FIATAGRI

FIAT 86 Series Tractors

3–cylinder engine models: 50V 55V 55F 60V 60F 62F
4–cylinder engine models: 70V 72F 72LP 82F 82LP

WORKSHOP MANUAL

SECTIONS

A F T E R S A L E S S E R V I C E

06910107

Reprinted

FOREWORD

◊ *This Manual is subdivided into separately numbered (two–digits) Sections, each with indipendently numbered pages.*

For quick cross–reference, these Sections have the same identification number and denomination of the units appearing on the Repair Time Manual.

◊ *Topics and information contained herein can be easily traced by consulting the index pages that follow.*

◊ *Each page is identified at the bottom with the print number of the manual and the date of first issue or updating edition.*

◊ *Pages of future revised/updated editions will be identified with the same print number of the original edition, followed by a two–digit number (ex.: 1st updated edition 603.54.283.01; 2nd updated edition 603.54.283.02, etc.) and by the respective date of issue.*

These pages will be accompanied by a reprint of the index, updated.

◊ *All information herein are updated at the date appearing on the Manual. As NEW HOLLAND is constantly committed to product improvement, some information may not be to–date as a consequence of modifications implemented on the machines for technical or commercial reasons or for compliance to local legal requirements, differing in the various Countries.*

In case of discrepancies, please contact our nearest Sales and Service point.

IMPORTANT NOTICES

◊ *All maintenance and repair operations appearing on this manual must be performed exclusively by the FIATGRI Service network, which is committed to strictly follow the instructions and indications therein and to use, whenever necessary, the envisaged special tools.*

◊ *Whomever should carry out any operation or service work herein included without strictly following our indications and prescriptions will be held personally responsible for any ensuing damage.*

◊ *The Company and all of its Distributors, including but not limited to national, regional or local distributors, decline any and all responsibilities for any damage which may ensue from the abnormal behaviour of parts and/or components not duly authorized by the Company, including any of these used in carrying on maintenance and repair work on the product manufactured or distributed by the Company.*

In any case, no warranty coverage of any kind will be issued or prescribed regarding the product manufactured or distributed by the Company for damages consequent to an abnormal behaviour of parts or components which have not been duly authorized by the Company.

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23 – LIVE AXLE DRIVE

25 – FRONT DRIVE AXLE

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35 – HYDRAULIC SYSTEMS

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GENERAL INSTRUCTIONS

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Whomever should carry out any operation or service work herein included without strictly following our indications and prescriptions will be held personally responsible for any ensuing damage.

SHIMS

At each adjustment, select appropriate shim by measuring them one by one with a micrometer gauge and subsequently summing up the single thickness readings: do not rely on wrong overall reading of shim pack thickness or on the nominal value indicated for each shim.

ROTARY SHAFT SEALS

Install seals on rotary shaft correctly, as follows:

- prior to fitting, soak the seals for at least half an hour in the fluid to be retained;
- clean the shaft thoroughly and make sure that working surfaces are free from any damage;
- install the seal with the sealing lip side facing the fluid; in case of a thrower lip type seal, the grooves must be oriented so as to throw the fluid back in when the shaft is rotating;
- smear the sealing lip with a very thin coating of lubricant (oil is better than grease) and pack the space between sealing lip and dust shield with grease on double–lip type seals;
- fit seals into their housings by pressure or using a punch with a flat contact surface; under no circumstances hit the seal directly with a hammer or mallet;
- at assembly, make sure the seal is not entering the housing in tilted position and once fitted ensure that the seal is pressed fully home;
- to prevent that the sealing lip may be damaged by the shaft at installation, use some sort of protection when sliding it over the shaft.

O–RING SEALS

Lubricate each seal prior to fitting to prevent twisting at assembly and consequent loss of fluid tightness.

SEALING COMPOUNDS

On the mating surfaces indicated by a X apply one of the following sealing compounds: RTV SILMATE, RHODORSIL CAF 1 or LOCTITE PLASTIC GASKET.
Before applying the sealing compounds, treat mating surfaces as follows:

- using a wire brush, remove all metallic particles;
- thoroughly degrease surfaces using one of the following detergents: solvent, kerosene or a water/soda solution.

BEARINGS

When fitting bearings, it is recommended:

- pre–heating them 80°C to 90°C before installation on shafts;
- cooling them before force–fitting into their respective seats.

ROLL PINS

When fitting straight roll pins make sure the cut faces towards direction of work, to stress the pin.
Coil roll pins, instead, do not require any particular orientation at assembly.

Print No. **603.54.283.00** *– 09 – 1994*

SPARE PARTS

Use exclusively **NEW HOLLAND genuine spare parts**, the only ones that can be identified by this exclusive trademark.

NEW HOLLAND NEW HOLLAND

New Holland
Original
Controlled
Quality

New Holland
Original
Controlled
Quality

These are the only ones that guarantee the same quality, durability and safety of the original Factory parts, being the same ones installed on the assembly line.
Only the **genuine NEW HOLLAND spare parts** offer this guarantee.
When ordering spare parts please state:

- tractor model (marketing code) and chassis serial number;
- engine type and serial number;
- part number, (given on "Microfiches" or "Spare Parts Catalogue").

SERVICE TOOLS

The service tools proposed and illustrated in this Manual are:

- envisaged and designed specifically for use on tractors of the FIATAGRI range;
- necessary for reliable service work;
- accurately made and thoroughly tested to offer efficient and durable working tools.

We should like to remind to Service operators that being in possess of the right tools means:

- working under optimum technical conditions;
- obtaining the best possible results;
- save time and fatigue;
- working under better safety conditions.

NOTICES

Wear limits given in this manual for some of the parts and components are to be considered indicative only, for guidance purposes, and are not binding.
Indications such as "front", "rear", "right" and "left" referred to different components are intended for the tractor operator sitting in the driver's seat and facing the direction of normal tractor travel.

HOW TO START AND MOVE A TRACTOR WITHOUT BATTERY

Cables of the outside energyzer must be connected exclusively to their respective positive and negative posts on the tractor, using clean and efficient clamps assuring adequate and stable contacts.
Disconnect all users (lights, windshield wiper, etc.) prior to starting the tractor.
Should it be necessary to verify the tractor electrical system operation, do it only with the outside energyzer connected; Ultimated the check, disconnect all electrical accessories and de–activate the energyzer before disconnecting its cables.

Print No. ***603.54.283.00*** *– 09 – 1994*

SAFETY

PAY ATTENTION TO THIS SYMBOL

This warning symbol calls your attention on important messages involving your personal safety.
Read the precautionary statements attentively and strictly comply with the recommended precautions in order to avoid any potential risk and safeguard your personal health and wellbeing.
Throughout this manual you will find this symbol associated with the following keywords:

***CAUTION** – For warnings intended to make you avoid wrong or inadequate repair practices which may potentially involve the repairman personal safety.*

***DANGER** – In the presence of warnings that specifically alert of potential physical danger for the safety of the repairman or of other persons directly or indirectly involved.*

AVOID ACCIDENTS !

Most accidents occurring in the workshop are caused by the failure of following some basic and simple safety rules and precautions.
For this reason MOST ACCIDENTS CAN BE PREVENTED by paying attention in advance to avoid the possible causes and act accordingly, being careful and cautious.

No matter what the type of machine, and no matter how well this has been designed and manufactured, it will be impossible to absolutely exclude the possibility of an accident.

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

Just the compliance to this one only simple safety rule would prevent the occurrence of a good many serious accidents:

DANGER – Never attempt to clean, lubricate or service the tractor with the engine started.

PRECAUTIONARY STATEMENTS

GENERAL

◊ Strictly follow all maintenance and servicing directions.

◊ Do not wear rings, wrist watches, jewelry and loose or hanging apparel such as, for example: ties, torn clothing, scarves, unbottoned or unzipped jackets that can be caught in moving parts.
We recommend, instead, to wear proper safety clothing and accessories, such as , for example: anti–skid shoes, gloves, safety goggles, helmets, etc.

◊ Do not carry on service work on the machine with persons sitting in the driver's seat, with the exception of operators abilitated to cooperate with you for the work at hand.

◊ Carry on all performance tests from the operator's seat.

◊ Unless otherwise specified, do not do any work on the machine while the engine is running.

◊ Before taking off caps, covers, valves, etc., stop the engine and relieve pressure from hydraulic circuit involved.

◊ All service work and operations must be carried on by constantly using maximum care and paying best attention.

◊ Shop and field platforms and ladders should be constructed and maintained in accordance with accident prevention regulations.

◊ Disconnect batteries and label all controls to warn that work is in progress.
Restrain machine and any implement to be lifted.

◊ Never check levels or fill fuel tanks and storage batteries while smoking or near open flames as fluids involved are flammable.

◊ Brakes are inactive when disconnected for servicing the machine, it will therefore be necessary to make provisions to securely restrain it by means of wedge blocks in order to prevent any movement that might be physically dangerous for the operator.

◊ Make sure that the fuel filler gun is and remains in contact with the tank filler cap during refuelling to prevent sparks due to static electricity.

Print No. ***603.54.283.00*** *– 09 – 1994*

◊ Use only designated towing or pulling attachment points. Use great care in connecting: make sure pins and locks are secure before attempting to pull. Stay clear of drabars, chains and cables under load.

◊ To move a disabled machine use a trailer or low body truck, if available.

◊ Load or unload the machine from transporter on level grounds affording full support to the trailer or truck wheels. Anchor tractor to load or trailer platform for transport and fit wedge blocks under the wheels as requested by the carrier.

◊ Use only grounded auxiliary power sources for heaters, chargers, pumps and similar equipment to avoid potential electrical shocks.

◊ Lift and handle all heavy parts with lifting tackle of adequate capacity.

◊ Watch out for people in the vicinities.

◊ Never pour gasoline or diesel fuel in open, large and low containers.

◊ Never use gasoline, diesel fuel or other flammable liquids as detergents: use, instead, commercial solvents, non flammable and non toxic.

◊ When cleaning parts with compressed air wear safety goggles with side protection.

◊ Limit the pressure to 2.1 bar (30 psi) in accordance to local safety regulations.

◊ Do not keep the engine running inside closed premises without adequate ventilation.

◊ Do not smoke, do not use open flames and do not not cause sparks in the vicinity when refuelling or handling easily inflammable materials.

◊ Do not use open flames as light sources with work in progress or when searching for "leaks" on the machine.

◊ Move carefully when working under/on the machine or near the same and wear the envisaged safety clothing and accessories: helmets, goggles and safety shoes.

◊ When carrying on inspection or checks requiring that the engine be running, call on the assistance of an operator remaining seated in the driver seat while watching the mechanic at work at all times.

◊ Fo field service, drive the machine on level grounds and make provisions to block it securely in place. If working on sloping grounds cannot be avoided, first move the machine, if possible, to the best available level grounds and block machine and its attachment securely to avoid accidents.

◊ Guard against kinking chains or cables: do not use them to lift or pull. Always wear heavy gloves when handling them.

◊ Be sure chains are anchored securely: check that the anchor point is strong enough for the expected load. Nobody should be near the anchor point, chain or pull cable and ropes.

◊ Keep maintenance floor area always CLEAN and DRY. Remove water or oil puddles immediately.

◊ Do not let oily, greasy wrags to pile up: they are a serious fire hazard. Always store them in a closed metal container. Before starting the machine or moving equipment check and inspect the driver's seat setting and locking. Also make sure no one else is present within the operating radius of the machine or equipment.

◊ Do not carry loose objects in your pockets that might fall inside disassembled parts and components.

◊ When in the presence of a potential hazard of being hit by flying metal particles or similar, wear goggles or glasses with side protection, helmets, special safety shoes and heavy gloves.

◊ Wear welders' protective accessories such as dark glasses, helmets, protective clothing, gloves and safety shoes when welding. Dark safety glasses must be worn also by anyone standing by when welding is in progress. DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.

◊ Wire ropes develope steel slivers in time. When handling them, always use adequate protection (heavy gloves, safety glasses, etc.).

◊ Handle all parts with extreme care. Do not put hands and fingers in between parts. Always wear proper, designated clothing and accessories such as safety glasses, heavy gloves and safety shoes.

Print No. **603.54.283.00** – 09 – 1994

STARTING

◊ Do not run the engine inside closed premises without proper ventilation capable of eliminating exhaust gases.

◊ Never place head, body, legs and arms, feet, hands and fingers near rotating fans or belts.

ENGINE

◊ Turn radiator cap slowly to release cooling system pressure before removing it. Add coolant only when the engine is shut off or idling, if warm.

◊ Do not refuel with engine running, particularly if warm, to avoid the possibility of spilled fuel taking fire.

◊ Never attempt to verify or adjust fan belt tension when the engine is running. Do not adjust the fuel injection pump when the tractor is moving.

◊ Never lubricate a machine with the engine running.

ELECTRICAL SYSTEM

◊ When auxiliary batteries are used, be sure to connect both cable ends correctly: (+) with (+) and (–) with (–) and do not short–circuit terminals.
BATTERY GAS IS HIGHLY INFLAMMABLE.
Leave battery box open for better ventilation when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks and open flames away from battery area and avoid smoking to prevent explosions.

◊ Check for fuel or battery electrolyte leaks before starting service or maintenance work: eliminate leaks, if any, before proceeding.

◊ Do not charge batteries inside closed premises or areas: make sure ventilation is adequate to prevent accidental explosions due to accumulation of explosive gas given off during the charging process.

◊ Always disconnect batteries before working on the electrical system.

HYDRAULICS

◊ Fluid escaping under pressure from a very small hole can almost be invisible but can have sufficient force to penetrate the skin.
Use a piece of cardboard or wood when searching for suspected pressure leaks. NEVER USE HANDS: if the fluid jet has penetrated under the skin, see a doctor at once as serious infection or skin reactions may develop if proper medical treatment is not administered immediately.

◊ When checking hydraulic system pressure use accident prevention provisions and the proper instruments and gauges.

WHEELS AND TYRES

◊ Make sure tyres are properly inflated to manufacturers specifications. Inspect rims and tyres periodically for damage.

◊ Stand sideways when checking tyre pressures.

◊ Check pressure only under unloaded machine and cold tyres conditions to avoid getting a wrong, overinflated pressure value.
Do not use reworked wheel parts as improper welding, brazing or heating may have weakened them and cause failures.

◊ Never cut or weld a wheel rim with the tyre installed and inflated.

◊ When removing or installing one or two wheels, restrain all the others by means of wedge blocks in order to prevent accidental movements potentially dangerous for the operator.
After jacking up the tractor in correspondence of the wheel or wheels to be removed, place the designated floor stands for proper supporting and safety.

◊ Deflate tyres before foreign objects from treads.

◊ Never inflate tyres with a flammable gas: explosion and personal injuries could be the result.

REMOVAL AND INSTALLATION WORK

◊ Lift and handle all heavy parts using lifting tackle of proper capacity. Keep people away from the load being lifted and make sure that parts and components are securely supported by proper hooks and chains and use the specific steel eyes for attachment.

◊ Handle all parts with extreme care, keep hands and fingers from between parts and wear the approved safety clothing and accessories such as goggles and glasses, gloves and shoes.

◊ Guard against kinking chains or steel wire ropes and always wear safety gloves when handling them.

Print No. **603.54.283.00** – 09 – 1994

Print No. 603.54.283.00 – 09 – 1994

GENERAL SPECIFICATIONS	3 –cylinder	4–cylinder
Engine,:		
– 50V model – type 8035.06.220 (BOSCH pump)	See data on p.10–9	–
– 50V model – type 8035.06.321 (C.A.V. pump)	See data on p.10–11	–
– 55V and 55F models – type 8035.06.222 (BOSCH pump)	See data on p.10–13	–
– 55V and 55F models – type 8035.06.323 (C.A.V. pump)	See data on p.10–15	–
– 60V, 60F and 62F models – type 8035.05.208 (BOSCH pump)	See data on p.10–17	–
– 60V, 60F and 62F models – type 8035.05.309 (C.A.V. pump)	See data on p.10–19	–
– 70V, 72F and 72LP models – type 8045.06.208 (BOSCH pump)	–	See data on p.10–21
– 70V, 72F and 72LP models – type 8045.06.309 (C.A.V. pump)	–	See data on p.10–23
– 82F and 82LP models – type 8045.05.208 (BOSCH pump)	–	See data on p.10–25
– 82F and 82LP models – type 8045.05.309 (C.A.V. pump)	–	See data on p.10–27
Cycle	diesel, 4–cycle, aspirated	
Injection	direct	
Number of in–line cylinders	3	4
Cylinder sleeves	dry, force–fitted in cranckase	
Piston diameter:		
– 50V model	100 mm (3.94 in)	–
– 55V and 55F models	100 mm (3.94 in)	–
– 60V, 60F and 62F models	104 mm (4.10 in)	–
– 70V,72F and 72LP models	–	100 mm (3.94 in)
– 82F and 82LP models	–	104 mm (4.10 in)
Piston stroke	115 mm (4.53 in)	
Engine displacement:		
– 50V model	2710 cm^3 (165.31 in^3)	–
– 55V and 55F models	2710 cm^3 (165.31 in^3)	–
– 60V, 60F and 62F models	2931 cm^3 (178.79 in^3)	–
– 70V, 72F and 72LP models	–	3613 cm^3 (220.40 in^3)
– 82F and 82LP models	–	3908 cm^3 (238.39 in^3)
Compression ratio	17÷1	
Max. power:		
– 50V model	33,1 kW (45 HP)	–
– 55V and 55F models	40,4 kW (55 HP)	–
– 60V, 60F and 62F models	44,1 kW (60 HP)	–
– 70V, 72F and 72LP models	–	51,5 kW (70 HP)
– 82F and 82LP models	–	58,8 kW (80 HP)
Max. output speed	2500 rpm	
Max. torque speed: 50V model	1300 rpm	–
Max. torque speed: 55V and 55F models	1400 rpm	–
Max. torque speed: 60V, 60F and 62F models	1500 rpm	–
Max. torque speed: 70V, 72F and 72LP models	–	1500 rpm
Max. torque speed: 82F and 82LP models	–	1400 rpm
Main bearings	4	5
Oil sump	cast–iron	

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

GENERAL SPECIFICATIONS	3–cylinder	4–cylinder
Lubrication	forced, w/gear–type pump	
Pump drive	camshaft	
Engine/oil pump speed ratio	2:1	
Oil cleaning	through wire filter on intake and cartridge on delivery	
Normal oil pressure, warm engine running at max. speed :	2,9 ÷ 3,9 bar (3 ÷ 4 kg/cm^2 – 42.6 ÷ 56.9 psi)	
Pressure relief valve	inside pump housing	
Valve crack–off pressure	3,5 bar (3,6 Kg/cm^2 – 50.8 psi)	
For further lubrication data	See page 10–84	
Cooling	water circulation	
Radiator, 50V, 55V, 55F, 60V, 60F, 62F and 70V models	3–row vertical copper tubes	
Radiator, 72F, 72L, 82F and 82LP models	4–row vertical copper tubes	
Fan, attached to water pump pulley	suction, sheet metal, six blades	
Water pump	vane–type	
Engine/water pump speed ratio	1:1,403	
Temperature regulation	through thermostat	
Water temperature gauge	3–colour sector scale	
Temperature gauge dial sector temperatures:		
– starting white sector	30° ÷ 65° C (86° ÷ 149° F)	
– central green sector (normal operating temperature)	65° ÷ 105° C (86° ÷ 221° F)	
– final red sector	105° ÷ 115° C(221°÷ 239° F)	
For further cooling system data	See page 10–87	
Tractor meter	on instrument panel	
Drive	through camshaft gear	
Hourmeter/engine speed setting	1800 rpm	

(continued)

Print No. **603.54.283.00** – 09 – 1994

(follows)

GENERAL SPECIFICATIONS	3–cylinder	4–cylinder
Timing	overhead type valves driven by the timing camshaft, located in the engine crankcase, through the push rod and rocker arm mechanism; the camshaft is driven by the engine cranckshaft through helical–tooth gears.	
Intake:		
– commencement: before T.D.C.	12°	
– end: after B.D.C.	31°	
Exhaust:		
– commencement: before B.D.C.	50°	
– end: after T.D.C.	16°	
Valve clearance for timing check	0,45 mm (.018 in)	
Normal operating valve clearance, measured on cold engine:		
– intake	0,30 ± 0,05 mm (.012 ± .002 in)	
– exhaust	0,30 ± 0,05 mm (.012 ± .002 in)	
For further timing data	See page 10–73	
Fuel system		
Air cleaning	through a dual–cartridge dry air cleaner, with clogged filter warning light, centrifugal pre–cleaner and automatic dust ejector	
Fuel transfer pump	double–diaphragm	
Fuel filtering	through wire filter in fuel transfer pump and a replaceable, cartridge–type filter in pump output	
Min. fuel output with drive shaft rotating at 1600 rpm	100 l/h (22 UK or 26 US gal)	
Cam drive	actuated by the engine timing mechanism	
BOSCH or C.A.V. fuel injection pump	distributor type	
All–speed, built–in speed governor:		
BOSCH and C.A.V.	mechanical flyweights	
Automatic, built–in advance variator:		
BOSCH and C.A.V.	hydraulic	
For further fuel system data	See prospect below	
For information concerning fixed advance (pump setting on engine for commencement of delivery, before T.D.C.) – Pressure setting – Firing order and others completing BOSCH and C.A.V. pump data, refer to the pages indicated hereafter in relation to the type of engine:		
– 50V model – type 8035.06.220 (BOSCH pump)	See data on p. 10–9	–
– 50V model – type 8035.06.321 (C.A.V. pump)	See data on p.10–11	–
– 55V and 55F models – type 8035.06.222 (BOSCH pump)	See data on p.10–13	–
– 55V and 55F models – type 8035.06.323 (C.A.V. pump)	See data on p.10–15	–
– 60V, 60F and 62F models – type 8035.05.208 (BOSCH pump)	See data on p.10–17	–
– 60V, 60F and 62F models – type 8035.05.309 (C.A.V. pump)	See data on p.10–19	–
– 70V, 72F and 72LP models – type 8045.06.208 (BOSCH pump)	–	See data on p.10–21
– 70V, 72F and 72LP models – type 8045.06.309 (C.A.V. pump)	–	See data on p.10–23
– 82F and 82LP models – type 8045.05.208 (BOSCH pump)	–	See data on p.10–25
– 82F and 82LP models – type 8045.05.309 (C.A.V. pump)	–	See data on p.10–27

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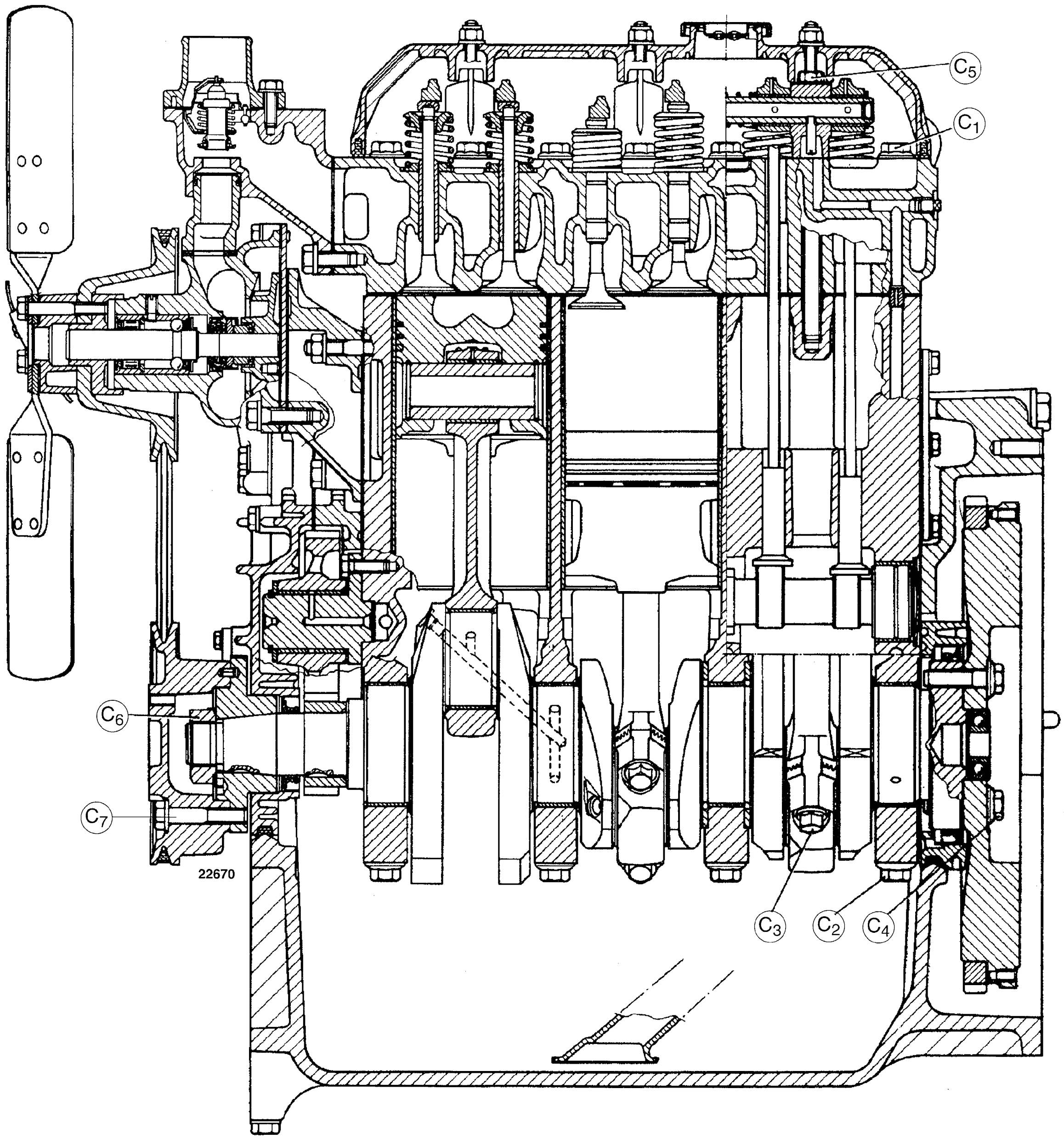

Longitudinal section of the 3–cylinder engine installed on the 50V – 55V – 55F – 60V – 60F – 62F model tractors

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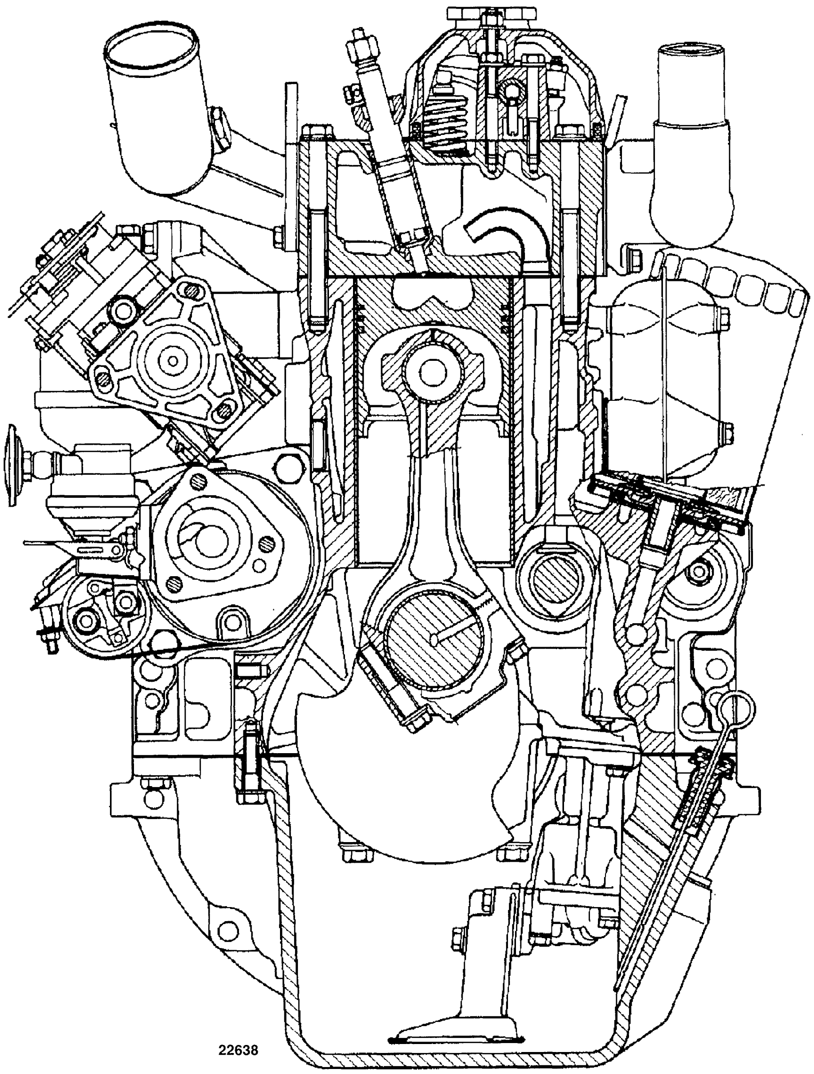

Cross–section of the 3–cylinder engine installed on the 50V – 55V – 55F – 60V – 60F – 62F model tractors

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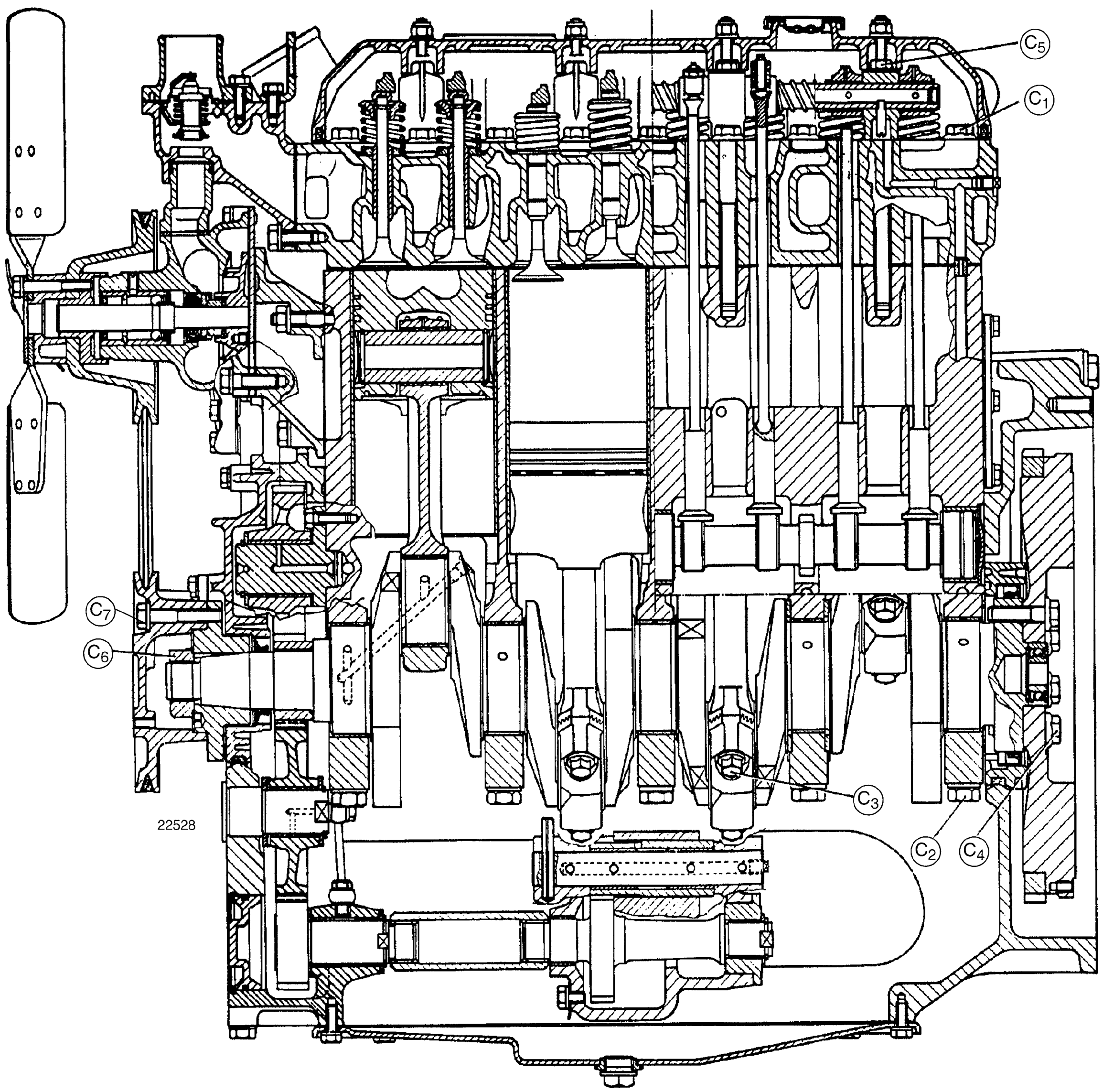

Longitudinal section of the 4–cylinder engine installed on the 70V – 72F – 72LP – 82F – 82LP model tractors

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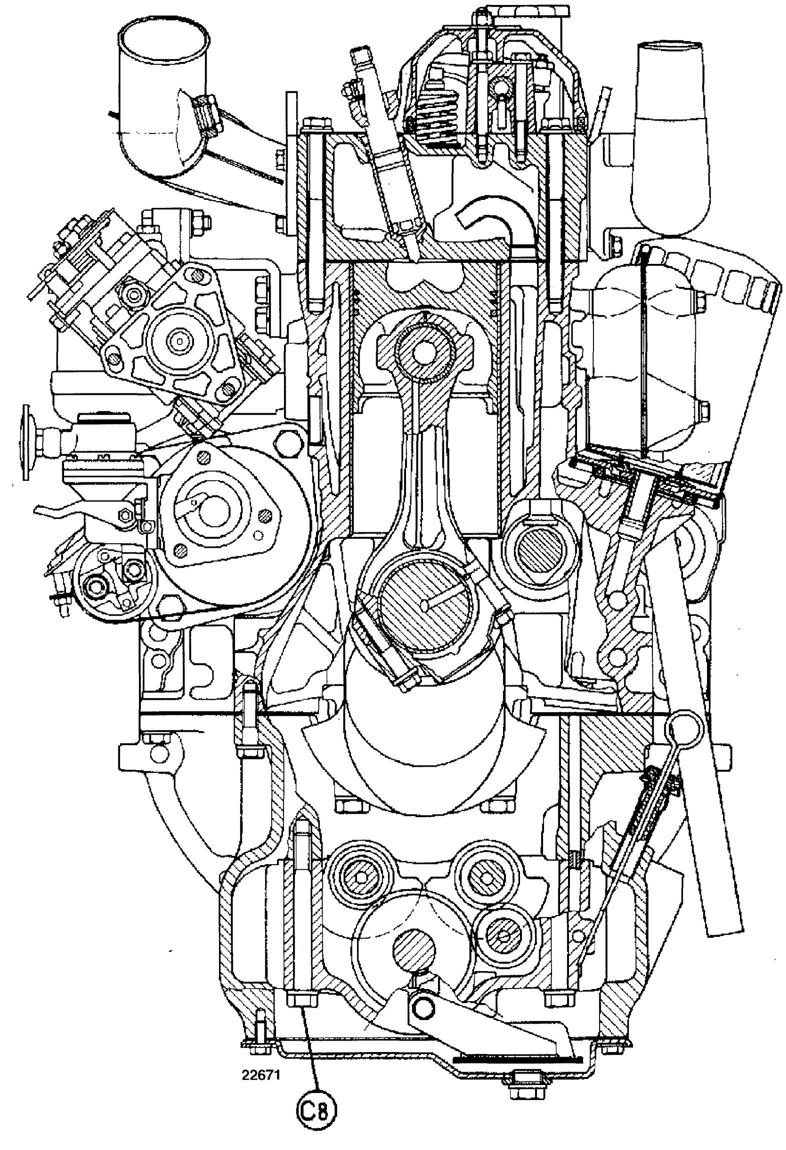

Cross–section of the 4–cylinder engine installed on the 70V – 72F – 72LP – 82F – 82LP model tractors

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ANGULAR TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque		Angle
		Nm	kgm/ft–lb	
Cap screws, cylinder head (**C_1**, page 10–4, or page 10–6)	M 12 x 1.25	60	6,1/44	90° + 90°
Cap screws, main bearing caps (**C_2**)	M 14 x 1.5	80	8,2/59	90°
Cap screws, connecting rod caps (**C_3**)	M 11 x 1.5	40	4,1/30	60°
Cap screws, engine flywheel (**C_4**)	M 12 x 1.25	40	4,1/30	60°

TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Cap screws, rocker arm shaft bracket (**C_5**, page 10–4, or page 10–6) .	M 8	25	2.5/18
Nut, crankshaft hub (**C_6**)	M 30 x 1.5	294	30/217
Cap screws, fan and alternator drive pulley (**C_7**)	M 10 x 1.25	55	5.6/40.5
Cap screws, balancer weights (**C_8**, page 10–7) for 70 – 72 – 82 models	M 12 x 1.25	110	11.2/81
Cap screws, inlet manifold (**C_9**, page 10–48)	M 8	25	2.6/19
Nut, alternator and belt stretcher (**C_{10}**, page 10–45)	M 10 x 1.25	55	5.6/40.5
Cap screws, engine coolant pump (**C_{11}**, page 10–46)	M 10 x 1.25	55	5.6/40.5
Nuts, injector stud (**C_{12}**, page 10–62)	M 8	25 **(*)**	2.6 **(*)**/19
Nuts, valve tappet cover (**C_{13}**)	M 8	15	1.5/11
Cap screws, rocker arm shaft brackets (**C_{14}**)	M 8	25	2.5/18
Cap screws, oil pump and cover (**C_{15}**, page 10–51)	M 8	25	2.6/19
Cap screws, timing box and cover (**C_{16}**, page 10–52)	M 8	25	2.6/19
Cap screws, intermediate flanged axle (**C_{17}**)	M 10 x 1,25	55	5.6/40.5
Cap screws, camshaft thrust plate (**C_{18}**)	M 8	35	3.6/26
Cap screws, crankcase rear cover (**C_{19}**, page 10–58)	M 8	25	2.6/19
Nuts, valve tappet adjustment setscrews (**C_{20}**, page 10–62)	M 8	22	2.2/16
Cap screws, exhaust manifold (**C_{21}**, page 10–46)	M 8	25	2.6/19
Cap screws, injection pump (**C_{22}**, page 10–93, or page 10–96)	M 8	25	2.6/19
Cap screws, engine oil sump (**C_{23}**, page 10–50)	M 12x1.25	69	7/51

(*) Tighten nuts at two subsequent stages, see page 10–62

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

BOSCH INJECTION SYSTEM	VE 3/11 F 1250 L 163–2 – 4804867
Engine	8035.06.220
Tractor	50V
Power output	45 HP
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	2710 cm^3 (165.31 in^3)
Max. power torque	2500 rpm
Injector types :	
– W ALTECNA	4802391
– BOSCH	4792442
– C.A.V.	–
– OMAP	4800032
Nozzle holder types :	
– W ALTECNA	KBEL 83S 1W200–4802392
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	–
– OMAP	OKLL 83S 3392–4796644
Spray nozzle types :	
– W ALTECNA	DDL124S 500W–4802393
– BOSCH	DLLA 124S 1001–4792443
– C.A.V.	–
– OMAP	OOL124S 3990–4792447
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	230 ÷ 238 bar (235 ÷ 243 kg/cm^2 – 3407 ÷ 3523 psi)
Delivery pipes	4797506
Pipe size	6 x 1.5 x 475 mm (.24 x .06 x 19 in)
Assembly data	
Sense of pump rotation (drive end)	counterclockwise
Firing order	1–2–3
Pumping element pre–lifting from B.D.C.	0,2 ± 0,05 mm (.008 ± .002 in)
Pump setting on engine: commencement of delivery before T.D.C. at cylinder 1 in the compression phase **(*)**	$6^o \pm 1$
Pump delivery connection to cylinder 1	designated by the letter **A**.
Calibration test conditions	
Test bench complying with ISO 4008/1./2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901020 **(°)**
Test fluid ISO 4113	at the temperature of $40^o + 2^o$ ($104^o \pm 4^o$F)
Test glasses emptying time	30’
Note (*) Pumping element pre–lifting from B.D.C. for timing on engine (with 291754 and 291755 tools)	1 mm (.039 in)
Note (°) With button	1680103096

(continued)

Print No. **603.54.283.00** – 09 – 1994

(follows)

BOSCH INJECTION SYSTEM	VE 3/11 F 1250 L 163–2 – 4804867
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.2 (0.2 – 2.9)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2– 2537 ÷ 2581 psi)
Pipes (complying with ISO 4093 std.)	6 x 2 x 840 mm (.24 x .08 x 33.6 in)

ADJUSTMENT DATA

Operation description	rpm	Advance piston stroke mm	Fuel pressure bar(kg/cm^2)	Unit delivery cm^3/1000 shots	Transfer bar (kg/cm^2)	Spread cm^3/1000 shots
Full load delivery	800	2.8 ÷ 3.2	4.2 ÷ 4.8	56.5 ÷ 57.5	0.2	3.5
Idle speed limit	350	–	–	10 ÷ 14	0.2	3
Starting delivery	150	–	–	100 ÷ 120	0.2	–
Full throttle limit	1350	–	–	39 ÷ 45	0.2	–

TEST DATA

Advance device check	rpm	mm	Fuel pressure check	rpm	bar (Kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	600	0.6÷1.4	–	600	3.2÷3.8	–	–	–
	800	2.8÷3.2	–	800	4.2÷4.8	–	–	–
	1200	4.6÷5.4	–	1200	6.4÷7.0	–	–	–

DELIVERY CHECK

Full throttle stop	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)	Idle speed shut–off	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)
	1400÷1460	≤2	0.2	–	350	10÷14	0.2
	1350	39÷45	0.2	–	400	≤2	0.2
	1250	50.5÷53.5	0.2	–	–	–	–
	800	56.5÷57.5	0.2	–	–	–	–
	500	52.5÷55.5	0.2	–	–	–	–
	250	≤47	0.2	–	–	–	–
	150	100÷120	0.2	–	–	–	–

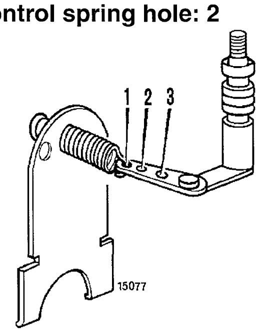
BENCH TEST PERFORMANCE DATA

Test conditions	
Fixed injection advance before T.D.C.at cylinder 1 in compression phase: (see page before).	Relative humidity: 70% + 5
Engine without fan, air cleaner and exhaust silencer.	Ambient temperature 20 ± 3° C (68 ± 3° F)
Barometric pressure 740 ± 5 mm Hg (at Turin altitude: 239 meters – 785 ft above sea level).	Fuel specific weight 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	Power output with engine run–in time of: 50–hour total kW (metric HP)	Fuel consumption kg/h
Maximum	For max power output	2500	≥ 32.4 (44)	33.1 ÷ 35 (45 ÷ 47.6)	7.8 ÷ 8.2
Maximum	For max torque	1500	≥ 22.8 (31)	23.5 ÷ 25 (32 ÷ 34)	5.1÷ 5.6
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Print No. **603.54.283.00** – 09 – 1994

FULE SYSTEM MAIN DATA

C.A.V. INJECTION SYSTEM	**DPS 8522 A 170 A – 98404118**
Engine	8035.06.321
Tractor	50V
Power output	45 (metric HP)
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	2710 cm^3 (165.31 in^3)
Max. power speed	2500 rpm
Injector type :	
– BOSCH	4824164
Nozzle holder type :	
– BOSCH	KBEL 83S 35–4791124
Nozzle type :	
– BOSCH	DLLA 134S 1113–4824165
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	260 ÷ 268 bar (265 ÷ 273 kg/cm^2 – 3842 ÷ 3958 psi)
Delivery pipes	–
Pipe size	6 x 2 x 475 (.24 x .08 x 19 in)
Assembly data	
Sense of pump rotation (drive end): counterclockwise	**Control spring hole: 2**
Firing order : 1–2–3	
Distance between governor bracket and metering pin: 40.45 ÷ 41.05 mm (1.618 ÷ 1.642 in)	
Pump timing on engine: commencement of delivery before T.D.C. at cylinder 1 in compression phase 0° ± 1°	
Flange centering guide diameter : 50mm	
Pump delivery connection corresponding to cylinder 1: designated by letter **U**	
Calibration test conditions	
Test bench complying with ISO 4008/1../2 standard	–
Injectors complying with ISO 7440 A 11 standard	–
Test fluid ISO 4113	at 40° ± 2° C (104° ± 4° F)
Test glass emptying time	30'
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.1 (1.45 psi)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2 – 3842 ÷ 3958 psi)
Pipes complying with ISO 4093/1 standards	6 x 2 x 845 mm (.24 x .08 x 33.8 in)
Projecting height of maximum delivery setscrew above its locknut surface	9 mm (.35 in)
Back off completely the transfer pressure set screw and then screw it in	3.5 revs
Position the release valve set screw just below its locknut surface	–
Back off completely the maximum, minimum and shut–off exclusion screws	–
The advance device, spring end, fits a 2 mm (.08) shim	no others required

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

C.A.V. INJECTION SYSTEM				**DPS 8522 A 170 A – 98404118**			
PUMP CALIBRATION DATA							
Test n.	Throttle lever position	Speed	Advance	Transfer pressure	Unit delivery	Spread	Back leakage
		rpm	degrees	bar (kg/cm²)	cm³/200 shots	cm³/200 shots	cm³/100 shots
1 (1)	max	200	–	–	–	–	–
2 (2)	max	1000	–	–	–	–	–
3	max	100	–	0.3	–	–	–
4 (+)	max	950	–	–	–	–	–
5 (3) – 6	max	950	2.75÷3.00 (15)	4.5÷5.6	–	–	–
7 (4)	max	1250	3.75÷4.75 (16)	–	–	–	–
8 – 9	max	750	–	–	8.6÷8.8(*)	≤1	40÷90(°)
10 (5)	max	1250	–	–	–	–	–
11 (6)	max	1420	–	–	1.5÷2.0	–	–
12 (x)	max	1520	–	–	≤1.4	–	–
13 (7)	max	1250	–	–	–	–	–
14 (8)	max	250	0.75÷1.75(17)	–	–	–	–
15 (9)	max	200	0	–	≥16.0	–	–
16 (11)	min	325	–	–	2.0÷2.5	–	–
17 (10)	min	850	–	–	–	–	–
18 (12)	min	325	–	–	≤0.8	–	–
19 (13)	min	325	–	–	≤0.5	–	–
20 (14)	min	–	–	–	–	–	–

1) Delivery to all injectors.
2) Run pump for 3'.
3) Set pressure adjusting screw for specified advance and check that pressure corresponds.
4) Stop test machine, disconnect transfer pressure gauge and install shut–off device. Activate the latter and re–start test machine.
5) Record average delivery.
6) Adjust max. speed screw and lock it in position.
7) Delivery shall not be less than in test 10 by more than 0.4 cm³/200 shots.
8) Prior to test, bring machine speed to 100 revs then stop it. Fully tighten release valve adjusting screw, start machine and slacken screw until reaching specified values.
9) Prior to test, bring machine speed to 100 revs then stop it and re–start it.
10) Adjust anti–stall screw for a delivery of 2 to 3 cm³/2000 shots and then lock it in position.
11) Adjust idling speed screw.
12) Shut–off lever closed.
13) With shut–off device deactivated and shut–off lever open, await 5" before performing test.
14) Connect delivery fitting "U" to injector tester and maintain 54 bar (757 psi) pressure. Using timing tool, bring about hydraulic lock–up, then position pump timing plate at 11.25°.
15) 2.2÷2.4 mm (.088÷.096 in)
16) 3.0÷3.8 mm (.12÷.15 in)
17) 0.6÷1.4 mm (.024÷.056 in)
x) If delivery is more, adjust rod length at minimum (see above).
+) Inside pressure in pump housing, measured with a pressure gauge connected to the orifice in the drain screw, should read 0.1÷ 0.3 bar (kg/cm²_–1.45÷ 4.35 psi).
*) Take reading after 15". °) Flow 300 ÷ 675 cm³/min. (18÷ 40.5 in³/min).

BENCH TEST PERFORMANCE DATA	
Fixed injection advance before T.D.C. at cylinder 1 in compression phase : (see page before). Engine without fan, air cleaner and exhaust silencer. Barometric pressure 740 ± 5 mm of Hg (at Turin altitude: 239 m – 785 ft. above sea level).	Relative humidity: 70% ± 5. Ambient temperature 20 ± 3° C. Fuel specific weight: 830 ± 10 g/liter.

Throttel	Brake load	Engine speed	Power output with engine run–in time of:		Fuel consumptioin
		rpm	2–hour total kW (metric HP)	50–hour total kW (metric HP)	kg/h
Maximum	For max power output	2500	≥ 32.3(44)	33.1 ÷ 35 (45 ÷ 47.6)	7.8 ÷ 8.2
Maximum	For max torque	1500	≥ 22.8 (31)	23.5 ÷ 25 (32 ÷ 34)	5.1÷ 5.6
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

BOSCH INJECTION SYSTEM	VE 3/11 F 1250 L 163–1–4794587–4800682
Engine	8035.06.222
Tractor	55V and 55F
Power output	55 HP
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	2710 cm^3 (165.31 in^3)
Max. power torque	2500 rpm
Injector types :	
– W ALTECNA	4802391
– BOSCH	4792442
– C.A.V.	–
– OMAP	4800032
Nozzle holder types :	
– W ALTECNA	KBEL 83S 1W200–4802392
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	–
– OMAP	OKLL 83S 3392–4796644
Spray nozzle types :	
– W ALTECNA	DDL124S 500W–4802393
– BOSCH	DLLA 124S 1001–4792443
– C.A.V.	–
– OMAP	OOL124S 3990–4792447
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	230 ÷ 238 bar (235 ÷ 243 Kg/cm^2 – 3407 ÷ 3523 psi)
Delivery pipes	4797506
Pipe size	6 x 1.5 x 475 mm (.24 x .06 x 19 in)
Assembly data	
Sense of pump rotation (drive end)	counterclockwise
Firing order	1–2–3
Pumping element pre–lifting from B.D.C.	0.2 ± 0.02 mm (.008 ±.0008 in)
Pump setting on engine: commencement of delivery before T.D.C. at cylinder 1 in the compression phase **(*)**	$6^o \pm 1$
Pump delivery connection to cylinder 1	designated by the letter **A**.
Calibration test conditions	
Test bench complying with ISO 4008/1./2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901020 **(°)**
Test fluid ISO 4113	at the temperature of $40^o + 2^o$ ($104^o \pm 4^o$F)
Test glasses emptying time	30'
Note (*) Pumping element pre–lifting from B.D.C. for timing on engine (with 291754 and 291755 tools)	1 mm (.039 in)
Note (°) With button	1680103096

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

BOSCH INJECTION SYSTEM	VE 3/11 F 1250 L 163–1 – 4794587–4800682
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.2 (0.2 – 2.9)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2– 2537 ÷ 2581 psi)
Pipes (complying with ISO 4093 std.)	6 x 2 x 840 mm (.24 x .08 x 33.6 in)

ADJUSTMENT DATA						
Operation description	rpm	Advance piston stroke mm	Fuel pressure bar(kg/cm^2)	Unit delivery cm^3/1000 shots	Transfer bar (kg/cm^2)	Spread cm^3/1000 shots
Full load delivery	800	0.8 ÷ 1.2	3.8 ÷ 4.4	64.5 ÷ 65.5	0.2	3.5
Idle speed limit	350	–	–	21 ÷ 125	0.2	3
Starting delivery	150	–	–	100 ÷ 120	0.2	–
Full throttle limit	1350	–	–	32 ÷ 38	0.2	–

TEST DATA								
Advance device check	rpm	mm	Fuel pressure check	rpm	bar (Kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	600	0÷0.6	–	600	3.0÷3.6 (2.8÷3.8)	–	–	–
	800	0.8÷1.2	–	800	3.8÷4.4	–	–	–
	1200	4.4÷5.2	–	1200	5.6÷6.2	–	–	–

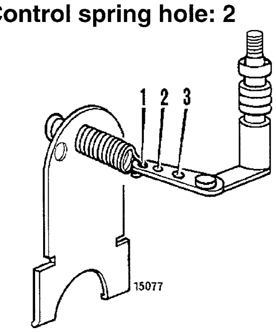
DELIVERY CHECK							
Full throttle stop	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)	Idle speed shut–off	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)
	1400÷1460	0	0.2	–	475	≤2	0.2
	1350	32÷38	0.2	–	425	4÷10	0.2
	1250	62.5÷65.5	0.2	–	350	21÷25	0.2
	800	64.5÷65.5	0.2	–	–	–	–
	500	56.5÷59.5	0.2	–	–	–	–
	250	≤55	0.2	–	–	–	–

BENCH TEST PERFORMANCE DATA	
Test conditions	
Fixed injection advance before T.D.C.at cylinder 1 in compression phase: (see page before).	Relative humidity: 70% + 5
Engine without fan, air cleaner and exhaust silencer.	Ambient temperature 20 ± 3° C (68 ± 3° F)
Barometric pressure 740 + 5 mm Hg (at Turin altitude: 239 meters – 785 ft above sea level).	Fuel specific weight 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	Power output with engine run–in time of: 50–hour total kW (metric HP)	Fuel consumption kg/h
Maximum	For max power out-put	2500	≥ 36.7 (50)	38.2 ÷ 40.1 (52 ÷ 54.5)	9.0 ÷ 9.4
Maximum	For max torque	1500	≥ 25.6 (34.8)	26.7 ÷ 28.3 (36.3 ÷ 38.5)	5.8÷6.2
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

C.A.V. INJECTION SYSTEM	**DPS 8522 A 161 A – 98459266**
Engine	8035.06.323
Tractor	50V and 55F
Power output	55 (metric HP)
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	2710 cm^3 (165.31 in^3)
Max. power speed	2500 rpm
Injector type :	
– BOSCH	4824164
– C.A.V.	4817265
Nozzle holder type :	
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	4816070
Nozzle type :	
– BOSCH	DLLA 134S 1113–4824165
– C.A.V.	BDLL 134S 6860–4817266
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	260 ÷ 268 bar (265 ÷ 273 kg/cm^2 – 3842 ÷ 3958 psi)
Delivery pipes	–
Pipe size	6 x 2 x 475 (.24 x .08 x 19 in)
Assembly data	
Sense of pump rotation (drive end): counterclockwise	**Control spring hole: 2**
Firing order : 1–2–3	
Distance between governor bracket and metering pin: 40.45 ÷ 41.05 mm (1.618 ÷ 1.642 in)	
Pump timing on engine: commencement of delivery before T.D.C. at cylinder 1 in compression phase +0° –1°	
Flange centering guide diameter : 50mm	
Pump delivery connection corresponding to cylinder 1: designated by letter **U**	
Calibration test conditions	
Test bench complying with ISO 4008/1../2 standard	–
Injectors complying with ISO 7440 A 11 standard	–
Test fluid ISO 4113	at 40° ± 2° C (104° ± 4° F)
Test glass emptying time	30’
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.1 (1.45 psi)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2 – 3842 ÷ 3958 psi)
Pipes complying with ISO 4093/1 standards	6 x 2 x 845 mm (.24 x .08 x 33.8 in)
Projecting height of maximum delivery setscrew above its locknut surface	9 mm (.35 in)
Back off completely the transfer pressure set screw and then screw it in	3.5 revs
Position the release valve set screw just below its locknut surface	–
Back off completely the maximum, minimum and shut–off exclusion screws	–
The advance device, spring end, fits a 2 mm (.08) shim	no others required

(continued)

Print No. **603.54.283.00** – 09 – 1994

(follows)

C.A.V. INJECTION SYSTEM					DPS 8522 A 161 A – 98459266		
PUMP CALIBRATION DATA							
Test n.	Throttle lever position	Speed rpm	Advance degrees	Transfer pressure bar (kg/cm^2)	Unit delivery cm^3/200 shots	Spread cm^3/200 shots	Back leakage cm^3/100 shots
1 (1)	max	200	–	–	–	–	–
2 (2)		1000	–	–	–	–	–
3		100	–	0.3	–	–	–
4 (+)		950	–	–	–	–	–
5 (3) – 6		950	2.75÷3.00 (15)	4.5÷5.6	–	–	–
7 (4)		1250	3.75÷4.75 (16)	–	–	–	–
8 – 9		750	–	–	10.2÷10.4(*)	≤1	40÷90(°)
10 (5)		1250	–	–	–	–	–
11 (6)		1420	–	–	1.5÷2.0	–	–
12 (x)		1520	–	–	≤1.4	–	–
13 (7)		1250	–	–	–	–	–
14 (8)		250	0.75÷1.75(17)	–	–	–	–
15 (9)		200	0	–	≥16.0	–	–
16 (11)	min	325	–	–	2.0÷2.5	–	–
17 (10)		850	–	–	–	–	–
18 (12)		325	–	–	≤0.8	–	–
19 (13)		325	–	–	≤0.5	–	–
20 (14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Run pump for 3'.
3) Set pressure adjusting screw for specified advance and check that pressure corresponds.
4) Stop test machine, disconnect transfer pressure gauge and install shut–off device. Activate the latter and re–start test machine.
5) Record average delivery.
6) Adjust max. speed screw and lock it in position.
7) Delivery shall not be less than in test 10 by more than 0.4 cm^3/200 shots.
8) Prior to test, bring machine speed to 100 revs then stop it. Fully tighten release valve adjusting screw, start machine and slacken screw until reaching specified values.
9) Prior to test, bring machine speed to 100 revs then stop it and re–start it.
10) Adjust anti–stall screw for a delivery of 2 to 3 cm^3/2000 shots and then lock it in position.
11) Adjust idling speed screw.
12) Shut–off lever closed.
13) With shut–off device deactivated and shut–off lever open, await 5" before performing test.
14) Connect delivery fitting "U" to injector tester and maintain 54 bar (757 psi) pressure. Using timing tool, bring about hydraulic lock–up, then position pump timing plate at 10.25°.
15) 2.2÷2.4 mm (.088÷.096 in)
16) 3.0÷3.8 mm (.12÷.15 in)
17) 0.6÷1.4 mm (.024÷.056 in)
x) If delivery is more, adjust rod length at minimum (see above).
+) Inside pressure in pump housing, measured with a pressure gauge connected to the orifice in the drain screw, should read 0.1÷ 0.3 bar (kg/cm^2_–1.45÷ 4.35 psi).
*) Take reading after 15". °) Flow 300 ÷ 675 cm^3/min. (18÷ 40.5 in^3/min).

BENCH TEST PERFORMANCE DATA	
Fixed injection advance before T.D.C. at cylinder 1 in compression phase : (see page before). Engine without fan, air cleaner and exhaust silencer. Barometric pressure 740 ± 5 mm of Hg (at Turin altitude: 239 m – 785 ft. above sea level).	Relative humidity: 70% ± 5. Ambient temperature 20 ± 3° C. Fuel specific weight: 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	50–hour total kW (metric HP)	Fuel consumptioin kg/h
Maximum	For max power output	2500	≥ 36.7 (50)	38.2 ÷ 40.1 (52 ÷ 54.5)	8.8 ÷ 9.2
Maximum	For max torque	1500	≥ 25.6 (34.8)	26.7 ÷ 28.3 (36.3 ÷ 38.5)	5.8 ÷ 6.2
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

BOSCH INJECTION SYSTEM	VE 3/11 F 1250 L 163 – 4794586
Engine	8035.05.208
Tractor	60V, 60F and 62F
Power output	60 (HP)
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	104 mm (34.16 in)
Displacement	2931 cm^3 (178.8 in^3)
Max. power torque	2500 rpm
Injector types :	
– W ALTECNA	4802394
– BOSCH	4800029
– C.A.V.	–
– OMAP	4800031
Nozzle holder types :	
– W ALTECNA	KBEL 83S 1W200–4802392
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	–
– OMAP	OKLL 83S 3392–4796644
Spray nozzle types :	
– W ALTECNA	DDL 136S 501W–4802395
– BOSCH	DLLA 136S 1000–4800030
– C.A.V.	–
– OMAP	OOL136S 9119–4776715
Spray orifice diameter	0.35 mm (.014 in)
Number of spray holes	3
Pressure setting	230 ÷ 238 bar (235 ÷ 243 Kg/cm^2 – 3407 ÷ 3523 psi)
Delivery pipes	4797506
Pipe size	6 x 1.5 x 475 mm (.24 x .06 x 19 in)
Assembly data	
Sense of pump rotation (drive end)	counterclockwise
Firing order	1–2–3
Pumping element pre–lifting from B.D.C.	0.2 ± 0.02 mm (.008 ±.0008 in)
Pump setting on engine: commencement of delivery before T.D.C. at cylinder 1 in the compression phase **(*)**	6° ± 1
Pump delivery connection to cylinder 1	designated by the letter **A**.
Calibration test conditions	
Test bench complying with ISO 4008/1./2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901020 **(°)**
Test fluid ISO 4113	at the temperature of 40° + 2° (104° ± 4°F)
Test glasses emptying time	30’
Note (*) Pumping element pre–lifting from B.D.C. for timing on engine (with 291754 and 291755 tools)	1 mm (.039 in)
Note (°) With button	1680103096

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

BOSCH INJECTION SYSTEM	**VE 3/11 F 1250 L 163 – 4794586**
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.2 (0.2 – 2.9)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2– 2537 ÷ 2581 psi)
Pipes (complying with ISO 4093 std.)	6 x 2 x 840 mm (.24 x .08 x 33.6 in)

ADJUSTMENT DATA

Operation description	rpm	Advance piston stroke mm	Fuel pressure bar(kg/cm^2)	Unit delivery cm^3/1000 shots	Transfer bar (kg/cm^2)	Spread cm^3/1000 shots
Full load delivery	800	2.3 ÷ 2.7	3.4 ÷ 4.0	72 ÷ 73	0.2	3.5
Idle speed limit	350	–	–	19 ÷ 23	0.2	3
Starting delivery	150	–	–	100 ÷ 120	0.2	–
Full throttle limit	1350	–	–	41 ÷ 47	0.2	–

TEST DATA

Advance device check	rpm	mm	Fuel pressure check	rpm	bar (Kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	600	0.2÷0.8	–	600	2.4÷3.0	–	–	–
	800	2.3÷2.7	–	800	3.4÷4.0	–	–	–
	1200	6.1÷6.9	–	1200	5.7÷6.5	–	–	–

DELIVERY CHECK

Full throttle stop	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)	Idle speed shut–off	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)
	1400÷1460	0	0.2	–	475	≤2	0.2
	1350	41÷47	0.2	–	350	19÷23	0.2
	1250	69.5÷72.5	0.2	–	–	–	–
	800	72÷73	0.2	–	–	–	–
	500	62.5÷65.5	0.2	–	–	–	–

BENCH TEST PERFORMANCE DATA

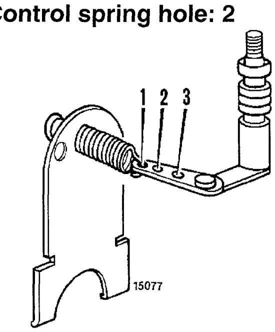
Test conditions

Fixed injection advance before T.D.C.at cylinder 1 in compression phase: (see page before).	Relative humidity: 70% + 5
Engine without fan, air cleaner and exhaust silencer.	Ambient temperature 20 ± 3° C (68 ± 3° F)
Barometric pressure 740 + 5 mm Hg (at Turin altitude: 239 meters – 785 ft above sea level).	Fuel specific weight 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	50–hour total kW (metric HP)	Fuel consumption kg/h
Maximum	For max power output	2500	≥ 40.4 (55)	41.9 ÷ 44.1 (57 ÷ 60)	9.7 ÷ 10.2
Maximum	For max torque	1500	≥ 28.3 (38.5)	29.4 ÷ 31.2 (40 ÷ 42.5)	6.4÷ 6.8
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

(continued)

FUEL SYSTEM MAIN DATA

C.A.V. INJECTION SYSTEM	**DPS 8522 A 151 A – 98459265**
Engine	8035.05.309
Tractor	60V, 60F and 62F
Power output	60 (HP)
Cylinders	3
Stroke	115 mm (4.53 in)
Bore	104 mm (4.16 in)
Displacement	2931 cm^3 (178.8 in^3)
Max. power speed	2500 rpm
Injector type :	
– BOSCH	4824170
– C.A.V.	4812762
Nozzle holder type :	
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	4816070
Nozzle type :	
– BOSCH	DLLA 138S 1112–4824171
– C.A.V.	BDLL 138S 6859–4817267
Spray orifice diameter	0.35 mm (.014 in)
Number of spray holes	3
Pressure setting	260 ÷ 268 bar (265 ÷ 273 kg/cm^2 – 3842 ÷ 3958 psi)
Delivery pipes	4797511
Pipe size	6 x 2 x 530 (.24 x .08 x 21.2 in)
Assembly data Sense of pump rotation (drive end): counterclockwise Firing order : 1–2–3 Distance between governor bracket and metering pin: 40.45 ÷ 41.05 mm (1.618 ÷ 1.642 in) Pump timing on engine: commencement of delivery before T.D.C. at cylinder 1 in compression phase +0° –1° Flange centering guide diameter : 50mm Pump delivery connection corresponding to cylinder 1: designated by letter **U**	**Control spring hole: 2** 
Calibration test conditions	
Test bench complying with ISO 4008/1../2 standard	–
Injectors complying with ISO 7440 A 11 standard	–
Test fluid ISO 4113	at 40° ± 2° C (104° ± 4° F)
Test glass emptying time	30’
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.1 (1.45 psi)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2 – 3842 ÷ 3958 psi)
Pipes complying with ISO 4093/2 standards	6 x 2 x 845 mm (.24 x .08 x 33.8 in)
Projecting height of maximum delivery setscrew above its locknut surface	9 mm (.35 in)
Back off completely the transfer pressure set screw and then screw it in	3.5 revs
Position the release valve set screw just below its locknut surface	–
Back off completely the maximum, minimum and shut–off exclusion screws	–
The advance device, spring end, fits a 2.5 mm (.010 in) shim	no others required

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

C.A.V. INJECTION SYSTEM				**DPS 8522 A 151 A – 98459265**			
PUMP CALIBRATION DATA							
Test n.	Throttle lever position	Speed	Advance	Transfer pressure	Unit delivery	Spread	Back leakage
		rpm	degrees	bar (kg/cm²)	cm³/200 shots	cm³/200 shots	cm³/100 shots
1 (1)	max	200	–	–	–	–	–
2 (2)		1000	–	–	–	–	–
3		100	–	0.3	–	–	–
4 (+)		750	–	–	–	–	–
5 (3) – 6		750	4.25÷4.50 (15)	3.4÷4.5	–	–	–
7 (4)		1000	5.75÷6.75 (16)	–	–	–	–
8 – 9		750	–	–	10.9÷11.1(*)	≤1	40÷90(°)
10 (5)		1250	–	–	–	–	–
11 (6)		1420	–	–	1.5÷2.0	–	–
12 (x)		1520	–	–	≤1.4	–	–
13 (7)		1250	–	–	–	–	–
14 (8)		250	2.75÷3.75(17)	–	–	–	–
15 (9)		200	0	–	≥14.0	–	–
16 (11)	min	325	–	–	2.0÷2.5	–	–
17 (10)		850	–	–	–	–	–
18 (12)		325	–	–	≤0.8	–	–
19 (13)		325	–	–	≤0.5	–	–
20 (14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Run pump for 3'.
3) Set pressure adjusting screw for specified advance and check that pressure corresponds.
4) Stop test machine, disconnect transfer pressure gauge and install shut–off device. Activate the latter and re–start test machine.
5) Record average delivery.
6) Adjust max. speed screw and lock it in position.
7) Delivery shall not be less than in test 10 by more than 0.4 cm^3/200 shots.
8) Prior to test, bring machine speed to 100 revs then stop it. Fully tighten release valve adjusting screw, start machine and slacken screw until reaching specified values.
9) Prior to test, bring machine speed to 100 revs then stop it and re–start it.
10) Adjust anti–stall screw for a delivery of 2 to 3 cm^3/2000 shots and then lock it in position.
11) Adjust idling speed screw.
12) Shut–off lever closed.
13) With shut–off device deactivated and shut–off lever open, await 5" before performing test.
14) Connect delivery fitting "U" to injector tester and maintain 54 bar (757 psi) pressure. Using timing tool, bring about hydraulic lock–up, then position pump timing plate at 8.75°.
15) 3.4÷3.6 mm (.136÷.144 in)
16) 4.6÷5.4 mm (.184÷.215 in)
17) 2.2÷3.0 mm (.088÷.120 in)
x) If delivery is more, adjust rod length at minimum (see above).
+) Inside pressure in pump housing, measured with a pressure gauge connected to the orifice in the drain screw, should read 0.1÷ 0.3 bar (kg/cm^2_–1.45÷ 4.35 psi).
*) Take reading after 15". °) Flow 300 ÷ 675 cm^3/min. (18÷ 40.5 in^3/min).

BENCH TEST PERFORMANCE DATA	
Fixed injection advance before T.D.C. at cylinder 1 in compression phase : (see page before). Engine without fan, air cleaner and exhaust silencer. Barometric pressure 740 ± 5 mm of Hg (at Turin altitude: 239 m – 785 ft. above sea level).	Relative humidity: 70% ± 5. Ambient temperature 20 ± 3° C. Fuel specific weight: 830 ± 10 g/liter.

Throttle	Brake load	Engine speed	Power output with engine run–in time of:		Fuel consumptioin
		rpm	2–hour total kW (metric HP)	50–hour total kW (metric HP)	kg/h
Maximum	For max power output	2500	≥ 40.4(55)	41.9 ÷ 44.1 (57 ÷ 60)	9.6 ÷ 10.1
Maximum	For max torque	1500	≥ 28.3 (38.5)	29.4 ÷ 31.6 (40 ÷ 42.5)	6.4 ÷ 6.8
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

FUEL SYSTEM MAIN DATA

BOSCH INJECTION SYSTEM	**VE 4/11 F 1250 L 164 – 1 – 4794589**
Engine	8045.06.208
Tractor	70V, 72F and 72LP
Power output	70 HP
Cylinders	4
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	3613 cm^3 (220.4 in^3)
Max. power torque	2500 rpm
Injector types :	
– W ALTECNA	4802391
– BOSCH	4792442
– C.A.V.	–
– OMAP	4800032
Nozzle holder types :	
– W ALTECNA	KBEL 83S 1W200–4802392
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	–
– OMAP	OKKL 83S 3392–4796664
Spray nozzle types :	
– W ALTECNA	DDL 124 S 500W–4802393
– BOSCH	DLLA 124S 1001–4792443
– C.A.V.	–
– OMAP	OOL124S 3990–4792447
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	230 ÷ 238 bar (235 ÷ 243 Kg/cm^2 – 3407 ÷ 3523 psi)
Delivery pipes	4797516
Pipe size	6 x 1.5 x 530 mm (.24 x .06 x 19 in)
Assembly data	
Sense of pump rotation (drive end)	counterclockwise
Firing order	1–3–4–2
Pumping element pre–lifting from B.D.C.	0.2 ± 0.02 mm (.008 ±.0008 in)
Pump setting on engine: commencement of delivery before T.D.C. at cylinder 1 in the compression phase **(*)**	$4^o \pm 1$
Pump delivery connection to cylinder 1	designated by the letter **A**.
Calibration test conditions	
Test bench complying with ISO 4008/1./2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901020 **(°)**
Test fluid ISO 4113	at the temperature of $40^o + 2^o$ ($104^o \pm 4^oF$)
Test glasses emptying time	30'
Note (*) Pumping element pre–lifting from B.D.C. for timing on engine (with 291754 and 291755 tools)	1 mm (.039 in)
Note (°) With button	1680103096

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

BOSCH INJECTION SYSTEM	VE 4/11 F 1250 L 164–1 – 4794589
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.2 (0.2 – 2.9)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2– 2537 ÷ 2581 psi)
Pipes (complying with ISO 4093 std.)	6 x 2 x 840 mm (.24 x .08 x 33.6 in)

ADJUSTMENT DATA						
Operation description	rpm	Advance piston stroke mm	Fuel pressure bar(kg/cm^2)	Unit delivery cm^3/1000 shots	Transfer bar (kg/cm^2)	Spread cm^3/1000 shots
Full load delivery	800	2.0 ÷ 2.4	3.8 ÷ 4.4	67 ÷ 68	0.2	3.5
Idle speed limit	350	–	–	21 ÷ 25	0.2	3
Starting delivery	150	–	–	100 ÷ 120	0.2	–
Full throttle limit	1350	–	–	30 ÷ 36	0.2	–

TEST DATA								
Advance device check	rpm	mm	Fuel pressure check	rpm	bar (Kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	600	0÷0.6	–	600	2.9÷3.5	–	–	–
	800	2.0÷2.4	–	800	3.8÷4.4	–	–	–
	1250	5.3÷6.1	–	1250	6.0÷6.6	–	–	–

DELIVERY CHECK							
Full throttle stop	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)	Idle speed shut–off	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)
	1400÷1460	0	0.2	–	475	≤2	0.2
	1350	30÷36	0.2	–	425	4÷10	0.2
	1250	60÷63	0.2	–	350	21÷25	0.2
	800	67÷68	0.2	–	–	–	–
	500	≤60	0.2	–	–	–	–

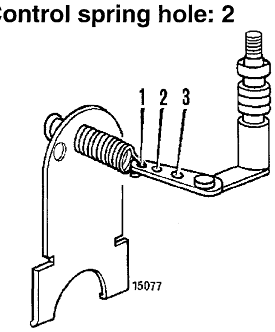
BENCH TEST PERFORMANCE DATA

Test conditions	
Fixed injection advance before T.D.C.at cylinder 1 in compression phase: (see page before).	Relative humidity: 70% ± 5
Engine without fan, air cleaner and exhaust silencer.	Ambient temperature 20 ± 3° C (68 ± 3° F)
Barometric pressure 740 + 5 mm Hg (at Turin altitude: 239 meters – 785 ft above sea level).	Fuel specific weight 830 ± 10 g/liter.

Throttle	Brale load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	50–hour total kW (metric HP)	Fuel consumption kg/h
Maximum	For max power output	2500	≥ 49.6 (67.5)	51.5 ÷ 53.7 (70 ÷ 73)	11.8 ÷ 12.3
Maximum	For max torque	1500	≥ 34.5 (47)	35.7 ÷ 37.9 (48.5 ÷ 51.5)	7.7 ÷ 8.2
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

C.A.V. INJECTION SYSTEM	**DPS 8250 A 791 A – 98459271**
Engine	8045.06.309
Tractor	70V, 72F and 72LP
Power output	70 (HP)
Cylinders	4
Stroke	115 mm (4.53 in)
Bore	100 mm (3.94 in)
Displacement	3613 cm^3 (220.39 in^3)
Max. power speed	2500 rpm
Injector type :	
– BOSCH	4824164
– C.A.V.	4817265
Nozzle holder type :	
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	4816070
Nozzle type :	
– BOSCH	DLLA 134S 1113–4824165
– C.A.V.	BDLL 134S 6860–4817266
Spray orifice diameter	0.31 mm (.012 in)
Number of spray holes	4
Pressure setting	260 ÷ 268 bar (265 ÷ 273 kg/cm^2 – 3842 ÷ 3958 psi)
Delivery pipes	4797522
Pipe size	6 x 2 x 530 (.24 x .06 x 21.2 in)
Assembly data	
Sense of pump rotation (drive end): counterclockwise	**Control spring hole: 2**
Firing order : 1–3–4–2	
Distance between governor bracket and metering pin: 40.45 ÷ 41.05 mm (1.618 ÷ 1.642 in)	
Pump timing on engine: commencement of delivery before T.D.C. at cylinder 1 in compression phase +0° –1°	
Flange centering guide diameter : 50mm	
Pump delivery connection corresponding to cylinder 1: designated by letter **U**	
Calibration test conditions	
Test bench complying with ISO 4008/1../2 standard	–
Injectors complying with ISO 7440 A 11 standard	–
Test fluid ISO 4113	at 40° ± 2° C (104° ± 4° F)
Test glass emptying time	30'
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.1 (1.45 psi)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2 – 3842 ÷ 3958 psi)
Pipes complying with ISO 4093/2 standards	6 x 2 x 845 mm (.24 x .08 x 33.8 in)
Projecting height of maximum delivery setscrew above its locknut surface	9 mm (.35 in)
Back off completely the transfer pressure set screw and then screw it in	3.5 revs
Position the release valve set screw just below its locknut surface	–
Back off completely the maximum, minimum and shut–off exclusion screws	–
The advance device, spring end, fits a 3 mm (.012 in) shim	no others required

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

C.A.V. INJECTION SYSTEM	DPS 8520 A 791 A – 98459271

PUMP CALIBRATION DATA

Test n.	Throttle lever position	Speed rpm	Advance degrees	Transfer pressure bar (kg/cm²)	Unit delivery cm³/200 shots	Spread cm³/200 shots	Back leakage cm³/100 shots
1 (1)		200	–	–	–	–	–
2 (2)		1000	–	–	–	–	–
3		100	–	0.3	–	–	–
4 (+)		900	–	–	–	–	–
5 (3) – 6		900	4.5 (15)	4.1÷5.4	–	–	–
7 (4)		1250	6.75÷7.75 (16)	–	–	–	–
8 – 9		750	–	–	9.1÷9.3(*)	≤1	40÷80(°)
10 (5)	max	1250	–	–	–	–	–
11 (6)		1420	–	–	1.5÷2.0	–	–
12 (x)		1520	–	–	≤1.4	–	–
13 (7)		1250	–	–	–	–	–
14 (8)		250	1.8÷2.8(17)	–	–	–	–
15 (9)		200	0	–	≥16.0	–	–
16 (11)		325	–	–	2.0÷2.5	–	–
17 (10)		850	–	–	–	–	–
18 (12)		325	–	–	≤0.8	–	–
19 (13)	min	325	–	–	≤0.5	–	–
20 (14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Run pump for 3'.
3) Set pressure adjusting screw for specified advance and check that pressure corresponds.
4) Stop test machine, disconnect transfer pressure gauge and install shut–off device. Activate the latter and re–start test machine.
5) Record average delivery.
6) Adjust max. speed screw and lock it in position.
7) Delivery shall not be less than in test 10 by more than 0.4 cm³/200 shots.
8) Prior to test, bring machine speed to 100 revs then stop it. Fully tighten release valve adjusting screw, start machine and slacken screw until reaching specified values.
9) Prior to test, bring machine speed to 100 revs then stop it and re–start it.
10) Adjust anti–stall screw for a delivery of 2 to 3 cm³/2000 shots and then lock it in position.
11) Adjust idling speed screw.
12) Shut–off lever closed.
13) With shut–off device deactivated and shut–off lever open, await 5" before performing test.
14) Connect delivery fitting "U" to injector tester and maintain 54 bar (757 psi) pressure. Using timing tool, bring about hydraulic lock–up, then position pump timing plate at 8.75°.
15) 3.6 mm (.144 in)
16) 5.4÷6.2 mm (.216÷.248 in)
17) 1.4÷2.2 mm (.056÷.088 in)
x) If delivery is more, adjust rod length at minimum (see above).
+) Inside pressure in pump housing, measured with a pressure gauge connected to the orifice in the drain screw, should read 0.1÷ 0.3 bar (kg/cm²_–1.45÷ 4.35 psi).
*) Take reading after 15". °) Flow 300 ÷ 600 cm³/min. (18÷ 40.5 in³/min).

BENCH TEST PERFORMANCE DATA

Fixed injection advance before T.D.C. at cylinder 1 in compression phase : (see page before). Engine without fan, air cleaner and exhaust silencer. Barometric pressure 740 ± 5 mm of Hg (at Turin altitude: 239 m – 785 ft. above sea level).	Relative humidity: 70% ± 5. Ambient temperature 20 ± 3° C. Fuel specific weight: 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	Power output with engine run–in time of: 50–hour total kW (metric HP)	Fuel consumptioin kg/h
Maximum	For max power output	2500	≥ 49.6(67.5)(o)	51.3 ÷ 53.7 (70 ÷ 73)	11.7 ÷ 12.2
Maximum	For max torque	1500	≥ 34.6 (47)(o)	35.7 ÷ 37.9 (48.5 ÷ 51.5)	7.7÷ 8.2
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

Note – (o) Expected values

Print No. ***603.54.283.00*** *– 09 – 1994*

FUEL SYSTEM MAIN DATA

BOSCH INJECTION SYSTEM	VE 4/11 F 1250 L 164 – 4794588
Engine	8045.05.208
Tractor	82F and 82LP
Power output	80 (HP)
Cylinders	4
Stroke	115 mm (4.53 in)
Bore	104 mm (4.16 mm)
Displacement	3908 cm^3 (238.38 in^3)
Max. power torque	2500 rpm
Injector types :	
– W ALTECNA	4802394
– BOSCH	4800029
– C.A.V.	–
– OMAP	4800031
Nozzle holder types :	
– W ALTECNA	KBEL 83S 1W200–4802392
– BOSCH	KBEL 83S 35–4791124
– C.A.V.	–
– OMAP	OKLL 83S 3392–4796644
Spray nozzle types :	
– W ALTECNA	DDL 136 S 501W – 4802395
– BOSCH	DLLA 136S 1000 – 4800030
– C.A.V.	–
– OMAP	OOL 136S 9119 – 4776715
Spray orifice diameter	0.35 mm (.014 in)
Number of spray holes	3
Pressure setting	230 ÷ 238 bar (235 ÷ 243 Kg/cm^2 – 3407 ÷ 3523 psi)
Delivery pipes	4797516
Pipe size	6 x 1.5 x 530 mm (.24 x .06 x 21.2 in)
Assembly data	
Sense of pump rotation (drive end)	counterclockwise
Firing order	1–3–4–2
Pumping element pre–lifting from B.D.C.	0.2 ± 0.02 mm (.008 ±.0008 in)
Pump setting on engine: commencement of delivery before T.D.C. at cylinder 1 in the compression phase **(*)**	$4^o \pm 1$
Pump delivery connection to cylinder 1	designated by the letter **A**.
Calibration test conditions	
Test bench complying with ISO 4008/1./2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901020 **(°)**
Test fluid ISO 4113	at the temperature of 40° ± 2° (104° ± 4°F)
Test glasses emptying time	30'
Note (*) Pumping element pre–lifting from B.D.C. for timing on engine (with 291754 and 291755 tools)	1 mm (.039 in)
Note (°) With button	1680103096

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

BOSCH INJECTION SYSTEM	VE 4/11 F 1250 L 164 – 4794588
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.2 (0.2 – 2.9)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2– 2537 ÷ 2581 psi)
Pipes (complying with ISO 4093 std.)	6 x 2 x 840 mm (.24 x .08 x 33.6 in)

ADJUSTMENT DATA

Operation description	rpm	Advance piston stroke mm	Fuel pressure bar(kg/cm^2)	Unit delivery cm^3/1000 shots	Transfer bar (kg/cm^2)	Spread cm^3/1000 shots
Full load delivery	800	3.8 ÷ 4.2	3.8 ÷ 4.4	71.5 ÷ 72.5	0.2	3.5
Idle speed limit	350	–	–	21 ÷ 25	0.2	3
Starting delivery	150	–	–	100 ÷ 120	0.2	–
Full throttle limit	1350	–	–	32 ÷ 38	0.2	–

TEST DATA

Advance device check	rpm	mm	Fuel pressure check	rpm	bar (Kg/cm^2)	Back leakage	rpm	cm^3/100 shots
	500	1.3÷2.0	–	500	2.3÷2.9	–	–	–
	800	3.8÷4.2	–	800	3.8÷4.4	–	–	–
	1250	7.6÷8.4	–	1250	5.7÷6.3	–	–	–

DELIVERY CHECK

Full throttle stop	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)	Idle speed shut–off	rpm	Delivery cm^3/1000 shots	Transfer pressure bar (kg/cm^2)
	1400÷1460	0	0.2	–	475	≤2	0.2
	1350	32÷38	0.2	–	425	4÷10	0.2
	1250	63.5÷66.5	0.2	–	350	21÷25	0.2
	800	71.5÷72.5	0.2	–	–	–	–
	250	≤65	0.2	–	–	–	–

BENCH TEST PERFORMANCE DATA

Test conditions

Fixed injection advance before T.D.C.at cylinder 1 in compression phase: (see page before).

Engine without fan, air cleaner and exhaust silencer.

Barometric pressure 740 + 5 mm Hg (at Turin altitude: 239 meters – 785 ft above sea level).

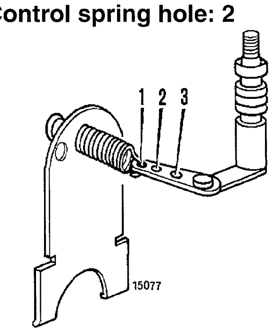
Relative humidity: 70% + 5

Ambient temperature 20 ± 3° C (68 ± 3° F)

Fuel specific weight 830 ± 10 g/liter.

Throttle	Brake load	Engine speed rpm	Power output with engine run–in time of: 2–hour total kW (metric HP)	50–hour total kW (metric HP)	Fuel consumption kg/h
Maximum	For max power output	2500	≥ 54.8 (74.5)	56.6 ÷ 58.8 (77 ÷ 80)	13.1 ÷ 13.6
Maximum	For max torque	1500	≥ 37.8 (51.5)	39 ÷ 41.2 (53 ÷ 56)	8.5÷ 9.0
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

FUEL SYSTEM MAIN DATA

C.A.V. INJECTION SYSTEM	**DPS 8520 A 400 A – 4829230**
Engine	8045.05.309
Tractor	82F and 82LP
Power output	80 (HP)
Cylinders	4
Stroke	115 mm (4.53 in)
Bore	104 mm (4.16 in)
Displacement	3908 cm^3 (238.38 in^3)
Max. power speed	2500 rpm
Injector type : – BOSCH	 4824170
Nozzle holder type : – BOSCH	 KBEL 83S 35–4791124
Nozzle type : – BOSCH	 DLLA 138S 1112 – 4824171
Spray orifice diameter	0.35 mm (.014 in)
Number of spray holes	3
Pressure setting	260 ÷ 268 bar (265 ÷ 273 kg/cm^2 – 3842 ÷ 3958 psi)
Delivery pipes	4797522
Pipe size	6 x 2 x 475 (.24 x .08 x 19 in)
Assembly data Sense of pump rotation (drive end): counterclockwise Firing order : 1–3–4–2 Distance between governor bracket and metering pin: 40.45 ÷ 41.05 mm (1.618 ÷ 1.642 in) Pump timing on engine: commencement of delivery before T.D.C. at cylinder 1 in compression phase 0° ± 1 Flange centering guide diameter : 50mm Pump delivery connection corresponding to cylinder 1: designated by letter **U**	**Control spring hole: 2** 
Calibration test conditions	
Test bench complying with ISO 4008/1../2 standard	–
Injectors complying with ISO 7440 A 11 standard	1688901000
Test fluid ISO 4113	at 40° ± 2° C (104° ± 4° F)
Test glass emptying time	30'
Fuel transfer pressure: bar (kg/cm^2 – psi)	0.1 (1.45 psi)
Injector pressure setting	172 ÷ 175 bar (175 ÷ 178 kg/cm^2 – 3842 ÷ 3958 psi)
Pipes complying with ISO 4093/1 standards	6 x 2 x 845 mm (.24 x .08 x 33.8 in)
Projecting height of maximum delivery setscrew above its locknut surface	9 mm (.35 in)
Back off completely the transfer pressure set screw and then screw it in	3.5 revs
Position the release valve set screw just below its locknut surface	–
Back off completely the maximum, minimum and shut–off exclusion screws	–
The advance device, spring end, fits a 2 mm (.08 in) shim	no others required

(continued)

Print No. **603.54.283.00** – 09 – 1994

(follows)

C.A.V. INJECTION SYSTEM				**DPS 8520 A 400 A – 4829230**			
PUMP CALIBRATION DATA							
Test n.	Throttle lever position	Speed	Advance	Transfer pressure	Unit delivery	Spread	Back leakage
		rpm	degrees	bar (kg/cm^2)	cm^3/200 shots	cm^3/200 shots	cm^3/100 shots
1 (1)	max	200	–	–	–	–	–
2 (2)		1000	–	–	–	–	–
3		100	–	≥ 0.3	–	–	–
4 (+)		900	–	–	–	–	–
5 (3) – 6		900	4.5 (15)	4.1÷5.4	–	–	–
7 (4)		1250	5.8÷6.8 (16)	–	–	–	–
8 – 9		750	–	–	10.1÷10.3(*)	≤1	40÷80(°)
10 (5)		1250	–	–	–	–	–
11 (6)		1420	–	–	1.5÷2.0	–	–
12 (x)		–	–	–	≤1.4	–	–
13 (7)		1250	–	–	–	–	–
14 (8)		350	1.8÷2.8	–	–	–	–
15 (9)		250	0	–	≥16.0	–	–
16 (10)	min	850	–	–	2.0÷2.5	–	–
17 (11)		325	–	–	–	–	–
18 (12)		325	–	–	≤0.8	–	–
19 (13)		325	–	–	≤0.5	–	–
20 (14)		–	–	–	–	–	–

1) Delivery to all injectors.
2) Run pump for 3'.
3) Set pressure adjusting screw for specified advance and check that pressure corresponds.
4) Stop test machine, disconnect transfer pressure gauge and install shut–off device. Activate the latter and re–start test machine.
5) Record average delivery.
6) Adjust max. speed screw and lock it in position.
7) Delivery shall not be less than in test 10 by more than 0.4 cm^3/200 shots.
8) Prior to test, bring machine speed to 100 revs then stop it. Fully tighten release valve adjusting screw, start machine and slacken screw until reaching specified values.
9) Prior to test, bring machine speed to 100 revs then stop it and re–start it.
10) Adjust anti–stall screw for a delivery of 2 to 3 cm^3/2000 shots and then lock it in position.
11) Adjust idling speed screw.
12) Shut–off lever closed.
13) With shut–off device deactivated and shut–off lever open, await 5" before performing test.
14) Connect delivery fitting "U" to injector tester and maintain 54 bar (757 psi) pressure. Using timing tool, bring about hydraulic lock–up, then position pump timing plate at 7.5°.
15) 3.6 mm (.0144 in)
16) 4.6÷5.4 mm (.184÷.216 in)

x) If delivery is more, adjust rod length at minimum (see above).
+) Inside pressure in pump housing, measured with a pressure gauge connected to the orifice in the drain screw, should read 0.1÷ 0.3 bar (kg/cm^2_–1.45÷ 4.35 psi).
*) Take reading after 15". °) Flow 300 ÷ 600 cm^3/min. (18÷ 40.5 in^3/min).

BENCH TEST PERFORMANCE DATA					
Fixed injection advance before T.D.C. at cylinder 1 in compression phase : (see page before). Engine without fan, air cleaner and exhaust silencer. Barometric pressure 740 ± 5 mm of Hg (at Turin altitude: 239 m – 785 ft. above sea level).			Relative humidity: 70% ± 5. Ambient temperature 20 ± 3° C. Fuel specific weight: 830 ± 10 g/liter.		
Throttle	Brake load	Engine speed	Power output with engine run–in time of:		Fuel consumptioin
			2–hour total	50–hour total	
		rpm	kW (metric HP)	kW (metric HP)	kg/h
Maximum	For max power output	2500	≥ 54.8(74.5)	56.6 ÷ 58.8 (77 ÷ 80)	13.1 ÷ 13.6
Maximum	For max torque	1500	≥ 37.8 (51.5)	39 ÷ 41.2 (53 ÷ 56)	8.5 ÷ 9.0
Maximum	None (idling)	2750÷2790	–	–	–
Minimum	None (idling)	625÷675	–	–	–

FUEL TRANSFER PUMP MAIN DATA	
Drive shaft out–of–round	3 mm (.12 in)
Drive shaft journal diameter	31.975 to 32.000 mm (1.2470 to 1.2480 in)
I.D. of bush bearings, press–fitted	32.050 to 32.075 mm(1.2499 to 1.2509 in)
Interference fit, bushes and housing bores	0.063 to 0.140 mm (.0024 to .0055 in)
Running fit, shaft journals and bushes	0.050 to 0.100 mm (.0019 to .0039 in)
Inner washer thickness	1.45 to 1.50 mm (.056 to .058 in)
Outer washer thickness	2.93 to 3.00 mm (.114 to .117 in)

Print No. ***603.54.283.00*** *– 09 – 1994*

ENGINE

Compression test (Op. 10 001 30)

In case of poor engine performance, in addition to the fuel injection system (injector nozzles and pump reconditioning), check compression at each cylinder also.

DANGER

Due to the presence of inflammable fluids, never use matches, cigarette lighters or torches as a source of lighting while working at the machine.

Compression level

The compression level is an indication of the volume of air aspirated by the engine and of the conditions of cylinder components assuring fluid tightness (piston rings and valves).

The uniformity of the compression level among cylinders assures their normal functioning, provided that the same quantity of fuel is injected in each cylinder.

A poor compression not only lowers engine efficiency but will not allow a complete combustion of fuel as the volume of air aspirated is insufficient to proper burning.

Thus the engine will not deliver the expected power and fuel consumption will be too high, with excessive smoke at the exhaust and reduction of the ejection orifices.

As the compression level also **depends on the engine temperature** level (lower compression with a cold engine, higher with a warm one), it should be measured when the engine has reached its operating temperature.

Test compression using the compression test special tool no. **291309/1**, as follows:

1) run the engine up to normal operating temperature;

2) shut the engine off;

3) disconnect the electrostop cable on the pump in order to close the electrovalve and, consequently, the flow of fuel to the injectors;

4) remove the injector corresponding to the cylinder to be tested;

5) crank the engine a few revs through the starter to expel any residual carbon contents;

6) install the test injector **293862** in place of the original one previously removed making sure to interpose the copper sealing washer;

7) connect the compression tester **291309/1** and crank engine through the starter to read compression values.

For an engine under perfect conditions of efficiency, the compression reading taken at a temperature of the oil in the engine sump of about 40°C (104°F), at an atmospheric pressure corresponding to that of sea level (760 mm of Hg) and at a cranking speed of 200/280 rpm should be comprised between 25.5 and 27.5 bar (26 and 28 kg/cm^2 or 377 and 406 psi).

8) Proceed and test compression on the other cylinders also, repeating operations 4–5–6–7, previously described, noting that:

The minimum permissible compression value for a worn engine is 21.6 bar (22 kg/cm^2 – 319 psi).

The permissible compression spread among cylinders of the same engine 3 bar (3 kg/cm^2 – 43.5 psi).

Besides, consider that each 100 meters of altitude (328 feet) above sea level compression will lower of 1%.

NOTES AND REMARKS

Normal compression level

Although the highest desirable levels of compression are usually looked for, the most important factor is the uniformity of compression among cylinders of the same engine as this will establish the normal performance of the engine.

Important compression losses

Should the compression reading in one cylinder shows a heavy loss, a second try is recommended.

Before measuring, pour about on spoonful of normal engine oil inside the cylinder through the injector seat bore.

Crank the engine a while to allow the oil to distribute uniformly over the cylinder inside surface, repeat the test and compare the two readings.

If the second test gives a higher value, the possibility is that piston rings are worn out, or that pistons and cylinder liners are out–of–round or damaged.

If, on the contrary, the second reading confirms the first one, then are the valves to be in a bad shape.
A slight improvement only, shown by the second reading with respect to the first, is an indication of both valves and piston rings being out of order.

*Print No. **603.54.283.00** – 09 – 1994*

ENGINE TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Engine will not start	**1.** Low battery output.	Check, charge batteries and replace them if necessary.
	2. Corroded or loose battery connections.	Clean, inspect and tighten loose connections and replace them if necessary.
	3. Incorrect injection pump/engine timing.	Adjust pump/engine timing.
	4. Water or impurities in fuel lines.	Remove fuel lines and injection pump and clean them thoroughly; if necessary clean and dry the fuel tank.
	5. Empty fuel tank.	Refill.
	6. Starved injection pump.	Check fuel transfer pump and replace it if necessary.
	7. Air in fuel system.	Check fuel lines, connections, transfer pump, filters and injection pump for air inside; finally, bleed the system.
	8. Damaged starting motor.	Service or replace starter.
	9. Malfunctioning thermostat.	Check or replace the auxiliary starting device.
Engine stalls	**1.** Low idle speed too low.	Adjust low idling speed.
	2. Erratic injection pump fuel delivery.	Check pump performance on test machine.
	3. Water or impurities in fuel lines.	Remove fuel lines and injection pump and clean them thoroughly; if necessary, clean and dry the fuel tank.
	4. Clogged fuel filters.	Replace filter cartridges.
	5. Incorrect valve clearance.	Adjust valve clearance.
	6. Burnt or cracked valves.	Replace valves.
	7. Air in fuel system.	Check fuel lines, connections, transfer pump filters and injection pump for air inside; finally, bleed the system.
	8. Damaged injection pump controls.	Replace damaged parts.

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

ENGINE TROUBLESHOOTING GUIDE

(follows)

Problem	Possible cause	Correction
Engine overheats	**1.** Malfunctioning cooling system vane–type pump.	Recondition the pump or replace it if necessary.
	2. Malfunctioning thermostat.	Replace thermostat.
	3. Partially plugged radiator.	Wash out any scale, search for leaks and in case repair tubelets.
	4. Scales in cylinder head and crankcase coolant ducts.	Wash and clean thoroughly.
	5. Low tension of the belt and water pump drive belt.	Check and adjust belt tension.
	6. Coolant (quantity insufficient).	Top up expansion tank using designated type of coolant.
	7. Incorrect engine timing.	Check and adjust engine timing.
	8. Misadjusted injection pump (in excess or in defect).	Adjust injection pump on test machine complying with calibration chart data.
	9. Clogged air cleaner.	Clean it and replace filtering element if necessary.
Engine does not develop full power and operates erratically	**1.** Incorrect injection pump/engine timing.	Adjust injection/pump engine timing.
	2. Damaged automatic advance variator, in injection pump.	Recondition the pump and adjust it on test machine complying with the calibration chart data.
	3. Worn distributor shaft.	Recondition the pump and adjust it on test machine complying with the calibration chart data.
	4. Erratic injection pump fuel delivery.	Recondition the pump and adjust it on test machine complying with the calibration chart data.
	5. Damaged all–speed governor.	Recondition the pump and adjust it on test machine complying with the calibration chart data.
	6. Partially plugged or damaged injectors.	Clean, recondition and adjust the injector pressure setting.
	7. Water or impurities in fuel lines.	Remove fuel lines and injection pump and clean them thoroughly; clean and dry fuel tank if necessary.

(continued)

Print No. **603.54.283.00** – 09 – 1994

ENGINE TROUBLESHOOTING GUIDE

(follows)

Problem	Possible cause	Correction
	8. Damaged fuel transfer pump.	Replace fuel transfer pump.
	9. Incorrect valve clearance.	Adjust valve clearance.
	10. Low engine compression.	Check compression level and recondition engine if necessary.
	11. Clogged air cleaner.	Clean it and replace filtering element if necessary.
	12. Misadjusted throttle rod length.	Adjust rod length.
	13. Misadjusted high speed set screw on injection pump.	Adjust high idle speed set screw.
Engine knocks	**1.** Partially plugged or damaged injectors.	Clean, recondition and adjust injector pressure setting.
	2. Impurities in fuel lines.	Clean fuel lines and replace heavily dented ones; clean injection pump if necessary.
	3. Incorrect injection pump/engine timing.	Adjust injection pump/engine timing.
	4. Crankshaft knocking due to excessive clearance at one or more main or connecting rod bearings or end play.	Re–grind crankshaft journals, fit over-size bush and thrust bearings.
	5. Unbalanced crankshaft.	Check crankshaft alignment and bal-ancing, replace it if necessary.
	6. Loose flywheel screws.	Replace loose screws and tighten all screws to specification torque + angle.
	7. Misaligned connecting rods.	Straighten connecting rods, check parallelism on center lines and replace them if necessary.
	8. Piston knocking due to excessive wear.	Re–bore cylinder liners and fit over-size pistons.
	9. Noisy piston pins due to excess-ive play in hubs and in connecting rod bushing. Loose bushings inside connecting rod housing bore.	Replace piston pin fitting a new, over-sized one, re–bore seats in piston and connecting rod bushings. Replace bushings with new parts.
	10. Noisy engine timing.	Inspect for broken springs, excessive valve stem and guide clearance; adjust valve clearance.

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

ENGINE TROUBLESHOOTING GUIDE

(follows)

Problem	Possible cause	Correction
Excessive engine smoke: black or dark grey.	**1.** Excessive pump output.	Adjust injection pump on test machine complying with the calibration chart data.
	2. Retarded pump or damaged automatic advance variator.	Adjust injection pump/engine timing or check the automatic advance variator.
	3. Avance timing of pump is excessive.	Adjust injection pump/engine timing.
	4. Partially and/or totally plugged or misadjusted injectors.	Clean, recondition and adjust injector pressure setting; replace if necessary.
	5. Clogged air cleaner.	Clean it and replace filtering element if necessary.
	6. Loss of engine compression due to: – stuck piston rings; – cylinder liner wear; – deteriorated or incorrectly adjusted valves.	Replace damaged parts or recondition the engine if necessary.
	7. Damaged fuel high pressure lines.	Inspect pressure lines and replace them if necessary.
Blue, grey–blue or grey tending to white	**1.** Retarded pump or damaged automatic advance variator.	Adjust injection pump/engine timing or check the automatic advance variator.
	2. Plugged or damaged injectors.	Clean, recondition and adjust injector pressure setting; replace them if necessary.
	3. Oil leaking past piston rings due to stuck rings or cylinder liner wear.	Replace damaged parts or recondition engine if necessary.
	4. Oil leaking through the intake valve guides due to guide or valve stem wear.	Recondition cylinder head.
	5. Low engine operating temperature (malfunctioning thermostat).	Replace thermostat.
Engine won't stop	**1.** Damaged shut–off solenoid.	Replace solenoid.
	2. Damaged all–speed governor.	Recondition injection pump and adjust it on test machine complying with the calibration chart data.

Print No. ***603.54.283.00*** *– 09 – 1994*

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **(X)**.

Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

List of the special tools necessary to carry on the service operations concerning this section of the Manual.

X	**292320**	Rotary stand for tractor disassembly.
	290740/1	Engine lift hook.
	290090	Rotary stand for engine overhauling.
	293860	Bracket set, use with **290090** rotary stand.
X	**291309/1**	Compression tester kit (with **293862** test injector).
	291966	Digital revolution counter.
	291979	Temperature gauge.
	292870	Lube oil pressure gauge kit.
	293679	Remover, cartridge filter.
X	**296118**	Fan belt tension checking device.
X	**291160**	Pliers, piston rings **(IVECO 99360183)**.
X	**291048**	Band–type installer, pistons **(IVECO 99360605).**
X	**292248**	Gauge, angular tightening **(IVECO 99395202).**
X	**291504**	Puller, crankshaft pulley hub.
X	**293329**	Replacer, front crankshaft seal (with **293709**) **(IVECO 99370349).**
X	**293299**	Replacer, rear crankshaft seal (with**293708**) (**IVECO 99360365**).
X	**293708**	Handle **(IVECO 9937006).**
X	**293709**	Handle **(IVECO 99370007).**
X	**291883**	Adjuster, valve rocker arms **(IVECO 99350108)..**
X	**291046/1**	Remover/installer, valve guides.
X	**294027**	Twist drill, valve guide housing re–boring.
X	**294028**	Milling tool, exhaust valve guide 8° taper milling.
X	**293231**	Installer, intake and exhaust valve guides (with **291046/1**) (**IVECO 99360923**).
X	**291177**	Reamer, valve guides (**IVECO 99390310**).
X	**291050**	Remover/installer, valve springs (**IVECO 99360357**).
X	**293270**	Milling kit, injector housing re–boring – Use: **292240** M12x1.75 tap, injector sleeve; **292243** burr remover, injector sleeve from cylinder head; **293784** puller, injector sleeve; **293861** burnisher, injector sle **293746/1** pilot bushing; **293747** reamer; **293790/1** milling tool.
	294006	Lathe, universal, valve seat re–boring.
X	**291182/1**	Puller, water pump impeller.
X	**293280**	Installer, water pump impeller seal.
	293786	Wrench, injection pump pressure connections.
	293671	Cleaning kit, injectors.
X	**293760**	Stand, injector disassembly (BOSCH–CAV–OMAP).
X	**293761**	Wrench set, injector disassembly.
	290284	Hand pump, injector test, with container and connection kit.
	293830	Adapter, injector removal (with**292927**).
	290064	Air–operated valve grinder.

*Print No. **603.54.283.00** – 09 – 1994*

Injection pump bench testing equipment

	291754	Comparator gauge (1/100 mm, 5 mm stroke, 40 mm dia., with **291755**).
	291755	Gauge, BOSCH pump installation.
X	**292411**	Installation device, C.A.V. pump.

*Print No. **603.54.283.00** – 09 – 1994*

ENGINE
Removal – Installation (Op. 10 001 10)

To remove the engine, first separate it from the front axle or live axle and from the transmission.

DANGER

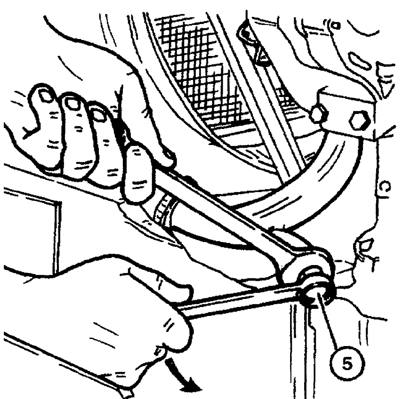
Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

Proceed as follows:

1. Lift up the tractor hood.

2. Disconnect positive cable from battery and insulate it.

3. Undo the cooling system radiator plug.



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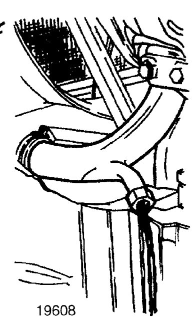
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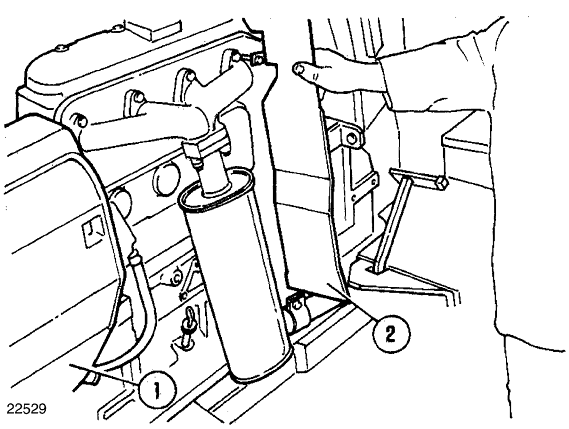
4. Undo the drain pipe plug (5) and drain system.



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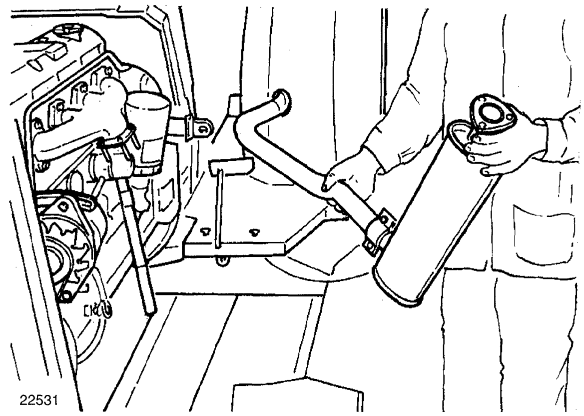
5. Undo holding screws and remove the rear heat shield (2) placed near the exhaust muffler.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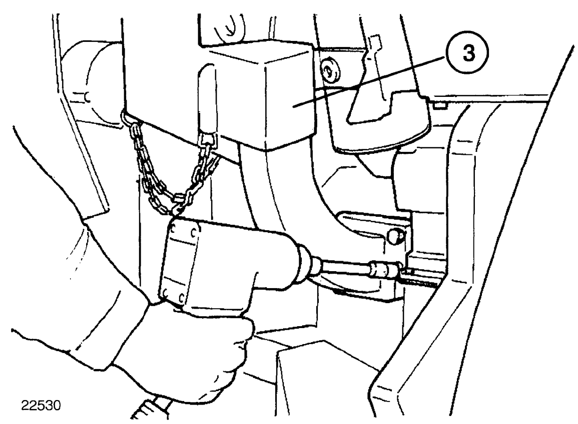
6. Undo the holding screws and remove the exhaust muffler with pipe.

7. Sling up the upper safety frame to a suitable lifting equipment, undo the two holding screws and pull it off its supports, both on the right– and left–hand side.



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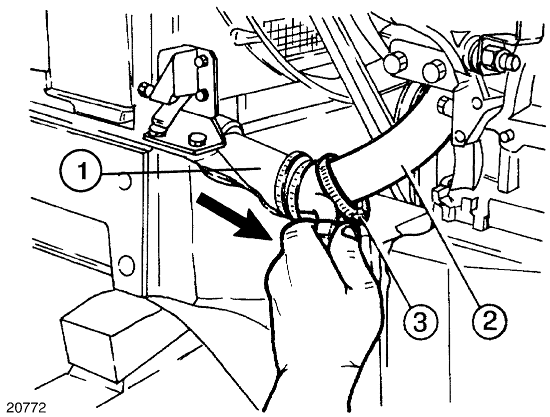
8. Undo holding screws and remove the safety frame supports (3) from both sides of the tractor.

9. Undo holding screws and remove both fan protection grilles, right–hand and left–hand side.

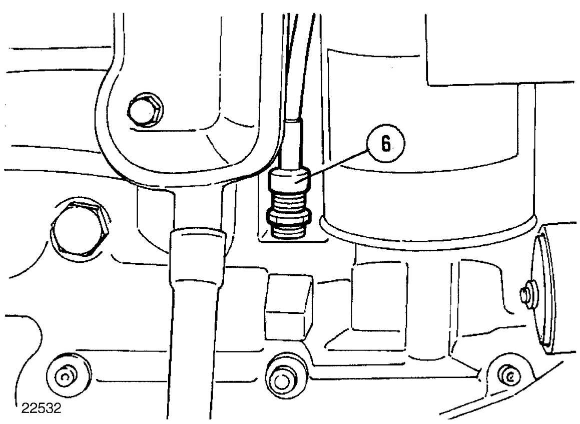
Print No. **603.54.283.00** – 09 – 1994

10. Undo band clamps and slide off the upper hose connecting radiator–thermostat and water pump.

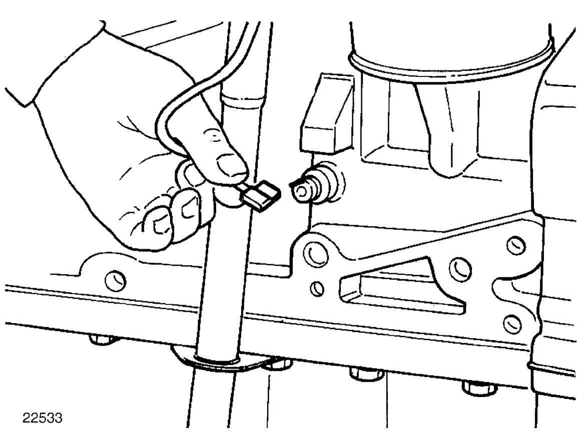


11. Undo band clamps on radiator side and slide off the lower hose (1) connecting radiator and pipe (2).

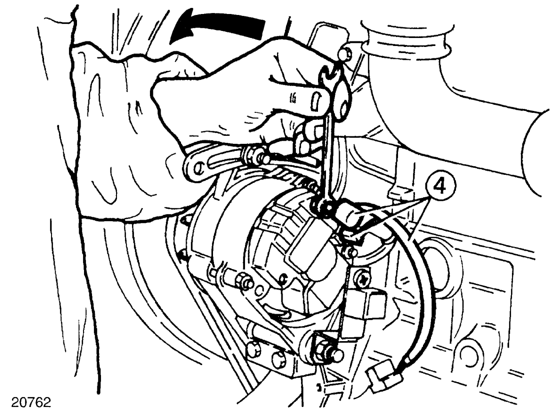
12. Undo the band clamp holding the upper hose (3) and remove the pipe (2) connecting radiator and water pump.



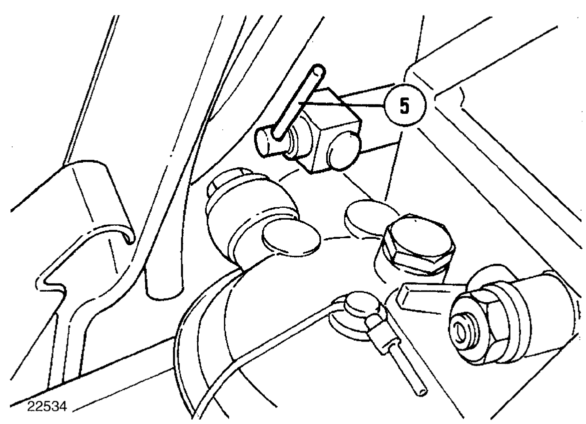
13. Unscrew retaining ring nut (6) and retrieve the seal and tachometer cable.



14. Detach the low lube oil pressure connection.



15. Detach electrical connections from the alternator.



16. Turn off the fuel tap (5) which is installed underneath the dashboard (engine side).

17. Undo the band clamp and remove the injector leak-back pipe.

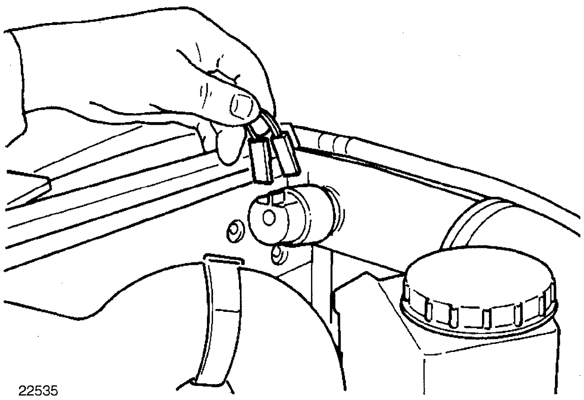
18. Undo the band clamp and remove the fuel delivery pipe to the injection pump.

19. Undo the front and rear holding clips and free the throttle rod end by sliding the latter off its bracket.

20. Remove the bracket supporting both the hand throttle cable and foot throttle pedal control rod.

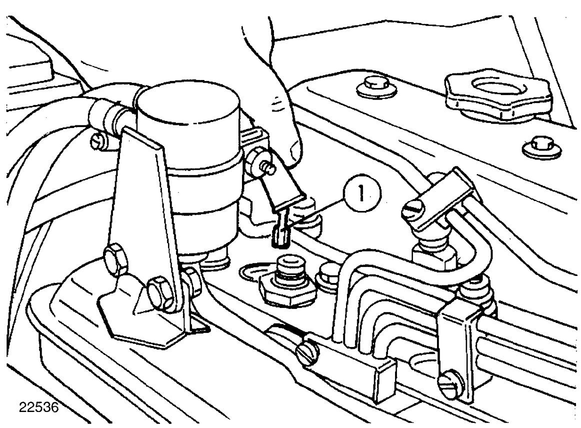
21. Detach the headlamp and turn signal electrical connections.

Print No. 603.54.283.00 – 09 – 1994



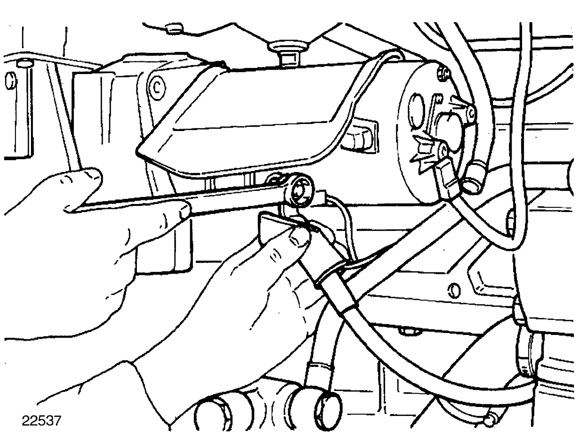
22535

22. Detach both clogged air filter and thermostarter warning light connections.



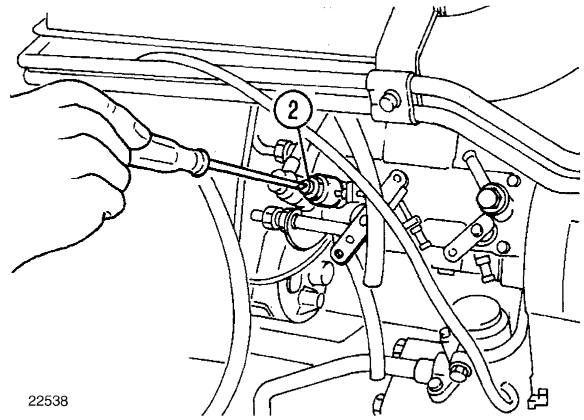
22536

23. Disconnect the cooling liquid temperature gauge connection (1).



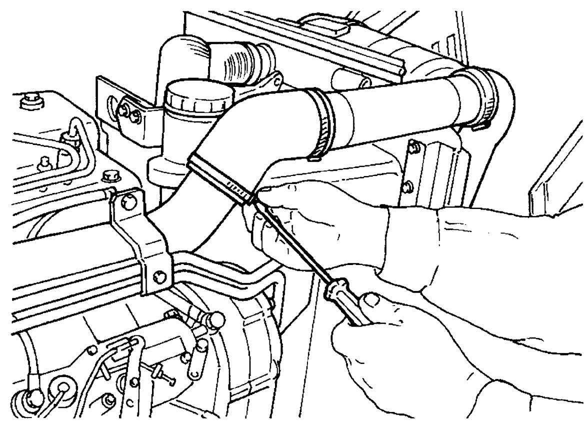
22537

24. Detach the electrical connection from the starter.



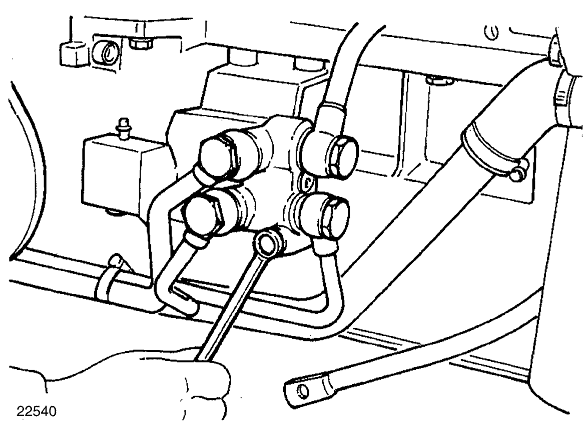
22538

25. Detach the C.A.V. pump shut–off solenoid connection (2).



22539

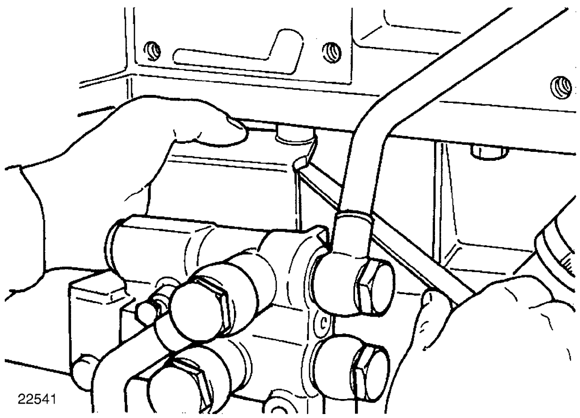
26. Undo end clamps, slide off the rubber hose together with the inlet duct connecting to the air cleaner.



22540

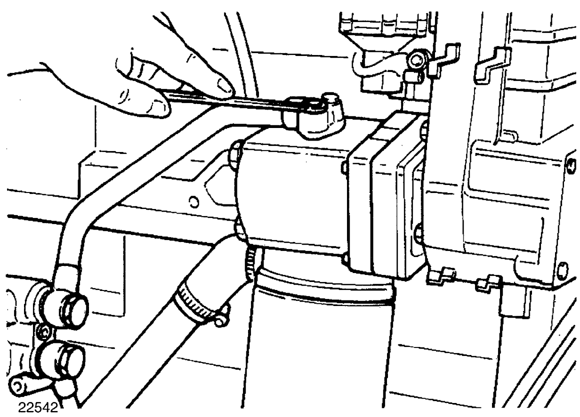
27. Remove screws securing the trailer brake valve–hydraulic lift to supporting bracket.

Print No. **603.54.283.00** – 09 – 1994



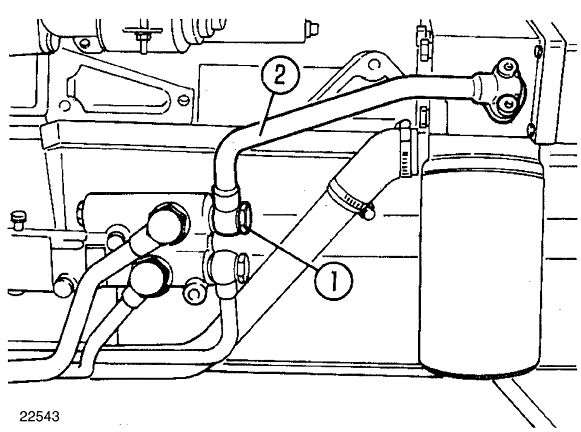
22541

28. Undo holding screws and remove the trailer brake valve support.



22542

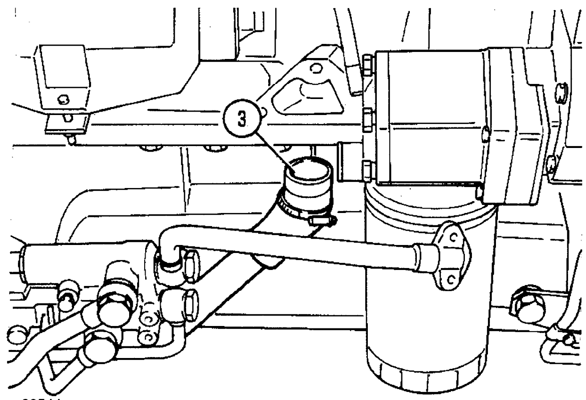
29. Remove the screws securing the pump delivery pipe to the trailer brake valve.



22543

30. Slacken off the delivery connection (1) installed on the trailer brake valve– hydraulic lift, turn pipe (2) outwards to prevent interference when removing the engine and tighten connection (1) back on again to prevent oil from coming out.

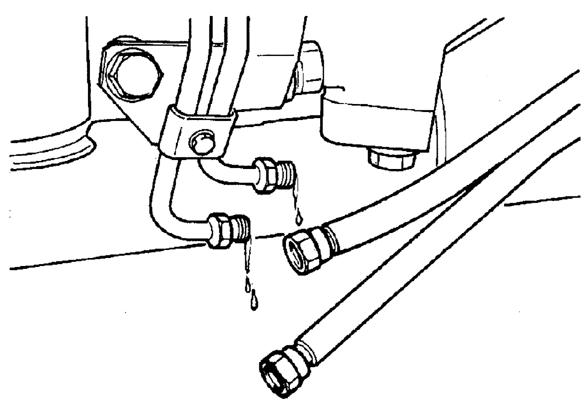
Note: plug up both pipe and connecting hole on pump to prevent entry of foreign matter.



22544

31. Loosen band clamps and free the rubber hose (3) connecting pipe and hydraulic lift oil filter rotating it by hand as illustrated in the figure above.

Note: plug up both hose and connecting hole on filter to prevent entry of foreign matter.

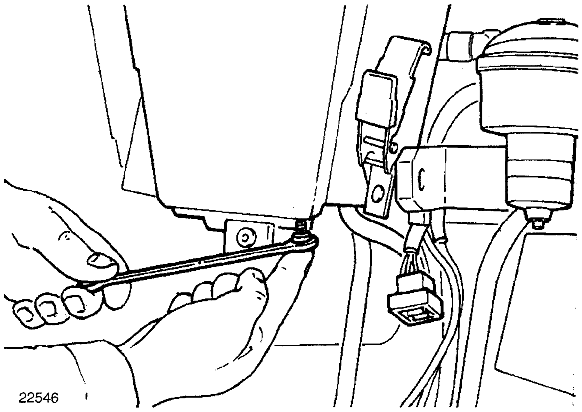


22545

32. Disconnect the flexible hoses connecting hydraulic steering with the front live axle ram and recover the oil which will be draining from the hydraulic steering reservoir.

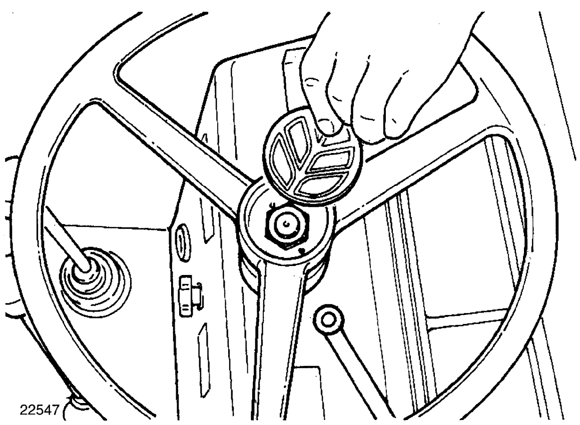
To remove the hydraulic steering piping and the safety frame reinforcing mounting, both installed under the tractor cowling, proceed as follows:

Print No. **603.54.283.00** – 09 – 1994



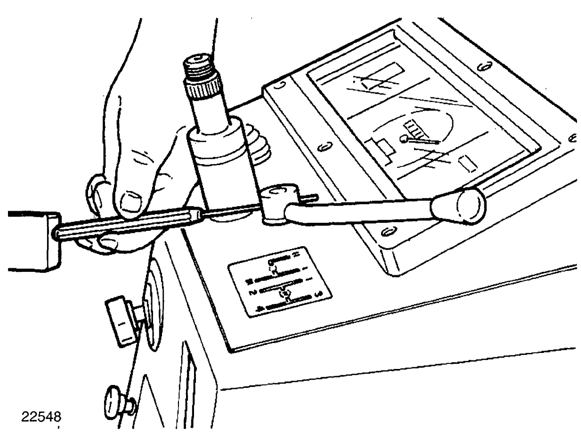
22546

33. Remove the screws securing the instrument panel to its mounting support.



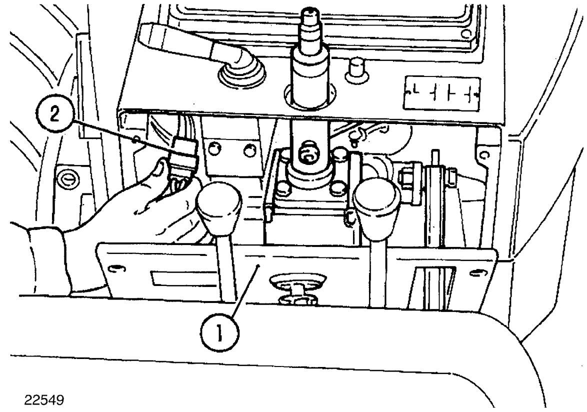
22547

34. Remove the steering wheel center hub cover, lock nut, wheel and the rubber booth underneath.



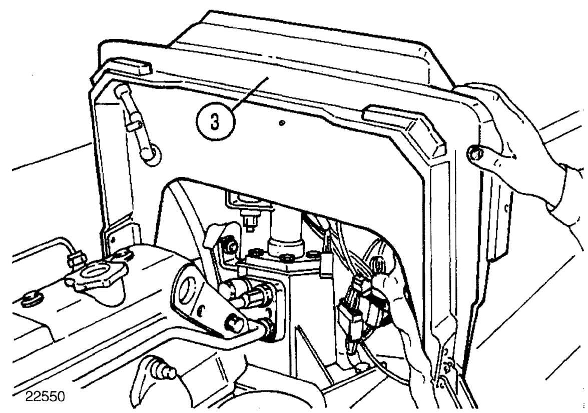
22548

35. Remove the cotter pin and hand throttle lever.



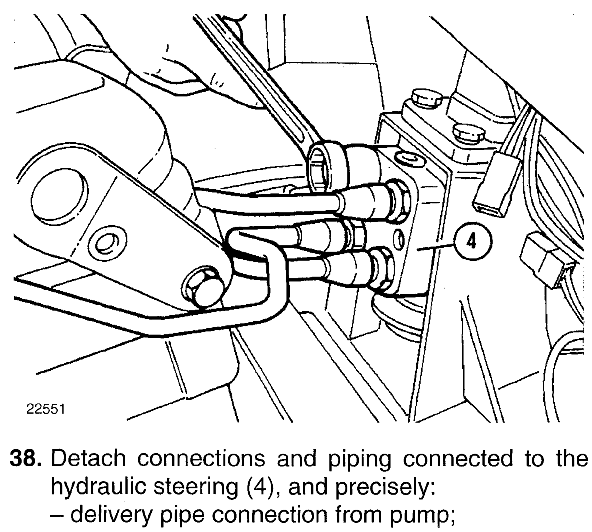
22549

36. Undo holding screws and remove the dashboard cover (1) and electrical connections (2) of the lights, turn signals and horn.



22550

37. Lift up and move towards the tractor seat the instrument panel (3) with cable harness which will ease the subsequent steps for engine removal.

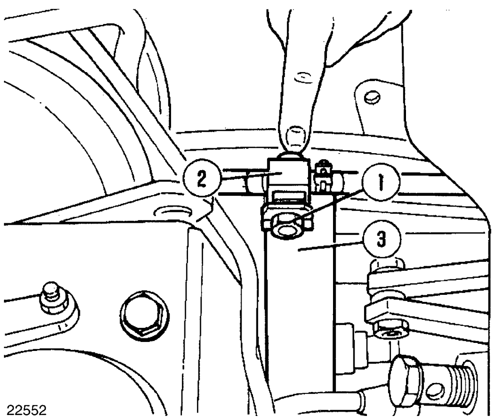


22551

38. Detach connections and piping connected to the hydraulic steering (4), and precisely:
– delivery pipe connection from pump;
– delivery pipe connections to hydraulic cylinder installed on live front axle;
– backleakage line connection to oil reservoir.

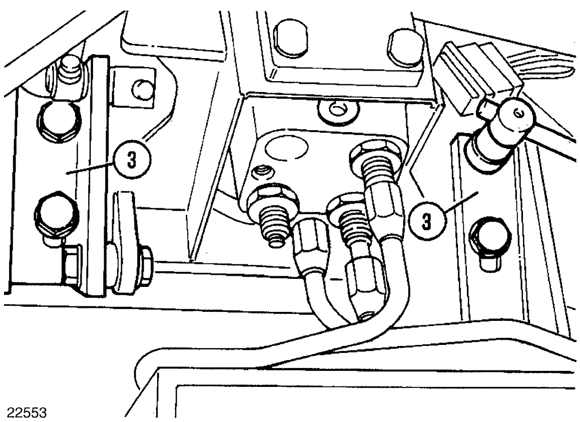
Note – Plug up all open holes to prevent entry of foreign matter.

Print No. ***603.54.283.00*** *– 09 – 1994*



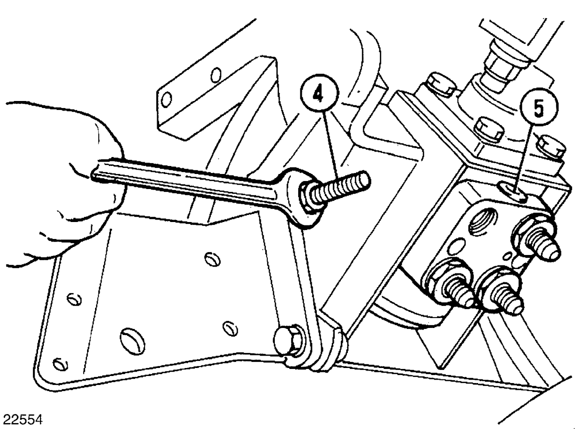
22552

39. Undo locknut (1) and disconnect fuel tap (2) from the safety frame brackets (3).



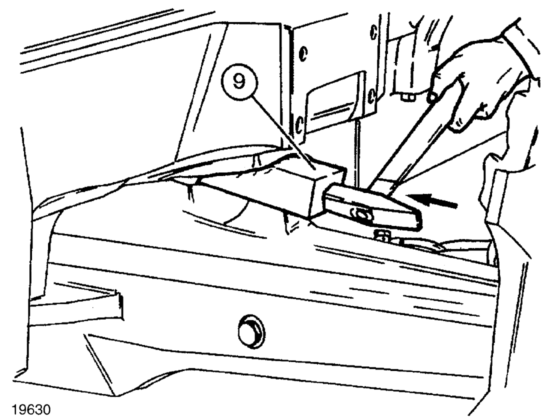
22553

40. Undo holding screws and remove the safety frame reinforcing brackets (3).



22554

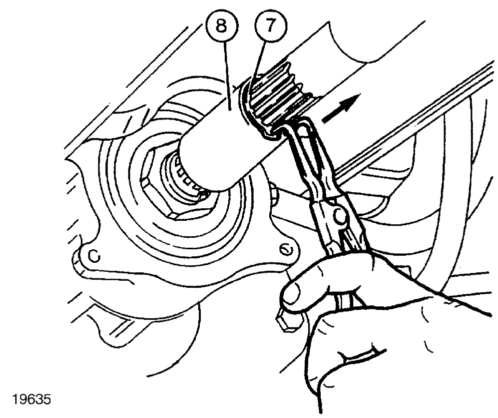
41. Remove the power take–off control rod (4) adjustment nut then free and move the hydraulic steering unit (5) towards the tractor seat to get to the engine–transmission housing attachment screws.



19630

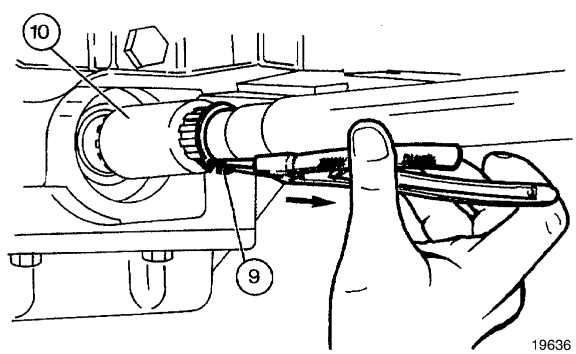
42. Block up the engine with respect to the front or live axle by placing wooden wedge blocks (9) (one each side) as shown in the figure.

43. Undo the front, central and rear holding screws and then remove the front live axle drive shaft protection.



19635

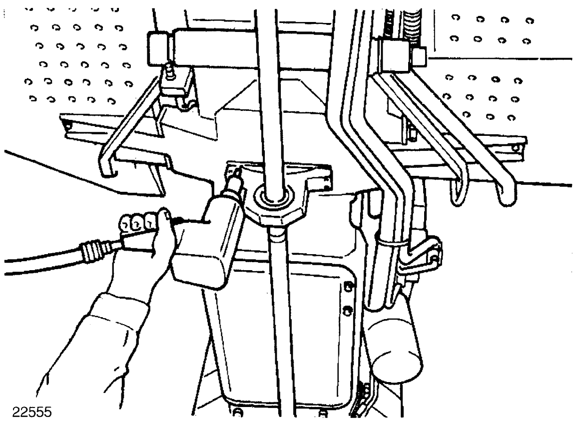
44. Remove circlip (7) and move sleeve (8) in the direction shown by the arrow in the figure so as to free it from the splined section on front live axle end.



19636

45. Remove circlip (8) and move sleeve (10), as shown by the arrow in the figure, so as to free it from the splined section on drive box end.

Print No. ***603.54.283.00*** *– 09 – 1994*



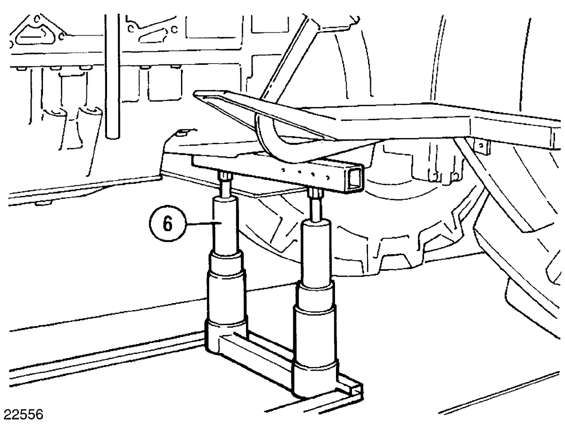
22555

46. Undo the two holding screws and then remove the propeller shaft supporting bracket from live front axle.

47. Recover the propeller shaft and support.

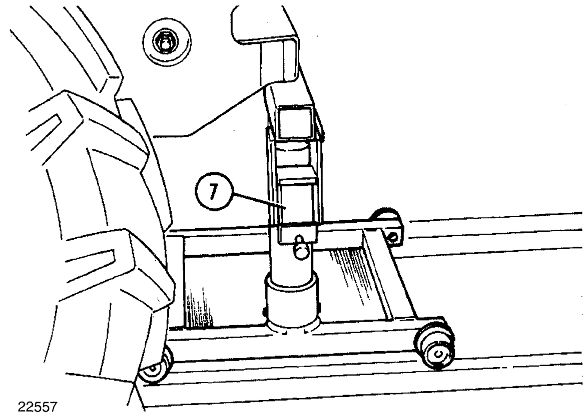
Note 1. – Operations numbered from 27 through 31 only apply to tractors equipped with trailer brake remote control valve.

Note 2. – Operations numbered from 43 through 47 apply to 4WD tractors only.



22556

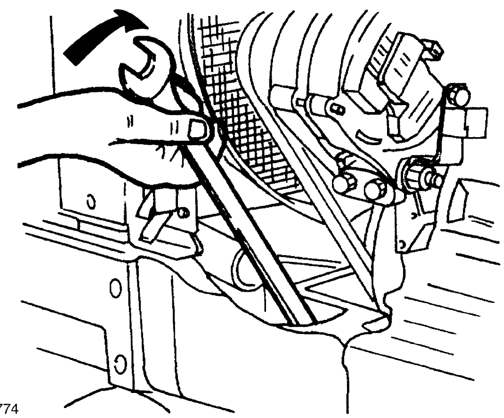
48. Place the **292320** (6) tractor disassembly stand in position by placing the **(292646)** fixed stands underneath the transmission housing near the flange for engine attachment, as shown in the figure.



22557

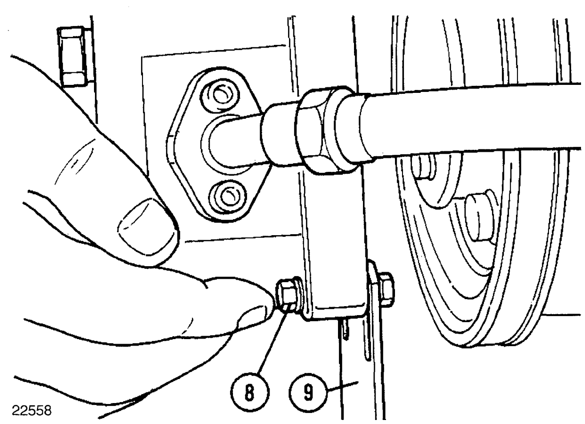
49. Hook up the **292645** mobile stand (7) underneath the front ballast weights, in order to prevent any possibility of front tipping movement of the live front axle during engine removal, operation 51.

50. Sling up the engine to hoist using specified steel lift eyes and the **290740/1** chains and just stretch the latter under load.



20774

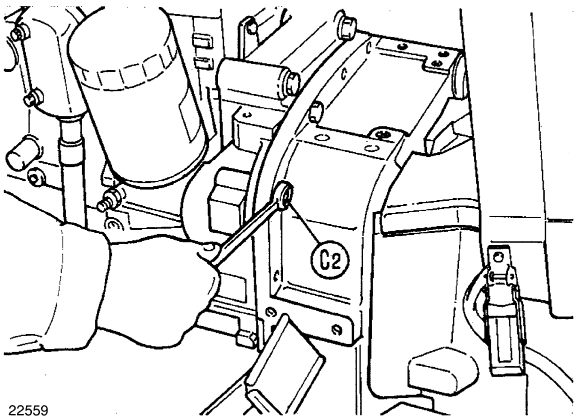
51. Remove the four screws attaching the engine to the front or live axle (two on each side).



22558

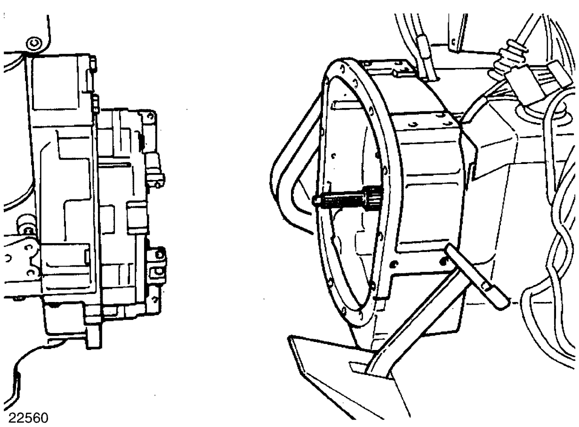
52. Slacken screws (8) securing the hydraulic steering restrainer plate and move upowards the slotted plate (9).

53. Move live front axle away from engine.



22559

54. Lock rear wheels by pulling the hand brake and placing wooden wedge blocks under both wheels and then remove the engine–transmission attachment flange screws (C_2).



22560

55. Separate carefully the engine from the transmission case making sure that it moves freely without cathing anywhere.

ENGINE INSTALLATION

56. Re–install the engine as follows:

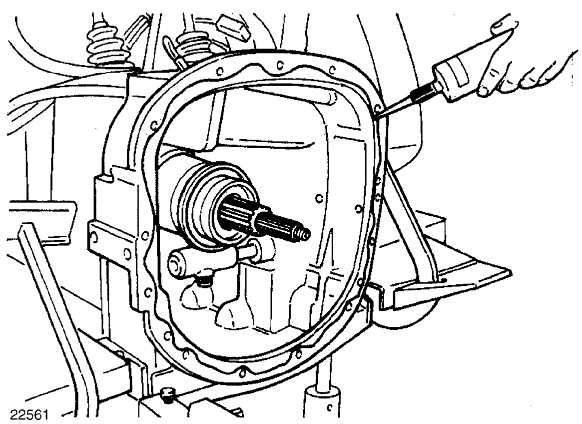
a. reverse the sequence of removal operations starting from no. 55 back to no. 1;

b. make sure to tighten fastenings at the torque tightening specifications of page 10–8;

c. smear **TUTELA G9** grease over the clutch disc hub splines;

d. temporarily fit the two **292888** pilot pins to ease alignment during the repositioning of engine and transmission case attachment also making sure that both move freely without catching.

e. prior to engine attachment to transmission case, clean and degrease carefully the mating surfaces and then apply an indicatevely 2 mm (.08) dia. seam of sealing compound following the tracing shown in the figure.



22561

Sealing compound application prior to re–attachment of engine to transmission case

The types of sealing compounds suitable for use are given on page 00–1.

CLUTCH REMOVAL

Note: operation 55 terminates the separation of the engine from the transmission case.

To work at best during engine disassembly, described on the following pages, requires removing the clutch which is fitted on the engine flywheel.

To remove the clutch, proceed as indicated in operations 14, 15 and 16, page 18 – 10.

Print No. 603.54.283.00 – 09 – 1994

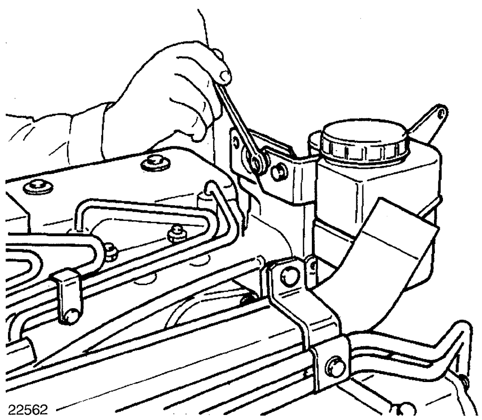
ENGINE

Disassembly – Assembly (Op.10 001 54)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

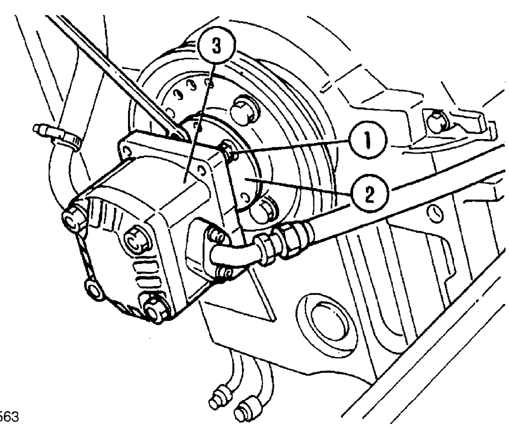
In order to install the **293860** supporting bracket and then the engine on the **290090** rotary stand, proceed as follows:



22562

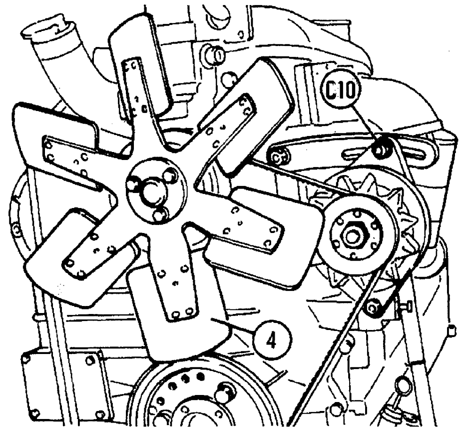
1. Undo the two holding screws and remove the hydraulic steering oil reservoir together with supporting bracket and pipe connecting it to the pump.

2. Undo the holding screws and remove the pump–hydraulic steering unit oil delivery pipe.



22563

3. Remove the holding screws (1), drive coupling (2) and oil pump (3) together with its piping connecting it to the oil reservoir and hydraulic steering unit.



22564

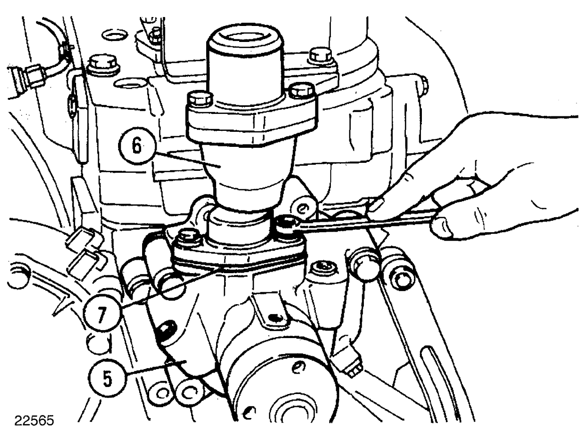
4. Slacken the alternator and belt tightener holding nuts (**C_{10}**).

5. Move away alternator and belt tightener and remove belt.

6. Remove holding screws and then the fan (4) and its drive belt.

7. Remove the belt tightener rod attachment screw.

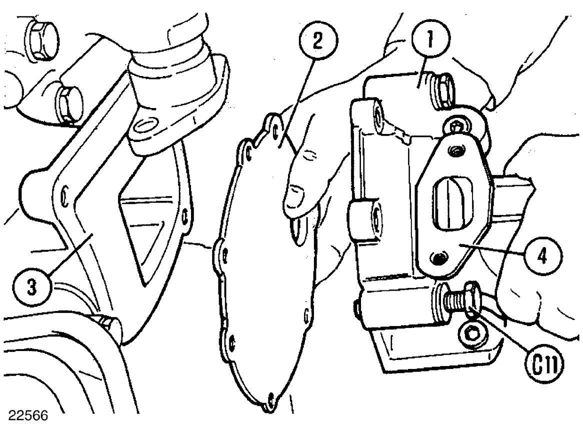
8. Undo holding screws and remove the mounting bracket complete of alternator.



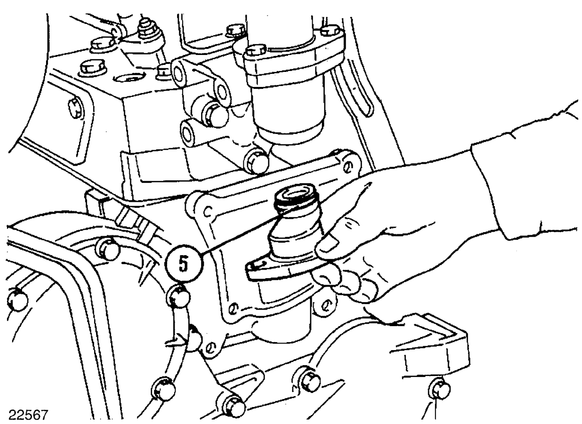
22565

9. Undo the screws securing the pump (5) connection to the thermostat (6) and then remove gasket (7).

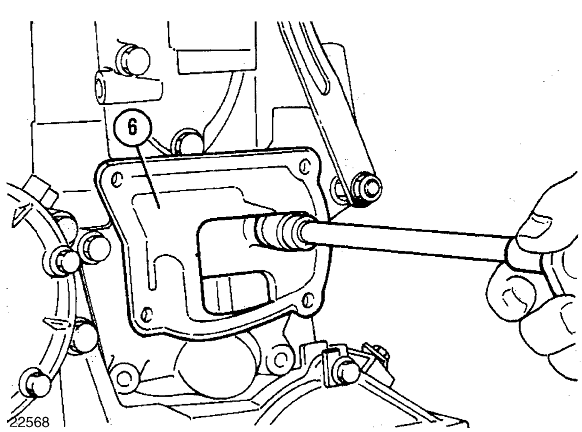
Print No. **603.54.283.00** – 09 – 1994



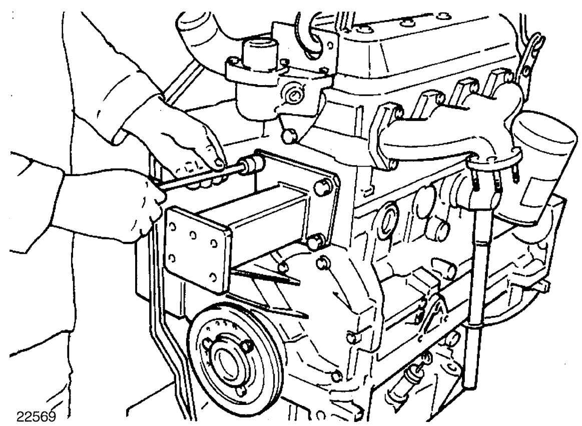
10. Undo the holding screws (C_{11}), pump (1) and cooling plant cover (2). If the pump sticks and will not come off, use a plastic mallet to remove it and then remove its gasket (3) and pipe flange gasket (4).



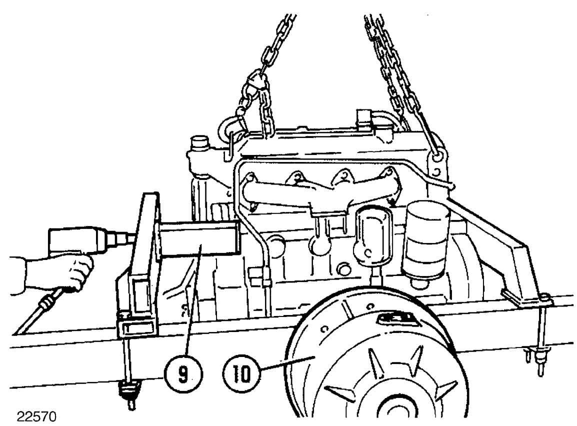
11. Retrieve the cooling plant–thermostat pump connection together with O–ring seal (5).



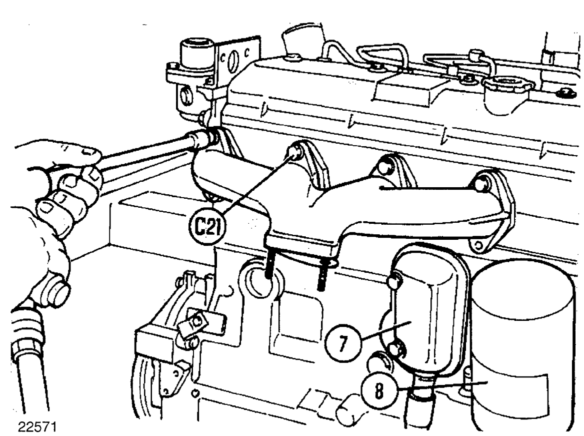
12. Undo holding screws and remove pump spacer (6) and gasket.



13. Install the series **293860** engine mounting bracket on the **29090** rotary stand.



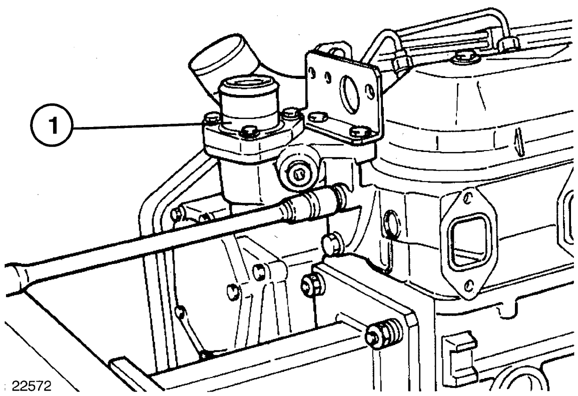
14. Use a suitable hoist and the special **290740/1** hook to sling and lift up the engine from the wooden shop floor platform, transport it, install it and finally secure it on the **290090** rotary stand (10) by means of the **293860** series bracket (9).



15. Undo holding screws (C_{21}), remove the exhaust manifold and recover the metallic gaskets.

Print No. ***603.54.283.00*** *– 09 – 1994*

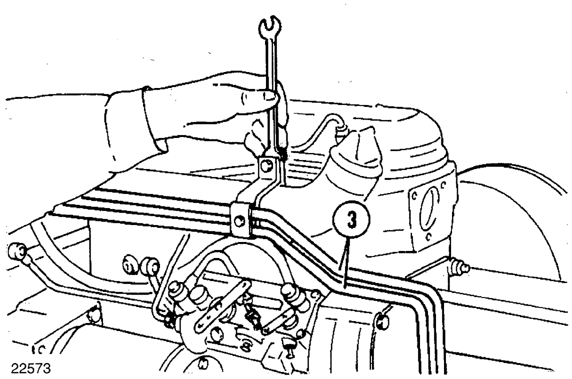
16. Undo the engine sump plug and drain the oil into a pan.



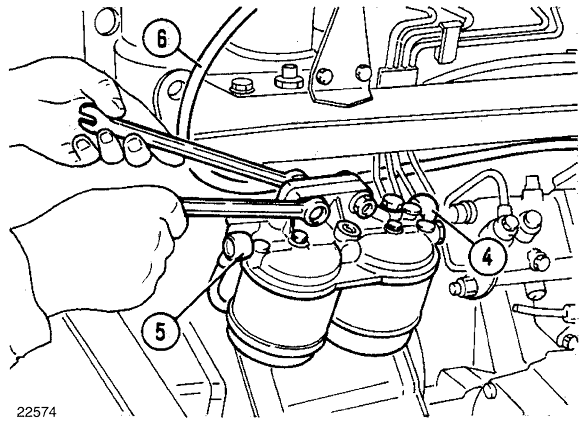
17. Undo the three holding screws and then remove the thermostat (1) and its gasket.

18. Undo holding screws and remove the exhaust vapour vent (7, page 10–46) and pipe.

19. Remove the engine oil filter cartridge (8, page 10–46) using the **293679** special tool.



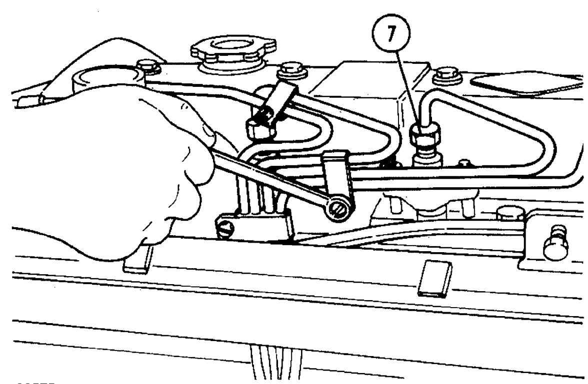
20. Remove the two mounting brackets and pipes (3) feeding oil to the operating cylinder.



21. Remove delivery pipe connections (4) from fuel transfer pump to filters, connections (5) from filters to injection pump and pipe (6) from fuel transfer pump to fuel pre–heater.

22. Undo holding nuts and then remove fuel filters from support.

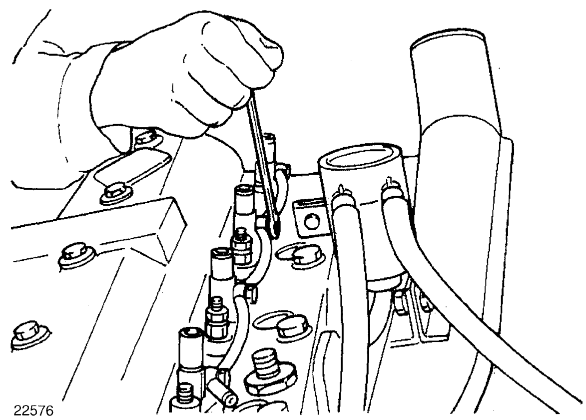
23. Undo the three holding screws and remove filters from their support.



24. Remove the pressure pipe retaining brackets.

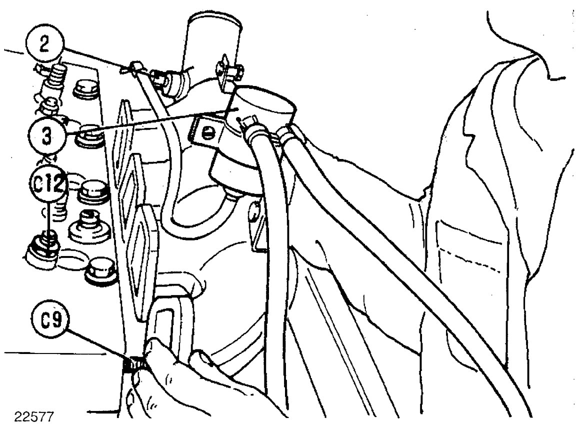
25. Remove connections (7) of pressure pipes on injection pump and injectors and then remove pressure pipes.

Print No. **603.54.283.00** – 09 – 1994



22576

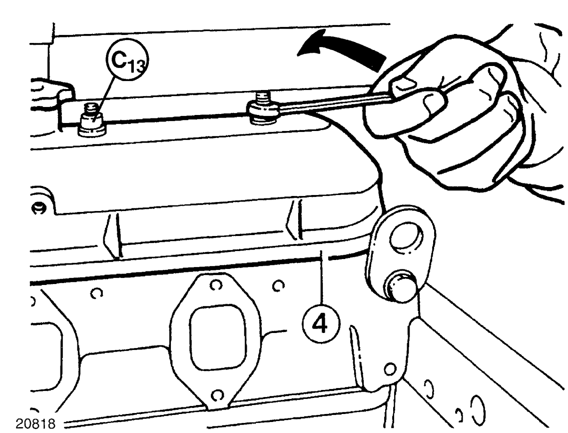
26. Disconnect fuel recovery pipe from injectors.



22577

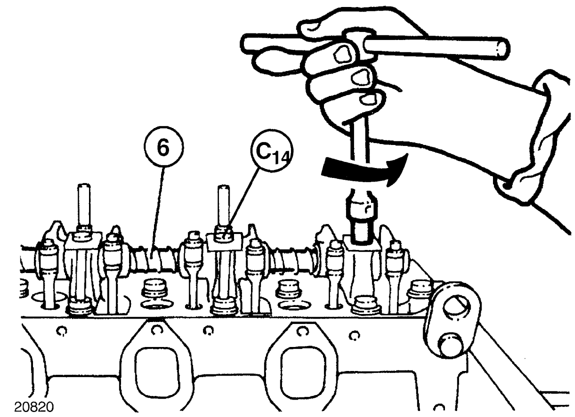
27. Undo holding screw (**C_9**), remove the intake manifold together with the thermostat (2), fuel pre–heater (3) and gaskets.

28. Undo the bracket holding nut (**C_{12}**), the washer gaskets underneath and then the brackets and injectors.



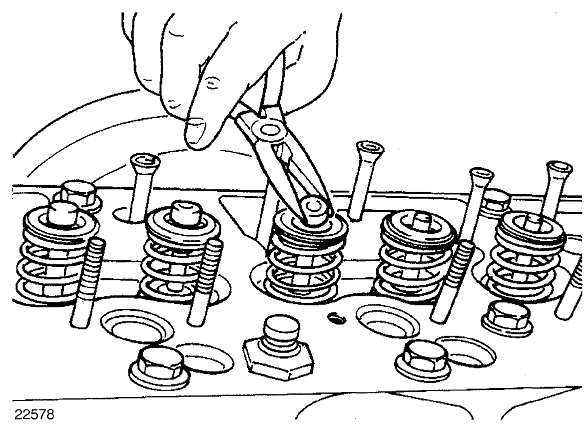
20818

29. Undo holding screws (**C_{13}**), washers and seals underneath and then the complete rocker arm cover and gasket.



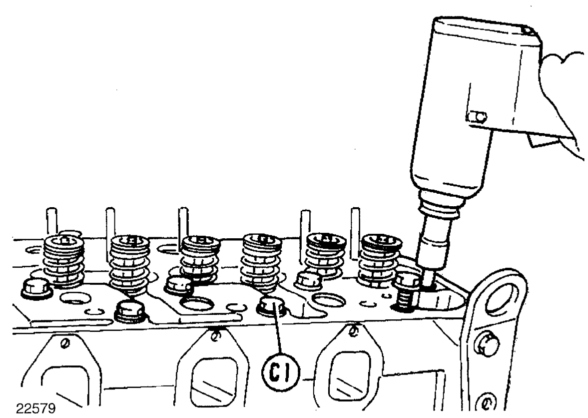
20820

30. Undo holding screws (**C_{14}**) and remove the rocker arm shaft (6) as an assembly.



22578

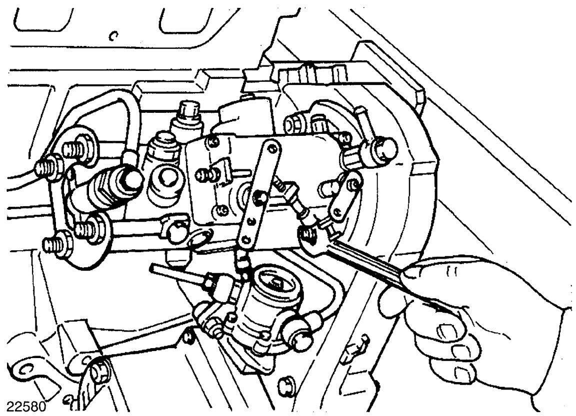
31. Remove valve caps and withdraw the valve tappet rods.



22579

32. Undo the cylinder head holding screws (**C_1**) and then remove the head using a hoist and the **290740/1** special hook.

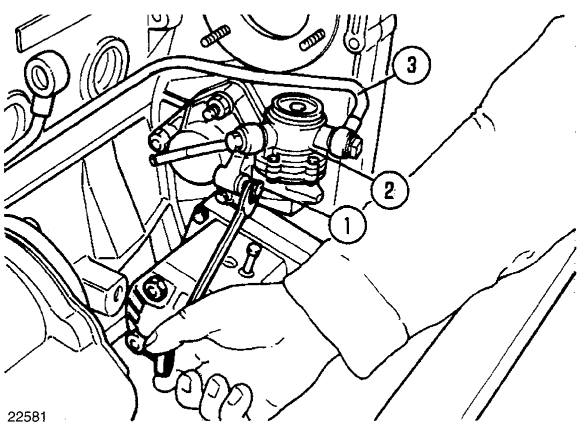
33. Remove the cylinder head gasket.



22580

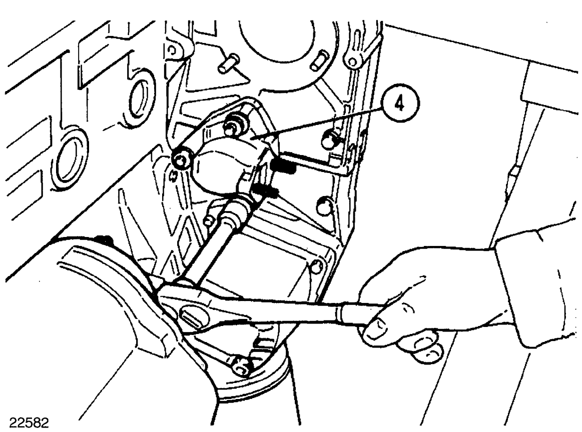
34. Carry on removal (or installation) of the BOSCH injection pump as instructed on page 10–93.

35. Carry on removal (or installation) of the C.A.V. injection pump as instructed on page 10–96.



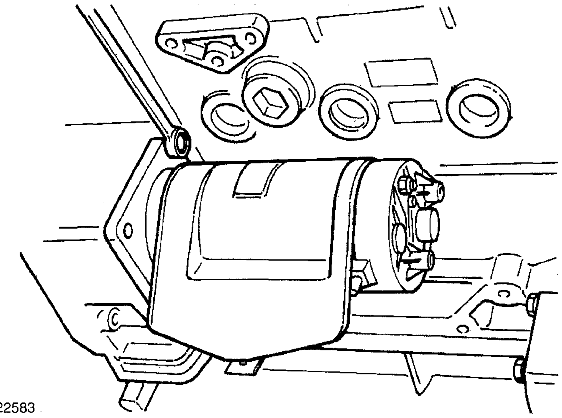
22581

36. Undo holding nuts (1), remove the fuel transfer pump (2) together with delivery pipe to filter (3) and the O–ring seal between pump and its support.



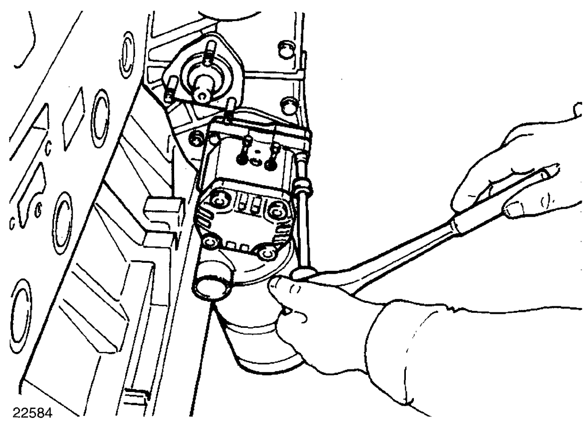
22582

37. Undo holding nuts and remove the fuel transfer pump (4) suppport and gasket.



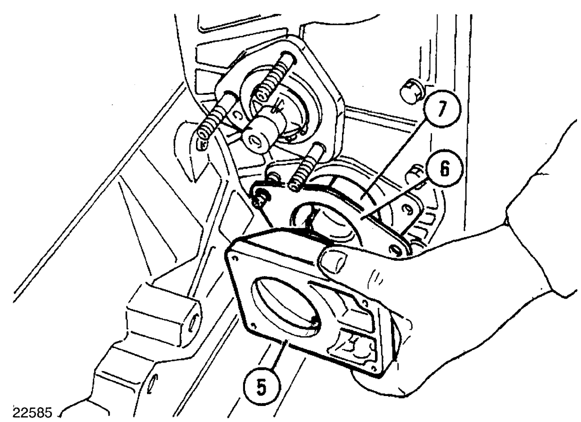
22583

38. Undo holding screws and remove starter.



22584

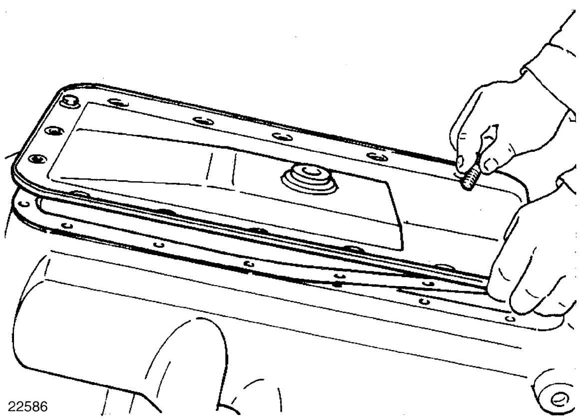
39. Undo holding screws and remove the hydraulic lift oil pump and filter.



22585

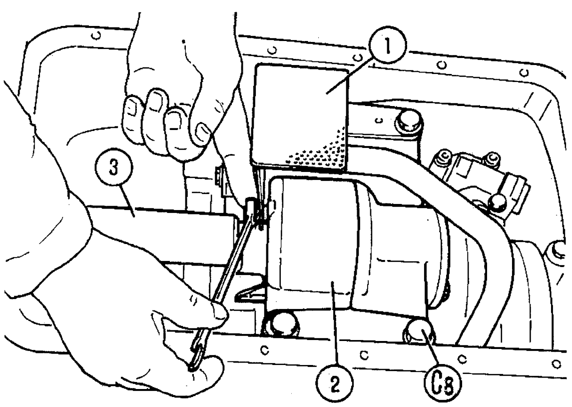
40. Remove the spacer (5), its gasket (6) and drive connection (7).

Print No. ***603.54.283.00*** *– 09 – 1994*



22586

41. Turn rotary stand 180°, undo holding screws and remove the oil sump cover and gasket.



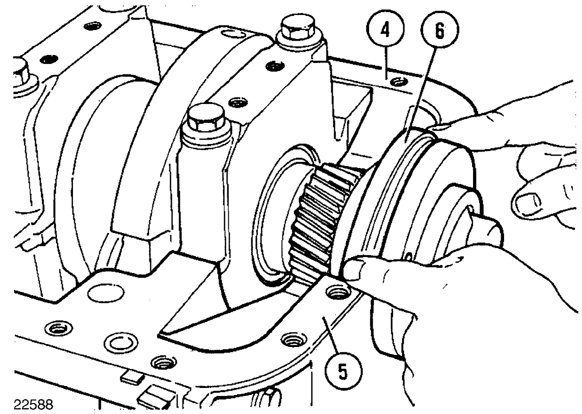
22587

42. Undo holding screws and recover the engine lube oil suction line (1) with strain filter and seal as an assembly.

43. Undo holding screws ($\mathbf{C_8}$), free the balancer weight box moving it outwards, remove sleeve (3) and box (2).

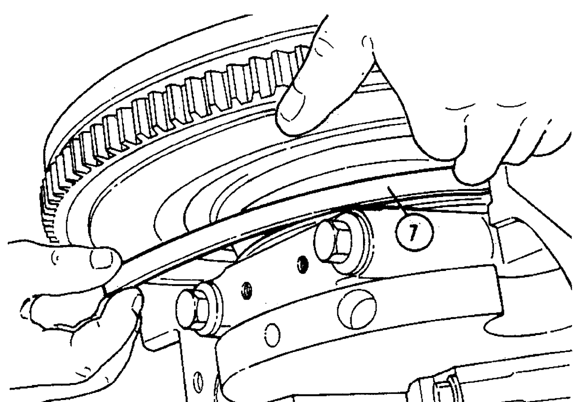
Note: operations **41–42–43** apply to 4–cylinder engines only. See instructions on pages 10–54 and 10–56 for the Removal–Installation operations concerning the engine dynamic balancer.

44. Undo the holding nut ($\mathbf{C_{23}}$) and remove the oil sump using a hoist, the **290740/1** hook and the lifting chain with eyelet end.



22588

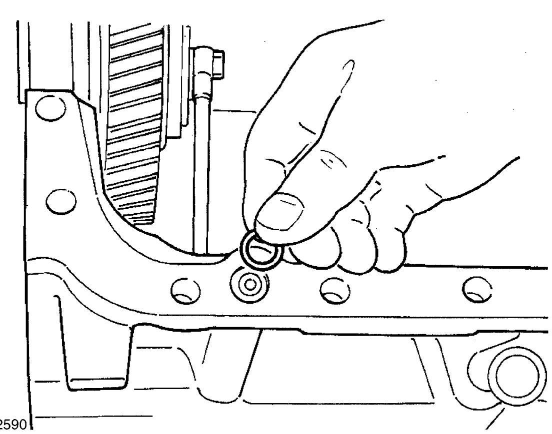
45. Remove the semi–gaskets (4) and (5) between crankcase and cylinder head and gasket (6) between crankcase and front timing gear case.



22589

46. Remove gasket (7) between engine oil sump and engine flywheel rer mount.

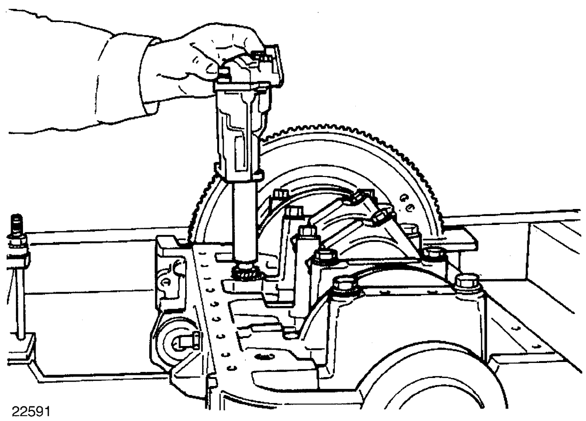
Note: at gasket (6) and (7) assembly apply CAF1 RHODORSIL silicon sealing compound on mating surfaces.



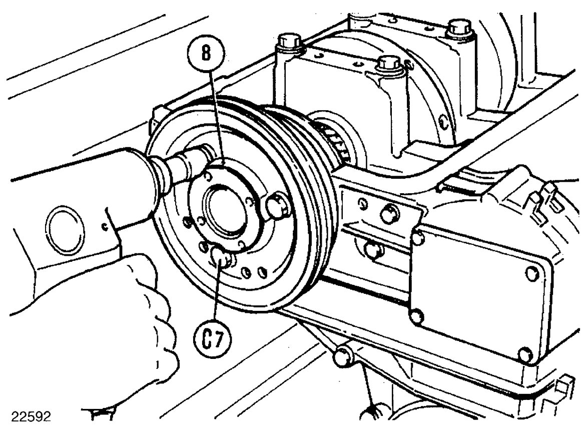
22590

47. Remove the balancer weight lube oil O–ring seal installed on crankcase–oil sump mating surfaces.

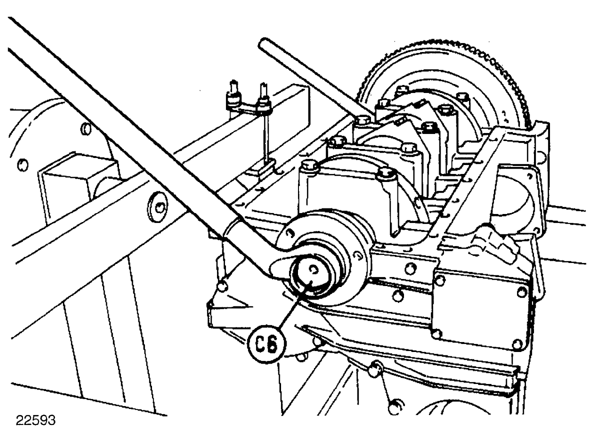
Print No. ***603.54.283.00*** *– 09 – 1994*



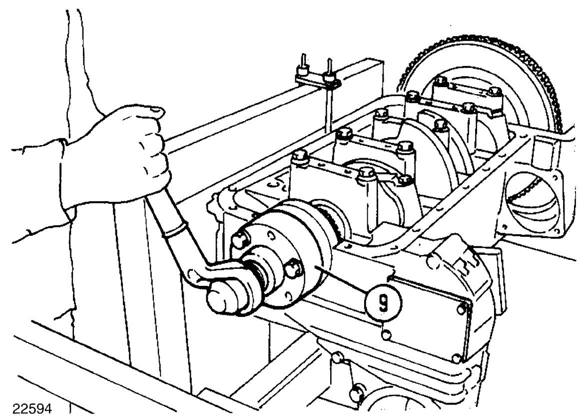
48. Undo holding screws (**C_{15}**) and remove the engine oil lube pump as an assembly.



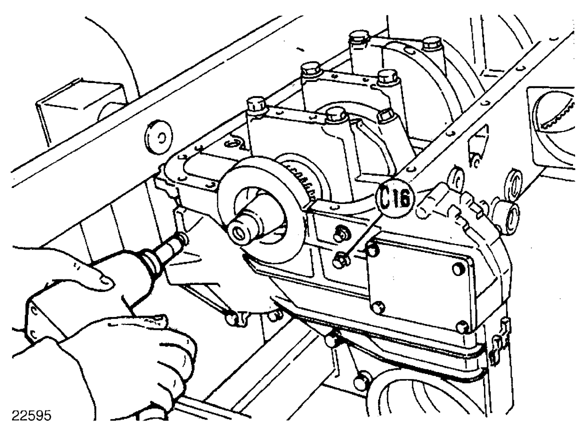
49. Undo holding screws (**C_7**) and remove the fan–alternator drive belt (8).



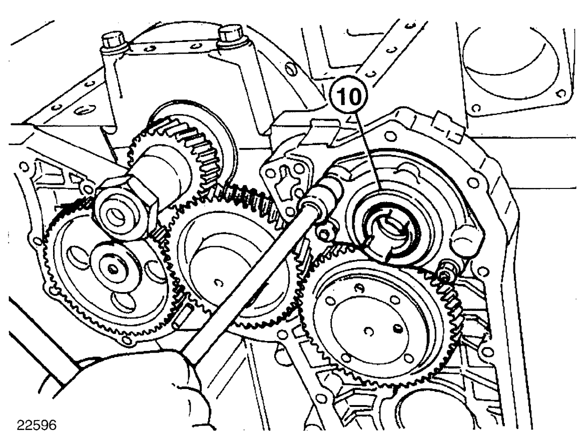
50. Straighten out the lockwasher tab and undo the nut (**C_6**) after making sure that engine is securely blocked.



51. Pull off the belt hub from crankshaft using tool **291504** (9); recover the lock key.

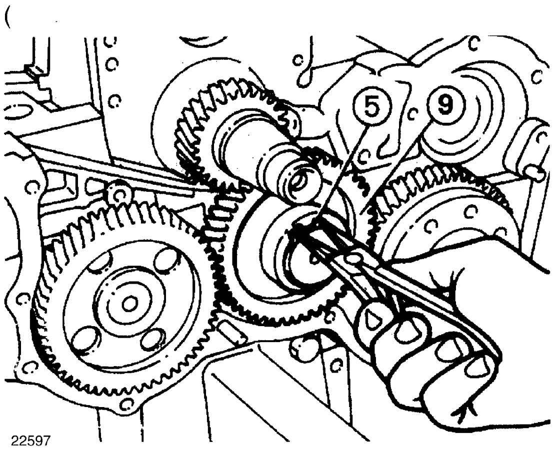


52. Undo holding screws (**C_{16}**) and remove the timing gear cover and gasket.



53. Undo holding screws and remove the hydraulic lift drive gear support (10).

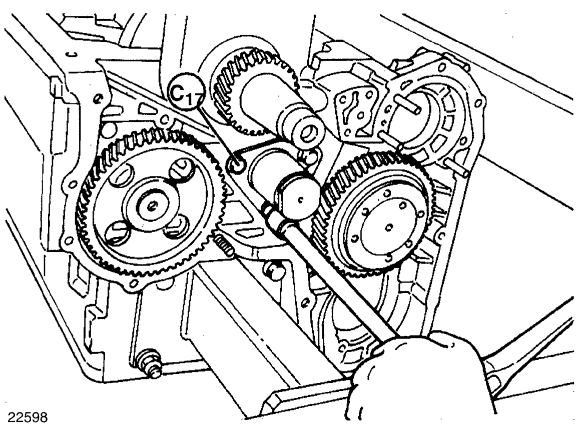
Print No. ***603.54.283.00*** *– 09 – 1994*



22597

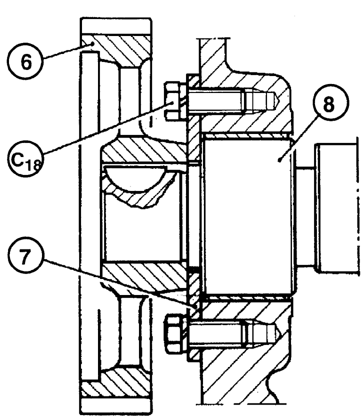
54. Undo the circlip (5) and remove spacer underneath and idler gear (9).

Note: at gear installation, see page 10–59 for timing instructions



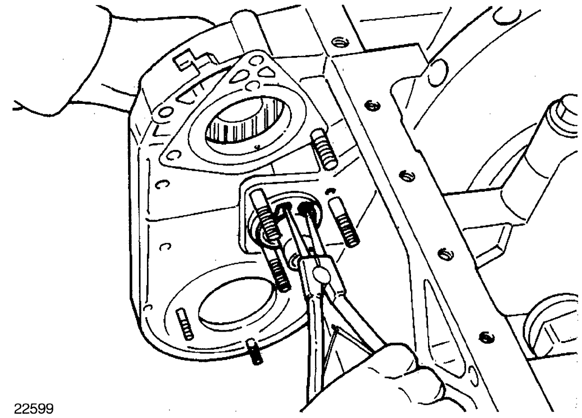
22598

55. Undo holding screws (**C_{17}**) and remove the idler gear axle pin.



22669

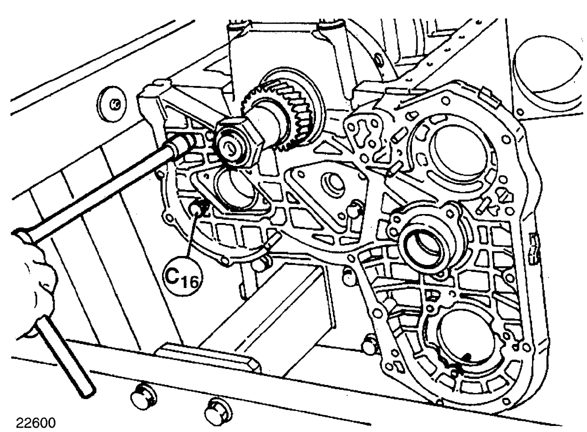
56. Undo holding screws (**C_{18}**) and slide out the camshaft (8) with drive gear (6) and end plate (7) as an assembly.



22599

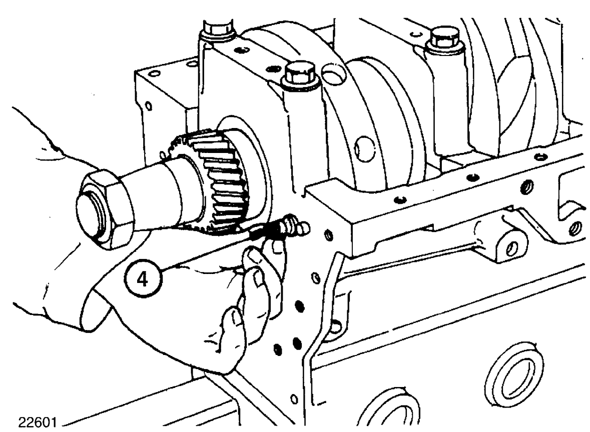
57. Undue the circlip and remove the thrust washer by sliding it out from the side opposite the gear with transfer pump drive camshaft.

Note: this same gear drives both the transfer pump gear and hydraulic lift pump drive gear. At re–assembly, see page 10–59 for timing instructions.



22600

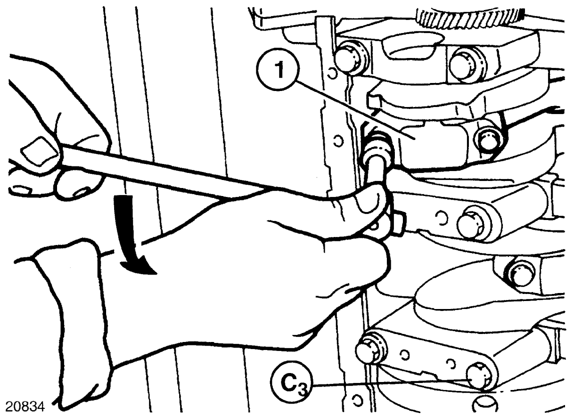
58. Undo holding screws (**C_{16}**) and remove the timing gear case.



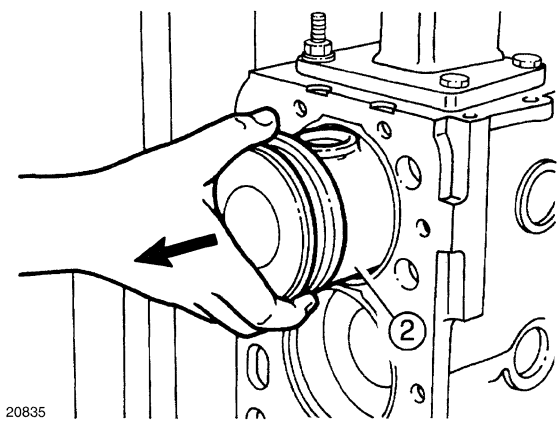
22601

59. Replace the O–ring seal (4) on the hydraulic lift pump drive shaft oil delivery side.

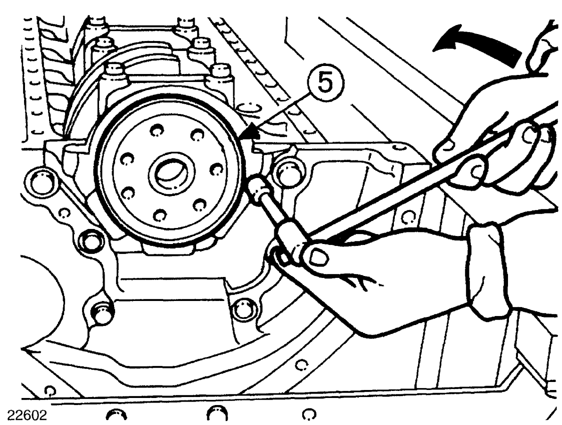
60. Remove the crankcase–timing gear case gasket.



61. Turn engine 90°, undo holding screws (**C_3**) and remove connecting rod bearing caps and shells.

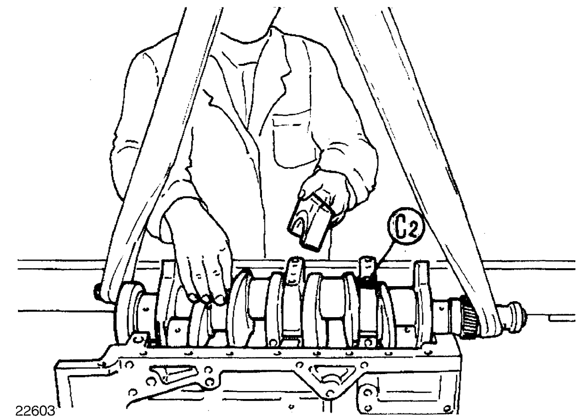


62. Slide out pistons (2) together with piston rings , pins and connecting rods.



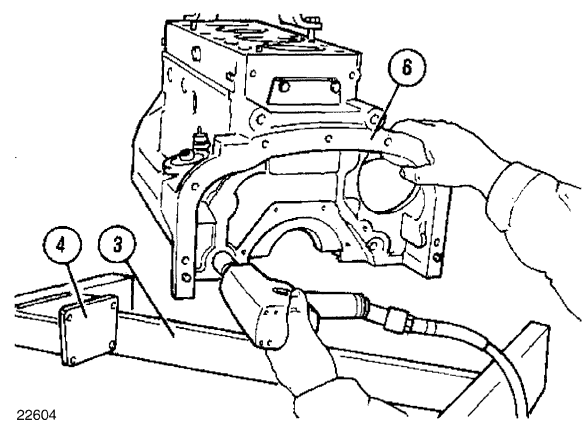
63. Return engine to horizontal position by turning it about 90° on the rotary stand, undo the holding screws (**C_4**) and then remove the flywheel using a hoist and the **290740/1** sling hook.

64. Undo holding screws (**C_{19}**) then remove the rear cover (5) together with seal.



65. Undo holding screws (**C_2**) then remove the main bearings and shells and recover the thrust washers un the main bearing before the last one shown in the figure.

66. Remove the engine crankshaft, using a suitable hoist and a nylon rope, and ,also, the bearings, thrust washers and valve tappets.



67. Turn the engine crankcase 180° on the **290090** rotary stand (3), attach the chain with eyelets to the crankcase as shown in the figure, pull the chain until slightly pre–loaded by means of the hoist and **290740/1** sling hook and finally undo the engine–rotary stand (3) and bracket (4) holding screws (**293860** set).

68. Lift up the engine crankcase, off the rotary stand.

69. Undo holding screws then remove the crankcase rear bracket (6) and gasket.

Note: operations 70 thru 78 which follow and concerning the disassembly of the balancer unit apply to the 4–cylinder engines only.

Print No. ***603.54.283.00*** *– 09 – 1994*

DISASSEMBLY OF THE COUNTER–ROTATING FLYWEIGHT TYPE DYNAMIC BALANCER

Note: through operations 41–42–43, page 10–50, the flyweight housing (10) and drive sleeve (13) were already removed from the engine oil sump.

To disassemble the dynamic balancer, work on the engine sump, previously removed with operation 44, page 10–50, as follows:

70. Remove the lubricating pipe (24).

71. Remove retaining ring (14).

72. Remove the retaining ring (6) and lid (7) together with its O–ring seal (5).

73. Withdraw gear (18) from sump.

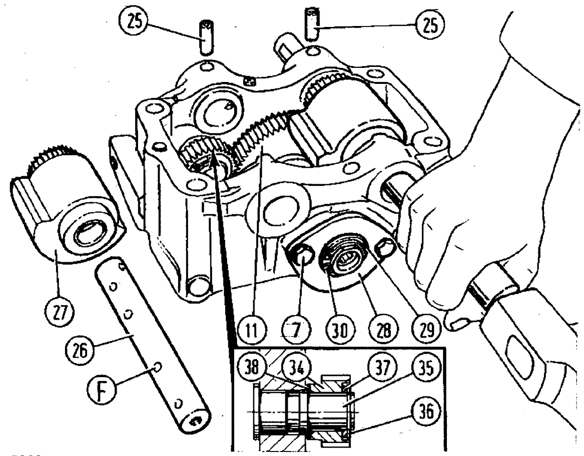
74. Remove the retaining ring (23), thrust washer (22), gear (19) and the two thrust washers (21).

75. Inspect shaft (20) for signs of scoring or wear, in which case it should be replaced.

76. Remove roll pins (25) and separate the flyweight carriers using a suitable driver.

77. Remove the drive gear (11) by removing the retaining ring (30) and the flange holding screws (7, Fig.**a**).

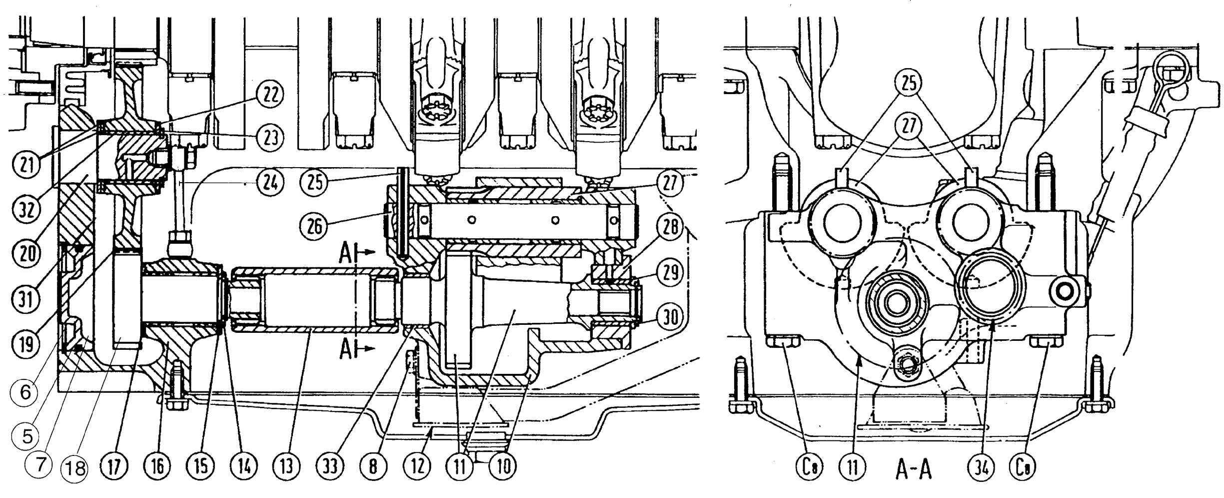
78. Remove the retaining ring (36) and idler gear (34).



5968

Driving out the balancer flyweight carriers

a. Detail section of idler gear (34) – F. Lube ports – 7. Flange (28) holding screws – 35. Flyweight (34) carrier – 36. Retaining ring – 37 and 38. Thrust washers.



22605

Dynamic balancer sectional view

C_8. Flyweight box–engine oil sump holding screws – 5. O–ring seal – 6. Retaining ring – 7. Sealing lid – 8. Gauze oil filter–flyweight housing (10) holding screws – 10. Flyweight housing – 11. Flyweight drive gear – 12. Engine oil gauze filter – 13. Coupling – 14. Retaining ring – 15. Thrust washer – 16. Drive pinion (18) flange – 17. Thrust washer – 18. Flylyweight drive pinion – 19. Idler gear – 20. Gear (19) axle – 21 and 22. Thrust washers – 23. Retaining ring – 24. Bushing (32) lubricating pipe 25. Carrier (26) retaining ring – 26. Flyweight carrier – 27. Flyweights – 28. Flyweight drive gear (11) flange – 29. Thrust washer – 30. Retaining ring – 32 and 33. Bushings – 34. Flyweight drive idler gear.

