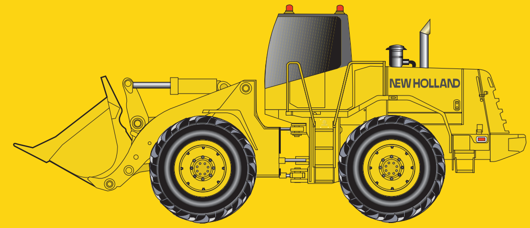
NEW HOLLAND CONSTRUCTION LW110 LW130



SERVICE MANUAL

75131007

March 1999

NEW HOLLAND

AVOID ACCIDENTS

Most accidents and injuries occurring in industry, on the farm, at home or on the road, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason, MOST ACCIDENTS CAN BE PREVENTED by recognizing the real cause and taking the necessary precautions, before the accident occurs.

Regardless of the care used in design and construction of any type of equipment, there may be conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

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

This rule is: Never attempt to clean, lubricate or adjust a machine while it is in motion.

⚠ WARNING

On machines having hydraulically, mechanically and/or cable controlled equipment (such as showels, loaders, dozers, scrapers etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing.

If it is necessary to have the equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical device used for controlling the equipment.

SUMMARY

SPECIFICATIONS - WHEEL LOADER W110

IDENTIFICATION - 2621.100.001

MARKING: W110

ENGINE

Net power at the flywheel .... 83 KW
Maximum torque speed .... 1500 rpm
Maximum power speed .... 2300 rpm
Make and model .... Fiat 8065.25.290
Diesel type, 4 stroke, direct injection, turbocharged
Number of cylinders 6
Bore x stroke .... 104 x 115 mm
Total displacement .... 5861 cm^3
Injector setting .... 260 + 12 bar
Valve/rocker operation lash:
- intake 0.30
- exhaust 0.30

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

ENGINE SPEEDS

Minimum idle speed (no load) .... 790 ÷ 870 rpm
Maximum idle speed (no load) .... 2430 ÷ 2530 rpm
Converter stall speed .... 2310 ÷ 2410 rpm
Steering stall at idle speed > 600 rpm
Attachment stall .... 2300 ÷ 2400 rpm
Full stal .... 1510 ÷ 1710 rpm
Minimum starting temperature: .... - 15°C
Engine coolant high temperature sender setting .... 101 ± 1°C
Engine oil low pressure switch setting .... 0.5 ± 0.1 bar

TORQUE CONVERTER

Type .... single-stage, single-phase
Main convertor pressure .... 5 bar
Convertor safety valve pressure .... 8.5 bar

TRANSMISSION

Maximum ground speeds (forward/reverse) in kph (with 17.5 R25 tyres):

Forward speed	Kph	Reverse speed	Kph
1st	7.67	1st	8.30
2nd	13.22	2nd	14.26
3rd	21.87	3rd	23.48
4th	35.70	4th	38.00

Oil pump flow rate (at 2100 rpm) .... lt/min
Main pressure on the control valve....... 20 ÷ 24 bar
Transmission disengagement sensor..... 15 ± 1 bar
Transmission induction sensors to gear teeth adjust clearance .... 0.5 ÷ 0.8 mm
Transmission oil high temperature sensor setting .. .. 122 ± 3°C

AXLES

Axles complete with disc brakes in oil bath.
Self-locking differentials.
Planetary final drives.
Stiff front axle, support structure type
- reduction ratio .... 1 : 23.258

Oscillating rear axle, support structure type
- reduction ratio .... 1 : 23.258

TYRES

Type .... tubeless
Radial type .... MICHELIN 17.5 R25 XTLA
Inflating pressure
- Work: front = 3, rear = 1.5 bar
- Transfer: front = 2, rear = 2 bar

Wheel tightening torque .... 86 daNm

BRAKES

Delivery, brakes pump at nominal speed .... 26 lt/min
Accumulator recharge start pressure .... 80 bar
Accumulator recharge end pressure ... 95 ÷105 bar
Accumulator pre-charge pressure (0.75 lt) ... 47 bar
Transmission disengagement pressure switch setting .... 15 ± 1 bar
Brake oil low presssure sensor setting ... 60 ± 5 bar
Brake lights pressure switch setting ... 1.8 ± 0.5 bar
Parking brake applied pressure switch setting .... ON 8 bar - OFF 12 bar

STEERING SYSTEM

Cylinders .... 2 double-acting
- bore x stroke .... 60 x 395 mm

Stand-by/main priority valve setting.............. 12 bar

ATTACHMENT HYDRAULIC SYSTEM

Sealed type with anti-cavitation and safety valves.
- Flow at rated speed .... 165 lt/min

2 or 3 spool control valve
Mechanical or piloted control
Hydraulic double-acting cylinders:
- Boom control 2
- Bore x stroke .... 110 x 681 mm

- Bucket control cylinder
- Bore x stroke .... 130 x 431 mm
- Pressure relief valve setting .... 210 ± 5 bar
- Lift safety valve setting ....230 ± 5 bar
- Bucket roll-back safety valve setting ....230 ± 5 bar
- Bucket roll-out safety valve setting ....120 ± 5 bar

OPTIONS

Electronic anti-pitch LTS (Load Travel Stabiliser) system.

Three-position control switch as follows:

Position 0: disengaged

Position 1: LTS engaged with speeds exceeding 5 kph

Position 2: (to be used only for maintenance or repair) LTS engaged at all times, even with speed lower than 5 kph.

- Accumulator safety valve setting .... 120 bar

ELECTRICAL SYSTEM

Operating voltage .... 24 V
Batteries in series 2
- maintenance -free type
BOSCH starter motor
Rated power .... 4 KW
BOSCH alternator with voltage regulator .... 55 A

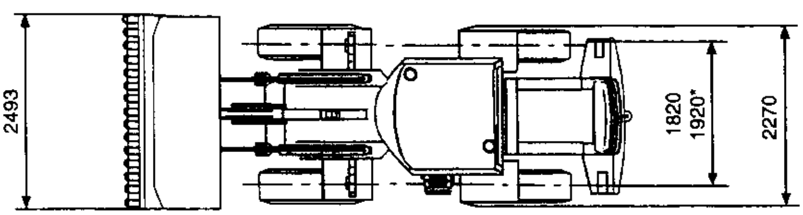
WEIGHT

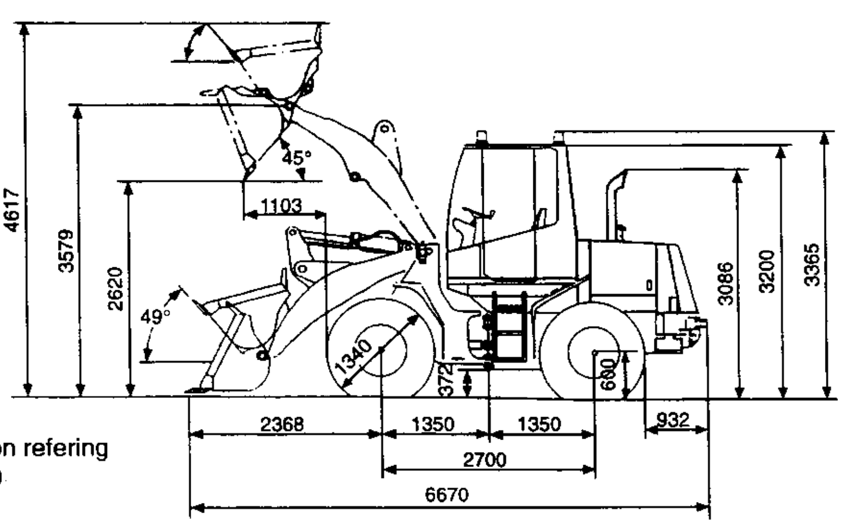
Loader weight with 17.5 R25 tyres, 1.6 m³ bucket, fully filled with fluids and operator 9200 kg.

MAIN DIMENSIONS

Dimensions taken with machine with the loader fitted with 17.5 R25 tyres and 1.6 load capacity bucket.

Unit of measure: mm





* Dimension refering to 555/70

SPECIFICATIONS - WHEEL LOADER W130

IDENTIFICATION - 2621.200.001

MARKING: W130

ENGINE

Net power at the flywheel .... 94.7 KW
Maximum torque speed .... 1400 rpm
Maximum power speed .... 2200 rpm
Make and model .... Fiat 8065.25.291
Diesel type, 4 stroke, direct injection, turbocharged
Number of cylinders 6
Bore x stroke .... 104 x 115 mm
Total displacement ....5861 cm³
Injector setting .... 260 + 12 bar
Valve/rocker operation lash:
- intake 0.30
- exhaust 0.30
Firing order ....

ENGINE SPEEDS

Minimum idle speed (no load) .... 785 ÷ 865 rpm
Maximum idle speed (no load) .... 2350 ÷ 2450 rpm
Converter stall speed .... 2100 ÷ 2200 rpm
Steering stall at idle speed > 600 rpm
Attachment stall .... 2240 ÷ 2340 rpm
Full stal .... 1470 ÷ 1670 rpm
Minimum starting temperature: .... - 15°C
Engine coolant high temperature sender setting ....101 ± 1°C
Engine oil low pressure switch setting .... 0.5 ± 0.1 bar

TORQUE CONVERTER

Type .... single-stage, single-phase
Main convertor pressure .... 5 bar
Convertor safety valve pressure .... 8.5 bar

TRANSMISSION

Maximum ground speeds (forward/reverse) in kph (with 17.5 R25 tyres):

Forward speed	Kph	Reverse speed	Kph
1st	7.72	1st	8.38
2nd	13.58	2nd	14.74
3rd	22.24	3rd	24.14
4th	39.12	4th	42.76

Oil pump flow rate (at 2100 rpm) .... 74 lt/min
Main pressure on the control valve .... 20 ÷ 24 bar
Transmission disengagement sensor ..... 15 ± 1 bar
Transmission induction sensors to gear teeth adjust clearance .... 0.5 ÷ 0.8 mm
Transmission oil high temperature sensor setting .. .. 122 ± 3°C

AXLES

Axles complete with disc brakes in oil bath.
Self-locking differentials.
Planetary final drives.
Stiff front axle, support structure type
- reduction ratio ....1 :
Oscillating rear axle, support structure type
- reduction ratio ....1 :

TYRES

Type .... tubeless
Radial type .... MICHELIN 17.5 R25 XTLA
Inflating pressure
- Work: front = 3.5
  rear = 1.5 bar
- Transfer: front = 2
  rear = 2 bar

Wheel tightening torque .... 86 daNm

BRAKES

Delivery, brakes pump at nominal speed .... 26 lt/min
Accumulator recharge start pressure .... 80 bar
Accumulator recharge end pressure ... 95 ÷105 bar
Accumulator pre-charge pressure (0.75 lt) ... 47 bar
Transmission disengagement pressure switch setting .... 15 ± 1 bar
Brake oil low presssure sensor setting ... 60 ± 5 bar
Brake lights pressure switch setting ... 1.8 ± 0.5 bar
Parking brake applied pressure switch setting .... ON 8 bar - OFF 12 bar

STEERING SYSTEM

Cylinders .... 2 double-acting
- bore x stroke .... 60 x 395 mm
Stand-by/main priority valve setting .... 12 bar

ATTACHMENT HYDRAULIC SYSTEM

Sealed type with anti-cavitation and safety valves.
- Flow at rated speed .... 165 lt/min

2 or 3 spool control valve
Mechanical or piloted control
Hydraulic double-acting cylinders:
- Boom control 2
- Bore x stroke .... 120 x 665 mm

- Bucket control cylinder
- Bore x stroke .... 150 x 431 mm
- Pressure relief valve setting .... 210 ± 5 bar
- Lift safety valve setting ....230 ± 5 bar
- Bucket roll-back safety valve setting .... 230 ± 5 bar
- Bucket roll-out safety valve setting .... 120 ± 5 bar

OPTIONS

Electronic anti-pitch LTS (Load Travel Stabiliser) system.

Three-position control switch as follows:
Position 0: disengaged
Position 1: LTS engaged with speeds exceeding 5 kph
Position 2: (to be used only for maintenance or repair) LTS engaged at all times, even with speed lower than 5 kph.
- Accumulator safety valve setting .... 120 bar

ELECTRICAL SYSTEM

Operating voltage .... 24 V
Batteries in series 2
- maintenance -free type
BOSCH starter motor
Rated power .... 4 KW
BOSCH alternator with voltage regulator .... 55 A

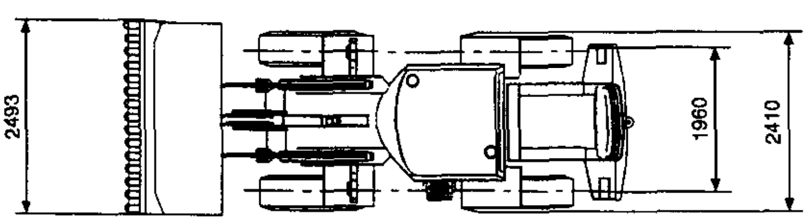
WEIGHT

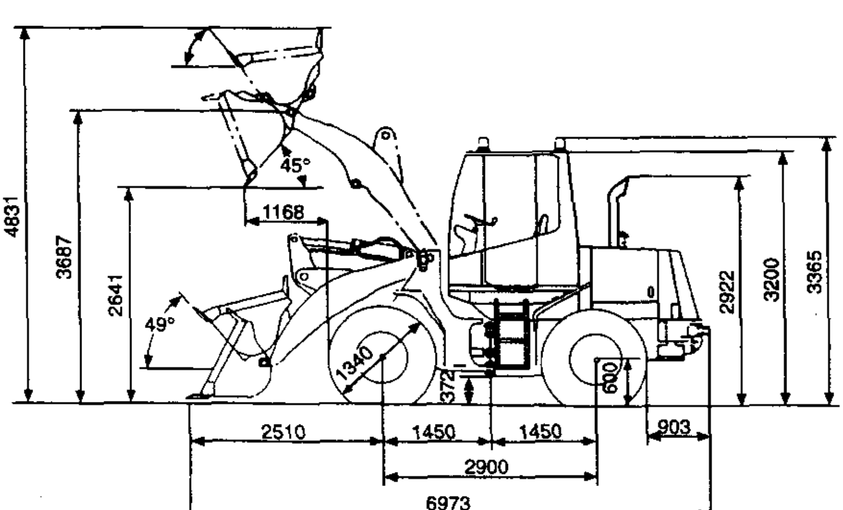
Loader weight with 17.5 R25 tyres, 1.9 m³ bucket, fully filled with fluids and operator kg.

MAIN DIMENSIONS

Dimensions taken with machine with the loader fitted with 17.5 R25 tyres and 1.9 load capacity bucket.

Unit of measure: mm





FLUIDS AND CAPACITY TABLE

Component to be filled	Fluid	Capacity (lts) W110	Capacity (lts) W130	Fluids and lubriants Ambra	International Specification
Engine	Oil	13.2	13.2	AMBRA - Super Gold 500	CCMCD5, QFH 586 EN
Cooling system	Radiator fluid	28	28	AMBRA - Agriflu	NH 900 A
Transmission	Oil	20	20	AMBRA - Super Gold 10W-30	CCMCD4 - NH 324 G
Hydraulic and brake syst.	Hydraulic and brake oils	80	80	AMBRA - Hi Tech 46	ISO VG46, DIN 51524 Part 1 and 2, QFH583/HD
Axles	Front axle oil	18	21	AMBRA TX Fluid	SAE 80W-90, QFH584 TR
	Rear axle oil	26	29		
Lubrication of pivot points	Grease			AMBRA - MG2	QFH585GR

SAFETY RULES

GENERALITIES

Read this Manual carefully before starting, operating, maintaining, fuelling or servicing the machine.

Read and comply with all safety precautions before any intervention.

Do not allow unauthorised personnel to operate or service this machine.

Do not wear rings, wrist watches, jewellery, loose or hanging garments, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can get caught in moving parts. Wear certified safety clothes such as: hard hat, no-slip footwear, heavy gloves, ear protection, safety glasses, reflector vests, respirators. Ask your employer about specific safety equipment requirements.

Keep the operator's compartment, step plates, grab-rails and handles clean and clear of foreign objects, oil, grease, mud or snow to minimize the danger of slipping or stumbling. Remove mud or grease from your shoes before attempting to mount or operate the machine.

Do not jump on or off the machine. Always keep both hands and one foot, or both feet and one hand in contact with steps and grab rails.

Do not use controls or hoses as hand holds when climbing on or off the machine. Hoses and controls are movable parts and do not provide solid support. Besides, controls may be inadvertently moved and cause unexpected movement of the machine or its attachments.

Never operate the machine or its attachments from any position other than sitting in the driver's seat.

Keep head, body, limbs, hands and feet inside the operator's compartment at all times to reduce exposure to external hazards .

Be careful of possible slippery conditions of the steps and hand rails as well as of the ground around the machine.

Do not leave the machine until it is has come to a complete stop.

Check the seat safety belt at least twice per year and replace it if it shows signs of wear, fraying or other weakness that could lead to failure.

STARTING

NEVER START OR OPERATE A FAILED MACHINE. Before operating the machine, always ensure that any unsafe condition has been satisfactorily corrected.

Check brakes, steering and attachment controls before moving off. Report any malfunctioning part or system to the maintenance managers for proper action.

Ensure all protective guards and panels as well as all safety devices provided are in place and in good operating condition.

Ensure that nobody is in the machine operating range before moving off or operating the attachment. WALK COMPLETELY AROUND the machine before mounting. Sound the horn.

Before starting machine, check, adjust and lock the driver's seat for maximum comfort and control of the machine.

Fasten your seat belts(when fitted).

Obey all flag signals and signs.

Due to the presence of flammable fluids on the machine, never check or fill fuel tanks or accumulator batteries near fires, open flames, or sparks.

REMEMBER THAT SPECIAL STARTING FLUIDS ARE FLAMMABLE. Scrupolously follow recommendations printed on the containers and in this Manual.

DO NOT PUNCTURE OR BURN CONTAINERS.

Containers must be stored in fresh, well ventilated places and out of the reach of unauthorised persons. Strictly follow the instructions provided by the Manufacturer.

Never use these products near fires, open flames, or sparks.

OPERATING

Check wheel and rim retainers before each working shift. If necessary, tighten to the torque specified.

Do not run the engine of this machine in closed buildings without proper ventilation capable to remove harmful exhaust gases.

Roll Over Protective Structures (ROPS) are required on wheel or crawler loaders, dozers, or graders. NEVER OPERATE the machine if such protective structure is removed.

Keep the operator's compartment free of foreign objects, especially if not firmly secured. Never use the machine to transport objects, unless proper securing points are provided.

DO NOT CARRY RIDERS ON THE MACHINE

Study and familiarize with escape routes alternate to normal exit routes.

According to law provisions, seat belts must be fitted with Roll Over Protection Structures or cabs. Keep safety belts fastened during operation.

For your personal safety, do not climb on or off the machine while it is in motion.

Make sure that bystanders are clear of the machine operating range before starting the engine and operating the attachment. Sound the horn. Obey all indications provided by flags, signs and signals.

DO NOT COAST OR FREEWHEEL down hills. Engage the most suitable gear speed to keep the machine under control.

SAFETY RULES

Do not operate the machine if you are extremely tired or feel ill. Be especially careful towards the end of the working shift.

Do not operate a machine with misadjusted brakes.

Operate the machine at low speed which can ensure complete control at all times.

Travel slowly over very rough terrain, slopes or near drop-offs, in congested areas or on frozen or slippery surfaces.

When backing, always look to where the machine is to be moved. Be alert of the position of bystanders. Should someone enter the work area, STOP THE MACHINE.

Maintain a safe distance from other machines or obstacles to ensure required visibility conditions. Give way to loaded machines.

Maintain a clear vision of the surroundings of the travel or work area at all times. Keep cab windows clean and repaired.

When machines are operating in tandem, the pusher (rear) must be equipped with the appropriate deflectors to protect the front unit driver against the air stream coming from the blower fan.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take-up slack carefully.

Carefuly inspect the towing items for flaws or problems before proceedig.

Avoid kinking or twisting chains or cables. Do not pull through a kinked chain or cable as the high stresses existing in this condition may induce failures. Always wear heavy gloves when handling chains or cables.

Chains and cables should be securely anchored. Anchor points should be strong enough to withstand the expected load. Keep anyone clear of anchor points and cables or chains.

DO NOT PULL UNLESS THE OPERATOR'S COMPARTMENTS OF THE MACHINES INVOLVED ARE PROPERLY PROTECTED AGAINST POSSIBLE BACKLAS IN CASE OF CABLE OR CHAIN FAILURE OR DETACHMENT.

Be alert of soft ground conditions close to newly constructed walls. The fill material and machine weight may cause the wall to collapse.

In darkness, check area of operation carefully before moving in with the machine. Use all lights provided. Do not move into low visibility areas.

If the engine tends to stall for whatever reason under load or at idle, immediately report this problem to the maintenance managers for proper action. Do not operate the machine until this condition has been corrected.

On machines fitted with suction radiator fans, regularly check the engine exhaust system for leaks, as exhaust fumes expelled towards the operator are toxic.

Operators must know thoroughly the performances of the machine they are driving. When working on slopes or near sudden level drops in the terrain, avoid areas where ground is loose or soft since overturn or loss of machine control could result.

If noise level is high and continuosly exceeds 90 dBA over 8 hours at the operator's ear, wear approved ear protection in compliance with local regulations.

Where counterweights are provided, do not operate the machine if they have been removed.

When transporting a loaded bucket, keept it as rolled-back and low as possible for maximum visibility, stability and safety of there machine. Ground speed should be adequate to the load and ground conditions.

The load must always be properly arranged in the bucket; move with extreme care when transporting oversize loads.

Use only the type of bucket recommended for the machine and the materials to be handled. Follow the recommendations concerning loading capacity, arrangement of the materials, characteristics of the ground and job to be performed.

Do not lift and move loads overhead where persons are standing or working, nor downhill when working crosswise on slopes. In this case, the bucket should be unloaded on the uphill side, whenever possible.

Start and stop the machine carefully when the bucket is full. Do not move off without first reducing engine speed.

Overtaking manoeuvres should be performed only when absolutely necessary and unavoidable. Beware possible uneven terrains, poor visibility, presence of other machinery or persons out of sight.

Operate the machine at a speed adequate to the working site conditions and in any case slow enough to ensure complete control at all times.

Check instruments at start-up and frequently during operation. Stop the machine immediately should any malfunction be signalled.

Never use the bucket as a man lift or to carry riders.

Never use the machine as a work platform or scaffolding, nor for other improper use (such as pushing railway cars, trucks or other machines).

Pay attetion to people within the machine operating range. Load trucks from the driver's side whenever possible.

Prior to operating the machine, check which obstacles and/or difficulties you will encounter, such as narrow streets, overhead doors, cables, piping, as well as ground, bridges, paving and ramps bearing load limitations.

In case of road transfers, find out beforehand what conditions are likely to be encountered, such as size restrictions, heavy traffic, paving type, etc.. Beware fog, smoke or dust that obscure visibility.

When crossing gullies or ditches, move at an angle with reduced speed after ensuring ground conditions will permit a safe traverse.

Always inspect the working area to identify potential risks such as: inclines, overhangs, trees, demolition rubble, fires, ravines, steep slopes, rough terrain, ditches, crowns, ridge trenches, heavy traffic, crowded parking and service areas, closed ambients. In such conditions, proceed with extreme care.

Whenever possible, avoid going over obstacles such as very rough terrain, rocks, logs, steps, ditches, railroad tracks. When obstructions must be crossed, do so with extreme care and at an angle, if possible. Slow down and select a lower gear. Ease up to the break-over point, pass the balance point slowly and ease down the other side.

In steep down-hill operation, do not allow the engine to over-speed. Select the proper gear before starting down grade.

Avoid crosswise hill travel, whenever possible. Drive up and down the slope. Should the machine start slipping sideways when going uphill, steer and turn machine front immediately downhill.

The gradient you may attempt to overcome is limited by factors such as ground conditions, load being handled, machine type and speed, and visibility.

There is no substitute for good judgement and experience when working on slopes.

Avoid operating the attachment too close to an overhang or high wall, either above or below the machine. Beware of caving edges, falling objects and landslips. Remember that such hazards are likely to be concealed by bushes, undergrowth and such.

When pushing-over trees, the machine must be equipped with proper overhead guards. Never drive a machine up the roots, particularly while the tree is being felled. Use extreme care when pushing over any tree with dead branches.

Avoid faggots, bushes, logs and rocks.

NEVER DRIVE OVER THEM, nor over any other surface irregularities that discontinue adherence or traction with the ground, especially near slopes or drop-offs.

Be alert to avoid changes in traction conditions that could cause loss of control. AVOID driving on ice or frozen ground when working on steep slopes or near drop-offs.

Working in virgin rough terrains is characterized by the presence of all the perils and risks listed above. In these conditions, it is emphasised the danger represented by large tree limbs (possibly falling on the machine), large roots (which may act as a leverage under the machine when up-rooted and cause the unit to overturn), etc.

STOPPING

When the machine is to be stopped for whatever reason, do so following the instructions given in chapters **"Stopping the machine"** and **"Shutting off the engine"** in the Operation and Maintenance Instruction Manual.

Always remember to move the gearshift lever to the neutral position and engage the control lever lock for safety purposes.

Apply the parking brake (if fitted).

NEVER LEAVE THE MACHINE UNATTENDED with the engine running.

Prior to leaving the operator's seat,and after making sure that all people are clear of the machine, always slowly lower the attachment until resting it safely to the ground

Park the machine in a non-operating and no-traffic area. Park on firm level ground. If this is not possible, position the machine at a right angle to the slope, making sure there is no danger of uncontrolled sliding. Apply the parking brake.

If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and signals as required to adequately warn the oncoming drivers.

Keep head, body, limbs, hands and feet clear of the dozer, arms, bucket or ripper when raised.

Always switch off the battery isolator switch before servicing the machine in whatever manner (i.e., cleaning, repairing, maintaining, etc.). Do the same when the machine is to remain parked for prolonged periods of time to avoid accidental or unauthorized starting.

Never lower the attachments other than sitting in the operator's seat. Sound the horn. Make sure that nobody is within the machine operating range. Lower the attachment slowly. DO NOT USE FLOAT POSITION in case of hydraulic controls.

Securely block the machine and lock it every time you leave it unattended. Return keys to authorized security. Perform all necessary operations as detailed in the Operation and Maintenance Instruction Manual. Apply the parking brake (if fitted) every time you leave the machine.

MAINTENANCE

GENERALITIES

Before operating or performing any intervention on the machine:

- carefully read all the norms contained in this Manual;
- read and observe all safety plates and instructions located on the machine.

Do not allow unauthorized personnel to service the machine. Do not carry out any maintenance work without prior authorization. Follow all recommended maintenance and service procedures.

Keep the operator's compartment free of loose objects that are not properly secured.

Do not wear rings, wrist watches, jewellery, loose or hanging garments, such as ties, torn clothing, scarves, unbut-

SAFETY RULES

toned or unzipped jackets that can get caught in moving parts. Wear certified safety clothes such as: hard hat, no-slip footwear, heavy gloves, ear protection, safety glasses, reflector vests, respirators. Ask your employer about specific safety equipment requirements.

Never service the machine with someone sitting in the driver's seat, unless this person is an authorized operator assisting in the maintenance being carried out.

Keep the operator's compartment, step plates, grab rails and handles clear of foreign objects, oil, grease, mud or snow to minimize the danger of slipping or stumbling.

Clean mud or grease from your shoes before climbing on the machine or driving it.

Never attempt to operate the machine or its attachments from any position other than sitting in the operator's seat.

Never stand under the boom.

Should it be necessary to move the attachment through the hydraulic controls for maintenance purposes, remember that this should be done while sitting in the operator's seat. Before starting the machine or moving its attachment, apply the brakes, sound the horn and call that you are about to manoeuvre. Raise the attachment slowly.

Always lock machine arms or any other parts that must be lifted for maintenance purposes using adequate external means. Do not allow anyone to pass near or even below a raised yet unlocked attachment. If you are not absolutely sure about your safety, do not stay under a raised attachment, even if it is locked.

Do not place body, limbs, or fingers near articulated cutting edges of uncontrolled machine parts or deprived of the necessary guards, unless they are suitably and safely locked.

Never perform any work on the machine with the engine running, except when this is specifically required. Do not wear loose clothing, jewellery or such near moving parts.

When service or maintenance require access to areas that cannot be reached from the ground, use a ladder or step platform conforming to regulations in force. If such means are not available, use machine grab rails and steps. Always perform all service or maintenance work with the greatest care and attention.

Shop and/or field service platforms or ladders should be manufactured in accordance with safety regulations in force.

Disconnect batteries and label all controls to warn that service work is in progress. Block the machine and all attachments to be raised.

Do not check or fill fuel tanks, batteries and accumulators, nor use the starting liquid if you are smoking or near open flames. These fluids are flammable!

BRAKES ARE INOPERATIVE when manually released for servicing. Provisions must be made to maintain control of the machine using suitable blocks or other means.

The fuel filler pipe nozzle must be constantly kept in contact with the filler neck. Keep this contact from the beginning to the end of the fuelling operation to avoid possible generation of sparks due to static electricity.

Tow the machine only from the attaching points provided. Use care in making connections and ensure pins and/or bolt are firmly secured before pulling. Stay clear of drawbars, cables or chains under load.

To move a failed machine, use a trailer or a low platform truck, if available. In case towing is needed, use all necessary signals required by local regulations, and follow directions provided in this Manual.

Load/unload the machine from transporter on firm level ground providing safe support to the wheels of the truck or trailer. Use strong access ramps, with adequate height and angle. Keep the loading platform free of mud, oil or slippery materials.

Tie the machine securely to the platform of the truck or trailer and opportunely wedge machine wheels or tracks as required.

Never align holes or slots using your fingers; always use appropriate aligning tools.

Remove all sharp edges and burrs from re-worked parts.

Use only approved and effectively grounded auxiliary power sources for heaters, battery chargers, pumps and similar equipment to reduce electrical shock hazard.

Lift and handle heavy components using hoisting devices of appropriate capacity. Ensure the sling has been correctly applied. Use lifting eyes if provided. Pay attention to bystanders.

Never pour gasoline or diesel fuel into open, wide and low containers. Never use gasoline, solvents or other flammable fluids to clean parts. Use proprietary certified non-flammable, non-toxic solvents only.

When using compressed air to clean parts, wear safety glasses with side shields. Limit pressure to max 2 bars, in accordance with local safety regulations in force.

Do not run the engine in closed buildings without proper ventilation capable to remove lethal fumes.

Do not smoke, use open flames or produce sparks nearby while refuelling the unit or handling highly flammable materials.

Do not use any flame as a light source during maintenance work or to look for leaks anywhere on the machine.

Make sure that all tools provided are in good condition at all times. NEVER USE tools with mushroomed or damaged heads. Always wear eye protections.

Move with extreme care when working under the machine, its attachments, and even on or near them. Always wear protective safety equipment as required, such as hard hat, goggles, safety shoes, and ear plugs.

SAFETY RULES

In case tests during which the engine should be kept runinng, a qualified operator must sit in the driver's seat with the mechanic in sight at all times. Place the transmission in neutral, apply and lock the brakes. KEEP HANDS OFF MOVING PARTS.

In case of field service, move machine to level ground, if possible, and block it. If work on an incline cannot be advised, block the machine and its attachments securely. Move damaged to level ground as soon as possible.

Do not trust worn and/or kinked chains and cables. Never use them for lifting or pulling. Always wear heavy gloves to handle chains or cables.

Be sure chains and cables are firmly fastened and that anchor points are strong enough to withstand the expected load. Nobody should stay near the anchor points, cables or chains. DO NOT PULL OR TOW UNLESS THE OPERATOR'S COMPARTMENTS OF THE MACHINES INVOLVED ARE FITTED WITH THE PROPER GUARDS AGAINST BACKLASH IN CASE OF CABLE OR CHAIN FAILURE OR DETACHMENT.
Keep the area where maintenance is carried out CLEAN and DRY at all times. Clean immediately all water and oil spillages.

Do not pile up oily or greasy rags as they represent a major fire hazard. Always store them in closed metal containers.

Before starting the machine or its attachment, check, adjust and lock the operator's seat. Also ensure that nobody is within the machine operating range. Sound the horn.

Rust inhibitors are volatile and flammable. Use them only in well ventilated areas. Keep open flames away - DO NOT SMOKE - Store containers in a cool well ventilatedplace where they could not be reached by unauthorised people.

Do not carry loose objects in your pockets that might fall unnoticed into open compartments.

Wear safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal particles or similar may be ejected and hit you.

Wear appropriate protective equipment such as dark safety glasses, hard hat, protective clothing, special gloves and footwear while welding. Nearby persons should also wear dark safety glasses even if they are not welding. DO NOT LOOK THE WELDING ARC WITHOUT PROPER EYE PROTECTION.

Become acquainted with all your jacking equipment and its capacity. Remember that the jacking point on the machine should be appropriate for the load applied. Also, be sure the support area of the jack at the machine and on the ground is appropriate and stable.

Any load supported by a jack represents a possible hazard. Always transfer the load onto appropriate support means according to local or national safety requirements before proceeding with service or maintenance work.

Metal cables get frayed after prolonged use. Always wear appropriate protections (heavy gloves, goggles, etc.) while handling them.

Handle all parts carefully. Keep hands and fingers away from gaps, gears, and similar. Always use and wear the appropriate protections.

Water can build up in pneumatic systems from condensate moisture due to changes in atmospheric conditions. If necessary, drain such deposits following instructions.

Before carrying out any maintenance work or service, lock the machine articulated frame modules using the appropriate safety device. Remember to remove and store it properly at the end of work.

If the machine is equipped with hydraulic brakes, make sure that the reservoir is always filled up to the correct level.

Always block all wheels, front and rear, before bleeding the braking system or disconnecting control hoses and/or cylinders.

STARTING

Do not run the engine in closed buildings without proper ventilation capable to remove lethal exhaust fumes.

Do not place head, body, limbs, feet, hands or fingers near rotating fans or belts.

Be especially careful near blower fans.

REMEMBER THAT THE STARTING FLUID IS HIGHLY FLAMMABLE. Follow recommendations provided in this Manual and printed on the containers. Containers must be stored in a cool, well ventilated place out of the reach of unauthorised persons.
DO NOT PUNCTURE OR BURN CONTAINERS.

ENGINE

Loosen the radiator cap very slowly to relieve system pressure before removing it. Always top-up coolant level with the engine off.

Avoid that flammable materials could touch exhaust parts. If not possible, provide necessary protections.

Do not refuel with the engine running, especially if hot, as this increases fire hazard.

Never attempt to check or adjust fan belt tensions when the engine is running.

Do not adjust the fuel pump when the machine is motion.

SAFETY RULES

Do not lubricate the machine with the engine running.

Do not run the engine with air intakes, door or guards open.

ELECTRICAL SYSTEM

Always disconnect the batteries prior to any intervention on the machine or its electrical system (cleaning, repair, maintenance).

Should booster batteries be used, remember to connect ends of the booster cables in the proper manner: (+) to (+) and (-) to (-). Do not short-circuit terminals. Thoroughly follow instructions given in this Manual.

Before any intervention, make sure that the battery isolator switch is off.

BATTERY GAS IS HIGHLY FLAMMABLE. Leave the battery compartment open during recharging to improve ventilation. Never check battery charge by placing metal objects across the posts. Keep sparks or open flames away from batteries. Do not smoke near the battery to prevent explosion hazard.

Before any intervention, make sure that there are no fuel or electrolyte leakages. If any, correct prior to proceeding with further work. Do not recharge batteries in confined spaces. Ensure proper ventilation is provided to avoid accidental explosions due to build-up of gas released during charging.

HYDRAULIC SYSTEM

Pressure fluid escaping from a very small hole can be almost invisible and still have sufficient force to penetrate the skin. Always check any suspected pressure leaks using a piece of cardboard or wood. DO NOT USE HANDS. If injured by escaping fluid, obtain medical attention immediately or serious infection or reaction may develop.

Stop the engine and relieve all system pressure before removing panels, housings, caps, plugs or covers.

Always use gauges of adequate capacity (end-of-scale reading) and follow recommended procedures.

TOOLS

Always keep head, body, limbs, feet, or hands away from bucket, blade, or ripper when in the raised position. Prior to *any intervention, install all safety devices according to* current regulations. In case the attachment is to be operated through the machine hydraulic system for maintenance purposes, remember to do so only while sitting in the driver's seat. Make sure that nobody is within the machine operating range. Before operating the attachment, alert people by sounding the horn and by voice. Raise the attachment slowly.

Do not use the machine to transport loose objects, unless proper devices to this purpose are provided.

Clutches and brakes of this machine as well as auxiliary devices and attachments (such as drive cylinder or winch control valves) should always be properly adjusted in accordance with the instructions provided by the Manufacturer. Never perform adjustments with the engine running, except when this is specifically required by the relevant *procedures.*

TYRES AND WHEELS

Make sure that the tyre inflation pressure corresponds to specifications issued by the Manufacturer. Regularly check inflation pressure.

Should pressure be changed, do this while staying on the tyre side and at a safe distance.

Pressure checks should always be carried out with the machine unloaded and cold tyres.

Never use reconditioned tyre rims, since possible weldings, incorrect heat-treatments or repairs can weaken *the wheels and cause damages or failures.*

Do not cut, nor weld rims with inflated tyres installed.

The spare tyre should be inflated only enough to keep the rim components assembled. Remember that when not installed on the disc, a tyre inflated to maximum pressure can **explode**.

Therefore, maximum care must be taken when handling a fully inflated tyre.

Before servicing tyres, block all wheels, front and rear. After jacking up the machine, block it in the raised position using suitable stands conforming to current safety regulations.

Deflate the tyre before removing objects from the tyre tread.

Never inflate tyres with flammable gas: explosions and severe bodily injuries may result !!

When starting your work shift, check for loose wheel or rim bolts and brackets and retighten to correct torque as necessary.

SAFETY RULES

WARNING

Ensure that the attachment is safely resting on to the ground before repairing,adjusting, or servicing machines fitted with hydraulically, mechanically or cable controlled attachments (such as excavators, loaders, dozers, scrapers, etc.). Should it be necessary to partially or fully raise the hydraulically, mechanically, or cable controlled attachment to gain access to certain items, make sure the attachment is adequately retained in the raised position by means other than the hydraulic lift cylinders, cable and/or mechanical devices used for controlling it.

UNITS OF MEASURE

Units of measure used in this manual are those adopted by the International System which replace the units previously used by the M.K.S. system.

Force: decanewton (daN) replaces kilogram (kg)

Pressure: bar, replaces kg/cm^2

Torque: decanewton x meter (daNm) replaces kgm

The following tables is to be used to convert units of measure:

	multiply	by	to obtain
Force	kg	0.9807	daN
Pressure	kg/cm^2	0.9807	bar
Torque	kgm	0.9807	daNm

Note - For current service use, the following equivalences can be considered to be valid:
kg = daN; kg/cm^2 = bar; kgm = daNm.

CLASSIFICATION OF STANDARD COMPONENTS TO DETERMINE THE TIGHTENING TORQUES

Note - In case, in the different sections, the tightening torque is not listed, refer to the table "TIGHTENING TORQUES", only after identifying exactly the component.

The latter is identified by a coded eight digit number, allowing a complete description of the item.

Example:

$\boxed{I}$ / $\boxed{a}$ $\boxed{b}$ $\boxed{c}$ $\boxed{d}$ $\boxed{e}$ / $\boxed{f}$ $\boxed{g}$

I - Standard index digit

It is always represented by the digit 1. This number indicates that the item can be fabricated in a number of versions differing for material and coating.

a - b - c - d - e - Standard base digits

It is a number always composed of five digits identifying dimensional specifications of the item.

f - Material index digit

This digit indicates the material used for a defined item. Its meaning is indicated in the table that follows.

g - Coating index digit

It indicates the coating applied to a defined item.

Material index (f)	Resistance class and material					
	FIAT	UNI	DIN	SAE	BSI	BNA
0	R 40	4D - 4S - 4A		1	A	42
1	R50	5S - 6S		3	P	56
2	R80	8G		5	T	80
3	R100	100	10K	8	V	100
4	Brass	Brass	Messing	Brass	Brass	Laiton
5	Alluminio	Alluminio	Aluminium	Aluminium	Aluminium	Aluminium
6	Copper	Copper	Kupfer	Copper	Copper	Cuivre
7	Blank for other metallic materials					

WARNING

- Lubricate all hardware until 24 dia., with engine oil. Use grease for larger diameters.
- Tolerance on torque: ± 5%
- Resistance classes R80, R100, R120 must be understood as follows:

10.9 replaces	R100	for screws
12.9 "	R120	
10 replaces	R80	for nuts
12 "	R100	

CDT= cadmed; FOSF= phosphated; ZNT= galvanised.

TORQUE TABLES

If correct torque is not specifically indicated in the relevant pages, refer to the following tables.

NUTS (ZNT)					SCREWS (ZNT / DEIDR)		
Strength grade: 10 (R 80)					Strength grade: 10.9 (R 100)		
Diameter and pitch mm	normal daNm	low type daNm	with polyamide ring normal daNm	with polyamide ring low type daNm	Diameter and pitch mm	normal ZNT daNm	self-locking ZNT daNm
M6 x 1	1.3	1.2	-	-	M6 x 1	1.3	-
M8 x 1.25	3.2	2.6	3.9	3.2	M8 x 1.25	1.3	3.5
M10 x 1.25	7.2	5.2	8.2	6.2	M10 x 1.25	7.1	7.9
M10 x 1.5	6.5	5	7.7	6	M10 x 1.5	6.5	7
M12 x 1.25	13	8.7	14.5	10.2	M12 x 1.25	12.7	13.9
M12 x 1.75	11	8.1	12.9	9.6	M12 x 1.75	11	12
M14 x 1.5	19.5	13	21.6	15	M14 x 1.5	20	22
M14 x 2	18	12.5	20	14.6	M14 x 2	18	19
M16 x 1.5	30	17	34	20	M16 x 1.5	30	33
M 16 x 2	-	-	-	-	M16 x 2	-	-
M18 x 1.5	45	25	50	29	M18 x 1.5	45	48
M18 x 2.5	-	-	-	-	M18 x 2.5	-	-
M20 x 1.5	60	30.5	64.5	35	M20 x 1.5	60	65
M20 x 2.5	-	-	-	-	M20 x 2.5	-	-
M22 x 1.5	80	41	-	-	M22 x 1.5	80	90
M22 x 2.5	-	-	-	-	M22 x 2.5	-	-
M24 x 2	100	47	108	52.5	M24 x 2	100	110
M24 x 3	-	-	-	-	M24 x 3	-	-
M27 x 2	95	40.1	-	-	M27 x 2	100	-
M30 x 2	130	49.4	-	-	M30 x 2	140	-
M33 x 2	170	-	-	-	M33 x 2	190	-
M36 x 3	220	-	-	-	M36 x 3	240	-

SECTION 1

ENGINE

CONTENTS

1.1 GENERAL DESCRIPTION

The engine on this loader is a turbo charged 4 stroke diesel engine, water cooled, overhead valves, with direct injection with rotary pump. The negine is mounted on the rear end of the loader and its power is driven from the flywheel to the torque converter through a flexible disc diaphragm.

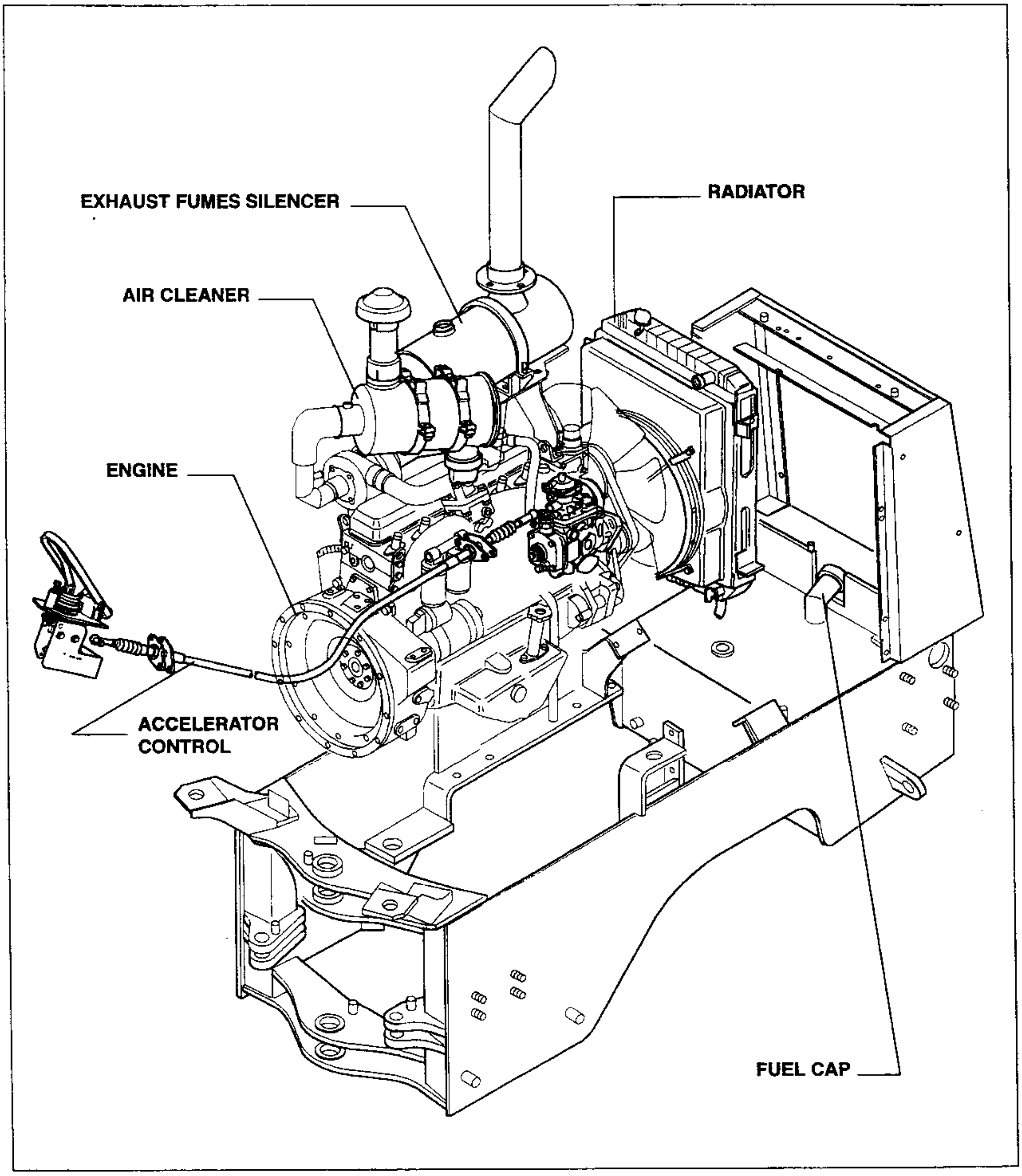


Fig. 1-1 Engine and accessories

1.2 GENERAL SPECIFICATIONS

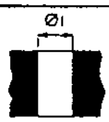
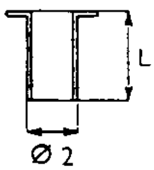
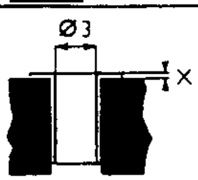
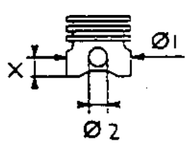
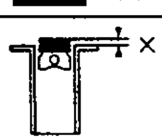
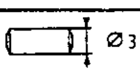
		W 110	W 130
Type		8065.25.290	8065.25.291
Cycle		4 stroke, direct injection, turbo charged Diesel	
Quantity of cylinders		6 in-line	
Diameter	mm	104	
Stroke	mm	115	
+ + +.. = Total displacement	cu cm (cu in)	5861	
ϱ Compression ratio		18 : 1	
Max. power	KW	83	94.7
	rpm	2300	2200
Max. torque	daNm	44.1	56.9
	rpm	1500	1500
Minimum idle speed	rpm	790 ÷ 870	785 ÷ 865
Maximum idle speed	rpm	2430 ÷ 2530	2350 ÷ 2450
Maximum speed with stalling converter	rpm	2310 ÷ 2410	2100 ÷ 2200
Maximum speed with stalling equipment	rpm	2300 ÷ 2400	2240 ÷ 2340
Minimum speed with stalling steering	rpm	> 600	> 600

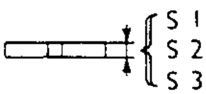
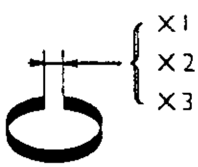
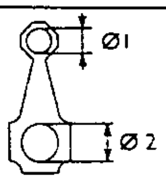
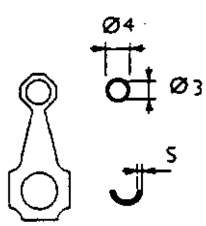
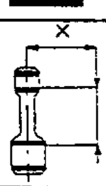
		W 110	W 130
		8065.25.290	8065.25.291
Maximum speed with stalling equipment + steering	rpm	1510 ÷ 1710	1470 ÷ 1670
Pressure at T.D.C. (*)	bar	≥	
Minimum allowed pressure at T.D.C. (*)	bar	≥	
Engine dragging speed	rpm	-	
TIMING			
starting B.T.D.C.	A	12°	
end A.B.D.C.	B	31°	
starting B.T.D.C.	D	50°	
end A.B.D.C.	C	16°	
Operational (*) X	mm	0.30	
	mm	0.30	
FUEL FEEDING		By fuel pump - injection pum - filters - *injectors - starter heater*	
Type:		BOSCH VE 6/12 F 1150 RV	BOSCH VE 6/12 F 1100 RV
Pump timing		7° ± 1	$6^{\circ}\,{}^{+0}_{-1}$
Delivery starting	mm	1	
Injector nozzle type		DLLA 13251320	
Firing order - injection pump - engine		A - B - C - D - E - F 1 - 5 - 3 - 6 - 2 - 4	
Injection pressure	bar	260 + 12	

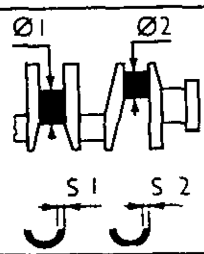
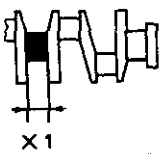
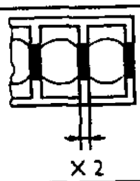
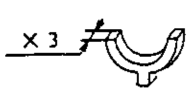
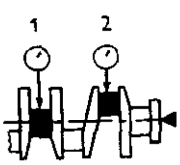
(*) The value of the pressure is measured rotating the engine using the electric starter motor only, with oil temperature of 40 - 50°C (104 - 122°F) and injection pump in stop condition.

	W 110	W 130
	8065.25.290	8065.25.291
TURBO CHARGING		
turbocharger type	GARRET TO 4B	
LUBRICATION	Forced by gear pumps, pressure relief valve, double filtration oil filters	
Oil pressure with hot engine:		
- at min. speed bar	≥ 1.2	
- at max. speed bar	≥ 3.5	
COOLING	Centrifugal pump, thermostat regulation, fan, radiator, heat exchanger.	
Water pump drive	V belts	
Thermostat		
- beginning of opening	79° ± 2° C	
- max. opening		
OIL CAPACITIES		
Total capacity 1st filling: Kg	14.5	
Periodic change capacity:		
- engine sump Kg	12	
- engine sump + filter Kg	13.2	

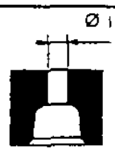
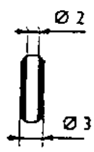
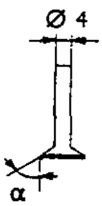
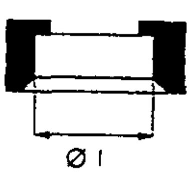
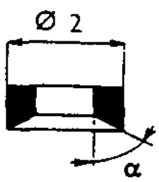
1.3 DATA - MOUNTING CLEARANCES

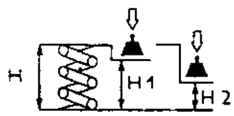
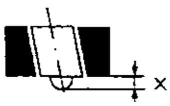
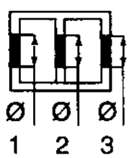
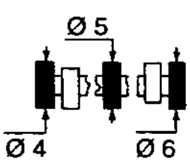
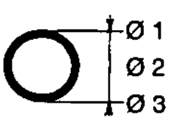
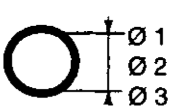
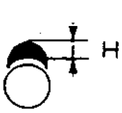
<table>
<tr><th colspan="2" rowspan="3">CYLINDER GROUP AND CRANKING COMPONENTS</th><th>W 110</th><th>W 130</th></tr>
<tr><th>8065.25.290</th><th>8065.25.291</th></tr>
<tr><th colspan="2">mm</th></tr>
<tr><td></td><td>Seat of cylinder liners: Ø 1</td><td colspan="2">106.85 ÷ 106.90</td></tr>
<tr><td></td><td>Cylinder liners:
outside diameter Ø 2
length L</td><td colspan="2">
107.02 ÷ 107.05
198.00 ÷ 198.50</td></tr>
<tr><td></td><td>Cylinder liners - cylinder block bore</td><td colspan="2">0.12 ÷ 0.2</td></tr>
<tr><td>></td><td>Outside diameter Ø 3</td><td colspan="2">+ 0.2</td></tr>
<tr><td></td><td>Cylinder liners:
inside diameter Ø 2
protrusion X</td><td colspan="2">104.000 ÷ 104.024</td></tr>
<tr><td></td><td>Pistons:
dimension of measurement X
outside diameter Ø 1
pin bore Ø 2</td><td colspan="2">12
103.870 ÷ 103.852
38.000 ÷ 38.006</td></tr>
<tr><td></td><td>Piston - cylinder liner</td><td colspan="2">0.130 ÷ 0.172</td></tr>
<tr><td><</td><td>Piston diameter Ø 1</td><td colspan="2">0.6</td></tr>
<tr><td></td><td>Protrusion of pistons X</td><td colspan="2">0.64 ÷ 0.97</td></tr>
<tr><td></td><td>Piston pin Ø 3</td><td colspan="2">37.984 ÷ 37.990</td></tr>
<tr><td></td><td>Piston pin - pin bore</td><td colspan="2">0.010 ÷ 0.022</td></tr>
<tr><td></td><td>Piston ring grooves X 1 *
X 2
X 3</td><td colspan="2">2.73 ÷ 2.70
2.55 ÷ 2.57
4.03 ÷ 4.05</td></tr>
<tr><td colspan="2">* The dimension is measured on the diameter 101 mm</td><td colspan="2"></td></tr>
</table>

CYLINDER GROUP AND CRANKING COMPONENTS			W 110	W 130
			8065.25.290	8065.25.291
			mm	
	Piston rings	S 1* S 2 S 3	2.595 ÷ 2.575 2.478 ÷ 2.490 3.975 ÷ 3.990	
* The dimension is measured on the diameter 101 mm				
	Piston rings - grooves	1 2 3	0.105 ÷ 0.155 0.060 ÷ 0.092 0.040 ÷ 0.075	
>	Piston rings		0.6	
	Piston ring gap in cylinder liners:	X 1 X 2 X 3	0.40 ÷ 0.65 0.30 ÷ 0.55 0.30 ÷ 0.55	
	Bushing seat in conrod small end conrod bearing seat	Ø 1 Ø 2	41.846 ÷ 41.884 67.407 ÷ 67.422	
	Diameter of conrod small end bushing outside inside Conrod half bearings	 Ø 4 Ø 3 S	 41.979 ÷ 42.017 38.004 ÷ 38.014 1.805 ÷ 1.815	
	Conrod small end bushing - bore		0.095 ÷ 0.171	
	Piston pin bushing		0.014 ÷ 0.031	
<	Conrod half bearings		0.254 - 0.508	
	Posizion of measurement Max. discrepancy of parallelism between center lines of conrod	X =	125 0.07	

<table>
<tr><td colspan="3" rowspan="2">CYLINDER GROUP AND CRANKING COMPONENTS</td><td>W 110</td><td>W 130</td></tr>
<tr><td>8065.25.290</td><td>8065.25.291</td></tr>
<tr><td colspan="3"></td><td colspan="2">mm</td></tr>
<tr><td></td><td>Main journals
Crankpin journals
Main journal half bearings
Crankpin journal half bearings</td><td>Ø 1
Ø 2
S 1
S 2</td><td colspan="2">79.791 ÷ 79.810
63.744 ÷ 63.725
2.169 ÷ 2.178
1.805 ÷ 1.815</td></tr>
<tr><td></td><td>Main journals</td><td>Ø 3</td><td colspan="2">84.200 ÷ 84.230</td></tr>
<tr><td></td><td>Half bearings - main journal
Half bearings - crankpin journal</td><td></td><td colspan="2">0.034 ÷ 0.101
0.033 ÷ 0.087</td></tr>
<tr><td>FIAT HITACHI PARTS <</td><td>Half bearings
Half bearings</td><td></td><td colspan="2">0.254 ÷ 0.508</td></tr>
<tr><td></td><td>Main journal for thrust ring</td><td>X 1</td><td colspan="2">32.0 ÷ 32.1</td></tr>
<tr><td></td><td>Center main journal support</td><td>X 2</td><td colspan="2">25.010 ÷ 25.060</td></tr>
<tr><td></td><td>Thrust half washers</td><td>X 3</td><td colspan="2">3.378 ÷ 3.429</td></tr>
<tr><td></td><td>Crankshaft thrust washer clearance</td><td></td><td colspan="2">0.082 ÷ 0.334</td></tr>
<tr><td>FIAT HITACHI PARTS ></td><td>Thrust half washers</td><td></td><td colspan="2">0.127 - 0.254 - 0.508</td></tr>
<tr><td></td><td>Alignment

Out of round
Taper</td><td>= 1
2
1-2
1-2</td><td colspan="2">≥ 0,10
± 0.25
0.008
0.012</td></tr>
</table>

CYLINDER HEAD - TIMING			W 110 8065.25.290	W 130 8065.25.291
			mm	
	Valve guide seat in cylinder head	Ø 1	13.950 ÷ 13.983	
	Valve guides	Ø 2	8.023 ÷ 8.043	
		Ø 3	13.993 ÷ 14.016	
	Valve guides and seats on cylinder head		0.010 ÷ 0.066	
>	Valve guides		+ 0.2	
	Valves:	Ø 4	7.985 ÷ 8.000	
		α	60° 30' ± 7'	
		Ø 4	7.985 ÷ 8.000	
		α	45° 30' ± 7'	
	Valve stem and relevant guide		0.023 ÷ 0.058	
	Valve seat bore on cylinder head:	Ø 1	-	
		Ø 1	39.000 ÷ 39.025	
	Outside diameter of valve seat; angle of valve seats on cylinder head:	Ø 2	-	
		α	60° ± 5'	
		Ø 2	39.136 ÷ 39.161	
		α	45° ± 5'	
	Valve fitted depth	X	0.7 ÷ 1	
	Between valve and cylinder head		0.111 ÷ 0.161	

CYLINDER HEAD - TIMING		W 110	W 130
		8065.25.290	8065.25.291
		mm	
 Valve spring height:			
free length	H	44.6	
under a load of N:			
270 ± 14	H1	34	
528 ± 26	H2	23.8	
 Nozzle protrusion	X	0.7 ÷ 1.7	
 Bore for camshaft bushings into the crankcase:			
	Ø 1	55.280 ÷ 55.305	
	Ø 2	54.780 ÷ 54.805	
	Ø 3	54.280 ÷ 54.305	
	Ø 4	53.780 ÷ 53.805	
 Camshaft journals:			
	Ø 5	51.470 ÷ 51.500	
	Ø 6	50.970 ÷ 51.000	
	Ø 7	50.470 ÷ 50.500	
	Ø 8	49.970 ÷ 50.000	
 Outside diameter, camshaft bushings:			
front	Ø 1	55.375 ÷ 55.430	
front interm.	Ø 2	54.875 ÷ 54.930	
rear interm.	Ø 3	54.375 ÷ 54.430	
rear	Ø 4	53.875 ÷ 53.930	
 Inside diameter, bushings:			
front	Ø 1	51.580 ÷ 51.630	
front interm.	Ø 2	51.080 ÷ 51.130	
rear interm.	Ø 3	50.580 ÷ 50.630	
rear	Ø 4	50.080 ÷ 50.130	
Bushings and seats into crankcase		0.07 ÷ 0.15	
 Bushings and journals:		0.08 ÷ 0.16	
 Cam lift:			
	H	5.97	
	H	6.25	

1.4 INJECTION PUMP SETTING DATA

1.4.1 ENGINE 8065.25.290 (W110)

Injection pump: VE6/12 F 1150 RV
Governor: all speed
Lift pump: membrane

Pressure lines (ENGINE): diam. 6 x diam. 1.75; lengths cylinder no. 1 = 650 mm; no. 2 = 650 mm; no. 3 = 650 mm; no. 4 = 650 mm; no. 5 = 650 mm; no. 6 = 650 mm.
Injector setting (ENGINE): 260 bar.
Engine idle speed: 825 ± 25 rpm.
Static coupling 7° ± 1 B.T.D.C. *with plunger no.1 in* delivery beginning position and engine piston no. 1 in compression stroke.

Tets bench with static and dynamic specifications in accordance with ISO 4008/1 and 4008/2 standards
Lines diam 6 x diam. 2 x 450 mm (ISO 4093.3 standard).
Injectors at ISO standard (calibrated orifice element)
Calibration of injectors 250 + 3 bar.
Testing fluid in accordance with ISO 4113 standard, temperature: 38 ÷ 42°C (100 ÷ 108°F)
Feeding pressure 0.35 bar.
Time for emptying the test tubes:......."
Pressure relief valve set at...........bar.
Backflow orifice diam. 0.55 mm

PUMP TIMING	
Plunger lifting (In correspondence with the delivery valve closing)	0.4 mm (from B.D.C.)
Firing order	A B C D E F 1 - 5 - 3 - 6 - 2 - 4
Rotation direction	Right

BASIC CALIBRATION OF PUMP					
Type of operation	Engine speed (rpm)	Rack travel (mm)	mm³/c/cil.	Max. variation among cylinders (cu cm)	Pressure on LDA (bar)
Calibration	750		75	3.5	0
Calibration	350		34	4	0 min.
Test	1150		66	3.5	0

1.4.2 ENGINE 8065.25.291 (W130)

Injection pump: VE6/12 F 1100 RV
Governor: all speed
Lift pump: membrane

Pressure lines (ENGINE): diam. 6 x diam. 1.75; lengths cylinder no. 1 = 650 mm; no. 2 = 650 mm; no. 3 = 650 mm; no. 4 = 650 mm; no. 5 = 650 mm; no. 6 = 650 mm.
Injector setting (ENGINE): 260 bar.
Engine idle speed: 825 ± 25 rpm.
Static coupling 7° ± 1 B.T.D.C. with plunger no. 1 in delivery beginning position and engine piston no. 1 in compression stroke.

Tets bench with static and dynamic specifications in accordance with ISO 4008/1 and 4008/2 standards
Lines diam 6 x diam. 2 x 450 mm (ISO 4093.3 standard).
Injectors at ISO standard (calibrated orifice element)
Calibration of injectors 250 + 3 bar.
Testing fluid in accordance with ISO 4113 standard, temperature: 38 ÷ 42°C (100 ÷ 108°F)
Feeding pressure 0.35 bar.
Time for emptying the test tubes:.......*
Pressure relief valve set at...........bar.
Backflow orifice diam. 0.55 mm.

PUMP TIMING	
Plunger lifting (in correspondence with the delivery valve closing)	1 mm (from B.D.C.)
Firing order	A B C D E F 1 - 5 - 3 - 6 - 2 - 4
Rotation direction	Right

BASIC CALIBRATION OF PUMP

Type of operation	Engine speed (rpm)	Rack travel (mm)	mm³/c/cil.	Max. variation among cylinders (cu cm)	Pressure on LDA (bar)
Calibration	750		82	3.5	1
Calibration	550		61.5	3.5	–
Calibration	400 min.		15	4	0 min.
Test	1250		65.5	3.5	1

1.5 OUTER VIEWS

DIESEL ENGINES 8065.25.290 - 8065.25.291

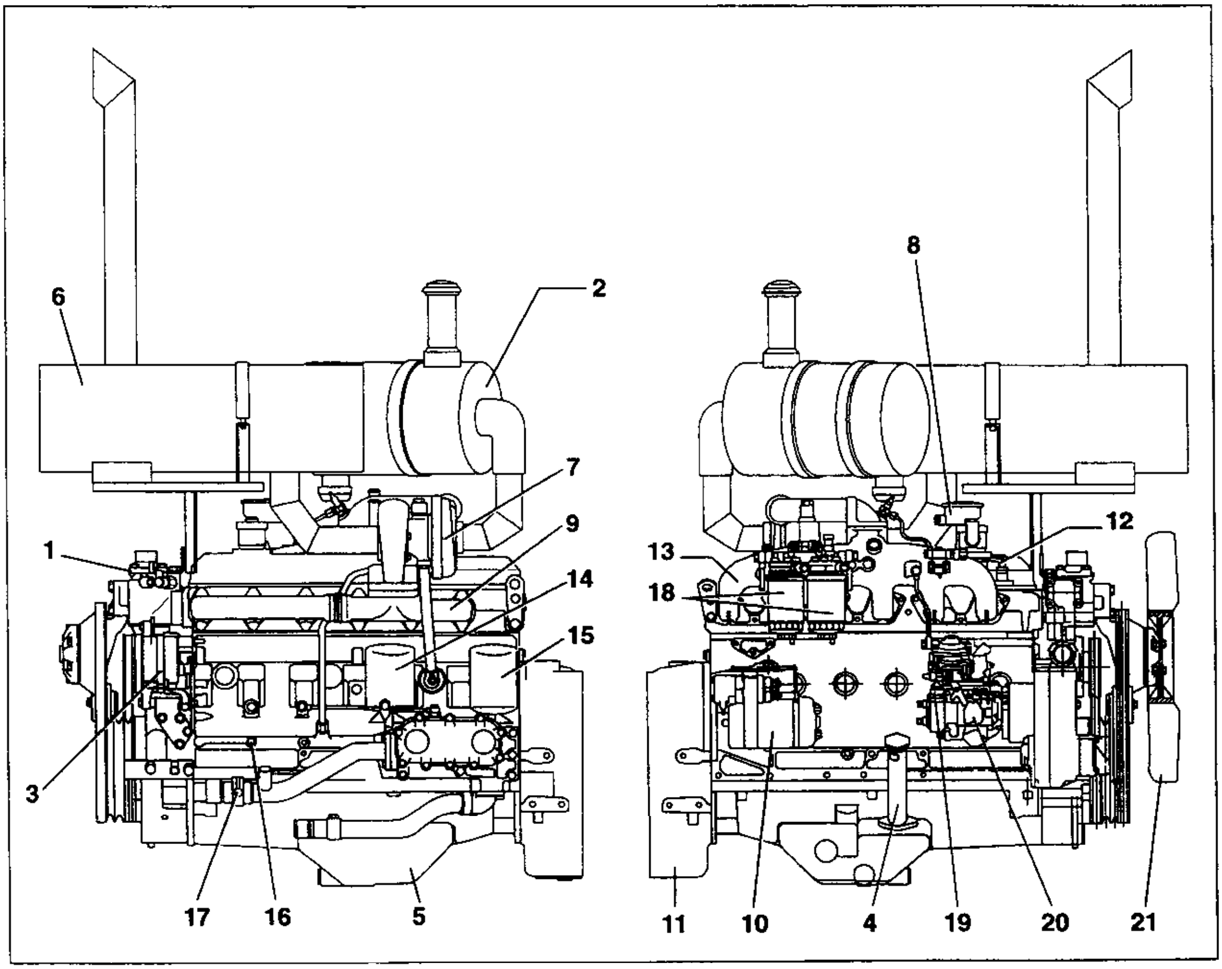


Fig. 1-2

1. THERMOSTAT HOUSING
2. AIR CLEANER
3. ALTERNATOR
4. OIL FILLER PLUG WITH DIPSTICK
5. OIL SUMP
6. EXHAUST SILENCER
7. TURBO CHARGER
8. ENGINE BREATHER
9. EXHAUST MANIFOLD
10. STARTER MOTOR
11. FLYWHEEL HOUSING
12. INJECTOR HOLDER
13. INTAKE MANIFOLD
14. OIL FILTER
15. OIL FILTER
16. PRESSURE SWITCH
17. WATER DRAINING VALVE
18. FUEL FILTERS
19. ENGINE STOP SOLENOID VALVE
20. INJECTION PUMP
21. RADIATOR FAN

1.6 ENGINE SUPPORTS

The engine is mounted on the rear module of the frame in four points:
in front, through the transmission-converter group that, in turn, is supported by bolted brackets on elastic pads and in the rear, through a plate bolted to the engine and attached on elastic pads, as well.

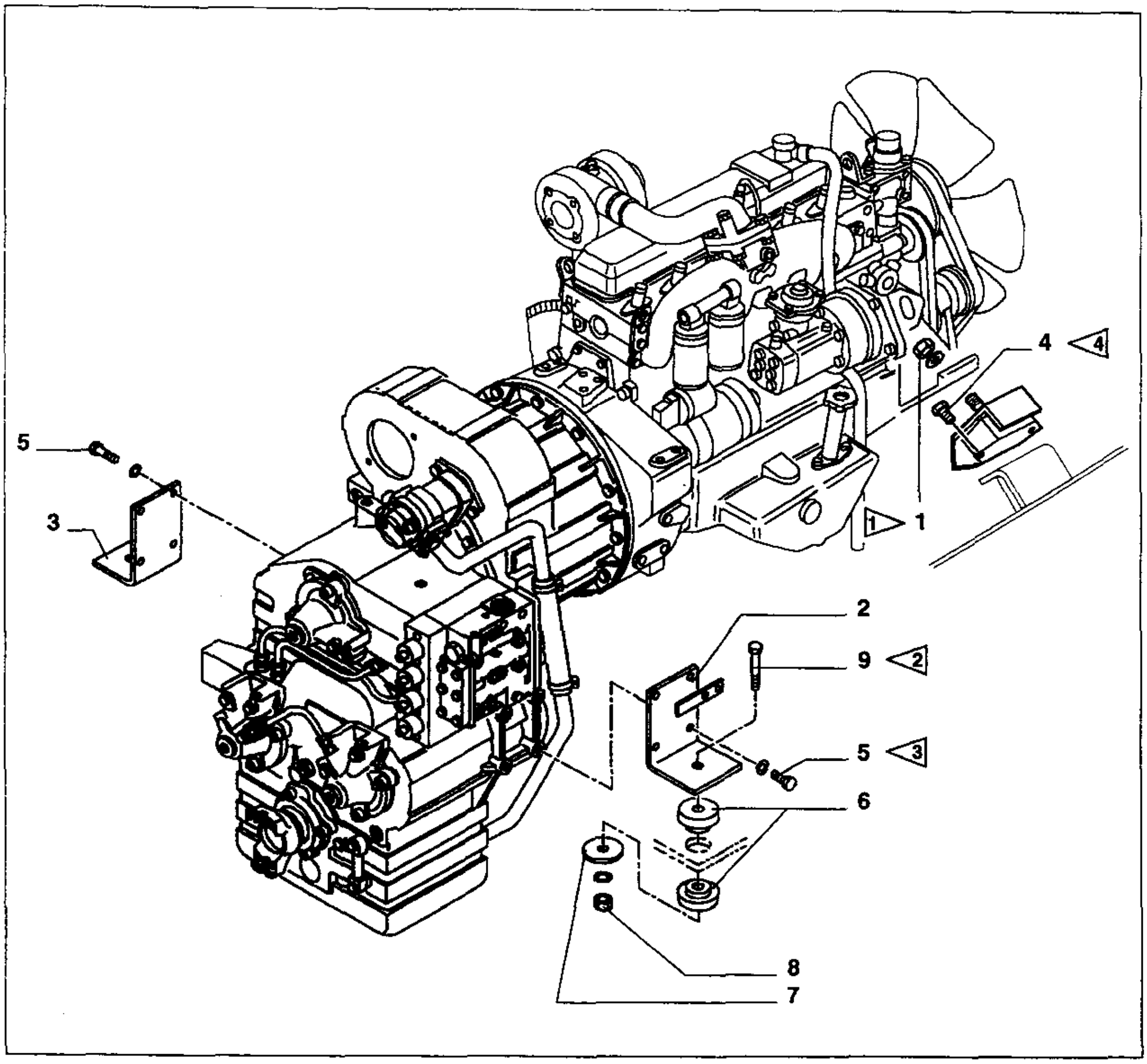


Fig. 1-3 Engine supports

1. NUT M12 ENGINE REAR MOUNTING
2. LEFT FRONT SUPPORT BRACKET
3. RIGHT FRONT SUPPORT BRACKET
4. SCREW M10 SECURING REAR PAD
5. SCREW M16 SECURING FRONT BRACKET
6. PAD
7. PLATE
8. NUT M20
9. SCREW M20 ENGINE FRONT MOUNTING

1 — 4 daNm

2 — 16.7 daNm

3 — 20 daNm

4 — 4 daNm

1.7 MAIN TIGHTENING TORQUES AND PRESSURE PICK-UP POINTS

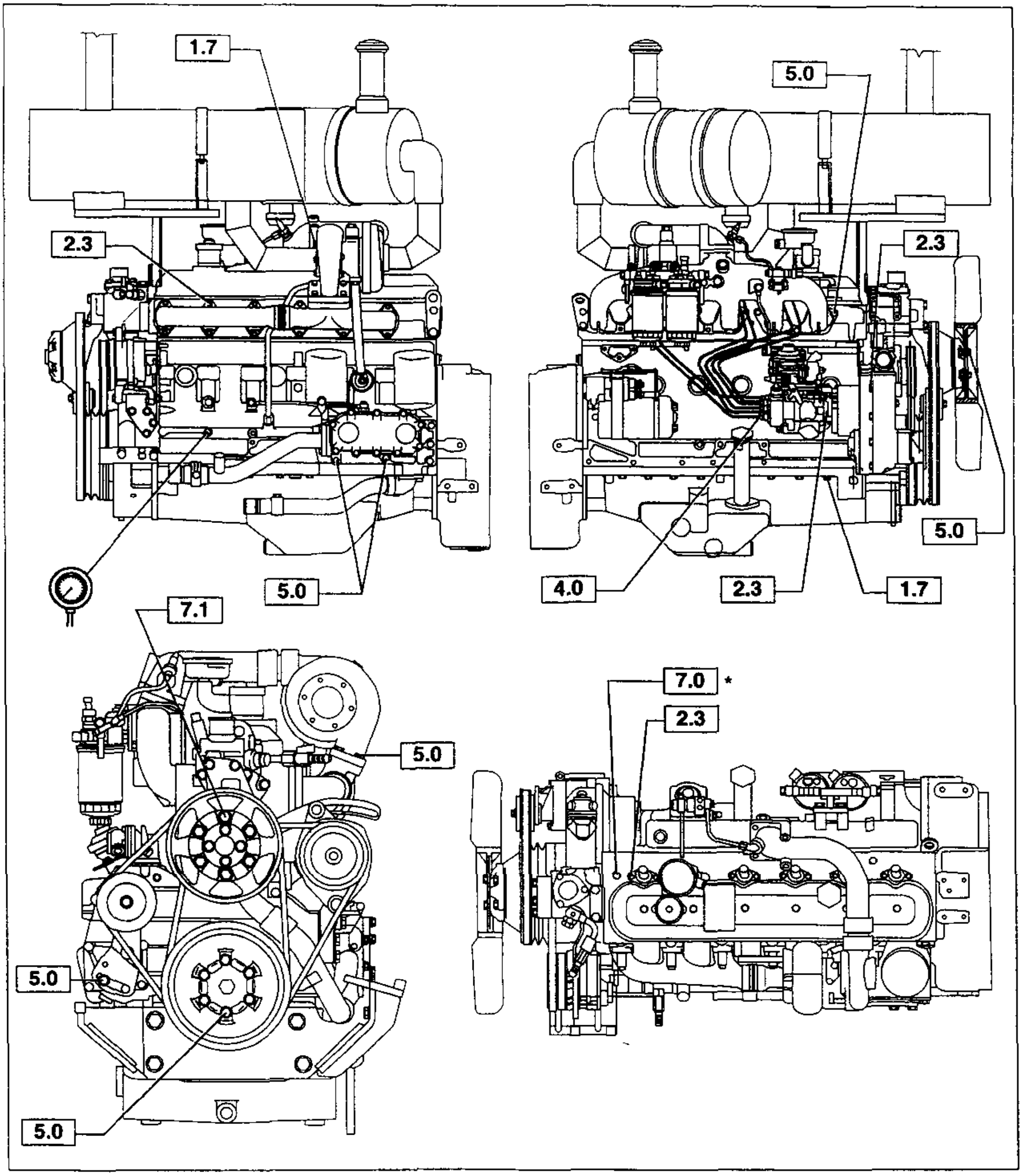


Fig. 1-4

daNm	Value of tightening torque
	* Additional tightening of 180°

 Pressure pick-up point

1.8 LUBRICATION SYSTEM

Lubrication: .... Forced
Lubrication pump: .... Gear type, driven by crankshaft
Filtering: .... Total flow and by-pass combined system
Cooling: .... Built-in water-oil heat exchanger
Oil pressure regulation: .... Plunger with spring
Quantity of lubricant oil (1st filling): .... 14.5 kg (31 lb)

The engine parts are lubricated by a forced circulation using an hydraulic pump. The pump sucks the engine oil from the sump and sends it, under pressure, through an oil filter and the heat exchanger, to a manifold in the cylinder block, to be distributed to the various organs of the engine, before returning to the oil sump. Eventual engine oil pressure malfunctions are signalled by the pressure switch or the filter clogging switch, and an indicator light located on the instrument panel in the operator compartment.

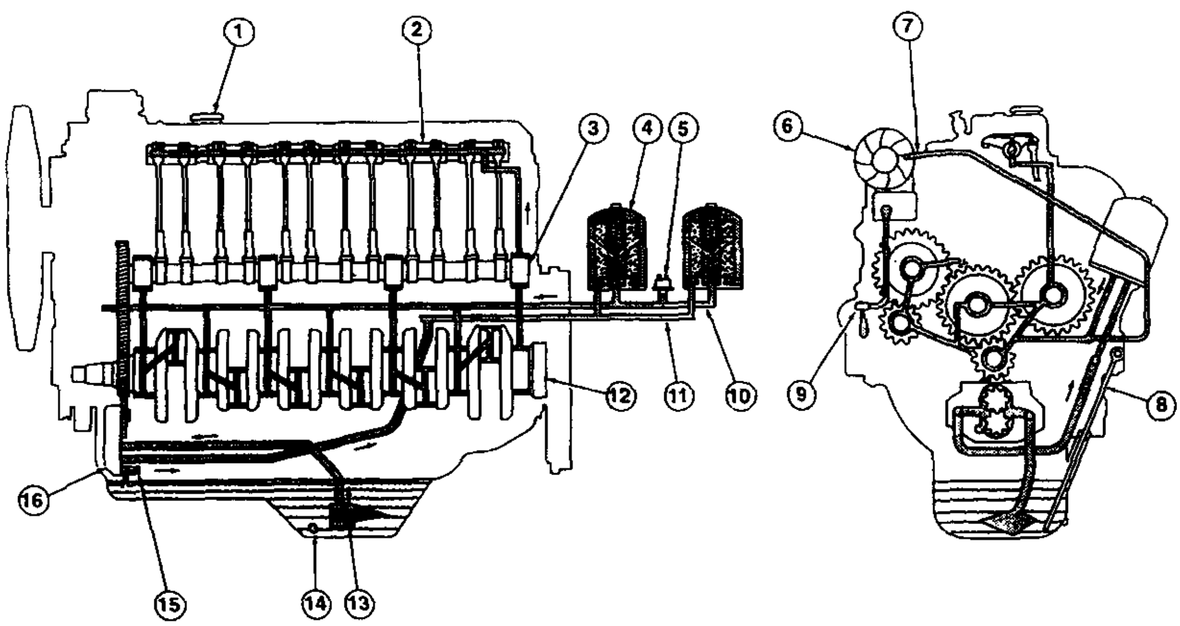


Fig. 1-5 Lubrication system

1. OIL FILLER PLUG
2. ROCKER ARM SHAFT
3. CAMSHAFT
4. OIL FILTER
5. LOW PRESSURE SWITCH
6. TURBO CHARGER
7. OUTER LUBRICATION DUCT
8. OIL DIPSTICK
9. OUTER OIL RETURN PIPING
10. LUBRICATION MAIN DUCT
11. DELIVERY PIPING
12. CRANKSHAFT
13. MESH FILTER ON SUCTION LINE
14. DRAIN PLUG
15. RELIEF VALVE
16. OIL PUMP

1.9 COOLING SYSTEM

Cooling:	water
Fan type:	blowing, 550 mm diam., 7 blades
Drive:	belt
Water pump:	belt driven, centrifugal type
Thermostat:	at outlet from cylinder head
Starting opening temperature:	79°C (174°F)
Complete opening temperature:	94°C (201°F)
Engine radiator:	corrugated fins and tubes
Converter radiator:	water radiator with multiple radiant fins
System filling capacity:	28 lit (7.4 US gal)

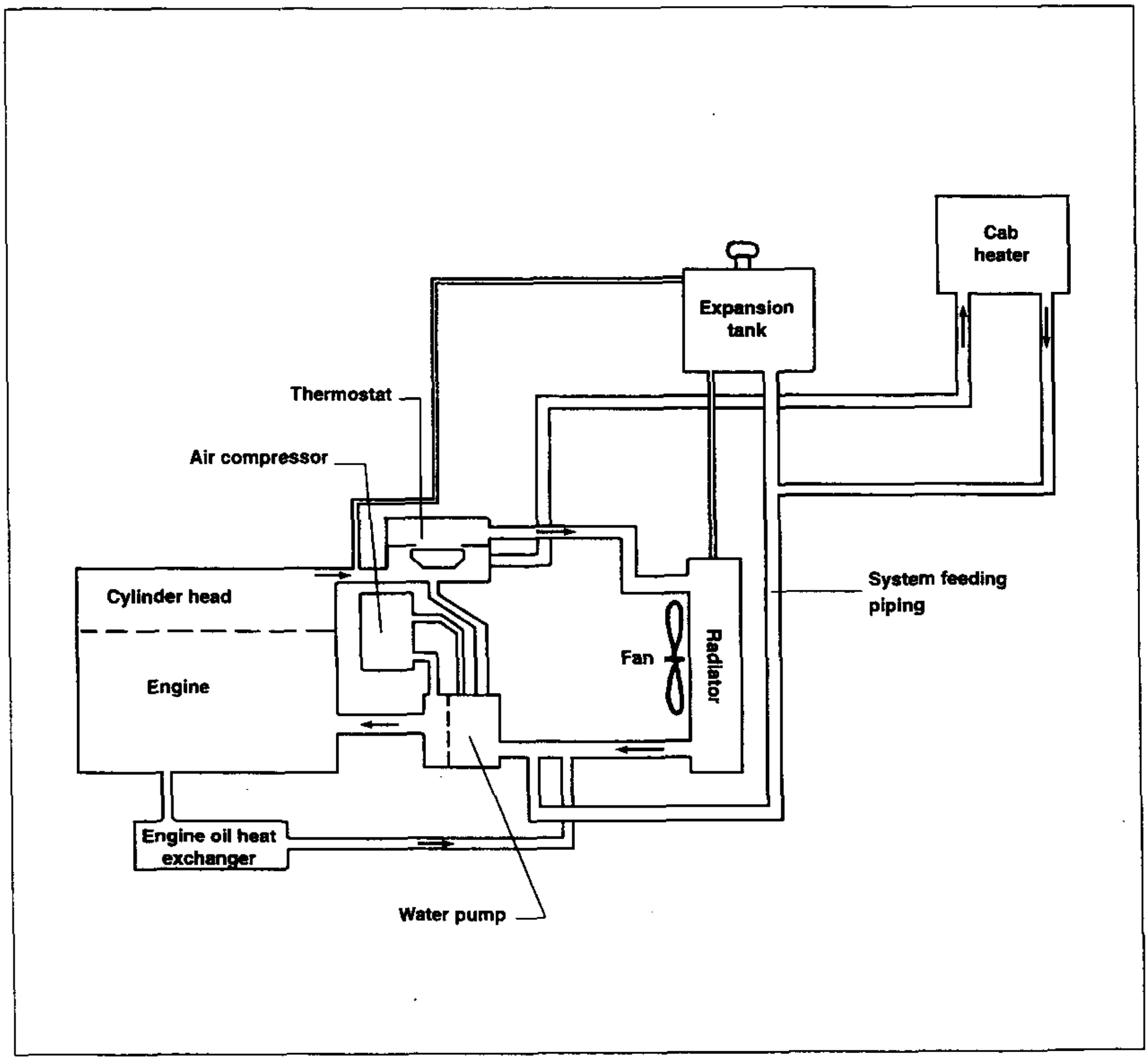


Fig. 1-6 Cooling system

1.9.1 GENERAL DESCRIPTION

The engine cooling system is a water type, with circulation forced by a pump.
The cooling water is taken from the radiator by the water pump and is sent to cool the various parts of the engine.
When the temperature of the coolant is lower than the thermostat opening temperature, the latter stays closed and the water is recirculated through the engine, without flowing to the radiator.
When the temperature of the coolant reaches the opening temperature of the thermostat, the water flows through the radiator to be cooled before getting to the water pump.
The coolant temperature is constantly monitored by a sensor located in the thermostat housing and is signalled by the "engine coolant temperature gauge" located on the instrument panel in the operator's compartment.

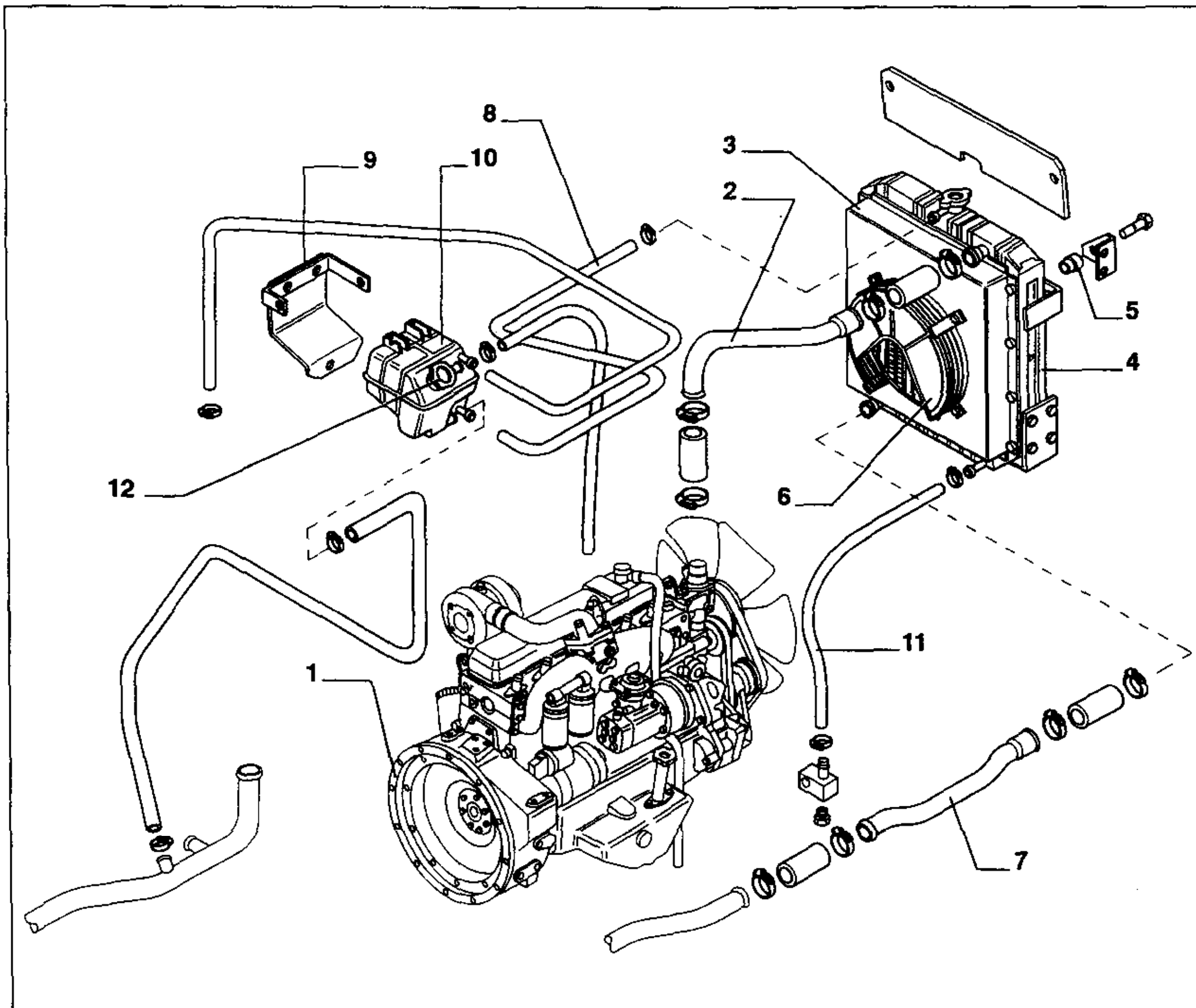


Fig. 1-7 Components of the engine cooling system

1. ENGINE
2. RADIATOR UPPER SLEEVE
3. FAN GUARD
4. RADIATOR
5. RUBBER PAD
6. FAN GUARD
7. RADIATOR LOWER SLEEVE
8. FLEXIBLE HOSE
9. BRACKET
10. EXPANSION TANK
11. RADIATOR WATER DRAINING PIPE
12. RADIATOR CAP

1.9.2 RADIATOR

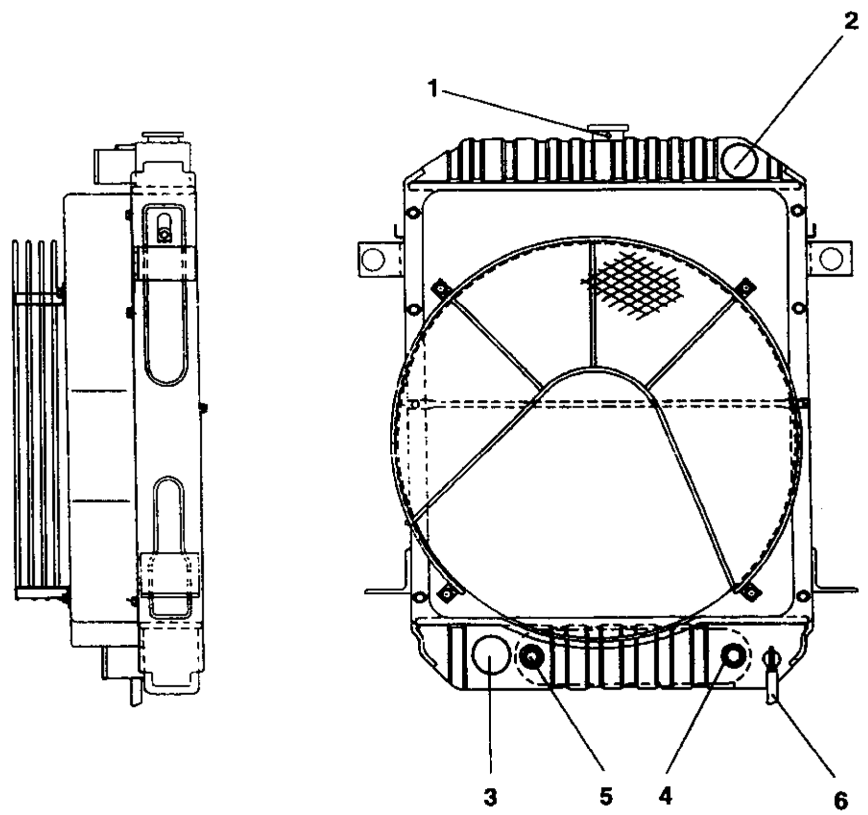


Fig. 1-8 Radiator

1. FROM EXPANSION TANK
2. COOLANT INLET
3. COOLANT OUTLET
4. TRANSMISSION OIL INLET
5. TRANSMISSION OIL OUTLET
6. WATER DRAINING

NOTE - The illustration represents the radiator of model W110.
For the model W130, the design of the radiator is the same.

1.10 FUEL SYSTEM

Injection pump: .... BOSCH
Injector nozzle: .... calibrated hole type
Fuel lifting pump: .... plunger type (with hand pump)
Fuel filter: .... paper filter
Governor: .... RVS type
Regulation: .... centrifugal, all speeds
Lubrication: .... forced
Capacity of fuel reservoir: .... 170 l (44.9 gal)

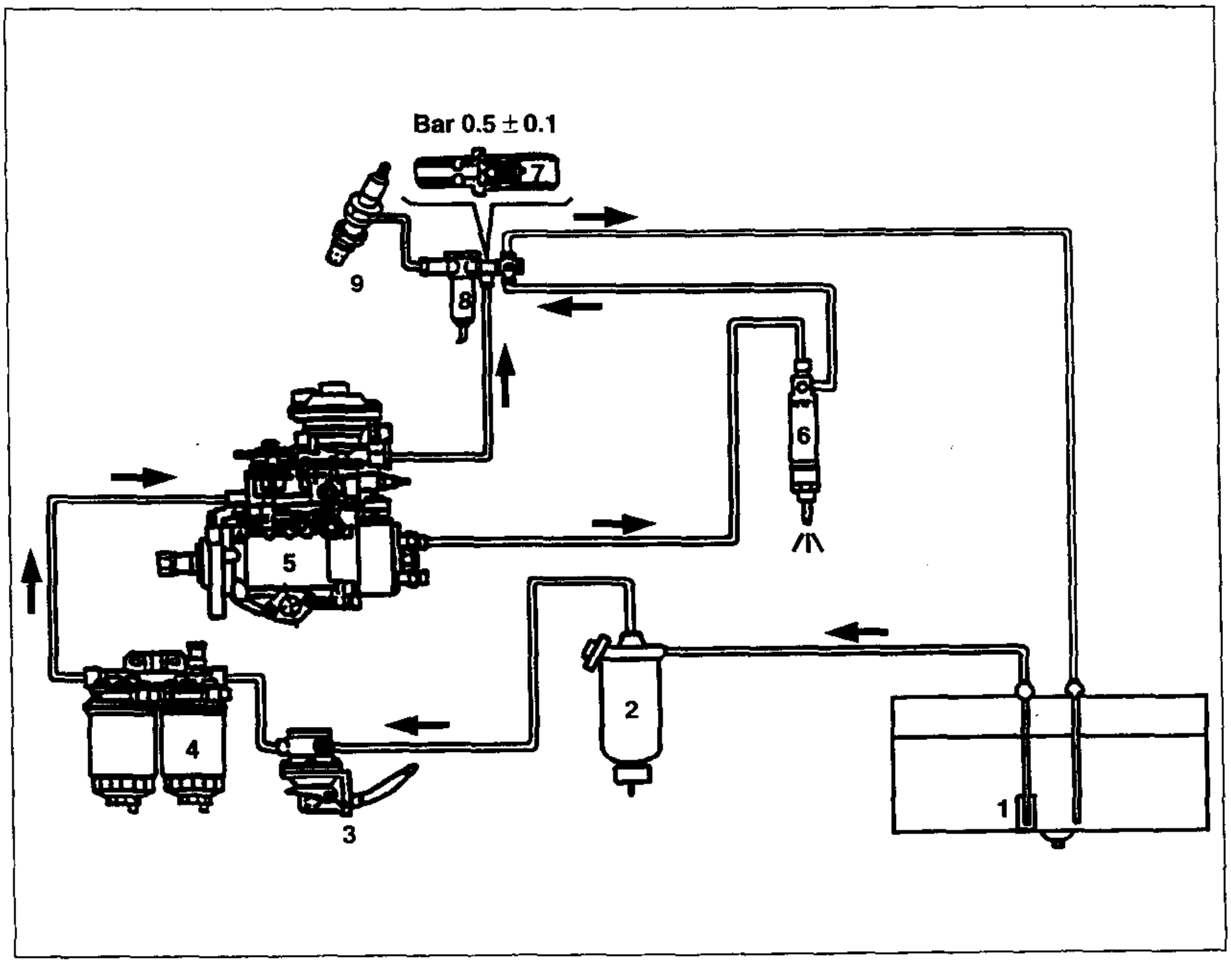


Fig. 1-9 Diagram of engine fuel feeding system

1. MESH FILTER INSIDE FUEL RESERVOIR
2. PRE-FILTER WITH BLEEDING PUMP AND WATER MONITORING INDICATOR (FILTRATION CAPACITY 100 μ)
3. MEMBRANE TYPE LIFT PUMP WITH BUILT-IN MANUAL BLEEDING PUMP
4. HEATED DOUBLE BODY FUEL FILTER
5. ROTARY PUMP TYPE VE
6. INJECTOR
7. ONE WAY VALVE
8. CONTROL NEUTRALISER SOLENOID VALVE
9. STARTING HEATER

1.10.1 FUEL RESERVOIR

The fuel reservoir is welded to the frame in the rear inner portion of the rear module, with its flexible hoses (delivery and return) connected to the engine.

The fuel reservoir is equipped with a level sensor connected to the level instrument on the instrument panel in the operator's compartment.

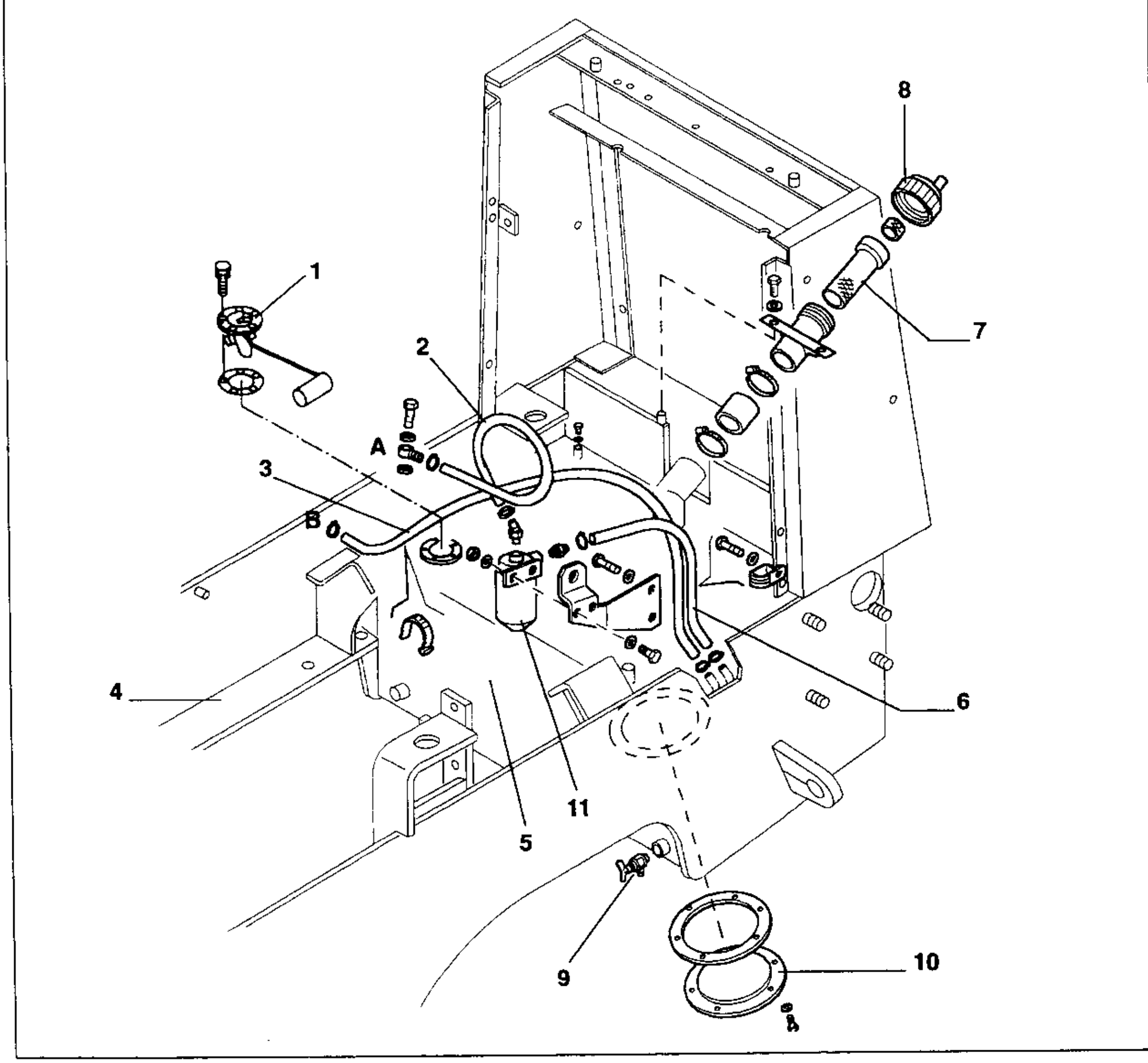


Fig. 1-10 Fuel feeding system

A: To LIFT PUMP
B: FUEL RETURN FROM SOLENOID VALVE

1. FUEL LEVEL SENSOR
2. FUEL DELIVERY FLEXIBLE HOSE
3. FUEL RETURN FLEXIBLE HOSE
4. FRAME REAR MODULE
5. FUEL RESERVOIR
6. FUEL SUCTION FLEXIBLE HOSE
7. MESH FILTER
8. CAP
9. DRAINING VALVE
10. COVER
11. WATER SEDIMENTATION FILTER

1.11 AIR INTAKE AND EXHAUST SYSTEM

Air filter .... with two paper elements
Silencer .... DONALDSON dia. 200 mm
Turbocharger GARRET-T03
Denomination .... TO 4B
Drive .... driven by exhaust gases
Lubrication .... pressure type, oil cooled

1.11.1 GENERAL DESCRIPTION

The engine air intake system is designed to bring outer air into the intake manifold through the air filter. The air filter is fitted with a filter clogged detector to warn the operator when the filter element requires cleaning.
The exhaust system is designed to convey combustion exhaust gases from the exhaust manifold to the silencer, and then into the atmosphere.

WARNING

Do not touch the silencer and exhaust manifold as they are hot when the engine is running and for a certain time after engine shut-down.

1.11.2 TURBOCHARGER

It is possible to increase engine power by feeding compressed air into the cylinders during the intake stroke (to supply a greater volume of air) and injecting more fuel.
Exhaust gas inlet into the turbocharger is connected to the exhaust manifold. Exhaust gases cause the turbine wheel to rotate at high speed before entering the silencer through the exhaust gas outlet.
The compressor wheel, which is assembled at the opposite end of same shaft as the turbine wheel, also rotating at high speed compresses the air drawn in by the air filter and then delivers it to the intake manifold.

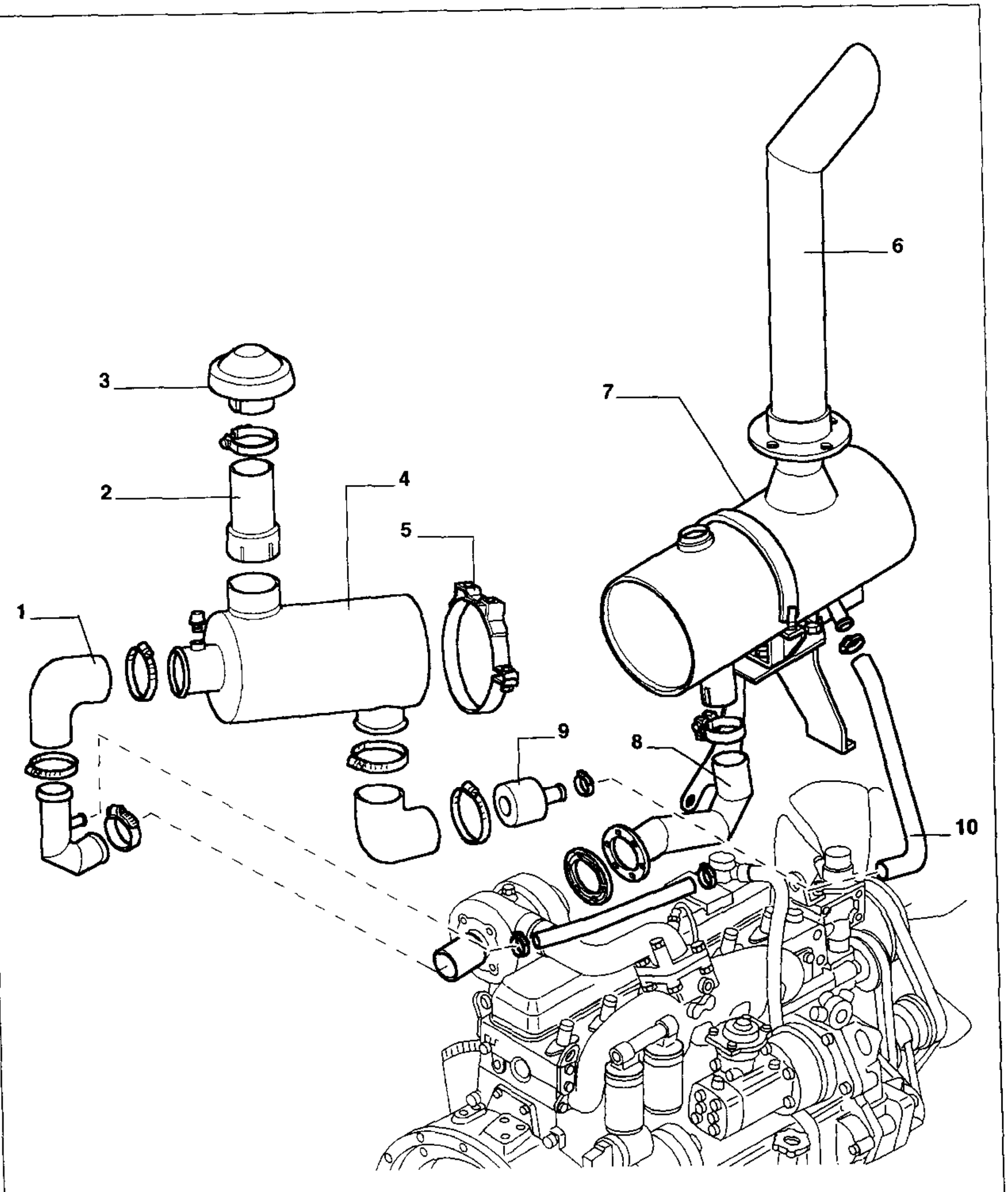


Fig. 1-11 **Intake and exhaust system**

1. AIR CLEANER SLEEVE
2. EXTENSION
3. COVER
4. AIR CLEANER
5. COLLAR
6. EXHAUST PIPE
7. SILENCER
8. EXHAUST MANIFOLD
9. DUST EJECTION VALVE
10. DUST EJECTION PIPE

1.11.3 AIR CLEANER

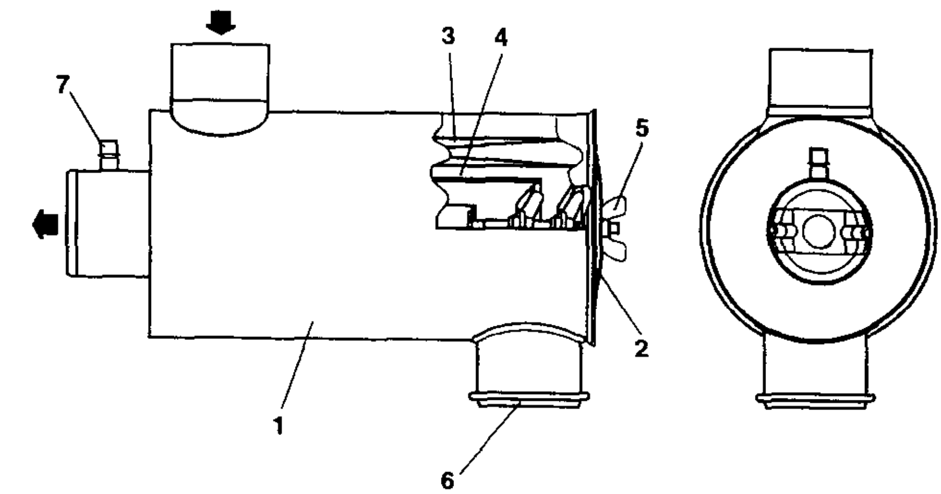


Fig. 1-12 Air cleaner

1. AIR CLEANER BODY
2. AIR CLEANER COVER
3. OUTER FILTERING ELEMENT
4. INNER FILTERING ELEMENT
5. COVER SECURING NUT
6. DUST EJECTION VALVE
7. CONNECTION FOR FILTER CLOGGING SENSOR

1.12 ELECTRICAL SYSTEM

Batteries: .... maintenance free type
Voltage and capacit: .... 12 Volt - 100Amph
Quantity: 2
Weight (each): .... 23 kg (5 3/4 lbs)
Starter motor
Type: .... electromagnetic engagement
V oltage and power: .... 24 Volt - 4 kW
Alternator
Type: .... A.C.
Voltage and power: .... 24 Volt - 55 Amp
Drive: .... belt
Automatic voltage regulator: .... IC built-in regulator
Cold starting device: .... pre-heating plug
Cut-off device: .... solenoid type

1.12.1 BATTERIES

There are two batteries located in the respective compartments on the right and left sides of the rear frame. Open the cover of the battery comartment to perform the checks required.

DANGER

Handle the batteries with special care.

1. Do not cause open flames or sparks. Never smoke nor approach batteries with open flames, since batteries always generate flammable gases.
2. The electrolyte used by batteries is a sulphuric acid solution. Skin contact can cause serious and painful burns. Blindness can result from contact with the eyes. If the electrolyte contacts the eyes, wash them freely with water and seek medical attention.

1.12.2 STARTER SWITCH

The starter switch has 4 positions:

OFF, ACC, ON, START

The engine cannot be started if the gearshift selector (control lever) is not in neutral (refer to 2.5.4 "TRANSMISSION CONTROL SYSTEM"). This has the purpose of avoiding that the loader is suddenly moving, when the starter switch is actuated.

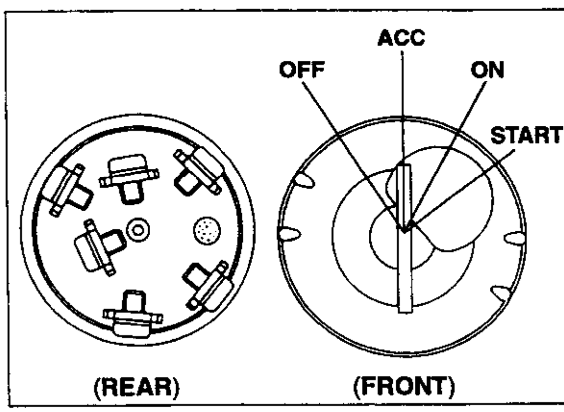


Fig. 1-13 Starter switch

TERMINALS / POSITION	B	G	G	ACC	M	ST
OFF						
ACC	O			O		
ON	O			O	O	
START	O		O		O	O

1.12.3 STARTING A COLD ENGINE

The cold engine starter operates when sensor (**3**, fig. 1-14) monitors a temperature below 8°C (46 °F). The starter heater (**2**), by glowing, in fact, ignites the fuel deviated into the air intake duct (**8**) by solenoid valve (**4**) heating the air sucked by the cylinders.

With the key of the switch in position "ON" the pre-heating phase, lasting 30 seconds, begins.
When the key is rotated further into position "START", the engine is started.

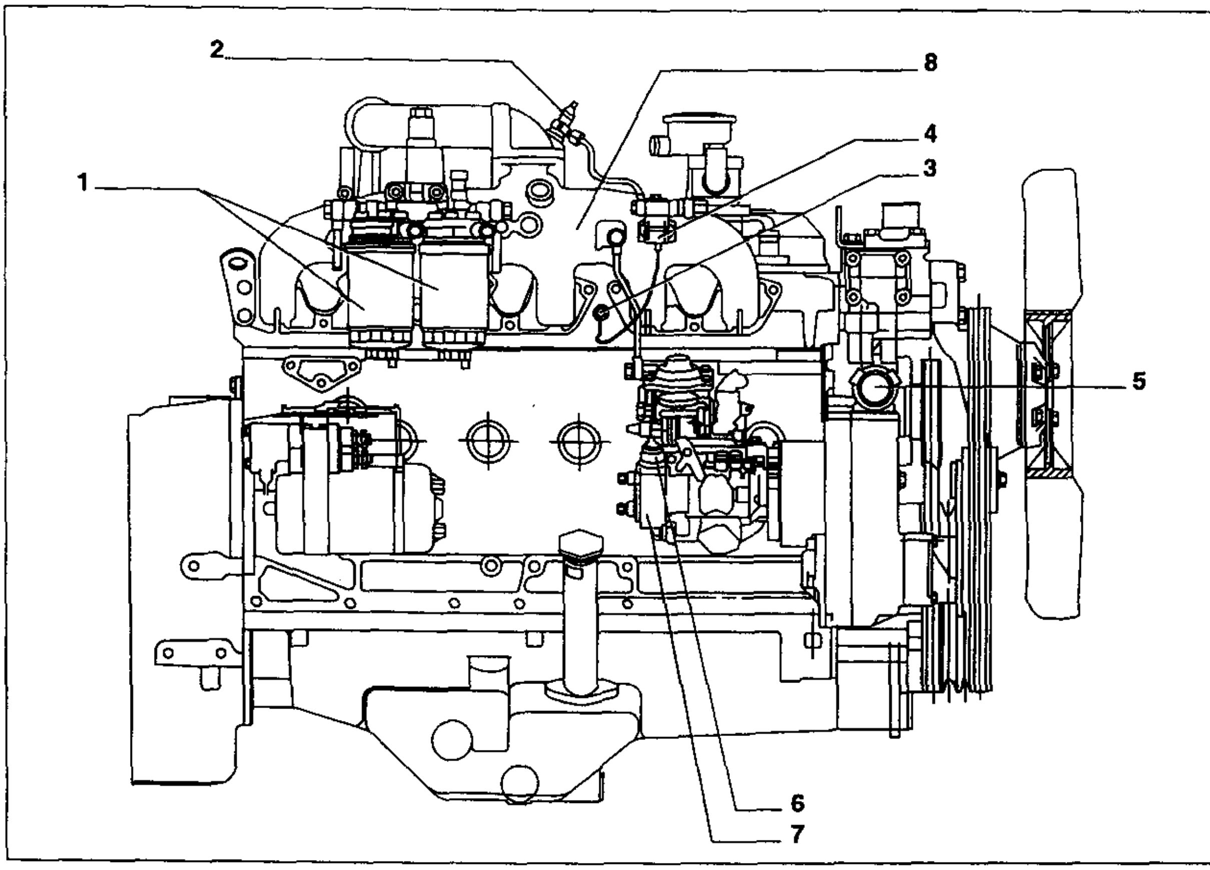


Fig. 1-14 Engine cold starting system

1. FILTERS WITH FUEL PRE-HEATER
2. STARTER HEATER
3. TEMPERATURE SENSOR
4. SOLENOID VALVE
5. FUEL PRIMING MEMBRANE PUMP
6. ENGINE CUT-OFF SOLENOID VALVE
7. INJECTION PUMP
8. AIR INTAKE MANIFOLD

1.12.4 ENGINE CUT-OFF DEVICE

Diesel engines have no electrical devices causing the combustion, as happens on petrol engines, thus the engine is normally cut-off by simply turning the main switch (starter switch) into the cut-off position. For this reason, wheel loaders are equipped with such a device.

When the starter switch is turned OFF, the engine cut-off solenoid (**6**) is energised, reducing the quantity of fuel provided by the injection pump to the injectors and finally cutting it off, thus stopping the engine.

1.12.5 ENGINE PRE-HEATING SEQUENCE

ENGINE WATER TEMPERATURE	ACTION PERFORMED OR FUNCTION	WARNING LAMP ON		THERMOSTART ON		SOLENOID VALVE ON	
		YES	NO	YES	NO	YES	NO
≥ 8°C	KEY START SWITCH TURNED TO THE RUN POSITION (VOLTAGE TO TERMINAL "15)	X			X		X
(≥ 46.4 °F)	AFTER 2±0.2 SEC.		X		X		X
≤ 8°C	KEY START SWITCH TURNED TO THE RUN POSITION (VOLTAGE TO TERMINAL "15)	X		X			X
(≤ 46.4 °F)	AFTER 2 SEC.	X		X			X
	PRE-HEATING (LASTS AS PER DIAGRAM) X		X			X	
	STATER MOTOR OPERATED BEFORE END OF PRE-HEATING (WITH LAMP ON). WRONG YET NOT DISABLED ACTION. THE SYSTEM SELF-RESETS		X		X		X
	END OF PRE-HEATING		X	X			X
	THE STARTER MOTOR IS NOT OPERATED WITHIN 30 ±1.5 SEC. FROM END OF PRE-HEATING (DISTRACTION TIME)		X		X		X
	ENGINE START (THROUGHOUT STATER MOTOR CRANKING)	X		X		X	
	AIR HEATING INSIDE THE INTAKE MAMIFOLD WITH THE ENGINE RUNNING (POST- HEATING)	TX		X		X	
	END OF POST-HEATING		X		X		X

1.12.6 PRE-HEATING MALFUNCTION WARNING LAMP MODES

FAULTY CIRCUIT	SYSTEM AND/OR COMPONENT	FAULT TYPE	DIAGNOSTIC THROUGH THE WARNING LAMP						DIAGNOSTIC TIME			SIGNAL ACTIVATED
			SIGNAL TYPE			CAUSED BY						
			WARNING LAMP OFF	FLASHING 1 Hz	FLASHING 4 Hz	KEY TURNED "15"	STARTING	POST-HEAT. END	60 SEC	UNTIL REMOVAL OF KEY "15"	UNTIL CONTROL BOX IS DISCON.	
CIRCUIT FAULTS OUTSIDE THE CONTROL BOX	REVERSED POLARITY	X										⊠
	POWER SUPPLY EXCEEDING RATED VALUE (32V INSTEAD OF 24V)		X									⊠
	NO POWER SUPPLY "30"			X		X			X			⊠
	NO POWER SUPPLY "15"		X									⊠
	THERMOSTARTS	OPEN CIRCUIT		X		X			X			⧓
		SHORT CIRCUIT		X		X			X			⧓
	SOLENOID VALVE	OPEN CIRCUIT		X		X			X			⊠
		SHORT CIRCUIT	X			X						⧓
	TEMP. SENSOR	OPEN CICUIT		X				X	X			⊠
	WARNING LAMP	OPEN CIRCUIT	X									⊠
		SHORT CIRCUIT	X									⊠
CIRCUIT FAULTS INSIDE THE CONTROL BOX	THERMOSTART RELAY	CONTACTS NOT CLOSED			X	X			X			⧓
		CONTACTS WELDED			X			X			X	⧓
	SOLENOID VALVE RELAY	CONTACTS NOT CLOSED			X		X		X			⧓
		CONTACTS WELDED			X			X		X		⧓

⊠ At all times, even when pre/post-heating is not operated

⧓ Only when pre/post-heating is operated

1.12.7 ACCELERATOR CONTROL LINKAGE

The engine speed is controlled by actuating the accelerator pedal.
When the accelerator pedal is pushed, to obtain an engine speed more appropriate to the working condition, the control lever on the injection pump is actuated, through the relevant cable.
Adjust the linkage so that when pedal (1) stops against screw (10), the lever located on the injection pump runs completely its stroke, stopping, in turn, against the stroke end screw.

WARNING: The stroke end screw on the injection pump is sealed. Do not change its setting.

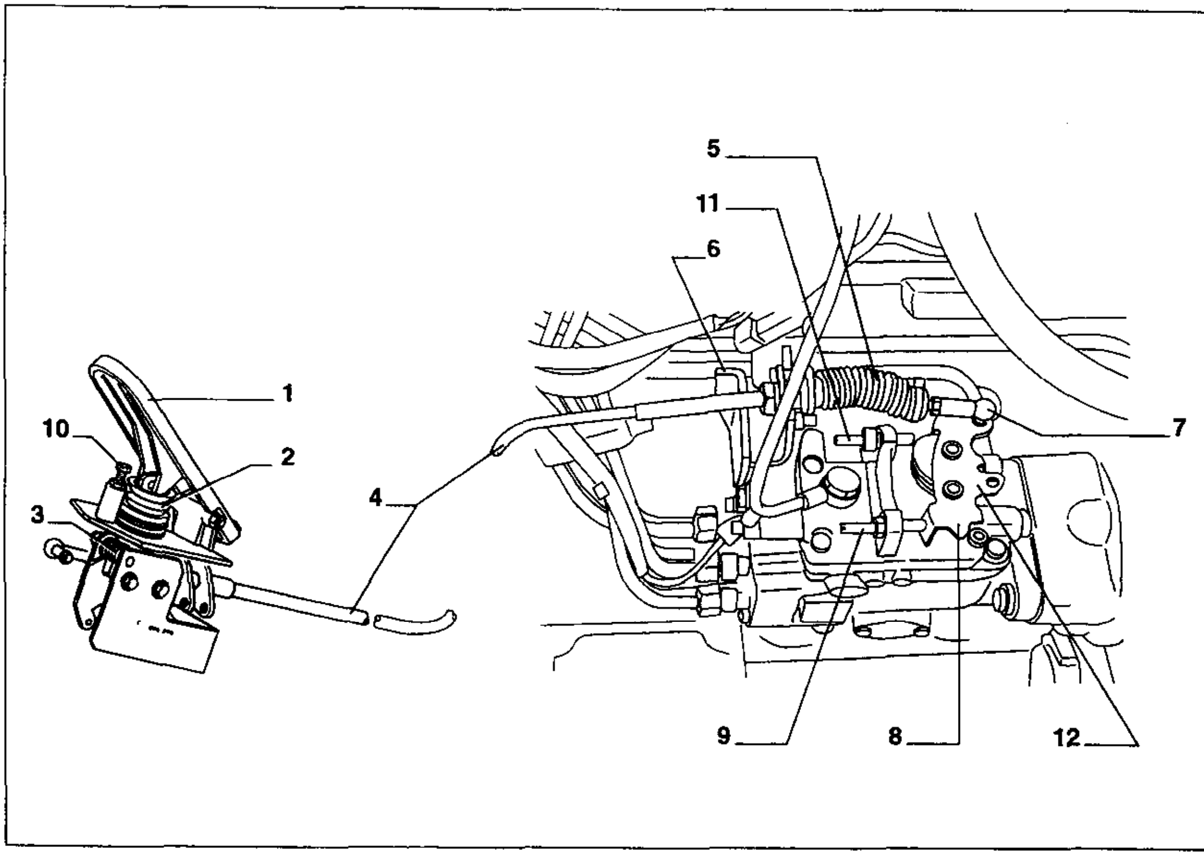


Fig. 1-15 Accelerator control

1. ACCELERATOR PEDAL
2. RUBBER BOOT
3. SPRING
4. CONTROL CABLE
5. RUBBER SLEEVE
6. CABLE SECURING BRACKET
7. BALL JOINT
8. INJECTION PUMP
9. IDLE SETTING SCREW
10. PEDAL STROKE END SETTING SCREW
11. PUMP CONTROL LEVER STROKE END SETTING SCREW
12. PUMP CONTROL LEVER

SECTION 2

TRANSMISSION

CONTENTS

2.1 GENERAL DESCRIPTION

The transmission power train is made of a drive group (torque converter and transmission), prop shafts, front and rear axles and tires.
The engine power is driven to the converter-transmission group, where the r.p.m. are reduced and the torque is increased. The power driven to each axle reaches, through the wheels, the tires, thus driving the loader.
Here below a diagram of the transmission power train is provided.

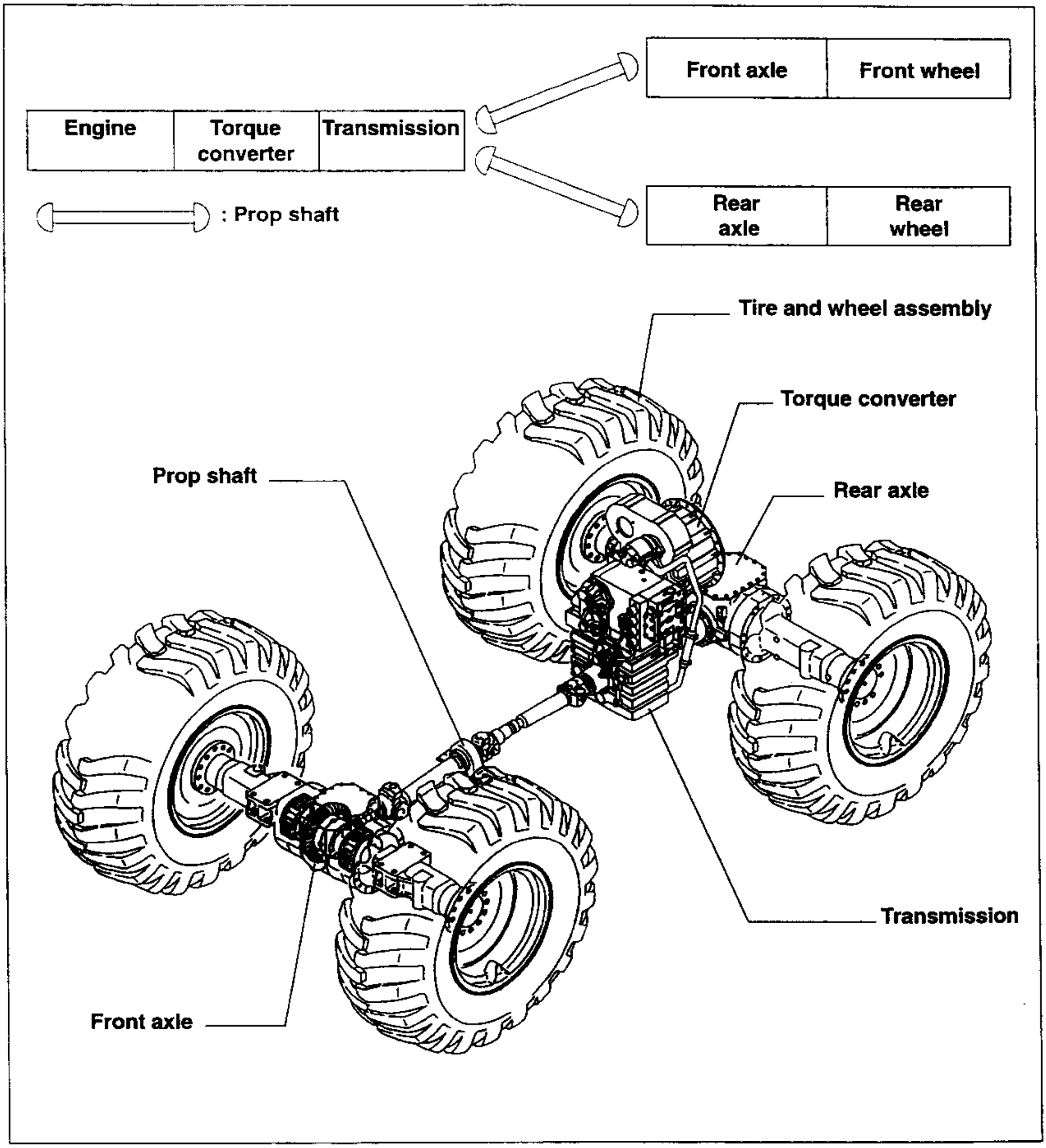


Fig. 2-1 Composition of transmission power train

2.2 TORQUE CONVERTER - TRANSMISSION

	W110	W130
TORQUE CONVERTER		
- Designation	TCM 641-25 (DAIKIN 12.5")	TCM 642-25 (NIIGATA 12.5")
- Type	3 elements, single stage, single phase	3 elements, single stage, single phase
- Radiator	Water cooled, with multiple radiating fins	Water cooled, with multiple ratiating fins
- Pressure setting, standard value	3.5 bar (50 psi)	4.0 bar (57 psi)
FEEDING PUMP		
- Designation	DDG1A27-9	SDY1A36-12
TRANSMISSION		
- Designation	TCM 641-25	TCM 642-25
- Type	Controlled by solenoid valves, full power shift with constant mesh gears	Controlled by solenoid valves, full power shift with constant mesh gears
- Speeds	4 forward and 4 reverse	4 forward and 4 reverse
CLUTCHES (TRANSMISSION)		
- Type	Oil bath, multiple disc	Oil bath, multiple disc
- Operation	Hydraulic	Hydraulic
- Pressione di taratura	20 ÷ 24 bar (284 ÷ 341 psi)	20 ÷ 24 bar (284 ÷ 341 psi)
- Pressure setting	20 l (5.3 gal)	20 l (5.3 gal)
- Weight (converter - transmission)	511 Kg (1127 lbs)	531 Kg (1171 lbs)

Note - The transmission oil heat exchanger is located in the lower tank of the radiator. For the technical specifications, please refer to "1.9 COOLING SYSTEM".