Print No. **603.54.283.00** – 09 – 1994

GENERAL NOTES AND INFORMATION

– After disassemblying the engine, clean loose parts carefully.

– Carry on re–assembly of the engine by reversing the disassembly sequence of operations of pages 10–45 through 10–54.

– Pages 10–56 through 10–62, which follow, illustrate the assembly operations that require priority attention for the correct placing and installation of components.

– See page 10–8 for torque tightening data.

IN ADDITION, MAKE SURE TO:

– Replace all seals and sealing gaskets when disassembling the engine, partially or completely;

– Wet loose rotating parts and seal with engine oil prior to installation;

– Wet seal with engine oil also when assembling the oil filter.

Print No. ***603.54.283.00*** *– 09 – 1994*

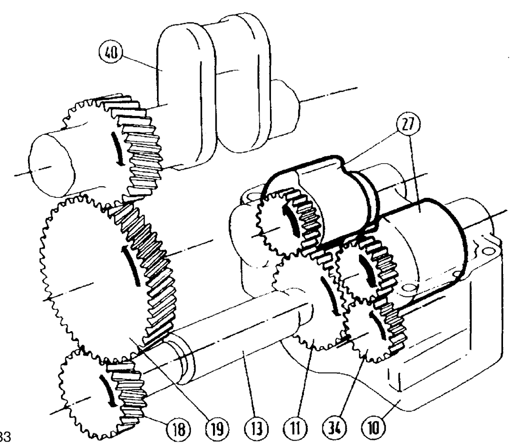
MAIN ASSEMBLY OPERATIONS

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

RE–ASSEMBLY OF THE COUNTER–ROTATING FLY-WEIGHT TYPE DYNAMIC BALANCER (operations 78 through 70, page 10–54)

Proceed as follows:



6033

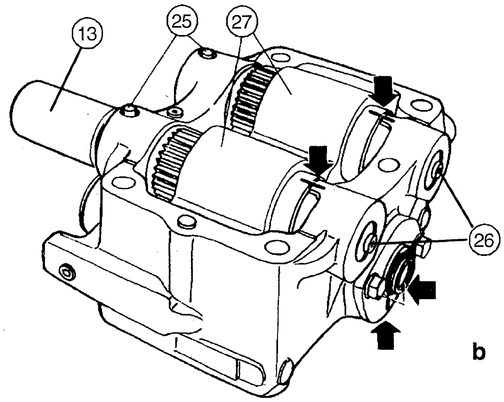
Work diagram of dynamic balancer installed on 70V, 72F, 72LP, 82F, 82LP tractors.

10. Flyweight housing – 11. Flyweight drive gear – 13. Coupling – 18. Flyweight drive gear – 19. Idler gear – 27. Flyweights – 34. Flyweight drive intermediate gear – 40. Engine crankshaft.

Assemble loose parts on flyweight housing (10) by reversing the disassembly sequence of operations 78 to 78, position both gear (11, Fig.a) and flyweights (27) so to obtain the alignment of the reference marks indicated by arrows (see Fig. b).

With reference to the figures consider that:

– the flyweight drive intermediate gear (34, Fig.a, page 10–54) must be fitted with its hub longer end facing the housing side;



22620

Position and correspondence of reference marks for timing the dynamic balancer, engine cylinder no. 1 at T.D.C.

13. Coupling – 25. Carrier (26) retaining roll pins – 27. Fly-weights.

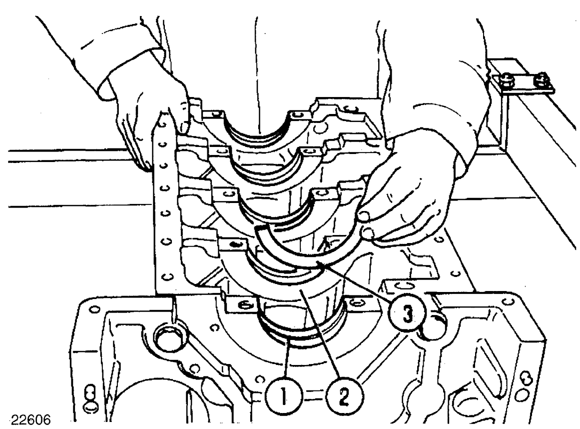
– roll pin (25) holes drilled on carriers (26) must align with corresponding holes on the housing;

Proceed installing loose parts on engine oil sump by reversing the sequence of operations 70 through 74 of page 10–54.

ASSEMBLY OF VALVE MECHANISM AND ENGINE CRANKSHAFT WITH MAIN BEARING CAPS, BEAR-INGS AND THRUST RINGS AND CRANKSHAFT END PLAY CHECK (operations 66 and–66, page 10–53)

Proceed as follows.

Assemble valve tappets in place on the engine crank-case.

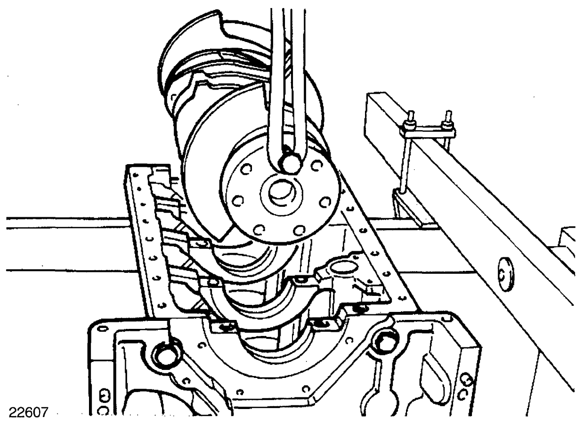


22606

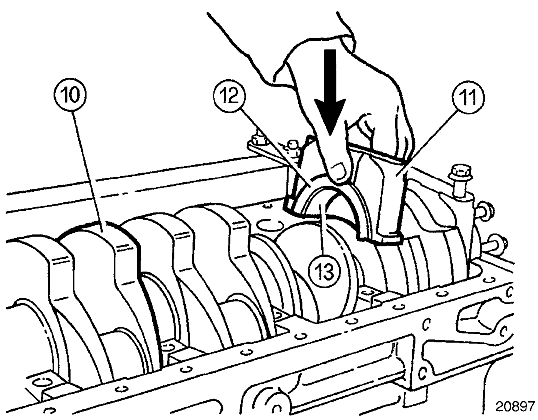
Wet crankcase seats with engine oil and place the main half–bearing shells (1) in position.

Fit the two bottom thrust ring halves (3) by applying grease on the sides (2) of the third main bearing so to make work easier.

Print No. 603.54.283.00 – 09 – 1994



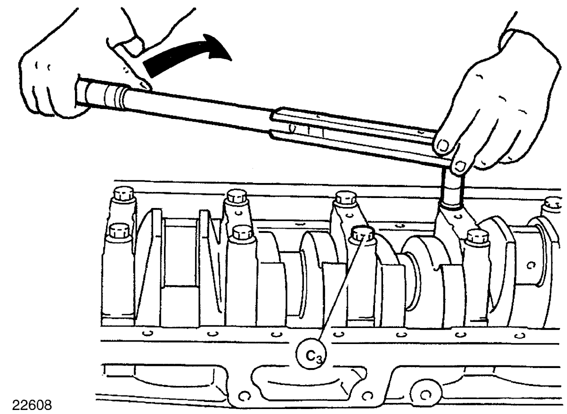
Wet with engine oil the upper main bearing side and install the crankshaft being careful not to displace the thrust bearings positioned before.



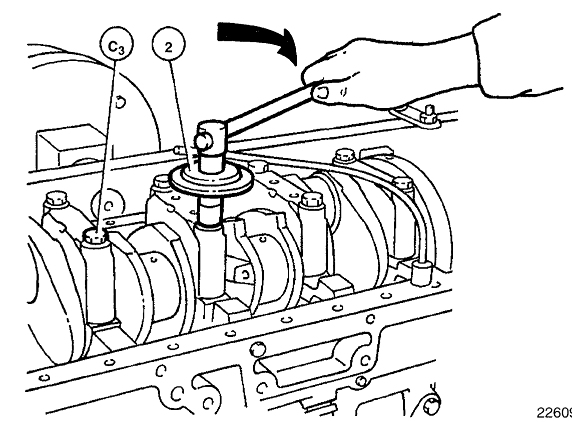
Wet with engine oil the main bearing journals, place the main bearing caps (11) in position together with the half–bearing shells (13) and fitting the upper thrust bearing half–rings (12).

Rotate the crankshaft a few turns in order to make the various parts to adapt to each other.

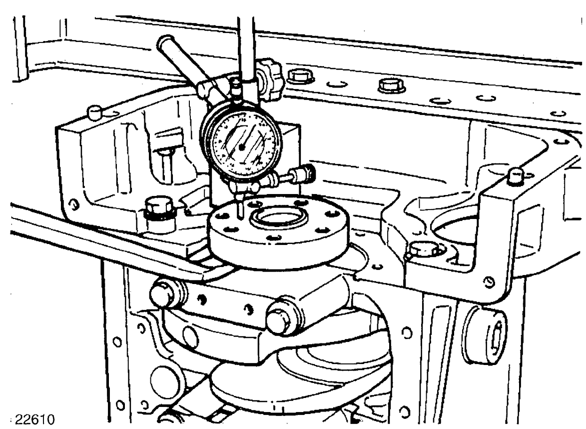
Fit the main bearing cap screws in their holes.



Torque tighten the main bearing cap screws (**C_3**) at 80 Nm (8.2 kgm – 59.3 ft.lb).



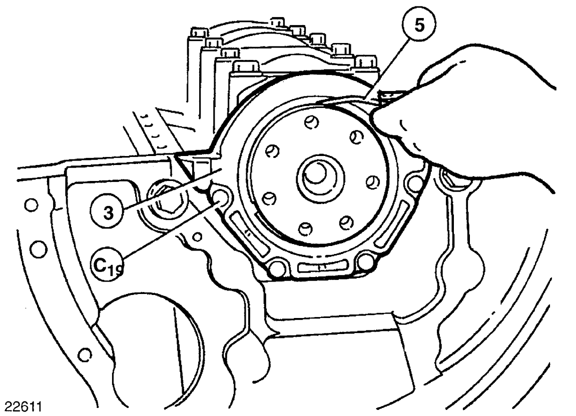
Using the **292248** tool (2) further tighten each screw (**C_3**) through a 90° angle.



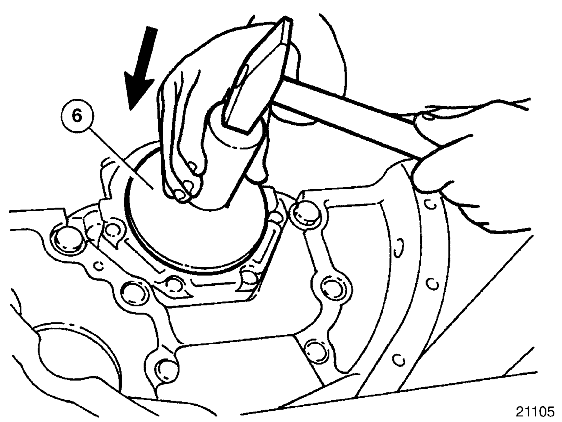
Check that end play does not exceed values of page 10–65.

FITTING THE REAR COVER WITH OUTER SEAL AND ENGINE FLYWHEEL(operations 64–63, page 53).

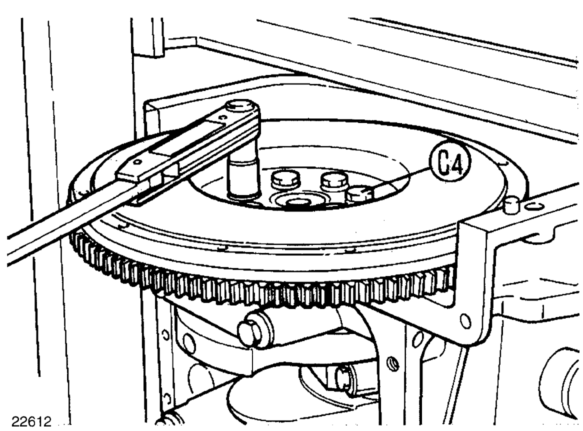
Proceed as follows.



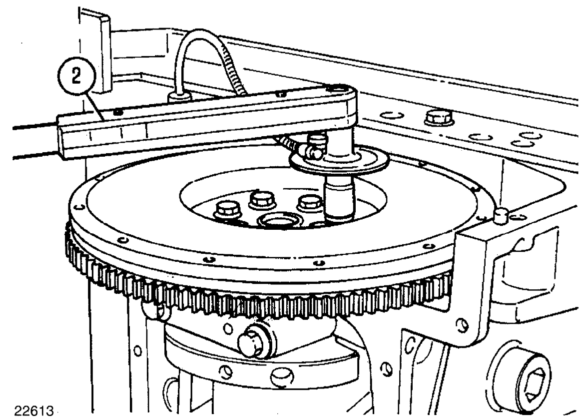
Fit the rear cover (3) with its outer seal, tighten holding screws (**C_{19}**) at the torque value specified on page 10–8 and making sure, using a feeler gauge (5), that the engine crankshaft flange is axially aligned with the cover.



Force fit the inner rear seal using the **293299** installer (3) and **293708** handle.



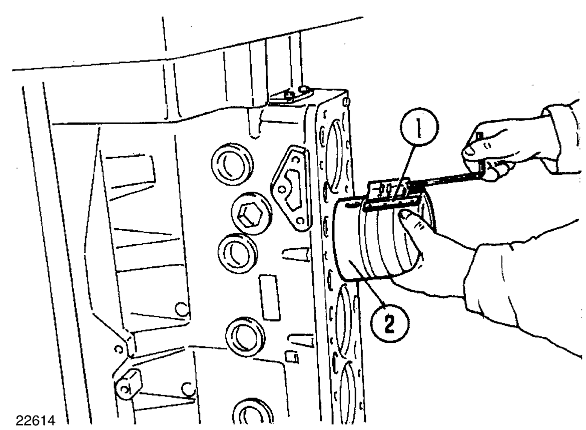
Install the engine flywheel and torque tighten holding screws (**C_4**) at 40 Nm (4.1 kgm – 29.6 ft.lb).



Using the **292248** tol (2) further tighten each flywheel holding screw (**C_4**) through a 60° angle.

FITTING PISTONS WITH RINGS, PINS, CONNECTING RODS, BEARINGS AND CAPS - CHECKING THE PROJECTION ABOVE THE CRANKCASE TOP SURFACE (operations 62 and 61, page 10–53).

Proceed as follows.



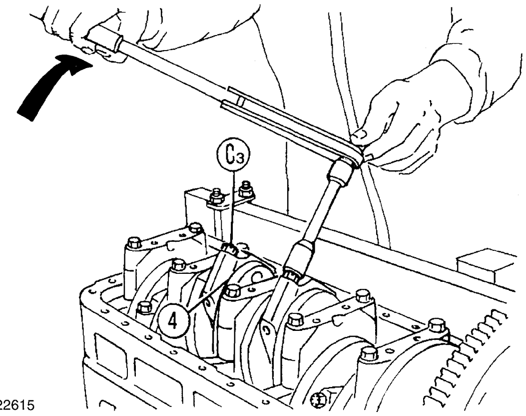
Wet with engine oil the pistons, rings and cylinder liners, prior to installation.

Fit with the **291160** pliers the piston rings in their seats and finally check, once installed, that the end cuts are offset 180°.

Install the **291048** special tool (1) to introduce pistons (2) inside cylinder liners, being careful not to offset the position of the rings with respect to each other as mentioned in the preceding paragraph.

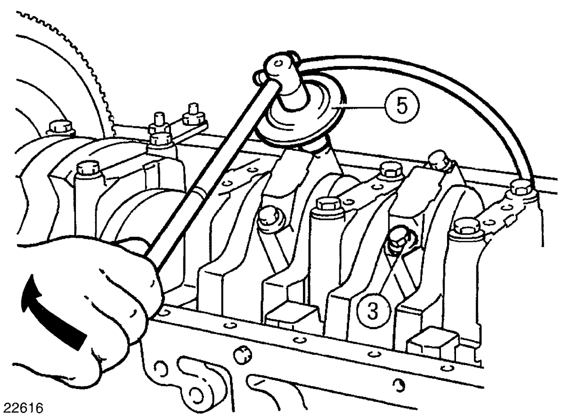
Install piston and connecting rod assemblies in the engine crankcxase, making sure that the connecting rod position number corresponds to that of the cylinder and that that the figure marked on the connecting rod faces the side opposite the camshaft.

Print No. **603.54.283.00** – 09 – 1994



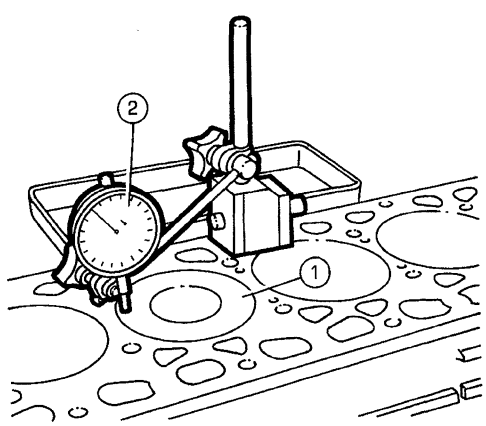
22615

Place connecting rod bearing caps (4) and their bearings on the crankshaft and torque tighten the holding screws (C_3) at 40 Nm (4.1 kgm – 29.6 ft.lb).



22616

Using the **292248** tool (5) further tighten each connecting rod bearing cap holding screw (3) through a 60° angle.



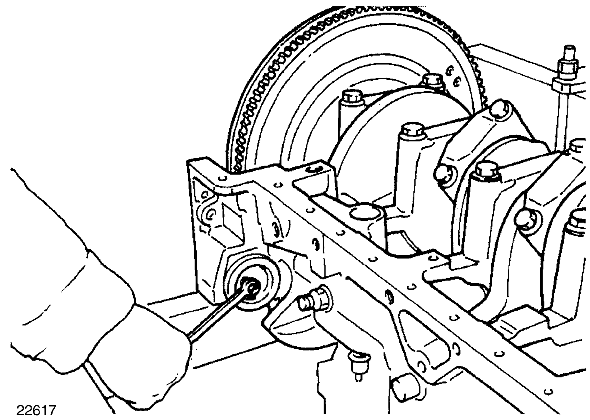
22668

Turn the rotary shaft 180° and clean the crankcase top surface.

Position pistons (1) at T.D.C. and check with a magnetic base dial gauge (2) that piston head projection (1) over the crankcase surface remains within limits specified on page 10–69.

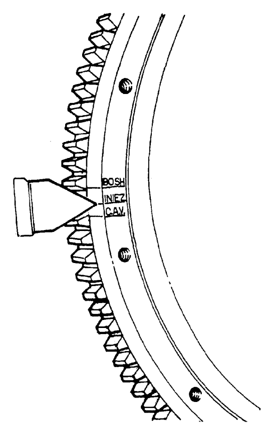
TIMING GEAR PHASING – (operations 57 through 53, page 10–52)

Proceed as follows.



22617

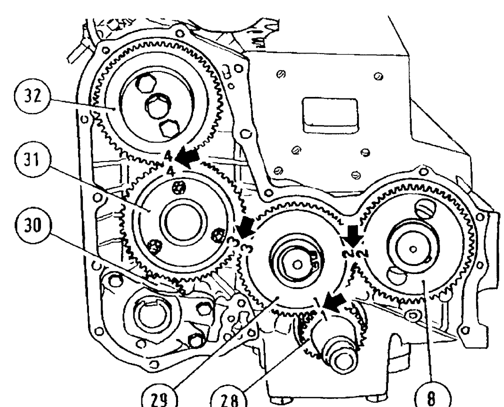
Remove the flywheel inspection lid an recover the seal.



22618

Turn the crankshaft so to bring cylinder 1 at T.D.C. (compression phase).

Check through the inspection opening that the mark corresponding to the C.A.V. pump (or BOSCH) lines up with the index.



22619

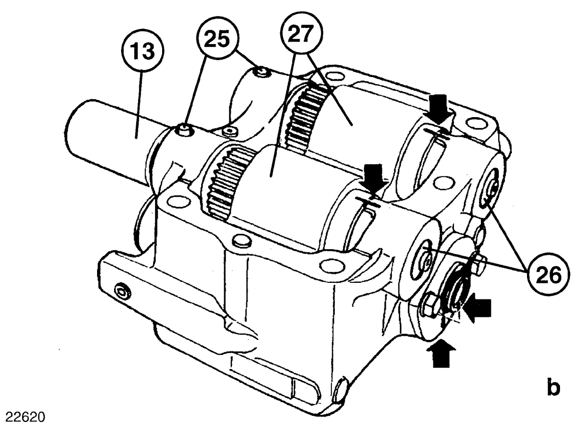
Install timing gears with arrowed marks aligned.

Print No. **603.54.283.00** – 09 – 1994

INSTALLATION OF THE DYNAMIC BALANCER ON THE ENGINE OIL SUMP (Operation 43, page 10–50)

At installation, time the dynamic balancer with respect to the engine as follows.

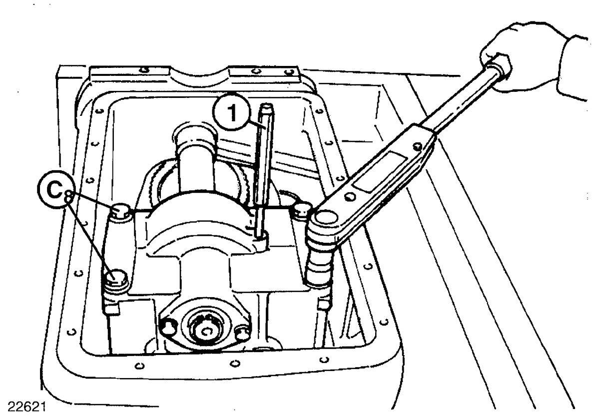
Move piston of cylinder no. 1 at T.D.C.



Location and alignment of the dynamic balancer timing reference marks, with piston of cylinder 1 at T.D.C.
(arrows indicate reference mark positions for correct timing)

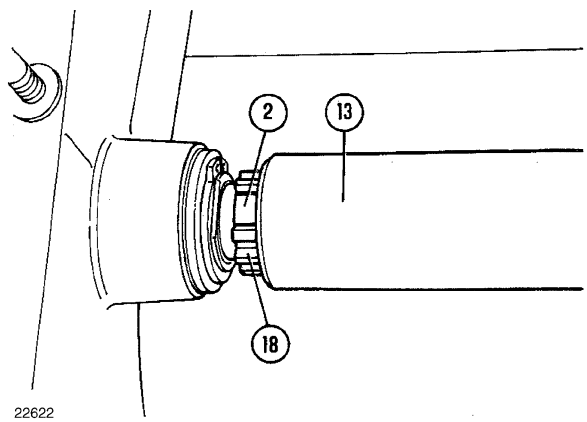
13. Coupling – 25. Carrier (26) retaining roll pins – 27. Flyweights.

Phase the dynamic balancer making the marks shown in the figure to coincide.



Turn the dynamic balancer housing over and fit in the dowel pin (1) in the hole pre–arranged to maintain the unit correct phasing during installation.

Using a hoist and lift chains, lift up and move the dynamic balancer inside the engine oil sump and lay it over the designated mountings.



Slide coupling (13) over the drive gear splines as shown in figure b.

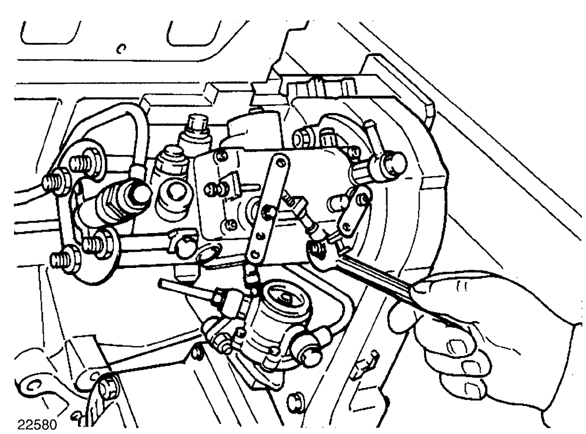
Slide coupling (13) over the splined shaft (18) of the drive intermediate gear making their respective toothed tops correspond to the wider timing space (2).

Torque tighten the dynamic balancer housing holding screws (**C**$_8$) at the value specified on page 10–8.

Remove dowel pin (1).

INSTALLATION OF BOSCH or C.A.V INJECTION PUMP (operation 34 or 35, page 10–49)

Proceed as follows.



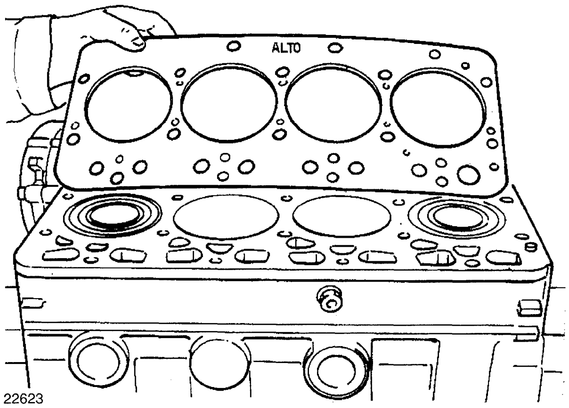
Install BOSCH injection pump and phase it with respect to the engine, in case; see page 10–94.

Install C.A.V. injection pump and phase it with respect to the engine, in case; see page 10–97.

Print No. 603.54.283.00 – 09 – 1994

FITTING THE CYLINDER HEAD GASKET (operation 33, page 10–48)

Proceed as follows.



22623

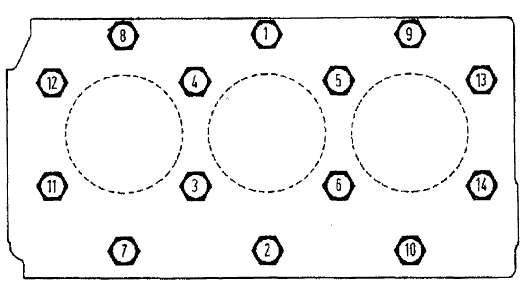
Before fitting the cylinder head, clean and degrease carefully the crankcase top surface and place the gasket with the **ALTO** sign facing upwards.

FITTING THE CYLINDER HEAD AND TORQUE TIGHTENING HEAD SCREWS (operation 32, page 10–48)

Proceed as follows.

Place head in position on the crankcase and fit and turn the screws (**C**$_1$) just contacting the head.

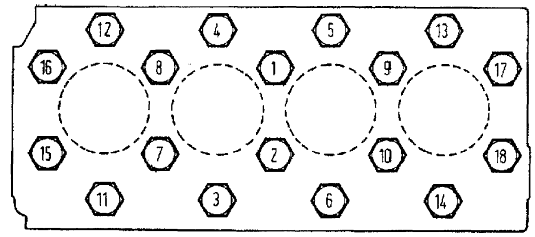
A



5308

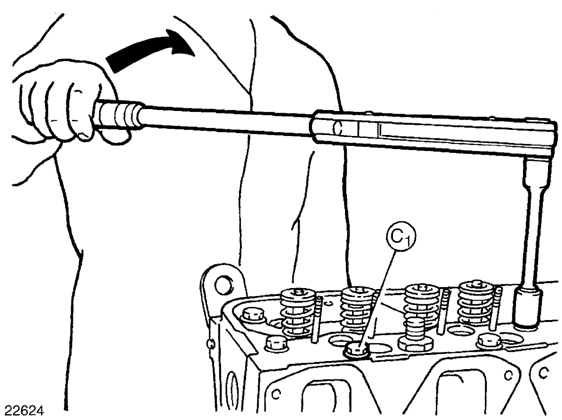
Tightening sequence of screws (**C**$_1$) on 3–cylinder heads, to carry on in each of the four tightening stages (**A**= fan side).

A



7670

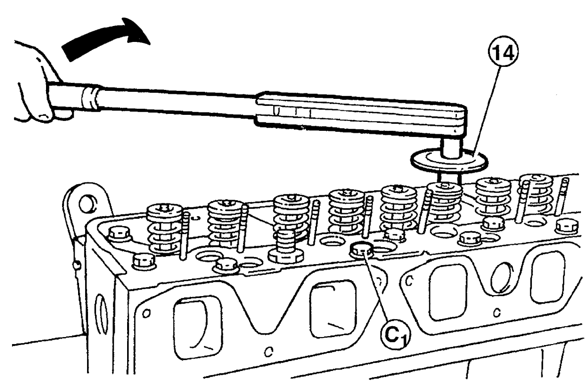
Tightening sequence of screws (**C**$_1$) on 4–cylinder heads, to carry on in each of the four tightening stages (**A**= fan side).



22624

Torque tighten screws (**C**$_1$) at 60 Nm (6.1 kgm – 44 ft.lb) following the sequence shown in the previous figures (1st stage).

Re–check torque on all screws following the sequence shown in the previous figures (2nd stage).



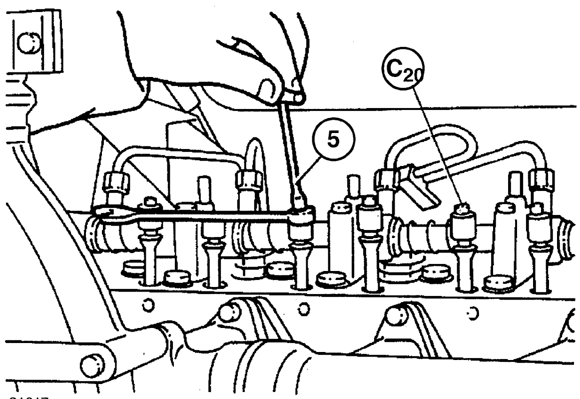
22625

Using the **292248** tool (14) tighten each screw (**C**$_1$) through a 90° angle (3rd stage) and finally tighten through a further 90° (4th stage) following the sequence shown in the previous figures.

Print No. **603.54.283.00** – 09 – 1994

VALVE CLEARANCE ADJUSTMENT (operation 29, page 10–48)

Proceed as follows.



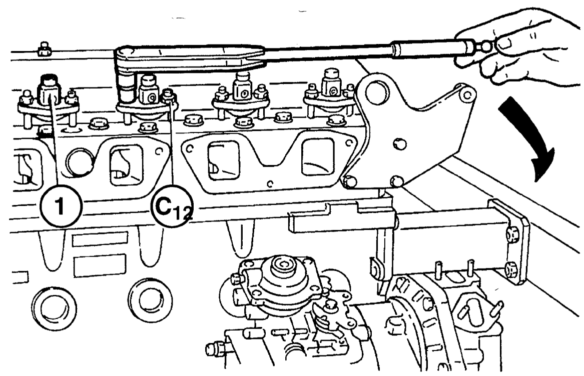
21617

Before re–fitting the cover, adjust the valve–rocker arm gap as instructed on page 10–76.

Torque tighten the valve–rocker arm gap adjustment nuts (**C_{20}**) at the value indicated on page 10–8.

FITTING INJECTORS – (operation 28, page 10–48)

Proceed as follows.



22627

Fit injectors (1) in their respective housing holes.

Position brackets and fit round gaskets.

Bring the bracket holding nuts (**C_{12}**) against the round gaskets and torque tighten them at the value of page 10–8, working in two successive stages:
1st stage: torque tighten nuts to 10 Nm (1 kgm – 7.23 ft.lb);
2nd stage: torque tighten nuts to 25 Nm (2.6 kgm – 18.8 ft.lb).

Tighten the injectors return fuel pipe connection.

Tighten the injectors high pressure pipe connection.

FAN BELT ADJUSTMENT (operation 4, page 10–45)

Note: adjust belt as instructed on page 10–89.

INDEX

This index which is made for your convenience includes a list of engine main components and operations dealt with in the text, referred to the pages where they appear, for quick consultation and information retrieval at work.

CHECKS – DIMENSIONS – REPAIRS

Print No. 603.54.283.00 – 09 – 1994

ENGINE CRANKCASE MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Crankcase	cast–iron block with dry and replaceable cylinder liners and crankshaft, camshaft and tappet housing bores	
Cylinder liner I.D.	100.000 ÷ 100.024 (1) (3.9370 ÷ 3.9379)	104.000 ÷ 104.024 (1) (4.0560 ÷ 4.0569)
Cylinder liner O.D.	103.020 ÷ 103.050 (4.0178 ÷ 4.0189)	107.020 ÷ 107.050 (4.1738 ÷ 4.1749)
Cylinder liner housing bore in crankcase, dia.	102.850 ÷ 102.900 (4.0112 ÷ 4.0131)	106.850 ÷ 106.900 (4.6720 ÷ 4.1691)
Interference fit of liners and housing bores	0,120 ÷ 0,200 (.0047÷ .0078)	
Oversized liner I.D.	0,4 ÷ 0,8 0.120 ÷ 0.200	
Oversized liner O.D.	0.2 (.008)	
Maximum permissible liner ovality or taper due to wear (2)	0.12 (.005)	
Main bearing housing bore dia.	84.200 ÷ 84.230 (3.2838 ÷ 3.2850)	
Camshaft bushing housing bore dia.:		
– front	54.780 ÷ 54.805 (2.1364 ÷ 2.1374)	
– intermediate	54.280 ÷ 54.305 (2.1169 ÷ 2.1179)	
– rear	53.780 ÷ 53.805 (2.0974÷ 2.0984)	
Tappet housing bore dia.	15.000 ÷ 15.018 (.5850 ÷ .5857)	
Spare tappet oversizes	0,1 – 0,2 – 0,3 (.004 – .008 – .012)	

(1) After press–fitting and reaming.
(2) Measure piston ring working area, in parallel and perpendicularly with respect to engine axis.

CHECKS – DIMENSIONS – REPAIRS (crankcase and cylinder head)

Before starting make sure to thoroughly clean all loose parts to be assembled.

Note – Cylinder liners inside diameter should never be measured when parts are loose because subject to deformations: always measure it once liners are press–fitted in place.

Check cylinder liner wear as follows:

– measure the I.D. on the (X, page 64) area delimitated by the piston ring stroke;

– measure both upper and lower sections of this area at the (a) axis, parallel to the engine crankshaft, and at the (b) axis, perpendicular to it;

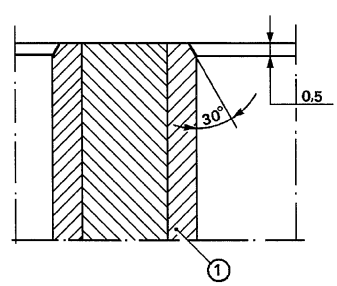
– compare readings to determine liner ovalization or taper.

Instead, to check the piston running clearance, measure the I.D. of each liner in the (Z) area, solely along the (b) axis, perpendicular to the engine crankshaft.

In case ovalization or taper exceed 0.12 mm (.005 in), or should the piston running clearance exceed 0.3 mm (.012 mm), proceed to re–bore and grind (or replace) the liners up to one of the oversizes specified in the table.

In this case, mate oversized liners and pistons of the same class (see page 10–69).

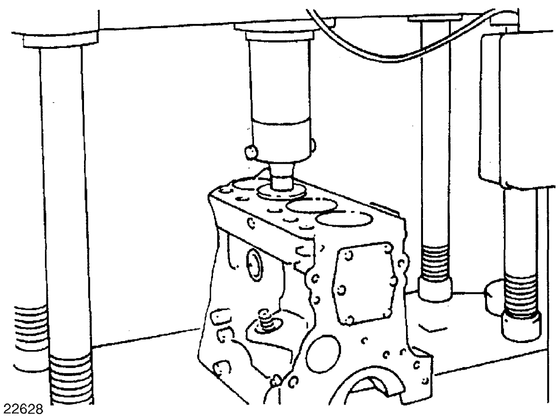
Note – In case of re–boring, all liners of the same engine must be processed the same way.



21596

After re–boring, mill the 0.5 mm (.02 mm) – 30° chamfer on liner (1).

Print No. **603.54.283.00** – 09 – 1994



22628

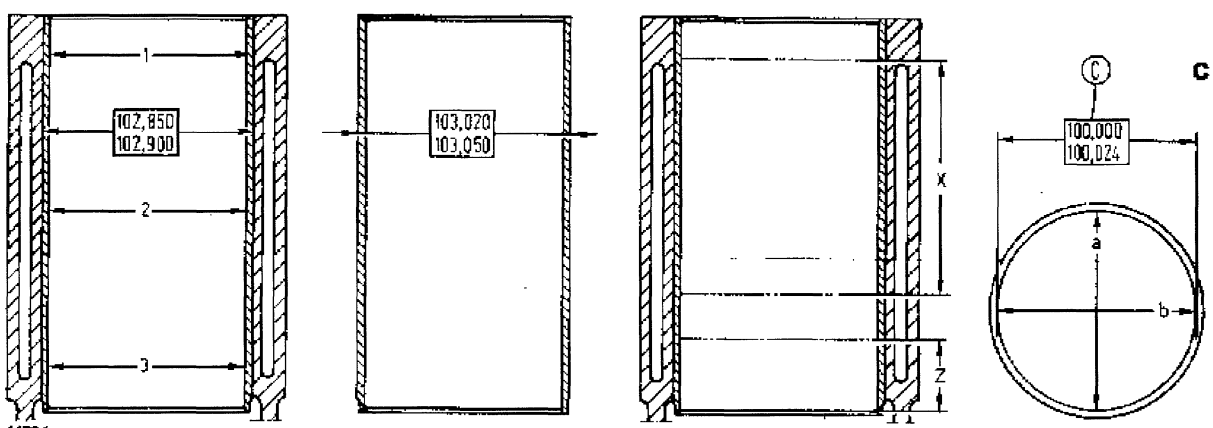
In case of replacement, disassemble–reassemble liners in engine crankcase with a cold process using a press and proceeding as follows.

Remove the worn liner under the press from the crank-case bottom side and using the specified plates.

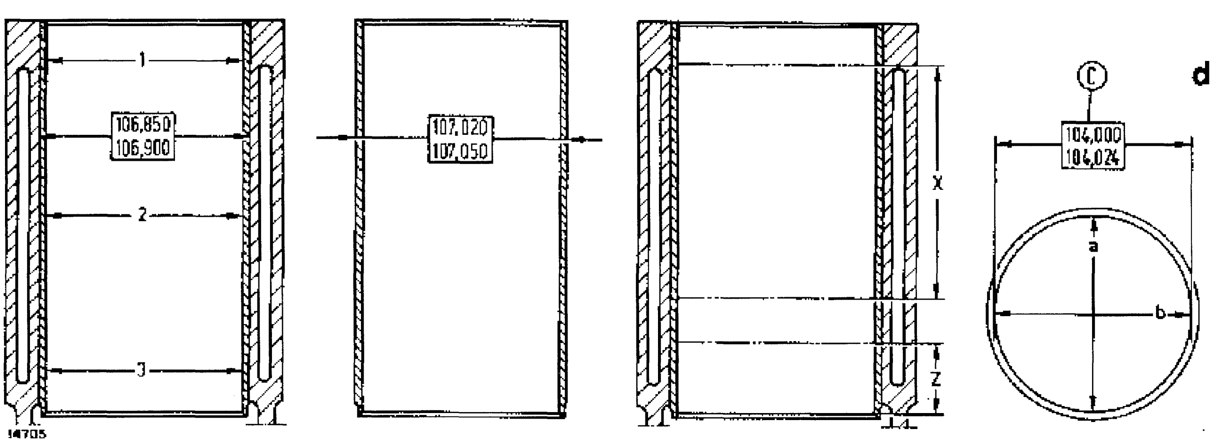
Verify the ovalization of the liner housing bore in the crankcase and, if necessary, re–bore it to the next 0.2 mm (.008 in) oversize.

Press–fit the new liner (0.2 mm oversize in this case) from the crankcase top using the designated plate.

Bore and grind the liner to the specified I.D. (see page 63).



14704



14705

Standard dimensions (mm) of cylinder liners and or respective housing bores in the engine crankcase – Checking liner wear.

a,b. Perpendicular positions of the micrometer dial gauge for measuring the liner inside diameter – c. 50V, 55V, 55F, 70V, 72F and 72LP tractors – d. 60V, 60F, 62F, 82F and 82LP tractors – C. Dimension after press–fitting and reaming – Z. Measurement area of worn liner I.D. to determine the mating clearance fit class with pistons (measure along axis b, perpendicular to the engine crankshaft) – X. Measurement area of worn liner I.D. (corresponding to the piston ring working area) to determine ovalization and taper (measure along axes a,b, parallel and perpendicular to the engine crankshaft, respectively) – 1, 2, 3. Measuring plane of the I.D. of liners, new or re–bored, along two perpendicular axes (a,b).

CRANKSHAFT AND BEARING MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Crankshaft	balanced, with built–in counterweights	
Standard main bearing journal dia.	79.791 ÷ 79.810 (1) (3.1180 ÷ 3.1126)	
Undersizes	0.254 – 0.508 – 0.762 – 1.016 (.0099 – .0199 – .0299 – .0399)	
Standard main bearing thickness	2.168 ÷ 2.178 (.0846 ÷ .0849)	
Spare main bearing I.D. undersizes	0.254 – 0.508 – 0.762 – 1.016 (.0099 – .0199 – .0299 – .0399)	
Main bearing and journal running clearance	0.034 ÷ 0.103 (.0013 ÷ .0040)	
Maximum permissible worn clearance	0.180 (.0070)	
Standard connecting rod bearing journal dia	63.725 ÷ 63.744 (1) (2.4853 ÷ 2.4860)	
Undersizes	0.254 – 0.508 – 0.762 – 1.016 (.0099 – .0199 – .0299 – .0399)	
Standard connecting rod bearing thickness	1.805 ÷ 1.815 (.0710 ÷ .0715)	
Spare connecting to bearing I.D. undersizes	0.254 – 0.508 – 0.762 – 1.016 (.0099 – .0199 – .0299 – .0399)	
Connecting rod bearing and journal running clearance	0,033 ÷ 0,087 (.0012 ÷ .0034)	
Max. permissible running clearance	0.180 (.0071)	
Thickness of standard crankshaft thrust washers	3.378 ÷ 3.429 (.1329 ÷ .1349)	
Spare thrust washer thickness oversizes	0.127 – 0.254 – 0.381 – 0.508 (.0049 – .0099 – .0149 – .0199)	
Width of the main bearing with thrust washers	31.766 ÷ 31.918 (1.2506 ÷ 1.2566)	
Width or corresponding crankshaft journal	32.000 ÷ 32.100 (1.2598 ÷ 1.2638)	
Crankshaft end float	0.082 ÷ 0.334 (.0032 ÷ .0131)	
Max. permissible end float	0.40 (.016)	
Max. permissible out–of–round or taper of main and connecting rod bearing journals after re–grinding	0.01 (.0004)	
Max. permissible out–of–round or taper of worn main and connecting rod bearing journals	0.05 (.002)	
Max. permissible tolerance on main bearing journal alignment, with crankshaft born by the two outer journals	0.10 (.004)	
Max. permissible tolerance, in both senses, on connecting rod bearing journal alignment (3–cylinder engines) or for each pair of connecting rod bearing journal alignment (4–cylinder engines)	0.25 (.010)	
Max. permissible tolerance on the distance of any connecting rod bearing journal outer surface from crankshaft center line	± 0.10 (.004)	

(continued)

(1) Crankshafts with main and connecting rod bearing journals 0.1 mm undersize may be fitted at the factory, coupled with corresponding undersized bearings.

Print No. ***603.54.283.00*** *– 09 – 1994*

(follows)

CRANKSHAFT AND BEARING MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Max. permissible tolerance on the squareness of the crankshaft/ flywheel flange with respect to crankshaft center line, with comparator dial gauge applied to the front surface (A, page 10–67) over a 108 mm (4.250 in) dia. (total comparator reading)	0.025 (.001)	
Max. permissible tolerance on co–axial alignment of the flywheel centering seat (B, page 10–67) with respect to the main bearings (total comparator reading)	0.04 (.0016)	

CHECKS, DIMENSIONS AND REPAIRS (CRANKSHAFT, BEARINGS AND FLYWHEEL)

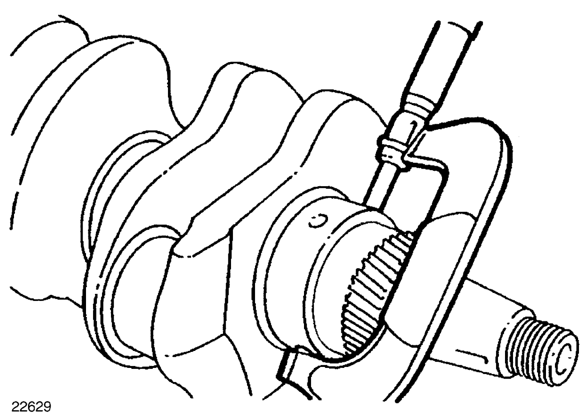
Crankshaft

Before starting make sure to thoroughly clean all loose parts to be assembled.

Inspect thoroughly the crankshaft which will have to be replaced if cracks, even minor ones, are found.

Inspect main and connecting rod bearing journals: slight signs of seizure or of surface scoring can be eliminated with a very fine grain emery cloth.

Deep scoring, out–of–rounds or taper exceeding 0.05 mm (.002 in) must be eliminated by grinding.



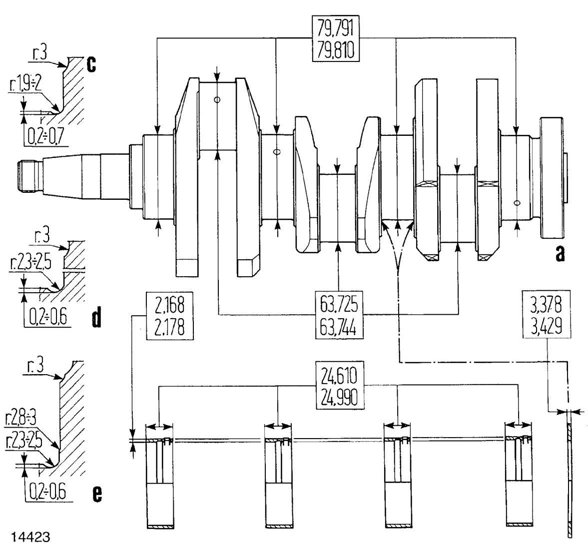
22629

Measure the journal diameter to establish the nearest undersize (see page 10–65).

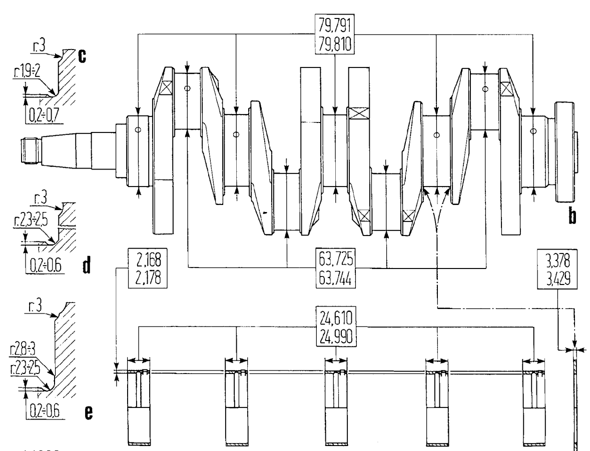
After grinding, round the corners and fillets as shown in the detail drawings below, Figs. (a) and (b) and check crankshaft for the following:

– journal out–of–round must not exceed 0.008 mm (.0003 in);

– journal taper must be less than 0.01 mm (.0039 in);



14423



14388

Standard dimensions (mm) of crankshaft pins, main bearings and thrust washers.

a. 50V, 55V, 55F, 60V, 60F, 62F tractors – b. 70V, 72F, 72LP, 82F and 82LP tractors – c. Connecting rod bearing journal rounds and fillets – d. Standard main bearing journal rounds and fillets – e. Detail of rounds and fillets of the main bearing journals with thrust washers.

Print No. **603.54.283.00** – 09 – 1994

– with crankshaft on parallel gauge blocks, the max misalignment among main bearing journals should not exceed 0.10 mm (.004 in) (D);

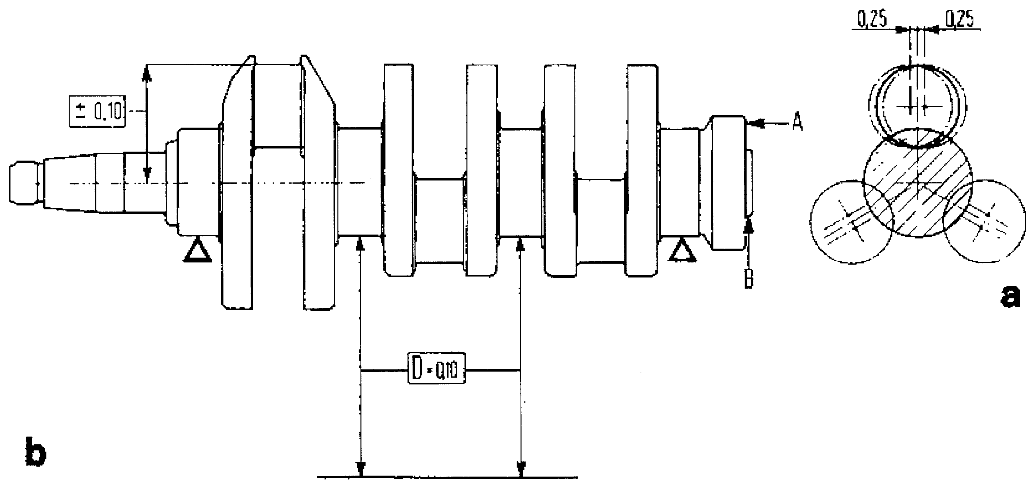
– the center line of each connecting rod bearing journal (50V, 55V, 55F, 60V, 60F and 62F tractors) or of each pair (70V, 72F, 72LP, 82F and 82LP tractors) should lay on the same plane of the main bearing journal center line within ± 0.25 mm (.010 in) measured perpendicularly to the same plane (see Figs. a, b);

– the measure of the distance between the outer surface of the connecting rod bearing journals and the crankshaft center line should be within a tolerance of ± 0.10 mm (.004 in);

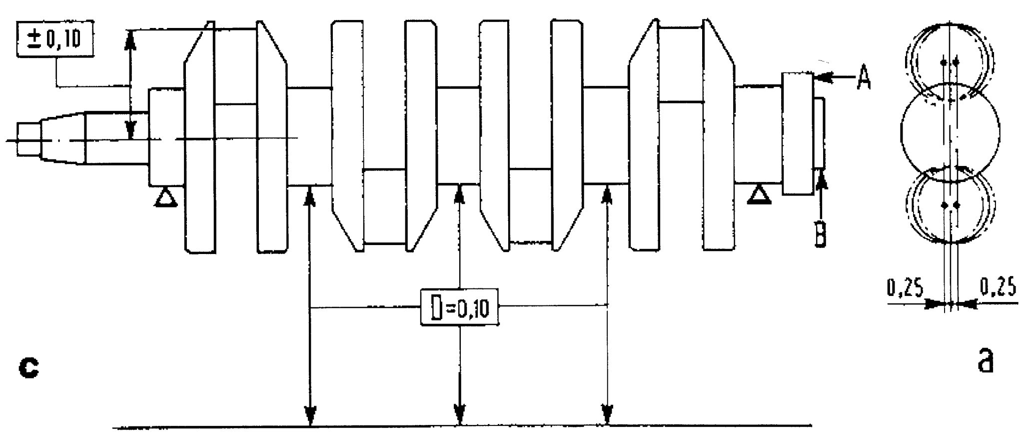
– with the dial tip on (A) or (B), readings of the comparator gauge should not exceed the limits specified on page 10–66;

– check plug oil tightness at a pressure of 14.7 bar (15 kg/cm^2–217 psi);

– in case of replacement, after force–fitting, punch–lock the plugs and re–check oil tightness with the system pressurized.



8992

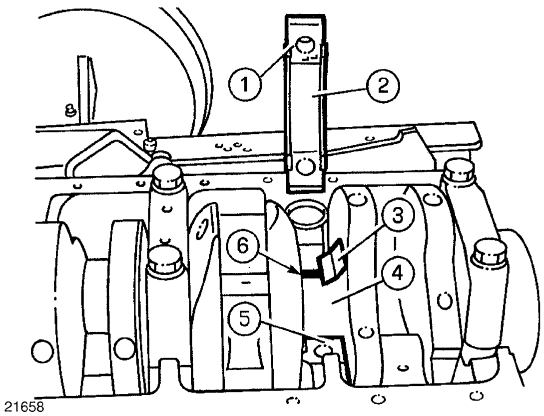


7673

Max. permissible tolerances on main and connecting rod bearing journal alignment with respect to the crankshaft center line and connecting rod bearing journal alignment with respect to main bearing journals.

b. 50V, 55V, 55F, 60V, 60F, 62F tractors – c. 70V, 72F, 72LP, 82F, 82LP tractors – A and B. Comparator gauge dial tip position for checking perpendicularity and alignment of the flywheel mounting flange – D. Max. permissible difference of main bearing alignment.

Bearings



21658

Check clearance between bearings crankshaft journals using the calibrated wire gauge, as follows:

– make sure that all parts are perfectly clean and with no trace of oil;

– place the bearing shells on their respective seats (5);

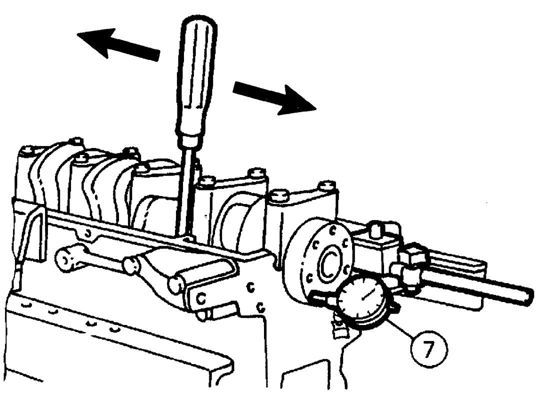
– install the crankshaft;

– place in position along the crankshaft center line, a segment of calibrated gauge wire (6) on the crankshaft pins (4);

– fit bearing caps (1) together with bearing shells (2) in their respective seats;

– wet main bearing cap screws (**C**$_2$) with engine oil and torque tighten them at the specified value (see page 10–8);

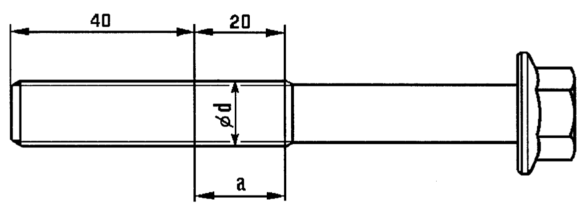
– remove caps from supports and establish the existing clearance between main bearing shells and crankshaft pins by comparing the width of the wire segment at the point subjected to maximum pressing with the graduated scale provided on the envelope (3) containing the wire;



22630

–after installation of the crankshaft back in the engine crankcase and after securing it in place with the bearing caps, check, using the comparator gauge (7), the end float at the cap before the last one;

– should the crakshaft end float exceed specifications (see page 10–65), replace existing thrust washers and fit oversized ones.



14800A

Main bearing cap screws (C$_2$, pages 10–4 and 10–6).

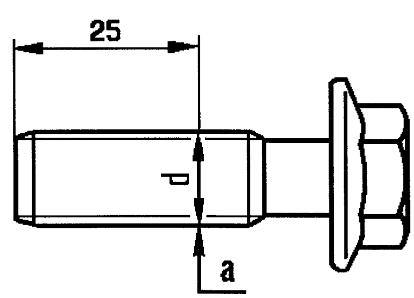
In case of re–use of these screws, check before fitting that dsia. **d** (measured as shown in the figure above, over section a) is 13.5 mm (.532 in) larger; if not, replace the screws.

Engine flywheel

The flywheel is attached to the crankshaft by means of self–locking screws and is provided on the inside annular band, engine side, with the starter drive ring, force fitted after pre–heating.

Should it be necessary to replace the starting ring, it will be necessary, at assembly, to pre–heat it in hot oil at 80^o to 90^{o}C (17^o to 194^{o}F) before force fitting it in place with the chamfer on its teeth facing on the inside (starting motor side).

The flywheel has a fixed mounting position on the crankshaft, which explains why the screw holes are offset accordingly.



14802A

Engine flywheel screws (C$_4$, pages 10–4 and 10–6).

In case of re–use, check that diameter **d** (measured as shown in the figure above, section a) is 11.5 mm (.453 in) larger; if not, replace the screws.

Print No. **603.54.283.00** – 09 – 1994

CONNECTING ROD MAIN DATAI	mm (in)	
	100 mm bore	104 mm bore
Connecting rods	cast iron with lube port	
Dia. of big end bushing housing bore	41.846 ÷ 41.884 (1.6319 ÷ 1.6335)	
O.D. of big end bushing	41.979 ÷ 42.017 (1.6372 ÷ 1.6387)	
Interference fit of bushing in big end bore	0.095 ÷ 0.171 (.0037 ÷ .0067)	
I.D. of big end bushing (measured after force fitting and reaming)	38.004 ÷ 38.014 (1.4822 ÷ 1.4825)	
Dia. of connecting rod bearing shell seats	67.407 ÷ 67.422 (2.6289 ÷ 2.6295)	
Tolerance on connecting rod big and small end center line alignment, checked at 125 mm (5 in)	± 0,07(.0028)	
Max. weight difference among connecting rods installed on same engine	25 grams (.87 oz)	

PISTON MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Pistons	cast light alloy provided with three rings of which two oil seal rings and one oil scraper	
Dia. of standard pistons measured at 57 mm (2.25 in) from base of skirt and perpendicularly to the pin axis	99.827 ÷ 99.841 (3.8933 ÷ 3.8938)	103.812 ÷ 103.826 (4.0487÷ 4.0492)
Piston/cylinder liner running clearance	0.159 ÷ 0.197 (.0062 ÷ .0077)	0.174 ÷ 0.212 (.0068 ÷ .0083)
Wear limit	0.30 (.0117)	
Spare piston oversizes	0.4 ÷ 0.8 (.016 ÷ .032)	
Projection over crankcase of pistons at T.D.C	0.355 ÷ .0761 (.0138 ÷ .0297)	
Dia. of piston pin	37.983 ÷ 37.990 (1.4813 ÷ 1.4816)	
Dia. of piston pin housing bores	37.993 ÷ 38.000 (1.4817 ÷ 1.4820)	
Piston bore/pin assembly clearance	0.003 ÷ 0.017 (.0001 ÷ .0007)	
Piston pin/connecting rod small end bushing assembly clearence ..	0.014 ÷ 0.031 (.0005 ÷ .0012)	
Wear limit	0.06 (.002)	
Max. weight difference among pistons installed on same engine ...	20 grams (.7 oz)	
Assembly clearance of piston rings installed (measured vertically in ring groove):		
– 1st ring	0.090 ÷ 0.122 (.0035 ÷ .0048)	
– 2nd ring	0.060 ÷ 0.092 (.0023 ÷ .0036)	
– 3rd ring	0.040 ÷ 0.075 (.016 ÷ .029)	

(continued)

*Print No. **603.54.283.00** – 09 – 1994*

(follows)

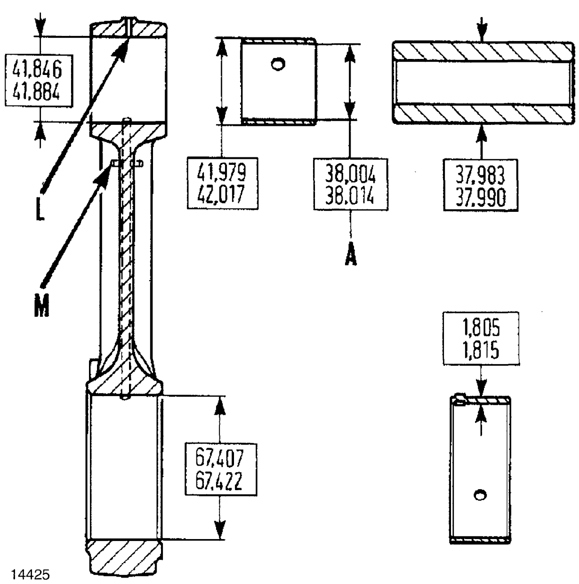
PISTON MAIN DATA	mm (in)	
	100 mm bore	**104 mm bore**
Max. permissible clearance (wear limit):		
– 1st ring	0.50 (.020)	
– 2nd and 3rd ring	0.20 (.008)	
Assembled ring end gap:		
– 1st ring	0.35 ÷ 0.55 (.014 ÷ .021)	0.40 ÷ 0.65 (.016 ÷ .025)
– 2nd ring	0.30 ÷ 0.45 (.012 ÷ .018)	0.30 ÷ 0.55 (.012 ÷ .021)
– 3rd ring	0,30 ÷ 0,60 (.012 ÷ .023)	
Max. permissible ring gap (wear limit)	1.20 (.047)	

CHECKS, DIMENSIONS AND REPAIRS (CONNECTING RODS)

Before starting make sure to clean all loose parts thercoughly.

Check that bushings in the connecting rod small end are tight in their bores and flush with the rod side surfaces.

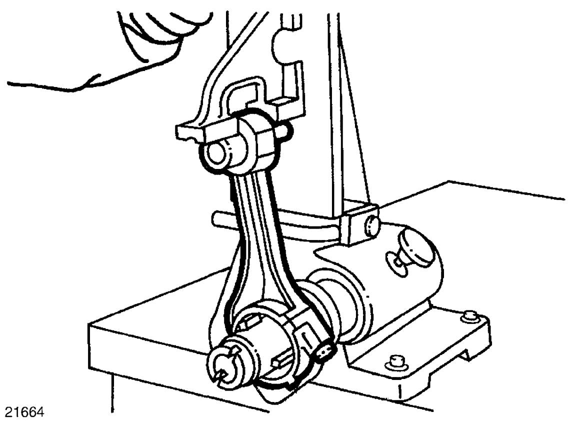
If necessary, replace bushings and ream them, after assembly, to specification (dimension A).



14425

Dimensions (mm) of the connecting rods, bearings, bushings and standard pins.

A. Final dimension after force fitting and reaming – L,M. Oil ports.



21664

Check parallelism of connecting rod axes: max. permissible tolerance is + 0.07 mm (.003 in) measured at 125 mm (5 in) from the rod longitudinal axis.

If a connecting rod is only slightly bent, straighten it out under a press, otherwise replace them.

New connecting rods are marked with the designation number of the cylinder in which they are to be fitted; besides, make sure that among the connecting rods assembled in the same engine, the weight difference is not more than 25 grams (.88 oz).

Also check that lube oil ports (L and M) are unobstructed and free from scale and impurities.

*Print No. **603.54.283.00** – 09 – 1994*

CHECKS, DIMENSIONS AND REPAIRS (PISTONS)

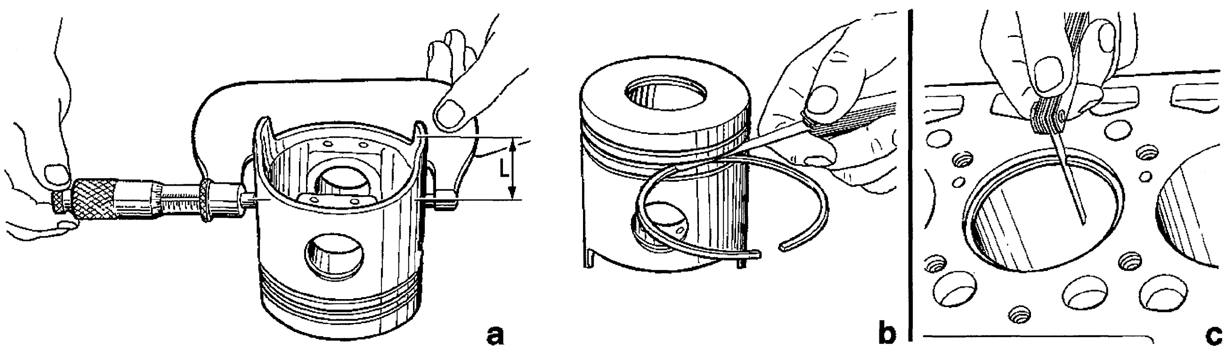
Before starting make sure to thoroughly clean all loose parts to be assembled.

Establish the state of wear of pistons and cylinder liners as instructed on pages 10–63, 10–69 and 10–70 and as shown in the figures below.

If the assembly clearance is more than 0.30 mm (.012 in), re–bore and grind the liners and fit oversized pistons and rings (see pages 10–63, 10–69 and 10–70).

In case of piston replacement check that the weight difference among pistons assembled in the same engine is not greater than 20 grams (.70 oz).

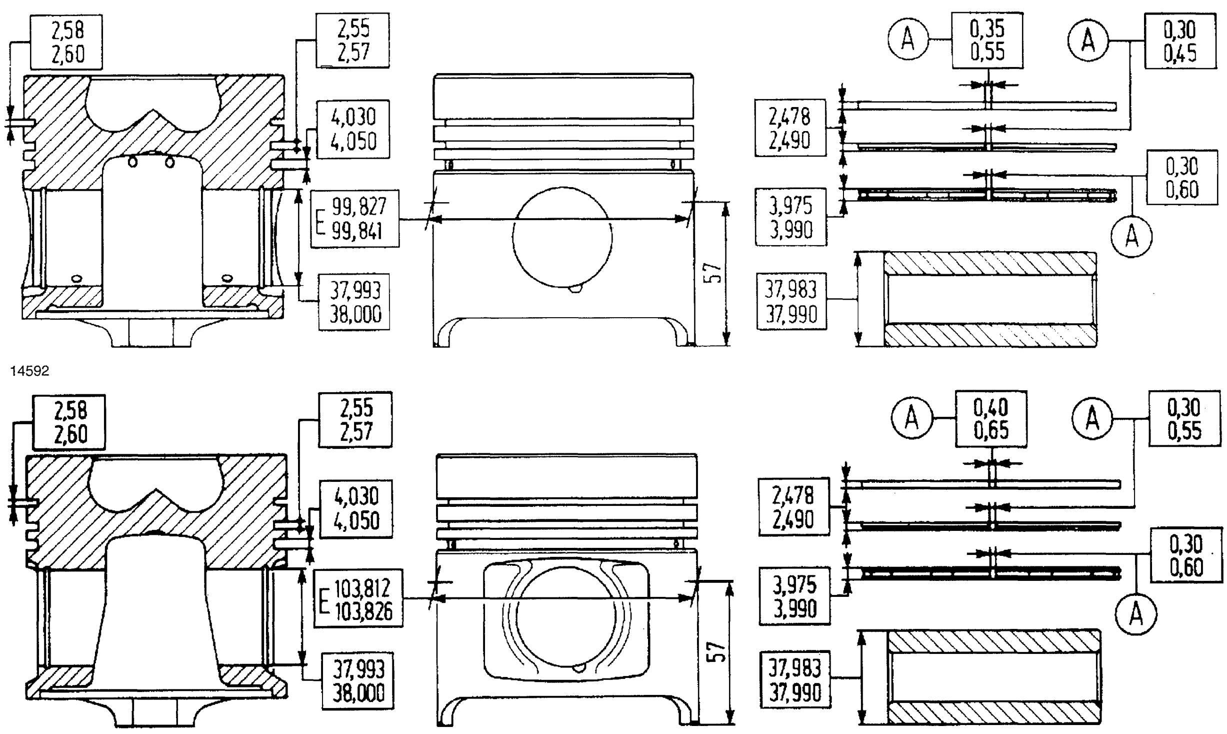
Check that the assembly clearance of piston rings in their seats (b) and the end gap (c) are conforming to specifications on pages 10–69 and 10–70. If the piston ring gap should be less than normal, increase it by grinding ends.



6840B

Checking pistons and their rings

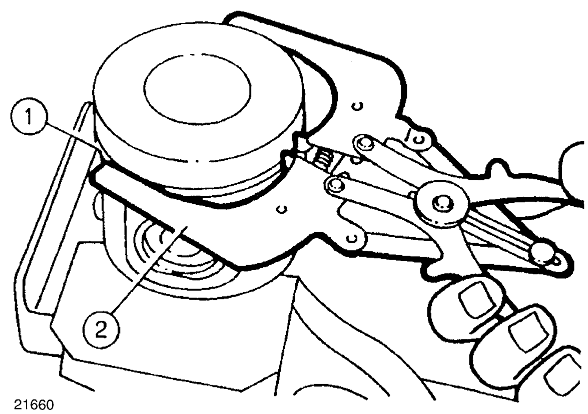
a. Checking piston diameter measured at height (L) from the base of its skirt –b. Checking piston ring/seat clearance – c. Checking assembled piston ring end gap – L. Measuring dimension: 57 mm 2.25 in).



Dimensions (mm) of standard pistons, pins and rings

a. 50V, 55V, 55F, 70V, 72F, 72LP tractors – b. 60V, 60F, 62F, 82F, 82LP tractors – A. Dimension to be measure after piston assembly inside liners – E. Piston dia. measured at 57 mm (2.25) in from skirt base.

Print No. 603.54.283.00 – 09 – 1994

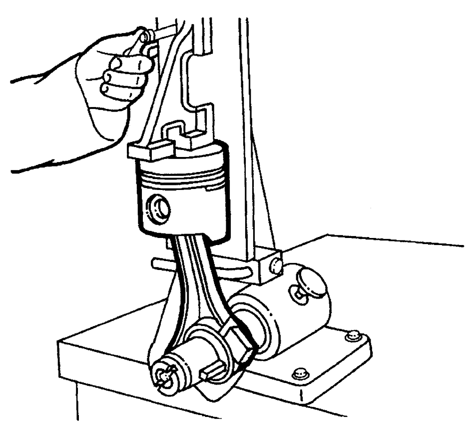


21660

For operations requiring the disassembly–assembly of new piston rings (1) use the **291160** special pliers (2).

Install rings in their seats as indicated on page 10–71.

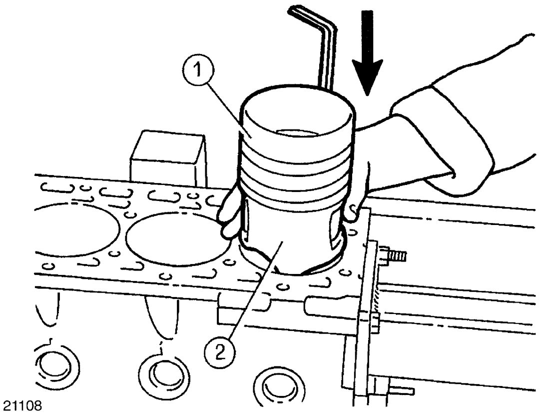
At connecting rod–piston assembly check that the pin clearance fit in piston hub meets specifications of page 10–69.



21665

Controllare la perfetta quadratura fra bielle e stantuffi.

Check for perfect squareness of the connecting rod–piston assembly and replace any part that would not allow it.



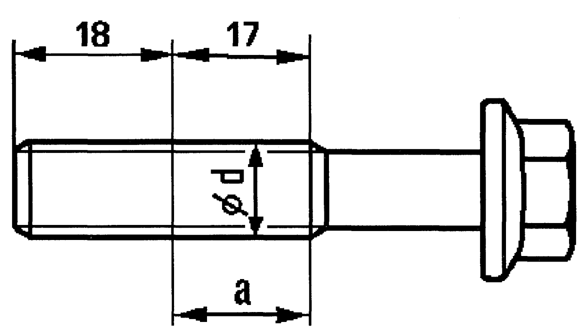
21108

Notes:

– Lubricate pistons, rings and cylinder liners prior to fitting pistons inside liners;

– Before fitting the special **291048** compression band (1) on the pistons (2) prior to introducing the latter inside the cylinder liners, make sure that piston ring end gaps are offset 180°.

This will allow for better compression and better oil sealing.



14805A

Connecting rod cap screws (C_3, pages 10–4 and 10–6)

In case these screws are to be re–used, check that dia. **d** (measured where shown in the figure, zone a) is 10.5 mm (.41 in) larger; if not, replace the screws.

Note – it is advisable to fit new cap holding screws every time connecting rods have been disassembled.

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*Print No. **603.54.283.00** – 09 – 1994*

VALVE TIMING GEAR MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Timing gear tooth backlash	0.160 (.0062)	
Idler gear bushings I.D. (press fitted and reamed)	37.050 ÷ 37.075 (1.4586 ÷ 1.4596)	
Idler gear jack shaft diameter	36.975 ÷ 37.000 (1.4557 ÷ 1.4567)	
Jack shaft journal clearance in bushing	0.050 ÷ 0.100 (.002 ÷ .004)	
Max. running clearance (wear limit)	0.15 (.006)	
Bushing interference fit in idler gear	0.063 ÷ 0.140 (.0025 ÷ .0055)	
Camshaft bushing O.D.:		
– front	54.875 ÷ 54.930 (2.1604 ÷ 2.1626)	
– intermediate	54.375 ÷ 54.430 (2.1407 ÷ 2.1429)	
– rear	53.875 ÷ 53.930 (2.1210 ÷ 2.1232)	
Bushing interference fit in housing	0.070 ÷ 0.150 (.0028 ÷ .0059)	
Camshaft bushing I.D. (press fitted and reamed):		
– front	51.080 ÷ 51.130 (2.011 ÷ 2.013)	
– intermediate	50.580 ÷ 50.630 (1.9913 ÷ 1.9933)	
– rear	50.080 ÷ 50.130 (1.9716 ÷ 1.9736)	
Camshaft journal diameter:		
– front	50.970 ÷ 51.000 (2.0067 ÷ 2.0079)	
– intermediate	50.470 ÷ 50.500 (1.9870 ÷ 1.9882)	
– rear	49.970 ÷ 50.000 (1.9673 ÷ 1.9685)	
Camshaft journal clearance in bushing	0.080 ÷ 0.160 (.0031 ÷ .0063)	
Max. running clearance (wear limit)	0.20 (.008)	
Camshaft end float (between thrust plate and seat)	0.070 ÷ 0.220 (.0028 ÷ .0087)	
For additional valve gear timing data	see page 10–3	

VALVE TAPPET MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Tappet seat diameter in crankcase	15,000 ÷ 15,018 (.5905 ÷ .5912)	
Standard tappet O.D.	14,950 ÷ 14,970 (.5885 ÷ .5894)	
Tappet clearance in crankcase seats	0,030 ÷ 0,068 (.0012 ÷ .0027)	
Max. clearance (wear limit)	0.15 (.006)	
Spare tappet oversizes	0.1 – 0.2 – 0.3 (.004 – .008 – .012)	

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

VALVE ROCKER ARM MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Rocker arm bracket bore diameter	18.016 ÷ 18.034 (.7093 ÷ .7100)	
Rocker arm shaft diameter	17.982 ÷ 18.000 (.7079 ÷ .7087)	
Rocker arm shaft clearance in bracket	0.016 ÷ 0.052 (.0006 ÷ .0020)	
Max. clearance (wear limit)	0.15 (.006)	
Rocker arm spacing spring specifications:		
– nominal free length	59.5 (2.242)	
– length under load of 46 ÷ 52 N (4.7 ÷ 5.3 kg – 10.4 ÷ 11.9 lb)	44 (1.732)	
Valve clearance, timing check	0.45 (.018)	
Valve clearance, normal operation (cold engine):		
– intake valve	0.30 ± 0.05 (.012 ± .002)	
– exhaust valve	0.30 ± 0.05 (.012 ±.002)	
Cam lift:		
– intake valve	5.67 (.223)	
– exhaust valve	5.95 (.234)	

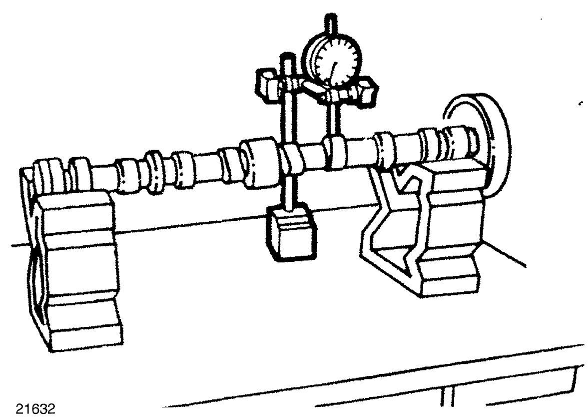
CHECKS, DIMENSIONS AND REPAIRS (CAMSHAFT, TAPPETS AND VALVES)

Before starting make sure to thoroughly clean all loose parts to be assembled.

Camshaft

To check the camshaft, place it on V–gauge blocks and then check with a comparator gauge that excentricity of journals with respect to shaft axis is no more than 0.02 mm (.008 in).

If excentricity does not exceed 0.2 mm (.008 in), straighten the shaft under the shop press; replace the shaft if excentricity is higher.



21632

Check cam lift using a comparator gauge; readings should be as follows:

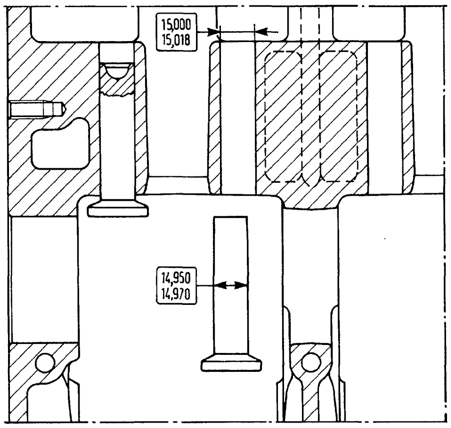
– intake valve = 5.97 mm (.235 in);

– exhaust valve = 6.25 mm (.274 in).

Replace worn bushings using the appropriate driver and installation tools to force fit them in place and then ream the bushing I.D. to the specified dimension (see figure on page 10–75).

Print No. 603.54.283.00 – 09 – 1994

Valve tappets



14451

Check for free running of valve tappets.

If excessive clearance is found, fit oversized tappets (see page 10–73) and re–bore seats.

Pushrods must be perfectly straight and the rocker screw seat should not show signs of pick–up or undue wear. Replace as necessary.

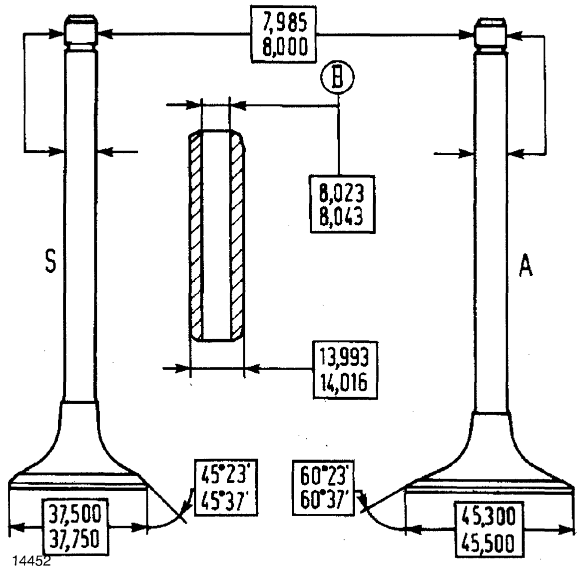
In case of rocker arm and screw working surface dressing remove as little material as possible.

Valves

Use the **291050** special tool for valve disassembly/reassembly.

For minor fluid tightness faults, valves and their respective cylinder head seat surfaces can be re–faced using the **290064** compressed air grinder or the **294006** universal bench lathe. In case of more consistent defects, re–face the cylinder head seats and grind valve heads as illustrated in the specific topic.

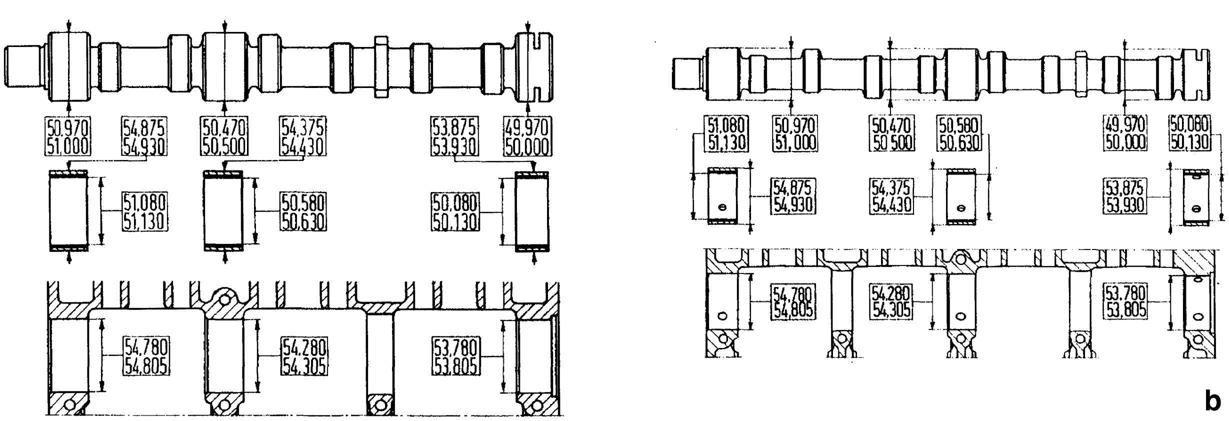
After grinding, check that the minimum land below valve head chamfer is not less than 0.5 mm (.020 in).



14452

Valve and valve guide dimensions (mm)

A. Intake – B. After force fitting and reaming – S. Exhaust.



b

a

9674

5952

Camshaft and bearing dimensions (mm)

Note – Bushing I.D. measured after force fitting – a. 50V, 55V, 55F, 60V, 60F, 62F tractors – b. 70V, 72F, 72LP, 82F, 82LP tractors.

Print No. ***603.54.283.00*** *– 09 – 1994*

Valve timing diagram

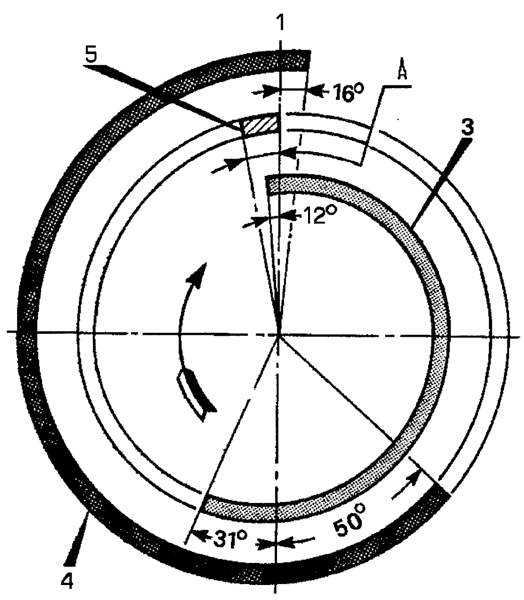
If the valve timing diagram is to be verified after completion of disassembly/assembly or overhauling operations, proceed as follows:

Check phasing of the timing gears (see page 10–59);

Provisionally set valve clearance at 0.45 mm (.018 in);

Turn crankshaft and, using an angle gauge, check that valves open and close as specified in the diagram;

Adjust valve clearance for operation as indicated hereafter.



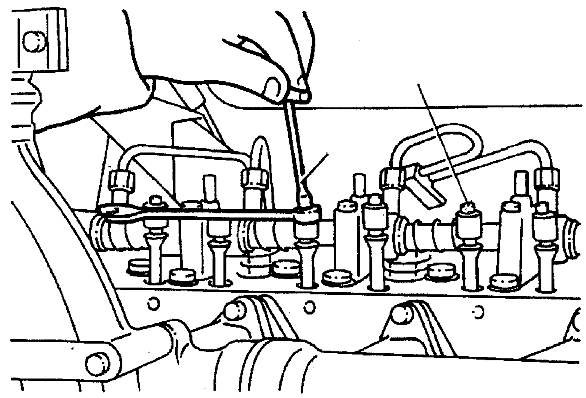
21591

Valve timing diagram

A. Fixed advance (*) – 1. T.D.C. – 2. B.D.C. – 3. Intake – 4. Exhaust – 5. Injection.

(*) According to injection pump type and tractor model (see page 10–3).

Valve/rocker arm clearance adjustment



21617

Use a feeler gauge and the **291883** special wrench (5) before fitting the cylinder head cover.

To adjust on 3–cylinder model 50V, 55V, 55F, 60V, 60F, 62F tractors, proceed as follows:

Turn crankshaft until intake and exhaust valves of cylinder no. 1 balance (commencement of intake); this condition is confirmed by the alignment of the "P.M.S 1" (top dead center 1) timing mark stamped on the flywheel with the reference pointer.

Rotate the crankshaft through one full turn to bring back the "P.M.S. 1" timing mark to the previous position and then check that the valve/rocker arm clearance corresponds to the value charted on page 10–74.

Proceed the same way for the remaining pairs of valves, considering, however, that for pistons 2 and 3 there are no P.M.S.2 or P.M.S. 3 timing marks on the flywheel.

To adjust on 4–cylinder model 70V, 72F, 72LP, 82F, 82LP tractors proceed as follows:

Turn crankshaft until intake and exhaust valves of cylinder no. 1 balance (commencemnt of intake); this condition is confirmed by the alignment of the "P.M.S. 1" (top dead center 1) with the reference pointer.

Check then that the valve/rocker arm clearance at cylinder no. 4, symmetrical with cylinder no. 1, corresponds to the value charted on page 10–74. Turn crankshaft through 3605 and adjust on cylinder no. 1.

Do the same for the remaining valve pairs, considering that cylinders 1–4 and 2–3 are symmetrical.

Print No. 603.54.283.00 – 09 – 1994

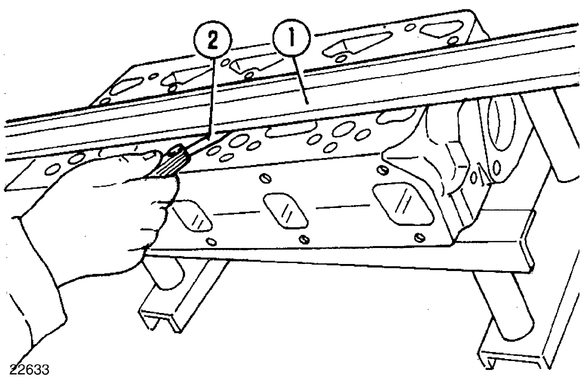
CYLINDER HEAD MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Cylinder head	with valve seats cast directly in cylinder head and force fitted, steel valve guides	
Cylinder head original height	92 (3.622)	
Max. thickness removable by grinding	0.5 (.020)	
Dia. of standard valve guide housing on cylinder head	13.950 ÷ 13.983 (.5492 ÷ .5505)	
O.D. of standard valve guides	13.993 ÷ 14.016 (.5509 ÷ .5518)	
Valve guide interference fit in cylinder head	0.010 ÷ 0.066(.0004 ÷ .0026)	
I.D. of valve guides(measured after force fitting in cylinder head .	8. 023 ÷ 8.043(.3158÷ .3166)	
Valve stem dia.	7,.985 ÷ 8.000(.3144 ÷ .3150)	
Valve stem/seat assembly clearance	0.023 ÷ 0.058(.0009÷ .0023)	
Max. assembly clearance (wear limit)	0.13 (.005)	
Max. out–of–round of valve guided on its stem through a full turn measured with a comparator dial gauge tip at center of tapered sealing surface	0.003 (.001)	
Spare valve guide oversizes	0.2 (.008)	
Valve seat angle with respect to cylinder head surface:		
– intake valve seats	60° ± 5’	
– exhaust valve seats	45° ± 5’	
Valve head angle:		
– intake valves	60° 30’ ± 7’	
– exhaust valves	45° 30’ ± 7’	
Valve head dia.:		
– intake valves	45.300 ÷ 45.500 (1.7835 ÷ 1.7913)	
– exhaust valves	37.500 ÷ 37.750 (1.4763÷ 1.4862)	
Valve stand–in below cylinder head top	0.7 ÷ 1.0 (.027 ÷ .040)	
Max. permissible stand–in	1.3 (.051)	
Intake/exhaust valve spring specifications:		
– nominal free length	44.6 (1.756)	
– spring length with valve closed, under a load of 256 ÷ 284 N (26.1 ÷ 28.9 kg – 57.5 ÷ 63.7 lb)	34 (1.338)	
– spring length with valve open, under a load of 502 ÷ 554 N (51.2 ÷ 56.5 kg – 113 ÷ 124.5 lb)	23.8 (.937)	
Injector stand–out above cylinder head top:		
• BOSCH inject. part no. 4792442, 4824164, 4800029, 4824170	0.3 ÷ 1.1 (.012 ÷ .043)	
• C.A.V. injector part no. 4817265 and 4812762	0.1 ÷ 1.1 (.004 ÷ .043)	
• ALTECNA injector part no. 4802391 and 4802394	0.25 ÷ 1.05 (.010 ÷ .041)	
• OMAP injector part no. 4800031 and 4800032	0.15 ÷ 0.95 (.006 ÷ .0437)	

Print No. ***603.54.283.00*** *– 09 – 1994*

CHECKS, DIMENSIONS AND REPAIRS (CYLINDER HEAD)

Use the **291050** special tool for valve spring disassembly/assembly operations.

Before starting make sure to thoroughly clean all loose parts to be assembled.

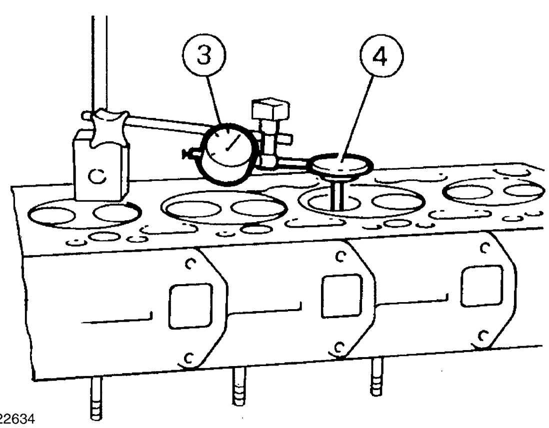


22633

Check the cylinder head mating surface (with crankcase) using a steel ruler (1) and feeler gauge (2).

Re–face the cylinder head on a surface grinder if uneven spots more than 0.15 mm (.006 in) are found.

Note: remove by grinding as little material as possible considering that the maximum total processing depth is 0.5 mm (.020 in).



22634

Check with a magnetic base, dial comparator gauge (3) the alignment and clearance of valve stem (4) and housing.

If excessive clearance is found (see page 10–77) replace the valve and, if necessary, its valve guide also.

VALVE GUIDES
Replacement (Operation 1010153)

DANGER

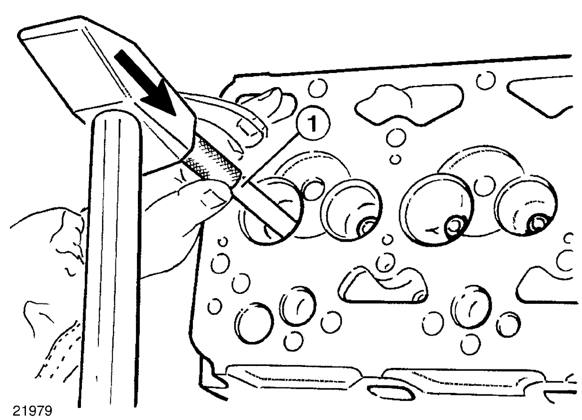
Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

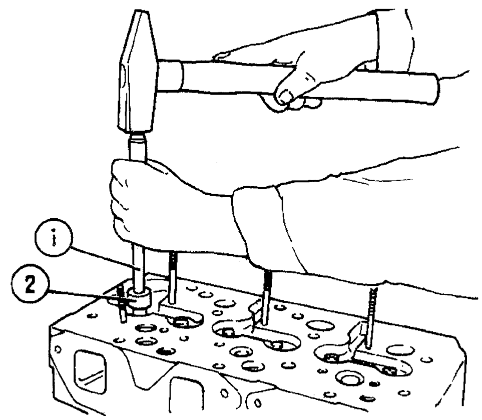
Install cylinder head on workbench, then proceed as follows.

1. Enlarge the housing bore of the valve guide to be fitted by means of the **294027** twist drill.



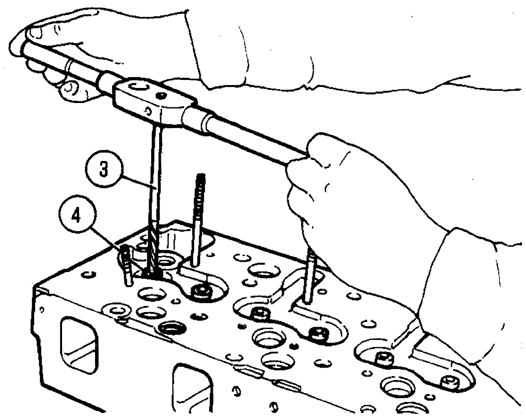
21979

2. Place the cylinder head on an adequate support and remove the valve guide to be replaced using the **291046/1** driver tool (1).



22635

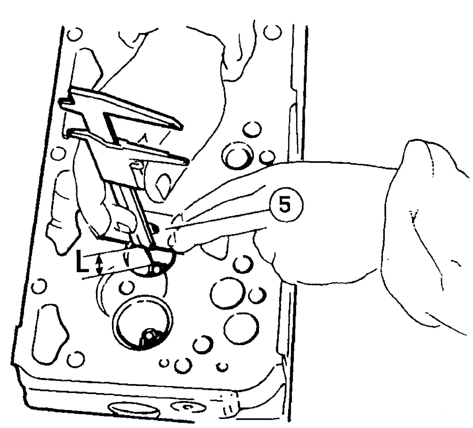
3. Turn cylinder head upside down and force fit the new valve guide, with enlarged hole, using the **291046/1** driver tool (1) and **293231** pilot bushing (2).



22636

4. Reface the valve guide (4) I.D. with the **292177** reamer (4).

Note: in case of replacement of the exhaust valve guide proceed in the sequence further indicated.



21982

5. Measure distance (L) between cylinder head base and valve guide base using a caliper and special plate (5) of the **294028** special tool.

Depth of cutting will be:

B – L = C

where

B = dimension of taper milled end (see illustration on page 10–81)

L =dimension measured between the cylinder head base and valve guide base.

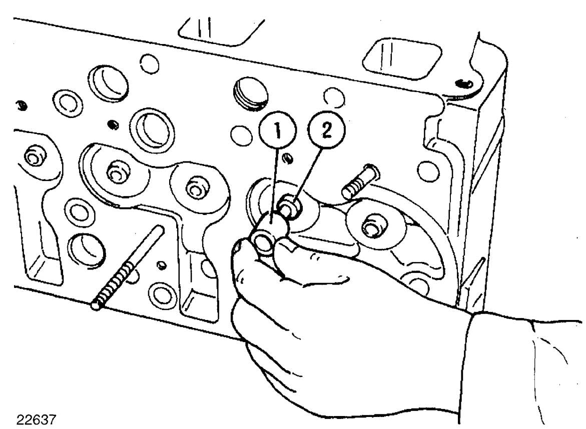
C = depth of taper milling to be processed.

Example (4–cylinder engine)

B = 43.1 ÷ 43.6 mm (1.70 ÷ 1.72 in)

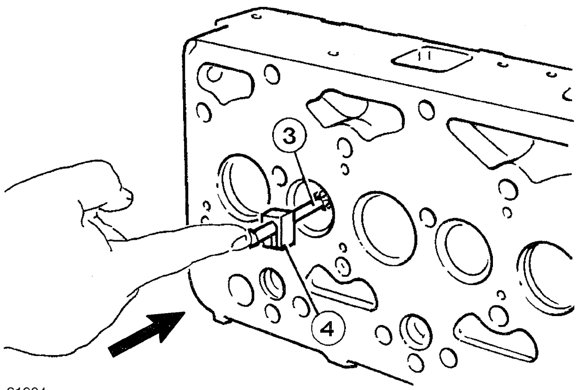
L = 34mm (1.34 in). Reading.

C = (43.1 ÷ 43.6) – 34 = 9.1 ÷ 9.6 mm or (1.70 ÷ 1.72 in) – 1.34 = . 36 ÷ .38 in. Depth of the taper milling.



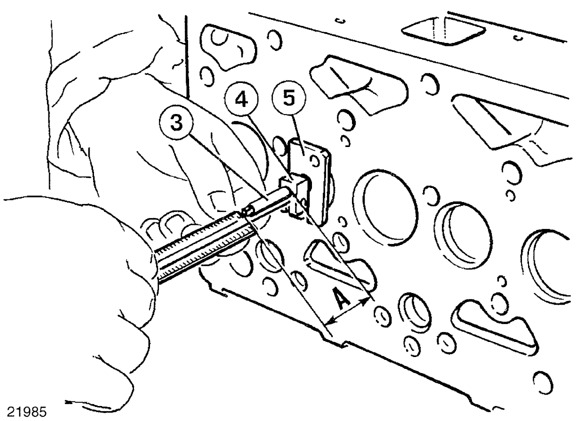
22637

6. Fit in bushing (1) of the **294028** tool on valve guide (2) from the upper side of the cylinder head.



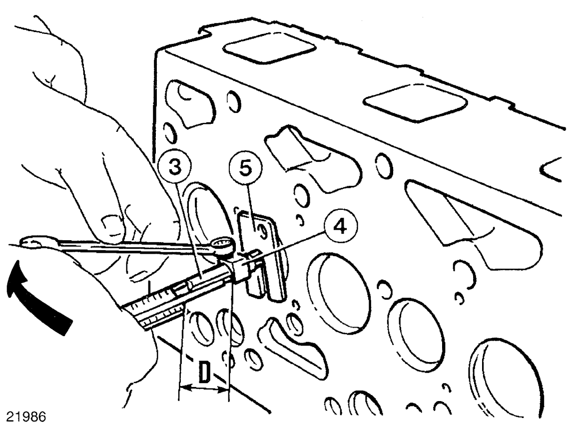
21984

7. Introduce the milling cutter head (3) of the **294028** tool, complete with stop block (4), on the previously located bushing until the cutting head comes to contact the valve guide.



21985

8. Place the plate (5) of the **294028** tool flush with the cylinder head base, place the stop block (4) flush against the plate and measure distance (A) between block ends and cutting head end (3).



21986

9. Place the stop block (4) at distance (D) = 35.9 ÷ 36.4 mm (1.41 ÷ 1.43 in) from cutting tool end and fix it in position by tightening its set screw.

Distance (D) will be:

D = A – C

where:

D = dimension establishing the end of the taper milling cut.

A = distance between the end of the cutter and stop block end, with plate flush against the head.

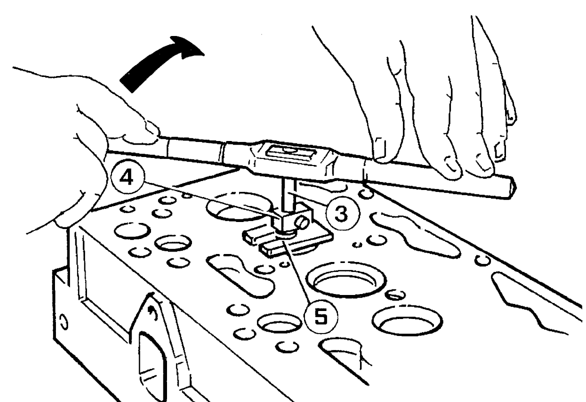
C = depth of taper milling cut.

Example

A = 45.5 mm (1.79 in)

C = 9.1 ÷ 9.6 mm (.36 ÷ .38 in)

D = 45.5 – (9.1 ÷ 9.6) = 35.9 ÷ 36.4 mm or 1.79 in –(.36 ÷ .38 in) = 1.41 ÷ 1.43 in.



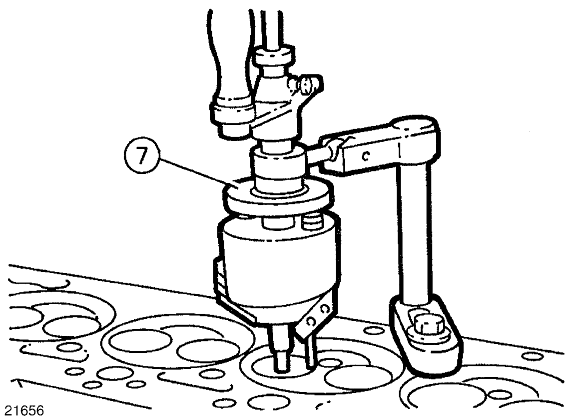
21987

10. Turn milling cutter (3) until plate (5), pushed by block (4) comes into contact with the cylinder head base.

Note: before assembling the cylinder head clean the same thoroughly in order to eliminate any and all residual metal consequent to the milling process.

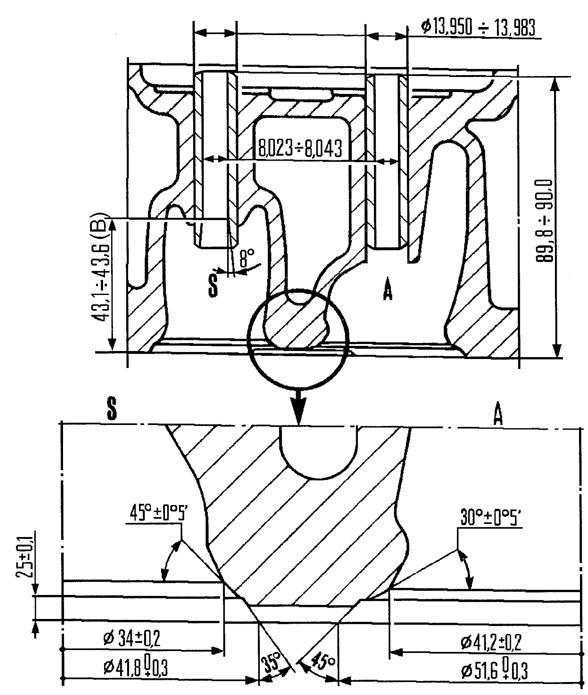
Print No. **603.54.283.00** – 09 – 1994

CYLINDER HEAD VALVE SEATS – Refacing



21656

11. Should it be necessary to reface the valve seats in order to assure optimum tightness, use th **294006** universal lathe tool (7) removing as little material as possible.

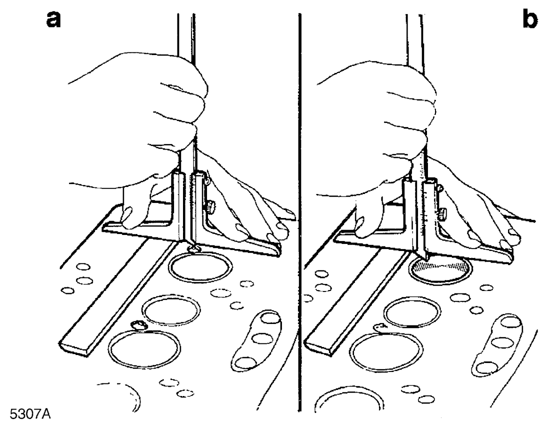


21693

Dimensions (mm) of the valve and valve guide housings

A. Intake – B. End of milling taper cut on 3 and 4–cylinder tractors – S. Exhaust.

INJECTOR HOLDER SLEEVE – Replacement (Operation 10 101 60).

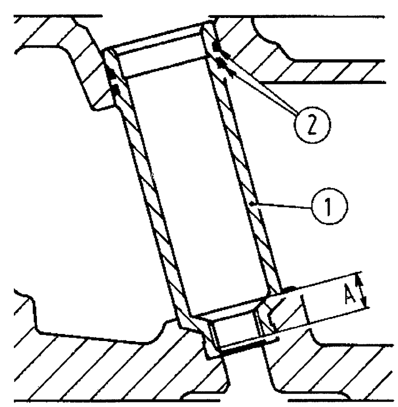


5307A

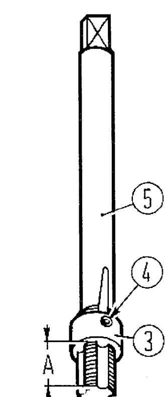
Checking the injector and valve height with respect to the cylinder head top surface.

a. Injector stand–out check (see page 10–77) – b. Valve stand–in check: 0.7÷1.0 mm – .027÷.040 in (max. permissible stand–in 1.3 mm = .050 in).

1. After cylinder head surface grinding, if any, check that the injector stand–out meets specification of page 10–77.



14138



14139

If stand–out is more, replace the injector holder sleeve using the **293270** tool kit and proceeding as follows:

2. Adjust dimension (A) on the **292240** tool (5) at 9 mm (.354 in) through ring nut (3) and lock it in place by tightening the set screw (4).

3. Tap the sleeve I.D. using the **292240** (M12x1.75) tool making sure that the process involves the sleeve only.

Print No. ***603.54.283.00*** *– 09 – 1994*

4. Attach the **293784** tool to the cylinder head by screwing on M8x1.25 nuts (E) on the injector holding studs.

5. Screw in fully inside the previously tapped hole the part (C) and pull the injector holder sleeve (1) out of the cylinder head by screwing on nut (D).

6. Remove any copper residue left on the cylinder head using the **292243** tool (6), as shown in Fig. f.

7. Fit seals (2, Fig. g) on the new sleeve, introduce it in its housing making sure that its bottom is flush against the seat in the cylinder head and then knurl it using the **293861** tool (F, Fig. g).

8. Fit, in the new sleeve (1, Fig. h) the **293746/1** bushing (G), fix it in its housing by screwing rinh nut (H) clockwise, introduce the **293747** reamer (I) in the bushing (g) and ream the bottom end of the sleeve.

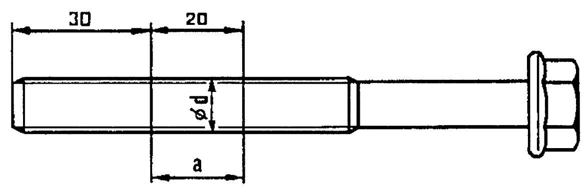
9. Remove the reamer (I) and back off ring nut (H) of about 10 mm (.40 in).

10. Press by hand, or tap slightly with a plastic–head hammer, on ring nut (H) until the inside of the **293746/1** bushing (G) is free.

11. Remove the bushing, introduce the **293790/1** cutter (L, Fig. i) in the same bushing, install it inside the sheath (1) and fix it in place by screwing the ring nut (H) clockwise.

12. Work with the cutting head to remove material until the seat is perfectly smooth and without any residual material left.

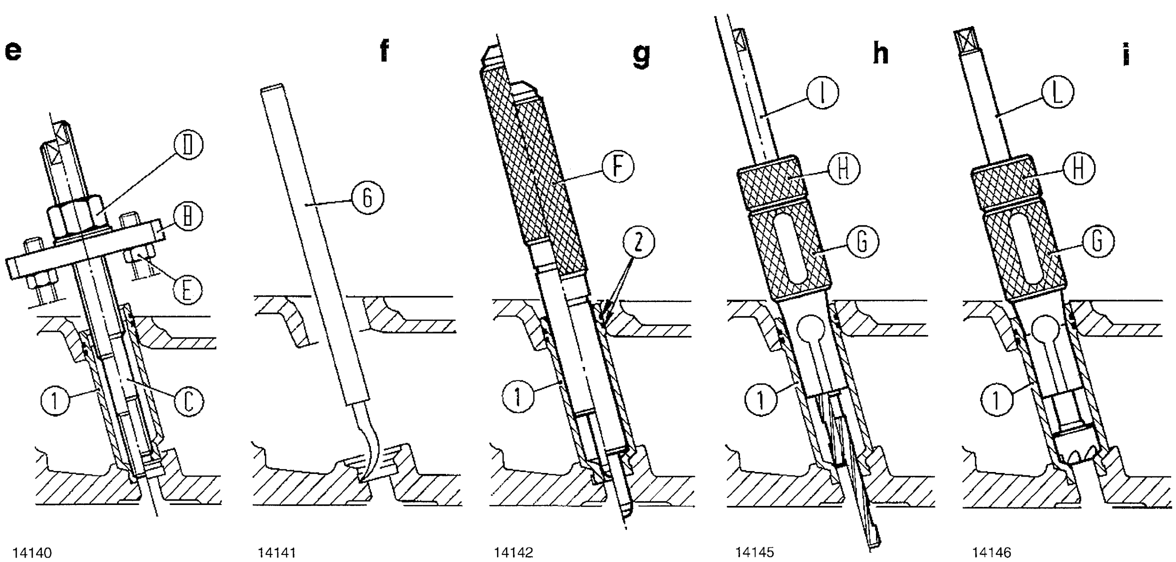
13. After facing, fit the injector inside the sleeve (1) and check that it stands out with respect to the cylinder head face as specified on page 10–77.



14801A

Cylinder head holding screws (C_1, pages 10–4 and 10–6)

In case the screws are re–used check that their diameter **d** (measured as indicated in the above figure, segment a) is 11.5 mm (.453 in) larger; if not, fit new screws).



14140 14141 14142 14145 14146

Disassembly (e), removal of residual material (f), assembly andrefacing (h, i) of the injector holder sleeve on cylinder head using the 293270 tool kit.

B,C,D. Injector holder sleeve **293784** puller – E. M*x1.25 injector holding nuts – F. Injector holder sleeve **293861** knurling tool – G,H. **293746/1** pilot bushing – I. **293747** reamer – L. **293790/1** milling cutter – 1. Injector holder sleeve – 2. O–ring seals – 6. **292243** material residue remover.

Print No. **603.54.283.00** – 09 – 1994

FLYWEIGHT–TYPE DYNAMIC BALANCER (*)	(*) installed on 4–cylinder engines only mm (in)
Interference fit of bushings (32) in gear (19)	0.063 ÷ 0.140 (.0025 ÷ .0055)
Idler gear jack shaft (2) clearance in bushings (32)	0.050 ÷ 0.100 (.0020 ÷ .0040)
Interference fit of bushings in bearing seat (16)	0.063 ÷ 0.140 (.0025 ÷ .005)
Running clearance of gear (18) shaft and bushings	0.050 ÷ 0.100 (.0020 ÷ .0040)
Tooth backlash on splined sections of sleeve (13), connecting drive box gear (18) and flyweight drive gear (11)	0.038 ÷ 0.106 (.0015 ÷ .0042)
Interference fit of front bushing (33) and bore in balancer housing (10)	0.063 ÷ 0.140 (.0025 ÷ .0055)
Running fit of flyweight drive shaft (11) and front bushing (33) ..	0.050 ÷ 0.100 (.0020 ÷ .0040)
Interference fit, drive gear rear bushing (11) and seat (28)	0.037 ÷ 0.101 (.0014 ÷ .0040)
Gioco fra albero comando (11) e relativa boccola posteriore	0.013 ÷ 0.061 (.0005 ÷ .0024)
Interference fit of bushings in flyweight (27) housing	0.040 ÷ 0.100 (.0016 ÷ .0040)
Clearance of flyweight jack shaft (26) in bushings	0.020 ÷ 0.073 (.0008 ÷.0029)
Interference fit of idler gear (34) bushing in flyweight housing (10) bore	0.037 ÷ 0.101 (.0014 ÷ .0040)
Running fit of idler gear (34) shaft and bushing	0.013 ÷ 0.061 (.0005 ÷ .0024)
Meshed gear tooth backlash	0.080 (.0031)

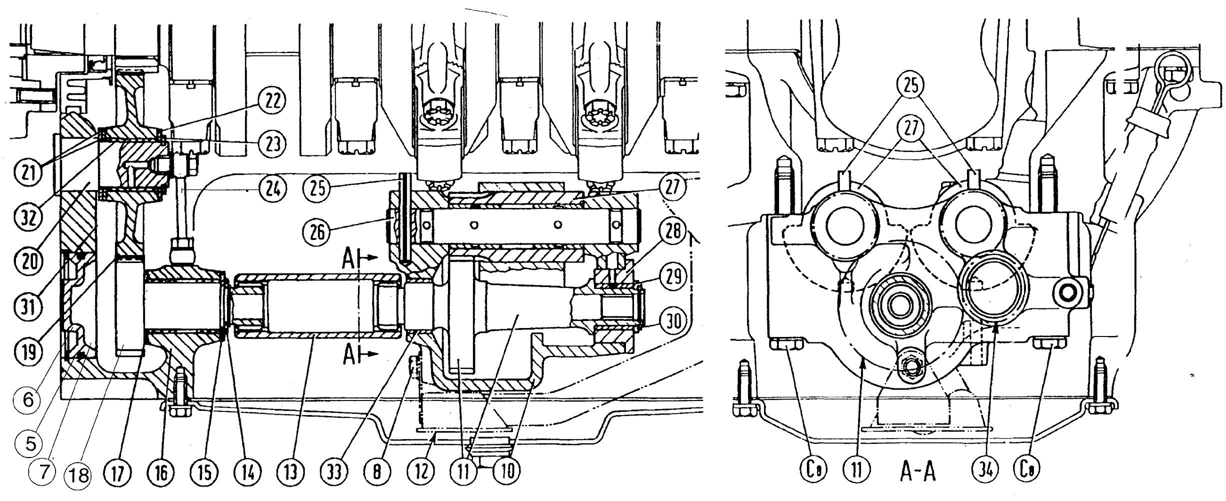
CHECKS, DIMENSIONS AND REPAIRS (FLY-WEIGHT–TYPE DYNAMICBALANCER

Before starting make sure to thoroughly clean all loose parts to be assembled.

Check parts wear and replace defective ones.

In case of replacement, force fit the flyweight bushings inside their housing bores after pre–heating them in oil at 140° to 160°C (284 to 320°F) temperature.

Ream the new bushing I.D. after fitting, using expansible–blade reamers, conforming to tolerances and specifications given in the table of data.



22605

Sectional view of the flyweight–type dynamic balancer

C_8. Flyweight housing holding screws on engine sump – 5. O–ring seal – 6. Circlip – 7. Cover – 8. Gauze filter holding screws on flyweight housing (10) – 10. Flyweight housing – 11. Flyweight drive gear – 12. Wire gauze filter – 13. Connecting sleeve – 14. Circlip – 15. Thrust washer – 16. Gear (18) housing – 17. Thrust washer – 18. Gear with flyweight drive – 19. idler gear – 20. Idler gear (19) axle – 21 and 22. Thrust washers – 23. Circlip – 24. Bushing lubrication tubelet – 25. Axle (26) retaining split pin – 26. Flyweight rotation axle – 27. Flyweights – 28. Flyweight drive gear (11) support – Thrust washer – 30. Circlip – 32 and 33. Bushings – 34. Flyweight drive idler gear.

Print No. ***603.54.283.00*** *– 09 – 1994*

LUBRICATION SYSTEM MAIN DATA	mm (in)	
	100 mm bore	104 mm bore
Drive shaft clearance in bushing	0.016 ÷ 0.055 (.0006 ÷ .0002)	
Shaft/driven gear assembly clearance	0.033 ÷ 0.066 (.0013 ÷ .0026)	
Drive/driven gear tooth backlash	0.100 (.0040)	
Drive/driven gear radial clearance in pump housing	0.060 ÷ 0.170 (0.060 ÷ 0.170)	
Drive/driven gear thickness	40.961 ÷ 41.000 (.0024 ÷ .0067)	
Height of gear seat in pump housing	41.025 ÷ 41.087 (1.6126 ÷ 1.6142)	
Gear/pump housing end play	0.025 ÷ 0.126 (1.6151 ÷1.6176)	
Pressure relief valve specifications:		
– free length	45 (1.772)	
– length under a load of 45 ÷ 49 N (4.6 ÷ 5 kg 10.1 ÷ 11.0 lb)	37.5 (1.476)	
– length under a load of 88 ÷ 94 N (9 ÷ 9,6 kg 19.8 ÷ 21.2 lb) ...	30.5 (1.200)	
For further data concerning the lubrication system	see page 10–2	

CHECKS, DIMENSIONS AND REPAIRS (LUBRICATION)

Before starting make sure to thoroughly clean all loose parts to be assembled.

OIL PUMP – (Overhauling)

To reach the oil pump, first remove the engine oil sump.

At overhauling, measure wear of pump components and compare readings with the dimensions given in the table of data.

In case of replacement, hold in mind that the drive shaft (2) and corresponding gear are supplied as an assembly being the latter force–fitted on the shaft.

OIL FILTER – (Replacement)

The oil filter (F, see pages 10–85 and 10–86) is of the integral paper cartridge type, full–flow and installed on pump delivery end.Should the filter become clogged, the pressure safety valve (Vf) opens allowing the oil flow to exclude the filter, assuring in any case the necessary engine lubrication although with unfiltered oil.

Periodically (after every 400 work hours) replace the cartridge, making sure to:

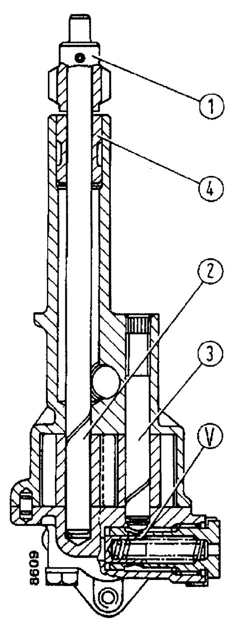
– pre–lubricate the seal in engine oil on the outside mating with the crankcase flat;

– screw in the new cartridge bringing the seal against the mating surface on the crankcase;

– finally tighten the cartridge in place, **manually only**, then further tighten by hand through a 3/4 turn.

LOW OIL PRESSURE WARNING INDICATOR – (Operational checks)

The indicator consists of a control switch (G, pages 10–85 and 10–86) and dashboard–mounted red warning lamp that lights up in the following cases:



Engine lubrication oil pump sectional view.

V. Pressure relief valve – 1. External drive gear – 2. Drive shaft and gear – 3. Driven shaft and gear – 4. Bushing.

– low oil pressure (the indicator lights up normally, with no problem present, with warm engine at low idling speed also);

– ineffective control switch.

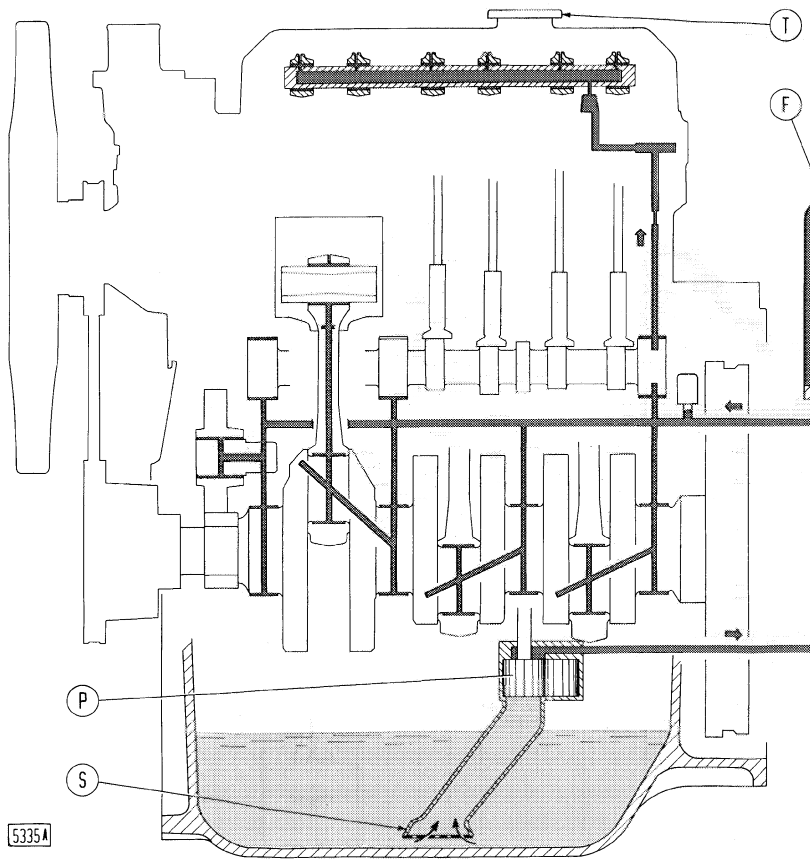
If, swith engine shut–off and starter switch on the red light fails to go on, the possible causes are:

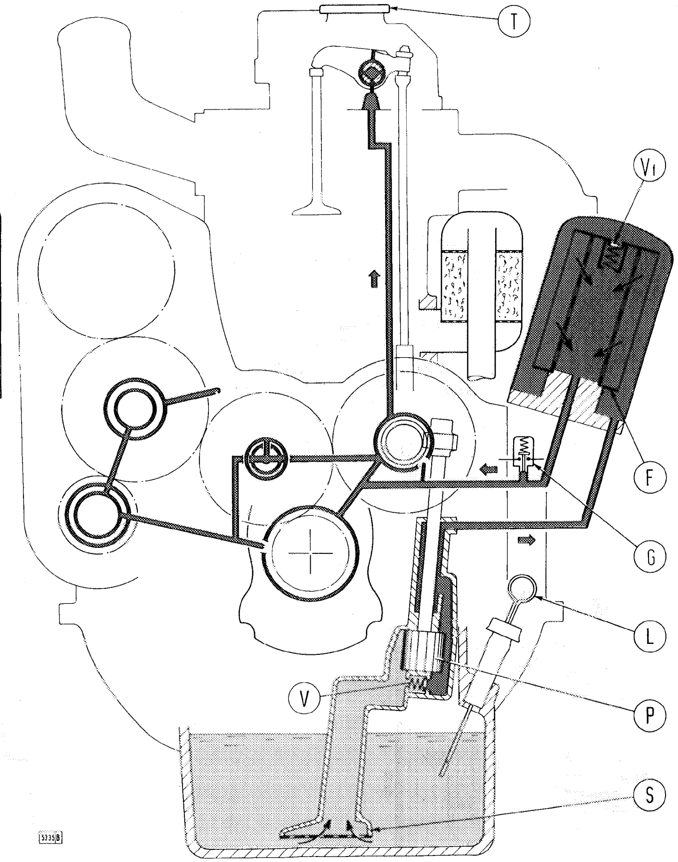
– burnt fuse;

– burnt lamp;

– broken switch/indicator wire.

*Print No. **603.54.283.00** – 09 – 1994*

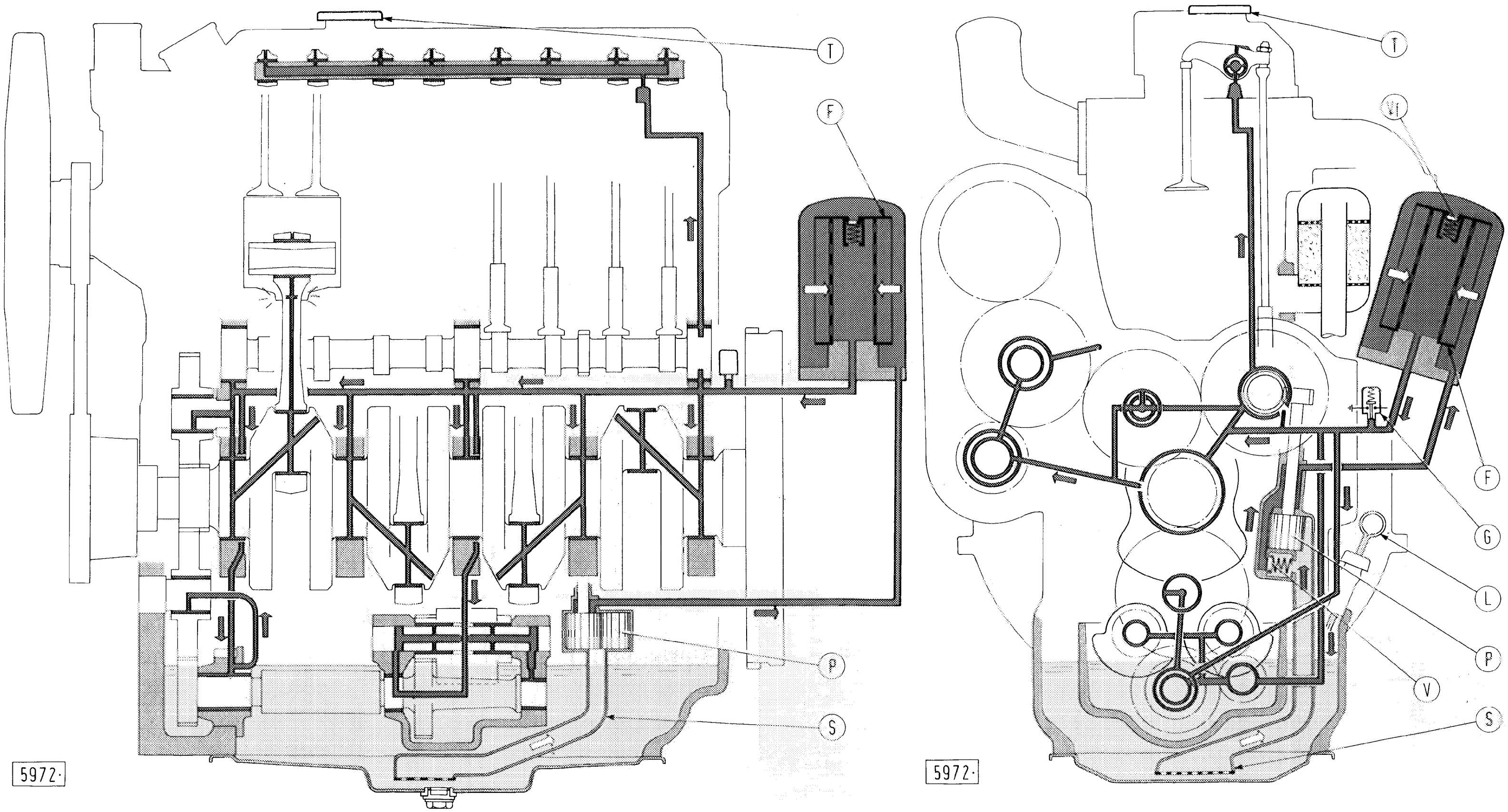




3–cylinder engine lubrication diagram

F. Filter – G. Low engine oil pressure warning light (dashboard–mounted) switch – L. Dipstick gauge – P. Pump – S. Intake wire gauze filter – T. Oil filter plug – V. Oil pressure relief valve Vf. Filter psi safety valve (cracks off when the oil pressure at filter inlet is higher of 1.5 ÷ 1.7 bar/kg/cm^2 – 21.7 ÷ 24.6 psi than the oil pressure at filter outlet).

Print No. 603.54.283.00 – 09 – 1994



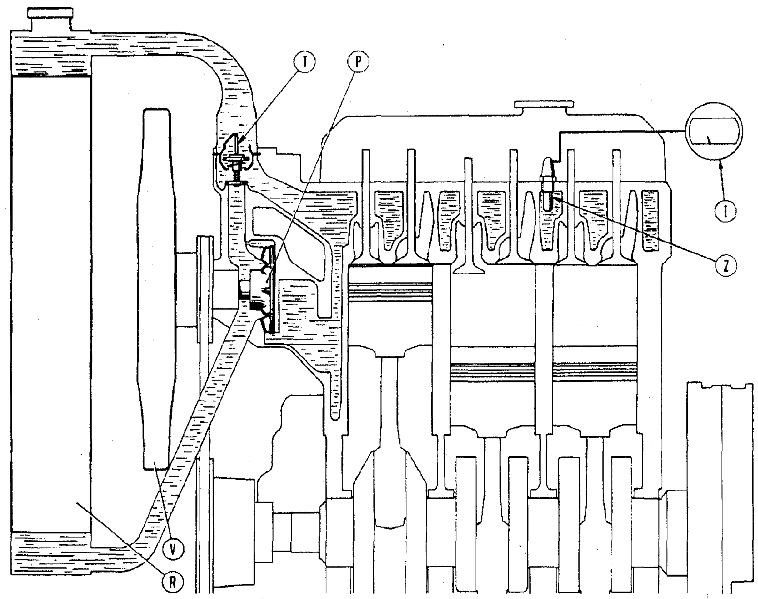
4–cylinder engine lubrication diagram

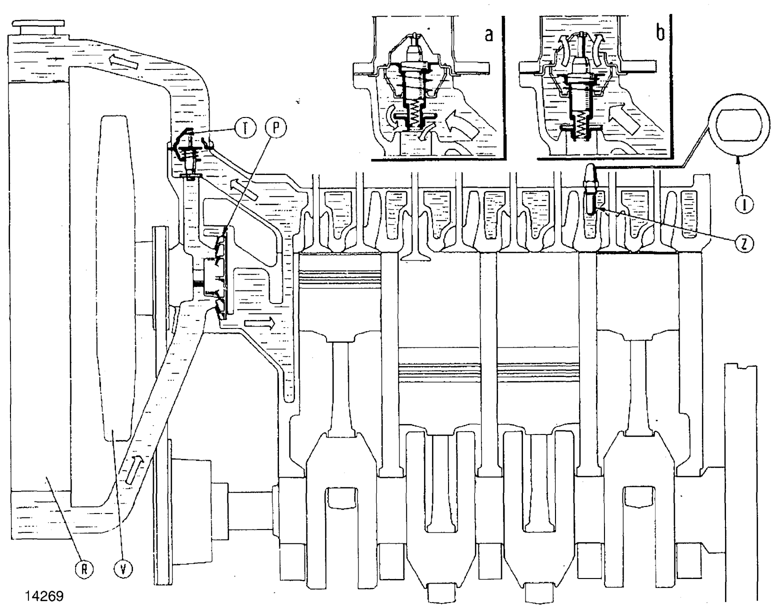
F. Filter – G. Low pressure warning light (dashboard–mounted) switch – L. Dipstick gauge – P. Pump – S. Intake wire gauze filter – T. Oil filler plug – V. Oil pressure relief valve Vf. Filter safety valve (cracks off when oil pressure at filter inlet is higher of 1.5÷ 1.7 bar/kg/cm^2– 21.7÷ 24.6 psi than the oil pressure at filter outlet).

22626

Print No. **603.54.283.00** – 09 – 1994

COOLING SYSTEM MAIN DATA	mm (in)	
	100 mm bore	104 m bore
Water pump impeller/shaft interference fit	0.017÷ 0.059 (.0007 ÷ .0023)	
Fan hub/shaft interference fit	0.024 ÷ 0.058 (.0009 ÷ .0023)	
Impeller/permanent seal bushing interference fit	0.012 ÷ 0.058 (.0005 ÷ .0023)	
For further cooling system specifications	see page 10–2	





Engine cooling system diagram

a. Water circulation with thermostat closed – b. Water circulation with thermostat open – c. 3–cylinder engine models – d. 4–cylinder engine models – I. Engine coolant electric temperature gauge – P. Pump – R. Radiator – T. Thermostat – V. Fan – Z. Sender.

Print No. 603.54.283.00 – 09 – 1994

CHECKS, DIMENSIONS AND REPAIRS (COOLING SYSTEM)

Before starting make sure to thoroughly clean all loose parts to be assembled.

PARAFLU COOLANT (change)

The engine cooling system is supplied with a permanent cooling fluid consisting of a 50% strength solution of "**PARAFLU 11**" anti–freeze and water, imparting resistance to freezing up to the following ambient temperatures:

°C	–8	–15	–25	–35
"PARAFLU 11" strength (%)	20	30	40	50

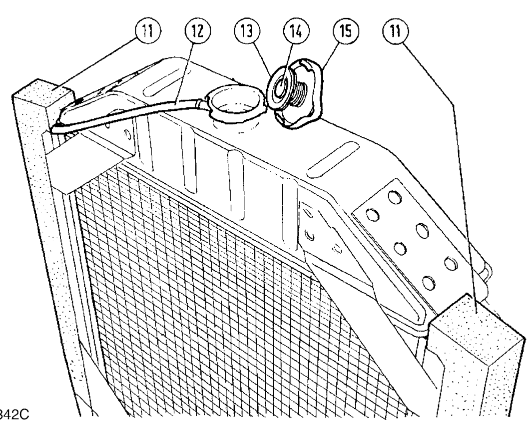
This solution, in addition, has the following properties: anti–oxidation, anti–corrosion, foam and scale resistance, such as to guarantee long time protection of the cooling system.

The same solution keeps its properties in the cooling system for a maximum of 2 years or 1600 hours of operation, whichever comes first.

RADIATOR (flushing and inspection)

The radiator cap is provided with two valves, one compression and one vacuum, inspect them periodically for proper operation.

In case of overhauling, eliminate scales from the inside of the radiator using a flushing solution of water and specific products in the proportions indicated on the container.



Cooling system radiator

11. Air sealing strips – 12. Vapour vent pipe – 13. Compression valve (setting: 0.7 bar – 0.7 kg/cm_ – 10.15 psi) – 14. Vacuum valve – 15. Water filler cap.

It is not advisable to flush the radiator only, rather, flush the complete cooling system, by filling in the above flushing solution.

Run the engine for about one hour before draining (with engine shut off) the solution through the drain plug.

In case of leaks, check radiator tightness by immersion in a tank of water at the temperature of 20° ÷ 40°C (68°÷104°F) and then blowing compressed air in the radiator at 0.98 bar pressure (1 kg/cm^2 – 14.5 psi) for about two minutes (repeat this same test at least three times).

WATER TEMPERATURE GAUGE (check)

In doubtful cases, check the instrument in water and check scale indications comparing it against a test thermometer (repeat this same test a few times).

THERMOSTAT (replacement)

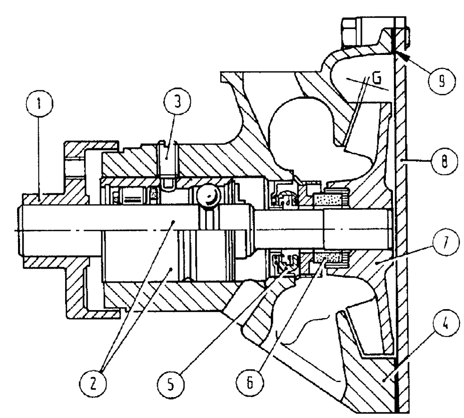
The thermostat (T, page 10–87) is fitted inside the cylinder head water drain pipe connection. As the thermostat is supplied with a fixed setting, it must be replaced as an assembly when not meeting the temperature data charted on page 10–2.

WATER PUMP (overhauling)

Centrifugal, vane type water pump. The bearing (2) is integral with the drive shaft, is permanently sealed and does not require any lubrication.

Overhaul the pump as follows:

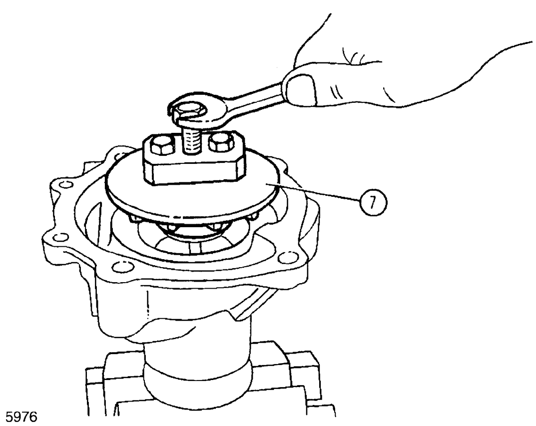
–remove cover (8) and the shaft–bearing (2) set screw (3);



Water pump sectional view

G = 0.5 ÷ 0.7 mm (.020 ÷ .028 in). Assembly play – 1. Fan and pump drive hub – 2. Shaft/life sealed bearing assembly – 3. Shaft/bearing set screw – 4. Pump housing – 5. Seal – 6. Bushing with end life–seal – 7. Impeller – 8. Cover – 9. Seal.

Print No. 603.54.283.00 – 09 – 1994



Removing the water pump impeller with the 291182/1 puller

7. Impeller

– slightly tap shaft end to break off the film of oxidation between shaft and impeller, withdraw the latter using the **291182/1** puller;

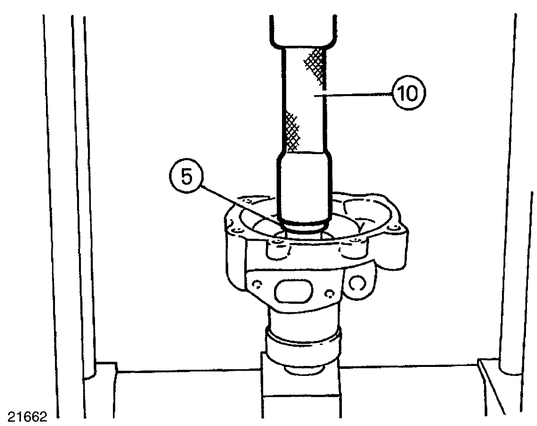
– push out with hammer and driver the shaft/bearing/fan hub assembly from the pump housing;

Note – Remove seal (5) for replacement only.

Inspect component for wear and replace defective ones.

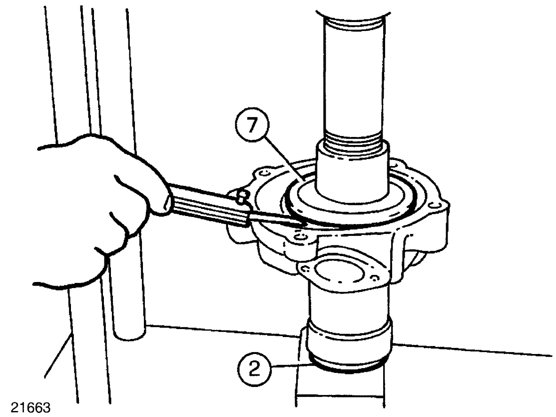
Reassemble as follows:

– fit the shaft/bearing (2. page 10–88) and hub (1) on pump housing (4) and tighten the set screw (3), after smearing LOCTITE 242 on the latter;



– fit seal (5) in its seat using the **293280** installer (10);

– pre–heat the impeller (7) in an air oven up to a temperature difference of 130º÷150ºC (266º÷302ºF) with respect to the shaft(2);



– fit impeller (7) onto the shaft (2), acting on shaft end to avoid damaging bearing (2), until obtaining play G = 0.5 ÷ 0.7 mm (.020 ÷ .028 in) (see page 10–88);

– fit seal (9) and cover (8) and tighten holding screws.

WATER PUMP AND ALTERNATOR DRIVE BELTS Tension adjustment (operation 1041410).

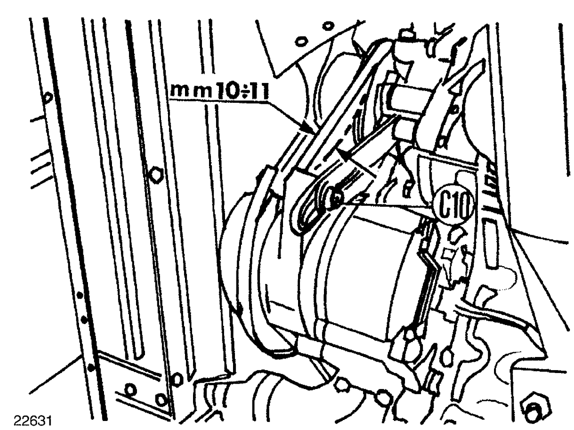
The correct tension of the fan–water pump–alternator pulley drive belt, under a pressure of 78 ÷ 98 N (8 ÷ 10 kg – 17.6 ÷ 22 lb) exercised over the belt segment included between alternator pulley and water pump pulley, the belt deflects from 10 to 11 mm (.40 to .43 in).

1. Check with the **296118** gauge and if deflection differs from specifications adjust tension as follows:

2. Slacken nut (**C_{10}**) securing the alternator to the belt stretcher;

3. Move the alternator on the belt stretching bracket until the desired belt tension is achieved, then tighten the alternator holding nut (**C_{10}**).

Note: when installing a new belt, repeat this same check after one hour of engine operation.



Fan, water pump and alternator drive belt tension adjustment

a. Alternator–belt stretcher bracket lock nut.

Print No. 603.54.283.00 – 09 – 1994

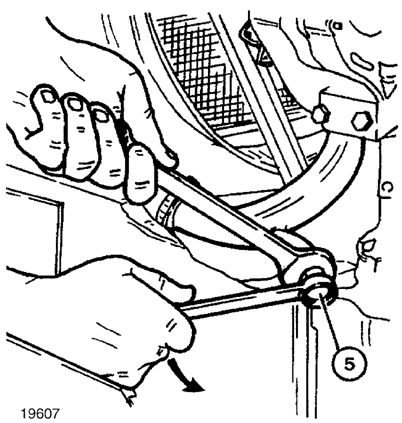
CRANKSHAFT FRONT SEAL
Replacement (Operation 10 102 70)

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

Proceed as further indicated.

1. Lift up tractor hood, disconnect the battery positive (+) cable and insulate it.
2. Remove the engine cooling plant radiator cap.



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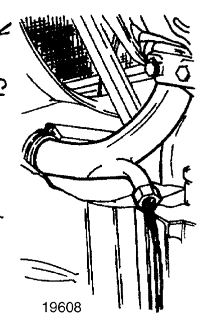
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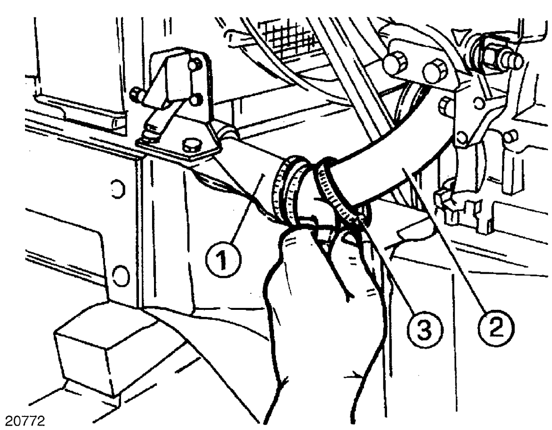
3. Remove the drain pipe plug (5) and drain the system.
4. Undo the band clamp and remove the upper radiator–engine connecting hose.



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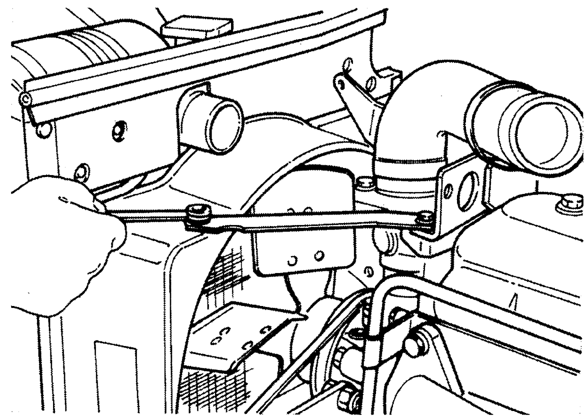
5. Undo the band clamp, radiator side, and withdraw the lower hose (1) from the connecting pipe to radiator.
6. Undo the upper band clamp (3) and remove pipe (2) and hose as an assembly.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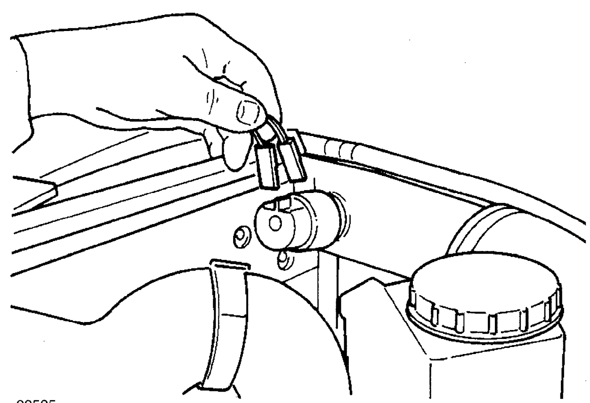
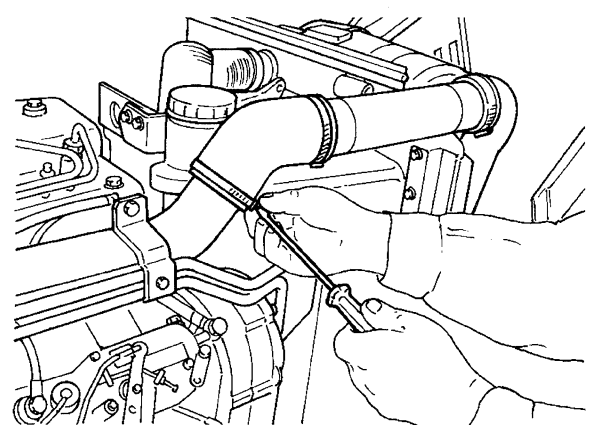
7. Remove the radiator–engine attaching bracket.

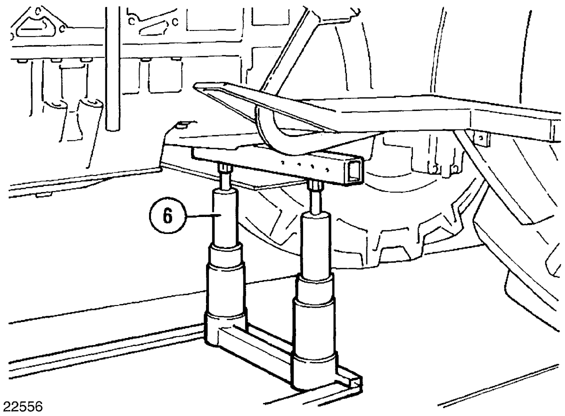

22535

8. Disconnect the clogged air cleaner, headlamp, turn signal connections and move the cable strap towards the front of the tractor.


22539

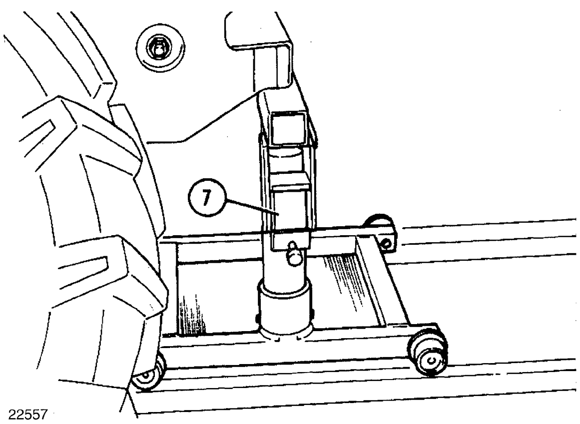
9. Slacken front band clamps (air cleaner side) and rear one (intake manifold side), then remove connecting pipe.

Print No. 603.54.283.00 – 09 – 1994



22556

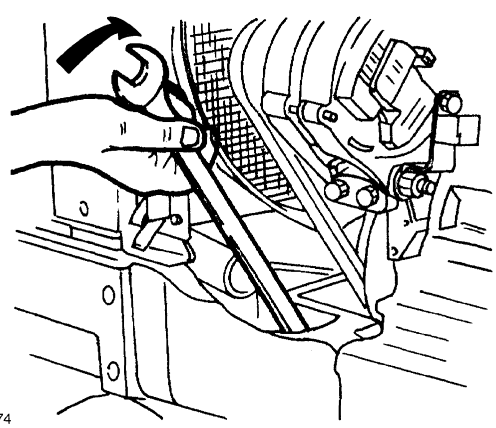
10. Place the **292320** stand (6) arranged with the fixed support underneath the transmission housing.



22557

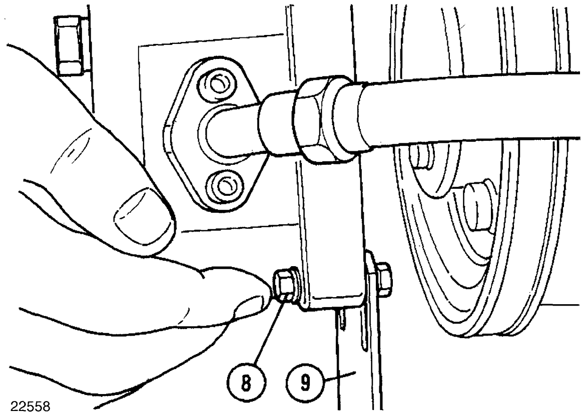
11. Place the mobile stand under the ballast weights, as shown in the figure.

12. Sling up the engine to the hoist using the specific steel lifting eyes and the **290740/1** lift chains and slightly tensioning them.



20774

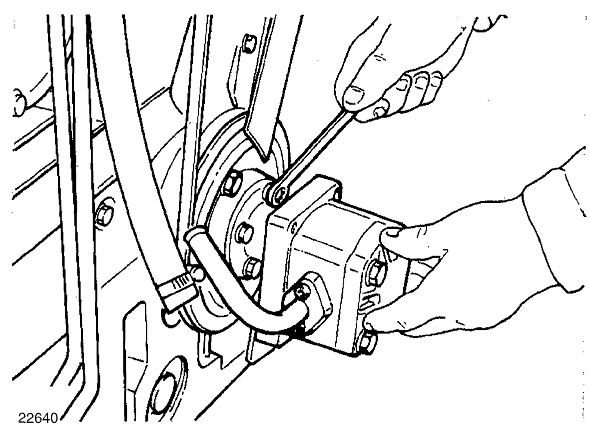
13. Undo the four screws (two on each side) attaching the engine to the front axle.



22558

14. Slacken the hydraulic steering pump stop plate holding screws and free the plate pulling it upwards (slotted plate).

15. Move away the front axle/radiator assembly from the engine.



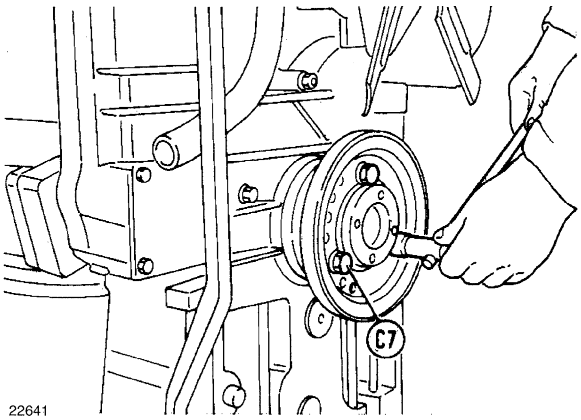
22640

16. Undo the band clamp from hydraulic steering–oil reservoir connecting pipe and recover the oil herein.

17. Undo the four holding screws and remove the pump–engine crankshaft drive joint.

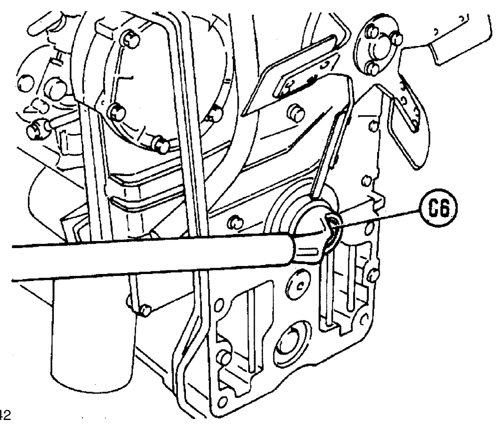
18. Loosen the alternator/belt stretcher bracket nuts, move the alternator enough to remove the alternator–water pump drive belt.

Print No. **603.54.283.00** – 09 – 1994



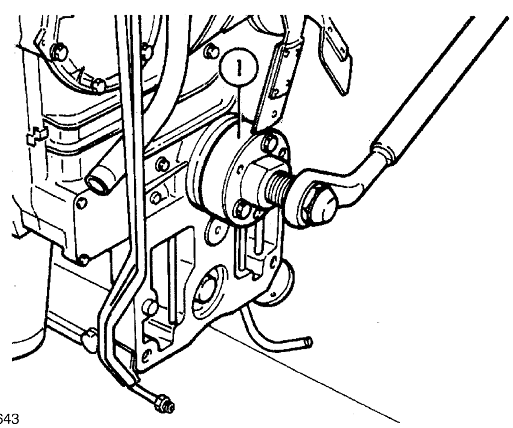
22641

19. Undo the holding screws (**C**$_7$) and remove the alternator–water pump drive belt.



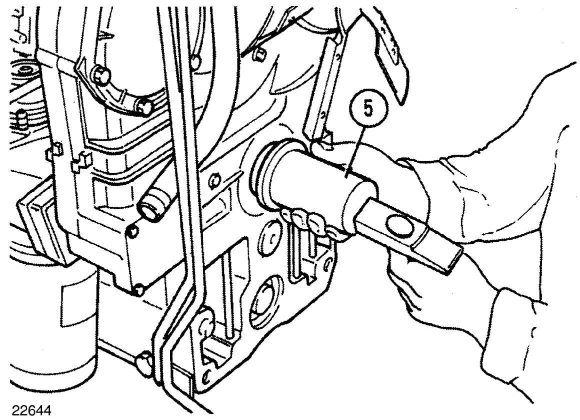
22642

20. Straighten up the lockwasher tab, undo the nut (**C**$_6$) holding the hub onto the crankshaft.



22643

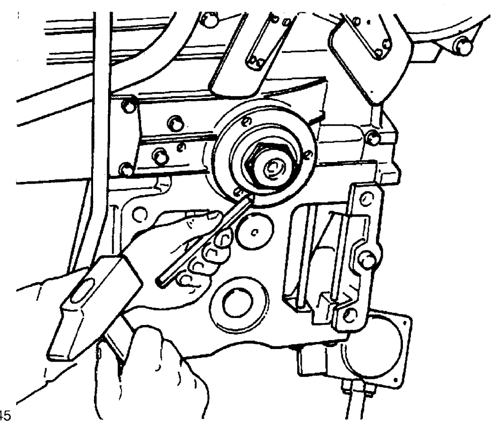
21. Install the **291504** puller (1) with three screws and, through the central puller screw, pull off the crankshaft hub.



22644

22. By means of a screwdriver, remove the seal from its seat.

23. Force fit the new seal in place, using the **293329** installer (5).



22645

24. Place the hub on the crankshaft, tighten the nut (**C**$_6$) to torque specification (see page 10–8) and lock it with the safety tab.

25. Assemble all other loose parts as follows:

a. before starting, thoroughly clean all parts;

b. proceed by reversing the previous disassembly sequence of operations, starting from no. **24** back to no. **1**;

c. apply the tightening torque values given on page 10–8;

d. check the water pump–alternator drive belt tension as described on page 10–89.

Print No. ***603.54.283.00*** *– 09 – 1994*

BOSCH INJECTION PUMP
Removal–Installation, timing check and air bleeding (Operation 10 246 14)

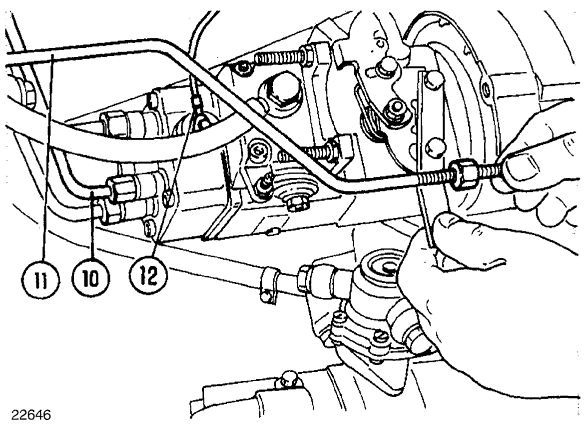
CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

CAUTION

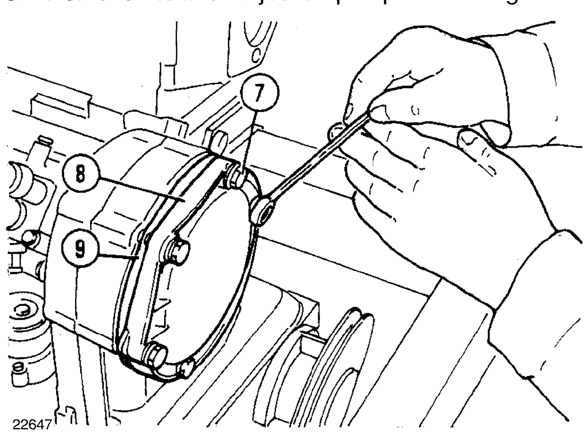
Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

For removal, proceed in the following sequence.



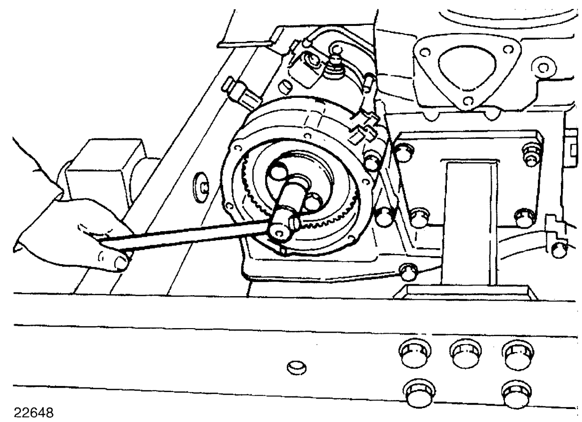
22646

1. Lift up the hood, disconnect the battery positive (+) cable and insulate it, remove the hand throttle control rod (11).
2. Disconnect the engine shut–off solenoid cable (12).
3. Turn off the fuel tap and remove the injection pump feed line.
4. Unscrew connections and remove the fuel high pressure pipes (10) from the pump and injectors.
5. Remove the filter–injection pump connecting line.

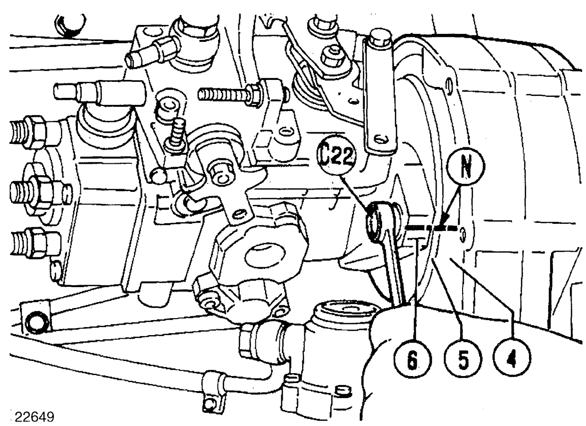


22647

6. Undo holding screws (7), remove front cover (8) and gasket (9). We suggest making a reference paint mark on meshed teeth of gears (5 and 6, page 10–94) to have a visual gear timing control when refitting the pump.


22648

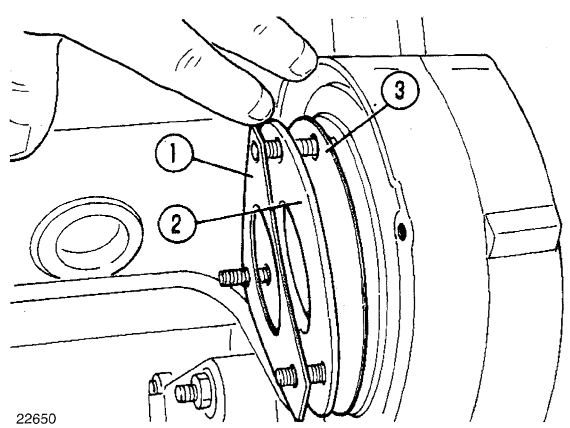
7. Pull out the pump drive gear by turning the central nut counterclockwise.



22649

8. Before removing the pump, make sure that the timing marks (N) stamped on protection (4), pump (6) and spacer (5) are clearly visible.

9. Undo holding screws (**C**$_{22}$) and retrieve the injection pump.



22650

10. Recover the gasket (1), spacer (2) and seal (3).

Print No. **603.54.283.00** – 09 – 1994

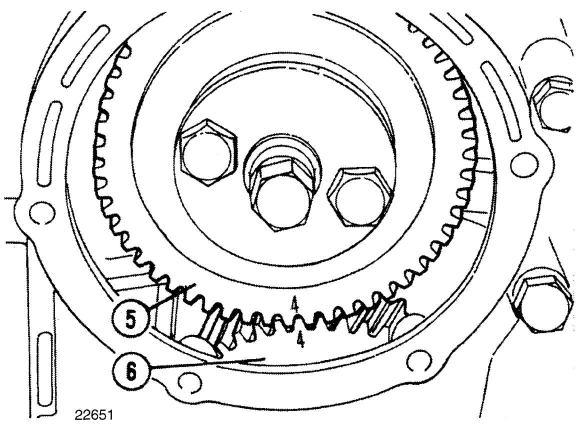
Note: Absolutely avoid any crankshaft rotation to prevent alteration of phasing of timing gears (5) and (6), and consequently of the pump.

11. For installation, proceed as follows:

– Reverse the removal sequence of operations previously described;

– When installing the BOSCH pump, provide for the alignment of the timing marks (N) stamped on the pump, protection and spacer (see figure below).

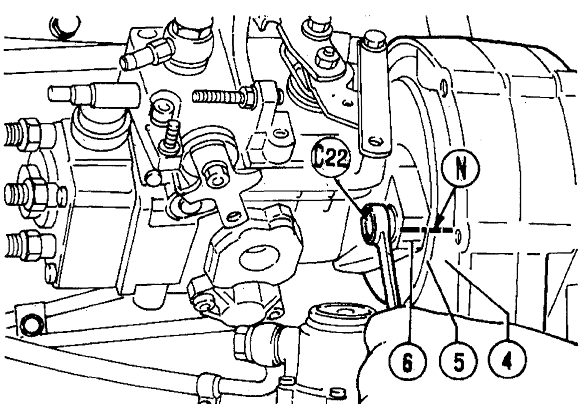
– Tighten the pump holding nuts ($\mathbf{C_{22}}$) to torque specification of page 10–8.



22651

– At pump drive gear (5) installation, line up timing marks with gear (6), previously marked with paint.

12. Timing the BOSCH pump on the engine (if required).



22649

If engine operation is not normal, if timing marks (N) are not visible or should doubts arise about their being correct, proceed as follows:

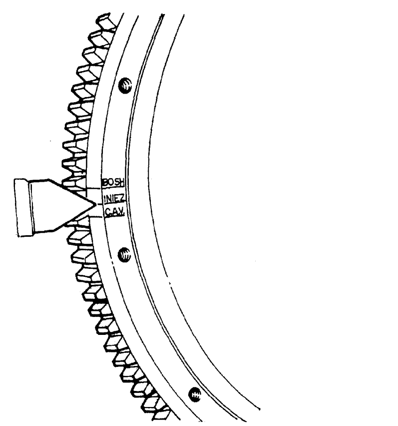
– Remove piping that may hamper pump rotation.

– Remove cover as previously indicated (operation 6, page 10–93).

– Check the alignment of timing marks (4) on pump drive gear (5) and meshing gear (6) (see figure on the left).

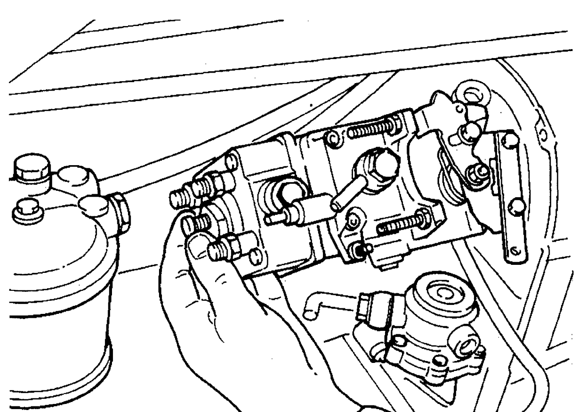
– Remove the flywheel inspection lid;

– Turn the crankshaft to bring the piston of cylinder no. 1 at T.D.C. (compression phase).



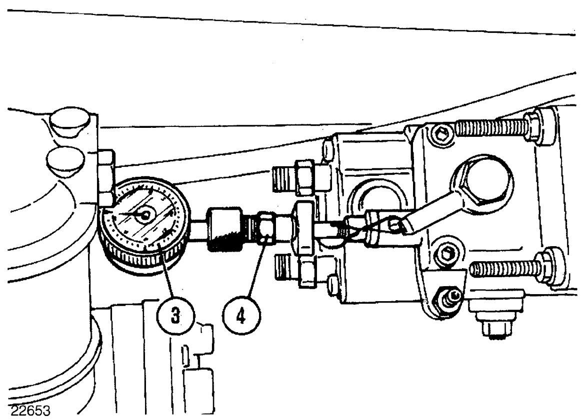
22618

– Looking through the flywheel inspection lid opening check that the index is lined up with the 6° mark (on 50V, 55V, 55F, 60V, 60F, 62F tractors) or with the 4° mark (on 70V, 72F, 72LP, 82F, 82LP tractors).


22652

– With the injection pump placed in position and holding screws slack, remove the plug on pump cover.

Print No. ***603.54.283.00*** *– 09 – 1994*



22653

– Install the **291754** dial gauge (3) and its **291755** attachment tool (4) and pre–load the tip of about 2.5 mm (.10 in).

– Turn the flywheel further and slowly to bring the pumping element at B.D.C. (commencement of delivery stroke, evidenced by the comparator dial indicator which stops going down).

– Set the comparator dial gauge at zero and the slowly turn the flywheel clockwise (looking from the fan side) until the index lines up with the 6^{o} mark (on 50V, 55V, 55F, 60V, 60F, 62F tractors) or with the 4^{o} mark (on 70V, 72F, 72LP, 82F, 82LP tractors).

– Check on the comparator dial gauge if the pumping element has made a 1 mm (.040 in) stroke when lined up with the mark. If not, loosen the pump holding screws.

– If the stroke is less, rotate the pump counterclockwise or, on the contrary, rotate it clockwise if the stroke is more, until the correct 1 mm stroke is obtained.

– Once these conditions are achieved, fix the pump in place by tightening its holding nuts (C_{22}) at the torque specification of page 10–8.

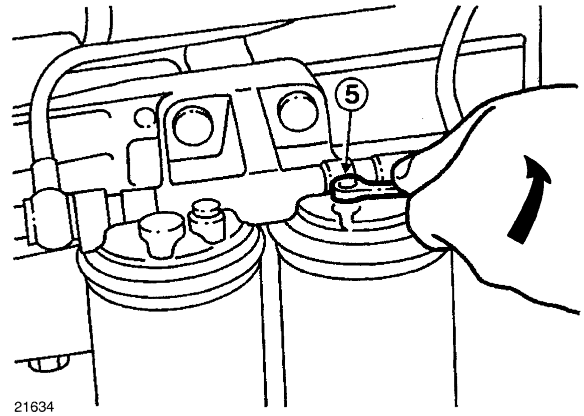
– Stamp the pump timing marks (N) on the carter, pump and spacer as shown on page 10–93.

– Remove the **291754** comparator dial gauge (3) and its **291755** attachment tool (4) and refit the plug torque tightening it at 8÷10 Nm (0.8÷1 kgm – 5.8÷7.2 ft.lb).

– Install all other loose parts by reversing the removal sequence of operations previously described.

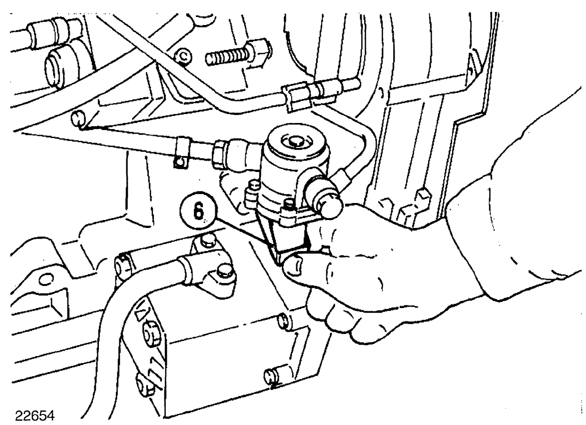
13. Air bleeding the BOSCH pump.

Proceed as follows.



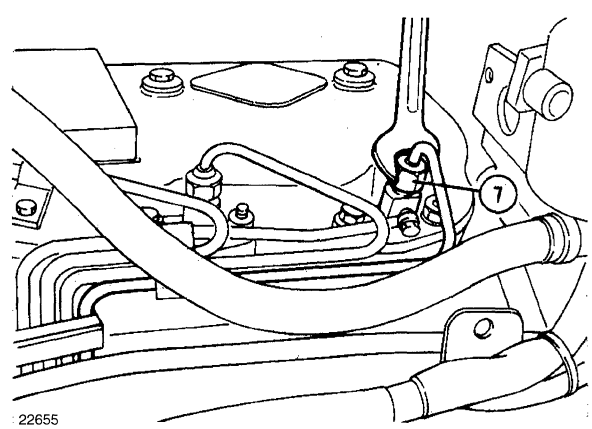
21634

– Unscrew plug (5) on first filter.



22654

– Actuate the priming lever (6) on the fuel transfer pump until fuel comes out through the orifice free of air bubbles, then re–tighten plug (5).



22655

– Loosen the connection (7) of the fuel delivery lines to injectors, start the engine and re–tighten connection (7) once the fuel flows out without air bubbles.

Print No. **603.54.283.00** – 09 – 1994

C.A.V. INJECTION PUMP
Removal–Installation, timing check and air bleeding (Operation 10 248 14)

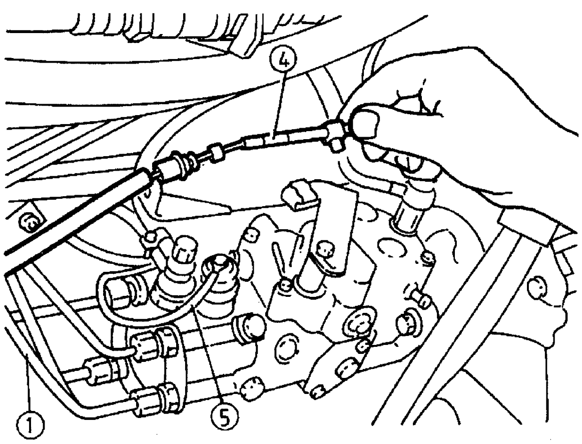
CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

For removal, proceed in the following sequence.



21623

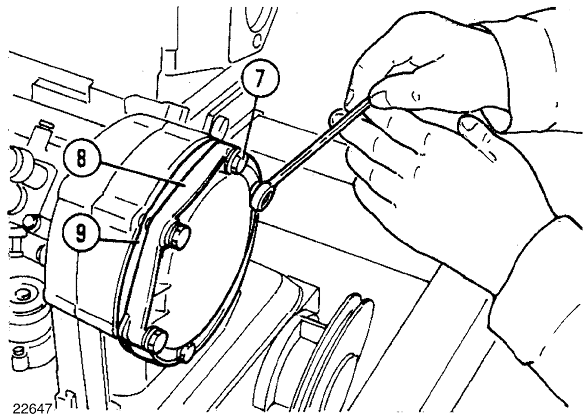
1. Lift up hood, disconnect the battery positive (+) cable and insulate it, remove the hand throttle control cable (4).

2. Disconnect the engine shut–off solenoid control cable (5).

3. Turn off the fuel tap and remove the injection pump feed line.

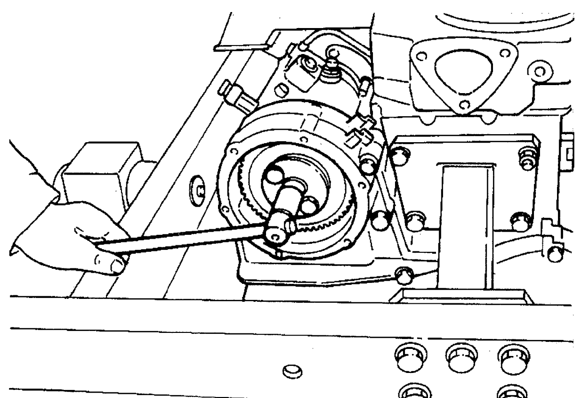
4. Unscrew connections and remove the fuel high pressure pipes (1) from the pump and injectors.

5. Remove the filter–injection pump connecting line.



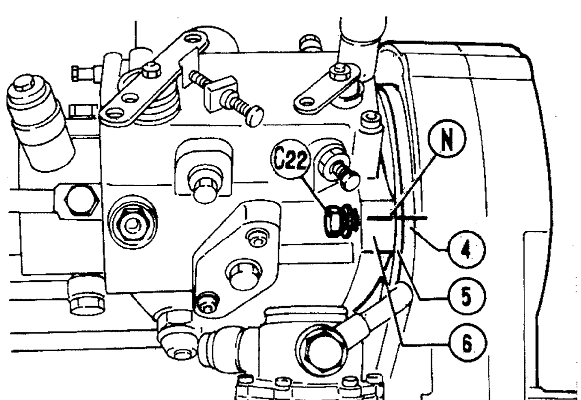
22647

6. Undo holding screws (7) and remove front cover (8) and gasket (9). We suggest making a reference paint mark on meshed teeth of gears (5 and 6, page 97) to have a visual gear timing control when re–fitting the pump.



22648

7. Pull out the pump drive gear by turning the central nut counterclockwise.

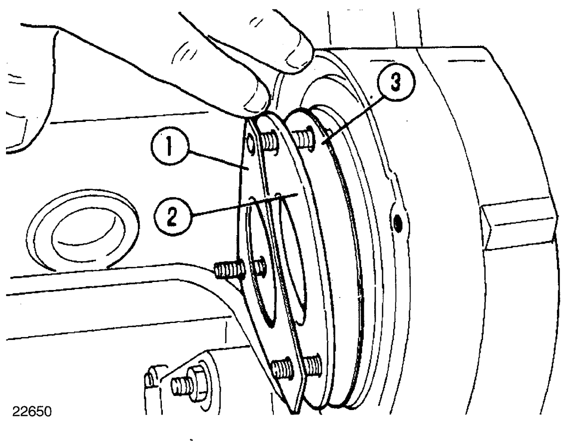


22657

8. Before removing the pump, make sure that the timing marks (N) stamped on the protection (4), pump (6) and spacer (5) are clearly visible.

9. Undo holding screws (C_{22}) and retrieve the injection pump.

Print No. **603.54.283.00** – 09 – 1994



10. Recover the gasket (1), spacer (2) and seal (3).

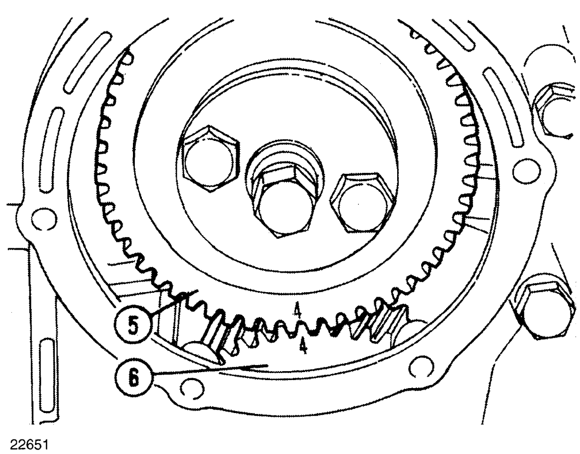
Note: Absolutely avoid any crankshaft rotation to prevent alteration of phasing of timing gears (5) and (6), and consequently of the pump.

11. For installation, proceed as follows.

– Reverse the removal sequence of operations previously described.

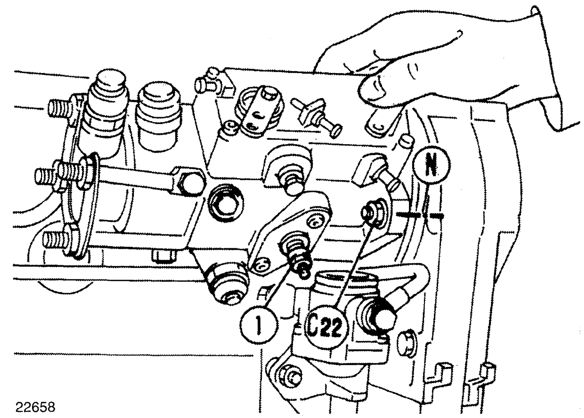
– When installing the C.A.V. pump, provide for the alignment of the timing marks (N) stamped on the pump, protection and spacer (see figure on right side).

– Tighten the pump holding nuts (**C_{22}**) to torque specification of page 10–8.



– At pump drive gear (5) installation, line up timing mark (4) with that of gear (6), previously marked with paint.

12. Timing the C.A.V. pump on the engine (if required).



If engine operation is not normal, if timing marks (N) are not visible or should doubts arise as to their being correct, proceed as follows.

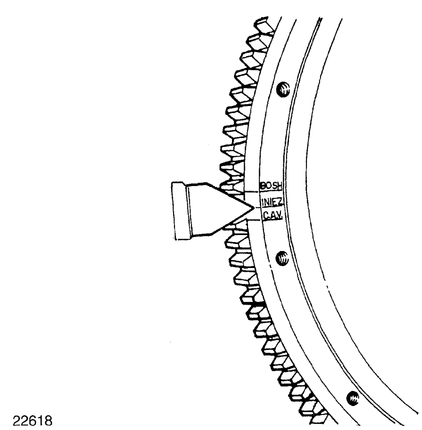
– Remove piping that may hamper pump rotation.

– Remove the front cover as previously indicated (operation 6, page 10–96).

– Check the alignment of timing marks (4) on pump drive gear (5) and meshing gear (6) (see figure on the side).

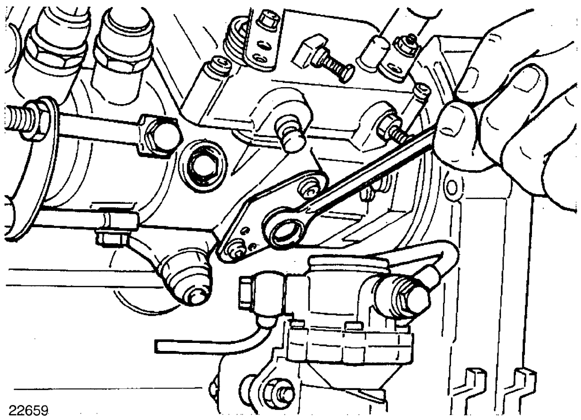
– Remove the engine flywheel inspection lid.

– Turn the crankshaft to bring the piston of cylinder no. 1 at T.D.C. (compression phase).

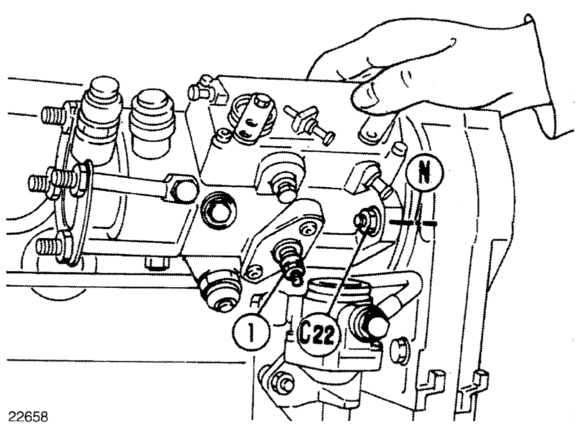


– Looking through the flywheel inspection lid opening check for alignment of the C.A.V. pump mark with the index shown in the figure.

Print No. **603.54.283.00** – 09 – 1994



– With the injection pump placed in position and holding screws slack, remove the plug on pump cover.



– Screw the **292411** dowel pin (1) in the cover and rotate the pump so as to favour the introduction of pin (1) in the timing dent on the pump shaft.

– Once these conditions are achieved, fix the pump in place by tightening its holding nuts ($\mathbf{C_{22}}$) at the torque specification of page 10–8.

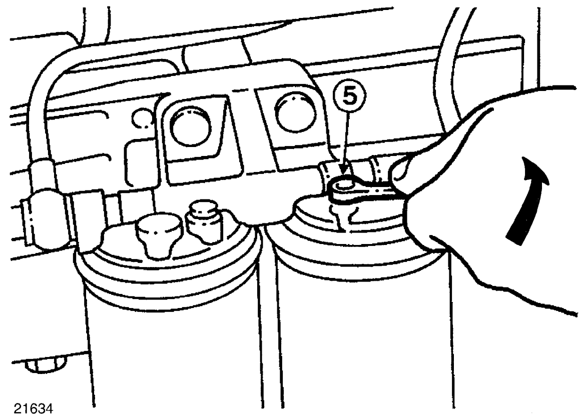
– Stamp timing marks (N) on the protection frame, pump and spacer as shown in the figure.

Unscrew the **292411** dowel pin (1) and refit the plug previously removed.

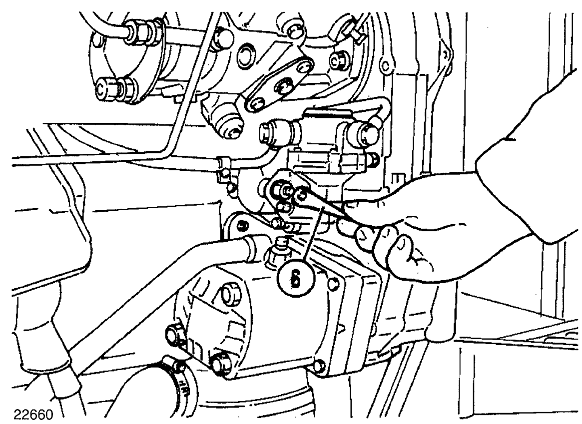
– Install all other loose parte by reversing the removal sequence previously described.

13. Air bleeding the C.A.V. pump.

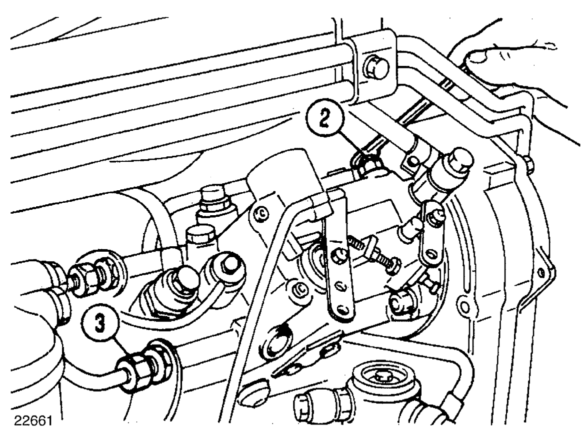
Proceed as follows.



– Unscrew plug (5) on fuel filter.



– Actuate the priming lever (6) of the fuel transfer pump until fuel flows out through the orifice free of air bubbles, then refit plug (5).



– Back off two turns the bleeder screw (2) on the pump and a connection (3), prime lever (6) of the fuel transfer pump until fuel flows out without any air bubbles.

– Re–tighten connection (3), start the engine and, once sure that fuel is free of air bubbles, tighten the bleed screw (2).

COOLING SYSTEM THERMOSTAT
Replacement (Operation 10 402 30)

Proceed in the following sequence.

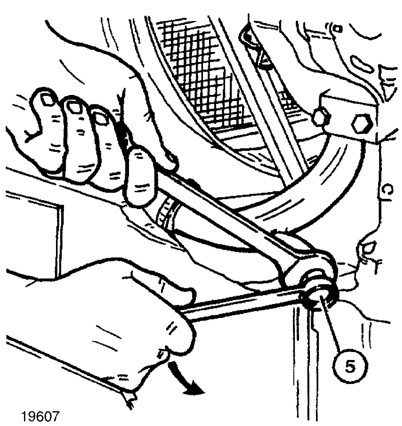
CAUTION

Handle all parts carefuly. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

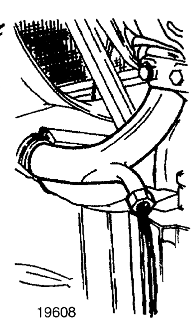
1. Lift up the hood.

2. Disconnect the battery positive (+) cable and insulate it.

3. Remove the engine cooling system radiator cap.

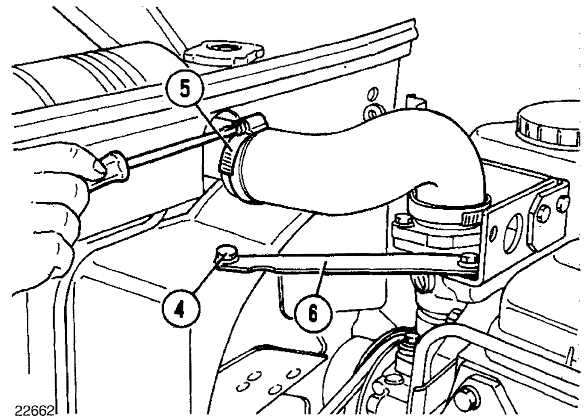


19607



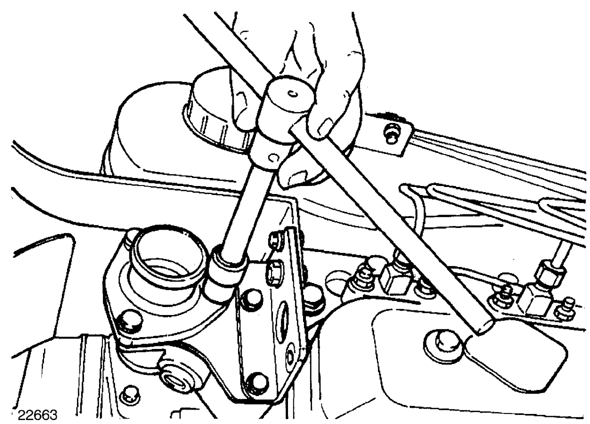
19608

4. Remove plug (5) from drain pipe and empty the system.



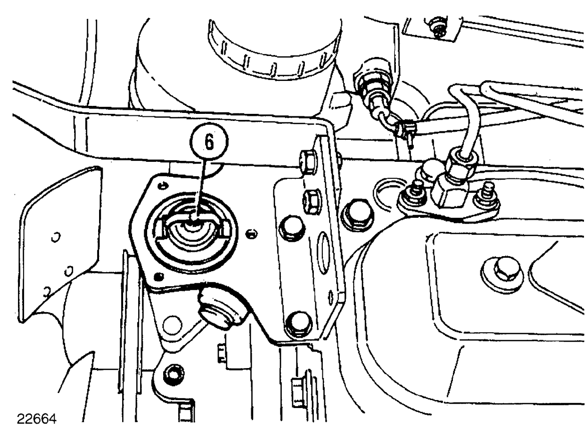
22662

5. Undo the band clamps (5) and slide out the radiator–pump thermostat upper connecting hose.



22663

6. Undo holding screws and remove the thermostat retaining flange and gasket.



22664

7. Retrieve the thermostat (6).

8. Reassemble loose parts by reversing the removal sequence of operations previously described.

Print No. ***603.54.283.00*** *– 09 – 1994*

**RADIATOR – Removal–Installation
(Operation 10 406 10)**

DANGER

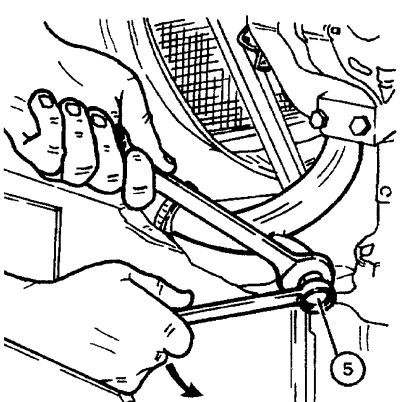
Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

Proceed in the following sequence.

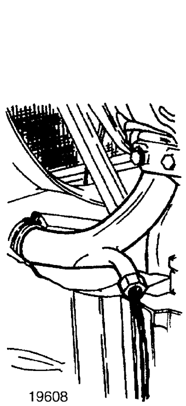
1. Lift up the hood.

2. Disconnect the battery positive (+) cable and insulate it.

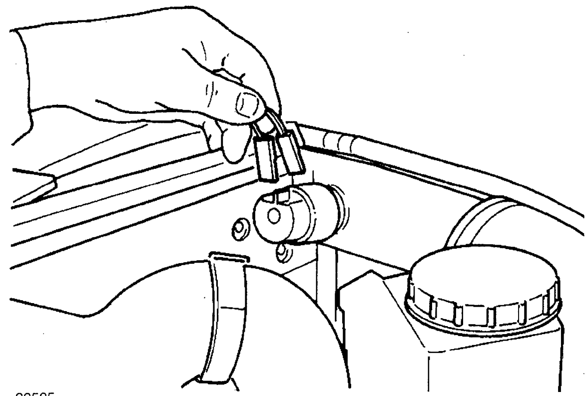
3. Remove the engine cooling system radiator cap.



19607

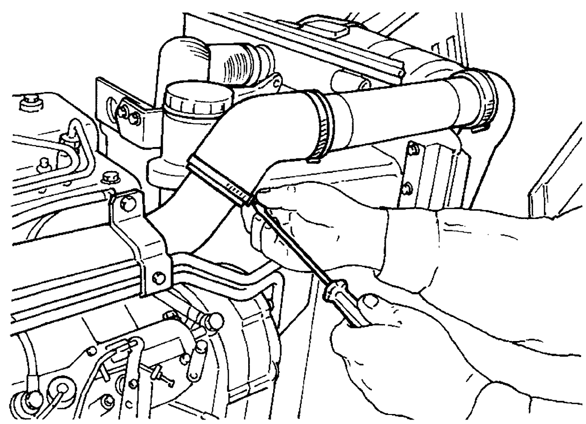

19608

4. Undo plug (5) from the drain pipe and empty the system.

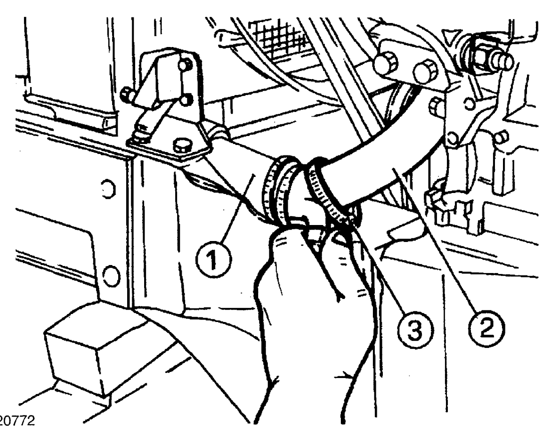

22535

5. Detach the clogged air cleaner and thermostarter indicator sender connections.

6. Detach the headlamp and turn signal electrical connections.


22539

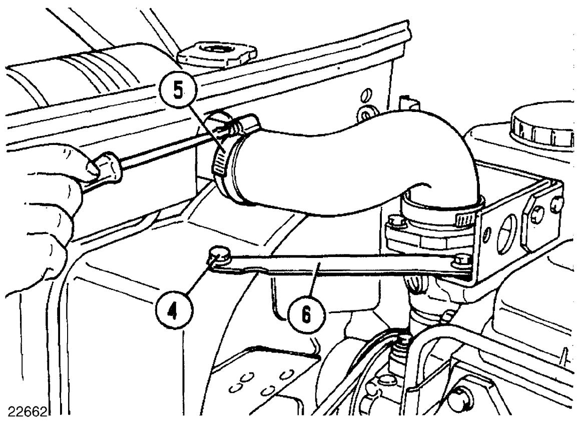
7. Undo the end band clamps and retrieve the rubber hose complete with the air intake duct connecting to air cleaner.



20772

8. Undo the band clamps, radiator side, and retrieve the radiator–cap pipe (2) lower connecting hose (2).

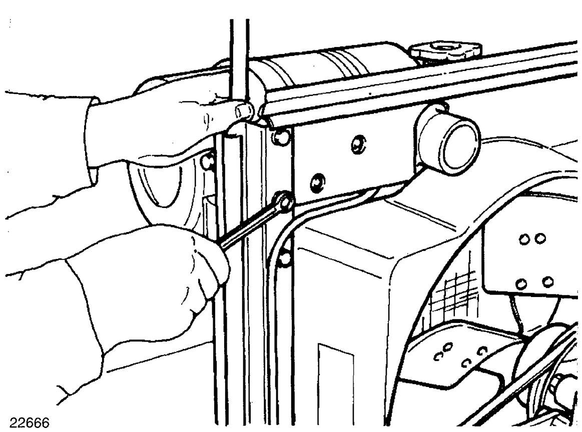
Print No. ***603.54.283.00*** *– 09 – 1994*



22662

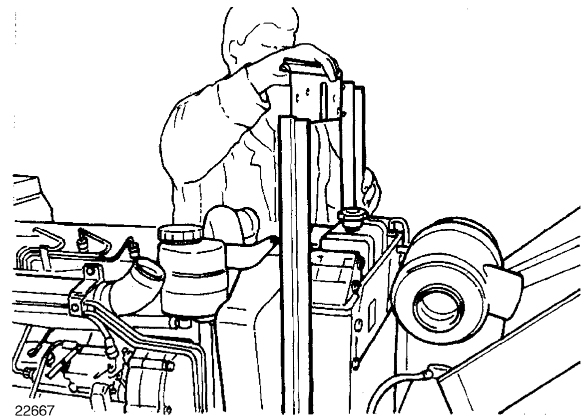
9. Undo the band clamp (5) and retrieve the radiator–thermostat–water pump connection upper hose.