GENERAL DESCRIPTION

The power train system of the transmission is made of the coupling of a torque converter and a transmission, in a single body.
The engine power is driven to the transmission unit by the flywheel and the converter.
The engine and the torque converter-transmission are connected to each other by dry flexible discs.

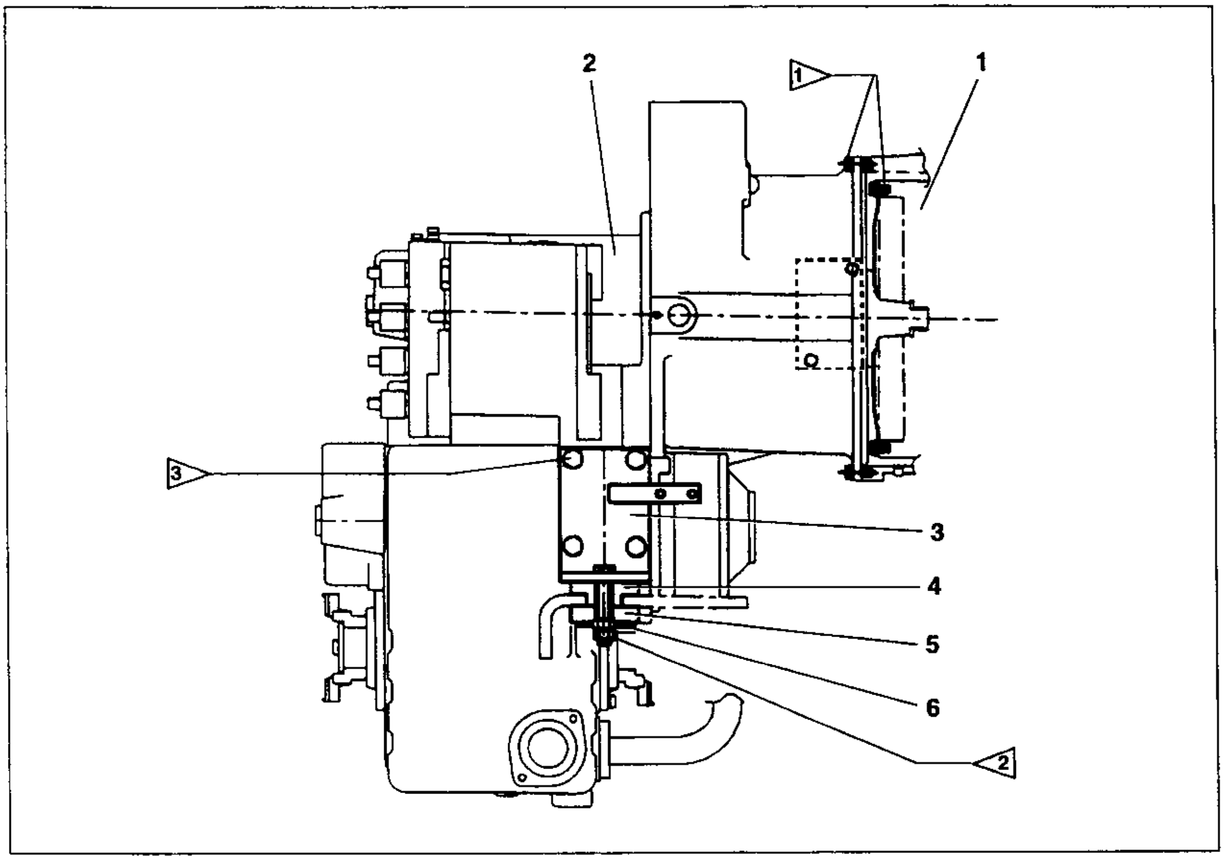


Fig. 2.2 Transmission-torque converter group supports.

Note - 1 4.6 daNm (33 ft-lbs)

Threaded part: LOCTITE 262

2 16.7 daNm (123 ft-lbs)

3 20 daNm (145 ft-lbs)

1. (ENGINE)
2. TRANSMISSION TORQUE CONVERTER GROUP
3. SUPPORT BRACKET
4. RUBBER SUPPORT PAD (UP.)
5. RUBBER SUPPORT PAD (LOW.)
6. WASHER

1. From BRAKE VALVE
2. From HEAT EXCHANGER
3. OIL FILLER HOLE
4. PARKING BRAKE DISENGAGEMENT PRESSURE
5. To HEAT EXCHANGER
6. From FILTER

11. REVERSE CLUTCH 20 - 24 bar PRESSURE PORT
12. FORWARD CLUTCH 20 - 24 bar PRESSURE PORT
13. 1st SPEED CLUTCH 20 - 24 bar PRESSURE PORT
14. 2nd SPEED CLUTCH 20 - 24 bar PRESSURE PORT
15. 3rd SPEED CLUTCH 20 - 24 bar PRESSURE PORT
16. 4th SPEED CLUTCH 20 - 24 bar PRESSURE PORT
17. PRESSURE SWITCH MOUNTING PORT
18. TEMPERATURE SENSOR MOUNTING PORT
19. CONVERTER OUTPUT PRESSURE PORT
20. CONVERTER INPUT PRESSURE PORT

31. CHARGING PUMP
32. SUCTION PUMP
33. MESH FILTER
34. CONTROL VALVE
35. OIL DIPSTICK
36. PLUG
37. BREATHER
38. SPRING
39. PLUNGER (SAFETY VALVE)
40. EMERGENCY STEERING PUMP
41. EQUIPMENT - STEERING/BRAKES PUMP

Clutch engagement oil pressure: 20 - 24 bar
Safety valve opening pressure: 7.2 bar

daNm Value of tightening torque

Pressure test point

Notes:

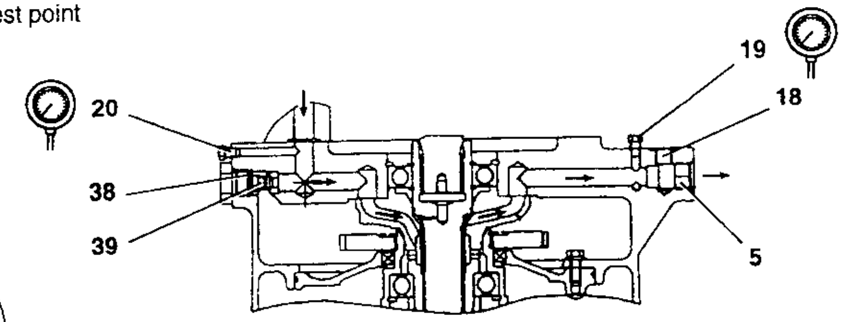
1 Threaded portion: LOCTITE 572

2 Outer diameter: LOCTITE 572

3 Transmission control valve solenoid valves energising table ● = ENERGISED

	FOR. sol.	REV. sol.	sol. A	sol. B
4th FORW.	●			●
3rd FORW.	●			
2nd FORW.	●		●	●
1st FORW.	●		●	
N				
1st REV.		●	●	
2nd REV.		●	●	●
3rd REV.		●		
4th REV.		●		●

Note - Threaded portion of plug: LOCTITE 572



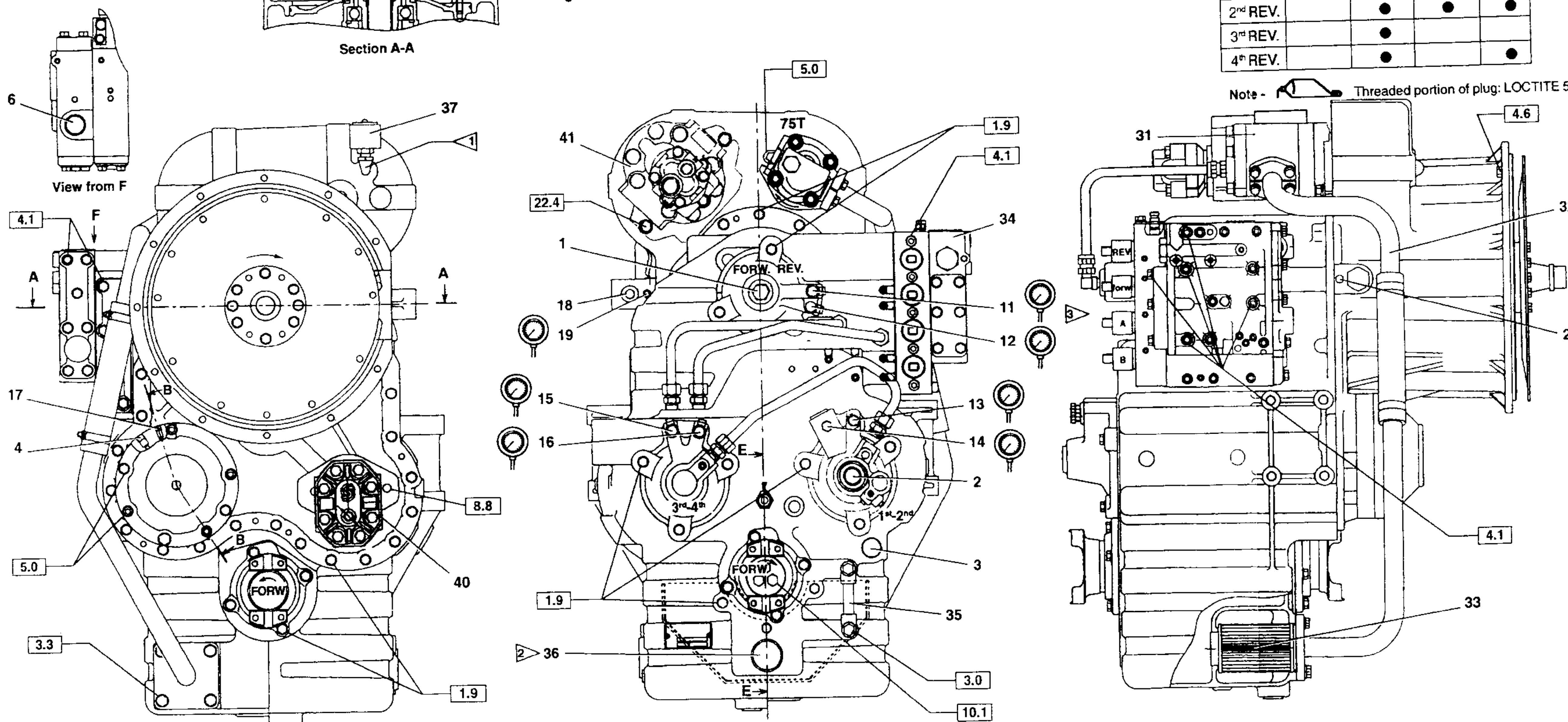


Fig. 2-3 Transmission - torque converter unit of model W110 (1)

Note - For sections B-B, and E-E, please refer to the next page

1. CHARGING PUMP
2. PUMP SLEEVE
3. PUMP DRIVE GEAR
4. BEARING SUPPORT
5. OIL SEAL COVER
6. PUMP WHEEL PINION GEAR
7. SEAL
8. STATOR SUPPORT
9. TURBINE SHAFT
10. PUMP WHEEL
11. CONVERTER HOUSING
12. PLUG
13. SCREW (PARKING BRAKE DISENGAGE-MENT)
14. PLUG
15. FLANGE
16. SEAL
17. BEARING HOLDER COVE
18. DRAINING PLUG
19. INVERTER GEAR
20. BALL
21. SHAFT
22. FORW./REV. CLUTCH SHAFT
23. OIL DISTRIBUTION COVER
24. GEAR
25. GEAR
26. IDLE SHAFT
27. $1^{st}/2^{nd}$ SPEEDS SHAFT
28. OIL DISTRIBUTION COVER
29. GEAR
30. GEAR
31. FLANGE
32. OUTPUT SHAFT
33. OIL SEAL
34. TRANSMISSION HOUSING
35. PISTON HOUSING
36. COVER
37. DOWEL
38. SPRING
39. PISTON
40. BRAKE HOUSING
41. FINAL DISC
42. INNER TOOTHED DISC
43. OUTER TOOTHED DISC
44. $3^{rd}/4^{th}$ SPEEDS SHAFT
45. OIL DISTRIBUTION COVER
46. ANGLE SPEED SENSOR (FOR TACHOME-TER)

Clutch engagement oil pressure: 20 - 24 bar
Safety valve opening pressure: 7.2 bar

daNm Value of tightening torque

Pressure test point

Note:

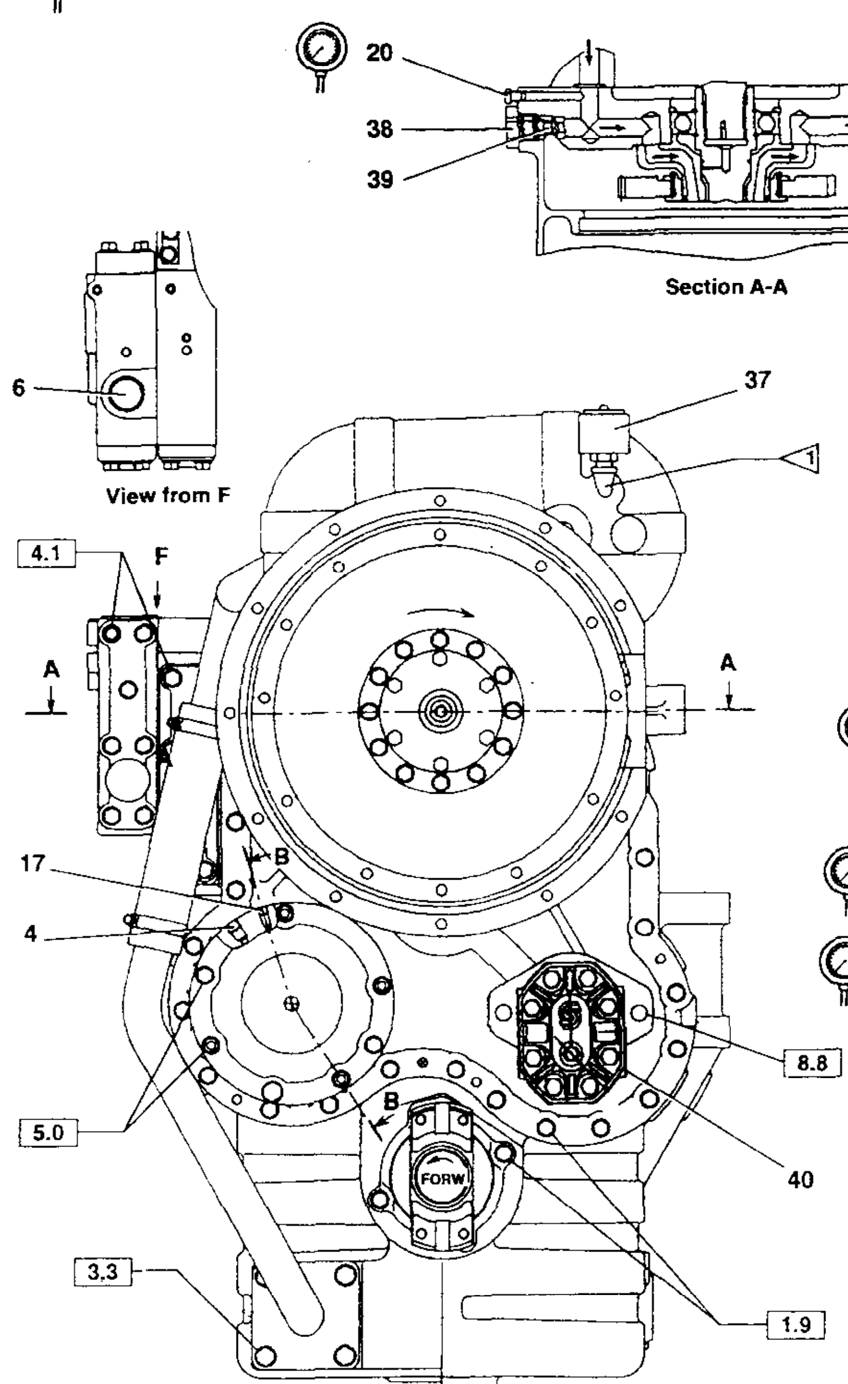
1 Threaded portion: LOCTITE 572

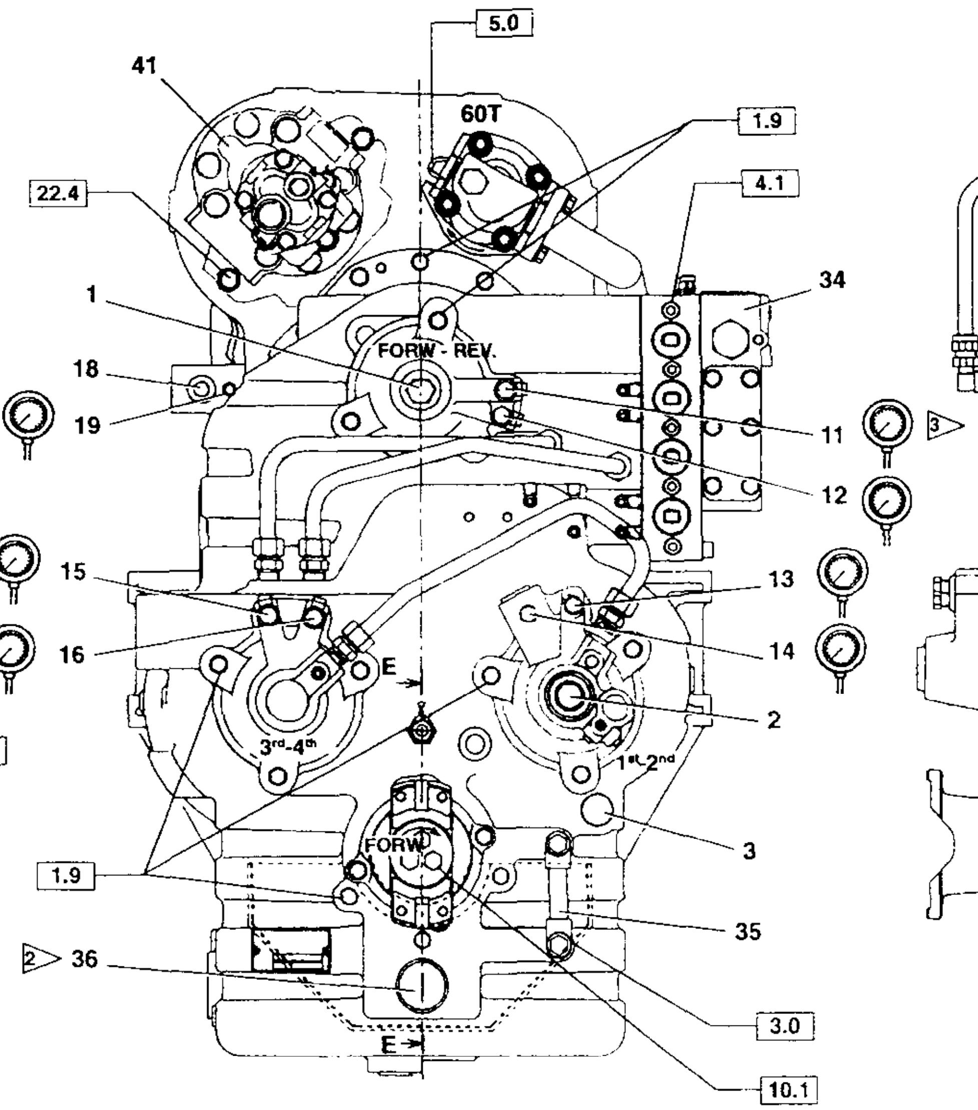
2 Outer diameter: LOCTITE 572

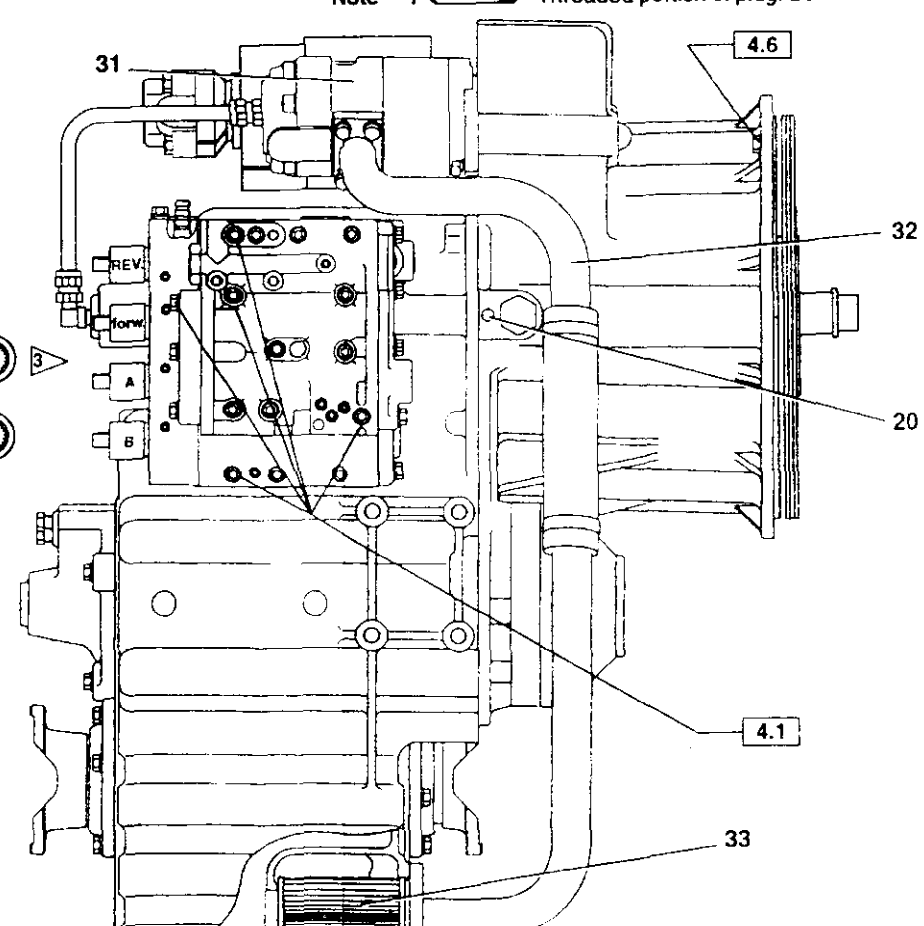
3 Transmission control valve solenoid valves energising table ● = ENERGISED

	FOR. sol.	REV. sol.	sol. A	sol. B
4th FORW.	●			●
3rd FORW.	●			
2nd FORW.	●		●	●
1st FORW.	●		●	
N				
1st REV.		●	●	
2nd REV.		●	●	●
3rd REV.		●		
4th REV.		●		●

Note - Threaded portion of plug: LOCTITE 572



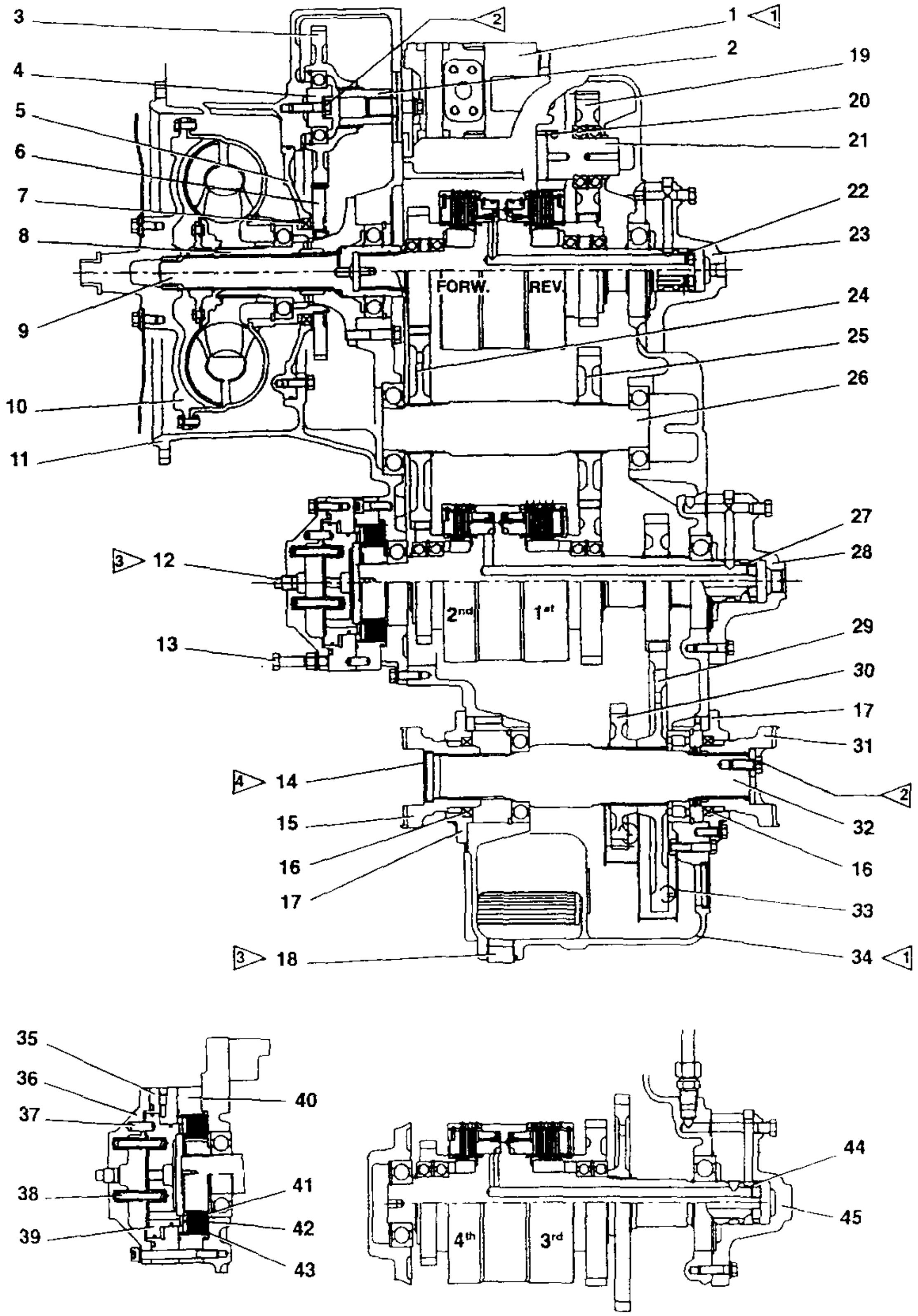




Note - For sections B-B, and E-E, please refer to the next page.

Fig. 2-5 Transmission - torque converter unit of model W130 (1)

1. From BRAKE VALVE
2. From HEAT EXCHANGER
3. OIL FILLER HOLE
4. PARKING BRAKE DISENGAGEMENT PRESSURE
5. To HEAT EXCHANGER
6. From FILTER
11. REVERSE CLUTCH 20 - 24 bar PRESSURE PORT
12. FORWARD CLUTCH 20 - 24 bar PRESSURE PORT
13. 1st SPEED CLUTCH 20 - 24 bar PRESSURE PORT
14. 2nd SPEED CLUTCH 20 - 24 bar PRESSURE PORT
15. 3rd SPEED CLUTCH 20 - 24 bar PRESSURE PORT
16. 4th SPEED CLUTCH 20 - 24 bar PRESSURE PORT
17. PRESSURE SWITCH MOUNTING PORT
18. TEMPERATURE SENSOR MOUNTING PORT
19. CONVERTER OUTPUT PRESSURE PORT
20. CONVERTER INPUT PRESSURE PORT
31. CHARGING PUMP
32. SUCTION PUMP
33. MESH FILTER
34. CONTROL VALVE
35. OIL DIPSTICK
36. PLUG
37. BREATHER
38. SPRING
39. PLUNGER (SAFETY VALVE)
40. EMERGENCY STEERING PUMP
41. EQUIPMENT - STEERING/BRAKES PUMP



Section **B-B** Section 3^{rd} and 4^{th} clutches shaft

Notes - [1] Converter housing mating flang: LOCTITE 509

[2] Threaded portion: LOCTITE 262

[3] Threaded portion: LOCTITE 572

[4] Outer diameter: LOCTITE 572

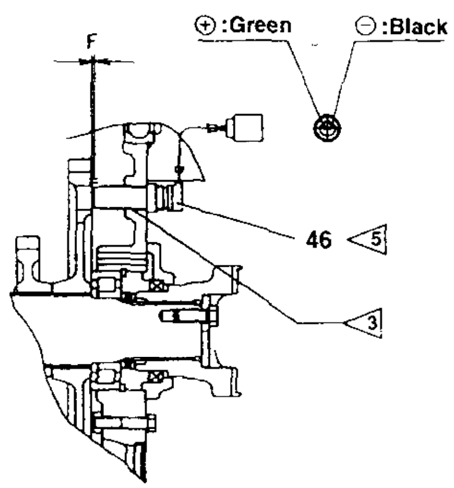
[5] Adjustment of gap F: after having the sensor bottoming with the gear, move it back, by unscrewing the adjuster 1.5 turn.

Notes - Seals mounting procedure

Seal (metal) outer diameter: LOCTITE 262

Seal lip: Grease

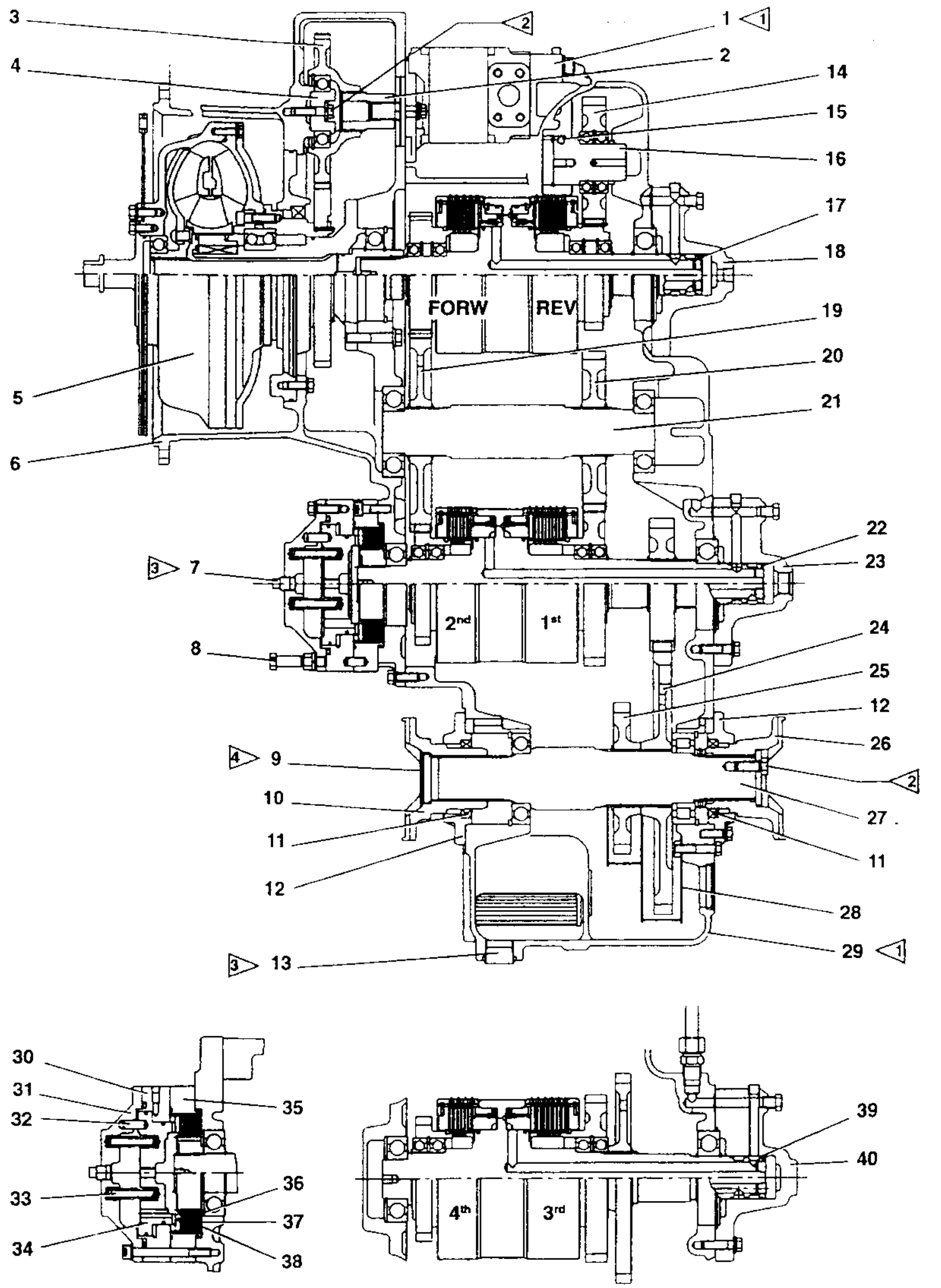
Chamfer and sliding surface of mating flanges: Grease



Section **E-E**

Fig. 2-4 Transmission - torque converter unit of model W110 (2)

1. CHARGING PUMP
2. PUMP SLEEVE
3. PUMP DRIVE GEAR
4. BEARING SUPPORT
5. CONVERTER WHEEL
6. CONVERTER HOUSING
7. PLUG
8. SCREW (PARKING BRAKE DISENGAGE-MENT)
9. PLUG
10. FLANGE
11. SEAL
12. BEARING HOLDER COVER
13. DRAINING PLUG
14. INVERTER GEAR
15. BALL
16. SHAFT
17. FORW./REV. CLUTCH SHAFT
18. OIL DISTRIBUTION COVER
19. GEAR
20. GEAR
21. IDLE SHAFT
22. 1st/2nd SPEEDS SHAFT
23. OIL DISTRIBUTION COVER
24. GEAR
25. GEAR
26. FLANGE
27. OUTPUT SHAFT
28. OIL SEAL
29. TRANSMISSION HOUSING
30. PISTON HOUSING
31. COVER
32. DOWEL
33. SPRING
34. PISTON
35. BRAKE HOUSING
36. FINAL DISC
37. INNER TOOTHED DISC
38. OUTER TOOTHED DISC
39. 3rd/4th SPEEDS SHAFT
40. OIL DISTRIBUTION COVER
41. ANGLE SPEED SENSOR (FOR TACHOME-TER)



Section B-B

Section 3rd and 4th clutches shaft

Notes - 1 Converter housing mating flange: LOCTITE 509

2 Threaded portion: LOCTITE 262

3 Threaded portion: LOCTITE 572

4 Outer diameter: LOCTITE 572

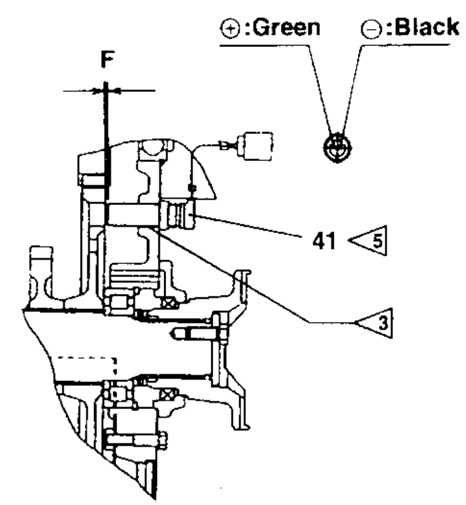
5 Adjustment of gap F: after having the sensor bottoming with the gear, move it back, by unscrewing the adjuster 1.5 turn

Notes - Seals mounting procedure

Seal (metal) outer diameter: LOCTITE 262

Seal lip: Grease

Chamfer and sliding surface of mating flanges: Grease



Section E-E

Fig. 2-6 Transmission - torque converter unit of model W130 (2)

2.3 TORQUE CONVERTER

The torque converter consist of a torque converter group, an hydraulic pumps drive and a turbine shaft. The torque converter group is composed of a pump and a turbine mounted one in front of the other, with an intermediate stator, and is arranged in the torque *converter housing filled with oil.*

The hydraulic pumps drive unit drives the charging pump and the main pump through the drive gear mounted on the converter pump hub.

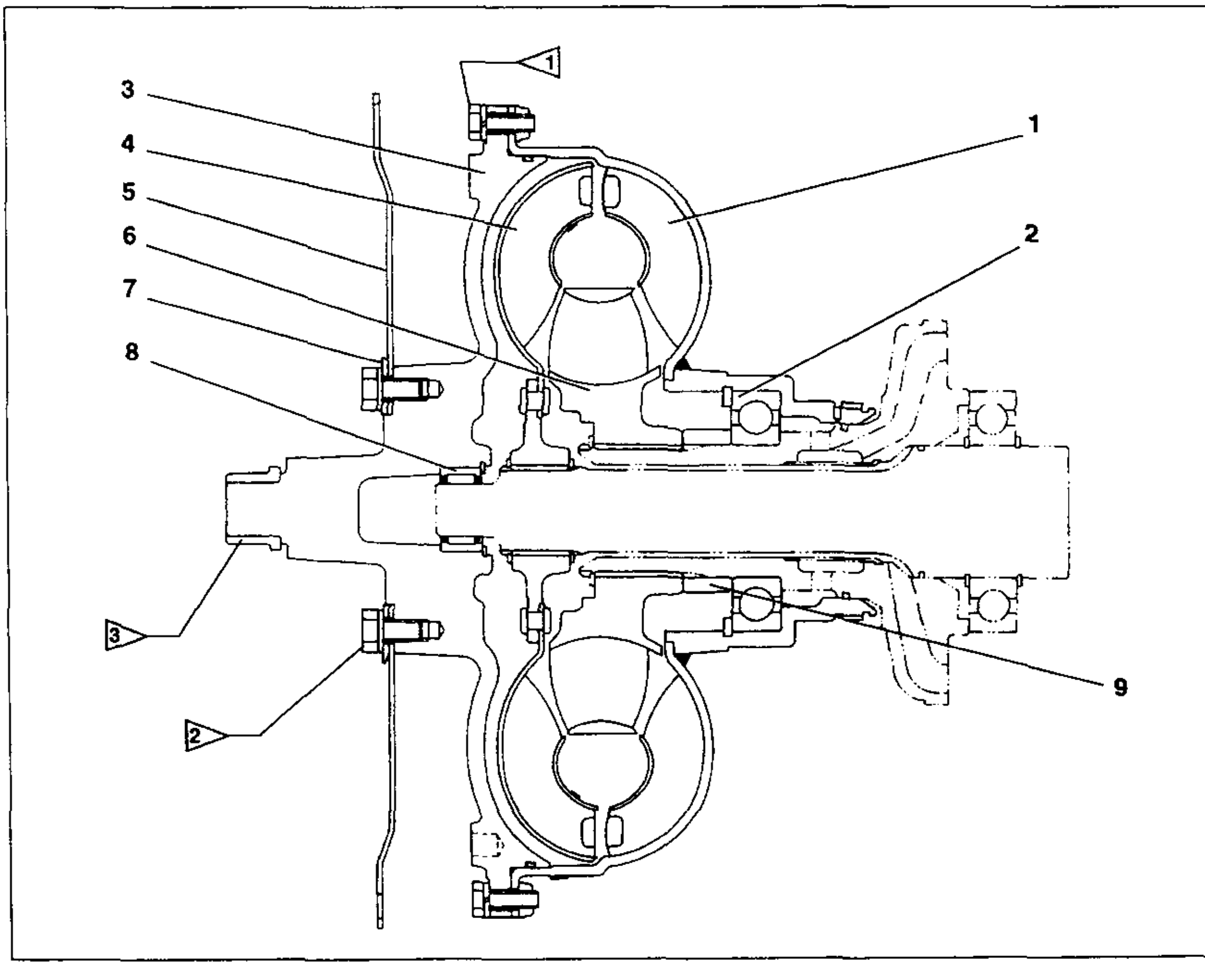


Fig. 2-7 Torque converter group W110

Note - 1 2.0 daNm (14 ft-lbs)

2 6.2 daNm (45 ft-lbs) Threaded part: LOCTITE 262

3 Mobile surfaces: molybdenum based grease

1. CONVERTER PUMP
2. BALL BEARING
3. FRONT COVER
4. TURBINE
5. DIAPHRAGM COUPLING
6. STATOR
7. WASHER
8. NEEDLE BEARING
9. SPACER

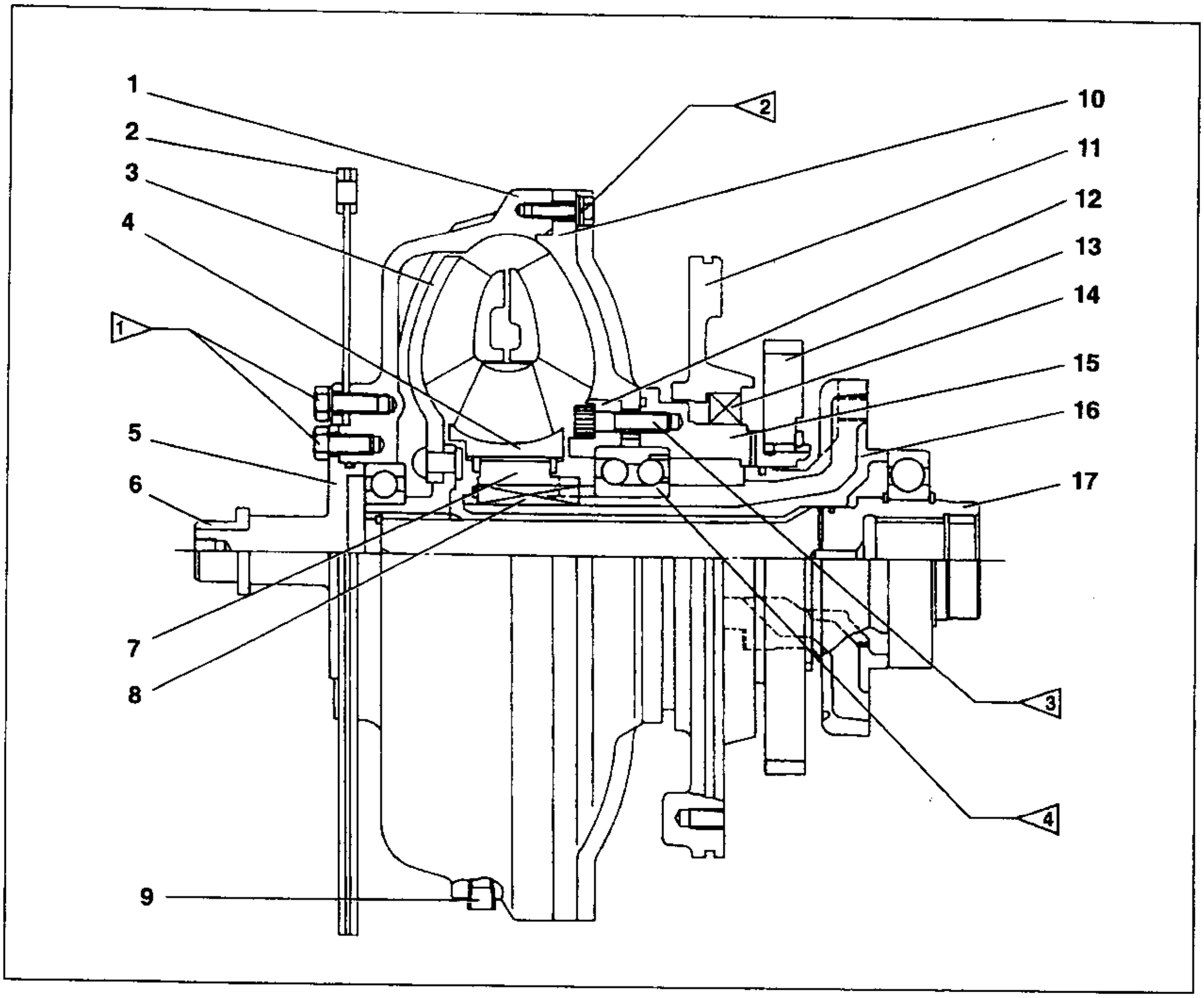


Fig. 2-8 **Torque converter group W130**

Note - 1 4.3 ÷ 4.8 daNm (31 ÷ 35 ft-lbs)

2 2.1 ÷ 2.3 daNm (15 ÷ 17 ft-lbs)

3 5.2 ÷ 5.9 daNm (38 ÷ 43 ft-lbs)

4 Install the torque converter group with the notch for the introduction of the balls directed toward the end of the output shaft.

1. PUMP WHEEL COVER
2. DIAPHRAGM COUPLING
3. TURBINE
4. STATOR
5. COUPLING CENTERING HUB
6. BUSHING
7. STATOR HUB
8. KEY
9. TAPER PLUG
10. PUMP
11. SEAL HOLDER COVER (OIL BAFFLE)
12. PUMP HUB
13. HYDRAULIC PUMPS DRIVE GEAR
14. SEAL
15. HYDRAULIC PUMPS DRIVE HUB
16. HUBS SUPPORT (STATOR SUPPORT)
17. TURBINE SHAFT

Power train

The engine power is driven to the transmission through the flywheel, the diaphragm coupling, the front cover, the converter pump, the turbine and the turbine shaft.

Oil flow run

The torque converter oil coming from the transmission control valve enters the converter wheel through the duct in the stator support.
As soon as the engine is started, the pump wheel starts rotating, projecting the oil from the vanes of the blades of the wheel (under the effect of centrifugal force) toward the vanes of the blades of the turbine wheel. The oil flows hits the vanes of the turbine at an angle that, in turn, rotates the turbine shaft. The reaction torque generated by the oil flow hitting the blades of the turbine, represents the output torque provided by the turbine shaft.
The stator diverts the oil flow coming from the turbine vanes, directing it into the pump vanes, thus creating an increase of the torque.
Part of the oil contained by the converter wheel is directed into the heat exchanger through the appropriate duct in the stator support. In correspondence with the oil inlet into the converter, a safety valve is fitted, discharging the excess oil in the converter housing.

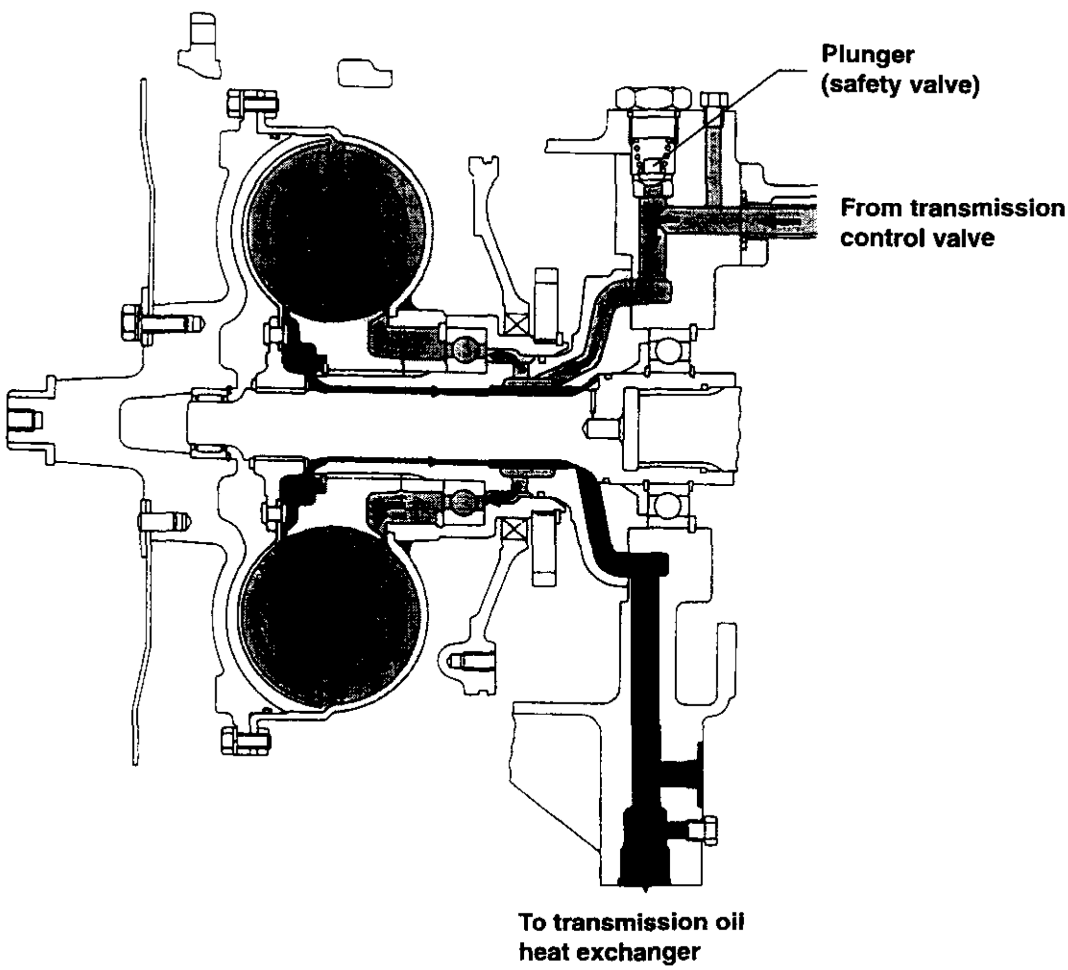


Fig. 2-9 Oil flow inside the torque converter

2.4 TRANSMISSION - TORQUE CONVERTER PUMP

The pump is mounted on the torque converter cover. It operates, through the control valve. the forward-reverse and speed clutches, it lubricates the inner components of the transmission, it charges the torque converter and also, pilots the parking brake by sending the pressurised oil required for releasing the brake of the machine.

Main specifications of pump:	
Type:	gear
Drive:	gear
Flow at rated speed:	68 + 23 l/min 95 + 31 l/min. (W130)
Engine/pump speed ratio	0.9375 : 1 0.845 : 1 (W130)

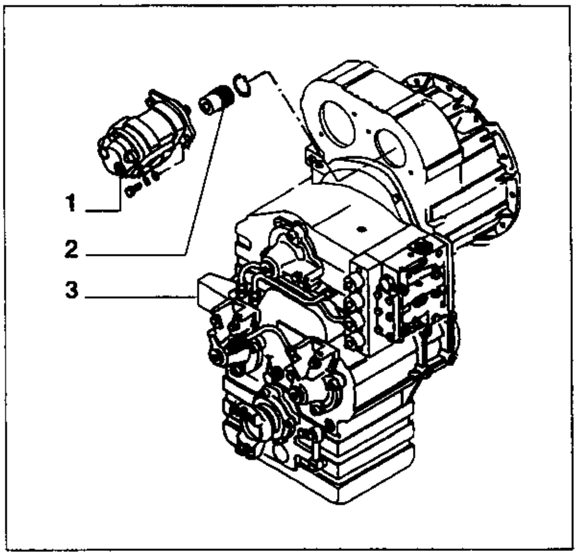


Fig. 2-10 Installation of pump on transmission/torque converter group

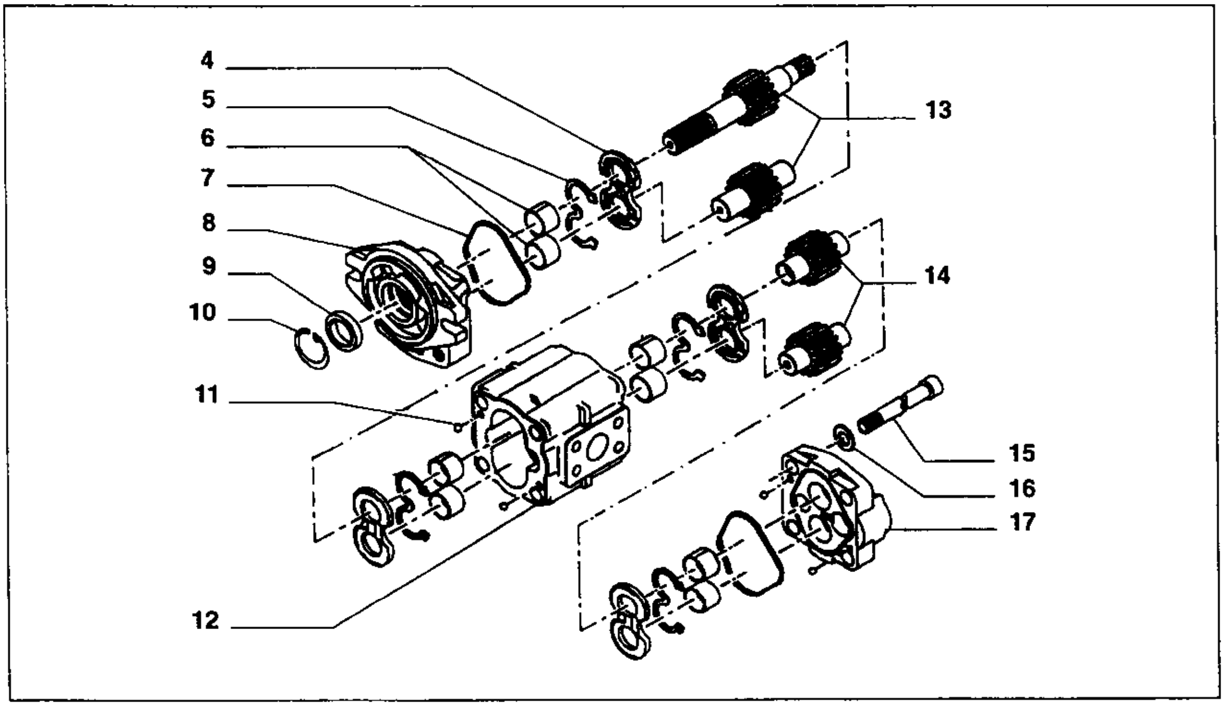


Fig. 2-11 Composition of transmission/torque converter pump

1. TRANSMISSION/CONVERTER PUMP
2. DRIVE SLEEVE
3. TRANSMISSION/TORQUE CONVERTER GROUP
4. PLATE
5. SEAL
6. BUSHINGS
7. SEAL
8. MOUNTING FLANGE
9. OIL SEAL
10. SNAP RING
11. BALL
12. PUMP BODY
13. GEARS
14. GEARS
15. SCREW
16. WASHER
17. COVER PLATE

2.5 TRANSMISSION

The transmission changes the speeds and the travel direction.

The transmission includes three clutch shaft groups, one inverter gear, one output shaft, a parking brake and a control valve.

2.5.1 DIRECTION CLUTCHES SHAFT

The direction clutches allow the engagement of power, under load, no matter what speed is engaged.

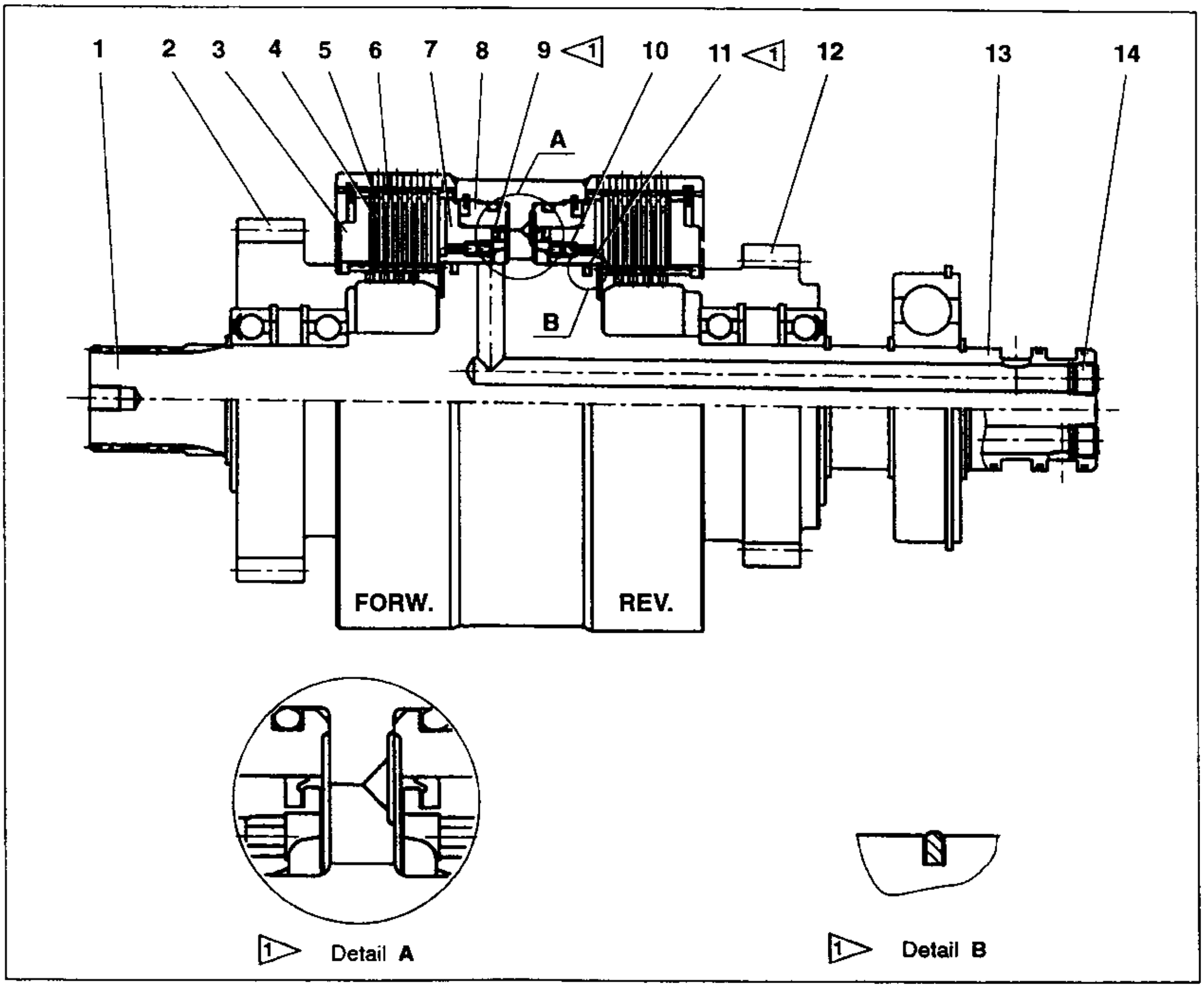


Fig. 2-12 Typical arrangement of the direction clutches shaft on models W110 and W130

Nota - Sliding surfaces: grease. (Pay attention to the mounting direction. Please refer to the enlarged views shown above).

1. SHAFT AND DRUM
2. GEAR
3. FINAL DISC
4. INNER TOOTHED DISC
5. RETURN SPRING
6. OUTER TOOTHED DISC
7. PISTON
8. SPACER
9. ASEALING RING (OUTER)
10. DISCHARGE VALVE
11. SEALING RING (INNER)
12. IGEAR
13. SEALING RING
14. PLUG

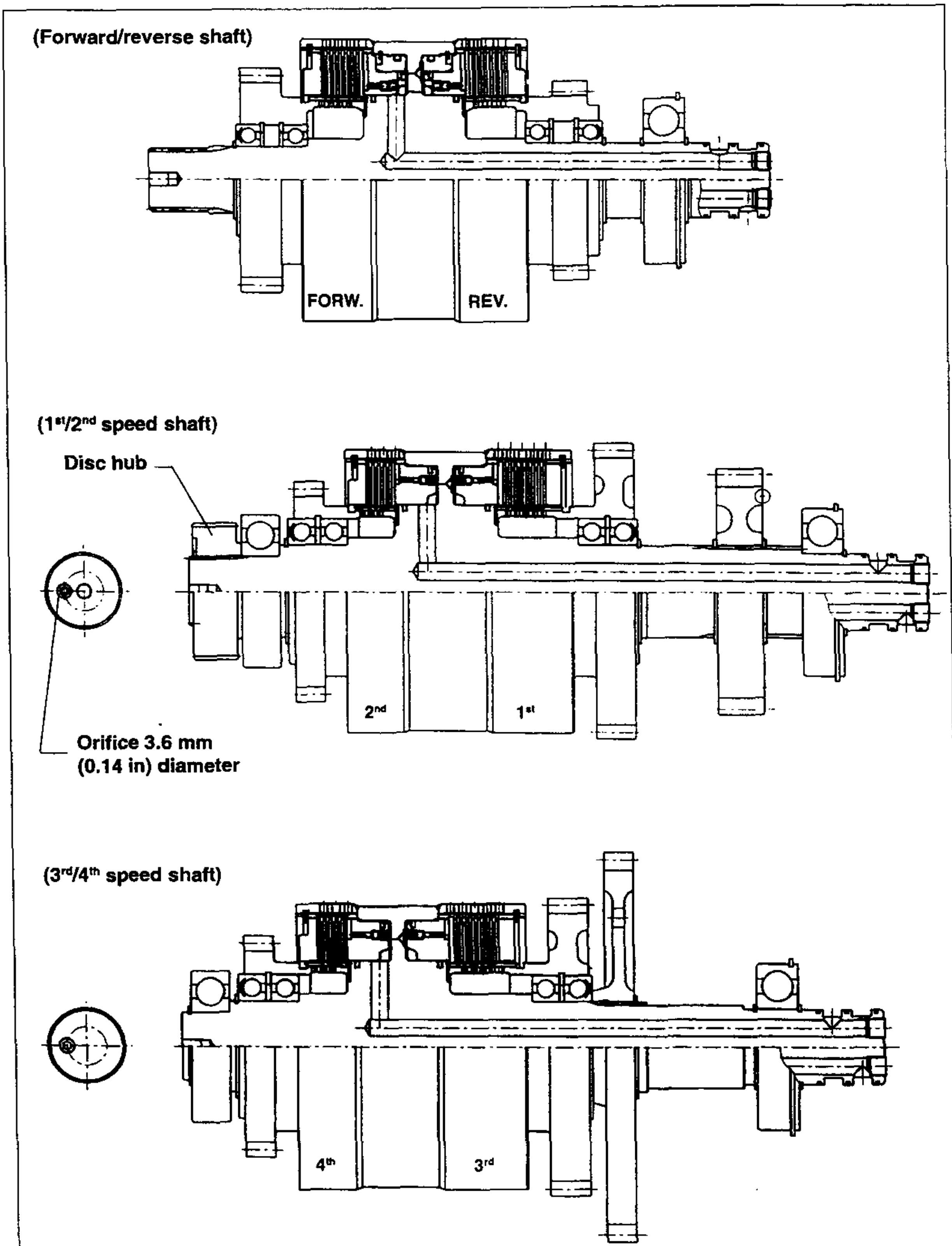


Fig. 2-13 Clutch shafts W110

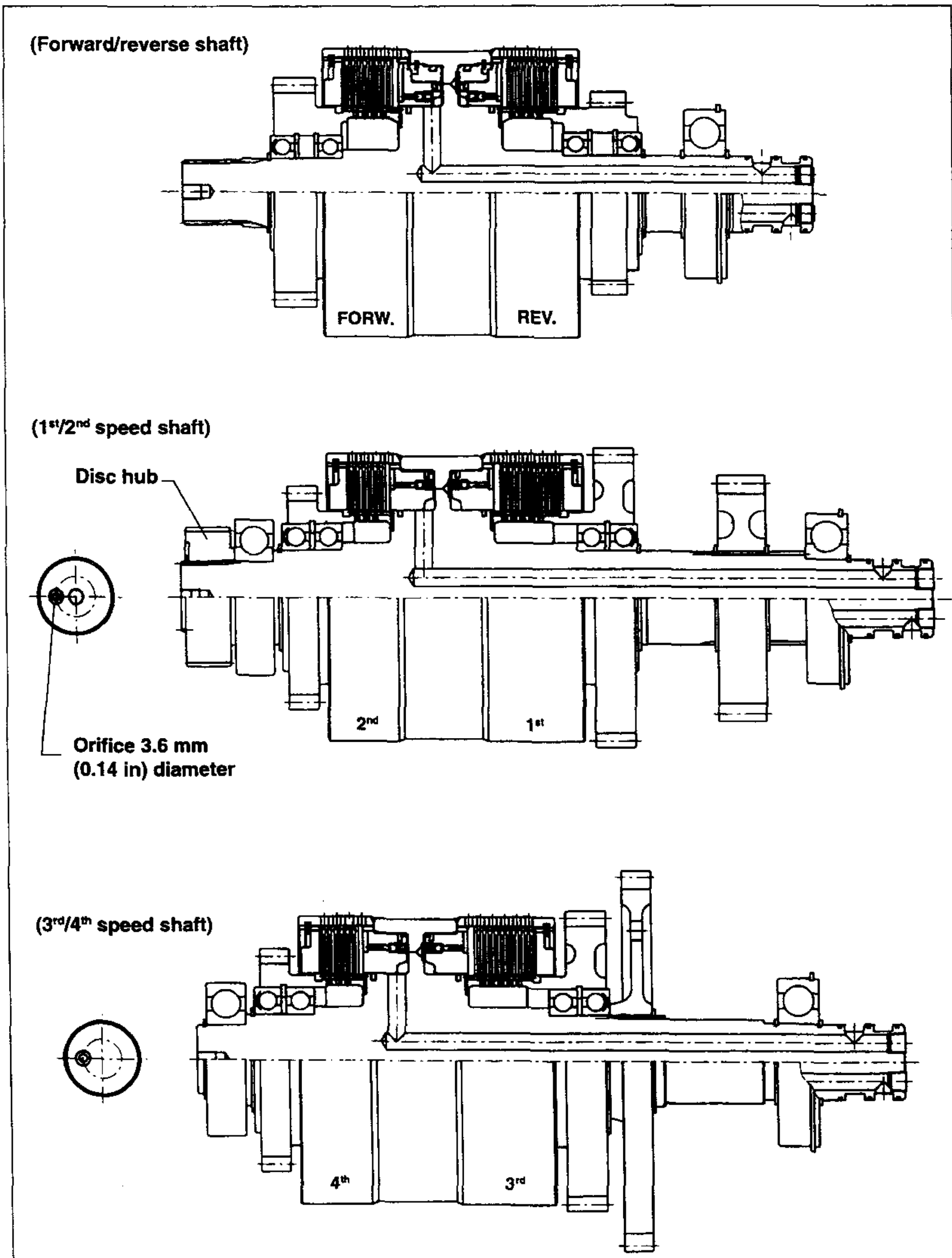


Fig. 2-14 Clutch shafts W130

OPERATION

The clutch is engaged by the oil under pressure flowing from the transmission control valve.
Pressurised oil flows through the distribution cover and the ducts in the clutch shaft reaching the rear side of the clutcton, moving it.

Then the clutch piston compresses the outer and inner disc fully, thus holding the clutch shaft with the clutch hub, allowing the driving of the power through the output shaft of the transmission.

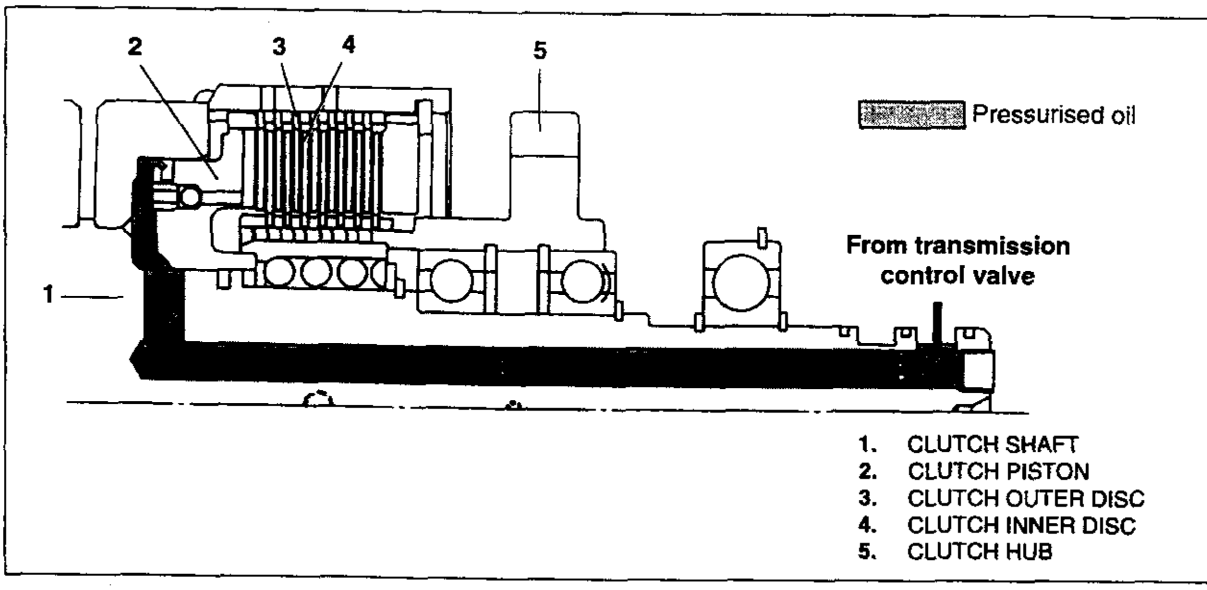


Fig. 2-15 Clutch engagement

When pressurised oil from the control valve is cut-off, the return spring moves the clutch piston backward, freeing the clutch inner and outer disc pack, allowing the clutch shaft and the clutch hub to rotate independently, thus avoiding the transmission of power to the output shaft of the transmission.

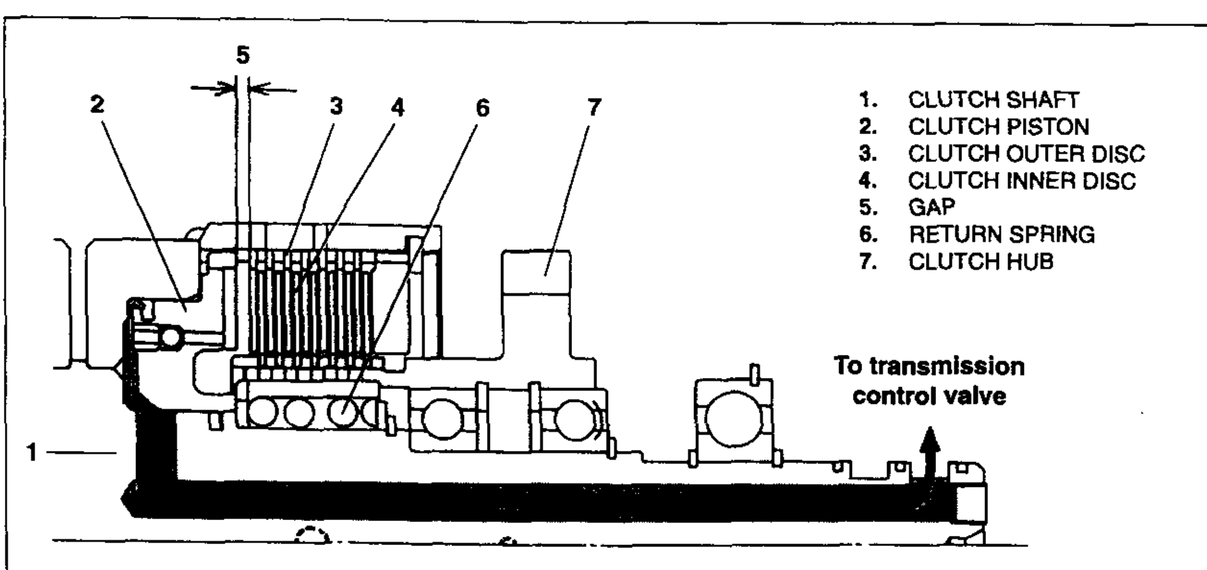


Fig. 2-16 Clutch disengagement

2nd SPEED CLUTCH ACCUMULATOR

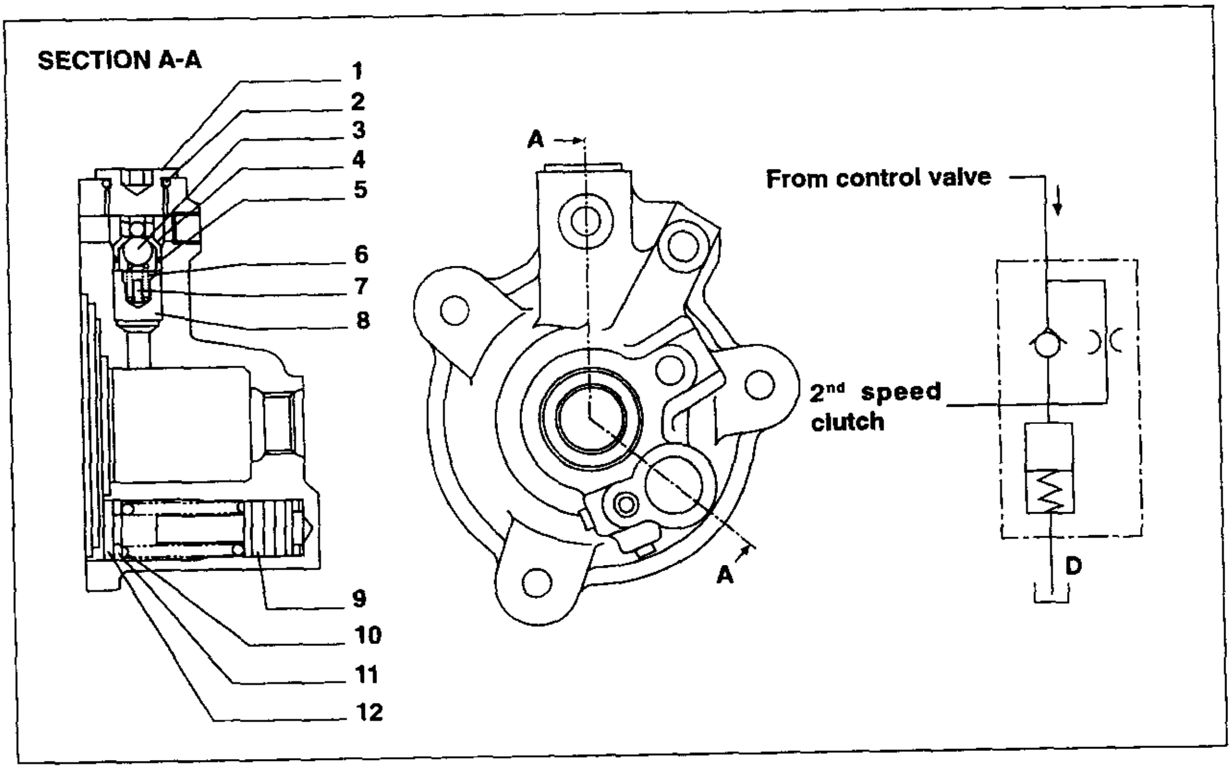


Fig. 2-17 1st - 2nd speed oil distribution cover

1. PLUG
2. O-RING
3. BALL
4. BALL SEAT
5. O-RING
6. SPRING
7. SPRING GUIDE
8. SPRING SEAT
9. PISTON
10. SPRING
11. WASHER
12. ELASTIC RING

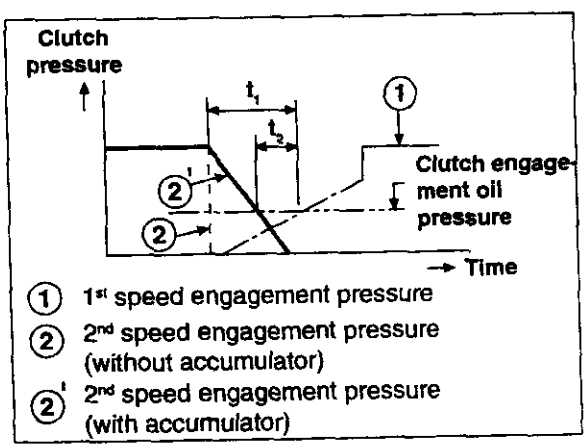


Fig. 2-18 Diagram of accumulator operation

The diagram of Fig. 2.18 shows the difference in the pressure dropping with and without accumulator. The engagement time t_2 of the first gear is definitely lower than the time t_1 occurring without the accumulator. This results into a practically constant availability of drive power during gear shiftings, preventing unwanted reversing of the machine, under the operation conditions described above.
The accumulator acts, also, in the same manner during normal gearshifting (from 2nd to 1st, from 2nd to 3rd).

Operation

1. When the 2nd gear is engaged, pressurised oil flowing out the control valve flows through the check valve, to the 2nd speed clutch pack and into the accumulator.
2. When from the 2nd gear the operator shifts to another speed, pressurised oil is discharged through an orifice, so that the oil pressure in the 2nd speed clutch decreases gradually.

2.5.2 POWER TRAIN DIAGRAM W110 - W130 (4th forward - 4th reverse)

1. Gearshift lever in neutral

When both the forward and reverse clutches are disengaged, the power driven from the torque converter rotates the forward-reverse clutches shaft, without driving the speed clutches.

2. Gearshift lever in forward

When both the forward and reverse clutches are disengaged, the power driven from the torque converter rotates the forward-reverse clutches shaft, without driving the speed clutches.

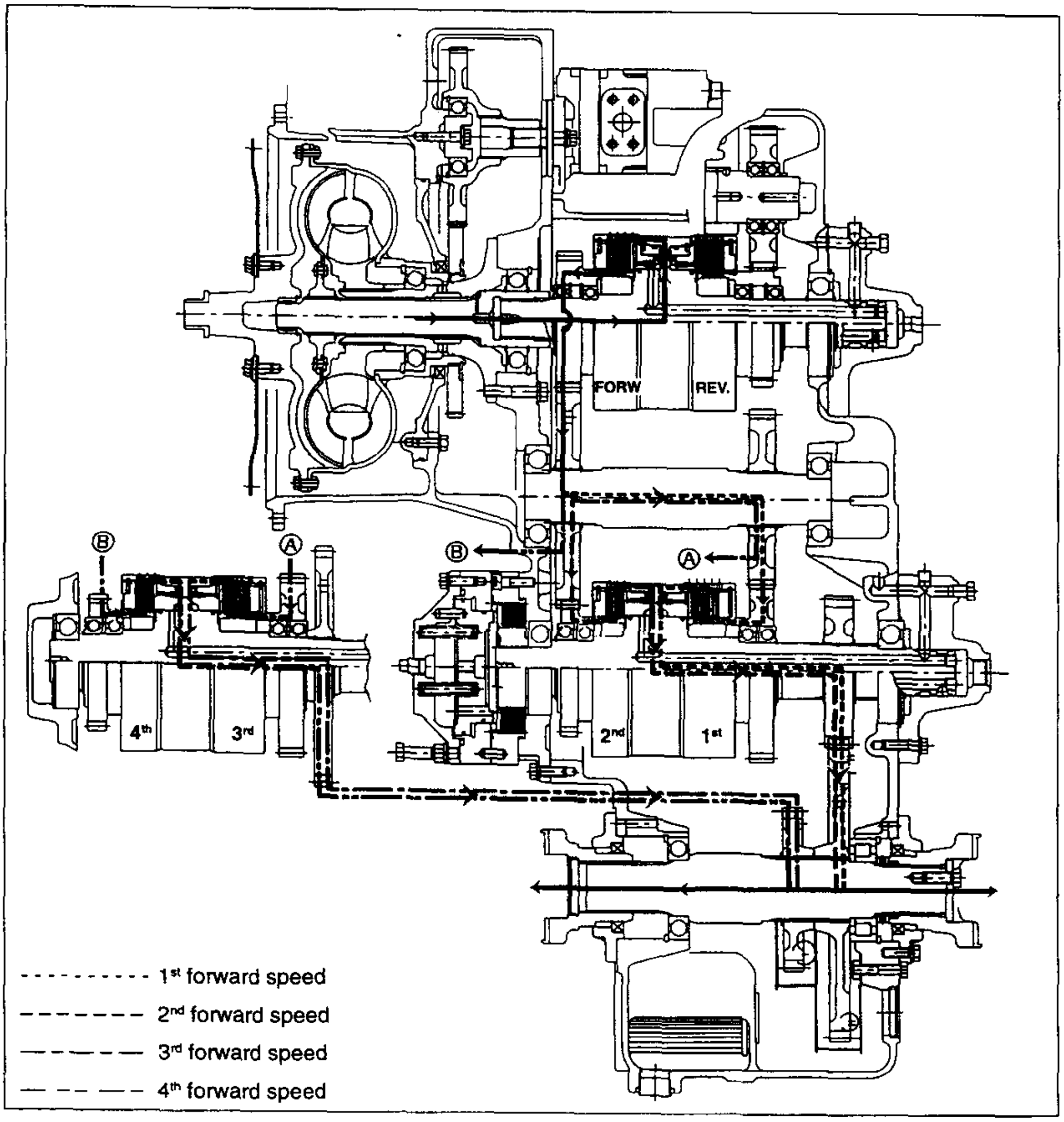


Fig. 2-19 Power train diagram in forward speed W110 - W130

3. Transmission gearshift lever in reverse

When the gearshift lever is in any of the four reverse gears, the power driven from the torque converter can reach the transmission output shaft through the forward clutch and the clutch of the speed selected.

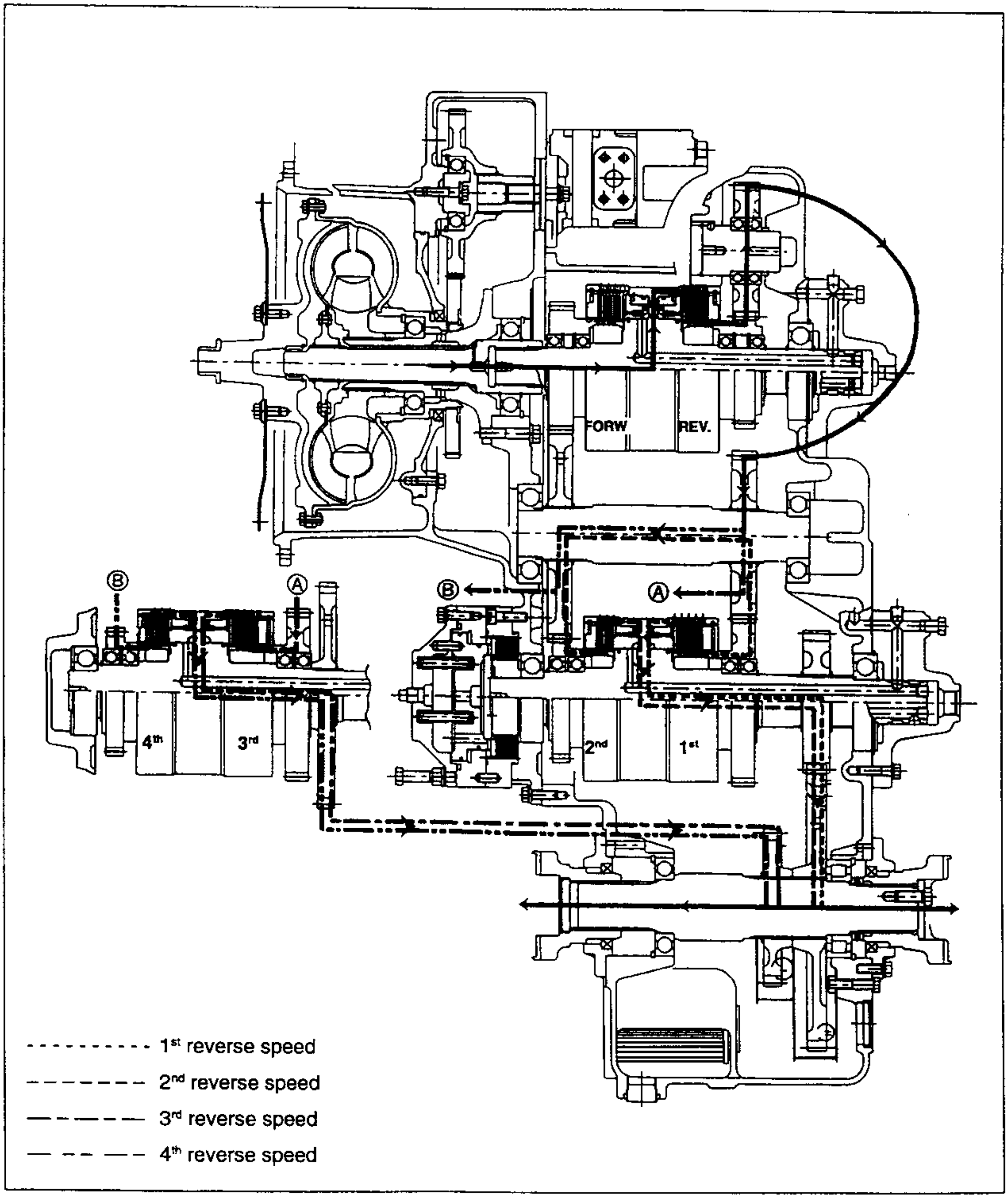


Fig. 2-20 Power train diagram in reverse speed W110 - W130

2.5.3 TRANSMISSION CONTROL VALVE

The transmission control valve allows the selection of the clutches receiving oil at the engagement pressure to shift direction and speed of the loader.

The control valve includes a body and 4 solenoid valves that are energised and de-energised by the transmission gearshift selector (control lever), to move the distribution spools regulating the oil under pressure.

The control valve is equipped, also, with a modulation device operating distinctly, depending upon the speed engaged. If the electrical system fails, it is possible to operate manually the control valve.

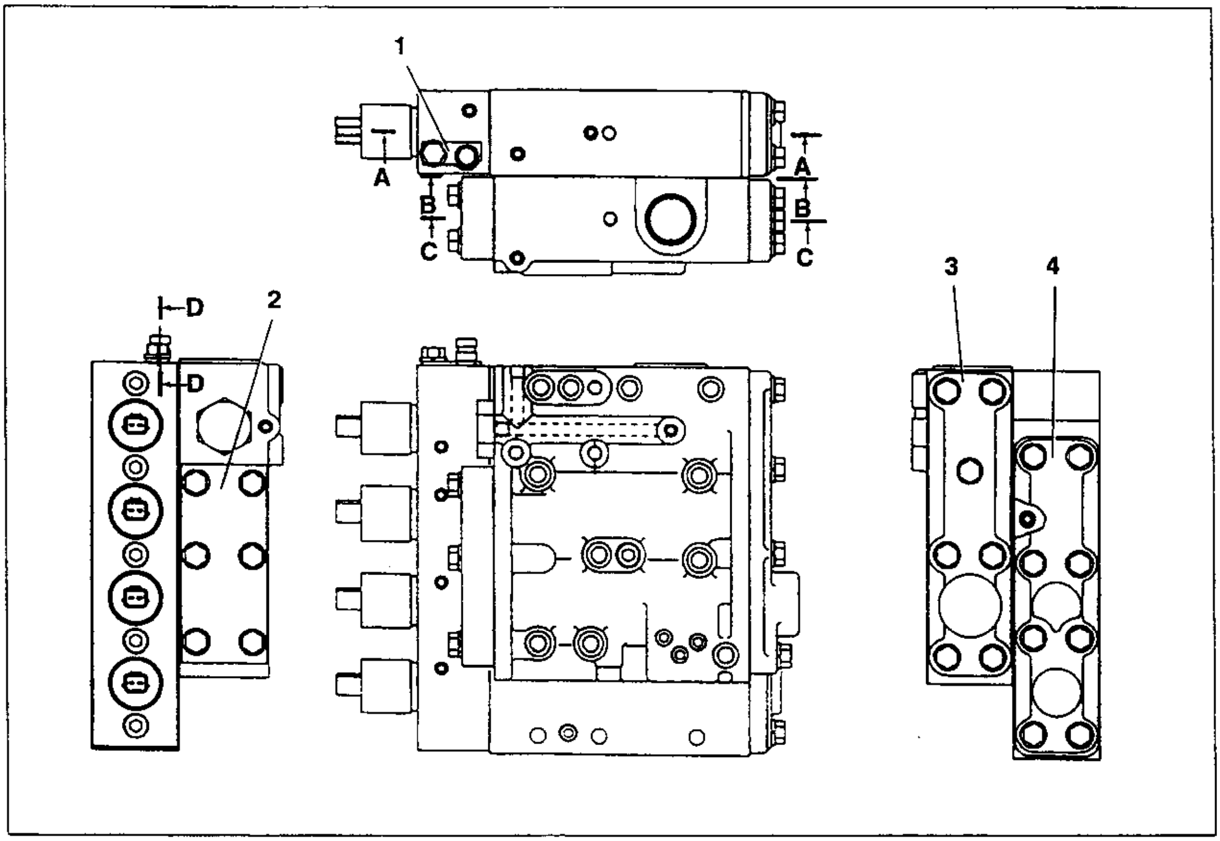


Fig. 2-21 Transmission control valve

1. PLATE (FOR MANUAL OPERATION)
2. COVER
3. COVER
4. COVER
5. SOLENOID VALVE
6. CONNECTION BLOCK
7. CONTROL VALVE BODY (LOWER)
8. FORW./REV. SELECTOR SPOOL
9. ADAPTER
10. SPRING
11. SPOOL (**A**)
12. SELECTOR SPOOL SPRING
13. SPOOL(**B**)
14. SELECTOR SPOOL SPRING
15. ORIFICE 0.8 mm (0.031 in) diam. (for SOLENOID VALVE)
16. ORIFICE [W] PASSAGE PLUG
17. ORIFICE [Z] PASSAGE PLUG see note
18. ORIFICE [Y] PASSAGE PLUG
19. ORIFICE [X] PASSAGE PLUG
20. CONTROL VALVE BODY (UPPER)
21. SPRING
22. FLOW VALVE
23. SPRING
24. PIN
25. ROD
26. INNER SPRING
27. INTERMEDIATE SPRING
28. OUTER SPRING
29. LOAD PLUNGER (**H**)
30. PRESSURE RELIEF VALVE
31. PLUNGER

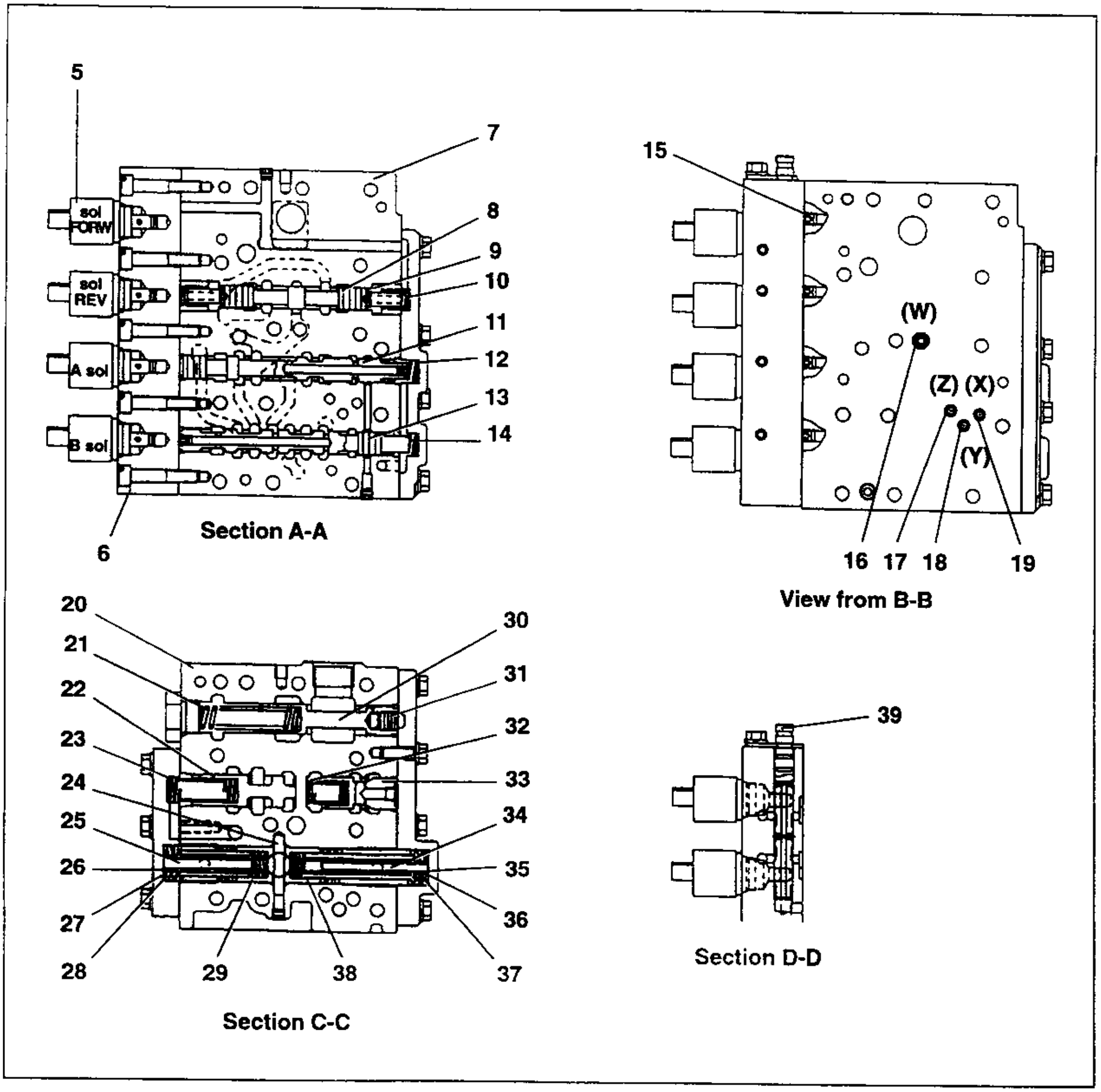


Fig. 2-22 Transmission control valve (2)

Note - Diameter of orifices in mm (inch)

Feeding orifice [W]	1st / 2nd orifice [X]	2nd orifice [Y]	3rd and 4th orifice [Z]
6.0 (0.24)	0.9 (0.035)	0.9 (0.035)	1.5 (0.059)

32. SPRING
33. MODULATING VALVE
34. ROD
35. INNER SPRING
36. INTERMEDIATE SPRING
37. OUTER SPRING
38. LOAD PLUNGER L
39. MANUAL SPOOL (FOR EMERGENCY TRAVEL SPOOL)

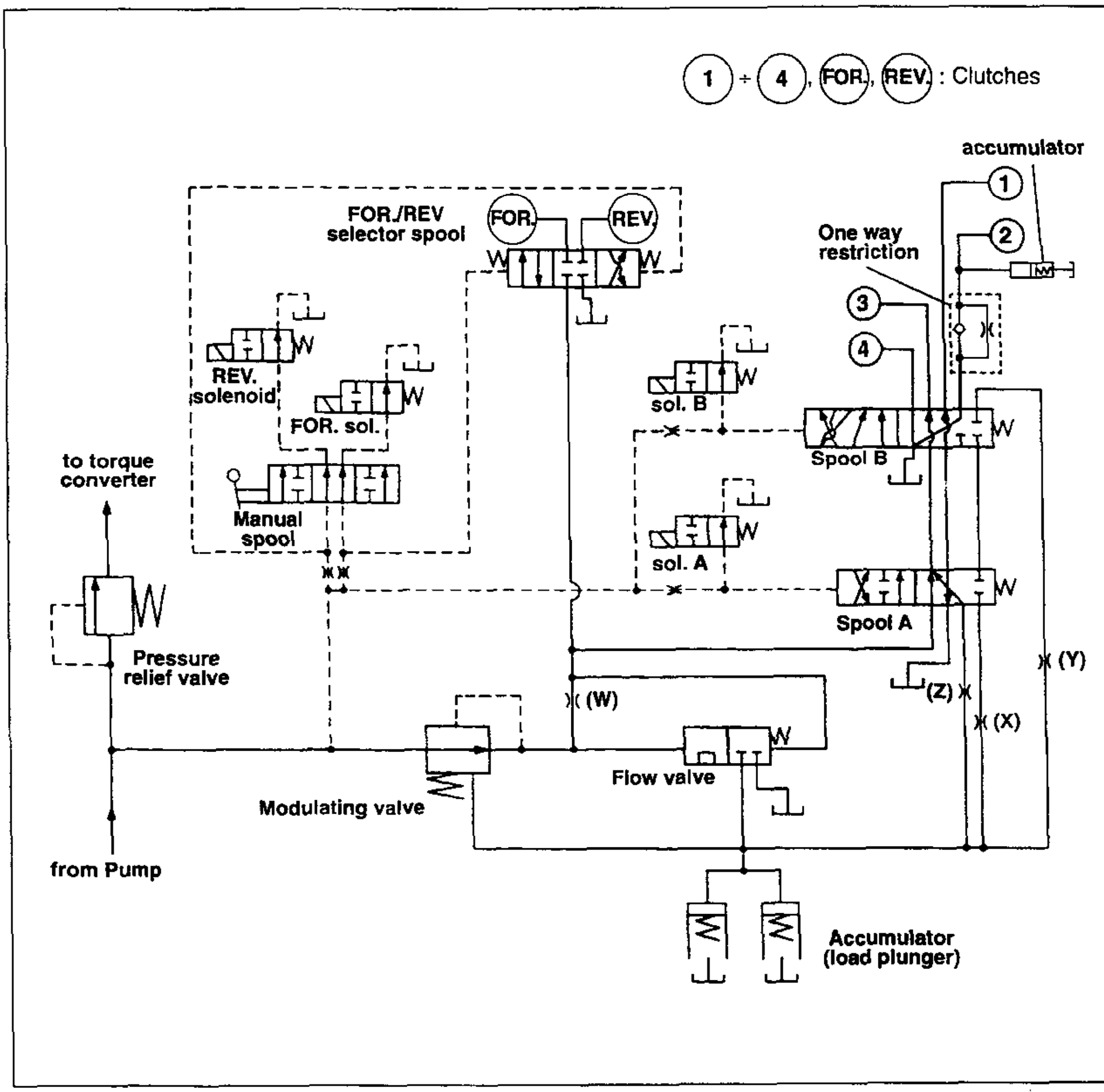


Fig. 2-23 Transmission control valve - Hydraulic system diagram

OPERATION

The modulating valve in this control valve changes the time required to increase the oil pressure to the clutch engagement value, i.e. it changes the pressure increment curve, in accordance with the transmission speeds, allowing a smooth gear shifting.

The intervention of the modulating valve is represented in the diagram by points **A - E**. The intervention of the solenoid valves and the manual spool (emergency travel spool) is explained in the pages to follow.

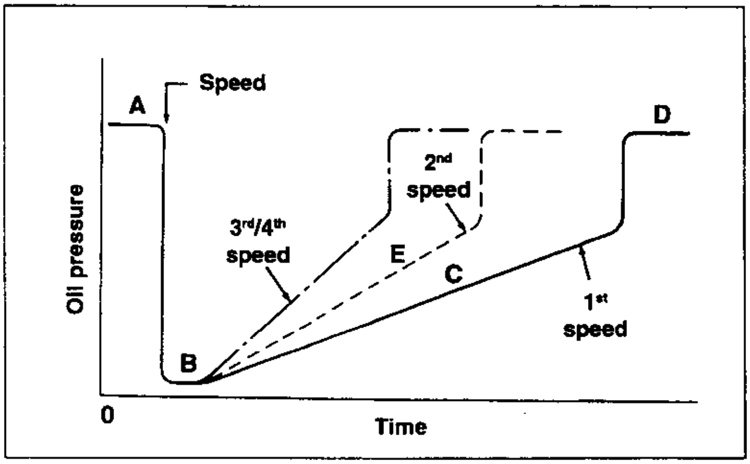


Fig. 2-24 Variation curves of clutches engagement oil pressure

Forw./Rev. in Neutral, 3rd speed in Neutral
(Point **A** of fig. 2-24)

1. The oil sent to intake port (**1**) of the control valve, flows through the small calibrated hole "**a**" of the pressure relief valve, filling chamber (**2**) behind the spool, moving it leftward, as indicated in the figure. The oil, at a pressure that has been regulated at the clutch engagement value, flows through circuit (**3**) reaching the modulating valve (**5**) circuit. Excess oil is discharged into the torque converter through circuit (**4**).

2. The oil in circuit (**5**) flows through the gap left open by the chamfer of the modulating valve plunger, reaching circuit (**6**), communicating, through orifice **[W]** with the circuits of the gear shift spool (**8**), of flow valve (**9**) and forward/reverse selector spool (**12**).

3. Oil sent into circuit (**8**) reaches, through (**8**) → (**16**) → (**17**) → (**18**) the piston chamber of the 3 rd speed clutch. The other clutches are connected to the discharge circuit.

4. The oil in circuit (**8**) flows through the axial hole of spool **A**, reaching circuit (**19**). Then, the oil goes through orifice **[Z]** and joins chamber (**20**) of the accumulator.
   In this chamber there are two load plungers, one for low pressure, the other for high pressure. After the movement of the low pressure plunger moves to contact the rod, the high pressure plunger starts moving.

5. The oil in circuit (**12**) is stopped by the FORW./REV. selector spool. Both the forward and reverse clutches are disengaged (neutral).

6. All solenoid valves are in "**OFF**" (not energised) condition, thus the oil reaching them through the relevant orifices is discharged.

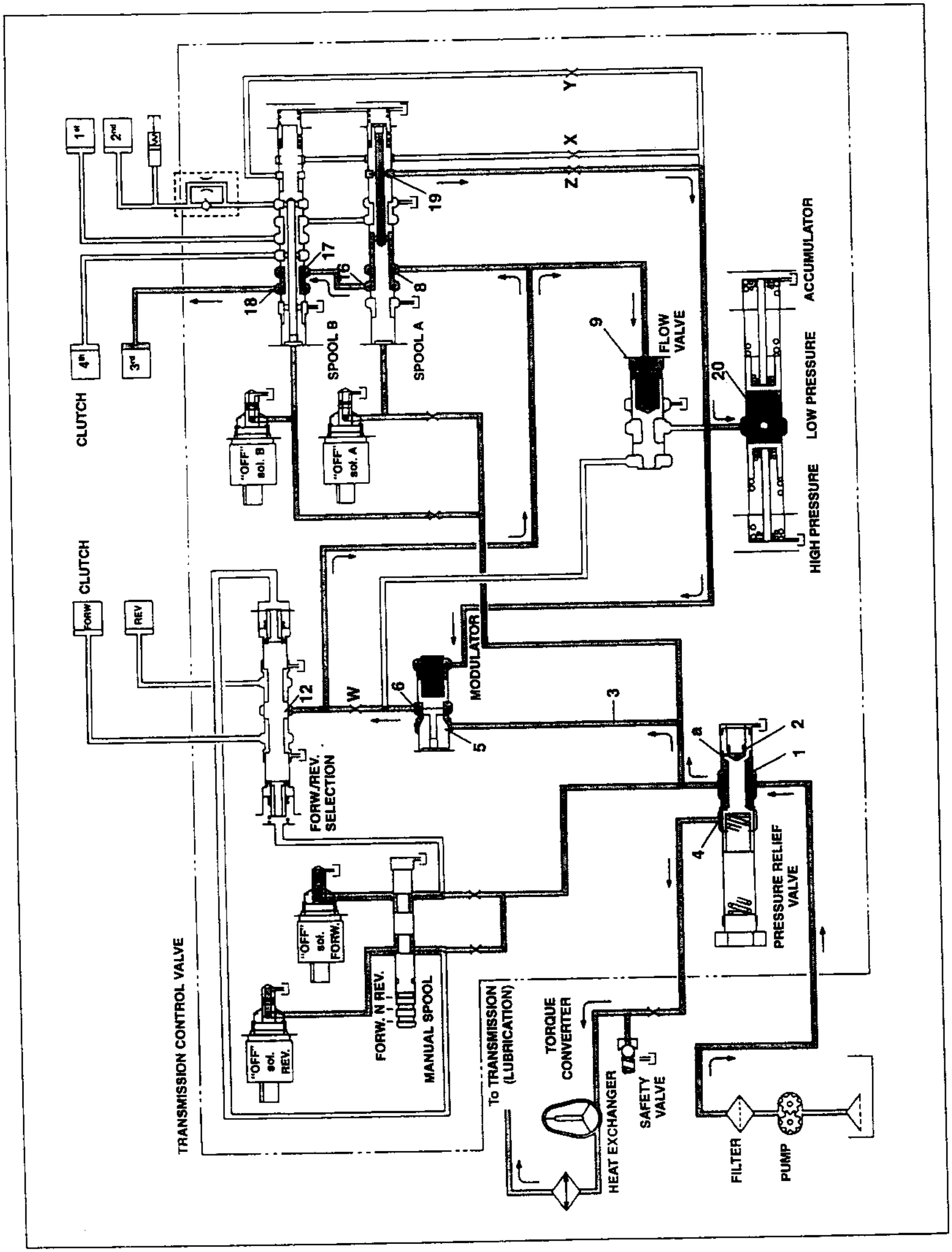


Fig. 2-25 In Neutral (3rd speed in Neutral)

Transmission in 1st forward
(Point **B** of fig. 2-24)

1. Solenoid valves **F** and **A** are energised.

2. With solenoid valve **AV** energised, the oil discharge is closed, so the oil flow coming from the pressure relief valve is forced to move toward circuit **(26)** where the FORW./REV. selector spool is located. The pressure created by this oil flow moves the FORW./REV. selector spool rightward, as shown in the figure.

3. In the same manner, with solenoid valve **A** energised, spool **A** moves rightward, as shown in the figure.

4. After the FORW./REV. selector spool movement, the oil from circuit (**12**) can reach circuit (**21**) where the FORW. clutch is located. During the oil filling of the FORW. clutch piston chamber, a pressure differential is created between the circuits (**6** for modulating valve, **22** for the left side-flow valve) upstream, and the downstream circuits (**8** of gearshifting selection spool **A**, **9** for the right side-flow valve, **12** for FORW./REV. selection spool), with respect to orifice [**W**]. The upstream circuit have a higher pressure).

5. The pressure difference between circuits (**9**) and (**22**) moves the flow valve plunger rightward, as indicated in the figure, discharging the oil of accumulator **(20)**.

6. The modulating valve plunger moves rightward, as shown in the figure, as a consequence of the pressure drop in circuit (**25**), letting only the quantity of oil due to circuits (**5, 6**) go through.

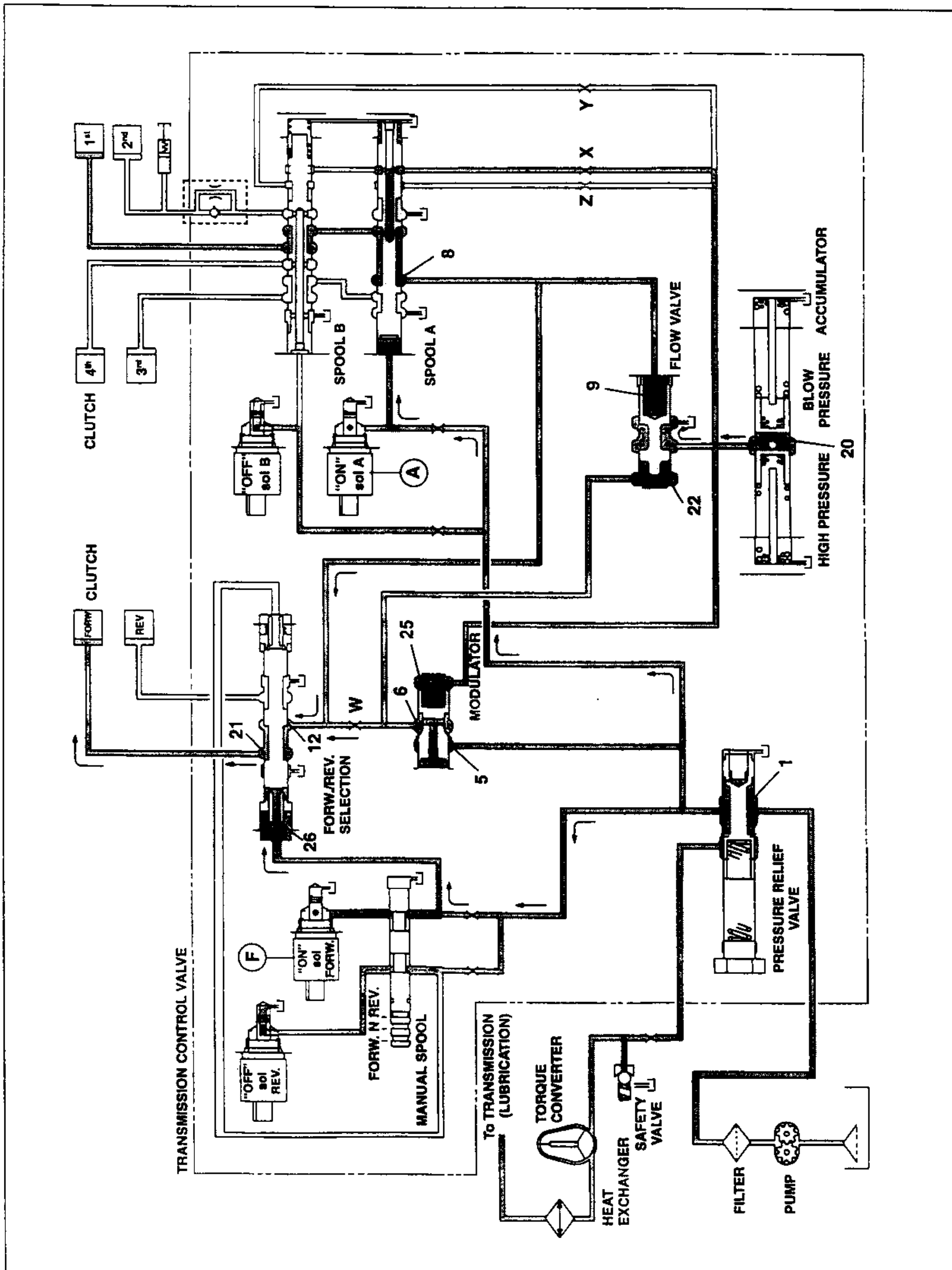


Fig. 2-26 Transmission in 1st Forward

Engagement of clutches
(Point **C** of fig. 2-24)

1. When the clutches selected have been filled with oil, the pressure differential before and after orifice [**W**] is eliminated, thus the plunger of the flow valve moves leftward, as shown in the figure, pushed by the spring, thus closing the oil discharge.
   The oil in circuit (**23**) flows through the axial hole of spool **A**, enters circuit (**24**), then goes through orifice [**X**] and enters chamber (**20**) of the accumulator.

2. At the same time, the oil flows through the gaps (**5, 6**) of the modulating valve and the holes in the plunger of the valve itself, moving into chamber (**7**) behind the plunger. Consequently, the plunger of the modulating valve moves gradually leftward for the combined effect of the oil pressure in chamber (**25**) and the spring, increasing gradually the engagement pressure of the clutch.

3. When the clutch engagement pressure reaches the pre-established value, the load plunger in chamber (**20**) of the accumulator stops against the rod.

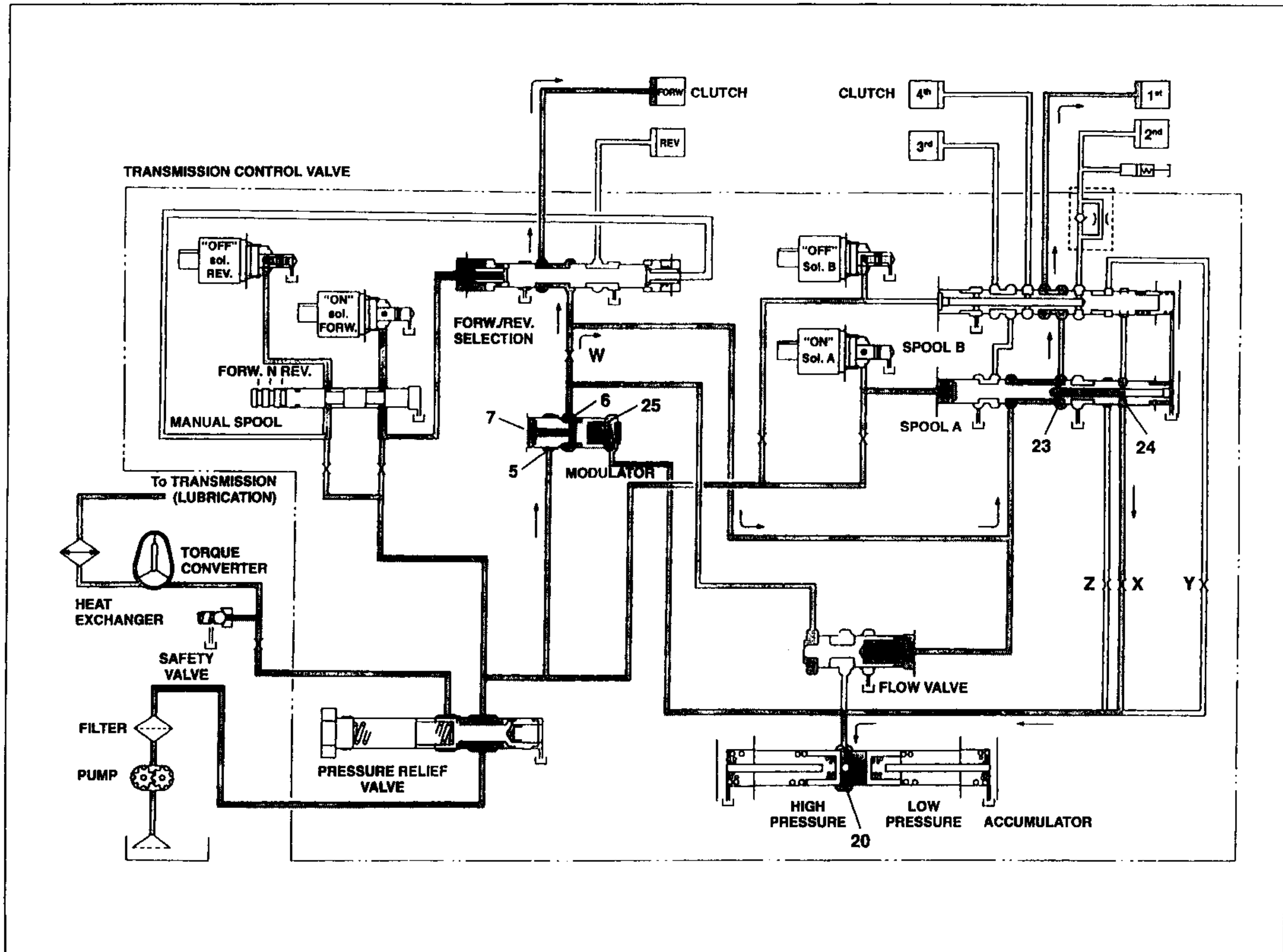


Fig. 2-27 Engagement of clutches (1st forward)

After the engagement of the clutches
(Point **D** of fig. 2-24)

1. As soon as the FORW. and 1st speed clutches are both engaged, the pressure in chamber **(20)** of the accumulator, has the tendency to increase, forcing the load plunger to move until it touches the stop rod (max. load).
   At the same time, the pressure increases also in chamber **(25)** of the modulating valve, until the pressure existing in the other side **(7)** of the modulating valve plunger is equalised. The plunger, in any case, moves leftward, as a consequence of the combined action of pressure and spring.
   At this point, the pressure has reached its maximum value, corresponding to the pressure setting of the relief valve.

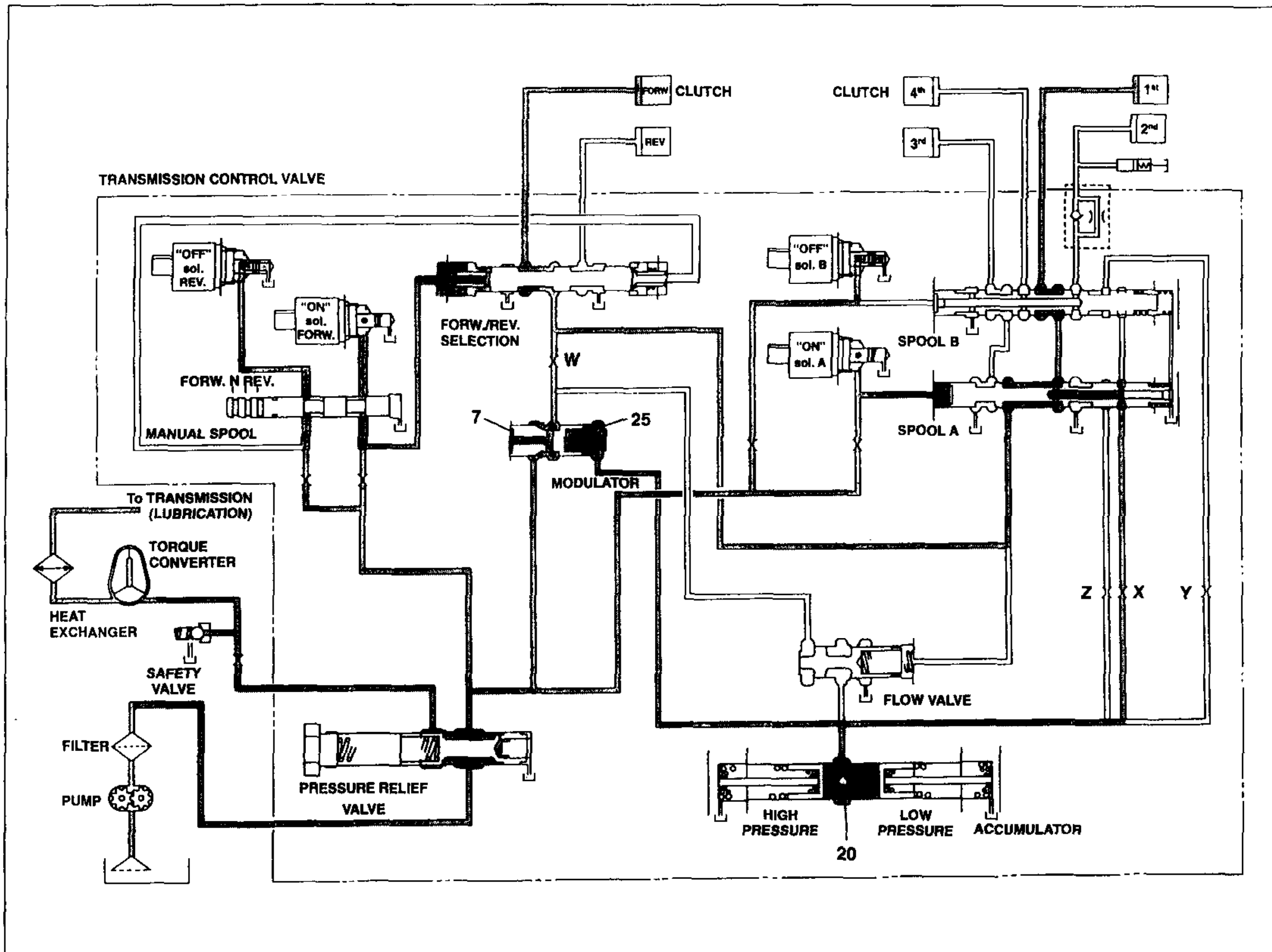


Fig. 2-28 Conditions with clutches engaged (1st Forward)

Engagement of Forward and 2nd speed clutches
(Point E of Fig. 2-24)

1. Being solenoid valves **A** and **B** energised, the gearshift spools **A** and **B** move rightward, as shown in the figure.

2. Oil entering circuit (**8**) from gearshift selector spool **A** can flow into circuit (**23**). Then, it feeds, through the holes in the spool, circuit (**24**) from which, part of the oil is channelled through orifice [**X**] into chamber (**20**) of the accumulator, whereas the remaining portion of the oil moves from circuit (**24**) into circuit (**27**) of gearshift selector spool **B**. From circuit (**27**) the oil crosses circuit (**28**) and orifice [**Y**] of circuit (**29**), flowing into chamber (**20**) of the accumulator.
   In other words, when the control lever is moved to 2 nd speed, the oil passes through orifices [**X**, **Y**], so that the time required to increment the clutch engagement pressure is lower than in the case of selection of the 1st speed.

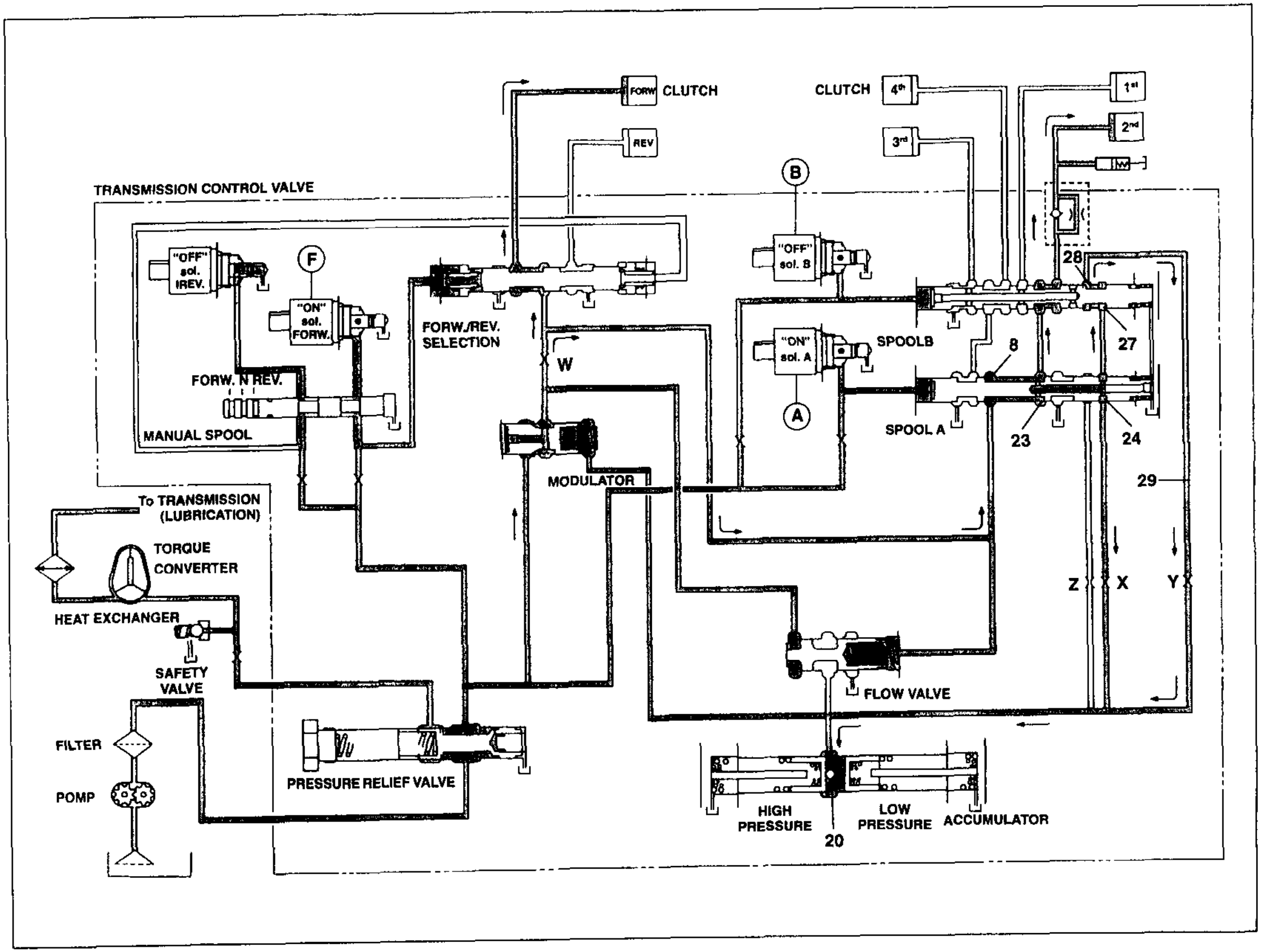


Fig. 2-29 Engagement of clutches (2nd speed Forward)

Operation of solenoid valves

Four solenoid valves are mounted on the lower side of the control valve.
The solenoid valves are energised by moving the gearshift lever located in the operator's compartment, to control the FORW./REV. selector spool and spools **A** and **B**.
The table on the side represents the solenoid valves being energised in correspondence with the speeds.
(●: solenoid valve energised).

		sol. FORW.	sol. REV.	sol. A	sol. B
FORW.	4th	●			●
	3rd	●			
	2nd	●		●	●
	1st	●		●	
REV.	1st		●	●	
	2nd		●	●	●
	3rd		●		
	4th		●		●

Solenoid valve not energised

The oil, at the pressure set by the relief valve, flows constantly through the orifice and enters the solenoid valve. When the solenoid valve is de-energised, the oil flows through it and is discharged.
The oil pressure in point **P** is 0 bar (0 psi).

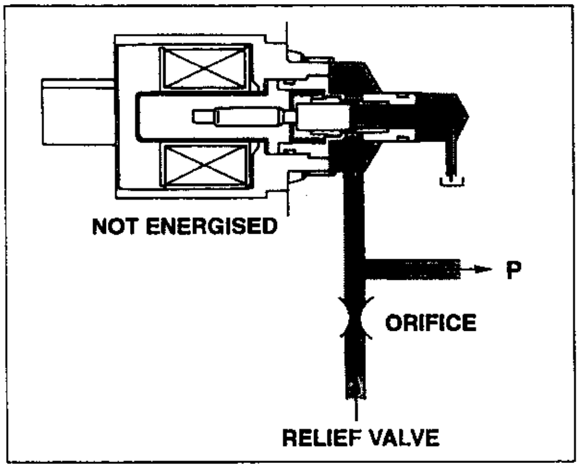


Fig. 2-30

Solenoid valve energised

When the solenoid valve is energised, it closes the oil passage through it, thus the oil is prevented from discharging. The oil pressure in point **P** becomes equal to the pressure set by the relief valve. The travel direction and the speed gearshifting is actuated by the action of this pressure on FORW./REV. selector spool and transmission spools **A** and **B**.

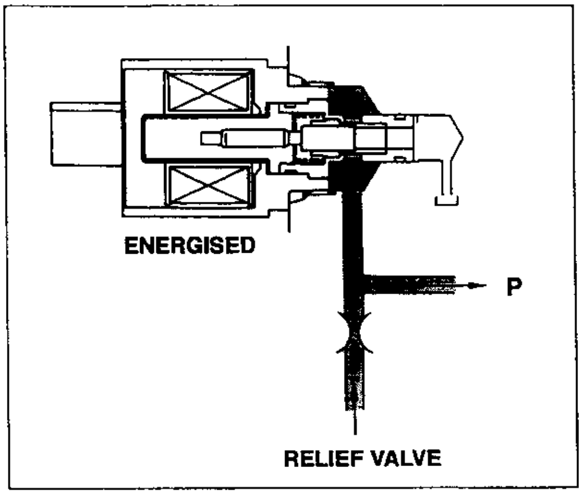


Fig. 2-31

Operation of manual spool (emergency travel)

Should the solenoid valves fail to operate correctly due to a cut-off electrical connection or any other electrical fault, it is possible to actuate the transmission control valve in 3rd forward or reverse, using this spool.
It is recommended that this spool is used when the loader can me moved away from a traffic area or to be repaired.

WARNING

Ensure that the engine is not running prior to operate the manual spool. Should the spool actuated when the engine is running, the loader could move suddenly, causing accidents.

a. Transmission in 3rd Forward

To shift into 3rd forward, pull-out the manual spool about 10 mm (0.39 in).

1. The oil, at the pressure set by the relief valve, goes through the orifices and reaches the circuits of the manual spool (**31, 32**). Since circuit (**31**) is blocked by the spool, the oil is diverted from circuit (**33**) into circuit (**26**) of the FORW./REV. selector spool, moving it rightward, as indicated in the figure, so that the oil pressure in the FORW. clutch increases.
2. The oil of circuit (**32**) goes through the spool and the REV. solenoid valve to be discharged.
3. Being both solenoid valves **A** and **B** of the gear-shift spools not energised, the pressure in the 3rd speed clutch increases (refer to Fig. 2-24). Consequently, the loader will travel in 3rd forward.

b. Transmission in 3rd reverse

To shift into 3rd reverse, push-in the manual spool about 10 mm (0.39 in).
The operation principle is the same as in the case of 3rd forward.

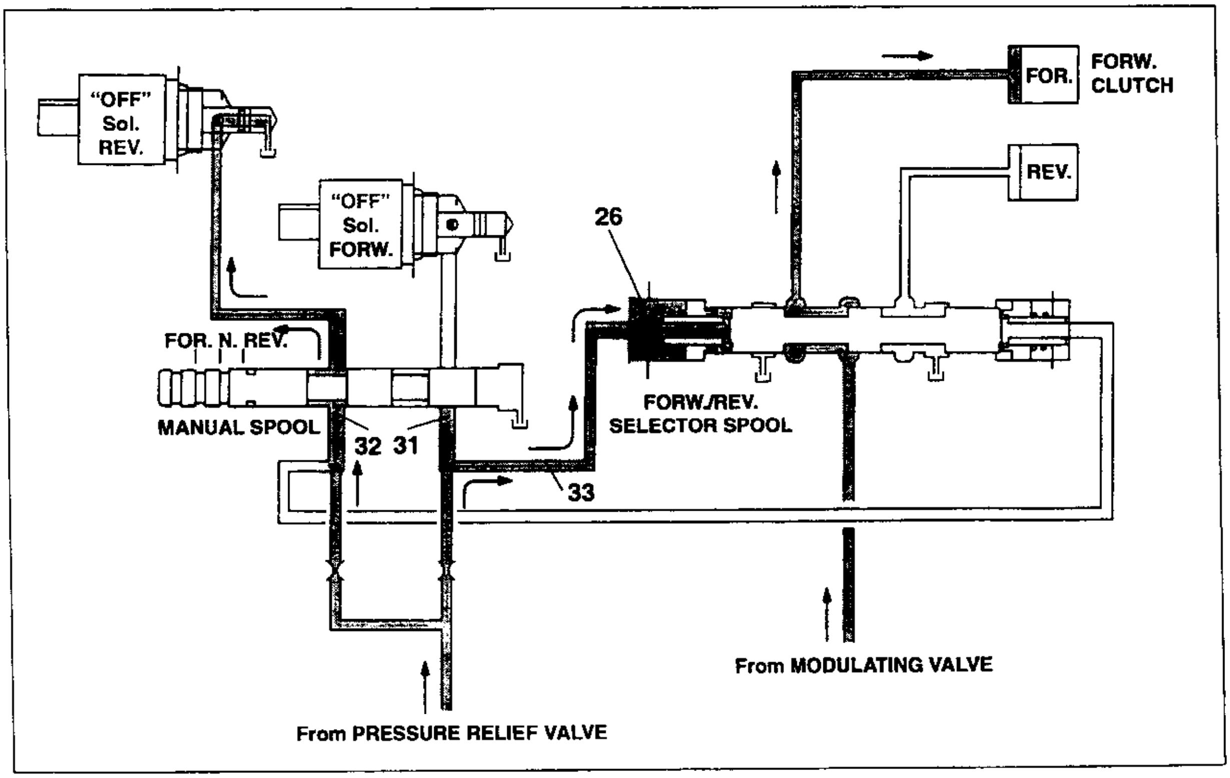


Fig. 2-32 Operation of manual operation (FORW.)

2.5.4 TRANSMISSION CONTROL SYSTEM

The transmission control system is of an electric type, with solenoid valves in the transmission control valve, being energised or de energised, when the gearshift lever (transmission control selector) is actuated, deviating the oil into various ducts connected to the transmission clutches, thus allowing the selection of the desired speed.

The transmission control system is composed of a control lever, a kick-down button switch, two kick-down relays, one neutral relay (transmission neutraliser).

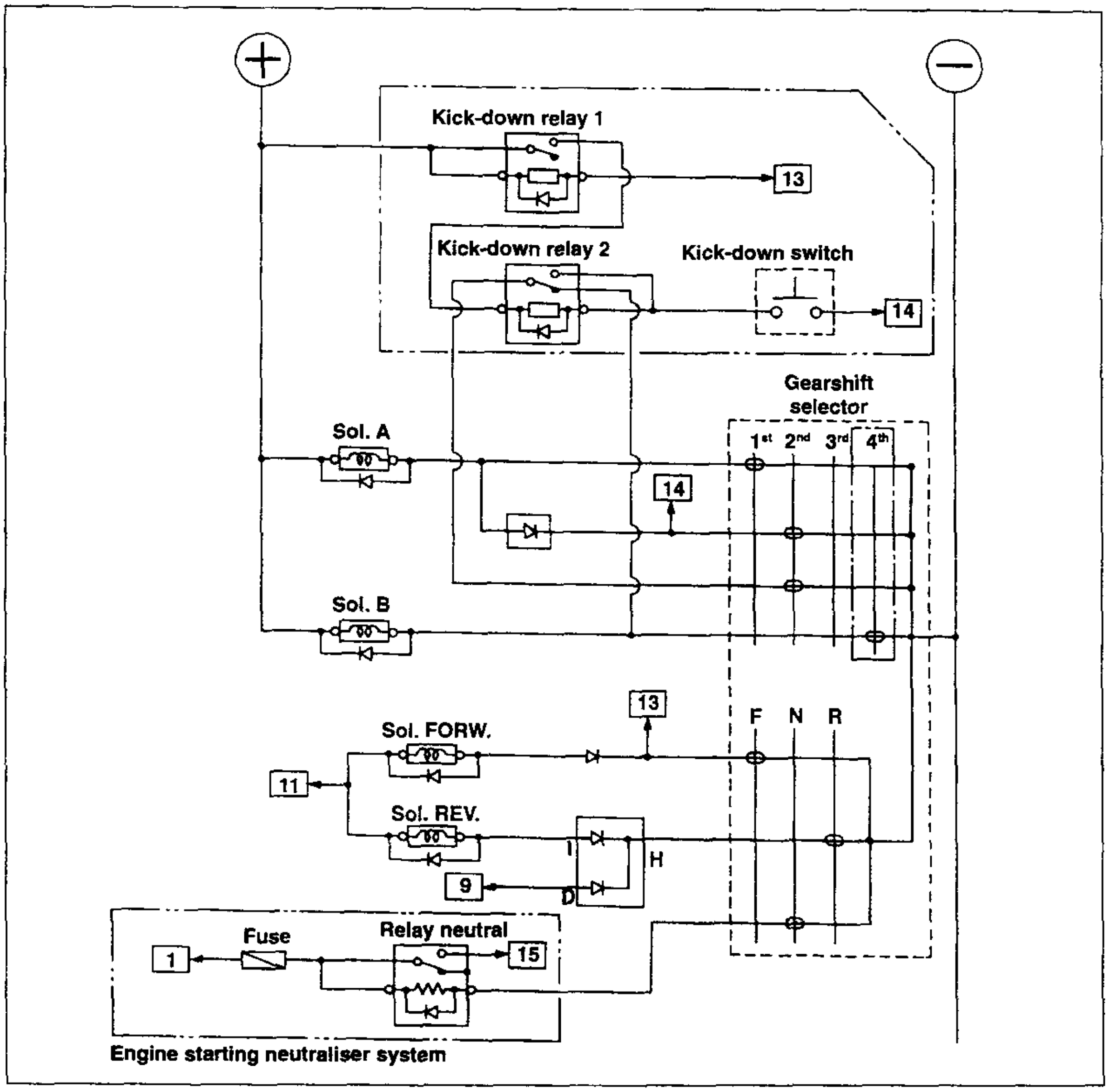


Fig. 2-33 Diagram of transmission control electrical system

Note - 11 from parking relay (electric power)

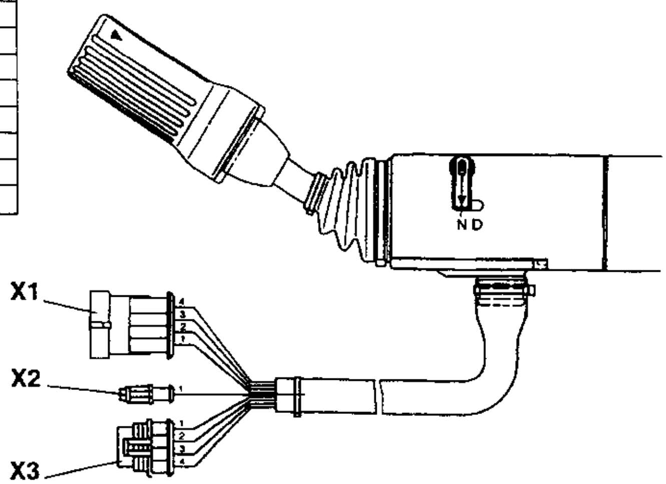
1 from starter switch "C"

9 from reverse indicator relay

15 from neutraliser relay "S"

Control selector for models W110 - W130

CONNECTIONS	WIRE	TERMINAL	COLOUR
X1	1	VP	RED
	2	E	YELLOW
	3	F	PINK
	4	G	GREY
X2	1	B	WHITE
X3	1	C	BROWN
	2	D	GREEN
	3	A	BLUE
	4	H	VIOLET

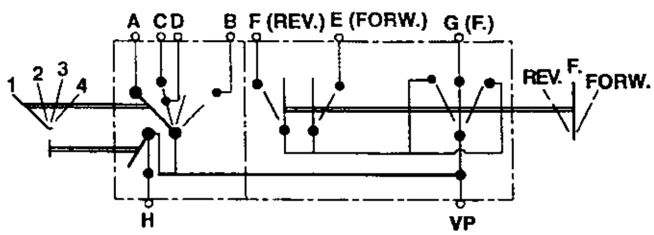


TABLEOF THE SOLENOIDS ENERGISED IN RELATION WITH THE SPEED SELECTED BY THE GEARSHIFT

FORWARD	SOLENOIDS				RELAY
	A	B	FORW.	REV.	NEUTRAL
1st	1	0	1	0	
2nd	1	1	1	0	
3rd	0	0	1	0	
4th	0	1	1	0	
NEUTRAL	SOLENOIDS				
					1
REVERSE	SOLENOIDS				
	A	B	FORW.	REV.	
1st	1	0	0	1	
2nd	1	1	0	1	
3rd	0	0	0	1	
4th	0	1	0	1	

(1) SOLENOID ENERGISED
(0) SOLENOID NOT ENERGISED

Speed selected
1 = 1st speed
2 = 2nd speed
3 = 3rd speed
4 = 4th speed



Transmission selector electrical system

Fig. 2-34 Transmission control selector

Engine starting in neutral neutralising system

The engine starting in neutral neutralising system prevents the starting of the engine if the gearshift lever is not in neutral. This prevents sudden movements of the loader when the starter switch is moved to START.
Make sure that the gearshift lever is in neutral prior to starting the engine.
The engine starting neutraliser system is incorporated in the engine starting system circuit.

Operation

1. When the starter switch is moved to START and the gearshift lever is in neutral, the neutral relay is closed, allowing the passage of electric power through the safety relay, thus powering the starter motor (of the engine).

2. When the starter switch is moved to START and the gearshift lever is not in neutral, the neutral relay is open, preventing the passage of electric power through the safety relay. Thus, the engine cannot be started.

KICK-DOWN device (speed kick-down button)

When the kick-down button is pushed, the KICK-DOWN device allows loading operations in a more efficient and faster manner, without moving the gearshift lever.
The device is composed of a kick-down button, incorporated in the boom/bucket control lever handgrip, and two relays for the speed kick-down.

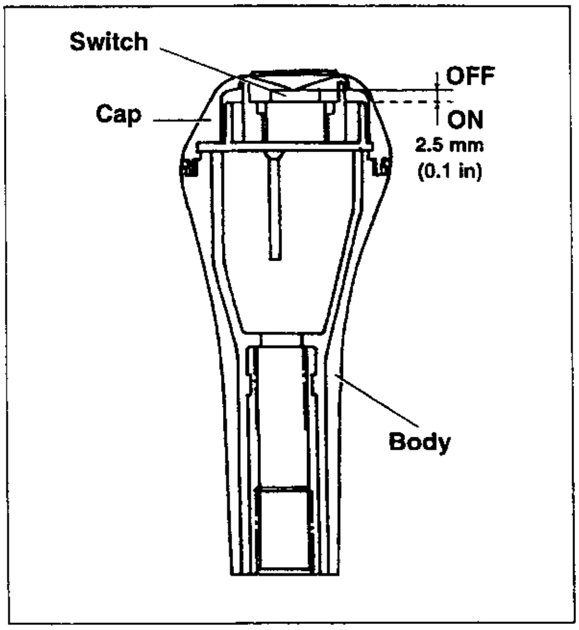


Fig. 2-35 Speed KICK-DOWN button

Operation of the KICK-DOWN device

When the loader starts digging in 2nd forward, by actuating the KICK-DOWN device, the relevant relay is actuated, thus the transmission is automatically shifted into 1st gear, providing more power to the front equipment.
When the gearshift lever is moved to reverse, after the loading or digging operation, the transmission is automatically shifted back to 2nd speed, to obtain a faster travel in reverse,
In other words, with the kick-down device it is possible to control both the digging force of the bucket and the travel speed of the loader, by actuating the bucket control lever only (kick-down button), with the gearshift lever in 2nd speed, during the bucket loading or digging operation.

Operation of the electrical system of the KICK-DOWN device

Gearshift lever in 2nd forward

1. When the gearshift lever is moved into 2nd speed, solenoid valve **F** is energised by power "**a**", whereas relay **1** is actuated by power "**b**".

2. Solenoid valve **A** is energised by power "**c**" whereas solenoid valve **B** is energised by power "**d**". *Consequently, the transmission engages the* 2nd forward.

Actuating the KICK-DOWN device

1. When the KICK-DOWN device is actuated, relay **2** is activated by power "**e**", that in turn, cuts-off power "**d**" to solenoid valve **B**, de-energising solenoid valve **B**. Thus, the transmission shifts to 1st speed.

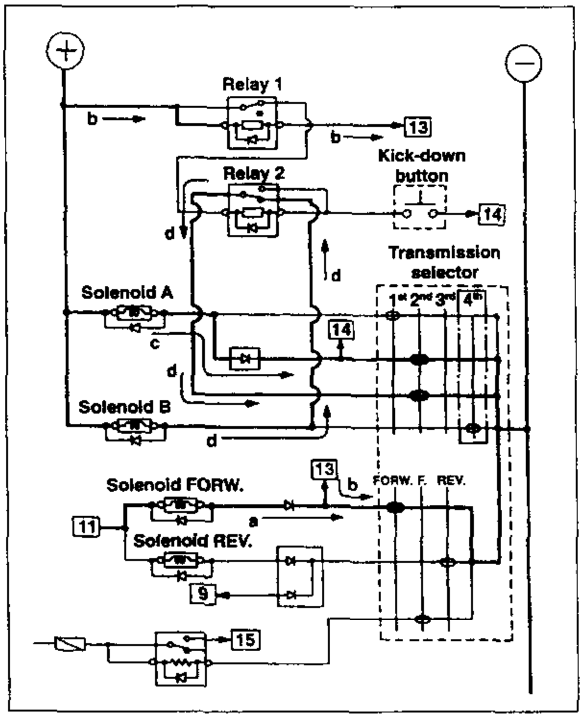


Fig. 2-36

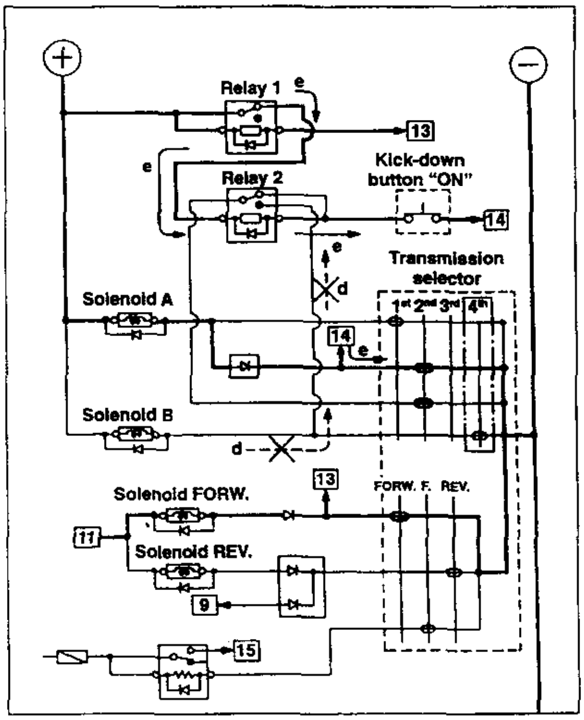


Fig. 2-37

2. At the same time, power "f" appears, allowing relay **2** to remain self energised, thus it stays activated also after the KICK-DOWN button device is released.
   Consequently, the transmission stays in 1st speed after the KICK-DOWN device is de-activated.

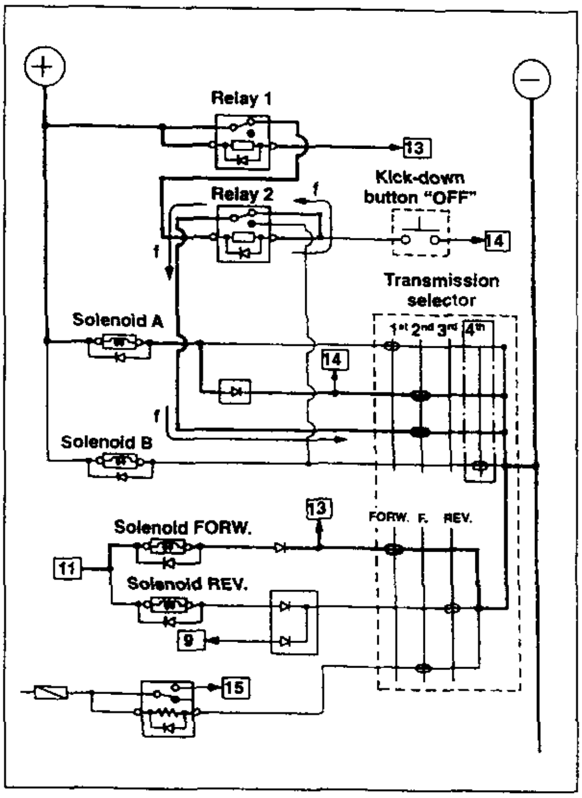


Fig. 2-38

Transmission in reverse direction

1. When the gearshift lever is moved to reverse, power "**b**" is zeroed, thus relay **1** is de-activated. This causes the cut-off of power "f" at relay **2** causing also the opening of relay **2**.

2. Power "**d**" energising solenoid valve **B** is re-established, thus shifting into 2nd speed.

3. Also, solenoid valve "REV." is energised by power "**g**" to engage the transmission in 2nd reverse.

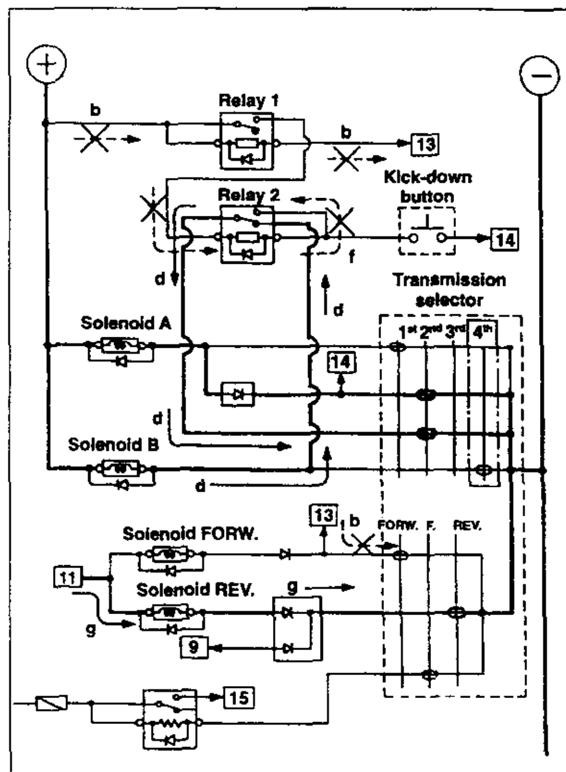


Fig. 2-39

2.5.5 CONFIGURATION OF AUTOMATIC TRANSMISSION (Var. W110 - W130)

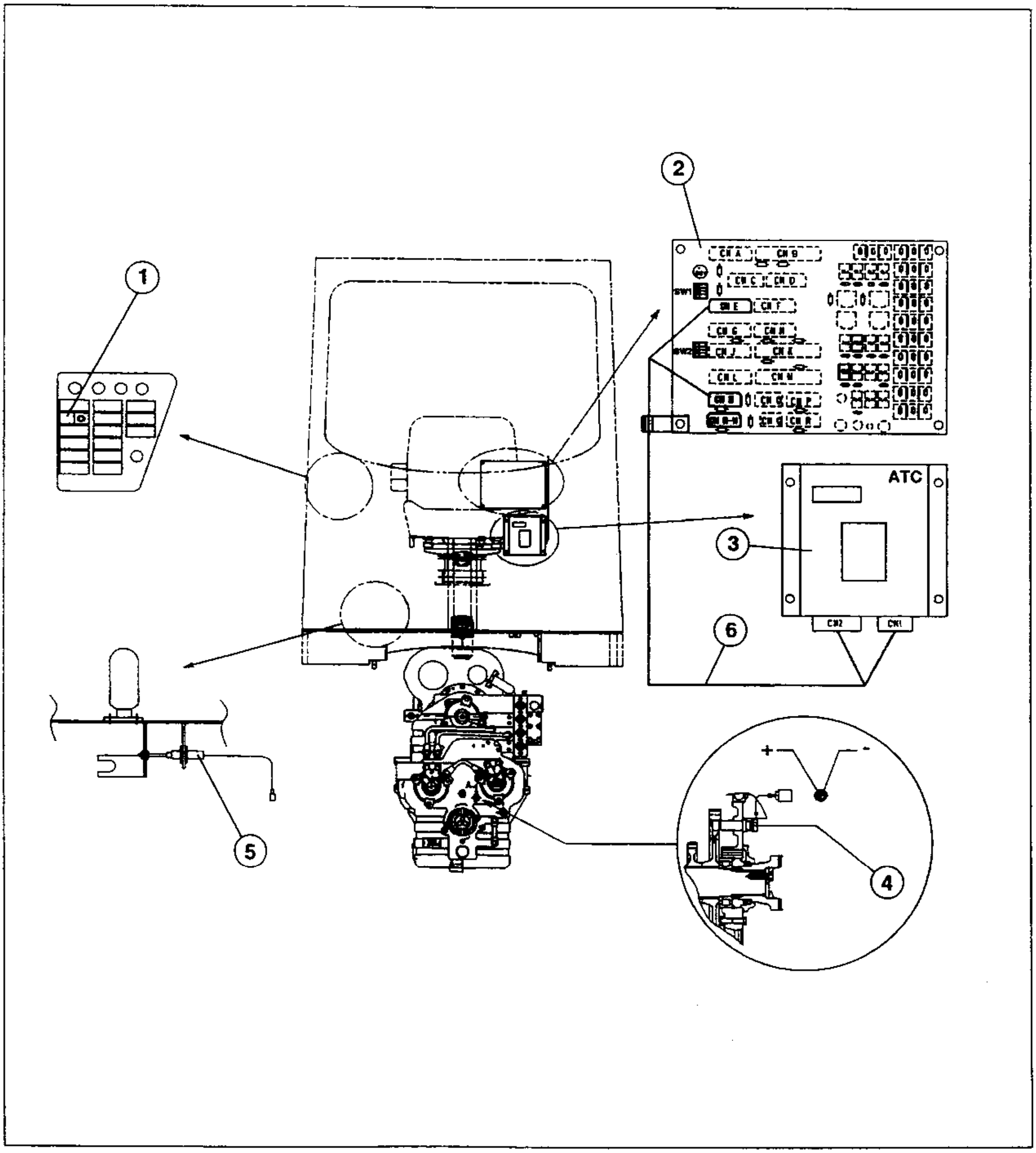
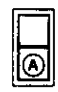


Fig. 2-40 Automatic transmission

1. AUTOMATIC TRANSMISSION TURNING ON BUTTON
2. LOGIC BOARD
3. AUTOMATIC TRANSMISSION "ATC" ELECTRONIC UNIT
4. TRANSMISSION SPEED SENSORS
5. ACCELERATOR PEDAL SENSOR
6. "ATC" UNIT CONNECTING WIRE

To convert models W110 and W130 from the mechanical transmission version into the automatic transmission version, it is necessary to perform the following operations:

1) An automatic transmission neutraliser switch is mounted on the instrument control panel. 

2) Install a proximity sensor on the accelerator pedal.

3) Remove the plug on the transmission and insert the second sensor.

4) The transmission control ATC electronic unit is installed.

5) Disconnect connection "N" and connect it to "N-N".

6) Add wire 76042597 connected as in fig. 2-40.

7) Remove relays RL9 - RL6.

8) Position switches SW1 and SW2 on the logic board, in the positions indicated here below:

MECHANICAL MODE SELECTION (BASE)

<u>SW1</u>
1 ON
2 OFF
3 OFF
4 OFF

<u>SW2</u>
1 OFF
2 ON
3 OFF
4 OFF

<u>JP1</u>
BRIDGE
2-3

MECHANICAL MODE SELECTION (VARIANT)

<u>SW1 (W110)</u>
1 OFF
2 ON
3 OFF
4 ON

<u>SW2</u>
1 ON
2 OFF
3 ON
4 ON

<u>SW1 (W130)</u>
1 OFF
2 ON
3 OFF
4 OFF

<u>JP1</u>
BRIDGE
1-2

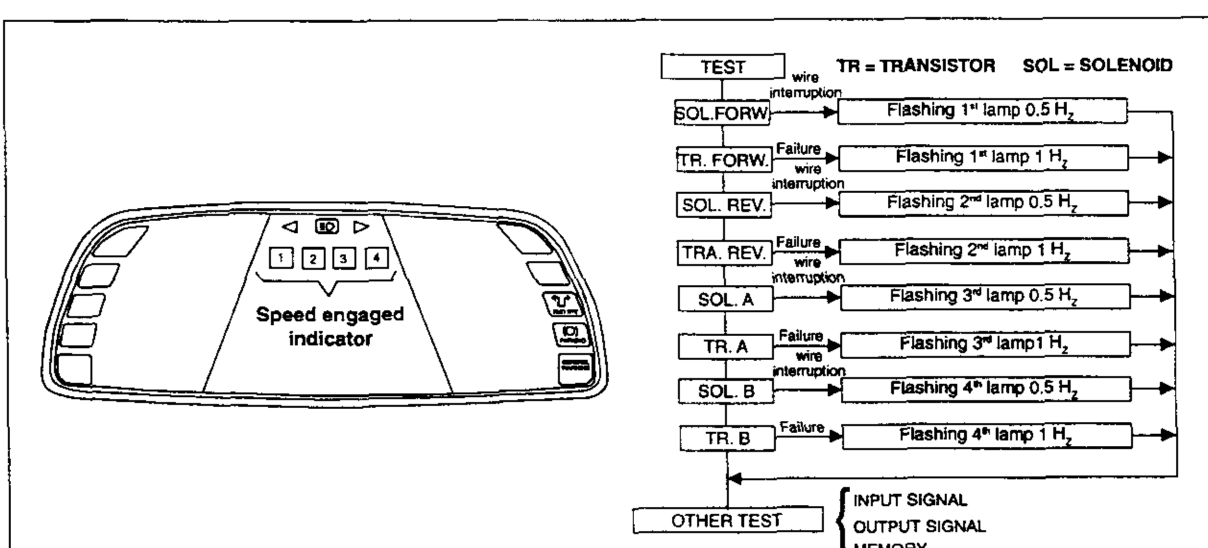


Fig. 2-41 Self-diagnosis of troubles on automatic transmission

2.6. DISASSEMBLY/REASSEMBLY TRANSMISSION

2.6.1 DISASSEMBLY

Note: When disassembling the drive unit, use a bench, a hoist (unit weight: 511 kg for W110 and 531 kg for W130) and hooks (M16 and M10) for your safety and easy maintenance.

2.6.1.1 Disassembling torque converter

a) Removing Charging Pump

1. Attach hooks (M16) into the tapped holes on the top surface of the transmission case side and hoist the drive unit. Remove the drain plug to drain off oil.
   Oil: 20 lts.
   After drainage, put the drive unit on the stand and make sure it is stable.

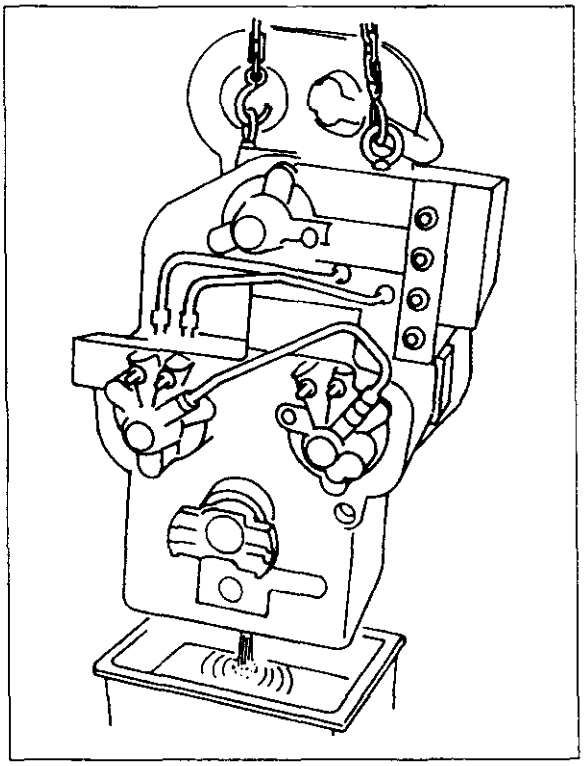


Fig. 2-42

2. Remove the suction tube and the charging pump. If they are securely so seated that you cannot remove them easily, tap them with a soft mallet to remove.
   Note: The configurations of the charging pump varies a little among different models of the drive unit.

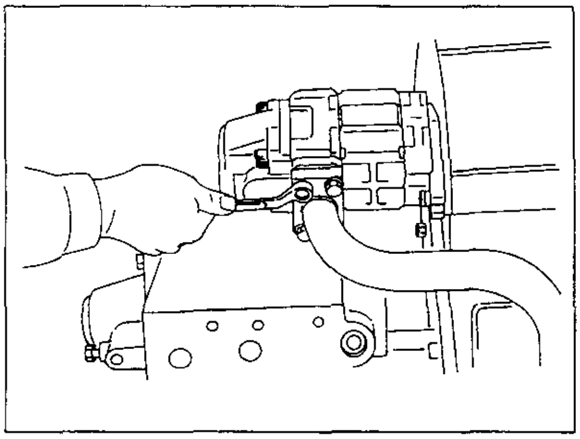


Fig. 2-43

3. Remove the pump drive sleeve from inside the converter housing.

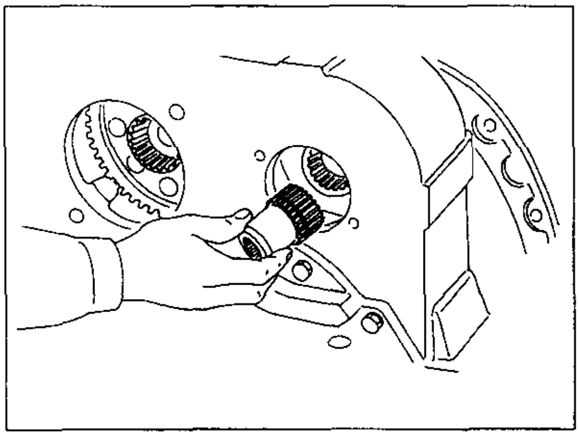


Fig. 2-44

4. Remove the O-ring and the strainer from the transmission case.

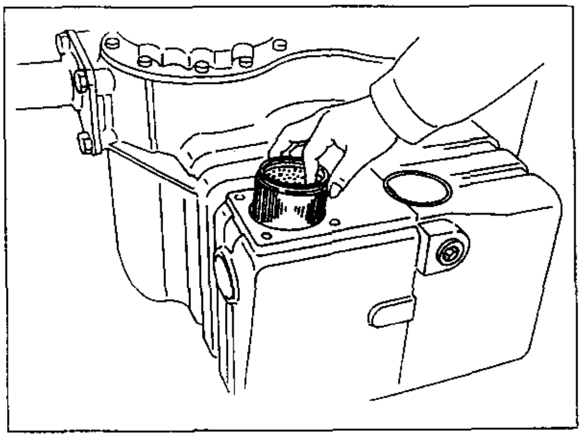


Fig. 2-45

5. Remove the flange from the front side.

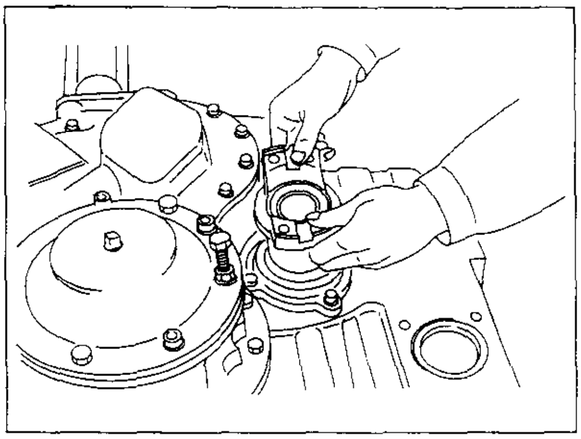


Fig. 2-46

b) **Removing and Disassembling Parking Brake (in the case of split-type housing):**
Note: When the piston housing is separate from the brake housing.

1. Remove the plug from the cap's center and screw in the brake releasing bolt.

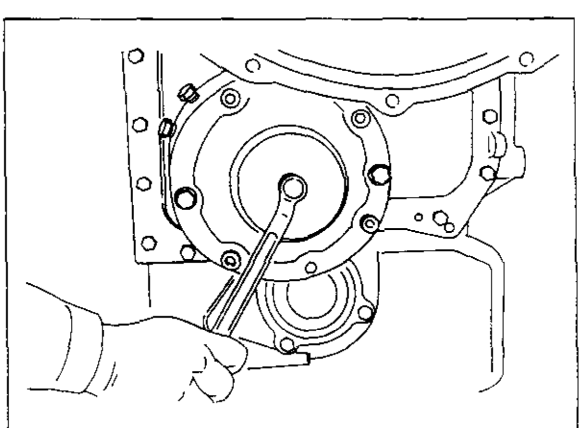


Fig. 2-47

2. Before disassembly, put match marks on the case's outer side.
Remove four flush head bolts and remove the cap and the piston housing as a set.
Do not loosen the two hex. headed bolts.

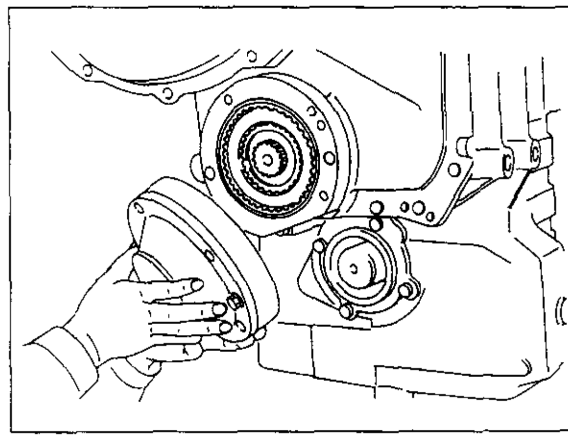


Fig. 2-48

3. Remove two flush head bolts. Remove the brake housing, prying with a screwdriver or a crow.

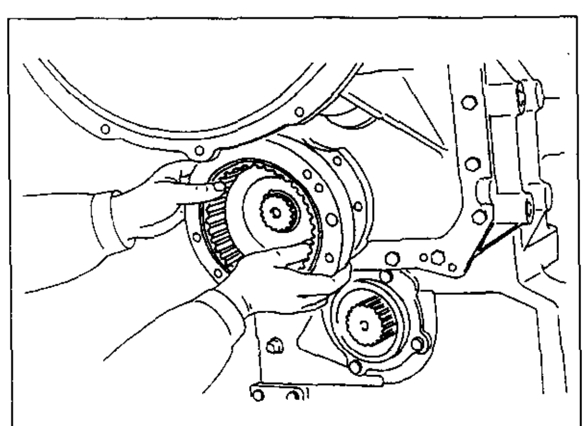


Fig. 2-49

4. Remove the snap ring and remove the disk hub from the shaft. Remove the end plate, six disks, and seven plates.

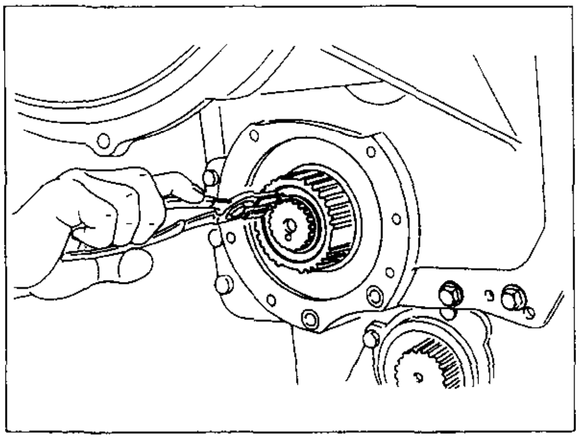


Fig. 2-50

5. Remove the brake releasing bolt from the cap's center of the brake subassembly.
6. Remove the two bolts securing the cap, by turning them gradually and evenly in turns, and separate the housing from the cap.

Warning:
Do not loosen the bolts abruptly because lots of strong springs are installed in the cap; otherwise, a serious accident might result. Loosen the two bolts gradually until spring force cannot be felt.

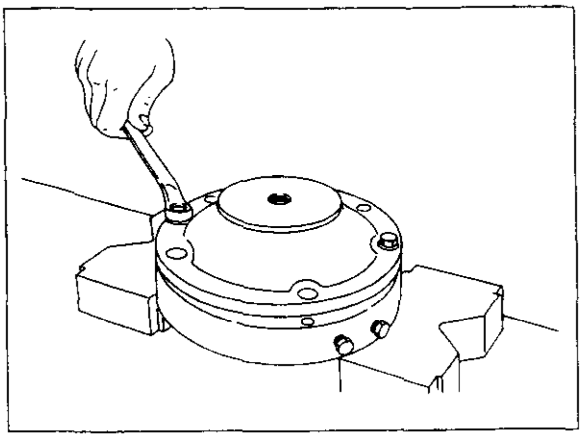


Fig. 2-51

7. Remove the cap and 18 springs (**1**). Remove the piston (**3**) from the piston housing (**2**).

8. Remove the two D-rings from the outer diameter of the piston.

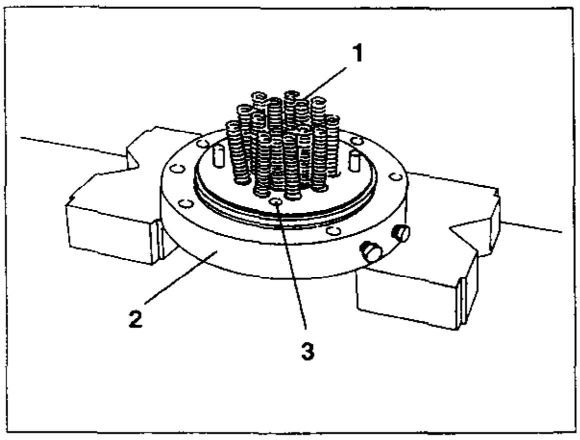


Fig. 2-52

c) **Removing and Disassembling Parking Brake (in the case of one-piece type housing):**
Note: When the piston housing and the brake housing are made into one-piece:

1. Remove two hex. headed bolts securing the cap and the parking brake releasing bolt.

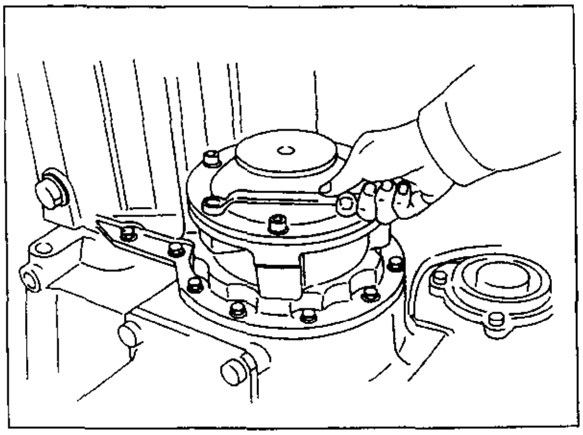


Fig. 2-53

2. Remove four flush head bolts, by turning them gradually in turns.

Warning:
Do not loosen the bolts abruptly because lots of strong springs are installed in the cap; otherwise, a serious accident might result. Loosen the bolts gradually until spring force cannot be felt.

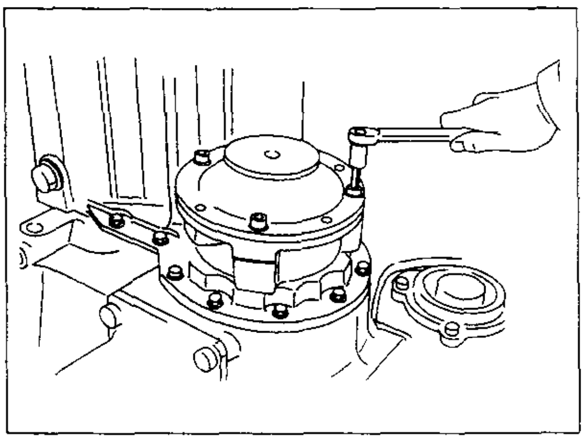


Fig. 2-54

3. Remove the cap and 18 springs.

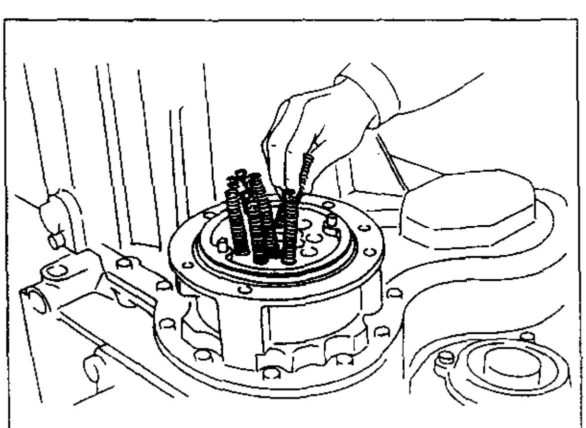


Fig. 2-55

4. Remove the piston from the brake housing. Remove the two D-rings from the outer diameter of the piston.

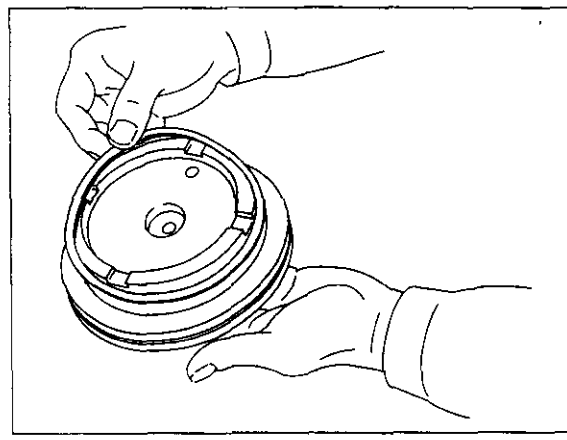


Fig. 2-56

5. Remove the brake housing. If it is securely so installed that you cannot remove it easily, pry it with a screwdriver or a crow.
Remove the O-ring from the brake housing.

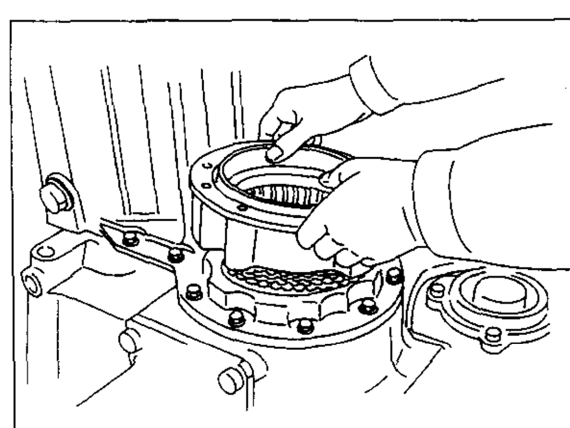


Fig. 2-57

6. Remove the end plate, six disks and seven plates.

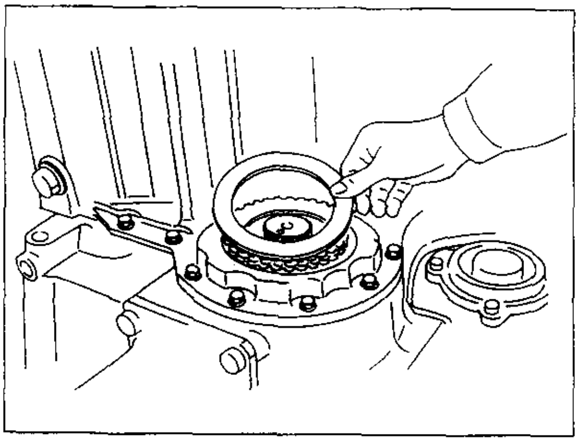


Fig. 2-58

7. Remove the snap ring from the clutch shaft and remove the disk hub.

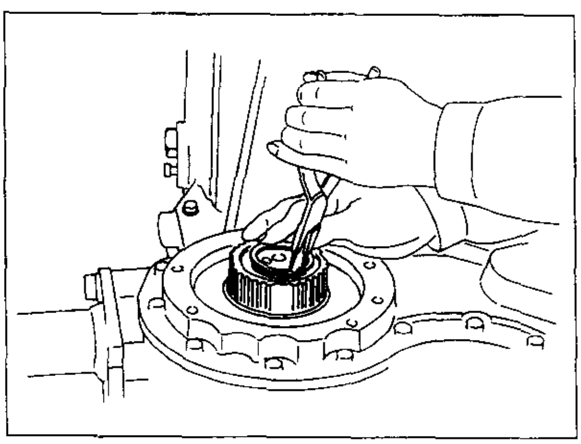


Fig. 2-59

d) Removing Torque Converter Unit

1. Remove 26 tightening bolts securing the converter housing and the transmission case.

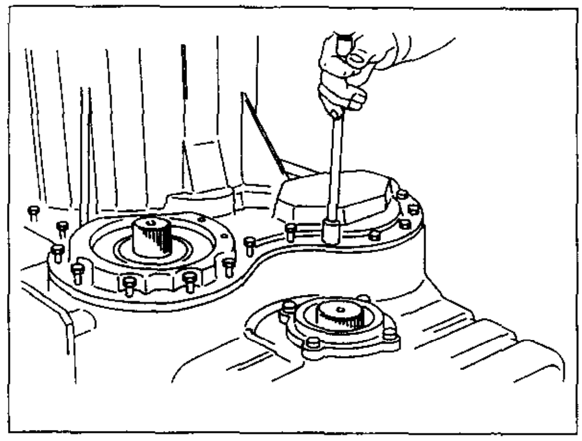


Fig. 2-60

2. Lift the mating surface with four puller bolts and make sure that the bearing is being removed from the converter housing. Lift the torque converter with a hoist.

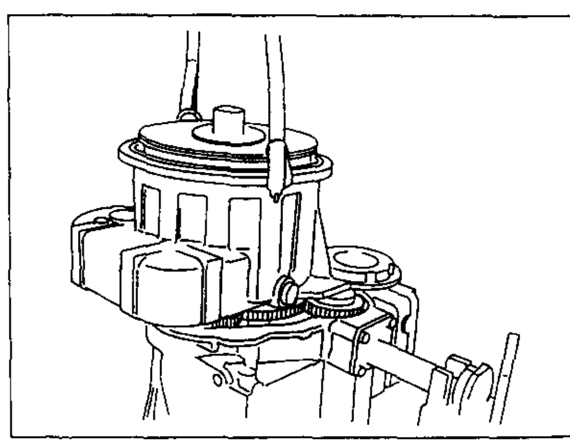


Fig. 2-61

e) Removing and Disassembling Converter Wheels (W110)

1. Remove the eight bolts securing the input plate and remove the plate.

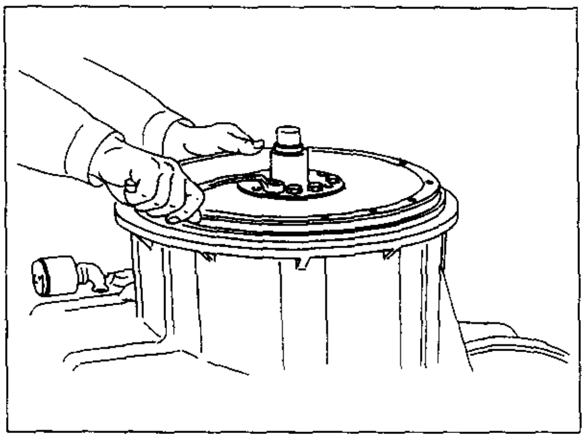


Fig. 2-62

2. Remove the 24 bolts securing the front cover and remove the cover with two puller bolts.

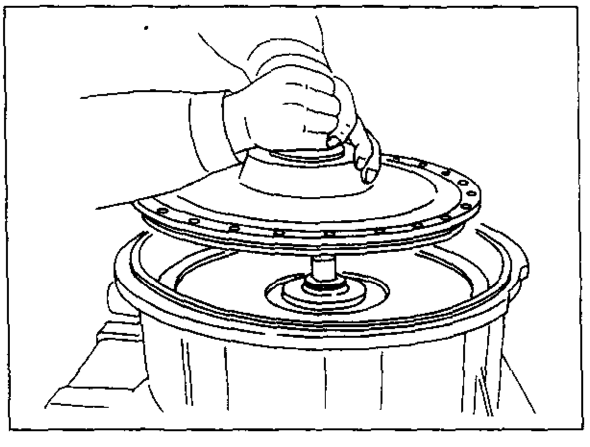


Fig. 2-63

3. Remove the snap ring from the turbine shaft and remove the turbine, holding the rivet head with pliers.

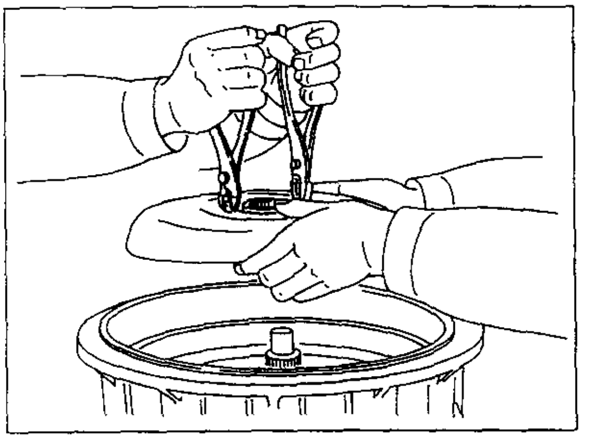


Fig. 2-64

4. Remove the snap ring. Remove the stator wheel and collar.

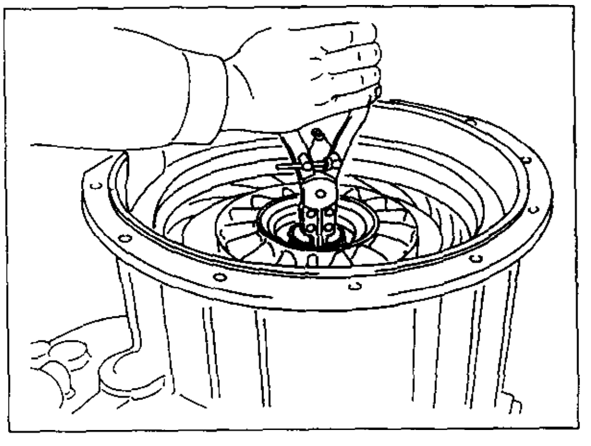


Fig. 2-65

5. Remove the three bolts securing the oil baffle from the output side of the torque converter.

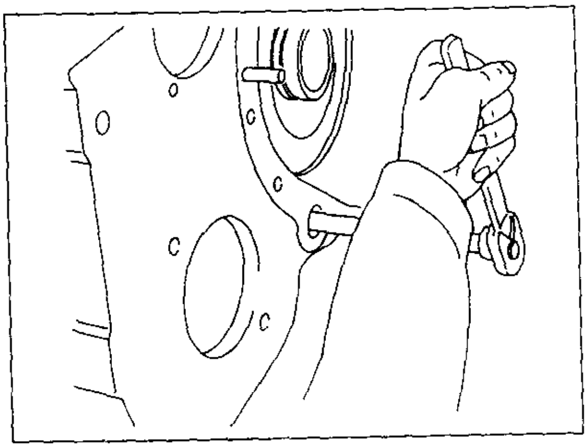


Fig. 2-66

6. Remove the impeller wheel and remove the oil baffle and impeller gear as a set.
If it is hard to remove, attach a hook to the impeller wheel and remove it with a hoist.

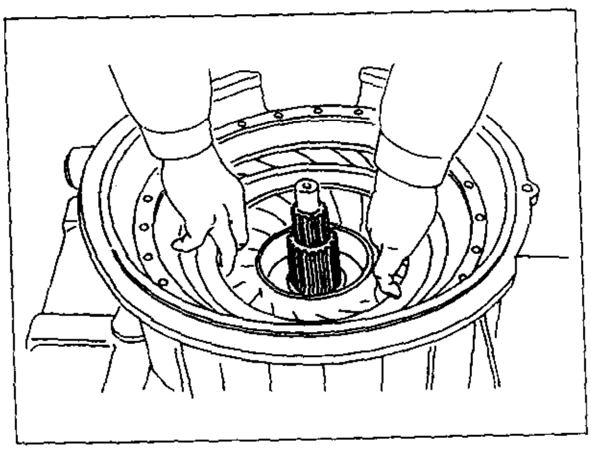


Fig. 2-67

7. Remove the snap ring from the outside of the impeller wheel hub. Remove the gear and oil baffle. Remove the snap ring from inside the impeller wheel hub and remove the bearing. Remove the oil seal from the oil baffle.

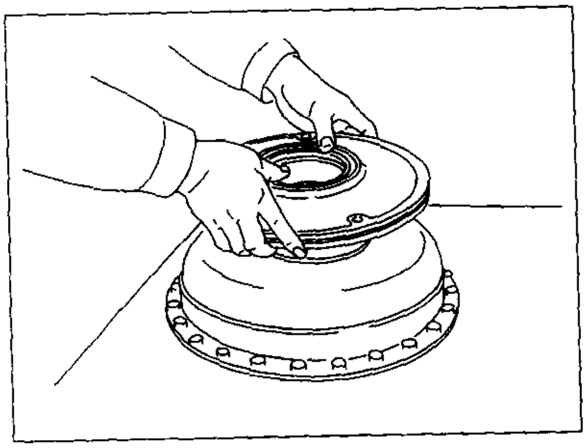


Fig. 2-68

8. Remove the seven bolts securing the stator support from the output side of the torque converter.

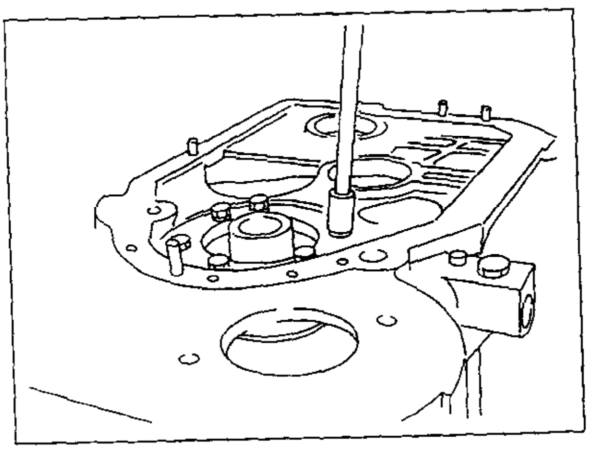


Fig. 2-69

9. Remove the stator support and turbine shaft by tapping the turbine shaft from the output side of the torque converter with a soft mallet.

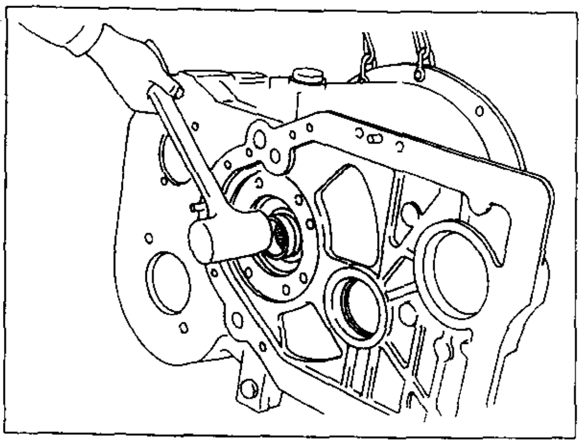


Fig. 2-70

10. Remove the seal ring from the turbine shaft. Remove the snap ring from the turbine shaft and remove the bearing.

11. Remove the seal ring from the stator support.

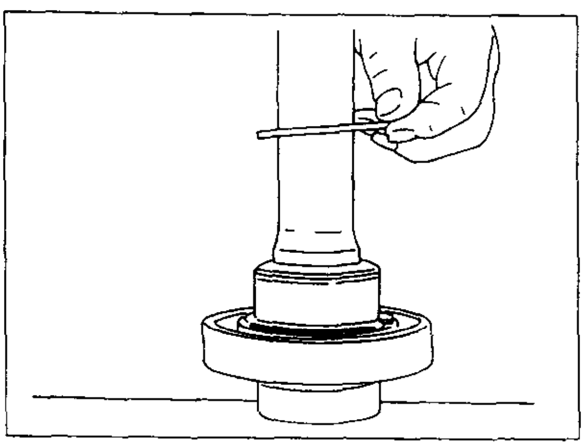


Fig. 2-71

f) Removing Converter Wheel (W130)

1. Remove the three bolts securing the seal carrier (oil baffle) from the output side of the torque converter.

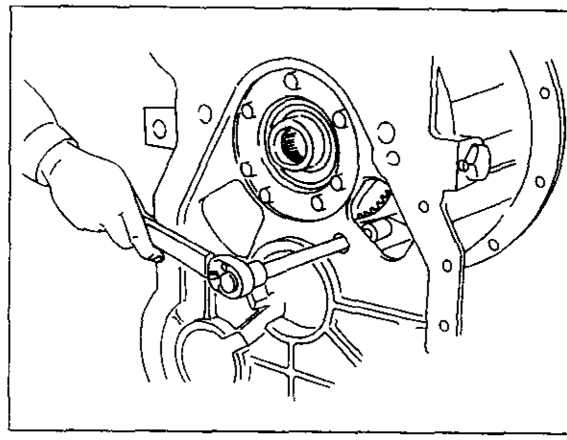


Fig. 2-72

2. Remove the seven bolts securing the guide carrier (stator support).

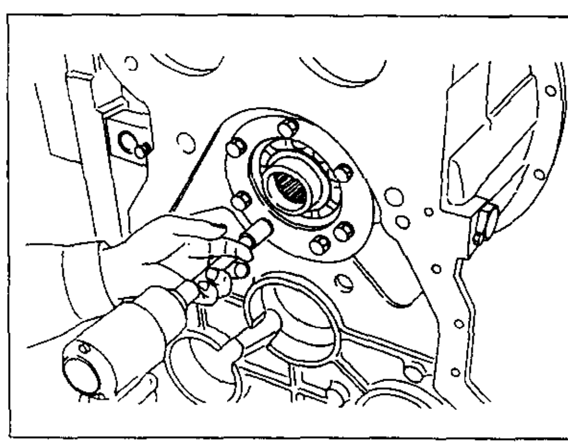


Fig. 2-73

3. Screw a hook into the input guide and hoist it. Separate the converter assembly from the housing gradually.
Converter assembly weight: 55 kg.

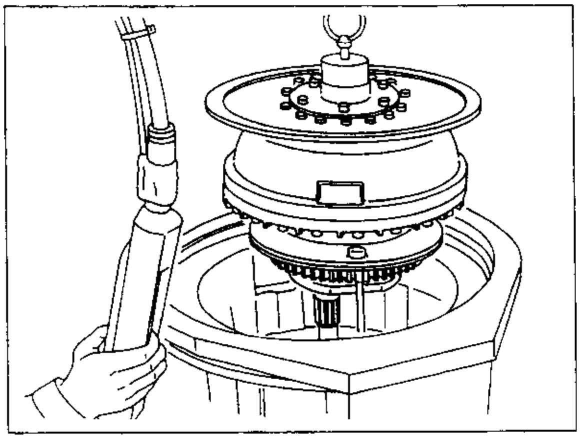


Fig. 2-74

4. Remove the turbine shaft and the snap ring from the housing.

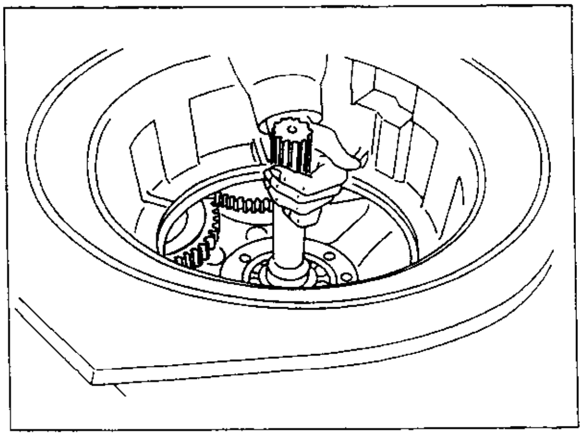


Fig. 2-75

5. Remove the seal ring from the turbine shaft. Remove the snap ring and drive the bearing out from the turbine shaft with a soft mallet.

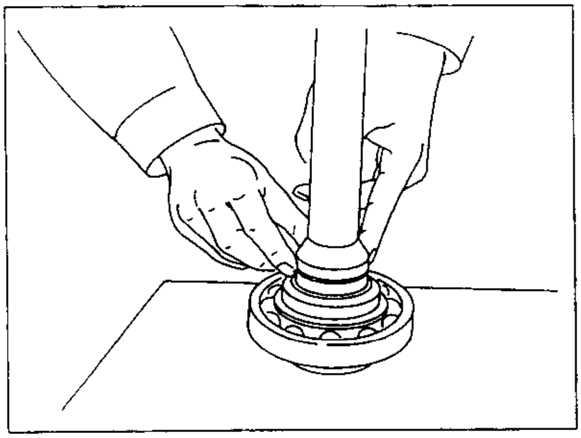


Fig. 2-76

g) Disassembling Converter Wheel (W130)

1. Remove the 12 bolts securing the input plate.

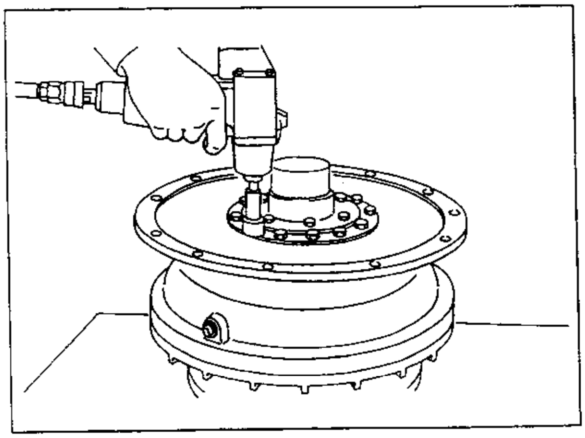


Fig. 2-77

2. Remove the spacer and input plate.

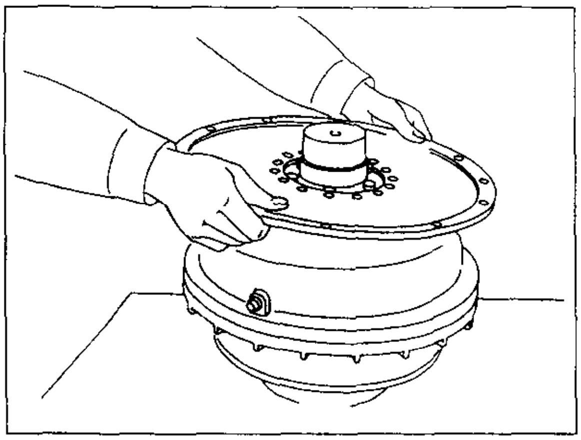


Fig. 2-78

3. Remove the six bolts securing the input guide and remove it.

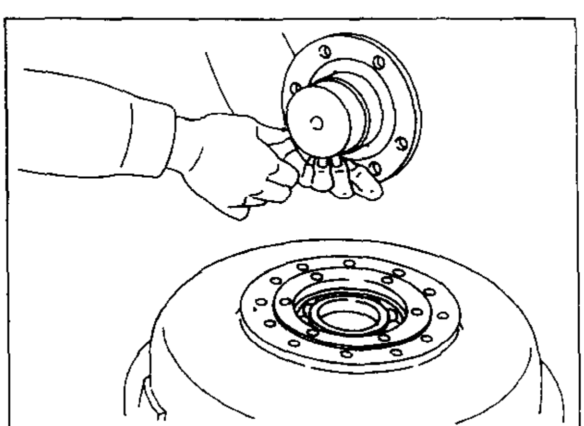


Fig. 2-79

4. Turn the converter wheel upside down. Remove the 20 bolts securing the cover wheel and the impeller wheel.

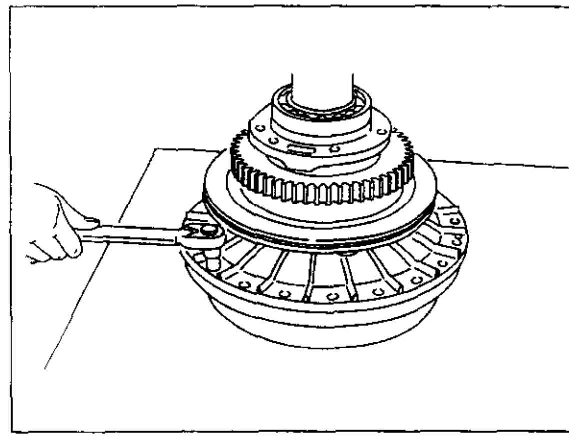


Fig. 2-80

5. Turn the converter wheel to the original position and separate it from the mating surface, using two bolts.

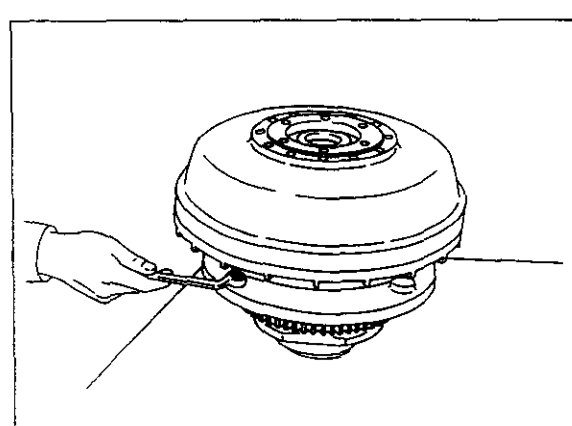


Fig. 2-81

6. Lift and remove the cover wheel. The turbine wheel can be removed at the same time.
Remove the O-ring at the mating surface.

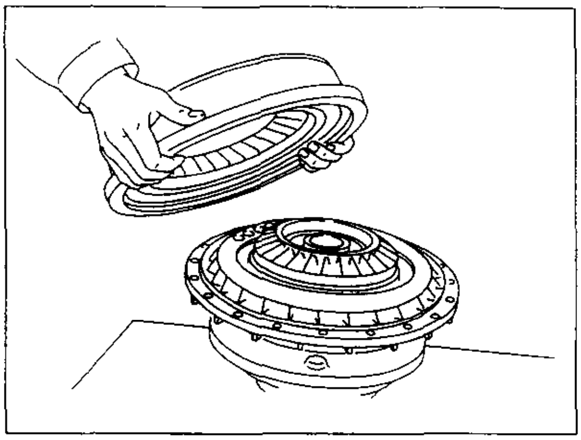


Fig. 2-82

7. Remove the snap ring from the shaft of the stator wheel hub.

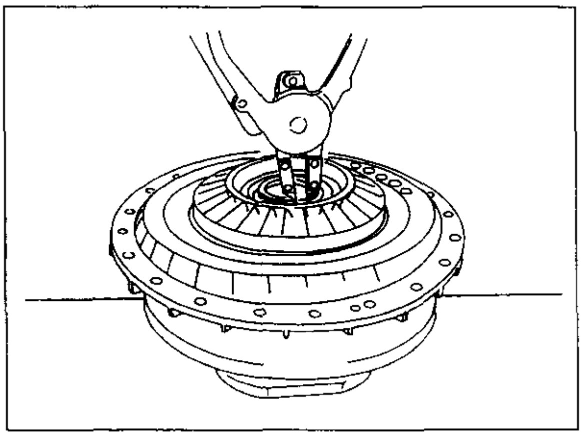


Fig. 2-83

8. Push the front end of the guide carrier (stator support) with a press and push the guide carrier out.
Remove the seal ring from the guide carrier.

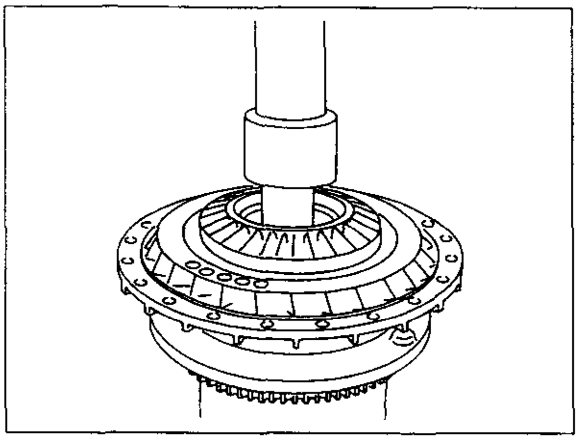


Fig. 2-84

9. Remove the stator wheel and the spacer in this order.

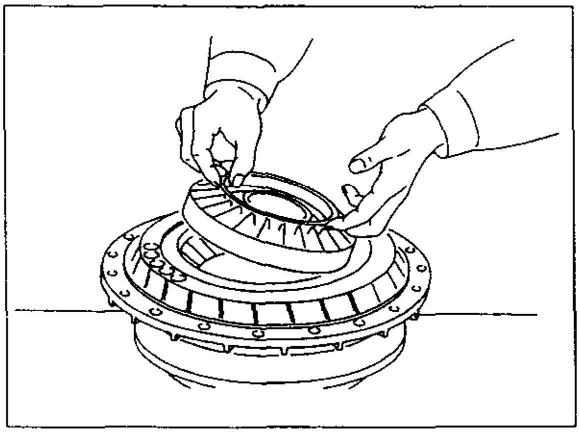


Fig. 2-85

10. Remove six flush head bolts securing the impeller hub, impeller wheel and pump drive sleeve.

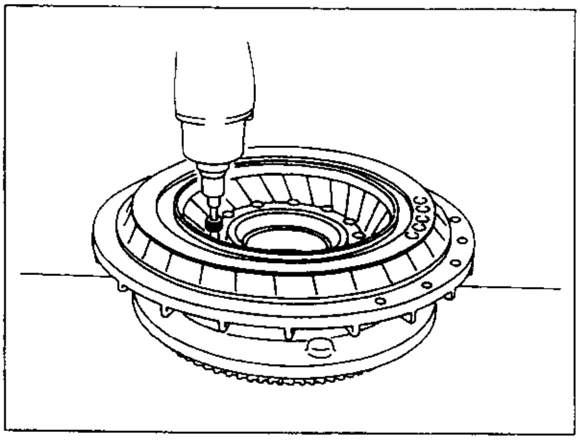


Fig. 2-86

11. Turn the converter wheel upside down, press the bearing shoulder and separate the impeller hub with the bearing.

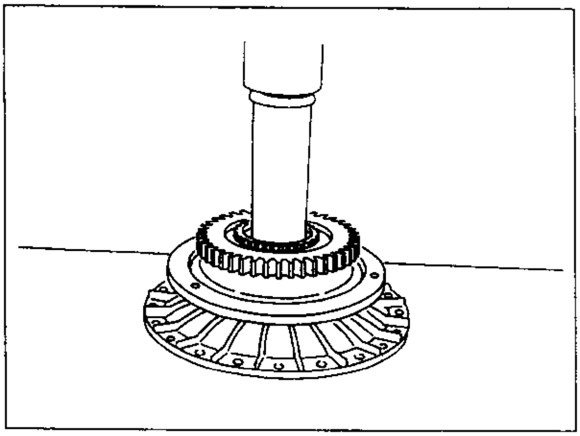


Fig. 2-87

12. Separate the pump drive sleeve equipped with the gear and seal carrier from the impeller wheel.
Remove the O-ring from the pump drive sleeve.

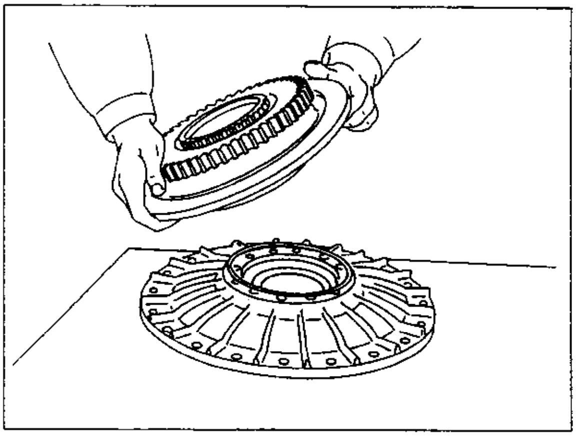


Fig. 2-88

13. Remove the bearing from the impeller hub with a press.

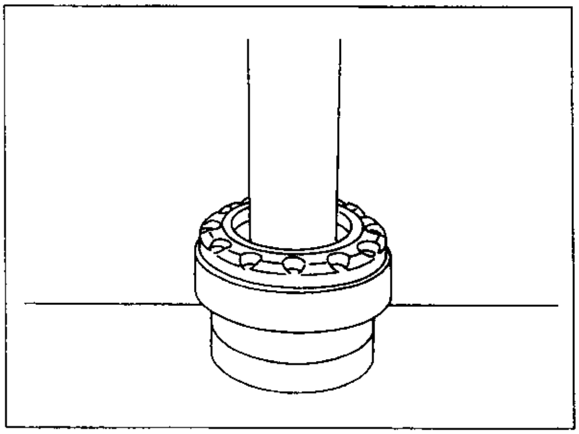


Fig. 2-89

14. Remove the snap ring of the pump drive gear. Remove the gear and the seal carrier (oil baffle).

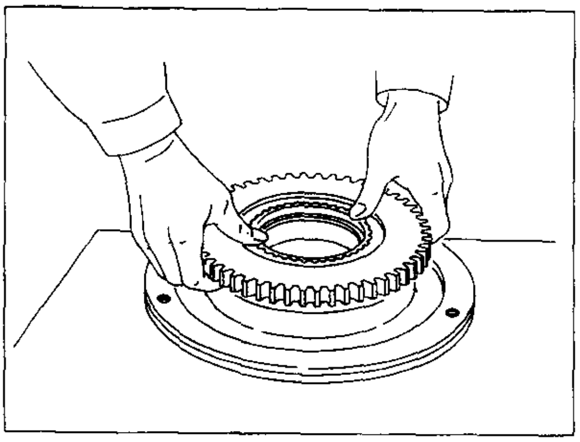


Fig. 2-90

15. Remove the oil seal from the seal carrier.

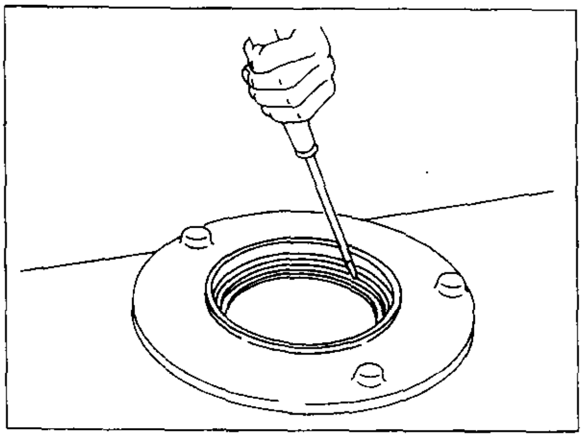


Fig. 2-91

h) Removing Pump Drive Gear

1. Remove the bolt securing the bearing support and remove the gear from the converter housing.

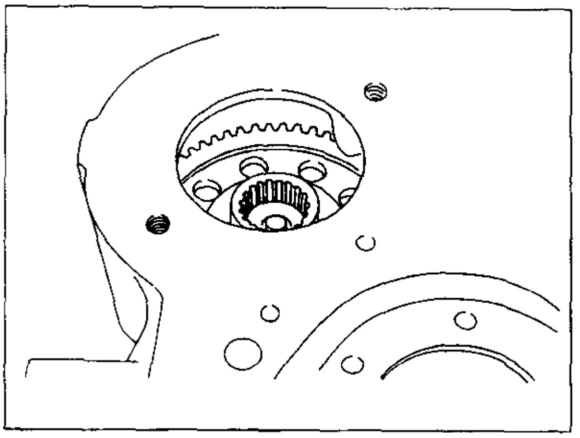


Fig. 2-92

2. Remove the snap ring from the gear and remove the bearing.

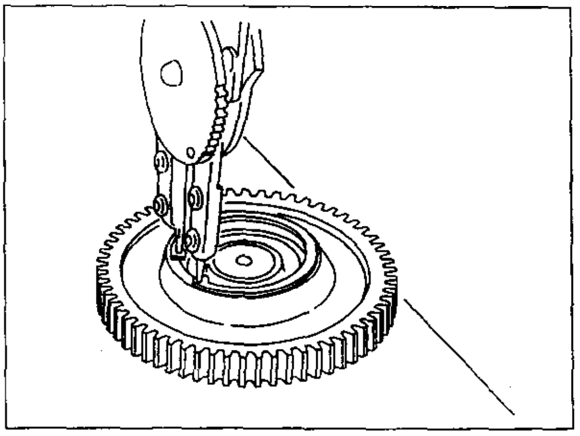


Fig. 2-93

3. Remove the bearing support from the bearing.

4. Remove and disassemble another pump drive gear, using the same procedure as above.

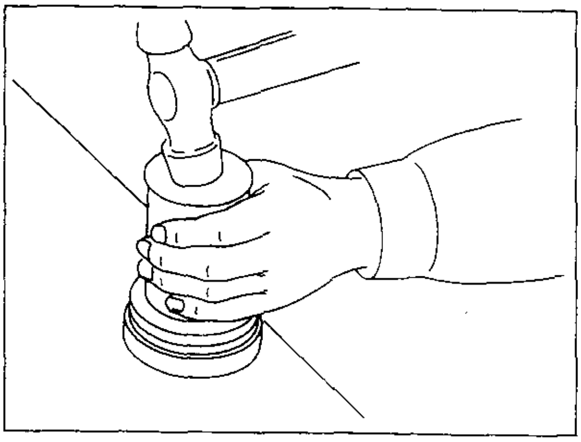


Fig. 2-94

i) **Removing Safety Valve**

1. Remove the plug of the safety valve at the housing side. Remove the spring and the plunger.

Note: The plunger contact seat is driven into the housing. Do not remove it unless it is defective.

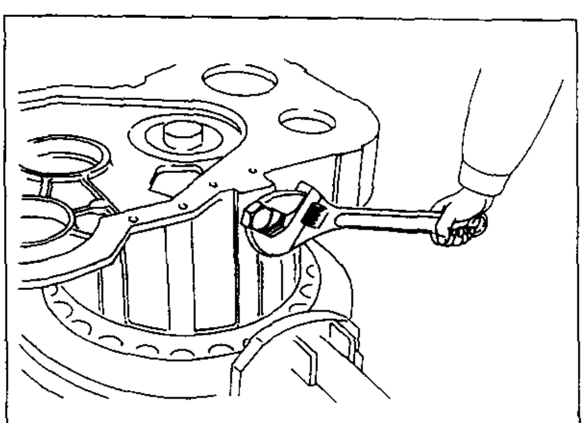


Fig. 2-95

2.6.1.2 Disassembling transmission

a) **Removing Control Valve**

1. Attach hooks (M10) on the upper valve and lift it with a hoist a little.
   Valve (upper): 16 kg.

2. Remove the 10 bolts securing the upper valve and remove it, tapping with a soft mallet.

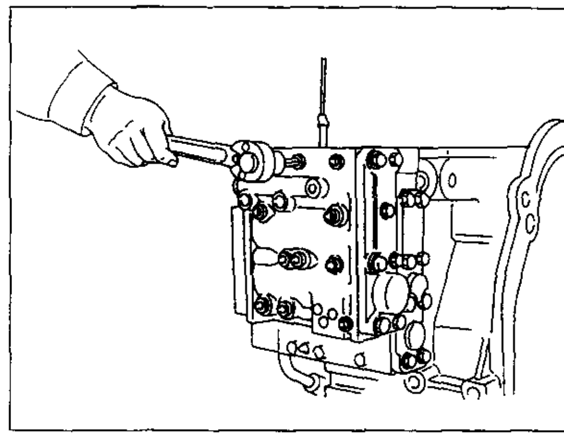


Fig. 2-96

3. Remove the lower valve, using the same procedure as above, except that the number of fitting bolts to be removed in this step is three.
   Valve (lower): 26 kg.

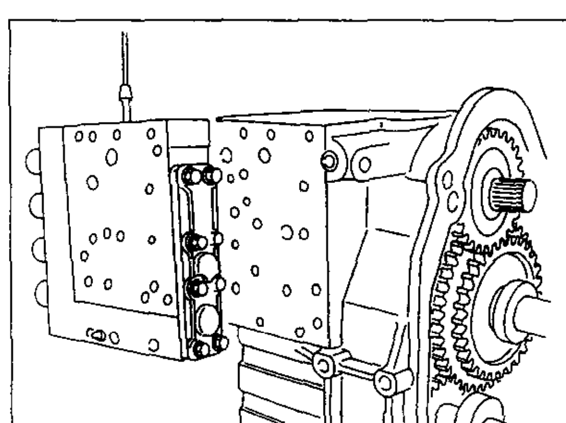


Fig. 2-97

b) Removing Distributor Cap and Piping

1. Loosen and remove the ball head lock nuts securing the hydraulic piping from the $1^{st}/2^{nd}$ cap to the $3^{rd}/4^{th}$ cap.

2. Remove the other two hydraulic pipings using the same procedure above.

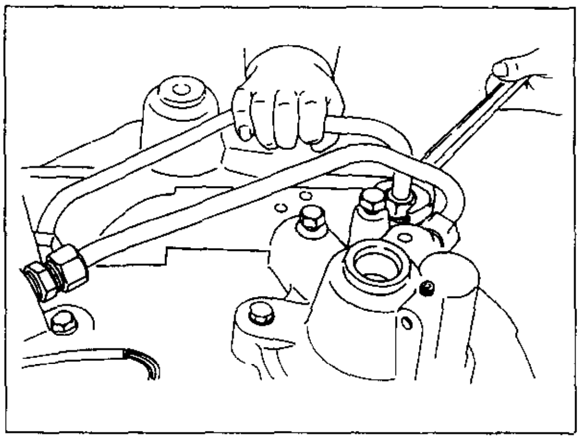


Fig. 2-98

3. Loosen the lock nut securing the rotation sensor on the same surface and remove the sensor turning by a wrench.

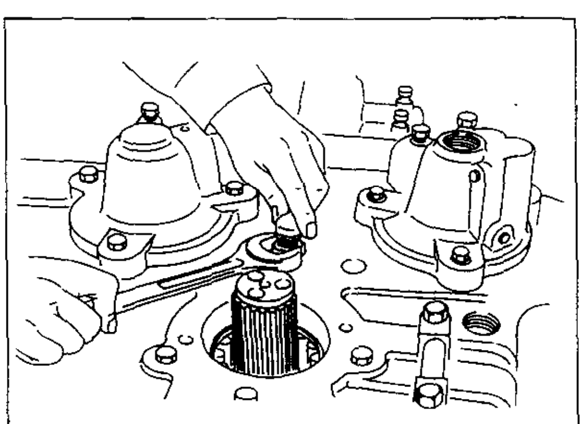


Fig. 2-99

4. Remove three bolts securing the each of the three distributor caps to the forward/reverse, $1^{st}/2^{nd}$, and $3^{rd}/4^{th}$ together with the two O-rings for the mating points.

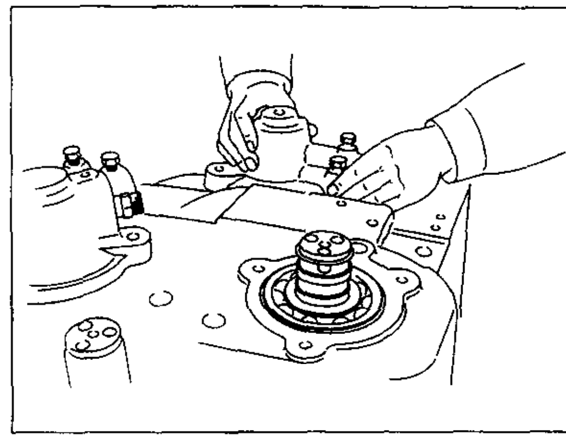


Fig. 2-100

c) Removing Clutch Shaft

1. Hold the transmission case upright and remove the snap ring from the outer diameter of the rear bearing at each of the three clutch shafts. Also, remove the three seal rings from each of the three shafts.

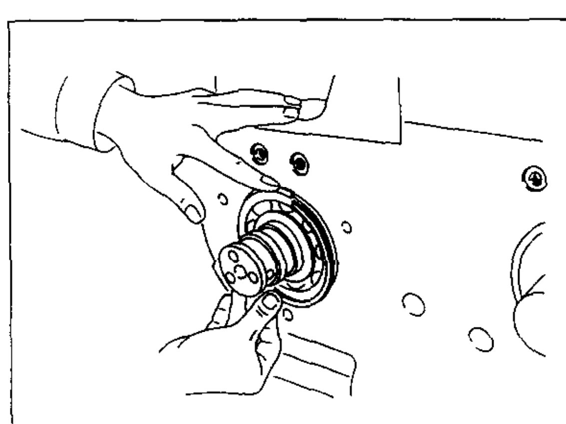


Fig. 2-101

2. Position the transmission so that the opening is pointing up and remove the bearing from the idler shaft with a puller.

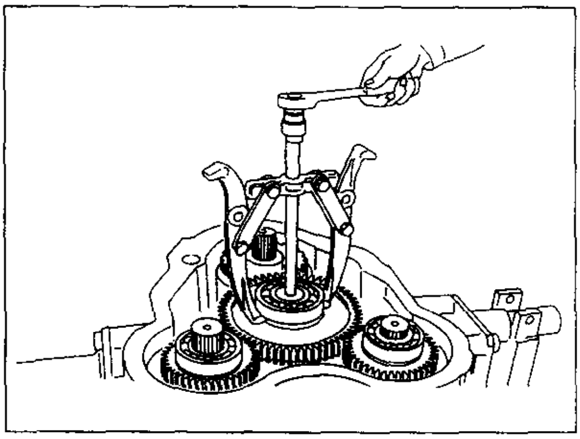


Fig. 2-102

3. Remove the snap ring and remove the idler gear from the shaft spline.

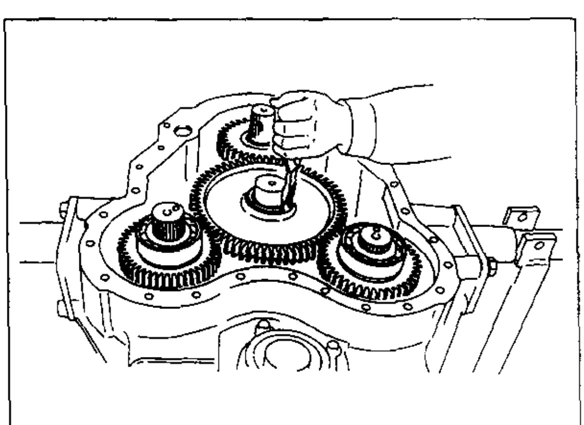


Fig. 2-103

4. Attach a hook to the forward/reverse shaft and remove it from the case.
Forward/reverse clutch shaft: 35 kg.

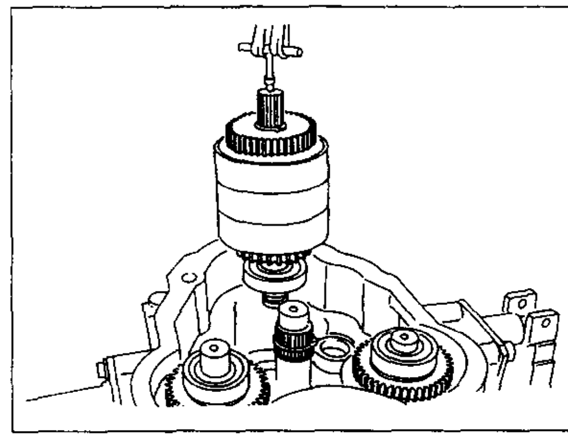


Fig. 2-104

5. After that, remove the 1st/2nd shaft, idler shaft, and 3rd/4th shaft in this order.
1st/2nd shaft: 40 kg.
3rd/4th shaft: 40 kg.

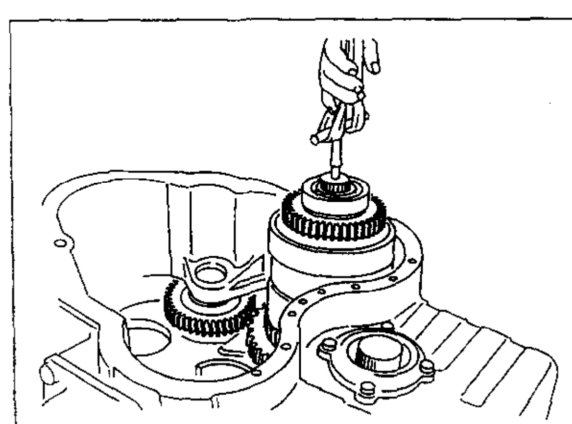


Fig. 2-105

6. Remove the bearing from the idler shaft above with a puller. After that, remove the snap ring and the gear.

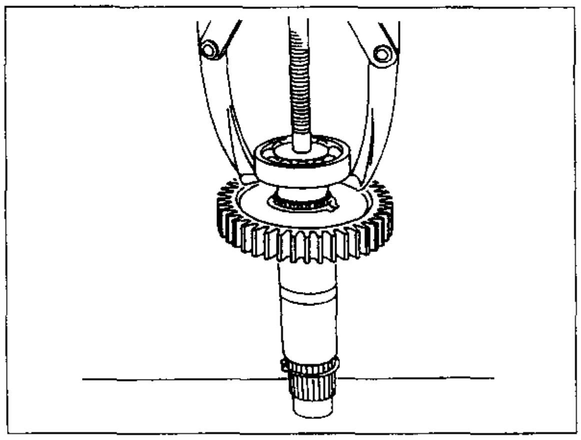
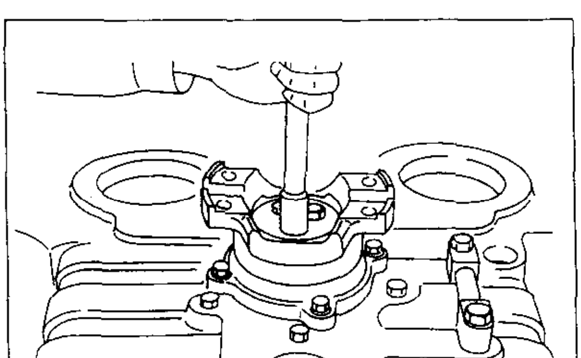


Fig. 2-106

d) Removing Output Shaft

1. Loosen the three bolts securing the companion flange to the case rear side.



2. Remove the plate, O-ring and companion flange.

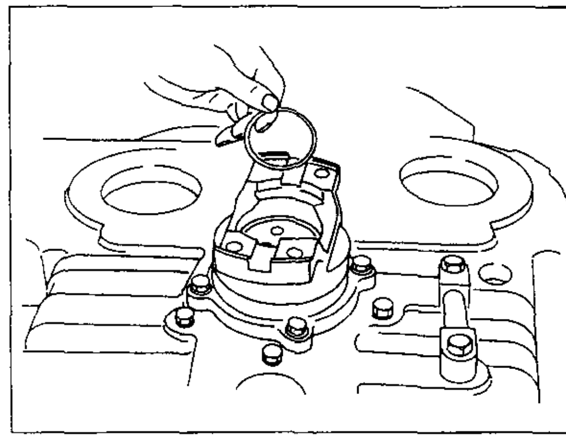
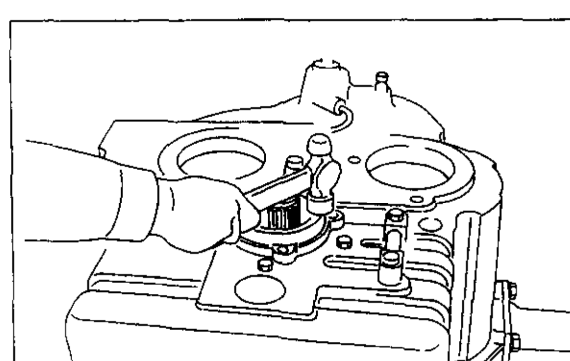


Fig. 2-108

3. Remove the four bolts securing the bearing cap, and remove the bearing cap.
Remove the oil seal from the bearing cap.



4. Remove the spacer and the bearing inner race from the shaft.

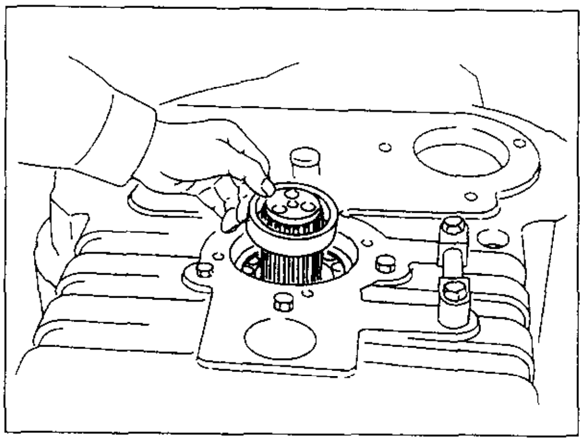


Fig. 2-110

5. Turn the case upside down. Loosen the four bolts securing the bearing cap to the front side and remove the bearing cap.
Remove the oil seal from the bearing cap.

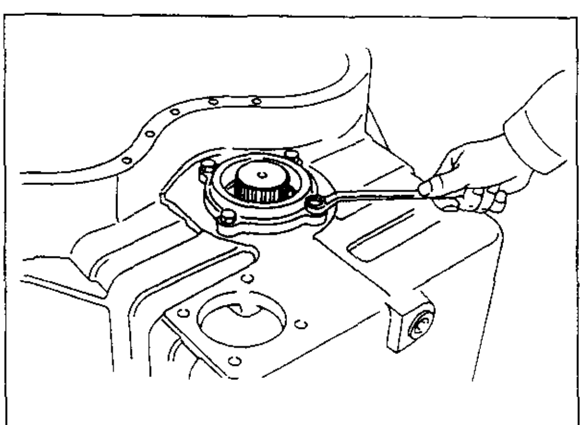


Fig. 2-111

6. Remove the snap ring from the case groove of the bearing outer diameter.

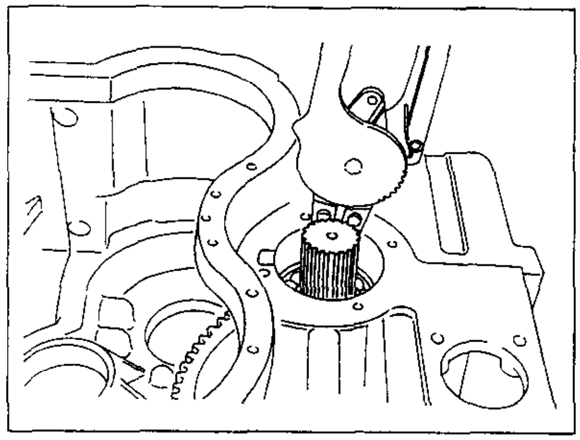


Fig. 2-112

7. Place a spacer with a proper length between the output gear and the case (so that the gear won't move when the shaft is driven in the next step).

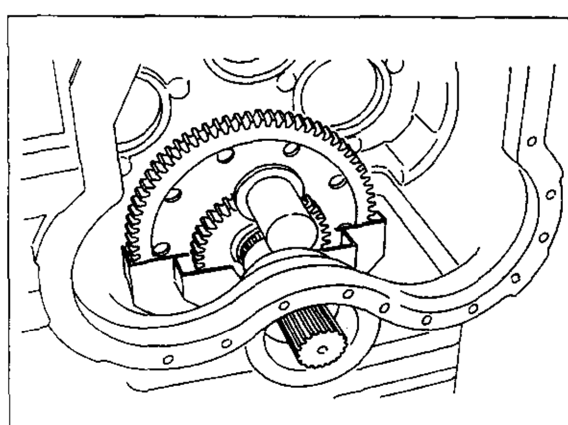


Fig. 2-113

8. Remove the shaft toward the front side by driving it from rear side with a soft mallet.

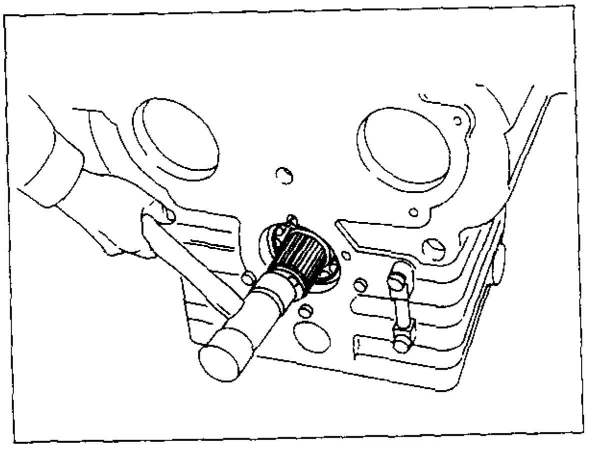


Fig. 2-114

9. After removing the shaft, remove the two output gears and the bearing inner race from inside the case.

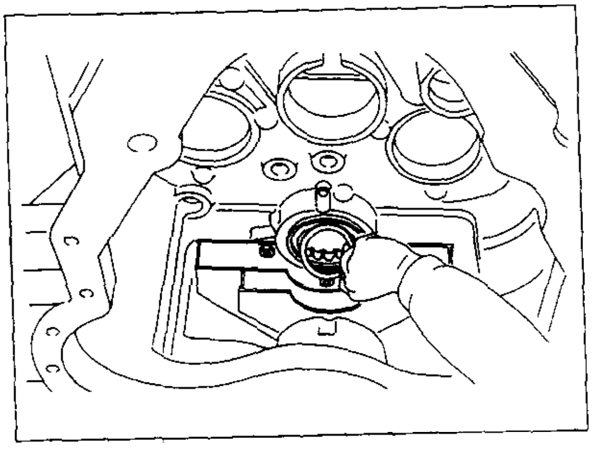


Fig. 2-115

10. Remove the snap ring from the case groove of the roller bearing outer diameter.

11. Push the outer race of the roller bearing with a jig and remove the outer race from the case.

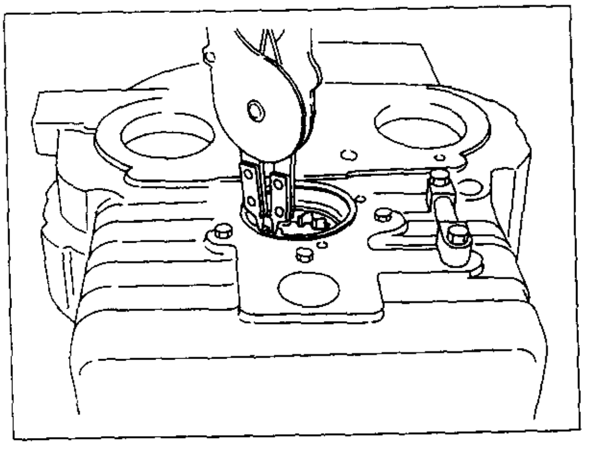


Fig. 2-116

12. Remove the snap ring and the bearing from the output shaft.

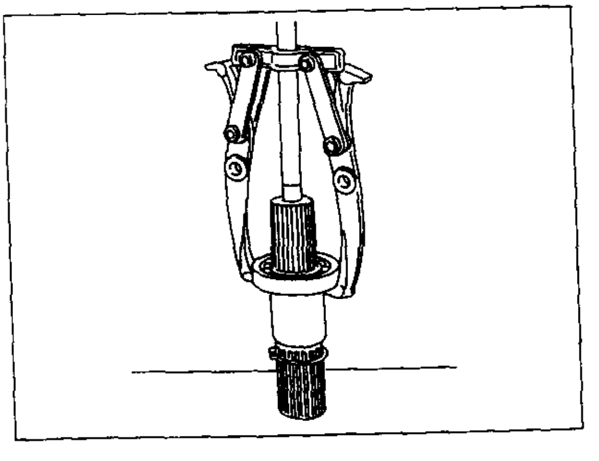


Fig. 2-117

13. Remove the three bolts securing the oil baffle from the case at the rear side.

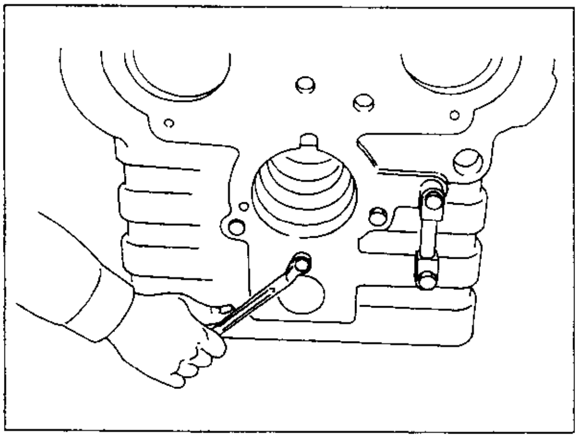


Fig. 2-118

14. Remove the oil baffle from inside the case.

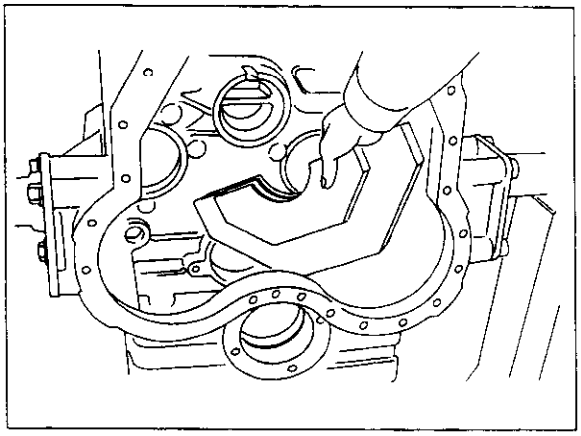


Fig. 2-119

e) **Removing Back Gear**

1. Remove the snap ring from the transmission case.

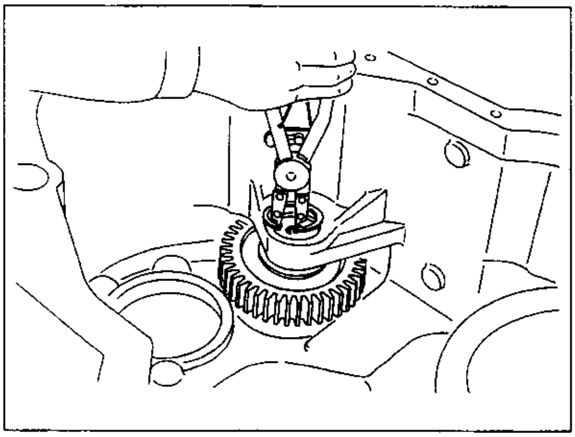


Fig. 2-120

2. Insert the vertical stud into the tap hole of the back gear shaft and remove the shaft.
Use caution not to lose the lock ball.

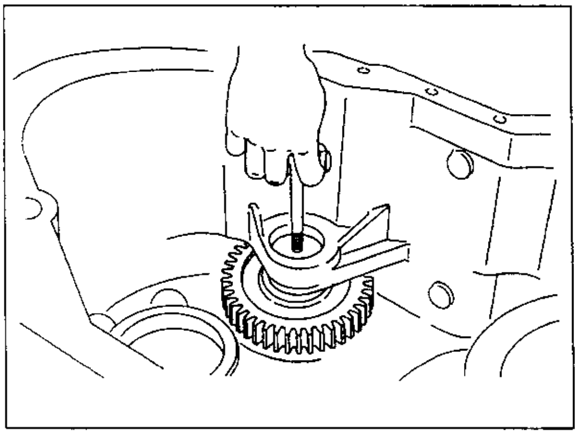


Fig. 2-121

3. Remove the back gear.

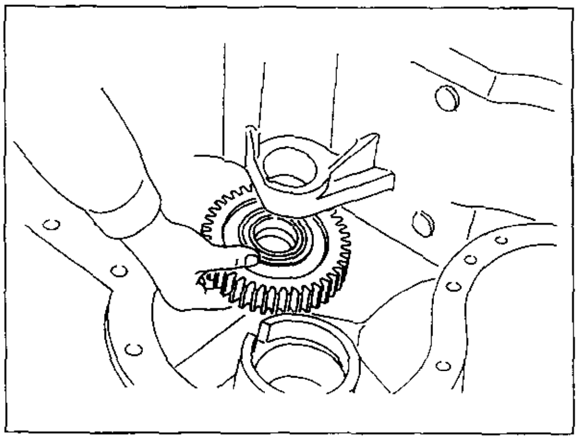


Fig. 2-122

4. Remove the spacer from the case side.

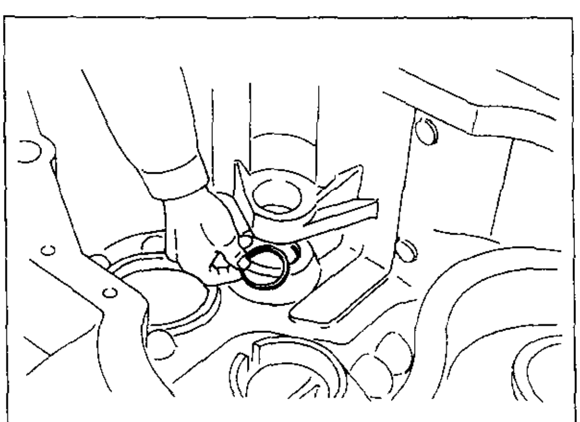


Fig. 2-123

5. Remove the two bearings and the snap ring from inside the back gear.

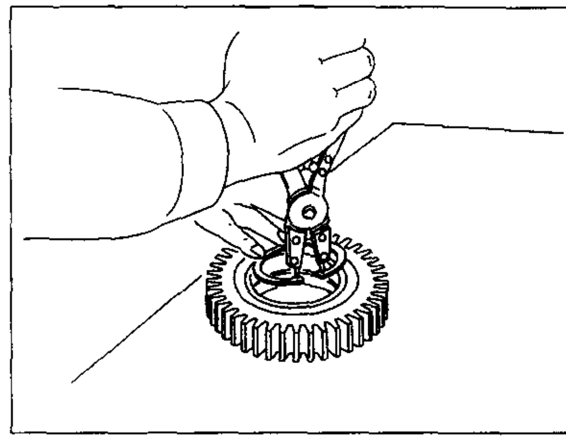


Fig. 2-124

2.6.1.3 Disassembling clutch shaft

a) Disassembling Forward/Reverse Clutch Shaft

1. Hold the clutch shaft upright with the forward clutch (the side having spline shaft) pointed upward.

2. Remove the snap ring from the shaft groove.

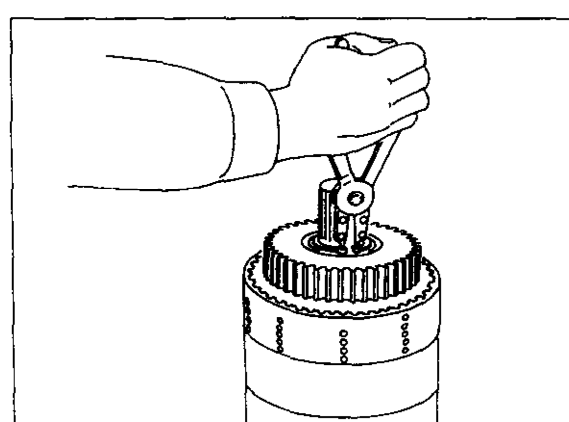


Fig. 2-125

3. Move the gear a little outward with a chisel (to engage the puller craw with the gear).

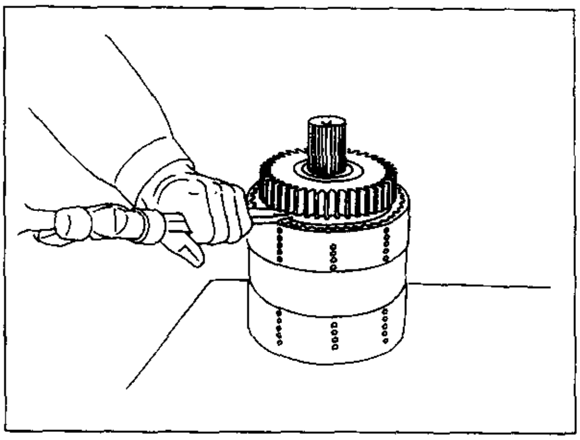


Fig. 2-126

4. Remove the hub gear with a puller.

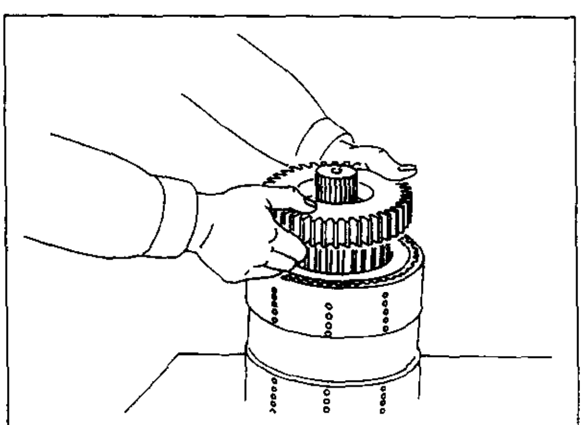


Fig. 2-127

5. Remove the bearing from inside the hub gear with a jig.

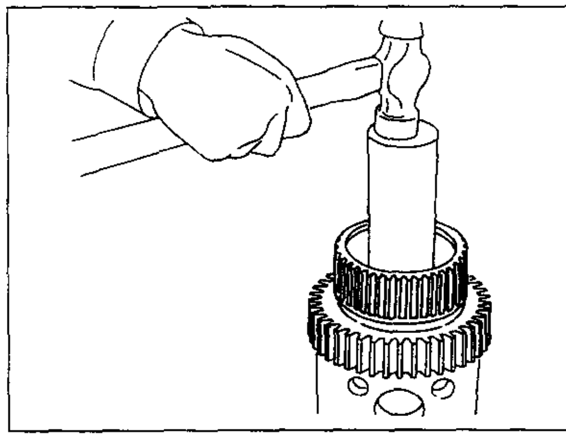


Fig. 2-128

6. Remove the snap ring from the clutch drum inner groove with a screwdriver.

Warning: Pay attention to the end plates which might pop out due to the return spring between the plates.

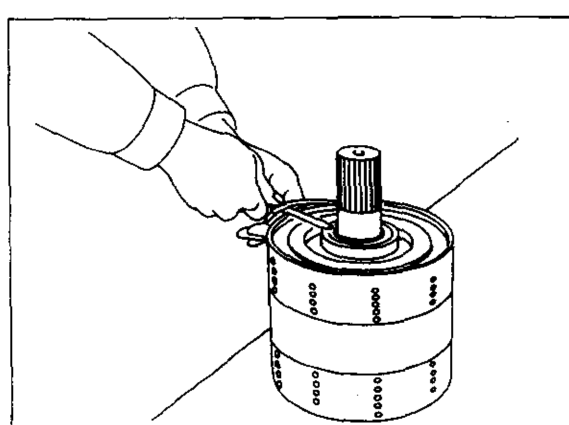


Fig. 2-129

7. Remove the end plates, disks, return springs and plates in this order.

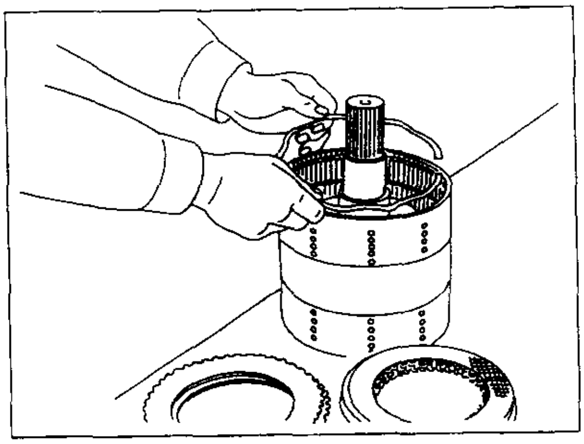


Fig. 2-130

8. Remove the other bearings from the shaft with a puller.

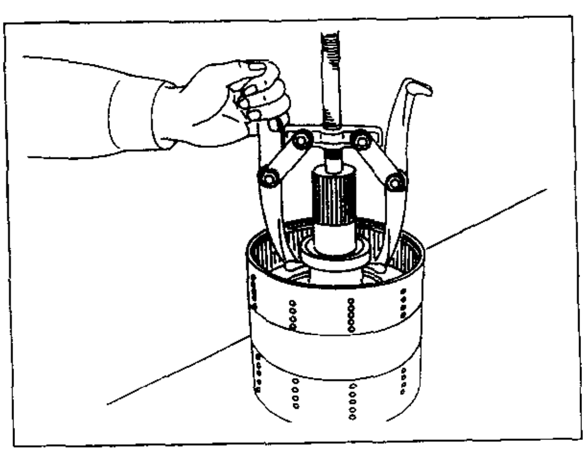


Fig. 2-131

9. Turn the clutch shaft upside down. Supply air through the forward clutch hydraulic hole so as to fall the piston down and remove it from the clutch drum.

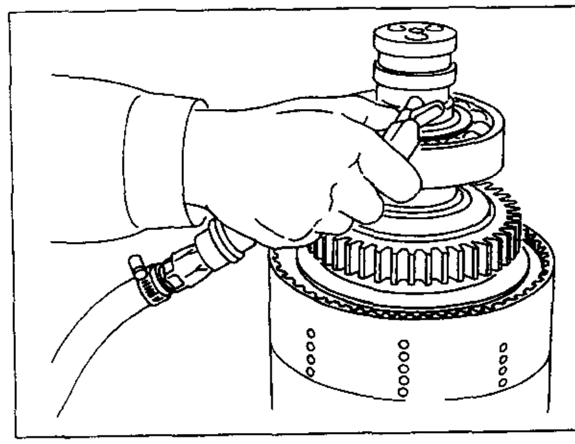


Fig. 2-132

10. Remove the outer seal ring from the piston.

11. Remove the inner seal ring of the piston from the clutch shaft.

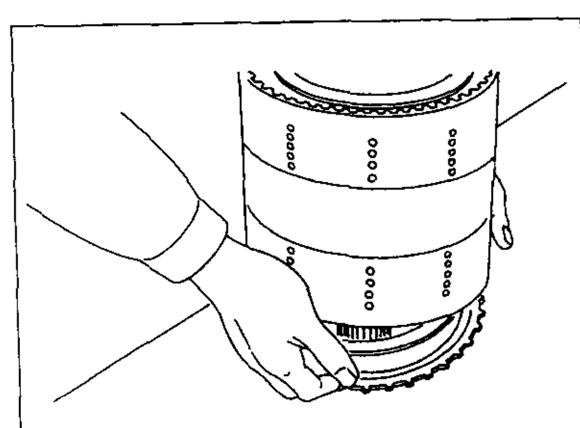


Fig. 2-133

12. Hold the clutch shaft upright with the reverse clutch pointed upward.

13. Remove the snap ring from the shaft.

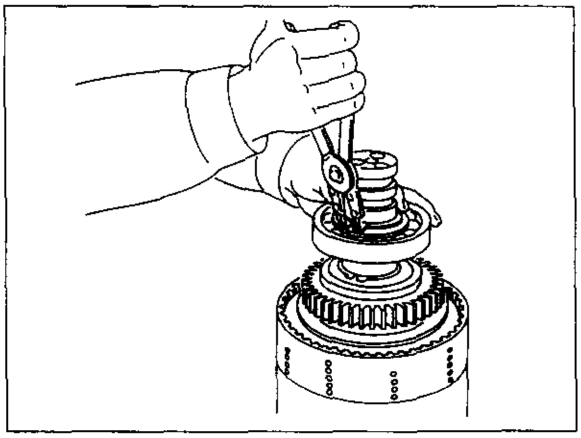


Fig. 2-134

14. Remove the bearing with a puller.

15. Disassemble the reverse clutch using the same procedure as disassembling forward clutch.

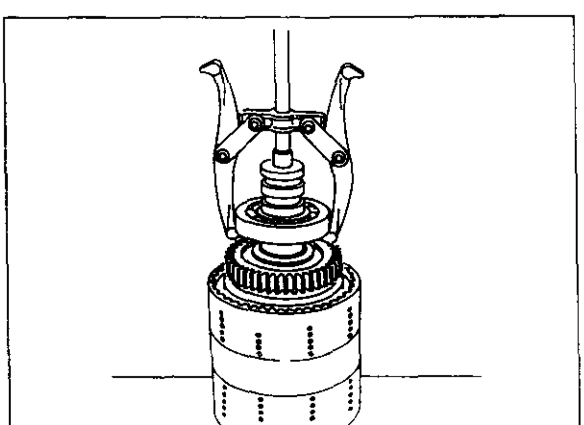


Fig. 2-135

b) Disassembling 3rd/4th Clutch Shaft

1. Hold the clutch shaft upright with the side having the gear pointed upward.

2. Remove the snap ring from the shaft and remove the bearing with a puller.

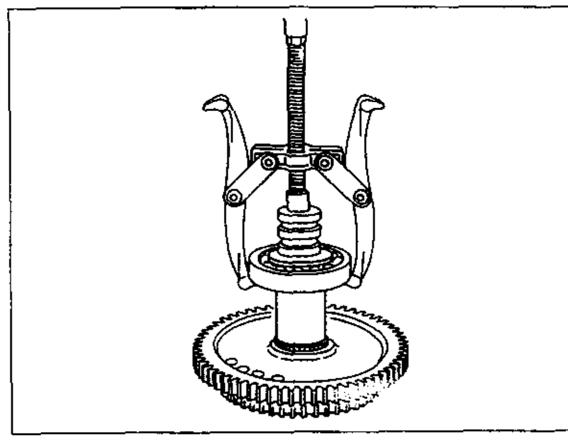


Fig. 2-136

3. Remove the snap ring from the shaft and remove the gear.

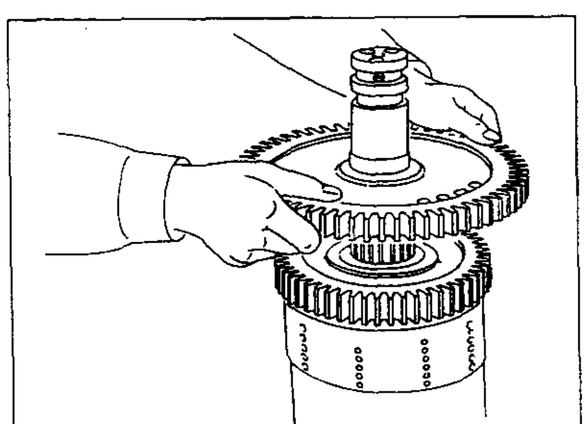


Fig. 2-137

4. Remove the hub gear with a puller.

5. Remove the bearing from inside the hub gear.

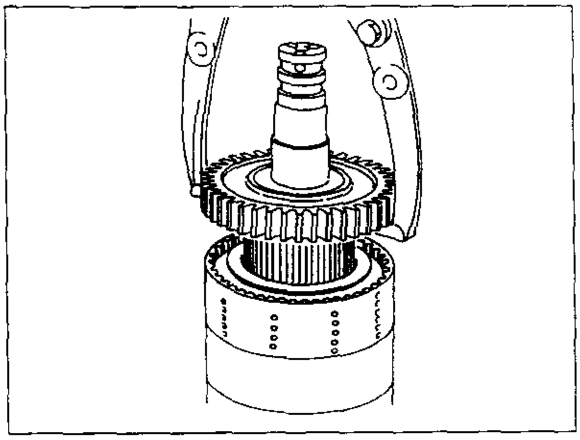


Fig. 2-138

6. Compress the inner return springs by pressing the end plate with a press and remove the snap ring from the clutch drum inner groove.

Warning: Be sure to press the end plate with a press because the strong return springs are installed.

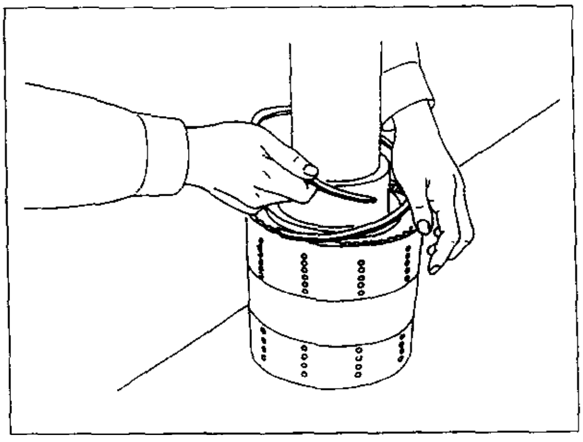


Fig. 2-139

7. Release the press and disassemble the 3rd clutch using the same procedure as disassembling the forward clutch.

8. Remove the other bearings from the shaft with a puller.

9. Disassemble the 4th clutch at the opposite side using the same procedure as disassembling the reverse clutch.

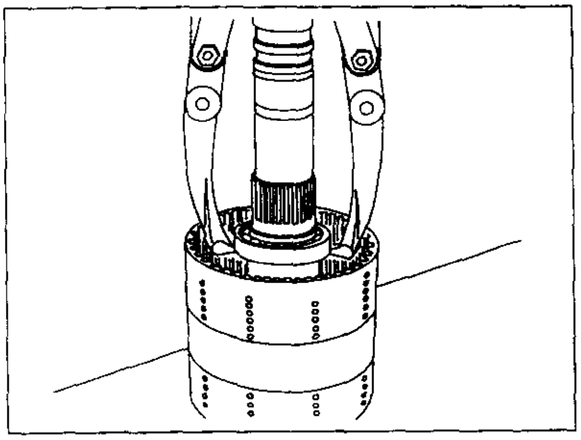


Fig. 2-140

c) **Disassembling 1st/2nd Clutch Shaft**
For disassembling 1st/2nd clutch shaft, refer to "b) Disassembling 3rd/4th Clutch Shaft".

2.6.1.4 Disassembling control valve

a) Disassembling Valve (Upper)

1. Remove the six bolts securing the 6-bolt cover and remove the cover. If the cover is stuck, remove it by tapping with a soft mallet.

Warning:
Do not loosen the bolts abruptly because lots of strong springs are installed in the cover; otherwise a serious accident might occur. Loosen the two bolts at the center which are longer than the others, gradually until spring force cannot be felt.

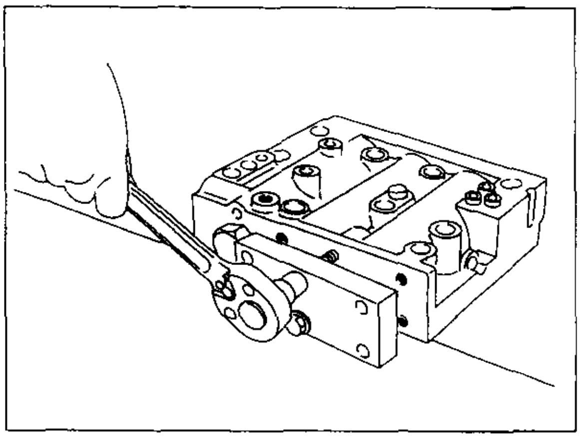


Fig. 2-141

2. Remove the rod (**1**), spring inner (**2**), outer (**3**) center (**4**) and load piston (**5**) from the outer spool hole.
   Remove the flow sensing spool (**6**) and spring (**7**) from the center spool hole.
   Remove the plug (**8**) and regulator spring (**9**).

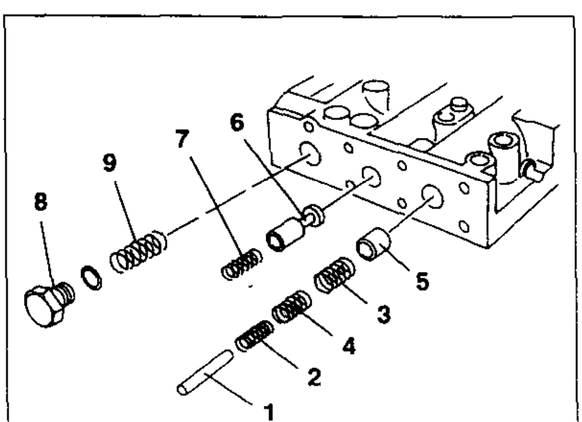


Fig. 2-142

3. Remove the seven bolts securing the cover at the opposite side. If the cover is stuck, remove it by tapping with a soft mallet.

Warning:
Do not loosen the bolts abruptly because lots of strong springs are installed in the cover; otherwise a serious accident might occur. Loosen the bolts alternately until spring force cannot be felt.

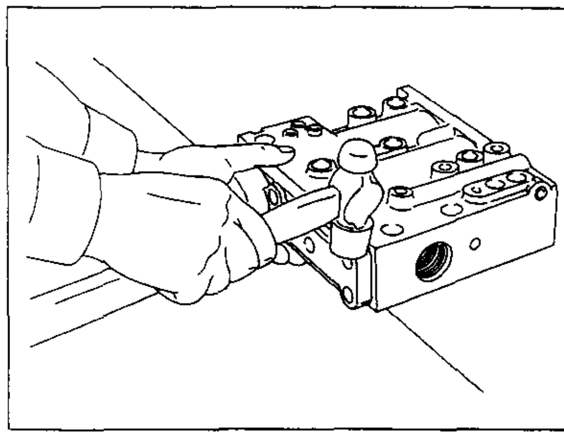


Fig. 2-143

4. Remove the rod (**1**), spring inner (**2**) outer (**3**) center (**4**) and load piston (**5**) from the outer spool hole.
   Remove the spring (**6**) and modulate spool (**7**) from the center spool hole.
   Remove the regulator spool (**8**) and piston (**10**) from the other spool hole.

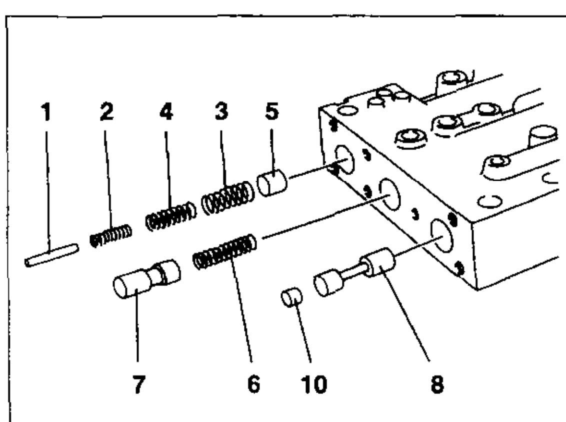


Fig. 2-144

b) Disassembling Valve (Lower)

1. Remove the five flush head bolts from the solenoid valve adapter to separate the adapter from the body unit. If the adapter is stuck, remove it by tapping with a soft mallet.