10. Undo holding screws (4) and the radiator–engine connection stiffening bracket (6).



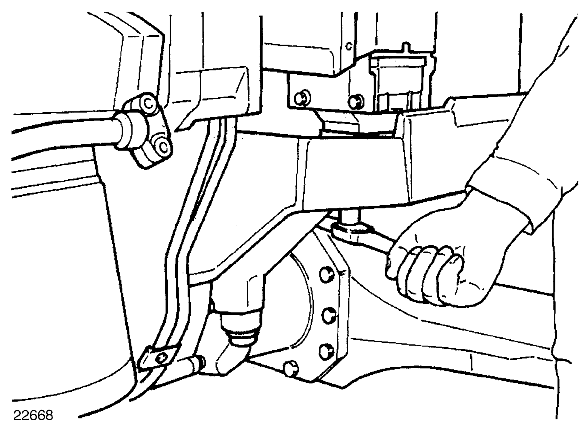
22666

11. Undo the top central and side protections (on both sides) frames.



22667

12. Remove top central and side protection frames.



22668

13. Undo the radiator holding screws onto the front axle support (both sides).

14. Withdraw the radiator upwards.

15. Retrieve and remove the radiator air conveyor.

16. Reassemble loose parts by reversing the removal sequence of operations previously described.

Print No. **603.54.283.00** – 09 – 1994

Print No. **603.54.283.00** – 09 – 1994

10”/10” LUK CLUTCH (50V, 55V, 55F TRACTORS)

Type	dry, twin–disc clutch
Controls	mechanical: foot–control for main clutch, hand lever for P.T.O clutch
Release mechanism	single release dish spring
Driven plate lining	organic
Driven plate thickness:	
— main clutch mm (in)	10.1 ÷ 10.5 (.397 ÷ .413)
— P.T.O clutch mm (in)	8.5 ÷ 8.9 (.334 ÷ .350)
— wear limit	see page 18–13
Assembly clearance of main clutch throw–out collar mm (in)	0.050 ÷ 0.151 (.0019 ÷ .0059)
Assembly clearance of P.T.O clutch throw–out collar mm (in)	0.060 ÷ 0.180 (.0024 ÷ .0071)
Release lever alignment adjustment	see page 18–14
Main and P.T.O clutch control adjustment	see page 18–16

11”/11” LUK CLUTCH (60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP TRACTORS)

Type	dry, twin–disc clutch
Controls	mechanical: foot–control for main clutch, hand lever for P.T.O. clutch
Release mechanism	single release dish spring
Driven plate facing:	
— main clutch:	
● standard on all models	organic material
● optional on 62F, 72F, 82F tractors	cerametallic facing
— P.T.O. clutch (all tractor models)	organic material
Driven plate thickness:	
— main clutch:	
● organic material (standard) mm (in)	9.7 ÷ 10.3 (.382 ÷ .406)
● on 62F, 72F, 82F tractors with cerametallic facing (optional) mm (in)	9.6 ÷ 10.4 (.378 ÷ .409)
— P.T.O. clutch mm (in)	7.3 ÷ 7.9 (.287 ÷ .311)
— wear limit	see pages 18–18 and 18–19
Assembly clearance of main clutch throw–out collar mm (in)	0.050 ÷ 0.151 (.0019 ÷ .0059)
Assembly clearance of P.T.O. clutch throw–out collar mm (in)	0.060 ÷ 0.180 (.0024 ÷ .0071)
Release lever alignment adjustment	see page 18–20
Main and P.T.O. clutch control adjustment	see pages 18–22 and 18–23

Print No. 603.54.283.00 – 09 – 1994

10"/10" VALEO CLUTCH (50V, 55V, 55F TRACTORS)

Type	dry, twin–disc clutch
Controls	mechanical: foot–control for main clutch, hand lever for P.T.O clutch
Release mechanism	single release dish spring
Driven plate facing	organic material
Driven plate thickness:	
— main clutch mm (in)	8.1 ÷ 8.7 (.318 ÷ .343)
— P.T.O. clutch mm (in)	8.1 ÷ 8.7 (.318 ÷ .343)
— wear limit	see page 18–13
Assembly clearance of main clutch throw–out collar mm (in)	0.050 ÷ 0.151 (.0019 ÷ .0059)
Assembly clearance of P.T.O clutch throw–out collar mm (in)	0.060 ÷ 0.180 (.0024 ÷ .0071)
Release lever alignment adjustment	see page 18–14
Main and P.T.O. clutch control adjustment	see page 18–16

11"/11" VALEO CLUTCH (60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP TRACTORS)

Type	dry, twin–disc clutch
Controls	mechanical: foot–control for main clutch, hand lever for P.T.O. clutch
Release mechanism	single release dish spring
Driven plate facing:	
— main clutch:	
● standard on all models	organic material
● optional on 62F, 72F, 82F tractor models	cerametallic facing
— P.T.O. clutch (all models)	organic material
Driven plate thickness:	
— main clutch:	
● on all models with organic material (standard) mm (in)	10.2 ÷10.8 (.402 ÷ .425)
● 62F, 72F, 82F models with cerametallic (optional) mm (in)	10.2 ÷ 10.8 (.402 ÷ .425)
— P.T.O. clutch mm (in)	7.4 ÷ 7.8 (.291 ÷ .307)
— wear limit	see page 18–18
Assembly clearance of main clutch throw–out collar mm (in)	0.050 ÷ 0.151 (.0020 ÷ .0059)
Assembly clearance of P.T.O. clutch throw–out collar mm (in)	0.060 ÷ 0.180 (.0024 ÷ .0071)
Release lever alignment adjustment	see page 18–20
Main and P.T.O. clutch control adjustment	see pages 18–22 and 18–23

Print No. **603.54.283.00** – 09 – 1994

11"/11" OMG CLUTCH (60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP TRACTORS)

Type	dry, twin–disc clutch
Controls	mechanical: foot–control for main clutch, hand lever for P.T.O. clutch
Release mechanism	single release dish spring
Driven plate facing:	
— main clutch:	
● standard on all models:	organic material
● optional on 62F, 72F, 82F tractor models	cerametallic facing
— P.T.O. clutch (all models)	organic material
Driven plate thickness:	
— main clutch:	
● on all models with organic material (standard) mm (in)	9.7 ÷10.3 (.382 ÷ .406)
● on 62F, 72F, 82F with cerametallic (optional) "	9.7 ÷ 10.3 (.382 ÷ .406)
— P.T.O. clutch "	7.4 ÷ 7.8 (.291 ÷ .307)
— wear limit	see page 18–18
Assembly clearance of main clutch throw–out collar mm (in)	0.050 ÷ 0.151 (.0019 ÷ .0059)
Assembly clearance of P.T.O. clutch throw–out collar mm (in)	0.072 ÷ 0.205 (.0028 ÷ .0081)
Release lever alignment adjustment	see page 18–20
Main and P.T.O. clutch control adjustment	see pages 18–22 and 18–23

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **X**.
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

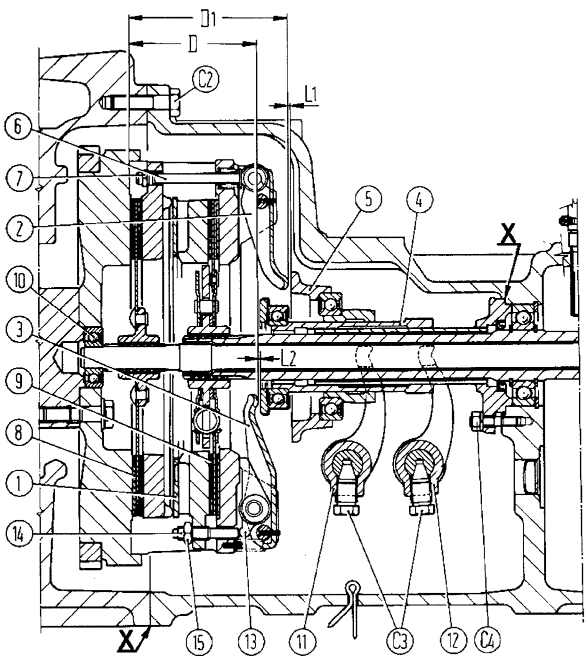
List of the special tools necessary to carry on the service operations concerning this section of the Manual.

292320	Rotary stand for tractor disassembly.
291291/2	Clutch overhauling kit (pre–modification).
293650	Clutch overhauling kit (post–modification).
292176	Compressor for clutch lever release test (with 293650).
292604	10"/10" LUK and VALEO clutch alignment and adjustment spigot (with clutch installed).
291184	11"/11" LUK, VALEO and OMG clutch alignment and adjustment spigot (with clutch installed).
292605	10"/10" LUK and VALEO adjustment clutch (with 292604).
293763	Release lever adjustment wrench set.
292888	Clutch housing–engine alignment dowel pin.

Print No. ***603.54.283.00*** *– 09 – 1994*

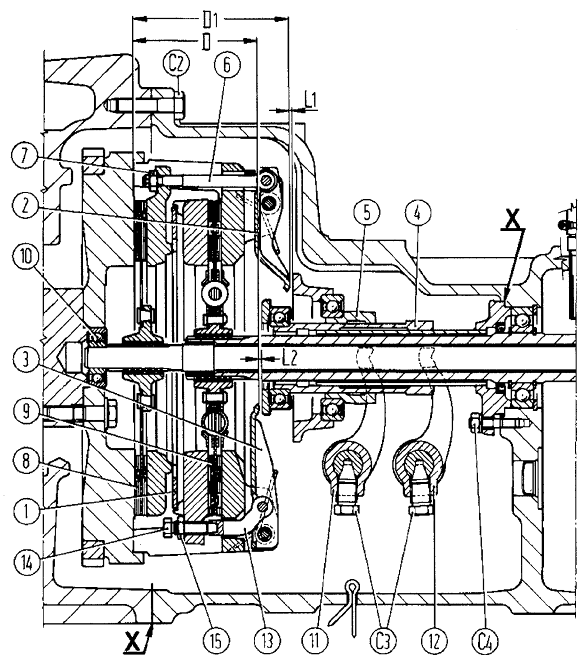
TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft. lb
Cap screw, clutch to engine flywheel (**C_1**, page 18–10) . . .	M 8 x 1.25	25	2.6	18.8
Set screw, release levers (**C_3**, pages 18–4 ÷ 18–7)	M 16 x 1.5	157	16	116
Cap screws, clutch/transmission housings	M 12 x 1.25	98	10	72
Cap screws, clutch housing to engine (**C_2**, pages 18–4 ÷ 18–7)	M 12 x 1.25	98	10	72
Stud nut, collar cover (**C_4**, pages 18–4 ÷ 18–7)	M 8 x 1.25	17	1.7	12.3



16250

Longitudinal sectional view of the 10"/10" VALEO clutch installed on 50V, 55V, 55F model tractors



16258

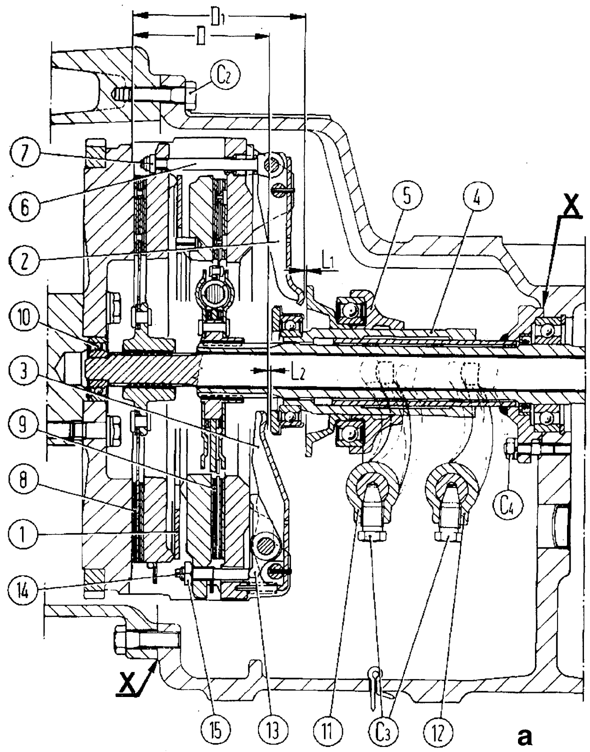
Longitudinal sectional view of the 10"/10" LUK clutch installed on 50V, 55V, 55F model tractors

C_2. Clutch housing–engine attachment cap screws – C_3. Fork lever holding screws – C_4. Collar cover attachment stud nuts – D = 101 mm (.398 in). Nominal distance of release levers (3) from the clutch–engine flywheel mating plane – D_1 = 125 mm (4.92 in). Nominal distance of release levers (2) from the clutch–engine flywheel mating plane – L_1 = 2.5 mm (.098 in). Nominal distance between P.T.O. release levers and thrust collar – L_2 = 2 mm (.08 in). Nominal distance of main clutch release levers and thrust collar – 1. Dish spring – 2. P.T.O. clutch release levers 3. Main clutch release levers – 4 and 5. Throw–out collars, complete with thrust bearings – 6 and 7. P.T.O. release lever adjustment tie–rod and locknut – 8. P.T.O. clutch plate – 9. Main clutch plate – 10. Pilot bearing on engine flywheel – 11 and 12. Throw–out collar shifter forks – 13, 14 and 15. Main clutch release lever trigger lever, set screw and locknut.

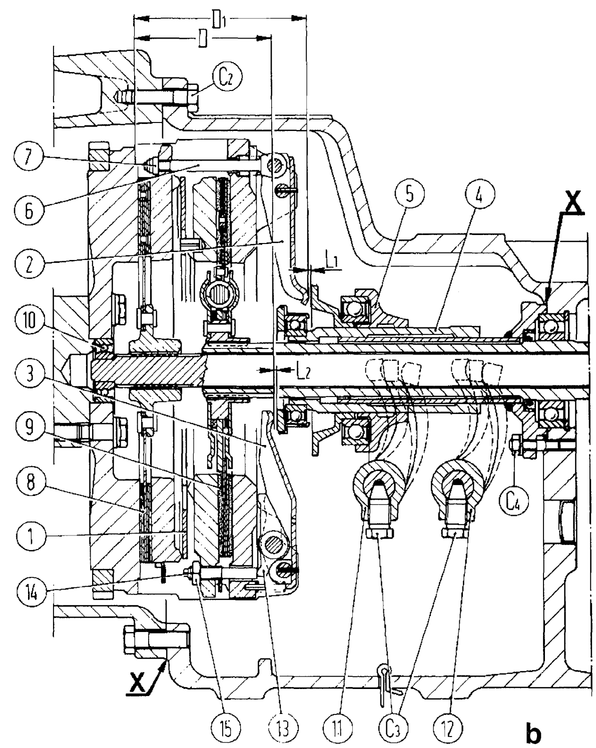
Attention – At assembly, make sure that clutch plates are positioned as shown in the figures.

Note– At assembly, thoroughly clean and degrease mating surfaces **X** and apply sealing compound following the instructions given on page 00–1.

*Print No. **603.54.283.00** – 09 – 1994*



14697



14698

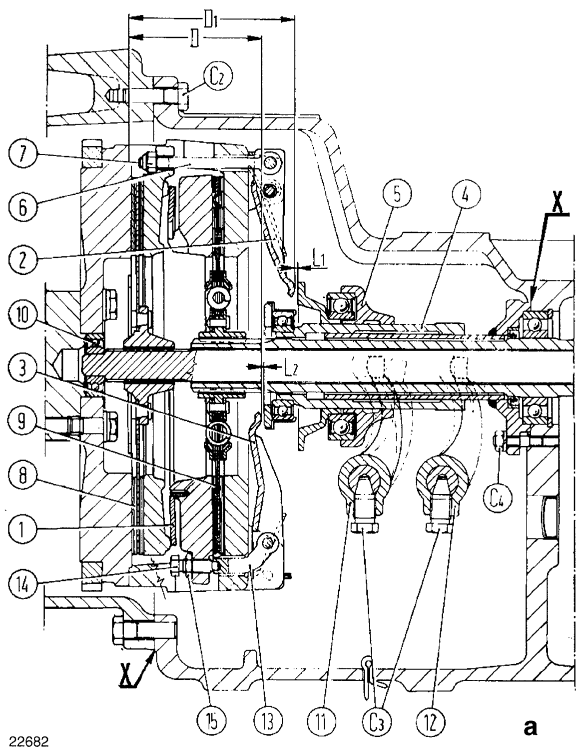
Longitudinal sectional view of the 11"/11" VALEO clutch.

a. Clutch unit with organic material main clutch plate (standard on 60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP model tractors) – b. Clutch unit with cerametallic facing main clutch plate (optional on 62F, 72F, 82F model tractors) – C_2. Clutch housing–engine attachment cap screws – C_3. Shifter fork set screws – C_4. Throw–out collar stud nuts – D = 98 mm (3.86 in). Nominal distance of release levers (3) from the clutch–engine flywheel mating plane – D_1 = 123 mm (4.84 in). nominal distance of release levers (2) from the clutch–engine flywheel mating plane – L_1. 2.5 mm (.10 in). Nominal distance of P.T.O. release levers from thrust collar L_2 = 2 mm. Nominal distance of main clutch release levers from thrust collar – 1. Dish spring – 2. P.T.O. clutch release levers – 3. Main clutch release levers – 4 and 5. Throw–out collars, with thrust bearings – 6 and 7. P.T.O. clutch release lever adjustment tie–rod and locknut – 8. P.T.O. clutch plate – 9. Main clutch plate – 10. Pilot bearing on engine flywheel – 11 and 12. Throw–out collar shifter forks – 13, 14 and 15. Main clutch release lever trigger levers, set screw and locknut.

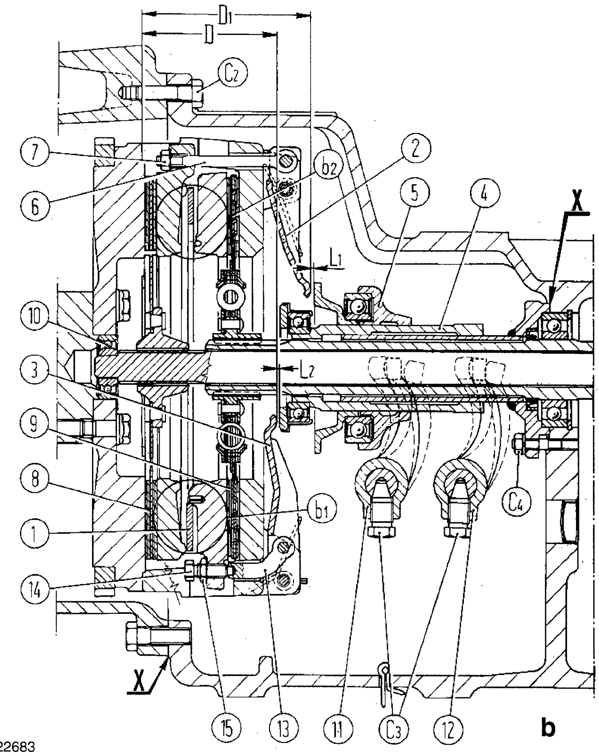
Attention– At assembly, make sure that clutch plates are positioned as shown in the figures.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply sealing compound following the instructions given on page 00–1.

Print No. **603.54.283.00** – 09 – 1994



22682 **a**



22683 **b**

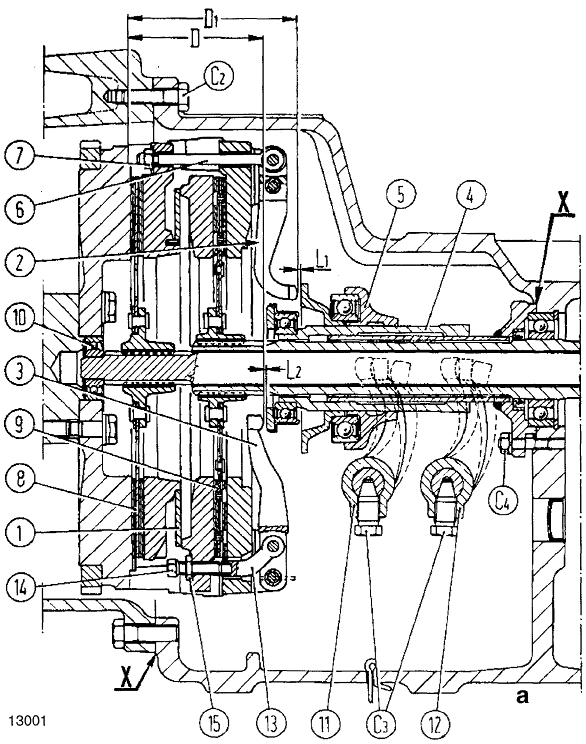
Longitudinal sectional view of the 11"/11" LUK clutch.

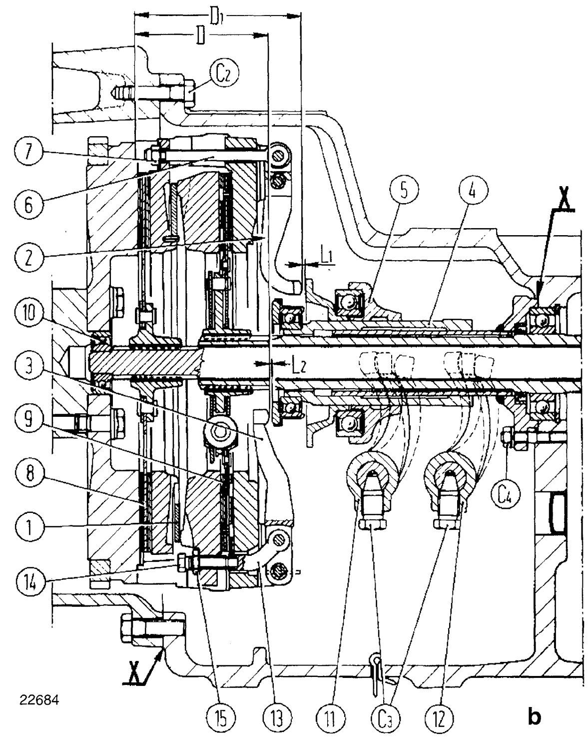
a. Clutch unit with organic material main clutch plate (standard on 60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP model tractors) – b. Clutch unit with cerametallic facing main clutch plate (optional on 62F, 72F, 82F model tractors) – b_1. Pre–modification type (without round–section ring) – b_2. Post–modification type (with round–section ring) – C_2. Clutch housing–engine attachment cap screws C_3. Shifter fork set screws – C_4. Throw–out collar cover stud nuts – D = 98 mm (3.86 in). Nominal distance of release levers (3) from the clutch–engine flywheel matin plane – D_1. 123 mm (4.84 in). Nominal distance of release levers (2) from the clutch–engine flywheel mating plane – L_1. = 2.5 mm (.10 in). Nominal distance of P.T.O. release levers from thrust collar – L_2 = 2 mm (.08 in). Nominal distance of main clutch release levers from thrust collar – 1. Dish spring – 2. P.T.O. clutch release levers – 3. Main clutch release levers – 4 and 5. Throw–out collars, with thrust bearings – 6 and 7. P.T.O. clutch release lever adjustment tie–rod and locknuts – P.T.O. clutch plate – 9. Main clutch plate – 10. Pilot bearing in engine flywheel – 11 and 12. Throw–out collar shifter forks – 13, 14 and 15. Main clutch release lever trigger lever, set screw and locknut.

Attention– At assembly, make sure that the clutch plates are positioned as shown in the figures.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply sealing compound following the instructions given on page 00–1.

*Print No. **603.54.283.00** – 09 – 1994*





Longitudinal sectional view of the 11"/11" O.M.G. clutch.

a. Clutch unit with organic material main clutch plate (standard on 60V, 60F, 62F, 70V, 72F, 72LP, 82F, 82LP model tractors) – . Clutch unit with cerametallic facing main clutch plate (optional on 62F, 72F, 82F model tractors) – C_2. Clutch housing–engine attachment cap screws – C_3. Shifter fork screws – C_4. Throw–out collar cover stud nuts – D = 98 mm (3.86 in). Nominal distance of release levers (3) from the engine flywheel mating plane – D_1 = 123 mm (4.84 in). Nominal distance of release levers (2) from the clutch–engine flywheel mating plane – L_1 = 2.5 mm (.10 in). Nominal distance of P.T.O. release levers and thrust collars – L_2 = 2 mm (.08 in). Nominal distance of main clutch release levers and thrust collar – 1. Dish spring – 2. P.T.O. clutch release levers – 3. Main clutch release levers – 4 and 5. Throw–out collars, with thrust bearings – 6 and 7. P.T.O. clutch release lever adjustment tie–rod and locknut – 8. P.T.O. clutch plate 9. Main clutch plate – 10. Pilot bearing on engine flywheel – 11 and 12. Throw–out collar shifter forks – 13, 14 and 15. Main clutch release lever trigger levers, set screw and locknut.

Attention – At assembly, make sure that the clutch plates are positioned as shown in the figures.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply sealing compound following the instructions given on page 00–1.

Print No. **603.54.283.00** – 09 – 1994

CLUTCH TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Clutch slips	**1.** Worn clutch plates 8 and 9, pages 18–4 ÷ 18–7, thrust plate and engine flywheel mating surfaces (1–2–3–4, page 18–13 and pages 18–18 and 18–19)	Check comparing to specifications on pages indicated, replace parts at or approaching their wear limits and adjust settings of release levers and external controls, as specified.
	2. Worn or damaged dish spring (1, pages 18–4 ÷ 18–7).	Replace the spring.
	3. Oil or grease on clutch plates (8 and 9, pages 18–4 ÷ 18–7).	Replace clutch plates, eliminate the cause of oil or grease presence inside the clutch compartment and thoroughly clean all friction surfaces.
Clutch chatters	**1.** Hardened external controls.	Inspect joints and pivots, lubricate them.
	2. Bent clutch plate (9).	Replace plate and adjust the clutch control lever setting.
	3. Clutch plate (9) with either damper springs damaged or loose hub rivets.	Replace the clutch plate.
	4. Oil or grease on clutch plates (8 and 9).	Replace clutch plates, eliminate the cause of oil or or grease presence inside the clutch compartment and thoroughly clean all friction surfaces.
Clutch does not release and drags	**1.** Bent clutch plates (8 and 9).	Replace clutch plates (and adjust).
	2. External control seizure.	Inspect, replace defective parts and lubricate.
	3. Wrong setting and adjustments.	Adjust controls (see pages 18–22 and 18–23).
Clutch noise at engagement/disengagement	**1.** Worn thrust bearing.	Replace the bearing.
	2. Clutch plate (9) with faulty damper springs.	Replace the clutch plate.
Clutch pedal hard to operate	**1.** Hardened external controls.	Inspect joints and pivots and lubricate.
	2. Hardened control pedal pivoting.	Inspect the pivot and lubricate.

Print No. ***603.54.283.00*** *– 09 – 1994*

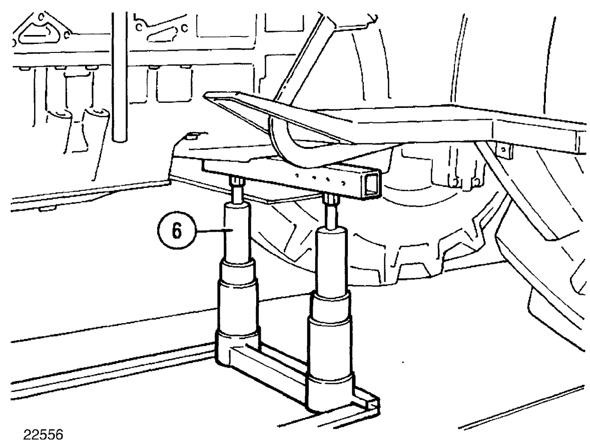
10"/10" LUK AND VALEO CLUTCHES or 11"/11" LUK, VALEO and O.M.G

Removal–Installation (Operation 18 110 10 or 18 110 13 or 18 110 16)

To gain access to the clutch, first separate the engine with front axle or live axle from the transmission.

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Make sure that the load is held and supported by suitable slings and hooks . Make sure that nobody is standing near by.



Proceed in the order further indicated.

1. Carry on removal operations 1–2–5–6 (page 10–37).

2. If the safety frame is installed, carry on operations 7–8 (page 10–37).

3. Proceed with operations 13–14–15–16–17–18–19–20–21–23–25 (pages 10–38 and 10–39).

4. If trailer brake valve is installed, carry on removal operations 27–28–29–30–31 (pages 10–39 and 10–40).

5. Proceed with removal operations 33 – 34 – 35 – 36 – 37 – 38 (page 10–41).

6. If safety frame is installed, remove stiffening brackets, operations 39–40 (page 10–42).

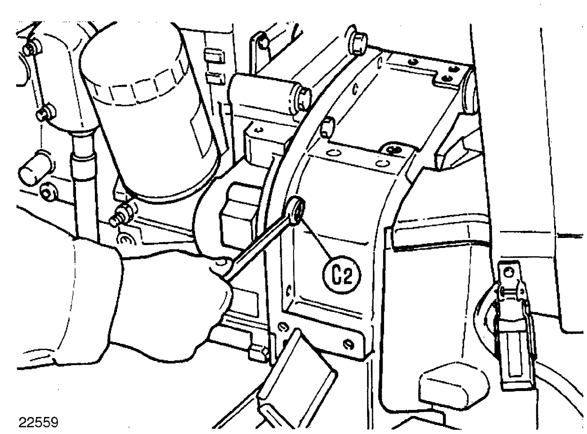
7. Proceed with operations 41–42 (page 10–42).

8. If the tractor is a 4WD, carry on operations 43–44–45–46–47 (pages 10–42 and 10–43).

9. Place the **292320** tractor disassembly stand (3) in position with the **292646** fixed supporting element underneath the transmission case, near the engine attachment flange, as shown in the figure.

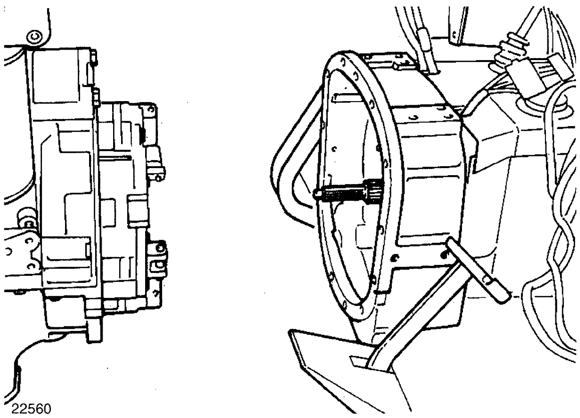
10. Position the **292645** mobile element of the **292320** stand underneath the engine, near the attachment flange to the transmission.

11. Sling up the engine to the hoist, using the specific **290740/1** steel chains and hook–up ends and then just put chains slightly under pull.



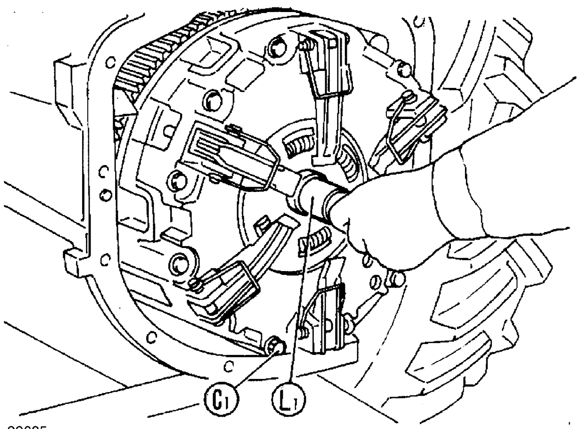
12. Lock rear wheels by pulling the hand brake lever and positioning stop wedge blocks underneath, on both sides, and then remove the engine–transmission case attachment cap screws (**C_2**).

Print No. **603.54.283.00** – 09 – 1994



22560

13. Carefully separate the engine from the transmission housing making sure from the beginning that components move freely without any interference or hardening.



22685

14. Fit the alignment and adjustment spigot L_1 (**292604** for 10"/10" LUK and VALEO clutches, or **291184** for 11"/11" LUK, VALEO and O.M.G. clutches) on the engine crankshaft.

15. Remove the clutch–flywheel attachment cap screws (**C_1**).

16. Remove the clutch with plate (8, pages 18–4 and 18–7) as an assembly and the alignment and adjustment spigot (**L_1**).

17. At installation, proceed as follows:

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

a. check conditions of the flywheel–installed pilot ball bearing (10, pages 18–4 ÷ 18–7) and replace it in case of noisy operation or hardening. Fit a new bearing and fill with TUTELA G9 grease;

b. use the already mentioned spigot when installing the clutch unit, together with the P.T.O. clutch plate, on the engine flywheel;

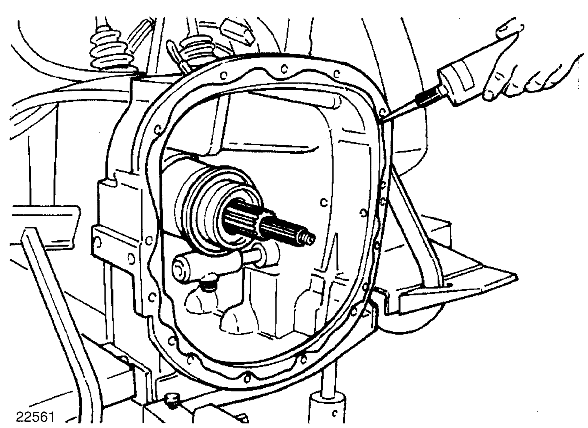
c. proceed by reversing the previous removal sequence starting from operation 16 back to operation 1;

d. torque tighten fastenings to specifications of page 10–4;

e. spread TUTELA G9 grease on the clutch plate shaft splines and on the throw–out collar compartments;

f. fit two **292888** pilot dowel pins to facilitate alignment when attaching the engine to the transmission case and also make sure that there are no interferences or hardening during the approaching phase;

g. before attaching the engine to the transmission case, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick, following the application scheme shown in the figure below.



22561

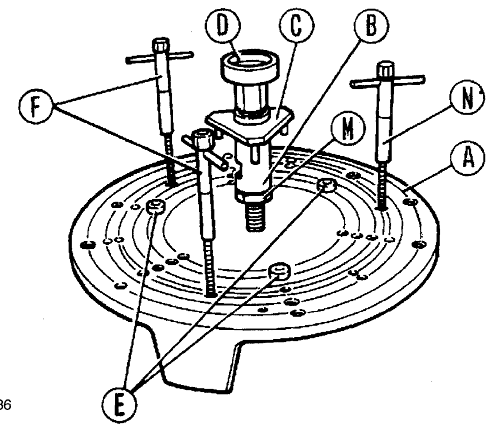
Sealing compound application scheme for engine–transmission case re–assembly.

Types of suitable sealing compounds are given on page 00–1.

*Print No. **603.54.283.00** – 09 – 1994*

10"/10" LUK or VALEO CLUTCH OVERHAULING AND ADJUSTMENT (Operation 18 110 30 or 18 110 31).

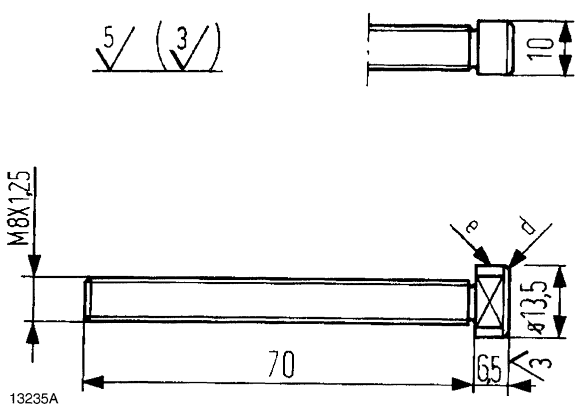
Clutch disassembly, re–assembly and adjustment are carried on using the **293650** clutch universal service kit or the **291291/2** clutch service kit.



22686

291291/2 clutch kit components necessary to adjust the 10"/10" VALEO or LUK clutches.

A. **292598** plate – B. **292450** central spacer – C. **293731** gauge – D. Spacer–gauge mounting **292344** nut – E. **50003** side spacers (self–made in the workshop) –. F. **291292/1** rod – M. M16x1.5 nut – N. **293737** spacers (for VALEO clutch only).

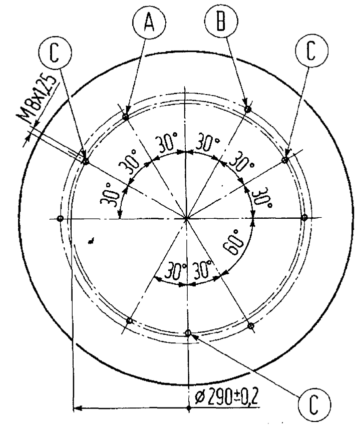


13235A

Working drawing of the self–made 50003 spacers for the 291291/2 clutch service kit (10"/10" LUK and VALEO clutches). Metric dimensions.

d = 1 mm (.04 in) chamfer – e = etch tool number (**50003**) – Use R80 steel for making the spacer.

For the **291291/2** clutch service kit only, make the three **50003** side spacers according to the working drawing and material specifications of the above figure.



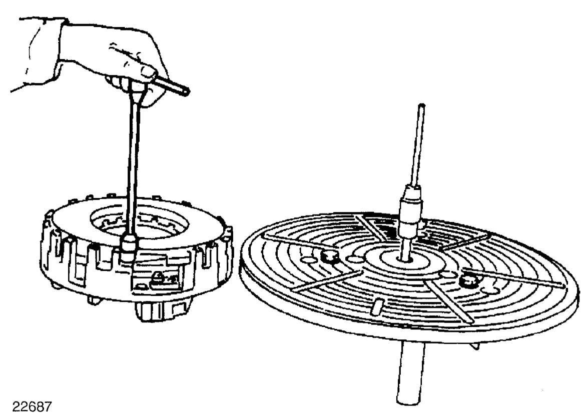
16278

Modification to be made on 292598 plate of 291291/2 service kit

A, b. Existing holes on the 295 mm dia. and 314 mm dia. – C. Holes to be drilled on the 290 mm dia.

In addition, modify the **292598** plate of the **291291/2** clutch service kit by drilling the three M8x1.25 holes on the 290 mm dia. circumference (follow indications given in the figure above).

Note – Applying to the VALEO clutch only.



22687

1. Before installing the VALEO clutch on the **291291/2** service kit or on the **293650** universal kit we suggest removing from the clutch housing the three P.T.O. clutch pressure ring drag keys holding screws.

To install the LUK or VALEO clutches on the 291291/2 service kit, proceed as follows:

— place the central spacer (B) on plate (A) and position it, with respect to the gauge (G) supporting plane, 126 mm (5 in) higher than the plate (A) supporting surface, then lock it in place with nut (M);

Print No. ***603.54.283.00*** *– 09 – 1994*

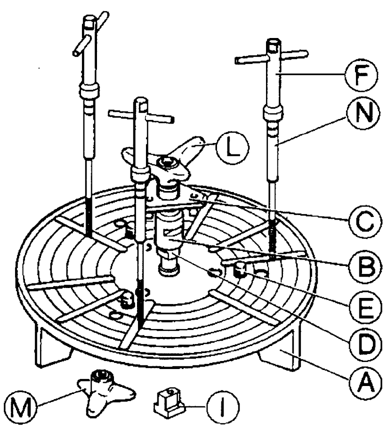
— place the two side spacers (E, page 18–11) on the 290 mm dia. circumference, positioning them with the top surface at a heigh (h) given by:

h = 0.25 mm (.010 in) + S

where **S** is the measured thickness of the P.T.O. clutch plate;

— place the clutch unit, without the P.T.O. plate, on the service kit and secure it in position by means of the three threaded rods (F) provided with spacers (N).

Instead, to install the LUK or VALEO clutches on the universal 293650 kit, proceed as follows:



293650 clutch kit components necessary to adjust the 10"/10" VALEO or LUK clutches

A. **293332/1** plate – B. **292450** central spacer – C. **293731** gauge – D. Central spacer **293730** locknut – E.**293726** side spacers F. **293725** threaded rods – I.**293755** gauge blocks – L. Gauge holding **292739** wing screw – M. Side spacer holding **293740** wing screws – N. **293737** VALEO clutch spacers or **292345** LUK clutch spacers.

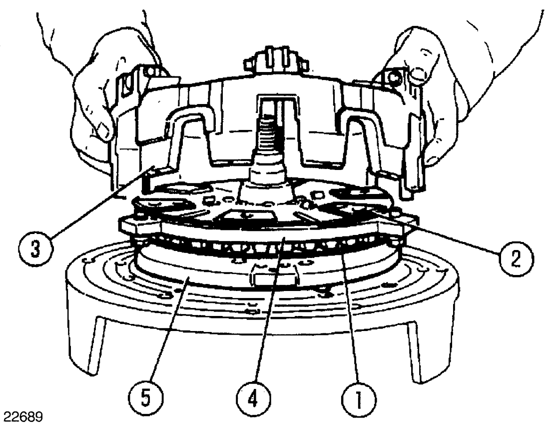
2. Place the central spacer (B) on plate (A) positioning it, with respect to the gauge (C) supporting plane, 126 mm (5 in) higher than the plate (A) supporting surface, then lock it in place with jam nut (D).

3. Measure thickness (S) of the P.T.O. clutch plate and place the adjustable side spacers (E) on the 240 mm (9.5 in) dia. circumference, positioned with the top surface at a height (h) given by:

h = 0.25 mm (.010 in) + S

where **S** is the the measured thickness of the P.T.O. clutch plate.

4. Tighten in place the adjustable side spacers (E) by means of wing nuts (M).



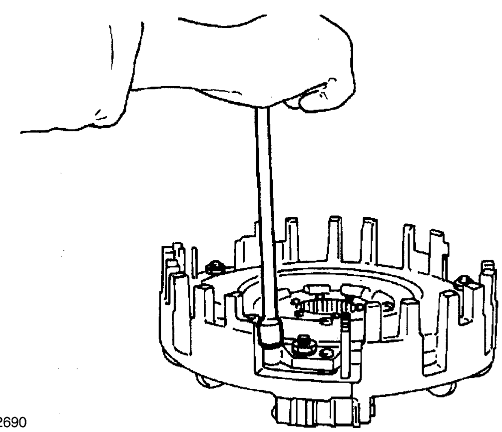
Removal (installation) of the clutch housing complete with release levers (LUK)

1. Dish spring – 2. Main clutch plate – 3. Clutch housing – 4. Main clutch pressure ring – 5. P.T.O. clutch pressure ring.

5. Place the clutch unit without the P.T.O. clutch plate on service kit plate (A), tighten the three threaded rods (F) provided with gauge blocks (I) and spacers (N) until the clutch housing is packed on plate (A).

6. Remove the P.T.O. clutch release lever adjustment tie–rods nuts (7, page 18–4) and gradually unscrew the threaded rods (F) to release the dish spring tension which will let the clutch parts to come loose, as shown in the above figure.

Note – Operation applying to VALEO clutch only.

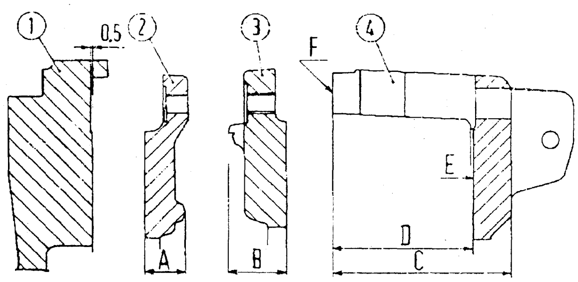


7. Remove from the VALEO clutch housing the three main clutch pressure ring spring key holding screws and retrieve the pressure ring.

Print No. ***603.54.283.00*** *– 09 – 1994*

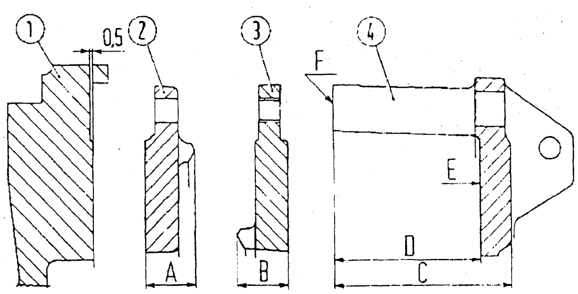
Attention – During the VALEO clutch disassembly, overhauling and adjustment operations be particularly careful not to displace the main and P.T.O. clutch pressure ring drag springs from their original assembled position on the pressure rings.

8. Inspect the main and P.T.O. clutch plates for wear and replace them if rivets are flush with or approaching the friction surface. Also replace the plates if the organic material surfaces are impregnated with oil.



16248

Minimum permissible dimensions after refacing of wear parts of the 10"/10" LUK clutch.
A. ≥ 19.4 mm (.76 in) – ≥ B. 24.4 mm (.96 in) – C. ≥ 85 mm (3.35 in) D = 68.5 ± 0.15 mm (2.70 ± .006 in) – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.



16249

Minimum permissible dimensions after refacing of wear parts of the 10"/10" VALEO clutch.
A. ≥ 23.2 mm (.91 in) – B. ≥ 25.1 mm (.99 in) – C. ≥ 86.3 mm (3.40 in) – D = 70 mm (2.7 in) – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.

9. Inspect pressure ring and clutch housing friction surfaces.

10. If necessary, they can be refaced, in which case it must be considered that dimensions (A, B, C, D) of refaced components must not be less than the minimum permissible ones given in the legends of the figures in the first column or they should be replaced.

It must also be considered that if surface (E) of the clutch housing is refaced, it will be necessary to reface surface (F) also, by the same amount, in order to re–establish dimension (D).

Proceed then as follows:

- reface pressure ring surfaces;
- replace worn or damaged clutch plates;
- reface clutch housing friction surfaces;
- calculate dimension (D) by the following formula:

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

where:

A and B = measured dimensions of the two pressure rings after refacing;

S_1 and S_2 = measured dimensions of main and P.T.O. clutch plates;

L = 0.5 mm (.02 in) = undersizing of engine flywheel;

P = 3.8 mm (.149 in) (VALEO) and 3.2 ± 5.2 mm (.125 ± .205 in) (LUK, on new and worn clutch, respectively) = dimensions of the to re–establish the original load.

11. Check if the resulting value (D) is larger or equal than the figures in the legends of the figures in the first column and that in order to re–establish it, dimension (D) of the housing will not be less than these values. If so, replace one or both pressure rings, considering the notice that follows.

Print No. **603.54.283.00** – 09 – 1994

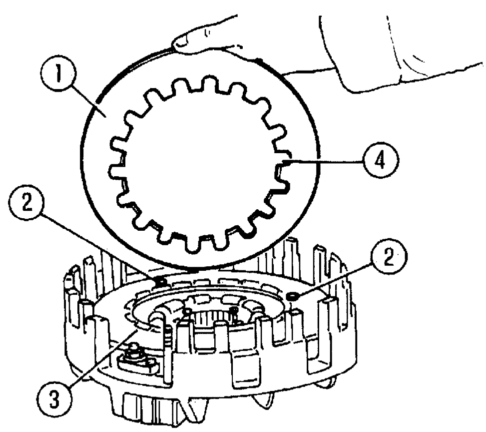
Attention – The thickness of the clutch housing, 4, page 18–13, must not be reduced below the following dimensions:
C ≥ D . 16.5 mm (.65 in) (10"/10" LUK clutch)
C ≥ D . 16.3 mm (.64 in) (10"/10" VALEO clutch)

12. If necessary, reface friction surface on engine flywheel keeping in mind that, after processing, the external undercutting of 0.5 mm (.02 in) must be re–established.

13. Reassemble clutch parts as shown in the figure on page 18–4, using the specific component tools of the **291291/2** clutch service kit or of the **293650** universal clutch kit and by reversing the disassembly sequence of operations previously described.

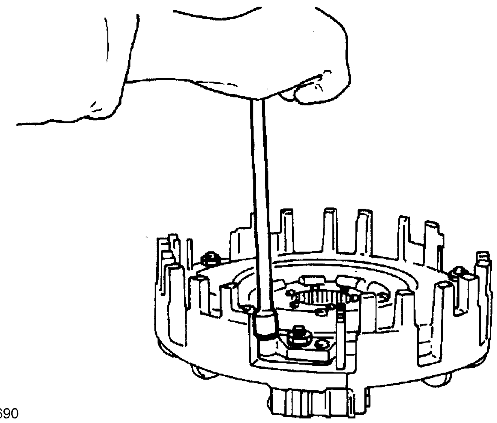
Also, consider the following information:

A) **for the VALEO clutch:**



22691

— make sure that the dish spring (1) is correctly positioned on the main clutch pressure ring (3) through the alignment of the pilot dowel pins (2) with cuts (4), as shown in the figure;


22690

— tighten the main and P.T.O. clutch pressure ring spring key holding screws on the housing at 1.5 da Nm (kgm) torque after application of a thin film of "LOCTITE" heavy–duty type thread–locking compound.

B) **for the LUK clutch:**

— make sure that the dish spring (1, page 18–4) is correctly positioned on the P.T.O. clutch pressure ring.

10"/10" LUK or VALEO CLUTCH ADJUSTMENT

To achieve the correct clutch adjustment, release levers must be aligned on the same plane and positioned at the dimensions D and D_1, page 18–4, with respect to the contact surface plane on the engine flywheel.

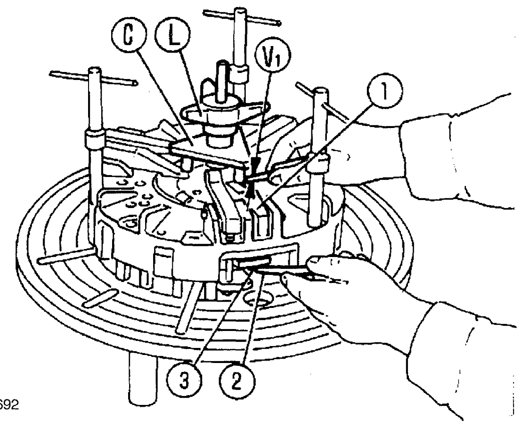
Adjustment can be carried on both with clutch on work bench or installed on the tractor.

1. Adjustment on work bench.

— Place the clutch unit on the plate of the **293650** universal tool or of the **291291/2** tool kit.

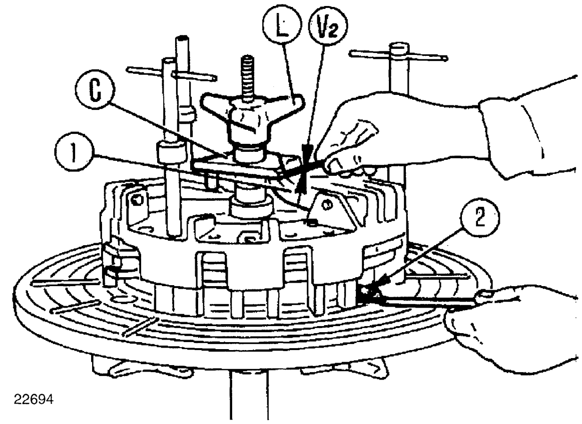
— Tighten the three threaded rods (F, page 18–11 and 18–120 until the clutch unit is solidly packed on plate (A).

Print No. **603.54.283.00** – 09 – 1994



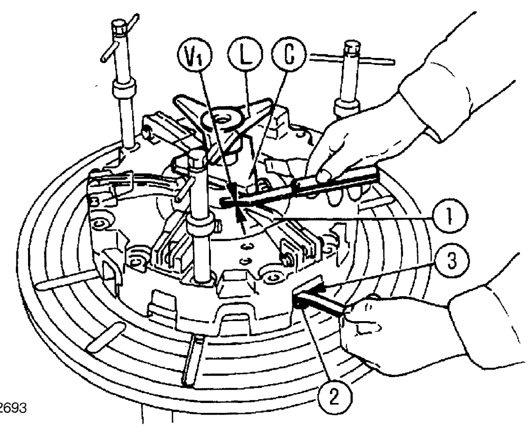
22692

Checking and adjusting on workbench the complanarity of the main clutch (VALEO) release levers using the 293650 universal kit.



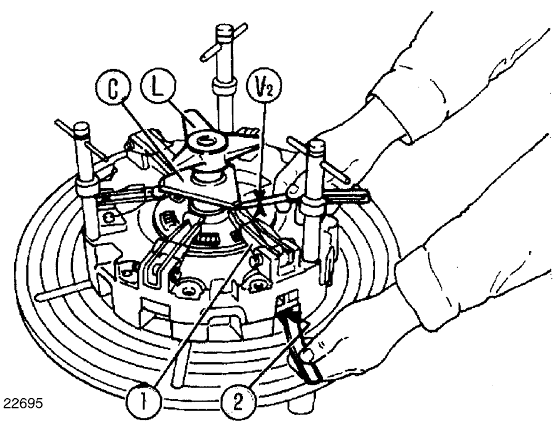
22694

Checking and adjusting on workbench the complanarity of the P.T.O. clutch (VALEO) release levers using the 293650 universalkit.



22693

Checking and adjusting on workbench the complanarity of the main clutch (LUK) release levers using the 293650 universal kit.



22695

Checking and adjusting on workbench the complanarity of the P.T.O. clutch (LUK) release levers using the 293650 universal kit.

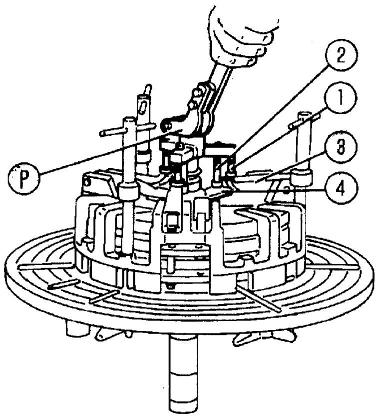
— Install gauge (C) and hold it in place by tightening the **293739** wing screw (L) of the **293650** universal kit, or by means of nut (D, page 18–11, of the **291291/2** clutch service kit.

— Screw on or back off the main clutch release lever (1) set screws (2) until obtaining the clearance $V_1 = 0.1$ mm (.004 in) between the ends of the gauge pins and the main clutch release levers (1). Lock then the set screws (2) by torque tightening nuts (3) at 4.9 da Nm (Kgm).

— Screw on or unscrew the P.T.O. clutch release lever (1) tie–rod nuts (2) until obtaining the clearance (V_2 = 0.1 mm – .004 in) between each release lever end and the gauge surface plane (C).

— After adjusting the clutch release levers, remove the **293739** wing screw (L) from the **293650** universal kit or (D) from the **291291/2** clutch service kit, and gauge (C).

Print No. ***603.54.283.00*** *– 09 – 1994*

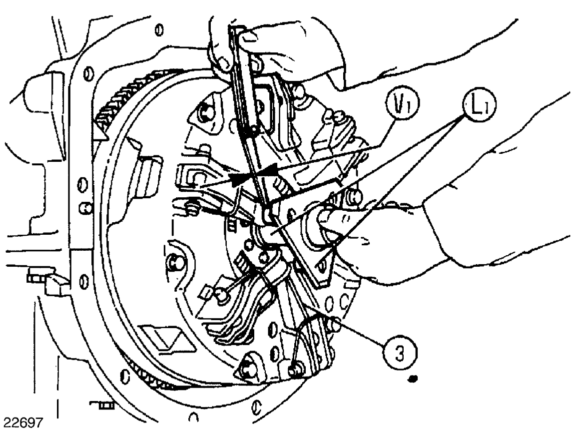


22696

— Install the **292176** compressor tool (P) on the kit plate, adjust the length of screws (1) until aligned on the same plane and bearing on the P.T.O. clutch release levers (3), then actuate the compressor (P) through the lever, as shown in the figure, and check the P.T.O. clutch disengagement.

— Make then screws (2) to bear on the main clutch release levers (4) and check main clutch disengagement.

2. Adjusting the clutch installed on engine flywheel.

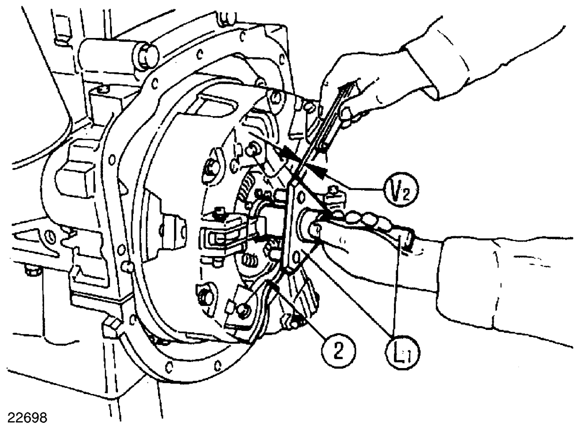


22697

Checking the main clutch release lever complanarity with clutch unit installed on engine flywheel.

L_1. **292604** dowel pin and **292605** gauge – V_1. = 0.1 mm (.004 in). Clearance between ends of gauge (L_1) pins and release levers (3) – 3. main clutch release levers.

— Introduce the **292604** oin (L_1) in the clutch plate shaft seats to check that the end thrust surface is contacting the bearing (10, page 18–4).



22698

Checking the P.T.O. clutch release lever complanarity with clutch unit (LUK) installed on engine flywheel.

L_1. **292604** dowel pin and **292605** gauge – V_2. = 0.1 mm (.004 in). Clearance between ends of release levers (2) and gauge plane (L_1) – P.T.O. clutch release levers.

— Press the gauge against the upper end of pin (L_1) and adjust clearances (V_1 and V_2) as described at point 1, page 18–15.

Notice – Any measured difference, even if appreciable, between the position of the release levers found on the workbench using the **293650** universal kit or **291291/2** clutch kit and that found with the clutch unit installed on the engine flywheel will have no practical consequences on clutch operation.
In fact, any such difference is mainly due to different thicknesses existing within processing tolerances or to P.T.O. clutch plate wear with respect to its nominal dimension, differences which become evident because of the high leverage multiplication factor.

ADJUSTING THE MAIN CLUTCH CONTROLS (Operation 18 100 40)

See page 18–22.

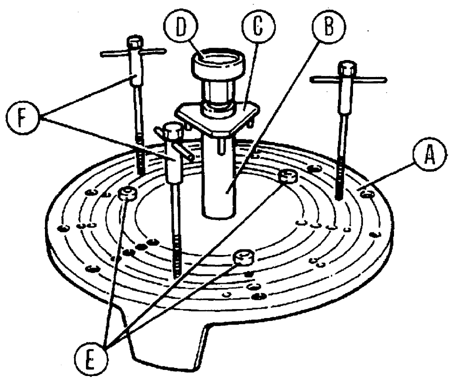
ADJUSTING THE P.T.O. CLUTCH CONTROLS (Operation 18 100 08)

Seee page 18–23.

Print No. 603.54.283.00 – 09 – 1994

OVERHAULING AND ADJUSTMENT OF THE 11"/11" LUK, VALEO or O.M.G. clutches (Operation 18 11 030 or 18 11 031 or 18 11 032).

Use the **293650** universal kit or the **291291/2** clutch service kit to disassemble, assemble and adjust the clutch.



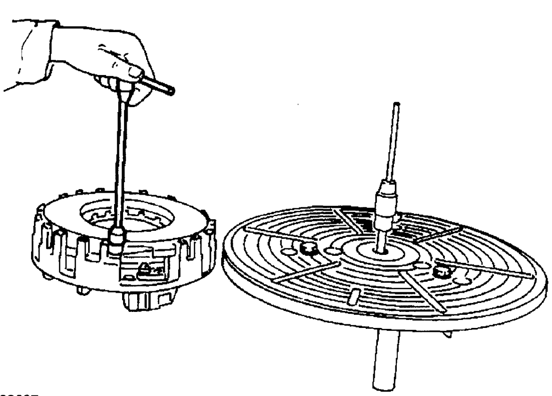
22699

Parts of the 291291/2 service kit necessary for the adjustment of the 11"/11" VALEO, LUK or O.M.G. clutch.

A. **292598**, plate – B. **292342**, central spacer – C. **291299**, gauge – D.**292344**, spacer and gauge attachment nut – E. **293454**, side spacers – F. **291292/1**, threaded rods.

Note: in addition, use three **292350** spacers and the **292343** cross–member for the only disassembly and re–assembly operations of the VALEO clutch dish spring and of the main clutch plate.

Note: operation involving the VALEO clutch only.



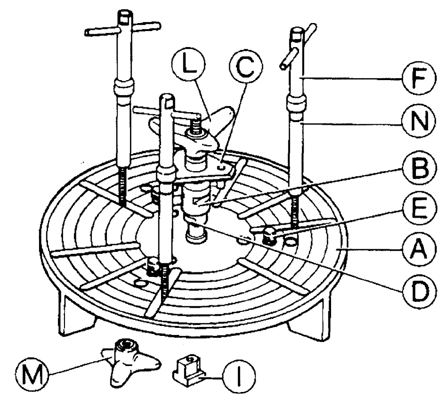
22687

1. Before placing the VALEO clutch on the **291291/2** kit or on the **293650** universal kit, we advise undoing from the clutch housing the three P.T.O. clutch pressure ring drag spring holding screws.

To install a VALEO, LUK or O.M.G. clutch on the 291291/2 kit proceed as follows:

— place on plate (A) the central spacer (B) and the three side spacers (E) on the 241 mm (9.5 in) dia. circumference;

— place the clutch unit, without P.T.O. plate, on the kit plate and secure it by tightening the three threaded rods (F).



22709

Parts of the 293650 universal kit necessary for the adjustment of the 11"/11" VALEO, LUK or O.M.G. clutch.

A. **293332/1**, plate – B. **293728**, central spacer – C. **293731**, gauge D. **293730**, central spacer locknut – E. **293726**, side spacers – F. **293725**, threaded rods – I. **293755**, gauge blocks – L. **293739**, gauge holding wing screw – M. **293740**, side spacer holding wing screws – N. **292345**, rod spacers.

Note: use in addition three **293744** spacers, three **293722** pins, three **293736** bushings and the **292343** cross–member for the only disassembly and re–assembly of the VALEO clutch dish spring and of the main clutch plate.

Instead, to install the clutch on the 293650 universal kit, proceed as follows:

2. Place the central spacer (B) on plate (A), positioning it so that the gauge (C) plane is 123 mm (4.84 in) higher than plate (A), then lock it in place by tightening the jam nut (D).

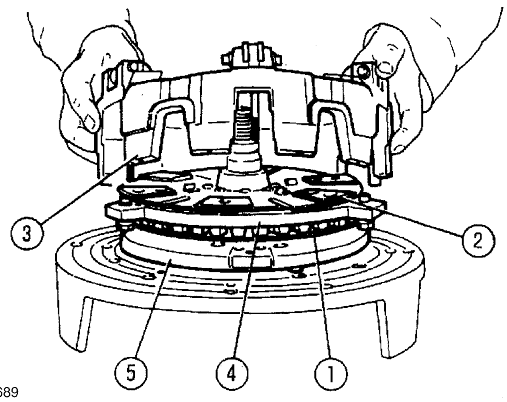
3. Measure thickness (S) of the P.T.O. clutch plate and place the adjustable side spacers (E) on the 240 mm (9.45 in) dia. circumference, positioning them with their top surface at a height (h) given by:

$$h = 2\ \text{mm} + S$$

where:
2 mm (.08 in) = constant
S = measured thickness of the P.T.O. clutch plate.

4. Lock then the adjustable side spacers (E) in place by tightening the wing screws (M).

Print No. ***603.54.283.00*** *– 09 – 1994*



22689

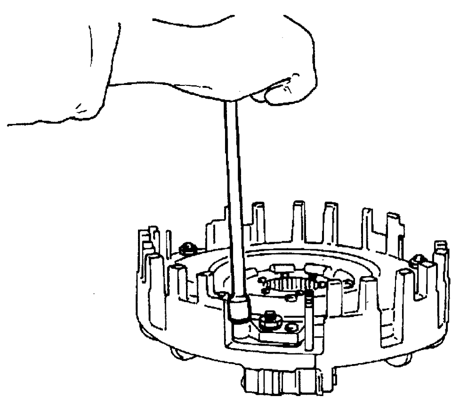
Disassembly (assembly) of the clutch housing complete of release levers (LUK clutch).

1. Dish spring – 2. Main clutch plate – 3. Clutch housing – 4. Main clutch pressure ring – 5. P.T.O. clutch pressure ring.

5. Place the clutch unit without P.T.O. clutch plate on service kit plate (A, page 18–17), tighten the three threaded rods (F), provided with the gauge blocks (I) and spacers (N) until the clutch unit is firm on plate (A).

6. Remove the P.T.O. clutch release lever tie–rod nuts (7, pages 18–5 ÷ 18–7) and gradually unscrew the threaded rods (F, page 18–7) to free the dish spring and clutch components as shown above.

Note: operation involving the VALEO clutch only.



22690

7. Remove from the VALEO clutch housing the three main clutch pressure ring drag spring holding screws and retrieve the pressure ring.

Attention – During the VALEO clutch disassembly, overhauling and re–assembly operations be particularly careful not to displace the main and P.T.O. clutch pressure ring drag springs from their original position on the pressure rings.

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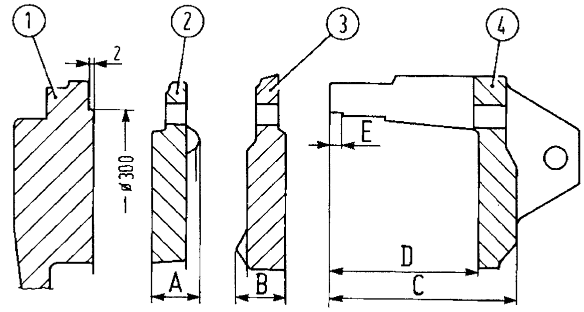
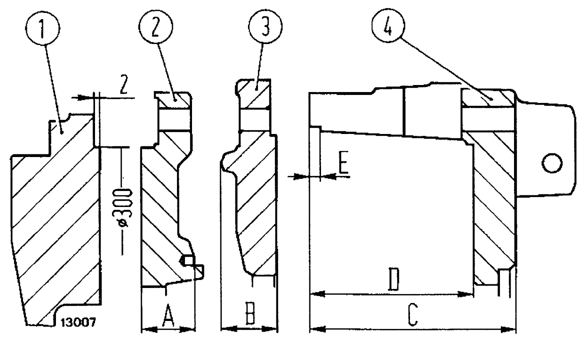
8. Check the main and P.T.O. plate for excessive wear and replace them if rivets are flush with or near to the friction material. Replace the organic material plate if friction surfaces are impregnated with oil.



22700

Minimum permissible dimensions after refacing of wear parts on the 11"/11" VALEO clutch.

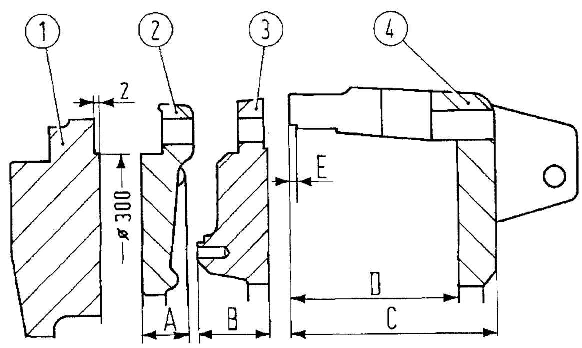
A ≥ 19.1 mm (.752 in) – B ≥ 24.8 mm (.976 in) – C ≥ 86 mm (3.39 in) – D ≥ 69 mm (2.72 in) – E ≥ 6.5 mm (.256 in) – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.



13007

Minimum permissible dimensions after refacing of wear parts on the 11"/11" O.M.G. clutch.

A ≥ 16.5 mm (.65 in) – B ≥ 30 mm (1.18 in) – C ≥ 87 mm (3.43 in) – D = 70 mm ± 0.15 mm (2.76 ± .006 in) – E ≥ 2.5 mm (.10 in) – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.

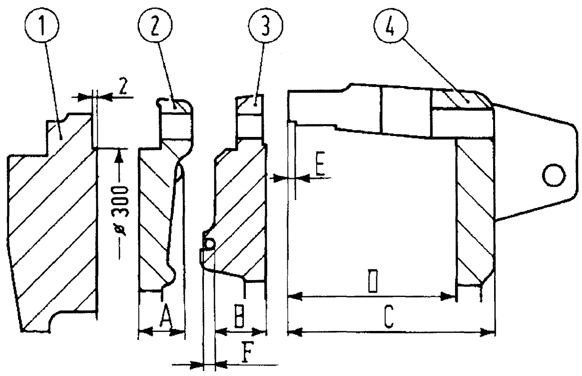


22701

Minimum permissible dimensions after refacing of wear parts on the 11"/11" LUK pre–modification clutch.

A ≥ 18 mm (.70 in) – B ≥ 28.2 mm (1.11 in) – C ≥ 88.2 mm (3.47 in) – D = 71,2 ± 0.15 mm (2.80 ± .006 in) – E ≥ 2.5 mm (.10 in) – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.

Print No. ***603.54.283.00*** *– 09 – 1994*



22702

Minimum permissible dimensions after refacing of wear parts on the post–modification 11"/11" LUK clutch.
A≥18 mm (.70 in) – B ≥ 24.1 mm (.95 in) – C ≥ 88.2 mm (.3.47 in) – D = 71.2 ± 0.15 mm (2.80 + .006 in) – E ≥ 2.5 mm (.09 in) – F = 4.1 mm (.16 in), round–section ring diameter – 1. Engine flywheel – 2. P.T.O. clutch pressure ring – 3. Main clutch pressure ring – 4. Clutch housing.

9. Inspect friction surfaces of pressure rings and clutch housing. If necessary, they can be refaced, holding in mind that the dimensions (A,B,C and D) of refaced parts must not be riduced below the limits appearing in the previous figures, in which case parts should be replaced.

10. Proceed as follows:

— reface the pressure rings;

— replace worn or damaged clutch plates;

— reface clutch housing friction surface;

— calculate dimension (D) for the post–modification, 11"/11" LUK clutch (see figure above) by the following formula:

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

— Calculate dimension (D) for all other 11"/11" clutches (see figures on page 18–18) using the following formula:

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

where:

A and B = red dimensions of both pressure rings after refacing;

F = 4.1 mm (.16 in), round–section ring diameter;

S_1 and S_2 = measured dimensions of main and P.T.O. clutch plates;

L = 2 mm (.08 in). Undercut on engine flywheel;

P = 4 mm – .16 in (O.M.G.), 4.15 mm – .163 in (VALEO), 3.4 ÷ 5.4 mm – .13 ÷ .21 in ((LUK, for pre– and post–modification clutch, respectively). Dimension necessary for the spring to re–establish the original load.

11. Verify that the obtained value of (D) is equal or greater than the dimensions reported in the previous figures and that in order to re–establish it, dimension (C) on the clutch housing will not be reduced below the values indicated in the same figures. If not, replace one or both the pressure rings, considering the information which follows.

Attention – The clutch housing (4) thickness must not be less than 17 mm (.67 in).
Check using the following formula:

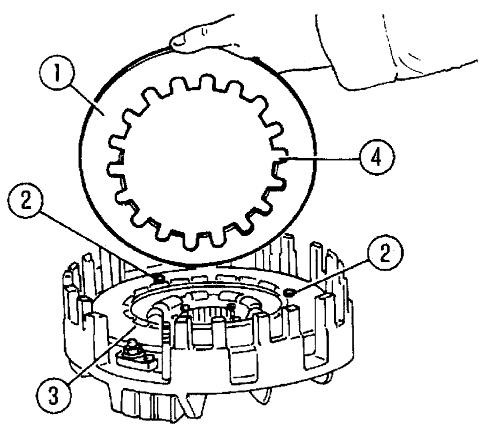
C – D≥17 mm (.67 in)

---

12. Check that dimension (E) is greater than the values shown in the figures and re–establish it in case. Reface, if necessary, the friction surface on the engine flywheel, keeping in mind that the external undercut of 2 mm (.08 in) must be re–established after completion of this operation.

13. Re–assemble the clutch as shown in the figures on pages 18–5, 18–6 and 18–7, using the specific tools of the **291291/2** service kit or of the **293650** clutch universal kit and proceeding by reversing the disassembly sequence of operations previously described.

Print No. ***603.54.283.00*** *– 09 – 1994*



22691

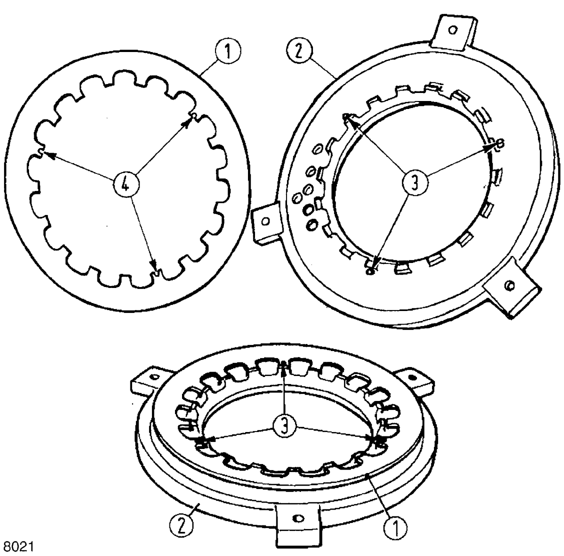
In addition, consider the following instructions:

A) for the VALEO clutch:

— position correctly the dish spring (1) on the main clutch pressure ring (3) making the spring alignment pins (2) fit in the corresponding cuts (4) as shown in the above figure;

— torque tighten the main and P.T.O. clutch pressure ring drag spring holding screws at 1.5 da Nm (kgm) after applying a thin film of "LOCTITE" heavy–duty thread locking compound.

B) for the LUK and O.M.G. clutch:



8021

— position correctly the dish spring (1) on the P.T.O. clutch pressure ring (2) making the spring alignment pins (3) fit in the corresponding cuts (4).

ADJUSTING THE 11"/11" LUK, VALEO or O.M.G. CLUTCHES.

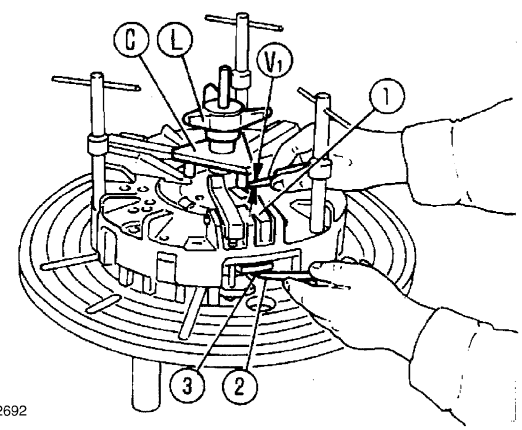
For correct clutch adjustment, release levers must be aligned on the same plane (complanarity) and positioned at the dimensions (D and D_1, pages 18–5,6 and 7) with respect to the engine flywheel surface plane.

Adjustment is possible both with the clutch unit removed and placed on a workbench or installed on the tractor.

1. Clutch adjustment on workbench.

— Place the clutch unit on the plate of the **293650** universal or **291291/2** clutch service kit.

— Tighten the three threaded rods (F, page 18–17) until the clutch cover is firmly packed on plate (A).

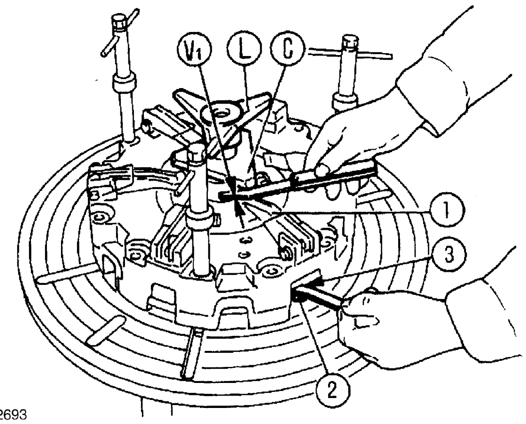


22692

Checking and adjusting on workbench the complanarity of the VALEO main clutch release levers using the 293650 universal kit.

— Install gauge (C) and secure it using the **293739** wing screw (L) on the **293650** universal kit or nut (D, page 18–17) on the **291291/2** kit.

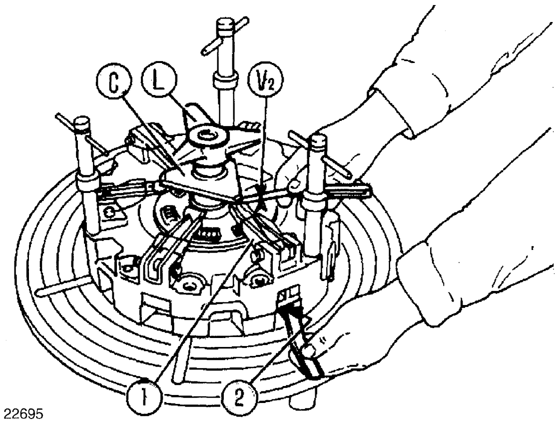
Print No. 603.54.283.00 – 09 – 1994



22693

Checking and adjusting on the workbench the complanarity of the main clutch (LUK or O.M.G.) release levers using the 293650 universal kit.

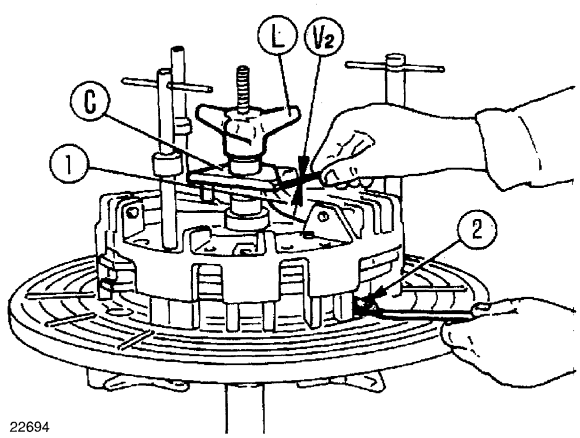
— Screw on or back off the main clutch release lever (1) set screws (2) until obtaining the clearance (V_1 = 0.1 mm – .004 in) between the ends of the gauge (C) pins and the main clutch release levers, then torque tighten their locknuts (3) at 4.9 da Nm (kgm).



22695

Checking and adjusting on the workbench the complanarity of the LUK or O.M.G. clutch release levers using the 293650 universal kit.

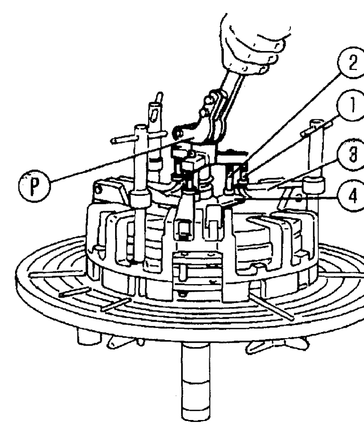
— After adjusting the clutch release levers, remove the **293739** wing screw (L) of the **293650** universal kit or nut (D, page 18–17) of the **291291/2** kit and the gauge (C).



22694

Checking and adjusting on the workbench the complanarity of the VALEO P.T.O. clutch release levers using the 293650 universal kit.

— Screw on or back off the P.T.O. clutch release lever (1) tie–rod set nuts (2) until obtaining the clearance (V_2 = 0.1 mm – .004 in) between the end of each release lever and the mating plane of gauge (C).



22696

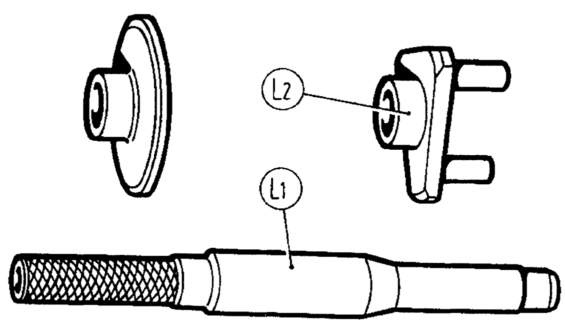
Checking the clutch release lever operation

— Fit the **292176** compressor tool (P) on the kit base plate, adjust the length of screws (1) until aligned on the same plane (complanarity) and rest on the P.T.O. clutch release levers (3), then actuate the compressor tool (P) through its control lever, as shown in the figure to verify the P.T.O. clutch disengagement.

— Make then the screws (2) rest on the main clutch release levers (4) and verify that it will disengage.

Print No. ***603.54.283.00*** *– 09 – 1994*

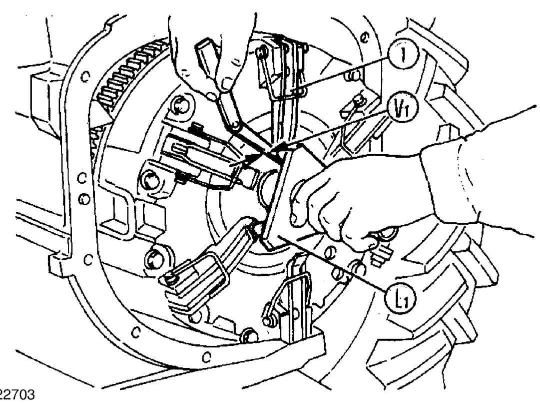
2. Adjustment operations with clutch installed on engine flywheel.



14261

Parts of the 291184 tool for adjusting the 11"/11" VALEO, LUK or O.M.G. clutches installed.

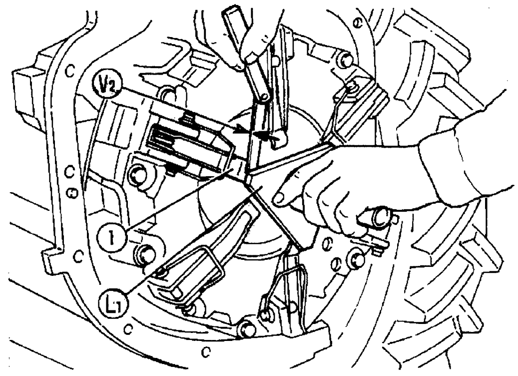
— Fit the **291184** spigot (L_1 w/gauge L_2) in the clutch plate shaft seats verifying that the end contacts the pilot bearing (10, pages 18–5 ÷ 18–7).



22703

Checking the complanarity of the release levers with clutch installed on the engine flywheel (LUK or O.M.G.).

L_1. **291184** spigot (with gauge L_2) – V_1. = 0.1 mm (.004 in). Clearance between ends of gauge (L_1) pins and release levers (1) – 1. Main clutch release levers.



22704

Checking the complanarity of the P.T.O. clutch release levers with clutch installed on the engine flywheel (LUK or O.M.G.).

L_1. **291184** spigot (with gauge L_2) – V_2 = 0.1 mm (.004 in). End clearance between release levers (1) and gauge (L_1) – 1. P.T.O. clutch release levers.

— Press against the top end of spigot (L_1) the gauge (L_2) and measure clearances (V_1 and V_2) as described at point 1 of page 18–21.

Notice – Any measured difference, even if appreciable, between the position of the release levers found on the workbench using the **293650** universal kit or the **291291/2** clutch kit and that found with the clutch installer on the engine flywheel will have no practical consequence on clutch operation.
In fact, any such difference is mainly due to different thicknesses existing within processing tolerances or to P.T.O. clutch plate wear with respect to its nominal dimension, differences which become evident because of the high leverage multiplication factor.

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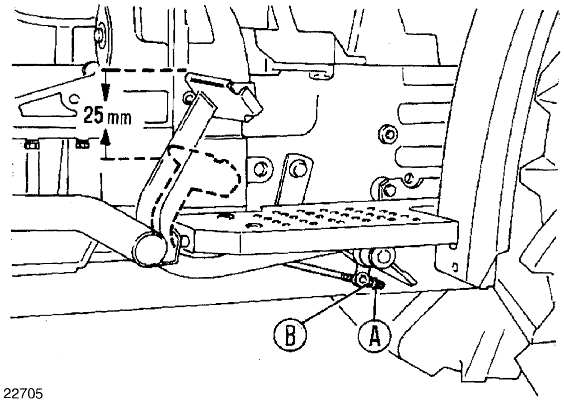
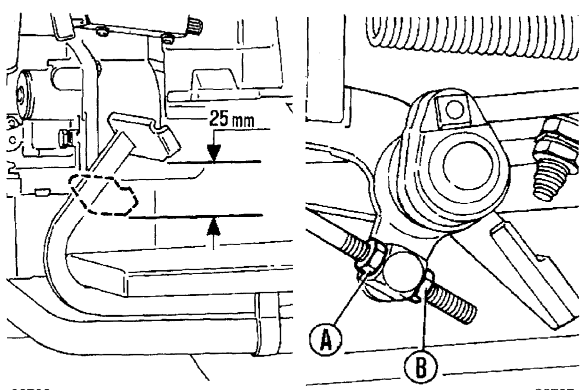
*Print No. **603.54.283.00** – 09 – 1994*

ADJUSTING THE MAIN CLUTCH CONTROLS (operation 18 100 40)



22705

Adjusting the main clutch control pedal free travel (50V, 55V, 55F, 60V, 60F, 70V model tractors).



22706 22707

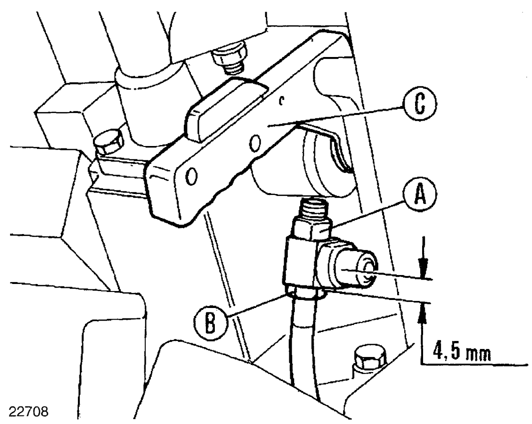
Adjusting the main clutch control pedal free travel (62F, 72F, 82F, 72LP, 82LP model tractors).

1. Check that the pedal free travel before starting to engage the clutch is about 25 mm (1 in). When the free travel is reduced to 15 mm (.60 in), adjust it as per the following order of operations.

2. Slacken locknut (A) and screw up nut (B) until the free travel measures 25 mm (1 in).

3. Tighten then with locknut (A).

ADJUSTING THE POWER TAKE–OFF CLUTCH CONTROL (operation 18 100 08)



22708

Adjusting the free travel of the power take–off clutch control lever (all models)

1. Lift up control lever (C) in engaged position.

2. Undo holding screws and remove the control panel.

3. Move lever (C) in rest position (all down) and check that its free travel, before clutch starts to disengage, measures 4.5 mm (3/16 in) (see figure on top of page).

4. If free travel is different from the value given at point 3, slacken locknut (B) and adjust by re–setting the free travel at its correct value of 4.5 mm (3/16 in) through nut (A).

5. Tighten then the locknut (B) and refit the control panel and holding screws.

Print No. 603.54.283.00 – 09 – 1994

Print No. 603.54.283.00 – 09 – 1994

Description transmission
Model 50V – 55V – 60V – 55F – 70V tractors

Constant–mesh, all–speed synchromeshed gear mechanical transmission.
Cascade–type range splitter with three forward and one reverse speed ranges for a total of 12 forward and 4 reverse gears.
With creeper speed unit installed: 20 forward and 8 reverse gears.
With mechanical reverser installed: 12 forward and 12 reverse gears.
Separate transmission and splitter control levers.
Creeper or reverser control lever situated on the operator's LH side.

IDENTIFICATION DATA

Marketing denomination: – 2WD – 4WD	**50 V** **50 DTV**	**55 V** **55 DTV**	**60 V** **60 DTV**	**55 F** **55 DTF**	**60 F** **60 DT**	**70 V** **70 DTV**
Technical denomination:	version 30 km/h	version 30 km/h	version 30 km/h	version 30 km/h	version 30 km/h	version 30 km/h
2WD version						
– with 12F + 4R synchromeshed gear mechanical transmission	674.506.000 (standard)	674.306.000 (standard)	674.606.000 (standard)	674.308.000 (standard)	674.608.000 (standard)	674.706.000 (standard)
– with combined 20F+8R gears,creeper speeds and reverser units	674.506.000 var.720.111	674.306.000 var.720.111	674.606.000 var.720.111	674.308.000 var.720.111	674.608.000 var.720.111	674.706.000 var.720.111
– with 12F + 12R synchromeshed gear mechanical reverser	674.506.000 var. 720.110	674.306.000 var. 720.110	674.606.000 var. 720.110	674.308.000 var. 720.110	674.608.000 var. 720.110	674.706.000 var. 720.110
4WD (DT) version						
– with 12F + 4R synchromeshed gear mechanical transmission	674.514.000 (standard)	674.314.000 (standard)	674.614.000 (standard)	674.313.000 (standard)	674.613.000 (standard)	674.714.000 (standard)
– with combined 20F + 8R gears, creeper speeds and reverser units	674.514.000 var.720.111	674.314.000 var.720.111	674.614.000 var.720.111	674.313.000 var.720.111	674.613.000 var.720.111	674.714.000 var.720.111
–with 12F + 12R synchromeshed gear mechanical reverser	674.514.000 var. 720.110	674.314.000 var. 720.110	674.614.000 var. 720.110	674.313.000 var. 720.110	674.613.000 var. 720.110	674.714.000 var. 720.110
Rear bevel gear drive	9/43	9/43	9/43	9/43	9/43	9/43
Front bevel gear (DT)	9/41	9/41	9/41	13/37	13/37	13/37
Rear/front drive mechanical speed ratio	1/1,63	1/1,63	1/1,63	1/1,539	1/1,539	1/1,539

Print No. ***603.54.283.00*** *– 09 – 1994*

TRANSMISSION AND SPLITTER – 50V – 55V – 60V – 55F – 60F – 70V

Transmission	4 gear ratios, constant–mesh, fully synchronized speeds
Gear type	helical teeth
Range splitter	cascade–type gears, three forward and one reverse speed ranges for a total of 12 forward and 4 reverse gears
— gear type	spur gears
— speed reduction ratio	
● low range	20/42x15/47=1/6.58
● medium range	20/42x28/34=1/2.55
● high range	1
Transmission and splitter controls	separate hand control levers
Thickness of transmission drive shaft shims , (S, page 21–7) mm (in)	2.80–3.00–3.20–3.40–3.60 (.112–.118–.126–.134–.142)
Diameter, P.T.O. shaft (8) mm (in)	21.979 ÷ 22.000 (.8653 ÷.8661)
I.D. of force–fitted bushing in constant–mesh and creeper speed drive shaft (9) "	22,040 ÷ 22,092 (1) (.8677 ÷ .8698)
P.T.O. clutch shaft/bushing running fit "	0.040 ÷ 0.013 (.0016 ÷.0005)
Interference fit of force–fitted bushing on the constant–mesh and creeper speed drive shaft (9) "	0.037 ÷ 0.091 (.0015 ÷.0036)
Transmission and splitter shift rail detent ball spring specifications:	
– free nominal length mm (in)	18,8 (.74)
– compressed length under load (73÷81 N – 7.5÷8.3 Kg 16.5÷18.3 lb) "	15,8 (.62)
Transmission and splitter control lever detent spring specifications:	
– free nominal length mm (in)	76 (2.9)
– compressed lentgh under load (238÷240 N – 24.3÷24.5 kg – 53.6÷54 lb) "	40 (1.6)

(1) Force–fit dimension without reaming.

CREEPER SPEED UNIT

Type	cascade–type spur gear unit installed between clutch and transmission. 20 forward and 8 reverse gears.
Gear ratio	18/52 x29/39 = 1/3.885
Control	hand lever on the operator's LH side

REVERSER

Type	mechanical spur gear unit installed between clutch and transmission. One driven gear, one intermediate and one idler gear.
Synchromesh gear ratio	26/23 x 23/29 x 37/32 = 1/0.965
Control	hand lever on the operator's LH side

Print No. 603.54.283.00 – 09 – 1994

TRANSMISSION, CREEPER SPEED OR REVERSER UNIT TROUBLESHOOTING GUIDE
Model 50V – 55V – 60V – 55F – 60F – 70V tractors

Problem	Possible cause	Correction
Excessive noise, with splitter in neutral and transmission engaged.	1. Wrong driving and driven shaft bearing adjustment.	Remove the clutch–transmission case and adjust bearings (see page 21–22).
	2. Failure of or faulty component.	Remove case, overhaul the transmission and replace defective parts.
	3. Component seizure due to poor lubrication.	Overhaul the transmission and fill with lube oil at correct level.
Excessive noise with tractor stationary, engine idling and transmission in neutral.	1. Broken main clutch plate damper springs.	Replace the clutch plate.
Self–disengagement of speed, range, reverser or creeper speed gears.	1. Wrong adjustment of external control levers and linkage.	Adjust correctly.
	2. Failure of shift rail detent springs.	Replace springs.
	3. Broken synchromesh teeth.	Remove the clutch–transmission case and replace the synchromesh involved.
	4. Insufficient engagement travel.	Correct causes and re–set for full travel.
Hard shifting of speed, range, reverser or creeper speed gears.	1. Wrong adjustment of control levers and linkage.	Adjust correctly.
	2. Hardening and/or seizure of external control levers and linkage.	Inspect hinge points and lubricate them.
	3. Dragging of main clutch plate.	See page 18–8.
	4. Failure of any one synchromesh.	Remove the clutch–transmission case and replace the synchromesh involved.
	5. Sticking internal sliding controls: shift rails, forks and collars.	Overhaul controls.

SERVICE TOOLS

Attention – Operations included in this section of the manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code (**X**).
Besides, to work safely and achieve the besat technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and futher integrated with the self–made ones for the construction of which you will find the necessary working drawings and materials specifications directly in this Manual.

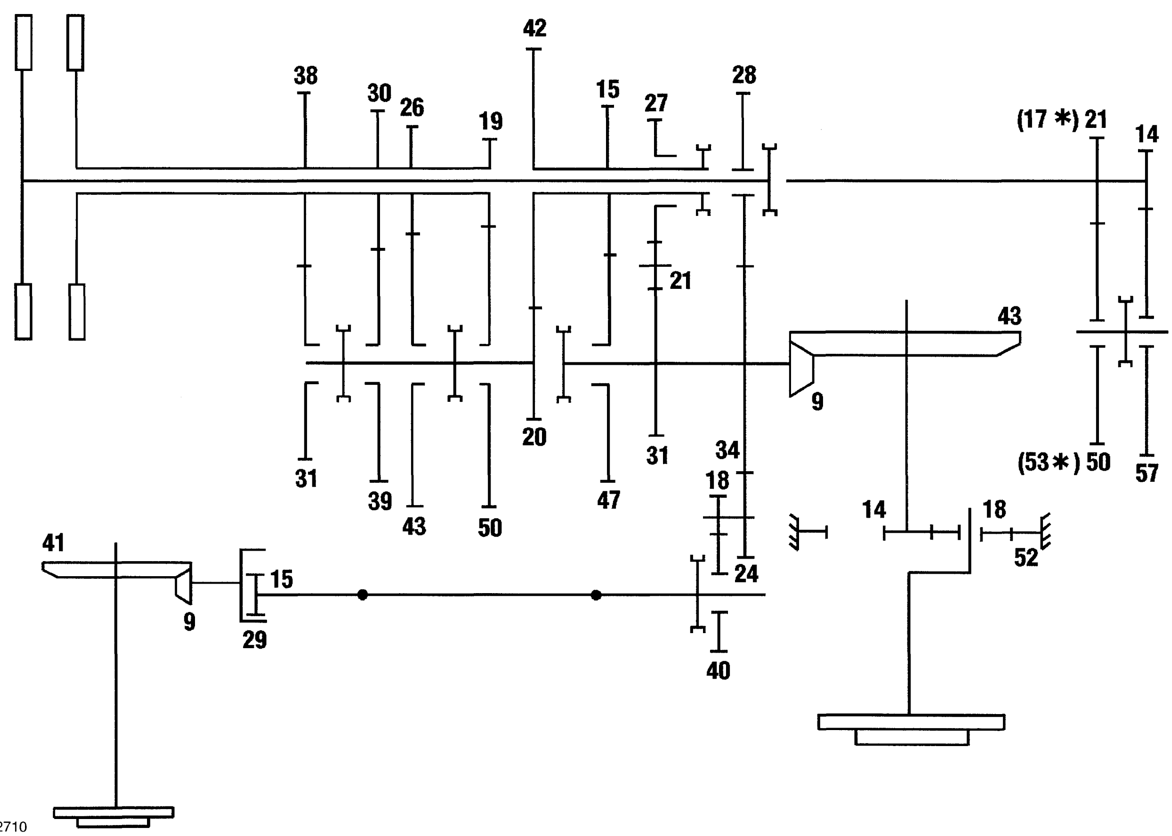
List of the special tools needed to carry on the service operations concerning this section of the Manual.

292320	Tractor disassembly stand.
291517	Transmission case removal–installation hook.
292888	Assembly dowel pins, transmission–clutch cases.
292927	Slide–hammer puller.

Print No. **603.54.283.00** – 09 – 1994

12 + 4 Transmission – 30 km/h Version – Model 50V – 55V – 60V tractors with 540/1000 rpm P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 4 STANDARD				
RANGE / GEAR		TYRE SIZE		
FORWARD		9.5 – 28	11.2 – 28	12.4 – 24
Low	1st	1.3 (0.8)	1.4 (0.87)	1.3 (0.8)
	2nd	2.1 (1.3)	2.2 (1.37)	2.1 (1.3)
	3rd	2.7 (1.7)	2.7 (1.68)	2.6 (1.6)
	4th	4.2 (2.6)	4.4 (2.73)	4.2 (2.6)
Medium	1st	3.4 (2.1)	3.5 (2.17)	3.4 (2.1)
	2nd	5.4 (3.4)	5.6 (3.48)	5.4 (3.4)
	3rd	6.9 (4.3)	7.1 (4.4)	6.8 (4.2)
	4th	11.0 (6.8)	11.3 (7.0)	10.9 (6.8)
High	1st	8.7 (5.4)	9.0 (5.6)	8.6 (5.3)
	2nd	13.8 (8.6)	14.3 (8.9)	13.7 (8.5)
	3rd	17.5 (10.9)	18.2 (11.3)	17.4 (10.8)
	4th	27.9 (17.3)	29.0 (18.0)	27.7 (17.2)
REVERSE				
	1st	3.6 (2.2)	3.7 (2.3)	3.5 (2.2)
	2nd	5.7 (3.5)	5.9 (3.7)	5.7 (3.5)
	3rd	7.3 (4.5)	7.5 (4.7)	7.2 (4.5)
	4th	11.6 (7.2)	12.0 (7.5)	11.5 (7.1)



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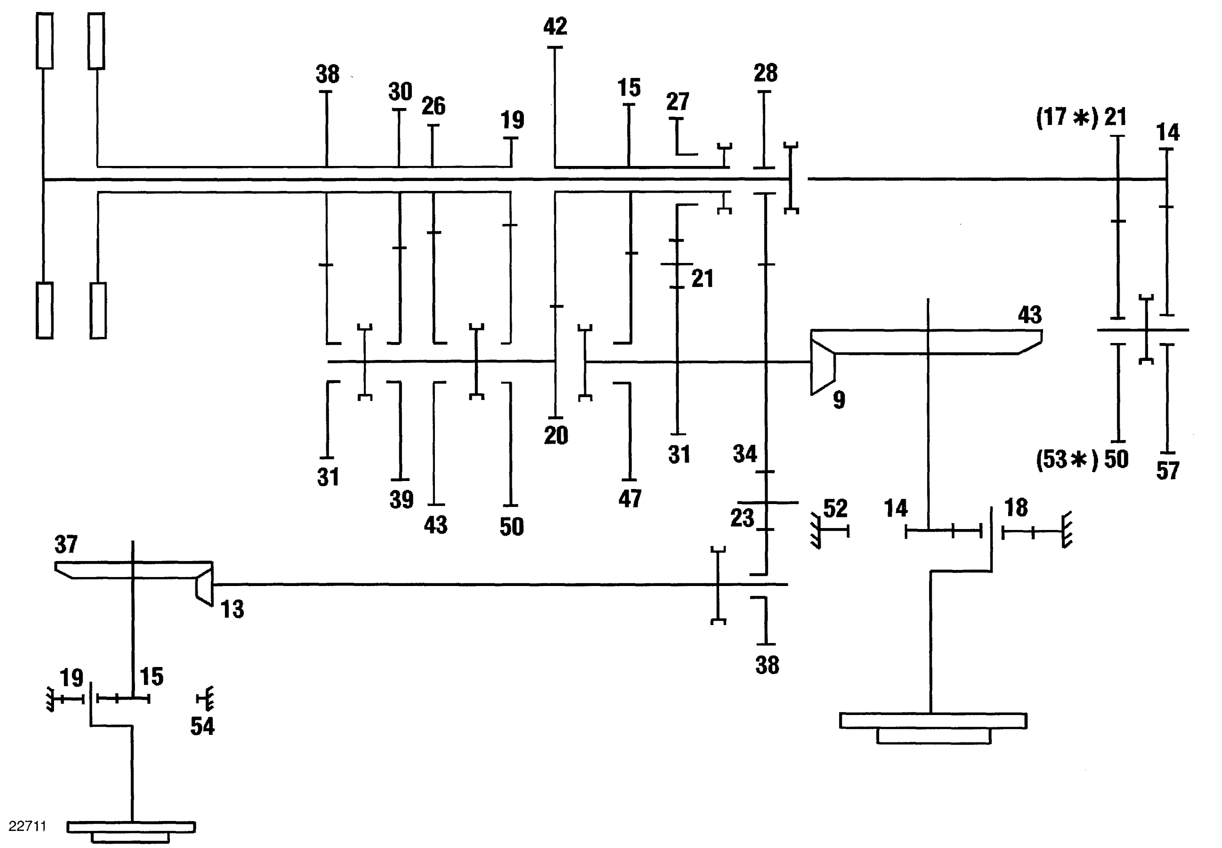
Note (*) 540/750 rpm P.T.O. version.

Print No. ***603.54.283.00** – 09 – 1994*

12 + 4 Transmission – 30 km/h Version – Model 55F – 60F tractors with 540/1000 rpm P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 4 STANDARD				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.5 – 20	11.2 – 24	13.6 – 24
Low	1st	1.2 (0.7)	1.2 (0.7)	1.3 (0.8)
	2nd	2.0 (1.2)	2.0 (1.2)	2.1 (1.3)
	3rd	2.5 (1.6)	2.5 (1.6)	2.7 (1.68)
	4th	4.0 (2.5)	4.0 (2.5)	4.3 (2.7)
Medium	1st	3.2 (2.0)	3.2 (2.0)	3.5 (2.2)
	2nd	5.0 (3.1)	5.1 (3.2)	5.5 (3.4)
	3rd	6.4 (4.0)	6.5 (4.04)	7.1 (4.4)
	4th	10.3 (6.4)	10.3 (6.4)	11.2 (7.0)
High	1st	8.1 (5.0)	8.2 (5.1)	8.9 (5.5)
	2nd	12.9 (8.0)	13.0 (8.1)	14.2 (8.8)
	3rd	16.4 (10.2)	16.6 (10.3)	18.0 (11.2)
	4th	26.1 (16.2)	26.4 (16.4)	28.7 (17.8)
REVERSE				
	1st	3.3 (2.0)	3.4 (2.1)	3.7 (2.3)
	2nd	5.3 (3.3)	5.4 (3.4)	5.9 (3.7)
	3rd	6.8 (4.2)	6.9 (4.3)	7.5 (4.7)
	4th	10.9 (6.8)	11.0 (6.8)	11.9 (7.4)

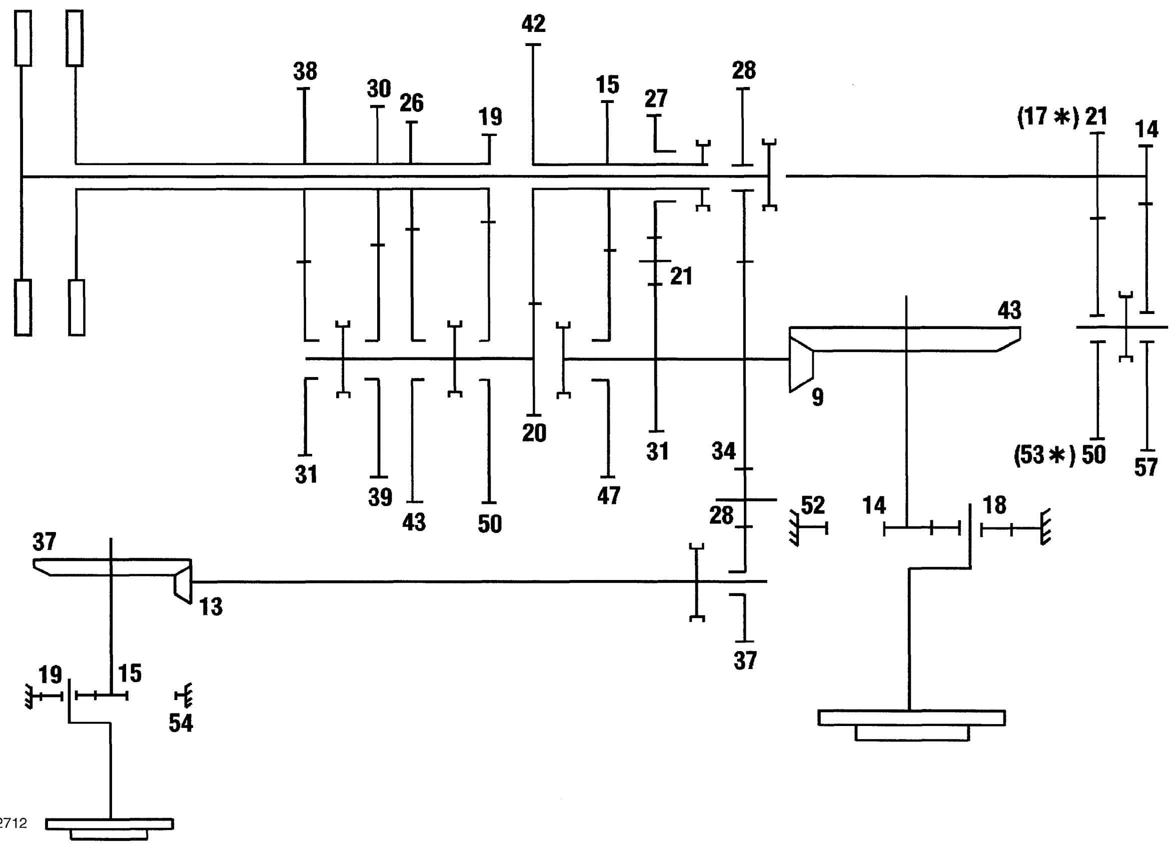


Note (*) 540/750 rpm P.T.O. Version.

Print No. ***603.54.283.00*** *– 09 – 1994*

12 + 4 Transmission – 30 km/h Version – Model 70V tractors with 540/1000 rpm P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 4 STANDARD				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.5 – 20	12.4 – 28	380/70 – 24
Low	1st	1,2 (0.7)	1.4 (0.9)	1.3 (0.8)
	2nd	2,0 (1.2)	2.3 (1.4)	2.1 (1.3)
	3rd	2,5 (1.6)	2.9 (1.8)	2.7 (1.7)
	4th	4.0 (2.5)	4.6 (2.9)	4.4 (2.7)
Medium	1st	3.2 (2.0)	3.7 (2.3)	3.5 (2.2)
	2nd	5.0 (3.1)	5.8 (3.6)	5.6 (3.5)
	3rd	6.4 (4.0)	7.4 (4.6)	7.1 (4.4)
	4th	10.3 (6.4)	11.9 (7.4)	11.3 (7.0)
High	1st	8.1 (5.0)	9.4 (5.8)	8.9 (5.5)
	2nd	12.9 (8.0)	14.9 (9.3)	14.2 (8.8)
	3rd	16.4 (10.2)	19.0 (11.8)	18.0 (11.2)
	4th	26.1 (16.2)	30.3 (18.8)	28.7 (17.8)
REVERSE				
	1st	3.3 (2.0)	3.9 (2.4)	3.7 (2.3)
	2nd	5.3 (3.3)	6.2 (3.9)	5.9 (3.7)
	3rd	6.8 (4.2)	7.9 (4.9)	7.5 (4.7)
	4th	10.9 (6.8)	12.5 (7.8)	11.9 (7.4)



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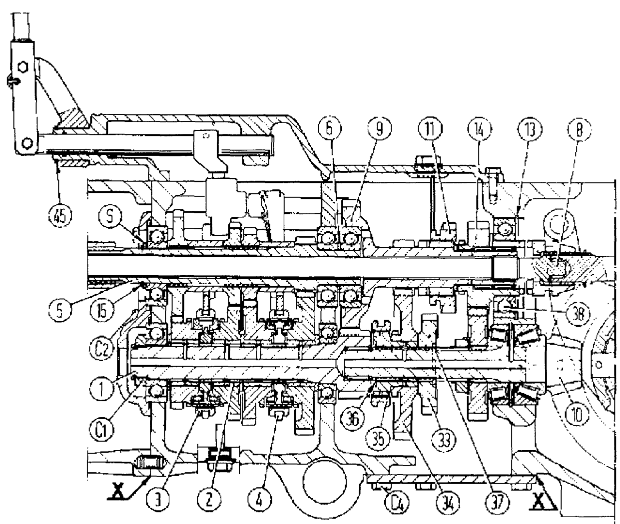
Note (*) 540/750 P.T.O. Version.

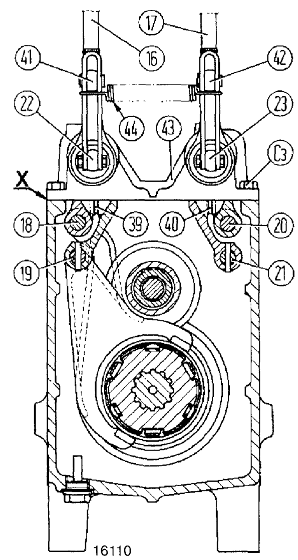
Print No. ***603.54.283.00*** *– 09 – 1994*

TORQUE WRENCH DATA – Model 50V – 55V – 70V – 55F – 60F tractors

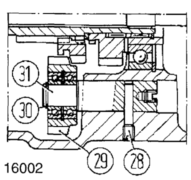
DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Transmission and splitter Locknut, driven gear shaft (C_1)	M 32 x 1.5	294	30/217
Cap screws, transmission shaft bearing housings (C_2)	M 8 x 1.25	28	2.9/21
Cap screws, transmission case upper cover (C_3)	M 8 x 1.25	25	2,6/19
Cap screws, transmission case bottom cover (C_4)	M 10 x 1.25	59	6/43
Creeper speed – Reverser units Setscrews, creeper driven shaft lockplate or reverser driven shaft and intermediate gear axle (C_1, page 21–11 and 21–15)	M 12 x 1.25	67	6.8/49



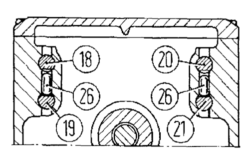
16109



16110



16002



16005

Longitudinal and cross–sections of the 12F + 4R transmission and splitter units – Model 50V – 55V – 60V – 70V – 55F – 60F tractors

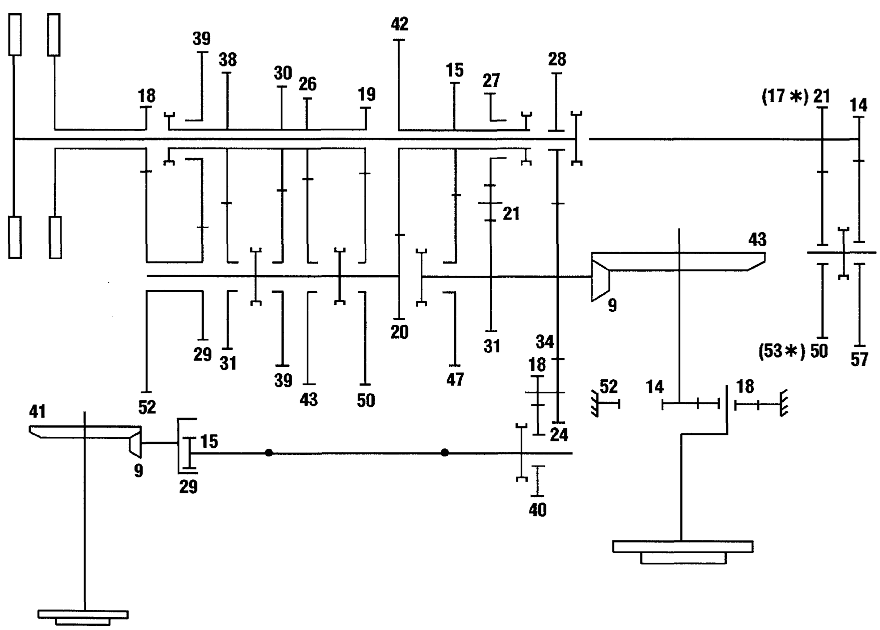
C_1. Driven gear shaft locknut – C_2. Bearing housing holding screws – C_3. Upper cover screws – C_4. Bottom cover screws – S. Drive shaft bearing adjustment shims – 1. Transmission driven shaft – 2. Transmission driven gear bearing bushings – 3. 3rd and 4th speed gear shift collar – 4. 1st and 2nd speed gear shift collar – 5.Transmission drive shaft – 6. Thrust washer – 8. Power take-off shaft – 9. Constant–mesh and creeper speed drive shaft – 10. Bevel pinion shaft – 11. Speed engagement gear through reverse gears – 13, 15, 30, 36 and 45. Circlips – 14. Medium range drive gear – 16. Transmission control lever – 17. Splitter control lever – 18. 1st and 2nd speed shift rail – 19. 3rd and 4th speed shift rail – 20. Low and high range shift rail 21. Medium range and reverse gear shift rail – 22. Transmission horizontal control rod – 23. Splitter horizontal control rod – 26. Range and gear shift detents – 28. Screw – 29. Reverse intermediate gear – 31. Reverser gear axle pin – 33. Reverse gear – 34. Low speed range driven gear – 35. Low speed range and transmission straight drive shift collar – 37. Half–rings – 38. Bearing – 39. Transmission control rod – 40. Splitter control rod 41. Transmission control lever articulation mount – 42. Splitter control lever articulation mount – 43. Transmission case cover – 44. Spring.

Note – At assembly, apply sealing compound on mating surfaces **X** following the instructions reported on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

20 + 8 Transmission – 30 km/h Version – Model 50V – 55V – 60V tractors with 540/1000 rpm P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) 20 + 8 Var. 111 (* Creeper Speed)				
RANGE / GEAR		TYRE SIZE		
FORWARD		9.5 – 28	11.2 – 28	12.4 – 24
Low C.S.	1st	* 0.4 (0.2)	* 0.4 (0.2)	* 0.4 (0.2)
	2nd	* 0.5 (0.3)	* 0.5 (0.3)	* 0.5 (0.3)
	3rd	* 0.7 (0.4)	* 0.7 (0.4)	* 0.7 (0.4)
	4th	* 1.1 (0.7)	* 1.1 (0.7)	* 1.1 (0.7)
Medium C.S.	1st	* 0.9 (0.6)	* 0.9 (0.6)	* 0.9 (0.6)
	2nd	* 1.4 (0.9)	* 1.4 (0.9)	* 1.4 (0.9)
	3rd	* 1.8 (1.1)	* 1.8 (1.1)	* 1.7 (1.1)
	4th	* 2.8 (1.7)	* 2.9 (1.8)	* 2.8 (1.7)
Low	1st	1.3 (0.8)	1.4 (0.9)	1.3 (0.8)
	2nd	2.1 (1.3)	2.2 (1.4)	2.1 (1.3)
	3rd	2.7 (1.7)	2.7 (1.7)	2.6 (1.6)
	4th	4.2 (2.6)	4.4 (2.7)	4.2 (2.6)
Medium	1st	3.4 (2.1)	3.5 (2.2)	3.4 (2.1)
	2nd	5.4 (3.4)	5.6 (3.5)	5.4 (3.4)
	3rd	6.9 (4.3)	7.1 (4.4)	6.8 (4.2)
	4th	11,0 (6.83)	11.3 (7.0)	10.9 (6.8)
High	1st	8.7 (5.4)	9.0 (5.6)	8.6 (5.3)
	2nd	13.8 (8.6)	14.3 (8.9)	13.7 (8.5)
	3rd	17.5 (10.9)	18.2 (11.3)	17.4 (10.8)
	4th	27.9 (17.3)	29.0 (18)	27.7 (17.2)
REVERSE				
Creeper S.	1st	* 0.9 (0.6)	* 0.9 (0.6)	* 0.9 (0.6)
	2nd	* 1.5 (0.9)	* 1.5 (0.9)	* 1.4 (0.87)
	3rd	* 1.9 (1.2)	* 1.9 (0.6)	* 1.8 (1.1)
	4th	* 3.0 (1.9)	* 3.1 (1.93)	* 2.9 (1.8)
Standard	1st	3.6 (2.2)	3.7 (2.3)	3.5 (2.17)
	2nd	5.7 (3.5)	5.9 (3.7)	5.7 (3.5)
	3rd	7.3 (4.5)	7.5 (4.7)	7.2 (4.47)
	4th	11.6 (7.2)	12.0 (7.5)	11.5 (7.1)



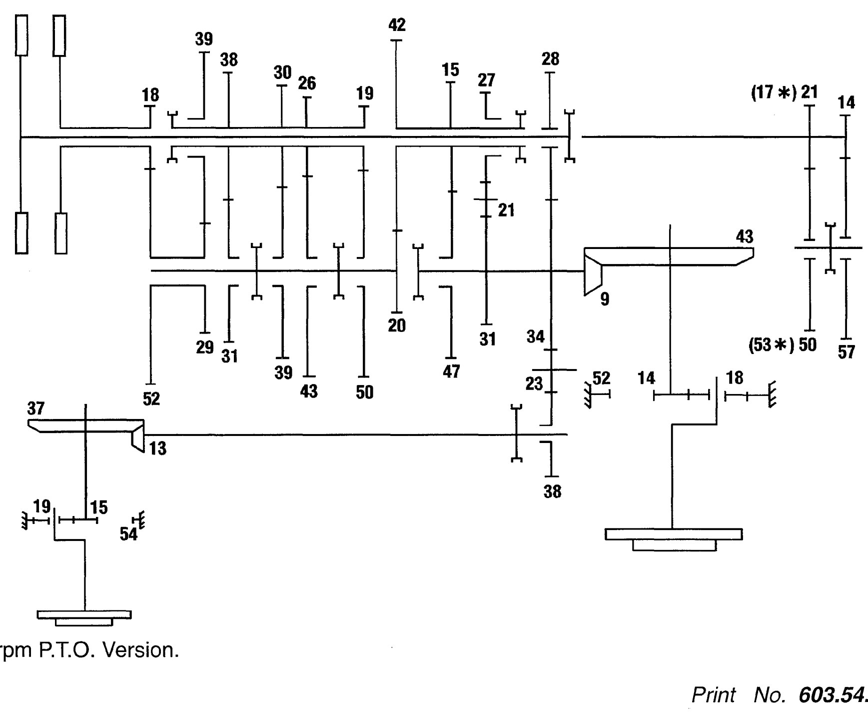
22713

Note (*) 540/750 rpm Version

Print No. ***603.54.283.00*** *– 09 – 1994*

20 + 8 Transmission – 30 km/h Version – Model 55F – 60F tractors with 540/1000 P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 20+8 VAR. 111 (* Creeper Speed)				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.5 – 20	11.2 – 24	13.6 – 24
Low C.S.	1st	* 0.3 (0.2)	* 0.3 (0.2)	* 0.4 (0.25
	2nd	* 0.5 (0.3)	* 0.5 (0.3)	* 0.5 (0.3)
	3rd	* 0.6 (0.4)	* 0.6 (0.4)	* 0.7 (0.45)
	4th	* 1.0 (0.6)	* 1.0 (0.6)	* 1.1 (0.7)
Medium C.S.	1st	* 0.8 (0.5)	* 0.8 (0.5)	* 0.9 (0.6)
	2nd	* 1.3 (0.8)	* 1.3 (0.8)	* 1.4 (0.9)
	3rd	* 1.6 (1.0)	* 1.7 (1.1)	* 1.8 (1.12)
	4th	* 2.6 (1.6)	* 2.6 (1.6)	* 2.9 (1.8)
Low	1st	1.2 (0.7)	1.2 (0.7)	1.3 (0.8)
	2nd	2.0 (1.2)	2.0 (1.2)	2.1 (1.3)
	3rd	2.5 (1.6)	2.5 (1.6)	2.7 (1.7)
	4th	4.0 (2.5)	4.0 (2.5)	4.3 (2.7)
Medium	1st	3.2 (2.0)	3.2 (2.0)	3.5 (2.2)
	2nd	5.0 (3.1)	5.1 (3.2)	5.5 (3.4)
	3rd	6.4 (4.0)	6.5 (4.05)	7.1 (4.4)
	4th	10.3 (6.4)	10.3 (6.4)	11.2 (7.0)
High	1st	8.1 (5.0)	8.2 (5.1)	8.9 (5.5)
	2nd	12.9 (8.0)	13.0 (8.1)	14.2 (8.8)
	3rd	16.4 (10.2)	16.6 (10.3)	18.0 (11.2)
	4th	26.1 (16.2)	26.4 (16.4)	28.7 (17.8)
REVERSE				
Creeper S.	1st	* 0.9 (0.6)	* 0.9 (0.6)	* 0.9 (0.6)
	2nd	* 1.4 (0.9)	* 1.4 (0.9)	* 1.5 (0.93)
	3rd	* 1.7 (1.1)	* 1.7 (1.1)	* 1.9 (1.2)
	4th	* 2.8 (1.7)	* 2.8 (1.7)	* 3.1 (1.9)
Standard	1st	3.3 (2.0)	3.4 (2.1)	3.7 (2.3)
	2nd	5.3 (3.3)	5.4 (3.4)	5.9 (3.7)
	3rd	6.8 (4.2)	6.9 (4.3)	7.5 (4.7)
	4th	10.9 (6.8)	11.0 (6.83)	11.9 (7.4)



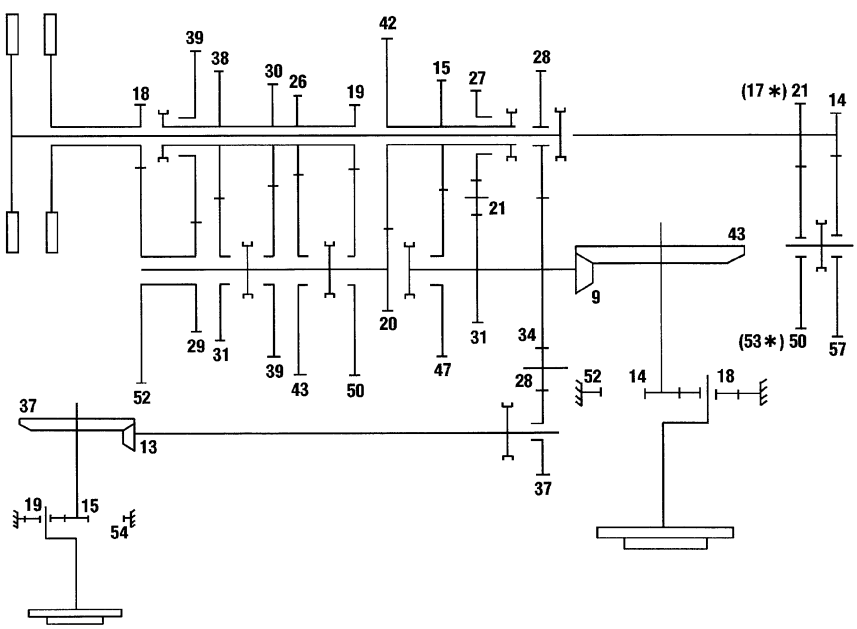
22714

Note (*) 540/750 rpm P.T.O. Version.

Print No. ***603.54.283.00*** *– 09 – 1994*

20 + 8 Transmission – 30 km/h Version – Model 70V tractors with 540/1000 rpm P.T.O.

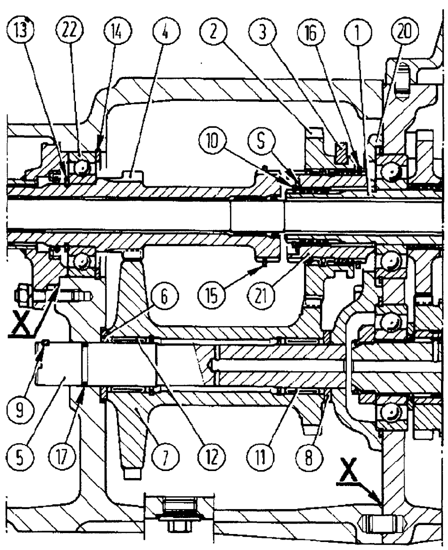
MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 20 + 8 VAR. 11 (* Creeper Speed)				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.5 – 20	12.4 – 28	380/70 – 24
Low. C.S.	1st	* 0.2 (0.1)	* 0.4(0.25)	* 0.3 (0.2)
	2nd	* 0.5 (0.3)	* 0.6 (0.4)	* 0.5 (0.3)
	3rd	* 0.6 (0.4)	* 0.7 (0.45)	* 0.7 (0.45)
	4th	* 1.0 (0.65)	* 1.2 (0.75)	* 1.1 90.7)
Medium C.S.	1st	* 0.8 (0.5)	* 0.9 (0.6)	* 0.9 ().6)
	2nd	* 1.3 (0.8)	* 1.5 (0.95)	* 1.4 (0.9)
	3 3rd	* 1.6 (1.0)	* 1.9 (1.2)	* 1.8 (1.1)
	4th	* 2.6 (1.65)	* 3.0 (1.9)	* 2.9 (1.8)
Low	1st	1.2 (0.75)	1.4 (0.9)	1.3 9(0.8)
	2nd	2.0 (1.2)	2.3 (1.4)	2.1 (1.3)
	3rd	2.5 (1.6)	2.9 (1.8)	2.7 (1.7)
	4th	4.0 (2.5)	4.6 (2.9)	4.4 (2.7)
Medium	1st	3.2 (2.0)	3.7 (2.3)	3.5 (2.2)
	2nd	5.0 (3.1)	5.8 (3.6)	5.6 (3.5)
	3rd	6.4 (4.0)	7.4 (4.6)	7.1 (4.4)
	4th	10.3 (6.4)	11.9 (7.4)	11.3 (7.0)
High	1st	8.1 (5.0)	9.4 (5.8)	8.9 (5.5)
	2nd	12.9 (8.0)	14.9 (9.3)	14.2 (8.8)
	3rd	16.4 (10.2)	19.0 (11.8)	18.0 (11.2)
	4th	26.1 (16.2)	30.3 (18.8)	28.7 (17.8)
REVERSE				
Creeper S.	1st	* 0.9 (0.6)	* 1.0 (0.65)	* 0.9 (0.6)
	2nd	* 1.4 (0.9)	* 1.6 (1.0)	* 1.5 (0.9)
	3rd	* 1.7 (1.1)	* 2.0 (1.25)	* 1.9 (1.2)
	4th	* 2.8 (1.7)	* 3.2 (2.0)	* 3.1 (1.9)
Standard	1st	3.3 (2.0)	3.9 (2.4)	3.7 (2.3)
	2nd	5.3 (3.3)	6.2 (3.9)	5.9 (3.7)
	3rd	6.8 (4.2)	7.9 (4.9)	7.5 (4.7)
	4th	10.9 (6.8)	12.5 (7.8)	11.9 (7.4)



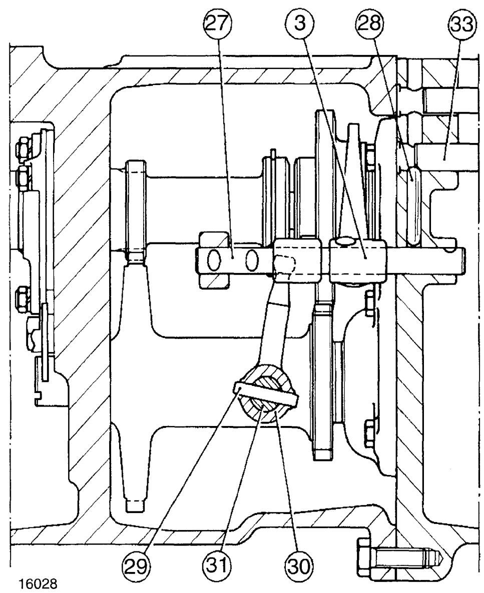
22715

Note (*) 540–750 rpm P.T.O. Version.

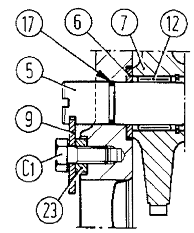
*Print No. **603.54.283.00** – 09 – 1994*



16027



16028



16032

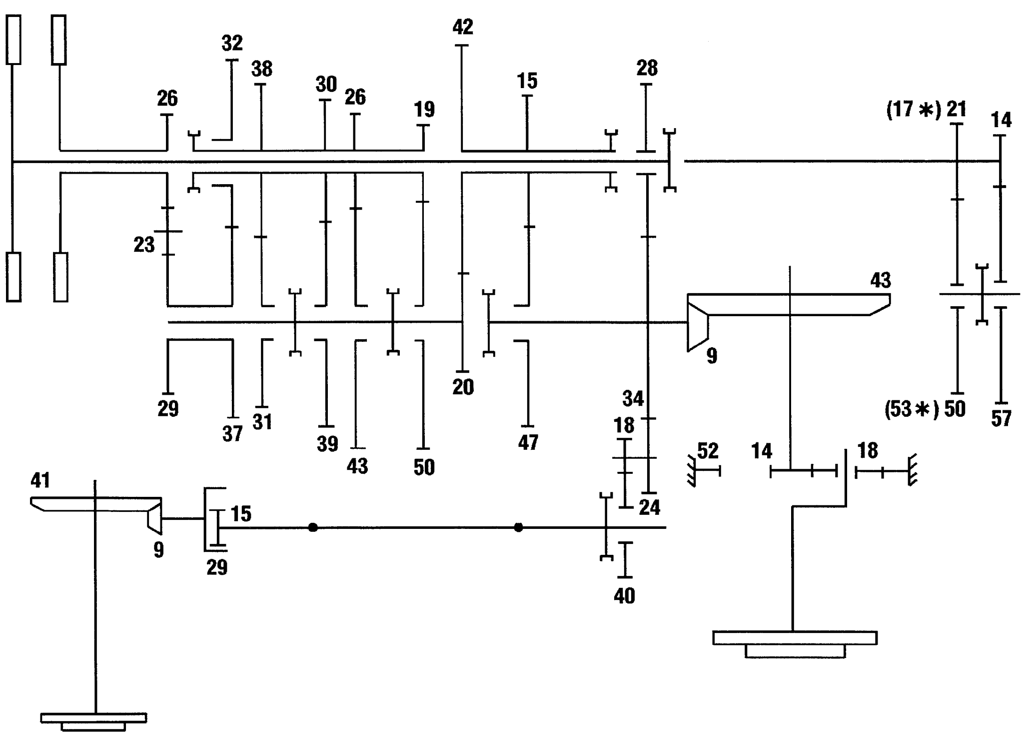
Sectional view of the 20F + 8R creeper speed unit – Model 50V – 55V – 60V – 70V – 55F – 60F tractors.

C_1. Lock plate (9) set screw) – G= 0 ÷ 0,2 mm (0 ÷ .008 in). Giuoco di montaggio manicotto (21) – S. Shim – 1. Transmission–creeper speed unit shaft – 2. Creeper speed unit engagement gear – 3. Creeper speed shift fork – 4. Clutch–creeper speed unit shaft – 5. Perno ingranaggio condotto – 6. Ralla anteriore di spallamento ingranaggio condotto – 7. Ingranaggio condotto riduttore – 8. Driven gear rear thrust ring – 9. Pin (5) retaining plate – 11 e 12. Roller bearings – 10,13,14,15 and 16.Circlips – 17. O–ring seals – 18. P.T.O. shaft bearing bushing – 19. Oil seal – 20. Transmission bearing housing – 21. Creeper speed collar – 22. Ball bearing – 23. Lock plate spacer – 27. Creeper speed shift fork rail – 28. High speed detent – 29. Split pin – 30. Shift fork control lever – 31. Creeper speed unit engagement shaft assembly – 33. Range splitter low and high speed shift fork rail.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

12 +12 Transmission – 30 km/h Version – Model 50V – 55V – 60V tractors, with 540/1000 with power take–off

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 12 VAR. 110				
RANGE / GEAR		TYRE SIZE		
FORWARD		9.5 – 28	11.2 – 28	12.4 – 24
Low	1st	1.3 (0.8)	1.4 (0.9)	1.3 (0.8)
	2nd	2.1 (1.3)	2.2 (1.4)	2.1 (1.3)
	3rd	2.7 (1.7)	2.7 (1.7)	2.6 (1.65)
	4th	4.2 (2.6)	4.4 (2.7)	4.2 (2.6)
Medium	1st	3.4 (2.1)	3.5 (2.2)	3.4 (2.1)
	2nd	5.4 (3.4)	5.6 (3.5)	5.4 (3.4)
	3rd	6.9 (4.3)	7.1 (4.4)	6.8 (4.2)
	4th	10.9 (6.8)	11.3 (7.0)	10.9 (6.8)
High	1st	8.7 (5.4)	9.0 (5.6)	8.6 (5.3)
	2nd	13.8 (8.6)	14.3 (8.9)	13.7 (8.5)
	3rd	17.5 (10.9)	18.2 (11.3)	17.4 (10.8)
	4th	27.9 (17.3)	29.0 (18.0)	27,7 (17.2)
REVERSE				
Low	1st	1.4(0.9)	1.4 (0.9)	1.3 (0.8)
	2nd	2.2 (1.4)	2.2 (1.4)	2.1 (1.3)
	3rd	2.8 (1.7)	2.9 (1.8)	2.7 (1.7)
	4th	4.4 (2.7)	4.6 (2.9)	4.4 (2.7)
Medium	1st	3.5 (2.2)	3.6 (2.25)	3.5 (2.2)
	2nd	5.6 (3.5)	5.8 (3.6)	5.5 (3.4)
	3rd	7.1 (4.4)	7.4 (4.6)	7.1 (4.4)
	4th	11.4 (7.05)	11.8 (7.3)	11.3 (7.0)
High	1st	9.0 (5.6)	9.3 (5.8)	8.9 (5.5)
	2nd	14.3 (8.9)	14.8 (9.2)	14.2 (8.8)
	3rd	18.2 (11.3)	18.8 (11.7)	18.0 (11.2)
	4th	29.0 (18.0)	30.0 (18.6)	28.7 (17.8)



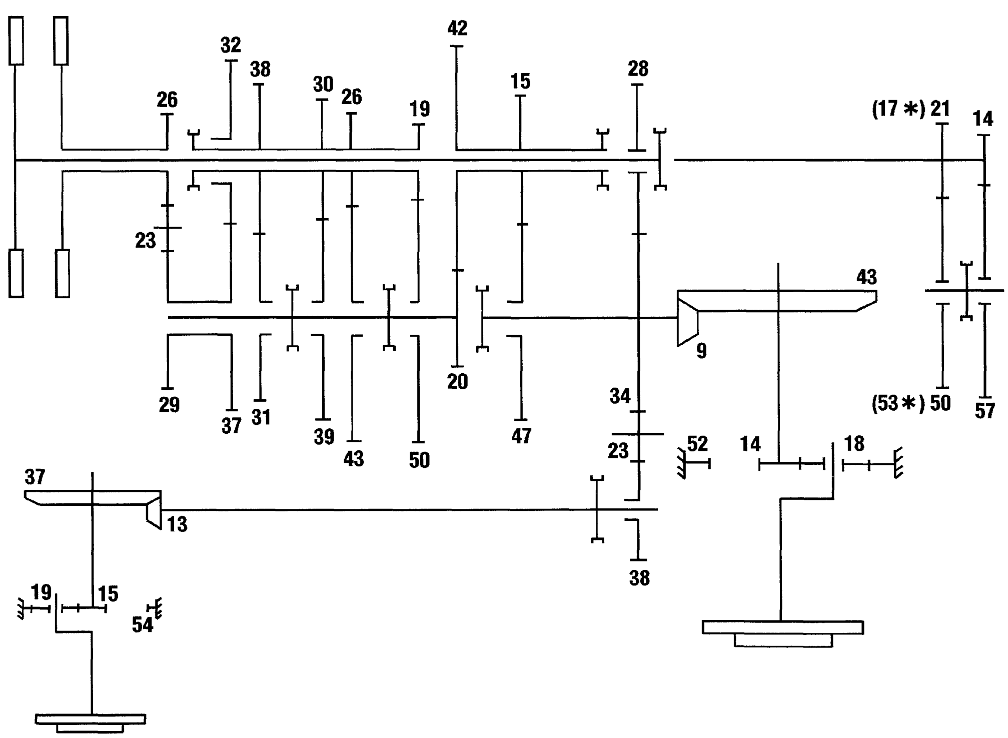
22716

Note (*) 540/750 rpm P.T.O. Version.

Print No. ***603.54.283.00*** *– 09 – 1994*

12 + 12 Transmission – 30 km/h Version – Model 55F – 60F tractors with 540/1000 rpm P.T.O.

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 12 VAR. 110				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.5 – 20	11.2 – 24	13.6 – 24
Low	1st	1.2 (0.7)	1.2 (0.7)	1.3 (0.8)
	2nd	2.0 (1.2)	2.0 (1.2)	2.1 (1.3)
	3rd	2.5 (1.6)	2.5 (1.6)	2.7 (1.7)
	4th	4.0 (2.5)	4.0 (2.5)	4.3 (2.7)
Medium	1st	3.2 (2.0)	3.2 (2.0)	3.5 (2.2)
	2nd	5.0 (3.1)	5.1 (3.2)	5.5 (3.4)
	3rd	6.4 (4.0)	6.5 (4.05)	7.1 (4.4)
	4th	10.3 (6.4)	10.3 (6.4)	11.2 (7.0)
High	1st	8.1 (5.0)	8.2 (5.05)	8.9 (5.5)
	2nd	12.9 (8.0)	13.0 (8.0)	14.2 (8.8)
	3rd	16.4 (10.2)	16.6 (10.3)	18.0 (11.2)
	4th	26.1 (16.2)	26.4 (16.4)	28.7 (17.8)
REVERSE				
Low	1st	1.3 (0.8)	1.3 (0.8)	1.4 (0.9)
	2nd	2.0 (1.2)	2.0 (1.2)	2.2 (1.3)
	3rd	2.6 (1.65)	2.6 (1.65)	2.8 (1.8)
	4th	4.1 (2.5)	4.2 (2.6)	4.5 (2.8)
Medium	1st	3.3 (2.0)	3.3 (2.0)	3.6 (2.2)
	2nd	5.2 (3.25)	5.3 (3.3)	5.7 (3.5)
	3rd	6.7 (4.2)	6.7 (4.2)	7.3 (4.5)
	4th	10.6 (6.6)	10.7 (6.65)	11.7 (7.3)
High	1st	8.4 95.20	8.5 (5.3)	9.2 (5.7)
	2nd	13.4 (8.3)	13.5 (8.4)	14.7 (9.1)
	3rd	17.0 (10.6)	17.2 (10.7)	18.7 (11.6)
	4th	27.1 (16.8)	27.4 (17.0)	29.8 (18.5)



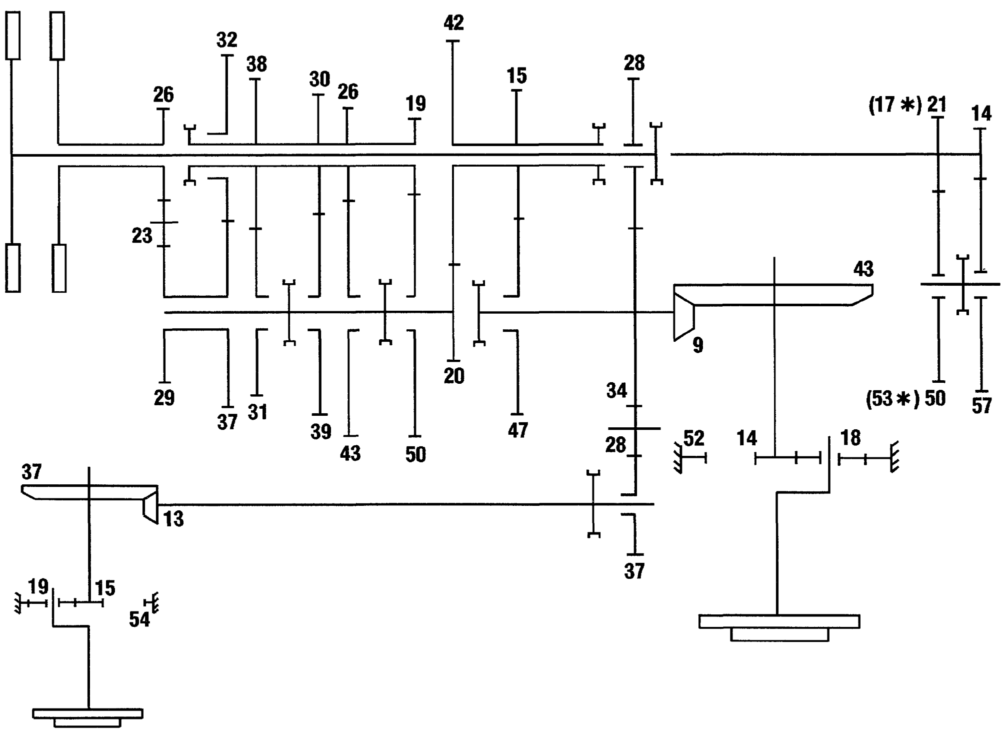
22717

Note (*) 540/750 rpm P.T.O. Version.

Print No. **603.54.283.00** – 09 – 1994

12 + 12 Transmission – 30 km/h Version – Model 70V tractors with 540/1000 rpm P.T.O.

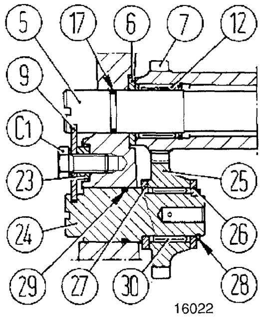
MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 12 VAR. 110				
RANGE / GEARS		TYRE SIZE		
FORWARD		14.5 – 20	12.4 – 28	380/70 – 24
Low	1st	1.2 (0.7)	1.4 (0.9)	1.3 (0.8)
	2nd	2.0 (1.2)	2.3 (1.4)	2.1 (1.3)
	3rd	2.5 (1.6)	2.9 (1.8)	2.7 (1.7)
	3th	4.0 (2.5)	4.6 (2.9)	4.4 (2.7)
Medium	1st	3.2 (2.0)	3.7 (2.3)	3.5 (2.2)
	2nd	5.0 (3.1)	5.8 (3.6)	5.6 (3.5)
	3rd	6.4 (4.0)	7.4 (4.6)	7.1 (4.4)
	4th	10.3 (6.4)	11.9 (7.4)	11.3 (7.0)
High	1st	8.1 (5.0)	9.4 (5.8)	8.9 (5.5)
	2nd	12.9 (8.0)	14.9 (9.3)	14.2 (8.8)
	3rd	16.4 (10.2)	19.0 (11.8)	18.0 (11.0)
	4th	26.1 (16.2)	30.3 (18.8)	28.7 (17.8)
REVERSE				
Low	1st	1.3 (0.8)	1.5 (0.95)	1.4 (0.9)
	2nd	2.0 (1.2)	2.3 (1.4)	2.2 (1.3)
	3rd	2.6 (1.65)	3.0 (1.9)	2.8 (1.7)
	4th	4.1 (2.5)	4.8 (3.0)	4.5 (2.8)
Medium	1st	3.3 (2.0)	3.8 (2.4)	3.6 (2.2)
	2nd	5.2 (3.2)	6.1 (3.8)	5.8(3.6)
	3rd	6.7 (4.2)	7.7 (4.8)	7.3 (4.5)
	4th	10.6 (6.6)	12.3 (7.6)	11.7 (7.3)
High	1st	8.4 (5.2)	9.7 (6.0)	9.2 (5.7)
	2nd	13.4 (8.3)	15.5 (9.6)	14.7 (9.1)
	3rd	17.0 (10.6)	19.7 (12.2)	18.7 (11.6)
	4th	27.1 (16.8)	31.4 (19.5)	29.8 (18.5)



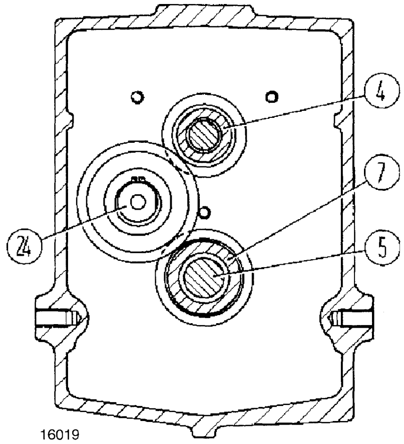
22718

Note (*) 540/750 rpm P.T.O. Version.

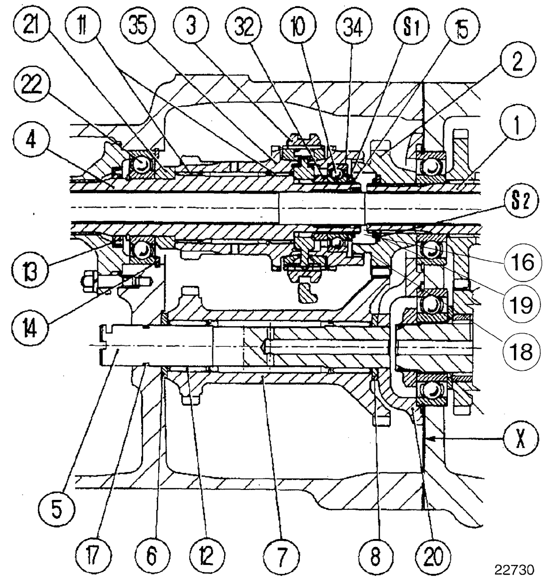
Print No. ***603.54.283.00*** *– 09 – 1994*



16022



16019



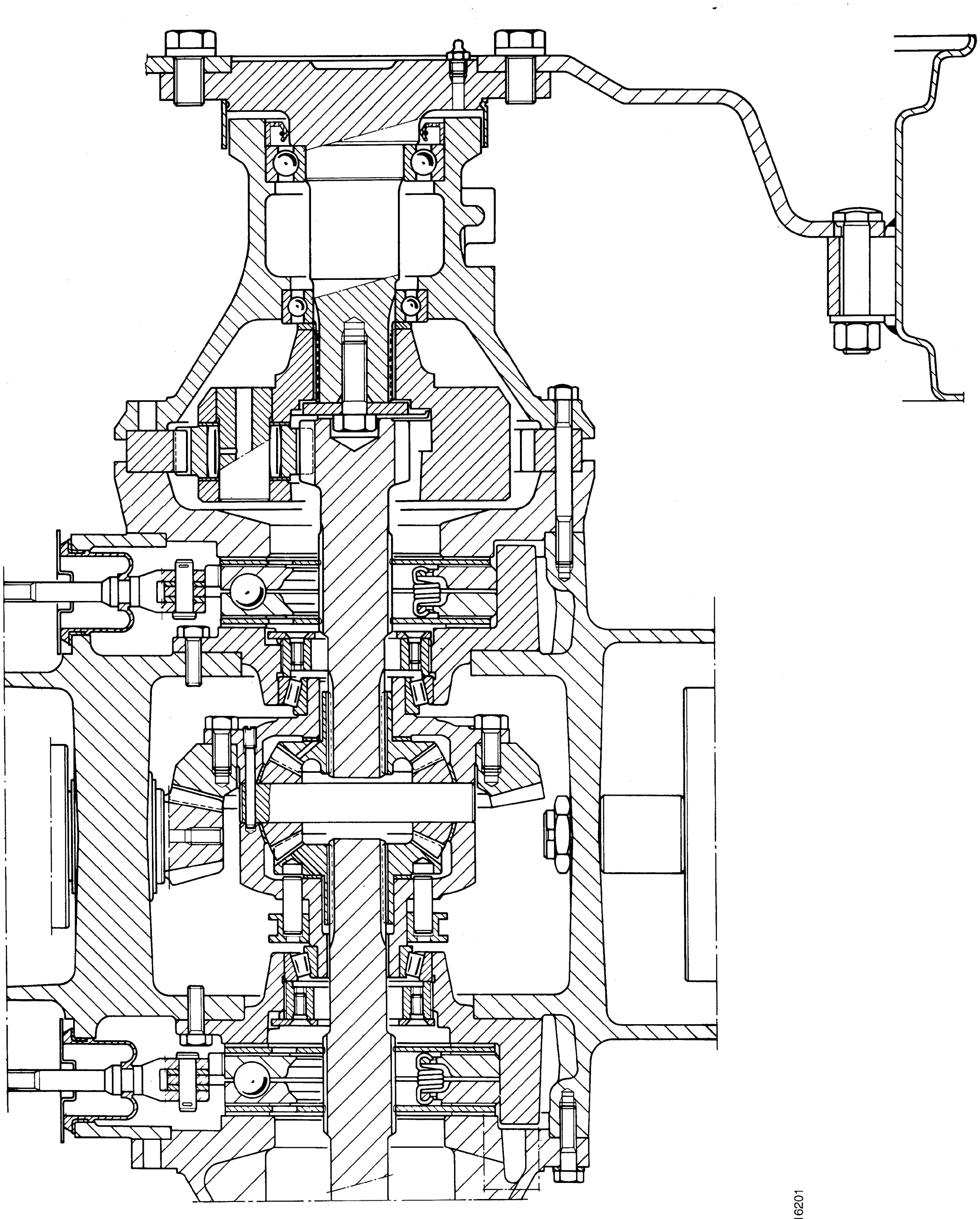
22730

Sectional views of the synchromesh mechanical reverser (12F+12R) model 50V – 55V – 60V – 70V – 55F – 60F tractors.

C_1. Lock plate (9) set screw (9) – $G_1 = 0 \div 0{,}1$ mm ($0 \div .004$ in). End play between bearing (10) and circlip (15) – $G_2 = 0 \div 0{,}1$ mm ($0 \div .004$ in) End play between circlip (16) and gear (2) – S_1. Shim for obtaining the end play (G_1) – S_2. Shim for obtaining end play (G_2) –1. Transmission–mechanical reverser shaft – 2. Gear – 3. Reverser synchromesh control – 4. – 5. Intermediate gear axle – 6. Intermediate gear front thrust washer – 7. Reverser intermediate gear – 8. Intermediate gear rear thrust washer – 9. Axle (5 and 24) lock plate – 10. Ball bearing – 11 and 12. Roller bearings – 13,14,15 and 16. Circlips – 17. O–ring seals – 18. P.T.O. shaft bearing bushing – 19. Seals – 20. Transmission bearing housings – 21. Thrust washer 22. Ball bearing – 23. Lock plate spacer – 24. Intermediate gear axle – 25. Reverser intermediate gear – 26 and 27. Intermediate gear thrust washers – 28. Circlip – 29. O–ring seal – 30. Roller bearing – 32. Thrust washer – 34. Collar – 35. Reverser drive gear.

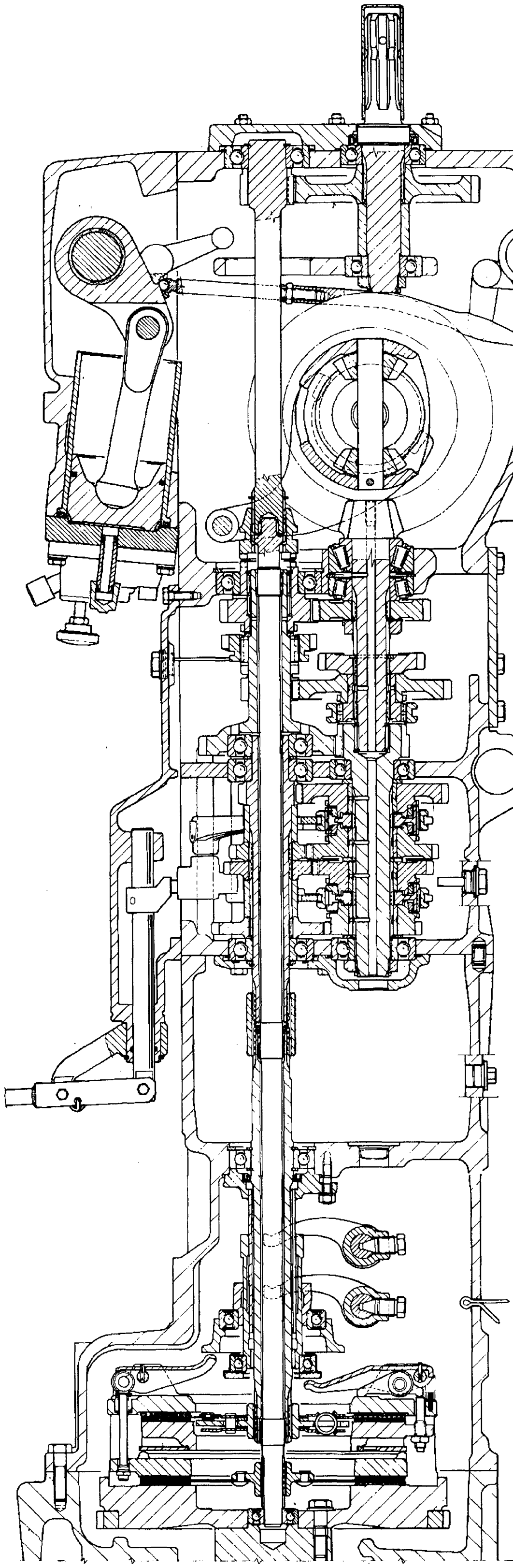
Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*



Cross–sectional view of the transmission – Model 50V – 55V – 60V – 60F and 70V tractors

Print No. **603.54.283.00** – 09 – 1994



16112

Longitudinal section of the 12 + 4 transmission – Model 50V – 55V – 60V – 55F – 60F and 70V tractors

Print No. **603.54.283.00** – 09 – 1994

Attention – Removal/installation of tractor components dealt with in this section refer to the transmission and range splitter overhauling operations.
In case of overhauling of the range splitter unit only, it will not be necessary to separate the transmission–rear drive case from the clutch housing because the inside parts of the splitter can be reached directly from the tractor rear end. To remove and install tractor parts and components involved in the overhauling of the range splitter only, refer to description concerning the rear drive bevel gear and pinion in Section 27.

TRANSMISSION–REAR DRIVE CASE
Removal–Installation (Operation 21 118 10, applying to all 86 Series models)

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Make sure that the load is held and supported by suitable slings and hooks. Make sure that nobody is standing near by.

To gain access to the transmission, the clutch housing and the transmission–rear drive case must be separated, as follows:

1. Drain the transmission–rear drive case oil.
2. Disconnect the battery negative cable and the cables of the mudguard–mounted multi–pole socket and indicator lights from their connections.
3. Remove the hydraulic lift pipes, the main clutch control rod from the external control lever, the throttle control rod from its pedal and the creeper speed unit control rod.
4. Remove, on the DT's, the front drive propeller shaft and guard.

Should the tractor be fitted with ballast weights and these could not be removed, it is advisable to connect them to a hoist in order to avoid any possibility for the tractor to tilt forward.

5. Remove the mudguards, footboards and hydraulic lift.
6. Place a steel stand underneath the rear end of the transmission case and then remove the wheels, final drives, brakes and the plastic support of the transmission and splitter control levers.
7. Connect the transmission case to a hoist using the **291517** lift hook.
8. Place the steel stand under the clutch housing , remove the clutch/transmission case union screws and then the transmission/rear drive case as an assembly.

Note – To ease the operations of removal and subsequent installation of the cltch and transmission/rear drive cases, make previously sure that the transmission and creeper speed units are in neutral and the splitter low speed range engaged.

9. At installation, proceed as follows:

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

a. proceed by reversing the previous removal sequence of operations starting from no. 8 back to no. 1;

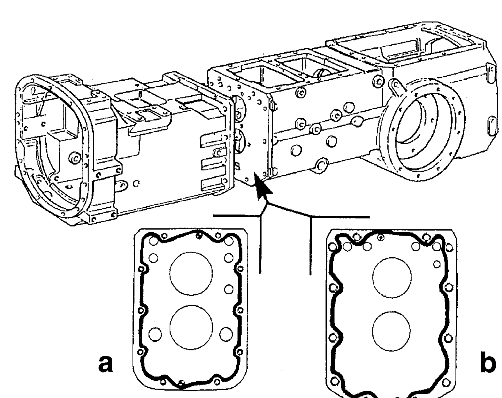
b. tighten fastenings to the torque data of page 21–7 (50V – 55V – 60V – 70V – 55F – 60F models) and of page 21–35 (62F – 72F – 82F – 72LP – 82LP models);

c. spread TUTELA G9 grease on the transmission drive shaft splines and inside the shaft drive sleeve compartment;

d. fit two **292888** alignment dowel pins to facilitate the attachment of the clutch housing to the transmission case and also make sure, when getting the two together, of the absence of any interference;

e. install the hydraulic lift unit on the transmission case following the instructions reported in section 35 of this Manual;

f. similarly, re–attach the final drives to the transmission case by following the instructions given in Section 27;



22803

g. Prior to re–fitting the reconditioned transmission case onto the clutch housing, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound , about 2 mm (.08 in) diameter, following the schemes indicated in Figs. **a** (50V – 55V – 60V – 70V – 55F – 60F models) and **b** (62F – 72F – 82F – 72LP – 82LP models). Use the sealing compounds indicated on page 1, Section 00.

Print No. 603.54.283.00 – 09 – 1994

TRANSMISSION–REAR DRIVE CASE

Preliminary disassembly operations (applying to all models)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

To facilitate the following disassembly operations it is recommended that the transmission–rear drive case be installed on the rotary stand with the rear end of the case supported on a mechanical floor stand.

Prior to install the transmission–rear drive case on the rotary stand, carry on the following preliminary operations:

a. remove the power take–off, as indicated in section 31 of this Manual;

b. remove the hydraulic lift flex bar mounting support (on 62F, 72F, 82F, 72LP, 82LP models only);

c. undo holding screws and then remove the transmission case upper cover complete with external control levers;

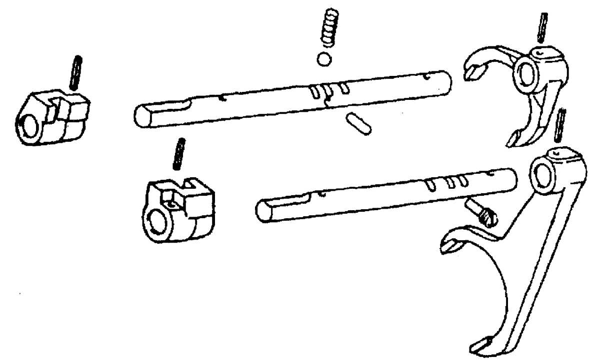
d. disassemble the differential lock and power–take off control devices;

e. disassemble the differential bearing housings and then the bevel ring gear and pinion as described in the relevant section.

TRANSMISSION–REAR DRIVE CASE INSIDE COMPONENTS

50V – 55V – 60V – 70V – 55F – 60F tractor models

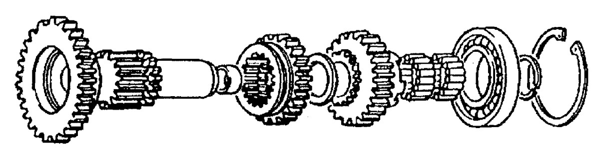
Disassembly–Assembly with transmission–rear drive case removed from the tractor (operations 2114840 – 2114842 – 2114844 – 2114848 – 2114860 – 2114862 – 2114868)



22719

Central reduction unit internal control parts

1. Undo the fork shift rail holding split pins.
2. Undo the range splitter spring and ball holding screws, then retrieve the horizontal rails and recover the loose forks, balls, springs and pawls, as shown in the figure.

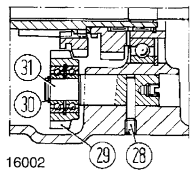


22720

Constant–mesh drive shaft and creeper speed parts

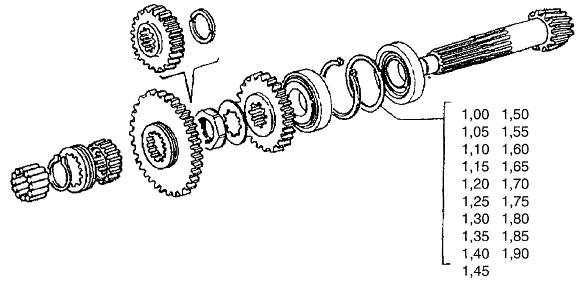
3. Remove the reduction unit drive shaft rear bearing circlip (13, page 21–7).
4. Remove the medium range speed drive gear (14), ball bearing (38) and needle bearing as an assembly, using a driver punch.
5. Remove the constant–mesh and creeper speed drive shaft (9) and medium range/reverse engagement gear (11).

Print No. 603.54.283.00 – 09 – 1994



16002

Reverse gear axle parts

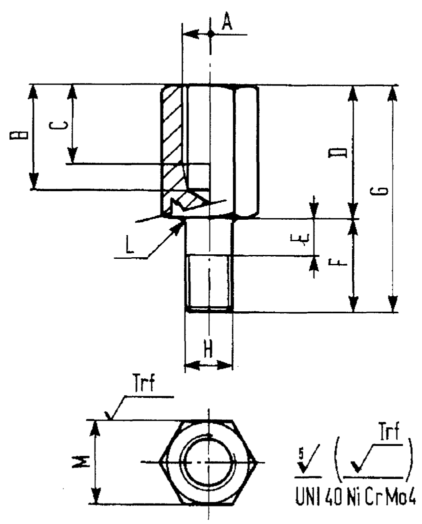


22722

Bevel pinion shaft parts.

6. Remove the circlip (30) and reverse speed intermediate gear (29), the latter complete with bearings and inner circlip. If necessary, remove the setscrew (28), install the adapter and pull off the axle (31) using the **292927** hammer–type puller.

7. Partially undo the bevel pinion shaft bearing adjustment nut (see on page 21–7).



13011

Self–made adapter for the removal of the reverse gear axle and bevel pinion shaft.

A = M14x1.5 – B = 28 mm (1.102 in) – C = 21 mm (.827 in) – D = 35 mm (1.378 in) – E = 10 mm (.394 in) – F = 25 mm (.984 in) – G = 60 mm (2.362 mm) – H = M12x1.25 – L = 2.5 mm (.098 in) radius – M = 22 mm x 11 mm thick (.866x.433 in).

8. Install the self–made adapter (see figure above) on the bevel pinion (10, page 21–7).

9. Install the **292927** hammer–type puller on the self–made adapter.

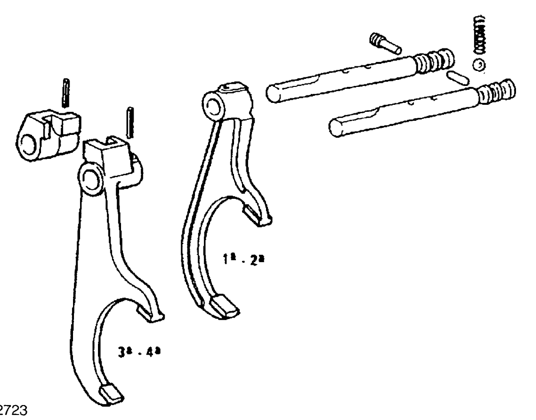
10. Act simultaneously on the puller and on the bevel pinion (10) shaft bearing adjustment nut to withdraw the latter enough to consent removal of the circlip (36, page 21–7).

11. Move the gears (33 and 34) towards the front end of the transmission case and remove the half–rings (37).

12. Undo the bevel pinion shaft bearing adjustment nut completely , withdraw the pinion and retrieve gears from inside the case (besides, in order to recover the bevel pinion shims, remove the bearing outer ring on the bevel pinion head side).

13. Undo holding screws (C_2, page 21–7) and then remove the transmission front bearing housing.

14. Shift into any two gears and loosen the driven shaft (1) bearing retaining nut (C_1).

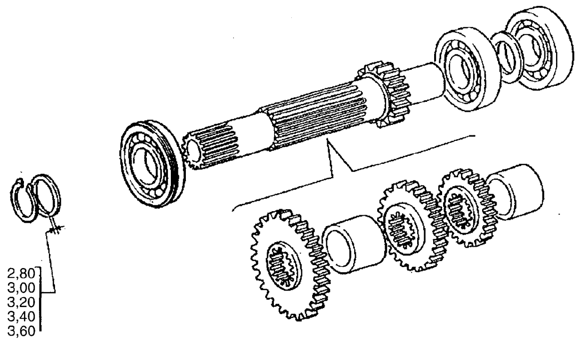


22723

Transmission case inside controls

15. Remove the shift fork split pins, shift pawls, spring set screws and the detent balls, then withdraw the shift rails (18–19, page 21–7) and retrieve loose parts as shown in the figure.

*Print No. **603.54.283.00** – 09 – 1994*



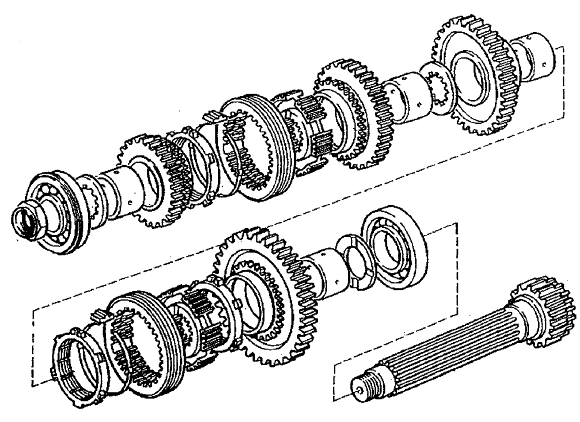
22724

Transmission drive shaft parts

16. Remove the circlip (15, page 21–7) and the drive shaft (5) bearing adjustment shim.

17. Using an appropriate driver punch and acting on the drive shaft (5) front end drive the latter out through the transmission case rear end together with its two rear bearings and ring nut (6).

18. Retrieve the gears and spacers from the drive shaft (5).



22725

Transmission driven shaft parts

19. Remove nut (C_1), previously loosened (operation 14), then using an appropriate driver punch and acting on the front end of the driven shaft (1) remove the latter, together with its rear bearing, through the transmission case rear end.

20. Retrieve gears, spacers and 1st–2nd–3rd–4th speed shift collars from the inside of the transmission case.

21. ASSEMBLY

Assemble the transmission and splitter in accordance with the following instructions and information:

a. proceed by reversing the previous disassembly sequence of operations starting from no. 20 back to no. 1:

b. consult the former figures and exploded views to make sure to install parts the correct way;

c. make sure the housing is duly clean, inside compartments in particular;

d. prior to the installation of housings, bearing housings and covers, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the scheme indicated in the respective sections of the Manual;

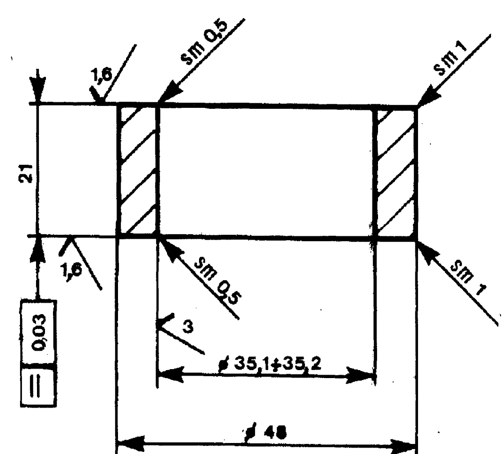
e. tighten fastenings to the torque data of page 21–7;

f. follow instructions and information and adjust as indicated here below:

— Install the transmission driven shaft (1, page 21–7) together with its rear end bearing, by introducing gears, bushings and syncho rings from the inside of the case, lubricating working surfaces with engine oil.

— Place the front bearing in position, force fit it in the housing using an appropriate driver punch and torque tighten the retaining ring nut (C_1).

— Insert the two speed gear shifter forks without connecting them to their respective shift rails.

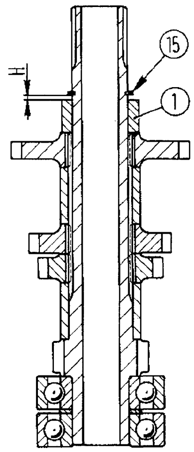


14684A

50037 self–made, bearing adjustment tool.

Note – Once installed, the end play of the drive shaft gears should measure 0÷0.20 mm (0÷ 008 in). It is therefore necessary to proceed to adjust the bearings to avoid fitting them with an axial pre–load.
To carry on this adjustment, it is suggested to use the **50037** tool, made in the workshop according to the data supplied in the figure above.

Print No. ***603.54.283.00*** *– 09 – 1994*



16008

Transmission drive shaft bearing adjustment

H = Clearance to be measured with feeler gauge – 1. **50037** self–made tool – 15. Circlip.

— Assemble on bench the transmission drive shaft complete with the two rear end bearings and gears, but without adjustment shim (S, page 21–7) and front bearing.

— Install the previously made tool and keep it in contact with gears by inserting a screwdriver between the circlip (15) and tool (1).

— Measure, with a feeler gauge, the clearance (H) existing between the circlip (15) and tool (1) created by the insertion of the screwdriver.

— Then, measure the thickness (Hs) of the self–made tool and that (Hc) of the front front bearing inner race.

— The thickness of shim (S, page 21–7) is given by:

$$S=H+H_S - H_C$$

where:
H = measured clearance
$\mathbf{H_S}$ = measured tool thickness
$\mathbf{H_C}$ = measured bearing thickness

Note – Fit a shim (S, page 21–2) allowing a final end play of 0÷0.20 mm (0÷.008 in) among the drive shaft gears.

— Fit the shaft, gears and the previously established shim in the transmission case.

— Fit the shift rail already assembled with their detent balls, springs and pawls.

— Fit the bevel pinion shaft and gears as an assembly after adjusting the assembly position and the bearing pre–load as described in the relevant section of the Manual.

— Fit the reverse gear and the shifter fork on the bevel pinion gear.

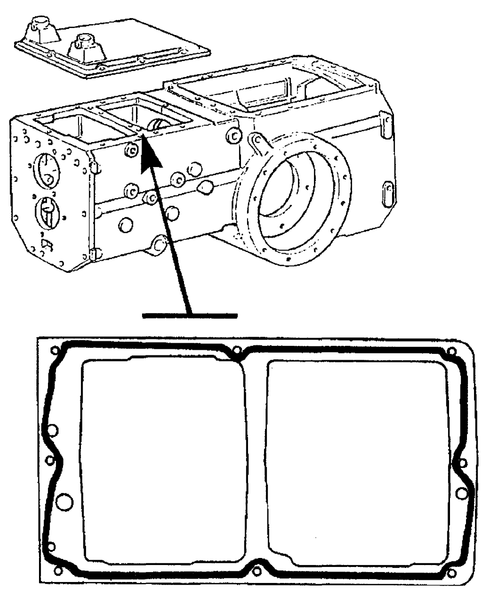
— Fit the splitter drive shaft, assembled.

— Fit the shift fork collar and the range selection shift rails completed with their detent balls, springs and pawls.

Note – This last operation concludes the assembly of the transmission internal components.

In addition, install the other devices and sub–assemblies previously removed from the transmission–rear drive case to facilitate both the assembly operations on the rotary stand and the disassembly of internal components.

To install these devices and sub–assemblies, proceed by reversing the sequence of disassembly operations indicated on page 21–19, making sure to follow the various instructions and information indicated in their respective sections of the Manual.



16268

Refit the upper transmission–rear drive case cover after thoroughly cleaning and degreasing mating surfaces and applying a round strip of sealing compound about 2 mm (.08 in thick) following the scheme shown in the figure.

The appropriate types of sealing compounds are indicated on page 1, Section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

REPLACING BEARING (38) ALONE OR GEAR (14) WITH BEVEL RING GEAR INSTALLED
Model 50V – 55V – 60V – 70V – 55F – 60F tractors

Note – In case of need for replacement of the splitter drive shaft bearing (38) alone or of the medium range drive gear (14) it is possible to proceed without dismantling the bevel ring gear–differential assembly.
Proceed as follows:

— (first make in the workshop the set of self–made tools according to the working drawings shown at the bottom of this page).

1. Remove from the tractor the transmission case upper cover, the power take–off rear cover and shaft and, finally, the hydraulic lift unit.

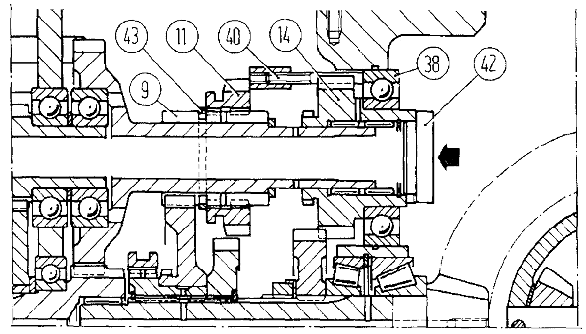
2. Remove the bearing retaining circlip (13, page 21–7).

3. Move gear (14) and bearing (38) towards the transmission case rear end , fit the tool (43) on the constant–mesh and creeper speed drive shaft (9) and bring gear (1) against tool (43) as illustrated on the side.

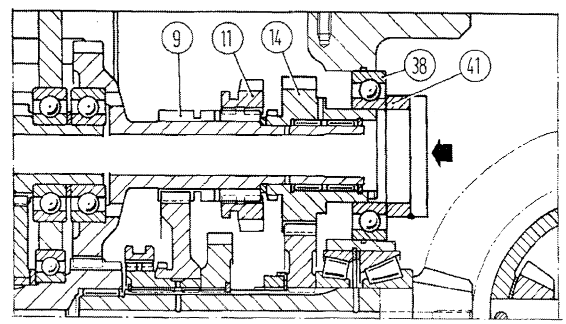
4. Fit at 180° the two tools (40) setting their length so to create a reaction both on gear (11) and on the outer race of bearing (38).

5. Fit tool (42) and hit on it until gear (14) comes off bearing (38).

6. Retrieve bearing (38) and, if necessary, gear (14) through the rear end.



16208 **a**

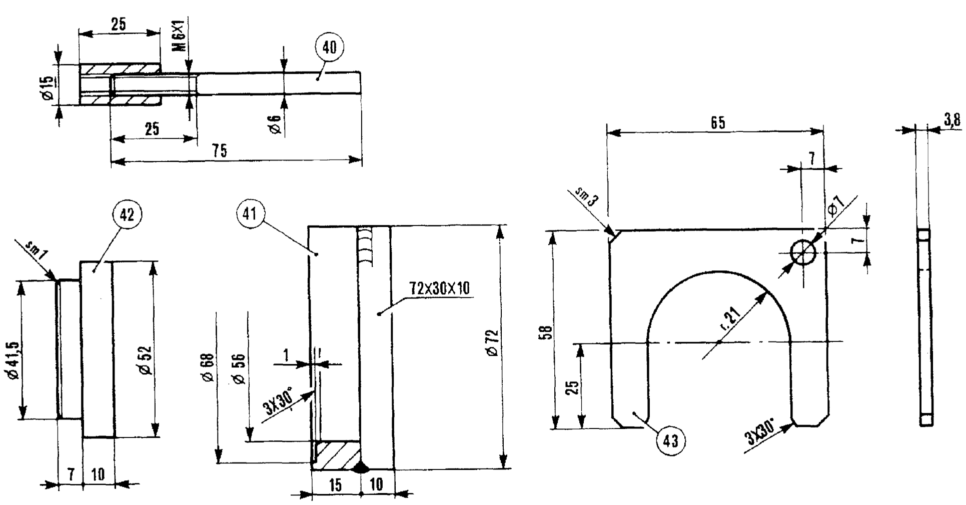


16209 **b**

Assembly (Fig.a) and disassembly (Fig.b) of the drive shaft rearbearing (38) and of the medium range drive gear (14) with bevel ring gear–differential unit installed.

9. Creeper speed and constant–mesh drive shaft – 11. Reverse and medium range gear selection gear – 40,41,42,43 – Set of self–made tools.

7. Install the new bearing using tool (41) as shown above.



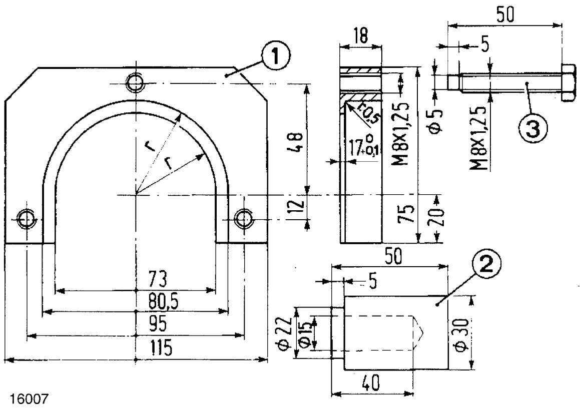
14681

Tool set to be made in the workshop for disassembling the reduction unit drive shaft rear bearing and the medium range and reverse selection gear (mark tools with no.: 50030) – Metric dimensions (mm).

Note – Make two samples of tool (40).

Print No. ***603.54.283.00*** *– 09 – 1994*

DISASSEMBLY–ASSEMBLY OF THE TRANSMISSION DRIVE SHAFT (5, page 21–7) WITH BEVEL PINION SHAFT INSTALLED
Model 50V – 55V – 60V – 70V – 55F – 60F tractors



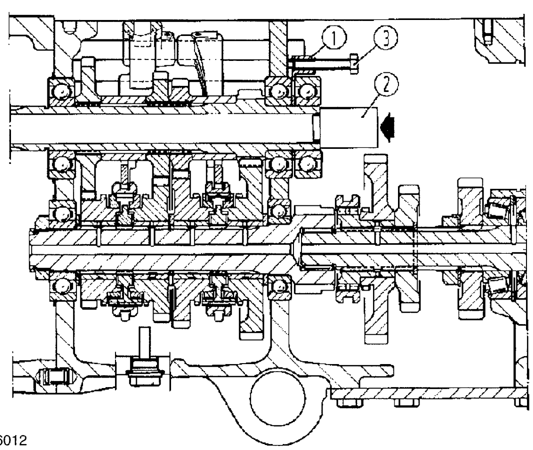
16007

Self–made workshop tools for the disassembly of the transmission drive shaft with bevel pinion shaft installed (etch tool number:50038). Metric dimensions (mm).

Note –make three samples of part no. 3.

Note – After removing all gears (9, page 21–7) and bearings from the reduction unit drive shaft, proceed as folows:

1. Undo circlip (15).



16012

2. Fit the **50038** tool set as shown in the figure.
3. Use a driver punch on tool (2) to push the transmission drive shaft forward all the way.
4. Tighten screws (3) to move back the transmission drive shaft.
5. Use again the tool (2) until the rear bearing comes off the shaft.

After the bearing has come off the shaft, the latter can be removed without involving the bevel pinion shaft.

CREEPER SPEED REDUCTION UNIT (description)

Model 50V – 55V – 60V – 70V – 55F – 60F tractors

The creeper speed auxiliary reduction is a cascade type, spur gear unit installed between the clutch and transmission and allowing 20 forward and 8 reverse speeds (see page 21–11).
Hand–controlled through a lever located on the LH side footboard.

SYNCHRONIZED MECHANICAL REVERSER (description)

Model 50V – 55V – 60V – 70V – 55F – 60F tractors

The mechanical reverser (synchromesh) installed between clutch and transmission the latter without reverse gears, in this case and allows 12 forward and 12 reverse speeds (see page 21–15).
Hand–controlled trough a lever located on the LH side footboard.

REMOVAL–INSTALLATION OF THE CREEPER SPEED OR REVERSER UNIT.

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Make sure that the load is held and supported by suitable slings and hooks.
Make sure that nobody is standing near by.

To reach the creeper speed or reverser unit, first separate the transmission–rear drive case from the clutch housing, as described on page 21–18. Main operations are as follows:

1. Drain the transmission–rear drive case oil.
2. Disconnect the battery negative cable and the cables of the multi–pole socket and indicator lights from their respective connections on the tractor mudguards.
3. Remove the hydraulic lift pipes, the main clutch control tie–rod from the external control lever, the throttle foot control pedal tie–rod, the creeper speed (or reverser) control tie–rod.
4. On DT's, remove the front drive propeller shaft and guard.

*Print No. **603.54.283.00** – 09 – 1994*

If ballast weights are installed on the tractor and cannot be removed, we recommend connecting them to a hoist in order to prevent the engine from tipping forward.

5. Place the **292320** mobile stand with the fixed part underneath the transmission–rear drive case and the mobile ones underneath the engine oil sump and clutch housing, respectively.

6. Place a telescopic stand underneath the drawbar bracket in order to prevent the transmission–=rear drive case from tipping back.

7. Undo the transmission–rear drive case and clutch housing union screws and split off the tractor complete with front axle or live axle and clutch housing from the rest of the tractor.

8. At installation, proceed in accordance with the following instructions and information:

Note –To ease the operations of removal and installation of the transmission–rear drive case with respect to the clutch housing, make sure that both the transmission and creeper speed gears are in neutral and the range splitter is shifted in the low–speed range.

CAUTION

Use suitable tools to align holes. DO NOT PUT HANDS OR FINGERS BETWEEN PARTS.

a. proceed by reversing the previous sequence of removal operations starting from no. 7 back to no. 1;

b. tighten fastenings to the the torque data of page 21–7;

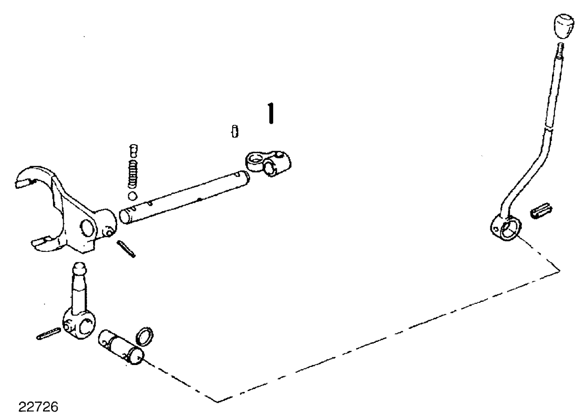
c. spread TUTELA G9 grease on the splined section of the transmission drive shaft and the housing compartment of the collar connecting it to the drive shaft from the main clutch;

d. fit two **292888** pilot dowel pins to ease installation of transmission–rear drive case and clutch housing together making sure there are no interference or hard points during the nearing process;

e. prior to re–fitting the reconditioned transmission case onto the clutch housing thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the scheme of page 21–18. For sealing compound to use, see page 1 – Sect. 00.

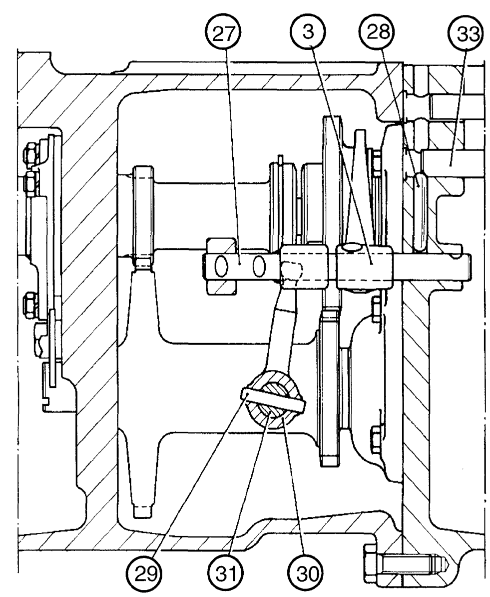
CREEPER SPEED UNIT GEARS, SHAFTS AND BEARINGS

Model 50V – 55V – 60V – 70V – 55F – 60F tractors. Disassembly–Assembly (operations 2116031 and 2116010), with clutch transmission case removed from tractor.



22726

Creeper speed unit control parts

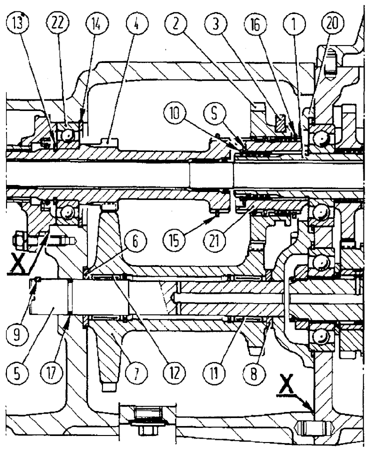


16028

1. Remove the shift rail (27) set screw, retrieve detent spring and ball.

2. Withdraw split pin (29) and remove the shifter fork control lever (30), partially withdraw in the outwards direction the shaft (31); if necessary, disassemble the creeper speed unit controls as shown in the exploded view illustrated above.

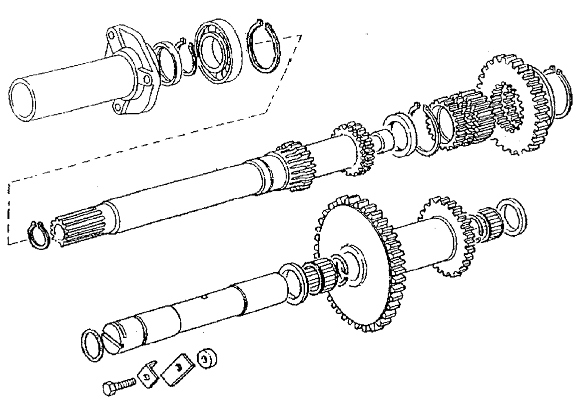
Print No. 603.54.283.00 – 09 – 1994



16027

3. Remove the engagement gear (2) and shift fork (3).
4. Undo circlip (14) and partially withdraw the creeper clutch shaft (4) with bearing (22) and circlip (23) as an assembly.
5. Retrieve gear (7) and finally remove shaft (4).

Note – Operations previously described apply to overhauling operations involving the creeper speed gears only.

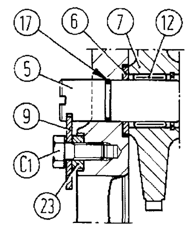


22727

Exploded view of creeper speed gear reduction (20+8)

Should it be necessary to replace gear axle (5) or if it was not possible to remove the clutch–creeper unit shaft (4) and, consequently, the driven gear (7), separate the engine from the clutch housing, as follows:

6. Disconnect the throttle and shut–off control tie–rods from the control levers on the injection pump, the starter cables and the electric cables from their instrument panel connections and, finally, the hour-meter/revs counter flexible drive.
7. Remove the fuel lines (from feed pump, filters, injector spill–back) and the hydraulic steering lines (after draining the reservoir oil).
8. Disconnect the power take–off control tie–rod from the hand control lever and separate the fuel tank assembly complete with cowling and hydraulic steering control valve or steering box from clutch housing.
9. Remove the engine–clutch housing holding screws and split off the engine/front axle or live front axle assembly from the clutch housing.



16032

10. Undo screw (C_1) and remove axle pin (5).
11. Remove clutch shift collar and thrust bearings.
12. Remove the ball bearing thrust housing holding nuts and, acting from the opposite side, remove the shaft assembly with circlip (13) and bearing (22).

13. Assembly

Assemble the transmission and splitter inside the case in accordance with the following instructions and information:

a. thoroughly clean the housing, inside compartments in particular;

b. proceed by reversing the previous disassembly sequence of operations, starting from no. 12 back to no. 1;

c. carefully consult previous illustrations to make sure of correct placement of parts;

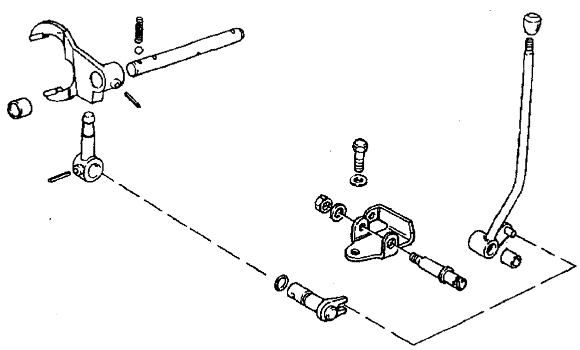
d. when fitting the collar (21) also fit a shim (S) in order to obtain a final play (G) of 0÷0.2 mm (0÷.008 in);

e. also, make sure that the high–range speed detent pawl (28, page 21–25) is fully and correctly fitted in its seat;

f. tighten fastenings to the torque data of page 21–7;

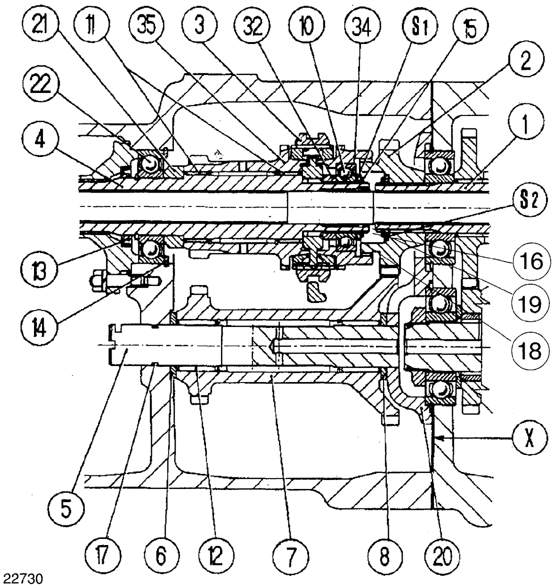
g. prior to the installation of housings, supports and covers thoroughly clean and degrease all mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick following the schemes indicated in the respective sections of this Manual.

REVERSER GEARS, SHAFTS AND BEARINGS
Model 50V – 55V – 60V – 70V – 55F – 60F tractors
Disassembly–Assembly (operations 2116217, 2116231 and 2116237) with clutch housing removed from the tractor

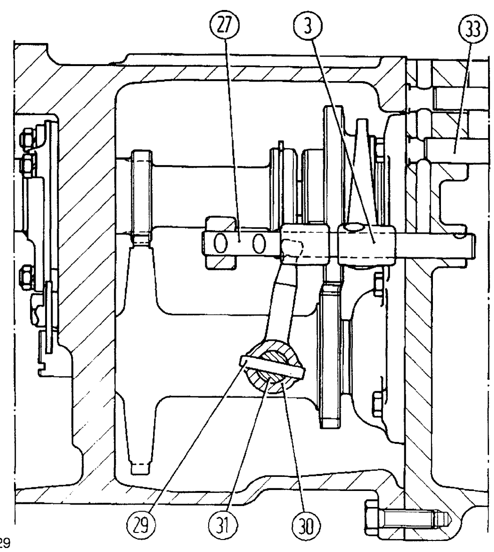


22728

Exploded view of the reverser controls



22730



22729

1. Remove shift rail set screw (27) and retrieve detent spring and ball.

2. Withdraw split pin (29), remove shift fork control lever (30) and partially withdraw in the outwards direction the shaft (31); if necessary, disassemble the reverser control device as shown in the exploded view illustrated above.

3. Remove circlip (15), shim (S_1), collar (34) with ball bearing (10) and thrust ring (32).

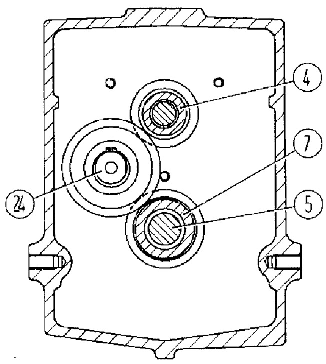
4. Remove the synchromesh assembly (3), the reverser intermediate gear (7) with its needle bearing (12) and the front thrust ring (6).

5. Remove the reverser drive gear (35) complete with its needle bearing (11).

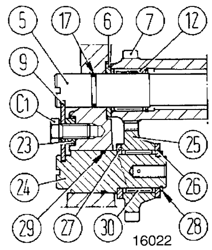
6. If necessary, remove circlip (14) and withdraw the clutch–reverser shaft (4) complete with bearing (22), thrust ring (21) and circlip (13), as an assembly.

Note – The previously described operations apply to the overhauling operations of the synchromesh reverser gears only.

Print No. 603.54.283.00 – 09 – 1994



16019



16022

Should it be necessary to replace the axle pins (5 and 24) or if it was not possible to remove the clutch–reverser shaft (4), then separate the engine from the clutch housing, as follows:

7. Disconnect the throttle and shut–off control tie–rods from the control levers on the injection pump, the starter cables and the electric cables from their instrument panel connections and, finally, the hour-meter/revs counter flexible drive.

8. Remove fuel lines (from feed pump, filters, injector leak–back) and hydraulic steering pipes (after draining the reservoir oil).

9. Disconnect the power take–off control tie–rod from the hand control lever and the vent hose from its connection on the clutch housing and then separate the fuel tank assembly complete with cowling and hydraulic steering control valve or steering box from the clutch housing.

10. Remove the engine–clutch housing union screws and split off the engine with front axle or live front axle from the clutch housing.

11. Undo screw (C_1) and remove axle pins (5 and 24).

12. Remove the clutch shift collars with thrust bearings, as an assembly.

13. Remove the ball bearing thrust housing holding nuts and, acting on the opposite side, the shaft assembly with circlip (13), bearing (22) and thrust ring (21).

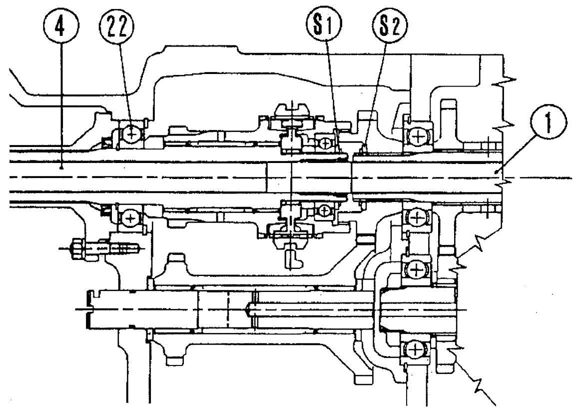
14. Assembly

Assemble the transmission and splitter inside the case in accordance with the following instructions and information:

a. thoroughly clean the housing, inside compartments in particular;

b. proceed by reversing the prevous disassembly sequence of operations, from no. 13 back to no. 1;

c. carefully consult previous illustrations to make sure of the correct placement of parts;



22731

d. after fitting all detail parts on shafts (1) and (4) check the end play of the assembled parts and determine the thickness of shims (S_1) and (S_2), as follows:

To find shim thickness S_1:

— make sure that the reverser pack contacts the front bearing (22);

— using a feeler gauge, measure existing clearance between circlip (15, page 21–27) and bearing (10); The thickness is given by the measured clearance minus the operating clearance which is comprised between 0÷0.18 mm (0÷.007 in).