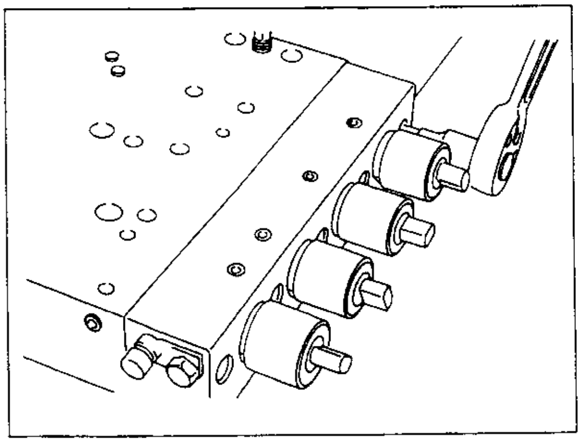


Fig. 2-145

2. Remove the four solenoid valves by using a wrench (34 mm width across flats by 3 mm thickness).

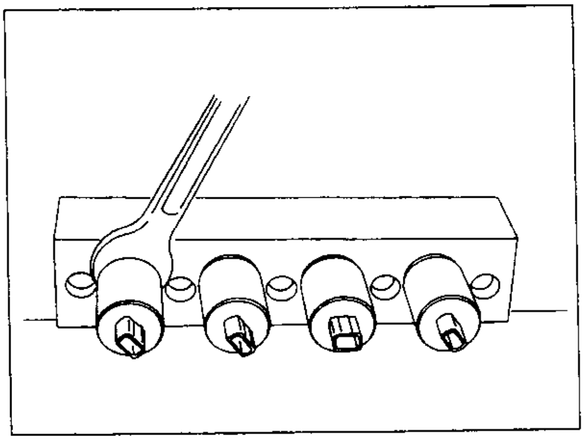


Fig. 2-146

3. Remove the manual spool lock plate and lock bolt from the upper surface. Remove the spool.

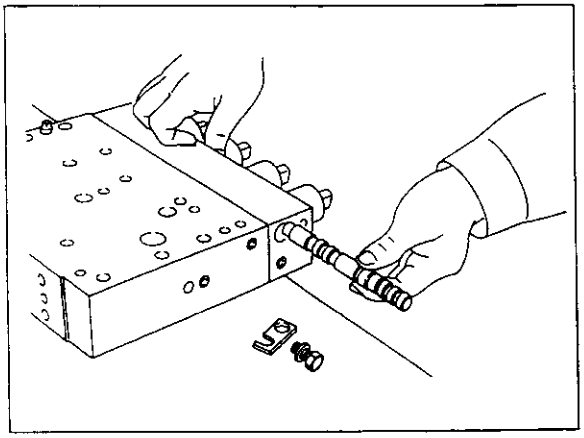


Fig. 2-147

4. Remove the eight bolts securing the eight-bolt cover. Remove the cover. If it is stuck, remove it by tapping with a soft mallet.

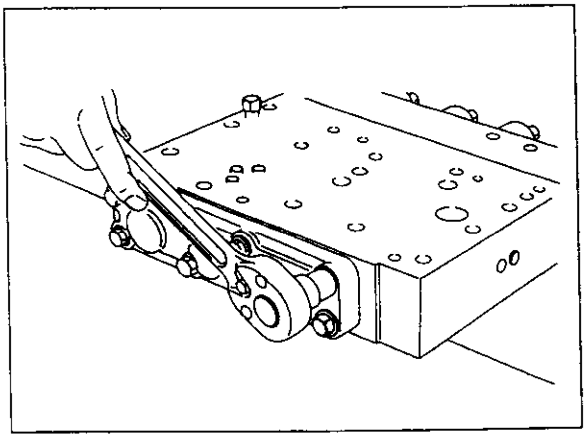


Fig. 2-148

5. Remove the forward/reverse selective spool (**1**) and adapter (**2**) and spring (**3**) from the spool hole.
   Remove the spool **A** (**4**) and selective spring (**5**) from the center spool hole.
   Remove the spool **B** (**6**) and selective spring (**5**) from the other spool hole.

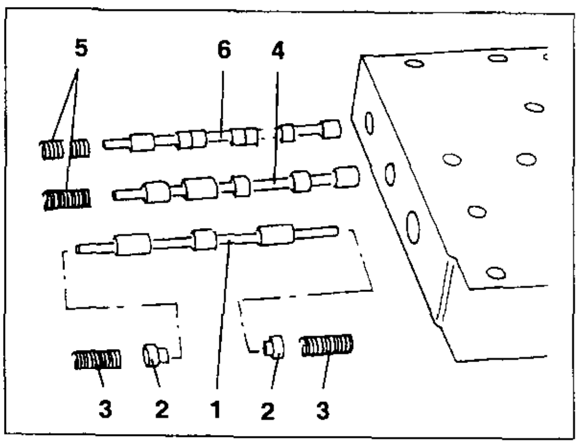


Fig. 2-149

6. Both adapter side and valve body mating surface have four throttle plugs. All of these plugs can be removed with a plug wrench.

Note:
The throttle plugs are select fit. When you are going to remove more than one plug at a time, mark them before removal. Installing a plug in the wrong bore might cause poor performance of the truck.

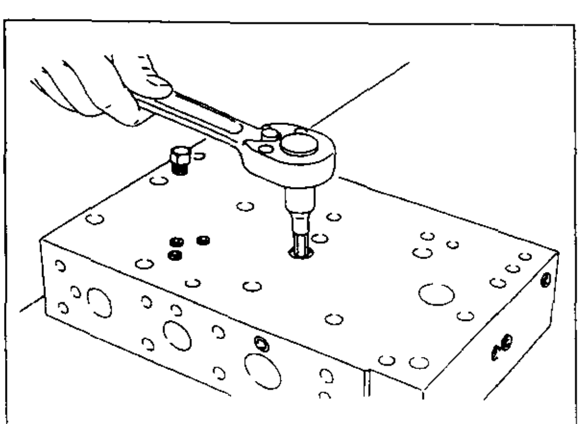


Fig. 2-150

2.6.2 REASSEMBLY

Cautions to be taken when reassembling the drive unit.

1. Wash all disassembled parts with flushing oil and dry them by blowing air. Remove any LOCTITE and gasket on the case mating surfaces carefully with a chisel.

2. Handle each washed part with care to prevent dirt, dent or damage.

3. Check each disassembled part for wear or damage.
   Replace any damaged or worn part. Refer to "2.6.4 STANDARD VALUES FOR MAINTENANCE."

4. Replace the seals with new ones.

2.6.2.1 Reassembling torque converter

a) **Installing Safety Valve**
   Insert the plunger and spring into the transmission case in this order.

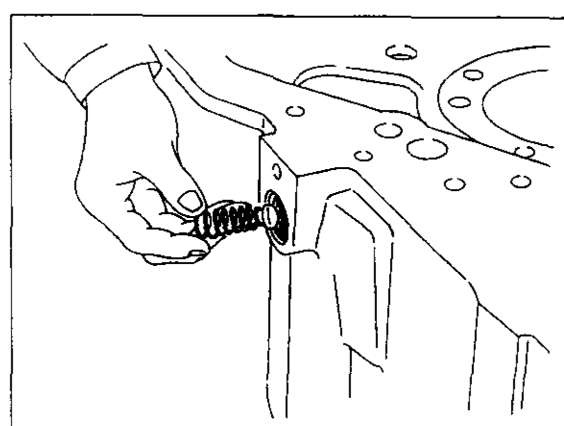


Fig. 2-151

2. Install an O-ring in the plug and screw the plug in the case.

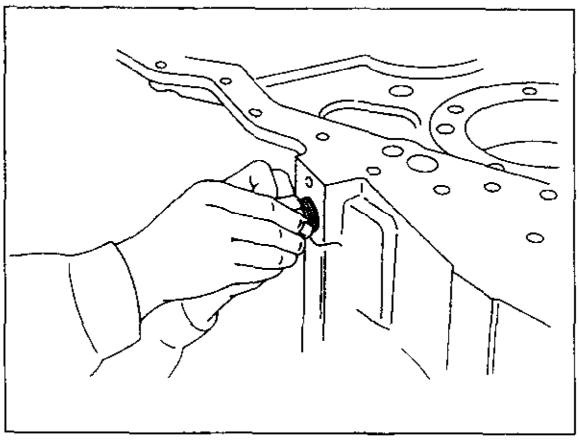


Fig. 2-152

b) ***Installing Pump Drive Gear***

1. Press the bearing support into the bearing bore.

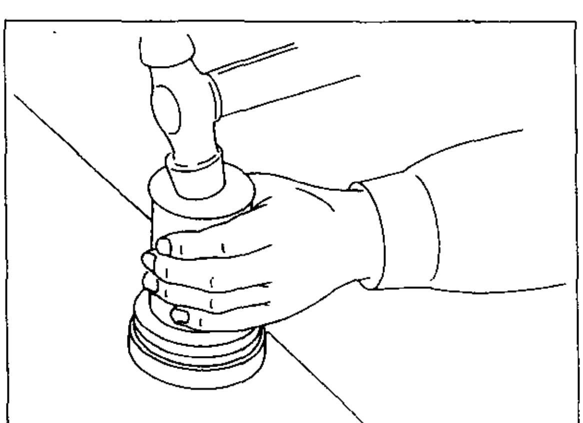


Fig. 2-153

2. Press the bearing with the bearing support into the gear bore.

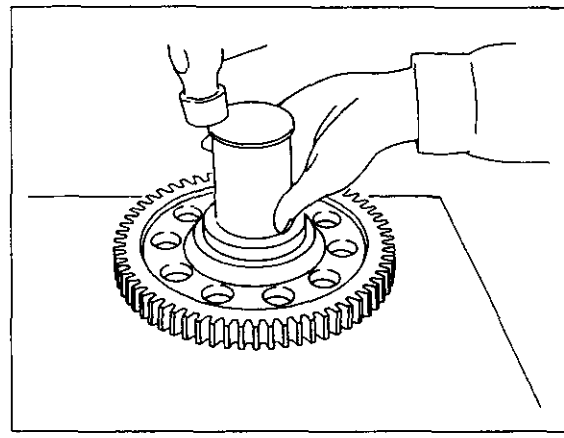


Fig. 2-154

3. Install the snap ring to secure the bearing.

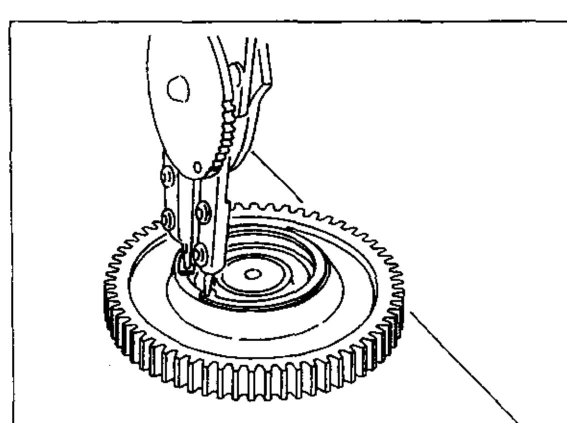


Fig. 2-155

4. Insert the reassembled gear into the support hole inside the housing and install the gear by tightening the bolt. Apply LOCTITE 262 to the threaded area of the bolt.
   Tightening torque: 4.7 kgm.

Note: Install the 79T gear (67T gear for W110) at the right side and 75T gear (60T gear for W130) at the left side when viewed from the torque converter input side.

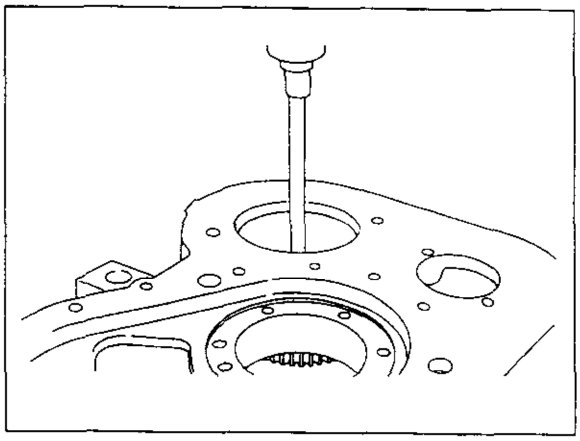


Fig. 2-156

5. Install another pump drive gear using the same procedure as above.

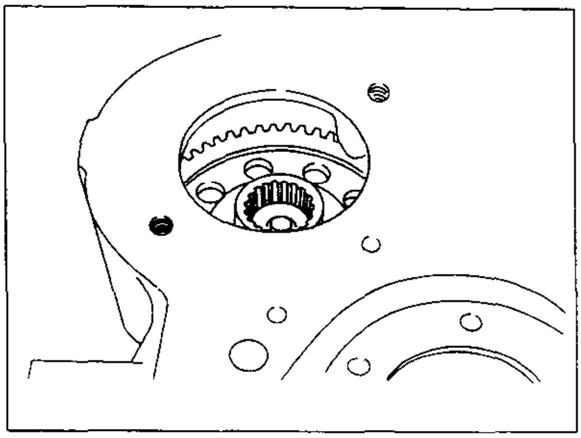


Fig. 2-157

c) Reassembling Converter Wheel (W130)

1. Install the O-ring on the outer diameter of the seal carrier (oil baffle) and press the oil seal into its inside with a jig.
   Apply LOCTITE 262 to the outer diameter of the oil seal and apply grease to the lip of the oil seal.
   The oil seal should be installed with the main lip pointed upward.

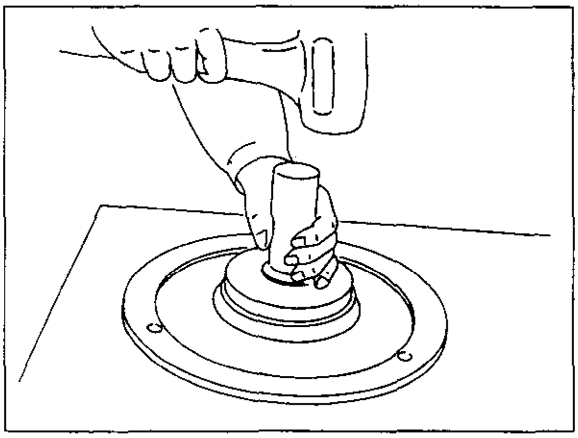


Fig. 2-158

2. Insert the seal carrier into the pump drive sleeve. Use caution not roll up the main lip of oil seal.

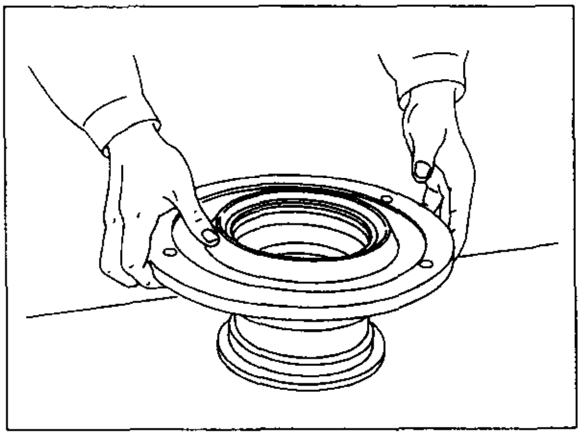


Fig. 2-159

3. Install the pump drive gear in the pump drive sleeve and secure with the snap ring.

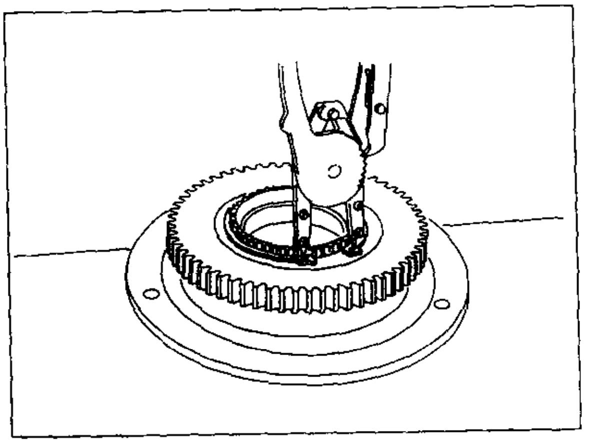


Fig. 2-160

4. Apply converter oil to the seal ring and install the seal ring in the guide carrier (stator support). Install the reassembled pump drive sleeve on the guide carrier.

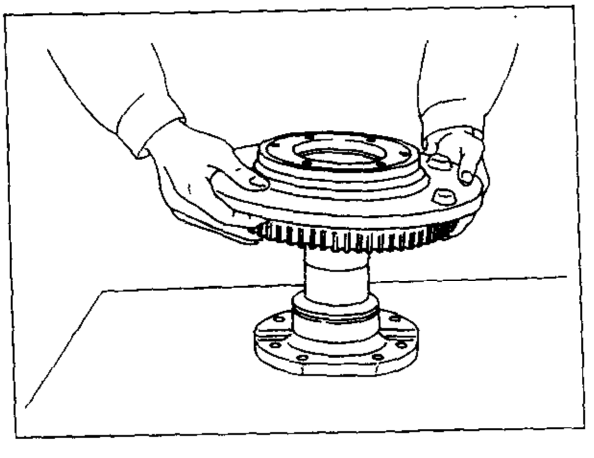


Fig. 2-161

5. Apply grease to the O-ring and install it in the pump drive sleeve groove.

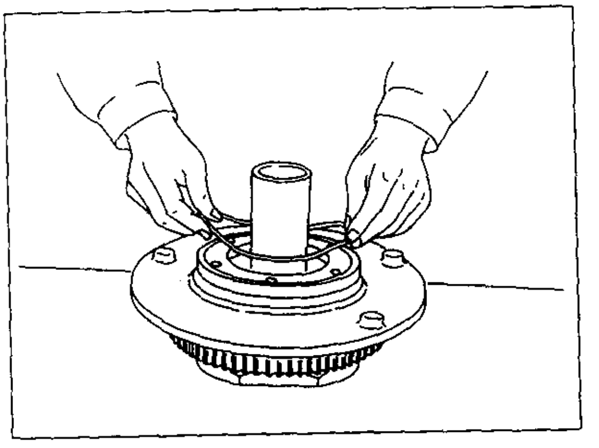


Fig. 2-162

6. Place the impeller wheel on the pump drive sleeve.

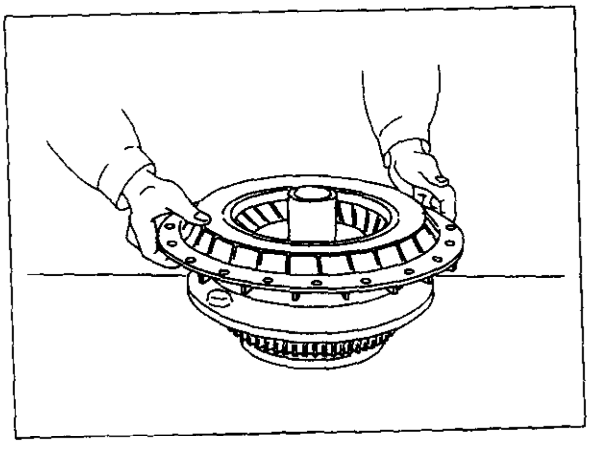


Fig. 2-163

7. Press the bearing into the impeller hub. Reassemble the bearing with the groove for the balls positioned at the output side.

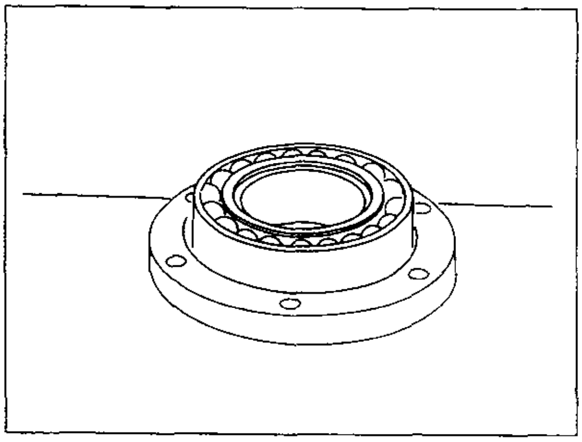
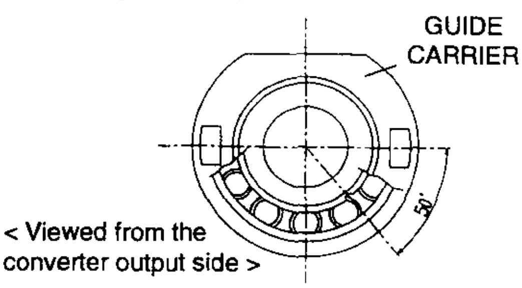


Fig. 2-164

8. Install the impeller hub in the guide carrier and press the bearing with a press until it bottoms. Pay attention to the positions of the bolt holes and the groove for the bearing balls. (Refer to the figure below).



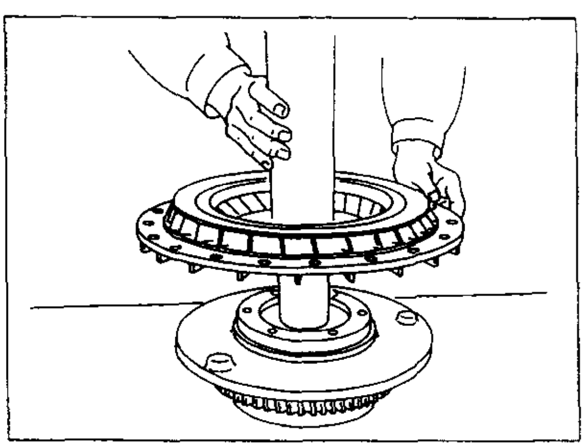


Fig. 2-165

9. Push the impeller hub with a press until there is no clearance between the carrier and the impeller hub and secure it with six flush head bolts.
Tightening torque: 5.2 to 5.9 kgm.

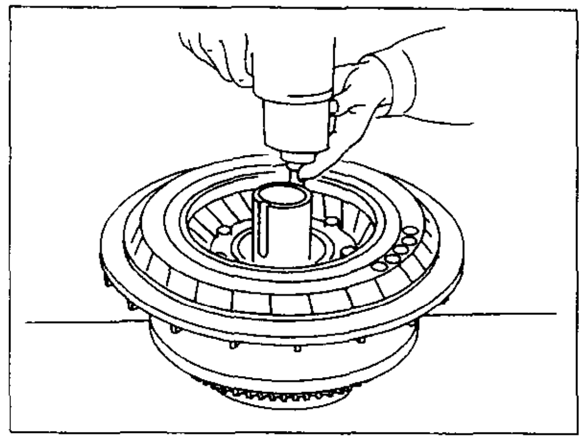


Fig. 2-166

10. Install the spacer in the guide carrier.

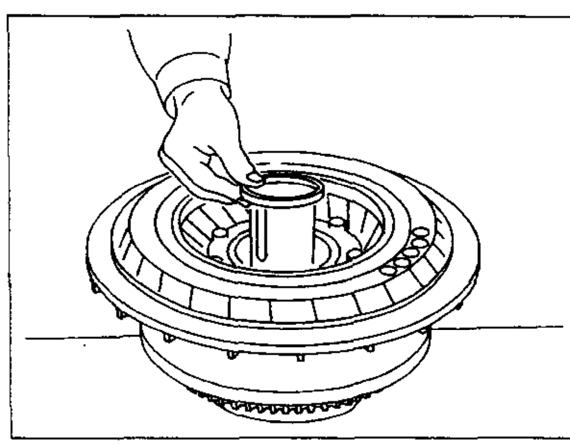


Fig. 2-167

11. Align the stator wheel (with the hub) with the key groove and press the stator wheel into the guide carrier with a press.

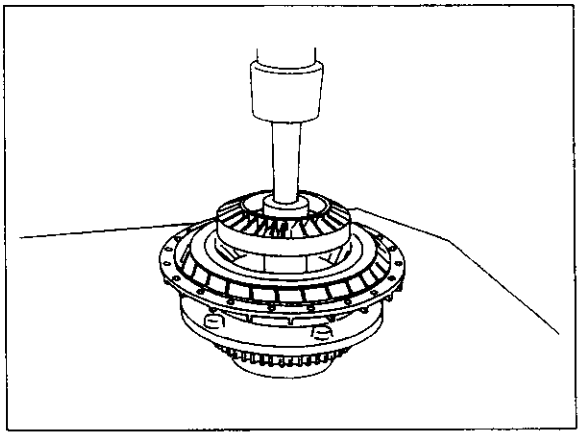


Fig. 2-168

12. Install the snap ring in the guide carrier groove and secure the stator wheel.

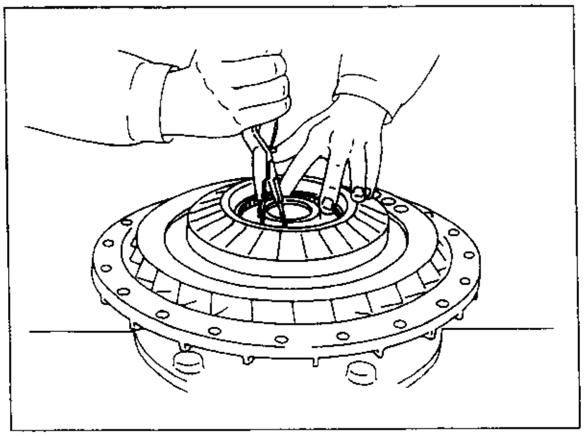


Fig. 2-169

13. Press the bearing into the turbine shaft and lock snap rings at its both sides.
Apply converter oil to the seal ring and install it to the turbine shaft.

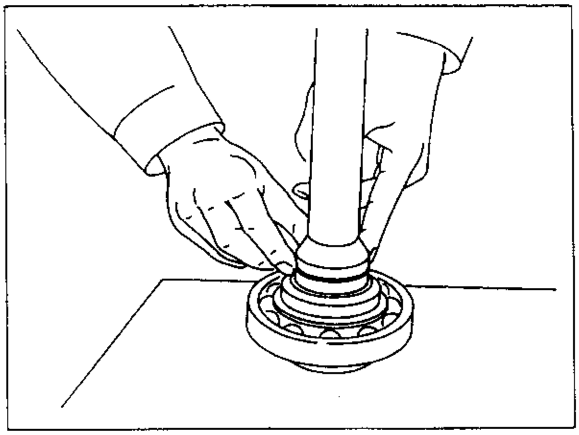


Fig. 2-170

14. Hold the turbine shaft upright and insert the reassembled guide carrier onto the shaft.
Apply grease to the O-ring and install it in the impeller wheel.

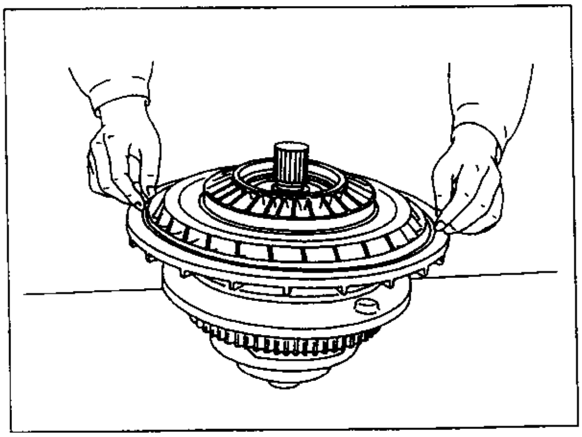


Fig. 2-171

15. Install the turbine wheel onto the turbine shaft. In this step, the turbine wheel inner spline should be engaged with the shaft spline.

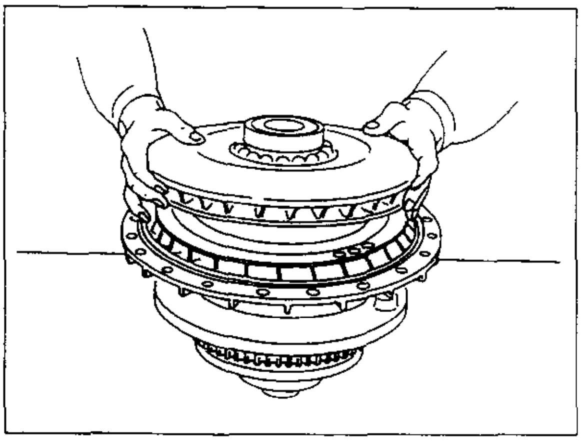


Fig. 2-172

16. Cover the turbine wheel with the cover wheel. Turn the reassembled converter wheel upside down and tighten the 20 fitting bolts.
Tightening torque: 2.1 to 2.3 kgm.

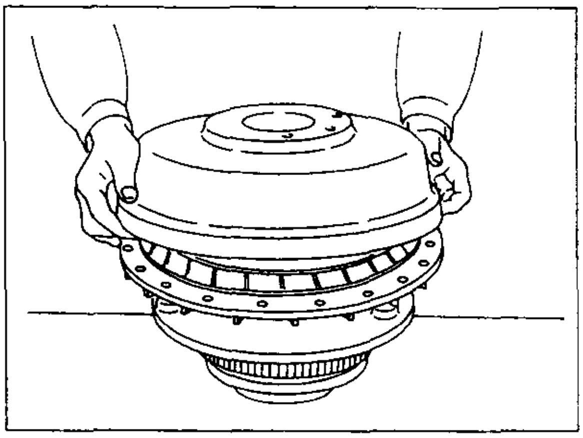


Fig. 2-173

17. Apply grease to the O-ring before assembling into the input guide and install it on the cover wheel. Tighten the six fitting bolts.
Tightening torque: 4.3 to 4.8 kgm.

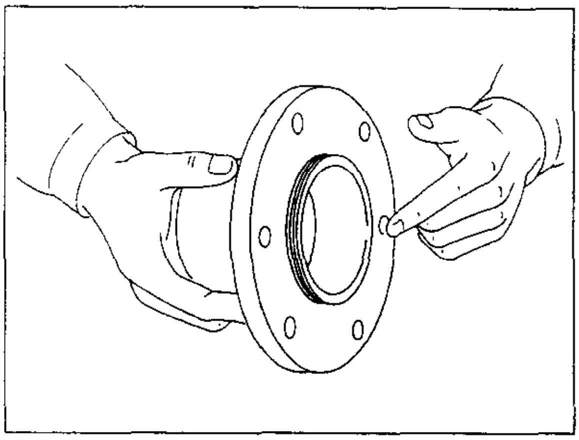


Fig. 2-174

18. Install the input plate and spacer on the cover wheel and secure them with 12 fitting bolts.
Tightening torque: 4.3 to 4.8 kgm.

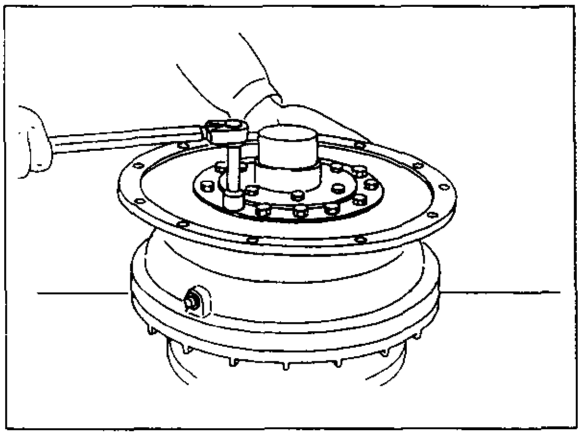


Fig. 2-175

d) Installing Converter Wheel (W130)

1. Install the snap ring into the hole for mounting the turbine shaft in the housing.

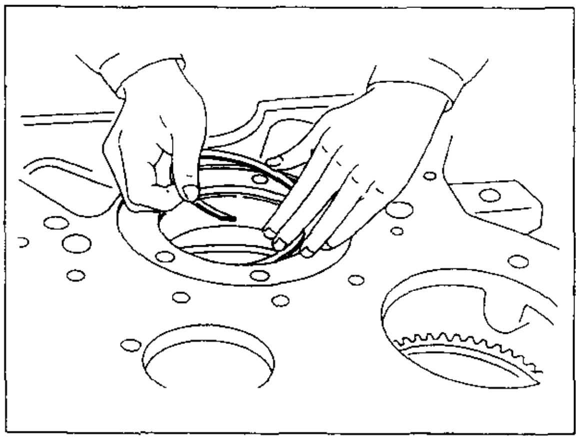


Fig. 2-176

2. Apply grease to the converter housing surface with which the O-ring of the seal carrier (oil baffle) comes in contact.

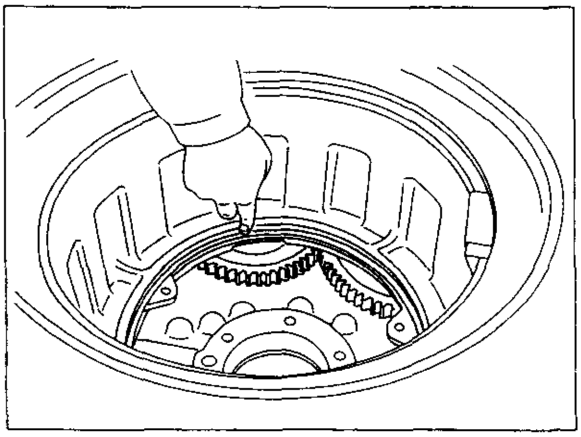


Fig. 2-177

3. Remove the turbine shaft from the reassembled converter wheel.
   Insert the turbine shaft until its bearing comes in contact with the snap ring of the housing.

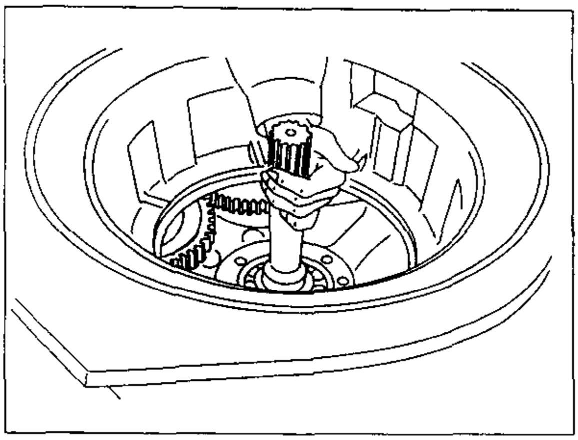


Fig. 2-178

4. Lift the converter wheel with a hoist and screw a stud (M10, l = 200 mm) into a fitting screw hole of the seal carrier (oil baffle).

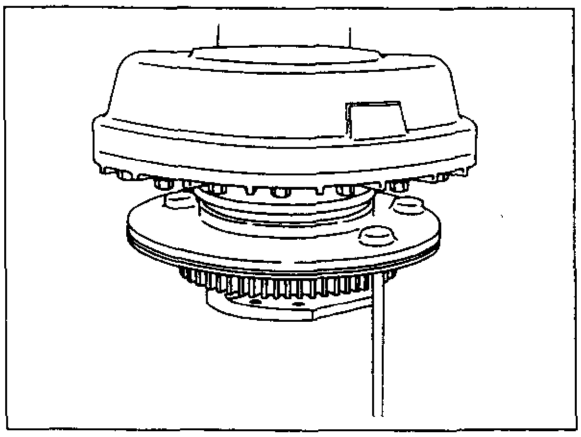


Fig. 2-179

5. Lower the converter wheel gradually, using the stud as a guide and making sure that the guide carrier (stator support) holes are aligned with the holes in the housing.

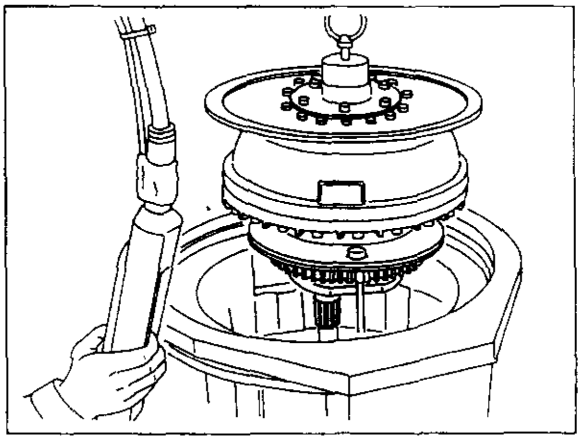


Fig. 2-180

6. After making sure the pump drive gear is engaged with the converter wheel, press the guide carrier by tapping it with a soft mallet until the carrier is inserted into the socket and spigot joint inside the housing.

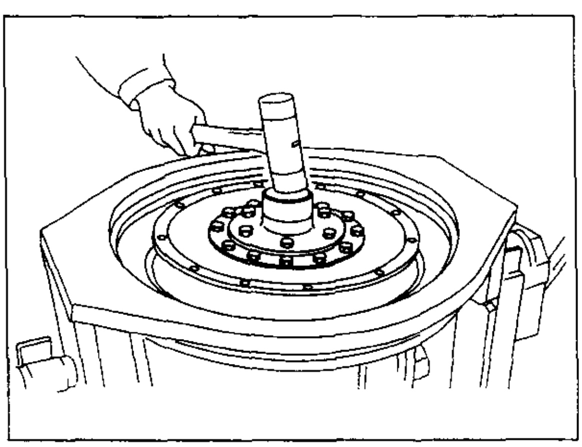


Fig. 2-181

7. Turn the housing upside down and tighten the seven bolts securing the guide carrier.
Tightening torque: 10.3 kgm.

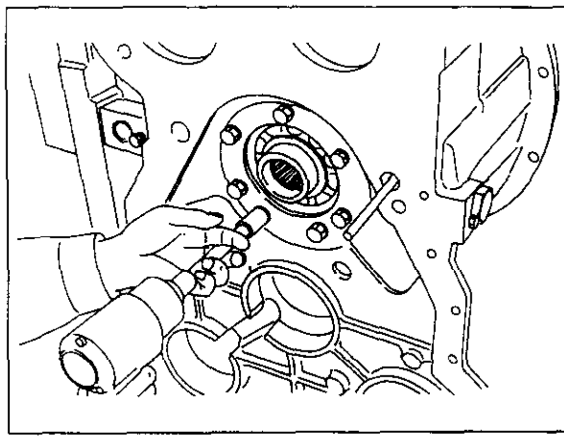


Fig. 2-182

8. Remove the stud used as a guide and tighten the three bolts securing the seal carrier (oil baffle).
Tightening torque: 5.6 kgm.

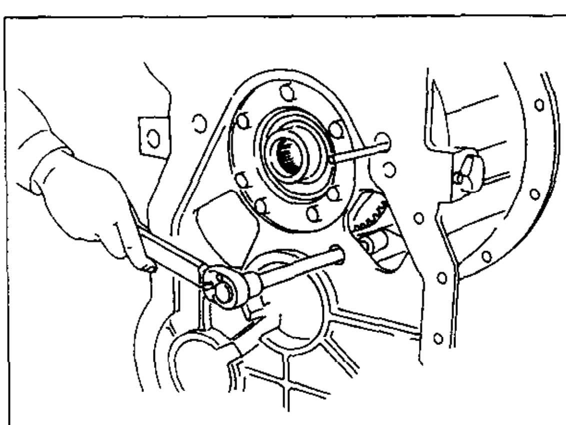


Fig. 2-183

e) Reassembling and Installing Converter Wheel (W110)

1. Apply converter oil to the seal ring and install it in the stator support.

2. Press the stator support into the socket and spigot joint inside the converter housing. Secure the support with seven fitting bolts from the rear side.
Tightening torque: 10.3 kgm.

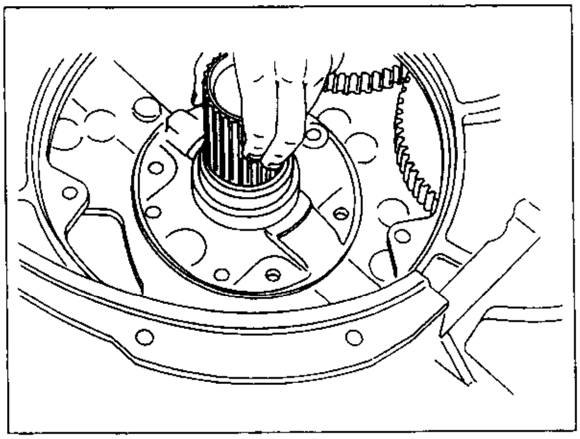


Fig. 2-184

3. Press the bearing into the rear end of the turbine shaft and secure its both sides with snap rings.
Apply converter oil to the seal ring and install it onto the turbine shaft.

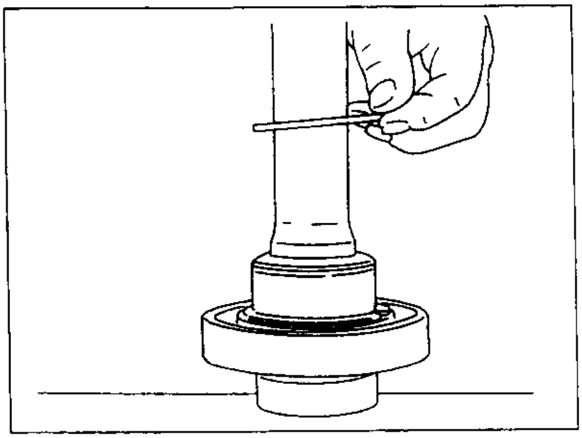


Fig. 2-185

4. Press the turbine shaft from the output side of the converter housing. Secure the bearing with snap ring.

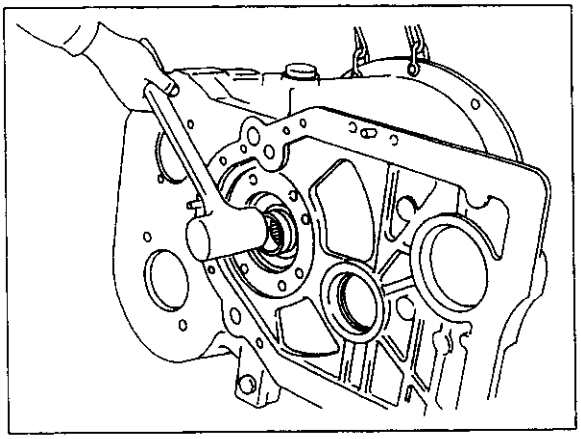


Fig. 2-186

5. Press the ball bearing into the impeller wheel hub and secure it with snap rings.

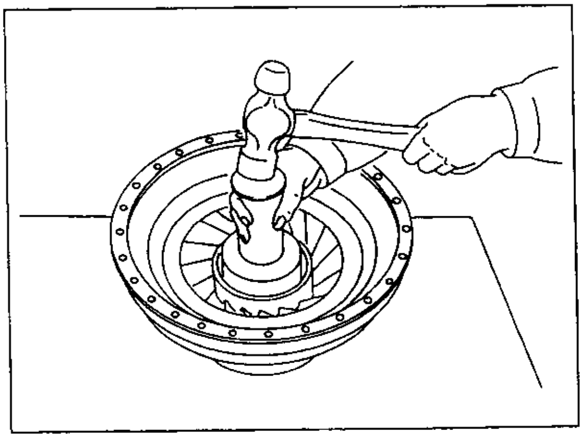


Fig. 2-187

6. Apply grease to the oil seal lip and apply LOCTITE 262 to the outer diameter.
Press the oil seal into the inner diameter of the oil baffle and install the O-ring to which grease is applied, in the outer diameter.
Install the oil seal with the main lip (spring side) positioned at the convex side of the oil baffle.

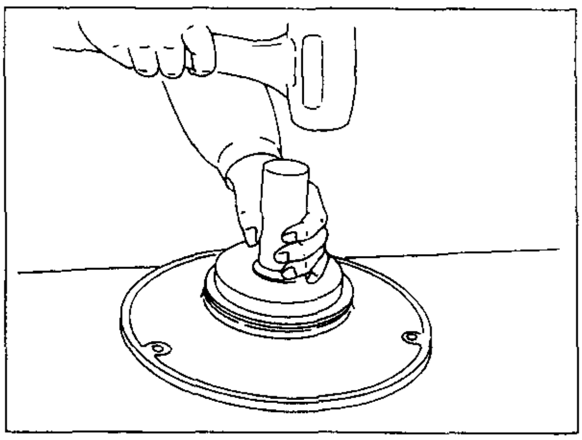


Fig. 2-188

7. Install the oil baffle and impeller hub gear on the impeller wheel hub and secure them with snap ring.

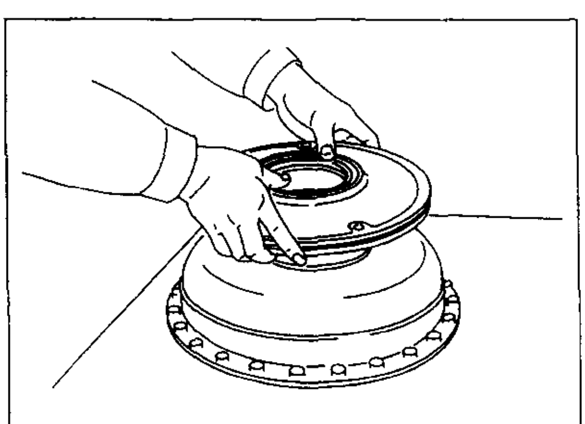


Fig. 2-189

8. Install the long stud into the screw hole of the oil baffle to center the screw hole securing the oil baffle.
Screw size: M10 x 1.25.

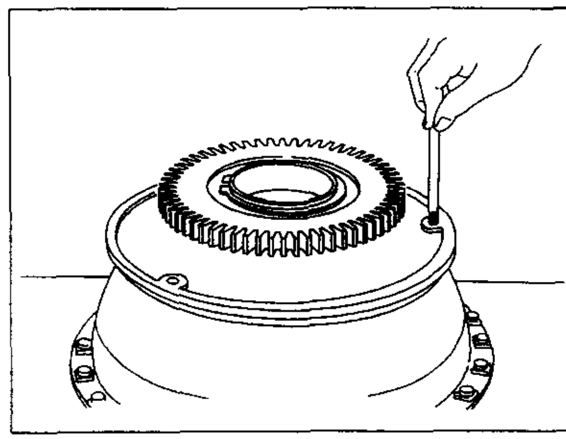


Fig. 2-190

9. Insert the impeller wheel assembly into the stator support. Make sure that the stud for centering the oil baffle is aligned with the hole of the converter housing and press the bearing until its shoulder bottoms.
10. Remove the stud from the rear side and tighten the three fitting bolts.
Tightening torque: 5.6 kgm.

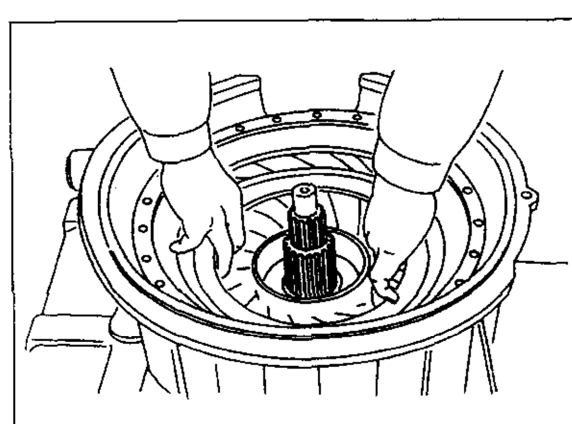


Fig. 2-191

11. Install the collar and stator wheel in the stator support, and secure them with snap ring.

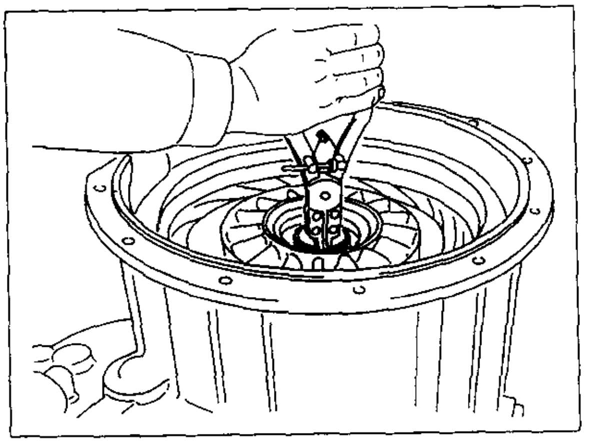


Fig. 2-192

12. Install the snap ring, turbine wheel and the snap ring onto the turbine shaft in this order.

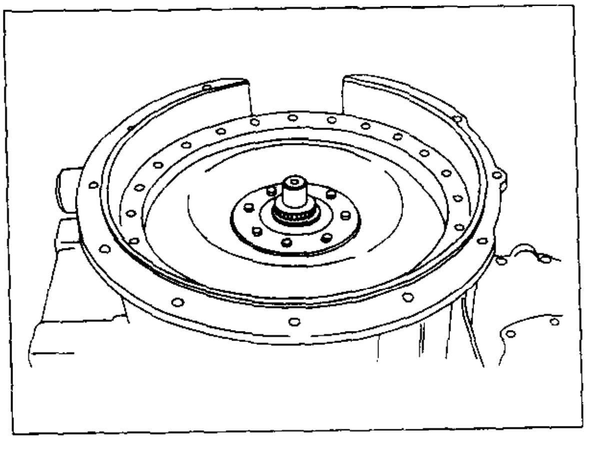


Fig. 2-193

13. Install the front cover assembly which has the needle bearing in its center, and secure them by tightening the 24 bolts.
Tightening torque: 2 kgm.

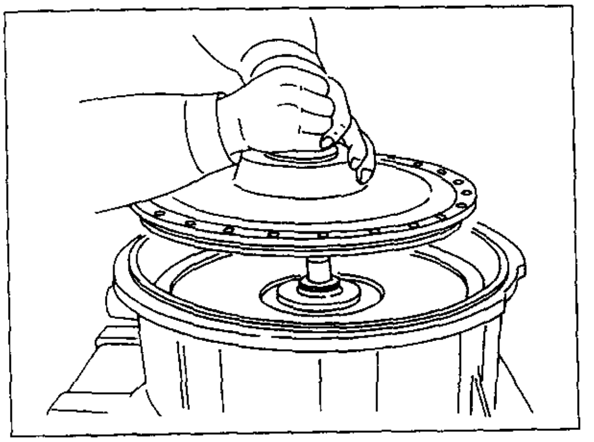


Fig. 2-194

14. Install the input plate on the front cover. After that, install the washer on the plate with its chamfer pointed to the input plate side, securing with the eight bolts. LOCTITE 262 should be applied to the threaded area of each bolt.
Tightening torque: 6.2 kgm.

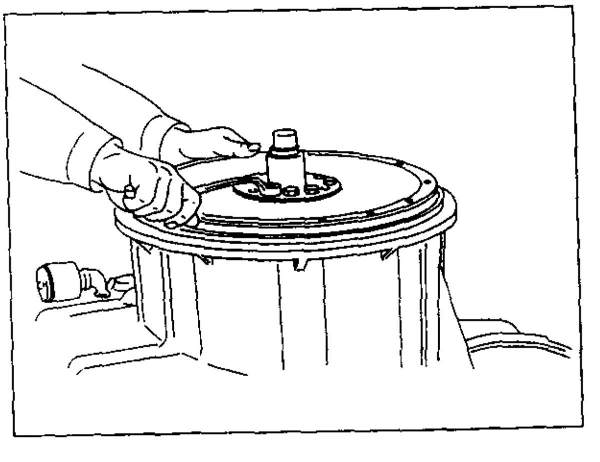


Fig. 2-195

6.2.2.2 Reassembling clutch shaft

a) Reassembling Forward/Reverse Shaft

1. Hold the clutch shaft upright on a bench with the forward clutch pointed upward.

2. Apply grease to the outer seal ring and install it into the clutch piston with the seal ring lip pointed upward.

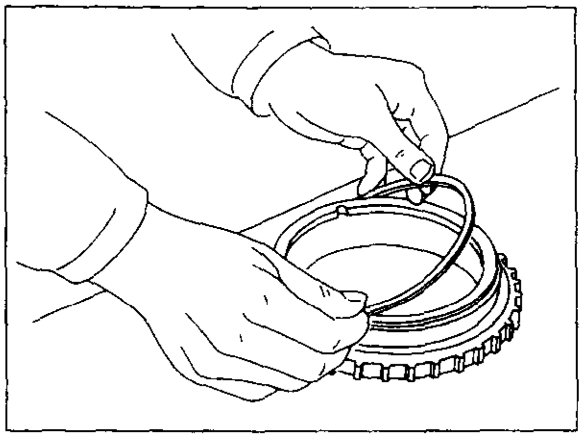


Fig. 2-196

3. Apply grease to the inner seal ring and install it onto the shaft.

4. Insert the clutch piston into the drum.

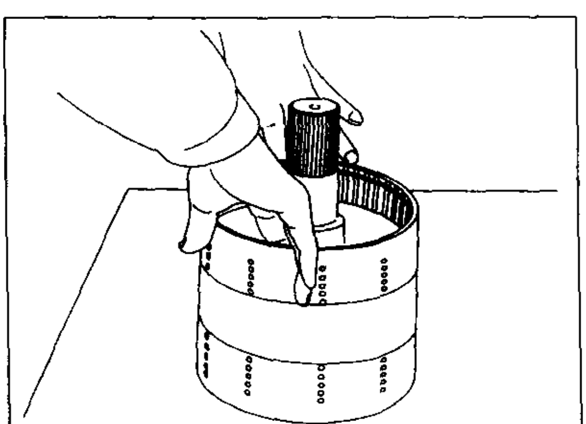


Fig. 2-197

5. Insert the plates, return springs and disks into the drum in this order.

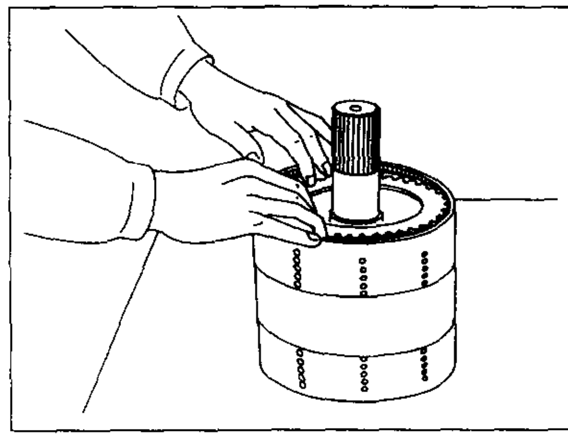


Fig. 2-198

6. Install the end plate with the convex side to the outside.

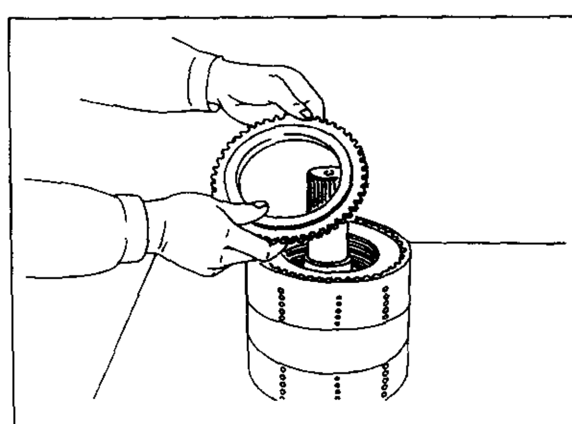


Fig. 2-199

7. Press the end plate with a press to compress the return springs and install the snap ring in the drum groove.

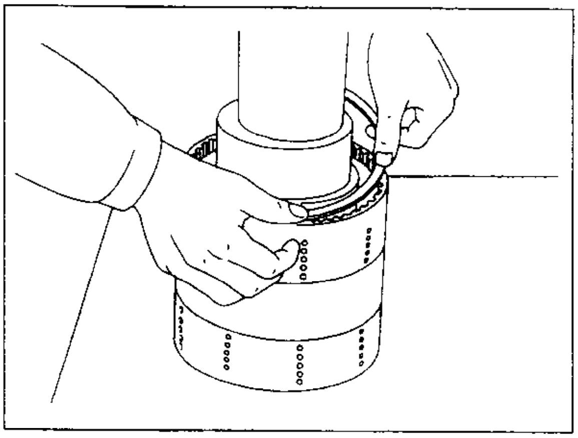


Fig. 2-200

8. Press the bearing inside the hub gear into the shaft.

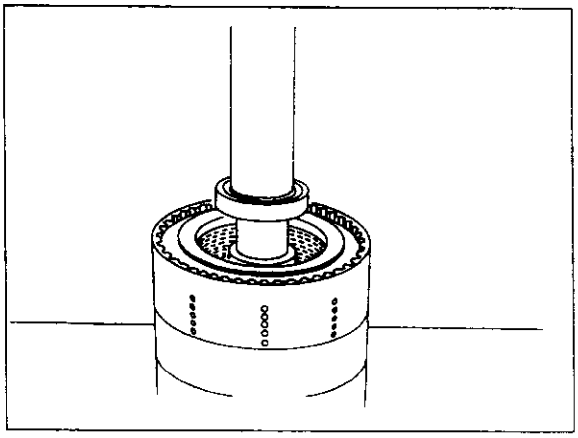


Fig. 2-201

9. After making sure that two snap rings are installed inside the hub gear, turn the hub gear to right and left to engage it with the disk spline. Press the gear into the shaft with a soft mallet until it comes in contact with the bearing of the shaft.

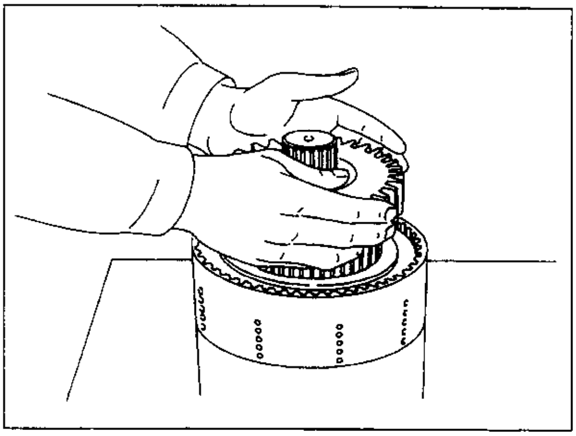


Fig. 2-202

10. Press and install the outer bearing of the hub gear with the shield pointed to outside.

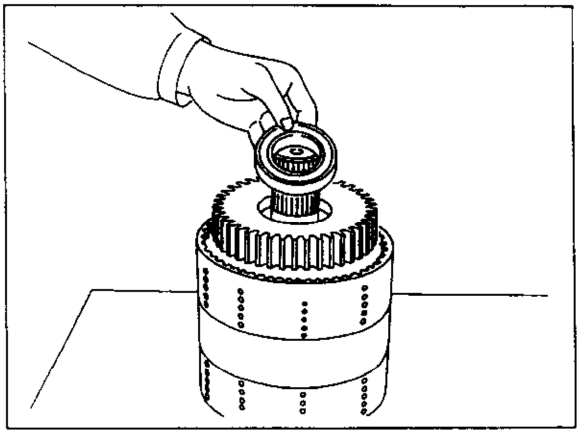


Fig. 2-203

11. Insert the snap ring into the shaft groove to secure the bearing.

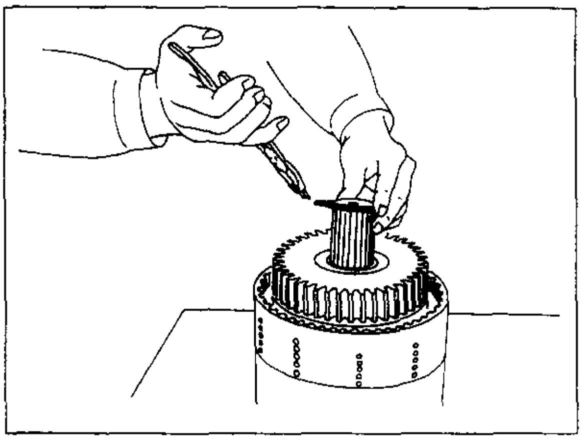


Fig. 2-204

12. Reassemble the reverse clutch using the same procedure as above.

13. Install the snap ring, the bearing and the snap ring onto the clutch shaft in this order, with the snap ring groove in the bearing outer diameter pointed to the outside.

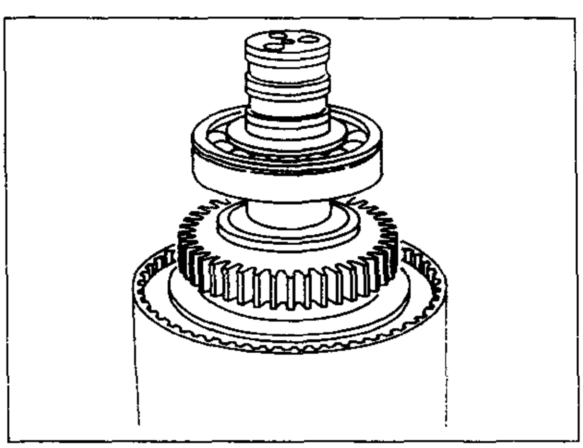


Fig. 2-205

b) Reassembling 3rd/4th Shaft

1. Reassemble the 3rd clutch until the clutch piston is installed, using the same procedure as reassembling the forward clutch.

2. When installing the clutch plates, return springs and disks, use rod jigs which are useful to engage the drum with the spline of the plates, at the five points in the circumference.

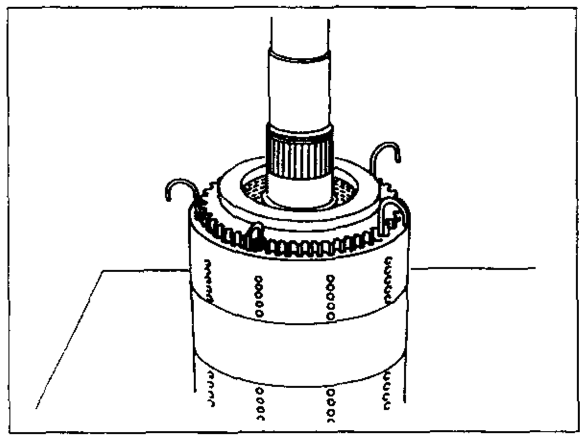


Fig. 2-206

3. Place the end plate and push it with a press. Compress the return spring until the snap ring groove of the drum can be seen.

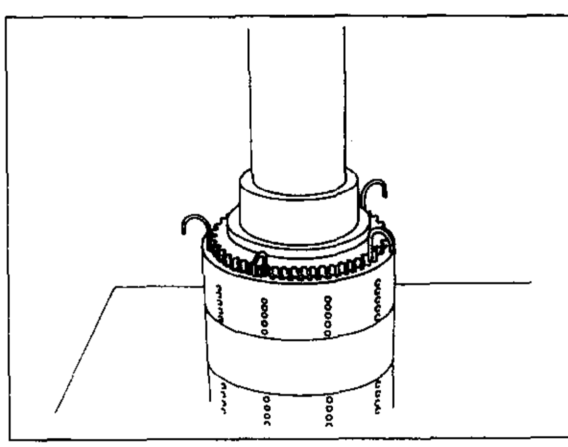


Fig. 2-207

4. Install the snap ring into the drum groove after removing all rod jigs.
   Press the inner bearing of the hub gear into the shaft.

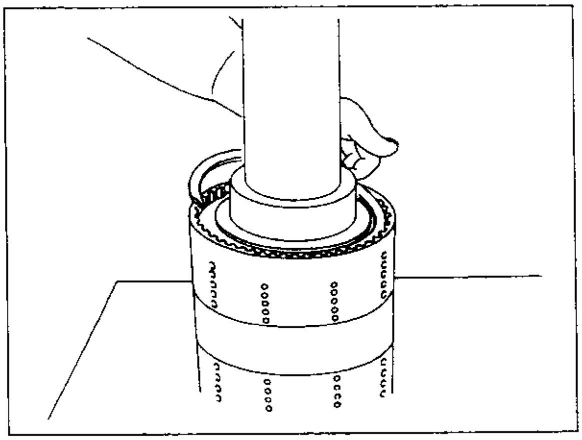


Fig. 2-208

5. After making sure that snap ring is installed inside the hub gear, turn the hub gear to right and left a little to engage it with the plate spline and install it by driving with a soft mallet.

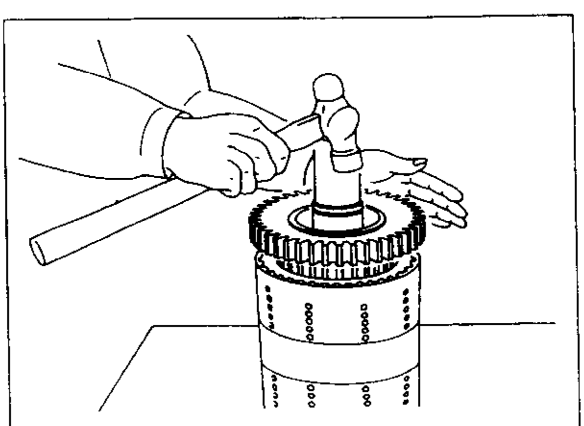


Fig. 2-209

6. Press the outer bearing of the hub gear into the shaft with the shield pointed to outside.

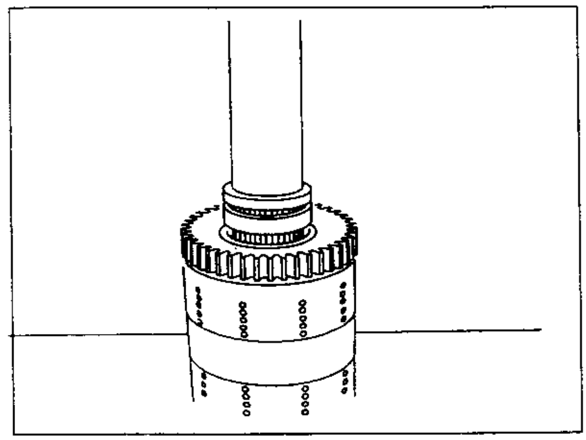


Fig. 2-210

7. Insert the gear into the shaft to secure it with snap ring, with the boss projection pointed to the bearing side.

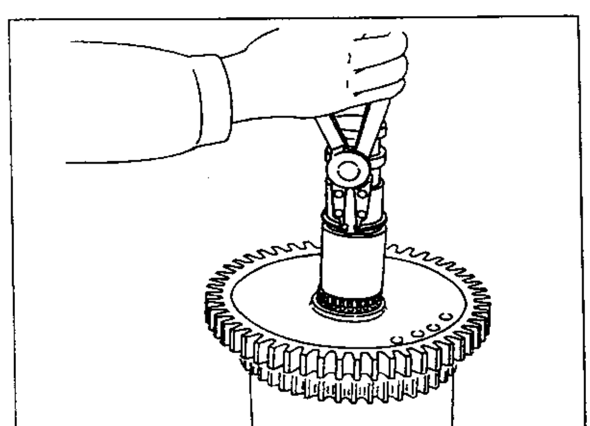


Fig. 2-211

8. Install the snap ring, the bearing and the snap ring onto the shaft in this order, with the snap ring groove in the bearing outer diameter pointed to the outside.

9. Turn the clutch shaft upside down and reassemble the 4^{th} clutch using the same procedure as reassembling the forward clutch.

c) **Reassembling $1^{st}/2^{nd}$ Shaft**
Reassemble the $1^{st}/2^{nd}$ shaft, referring to "b) Reassembling $3^{rd}/4^{th}$ Shaft".

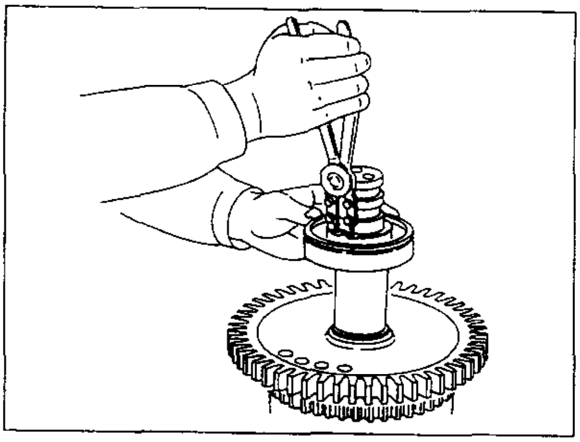


Fig. 2-212

2.6.2.3 Reassembling control valve

Cautions to be taken when reassembling the control valve.

Wash all disassembled parts thoroughly and dry them by blowing air. Do not wipe them with waste cloth or paper; otherwise dirt might gather the parts, causing a trouble in the hydraulic circuit. Check the passages and the orifices of the spools for clogging. If any clogging is found, remove and wash. Apply LOCTITE 572 to the threaded area of plugs which do not use O-rings, before installing them.

Do not use the seal tape because it might cause clogging.

a) **Reassembling Valve (lower)**

1. Apply LOCTITE 572 to the threaded area of the four throttle plugs at the side and the four throttle plugs at the top, before installing them on the valve body securely.
Use caution not to install the plugs in the wrong bores.

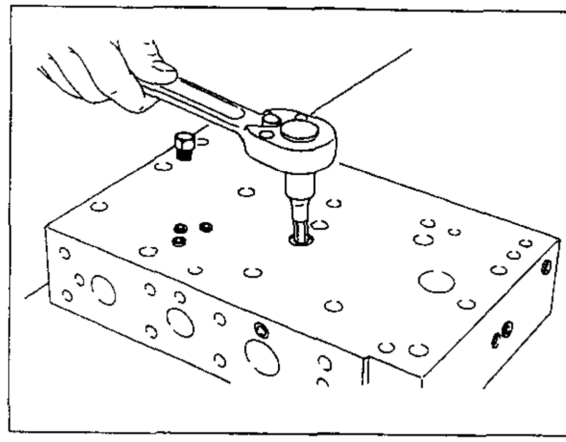


Fig. 2-213

2. Install the spring (**3**), adapter (**2**) and forward/reverse selection spool (**1**) into the spool hole of the eight-bolt cover.
Install the selection spring (**5**) and spool **A** (**4**) into the center spool hole.
Install the selection spring (**5**) and spool **B** (**6**) into the other spool hole.

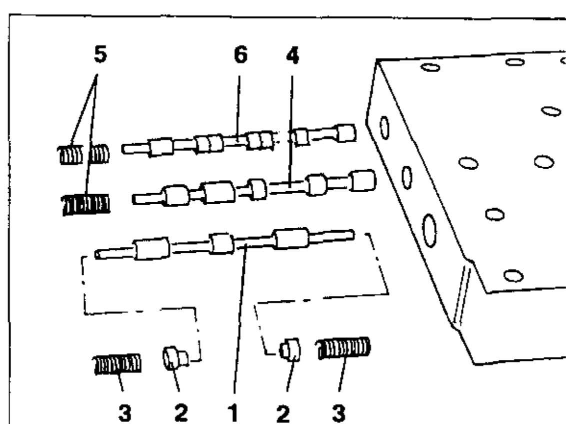


Fig. 2-214

3. Attach the gasket to the cover and fit the cover to the body, securing with the eight bolts.
The eight bolts should be tightened in turns evenly to compress the inner spring properly.
Tightening torque: 4.2 kgm.

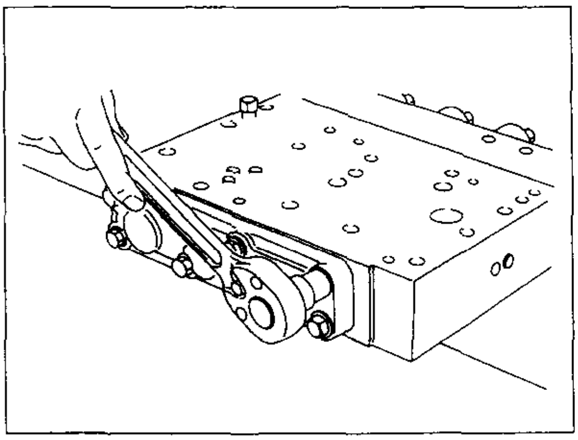


Fig. 2-215

4. *Install the four solenoid valves into the adapter.*

5. Attach the gasket to the adapter and fit the adapter to the body, securing with five flush head bolts.
Tightening torque: 4.2 kgm.

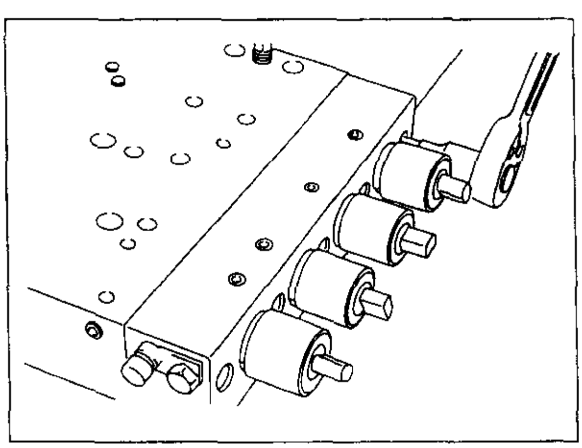


Fig. 2-216

6. Install the manual spool and lock it with the lock plate and lock bolt.

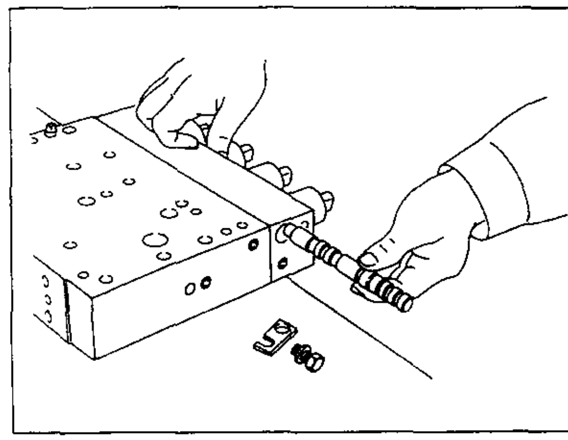


Fig. 2-217

b) Reassembling Valve (upper)

1. Install the load piston (5), spring center (4), inner (2), outer (3) and rod (1) into the spool hole in the seven-bolt cover.
Install the spring (6) and modulate spool (7) into the center spool hole.
Install the regulator spool (8) and piston (10) into the other spool hole.

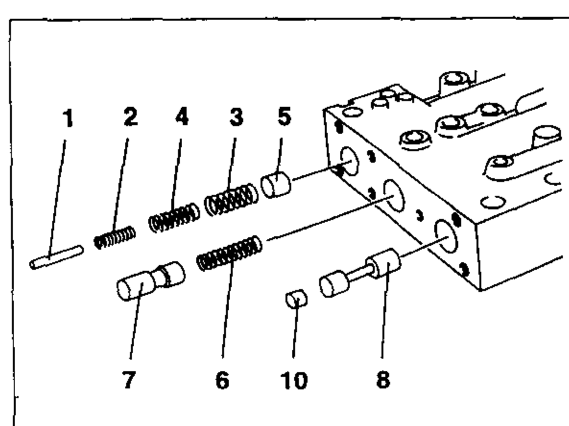


Fig. 2-218

2. Attach the gasket to the cover and fit the cover to the body, securing with seven bolts.
The seven bolts should be tightened in turns to compress the inner spring properly.
Tightening torque: 4.2 kgm.

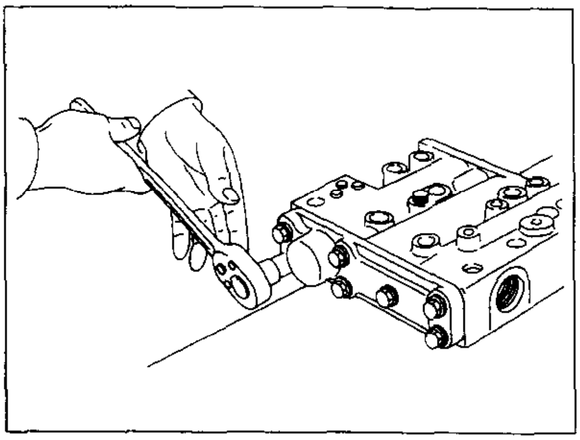


Fig. 2-219

3. Install the load piston (**5**), spring center (**4**), inner (**2**), outer (**3**) and rod (**1**) into the spool hole in the six-bolt cover.
Install the flow sensing spool (**6**) and spring (**7**) into the center spool hole.
Install the regulator spring (**9**) into the plug hole and secure the spring with the plug (**8**).

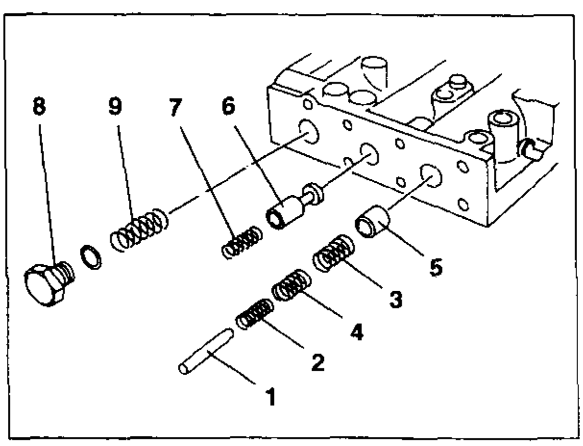


Fig. 2-220

4. Attach the gasket to the cover and fit the cover to the body, securing with the six bolts.
The six bolts should be tightened in turns to compress the strong spring properly. The two bolts at the center are longer than the other bolts. Pay attention to the bolt length when re-assembling the bolts.
Tightening torque: 4.2 kgm.

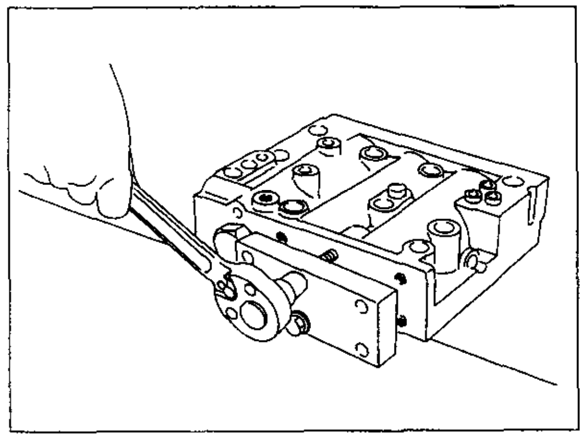


Fig. 2-221

2.6.2.4 Reassembling transmission

a) Installing Output Shaft

1. Put the oil baffle in the transmission case and secure it with three fitting bolts from the case rear side.

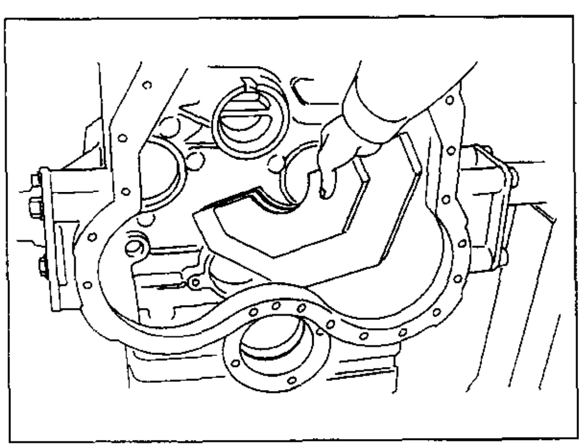


Fig. 2-222

2. Install the snap ring onto the output shaft.

3. Turn the shaft upside down and press the ball bearing into the shaft.

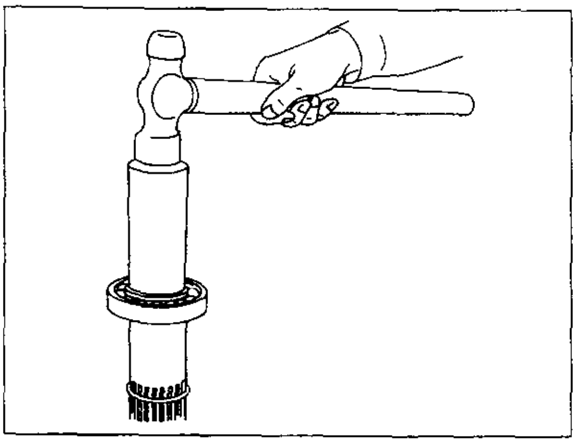


Fig. 2-223

4. Press the roller bearing outer race into the case at its rear side.

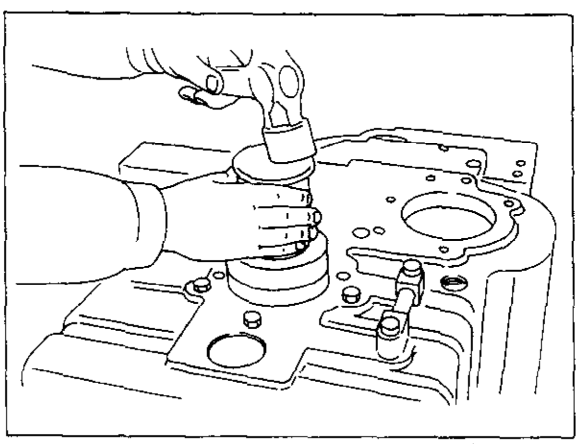


Fig. 2-224

5. Install the snap ring in the case groove at the outer diameter of the pressed outer race.

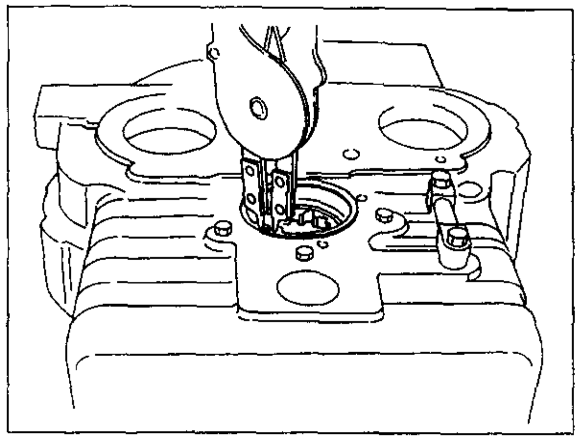


Fig. 2-225

6. Install the inner race of the roller bearing from inside the case.

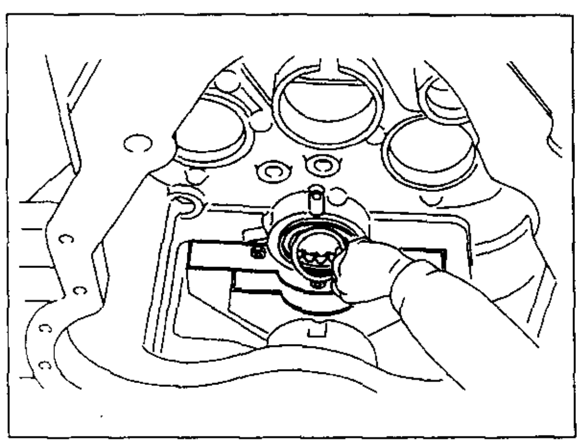


Fig. 2-226

7. Put the 63T and 33T gears (35T gear for W130) into the case at its rear side.
Insert the output shaft from the front side of the case through two gears.

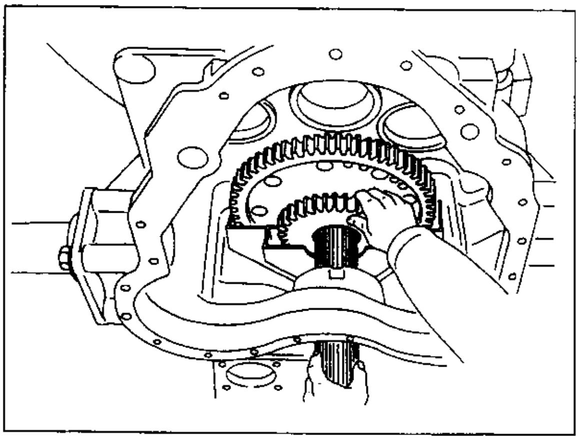


Fig. 2-227

8. Press the roller bearing by driving the output shaft with a soft mallet from the front side of the output shaft.

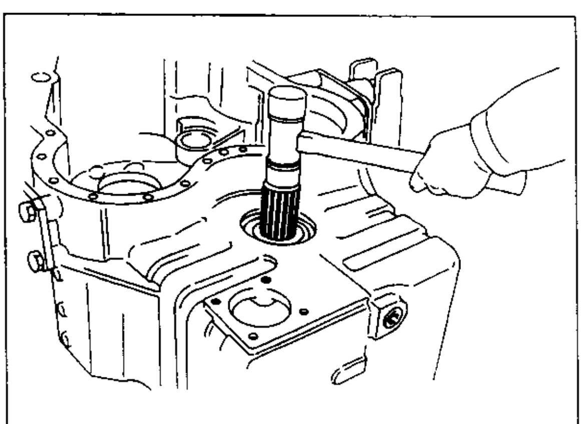


Fig. 2-228

9. Install the snap ring in the case groove at the outer diameter of the ball bearing and secure the output shaft.

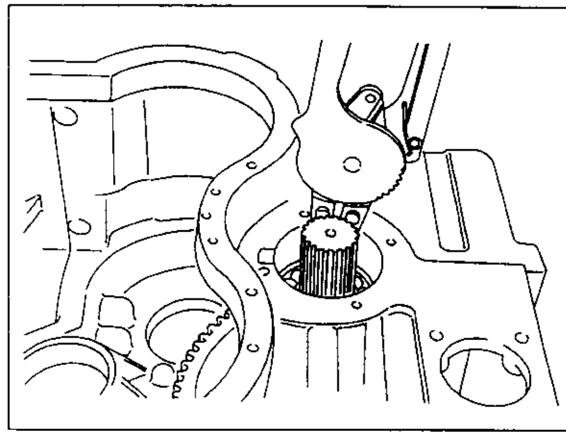


Fig. 2-229

10. Before installing the oil seal, apply grease to the lip and LOCTITE 262 to the outer diameter. Press the oil seal into the front bearing cap with the main lip (spring side) pointed to the case inside.

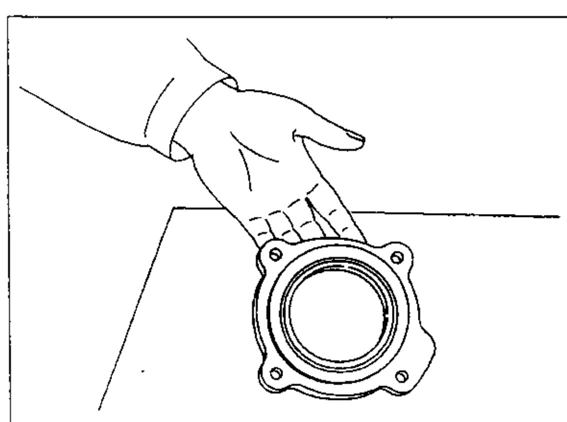


Fig. 2-230

11. Install the reassembled bearing cap in the transmission case with a gasket and secure it with the four bolts.
Tightening torque: 1.9 kgm.

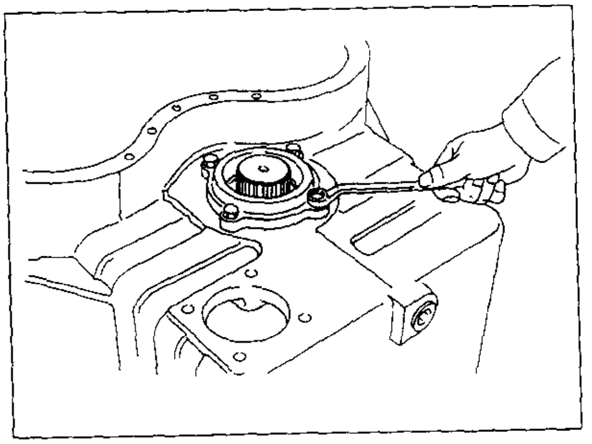


Fig. 2-231

12. Insert the inner race of the roller bearing into the output shaft at its rear side.

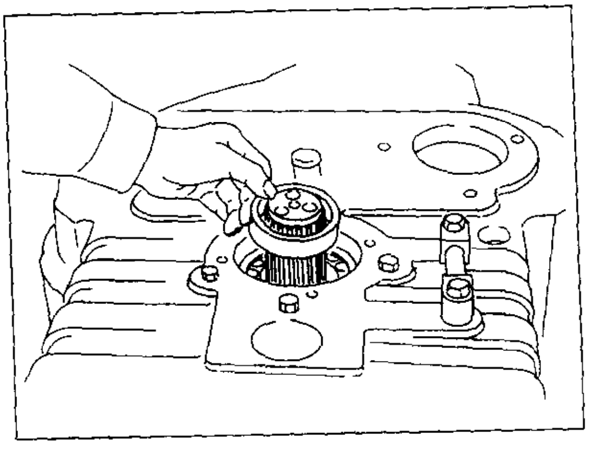


Fig. 2-232

13. Place another spacer on the inner race and press it by driving a jig with a mallet until the spacer comes in contact with the bearing.

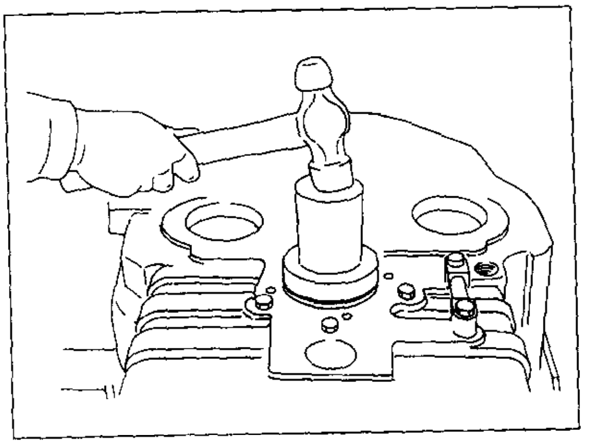


Fig. 2-233

14. Install the oil seal on the rear side bearing cap using the same procedure as installing the oil seal on the front side bearing cap.
Install the bearing cap with the oil seal in the transmission case through the gasket and secure it with four bolts.
Tightening torque: 1.9 kgm.

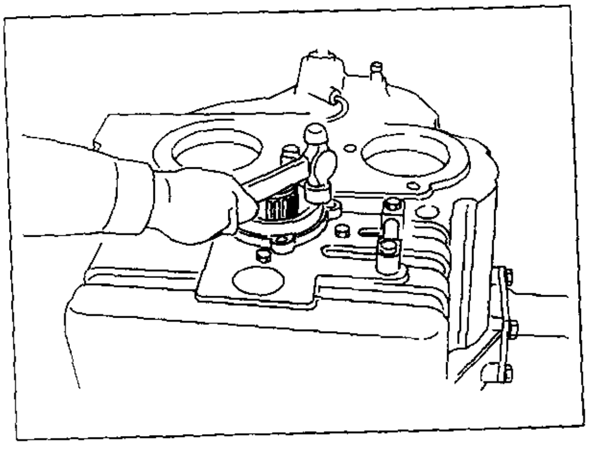


Fig. 2-234

15. Insert the flange into the output shaft at the rear side and install the O-ring between the shaft and flange.

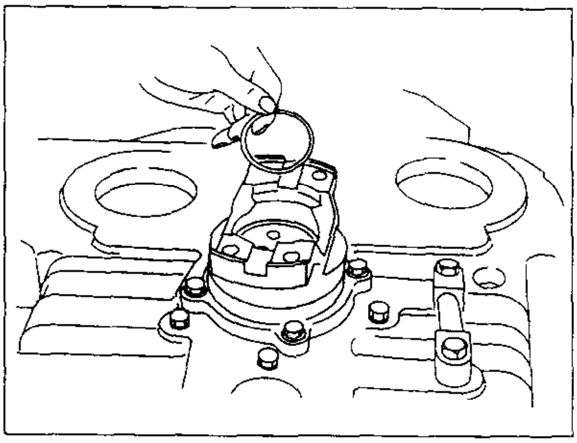


Fig. 2-235

16. Place the plate on the O-ring and secure the flange with three fitting bolts.
    Apply LOCTITE 262 to the threaded area of each bolt.
    Tightening torque: 9.3 kgm.

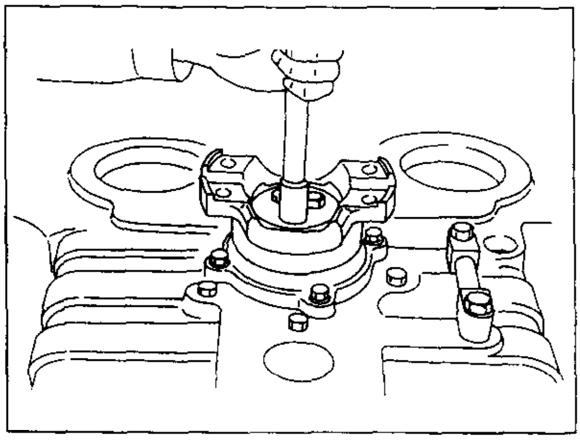


Fig. 2-236

b) Installing Back Gear

1. Install the snap ring in the groove at the center of the gear.

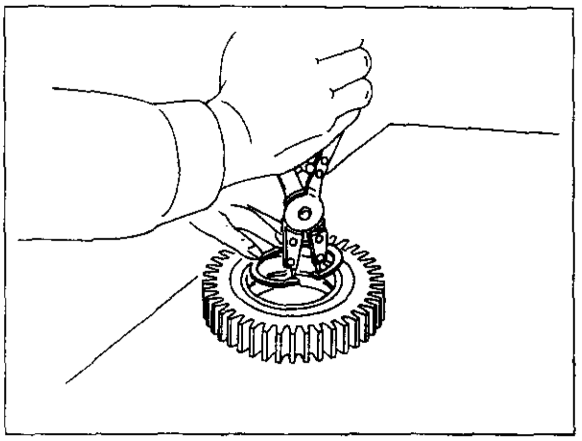


Fig. 2-237

2. Press the ball bearing from the both sides of the gear.

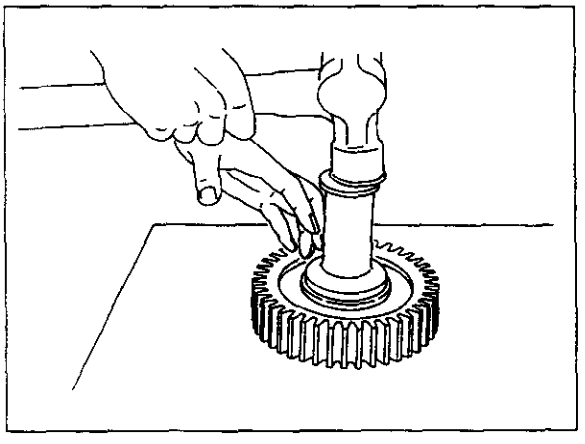


Fig. 2-238

3. Snap the spacer in the insert at the back gear shaft front edge of the transmission case.

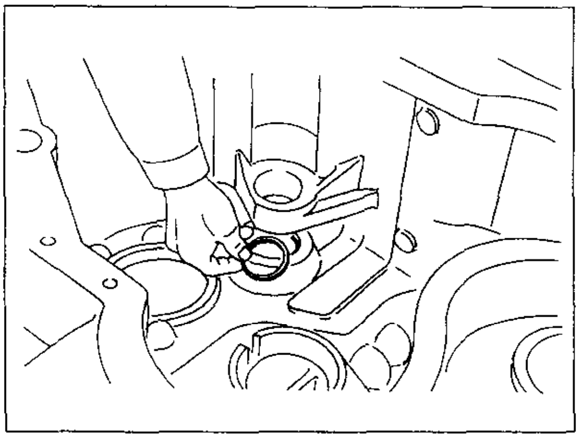


Fig. 2-239

4. Put the back gear with the pin hole aligned with the transmission case mounting area.

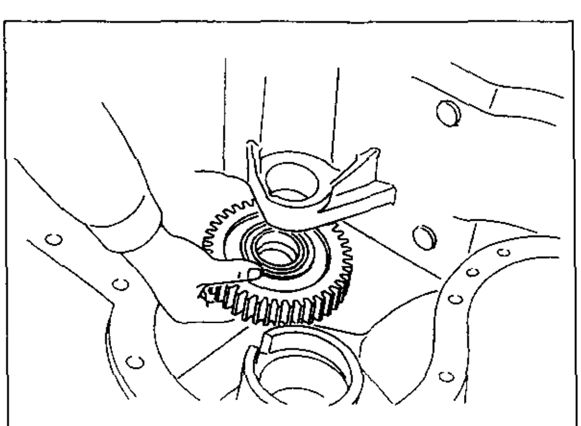


Fig. 2-240

5. Set the lock ball coated with grease in the hole at the big diameter of the back gear shaft to prevent it from falling down.

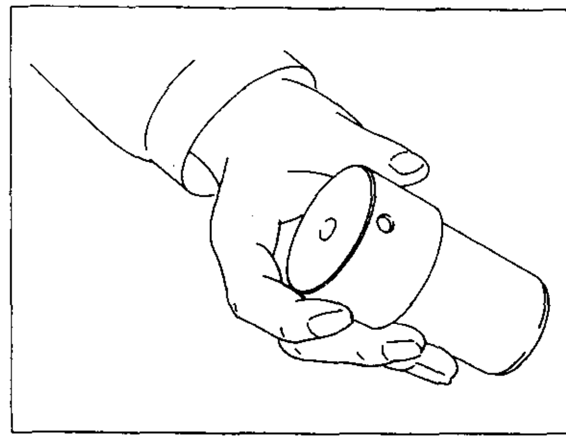


Fig. 2-241

6. Align the position of the shaft lock ball with the case groove, and press the shaft into the case and back gear.

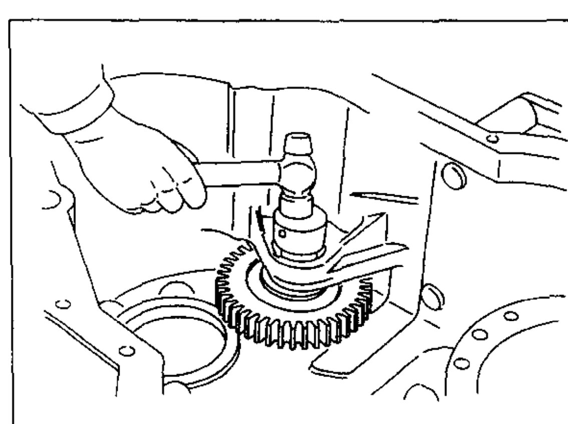


Fig. 2-242

7. After pressing the shaft, install the snap ring in the case groove.

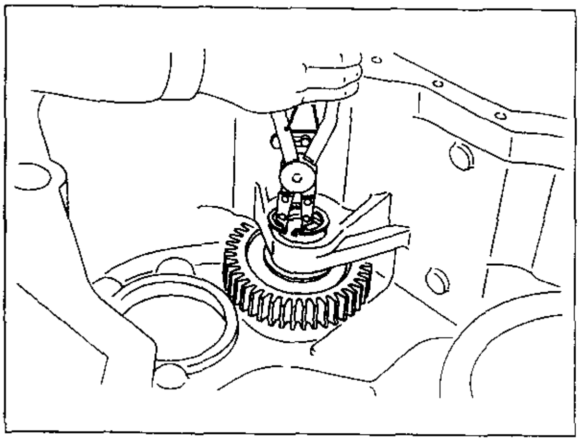


Fig. 2-243

2. Install the 43T gear and the snap rings at the gear's both sides onto the idler shaft, and press the bearing into the shaft at the front edge. Install only the snap ring at the opposite edge of the shaft.

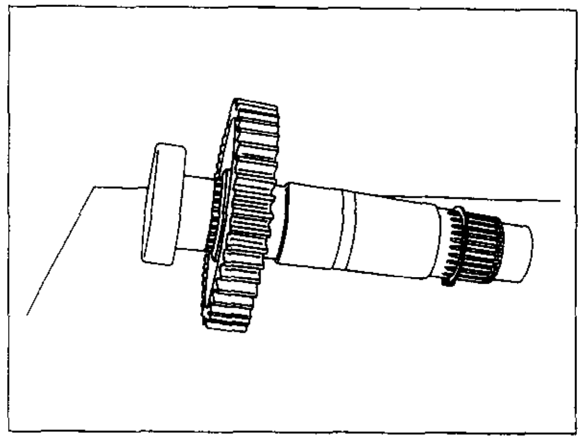


Fig. 2-245

c) Installing Clutch Shaft

1. Lift the 3rd/4th shaft with a hoist. Engage the shaft with the output gear and press it into the hole of the case.

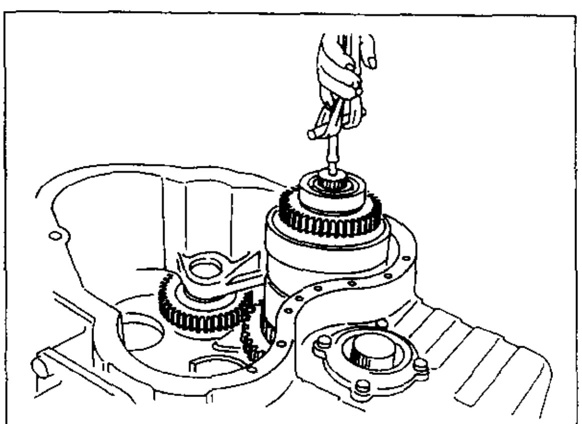


Fig. 2-244

3. Engage the gear of the idler shaft with the hub gear of the 3rd/4th shaft and the back gear, and press the shaft into the case.

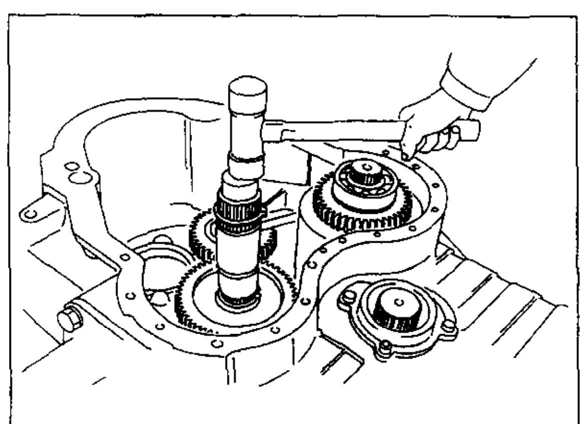


Fig. 2-246

4. Engage the hub gear of the 1st/2nd shaft with the idler gear and the output gear, and press the shaft into the hole of the case.

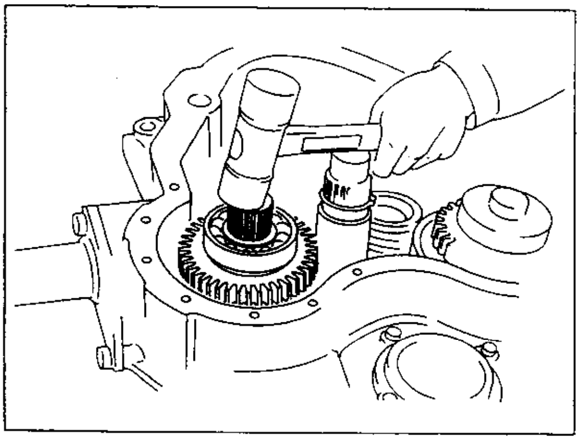


Fig. 2-247

5. Engage the hub gear of the forward/reverse shaft with the back gear, and press the shaft into the hole of the case.

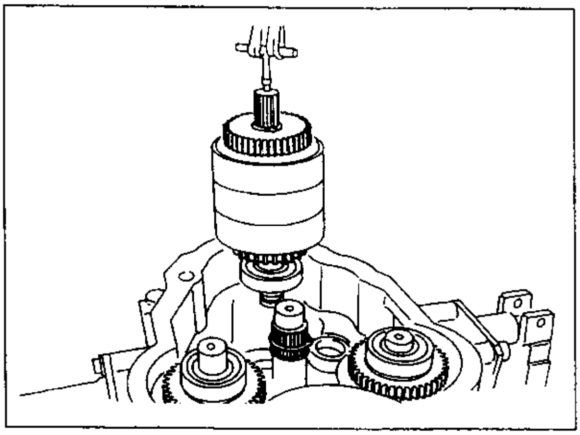


Fig. 2-248

6. Install the 55T gear onto the idler shaft. Engage the 55T gear with each hub gear of the forward/reverse, 3rd/4th and 1st/2nd shafts and secure the 55T gear with the snap ring.

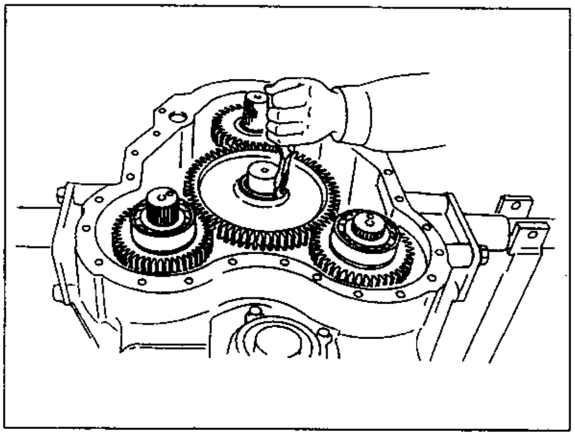


Fig. 2-249

7. Press the bearing into the idler shaft at the front edge.

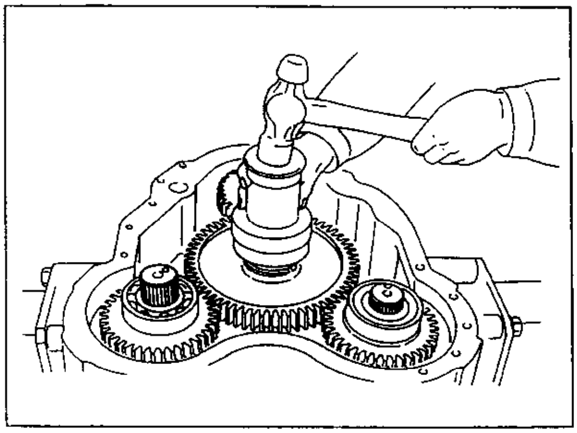


Fig. 2-250

8. Hold the transmission case upright and install the snap ring in the rear bearing outer diameter groove of each of three clutch shafts.

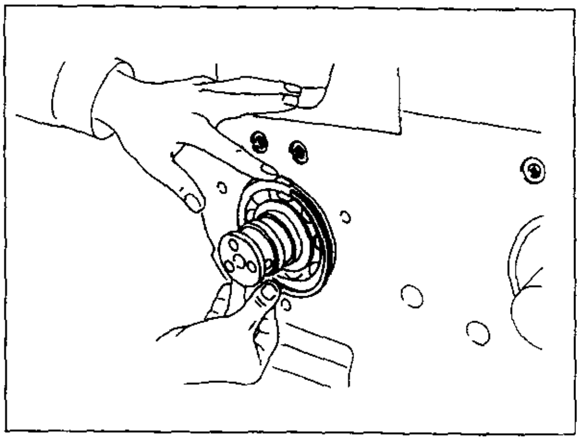


Fig. 2-251

9. Apply converter oil to seal rings and install three seal rings in each of three clutch shafts.

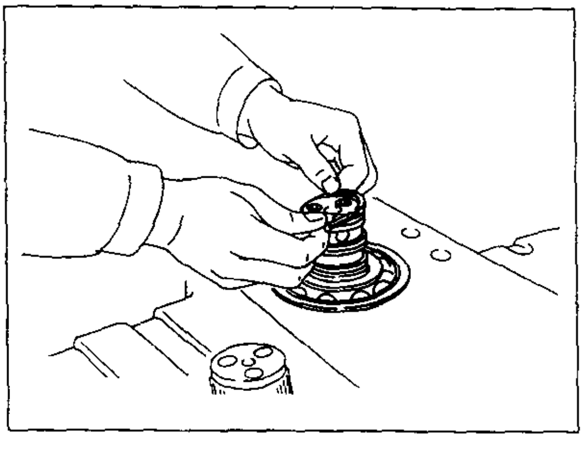


Fig. 2-252

d) Installing Distributor Cap and Piping

1. Put two O-rings and a gasket on each distributor cap mounting surface of the three clutch shafts. Place the distributor caps over the O-rings and the gaskets and secure each of them with three bolts.
   Tightening torque: 1.9 kgm.

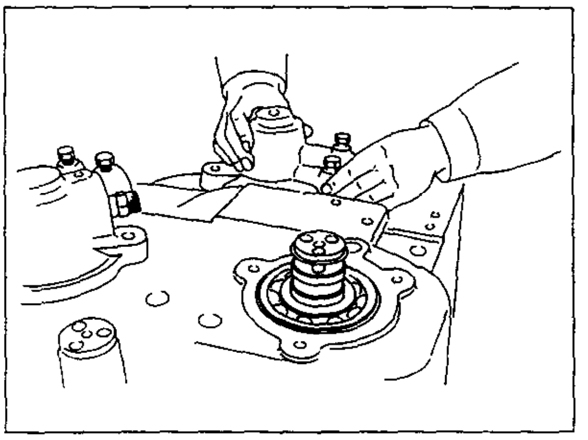


Fig. 2-253

2. Apply LOCTITE 572 to the threaded area of the rotation sensor and screw the sensor into the case.
   After screwing the sensor all the way against the output gear, back off the sensor 1.5 turns. Secure the sensor with the lock nut.

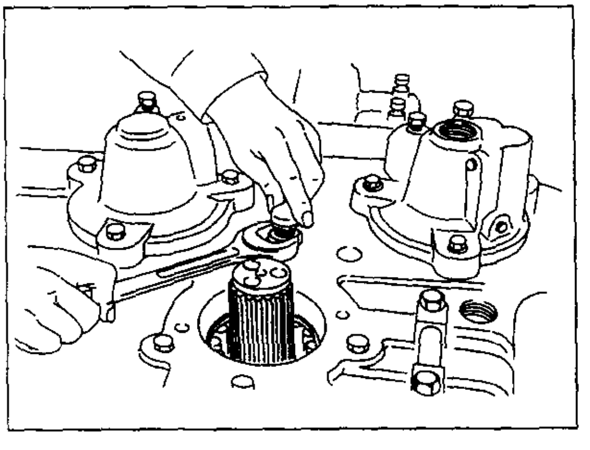


Fig. 2-254

3. Install the hydraulic piping between the 3rd/4th cap and 1st/2nd cap.

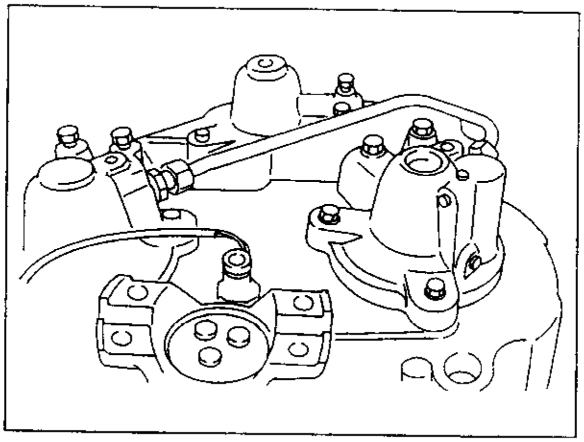


Fig. 2-255

4. Install the two hydraulic piping at the rear side.

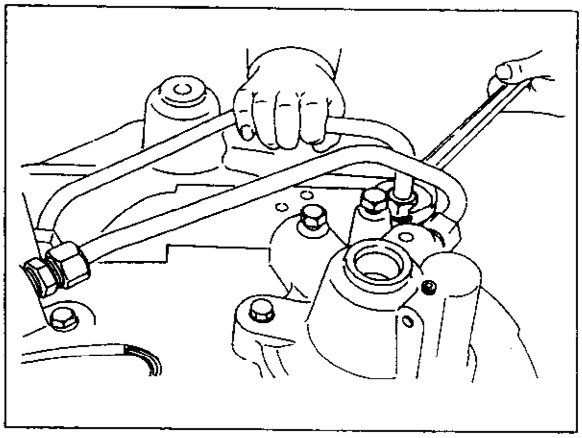


Fig. 2-256

e) Installing Torque Converter

1. Apply LOCTITE 509 to the mating surface of the transmission case continuously, avoiding the bolt holes.

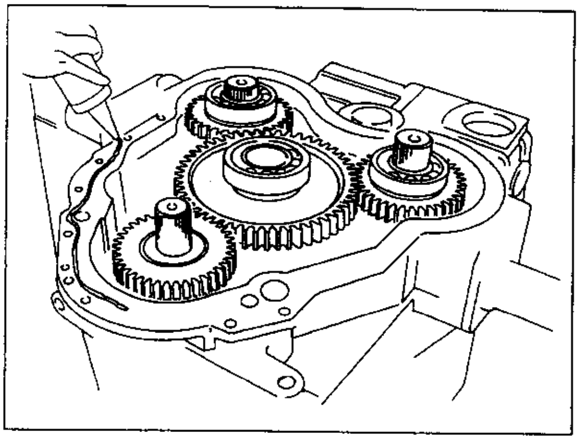


Fig. 2-257

2. Lift the torque converter with a hoist, lower the converter on the transmission so as to align the bearing holes of each shaft.

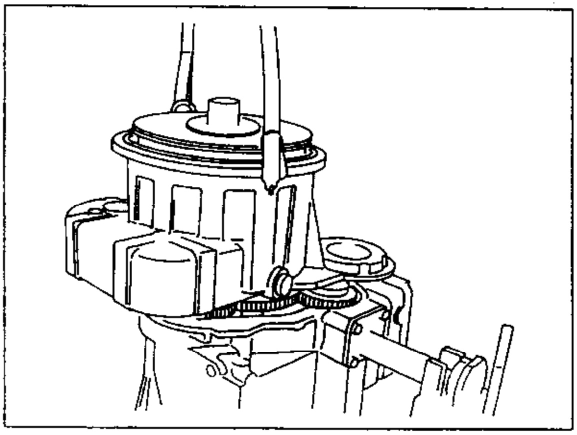


Fig. 2-258

3. Align the two dowel pins of the transmission case with the holes of the converter housing and drive them with a soft mallet until no clearance is given.

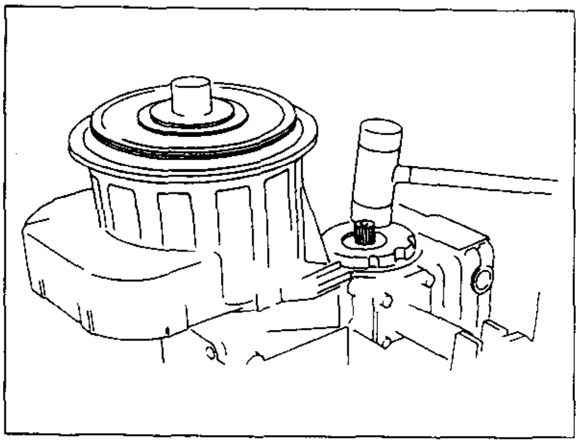


Fig. 2-259

4. Tighten the 26 fitting bolts.
Tightening torque: 1.9 kgm.

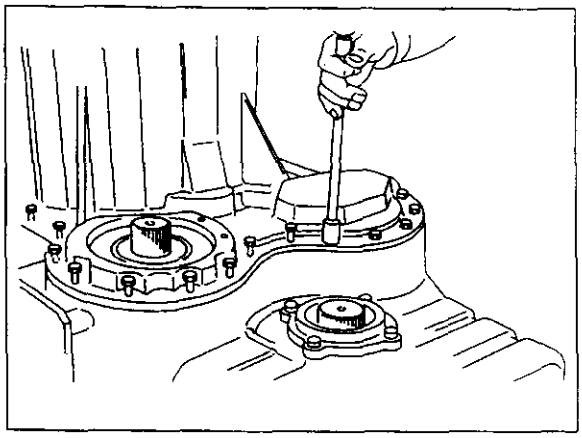


Fig. 2-260

5. Insert the flange (with the plug) into the output shaft at the front side.

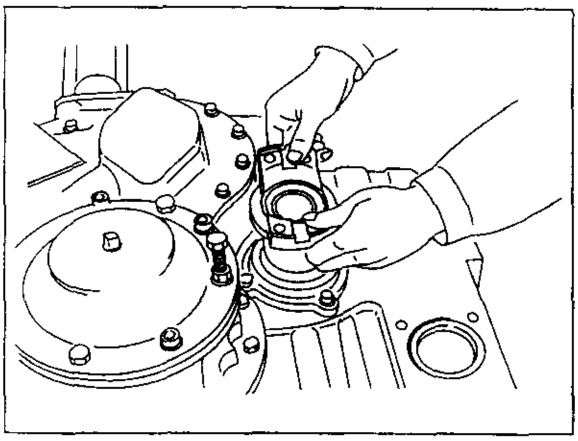


Fig. 2-261

f) Installing Charging Pump

1. Insert the strainer into the transmission case. Install the O-ring between the strainer and the case surface, and place the gasket on it.

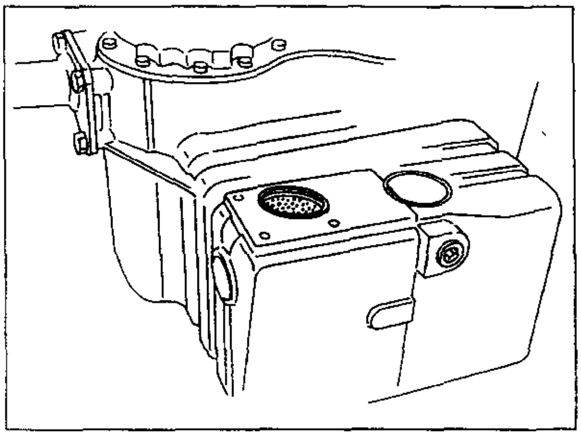


Fig. 2-262

2. Install the flange of the suction tube and tighten the four fitting bolts.

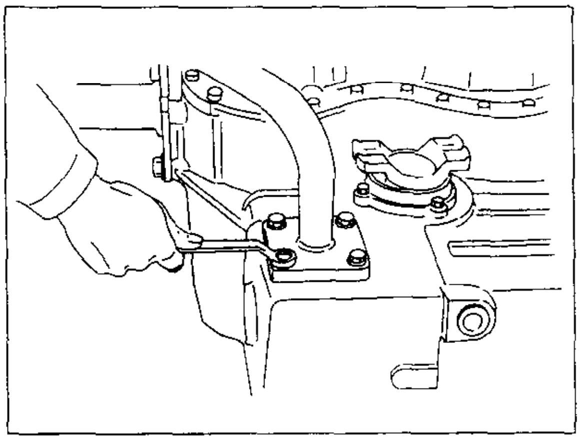


Fig. 2-263

3. Insert the pump drive sleeve into the pump drive gear.

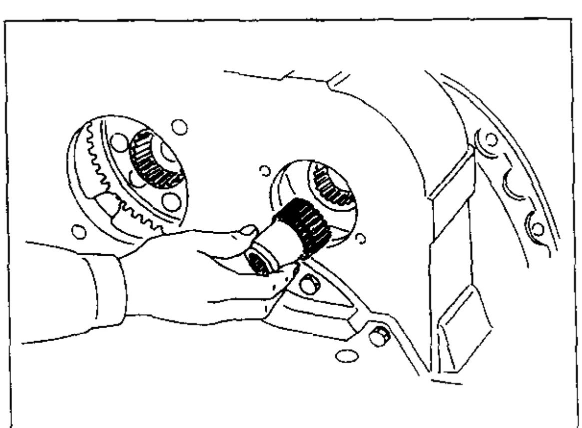


Fig. 2-264

4. Apply LOCTITE 509 to the installation seat of the charging pump.

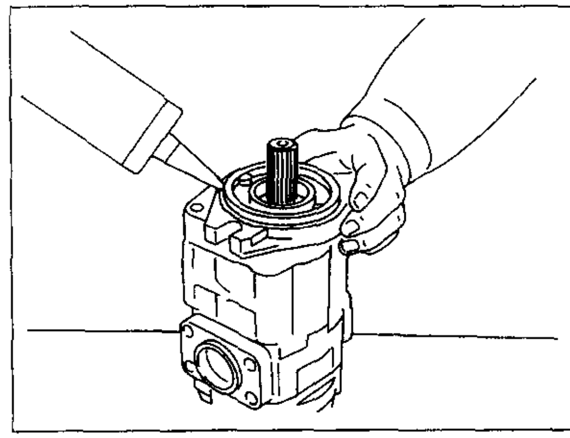


Fig. 2-265

5. Install the charging pump in the converter housing and secure it with two fitting bolts. Tightening torque: 5.1 kgm.

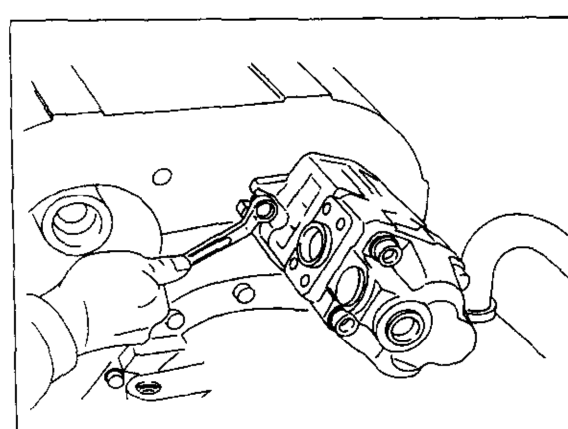


Fig. 2-266

6. Install the O-ring on the flange surface of the suction tube and install the flange in the charging pump, securing by tightening the four mounting bolts.

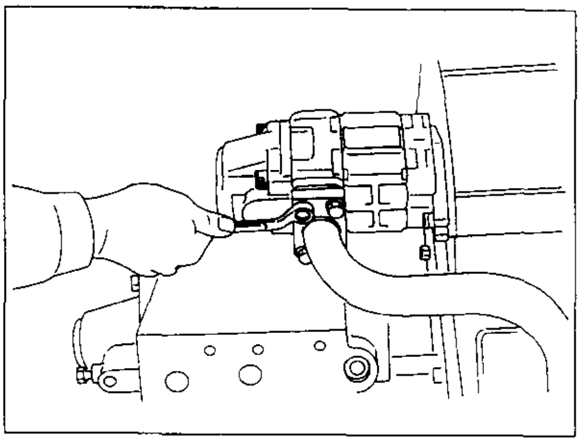


Fig. 2-267

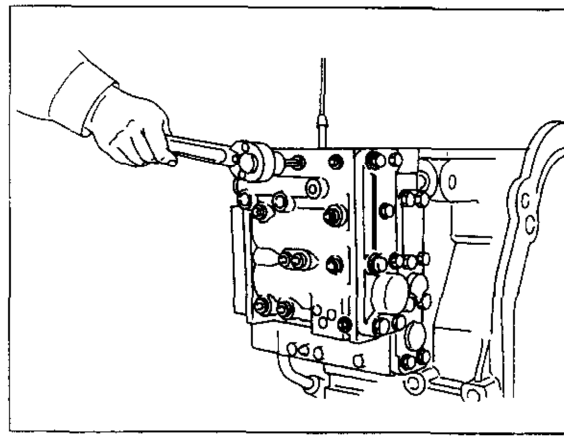


Fig. 2-269

2. Install the upper valve through the gasket, aligning with the lower valve and secure it with ten bolts.
Tightening torque: 5.1 kgm.

g) Installing Control Valve

1. Install the lower valve in the transmission case through the gasket, securing with three bolts.
Tightening torque: 5.1 kgm.

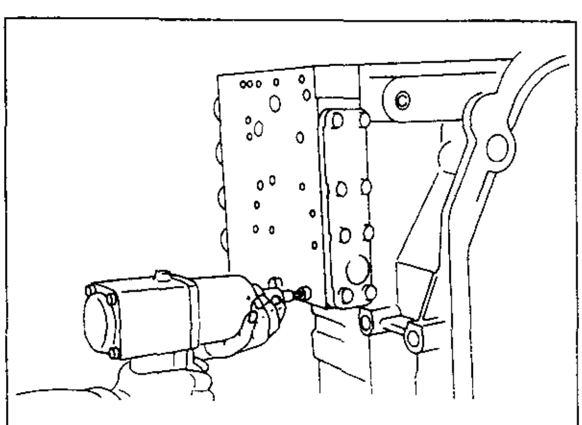


Fig. 2-268

h) Reassembling and Installing Parking Brake (in the case of one-piece type housing)

1. Insert the brake hub into the front side spline of the 1st/2nd shaft, and secure it with a snap ring.

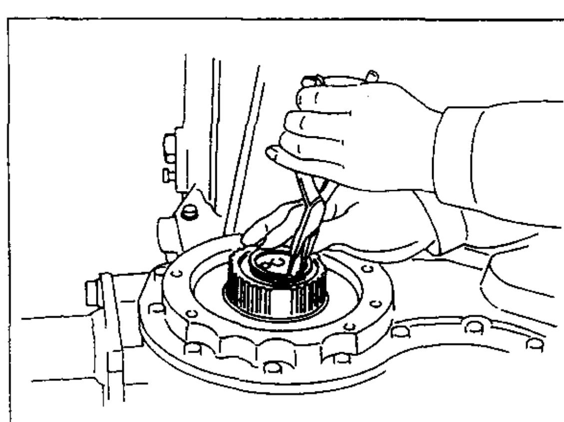


Fig. 2-270

2. Install the seven plates and six disks in the brake hub alternately, and install the end plate.

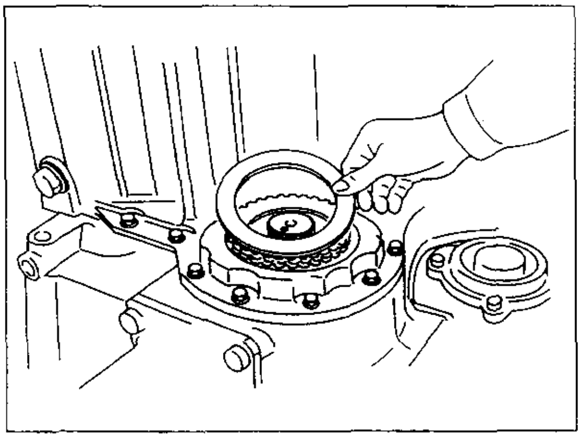


Fig. 2-271

3. Install the O-ring coated with grease in the brake housing.

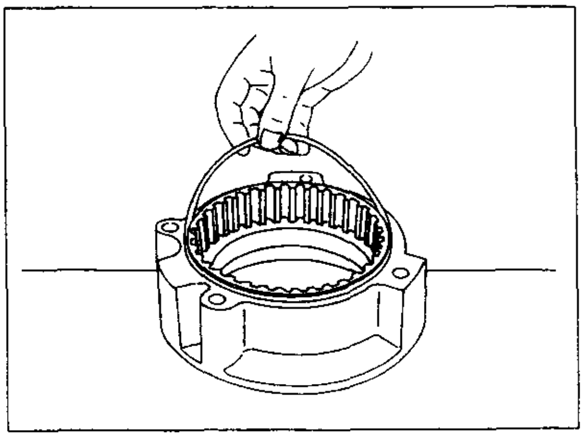


Fig. 2-272

4. Turn the brake housing upside down and install it in the converter housing by turning to right and left to align with the teeth of the plate.

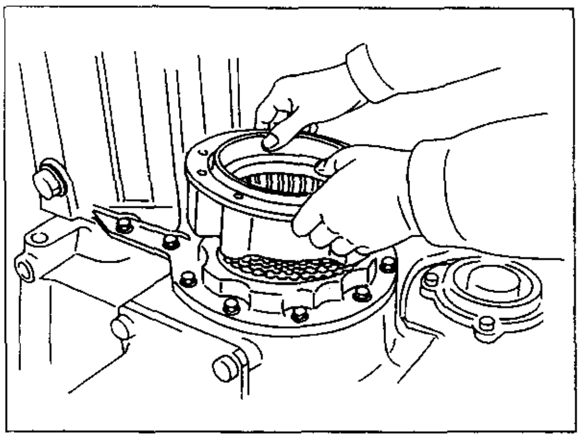


Fig. 2-273

5. Apply grease to the big and little D-rings and install them on the piston outer diameter.

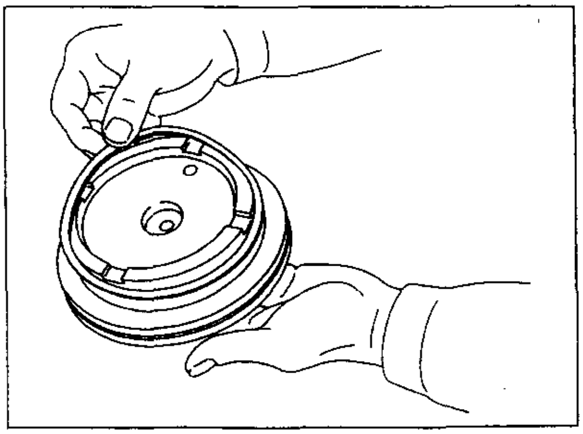


Fig. 2-274

6. Apply grease generously to the contact surface of the piston seal inside the brake housing and insert the piston into the brake housing.

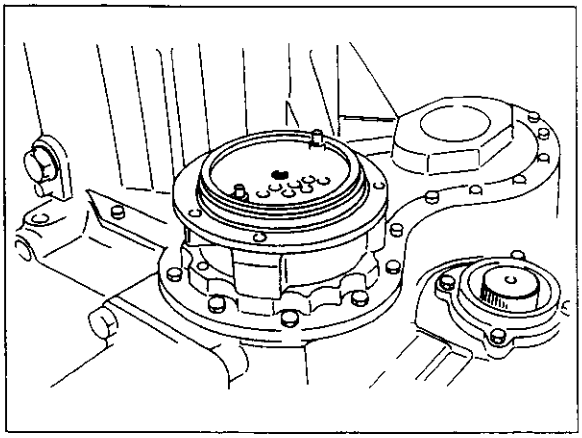


Fig. 2-275

7. Insert the 18 springs into the holes of the piston.

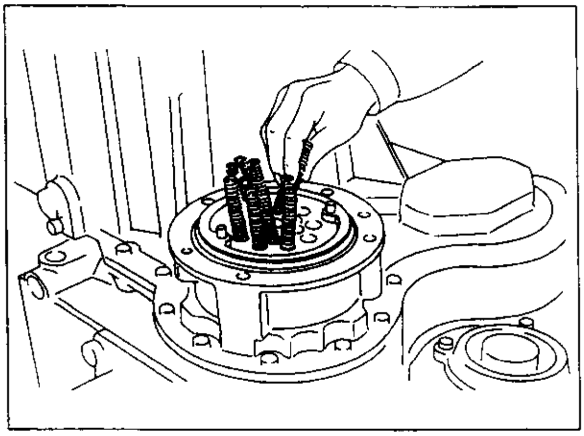


Fig. 2-276

8. Put the caps over the spring and the dowel pins, and secure them in the brake housing with four flash head bolts.
Tighten the four bolts alternately to compress the inner spring.
Tightening torque: 5.1 kgm.

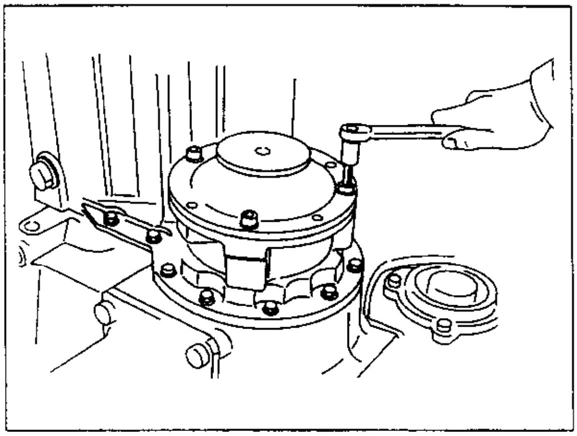


Fig. 2-277

9. Install the other two hex. headed bolts and brake releasing bolt.
Apply LOCTITE 572 to the threaded area of the plug and install the plug in the center of the cap.

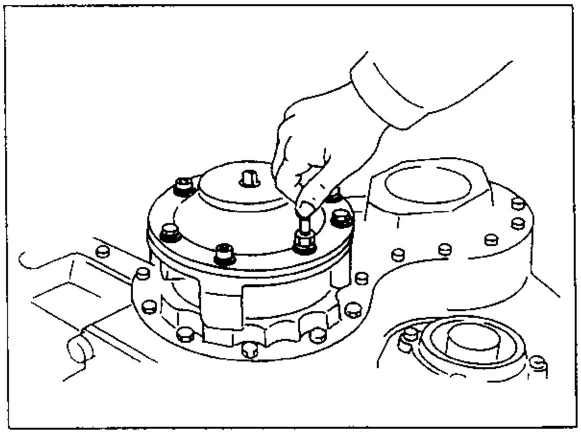


Fig. 2-278

i) **Reassembling and Installing Parking Brake (in the case of split-type housing)**

1. Apply grease to the big and little D-rings and the sliding surface of the piston. Install the D-rings on the piston outer diameter and insert the piston into the piston housing.

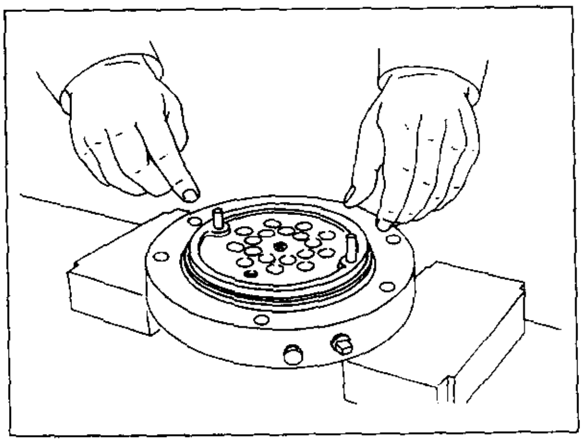


Fig. 2-279

2. Apply grease to the O-ring and install it in the groove of the piston housing.

3. Insert the 18 springs into each hole of the piston.

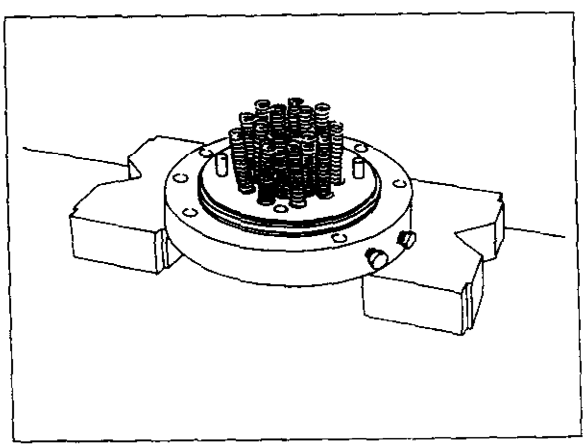


Fig. 2-280

4. Fit the cap over the springs and dowel pins, and secure it with two hex. headed bolts.
   Tighten the two bolts alternately to compress the inner spring.
   Tightening torque: 5.1 kgm.

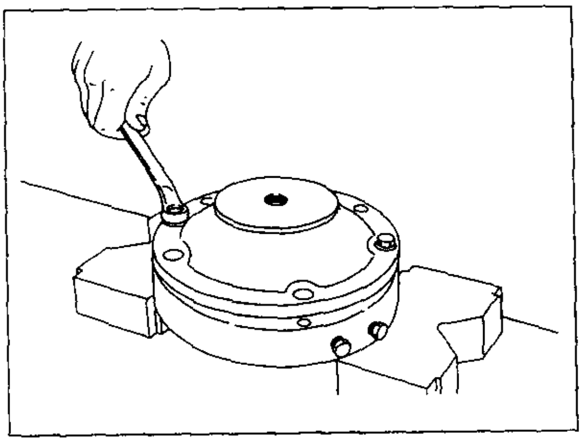


Fig. 2-281

5. Insert the brake hub into the front side spline of the 1st/2nd shaft, and secure it with a snap ring.

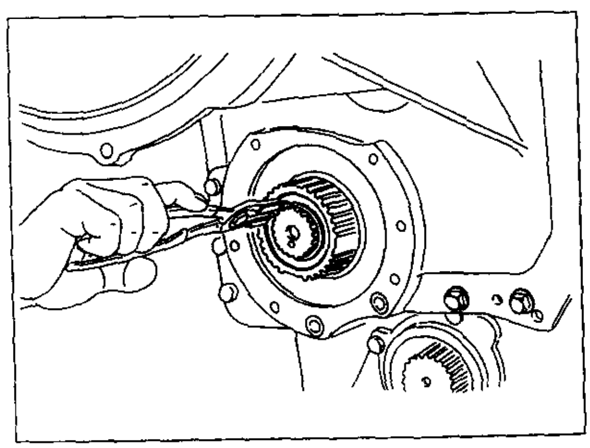


Fig. 2-282

6. Apply grease to the two O-rings and install them in the brake housing.

7. Install the brake housing in the converter housing with two flash head bolts.
Tightening torque: 5.1 kgm.

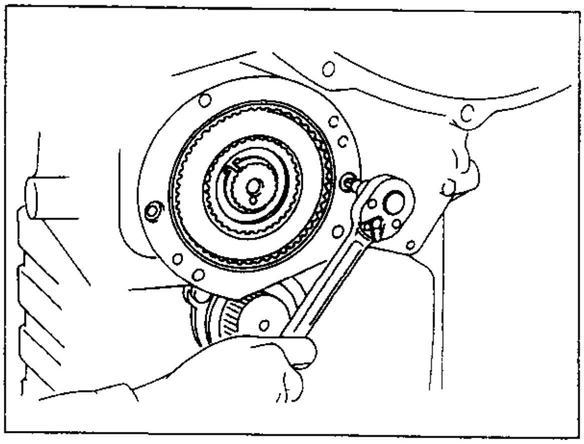


Fig. 2-283

8. Install the seven plates and six disks alternately, and install the end plate.

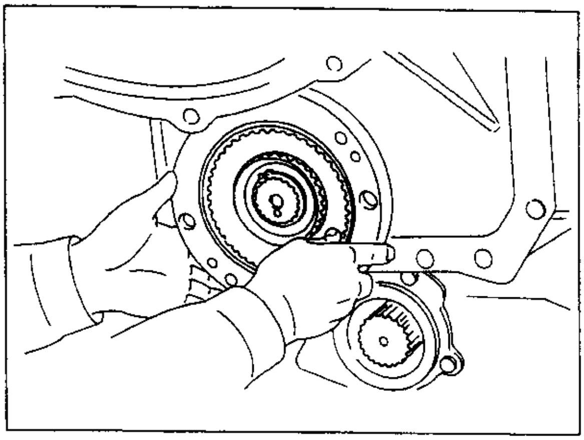


Fig. 2-284

9. Install the reassembled parking brake subassembly in the brake housing with four flash head bolts.
Tightening torque: 5.1 kgm.

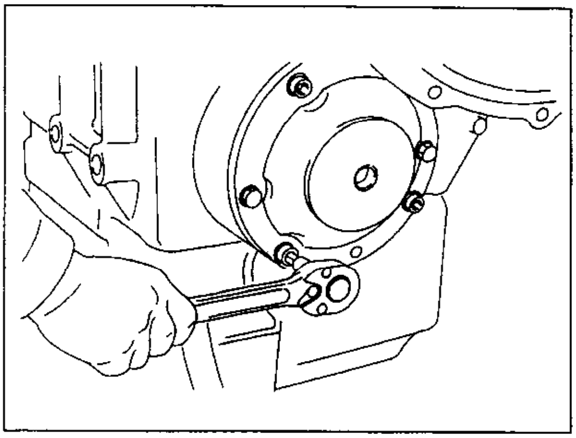


Fig. 2-285

10. Apply LOCTITE 572 to the threaded area of the plug.
Install the parking brake releasing bolt and center plug.

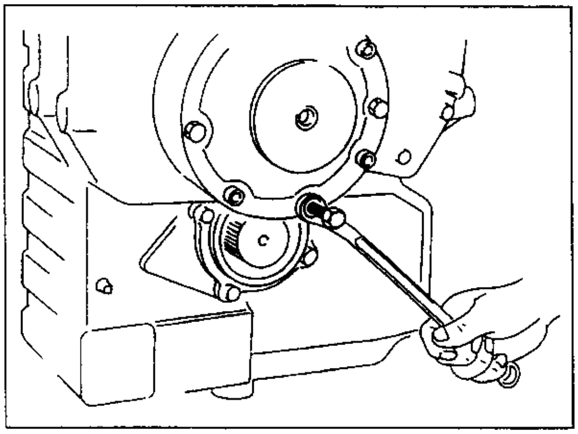


Fig. 2-286

2.6.3. Troubleshooting guide
2.6.3.1 Torque converter

Problem	Cause	Inspection	Corrective Action
Overheat or lower horsepower	Low oil level	Check oil level with oil level gauge	Add oil to the specified level
	Improper oil used	Check oil type	Change for the specified oil
	Malfunction of cooler line	Check cooling water for dirt	Clean
	Defective oil seal ring	Measure oil pressure at inlet port of torque converter	Disassemble and replace parts
		Check breather for oil flash	Disassemble and replace parts
	Malfunction of safety valve	Measure oil pressure at inlet port of torque converter	Disassemble and replace parts
	Broken bearing	Observe foreign material in transmission drain	Disassemble and replace parts
		Check line filter and oil	Disassemble and replace parts
	Low discharge from charging pump	Check transmission strainer for clogging	Clean
		Measure oil pressure at inlet port of torque converter	Replace pump
		Measure oil pressure of transmission clutch	Replace pump
	Excessive use	Check operating conditions and operation	Use properly
	Transmission failure	Refer to "2.6.3.2 TRANSMISSION"	
Oil leak (from flywheel)	Defective oil baffle oil seal	Check for oil leak to flywheel	Replace parts
	Defective O-ring of oil baffle	Check for oil leak to flywheel	Replace parts
Unusual noises	Broken bearing	Observe foreign material in transmission drain	Disassemble and replace
		Check line filter and oil	Disassemble and replace parts
	Broken gear or improper backlash	Check with sound checker	Disassemble and replace parts
	Broken pump or drive unit	Check with sound checker	Replace pump
	Air in oil	Check oil for air mixed	Retighten piping or replace parts
	Improper oil used	Check oil type	Change for the specified oil

2.6.3.2 Transmission

Problem	Cause	Inspection	Corrective Action
Overheat or lower horsepower	Torque converter overheat	Refer to "2.6.3.1 "TORQUE CONVERTER"	
	Low oil level	Check oil level with oil level gauge	Add oil to the specified level
	Improper oil used	Check oil type	Change for the specified oil
	Slipping or seizing of clutch	Measure oil pressure of transmission clutch	Disassemble and replace parts
	Low clutch lubricant	Measure oil pressure at outlet port of torque converter	Clean oil cooler
	Broken bearing	Observe foreign material in transmission drain	Disassemble and replace parts
		Check line filter and oil	
	Low engine output and speed	Check stolen speed	Adjust engine
Unusual noises	Broken bearing or improper assembling	Check with sound checker	Disassemble and replace parts
		Observe foreign material in transmission drain	
		Check line filter and oil	
	Broken gear or excessive backlash	Check with sound checker	Disassemble and replace parts
		Observe foreign material in transmission drain	
		Check line filter and oil	
	Seizing clutch	Measure oil pressure of transmission clutch	Disassemble and replace parts
Machine won't travel forward/ reverse	Low oil level	Check oil level with oil level gauge	Add oil to the specified level
	Malfunction of changing pump	Measure oil pressure of transmission clutch (lowered in all ranges)	Replace charging pump
	Regulator valve stayed open	Measure oil pressure of transmission clutch (lowered in all ranges)	Disassemble and replace parts
Machine won't travel forward/ reverse	Broken bolts securing torque converter input plate	Check the operation of load handling system	Replace parts
	Parking brake won't release (stuck or dragged)	Refer to "2.6.3.3 PARKING BRAKE"	

Problem	Cause	Inspection	Corrective Action
Machine won't travel forward (can travel reverse)	Manual spool (emergency travel spool) is pressed in the position for reverse travel	Check manual spool position at the control valve	Raise the spool to locate it in the normal condition
	Slipping forward clutch (F solenoid valve is not operated	Measure oil pressure of forward clutch	Disassemble and replace parts
	Seizing reverse clutch	Check if machine travels reverse with clutch in neutral	Disassemble and replace parts
Machine won't travel reverse (can travel forward)	Manual spool (emergency travel spool) is pulled in the position for forward travel)	Check manual spool position at the control valve	Lower the spool to locate it in the normal condition
	Slipping reverse clutch (R solenoid valve is not operated)	Measure manual spool position at the control valve	Disassemble and replace parts
	Seizing forward clutch	Check if machine travels forward with clutch in neutral	Disassemble and replace parts
Machine won't travel in 2nd gear	Slipping 2nd clutch (A and B solenoid valves are not operated)	Measure oil pressure of 2nd clutch	Disassemble and replace part
Machine won't travel in 1st gear	Slipping 1st clutch (A solenoid valve is not operated)	Measure oil pressure of 1st clucth	Disassemble and replace parts
Machine won't travel in 4th gear	Slipping 4th clutch (B solenoid valve is not operated)	Measure oil pressure of 4th clutch	Disassemble and replace parts

2.6.3.3 Parking brake

Problem	Cause	Inspection	Corrective Action
Parking brake won't release (stuck or dragged)	Oil leak from parking brake piston (defective D-ring)	Measure braking oil pressure (Check for oil leakage)	Disassemble and replace parts
	Malfunction of disk brake (Piston has foreign matter caught or stuck, or brake disk is seized)	Overhaul	Wash and replace parts
Parking brake won't activate	Slackened or broken brake spring of disk brake	Overhaul	Wash and replace parts
	Malfunction of disk brake (Piston has foreign matter caught or stuck, or brake disk is worn)	Overhaul	Wash and replace parts

2.6.4 Standard values for maintenance

(1) Torque converter (W110)

Item		Standard value (mm)	Useful limit (mm)	Remarks
Pump drive gear backlash		0.13 - 0.23	–	
Turbine shaft seal ring	Width (axial direction)	1.95 - 2.05	1.7	
	Thickness (radial direction)	1.95 - 2.05	1.9	
Turbine shaft seal ring groove width		2.1 - 2.2	2.3	
I.D. of turbine shaft seal ring sliding area in stator support		60.33 - 60.35	60.41	
Stator support seal ring	Width (axial direction)	1.95 - 2.05	1.7	
	Thickness (radial direction)	1.95 - 2.05	1.9	
Stator support seal ring groove width		2.1 - 2.2	2.3	
I.D. of stator support seal ring sliding area in impeller wheel hub		79.38 - 79.40	79.48	

(2) Torque converter (W130)

Item		Standard value (mm)	Useful limit (mm)	Remarks
Pump drive gear backlash		0.13 - 0.23	–	
Turbine shaft seal ring	Width (axial direction)	2.0	1.7	
	Thickness (radial direction)	2.4	2.2	
Turbine shaft seal ring groove width		2.1	2.3	
I.D. of turbine shaft seal ring sliding area in stator support		52	52.2	
Stator support real ring	Width (axial direction)	2.38	2.1	
	Thickness (radial direction)	3.2	3.0	
Stator support seal ring groove width		2.5	2.7	
I.D. of guide carrier seal ring sliding area in pump impeller wheel bub		92	92.2	

(3) Control valve (W110, W130)

Item		Standard value (mm)	Useful limit (mm)	Remarks
Regulator spring	Free height	97.9	94.0	
	Setting load kg	31.62	28.5	
	Setting height	82.4	–	
Modulate spring	Free height	53.1	51.0	
	Setting load kg	7.27	6.5	
	Setting height	34.5	–	
Flow sensing spring	Free height	65.4	62.8	
	Setting load kg	0.90	0.8	
	Setting height	57.5	–	
Load piston L spring	Free height	116	111.4	Inner
	Setting load kg	10.58	9.5	
	Setting height	90	–	
	Free height	116	111.4	Center
	Setting load kg	27.38	24.6	
	Setting height	90	–	
	Free height	91	87.4	Outer
	Setting load kg	32.76	29.5	
	Setting height	65	–	
Load piston H spring	Free height	109.9	105.5	Inner
	Setting load kg	15.69	14.1	
	Setting height	85	–	
	Free height	109.9	105.5	Center
	Setting load kg	23.23	20.9	
	Setting height	85	–	
	Free height	84.9	81.5	Outer
	Setting load kg	28.16	25.3	
	Setting height	60	–	
F/R select spool spring	Free height	39	37.4	
	Setting load kg	8.47	7.6	
	Setting height	26.5	–	
Spool A spring Spool B spring	Free height	43	41.3	
	Setting load kg	6.84	6.2	
	Setting height	32.5	–	
Throttle diameter	for main (W)	6.0	–	
	for 1st/2nd (X)	0.9	–	
	for 2nd (Y)	0.9	–	
	for 3rd/4th (Z)	1.5	–	
	for solenoid valve	0.8	–	

(4) Trasmission

Item		Standard value (mm)	Useful limit (mm)	Remarks
I.D. of distributor cap in clutch shaft seal ring sliding area (fwd/rev, 1st/2nd, 3rd/4th)		50.000 - 50.030	50.08	
Clutch shaft seal ring	Width (awial direction)	1.95 - 2.05	1.7	
	Thickness (radial direction)	1.95 - 2.05	1.9	
Clutch shaft seal ring groove width		2.10 - 2.15	2.3	
Clutch plate thickness		1.65 - 1.75	1.5	
Clutch disk thickness		2.12 - 2.28	1.9	
Return spring	Free height	4.105 - 4.355	3.94	
	Compressed load at height of 2.20 mm kg	92.2 - 112.8	83.0	

2.6.5 Tightening torque values for main bolts

(1) Torque converter (W110)

Item	Tightening torque (kgm)	Remarks
Pump drive gear fitting bolt	4.7	Apply LOCTITE 262
Stator support fitting bolt	10.3	
Oil baffle fitting bolt	5.6	
Front cover fitting bolt	2.0	
Input plate fitting bolt	6.2	Apply LOCTITE 262
Charging pump fitting bolt	5.1	

(2) Torque converter (W130)

Item	Tightening torque (kgm)	Remarks
Pump drive gear fitting bolt	4.7	Apply LOCTITE 262
Guide carrier (stator support) fitting bolt	10.3	
Seal carrier (oil baffle) fitting bolt	5.6	
Impeller wheel - cover wheel fitting bolt	2.1 - 2.3	
Impeller hub fitting bolt	5.2 - 5.9	
Input guide fitting bolt	4.3 - 4.8	
Input plate fitting bolt	4.3 - 4.8	
Charging pump fitting bolt	5.1	

(3) Trasmission (W110, W130)

Item	Standard value (mm)	Remarks
Distributor cap fitting bolt	1.9	
Output shaft bearing cap fitting bolt	1.9	
Output companion flange retainer plate fitting bolt	9.3	Apply LOCTITE 262
Parking brake housing fitting bolt	5.1	
Converter housing fitting bolt	1.9	
Control valve fitting bolt	5.1	

2.7 OIL CIRCUIT

General description

The oil used to engage the clutches is sucked from the transmission housing.
As soon as the engine is started, the feeding pump sucks oil from the sump of the transmission housing through the mesh filter and sends it, under pressure, through the delivery filter, to the transmission control valve. The control valve divides the oil flow into two portions: one for the operation of the torque converter and the other for the operation of the transmission clutches.

The oil sent into the torque converter, after coming out, flows through the heat exchanger to be cooled. After leaving the heat exchanger, the oil goes to lubricate and cool each clutch pack, before returning to the transmission housing sump.

Note - The heat exchanger is located inside the lower tank of the engine coolant radiator. For the heat exchanger, please refer to chapter "1.9 COOLING SYSTEM".

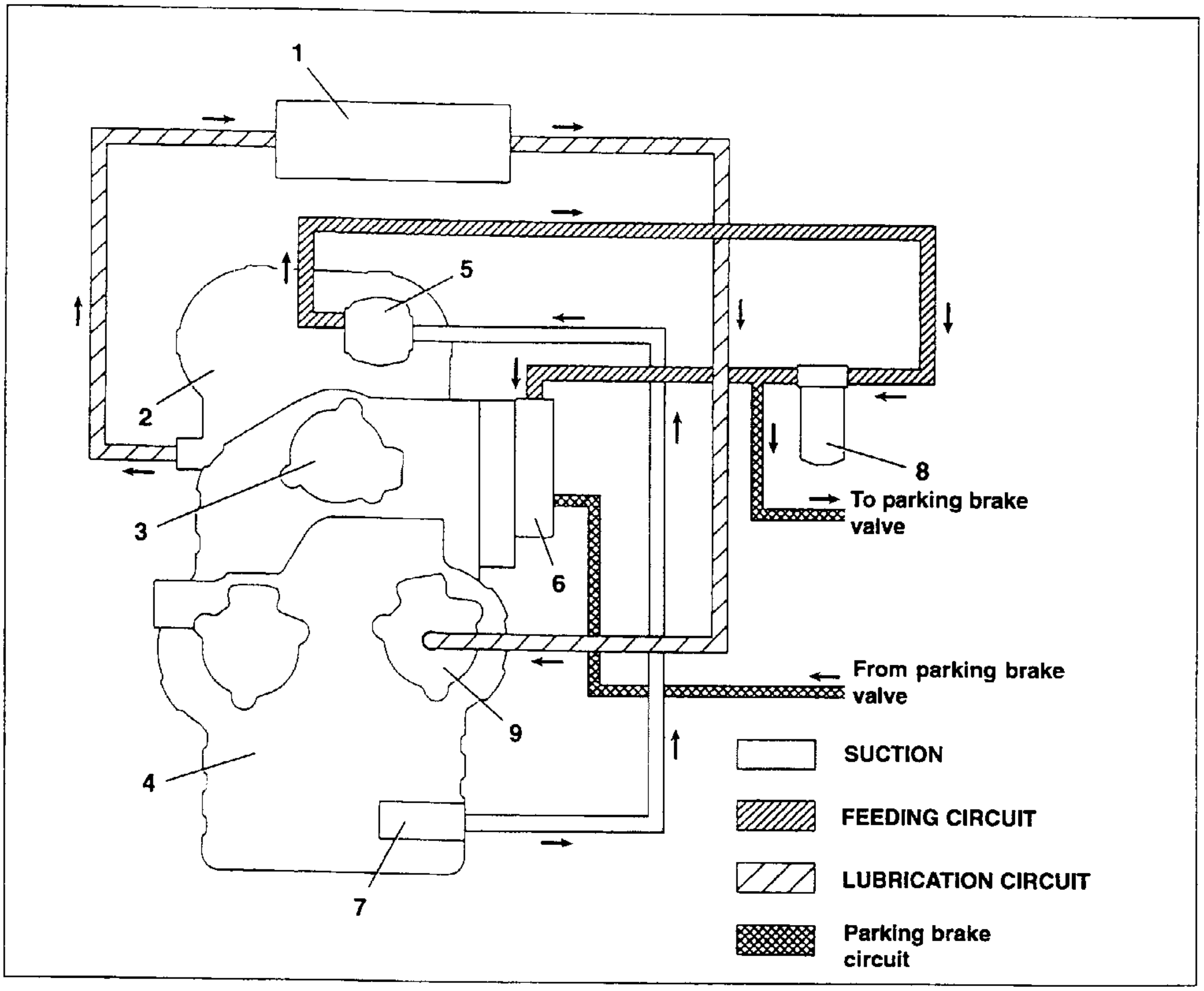


Fig. 2-287 Transmission oil circuit (W110 - W130)

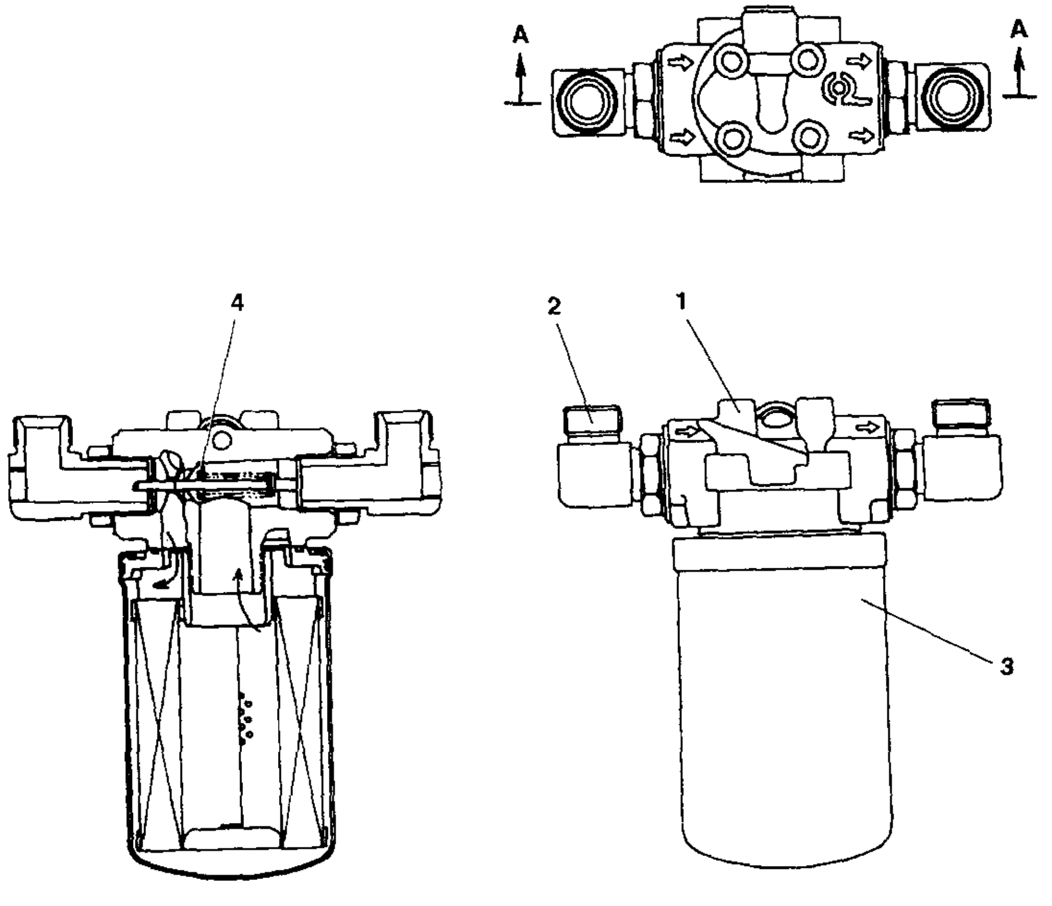
1. HEAT EXCHANGER
2. TORQUE CONVERTER
3. OIL DISTRIBUTION COVER (FORW./REV. SHAFT)
4. TRANSMISSION
5. FEEDING DOUBLE PUMP
6. TRANSMISSION CONTROL VALVE
7. MESH FILTER
8. DELIVERY FILTER
9. OIL DISTRIBUTION COVER (1^{st} and 2^{nd} SPEEDS SHAFT)

Delivery filter

The delivery filter is located in the transmission clutch engagement control oil delivery circuit.
The oil flows through the filtering element from the outside to the inside and filtered oil is sent to the transmission control valve.

When the filtering element is clogged, the pressure at the filter inlet port increases so that the by-pass valve opens, letting the oil flow directly to the outlet port of the filter.

Operating pressure of the by-pass valve: 1.75 bar (24.9 psi)
Filtering capacity: 25 μ



Section A-A

Fig. 2-288 Delivery filter

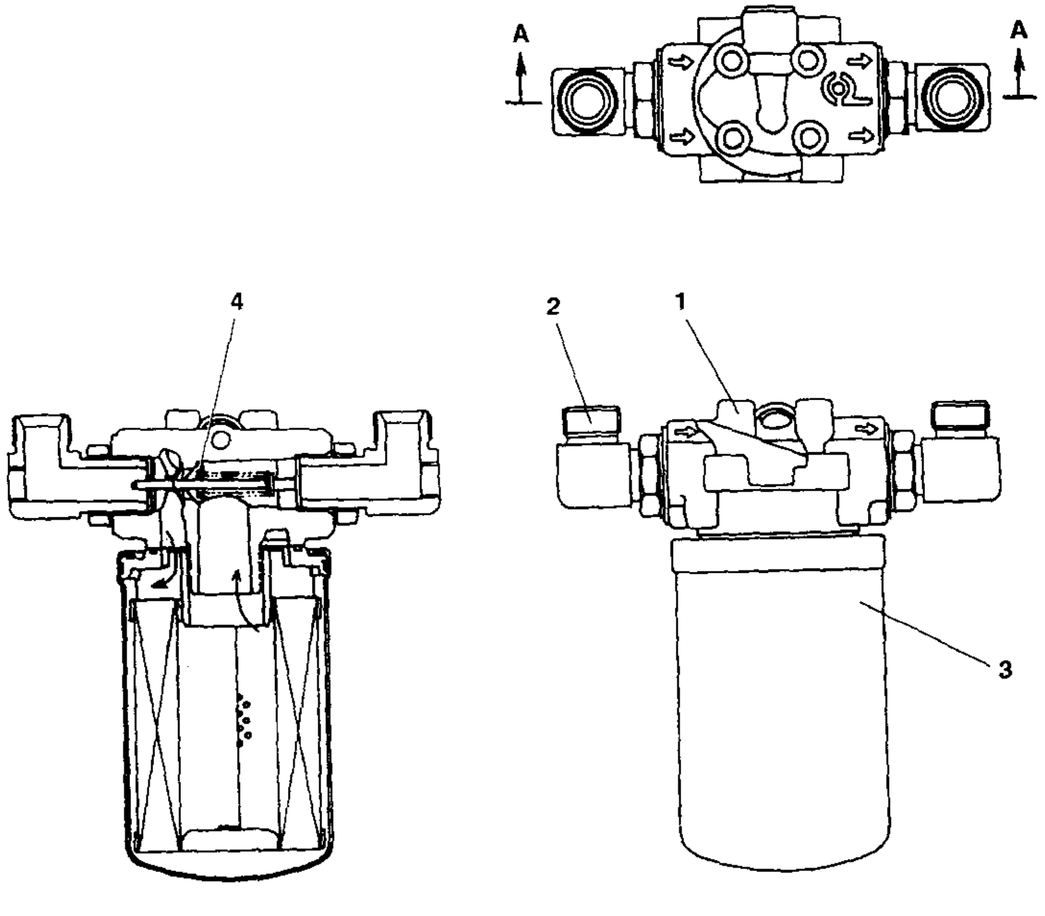
1. FILTER SUPPORT
2. CONNECTION
3. FILTER BODY
4. FILTER SAFETY VALVE (BY-PASS)

Delivery filter

The delivery filter is located in the transmission clutch engagement control oil delivery circuit.
The oil flows through the filtering element from the outside to the inside and filtered oil is sent to the transmission control valve.

When the filtering element is clogged, the pressure at the filter inlet port increases so that the by-pass valve opens, letting the oil flow directly to the outlet port of the filter.

Operating pressure of the by-pass valve: 1.75 bar (24.9 psi)
Filtering capacity: 25 µ



Section A-A

Fig. 2-288 Delivery filter

1. FILTER SUPPORT
2. CONNECTION
3. FILTER BODY
4. FILTER SAFETY VALVE (BY-PASS)

2.8 PROP SHAFTS

	W110	W130
Type	universal	universal
Length (between pins):		
Front	702 mm	710 mm
Intermediate	490 mm	587 mm
Rear	215 mm	229 mm
Weight:		
Front	6.9 Kg	12 Kg
Intermediate	9.7 Kg	12.7 Kg
Rear	7 Kg	8.2 Kg

The prop shafts, located between the transmission and the front axle and between the transmission and the rear axle, drive the power from the transmission to the front and rear axles.
The prop shaft connected to the front axle is equipped with an intermediate support, secured to the front frame, as a stop element, being the loader an articulated type.
The prop shafts have the purpose of compensating the changes of the distance and the angle between the output shaft of transmission and the input shaft of each axle, occurring during the travel of the loader, ensuring a smooth drive of the power from the transmission to the axles.

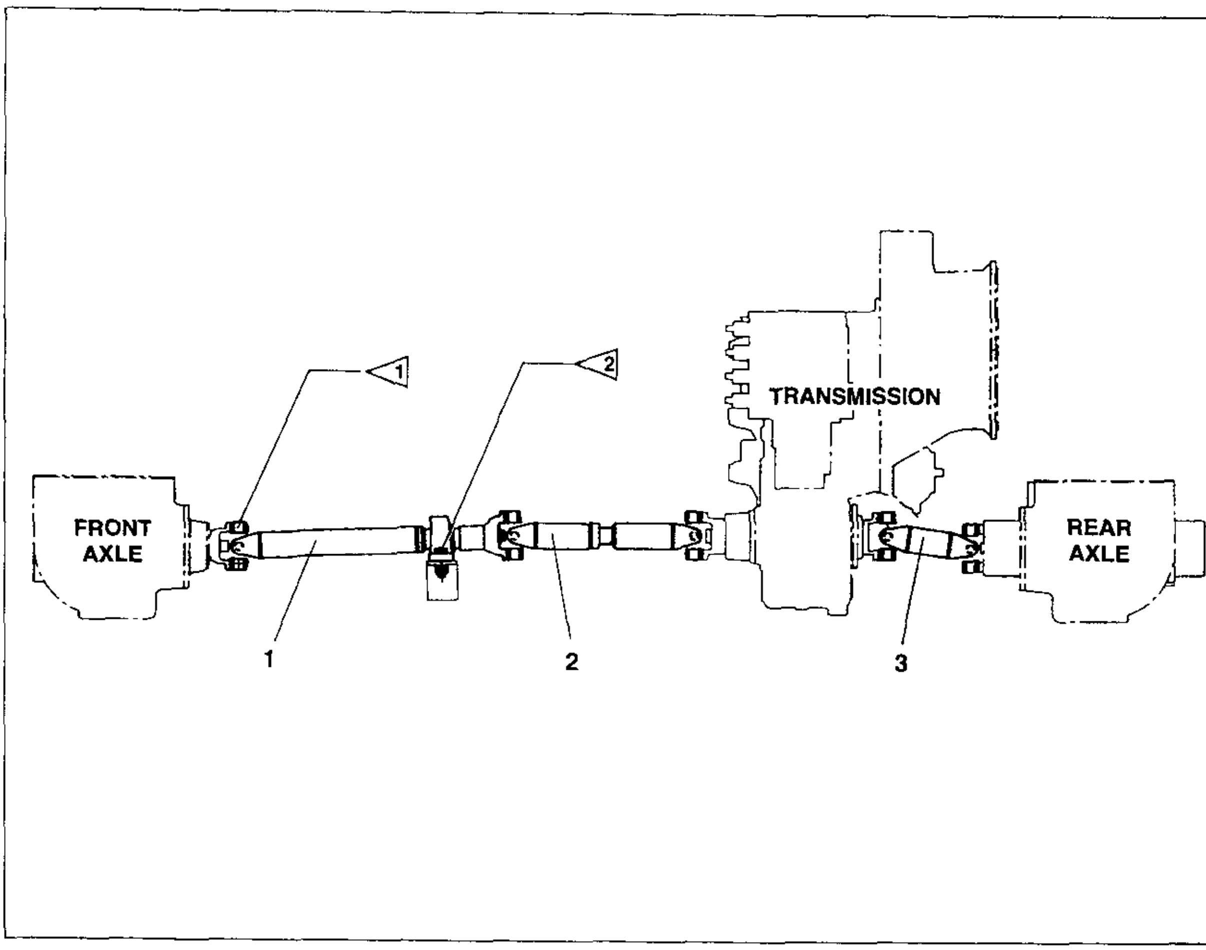


Fig. 2-289 Prop shafts group

1. FRONT PROP SHAFT
2. INTERMEDIATE PROP SHAFT
3. REAR PROP SHAFT

Note - 1 7.5 daNm (55 ft-lbs)

Threaded portion: LOCTITE 262

2 22.8 daNm (165 ft-lbs)

Front and intermediate prop shafts

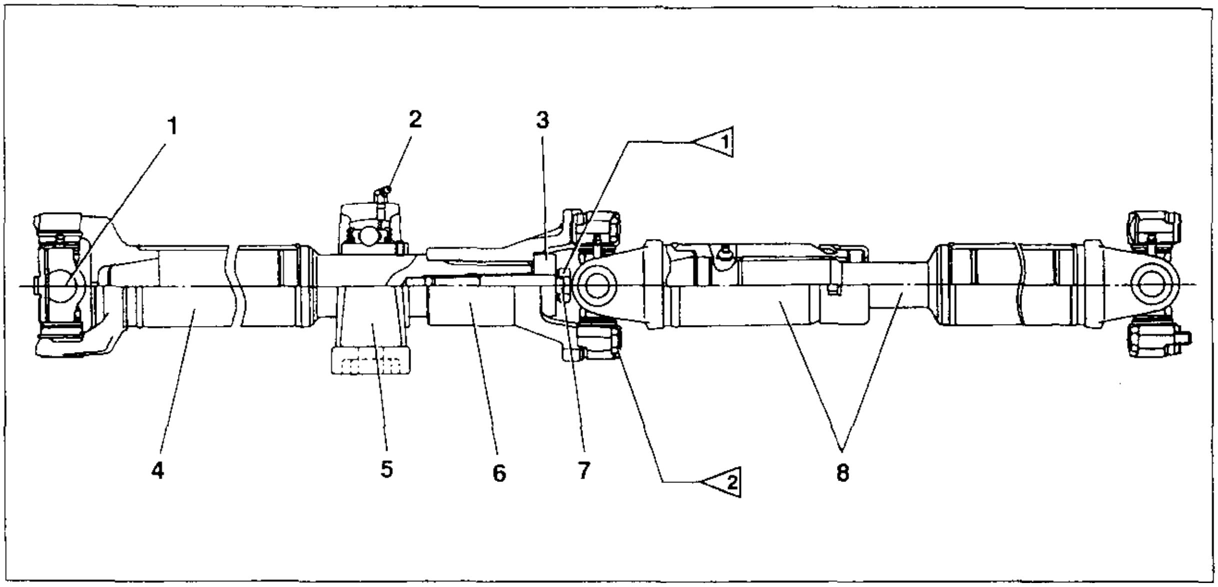


Fig. 2-290 Front and intermediate prop shafts group

1. SPIDER
2. GREASE FITTING
3. THRUST RING
4. YOKE SHAFT GROUP
5. INTERMEDIATE SUPPORT
6. YOKE WITH SPLINED SLEEVE
7. STOP PLATE
8. SHAFT/SPLINED SLEEVE GROUP

Note - 1 13.5 daNm (98 ft-lbs)

2 7.6 daNm (55 ft-lbs)

Rear prop shaft

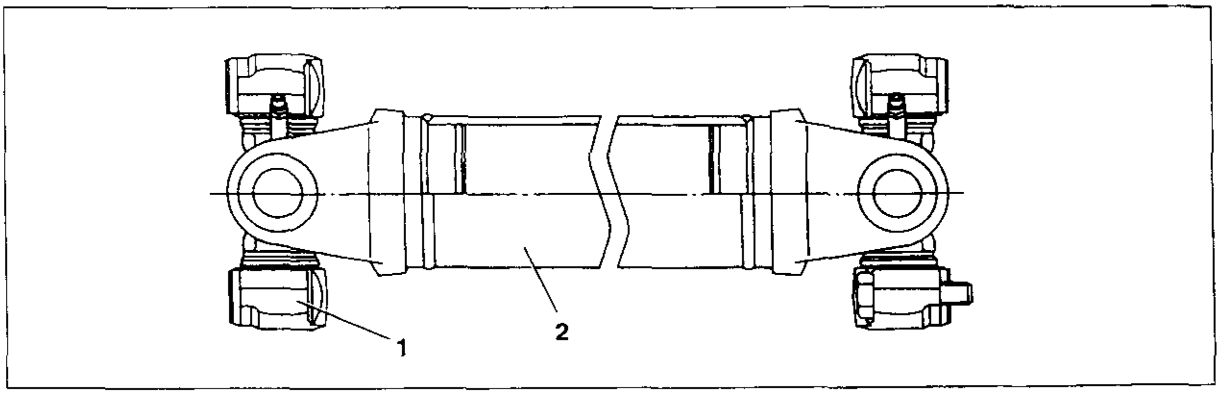


Fig. 2-290a Rear prop shaft

1. SPIDER BEARING
2. COUPLING YOKE

2.9 FRONT AND REAR AXLES

	W110	W130
Drive	4 wheel	4 wheel
Front axle	Fixed to the frame Semi floating type	Fixed to the frame Semi floating type
Rear axle	Pivot pin Semi floating type	Pivot pin Semi floating type
Reduction unit and differential Model Type	 TCM 641-30 Current, 2 stage reduction	 TCM 642-30 Current, 2 stage reduction
Differential housing	Single piece	Single piece
Differential limiting device	Torque proportioning differential	Torque proportioning differential
Final reduction Model Type	 TCM 641-30 Planetary	 TCM 642-30 Planetary
Weight Front Rear	 490 Kg (1080 lbs) 478 Kg (1050 lbs)	 638 Kg (1410 lbs) 624 Kg (1380 lbs)

2.9.1 AXLE

The axle is composed of a differential, final reduction units, oil-bath disc brakes and axle shafts connected to the wheels.
The power output from the transmission is driven by the prop shafts to the front and rear axles. Thus, the power is driven to the differential that splits it to the axle right and left shafts driving the final drives, reaching the wheels.
The oil bath disc brake is mounted in front of the final drive and operates as service brake. As for the operation of the service brakes, please refer to section "3 - BRAKES SYSTEM".

Axle mounting

The front axle is mounted directly on the front axle by screws.

The rear axle is mounted with a pivot pin, using supports on both sides of the axle, secured by screws to the rear frame. Consequently, the rear axle can pivot around the axle of the differential with an amplitude depending upon the ground conditions travelled by the loader. The drive axle mounted with a pivoting pin improves the driving conditions of the loader when travelling on rough terrain, since the loader jumps at a lesser extent than a loader with axle supported by a traditional oscillating cradle system.

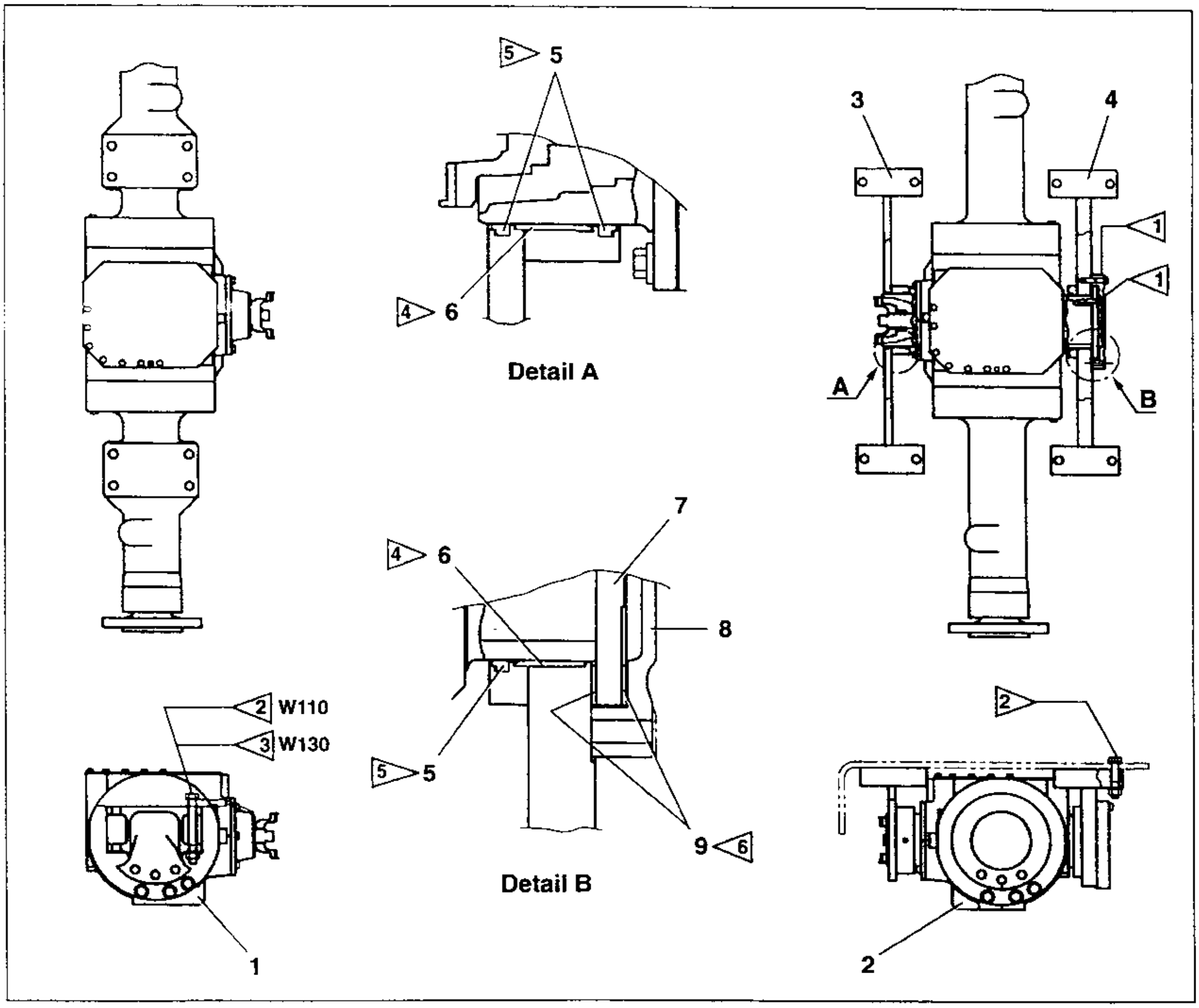


Fig. 2-291 Mounting of axles

Note - These illustrations refer to the mounting of the axles on model W90. The structure of the axles on other models is the same.

Note - [1] 10.3 daNm (74.5 ft - lbs)

Threaded parts: LOCTITE 262

[2] 52 daNm (380 f-lbs)

(W130) [3] 80 daNm (580 ft-lbs)

[4] Inner surface: grease (Install with the chamfer side toward the axle)

[5] Install the lip oriented outward

[6] Install the spline toward the thrust plate (7)

1. FRONT AXLE
2. REAR AXLE
3. REAR AXLE SUPPORT
4. REAR AXLE SUPPORT
5. SEAL
6. BUSHING
7. THRUST PLATE
8. THRUST PLATE COVER
9. THRUST RING

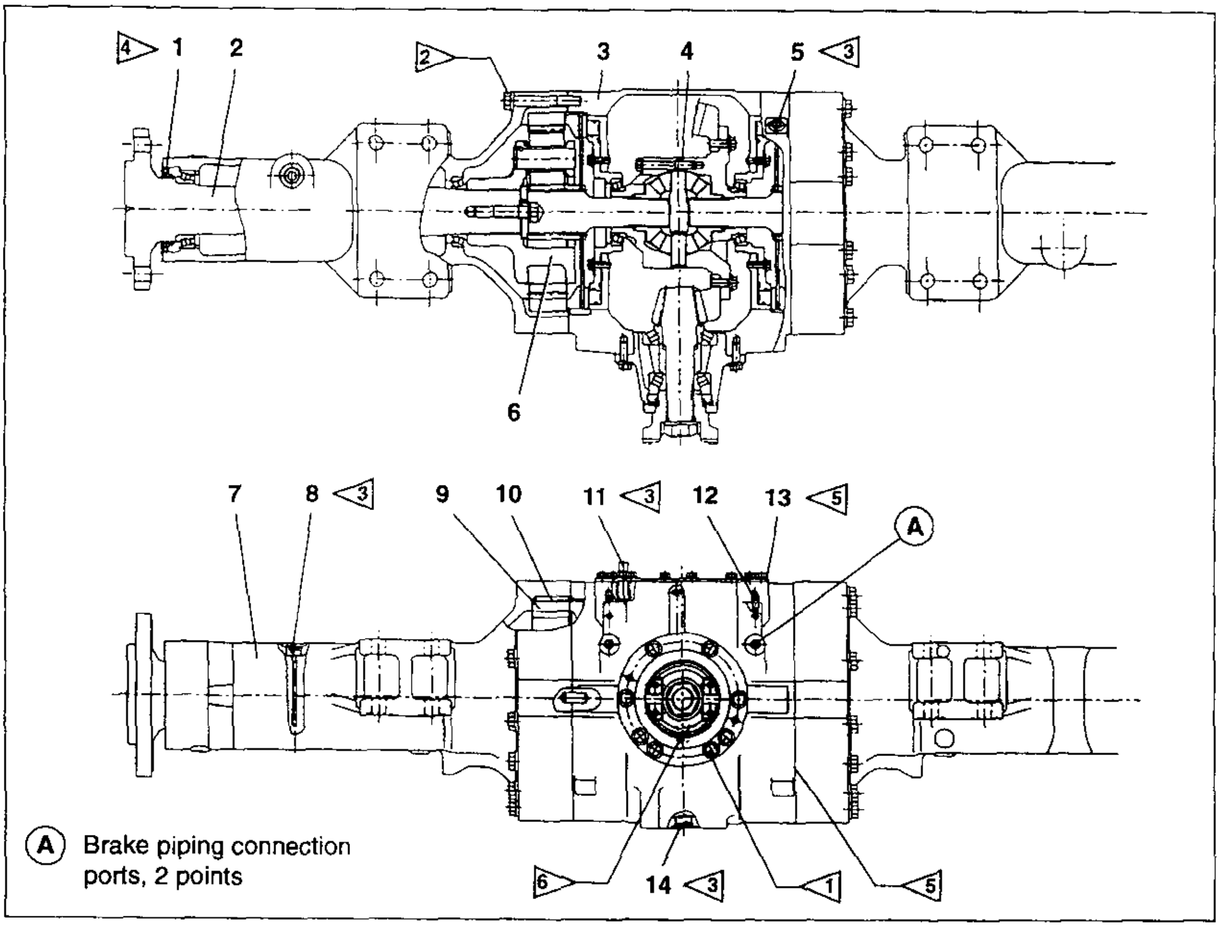


Fig. 2-292 Front axle (W110 - W130)

Note - The illustrations shown above refer to the axle for model W110. The specifications of the axle mounted on model W130 are the same.

Note -

1 9 daNm (65 ft-lbs)

2 23 daNm (170 ft-lbs)

3 Threaded part: LOCTITE 262

4 Lip: Grease

5 Mating surfaces: LOCTITE 509

6 Install with the spline of the bearing holding housing downward

Threaded part: LOCTITE 262

Threaded part: LOCTITE 262

1. OIL SEAL
2. AXLE SHAFT
3. DIFFERENTIAL HOUSING
4. DIFFERENTIAL
5. PLUG (LEVEL CHECK)
6. FINAL DRIVE
7. AXLE HOUSING
8. OIL DIPSTICK
9. CROWN WHEEL
10. PIN
11. BLEEDING SCREW
12. BLEEDING SCREW
13. COVER
14. DRAINING PLUG

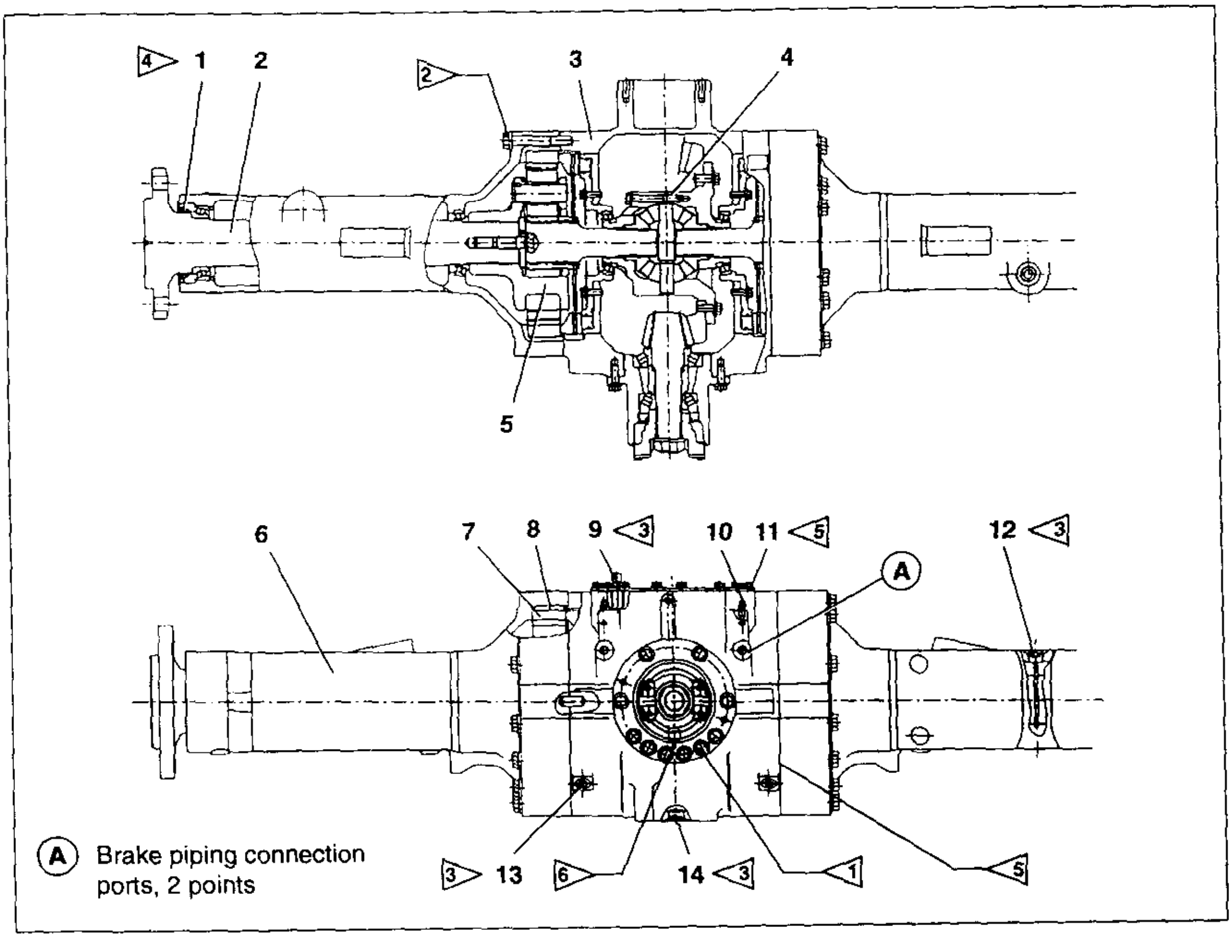


Fig. 2-293 ***Rear axle (W110 - W130)***

Note - The illustrations shown above refer to the axle for model W110. The specifications of the axle mounted on model W130 are the same.

Note:

- 1: 9 daNm (65 ft-lbs)
- 2: 23 daNm (170 ft-lbs)
- 3: Threaded part: LOCTITE 572
- 4: Lip: Grease
- 5: Mating surfaces: LOCTITE 509
- 6: Install with the spline of the bearing holding housing downward

Threaded part: LOCTITE 262

Threaded part: LOCTITE 262

1. OIL SEAL
2. AXLE SHAFT
3. DIFFERENTIAL HOUSING
4. DIFFERENTIAL
5. FINAL DRIVE
6. AXLE HOUSING
7. CROWN WHEEL
8. PIN
9. BLEEDING SCREW
10. BLEEDING SCREW
11. COVER
12. OIL DIPSTICK
13. PLUG (LEVEL CHECK)
14. DRAINING PLUG

2.9.2 DIFFERENTIAL

The differential forms a single body with the reduction unit.
The power is driven from the prop shafts to the differential gear housing through the pinion/bevel gear group. Thus, it is driven through the right and left gears, to the final drives. The reduction of r.p.m. is obtained by the pinion/bevel gear ratio.

Operation of the differential

When the loader is moving straight, the bevel ring gear, the differential gear cage and the differential side gears rotating together; the idle pinions inside the gear cage do not rotate. Thus the right and left side gears drive the power to the wheels. When the loader turns, the right and left wheels turn at different speeds, the idle pinions in the gear cage rotate around their pin, proportionally with the speed difference between the right and left side gears.

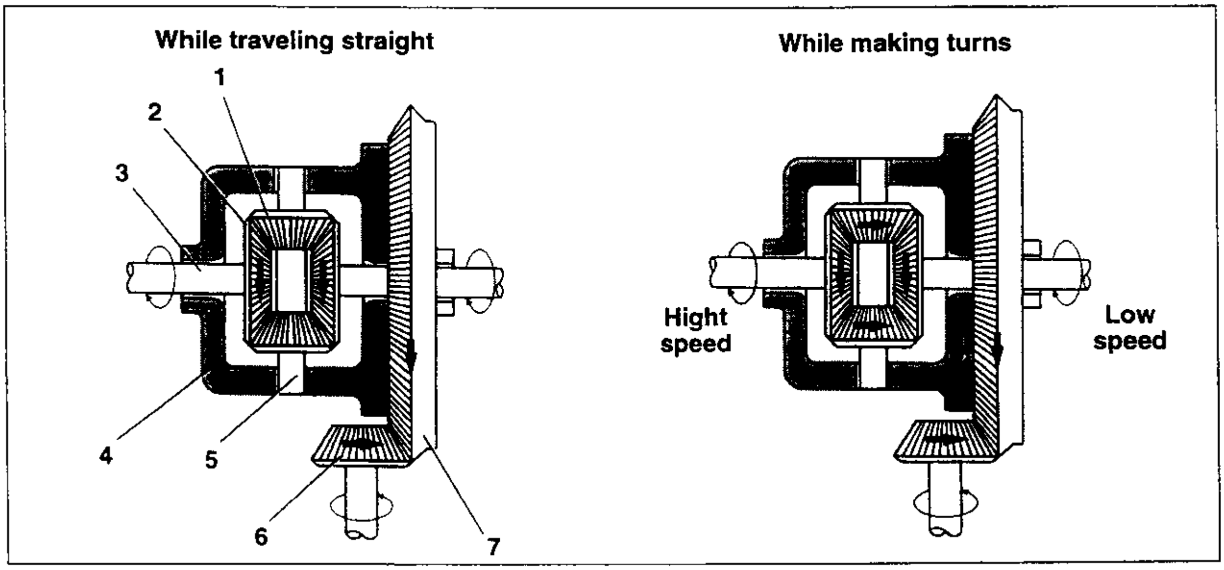


Fig. 2-294 Operation of differential

1. IDLE GEAR
2. SIDE GEAR
3. AXLE SHAFT
4. DIFFERENTIAL GEAR CAGE
5. IDLE PINION SPIDER
6. BEVEL DRIVE PINION
7. BEVEL DRIVE RING GEAR

Proportional torque differential

Wheel loaders often operate under severe terrain conditions, such as sandy or muddy grounds. Under such unfavourable terrain conditions, a loader equipped with a standard differential could experience a spinning of the wheels, thus making difficult to exploit fully its potential performance. Also, the tyres could wear quickly. To avoid this, some models are equipped with a proportional torque type differential, limiting its function.

A proportional torque differential design is almost identical to a normal differential, with the exception of the idle pinions, having an odd number of teeth with a special profile. When the tyres start spinning on soft ground, the idle pinions continue to drive both side gears, without turning on their pins, until the difference of the adhesive force of the right and left tyres on the ground reach a certain value. In this manner, the spinning of the tyres is prevented.

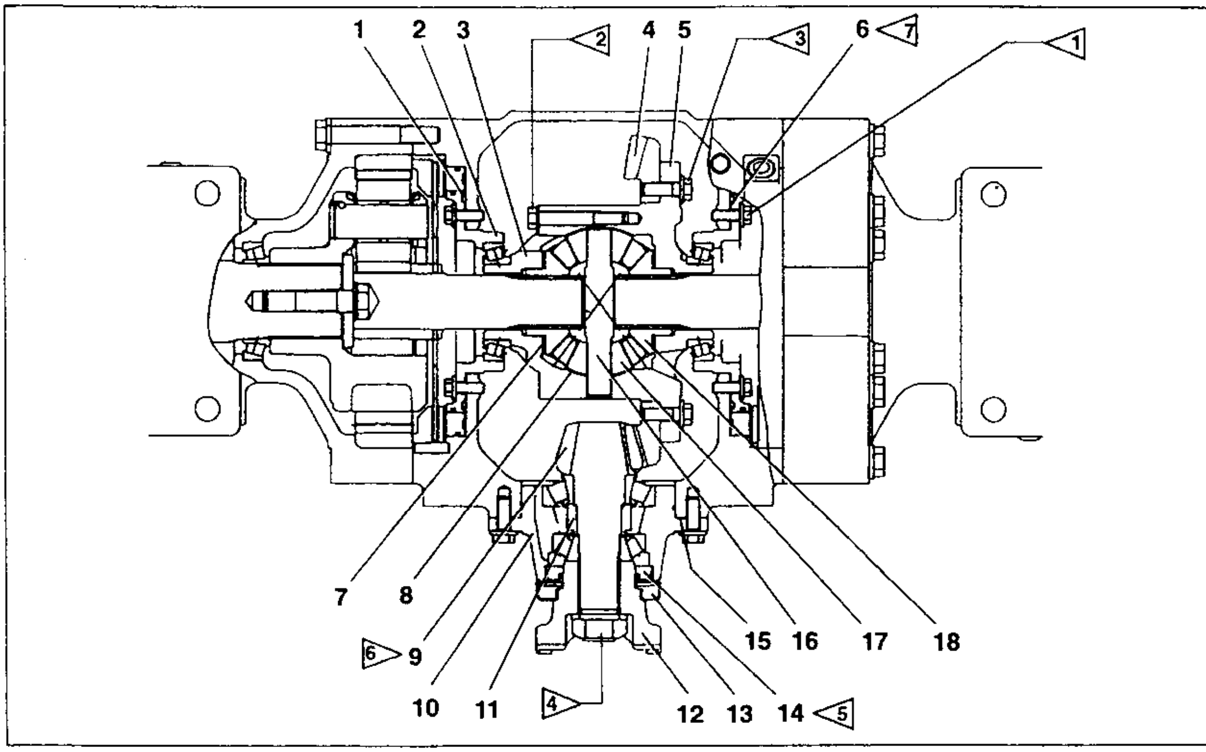


Fig. 2-295 Differential

Note - This illustration shows the model W90. The characteristics of the differential on models W110 and W130 are the same.

Note -

	W110	W130	
1	5 daNm (36 ft-lbs)	9 daNm (65 ft-lbs)	Threaded part: LOCTITE 262
2	9 daNm (65 ft-lbs)	9 daNm (65 ft-lbs)	
3	9 daNm (65 ft-lbs)	15 daNm (110 ft-lbs)	
4	25 daNm (180 ft-lbs)	25 daNm (180 ft-lbs)	—

5 Outer diameter: liquid gasket

Lip: grease

6 Backlash between bevel pinion/ring gear: 0.20 ÷ 0.28 mm (0.0079 ÷ 0.0110 in) for W110
0.25 ÷ 0.36 mm (0.0098 ÷ 0.0142 in) for W130

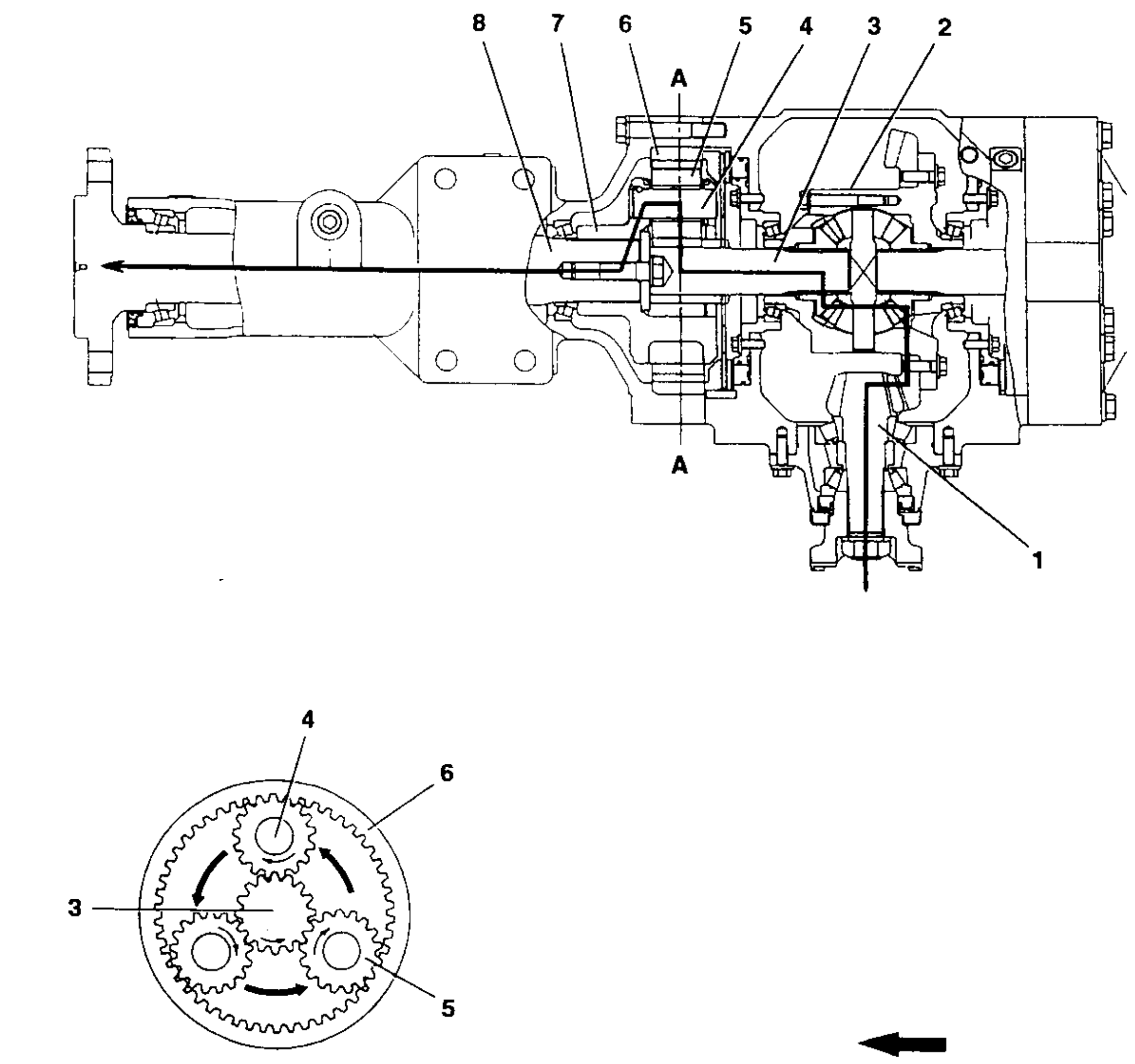
7 Setting by shims (both sides): 0.55 ÷ 1.55 mm (0.022 ÷ 0.061 in)

1. GASKET
2. BEARING SUPPORT
3. HALF CAGE (B)
4. RING GEAR
5. HALF CAGE (A)
6. SHIMS
7. THRUST WASHER
8. THRUST WASHER
9. PINION
10. BEARING CAGE
11. SPACER
12. FLANGE
13. COVER
14. SEAL
15. SHIMS
16. SPIDER
17. IDLE PINION
18. SIDE GEAR

2.9.3 FINAL DRIVES

The final drive units are of a planetary type and create the final rpm reduction in the power train.

The power driven by the differential to the sun gear shaft rotates the three planet gears inside the toothed drum, thus driving the axle shaft through the planet gear carrier.



Section A-A
(Operation of planet gears)

Power drive

Fig. 2-296 Drive of power

1. PINION
2. DIFFERENTIAL
3. SOLAR GEAR SHAFT
4. PLANET GEAR PIN
5. PLANET GEAR
6. TOOTHED DRUM
7. PLANET CARRIER
8. AXLE SHAFT

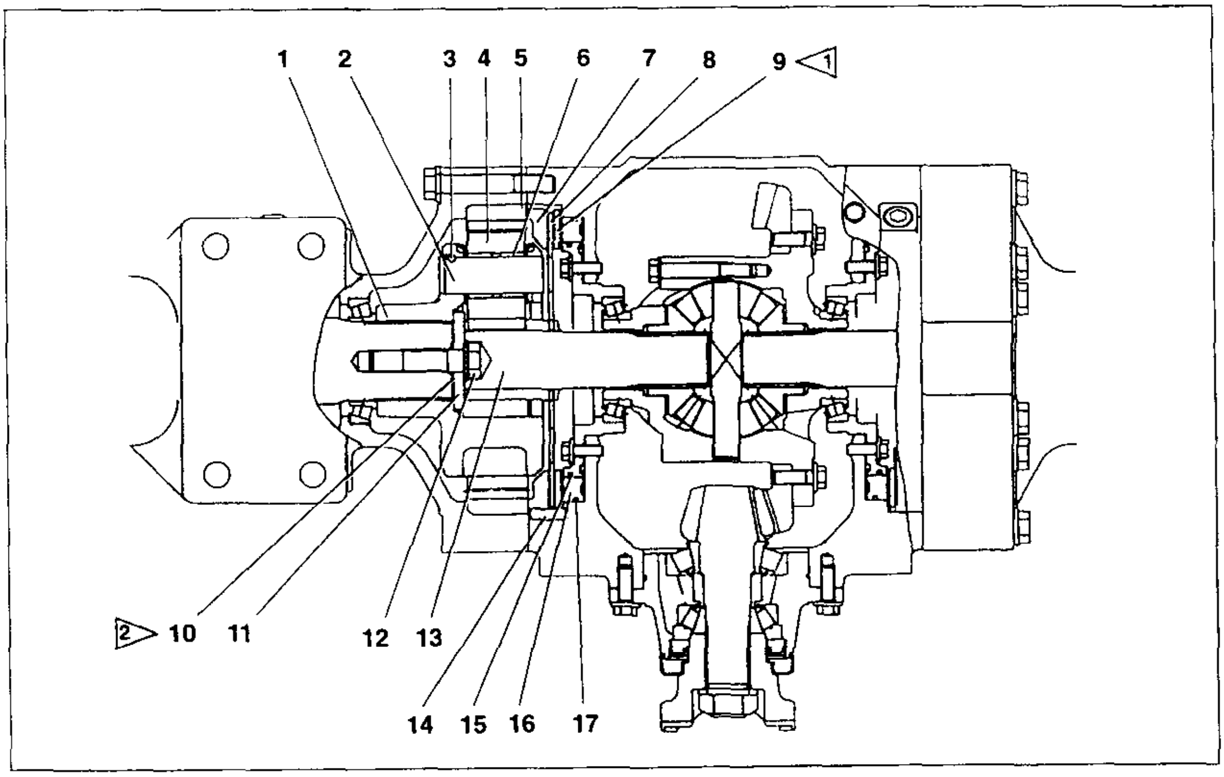


Fig. 2-297 Final drive

Note - This illustration shows the model W90. The characteristics of the differential on models W110 and W130 are the same.

Note - 1 Place the surface marked toward the piston

2 Use of adjusting shims

1) Tighten screw (**12**) to a torque of 5 daNm (36 ft-lbs) and set inward the taper bearing, rotating the axle shaft.

2) Measure the gap between thrust ring (**11**) and the axle shaft. Value measured = **Y**.

3) Select the adjusting shims to form a stack no thicker than 0.03 to 0.10 mm (0.00118 to .00393 in) than value **Y**.

4) Install the shim stack, the retaining ring and the screw.

65.7 daNm (475 ft-lbs) Threaded part: LOCTITE 262

The rolling torque of the bearing must be within 2 and 2.5 daNm (14 and 18 ft-lbs) [2 ÷ 4 daNm (14 ÷ 29 ft-lbs) for W130].

1. CARRIER
2. PLANET GEAR PIN
3. STOP BALL
4. PLANET GEAR
5. TOOTHED DRUM
6. NEEDLE BEARING
7. SUPPORT PLATE
8. BRAKE DISC
9. DISC PUSHING RING
10. ADJUSTING SHIM
11. THRUST RING
12. SCREW
13. SOLAR GEAR SHAFT
14. HOLDING PIN
15. SEAL
16. PISTON
17. SEAL

2.9.4 AXLES

2.9.4.1 Disassembly

Note: The illustrations for disassembly and reassembly in this manual show the rear axle of the model W90.
Note: When disassembling and reassembling the axle, it is good practice to place it on a suitable support stand.

a) Removing the axle housing.

1. Remove the drain plug and discharge oil.
   Gear oil: 13 to 29 lt.

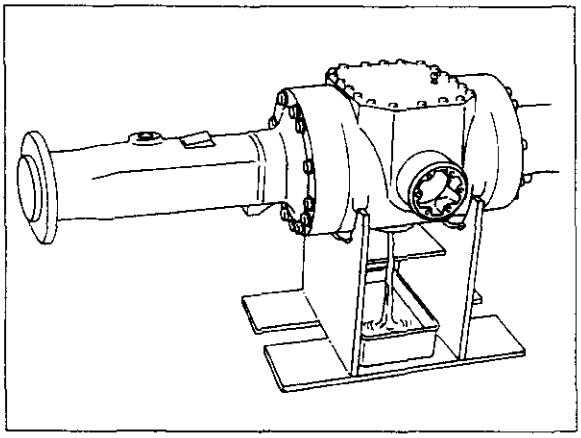


Fig. 2-298

2. Lift the axle housing temporarily with a hoist, holding the axle housing opposite side to prevent it from lowering.
   Axle housing: 110 to 160 kg.
3. Remove 14 axle housing bolts. Detach the axle housing assembly from the center housing.

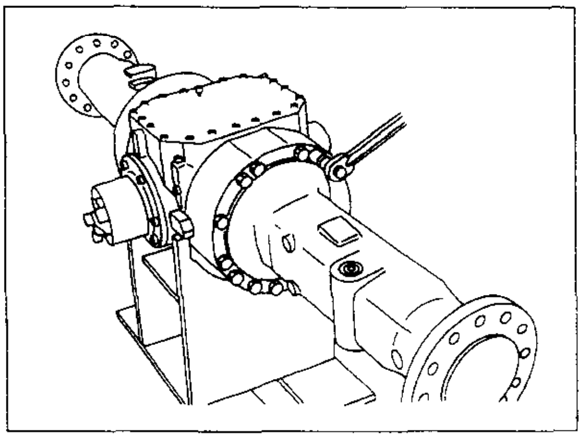


Fig. 2-299

Note that the center housing and axle housing are joined with dowel pins. Separate one from the other by prying.

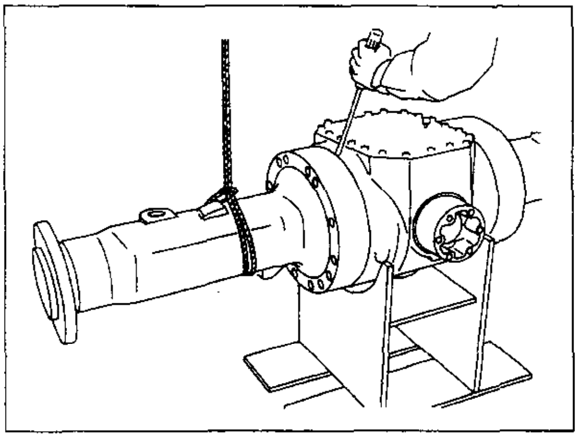


Fig. 2-300

4. Remove the shaft (sun gear) from the differential.

5. Remove the axle housing and shaft at the opposite side, using the same procedure as above.

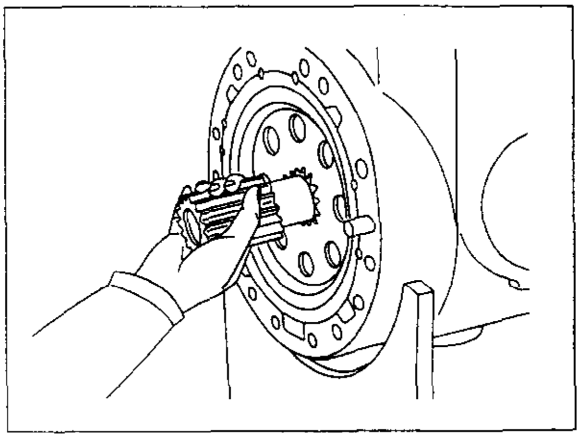


Fig. 2-301

b) Disassembling the axle housing.

1. Secure the axle shaft using 2 wheel bolt holes.
2. Loosen the retainer plate mounting bolt and remove it.
   A torque of approx. 100 kgm is required to loosen the bolt because it is locked with LOCTITE.

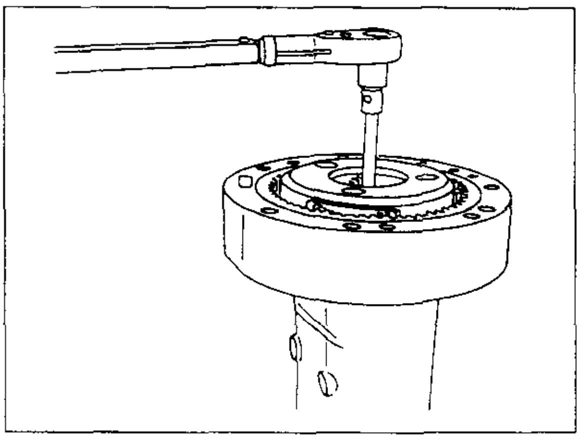


Fig. 2-302

3. Remove the final drive assembly (planetary carrier) using a bar.
   Remove any shim attached to the axle shaft end.
   Planetary carrier: 17 to 22 kg.

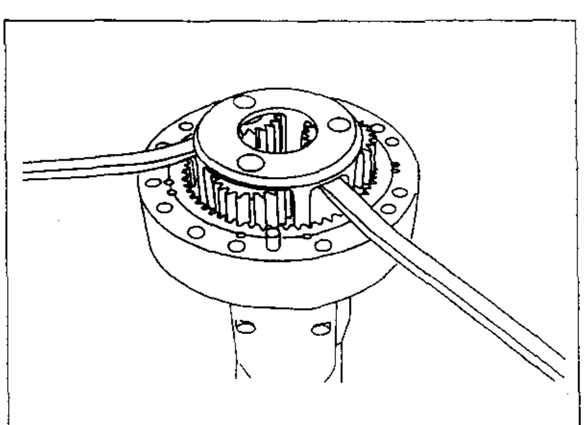


Fig. 2-303

4. Remove the outer ring of the axle shaft oil seal from the axle housing, using a screwdriver.
5. Push the end of the axle shaft to remove it from the axle housing. Use a press if it is hard to remove.
   Axle shaft: 33 to 45 kg.

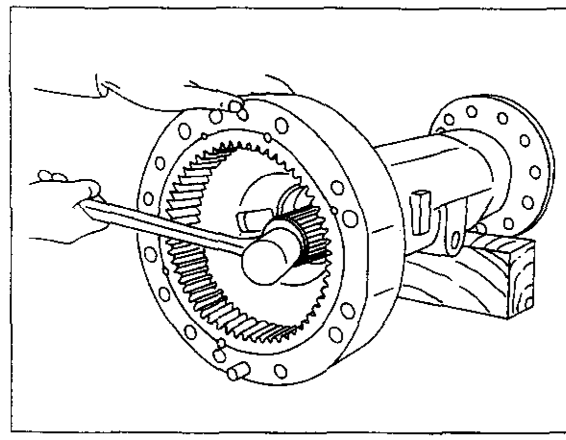


Fig. 2-304

6. Remove the bearing cone from inside the axle housing.

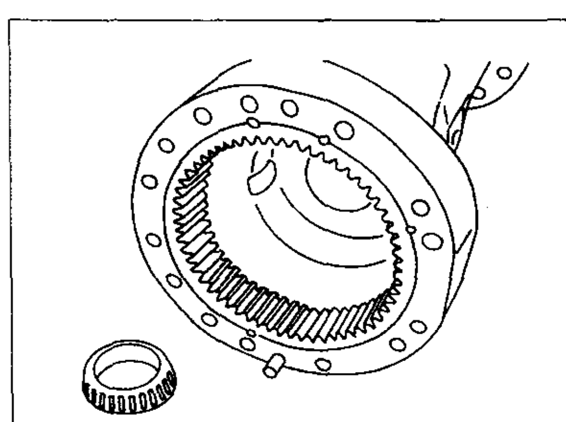


Fig. 2-305

7. Using a puller, remove the bearing cone from the axle shaft.
8. Cut the axle shaft oil seal sleeve and remove the oil seal.

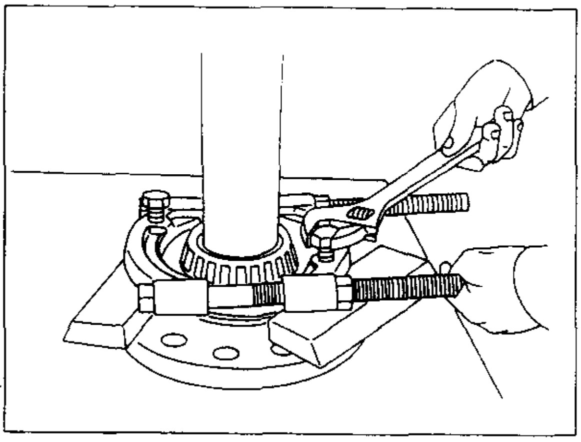


Fig. 2-306

9. If the axle shaft bearings are to be replaced, remove the two bearing races from the axle housing.

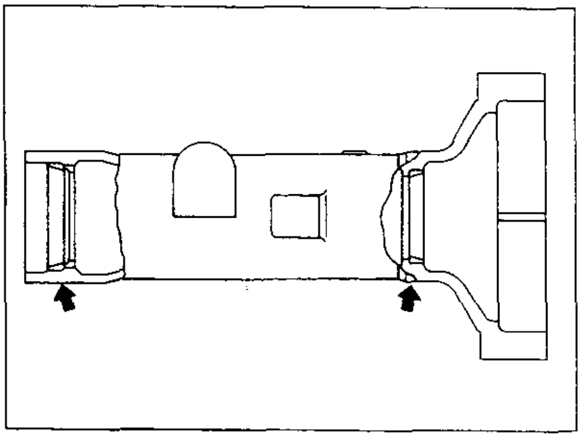


Fig. 2-307

10. If the ring gear is to be replaced, remove it from the axle housing using a puller and a plate placed into the axle housing to support the puller shaft.

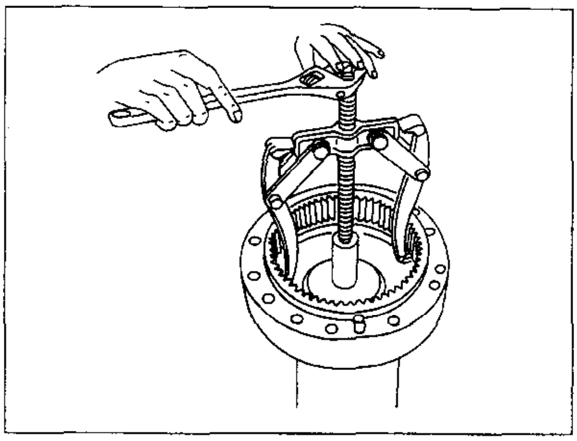


Fig. 2-308

c) **Disassembling the final drive assembly.**

1. Remove the snap ring from the planetary gear shaft.

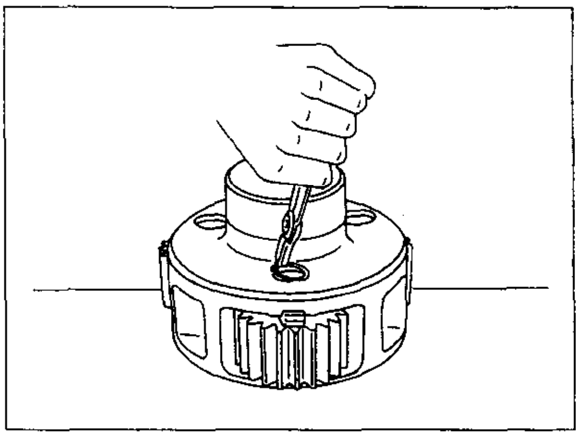


Fig. 2-309

2. Remove the shaft by driving it out of the opposite side. Use caution not to lose the shaft lock ball.

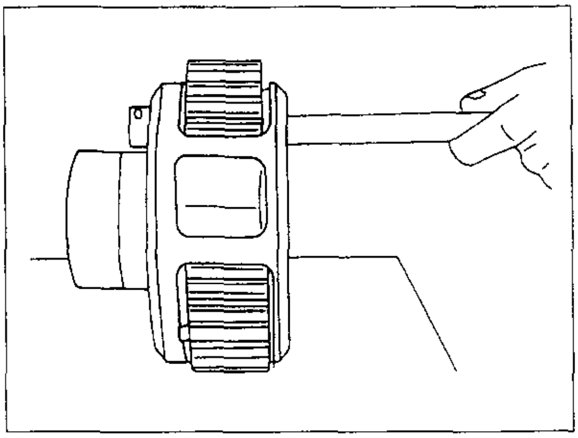


Fig. 2-310

3. Remove the planetary gear and two thrust washers.

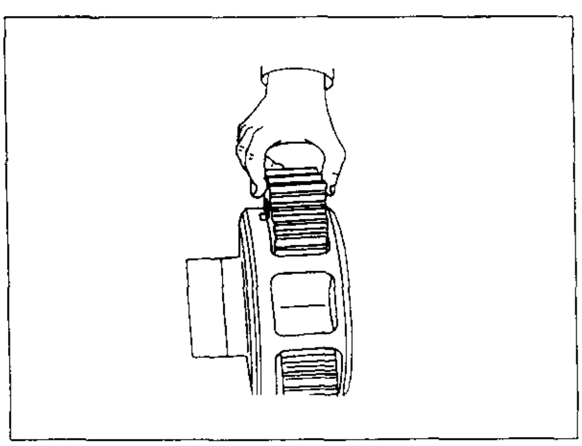


Fig. 2-311

4. Remove the 56 needle rollers and spacers from inside the gear.

5. Disassemble the other two planetary gear shafts using the same procedure as above.

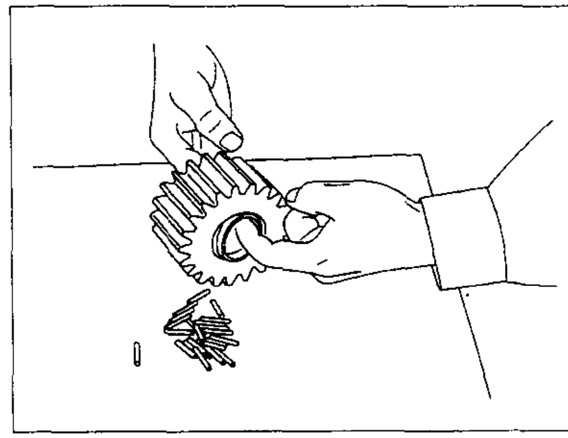


Fig. 2-312

6. Remove the reatiner plate from the planetary carrier. Keep any shim, if used.

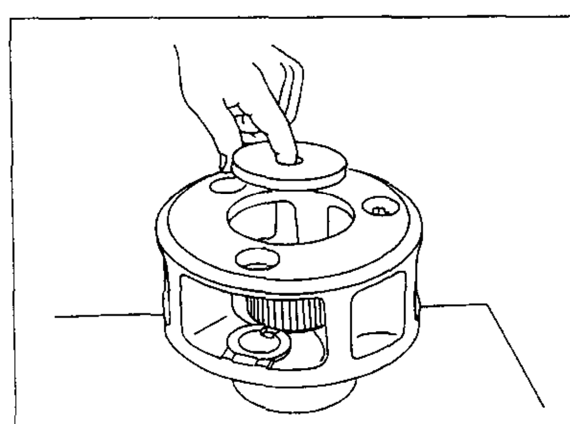


Fig. 2-313

d) Removing the brake unit.

1. Remove the end plate, brake disc, and brake ring from the center housing in this order. Then, remove the 8 pins.

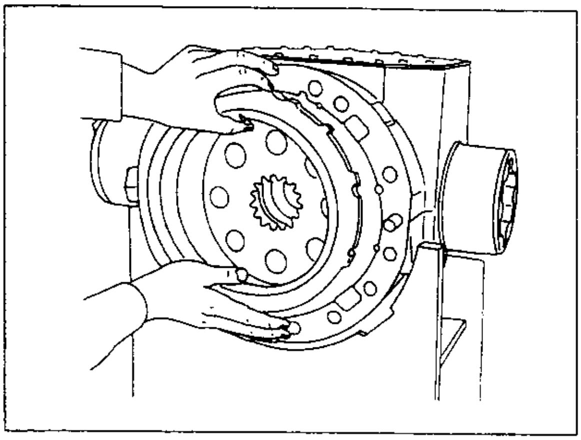


Fig. 2-314

2. Install 2 jacking bolts into the brake piston jacking holes (M6) and remove the brake piston, holding the 2 bolts.

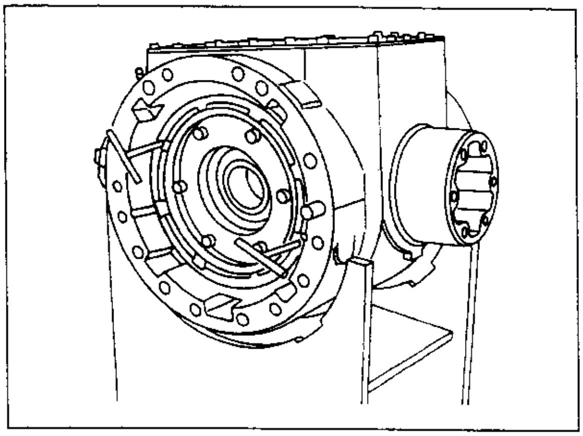


Fig. 2-315

If the brake piston is hard to remove, drive it out by blowing compressed air through the brake piping port.

WARNING: Install a stop plate on the center housing, to prevent the piston from popping out. (See Fig. 2-316).

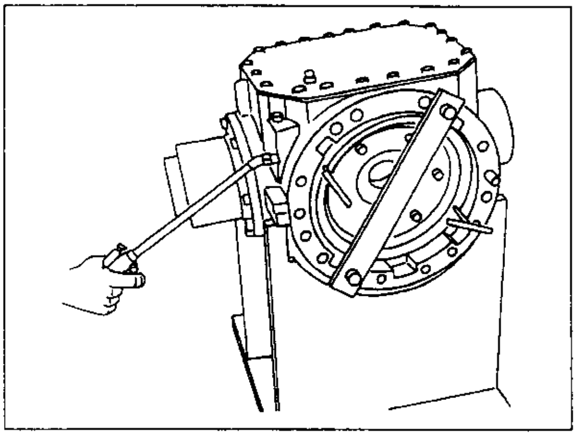


Fig. 2-316

3. Remove the ring from the outer diameter of the brake piston.

4. Remove the brake unit at the opposite side, using the same procedure.

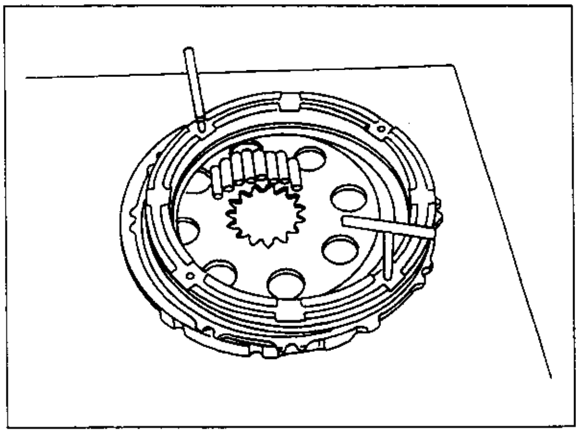


Fig. 2-317

e) Removing the drive pinion (bearing cage).

1. Loosen the bolts (24 off) securing the cover to the center housing and remove the cover.

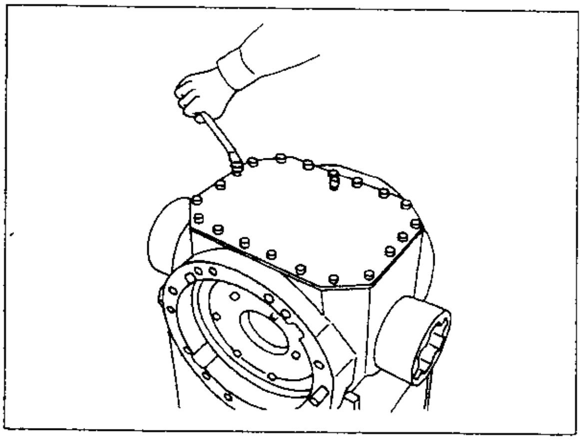


Fig. 2-318

2. Check the ring gear for tooth contact pattern and backlash. (See page 2-144).

3. Remove the companion flange lock nut. Take out the washer and O-ring.
While loosening the lock nut, lock the companion flange with the ring gear.

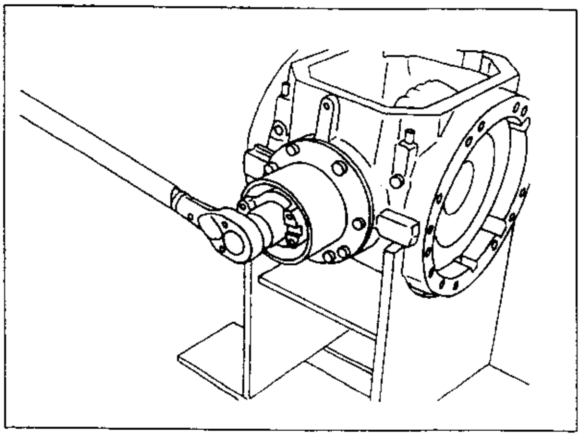


Fig. 2-319

4. Remove the companion flange.
Use a puller if it is hard to remove.

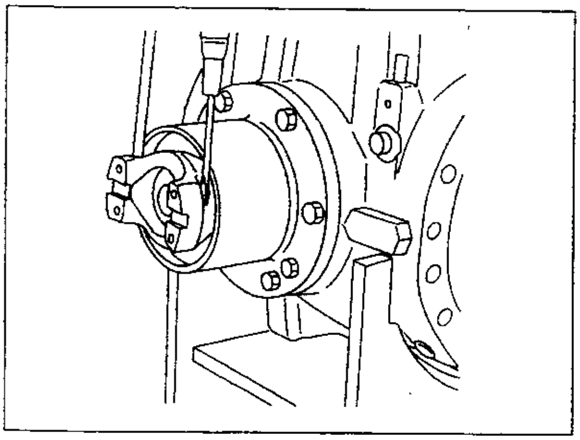


Fig. 2-320

5. Remove the bearing cage mounting bolts.

Number of bolts: Front 8
Rear 10

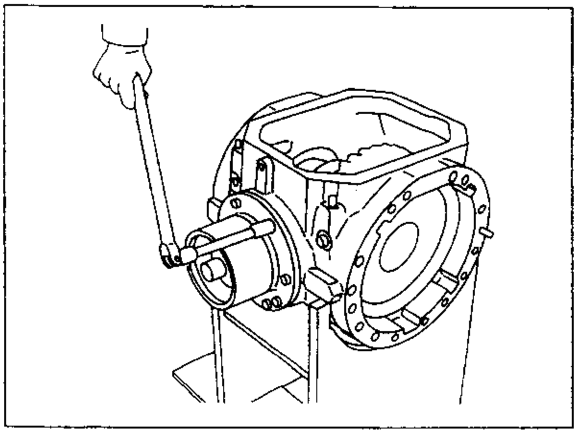


Fig. 2-321

6. Install two of the mouting bolts previously removed into the bearing cage jacking holes and tighten. Remove the bearing cage and drive pinion a holding the bolts.

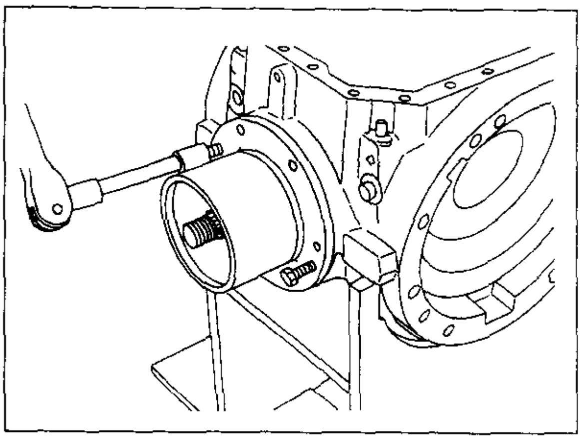


Fig. 2-322

7. Remove any shim from the bearing cage.

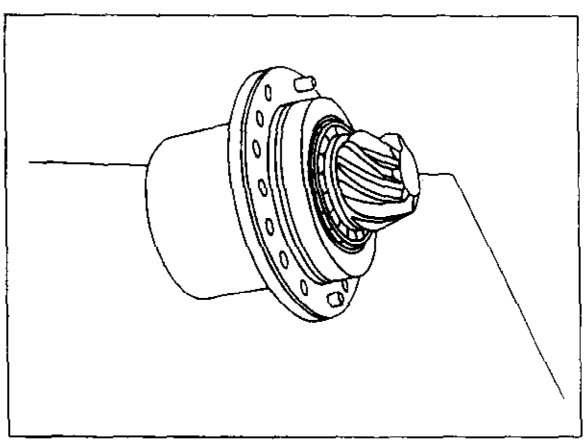


Fig. 2-323

f) Disassembling the drive pinion.

1. Remove the drive pinion from the bearing cage using a press.
   Slide out the spacer from the pinion shaft.

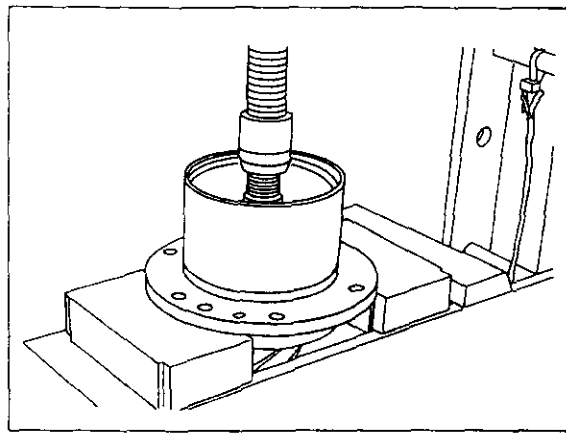


Fig. 2-324

2. Remove the oil seal and bearing cone from the bearing cage. To remove the oil seal, break it with a screwdriver.
   Remove the O-ring from the outer diameter of the bearing cage.

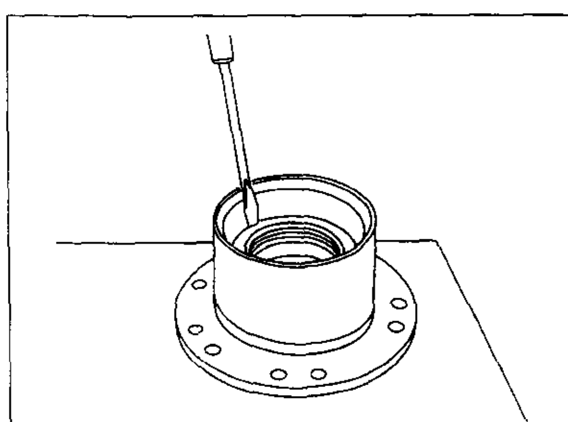


Fig. 2-325

3. If the bearing is to be replaced with a new one, remove the bearing cone from the drive pinion shaft using a puller.

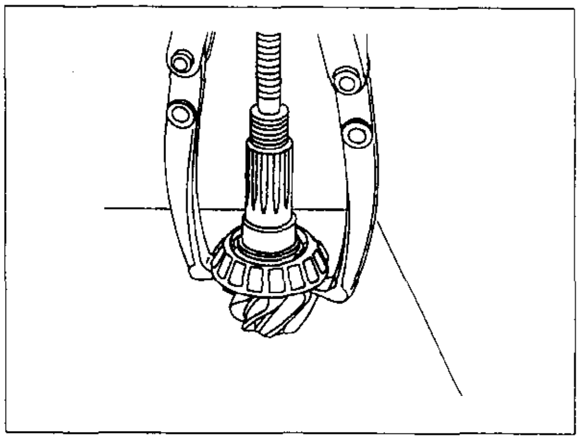


Fig. 2-326

4. After that, remove the 2 bearing cones from inside the bearing cage, using a dirft or a tube.

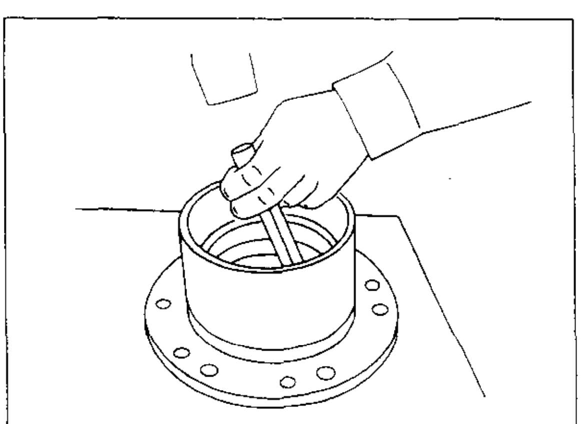


Fig. 2-327

g) Removing the differential casing.

1. Temporarily lift the centre housing with a hoist. Centre housing: 35 to 58 kg.
2. Remove the bearing retaining bolts (8 off).

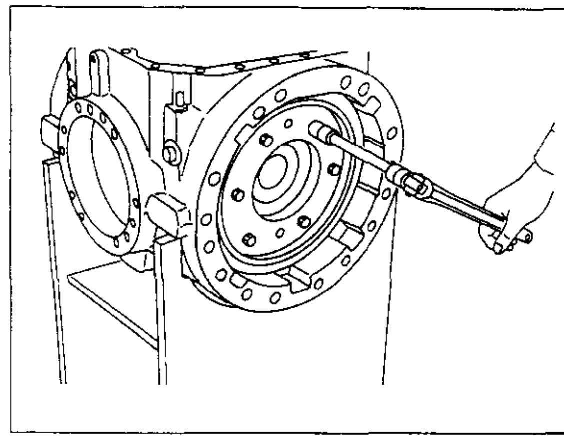


Fig. 2-328

3. Install two of the mouting bolts previously removed into the bearing retainer jacking holes and tighten evenly. Slide out the bearing retainer holding the bolts. Thenremove any shim. Remove the box ring and D-ring from the bearing retainer.

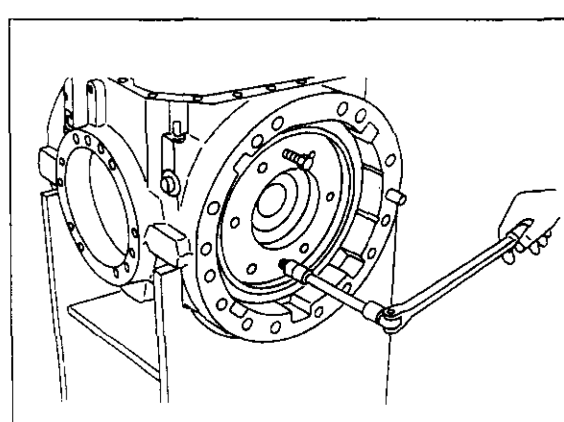


Fig. 2-329

4. Remove the bearing retainer and shims at the opposite side using the same procedure as above.

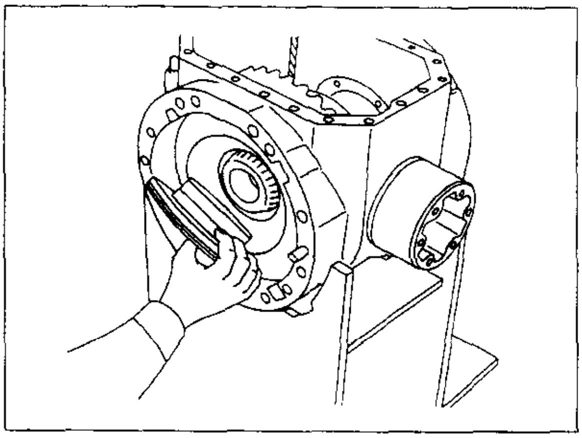


Fig. 2-330

5. Remove the crown wheel and differential assembly from the center housing.

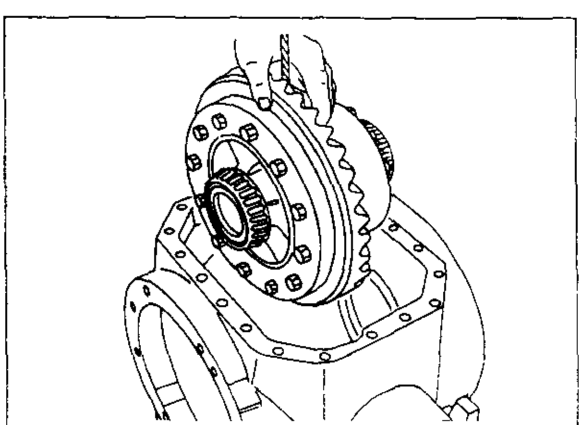


Fig. 2-331

6. If the differential bearing is to be replaced with a new one, remove the bearing cup from inside the bearing retainer.

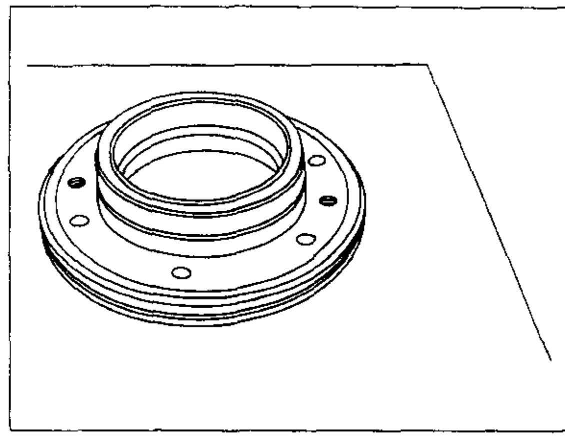


Fig. 2-332

h) **Disassembling the differential assembly.**

1. Loosen the crown wheel mounting bolts (16 off) and remove the crown wheel.

   If the crown wheel is hard to remove, take it out by tapping its back with a mallet.

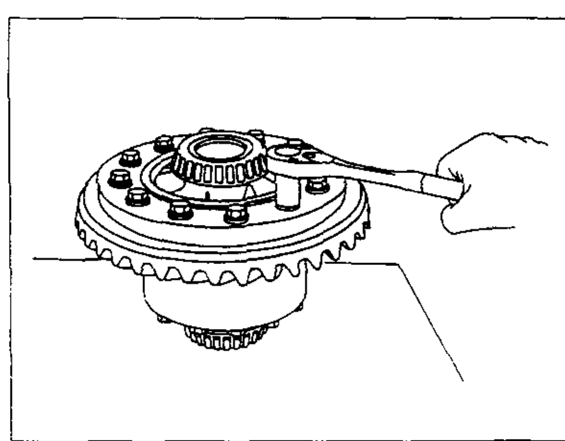


Fig. 2-333

2. Remove the 12 differential casing mounting bolts and disassemble the differential assembly.

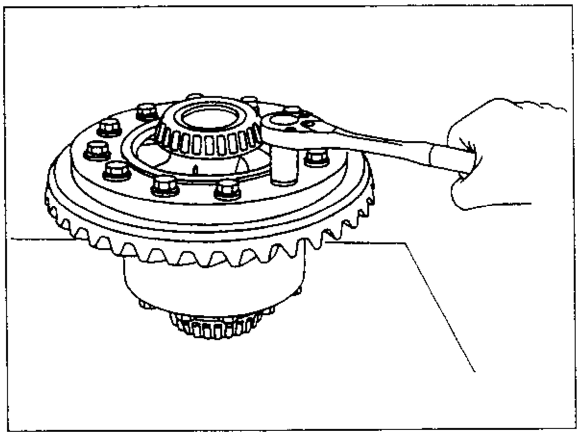


Fig. 2-334

Tap the spider with a drift and mallet.

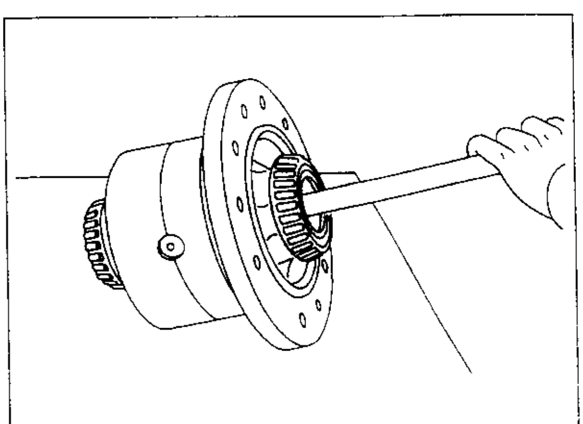


Fig. 2-335

3. Remove the 2 side gears, spider, 4 planetary gears and 6 thrust washers from inside the differential casing.

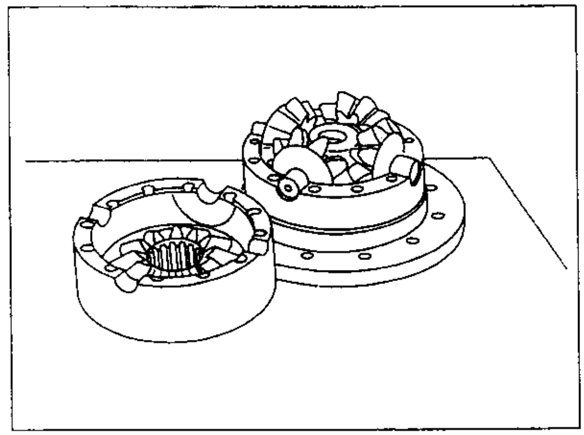


Fig. 2-336

4. If the differential bearings are to be replaced, remove the bearng cone from the differential casings **A** and **B** using a puller.

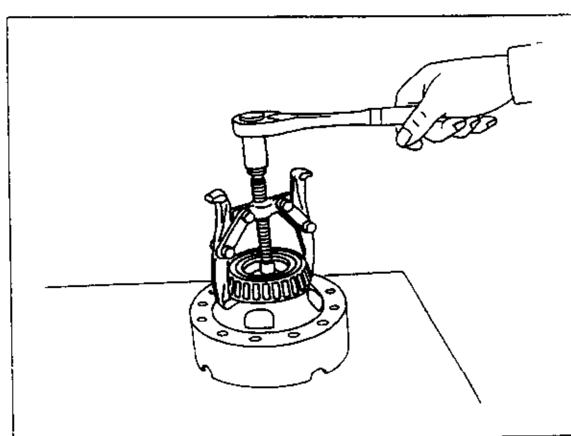


Fig. 2-337

2.9.4.2 Reassembly

Precautions to observed when reassembling the shaft axle.

- Wash each disassembled part with a clean detergent oil and dry it by blowing compressed air.
- Handle the washed parts with care not to damage or contaminate them.
- Check the disassembled parts for wear or damage and replace any worn or damaged part. Refer to "2.9.4.4 STANDARD VALUES FOR MAINTENANCE".
- Replace all the seals with new ones.

a) Reassembling the differential assembly.

1. Place the flanged half case (differential case **A**) on a work bench, and install the thrust washer and side gear.
   For the model W130, align 2 thrust washer lock pins with the thrust washer holes.

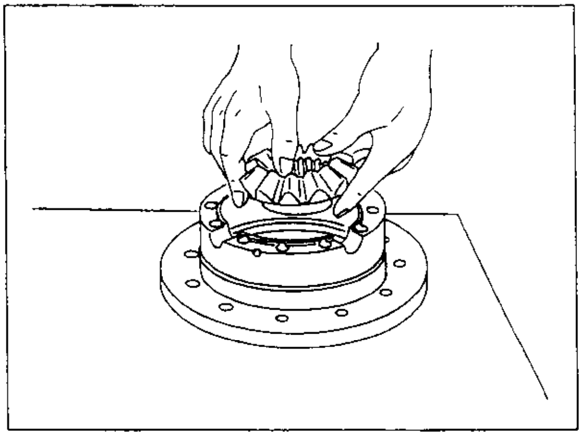


Fig. 2-338

2. Install 4 planetary gears and 4 thrust washers on the spider, and install them as a unit on the side gear, engaging the gear teeth.

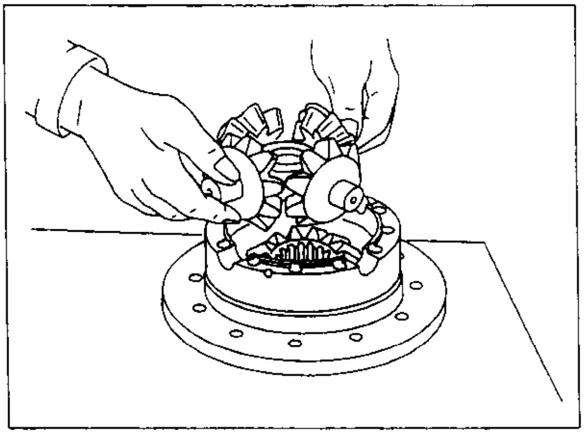


Fig. 2-339

3. Direct the tooth surface of the side gear downward so that the side gear engages with the planetary gears.
   Install the side gear thrust washer.
   The model W130 has 2 thrust washer lock pins, so for the model W130, fix the thrust washer with grease to the case half at the opposite side (differential case **B**).

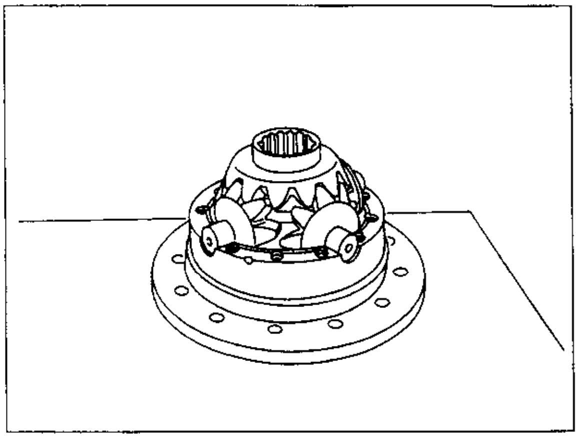


Fig. 2-340

4. Install the half case (differential case **B**), matching the marks made during disassembly. Tap the case with a soft mallet to make sure that the half case is installed without looseness.

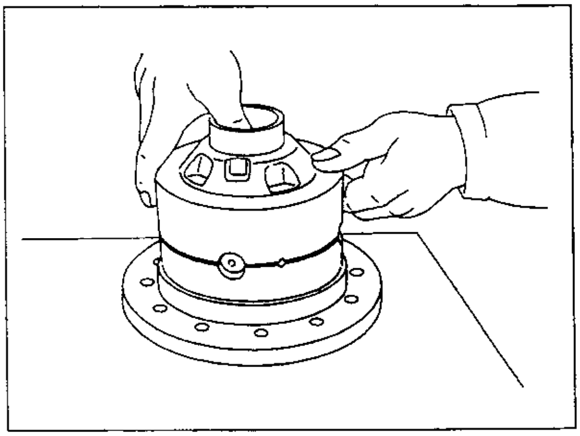


Fig. 2-341

5. Install the 12 case bolts and tighten them in diagonal order.
Apply LOCTITE 262 to the threaded area of each bolt.

9 kgm

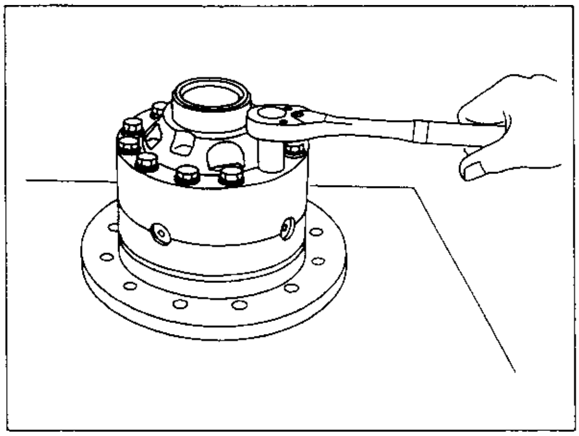


Fig. 2-342

6. If the differential bearing was replaced with a new one, press bearing cones on the differential case halves **A** and **B**.

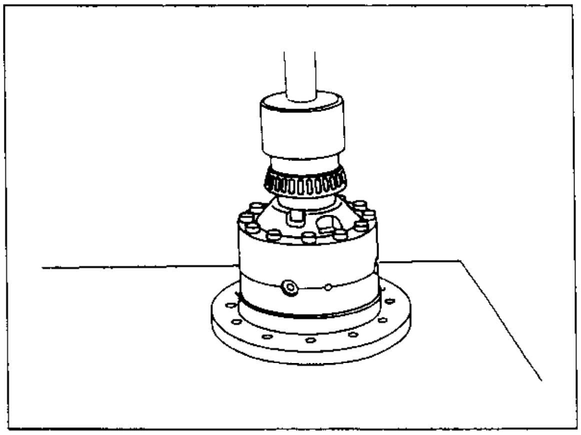


Fig. 2-343

7. Install the crown wheel on the flanged half case (differential case **A**) and tighten the mounting bolts. Tap the crown wheel with a soft mallet to install it without looseness.

No. of bolts:

W110	16	9 kgm
W130	16	15 kgm

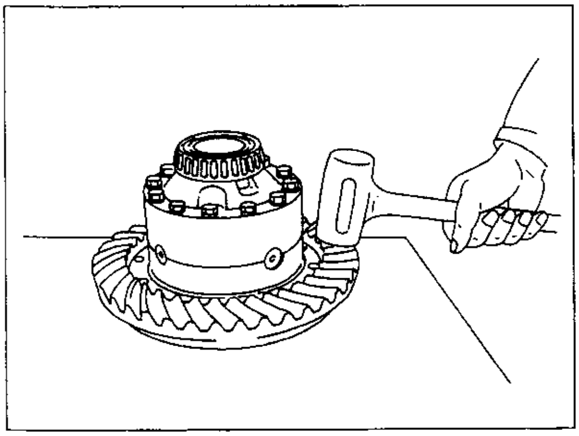


Fig. 2-344

b) Reassembling the drive pinion (bearing cage).

1. If the drive pinion bearing was replaced, press the 2 bearing cups into the bearing cage.

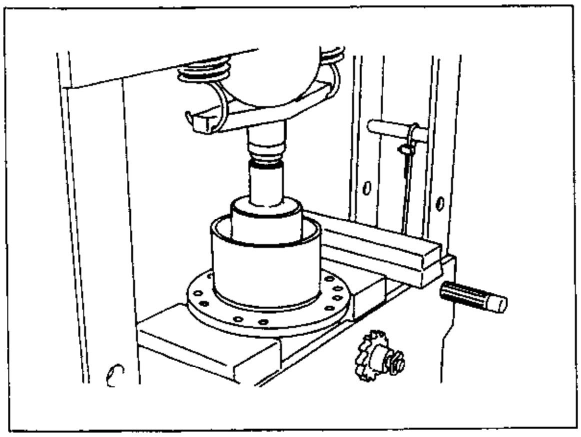


Fig. 2-345

2. Press the bearing cone into the drive pinion.

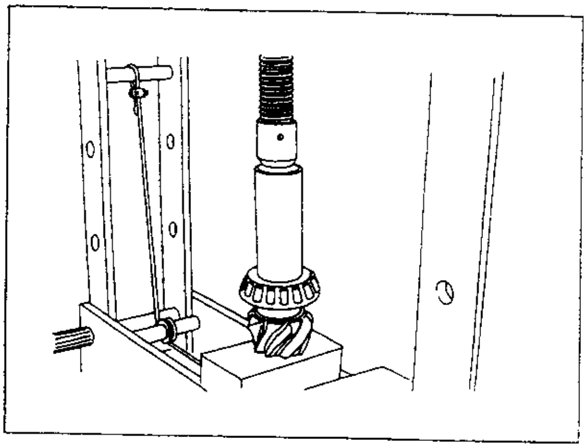


Fig. 2-346

3. Insert the spacer onto the drive pinion, directing the stepped area of the spacer upward.

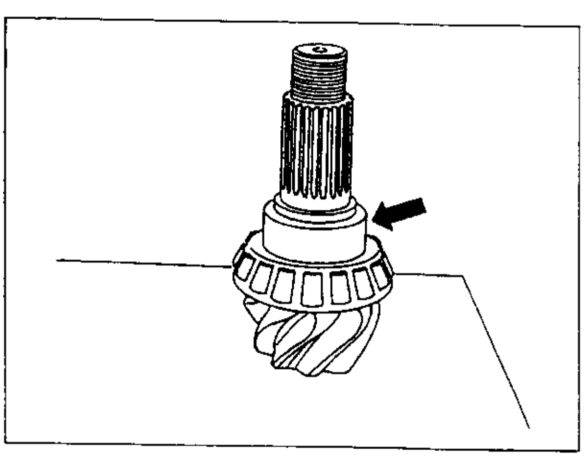


Fig. 2-347

4. Place the bearing cage on the drive pinion.

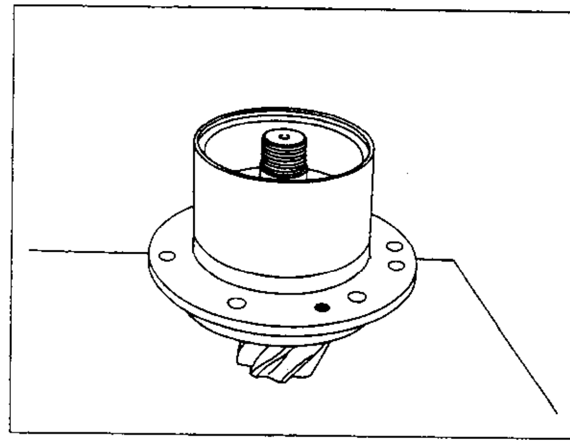


Fig. 2-348

5. Press the bearing cone onto the drive pinion. After that, make sure that the bearing cage turns smoothly without looseness.

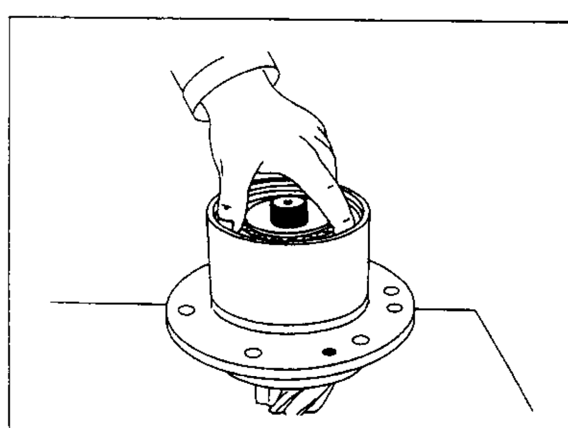


Fig. 2-349

6. Apply a light coat of liquid seal on the outer diameter of the oil seal and apply grease between the lips.
   Press the oil seal into the bearing cage.

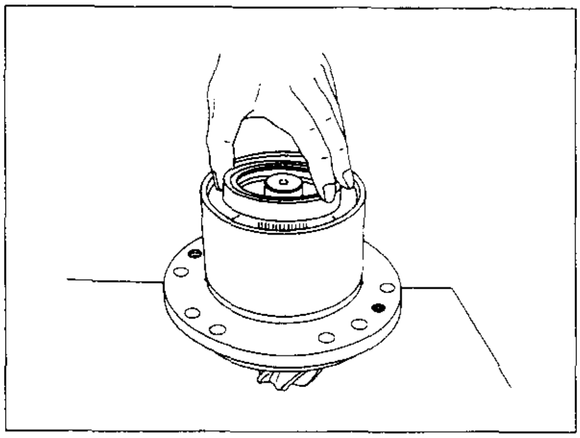


Fig. 2-350

7. Install the companion flange onto the drive pinion. Slide the flange several times to eliminate strain at the seal lip.