To find shim thickness S_2:

— fit circlip (16, page 21–27) without shim and driven gear (2);

— measure dimension between circlip and bearing. This same dimension, minus the thickness of the driven gear, gives the value of shim thickness S_2: consider that the maximum permissible play is 0.18 mm (.007 in).

e. prior to the installation of housings, supports and covers thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the schemes indicated in the respective sections of this Manual.

Print No. ***603.54.283.00*** *– 09 – 1994*

Transmission – Model 62F – 72F – 82F – 72LP – 82LP tractors

Constant–mesh helical gears, fully synchromeshed. Spur gear train splitter, three forward and one reverse speed ranges, for a total of 12 forward and 4 reverse speeds. Separate transmission and splitter hand lever controls. In the combined version (creeper speed unit and reverser): 20 forward and 12 reverse speeds. Separate creeper speed unit and reverser hand lever controls located at the operator's L.H. side. Instead, 12 forward and 12 reverse speeds with mechanical reverser version. Reverser control lever located at the operator's L.H. side.

IDENTIFICATION DATA

Marketing code: – 2WD – 4WD	**62 F** **62 DTF**		**72 F** **72 DTF**		**82 F** **82 DTF**		**72 LP** **72 DTLP**		**82 LP** **82 DTLP**	
Technical code:	30 km/h version	40 km/h version	30 km/h version	40 km/h version	30 km/h version	40 km/h version	30 km/h version	40 km/h version	30 km/h version	40 km/h version
2WD										
– w/synchro, 12F + 4R gear mechanical transmission	670.308.000 var.720.116+ 720.014	–	671.308.000 var.720.116+ 720.014	–	672.308.000 var. 720.116+ 720.014	–	671.303.000 var. 720.116+ 720.014	–	672.303.000 var.720.116+ 720.014	–
– w/combined, creeper speed and reverser units synchro, 20F + 12R gears	670.308.000 var. 720.113	–	671.308.000 var. 720.113	–	672.308.000 var.720.113	–	671.303.000 var.720.113	–	672.303.000 var.720.113	–
– w/mechanical reverser 12F + 12R gear, synchro	670.308.000 (standard)	–	671.308.000 (standard)	–	672.308.000 (standard)	–	671.303.000 (standard)	–	672.303.000 (standard)	–
4WD										
– w/mechanical 12F + 4R gear transmission, synchro	670.313.000 var. 720.116+ 720.014	670.313.000 var.720.116+ 720.320 or 720.324	671.313.000 var. 720.116+ 720.014	671.313.000 var.720116+ 720.320 or 720.324	672.313.000 var.720.116+ 720.014	672.313.000 var. 720.116+ 720.320 or 720.324	671.315.000 var. 720.116+ 720.014	671.315.000 var.720.116+ 720.320 or 720.324	672.315.000 var. 720.116+ 720.014	672.315.000 var. 720.116+ 720.320 or 720.324
– w/combined creeper speed and reverser units, synchro 20F + 12R gears	670.313.000 var.720.113	670.313.000 var.720.113+ 720.320 or 720.324	671.313.000 var.720.113	671.313.000 var.720.113+ 720.320 or 720.324	672.313.000 var.720.113	672.313.000 var.720.113+ 720.320 or 720.324	671.315.000 var.720.113	671.315.000 var.720.113+ 720.320 or 720.324	672.303.000 var.720.113	672.315.000 var.720.113+ 720.320 or 720.324
– w/mechanical reverser 12F + 12R gears, synchro	670.313.000 (standard)	670.313.000 var. 720.320 or 720.324	671.313.000 (standard)	671.313.000 var. 720.320 or 720.324	672.313.000 (standard)	672.313.000 var. 720.320 or 720.324	671.315.000 (standard)	671.315.000 var. 720.320 or 720.324	672.315.000 (standard)	671.315.000 var. 720.320 or 720.324
Rear bevel drive	9/43	11/ 43	9/43	11/ 43	9/43	11/ 43	9/43	11/ 43	9/43	11/ 43
Front live axle bevel drive (DT)	10/36	13/37	10/36	13/37	10/36	13/37	10/36	13/37	10/36	13/37
Rear/front drive axle drive mechanical ratio	1/1.50		1/1.50		1/1.50		1/1.50		1/1.50	

Print No. 603.54.283.00 – 09 – 1994

TRANSMISSION AND RANGE SPLITTER Model 62F – 72F – 82F – 72LP – 82LP tractors

Transmission	4 gear ratios, constant–mesh, fully synchronized speeds
Gear type	helical teeth
Range splitter	cascade–type, 3 forward and 1 reverse speed ranges for a total of 12 forward and 4 reverse gears
— gear type	spur gears
— speed reduction ratio:	
● low range	23/43x17/50=1/5.49
● medium range	23/43x27/34=1/2.53
● high range	1
Transmission and splitter controls	separate hand control lever
Thickness of transmission drive shaft rear bearing thrust washer (S, page 21–35) mm (in)	3.00–3.25–3.50–3.75–4.00 (.118–.128–.138–.148–.157)
I.D. of transmission driven gears mm (in)	50.050 ÷ 50.075 (1.9705 ÷ 1.9715)
O.D. of respective bushings (2) mm (in)	49.925 ÷ 49.950 (1.9655 ÷ 1.9655)
Gear/bushing running fit mm (in)	0.100 ÷ 0.150 (.0039 ÷ .0059)
Diameter, transmission drive shaft (1) mm (in)	39.175 ÷ 39.191 (1.5423 ÷ 1.5429)
O.D., respective bushings (2) mm (in)	39.200 ÷ 39.239 (1.5433 ÷ 1.5448)
Shaft/bushing running fit mm (in)	0.009 ÷ 0.064 (.0004 ÷ .0025)
Diameter, P.T.O. shaft (8) mm (in)	24.979 ÷ 25.000 (.9834 ÷ .9843)
I.D., force–fitted bushing (6) mm (in)	25.040 ÷ 25.092(1) (.9858 ÷ .9879)
P.T.O.shaft/bushing running fit mm (in)	0.040 ÷ 0.113 (.0016 ÷ .0044)
Transmission drive shaft (5)/force–fitted bushing interference fit mm (in)	0.037 ÷ 0.091 (.0015 ÷ .0036)
Transmission and splitter shift rail detent ball spring specifications:	
– free nominal length mm (in)	30 (1.2)
– compressed length under load (50÷56 N – 5.13÷5.67 kg – 11.3 ÷ 12.5 lb) mm (in)	25,5 (1)
Transmission and splitter lever detent spring specifications:	
– free nominal length mm (in)	75 (3)
– compressed length under load (193÷232 N – 19.7÷23.7 kg – 43.4÷52.2 lb) mm (in)	51 (2)

(1) Force–fitted without reaming.

Print No. **603.54.283.00** – 09 – 1994

CREEPER SPEEDS–REVERSER COMBINATION – Model 62F – 72F – 82F – 72LP – 82LP tractors

Type	spur gears, installed between engine and transmission, 20 forward and 12 reverse gears
Medium creeper gear ratio	1
Low creeper gear ratio	18/55 x 26/47 = 1/5.5
Reverser gear ratio	18/29 x 29/20 x 38/36 = 1/1.05
Creeper speeds and reverser controls	separate floor levers (1+1) on operator's LH side.

REVERSER

Type	mechanical, spur gears installed betweenengine and transmission
Synchromeshed reverser gear ratio	26/23 x 23/28 x 38/36 = 1/1.020
Control	floor lever on operator's LH side.

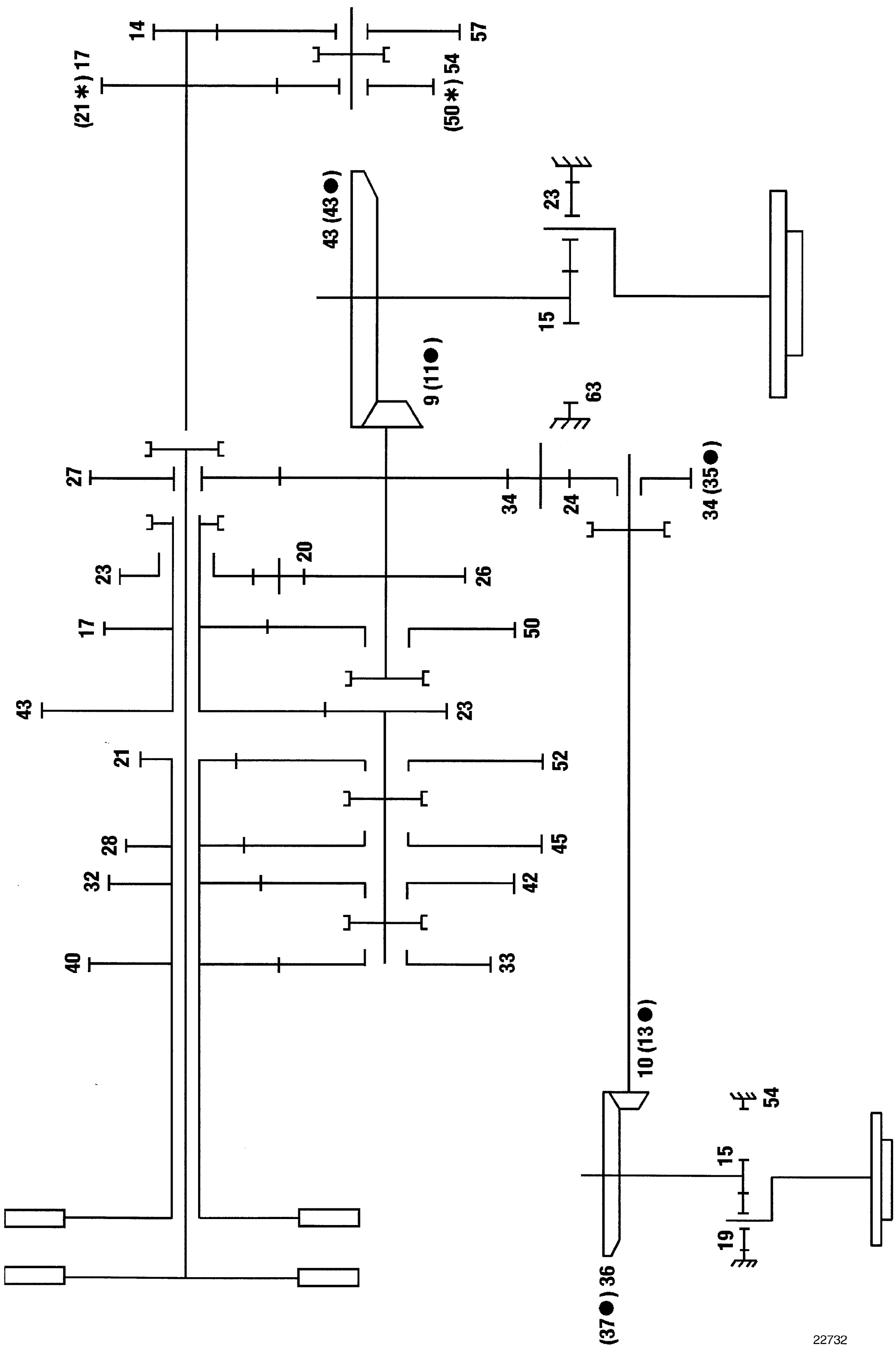
TRANSMISSION WITH CREEPER SPEED, REVERSER COMBINATION OR REVERSER ONLY TROBLE-SHOOTING GUIDE – Model 62F, 72F, 82F, 72LP, 82LP tractors

Problem	Possible cause	Correction
Excessive noise, with splitter in neutral and transmission engaged.	**1.** Wrong driving and driven shaft bearing adjustment.	Remove the clutch–transmission case and adjust bearings (see page 21–22).
	2. Failure of or faulty component.	Remove case, overhaul the transmission and replace defective parts.
	3. Component seizure due to poor lubrication.	Overhaul the transmission and fill with lube oil at correct level.
Excessive noise with tractor stationary, engine idling and transmission in neutral.	**1.** Broken main clutch plate damper springs.	Replace the clutch plate.
Self–disengagement of speed, range, reverser or creeper speed gears.	**1.** Wrong adjustment of external control levers and linkage.	Adjust correctly.
	2. Failure of shift rail detent springs.	Replace springs.
	3. Broken synchromesh teeth.	Remove the clutch–transmission case and replace the synchromesh involved.
	4. Insufficient engagement travel.	Correct causes and re–set for full travel.
Hard shifting of speed, range, reverser or creeper speed gears.	**1.** Wrong adjustment of control levers and linkage.	Adjust correctly.
	2. Hardening and/or seizure of external control levers and linkage.	Inspect hinge points and lubricate them.
	3. Dragging of main clutch plate.	See page 18–8.
	4. Failure of any one synchromesh.	Remove the clutch–transmission case and replace the synchromesh involved.
	5. Sticking internal sliding controls: shift rails, forks and collars.	Overhaul controls.

SERVICE TOOLS
Note – See on page 21–3 the list of tools necessary to carry on the operations described in this Section.

Print No. ***603.54.283.00*** *– 09 – 1994*

Lay–out of the 12+4 transmission – 30 km/h (and 40 km/h •) Versions – Model 62F – 72F – 82F – 72LP – 82LP (540/750 rpm P.T.O.) tractors



22732

Note (*) Variant for 540/1000 rpm P.T.O

Note (•) Variants for 40 km/h versions

Print No. ***603.54.283.00*** *– 09 – 1994*

Model 62F – 72F – 82F tractors, 30 km/h version

MAXIMUM NOMINAL SPEED IN KM/H (MPH) – 12 + 4 Var. 720.116 TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.5 – 20	380/70 – 24	420/70 – 24	13.6 – 28 380/70 – 28	14.9 – 28 (*)
Low	1st	1.4 (.9)	1.5 (.93)	1.6 (1)	1.7 (1.1)	1.8 (1.1)
	2nd	2.2 (1.4)	2.4 (1.5)	2.5(1.6)	2.6 (1.6)	2.7 (1.7)
	3rd	2.6 (1.6)	2.9 (1.8)	3.1 (1.9)	3.2 (2)	3.3 (2)
	4th	4.2 (2.6)	4.7 (2.9)	4.9 (3)	5.1 (3.2)	5.3 (3.3)
Medium	1st	3.3 (2)	3.6 (2.2)	3.8 (2.4)	4.0 (2.5)	4.2 (2.6)
	2nd	5.0 (3.1)	5.6 (3.5)	5.9 (3.7)	6.1 (3.8)	6.4 (4)
	3rd	6.2 (3.9)	6.9 (4.3)	7.2 (4.5)	7.5 (4.7)	7.8 (4.8)
	4th	9.8 (6)	10.9 (6.8)	11.5 (7.1)	11.9 (7.4)	12.5 (7.8)
High	1st	7.7 (4.8)	8.6 (5.3)	9.0 (5.6)	9.4 (5.8)	9.8 (6)
	2nd	11.9 (7.4)	13.2 (8.2)	13.9 (8.6)	14.4 (8.9)	15.1 (9.4)
	3rd	14.5 (9)	16.2 (10)	17.0 (10.6)	17.6 (10.9)	18.5 (11.5)
	4th	23.1 (14.3)	25.7 (16)	27.1 (16.8)	28.0 (17.4)	29.4 (18.3)
REVERSE						
	1st	3.6 (2.2)	4.0 (2.5)	4.2 (2.6)	4.4 (2.7)	4.6 (2.9)
	2nd	5.6 (3.5)	6.2 (3.9)	6.5 (4)	6.8 (4.2)	7.1 (4.4)
	3rd	6.9 (4.3)	7.6 (4.7)	8.0 (5)	8.4 (5.2)	8.7 (5.4)
	4th	10.9 (6.8)	12.1 (7.5)	12.8 (7.9)	13.3 (8.3)	13.9 (8.6)

Model 62F – 72F – 82F tractors, 40 km/h version with high–speed bevel drive unit (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) 12 + 4 Var. 720.116 + Var. 720.320 or 324 TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.9 – 28 (*)	13.6 – 28 380/70 – 28	380/70 – 24	14.5 – 20	420/70 – 24
Low	1st	2.2 (1.4)	2.1 (1.3)	1.9 (1.2)	1.7(1.1)	2.0 (1.2)
	2nd	3.4 (2.1)	3.2 (2.1)	2.9 (1.8)	2.6 (1.6)	3.1 (1.9)
	3rd	4.1 (2.5)	3.9 (2.5)	3.6 (2.2)	3.2 (2)	3.8 (2.4)
	4th	6.5 (4)	6.2 (3.9)	5.7 (3.5)	5.1 (3.2)	6.0 (3.7)
Medium	1st	5.1 (3.2)	4.8 (3)	4.4 (2.7)	4.0 (2.5)	4.7 (2.9)
	2nd	7.8 (4.8)	7.5 (4.7)	6.9 (4.3)	6.2 (3.9)	7.2 (4.5)
	3rd	9.6 (6)	9.1 (5.7)	8.4 (5.2)	7.5 (4.7)	8.9 (5.5)
	4th	15.3 (9.5)	14.6 (9)	13.4 (8.3)	12.0 (7.5)	14.1 (8.8)
High	1st	12.0 (7.5)	11.4 (7)	10.5 (6.5)	9.4 (5.8)	11.0 (6.8)
	2nd	18.5 (11.5)	17.6 (10.9)	16.2 (10)	14.5 (9)	17.0 (10.6)
	3rd	22.6 (14)	21.5 (13.4)	19.8 (12.3)	17.8 (11)	20.8 (12.9)
	4th	36.0 (22.4)	34.3 (21.3)	31.5 (19.6)	28.3 (17.6)	33.2 (20.6)
REVERSE						
	1st	5.7 (3.5)	5.4 (3.4)	5.0 (3.1)	4.4 (2.7)	5.2
	2nd	8.7 (5.4)	8.3 (5.2)	7.6 (4.7)	6.9 (4.3)	8.1
	3rd	10.7 (6.6)	10.2 (6.3)	9.4 (5.8)	8.4 (5.2)	9.9
	4th	17.0 (10.6)	16.2 (10)	14.9 (9.3)	13.4 (8.3)	15.7

(*) Do not apply to model 62F.

*Print No. **603.54.283.00** – 09 – 1994*

Model 72LP – 82LP tractors, 30 km/h version

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 4 Var. 720.116 TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		420/70 – 24	14.9 – 28	16.9 – 28
Low	1st	1.7 (1.1)	1.8 (1.1)	1.9 (1.2)
	2nd	2.6 (1.6)	2.7 (1.7)	2.9 (1.8)
	3rd	3.1 (1.9)	3.4 (2.1)	3.5 (2.2)
	4th	4.9 (3)	5.3 (3.3)	5.6 (3.5)
Medium	1st	3.9 (2.4)	4.2 (2.6)	4.4 (2.7)
	2nd	5.9(3.7)	6.4 (4.0)	6.7 (4.2)
	3rd	7.2 (4.5)	7.9 (4.9)	8.2 (5)
	4th	11.5 (7.1)	12.5 (7.8)	13.1 (8.1)
High	1st	9.1 (5.7)	9.8 (6)	10.3 (6.4)
	2nd	13.9 (8.6)	15.1 (9.4)	15.8 (9.8)
	3rd	17.1 (10.6)	18.5 (11.5)	19.4 (12)
	4th	27.1 (16.8)	29.4 (18.3)	30.8 (19.1)
REVERSE				
	1st	4.2 (2.6)	4.6 (2.9)	4.8 (3)
	2nd	6.5 (4)	7.1 (4.4)	7.4 (4.6)
	3rd	8.0 (5)	8.7 (5.4)	9.1 (5.7)
	4th	12.8 (7.9)	13.8 (8.6)	14.5 (9)

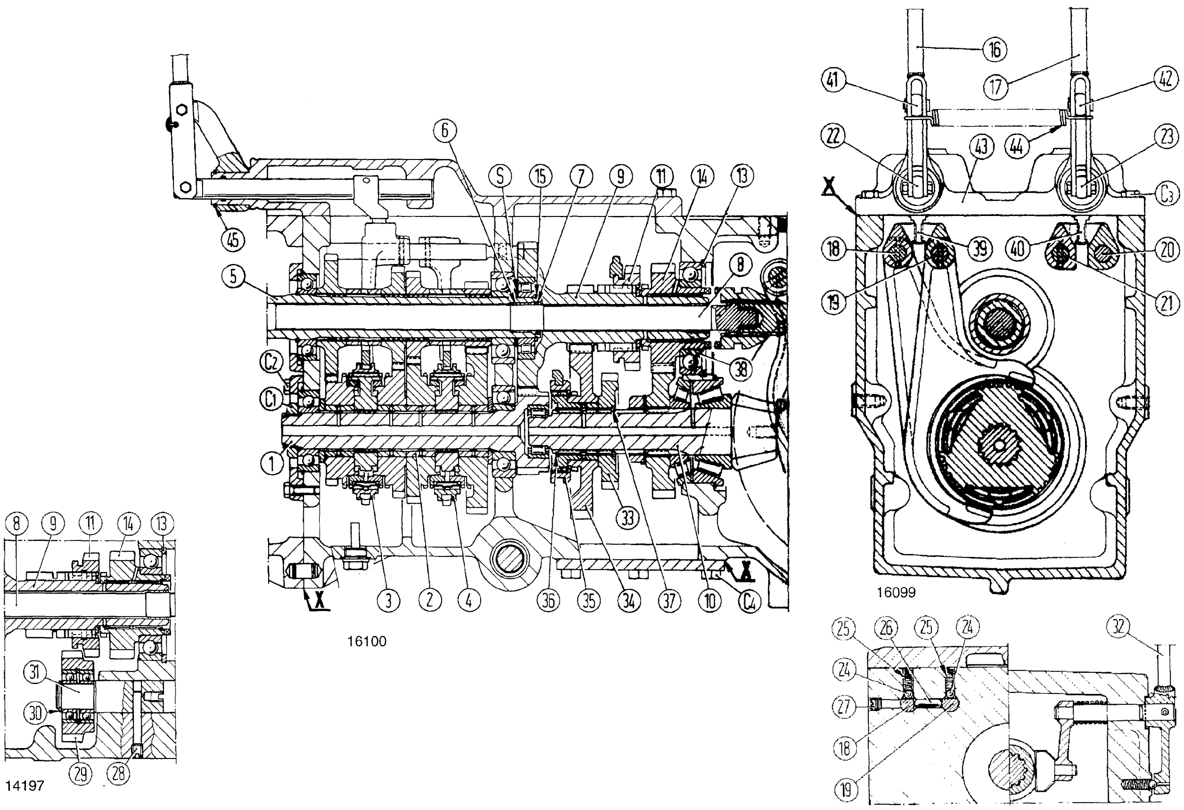
Model 72LP – 82LP tactors, 40 km/h version with high–speed bevel drive unit (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 4 Var. 720.116 + Var. 720.320 or 324 TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.9 – 28	420/70 – 24	16.9 – 28
Low	1st	2.2 (1.4)	2.0 (1.2)	2.3 (1.4)
	2nd	3.4 (2.1)	3.1 (1.9)	3.5 (2.2)
	3rd	4.1 (2.5)	3.8 (2.4)	4.3 (2.7)
	4th	6.5 (4)	6.0 (3.7)	6.8 (4.2)
Medium	1st	5.1 (3.2)	4.7 (2.9)	5.3 (3.3)
	2nd	7.8 (4.8)	7.2 (4.5)	8.2 (5.1)
	3rd	9.6 (6)	8.9 (5.5)	10.1 (6.3)
	4th	15.3 (9.5)	14.1 (8.8)	10.0 (6.21)
High	1st	12.0 (7.5)	11.0 (6.8)	12.5 (7.8)
	2nd	18.5 (11.5)	17.0 (10.6)	19.3 (12)
	3rd	22.6 (14)	20.8 (12.9)	23.7 (14.7)
	4th	36.0 (22.4)	33.2 (20.6)	37.7 (23.4)
REVERSE				
	1st	5.7 (3.5)	5.2 (3.2)	5.9 (3.7)
	2nd	8.7 (5.4)	8.1 (5)	9.1 (5.7)
	3rd	10.7 (6.6)	9.9 (6.1)	11.2 (7)
	4th	17.0 (10.6)	15.7 (9.7)	17.8 (11.1)

Print No. 603.54.283.00 – 09 – 1994

TORQUE WRENCH DATA – Model 62F – 72F – 82F – 72LP – 82LP tractors

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Transmission and splitter Driven gear shaft locknut (C_1)	M 32 x 1.5	294	30/217
Transmission shaft bearing housing screws (C_2)	M 8 x 1.25	28	2.9/21
Transmission–rear drive case upper cover holding screws (C_3)	M 10 x 1.25	59	6/43.4
Transmission–rear drive case bottom cover holding screws (C_4)	M 12 x 1.25	98	6/43.4
Reverser Reverser intermediate gear axle and driven shaft lock plate set screws (C_1, page 21–43)	M 12 x 1.25	67	6.8/49



Longitudinal and cross–sectional views of the transmission and splitter units installed on model 62F – 72F – 82F – 72LP – 82LP tractors

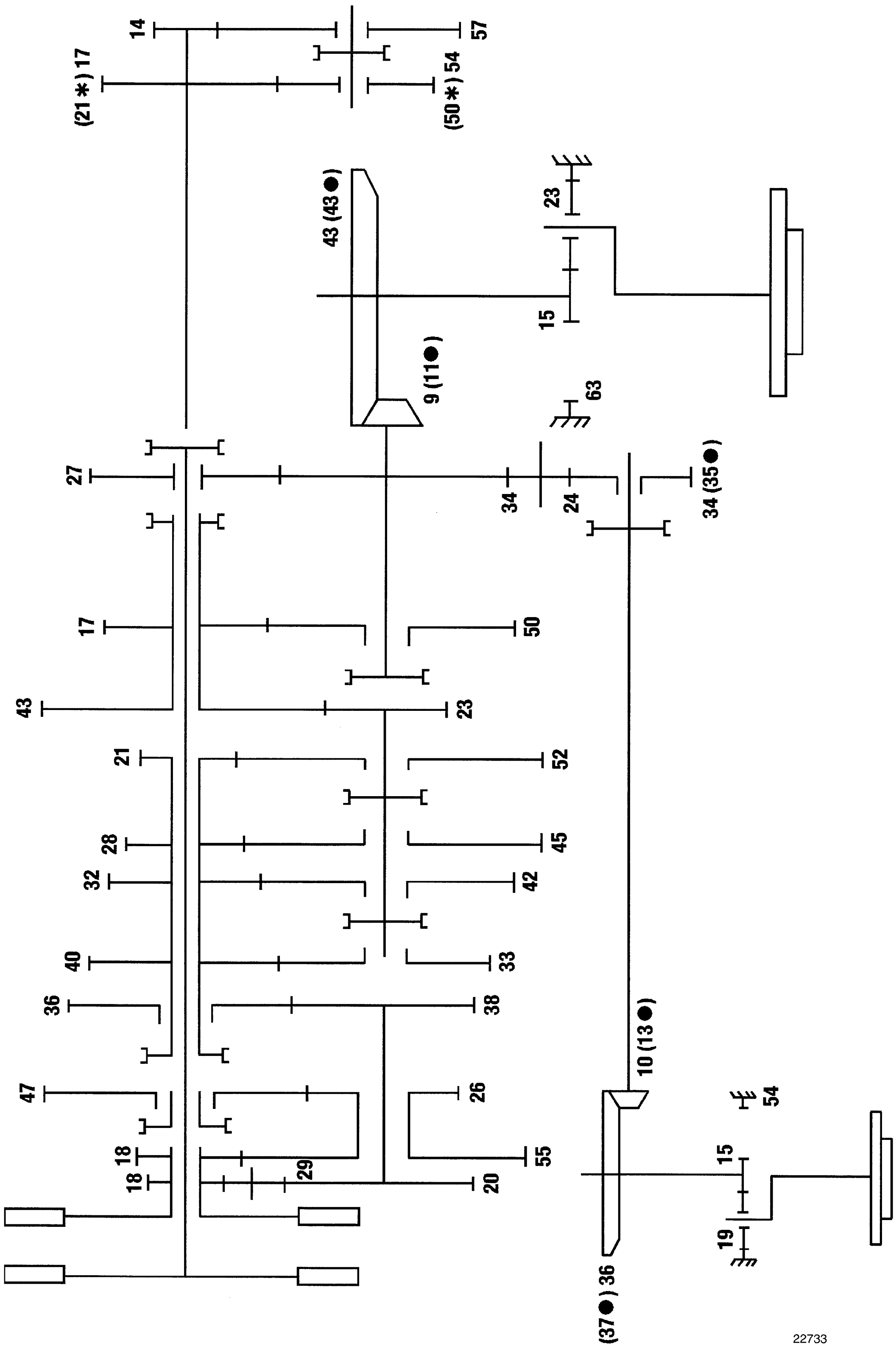
C_1. Driven gear shaft locknut – C_2. Bearing holding screws – C_3. Upper cover screws – C_4. Bottom cover screws – S. Drive shaft bearing adjustment shim – 1. Transmission driven shaft – 2. Transmission driven gear bearing bushings – 3. 3rd and 4th speed gear shift collar – 4. 1st and 2nd speed gear shift collar – 5. Transmission drive shaft – 6. Power take–off shaft bearing bushing – 7. Oil seal – 8. Power take–off shaft – 9. Constant–mesh and creeper speed gera drive shaft – 10. Bevel pinion shaft – 11. Reverse and medium range engagement gear – 13,15,30,36 and 45. Circlips – 14. Medium range speed drive gear – 16. Transmission control levere – 17. Splitter control lever – 18. 1st and 2nd speed gear shift rail – 19. 3rd and 4th speed gear shift rail – Low and high speed gear shift fork rail – 21. Medium range and reverse speed gear shift fork rail – 22. Transmission control rod 23. Splitter control rod – 24 and 25. Horizontal control rod detent springs and balls – 26. Gear shift detent pawl – 27. Plug 28. Screw – 29. Reverse intermediate gear – 31. Reverse gear axle pin – 32. Power take–off external control lever – 33. Reverse gear – 34. Low range driven gear – 35. Transmission straight drive and low range gear shift collar – 37. Half–rings – 38. Bearing – 39. Transmission control rod – 40. Splitter control rod 41. Transmission control lever articulation mount – 42. Splitter control lever articulation mount – 43. Transmission case cover – 44. Spring.

Note – At assembly, apply sealing compound on mating surfaces **X** following the instructions reported on page 1, section 00.

Important – Apply one of the sealing compounds indicated on page 1, Section 00, prior to tightening the plug (27) and screw (28). After assembly, inspect to make sure of the absence of oil leaks.

Print No. **603.54.283.00** – 09 – 1994

Layout of the 20 + 12 transmission – 30 km/h (and 40 km/h) Versions – Model 62F – 72F – 82F – 72LP – 82LP tractors (540/750 rpm P.T.O)



Note (*) Variant for the 540/1000 rpm P.T.O. version.
Note (•) Variants for the 40 km/h version.

Print No. **603.54.283.00** – 09 – 1994

Model 62F – 72F – 82F tractors, 30 km/h version

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 20 + 12 Var.113 (Creeper Speeds) TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.5 – 20	380/70 – 24	420/70 – 24	13.6 – 28 380/70 – 28	14.9 – 28 (**)
Low C.S.	1st	*0.2 (.1)	*0.3 (.2)	*0.3 (.2)	*0.3 (.2)	*0.3 (.2)
	2nd	*0.4 (.2)	*0.4 (.2)	*0.5 (.3)	*0.5 (.3)	*0.5 (.3)
	3rd	*0.5 (.3)	*0.5 (.3)	*0.6 (.4)	*0.6 (.4)	*0.6 (.4)
	4th	*0.8 (.5)	*0.8 (.5)	*0.9 (.6)	*0.9 (.6)	*1.0 (.65)
Medium C.S.	1st	*0.6 (.4)	*0.7 (.45)	*0.7 (.45)	*0.7 (.4)	*0.7 (.4)
	2nd	*0.9 (.6)	*1.0 (.65)	*1.1 (.7)	*1.1 (.7)	*1.2 (.75)
	3rd	*1.1 (.7)	*1.2 (.75)	*1.3 (.8)	*1.4 (.9)	*1.4 (.9)
	4th	*1.8 (1.1)	*2.0 (1.2)	*2.1 (1.3)	*2.2 (1.4)	*2.3 (1.45)
Low	1st	1.4 (.9)	1.6 (1)	1.6 (1)	1.7 (1.1)	1.8 (1.15)
	2nd	2.2 (1.4)	2.4 (1.5)	2.5 (1.6)	2.6 (1.6)	2.7 (1.7)
	3rd	2.6 (1.6)	2.9 (1.8)	3.1 (1.9)	3.2 (2)	3.4 (2.1)
	4th	4.2 (2.6)	4.7 (2.9)	4.9 (3)	5.1 (3.2)	5.3 (3.3)
Medium	1st	3.3 (2)	3.6 (2.2)	3.8 (2.4)	4.0 (2.5)	4.2 (2.6)
	2nd	5.0 (3.1)	5.6 (3.5)	5.9 (3.7)	6.1 (3.8)	6.4 (4)
	3rd	6.2 (3.9)	6.9 (4.3)	7.2 (4.5)	7.5 (4.7)	7.9 (4.9)
	4th	9.8 (6.1)	10.9 (6.8)	11.5 97.1)	11.9 (7.4)	12.5 (7.8)
High	1st	7.7 (4.8)	8.6 (5.3)	9.0 (5.5)	9.4 (5.8)	9.8 (6.1)
	2nd	11.9 (7.4)	13.2 (8.2)	13.9 (8.6)	14.4 (8.9)	15.1 (9.4)
	3rd	14.5 (9)	16.2 (10.1)	17.0 (10.6)	17.6 (10.9)	18.5 (11.5)
	4th	23.1 (14.3)	25.8 (16)	27.1 (16.8)	28.0 (17.4)	29.4 (18.3)
REVERSE						
Low	1st	1.3 (.8)	1.5 (.9)	1.6 (1)	1.6 (1)	1.7 (1.1)
	2nd	2.0 (1.2)	2.3 (1.4)	2.4 (1.5)	2.5 (1.6)	2.6 (1.65)
	3rd	2.5 (1.6)	2.8 (1.7)	2.9 (1.8)	3.0 (1.9)	3.2 (2)
	4th	4.0 (2.5)	4.4 (2.7)	4.7 (2.9)	4.9 (3)	5.1 (3.2)
Medium	1st	3.1 (1.9)	3.5 (2.2)	3.6 (2.25)	3.8 (2.4)	4.0 (2.5)
	2nd	4.8 (3)	5.3 (3.3)	5.6 (3.5)	5.8 (3.6)	6.1 (3.8)
	3rd	5.9 (3.7)	6.5 (4)	6.9 (4.3)	7.1 (4.4)	7.5 (4.7)
	4th	9.3 (5.8)	10.4 (6.5)	11.0 (6.8)	11.3 (7)	11.9 (7.4)
High	1st	7.3 (4.5)	8.1 (5)	8.6 (5.3)	8.9 (5.5)	9.3 (5.8)
	2nd	11.3 (7)	12.6 (7.8)	13.2 (8.2)	13.7 (8.5)	14.3 (8.9)
	3rd	13.8 (8.6)	15.4 (9.6)	16.2 (10)	16.7 (10.4)	17.6 (10.9)
	4th	22.0 (13.6)	24.5 (15.2)	25.8 (16)	26.7 (16.6)	28.0 (17.4)

Model 62F – 72F – 82F tractors, 40 km version with high–speed bevel drive unit (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 20 + 12 Var. 720.113 + 720.320 or 324 (* Creeper speeds) TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.9 – 28 (**)	13.6 – 28 380/70 – 28	380/70 – 24	14.5 – 20	420/70 – 24
Low C.S.	1st	*0.4(.2)	*0.4 (.2)	*0.3 (.2)	*0.3 (.2)	*0.4 (.2)
	2nd	*0.6 (.4)	*0.6 (.4)	*0.5 (.3)	*0.5 (.3)	*0.6 (.4)
	3rd	*0.7 (.45)	*0.7 (.45)	*0.6 (.4)	*0.6 (.4)	*0.7 (0.45)
	4th	*1.2 (.75)	*1.1 (.7)	*1.0 (.6)	*0.9 (.6)	*1.1 (.7)
Medium C.S.	1st	*0.9 (.6)	*0.9 (.6)	*0.8 (.5)	*0.7 (.45)	*0.8 (.5)
	2nd	*1.4 (.9)	*1.4 (.9)	*1.2 (.7)	*1.1 (.7)	*1.3 (.8)
	3rd	*1.7 (1)	*1.7 (1)	*1.5 (.9)	*1.4 (.9)	*1.6 (1)
	4th	*2.8 (1.7)	*2.6 (1.6)	*2.4 (1.5)	*2.2 (1.4)	*2.6 (1.6)
Low1st		2.2 (1.4)	2.1 (1.3)	1.9 (1.2)	1.7 (1)	2.0 (1.2)
	2nd	3.4 (2.1)	3.2 (2)	2.9 91.8)	2.6 (1.6)	3.1 (1.9)
	3rd	4.1 (2.5)	3.9 (2.4)	3.6 92.2)	3.2 (2)	3.8 (2.4)
	4th	6.5 (4)	6.2 (3.9)	5.7 (3.5)	5.1 (3.2)	6.0 (3.7)
Medium,	1st	5.1 (3.2)	4.8 (3)	4.4 (2.7)	4.0 (2.5)	4.7 (2.9)
	2nd	7.8 (4.8)	7.5 (4.7)	6.9 (4.3)	6.2 (3.9)	7.2 (4.5)
	3rd	9.6 (6)	9.1 (5.7)	8.4 (5.2)	7.5 (4.7)	8.9 (5.5)
	4th	15.3 (9.5)	14.6 (9.1)	13.4 (8.3)	12.0 (7.5)	14.1 (8.8)
High	1st	12.0 (7.5)	11.4 (7.1)	10.5 (6.5)	9.4 (5.8)	11.0 (6.8)
	2nd	18.5 (11.5)	17.6 (10.9)	16.2 (10.1)	14.5 (9)	17.0 (10.6)
	3rd	22.6 (14)	21.5 (13.4)	19.8 (11.9)	17.8 (11.1)	20.8 (12.9)
	4th	36.0 (22.4)	34.3 (21.3)	31.5 (19.6)	28.3 (17.6)	33.2 (20.6)
REVERSE						
Low	1st	2.1 (1.3)	2.0 (1.2)	1.8 (1.1)	1.6 (1)	1.9 (1.2)
	2nd	3.2 (2)	3.0 (1.9)	2.8 (1.7)	2.5 (1.6)	2.9 (1.8)
	3rd	3.9 (2.4)	3.7 (2.3)	3.4 (2.1)	3.1 (1.9)	3.6 (2.2)
	4th	6.2 (3.9)	5.9 (3.7)	5.4 (3.4)	4.9 (3)	5.7 (3.5)
Medium	1st	4.8 (3)	4.6 (2.9)	4.2 (2.6)	3.8 (2.4)	4.5 (2.8)
	2nd	7.4 (4.6)	7.1 (4.4)	6.5 (4)	5.9 (3.7)	6.9 (4.3)
	3rd	9.1 (5.7)	8.7 (5.4)	8.0 (5)	7.2 (4.5)	8.4 (5.2)
	4th	14.5 (9)	13.8 (8.6)	12.7 (7.9)	11.4 (7.1)	13.4 (8.3)
High	1st	11.4 (7.1)	10.8 (6.7)	9.9 (6.1)	8.9 (5.5)	10.5 (6.5)
	2nd	17.4 (10.8)	16.7 (10.4)	15.3 (9.5)	13.8 (8.6)	16.2 (10.1)
	3rd	21.5 (13.4)	20.5 (12.7)	18.8 (11.7)	16.9 (10.5)	19.8 (12.3)
	4th	34.2 (21.2)	32.6 (20.2)	29.9 (18.6)	26.9 (16.7)	31.5 (19.6)

(**) Do not apply to model 62F.

Print No. ***603.54.283.00*** *– 09 – 1994*

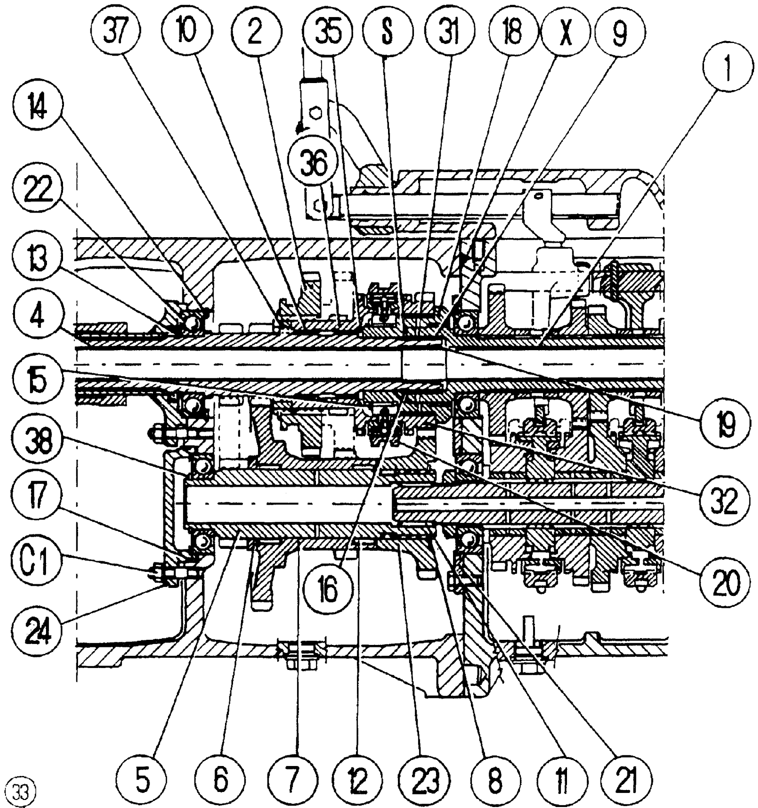
Model 72LP – 82LP tractors, 30 km/h version

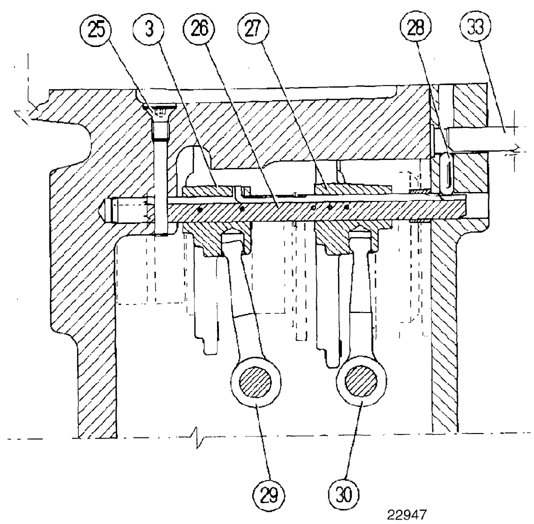
MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 20 + 12 Var. 113 (* Creeper Speeds) TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		420/70 – 24	14.9 – 28	16.9 – 28
Low C.S.	1st	*0.3 (.2)	*0.3 (.2)	*0.3 (.2)
	2nd	*0.4 (.25)	*0.5 (.3)	*0.5 (.3)
	3rd	*0.5 (.3)	*0.6 (.4)	*0.6 (.4)
	4th	*0.9 (.6)	*1.0 (.65)	*1.0 (6.5)
Medium C.S.	1st	*0.7 (.45)	*0.7 (.45)	*0.8 (.5)
	2nd	*1.1 (.7)	*1.2 (.75)	*1.2 (.75)
	3rd	*1.3 (.8)	*1.4 (.9)	*1.5 (.95)
	4th	*2.1 (1.3)	*2.3 (.8)	*2.4 (1.5)
Low	1st	1.7 (1.1)	1.8 (1.1)	1.9 (1.2)
	2nd	2.6 (1.6)	2.8 (1.7)	2.9 (1.8)
	3rd	3.1 (1.9)	3.4 (2.1)	3.5 (2.2)
	4th	4.9 (3)	5.3 (3.3)	5.6 (3.5)
Medium	1st	3.9 (2.4)	4.2 (2.6)	4.4 (2.7)
	2nd	5.9 (3.7)	6.4 (4)	6.7 (4.2)
	3rd	7.2 (4.5)	7.9 (4.9)	8.2 95.1)
	4th	11.5 (7.1)	12.5 (7.8)	13.1 (8.1)
High	1st	9.1 (5.7)	9.8 (6.1)	10.3 (6.4)
	2nd	13.9 (8.6)	15.1 (9.4)	15.8 (9.8)
	3rd	17.1 (10.6)	18.5 (11.5)	19.4 (12)
	4th	27.1 (16.8)	29.4 (18.3)	30.4 (18.9)
REVERSE		20 + 12 VAR. 720.113 TRANSMISSION		
LOw	1st	1.6 (1)	1.7 (1.1)	1.8 (1.15)
	2nd	2.4 (1.5)	2.6 (1.6)	2.7 (1.7)
	3rd	2.9 (1.8)	3.2 (2)	3.3 (2.5)
	4th	4.7 (2.9)	5.1 (3.2)	5.3 (3.3)
Medium	1st	3.6 (2.2)	4.0 (2.5)	4.1 (2.55)
	2nd	5.6 (3.5)	6.1 (3.8)	6.4 (4)
	3rd	6.9 (4.3)	7.5 (4.7)	7.8 (4.8)
	4th	10.9 (6.8)	11.9 (7.4)	12.4 (7.7)
High	1st	8.5 (5.3)	9.3 (6)	9.7 (6)
	2nd	13.2 (8.2)	14.3 (8.9)	15.0 (6)
	3rd	16.2 (10.1)	17.6 (10.9)	18.4 (11.4)
	4th	25.8 (16)	28.0 (17.4)	29.3 (18.2)

Model 72LP – 82LP tractors, 40 km/h version with high–speed bevel drive unit (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 20 + 12 Var. 720113 + 720320 or 324 (* Creeper Speeds) TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.9 – 28	420/70 – 24	16.9 – 28
Low C.S.	1st	*0.4 (.2)	*0.4 (.2)	*0.4 (.2)
	2nd	*0.6 (.4)	*0.6 (.4)	*0.6 (.4)
	3rd	*0.7 (.45)	*0.7 (.45)	*0.8 (.5)
	4th	*1.2 (.75)	*1.1 (.7)	*1.2 (.75)
Medium C.S.	1st	*0.9 (.6)	*0.8 (.5)	*1.0 (.65)
	2nd	*1.4 (.9)	*1.3 (.8)	*1.5 (.9)
	3rd	*1.7 (1.1)	*1.6 (1.0)	*1.8 (1.15)
	4th	*2.8 (1.7)	*2.6 (1.6)	*2.9 (1.8)
Low	1st	2.2 (1.4)	2.0 (1.2)	2.3 (1.45)
	2nd	3.4 (2.1)	3.1 (1.9)	3.5 (2.2)
	3rd	4.1 (2.5)	6.8 (4.2)	4.3 (2.7)
	4th	6.5 (4.0)	6.0 (3.7)	6.8 (4.2)
Medium	1st	5.1 (3.2)	4.7 (2.9)	5.3 (3.3)
	2nd	7.8 (4.8)	7.2 (4.5)	8.2 (5.1)
	3rd	9.6 (6.0)	8.9 (5.5)	10.1 (6.3)
	4th	15.3 (9.5)	14.1 (8.8)	16.0 (9.9)
High	1st	12.0 (7.5)	11.0 (6.8)	12.5 (7.8)
	2nd	18.5 (11.5)	17.0 (10.6)	19.3 (12.0)
	3rd	22.6 (14.0)	20.8 (12.9)	23.7 (14.7)
	4th	36.0 (22.4)	33.2 (20.6)	37.7 (23.4)
REVERSE		20 + 12 Var. 720113 + 720320 or 324 TRANSMISSION		
Low	1st	2.1 (1.3)	1.9 (2.1)	2.2 (1.4)
	2nd	3.2 (2.0)	2.9 (1.8)	3.3 (1.4)
	3rd	3.9 (2.4)	3.6 (2.2)	4.1 (2.5)
	4th	6.2 (3.9)	5.7 (3.5)	6.5 (4.0)
Medium	1st	4.8 (3.0)	4.5 (2.8)	5.1 (3.2)
	2nd	7.4 (4.6)	6.9 (4.3)	7.8 (4.8)
	3rd	9.1 (5.7)	8.4 (5.2)	9.5 (5.9)
	4th	14.5 (9.0)	13.4 (8,.3)	15.2 (9.4)
High	1st	11.4 (7.1)	10.5 (6.5)	11.9 (7.4)
	2nd	17.4 (10.8)	16.2 (10.1)	18.4 (11.4)
	3rd	21.5 (13.4)	19.8 (12.3)	22.5 (14.0)
	4th	34.2 (21.2)	31.5 (19.6)	35.8 (22.2)

Print No. **603.54.283.00** – 09 – 1994





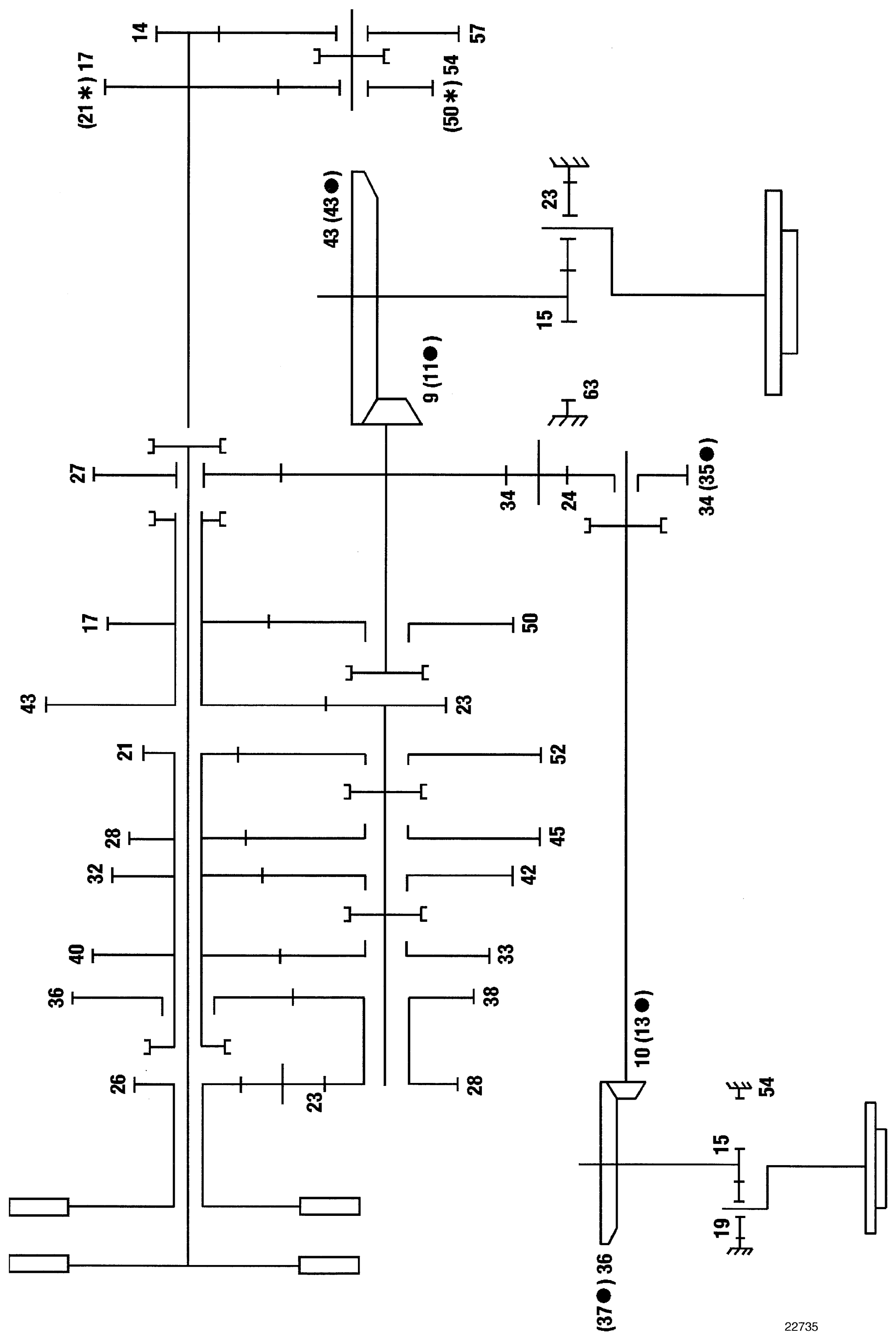
Sectional views of the creeper speed unit (20 forward + 12 reverse speed gear transmission)
Models 62F – 72F – 82F – 72LP – 82LP

C_1. Housing (24) nut – S. Shim – 1. Transmission–creeper speed shaft – 2. Creeper speed unit engagement nut – 3. Creeper speed unit shift fork – 4. Clutch–creeper speed unit shaft – 5. Reverser driven gear axle pin – 6. Driven gear thrust ring – 7. Creeper speed unit driven gear – 8. Driven gear (23) retaining circlip – 9,10,11,12. Needle bearings – 13,14,15,16. Circlips – 17. O–ring seal – 18. Collar – 19. Oil seal – 20. Transmission drive shaft synchromesh – 21. Transmission drive and driven shaft bearing housing – 22. Ball bearing – 23. reverser driven gear – 24. Housing – 25. Shift rail (26) retaining pin – 26. Shift fork rail – 27. Creeper speed unit shift in fork – 28. High–speed detent pawl – 29. Fork (3) control lever – 30. Fork (27) control lever – 31. Needle bearing – 32. Reverser gear – 33. Horizontal shifter rail for splitter low and high range speeds – 35. Thrust rings – 36,37. Collars – 38. Circlip.

Note – At assembly, clean and degrease mating surfaces **X** and apply one of the sealing compounds indicated on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

Layout of 12 + 12 – 30 km/h (and 40 km/h •) transmission – Model 62F – 72F – 82F – 72LP – 82LP (540/750 rpm P.T.O.) tractors



Note (*) Variant for 540/1000 rpm P.T.O
Note (•) Variant for 40 km/h version

*Print No. **603.54.283.00** – 09 – 1994*

Model 62F – 72F – 82F tractors, 30 km/h version

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 12 Standard TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.5 – 20	380/70 – 24	420/70 – 24	13,6 – 28 380/70 – 28	14,9 – 28 (*)
Low	1st	1.4 (9.9)	1.5 (.95)	1.6 (1.0)	1.7 (1.1)	1.8 (1.85)
	2nd	2.2 (1.4)	2.4 (1.5)	2.5 (1.6)	2.6 (1.6)	2.7 (1.7)
	3rd	2.6 (1.65)	2.9 (1.8)	3.1 (1.9)	3.2 (2.0)	3.3 (2.05)
	4th	4.2 (2.6)	4.7 (2.9)	4.9 (.0)	5.1 (3.2)	5.3 (3.3)
Medium	1st	3.3 (2.0)	3.6 (2.2)	3.8 (2.4)	4.0 (2.5)	4.2 (2.6)
	2nd	5.0 (3.1)	5.6 (3.5)	5.9 (3.7)	6.1 (3.8)	6.4 (4.0)
	3rd	6.2 (3.9)	6.9 (4.3)	7.2 (4.5)	7.5 (4.7)	7.8 (4.8)
	4th	9.8 (6.1)	10.9 (6.8)	11.5 (7.1)	11.9 (7.4)	12.5 (7.8)
High	1st	7.7 (4.8)	8.6 (5.3)	9.0 (5.6)	9.4 (5.8)	9.8 (6.1)
	2nd	11.9 (7.4)	13.2 (8.2)	13.9 (8.6)	14.4 (8.9)	15.1 (9.4)
	3rd	14.5 (9.0)	16.2 (10.1)	17.0 (10.6)	17.6 (10.9)	18.5 (11.5)
	4th	23.1 (14.3)	25.7 (16.0)	27.1 (16.8)	28.0 (17.4)	29.4 (18.3)
REVERSE						
Low	1st	1.4 (.9)	1.6 (1.0)	1.6 (1.0)	1.7 (1.1)	1.8 (1.15)
	2nd	2.2 (1.4)	2.4 (1.5)	2.5 (1.6)	2.6 (1.6)	2.7 (1.7)
	3rd	2.6 (1.6)	2.9 (1.8)	3.0 (1.9)	3.1 (1.9)	3.2 (2.0)
	4th	4.1 (2.5)	4.6 (2.9)	4.8 (3.0)	5.0 (3.1)	5.2 (3.2)
Medium	1st	3.2 (2.0)	3.5 (2.2)	3.7 (2.3)	3.9 (2.4)	4.0 (2.5)
	2nd	5.0 (3.1)	5.5 (3.4)	5.8 (3.6)	6.0 (3.7)	6.2 (3.9)
	3rd	6.1 (3.8)	6.9 (3)	7.2 (4.5)	7.3 (4.5)	7.5 (4.7)
	4th	9.6 (6.0)	10.8 (6.7)	11.4 (7.1)	11.8 (7.3)	12.0 (7.5)
High	1st	7.5 (4.7)	8.4 (5.2)	8.8 (5.5)	9.2 (5.7)	9.4 (5.8)
	2nd	11.7 (7.3)	12.9 (8.0)	13.6 (8.4)	14.2 (8.8)	14.5 (9.0)
	3rd	14.3 (8.9)	15.9 (9.9)	16.8 (10.4)	17.3 (10.7)	17.7 (11.0)
	4th	22.7 (14.1)	25.3 (15.7)	26.7 (16.6)	27.5 (17.1)	28.3 (17.6)

Model 62F – 72F – 82F tractors, 40 km/h version with high–speed bevel drive unit (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 12 Var. 720.320/234 TRANSMISSION						
RANGE / GEAR		TYRE SIZE				
FORWARD		14.9 – 28 (*)	13.6 – 28 380/70 – 28	380/70 – 24	14.5 – 20	420/70 – 24
Low	1st	2.2(11.4)	2.1 (1.3)	1.9 (1.2)	1.7 (1.1)	2.0 (1.2)
	2nd	3.4 (2.1)	3.2)2.0)	2.9 (1.8)	2.6 (1.6)	3.1 (1.9)
	3rd	4.1 (2.5)	3.9 (2.4)	3.6 (2.2)	3.2 (2.0)	3.8 (2.4)
	4th	6.5 (4.0)	6.2 (3.9)	5.7 (3.5)	5.1 (3.2)	6.0 (3.7)
Medium	1st	5.1 (3.2)	4.8 (3.0)	4.4 (2.7)	4.0 (2.5)	4.7 (2.9)
	2nd	7.8 (4.8)	7.5 (4.7)	6.9 (4.3)	6.2 (3.9)	7.2 (4.5)
	3rd	9.6 (6.0)	9.1 (5.7)	8.4 (5.2)	7.5 (4.7)	8.9 (5.5)
	4th	15.3 (9.5)	14.6 (9.1)	13.4 (8.3)	12.0 (7.5)	14.2 (8.8)
High	1st	12.0 (7.5)	11.4 (7.1)	10.5 (6.5)	9.4 (5.8)	11.0 (6.8)
	2nd	18.5 (11.5)	17.6 (10.9)	16.2 (10.1)	14.5 (9.0)	17.0 (10.6)
	3rd	22.6 (14.0)	21.5 (13.4)	19.8 (12.3)	17.8 (11.1)	20.8 (12.9)
	4th	36.0 (22.4)	34.3 (21.3)	31.5 (19.6)	28.3 (17.6)	33.2 (20.6)
REVERSE						
Low	1st	2.1 (1.3)	2.0 (1.2)	1.9 (1.2)	1.7 (1.1)	2.0 (1.2)
	2nd	3.3 (2.0)	3.1 (1.95)	2.9 (1.8)	2.6 (1.6)	3.0 (1.9)
	3rd	4.0 (2.5)	3.8 (2.4)	3.5 (2.2)	3.2 (2.0)	3.7 (2.3)
	4th	6.4 (4.0)	6.1 (3.8)	5.6 (3.5)	5.0 (3.1)	5.9 (3.7)
Medium	1st	5.0 (3.1)	4.8 (3.0)	4.4 (2.7)	3.9 (2.4)	4.6 (2.9)
	2nd	7.7 (4.8)	7.3 (4.5)	6.7 (4.2)	6.0 (3.7)	7.1 (4.4)
	3rd	9.4 (5.8)	9.0 (5.6)	8.2 (5.1)	7.4 (4.6)	8.7 (5.4)
	4th	15.0 (9.3)	14.3 (8.9)	13.1 (8.1)	11.8 (7.3)	13.8 (8.6)
High	1st	11.7 (7.3)	11.2 (7.0)	10.3 (6.4)	9.2 (5.7)	10.8 (6.7)
	2nd	18.1 (11.2)	17.3 (10.7)	15.8 (9.8)	14.2 (8.8)	16.7 (10.4)
	3rd	22.2 (13.8)	21.1 (13.1)	19.4 (12.0)	17.4 (10.8)	20.4 (12.7)
	4th	35.2 (21.9)	33.6 (20.9)	30.8 (19.1)	27.7 (17.2)	32.5 (20.2)

(*) Do not apply to model 62F

Print No. **603.54.283.00** – 09 – 1994

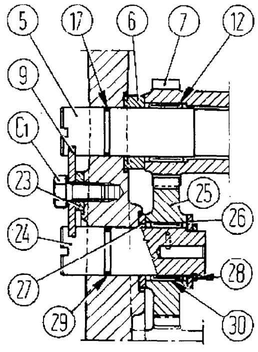
Model 72LP – 82LP, 30 km/h version tractors

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 12 Standard TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		420/70 – 24	14.9 – 28	16.9 – 28
Low	1st	1.7 (1.1)	1.8 (1.15)	1.9 (1.2)
	2nd	2.6 (1.6)	2.7 (1.7)	2.9 (1.8)
	3rd	3.1 (1.9)	3.4 (2.1)	3.5 (2.2)
	4th	4.9 (3.0)	5.3 (3.3)	5.6 (3.5)
Medium	1st	3.9 (2.4)	4.2 (2.6)	4.4 (2.7)
	2nd	5.9 (3.7)	6.4 (4.0)	6.7 (4.2)
	3rd	7.2 (4.5)	7.9 (4.9)	8.2 (5.1)
	4th	11.5 (7.1)	12.5 (7.8)	13.1 (8.1)
High	1st	9.1 (5.7)	9.8 (6.1)	10.3 (6.4)
	2nd	13.9 (8.6)	15.1 (9.4)	15.8 (9.8)
	3rd	17.1 (10.6)	18.5 (11.5)	19.4 (12.0)
	4th	27.1 (16.8)	29.4 (18.3)	30.8 (19.1)
REVERSE				
Low	1st	1.7(1.1)	1.8 (1.1)	1.9 (1.2)
	2nd	2.5 (1.6)	2.7 (1.7)	2.8 (1.7)
	3rd	3.0 (1.9)	3.3 (2.0)	3.4 (2.1)
	4th	4.8 (3.0)	5.3 (3.3)	5.5 (3.4)
Medium	1st	3.8 (2.4)	4.1 (2.5)	4.3 (2.7)
	2nd	5.8 (3.6)	6.3 (3.9)	6.6 (4.1)
	3rd	7.0 (4.3)	7.7 (4.8)	8.0 (5.0)
	4th	11.3 (7.0)	12.2 (7.6)	12.8 (7.9)
High	1st	8.9 (5.5)	9.6 (6.0)	10.1 (6.3)
	2nd	13.7 (8.5)	14.8 (9.2)	15.6 (9.7)
	3rd	16.7 (10.4)	18.1 (11.2)	19.0 (11.8)
	4th	26.7 (16.6)	28.9 (17.9)	30.3 (18.8)

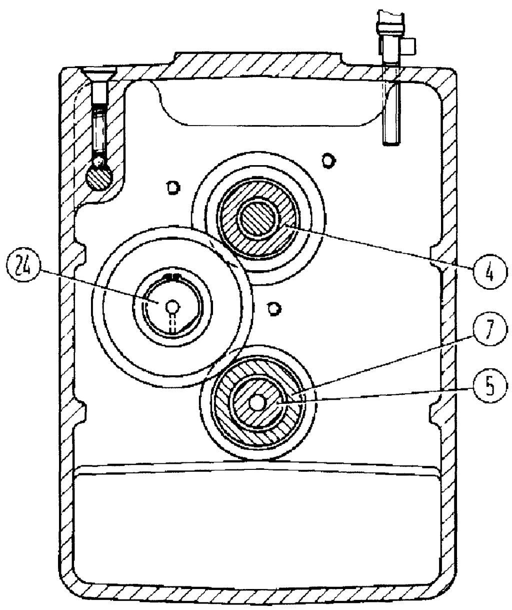
Model 72LP – 82LP, 40 km/h version tractors with high–speed bevel drive (DT version only)

MAXIMUM NOMINAL SPEEDS IN KM/H (MPH) – 12 + 12 Var. 720.320/324 TRANSMISSION				
RANGE / GEAR		TYRE SIZE		
FORWARD		14.9 – 28	420/70 – 24	16.9 – 28
Low	1st	2.2 (1.4)	2.0 (1.2)	2.3 (1.4)
	2nd	3.4 (2.1)	3.1 (1.9)	3.5 (2.2)
	3rd	4.1 (2.5)	3.8 (2.4)	4.3 (2.7)
	4th	6.5 (4.0)	6.0 (3.7)	6.8 (4.2)
Medium	1st	5.1 (3.2)	4.7 (2.9)	5.3 (3.3)
	2nd	7.8 (4.8)	7.2 (4.5)	8.2 (5.1)
	3rd	9.6 (6.0)	8.9 (5.5)	10.1 (6.3)
	4th	15.3 (9.5)	14.1 (8.8)	16.0 (9.9)
High	1st	12.0 (7.5)	11.0 (6.8)	12.5 (7.8)
	2nd	18.5 (11.5)	17.0 (10.6)	19.3 (12.0)
	3rd	22.6 (14.0)	20.8 (12.9)	23.7 (14.7)
	4th	36.0 (22.4)	33.2 (20.6)	37.7 (23.4)
REVERSE				
Low	1st	2.1 (1.3)	2.0 (1.2)	2.2 (1.4)
	2nd	3.3 (2.0)	3.0 (1.9)	3.4 (2.1)
	3rd	4.0 (2.5)	3.7 (2.3)	4.2 (2.6)
	4th	6.4 (4.0)	5.9 (3.7)	6.7 (4.2)
Medium	1st	5.0 (3.1)	4.6 (2.9)	5.2 (3.2)
	2nd	7.7 (4.8)	7.1 (4.4)	8.1 (5.0)
	3rd	9.4 (5.8)	8.7 (5.4)	9.9 (6.1)
	4th	15.0 (9.3)	13.8 (8.6)	15.7 (9.7)
High	1st	11.7 (7.3)	10.8 (6.7)	12.3 (7.6)
	2nd	18.1 (11.2)	16.7 (10.4)	18.9 (11.7)
	3rd	22.2 (13.8)	20.4 (12.7)	23.2 (14.4)
	4th	35.2 (21.9)	32.5 (20.2)	36.9 (22.9)

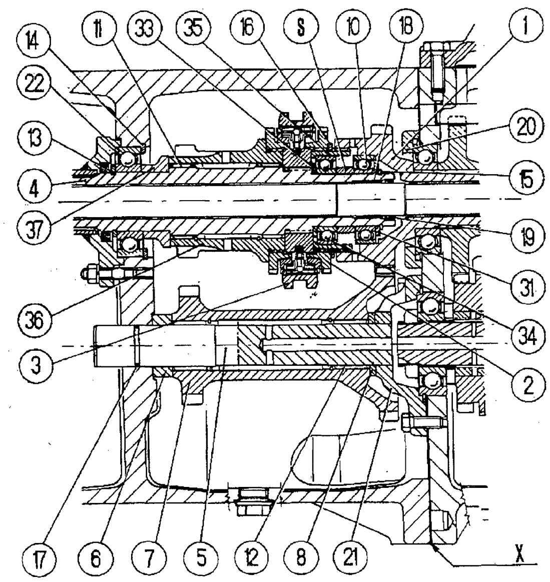
Print No. **603.54.283.00** – 09 – 1994



13021



11653

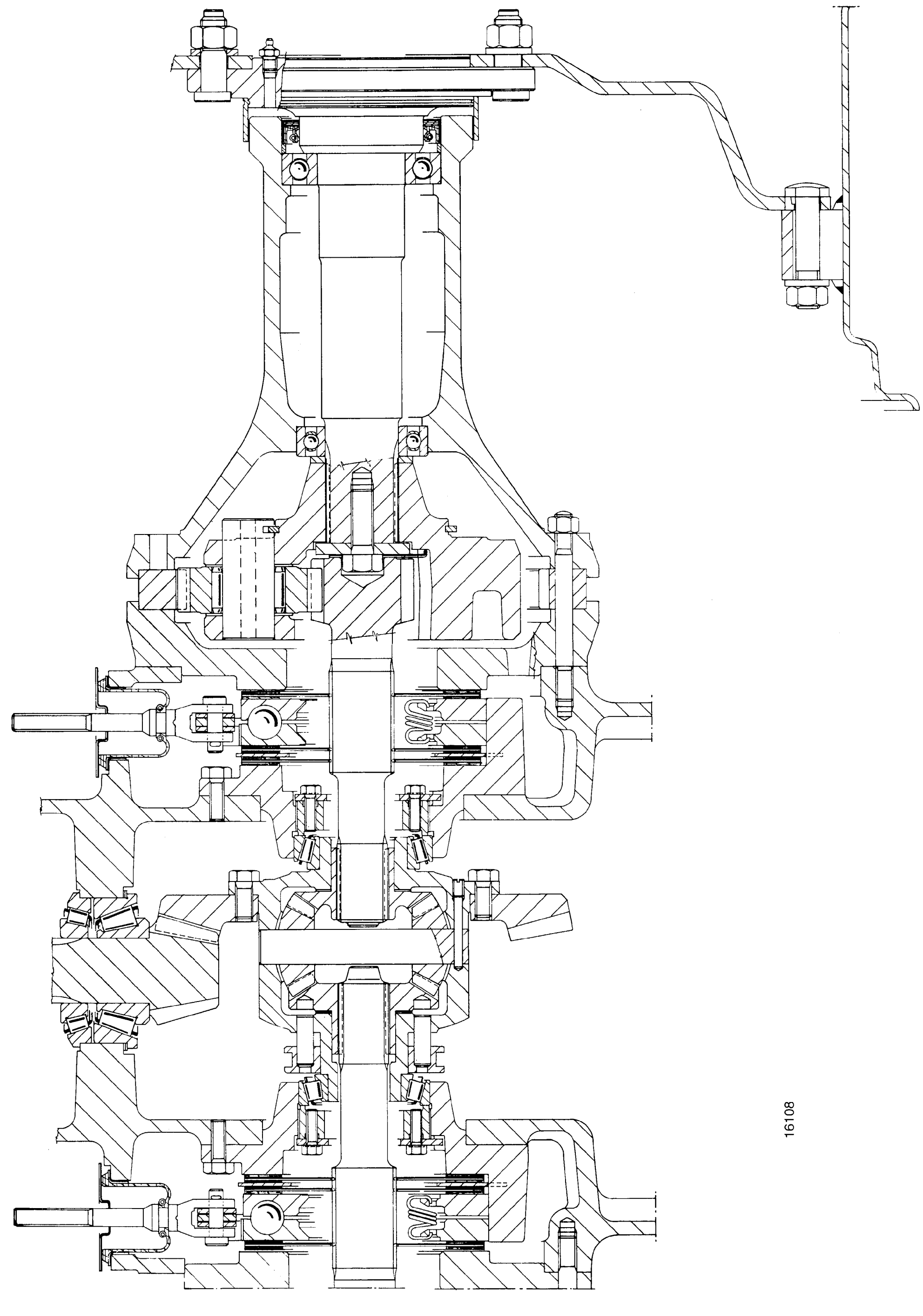


22736

Sectional views of the mechanical synchromeshed reverser unit model 62F – 72F – 82F – 72LP – 82LP tractors

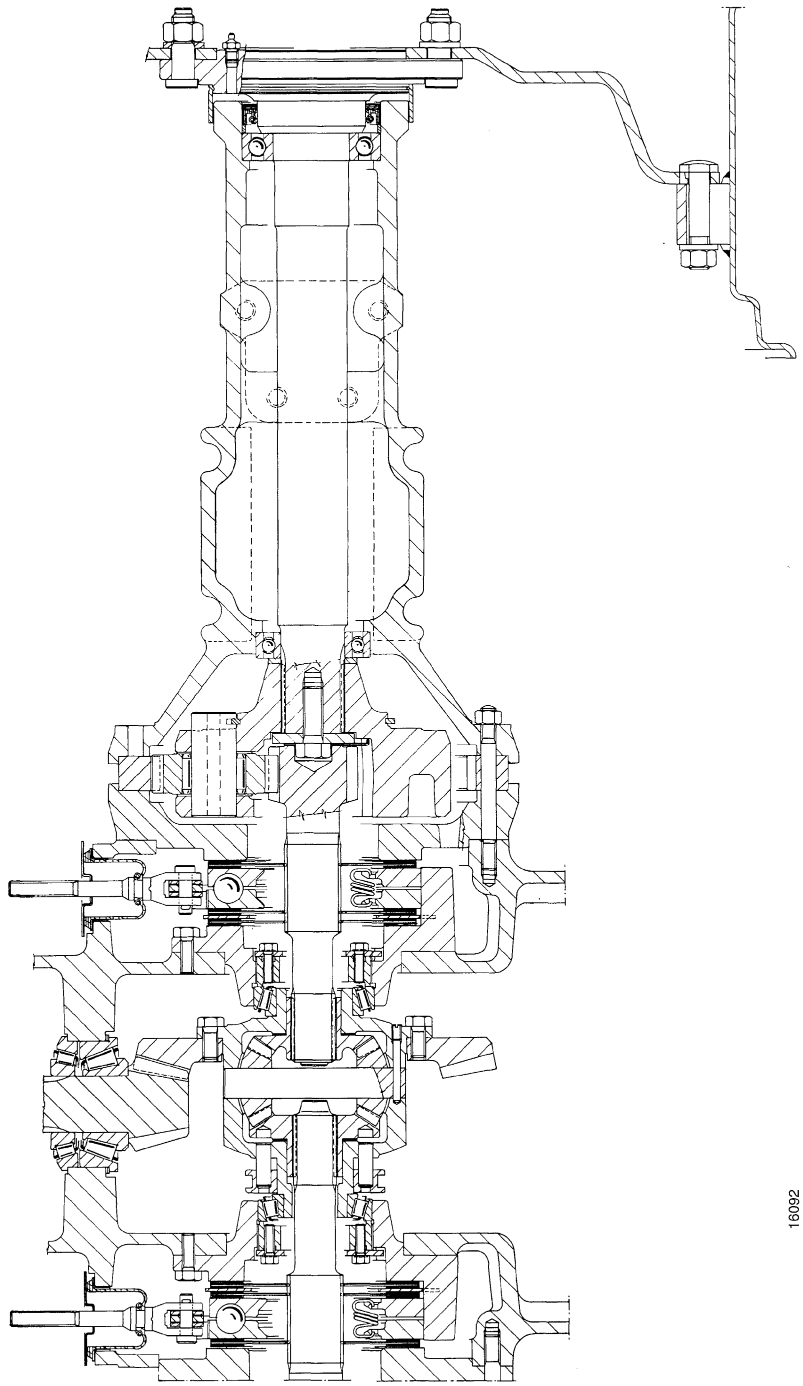
C_1. Lock plate (9) set screw – S. Shim – 1. Transmission–reverser shaft – 2. Reverser engagement – 3. Reverser copntrol synchromesh – 4. Clutch–reverser shaft – 5. Intermediate gear axle pin – 6. Intermediate gear front thust ring – 7. Lower intermediate gear – 8. Intermediate gear rear thrust ring – 9. Axle pin (5 and 24) lock plate – 10. Ball bearings – 11,12. Needle bearings – 13,14,15,16. Retaining circlips – 17. O–ring seal – 18. Power take–off shaft bearing bushing – 19. Oil seals – 20. Transmission drive shaft bearing housing – 21. transmission driven shaft bearing housing – 22. Ball bearing – 23. Lock plate spacer – 24. Intermediate gear axle pin – 25. reverser intermediate gear – 26,27. Intermediate gear thrust rings – 28. Retaining circlip – 29. O–ring seal – 30. Needle bearing – 31,33. Thrust rings – 34. Ball bearing – 35. Collar – 36. Reverser drive shaft – 37. Thrust ring.

Nota – At assembly, clean and degrease mating surfaces **X** and apply one of the sealing compounds indicated on page 1, section 00.



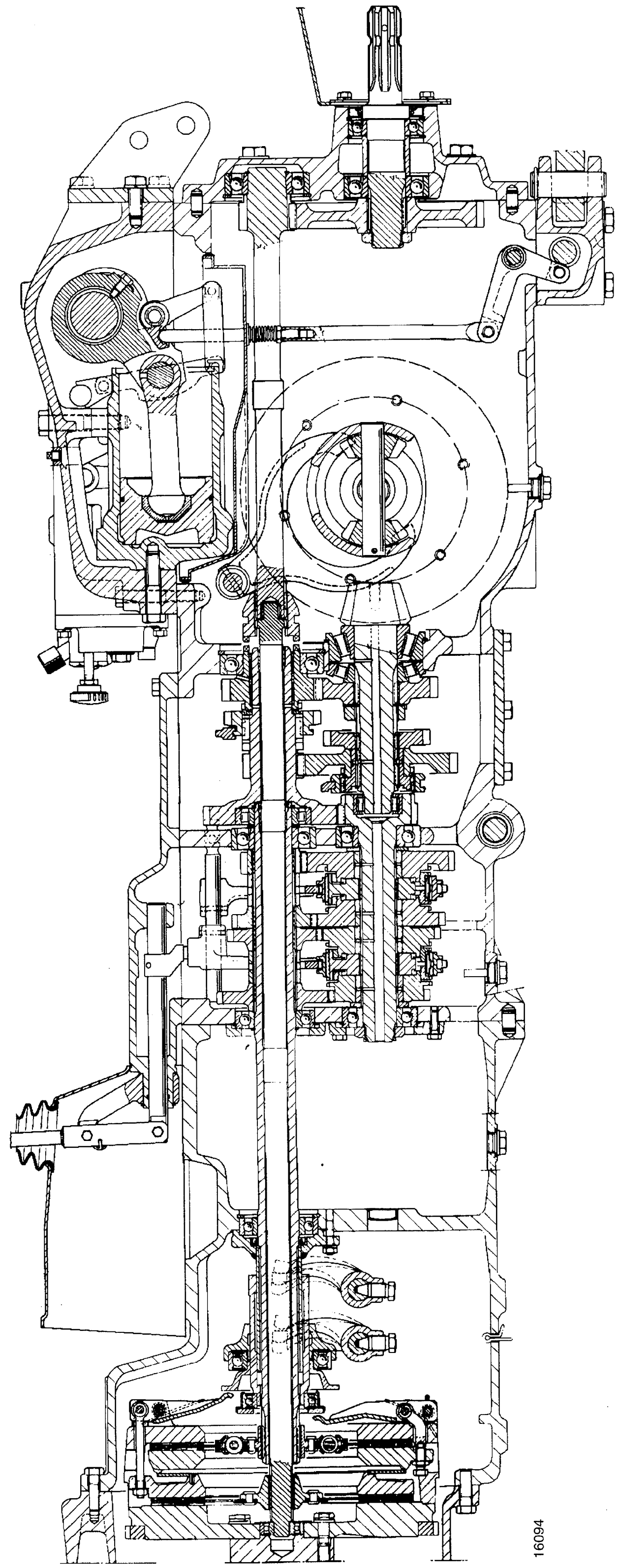
Transmission cross-sectional view – Model 62F – 72F – 82F tractors

Print No. ***603.54.283.00*** *– 09 – 1994*



Transmission cross–sectional view – Model 72LP – 82LP tractors

Print No. **_603.54.283.00_** _– 09 – 1994_



12 + 4 transmission longitudinal section – Model 62F – 72F – 82F – 72LP – 82LP tractors

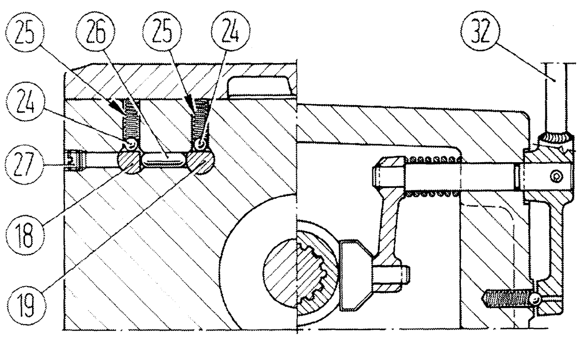
Print No. **603.54.283.00** – 09 – 1994

TRANSMISSION–REAR DRIVE CASE
Model 62F – 72F – 82F – 72LP – 82LP tractors
Removal–Installation (Operation 2111810)

Proceed as illustrated on page 21–18.

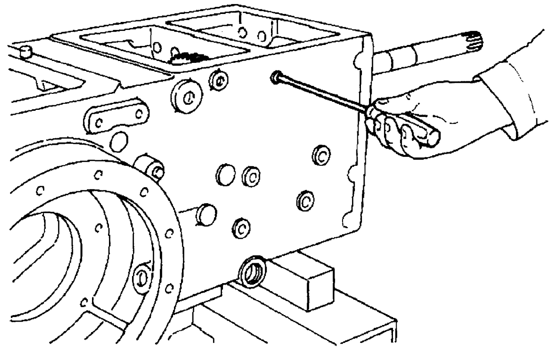
Prior to implementation of any further operation, carry on the preliminary disassemblies, following instructions of page 21–19, necessary for the subsequent installation of the transmission case on the revolving stand.

INSIDE COMPONENTS – Model 62F – 72F – 82F – 72LP – 82LP tractors Disaaembly–Assembly of transmission case removed from tractor (Operations 2114840 – 2114842 – 2114844 – 2114848 – 2114860 – 2114862 – 2114868).



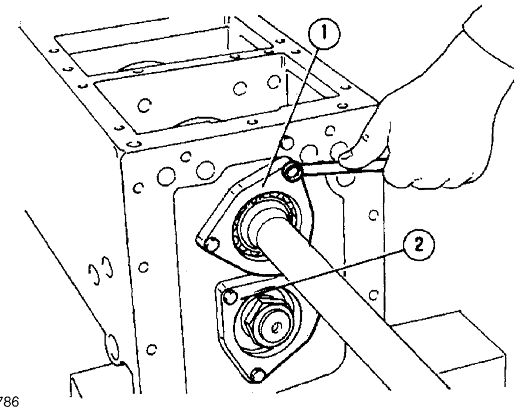
13025

1. Remove the transmission and splitter shift rails (18,19 and 20,21, respectively, see page 21–35) and retrieve their respective detent springs (25) and balls (24).



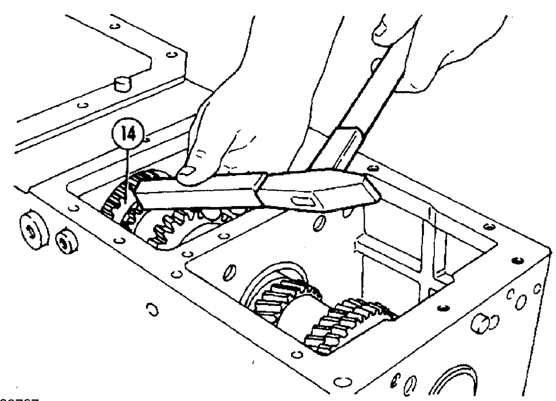
22785

2. Undo the two screws (27) on both sides of the transmission case and then remove the speed range selection detent pawls (26).



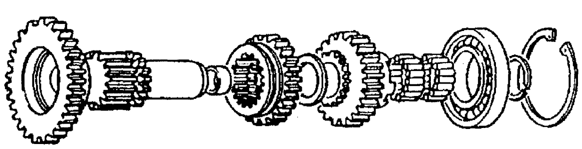
22786

3. Remove the transmission front bearing housings (1 and 2), shift into any two gears.



22787

4. Undo the splitter drive shaft (9) rear bearing (38) retaining circlip (13, page 21–35) and then remove the medium speed range drive shaft (14) together with ball bearing (38) and needle bearing, proceeding as shown in the accompanying figure.



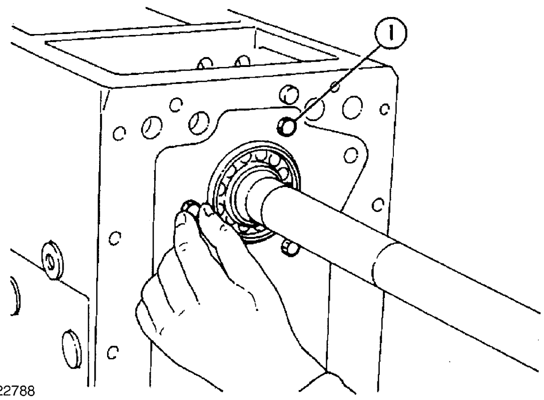
22720

Exploded view of the constant–mesh and creeper speed drive shaft

5. Withdraw the constant–mesh and creeper speed drive shaft (9) complete with the medium range speed and reverse gear (11).

Print No. **603.54.283.00** – 09 – 1994

6. Remove the transmission drive shaft rear bearing retaining circlip (15, page 21–35).

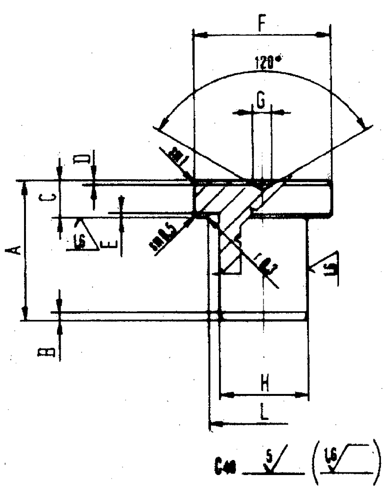


22788

7. Fit three M8x1.25 screws (1) in the front bearing housing threaded holes and screw them up until contacting three teeth of the fourth speed gear.

Note – This operation is necessary to establish a reaction so to prevent interference, when forcing the shaft (5, page 21–35) out, as further described, between the drive shaft rear ball bearing outer race and the 1st speed gear on the transmission driven shaft.

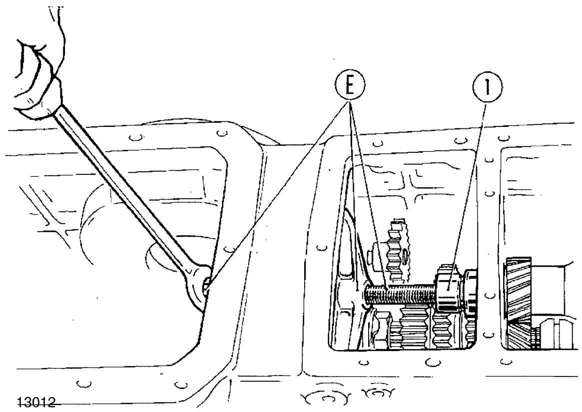
Note – To remove the transmission drive shaft, we recommend the use of the special drive punch that can be made in the workshop with the aid of the dimensioned working drawing which follows.



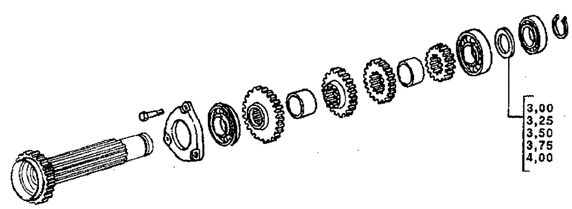
13015

Working drawing of the self–made drive punch for the removal of the transmission drive shaft (mark 50006).

A = 40 mm (1.575 in) – B = 2.5 mm (.010 in) 15° chamfer – C = 10 mm (.394 in) – D = 1 mm (.039 in) – E = 1.5 mm (.059 in) – F = 39.5 mm (1.555 in) dia. – G = 5 mm (.197 in) dia. – H = 24.85÷24.95 mm (.978÷982 in) dia. – L = 31.5 mm (1.240 in) dia. – Sm 0.5 = 0.5 mm (.02 in) chamfer – Sm 1 = 1 mm (.04 in) chamfer – r 0.3 = 0.3 mm (.012 in) radius.



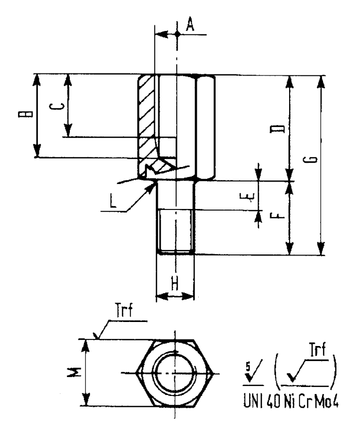
8. Fit the self–made drive punch (1) in the drive shaft housing, then remove the shaft using a universal puller (E), as shown in the figure, and, finally, recover components from inside the transmission case.



22789

Explodede view of the transmission drive shaft

Note – To remove the reverse intermediate gear axle pin and the bevel pinion shaft make the adapter illustrated in the dimensioned working drawing which follows.

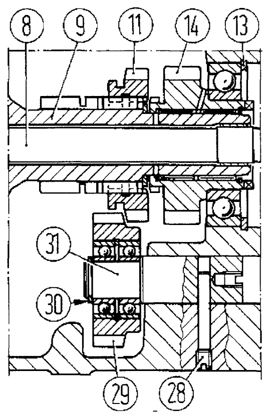


13011

Self–made adapter for the removal of the reverse intermediate gear axle pin and the bevel pinion shaft.

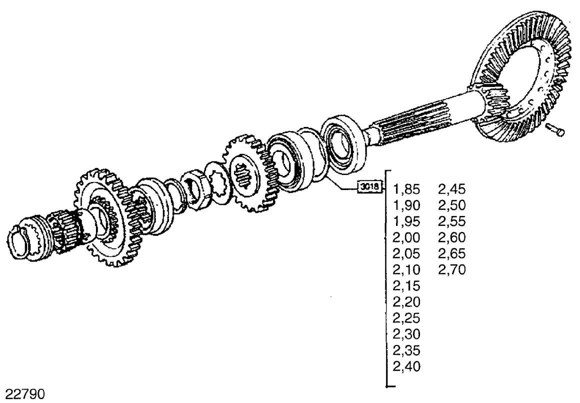
A = M14x1.5 – B = 28 mm (1.102 in) – C = 21 mm (.827 in) – D = 35 mm (1.378 in) – E = 10 mm (.394 in) – F = 25 mm (.984 in) – G = 60 mm (2.362 in) – H = M12x1.25 – L = 2.5 mm (.010 in) radius – M = 22 h 11 mm (.86 H .04 in).

Print No. ***603.54.283.00*** *– 09 – 1994*



14197

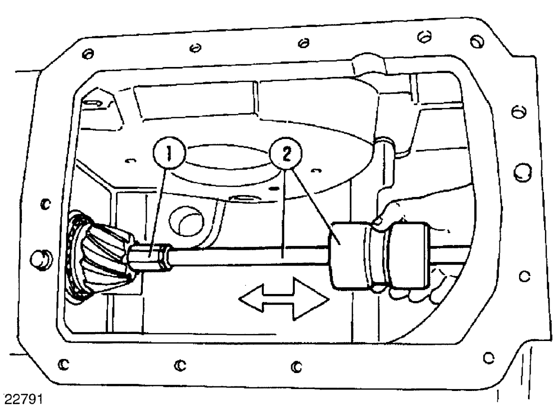
9. Remove circlip (30) and the reverse intermediate gear (29) with bearings and internal circlip, as an assembly. If necessary, remove the set screw (28), apply the adapter and remove shaft (31) using the **292927** hammer–type puller.



22790

Exploded view of the bevel drive pinion shaft

10. Partially unscrew the bevel drive pinion shaft bearing adjustment nut.

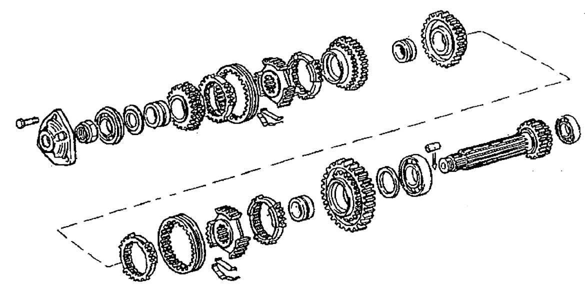


22791

11. Install the self–made adapter (1) and attach it to a hammer–type driver tool (2).

12. Operate the driver to partially withdraw the pinion for removing the retaining circlip (36, page 21–35), move gears (33 and 34) towards the transmission case side and , finally, remove half–rings (37).

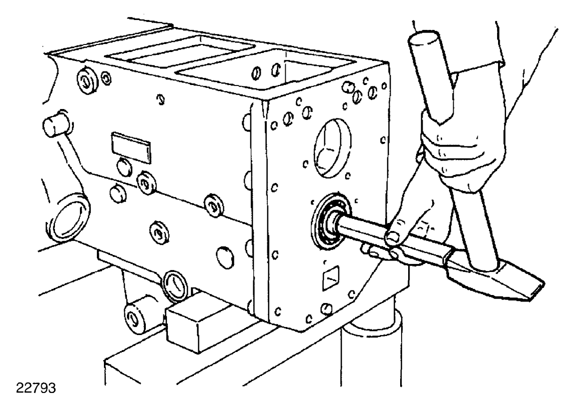
13. Undo pinion shaft bearing adjustment nut, remove pinion and retrieve gears from inside case (to retrieve shims, remove the outer race of the bearing pinion end, from the case housing also).



22792

Exploded view of the transmission driven shaft

14. Remove the driven gear shaft locknut (C_1, page 21–35).



22793

15. Using a driver and hammer, push on the front end of the transmission driven shaft and retrieve from the inside of the housing the loose parts illustrated here above.

Important – The removal and installation operations described in this section of the Manual are referred to the transmission and splitter overhauling process. To overhaul the splitter only, it is not necessary to separate the transmission–rear drive case from the clutch housing as access to the splitter gears is possible through the rear end of the tractor. See the bevel drive topic in section 27 for instructions concerning the removal and installation operations necessary to overhaul the splitter alone.

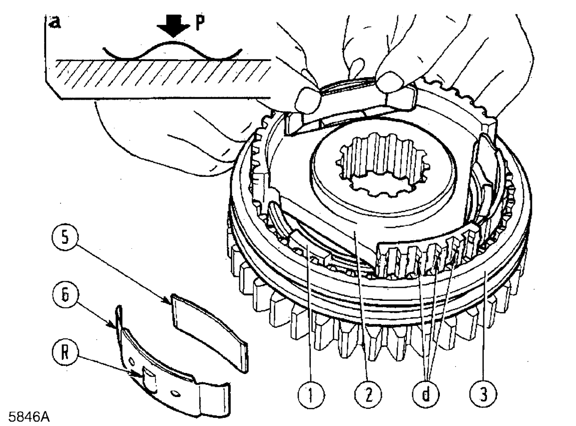
Print No. **603.54.283.00** – 09 – 1994

INSPECTIONS

CAUTION

Never use petrol, solvents or other flammable fluids to clean loose parts. Use exclusively homologated, non–flammable and non toxic commercial solvents.

Check that oil seals are in good conditions without evidence of deep scoring or tear on working surfaces or of permanent deformations, in which case they should be replaced.



Fitting blade springs (5) and adapters (6) on synchromesh units.

a. Detail drawing showing the checking of blade springs – d. Gear disengagement safety yeeth – P = 31÷34 N (3.2÷3.5 kg – 7÷7.7 lb). Check load – R. Blade adapter central projection – 1. Tapered synchromesh ring – 2. Fixed collar – 3. Sliding collar.

Verify blade spring (5) conditions as follows:

— place the spring on a flat surface (see detail a), press on center of spring and check that under a load (P) of 31÷34 N (3.2÷3.5 kg – 7÷7.7 lb) the spring will deflect 1.4 mm (.06 in), approximately;

— inspect adapters (6) to make sure that no permanent deformation or kinks are present, especially on the central projecting surface (R).

16. ASSEMBLY

Assemble the transmission and splitter in accordance with the following instructions and information:

a. proceed by reversing the previous disassembly sequence of operations starting from no. 15 back to 1;

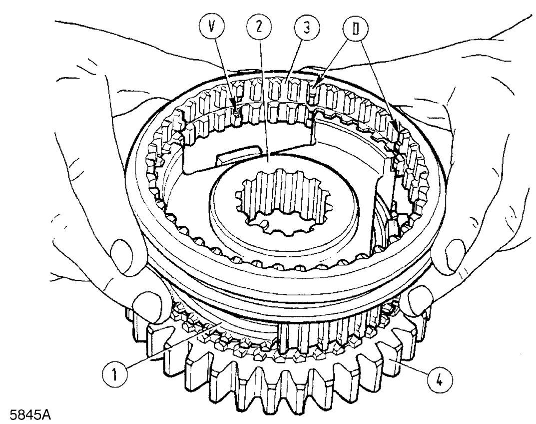
b. consult the preceding figures and exploded views to make sure to install parts the correct way;

c. make sure the housing is duly clean, inside compartments in particular;

d. prior to the installation of housings, bearing housings and covers, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the scheme indicated in the respective sections of the Manual;

e. tighten fastenings to the torque data of page 21–35;

f. follow instructions and information and adjust as indicated herebelow.



Fitting the synchromesh device sliding collar (3).

D. Projecting teeth – V. Blade spring adapter retaining seat – 1. Tapered synchromesh ring – 2. Fixed collar – 3. Sliding collar – 4. Driven gear

Fit the synchromesh devices (here exemplified by the 3rd and 4th speed gears) as follows:

— place on the 3rd driven gear (4), complete with inside ring, a synchromesh ring (1) and fixed collar (2) with the three toothed sectors meshing with the vanes of the previously installed one and with the spline pilot chamfer facing the gear:

— fit the sliding collar (3) with its projecting teeth (D) delimitating the three splined sectors of fixed collar (2);

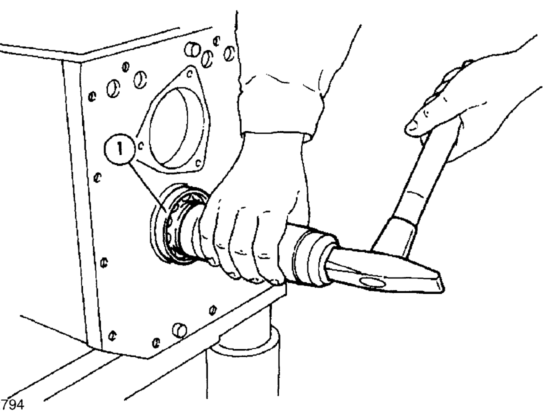
— fit blade spring (5) to adapter (6) as shown in the accompanying figure and fit them together in their respective seats;

Print No. ***603.54.283.00*** *– 09 – 1994*

— introduce the second synchromesh ring with the three front tabs corresponding to the ones on the previous ring and then install the 4th speed driven gear;

— try, by hand, to engage the sliding collar in both directions.

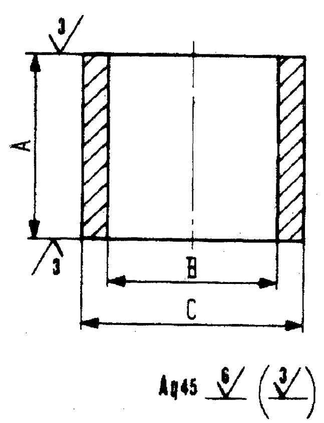
Install the transmission driven shaft with its rear bearing, as indicated on pages 21–35 and 49, fitting the gears, bushings and synchromesh devices inside the housing and lubricating mating surfaces with engine oil.



22794

Place front bearing (1) positioned on the housing and force fit it in place using a specific driver punch and hammer, then torque tighten the ring nut (C_1, page 21–35).

Introduce the two gear shift forks without connecting them to their respective shift rods.

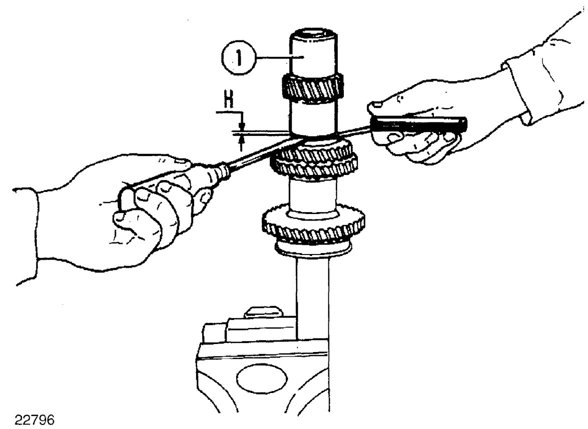


13014

Self–made tool for the transmission drive shaft bearing adjustment (Stamp 50007).

A = 43.3÷43.5 mm (1.7÷1.71 in) – B = 40.5 mm (1.59 in) dia.– C =52 mm (2 in) dia.

Note – Once assembled, the prescribed drive shaft gear end play is 0÷0.25 mm (0÷.010 in). Consequently, it is necessary to adjust the bearings to avoid the possibility of their being pre–loaded, using the self–made tool illustrated here above.



22796

Adjusting the transmission drive shaft bearings

H. Clearance measured with the feeler gauge – 1. Self–made tool (see working drawing in the accompanying figure).

Assemble on the work bench the transmission drive shaft fitted with front bearing and gears but without shim (S, page 21–35) and the two rear bearings (one ball and one needle bearing).

Install the self–made tool (1) and keep it in contact with the rear retaining circlip by inserting a screwdriver tip between gear and bushing, as shown.

Measure, using a feeler gauge, clearance (H) between gear and bushing produced by the screwdriver pressure.

Measure, then, the thickness **(Hs)** of the self–made tool and the thickness of the inner races of both bearings.

The thickness of shim (S, page 21–35) is given by:

$$\mathbf{S = H + Hs - Hc_1 - Hc_2}$$

where:
H = measured clearance
Hs = tool thickness
Hc_1 e Hc_2 = measured bearing thickness.

Example:
— measured clearance H = 1.3 mm (0.5 in)

— tool thickness Hs = 43.5 mm (1.71 in)

— ball bearing thickness Hc_1 = 22.9 mm (.9 in)

— needle bearing thickness Hc_2 = 18 mm (.7 in)

— shim thickness:

S = 1.3 + 43.5 – 22.9 – 18 = 3.9 mm (.15 in)

Print No. ***603.54.283.00*** *– 09 – 1994*

Note – As gears are to be assembled with a 0÷0.25 mm (0÷.010 in) end play, in this case the desired thickness of shim (S, page 21–30) is 3.75 mm (.148 in) allowing a 3.9 – 3.75 = 0.15 mm (.006 in) end play.

Install the transmission drive shaft with gears and a shim (S) of the previously calculated thickness (as indicated on pages 21–35 and 21–48) paying attention to the positioning of the 4th speed gear (inner chamfer facing the front bearing).

Install the transmission shift rails assembled with detent balls, springs and pawl.

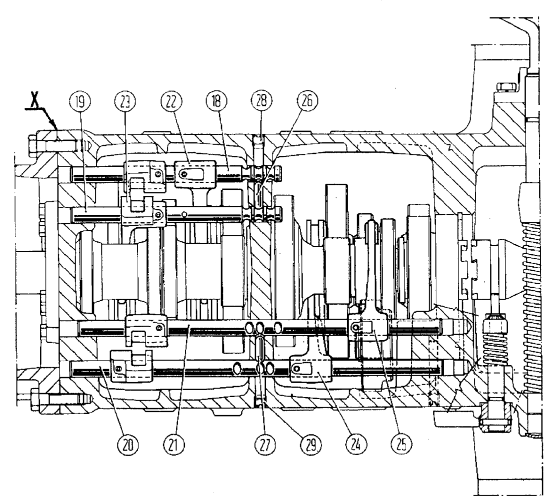
Install the bevel drive pinion shaft with gears (as indicated on pages 21–35 and 21–49) after adjusting the bearing positioning and pre–load as described in section 27.

In addition, pay a particular attention to the assemblying of the transmission straight drive and low range speed shift collar (35) which must be positioned as shown in the illustartion on page 21–35.

Install the reverse speed gear as shown on page 21–49 and the shift fork.

Install the splitter drive shaft assembly as indicated on page 21–47.

Fit the sliding collar shift fork and the speed range selection horizontal shift rods assembled with their detent balls, springs and pawl.



Top view of the transmission and splitter unit

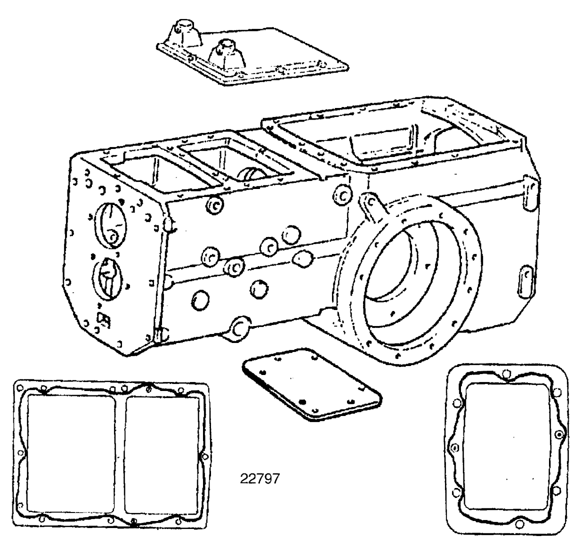
18. 1st and 2nd speed gear shift rail – 19. 3rd and 4th speed gear shift rail – 20. Low and medium range speed shift rail – 21. Medium and reverse speed gear shift rail – 22. 1st and 2nd speed gear shift fork – 3rd and 4th speed gear shift fork – 24. Low and high speed gear shift fork – 25. medium range and reverse speed gear shift fork – 26. Speed range detent pawl – 28,29. Plugs.

Important – Screw plugs (28 and 29) on using one of the sealing compounds indicated on page 1, Section 00. After assembly, inspect for oil leaks.

Note – This operation completes the assembly of the transmission inside component parts.

In addition, it will be necessary to assemble/install those component units and parts previously removed from the transmission case to facilitate its installation on the revolving stand and the disassembly of the transmission and removal of inside parts.

To re–assemble these components or units, proceed by reversing the disassembly sequence of operations of page 21–19, following the instructions and informations indicated in the relevant sections of this Manual.



Re–fit the top and bottom covers, if previously removed, to the transmission–rear drive case after thoroughly cleaning and degreasing mating surfaces followed by the application of a round strip of sealing compound about 2 mm (.08 in) thick following the scheme shown above.

Suitable types of sealing compounds are indicated on page 1, section 00.

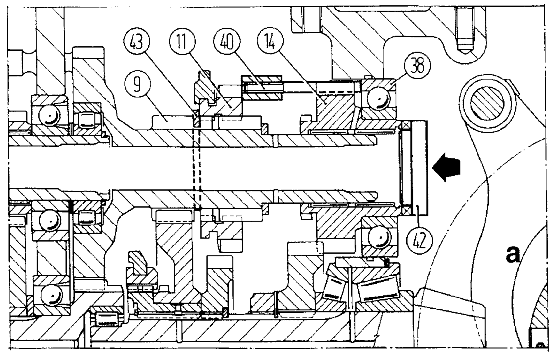
Print No. 603.54.283.00 – 09 – 1994

REPLACING BEARING (38) ALONE OR GEAR (14) WITH BEVEL DRIVE UNIT INSTALLED
Model 62F – 72F – 82F – 72LP – 82LP tractors

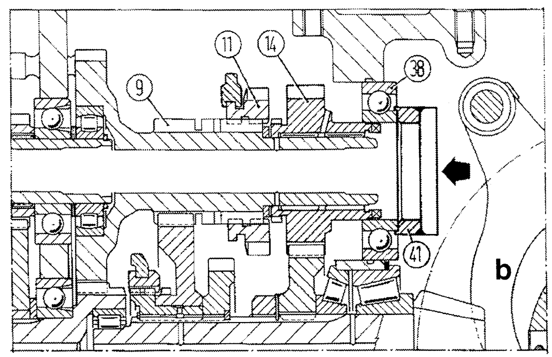
Note – The replacement of the splitter drive shaft bearing (38) alone or of the medium speed range drive gear (14) does not require the disassembly of the bevel ring gear–differential unit.

In this case, after making in the workshop the self–made special tools according to the dimensioned working drawings at the bottom of this page, proceed as follows:

1. Remove from the tractor the transmission case top cover, power–take off rear cover and hydraulic lift unit.
2. Undo the bearing retaining circlip (13, page 21–35).
3. Push gear (14) with bearing (38) towards the rear in the transmission case, fit the self–made tool (43) on the constant–mesh and creeper speed drive gear (9) and move gear (11) against tool (43) as shown in the accompanying figure.
4. Install at 180° from each other the two self–made tools (40) setting their length so to produce a reaction both on the gear (11) and outer race of bearing (38).
5. Install self–made tool (42) and hammer it to drive gear (14) off the bearing (38).
6. Recover from the rear end of the transmission the bearing (38) and, if desired, gear (14) also.
7. Fit the new bearing using the self–made tool (41) as shown in the accompanying figure.



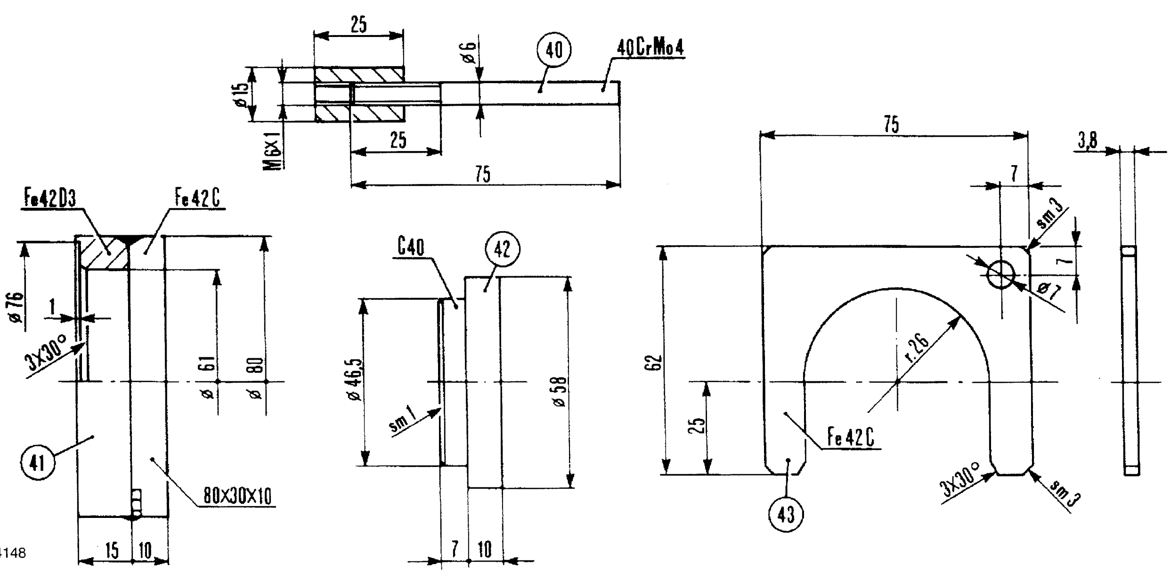
14151



14156

Disassembly (Fig. a) and assembly (Fig. b) of the splitter drive shaft rear bearing (38) and of the medium speed range drive gear (14) woth bevel ring gear–differential unit installed.

9. Constant–mesh and creeper speed drive shaft – 11. Reverse gear and medium speed range shift gear – 40,41,42,43. Self–made special tool working drawings.



14148

Dimensioned working drawings of self–made special tools to be made in the workshop for the removal of the splitter driven shaft rear bearing and of the medium speed range drive gear (stamp self–made tools with code no.: 50028) – Metric dimensions (mm).
Note – Make two samples of tool no. 40.

Print No. 603.54.283.00 – 09 – 1994

CREEPER SPEEDS AND REVERSER (Description) – Model 62F – 72F – 82F – 72LP – 82LP tractors.

The combination of the creeper speeds and mechanical reverser, full synchromesh and cascade–scheme, spur gear type, is installed between the clutch and transmission, allowing the selection of 20 forward and 12 reverse speed gears.

The creeper speed and reverser units are separately controlled through two hand levers situated on the operator's left–hand side.

SYNCHROMESHED MECHANICAL REVERSER (Description) – Model 62F – 72F – 82F – 72LP – 82LP tractors

It is installed between the clutch and transmission (the latter, in this case, without reverse gears) allowing the selection of 12 forward and 12 reverse speed gears.

Hand–control lever situated on the left–hand side floor board.

REMOVAL–INSTALLATION

DANGER

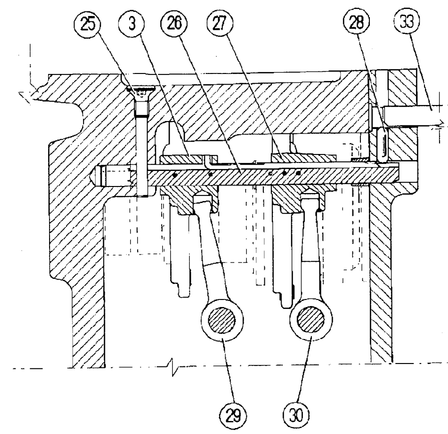
Lift and handle all heavy parts using the appropriate lifting equipment. make sure that the load is held and supported by suitable slings and hooks. Make sure that nobody is standing near by.

To gain access to the creeper speed–reverser combination (or to the reverser), split off the transmission case from the clutch housing. Proceed as instructed on pages 21–24 and 21–25; further, before re–joining the overhauled transmission case to the clutch housing:

Thoroughly clean and degrease the mating surfaces and then apply a round strip of sealing compound about 2 mm (.08 in) thick following the scheme shown in Fig. b, page 21–18.

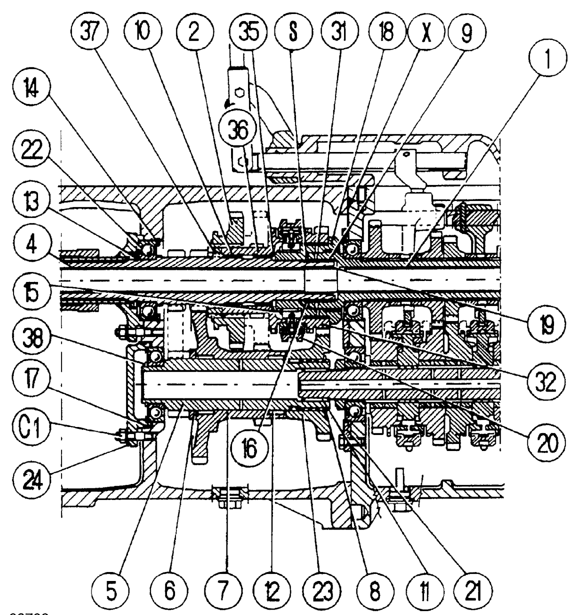
Suitable types of sealing compounds are indicated on page 1, section 00.

REVERSER AND CREEPER SPEED GEARS, SHAFTS AND BEARINGS
Model 62F – 72F – 82F – 72LP – 82LP tractors
Disassembly–Assembly (Operation no. 2116431) with clutch transmission or transmission case removed from tractor



22947

1. Remove the shift rail (26) holding screw (25), the spring pin and recover collars (3), (27), shift rail (26), detent ball and spring and pawl (28).



22798

2. Recover bearings (9) and (11), remove the retaining circlip (8) and gear (23).
3. Remove retaining circlip (16) and withdraw the collar (18) with needle bearing (31), gear (32) and synchromesh (20) together with the shift work

Note – Remove retaining circlip (15) to disassemble.

4. Recover the shim (S) and thrust ring (35).

Print No. ***603.54.283.00*** *– 09 – 1994*

5. Remove the collar (36, page 21–54), needle bearings (10), shift gear (2) and associated shift fork and collar (37).

6. If necessary, remove circlip (14) and pull out the clutch–reverser shaft (4) and associated bearing (22) and circlip (13).

7. Remove the driven gear (7) and recover bearings (12) and thrust ring (6).

Note – Up to this stage the operations described apply exclusively to the overhauling of the creeper speed transmission.

Should instead be necessary to replace the driven gear axle pin (5, page 21–54) also or if it was not possible to disassemble the shaft (4) and, consequently, the driven gear (7) as previously described, then it would be necessary to split off the engine from the clutch case, as follows:

8. Disconnect the engine throttle and shut–off control rods from their respective injection pump leverage, starter cables and panel instrument and indicator electrical cables and the hourmeter flexible cable.

9. Disconnect the fuel lines from transfer pump, filter, injector return connections and the hydraulic steering oil lines (after draining the reservoir).

10. Disconnect the power take–off clutch control cable from the external control lever and the vent rubber tube from its connection on the clutch housing and then separate the fuel tank and associated cowling and hydraulic steering control valve or steering box from the clutch housing.

11. Remove the engine–clutch housing attachment screws and split off the engine with associated front axle or live axle, from the clutch housing.

If, previously, it was not possible to remove the clutch–reduction unit shaft (4, page 21–54), proceed as follows:

remove the retaining circlip (14), withdraw shaft (4) and associated bearing (22) and circlip (13) and retrieve the driven gear (7), bearings (12) and thrust ring (6).

To remove the driven gear (5, page 21–54) axle pin, proceed as per following point 12.

12. Remove nuts (C_1), lid 24, circlip (38) and, finally, the axle pin (5).

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

---

13. ASSEMBLY

Assemble parts in their housing in accordance with the following instructions and information:

a. proceed by reversing the previous disassembly sequence of operations starting from no. 12 back to no. 1;

b. consult the preceding figures and exploded views to make sure to install all parts the correct way;

c. make sure that the housing is duly clean, inside compartments in particular;

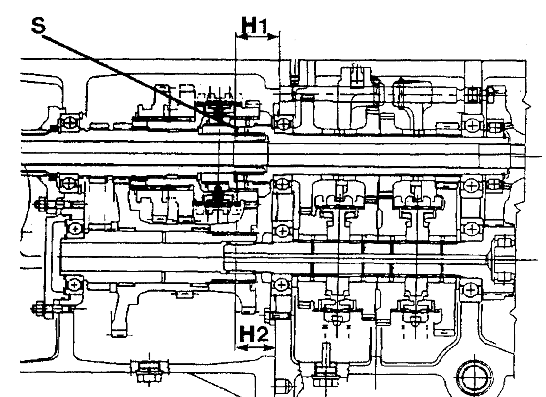
d. prior to the installation of housings, bearing housings and covers, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the scheme indicated in the respective sections of the Manual;

e. tighten fastenings to the torque data of page 21–35.

IMPORTANT

At assembly, make sure that the high speed range detent pawl (28, page 21–54) in correctly fitted in its seat.

When installing collar (18, page 21–54) fit an adjuster shim (S) so to obtain, once assembly operations are completed, a 0÷0.2 mm (0÷.008 in) end play (G).



22799

The shim thicness is found by the following formula:

$\mathbf{S = H_1 - H_2 - G}$ where:

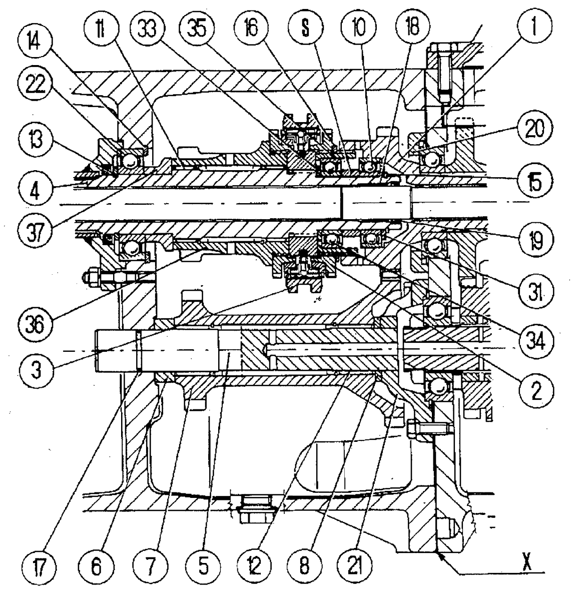
H_1 = distance between inside mating surface of the synchro bearing bushing and clutch housing flange.

H_2 = distance between the transmission drive shaft outer mating surface and transmission housing flange.

G = 0÷0.2 mm (0÷.008 in) end play.

Print No. 603.54.283.00 – 09 – 1994

REVERSER GEARS, SHAFTS AND BEARINGS
Model 62F – 72F – 82F – 72LP – 82LP tractors
Disassembly–Assembly (Operation nos. 2116231 and 2116237)with clutch–transmission case removed from tractor



22736

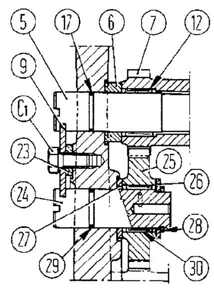
1. Remove the retaining circlip (15), thrust washer (31), ball bearing (10), spacer (32), collar (35) and associated ball bearing (34) and retaining circlip (16) and, finally, thrust ring (33).

2. Remove the synchromesh assembly (3), then the reverser intermediate gear (7) and associated needle bearings (12) and front thrust ring (6).

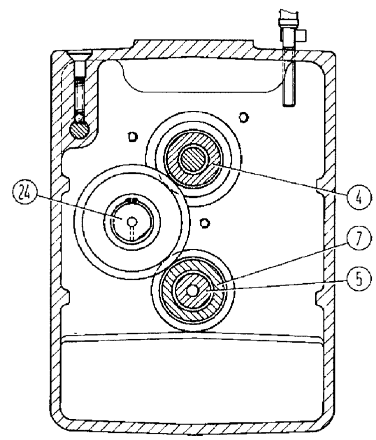
3. Remove the reverser drive gear (36) and associated needle bearings (11).

4. If required, remove the retaining circlip (14) and then withdraw the clutch–reverser shaft (4) and associated bearing (22), thrust ring (37) and circlip (13).

Note – Up to this stage the operations described apply exclusively to the overhauling of the synchromeshed mechanical reverser.



13021



11653

Should instead be necessary to replace the axle pins (5 and 24) or if it was not possible removing the clutch–reverser shaft (4), as previously mentioned, the engine must be separated from the clutch housing, as follows:

5. Disconnect the throttle and shut–off controls rods from their respective injection pump leverage, starter and panel instrument and indicator electric cables and the hourmeter flexible cable.

6. Disconnect the fuel lines from the transfer pump, filters, and injector return connections and the hydraulic steering oil lines, after draining the reservoir.

7. Disconnect the power take–off clutch control rod from the external control lever and the vent rubber tube from its connection on the clutch housing, then separate the fuel tank with cowling and hydraulic steering control valve or steering box as an assembly from the clutch housing.

8. Remove the engine–clutch housing attachment screws and split off the engine with front axle o live axle as an assembly.

9. Remove screw (C_1) and axle pins (5 and 24).

10. Remove the clutch thow–out collars and associated thrust bearings.

11. Remove the ball bearing housing nut and, acting from the opposite end, the shaft and associated circlip (13), bearing (22) and thrust ring (37).

*Print No. **603.54.283.00** – 09 – 1994*

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

12. ASSEMBLY

Assemble parts in their housing in accordance with the following instructions and information:

a. make sure that the housing is duly clean, inside compartments in particular;

b. proceed by reversing the previous disassembly sequence of operations starting from no. 11 back to no. 1;

c. consult the preceding figures and exploded views to make sure that parts are correctly positioned;

d. after assembly of component parts on the clutch–reverser shaft (4, page 21–56) check for an **end play G = 0 ÷ 0.1 mm (0 ÷ .04 in)** between the retaining circlip (15) and thrust ring (31); if not, replace shim **(S)** with another of a suitable thickness.

The following shim thicknesses are available: 13.00 – 13.20 – 13.40 – 13.60 mm with a ± 0.05 mm tolerance (.512 – .520 – .528 – .535 ± .002 in).

e. prior to the installation of housings, bearing housings and covers, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound, about 2 mm (.08 in) thick, following the scheme indicated in the respective sections of the Manual.

f. tighten fastenings to the torque data of page 21–35.

Print No. ***603.54.283.00*** *– 09 – 1994*

Print No. 603.54.283.00 – 09 – 1994

MECHANICAL ENGAGEMENT (DT)

	mm (in)			
	50VDT – 55VDT 60VDT	**55FDT – 60FDT**	**70VDT**	**62FDT – 72FDT 82FDT – 72LPDT 82LPDT**
Speed reduction ratio, 30 km/h version ...	1 : 1,57 (34/24 x 18/40)	1 : 1,12 (34/23 x 23/38)	1 : 1.09 (34/28 x 28/37)	1 : 1 (34/24 x 24/34)
Speed reduction ratio, 40 km/h version ...	—	—	—	1 : 1.03 (34/24 x 24/35)
Width of the drive engagement lever block (34, page 23–4)	7.978÷8.000 (.3141÷.3150)			7.910÷8.000 (.3114÷.3150)
Width of block seat in the drive engagement collar (50)	8.280÷8.370 (.3260÷.3295)			
Block/seat assembly clearance	0.280÷0.392 (.0110÷.0154)			0.280÷0.460 (.011÷.018)
Diameter of drive engagement lever pin (35)	15.973÷16.000 (.6288÷.629)			
Diameter of pin housing bore in the drive unit case	16.016÷16.059 (.6305÷.6322)			
Pin/bore assembly clearance	0.016÷0.086 (.0006÷.0034)			
Drive engagement lever detent spring specifications:				
– nominal free length	24.5 (.965)			—
– compressed length under a load of 178.2÷197.8 N – 18.17÷20.17 kg – 40÷44.5 lb)	19.3 (.760)			—
Engagement lever detent spring specifications:				
– nominal free length	—			130 (5.12)
– compressed length under a load of 299÷330N (30,5÷33,7 kg – 67÷74 lb) ..	—			142.5 (5.61)

DRIVE SHAFT

	mm (in)			
	50VDT – 55VDT 60VDT	**55FDT – 60FDT**	**70VDT**	**62FDT – 72FDT 82FDT – 72LPDT 82LPDT**
Adjustment of the drive shaft–bevel pinion splined sleeve coupling	—	see page 23–3		
Available shims (S_5, page 23–3) for splined sleeve (27) position adjustment	—	1.5–1.9–2.2–2.5–2.8–3–3.3–3.7–4–4.3 (.060–.075–.087–.010–.118–.130–.146–.158–.169)		

SERVICE TOOLS

293836 Protection, drive shaft seal installation.

Print No. **603.54.283.00** – 09 – 1994

TORQUE DATA

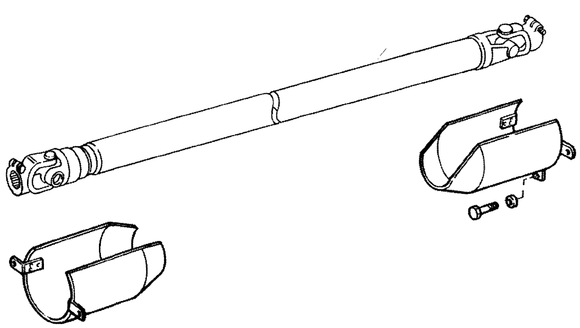
DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft.lb
Cap screw, axle drive housing (C_{13} page 23–4, models 50VDT 55VDT 60VDT)	M 10 x 1.25	59	6/43
Cap screw, drive shaft centre bearing (C_{12} page 23–3, models 55FDT–60FDT–70VDT–62FDT–72FDT–82FDT–72LPDT–82LPDT.	M 12 x 1.25	98	10/72
Cap screw, axle drive housing (C_{13} page 23–4, models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT	M 12 x 1.25	98	10/72

DRIVE SHAFT GUARDS
Model 50VDT – 55VDT – 60VDT tractors
Removal–Installation (Operation no. 23 101 20)

CAUTION

Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as follows:



22809

Drive shaft parts, model 50VDT – 55VDT – 60VDT tractors

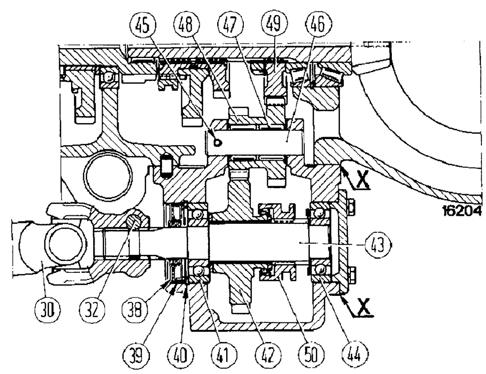
1. Undo holding screws and then remove the front and rear guards shown in the accompanying figure.
2. At drive shaft installation, reverse the removal sequence of operations.

DRIVE SHAFT
Model 5OVDT – 55VDT – 60VDT tractors
Disassembly–Assembly (Operations no. 23 101 26)

Remove shaft guards, then proceed in accordance with the following instructions and information.

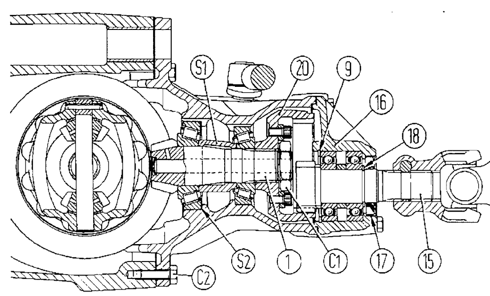
CAUTION

Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.



16204

1. Remove the two universal joint attachment nuts (32) to the live axle housing and drive housing splined driven shaft.



16225

2. Push rearwads the front end of the drive shaft until disconnecting it from the reduction pinion (15).
3. Retrieve the universal joint drive shaft (30).
4. Assemble the drive shaft by first fitting its rear end onto the drive box driven shaft and then its front end onto the live axle bevel pinion. Adjust shaft length so that the two attachment nuts (32) fit exactly in their seats on the live axle bevel pinion and drive box driven gear, respectively.
5. Look tighten nuts (32).

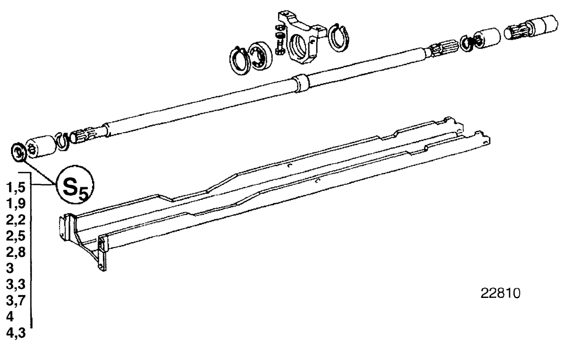
Print No. 603.54.283.00 – 09 – 1994

DRIVE SHAFT GUARD
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors
Removal–Installation (Operation no. 23 101 20)

⚠ CAUTION ⚠

Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.



Drive shaft parts – Model 55FDT – 60FDT – 70VDT 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors

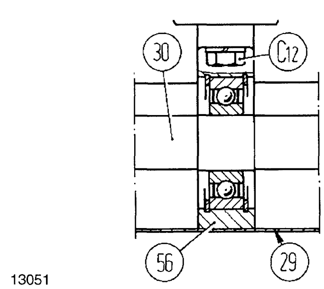
1. Undo the front, central and rear screws and remove the drive shaft guard.
2. At shaft guard installation, reverse the removal sequence of operations.

DRIVE SHAFT AND BEARING
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT 82FDT – 72LPDT – 82LPDT tractors
Disassembly–Assembly (Operation no. 23 101 26)

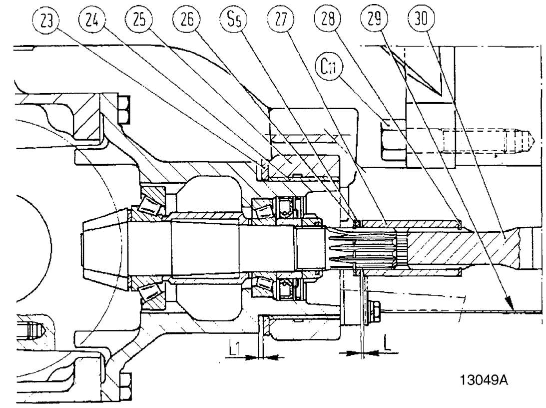
Once drive shaft has been removed, proceed as follows:

⚠ CAUTION ⚠

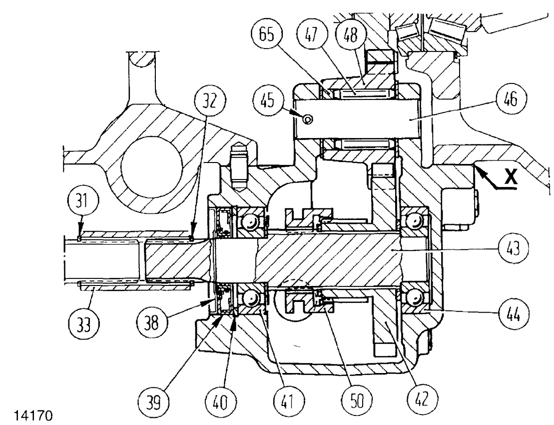
Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.



1. Remove the drive shaft centre bearing cap screws (C_{12}).



2. Remove the front splined sleeve (27) retaining circlip (28).



3. Remove the rear splined shaft (33) retaining circlip (31).
4. Move the splined sleeves (27) and (33) over the drive shaft and remove the latter.
5. At drive shaft assembly, proceed by reversing the previous disassembly sequence of operations and make the following adjustments:

— bring the live axle housing against the thrust washer (23, figure at top) of the rear pivot support (25) so to take up completely the live axle pivot play (L_1) between axle and support (25);

— place the front splined sleeve (27) positioned against retaining circlip (28), using a feelker gauge read the clearance existing between sleeve and circlip (26) and then fit a shim (S_5) having a thicknees that allows for a play (L) of sleeve (27) of 1÷1.5 mm (.04 ÷.06 in).

Note – See figure at top left for available shim (S_5) dimensions.

Print No. **603.54.283.00** – 09 – 1994

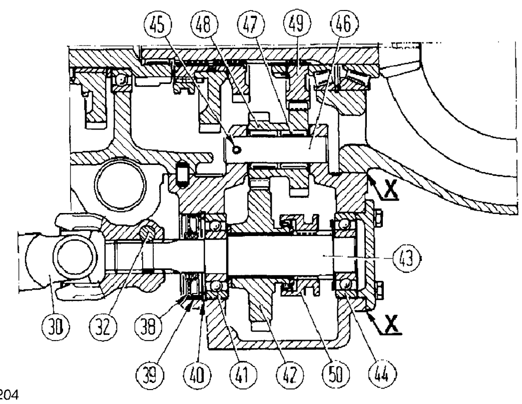
DRIVE BOX SHAFT OIL SEALS (all models)
Replacement with drive shaft removed
(Operation no. 23 101 32)

The drive box shaft oil seal can be replaced both with the drive box on work bench and installed on the tractor. Proceed as further indicated.

CAUTION

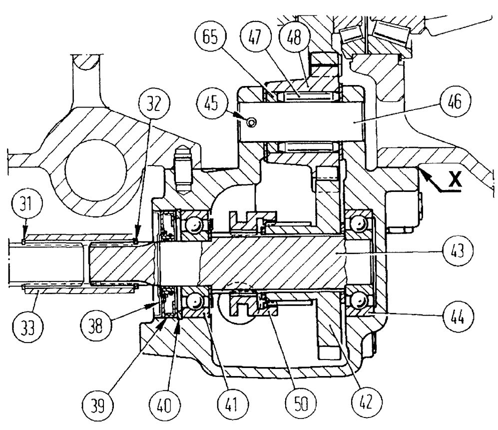
Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

1. In case of installed drive box: disconnect battery cables, drain the transmission–rear drive case oil reservoir.



16204

Drive box – Models 50VDT – 55VDT – 60VDT



14170

Drive box – Models 55FDT – 60FDT – 70VDT – 62FDT 72FDT – 82FDT – 72LPDT – 82LPDT

2. Remove the oil seal (39) and dust ring (38) using a screwdriver or punch.
3. Fit the **293836** tool for oil seal (39) protection on the splined section of shaft (43), then fit the new seal correctly positioned.
4. Fit the new dust excluder ring (38) and retaining circlip (32).
5. Refill the transmission case with oil.
6. Reconnect the battery cables.

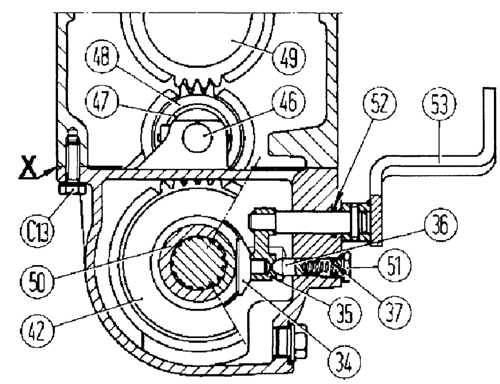
4WD DRIVE BOX (all models)
Removal–Installation (Op. 23 101 40)

Remove the drive box from the tractor as further indicated.

CAUTION

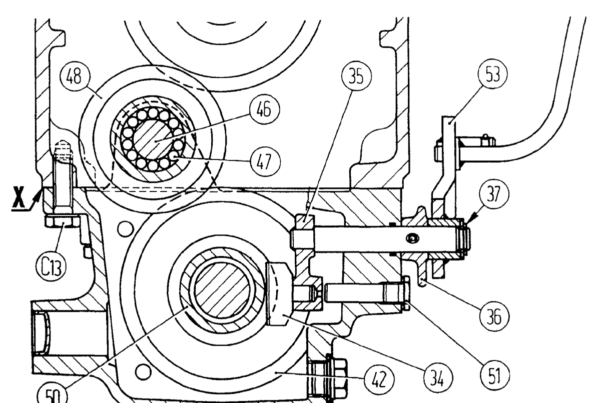
Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

1. Remove the drive shaft guard (or guards) as previously described on pages 23–2 or 23–3.
2. Remove the drive shaft as previously described on pages 23–2 or 23–3.
3. Drain the transmission case oil and, preferably, the drive box oil also.



16223

Drive box – Models 50VDT – 55VDT – 60VDT – 70VDT

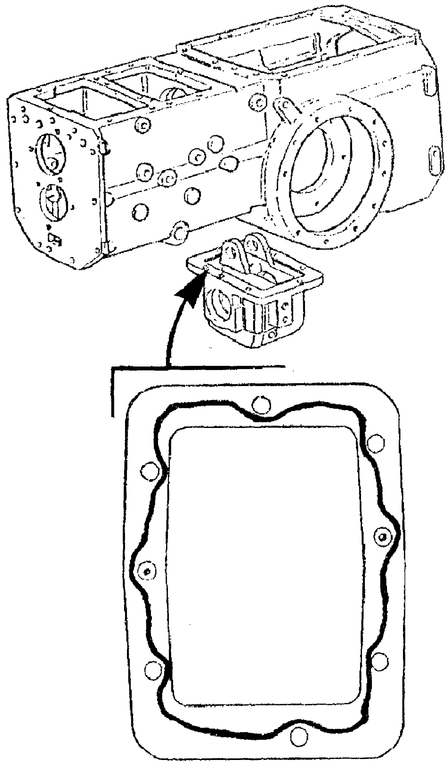


14168

Drive box – Models 55FDT – 60FDT – 62FDT – 72FDT 82FDT – 72LPDT – 82LPDT

4. Disconnect the drive box external control lever (53), holding screws (C_{13}) and, finally, the drive box as an assembly.

Print No. 603.54.283.00 – 09 – 1994



12865D

5. Prior to installing the drive box to the transmission case thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick, following the scheme shown in the accompanying figure.

Suitable types of sealing compounds are indicated on page 1, section 00.

4WD DRIVE BOX (all models)
Disassembly–Assembly with unit removed
(Operation no. 23 101 42)

CAUTION

Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Disassemble the drive box unit on the workbench as further indicated.

1. Punch out roll pin (45, page 23–4), remove the intermediate shaft (46) and the associated (48) complete with needle bearing (47). On models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT, also remove the needle bearing spacer (65).

2. From the oustside, remove the dust ring (38), oil seal (39), circlip (40) and driven shaft (43) with associated ball bearing (41).

3. From the inside, remove the front wheel drive engagement sleeve (50) and driven gear (42) with associated thrust washers.

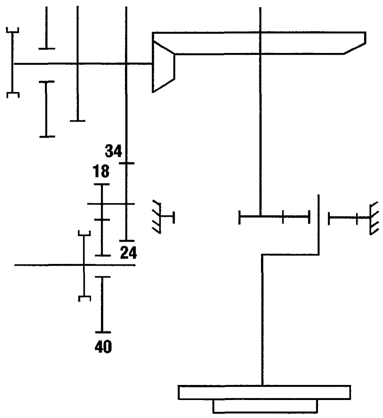
4. Pull out the ball bearing (44) after removing the drive box rear cover (on models 50VDT – 55VDT – 60VDT) or using a hammer–type puller (on models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT).

5. Check wear conditions of the thrust washers and bearing status. If not in top conditions, replace the oil seal (39) using the **293836** special tool for protection at installation.

6. At assembly, proceed by reversing the previous disassembly sequence of operations and consulting the illustrations on page 23–4.

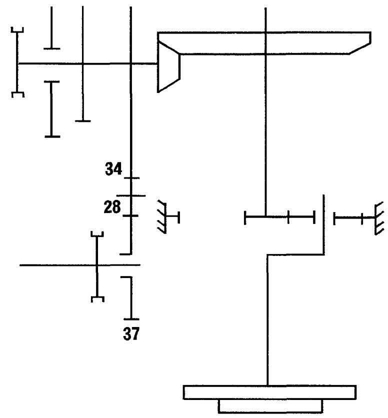
7. Preferably, fit a new dust excluder ring (38) being careful to avoid getting it installed out–of–shape.

Print No. ***603.54.283.00*** *– 09 – 1994*



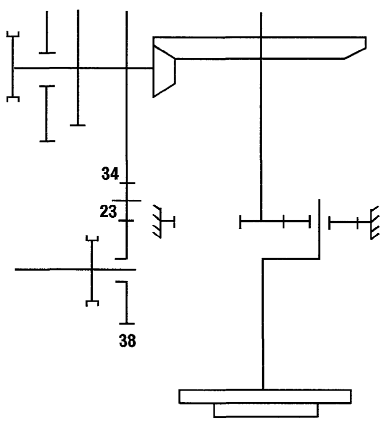
22811

LIVE AXLE DRIVE BOX GEAR LAYOUT
Models 50VDT – 55VDT – 60VDT



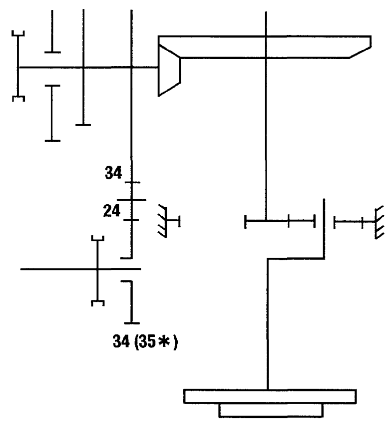
22813

LIVE AXLE DRIVE BOX GEAR LAYOUT
Model 70VDT



22812

LIVE AXLE DRIVE BOX GEAR LAYOUT
Models 55FDT – 60FDT



22814

LIVE AXLE DRIVE BOX GEAR LAYOUT
Models 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT

Note – Variant for 40 km/h version.

Print No. ***603.54.283.00*** *– 09 – 1994*

LIVE FRONT AXLE (DT)

	mm (in)		
	50VDT – 55VDT 60VDT	55FDT – 60FDT 70VDT	62FDT – 72FDT 82FDT – 72LPDT 82LPDT
Type	Steering, full–floating, centrally pivoted		
Reduction ratio (power intake, see page 25–5)	15/29 = 1:1.933	—	
Bevel drive and differential			
Reduction ratio (30 km/h version)	9/41 = 1:4,555 (see page 25–5)	13/37 = 1:2,846 (see page 25–7)	10/36 = 1:3,6 (see page 25–9)
Reduction ratio (40 km/h ratio)	—	—	13/37 = 1:2,846 (see page 25–9)
Bevel drive tooth backlash		0.15÷0.20 (.006÷.008)	
Bevel pinion bearing shim thickness (S_1, pages 25–6,8,10)	—	2.50–2.55–2.60–2.65–2.70–2.75–2.80–2.85 2.90–2.95–3–3.05–3.10–3.15–3.20–3.25–3.30 3.35–3.40–3.45–3.50–3.55–3.60–3.65–3.70 (.098–.100–.102–.104–.106–.108–.110–.112– .114–.116–.1–.120–.122–.124–.126–.128.130 .132–.134–.136–.138–.140–.142–.144–.146)	
Bevel pinion bearing spacer (S_1, page 25–5) thickness	39.50–39.60–39.70 39.80–39.90–40–40.1 40.20–40.30–40.40 (1.555–1.559–1.563 1.567–1.571–1.575 1.579–1.583–1.5871.591)	—	
Bevel pinion position shim thickness (S_2, pages 25–5,6,8,10)	0.20–0.25–0.50	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–.1–.122–.126–.130 –.134–.138–.142–.146)	
Differential pinion and side gear backlah	0.18 (.007)	0.15 (.006)	
Side gear thrust washer thickness (7, pages 25–4,6,8,10)	2 (.1)	1.470÷1.530 (.058–.006)	
Differential pinion thrust washer thickness (6)	2 (.1)	1.50–1.60 (.059–.063)	
Differential pinion journal (63) dia	17.982÷18.000 (.7080÷.7087)	21.939÷21.960 (.8637÷.8646)	
Differential pinion bore (62) dia	18.050÷18.071 (.7106÷.7115)	22.040÷22.061 (.8677÷.8685)	
Differential pinion journal (63) clearance in pinion bore (62)	0.050÷0.089 (.0020÷.0035)	0.080÷0.122 (.0031÷.0048)	
Side gear spigot dia	—	37.961÷38.000 (1.4945÷1.4961)	
Side gear spigot bore dia. in differential case	—	38.080÷38.119 (1.4992÷1.5007)	
Side gear spigot clearance in differential case	—	0.080÷0.158 (.0031÷.0062)	
Axle shafts and joints			
Axle shaft journal (5) dia. at bearing bushings (14)	37.975÷38.000 (1.4951÷1.4961)	29.914÷29.935 (1.1777÷1.1785)	
Force fitted bushing (14) I.D.	38.050÷38.089 (1) (1.4980÷1.4996)	30.050÷30.105 (2) (1.1831÷1.1852)	
Axle shaft running clearance in bushing	0.050÷0.114 (.0020÷.0045)	0.115÷0.191 (.0045÷.0075)	
Bushing interference fit in housing	0.009÷0.059 (.0004÷.0023)	0.064÷0.129 (.0025÷.0051)	
King pin bearing shim (S_3) thickness	0.20–0.25–0.50 (.008–.01–.02)	0.10–0.15–0.20–0.25–0.30 (.004–.006–.008–.010–.012)	

(1) Dimension after reaming. (2) Dimension without reaming.

Print No. 603.54.283.00 – 09 – 1994

LIVE AXLE

	mm (in)		
	50VDT – 55VDT 60VDT	**55FDT – 60FDT 70VDT**	**62FDT – 72FDT 82FDT – 72LPDT 82LPDT**
Planetary final drives			
Reduction ratio	—	15: (19+54) = 1:4.86	
Driven gear thrust washer thickness (18, pages 25–6,8,10)	—	0.77÷0.83 (.030÷.033)	
Centre pivot			
Pivot shaft dia	29.967÷30.000 (1.1798÷1.1811)	—	
Bushing I.D. (force fitted and processed after installation)	30.010÷30.015 (1.1815÷1.1817)	—	
Shaft/bushing clearance fit	0.010÷0.048 (.0004÷.0019)	—	
Front pivot shaft dia	—	52.652÷52.671 (2.0729÷2.0737)	
Front bushing I.D. (force fitted and processed after installation)	—	52.720÷52.790(1) (2.0759÷2.0783)	
Front shaft/bushing clearance fit	—	0.049÷0.138 (.0019÷.0054)	
Bevel pinion carrier rear end O.D.	—	99.040÷99.072 (3.8992÷3.9005)	
Rear bushing I.D. (force fitted)	—	99.146÷99.221(1) (3.9034÷3.9063)	
Rear end/bushing clearance fit	—	0.074÷0.181 (.0029÷.0071)	
Thrust washer thickness	3.925÷4.000 (.1545÷.1575)	4.950÷5.000 (.1949÷.1969)	

(1) Dimension without reaming.

TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Front axle			
Lock ring, bevel pinion (C_1, pages 25–5,6,8,10)			
— Models 50VDT – 55VDT – 60VDT	M 30 x 1,5	245	25/180
— Models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT 72LPDT – 82LPDT	M 35 x 1,5	294	30/217
Differential carrier capscrew (C_2)			
— Models 50VDT – 55VDT – 60VDT	M 10 x 1,5	40	4.1/29.6
— Models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT 72LPDT – 82LPDT	M 12 x 1,25	113	11.5/83
Ring gear capscrew (C_3, pages 25–4,6,8,10)			
— Models 50VDT – 55VDT – 60VDT	M 10 x 1,25	61	6.2/44.8
— Models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT 72LPDT – 82LPDT	M 12 x 1,25	113	11.5/83
King pin bearing capscrew (C_4) – Models 50VDT – 55VDT – 60VDT	M 10 x 1,5	40	4.1/29.6
King pin bearing capscrew (C_4) – All other models	M 10 x 1,25	64	6.5/47

Print No. 603.54.283.00 – 09 – 1994

TORQUE WRENCH DTA

DESCRIPTION	Thread size	Torque	
		Nm	kgm/lb
Steering knuckle capscrew (C_5, pages 25–6,8,10), excluding model 50VDT – 55VDT – 60VDT tractors	M 12 x 1.25	113	11.5/83
Wheel hub bearing lock ring (C_6) — models 50VDT – 55VDT – 60VDT	M 85 x 2	392	40/289
— models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT 72LPDT – 82LPDT	M 45 x 1.5	See page 25–18, operations 11÷14	
Final drive housing capscrew (C_7, pages 25–4,6,8,10): All models	M 10 x 1.25	64	6.5/47
Wheel rim/disc bolt nut: All models	M 14 x 1.5	216	22/159
Live front axle Axle pivot support capscrew (C_9, pages 25–7 and 9), models 50VDT – 55VDT – 60VDT excluded	M 18 x 1.5	392	40/289
Differential bearing cap capscrew (C_{10}, pages 25–5,7,9): — Models 55FDT – 60FDT – 70VDT – 62FDT 72FDT – 82FDT – 72LPDT – 82LPDT	M 12 x 1.25	113	11.5/83
— Models 50VDT – 55VDT – 60VDT (see page 25–16)	—	—	—

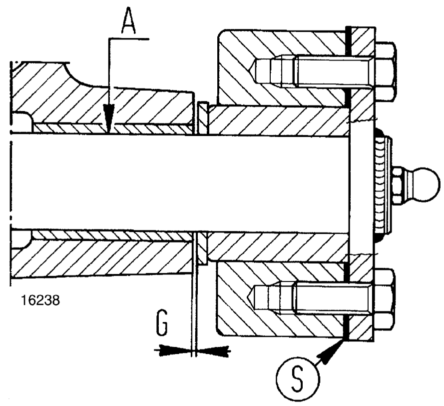
SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **X**.
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and furtherintegrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

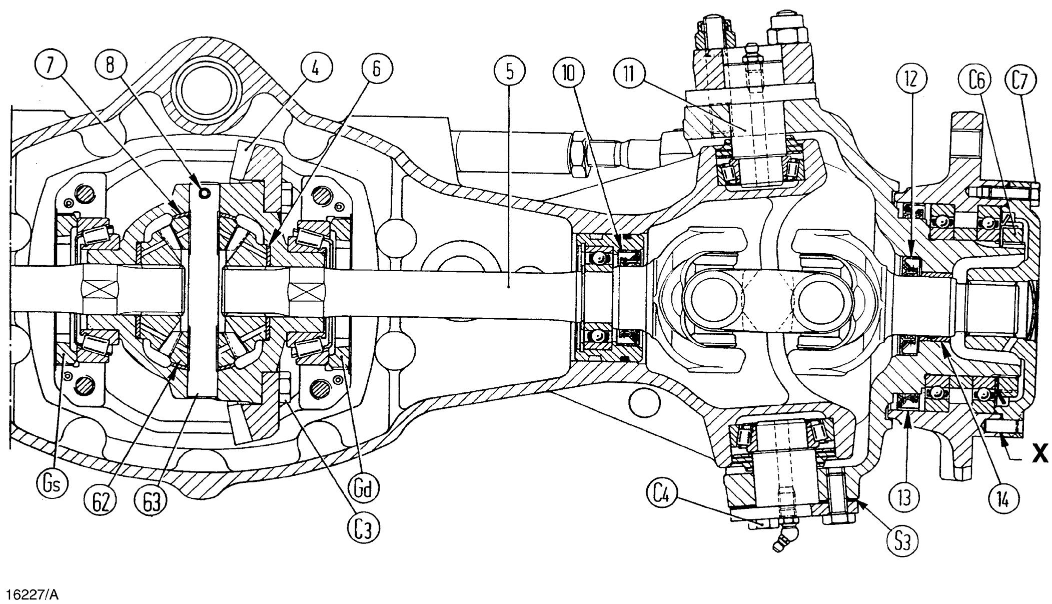
List of the special tools necessary to carry on the service operations concerning this section of the Manual.

	293460	Stand, overhaul, front axle (all models).
	293743	Support, fron differential housing overhaul (all models).
	293785	Wrench, front bevel pinion lock ring, w/ **293782/1** (models 55F – 60F – 70V – 62F – 72F – 82F – 72LP – 82LP).
	293782/1	Wrench, front bevel pinion, w/**293785** (models 55F – 60F – 70V – 62F – 72F – 82F – 72LP – 82LP).
	293510	Gauge, live front axle wheel bearings, in alternative to **293752** and **293438/2** special tools.
	293951	Torque wrench, bevel pinion check (models 50VDT – 55VDT – 60VDT).
	293752	Adjuster, front bevel pinion bearing (models 50VDT – 55VDT – 60VDT).
	293438/2	Adjuster, front bevel pinion bearing (models 55FDT – 60FDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT).
	293400/1	Gauge, front bevel pinion (all models).
	293544	Wrench, front differential bearing lock ring (all models).
	293837	Wrench, live front axle bearing lock ring (models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT).
	293655	Wrench, live front axle bearing lock ring (models 50VDT – 55VDT – 60VDT).
	291525	Centralizers (M10x1.25), front final drive cover (all modelas).
	293812	Centralizrs (M16x1.25), front wheel disassembly/assembly (all models).
X	**293857/1**	Remover, live front axle pivot (all models).
X	**292161**	Remover, live front pivot bearing outer race (all models).
X	**292220/4**	Adapter, front axle bearing rotating torque tester (all models).

Print No. ***603.54.283.00*** *– 09 – 1994*



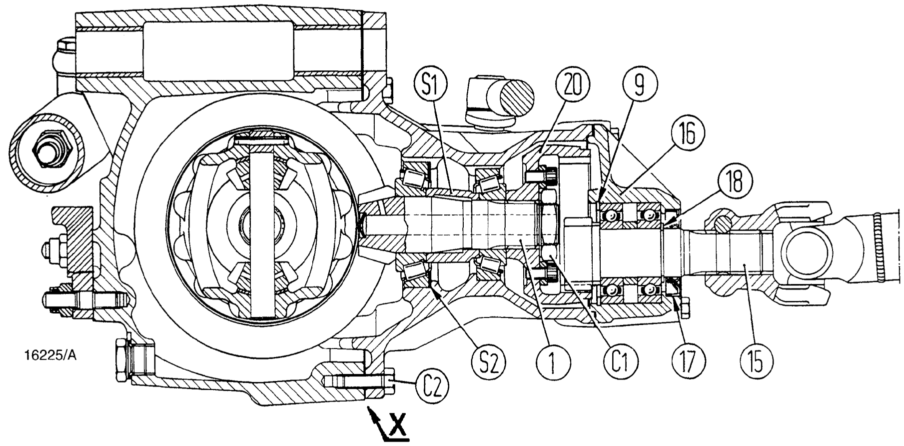
Live axle centre pivot section – Model 5OVDT – 55VDT – 60VDT

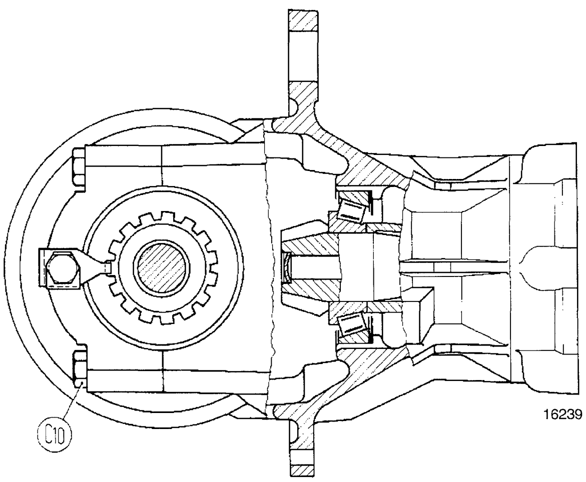


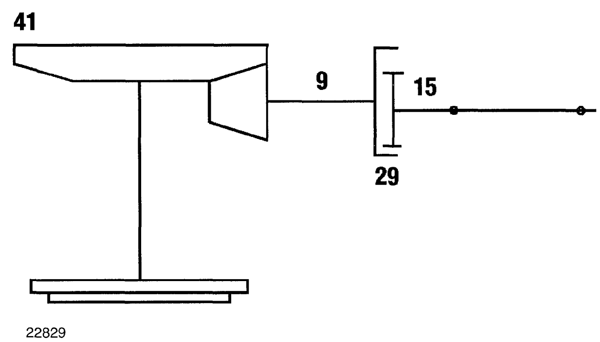
Live axle longitudinal sectional view – Models 50VDT – 55VDT – 60VDT

A. Inner bushings associated with the live axle centre pivot – G = 0.6 ÷ 0.8 mm (.02 ÷ 0.3 in). Assembly clearance – S. Adjustment shims (thickness of single shims = 0.2 mm – .008 in) – C_3. Ring gear capscrew – C_4. King pin bearing capscrew – C_6. Wheel hub bearing lock ring – C_7. Final drive housing capscrew – Gd and Gs. Ring gear RH and LH bearing lock ring – S_3. King pin adjustment shims – 4. Ring gear – 5. Axle shaft with universal joint – 6. Side gear washers – 7. Differential pinion washers – 8. Differential pinion journal capscrews – 10. Seal – 11. King pin bearing – 12,13. Seals – 14. Axle shaft bushing – 62. Idle pinion – 63. Pivot.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.







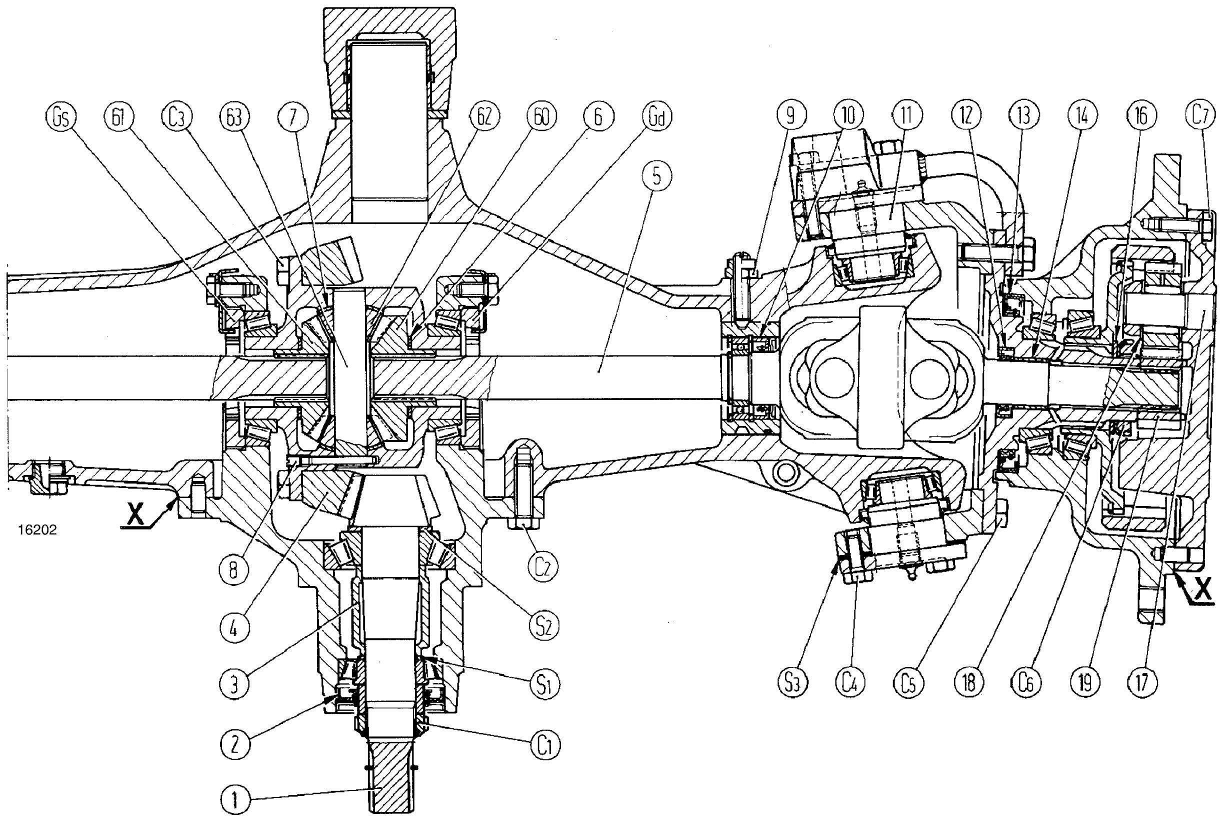
Front wheel drive transmission diagram Model 50VDT – 55VDT – 60VDT tractors

Live axle and centre pivot cross sectional views – Model 50VDT – 55VDT – 60VDT tractors

C_1. Bevel pinion bearing lockring – C_2. Differential carrier capscrew – C_{10}. Differential bearing capscrew – S_1. Bevel pinion bearing shim – S_2. Bevel pinion position shim – 1. Bevel pinion – 15. Front reduction gear unit pinion – 16. Flange – 17. Oil seal – 18. Circlip – 20. Front reduction unit ring gear.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

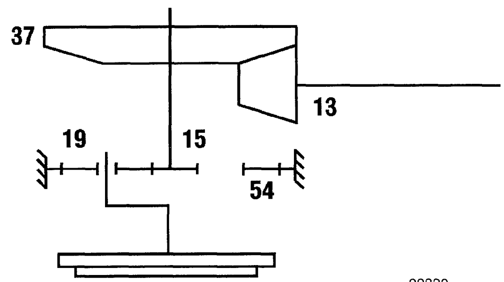


Live axle and centre pivot longitudinal sectional views – Model 55FDT – 6OFDT – 70VDT tractors.

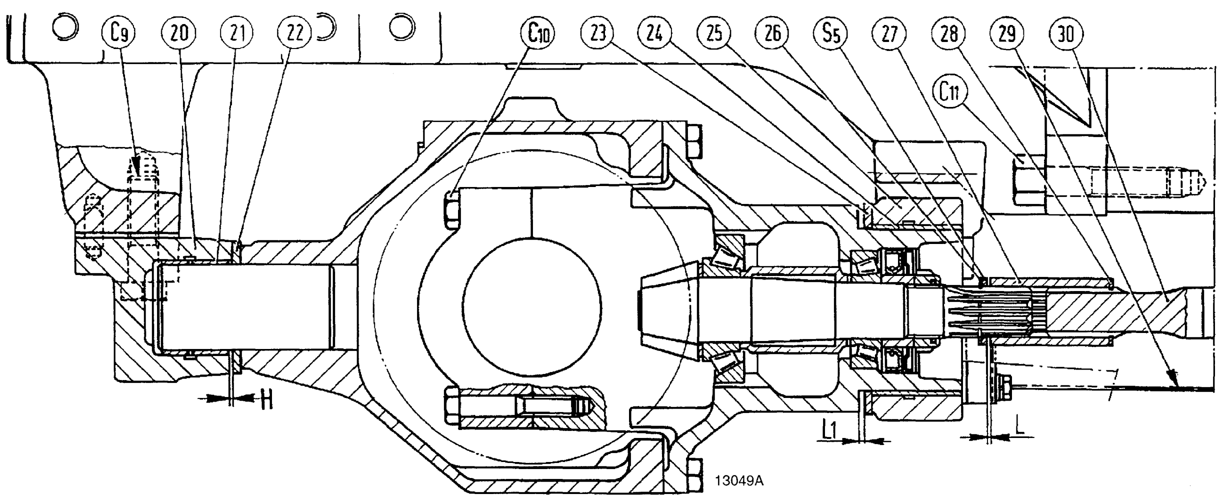
C_1. Bevel pinion bearing lockring – C_2. Differential carrier capscrew – C_3. Ring gear capscrew – C_4. King pin bearing capscrews – C_5. Steering knuckle capscrew – C_6. Wheel hub bearing lock ring – C_7. Final drive housing capscrew – Gd and Gs. RH and LH differential bearing lock ring – S_1. Bevel pinion bearing shim – S_2. Bevel pinion position shim – S_3. King pin bearing shims – 1. Bevel pinion – 2. Seal – 3. Bevel pinion bearing spacer – 4. Ring gear – 5. Axle shaft with universal joint – 6. Side gear washers – 7. Differential pinion washers – 8. Differential pinion journal capscrew – 9. Beraing carrier capscrew – 10. Seal – 11. King pin bearing – 12 and 13. Seals – 14. Axle shaft bushing – 16. Thrust washer – 17. Planet wheel journals – 18. Planet wheel shims – 19. Sun gear – 60 and 61. Side gears – 62. Differential pinion – 63. Differential pinion journal.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*



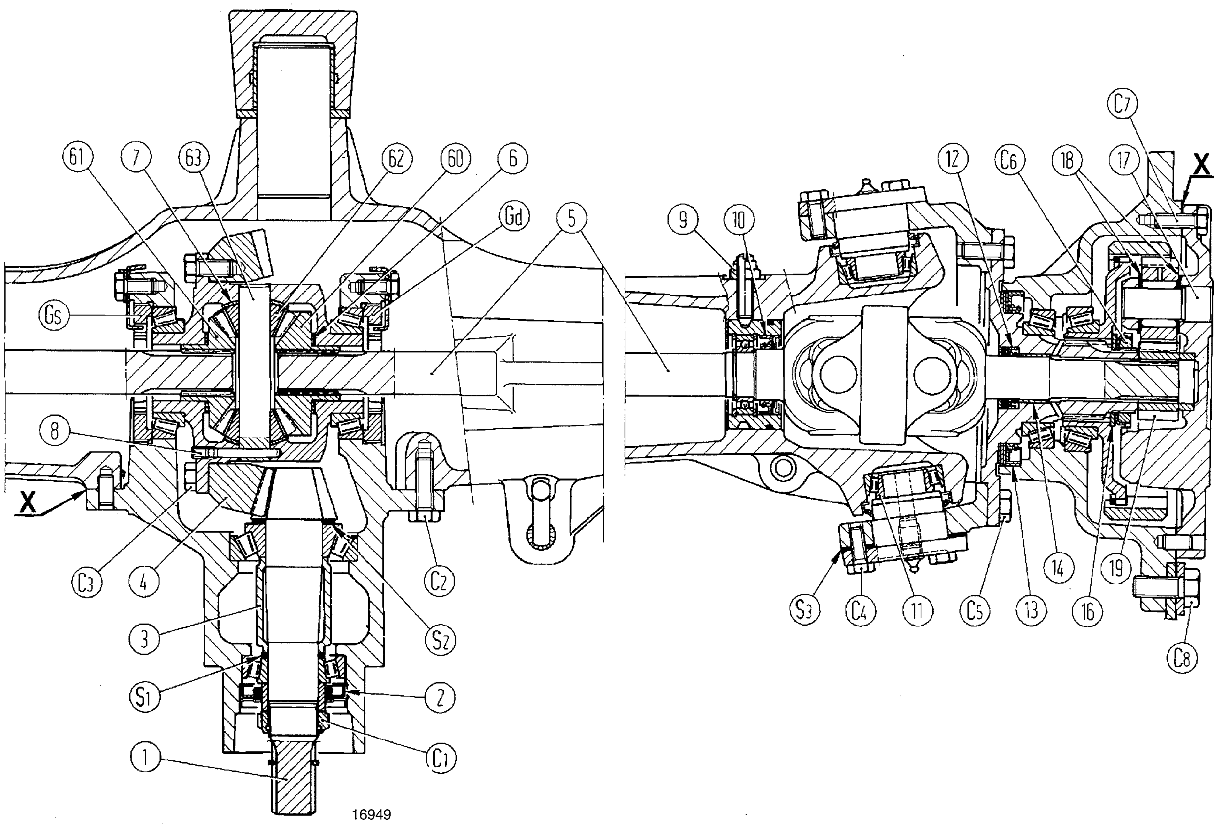
Front wheel drive transmission diagram – Model 55FDT – 60FDT – 70VDT tractors



Live axle and centre pivot cross sectional view – Model 55FDT – 60FDT – 70VDT tractors

e. Correct bushing installation in front axle pivot support (split arrowed) – f. Correct bushing installation in rear axle pivot support – C_9. Axle pivot support capscrew – C_{10}. Differential bearing cap capscrew – C_{11}. Capscrews securing front axle support to engine – H = 1 mm (.04 in). Front bushing (21) fitted stand–in – L = 1÷1.5 mm (.04÷.06 in). Sleeve (27) end play – L_1 = 0.3÷1.1 mm (.01÷.04 in). Live axle pivot end play – S_5. Sleeve (27) positioning shim – 20. Live axle center pivot front support – 21. Front bushing – 22. Front thrust washer – 23. Rear thrust washer – 24. Rear bushing – 25. Live axle pivot rear support – 26 and 28. Retaining circlips – 27. Splined front sleeve – 29. Drive shaft guard – 30. Drive shaft.

Print No. ***603.54.283.00*** *– 09 – 1994*

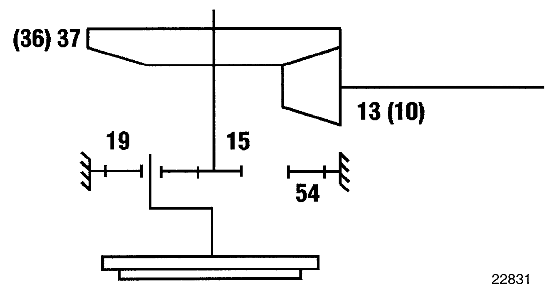


Live axle longitudinal sectional view – Model 62FDT – 72FDT – 82FDT tractors.

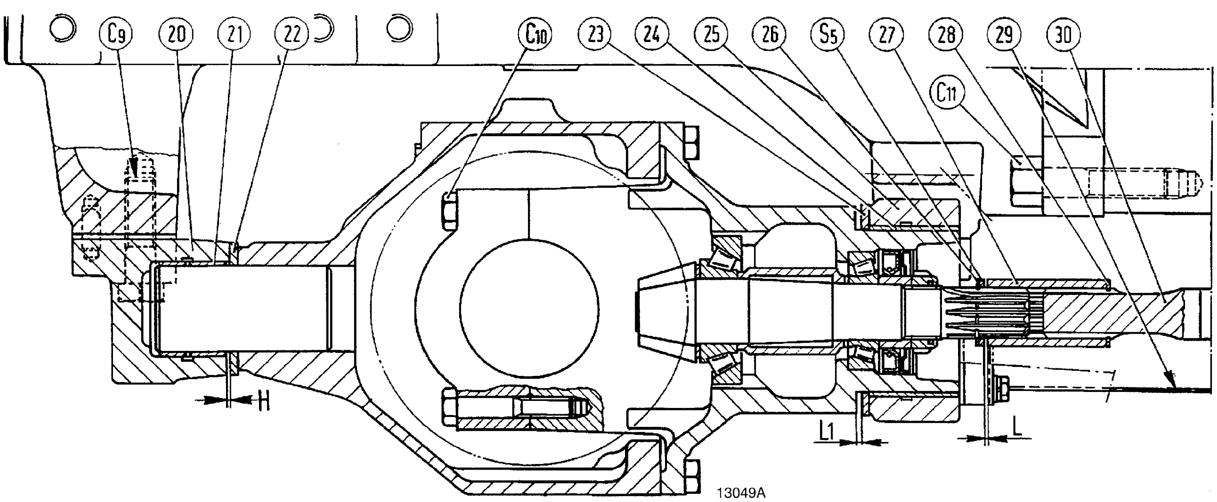
C_1. Bevel pinion bearing lock ring – C_2. Differential carrier capscrew – C_3. Ring gear capscrew – C_4. King pin bearing capscrews – C_5. Steering knuckle capscrew – C_6. Wheel hub bearing lock ring – C_7. Final drive housing capscrew – C_8. Wheel capscrew – Gd and Gs. RH and LH differential bearing lock ring – S_1. Bevel pinion bearing shim – S_2. Bevel pinion position shim – S_3. King pin bearing shims – 1. Bevel pinion – 2. Seal – 3. Bevel pinion bearing spacer – 4. Ring gear – 5. Axle shaft with universal joint – 6. Side gear washers – 7. Diffrential pinion washers – 8. Diffrential pinion journal capscrew – 9. Bearing carrier capscrew – 10. Seal – 11. King pin bearing – 12,13. Seals – 14. Axle shaft bushing – 16. Thrust washer – 17.Planet wheel journals – 18. Planet wheel shims – 19. Sun gear 60,61. Side gears – 62. Differential pinion – 63. Differential pinion journal.

Note – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

Note (*) 10:36 bevel drive ratio (30 km/h version)
13:37 bevel drive ratio (40 km/h version)



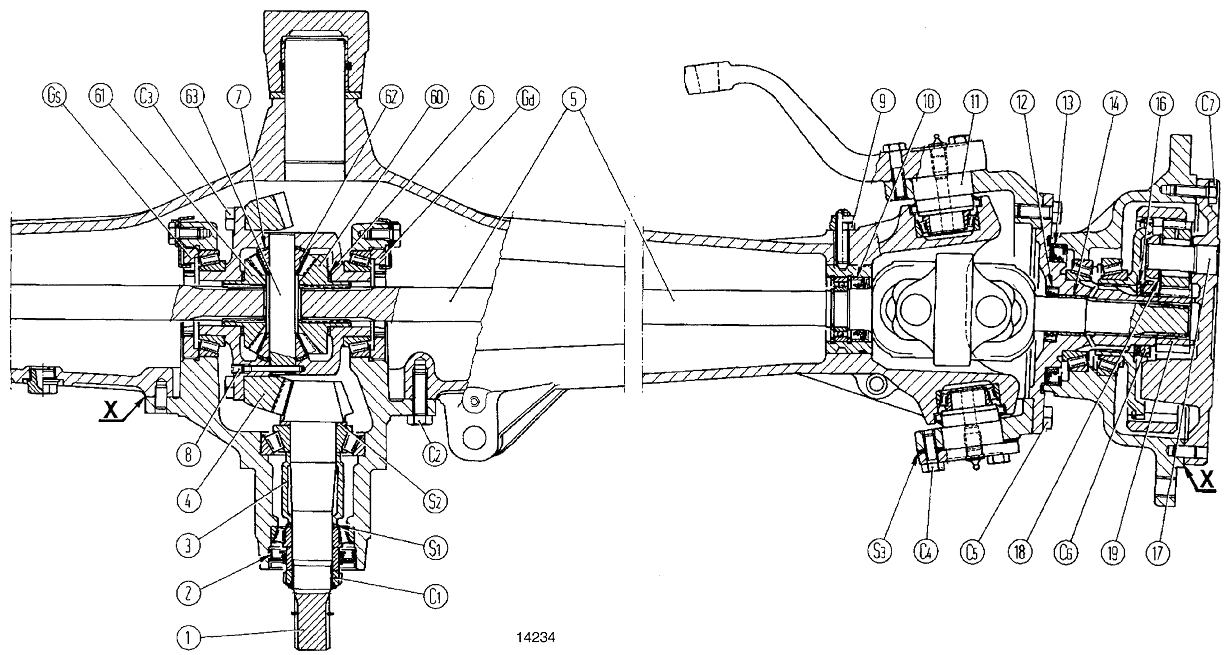
(*) Front axle transmission diagram – Model 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.



Live axle and centre pivot cross sectional views – Model 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

e. Correct bushing installation in front axle pivot support (split arrowed) – f. Correct bushing installation in rear axle pivot support – C_9. Axle pivot support capscrew – C_{10}. Differential bearing cap capscrew – C_{11}. Capscrews securing front axle support to engine – H = 1 mm (.04 in). Front bushing (21) fitted stand–in – L = 1 ÷ 1.5 mm (.04 ÷ .06 in). Sleeve (27) end play – L_1 = 0.3 ÷ 1.1 mm (.012 ÷ .043 in). Axle pivot end play in support – S_5. Sleeve (27) position shim – 20. Front axle pivot support – 21. Front bushing – 22. Front thrust washer – 23. Rear thrust washer – 24. Rear bushing – 25. Rear axle pivot support – 26,28. Retaining circlips – 27. Front splined sleeve – 29. Drive shaft guard – 30. Drive shaft.

Print No. ***603.54.283.00*** *– 09 – 1994*



Live axle longitudinal sectional view – Model 72LPDT – 82LPDT tractors

C_1. Bevel pinion bearing lock ring – C_2. Differential carrier capscrew – C_3. Ring gear capscrew – C_4. King pin bearing capscrews – C_5. Steering knuckle capscrew – C_6. Wheel hub bearing lock ring – C_7. Final drive housing capscrew – Gd and Gs. RH and LH differential bearing lock ring – S_1. Bevel pinion bearing shim – S_2. Bevel pinion position shim – S_3. King pin bearing shims – 1. Bevel pinion – 2. Seal – 3. Bevel pinion bearing spacer – 4. Ring gear – 5. Axle shaft with universal joint – 6. Side gear washers – 7. Differential pinion washers – 8. Differential pinion journal capscrew – 9. Bearing carrier capscrew – 10. Seal – 11. King pin bearing – 12,13. Seals – 14. Axle shaft bushing – 16. Thrust washer – 17. Planet wheel journals – 18. Planet wheel shims – 19. Sun gear – 60,61. Side gears – 62. Differential pinion – 63. Differential pinion journal.

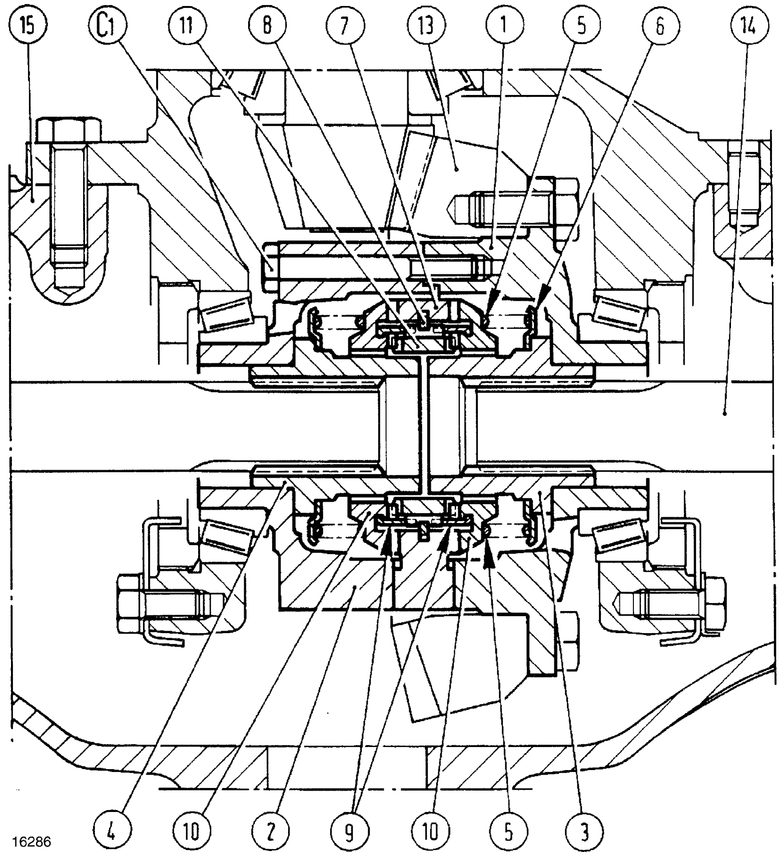
Nota – At assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the selaing compounds listed on page 1, section 00.

Print No. 603.54.283.00 – 09 – 1994

IMPORTANT

Check the NO SPIN operation as follows:

- with engine shut–off, shift in any one gear and engage the front wheel drive, apply parking brake and raise front of tractor;
- rotate front wheels in a forward direction to eliminate play, hold LH wheel and rotate RH wheel rearwards; NO SPIN differential disengages and wheel rotates with an indexing or metallic clicking sound;
- stop RH wheel, then turn forward slightly: NO SPIN will automatically engage and stops the wheel;
- turn both wheels backwards until the play is eliminated, then hold LH wheel and rotate RH wheel forwards: NO SPIN disengages and wheel rotates with an indexing or metallic clicking sound;
- stop RH wheel and turn backwards slightly: NO SPIN differential engages and stops the wheel;
- repeat above operations holding the RH wheel.



Differential (with NO SPIN, optional) sectional view – Model 50VDT – 55VDT – 60VDT tractors.

C_1. Half–carrier union screw; 39 Nm (4 kgm – 29 ft–lb) tightening torque – 1. Ring gear carrier half – 2. Closing carrier element – 3 and 4. Axle shaft (14) drive sleeves – 5. Reaction springs – 6. Spring (5) holders – 7. Cntral toothed sector – 8. Retaining circlip – 9. Toothed rings – 10. Drive or outer wheel disengagement flanges – 11. Central cam – 13. Ring gear – 14. Axle shafts – 15. Front axle housing.

OPERATION

The **NO SPIN** differential performs the following key functions:

— allows full use of available tractor pull at the live axle;
— allows tighter turns with respect to standard differentials;
— prevents that the traction loss at either wheel will result in no or reduced traction at the other wheel;
— allows wheels to turn at different speeds and so compensate for differences in wheel travel when turning or travelling over uneven grounds.

When the tractor is travelling straight forward, the **NO SPIN** will hold the wheels solid with the ring gear thus allowing the live axle to distribute equal speed to both wheels.

As soon either wheel starts braking (ex.: the outer wheel when the tractor makes a turn or the wheel riding over an obstacle) it will act upon the **NO SPIN** which in turn will disengage the associated axle shaft and continue to turn idle.

If either wheel should loose traction, the other will continue to exercise the same pulling effort as before.

Steering

In a left turn, for instance, the right wheel increases speed. Axle shaft (14) transmits this speed increse to the sleeve (13) which in turn will transmit it to flange (10) and associated toothed ring (9).

As soon as the right wheel brakes down exceeding a given value, ring (9) and flange (10) overcome spring (5) load and disengage from center cam (11), remaining in this position up to the end of the curve.

NOTE – For correct **NO SPIN** operation, the circumferential length of the two front tyres must be equal or differ slightly, of a few millimeters only. Small differences can be corrected by adjusting tyre inflation pressure slightly.

LIVE FRONT AXLE , ASSEMBLY

Removal–Installation (Operation 25 100 30) – Models 50VDT – 55VDT – 6OVDT.

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by suitable slings and hooks. Make sure that nobody is standing near by.

Proceed as follows:

1. Disconnect the battery cables and place wedge blocks under both rear wheels.
2. Remove the drive shaft guards as indicated at page 23–2;
3. Remove the drive shaft as indicated at page 23–2;
4. Jack up the tractor front end;
5. Place a stand under engine sump interposing wood lists between sump and stand.
6. Remove front wheels.
7. Disconnect the two hydraulic steering system unions from their respective ram hoses.
8. Suitably sling up the front axle assembly.
9. Remove the axle/front support holding scarews.
10. Remove the axle/rear suport holding screws.
11. At installation, secure the front axle to the engine in accordance with the following instructions and information:
    a. proceed by reversing the previous removal sequence of operations starting from no. 10 back to no. 1;
    b. at drive shaft installation, proceed as indicated at point 4, page 23–2;
    c. tighten fastenings to the torque data of page 23–2;

WHEEL HUB AND STEERING KNUCKLE

Disassembly–Assembly (Operation 25 108 38) – Model 5OVDT – 55VDT – 60VDT tractors

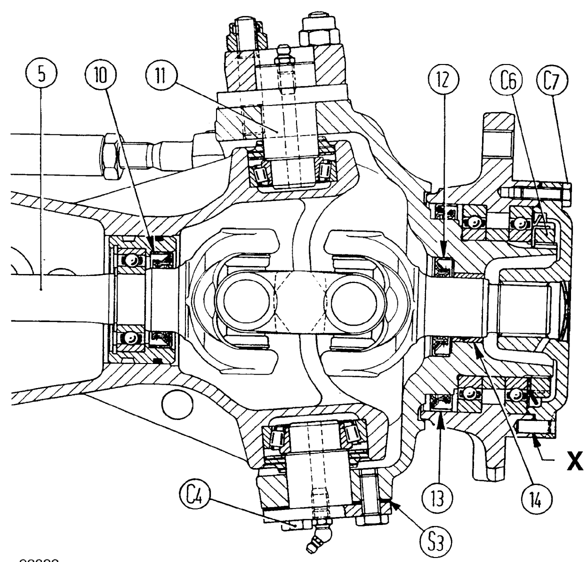
CAUTION

Handle all parts carefully.
Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Disassembly and assembly operations can be carried on with the front axle final drives removed from the tractor and secured to the **293460** stand (in which case hydraulic steering cylinders must be removed first) or with the front axle installed.

In the latter case, proceed as follows:

1. Place a stand under engine sump.
2. Lock parking brake.



22832

3. Remove the two final drive housing cover screws (C_7), fit the two **291525** centralizers, remove remaining screws and, finally, the cover from final drive side.
4. Straighten out the lockwasher tab and unscrew the wheel hub bearing lock ring (C_6) using the **293655** wrench.
5. Remove wheel hub.
6. Remove capscrews (C_4) and grease nipples, install the **293857/1** tool and pull out king pins (11) and steering knuckle carrier.

Print No. 603.54.283.00 – 09 – 1994

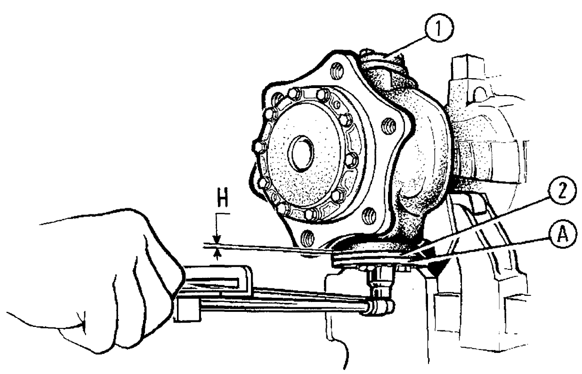
7. Re–assemble loose parts by reversing the previous disassembly sequence of operations and referring to the section illustrated on page 25–12 for the correct fitting of parts.

8. Prior to reassembly of the steering knuckle carrier, insert articulated axle shaft (5) in case and lubricate the inside of the bushing with **TUTELA MULTI F** oil.

9. At installation, fill wheel hub inside compartments with **TUTELA G9** grease and, finally, fit the side cover and tighten capscrews (C_7) to the torque specified on page 25–3.

Adjust wheel hub bearing pre–load as further indicated.

10. Check bearing outer races in axle case and associated seals for wear and pack with **TUTELA G9** grease.



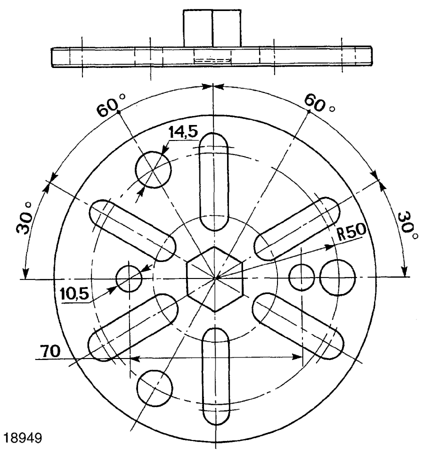
9513

11. Install top cover cover (1) without shims.

12. Torque capscrews (C_4, page 25–12) at the value specified on page 25–2.

13. Install bottom cover (2) without shims using three capscrews previously lubricated with engine oil.

14. Tighten, progressively and in alternative sequence, the three bottom cover capscrews, apply a torque wrench to the **292220/4** (A) tool and tighten until the carrier swings at 18÷22 Nm (1.8÷2.2 kgm – 13÷16 ft–lb), without taking starting torque into account.



18949

Modifications to be made on the 292220 tool for checking the roll torque of the front axle knuckle king pin (tool number becomes 292220/4)

15. Using a feeler gauge, measure gap (H) between bottom cover and carrier alongside the capscrews.

16. Thickness of shims (S_3, page 25–12) under bottom cover will be given by the arithmetical average of readings.

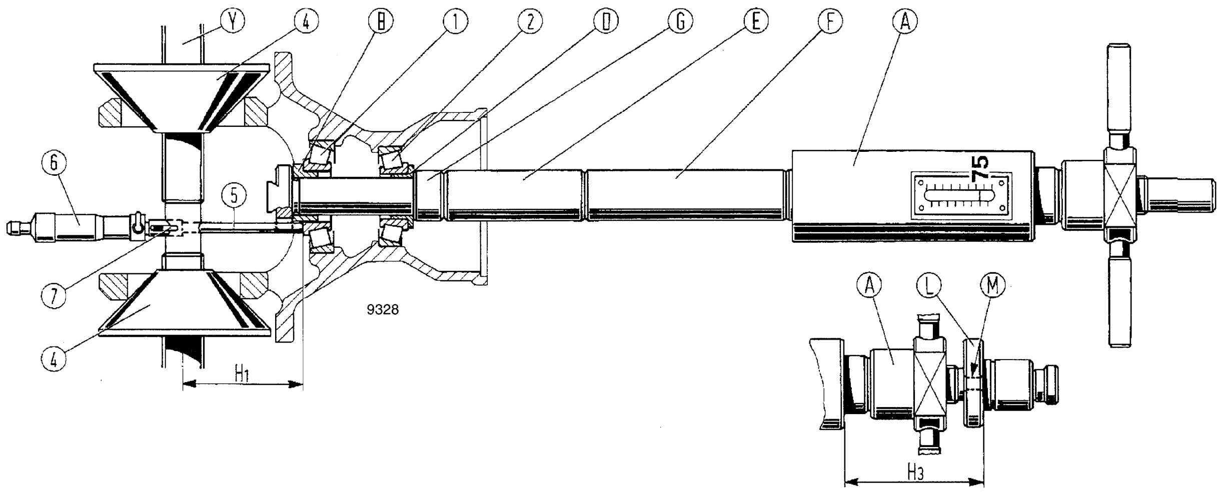
17. Partially slacken bottom cover capscrews (C_4), insert shims (S_3) and tighten capscrews to the torque on page 25–2.

18. Swing carrier several times to settle the bearings and, using a torque wrench and the **292220/4** (A) tool, check that the torque required to swing the carrier is 18÷22 Nm (1.8÷2.2 kgm – 13÷16 ft–lb).

19. If a higher torque is required, increase shim thickness, and, conversely, reduce it if the torque is less.

20. Install lubricators on top and bottom covers and grease.

Print No. 603.54.283.00 – 09 – 1994



Finding bevel pinion bearing shim thickness (S_1, page 25–5) and position shim thickness (S_2), using the 293510 universal gauge, on live axle of model 50VDT – 55VDT – 60VDT tractors.

FRONT AXLE BEVEL RING GEAR AND PINION ADJUSTMENTS

On model 50VDT – 55VDT – 60VDT tractors, using the 293510 universal gauge

Bevel pinion position adjustment and determination of required shim thickness (S_2, page 25–5).

Proceed as further indicated.

1. Install bushings **293632** (B, see accompanying figure) and **293633** (D) and, further, spacers **293625** (G), **293619** (E) and **293620** (F) on the universal gauge **293510** (A). Place the latter in the bevel pinion bearing housing, complete with taper roler bearings (1 and 2), prevoiusly lubricated with engine oil.

2. Turn gauge handwheel to bring pointer gradually to 75 kg (165 lb), simultaneously turning the gauge to settle the bearings.

3. Install the **293400/1** (Y) gauge on differential carriers, without bearings.

4. Act on the two cones (4) to bring rod (5) to correspond to the slot in (B) and, consequently, of bearing cup (1).

Note – Fit on micrometer (6) the spindle marked 75 ÷ 100.

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5. Tighten cones (4) manually to bring cones against seats eliminating end play.