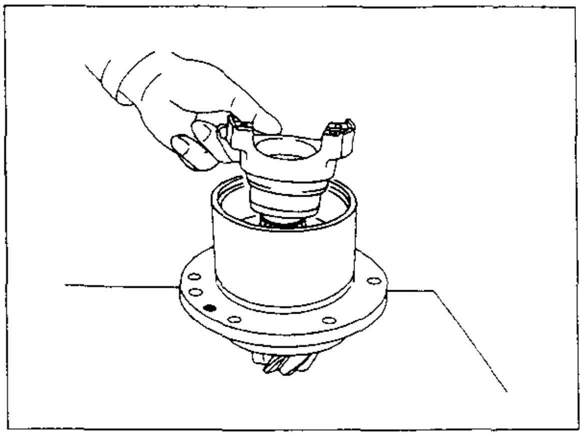


Fig. 2-351

8. Then, insert the O-ring and washer and tighten the lock nut. Before tightening the lock nut, apply LOCTITE 262 on its threaded area. When tightening the lock nut, lock the companion flange with a monkey wrench.

   55 kgm

   Make sure that the bearing cage turns smoothly without binding.

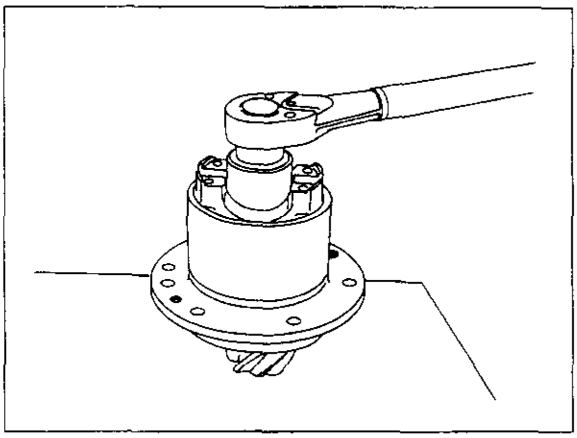


Fig. 2-352

9. Apply grease to the O-ring. Install the O-ring in the groove at the outer diameter of the bearing cage.

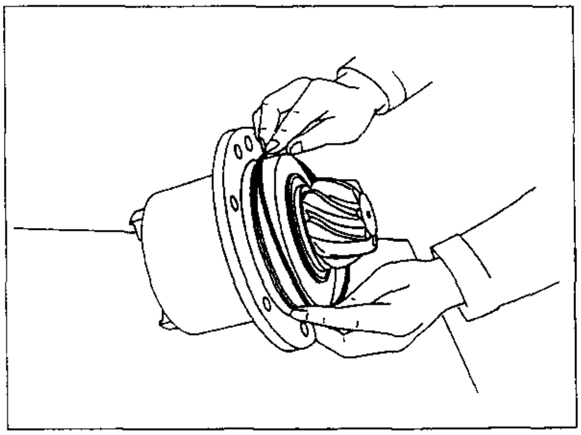


Fig. 2-353

c) **Installing the differential assembly.**

1. If the differential bearing was replaced with a new one, press bearing cups on the 2 bearing retainers.

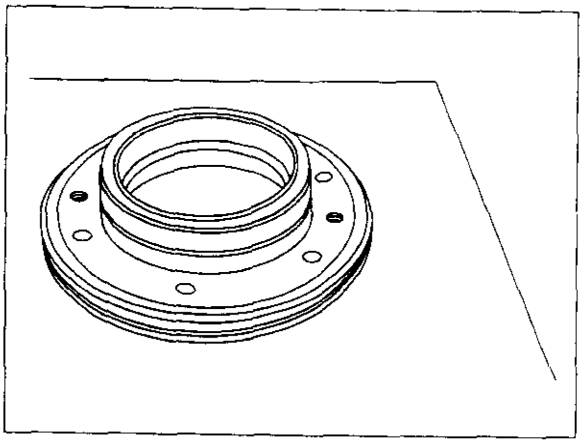


Fig. 2-354

2. Lift the reassembled differential assembly with a hoist and put it in the center housing, aligning the crown wheel with the notch in the center housing.

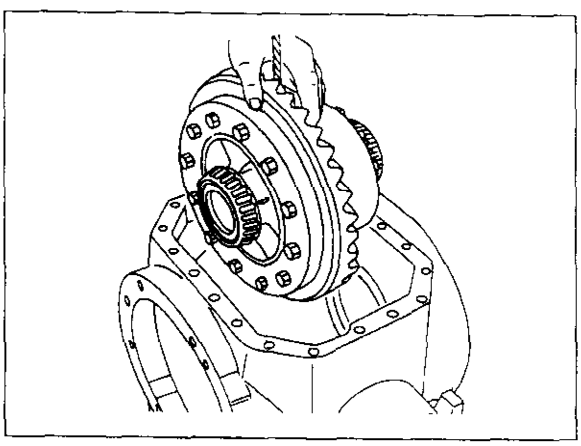


Fig. 2-355

3. Install the box rings and shims on the 2 bearing retainers. Use shims of the same size as was removed during disassembly.

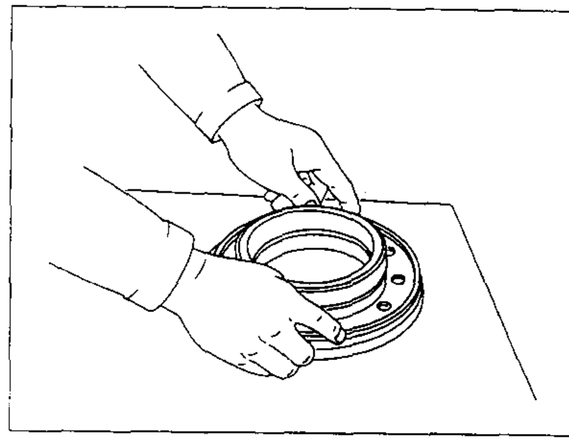


Fig. 2-356

4. Install the bearing retainers at the right and left sides of the center housing to hold the differential case. Temporarily install the bearing retainer mounting bolts (8 off).

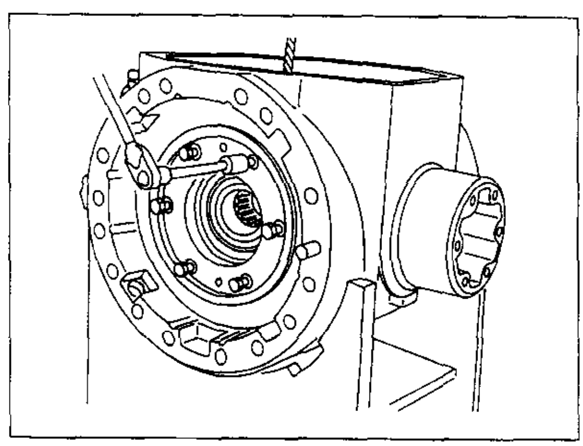


Fig. 2-357

5. Make sure that the differential assembly has no looseness in the right and left directions and turns smoothly.
If any defect is found, adjust the bearing retainer shim thickness.

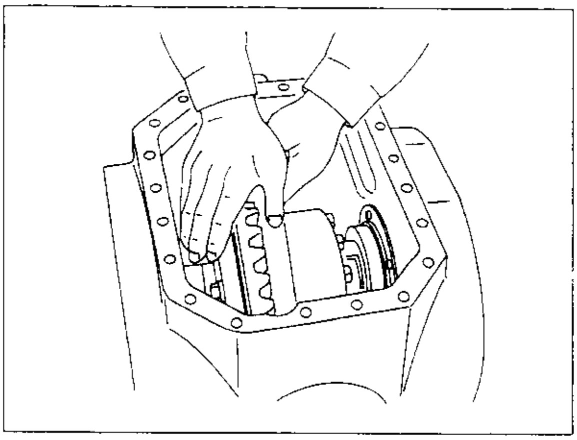


Fig. 2-358

d) Installing the drive pinion bearing (bearing cage).

1. Install the bearing cage shims in the center housing. Then, install the bearing cage and the drive pinion assembly. Use the same size of shims as was removed during disassembly. The shims are two-piece type, so divide them in the upper and lower areas, respectively.

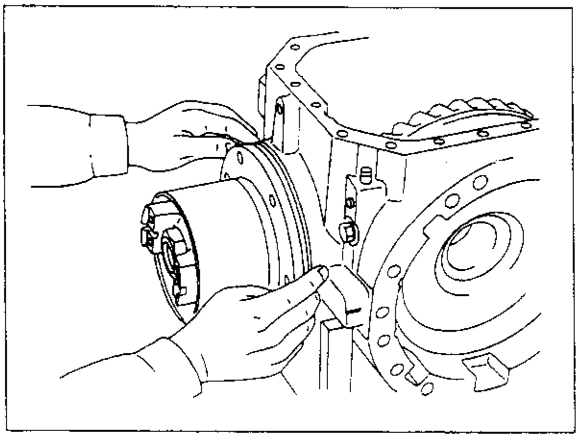


Fig. 2-359

2. Temporarily install the bearing cage mounting bolts temporarily and check gear backlash and tooth contact pattern. Refer to steps **(e)** and **(f)**.

For the front axle, position the bearing cage groove, refering to Fig. 2-360 or Fig. 2-361.
For the axles of the other models, position the bearing cage groove according to the location of the mounting bolts.

Number of bolts:

W110	Front	8
W130	Rear	10

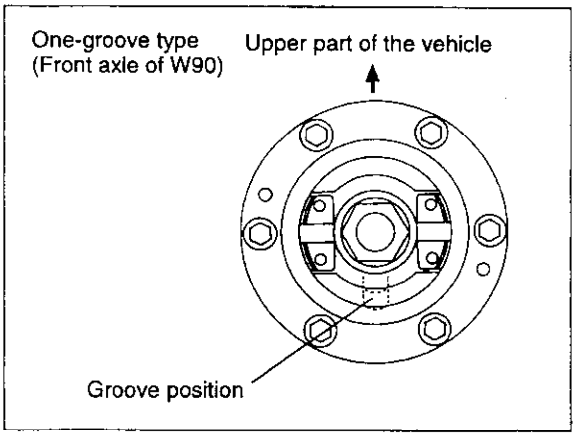


Fig. 2-360

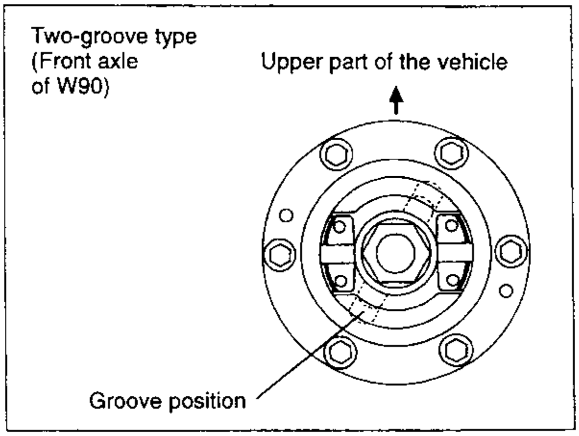


Fig. 2-361

3. After positioning, remove the bolts which were temporarily installed to the bearing cage, apply LOCTITE 262 to the threaded area of each bolt and retighten to the specified torque.

9 kgm

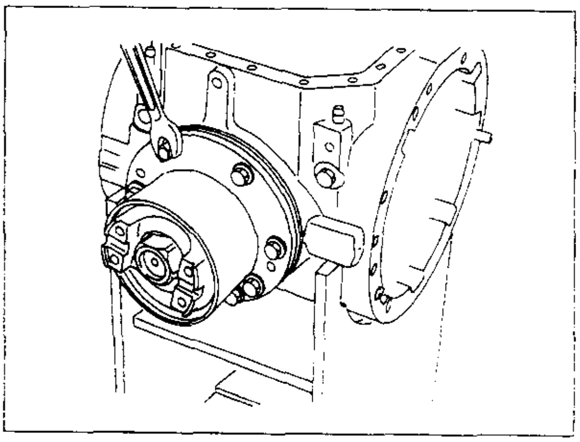


Fig. 2-362

4. Remove the bolt temporarily installed to the bearing retainer, apply LOCTITE 262 to the threaded area of each bolt and retighten to the specified torque.

W110: 5 kgm
W130: 9 kgm

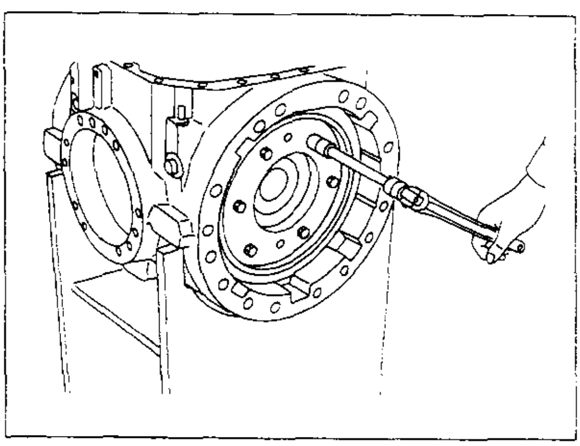


Fig. 2-363

e) Adjusting crown wheel backlash

1. Place a dial gauge on the tooth profile outer edge of crown wheel.
2. Lock the drive pinion and turn the crown wheel back and forth to measure the backlash, which should be 0.20 ÷ 0.28 mm for model W110 and 0.25 ÷ 0.36 mm for model W130.

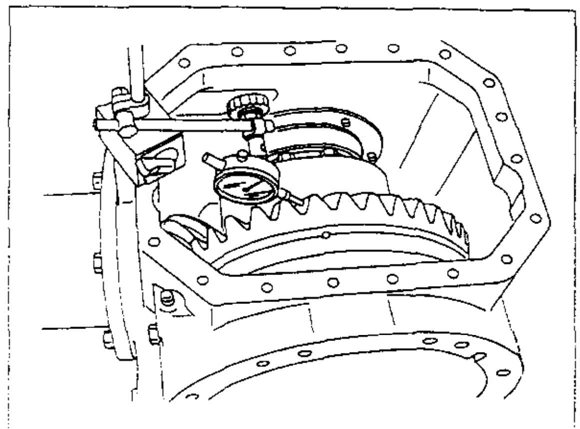


Fig. 2-364

3. Adjust the backlash by adding or removing a number of shims from the differential bearing retainers.
   If the backlash is too large, move some shims from the crown wheel side to the opposite side. Do not change the total shim thickness.
   If the backlash is too small, adjust it following opposite procedure as above.

Adjust the number of shims within the range of 0.55 to 1.55 mm (on both sides)

Fig. 2-365

f) Adjusting the crown wheel tooth surface contact pattern.

1. Apply a thin layer of red lead to several crown wheel teeth and turn the crown wheel back and forth with a hand to check the tooth contact pattern.

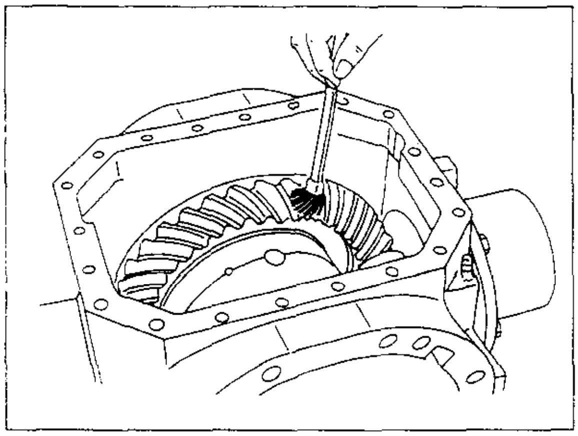


Fig. 2-366

2. Adjust the tooth contact pattern referring to the steps a. to e.
3. After acquiring the correct tooth contact pattern, check the backlash again.

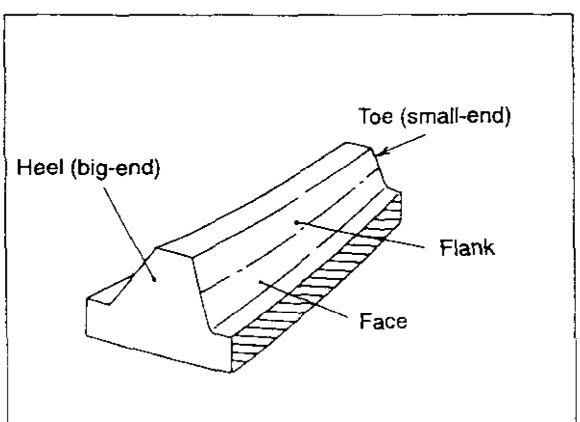


Fig. 2-367

a. Normal contact pattern (Fig. 2-368).
A correct contact pattern of the tooth surface is from the toe to the heel and its length is approx. 80% of the total tooth length (face).
Note: The following adjustment steps (b. to e.) show the procedures for checking the convex surface of the tooth.
Remember that the concave surface side has opposite contact conditions.

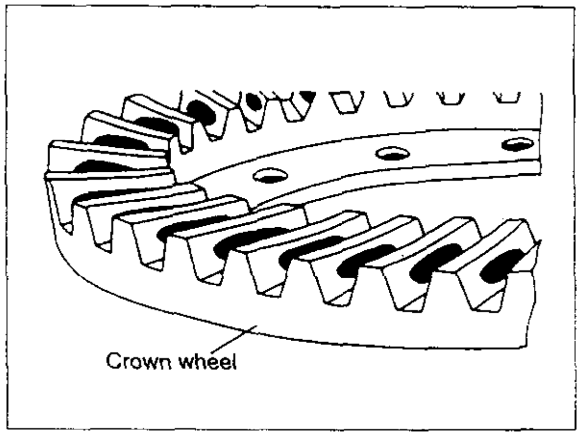


Fig. 2-368

b. Adjusting contact condition at the toe (Fig. 2-369).
Move some shims from the side other than the crown wheel side to the opposite side to move the crown wheel away from the drive pinion.
Then, reduce shim thickness at the bearing cage and bring the crown wheel closer.

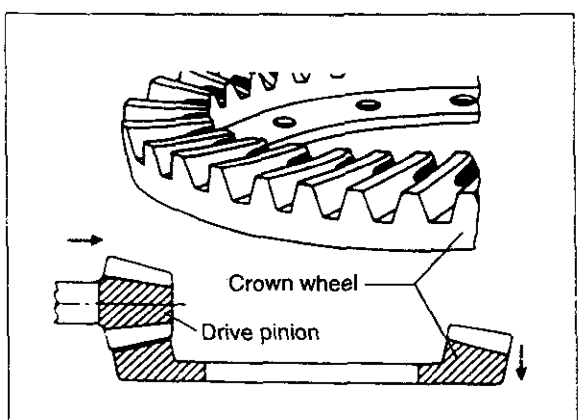


Fig. 2-369

c. Adjusting contact condition at the heel (Fig. 2-370).
Move some shims from the crown wheel side to the opposite side to bring the crown wheel closer to the drive pinion.
Then, increase shim thickness at the bearing cage and move the drive pinion away from the crown wheel.

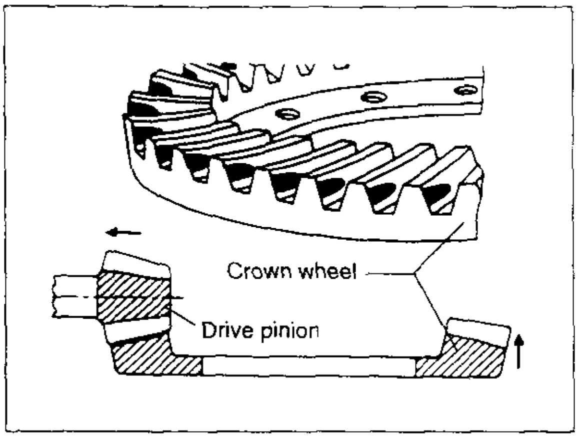


Fig. 2-370

d. Adjusting contact condition at face (Fig. 2-371).
Reduce the shim thickness at the bearing cage to bring the drive pinion closer to the crown wheel.
Then, move some shims from the side other than the crown wheel side to the opposite side to move the crown wheel away from the drive pinion.

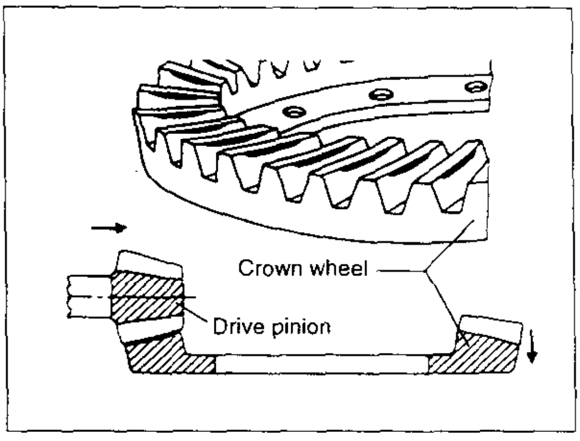


Fig. 2-371

e. Adjusting contact condition at flank (Fig. 2-372).
Increase shim thickness at the bearing cage to move the drive pinion away from the crown wheel.
Then, move some shims from the crown wheel side to the opposite side to bring the crown wheel closer to the drive pinion.

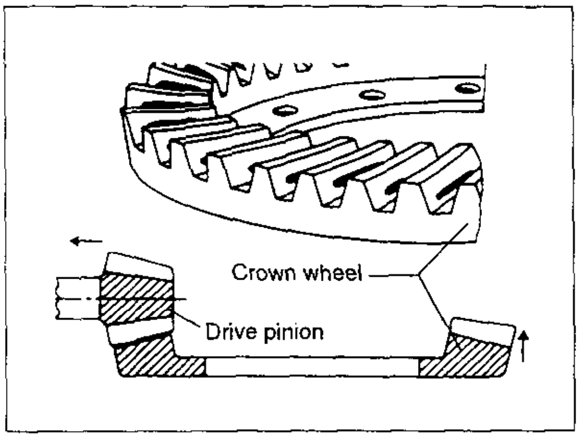


Fig. 2-372

g) Installing the brake assembly.

1. Install the brake piston ring in the center housing (bearing retainer).

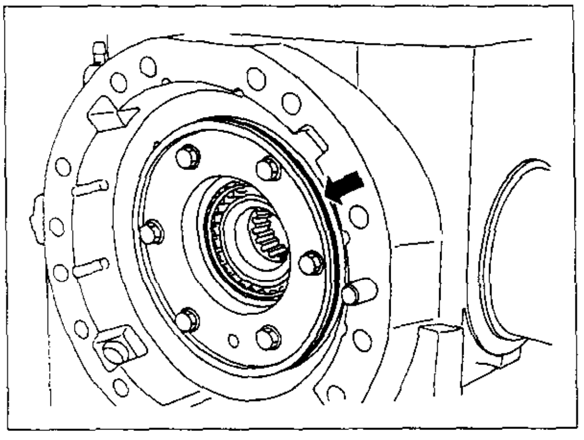


Fig. 2-373

2. Install the ring on the outer diameter of the brake piston and insert the brake piston into the piston groove in the center housing.

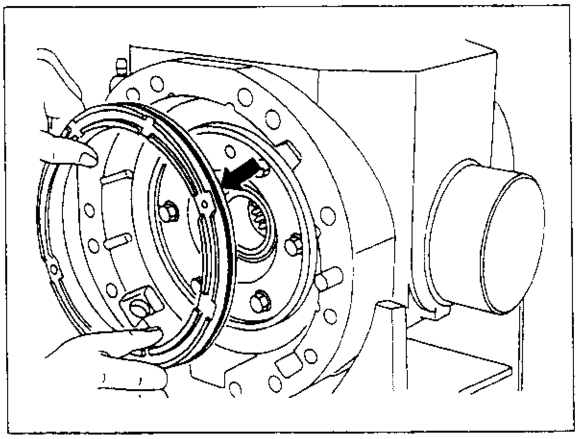


Fig. 2-374

3. Install two pins in the two lower grooves of the eight grooves at the inner diameter of the center housing.
4. Install the brake plate, brake disc, and end plate in the center housing in this order.

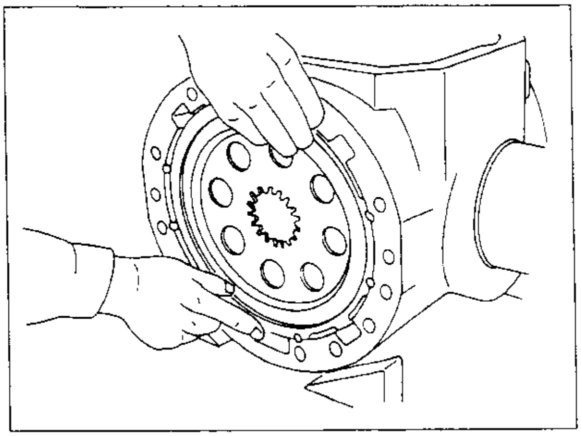


Fig. 2-375

Ensure that the outer diameter convex area of each brake plate and end plate is in alignment with the plug hole for measuring disc thickness. (See Fig. 2-376).

5. Install pins in the remaining 6 pin grooves at the inner diameter of the center housing.
6. Reassemble the brake unit at the opposite side, using the same procedure as a above.

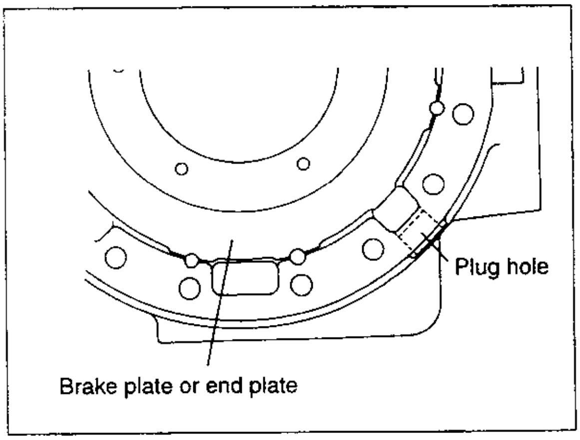


Fig. 2-376

(2) Reassembling the axle housing.

1. If the ring gear was replaced with a new one, install the ring gear on the axle housing, securing it with 4 pins.

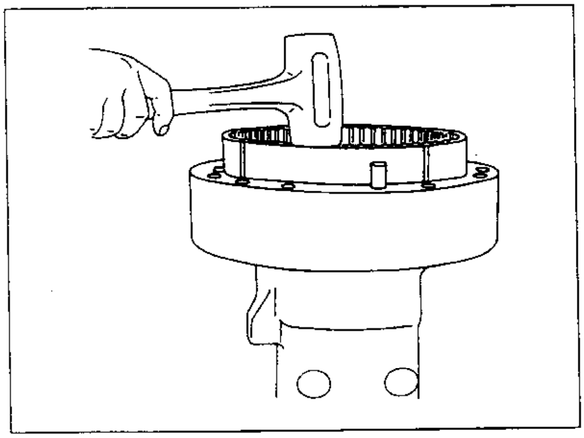


Fig. 2-377

2. If the axle shaft bearing was replaced, press the bearing cup into the wheel side of the axle housing.
3. Then, install a proper bearing cone into the cup.

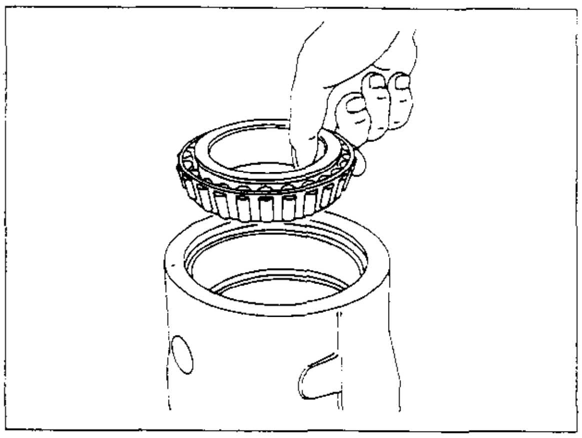


Fig. 2-378

4. Press the axle shaft oil seal into the axle housing.

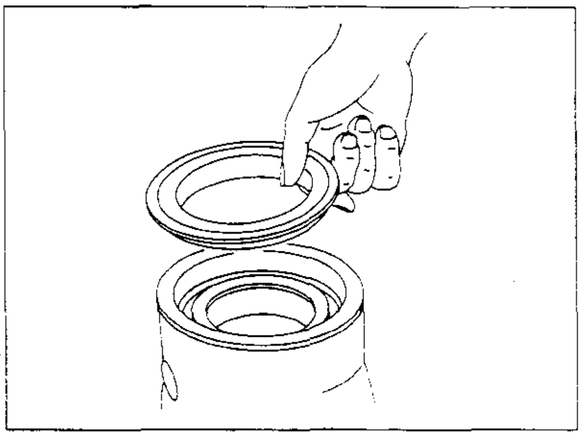


Fig. 2-379

5. Remove the inner sleeve from the oil seal pressed and press the sleeve onto the axle shaft.

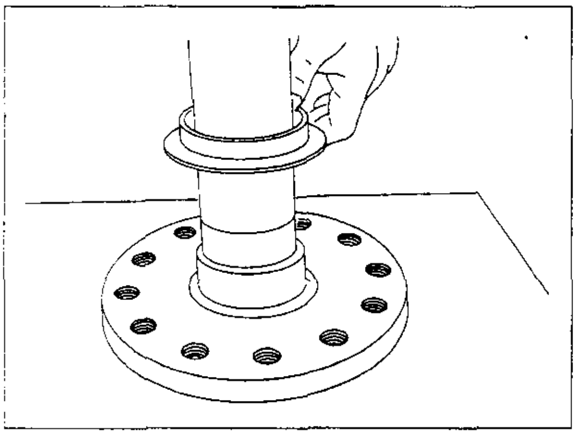


Fig. 2-380

6. Stand the axle housing, directing the wheel side up, and insert the axle shaft from top.
   Drive the axle shaft from top and press the bearing cup which was inserted into the axle housing, onto the shaft side.

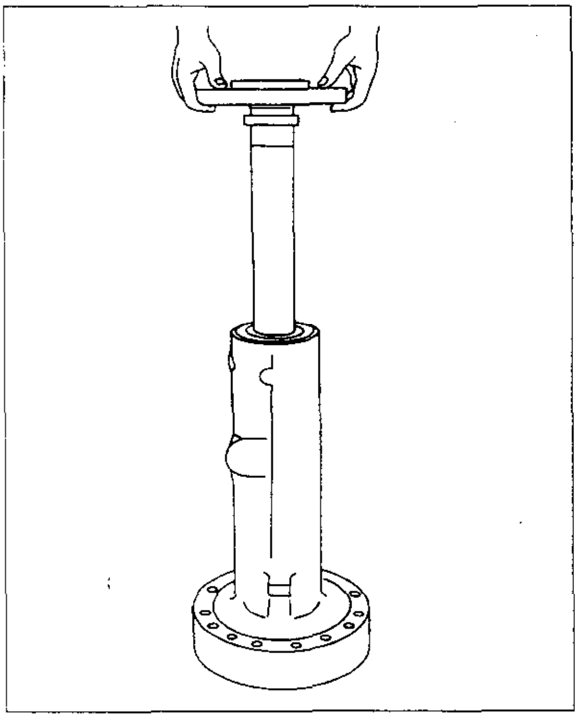


Fig. 2-381

7. Turn the reassembled axle housing and axle shaft upside down. If the axle shaft bearing was replaced, press the bearing cup into the axle housing.

8. The location of the bearing cup should be *adjusted as inpara "i) Adjusting the axle shaft* bearing preload".

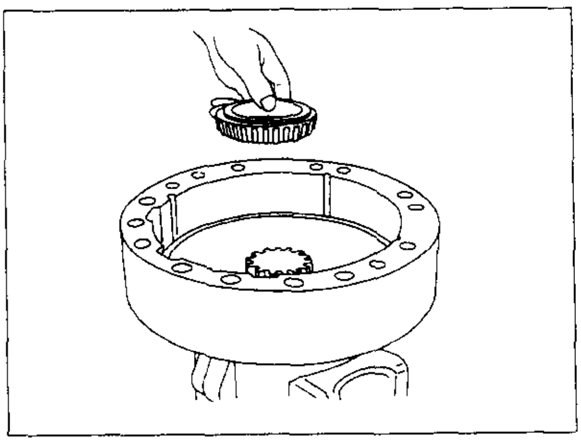


Fig. 2-382

i) Adjusting the axle shaft bearing preload (shim adjustment).

1. Install the planetary carrier on the axle shaft to adjust the axle shaft bearing preload.
No gear is attached to the planetary carrier.

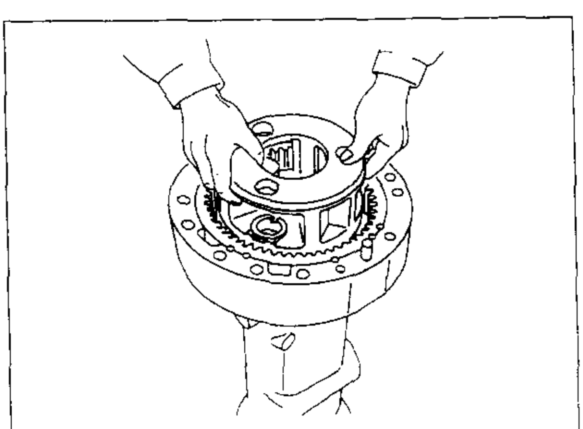


Fig. 2-383

2. Put the retainer plate in the planetary carrier and tighten the mouting bolt to 5 kgm. Set the axle shaft bearing cup into the axle shaft, by turning the axle housing and reset the 5 kgm torque.

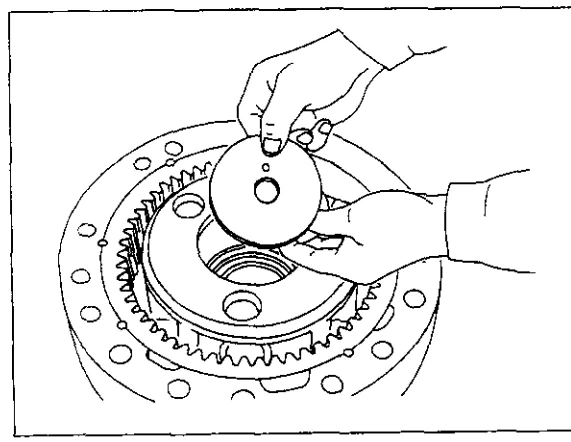


Fig. 2-384

3. Loosen the bolt and remove the retainer plate. Measure the difference in height (**Y**) between the axle shaft end surface and the planetary carrier.

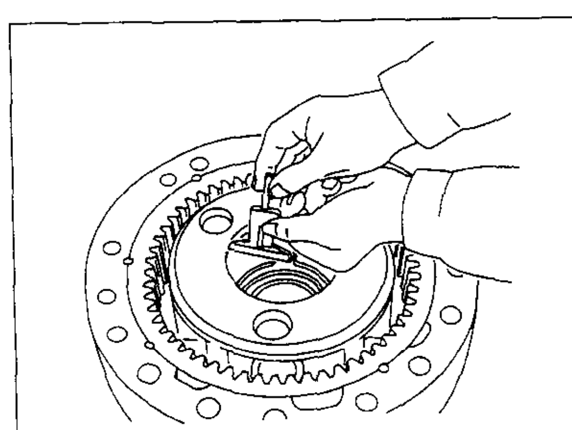


Fig. 2-385

The measurement position of the height difference (Y) is shown in Fig. 2-386.

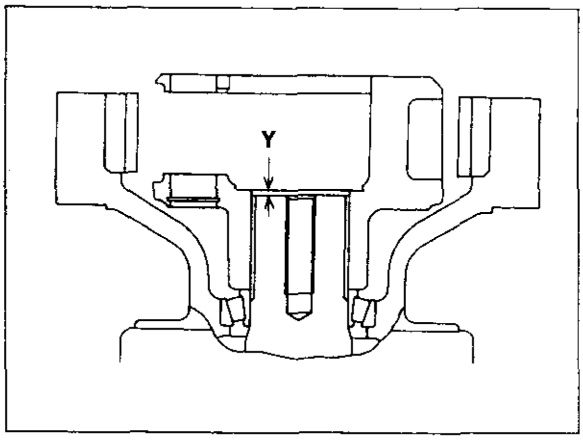


Fig. 2-386

4. Select a shim which is 0.03 to 0.10 mm thicker than the height difference (Y).

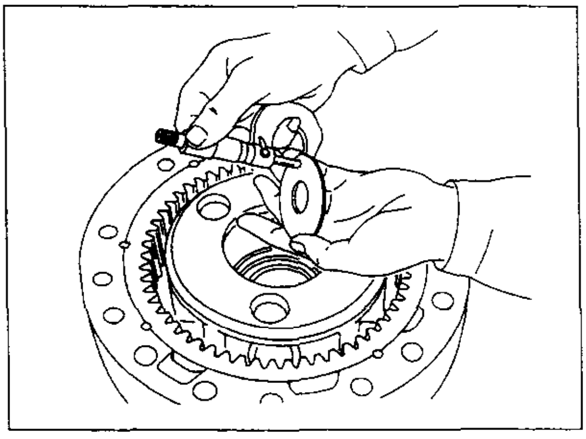


Fig. 2-387

5. Install the selected shim on the axle shaft and the retainer plate in this order. Tighten the bolt.

65.7 kgm

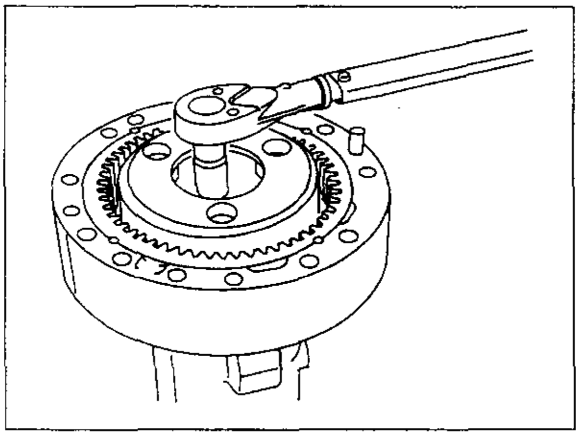


Fig. 2-388

6. Secure the axle shaft and hook a spring dynamometer in the axle housing bolt hole, to measure the bearing rolling resistance torque.
7. Normal bearing rolling resistance torque is 2 to 2.5 kgm for model W110 and from 2 to 4 kgm for model W130.
   Adjust shim thickness so that the bearing rolling resistance torque is within the above range of values. If the rolling resistance torque is smaller than specified, reduce shim thickness; increase shim thickness if larger.

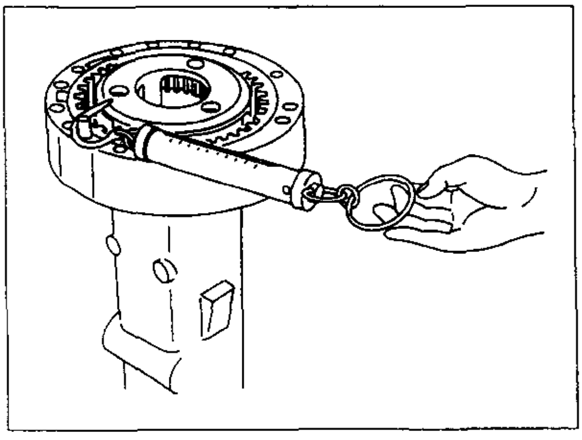


Fig. 2-389

8. After the shim thickness is determined, loosen the bolt securing the retainer plate and remove the planetary carrier which was temporarily installed.

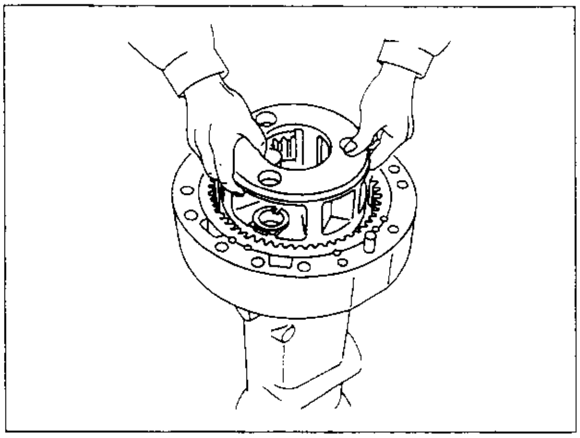


Fig. 2-390

l) Reassembling and installing final reduction gear assembly

1. Install the needle bearings on the planetary gears. Each planetary gear has 56 needle rollers and one spacer.
   Prevent the bearings from dropping off by applying grease properly.

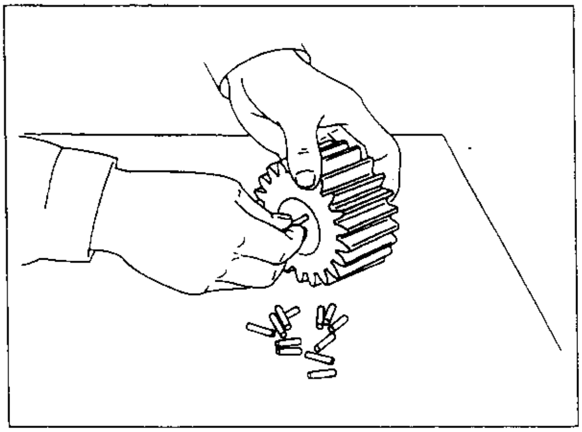


Fig. 2-391

2. Install the reassembled planetary gear (with the thrust washers at top and bottom) in the planetary carrier.

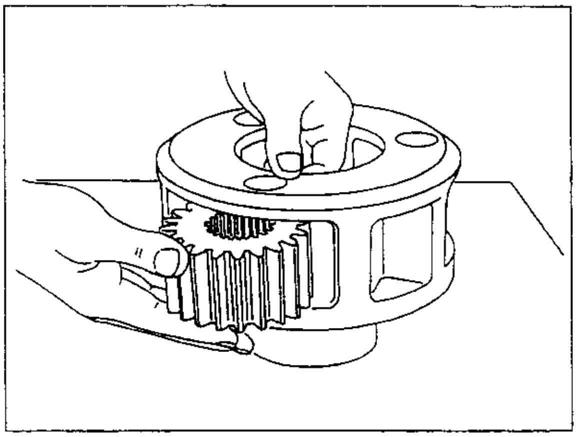


Fig. 2-392

3. Install the lock ball in the planetary gear shaft and press the shaft into the planetary carrier.

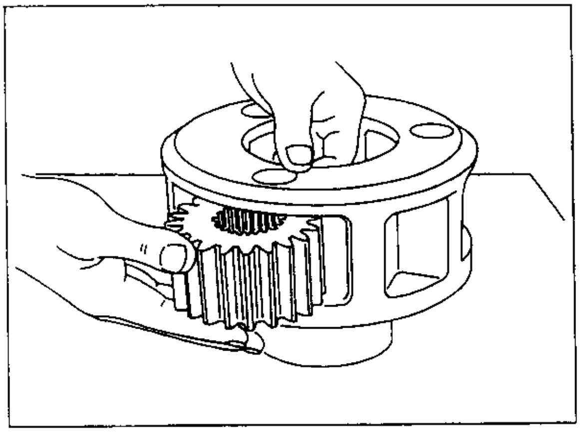


Fig. 2-393

4. Secure the planetary shaft with a snap ring.

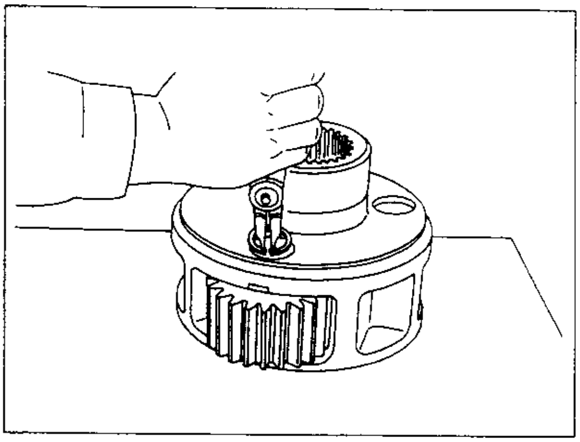


Fig. 2-394

5. Put the retainer plate in the planetary carrier.

6. Reassemble the other 2 planetary gears and install them in the planetary carrier, using the same procedure as above.

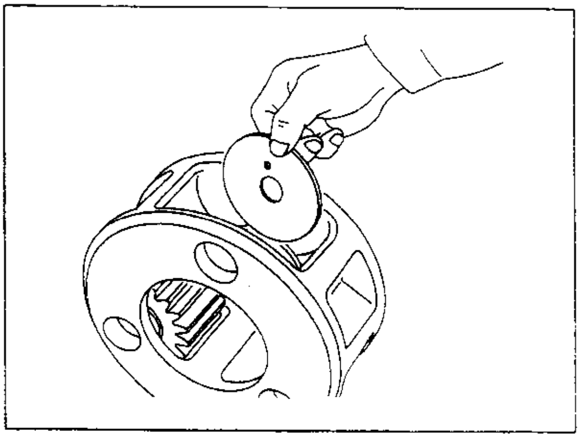


Fig. 2-395

7. Install the selected shims on the axle shaft and install the reassembled planetary carrier on the shaft.

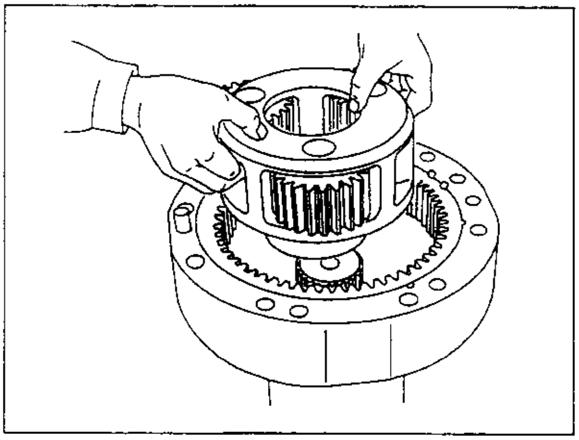


Fig. 2-396

8. Apply LOCTITE 262 to the threaded area of the retainer plate mounting bolt and tighten the bolt to the specified torque to secure the planetary carrier.

65.7 kgm

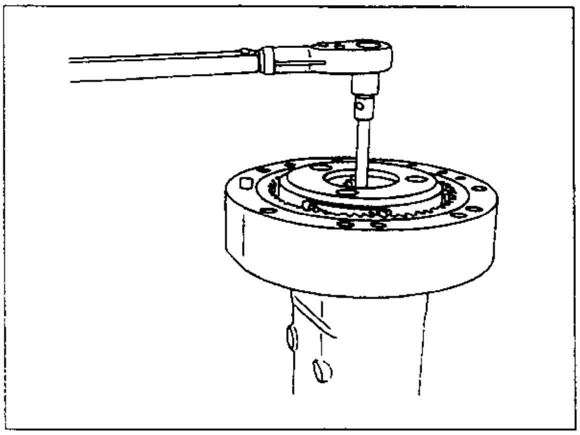


Fig. 2-397

m) Installing the axle housing.

1. Apply LOCTITE 509 to the axle housing surface which will mate with the centre housing. Make sure that a continuos bead of LOCTITE is applied on the axle housing surface, inside the row of the bolt holes.
   Bead width: 2 to 3 mm.

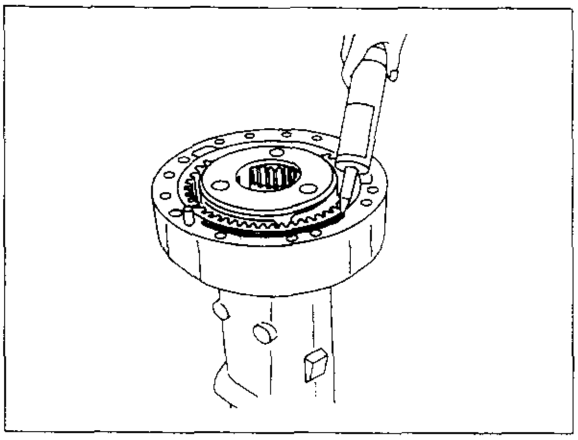


Fig. 2-398

2. Insert the shaft (sun gear) into the differential.

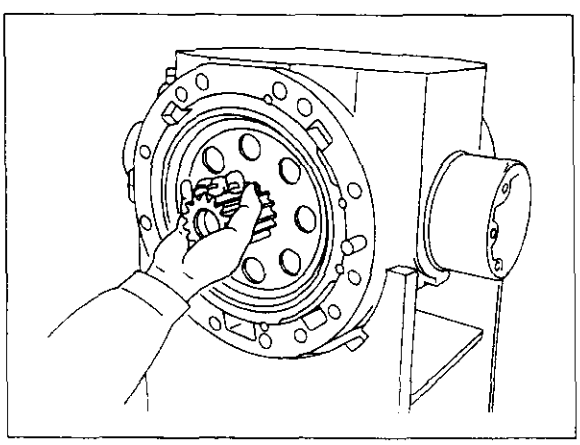


Fig. 2-399

3. Lift the axle housing assembly and install it on the differential.
   Apply LOCTITE 262 to the threaded area of the 14 mounting bolts and tighten them.

   23 kgm

4. Install the axle housing assembly at the opposite side, using the same procedure as above.

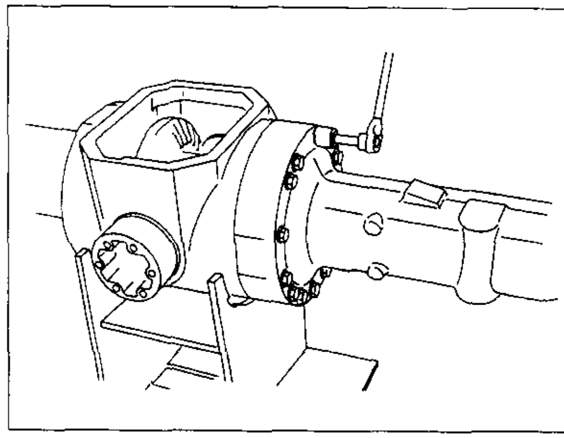


Fig. 2-400

5. Fill the differential with gear oil.

	Front diff.	Rear diff.
W110	18 ltr	26 ltr
W130	21 ltr	29 ltr

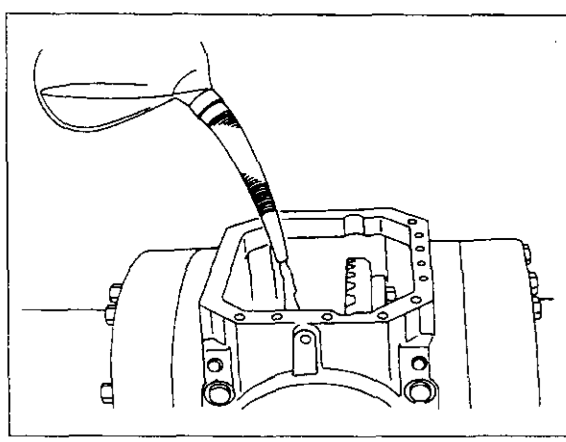


Fig. 2-401

6. Apply LOCTITE 509 to the differential cover mounting area.
   Note that LOCTITE should be applied to the inside of the row of bolt holes.
7. Install the cover on the differential and tighten the mounting bolts.

   Number of bolts: 24 3 kgm

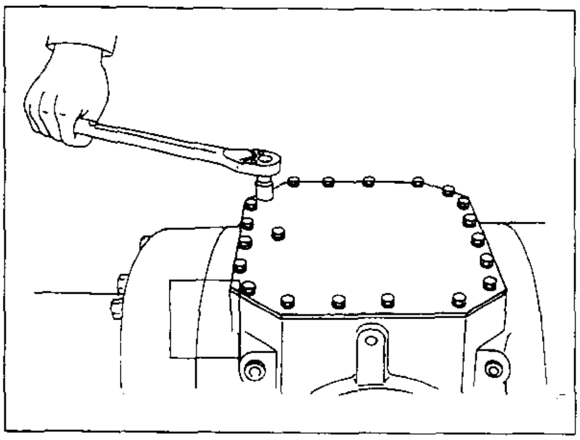


Fig. 2-402

2.9.4.3 Troubleshooting

Problem	Possible cause	Remedy
Noisy differential	Gear worn, damaged or broken	Replace
	Excessive backlash of each gear	Adjust or replace
	Bearing worn, damaged or broken	Replace bearing
	Loose engagement of side gear and shaft splines	Replace
	Loose bolts	Retighten
	Low gear oil	Add oil to specified level
Noisy axle housing	Gear (final reduction gear) worn, damaged or broken	Replace
	Excessive backlash of each gear	Replace
	Bearing worn, damaged or broken	Replace bearing
	Loose planetary carrier bolt (retainer plate mounting bolt)	Retighten (Adjust shimsi)
	Improper preload of axle shaft bearing	Adjust shims
	Low gear oil	Add oil to specified level
Oil leakage from differential	Broken liquid seal of differential cover	Apply liquid seal
	Broken liquid seal of axle housing	Apply liquid seal
	Worn or damaged O-ring of bearing cage	Replace O-ring
	Oil seal worn or damaged	Replace oil seal
	Loose bolt	Retighten
Oil leakage from axle shaft	Oil seal worn or damaged	Replace oil seal
	Oil seal installed improperly	Repair or replace

Problem	Possible cause	Remedy
Poor braking	Brake piston seal (D-ring) deteriorated or damaged	Overhaul and replace
	Brake disc or brake ring worn or damaged	
	Brake piston rusted	
	Foreign matter caught on brake disc	
	Loose or damaged bleed screw of disc brake	Retighten or replace
Erratic braking	Brake disc or brake ring run-out or worn unevenly	Overhaul and replace
	Worn parallel pin of brake piston	
Dragging brake	Rusted brake piston	Overhaul and replace
	Brake disc and brake ring seized	

2.9.4.4 Standard values for maintenance

Item		Standard size (mm)	Limite d'uso (mm)	Remarks
Thickness of bearing cage shim		0.1; 0.2; 0.25	–	
Length of bearing cage spacer	W110	49.674 ÷ 49.724	–	
	W130	57.683 ÷ 57.733	–	
Inner diameter of differential planetary gear	W110	23.85 ÷ 23.88		
	W130	28.70 ÷ 28.73		
Diameter of differential spider pin	W110	23.72 ÷ 23.75		
	W130	28.55 ÷ 28.58		
Thickness of differential planetary gear thrust washer	W110	1.562 ÷ 1.613	1.45	
	W130	1.575 ÷ 1.625	1.46	
Thickness of differential side gear thrust washer		2.31 ÷ 2.36	2.15	
Backlash between drive pinion and crown wheel	W110	0.20 ÷ 0.28	–	Shim adjustment
	W130	0.25 ÷ 0.36	–	
Shim adjustment of differential bearing retainer		Adjust shim thickness within the range of 0.55 to 1.55 mm (each sides).		Shim thickness: 0.1; 0.2; 0.25; 0.5; 1.0 mm
Rolling resistance torque of axle shaft bearing (on pitch circle of housing mounting bolt)	W110	2.0 ÷ 2.5 kg	–	Shim thickness: 0.1; 0.2; 0.25; 0.5; 1.0 mm
	W130	2.0 ÷ 4.0 kg	–	
Brake disc thickness	W110	5.9 ÷ 6.5	5,3	
	W130	6.9 ÷ 7.5	6,3	
Brake ring thickness	W110	6.38 ÷ 6.50	5,7	
	W130	9.88 ÷ 10.00	9,2	

2.9.4.5 Tightening torque values for main bolts

Item		Tightening torque (Kgm)	Remarks
Crown wheel mounting bolt	W110	9.0	Apply LOCTITE 262
	W130	15	
Crown wheel mounting bolt		9.0	Apply LOCTITE 262
Differential bearing retainer mounting bolt	W110	5.0	Apply LOCTITE 262
	W130	9.0	
Bearing cage mounting bolt		9.0	Apply LOCTITE 262
Flange nut		55	Apply LOCTITE 262
Planetary carrier lock bolt (Retainer plate mounting bolt)		65.7	Apply LOCTITE 262
Axle housing mounting bolt		23	Apply LOCTITE 262
Differential cover mounting bolt		3.0	Apply LOCTITE 262

2.10 WHEELS

	W110		W130	
Tyre	17.5 R 25 XTLA Tubeless, L-2		17.5 R 25 XTLA Tubeless, L-2	
Rim	13.00 x 25"		13.00 x 25"	
Inflating pressure	Front 3.00 bar	Rear 1.50 bar	Front 3.50 bar	Rear 1.50 bar

Note - The inflating pressures refer to machine in operating conditions.

The wheel is composed of a rim and disc. The wheel disc is bolted to the axle shaft.
The tyre is mounted onto the rim to form a single unit with it. Consequently, it is of the utmost importance that a correct rim is used according to the type of tyre to be mounted. The use of an incorrect rim can shorten the life of the tyre, or in the worst case, can result in serious accidents. The dimension of the rim is also provided in inches. The first set of digits identifies the width of the rim and the second the diameter of the rim.

2.10.1TYRES

In the standard configuration, the loader is equipped with radial type tyres with an L-2 tread with high traction characteristics. It is recommended to select the most appropriate tyres, since a wide range is available to meet the type of operation and working conditions.
The dimensions of tyres are given in inches.

Example: 15.5 x 25 - XTLA

15.5 = Width of tyre
25 = Diameter of rim
XTLA = Type of tread

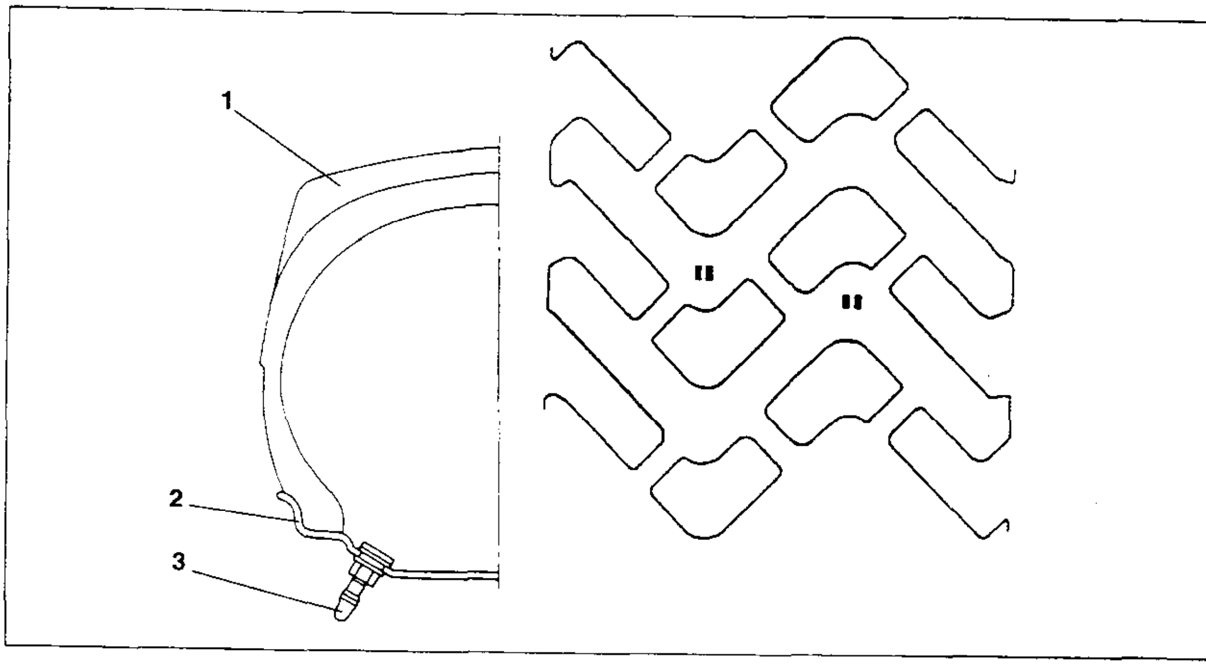


Fig. 2-403 Tyre

1. TYRE
2. RIM
3. VALVE

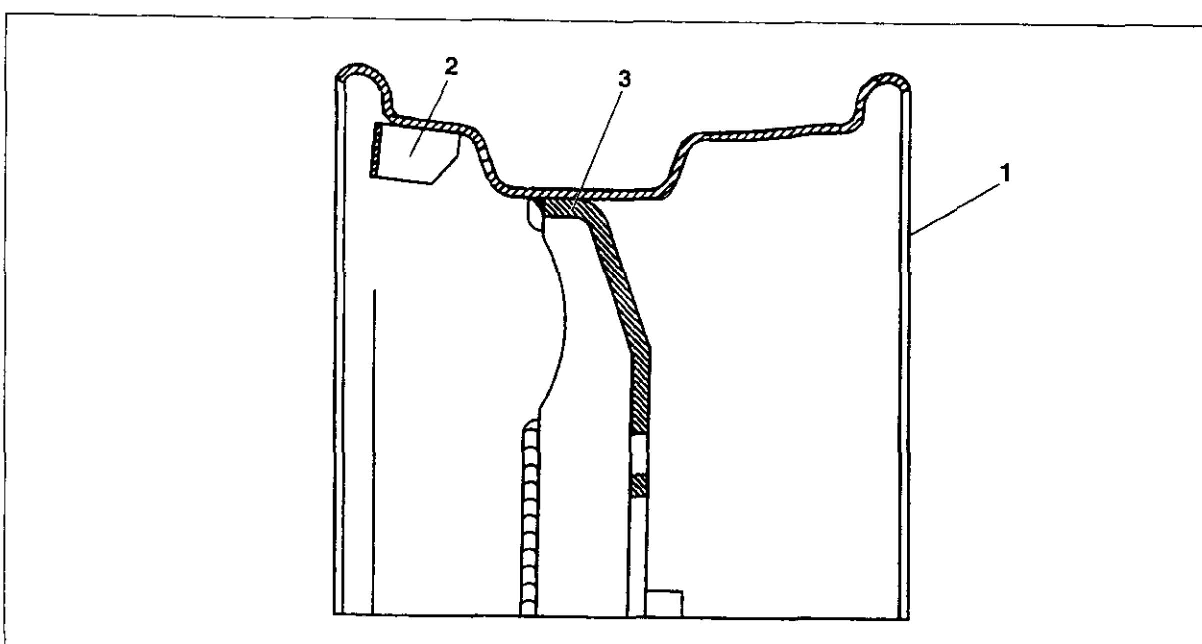


Fig. 2-404 Rim

1. RIM
2. VALVE PROTECTION
3. DISC

Note - Tightening torque of wheel nuts: 86.2 daNm (627 ft-lbs)

SECTION 3

BRAKING SYSTEM

CONTENTS

3.1 GENERAL DESCRIPTION

The brake system consists in (refer to Fig. 3-1):

- A two-stage gear charge pump (**11**), bolted to the convertor cover plate;
- A filter (**10**) at pump outlet;
- A brake pedal valve (**5**) controlling simultaneously front and rear brakes (**1** and **2**, respectively), which are located inside the drive axles;
- Two accumulators (**8** and **9**) which during normal operation stabilises system pressure and, in case of emergency, with the engine stopped, allow to positively apply the brakes for several times;
- Oil in the system is same as the attachment hydraulic oil; it is taken from the hydraulic reservoir (**S**) through a filter fitted with a by-pass valve.

The parking brake consists in:

- A recharge pump, gear type;
- A three-way diverter valve (**14**) which controls engagement and disengagement of the parking brake (**17**);
- A hydraulic ram (**16**) composed of springs and a hydraulic cylinder to counter-act them. Spring force is used to lock the parking brake discs (**17**) when pressure oil in the cylinder is dumped by means of the diverter/control valve. When fed with pressure oil (by means of the diverter/control valve), the cylinder overcomes spring action and consequently the brake is released;
- An accumulator (**13**) which during normal operation stabilises system pressure and, with the engine stopped, allows to release the parking brake several times.

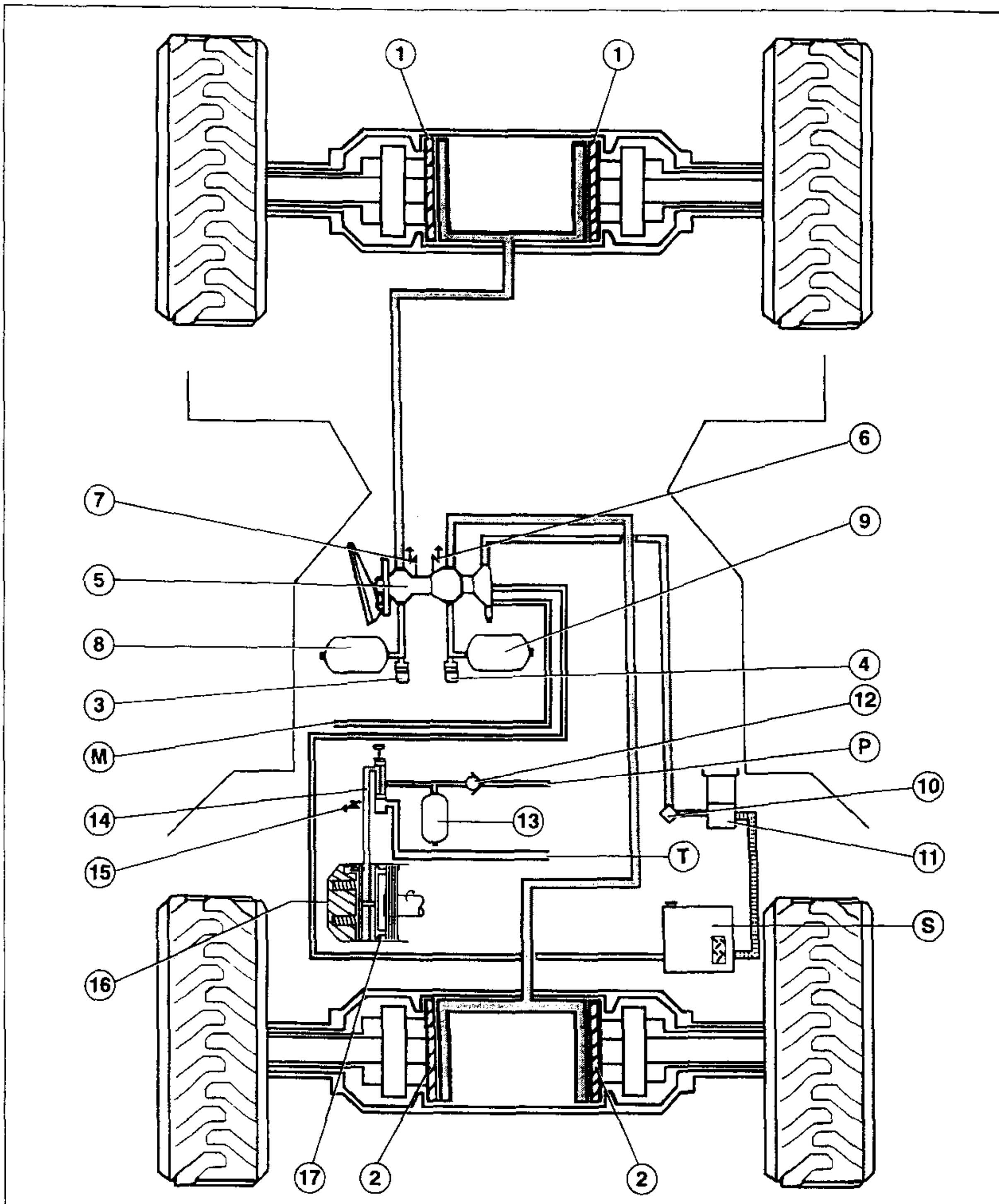


Fig. 3-1 Braking system

S. Reservoir - **M.** Dump oil - **P.** From the recharge pump (located on the transmission) - **T.** Dump oil (transmission housing) - **1.** Front brakes - **2.** Rear brakes - **3 & 4.** Quick coupling pressure test ports - **5.** Brake pedal valve - **6.** Brake lights pressure switch - **7.** Transmission disengagement pressure switch - **8 & 9.** Braking system accumulators - **10.** Inlet oil filter- **11.** Oil pump - **12.** Check valve - **13.** Parking brake accumulator - **14.** Parking brake three-way diverter/control valve - **15.** Parking brake pressure switch - **16.** Hydraulic ram (integral to the parking brake) - **17.** Parking brake.

3.2 OPERATION

GENERALITIES
(Fig. 3-2)

Braking system

The brake system is fed by the pump (**11**) which draws oil from the attachment oil reservoir and sends it to the flow regulator valve (**27**). This valve is controlled by the accumulator recharge valve (**18**). Two hydraulic accumulators (**7** and **8**) and two check valves (**19** and **20**) allow to store an amount of pressure oil sufficient to positively apply the brakes a limited number of times, also with the engine stopped, and therefore without pump (**11**) delivery.

Parking brake

The parking brake is composed by a disc brake (**17**) which acts on the transmission output shaft. This system, which is separate from the braking system, receives pressure oil from the recharge pump (**25**) splined to the transmission. The braking force comes from the spring (**26**) action. The brake is released when pressure oil is sent to the ram piston by means of the diverter valve (**14**). In this way, springs are compressed and the brake is disengaged.
The pressure switch (**15**) closes the electrical circuit signalling "parking brake applied" when pressure drops below 60 bars with consequent the parking brake engaged.

Service brakes

The brakes are disc type, in oil bath, and are located within the axle side reduction gears (**1** and **2**). When the brake pedal is pressed, the valve (**5**) supplies control oil to the braking circuit at a pressure (and consequently with braking action) proportional to the travel of the brake pedal.
When the pedal is released, the valve (**5**) dumps brake circuit oil and nullifies the braking action on the discs (**1** and **2**).
During braking, the sensor (**4**) activates the brake lights electrical circuit. The sensor (**3**) controls the transmission disengagement system (**24**).

3.2.1 OPERATING CONDITIONS
(Fig. 3-2)

With:

- Engine running
- Brakes released
- Parking brake applied
- Accumulators being recharged

The flow from the pump (**11**) reaches the flow regulating valve (**27**). The oil flow opens and goes through the primary check valve (**21**), then opens and goes through the check valves (**19** and **20**) thereby charging the brake accumulators (**7** and **8**).
The brake pedal (**P**) being released, the distributing valves (**22** and **23**) stop oil flowing from the pump and keep dumping oil from the brake pistons (**1** and **2**). The brakes are disengaged.
The parking brake diverter/control valve (**14**) is positioned as to dump oil from the parking brake chamber. Therefore the parking brake (**17**) is kept applied by the spring force.
Accumulator recharge ends when the maximum recharge pressure having been attained, the spool of the valve (**18**) moves to the right.

With:

- Engine running
- Brakes released
- Parking brake applied
- Accumulators charged

In these conditions as shown in the schematic the spool of the valve (**18**) opens and allows oil from the spring side of the valve (**27**) to dump. Therefore, the valve moves to the right and diverts the pump oil flow to dump (**M**).
At the same time, the primary check valve (**21**) closes and traps pressure oil inside the brake hydraulic circuit.
When, following braking or leakage in the brake valves, pressure after the valve (**21**) drops below the minimum preset value, the spool of the valve (**18**) moves to the left closes the valve (**27**) and the accumulators start being recharged.

With:

- Engine running
- Brakes applied
- Parking brake released
- Accumulators charged

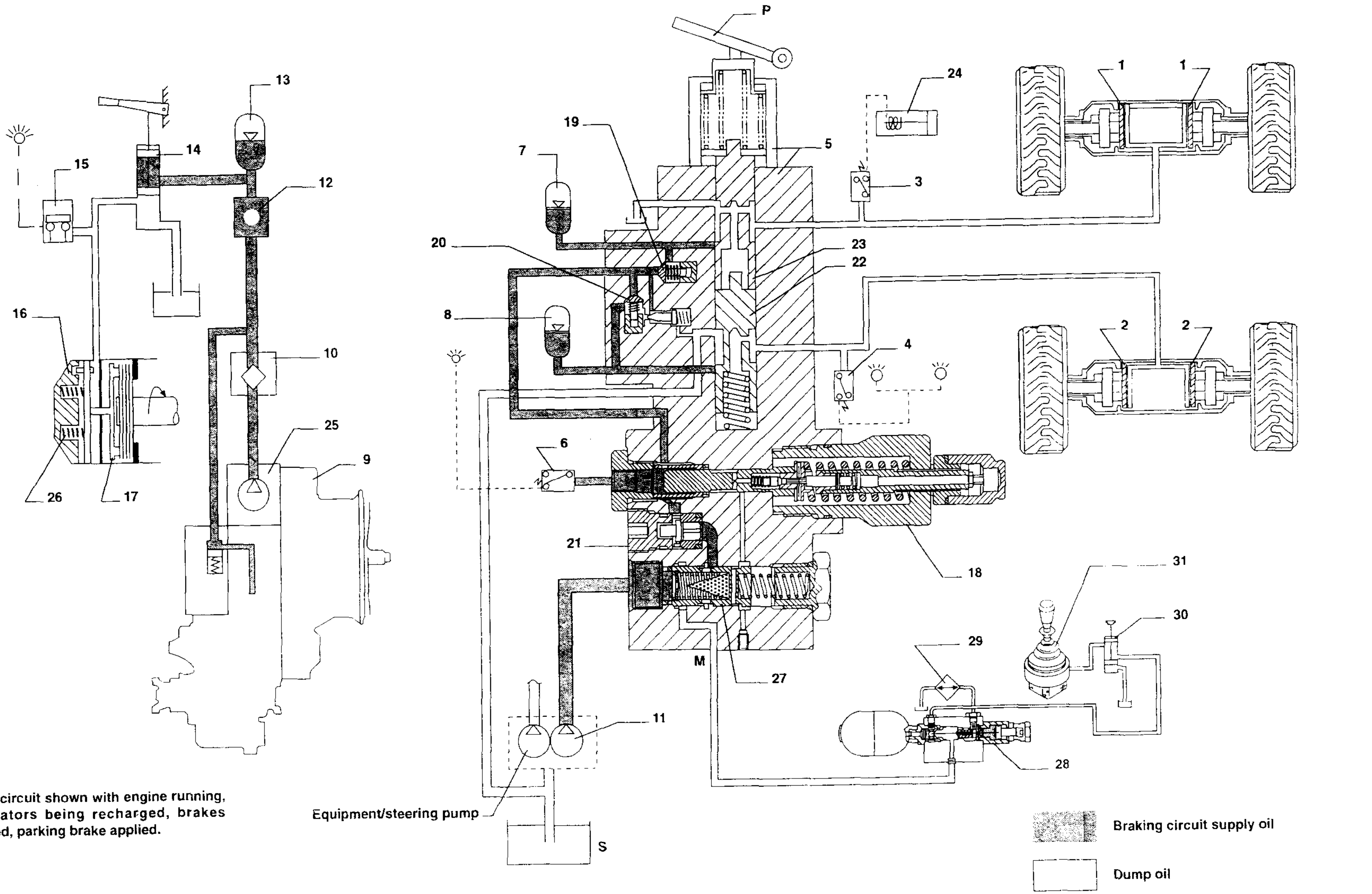
This condition occurs when the machine is braked while working.
The parking brake is released as the diverter valve (**14**) sends pressure oil to the brake piston which overcomes the action of the control springs (**26**).
When the brake pedal (**P**) is pressed, it compresses the springs which act on the distributing valves (**22** and **23**) and cause the inlet ports (**1** and **2**) to the brakes to open.

The braking pressure acting on the bottom side of the distributing valve (**23**) packs the brake discs (**1** and **2**). In the way, as pressure on the brake discs increases, the distributing valves (**22** and **23**) are pushed upwards and close the inlet ports.
As a result, the pressure applied to the brake discs (**1** and **2**), and consequently the braking action, are proportional to the pressure applied to the pedal (**P**).
The presence of two accumulators (**7** and **8**) and two distributing valves (**22** and **23**) allow separate control circuits for the front and rear brakes. Should one circuit fail, this will not affect proper operation of the other circuit.

Fig. 3-2 Brake system hydraulic diagram

P. Brake pedal - **S.** Reservoir - **M.** To equipment pilot circuit - **1.** Rear brakes - **2.** Front brakes - **3.** Transmission disengagement pressure switch - **4.** Brake lights pressure switch - **5.** Brake pedal valve - **6.** Accumulator control pressure switch - **7** and **8.** Brake system accumulators - **9.** Transmission - **10.** Inlet oil filter - **11.** Oil pump - **12.** Check valve - **13.** Parking brake accumulator - **14.** Parking brake three-way diverter/control valve - **15.** Parking brake pressure switch - **16.** Hydraulic ram - **17.** Parking brake - **18.** Accumulator recharge valve - **19** and **20.** Check valves - **21.** Primary check valve - **22.** Front axle brake distributing valve - **23.** Rear axle brake distributing valve - **24.** Transmission disengagement system - **25.** Recharge pump - **26.** Hydraulic ram springs - **27.** Flow regulating valve - **28.** Pilot system pressure relief valve - **29.** Heat exchanger - **30.** Pilot controls safety valve - **31.** Equipment pilot valve.

HYDRAULIC BRAKING CIRCUIT SCHEMATIC



Hydraulic circuit shown with engine running, accu-mulators being recharged, brakes disengaged, parking brake applied.

Fig. 3-2 Hydraulic braking circuit schematic

3.3 DISC BRAKE

The disc brake is composed of a disc in oil bath and is assembled inside the axle center housing. This loader is fitted with four braking assemblies on the four wheels, one per wheel.
The disc brake structure is described in the Section "DRIVE/LINE TRANSMISSION".

OPERATION

1) Applying the brakes

The brake oil pressure acts onto the rear surface of the brake piston and tigthens the brake disc between the brake pressure plate and the support plate.
The inner disc edge is splined and is coupled to the drive line sun gear. The outer edges of the pressure and support plates are secured to the center housing by means of pins. Therefore, when the brake disc is pushed tight, the sun gear is stopped and the loader is braked.

2) Releasing the brakes

When oil pressure is relieved from the brake piston, this moves slightly rearwards to release the brake disc and the the braking action stops.

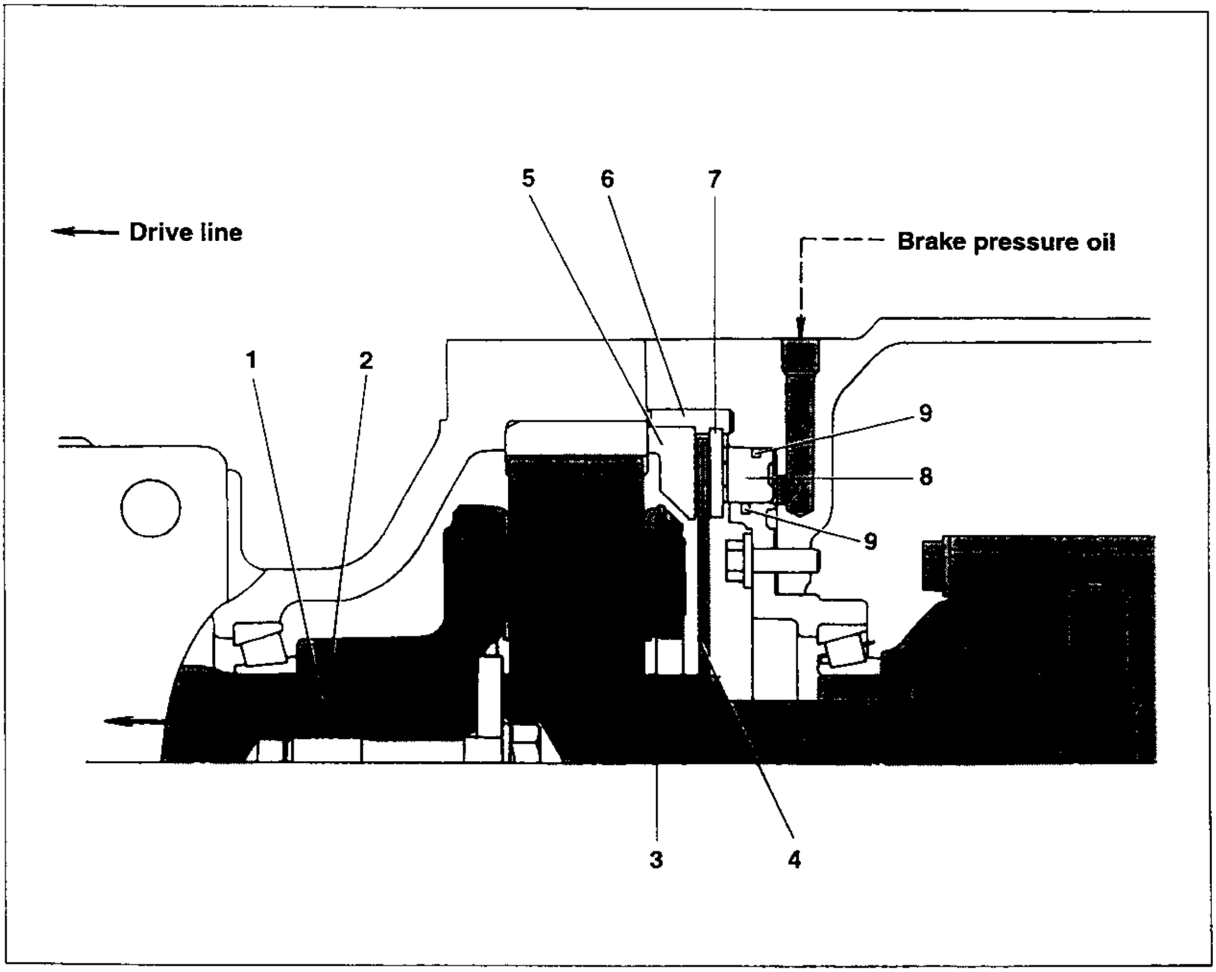


Fig. 3-3 **Disc brake operation**

1. Axle-shaft - 2. Planetary carrier - 3. Sun gear - 4. Brake disc - 5. Support plate - 6. Pin - 7. Pressure plate - 8. Brake piston - 9. Sealing ring.

3.4 BRAKE PEDAL VALVE

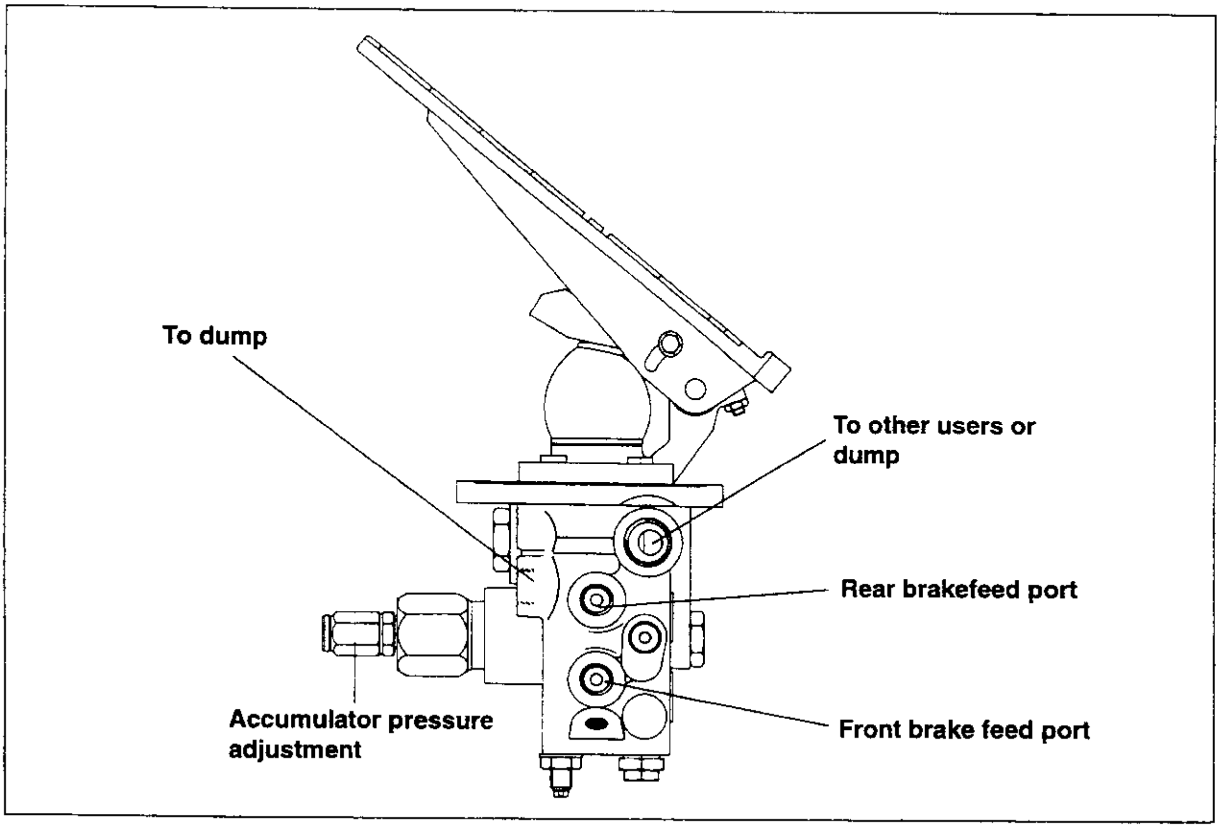


Fig. 3-4 Brake pedal valve

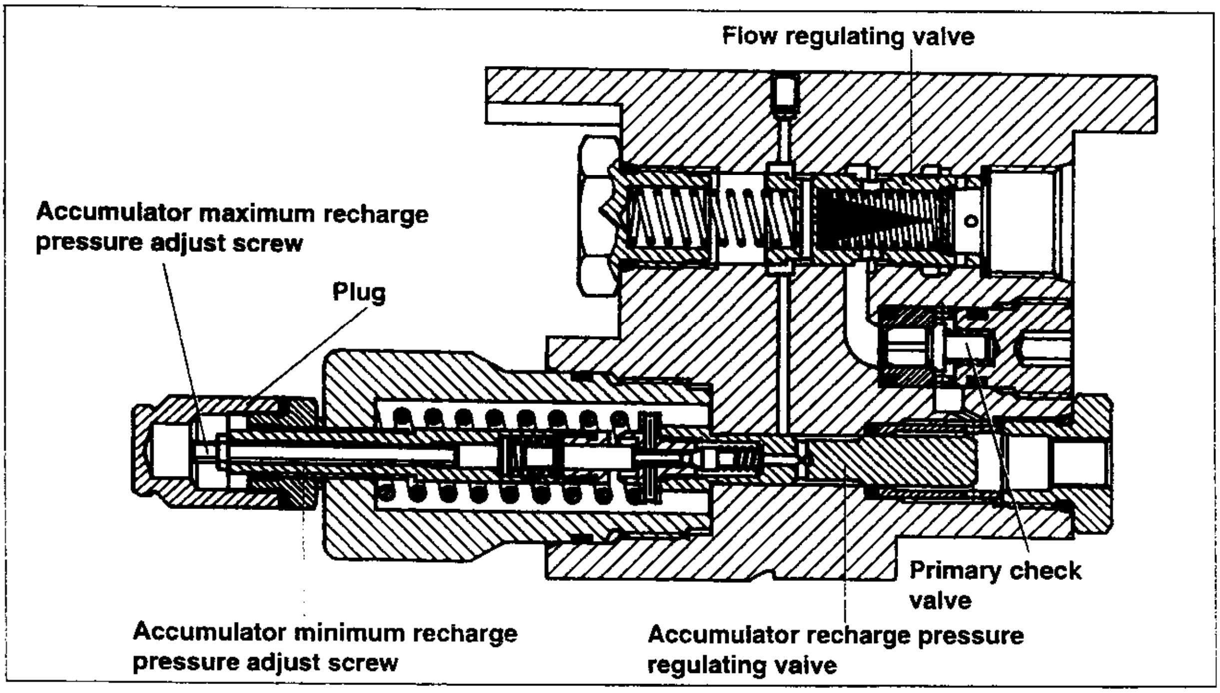


Fig. 3-5 Accumulator recharge pressure and flow regulating valve section view

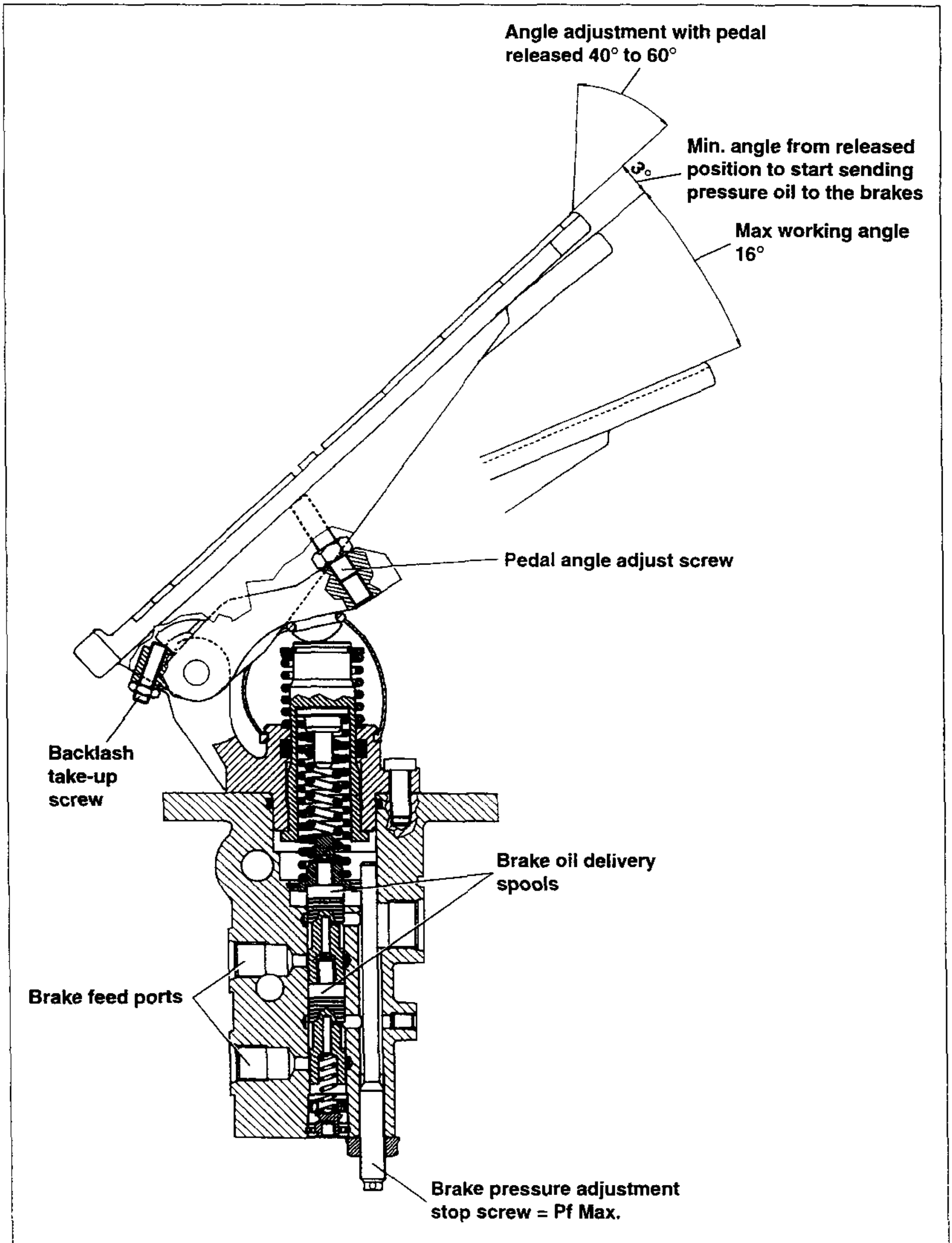


Fig. 3-6 Section view of oil delivery spools to users

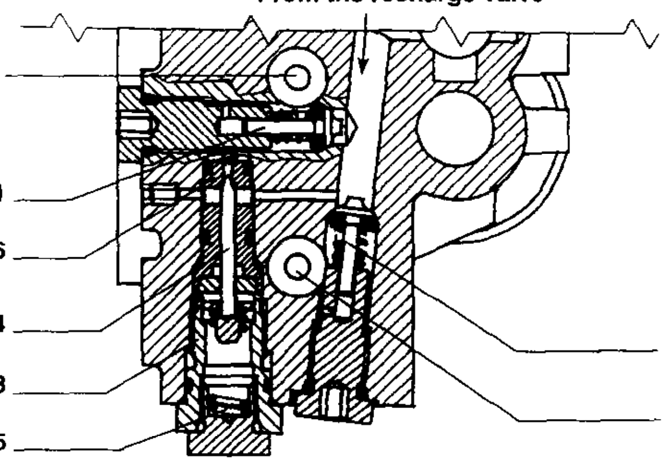


Fig. 3-7 Section view of circuit separation valve and accumulator recharge one-way valves

1. ONE-WAY VALVE
2. ONE-WAY VALVE
3. CIRCUIT SEPARATION VALVE
4. TAPERED PISTON
5. SPRING
6. PISTON SEAL SEAT

3.4.1 CIRCUIT SEPARATION VALVE OPERATION INSIDE THE BRAKING SYSTEM

If a preset value is exceeded, this valve connects the reference accumulator and the charge valve pressure sensor. Below said value, it accomplishes definite separation of the valve from the accumulator.

Operation description

The charge valve starts operating by sending oil to the accumulators through the one-way valves (see figure). The pressure created acts also on the tapered piston (**4**) which after reaching a certain pressure, overcomes the spring (**5**) action and moves away from the sealing seat (**6**).
At charge end, the one-way valves close, and the charge valve senses only pressure in accumulator no. 1 through the piston (**4**) and its seat (**6**). The spring (**5**) pin depends upon accumulator pressure and it is usually kept at -10/-15 bars maximum below the accumulator recharge pressure. This adjustment is obtained by means of shims.
To test the separation valve operation and setting, cause a minor oil leak in the accumulator feed line and read the pressure at the reference accumulator no. 1. Pressure decreases, the spring (**5**) overcomes the pressure on the piston (**4**) which closes the valve/accumulator communication port. Residual pressure into accumulator no. 1 corresponds to the valve regulation pressure.

Note - If the leak from the accumulator charge valve is considerable due to pressure drop, the piston (**4**) pin closes the valve/accumulator communication port before the reference accumulator attains minimum pressure. This feature is to the advantage of normal operation, but it alters pressure reading. Therefore, it is important that the oil leak purposely created be small.

Possible failures

1. Failure in the accumulator no. 2 side, not used as a reference for the charge valve.
   In this case, pressure in accumulator no. 1 decreases to the setting value given by the spring (**5**).

Note - If the oil leak is considerable, the accumulator pressure remains at the value as it is.

2. Accumulator no. 1 failure.
   In this case, accumulator no. 2 remains in the condition as it is.
3. Accumulator charge valve failure.
   If the leak is small, accumulator no. 2 remains at the pressure as it is, while reference accumulator no. 1 drops to the cut-out pressure given by the spring.
4. If the leak is considerable, accumulator pressures remain as they are as the piston (**4**) immediately closes the accumulator/valve port.

3.5 PARKING BRAKE CONTROL VALVE

The parking brake control valve controls pressure oil flow to the disc brake.
The parking brake valve displacement is controlled by means of the control knob to operate the disc brake.

The parking brake valve is fitted with detents to maintain the rod in each position.

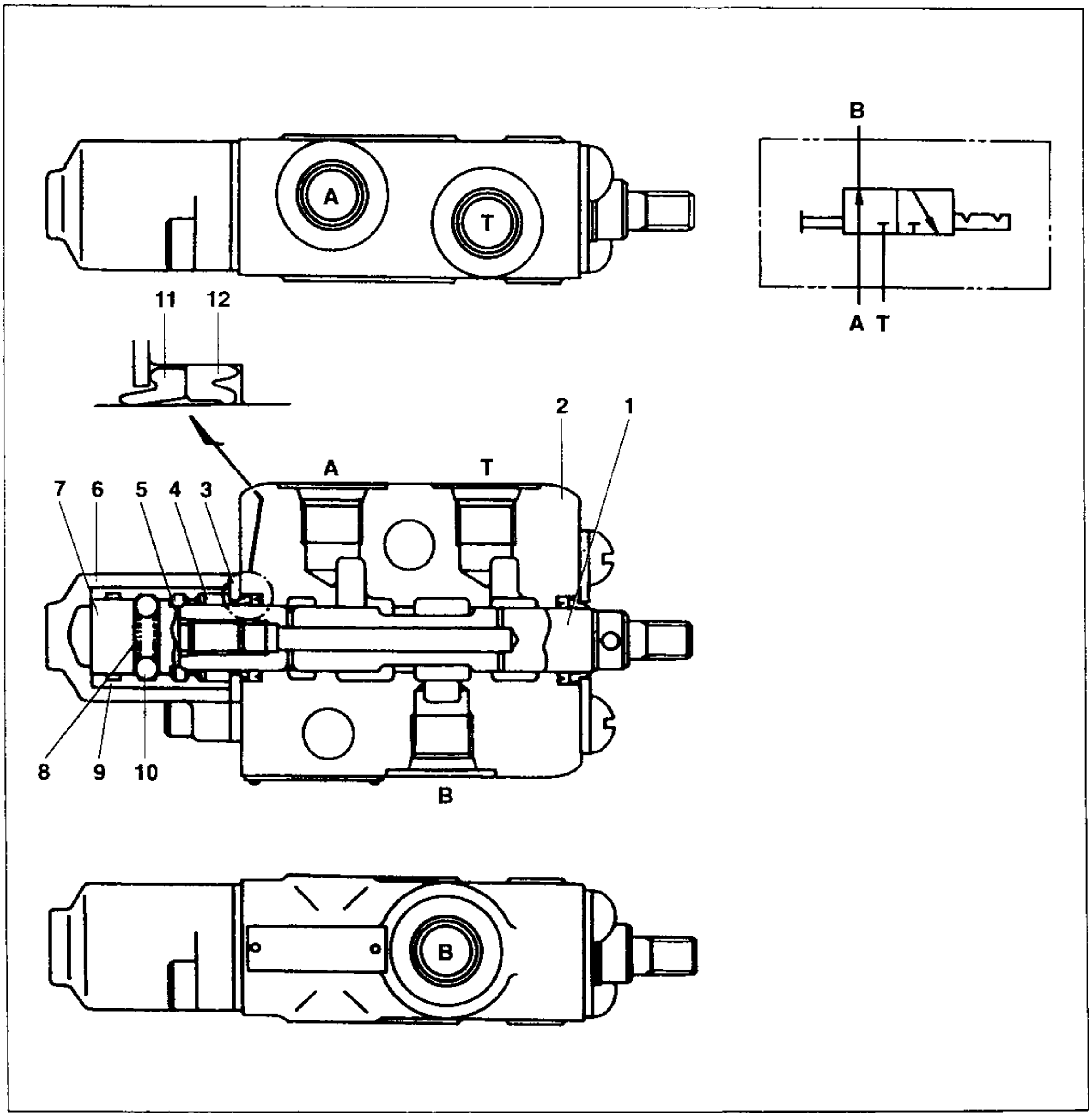


Fig. 3-8 **Parking brake valve**

1. Rod - **2.** Valve body - **3.** Gland ring - **4.** Ring - **5.** O-Ring seal - **6.** Cover - **7.** Spool - **8.** Detent spring - **9.** Sleeve - **10.** Detent ball - **11.** Dust ring - **12.** Oil seal.

3.6 PARKING BRAKE

Parking brake manual disengagement (in case of emergency)

WARNING

If it is not possible to release the parking brake by means of the control knob following pump failure or for any other reason, disengage it manually through the parking brake release screw.

WARNING

Disengage the parking brake manually only if it is absolutely necessary. Namely, this should be done only when towing a failed loader to traffic-free areas. If the loader is on an incline, check that the wheels are securely blocked with wedges or stones prior to releasing the parking brake.

3.6.1 MANUAL RELEASE PROCEDURE

1. Remove the manual release bolt and nut (**1**) from the parking brake cover on the transmission housing.
2. Remove the plug (**2**) from the middle of the cover.
3. Insert the bolt (**1**) into the plug hole and screw it into the threaded hole at the centre of the brake piston (**3**), as shown in Fig. 3-10.
4. Screw the release bolt fully in to retract the brake piston (**3**) and release the brake disc.

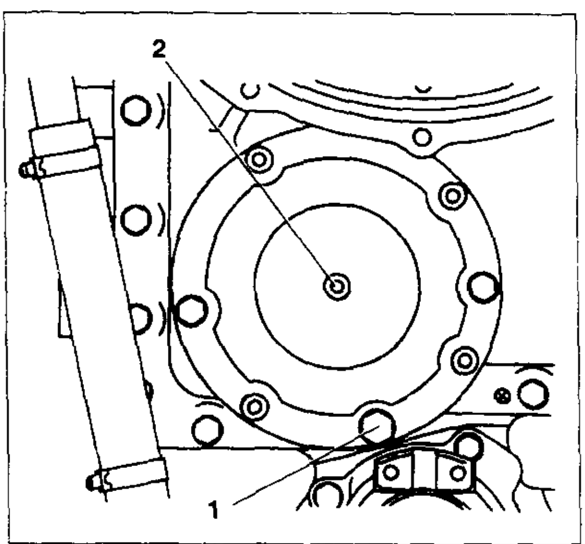


Fig. 3-9

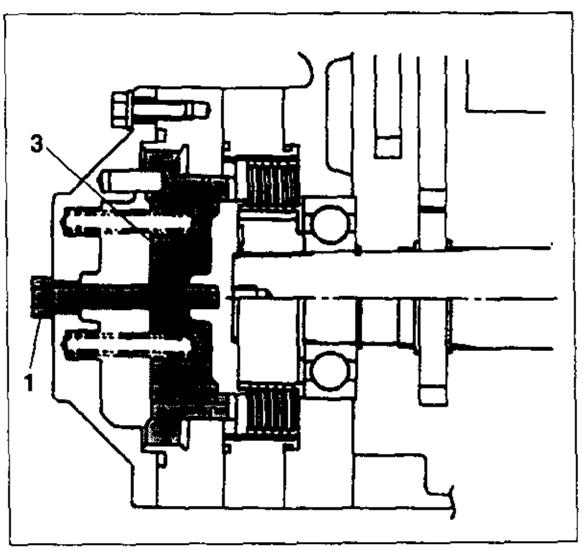


Fig. 3-10

The parking brake is multiple disc type, in oil bath, and is assembled to the transmission intermediate shaft.
The brake is activated by means of an internal spring and is released by pressure oil controlled by the parking brake valve.
Parking brake structure is detailed in "Section 2 "CONVERTOR-TRANSMISSION".

3.6.2 DISC PARKING BRAKE OPERATION

1. When pressure oil acting on the piston brake is dumped, this is pushed by the spring force and packs the brake discs (rotary) against the fixed plates.
2. The brake disc inner edge is coupled to the transmission shaft through the brake disc hub. The fixed brake plate outer edge is coupled to the brake housing. As the brake discs are pushed tight against the fixed plates, they stop rotating. This causes the transmission shaft to stop rotating by means of the disc hub and the loader is braked.

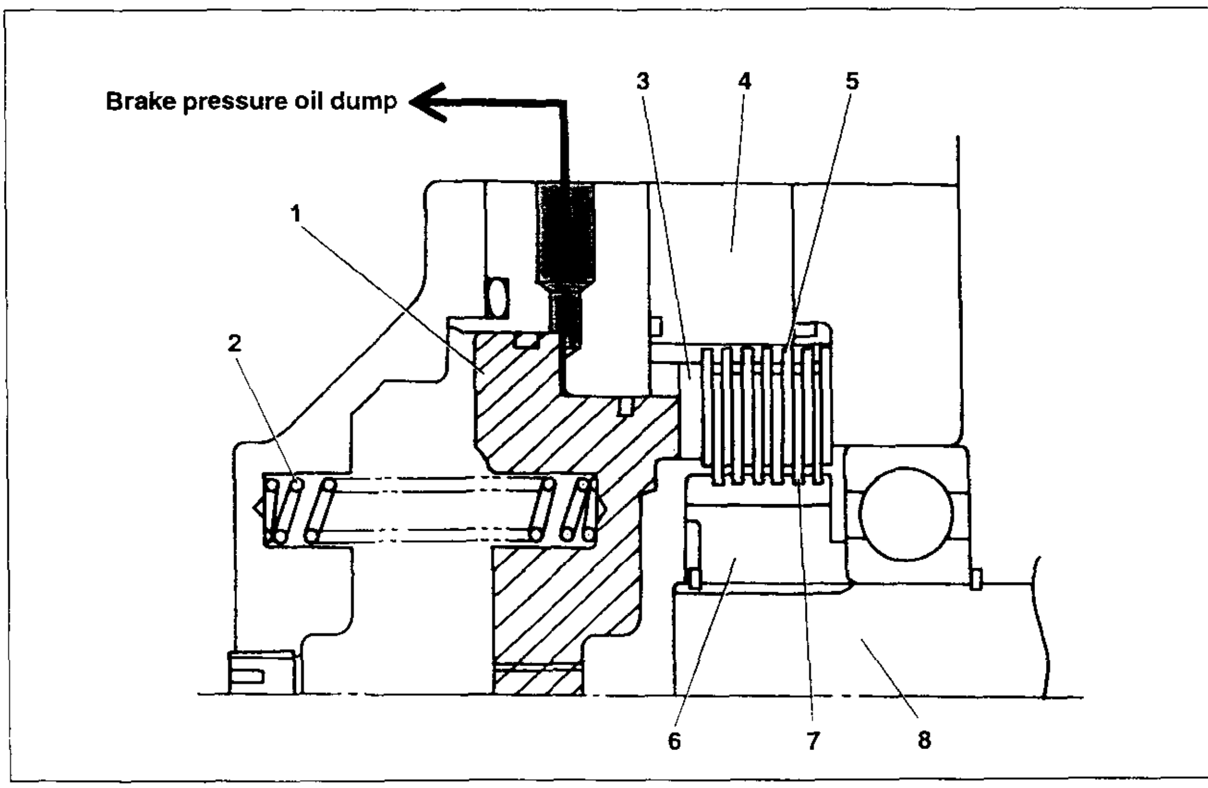


Fig. 3-11 **Parking brake**

1. Brake piston - **2.** Spring - **3.** Support plat e - **4.** Brake housing - **5.** Fixed brake plate - **6.** Disc hub - **7.** Brake disc (rotary) - **8.** Transmission shaft.

3.6.3 BRAKE DISENGAGEMENT

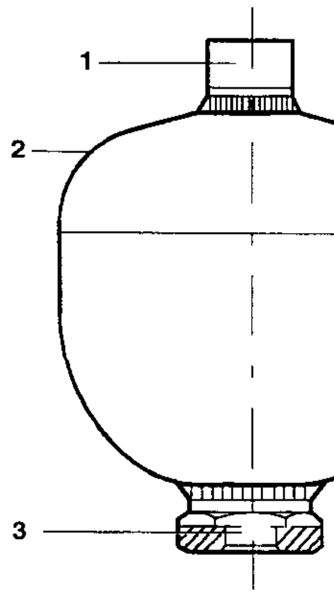
1. When pressure oil is sent to the rear surface of the brake piston, this overcomes the spring action and moves.
2. A clearance is established between each brake disc and fixed plate, the brake discs are released and the brake is disengaged.

3.7 OTHER COMPONENTS

3.7.1 BRAKE ACCUMULATOR

The membrane accumulator is used to store pressure oil to release the parking brake.

Oil from the charge pump is diverted by the check valve to the accumulator which maintains the pressure at a certain value.



CAPACITY .... 0.75 lt.
MAX. WORKING PRESSURE PER ACCUMULATOR .... 210 bars

GAS TO BE USED .... NITROGEN
GAS PRE-CHARGE PRESSURE .... 9 bars
WEIGHT .... 2.8 kg abt

Fig. 3-12 Accumulator

1. Gas filling plug - **2.** Accumulator body - **3.** Oil inlet connection.

3.7.2 CHECK VALVE

The check valve is used to prevent oil back-feeding from the accumulator.

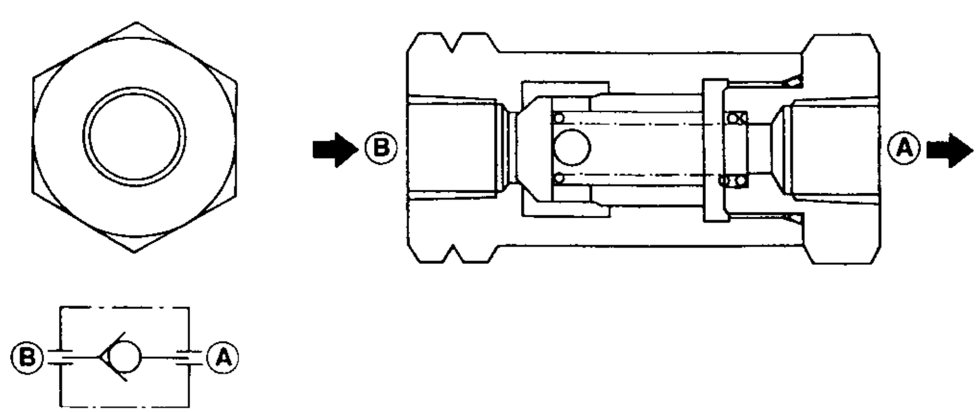


Fig. 3-13 Check valve

A. To the accumulator - **B.** From the outlet filter.

Opening pressure: 1.5 kg/cm² (21 psi)

3.8 BRAKE PEDAL VALVE HYDRAULIC CONNECTIONS

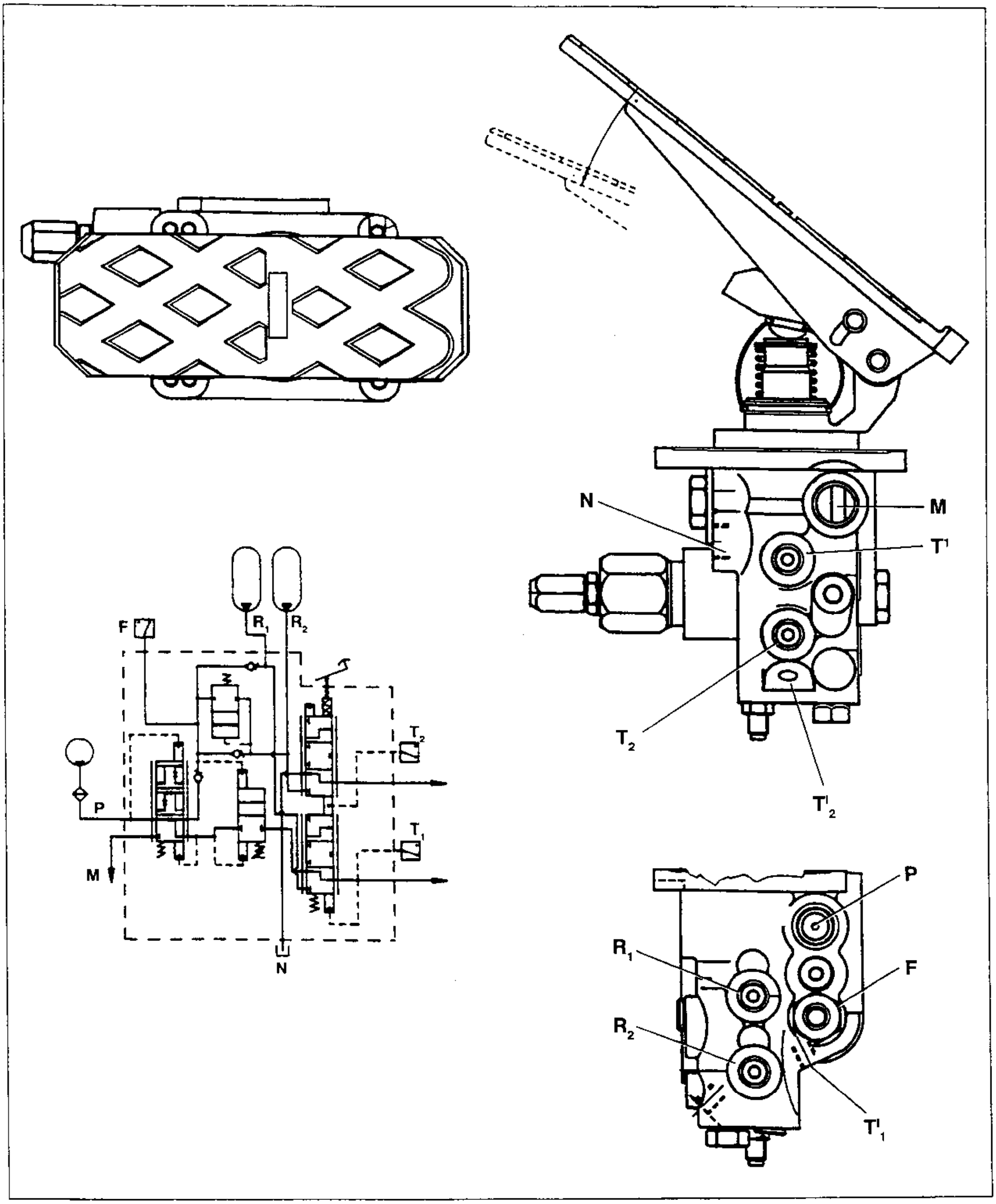


Fig. 3-14 Brake pedal valve hydraulic connection

F. Accumulator control pressure switch - **M.** Other users or to dump - **N.** Dump - P. Inlet - **R**$_{1-2}$. Accumulator -**T**$_{1-2}$. To the brakes -T'$_{1-2}$. Brake control pressure switch.

3.9 DIAGNOSTICS AND TESTING

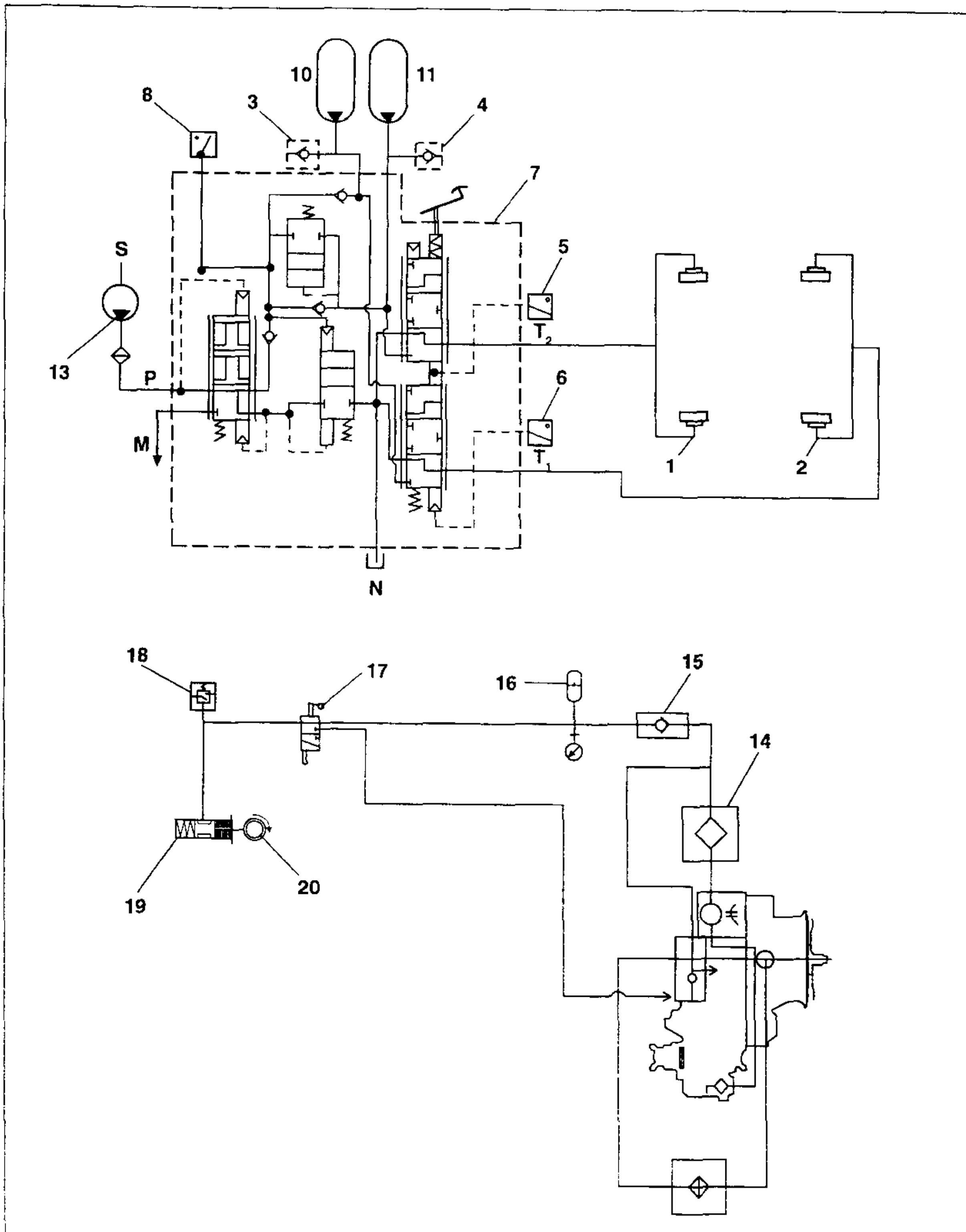


Fig. 3-15 Braking system schematic

Brake system schematic

M. Other users or to dump

N. Dump

S. From hydraulic oil reservoir

S1. To hydraulic oil reservoir

1. Rear axle brakes

2. Front axle brakes

3. Quick coupling pressure port

4. Quick coupling pressure port

5. Transmission disengagement pressure switch (pressure switch setting = 15 bars)

6. Brake lights pressure switch (pressure switch setting = 1.8 bars)

7. Brake pedal valve (operating pressure = 30 bars)

8. Accumulator control pressure switch (60 ± 5 bars)

10. Brake accumulator (capacity = 0.75 lt - pre-charge = 45 bars)

11. Brake accumulator (capacity = 0.75 lt - pre-charge = 45 bars)

13. Charge pump (for the braking system)

14. Delivery oil filter

15. Check valve

16. Parking brake accumulator (capacity = 0.75 lt.- pre-charge = 9 bars)

17. Three-way diverter valve to control parking brake engagement/disengagement

18. Parking brake pressure switch (pressure switch setting: OFF = 12 bars; ON = 8 bars)

19. Brake shoe control ram

20. Brake disc

WARNING - DANGER

Always disconnect and connect all fittings with the engine stopped and braking system disabled.
Accumulators keep some branches of the circuit under pressure even if the engine is stopped.
Pressure oil escaping from loose fittings may cause personal injury and damages to things.
Wear safety glasses with side shields.

3.9.1 BRAKE CONTROL PRESSURE TESTING TEST

Connect two pressure gauges (end of scale 100 bars) to the pressure ports shown in Fig. 3-16.

Apply the parking brake.

Start machine engine and wait until it settles to maximum torque speed.

With the engine idling, press the brake pedal and check that pressure reading on the gauges is approximately 30 bars.

Release the lock-nut (**E**, Fig. 3-16) and turn the screw in or out if pressure values are not within the rated range.

Such a pressure must be measured after a pedal stroke of about 70 mm (2.79 in).

Seal the screw after adjustment.

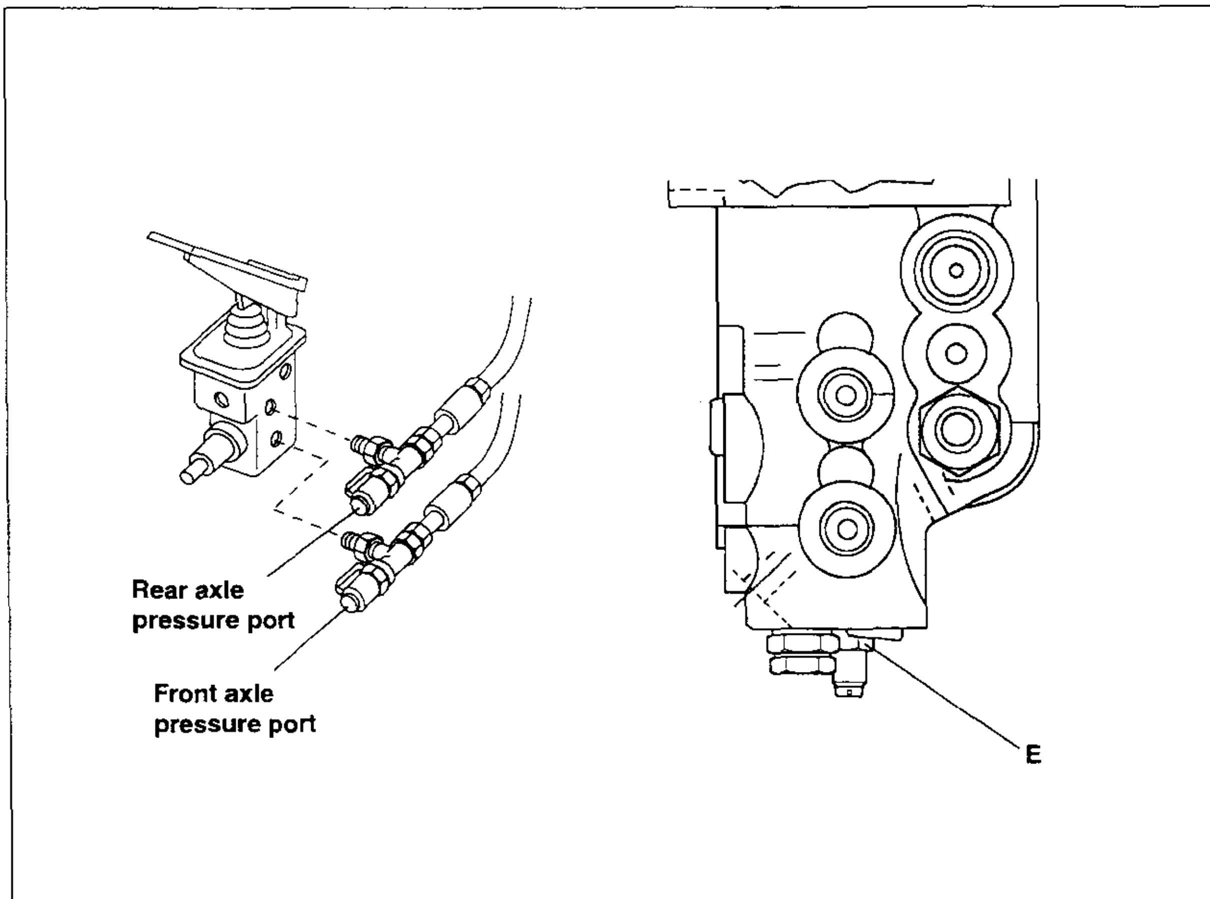


Fig. 3-16 Braking pressure adjustment

3.9.2 MINIMUM AND MAXIMUM ACCUMULATOR RECHARGE PRESSURE ADJUSTMENT

Connect two pressure gauges (end of scale 200 bars) to the quick coupling pressure ports (**7** and **8**, Fig. 3-17) on the accumulators.
Start machine engine and bring oil temperature to approximately 40 to 50°C by means of the attachment control lever. Cycle the brake pedal several times to make oil temperature even.

Minimum recharge value

With the engine idling and machine at a standstill, brake slowly 4 or 5 times.
Observe minimum pressure values on pressure gauges **M1** and **M2** before recharge starts.
The pressure gauges should momentarily read 80 ± 5 bars. If minimum recharge pressure is different from the rated value, remove the plug (**1**), release the lock-nut (**5**) and turn the screw (**4**) with micrometric variations until obtaining correct value. Check pressure again before tightening the lock-nut (**5**).

Maximum recharge value

With the engine idling and the parking brake applied, observe maximum recharge pressure on pressure gauges **M1** and **M2**.
Pressure should be 100 ± 5 bars.
If maximum recharge pressure is different from the rated value, remove the plug (**1**), release the lock-nut (**3**) and turn the screw (**2**) out to increase the accumulator maximum recharge pressure.

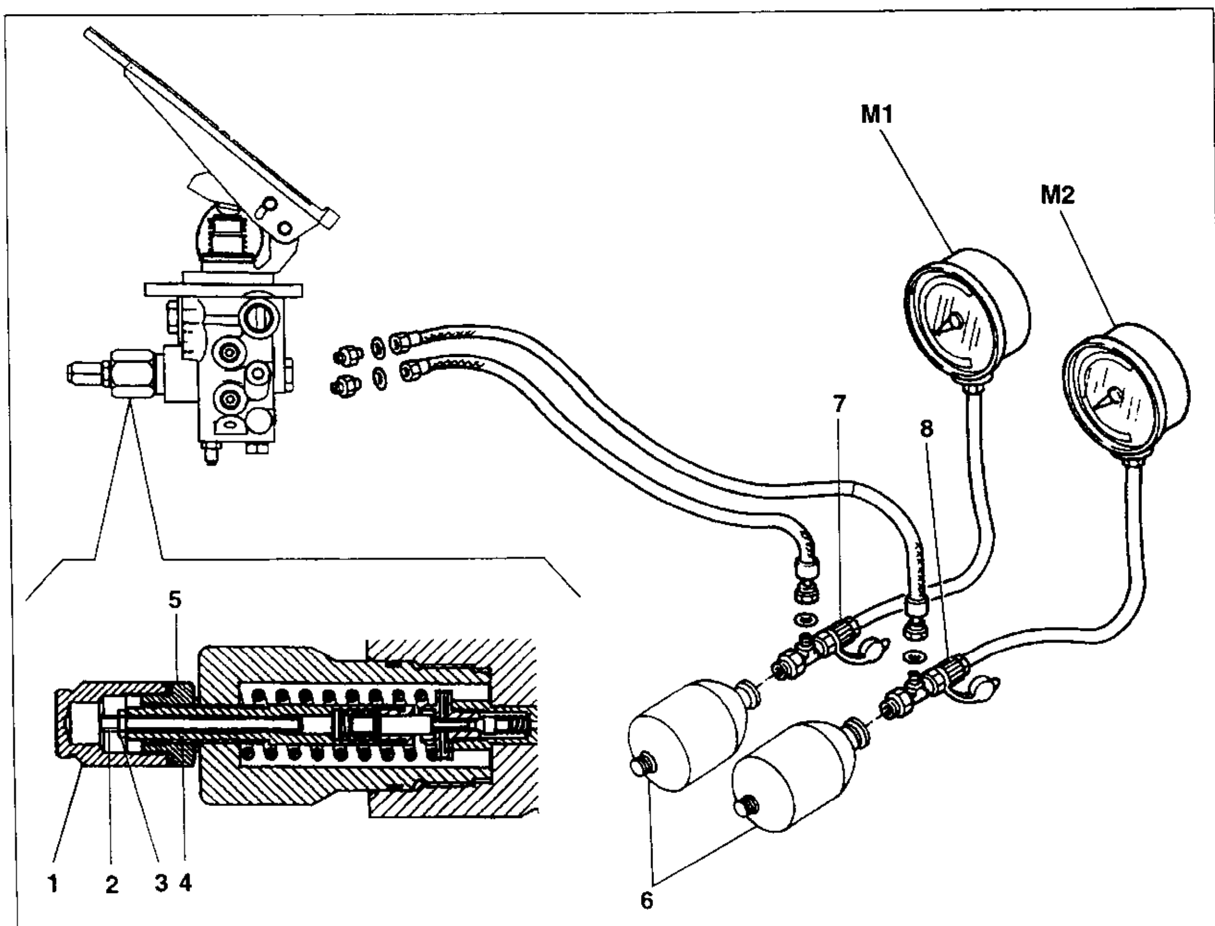


Fig. 3-17 Minimum and maximum accumulator recharge pressure adjustment

M1 & **M2.** Pressure gauges - **1.** Plug - **2.** Maximum pressure adjust screw - **3.** Lock-nut - **4.** Minimum pressure adjust screw - **5.** Lock-nut - **6.** Accumulators - **7** & **8.** Pressure ports.

3.9.3 PARKING BRAKE ENGAGEMENT TEST

Start the engine and let it run for about thirty seconds to charge the accumulator.

Move the parking brake control lever to the "released" position.

With the help of an assistant, observe the operation of the parking brake control linkage.

Operate the control lever two or three times always checking that the brake linkage moves completely.

The machine must be fully blocked when on an incline.

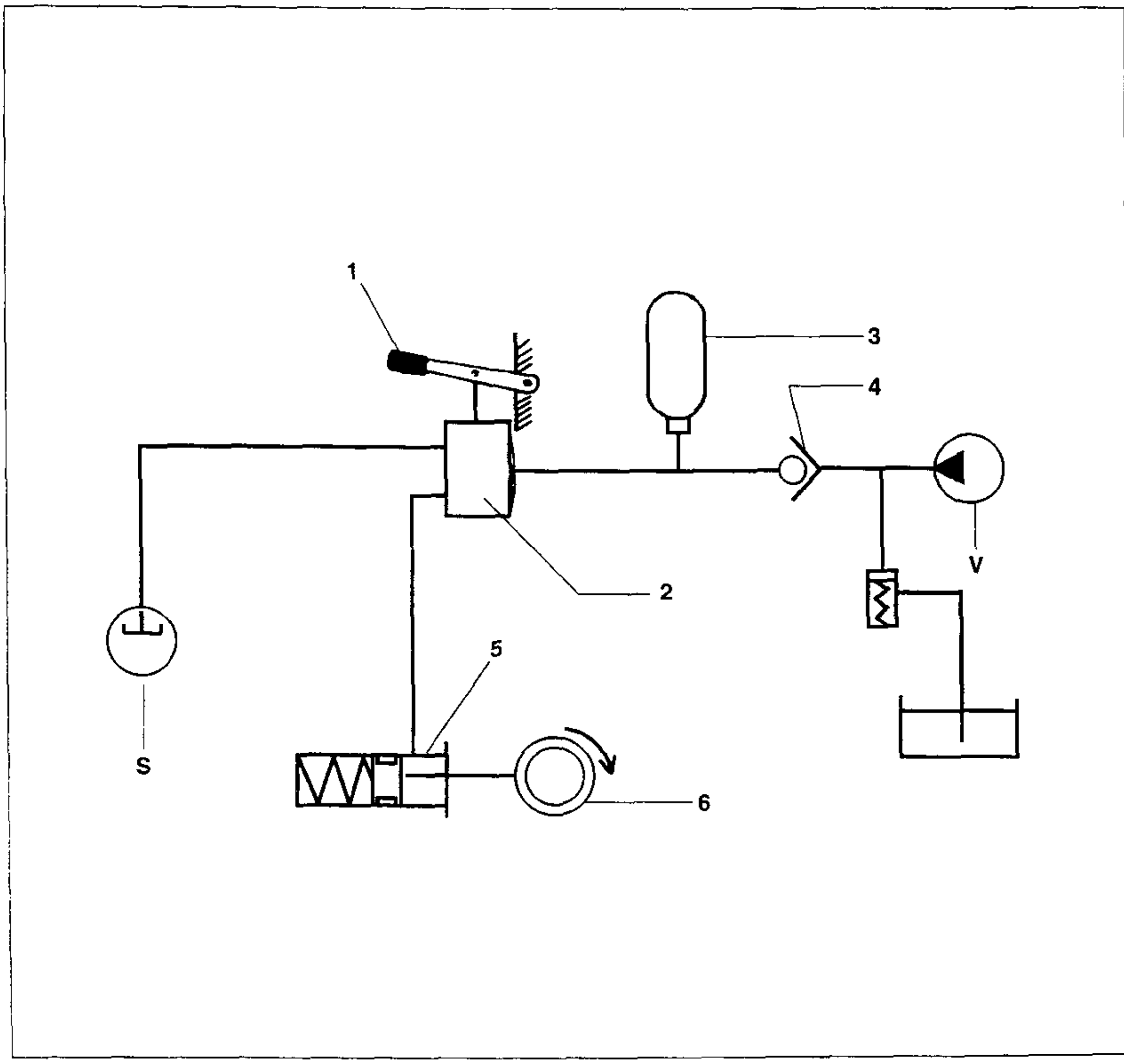


Fig. 3-18 Parking brake schematic

S. Dump to oil reservoir - **V.** From recharge pump - **1.** Parking brake engagement/disengagement lever - **2.** Three-way valve - **3.** Parking brake accumulator - **4.** Check valve - **5.** Ram - **6.** Parking brake.

3.9.4 ACCUMULATOR PRE-CHARGE TEST

Accumulators fitted to the braking system are membrane type, pre-charged using nitrogen.

Normal minimum membrane porosity and continued use reduce pre-charge pressure in time and limit accumulator efficiency.

It is advised to check the nitrogen pre-charge every six months and restore it, if necessary.

Pre-charge pressure should never drop below apporximately 90% of the rated value.

Check is to be carried out with the accumulators drained of hydraulic oil. This condition is obtained as follows:
- as regards accumulators (**7** and **8**, Fig. 3-2) by pressing the brake pedal slowly several times
- as regards the parking brake release accumulator (**13**, Fig. 3-2) by operating repeatedly the diverter valve (**14**) with the engine stopped.

Check the pre-charge as follows:

- Remove protection cover (**1**, Fig. 3-19).
- Loosen the screw (**2**) by half turn using an hexagonal Allen wrench.
- Screw in tool no. **75298472** (**D**) on the accumulator connection.
- Ensure tap (**D2**) is closed.
- Turn the handwheel (**D1**) to loosen the screw (**2**).
- When the pointer of the pressure gauge (**M**) starts moving, turn out the handwheel (**D1**) by one more turn.

Now the pressure gauge shows the accumulator pre-charge pressure, which should be 45 bars.

If pressure is not within the specified range of values, proceed as follows:

- Close handwheel (**D1**).
- Open tap (**D2**) to discharge nitrogen pressure from within the tool (**D**).
- Disconnect tool (**D**) from the accumulator.
- Tighten the screw (**2**) to a torque of 1.1 daNm.
- Test accumulator sealing using soapy water.
- Screw on protective cover (**1**).

Recharge the accumulator if the pressure is lower than rated value.

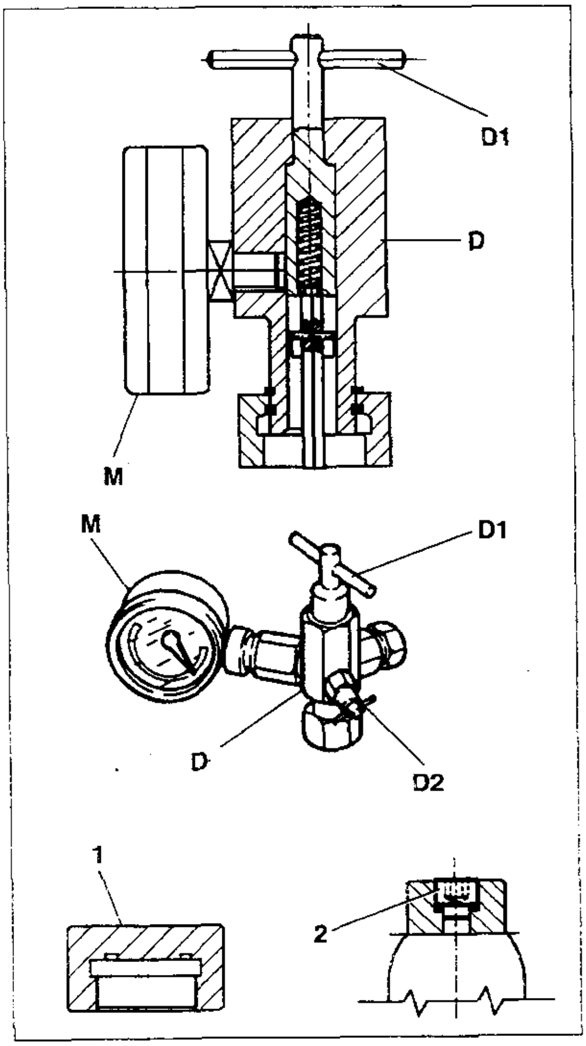


Fig. 3-19 Accumulato pre-charge test

D. Accumulator pre-charge test tool - **D1.** Plug control handwheel (**2**) - **D2.** Discharge tap - **M.** Pressure gauge - 1. Protective cover - **2.** Threaded plug.

3.9.5 ACCUMULATOR PRE-CHARGE RESET INSTRUCTIONS

Using tool no. **75298472** (**D**, Fig. 3-20) screwed to the accumulator connection (see 3.9.4. before) proceed as follows.

Loosen the plug and screw in the hose from a nitrogen bottle complete with safety valve (**V**).

WARNING - DANGER

Use only nitrogen to recharge accumulators. Never use oxygen or other gases for any reason whatever as explosion hazard may result.

Slowly open the nitrogen bottle tap and check refilling pressure as it increases on the pressure gauge (**M**).

IMPORTANT - Refilling pressure should be 10% at least higher than rated pressure considering that pressure inside the accumulator decreases when the compressed gas cools down.

Close the nitrogen bottle tap.
Wait five minutes.
Check on the pressure gauge (**M**) that inflating pressure is 45 bars. Repeat the operation if lower.
If pressure is higher, proceed as follows:

- Slowly turn the handwheel (**D2**) to let the nitrogen out and close.
- Check on the pressure gauge (**M**) that pressure is as required. If not, repeat the operation.
- Turn the handwheel (**D1**) to screw in the accumulator screw (**2**).
- Remove tool (**D**).
- Tighten the screw (**2**) to a torque of 1.1 daNm.
- Check accumulator sealing using soapy water.
- Screw on protection cover (**1**).

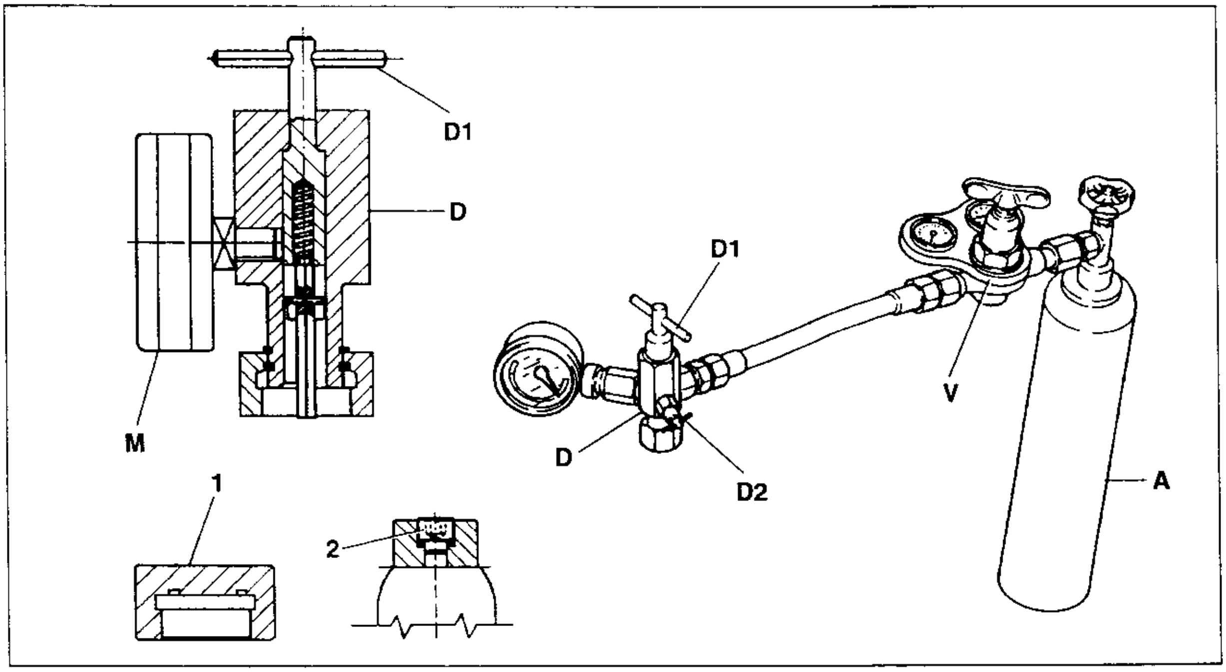


Fig. 3-20 Accumulator recharge device

D. Accumulator pre-charge test tool - **D1.** Plug control handwheel (2) - **D2.** Discharge tap - **A.** Nitrogen bottle - **M.** Pressure gauge - **V.** Safety valve - **1.** Protection cover - **2.** Threaded plug.

3.9.6 BLEEDING THE BRAKE SYSTEM

It will be necessary to bleed the brake system whenever one of the following occurs:

- After replacing hydraulic oil in the attachment oil reservoir.
- When air has entered the system because of poor sealing of hoses or charge pump.
- After disconnecting or replacing any of the system parts.

Bleed the system as detailed below (this is a two-man operation):

- Park the machine on level ground and start the engine.
- With the engine idling, one operator should release the bleed screw (two on each axle) while the other is pressing the brake valve pedal. Tighten the bleed screw before releasing the brake pedal.
- Repeat this operation until bleeding all air from the system (fluid should come out of the bleed screw free of bubbles).
- Repeat for the other axle.

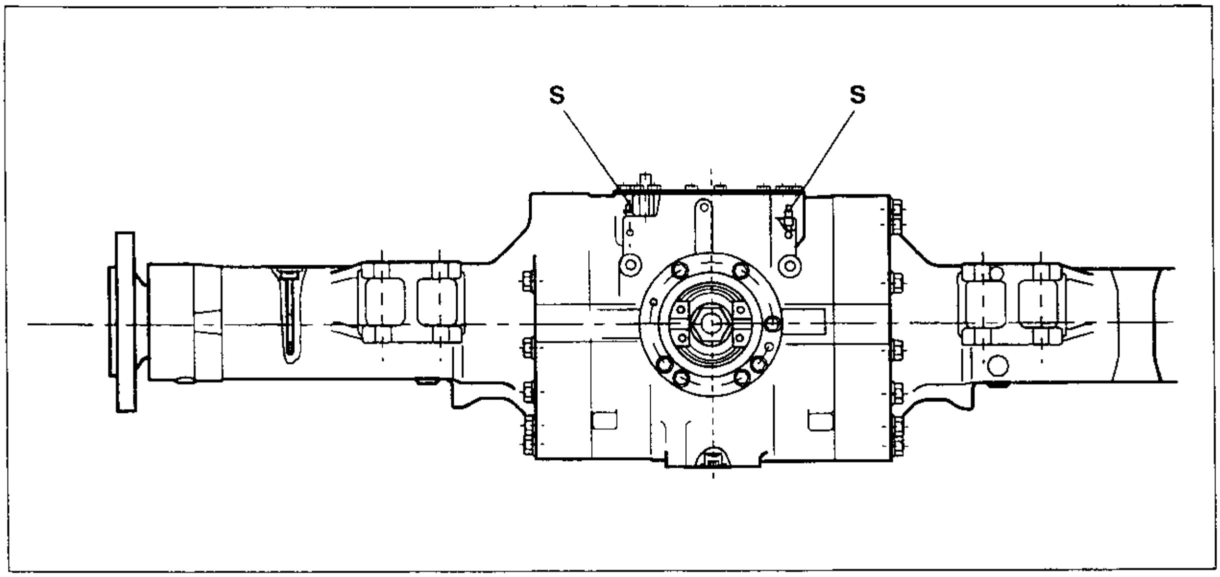


Fig. 3-21 Brake oil bleed screw (S) locations on the axle (1 per brake)

3.9.7 BRAKE DISC WEAR CHECK

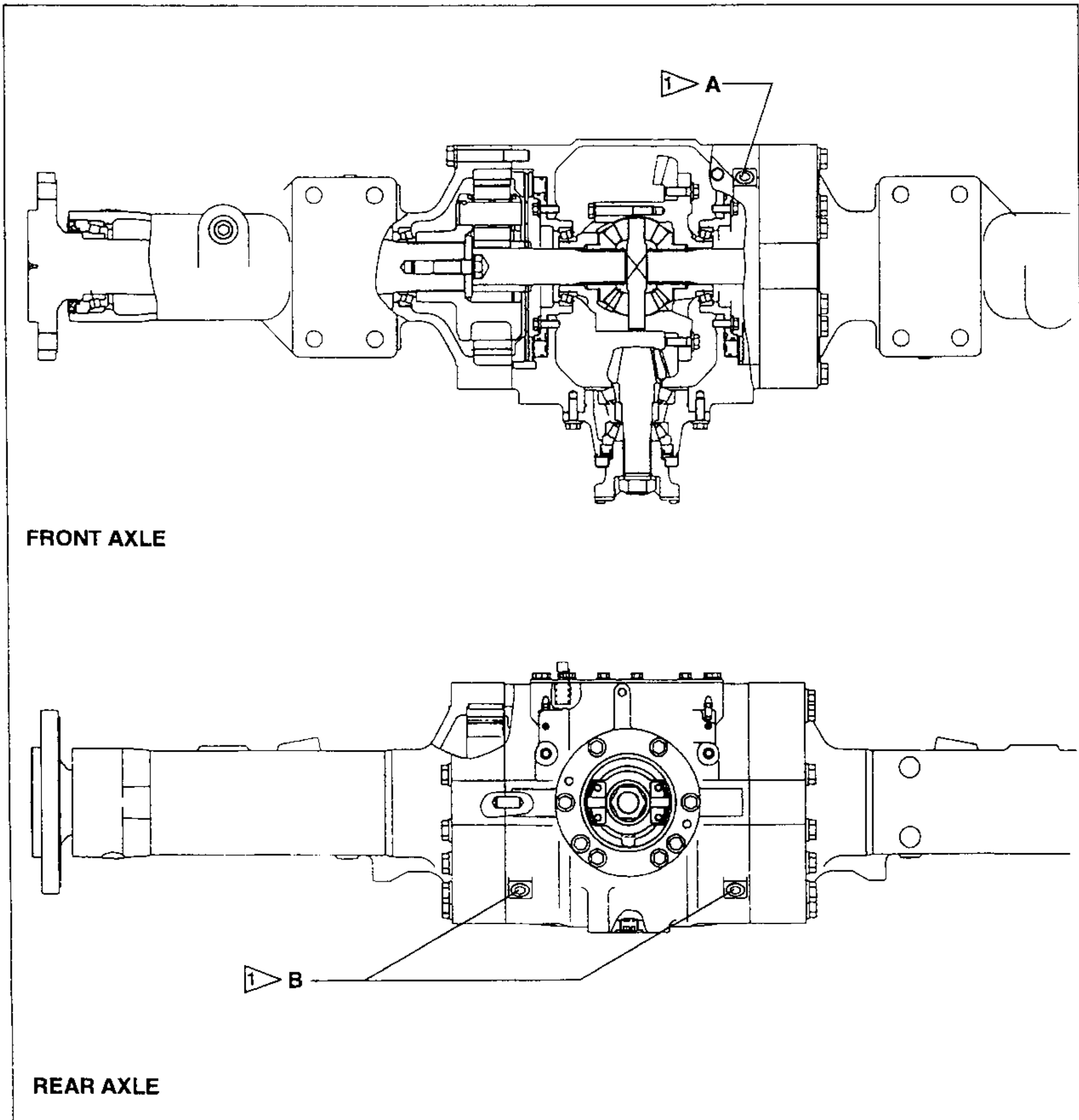


Fig. 3-22 Brake disc wear check hole locations

 Threads: LOCTITE 572

Drain oil from the assemblies by loosening the plugs (**A**) and (**B**) for the front and rear axles, respectively. Check wear of the two brake discs (per axle) by inserting a feeler gauge.

The brake disc must be replaced if less than 5.3 mm (.208 in) thick for W110 and 6.3 mm (.244 in) for W130.

SECTION 4

STEERING SYSTEM

CONTENTS

4.1 GENERAL DESCRIPTION

The steering system uses the same oil of the equipment system. The two systems are combined so that the excess oil of the steering pump is sent to the equipment system. The system is made of an hydraulic reservoir (**S**), a pump (**1**) a main priority valve (**2**), a steering unit (orbitrol) (**3**) complete with valves block, a cushion valve (**5**) and steering cylinders (**4**).

The oil in the reservoir (**S**) is sucked by pump (**1**), composed of two sections: one section supplies the steering/equipment system, the other supplies the brake system.

The oil is directed by a priority valve (**2**) that includes a control valve spool.

When it is required, oil is sent to the steering system and the equipment system. When the steering is at rest, oil at the end of the priority spool pushes it upward, allowing the oil from the pump to flow to the equipment system. The steering system has a priority and receives oil first. The priority valve, together with the orbitrol, make the **LOAD SENSING SYSTEM (LS)**.

Operation of the LOAD SENSING system

The load sensing system allows the feeding of the steering valve (orbitrol) with a quantity of oil (taken from the main pump delivery) required by the steering function, allowing the residual delivery of the pump to flow into the equipment system (equipment control valve).
As an example, when the steering wheel is in neutral position, the majority of the oil flow of the main pump is sent to the hydraulic control valve to operate the equipment hydraulic system, so that the oil delivered by the main pump is used in an efficient manner to obtain the highest conservation of energy.

When the operator actuates the steering wheel, oil is directed to the steering cylinders through the orbitrol. The oil directed to the cylinder is diverted to the cushion valve, working as a shock absorber, to reduce the shock load, when the rotation of the steering wheel is over. The spool inside the cushion valve moves to limit the increase of the pressure in the cylinders. If the pressure raises beyond the setting of this valve, the safety and anti cavitation valves (**6**) (refer to the hydraulic system diagram) inside valves block (**12**) prevent the pressure from exceeding the setting of the cushion valve.
Also, the valves have an anti cavitation function, ensuring that when the orbitrol is in neutral, the chambers of the cylinders are always filled with oil, thus avoiding cavitations of oil in the circuit, in case of intervention of the safety valves (anti shock) protecting against strong shocks on the wheels.

Under emergency conditions, the oil flow from the steering pump is lost. When the tyres are rotating, emergency pump (**7**) generates a flow directed to emergency secondary priority valve (**9**). Oil flowing to the steering system is sufficient to ensure the steering, when the engine stops for accidental reasons.

On units equipped with emergency steering system, besides the standard system, the following items have been added, among other components:
- emergency pump (**7**);
- a secondary priority valve (**9**);
- a multiple make-up valve (**8**) and check valves on the main and secondary priority valves.

If an accidental drop of the feeding pressure occurs in the system, pressure switch (**10**), fitted on the main priority valve, signals the problem on the dashboard, switching on the indicator.
The pressure switch signals this pressure drop only when the pressure reaches less than 1 bar. Another pressure switch (**11**) is positioned on check valve (**13**) signalling a pressure drop in the emergency system, switching on the same indicator on the dashboard.

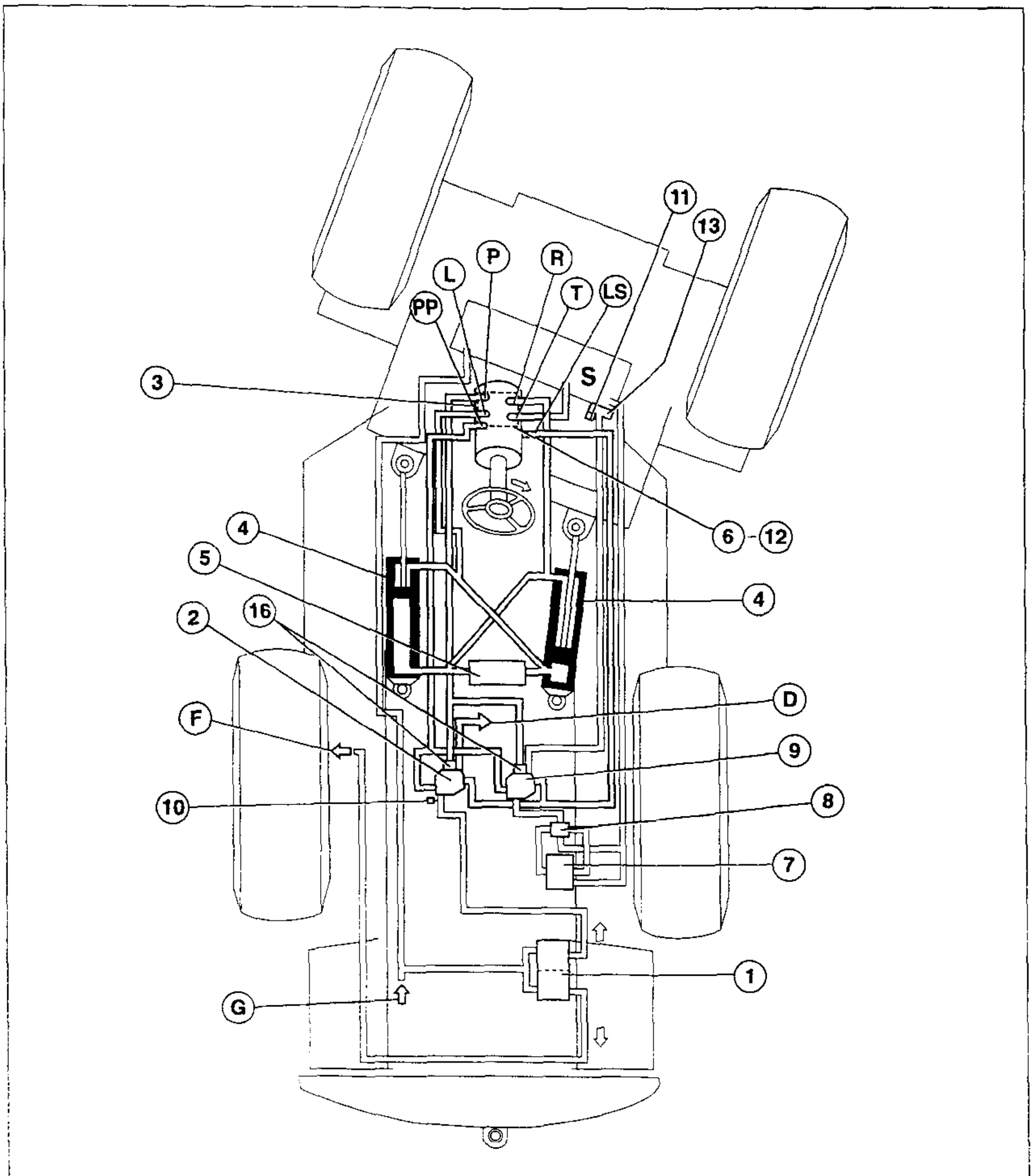


Fig. 4-1 **Steering system with emergency steering**

D. To equipment control valve - **F.** To brake pedal valve - **G.** From brake pedal valve - **L.** To left cylinder (rod side) - **LS.** Load-Sensing signal - **P.** Flow from pump - **PP.** Pilot pressure - **R.** To right cylinder (rod side) - **T.** Discharge to reservoir - **1.** Double feeding pump (for steering, equipment and brakes) - **2.** Main priority valve - **3.** Steering valve - **4.** Steering cylinders - **5.** Cushion valve - **6.** Safety and anti cavitation valve - **7.** Emergency steering pump - **8.** Multiple check valve - **9.** Secondary priority valve - **10.** Main pump low pressure switch - **11.** Emergency steering pump low pressure switch - **12.** Valves block - **13.** Check valve on reservoir - **16.** Check valve.

Fig. 4-2 STEERING SYSTEM DIAGRAM

1. Double feeding pump:
   - Equipment-steering section: Q = 165 ltr/min (W110), 173 ltr/min (W130)
   - Brakes section Q = 26 ltr/min
2. Main priority valve (setting = 12 bar)
3. Steering valve OSPL 520 LS
4. Steering cylinders
5. Cushion valve
6. Safety and anti cavitation valve (setting = 230 - 250 bar)
12. Valves block OVPL 24
14. Main relief valve (setting = 175 bar)
15. Spool
17. Plug with pressurising valve
18. Oil filter on return from control valve (10 μ)
19. By-pass valve on hydraulic oil filter

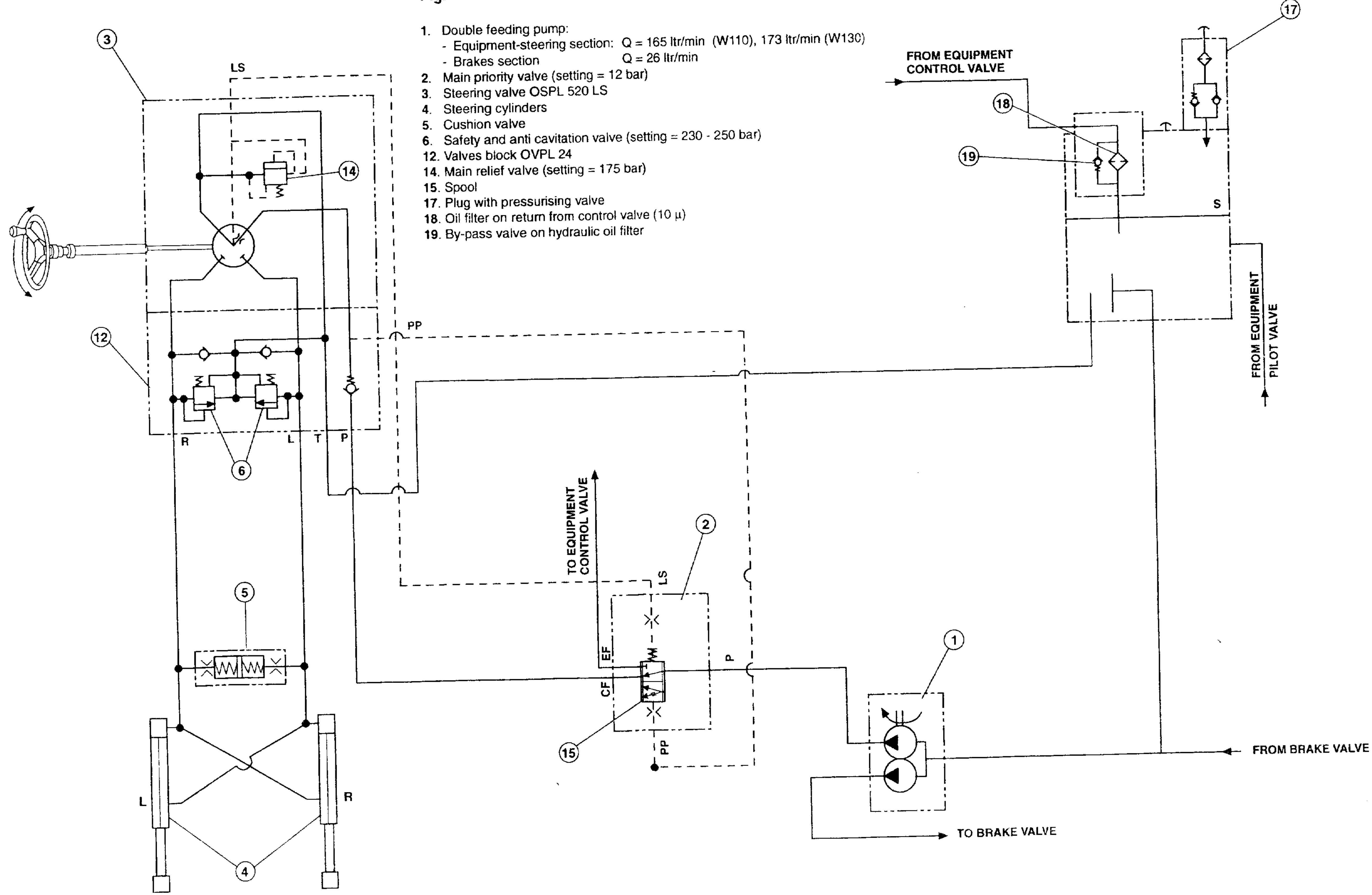
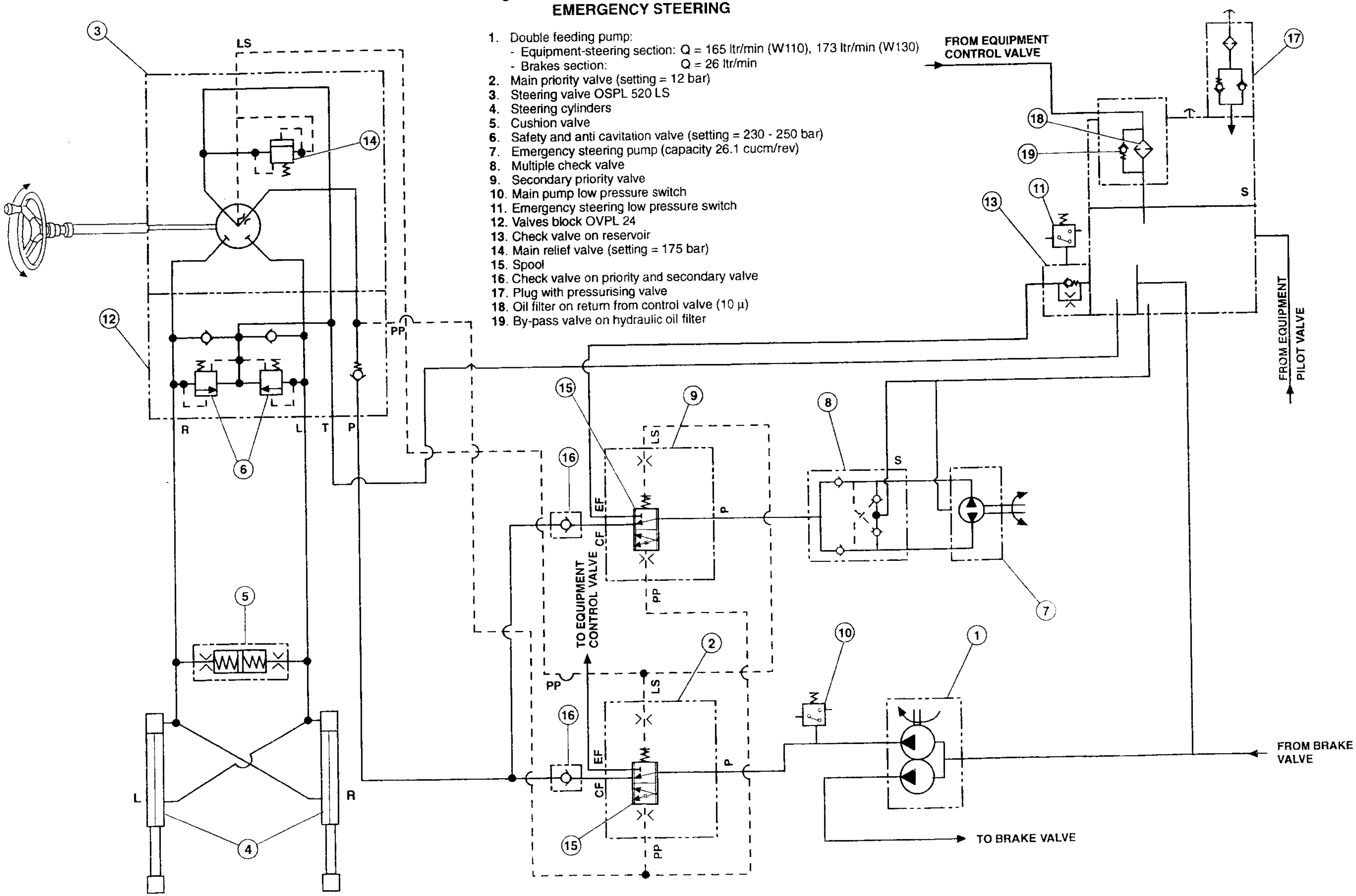


Fig. 4-3 DIAGRAM OF STEERING HYDRAULIC SYSTEM WITH EMERGENCY STEERING

1. Double feeding pump:
   - Equipment-steering section: Q = 165 ltr/min (W110), 173 ltr/min (W130)
   - Brakes section: Q = 26 ltr/min
2. Main priority valve (setting = 12 bar)
3. Steering valve OSPL 520 LS
4. Steering cylinders
5. Cushion valve
6. Safety and anti cavitation valve (setting = 230 - 250 bar)
7. Emergency steering pump (capacity 26.1 cucm/rev)
8. Multiple check valve
9. Secondary priority valve
10. Main pump low pressure switch
11. Emergency steering low pressure switch
12. Valves block OVPL 24
13. Check valve on reservoir
14. Main relief valve (setting = 175 bar)
15. Spool
16. Check valve on priority and secondary valve
17. Plug with pressurising valve
18. Oil filter on return from control valve (10 μ)
19. By-pass valve on hydraulic oil filter



4.2 PRINCIPLES OF OPERATION OF MAIN PRIORITY VALVE

The oil is sucked by the pump and sent directly to the main priority valve. The oil feeds the valve through duct (**P**, fig. 4-4).

In case of steering of the machine, spool (**2**) is positioned as in detail (**a**). This position is maintained by the return spring and by the oil coming from duct (**LS**).

Duct (**LS**) is connected to the steering valve and the pressure is directly proportional to the steering speed. If the steering is gradually zeroed (detail **b**), the pressure in the steering valve decreases, as well as in duct (**LS**).

Being, under these conditions, the delivery pressure at the steering valve (duct **CF**), spool (**2**) moves and compresses the return spring, freeing, gradually, the delivery to control valve (**EF**).

In detail (**C**) the position of the spool in the equipment only operation mode (boom and bucket) without the intervention of the steering is represented.

Check valve (**1**) is closed due to the lack of flow toward the steering valve, keeping it pressurised. This condition is maintained for a few seconds, due to the dynamic losses inside the steering valve, where an alternating closing and opening movement of the feeding duct (**CF**) results.

The two restrictions (**S_1** and **S_2**), by creating a pressure differential after them, allow a gradual movement of spool (**2**) during the various phases of operation.

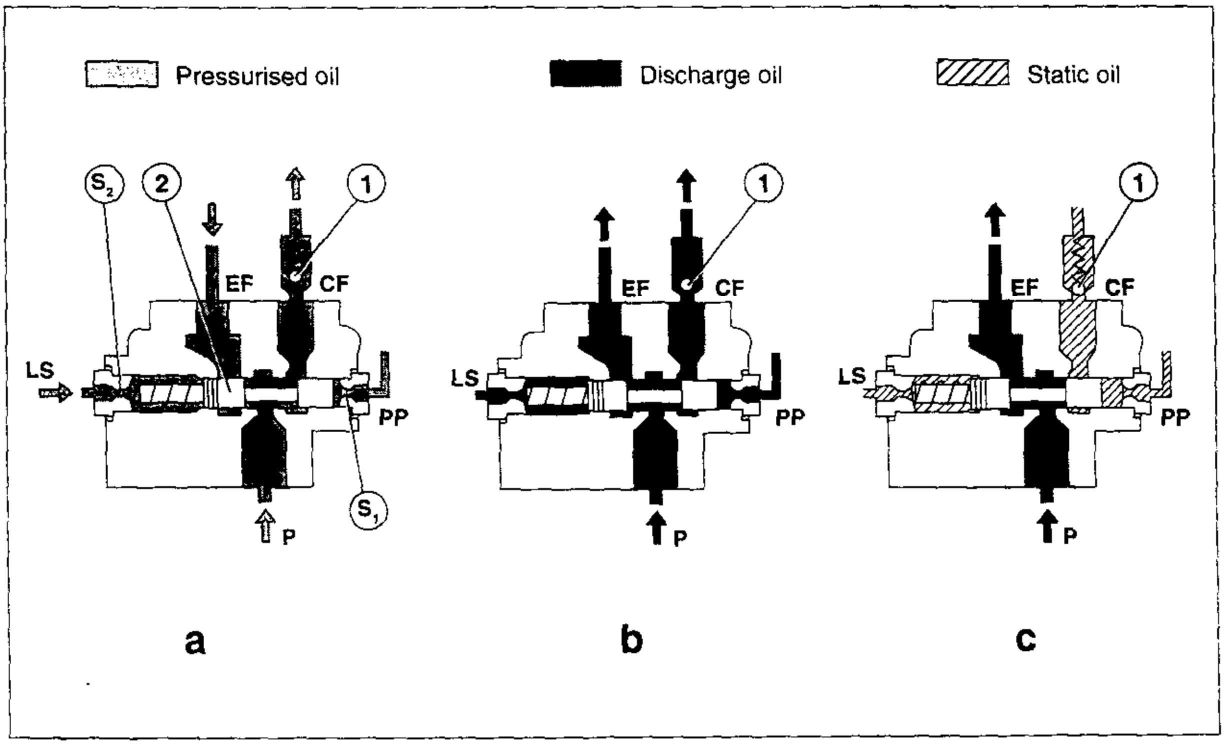


Fig. 4-4 Operational phases of the main priority valve

a. Delivery phase of the whole flow to the steering valve - **b.** Delivery phase at the same time to the steering valve and equipment control valve - **c.** Complete cut-off of the steering valve and total flow to the control valve - **S_1** and **S_2**. Restrictions - **1.** Check valve - **LS.** To steering valve - **EF.** To equipment control valve - **CF.** To steering valve and (optional) to secondary priority valve - **P.** From hydraulic pump - **2.** Spool.

4.3 STEERING VALVE (ORBITROL)

The orbitrol consists of the control valve and the rotor set. The control valve is a rotary valve which changes the alignment of oil passages by its rotation, thus actuating the steering cylinders. The rotor set is located under the control valve.

Usually it acts as an hydraulic motor performing metering functions. In case of emergency, it is used as a manual pump acting as a manual steering unit (without hydraulic power).

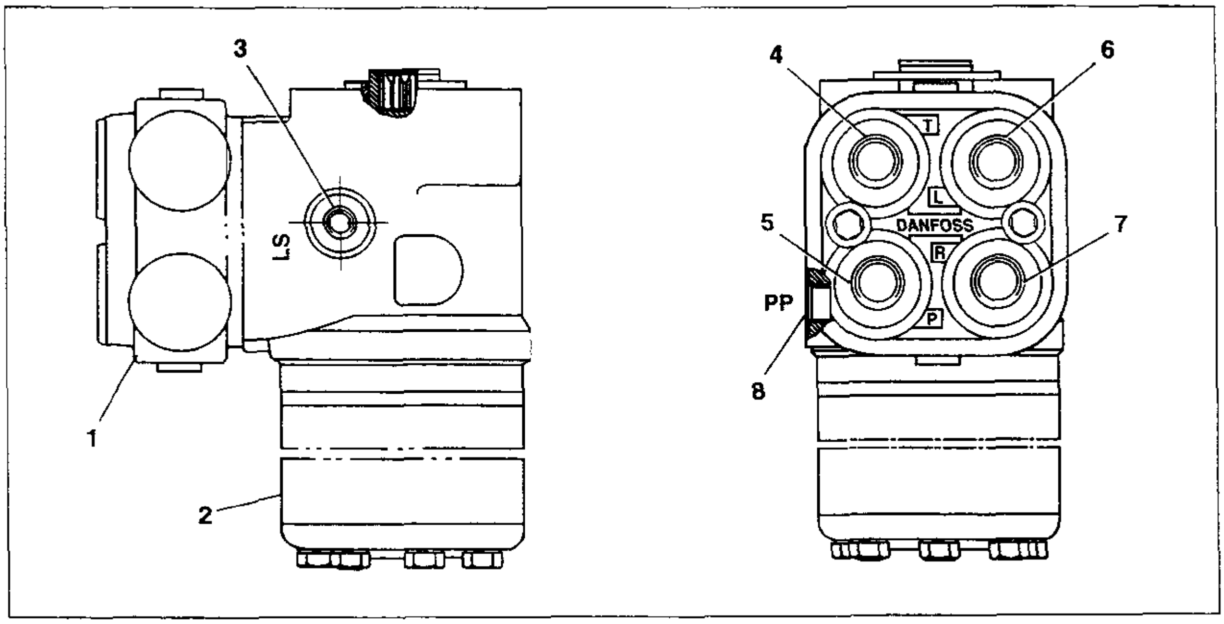


Fig. 4-5 Steering valve

1. Valves block - **2.** Steering valve - **3.** To main and secondary priority valve (unit with emergency steering unit) - **4.** To reservoir - **5.** From pump - **6.** To left steering cylinder - **7.** To right steering cylinder - **8.** To main and secondary priority valve (unit with emergency steering unit).

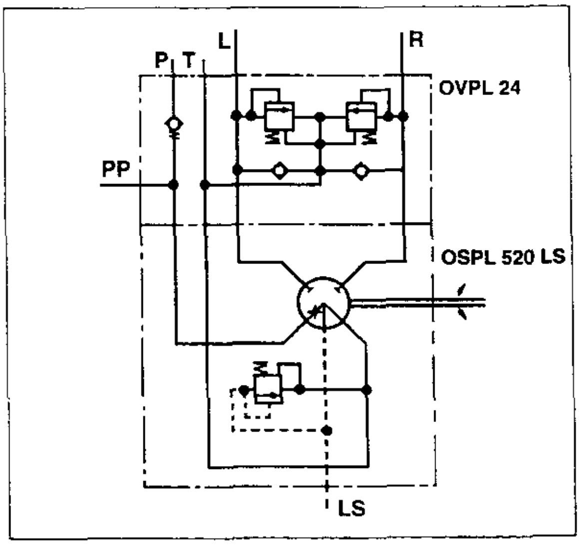


Fig. 4-6 Hydraulic diagram

4.3.1 STEERING VALVE

Removal

Drain the hydraulic oil from the reservoir, steer completely to the right and to the left, to reach the area under the cab. Tag and disconnect the oil pipes from valves block (**2**). From the inside of the cab, remove the steering column cover, so that it is possible to reach the steering valve securing screws, then, remove the four screws (**5**). Remove the steering valve complete with valves block.

The steering valve is complete with valves block (**2**) flanged on the steering valve.
It is recommended that the sections of the steering valve are marked, to re-assemble them in the same position.
Remove the securing screws and extract valves block (**2**) from the steering valve (**1**, fig. 4-7).

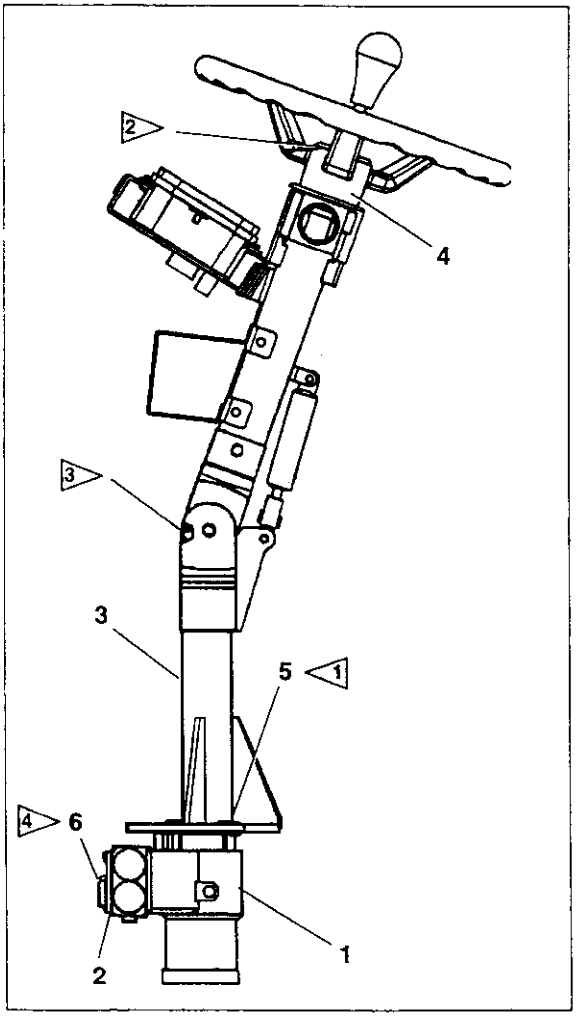


Fig. 4-7 Steering column complete with steering valve

1. Steering valve - **2.** Valves block - **3.** Steering column - **4.** Steering wheel - **5.** Steering valve securing screws - **6.** Valves block securing screws.

Notes - 1 ▷ 3.5 daNm

2 ▷ 3.5 - 4.5 daNm

3 ▷ 2 daNm

4 ▷ 6.5 daNm ± 0.5

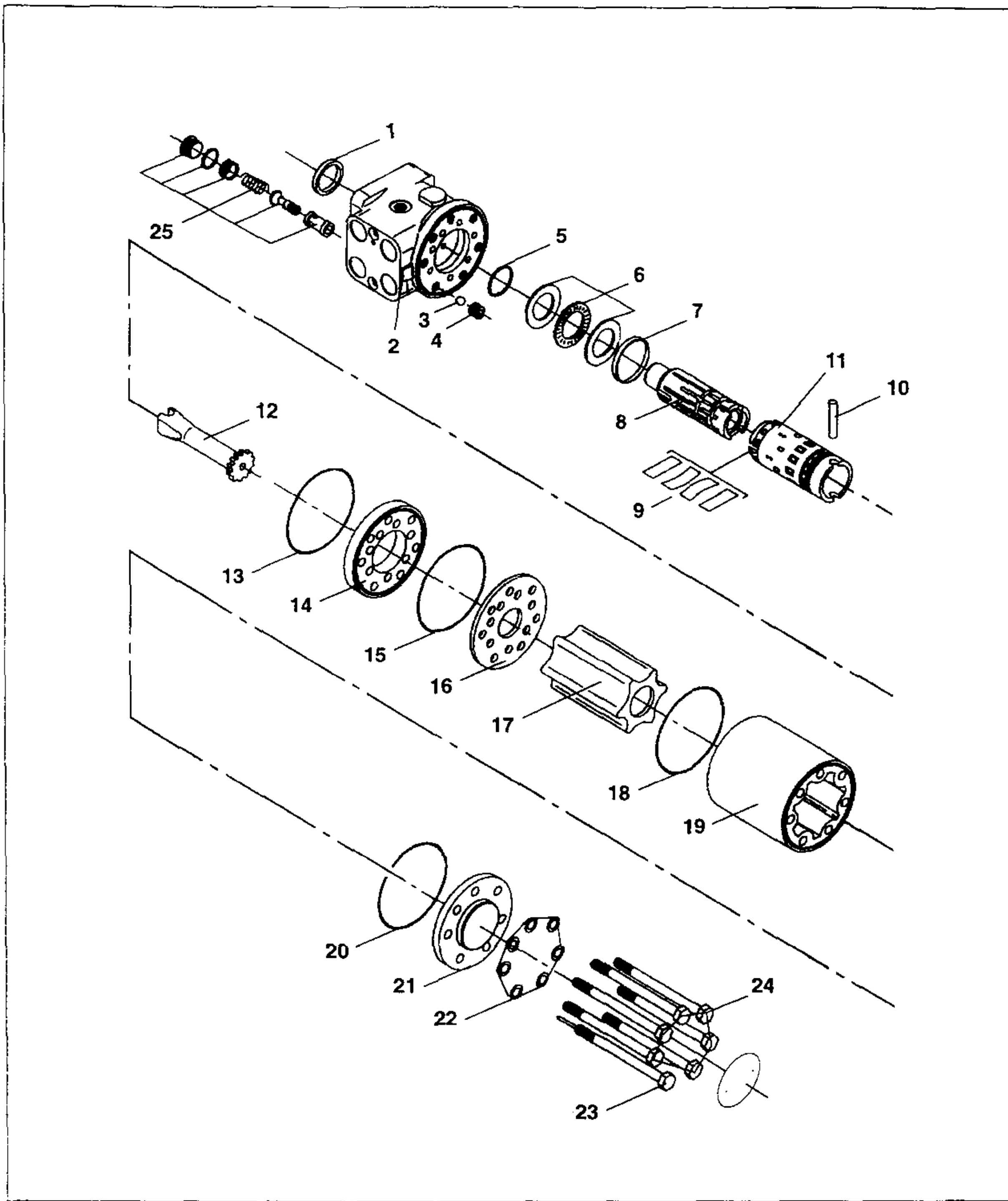


Fig. 4-8 Components of steering valve

1. Dust seal - **2.** Steering valve body - **3.** Check valve ball - **4.** Threaded bush - **5.** Seal - **6.** Parts of thrust bearing - **7.** Ring - **8.** Rotor set - **9.** Sleeve (**11**) return springs - **10.** Sleeve (**11**) and shaft (**12**) drive pin - **11.** Valve seat sleeve - **12.** Rotor (**17**) drive shaft - **13.** O-ring - **14.** Intermediate plate - **15.** O-ring - **16.** Thrust plate - **17.** Rotor set - **18.** O-ring - **19.** Rotor (**17**) fixed ring - **20.** O-ring - **21.** Cover - **22.** Washers - **23.** Screw with pin - **24.** Cover (**21**) securing screws - **25.** Pressure relief valve.

Disassembly

Remove plugs (**8**) from the valves block and remove the safety, anti-shock and anti cavitation multiple valves (**5**).

Always from the block, extract check valves (**9**).

Clean thoroughly all the components and check that the sliding surfaces are free from scratches.

Lubricate the components.

Reassemble the components, reversing the disassembly sequence, referring to fig. 4-9.

Replace the O-rings.

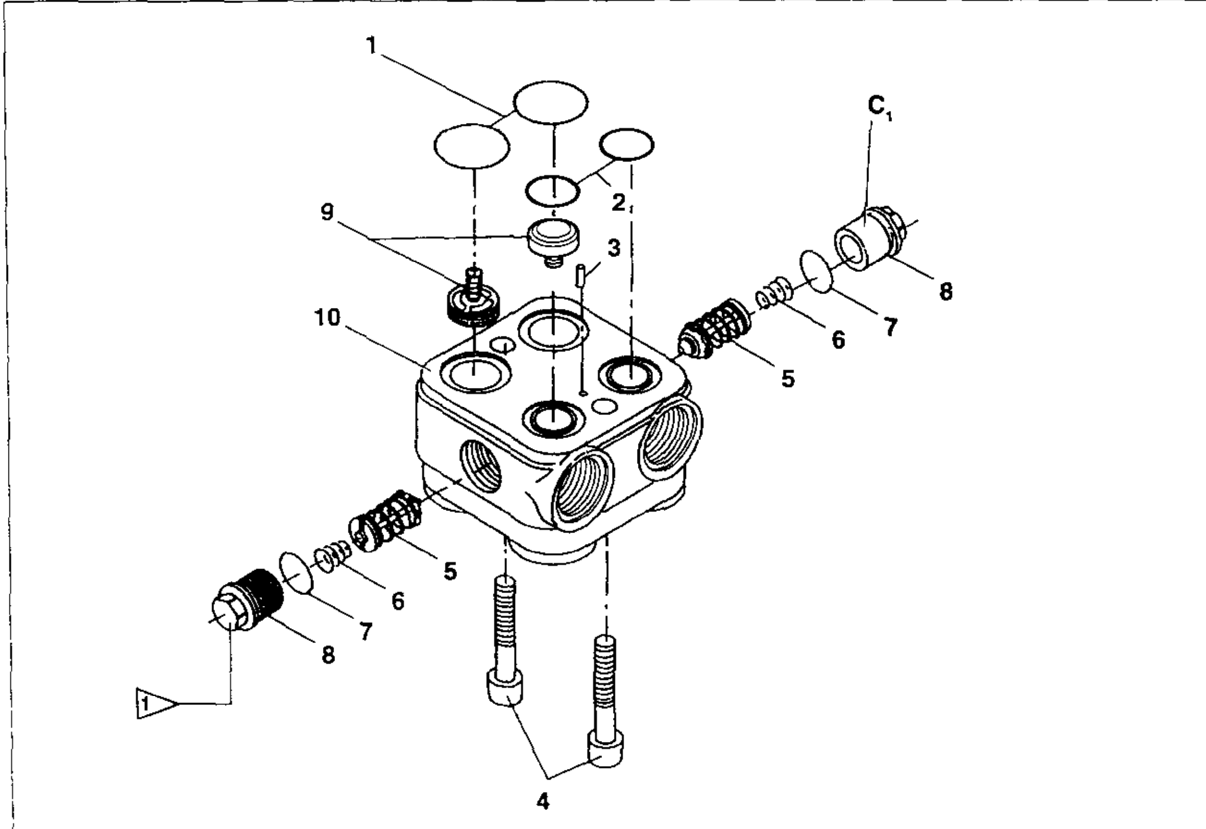


Fig. 4-9 Components of the valves block

1 and **2.** O-rings - **3.** Dowel - **4.** Securing screws - **5.** Multiple safety valves - **6.** Springs - **7.** O-ring - **8.** Plugs - **9.** Check valves - **10.** Valves body.

Note - 1 3.7 - 4.3 daNm

Disassembly of steering valve

Loosen the securing screws (**24**, fig. 4-8) and remove cover (**21**).

Remove fixed ring (**19**) complete with inner rotor (**17**).

Extract spacer (**16**) and O-ring (**15**).

Remove intermediate plate (**14**) and O-ring (**13**).

Loosen threaded bush (**4**) and extract ball (**3**) of the check valve.

To extract the springs, it is necessary to extract partially the rotor valve of the sleeve, removing flat springs (**9**), extract the valve pushing it out the sleeve, rotating it slowly, to facilitate the operation.

Inspect thoroughly all components.
Check that the sliding surfaces are free from scratches and deformations.
Replace all damaged components.
Replace all seals and, possibly, the flat springs as well.

It is important that the reassembly of the steering valve components is performed in totally clean conditions.

Lubricate freely all components with hydraulic oil.

Check that all ducts are free from cloggings.

Extract sleeve (**11**) complete with rotor valve (**8**).
Extract thrust bearing (**6**) and the return sleeve spring retaining ring.
Separate the rotor valve from the sleeve, pulling out drive pin (**10**).

Reassembly of steering valve

Position the seal on the steering valve body.

Reassemble rotor valve (**8**) into sleeve (**11**) rotating it slowly during the operation.

Align the spring passing boring and insert the springs inside the sleeve and the rotor valve.

NOTE - In case a tool is required to install the springs, obtain it from a socket wrench that can be adapted to the seat.
The long portion of the wrench must be grooved to a depth of about 13 mm and a width of 3.2 mm.

Center the springs mounted correctly to position them flat with the outside diameter of the sleeve.

Insert the spring retaining ring (**7**).

Install the sleeve/rotor valve drive pin (**10**).

Install thrust bearing (**6**).

Insert the sleeve assembly into the steering valve body, ensuring that the matching parts rotate freely.

NOTE - During the installation of sleeve (**11**) into the steering valve body, make sure that the drive pin stays horizontal.

Insert ball (**3**, fig. 4-8) into its seat on the body and tighten threaded bush (**4**).

To facilitate the operations to follow, prior to the installation of the drive shaft, mark it with a sign parallel to the pin groove.

Install the drive shaft, checking that the spline enters the pin.

NOTE - Mark (**B**) on the shaft must be parallel (**C**) with the drive pin and the valves block securing surface (**D**).

Position intermediate plate (**14**, fig. 4-8) and shim ring (**16**) with the relevant O-Rings.

Install fixed ring (**19**) complete with rotor (**17**).

NOTE - Ensure that the two spaces of the rotor as *indicated in the figure, are parallel* (**A**) *with the sign* (**B**) previously made on the shaft, thus with drive pin (**C**) and valve bloc mounting surface (**D**).

Install the cover, checking that the marks made prior to the disassembly match.

Install the assembly, tightening the screws to a torque of 3.5 daNm, following the sequence specified in fig. 4-10.

Install the valves block assembly, tightening the securing screws to a torque of 6.5 daNm.

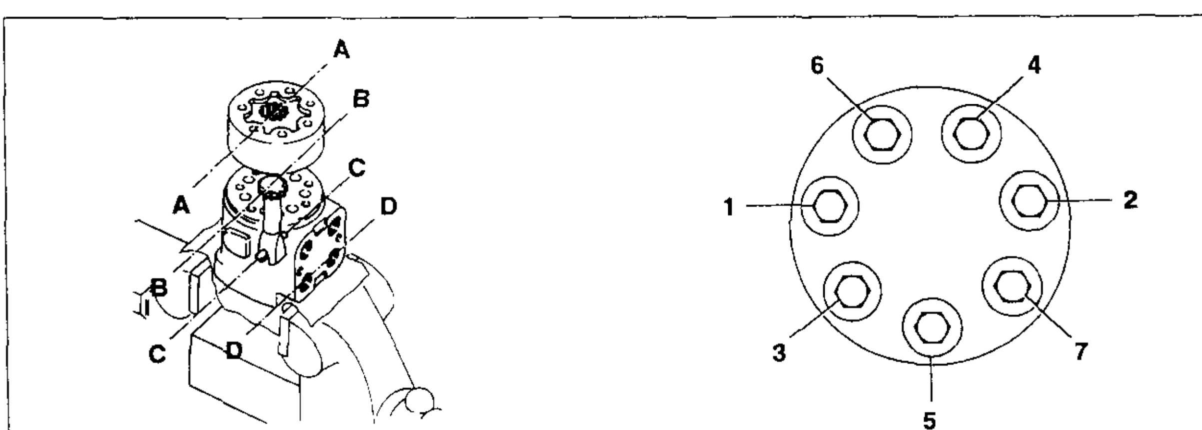


Fig. 4-10 Timing of the steering valve

A - B - C - D. Surfaces that must result parallel among themselves, during the reassembly.

4.3.2 MAIN PRIORITY VALVE

The priority valve is combined with the steering valve to create a "load sensing" system distributing the flow of the main pump to the steering and equipment systems.

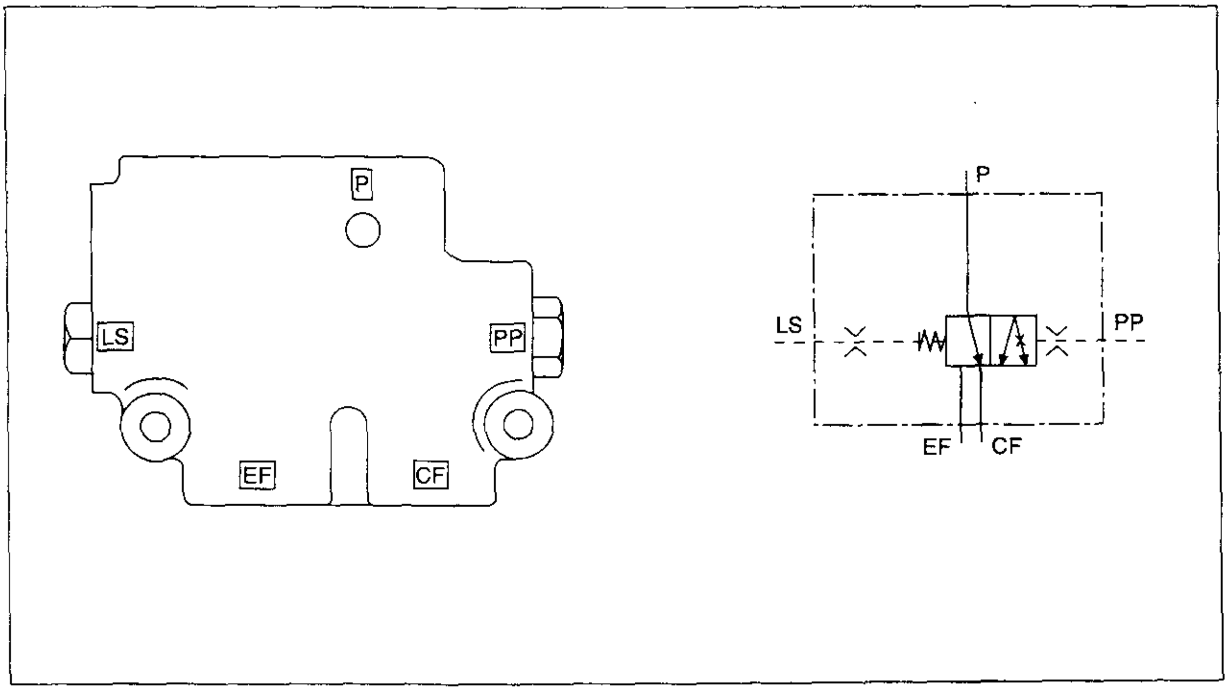


Fig. 4-11 Diagram of main priority valve

P: PUMP (from main pump)
LS: LOAD SENSING (from Orbitrol)
EF: MAIN CIRCUIT (to equipment control valve)
CF: STEERING CIRCUIT (to steering valve)
PP: PILOT PRESSURE (from Orbitrol)

Setting = 10 bar

Removal

The valve is mounted on the frame on the left side of the machine, under the cab.

Drain the hydraulic oil from the reservoir, tagging the oil hoses before disconnecting them. Loosen the securing screws and remove the valve.

Disassembly

To disassemble the priority valve, perform the following operations:

1) loosen plug (**1**, fig. 4-12) and the relevant O-ring (**2**) from port (**PP**);

2) loosen plug (**6**) and the relevant O-ring (**2**) from port (**LS**) and extract spring (**5**);

3) extract spool (**3**) using a nylon rod, pushing from the opposite side of the valve.

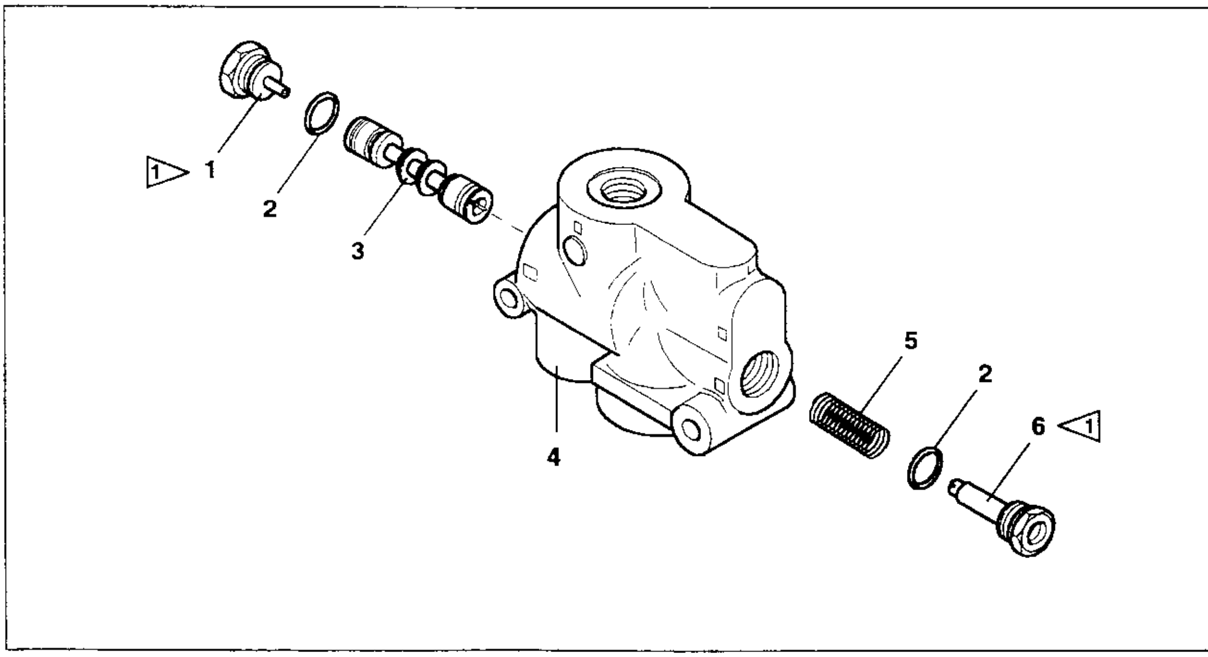


Fig. 4-12 Main priority valve

1. Plug - **2.** O-ring - **3.** Spool - **4.** Valve body - **5.** Spring - **6.** Plug with orifice.

1 6 daNm

Reassembly and installation

The reassembly and the installation is performed by reversing the sequence of operations above. Tighten the components to the prescribed torque, as indicated in fig. 4-12.

4.3.3 SECONDARY PRIORITY VALVE (OPTIONAL)

The secondary priority valve is like the main priority valve, but has a different "stand-by" pressure of 4 bar, and it is mounted on the frame, on the right side under the cab.

The removal/disassembly/reassembly and installation operations are the same as for the main priority valve.

4.3.4 CUSHION VALVE

At the beginning and at the end of the rotation of the steering wheel, a quick surge of the oil pressure in the steering cylinder circuit occurs. The cushion valve discharges this pressure temporarily into the return circuit to the hydraulic oil reservoir, to ensure a smooth steering action.

Disassembly

The valve is located on the left side of the rear frame.

Proceed as follows:

- discharge the oil from the equipment reservoir;
- disconnect the oil pipes;
- loosen the valve securing parts and remove it. To disassemble the valve, it is enough to loosen plugs (**1**, fig. 4-13) and to pull-out the components shown in the figure;
- wash and clean all the components with a non flammable, non toxic detergent solution;
- check that the plungers are free from scratches and that they can slide freely in their seats.

Reassemble the components, reversing the disassembly sequence, making sure that the O-rings are replaced with new ones.

After the installation of the valve on the machine, check that no leakages occur.

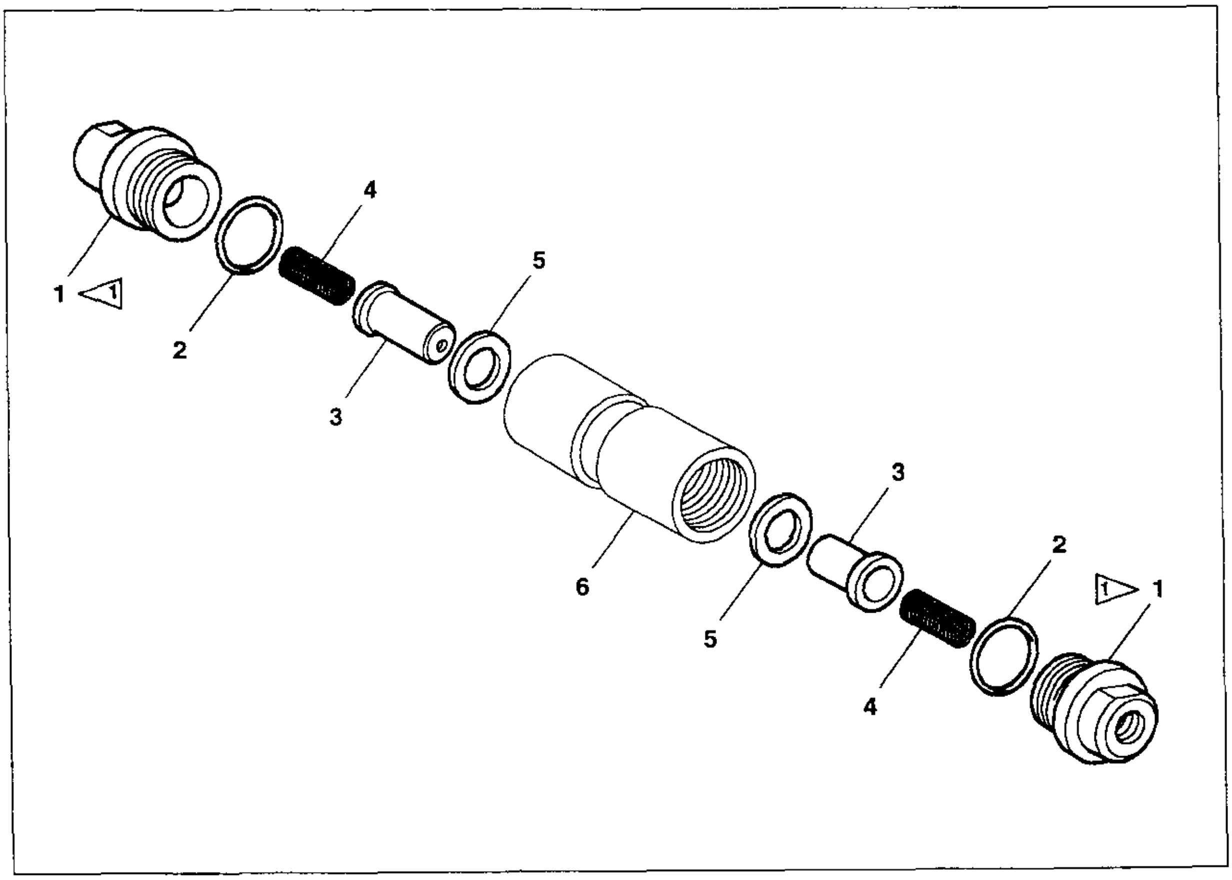


Fig. 4-13 Components of cushion valve

1. Plug - **2.** O-ring - **3.** Plunger - **4.** Spring - **5.** Retaining ring - **6.** Valve body.

1 45 - 55 daNm

4.3.5 STEERING CYLINDERS

The two double acting steering cylinders, with a rod and sleeve, are mounted, respectively, to the front and rear module of the frame.

The steering action of the loader is obtained by pushing out or retracting the rod.

Specifications:

Inner diameter of sleeve .... 60 mm
Diameter of rod ....35 mm
Cylinder stroke .... 395 ± 2 mm

Removal

Proceed as follows:

- drain the oil from the equipment reservoir;
- disconnect the oil pipes;
- from the rod side, loosen the screw securing the retaining plate and extract the pin;
- disconnect the pin greasing pipe of the pivot pin from the left cylinder;
- from the sleeve side, loosen the retaining plate securing screw and extract the pin.
- remove the cylinder assembly.

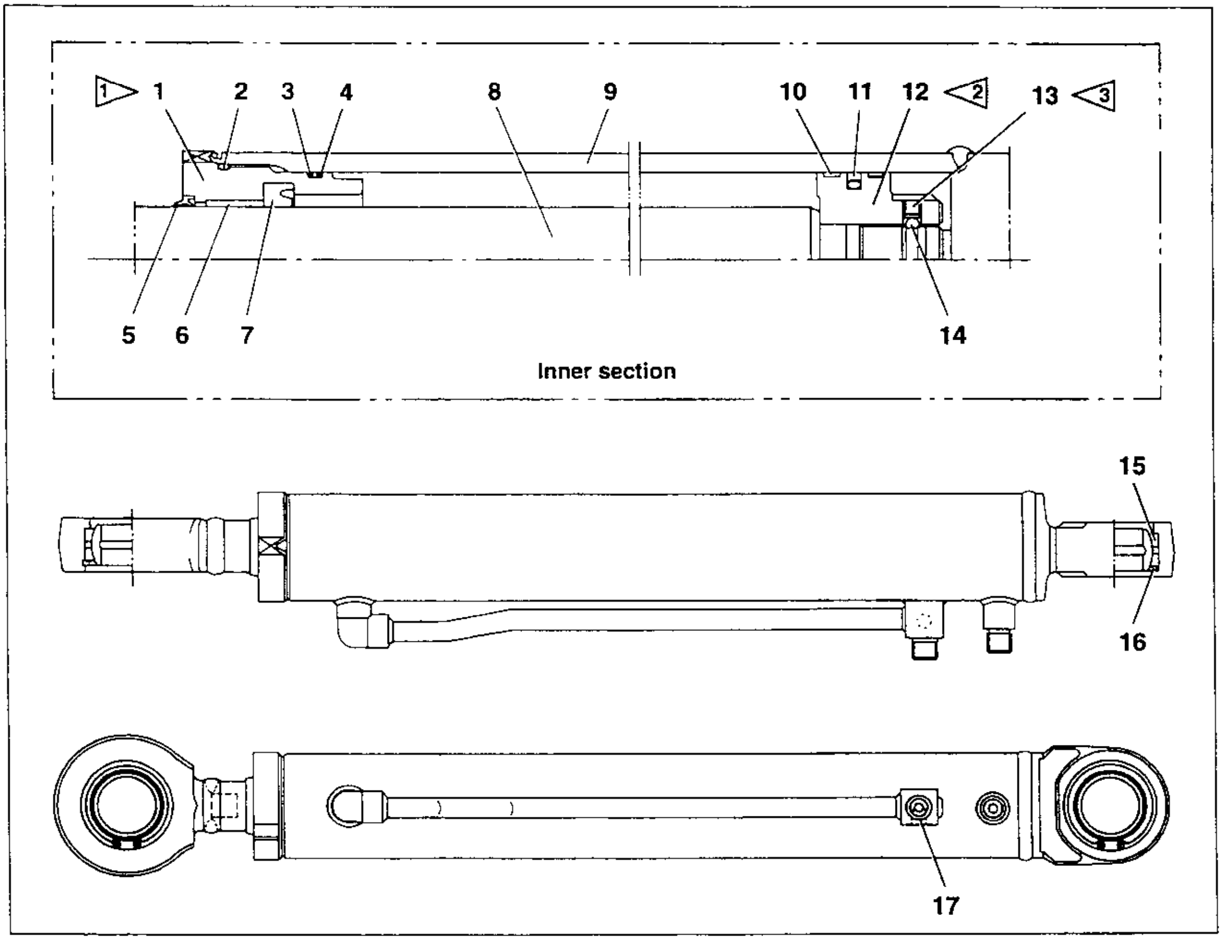


Fig. 4-14 Components of the steering cylinder

1. Cylinder sleeve - **2.** O-ring - **3.** Back-up ring - **4.** O-ring - **5.** Mud scraper seal - **6.** Bush - **7.** Sealing ring - **8.** Cylinder rod- **9.** Cylinder sleeve - **10.** Piston seal - **11.** O-ring - **12.** Piston - **13.** Locking screw - **14.** Steel ball - **15.** Pivoting bush - **16.** Snap ring - **17.** Pressure pick-up plug.

Notes - 1 31 daNm (M65 x 2)

2 40 daNm (M24 x 1.5)

3 0.7 daNm (M6 x 1)

Disassembly and reassembly

Loosen front sleeve (**1**) and pull-out rod (**8**) complete with piston (**12**).

Remove the screw locking the piston and loosen it.

If the ball joint shows an excessive play, replace it as follows:

- remove snap rings (**16**);
- using a punch or a press, extract bush (**15**) from its seat, taking care that the outer side of the bush only is pushed.

Check that the rod is free from imperfections, such as dents, burrs, or wear.
Check, using a ruler or by positioning it on a flat surface, that the rod is not bent.
Inspect the inside of the cylinder, to verify if scratches or wear require its replacement.
Replace all damaged parts.

Reassemble the cylinders, reversing the disassembly procedures, considering the following items:

- lubricate adequately the components;
- install new seals, ensuring a proper installation and correct position;
- tighten the piston to torque ◁2;
- tighten screw (**13**) to torque ◁3 and stake;
- tighten front sleeve (**1**) to torque ◁1.

Installation

Install the cylinder on the machine, reversing the removal procedure.

Check that after starting the engine and after several movements of the steering, the cylinder rod does not show oil leakages.

Handle all components with great attention. Do not place hands and fingers between components. Wear glasses, gloves and safety shoes.

4.3.6 MULTIPLE CHECK VALVE (for emergency steering)

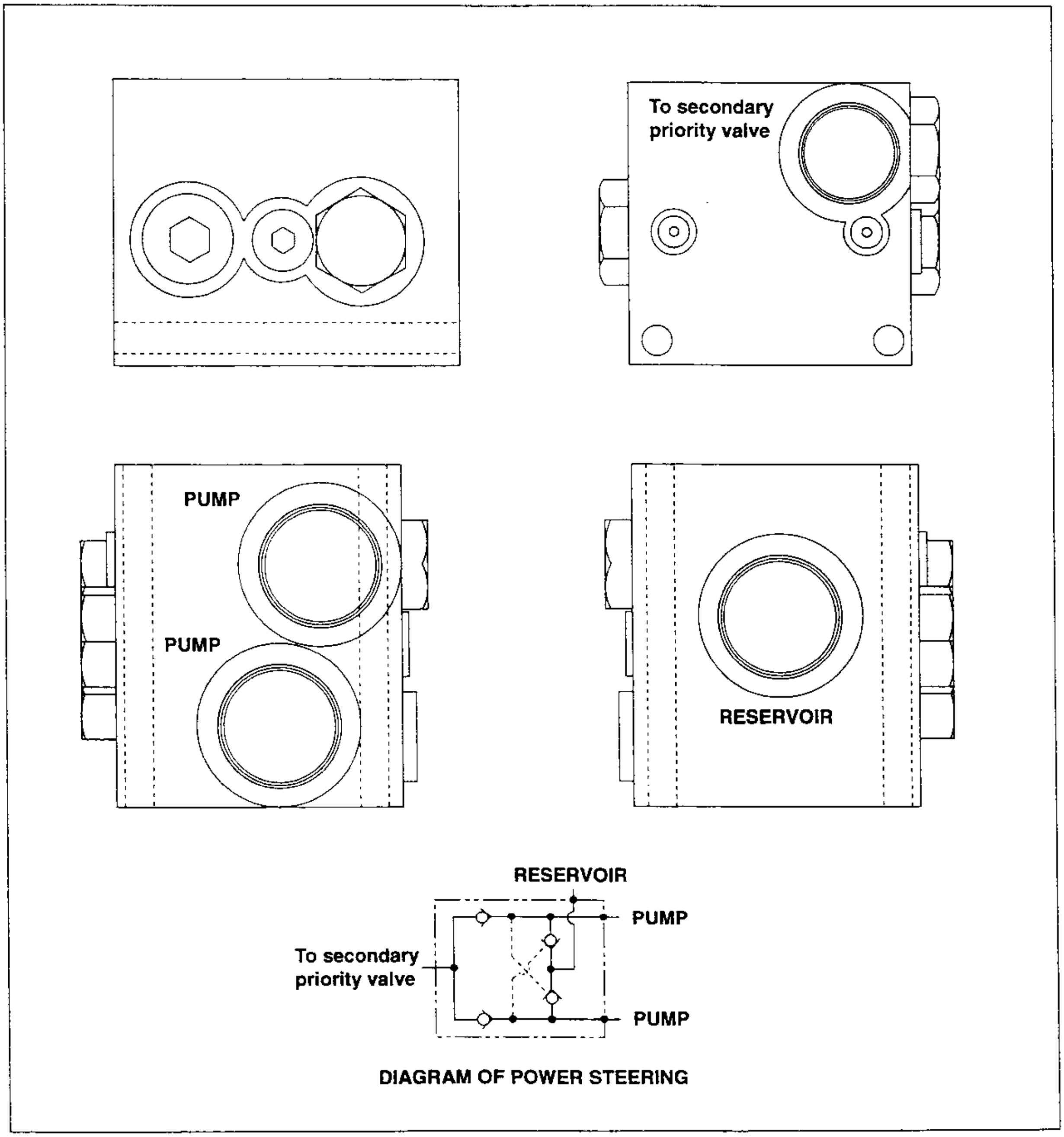


Fig. 4-15 Multiple check valve

The valve is located on the right side of the machine under the cab.

SECTION 5

BUCKET BOOMS AND FRAME

CONTENTS

5.1 LOAD HANDLING SYSTEM

The load handling system is operated by hydraulic cylinders and is used to dig, load and unload, and transport loads.

The linkage employed for the loading system is a Z-shape type which is simpler in design and produces more powerful bucket break-out force than the duplex or other types.

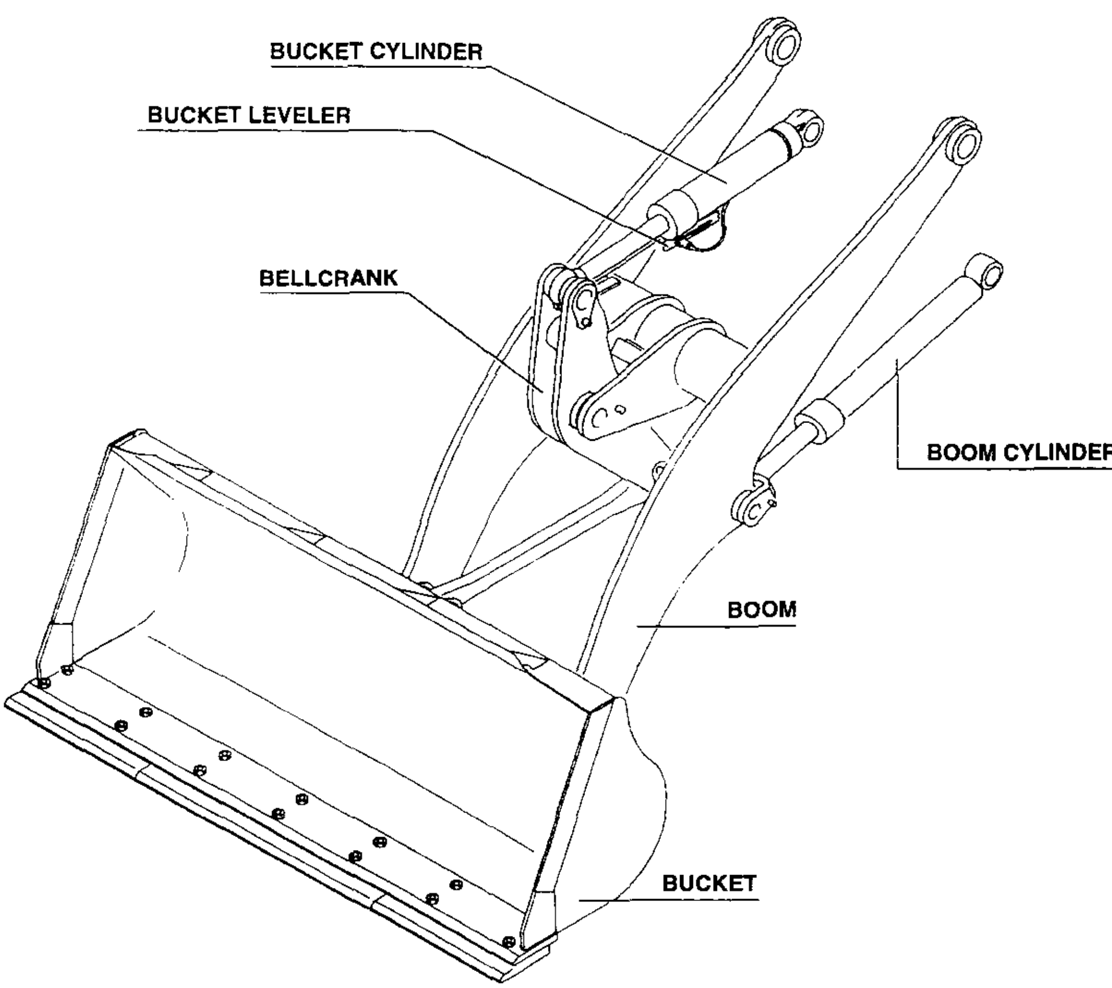


Fig. 5-1

5.2 BOOM, BELLCRANK AND BUCKET

	W110	W130
- Linkage	Z	Z
- Bucket capacity Heaped Struck	m^3 1.6 1.3	m^3 1.9 1.6
- Bucket automatic leveller		
- Boom kick-out		
- Weight Booms Bellcrank Pushrod Bucket	Kg 575 117 31 605	Kg 781 132 35 750

5.2.1 GENERAL DESCRIPTION

The load handling system consists of booms, bellcrank, pushrod, bucket, bucket cylinder, boom cylinders, and pins. The bucket leveler helps provide efficient load handling operation. All connecting pins of the load handling system have dust seals to prevent the entrance of water, mud or dust into the system. The three connecting pins of the bucket are provided with "O-rings". All the connecting pins are secured with lock bolts.

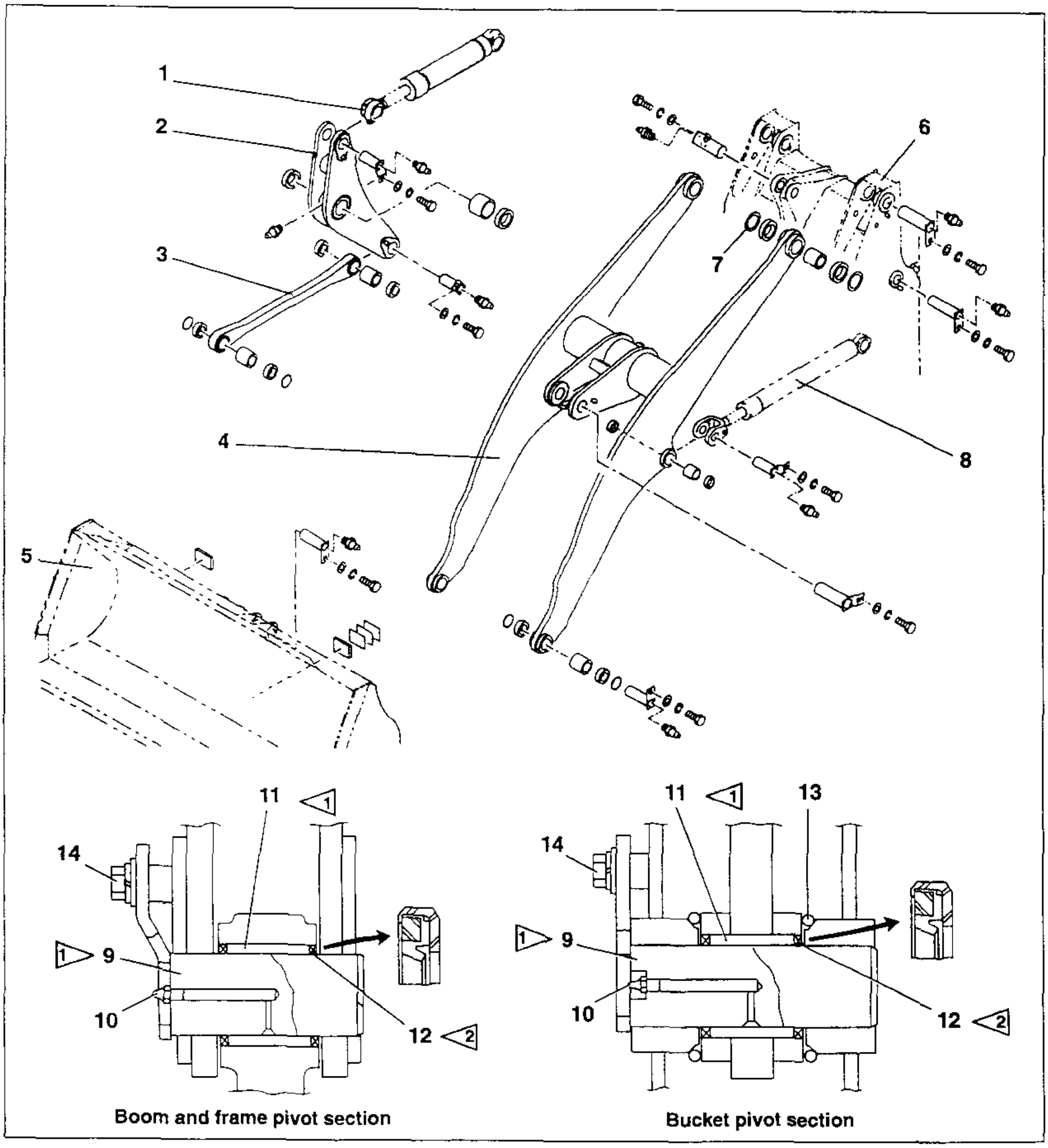


Fig. 5-2 Booms, bellcrank and bucket

Notes - 1 All pins, bushes and hubs: grease (apply before mounting the pins)

2 Install the mud scrapers with the lip toward the outside

1. BUCKET CYLINDER
2. BELLCRANK
3. PUSHROD
4. BOOM
5. BUCKET
6. FRONT FRAME
7. SPACER
8. BOOM CYLINDER
9. PIN
10. GREASE FITTING
11. BUSHING
12. DUST SEAL
13. O-RING
14. LOCK BOLT

5.2.2 BUCKET

The general purpose bucket with a bolt-on reversible cutting edge (DEB) is standard. The light-material bucket with welded cutting edge and the general-purpose bucket with bolt-on teeth are optionally available.
The bucket should be selected with due care, considering the condition of job sites, the nature of loads to be handled, and the operating conditions. A wrong bucket will cause an inefficient operation and may cause the malfunction of the load handling system as well.

General-purpose bucket with bolted reversible cutting edge, DEB

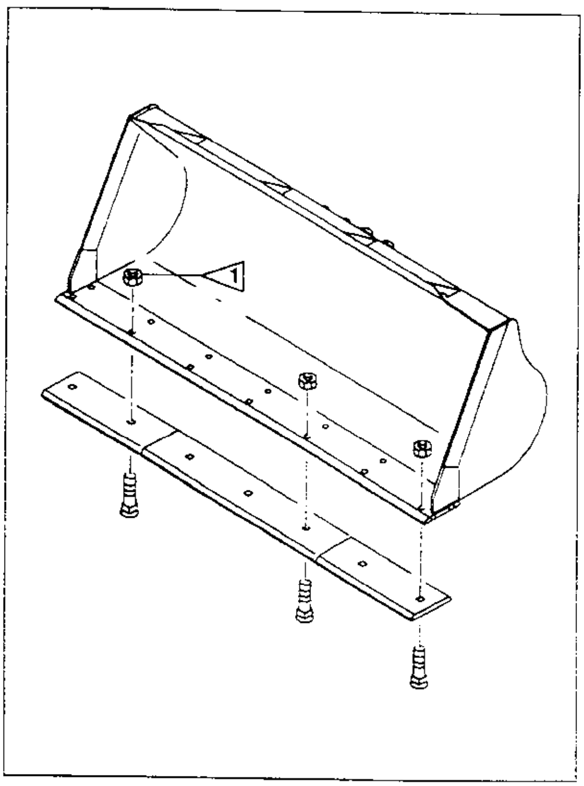


Fig. 5-3

Note - 1 Tightening torque 10.5 daNm

General-purpose bucket with bolt-on teeth

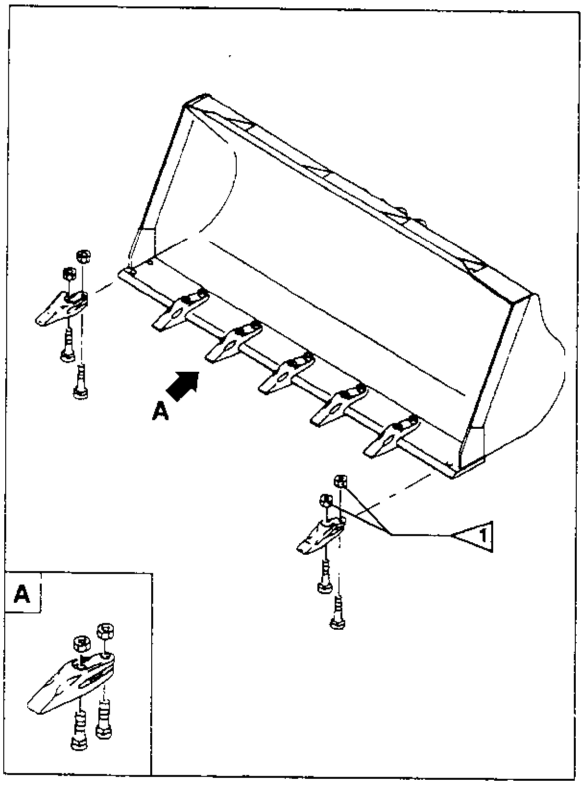


Fig. 5-4

Note - 1 Tightening torque 10.5 daNm

5.2.3 BUCKET LEVELER

With the control lever put in Roll-back after dumping the bucket, the bucket leveler automatically returns the control lever to neutral when the bucket is put in horizontal position.

Operation

As the bucket is rolled back, the bucket cylinder piston rod extends enough to let the leveler plate leave the sensing surface of the proximity switch (thus opening the electric circuit).

The proximity switch is connected to the solenoid detent coil of the control valve bucket section. The solenoid detent is thus released to let the control lever return to neutral, stopping the rolling back operation of the bucket.

Note - The bucket spool is a solenoid detent mechanism. When the bucket is rolled back beyond the horizontal line, no further electricity will flow to the solenoid detent coil so that the control lever detent mechanism won't work.

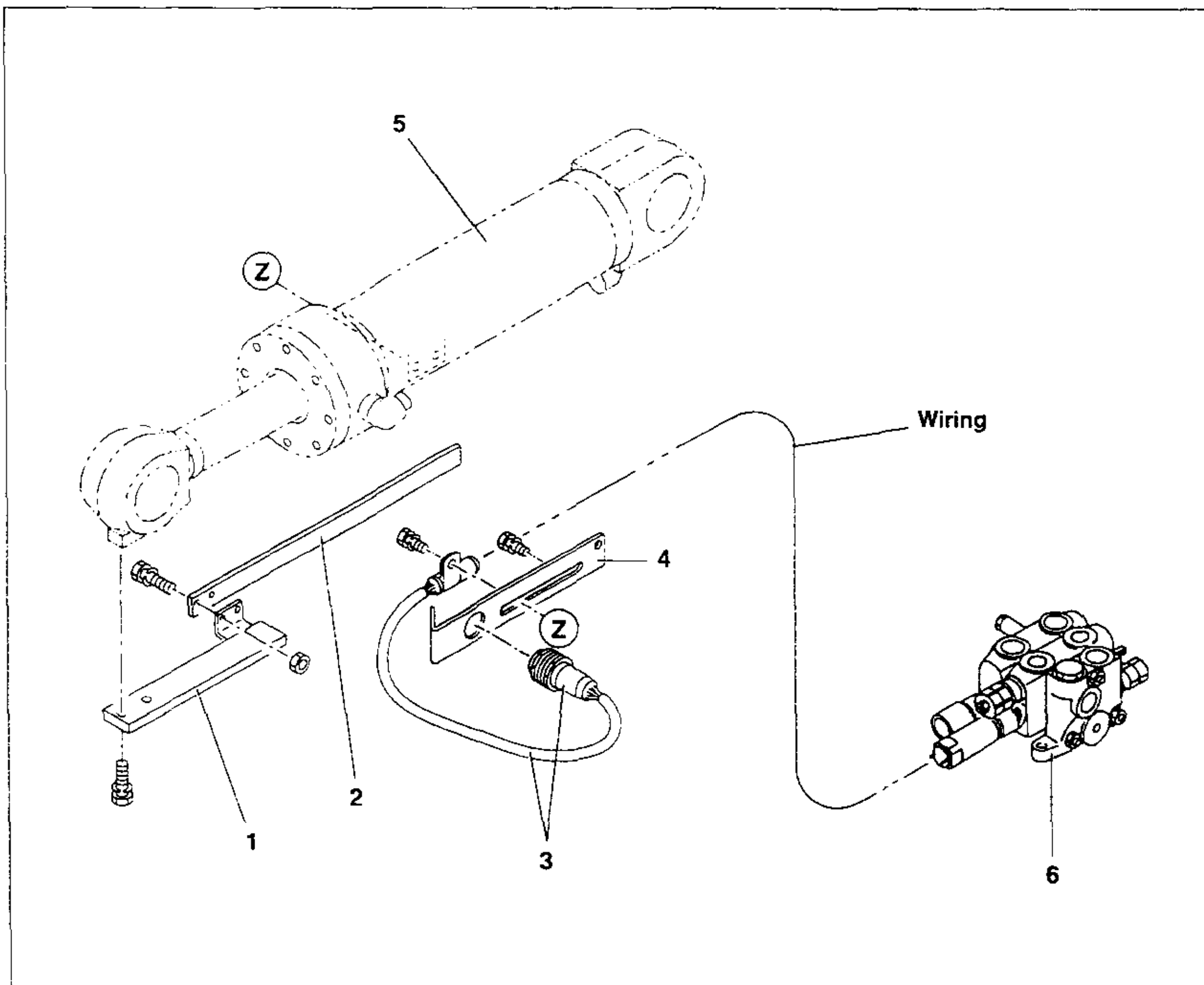


Fig. 5-5 Bucket leveler

1. BRACKET
2. LEVELER BAR
3. PROXIMITY SWITCH
4. BRACKET
5. BUCKET CYLINDER
6. CONTROL VALVE

5.2.4 BOOM KICKOUT (optional)

The boom kickout device stops the booms at a preset height during the lifting phase. With the control lever in RAISE position, the boom kickout device automatically returns the control lever into neutral when the booms are raised to a preset height, thus stopping the lifting operation of the booms.

Operation

1. When the booms are raised to a preset height, the level plate fitted to the boom leaves the sensing surface of the proximity switch (thus opening the electric circuit).
2. The proximity switch is connected to the solenoid detent coil of the control valve boom section. The solenoid detent is thus released to let the control lever return to neutral, stopping the lifting operation of the booms.

Note - The control valve of loaders equipped with the boom kickout device differs from that of the standard loaders.

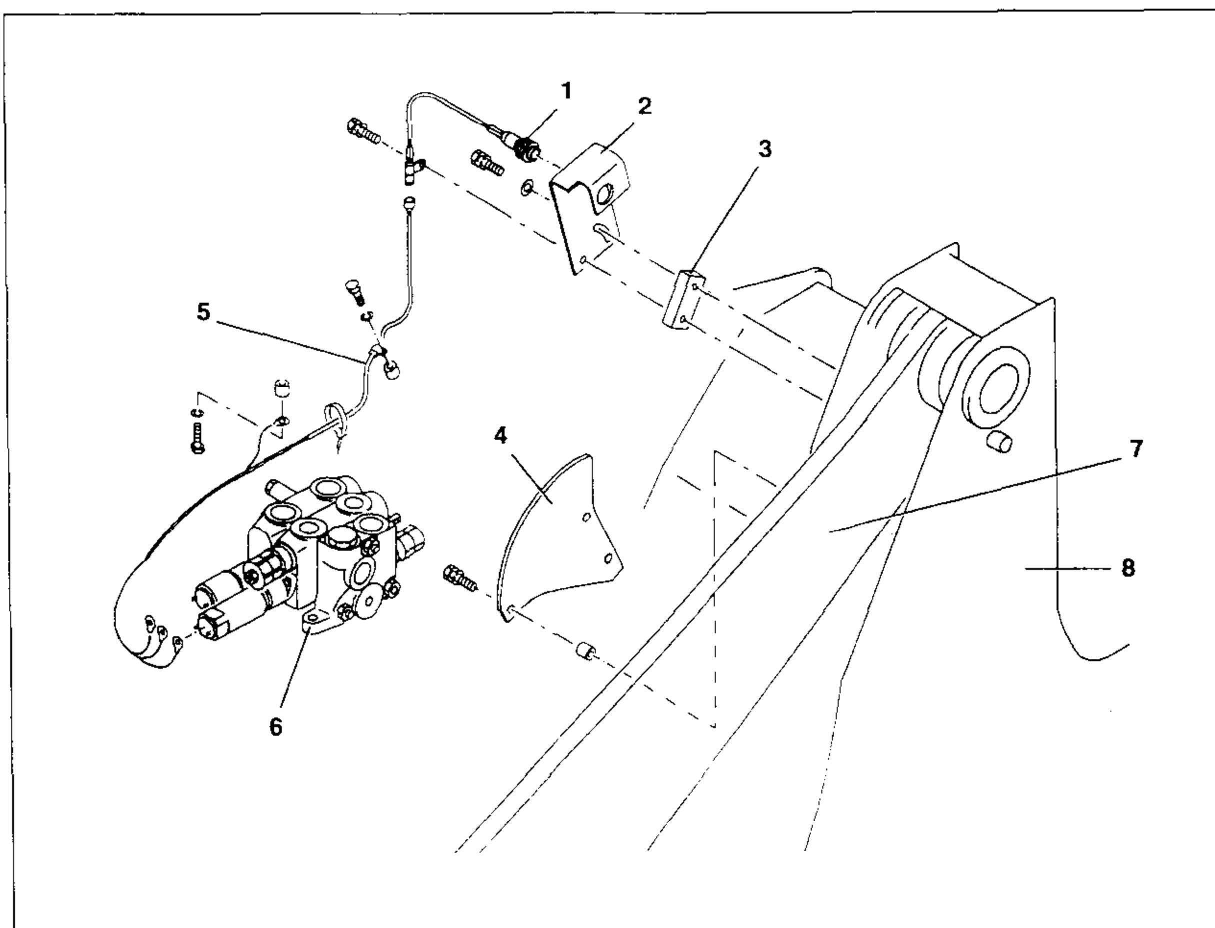


Fig. 5-6 Boom kickout device

1. PROXIMITY SWITCH
2. BRACKET
3. TAPPED PLATE
4. LEVEL PLATE
5. WIRING
6. CONTROL VALVE
7. BOOM
8. FRONT FRAME

5.3 FRAME PIVOT PINS

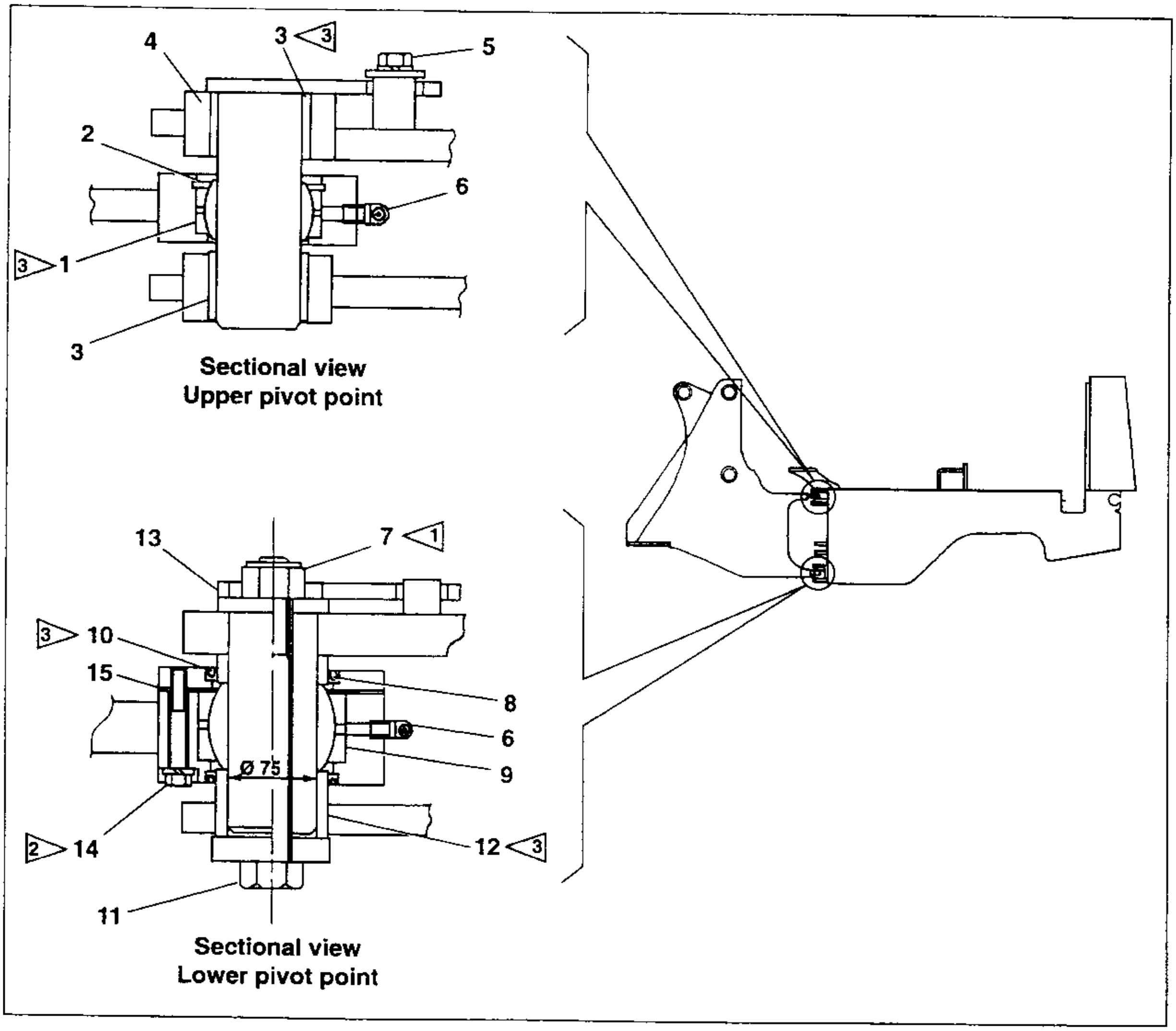


Fig. 5-7 Frame pivot points

Notes - 1▷ Tightening torque 56 daNm

2▷ Tightening torque 3.5 daNm

Threaded area: Loctite 262

3▷ Inner surface (prior to installation)

SPECIFICATIONS OF PINS

* Diameter of upper pivot pin 59.981 ÷ 60.000

** Diameter of lower pivot pin 74.966 ÷ 74.985

1. BUSH
2. SNAP RING
3. BUSH
4. UPPER PIVOT PIN DIA. 60 *
5. SECURING SCREW M12X25
6. GREASE NIPPLE
7. NUT (apply LOCTITE 262)
8. SEAL
9. BUSH
10. COLLAR
11. SCREW M24X2X185
12. COLLAR
13. LOWER PIVOT PIN DIAM. 75 **
14. SCREW M10X80
15. SHIMS

SECTION 6

EQUIPMENT HYDRAULIC SYSTEM

CONTENTS

6.1 GENERAL DESCRIPTION

The equipment hydraulic system receives hydraulic power by the main pump and, through a control valve, directs the oil flow to the functions required to actuate the equipment.

The hydraulic system is composed of: main pump, control valve, wires and control valve control, oil reservoir and hydraulic pipes.

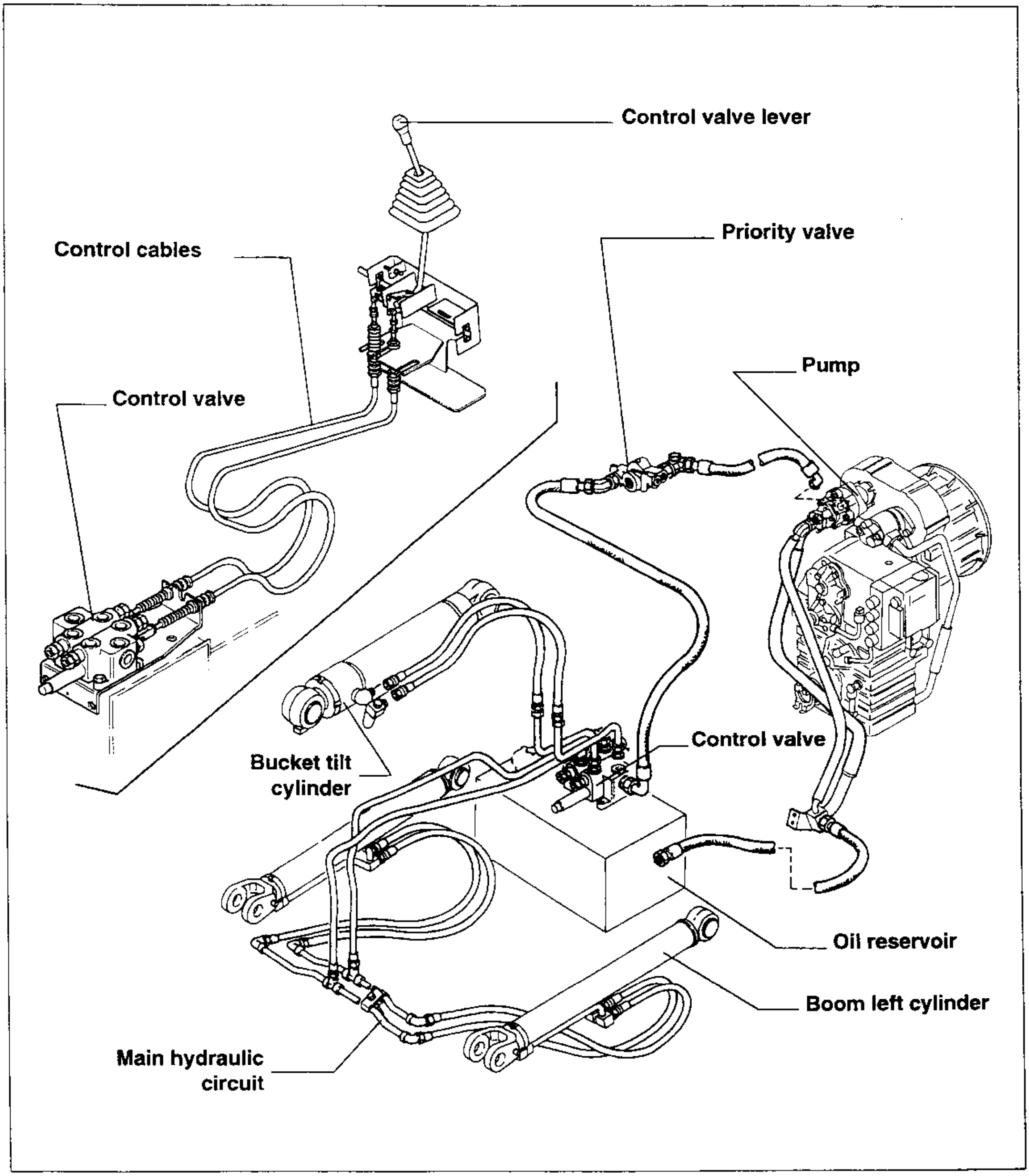


Fig. 6-1 Equipment hydraulic system

6.2 OIL CIRCUIT

The hydraulic system of the loader is composed of the equipment hydraulic system and the steering hydraulic system.
For the steering hydraulic system, please refer to section "4 - STEERING SYSTEM".

6.2.1 EQUIPMENT HYDRAULIC CIRCUIT

The oil sucked from the hydraulic oil reservoir, by the main pump, is delivered to the priority valve from which two circuits divert: equipment hydraulic circuit and steering hydraulic circuit.
The oil required by the equipment hydraulic circuit is delivered to the control valve. When the control valve is in neutral, the oil goes through it and returns to the hydraulic oil reservoir. With the control valve in control position, the oil goes through the ports open by the spools and reaches the cylinders.
The oil discharged by the cylinders returns to the control valve that in turn directs it to the return filter.

Fig. 6-2a GENERAL DIAGRAM OF EQUIPMENT HYDRAULIC SYSTEM (3 SPOOL-MECH. CONTROL)

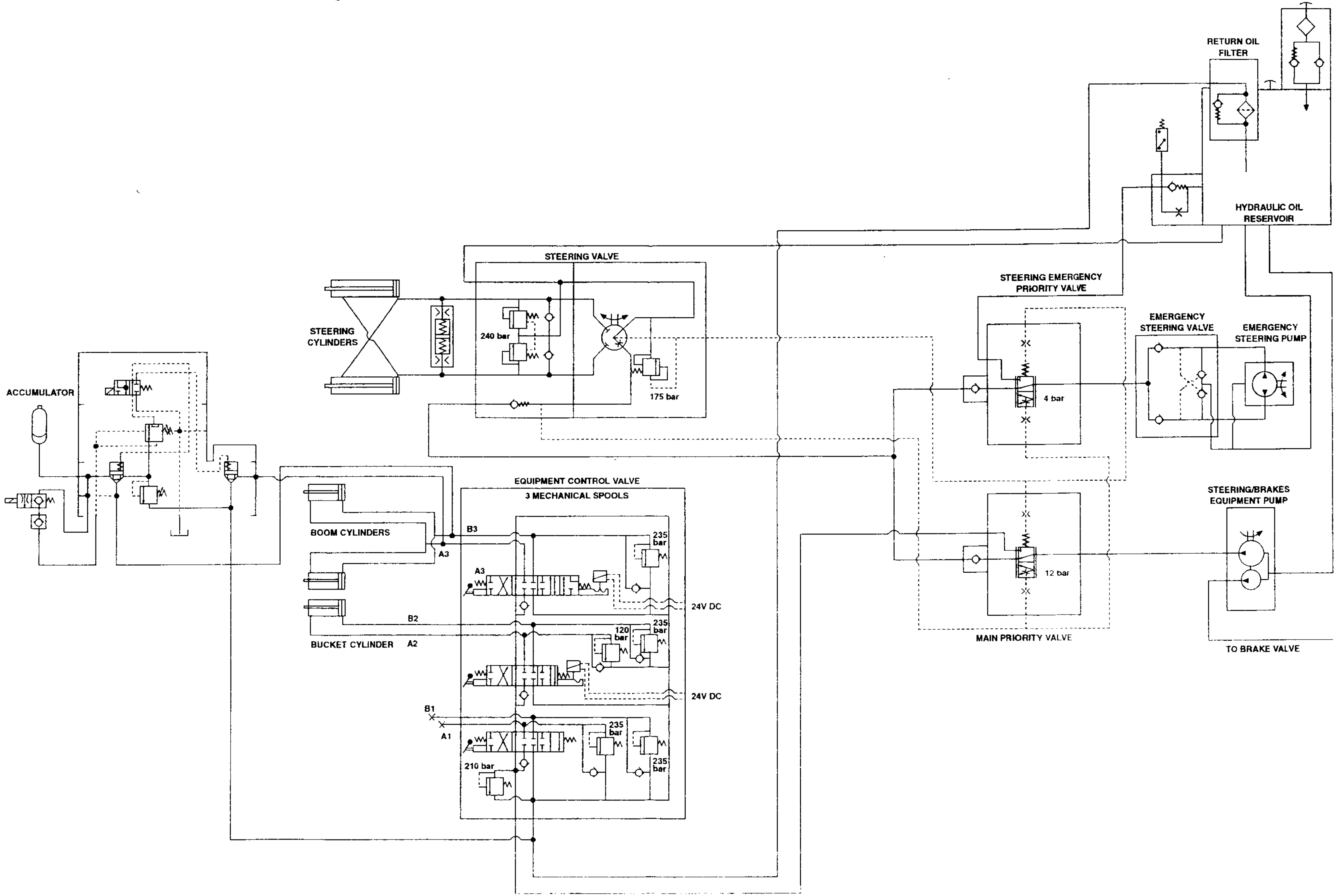
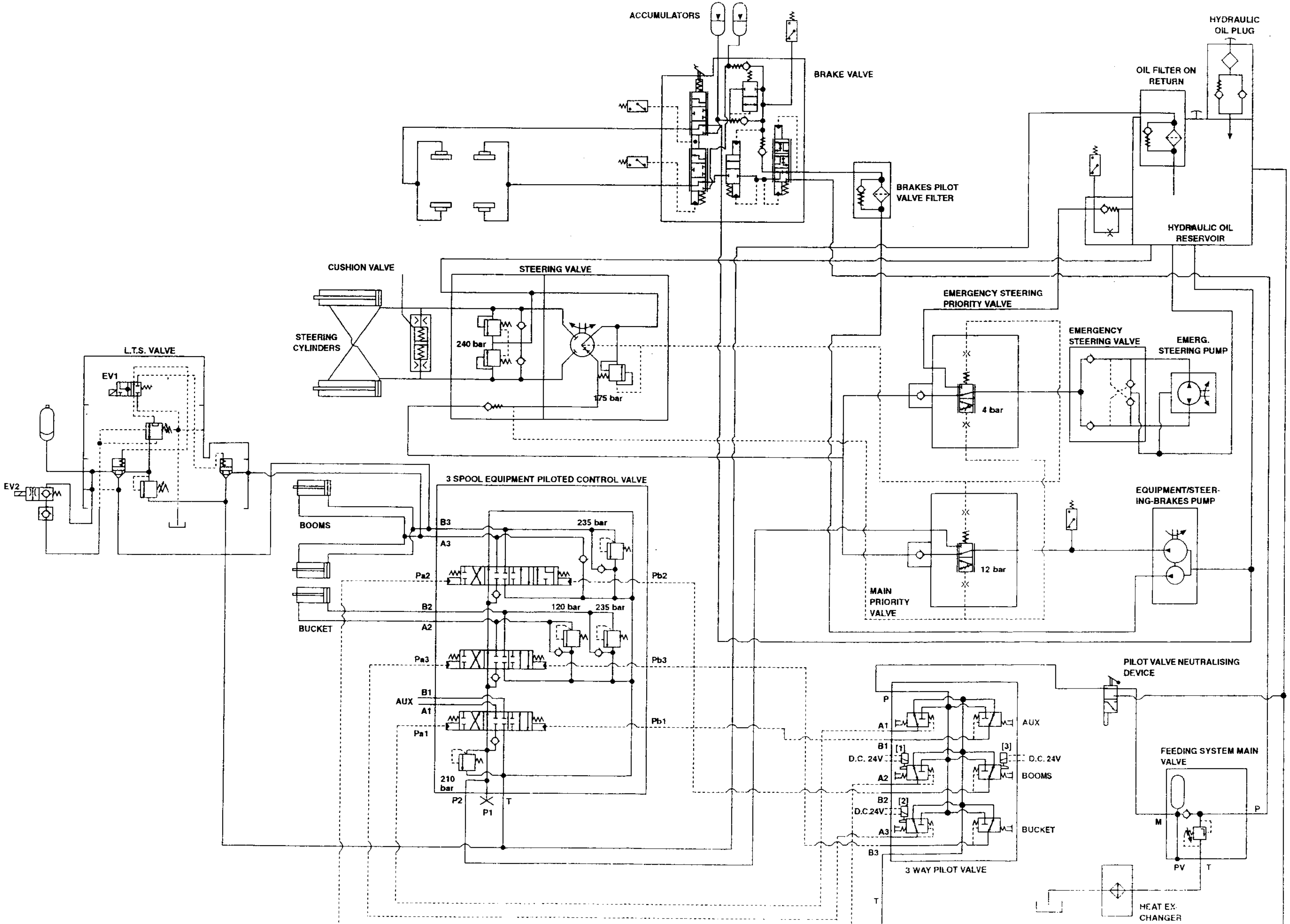


Fig. 6-2b GENERAL DIAGRAM OF EQUIPMENT HYDRAULIC SYSTEM (3 SPOOL-PILOTED CONTROL)



6.3 HYDRAULIC SYSTEM PUMP

The control circuit of the hydraulic cylinders is powered by a double hydraulic pump.
One section of the pump feeds, through the main priority valve, the steering system and the equipment system. The other section powers the brakes system and the pilot valve (variant).
The steering system has priority, thus it receive oil first. If the steering is not used, the main priority valve diverts the oil to the equipment system. The pump sucks oil from the hydraulic reservoir and sends it, when the steering system is not used, to the equipment control valve. The pressure established in the delivery circuit is proportional to the performance requested and it is, in any case, limited by the relief valve. This valve, set at 210 bar, regulates the maximum pressure of the system, discharging the excess pressure.

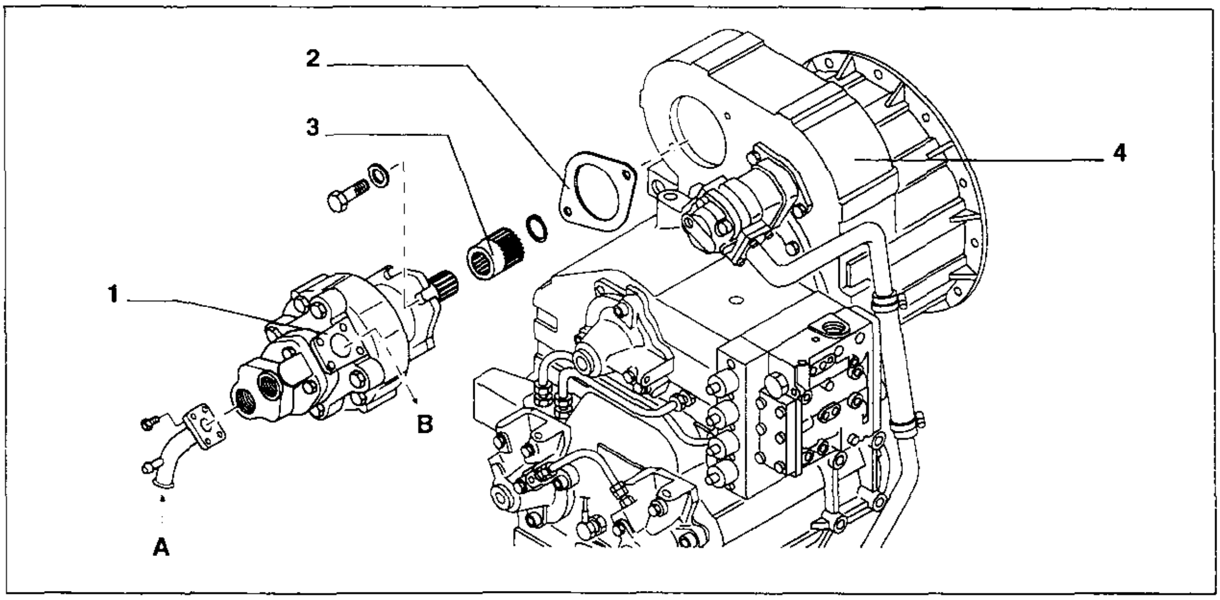


Fig. 6-3 Installation of pump on transmission-converter group

A. from HYDRAULIC OIL RESERVOIR
B. from PRIORITY VALVE
1. EQUIPMENT PUMP
2. PUMP DRIVE SLEEVE
3. PUMP DRIVE SLEEVE
4. TORQUE CONVERTER

Equipment - steering section	
Designation:	Kayaba KFP5171
Type:	gear
Drive:	gear
Flow rate at nominal speed:	165 ltr/min (43.5 USGal)
Maximum pressure:	210 bar
Engine/pump speed ratio:	0.9875 : 1 (W130: 0.944 : 1)

Brakes (and pilot valve) section	
Designation::	Kayaba KP1011CBG
Type:	gear
Drive::	gear
Flow rate at nominal speed:	26 ltr/min (6.9 USGal)
Maximum pressure:	30 bar
Engine/pump speed ratio	0.9875 : 1 (W130: 0.944 : 1)

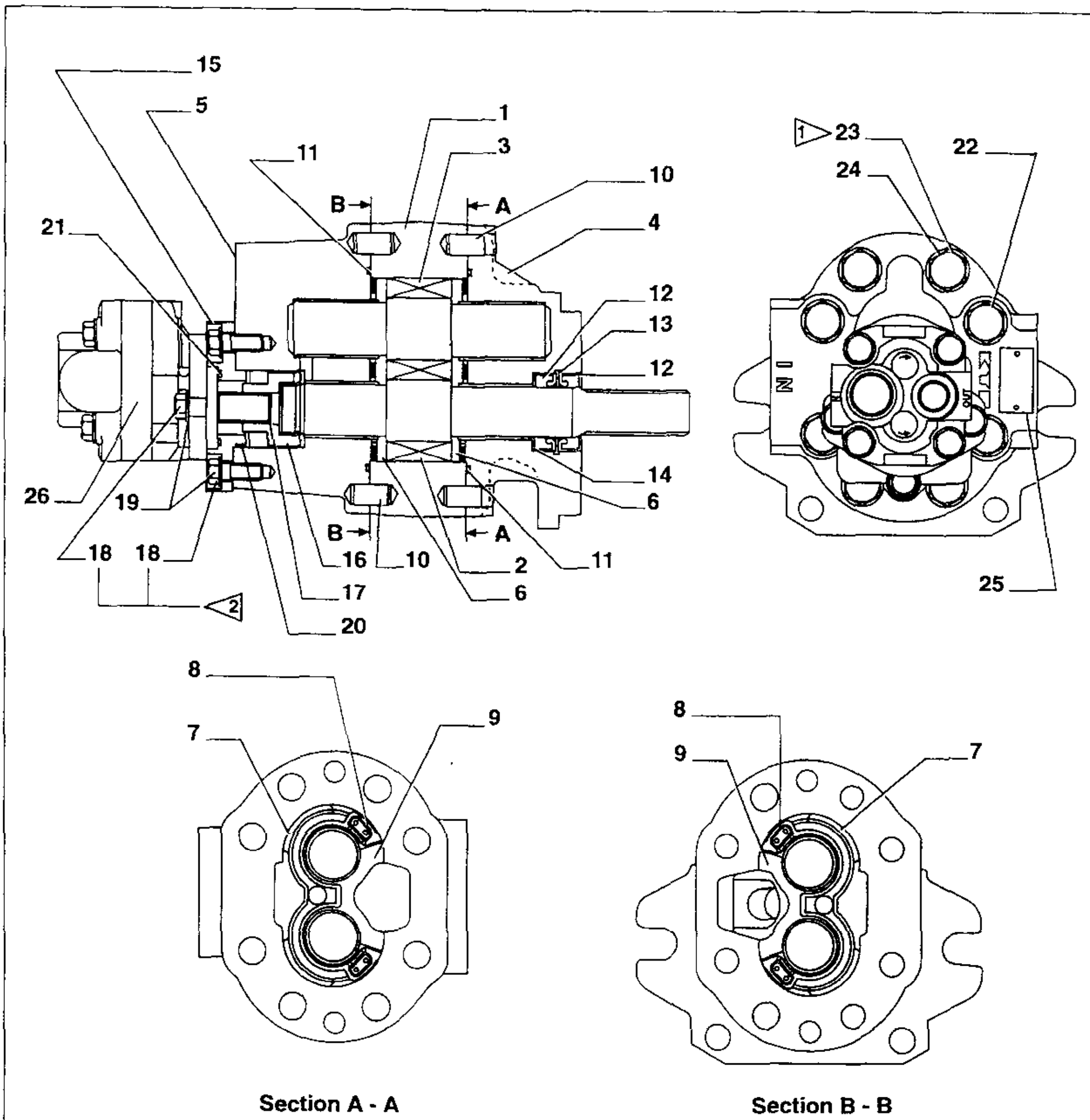


Fig. 6-4 **Equipment/steering pump sections**

Note - 1 13.2 to 13.7 daNm

2 4.2 to 4.6 daNm

1. INTERMEDIATE PLATE
2. DRIVING GEAR
3. DRIVEN GEAR
4. MOUNTING FLANGE
5. CLOSING PLATE
6. PLATE
7. SEAL
8. BACK-UP RING
9. PLATE
10. DOWEL
11. O-RING
12. SEAL
13. ELASTIC RING
14. WASHER
15. ADAPTER
16. COUPLING SLEEVE
17. ELASTIC RING
18. SCREW
19. WASHER
20. O-RING
21. O-RING
22. SCREW
23. SCREW
24. WASHER
25. I D PLATE
26. BRAKES PUMP

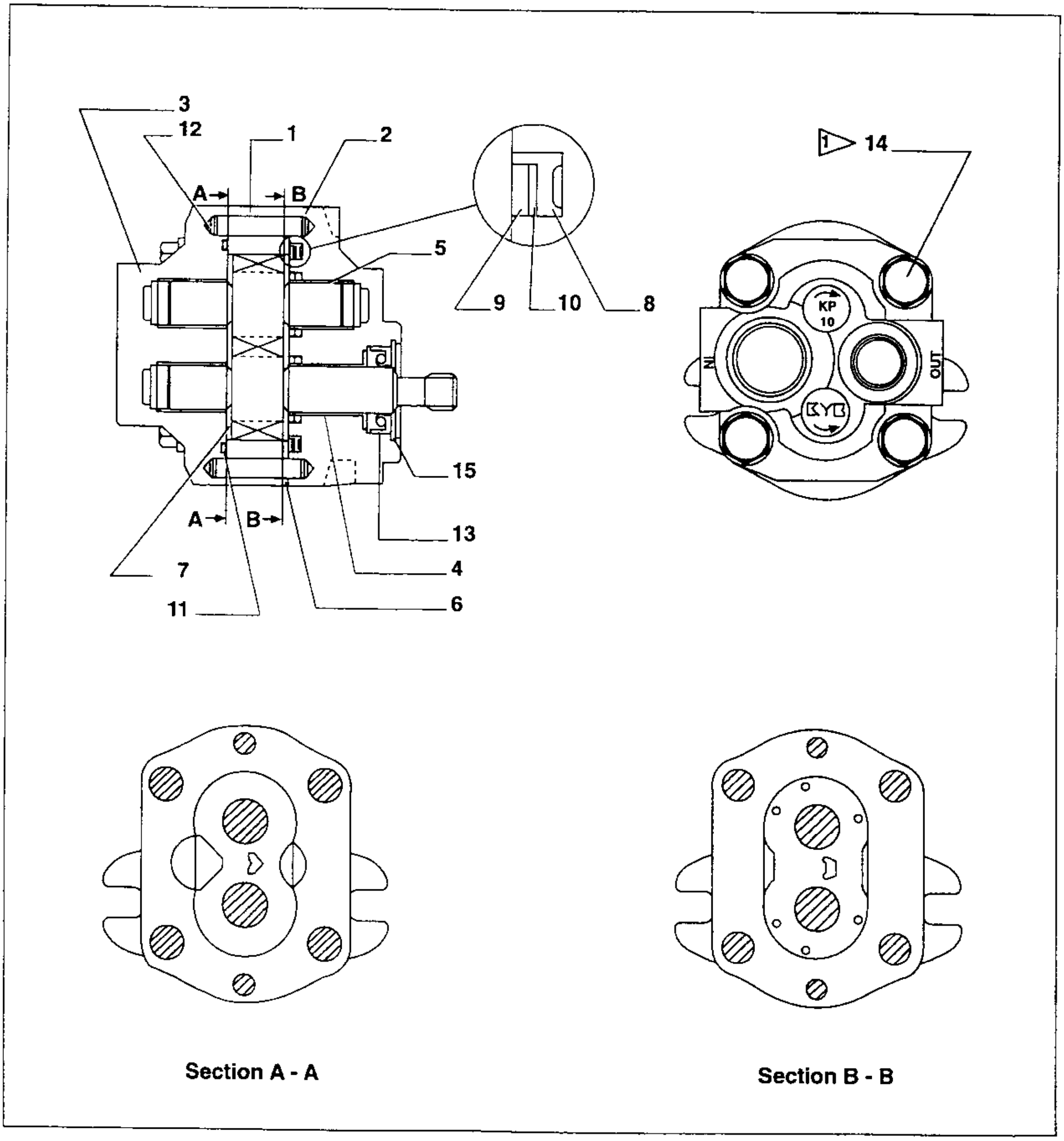


Fig. 6-5 **Brakes pump section**

Note - 3.4 to 3.9 daNm

1. INTERMEDIATE PLATE
2. MOUNTING FLANGE
3. CLOSING PLATE
4. DRIVING GEAR
5. DRIVEN GEAR
6. PLATE
7. PLATE
8. SEAL
9. SEAL
10. SEAL
11. O-RING
12. DOWEL
13. SEAL
14. SCREW
15. SNAP RING

6.3.1 INSPECTION AND REPAIR OF EQUIPMENT - STEERING PUMP

When disassembling, mark all components so that they can be re-installed in the correct position.
After cleaning each individual item, inspect all the parts of the pump.