6. Stop the micrometer through set screw (7) and measure dimension (H_1).

7. Establish the correct nominal dimension (H_2) from ring gear centerline to back of pinion:

$$\mathbf{H_2 = 98\ mm \pm C}$$

where:

98 mm = nominal dimension from ring gear centerline to back of pinion;

C = correction factor stamped on pinion, expressed in mm and preceded by sign + or – if different from 0, to be added or subtracted from the nominal dimension (98 mm) depending on the sign;

8. Shim thickness (S_2, page 25–5) is given by:

$$\mathbf{S_2 = H_1 - H_2}$$

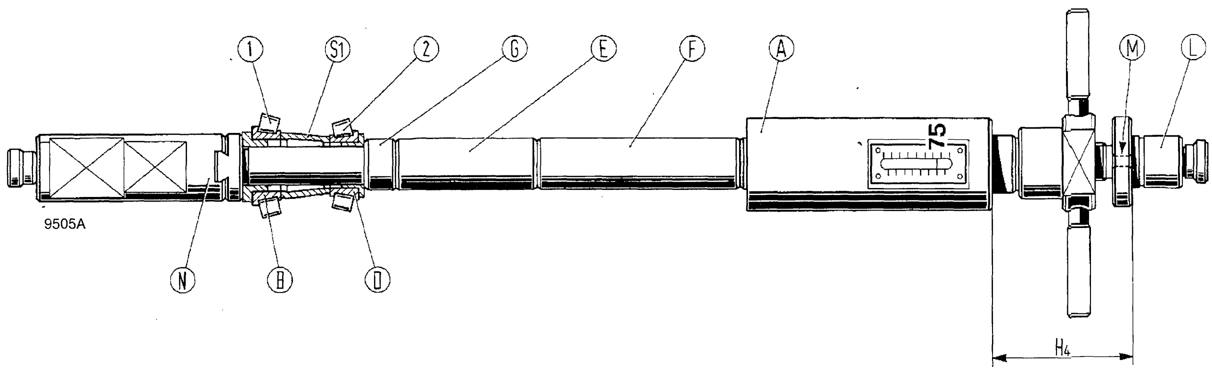
where:

H_1 = micrometer reading;

H_2 = correct nominal dimension from ring gear centerline to back of pinion.

Example:
Micrometer reading H_1 = 98.5 mm
Nominal dimension = 98 mm
Correction factor C = + 0.2 mm
Corrected nominal dimension H_2 = 98 + 0.2 mm
Shim thickness S_2 = 98.5 – 98.2 = 0.3 mm
Correction factor C = – 0.2 mm
Corrected nominal dimension H_2 = 98 – 0.2 = 97.8 mm
Shim thickness S_2 = 98.5 – 97.8 = 0.7 mm
Correction factor C = 0 mm
Corrected nominal dimension H_2 = 98 mm
Shim thickness S_2 = 98.5 – 98 = 0.5 mm

Print No. **603.54.283.00** – 09 – 1994



Bevel pinion bearing adjustment and shim thickness (S_1, page 25–5) determination.

Proceed as further indicated.

9. After finding shim thickness (S_2), fit the **293624** register (L) on the universal gauge (A, page 25–14), with holes (M) corresponding to the flat surfaces of the handwheel hub (detail a).

10. Using a depth micrometer gauge, measure dimension (H_3) previously obtained.

11. Disassemble universal gauge (A) from pinion bearing carrier, re–assemble it on work bench installing adapter **293617** (N) to to secure it in vise, then insert spacer shim (S_1) fitted on the bevel pinion and bearing cones (1 and 2) positioned as shown in figure at top of page.

12. Bring back the pointer of the graduated scale to 75 kg and, proceeding as previously indicated, measure dimension (H_4).

13. Thickness of bevel pinion bearing adjustment shim (S_1) is given by:

$$S_1 = \text{shim thickness} = H_4 - H_3 + S_2$$

where:

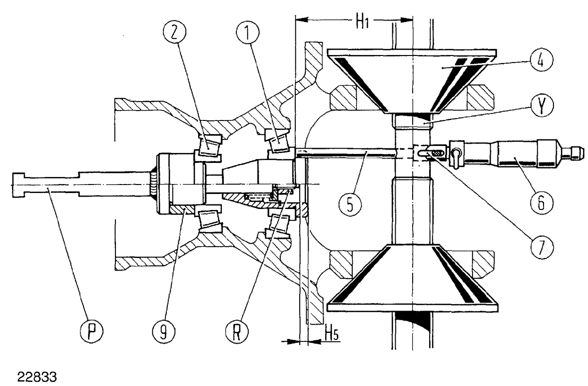
S_2 = bevel pinion position adjustment shim thickness, as previously established.

If necessary, round off (S_1) to the nearest 0.1 mm (.004 in) up.

FRONT AXLE BEVEL DRIVE ADJUSTMENT

On model 50VDT – 55VDT – 60VDT tractors, using the 293752 special tool.

Bevel pinion position and bearing adjustment, determination of the required shim thickness (S_1 and S_2, page 25–5).



Proceed as further indicated.

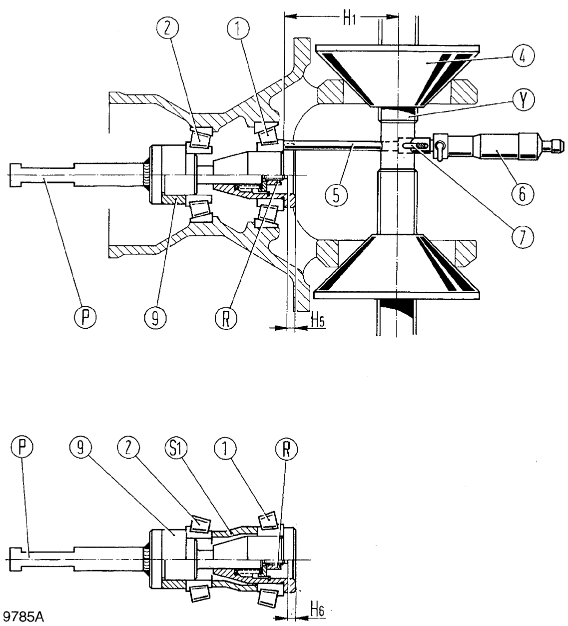
1. Install the **293752** tool (P) with associated spacer (9) on the bevel pinion bearing carrier complete with tapere roller ebarings (1 and 2) previously lubricated with engine oil.

2. Fully tighten the tool nut (R) while simultaneously turning the tool by hand to settle the bearings.

3. Insert the **293400/1** universal tool (Y) in the differential carriers without bearings.

4 ÷ 8. Find shim thickness (S_2, page 25–5) as previously indicated on page 25–14, operations 4 ÷ 8.

Print No. 603.54.283.00 – 09 – 1994



9785A

Determining bevel pinion bearing and position adjustment shim thickness (S_1 and S_2, page 25–5, respectively), using the 293752 special tool, on front live axle of model 50VDT – 55VDT – 60VDT tractors.

9. After detemining shim thickness (S_2, page 25–5), using a depth micrometer gauge, measure dimension (H_5) between top and end of tool spindle (P).

Proceed further as per the following points.

10. Dismantle tool (P) from the pinion bearing carrier.

11. Re–assemble tool (P) on work bench and insert adjustment spacer (S_1, page 25–5), fitted on the axle pinion and the bearing cones (1 and 2) positioned as shown in the accompanying figure.

12. Fully tighten nut (R) and measure dimension (H_6) using a depth micrometer gauge.

13. The bevel pinion bearing adjustment shim thickness (S_1) is given by:

$$S_1 = \text{shim thickness} = H_5 - H_6 + S_2$$

where:

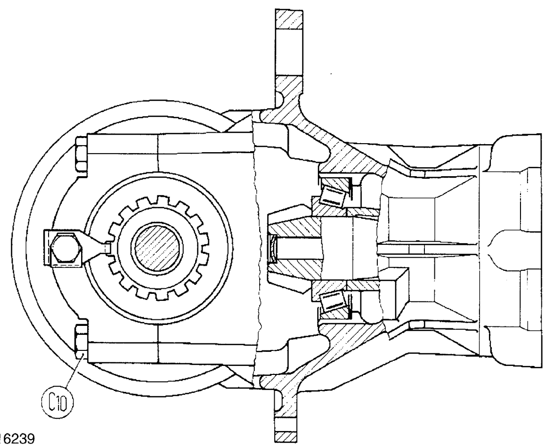
S_2 = bevel pinion position shim thickness, as previously established.

If necessary, round off to the nearest 0.1 mm (.004 in) up.

FRONT LIVE AXLE RING GEAR AND BEVEL PINION ADJUSTMENT

Differential bearing adjustment and bevel drive backlash check on model 50VDT – 55VDT – 60VDT tractors.

Proceed as further indicated.



16239

14. With pinion installed, position the ring gear–differential unit making sure that the ring gear will not force on the pinion and torque cap screws (C_{10}) at 59 Nm (6 kgm – 43 ft–lb), then slacken and re–torque them at 20 Nm (2 kgm – 14.5 ft–lb).

15. Lubricate ring gear bearings, turn ring gear and simultaneously tighten the LH side lock ring (G_s, page 25–4) up to 1.8 ÷ 2.3 Nm (0.18 ÷ 0.24 kgm – 1.3 ÷ 1.7 ft–lb) torque measuring it with a dynamometer and wire wound around the ring gear capscrews. The torque required to rotate shaft corresponds to a dynamometer reading of 24 ÷ 34 Nm (2.5 ÷ 3.5 kgm – 18 ÷ 25 ft–lb).

16. Measure bevel drive tooth backlash using a dial gauge positioned at right angle on the flank of a ring gear tooth.

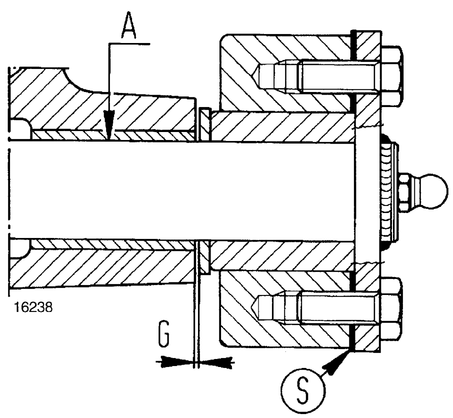
17. Repeat measurement at other two positions at 120° and compare the average of the three readings with specified backlash of 0.15 ÷ 0.20 mm (.006 ÷ .008 in).

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

Print No. **603.54.283.00** – 09 – 1994

LIVE FRONT AXLE

Central pivot installation on model 50VDT – 55VDT – 60VDT tractors (Operation no. 25 100 19).



1. Prior to installation, lubricate inside surfaces (A) of bushings force–fitted in live axle housing with TUTELA MULTI F oil.

2. Fit an equal shim thickness (S) under each attachment capscrew.

3. Check that the articulation end play (G) is comprised between 0.6 and 0.8 mm (.02 and .03 in).

4. If end play is not included within the specified tolerance range, add or remove shims (S) under the previously mentioned capscrews considering that each shim thickness is = 0.2 mm (.008 in).

5. Once correct play is obtained, tighten and lock attachment capscrews.

Removal–Installation (Op. 25 100 30) for models 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment.
Make sure that the load is held and supported by suitable slings and hooks. Make sure that nobody is standing near by.

Proceed as further indicated:

1. Disconnect battery cables and place stop blocks under rear wheels.

2. Remove drive shaft guards (page 23–3).

3. Remove drive shaft (page 23–3).

4. Jack up the tractor front end.

5. Place a shop stand under the engine oil sump, interposing a wod listel.

6. Remove front wheels.

7. Detach the two hydraulic steering connections from the power cylinder lines.

8. Suitably sling up the front live axle.

9. Remove the front support attachment screws.

10. Remove the rear support attachment screws and retrieve the live axle.

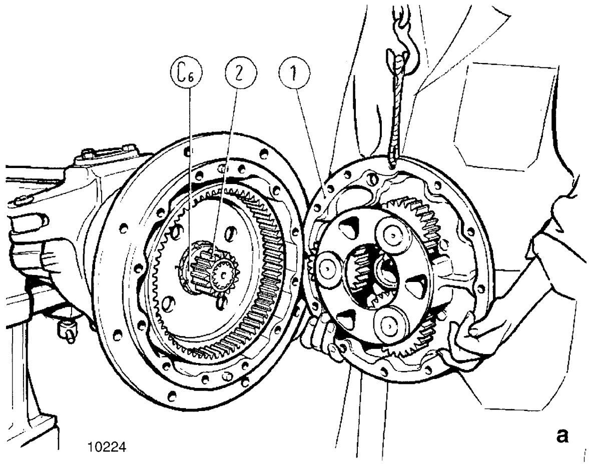
11. At installation, re–attach the live axle to engine in accordance with the following instructions and information:

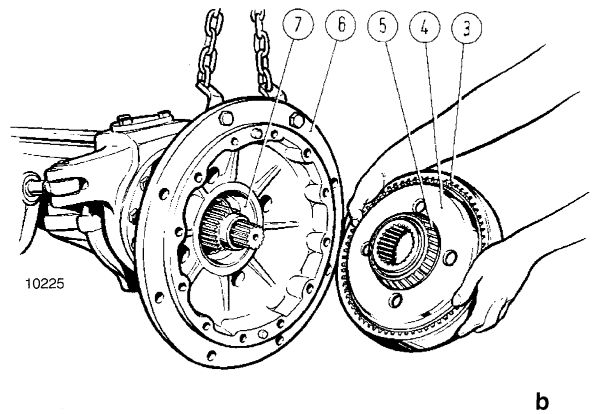
    a. proceed by reversing the previous removal sequence of operations starting from no. 10 back to no. 1;

    b. at drive shaft installation, proceed as per point 5, page 23–3;

    c. tighten fastenings to torque specifications of page 25–2;

Print No. 603.54.283.00 – 09 – 1994





Disassembly (assembly) of planetary final drive housing (a) and ring gear/fixed gear assembly (b).
C_6. Wheel bearing lock ring – 1. Final drive housing – 2. Sun gear – 3 and 4. Fixed gear/ring gear assembly – 5. Taper roller bearing cone – 6. Wheel hub – 7. Taper roller bearing cup.

FRONT FINAL DRIVE

Disassembly–Assembly (Operation 25 108 30) Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors

CAUTION

Handle all parts carefully.
Do not puts hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

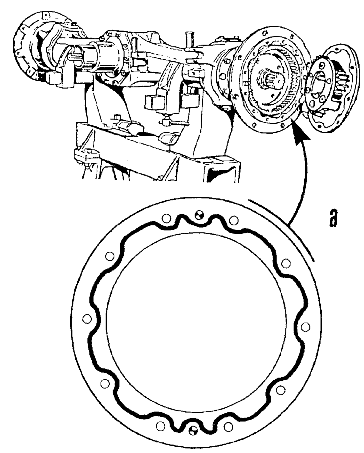
Front planetary gear final drives can be disassembled–assembled with live axle removed and secured to **293460** stand or normally installed on tractor. In the latter case, place a stand under engine sump and put on parking brake.

Remove hydraulic steering cylinders and secure live axle to the **293460** stand.

1. Drain final drive oil.
2. Remove capscrews and fit two **291525** centralizers.
3. Fit a hammer–type puller screwed in the oil drain plug threaded hole and split off from tractor.
4. Disassemble the final drive housing (1) with planet wheels.
5. Remove sun gear (2).
6. Eliminate lock on the wheel hub bearing ring nut (C_6).
7. Remove lock ring (C_6) using the **293837** special wrench.
8. Remove the fixed gear/ring gear assembly (3 and 4).
9. Assemble final drive by reversing the previous disassembly sequence of operations.
10. Fit the fixed gear/ring gear (3 and 4) and the wheel hub bearing lock ring (C_6).
11. Adjust wheel hub bearings by progressively tightening lock ring (C_6) using a torque wrench and the **293837** special lock ring wrench up to the torque of 147 ÷ 196 Nm (15 ÷ 20 kgm – 108P145 ft–lb) while rotating the wheel hub to settle the bearings.
12. Slacken lock ring completely and then re–tighten and torque it at 59 Nm (6 kgm – 43 ft–lb) while rotating the wheel hub.
13. Secure the lock ring by bending a safety washer tab (if no tab coincides with the flat on the lock ring, screw up the latter further until the flat corresponds to a tab).
14. Rotate hub by hand to make sure that it can turn freely without play or hard points.
15. Fit sun gear (2) and final drive housing (1) with planet wheels.
16. Prior to installation of the housing on to the tractor, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2mm (.08 in) thick following the lay–out shown on page 25–19.

Tighten fastenings to torque specifications of page 25–2.

Print No. ***603.54.283.00*** *– 09 – 1994*



13030

Sealing compound application lay–out scheme for live axle final drive case installation – Model 55FDT – 60FDT 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

Suitable types of sealing compounds are given on page 1, section 00.

WHEEL HUB AND STEERING KNUCKLE

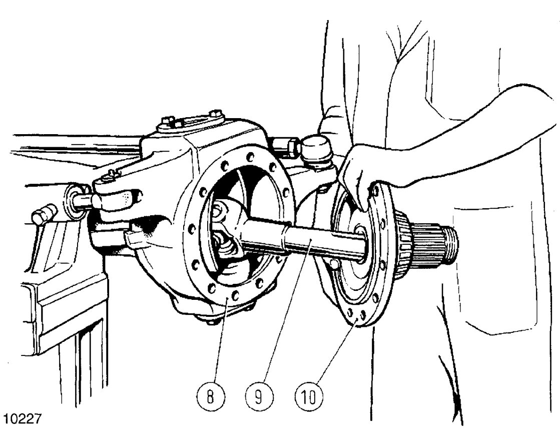
Disassembly–Assembly (Operation 25 108 34) Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT

CAUTION

Handle all parts carefully.
Do not put hands or fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Wheel hub can be disassembled only after disassembly of the associated final drive (page 25–18, operations 1 ÷ 8).

1. Remove wheel hub (6, page 25–18) with taper roller bearing cones (7) and associated oil seal (13, pages 25–6,8,10) being careful not to damage it.

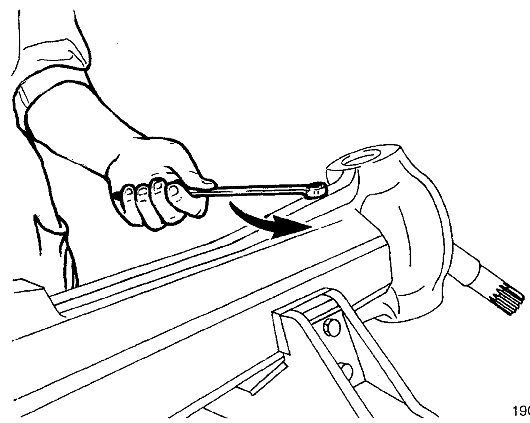


10227

2. Remove the steering tie–rod and hydraulic cylinder.

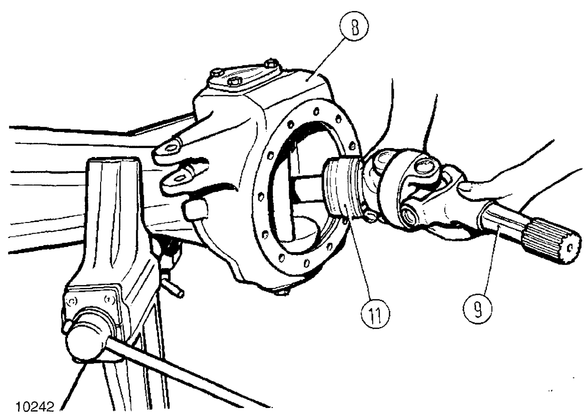
3. Undo holding capscrews (C_5, pages 25–6,8,10) and remove steering knuckle (10) with wheel hub support.

4. Remove grease fitting from king pins and holding screws then insert the **293857/1** puller, fit the puller screw in the grease fitting threaded hole and tighten it to remove the king pins.



19016

5. Remove the axle shaft holding screw.



10242

6. Remove articulated axle shaft (9) with bearing carrier (11).

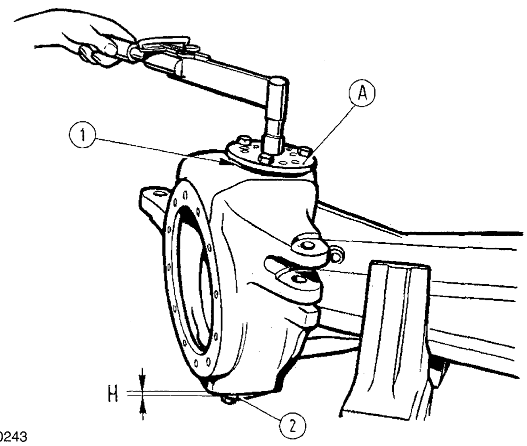
7. Remove knuckle carrier (8).

8. Reassemble wheel hub and steering knuckle by reversing the previous disassembly sequenceof operations and adjust steering knuckle bearings as further indicated.

9. Spread **Tutela G9** grease on bearing outer races.

10. install the king pin with top cover (1, page 25–20) without shims but with the **292220/4** special tool (A). Torque holding screws at 64 Nm (6.5 kgm – 47 ft–lb).

Print No. 603.54.283.00 – 09 – 1994



10243

Determining king pin bearing pre–load shim thickness (S_3, pages 25–6,8,10).

A.**292220/4** special tool for knuckle carrier swing torque check – H. Gap between carrier and bottom cover – 1. Top cover – 2. Bottom cover.

11. Install bottom cover (2) without shims, with three holding screws lubricated with engine oil.

12. Tighten bottom cover screws progressively and in alternating sequence up to the torque of 2.9 Nm (0.3 kgm – 2.1 ft–lb) each screw, with increments of 0.98 Nm (0.1 kgm – .7 ft–lb) in the meantime swinging the carrier to settle the bearings.

13. Using a feeler gauge, measure gap (H) between bottom cover and carrier alongside the capscrews.

14. Shim pack thickness (S_3, pages 25–6,8,10) under bottom cover is found by calculating the arithmetical average of readings.

If necessary, round off to 0.05 mm (.002 in), by defect.

15. Partially slacken bottom cover screws, insert shims and torque screws at 64 Nm (6.5 kgm – 47 ft–lb).

16. Swing carrier a few times to settle correctly and, using a torque wrench and the **292220/4** special tool (A) check that the torque required to swing the carrier is 2.9 ÷ 7.8 Nm (0.3 ÷ 0.8 kgm – 2.2 ÷ 5.8 ft–lb).

17. If torque is higher increase the shim pack thickness, reduce it if less.

18. Install grease fittings in top and bottom covers and apply grease.

BEVEL DRIVE–DIFFERENTIAL UNIT

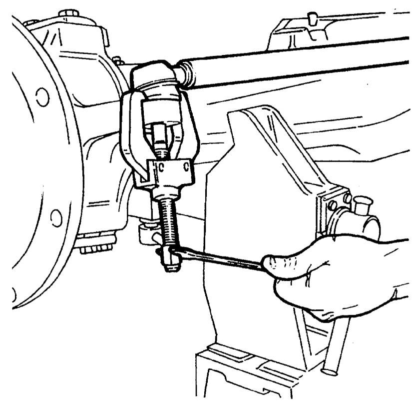
Removal–Installation (Operation 25 102 15) – Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT

CAUTION

Handle all parts carefully.
Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

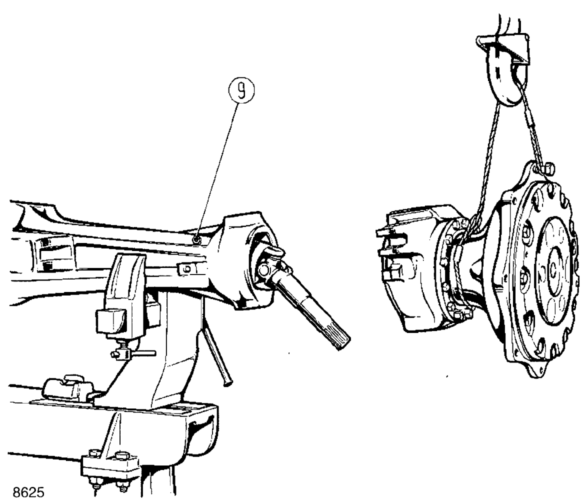
Secure the live axle to the **293460** stand and proceed in accordance with the following instructions and information.

1. Drain final drive and live axle oil.



22834

2. Remove the steering cylinder and rod nuts and, using the **293857/1** puller, remove pins from knuckle carriers and, finally, retrieve the steering cylinder and rod.



8625

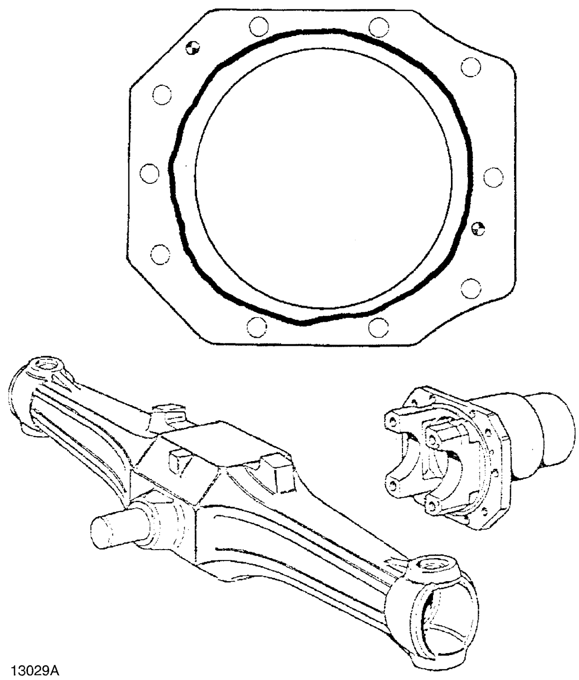
3. Remove at live axle ends the final drive assemblies made of planet gear units, wheel hubs and knuckle carriers, undo the axle shaft bearing carrier attchment screws (9) and then remove axle shafts with universal joints.

Print No. **603.54.283.00** – 09 – 1994

4. Sling up the bevel drive–differential carrier to a hoist.

5. Undo holding screws and separate carrier from live axle.

6. At installation, reverse the previous removal sequence of operations and proceed in accordance with the following instructions and information.



13029A

7. Thoroughly clean and degrease mating surfaces and apply a round strip of any one of the sealing compounds listed on page 1, section 00, following the application lay–out scheme shown in the figure above.

8. Re–attach the assembled final drives consisting of planet gear units, wheel hubs and steering knuckle carriers.

9. Install axle shafts with universal joints and tighten bearing carrier holding screws (9, page 25–20).

10. Adjust steering knuckle bearings as per points 9 ÷ 18, page 25–19.

11. Install the steering cylinder and tie–rod.

12. Fill in the final drive and live axle cases with specified quantities of oil.

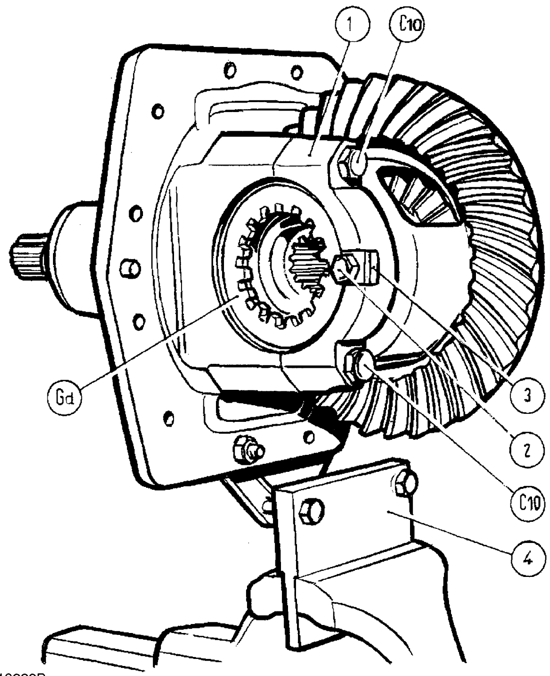
13. Tighten fastenings to torque specifications of page 25–2.

BEVEL DRIVE

Overhauling (Operation 25 102 20) – Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT.

CAUTION

Handle all parts carefully.
Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.



10238B

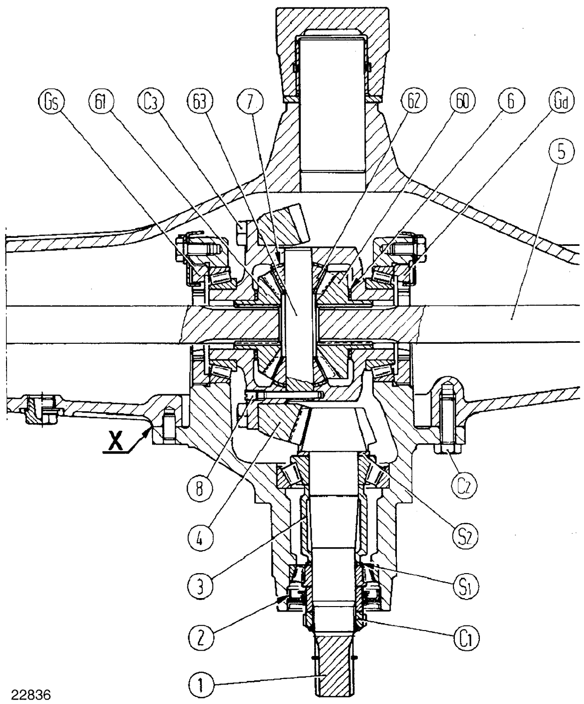
1. Remove complete bevel drive–differential carrier, secure it to the **293743** stand, lock the latter in a workbench vise and disassemble and proceed to disassembly as further indicated.

2. Remove holding screws (2) and adjuster ring (G_d) lock plates (3).

3. Remove cap (C_{10}) screws, caps (1) and ring gear adjustment ring (G_d), then separate the ring gear–differential assembly from the bevel pinion bearing carrier.

ATTENTION: before removing capscrews (C_{10}) make sure that caps (1) are identified so to avoid misplacing them at assembly.

Print No. 603.54.283.00 – 09 – 1994



22836

4. Remove ring gear capscrews (C_3) and differential pinion journal set screw (8), then proceed to disassemble the differential.

5. Remove circlip on bevel pinion shaft (1).

6. Using the **293785** wrench and **293782/1** pinion retainer unscrew bevel pinion lock ring (C_1).

7. Drive out the bevel pinion shaft from the rear end, recover front bearing and inner spacer (3).

8. Remove seal (2), dust excluder and retrieve rear bearing and spacer.

9. Assemble the bevel drive in accordance with the folowing instructions and information:

   a. proceed by reversing the previous disassembly sequence of operations, starting from no. 8 back to no. 1;

   b. consult figures and illustrations on pages 25–6,8,10 for correct placement of parts;

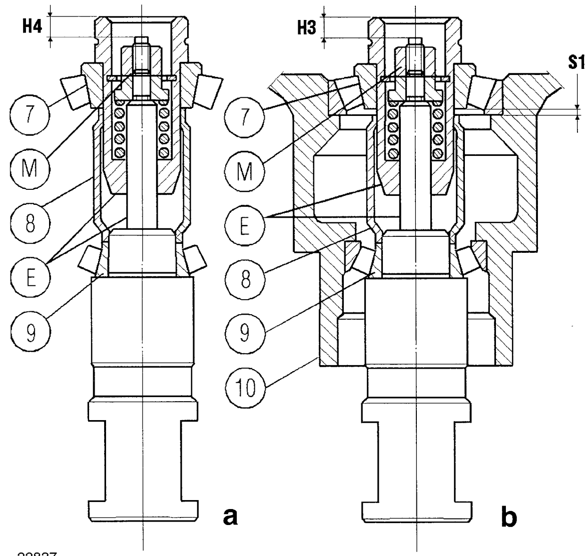
   c. tighten fastenings to torque specifications of page 25–2;

   d carry on adjustments as further indicated..

BEVEL DRIVE ADJUSTMENTS
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

Bevel pinion bearing adjustment and shim thickness (S_1, page 25–22) determination using the 293438/2 special tool.

Proceed as further indicated.



22837

10. Fit bevel pinion bearing cones (7 and 9) and associated spacer (8) on the **293438/2** tool (E).

11. Tighten tool nut (M) to stop.

12. Measure dimension (H_4) between upper plane and end of tool spindle.

13. Disassemble, lubricate bearings with engine oil and re–install parts on tool (E), see figure,detail **b**, inserting the bevel drive–differential carrier (10) with bearing cups.

14. Tighten tool nut (M) to stop and in the meantime rotate the bevel drive carrier about ten turns to settle bearings.

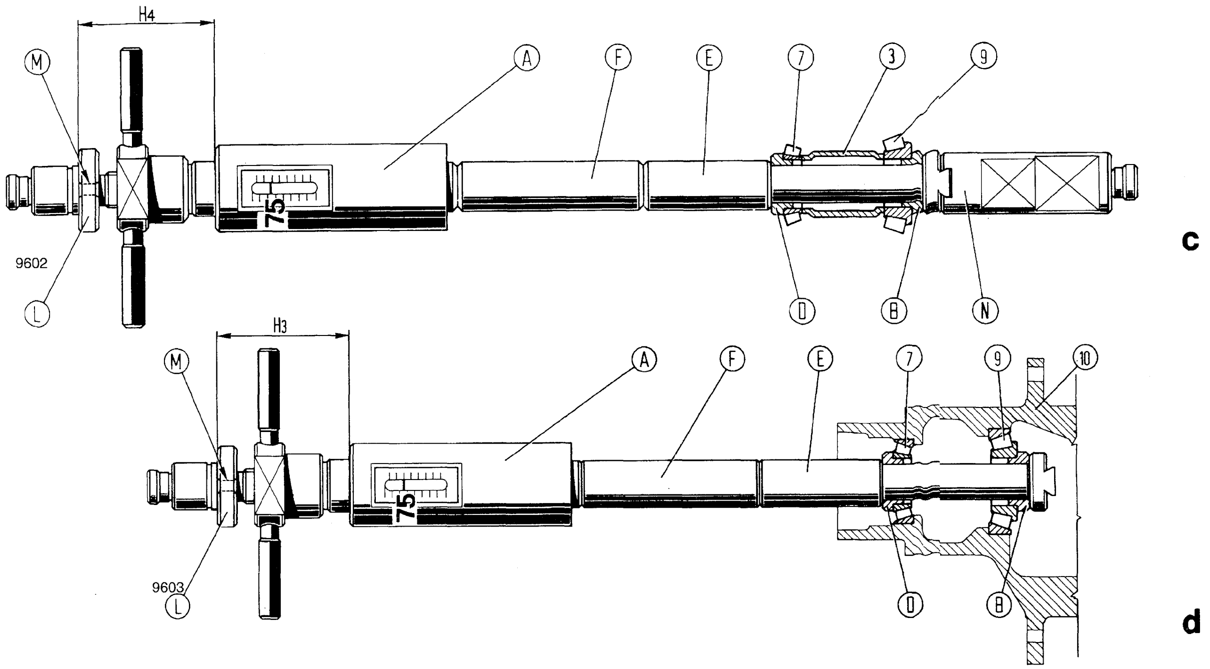
15. Measure dimension (H_3) of the tool under these conditions: shim thickness (S_1) is given by:

$$S_1 = H_3 - H_4 + 0.10 \text{ mm}$$

If necessary, round off calculated shim thickness (S_1) 0.05 mm (.002 in) up.

Note – At end of adjustment, do not remove tool from differential carrier, as it will be used for subsequent bevel pinion position adjustment.

Print No. 603.54.283.00 – 09 – 1994



Determining bevel pinion bearing shim thickness (S_1, page 25–22) using the 293510 universal gauge.

BEVEL DRIVE ADJUSTMENTS
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

Bevel pinion bearing adjustment and shim thickness (S_1, page 25–22) determination using the 293510 universal gauge.

Proceed as further indicated.

16. Install bushings **293632** (B) and **293633** (D) and spacers **293619** (E) and **293620** (F) on the **293510** universal gauge (A).

17. In addition, install part **293617** (N) to secure gauge in vice and insert bearing cones (7 and 9) and spacer (3) as shown in Fig. **c**.

18. Turn gauge handwheel to bring pointer gradually to 75 kg (165 lb).

19. Install register **293694** (L) on universal gauge (A) positioning holes (M) with flats on handwheel hub.

20. Measure dimension (H_4) using a depth gauge.

21. Disassemble unit, lubricate bearings with engine oil and reassemble gauge with bushings (B and D) and spacers (E and F) in differential carrier as shown in Fig. **d**.

22. Gradually bring pointer back to 75 kg (165 lb) on graduated scale , rotating tool at the same time to settle the bearings> Measure dimension (H_3) as described above.

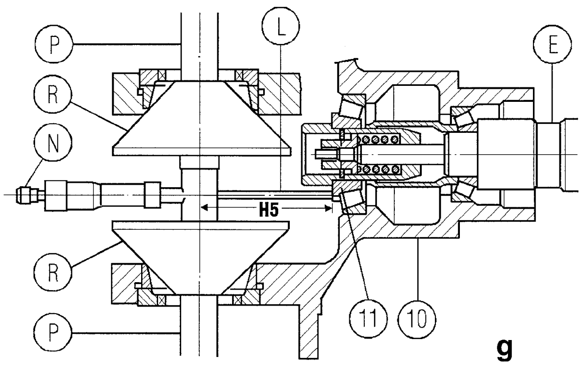
Shim thickness (S_1, page 25–22) is given by:

$$S_1 = H_4 - H_3 + 0.10 \text{ mm}$$

If necessary, round off (S_1) to the nearest 0.05 mm (.002 in) up.

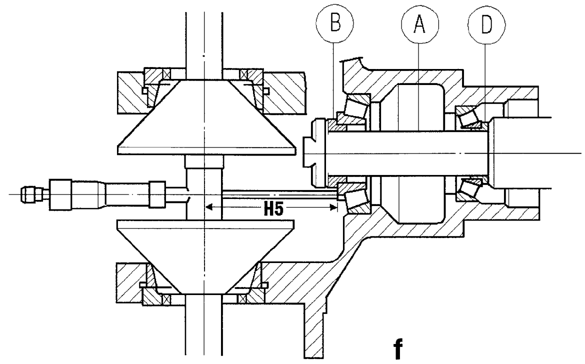
Note – At end of adjustment, do not remove tool from differential carrier, as it will be used for subsequent bevel pinion position adjustment.

Print No. **603.54.283.00** – 09 – 1994



g

22838



f

22839

Determining bevel pinion position shim thickness (S_2, page 25–22)
f. Measuring dimension H_5 using the **293510** universal gauge – g. Measuring dimension H_5 using the **293438/2** tool – A. **293510** universal gauge – B. **293632** bushing – D. **293633** bushing – E. **293438/2** tool – L,N,P,R. **293400/1** tool – 10. Differential carrier 11. Front taper roller bearing.

BEVEL DRIVE ADJUSTMENTS
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT

Bevel pinion position adjustment shim thickness (S_2, page 25–22) determination using the 293400/1 gauge (and the 293438/2 pseical tool, Fig. g, or the 293510 universal gauge, Fig. f).

Proceed as further indicated.

23. Position differential bearing cups on shaft (P) of the **293400/1** special tool with cones (R) and install cups in differential carrier.

24. Torque cap screws (C_{10}, page 25–25) at 113 Nm (11.5 kgm – 83 ft–lb).

25. Tighten or back off tool cones (R) to position the 100 mm (3.9 in) tool spindle (L) in the direction of bearing cone (11) and eliminate end play between cones (R) and ring gear bearing cups.

26. Turn depth gauge (N) to bring spindle (L) into contact with bearing cone (11) and measure dimension (H_5).

27. Establish nominal dimension (H_7) from ring gear centerline to back of pinion:

$$H_7 = H_6 \pm C$$

where:

H_6 = 100 mm. quota nominale fra asse corona e base maggiore del pignone;

C = quota di correzione stampigliata sul pignone e preceduta dal segno + oppure – se diversa da 0, da sommare oppure sottrarre alla quota nominale (H_6) secondo il segno indicato.
Lo spessore dell'anello di registro (S_2, pagg. 25–6, 25–8 e 25–10) sarà dato da:

$$S_2 = H_5 - H_7$$

dove:

H_5 = micrometer reading;

H_7 = corrected nominal dimension from ring gear centerline to back of pinion.

Example:
Micrometer reading H_5 = 103.3 mm
Nominal dimension from ring gear centerline to back of pinion H_6 = 100 mm
Correction factor C = + 2 mm
Corrected nominal dimension H_7 = 100 + 0.2 = 100.2 mm
Shim thickness S_2 = 103.3 – 100.2 = 3.1 mm
Correction factor C = 0.2 mm
Corrected nominal dimension H_7 = 100 – 0.2 = 99.8 mm
Shim thickness S_2 = 103.3 – 99.8 = 3.5 mm
Correction factor C = 0 mm
Corrected nominal dimension H_7 = H_6 = 100 mm
Shim thickness S_2 = 103.3 – 100 = 3.3 mm

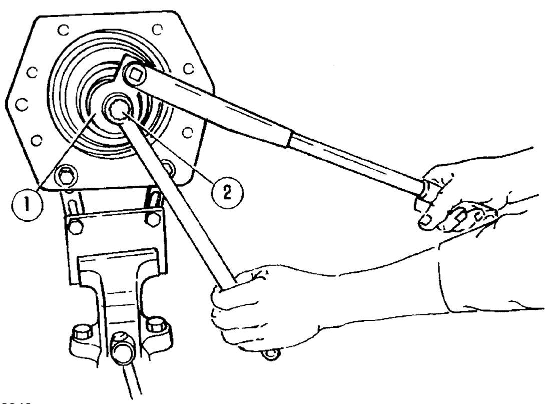
Print No. **603.54.283.00** – 09 – 1994

BEVEL DRIVE ADJUSTMENTS
Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

Ring gear bearing adjustment and bevel drive tooth backlash check.

Proceed as further indicated.

28. Install bevel pinion with all parts, including shims (S_1 and S_2, page 25–26) previously established, but without seals (2), in differential carrier and lubricate bearings with engine oil.

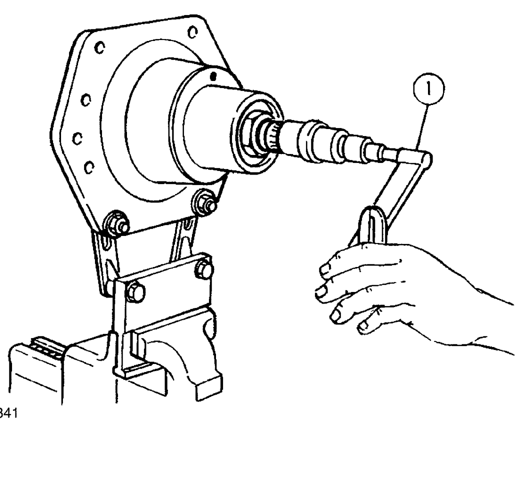


22840

29. Fit the **293785** wrench (1) on adjustment lock ring (C_1, page 25–26).

30. Fit the **293782/1** pinion holding wrench (2) over the bevel pinion splined section.

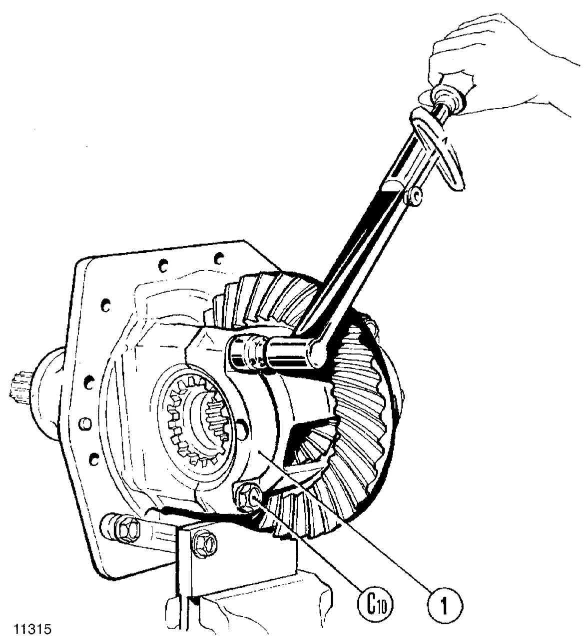
31. Hold bevel pinion and, using a torque wrench positione exactly as shown in the figure on the lock ring wrench (1), torque the lock ring at 294 Nm (30 kgm – 217 ft–lb) while rotating the bevel pinion shaft to settle bearings dynamically.



22841

32. Check that the torque required to rotate shaft is 0÷0.2 Nm (0÷.02 kgm – .15 ft–lb) using the **293951** torque wrench (1) without taking starting torque into account.

Note –The rotating torque indicated above applies to pinion shaft installed without seal; insterad, if the seal is installed, correct rotating torque is ≤ 0.5 Nm (0.05 kgm – .36 ft–lb).



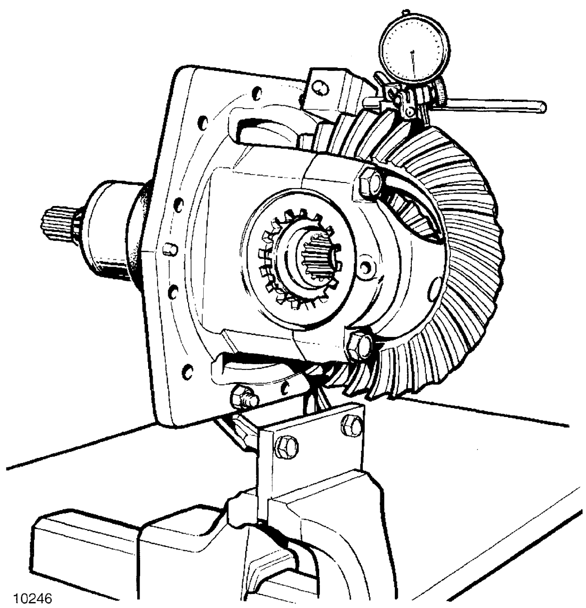
11315

33. Install differential unit in carrier ensuring that ring gear does not force on pinion.

34. Install caps (1) on differential carrier, torque cap screws (C_{10}) at 59 Nm (6 kgm – 43 ft–lb) then slacken and re–tighten at 20 Nm (2 kgm – 14.5 ft–lb).

35. Lubricate ring gear bearings, rotate bevel drive and at the same time tighten the LH lock ring (G_s, page 25–26) using the **293544** wrench up to a torque of 39÷59 Nm (4 ÷ 6 kgm – 29 ÷ 43 ft–lb) to establish the specified axial pre–load.

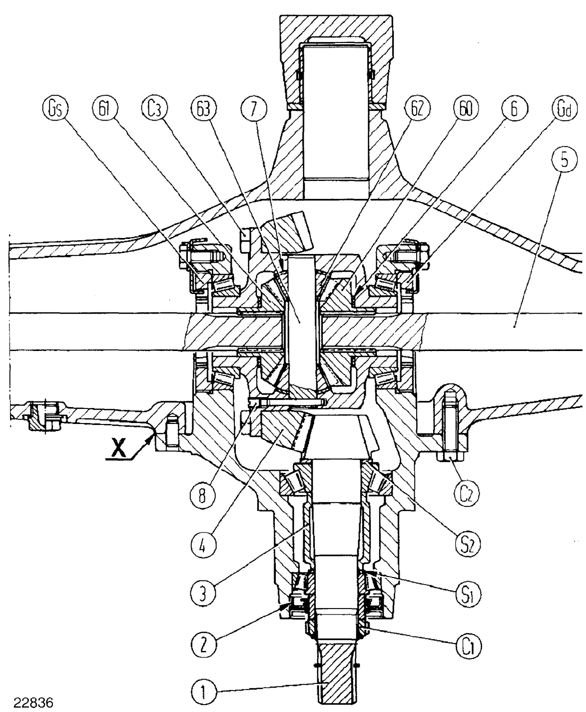
Print No. **603.54.283.00** – 09 – 1994



10246

36. Measure bevel drive backlash using a dial comparator gauge positioned at right angles outside a ring gear tooth.

37. Take two more readings at points 120° from each other and compare the arithmetical average of the three readings with specified backlash: 0.15 ÷ 0.20 mm (.006 ÷ .008 in), 0.18 mm (.007 in) being the average backlash.



22836

38. If backlashis out of specified tolerance range, correct through lock rings (G_s) and (G_d), backing one off and tightening the other by the same amount to restore axial pre–load and obtain specified backlash.

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

$A_2 = A_1 + 1 \div 1.5$ Nm (0.1 ÷ 0.15 kgm – .72 ÷ 1.08 ft–lb)

where:

A_2 = ring gear and pinion rotating torque;

A_1 = pinion rotating torque as previously measured, that is:

- 0÷0.2 Nm (0÷0.02 kgm – 0 + .145 ft–lb), with pinion installed without seal.
- ≤ 0.5 Nm (0.05 kgm – .36 ft–lb), pinion installed with seal.
- 1 ÷ 1.5 Nm (0.1 ÷ 0.15 kgm – .72 ÷ 1.08 ft–lb) = ring gear rotating torque measured at pinion end using the **293782/1** wrench and **293951** torque wrench.

39. Finally, torque cap screws (C_{10}, page 25–25) at 113 Nm (11.5 kgm – 83 ft–lb) and secure lock rings through associated safety plates (3).

Note – If plate does not correspond to notch, tighten lock ring further, as required.

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40. Install the bevel drive–differential carrier on the front axle case after thoroughly cleaning and degreasing mating surfaces followed by the application of a round strip about 2 mm (.08 in) thick of one of the sealing compounds listed on page 1, section 00, following the lay–out scheme shown on page 25–21.

FRONT LIVE AXLE DIFFERENTIAL

Overhaul (Operation 25 102 24) – Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors

CAUTION

Handle all parts carefully.
Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Side gear and pinion tooth backlash adjustment

In case of differential unit overhauling , adjust the side gear and pinion tooth backlash.

Proceed as further indicated.

1. Thoroughly wash differential loose parts to remove any presence of oil which would alter backlash measurements.
2. Install the two side gears (60 and 61, page 25–26) without thrust washers (6).
3. Install pinions (62) with thrust washers (7) and journal (63) then tighten a few turns set screw (8) to prevent the journal pin from coming off.
4. Bring the LH side gear to contact the pinion and measure dimension (H_1), using a depth gauge, taking two readings at 180° from each other and then making their arithmetical average (see figure below).
5. Push then the side gear against the differential carrier and measure dimension (H_2).

Repeat same operation on RH side gear.

The axial movement of each side gear, installed without thrust washer, is given by:

$$G_s \text{ or } G_d = H_1 - H_2$$

where:

Gs = axial movement of LH side gear;

Gd = axial movement of RH side gear;

H_1 and H_2 = readings on LH side gear or on RH side gear.

Normal backlash specified for the differential side gear and pinion teeth is **0.15 mm** (.006 in).

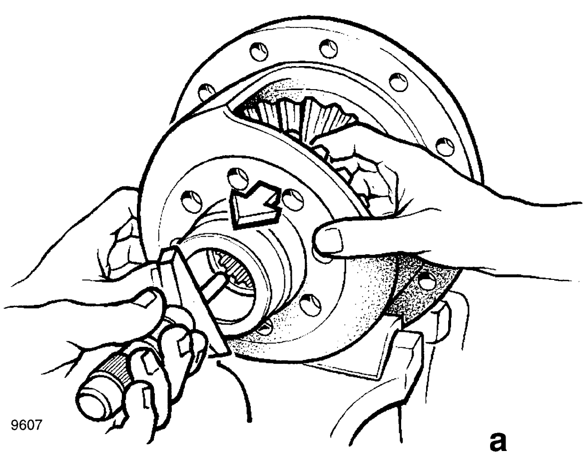
It should be taken into account that the average ratio between normal tooth backlash and equivalent axial movement of side gears is **1:1.7**.

The axial movement of side gears, corresponding to normal tooth backlash is: **0.15 x 1.7 = 0.25**.

Consequently, thrust washer thickness to be installed in the differential carrier will be:

$S_s = G_s - 0.25$ (under LH side gear);
$S_d = G_d - 0.25$ (under RH side gear).

Install washer thickness nearest to established value, considering that available thrust washers are 1.5 and 1.6 mm (.06 and .063 in) thick.



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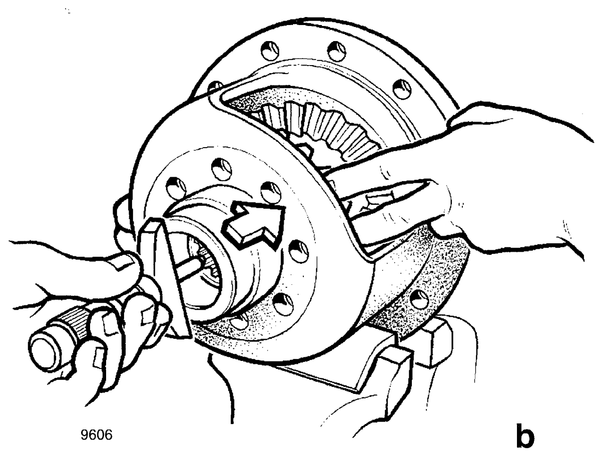

b

Determining differential side gear thrust washer (6, page 25–26) thickness.
a. Measuring dimension (H_1) – b. Measuring dimension (H_2).

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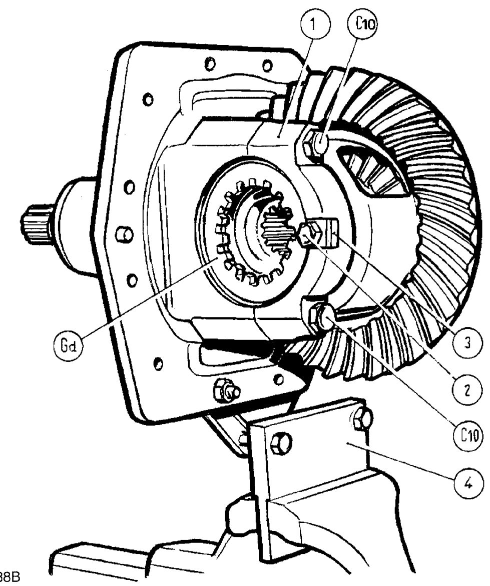
FRONT DIFFERENTIAL WITH LIM–SLIP UNIT

Overhaul (Operation 25 102 27) – Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT – 72LPDT – 82LPDT tractors.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear safety clothing and accessories such as goggles, gloves and safety shoes.



10238B

1. Remove assembled bevel drive–differential carrier, secure it to the **293743** stand, lock it in bench vise and proceed to disassemble it as further indicated.

2. Remove right and left lock ring (G_d) set screws (2) and safety plates (3).

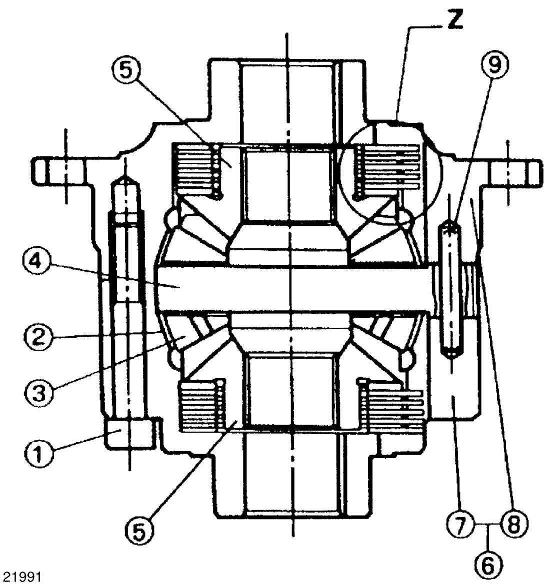
3. Check that the right and left caps are identified in order to re–position them correctly at assembly.

4. Remove the right and left ring gear bearing lock rings (G_d).

5. Remove screws (C_{10})) and caps (1) and separate the ring gear from the bevel pinion bearing carrier.

6. If necessary, remove holding screws (C_3, page 25–26) and ring gear.

Proceed to disassemble the self–locking LIM–SLIP differential as further indicated.



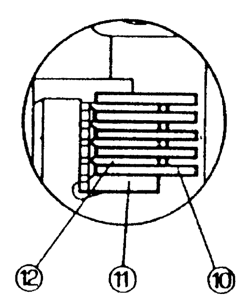
21991

LIM–SLIP differential for class 1 front live axle

7. Remove the differential carrier halves holding screws (1).

8. Open differential carrier (6).

9. Remove from carrier half (7) the differential pin (4) with pinions (3), thrust washers (2) and spring pin (9).



21994

Detail Z of friction element

10. Remove side gear (5), friction plate (11) and, alternatively, metal plates (10) and friction plates (12).

11. Remove from carrier half (8) the side gear (5), friction plate (11) and, alternatively, metal plates (10) and friction plates (12).

*Print No. **603.54.283.00** – 09 – 1994*

LIM–SLIP self–locking differential friction plates for Class 1 front live axles				
Part no.	**Description**	**Q.ty**	**Thickness mm (in)**	**Max. disc wear allowance mm (in)**
10	Metal plate	10	1.5 (.06)	—
11	Friction plate	2	2.8 (.11)	0.10 (.004)
12	Friction plate	8	1.6 (.06)	0.15 (.006)

12. Check metal plates (10) and friction plates (11) and (12) for wear, see table above, replacing those approaching wear limits.

13. Assemble self–locking differential by reversing the disassembly sequence of operations previously described, wet threads of screws (1) with LOCTITE 270 and torque at 50 Nm (5 kgm – 36 ft–lb).

14. If previously dismantled, re–install ring gear on carrier half (8) and torque screws (C_3, page 25–26) at 113 Nm (11.5 kgm ÷ 83 ft–lb).

15. Check the bevel pinion rotating torque as per operation 25, page 25–25.

16. Install ring gear with LIM–SLIP unit on bevel drive carrier, remembering that, at ring gear bearing cap installation, the respective identification reference marks must coincide and then proceed with the assembly and subsequent adjustment of bevel ring bearings as per operations 26÷32, pages 25–25 and 25–26.

LIM–SLIP SELF–LOCKING DIFFERENTIAL – Model 55FDT – 60FDT – 70VDT – 62FDT – 72FDT – 82FDT 72LPDT – 82LPDT tractors.

Operation

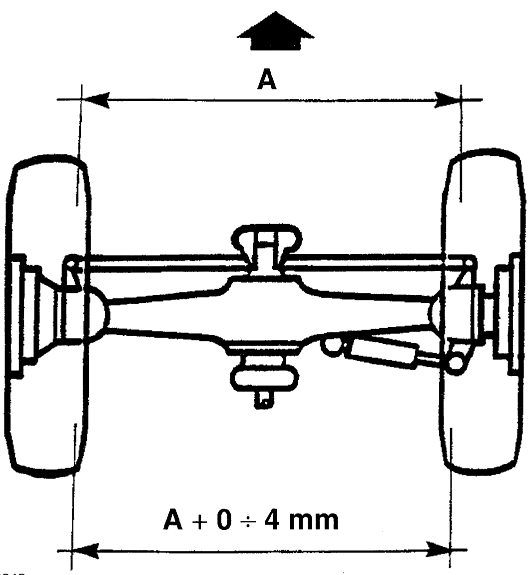
The limited slip locking differential (LIM–SLIP) is of a 2–pinion type unit and is provided with two multi–plate clutch packs installed between side gears and differential carrier.

It is fully automatic, does not require any manual intervention and reduces loss of adherence on the ground and consequent wheel slippage considerably, without totally eliminating it.

The difference in revolutions, occurring between side gers and differential carrier when one wheel starts slipping due to reduced adherence, is counteracted by the clutch packs which are compressed by axial thrusts deriving from the forces imparted by the bevel drive onto side gears through the teeth of the two pinions.

These angular forces can differ, as a function of the nature of soil and of the path followed by tractor, and their intensity can also vary, determining proportional axial forces acting onto the clutch packs and tending to compact the side gears with the differential carrier, thus allowing the front axle drive to overcome ground asperities.

Print No. **603.54.283.00** – 09 – 1994



Front drive–steering wheel geometry check diagram

FRONT DRIVE–STEERING WHEEL TOE–IN CHECK (Operation 44 511 80)

In straight–ahead driving, 4WD tractor wheels should be parallel to the tractor longitudinal centerline. Hovever, a slight toe–in up to a maximum of 4 mm (.16 in), measured between rim edges, is allowed on tractors equipped with 16" to 20" rims.

To find the exact measure of the toe–in on 4WD tractors, proceed as further indicated.

1. Inflate both front tyres to specified pressure.
2. Turn steering wheel at about half–way, with one rung aligned with tha tractor longitudinal centerline.
3. Check that wheels are parallel to the tractor longitudinal centerline.
4. Measure, on the horizontal plane passing through the wheel centerlines, distance (A) between **front inside edges** of rims (see accompanying figure).
5. Further, measure still on same plane, the distance between **rear inside edges** of rims, comparing it with (A): it should be equal or greater up to a maximum of 4 mm (.16 in) (see accompanying figure).
6. In case, correct the toe–in through the front tie–rod adjustable ends.

BEVEL DRIVE AND DIFFERENTIAL

Bevel drive gear ratio:	50V – 55V – 60V – 70V 55F – 60F	62F – 72F – 82F – 72LP 82LP
– 30 km/h versions	9/43 = 1:4.8	
– 40 km/h versions(*)	—	11/43 = 1:3.9
Bevel gear tooth backlash .... mm (in)	0.15÷0.20 (.006÷.008)	0.18÷0.23 (.007÷.009)
Differential	2–pinion	
Differential lock	control pedal	
Differential pinion bore dia. .... mm (in)	—	24.040÷24.061 (.9464÷.9473)
Differential pinion journal dia. .... mm (in)		23.939÷23.960 (.9425÷.9433)
Differential pinion running clearance .... mm (in)		0.080÷0.122 (.0031÷.0048)
Side gear boss housing dia. in differential case . mm (in)	—	44.080÷44.119 (1.7354÷1.7370)
Side gear boss dia. .... mm (in)		43.961÷44.000 (1.7307÷1.7323)
Side gear boss clearance in case .... mm (in)		0.080÷0.158 (.0031÷.0062)
Bevel pinion bearing adjustment	see page 27–9	
Bevel drive cone point adjustment	see page 27–8	
Bevel drive coin point shim thickness .... mm (in)	1.00–1.05–1.10–1.15–1.20–1.25–1.30–1.35–1.40–1.45–1.50–1.55–1.60–1.65–1.70–1.75–1.80–1.85–1.90–1.95–2.00–2.05–2.10–2.15–2.20 (.039–.041–.043–.045–.047–.049–.051–.053–.055–.057–.059–.061–.063–.065–.067–.069–.071–.073–.075–.077–.079–.080–.083–.085–.087)	1.85–1.90–1.95–2.00–2.05–2.10–2.15–2.20–2.25–2.30–2.35–2.40–2.45–2.50–2.55–2.60–2.65–2.70 (.073–.075–.077–.079–.081–.083–.085–.087–.089–.091–.093–.095–.097–.098–.100–.102–.104–.106)
Ring gear bearing and bevel drive tooth backlash adjustment	see page 27–10	
Differential side gear/pinion tooth backlash .... mm (in)	0.15 (.006)	
Differential side gear thrust washer thickness .. mm (in)	1.5–1.6 (.059–.063)	
Differential pinion thrust washer thickness ..... mm (in)	1.5 (.06)	
Differential lock adjustments	see page 27–13	
Differential lock shift fork adjustment shim thickness .... mm (in)	0.5 (.020)	
Differential lock shift fork spring specifications:		
– free nominal length .... mm (in)	156 (6.142)	220 (8.661)
– compressed length under a load of:		
329÷363 N (33.6÷37 kg – 74÷81.5 lb)	102 (4.016)	—
177÷195 N (18.1÷19.9 kg – 40÷44 lb)	—	157.5 (6.201)

(*) Optional on model 62F 72F 82F 72LP 82LP tractors

FINAL DRIVES

	50V – 55V – 60V – 70V 55F – 60F	62F – 72F – 82F – 72LP 82LP
Type	epicyclic, 3 planet wheels, spur geras	
Gear reduction ratio	14:(18+ 52) = 1:5	15:(23 + 63) = 1:5.73
Driven gear carrier end play adjustment shim thickness .... mm (in)	3.5–3.6–3.7–3.8–3.9–4.0–4.1–4.2–4.3–4.4–4.5–4.6–4.7–4.8 (.138–.141–.146–.150–.153–.157–.161–.165–.169–.173–.177–.181–.185–.189)	

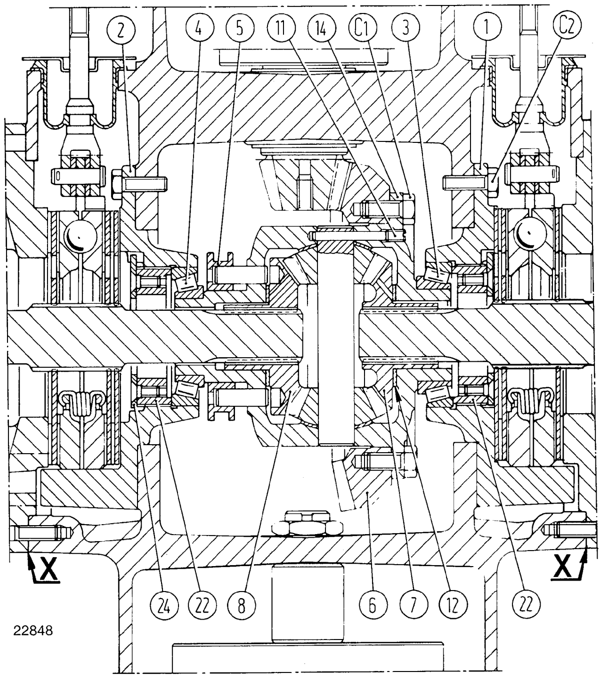
TORQUE WRENCH DATA: model 50V – 55V – 60V – 70V – 55F – 60F tractors

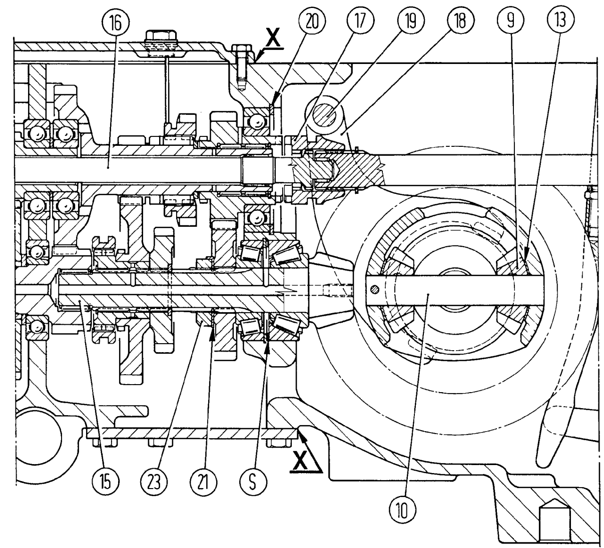
DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Bevel drive and differential Ring gear capscrews (C_1, page 27–3)	M12x1.25	123	12.5/90
Ring gear–differential carrier self–locking screws (C_2)	M10x1.25	59	6/43
Differential lock pedal mount screws (C_3, page 27–13)	M10x1.25	49	5/36
Final drives Final drive case stud nuts (C_1, page 27–15) .... Drive wheel axle shaft lock screw (C_2)	M10x1.25 M18x1.5	73 250	7.5/54 25.5/184
Drive wheel disc/rim attachment screw nuts (C_3)	M16x1.5	245	25/180
Drive wheel disc/hub attachment screw (C_4)	M18x1.5	255	26/188
Drive wheel ballast weight attachment screw nuts	M16x1.5	221	22.5/163

TORQUE WRENCH DATA: model 62F – 72F – 82F – 72LP – 82LP tractors

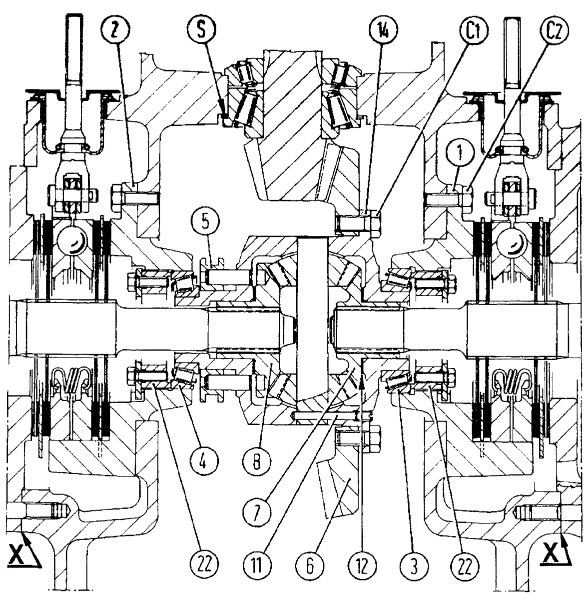
DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Bevel drive and differential Ring gear capscrews (C_1, page 27–3)	M12x1.25	123	12.5/90
Ring gear/differential carrier self–locking screws (C_2)	M10x1.25	59	6/43
Differential lock pedal mount screws (C_3, page 27–13)	M10x1.25	49	5/36
Final drives Final drive case stud nuts (C_1, page 27–15)	M12x1.25	98	10/72
Drive wheel axle shaft lock screw (C_2)	M18x1.5	250	25.5/184
Drive wheel disc/rim attachment screw nuts (C_3)	M16x1.5	245	25/180
Drive wheel disc/hub attachment nut (C_4)	M18x1.5	255	26/188
Drive wheel ballast weight attachment screw nuts	M14x1.5	98	10/72

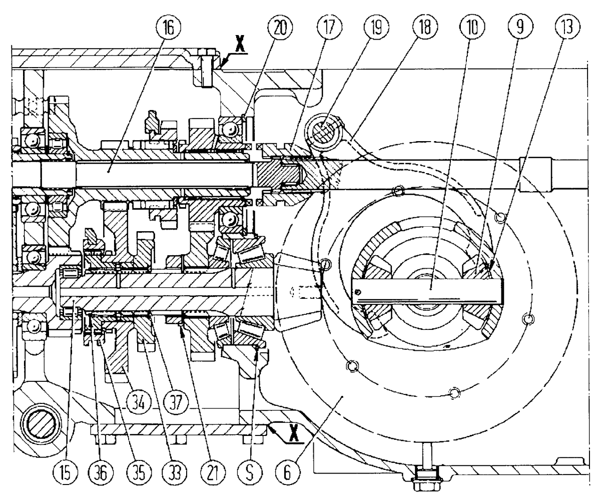
Print No. ***603.54.283.00*** *– 09 – 1994*





a





b

Longitudinal and cross–sectional views through bevel drive and differential

a. Model 50V – 55V – 55F – 60V – 60F – 70V – 72LP – 82LP tractors – b. Model 62F – 72F 82F tractors – C_1. Bevel ring gear screws – C_2. Bevel drive–differential carrier screws – S. Bevel pinion cone point adjustment shims – 1 and 2. Differential carriers – 3and 4. Taper roller bearings – 5. Differential lock sleeve – 6. Bevel ring gear – 7 and 8. Differential side gears – 9. Differential pinion – 10. Journal – 11. Pinion journal set screw – 12 and 13. Thrust rings – 14. Differential housing – 15. Bevel pinion shaft – 16. Power take–off shaft – 17. Power take–off engagement collar – 18. Shift fork – 19. Fork bar 20. Circlip – 21. Lock washer – 22. Bevel ring gear–differential bearing adjustment ring nut – 23. Bevel pinion bearing adjustment nut – 24. Lock washers – 33. Reverse gear – 34. Low speed range driven gear – 35. Transmission straight drive and low speed range shift collar – 36. Circlip – 37. Half–rings.

Note – Prior to assembly, thoroughly clean and degrease mating surfaces **X** and apply one of the sealing compounds listed on page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

BEVEL DRIVE AND DIFFERENTIAL TROUBLESHOOTING GUIDE

Problem	Possible causes	Correction
Excessive noise while driving, with transmission in neutral also (not due to final drives).	**1.** Wrong bevel pinion and/or ring gear bearing adjustment.	Remove rear drive case and adjust bevel drive pinion and ring rear bearings correctly (pages 27–8 ÷ 27–10).
	2. Differential side gear and pinion wrong adjustment or wear.	Remove rear drive case, replace worn parts and adjust differential side gears and pinions correctly (page 27–12).
	3. Excessive spline backlash of axle shaft/side gear mesh.	Remove rear drive case and replace damaged parts.
Excessive noise under load and during release.	**1.** Excessive bevel ring gear and pinion tooth backlash.	Remove rear drive case and adjust bevel drive pinion and ring gear bearings correctly (pages 27–8 ÷ 27–10).
	2. Failure or defective differential part/s.	Remove rear drive case, replace worn parts and adjust differential gear tooth backlash correctly (page 27–12).
Excessive noise and overheating.	**1.** Insufficient clearance fit of bevel pinion and/or ring gear bearings.	Remove rear drive case and adjust bevel drive pinion and ring gear bearings correctly (pages 27–8 ÷ 27–10).
	2. Insufficient bevel drive gear tooth backlash.	Remove rear drive case and adjiust bevel ring gear bearings correctly (page 27–8 ÷ 27–10).

FINAL DRIVE TROUBLESHOOTING GUIDE

Problem	Possible causes	Correction
Excessive noise while driving, with transmission in neutral also.	**1.** Planetary gear carrier wrong end play adjustment at assembly.	Remove final drive case , check and adjust play (page 27–16).
	2. Failure or defective internal component/s.	Remove final drive case and replace damaged parts.
	3. Excessive spline backlah of axle shaft/planetary gear mesh.	Remove final drive case and replace damaged parts.

Print No. ***603.54.283.00*** *– 09 – 1994*

DIFFERENTIAL LOCK TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Differential lock fails to engage.	**1.** Hardening or seizure of control leverage.	Lubricate control leverage with grease.

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code (**X**).
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

List of the special tools needed to carry on the service operations concerning this section of the Manual.

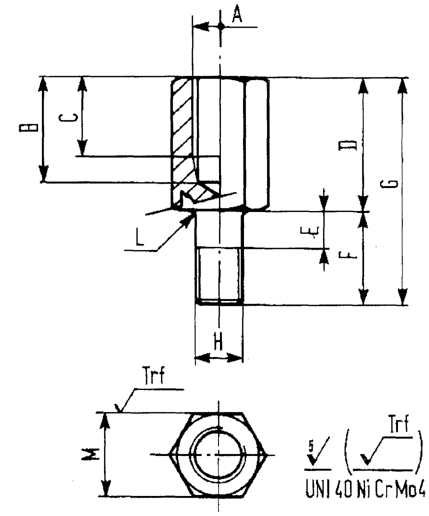
291517 Lifting hook, rear drive, cover and final drives (500 kg capacity).

293400/1 Gauge, bevel drive cone point adjustment.

291525 M10x1.25 centralizer, ring gear and differential carrier and final drive cover installation.

X 293452 Compressor, differential lock fork spring installation (models 62F – 72F – 82F – 72LP – 82LP).

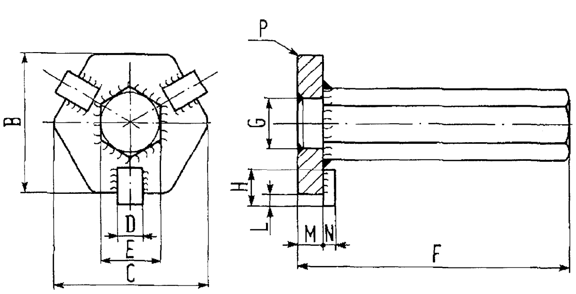
X 292576 Compressor, differential lock fork spring installation, (models 50V – 55V – 55F – 60V – 60F – 70V).



13011

Self–made adapter for bevel pinion shaft and reverse gear journal removal (applies to all models) – Material: UNI Aq 42 steel.

A=M14x1.5 – B=28 mm (1.10 in) – C=21 mm (.83 in) – D=35 mm (1.38 in) – E=10 mm (.40 in) – F=25 mm (.98 in) – G=60 mm (2.36 in) – H=M12x1.25 – L=2.5 mm (.10 in) radius – M=22h11 mm (.87H.43 in).



13010

UNI Aq 42

Self–made tool for bevel ring gear–differential bearing adjustment (applies to all models) – Material: Aq 42 steel. Mark 50027.

B=54.7÷55 mm (2.15÷2.16 in) – C=62 mm (2.44 in) dia. – D=10 mm (.10 in) – E=29.8÷30 mm (1.17÷1.18 in) – F=110 mm (4.33 in) – G=20 mm (.80 in) dia. – H=15 mm (.59 in) – L=5 mm (.20 in) – M=10 mm (.10 in) – N=5mm (.20 in) – P=1 mm (.04 in)x30° chamfer.

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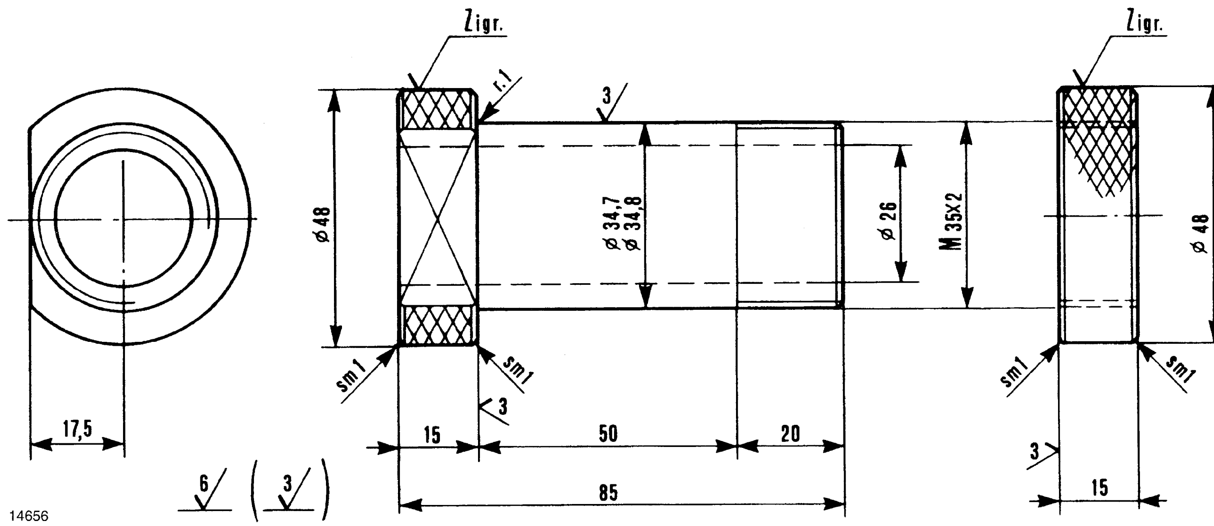
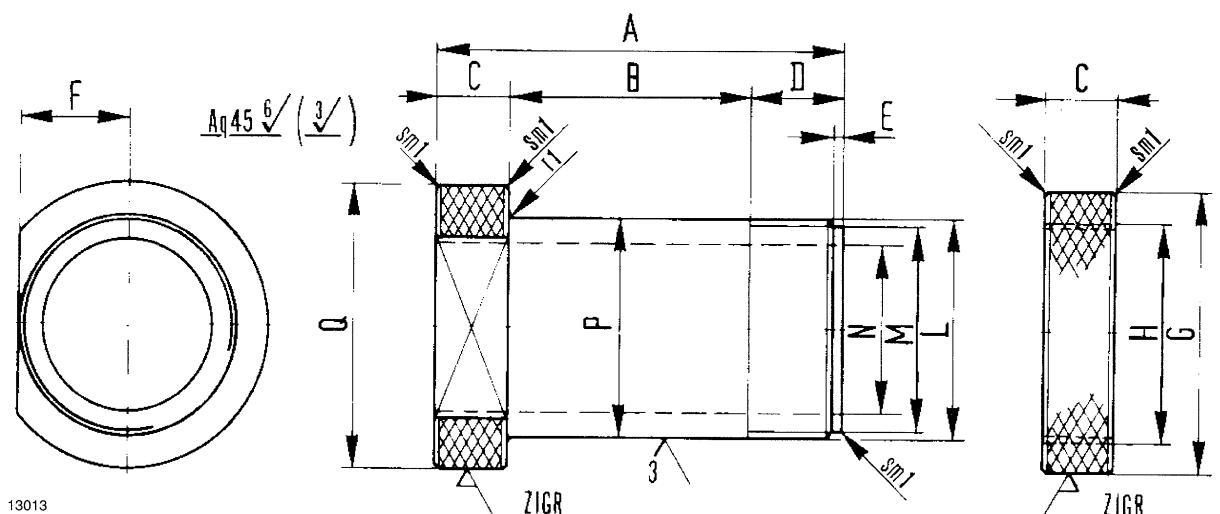


a

Self–made tools for bevel drive shaft cone point adjustment
Model 50V – 55V – 60V – 70V – 55F – 60F tractors – Metric dimensions
(Mark 50029)



b

Self–made tool for bevel pinion shaft positioning at assembly.
Model 62F – 72F – 82F – 72LP – 82LP tractors (Mark 50004).
A=85 mm (3.35 in) – B=50 mm (1.97 in) – C=15 mm (.59 in) – D=20 mm (.80 in) – E=2 mm (.08 in) – F=22.5 mm (.88 in) – G=58 mm (2.28 in) dia. – H = M45 x2 – L=M45x2 – M=42.5 mm (1.67 in) dia. – N=35 mm (1.38 in) dia. – P=44.7÷44.8 mm (1.760÷1.764 in) – Q=58 mm (2.28 in) dia. – r1=1 mm (.04 in) radius – Sm1 = 1 mm (.04 in) chamfer – ZIGR=knurl.

Print No. ***603.54.283.00*** *– 09 – 1994*

REAR DRIVE AXLE CASE ASSEMBLY
Removal–Installation (Operation 21 118 10)

For rear drive axle case assembly removal–installation follow operations 1 through 9 of page 18, section 21.

BEVEL DRIVE–DIFFERENTIAL
Disassembly–Assembly, with rear drive case removed from tractor (Operations 27 106 10 – 27 106 36 – 27 110 18)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.

1. Remove the power take–off rear and top covers.

2. Remove bearing quills and then the complete bevel ring gear differential unit from the case top (models 50V – 55V – 60V – 70V – 55F – 60F) or from the case rear end (models 62F – 72F – 82F – 72LP – 82LP).

Disassemble the ring gear–differential unit as further indicated.

3. If necessary, separate the ring gear from differential housing by removing capscrews (C_1, page 27–3).

4. Remove set screw (11) and journal (10) and retrieve differential pinions (9) and side gears (7) and (8).

5. Remove the power take–off control lever and differential lock.

6. Remove the transmission splitter rear drive shaft bearing retaining circlip (20, page 27–3).

7. Remove the medium speed range gear with ball bearing and needle bearings and then the transmission splitter drive shaft with reverse gear shift collar.

8. Remove bevel pinion shaft using the self–made adapter of page 27–5.

A. On models **50V – 55V – 60V – 70V – 55F – 60F:**

— unscrew the bevel pinion shaft bearing adjustment nut (23, page 27–3), fit the self–made adapter and secure it onto a hammer–type puller to remove the bevel pinion, recovering gears from inside of case.

Note – To retrieve the bevel position adjustment shims (S, page 27–3 first remove the bevel pinion end bearing cup from inside the case.

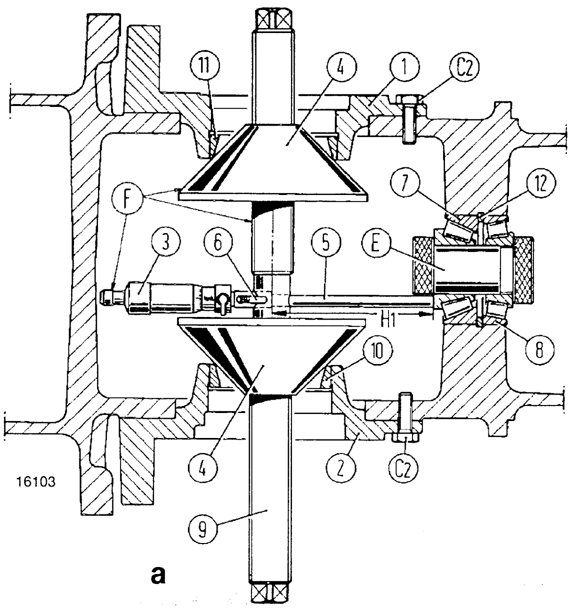
B. On models **62F – 72F – 82F – 72LP – 82LP:**

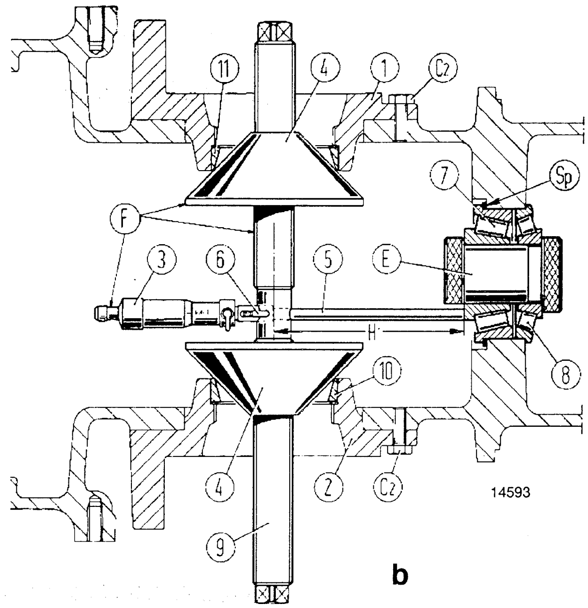
— partially unscrew the bevel pinion shaft bearing adjustment shim, fit he self–made adapter of page 27–5 and secure it to a hammer–type puller;

— using the puller, drive out the pinion partially and remove circlip (36, page 27–3), move gears (33 and 34) towrds the transmission case and remove hal–rings (37);

— unscrew the bevel pinion shaft bearing adjustment nut (21) completely and remove bevel pinion then retrieve gears from inside the case (to recover the pinion position adjustment shims, first remove from transmission case the cup of the bearing on bevel pinion head side.

Print No. ***603.54.283.00*** *– 09 – 1994*





Bevel drive pinion cone point adjustment gauge installation.

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – C_2. Carrier (1 and 2) capscrews – E. Self–made tool – F.**293400/1** universal gauge – H_1. Dimension measured using the gauge – Sp. Test ring – 1 and 2. Ring gear–differential carriers – 3. Micrometer caliper – 4. Centralizing cones – 5. Micrometer spindle – 6. Micrometer (3) set screws – 7 and 8. Bevel pinion bearings – 9. Threaded rod – 10 and 11. Taper roller bearing cups 12. Circlip.

BEVEL DRIVE ADJUSTMENTS

Bevel pinion cone point adjustment and shim thickness finding.

Important– Pinion cone point adjustment requires the use of the tool to be made in the workshop following indications contained in the working drawing og page 27–6.

Proceed as further indicated.

9. Fit self–made tool (E) as shown in the figures above, taking into account that:

A. On models **50V – 55V – 60V – 70V – 55F – 60F:**

— this tool fits on the cones of the bevel pinion taper roller bearings on the rear drive case, with bearing cups (7 and 8) and circlip (12) installed but without adjustment shims (**S**, page 27–3)

B. On models **62F – 72F – 82F – 72LP – 82LP:**

— tool (E) fits on the cones of the taper roller bearings on the rear drive case with bearing cups (7 and 8) and test rig shim (Sp) installed.

10. Install the **293400/1** gauge (F) on differential bearing carriers (1 and 2) with bearing (10 and 11) cups fited.

11. Screw in or back the two cones (4) to bring the micrometer (3) spindle (5) at the bevel pinion shaft bearing (7).

12. Operate cones (4) by hand or using a lock ring wrench to tighten gauge lightly on bearing cups (10 and 11) so to eliminate any end play.

13. Secure the micrometer gauge with spindle through set screw (6).

14. Bring the micrometer spindle (5) to contact bearing (7) and measure dimension (H_1).

15. Establish the corrected nominal dimension (H_3) between ring gear centerline and pinion large base:

$$H_3 = H_2 \pm C$$

Print No. **603.54.283.00** – 09 – 1994

where:

A. On models **50V – 55V – 60V – 70V – 55F – 60F:**

H_2 = 118.5 mm. Nominal dimension between ring gear centerline and pinion large base.

C = correction factor stamped on pinion, expressed in mm's and preceded by a + or – sign, if different from 0, to be added or sutracted from nominal dimension (H_2) as indicated by the sign.

Shim thickness (**S**, page 27–3) is given by:

$$\mathbf{S = H_1 - H_3}$$

H_1 = micrometer reading.

H_3 = corrected nominal dimension between ring gear centerline and pinion large base.

B. On models **62F – 72F – 82F – 72LP – 82LP:**

H_2 = 145.5 mm. Nominal dimension between ring gear centerline and pinion large base.

C = correction factor stamped on pinion and preceded by a + or – sign , if different from 0, to be added or subtracted from nominal dimension (H_2) as indicated by the sign.

Shim thickness (**S**, page 27–3) is given by:

$$\mathbf{S = H_1 + Sp - H_3}$$

H_1 = micrometer reading;

H_3 = corrected nominal dimension between ring gear centerline and pinion large base.

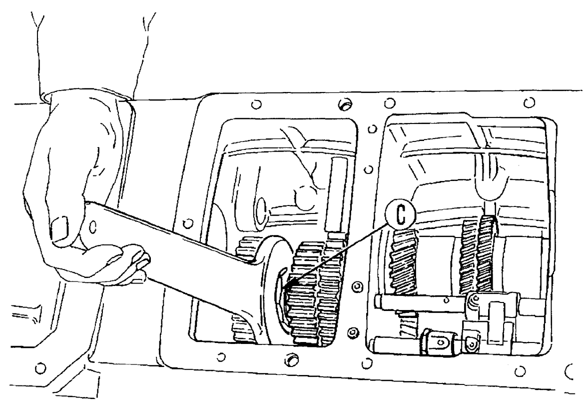
Sp = test rig shim.

Example

Micrometer reading H_1 = 145.9 mm.
Test rig shim thickness Sp = 1.90 mm.
Nominal dimension between ring gear enterline and pinion large base H_2 = 145.5 mm.
Correction factor C = + 0.2 mm.
Corrected nominal dimension
H_3 = 145.5 + 0.2 mm = 145.7 mm.
Shim thicknees S = 145.9 + 1.90 – 145.7 = 2.10 mm.
Corrected nominal dimension
H_3 = 145.5 – 0.2 = 145.3 mm.
Shim thickness S = 145.9 + 1.90 – 145.3 = 2.50 mm.
Correction factor C = 0 mm.
Corrected nominal dimension H_3 = H_2 = 145.5 mm.
Shim thickness: S = 145.9 + 1.90 – 145.5 = 2.30 mm.

BEVEL DRIVE ADJUSTMENTS

Bevel pinion shaft taper roller bearing adjustment

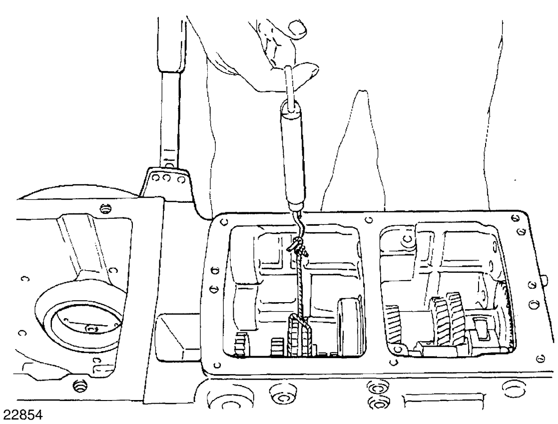


22853

Bevel pinion shaft taper roller bearing adjustment
C. Bearing adjustment nut.

16. Install the bevel pinion shaft on rear drive case complete with bearing cones, cone point adjustment shims (S, page 27–3) previously calculated, gears and bearing adjustment nut (C).

17. Tighten adjustment nut (C), while turning pinion shaft to settle bearings, up to a rotation torque of:



22854

Bevel pinion shaft taper roller bearing adjustment

A. On models **50V – 55V – 60V – 70V – 55F – 60FP:** 1÷1.5 Nm (0.1÷0.15 kgm – .72÷1.1 ft–lb).

B. On models **62F – 72F – 82F – 72LP – 82LP:** 1.5÷2 Nm (0.15÷0.20 kgm – 1.1÷1.4 ft–lb)

measuring it using a dynamometer and string wound around the low speed range gear on the pinion, making sure to avoid dragging the transmission shafts.

Print No. **603.54.283.00** – 09 – 1994

Correct rolling torque corresponds to a dynamometer reading of:

A. On models **50V – 55V – 60V – 70V – 55F – 60 F:** 13.3÷20 Nm (1.36÷2.04 kgm – 9.8÷14.7 ft–lb)

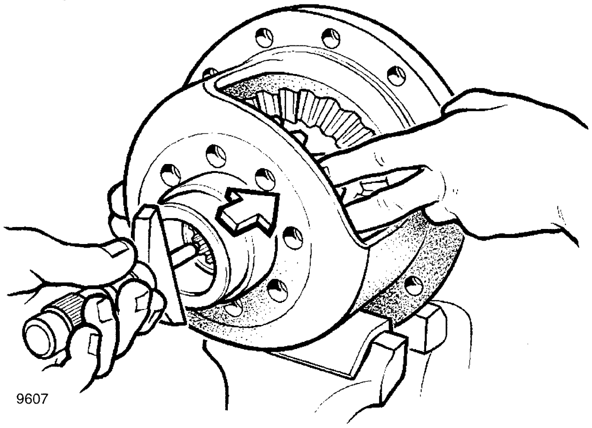
B. On models **62F – 72F – 82F – 72LP – 82LP:** 17.6÷23.5 Nm (1.8÷2.4 kgm – 13.0÷17.3 ft–lb)

Important – After adjustment, bend lockwasher (21. page 27–3) safety tab on adjustment nut to prevent it from becoming loose.

Differential unit assembly and gear tooth backlash adjustment.

18. Install the two side gears (7 and 8, page 27–3) in differential housing without end washers (12).

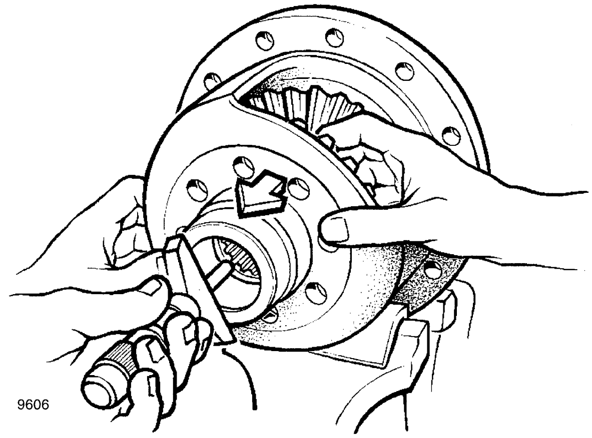
19. Install pinions (9) with end washers (13) and journal (10), then tighten set screw (11) just a few turns to prevent journal from coming off.



Establishing differential side gear adjustment shim thickness.

Measuring dimension (H_1).

20. Bring the LH side gear completely against the pinion and, using a depth micrometer gauge, measure dimension (H_1) at two opposite points and then finding the arithmetical average of the two readings.



Establishing differential side gear adjustment shim thickness.

Measuring dimension (H_2)

21. Move then the side gear aginst the differential housing and measure dimension (H_2).

22. Repeat same operations on RH side gear.

The axial movement of each side gear without shims is given by:

$$G_s \text{ or } G_d = H_1 - H_2$$

where:

G_s = axial movement of LH side gear;

G_d = axial movement of RH side gear;

H_1 **and** H_2 = readings on LH or RH side gear.

Normal side gear/pinion tooth backlash is 0.15 mm (.006 in).

Consider that the ratio of normal tooth baklash and equivalent side gear axial displacement is in the average 1:1.7.

Axial side gear displacement corresponds to expected normal tooth backlash:

0.15x1.7 = 0.25 mm (.o10 in)

Consequently, shim thikness to install is given by:

$S_s = G_s - 0.25$ (LH side gear)

$S_d = G_d - 0.25$ (RH side gear)

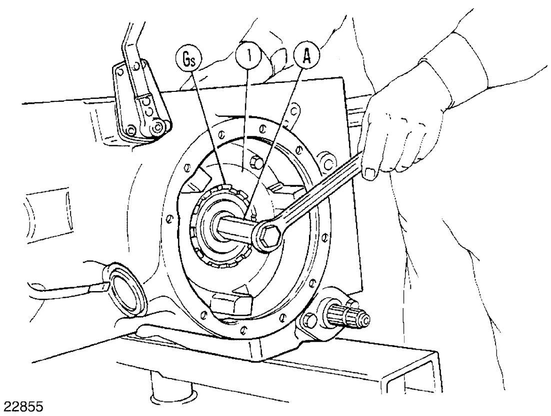
23. Fit shim thickness nearest to calculated value considering that available available thicknesses are 1.5 and 1.6 mm (.059 and .063 in).

BEVEL DRIVE ADJUSTMENTS

Ring gear bearing adjustment and bevel drive tooth backlash chek.

24. With bevel pinion installed, fit the differential unit with ring gear and differential lock collar (5) as indicated on page 27–3.

Note – We recommend the use of the self–made tool (made following working drawing instructions of page 27–5) for the installation of the bearing adjustments and locking ring nuts.

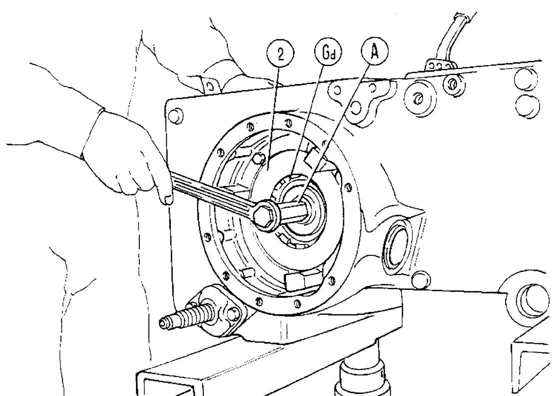


22855

Installing ring gear–differential bearing LH adjustment ring nut (G_s).

A. Self–made tool (50027) – 1. Differential LH carrier.

25. Install LH side ring nut (G_s) and tighten so to ensure a bevel drive gear tooth backlash of 1 mm (.040 in), at least.



22856

Installing ring gear–differential bearing RH adjustment ring nut (G_d).

A. Self–made tool (50027) – 2. Differential RH carrier.

26. Install RH side ring nut (G_d) and tighten up to bevel pinion–ring gear rolling torque of:

A. On models **50V – 55V – 60V – 70V – 55F – 60F:**

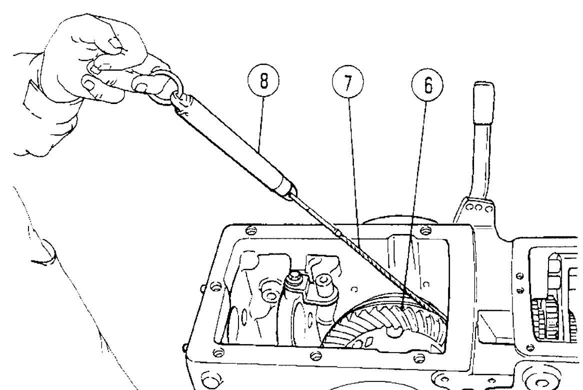
5 + 1÷2.5 Nm (0.5 + 0.1÷0.25 kgm – 3.6 + .7÷1.8 ft–lb) in case of a 1 Nm (0.1 kgm – .7 ft–lb) pinion reading corresponding to a dynamometer force reading of 61.8÷77.5 N (6.3÷7.9 kg – 13.9÷17.4 lb) **(*)**.

or

7 + 1÷2.5 Nm (0.7 + 0.1÷0.25 kgm – 5 + .7÷1.8 ft–lb) in case of a 1.5 Nm (0.15 kgm – 1.1 ft–lb) pinion reading corresponding to a dynamometer force reading of 83.3÷99 N (8.5÷10.1 kg – 18.7÷22.3 kg)**(*).**

B. On models **62F – 72F – 82F – 72LP – 82LP:**

9.8÷14.7 Nm (1÷1.5 kgm – 7.2÷10.8 ft–lb) correspon-ding to a dynamometer force reading of 98÷147 N (10÷15 kg – 22÷33 lb).



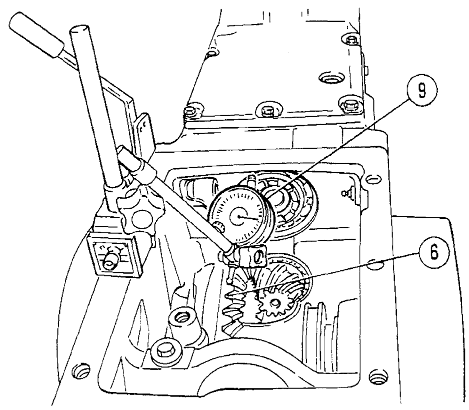
22857

Checking ring gear–differential bearing rotating torque.

6. Ring gear – 7. String – 8. Dynamometer.

(*) **Note** – Measurable by using a dynamometer and attached string, the latter wound around the differential housing flange. Make sure that differential lock fork has no interference in its seat and that bevel pinion does not drag transmission shafts.

Print No. **603.54.283.00** – 09 – 1994



Checking normal bevel drive gear tooth backlash.
6. Ring gear – 9. Comparator dial gauge.

27. Check gear tooth backlash (G) using a comparator dial gauge (three readings at 120° from each other and arithmetical average of the three readings) and compare with the expected normal value:

A. On models **50V – 55V – 60V – 70V – 55F – 60F:** 0.15÷0.20 mm (.006÷.008 in), 0.18 mm (.007 in) average

B. On models **62F – 72F – 82F – 72LP – 82LP:** 0.18÷0.23 mm (.007÷.009 in), 0.21 mm (.008 in) average.

To compensate for the higher tooth backlash reading, consider that the average ratio of normal tooth backlash and ring gear axial displacement is 1:1.4.

Consequently, ring gear axial displacement (Z) is:

A. On models **50V – 55V – 60V – 70V – 55F – 60F:**

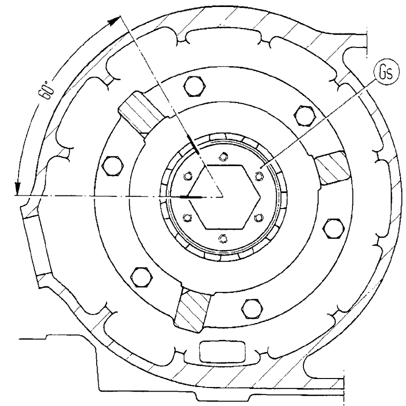
Z = (G – 0.18) x 1.4

B. On models **62F – 72F – 82F – 72LP – 82LP:**

Z = (G – 0.21) x 1.4

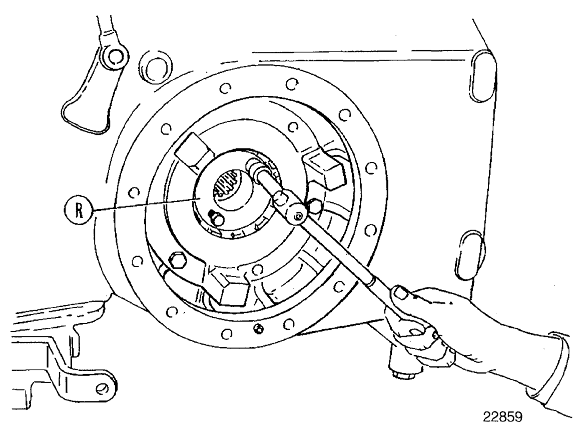
where:
G = existing bevel drive gear tooth backlash measured before.

28. Screw back the RH ring nut first and then screw in the LH one of the same amount to obtain the desired gear tooth backlash.



Adjusting ring gear bearings.
60° = ring nut rotation (G_s or G_d) equivalent to one side of the inside hexagon and corresponding to a ring gear axial movement of about 0.33 mm (.013 in).

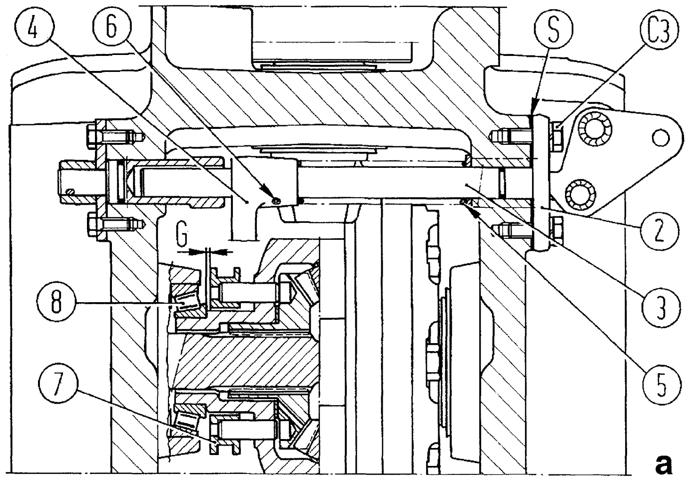
Note – Consider that one full ring nut turn corresponds to a 2mm (.08) ring gear axial movement (Z) and consequently to a 60° rotation equivalent to the length of one side of the nut inside hexagon corresponds a ring gear axial movement (Z) of about 0.33 mm (.013 in).

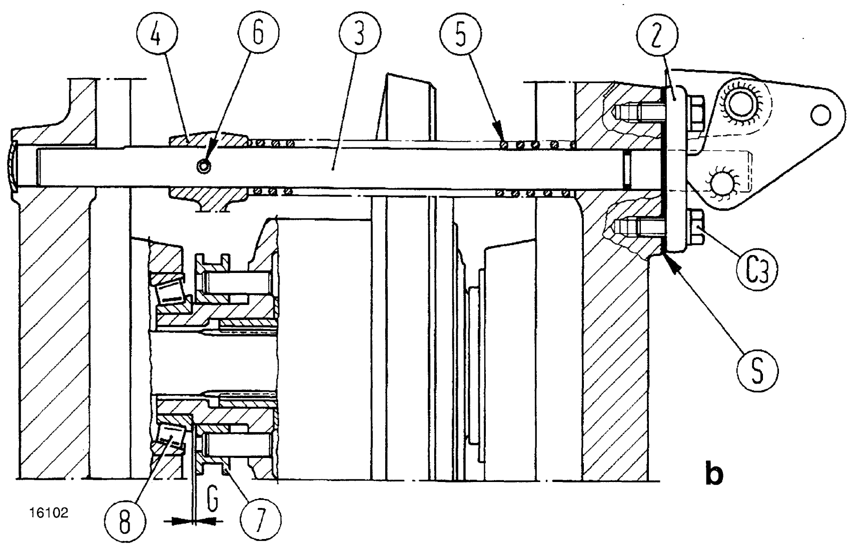


Installing lockwasher (R).

29. Install lockwashers (R) on ring nuts with the washer tooth corresponding to one notch on differential carriers.

Print No. ***603.54.283.00*** *– 09 – 1994*





Differential lock installation and adjustment

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – C_3. Differential lock control lever mount capscrew – G = 2 mm (.08 in). Clearance between collar (7) and bearing (8) – S. Collar (7) positioning shims – 2. Control lever mount – 3. Fork (4) shifter rod – 4. Fork – 5. Spring – 6. Spring pin – 7. Differential lock collar – 8. Ring gear bearing.

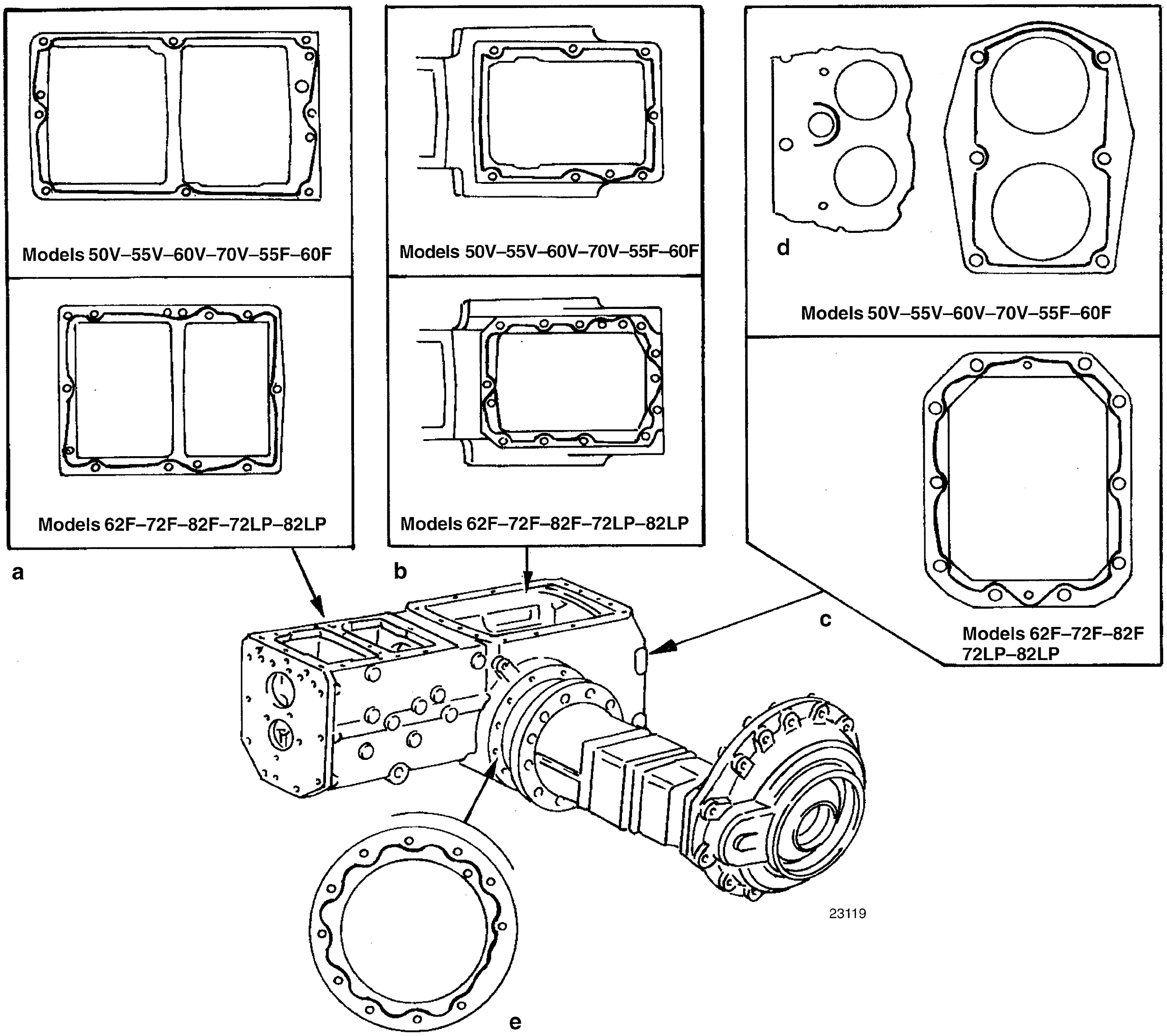
Assembly and adjustment

30. Assemble the differential lock control using the **292576** tool (on models 50V – 55V – 60V – 70V – 55F – 60F) and **293452** (on models 62F – 72F – 82F – 72LP – 82LP) to compress reaction spring (5) and fit spring pin (6) securing fork (4) onto control rod.

31. Using a feeler gauge, check that between collar (7) and ring gear–differential RH side bearing (8) there exists a 2 mm (.08 in) clearance (G).

32. In case, adjust above clearance by varying shim thickness (S) between mounting support (2) and rear drive housing.

Print No. ***603.54.283.00*** *– 09 – 1994*



Sealing comppound application scheme.

Sealing compound application scheme prior to installation of: a. Transmission case top cover – b. Hydraulic lift housing cover – c. Power take–off rear cover – d. Detail through transmission case – e. Final drives.

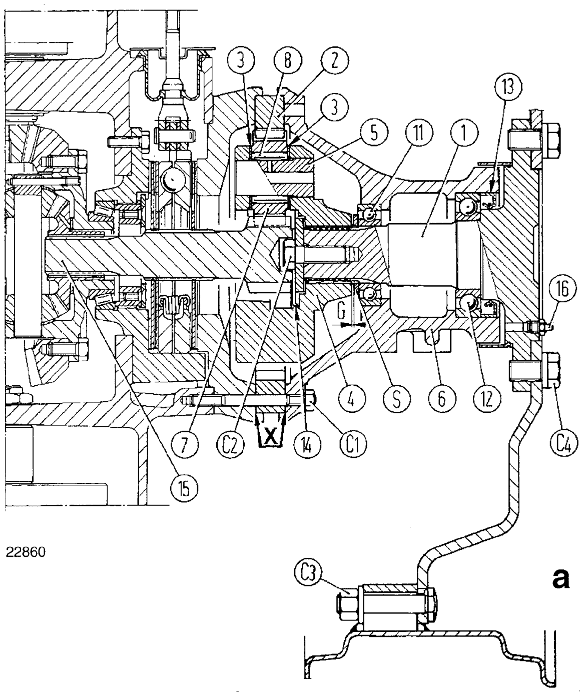
Suitable types of sealing compounds are indicated on page 1, section 00.

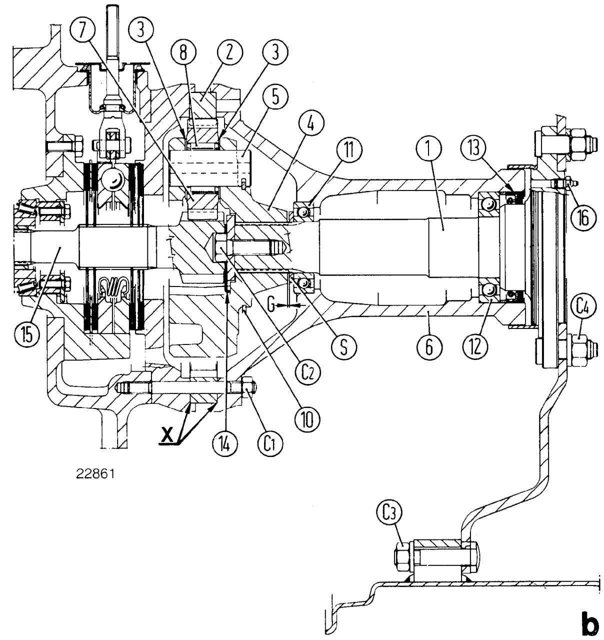
CAUTION

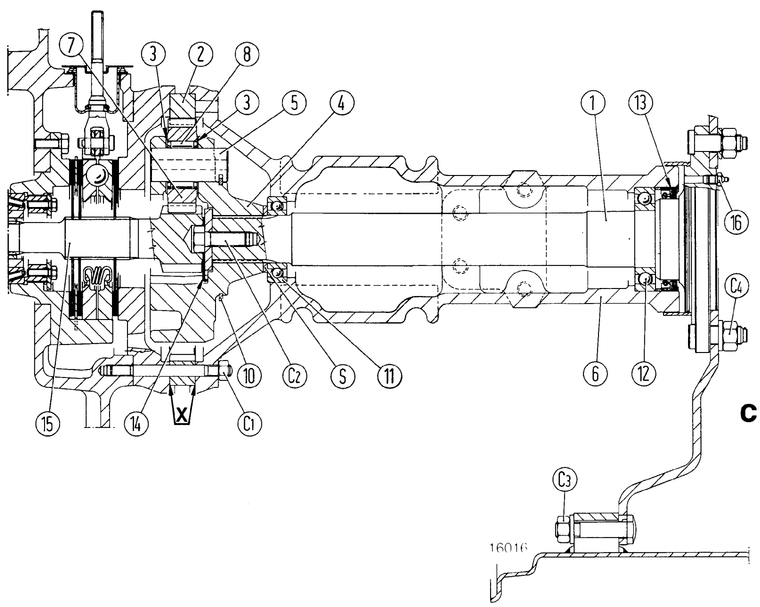
Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

33. Prior to installation of housings, supports and covers, thoroughly clean and degrease mating surfaces and apply a round strip about 2 mm (.08 in) thick following the lay–outs shown in the figure above.

a. In addition, tighten fastenings to torques listed on page 27–2.







Longitudinal sectional view through RH side final drive.

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – c. Models 72LP – 82LP – C_1. Final drive case stud nuts – C_2. Wheel drive shaft set screw – C_3. Drive wheel disc–to–rim screw nut – C_4. Drive wheel disc–to–hub on models 50V – 55V – 60V – 70V – 55F – 60F – C_4. Drive wheel disc–to–hub on models 62F – 72F – 82F – 72LP – 82LP – G = 0.2÷0.4 mm (.008÷.016 in). Driven gear carrier end play – S. End play (G) adjustment shim – 1. Drive wheel shaft – 2. Crown wheel – 3. End washers – 4. Driven gear carrier – 5. Driven gear journal – 6. Final drive case – 7. Driven gear – 8. Needle bearings – 10. Driven gear journal retaining circlip – 11 and 12. Ball bearings – 13. Seal – 14. Screw (C_2) lockwasher – 15. RH side planetary unit axle shaft – 16. Grease fitting.

Note – Prior to installation, apply sealing compound on mating surfaces **X**, see page 1, section 00.

Print No. ***603.54.283.00*** *– 09 – 1994*

FINAL DRIVE CASE, RH OR LH SIDE

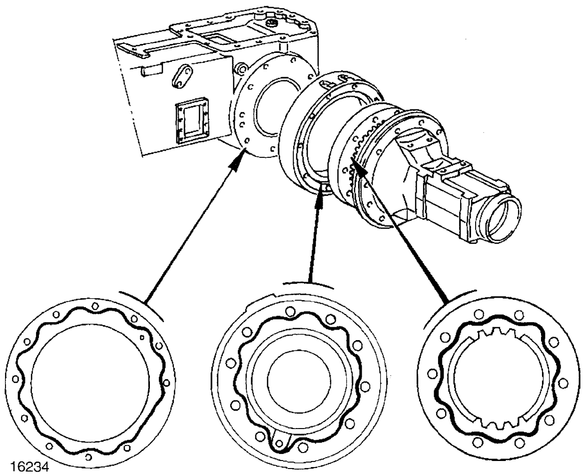
Removal–Installation (Operation 27 120 10).

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Ensure that the load is held and supported by means of suitable slings and hooks. Make sure that nobody is standing near by.

Proceed as further indicated.

1. Drain rear drive case oil.
2. Place a metal stand underneath and remove safety frame, wheels, mudguards and footboards.
3. Remove final drive case stud nuts (C_1, page 27–15) and, finally, the case unit with associated crown wheel.



16234

4. Reattach final drive case to rear drive housing in accordance with the following instructions and information:
   a. proceed by reversing previous removal sequence of operations starting from no. 3 back to no. 1;
   b. prior to installation, thoroughly clean and degrease mating surfaces and apply a round strip about 2 mm (.08 in) thick of sealing compound following the lay–out scheme illustrated above;
   c. tighten fastenings at the torque data listed on page 27–2.

FINAL DRIVE

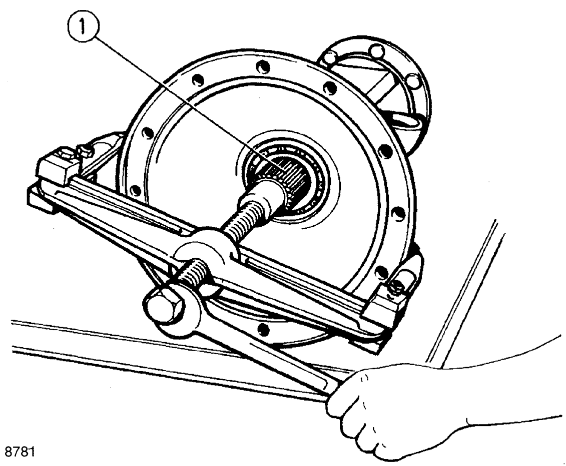
Disassembly–Assembly (Operations 27 120 32 – 27 120 34)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

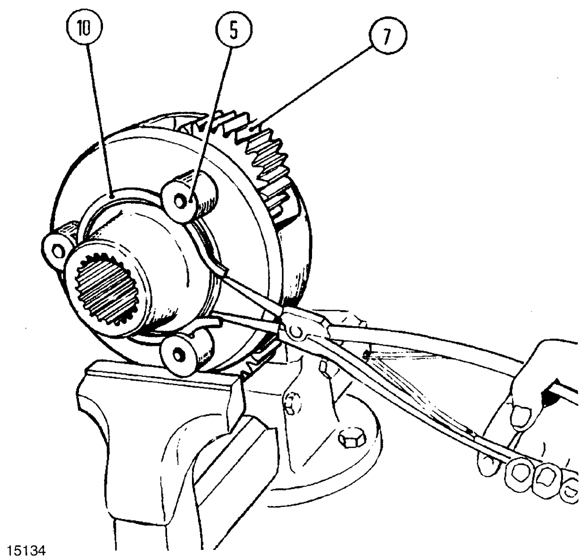
Proceed as further indicated.

1. Remove driven gear carrier (4, page 27–15) by removing lockwasher (14) and screw (C_2) and retrieve adjustment shims (S).



8781

2. Remove drive wheel shaft (1) using a universal puller as illustrated.



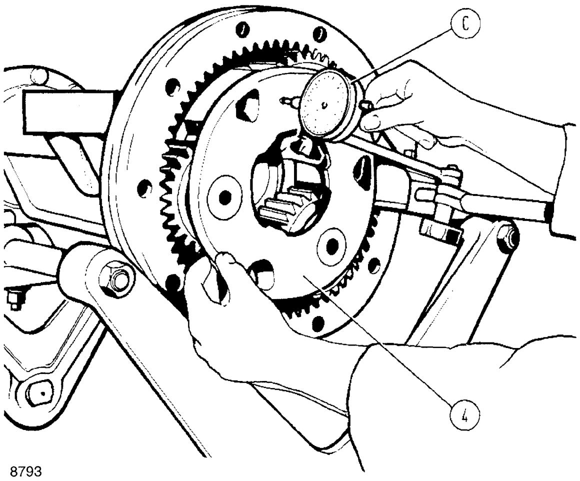
15134

3. Undo circlip (10), remove journals (5), driven gears (7) and retrieve needle bearings (8, page 27–15).

Print No. 603.54.283.00 – 09 – 1994

4. If necessary, replace seal (13, page 27–15) using a hammer–type driver of adequate size to force fit the new seal without damaging it.

5. Position case uprightand assemble final drive as per further indications.



8793

Checking planetary unit driven gear carrier end play.
C. Comparator dial gauge – 4. Driven gear carrier.

6. Fit seal (13, page 27–15), introduce the drive wheel shaft (1) and, acting on its flanged end, place it against bearing (12).

7. Fit bearing (11) and install driven gear (4) carrier with shim (S).

8. Lock screw (C_2) at specified torque and, using a comparator gauge, check that the carrier (G) end play is 0.2÷0.4 mm (.008÷.016 in); if not so, vary shim thickness (S) to suit.

9. Prior to installation of the final drive case, thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick following the illustrated lay–out scheme of page 27–16.
Suitable types of sealing compounds are indicated on page 1, section 00.

10. Torque tighten attachment screws (C_1, page 27–15) and pump **TUTELA G9** grease through fitting (16) until grease comes out of inside cover (rotate the hub to assure uniform filling of grease compartment between hub and cover).

Print No. **603.54.283.00** – 09 – 1994

Print No. 603.54.283.00 – 09 – 1994

POWER TAKE–OFF

	50V – 55V – 60V 70V – 55F – 60F	62F – 72F – 82F 72LP – 82LP
540–rpm power take–off (standard on models 50V–55V–60V–55F–60F–62F–72F–82F–72LP–82LP)		
Type	indipendent from tractor speed or: synchronized with transmission (ground–speed PTO)	
Engagement and controls	mechanical, hand lever	
Sense of rotation (looking from tractor rear end)	clockwise	
Engine speed with PTO running at 540 rpm (rpm)	2200	
Engine speed with PTO running at rated speed (2500 rpm) (rpm)	614	
PTO splined shaft diameter	$1^3/_8$" (6 splines)	
540/750rpm PTO (optional on all models)		
Type / Engagement and controls / Sense of rotation (from rear)	same as 540–rpm PTO	
Speed selection	by hand lever positioned on PTO box	
Engine speed with PTO running at 540 rpm (rpm)	2200	
Engine speed with PTO running at 750 PTO (rpm)	2338	2383
PTO speed with engine running at rated speed (2500 rpm): — 540–rpm PTO (rpm)	614	
— 750–rpm PTO (rpm)	802	787
540/1000 rpm PTO (standard on 70V model and otpional on all other models)		
Type / Engagement and controls / Sense of rotation (from rear)	same as 540–rpm PTO	
Speed selection	by hand lever positioned on PTO box	
Engine speed with PTO running at 540 rpm (rpm)	2200	
Engine speed with engine running at 1000 rpm (rpm)	2380	
PTO speed with engine running at rated speed (2500 rpm): — 540–rpm PTO (rpm)	614	
— 1000–rpm PTO (rpm)	1050	
Ground–speed PTO:		
— 540–rpm, (revs/1 wheel turn)	6.7	7.7
— 750–rpm, "	8.8	9.9
— 1000–rpm, "	11.5	13.1

(continued)

Print No. **603.54.283.00** – 09 – 1994

POWER TAKE–OFF

(follows)

	50V – 55V – 60V 70V – 55F – 60F	62F – 72F – 82F 72LP – 82LP
PTO splined output shaft dia.:		
— 540–rpm or 750–rpm PTO	1–3/8” (6 splines)	
— 1000–rpm PTO	1–3/8” (21 splines)	
Driven gear bearing bushing O.D. (14, pages 31–3 and 31–4), ... mm (in)	45.925÷45.950 (1.8081÷1.8091)	49.925÷49.950 (1.9655÷1.9665)
Driven gear I.D. (10 and 11), ... mm (in)	46.050÷46.075 (1.8130÷1.8140)	50.050÷50.089 (1.9705÷1.9720)
Gear/bushing assembly clearance, ... mm (in)	0.100÷0.150 (.0039÷.0059)	0.100÷0.164 (.0040÷.0065)
Driven gear shaft dia. (3), ... mm (in)	37.966÷37.991 (1.4947÷1.4957)	39.166÷39.191 (1.5420÷1.5429)
Bushing I.D (14), ... mm (in)	38.000÷38.039 (1.4961÷1.4976)	39.200÷39.239 (1.5433÷1.5448)
Shaft/bushing running fit .... mm (in)	0.009÷0.073 (.0004÷.0029)	0.009÷0.073 (.0004÷.0029)

TORQUE WRENCH DATA (Models 50V – 55V – 60V – 55F – 60F)

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Driven gear shaft lock nut (C_1, page 31–3)	M 28x1.5	294	30/217
PTO cover attachment screw nuts (C_2)	M 12x1.25	162	16.5/19
PTO splined output shaft self–locking nuts (540/750 and 540/1000 rpm), (C_3)	M 8x1.25	25	2.6/119

TORQUE WRENCH DATA (Models 62F – 72F – 82F – 72LP – 82LP)

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Driven gear shaft lock nut (C_1, page 31–4)	M 32x1.5	294	30/217
PTO cover attachment screws (C_2)	M 16x1.5	221	22.5/163
PTO splined output shaft self–locking nuts (540/750 and 540/1000 rpm), (C_3)	M 12x1.25	162	16.5/119
Bearing housing screw (540/750 and 540/1000 rpm PTO)	M 12x1.25	98	10/72
PTO guard attachment screws	M 8x1.25	25	2.6/19

Print No. ***603.54.283.00*** *– 09 – 1994*

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **X**.
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of whichyou will find the necessary working drawings and material specifications directly in this Manual.

List of the special tools needed to carry on the service operations concerning this section of the Manual.

Models 50V – 55V – 60V – 70V – 55F – 60F

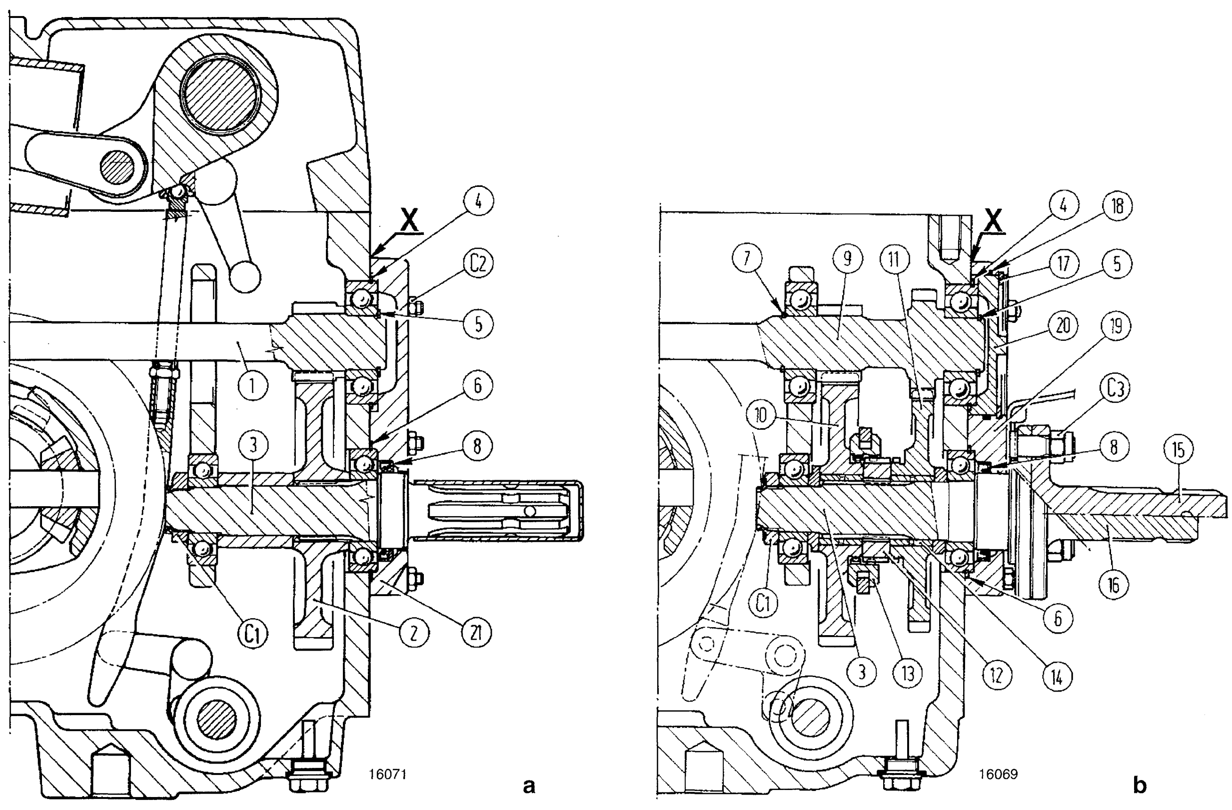
293838	Installer, PTO drive shaft needle roller bearing.

Models 62F – 72F – 82F – 72LP – 82LP

291928	Installer, PTO drive shaft needle roller bearing.
293812	Locators, M16x1.5, PTO.

Models 60V – 70V – 60F – 62F – 72F – 82F – 72LP 82LP

293834	Protection, PTO output shaft.

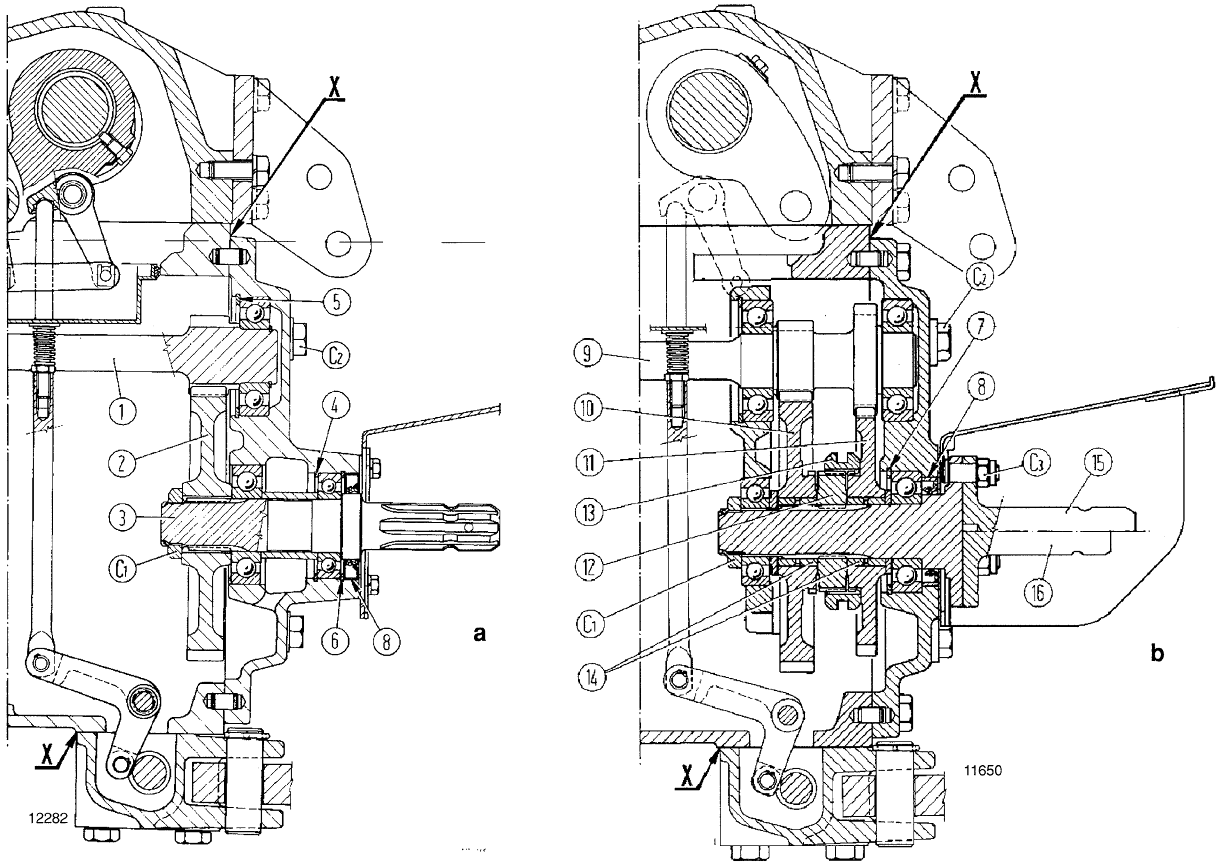


Power take–off longitudinal section, models 50V – 55V – 60V – 70V – 55F – 60F

a. 540–rpm PTO sectional view – b. Dual speed, 540/750 rpm or 540/1000 rpm PTO sectional view – C_1. Driven shaft lock nut – C_2. PTO cover attachment screw nuts – C_3. Splined output shaft self–locking nut – 1. Drive gear – 2. Driven gear – 3. Driven shaft – 4,5,6,7. Circlips – 8. Seal – 9. Dual drive gear – 10. 540–rpm driven gear – 11. 750 or 1000–rpm driven gear – 12. Fixed gear – 13. Engagement collar – 14. Driven gear bearing bushing – 15. 540–rpm or 750–rpm splined output shaft – 16. 1000–rpm splined output shaft – 17. Circlip – 18. O–ring seal – 19. PTO cover (540/750 or 540/1000–rpm) – 20. Drive shaft rear bearing quill (540/750 rpm or 540/1000–rpm) – 21. Pto cover (540–rpm).

Note – Prior to assembly, apply sealing compound on surfaces **X** according to directions and scheme of page 31–6.

Print No. ***603.54.283.00*** *– 09 – 1994*



Power take–off longitudinal section, models 62F – 72F – 82F – 72LP – 82LP

a. 540–rpm PTO sectional view – b. Dual speed, 540/750–rpm or 540/1000–rpm PTO sectional view – C_1. Driven shaft lock nut – C_2. PTO box attachment screws – C_3. Splined output shaft self–locking nut – 1. Drive gear – 2. Driven gear – 3. Driven shaft – 4,5,6,7. Circlips – 8. Seal – 9. Dual drive gear – 10. 540–rpm driven gear – 11. 750–rpm or 1000 rpm driven gear – 12. Fixed gear – 13. Engagement collar – 14. Driven gear bearing bushing – 15. 540–rpm or 750–rpm splined output shaft – 16. 1000–rpm splined output shaft.

Note – Prior to assembly, apply sealing compound on surface **X** according to directions and scheme of page 31–7.

Disassembly–Assembly – 540–rpm PTO, models 50V – 55V – 60V – 70V – 55F – 60F power take–off (Operations 31 110 56 – 31 110 58)

⚠ CAUTION ⚠

Handle all parts carefully. Do not put hands and fingers between parts . Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.

1. Drain rear drive case oil.
2. Remove drawbar, mounting bracket and draw hook, if any, and the hydraulic lift.
3. Undo screws (C_2, page 31–3) and remove rear cover (21).
4. Engage the ground–speed PTO to prevent the engagemnt collar from falling down while removing drive shaft (1).
5. Remove drive shaft (1).
6. Unscrew nut (C_1) and remove driven shaft (3), also retrieving gear (2), spacer and bearing from inside the case.

NOTE – To retrieve seal (8) just remove rear cover (21).

*Print No. **603.54.283.00** – 09 – 1994*

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

7. Re–assemle the PTO box in accordance with the following instructions and information:

   a. proceed by reversing the previous disassembly sequence of operations, starting from no. 6 back to no. 1;

   b. inspect seal (8, page 31–3) and bearings, replace them if necessary;

   c. tighten fastenings to the torque data of page 31–2;

   d. consult sectional view of page 31–3, Fig. a, for correct positioning of parts;

   e. proceed considering the operations further indicated.

8. Thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick following the lay–out shown in the scheme of page 31–6. Suitable types of sealing compounds are listed on page 1, section 00.

9. Install rear cover on power take–off case.

Disassembly–Assembly of 540/750–rpm or 540/1000–rpm PTO, models 50V 55V 60V 70V 55F 60F.
(Operations 31 112 45 – 31 112 46 – 31 112 48 – 31 114 45 – 31 114 46 – 31 114 48).

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and special shoes.

Proceed as further indicated.

1. Drain rear drive case oil.

2. Remove drawbar, supporting bracket and drawhook, if any, and the hydraulic lift.

3. Remove circlip (17, page 31–3, Fig. b) and cover (20).

4. Remove circlip (7) and circlip (9) from drive shaft, at the PTO engagement collar;

5. Engage ground–speed PTO to prevent the engagement collar from falling down while removing drive shaft (9).

6. Remove drive shaft (9).

7. Unscrew nut (C_1) and remove driven shaft (3), also retrieving driven gears (10 and 11), fixed gear (12), engagement collar (13), the two bearing bushes (14) and thrust washers from inside the PTO case.

8. Finally, remove cover (19).

Note – To replace seal (8, page 31–3), it is necessary to disassemble the power take–ff as previously described. To replace seal (18), instead, just remove circlip (17) and rear bearing quill (20).

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

Print No. **603.54.283.00** – 09 – 1994

9. Reassemble PTO components in accordance with the following instructions and information:

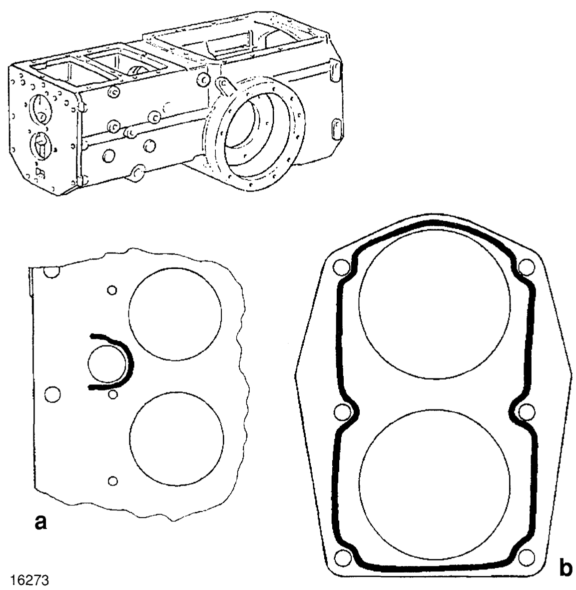
   a. proceed by reversing the previous disassembly sequence of operations starting from no. 8 back to no. 1;

   b. inspect all seals and bearings and replace whenever necessary;

   c. tighten fastenings to torque data of page 31–2;

   d. consult sectional view of page 31–3, Fig.b, for the correct placement of parts;

   e. proceed as further indicated.



Sealing compound application prior to power take–off cover installation on rear axle and transmission housing.

a. Sealing compound application scheme on rear axle and transmission housing mating surface – b. Sealing compound application scheme on PTO rear cover mating surface.

10. Thoroughly clean and degrease mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick following the lay–out shown in the accompanying figure. Suitable sealing compound products are listed on page 1, section 00.

11. Fit PTO rear cover to transmission and rear axle case.

Removal–Installation of 540, 540/750 or 540/1000 rpm PTO.
Models 62F – 72F – 82F – 72LP – 82LP.
(Operations 31 110 30 – 31 112 20 – 31 114 20).

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

To remove the assembled PTO unit proceed as further indicated.

1. Drain rear drive case oil.

2. Remove drawbawr, mounting bracket and draw hook, if any.

3. Sling up unit.

4. Remove PTO rear cover attachment screws (C_2, page 31–4).

5. Engage ground–speed PTO to prevent the engagement collar from falling down while moving the PTO box and drive shaft outwards for removal.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

6. Re–install power take–off box to rear axle and transmission case in accordance with the following instructions and information:

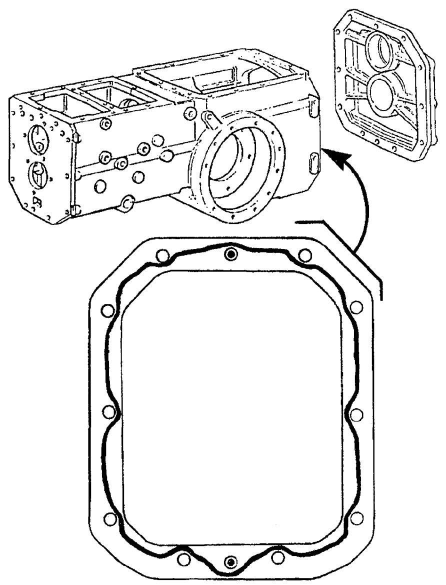
   a. proceed by reversing the previous removal sequence of operations starting from no. 5 back to no. 1;

   b. prior to power take–off installation, thoroughly clean and degrease mating sutfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick following the lay–out scheme shown in the figure on page 31–7;

   c. tighten fastenings to torque data of page 31–2;

   d. consult illustrations on page 31–4 for the correct positioning of parts.

Print No. 603.54.283.00 – 09 – 1994



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Sealing compound application prior to power take–off case installation on rear axle and transmission housing.

Suitable sealing compound types are listed on page 1, section 00.

Disassembly–Assembly of 540/750 or 540/1000 rpm PTO.
Models 62F – 72F – 82F – 72LP – 82LP.
(Operations 31 110 08 – 31 110 50 – 31 110 57 – 31 110 58)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.

1. Secure the power take–off box onto a revolving stand, remove holding screws and shaft guard.
2. Unscrew nut (C_1, page 31–4, Fig. a).
3. Retrieve gear (2) and remove the driven shaft (3), seal (8), circlip (6), bearings and associated inside spacer.

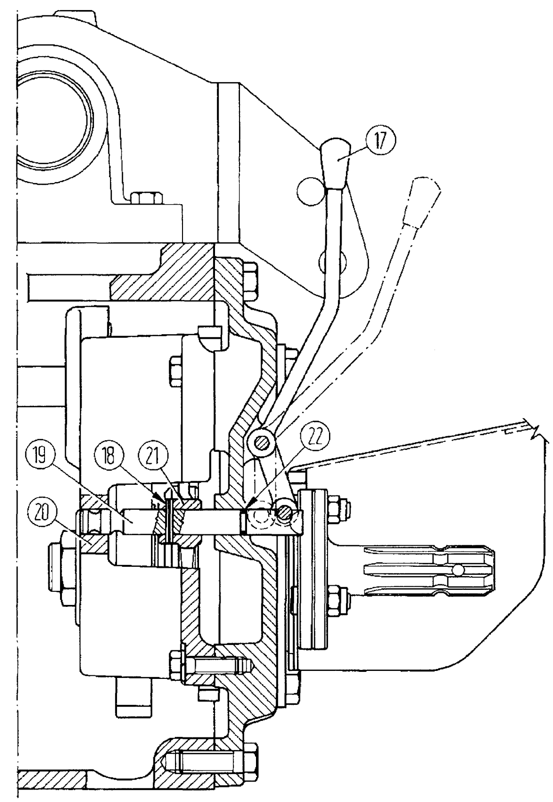
CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS

Assemble power take–off parts in accordance with the following instructions and information:

- **a.** proceed by reversing the previous disassembly sequence of operations starting from no. 3 back to no. 1;
- **b.** inspect seal (8) and bearings, replace them if necessary;
- **c.** tighten fastenings to torque data of page 31–2;
- **d.** consult illustration of page 31–4, Fig. a for correct positioning of parts.

Disassembly–Assembly of 540/750 or 540/1000 rpm power take–off.
Models 62F – 72F – 82F – 72LP – 82LP.
Operations 31 112 14 – 31 112 45 – 31 112 47 – 31 112 48 or 31 114 14 – 31 114 45 – 31 114 47 – 31 114 48).



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Longitudinal section through the power take–off speed selection

17. Speed selection control lever – 18. Spring pin – 19. Pin – 20. Rear cover – 21. Collar shift fork – 22. O–ring seal.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.

1. Secure the power take–off box onto a revolving stand.
2. Take out the speed selection lever (17) spring pin and mounting pin, then remove the lever.
3. Take out spring pin (18), securing pin (19) to fork (21), then remove the pin and recover detent spring and ball.
4. Undo holding screws (C_2, page 31–4) and remove rear cover (20).

Print No. 603.54.283.00 – 09 – 1994

5. Remove nut (C_1, page 31–4, Fig. b) and the power take–off driven shaft, then retrieve gear (10), engagement collar (13), fixed gear (12) and gear (11).

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

Assemble the power take–off unit in accordance with the following instructions and information:

a. proceed by reversing the previous disassembly seuence of operations staring from no. 5 back to no. 1;

b. inspect seal (8) and replace it if necessary;

c. tighten fastenings to torque data of page 31–2;

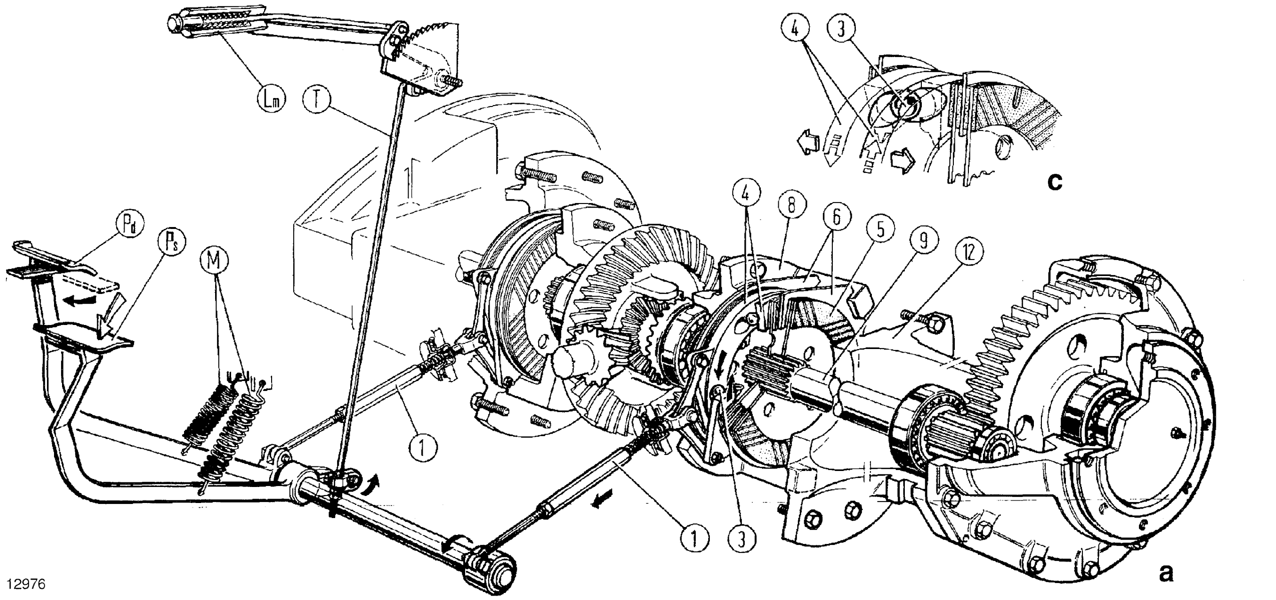
d. consult illustration of page 31–4, Fig. b, for correct positioning of parts.

Print No. 603.54.283.00 – 09 – 1994

BRAKES

	50V – 55V – 60V 70V – 55F – 60F	62F – 72F – 82F	72LP – 82LP
Type:			
– foot brakes	oil–bath discs operating on differential axle shafts		
– parking brake	same foot brake discs		
Controls:			
– foot brakes	mechanical, indipendent pedales (or latched for joint operation)		
– parking brake	mechanical, hand control lever		
Q.ty of brake discs	3	4	3
Brake lining material	organic conglomerate		
Brake pedals articulation			
Right pedal bore dia. mm (in)	28.000 ÷ 28.033 (1.1024 ÷ 1.1037)		
Left pedal bore dia. mm (in)	30.000 ÷ 30.052 (1.1811 ÷ 1.1831)		
Right pedal bushing O.D. mm (in)	27.936 ÷ 28.000 (1.0998 ÷ 1.1024)		
Right pedal bushing minimum I.D. mm (in)	25.052 (.9863)		
Right pedal shaft journal dia. mm (in)	24.967 ÷ 25.000 (.9830 ÷ .9843)		
Right pedal shaft running fit mm (in)	0.052 ÷ 0.085 (.0020 ÷ .0033)		
Brake pedal shaft bearing bushing minimum I.D. mm (in)	30.053(1.1832)		
Brake pedal shaft bearing bushing O.D. mm	33.917 ÷ 33.989 (1.3353 ÷ 1.3381)		
Bushing interference fit in transmission case bore mm	0 ÷ 0.097 (0 ÷ .0038)		
Brake pedal shaft journal dia. mm	29.947 ÷ 29.980 (1.1790 ÷ 1.1803)		
Shaft/bushing assembly clearance mm	0.073 ÷ 0.106 (.0029 ÷ .0042)		
Trailer brake control valve			
Maker	BOSCH		
Location	attached to transmission case		
Valve controls	through tractor foot brake pedal		
Trailer brake controls	using the same hydraulic lift oil		
Type	0.538.008.321		

Print No. ***603.54.283.00*** *– 09 – 1994*



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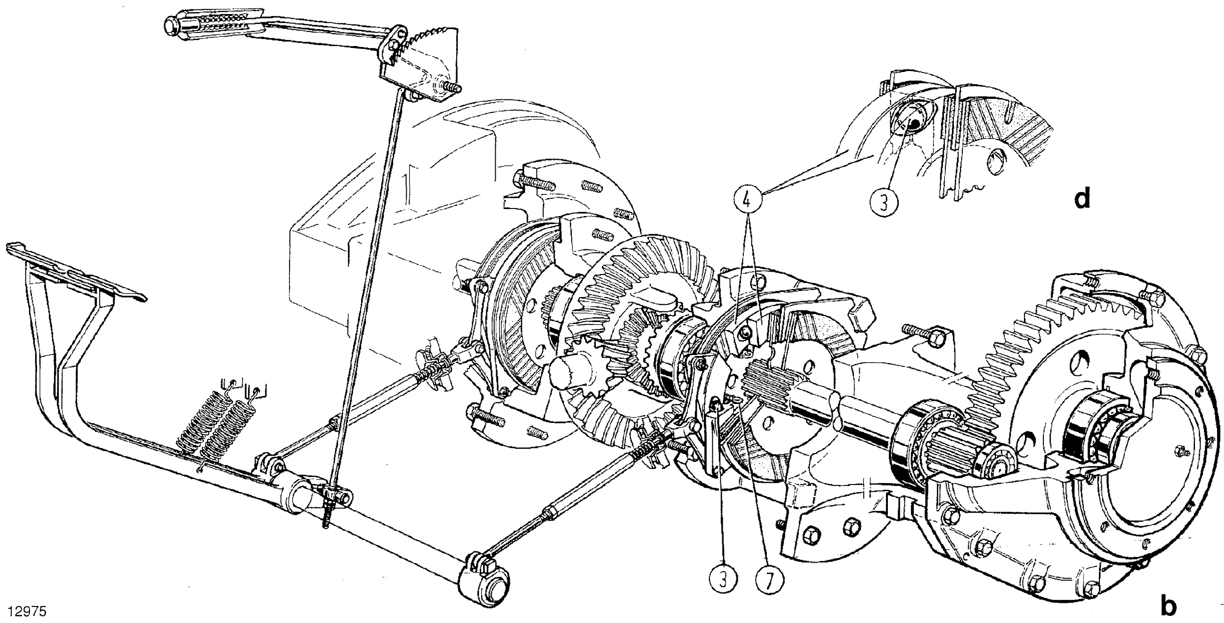


12975

Perspective sectional view through brakes and controls

a. Operated L.H. side brake, R.H. side brake at rest – b. Both brakes at rest – c. Brake operation detail – d. Detail of brakes at rest – Lm. Parking brake hand lever – M. Brake pedal return springs – Pd. Right pedal brake – Ps. Left pedal brake – T. Parking brake control rod – 1. Brake links – 3. Drive plate (4) actuating balls – 4. Actuator – 5. Brake disc – 6. Pressure plate – 7. Drive plate (4) return spring – 8. Differential carrier – 9. Differential axle shaft – 12. Final drive housing.

BRAKE OPERATION

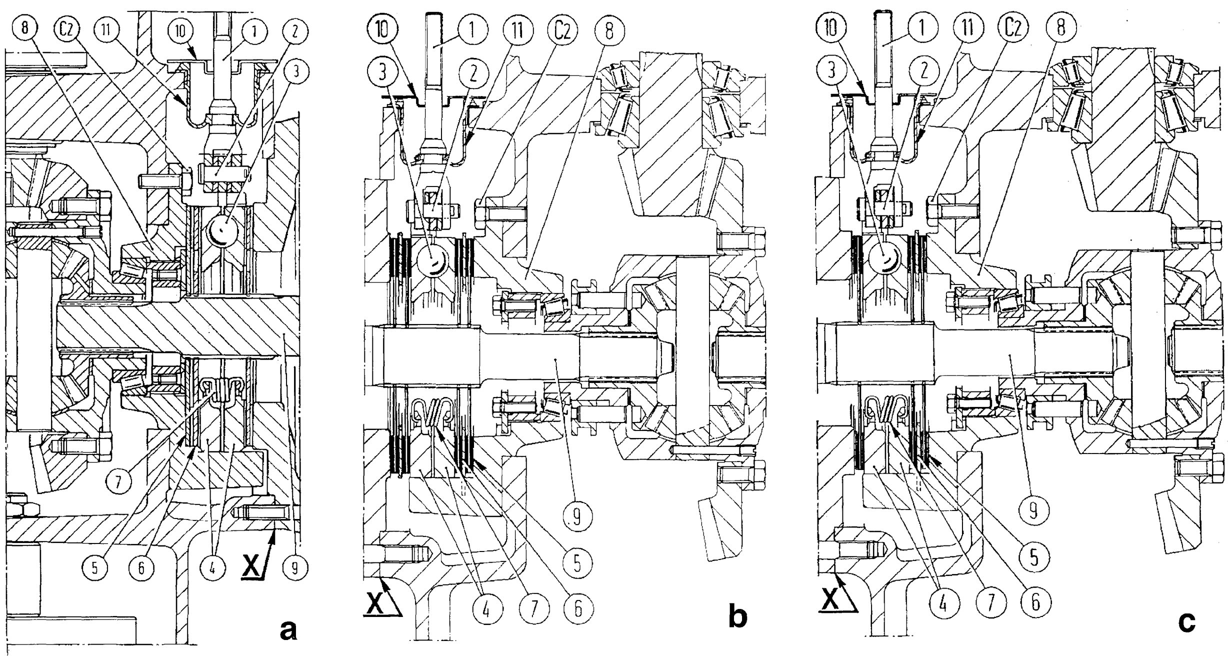
When the operator depresses the L.H. brake pedal (Ps, Fig. a) the control mechanism is actuated in the directions shown by the arrows and makes the two discs of actuator (4) turn in the opposite sense of rotation one respect to the other. The discs, under the effect of springs (3), fitted in taper seats, will also move axially as shown in detail (c).

These two simultaneous actions determine the compression of the brake disc packs which react against the differential carrier (8), pressure plates (6), the actuator (4) and against the final drive housing (12).
As soon as pedal is released, the brake disc pack slackens under the action of springs (7) which call actuator (4) back to rest (Fig. b, detail d).
Identical actions occur at the R.H. side brake when pedal (Ps) is depressed.

Print No. ***603.54.283.00*** *– 09 – 1994*

TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Brake pedal screw	M 16 x 1.5	147	15	108
Toothed sector/lever screw	M 16 x 1.5	147	15	108



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Sections through the braking system

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – c. Models 72LP – 82LP C_2. Differential carrier attachment screws – 1. Brake control rod – 2. Pin – 3. Ball – 4. Actuator – 5. Brake discs – 6. Brake pressure plate – 7. Drive return spring – 8. Differential carrier – 9. Differential axle shaft – 10. Brake link bellows cover – 11. Brake link bellows.

Note – Prior to assembly apply sealing compound on mating surfaces **X** in accordance with text notes and application scheme of page 16, section 27.

Important – In case of replacement of disc brakes (5), prior to install the new discs it is **essential** to put them in a TUTELA MULTI F oil bath for 2 hours at least or, preferably, 5 to 6 hours.

Print No. ***603.54.283.00*** *– 09 – 1994*

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **(X).**
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

List of the special tools needed to carry on the service operations concerning this section of the Manual.

X 293847	Installer, brake link bellows.
292870 (ex 293300)	Universal pressure gauge and connection kit for hydraulics pressure test with **293190** connection, trailer brake control valve .

BRAKE TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Brake noise.	**1.** Worn brake disc linings (5, page 33–2).	Replace brake discs.
Excessive pedal travel.	**1.** Misadjusted pedal free travel.	Re–adjust.
Unbalanced braking.	**1.** Wrong tyre inflating pressure. **2.** Worn lining on one brake disc (55, page 33–2).	Inflate tyres to correct pressure. Replace disc.
Poor braking action.	**1.** Worn brake disc linings (5, page 33–2).	Replace brake discs.
Inefficient parking brake.	**1.** Misadjusted brake controls. **2.** Worn brake disc linings (33, page 33–2).	Re–adjust. Replace breake discs.
Tractor remains braked upon releasing the parking brake hand control lever.	**1.** Hindered control lever return travel.	Remove obstructions.

TRAILER BRAKE CONTROL VALVE TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Jerking brake action with more than two braking impulses per second.	Leaking check valve (3, page 33–9).	Remove and clean check valve.
No braking action.	Choked restriction (9).	Remove and clean metering device (1).

Print No. ***603.54.283.00*** *– 09 – 1994*

RIGHT AND LEFT BRAKE DRIVE PLATES

Removal–Installation (Operation 33 120 60)

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment.
Ensure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

Complete operations 1÷3 of page 16, section 27, covering the final drive removal, then proceed as further indicated.

1. Remove safety cotter pin and associated hinge pin (2, page 33– 2) connecting brake link (1) and actuator (4).
2. Unscrew control link (1) and remove the actuator unit.

CAUTION

Use suitable tools to align holes.
DO NOT USE FINGERS OR HANDS.

3. At brake drive plate installation, proceed by reversing the previous removal sequence of operations, use the **293847** installer to fit the bellow gasket (11, page 33–2) correctly on the brake link (1) milled flat.
4. Install the final drive case in accordance with instructions and information of operation 4 and associated notes on page 16, section 27.

REMOVED RIGHT AND LEFT BRAKE ACTUATORS

Disassembly–Assembly (Operation 33 120 68)

1. Remove return springs (7, page 33–2) and disassemble.
2. Check and inspect actuator (4) balls (3), brake discs (5), pressure plates (6), springs (7) and carrier (8) for wear.
3. Replace brake discs (5) if the syntherized surface lining is worn out or expected to wear out soon.

CAUTION

Use suitable tools to align holes.
DO NOT USE FINGERS OR HANDS.

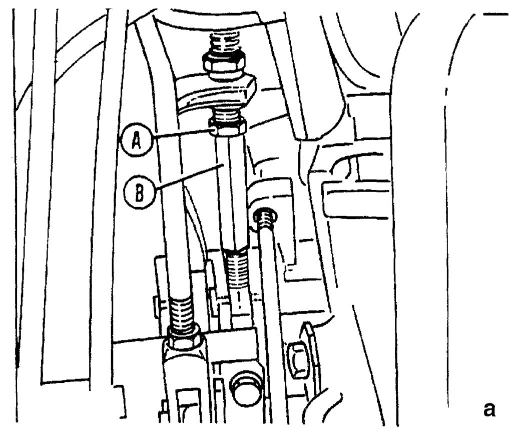
4. Assemble the unit in accordance with the following instruc tions and information:
   a. consult sectional views on page 33–2 for correct placement of parts;
   b. tighten fastenings to torque specifications of page 33–1.

Brake pedal travel adjustment and alignment (Operation 33 120 08)

1. Check that free travel is the same for both pedals and no more than:
   70 mm (2.76 in) on models 50V – 55V – 60V – 70V – 55F – 60F;
   80 mm (3.15 in) on models 62F – 72F – 82F – 72LP – 82LP.

If not, proceed as further indicated:

2. Move parking brake hand lever (H) down.



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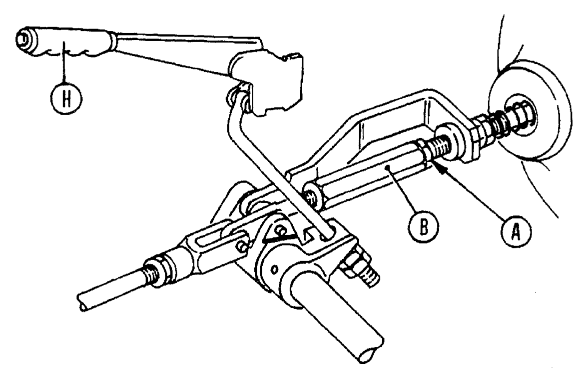


23144 b

Foot brake adjustment

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – A. Jam nuts – B. Turnbuckle sleeves.

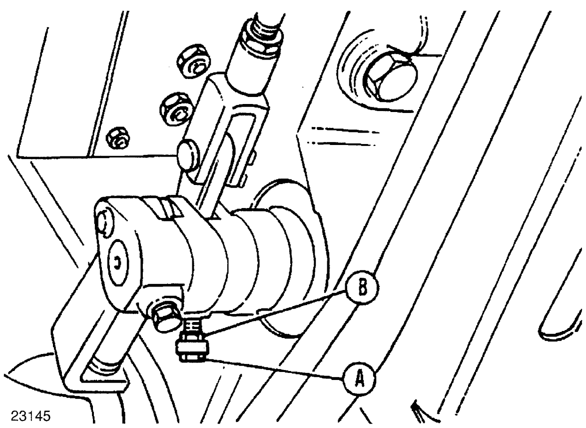
3. Slacken jam nuts (A), one each side, and turn sleeves (B), one each side, to obtain a free travel of 55÷60 mm (2.16÷2.36 in), on all tractor models.
4. Tighten jam nuts (A).

Print No. **603.54.283.00** – 09 – 1994

Parking brake lever free travel adjustment (Operation 33 110 08)

Note– Starting from rest, the parking brake control lever must go through four detent steps to hold the tractor in parking position.

1. If four lever ratchet tooth positions are not sufficient, proceed as follows:



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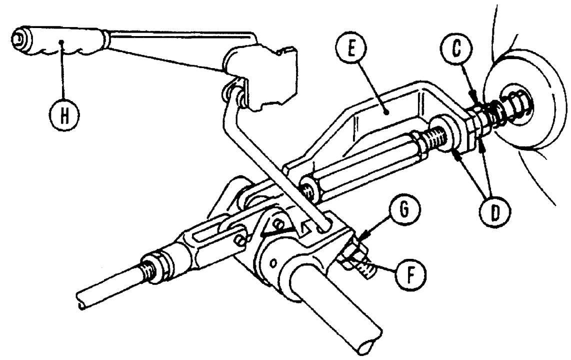
A. **Models 50V – 55V – 60V – 70V – 55F – 60F:**

— slacken L.H. thread jam nut (A);

— turn nut (B) checking in the meantime that control lever (H) locks at the fourth detent on the toothed;

— tighten jam nut (A).



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B. **Models 62F – 72F – 82F – 72LP – 82LP:**

— slacken jam nut (C);

— move sleeve (D) against bracket (E);

— tighten jam nut (C);

— through the link on the R.H. side, slacken left–hand thread jam nut (F);

— tighten or slacken nut (G) checking that in the meantime that control lever locks at the fourth detent on toothed sector;

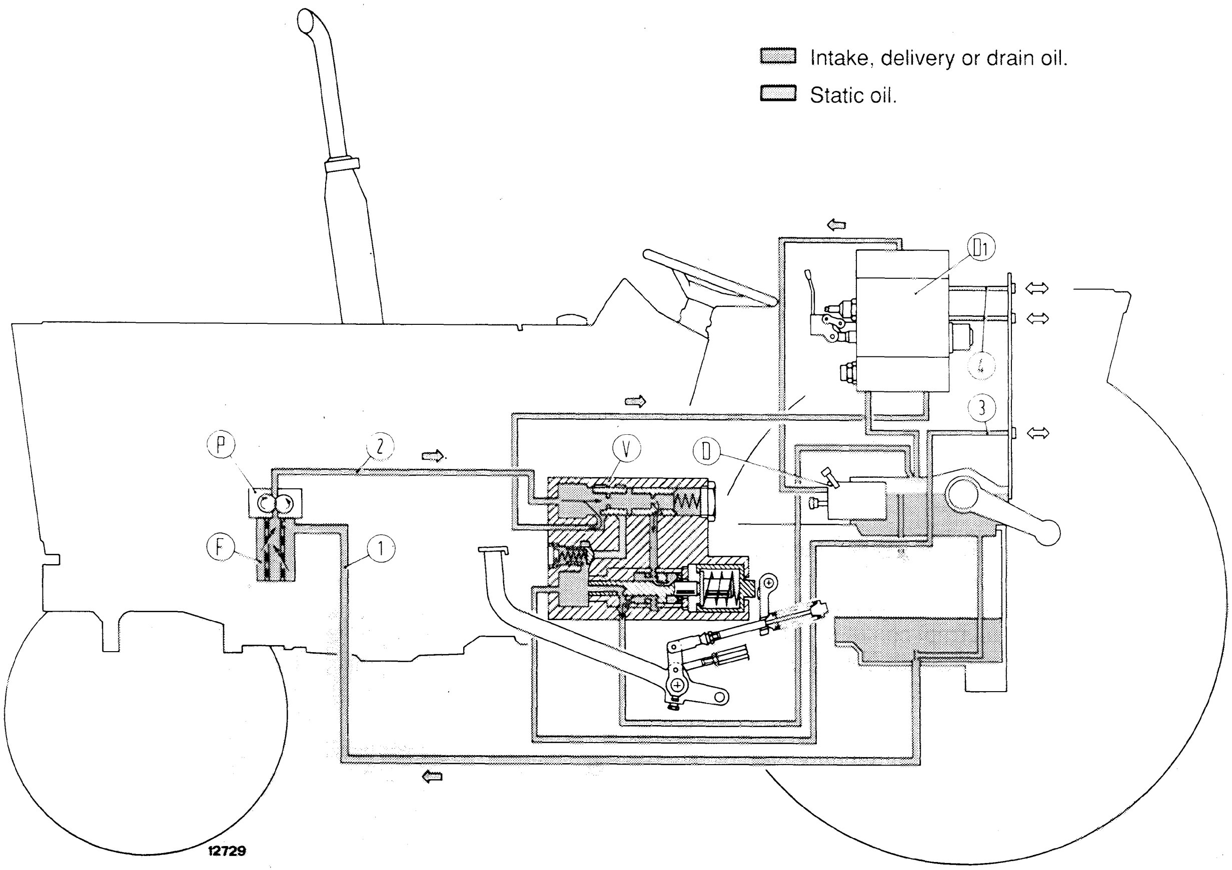
— tighten jam nut (F).

Print No. **603.54.283.00** – 09 – 1994

TRAILER BRAKE REMOTE CONTROL VALVE

The trailer brake remote control valve, available as an optional, is attached to the transmission housing by means of a mounting bracket.

Is automatically controlled through the tractor R.H. side brake pedal and allows the operator to brake the trailer using the same circuit of the tractor hydraulic lift system.



Trailer brake remote control valve oil flow diagram

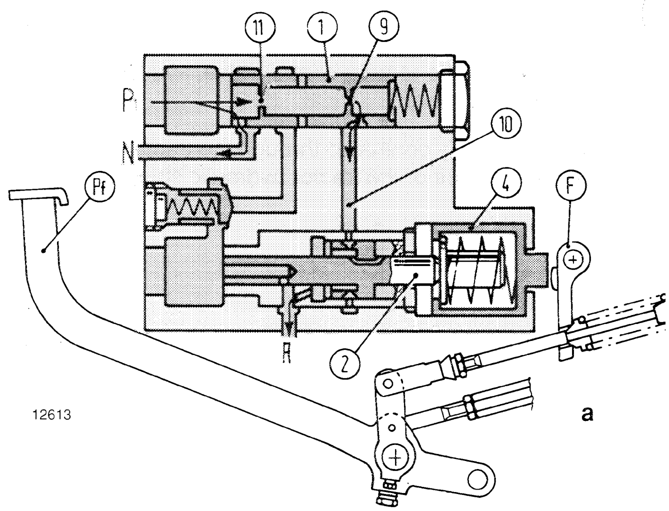
D. Hydraulic lift control valve – D_1. Remote control valve – F. Filter – P. Oil feed pump (used jointly with hydraulic lift) – V. Trailer brake remote control valve – 1. Oil suction line from rear axle drive case reservoir – 2. Oil delivery line to trailer brake remote control valve – 3. Oil delivery line to trailer brake – 4. Oil delivery line to operated equipment.

Print No. **603.54.283.00** – 09 – 1994

a. TRAILER BRAKES AT REST – When tractor brakes are not operated, the pressure limiter (4) and reciprocating piston (2) are posi tioned as shwn in Fig. **a**.

The oil flowing from hydraulic pump (P, page 33–7) in connection (P_1) through the diaphragm (11) and restriction (9) undergoes a pressure drop and consequently will actuate metering valve (1) rightwards.

Large part of the oil flows through the remote control valves through connection (N) whilst the rest of the oil will drain into the hydraulic lift through duct (10), reciprocating piston (2) and connection (R).



Trailer brakes at rest

N. To remote control valves – P_1. From hydraulic lift oil pump – R. To drain into hydraulic lift.

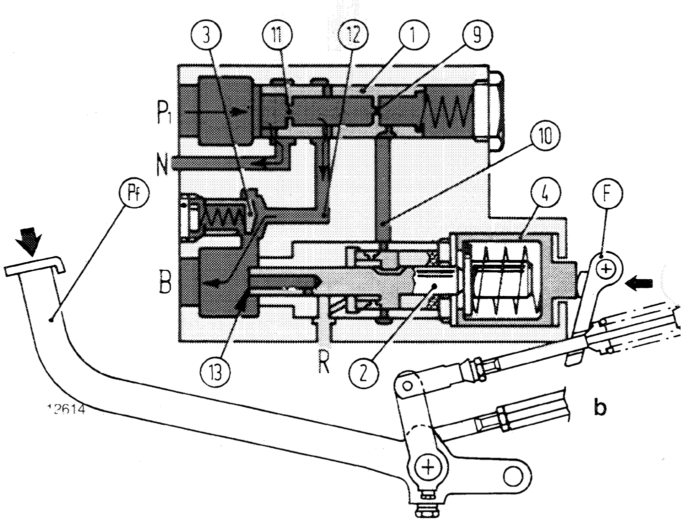
- Pressurized oil
- Intake, delivery or drain oil
- Static oil

b. INITIAL BRAKING STAGE – When the tractor brake pedals (Pf) are depressed, fork (F) will displace, rightwards, the pressure limiter (4) and reciprocating piston (2) which, in turn, will interrupt communication between the oil drain connection (R) with both the trailer brake connection (B) and oil duct (10).

The oil inside the metering valve (1) maintains a constant pres sure and consequently will be forced by the spring to move to the left to the position shown in **b**.

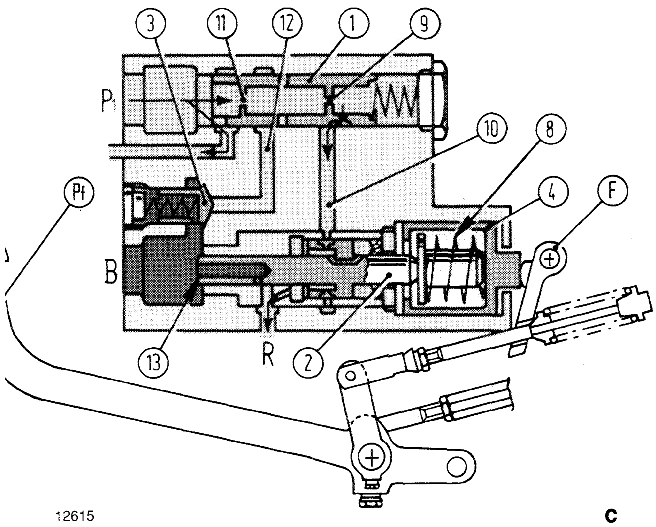
The oil flowing from the hydraulic pump in connection (P_1) will partially go to the remote control valves through connection (N) whilst the remaining output reaches the trailer braking system through the diaphragm (11), duct (12), check valve (3) and connection (B).

The oil inside the trailer brake connection (B), under increasing pressure, will exercise a force over the working surface (13) of piston (2), thus counteracting the pressure exercised on pressure limiter (4) by the control fork (F).



Initial braking stage

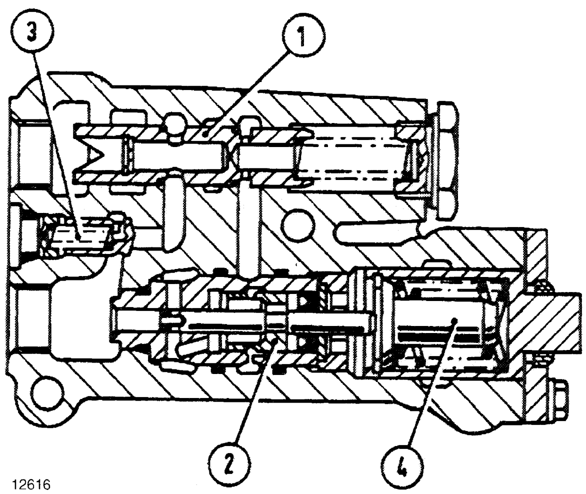
B. To trailer brake – N. To remote control valves – P_1. From hydraulic lift oil pump – R. To drain into hydraulic lift.



12615 **c**

Brake operation

B. To trailer brake – P_1. From hydraulic lift oil pump – R. To drain into hydraulic lift.



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Section through the trailer brake remote control valve

1. Flow metering valve – 2. Reciprocating piston – 3. Check valve – 4. Pressure limiting valve.

c. BRAKE OPERATION – If brake pedal (Pf) are held depressed, the oil inside the trailer brake connection (B) undergoes increa sing pressure and consequently will act upon the working surface (13) of reciprocating piston (2) and force it to the right, overcoming the presure limiter (4) spring (8) reaction.

As soon as the pressure inside the trailer brake system equals that of springs (8), the reciprocating piston (2) will assume the position shown in Fig. **c** and put in communication the oil flowing from the hydraulic pump with the drain into the hydraulic lift, through connection (P_1), diaphragm (11), restriction (9), duct (10) and connection (R).

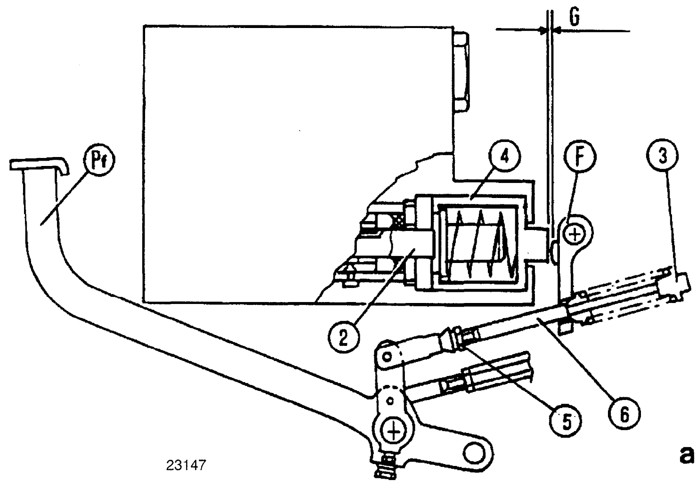
Diaphragm (11) and restriction (9) cause a pressure drop of the oil flowing inside the metering valve (1) which will be forced to move to the right and consequently close duct (12) and check valve (3).

A further operation of the brake pedals (Pf) will force the pressure limiter (4) and piston (2) to move to the right thus causing a pressure increase of the oil inside the trailer braking circuit repeating the same conditions described in paragraph **b** (INITIAL BRAKING STAGE).

If tractor brake pedals are released, the system will return in the conditions shown in Fig. **a**, page 33–8.

- Pressurized oil
- Intake, delivery or drain oil.
- Static oil.

Print No. **603.54.283.00** – 09 – 1994



Trailer brakes at rest

F. Trailer brake valve control fork – G = 0.3÷0.5 mm (.012÷.020 in). Gap between fork (F) and pressure limiter (4) piston – Pf. Brake pedal – 2. Reciprocating piston – 3. Cup – 4. Pressure limiter piston – 5. Jam nut – 6. Adjustment rod.

Adjusting the trailer brake remote control valve linkage

Proceed as further indicated.

1. Adjust brake pedal (Pf) free travel as per directions on page 33–5.
2. Adjust he parking brake (H) control lever as per directions on page 33–6.
3. Tighten cup (3), slacken jam nut (5) and adjust length of link (6) to obtain a gap (G) of 0.3 ÷ 0.5 mm (.012 ÷ .020 in) between control fork (F) and pressure limiter (4) which works on the trailer brake control valve piston (2).
4. Tighten jam nut (5).
5. Join the female quick–connect **293190** and the trailer brake valve male connection.
6. Connect pressure dial gauge **293190** (0 ÷ 250 kg/cm_ scale) of the **292870** (former **293300**) universal kit to the female end.
7. Start engine and run it to warm up the hydraulic fluid to 50 ÷ 60°C (122 ÷ 140°F).
8. Keep engine running at approximately 2000 rpm.
9. Check for zero reading on pressure gauge when brake pedals (Pf) are at rest.
10. Depress brake pedals to take up the free travel and check pressure gauge for a reading greater or equal to 100 bar (102 kg/cm^2).
11. Repeat this same operation three times at least checking that every time brake pedals are released oil pressure inside the system drops to zero.
12. With pedals at rest, operate the parking brake hand lever a few times and check that pressure gauge reading remains at zero.

Print No. ***603.54.283.00*** *– 09 – 1994*

REAR–MOUNTED HYDRAULIC LIFT

	50V – 55V – 60V 70V – 55F – 60F	62F	72F – 82F 72LP – 82LP
Type	position/draft and mixed control		
Controls	through two separate levers		
Variospeed (sensitivity regulation)	through 4–position external lever on control valve housing		
LIFT–O–MATIC	allows push–button control of raise/lower operations with the exclusion of manual hand lever controls		
Lift arms drop rate adjustment	through slotted lever fitted on control valve	through control–valve mounted panel	
Single–acting power cylinder:			
– nominal bore and stroke .... mm (in)	90 x 110 (3.54 x 4.33)	100 x 128 (3.93 x 5.04)	110 x 128 (4.33 x 5.04)
– capacity .... cm^3 (in^3)	700 (42.7)	1005 (61.3)	1216 (74.2)
System pressure relief valve setting (cracking–off) .... bar	186 ÷ 191 (190 ÷ 195 kg/cm^2 – 2755÷2827 psi)		
Cylinder pressure relief valve .... bar	210 ÷ 215 (214 ÷ 219 kg/cm^2 – 3103÷3175 psi)		
Lift piston dia. .... mm (in)	89.980 ÷ 90.000 (3.5425÷3.5433)	99.980 ÷100.000 (3.9362÷3.9370)	109.980 ÷ 110.000 (4.3299÷4.3307)
Cylinder liner I.D. .... mm (in)	90.036 ÷ 90.071 (3.5447÷3.5461)	100.036 ÷100.071 (3.9384÷3.9398)	110.036 ÷ 110.071 (4.3321÷4.3335)
Piston/liner running clearance .... mm (in)	0.036 ÷ 0.091 (.0014 ÷ .0036)		
Rockshaft diameter at bearing bushes:			
– RH side .... mm (in)	47.970 ÷ 48.000 (1.8885÷1.8898)	54.970 ÷ 55.000 (2.1642÷2.1653)	
– LH side .... mm (in)	54.970 ÷ 55.000 (2.1642P2.1653)	62.670 ÷ 62.700 (2.4673÷2.4685)	
I.D. of bearing bushes, force–fitted in lift case housing bores:			
– RH side .... mm (in)	48.100 ÷ 48.184(1) (1.8937÷1.8970)	55.100 ÷ 55.184(1) (2.1691÷2.1726)	
– LH side .... mm (in)	55.100 ÷ 55.184(1) (2.1693÷2.1726)	62,800 ÷ 62,884(1) (2.4724÷2.4757)	
Rockshaft/bearing bush assembly clearance .... mm (in)	0.100 ÷ 0.214 (.0039÷.0084)	0.100 ÷ 0.214 (.0039÷.0084)	
Interference fit of installed RH bearing bush .... mm (in)	0.65 ÷ 0.161 (.0025÷.0063)	0.065 ÷ 0.161 (.0025÷.0063)	
Interference fit of installed LH bearing bush .... mm (in)	0.065 ÷ 0.161 (.0025÷.0063)	0.089 ÷ 0.185 (.0035÷.0073)	
Rockshaft w/arms end play .... mm (in)	0.200 ÷ 1.400 (.0079÷.0551)	0.200 ÷ 1.400 (.0079÷.0551)	
Draft control hollow shaft O.D. ...... mm (in)	21.967 ÷ 22.000 (.8648 ÷ .8661)		
Housing diameter in lift case .... mm (in)	22.020 ÷ 22.072 (.8669 ÷ .8690)		
Shaft/housing assembly fit .... mm (in)	0.020÷ 0.105 (.0008 ÷ .0041)		

(1) Dimension after force–fitting, without reaming.

(continued)

Print No. ***603.54.283.00*** *– 09 – 1994*

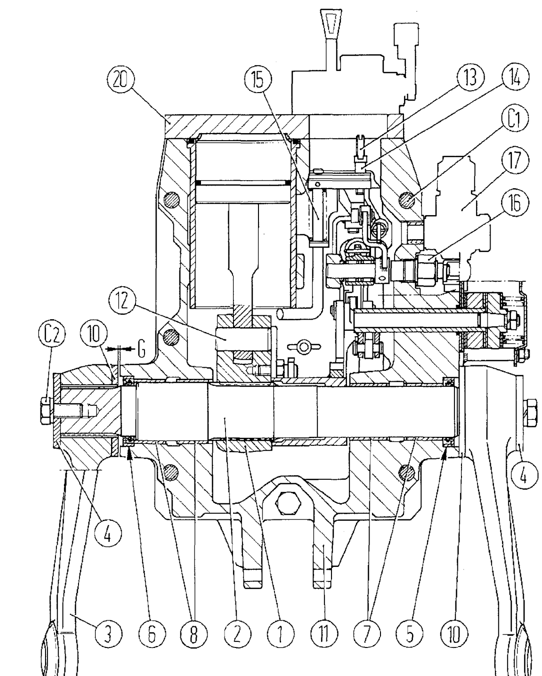
REAR–MOUNTED HYDRAULIC LIFT

(follows)

Diameter, position control shaft ...... mm (in)	13.973 ÷ 14.000 (.5501 ÷ .5511)
Diameter, shaft housing in draft control hollow shaft .... mm (in)	14.106 ÷ 14.059 (.5553 ÷ .5535)
Shaft running clearance fit .... mm (in)	0.016÷ 0.086 (.0006 ÷ .0034)
Diameter, draft control transmission lever pin and internal lever pivot pin at needle bearings .... mm (in)	13.973 ÷ 14.000 (.5501 ÷ .5512)
I.D., control valve link arm and internal draft control lever at needle bearings .... mm (in)	19.985 ÷ 20.006 (.7868 ÷ .7876)
Assembly clearance, control valve spool .... mm (in)	0.008 ÷ 0.012(1) (.0003 ÷ .0005)
Assembly clerance, lift pilot valve in control valve housing .... mm (in)	0.008÷ 0.012(1) (.0003 ÷ .0005)
Control valve spool return spring:	
– free length .... mm (in)	50.5 (1.99)
– compressed length under a load of 31.7÷35 N (3.23÷3.57 kg – 7.1÷7.9 lb) .... mm (in)	34 (1.34)
Pilot valve return spring:	
– free length .... mm (in)	44 (1.73)
– compressed length under a load of 103÷114.7 N (10.5÷11.7 kg – 23÷25.8 lb) .... mm (in)	29 (1.14)
Lift arm drop rate regulation valve return spring:	
– free length .... mm (in)	13 (.51)
– compressed length under a load of 1.7÷2.3 N (0.17÷0.23 kg – .37P.51 lb) .... mm (in)	9.8 (.39)
Sensitivity adjustment valve return spring:	
– free length .... mm (in)	14.5 (.57)
– compressed length under a load of 15.8÷17.6 N (1.61÷1.79 kg – 3.55÷3.95 lb) ...... mm (in)	11 (.43)
Check valve return spring:	
– free length .... mm (in)	23.5 (.92)
– compressed length under a load of 35.3÷39.2 N (3.6÷4 kg – 7.9÷8.8 lb) .... mm (in)	18 (.71)
Sensitivity valve spool external detent valve:	
– free length .... mm (in)	20.5 (.81)
– compressed length under a load of 61.8÷67.7 N (6.3÷6.9 kg – 13.9÷15.2 lb) .... mm (in)	13.8 (.54)

(1) Spools, control and pilot valves, are suitably selected at assembly to obtain the correct fits.

Print No. **603.54.283.00** – 09 – 1994



a

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HYDRAULIC LIFT PRESSURE RELIEF VALVE

Pressure relief valve (17, Fig. a) is not fitted on model 50V – 55V – 60V – 70V – 55F – 60F tractors equipped with remote control valves because already built–in the housing of one of these. Instead, it is fitted on all tractor models without remote control valve (Figs. a and b) or on model 62F – 72F – 82F – 72LP – 82LP tractors (Fig. b) equipped with remote control valves without built–in pressure relief valve (see remote control valve text).

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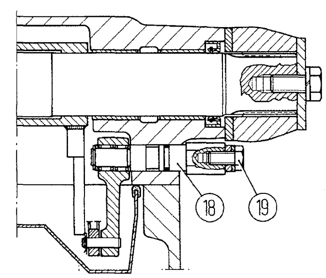
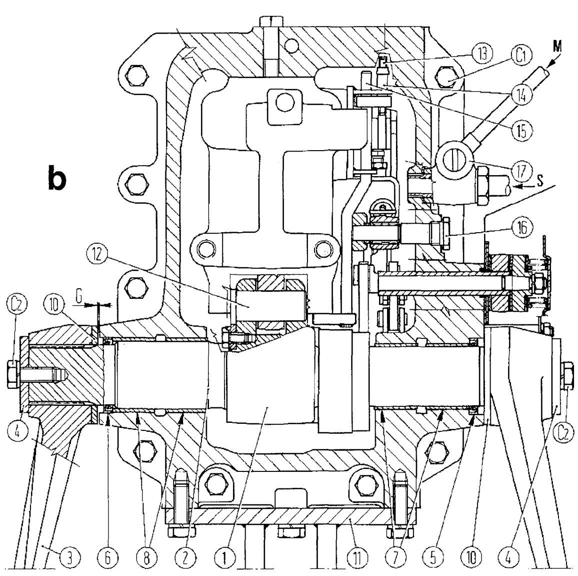


b



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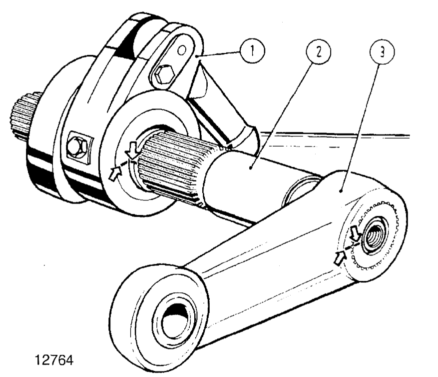

c

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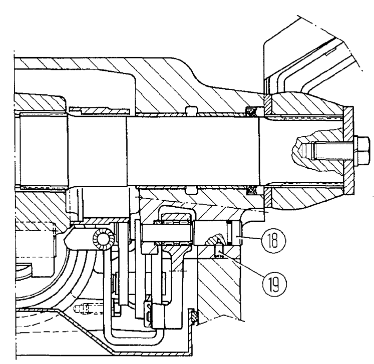

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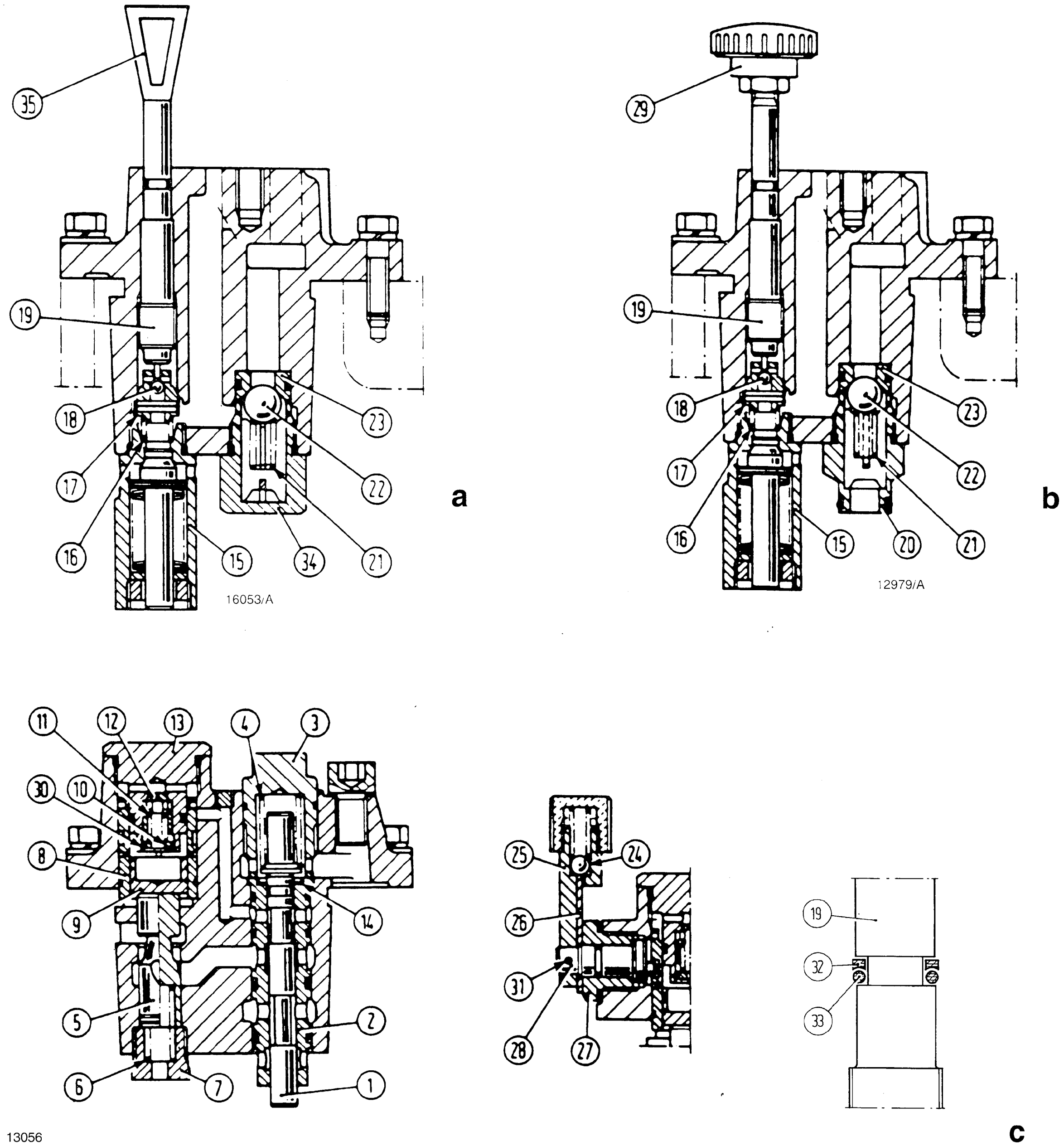
Hydraulic lift sectional views

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – C. Detail of reference marks for correct lift arm installation – C_1. Lift mounting screws – C_2. Thrust plate holding screws – G = 0.2 ÷ 1.4 mm (.008 ÷ .055 in). Rockshaft end play – M. Pump oil delivery line – S. Oil drain line from remote control valves (see page 35–50) – 1. Inside arm – 2. Rockshaft – 3. Raise/lower arms – 4. Arm thrust plates – 5. Oil seal, RH side – 6. Oil seal, LH side – 7. Bearing bushes, RH side – 8. Bearing bushes, LH side – 10. Thrust washers – 11. Top link bracket – 12. Piston pivot pin – 13. Travel stop setting screw – 14. Travel stop setting screw jam nut – 15. Travel stop control rod – 16. Control valve link pin – 17. Pressure relief valve – 18. Draft control lever pivot pin – 19. Set screw – 20. Front cover.

Print No. ***603.54.283.00*** *– 09 – 1994*



Sections through rear–mounted lift control valve.

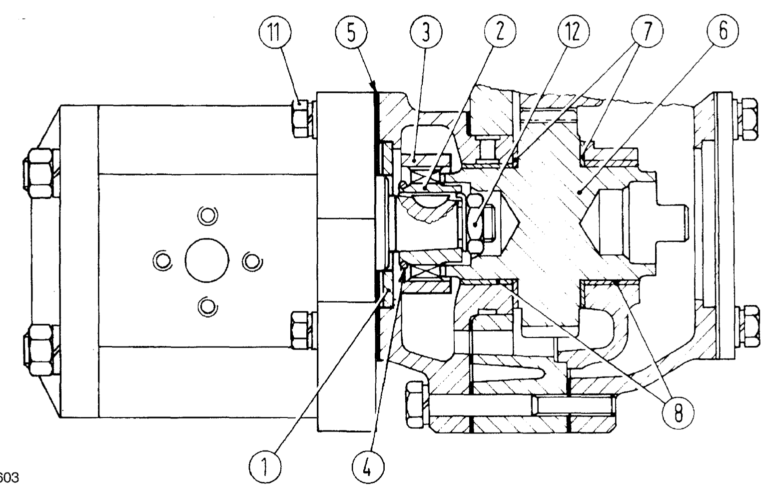
a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – c. Installation detail for correct placement of O–ring seal (33) and back–up ring (32) – 1. Control valve spool– 2. Spool seat – 3. Plug – 4. Spool spring – 5. Pilot valve spool – 6. Spool spring – 7. Plug – 8. Pilot valve plunger seat – 10. Spring back–up ring – 11. Sensitivity valve spring – 12. Sensitivity valve – 13. Plug – 14. Control valve seat ring – 15. Cylinder safety valve – 16. Arm drop rate regulation valve spring – 17. Arm drop rate regulation valve – 18. Ball – 19. Arm drop rate valve spool – 20. Oil delivery to cylinder connection – 21. Check valve spring – 22. Check valve – 23. Check valve seat – 24. Detent ball – 25. Regulation spool lever – 26. Toothed sector – 27. Plug – 28. Regulation spool – 29. Arm drop rate regulation spool knob – 30. Retaining circlip – 31. Spring pin – 32. Spool (19) seal back–up ring – 33. O–ring seal – 34. Plug – 35. Arm drop rate regulation spool slotted lever.

Attention – Install seal (33) and back–up ring (32) as shown in detail (c), using the special **293858** protection and warming up ring (32) in oil at about 50°C (122°F). Pay a particular attention to back–up ring (32) which must be fitted with its flat side facing upwards and concave side facing the seal.

REAR–MOUNTED LIFT OIL PUMP

Filter	
Type	paper cartridge
Installation	fitted on pump housing, suction end
Pump	
Type	gear–type, aspirating oil from reservoir in rear drive case
Installation	on back of engine timing cover
Model	A31
Maker	FIAT
Control	driven through timing gears
Rotation (looking from drive side)	counterclockwise
Engine/pump speed ratio	1 : 0.925
Rated speed (with engine running at rated speed of 2500rpm) rpm	2700
Rated output l/min (UK gal/min)	40 (8.8)
Test bench output at 1450 rpm and 172 bar (175 kg/cm^2 – psi) pressure:	
– new or reconditioned pump l/min (UK gal/min)	19 (4.2)
– used pump l/min (UK gal/min)	13.3 (3.0)
– test oil temperature °C (°F)	55÷65 (131÷149)
– test oil viscosity	SAE 20

(continued)



Sectional view of pump drive.

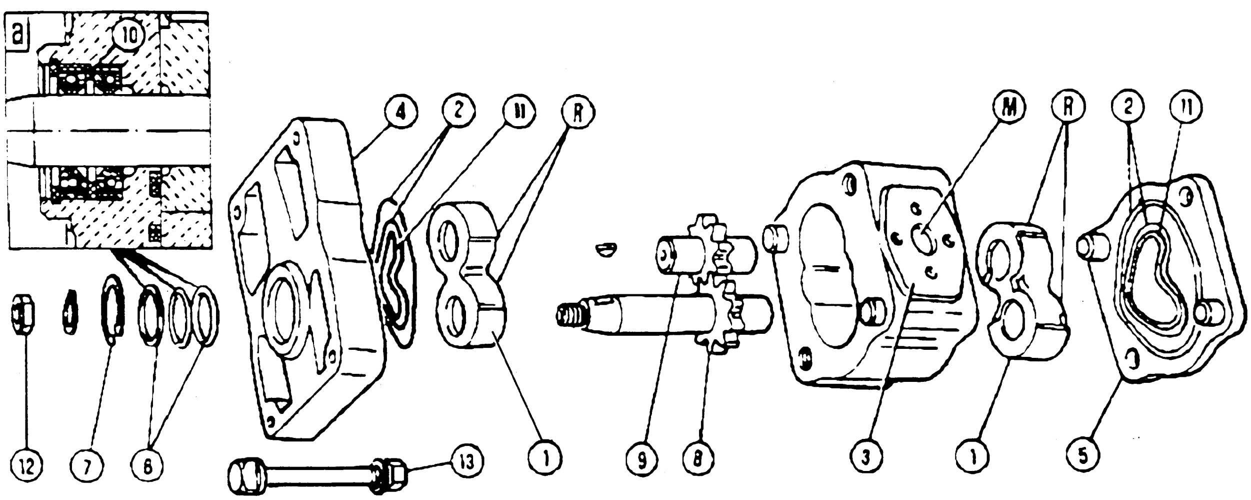
1. Pump centralizing ring – 2. Pump drive sleeve – 3. Sleeve drag ring – 4. Ring (3) retaining circlip – 5. Gasket – 6. Pump drice driven gear – 7. Thrust rings – 8. Gear bearing bushes – 11. Pump mounting screws – 12. Sleeve holding nut.

Print No. **603.54.283.00** – 09 – 1994

REAR–MOUNTED LIFT OIL PUMP

(follows)

Diameter, drive and driven gear shafts .... mm (in)	17.400 ÷ 17.418 (.6850 ÷ .6857)
I.D., shaft bearing bores .... mm (in)	17.450 ÷ 17.470 (.6870 ÷ 6878)
Running fit, shafts in bearing bores .... mm (in)	0.032 ÷ 0.070 (.0012 ÷ .0027)
– wear limit .... mm (in)	0.1 (.004)
Radial play of bearings in pump housing .... mm (in)	0.020 ÷ 0.064 (.0008 ÷ .0025)
Wear limit at pump housing, inlet side, at bearing location .... mm (in)	0.1 (.004)
Gear width .... mm (in)	24.000 ÷ 24.015 (.9449 ÷ .9455)
Bearing width .... mm (in)	24.490 ÷ 24.510 (.9642 ÷ 9649)
Pump housing width corresponding to gear and bearing location .... mm (in)	73.135 ÷ 73.160 (2.8793 ÷ 2.8803)
End play of gear/bearing assemblies in pump housing (apply also to pump reconditioning process) .... mm (in)	0.100 ÷ 0.180 (.0039 ÷ .0071)



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Exploded view of oil pump.

a. Seal installation detail – M. Pump oil delivery outlet – R. Gear bearing fillets (outlet side) – 1. Gear bearings – 2. Oil seals in pump cover – 3. Pump housing – 4. Rear cover – 5. Front cover – 6. Drive shaft seal – 7. Seal retaining circlip – 8. Drive gear shaft – 9. Driven gear shaft – 10. Spacer – 11. Anti–extrusion ring – 12. Nut securing sleeve to drive shaft and associated lock washer – 13. Cover bolt nuts.

IMPLEMENT CARRIER

	50V – 55V – 60V	70V – 55F – 60F – 62F 72F – 82F – 72LP – 82LP
Type	3–point hitch	
Category	1st	1st and 2nd
Draft control	through lower links by flexible bar	

	50V	55V	55F	60V	60F	70V	62F	72F	82F
Maximum load lifting capacity over the full raise stroke with lower links horizontal and top link connected to upper bracket hole:									
– at lower link ball ends kg (lb)	2375 (5237)						3045 (6714)		3880 (3555)
– w/center of gravity at 610 mm (24 in) from ball ends kg (lb)	1960 (4322)						2225 (4906)	2690 (5931)	
– w/center of gravity at 1010 mm (39.75 in) from ball ends kg (lb)	1880 (4145)	–	–	–	–	–	–	–	–
– w/center of gravity at 1050 mm (41.35 in) from ball ends kg (lb)	–	1880 (4145)		–	–	–	–	–	–
– w/center of gravity at 1090 mm (42.91 in) from ball ends kg (lb)	–	–	–	1880 (4145)		–	1755 (3870)	–	–
– w/center of gravity at 1170 mm (46 in) from ball ends kg (lb)	–	–	–	–	–	1880 (4145)	–	2030 (4476)	–
– w/center of gravity at 1250 mm (49.2 in) from ball ends kg (lb)	–	–	–	–	–	–	–	–	2030 (4476)

	72LP	82LP
Maximum load lifting capacity over the full raise stroke, with lower links horizontal, lift rods connected to rear mounting holes and top link connected to upper bracket hole:		
– at lower link ball ends kg (lb)	3635 (8015)	
– w/center of gravity at 610 mm (24 in) from ball ends kg (lb)	2800 (6174)	
– w/center of gravity at 1170 mm (46 in) from ball ends kg (lb)	2200 (4851)	–
– w/center of gravity at 1250 mm (49.2 in) from ball ends kg (lb)	–	2200 (4851)

	50V	55V	60V	55F	60F	70V	62F	72F	82F
Maximum lower link ball end travel:									
– w/fully extended lift rods mm (in)	570 (22.441)			540 (21.260)			655 (25.787)		
– w/fully retracted lift rods mm (in)	–						585 (23.031)		

	72LP	82LP
Maximum lower link ball end travel:		
– w/lift rods fully extended and connected to front holes mm (in)	770 (30.315)	
– w/lift rods fully extended and connected to rear holes mm (in)	660 (25.984)	

Flex bar diameter (all models) mm (in)	24.867 ÷ 24.900 (.9790 ÷ .9803)
Flex bar end play (models 50V – 55V – 60V 70V – 55F – 60F) mm (in)	1.5 ÷ 5.4 (.059 ÷ .213)
Flex bar end play (models 62F – 72F – 82F 72LP – 82LP) mm (in)	1.2 ÷ 4.1 (.047 ÷ .161)

Print No. ***603.54.283.00*** *– 09 – 1994*

REMOTE CONTROL VALVES

Filter	paper cartridge, the same of the hydraulic lift circuit
Pump	gear–type, the same that feeds the hydraulic lift circuit
Remote control valves SALAMI, on models 50V – 55V – 60V – 70V – 55F – 60F	
Type	spool–type, with automatic return to neutral or with detent in raising, in lowering or in float (see description, pages 35–56 thru 35–61)
Installation	pack–type, up to a maximum of three valves, installed on top of hydraulic lift
Control	hand levers
Pressure relief valve setting ... bar	186 ÷ 191 (190 ÷ 195 kg/cm^2 – 2755÷2877 psi)
Remote control valves KONTAK, on models 62F – 72F – 82F 72LP – 82LP	
Type	spool–type, with automatic return to neutral or with detent in raising, in lowering or in float (see description on pages 35–50 thru 35–55)
Installation	pack–type, up to a maximum of three valves, installed on the R.H. final drive
Control	hand levers
Pressure relief valve setting ... bar	186 ÷ 191 (190 ÷ 195 kg/cm^2 – 2755÷2877 psi)
Valve/spool assembly clearance fit ... mm (in)	0.003 ÷ 0.006 (.0001÷.0002)
Pressure relief valve spring:	
– free length ... mm (in)	39.4 (1.551)
– compressed length under load of 294±53 N (30±5.4 kg – 66±12 lb) ... mm (in)	38.2 (1.504)
Valve spool spring length ... mm (in)	42.8 (1.685)
Check valve spring length ... mm (in)	15.9 (.626)

Print No. **603.54.283.00** – 09 – 1994

TORQUE WRENCH DATA

For models 50V – 55V – 60V – 70V – 55F – 60F:

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Hydraulic lift Screws, lift installation on rear drive case (C_1, page 35–3)	M14 x 1,5	147	15	108
Screws, control valve to lift case	M 8 x 1.25	26	2.7	19.5
Screws, raise arm end plates (C_2)	M14 x 1.5	147	15	108
Plug, lift arm height limit adjustment	M12 x 1.25	103	10.5	76
Nut, position control shaft	M10 x 1.25	15	1.5	11
Stud nuts, lever sector bracket (C_4, page 35–23)	M 8 x 1.25	25	2.6	19
Screw, lift case cover	M14 x 1.5	147	15	108
Screw, top link bracket	M16 x 1.5	221	22.5	163
Screw, oil inlet connection	M12 x 1.25	98	10	72
Screw, oil delivery connection	M10 x 1.25	59	6	43
Implement carrier and towing attachments Screw, draw bar and hook mounting bracket	M16 x 1.5	221	22.5	162.7
Nut, drawbar end screw	M 18 x 1.5	343	35	253

For models 62F – 72F – 82F – 72LP – 82LP:

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Hydraulic lift Screws, lift installation on rear drive case (C_1, page 35–3)	M12 x 1.25	98	10	72
Screws, control valve to lift case	M 8 x 1.25	26	2.7	19.5
Screws, raise arm end plates (C_2)	M14 x 1.5	147	15	108
Plug, lift height limit adjustment	M12 x 1.25	103	10.5	76
Nut, position control shaft	M10 x 1.25	59	6	43
Stud nuts, control lever sector bracket (C_4, page 35–23) .	M 8 x 1.25	25	2.6	19

(continued)

Print No. **603.54.283.00** – 09 – 1994

TORQUE WRENCH DATA

(follows)

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Screws, lift power cylinder	M14 x 1.5 M16 x 1.5	211 260	21.5 26.5	155 192
Screw, top link mounting bracket	M14 x 1.5	147	15	108
Screw, lift inside arm	M10 x 1.25	61	6.2	45
Screw, control valve oil inlet connection	M12 x 1.25	98	10	72
Screw, oil delivery connection	M 10 x 1.25	59	6	43
Implement carrier and towing attachments Screw, flex bar mounting	M16 x 1.5	221	22.5	163
Screw, sway limiting chain mounting	M16 x 1.5	221	22.5	163
Screw, top link mounting bracket	M16 x 1.5	221	22.5	163
Screw, sway limiting rod mounting	M16 x 1.5	221	22.5	163
Nut, drawbar end screw	M18 x 1.5	343	35	253

For all models:

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Hydraulic pump Screws, pump installation (11, page 35–5)	M 6 x 1	8	0.8	5.8
Nuts, pump cover holding screws	M 10 x 1.25	41	4.2	30
Remote control valves Nuts, control valve tie–rods	–	20	2	14.5
Connection, oil return to lift	–	20	2	14.5
Plug, pressure relief valve spring	–	20	2	14.5
Set screw, control valve spool	–	5.5	0.6	4.3
Screws, control lever support (8, page 35–53) and lid (4)	–	11	1.1	8
Plug, single/double acting commutation valve	–	20	2	14.5

Print No. ***603.54.283.00*** *– 09 – 1994*

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code (**X**).
Besisdes, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

List of the special tools needed to carry on the service operations concerning this section of the Manual.

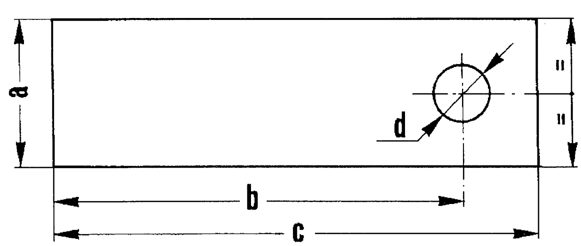
X	292870	Tester, remote control valve.
X	293838	Installer, upper draft control lever needle roller bearing.
X	293839	Installer, control valve lever needle roller bearings.
	291215	Hook, control valve link spring.
X	291862	Wrench, lift cylinder safety valve lock ring.
X	291863	Wrench, lift relief valve lock ring.
X	293463	Wrench, relief valve (Z, page 35–60) incorporated in the remote control valves on models 50V – 55V – 60V – 70V – 55F – 60F.
X	293858	Seal installer, lift drop rate valve spool.
X	293846	Adjuster, position/draft control.
X	290284	Hand pump, hydraulic lift valve setting.
X	290828	Adapter, lift cylinder relief valve (w/ **290284**).
X	290824	Adapter, lift relief valve (w/ **290284**).
X	293870	Wrench, lift arm height limit adjustment.
X	293195	Guide, installer, KONTAK control valve check valve O–ring seal (11, page 35–53).
X	293982	Adapter, control valve pilot valve fluid tightness check (w/ **290284**).
X	293984	Protection, control valve pilot valve seal installation.

Models 50V – 55V – 60V – 70V – 55F – 60F

X	292547	Installer, lift piston with seal.
X	292535	Installer, rocker shaft seal.
X	292541	Adjuster, draft control (w/ **293846**).
X	293872	Adapter, (w/ **293846**).

Models 62F – 72F – 82F – 72LP – 82LP

X	293842	Installer, rocker shaft seal.
	292607	Adapter (w/ **391359/2**).
	291359/2	Sling, hydraulic lift.
X	293845/1	Adjuster, lift draft control (w/ **293846**).
X	293843	Installer, lift piston with seal (model 62F).
X	291483	Installer, lift piston with seal (models 72F – 82F – 72LP – 82LP).



12982

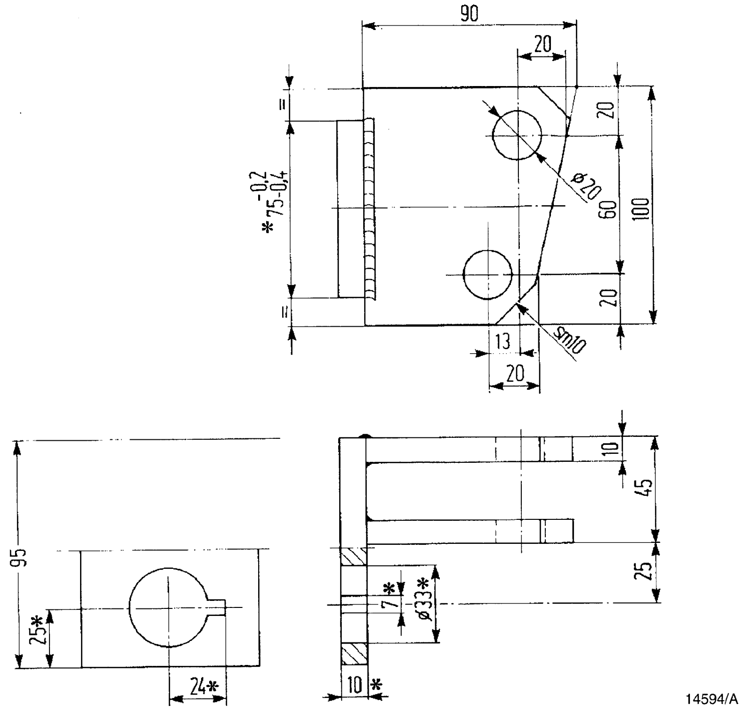
Working drawing of self–made tool for the removal of the lift control lever damper springs (all models.

a = 40 mm (1.575 in). Tool height – b = 110 mm (4.331 in) – C = 130 mm 5.119 in). Approx. tool length – d = 15 mm (.591 in). Hole dia.

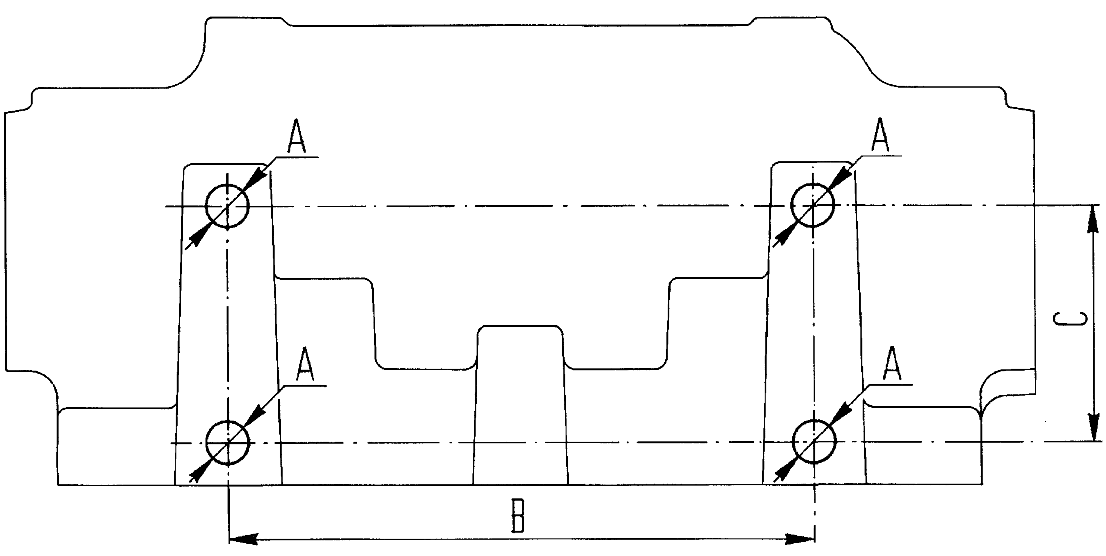
(**Note** – Approx. tool thickness: 8÷10 mm (.315÷.394 in).

Print No. 603.54.283.00 – 09 – 1994

SERVICE TOOLS



Working drawing of 50032 self–made bracket for lift unit installation on the workshop floor 290086 revolving stand – Models 50V – 55V – 60V – 70V – 55F – 60F – Metric dimensions (mm).



Centerline and hole dimensions of bracket (1, page 35–24) for lift unit installation on the workshop floor 290086 revolving stand – Models 62F – 72F – 82F – 72LP – 82LP.

A = 15 mm (.590 in). Diameter of holes to drill in the lift mounting plate – B = 204 mm (8.031 in). Centerline distance – C = 82 mm (3.228 in). Centerline distance.

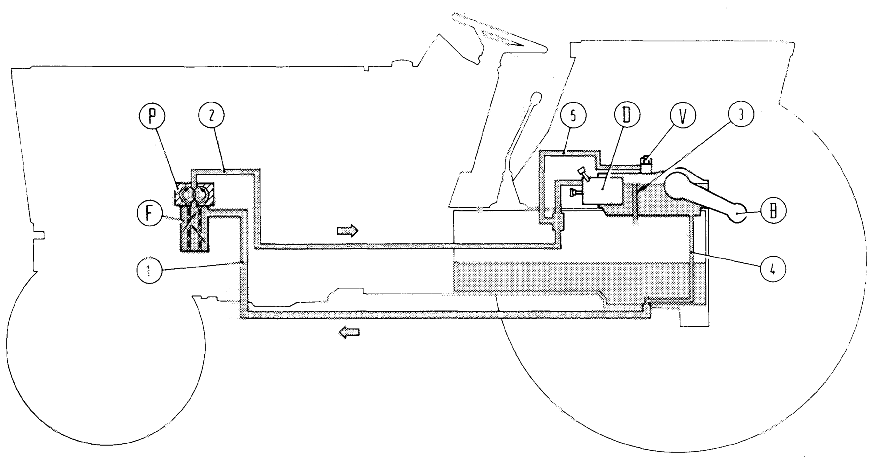
Note: For the remaining dimensions, see data marked * in the accompanying figure.

*Print No. **603.54.283.00** – 09 – 1994*

HYDRAULIC LIFT TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
1. System does not operate.	**a.** Control valve stuck open.	Free valve by cleaning drain ports (T_1, T_2 and T_3, page 35–15) and inspect filter.
	b. Inefficient oil pump.	Disassemble and inspect oil pump (P).
2. Jerky operation.	**a.** Clogged oil filter.	Inspect filter (F) and replace cartridge, if needed.
	b. Air inside pump suction line.	Check fluid tightness at connections and inspect oil seals.
3. Lift fails to hold load in raised position (continuous pitching movement while engine is running; when stopped, the load drops).	**a.** Oil leakage at control valve plunger seat (2, page 35–4).	Replace oil seals.
	b. Poor control valve plunger (1) fluid tightness.	Disassemble, check fluid tightness and replace punger and seat, if necessary. Inspect filter.
	c.Poor check valve (22) fluid tightness.	Disassemble, inspect and clean components.
	d. Oil leakage at cylinder piston gland or at at delivery line connection seal (20).	Replace seals.
	e. Poor fluid tightness or low spring setting of the cylinder safety valve (15).	Replace.
4. Pressure relief valve cracks off with lift arms in upper height position.	Lift arm raise/lower stroke not properly adjusted.	Adjust properly.
5. Poor lifting capacity.	**a.** Pressure relief valve (V, page 35–16) not correctly set.	Replace, or, if installed on remote control valves, adjust it properly.
	b. Cylinder safety valve (15, page 35–4) not correctly set.	Replace.
	c. Poor oil pump efficiency (normally associated with increasing raise time).	Check pump performance, and, if necessary, overhaul or replace it.

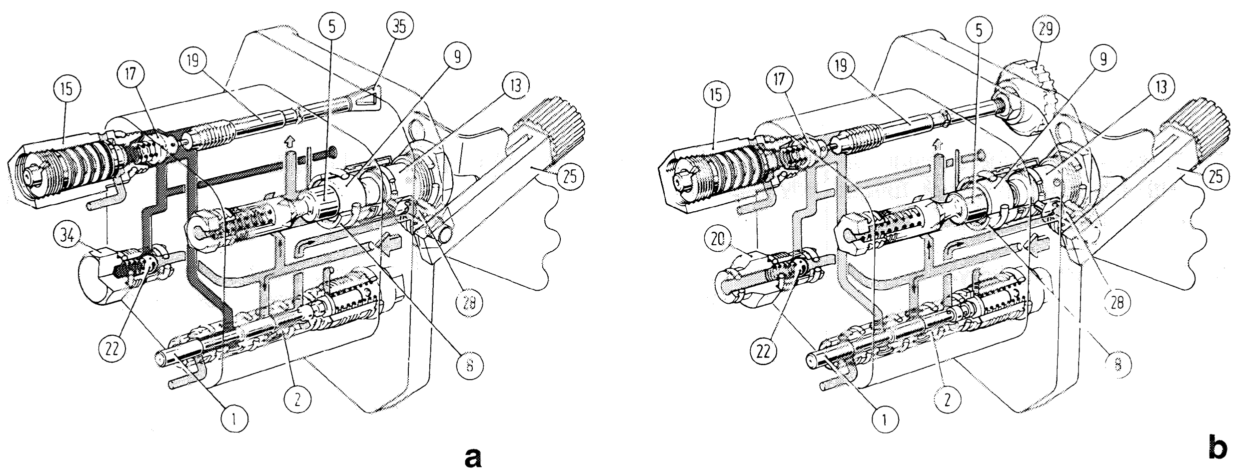
Print No. ***603.54.283.00*** *– 09 – 1994*



12981/A

Hydraulic lift oil flow diagram.

B. Lift arm – D. Control valve – F. Oil filter with paper cartridge – P. Engine timing gear–driven oil pump – V. Pressure relief valve installed on hydraulic lift case – 1. Oil suction line (from reservoir in rear drive case) – 2. oil delivery line (to control valve) – 3. Oil level line inside hydraulic lift case – 4. Oil drain line (from hydraulic lift case) – 5. Oil connecting line (to pressure relief valve).



16292/A

11570

pressurized oil — suction, delivery or drain oil — static oil

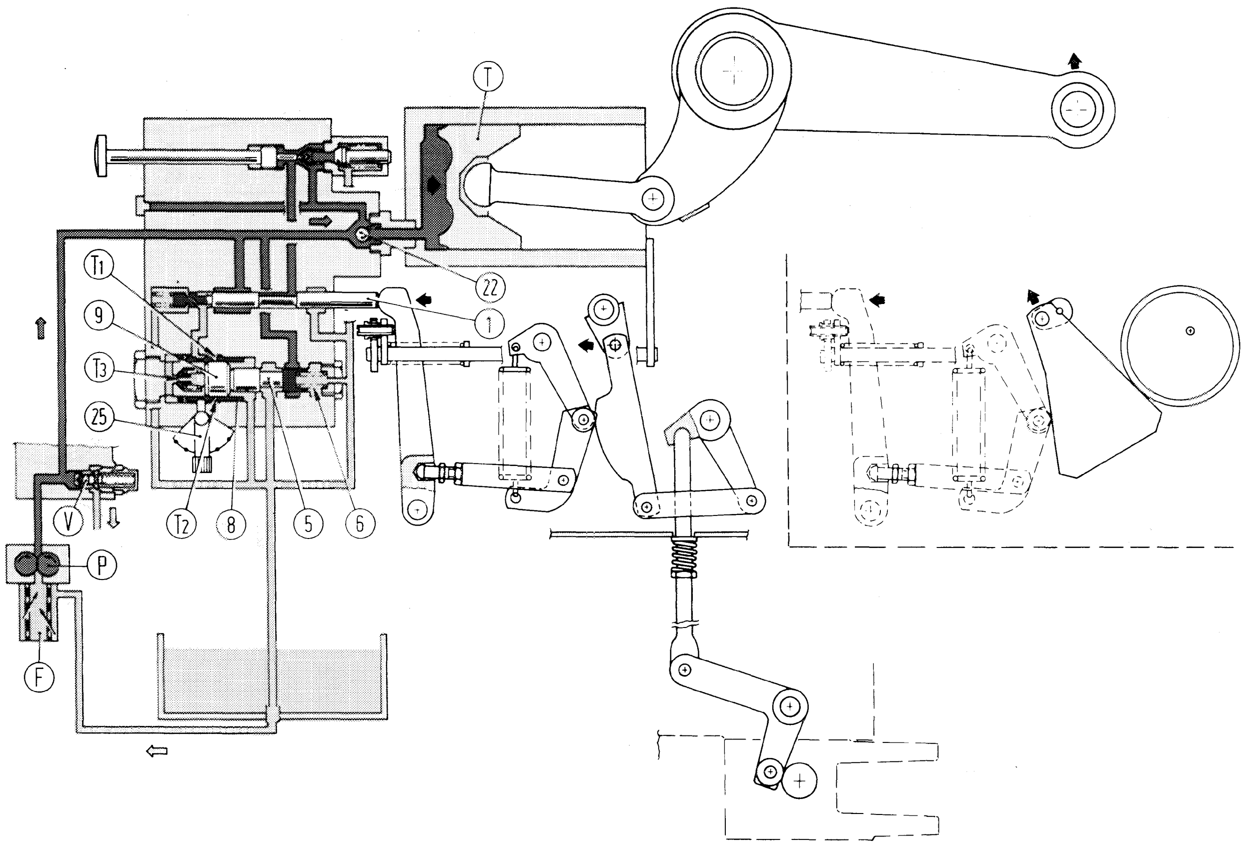
Perspective view of the hydraulic lift.

Note – The oil flow is referred to the neutral condition.

a. Models 50V – 55V – 60V – 70V – 55F – 60F – B. Models 62F – 72F – 82F – 72LP – 82LP – 1. Control valve spool – 2. Control valve spool housing bore – 5. Pilot valve spool – 8. Pilot valve plunger seat – 9. Pilot valve plunger – 13. Plug – 15. Cylinder safety valve – 17. Lift arm drop rate regulation valve – 19. Drop rate regulation valve spool – 20. Oil delivery line to cylinder connection – 22. Check valve – 25. Sensitivity valve spool lever – 28. Sensitivity valve spool – 29. Lift arm drop rate regulation knob – 34. Plug – 35. Lift arm drop rate regulation spool slotted lever.

Note – The only significative difference between (**a**) and (**b**) schemes, for models 50V – 55V – 60V – 70V – 55F – 60F and 62F – 72F – 82F – 72LP – 82LP, respectively, concerns the oil intake mode. In the case of models 50V – 55V – 60V – 70V – 55F – 60F, the oil ingress in the system occurs through a specific connection located outside of the control valve. Instead, on models 62F – 72F – 82F – 72LP – 82LP, the oil flows in through the oil–to–cylinder delivery connection (20).

The oil flow diagrams illustrated in the folowing pages concern exclusively the tractor models 62F – 72F – 82F – 72LP – 82LP as practically equal to models 50V – 55V – 60V – 70V – 55F – 60F, the only difference being the previously described oil intake mode in the power cylinder.



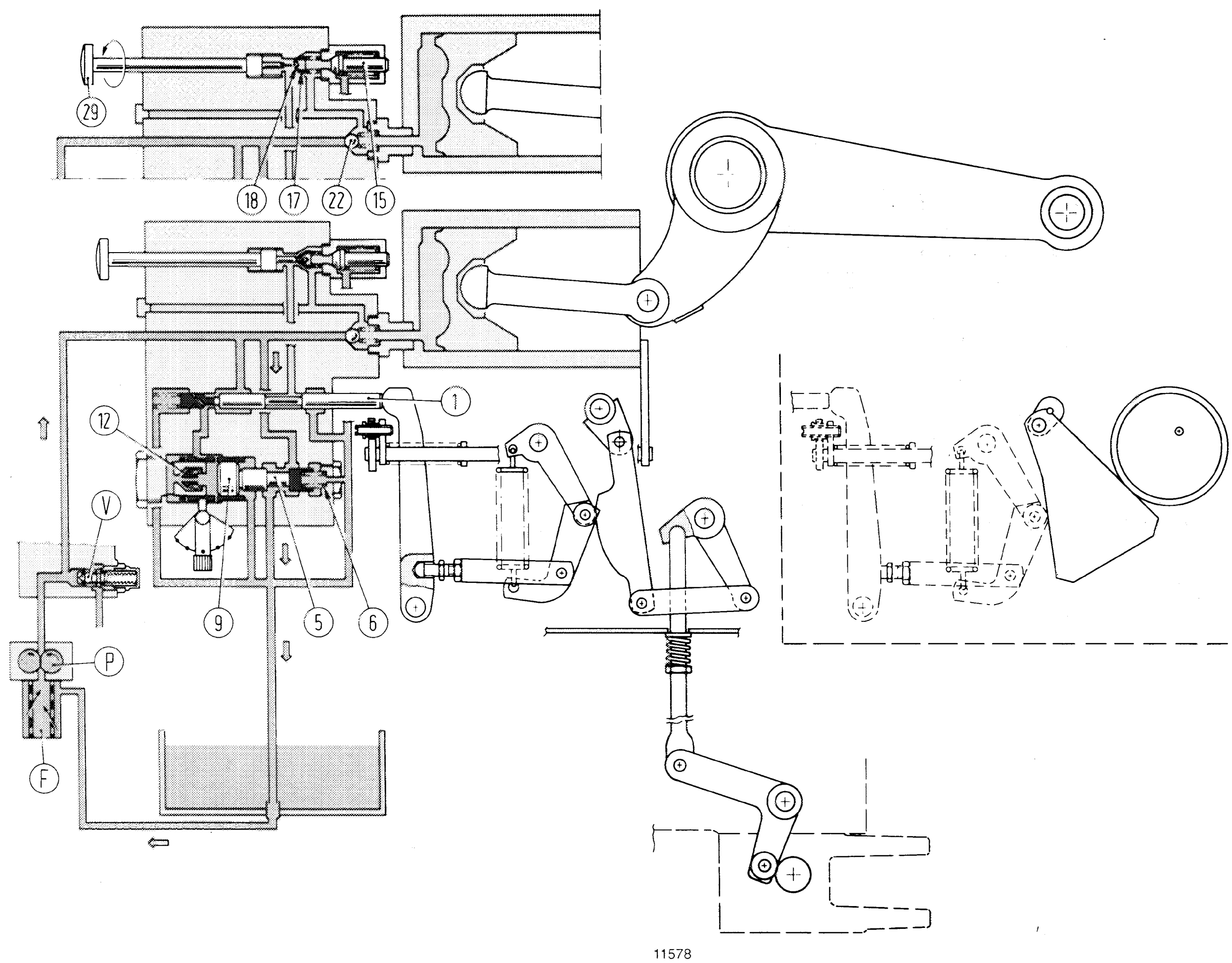
F. Filter – P. Oil pump – T. Implement lift arm actuating piston – T_1 and T_2. Ports, plunger seat of pilot valve (8) – T_3. Port, sensitivity valve (12) – V. Pressure relief valve (fitted on hydraulic lift case or on remote control valves, if installed) – 1. Control valve spool – 5. Pilot valve spool – 6. Pilot valve spool spring – 8. Pilot valve plunger seat – 9. Pilot valve spool – 22. Check valve – 25. Regulation spool lever.

DESCRIPTION OF OPERATION (S. Arm lifting made).

The displacement of control valve spool (1) stops the oil flow to plunger (9) and consequently the pilot valve spool (5), under the pressure exercised by spring (6), moves to the left and closes the drain port. Pressurized oil will then open check valve (22) and actuate piston (T) and lift arms will raise.

Note – Lever (25) makes possible to modify lift sensitivity (intervention rate); in fact, by moving control lever (8) to the right, piston (9) will cover ports (T_1 and T_2) and consequently the oil inside the valve can only drain out through port (T_3) thus taking more time to flow out and consequently increasing the reaction time (lower sensitivity). Instead, moving seat (8) towards the left, ports (T_1 and T_2) are left free and consequently the oil can flow out more quickly through drain through all the ports (T_1, T_2 and T_3), thus shortening reaction time (sensitivity increase).

Print No. **603.54.283.00** – 09 – 1994



pressurized oil | suction, delivery or drain oil | static oil

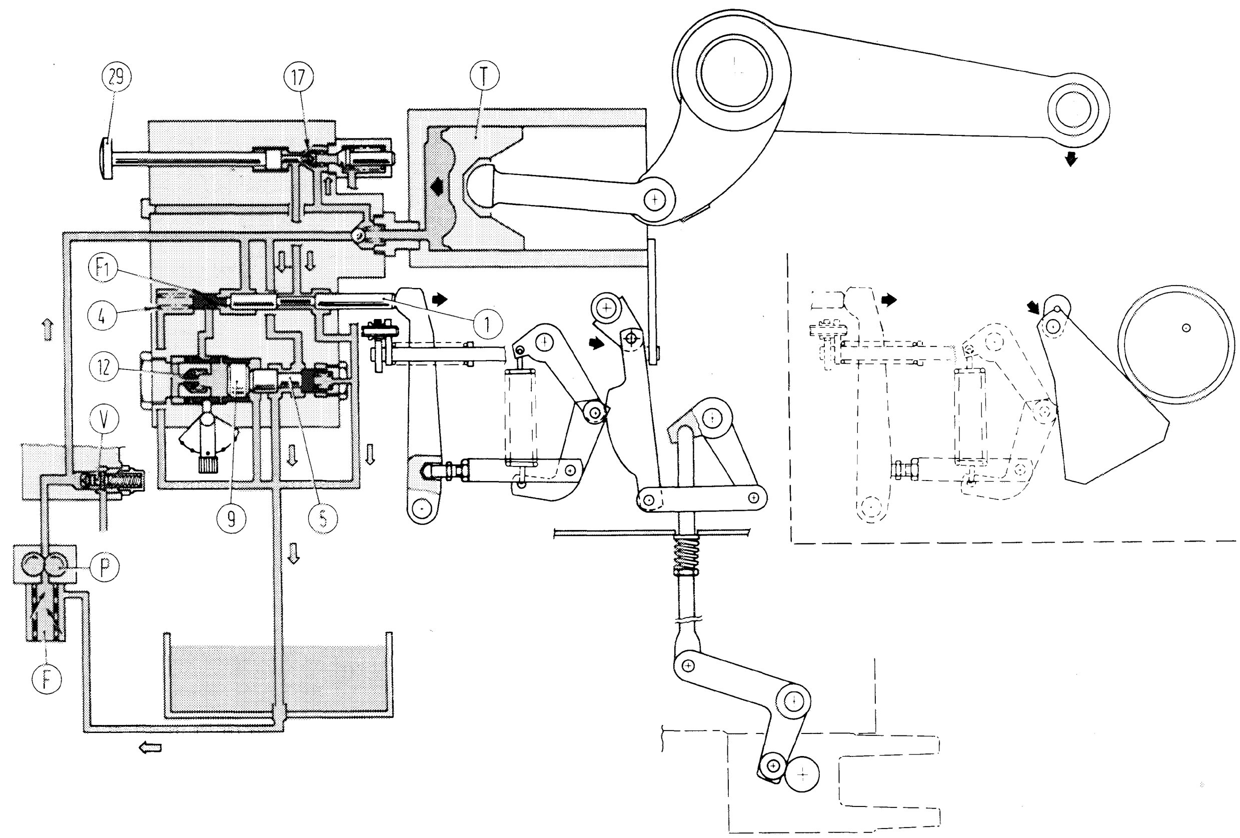
DESCRIPTION OF OPERATION (N. Neutral mode).

The position taken by control valve spool (1) will convey the oil flow through sensitivity valve (12) and, finally, plunger (9) which overcomes spring (6) resistance and moves plunger (5) to the left, thus opening the drain valve and letting the oil free to drain back into the reservoir (inside rear drive case) instead of flowing to the power cylinder.

Note – While hauling mounted implements by road, these can be locked in the desired position by unscrewing knob (29) completely: thus, the oil contained inside the power cylinder is restrained from flowing out both by check valve (22) and arm drop rate regulation valve (17). This will prevent any lift arm movement in case the operator accidentally moves the lift control levers and the lift arms, even if should occurr, will remain locked in the selected position. At this stage, the cylinder safety valve (15) protects the pressurized hydraulic circuit connected to the power cylinder, whilst pressure relief valve (V) will protect the hydraulic circuit connected to the oil pump.

Note – Refer to the legend of the diagram of page 35–17 for the description concerning the hydraulic lift operating modes.

*Print No. **603.54.283.00** – 09 – 1994*



F. Filter – F_1. Orifice on control valve spool (1) – P. Oil pump – T. Implement lift arm operating piston – V. Pressure relief valve (fitted on hydraulic lift case or on remote control valves, if installed) – 1. Control valve spool – 4. Control valve spool return spring – 5. Pilot valve spool – 6. Pilot valve spool spring – 9. Pilot valve plunger – 12. Sensitivity regulation valve – 15. Cylinder safety valve – 17. Arm drop speed rate regulation valve – 18. Ball – 22. Check valve – 29. Arm drop speed rate spool knob.

DESCRIPTION OF OPERATION (A. Arm lowering mode).

The spring (4) will displace the control valve spool (1) to the right thus allowing the oil, pushed by piston (T), to drain out of the cylinder through the arm drop rate regulation valve (17) and the port uncovered by the spool. The system oil, through port (F_1) of the control valve spool and the sensitivity regulation valve (12), acts upon the plunger (9) maintaining the pilot valve spool (5) in the position shown in the illustartion, thus allowing the oil flow coming from the pump to drain out through the clearance between spool (5) and associated control valve housing bore.

Note – The drop speed rate of the mounted implement, connected to the lift arms, is regulated by the position of knob (29). Thus, screwing the latter in, the drain clearance between valve (17) and control valve will be proportionally reduced and the implement drops more slowly, whilst tightening knob (29) will increase the drain clearance and consequently the implement lowers more quickly.

Print No. ***603.54.283.00*** *– 09 – 1994*

OPERATION

Position control

Moving lever (P) backwards causes, through the cam fitted on the inner end of the associated pivot pin (27), the upward movement of lever (14) situated between roller (12) and the excentric reaction ring (28). As ring (28), fixed to the rockshaft, is initially stationary, lever (14) will react upon it and push forward the roller (12) and consequently the link (9) and lever (6) in the direction shown by the black arrows, thus setting control valve (1) for delivery (S, page 35–15).

Arms will raise until the reaction cam (28), turning over itself, allows the lever (6), link (9) and lever (14) to move in the direction shown by the white arrows, pushed by the control valve spool return spring (4, page 35–17).

Control valve will return to neutral and arms stop.

The arm height limit is limited by the stop control rod (16) which, when coming in contact with piston (29), brings the control valve back to neutral, through set screw (3), before the piston can reach the mechanical stop.

Same movements, but in oposite direction, occur when lever (P) is moved forward to lower the implement.

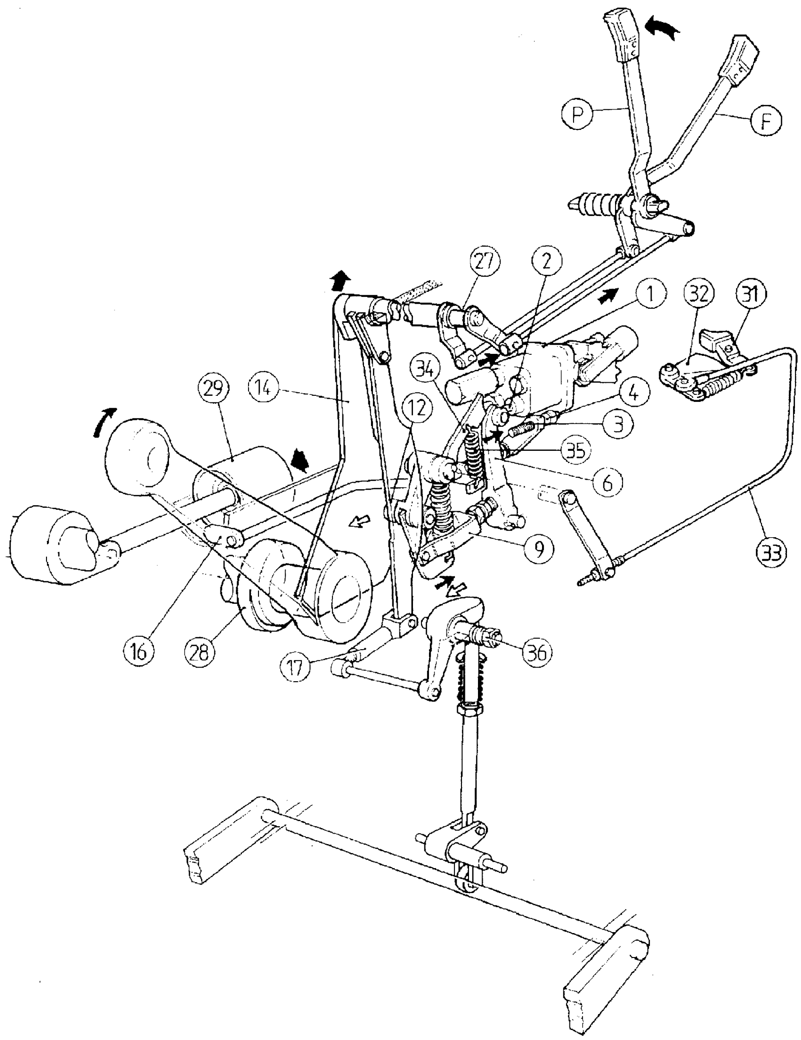
Floating

Moving forward the position control lever (P) and draft control lever (F) will result in:

— the non–intervention of the draft control sensor linkage;

— the displacement of lever (14), link (9) and lever (6) in the direction opposite to that shown by the black arrows, consequently maintaining the control valve in its lowering position (A, page 35–17) which allows arms to oscillate freely and the mounted implement to lay on the ground because the lift arms cannot complete their downwards stroke.

Print No. **603.54.283.00** – 09 – 1994



MECHANICAL SCHEME OF THE CONTROL VALVE AND LINKAGE OPERATION.

F. Draft control lever – P. Position control lever – 1. Hydraulic lift control valve – 2. Control valve spool – 3. Stop set screw – 4. Stop set screw jam nut – 6. Control valve lever – 9. Control valve lever link – 12. Position control lever roller – 14. Internal position control lever – 16. Travel stop control rod – 17. Adjustable draft control rod – 27. Position control lever pivot – 28. Excentric reaction ring for internal lift arm – 29. Piston – 31 and 32. LIFT–O–MATIC device push–button controls – 33. LIFT–O–MATIC external cable – 34. LIFT–O–MATIC internal control lever – 35. Lever (34) return spring – 36. Draft control regulation cam.

Implement lifting in position control operation.

(Draft control lever, F, positioned all forward at travel stop. Levers drawn with light lines are not involved and concern solely the draft control operation).

Note – Arrows show direction of linkage movements during the arm raising stage – The same movements will occur in the opposite direction during the lowering stage.

Print No. **603.54.283.00** – 09 – 1994

Draft control

Position control lever (F) in the sector until the implement has reached the desired depth and suppose that because of a greater ground resistance to sinking the effective draft (T) exercised by the implement on lower links will tend to increase. This draft increase causes a deflection of the bar (23) which, in turn, reacting against roller (22), will cause a rotation of the arm (21). The latter, will transmit the movement, in the direction shown by arrows, to lever (18), rod (17), lever (15) link (9) and, finally. to lever (6) which will set the control valve for delivery (S, page 35–15).

Arms will raise until the consequent reduction of draft (T) reduces the deflection of bar (23) and causes lever (21) to rotate in the opposite direction thus allowing lever (6), under the action of the valve spool return spring (4, page 35–17), to move back.

Control valve will go back to neutral and arm movement stops.

Once overcomed ground resistance, any further draft (T) reduction will diminish the deflection of bar (23) and consequently a further backwards movement of lever (6).

Control valve is thus set for discharge stage (A, page 35–17) allowing the lift arms to drop until the original working conditions have been re–established.

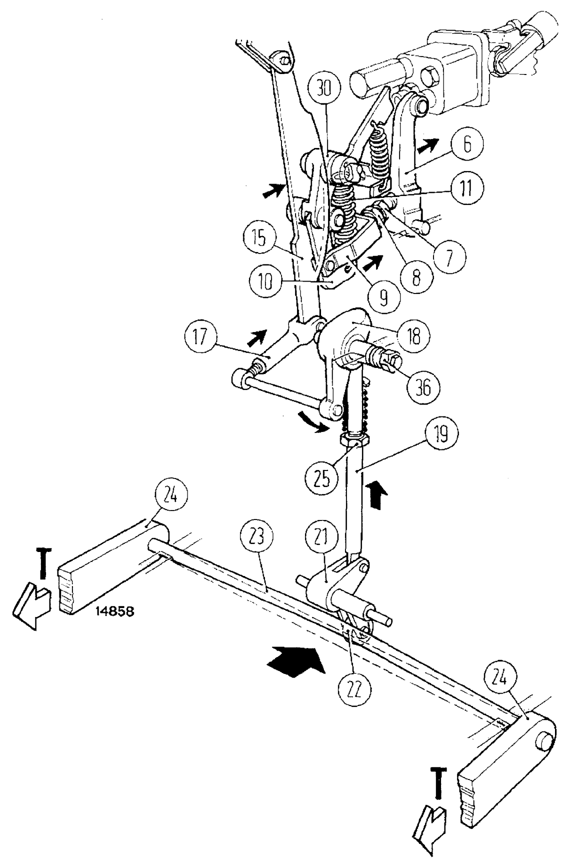
If control lever (F) is positioned further back in the sector (draft reduction) the hollow shaft (26, page 35–21) will push lever (15), roller (13), link (9) and lever (6) to react against the control valve spool, thus setting the latter for delivery.

Instead, in case lever (F) is moved forward (draft increase), resulting operation will be the same, but with linkage moving in the opposite direction.

Mixed position–draft control

By setting the position control lever (P) all the way forward in the sector and moving the draft control lever (F) gradually forward starting from the opposite setting in the sector, sinking depth of the implement is searched as previously described in draft control operation. Any subsequent backwards movement of the position control lever (P) will cause the movements, shown by the black arrows in the position control operation diagram, of lever (14, page 35–19), link (9) and lever (6), thus setting the control valve for delivery and consequently causing a slight upwards movement of the lift arms.

This condition will not prevent the hydraulic lift from working in draft control operation when the draft tends to increase because of more resistance encountered by the implement in the ground. As a result, the mixed position–draft control operation consents to limit the extent of implement sinking variations occurring in draft control operation.



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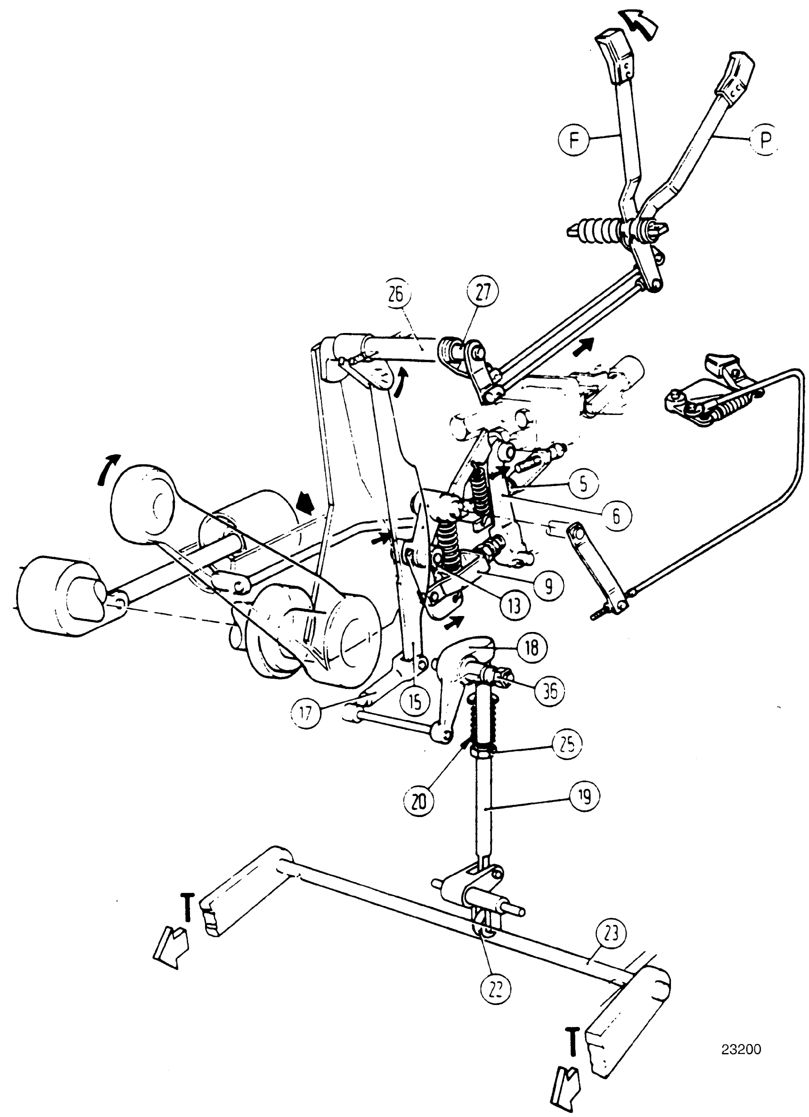
Draft increase.

(Temporary raising of arms, after overcoming the hard point in the ground the flexion bar (23) will return to its original position thus allowing arms to lower down).

Print No. 603.54.283.00 – 09 – 1994



MECHANICAL SCHEME OF CONTROL VALVE AND LINKAGE OPERATION.

F. Draft control lever – P. Position control lever – T. Draft exercised on lift arms with tractor in forward motion – 5. Travel stop rod spring – 6. Control valve lever – 7. Control valve lever link tip – 8. Jam nut – 9. Control valve lever link – 10. Control valve link arm lever – 11. Arm lever spring – 13. Draft control lever roller – 15. Internal draft control lever – 17. Adjustable draft control rod – 18. Internal draft control check lever – 19. Draft control rod – 20. Draft control rod spring – 21. Draft control intermediate lever – 22. Draft control intermediate lever roller – 23. Flex bar – 24. Implement carrier lower links – 25. Jam nut – 26. Draft control hollow shaft – 30. Control valve rod arm – 36. Draft control regulation cam.

Implement lifting in draft control operation.

(Position control lever, P, positioned all forward at travel stop. Levers drawn with light lines are not involved and concern solely the position control operation).

Note – Arrows show direction of linkage movements during the arm raising stage. The same movements will occur in the opposite direction during the lowering stage.

Print No. **603.54.283.00** – 09 – 1994

REAR–MOUNTED HYDRAULIC LIFT
Removal–Installation (Operation 35 110 30)

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Ensure that the load is held and supported by means of suitable slings and hooks. Make sure that nobody is standing near by.

Proceed as further indicated.

1. Disconnect the battery negative cable.
2. Remove operator's seat.
3. Free the lift position and draft control linkage and the LIFT–O–MATIC flex cable.
4. Remove from the lift the oil delivery lines and, if installed, the remote control valve oil drain lines.
5. Remove those remote control valve oil lines and hoses which could interfere while removing the lift assembly from the tractor.
6. Disconnect lift arms from the three–point hitch.
7. In addition:

A. Models 50V – 55V – 60V – 70V – 55F – 60F:

— remove the plate with the remote control valve coupling support;

— remove the mudguard mounting brackets.

B. Models 62F – 72F – 82F:

— remove the remote control valve coupling plate with top link mounting bracket from the hydraulic lift housing;

— remove rear wheels and the mudguard stiffening beam screws above the fuel tank;

— empty fuel tank;

— undo holding screws and remove fuel tank.

C. Models 72LP 82LP:

— drain fuel tank;

— remove tank rear guards, disconnect fuel level gauge wire and fuel pipes from the tank;

— undo holding screws and remove fuel tank;

— remove the remote control valve coupling plate and top link mounting bracket from the lift housing.

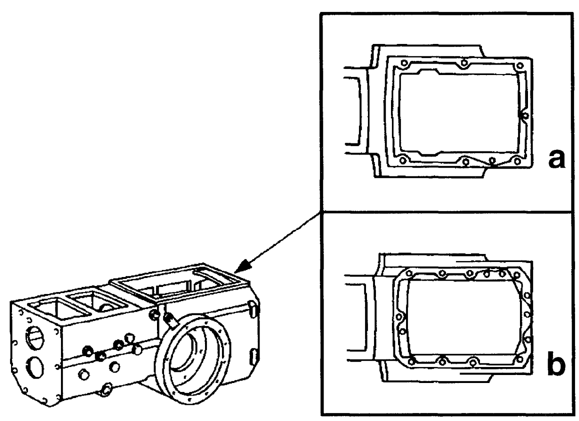
8. Undo holding screws and separate the hydraulic lift unit from the transmission housing using the **291359/2** hook with the **292607** adapter slinged to a hoist, taking care that the draft control rod does not interfere with the lift control linkage.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

9. Install the hydraulic lift in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations starting from no. 8 back to no. 1;



23201

Sealing compound application scheme on rear drive case prior to hydraulic lift installation.
a. Models 50V – 55V – 60V – 70V – 55F – 60F – **b.** Models 62F – 72F – 82F – 72LP – 82LP.

   b. Thoroughly clean mating surfaces and apply on the transmission case a round strip of sealing compound about 2 mm (.08 in) thick following the scheme shown in the accompanying figure. Suitable types of sealing compounds are listed on page 1, section 00.

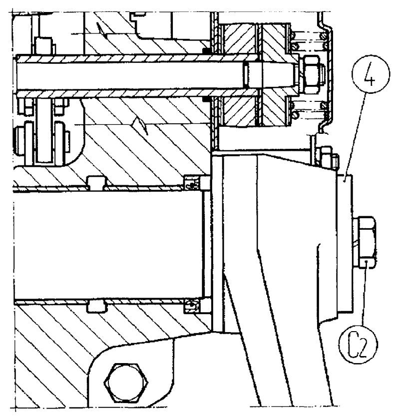
   c. tighten fastenings to torque specs of page 35–9.

Print No. 603.54.283.00 – 09 – 1994

REAR–MOUNTED HYDRAULIC LIFT EXTERNAL CONTROLS
Disassembly–Assembly (Operation 35 110 17)

The disassembly–assembly operations of the hydraulic lift external controls can be carried on the workbench or stand after removal of the lift or directly on the tractor with hydraulic lift installed.

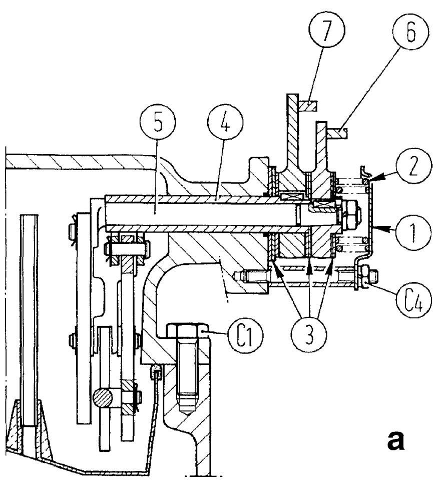
Proceed as further indicated.



23202

1. Remove screw (C_2) and the arms end plate (4) shown in the figure.

2. Fit the self–made special tool (see working sketch and information on page 35–11), secure it to the arm shaft interfacing with the thrust plate previously removed and, finally, re–fit and tighten screw(C_2) to compress springs (2).



a

23203

Sectional view of lift contol levers and linkage.
a. Models 50V – 55V – 60V – 70V – 55F – 60F
b. Models 62F – 72F – 82F – **c.** Models 72LP – 82LP

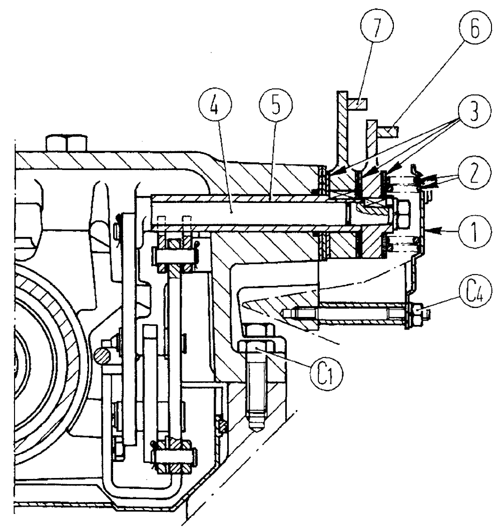
C_1. Lift holding screws – C_4. Lever sector bracket stud nuts – 1. Lever sector bracket – 2. Springs – 3. Clutch discs – 4. Position control lever pin – 5. Draft control inside axle pin – 6. Position control lever – 7. Draft control lever.

3. Remove nuts (C_4).

4. Then, recover bracket (1) and springs (2).

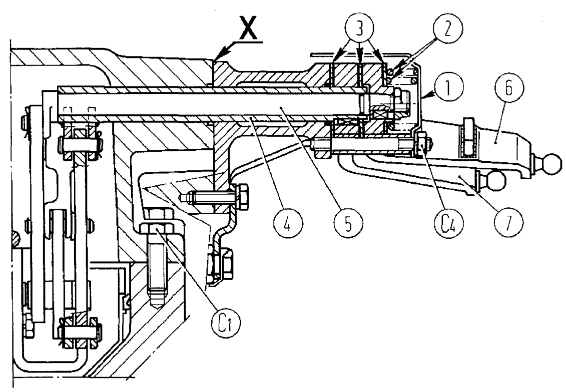
5. Remove the draft control pin nut, retrieve external levers (6 and 7) and clutch discs (3).

6. Re–assemble the lift external linkage in accordance with the following instructions and information:
   - **a.** proceed by reversing the previous disassembly sequence of operations starting from no.5 back to no. 1;
   - **b.** consult sections below for the correct placement of parts;
   - **c.** tighten fastenings to the torque specs of page 35–9.



23204

b



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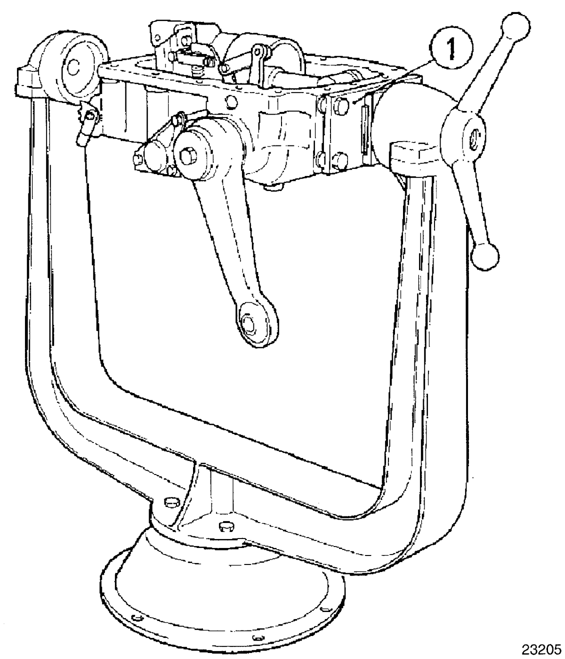
c

REAR–MOUNTED LIFT INTERNAL CONTROLS
Disassembly–Assembly (Operation 35 110 40)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.



1. Install lift on rotary stand using the self–made bracket (1) previously built following the working sketch and instructions of page 35–12, as follows:

a. Models 50V – 55V – 60V – 70V – 55F – 60F:

— remove the lift front cover (20, page 35–3) with control valve.

b. Models 62F – 72F – 82F – 72LP – 82LP

— remove holding screws and control valve assembly;

— undo holding screws of cylinder barrel on lift housing and the two attachment screws to the control valve lever mounting.

2. Remove cylinder barrel and piston.

3. Remove the inside arm holding screw (1, page 35–3).

4. Remove holding screws (C_2) and thrust plates (4), the lift arms and, finally, drive out the rocker shaft (2) working on its right end.

5. Remove pin (16), screw (19), pin (18) and, finally, the control leverage from inside the lift case.

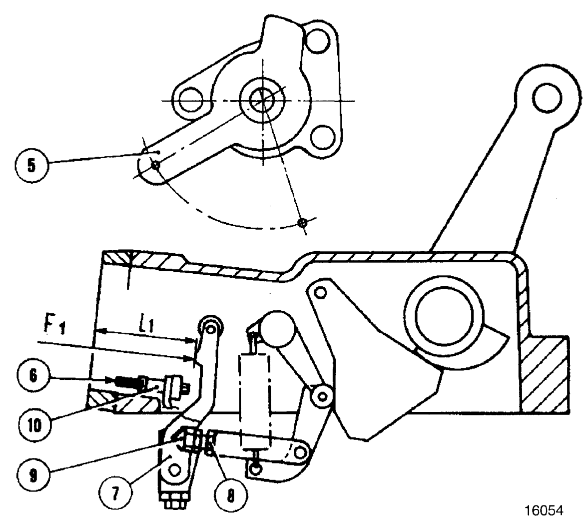
6. Re–assemble the internal control linkage by reversing the previous disassembly sequence of operations using tools **293838**, **293839**, **291215** (page 35–11) and finalizing with the adjustments described below.

HYDRAULIC LIFT ADJUSTMENTS

The following adjustments, as further described, are intended for an hydraulic lift unit without control valve and installed on the rotary stand by means of the special self–made bracket (see page 35–12).
Instead, with the hydraulic lift unit normally installed on the tractor, only the arm height limit control can be adjusted.
The LIFT–O–MATIC device must be excluded (outside control lever locked in upright position) until otherwise indicated.

7. Position control adjustment

A. Adjusting the position control – Models 50V – 55V – 60V – 70V – 55F – 60F. Proceed as follows:



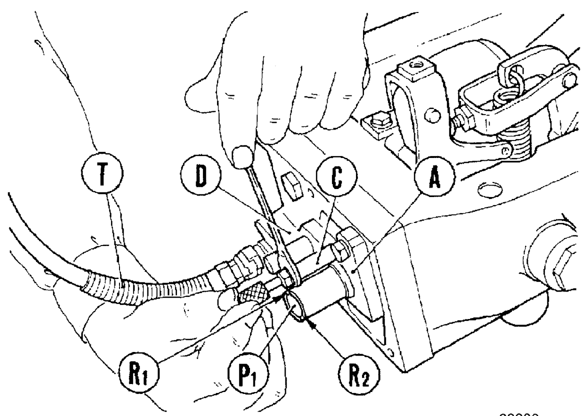
Adjusting the position control
on models 50V – 55V – 60V – 70V – 55F – 60F

F_1 = 4÷4.5 da N (kg – 9÷10 lb). Force exercised by the **293846** tool (A, page 35–25) upon lever (7) – L_1. Distance between end of lever (7) and lift front refernce plane – 5. Position control external lever – 6. Travel limit screw – 7. Control valve lever – 8. Jam nut – 9. Control valve lever link stop – 10. Travel limit screw jam nut.

— position the external position control idler lever (5) all forward against the spacer;

— rotate the rocker shaft so that the internal arm will come in contact with the lift housing;

Print No. 603.54.283.00 – 09 – 1994



23206

A.**293846** special tool – C. **293870** wrench – D. **293872** connection – P_1. Mobile rod of **293846** tool – R_1. External reference plane of **293846** tool – R_2. Internal reference plane of **293846** tool – T. Compressed air line.

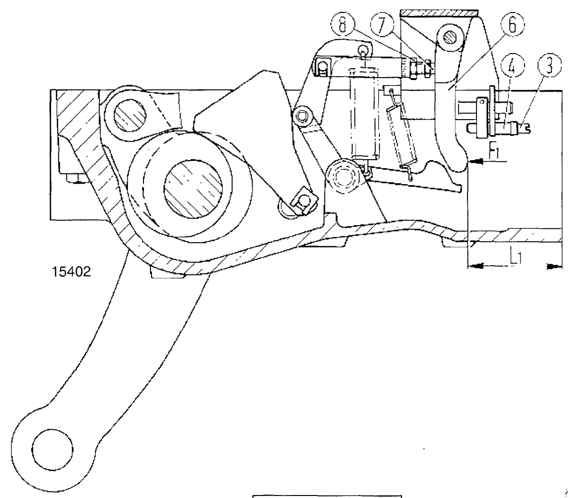
- using the special **293870** wrench (C), loosen jam nut (10, page 35–24);
- back off the travel limit screw (6) until the same will no further contact the control valve lever (7);
- install the special **293846** tool on the lift case (A, see figure above);
- using two wrenches unscrew jam nut (8, page 35–24);
- turn in or out the adjustable rod (9) until the rod tip (P_1, see figure above) is exactly aligned with the external reference plane (R_1) of tool (A);

Note – This condition corresponds to a dimension (L_1, page 35–24) of 82÷82.1 mm (3.228÷3.233 in) measured between end of lever (7) and lift case front reference plane upon applying a force (F_1) of 4 ÷ 4.5 da N (Kg – 9 ÷ 10 lb) at lever end.

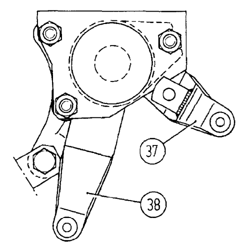
- tighten jam nut (8);
- position the external position control link lever (5) all backwards against the spacer;
- turn the rocker shaft to bring piston to end of forward stroke, then check that the mobile rod tip (P_1, see figure above) of the **293846** tool (A) has regressed 1.3 ÷ 1.7 mm (.05 ÷ .07 in) with respect to the internal reference plane (R_2) of the same tool.

Note – This condition corresponds to a dimension (L_1, page 35–24) of 86.3 ÷ 86.7 mm – 3.40 ÷ 3.41 in) measured between lever end and lift case front reference plane upon applying a force (F_1) of 4 ÷ 4.5 da N (kg – 9 ÷ 10 lb) at lever end.

B. Adjusting the position control – Models 62F – 72F – 82F – 72LP – 82LP Proceed as follows:



15402



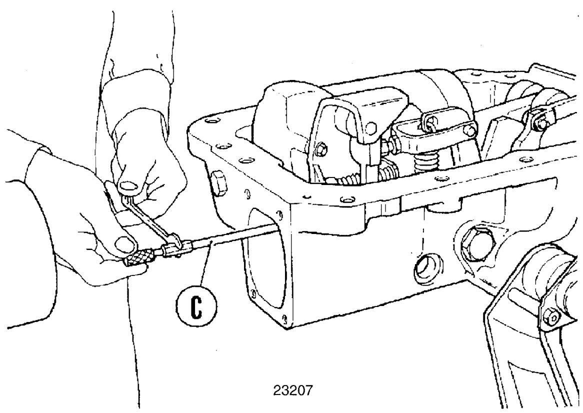
15401

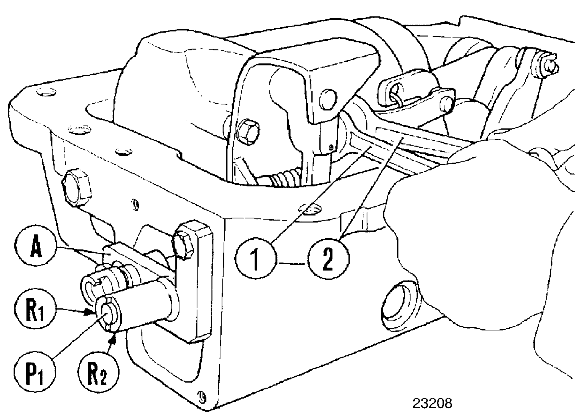
Adjusting the position control on models 62F – 72F – 82F – 72LP – 82LP

F_1. 4 ÷ 4.5 da N (kg – 9 ÷ 10 lb). Force exercised by the **293846** tool on lever (6) – L_1. Distance between end of lever (6) and lift front reference plane – 3. Adjustment screw – 4. Travel limit screw jam nut – 6. Control valve lever – 7. Control valve lever rod – 8. Jam nut – 37. External position control lever – 38. External draft control lever.

- position the external draft control lever (37) all forward, against the spring retaining bracket stud spacer;
- turn rockshaft to bring the inside arm against the lift case;
- use the special **293870** wrench (C, page 35–26) to loosen jam nut (4, see figure above);
- back off the travel limit adjustment screw (3) off the control valve lever (6);

Print No. **603.54.283.00** – 09 – 1994





A. **293846** special tool – C. **293870** wrench – P_1. Mobile rod of **293846** tool – R_1. External reference plane of **293846** tool – R_2. Internal reference plane – 1 and 2. Wrenches.

— install the **293846** special tool (A) on lift case;

— using two wrenches (1 and 2) loosen jam nut (8, page 35–25) and screw in or out the adjustable rod (7) until the mobile rod tip (P_1, see figure above) is exactly aligned with external reference plane (R_1) of tool (A);

Note – This condition corresponds to a dimension (L_1, page 35–25) of 82÷82.1 mm (3.228÷3.233 in) measured between end of lever (6) and lift front reference plane upon application of a force (F_1) of 4÷4.5 da N (kg – 9÷10 lb) on lever end.

— tighten jam nut (8);

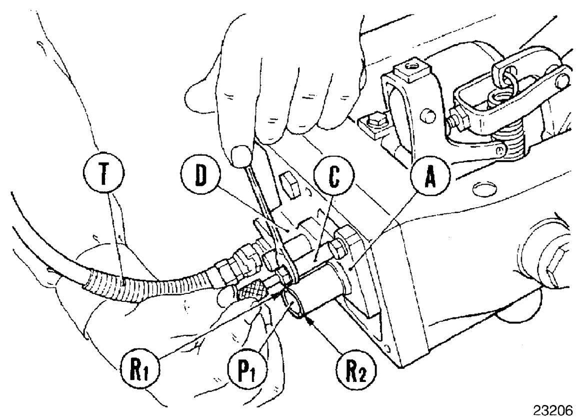
— position the external position control lever (37) all back against the stud spacer.

— turn rocker shaft to bring piston to end of forward stroke and then check that the mobile rod tip (P_1, see figure above) has regressed 1.3÷1.7 mm (.05÷.07 in) with respect to the internal reference plane (R_2) of the **293846** tool (A).

Note– This condition corresponds to a measured dimension (L_1, page 35–25) of 86.3÷86.7 mm (3.40÷3.41 in) between end of lever (6) and lift front reference plane upon application of a force (F_1) of 4÷4.5 da N (kg – 9÷10 lb) on the end of lever.

8. Upper height limit adjustment.

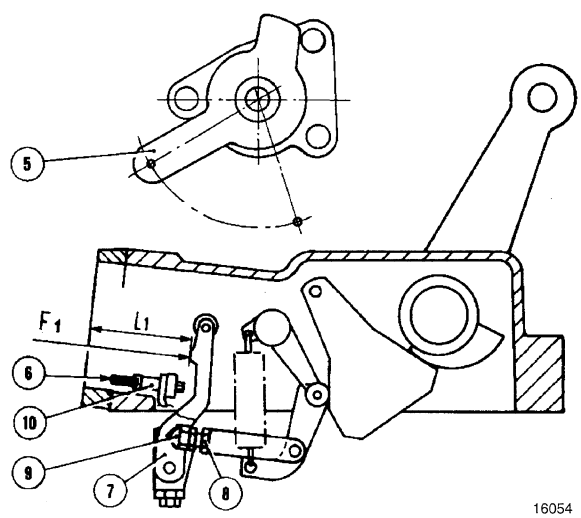
A. Adjust the upper height limit – Models 50V – 55V – 60V – 70V – 55F – 60F Proceed as follows:



A. **293846** tool – C. **293870** wrench – D. **293872** connection – P_1. Mobile rod tip of **293846** tool – R_1. External reference plane of **293846** tool – R_2. Internal reference plane – T. Compressed air line.

— install the **293846** tool (A) on lift case;

— fit the **293872** connection (D);



Adjusting the upper height limit on models 50V – 55V – 60V – 70V – 55F – 60F

F_1 = 4 ÷ 4.5 da N (kg – 9 ÷ 10 lb). Force exercised by the **293846** tool on lever (7) – L_1. Distance measured between end of lever (7) and lift front refernce plane – 5. Position control external idler lever – 6. Travel limit adjustment screw – 7. Control valve lever – 8. Jam nut – 9. Control valve lever rod tip – 10. Travel limit adjustment screw jam nut.

— move the external position control lever (5) all forward against spacer;

*Print No. **603.54.283.00** – 09 – 1994*

— turn rockshaft to bring internal arm against lift case;

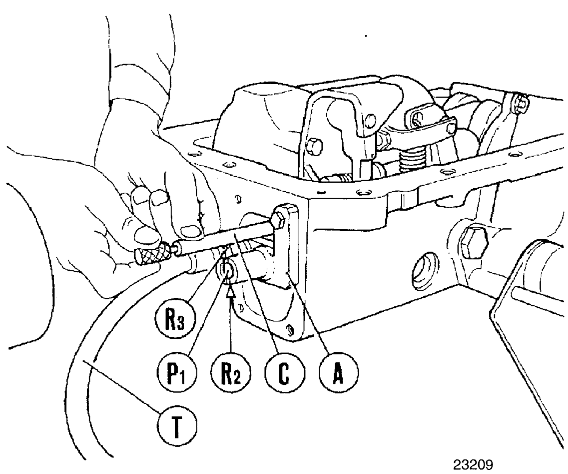
— connect the **293872** union (D, page 35–26) to the workshop compressed air system (T) and introduce air inside the cylinder chamber so to drive piston to end of raise stroke, then hold it in this position with compressed air;

— using the **293870** wrench (C) tighten screw (6) until the mobile rod tip (P_1) has regressed 1.3÷1.7 mm (.05÷.07 in) with respect to the internal reference plane (R_2) of the **293846** tool (A);

Note – This condition corresponds to a measured dimension (L_1) of 86.3÷86.7 mm (3.40÷3.41 in) between end of lever (7) and lift front reference plane.

— tighten jam nut (10).

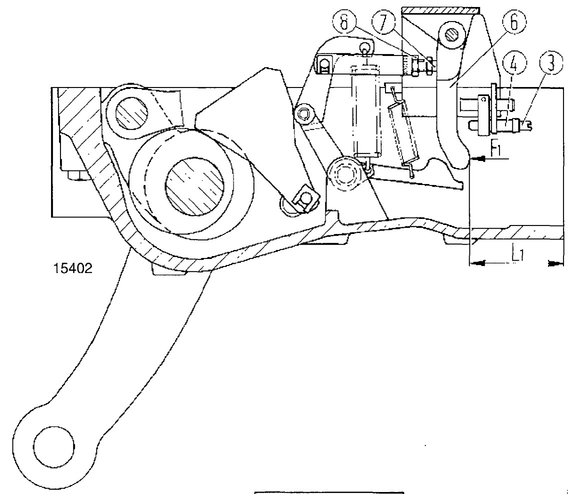
B. Adjusting the upper height limit – Models 62F – 72F – 82F – 72LP – 82LP. Proceed as follows:

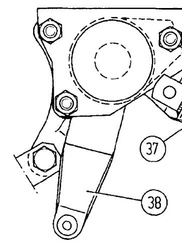


A. **293846** tool – C. **293870** wrench – P_1. Mobile rod tip of **293846** tool – R_2. Internal reference plane of **293846** tool – R_3. Compressed air connection for **293846** tool – T. Compressed air line.

— install the **293846** tool (A) on lift case;

— move the draft control external lever (38) all the way back against the spacer and the position control external lever (37) all the way forward, against the spacer;





15401

Adjusting the upper height limit on models 62F – 72F – 82F – 72LP – 82LP

F_1 = 4÷4.5 mm da N (9÷10 lb). Force excersized by the **293846** tool upon lever (6) – L_1. Distance between end of lever (6) and the lift front reference plane – 3. Lift adjustment screw – 4. Upper height limit adjustment screw jam nut – 6. Control valve lever – 7. Control valve lever rod tip – 8. Jam nut – 37. External position control lever – 38. External draft control lever.

— turn rockshaft to bring internal arm against lift case;

— connect union (R_3) of tool (A) to the workshop compressed air system (T) and introduce air inside the cylinder barrel to drive piston to end of raise stroke, the hold it in this position with compressed air;

— using the **293870** wrench (C) tighten screw (3) to make the mobile rod tip (P_1) regress 1.3÷1.7 mm (.05÷.07 in) with respect to the internal reference plane (R_2) of the **293846** tool (A);

Note – This condition corresponds to a measured dimension (L_1) of 86.3÷86.7 mm (3.40÷3.41 in) between end of lever (6) and the lift front reference plane.

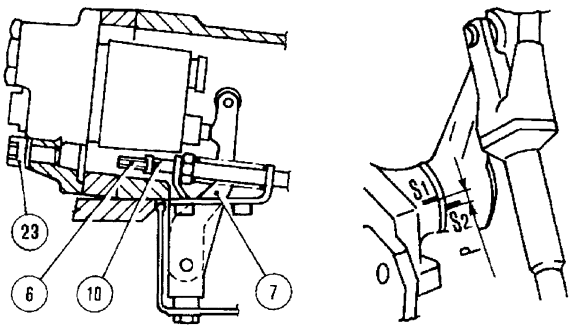
— tighten jam nut (4).

Print No. ***603.54.283.00*** *– 09 – 1994*

C. Adjusting the hydraulic lift upper height limit on tractor
Models 50V – 55V – 60V – 70V – 55F – 60F. Proceed as follows:

— apply a 50 kg (110 lb) weight to the implement carrier lower link ball joints;

— warm up oil to 50÷60°C (122°÷140°F) temperature;



14721A

— stop engine, wait for five minutes to allow the oil contained in the lift case to drain out into the reservoir, remove plug (23) and introduce the **293870** wrench (C, page 35–26) in the hole;

— start engine over again and run it at 1200 ÷ 1500 rpm;

— both on tractors with and without cab, hold the lift position and draft control levers in full forward position in the sector and raise arms using the LIFT–O–MATIC device;

— using the **293870** wrench, loosen jam nut (40 and back off the travel stop set screw (6) until the pressure relief valve cracks off;

— make two coincident reference marks on lift case (S_1) and on a lift arm (S_2);

— using the **293870** wrench, turn adjusting screw (6) clockwise until the distance between the two refernce marks is 2÷3 mm (.08÷.12 in);

— tighten jam nut (10);

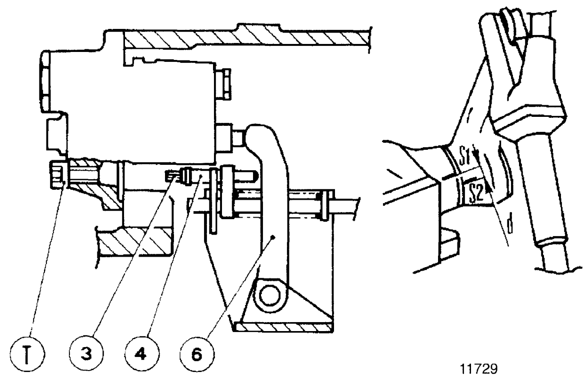
— stop the engine, wait again for another five minutes, remove the **293870** wrench and re–fit plug (23);

— raise/lower lift arms a few times to check if adjustment is correct.

On models 62F – 72F – 82F – 72LP – 82LP, proceed as follows:

— apply a 50kg (110 lb) weight to the implement carrier lower link ball joints;

— warm up oil to 50÷60°C (122°÷140°F) temperature;



11729

— stop the engine, wait for five minites to allow the oil inside the lift case to drain out into the reservoir, remove plug (T) and introduce the **293870** wrench in the hole;

— start engine over again and run it at 1200÷1500 rpm;

— both on tractors with and without cab, hold the lift position and drft control levers in fully forward position in the sector and raise arms through the LIFT–O–MATIC device;

— using the **293870** wrench, loosen jam nut (4) and back off the adjustment screw (3) until the presure relief valve cracks off;

— make two coincident reference marks on lift case (S_1) and on one arm (S_2);

— using the **293870** wrench, turn adjusting screw (3) clockwise until distance (d) between reference marks is 2÷3 mm (.08÷.12 in);

— tighten jam nut (4);

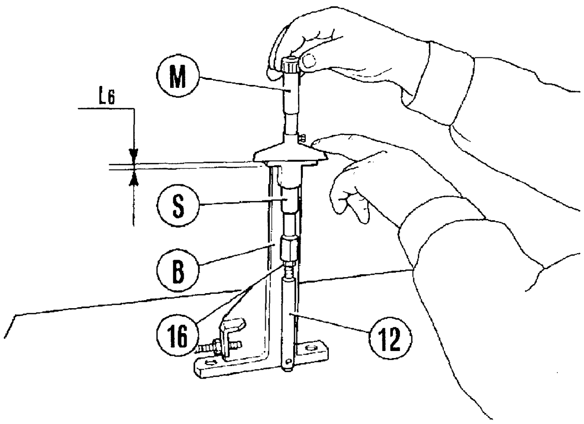
— stop engine, wait for another five minutes, remove the **293870** wrench and re–fit plug (T);

— raise/lower lift arms a few times to check that adjustment is correct.

Print No. **603.54.283.00** – 09 – 1994

9. Draft control adjustment

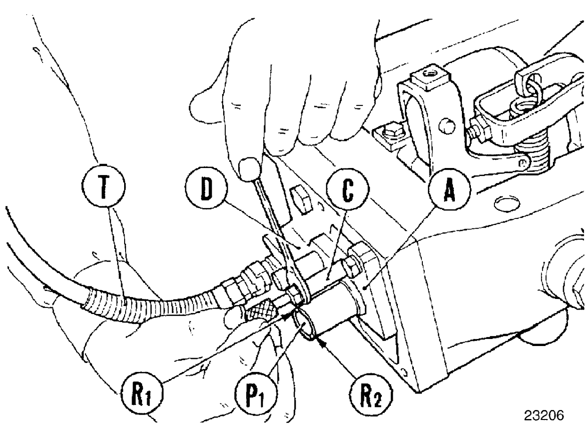
A. On models 50V – 55V – 60V – 70V – 55F – 60F, proceed as follows:



23210

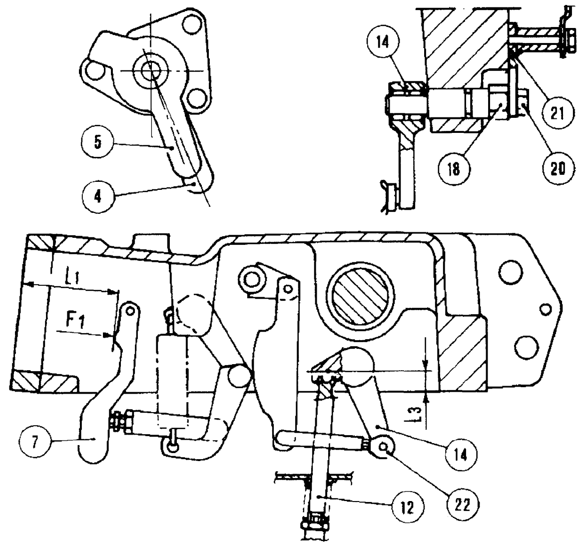
— remove the draft control rod tip (12) and fit it in rod (S) of the **292541** gauge and tighten jam nut (16);

— place the **292541** (B) tool with rod (S) and draft control rod tip (12) on a surface plate and measure, using a micrometer (M), the dimension (L_6) between the rod upper tip and the micrometer reference plane on the gauge (always tighten rod (12) on rod (S) so that the surface of the latter is some mm's lower with respect to the micrometer/gauge reference plane);



23206

— using the **293846** tool (A) installed on lift case and disconnected from compressed air, move the external draft (4) and position (5) control levers all the way back against the spacer;

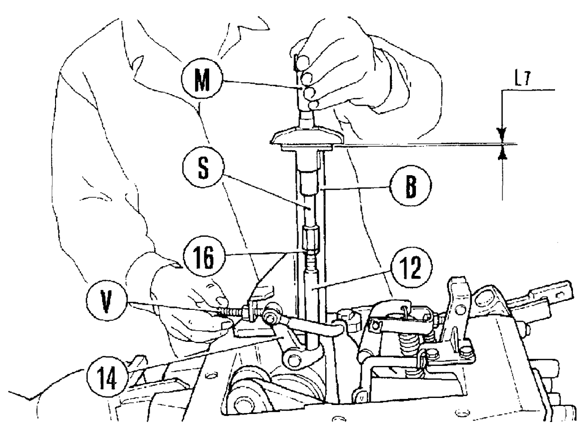


16055

Adjusting the draft control on models 50V – 55V – 60V – 70V – 55F – 60 F.

F_1 = 4÷4.5 da N (kg – 9÷10 lb). Force exercised by **293846** tool on lever (7) – L_1 = 81.9÷82.1 mm (3.22P3.23 in). Distance between lever (7) and lift case front reference plane – L_3 = 22.9÷23.1 mm (.90÷.91 in). Operating dimension, measured between lift case/transmission case mating surface and rod (12)/lever (14) mating surface – 4. External draft control idler lever – 5. External position control idler lever – 7. Control valve lever – 12. Draft control rod – 14. Internal draft control lever – 18. Cam – 20. Screw – 21. Bracket – 22. Draft control adjustable link.

— position the internal draft control lever pivot pin (18) in horizontal position with cam facing the lift rear end;



23211

— install the **292541** tool (B) on lift case securing it at two holes and turn screw (V) on the internal draft control lever (14) to bring the mobile rod tip (P_1) as close as possible to the internal reference plane (R_2) of the **293846** tool (A);

Print No. 603.54.283.00 – 09 – 1994

— turn pin (18, page 35–29) slightly to make the mobile rod tip (P_1) of the **283846** tool (A) regress as much as possible;

— using screw (V) operate again upon the internal draft control lever (14) to bring the mobile rod tip (P_1) into alignment with the internal refrence plane (R_2) of the **293846** tool (A);

— turn then the excentric pin (18) to bring the mobile rod tip (P_1) into alignment with the external reference plane (R_1);

— fit rod (S) of the **292541** gauge (B) inside the internal draft control lever (14);

— with the tip (P_1) of mobile rod of the **293846** tool (A) exactly aligned with the external reference plane (R_1), turn adjustable link (22) and measure, using depth micrometer gauge (M), the dimension (L_7) between the upper surface of rod (S) and the micrometer bearing surface on the **292541** gauge;

— dimension (L_7) should be:

$$L_7 = L_6 + L_3$$

where:

L_6 = dimension measured with the **292541** gauge (B) placed on surface plate;

L_3 = **22.9÷23.1 mm** (.90÷.91 in). Operating dimension between lift/transmission case mating surfaces and rod (12) bearing plane on lever (14), see page 35–29.

Note – This condition corresponds to a measured dimension (L_1) of 81.9÷82.1 mm (3.22÷3.23 in) between end of lever (7) and the lift case front reference plane upon application of a force (F_1) of 4÷4.5 da N (kg – 9÷10 lb) on lever end.

ATTENTION – Always check that with the mobile rod tip (P_1) exactly coincident with the external reference plane (R_1) of the **293846** tool (A), dimension (L_7, page 35–29) measures:

$$L_7 = L_6 + L_3$$

where:

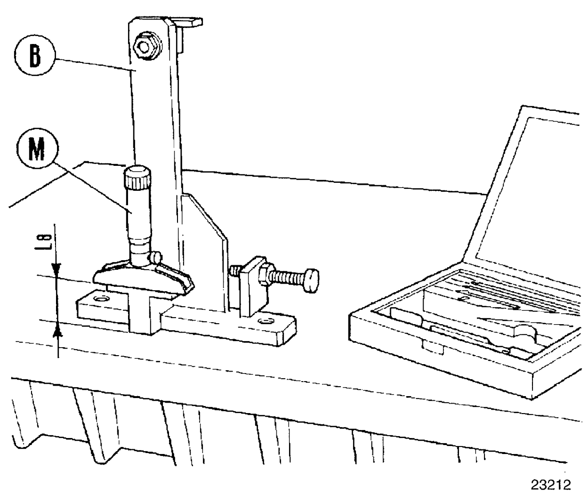
L_6 = dimension measured with the **292541** gauge placed on surface plate;

L_3 = **22.9÷23.1 mm** (.90÷.91 in). Operating dimension between lift/transmission mating surfaces and rod (12) bearing plane on lever (14).

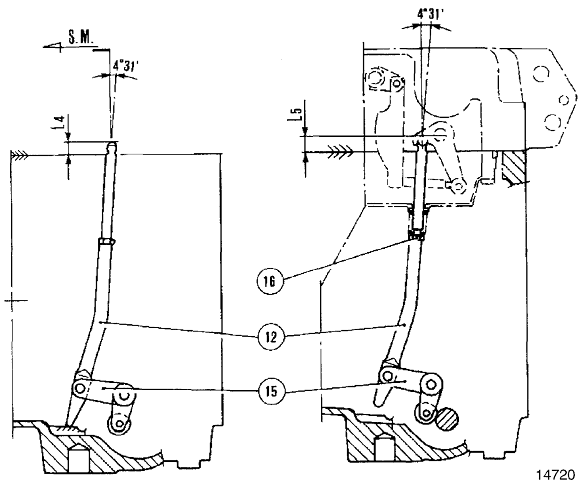
In case of conditions differing from above, adjust through cam (18) and knurled screw (V) of the **292541** gauge.

— tighten screw (20) so that cam (18) is solidly fixed to bracket (21) and then remove the **293846** and **292541** tools.

Re–assemble and install the hydraulic lift in accordance with the following instructions and information:



IMPORTANT – First place the **292541** (B) gauge on a surface plate an then, using a depth micrometer gauge (M), measure dimension (L_8) between gauge/surface plate and micrometer/gauge mating surfaces.
Finally, stamp reading (L_8) on gauge

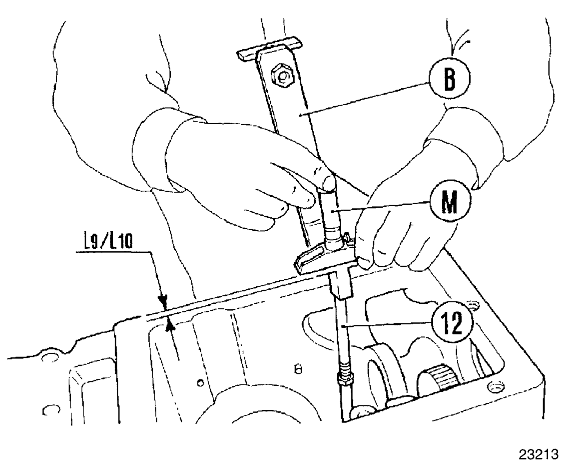


Adjusting the draft control on models 50V – 55V – 60V – 70V – 55F – 60F.

L_4. Stand–out of rod (12) tip from rear drive case (without flex bar) – L_5. Stand–out of rod (12) tip from rear drive case (with flex bar installed) – S.M. Direction of tractor travel – 12. Draft control rod – 15. Draft control transmission lever – 16. Jam nut.

— install transmission lever (15) with draft control rod (12) on the rear drive case:

— make transmission lever (15) rest on associated stop in rear drive case and install the **292541** gauge (B), securing it at two holes on the case so that draft control lever (12) fits exactly in the gauge hole (see figure below);



— using a micrometer depth gauge (M), measure dimension (L_9) between rod (12) tip and the micrometer/gauge mating surface;

Note – The stand–out (L_4) of the rod (12) tip with respect to the rear drive case (without flex bar) is given by:

$$L_4 = L_8 - L_9$$

where:

L_8 and L_9 = dimensions measured with the 292541 gauge (B) placed on surface plate (L_8, page 35–30) or on rear drive case (L_9), see figure below.

— install flex bar and measure the new dimension (L_{10}) between tip of rod (12) and micrometer bearing surface on tool;

Note – The stand–out (L_5) of the rod (12) tip from the rear drive case (with flex bar installed) is given by:

$$L_5 = L_8 - L_{10}$$

where:

L_8 and L_{10} = dimensions measured with the **292541** gauge (B) placed on surface plate (L_8, page 35–30) or on rear drive case (L_{10}, see figure below).

— check that (L_5) is greater than (L_4) by at least 5 mm (.20 in);

— loosen jam nut (16) and adjust length of draft control rod until a new stand–out dimension is obtained (L_5 = 18.3÷18.5 mm – .72÷.73 in);

— this dimension (L_5) can be measured by difference using the **292541** gauge (B):

$$L_{11} = L_8 - L_5$$

where:

L_5 = 18,3 ÷ 18,5 mm (.72÷.73 in). Operating stand–out of rod (12) tip with respect to transmission case;

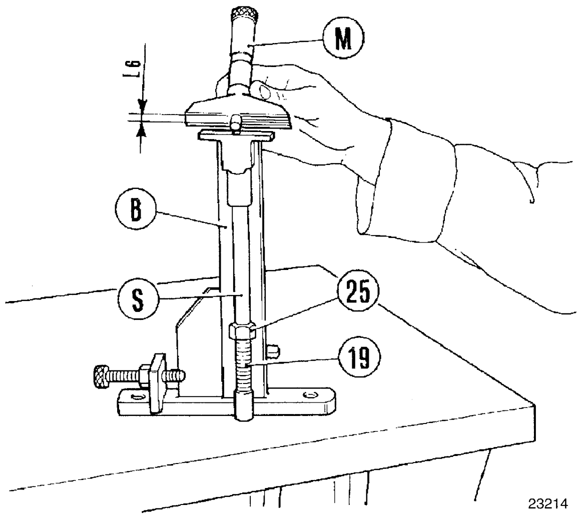
L_8 = dimension measured with the **292541** gauge (B) placed on surface plate, see page 35–30;

L_{11} = dimension to be measured with micrometer placed on the **292541** gauge (B);

— tighten jam nut (16) and install hydraulic lift on tractor.

Print No. **603.54.283.00** – 09 – 1994

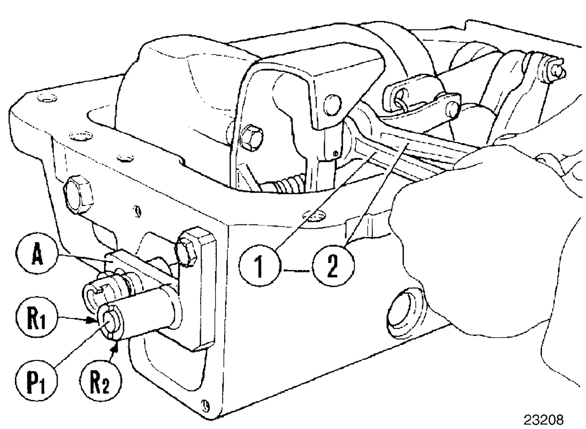
B. Adjusting the draft control on models 62F – 72F – 82F – 72LP – 82LP. Proceed as follows:



23214

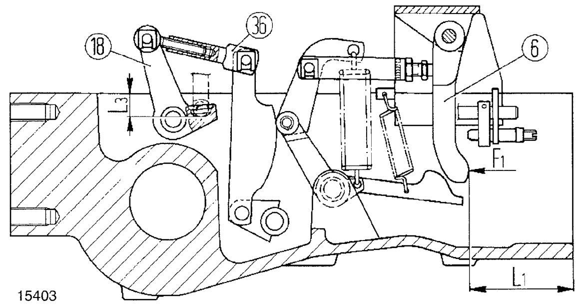
— remove the draft control rod (19) tip and fit it on rod (S) of the **293845/1** tool (B) and tighten jam nut (25);

— place the **293845/1** (B) tool with own rod (S) and with the draft control rod (19) tip on a surface plate and, using a depth gauge (M), measure dimension (L_6) between rod tip and depth gauge/tool mating surface (always turn rod 19 on rod (S) so that the surface of the latter is a few mm's lower than the depth gauge/tool surface.

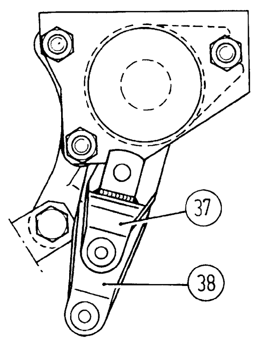


23208

— with the **293846** tool (A) installed on the lift case and disconnected from compressed air system, move the position (37) and draft (38) control levers all the way back against the spacer;



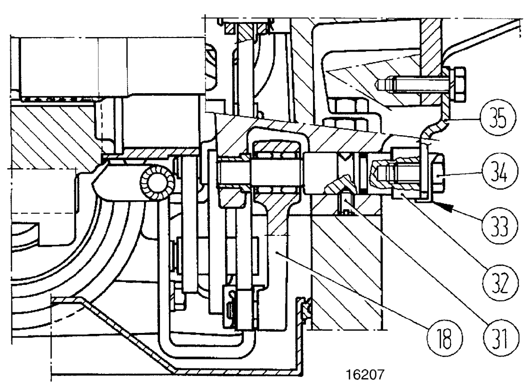
15403



15407

Adjusting the draft control on models 62F – 72F – 82F – 72LP – 82LP.

$F_1 = 4 \div 4.5$ da N (kg – 9÷10 lb). Force exercised by tool **293846** on lever (6) – L_1 = 81.9 ÷82.1 mm (3.22÷3.23 in). Distance between end of lever (6) and lift case front reference plane – L_3 = 23.9 ÷ 24.1 mm (.94÷.95 in). Operating dimension between lift/transmission case and rod (19)/lever (18) mating planes – 6. Control valve lever – 18. Internal draft control lever – 36. Draft control adjustable link – 37. External position control lever – 38. External draft control lever.



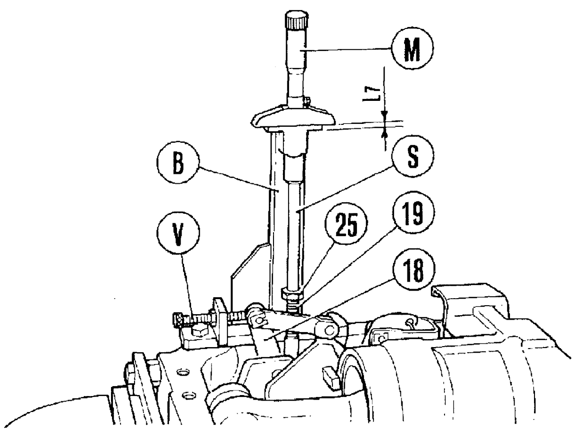
16207

Section through the internal draft control lever articulation.

18. Internal draft control lever – 31. Threaded dowel pin – 32. Excentric lever (18) pivot pin – 33. Safety washer – 34. Screw – 35. Bracket.

— place the excentric lever pivot pin (32) horizontal with its cam facing the rear end of tractor;

Print No. **603.54.283.00** – 09 – 1994



23215

— install the **293845/1** tool (B) on lift case securing it at two holes (see figure above) and turn set screw (V) on draft control internal lever (18) to bring the mobile rod tip (P_1, page 35–32) as close as possible to the internal reference plane (R_2) of the **293846** tool (A);

— tun slightly the excentric pin (32) to make the mobile rod tip (P_1) of the **293846** tool (A) regress as much as feasible;

— turning again the same screw (V, see figure above) on the draft control internal lever (18), bring the mobile rod tip (P_1) into alignment of the internal reference plane (R_2, page 35–32) of the **293846/A** tool);

— finally, turn cam (32) and bring typ of mobile rod (P_1) on the same plane of external reference (R_1);

— fit rod (S) of the **293845/1** tool (B, see figure above) in the draft control internal lever (18) seat;

— with the tip of the mobile rod (P_1, page 35–32) of the **293846** tool (A) positioned in the same plane of the external reference (R_1), through adjustable link (36) and depth gauge (M, see figure above) measure dimension (L_7) between rod tip (3) and micrometer gauge/**293845/1** tool (B) mating plane;

— dimension (L_7) should read:

$$L_7 = L_6 + L_3$$

where:

L_6 = dimension measured with the **293845/1** tool (B) installed on surface plate;

L_3 = **23,9 ÷ 24,1 mm** (.94÷.95 in). Operating dimension between lift/transmission case and rod (19) / lever (18) mating planes, see figure on page 35–32.

Note – This condition corresponds to a measured dimension (L_1, page 35–32) of 81.9 ÷ 82.1 mm (3.22÷3.23 in) between end of lever (6) and the lift front refrence plane upon application of a force (F_1) of 4÷4.5 da N (kg – 9÷10 lb) on lever end.

IMPORTANT – Always check that with the mobile rod tip (P_1) coincident with the external reference plane (R_1) of the **293846** tool (A), dimension (L_7, see figure on side column) is:

$$L_7 = L_6 + L_3$$

where:

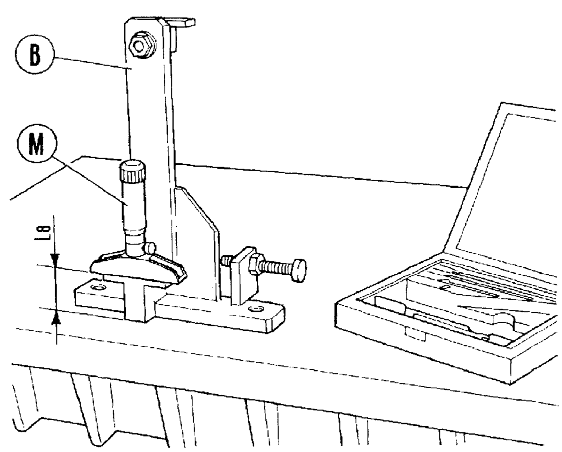
L_6 = dimension measured with the **293845/1** tool installed on surface plate (see page 35–32);

L_3 = 23,9 ÷ 24,1 mm(.94÷.95 in). Operating dimension between the lift/transmission case and rod (19)/lever (18) refrence plane.

In case conditions differ from above, adjust through excentric pin (32) and knurled screw (V, see figure on side column) of the **293845/1** tool until conditions above are met.

— fit threaded dowel pin (31, page 35–32) and tighten screw (34) without calking the lock washer (33) edge, then remove the **293846** and **293845/1** tools.

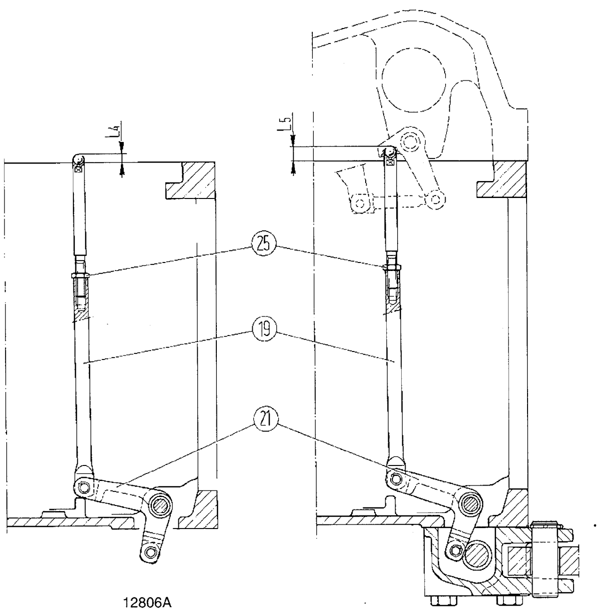
Re–assemble and install the hydraulic lift in accordance with the following instructions and information:



23212

IMPORTANT – First place the **293845/1** tool (B) on the surface plate and measure, using a depth micrometer gauge (M) the dimension (L_8) between tool/surface plate and micrometer/tool mating surfaces.
Finally, stamp reading (L_8) on tool.

*Print No. **603.54.283.00** – 09 – 1994*



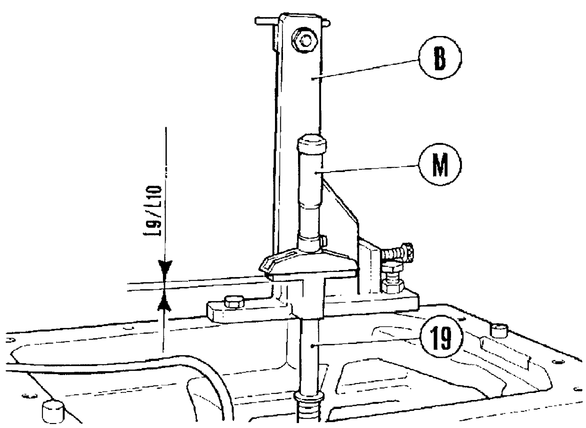
12806A

Draft control adjustment on models 62F – 72F – 82F – 72LP – 82LP

L_4. Stand–out of the upper end of rod (19) from rear drive case (without flexion bar) – L_5. Stand–out of rod (19) from rear drive case (with flexion bar installed) – 19. Draft control rod – 21. Draft control intermediate lever – 25. Jam nut.

— install the draft sensor, with intermediate lever (21) and draft control check rod (19), but without flex bar, on the rear drive case;

— place intermediate lever (21) on the special stop in rear drive case;



23216

— fit the **293845/1** (B) special tool securing to two holes on the case so that the draft control rod (19) will fit exactly in the tool hole, as shown above;

— measure, using the depth micrometer gauge (M), dimension (L_9) between the rod (19) upper end and the micrometer gauge lay surface;

Note – Stand–out (L_4) of rod (19) upper end form rear drive case (without flex bar) is given by:

$$L_4 = L_8 - L_9$$

where:

L_8 and L_9 = readings obtained using the **293845/1** gauge (B) installed on surface plate (L_8, page 35–33)) or on rear drive case (L_9, see figure below).

— install the flexion bar and measure the new dimension (L_{10}) between the rod (19) upper end and the micrometer gauge lay surface;

Note – Stand–out (L_5) of rod (19) upper end from rear drive case (with flex bar installed) is given by:

$$L_5 = L_8 - L_{10}$$

where:

L_8 and L_{10} = readings obtained using the **293845/1** gauge (B) applied on gauge plate (L_8, page 35–33) or on rear drive case (L_{10}, see figure below).

— check that dimension (L_5) is greater than (L_4) by 5 mm (0.2 in) at least;

— loosen jam nut (25) and adjust the length of the draft control rod to obtain a new stand–out (L_5 = 18.3÷18.5 mm – .720÷.728 in);

— the latter (L_5) can be measured can be measure by difference using th **293845/1** gauge (B):

$$L_{11} = L_8 - L_5$$

where:

L_5 = 18,3 ÷ 18,5 mm (.720÷.728 in). Operating stand–out of rod (19) upper end from rear drive case;

L_8 = dimension measured using the **293845/1** gauge (B) placed on surface plate;

L_{11} = dimension to be measured using a micrometer on the **293845/1** gauge;

— tighten jam nut (25) and install hydraulic lift on the tractor.

CONTROL LINKAGE ADJUSTMENT
(Operation 35 110 08)

1. To adjust the position control rod, proceed as folows:

A. Models 50V – 55V – 60V – 70V – 55F – 60F

— place the position control lever (P) at a 15 mm (.590 in) distance (L_{13}) measured between slot end and rear profile of the lever;

— place the external position control intermediate lever (37) all forward against the spacer;

— connect the link and adjust length by screwing or unscrewing ends;

— lock in desired position by tightening the jam nuts;

B. Models 62F – 72F – 82F – 72LP – 82LP

— move up the position control lever to height limit in the sector and check that distance (L_{12}) from slot upper end is 11 mm (.433 in);

— move the external position control intermediate lever (37) all forward against spacer;

— connect the control rod, modifying its length if necessary, and check that distance is 11 mm (.433 in);

— lock rod in desired position by tightening the jam nuts.

2. To adjust the draft control rod, proceed as follows:

— check that the implement carrier lower links are unloaded, start engine and run at medium speed;

— move position control lever (P) all forward in the sector for minimum height;

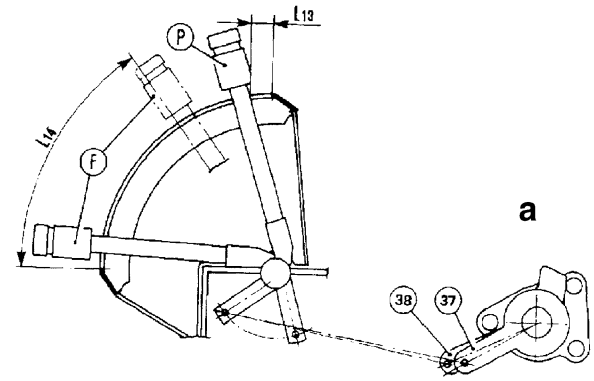
A. Models 50V – 55V – 60V – 70V – 55F – 60F

— position the external draft control intermediate lever (38) all the way forward in the sector against the spacer;

— move the draft control lever (F) at 15 mm (.590 in) (L_{13}) between slot end and lever rear edge;

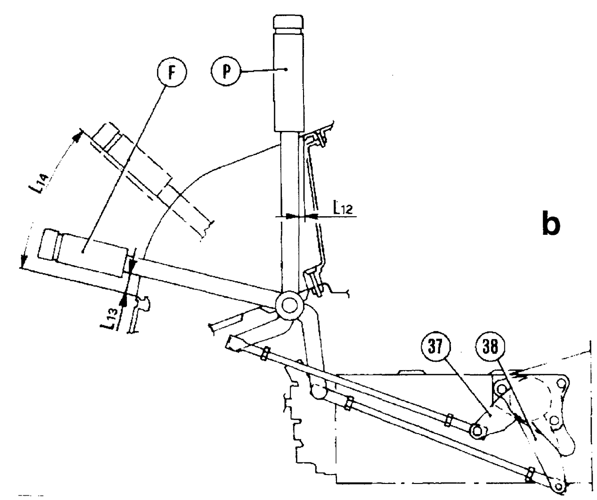
— connect the draft control rod;

— check that draft control starts operating at a travel distance (L_{14}) of 165÷175 mm (6.50÷6.89 in) measured from where the slot starts in the sector to the front edge of the draft control lever (F).



Position control (P) and draft control (F) rod adjustment Models 50V – 55V – 60V – 70V – 55F – 60F

F. Draft control lever – L_{13} = 15 mm (.590 in). Distance between slot end and rear edge of levers (P,F) – L_{14} = 165÷175 mm (6.50÷6.89 in). Distance between slot start and front edge of lever (F) – P. Position control lever – 37. External position control intermediate lever – 38. External draft control intermediate lever.



Position control (P) and draft control (F) rod adjustment Models 62F – 72F – 82F – 72LP – 82LP

F. Draft control lever – L_{12} = 11 mm (.433 in). Distance between position control lever (P) and slot sart – L_{13} . Distance of draft control lever (F) and bottom slot start – L_{14}. Distance between bottom slot start and front edge of lever (F) – P. Position control lever – 37. External lever, on the hydraulic lift, for position control – 38. External lever, on the hydraulic lift, for draft control.

Print No. **603.54.283.00** – 09 – 1994

— if not, re–establish this dimension through the cam (18, page 35–29);

— finally, lock set screw (20);

B. Models 62F – 72F – 82F

— position the external draft control intermediate lever (38, page 35–35) all the way back against the spacer;

— move the draft control lever (F) to a distance L_{13} = 12 mm (.472 in) measured from front edge of lever to where the slot starts in the sector;

— connect the draft control rod, modifying its length if necessary, and check that distance (L_{13}) is 12 mm (.472 in);

— position the draft control lever (F) at a distance L_{14} = 165÷175 mm (6.50÷6.89 in) on the sector and check that this setting of the lever corresponds to the beginning of full arm raising;

— if not, re–establish this distance through the cam (32, page 35–32);

— lock the cam (32) through the threaded dowel pin (31) and lockwasher (33).

C. Models 72LP – 82LP

— position the external draft control intermediate lever (38, page 35–35) all the way back against spacer;

— move the draft control lever (F) all the way forward in the sector;

— connect the draft control rod, modifying its length if necessary;

— position the draft control lever (F) at a distance L_{14} = 185÷195 mm (7.283÷7.677 in) in the sector and check that this setting of the lever corresponds to the beginning of full arm raising;

— if not, re–establish this distance (L_{14}) through the cam (32, page 35–32);

— lock the cam (32) through the threaded pin (31) and lockwasher (33).

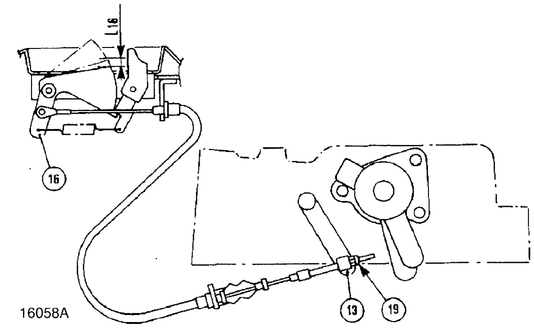
3. To adjust the LIFT–O–MATIC device, proceed as follows:

Note – To re–activate the LIFT–O–MATIC, free lever (13), previously locked for adjustments.

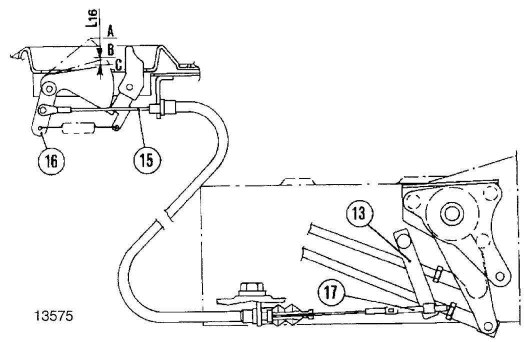
With engine shut–off, move the draft and position control levers (F and P, page 35–35) all the way forward in the sector.

A. Models 50V – 55V – 60V – 70V – 55F – 60F

— connect the flexible drive to the push–button control (16) and lever (13), then secure LIFT–O–MATIC to mudguard;



a



b

LIFT–O–MATIC adjustment

a. Models 50V – 55V – 60V – 70V – 55F – 60F
b. Models 62F – 72F – 82F – 72LP – 82LP.

A. Push–button control OFF – B. LIFT–O–MATIC push–button control position in the initial control valve draining stage – C. Engagement position of the LIFT–O–MATIC push–button – L_{16} = 9÷12 mm (.35÷.47 in). Residual stroke of the LIFT–O–MATIC control – 13. External LIFT–O–MATIC control lever, on hydraulic lift – 15. Flexible control cable – 16. LIFT–O–MATIC control button – 17 and 19. Cable terminals.

— start engine and run it at medium speed;

— connect cable to lever (13) and adjust length so that, when button (11) is activated, the discharging stage starts, with a residual stroke L_{16} = 9÷12 mm (.35÷47 in) measured at button end.

B. Models 62F – 72F – 82F – 72LP – 82LP

— connect flex cable (15) to control button (16) and external lever (13), then fix the LIFT–O–MATIC unit to the mudguard;

— start engine and run it at medium speed;

— adjust cable (15) though terminal (17) so that when button (16) is activated, discharge begins (lowering) with a residual stroke L_{16} = 9÷12 mm (.35÷47 in) measured at button end;

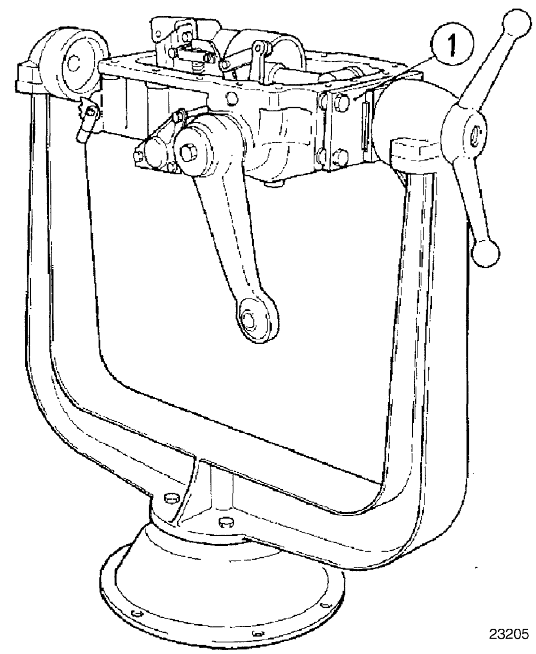
— fix terminal (17) to external lever (13) by means of its specific safety lock.

ARM ROCKSHAFT AND LIFTING CYLINDER – Disassembly–Assembly (Op. 35 110 42)

CAUTION

Handle all parts carefully.
Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Proceed as further indicated.



23205

1. By means of bracket (1), fix the lifter on the rotary stand. The bracket is made according to the instruction given on pages 35–12.
   Proceed as follows:

A. Models 50V – 55V – 60V – 70V – 55F – 60F:

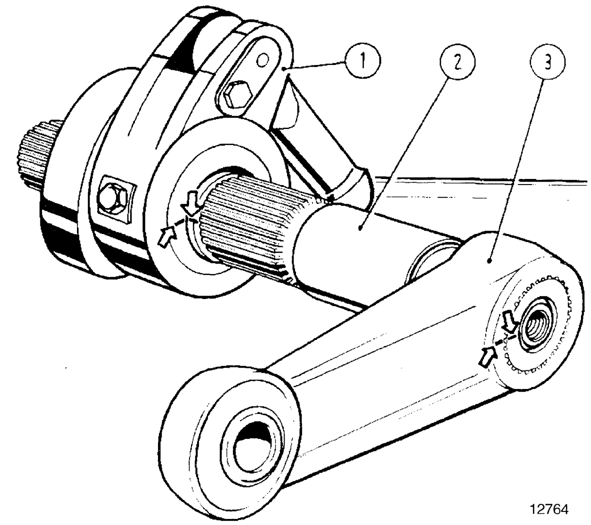
— remove the lift front cover (20, page 35–3) together with the distributor.

B. Models 62F – 72F – 82F – 72LP – 82LP

— remove the fixing screws and the whole distributor;

— remove the three screws fixing the cylinder liner to the lift and the two support fixing screws of the distributor control valve lever.

2. Remove the cylinder liner and the piston.
3. Remove the inner arm fixing screw (1, page. 35–3).
4. Remove screws (C_2, page 35–3) and arm end washer (4).



12764

5. Make sure that the reference marks on both lifting arms and drive shaft are present. If no mark is present, it is to be written.

6. Remove the lifting arms.

7. Beat on the right end of the lifting shaft to make the shaft slide out of the assembly.

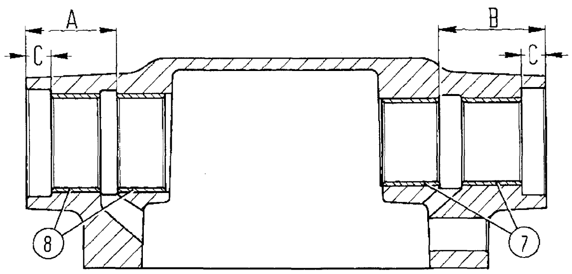
8. Reassemble parts reversing sequence of removal operations from no. 7 back to no. 1 and take note of the following instructions:

   a. In case of replacement, fit the lifting arm rockshaft bushes from the outside to the inside of the lift body, making sure the values given on page 35–38 are respected. After fitting in the bushes, no further rectification is needed on them.

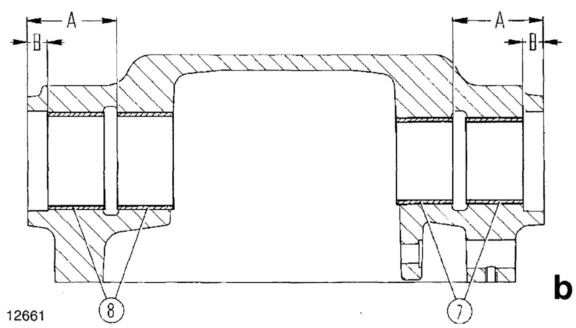
   b. In case of replacement extract right seal gasket (5) and left seal gasket (6, page 35–3).

   c. Couple the drive shaft (2, Fig. above) into the inside arm (1) and to the lifting arms (3), according to the reference marks on the parts (as shown in the figure above).

Print No. **603.54.283.00** – 09 – 1994



16059 **a**



12661 **b**

Bush driving values for lifting arm shaft.
a. Models 50V – 55V – 60V – 70V – 55F – 60F – **b.** Models 62F – 72F – 82F – 72LP – 82LP – 7. Right bushes – 8. Left bushes.
Models 50V – 55V – 60V – 70V – 55F – 60F:
A = 55 mm (2.17 in) – B = 67 mm (2.64 in) – C = 15 mm (.59 in)
Models 62F – 72F – 82F – 72LP – 82LP:
A = 62 mm (2.44 in)– B = 14 mm (.55 in)

d. With the drive shaft (2, page 35–37) installed, reassemble the right seal (5, page 35–3) and the left seal (6). In order to avoid any damage to occur to the lips of the seals, a flexible brass protection plate must be used. Plate dimensions: 200 x 90 mm (7.87 x 3.54 in), thickness 0.05–0.1 mm (.02–.04 in) Enroll the brass plate and insert the gasket in it. Put the protected seal on the splined edge and push it by hand in its seat. Slide the brass plate out.

Note – If the right seal (5, page 35–3) has enough efficacy, mount the above cited protection plate on it and fit the drive shaft from the left lift side and mount the seal (6) using the driftpin **292535** (models 50V – 55V – 60V – 70V – 55F and 60F) or driftpin **293842** (models 62F – 72F – 82F – 72LP – 82LP).

---

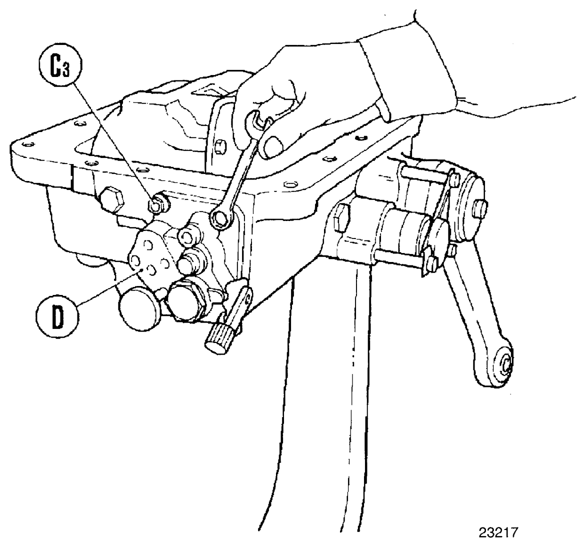
e. After assembling, check that the lift arm shaft end play is 0.2÷1.4 mm (.008 x .055 in) (G, page 35–3).

f. To avoid any damage to the seal, fit the piston into the cylinder liner using the driving ring:
292547 for models 50V – 55V – 60V – 70V – 55F – 60F
293843 for models 62F
291483 for models 72F – 82F – 72LP – 82LP

LIFT CONTROL VALVE
Remove – Install (Op. 35 114 10)

Proceed as follows:

1. Disconnect the oil feed and outlet lines from the control valve.



23217

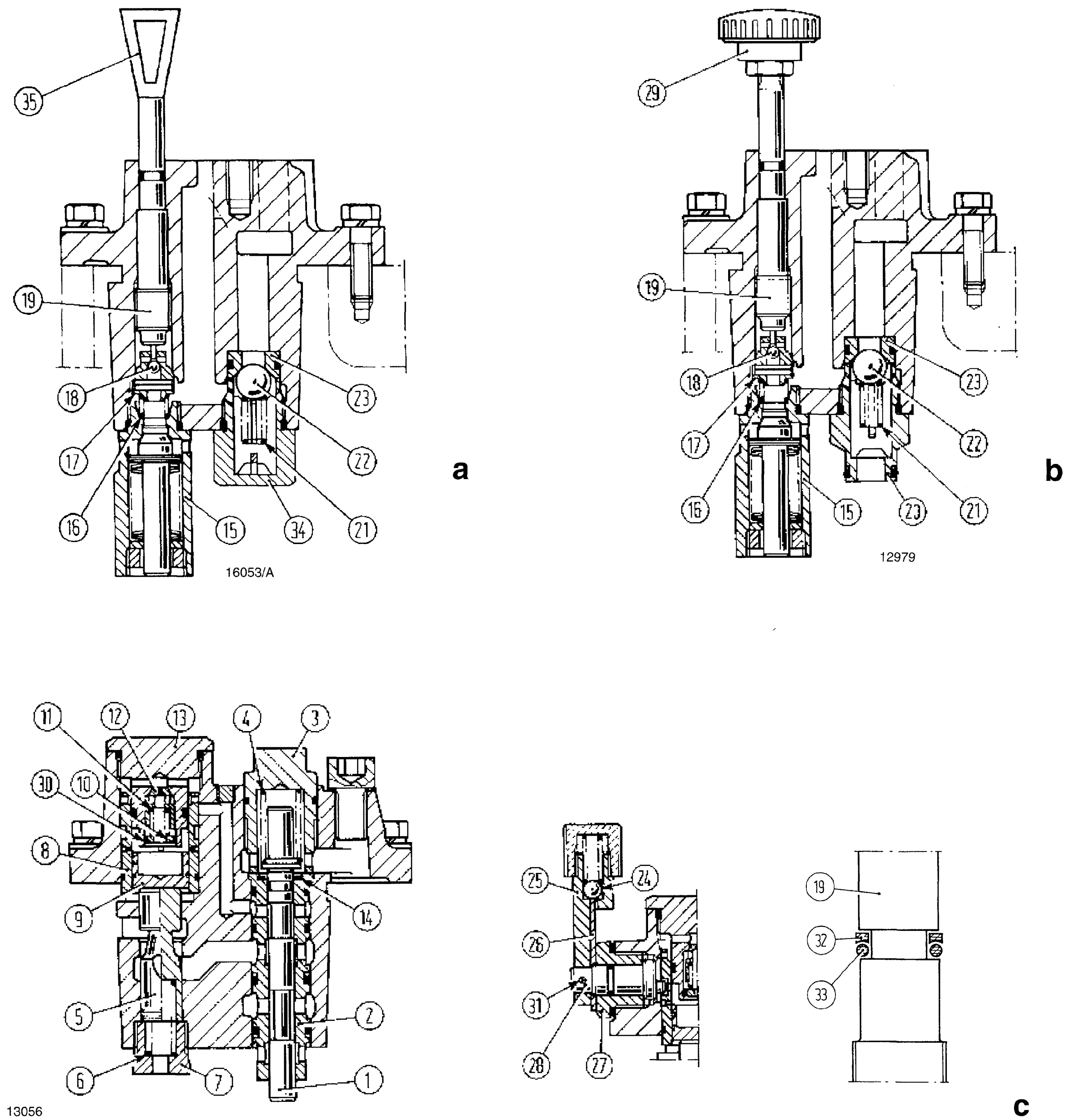
2. Remove the holding screws (C_3) and the whole distributor unit (D).

3. To re–install the distributor on the lift housing, reverse sequence of removal operations described, taking note of the following instructions:

   a. Thoroughly clean mating surfaces and apply a 2 mm (.001 in) strip of sealing cement along the perimeter profile of joining flange. Suitable sealing cement types to use are listed on page 1. Section 00.

   b. Install the control valve on the lift housing and set the right torque as listed in the table on pages 35–9 and 35–10.

Print No. 603.54.283.00 – 09 – 1994



Sectional view of rear–mounted lift control valve.

a. Models 50V – 55V – 60V – 70V – 55F – 60F – **b.** Models 62F – 72F – 82F – 72LP – 82LP – **c.** Installation detail for correct placement of O–ring seal (33) and back–up ring (32) – 1. Control valve spool – 2. Spool seat – 3. Plug – 4. Control valve spool return spring – 5. Pilot valve spool – 6. Pilot valve spool spring – 7. Plug – 8. Pilot valve plunger seat – 9. Pilot valve plunger – 10. Spring (11) back–up ring – 11. Sensitivity speed rate valve spring – 12. Sensitivity speed rate regulation valve – 13. Plug – 14. Control valve seat ring – 15. Cylinder safety valve – 16. Arm drop rate regulation valve spring – 17. Arm drop rate regulation valve – 18. Ball – 19. Arm drop rate valve spool – 20. Oil delivery to cylinder connection – 21. Check valve spring – 22. Check valve – 23. Check valve seat – 24. Detent ball – 25. Regulation spool lever – 26. Toothed sector – 27. Plug – 28. Regulation spool – 29. Arm drop rate regulation spool knob – 30. Retaining circlip – 31. Spring pin – 32. Spool (19) seal back–up ring – 33. O–ring seal – 34. Plug – 35. Arm drop rate regulation spool slotted lever.

Attention – Install seal (33) and back–up ring (32) as shown in detail (c), using the special **293858** protection and warming up ring (32) in oil at about 50 °C (122 F). Pay a particular attention to back–up ring (32) which must be fitted with its flat side facing upwards and concave side facing the seal.

Print No. **603.54.283.00** – 09 – 1994

LIFT CONTROL VALVE – REMOVED
Removal – Installation (Op. 35 114 14)

Proceed as follows:

1. Remove cylinder safety valve (15, page 35–39), arm drop rate regulation valve (17) and spool (19), after removing the slotted lever (35) on models 50V – 55V – 60V – 70V – 55F – 60F or the knob on models 62F – 72F – 82F – 72LP – 82LP.

   On models 50V – 55V – 60V – 70V – 55F – 60F:

   remove plug (34) and recover check valve (22) and its seat (23).

   On models 65F – 72F – 82F – 72LP – 82LP:

   remove connection (20) and recover check valve (22) and its seat (23).

2. Remove plug (3) and recover control valve spool (1), its associated seat (2), spring (4) and ring (14);

3. Remove sensitivity speed regulation valve plug (13) and control valve plug (7); recover spool (5) , spring (6), plunger (9) and its seat (8).

4. Remove circlip (30) and recover the back–up ring (10), the spring (11) and the sensitivity speed regulation valve (12).

5. Take plug (27) away, remove the elastic plug (31) and recover sensitivity speed regulation valve control spool (28).

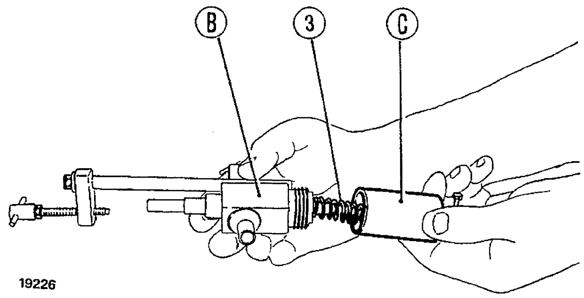
6. Carry out the following tests:

   a. Check the seals carefully and replace the damaged ones using tools **293858** and **293984** as indicated on page 35–11;

   b. Check valves for wear and nating clearance in their seats.

   c. In case of replacement, remember that the control valve spool (5, page 35–4) is supplied together with control valve housing;

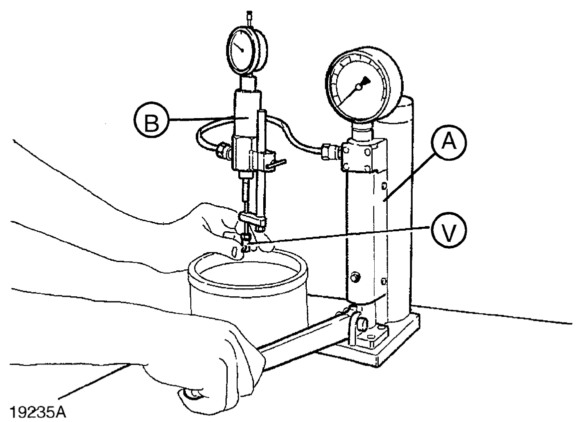
   d. check efficiency of spool (1, page 35–39) as follows:



19226

– Fit spool (1, page 35–39) and associated housing (2) on tool **293282** (B).

– Fit spool spring (3) and plug (C)of tool **293982** (B), tightening it and then check that spool is free to slide.



19235A

– Fit tool **293982** (B) on hand pump **290284** (A), supplied with **IDRAULICAR AP51** oil and attach a comparator dial gauge to the tool.

– Working at the same time on the hand pumps, tighten tool screw (V) until the outcoming oil flow from the control valve spool seat stops.

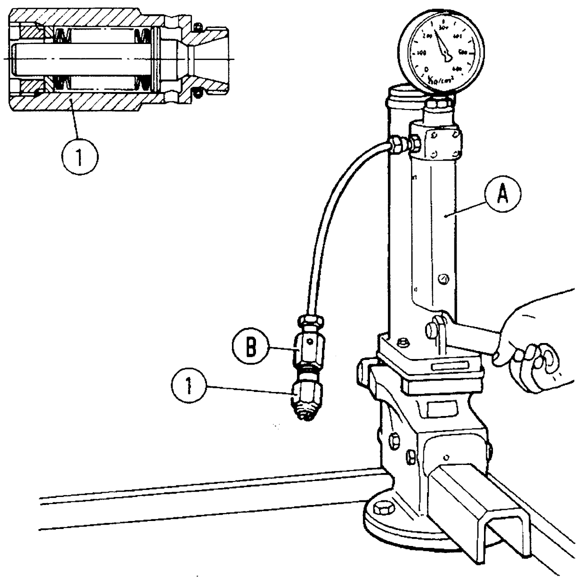
– Set comparator gauge dial at zero.

– Further tighten the tool screw (V) to move the spool 1.8 to 2 mm, reading this dimension on the comparator gauge dial.

– Actuate the hand pump making the oil inside the system to reach a pressure of 245 bar (250 kg/cm^2–3555 psi) and then check on pressure gauge that it takes over six seconds for the pressure to drop from 196 bar (200 kg/cm^2–2844 psi) down to 98 bar (100 kg/cm^2–1422 psi). If elapsed time is less than six seconds, replace the control valve spool (supplied as spare part together with its housing seat).

Print No. 603.54.283.00 – 09 – 1994

e. Check the setting of the **cylinder safety valve** (15, page 35–39) as follows:



23424

Install the cylinder safety valve (1) on the valve holding connection **290828** (B) and connect the same to the hand pump **290284** (A).

Work on the hand pump (A) and check that the cylinder safety valve opens at a pressure of 210÷215 bar (214 ÷ 219 kg/cm^2 – 3043 – 3114 psi).

If valve setting does not correspond to the given volue, it is advisable to replace the valve.

If necessary, it is also possible to set the valve again by means of wrench **291862** working on the threaded plug. Screw the plug to increase valve setting and unscrew it to decrease valve setting value.

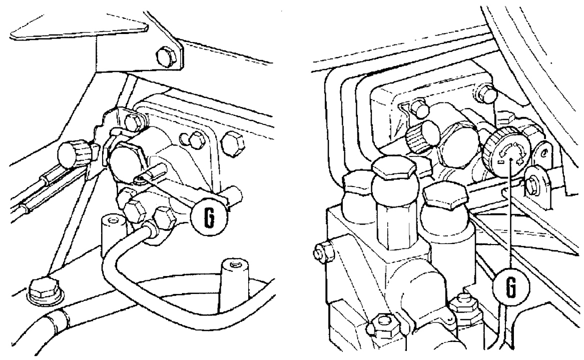
f. Install the hydraulic control valve, paying attention to following instruction:

— proceed by reversing the previous sequence of removal operations starting from no. 5 back to no.1;

— consult figures on page 35–39 for the correct placement of parts;

— tighten fastenings to the torque specs of page. 35–9.

g. To set the arm drop rate of the lift, proceed as follows:



23220 **a** 23221 **b**

Models 50V – 55V – 60V – 70V – 55F – 60F:

put the slotted lever in the right position (G – fig. a)

Models 62F – 72F – 82F – 72LP – 82LP:

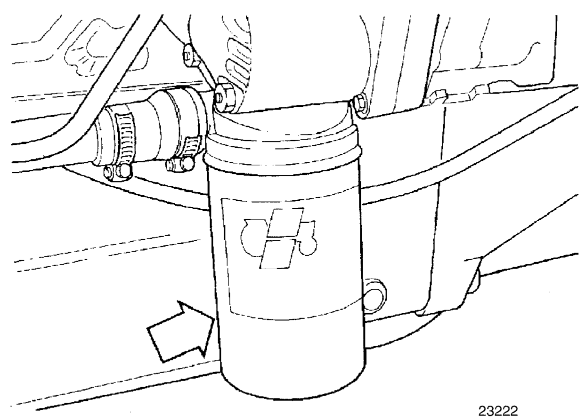
turn the knob (G – fig. b).

Turn right (+) = higher arm drop rate

Turn left (–) = lower arm drop rate

OIL FILTER
Replacement (Op. 35 100 06)

Proceed as follows:



23222

1. Unscrew the cartridge
2. Oil the gasket
3. Insert the new cartridge and tighten it by hand for 3/4 turn.
4. Check oil level and top–up if necessary.

Print No. ***603.54.283.00*** *– 09 – 1994*

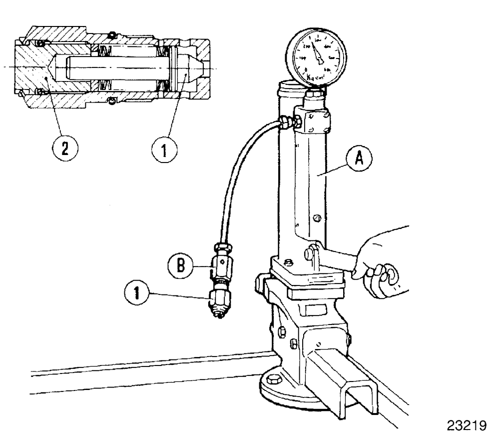
LIFT PRESSURE RELIEF VALVE

Pressure relief valve (17, page 35–3) is not mounted on models 50V – 55V – 60V – 70V – 55F – 60F which are equipped with remote control valve. Reason for this is that pressure relief valve is already built–in in one of the remote control valves. Pressure relief valve is mounted on lifts of all models which are not equipped with remote control valves (fig. a and b) or on models 62F – 72F – 82F – 72LP – 82LP (fig. b), which are equipped with remote control valves KONTAK without built–in pressure relief valve (see remote control valves).

LIFT PRESSURE RELIEF VALVE
Setting (Op. 35 114 32)

1. **Relief valve setting can be checked either on tractor or on bench.**

A. **To check on bench the setting of lift pressure relief valve (17, page 35–3), proceed as follows:**



Devices for bench testing of setting of cylinder relief and safety valves.
A. Hand pump **290284** – B. Connection **280824** for pressure relief valve holding – 1. Relief valve – 2. Ring nut for valve (1) setting.

— Install pressure relief valve (1) on valve holding connection **290824** (B) and connect the valve holder to hand pump **290284** (A).

— Work on hand pump (A) and check pressure relief valve opens at a pressure of about 186÷191 bar (190÷195 kg/cm^2 – 2072 – 2773 psi).

— If not, work on the pressure setting ring nut (2) by means of wrench **291863** to set the right pressure stated above. Then press down again locking labels as indicated in the figure above.

Attention – Checking the relief valve setting by means of hand pump **290284** only gives indicative values. It is therefore advisable to check the setting of the valve mounted on tractor as indicated on page 35–43.

B. **Bench test of relief valve (S, page 35–43) pressure. Valve built in SALAMI remote control valves (only on models 50V – 55V – 60V – 70V – 55F – 60F).**

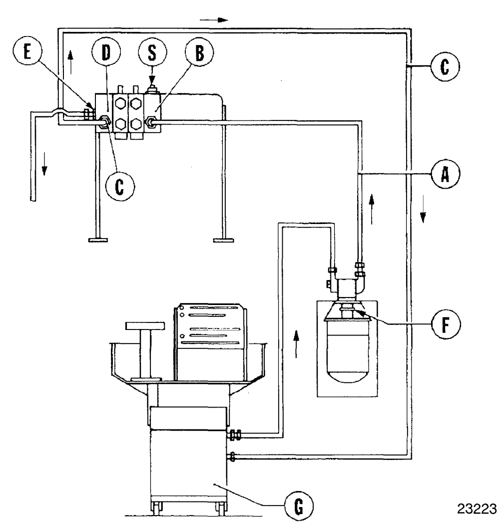
Proceed as follows:

— Install remote control valve assembly and the testing tools as shown in the scheme below. The delivery pipe (A) must be fixed to outlet plate of the lift (C). D. Connect outlet (E) as shown in the figure.

— Operate the hydraulic pump (F) and increase pressure gradually working on handwheel of output testing device (H,G). Check on the device manometer that the relief valve opens at a pressure of 186–191 bar (190–195 kg/cm^2 – 2702 – 2773 psi).

— If the recorded pressure is different from the right pressure indicated, undo the nut (02) and adjust the setting by means of the setting screw (01, page 35–43). Turn the screw right to increase the pressure and turn it left to decrease. After setting, tighten nut (02) again. If pressure setting this way is not successful, replace the valve.

Note – With testing device filled with oil AP51 (SAE 20W), the pressure checking must be carried out at a temperature of about 60 °C (140 °F) and with an output of 12,5 l/min, which can be obtained by operating the electric motor at its higher speed (1450 rpm).

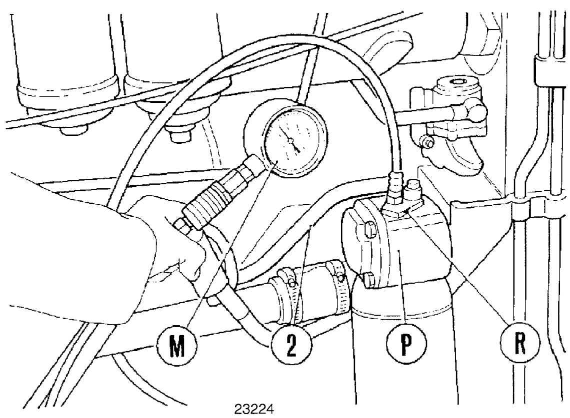


Installation diagram of tools and devices for checking relief valve.

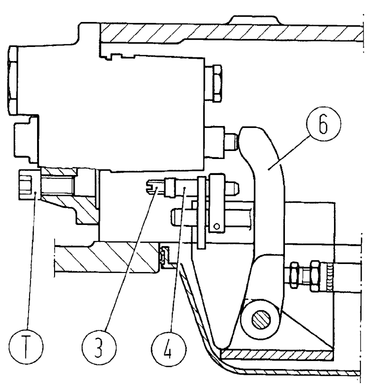
Print No. 603.54.283.00 – 09 – 1994

C. Setting test of pressure relief valves on lift (17, page 35–3) on combines w/o remote control valves or with KONTAK auxiliary control valves without relief valves fitted in inlet plate (pressure relief valve fitted in lift).

Proceed as follows:



— Operate the engine until the circuit oil reaches a temperature of 50±3 °C (122 ± 37 °F);



— Stop the engine, wait about 5 minutes for the oil from the lift housing to be discharged into the gearbox, remove plug (T) and insert wrench **293870** into the hole;

— Put connection **291326** (R) between oil delivery to control valve pipe (2) and hydraulic pump (P) and connect it to manometre (M) with scale 0 ÷ 250 kg/cm^2 (0 – 3555 psi) of tool set **292870**;

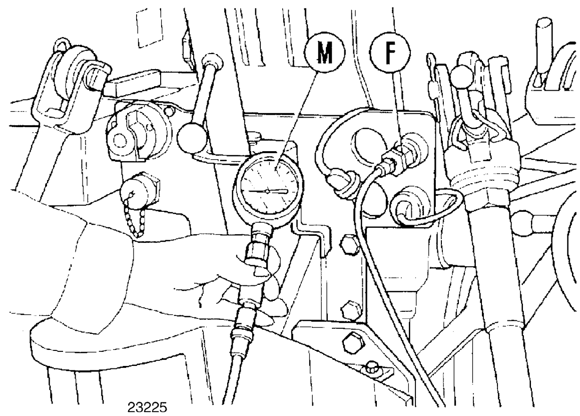
— Start the engine again;

— Take the position control lever to its travel end back on the sector; by means of wrench **293870** loosen the counternut (4) and unscrew the travel end setting screw (3) until the pressure relief valve opens;

— With engine running at 1500–1700 rpm, a pressure of 186÷191 bar (190÷195 kg/cm^2 – 2702 – 2773 psi) must be read on the manometre. If not, replace the valve (17, page 35–3) or, if necessary, set it again by turning the threaded plug by means of wrench **291863**.

D. Checking the pressure setting on combines with pressure relief valve fitted in SALAMI remote control valves (models 50V – 55V – 60V – 70V – 55F – 60F).

Proceed as follows:

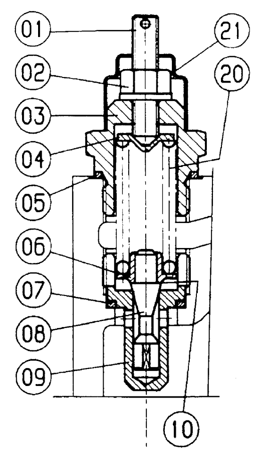


— Insert connection **293449** (F) into a fast–coupling female half–joint and connect it to a manometre scaled 0÷250 kg/cm^2 (0 ÷ 3555 psi) of the tool set **292870**;

— Run the engine until oil reaches a temperature of 50±3 C (122 ± 37.4 F);

— Operate on the control valve lever corresponding to the half–joint employed until the pressure relief valve opens;

— With engine running at 1500–1700 rpm, a pressure of 186÷191 bar (190÷195 kg/cm^2 / 2702 ÷ 2773 psi)) must be read on manometre (M);

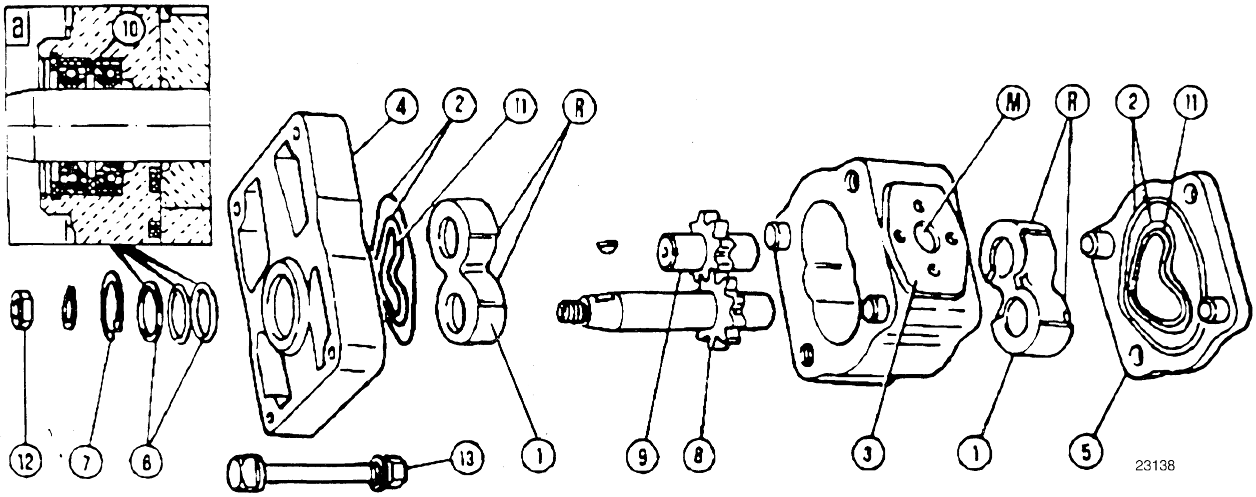


— If the pressure recorded is different from the right value indicated, loosen nut (02) and adjust the setting by turning screw (01) right, to increase the pressure, and left to decrease the pressure.

— After setting, tighten nut (02) again.

— If the valve has to be replaced, use the proper wrench **293463** to remove part (09).

Print No. **603.54.283.00** – 09 – 1994



Exploded view of oil pump.

a. Seal installation detail – M. Pump oil delivery outlet – R. Gear bearing fillets (outlet side) – 1. Gear bearings – 2. Oil seals in pump cover – 3. Pump housing – 4. Rear cover – 5. Front cover – 6. Drive shaft seal – 7. Seal retaining circlip – 8. Drive gear shaft – 9. Driven gear shaft – 10. Spacer – 11. Antiextrusion ring – 12. Nut securing sleeve to drive shaft and associated lock washer – 13. Cover bolt nuts.

LIFT HYDRAULIC SYSTEM OIL PUMP
Disassembly – Assembly (Op. 35 104 30)

Proceed as follows:

1. Remove covers bolt nuts (13), screws and associated lock washers.

2. Remove nut (12) securing sleeve to drive shaft and the associated lock washer.

3. Remove rear cover (4), seal retaining circlip (7) and drive shaft seal (6).

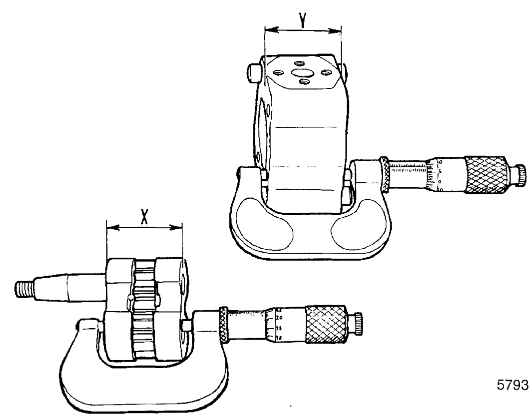
4. Mark parts (1), (3), (4), (9) and install them again if they prove efficient.

5. Remove gear bearings (1), gear (8) and (9) from rear cover (4) and pump housing (3).

6. Remove seal gaskets (2) and antiextrusion rings (11).

After removing these parts, proceed as follows:

7. Check thrust surfaces of gears and associated bearings for flatness and squareness by putting a thin film of carbon black powder between them. Small rough spots on the parts can be abraded away by means of a fine abrasive paper, lubricated.



Checking end play of gear unit and bearings in pump housing.

Value **X** must be less than **Y** by 0.090÷0.160 mm (.004÷.001 in)

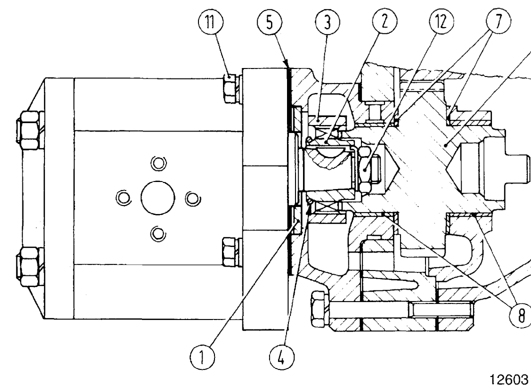
8. Check rockshafts and associated seats for wear and compare the recorded values with the data indicated on page 35–6.

9. Make sure that end play of gear–bearing assembly in pump housing is 0.090÷0.160 mm (.004÷.001 in).

10. If necessary, reface flat surfaces by abrading away little material with oiled abrasive paper and clean all components thoroughly.

11. Replace seal gaskets (2), (6), (11).

Print No. **603.54.283.00** – 09 – 1994



Sectional view of pump drive.

1. Pump centralizing ring – 2. Pump drive sleeve – 3. Sleeve drag ring – 4. Ring (3) retaining circlip – 5. Gasket – 6. Pump drive driven gear – 7. Thrust rings – 8. Gear bearing bushes – 11. Pump mounting screws – 12. Sleeve holding nut.

12. Lubricate the components with oil from the circuit and install pump following the instruction in figure on page 35–44. Also pay attention to the following:

a. Install the pump reversing previous operations from no.6 back to no. 1;

b. always work in clean surroundings in order to avoid any dirt or other particles to get into the pump and damage it;

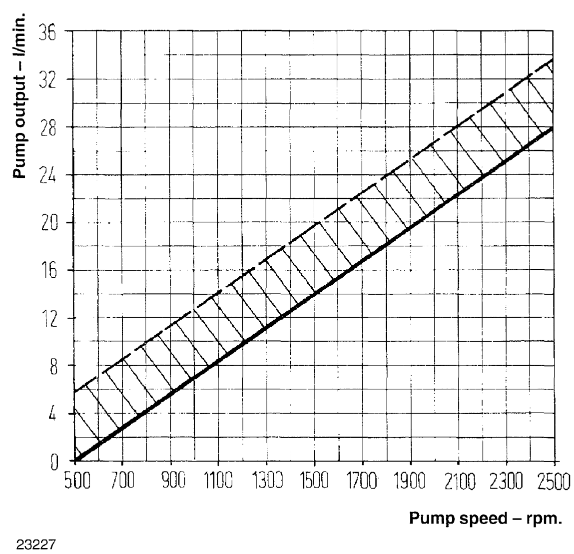
c. couple components (1), (3), (4) and (9), which you have previously marked, as described at Op. 4, page 35–44, to set them in their right place;

d. install manually gear bearings (1) in pump housing. Make sure fillets (R) of outer edge are oriented to delivery pipe (M) and front faces with lubrication milling thrust gears;

e. Insert plastic antiextrusion ring inside the central O–ring seal (2);

f. Install gaskets (6) on rear cover (4) together with spacer (10). Place them as indicated at point a. on page 35–44. Fill cavity between sealing edged with grease **TUTELA G9.**

g. Gradually tighten bolt nuts and holding screws to pump housing at torques as specified in table on page 35–10.



Pump speed – rpm
Diagram pump speed–output, lift control pump A31.

Tested pressure 166 bar (170 kg/cm^2 / 2417 psi) – Oil temperature 55÷65 °C (131÷149 °F). Engine – pump rpm ratio: 1:0.925.

13. Install pump on tractor, fill oil **TUTELA MULTI F** in inlet pipe and pump housing to facilitate pump intake and avoid seizure during initial operation.

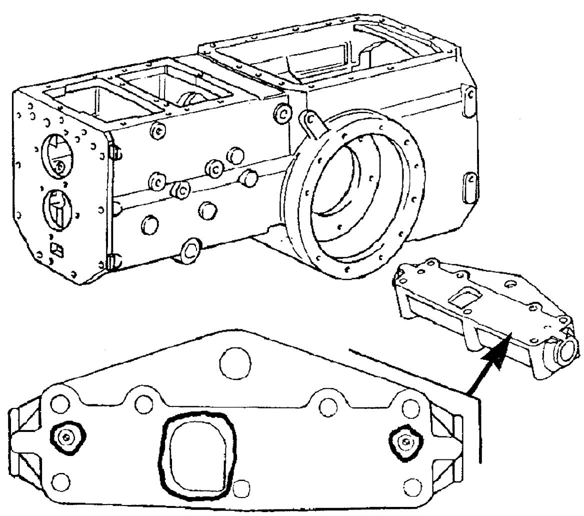
14. Steer tractor right and left to bleed air from hydraulic circuit. Top oil up if necessary.

Print No. ***603.54.283.00*** *– 09 – 1994*

DRAFT CONTROL DEVICE
Removal – Installation (Op. 35 120 50)
Models 62F – 72F – 82F – 72LP – 82LP

To remove the flex rod, which controls and senses draft on implement arms, proceed as follows:

1. Discharge oil from transmission box.
2. Remove rods and lower arms for implement coupling (24, page 35–47).
3. Remove holding screws to transmission box and the support complete with flex rod.
4. Install draft control lever paying attention to following instructions:
   a. reverse the previous removal sequence of operations starting from no. 3 back to no.1



12861A

Sealing compound application scheme on flex rod support

   b. thoroughly clean mating surfaces and apply a round strip of sealing compound about 2 mm (.08 in) thick following the scheme shown in the figure above.
   Suitable types of sealing compounds are listed on page 1, section 00.
   c. tighten fastenings to torque specs of page 35–10.
   d. make sure flex rod end play is G = 1.2 – 4.1 mm (.05 – .16 in).

DRAFT CONTROL DEVICE
Disassembly – Assembly (Op. 35 120 58)
Models 62F – 72F – 82F – 72LP – 82LP

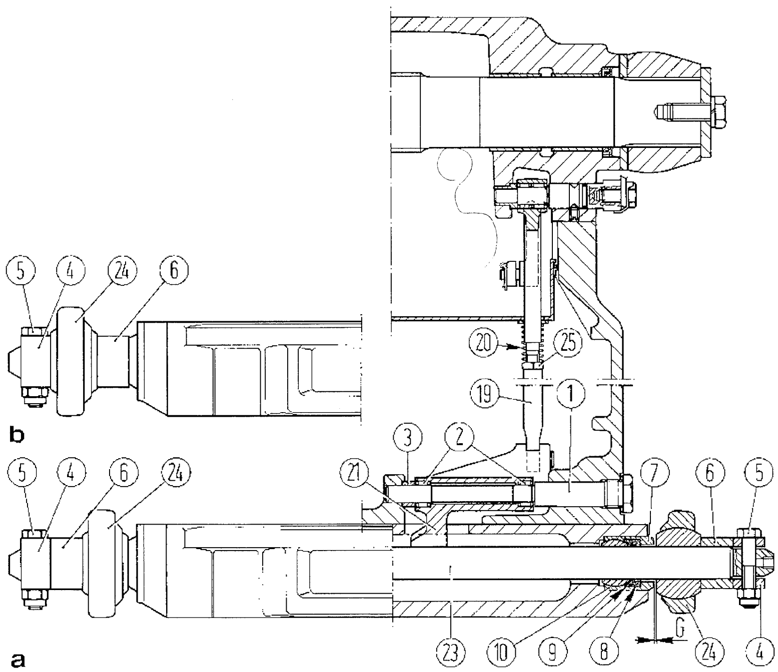
1. Slide flex bar out from its seat (23, page 35–47).
2. Using the hammer–type extractor, take bushes (10) and inner bearing spacer (7) out.
3. Install the parts reversing the previous removal sequence of operations from no. 2 back to no. 1 in accordance with following instructions:
   a. if necessary, replaces worn bushes
   b. tighten fastenings to torque specs of table on page 35–10.

Attention – Working in draft or mixed control, a higher lift sensitivity is obtained with light implements by mounting lower arms (24) with spacers (6) fitted inside arms (see fig. b, page 35–47).

Working in normal or heavy conditions, spacers (6) must be fitted outside lower arms (see fig. a, page 35–47).

This position control, which gives a lower tractor sensitivity, will make it possible to make tractor perform a higher power.

Print No. ***603.54.283.00*** *– 09 – 1994*



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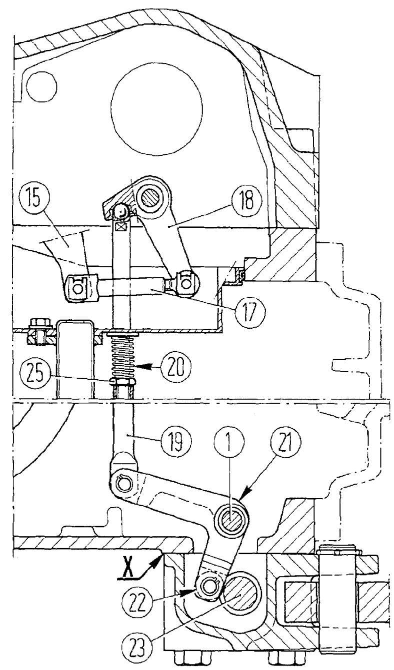


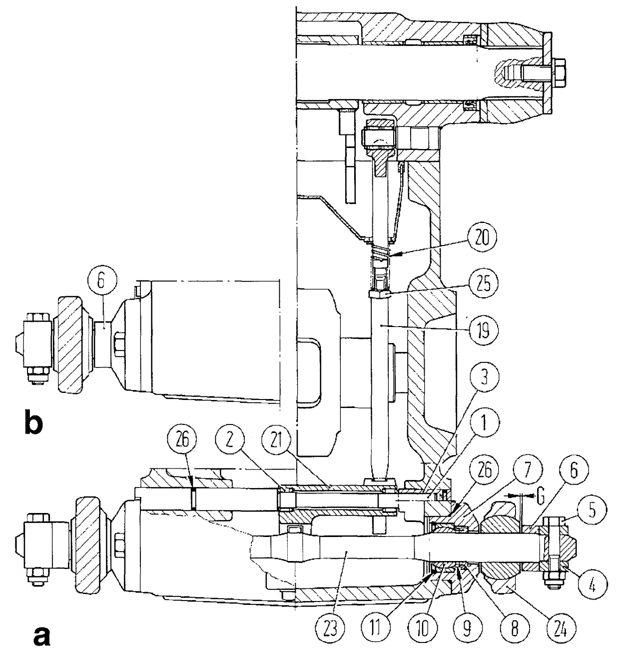
12732A

Sectional view of draft control lever. Models 62F – 72F – 82F – 72LP – 82LP.

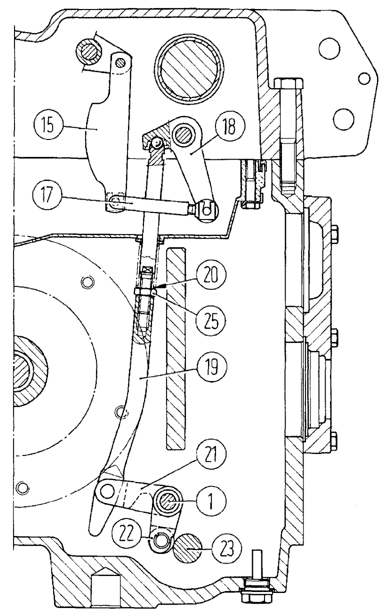
a. Placing spacer (6) for heavy and normal work – b. Placing spacer (6) for light work– G = 1.2÷4.1 mm (.05 ÷ .016 in). Flex bar end play – 1. Draft control transmission lever pin – 2. Needle bearings – 3. Draft control transmission lever spacer – 4. Ball end shoulder bush – 5. Arm holding screw – 6. Ball end shoulder outer spacer – 7. Ball end shoulder inner spacer – 8. Gasket – 9. Shoulder ring – 10. Flexible rod holding bush – 15. Draft control lift inner lever – 17. Draft control linkage – 18. Draft control inner lever – 19. draft control rod – 20. Draft control rod spring –21. Draft control transmission lever – 22. Draft control transmission lever roller – 23. Flexible bar – 24. Implement linkage lower arms – 25. Counternut.

Note – When installing parts, thoroughly clean and remove grease from all mating surfaces **X** and apply one sealing compound chosen among those listed on page 1, section 00.

Print No. **603.54.283.00** – 09 – 1994



16072



16073

Sectional view of draft control lever. Models 50V – 55V – 60V – 70V – 55F – 60F

a. Placing spacer (6) for heavy and normal work – b. Placing spacer (6) for light work– G = 1.5÷5.4 mm (.06 ÷ .21 in). Flex bar end play – 1. Draft control transmission lever pin – 2. Needle bearings – 3. Draft control transmission lever bush – 4. Ball end shoulder bush – 5. Arm holding screw – 6. Ball end shoulder outer spacer – 7. Flex bar holder – 8. Gasket – 9. Shoulder ring – 10. Flexible rod holding bush – 11. Lock ring – 15. Draft control lift inner lever – 17. Draft control linkage – 18. Draft control inner lever – 19. Draft control rod – 20. Draft control rod spring –21. Draft control transmission lever – 22. Draft control transmission lever roller – 23. Flexible bar – 24. Implement linkage lower arms – 25. Counternut. – 26. O–ring seals.

DRAFT CONTROL
Replacement of flex bar (Op. 35 120 54) on models 50V – 55V – 60V – 70V – 55F – 60F.

To remove the flex bar, which works as draft control and draft detection on implement linkage arms, proceed as follows:

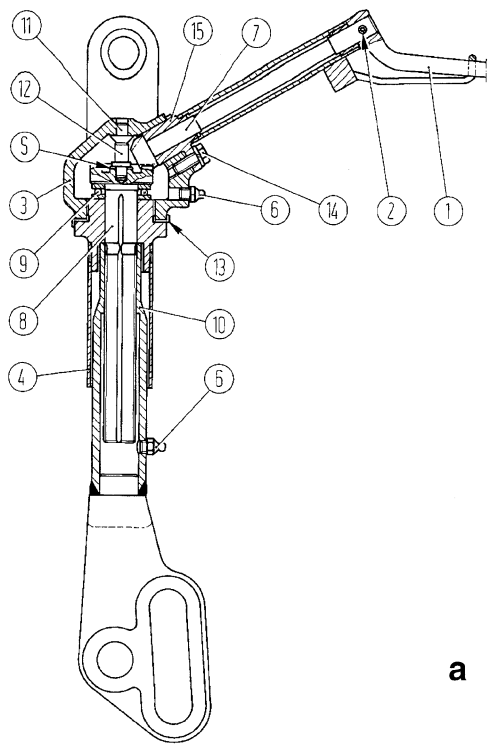
1. Discharge oil from transmission box.
2. Remove implement linkage lower arms (24).
3. Remove support (7) holding screws to transmission box and remove flex bar holders (7); recover the bar (23).
4. Install flex bar again reversing removal sequence of operations from no. 3 back to no. 1. After installing, check that flex bar end play (G) is 1,5 ÷ 5.4 mm (.06 ÷ .021 in).

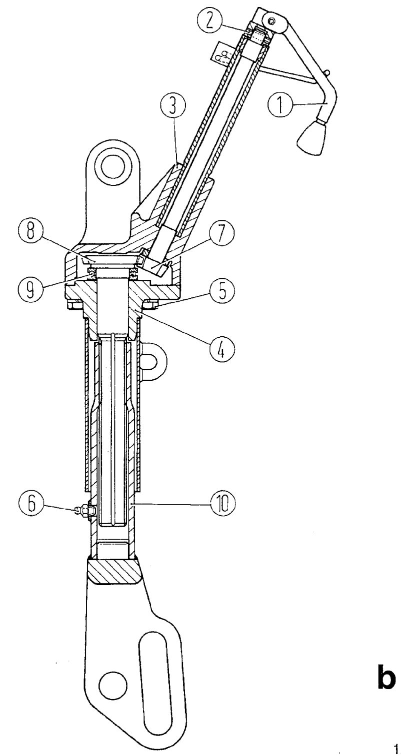
Attention – Working in draft or mixed control, a higher lift sensitivity is obtained with light implements by mounting lower arms (24) with spacers (6) fitted inside the arms (see fig. b).

Working in normal or heavy conditions, spacers (6) must be fitted outside lower arms (see fig. a).

This position control, which gives a lower tractor sensitivity, will make it possible to make tractor perform at a higher power.

Print No. **603.54.283.00** – 09 – 1994





Sectional view of right lift rod.

a. Models 50V – 55V – 60V – 70V – 55F – 60F – b. Models 62F – 72F – 82F – 72LP – 82LP – S. End play adjusting shims – 1. Rod adjusting handle – 2. Elastic ring– 3. Upper end – 4. Cover – 5. Cover to box holding screws – 6. Grease nipple – 7. Drive gear – 8. Driven gear – 9. Thrust bearing – 10. Lower end – 11. Fix cup – 12. Driven gear cup – 13. Lock washer – 14. Drive gear holder fixing screws – 15. Drive gear holder.

ADJUSTABLE LIFT ROD
Removal – Installation (Op. 35 120 14)

1. Remove the rod as follows:

   Models 50V – 55V – 60V – 70V – 55F – 60F:

   place lock washer (13) vertically and loosen plug (4), taking it away together with driven gear (8);

   undo screw (14) and remove holder (15) with its driven gear (7);

   Models 62F – 72F – 82F – 72LP – 82LP:

   remove screws (5) and plug (4) complete with its driven gear (8);

2. Unscrew lower end (10) and extract driven gear and thrust bearing (9).
3. Remove handle (1) by taking pin (2) away and recovering the driven gear.
4. Install the parts reversing the removal sequence of operations from no. 3 back to no. 1 and following the instructions below:

   a. put grease **TUTELA G9** inside inner holes of upper and lower ends.

   For models 50V – 55V – 60V – 70V – 55F – 60F:

   — insert shims (S) between cup (12) and driven gear (8), so that a end play of 0.1 ÷ 0.3 mm is obtained. This end play is checked by measuring end play between cups 11 and 12 through a thickness gauge.

   b. tighten fastenings at torque as specified in table on pages 35–9 and 35–10.

Print No. 603.54.283.00 – 09 – 1994

DESCRIPTION AND OPERATION – KONTAK REMOTE CONTROL VALVES (Models 62F – 72F – 82F – 72LP – 82LP)

These remote control valves work through slide valve gears and can be used for remote control of linked implements powered by either simple or double acting cylinders. Floating operation is also possible and, upon request, also a control valve for hydraulic braking of trailers can be supplied. (see pages 33–7 through 33–10).

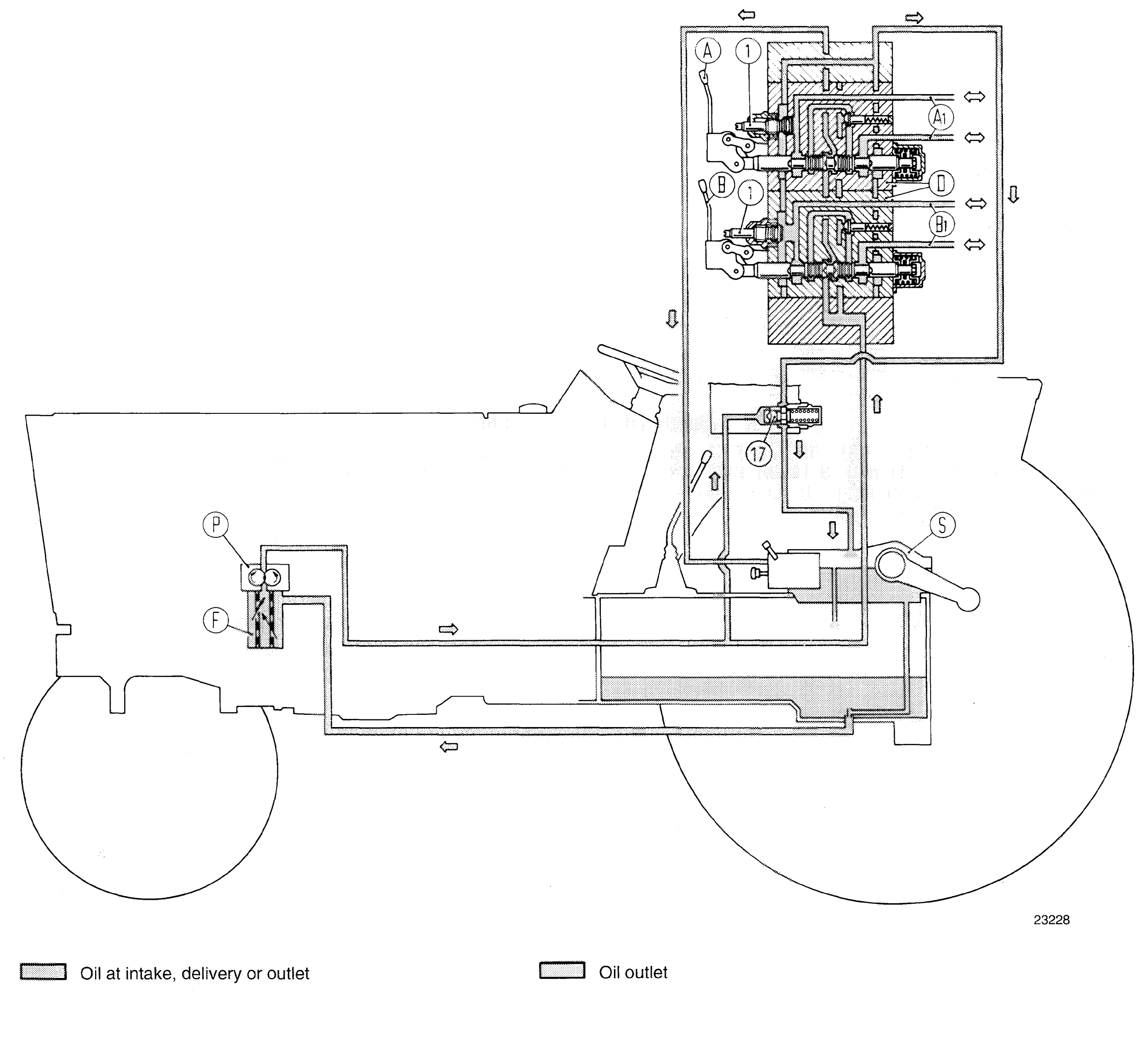
To operate the single–acting operating cylinder, screw (1) must be completely loose, and completely screwed in to operate the double effecting cylinder.

Cylinders are mounted in sets of max. three units and are fixed to right final drive by means of brackets.

Cylinders work using the same oil of the hydraulic lift (i.e. lubrication oil of rear transmission); nevertheless, they are controlled by independent hand lever (A and B). Simultaneous operation of one remote control valve and hydraulic lift is possible only when control valve is in floating position.

Pressure relief valve (17, page 35–3; valve setting 186 ÷ 191 bar / 190 ÷ 195 kg/cm^2 / 2702 ÷ 2773 psi) is fitted into hydraulic lift, either with or without remote control valves mounted.

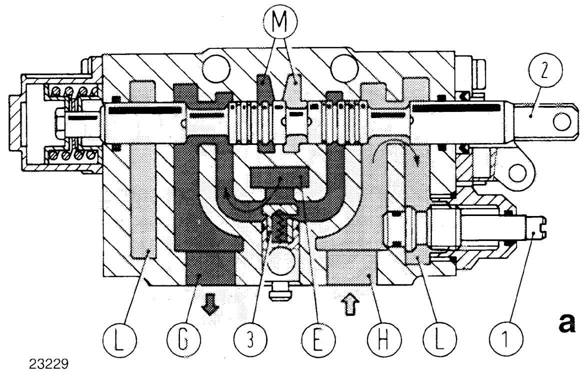
Figure below illustrates how oil flows in two control valves (one for operating a single–acting cylinder and one operating the double–acting cylinder) when associated control levers are in neutral position. Oil flows thus from pump through control valve units in the direction as shown by arrows and reaches the lift control valve.



Sectional view of hydraulic circuit of KONTAK remote valves for remote control (Models 62F – 72F – 82F – 72LP – 82LP).

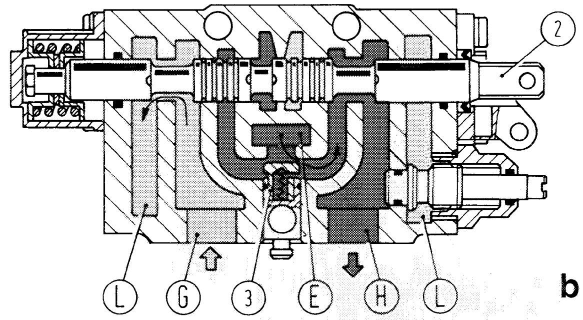
A. Control valve lever for double–acting cylinder operating – B. Control valve lever for single–acting cylinder operating – A1, B1 – Female half–joints for single– and double–acting cylinders – D. Remote control valves – F. Oil filter with paper cartridge for total delivery on pump intake (common with hydraulic lift) – P. Hydraulic delivery pump (common with hydraulic lift) – S. Hydraulic lift housing – 17. Pressure relief valve built in lift (see page 35–3) – 1. Single to double action switch screw.

Print No. 603.54.283.00 – 09 – 1994



23229 **a**

a. LIFTING – When control lever (A, Page 35–50) is taken backwards, the control valve rod (2) is also moved; consequently, check valve (3) opens making delivery pipe (E) flow into cylinder lower chamber through duct (G) and cylinder upper chamber discharge into outlet (L) through duct (H), catching oil delivered to hydraulic lift control valve. Keeping lever back, lifting is brought to cylinder end travel. After releasing, lever return spring brings the lever automatically to neutral position and the whole pump delivery is sent to lift control valve through delivery pipes (M).



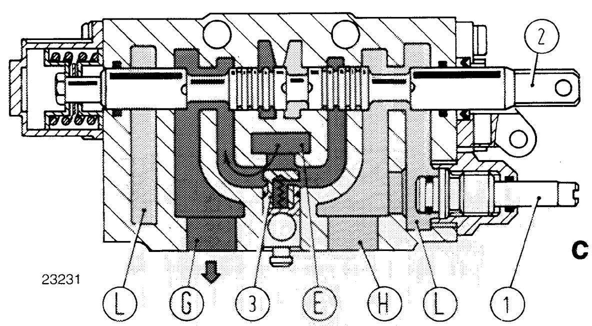
23230 **b**

b. LOWERING – To lower the implement, push control lever (A, page 35–50) forward. Control valve rod (2) moves as shown in fig. b and makes oil flow from cylinder lower chamber into outlet (L) through duct (G). Cylinder upper chamber is connected to delivery (E) through duct (H) and detent valve (3).

Sectional view of operating steps of a KONTAK switchable remote control valve to operate a double–acting cylinder (figures a, b).

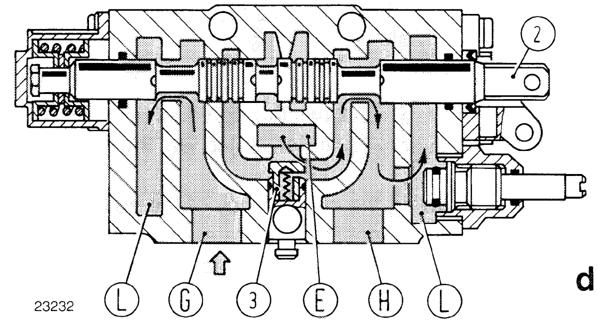
Note – To operate a double–acting cylinder, tighten screw (1).

- oil in pressure
- oil at intake, delivery or outlet
- oil still



23231 **c**

c. LIFTING – When control lever (B, Page 35–50) is moved backwards, the control valve rod (2) is also moved; consequently, check valve (3) opens making pipe (E) to deliver oil into cylinder lower chamber through duct (G). Duct (H), which is used to operate double–acting cylinders, remains still in this step, as it is steadily connected to outlet (L) by switching valve (1).



23232 **d**

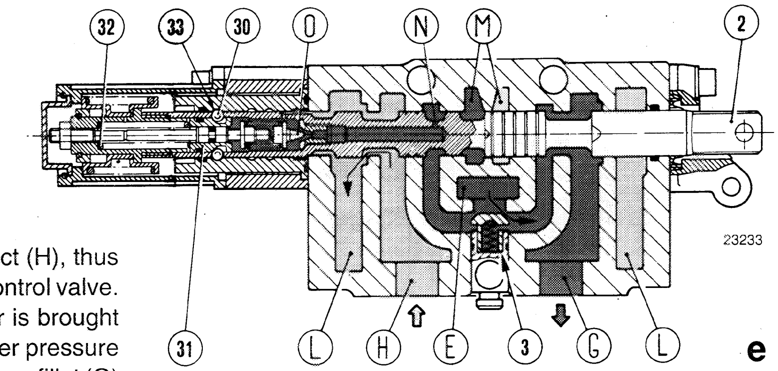
d. LOWERING – When control lever (B, page 35–50) is pushed forward, control valve rod (2) is moved as shown in fig. d. Under the weight of the implement, cylinder oil flows to outlet (L) through duct (G) and all pump delivery is sent to outlet (L) through detent valve (3) and duct (H).

Sectional view of operating steps of a KONTAK switchable remote control valve to operate a single–acting cylinder (figures c, d)

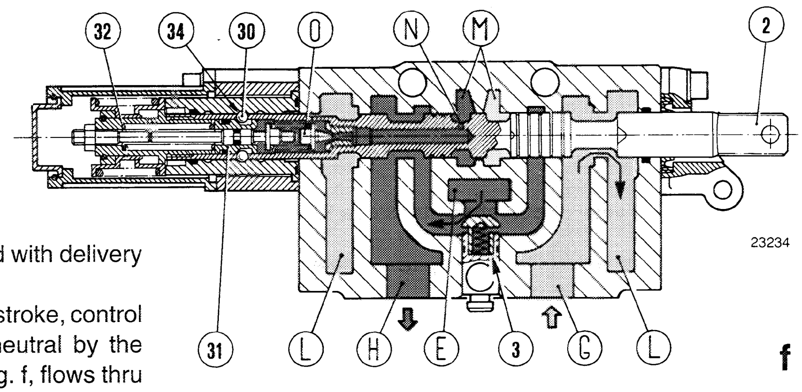
Note – To operate a single–acting cylinder, loosen screw (1).

Print No. **603.54.283.00** – 09 – 1994

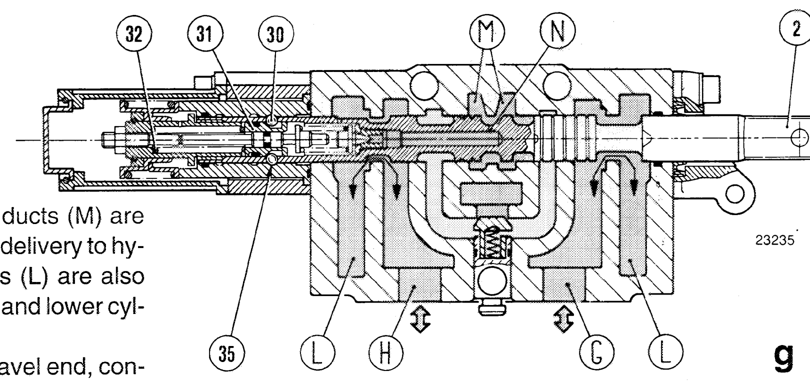
e. LIFTING – When control lever is pulled backwards, the control valve rod (2) is also moved as illustrated; balls (30) fit in the lifting position detent seat (33) and are thereby held by cylinder (31) and spring (32). In this position delivery duct (E) connects to the cylinder lower chamber through check valve (3) and duct (G) and upper chamber to drain duct (L) through duct (H), thus intercepting oil delivery to the hydraulic lift control valve. After completing implement lifting, the lever is brought automatically to neutral position by the higher pressure of circuit oil, which goes through inlet (N), opens fillet (O) at a pressure of 170 ÷ 175 bar. The small cylinder (31) is displaced left and ball (30) is detached from its seat (33). The whole pump delivery is therefore again delivered to lift control valve through ducts (M).



f. LOWERING – To lower the implement, push control lever forward. Control valve rod (2) moves as shown in fig. f. Balls (30) are set into coupling seat (34) associated to lowering position and are kept there by small cylinder (31) and spring (32). This ball position makes oil flow from cylinder lower chamber into outlet (L) through duct (G). Cylinder upper chamber is connected with delivery (E) through duct (H) and check valve (3). When cylinder reaches the bottom end of stroke, control lever is automatically brought back to neutral by the pressurized oil which, thru duct M, see Fig. f, flows thru port (N), opens needle (O) at 170 ÷ 175 bar pressure, moves cylinder (31) towards the left and free balls (30) from detent seats (34).



g. FLOATING – To set the implement in floating position, push control lever completely forward.
Control valve rod (2) is displaced as shown in figure g. and is kept there by balls (30), which fit into coupling position (35) associated to implement floating position. Balls are kept in this seat by small cylinder (31) and spring (32). Both ducts (M) are thus connected and send the whole pump delivery to hydraulic lift control valve. Both outlet ducts (L) are also connected, through ducts (H, G), to upper and lower cylinder chambers respectively.
When control cylinder reaches its lower travel end, control lever is brought automatically to neutral position by the pressure of circuit oil, which flows through duct (M) (see fig. f.) and hole (N). Oil opens fillet (O) at a pressure of 170 ÷ 175 bar and displaces small cylinder (31) to left, thus making small balls (30) be displaced from their seat (34).
The linked implement stays on the soil pressing with its own weight and following the consistency of the soil. In this operating way, hydraulic lift can also be operated. To bring control valve to neutral position, operate on control lever manually, as ducts (M), connected to inlet hole (N), are under pressure and the whole system is connected to the outlets.



Oil in pressure
Oil at intake, delivery or outlet
Oil still

Sectional view of operation step of a automatic detachable KONTAK remote control valve for controlling a double–acting cylinder (figures e, f) and in floating operation (fig. g).

Print No. 603.54.283.00 – 09 – 1994

KONTAK REMOTE CONTROL VALVES
Disassembly – Assembly (Op. 35 204 46)

Proceed as follows:

1. Remove rods of each control valve from control side, after removing covers (4), springs (6) and associated cups (5) (when removing rod from a double–acting control valve with float – fig. c – also recover rod displacing balls 30, small cylinder 31 and spring 32).

On control valves equipped with single to double action switch valve (figures a, b), undo holding plug (9) and then the valve (1);

2. Using pincers, extract valve seat (10) and then check valve (3), recovering also its spring;

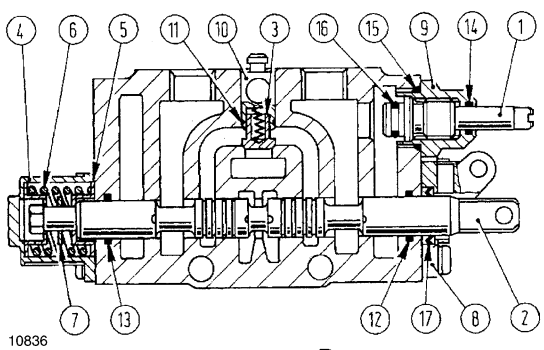
3. Install control valves reversing sequence of removal operations from no. 3 back to no. 1 and following the instructions below:

   a. check gaskets for wear and replace the inefficient ones;

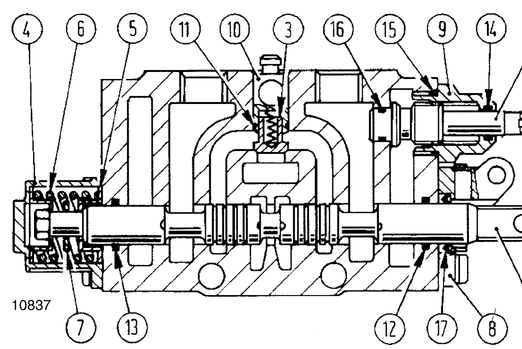
   b. in case of replacement, check that control valve rods are supplied togehter with control valve assy;

   c. see figures below for a proper placing of parts;

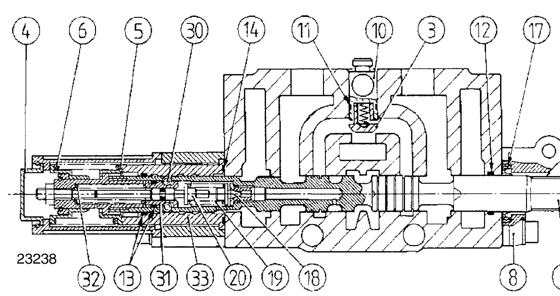
   d. tighten nuts (E, page 35–55) of control valve link rods at a torque of 20 Nm and carry out hydraulic tests as given below:



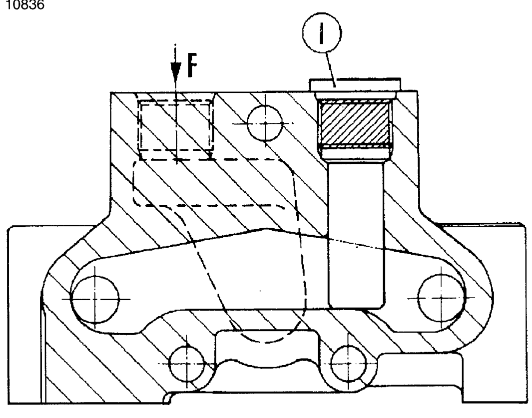
a



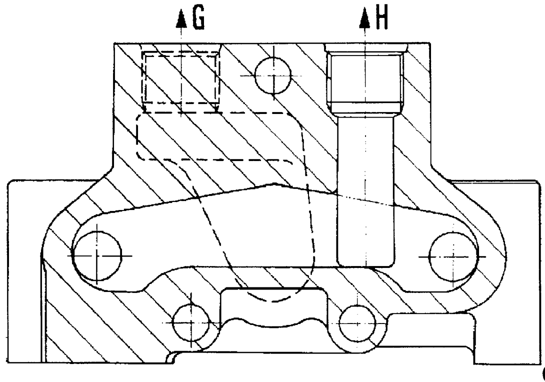
b



c



d



e

Sectional view of KONTAK remote control valves.

A. Remote control valve for single–acting cylinder operation – b. Remote control valve for double–acting cylinder operation – c. Remote control valve for operating a double–acting cylinder with float – d. Inlet side – e. Outlet side – F. Oil delivery from lift pump – G. Outlet connected to lift control valve – H. Pipe connected to hydraulic lift outlet. – I. Plug – 1. Single to double acting switch valve – 2. Control valve rod – 3. Check valve – 4. Cover – 5. Cup – 6. Control rod return spring – 7. Spacer – 8. Control lever holder – 9. Valve (1) holding plug – 10. Check valve seat – 11, 12, 13, 14, 15 and 16. O–ring seals – 17. Seal – 18. Spool – 19. Spool spring – 20. Spool set pin – 21. Front plate – 22. Plug – 23. Duct – 30. Control valve rod displacing balls – 31. Holding cylinder for balls (30) – 32. Spring – 33. Locking bush.

Print No. **603.54.283.00** – 09 – 1994

KONTAK REMOTE CONTROL VALVES
Bench test (Op. 32 204 50)

Note – Work with testing device full of oil IDRAULICAR AP51 (SAE 20W). Tests must be carried out at a temperature of about 60ºC (140ºF) and with a 12.5 litre/min (2.75 gall) output, which can be obtained by making electric motor run at highest rate (1450 rpm).

Control valve rod hardening test (b, b_1)

1. Install remote control valve unit under test and connect valves as shown in scheme (b, b_1), also paying attention to following instructions:

— on control valves pre–set for double–action operation (fig. b), connect both oil delivery holes to cylinders to the two – way fitting, whit alternative delivery (1) through associated ducts (2);

— connect pump to delivery hole (3) and outlet pipe to hole (4);

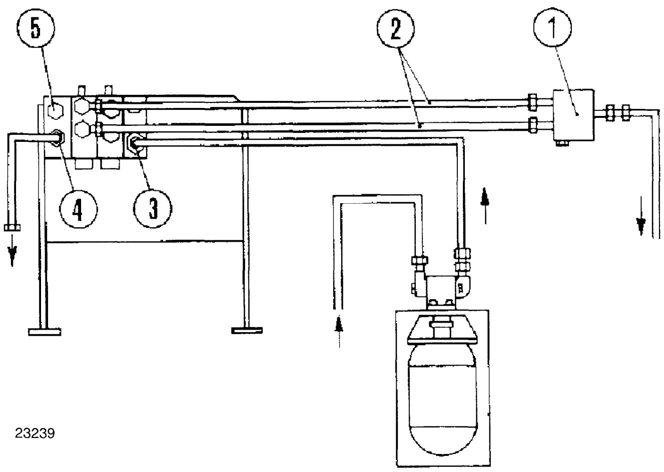
— close other plugs (5)

— on control valves for single–operation (fig. b_1), connect valves as shown in the figure. Connect return pipe (6) to oil delivery hole (7) to cylinder of control valve; all other holes must be closed with plugs (5).

2. Operate hydraulic pump and control valve hand lever (move lever in both directions for double–action control valves);

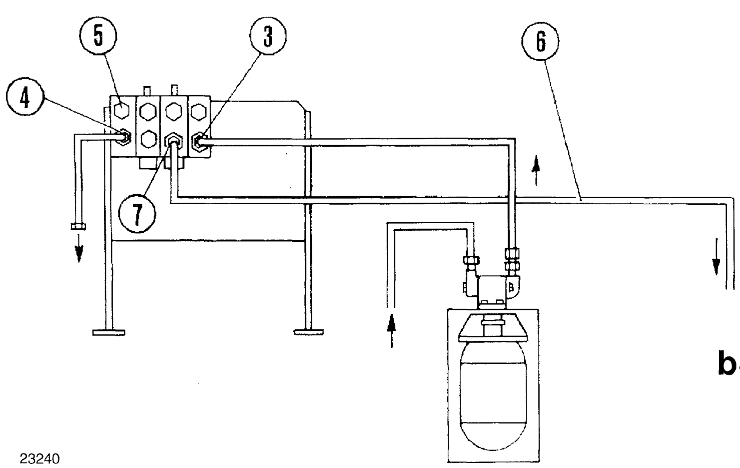
3. Increase pressure gradually working on the handwheel of the testing devices and check that a pressure of 172 bar (175kg/cm^2 / 2489 psi) is shown on the manometre. In this condition, control valve rod must move smoothly and come back to neutral position as soon as associated control lever is released;

4. Repeat the same test on the other control valves, always connecting them according to the instructions.



23239

b



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b_1

Installation diagram of devices and tools for rod hardening tests of double–action control valves (b) and single–action control valves (b_1).

Print No. **603.54.283.00** – 09 – 1994

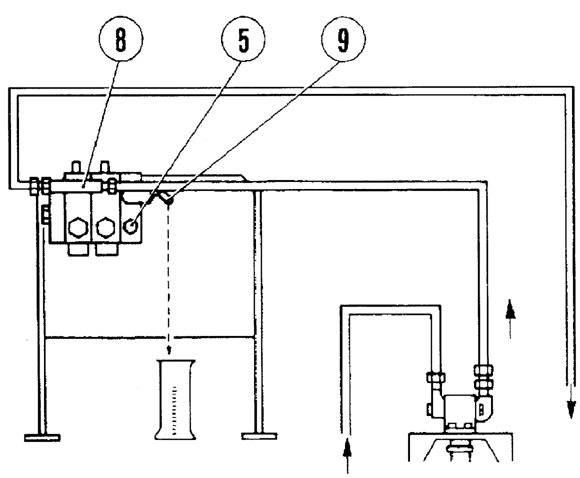
Oil leakage test on KONTAK control valves

5. Install remote control valve unit under test and connect valves as shown in scheme below, paying attention that three–way connection (8) is fixed to delivery (F4) or (F5) of single and double–action control valves.Close other holes with plugs (5).

6. Operate the hydraulic pump and increase pressure gradually working on the handwheel of the testing devices and check that a pressure of 150 bar (147 kg/cm^2 / 2090 psi) is shown on the manometre.

7. Collect oil leaking from connection (9) into the test glass for about a minute and check the oil leakage does not exceed 25 cm^3/min (1.53 cu in/min) on a new control valve and 60 cm3/min (3.66 cu in/min) on a used control valve.

8. Repeat the same test on each control valve, connecting the two delivery pipes (F_4) and (F_5) of associated cylinder separately.



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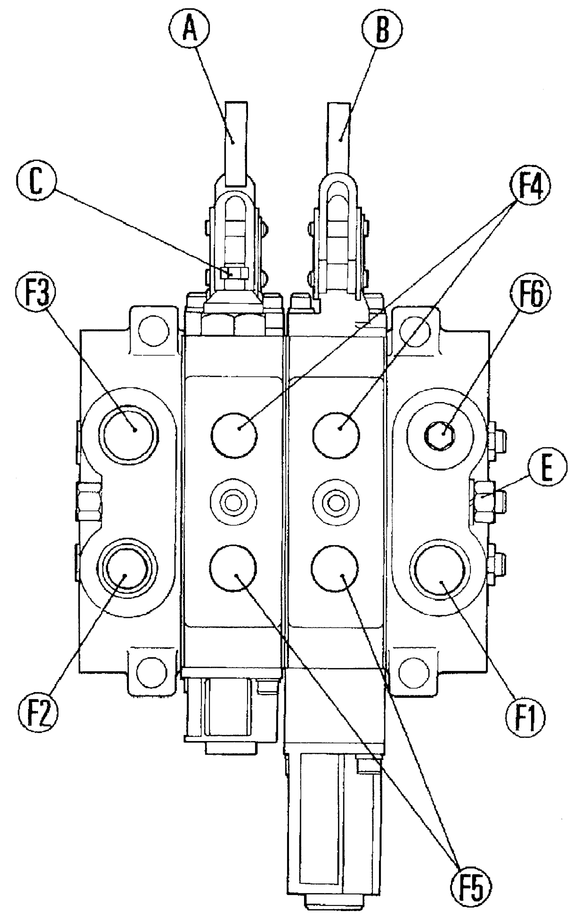
Installation diagram of devices and tools for oil leakage tests of KONTAK control valve rods.



23242

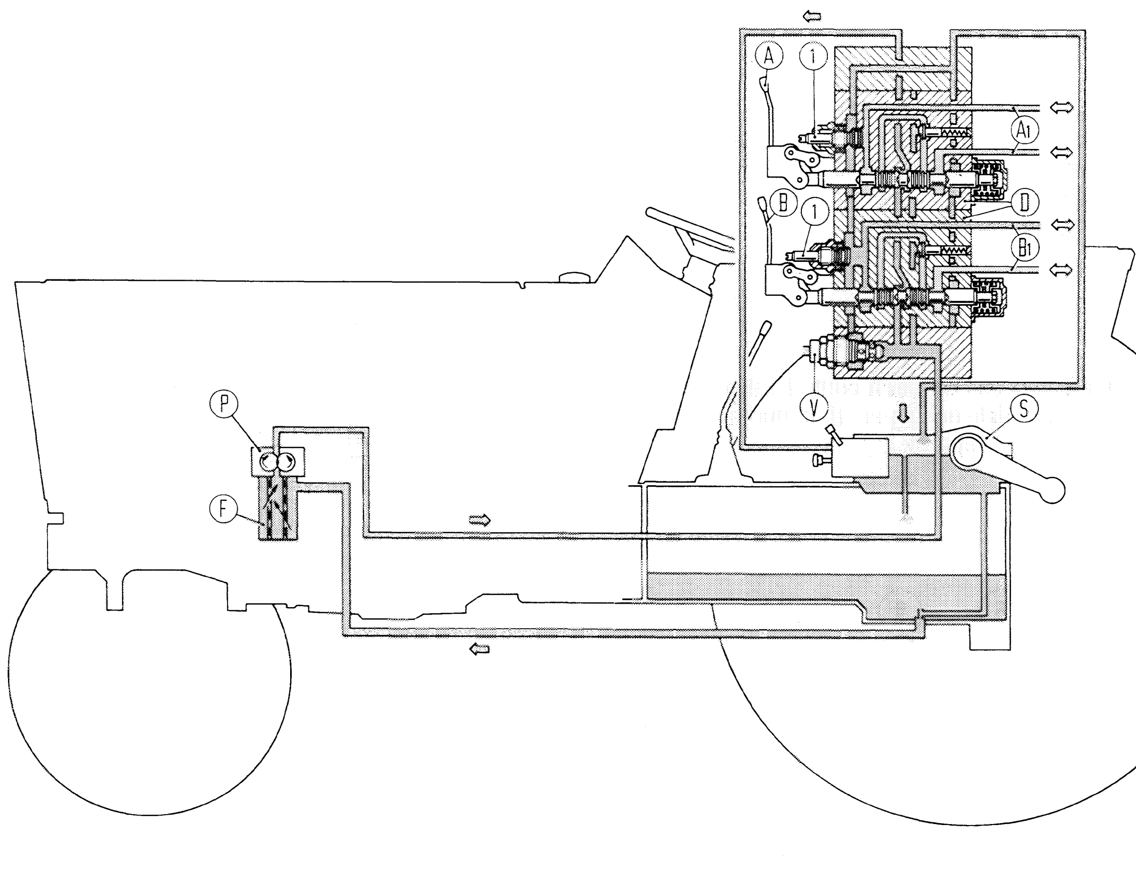
Scheme of pipe connection to KONTAK remote control valves.

A. Single/double–action switchable remote control valve lever – B. Control lever of double–action control valve with float – C. Single/double–action switch valve – F_1. Threaded hole (M22x1.5) for oil pipe connection from hydraulic pump – F_2. Threaded hole (M22x1.5) for oil discharge pipe connection in lift housing – F_3. Threaded hole (M22x1.5) for oil delivery pipe to hydraulic lift control valve – F_4. and F_5. Threaded holes for oil delivery pipes to single or double–acting cylinder – F_6. Threaded plug (M22x1.5).

Print No. **603.54.283.00** – 09 – 1994

DESCRIPTION AND OPERATION – SALAMI REMOTE CONTROL VALVES
(Models 50V – 55V – 60V – 70V – 55F – 60F)

These remote control valves work through slide valve gears and can be use to remote control of linked implements powered by either simple or double acting cylinders. Floating operation is also possible and, upon request, also a control valve for hydraulic braking of trailers can be supplied. (see pages 33–7 through 33–10). To operate the single acting operating cylinder, screw (1) must be completely lose, which must be completely screwed in to operate the double–acting cylinder. Cylinders are mounted in sets of max. three units and are fixed to upper part of fillet cover by means of brackets. Cylinders work using the same oil of the hydraulic lift (i.e. lubrication oil of rear transmission); nevertheless, they are controlled by independent hand lever (A and B). Simultaneous operation of one remote control valve and hydraulic lift is possible because of the **delivery priority regulation valve** (see page 35–59). Pressure relief valve (V) (valve setting 186÷191 bar / 190÷195 kg/cm^2 / 2702÷2773 psi) is fitted into hydraulic lift (see page 35–3); with SALAMI remote control valves mounted, it is installed on control valve inlet plate. Figure below illustrates how oil flows in two control valves (one for operating a single–acting cylinder and one operating the double–acting cylinder) when associated control levers are in neutral position. Oil flows thus from pump through control valve units in the direction as shown by arrows and reaches the lift control valve.



Oil at intake, delivery or outlet

Oil still

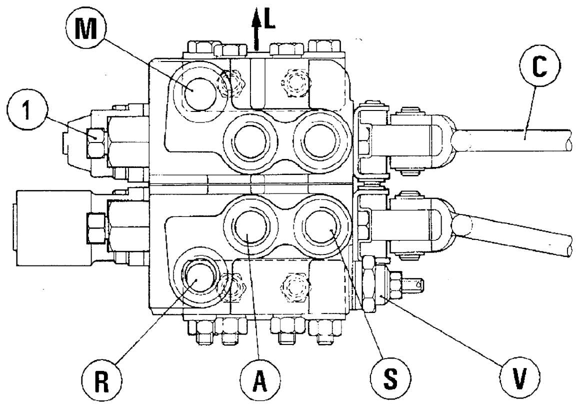
Sectional view of hydraulic circuit of SALAMI remote valves for remote control
(Models 50V – 55V – 60V – 70V – 55F – 60F)

A. Control valve lever for double–acting cylinder operating – B. Control valve lever for single–acting cylinder operating – A_1, B_1 – Female half–joints for single– and double–acting cylinders – D. Remote control valves – F. Oil filter with paper cartridge for total delivery on pump intake (common with hydraulic lift) – P. Hydraulic delivery pump (common with hydraulic lift) – S. Hydraulic lift housing – V. Pressure relief valve – 1. Single to double action switch screw.

Print No. 603.54.283.00 – 09 – 1994

Operating steps of a SALAMI switchable remote control valve to operate a double–acting cylinder (descriptions a, b)

Note – To operate a double–acting cylinder, tighten screw (1) to close connection of line (S) with line (M) for delivery to lift control valve.



23244

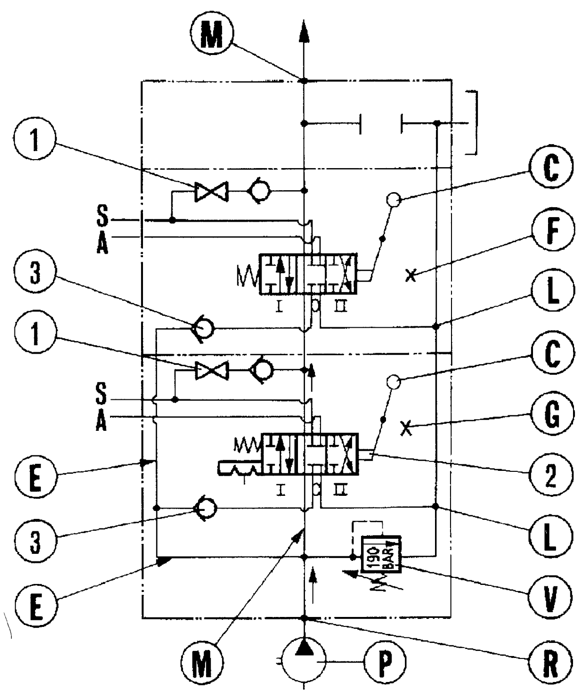
a. LIFTING – When lever (C) is pulled backwards, control valve rod (2) is also moved right to position (I) and closes duct (M) through which pressurized oil from pump (P) flows to lift control valve. Consequently, check valve (3) opens making pipe (E) to deliver oil into cylinder lower chamber through duct (S) and cylinder upper chamber discharge into outlet (L) through duct (A), catching oil delivered to hydraulic lift control valve. Keeping lever back, lifting is brought to cylinder end travel. After releasing, lever return spring brings the lever automatically to neutral position and the whole pump delivery is sent to lift control valve through delivery pipes (M).

Note – If control valve is double–acting with lock (G) in position I and II, lever (C) has to be unlocked manually when cylinder comes to its upper travel end.

b. LOWERING – To lower the implement, push control lever (C) forward. Control valve rod (2) moves to left position II, closes duct (M) and makes oil flow from cylinder lower chamber into outlet (L) through duct (S). Cylinder upper chamber is connected with delivery (E) through duct (A) and check valve (3).

Note – If control valve is double–acting with lock (G) in position I and II, lever (C) has to be unlocked manually when cylinder comes to its lower travel end.

To hydraulic lift control valve



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c. LIFTING – When lever (C) is taken backwards, the control valve rod (2) is also moved to right position I and closes duct (M) through which pressurized oil from pump (P) flows to lift control valve. Consequently, check valve (3) opens making pipe (E) to deliver oil into cylinder lower chamber through duct (S). Duct (H), which is used to operate double–acting cylinders, remains still in this step, as it is steadily connected to delivery from hydraulic lift (M) to control valve (L) by switching valve (1). Further, cylinder upper chamber is connected to outlet (L) through ducts (D), so that no lifting occurs.

Note – If control valve is double–acting with lock in position I and II, lever (C) has to be unlocked manually.

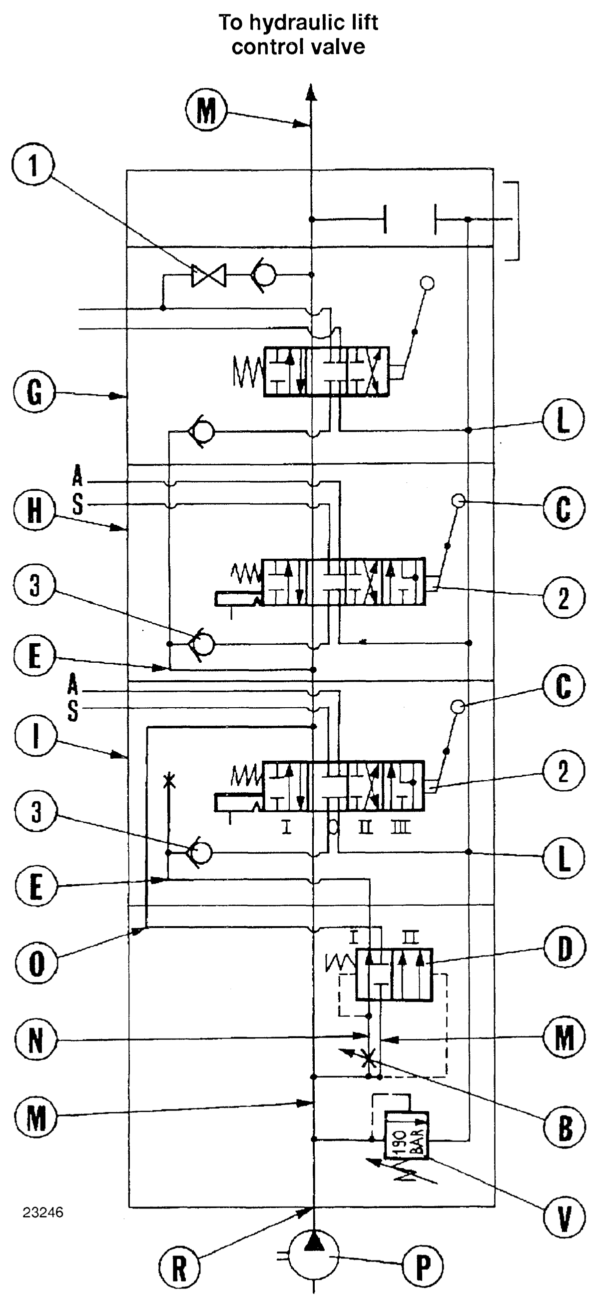
d. LOWERING – When control lever (C) is pushed forward, control valve rod (2) is moved to left position II and closes duct (M). Under the weight of the implement, cylinder oil flows to outlet (L) through duct (S) and all pump delivery is sent to cylinder upper chamber through check valve (3) and duct (A).

When the cylinder controlled by valve (G) is in its lower travel end, the whole pump delivery goes to control valve (F) or to lift control valve, through duct (E).

Operating steps of a SALAMI switchable remote control valve to operate a double–acting cylinder (descriptions c, d)

A. Connection pipe to cylinder upper chamber – C. Control lever – E. Delivery to control valves – F. Single/double action control valve – G. Single/double–action control valve with locking – L Outlet – M. Delivery to lift control valve – P. Pump – R. Intake from pump (P) – S. Connection pipe to cylinder lower chamber – V. Pressure relief valve – 1. Single to double action switch valve – 2. Control valve rod – 3. Check valve.

Note – To operate a double–acting cylinder, tighten screw (1) to close connection of line (S) with line (M) for delivery to lift control valve.



e. LIFTING – When control lever (C) is pulled backwards, the control valve rod (2) is also moved to right position I and closes duct (M) in which pressurized oil from pump (P) flows to lift control valve. Consequently, check valve (3) opens making pipe (E) to deliver oil into cylinder lower chamber through duct (S) and cylinder upper chamber discharge into outlet (L) through duct (A), catching oil (M) delivered to hydraulic lift control valve. Keeping lever backwards, implement lifting stops when the cylinder reaches its travel end. When released, lever is brought automatically to neutral position by the return spring and the whole pump delivery is sent again to lift control valve through ducts (M).

f. LOWERING – To lower the implement, push control lever (C) forward. Control valve rod (2) moves to lift position II and closes duct (M). This position makes oil flow from cylinder lower chamber into outlet (L) through duct (S). Cylinder upper chamber is connected with delivery (E) through duct (A) and check valve (3).

g. FLOATING – To set the implement in floating position, push control lever (C) completely forward.
Control valve rod (2) is displaced to position II and is kept there by ball (08, page 35–60), which is locked in seat on pin (13) by spring (15) and guide (09). In this position, ducts (M) are connected and send the whole pump delivery to either hydraulic lift control valve or one of control valve (G) or (H). Outlet (L) is connected to ducts (A, S), with cylinder upper and lower chamber respectively.
The linked implement stays on the soil pressing with its own weight and following the consistency of the soil. In this operating way, hydraulic lift or one of control valves (G) or (H) can also be operated.

Note – To bring back control valve rod (2) to NEUTRAL position, operate on control lever (C) manually taking it backwards, so that ball (08, page 35–60) is unlocked from return spring on part (13).

Sectional view of operation step of a SALAMI remote control valve for controlling a double–acting cylinder (descriptions e, f) and in floating operation (manual lock and unlock – description g).

A. Connection pipe to cylinder upper chamber – B. Delivery regulator – C. Control lever – D. Plunger – E. Delivery to control valves – G. Switchable single/double–action control valve – H. e I. Double–action remote control valves with float – L. Outlet – M. Delivery to lift control valve – N. Connection duct from delivery (M) to outlet – P. Pump – R. Inlet from pump (P) – S. Connection duct to cylinder lower chamber – V. Pressure relief valve – 1. Single to double action switch valve – 2. Control valve rod – 3. Check valve.

Print No. 603.54.283.00 – 09 – 1994

A) MAIN DELIVERY REGULATOR (B) (see scheme on page 35–58 and figure below).

When delivery regulation valve (B) is completely closed and knob (6) is tight as shown in figure below, a coupling between collar (4) and seat on valve unit makes it possible for oil to flow to first control valve (I), with a minimum delivery of 8 litre/min (1.76 gall). Pressurized oil from pump (P, page 35–58) comes to duct (M) and flows through duct (N) and then through collar (4), going to duct (E) to feed the main control valve (I). Simultaneously, oil from pump delivery in duct (M) flows through inner chamber holes and displaces plunger (D) upside to position II (see page 35–58). Duct (M) is thus connected to duct (O) to feed hydraulic lift control valve or the downside control valves (H) and (G), using the rest delivery from pump.

Turning knob (6) left, oil flow opening from collar (4) and seat on valve unit is increased and so the main delivery through ducts (N) and (E) and to control valve (I). With knob (6) completely open, the whole pump delivery (40 litre/min / 8.80 gall/min)) is obtained.

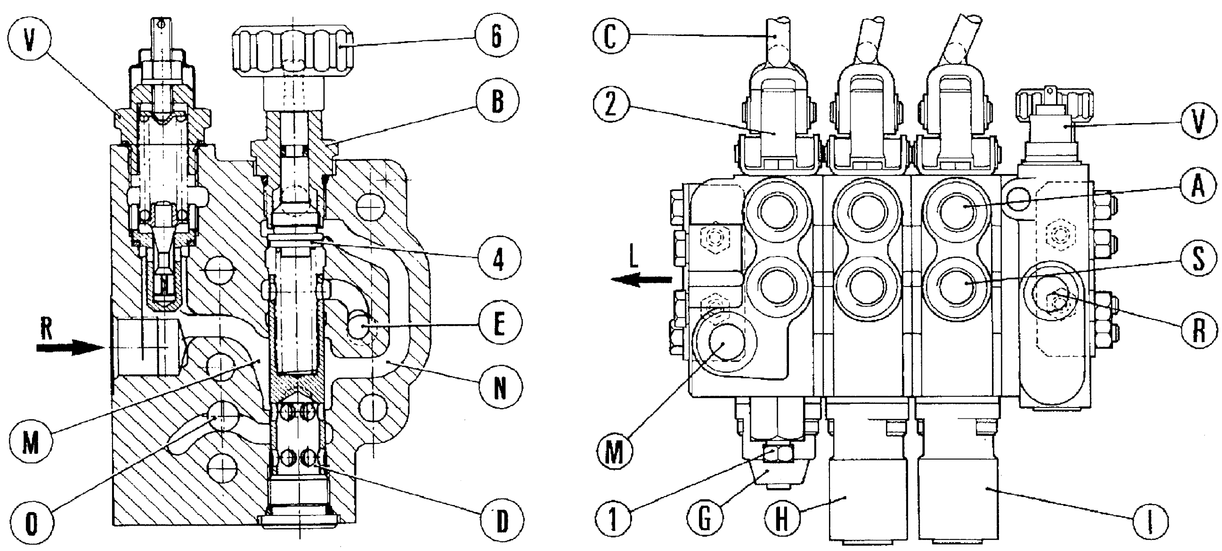
Delivery regulator makes it possible to operate using all three different control valves (G), (H) and (I) and also with lift, bearing in mind that valve (4) regulates main delivery on control valve (I) and, consequently, also on downside control valves (H) and (G) and on lift control valve.

The following three cases are possible:

1st case – Operating according to first working step, a regulated delivery comes from outlets and can be regulated from some litre/min to full delivery.

2nd case – Operating with any working step, from 2nd step onwards a full delivery is given.

3rd case – Operating with first and any of other working steps simultaneously, a regulated delivery is given from outlet of first working step while from the other outlets the remaining delivery available occurs.
In this third case, two separate circuits are operating.

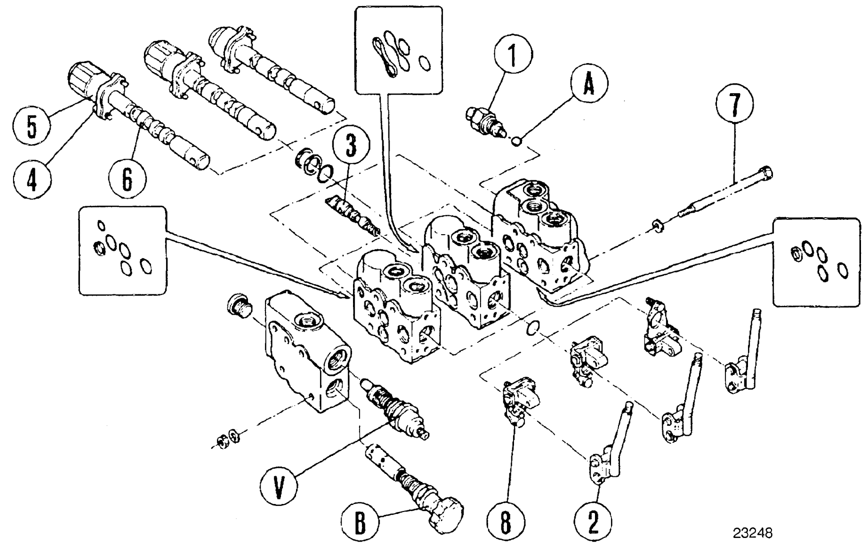


23247

Three–element SALAMI battery (no.1 single–double action, switchable + no.2 single–double action with float), complete with pressure relief valve, delivery regulation valve and single to double action switch valve.

A. Connection pipe to cylinder upper chamber – B. Delivery regulator – C. Control lever – D. Plunger – E. Delivery to control valves – G. Switchable single/double–action control valve – H. and I. Double–action remote control valve with float – L. Outlet – M. Delivery to lift control valve – N. Connection duct from intake to outlet delivery ducts (M) – R. Intake from pump – S. Connection duct to cylinder lower chamber – V. Pressure relief valve – 1. Single–double action switch valve – 2. Control valve rod – 4. Collar of delivery regulation valve – 5. Spring – 6. Main valve regulation knob.

Print No. 603.54.283.00 – 09 – 1994



23248

SALAMI REMOTE CONTROL VALVES
Disassembly – Assembly (Op. 35 204 46)

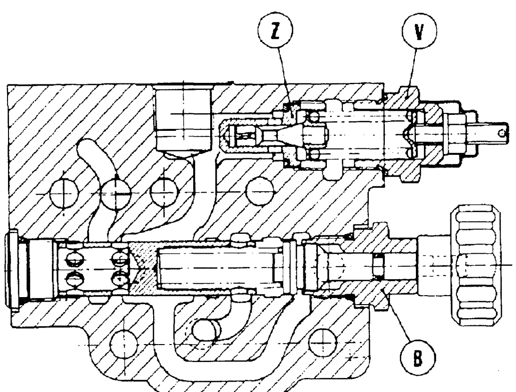
1. Remove holding screws (7).

2. Remove locking pins (2) to front covers (8).

3. Remove holding screws and front covers (8).

4. Remove holding screws (4) and reassemble rear covers (5) complete with control valve rod (6).

5. Remove single to double action switch valve (1) and recover ball (A).

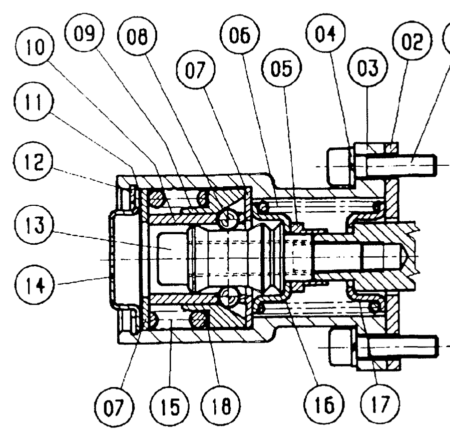


23249

6. Remove pressure relief valve (V) bearing in mind part (Z) must be removed with wrench **293463** and inner parts must be recovered.

7. Remove delivery regulator (B) and recover inner parts.

8. Remove check valves (3) with all inner parts.



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9. To remover rear covers (5), remove circlip (12), cup (14) and all inner parts.

10. Install control valves reversing the sequence of removal operations from no. 9 back to no. 1 and following instructions below:

    a. Check seals and gaskets for wear and replace the inefficient ones.

    b. Refer to figures below for right placing of parts.

    c. Carry out hydraulic tests as specified in following pages.

Print No. **603.54.283.00** – 09 – 1994

SALAMI REMOTE CONTROL VALVES
Bench tests (Op. 35 204 50)

Note – Work with testing device full of oil IDRAULIPCAR AP51 (SAE 20W). Tests must be carried out at a temperature of about 60 °C (140°F) and with a 12.5 litre/min (2.75 gall/min) output, which can be obtained by making electric motor run at highest rate (1450 rpm).

Hardening test on control valve rod (b, b_1)

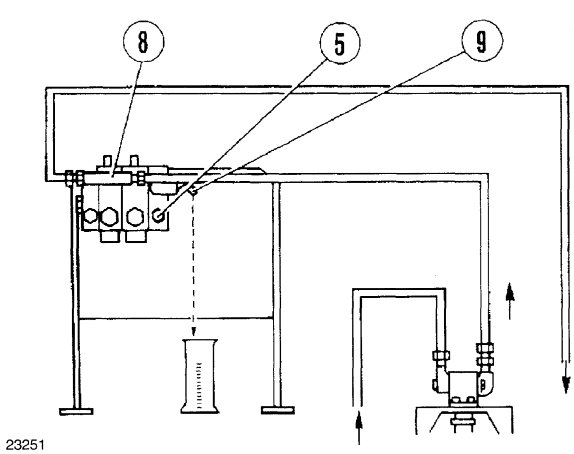
See descriptions on page 35–54 (**Op. 1 through 4**) relevant to KONTAK control valves

Oil leakage on control valves (c)

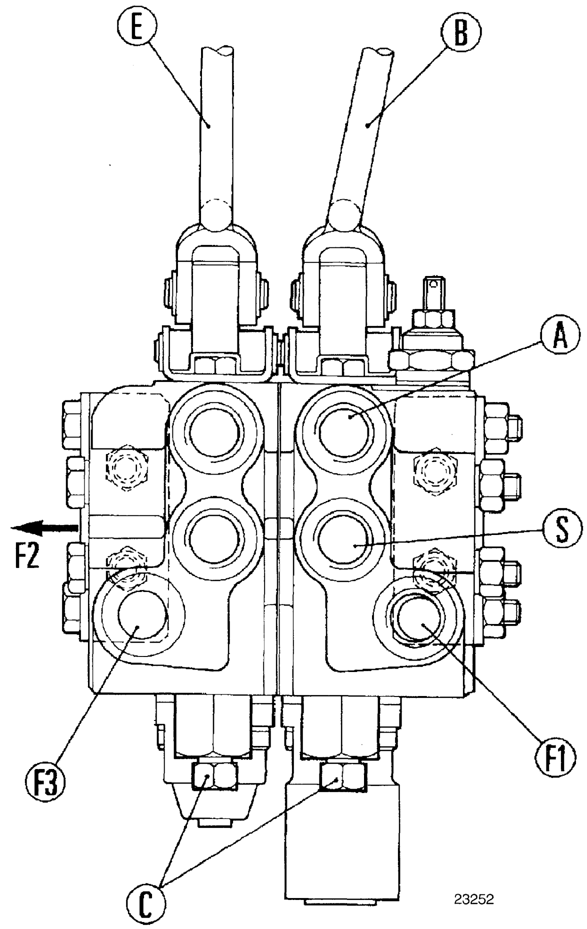
5. Install remote control valve unit under test and connect valves as shown in scheme below making sure the three–way connection (8) must be connected on delivery (A) or (S) of control valves with single and double action. Close other plugs (5)

6. Operate the hydraulic pump and increase pressure gradually working on the handwheel of the testing devices and check that a pressure of 150 bar (147 kg/cm^2 / 2090 psi) is shown on the manometre.

7. Collect oil leaking from connection (9) into the test glass for about a minute and check the oil leakage does not exceed 25 cm^3/min (1.53 cu in/min) on a new control valve and 60 cm^3/min (3.66 cuin/min) on a used control valve.
Repeat the same test on each control valve, connecting the two delivery pipes (A) and (S) of associated cylinder separately.



Installation diagram of devices and tools for oil leakage tests of control valve rods.



Scheme of pipe connection to remote control valves.

A. Delivery hole to upper chamber of single–double acting cylinder – B. Double–action switchable remote control valve lever – C. Single/double–action switch valve – E. Single to double action switchable control valve lever – F_1. Threaded hole for oil pipe connection from hydraulic pump – F_2. Threaded hole for oil discharge pipe connection in lift housing – F_3. Threaded hole for oil delivery pipe to hydraulic lift control valve –S. Threaded holes for oil delivery pipes to lower chamber of single or double–acting cylinder.

Print No. **603.54.283.00** – 09 – 1994

Print No. **603.54.283.00** – 09 – 1994

HYDROSTATIC STEERING

Type	hydrostatic control
Manufacturer	DANFOSS
Hydraulic circuit	indipendent feeding by oil pump
Oil reservoir	transparent plastic material, installed on the engine RH side
Oil filter	metal cartridge, incorporated in oil reservoir
Control valve manufacturer	DANFOSS
Type	distributor–type valve, direct steering column control; steering feasible in case of hydraulic pump failure
Model description and denomination:	
– DANFOSS (valves incorporated in control valve unit)	OSPC 100
Relief valve (24, page 41–3) pressure setting:	
– on 4WD models 62DTF – 72DTF – 82DTF – 72DTLP – 82DTLP ... bar	100 (102 kg/cm^2 – 1450 psi)
On all other models, 2WD and 4WD ... bar	70 (71,4 kg/cm^2 – 1015 psi)
Cylinder safety valve (33, page 41–3) pressure setting:	
– on 4WD models 62DTF – 72DTF – 82DTF – 72DTLP – 82DTLP ... bar	160 (163 kg/cm^2 – 2320 psi)
On all other models, 2WD and 4WD ... bar	140 (143 kg/cm^2 – 2030 psi)
Operating cylinder:	
Type	double–acting, hinged to live axle on 4WD models or to front axle on 2WD models

HYDROSTATIC STEERING OIL PUMP

Type	gear
Model	C 25
Manufacturer	FIAT
Comando	engine timing gear–driven
Sense of rotation (looking from driver's seat)	clockwise
Engine/pump speed ratio (models 62DTF – 72DTF – 82DTF)	1:1
Engine/pump speed ratio (all other models)	1:1.08

(continues)

Print No. ***603.54.283.00*** *– 09 – 1994*

HYDROSTATIC STEERING OIL PUMP

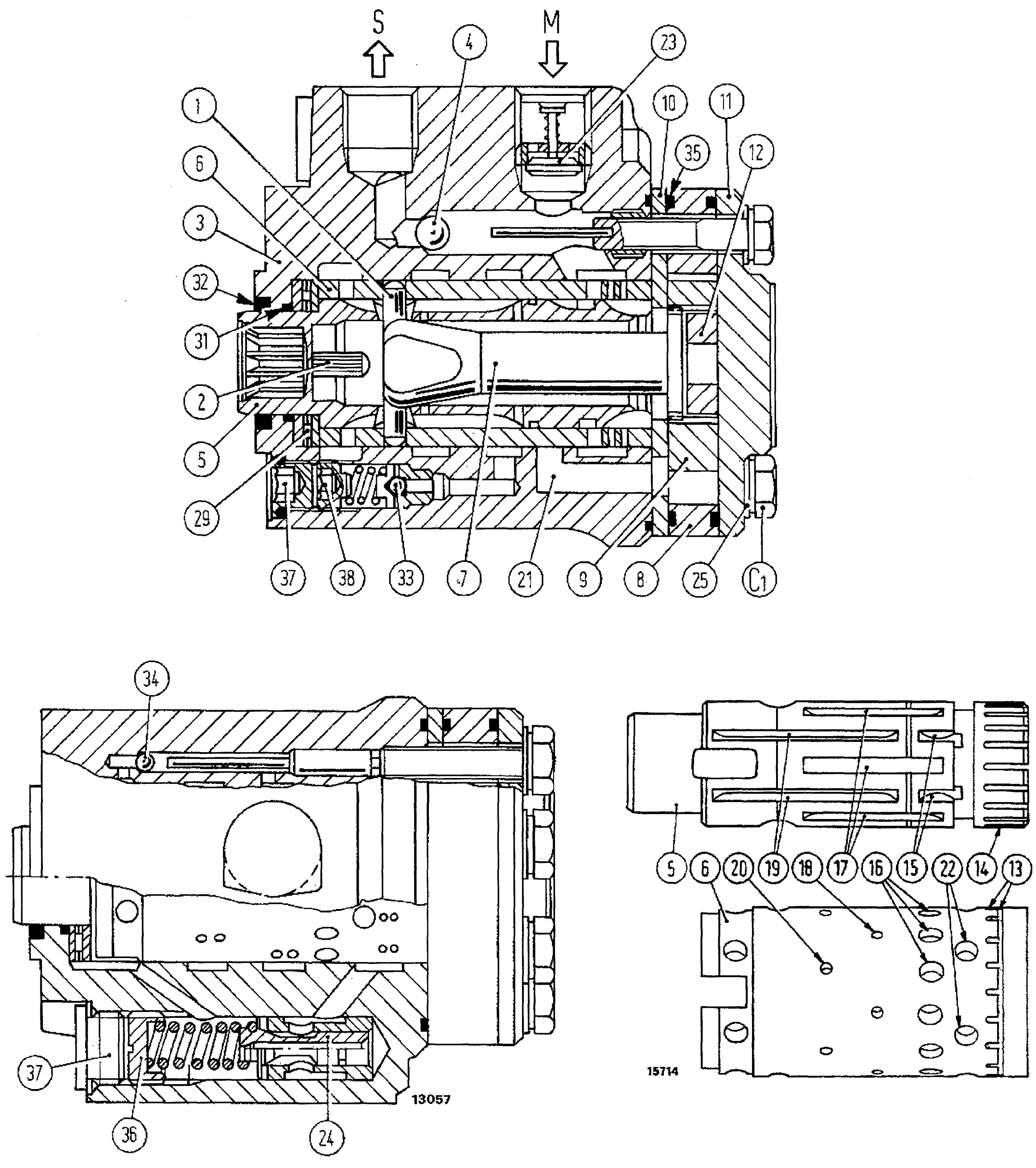
(follows)

Pump speed with engine running at rated speed (2500 rpm):	
– models 62DTF – 72DTF – 82DTF .... rpm	2500
– all other models .... rpm	2700
Nominal pump output with engine running at rated speed (2500 rpm):	
– models 62DTF – 72DTF – 82DTF .... l/min (UK/US gal/min)	28.4 (6.25/7.50)
– all other models .... l/min (UK/US gal/min)	30.6 (6.73/8.08)
Test bench output at 1450 rpm and 68.5 bar (70 kg/cm^2 – 993 psi) pressure (all models):	
– new or reconditioned pump .... l/min (UK/US gal/min)	15.3 (3.37/4.04)
– used pump .... l/min (UK/US gal/min)	10.7 (2.35/2.82)
– test fluid temperature .... °C	55 ÷ 65
– test fluid viscosity	SAE 20
Drive/driven gear dia. .... mm (in)	17.400 ÷ 17.418 (.6850 ÷ .6857)
Shaft seat bore dia. .... mm (in)	17.450 ÷ 17.470 (.6870 ÷ .6878)
Shaft/bore clearance fit .... mm (in)	0.032 ÷ 0.070 (.0013 ÷ .0028)
Maximum permissible wear limit .... mm (in)	0.1 (.004)
Gear/pump case radial clearance .... mm (in)	0.020 ÷ 0.064 (.0008 ÷ .0025)
Maximum permissible pump housing wear, oil intake side corresponding to gear width .... mm (in)	0.1 (.004)
Gear width .... mm (in)	18.323 ÷ 18.348 (.7214 ÷ .7224)
Gear bearing width .... mm (in)	19.796 ÷ 19.812 (.7794 ÷ .7800)
Gear–bearing seat width in pump case .... mm (in)	58.072 ÷ 58.122 (2.2863 ÷ 2.2883)
Gear–bearing end play in pump case (overhauling also) ..... mm (in)	0.1 ÷ 0.2 (.004 ÷ .008)

TORQUE WRENCH DATA

DESCRIPTION	Thread size	Torque	
		Nm	kgm/ft–lb
Hydrostating steering unit attachment screws	3/8"–16 UNC	44	4.5/32.5
Hydrostatic steering case cover attachment screw (C_1, page 41–3)	M 8 x 1	34	3.5/25.3
Hydraulic cylinder pivot pin holding nut	M 18 x 1,5	294	30/217
Steering cylinder rod/knuckle arm holding nut	M 14 x 1,5	147	15/108
Hydrostatic steering oil pump attachment screw (C_1, page 41–23) ...	M 6 x 1	8	0.8/5.8
Oil pump cover attachment screw nut (C_4, Fig. 41–23)	M 10 x 1.25	39	4/29
Drive sleeve/oil pump shaft lock nut (C_3, page 41–23)	7/16"–20UNF –2B	28	2.8/20.2
Hydrostatic steering unit support attachment screw	M 16 x 1.5	147	15/108

Print No. 603.54.283.00 – 09 – 1994



Sectional views through the hydrostatic steering control valve

C_1. Control valve cover screws – M. Pump delivery – S. Discharge – 1. Drive pin, sleeve (6) and rotor shaft (7) – 2. Sleeve (6) return springs – 3. Control valve housing – 4. Check valve – 5. Rotary valve – 6. Sleeve, valve (5) seat – 7. Rotor (9) drive shaft – 8. Rotor stationary ring – 9. Rotor – 10. Abutment plate 11. Cover – 12. Spacer – 13 and 14. Oil ducts in neutral – 15. Rotor feeding grooves (q.ty:6) – 16. Oil ducts (q.ty:12) communicating with grooves (15 and 17), alternatively – 17. Oil grooves (q.ty:6) to power cylinder connecting with rotor outlet oil grooves and ducts (18 and 20) – 18. Power cylinder RH chamber outlet or exhaust oil ducts (q.ty:6) – 19. Power cylinder exhaust oil grooves (q.ty:6) communicating with ports (18 and 20) – 20. Power cylinder LH chamber outlet or exhaust oil ports (q.ty:6) – 21. Oil grooves connecting ducts (16) to rotor inlet or outlet compartments – 22. Feed ducts to oil grooves (15) – 23. Check valve – 24 Pressure relief valve – 25. Washer – 26. Connecting line to power cylinder LH chamber – 27. Connecting line to power cylinder RH chamber – 29. Thrust bearing – 31. Oil seals – 32. Dust shield – 33. Power cylinder safety valves – 34. Back–flow valves – 35. O–ring seals – 36. Valve (24) set screws – 37. Plugs 38. Valve (33) set screw.

Print No. **603.54.283.00** – 09 – 1994

HYDROSTATIC STEERING TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Oil leakage at hydrostatic unit: **a. Drive end.** **b. Cover end.**	**1.** Faulty O–ring seal (31, page 41–3)	Replace oil seal and associated dust shield using the **293388** special tool.
	2. Poor tightening of screws (C_1).	Tighten capscrews to specified torque (see page 41–2).
	3. Faulty gaskets (25) or O–ring seals (35).	Replace gaskets and seals.
Excessively hard steering wheel.	**1.** Inefficient hydraulic pump.	Rectify pump operation.
	2. Check valve (4, page 41–3) stuck open, presence of impurities or missing ball.	Remove impurities and clean filter; fit a new ball in valve seat (if missing).
	3. Misadjusted pressure relief valve (24).	Adjust valve pressure setting.
	4. Pressure relief valve (24) stuck or open due to presence of foreign matter.	Remove foreign matter and clean filter (E, page 41–20). If problem persists, replace control valve.
	5. Steering column binding in bushing owing tu rust, seizure, etc.	Rectify causes.
Excessive play at steering wheel.	**1.** Excessive play of steering column with rotary valve (5, page 41–3).	Replace worn parts.
	2. Excessive play of shaft (7) with drive pin (1).	Replace worn parts.
	3. Excessive shaft (7) and rotor (9) coupling spline backlash.	Replace worn parts.
	4. Summation of previous assembly plays and clerance fits.	Replace parts evidencing more wear.
	5. Broken or weakened leaf springs (2).	Replace springs.
Steering wheel turns normally but:	**1.** Poor fluid tightness of power cylinder seal.	Replace seal.
a. Steering effect is too slow.	**2.** Cylinder rod failure.	Replace damaged part.
b. No steering effect.	**3.** Rotor shaft (7, page 41–3) or pin (1) failure.	Replace damaged part.
With engine shut–off, steering wheel can be turned but is inoperative.	**1.** Excessive wear between rotor (9, page 41–3) and stationary ring (8).	Replace worn parts.
	2. Damaged check valve (23).	Replace control valve.
	3. Power cylinder safety valves (33) stuck open owing to the presence of foreign matter or because damaged.	Remove foreign matter and clean filter or replace control valve.

(continues)

Print No. ***603.54.283.00*** *– 09 – 1994*

HYDROSTATIC STEERING TROUBLESHOOTING GUIDE

(follows)

Problem	Possible cause	Correction
Jerking and chattering at steering wheel, steering out–of–control, tractor wheels steering in direction opposite to selection.	1. Wrong hydrostatic phasing.	Rectify phasing.
	2. Reversed position of oil lines to power cylinder.	Rectify connections.
Impossible to hold selected course, continuous corrections needed.	1. Insufficient oil level in hydraulic system reservoir.	Top up to correct level and bleed system by following directions on page 41–23.
	2. Worn cylinder piston gland.	Replace gland.
	3. Power cylinder safety valves (33, page 41–3) or back–flow valves stuck open owing to presence of impurities or because damaged.	Remove impurities and clean filter or replace control valve.
	4. Control valve mechanical wear.	Replace control valve.
Impossible to obtain and hold hydrostatics in neutral. Manual steering operates normally; ceasing this, steeringwheel tends to turn on its own, or remain stationary but steering action slowly continues along the direction originally selected ("motoring" effect), requiring continued corrections of the steering wheel asset.	1. Broken or weakened leaf springs (2, page 41–3) calling back sleeve (6) to neutral.	Replace leaf spring pack.
	2. Sleeve (6) and rotary valve (5) stuck in delievery position because of interposed foreign matter.	Remove foreign matter and clean filter.
	3. Sleeve (6) squeezing on rotary valve (5) owing to excessive fluid pressure.	Check relief valve (24, page 41–3) pressure setting.
Front wheel shimmy.	1. Air inside power cylinder.	Bleed system and remove causes of any entry of air.
	2. Worn steering linkage mechanical joints.	Replace worn parts.
	3. Power cylinder safety valves (33, page 41–3) or check valve (34) stuck open owing to presence of impurities or because damaged.	Remove impurities and clean filter or replace control valve.
Difficult steering in general or in one direction only.	1. Insufficient oil pressure.	Check oil pump and releif valve (24, page 41–3) pressure setting.
	2. Poor fluid tightness inside control valve.	Replace control valve.
	3. Misadjusted power cylinder safety valves (33, page 41–3) or presence of drillings or foreign particles preventing correct tightness of either valve.	Remove impurities and clean filter. If problem persists, replace control valve.

Print No. **603.54.283.00** – 09 – 1994

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **(X)**.
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used in conjunction with the suggeseted special tools listed below and further integrated with the self–made ones for which you will find the necessary working drawings and specifications directly on this manual.

List of the special tools necessary to perform service operations covered by this section of the Manual:

X293388	Installer, power steering, O–ring.
293389	Installer, power steering, rotary valve spring.
293390	Retainer, power steering rotor shaft.
292870	Tester, power steering relief valve (with **293160** connection).
X291182/1	Puller, steering wheel.

HYDROSTATIC CYLINDER CONTROL VALVE
Removal–Installation (Operation 41 204 30)

⚠ CAUTION ⚠

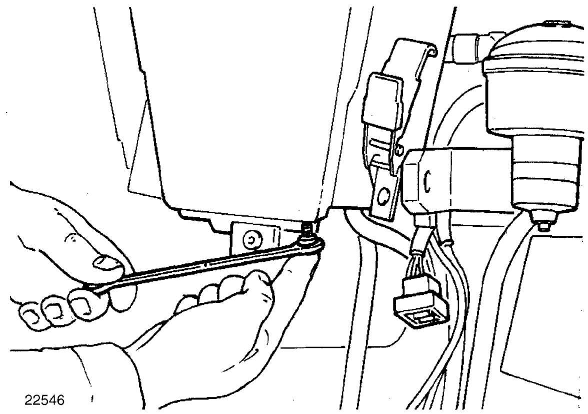
Handle all parts carefully. Do not put hands or fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

To remove the hydrostatic cylinder control valve proceed as further indicated.

1. Raise hood.

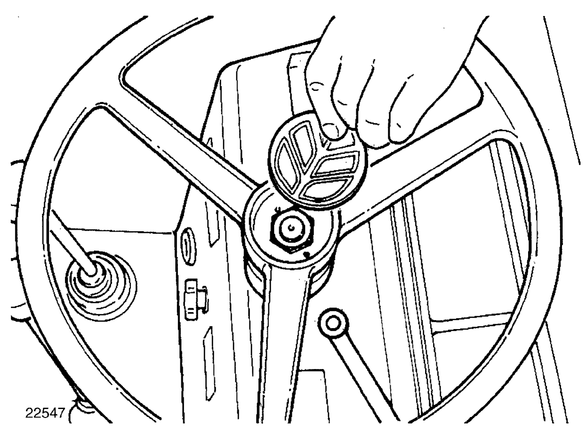
2. Disconnect battery cables.

3. Drain hydrostatic fluid reservoir.



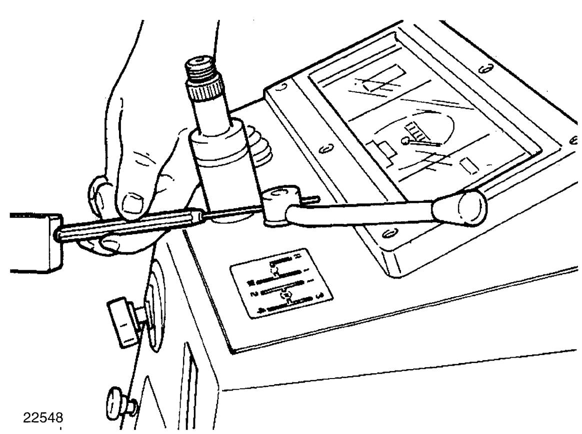
22546

4. Remove console holding screws.



22547

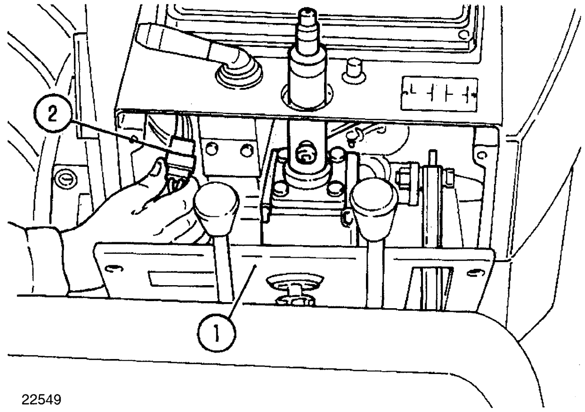
5. Remove the lobe at steering wheel center, then the lock nut, the steering wheel using the **291182/1** puller, and, finally, the bellow gasket underneath.



22548

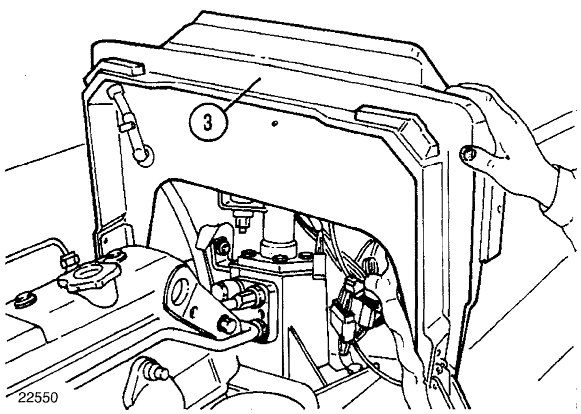
6. Remove cotter pin and hand throttle lever.

*Print No. **603.54.283.00** – 09 – 1994*



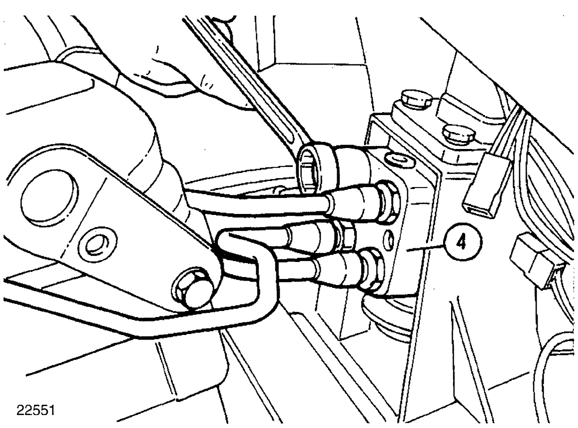
22549

7. Undo holding screws, remove dashboard cover (1) and light, indicator and horn electrical connections (2).



22550

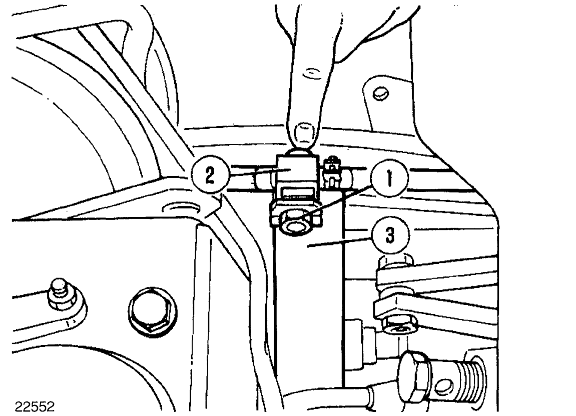
8. Lift console (3) and move it towards tractor seat with all electrical cables.



22551

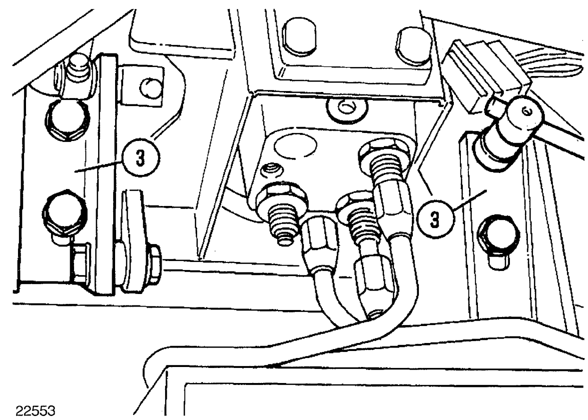
9. Remove hydraulic connections and piping from hydrostatic unit (4), and precisely:
– pump delivery line connections;
– power cylinder feed line connections;
– back–flow recivery connection at reservoir.

Note – Plug holes to prevent entry of foreign matter.



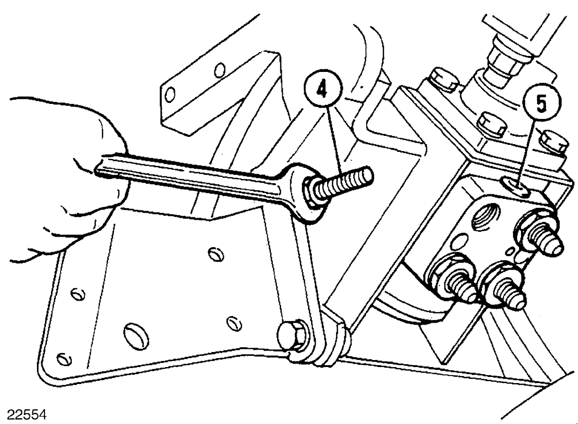
22552

10. Remove lock nut (1) and fuel tap (2) from safety frame reinforcing brackets (3).



22553

11. Undo holding screws and remove safety frame reinforcing brackets (3).



22554

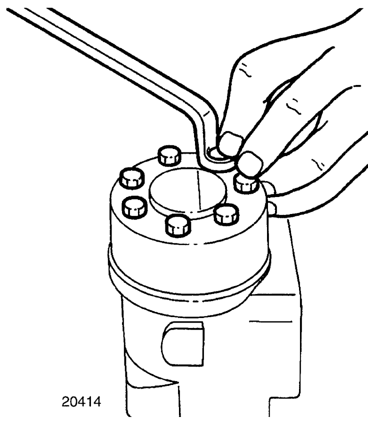
12. Undo the power take–off rod adjustment nut (4) and remove hydrostatic assembly (5).

13. Re-install the hydrostatic steering control valve in accordance with the following instructions and information:
a. proceed by reversing the previous removal sequence of operations starting from no. 12 back to no. 1;
b. pay a particular attention to the correct alignment of the holes on the hydrostatic steering control valve with the associated attachment screws on the steering column.

Print No. ***603.54.283.00*** *– 09 – 1994*

HYDROSTATIC STEERING CONTROL VALVE
Disassembly–Assembly with control valve removed
(Operation 41 204 34)

To disassemble the control valve, proceed as further indicated.

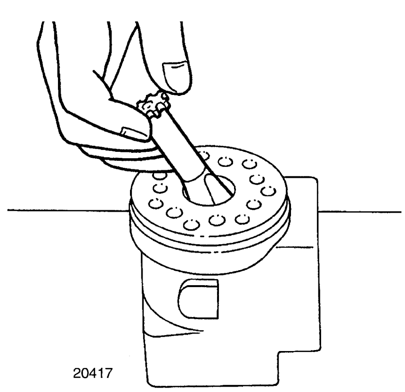


20414

1. Remove hydrostatic steering cover screws.
2. Remove cover sliding it off sideways.

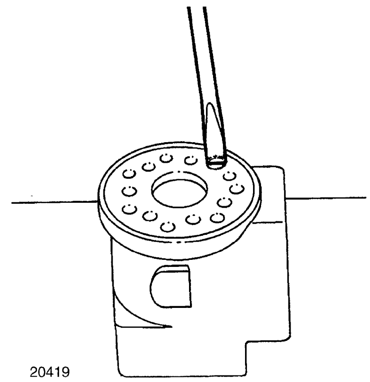
20416

3. Remove rotor stationary ring, rotor and associated inside spacer.
4. Remove the two stationary ring seals.



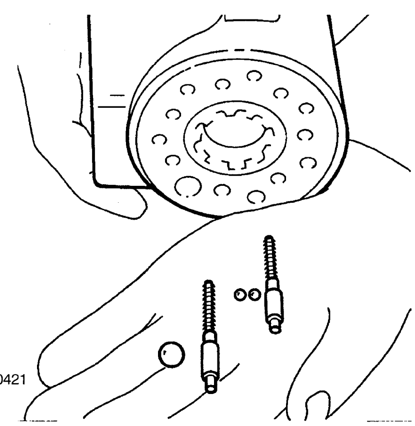
20417

5. Pull out rotor shaft.
6. Remove abutment ring.



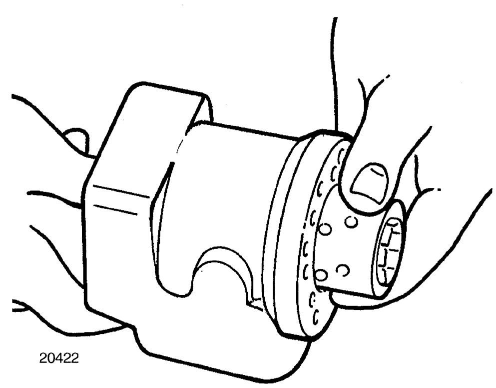
20419

7. Remove threaded plug from check valve seat.
8. Remove O–ring from control valve housing.



20421

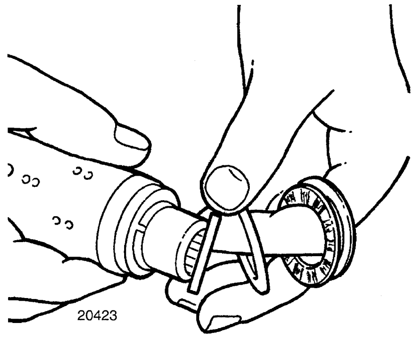
9. Turn control valve housing around and remove check valve ball and the back–flow valve two balls with associated pins and springs.



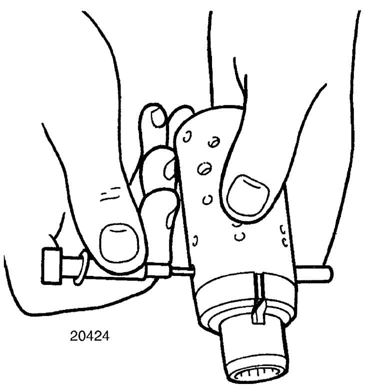
20422

10. Position control valve housing and rotor drive shaft so that the sleeve–drive shaft pin is placed horizontally.
11. Push rotary valve inwards to allow retrieveing from the inside of the control valve: rotary valve, valve sleeve and thrust bearing.

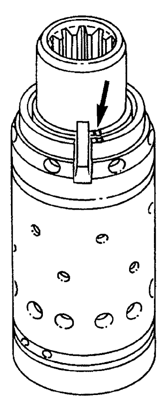
Print No. **603.54.283.00** – 09 – 1994


20423

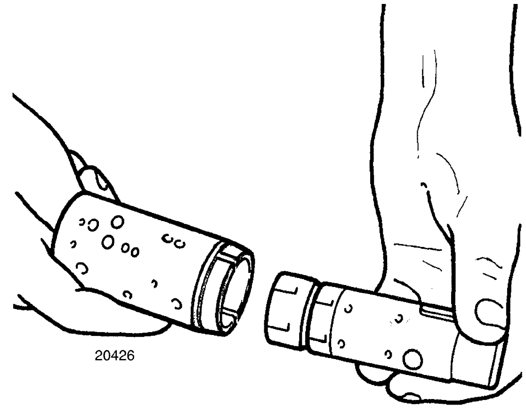
12. Remove thrust bearing from rotary valve, with both external rings, and undo spring retaining ring from valve housing sleeve.


20424

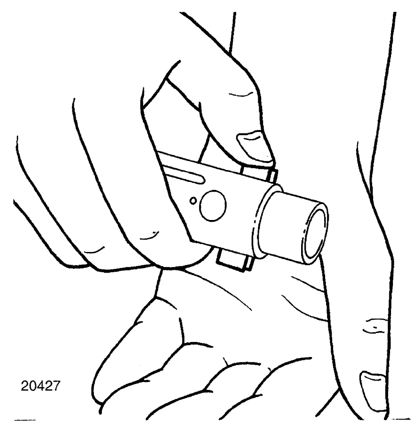
13. Remove valve–sleeve drive pin.


20425

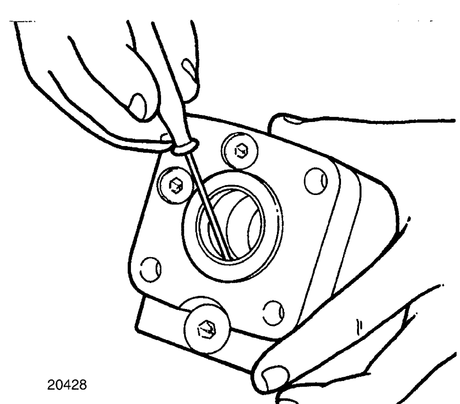
Attention: two reference marks are made at assembly on both rotary valve and sleeve, coincident with the neutral position maintained by springs. Prior to spring removal, make sure these marks are visible, otherwise renew them.


20426

14. Remove rotary valve from housing sleeve.

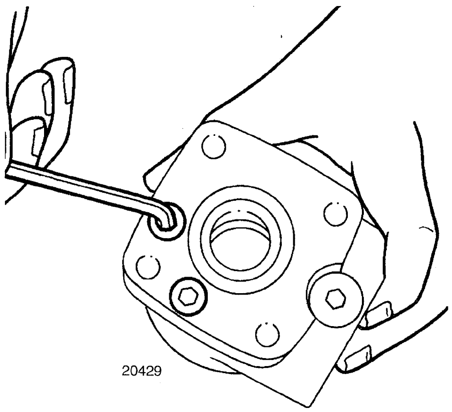

20427

15. Retrieve the **neutral** position springs from their seats.


20428

16. Remove the dust shield and O–ring seal from their respective seats on control valve housing.

Print No. **603.54.283.00** – 09 – 1994

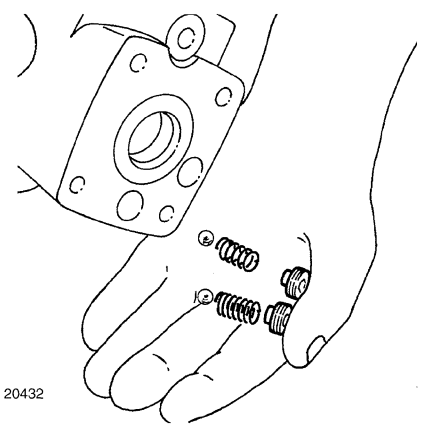


20429

17. Remove cylinder spring retaining plugs using a 6 mm set screw wrench.

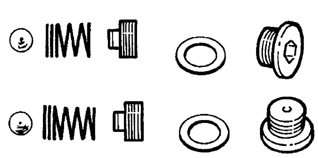
18. Remove gaskets.

19. Remove the two cylinder safety valve pressure setting screws using a 6 mm set screw wrench.



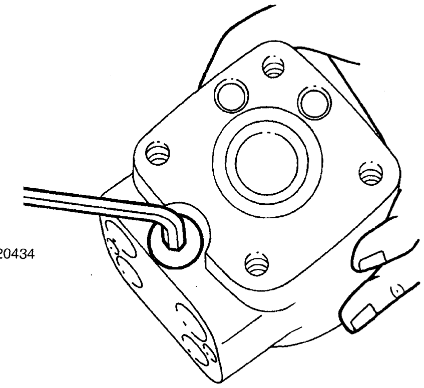
20432

20. Turn control valve housing upside down and retrieve the two cylinder safety valve balls, springs and spring guides.



20433

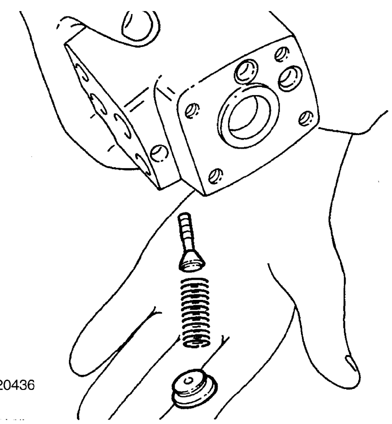
Exploded view of cylindere safety valve (disassembly–assembly sequence).



20434

21. Remove the pressure relief valve threaded plug using a 6 mm set screw wrench, then retrieve gasket.

22. Remove the pressure relief valve adjustment set screw.



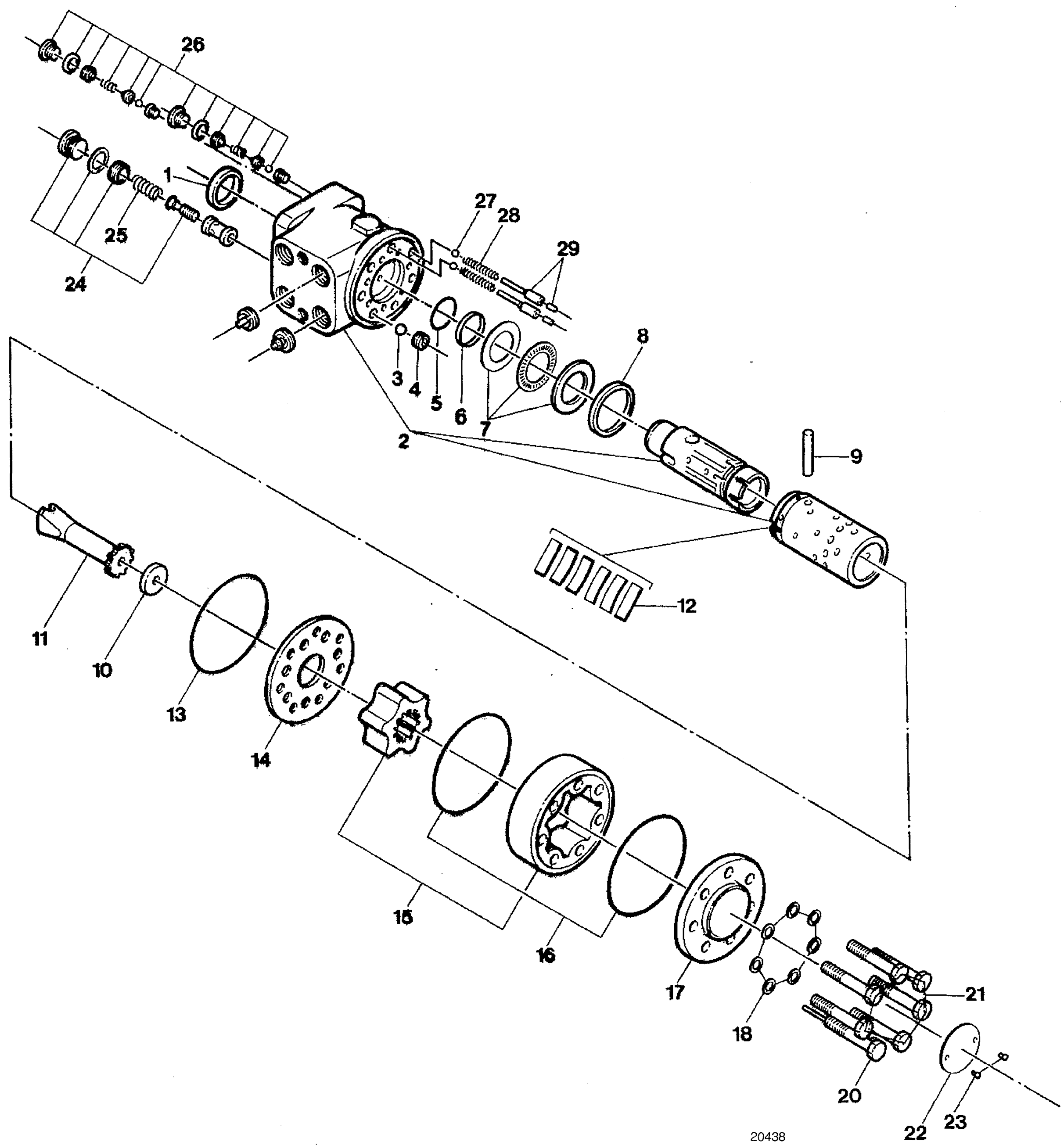
20436

23. Turn the control valve housing upside down and complete disassembly by retrieving the pressure relief valve spring and stem.

20437

Exploded view of pressure relief valve (disassembly–assembly sequence).

Print No. ***603.54.283.00*** *– 09 – 1994*



Exploded view of hydrostatic steering control valve

1. Dust shield – 2. Control valve housing, rotary valve and rotary valve housing sleeve – 3. Check valve ball – 4. Check valve threaded plug – 5. O–ring seal – 6. Seal (5) retaining ring 7. Thrust bearing parts – 8. Spring (12) retaining ring – 9. Rotor shaft–sleeve drive pin – 10. Spacer – 11. Rotor drive shaft 12. Sleeve **neutral** position call springs – 13. O–ring seal – 14. Abutment ring – 15. Rotor and stationary ring – 16. O–ring seals – 17. Cover – 18. Washers – 20. Check valve seat retaining screw – 21. Cover screws – 22. Plate – 23. Holding screw – 24 and 25. Pressure relief valve with spring – 26. Cylinder safety valves – 27. Back–flow valve balls – 28. Back–flow valve springs – 29. Back–flow valve stems.

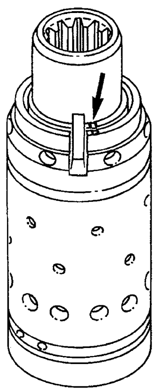
Print No. ***603.54.283.00*** *– 09 – 1994*

24. Thoroughly clean control valve loose parts.

25. Replace gaskets and seals.

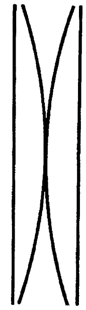
26. Inspect mechanical components and replace those evidencing signs of wear.

27. Prior to assembly, lubricate loose parts with hydraulic fluid.

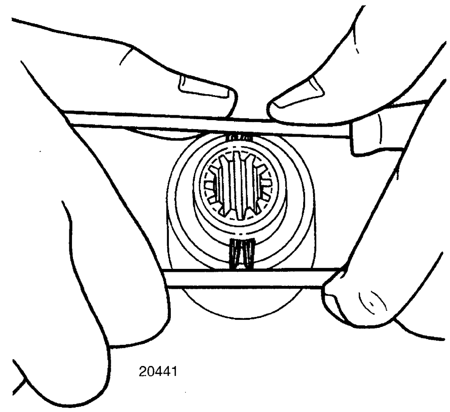

20425

28. Assemble rotary valve on on housing sleeve, checking that reference marks shown in the accompanying figure coincide.

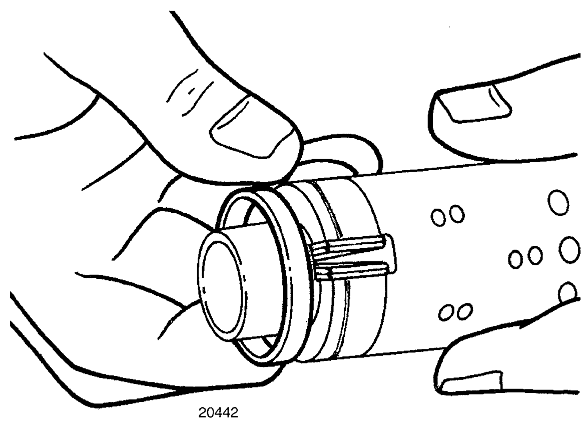
29. Using the **293389** special tool, fit the two flat springs and the two dished springs in their respective seats, pressing them totgether in place as shown in the accompanying figure below.


20440

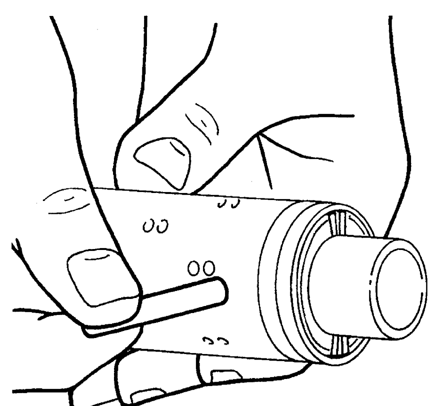
Neutral position spring assembly scheme.


20441

30. Align and centralize the **neutral** position springs.

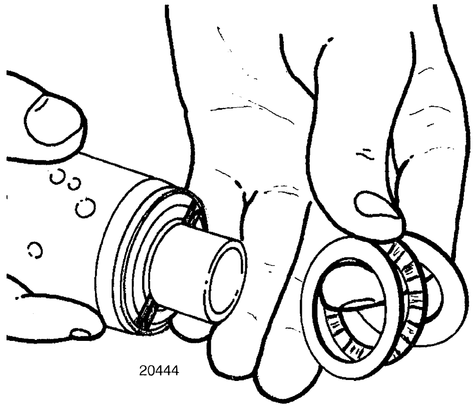

20442

31. Fit the **neutral** position spring retaining ring on housing sleeve, taking into account that the ring must be free to turn without being hampered by springs.

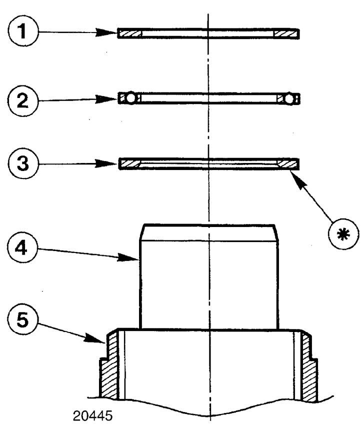

20443

32. Fit the rotor sleeve–shaft drive pin.

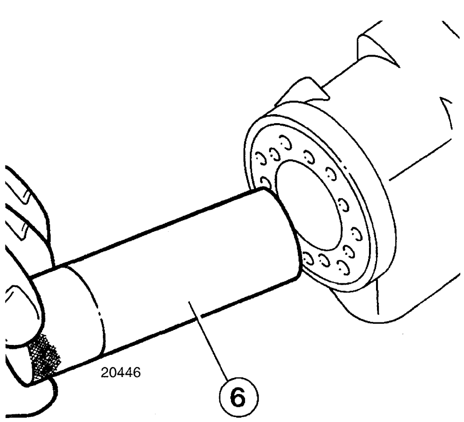
Print No. ***603.54.283.00*** *– 09 – 1994*



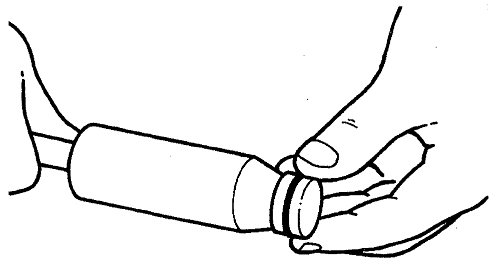
33. Fit thrust bearing in accordance with the sequence and information given in the accompanying figure below.

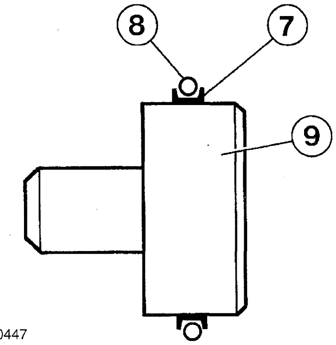


1. Bearing outer race – 2. Thrust bearing – 3. Bearing inner race with chamfer(*) facing abutting side of detail (5) – 4. Rotary valve – 5. Rotary valve housing sleeve.



34. Place the control valve housing with the rotary valve sleeve housing seat in horizontal position, then insert the pilot bushing of the **293388** special tool.

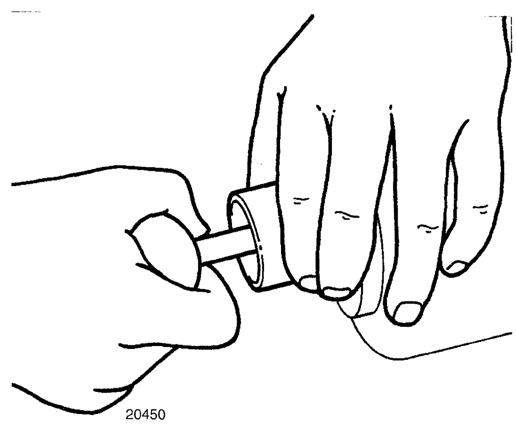




Tool head for seal and seating ring installation (part of the 293388 special tool)

35. Lubricate O–ring seal (8) and ring (7) with hydraulic fluid and fit them on the head (9) of the **293388** special tool as shown in the accompanying figures above.

36. Fit the complete driver inside the pilot bushing previously installed.

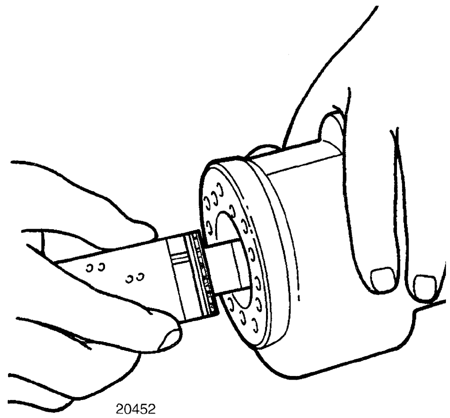


37. Hold outside bushing manually, push all the way down and at the same time turn the driver so to ease entry of seal in its seat on control valve housing.

38. Take out the **293388** tool parts (outer bushing and driver).

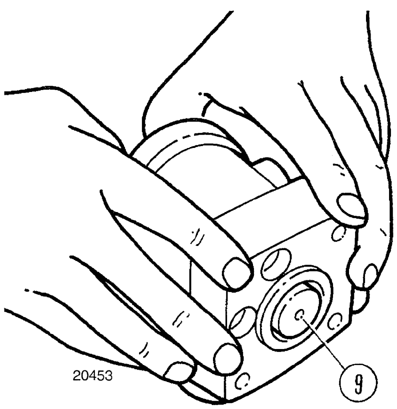
Note: on control valve housing remain the seal and ring fitted on tool head.

Print No. ***603.54.283.00*** *– 09 – 1994*



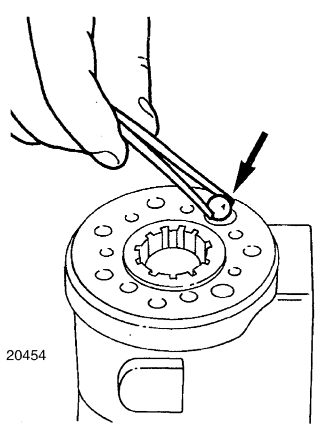
20452

39. Fit in control valve housing the parts previously installed (operations 28÷33) and hold the rotor sleeve–shaft drive pin horizontal to prevent it from entering the grooves existing in the control valve housing should it accidentally come off.



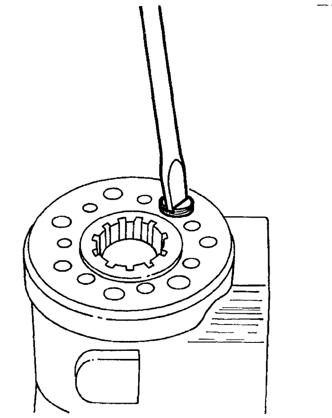
20453

40. Press on the rotary valve to bring the thrust bearing against the control valve housing: the head (9) of the **293388** special tool will be expelled and ring (7) and seal (8) will fit in their control valve housing seat.



20454

41. Turn the control valve housing and fit check valve ball in its seat, as shown in the accompanying figure above.



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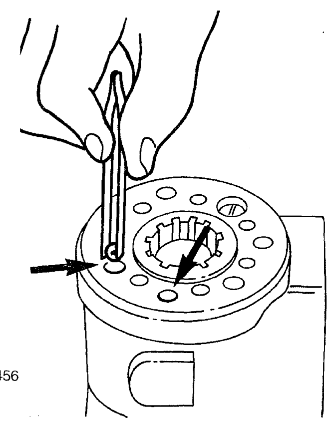
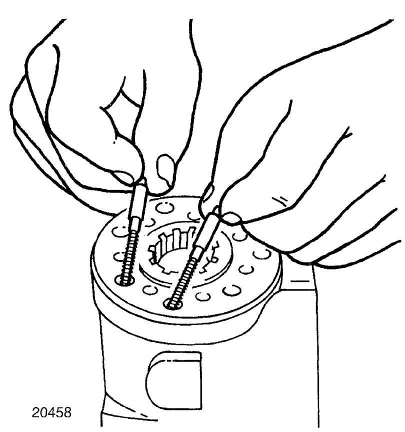
42. Screw the threaded plug in the check valve seat until the screw top is below the control valve housing surface.



20456

43. Fit the two back–flow valve balls inside the arrowed seats.

44. Fit springs onto the back–flow valve stems.



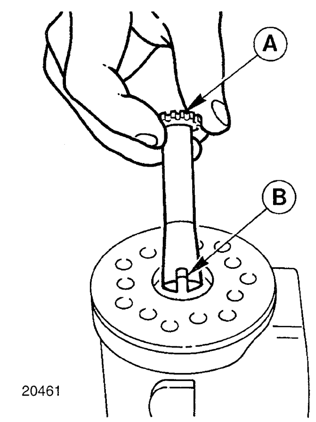
20458

45. Fit stems with spring inside the arrowed back–flow valve seats (see operation 43).

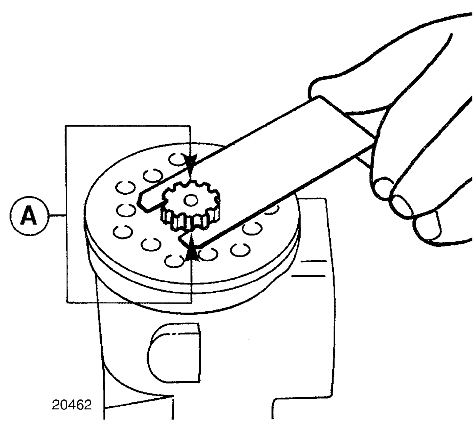
Print No. ***603.54.283.00*** *– 09 – 1994*

46. Lubricate the O–ring seal with hydraulic fluid and fit in place.

47. Fit abutment ring and align holes with the control valve housing ones.



48. Make a reference mark on the upper, toothed end (A) corrisponding to seat (B) to indicate exact assembly location of the valve–sleeve drive pin.

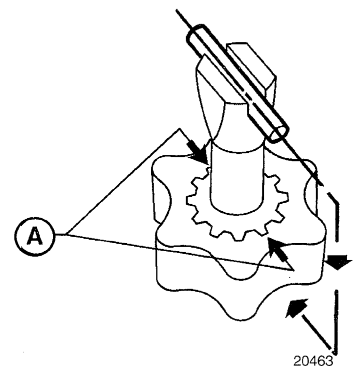


49. Fit the rotor drive shaft in control valve housing, introduce the **293390** retaining wrench between rotor shaft and abutment ring while turning the shaft to ease the assembly between seat (B) and drive pin installed on sleeve.

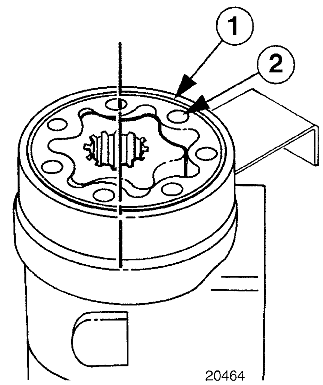
50. Assembly the rotor in accordance with the following instructions and information:

a) whenever disassembling hydrostatic steering, turn rotor upside down so to limit in time the wear of the splined coupling;

b) the figure which follows was made with the rotor shaft removed in order to put into evidence the correct phasing of rotor, rotor shaft and drive pin;



c) Fit rotor on shaft, considering that correct phasing is obtained by aligning, on the drive pin centerline plane, teeth (A), underlined in operation 48, with the centerline of a rotor vane.

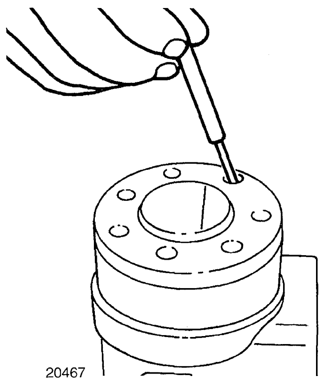


51. Lubricate the two O–ring seals (1) with hydraulic fluid and fit them in their seats on the rotor stationary ring, then fit the latter lining up mounting holes (2) with the ones present on the abutment ring.

52. Install inside spacer.

53. Install cover with mounting holes aligned with those present on the rotor stationary ring.

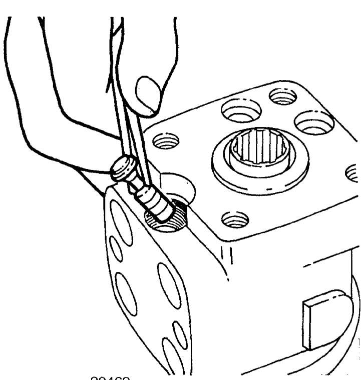
Print No. ***603.54.283.00*** *– 09 – 1994*



20467

54. Remove the **293390** retaining tool and fit in check valve seat, shown above, the special screw and associated washer.

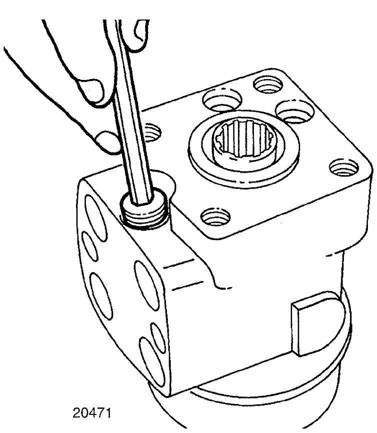
55. Fit the other six screws and associated washers and then gradually cross–tighten up to torque specification of page 41–2.



20469

56. Turn control valve housing upside down and fit the pressure relief valve plunger in the seat indicated in the accompanying figure (see valve details on page 41–10).

57. Fit the pressure relief valve spring.



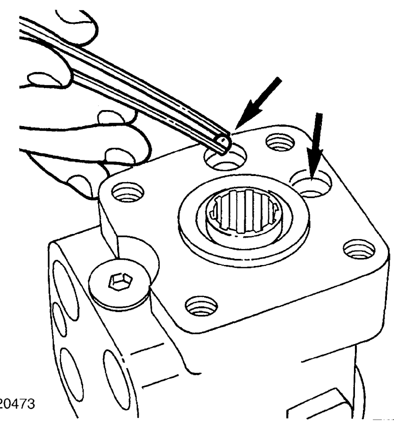
20471

58. Using a 8 mm set screw wrench, fit the pressure relief valve adjustment screw.

Note: adjust pressure setting later, on bench or on tractor, according to specifications of page 41–1.

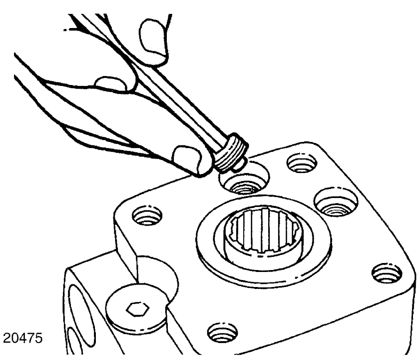
59. Tighten plug with associated seal using a 8 mm set screw wrench, then proceed to set pressure according to specifications, either on bench or on tractor and finally torque tighten at 40÷60 Nm (4.1÷6.1 kgm – 30÷44 ft–lb).

60. Fit the two balls in the arrowed seats on the cylinder safety valve (see parts detail on page 41–10).



20473

61. Fit spring guides and springs in the associated cylinder safety valve seats.

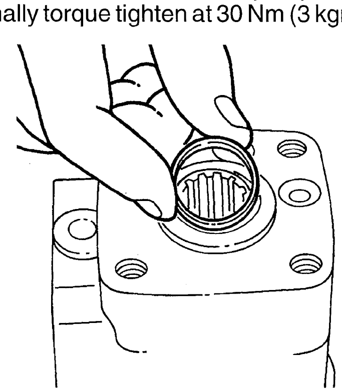


20475

62. Screw in the two cylinder safety valve pressure setting screws using a 6 mm set screw wrench.

Note: adjust pressure setting later, on bench or on tractor, according to specifications of page 41–1.

63. Screw in the two plugs with associated seals, using a 6 mm set screw wrench, adjust pressure setting and finally torque tighten at 30 Nm (3 kgm – 22 ft–lb).



20477

64. After completion of assembly, fit dust shield in its seat on control valve housing.

HYDROSTATIC STEERING CONTROL VALVE

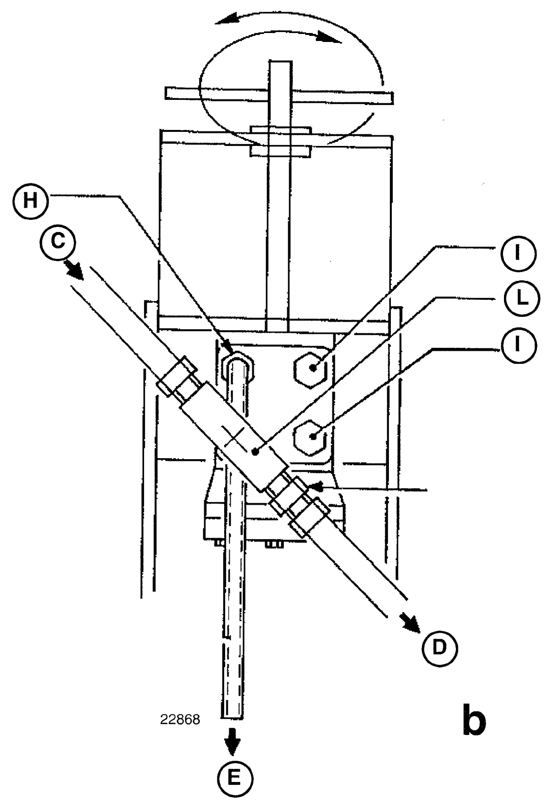
Bench tests (Operation 41 204 38)

A – ROTARY VALVE WEAR CHECK

1. Make connections shown in Fig.**a** and complete as shown in Fig. **b**. Using splined drive shaft (F), hold the hydrostatic steering control on turning position (right or left turn).
2. Through the test machine hand–wheel (G), increase system pressure up to the value nearest to relief valve setting (24, page 41–1) just before it opens.
3. Fit a torque wrench (P) to shaft (F) then check that, when applying a torque of about 34 Nm (3.5 kgm – 25 ft–lb) the time necessary for the rotary valve (5, page 41–3) to make one full turn is over ten seconds. If less, replace rotary valve and associated sleeve (6).

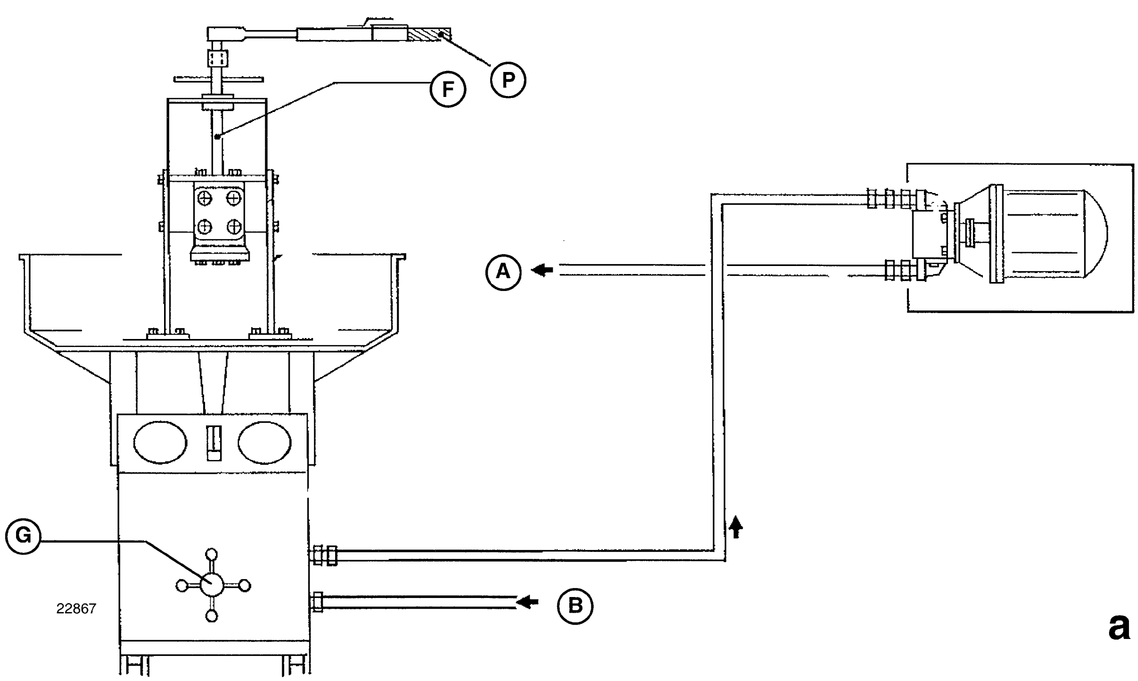
Test conditions.

Type of fluid	**IDRAULICAR AP51 oil**
Oil viscosity	SAE 20 W
Oil temperature	60^0C
Oil pump output	12 l/min (2.64UK/3.17US gal)
Bench motor speed	1450 rpm



b

Checking rotary valve wear.



a

Test rig for rotary valve check, seal tightness test, relief valve and cylinder safety valve pressure setting.

A. Delivery – B. Choke – C. From delivery – D. To choke – E. Drain – F. Splined drive shaft – G. Pressure regulation hand–wheel – H. Drain connection, G 1/2" – I. Plug, G 1/2" – L. Connection, G 1/2" – P. Torque wrench.

Print No. **603.54.283.00** – 09 – 1994

B – CHECKING RETURN TO NEUTRAL
Under same conditions of the **A** test, check that after each simulated turn the rotary valve (5, page 41–3) goes automatically back to neutral whenever shaft (F) is released.

C – CHECKING SEAL FLUID TIGHTNESS
Under same conditions of the **A** test, hold rotary valve (5, page 41–3) in steering position, through control shaft (F), for about three minutes and check fluid tightness of seals.

D – RELIEF VALVE PRESSURE SETTING

1. Make connections as shown in Fig. **a**, page 41–17 and complete rig as in Fig. **b**.
2. Through shaft (F), simulate steering controls (right or left turns) so to stop oil flow to drain.
3. Gradually increase pressure in the test rig by turning hand–wheel (G) and check on the pressure gauge dial that relief valve (24, page 41–3) blows open at specified pressure. If not, either increase or reduce the relief valve pressure setting by screwing in or backing off, respectively, set screw (36, page 41–3).

E – CYLINDER SAFETY VALVE PRESSURE SETTING

E1) Left turns

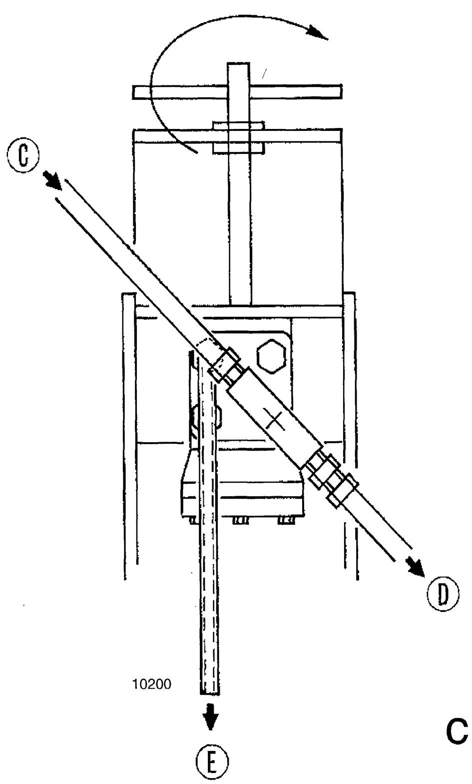
1. Make connections shown in Fig. **a**, page 41–17 and complete test rig as shown in Fig. **c**.
2. Through shaft (F), simulate a left turn (counterclockwise rotation) so to stop oil flow to drain.
3. Gradually increase pressure through the hand–wheel and check on pressure gauge dial that safety valve (33, page 41–3) blows open at aspecified pressure of page 41–1.

If pressure reading differs from specified value, ither increase or reduce the valve pressure setting (33, page 41–3), by turning in or backing off, respectively, set screw (38).

E2) Right turns

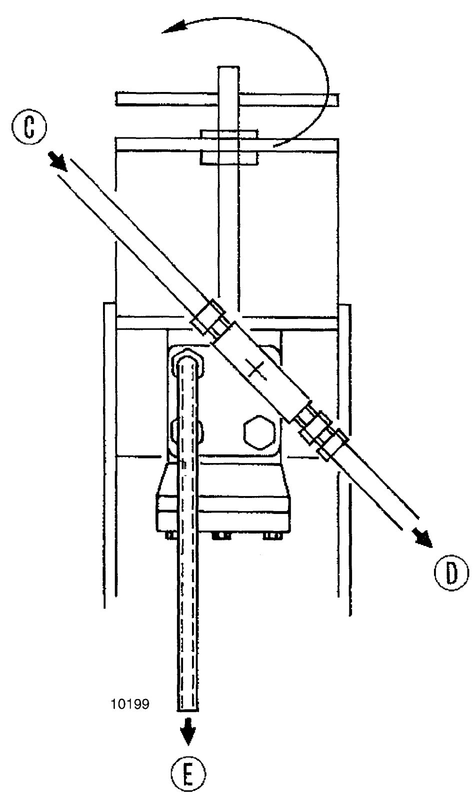
Make connections shown in Fig. **a**, page 41–17 and complete test rig as shown in Fig. **d.**

Proceed similarly as described at **c**, simply reversing the sense of rotation of shaft (F).



c

Cylinder safety valve pressure setting for left turns
C. From delivery – D. To choke – E. Drain.



d

Cylinder safety valve pressure setting for right turns
C. From delivery – D. To choke – E. Drain.

Print No. ***603.54.283.00*** *– 09 – 1994*

OPERATION

Neutral position

When steering wheel (V, page 41–20) is stopped, the rotary valve connected to it is in neutral with respect to sleeve (6). In this position, held by springs (2, sect. A–A), conditions are as follows:

– pin (1, sect. B–B) is centrally positioned with respect to of valve (5) housing bore;

– oil ducts (13 and 14) are aligned (sect. C–C), consequently the oil delivered by pump (P, page 41–20) flows freely to drain and returns to reservoir;

– oil grooves (15, 17 and 19) of the valve (sections D–D and E–E) are out–of–line with respect to ducts (16, 18 and 20) in the sleeve, consequently all communicating ports with cylinder are closed (see A and d, page 41–20).

Right turns (B, Sd, e, f page 41–20, and b, page 41–19)

When steering wheel (V, page 41–20) is turned clockwise, springs (2, section A–A) are strained thus allowing valve (5) to rotate with respect to sleeve (6), taking up play G1 (sect. B–B).

Under this condition, the following will occur:

– oil ducts (13 and 14, sect. C–C) are not lined up and consequently oil cannot flow to drain;

– six oil grooves (15, sect. D–D) will line up with as many oil ducts (16), connected at each instant with the vanes of the rotor, the latter in the inlet stage:

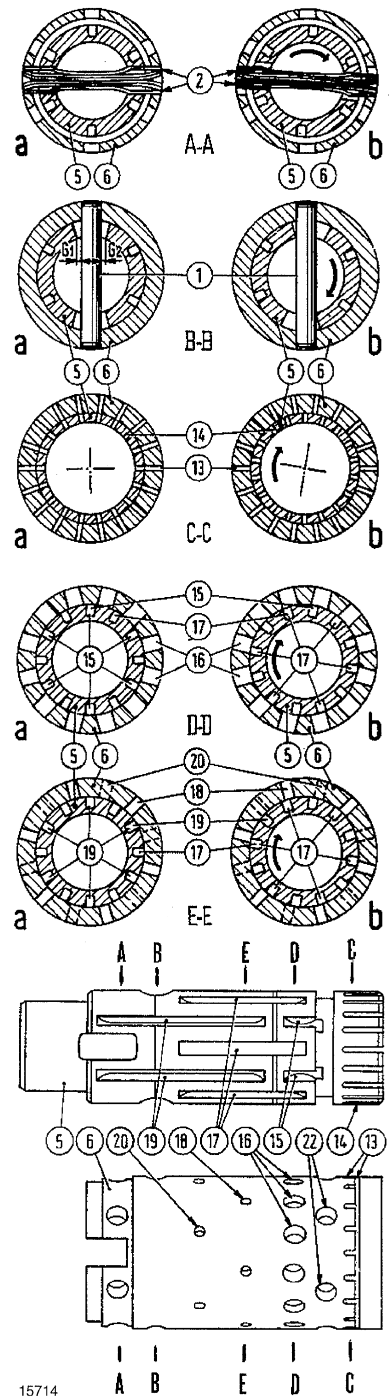
– the alignment of the six delivery grooves (17, sect. E–E) with oil ducts (18) communicating with the cylinder and, simultaneously, of the same grooves with the remaining ducts (16, sect. D–D) connected at each instant with the vanes of the rotor, the latter in the inlet stage;

– the alignment of the six drain grooves (19) with oil ducts (20, sect. E–E) communicating with the cylinder.

Once taken up play (G1), valve (5) will transmit solidly the steering wheel rotation to sleeve (6) and to rotor (9, page 41–3), through pin (1) and shaft (7).

Details (e, f, page 41–20) show the operating mode in the initial stage of right turning, after a given rotation of the steering wheel.

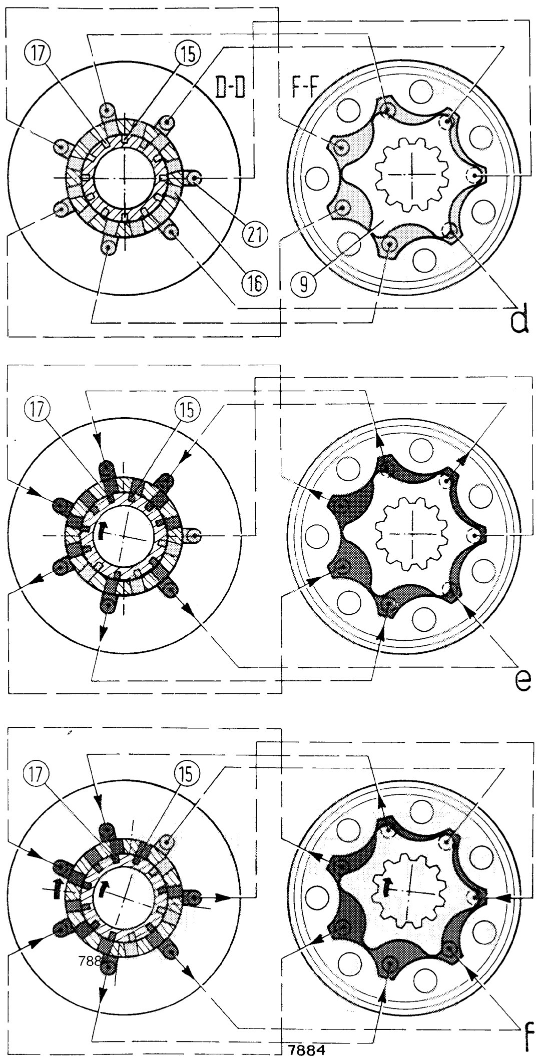
It should be noticed how, at every moment, the system assures the connection of the oil flow coming from the pump with the aspirating rotor vanes and of the oil flowing from the rotor vanes in the delivery phase with the associated duct conveying the oil to the power cylinder.

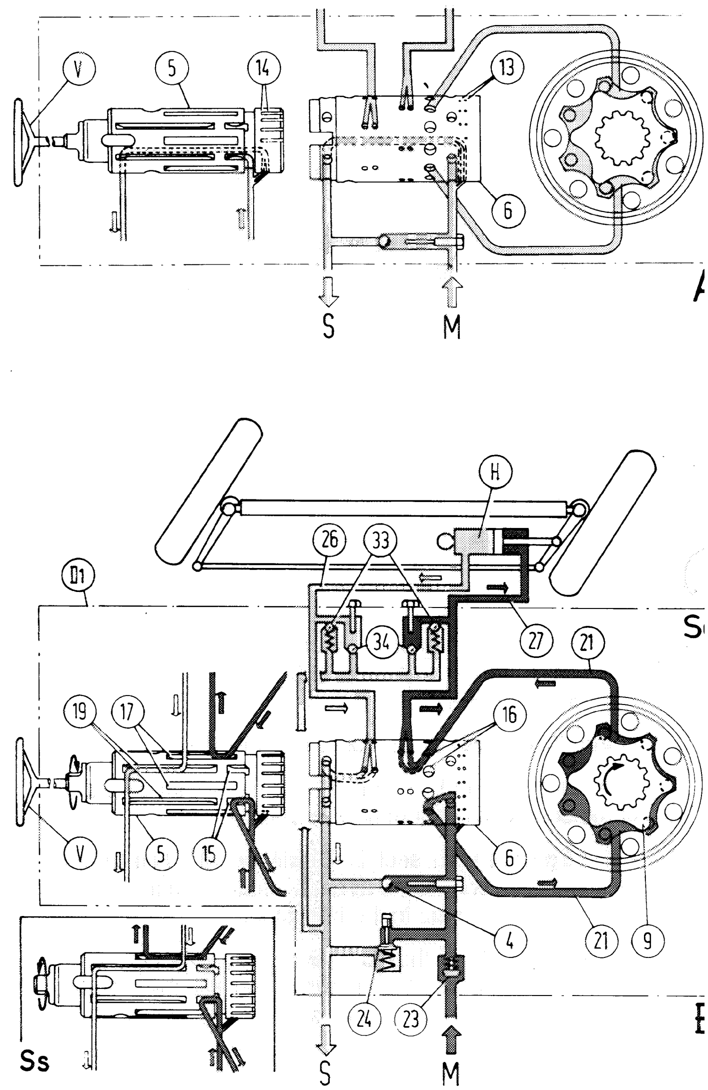


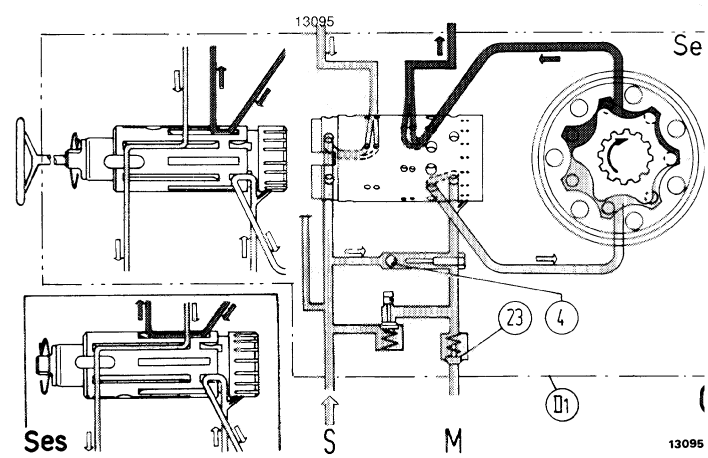
Sections illustrating hydrostatic steering operation

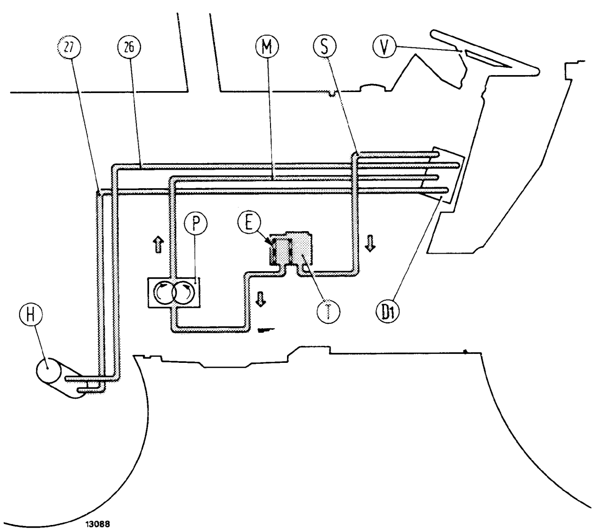
a. Cross–sections through valve (5) in neutral – b. Cross–sections through valve (5) rotated for right turns (for left turns, valve rotation occurs symmetrically in the opposite sense) – G1 and G2. Plays between pin (1) and hole in valve (5) – 1. Drive pin for sleeve (6) and shaft (7, page 41–3) – 2. Sleeve (6) return springs – 5. Rotary valve – 6. Valve (5) housing sleeve – 13 and 14. Oil ducts in neutral – 15. Delivery oil grooves (q.ty:6) to aspirating rotor vanes – 16. Oil ducts (q.ty:12) communicating alternatively with grooves (15 and 17) – 17. Delivery oil grooves (q.ty: 6) to cylinder communicating with delivering rotor vanes and with ducts (18 and 20) – 18. Delivery or drain oil ducts (q.ty:6), cylinder right chamber – 19. Drain oil grooves (q.ty:6) communicating with oil ducts (18 and 20) – 20. Delivery or drain oil ducts (q.ty:6), cylinder left chamber – 22. Oil feeding ducts to grooves (15).

Print No. 603.54.283.00 – 09 – 1994









g

Delivery oil to power cylinders.

Delivery oil to rotor.

Suction, low feed pressure or drain oil.

Static oil.

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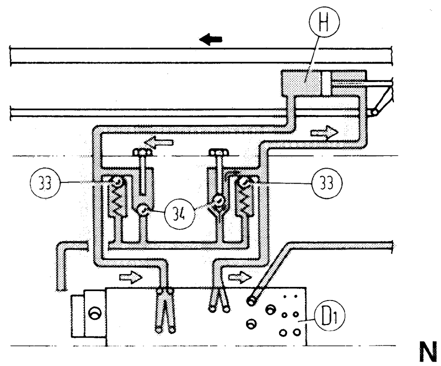


Hydrostatic steering working diagram (page 41–20)

N. Back–flow valve (34) operation with control valve (D_1) in neutral and piston of cylinder (H) subjected to an external force (shown by the black arrow) – 33. Safety valves.

Left turns (B, Ss, page 41–20)

Turning steering wheel counterclockwise causes the inversion of parts movements and, in particular, delivery oil grooves (17, sect. E–E, page 41–19) will now convey the flow to oil ducts (20) and actuate the left turn.

Emergency hydraulic control (C,Sed,Ses, page 41–20)

In case of oil feeding problems, it is still possible to steer.

When the steering wheel is turned, valve (5) works in the same position shown for normal operation, while the rotor operates as a hand pump, delivering oil to the control system.

Check valve (4) opens, the oil by–passes the feed pump and will flow directly to the rotor.

Instead, valve (23) will remain closed thus preventing the possibility of oil loss due to any failure or damage of pipes connecting the oil pump to hydrostatic steering.

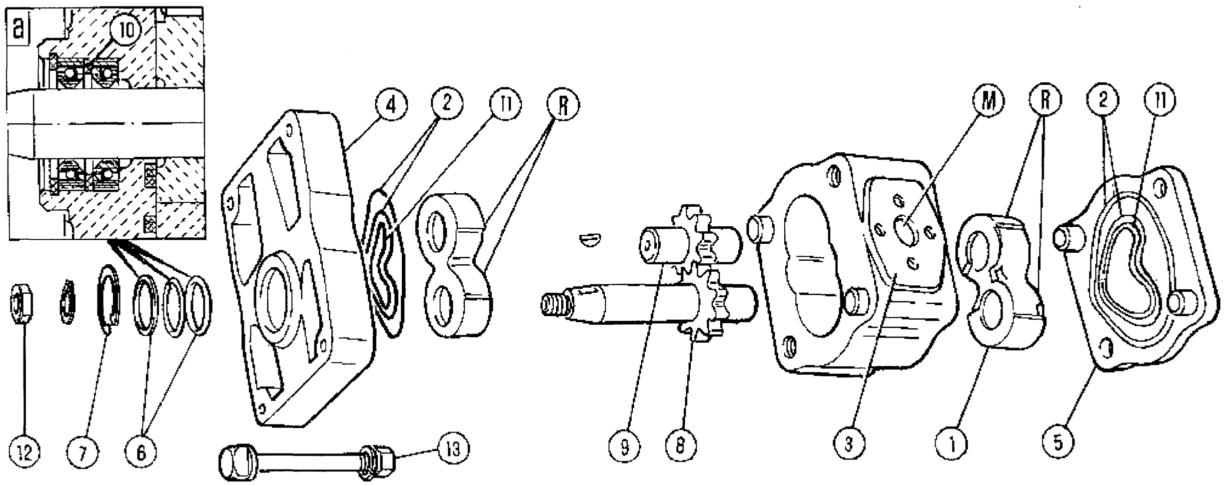
Cylinder safety and back–flow valves (N)

Open safety valves will discharge oil pressure created by piston (H) in either cylinder chamber under strong external forces acting on the tractor wheels.Simultaneously, the vacuum created inside the other chamber is compensated by oil flowing through the opening of the associated back–flow valve (34).The pressure of one of the cylinder chambers, consequent to small external forces not developing a pressure level sufficient to open the cylinder safety valve, will be discharged through normal leakage on control valve (D_1), whilst vacuum in the opposite chamber is compensated through back–flow valve (34), as shown an above detail N. Operation of these valves, besides eliminating the need for continuous correction of the steering asset, will prevent vibrations at the steering wheels (shimmy), hydraulic circuit damage and failures and steering linkage strains and deformations.

Hydrostatic steering working diagram (page 41–20)

A. Neutral operation – B. Right turns (Sd) and left turns (Ss) operation – C. Emergency right turns (Sed) and left turns (Ses) operation – d. Working diagram concerning sections D–D and F–F in neutral operation – D_1. Control valve – e,f. Working diagrams concerning sections D–D and F–F in two subsequent stages in right turns operation – E. Filtering cartridge – g. General working diagram of hydrostatic steering system installed – H. Power cylinder – M. Pump delivery – N. Working diagram of back–flow valves (34) with control valve (D_1) in neutral and power cylinder piston (H) being actuated from an axternal source (shown by black arrow) – P. Oil pump – S. Drain to reservoir – T. Oil reservoir – V. Steering wheel – 4. Check valve – 5. Rotary valve 6. Valve (5) housing sleeve – 9. Rotor – 13 and 14. Oil ducts in neutral – 15. Delivery oil grooves (q.ty:6) to aspirating rotor vanes – 16. Oil ducts (q.ty:12) communicating alternatively with grooves (15 and 17) – 17. Delivery oil grooves (q.ty:6) to cylinder communicating with delivering rotor vanes and with oil ducts (18 and 20, page 41–19) – 19. Cylinder drain oil grooves (q.ty:6) communicating with oil ducts (18 and 20, page 41–19) – 21. Oil ducts connecting ports (16) with rotor vanes, intake and delivery – 23. Check valve built in control valve housing – 24. Pressure relief valve built in control valve (see page 41–1 for pressure setting) – 26, 27. LH and RH pipe connecting to power cylinder – 33. Cylinder safety valve (see page 41–1 for pressure setting) built in control valve – 34. Back–flow valves built in control valve.

Print No. **603.54.283.00** – 09 – 1994



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Oil pump exploded view

a. Detail of seal assembly – M. Pump oil delivery duct – R. Gear bearing fillets (delivery end) – 1. Gear bearings – 2. Cover seals – 3. Pump housing – 4. Rear cover – 5. Front cover – 6. Drive shaft seals – 7. Seal retaining circlip – 8. Drive gear shaft – 9. Driven gear shaft – 10. Spacer – 11. Anti–extrusion ring – 12. Drive shaft bushing retaining nut and associated lock washer – 13. Cover holding screw nuts.

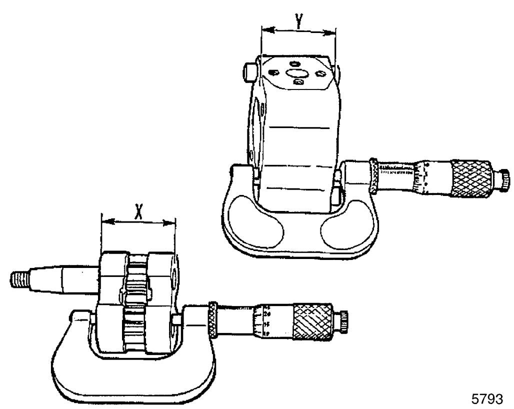
HYDROSTATIC STEERING OIL PUMP
Disassembly–Assembly of loose pump
(Operation 41 206 20)

Proceed as further indicated.

1. Remove cover holding nuts (13) and then the associated screws and lock washers.
2. Remove drive shaft bushing holding nut (12) and associated lock washer.
3. Remove rear cover (4), retaining circlip (7) and seals (6).
4. Make identification marks on parts (1), (3), (4) and (9) to reassemble them in their respective original positions, if still efficient.
5. Remove bearings (1), gears (8) and (9) from rear cover (4) and pump housing (3).
6. Remove seals (2) and anti–extrusion rings (11).

After pump disassembly, proceed with loose parts as further indicated.

7. Check planarity and squareness of gears and with bearing mating surfaces interposing a film of carbon black; very minor roughness can be eliminated using oiled emery cloth.



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Checking the gear–bearing unit end play in pump housing

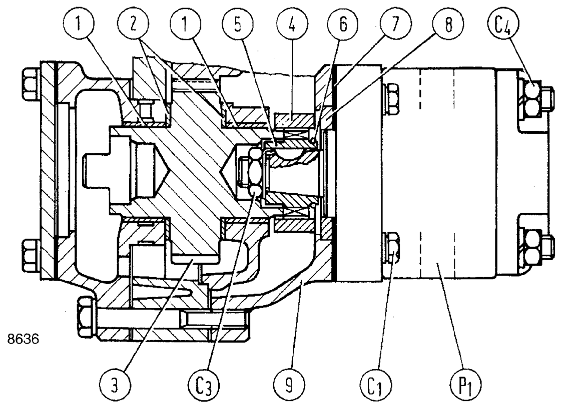
Dimension **X** should be less than **Y** by 0.090÷0.160 mm (.0035÷.0063 in).

8. Check that gear–bearing unit end play in pump housing is within 0.090÷0.160 mm (.0035÷.0063 in).

If necessary, reface flat mating surfaces using oiled emery cloth to remove minor surface hardness points.

9. Thoroughly clean all loose parts.
10. Replace oil seals (2), (6), (11).

Print No. 603.54.283.00 – 09 – 1994



Section through power assisted steering oil pump

C_1. Pump attachment screws – C_3. Bush holding nut – C_4. Pump cover holding screw nut – P_1. Oil pump – 1. Gear bearing bushes – 2. Abutment rings – 3. Pump drive gears – 4. Bush drive ring – 5. Drive bushing – Ring (4) retaining circlip – 7. Oil seal – 8. Centralizer ring – 9. Pump mounting bracket.

11. Lubricate loose parts with system oil and reassemble pump in accordance with the following instructions and information (refer also to figure of page 41–22):

a) proceed by reversing the previous disassembly sequence of operations, starting from no. 5 back to no. 1;

b) make sure to work always under conditions of absolute cleanliness to prevent entry of foreign particles that could damage the pump;

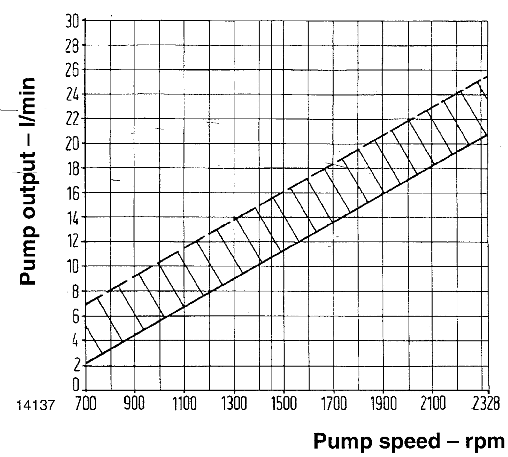
c) mate parts (1), (3), (4), (9), previously identified, see operation 4, page 41–22, for correct, original positioning;

d) fit gear bearings (1) in the pump body by hand, positioning them with their outer circumference fillets (R) corresponding to oil delivery duct (M) and bringing their front surfaces with oil grooves in mating contact with the associated gears;

e) insert the plastic ant–extrusion ring (11) on the inside of the central O–ring seal (2).

f) fit seals (6) with associated spacers (10) on rear cover (4), positioning them as shown in detail **a**, page 41–22 and fill cavity bbetween seal lips with **TUTELA G9** grease;

g) gradually tighten nuts and cover holding screws up to the wrench torque specifications of page 41–2.



Hydraulic steering C25 pump speed–output curve

Test pressure: 100 bar (102 kg/cm^2 – 1450 psi) – Oil temperature: 55°÷65°C.

12. At pump installation, fill intake pipe and pump housing with **TUTELA MULTI F** oil to ease priming and avoid the risk of seizure during the initial stage of operation.

13. Bleed hydraulic system by making a few right and left turns; finally, top up oil level if necessary.

Print No. ***603.54.283.00*** *– 09 – 1994*

Checking hydraulic steering pressure relief valve on control valve installed

Proceed as further indicated.

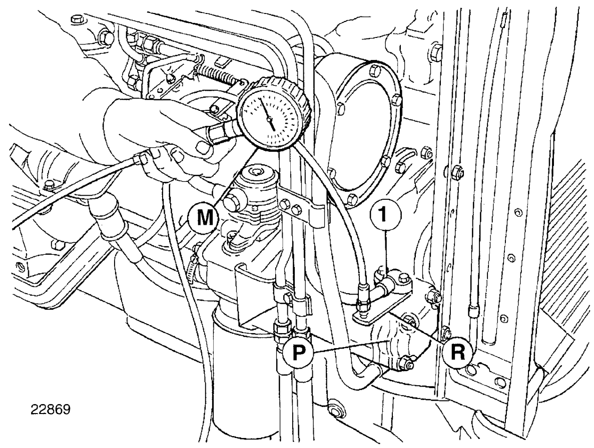
1. Start engine and steer tractor a few times until oil warms up to 50°C (122°F).

2. Stop the engine.

3. Fit connection (R) between oil delivery pipe (1) to control valve and pump (P) and connect it to pressure gauge (M) with 0÷150 kg/cm^2 scale.

4. Start engine again and run it at 1600 rpm, then make a full steering on one side. Under this condition, pressure relief valve (24) blows open at a pressure gauge reding of about 100 bar (102 kg/cm^2 – 1450 psi) for 4WD models 62DTF – 72DTF – 82DTF – 72DTLP – 82DTLP, or of 70 bar (71.4 kg/cm^2 – 1015 psi) for all other models, 2 and 4WD.

Note: in case pressure differs considerably, then adjust the relief valve pressure (24, page 41–3) setting through set screw (36).



Checking the hydraulic steering pressure relief valve with control valve installed.

M. Pressure gauge – P. Oil pump – R. Test connection **291326** (of kit **292870**) for checking pressure relief valve installed – 1. Oil delivery pipe to control valve.

*Print No. **603.54.283.00** – 09 – 1994*

FRONT AXLE

	50V – 55V – 60V	55F – 60F	70V
Type	inverted "U", telescoping and centrally pivoted		
Track widths, with tyres: 4.00–15 mm (in)	865 – 965 (34.1–38.0)		
7.00–12 mm (in)	920 – 970 (36.2–38.2)		
5.00–15 mm (in)	985 – 1050 (38.8–41.3)		
5.50–16 mm (in)	—	1040 – 1140 (40.9–44.9)	—
6.00–16 mm (in)	—	1040 – 1140 (40.9–44.9)	1040 – 1140 (40.9–44.9)
Steering knuckles			
Kingpin journal dia. (4, page 44–4) .... mm (in)	29.967÷30.000 (1.1808÷1.1811)		
Force–fitted bushing (5) I.D. .... mm (in)	30.100÷30.150 (1.1850÷1.1870)		
Kingpin (4) journal/bearing bushing (5) assembly clearance .... mm (in)	0.100÷0.183 (0089÷.0072)		
Axle pivot mounting			
Pivot dia. .... mm (in)	29.967÷30.000 (1.1808÷1.1811)		
Force–fitted bushing I.D. .... mm (in)	30.100÷30.150 (1.1850÷1.1870)		
Pivot/bushing assembly clearance ..... mm (in)	0.100÷0.183 (0089÷.0072)		
Wheel camber (all models)	See page 44–7		
Toe–in (all models) .... mm (in)	0 ÷ 5 (0 ÷ 2)		

FRONT AXLE

	62F – 72F – 82F	72LP – 82LP
Type	inverted "U", telescoping and centrally pivoted	
Track widths, with tyres: 6.50– 16 mm (in)	1180 – 1280 – 1380 – 1480 (46.5–50.4–54.3–58.3)	1410 – 1510 – 1610 – 1710 – 1810 – 1910 (55.5–59.4–63.4–67.3–71.3–75.2)
7.00–12 mm (in)	1180 – 1280 – 1380 – 1480 (46.5–50.4–54.3–58.3)	—
7.50–16 mm (in)	1215 – 1315 – 1415 – 1515 (47.8–51.8–55.7–59.6)	—
7.50–15 mm (in)	1230 – 1330 – 1430 – 1530 (48.4–52.4–56.3–60.2)	—

(continues)

Print No. ***603.54.283.00*** *– 09 – 1994*

FRONT AXLE

(follows)

	62F – 72F – 82F	72LP – 82LP
Steering knuckles		
Kingpin journal dia. (2, page 44–4) ..... mm (in)	37.961÷38.000 (1.4945÷1.4961)	
Force–fitted bushings (3) I.D. .... mm (in)	38.050÷38.140 (1.4980÷1.5016)	
Kingpin journal (2)/ bearing bushings (3) assembly clearance .... mm (in)	0.050÷0.179 (.0020÷.0070)	
Thickness of kingpin (2) bronze abutment ring (5) .... mm (in)	3.925÷4.000 (.1545÷.1575)	
Thickness of steel ring (12) .... mm (in)	3.925÷4.000 (.1545÷1.575)	
Axle pivot mounting		
Pivot (10) dia. .... mm (in)	37.961÷38.000 (1.4945÷1.4961)	
Force–fitted bushings (11) I.D. .... mm (in)	38.050÷38.140 (1.4980÷1.5016)	
Pivot (10)/bushings (11) assembly clearance .... mm (in)	0.050÷0.179 (.0020÷.0070)	
Wheel camber (all models)	See page 44–7	
Toe–in (all models) .... mm (in)	0 ÷ 5 (0 ÷ 2)	

TORQUE WRENCH DATA – Models 50V 55V 60V 70V 55F 60F

DESCRIPTION		Torque		
		Nm	kgm	ft–lb
Nut, axle support to engine	M 16 x 1.5	220	22.5	163
Capscrew, axle pivot	M 10 x 1.5	59	6	43
Nut, telescoping axle ends set screw	M 16 x 1.5	211	21,5	155
Capscrew, front wheel to hub (C_5, page 44–4)	M 20 x 1.5	216	22	159
Nut, steering tie–rod and drag link ball joints	M 14 x 1.5	134	14	101
Nut, RH and LH side steering arm screws	M 10 x 1.25	49	5	36

Print No. ***603.54.283.00*** *– 09 – 1994*

TORQUE WRENCH DATA Models 62F – 72F – 82F – 72LP – 82LP

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft–lb
Nut, RH and LH steering arm set screws (C_1, page 44–4)	M 14 x 1.5	147	15	108.5
Capscrew, front wheel to hub (C_2)	M 18 x 1.5	314	32	231
Capscrew, axle support to engine (C_3)	M 18 x 1.5	314	32	231
Capscrew, axle pivot (C_4)	M 10 x 1.25	59	6	43.4
Nut, telescoping axle ends set screw	M 16 x 1.5	221	22.5	162.5
Nut, steering tie–rod ball joint screw	M 14 x 1.25	98	10	72.3

SERVICE TOOLS

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code **X**.
Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used jointly with the recommended special tools listed below and further integrated with the self–made ones for the construction of which you will find the necessary working drawings and material specifications directly in this Manual.

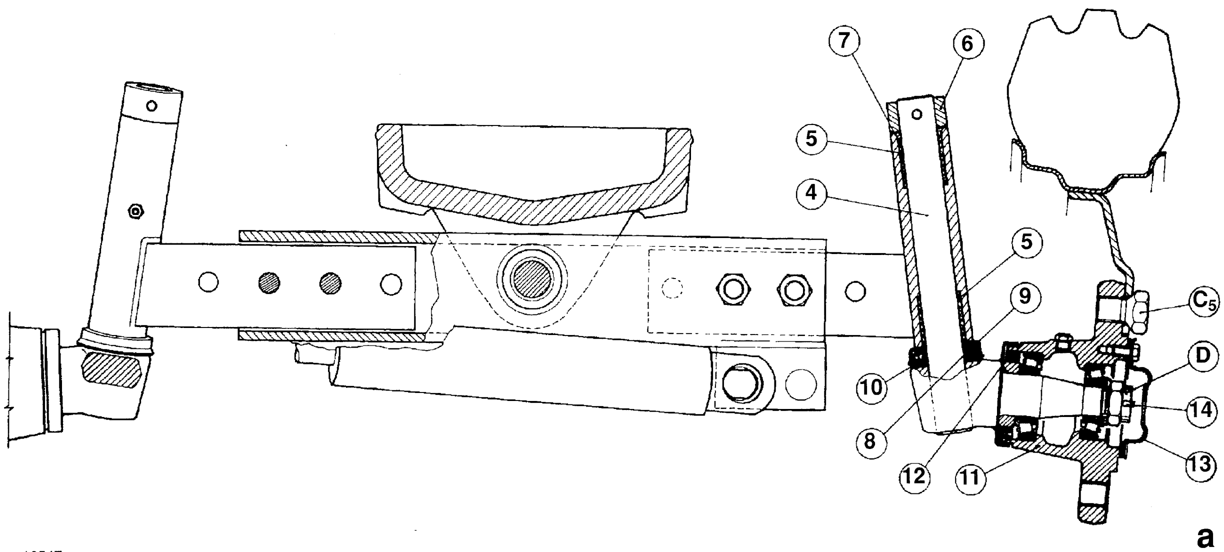
List of the special tools necessary to carry on the service operations concerning this section of the manual.

X 292927	Puller, slide hammer (M14x 1.5) axle pivot remover.
X 290793	Adapter, size M12x1.25, axle pivot remover (w/item **292297**).
X 292400	Hook, wheels.
293890	Tester, wheel toe–in.

FRONT AXLE TROUBLESHOOTING GUIDE

Problem	Possible cause	Correction
Premature tyre wear	**1.** Wrong inflating pressure.	Inflate tyres to the pressures suggested on the tractor Operator's Manual and comply in all cases with the specifications and instructions issued by the tyre Manufacturer.
	2. Wrong front wheel toe–in.	Rectify wheel toe–in.
Poor tractor stability.	**1.** Wrong inflating pressure.	Inflate tyres correctly in accordance with previous statement.

Print No. **603.54.283.00** – 09 – 1994



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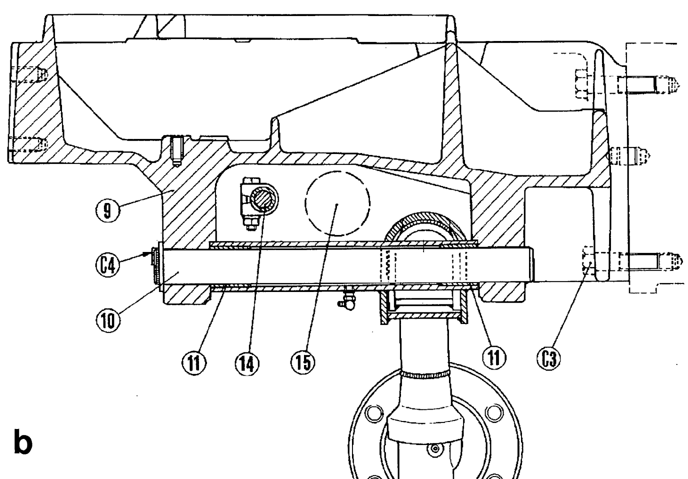
a

Front axle steering knuckle sectional view – Models 50V – 55V – 60V – 70V – 55F – 60F

C_5. Front wheel rim–to–hub attachment screw – D. Front wheel bearing adjustment nut – 4. Steering knuckle king pin – 5. Bu shings – 6. King pin ring – 7. Seal – 8. Ball bearing – 9. Bea ring cup – 10. O–ring – 11. Wheel hub – 12. Seal – 13. Whell hub cap – 14. Cotter pin.



b

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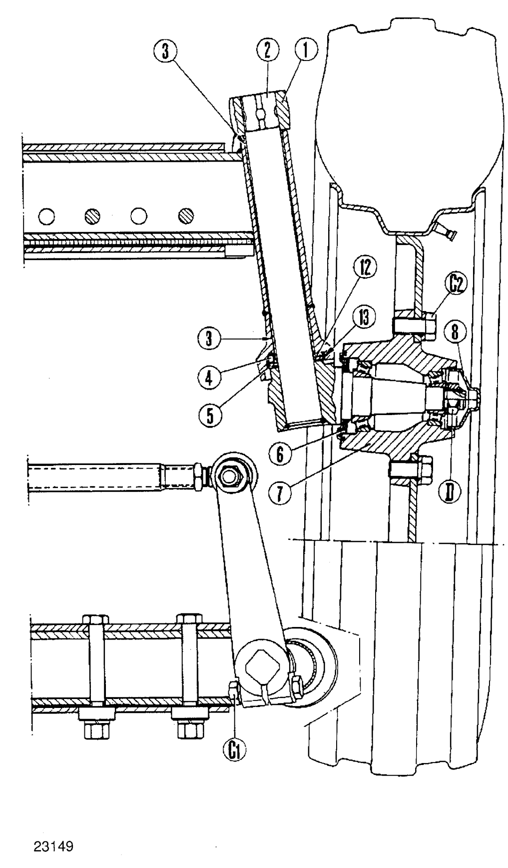


23149

Sectional view of front axle steering knuckle and articulation shaft – Models 62F – 72F – 82F – 72LP – 82LP

C_1. Steering arm (1) holding nut – C_2. Front wheel rim–to–hub attachment screw – C_3. Capscrews securing front axle to engine mounting bracket – C_4. Axle pivot capscrew – D. Bearing adju stment nut – 1. Steering arm – 2. King pin – 3. Bushings – 4. Dowel pin – 5. Bronze thrust washer – 6. Seals – 7. Wheel hub – 8. Bearing grease and adjustment cap – 9. Axle mounting bracket – 10. Axle pivot – 11. Axle pivot bushings – 12. Steel thrust washer – 13. Cup – 14. Steering tie–rod – 15. Hydraulic steering power cylinder mounting position.

Print No. 603.54.283.00 – 09 – 1994

FRONT AXLE

Removal–Installation (Operation 44 101 30)

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Ensure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

To separate the front axle from the tractor proceed as further indicated.

1. Disçonnect battery cables, apply parking brake, place stops under rear wheels and remove front weights and associated ballast carrier.
2. Remove power steering cylinder.
3. Lift the tractor front end using a hydraulic jack and place a mechanical stand under the axle mounting support (models 62F – 72F – 82F – 72LP – 82LP) or under the engine oil sump (models 50V – 55V – 60V – 70V – 55F – 60F).
4. Remove front wheels.
5. Remove axle pivot holding screw.
6. Remove axle pivot using the **292927** puller and **290793** adapter.
7. Remove the axle assembly altogether and then install it on the axle overhauling shop stand.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

8. Install the front axle in accordance with the following instructions and information:
   a. replace worn axle pivot bushings using suitable drivers and pullers.
   b. proceed by reversing the previous removal sequence of operations, starting from no. 7 back to no. 1; fit the axle pivot using a bronze driver.
   c. on models 62F – 72F – 82F – 72LP – 82LP consult illustrations on page 44–4, Fig. b, for the correct placement of parts.
   d. tighten fastenings to torque wrench specifications of pages 44–2 and 44–3.

FRONT WHEEL HUB

Disassembly–Assembly (Operation 44 101 22)

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts.
Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Wheel hubs can be disassembled while installed on the tractor as further indicated.

1. Disconnect battery cables and place stops under rear wheels.

Models 50V – 55V – 60V – 70V – 55F – 60F:

— undo holding screws and remove wheel hub cap (13, page 44–4);

— remove cotter pin (14);

— loosen front wheel holding screws (C_5).

Models 62F – 72F – 82F – 72LP – 82LP:

— remove lid (8, page 44–4);

— loosen adjustment nut (D) after eliminating caulking;

— loosen front wheel holding screws (C_2).

2. Apply parking brake, lift front end of tractor and place a mechanical stand under the front axle support (models 62F – 72F – 82F – 72LP – 82LP) or under the engine oil sump (models 50V – 55V – 60V – 70V – 55F – 60F).
3. Remove front wheel.
4. Retrieve wheel hub, remove wheel bearings and seal.

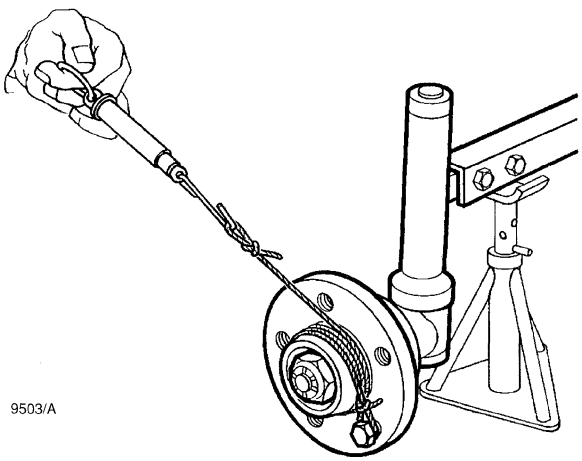
CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

5. Install wheel hub in accordance with the following instructions and information:
   a. replace seal, if uneffective, and bearings, if worn, using suitable drivers and pullers;
   b. proceed by reversing the previous removal seuqence of operations starting from no. 4 back to no. 1; fill wheel cap with TUTELA G9 grease;
   c. consult illustrations of page 44–4 for correct placement of parts.

Print No. 603.54.283.00 – 09 – 1994

6. **Adjust the wheel hub taper roller bearings as follows:**



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Models 50V – 55V – 60V – 70V – 55F – 60F:

— tighten nut (D, page 44–4) progressively up to a rolling torque of 0.2÷0.3 Nm (0.02÷0.03 kgm – .15÷7.5 ft–lb);

— this torque corresponds to a dynamometer reading of 6÷8 Nm (0.6÷0.85 kgm – 43.3÷6.2 ft–lb) measured using a rope wound around the wheel hub;

— following completion of adjustment, secure nut (D) by fitting the associated cotter pin (14) and install lid (13).

Models 62F – 72F – 82F – 72LP – 82LP:

— torque tighten nut (D, page 44–4) at 68 Nm (7 kgm – 51 ft–lb) while rotating the wheel hub (6) to settle bearings;

— loosen nut (D) and re–tighten it to a torque of 9.8 Nm (1 kgm 7.2 ft–lb) while rotating the wheel hub;

Note – Nut (D) must be replaced every time adjustment is made.

— lock nut (D) by caulking and refit lid (8).

STEERING KNUCKLE

Overhauling (Operation 44 101 46)

DANGER

Handle all parts carefully. Do not put hands and fingers between parts. Ensure that the load is held and supported by means of suitable slings and hooks.
Make sure that nobody is standing near by.

Steering knuckles can be disassembled without removing axle from tractor. Proceed as further indicated on each wheel.

1. Disconnect battery cables and chock rear wheels.

2. Remove holding screws and front wheel.

3. Apply parking brake, jack up the front end of the tractor and place a stand under the axle support (models 62F – 72F – 82F – 72LP – 82LP) or under the engine oil sump (models 50V – 55V – 60V – 70V – 55F – 60F).

4. Place the hydraulic jack underneath the steering knuckle.

Models 50V – 55V – 60V – 70V – 55F – 60F:

— unscrew nut and detach tie–rod from steering knuckle kingpin arm;

— remove cotter pin, ring (6, page 44–4) and retrieve seal (7);

— lower jack and withdraw steering knuckle (4) with wheel hub from below.

Models 62F – 72F – 82F – 72LP – 82LP:

— unscrew nut (C_1, page 44–4) and withdraw steering knuckle kingpin arm (1);

— lower jack and withdraw steering knuckle (2) with wheel hub from below.

5. Remove securing bolts and pull out telescoping axle end.

6. Tighten axle end in a bench vise and drive out kingpin bu shings using a hammer–type puller.

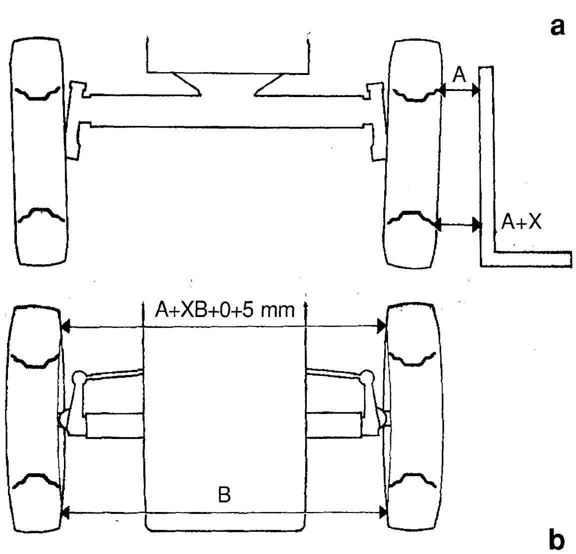
Print No. 603.54.283.00 – 09 – 1994

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

7. Re–assemble the steering knuckle in accordance with the follo wing instructions and information.
   - **a.** replace any defective seals;
   - **b.** use a specific driver to fit the new bushings on axle ends;
   - **c.** proceed by reversing the previous disassembly sequence of operations starting from no. 6 back to no. 1;
   - **d.** consult illustrations on page 44–4 for the correct placement of parts;
   - **e.** tighten fastenings to the torque specifications of pages 44–2 and 44–3.

CHECKING THE FRONT STEERING WHEEL ASSET (Operation 44 511 80)



Wheel asset checking scheme.

a. Wheel camber check – b. Toe–in check. On models 50V – 55V – 60V – 70V – 55F – 60F, X=20 mm (.79 in), approx. On models 62F – 72F – 82F – 72LP – 82LP, X=15 mm (.59 in) for 16" rims and 18 mm (.71 in), approx., for 20" rims.

When checking the steering wheel asset (see Fig. **a**) consider that in straigtforward position, i.e., with rims parallel to the tractor longitudinal center line, wheels must be inclined as follows:

— on models 50V – 55V – 60V – 70V – 55F – 60F, 3° with respect to ground line corresponding to an approximate distance (X) between edges of rim (A) of about 20 mm (.79 in);

— on models 62F – 72F – 82F – 72LP – 82LP, 2° with respect to ground linecorresponding to an approximate difference of 15 mm (.59 in) for 16" rims and of 18 mm (.71 in) for 20" rims measured between rim (A) edges.

Besides, in straightforward travel position wheels must be paral lel with the tractor longitudinal center line or with a slight toe–in at front up to a maximum of 5 mm (.20 in) measured between edges of opposite rims (see Fig. **b**) using the specific **293890** front wheel toe–in test gauge.

To check the exact toe–in value, proceed as further indicated.

1. Inflate front tyres to 2.5 bar (kg/cm^2– 36 psi).
2. Position the steering wheel for straightforward driving, with a spoke along the tractor center line;
3. Check that wheels are parallel to the tractor longitudinal center line.
4. Measure on the horizontal plane passing through wheel centers the distance (B, Fig. b) between the **front inside edges** of the rims.
5. Measure then, still on the horizontal plane passing through wheel centers, the distance between the **rear inside edges** of the rims, and check that this reading is equal to (B) or greater up to a maximum of 5 mm (.20 in).
6. To adjust toe–in, turn the adjustable ends of track rod.

Print No. 603.54.283.00 – 09 – 1994

CAB AIR CONDITIONING SYSTEM

SAFETY

Handle refrigerant fluid very carefully in order to avoid physical hazards; always wear safety glasses and gloves.

Undue direct contact with refrigerant fluid can produce skin freezing and serious eye damage, even blindness in the most serious cases.

Keep the refrigerant fluid container away from heat sources as the pressure increase consequent to warming can cause explosion of the container.

If in direct contact with open flames or hot metal surfaces, the refrigerant may produce a highly toxic gas which, if inhaled, will cause serious intoxication.

Make sure, therefore, to comply with the following simple precautions to avoid any risk of injuries.

When draining and charging the system with refrigerant make sure to operate in well–ventilated premises and far away from open flames.

When draining and charging the system take suitable precautions to protect your face and eyes above all from the refrigerant fluid.

In the event of an accident, proceed as follows:

— if the refrigerant has reached your eyes, wash them immediately with a few drops of mineral oil, then continue bathing them thoroughly and repeatedly with a boric acid and water solution (a teaspoonful of boric acid in a 1/4 cup of water) and seek immediate medical assistance.

— inside the air conditioning system the oil and refrigerant mixture is pressurized, consequently make sure never to loosen connections or tamper with pipes unless the system has been properly discharged.

— similarly, do not unscrew the oil level check plug if system is charged.

— do not heat or warm up the refrigerant container, as the consequent pressure increase is quite rapid above 50°C (122°F).

— keep heat sources away from the air conditioning system to prevent possibility of explosions due to the pressure increase inside the system pipelines.

When transferring or moving the refrigerant avoid using pressure containers or other containers in stock unless duly homologated and fitted with safety valves.

Never charge refrigerant fluid containers over 80% of their maximum capacity.

Never change the setting of safety valves or of any other check gauge or components.

Never connect the fluid recovery/recycling and drain/charge stations to electrical sockets different to the specified ones and do not leave them energysed unless immediate use is envisaged.

Print No. **603.54.283.00** – 09 – 1994

CAB VERSIONS

23253

Without cab	Cab without ventilation and heating	Ventilated and heated cab	Air conditioned cab
Standard	Optional	Optional	Optional
All models	62F – 72F – 82F models only		

Print No. **603.54.283.00** – 09 – 1994

SERVICE TOOLS – CAB AIR CONDITIONING SYSTEM

Attention – Operations included in this section of the Manual must be performed using the **ESSENTIAL** tools further evidenced by the identification code (**X**). Besides, to work safely and achieve the best technical results, with additional savings of time and fatigue, these mandatory tools should be used in conjonction with the suggested special tools listed below.

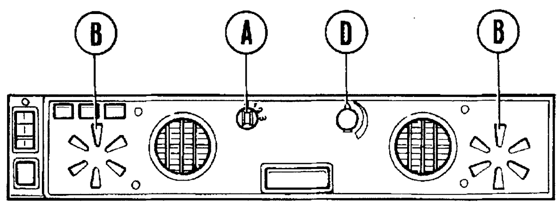
Air conditioning system		List of the special tools necessary to perform servicing operations envisaged in this Section
with R12 gas	**with R134a gas**	
X 294005	**X** 294030	Charge and evacuation station
X 294041	**X** 294048	Recovery/recycling station
293824	–	Hoses, for 294005 and 294041
–	294044	Hoses, for 294030 and 294048
294045	–	Tool kit, for 294005
–	294043	Tool kit, for 294030
294042		Receiver–dryier filter, for 294041 and 294048
294036		Acoustic leak detector
293826		Heat resistant tape, for expansion valve
X293831		Comb, condenser and evaporator fin cleaning and straightening

Print No. **603.54.283.00** – 09 – 1994

HEATED AND VENTILATED CAB CONTROLS

3–speed electric fan control knob (A)

The electric fan can be operated also with the starter switch key in 0 position being control knob (A) permanently energysed.



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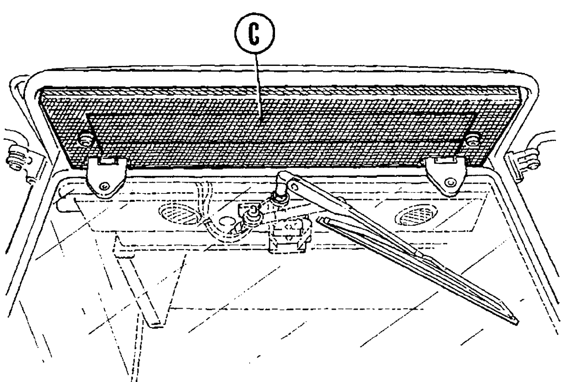
Air can be optionally drawn from the outside or from inside the cab by acting on circulating air inlets (B) which can be set in two different positions:



23255

inlets closed	air is drawn from the outside through front grille (C);
inlets open	a larger volume of air is drawn from inside the cab through the inlets themselves.

Set the electric fan control knob (A) in one of the positions indicated in the chart below to obtain the desired fan speed.

Setting	Electric fan speeds
0	Off
I	Low speed
II	Medium speed
III	High speed

The air entering the cab from the outsidfe is always filtered.With electric fan in operation and doors and window glasses closed, the pressure inside the cab is always higher than outside pressure, consequently air can enter the cab through front grille (C) only after being filtered.

Note – To increase pressure inside the cab, air must be drawn in only from the outside (air circulation outlets closed).

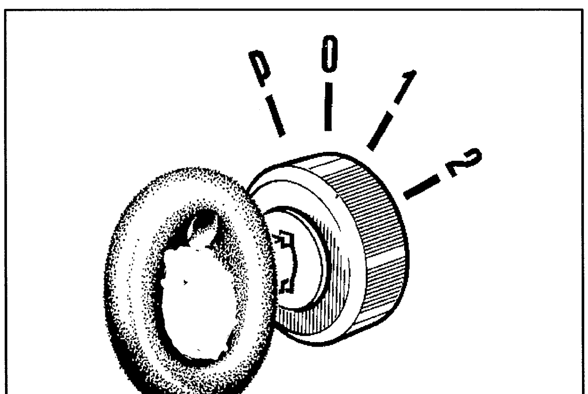
Heater control switch (D)

Set air temperature through control knob (D), as follows:

— for maximum temperature, turn knob (D) clocwise;

— to stop warm air circulation inside the cab, turn knob counterclockwise, which will produce minimum temperature.

Starter switch



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0. No user circuit energyzed, except the electric fan control knob (A). Key can be removed. Engine shut down. Automatic fuel injection pump fuel cut–off device on.

1. Engine starting circuit energysed. Warning indicators and instruments activated. Miscellaneous user circuits energysed.

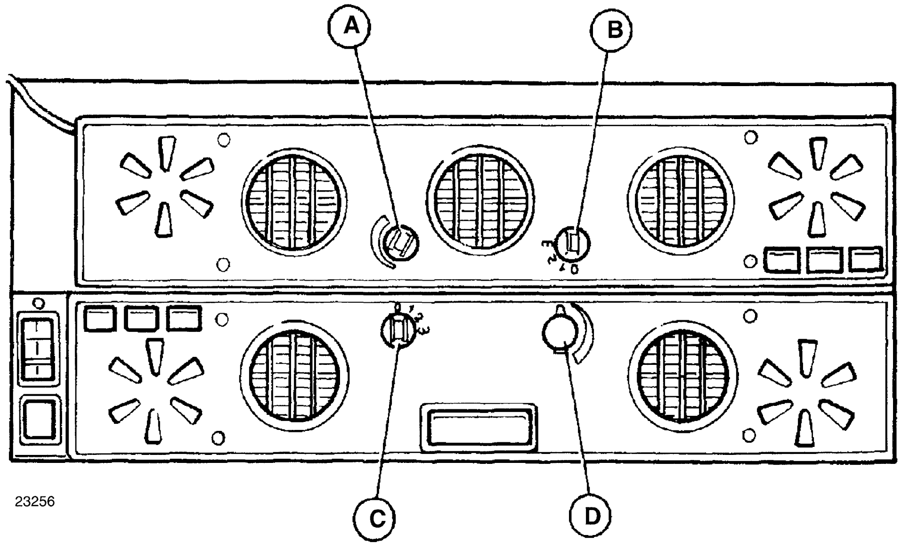
2. Ignition (when released, key will automatically return in 1 position).

P Parking and dashboard lights on (key can be removed).

Print No. 603.54.283.00 – 09 – 1994

AIR CONDITIONED CAB CONTROLS

Important – When tractor engine is stopped the air conditioner will not work because the compressor is driven through a belt driven by the engine crankshaft. With air conditioner in operation, set the "heater/ventilation" controls (C and D) in off position.



23256

Air conditioner and temperature regulation control knob (A).

Activated with starter switch key in 1 position and electric fan control knob (B) in one of the I, II and III positions.

Turn control knob (A) counterclockwise to activate the air conditioner and consequently lower the temperature inside the cab.

Turn knob clockwise to shut the conditioner off.

Note – In order to obtain the right temperature inside the cab, always open the air circulation outlets when the air conditioner is working and keep doors and window glasses closed.

3–speed electric fan control knob (B).

The electric fan can be operated also with starter switch key in 0 position, being the control knob (B) permanently energysed.

Setting	Electric fan speed
0	Off
I	Low speed
II	Medium speed
III	High speed

Note – To increase pressure inside the cab, air must be drawn in onlky from the outside (air circulation outlets closed).

Print No. 603.54.283.00 – 09 – 1994

CAB AIR CONDITIONING SYSTEM SPECIFICATIONS

Air conditioning system	R12 gas	R134 a gas
Refrigerant fluid quantity	1200 g (42.4 oz)	900 g (31.8 oz)
Output pressure	13÷24 bar (188÷348 psi)	16÷24 bar (232÷348 psi)
Intake pressure	0.5÷3 bar (.72÷43.5 psi)	
High pressure switch setting	25 bar (362 psi)	
Low pressure switch setting	2 bar (29 psi)	
Fluid temperature at compressor outlet	60÷120°C (140÷248°F)	
Fluid temperature at condenser outlet	50÷80°C (122÷176°F)	
Fluid temperature at evaporator outlet	0÷20°C (32÷68°F)	
Maximum 3–speed centrifugal fan flow output	1.5÷3.5 cu.m/1' (53÷124 cu.ft/1')	

SANDEN SD 709 compressor for R12 gas	
Cylinders	7
Displacement	155 cu.cm (9.5 cu.in)
Maximum speed	6000 rpm
Weight	6,5 kg (14.3 lb)
Lube oil q.ty	135 cu.cm (8.23 cu.in)
Lube oil type and grade	SUNISO 5 GS

SEIKO SEIKI SS121 compressor for R134a gas	
Developed displacement	121 cu.cm (7.4 cu.in)/rev
Displacement compared to alternating axial–type compressor	141 cu.cm (8.6 cu.in)/rev
Weight	6.7 kg (14.8 lb)
Continuous speed rate	7000 rpm
Maximum speed	8400 rpm
Lube oil q.ty.	220 ± 10 cu.cm (13.4 ± .6 cu.in)
Lube oil type	PAG SK 20

Print No. 603.54.283.00 – 09 – 1994

OPERATION

The air conditioning system is designed to create, inside the cab, the best possible environmental conditions for operator's comfort.

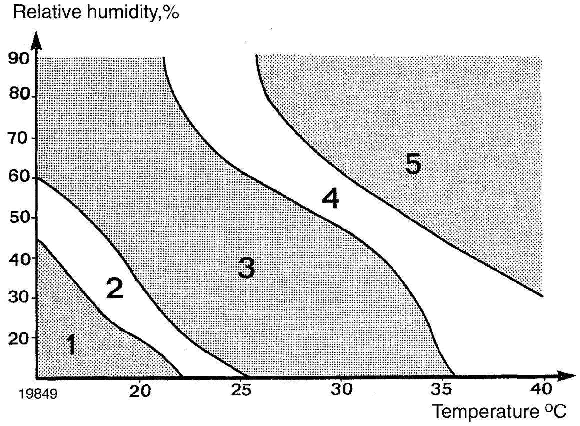
These conditions are strictly connected to four major factors:

— temperature;
— humidity;
— speed;
— cleanliness of air inside the cab.

Although optimum values cannot be fixed owing to different individual requirements, limits can be established within which sufficient comfort is assured in the majority of cases.

As regards temperature and humidity, an area of comfort, known as physical well–being area, has been found to correspond to certain temperature–humidity values assuring a comfortable permanence in the working environment.

The chart shows that ideal humidity levels are comprised between 30% and 70% (below 30%, dehydration causes nose and throat soreness, whereas above 70% transpiration or unpleasant feelings due to the presence of moisture over skin areas of the body are experienced) and a comfortable temperature varies between 18° and 28°C (62° and 84°F), approximately.



Simplified temperature–humidity chart

1. Sensation of unbearable cold – 2. Sensation of cold – 3. Area of physical comfort – 4. Sensation of heat – 5. Sensation of unbearable heat.

Air flow rate should not be excessiveto avoid physical annoyance and irritation. Values of 0.07 to 0.25 m/s are considered normal.

No strict limit has yet been established as to air purity. However, it is a known fact that the human body alters the composition of air in the surrounding environment by increasing the perecntage of carbon dioxide, raising humidity and decreasing oxygen content, etc.

These adverse effects can be rectified by drawing in small volumes of air from the outside; particularly in agricultural environments, characterized by high dust levels caused by tractor field work (soil processing, hay making, etc.), this requires the installation of dry air filters installed on the external air suction inlets.

Air conditioners are therefore installed in tractors and other agricultural machines in order to neutralize the causes of discomfort (heat and humidity) generated inside the operator's cab. The air conditioning system modifies the thermic and hygrometric characteristics of the air existing inside or of the air drawn in from the outside in order to obtain a cooling effect and a humidity level physically agreable to the operator.

The operating principle of an air conditioner is similar to that of a domestic refrigerator. To cool the ambient, heat is taken away through a physical process (evaporation of a liquid) absorbing heat from the surrounding environment.

The liquid utilized for the purpose, called refrigerant fluid, is a product with high cooling coefficient, low toxicity and good mixability with lubricating oils.

Suitable refrigerant fluid lines connect the various system components and assure the pressure level inside the system in which the fluid circulates.

Print No. 603.54.283.00 – 09 – 1994

Essentially, an air–conditioning system consists of the following main components:

1. **Compressor**
2. **Condenser**
3. **Receiver–drier filter**
4. **Expansion valve**
5. **Evaporator**

In order to understand the working cycle of the air conditioning system, follow the path of the fluid flow starting from compressor (1).

It draws the refrigerant at the cold vapor stage at 0.5 ÷ 3 bar pressure and compresses it to 13 ÷ 24 bar (R12) or 16 ÷ 24 bar (R134a).

The fluid, heated through compression to 60°÷120°C, is then admitted, still in the vapour stage, inside the condenser (2) located ahead of the engine radiator.

The flow of air produced by the travelling tractor cools the fluid through a heat exchange process.

Consequently, the fluid, with a condensation point of 50°÷80°C, becomes liquid.

It flows then through the receiver–drier filter (3) and, under high pressure, passes on to the expansion valve (4), through a restriction which lowers the pressure.

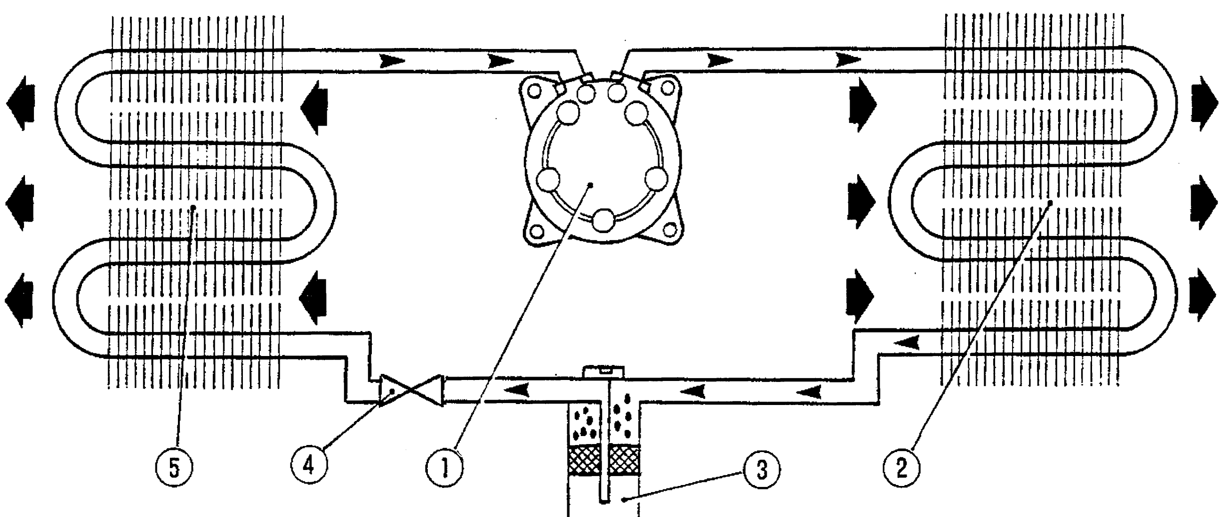
Passing through this valve, the liquid refrigerant is partially transformed into low temperature gas and the pressurized, low temperature gas–liquid mixture thus formed enters the evaporator (5).

Here, the electric fan generates a continuous flow of air from inside the cab over the evaporator fins, thus facilitating absorption of heat on the part of the mixture which is finally fully vaporized.

The evaporation process removes heat from the air impinging on the evaporator and as air is cooled the temperature inside the cab lowers.

Air flowing over the cold surface of the evaporator also causes a partial condensation of the water content which results in less humidity inside the cab.

The low–pressure gas flowing out of the evaporator at a temperature comprised between 0°÷20°C is aspirated by the compressor and a new cycle will start.



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Air conditioning system simplified flow chart

1. Compressor – 2. Condenser – 3. Receiver–drier filter – 4. Expansion valve with thermostatic sensor – 5. Evaporator.

Print No. 603.54.283.00 – 09 – 1994

CAB AIR CONDITIONING SYSTEM MAIN COMPONENTS

Compressor

The compressor provides compression and circulation of the refrigerant fluid through the air conditioning system.

SANDEN SD 709 MODEL

Reciprocating axial type , operated by the engine crankshaft through a V–belt drive.

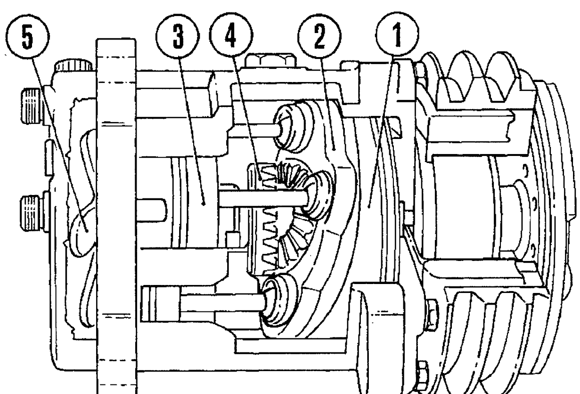
Schematically, this compressor functions as follows:

Actuator plate (2) resting on swash plate (1) carries the ball–head piston rods (3).

As it rotates, the swash plate exerts a continuous thrust on the actuator plate which cannot turn being meshed with fixed gear (4).

Due to the angled position of the swash plate surface with respect to its axis of rotation, each piston will alternatively reciprocate endwise.

Cylinder heads incorporate a single, seven–lobe reed valve (one lobe for each piston) designed to produce continuous suction–and–discharge cycles inside the cylinders.



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SANDEN SD 709 reciprocating axial compressor

1. Swash plate – 2. Actuator plate – 3. Piston with gland – 4. Fixed pilot gear – 5. Combined suction–discharge valve.

Valve opening and closing is automatic because of a suitable pre–loading of the reeds.

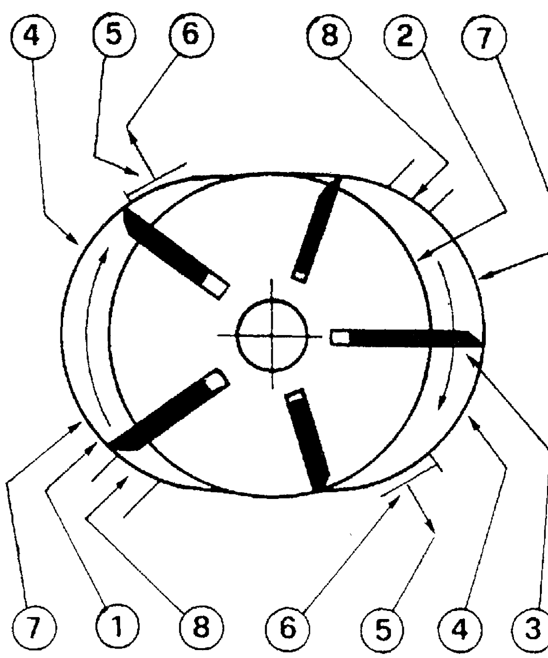
Compressor inside rotating parts are permanently lubricated by a special oil filled in at assembly, part of which flows mixed with the refrigerant fluid.

SEIKO SEIKI SS121 MODEL

Rotary, 5–blade type, elliptical stationary plate and round rotor with concentric axis of rotation.

The stator is the housing of the compressor, provided at the inside with an elliptical–shaped chamber within which the round–section rotor rotates; the latter is provided with a number of radial grooves for guiding the blades.

Blades are designed to change, through their rotation, the volumes inside the compression chambers, so to generate the correct operating stages for the compressor; valves are of the reed type, similar in design and scopes to those of the SANDEN compressor previously decribed.



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SEIKO SEIKI SS121 rotary–type, 5–blade compressor with elliptical stator.

1. Compressor housing – 2. Rotor – 3. Blades – 4. High–pressure side – 5. Drain valve – 6. To drain outlet – 7. Low pressure side – 8. From suction inlet.

Print No. 603.54.283.00 – 09 – 1994

Condenser

The condenser is designed to convert refrigerant fluid from a gas into a liquid.

As this transformation occurs through heat transfer from the gas to the ambient air, the principle is very similar to that of the engine cooling radiator.

It consists of a number of tubelets inside which the refrigerant fluid circulates and of a finned core that, pressed over the tubelets, covers them thoroughly with thin aluminium foils designed to transfer inside heat to the surrounding ambient.

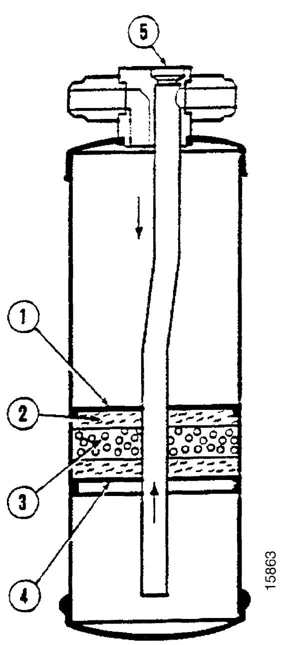
The condenser is installed in front of the radiator engine so as to exploit at its best the flow of air necessary for heat exchange purposes.

Receiver–drier filter

The receiver–drier filter installed between condenser and expansion valve performs two basic functions: it acts as a filtering element retaining water and solids and as a refrigerant fluid reservoir under variable load conditions.

The elimination of water from the system is important in order to prevent corrosion which would adversely affect the system component operation.

To this end, the filter contains specific moisture absorbing materials.



Receiver–drier filter

1. Upper shield – 2. Disc – 3. Drier pack – 4. Lower shield – 5. Sight glass.

Similarly, solid particles such as grit and sand, metal particles originating from wear of compressor parts, oxidation deposits and particles shed by pumping, potentially harmful to the air conditioning system, are retained through suitable filtering elements.

Thermostatic expansion valve

This valve is designed to reduce refrigerant fluid pressure at condenser outlet to facilitate its change of physical state in the evaporator and consequently the removal of heat and cooling of the surrounding ambient.

The expansion valve performs in two fundamental modes:

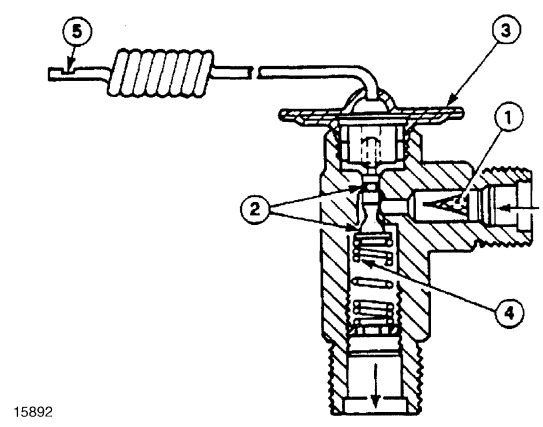
— metering mode: a calibrated orifice inside the valve body produces a refrigerant pressure differential between inlet (liquid state) and outlet (mixed liquid–gas state). The calibrated orifice is also designed to "atomize" the liquid, thus favouring subsequent eveporation;

— modulating mode: a thermostatically controlled sensor inside the valve moves between extreme positions of maximum opening and complete closure thereby metering the fluid flowing through. This ensures the correct volume of refrigerant allowed into the evaporator in order to obtain complete evaporation of the fluid.

If the thermostatic sensor detects a temperature increase inside the cab, it will increase the flow of regrigerant.

Conversely, as temperature lowers or the compressor output increases (owing to higher engine speed), then the sensor will reduce the volume of refrigerant fluid flowing to the evaporator.

The evaporator inlet connection is fitted with an expansion valve.



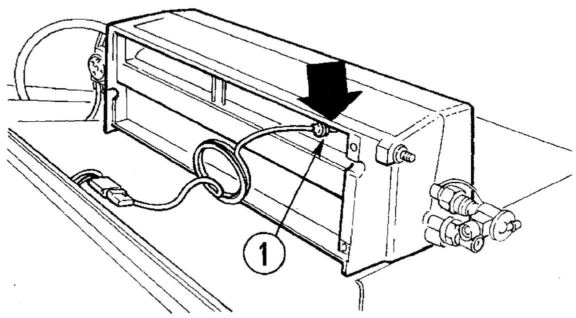
Thermostatic expansion valve

1. Gauze filter – 2. Modulator – 3. Diaphragm – 4. Spring – 5. Thermostatic sensor.

Print No. 603.54.283.00 – 09 – 1994

Thermostatic switch

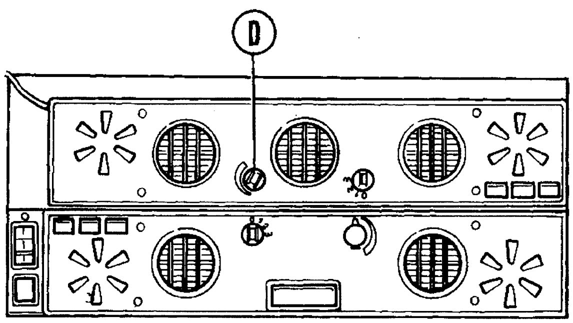
The thermostatic switch, or more simply thermostat, is a control device sensing the refrigerant temperature at the evaporator.



23259

It is provided with a thermostatic sensor (1) suitably placed into the evaporator core fins for a continuous pick–up of the evaporator temperature compared with pre–established values.

This sensor (1) is filled with a special gas, the volume of which varies with temperature, that by acting upon a diaphragm connected to a complex mechanism will open or close an electric circuit directly connected to the compressor clutch solenoid.



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Thus, depending on the pre–established setting of control knob (D), the compressor will be driven by the V–belt connected to the engine crankshaft for a certain period of time to supply the desired cooling effect inside the cab.

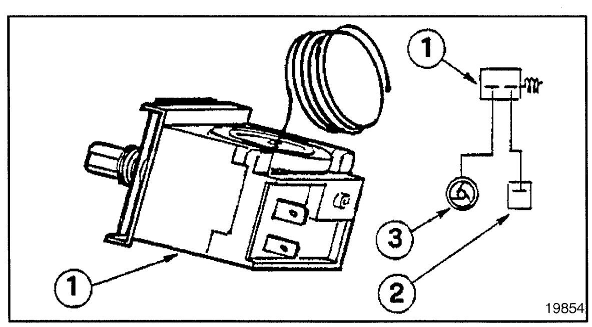
Once established a pre–determined temperature setting at the evaporator at which the compressor is disconnected, the device is so designed as to engage the compressor again when the temperature inside the cab rises over 3°C with respect to previous conditions.

The thermostat, through its thermostatic sensor (1), is also designed to prevent the evaporator pack from freezing, thus hindering air circulation, in the event of a particularly high level of moisture in the air.

It is therefore important that sensor (1) be placed exactly in the position shown in the figure, otherwise the system will fail to function correctly.

The functional range of the thermostatic switch extends over an evaporator temperature range of 2°÷16°C (36°÷61°F).

The thermostatic switch, of the dual–contact type, and its electrical connections are illustarated in the figure below.



Dual–contact thermostat and electric connections

1. Thermostatic switch – 2. Electric fan switch – 3. Solenoid–controlled clutch.

Print No. **603.54.283.00** – 09 – 1994

Evaporator

The cooling cycle is completed inside the evaporator.

The refrigerant fluid flowing out of the expansion valve is a mixture of gas and liquid at low temperature and pressure.

As it flows through the evaporator, it will absorb heat from the ambient to be conditioned, vaporizes to produce the required cooling effect and is subsequently aspirated by the compressor in the vapour state.

The evaporator is functionally controlled by the expansion valve which will meter the exact volume of refrigerant needed to produce the desired air conditioning effect.

The operation of the evaporator is exactly opposite to that of the condenser but its basic constructrion is similar except for the overall dimensions and internal flow scheme.

Moreover, the evaporator lowers the humidity level of the air.

As the air flowing through the evaporator contains a certain amount of moisture, if the latter is not suitably controlled the desired comfort for the operator cannot be achieved.

Thus, moisture is partially eliminated through condensation over the evaporator fins as air cools down.

The centrifugal electric fan is installed in order to draw ambient air through the evaporator core fins for cooling and de–moisturing prior to admission inside the cab.

The housing frame enclosing both the fin pack and electric fan is provided with a condensate trap and drain tubelets conveying the condensate to the outside.

CAB AIR CONDITIONG SYSTEM SERVICING NOTES AND PRECAUTIONS

At low temperature, starting the conditioner may result in compressor damage. The air conditioner should be activated only after the engine has been started and warmed up and the temperature inside the cab has reached 20°C (68°F).

When disconnecting refrigerant lines always seal open ends with plastic plugs or caps to prevent entry of dust and moisture.

The thermostatic sensor tubelet must be handled with special care to avoid damage which can jeopardize the air conditioning system performance.

When unscrewing fittings, always use a back–up wrench to prevent permanent deformation or twisting.

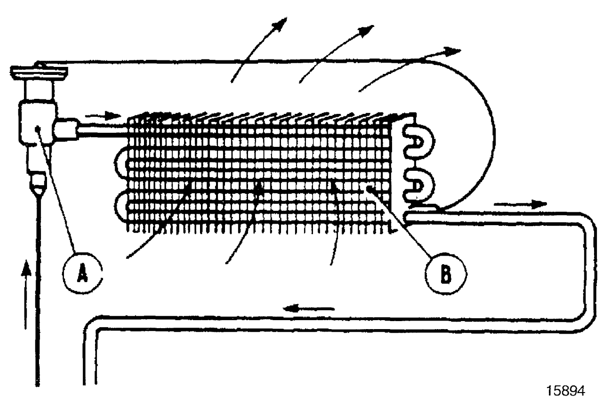
Never use engine oil, of any type or grade, to lubricate the conditioner and compressor.

Do not leave the compressor oil container open. Make sure it is closed tight as the oil will absorb moisture which is detrimental to the system

Do not transfer compressor oil from own container to a different one.

Do not add anything to the system refrigerant fluid and oil. Any additional substance may contain elements not compatible with the chemical constituent base of the refrigerant causing the degrade or loss of the fluid characteristics and specifications.

Make sure that the thermostatic sensor is duly inserted in the evaporator core fins to assure efficient system performance.



Evaporator
A. Expansion valve – B. Evaporator.

Print No. 603.54.283.00 – 09 – 1994

REFRIGERANT RECOVERY–RECLAIMING AND EVACUATION–CHARGE STATIONS

ATTENTION

We strongly recommend not to use the recovery–reclaiming and evacuation–charge stations with types of refrigerant fluids other than the prescribed ones as their characterics are not compatible with the constituent chemical base.

Before connecting the station to the system or to the refrigerant container check that the fitting is the correct one.

Note – Connections for the R134a type fluid are made different from the R12 ones in order to avoid unvoluntary but dangerous contaminations. Do not tamper trying to adapt the R134a connections to the R12 ones and viceversa: the operation of the air conditioning system and of the stations would be seriously and negatively affected.

When connecting station fluid lines to air conditioning system valves always connect the blue pipe (low pressure) to the valves located on the system inlet side (S–Suction) and the red pipe (high pressure) to the valve located on the system outlet side (D–Discharge).

RECOVERY–RECLAIMING STATION
(294048 for R134a and 294041 for R12 fluid)

Description

Designed to carry on the recovery–reclaiming process of refrigerants employed in air conditioning systems.

The recovered refrigerant undergoes a first separation from the lube oil, used in the system, by a vaporizing process in a special container.

The reclaiming station provides for neutralizing acids, absorbing moisture and eliminating solid particles present in the refrigerant.

The reclaimed refrigerant is stocked inside a dispenser cylinder.

TECHNICAL FEATURES

Recovery compressor provided with oil level indicator, drain valve and connection.

Refrigerant reclaiming acid cleaner with a high moisture absorption capacity.

Refrigerant/oil still with electrical resistance, automatic device for returning the oil to the recovery compressor and automatic metering valve regulating the refrigerant flowing back to the station.

Graduated cylinder for recovered refrigerant , 2.2 kg (4.85 lb) capacity, with electrical resistance and safety valve.

2–way pressure gauge set, with refrigerant flow indicator and pressure gauges for cylinder and refrigerant checks.

Humidity indicator for checking the state of the reclaimed refrigerant.

Pressure–operated switch for automatic cut–in/cut–off of compressor.

Graduated container for recovered oil.

Switch (1–0–2) for cylinder recovery and heating operations.

Operation check light indicators.

Flexible hoses with safety taps:

293824 for **R12** fluid;
294044 for **R134a** fluid.

Recovering capacity:	200 g/1’.
Feeding:	220 V (50 Hz).

Replacing refrigerant reclaiming filter

Attention – Replace the filter (3) after every 12 months or in any case when the moisture gauge (12, page 50–15) becomes yellow and maintains colour in the recovery–reclaiming stage.

— Close the yellow tap located underneath the reclaiming still (4).
— Carry on the recovery process if the presence of refrigerant is noted inside the circuit.
— Remove the contaminated filter, replace connection seals and install a new filter.

Print No. **603.54.283.00** – 09 – 1994

— Carry on a normal evacuation operation (about 30 minutes, using an evacuation pump) through valves (11) on the side of the recovery compressor.

— Open the yellow tap located underneath the recovery still (4).

— Carry on a brief operation of refrigerant recovery (100/200 grams) and check, using a leak detector, connections of replaced filter.

— Report operation on Maintenance Card.

Changing oil in recovery compressor

Attention – After every 12 months change the recovery compressor oil (of type and grade prescribed by the Manufacturer) in order to maintain full reclaiming capacity for the recovered refrigerant and to safeguard the compressor from any potential problem.

— Open oil tap (10), drain it out into a container for safe disposal in accordance with local regulations.

— Close tap (10).

— Remove plugs on both valves located on compressor sides on sight glass.

— Connect to the valve on the compressor side the pipe of a vacuum station and a suction pipe to the valve on the sight glass.

— Start the evacuation pump; oil charging can be effected by suction from an outside container through the suction pipe.

— Once the prescribed quantity of oil is in the compressor (reaching the middle on sight glass), disconnect the suction pipe and refit plug on the valve. Continue evacuation for about ten minutes.

— Finally, close taps, shut off the evacuation pump, disconnect suction pipe and tighten plug on valve.

— Report operation on the Maintenance Card.

EVACUATION–CHARGE STATION
(294030 for R134a and 294005 for R12 gas)

Description

This station is designed to carry out the refrigerant evacuation and subsequent charging operations on air conditioning systems.

Evacuation is necessary to eliminate moisture and any impurities existing inside the system.

The refrigerant, retrieved from the pressure container is transferred to the graduated cylinder and subsequently pumped into the air conditioning system.

Technical features

Rotary, oil–bath type evacuation pump, double–acting and ballasted.

Charging cylinder with maximum level indicator and graduated scale for measuring the quantity of refrigerant fluid contained therein.

5–way pressure gauge set provided with 2 pressure and vacuum gauges for measuring pressure/vacuum conditions inside the system.

Flexible hoses with safety taps:

293824 for **R12** fluid;
294044 for **R134a** fluid.

Feeding current: 220 V (50 Hz).

*Print No. **603.54.283.00** – 09 – 1994*

AIR CONDITIONING SYSTEM
De–moisturing, charging and checking the refrigerant (Operation 50 200 04)

Recovering the refrigerant from the cab air conditioning system using recovery–reclaiming stations 294048 for R134a gas (or 294041 for R12 gas).

Proceed as further indicated:

1. Make sure that re–charging cylinder (4) is not full and that it can contain the full quantity of refrigerant to be recovered from the system (maximum cylinder capacity is 2 kg = 4.4 lb; in case, carry on a partial transfer operation as decribed on page 50–17).

Note – The refrigerant recovery can be done more quickly and completely by previously warming up the system as heat helps refrigerant evaporation thus making it completely available for recovery.

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2. Possibly, operate the air conditioning system for a few minutes, with engine running and lowered hood so that, during the refrigerant recovery stage, accumulated heat will be slowly released to the various system components allowing the colder refrigerant fluid locks to evaporate.

3. Shut engine off.

DANGER

Make sure the engine is stopped before carrying on the refrigerant recovery operation.

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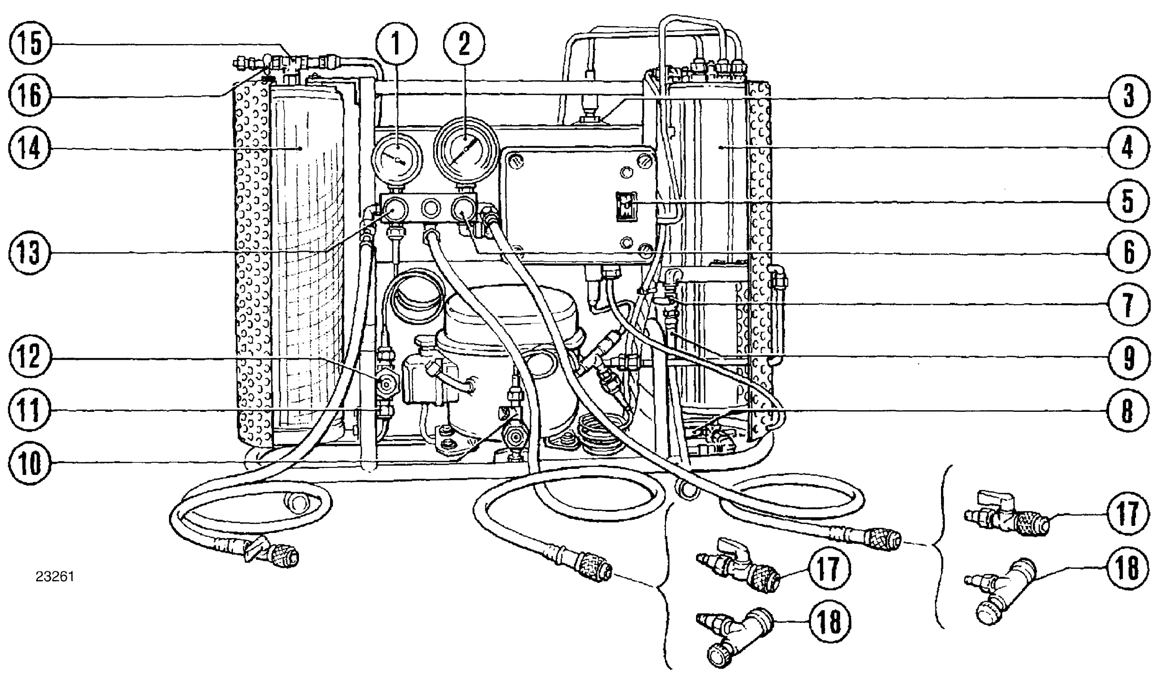
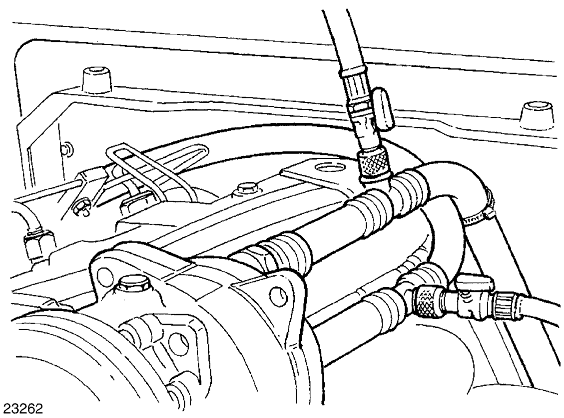
4. Connect the station feed cable to a socket.

5. Make sure all taps are closed.



1. Cylinder pressure gauge – 2. Recovery check pressure gauge – 3. Reclamation and anti–acid filter – 4. Recovered refrigerant/oil still – 5. Switch – 6. Inlet refrigerant check tap (LOW) – 7. Recovered oil drain tap (yellow) – 8. Oil return to compressor check tap (yellow) – 9. Recovered oil drain pipe – 10. Recovered compressor oil drain tap – 11. Recovery compressor valve (suction) – 12. Hygrometer (moisture indicator) – 13. Refrigerant transfer and reclaiming tap (REF) – 14. Refrigerant cylinder – 15. Safety valve – 16. Cylinder discharge (refrigerant gas state) tap (yellow) – 17. Safety taps for R12 gas – 18. Quick–connects with taps for R134a gas.

Print No. **603.54.283.00** – 09 – 1994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6. Remove plugs from valves.

7. Connect the blue pipe to the valve connected to the suction line (low pressure) of the air conditioning system (marked "S" on the compressor).

8. Connect the red pipe to the valve located on the delivery line (high pressure) of the air conditioning system (marked "D" on the compressor).

9. Start and run the electric fan in the cab at maximum speed in order to improve the heat exchange process between evaporator and ambient air.

10. Open taps (17, for R12 refrigerant station) or (18, for R134a refrigerant station).

11. Slowly open tap (6 – LOW, page 50–15) located on the pressure gauge set. Pressure gauge (2) indicates the presence and pressure of the refrigerant contained in the system; if the dial indicator is near "0", the system is discharged.

12. Set switch (5) in "1" (RECOVERY), green light on. The recovery compressor will now start to work.

During the recovery stage, the refrigerant flows into the still (where it is separated from oil) and then into the reclaiming filter (where major impurities will be removed) to finally reach and enter the graduated cylinder.

The compressor will automatically stop when pressure gauge (2) indicates a – 0.3 bar pressure.

As the recovery compressor stops, the oil (which has come out of the system with the refrigerant) will automatically return to the system compressor.

13. Wait a few minutes to allow the colder refrigerant locks remained in the system to vaporize and thus allow complete recovery.

14. Check pressure gauge (2): if the pressure has increased with respect to the previous – 0.3 reading, the station will automatically start on a second recovery operation; if, on the contrary, the pressure reading has remained closed to the value reached in the first recovery operation, meaning that in the system there is no more refrigerant to be recovered, this operation can be considered as concluded.

15. Close all taps, disconnect piping and shut the station off if no further work is required.

16. Shut off the electric fan inside the cab.

Reclaiming the recovered refrigerant

Once concluded the recovery operation, the refrigerant, already separated from contaminated oil, will have to be completely reclaimed.

⚠ ATTENTION ⚠

The recovered refrigerant, non yet completely reclaimed, must never be used.

Proceed as further indicated.

17. All taps should be closed and the station shut off.

18. Connect the tapless end of the yellow pipe to the free connection on the left–hand side of the pressure gauge set.

19. Connect the two ends of yellow and blue pipes to the connection supplied in the service kit.

20. Slowly open the yellow tap (13–REF, page 50–15) and the blue one (6–LOW) on the pressure gauge set and the taps on the two pipes previously connected.

Print No. 603.54.283.00 – 09 – 1994

21. Position the switch (5) in "1" position (RECOVERY), green light on. The recovery compressor will now start to work and the refrigerant starts passing from the graduated cylinder into the recovery circuit (still, filter and compressor) to flow back into the graduated cylinder. Repeat this operation until the moisture indicator (12, page 50–15) gets green in colour.

Note – The moisture indicator (12) should keep, in the recovery stage, its green colour. Instead, when the colour remains or tends to become yellow, the filter is saturated with moisture and must be replaced because unsuitable for refrigerant reclamation.

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22. Once the reclamation operation is completed, close tap (13) and continue to recover refrigerant. The recovery compressor will automatically stop when the pressure gauge reading is – 0.3 bar.

23. Close tap (6) and the two taps on yellow and blue pipe ends, disconnect these pipes and shut the station off if no further reclaiming work is needed.

Transferring the reclaimed refrigerant from graduated cylinder to an external container.

Once the graduated cylinder contains 2 kg of refrigerant, and, in any case, when the refrigerant is to be trnsferred, proceed as further indicated.

24. Check that all taps are closed and station shut off and that the container is capable of receiving the refrigerant to be transferred from the graduated cylinder, considering that the permissible safety level must not be exceeded.

25. Connect the tapless end of the yellow pipe to the free connection on the left–hand side of the pressure gauge set and the other one, provided with a tap, to the red connection of the pressure container.

26. Set the switch (5, page 50–15) in "2" position (HEATING CYLINDER) thus activating the resistance on the cylinder to ease refrigerant flow.

27. Open the yellow tap (13–REF), the yellow tap on the service pipe and the red tap on the pressure container.

28. Once the refrigerant transfer has been completed, close all taps and shut the station off.

Draining the recovered oil

The presence of contaminated oil can be visually detected inside the still cylinder (4). Recovered oil must always be drained and disposed of according to local regulations on used oils.

Proceed as further indicated.

29. Slowly open yellow tap (7) and drain recovered oil inside the special graduated container.

30. When charging the system again, fill in the same quantity of new oil.

Print No. ***603.54.283.00*** *– 09 – 1994*

Evacuating and charging the system using the 294030 evacuation–charge station for 134a gas (or 294005 station for R12 gas).

Proceed as further indicated.

Level check and pump oil change (routine check)

Verify the contamination level of the oil and drain trough tap (29), if necessary. The recovered, contaminated oil must always be disposed of in accordance to local regulations.

.Remove plug (19) and fill in the vacuum pump (30) with new oil of the type and grade specified by the Manufacturer until reaching the center line of sight glass (28).

Graduated cylinder vacuum

31. Close the low–pressure side tap (6–LOW), high–presure side tap (9–HIGH) and refrigerant transfer tap (5–REF).

32. Open the refrigerant charging tap (22–REF), vacuum test tap (13) and evacuation test tap (17–VAC).

33. Start pump through switch (24 – I position) to create vacuum inside cylinder (2). After five minutes, close taps and shut pump off.

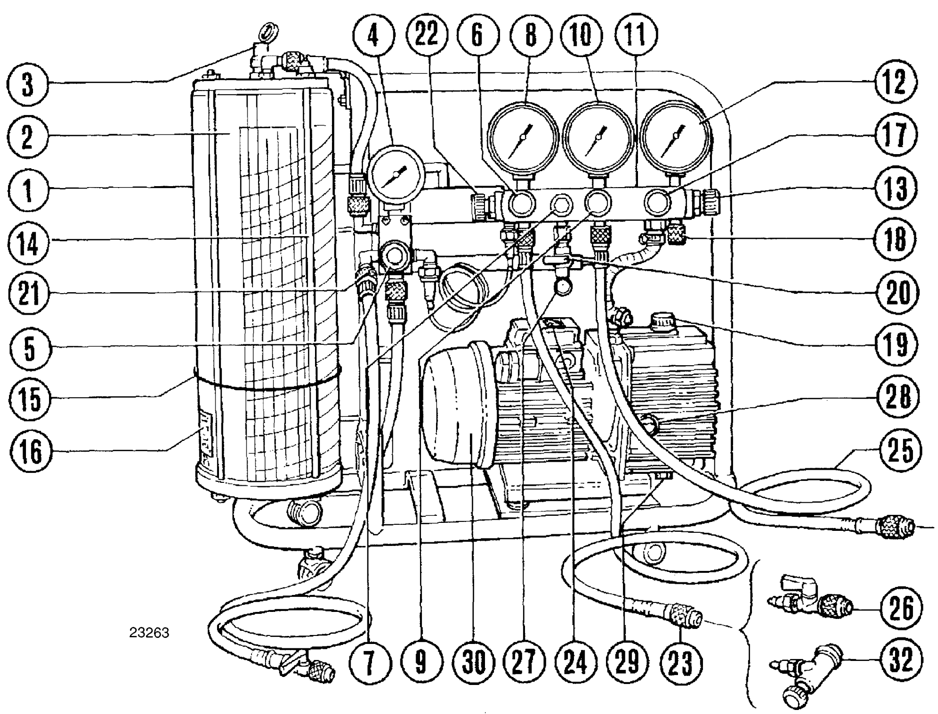
Charging the graduated cylinder

34. Connect the refrigerant pressure container (upside–down if without suction line) to connection (21) through yellow pipe (31).

35. Open the pressure container tap, charge pipe tap and tap (5).

36. Turn the outside protection (1) and align the pressure value on the graduated container with the pressure gauge (4) reading.

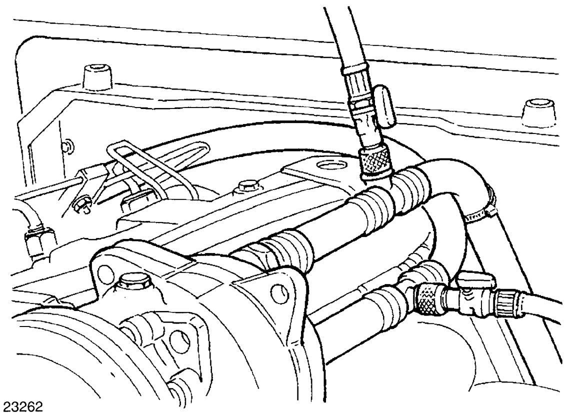
37. Once the refrigerant has reached the desired level inside the cylinder, which can be checked on glass stick (14), close the pressure container tap, charge pipe tap and tap (5).



1. Outside protection (Plexiglass) – 2. Refrigerant charge cylinder – 3. Safety valve – 4. Cylinder pressure gauge – 5. Refrigerant transfer tap (REF) – 6. Low–pressure side tap (LOW) – 7. Sight glass – 8. Lo–pressure gauge – 9. High–pressure side tap (HIGH) – 10. High–pressure gauge (RED) – 11. 5–way pressure gauge set – 12. Vacuum meter – 13. Vacuum test tap – 14. Glass dipstick – 15. Outside ring – 16. Cylinder resistance – 17. Vacuum test tap (VAC) – 18. Vacuum safety valve – 19. Oil plug – 20. Oil charge tap – 21. Refrigerant transfer connection – 22. refrigerant charge tap – 23. Servicing pipe (blu) – 24. On/off switch position (I), resistance on (II) – 25. Servicing pipe (red) – 26. Safety taps for R12 gas – 27. Oil metering connection – 28. Sight glass – 29. Oil drain plug – 30. Vacuum pump – 31. Servicing pipe (yellow) – 32. Quick–connects with taps for R134a gas.

Print No. **603.54.283.00** – 09 – 1994

Evacuating the system (previously discharged through the Recovery–Reclaiming station).



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38. Remove operating valve plugs.

39. Connect operating pipe (23, page 50–18–blue) to the valve located on the low–pressure side (marked "S" on compressor).

40. Connect operating pipe (25–red) to the high–pressure side valve (marked "D" on compressor).

41. Open tap (26 for R12 gas station) or (32 for R134a gas station) and taps (6–9–13–17).

42. Start vacuum pump (switch 24 – I position) and run it for about 30 minutes to evacuate the system (previously drained through the recovery–reclaiming station); pressure gauge (8–10–12) readings should show a negative pressure. If the evacuation process is not normal, check all connections.

43. Close tap (17), shut pump off and check the state of vacuum for at least five minutes using the vacuum meter (12). Then, close all taps again.

Charging the system (evacuated).

Note – The refrigerant quantities to fill in the system are 1100 grams (38.9 oz) for R12 gas and 900 grams (31.8 oz) for R134a gas).

---

44. Turn the outside protection (1) until the graduated scale and pressure values coincide with the pressure gauge (4) reading.

45. Move the outside ring (15) along the cylinder transparent in order to assist in measuring the quantity of refrigerant to be charged.

46. If the charging process is carried on through the high–pressure side, open tap (9); instead, if the charge is made on the low–pressure side, open tap (6).

47. Open tap (22), fill in about 300 g (9.5 oz) and check fluid tightness. If no leaks are detected, continue on the charging process (start engine and air conditioner if charging occurs on the low–pressure side) until prescribed quantity is filled in.

48. Finally, close taps (22 and 9) and refit plugs on valves.

Test system at maximum levels of performance, as further indicated.

Print No. **603.54.283.00** – 09 – 1994

CAB AIR CONDITIONING SYSTEM OPERATION CHECKS (Operation 50 200 03)

With pressure gauges properly connected to the system in the modes previously described and taps closed, proceed as further indicated.

1. Start engine and run it at 1500 rpm.
2. Set the system thermostat, inside the cab, for maximum cooling.
3. Set the electric fan for maximum speed.

After about a quarter of an hour of plant operation, take the readings specified hereafter (items 4–5–6–7–8).

4. Compressor intake pressure, on the low–pressure gauge dial.
5. Compressore delivery pressure, on the high–pressure gauge dial.
6. Ambient air temperature.
7. Ambient relative humidity.
8. Air temperature at air outlets inside the cab.

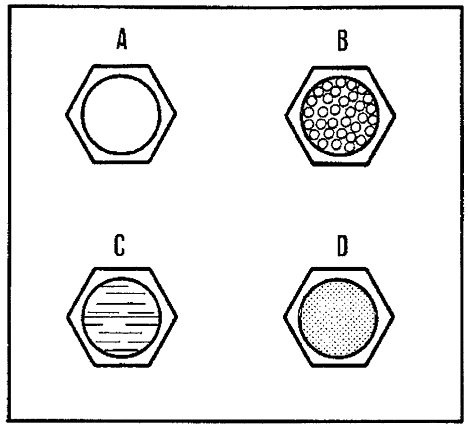
Pressure values depend on the outside ambient conditions.

Operation of the air conditioning system is considered normal if the pressure readings are within values of page 50–6 and temperatures within values of page 50–22.

9. Also check by touch the temperature of the system low– and high–pressure components:

— high–pressure components, starting from the compressor delivery side to the expansion valve located within the evaporator unit, should feel uniformly warm;

— low–pressure components, starting from the evaporator autlet to compressor intake side, should feel uniformly cool. Also check, visually, that condensation on the compressor intake duct and on the lo–pressure connection is not excessive.



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Useful information on plant operation are obtained by inspecting the sight glass located on the receiver–drier filter. Four different situations can visually be found, as shown in the figure below, where:

A. Clear glass: system has been charged correctly, or, on the contrary, there is no refrigerant inside (in this latter instance, a complete absence of cooling effect in the evaporator will be noted). In some case, the glass may be seen clear through, but an axcessive quantity of refrigerant may have been filled in the system. This will require an analysis of pressure readings.

B. Glass with bubbles: vapour or foaming bubbles under the glass mean either an insufficient quantity of refrigerant or air inside the system. Occasionally, bubbles appear at starting or during solenoid clutch disengament.

C. Glass with oil stripes: stands for complete lack of refrigerant with oil alone circulating through the system.

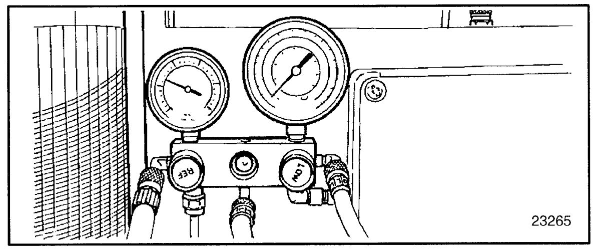
D. Glass with non–homogeneous, striped fluid: the drying material contained in the receiver–drier filter, because of the failure of container plates, has separated and is freely circulating in the system.

Print No. 603.54.283.00 – 09 – 1994

SUMMARY OF THE AIR CONDITIONING SYSTEM CHARGING OPERATIONS

(**Note –** Charted pressure values are indicative and referred to an outside ambient temperature of 25 °C)

Pressure gauge readings at completion of the refrigerant recovery–reclaiming process.



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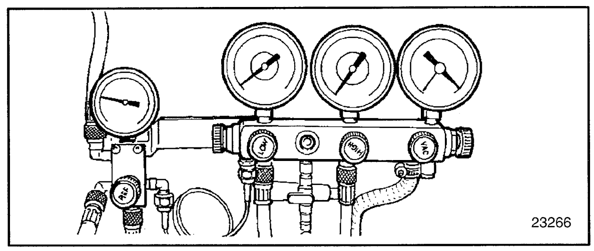
Pressure gauge readings with open taps (6–9–13–17, page 50–18), cylinder (2) with 1400 g (45 oz) of refrigerant fluid inside, blue and red pipes connected to the tractor system, closed taps (26) and compressor shut–off.



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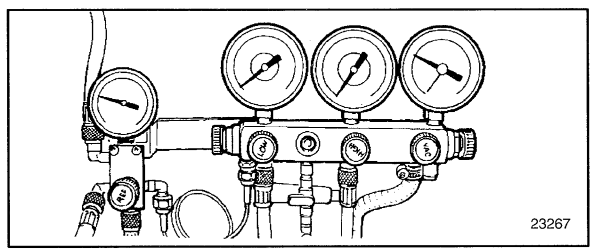
Pressure gauge readings with open taps (6–9–13–17), cylinder (2) with 1400 g (45 oz) of refrigerant fluid inside, blue and red pipes connected to the tractor system, closed taps (26) and compressor started (evacuation starting stage).



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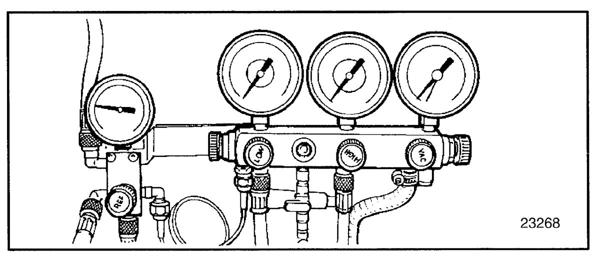
Pressure gauge readings with open taps (6–9–13–17), cylinder (2) with 1400 g (45 oz) of refrigerant fluid inside, blue and red pipes connected to the tractor system, open taps (26) and compressor running (evacuation final stage, after about 30–minute operation).



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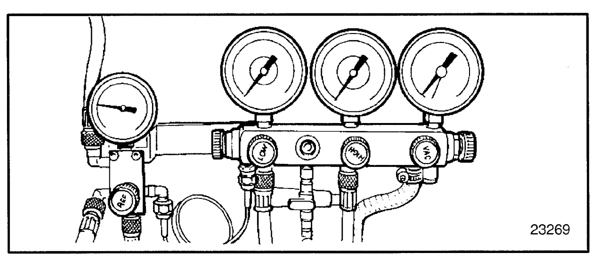
Pressure gauge readings with open taps (6–9–13), cylinder (2) with 1400 g (45 oz) of refrigerant fluid inside, blue and red pipes connected to the tractor system, open taps (26), compressore shut–off and closed tap (17) (check vacuum meter 12 which should not evidence pressure drops within 5 minutes time).



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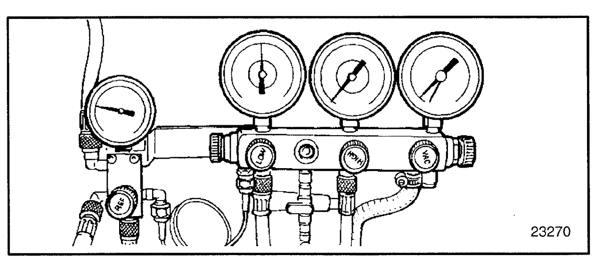
Pressure gauge readings (charge start – charge end). All previously opened taps are now closed, except taps (6 and 22), compressore shut–off. The level of the refrigerant fluid inside the charging cylinder can be seen dropping. Proceed until inside the charging cylinder will remain 300 g (9.6 oz) only of R12 refrigerant glass (1100 – 35.3 oz transferred) or 500 g (16 oz) of R134a refrigerant (900 g – 29oz transferred). Reading of vacuum gauge (12) remains unchanged from beginning to end.



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Checking air outlet temperature inside cab

When the ratio of outside / inside temperature measured at air outlets inside the cab remains inside the charted limits, the air conditioning system can be considered as functionally efficient.

Should the temperature of the inflowing air measured at the air outlets inside the cab exceed the maximum limit specified in the data chart, a fault diagnosis is required to detect and correct the problem (see the troubleshooting guide appearing in the next pages).

CAB AIR CONDITIONING SYSTEM OPERATING TEMPERATURE VARIATIONS

Outside ambient temperature	20°C 68°F	27°C 81°F	28°C 82°F	35°C 95°F	36°C 97°C	43°C 109°C
Air temperature at air outlets (inside cab)	4 ÷ 8°C (39°÷46°F)		6 ÷ 12°C (43°÷54°F)		12 ÷ 20°C (54°÷68°F)	

REFRIGERANT FLUID LEAKAGE SEARCH USING THE ELECTRONIC LEAK DETECTOR

Leak detector (294036)

The **294036** fluid leak detector is contained in a case including two batteries, sensitivity test tube and headphone connection.

The instrument consists of the detector unit and connected flexible sonde containing, in its tip, the pick–up unit.

To position the pick–up, slacken the knob located on the bottom left corner by turning it counterclockwise.

The front end of this instrument incorporates a slide–type on/off switch, the associated red indicator light (led) and an acoustic signal warning of the presence of gas.

The headphone round socket is located on the back of the instrument. The battery compartment contains a spare sensor and a few felts.

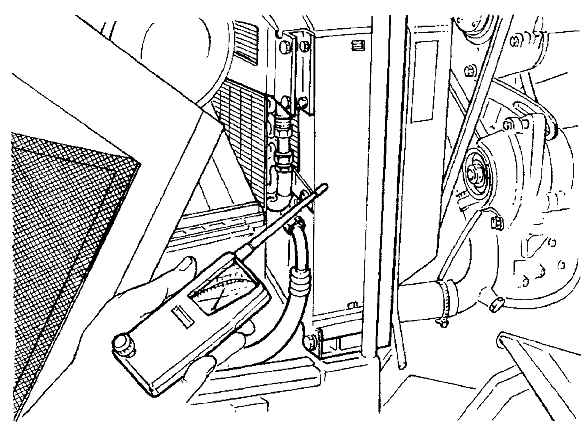
Use

Set switch in ”ON” position, then start searching for leaks. The frequency and amplitude of the sound signal will increase in the presence of gas.

Turn the instrument off and on again over areas affected by leakage: it will automatically adjust at a new sound level. Check instrument this way every time before actual use.

Keep the sensor close to the test tube (open) to check sensitivity and turn the instrument on and off as soon as it poroduces a warning sound.

If the signal amplitude keeps on increasing, turn the instrument on and off again.



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Leakage test

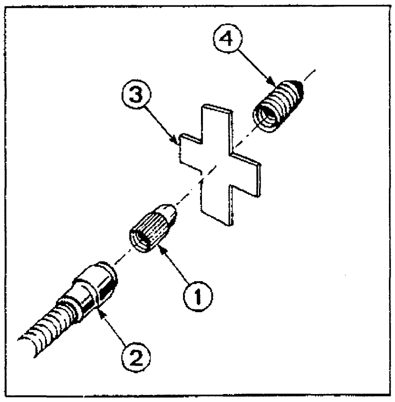
The instrument will thereby automatically adjust its sensitivity depending on the presence of gas in the proximities of the pick–up. This check occurs solely through the on/off switch.

In ventilated areas it may be extremely difficult to detect a consistent leakage as the refrigerant gas departs from the leakage point very quickly. In this case, after identifying the position of a potential source of leakage, it will be necessary to screen it in order to take more reliable readings.

Wherever serious leaks may cover the presence of minor ones, the former should be localized and corrected first to facilitate further search and detection of any minor leak.

Print No. 603.54.283.00 – 09 – 1994

Maintenance



Leak detector sonde

1. Sensor – 2. Flexible sonde – 3. Felt – 4. Protection.

Always make sure that the instrument is turned off before replacing the pick–up. To replace the latter, turn it counterclockwise, fit a new one with a new felt protection and turn them both clockwise on the tip of the sonde flex.

Do not turn the instrument on until the pick–up is securely fastened on the sonde tip.

At assembly, make sure that the hole connecting sonde and sensor is free from grease and dust.

AIR CONDITIONING SYSTEM

Leakage test using the 294036 leak detector and correction of leaks, if any (Operation 50 200 06)

With system charged and pressure gauges connected, proceed as further indicated.

1. Start the engine.
2. Set the thermostat, located inside the cab, for maximum cooling.
3. Set the electric fan for maximum speed.
4. Run engine at 1500 rpm.
5. Activate the electronic leak detector.
6. Check, using the sonde pick–up, every fluid line connection and any potential leakage source:

— any presence of refrigerant, and consequently of a lekage source, is evidenced by the instrument through increased frequency of sound signal emission.

Note – The refrigerant gas is heavier than air and consequently, in a leakage area, it will be easier to detect underneath the leak point rather than above.

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7. If leaks are found in correspondence of connecting lines, tighten connections to eliminate them.

Attention – In the event or replacement of any of the system components, always carry on the operations of refrigerant recovery, reclaiming and system charging described from page 50–15 through 50–20.

SUMMARY OF THE CAB AIR CONDITIONING SYSTEM POSSIBLE PROBLEMS AND THEIR CAUSES

In case of faults, three are the main conditions which may occur:

— conditioner fais to operate;

— poor cooling effect;

— random operation.

Once established that a poor cooling effect may well depend on external causes, indipendently from the air conditioning system operation, normally a preliminary mechanical check and visual inspection are sufficient to give a first indication on plant efficiency.

This information may then be completed by an electrical check of the plant.

If, at this stage, the problem has not yet been located, it wil be necessary to further proceed by pressure testing the various components.

Print No. **603.54.283.00** – 09 – 1994

Visual inspection of components

Make sure that the engine is stopped and the heating plant and air conditioning system are switched off, then proceed as follows:

— check fastening of compressor and bracket, pulley alignment and belt tension;

— check for visual traces of refrigerant leaks evidenced by the presence of oil on connections;

— check for visual evidence of cooling fluid;

— inspect fluid lines, especially the ones contacting the engine, connections and band clamps;

— check cleanliness of the evaporator, heating radiator and condenser and, in case, remove any foreign material;

— check conditions and positioning of the thermostat feeler tubelet in the evaporator core fins (page 50–11);

— check cab outside air inlets for obstructions;

— check conditions of the moisture condensate lines.

Functional check

Start the engine, set the air conditioner for maximum cooling and after 15 minutes of operation check that:

— the sight glass on the receiver–drier filter is clear and transparent, bubbles may appear when the coupling engages but should disappear immediately after;

— the compressor runs without any abnormal noise, the coupling engages audibly;

— the following components feel cold at touch: expansion valve outlet, evaporator, low–pressure line, suction connection on compressor;

— the following components should feel relatively warm at touch: condenser, expansion valve inlet, compressor delivery connection, high–pressure line;

— the expansion valve noise is normal, a squealing sound means that pressure is too low and moisture is present inside the system;

— no freezing evidence or ice are present on the evaporator.

Checking plant operation through pressure and temperature readings

The test consists in connecting the pressure gauge set to the air conditioning system, taking operating pressure readings and comparing them to the associated data charted on page is 50–6 and 50–22.

Remember that altitude influences pressure, as shown in the accompanying chart below; to obtain the actual pressure values at the various system components, just subtract the correction factor from the pressure gauge reading.

PRESSURE/ALTITUDE CORRECTION FACTOR

Altitude over s.l. (meters)	Absolute atmospheric pressure (kg/cm^2)	Correction factor (kg/cm^2)
0	1.029	0
300	0.994	– 0.035
600	0.959	– 0.070
900	0.924	– 0.105
1200	0.889	– 0.140
1500	0.854	– 0.175
1800	0.819	– 0.210
2100	0.791	– 0.238
2400	0.763	– 0.268

Attention – Wherever, in the following pages, it is requested to carry on the **test with refrigerant liquid on the expansion valve**, proceed as follows:

— keep system with thermostat set for maximum cooling;

— spray a small quantity of refrigerant on the diaphragm cover (1, page 50–11) or on the thermostatic sensor and take the reading of the low–pressure gauge. A pressure drop means that the valve functions correctly and the problem lies elsewhere.

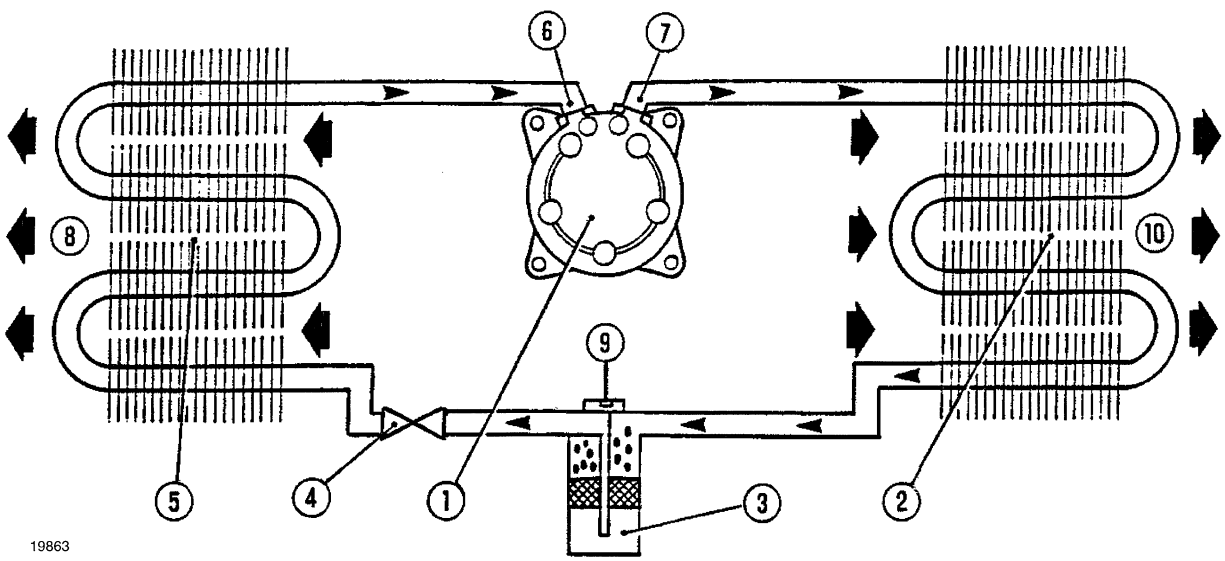
Print No. 603.54.283.00 – 09 – 1994

AIR CONDITIONING SYSTEM TROUBLESHOOTING GUIDE

CONDITIONER FAILS TO OPERATE

1. Check electric fuses.
2. Check compressor drive belt tension.
3. Check solenoid coil for current supply.
4. Check ground connection.

5. Check system control components and devices: relays, wiring, thermostat, etc
6. Inspect all fluid lines and connections.
7. Check distance (gap) between solenoid clutch plate and pulley.



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Air conditioning system lay–out and flow chart.

1. Compressor –2. Condenser – 3. Receiver–drier filter – 4. Expansion valve with thermostatic sensor – 5. Evaporator – 6. Suction line (low pressure) – 7. Delivery line (high pressure) – 8. Cold dried air – 9. Sight glass – 10. Warm air.

Print No. ***603.54.283.00*** *– 09 – 1994*

AIR CONDITIONING SYSTEM TROUBLESHOOTING GUIDE *(cont.)*

POOR COOLING EFFECT

HIGH DISCHARGE PRESSURE AND/OR HIGH SUCTION PRESSURE

CHECK ON SIGHT GLASS

EXCESS OF REFRIGERANT FLUID
Note: bubbles might be evidenced. Drain fluid until bubbles appear consistently, then add fluid until a bubble–free flow is obtained.

ENGINE WATER COOLING PLANT
Inspect (and check):
1. Fan belt tension.
2. Radiator cap and thermostat pressure setting.
3. Rubber hoses.
4. Antifreeze supplied.
5. Check heating plant water valve.

CONDENSER
1. Check if clogged and air starving. Clean core fins.
2. Distance between water radiator and condenser must correspond to design specs.

EXPANSION VALVE
Test valve with refrigerant liquid, using due precautions (safety glasses, gloves, etc. see page 50–24).
1. Positive test: remove thermostatic sensing tube from evaporator core and clean probing area; re–install in correct position (1, page 50–11).
2. Negative test: replace valve.

LOW DISCHARGE PRESSURE AND/OR LOW SUCTION PRESSURE

CHECK ON SIGHT GLASS

BUBBLING EVIDENCE
Insufficient refrigerant fluid quantity possibly caused by minor leaks.
1. Search for leaks and rectify.
2. Add refrigerant until bubble–free fluid flow is obtained and both pressure gauges give normal readings.

BUBBLE–FREE SIGHT GLASS
Pressure gauge readings too low: possibly no refrigerant liquid flowing through glass.
1. Major leak.
2. Expansion valve might be stuck closed.
Replace valve.

NORMAL DISCHARGE PRESSURE AND/OR NORMAL SUCTION PRESSURE

Note: Test reading may evidence vacuum or normal pressure.
INSIDE MOISTURE
1. Drain out refrigerant fluid.
2. Replace receiver–drier filter.
3. Evacuate system and re–charge with refrigerant.

Print No. ***603.54.283.00*** *– 09 – 1994*

AIR CONDITIONING SYSTEM TROUBLESHOOTING GUIDE *(cont.)*

POOR COOLING EFFECT

HIGH DISCHARGE PRESSURE AND/OR NORMAL SUCTION PRESSURE

Note: Constant high–pressure gauge reading, should not drop.

AIR INSIDE SYSTEM

1. Drain out refrigerant fluid.
2. Replace receiver–drier filter.
3. Evacuate system and re–charge with refrigerant.

HIGH DISCHARGE PRESSURE AND/OR LOW SUCTION PRESSURE

RESTRICTION

With water or ice formation down–stream (on receiver–drier filter or on condenser outlet to expansion valve line).

1. Remove component involved, rectify restriction or replace component.

NORMAL DISCHARGE PRESSURE AND/OR NORMAL–TO–HIGH SUCTION PRESSURE

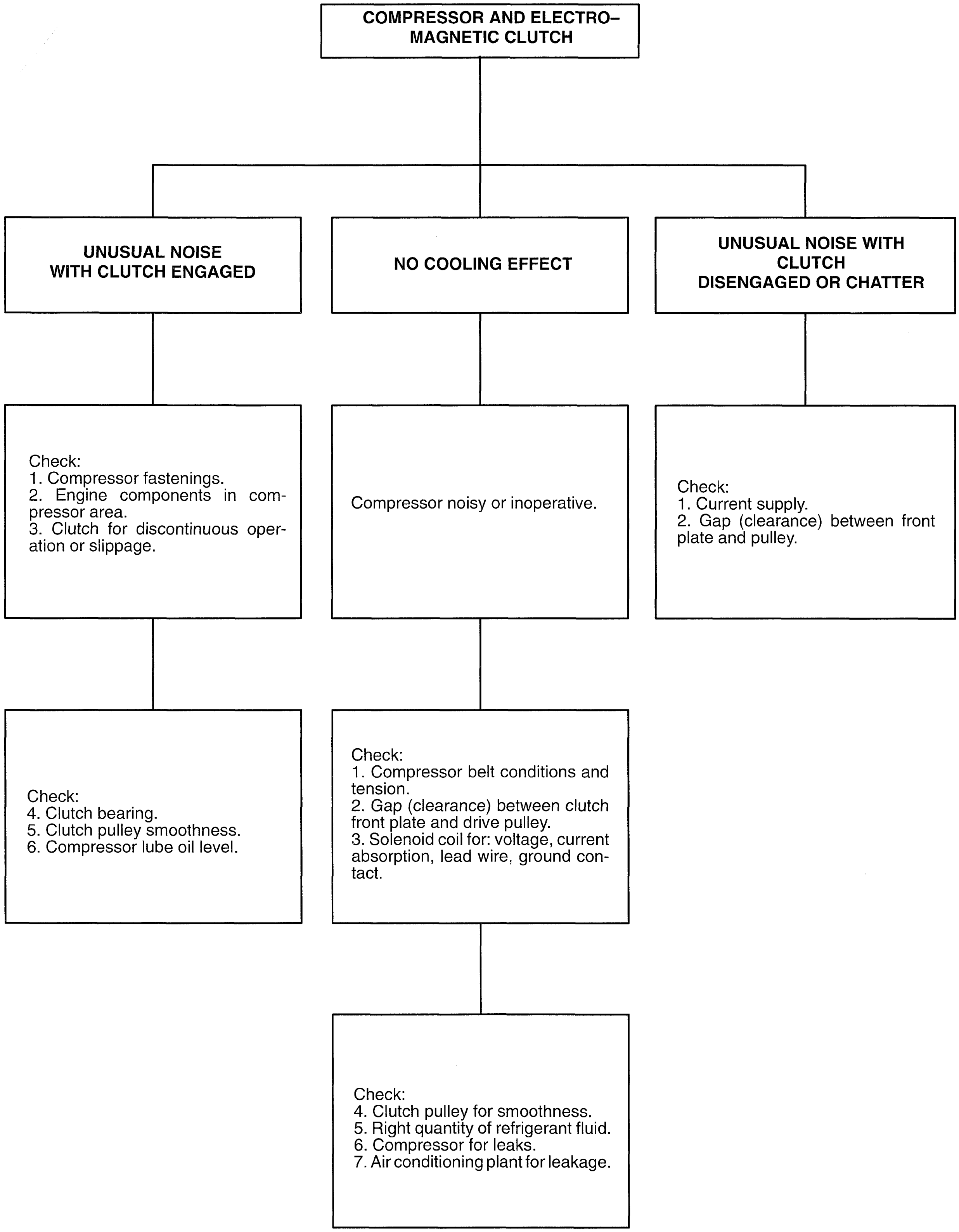
THERMOSTATIC SWITCH

Compressor solenoid–type clutch goes on and off too rapidly.

1. Faulty thermostat.
2. Replace thermostat (1, page 50–11), do not squeeze capillary sensing tubelet, re–install it in same position and depth inside evaporator core.

Print No. ***603.54.283.00*** *– 09 – 1994*

AIR CONDITIONING SYSTEM TROUBLESHOOTING GUIDE *(cont.)*



Print No. ***603.54.283.00*** *– 09 – 1994*

AIR CONDITIONING SYSTEM MAINTENANCE

At the start of every working season the operating conditions and efficiency of the cab air conditioning plant should be verified and assessed.

If the system has remained inoperative for long, any oil flown from the compressor through the plant must be returned to the compressor.

This is done by starting the engine and running it at 1500 rpm for about 10 minutes, with the conditioner thermostat set for maximum cooling and electric fan for maximum speed.

Check that the temperature ratio of outside ambient air and air inside the cab, the latter measured at the system outlets, meets values charted on page 50–22.

If this condition is met, the air conditioning system is efficient and further checks consist in the visual inspection of the main components:

1) COMPRESSOR: check fastening tightness, drive belt tension and oil level check.

2) CONDENSER: check fastening tightness and thet core fin surfaces are free from excess of deposits. When fins are bent, straighten them using the **293831** comb–type tool.

Note – Carry on the same check on EVAPORATOR (5) and CONDENSER (2).

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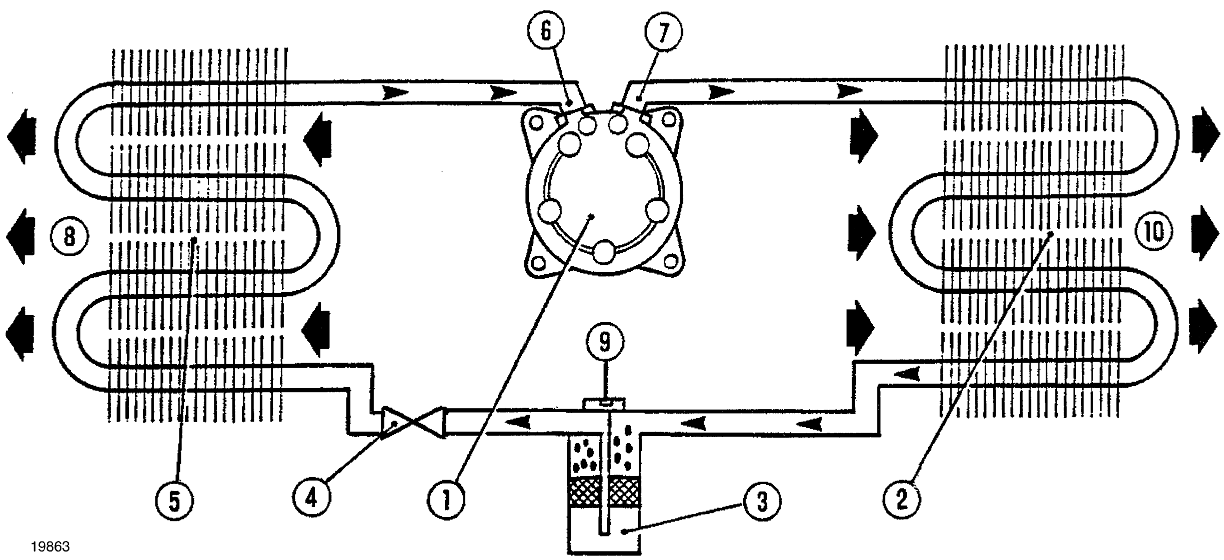
3) RECEIVER–DRIER FILTER: useful information on plant operation can be obtained through an inspection at the sight glass on this filter, as shown on page 50–20. Replace the filter after every two repairs made on the system.

4) EXPANSION VALVE: requires no maintenance, in case of problems check the valve and thermostatic sensor as described on page 50–24 or call for NEW HOLLAND specialized service.

If the temperature of the air measured at the air outlets inside the cab does not meet the specifications of page 50–22, proceed to search for the possible causes and faults which have made the plant inefficient, as described on page 50–23.

Attention – In case of replacement of one or more components, always carry on the recovery, reclaiming and charging operations, see pages 50–15 through 50–20.



Air conditioning plant lay–out and flow chart

1. Compressor – 2. Condenser – 3. Receiver–drier filter – 4. Expansion valve with thermostatic sensor – 5. Evaporator – 6. Suction line (low pressure) – 7. Delivery line (high pressure) – 8. Cold and dried air – 9. Sight glass – 10. Warm air.

*Print No. **603.54.283.00** – 09 – 1994*

SERVICING AND REPAIR PROCEDURES

AIR CONDITIONER EVAPORATOR

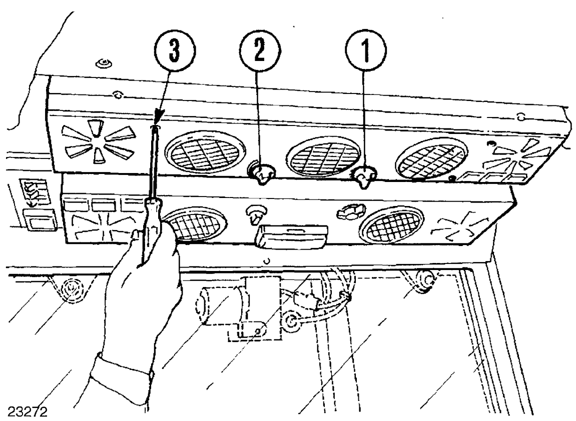
Replacement (Operations 50 200 04 – 50 206 56)

Proceed as further indicated.

1. Disconnect the battery negative cable.

DANGER

2. Recover the system refrigerant fluid in accordance with the safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



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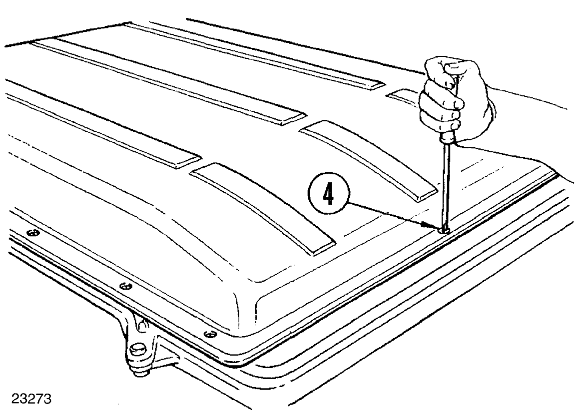
3. Remove control knobs (1 and 2, force–fitted) and associated fastenings.

4. Remove the four conditioner to evaporator unit attachment screws (3).



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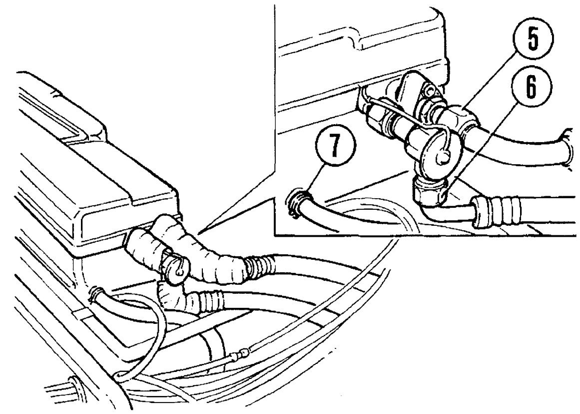
5. From outside, remove the attachment screws (4) and cab roof being a particular attention to avoid damaging the sealing gasket.



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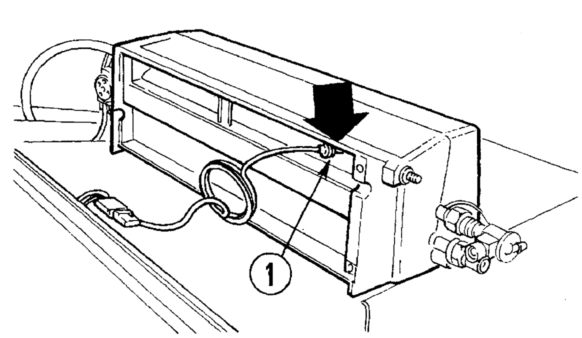
6. Remove piping heat insulation , connections (5 and 6), disconnect piping and protect open ends of the latter from ingress of grit and dust.

7. Slacken band clamps and disconnect the condensate drain lines (7, one on each side).

8. Disconnect the electric fan connection.



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9. Proceeding carefully, to avoid damages, withdraw from its seat the thermostatic sensor (1) and remove the evaporator unit, electric fan included.

10. Undo the four holding screws and remove the electric fan.

Print No. 603.54.283.00 – 09 – 1994

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

11. Install the cab air conditioner evaporator unit in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations, starting from no. 10 back to no. 1;

   b. consult previous illustrations in order to assure the correct placement of parts;

   c. in order to prevent inefficient operation:

Note – Make sure that the thermostatic sensor is correctly installed in the evaporator core fins, then apply the thermic insulation.

   d. make sure to always operate under the best cleanliness conditions. Should fluid lines remain loose, make sure their open ends are properly sealed;

   e. carry on the system evacuation, charge and functional check operations in accordance with the safety rules of page 50–1 and instructions given on pages 50–18 through 50–20.

AIR CONDITIONING SYSTEM HOSES PLACED DOWN–STREAM OF COMPRESSOR
Replacement (Operations 50 200 04 – 50 200 68)

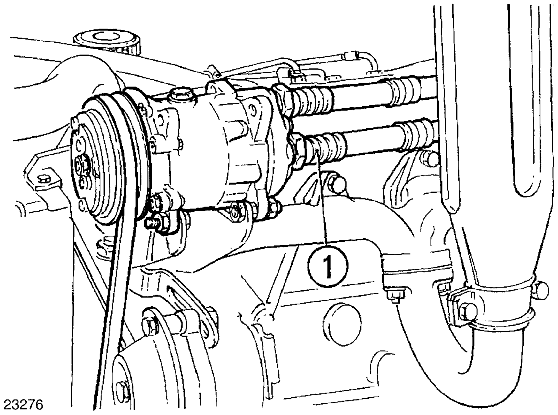
Compressor to condenser hose

Replace it as further indicated.

1. Disconnect the negative battery cable.

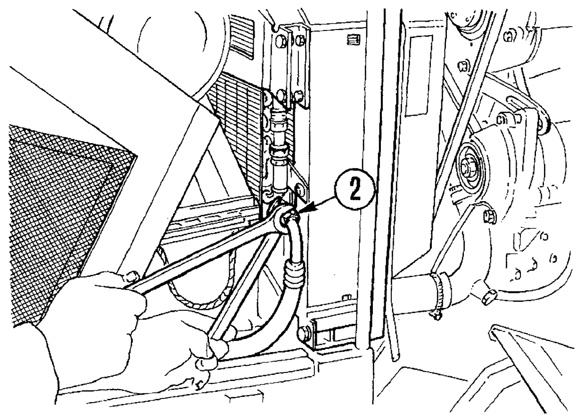
DANGER

2. Recover the system refrigerant fluid in accordance with safety rules on page 50–1 and instructions given on pages 50–15 through 50–17.



23276

3. Remove connection (1) and disconnect the high–pressure lines from the compressor, take care to protect the latter from entry of foreign materials, dust and dirt.



23277

4. Remove the condenser line connection (2) and replace the line.

5. Replace hose in accordance with the following instructions and information:

   a. reverse the previous sequence of operations starting from no. 4 back to no. 1;

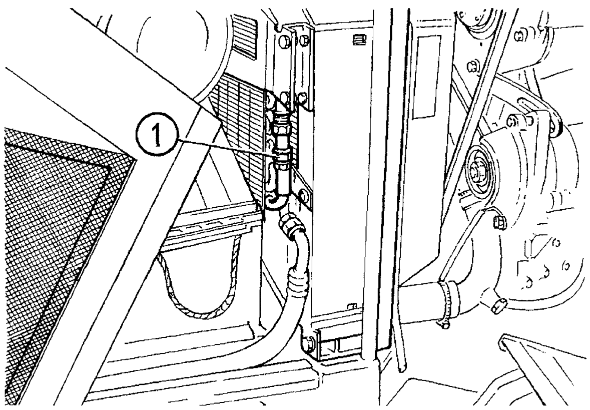
   b. consult previous illustrations to assure correct placement of parts;

   c. make sure to always operate under the best cleanliness conditions. Should fluid lines remain loose, make sure their open ends are properly sealed.

Print No. 603.54.283.00 – 09 – 1994

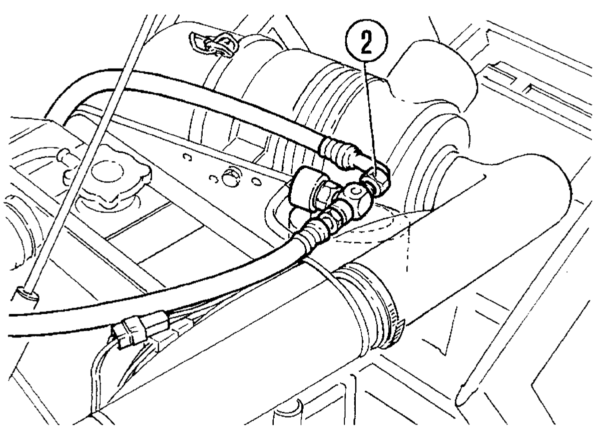
Condenser to receiver–drier filter line

Replace it as further indicated.



23278

6. Remove connection (1) and disconnect hose from condenser, protecting then the latter from entry of foreign material, grit or dust.



23279

7. Remove hose to filter connection (2) and replace hose.

8. Install hose in accordance with the following instructions and information:

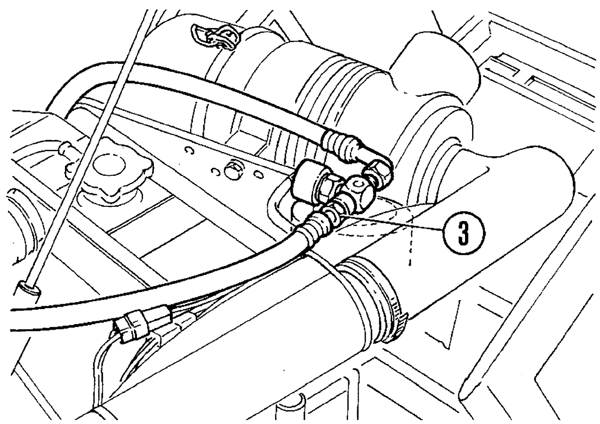
   a. reverse the previous sequence of operations starting from no. 7 back to no. 6;

   b. consult the previous illustrations in order to assure the correct placement of parts;

   c. make sure to always operate under the best cleanliness conditions. Should hoses remain loose, make sure their open ends are properly sealed.

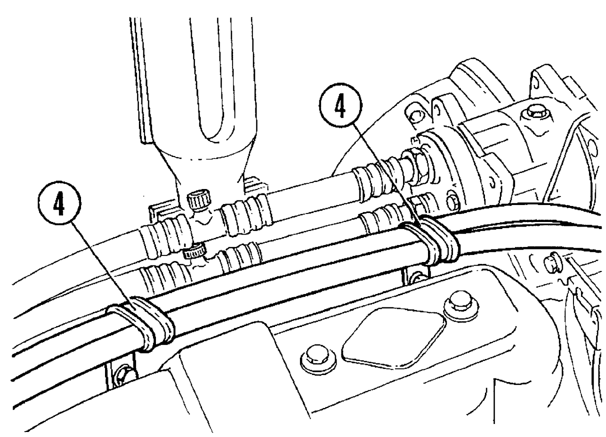
Receiver–drier filter to expansion valve line

Replace it as further indicated.



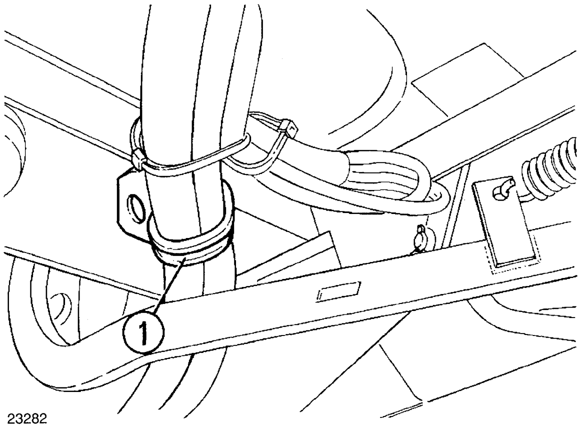
23280

9. Remove connection (3) and disconnect it from the receiver–drier filter, take care to protect the latter from entry of foreign material, grit or dust.



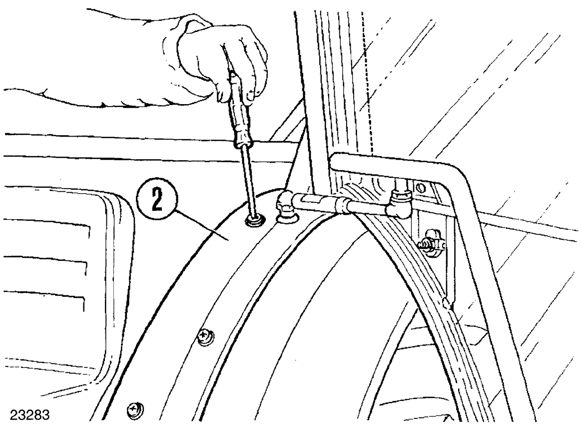
23281

10. Undo holding screws and remove fluid line holding brackets (4).



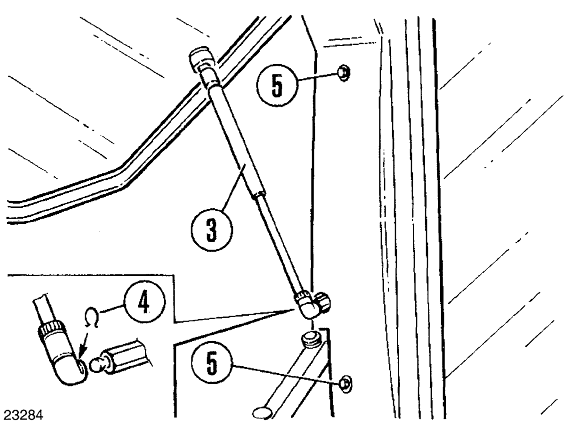
23282

11. Remove the line holding bracket (1) located under the tractor left–hand side foot–board.



23283

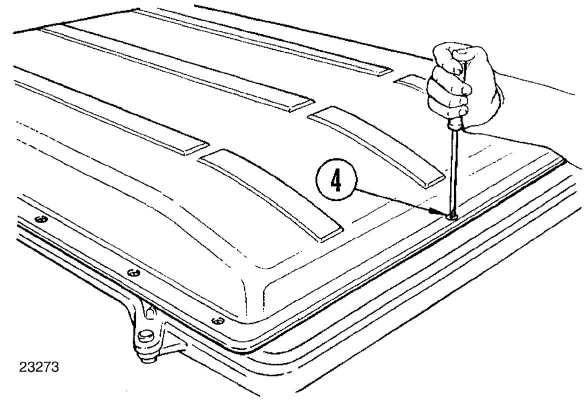
12. Remove the line guard (2) over the wheel and withdraw the hose accompanying it over its lay–out.



23284

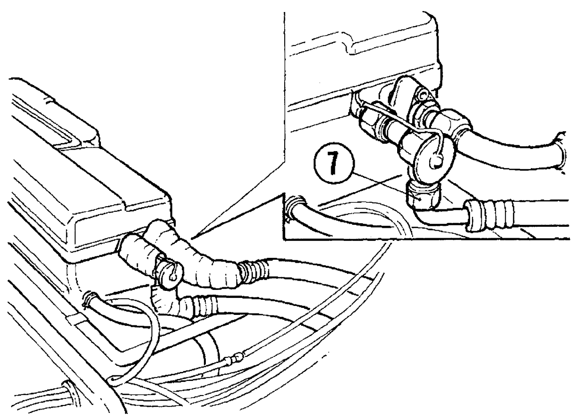
13. Disconnect the rear window glass spring opener (3), following removal of the ball joint retaining spring (4).

14. Undo holding screws (5) and remove side sealing gasket.



23273

15. From outside of cab, undo perimeter holding screws (4) and remove the cab hatch being careful not to damage the rubber seal.



23286

16. Remove the heat insulation from the fluid line, connection (7) and replace the fluid line.

17. Install the same in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations starting from no. 10 back to no. 1;

   b. consult previous illustrations for the correct placement of parts;

   c. make sure to always operate under the best cleanliness conditions. Should hoses remain loose, make sure their open ends are properly sealed.

18. Carry on system evacuation, charge and functional check operations in accordance with the directions given on pages 50–18 through 50–20.

Print No. ***603.54.283.00*** *– 09 – 1994*

AIR CONDITIONING SYSTEM HOSES PLACED UP-STREAM OF COMPRESSOR
Replacement (Operations 50 200 04 – 50 200 66)

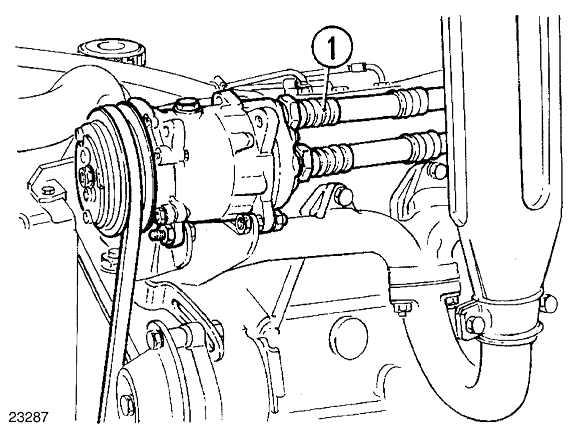
Evaporator to compressor hose

Replace as further indicated.

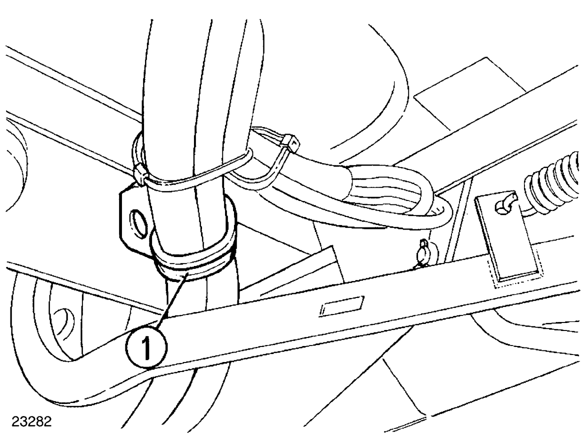
1. Disconnect the battery negative cable.

DANGER

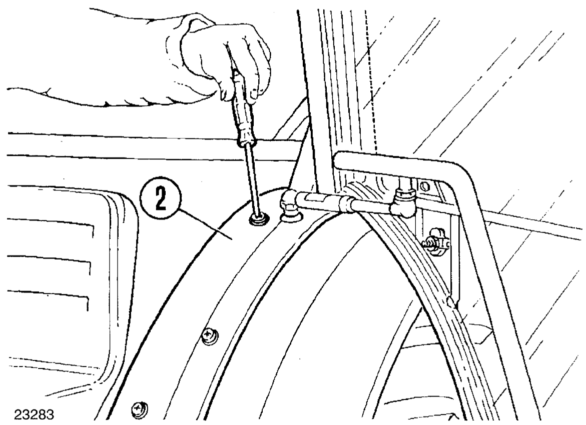
2. Recover the system refrigerant fluid in accordance with the safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



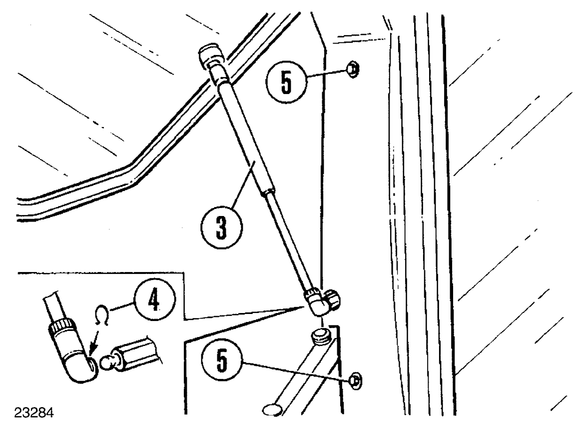
3. Remove connection and disconnect the low–pressure hose (1), then protect the compressor from entry of foreign material, grit or dust.



4. Remove hose retaining bracket (1) located under the tractor left–hand side foot–board.

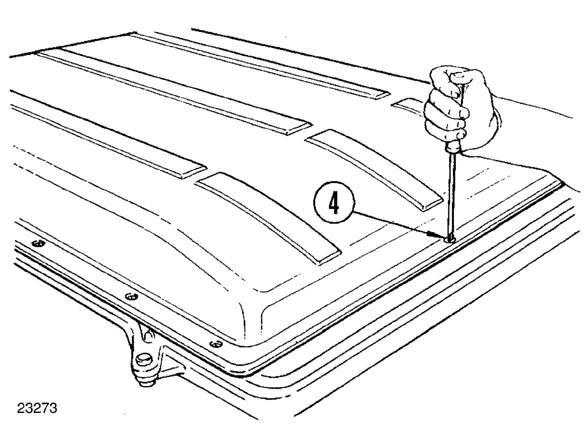


5. Remove hose guard (2) from wheel and withdraw the hose accompanying it along its lay–out.



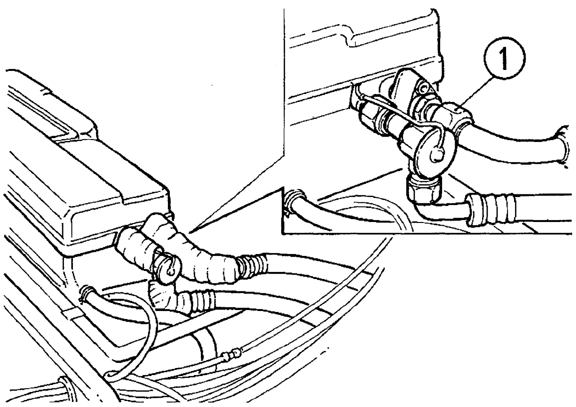
6. Disconnect the rear window glass spring opener (3), following the removal of the ball joint retaining spring (4).

7. Undo holding screws (5) and remove the side sealing gasket.



8. From the outside of cab, undo perimeter holding screws (4) and remove the cab hatch, paying attention not to damage the sealing strip.

Print No. **603.54.283.00** – 09 – 1994



23292

9. Remove the heating insulation from hose, connection (1) and replace the hose.
10. Install the hose in accordance with the following instructions and information:
    a. reverse the previous removal sequence of operations starting from no. 9 back to no. 1;
    b. consult previous illustrations to assure correct placement of parts;
    c. make sure to always operate under the best cleanliness conditions. Should hoses remain loose, make sure their open ends are properly sealed;
    d. carry on the system evacuation, charge and functional check operations in accordance to safety rules of pages 50–1 and instructions given on pages 50–18 through 50–20.

RECEIVER–DRIER FILTER

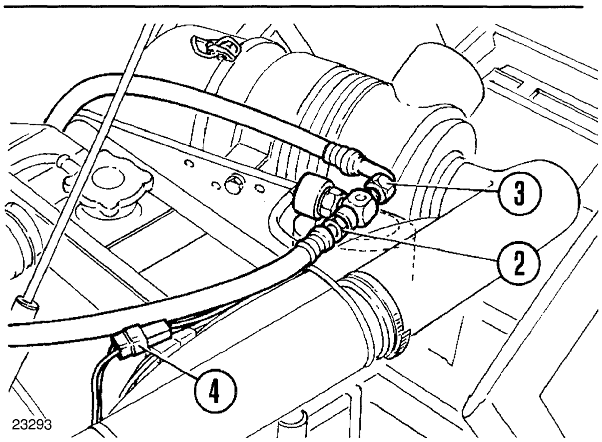
Replacement (Operations 50 200 04 – 50 200 74)

Proceed as further indicated.

1. Disconnect the battery negative cable.

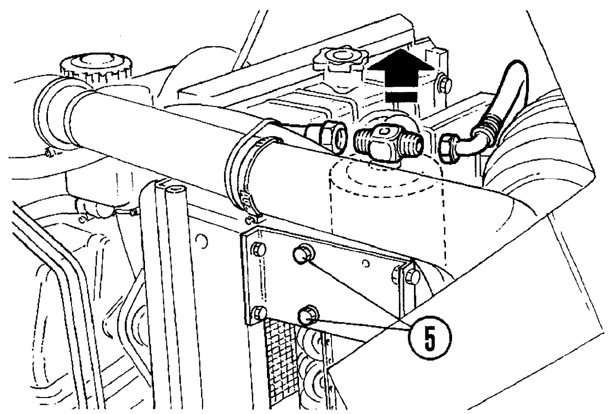
DANGER

2. Recover the system refrigerant fluid in accordance with safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



23293

3. Remove union (2) from the hose connecting expansion valve and receiver–drier filter, then protect the hose from entry of foreign matter, grit or dust.
4. Remove the union (3) from the hose connecting the condenser and receiver–drier filter, then protect the hose from entry of foreign matter, grit or dust.
5. Disconnect the electrical connection (4).



23294

6. Undo holding screws (5) and remove the receiver–drier filter from above.
7. Install the receiver–drier filter in accordance with the following instructions and information:
    a. reverse the previous removal sequence of operations starting from no. 6 back to no. 1;
    b. consult previous illustrations to ensure correct placement of parts;
    c. make sure to always work under the best cleanliness conditions. Should the unit remain disassembled make sure that associated fluid lines are properly sealed;
    d. carry on the system evacuation, charge and functional check operations in accordance to the safety rules of page 50–1 and instructions given on pages 50–18 through 50–20.

Print No. **603.54.283.00** – 09 – 1994

AIR CONDITIONING PLANT CONDENSER

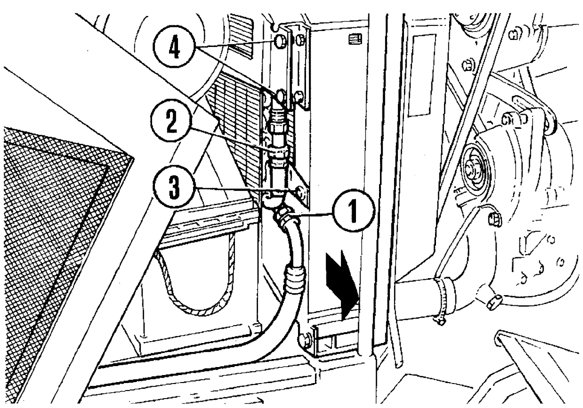
Replacement (Operations 50 200 04 – 50 200 72)

Proceed as further indicated.

1. Disconnect the battery negative cable.

DANGER

2. Recover the system refrigerant fluid in accordance with safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



23295

3. Remove union (1) from the hose connecting compressor and condenser, then protect the hose from entry of foreign matter, grit or dust.

4. Remove union (2) from the hose connecting receiver–drier filter and condenser, then protect the hose from entry of foreign matter, grit or dust.

5. Drill out rivets (3) to free the condenser.

6. Undo holding screws (4) and remove the condenser from the tractor left–hand side.

7. Install the air conditioning plant condenser unit in accordance with the following instructions and information:

   a. reverse the removal sequence of operations starting from no. 6 back to no. 1;

   b. consult previous illustrations to ensure correct placement of parts;

   c. make sure to work always under the best cleanliness conditions and lack of moisture. Should this unit remain loose, make sure that associated fluid lines are properly sealed.

   d. carry on the system evacuation, charge and functional check operations following the safety rules of page 50–1 and instructions given on pages 5–18 through 50–20.

COMPRESSOR

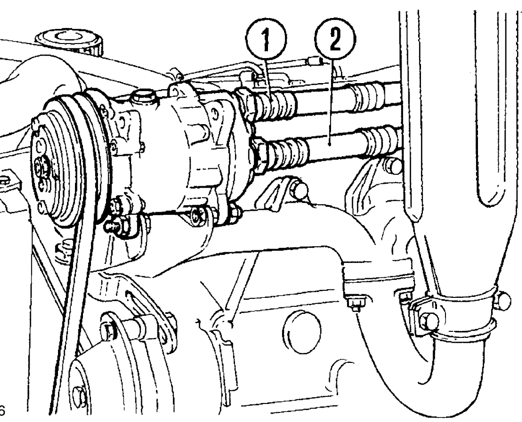
Removal–Installation (Operations 50 200 04 – 50 200 26)

Remove the compressor from the air conditioning system as further indicated.

1. Disconnect the battery negative cable.

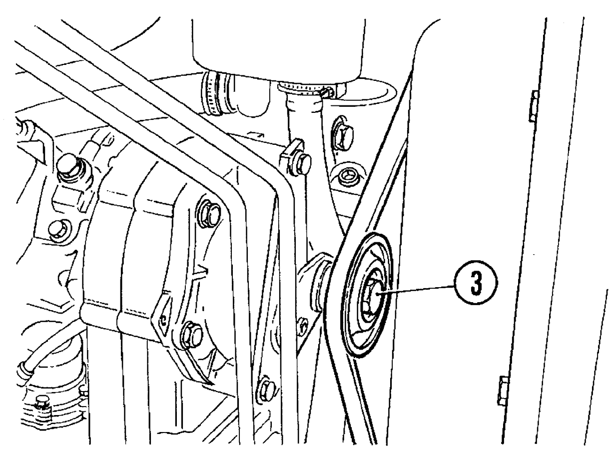
DANGER

2. Recover the system refrigerant fluid in accordance with safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



23296

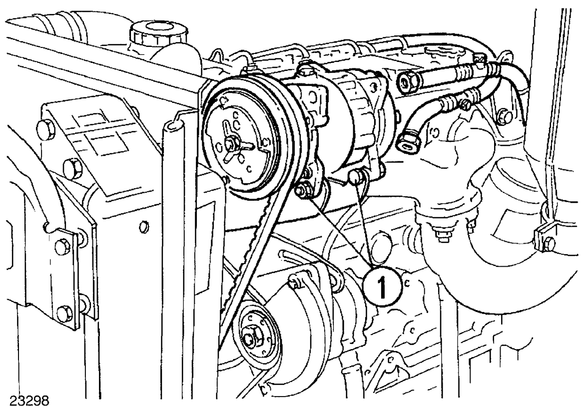
3. Remove connections and disconnect fluid lines (1 and 2), protecting them from entry of foreign mattre, grit or dust.



23297

4. Loosen drive belt tension through adjustment screw (3).

Print No. 603.54.283.00 – 09 – 1994



5. Remove drive belt, undo bolts (1, one on each side) and remove ccompressor from holding bracket.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

6. Install the compressor in accordance with the following instructions and information:

   a. reverse the sequence of removal operations starting from no. 5 back to no. 1;

   b. consult previous illustrations for the correct placement of parts;

   c. re–adjust drive belt tension as described on page 50–38;

   d. make sure to always work under best cleanliness conditions. Should fluid lines remain loose, make sure their open ends are properly sealed;

   e. carry on the system evacuation, charge and functional check operations following the safety rules of page 50–1 and instructions given on pages 50–18 through 50–20.

COMPRESSOR LUBE OIL TYPES AND LEVEL

Tractors are provided with either of the following compressors:

— SANDEN SD 709 for R12 refrigerant fluid;

— SEIKO SEIKI SS121 for R134a fluid.

At the factory, compressors are charged with the following types and quantities of oil.

SUNISO 5 GS oil for the SANDEN SD 709 compressors.

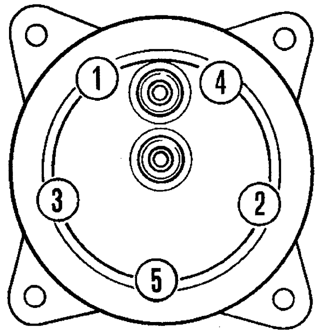
PAG SK 20 oil for the SEIKO SEIKI SS 121 compressors.

In the event of topping up or changing, use exclusively these types of oils.

Compressor (type)	Oil q.ty (cc)
SANDEN SD 709	135
SEIKO SEIKI SS 121	220

Routine oil level checks are not necessary. If checking should become necessary because of special technical reasons requiring it, then we recommend to have it done at a FIATAGRI service network workshop.

Print No. 603.54.283.00 – 09 – 1994



23311

Compressor head nut torque tightening sequence scheme.

COMPRESSOR DRIVE BELTS

Tension adjustment (Operation 50 200 10)

The compressor drive belt, conveying engine power to the air conditioning plant, is an essential factor for its efficient performance.

Particular attentions should therefore be dedicated to this component, and precisely:

1) Correct first installation.

2) Tension check.

3) Inspection.

New belt installation

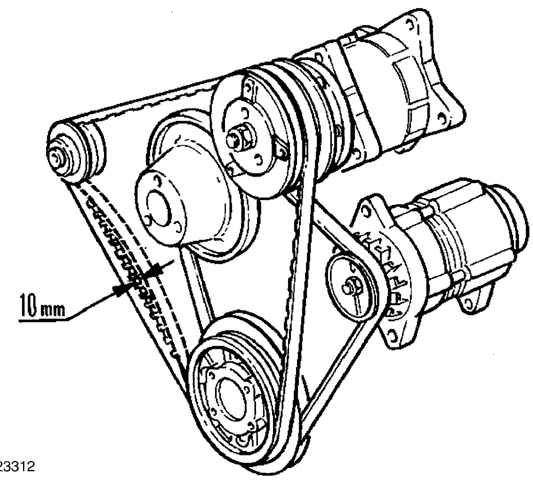
New belts should not be forced over the pulley, stretched using screwdrivers or pulled over and turned over pulley edges: these abuses cause abnormal stretching of the low–deformation cords with subsequent straining of the other plies.

Also, a new belt should be installed under greater tension than normally used to compensate for initial setting–in, therefore tension should be checked after the first 50 hours of operation and re–set to normal values.

This check is essential because if a belt is subjected to excessive tension at work, besides being the cause of potential pulley bearing damage, straining of reinforcing cords will result in a premature deterioration of the belt itself. Conversely, too low a tension will cause slippage, over–heating and accelerated wear.

Belt tension check

Belt tension should be checked under cold conditions (below 40°C – 104°F). Under a load of 59÷78 N (6÷8 kg – 13÷18 lb), applied as shown in the accompanying figure, belt will yield about ≅ 10 mm (.40 in).



23312

Routine checks

Belts should be inspected for wear at every tension test. Inspection may evidence one or more of the following conditions:

a) **Glazing** : glazed flanks can cause belt slippage.

b) **Cracks**: may fail suddenly as inner cracks are the cause for excessive flexion.

c) **Flank wear**: with worn flanks, or inner sides cracked, the belt may fail at any moment.

d) **Belt impregnated with grease**: will wear prematurely because of core softening.

Remedies are the following, respectively:

a) Check and restore correct tension, if necessary. If belt is too hot, replace it.

b) If cracks are deeper than half the thickness, replace belt.

c) Replace belt.

d) If belt is too hot, replace it.

Besides, if belt squeals in operation, check tension and restore it if necessary; should squealing persists, replace belt.

Also, excessive stretching prevents correcting tension and belt must be replaced.

Print No. 603.54.283.00 – 09 – 1994

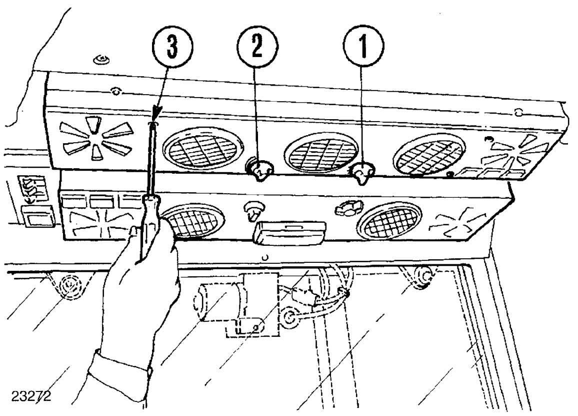
AIR CONDITIONER THERMOSTATIC SWITCH
Replacement (Operations 50 200 04 – 50 206 38)

Proceed as further indicated.

1. Disconnect the battery negative cable.

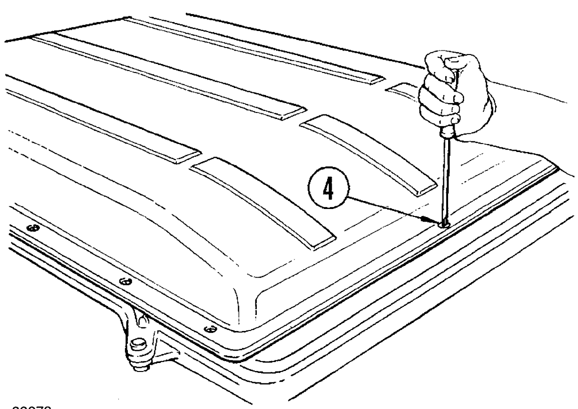
DANGER

2. Recover the system refrigerant fluid in accordance with safety rules of page 50–1 and instructions given on pages 50–15 through 50–17.



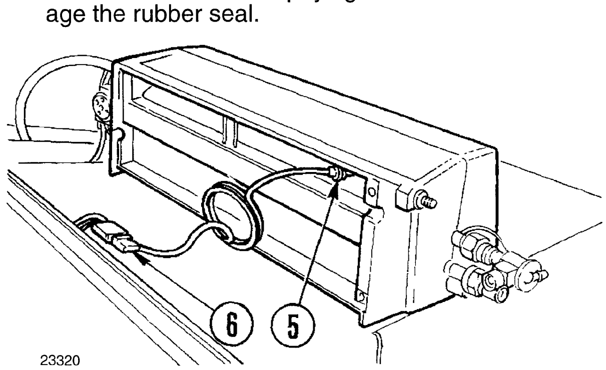
23272

3. Remove the pressure–fitted control knobs (1 and 2) and unscrew fastenings.
4. Remove the four conditioner/evaporator unit attachment screws (3).



23273

5. From the outside of cab, undo holding screws (1) and remove the hatch paying attention not to damage the rubber seal.



23320

6. Lift up the evaporator and withdraw the thermostatic sensor (5), removing the heat insulation also.

7. Disconnect electrical connection (6) and replace the thermostatic switch with associated sensor.

8. Assemble in accordance with the following instructions and information:

   a. proceed by reversing the previous disassembly sequence of operations starting from no. 7 back to no. 1;

   b. consult preceding illustrations for the correct placement of parts;

ATTENTION

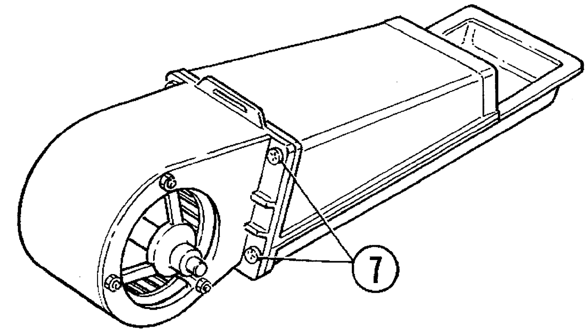
To avoid malfunctioning of the system make sure that the the thermostatic sensor is correctly placed within the evaporator core fins, then apply heat insulation.

   c. carry on the system evacuation, charge and functional check operations in accordance with safety rules of page 50–1 and instructions given on pages 50–18 through 50–20.

ELECTRIC FAN

Disassembly–Assembly with conditioner heater or evaporator removed (Operation 50 206 66)

To replace the electric fan proceed as further indicated.



23321

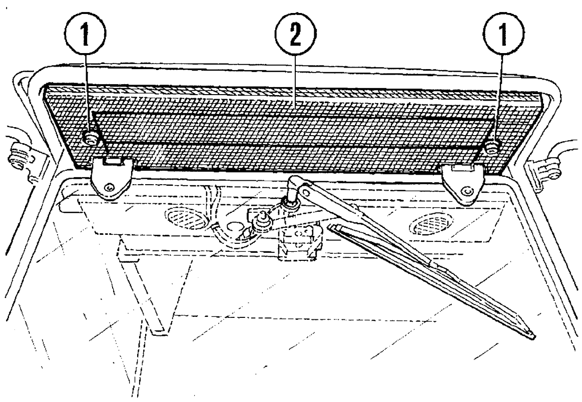
1. Undo the four holding screws (7) to remove it.

2. Re–tighten holding screws (7) to install it. Consult the preceding figure for the correct positioning of the unit.

*Print No. **603.54.283.00** – 09 – 1994*

AIR CLEANER, AIR CONDITIONED OR VENTILATED CAB
Replacement (Operation 50 200 612)

To replace the air cleaner, proceed as further indicated.



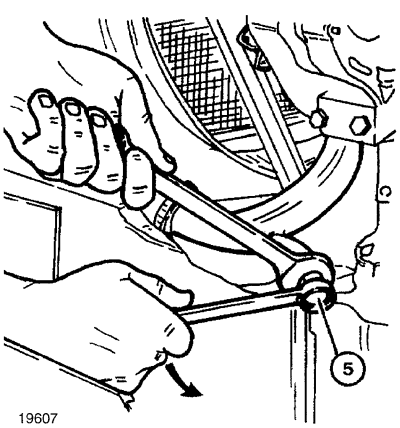
23322

1. Remove both knobs (1) and the air intake outer grille (2).
2. Remove air cleaner and replace it.
3. Install the new cleaner in accordance to the following instructions and information:
   a. reverse the previous removal sequence of operations;
   b. consult the preceding figure for the correct placement of parts.

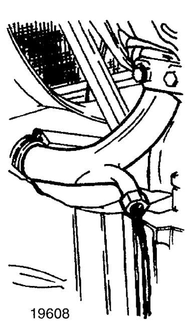
CAB HEATING AND VENTILATING UNIT
Removal–Installation (Operation 50 104 20)

Proceed as further indicated.

1. Disconnect the battery negative cable.



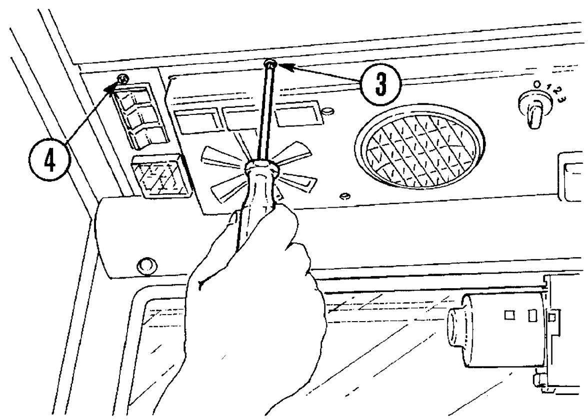
19607



19608

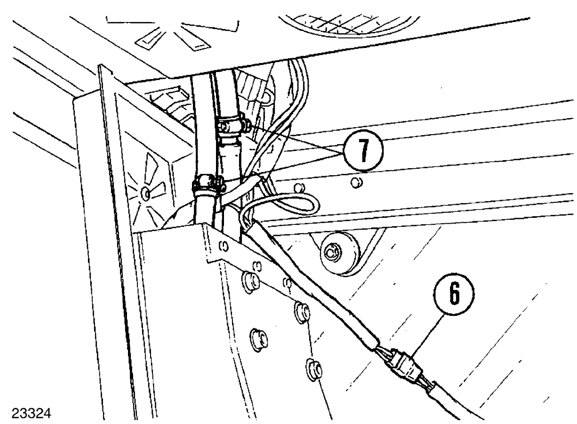
2. Remove plug (5) and drain the engine cooling plant, after removing the radiator cap to ease the liquid out (collect liquid in a suitable container).

To ease liquid out, remove the radiator cap.



23323

3. Undo the four heater/ventilation unit attachment screws (3) and the push–button control unit holding screw (4).



23324

4. Disconnect the electric fan feed connection (6).
5. Slacken band clamps (7) and disconnect the cooling liquid delivery and return lines, protecting them from entry of foreign matter or dirt once loose.
6. Remove the heater/ventilation unit and, only if necessary, undo the four holding screws and remove the electric fan also.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS AND HANDS.

7. Re–install the heater/ventilation unit in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations starting from no. 6 back to no. 1;

   b. consult previous illustrations for the correct placement of parts;

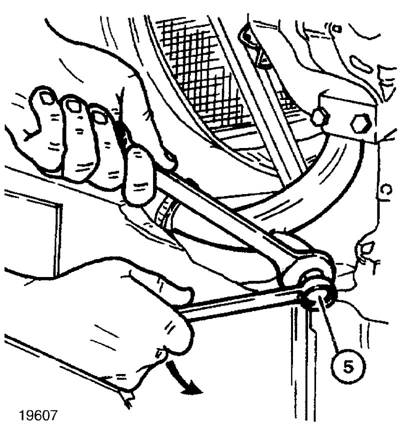
   c. make sure to always work under the best cleanliness conditions. If fluid lines are to remain loose, make sure tyeir open ends are properly sealed.

   d. finally, re–fill the cooling plant.

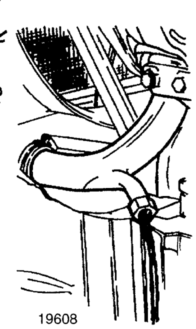
CAB HEATER WATER DELIVERY AND RETURN HOSES

Replacement (Operation 50 100 10)

Proceed as further indicated.

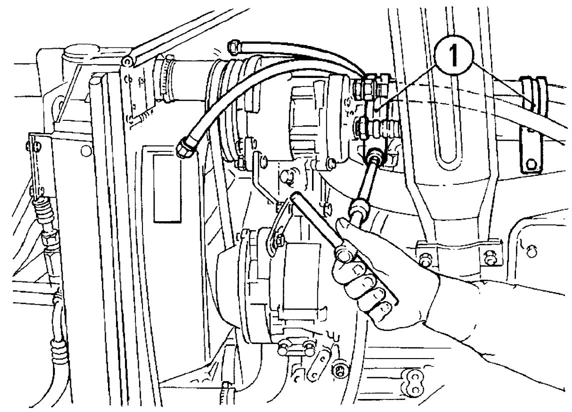


19607



19608

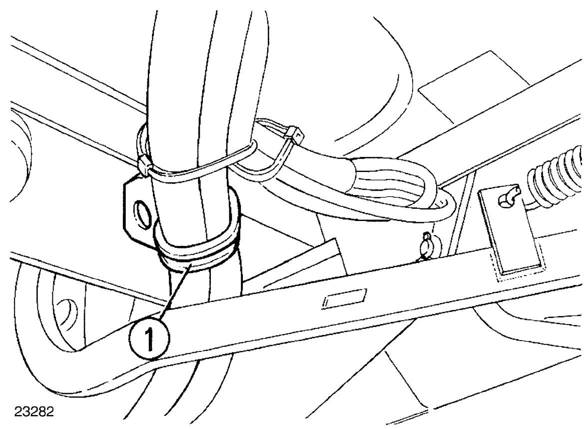
1. Remove plug (5) and drain the engine cooling plant, after removing the radiator cap to ease liquid out (collect liquid in a suitable container).



23325

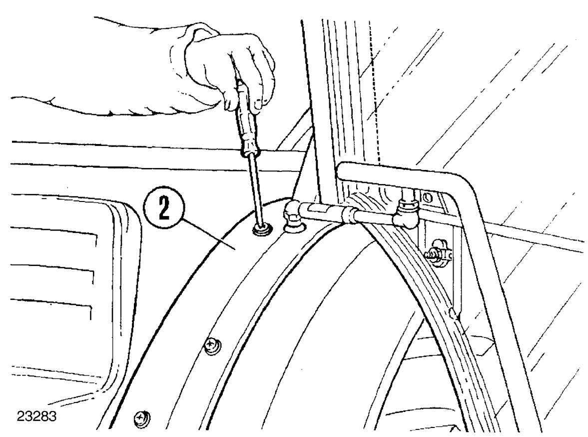
2. Slacken band clamps and disconnect hoses from water pump; protect the latter from entry of foreign material, grit and dust through open ends.

3. Remove the hose retaining brackets (1).



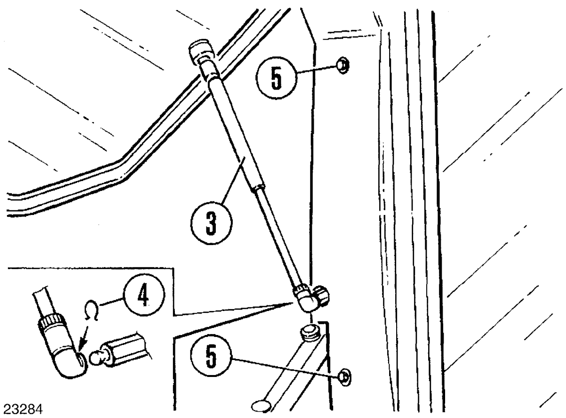
23282

4. Remove the hose retaining bracket (1) located underneath the tractor left–hand side foot–board.



23283

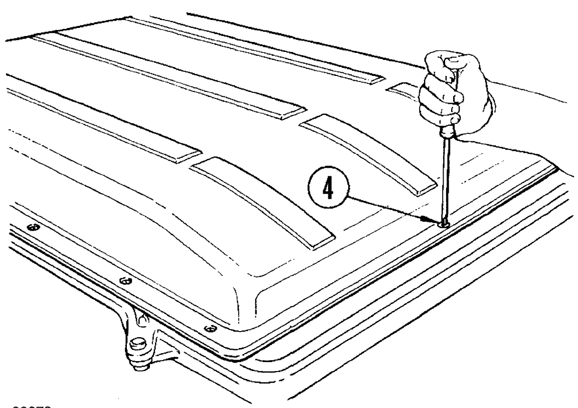
5. Remove wheel guard (2) and withdraw the hose.



23284

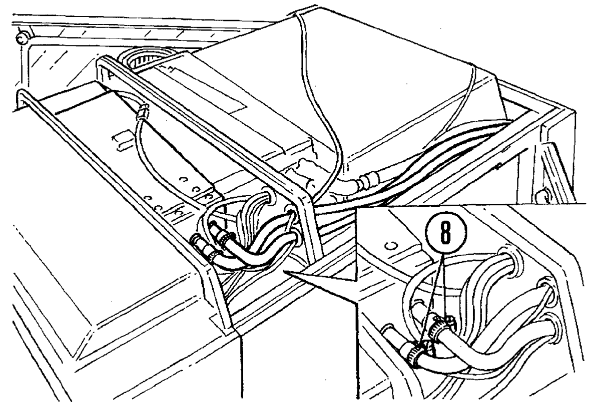
6. Disconnect the rear window glass opening damper (3) after removing the ball joint retaining spring (4).

7. Undo holding screws (5) and side sealing gasket.



23273

8. Working outside the cab, undo screws (4) on the perimeter and then remove the hatch being careful not to damage the rubber seal.



23326

9. Slacken band clamps (8) and disconnect hoses to replace them.

10. Install new hoses in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations starting from no. 9 back to no. 1;

   b. consult preceding illustrations for the correct placement of parts;

   c. make sure to always work under best cleanliness conditions. If hoses are to remain loose, make sure that their open ends are properly sealed.

   d. finally, re–fill the cooling plant.

Print No. **603.54.283.00** – 09 – 1994

BATTERY CHARGING SYSTEM (all models)

Alternator	
Type (three–phase, self–rectifying)	5101645 (MARELLI) 4762563 (LUCAS) 4766127 (ISKRA)
Nominal voltage ... V	14
Rotation (from pulley side)	clockwise
Charge starting speed at 12V (25 °C 277°F) ... rpm	1050 ÷ 1150
Current output at 14V, at operating temperature (°):	
— MARELLI type at 7000 rpm ... A	33
— LUCAS type at 6000 rpm ... A	45
— ISKRA type at 5000 rpm ... A	34
Rotor winding resistance:	
— type MARELLI ... Ohm	3.4 ÷ 3.8
— type LUCAS ... Ohm	3.04 ÷ 3.36
— type ISKRA ... Ohm	3.4 ÷ 3.74
Speed of alternator installed on 3–cylinder engines (at engine maximum power speed) ... rpm	5050
Speed of alternator installed on 4–cylinder engines (at engine maximum power speed) ... rpm	4800
Speed ratio: engine/alternator (3 cylinders) ... rpm	1: 2.02
Speed ratio: engine/alternator (4 cylinders) ... rpm	1: 1.90
Voltage regulator	transistors, incorporated in alternator
Alternator speed, test and adjustment ... rpm	4000
Test voltage:	
— MARELLI 5101645 model ... V	13.6 ÷ 14
— LUCAS 4762563 model ... V	14.2 ÷ 14.5
— ISKRA 4766127 models ... V	13.7 ÷ 14.5

(°) Measurable with fully shaped brushes.

Print No. ***603.54.283.00*** *– 09 – 1994*

MARELLI STARTING MOTOR – Models 50V – 55V – 60V – 55F – 60F – 62F

Type	MARELLI MT—71AA
Voltage ... V	12
Rated output ... kW	2.5
Rotation, from pinion end	clockwise
Pinion/ring gear tooth ratio	9/110
Poles	4
Excitation (field windings)	in series
Engagement	freewheel
Control	solenoid
Test bench data	
Running test (at 20°C – 68°F):	
— current ... A	≤ 500
— torque output ... Nm	16.6 (1.7 kgm)
— speed ... rpm	1300
— voltage ... V	8.3
Breakaway test at 20°C (68°F):	
— current ... A	≤ 950
— voltage ... V	4.8
— torque output ... Nm	≥ 36 (3.7 kgm 26.75 ft–lb)
— total internal resistance ... Ω	0.005 ± 0.0005
No–load test at 20°C (68°F):	
— current ... A	≤ 60
— voltage ... V	11.6
— speed ... rpm	8500
Mechanical specification checks	
Spring load on brushes (unworn) ... N	12.2÷15.2 (1.25÷1.55 kg – 2.76÷3.42 lb)
Insulation undercutting depth ... mm	1 (.04 in)
Flywheel efficiency: slip torque to drag pinion into slow rotation ... kgcm	6÷8 (.4÷.6 ft–lb)

(continues)

Print No. **603.54.283.00** – 09 – 1994

MARELLI STARTING MOTOR – Models 50V – 55V – 60V – 55F – 60F – 62F

(follows)

Commutator diameter .... mm (in)	44.840÷45.000 (1.7654÷1.7717)
— permissible wear limit .... mm (in)	43.5 (1.71)
— maximum out–of–round .... mm (in)	0.08 (.003)
— armature end float .... mm (in)	0.1÷0.4 (.004÷.020)
Solenoid	
Winding resistance at 20 °C (68°F): .... Ω	0.22±0.02
Current consumption at 12 V .... A	54
Activation voltage (minimum) V	≤ 5.5
Moving contact stroke .... mm (in)	3 (.01)
Core stroke .... mm (in)	13.8÷14.9 (.54÷.59)
Load at 12 V and core at end of stroke .... N	≤ 392 (40 kg – 88lb)
Assembly data	
Pole shoe I.D. .... mm (in)	75.830÷76.000 (2.9854÷2.9921)
Armature O.D. .... mm (in)	74.900÷74.950 (2.9488÷2.9508)
Drive end bushing I.D. .... mm (in)	12.475÷12.502 (.4911÷.4922)
Pinion shaft journal dia. .... mm (in)	12.425÷12.440 (.4892÷.4898)
Pinion shaft/bushing running clearance .... mm (in)	0.035÷0.077 (.0014÷.0030)
Intermediate bushing I.D. .... mm (in)	20.200÷20.264 (.7953÷.7978)
Shaft journal dia. .... mm (in)	19.967÷20.000 (.7861÷.7870)
Shaft/bushing running clearance .... mm (in)	0.200÷0.297 (.0079÷.0117)
Commutator end bushing I.D. .... mm (in)	14.000÷14.270 (.5512÷.5618)
Shaft journal dia. .... mm (in)	13.957÷13.984 (.5495÷.5506)
Shaft/bushing running clearance .... mm (in)	0.016÷0.313 (.0006÷.0123)
Lubrication	
Starter drive helical groove (at overhauls)	**TUTELA MR 3** grease
Commutator end thrust washer	**TUTELA MR 3** grease

Print No. ***603.54.283.00*** *– 09 – 1994*

MARELLI STARTING MOTOR – Models 70V – 72F – 82F – 72LP – 82LP

Type	MARELLI MT 68 AB
Voltage ... V	12
Rated output ... kW	3.5
Rotation (from pinion end)	clockwise
Pinion/ring gear tooth ratio	9/110
Poles	4
Excitation (field windings)	in series
Engagement	lever, with freewheel
Control	solenoid
Test bench data	
Running test at 20°C (68°F):	
— current ... A	≤ 700
— torque output ... Nm	19,6 (2 kgm – 14.5 ft–lb)
— speed ... rpm	1400÷1800
— voltage ... V	9
Breakaway test at 20°C (68°F):	
— current ... A	≤ 1400
— voltage ... V	5
— torque output ... Nm	≥ 49 (5 kgm – 36 ft–lb)
— total internal resistance ... Ω	0.004 ± 0.0004
No–load test at 20°C (68°F):	
— current ... A	≤ 85
— voltage ... V	12
— speed ... rpm	7000÷10000
Resistance at 20°C (68°F) of the main, in–series excitation winding ... Ω	0.002 ± 0.0002
Mechanical specification checks	
Spring load on brushes (unworn) ... N	14.7÷17.4 (1.5÷1.8 kg – 3.3÷4.0 lb)
Insulation undercutting depth ... mm (in)	1
Freewheel efficiency: slip torque to drag pinion into slow rotation ... kgcm (ft–lb)	6÷8 (.4÷.6 ft–lb)

(continues)

Print No. ***603.54.283.00*** *– 09 – 1994*

MARELLI STARTING MOTOR – Models 70V – 72F – 82F – 72LP – 82LP

(follows)

Commutator diameter . . . . mm (in)	44.840÷45.000 (1.7654÷1.7717)
— permissible wear limit . . . . mm (in)	43.5 (1.71)
— maximum out–of–round . . . . mm (in)	0.08 (.003)
— armature end float . . . . mm (in)	0.1÷0.4
Solenoid	
Winding resistance at 20°C (68°F) . . . . Ω	0.22±0.02 (.004÷.020)
Current consumption at 12V . . . . A	54
Activation voltage (minimum) V	≤ 5.5
Moving contact stroke . . . . mm (in)	3 (.12)
Core stroke . . . . mm (in)	13.8÷14.9 (.54÷.59)
Load at 12V and core at end of stroke . . . . N	≤ 392 (40 kg –88 lb)
Assembly data	
Pole shoe I.D. . . . . mm (in)	75.830÷76.000 (2.9854÷2.9921)
Armature O.D. . . . . mm (in)	74.900÷74.950 (2.9488÷2.9508)
Drive end bushing I.D. . . . . mm (in)	12.475÷12.502 (.4911÷.4922)
Pinion shaft journal dia. . . . . mm (in)	12.425÷12.440 (.4892÷.4898)
Pinion shaft running clearance . . . . mm (in)	0.035÷0.077 (.0014÷.0030)
Intermediate bushing I.D. . . . . mm (in)	20.200÷20.264 (.7953÷.7978)
Shaft journal dia. . . . . mm (in)	19.677÷20.000 (.7747÷.7874)
Shaft/bushing running clearance . . . . mm (in)	0.200÷0.587 (.0079÷.0231)
Commutator end bushing I.D. . . . . mm (in)	14.000÷14.022 (.5512÷.5520)
Shaft journal dia. . . . . mm (in)	13.957÷13.984 (.5495÷.5506)
Shaft/bushing running clearance . . . . mm (in)	0.016÷0.065 (.0006÷.0026)
Lubrication	
Starter drive helical groove (at overhauls)	**TUTELA MR 3** grease
Commutator end thrust washer	**TUTELA MR 3** grease

Print No. ***603.54.283.00*** *– 09 – 1994*

BOSCH STARTING MOTOR – Models 50V – 55V – 60V – 55F – 60F – 62F

Type BOSCH	JF→12V 0.001.362.039
Voltage V	12
Rated output kW	1.8
Rotation (from pinion end)	clockwise
Pinion/ring gear tooth ratio	9/110
Poles	4
Excitation (field windings)	in series
Engagement	displacement
Control	solenoid
Test bench data	
Running test at 20°C (68°F):	
— current A	735÷765
— torque output Nm	24.5 (2.5 kgm 18 ft–lb))
— speed rpm	950÷1250
— voltage V	9
Breakaway test (short circuit) at 20°C (68°F):	
— current A	700÷880
— tensione V	4.5
— torque output Nm	0
— total internal resistance Ω	0.00573
No–load test at 20°C (68°F):	
— current A	65÷95
— voltage V	11.5
— speed rpm	6500÷8500
Mechanical specification check	
Spring load on bushings (unworn) N	11.3÷12.7 (1.15÷1.3 kg – 2.5÷2.9 lb)
Armature end float mm (in)	0.1÷0.3 (.00÷.010)
Insulation undercutting depth mm (in)	0.5÷0.8 (.02÷.03)
Commutator dia. mm (in)	42 (1.7)
— permissible wear limit mm (in)	39.5 (1.56)
— maximum out–of–round: blade pack mm (in)	0.05 (.002)
— maximum out–of–round: commutator mm (in)	0.03 (.001)

(continues)

Print No. **603.54.283.00** – 09 – 1994

BOSCH STARTING MOTOR – Models 50V – 55V – 60V – 55F – 60F – 62F

(follows)

Solenoid	
Winding resistance at 20°C (68°F) — hold ... Ω	10.5
Winding resistance at 20°C (68°F) — launch ... Ω	0.25
Current consumption at 12 V ... A	60
Activation voltage (minimum) ... V	7.5
Core stroke ... mm (in)	12÷14 (.5÷.6)
Assembly data	
Pole shoe I.D. ... mm (in)	75.85÷75.98 (2.986÷2.991)
Armature O.D. ... mm (in)	73 (2.9)
Self–lubricating armature bushings I.D.(force–fitted):	
— pinion end bushing ... mm (in)	12.475÷12.502 (.4911÷4922)
— intermediate bushing ... mm (in)	19.020÷19.072 (.7488÷7509)
— commutator end bushing ... mm (in)	12,475÷12,502 (.4911÷4922)
Armature shaft journal diameter at:	
— pinion end bushing ... mm (in)	12.425÷12.440 (.4892÷.4898)
— intermediate bushing ... mm (in)	18.927÷18.960 (.7452÷.7465)
— commutator end bushing ... mm (in)	12.425÷12.440 (.4892÷.4898)
Shaft/bushing running clearance at:	
— pinion end ... mm (in)	0.035÷0.077 (.0014÷.0030)
— intermediate ... mm (in)	0.060÷0.145 (.0024÷.0057)
— commutator end ... mm (in)	0.035÷0.077 (.0014÷.0030)
Pinion hub force–fitted bushing I.D. ... mm (in)	14.245÷14.272 (.5608÷.5619)
Armature shaft journal dia. at pinion hub bushing ... mm (in)	14.123÷14.150 (.5560÷5571)
Shaft/bushing running clearance ... mm (in)	0.095÷0.149 (.0037÷.0059)
Lubrication (at overhauls)	
Starter drive helical groove ...	**TUTELA MR 3** grease

Print No. ***603.54.283.00*** *– 09 – 1994*

BOSCH STARTING MOTOR – Models 70V – 72F – 82F – 72LP – 82LP

Type		JD→12V 0.001.359.102	
Voltage	V	12	
Rated output	kW	2.94	
Rotation (pinion end)		clockwise	
Pinion/ring gear tooth ratio		9/110	
Poles		4	
Excitation (field windings)		in series and in parallel	
Engagement		lever, with freewheel	
Control		solenoid	
Test bench data			
Shorted test at 20°C (68°F):		(*)	(°)
— current	A	760÷900	650÷800
— torque output	Nm	45 (4.6 kgm– 33.2 ft–lb)	38 (3.9 kgm– 28.2 ft–lb)
— voltage	V	4	3.5
No–load test at 20°C (68°F):			
— current	A	60÷90	
— voltage	V	11.5	
— speed	rpm	4800÷6800	
Mechanical specification checks			
Spring load on brushes (unworn)	N	25.5÷27.4(2.6÷2.8 kg – 5.7÷6.2 lb)	
Armature shaft end float	mm (in)	0.1÷0.3 (.004÷.01)	
Insulation undercutting depth	mm (in)	0.5÷0.8 (.02÷.03)	
Commutator dia.	mm (in)	42 (1.7)	
— permissible wear limit	mm (in)	39.5 (1.56)	
— maximum out–of–round: blade pack	mm (in)	0.05 (.002)	
— maximum out–of–round: commutator	mm (in)	0.03	

(*) Can be measured with a charged battery (°) Can be measured with a discharged battery.

(continues)

Print No. ***603.54.283.00*** *– 09 – 1994*

BOSCH STARTING MOTOR – Models 70V – 72F – 82F – 72LP – 82LP

(follows)

Solenoid	
Winding resistance at 20°C (68°F) — hold .... Ohm	1.05
Winding resistance at 20°C (68°F) — launch .... Ohm	0.25
Current consumption at 12 V — hold .... A	11.4
Current consumption at 12 V — launch .... A	50
Activation voltage (minimum) V	8
Core stroke .... mm (in)	12÷14 (.5÷.6)
Assembly data	
Pole shoe I.D. .... mm (in)	75.85÷75.98 (2.986÷2.991)
Armature O.D. .... mm (in)	73 (2.9)
Self–lubricating armature bushing I.D. (force–fitted):	
— pinion end bushing .... mm (in)	12.475÷12.502 (.4911÷4922)
— intermediate bushing .... mm (in)	19.020÷19.072 (.7488÷.7509)
— commutator end bushing .... mm (in)	14.000÷14.018 (.5512÷.5519)
Armature shaft journal dia. at:	
— pinion end bushing .... mm (in)	12.425÷12.440 (.4892÷.4898)
— intermediate bushing .... mm (in)	18.777÷18.910 (.7393÷.7445)
— commutator end bushing .... mm (in)	13.932÷13.950 (.5485÷.5492)
Shaft/bushing assembly clearance at:	
— pinion end .... mm (in)	0.035÷0.077 (.0014÷.0030)
— intermediate .... mm (in)	0.110÷0.195 (.0043÷.0077)
— commutator end .... mm (in)	0.050÷0.086 (.0020÷.0034)
Pinion hub force–fitted bushing I.D. .... mm (in)	14.245÷14.272 (.5608÷.5619)
Armature shaft journal dia. at pinion hub bushing .... mm (in)	14.123÷14.150 (.5560÷.5571)
Shaft/bushing running clearance .... mm (in)	0.095÷0.149 (.0037÷.0059)
Lubrication (at overhauls)	
Starter drive helical groove	**TUTELA MR 3** grease

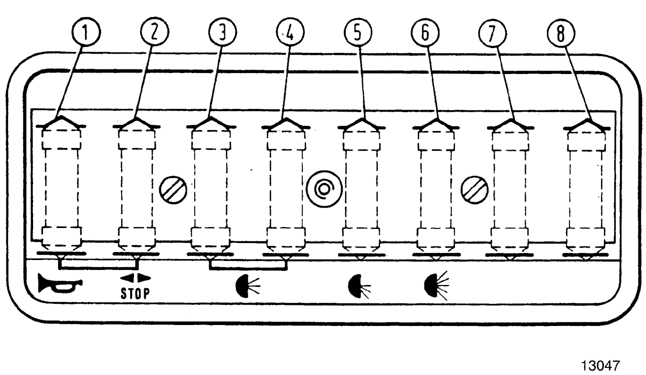
Print No. **603.54.283.00** – 09 – 1994

BATTERY

Voltage V	12
Rated output (20–hr discharge) for models 50V – 55V – 60V – 70V – 55F – 60F	90 A/hr or, in alternative, 110 A/hr, maintenance–free type
Rated output (20–hr discharge) for models 62F – 72F 82F – 72LP – 82LP	100 A/hr or, in alternative, 132 A/hr, maintenance–free type

FUSES

Fuse box with eight fuses, six 8–amp and two 16–amp		
Fuse	PROTECTED CIRCUITS	Amp
1	Horn, **engine shutdown solenoid.**	8
2	Stop and turn signal lights (tractor and trailers) and associated indicators, water temperature gauge, fuel level gauge, dry air cleaner restriction indicator, alternator charge indicator, low engine oil pressure indicator, applied parking brake indicator and associated switch.	8
3	Front right parking light, rear left parking light, license plate light, trailer left parking light, parking light indicator.	8
4	Front left parking light, rear right parking light, trailer right parking light, rear floodlamp, instrument cluster light.	8
5	Headlight low beams.	8
6	Headlight high beams and associated indicator.	8
7	Emergency lights and associated flasher, single–pole socket.	16
8	Thermostart.	16



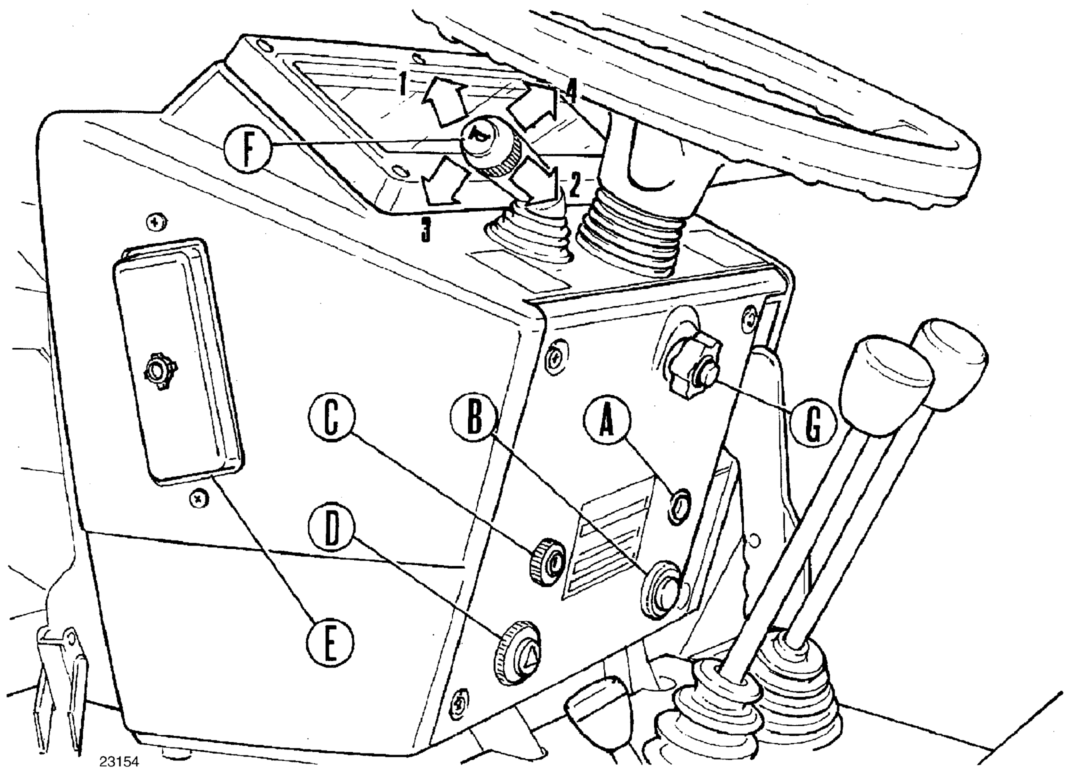
Electrical system fuses

Print No. **603.54.283.00** – 09 – 1994

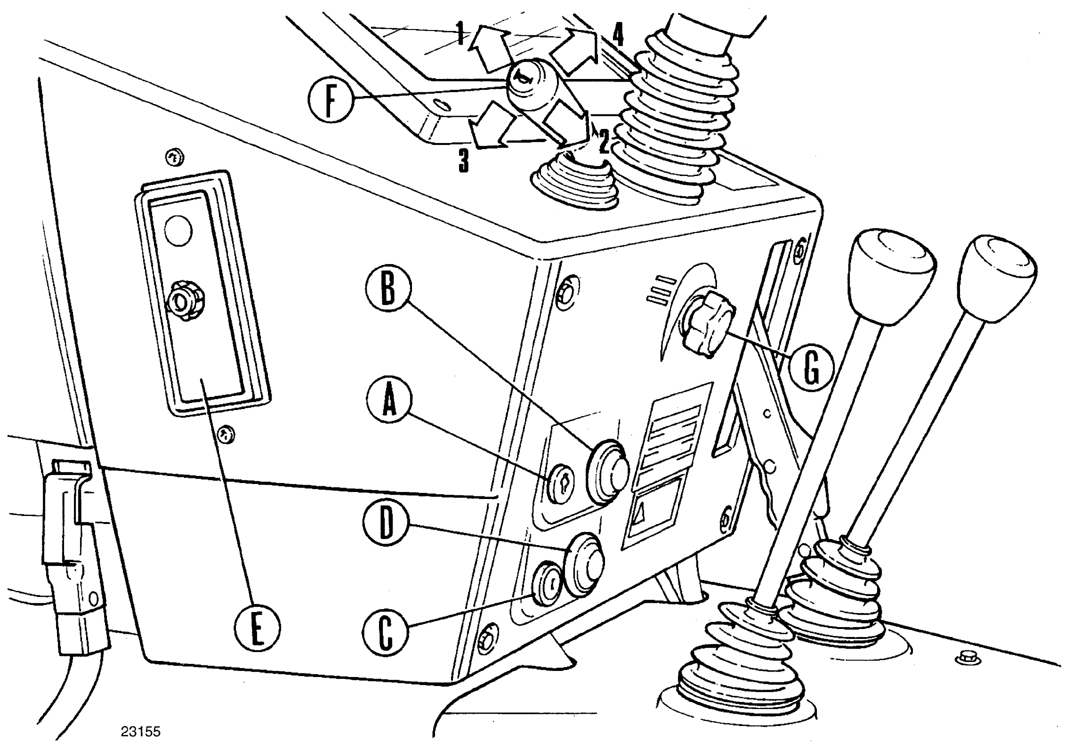
LIGHTS – INDICATORS – ACCESSORIES

Two front, asymmetrical headlamps with low and high–beam head lights provided with double–filament, 45/40 W bulbs (white or yellow light).
Two front lamps including: — parking light (5 W bulb) with white lens; — turn signal light (21 W bulb) with orange lens.
Two tail lamps including: — parking light (5 W bulb) with red lens; — turn signal light (21 W bulb) with orange lens; — stop light (21 W bulb) with red lens; — license plate light.
Two rear red reflex lens.
One rear floodlight with built–in switch (35 W bulb, white light).
A set of optical indicators and warning lights, with 3 W bulb, for: — alternator charge (red light); — low engine oil pressure (red light); — air cleaner restriction (red light); — hand brake on (red light); — parking lights on (green light); — high–beam headlights on (blu light); — turn signal lights on (green light); — 1st trailer turn signal lights on (green light); — 2nd trailer turn signal lights on (green light).
A low–temperature cold–starting aid (Thermostart).

Print No. 603.54.283.00 – 09 – 1994



OPERATING CONTROL BOARD, models 50V – 55V – 55F – 60V – 60F – 70V

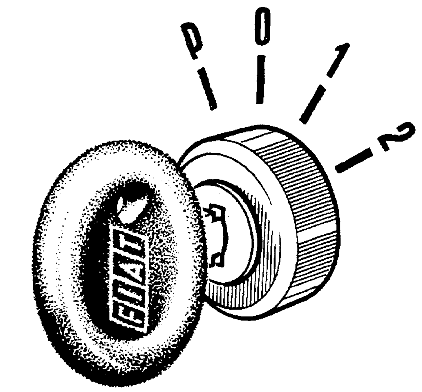


OPERATING CONTROL BOARD, models 62F – 72F – 82F – 72LP – 82LP

Print No. **603.54.283.00** – 09 – 1994

A. Single–pole socket.

B. Thermostart or start–pilote push–button control.



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C. Key start/stop switch.

0. No circuit energyzed (key can be removed). Engine shutdown: automatic fuel delivery override device.

1. Engine pre–starting. Indicators and check instruments inser ted. Accessories energyzed.

2. Engine starting (key, when released, will return automatical ly to **1** position).

P. Parking lights on, instrument panel illuminated (key can be removed).

D. Emergency flashing lights push–button control, with operating indicator lamp.
Operates permanently, even with switch **C** key removed. Push button to put emergency flashing lights on and still push a second time to switch them off.

E. Fuse box (see page 55–10).

F. Light switch and horn push–button control.
With switch **C** in **1** position, allowing operation of light switch, move lever **F**, page 55–12 and turn knob to bring index to correspond to one of the following symbols.

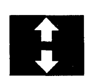
Turn signal lights and high–beam headlight flasher can be operated in this position.

Horn.
Just press on push–button on lever **F**, page 55–12, designated by this symbol; it operates with knob and lever in all positions.

Parking lights.
Turn signal indicator lights and flashing high–beam headlights can be selected.

Low–beam headlights.
Turn signal indicator lights and flashing high–beam headlights can be selected.

Permanent high–beam headlights.
With knob positioned for low–beam headlights move lever **F**, page 55–12 downwards, in **3** position. Turn signal lights can be selected.

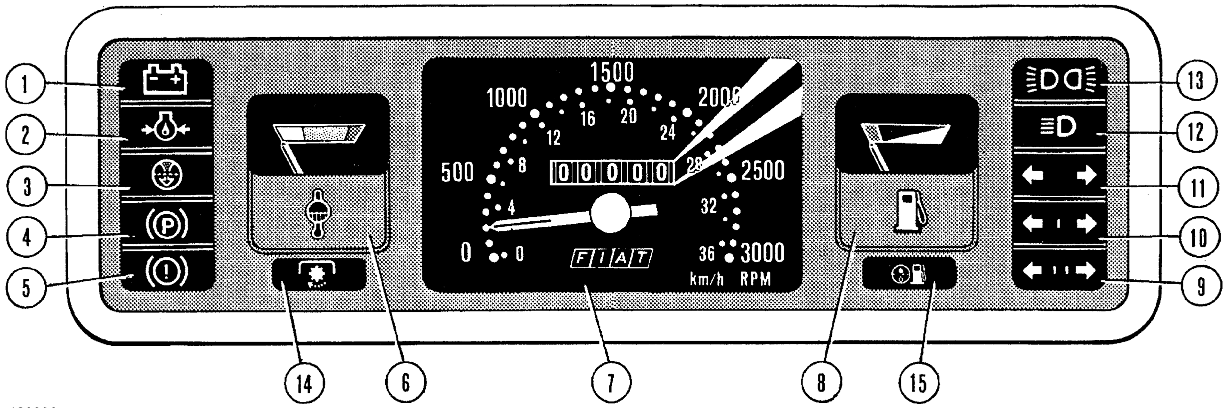


Turn signal lights.
With lever **F**, page 55–12, in either position:
— **1**,forward = right turn;
— **2**, rearward = left turn.

Flashing high–beam headlights.
Push lever upwards, in **4** position.

G. Steering wheel height adjustment knob.

Print No. **603.54.283.00** – 09 – 1994



13906A

INSTRUMENT PANEL

1. Wrong alternator charge operation indicator with built–in (red) warning lamp.
2. Low engine lube oil level indicator with built–in (red) warning lamp.
3. Dry air cleaner restriction indicator light (red).
4. Pulled hand brake warning flasher light (red).
5. Low brake fluid level indicator with built–in (red) warning lamp. (Only on models 62F – 72F – 82F – 72LP – 82LP, 40 km/hour version, unused on all other models).
6. Engine cooling fluid temperature gauge:
   — green sector = normal temperature;
   — white sector = temperature too low;
   — red sector = temperature too high.
7. Tractor hourmeter – Engine revolution counter.
8. Fuel level gauge.
9. 2nd trailer turn signal indicator light (green).
10. 1st trailer turn signal indicator light (green).
11. Tractor turn signal indicator light (green).
12. High–beam headlight indicator light (blu).
13. Lighted parking lamp indicator light (green).
14. Unused.
15. Unused.

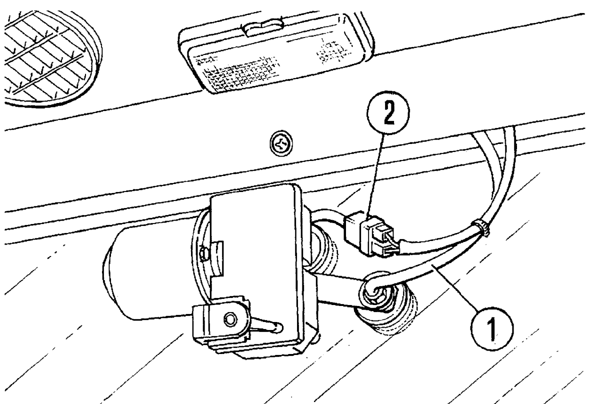
WINDSHIELD WIPER MOTOR

**Removal–Installation
(Operation 55 518 52, for models 62F – 72F – 82F)**

Note – Operations described hereafter concern the front windshield wiper motor. Same operations apply to rear window glass wiper motor.

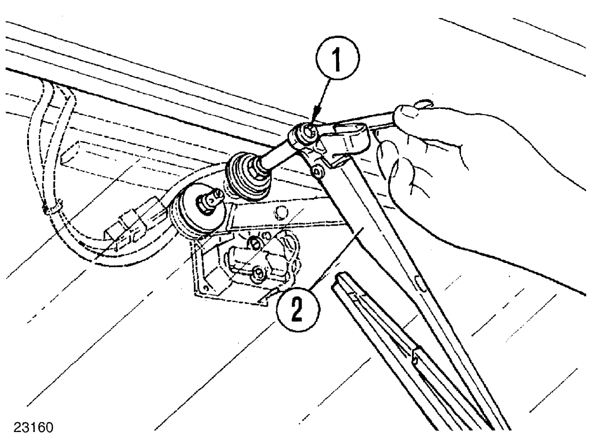
To remove motor, proceed as further indicated.

1. Disconnect the battery negative cable.



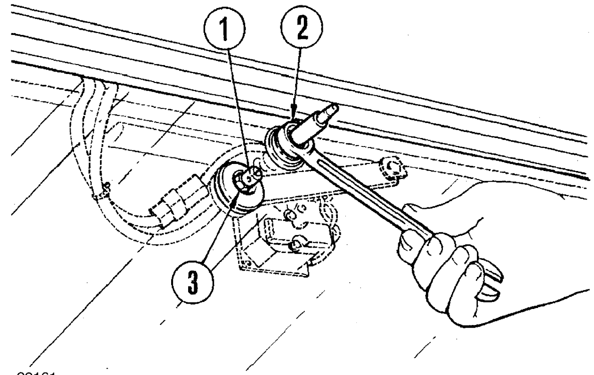
23159

2. Disconnect spray fluid line (1) and electrical connection (2).



23160

3. Unscrew nut (1) and remove wiper arm (2).



23161

4. Remove spray nozzle (1), pressure–fitted, unscrew nuts (2 and 3) and remove the windshield wiper motor from the inside.

5. Install the windshield wiper motor in accordance with the following instructions and information:

   a. proceed by reversing the previous removal sequence of operations, starting from no. 4 back to no. 1;

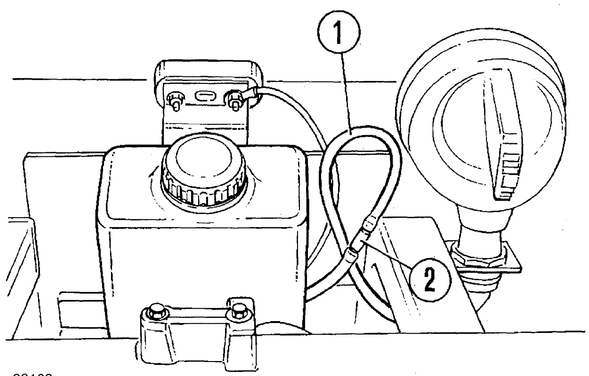
   b. consult previous illustrations for the correct placement of parts;

   c. check that the wiper blade stroke is correctly centered on the windshield between end stops; if not, correct by changing its position on the knurled end of the motor shaft.

FLEX HOSE CONNECTING CHECK VALVE AND SPRAYER

Replacement (Operation 55 518 14 fo models 62F – 72F – 82F)

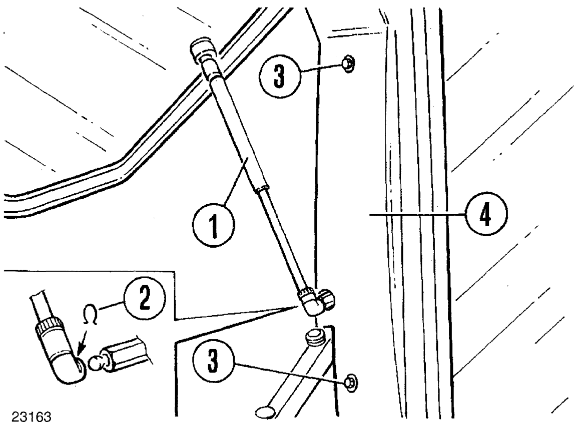
To replace flex hose, proceed as further indicated.



23162

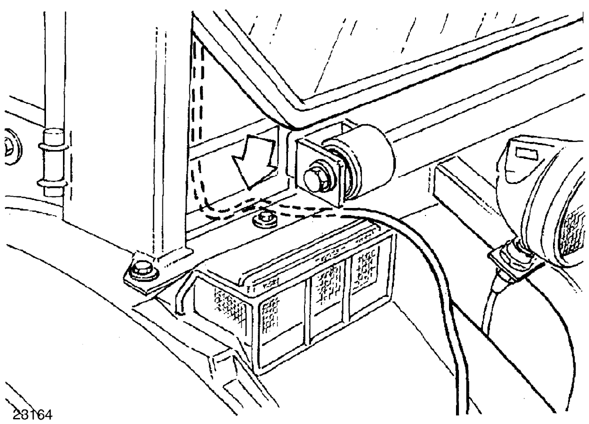
1. Disconnect delivery hose (1) from union (2).

Print No. 603.54.283.00 – 09 – 1994



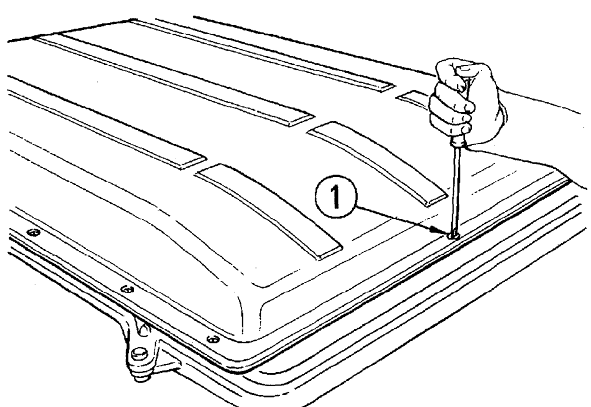
23163

2. Working inside the cab, disconnect the rear window opening damper (1) after removal of the ball joint flex spring (2).
3. Undo holding screws (3), remove side panel (4) and pull off the hose, accompanying it by hand while passing under the cab frame, as illustrated in the next figure.



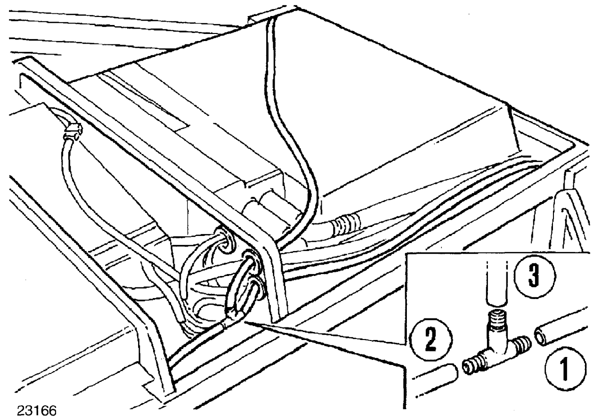
23164

4. Disconnect the pressure–fitted hose from the associated sprayer.



23165

5. Undo peripherical holding springs (1) and remove the cab roof, being careful not to damage the gasket.



23166

6. At this stage, disconnecting fluid lines from the T–union, replace the selected one:
   1. delivery from reservoir;
   2. windshield sprayer derivation;
   3. rear window glass sprayer derivation.

7. Install unit in accordance with the following instructions and information:

   a. proceed by reversing the previous removal sequence of opera tions starting from no. 6 back to no. 1;

   b. consult previous illustrations for the correct placement of parts;

   c. work always under top cleanliness conditions. Should the hose be expected to remain loose, make sure that ends are properly sealed;

   d. top up fluid level in windshield washer–wiper reservoir.

WINDSHIELD WIPER–WASHER WATER SPRAY

Replacement (Operation 55 518 24 for models 62F – 72F – 82F

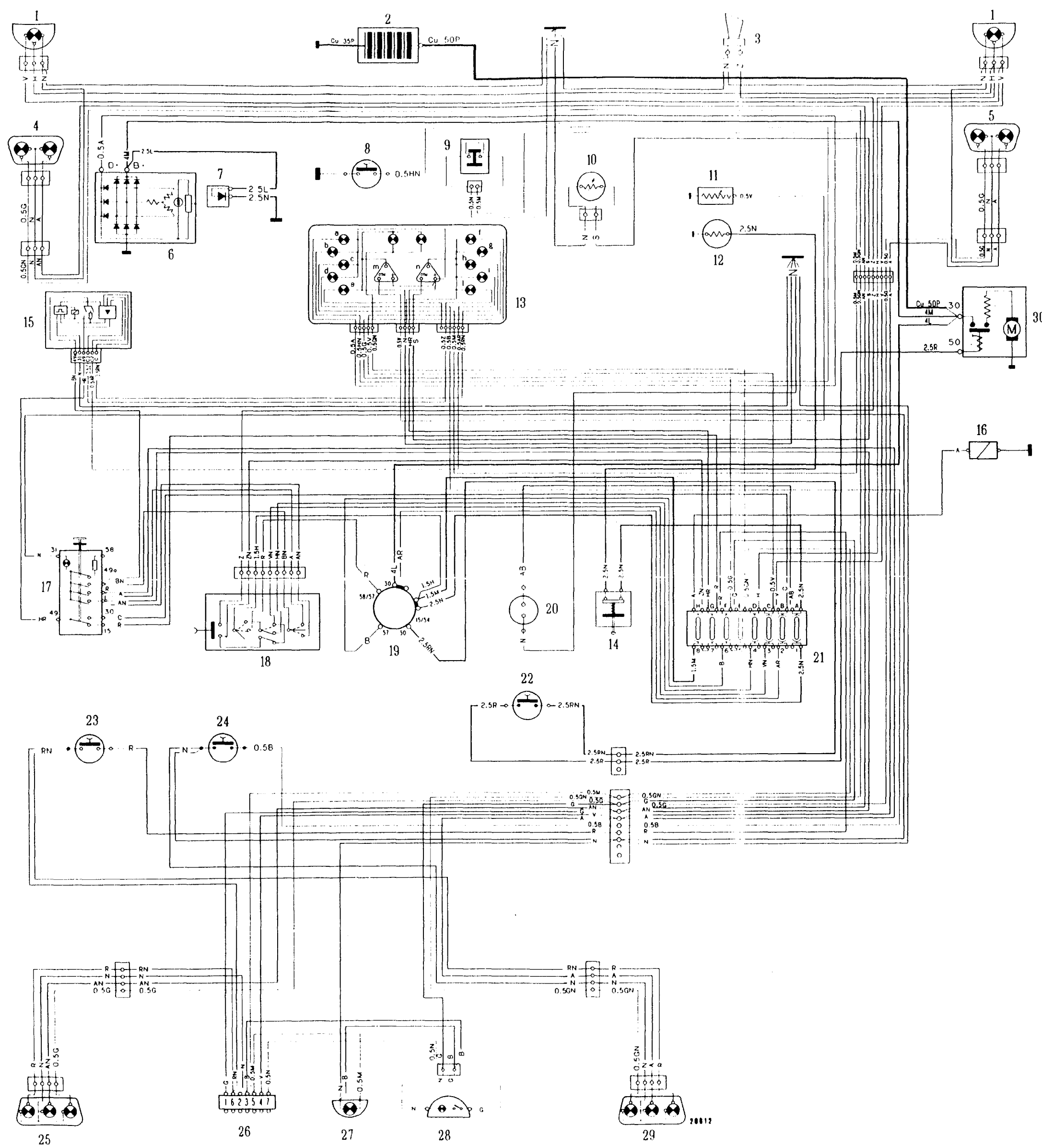
Proceed as further indicated.

1. Working inside the cab, disconnect the windshield washer fluid delivery line.

2. Remove the pressure–fitted sprayer.

3. Assemble by reversing the previous disassembly sequence of operations.

Print No. 603.54.283.00 – 09 – 1994



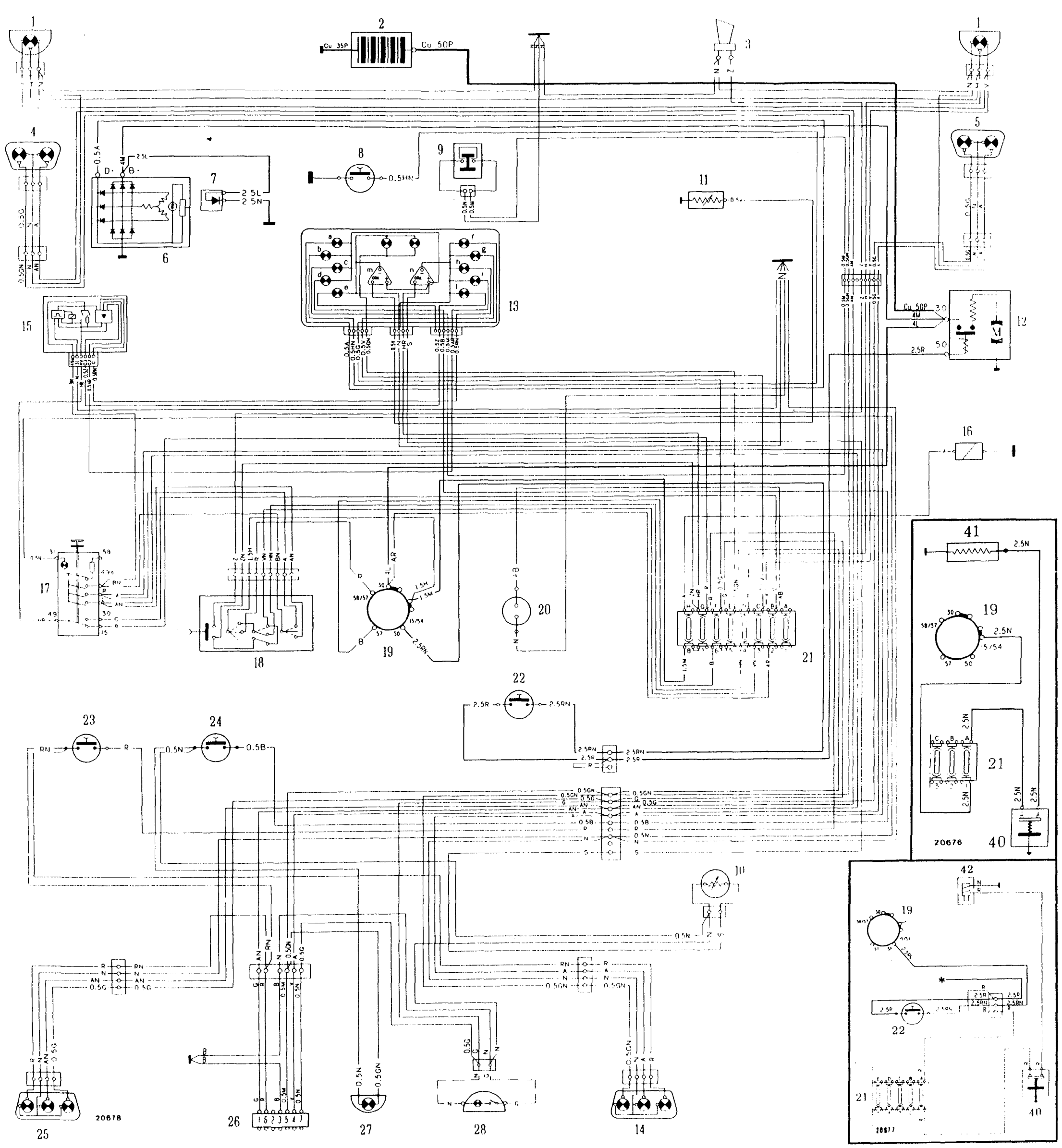
ELECTRICAL WIRING DIAGRAM
Model 50V – 55V – 60V – 70V – 55F – 60F tractors

1. Asymmetrical headlights, high–beam and low–beam.
2. Battery.
3. Horn.
4. Left front lamp, parking and turn signal lights.
5. Right front lamp, parking and turn signal lights.
6. Alternator.
7. Voltage–peak protection.
8. Low engine oil pressure indicator switch.
9. Dry air cleaner restriction indicator switch.
10. Fuel level gauge control.
11. Engine cooling fluid temperature gauge sender.
12. Thermostart.
13. Multi–function instrument cluster including:
    - a. wrong alternator charge indicator;
    - b. low engine oil pressure indicator;
    - c. dry air cleaner restriction indicator;
    - d. pulled hand brake indicator;
    - e. unused;
    - f. lighted parking lamp indicator;
    - g. high–beam headlight indicator;
    - h. tractor turn signal light indicator;
    - i. 1st trailer turn signal light indicator;
    - l. 2nd trailer turn signal light indicator;
    - m. engine coolant temperature gauge;
    - n. fuel level gauge.
14. Thermostart switch.
15. Turn signal and emergency light flasher.
16. Engine shutdown solenoid.
17. Push–button control for flashing emergency lights with built–in indicator lamp.
18. Stalk–type, multi–function switch.
19. Engine start/stop key switch.
20. Single–pole socket.
21. Fuse box.
22. Engine starting safety switch.
23. Stop light tumbler switch.
24. Pulled hand brake indicator switch.
25. Left tail lamp with stop, turn signal and parking lights.
26. 7–pole socket.
27. License plate light.
28. Rear floodlight.
29. Right tail lamp with stop, turn signal and parking lights.
30. Starting motor.

CABLE COLOUR CODE

A = Light blue
B = White
C = Orange
G = Yellow
H = Grey
L = Blu
M = Brown
N = Black
R = Red
S = Pink
V = Green
Z = Violet

Print No. 603.54.283.00 - 09 - 1994



ELECTRICAL WIRING DIAGRAM
Model 62F – 72F – 82F – 72LP – 82LP tractors

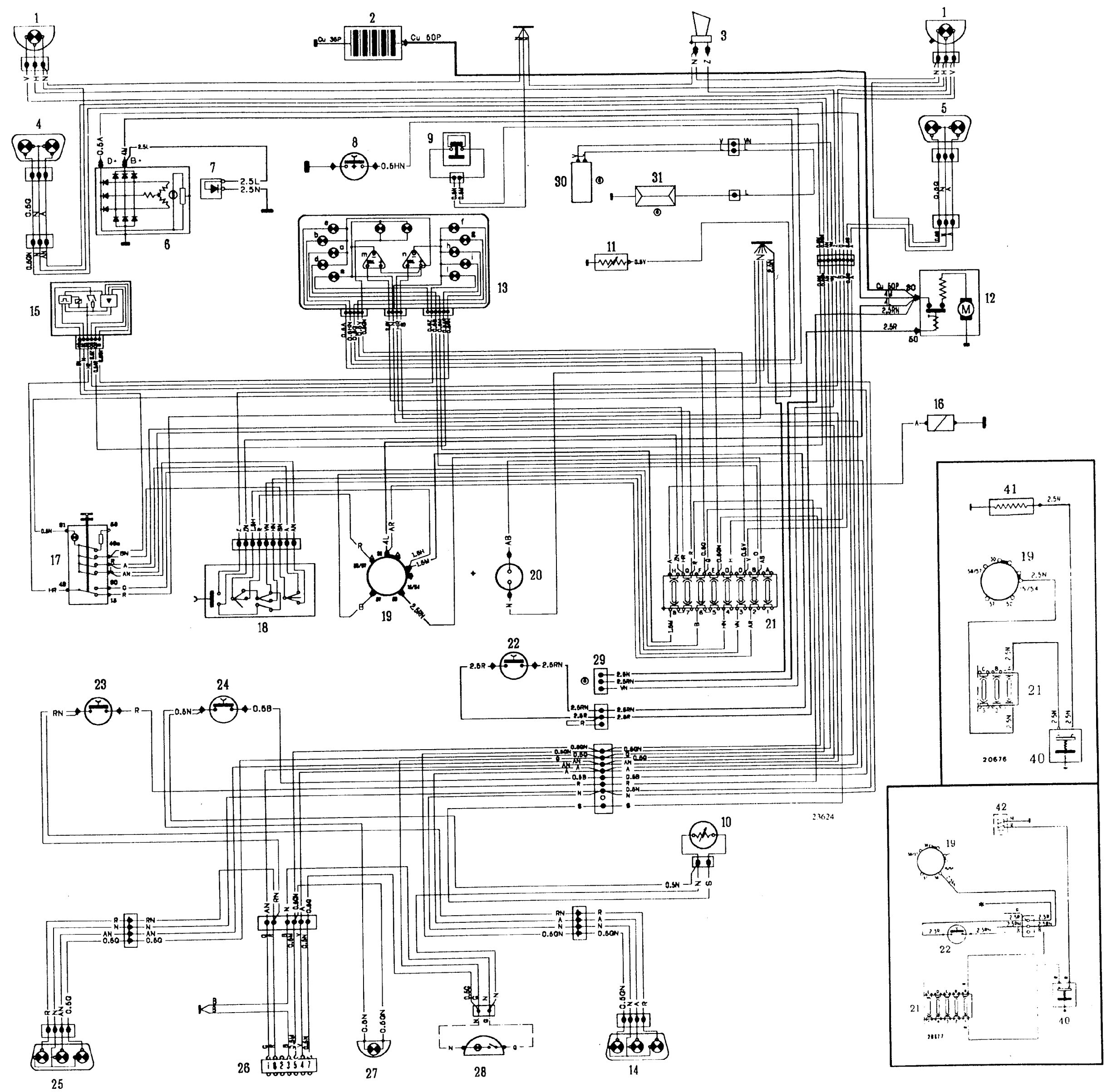
1. Asymmetrical headlights, high–beam and low–beam.
2. Battery.
3. Horn.
4. Left front lamp, parking and turn signal lights.
5. Right front lamp, parking and turn signal lights.
6. Alternator.
7. Voltage peak protection.
8. Low engine oil pressure indicator switch.
9. Dry air cleaner restriction indicator switch.
10. Fuel level gauge control.
11. Engine cooling fluid temperature gauge sender.
12. Starting motor.
13. Multi–function instrument cluster including:
    - **a.** wrong alternator charge indicator;
    - **b.** low engine oil pressure indicator;
    - **c.** dry air cleaner restriction indicator;
    - **d.** pulled hand brake indicator;
    - **e.** unused;
    - **f.** lighted parking lamp indicator;
    - **g.** high–beam headlight indicator;
    - **h.** tractor turn signal light indicator;
    - **i.** 1st trailer turn signal light indicator;
    - **l.** 2nd trailer turn signal light indicator;
    - **m.** engine coolant temperature gauge;
    - **n.** fuel level gauge.
14. Right tail lamp, parking and turn signal lights.
15. Flashing indicator lamp, emergency and and turn signal lights.
16. Engine shutdown solenoid.
17. Push–button control, flashing emergency lights with built–in indicator lamp.
18. Stalk–type, multi–function switch.
19. Engine start/stop key switch.
20. Single–pole socket.
21. Fuse box.
22. Engine starting safety switch.
23. Stop light tumbler switch.
24. Pulled hand brake indicator switch.
25. Left tail lamp with stop, turn signal and parking lights.
26. 7–pole socket.
27. License plate light.
28. Rear floodlight.
40. Thermostart or start–pilote control switch.
41. Thermostart (optional).
42. Start–pilote (optional).

* Connected to the starter 50 terminal.

CABLE COLOUR CODE

A = Light blue
B = White
C = Orange
G = Yellow
H = Grey
L = Blu
M = Brown
N = Black
R = Red
S = Pink
V = Green
Z = Violet.

Print No. 603.54.283.00 – 09 – 1994



ELECTRICAL WIRING DIAGRAM – Model 62F – 72F – 82F tractors with cab

1. Asymmetrical headlights, high–beam and low–beam.
2. Battery.
3. Horn.
4. Left front lamp, parking and turn signal lights.
5. Right front lamp, parking and turn signal lights.
6. Alternator.
7. Voltage peak protection.
8. Low engine oil pressure indicator switch.
9. Dry air cleaner restriction indicator switch.
10. Fuel level gauge control.
11. Engine cooling fluid temperature gauge sender.
12. Starting motor.
13. Multi–function instrument cluster including:
- **a.** wrong alternator charge indicator;
- **b.** low engine oil pressure indicator;
- **c.** dry air cleaner restriction indicator;
- **d.** pulled hand brake indicator;
- **e.** unused;
- **f.** lighted parking lamp indicator;
- **g.** high–beam headlight indicator;
- **h.** tractor turn signal light indicator;
- **i.** 1st trailer turn signal light indicator;
- **l.** 2nd trailer turn signal light indicator;
- **m.** engine coolant temperature gauge;
- **n.** fuel level gauge.

14. Right tail lamp, parking and turn signal lights.
15. Flashing indicator lamp, emergency and and turn signal lights.
16. Engine shutdown solenoid.
17. Push–button control, flashing emergency lights with built in indicator lamp.
18. Stalk–type, multi–function switch.
19. Engine start/stop key switch.
20. Single–pole socket.
21. Fuse box.
22. Engine starting safety switch.
23. Stop light tumbler switch.
24. Pulled hand brake indicator switch.
25. Left tail lamp with stop, turn signal and parking lights.
26. 7–pole socket.
27. License plate light.
28. Rear floodlight.
29. Connections to the cab.
30. Receiver–drier filter.
31. Air compressor.
40. Thermostart or start–pilote control switch.
41. Thermostart (optional).
42. Start–pilote (optional).
* Connected to the starter 50 terminal.

CABLE COLOUR CODE

A =	Light blue	M =	Brown
B =	White	N =	Black
C =	Orange	R =	Red
G =	Yellow	S =	Pink
H =	Grey	V =	Green
L =	Blu	Z =	Violet.

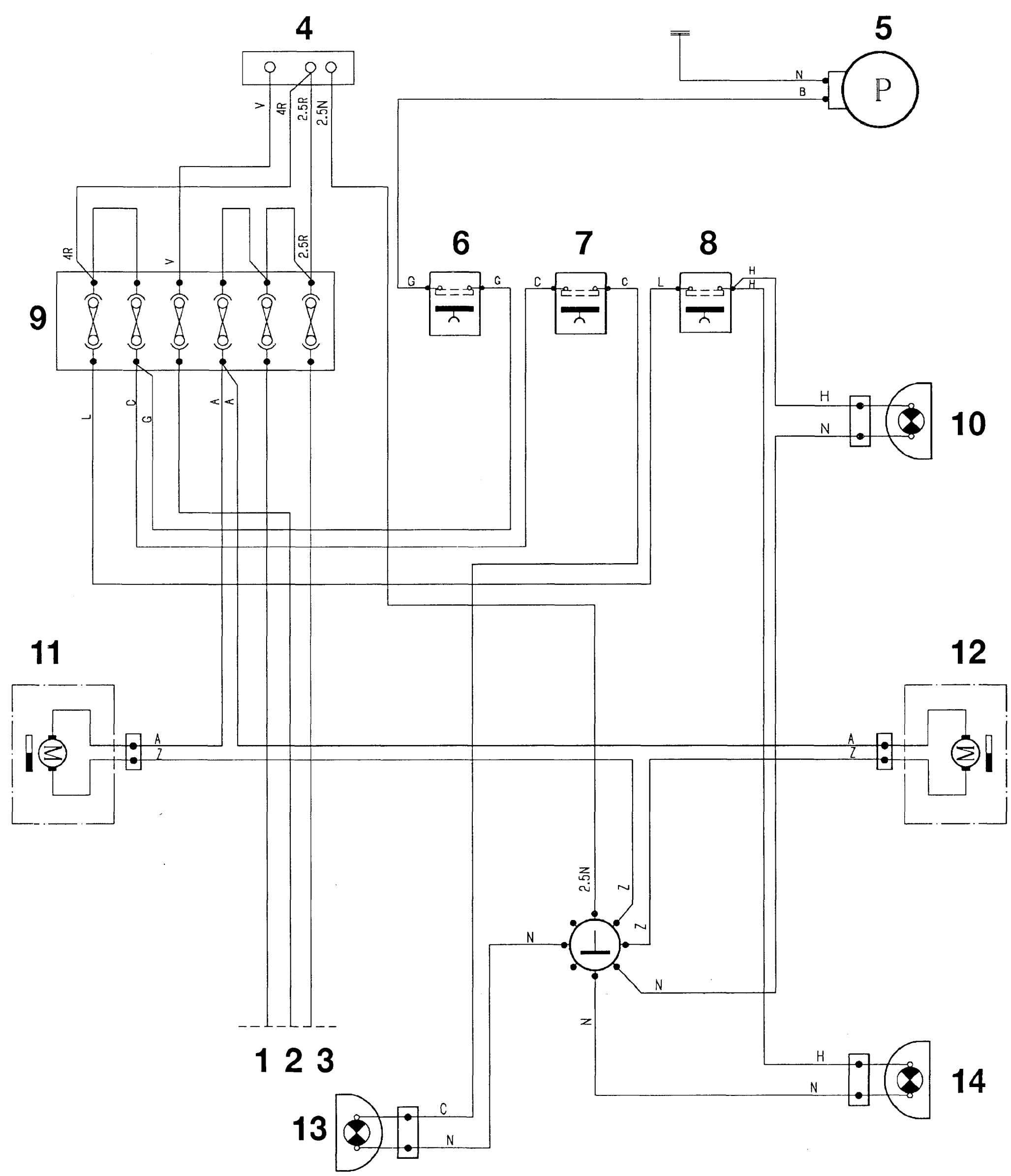
Print No. 603.54.283.00 – 09 – 1994

ELECTRICAL WIRING DIAGRAM
FOR TRACTORS models 62F, 72F, 82F with CAB .

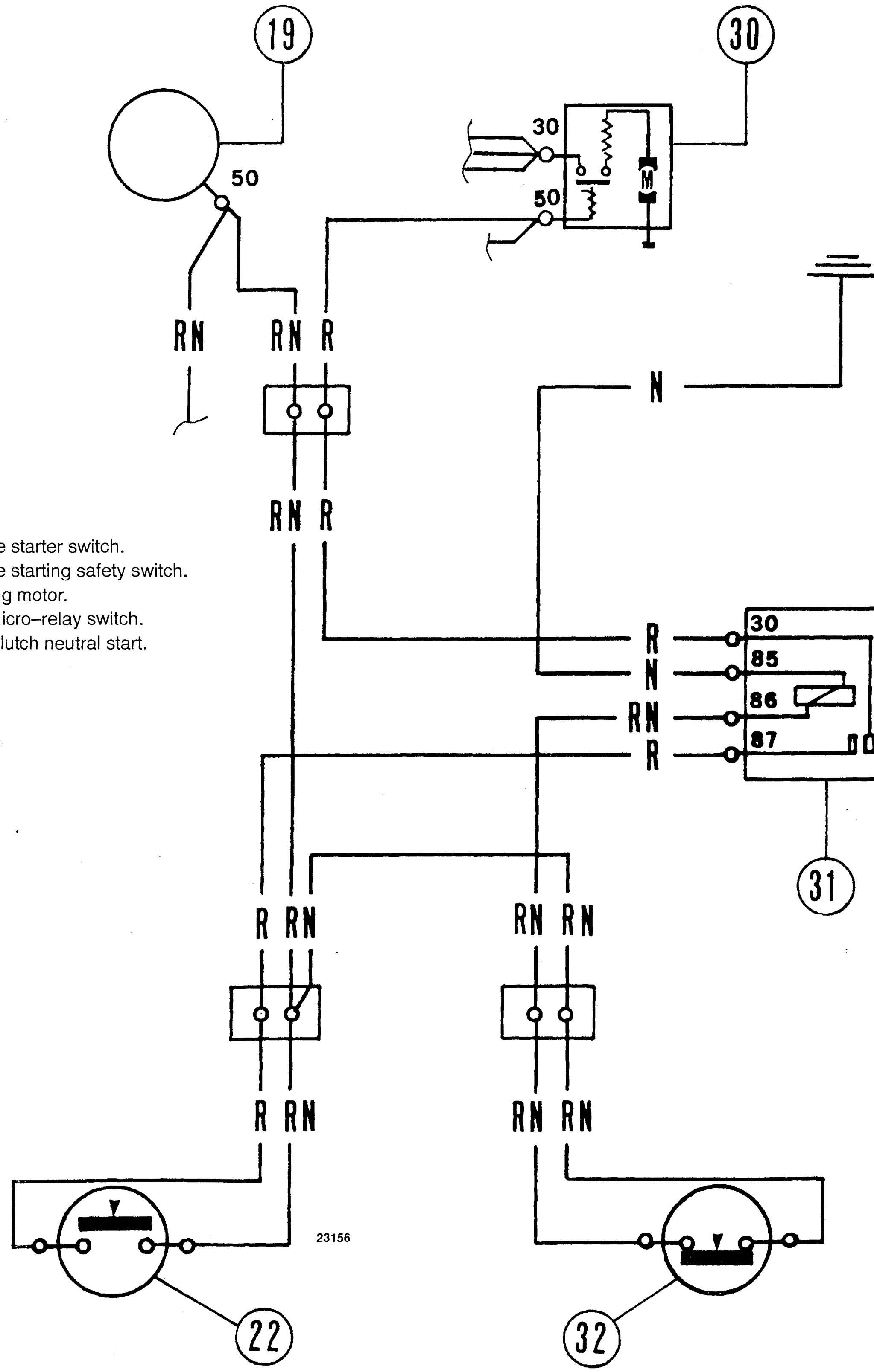
1. To the heater.
2. From the thermostat.
3. To the evaporator.
4. Connections to the tractor.
5. Windscreen washer pump.
6. Windscreen washer switch.
7. Roof beacon switch.
8. Work light switch.
9. Fuses.
10. Right rear work light.
11. Windscreen wiper motor.
12. Rear window wiper motor.
13. Roof beacon.
14. Left rear work light.

CABLE COLOUR CODE

A = Light blue
B = White
C = Orange
G = Yellow
H = Grey
L = Blu
N = Black
R = Red
V = Green
Z = Violet



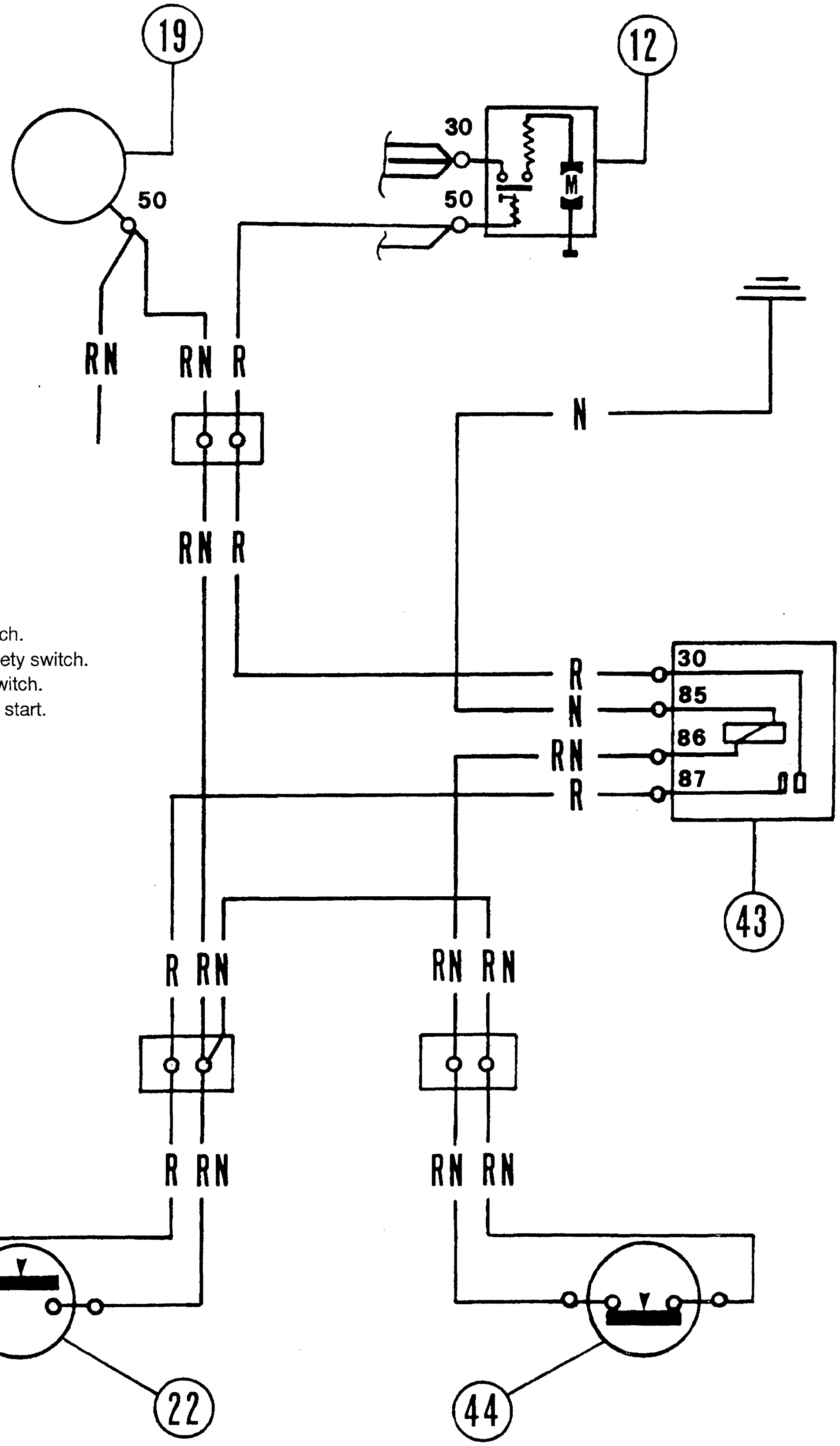
VARIANT TO THE ELECTRICAL WIRING DIAGRAM FOR USA MARKET
(models 50V – 55V – 60V – 70V – 55F – 60F, page 55–17)
Power take–off safety switch



19. Engine starter switch.
22. Engine starting safety switch.
30. Starting motor.
31. 70A micro–relay switch.
32. PTO clutch neutral start.

Print No. 603.54.283.00 – 09 – 1994

VARIANT TO THE ELECTRICAL WIRING DIAGRAM FOR USA MARKET
(models 62F – 72F – 82F – 72LP – 82LP, pages 55–18, 55–19)
Power take–off safety switch



12. Starting motor.
19. Engine starter switch.
22. Engine starting safety switch.
43. 70A micro–relay switch.
44. PTO clutch neutral start.

Print No. 603.54.283.00 – 09 – 1994

PAINT

Synthetic enamels available in the colours codified below.

FIATAGRI TRACTORS (EUROPE)

TA/19	Brick red
TA/2	Brown
TA/21	White
TA/8	Black

FORD TRACTORS (USA)

M1639	Blue
M1750	Grey
M1724P	Black

Print No. **603.54.283.00** – 09 – 1994

CAB
Removal–Installation (Operation 90 152 14)
(Separately, operation 50 200 04 for air–conditioned cabs)

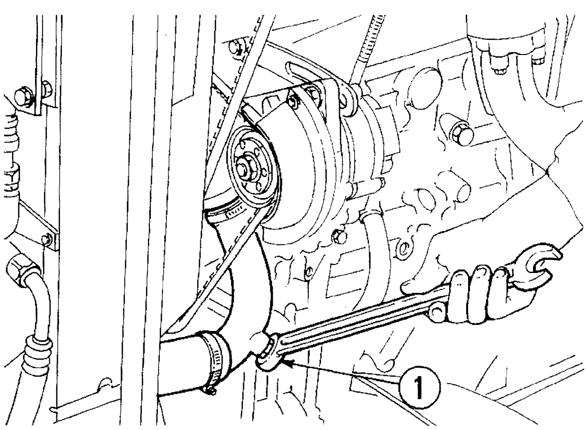
Note – Three optional types of cabs are available:
— standard cab;
— heated/ventilated cab;
— air conditioned cab.
The ”removal–installation” operations which follow deal with the last type of cab which is the most complex one.

DANGER

Lift and handle all heavy parts using the appropriate lifting equipment. Make sure that the load is held and supported by suitable slings and hooks. Make sure that nobody is standing near by.

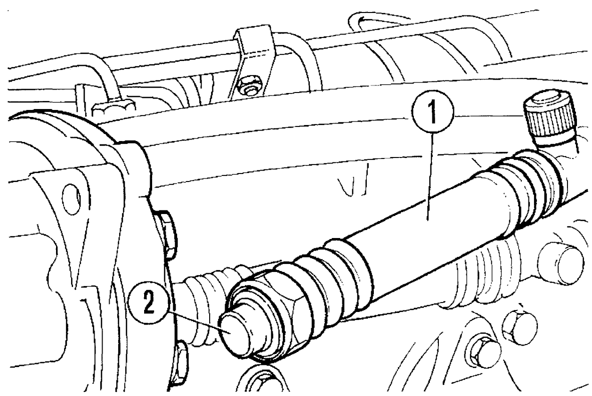
Proceed as further indicated.

1. Disconnect battery cables and lock the tractor rear wheels by operating the parking brake.



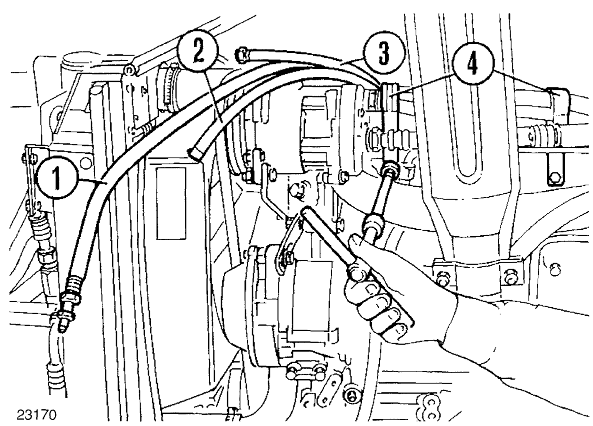
23168

2. Remove plug (1) from drain pipe and empty the engine cooling system; make sure to collect the PARAFLU fluid in a proper container and remove radiator cap to ease flow.



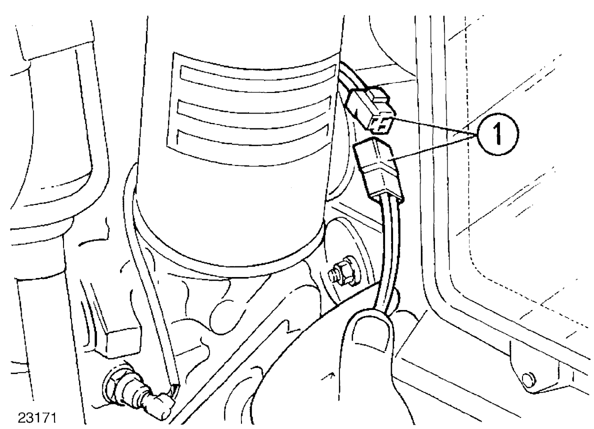
23169

3. Recover the air conditioning refrigerant fluid through the recovery and re–cycling station following instructions on page 50–15 and disconnect the low pressure line (1) from the compressor. Fit plastics plugs (2) to prevent entry of dust or impurities inside the compressor or loose fluid line.



23170

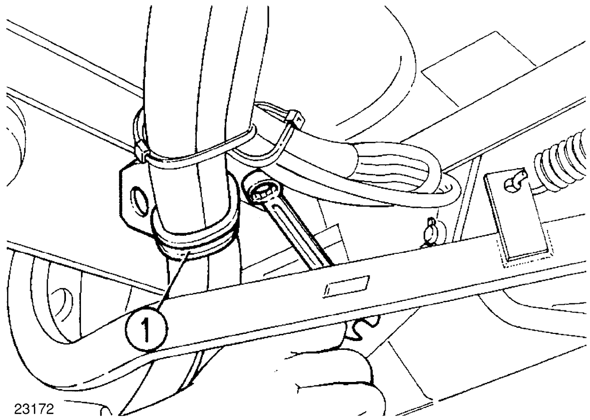
4. Disconnect lines (1, 2 and 3) and fit plastic plugs inside open ends.
5. Remove brackets (4) and arrange removed lines on the tractor left–hand side.



23171

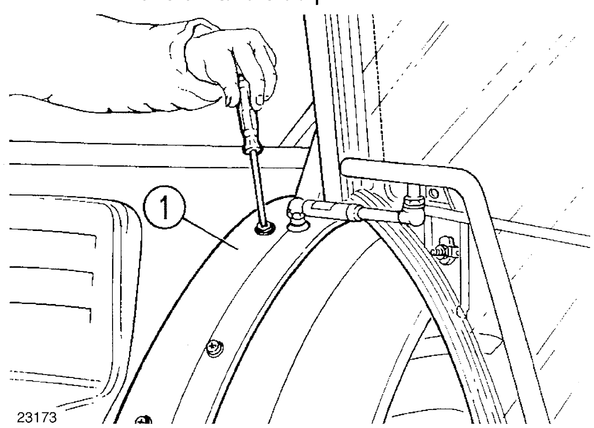
6. Disconnect the air conditioning and ventilation feeding system electrical terminal (1).

Print No. 603.54.283.00 – 09 – 1994



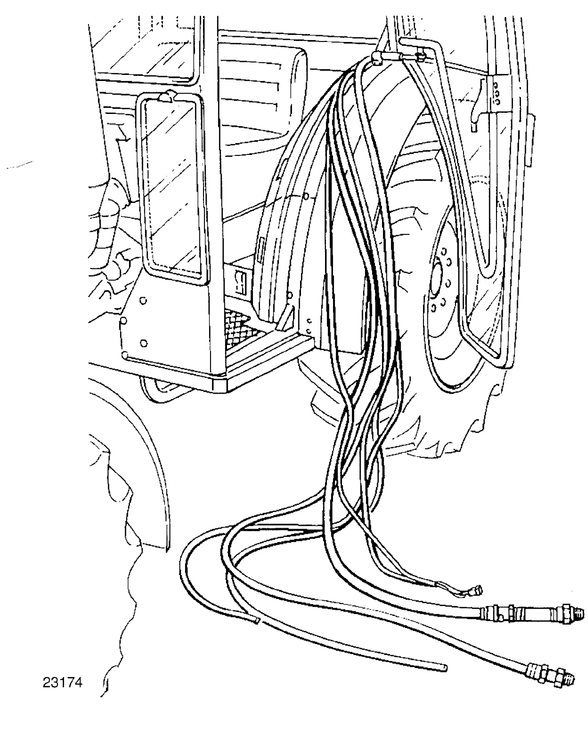
23172

7. Remove the fluid line retaining bracket (1) from under the left–hand side platform.

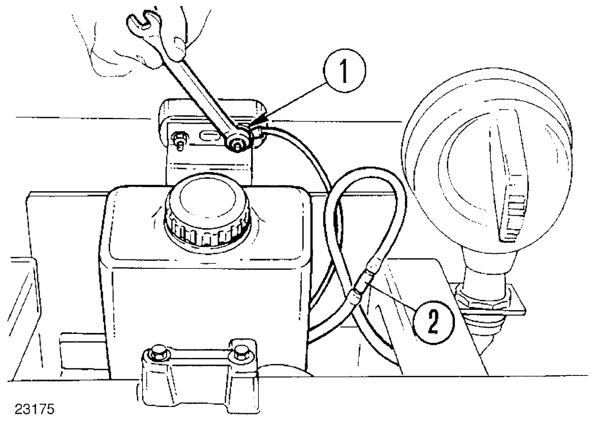


23173

8. Remove guard (1) and withdraw piping arranging it as shown in the figure below.

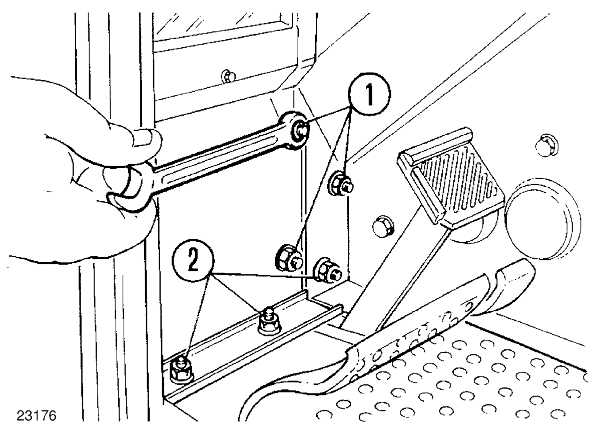


23174



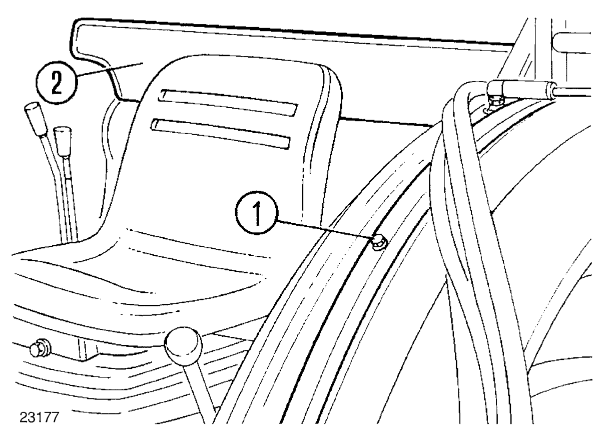
23175

9. Disconnect ground cable (1), line (2) and then the windshield wash reservoir electrical connection.



23176

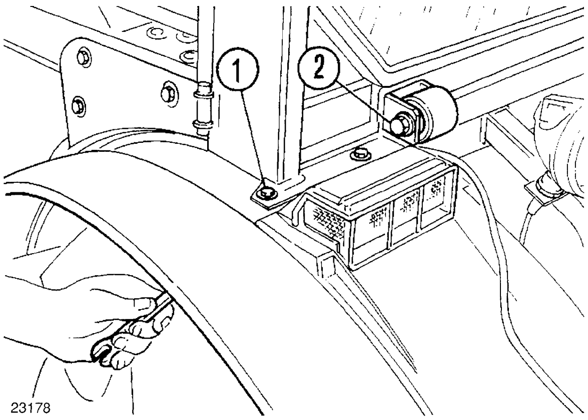
10. Undo holding screws (1), raise the platform lining and undo screws (2).



23177

11. Remove all screws (1) from the cab frame and separate the rear padding (2).

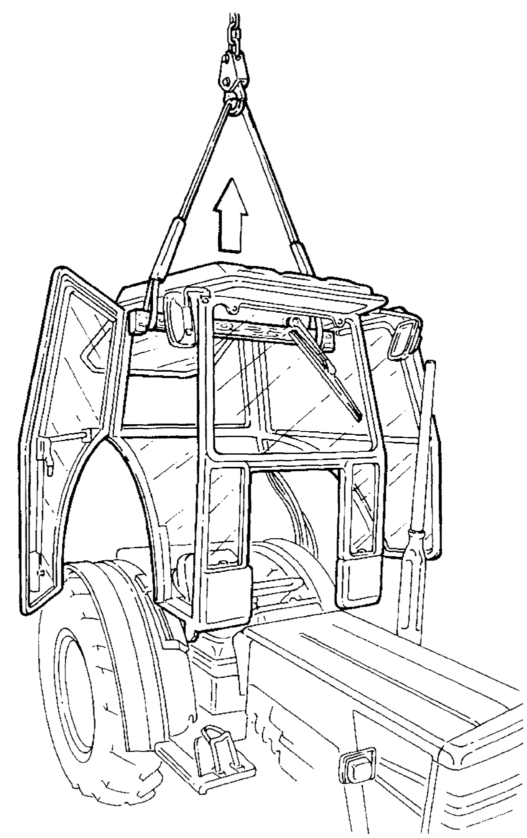
Print No. ***603.54.283.00*** *– 09 – 1994*



23178

12. Undo the nuts from under mudguards and then remove the associated screws (1).

13. Remove screws (2) securing cab to silent–blocks.



23179

14. Using a hoist and associated slinging equipment, lift up the cab very carefully and slowly to avoid damaging the cab and frame, while making sure that no mechanism or hydraulic piping of the air conditioning system is still attached or connected to the cab.

CAUTION

Use suitable tools to align holes. DO NOT USE FINGERS OR HANDS.

15. Install the cab in accordance with the following instructions and information:

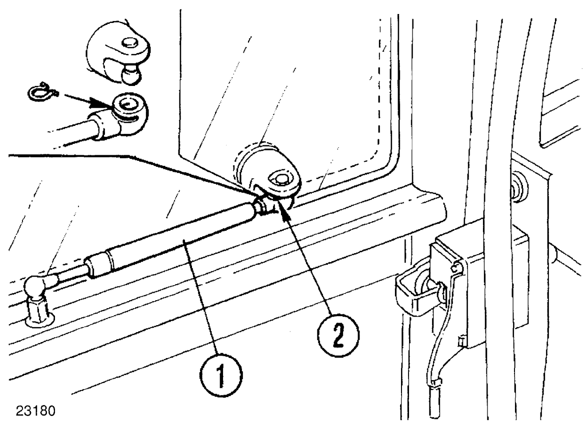
    a. reverse the previous removal sequence of operations, starting from no. 14 back to no. 1;

    b. consult the preceding illustrations for the correct placement of parts;

    c. replace any damaged or defective seal.

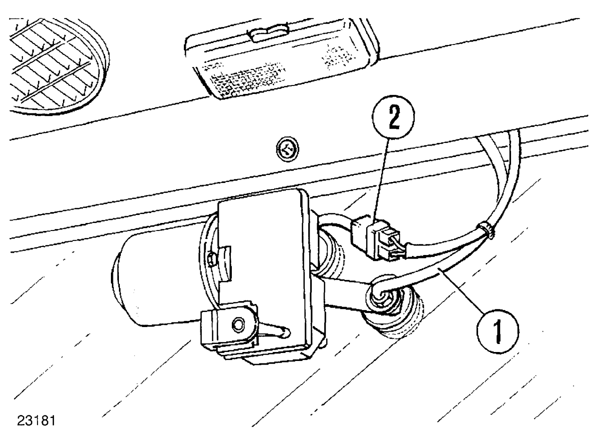
WINDSHIELD GLASS – Replacement (Operation 90 156 10)

Proceed as further indicated.



23180

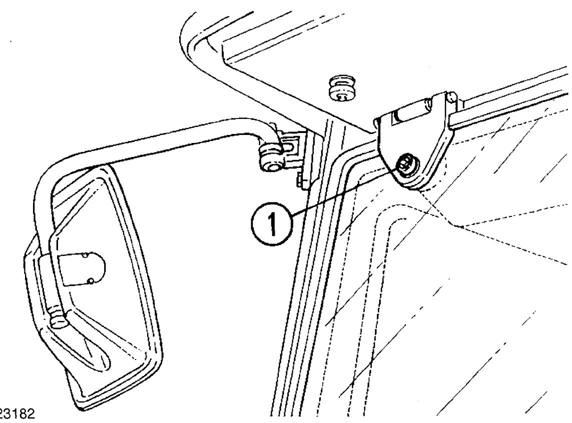
1. From inside the cab, disconnect the opening dampers (1) after removal of the ball joint retaining spring blades (2).



23181

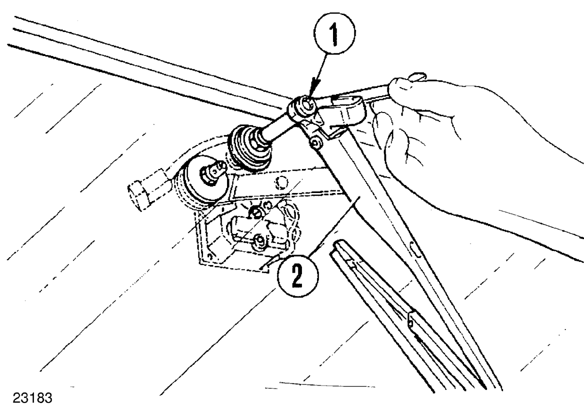
2. Disconnect the fluid delivery line (1) to the sprayer and the electrical connections (2) to the windshield wiper motor.

Print No. **603.54.283.00** – 09 – 1994



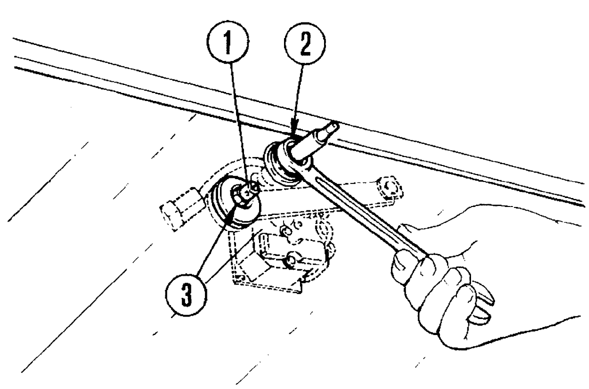
23182

3. From outside the cab, undo the hexagon–recessed head screws (1) from the associated hinges, recover the retaining washers an, finally, remove the complete windshield, with handle and wiper assembly.



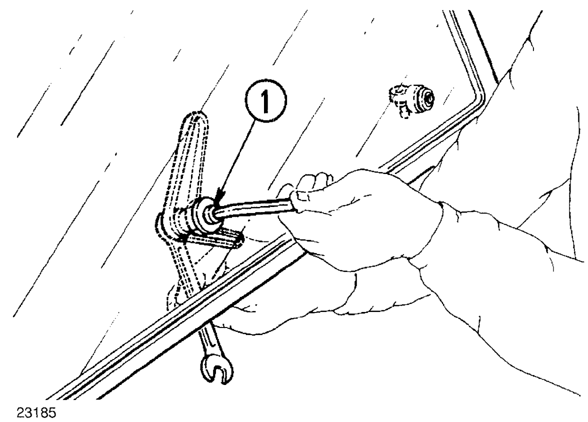
23183

4. At the workbench, undo the securing nut (1) and remove the windshield wiper blade (2).



23184

5. Remove the sprayer (1), force fitted in place, unscrew nuts (2 and 3) and withdraw the wiper motor from the inside, recovering the retaining washers.



23185

6. Undo holding screws and remove the complete damper mountings on the windshield glass, with retaining washer.
7. Undo recessed–head screw (1), withdraw handle and retrieve washer.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

Important – When replacing the windshield glass it is advisable to replace the rubber seal strip also. The seal is relatively ease to replace and no particular difficulty should be experienced in removing and installing it as fitting only requires a slight pressure on the glass. In addition, we suggest that the seal be wetted in 'PARAFLU 11' fluid, or better still in a soaped water solution prior to in stallation. Absolutely avoid using oil or grease which would shorten its life.

8. Install the windshield glass in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations, starting from no. 7 back to no. 1;

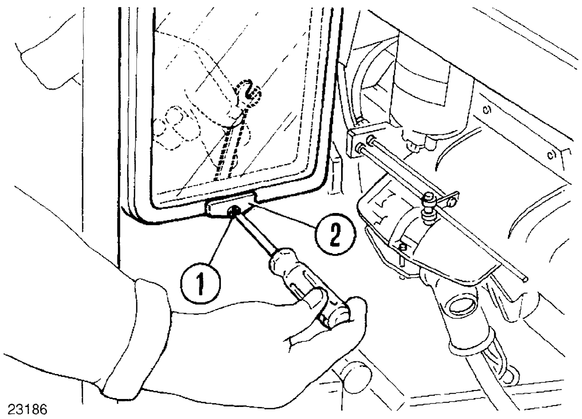
   b. consult the preceding illustrations for the correct placement of parts;

   c. check that the wiper blade travel is centered with respect to end stops and adjust it, in case, by suitably modifying the position of the blade on the windshield wiper motor splined shaft.

Print No. ***603.54.283.00*** *– 09 – 1994*

FRONT GLASS, RIGHT OR LEFT
Replacement (Operation 90 156 14)

Proceed as further indicated.



23186

1. Undo holding screws (1).
2. Remove glass and recover blocks (2).

Important – When replacing a glass it is advisable to replace the rubber seal also. The seal is relatively easy to replace and no particular difficulty should be experienced in removing and replacing it as fitting only requires a slight pressure on the glass. In addition, we suggest that the seal be wetted with "PARAFLU 11" fluid, or, better still, in a soaped water solution prior to installation. Absolutely avoid using oil or grease which would shorten its life.

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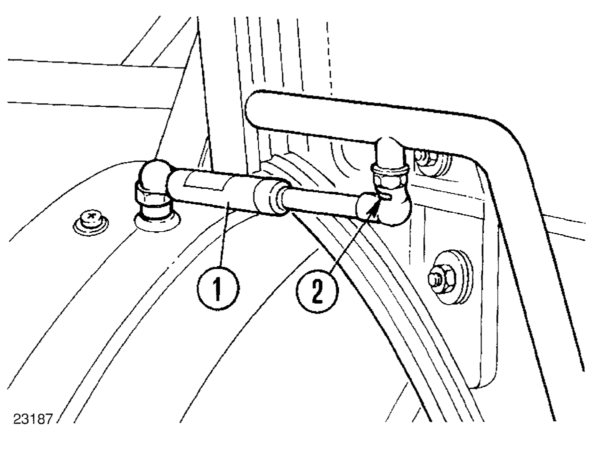
3. At installation, reverse the previous removal sequence of operations starting from no. 2 back to no. 1.

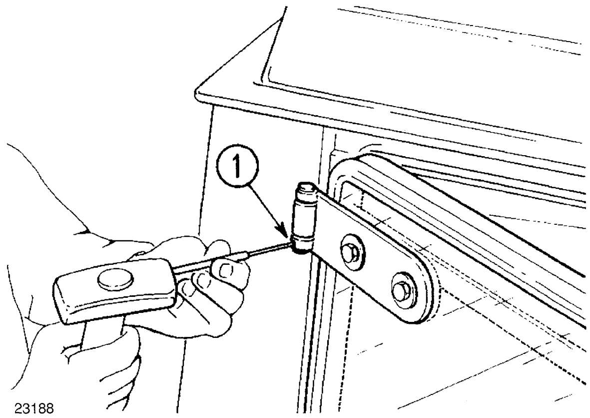
CAB DOOR, RIGHT OR LEFT
Removal–Installation (Operation 90 154 10)

Proceed as further indicated.



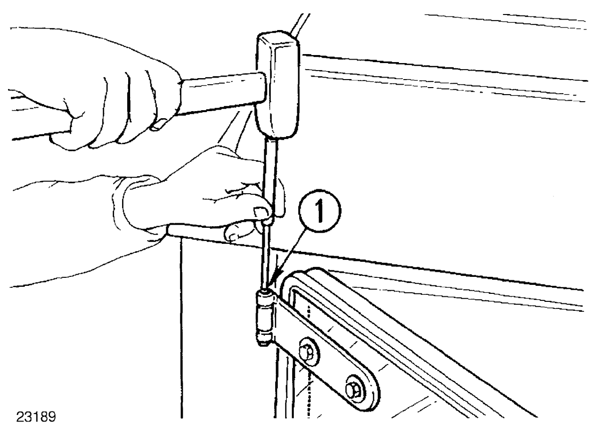
23187

1. From inside the cab, disconnect the door opening damper (1) after removing the ball joint retaining spring blade (2).



23188

2. From the outside of cab, remove spring pin (1) from the door hinges using a driver tool of the proper size.



23189

3. Still using a driver tool of the proper size, remove hinge pin (1) and separate the complete door from the tractor.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

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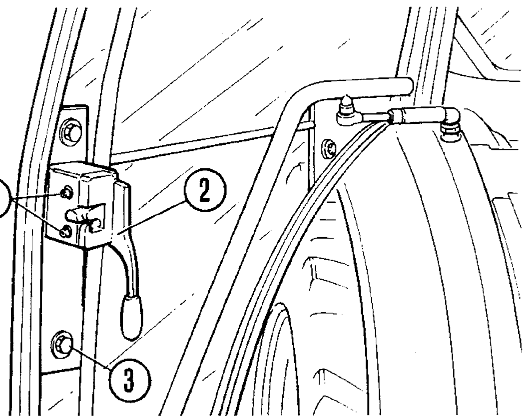
4. Install the windshield glass in accordance with the following instructions and information:
   a. reverse the previous removal sequence of operations, starting from no. 3 back to no. 1;
   b. consult the preceding illustrations for the correct placement of parts.

Print No. ***603.54.283.00*** *– 09 – 1994*

HANDLE WITH LOCK, RIGHT OR LEFT DOOR
Replacement (Operation 90 154 30)

Proceed as further indicated.



23190

1. From inside the cab, undo holding screws (1) and remove the lock assembly (2).

2. Remove inside screw and screw (3) and then the outside handle together with the lock block.

3. Assemble and fit components in accordance with the following instructions and information:

   a. reverse the previous removal and disassembly sequence of operations starting from no.3 back to no. 1;

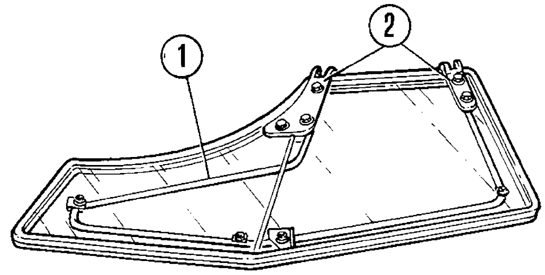
   b. consult preceding illustrations for the correct placement of components.

CAB DOOR GLASS
Replacement on door removed from cab
(Operation 90 154 24)

Note – The door glass is made of two parts, joined by a silicone strip, and that can therefore be replaced singly.

Replace components as further indicated.

1. Remove the door opening handle with lock, considering the information given in operation 90 154 30.



23191

2. From outside of cab, undo holding screws and then remove frame (1), hinges (2) and retaining washers.

3. Replace the door glass.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

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4. Assemble and fit components in accordance with the following instructions and information.

   a. reverse the previous removal and disassembly esequence of operations starting from no. 3 back to no. 1;

   b. consult preceding illustrations for the correct placement of parts.

Important – When replacing door glass it is advisable to replace the rubber seal also. In addition, we suggest that the seal be wetted with "PARAFLU 11" fluid, or, better still, in a soaped water solution prior to installation. Absolutely avoid using oil or grease which would shorten its life.

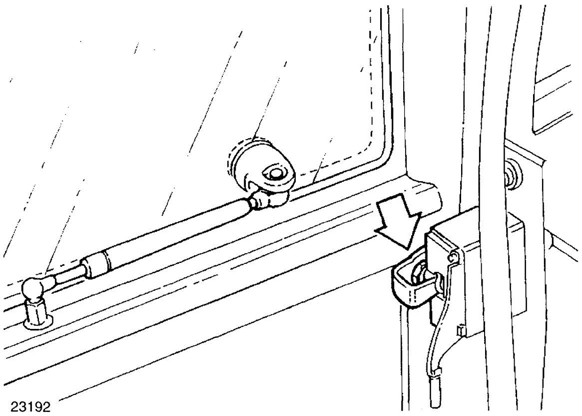
CAB DOOR SEALING STRIP, RIGHT OR LEFT
Replacement on door removed from cab
(Operation 90 154 20)

Note – The seal is relatively easy to replace and no particular difficulty should be experienced as fitting requires only a slight pressure on the glass.

Print No. 603.54.283.00 – 09 – 1994

CAB DOOR ALIGNMENT AND CLOSURE
Adjustment (Operation 90 154 05)

Adjust door as further indicated.



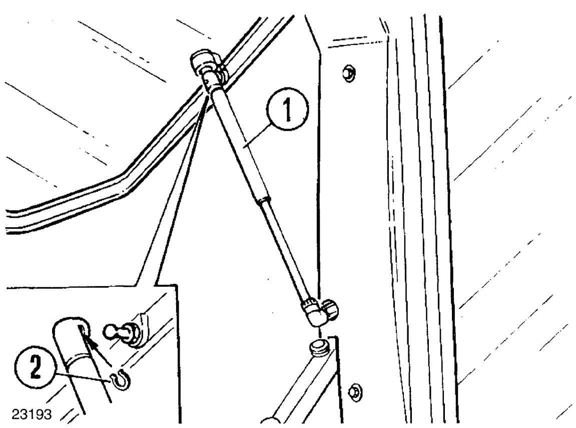
23192

1. Loosen holding nut, position the stop so that lock functions correctly and the door is contacting frame evenly all along its perimeter.

2. Tighten lock nut.

CAB REAR WINDOW GLASS
Replacement (Operation 90 156 52)

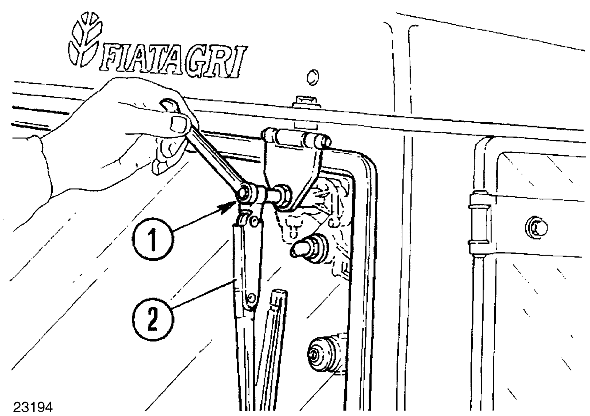
Replace glass as futher indicated.



23193

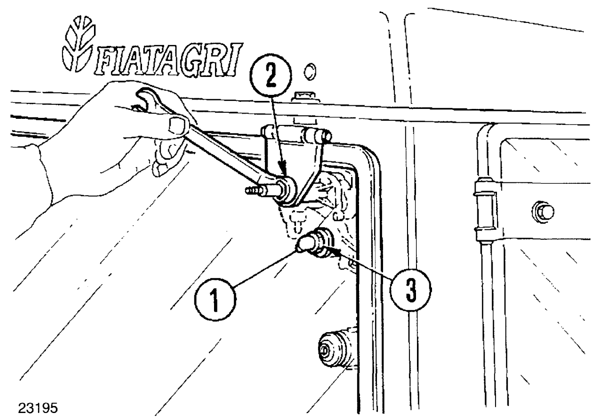
1. From inside of cab, remove the ball joint retaining springs (2) and disconnect closing dampers (1).

2. Disconnect the wash fluid delivery tube from sprayer and the electrical connections from rear window glass wiper motor.



23194

3. From the outside, remove nut (1) and retrieve wiper blade (2).



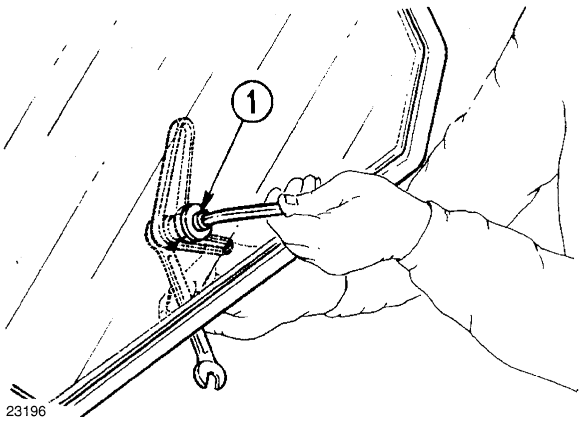
23195

4. Remove sprayer (1), force–fitted, remove nuts (2 and 3) and retrieve from inside of cab the wiper motor together with the associated retaining washers.

5. Remove the hexagon–recessed head screw form the opposite hinge and then the rear window glass and associated retaining washers.

6. On workbench, remove retaining screws and recover the damper mounts on the rear window glass, together with associated retaining washers.

Print No. ***603.54.283.00*** *– 09 – 1994*



7. Remove the hexagon–recessed head screw (1), withdraw the door opening handle and recover retaining washer.

CAUTION

Handle all parts carefully. Do not put hands and fingers between parts. Wear accident prevention clothing and accessories such as goggles, gloves and safety shoes.

8. Assemble and fit components in accordance with the following instructions and information:

   a. reverse the previous removal and disassembly sequence of operations starting from no. 7 back to no. 1;

   b. consult preceding illustrations for the correct placement of parts;

   c. check that the rear window glass wiper blade is centered with respect to end stops and adjust it, in case, by suitably modifying the position of the blade on the wiper motor splined shaft.

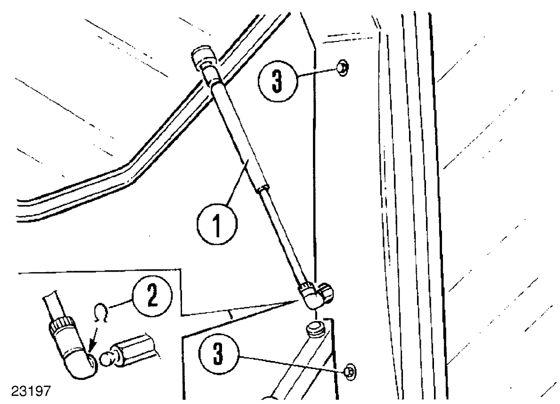
Important – When replacing the rear window glass it is advisable to replace the rubber seal also. In addition, we suggest that the seal be wetted in "PARAFLU 11" fluid or, better still, in a soaped water solution prior to installation. Absolutely avoid using oil or grease which would shorten its life.

CAB REAR WINDOW GLASS SEAL STRIP
Replacement (Operation 90 156 50)

Note – The seal is relatively easy to replace and no particular difficulty should be experienced as fitting requires only a slight pressure on the glass.

LEFT DOOR FRAME LINING STRIP
Replacement (Operation 90 160 16)

Replace lining as further indicated.



1. From the cab inside, remove the ball joint retaining spring (2) and disconnect the rear window opening damper (1).

2. Undo holding screws (3) and remove the strip.

3. Fit strip in accordance with the following instructions and information:

   a. reverse the previous removal sequence of operations;

   b. consult preceding illustrations for the correct placement of parts.

Print No. 603.54.283.00 – 09 – 1994

Print No. **603.54.283.00** – 09 – 1994