1) Gear plate

One of the methods to obtain a better volumetric efficiency of a gear pump is a design allowing the end of the teeth stay in contact with the inner wall of the chamber containing the gear itself. Consequently, once the pump starts running, marks left by the gear teeth are shown around the suction port (fig. 6-6)
The contact mark is normal as long as it is less than 1/2 the inner circumference of the gear cavity.
Dimension **a** of the mark depth (fig. 6-7) is normal if it as about 0.5 mm (.00196 in). When dimension **a** exceeds 0.15 mm (0.00589 in) also the shaft and bearings can wear out. Thus, these items as well, must be thoroughly checked.
If **a** is ≥ 0.15 mm (0.00589 in), replace the pump with a new one.

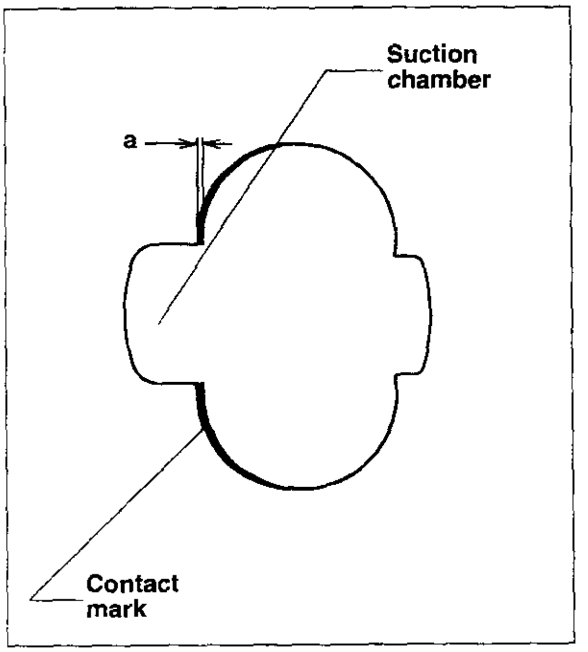


Fig. 6-7 Dimension of mark depth

2) Driving and driven gear

In case the shaft or the gear surface shows roughness felt by running a finger nail, or in case the surface of the teeth shows excessive wear zones, it is necessary to replace the item.
If the shaft diameter **d** is less than 31.627 mm (1.2451 in), replace the set of gears with a new one.

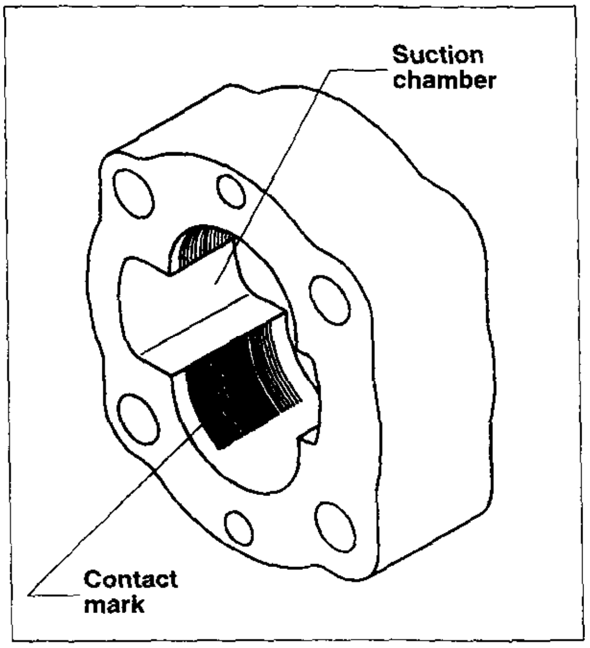


Fig. 6-6 Gear intermediate plate

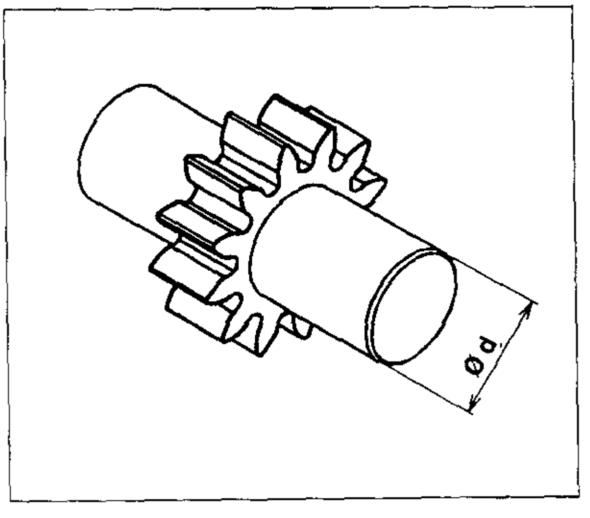


Fig. 6-8

3) Pressure plate (9, fig. 6-4)

As shown in fig. 6-9, the pressure plate, under normal conditions, shows smoothed irregularities on the copper alloy side of the surface touching the gear.
If during the disassembly operation, the following situation is found, replace the part with a new one:
- In case the level of roughness found shows several scratches that can be felt by a finger nail.
- In case the dimension of the thickness is less than 6.656 mm (0.02620 in).

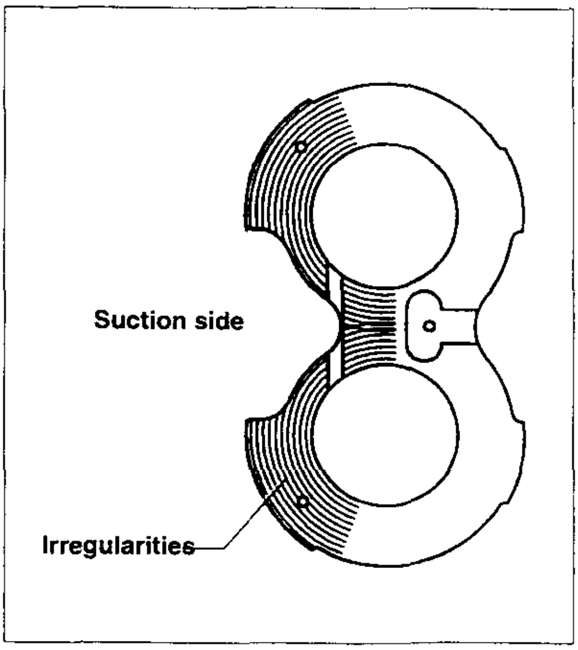


Fig. 6-9 Irregolarità sulle piastre

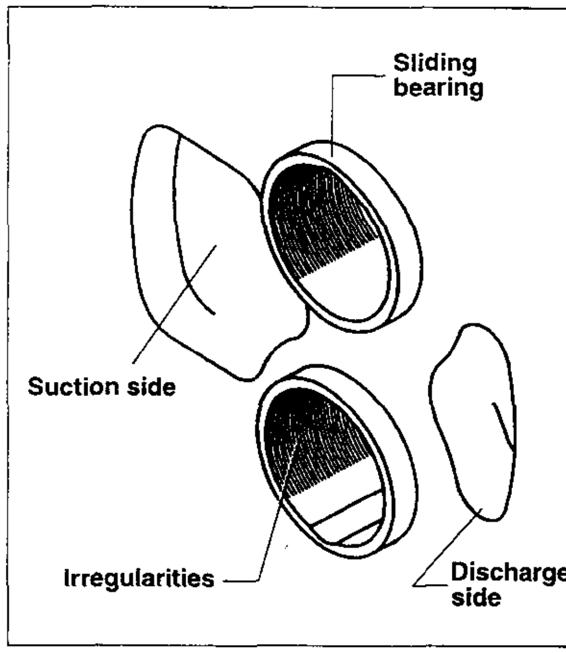


Fig. 6-10 Irregularities on the bearings

4) Mounting flange (4) and covering plate (5) (fig. 6-4)

Regarding the mounting flange and the cover plate, check to find out if there is an eventual wear in the bearing zone (fig. 6-10).
If the teflon film is worn-out and the red surface of the copper base metal is showing for an arc larger than 150° along the inner circumference of the bearings, change the part.

6.4 EQUIPMENT CONTROL VALVE

3 SPOOL (MECHANICAL)
EQUIPMENT CONTROL VALVE

Model: .... KVS - 120 H - 3 MD
Type: .... series - 3 control spools
Sequence of spools: .... AUXILIARY → BUCKET → BOOM → T
Setting of main valve: .... 210 bar
Setting of safety and anti cavitation valve (**A2**): .... 120 bar
Setting of safety and anti cavitation valve (**A1 - B1 - B2 - B3**): .... 230 ± 5 bar
Flow rate: .... 120 ltr/min (31.7 US Gal)
Weight: .... 27 Kg (59.5 lbs)

3 SPOOL (PILOTED) - VARIANT
EQUIPMENT CONTROL VALVE

Model:: .... KVS - 120 H - 3
Type: .... In series - 3 hydraulically piloted control spools
Sequence of spools: .... AUXILIARY → BUCKET → BOOM → T
Setting of main valve: .... 210 bar
Setting of safety and anti cavitation valve (**A2**): .... 120 bar
Setting of safety and anti cavitation valve (**A1 - B1 - B2 - B3**): .... 230 ± 5 bar
Flow rate: .... 120 ltr/min (31.7 US Gal)
Weight: .... 27 kg (59.5 lbs)

6.4.1 GENERAL DESCRIPTION

The multiple body control valve with 3 control spools, one of which optional, is composed of an intake and outlet section and sections for the equipment control spools. The oil ducts inside the control valve are of a series type.

Note - For the removal - installation of the control valve from the machine, please refer to Fig. 6-15.

1) **Pressure relief valve**
   The control valve is equipped with a pressure relief valve protecting the entire equipment hydraulic system, limiting the max. operating pressure at 210 bar.

2) **Safety and anticavitation valves on actuators**

   These valves protect the single circuits from sudden pressure picks due to mechanical shocks on the equipment and are mounted on the single spools of the control valve.
   The aux., bucket and boom cylinders ports, are equipped with safety valves discharging the excess oil pressure, when the cylinders are involved by considerable loads, so that a pressure pick, higher than the pre-established value, is generated, thus protecting the cylinders and the pipes.

3) Stopping devices

Two devices, electrically powered at 24 Volt D.C., operate to keep the boom spool in the raise position and the bucket spool in the bucket roll-in position.

DESCRIPTION OF FUNCTIONS
MECHANICAL CONTROL VALVE KVS 120H - 3MD

FUNCTION	SPOOL No.	SPOOL MOV.	STROKE	TYPE OF DETENT	ACTUATING FORCE ON SPOOL	RELEASING FORCE ON SPOOL
AUXILIARY FUNCTION		IN/OUT (P → B) (P → A)	± 8 MM	NONE	170 - 200 N	—
BUCKET ROLL-IN	2	IN (P → B)	8 MM	ELECTRIC	108 - 127 N	147 - 245 N
BUCKET TILT	2	OUT (P → A)	8 MM	NONE	108 - 127 N	—
BOOM RAISE	3	IN (P → B)	8 MM	ELECTRIC	113 - 146 N	149 - 316 N
BOOM LOWERING	3	OUT (P → A)	8 MM	NONE	113 - 146 N	—
FLOAT	3	OUT	16 MM	MECHANICAL	—	147 - 294 N

PORTS (DIMENSIONS AND TYPE)

P		PF	3/4 JIS O-RING TYPE
T		PF	1 JIS O-RING TYPE
A1	B1	PF	3/4 JIS O-RING TYPE
A2	B2	PF	3/4 JIS O-RING TYPE
A2	B2	PF	1 JIS O-RING TYPE

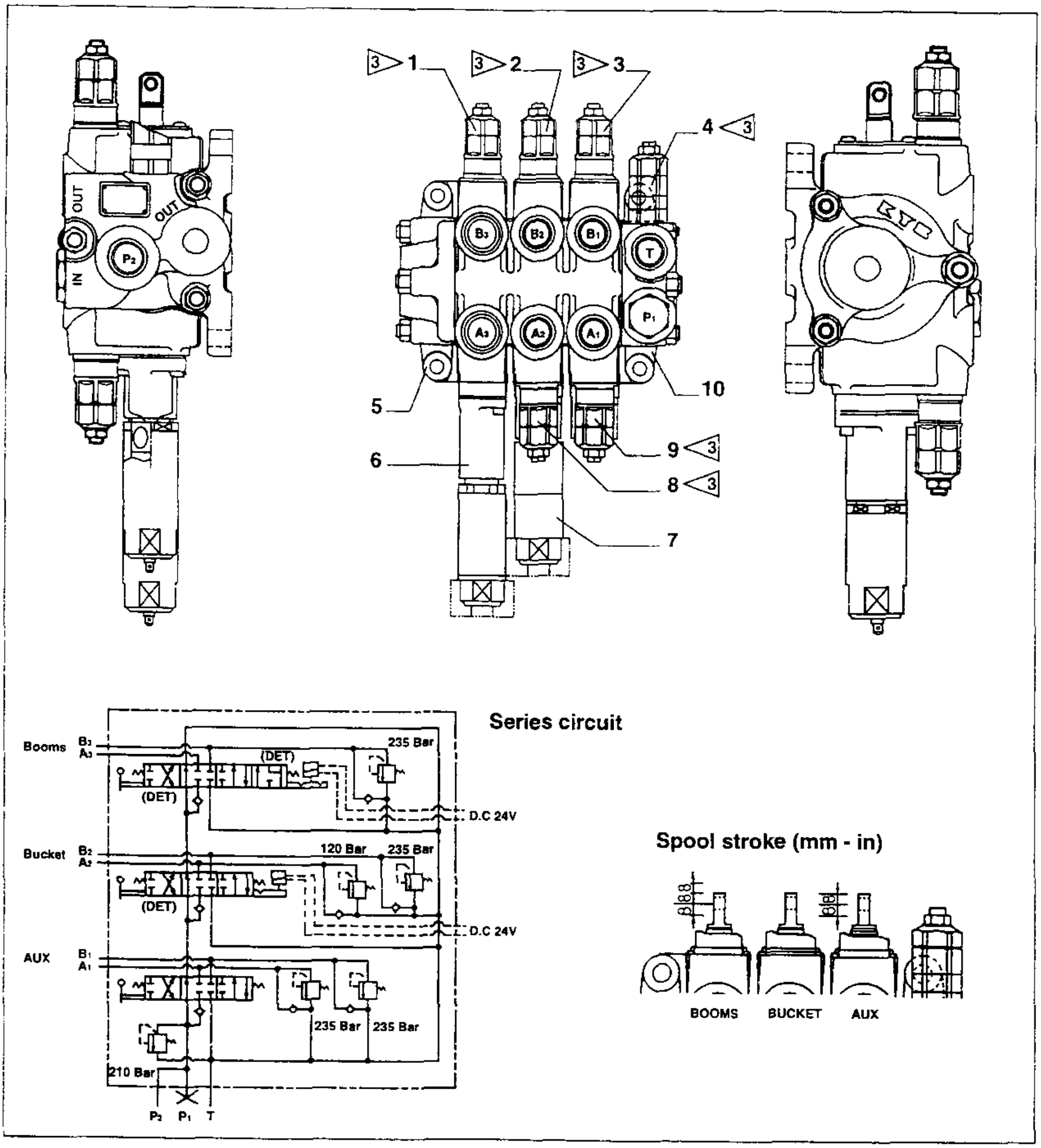


Fig. 6-11 3 spool equipment control valve (mechanical control)

Note - [1] [2 points]: 6.6 daNm (48 ft-lbs)

[2] 10.3 daNm (74.5 ft-lbs)

[3] [6 points] 7.8 ÷ 8.8 daNm (57 ÷ 64 ft-lbs)

1. SAFETY & ANTI CAVITATION VALVE (235 bar)
2. SAFETY & ANTI CAVITATION VALVE (235 bar)
3. SAFETY & ANTI CAVITATION VALVE (235 bar)
4. PRESSURE RELIEF VALVE (210 bar)
5. OUTLET SECTION
6. BOOMS SPOOL SECTION
7. BUCKET SPOOL SECTION
8. SAFETY & ANTI CAVITATION VALVE (120 bar)
9. SAFETY & ANTI CAVITATION VALVE (235 bar)
10. INLET SECTION

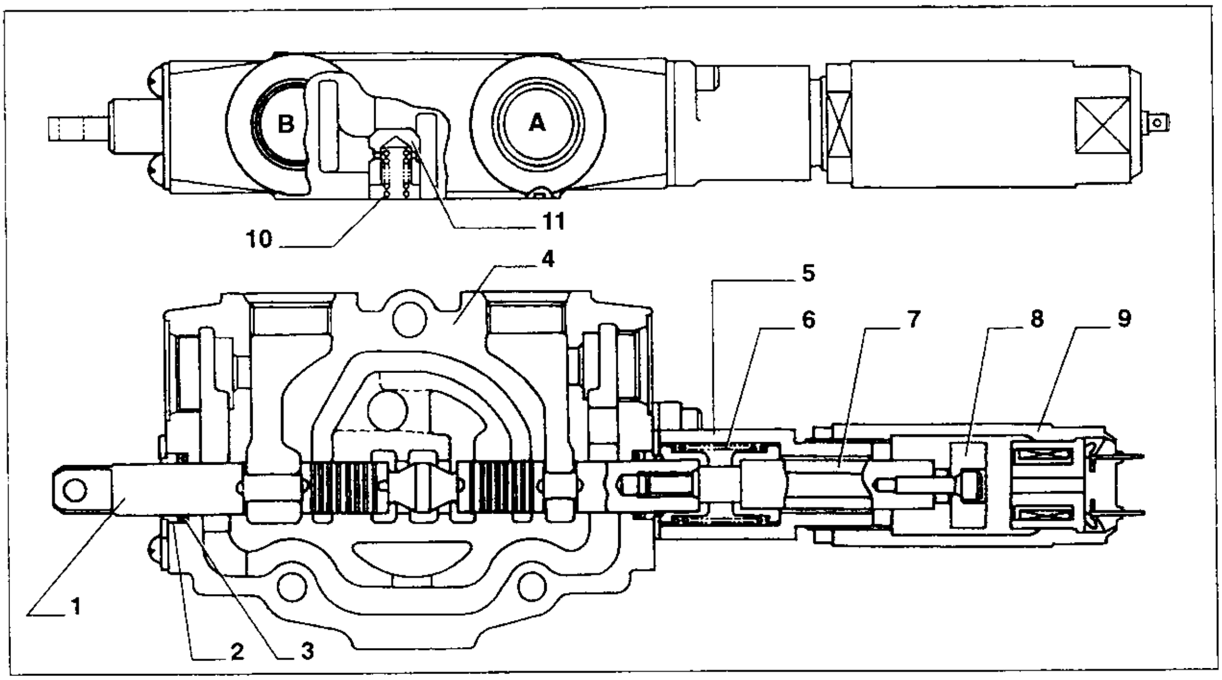


Fig. 6-12 Configuration of "Bucket" section of control valve (mechanical)

1. SPOOL
2. MUD SCRAPER
3. SEAL
4. CONTROL VALVE BODY
5. COVER
6. SPRING
7. PIN
8. PLATE
9. SOLENOID ASSEMBLY
10. CHECK VALVE SPRING
11. CHECK VALVE

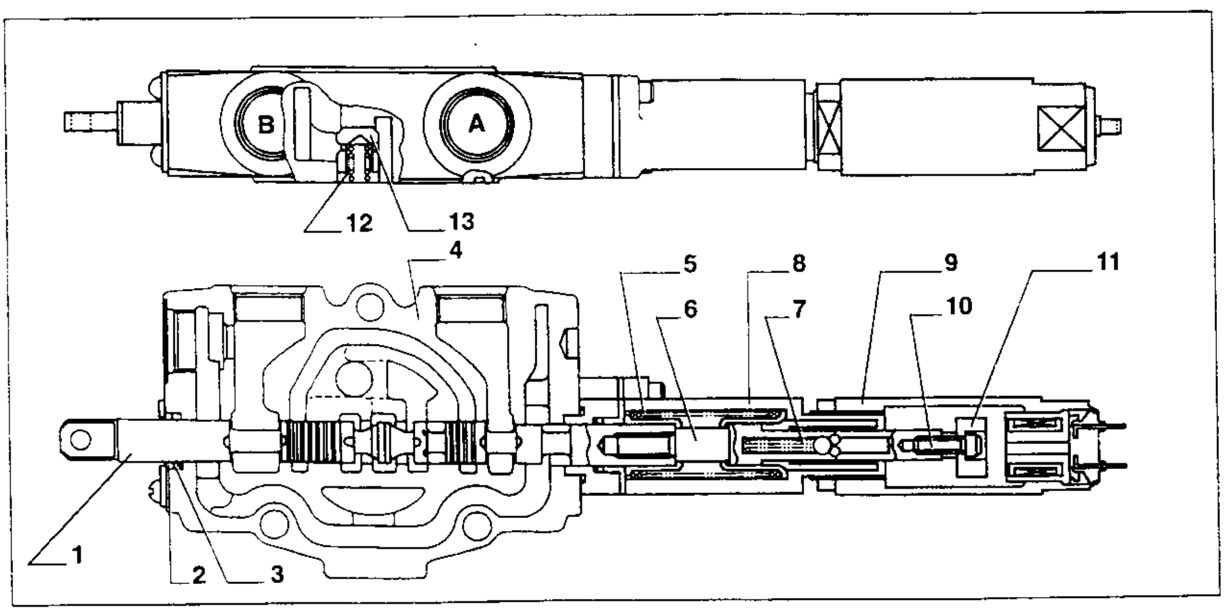


Fig. 6-13 Configuration of "Booms" section of control valve (mechanical)

1. SPOOL
2. MUD SCRAPER
3. SEAL
4. CONTROL VALVE BODY
5. SPRING
6. SPOOL STOP PIN
7. SPRING
8. COVER
9. SOLENOID ASSEMBLY
10. SCREW
11. PLATE
12. CHECK VALVE SPRING
13. CHECK VALVE

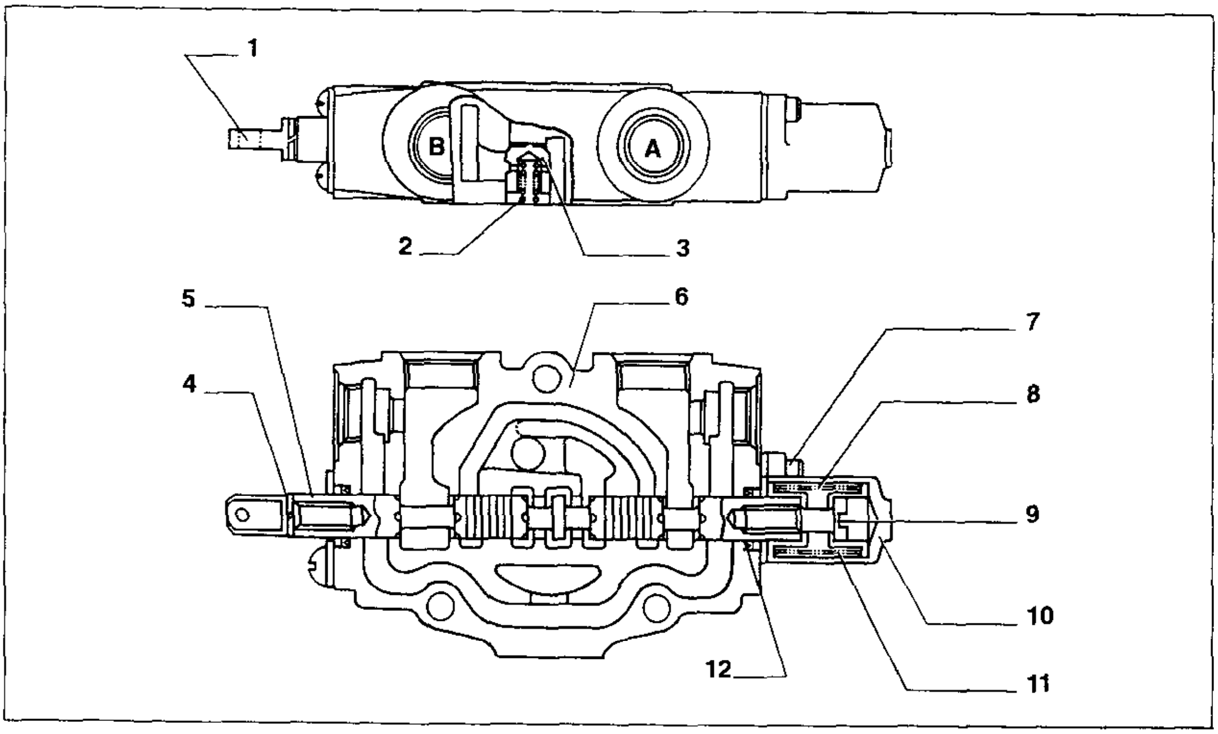


Fig. 6-14 Configuration of "Aux." section of control valve (mechanical)

1. SPOOL THREADED END
2. CHECK VALVE SPRING
3. CHECK VALVE
4. WASHER
5. SPOOL
6. CONTROL VALVE BODY
7. SPRING COVER SECURING SCREW
8. CUP
9. SPACER SCREW
10. COVER
11. SPRING
12. SPOOL SEAL

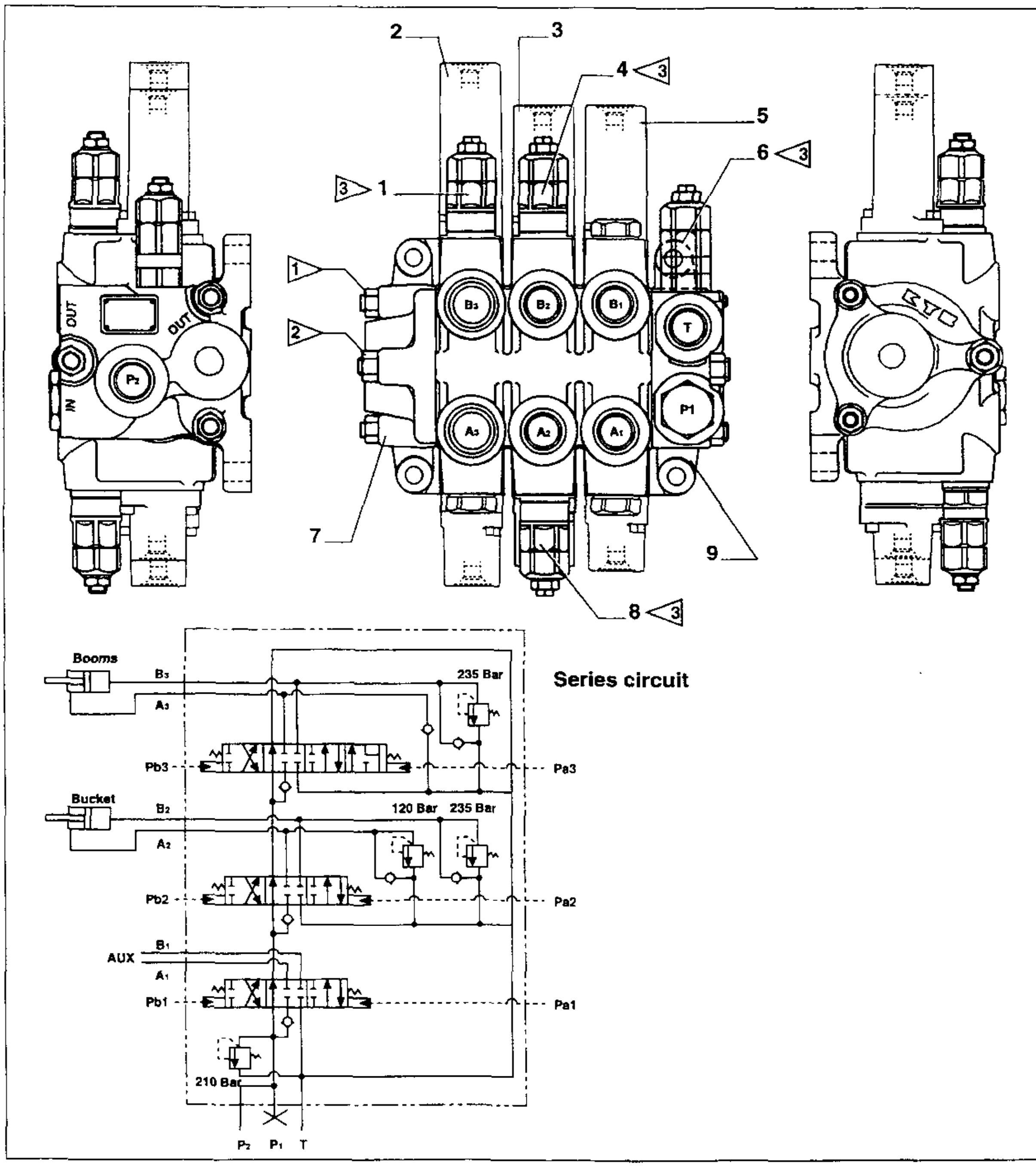


Fig. 6-15 3 spool equipment control valve (piloted control)

Note - [1] [2 points]: 6.6 daNm (48 ft-lbs)

[2] 10.3 daNm (74.5 ft-lbs)

[3] [4 points] 7.8 ÷ 8.8 daNm (57 ÷ 64 ft-lbs)

1. SAFETY & ANTI CAVITATION VALVE (235 bar)
2. BOOMS SPOOL SECTION
3. BUCKET SPOOL SECTION
4. SAFETY & ANTI CAVITATION VALVE (235 bar)
5. AUXILIARY SPOOL SECTION
6. PRESSURE RELIEF VALVE (210 bar)
7. OUTLET SECTION
8. SAFETY & ANTI CAVITATION VALVE (120 bar)
9. INLET SECTION

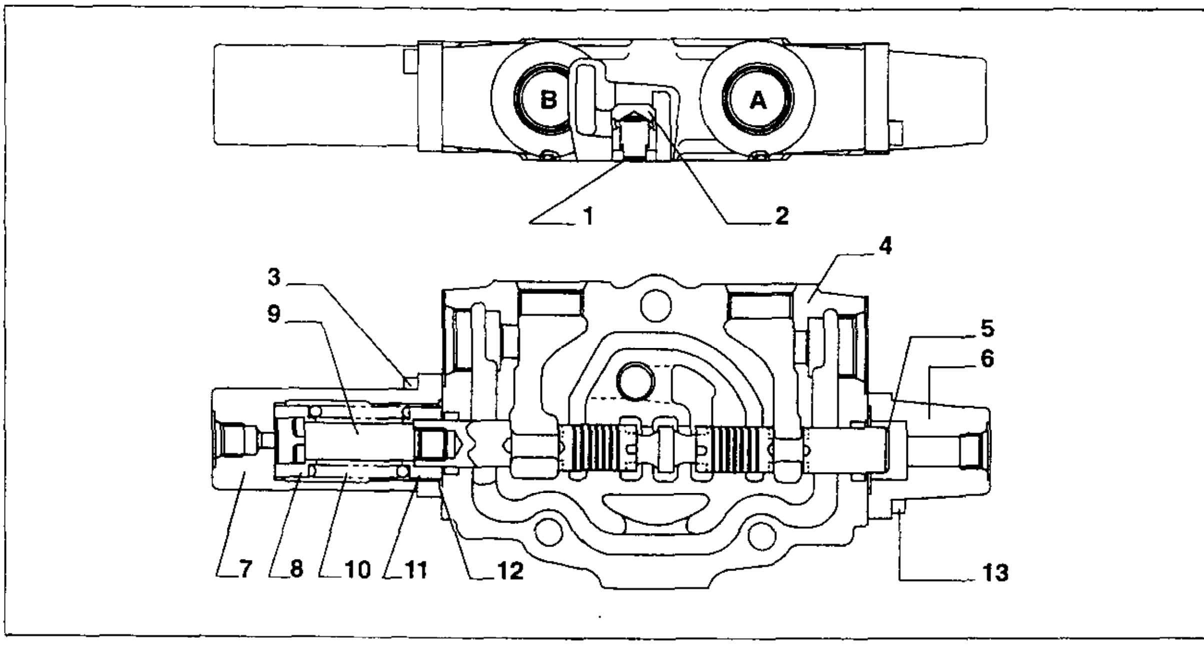


Fig. 6-16 Configuration of "Bucket" section of control valve (piloted)

1. CHECK VALVE SPRING
2. CHECK VALVE
3. COVER SECURING SCREW
4. CONTROL VALVE BODY
5. SPOOL
6. FRONT COVER
7. REAR COVER
8. CUP
9. SPACER SCREW
10. SPRING
11. CUP
12. O-RING
13. COVER SECURING SCREW

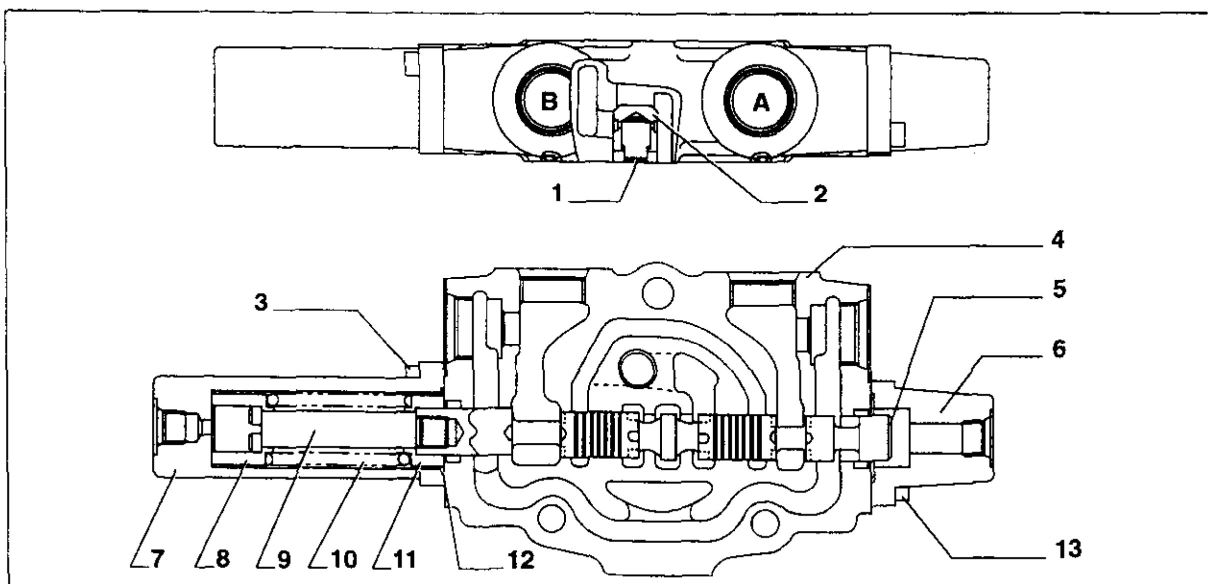


Fig. 6-17 Configuration of "Booms" section of control valve (piloted)

1. CHECK VALVE SPRING
2. CHECK VALVE
3. COVER SECURING SCREW
4. CONTROL VALVE BODY
5. SPOOL
6. FRONT COVER
7. REAR COVER
8. CUP
9. SPACER SCREW
10. SPRING
11. CUP
12. O-RING
13. COVER SECURING SCREW

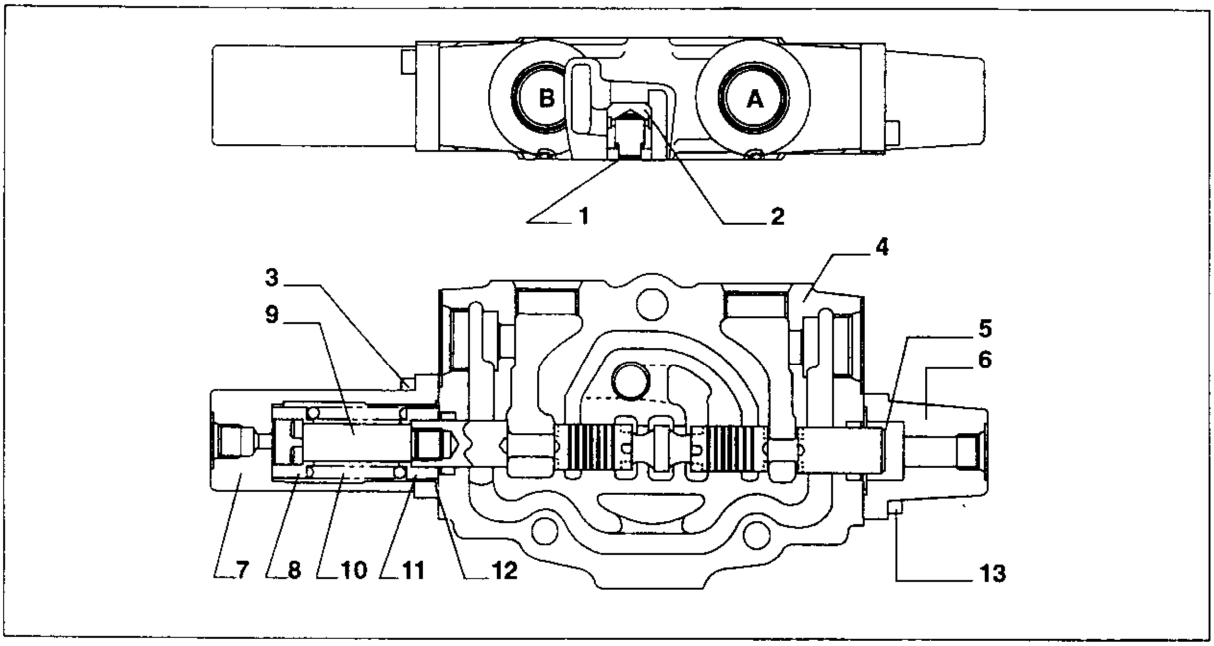


Fig. 6-18 Configuration of "Auxiliary" section of control valve (piloted)

1. CHECK VALVE SPRING
2. CHECK VALVE
3. COVER SECURING SCREW
4. CONTROL VALVE BODY
5. SPOOL
6. FRONT COVER
7. REAR COVER
8. CUP
9. SPACER SCREW
10. SPRING
11. CUP
12. O-RING
13. COVER SECURING SCREW

6.4.2 OPERATION OF CONTROL VALVE

When a control lever is actuated, the movement of the spools changes the oil flow inside the control valve so that pressurised oil coming from the priority valve is, as required, sent to the bucket cylinder and the booms cylinders.
The booms "Float" and "max. raise" position and the bucket "Roll-in" position have holding devices, in the mechanical control version, operating automatically, holding the spool in detent position, thus preventing it from returning into neutral position, when the operator releases the equipment control lever. The control lever returns automatically to neutral from all the other equipment positions, besides the "Float", "max. raise" and "Roll-in" positions. In piloted version control valves, on the other hand, the spool detent devices are located in the equipment pilot valve. These devices allow, when required, maintaining the above positions of the equipment.

1) Control valve in neutral

1. When the spools of the bucket and booms sections are in neutral, ports (**A**) (cylinder rod side) and (**B**) (cylinder bottom side) are closed by the spools.

2. Oil sent to the control valve, enters the feeding duct, through the inlet section, going around, respectively, the spools for auxiliary control, bucket and booms (being all spools in neutral) and through the discharge duct, returning to the hydraulic reservoir.

Note - The illustration below shows a typical control valve of the KVS series. The real configuration of the control valve can be slightly different from this illustration.

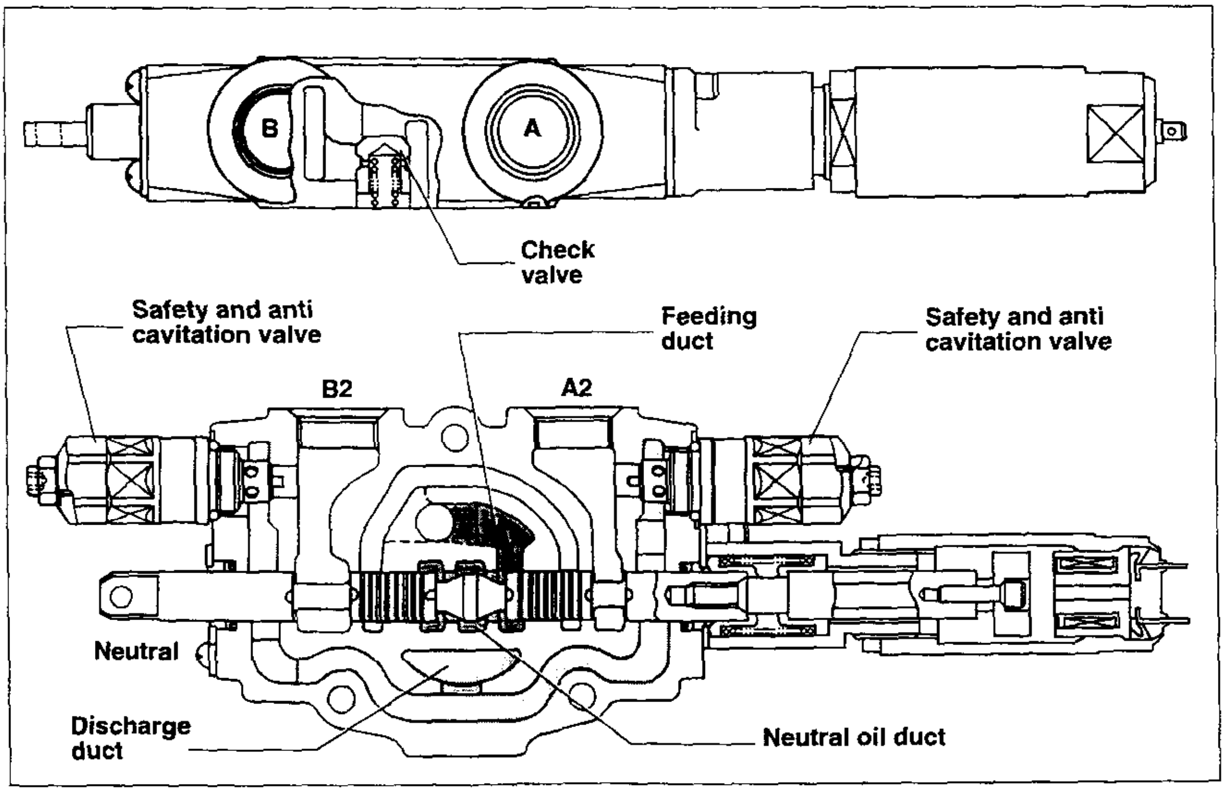


Fig. 6-19 Bucket section in neutral phase (mechanical control)

DELIVERY OIL (from pump)

DISCHARGE OIL (low pressure)

STATIC OIL

2) Operation of bucket control spool

(a) Bucket roll-in

1. When the control lever is moved to "Roll-in" position, the bucket spool moves in the direction indicated by the arrow.
2. The neutral duct is closed by the spool and the oil pressure opens the check valve, allowing the oil to reach port (B_2) thus entering the bucket cylinder from the rear bottom side.
3. The oil, leaving the bucket cylinder, from the rod side, is discharged into the hydraulic oil reservoir going through port (A_2) and the low pressure duct.

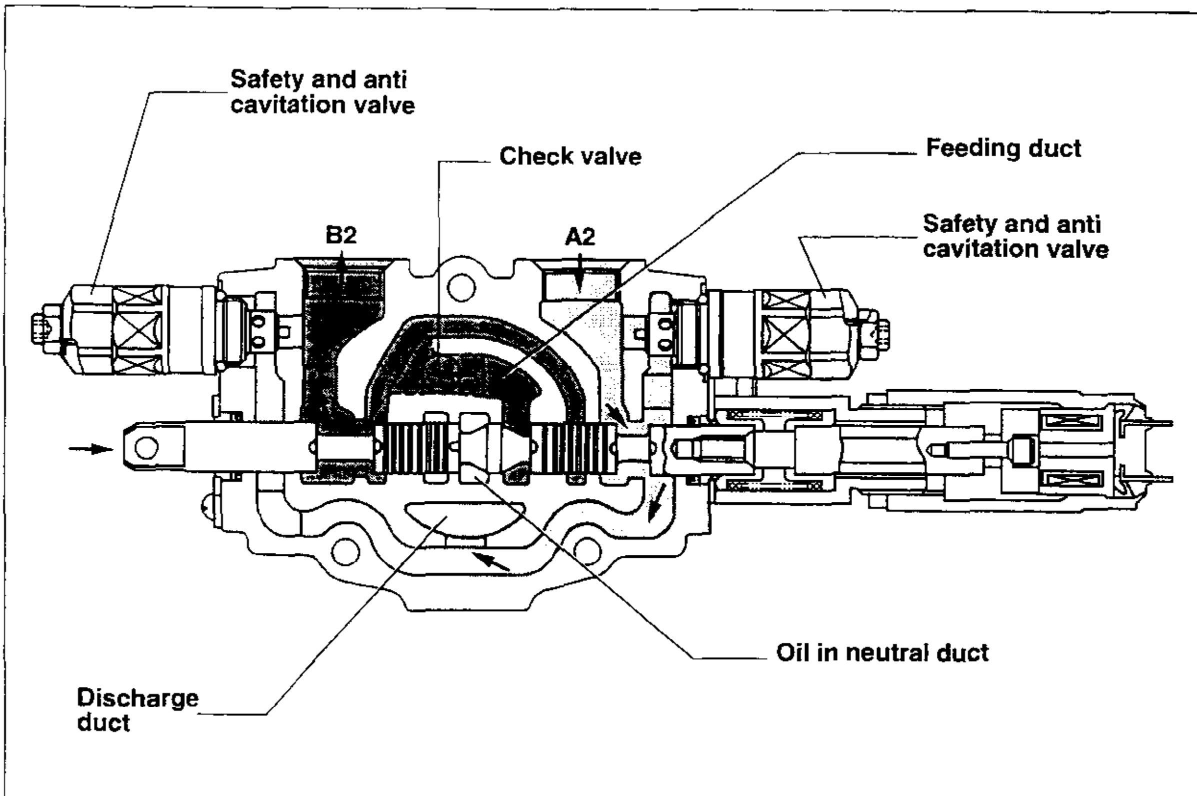


Fig. 6-20 Bucket section in roll-in phase (mechanical control)


DELIVERY OIL (from pump)


DISCHARGE OIL (low pressure)

(b) Bucket tilt

1. When the control lever is moved into "Tilt" position, the bucket spool moves in the direction indicated by the arrow.

2. The neutral duct is closed by the spool and the oil pressure opens the check valve, allowing the oil reaching port (A_2) thus entering the bucket cylinder, rod side.

3. The oil, flowing out the bucket cylinder, back side, discharges into the hydraulic oil reservoir through port (B_2) and the low pressure duct.

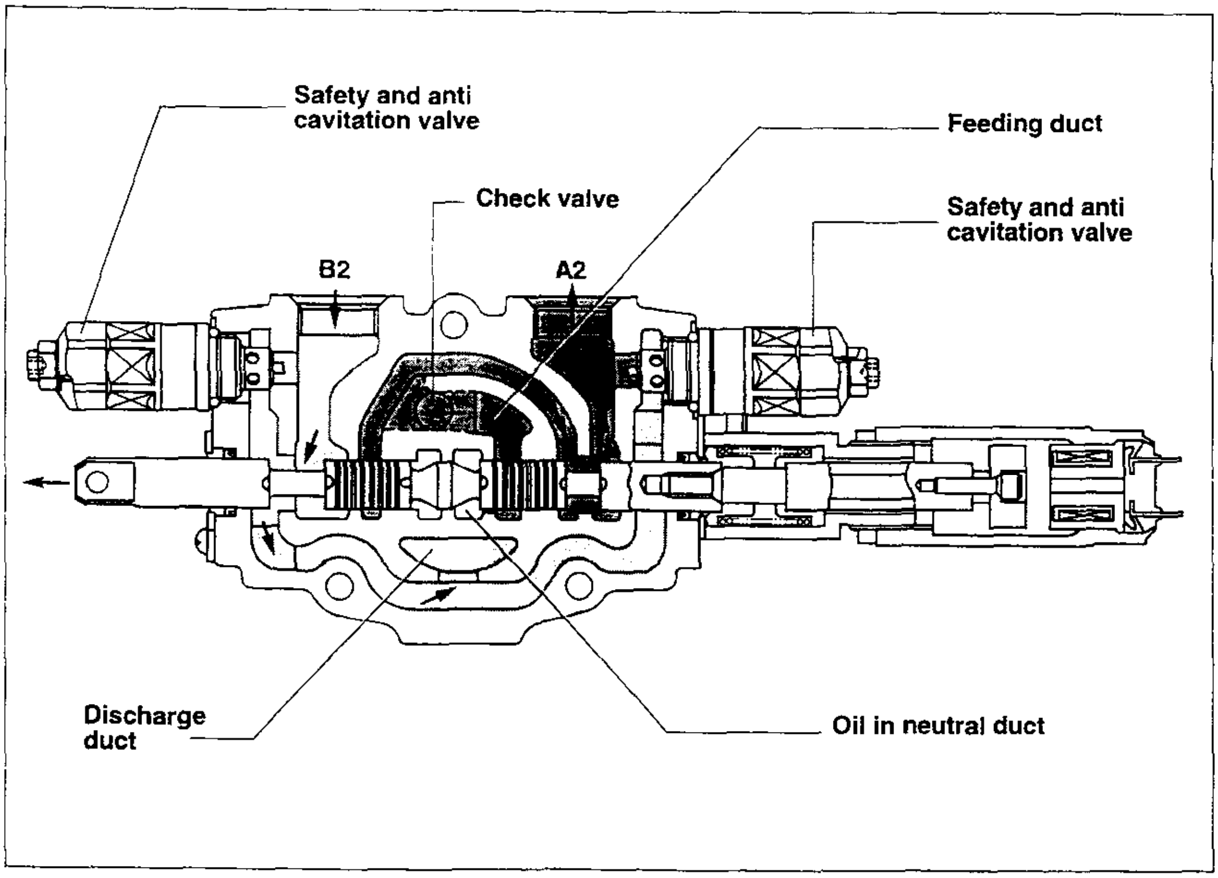


Fig. 6-21 Bucket section in tilt phase (mechanical control)

DELIVERY OIL (from pump)

DISCHARGE OIL (low pressure)

3) Operation of boom control spool

(a) Raise and lowering of boom

The oil ducts of the boom section are identical to those of the bucket section. Thus, the operation for the boom raise is identical to that for the bucket roll-in, whereas the operation of the boom lowering is identical to that of the bucket tilt. For the details of the operation of the boom control spool, please refer to the relevant descriptions of the operation of the bucket control spool.

Note - The booms control spool section can receive pressurised oil only with the bucket control spool in neutral position, so that the control valve is of a series circuit type.

(b) Float

1. When the control lever is further moved forward, from the "Lowering" position into "Float" position, the booms spool moves into the direction indicated by the arrow in the figure.

2. As a consequence of this movement, the neutral duct opens. The oil flow is identical to that for the spool in neutral position.

3. Ports (**A_3**) and (**B_3**), connected to the cylinders, communicate with the low pressure duct. Consequently, the bucket is floating on the ground, following its irregularities, under the action of the weight of the booms only. The oil, flowing out the rod side of the boom cylinders, can enter the rear side of the chamber and, respectively, the oil flowing out the rear side can enter the rod side through the low pressure duct in the control valve.

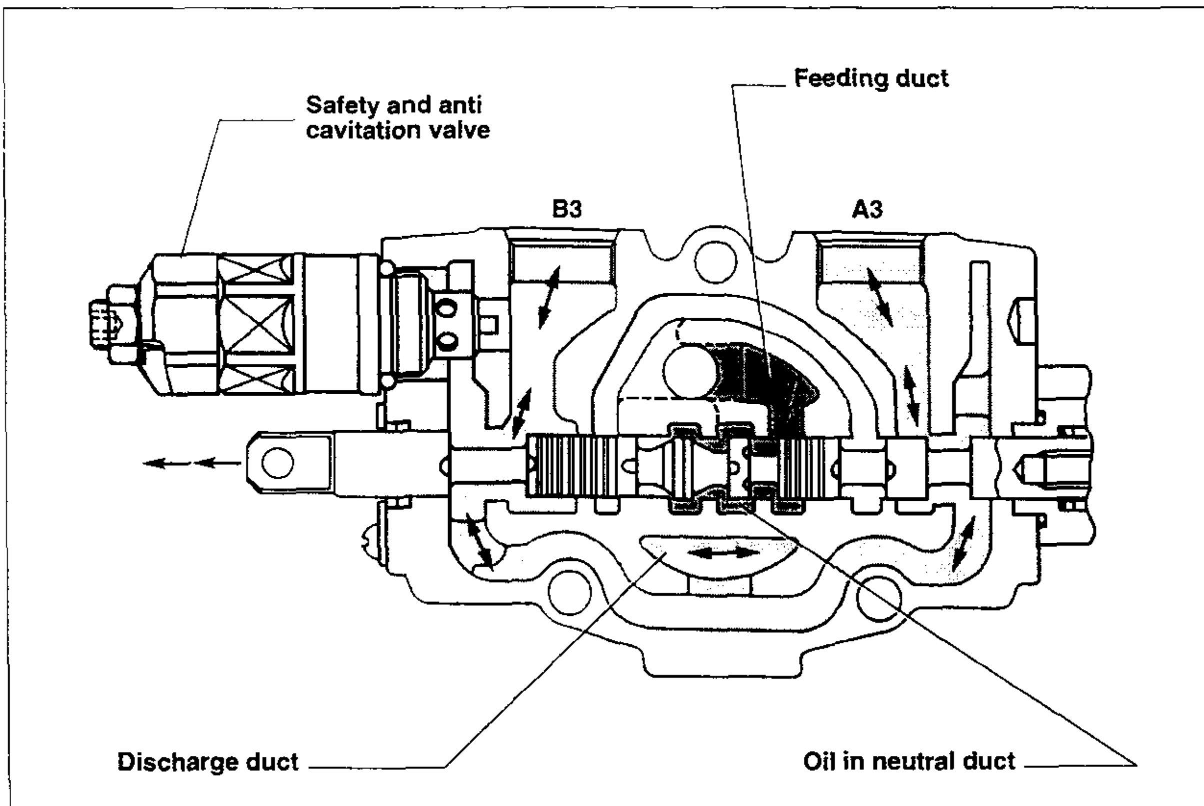


Fig. 6-22 Bucket section in floating phase (mechanical control)

DELIVERY OIL (from pump)

DISCHARGE OIL (low pressure)

4) Operation of Booms and Bucket electromagnetic detent device (mechanical version)

1. The electromagnetic detent device is illustrated for the booms and bucket control. The electrical circuit of the device consist of a proximity sensor connected to the battery through the solenoid mounted in the bucket/booms spool section of the control valve.

2. When the bucket is in tilt position, the proximity sensor is electrically closed, so that solenoid (4) is energised.

3. When the control lever is moved into "Roll-in" position, bucket spool (1) and rod (2) mounted on the tip of the spool, are totally withdrawn, bringing plate (3) against solenoid (4). Consequently, the bucket control spool keeps its position and the detent device is operational.

4. To free the detent, the electric contact of the proximity sensor must open so that the solenoid is de-energised or the control lever must be moved manually.

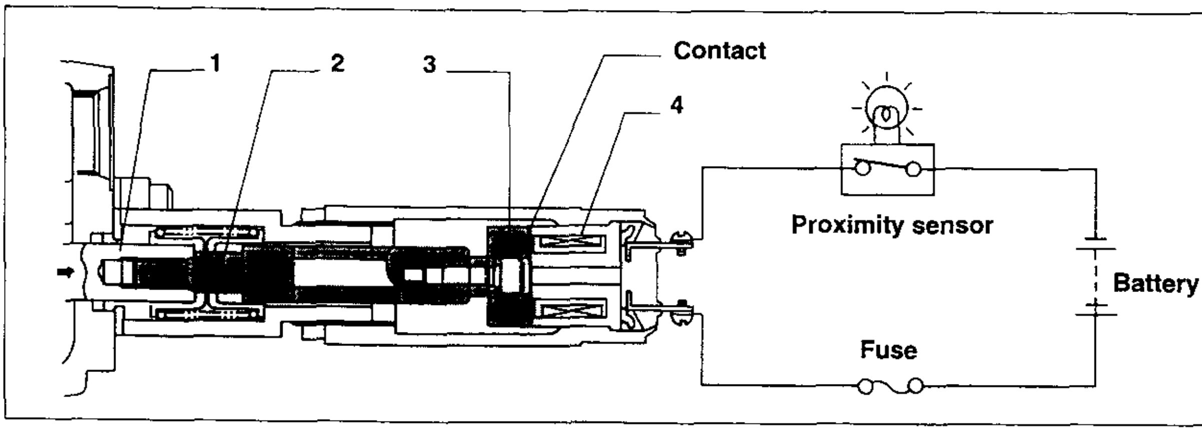


Fig. 6-23 Operation of bucket spool detent

5) Operation of booms spool detent device (mechanical version)

1. When the control lever is moved full stroke forward into "Float" position, the booms control spool (1) moves full stroke. Consequently, detent pin (2) mounted on the tip of the spool is also pushed outward full stroke, pushing detent balls (3) into the groove of detent sleeve (4).

2. Since the balls are pushed by detent spring (5), the booms spool is held in its position and the detent device stays operational.

3. To free the detent, move manually the control lever into "Neutral" position.

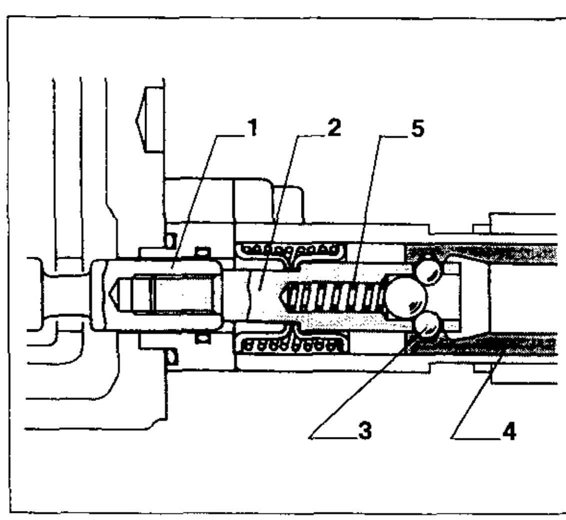


Fig. 6-24 Operation of booms detent spool

6.4.3 PRESSURE RELIEF VALVE

1) Main pressure relief valve

The main pressure relief valve is located in the inlet section, between the neutral duct and the low pressure duct (discharge duct).

Operation

a) At rest

Oil at the delivery pressure in neutral duct (**HP**) flows through orifice (**2**) of main valve (**1**) filling inner cavity (**3**). Because of the surface difference on which the pressure actuates, main valve (**1**) stays closed in its seat in sleeve (**4**).

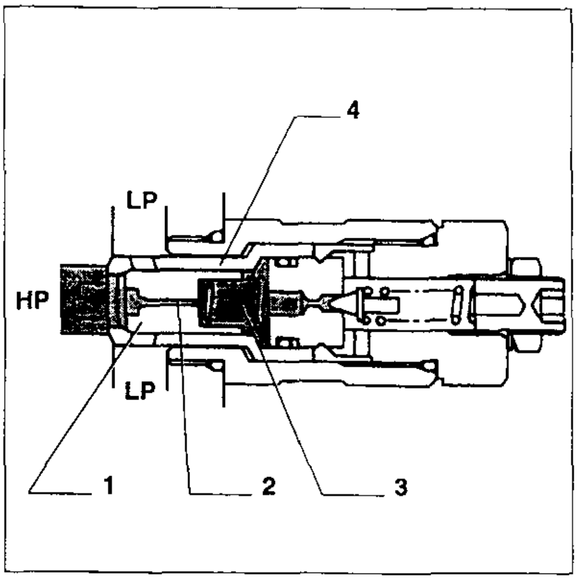


Fig. 6-25 At rest

b) Operation (A)

When the pressure in neutral duct (**HP**) increases and exceeds the pressure setting of the main relief valve piloted valve (**5**) opens. Pressurised oil, discharged by the pilot valve, enters low pressure duct (**LP**), flowing through sleeve (**4**) and valve seat (**6**).

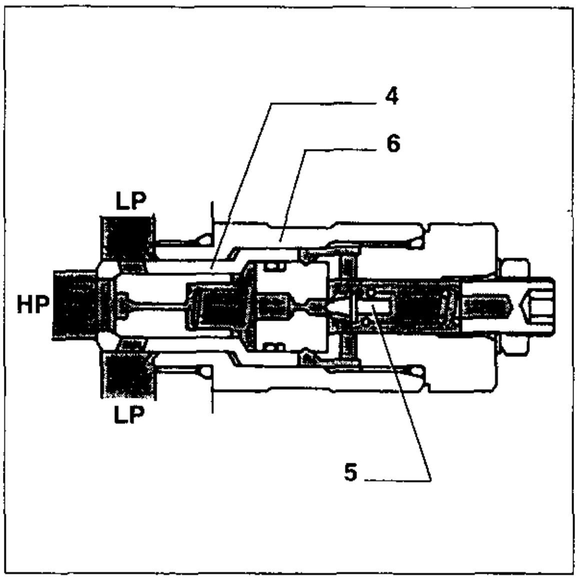


Fig. 6-26 Operation (A)

c) **Operation (B)**

When pilot valve (**5**) opens, the pressure in inner cavity (**3**) decreases, moving main valve (**1**), so that pressurised oil in neutral duct (**HP**) can discharge directly into low pressure duct (**LP**).

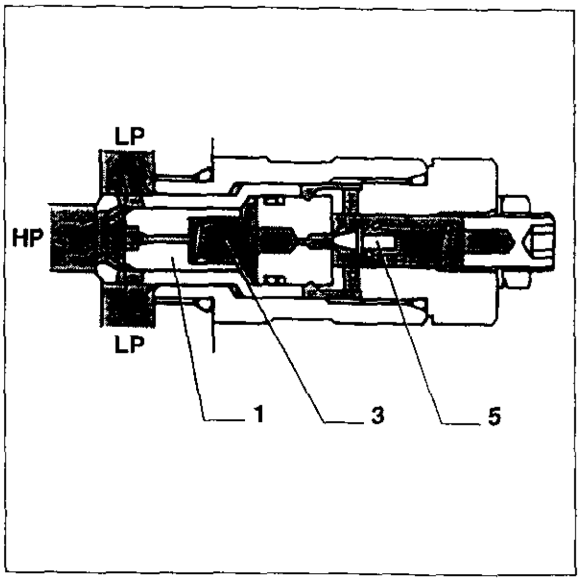


Fig. 6-27 Operation (B)

2) **Safety and anti cavitation valves**

The safety and anti cavitation valves are mounted in the booms and bucket sections. In the bucket section, a valve between port (A_2), connected to the cylinder (rod side) and the discharge duct, and a valve between port (B_2) and the discharge duct. The booms section is equipped with a single safety valve, located between port (B_3), connected to the cylinders (bottom side) and the discharge duct. The eventual auxiliary section (mechanical) is also equipped with two valves arranged respectively between ports (A_1 - B_1) and the discharge.

Operation

a) **At rest**

Pressurised oil, in the port connected to cylinder (**HP**), flows through the orifice in piston valve (**1**) and acts on the opposite surfaces of make-up valve (**2**) and safety valve (**3**). Due to the surface difference on which the pressure works, the two valves are kept closed, one against the other.

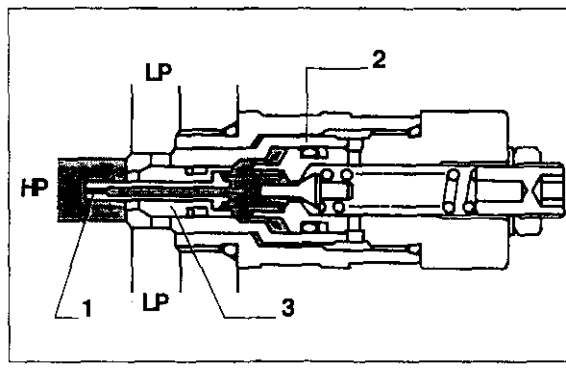


Fig. 6-28 At rest

b) **Operation (A)**

When the pressure in the port connected to cylinder (**HP**) increases and exceeds the setting of the safety pressure, piloted valve (**4**) opens. Pressurised oil, discharged by the piloted valve, enters low pressure duct (**LP**) flowing through make-up valve (**2**) and valve seat (**5**).

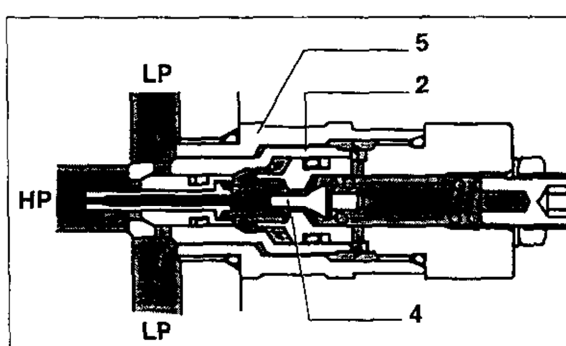


Fig. 6-29 Operation (A)

c) **Operation (B)**

When pilot valve (**4**) opens, the pressure on the rear side of piston valve (**1**) decreases, moving piston valve (**1**). Consequently, the orifice of piston valve (**1**) closes so that the pressure on the rear side of safety valve (**3**) decreases further.

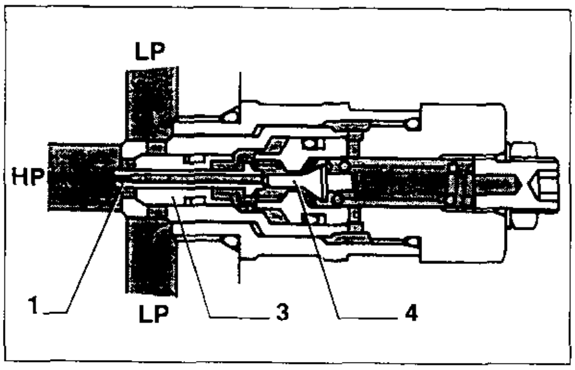


Fig. 6-30 Operation (B)

d) **Operation (C)**

The pressures acting on the opposite surfaces of safety valve (**3**) are unbalanced. Due to this pressure difference, the safety valve opens so that pressurised oil can be discharged directly from port (**HP**) connected to the cylinder, to low pressure duct (**LP**).

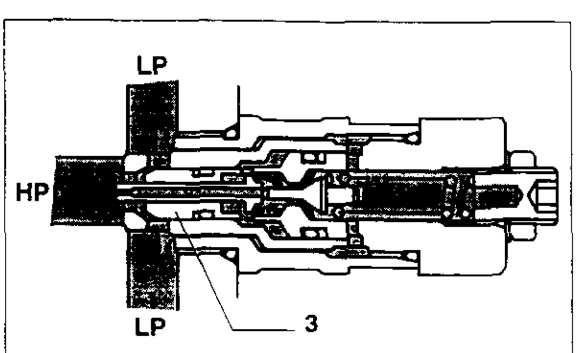


Fig. 6-31 Operation (C)

e) **Operation in make-up**

If the pressure at port (**HP**) connected to the cylinder is lower than the value in low pressure duct (**LP**), being a condition for potential cavitation, make-up valve (**2**) moves proportionally to the surface difference on which a negative pressure intervenes. Consequently, to avoid cavitations, oil can flow from low pressure duct (**LP**) to port (**HP**) connected to the cylinder.

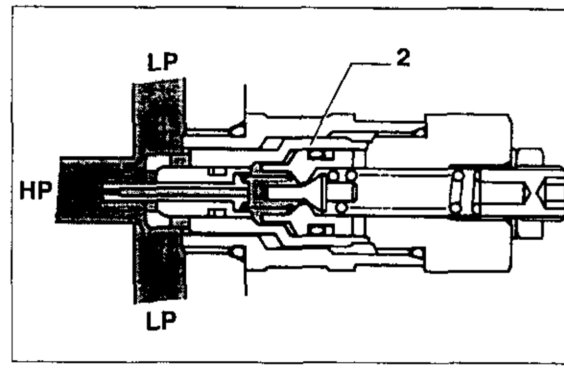


Fig. 6-32 Operation in make-up.

6.5 CONTROL VALVE CONTROLS

The standard control system of the control valve is of a mechanical, single lever type. When the control lever is moved, the control valve spools are actuated; the longitudinal movement (for and back) of the lever actuates the booms spool, whereas the sideways movement of the lever actuates the bucket control. The handgrip of the control lever incorporates the kick-down button. Please refer to chapter "2.5.4 - GEARSHIFT CONTROL" for the kick-down device.

It is possible to install, as an optional, a second lever controlling a third spool for the equipment control valve, in case a special attachment requires a third hydraulic function. For this purpose, a support is arranged in the cab for the installation of a second control lever.

WARNING

The control system of the control valve is equipped with a safety device locking it. Actuate the locking device to block the control lever in neutral position when the equipment is not to be operated.

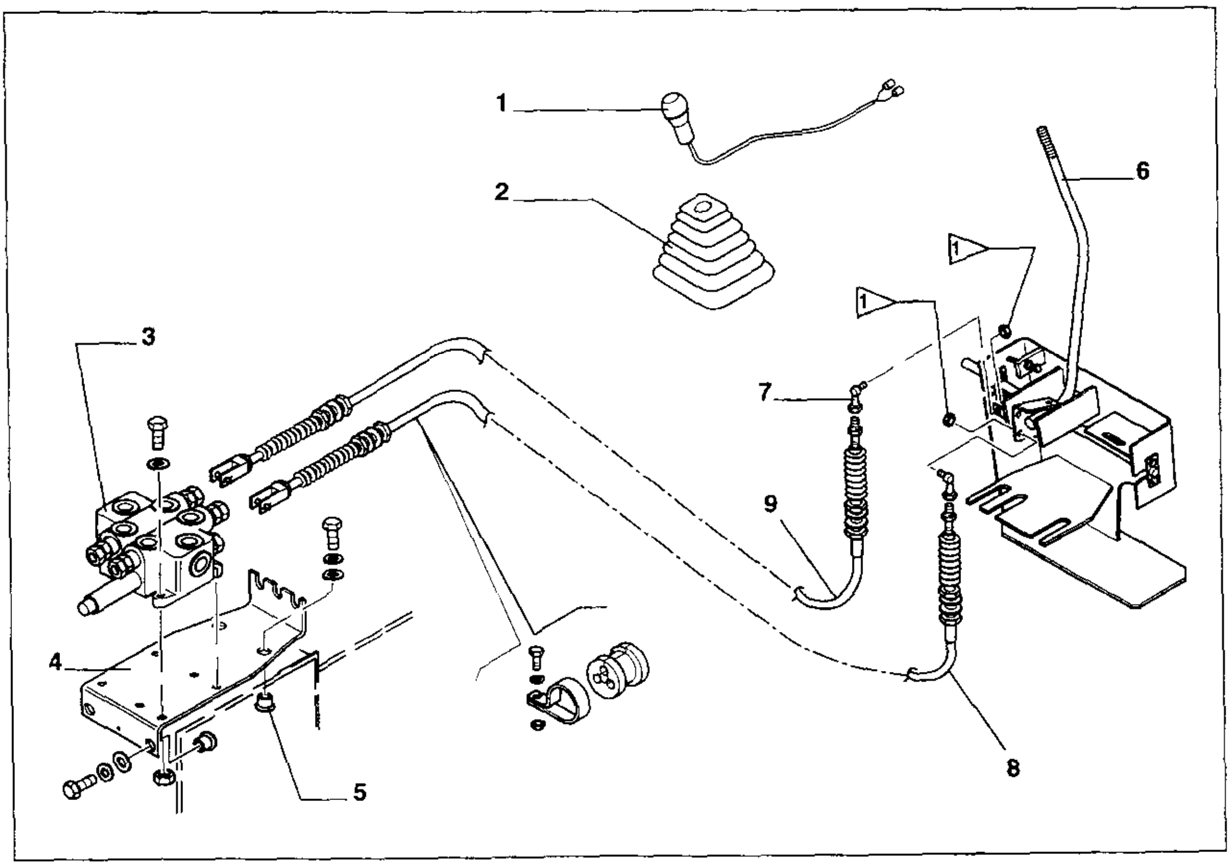


Fig. 6-33 Equipment control valve control assembly (mechanical version)

Note - 1 Threaded portion: LOCTITE 262

2 Apply grease during the installation

1. HANDGRIP (BUTTON)
2. BOOT
3. CONTROL VALVE
4. BRACKET
5. RUBBER PAD
6. CONTROL LEVER
7. BALL JOINT
8. CABLE (FOR BUCKET)
9. CABLE (FOR BOOMS)

6.5.1 HYDRAULIC CONTROL VALVE CONTROL (Variant)

Pilot valve

The pilot valve is of a modular type and is composed of two valve assemblies connected by two screws. If the booms or the bucket lever is actuated, the plunger of the pilot valve moves to direct pressurised oil to the port of the equipment control valve selected, moving the corresponding spool. The plungers of the booms valve body and the bucket roll-in plunger are equipped with solenoid type detents that hold them respectively in booms max. raise, float and bucket roll-in positions. The detent occurs when the relevant control levers are forced full stroke. The levers can be, in any case, disengaged at any moment.

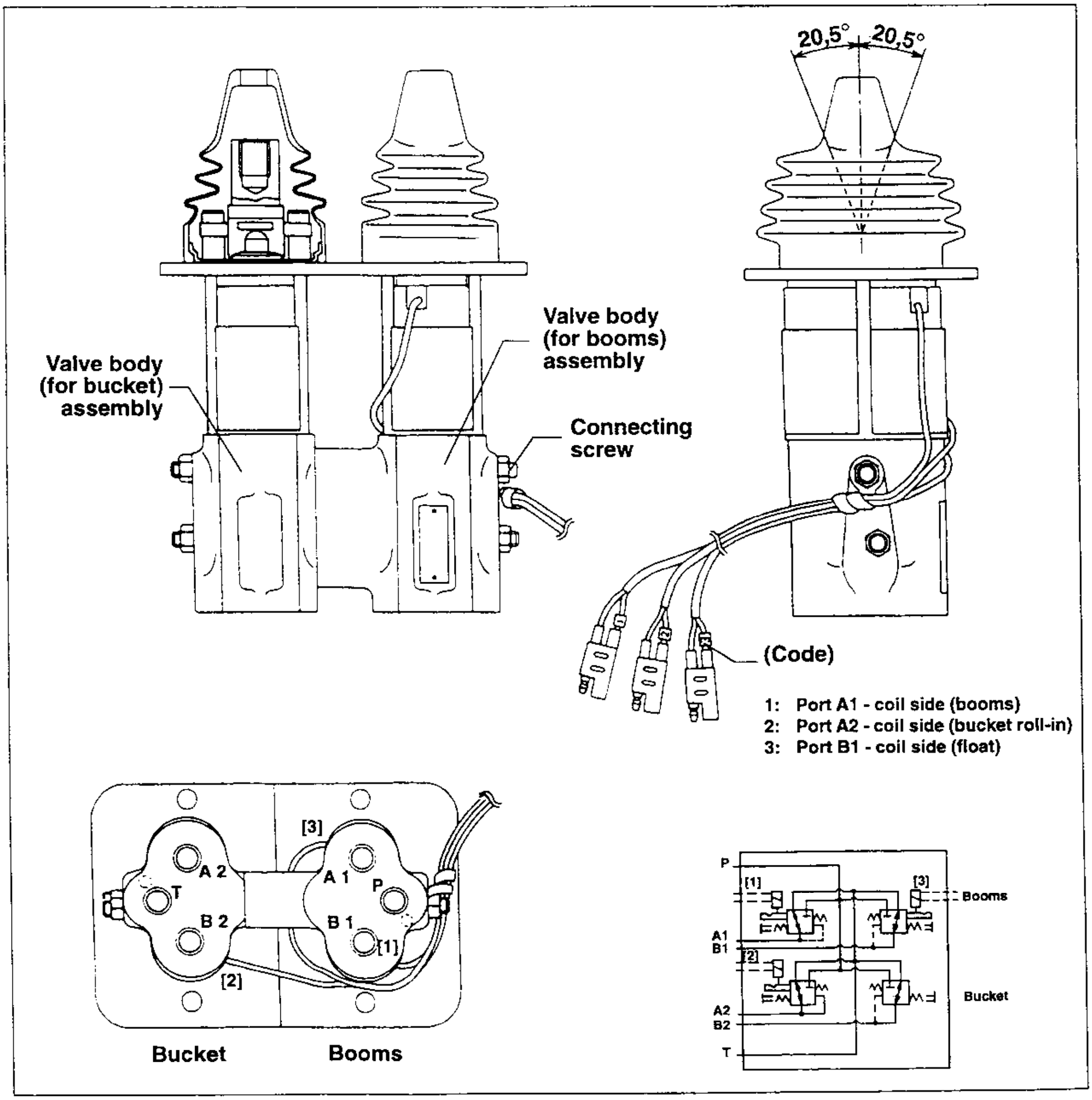


Fig. 6-34 Pilot valve

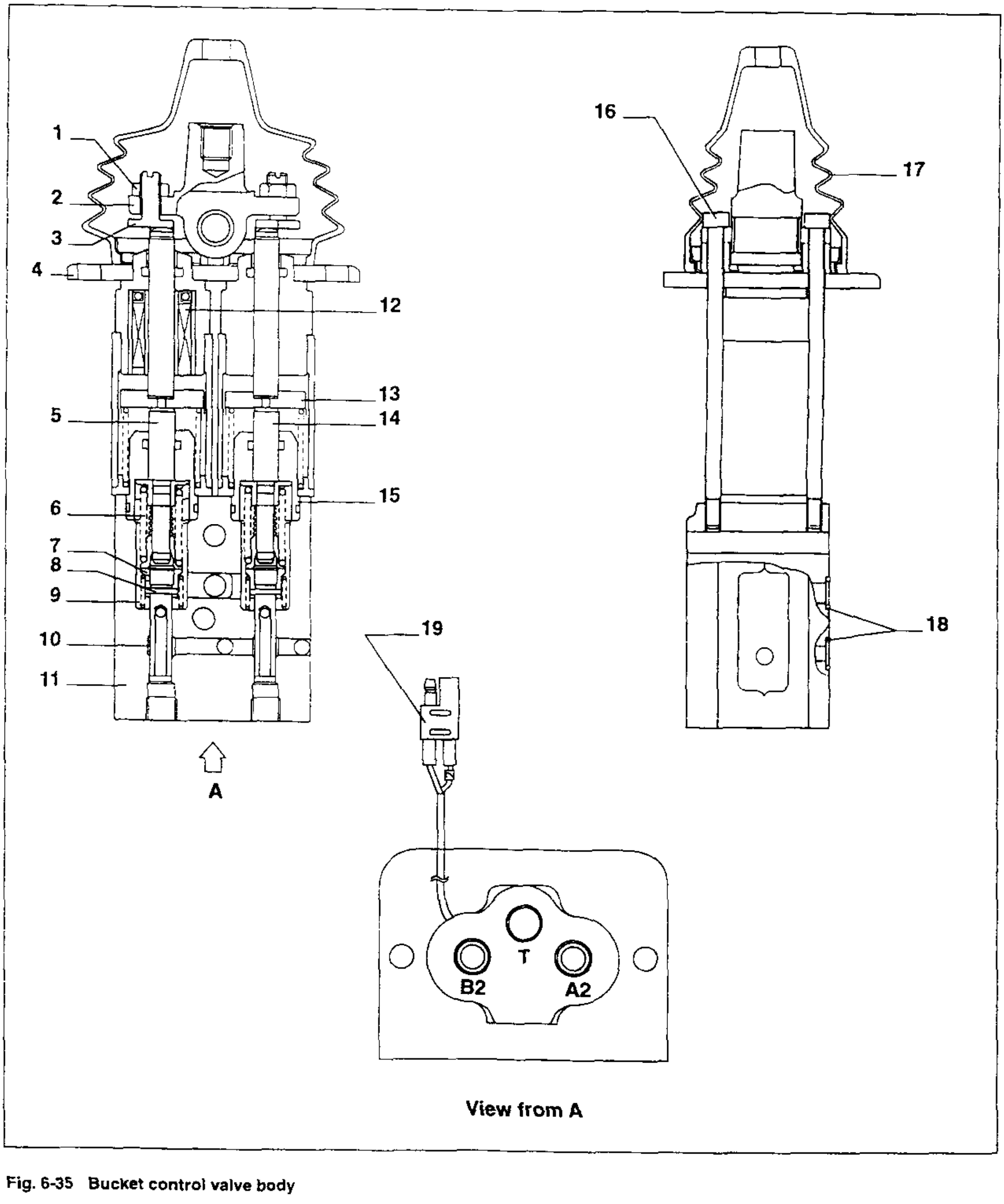


Fig. 6-35 **Bucket control valve body**

1. NUT
2. ROCKER ARM
3. ADJUSTING SCREW
4. SUPPORT FLANGE
5. PISTON
6. SPRING
7. CUP
8. SPLIT PIN
9. SPRING
10. PLUNGER
11. VALVE BODY
12. SOLENOID
13. PLATE
14. PISTON
15. GUIDE
16. SCREW CONNECTING UPPER AND LOWER BODIES
17. DUST BOOT
18. O-RING
19. ELECTRICAL CONNECTIONS

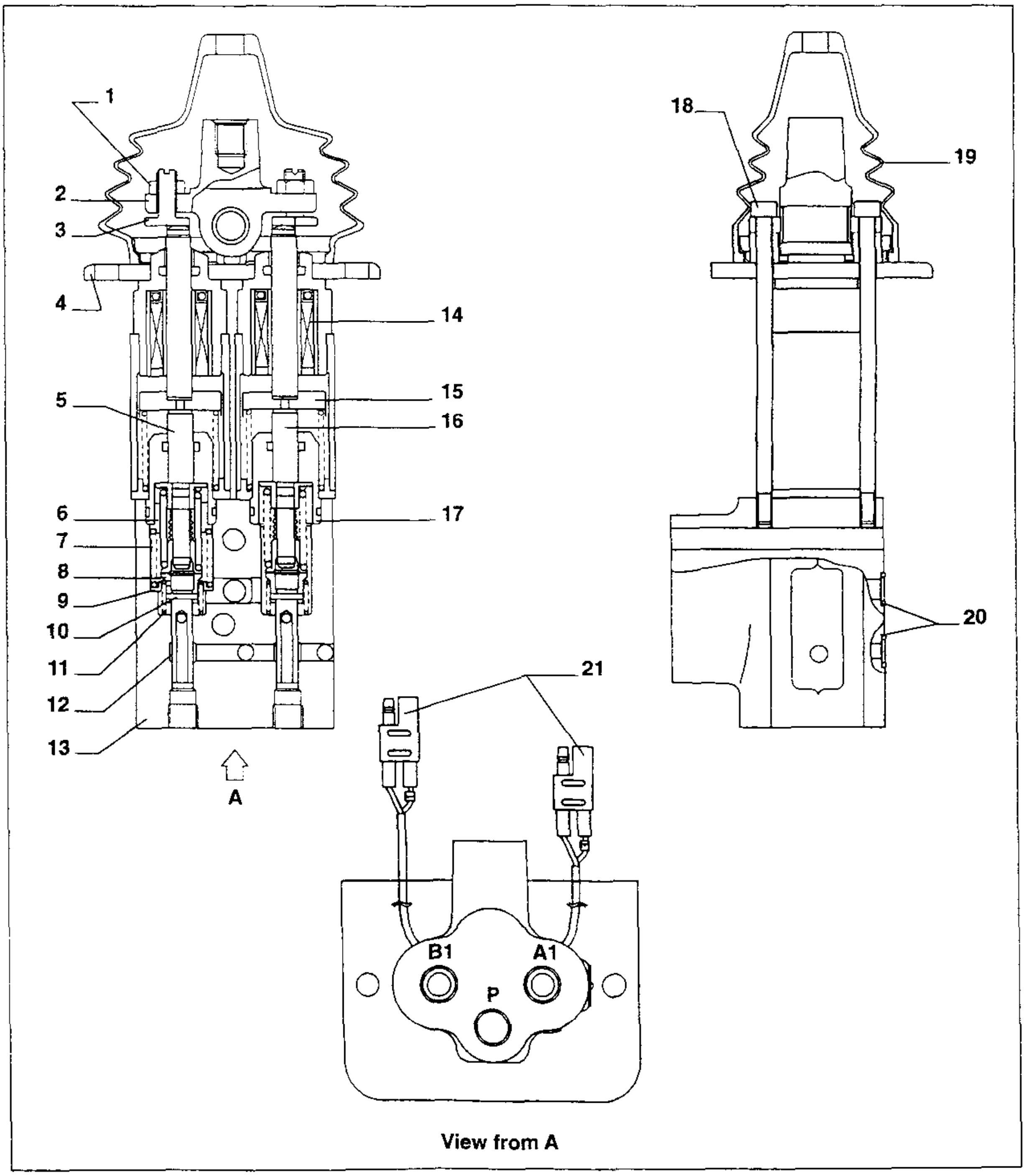


Fig. 6-36 Booms control valve body.

1. NUT
2. ROCKER ARM
3. ADJUSTING SCREW
4. SUPPORT FLANGE
5. PISTON
6. SPRING GUIDE
7. SPRING
8. CUP
9. SPRING SUPPORT RING
10. SPLIT PIN
11. SPRING
12. PLUNGER
13. VALVE BODY
14. SOLENOID
15. PLATE
16. PISTON
17. GUIDE
18. SCREW CONNEC. UPPER AND LOWER BODIES
19. DUST BOOT
20. O-RING
21. ELECTRICAL CONNECTIONS

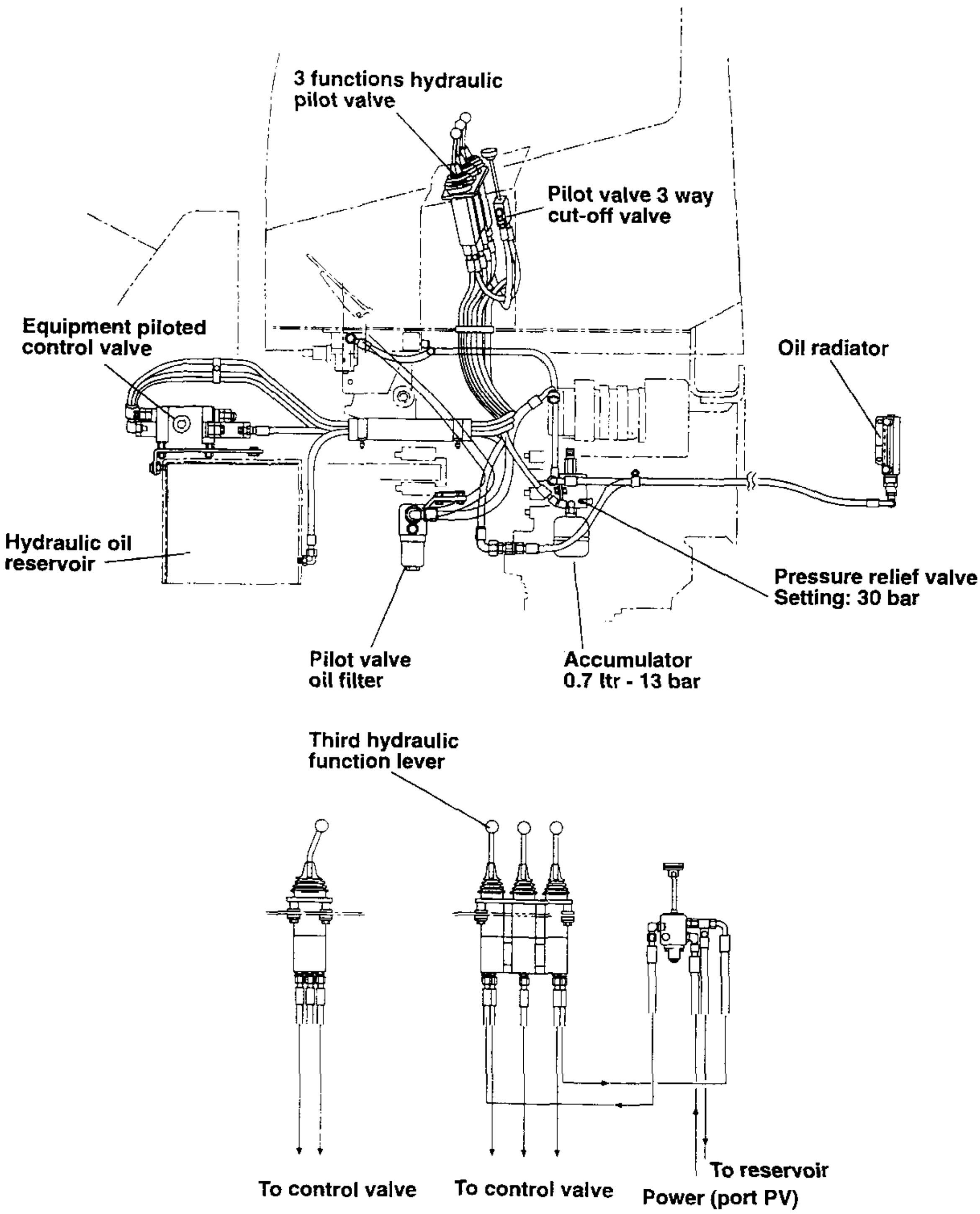


Fig. 6-37 Equipment control valve pilot valve assembly

Note - The illustration shows the variant for hydraulic third function.

6.6 HYDRAULIC OIL RESERVOIR

Type .... Pressurised
Capacity of reservoir .... 80 ltr (21 Gal)
Setting of by-pass valve on oil filter .... 2.5 ± 0.2 bar
Filter on return .... Inorganic fibre, filtering capacity 10μ

The reservoir contains the hydraulic oil for the main hydraulic system, the steering system and the brakes system.
Inside the reservoir, a filter is mounted, on the return line, equipped with a by-pass valve that, in case of clogging of the filtering element, discharges the oil directly into the reservoir.

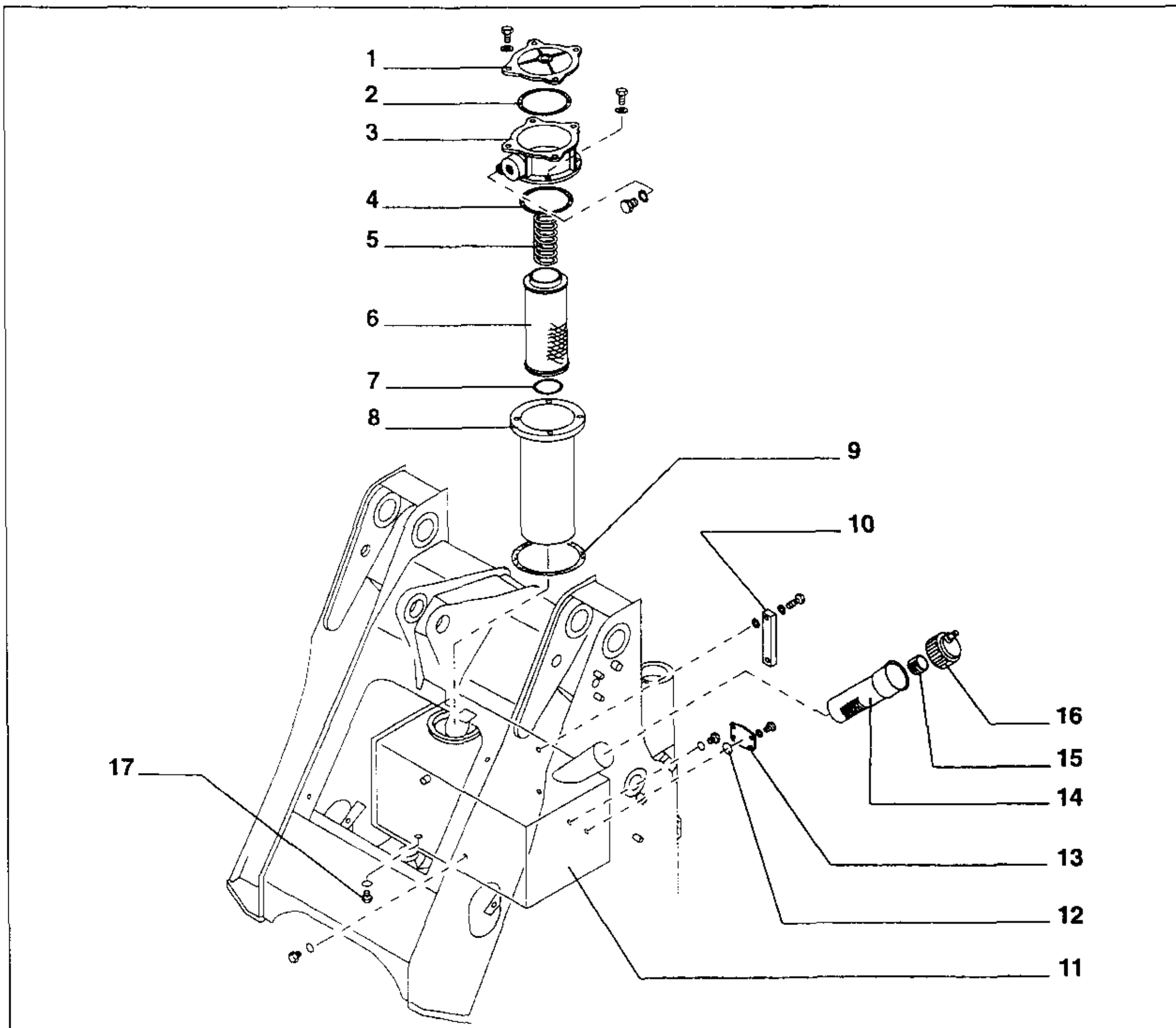


Fig. 6-38 Hydraulic oil reservoir

1. OIL FILTER COVER
2. O-RING
3. FILTER HEAD
4. O-RING
5. SPRING
6. FILTER
7. O-RING
8. FILTER CAN
9. O-RING
10. OIL LEVEL INDICATOR
11. OIL RESERVOIR
12. O-RING
13. FLANGE
14. OIL FILLER FILTER
15. FILTER
16. OIL FILLER CAP
17. CAP

6.7 CYLINDERS

	W110	W130
Booms cylinders		
Type	Double stroke	Double stroke
Q.ty	2	2
Inside diameter of cylinder	110 mm (4.3 in)	120 mm (4.7 in)
Diameter of rod	60 mm (2.4 in)	65 mm (2.6 in)
Cylinder rod stroke	681 mm (26.8 in)	665 mm (26.2 in)
Weight (unit)	86 Kg (189 lbs)	95 Kg (205 lbs)
Bucket cylinder		
Type	Double stroke	Double stroke
Q.ty	1	1
Inside diameter of cylinder	130 mm (5.1 in)	150 mm (5.9 in)
Diameter of rod	70 mm (2.8 in)	85 mm (3.3 in)
Cylinder rod stroke	431mm (17.0 in)	431 mm (17.0 in)
Weight (unit)	96 Kg (211 lbs)	127 Kg (279 lbs)

6.7.1 BOOMS CYLINDERS

The two boom cylinders are double stroke. The cylinders are extended or retracted, respectively to raise or lower the booms. The booms cylinder is composed of: cylinder sleeve, bottom, rod, piston and seal pack.

6.7.2 BUCKET TILT CYLINDER

The bucket tilt cylinder is double stroke. Depending upon the extension or retraction of the cylinder, the bucket is rolled-in or tilted by the linkage composed of the strut and rod. The bucket cylinder is composed of: cylinder sleeve, bottom, rod, piston and seal pack.

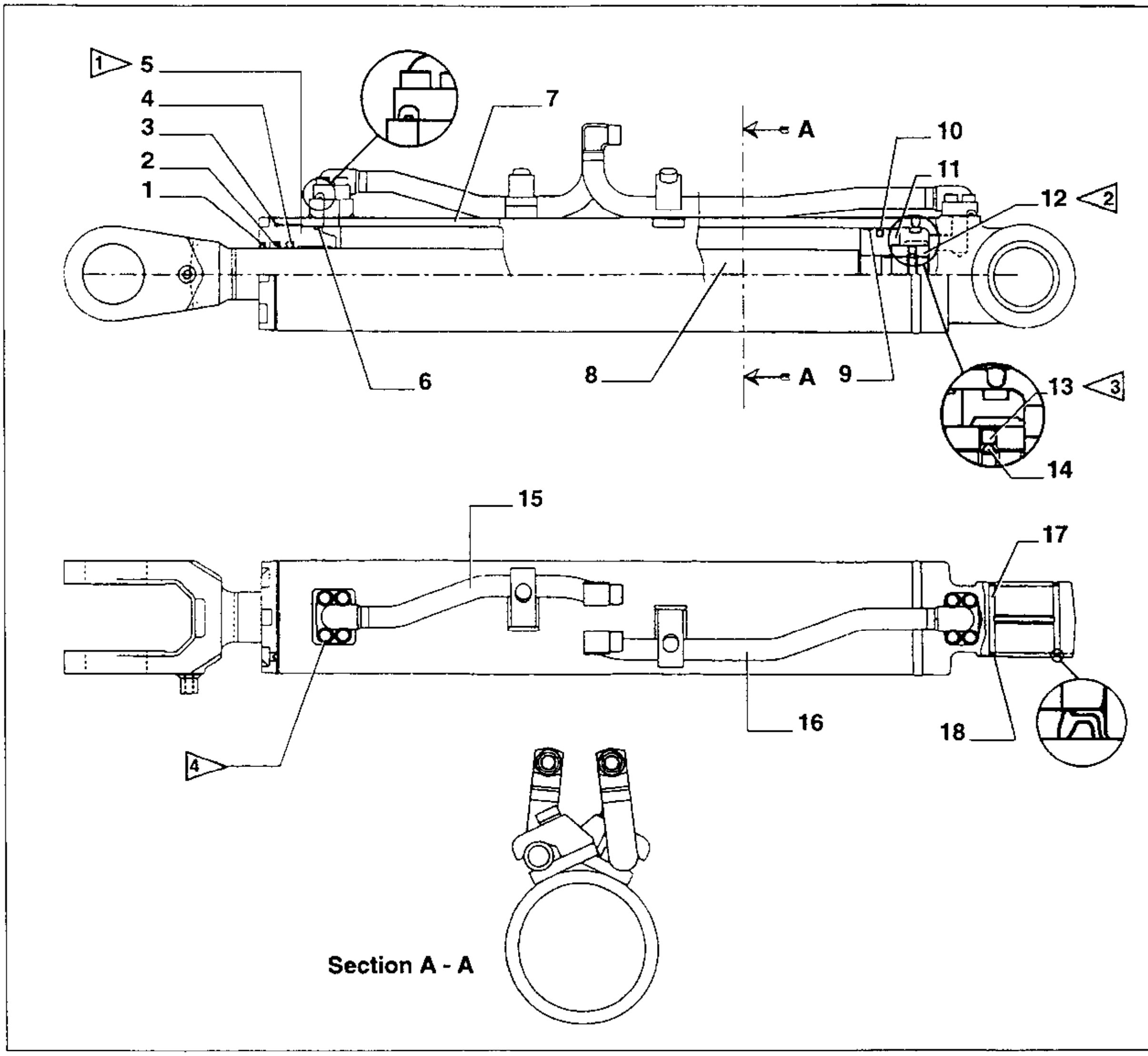


Fig. 6-39 Booms cylinders (W110, W130)

Note - The illustrations above show the booms cylinders of model W130. The booms cylinder of model W110 has the same configuration.

Note -

1 83 daNm (W110) and 106 daNm (W130) — Threaded portion: Three Bond 1901

2 215 daNm (W110) and 228 daNm (W130)

3 3.1 daNm (W110 and W130) (After tightening, stake in two points)

4 6.4 daNm (W110 and W130)

1. MUD SCRAPER
2. SEAL
3. O-RING
4. SEAL
5. FRONT SLEEVE
6. O-RING
7. CYLINDER SLEEVE
8. ROD
9. SLIDE RING
10. SEAL RING/O-RING
11. PISTON
12. LOCK NUT
13. LOCK SCREW
14. STEEL BALL
15. PIPE
16. PIPE
17. BUSHING
18. MUD SCRAPER

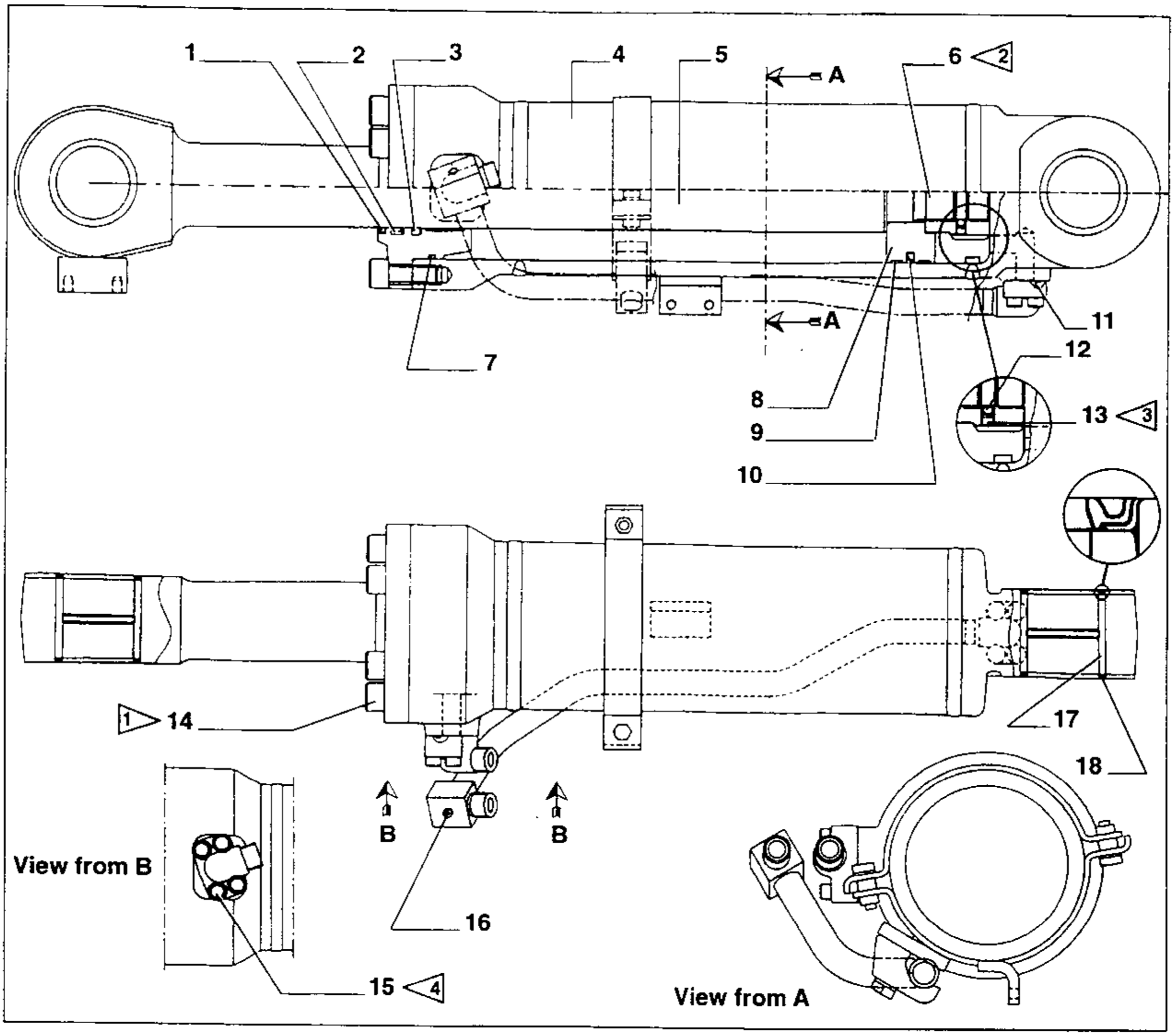


Fig. 6-40 Bucket cylinder (W110, W130)

Note - The illustrations above show the booms cylinders of model W130. The booms cylinder of model W110 has the same configuration.

Note -

1 — 44.2 daNm (W110 and W130)

2 — 357.7 daNm (W110) and 539 daNm (W130)

3 — 5.7 daNm (W110 and W130) (After tightening, stake in two points)

4 — 6.4 daNm (W110 and W130)

1. MUD SCRAPER RING
2. SEAL
3. SEAL
4. CYLINDER SLEEVE
5. ROD
6. LOCK NUT
7. O-RING
8. PISTON
9. SLIDE RING
10. SEAL RING/O-RING
11. O-RING
12. STEEL BALL
13. LOCK SCREW
14. SLEEVE LOCKING SCREW
15. FLANGE SCREW
16. PRESSURE PICK-UP POINT
17. BUSHING
18. MUD SCRAPER RING

6.8 L.T.S. ANTI-PITCHING SYSTEM (Variant)

6.8.1 DESCRIPTION

The L.T.S. (Load Travel Stabilised) system, supplied as an optional, ensures a better driving comfort and a reduction of dynamic loads on the components of the machine (frame, axles etc.) when the unit travels with or without load.
Without the L.T.S. system, the machine is subject, as a result of irregular terrains, to unwanted pitching, increasing with the travel speed.
With the L.T.S. system ON, the terrain irregularities are absorbed by the equipment. In this manner, it is possible to exploit completely the potential of the machine, especially on uneven terrains, without stressing mechanical components and providing max. comfort for the operator.

The system includes, essentially:
- A switch (incorporating the indicator) located on the dashboard, to activate or disactivate the system;
- A piston type accumulator (oil capacity = 3.9 Liters; gas capacity = 4 Liters) preloaded with nitrogen and connected to the boom raise/lowering cylinders;
- A valve block controlled by a solenoid valve.

L.T.S. system ON

The system is activated by a switch (incorporating an indicator) located on the dashboard.

The L.T.S. switch has three positions:

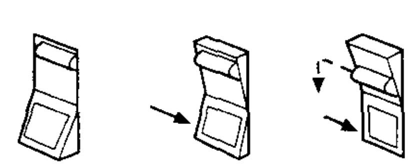


Fig. 6-41 L.T.S. three position switch.

Position 0 (L.T.S. OFF).

Position 1 (L.T.S. ON)
Automatic gearbox
The transmission control unit automatically engages the L.T.S. system whenever the speed of the machine exceeds 5 km/h (3.1 mph) and disengages it when the speed drops, thus allowing the loading and dumping of the bucket without unwanted movements of the boom. The indicator comes on when the system is ON and stays out when the system is OFF.
This position is recommended for normal use of the system.

Manual gearshifting
The L.T.S. is OFF when the gearshift lever is in first speed.

Position 2 (L.T.S. constantly ON).
The indicator stays constantly ON.
This position is useful only to allow the discharge of the accumulator in view of maintenance or repair interventions (for this purpose, it is necessary to place the equipment control valve in float position).
This position can be used for occasional operation only, to obtain the cushion effect at speeds below 5km/h (3.1 mph).

IMPORTANT - For an efficient performance of the L.T.S. system, the boom must be free to move.
Do not use the L.T.S. system when travelling on open roads requires the locking of the boom.

WARNING - DANGER

Prior to any maintenance intervention on the equipment and the L.T.S. systems it is required that the accumulator is discharged to avoid the exit of pressurised fluid.

6.8.2 DISCHARGE OF THE ACCUMULATORS

To discharge the accumulator, proceed as follows:
- start the engine at idle speed;
- place the L.T.S. switch on position 2 (the indicator must come ON);
- position the bucket flat on the ground;
- lock the equipment control lever in "Float" position;
- waiting a few seconds in this position the accumulator is discharged.

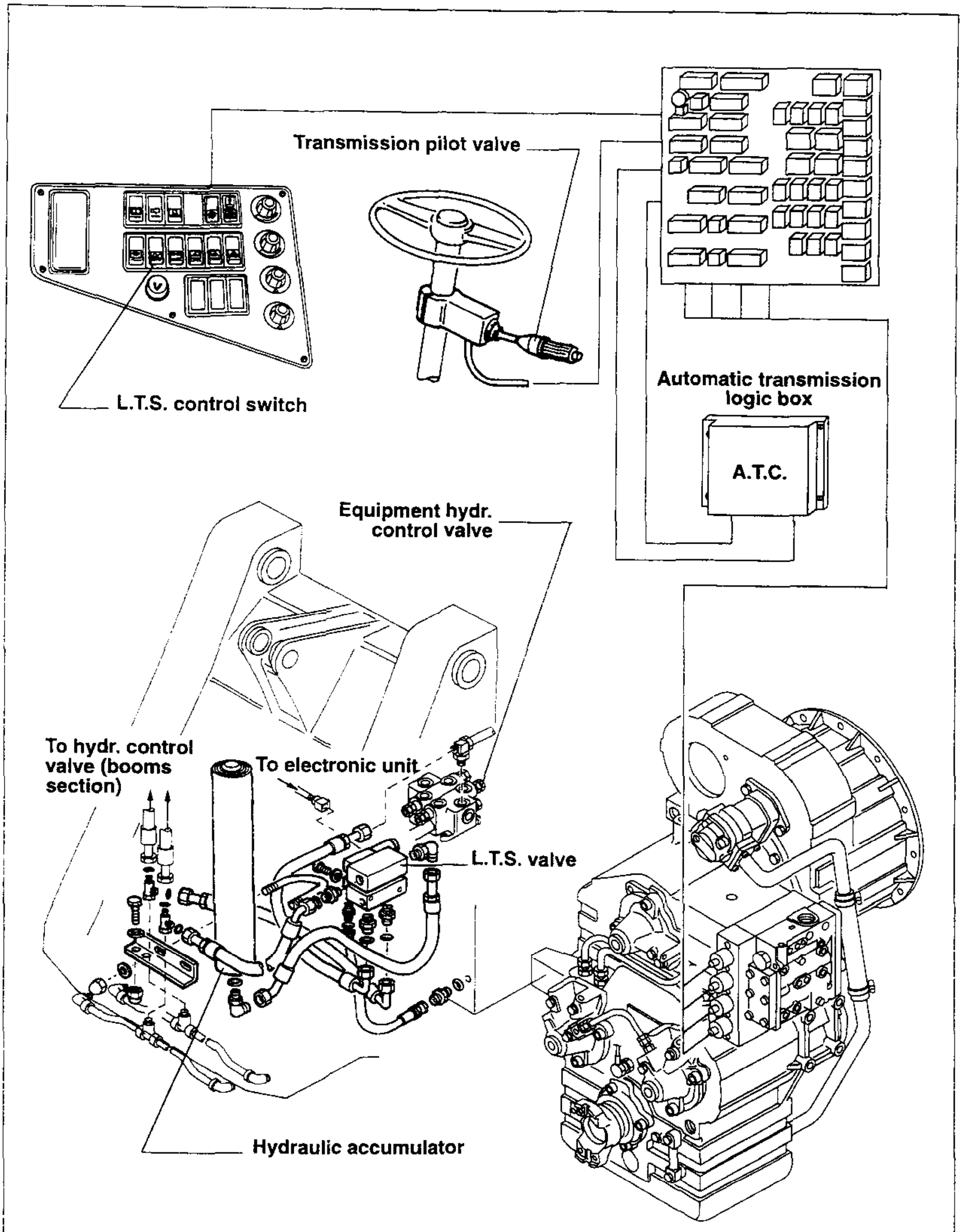


Fig. 6-42 Components of the L.T.S. (version with automatic transmission).

6.8.3 L.T.S. HYDRAULIC DIAGRAM

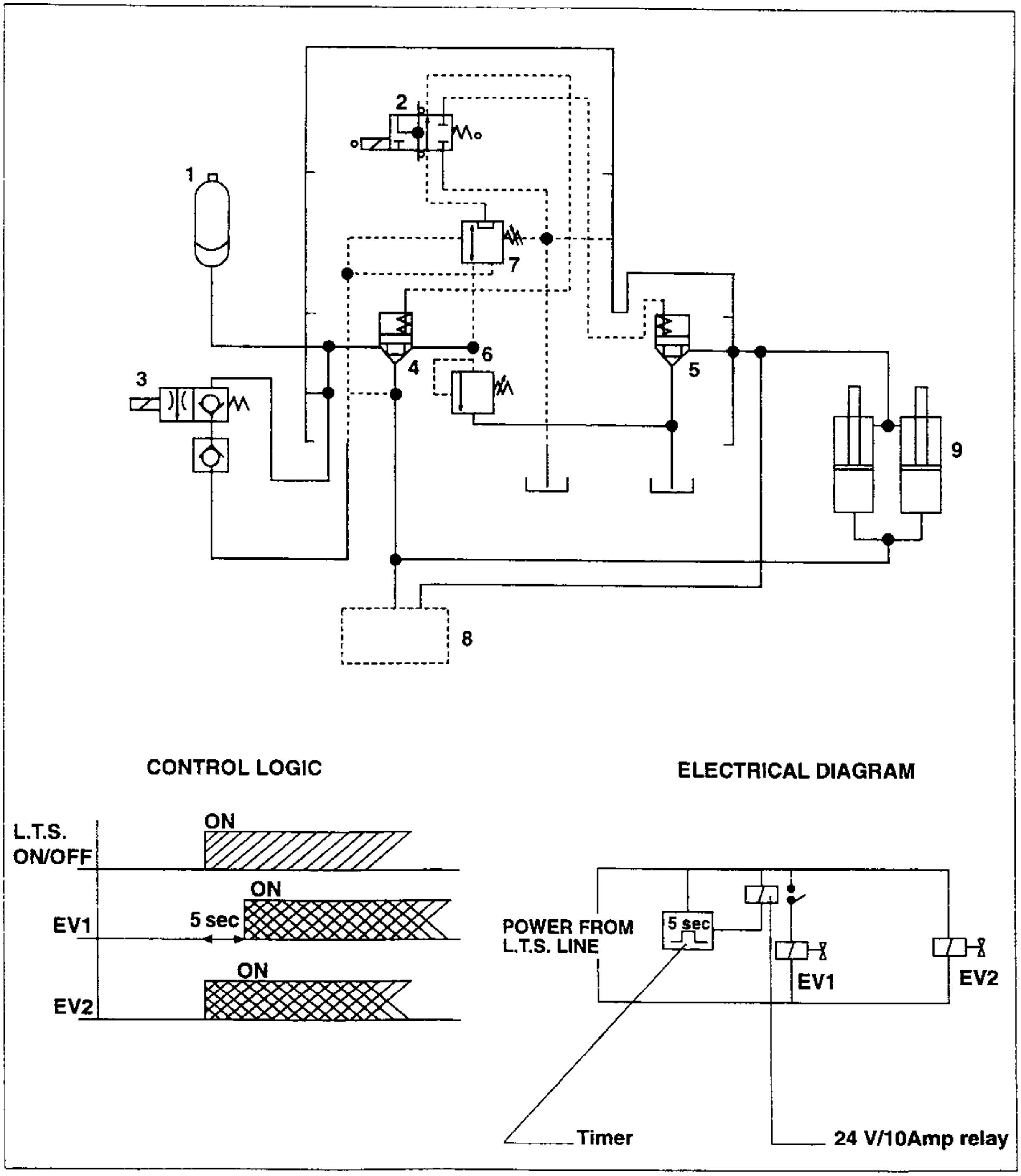


Fig. 6-43 L.T.S. hydraulic system diagram

1. ACCUMULATOR
2. SOLENOID VALVE "1"
3. SOLENOID VALVE "2"
4. CYLINDER BOTTOM SIDE VALVE
5. CYLINDER ROD SIDE VALVE
6. SEQUENCE VALVE
7. SEQUENCE VALVE
8. EQUIPMENT CONTROL VALVE
9. BOOMS CYLINDER

6.8.4 FUNCTIONAL TESTS OF L.S.T. SYSTEM

Testing of electrical system

Start the engine.

Place the L.T.S. switch on position **2**; the indicator must come ON.

Bring the engine to medium/high speed and raise the boom to max. height.

Lower quickly the boom and stop it suddenly at mid-level.

The boom must oscillate before stopping and no waving movements must be felt in the cab.

Bring the engine speed back to idle and move the L.T.S. switch to position **1**.

The indicator must remain OFF.

Engage second speed and start the machine.

When the speed of the machine reaches 5 km/h (3.1 mph), the indicator in the switch must come ON.

Slow down the machine and stop it; the indicator must go OFF.

Valve opening test

The scope of the test is to check the opening of valves (**4** and **5**, fig. 6-43).

Start the engine and run it at idle speed.

Move the L.T.S. switch to position **2**; the indicator must come ON.

With bucket flat on the ground, move the equipment pilot valve to "Float" position to discharge accumulator (**1**).

Move the pilot valve to neutral.

Switch OFF the L.T.S. system moving the switch to position **0**.

Raise the boom to max. height and insist in this position (valve activation) for about five seconds.

Lower the bucket to the ground.

Engage the L.T.S. system placing the L.T.S. switch into position **2** (the indicator must come ON).

The bucket should raise about 200 mm (7 3/4 in).

Test of hydraulic circuit between boom cylinders, bottom side, and accumulator

Start the engine and run it at idle speed.

With flat bucket, raise it about 30 cm (11 3/4 in) from the ground.

Lift the machine from the ground by tilting the bucket.

Move the equipment pilot valve to "Float" position so that the machine drops to the ground.

Engage the system positioning the L.T.S. switch on position **2** (the indicator comes ON) so as to discharge the accumulator.

Move the pilot valve back to neutral.

Roll-back the bucket: the boom should drop until touching the ground.

6.8.5 TEST OF ACCUMULATOR PRECHARGE

The accumulator installed on the L.T.S. anti-pitching system is of a piston type preloaded with nitrogen. The nominal precharge pressure is 18 bar at 15°C (59°F) with a **4** Ltr capacity).

Important - A precharge of the accumulator lower than the nominal value, can cause a defective operation of the L.T.S. anti-pitching system.

It could be useful to check yearly and when required the nitrogen precharge.
The checking operation must be performed with the accumulator emptied of hydraulic oil.

DANGER

Prior to any maintenance intervention on the equipment and the L.T.S. systems it is required that the accumulator is discharged to avoid pressurised fluid from escaping.

For the accumulator discharge procedure, please refer to point 6.8.2.

Check the pre-load, proceeding as follows:
- remove protection cover (**1**, fig. 6-44);
- loosen 1/2 turn screw (**2**) with an Allen wrench;
- install tool (**D**) 75298472 on the accumulator connection;
- ensure that valve (**D2**) is closed;
- rotate handle (**D1**) so as to loosen screw (**2**);
- when the pointer of pressure gauge (**M**) starts moving, unscrew handle (**D1**) a turn further.
  At this point, the pressure gauge indicates the precharge pressure of the accumulator, that must result 18 bar.

If the pressure is below the nominal value, recharge the accumulator.
After re-closing screw (**2**) using handle (**1**) discharge the nitrogen accumulated in block (**D**) opening cock (**D2**).

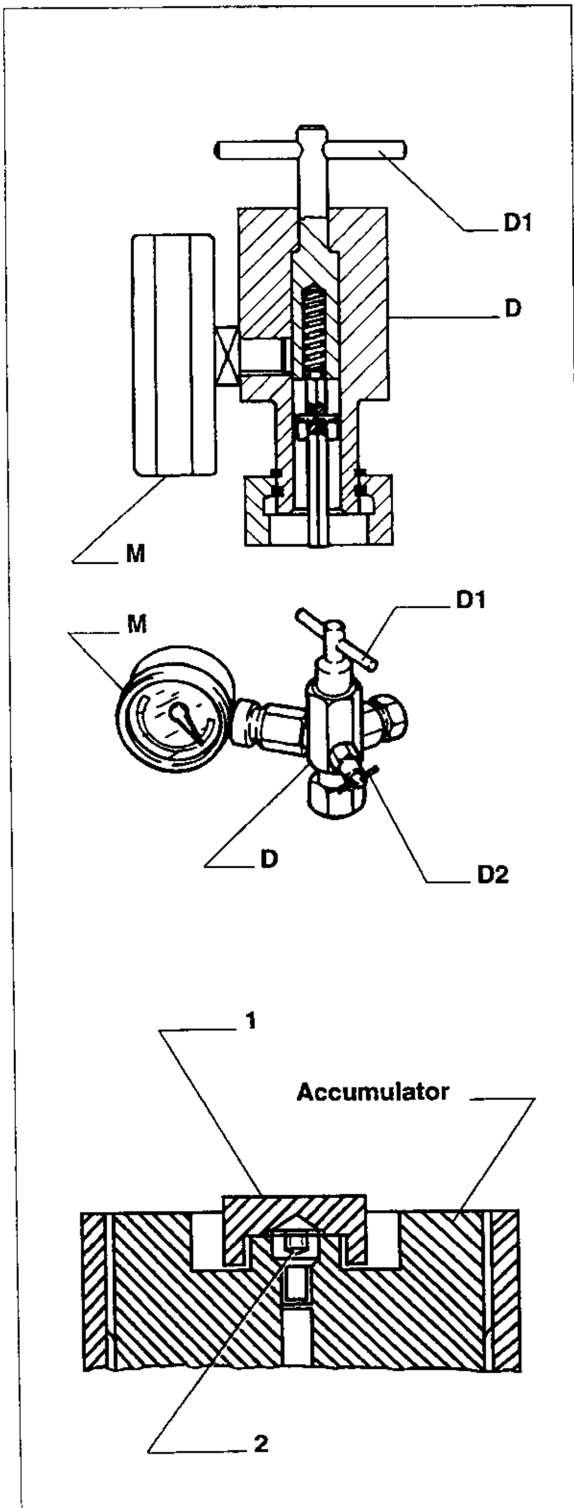


Fig. 6-44

D. Tool - **D1.** Handle - **D2.** Discharge cock - **M.** Pressure gauge - **1.** Protection cap - **2.** Threaded plug.

6.8.6 INSTRUCTIONS FOR THE RESETTING OF ACCUMULATOR PRECHARGE

With tool applied to the accumulator connection proceed as explained below:

- Remove the cap and install the hose of the nitrogen bottle equipped with pressure reduction valve (**V**);

WARNING - DANGER

To recharge accumulators use nitrogen only. Never and for no reasons use oxygen or other gases, since there is a great risk of explosions.

- With valve (**D2**) closed, open slowly the valve of the nitrogen bottle and check the filling pressure increment on the pressure gauge (**M**).

Important - The filling pressure must be at least 10% higher than the nominal value, considering that the pressure in the accumulator decreases when the compressed gas cools.

- Close the valve of the nitrogen bottle. Wait for about five minutes.
- Check on pressure gauge (**M**) that the filling pressure is 18 bar. If it is lower, repeat the operation.

If the pressure is higher, proceed as follows:

- Rotate slowly handle (**D2**) so as to make the nitrogen flow and re-close it.
- Check on pressure gauge (**M**) that the pressure is at the desired value, otherwise repeat the operation.
- Move handle (**D1**) so as to tighten screw (**2**) on the accumulator.
- Remove the filling rig.
- Tighten screw (**2**) to a torque of 1.1 daNm.
- Check that the accumulator is not leaking, using soapy water.
- Retighten the protective cap of the accumulator.

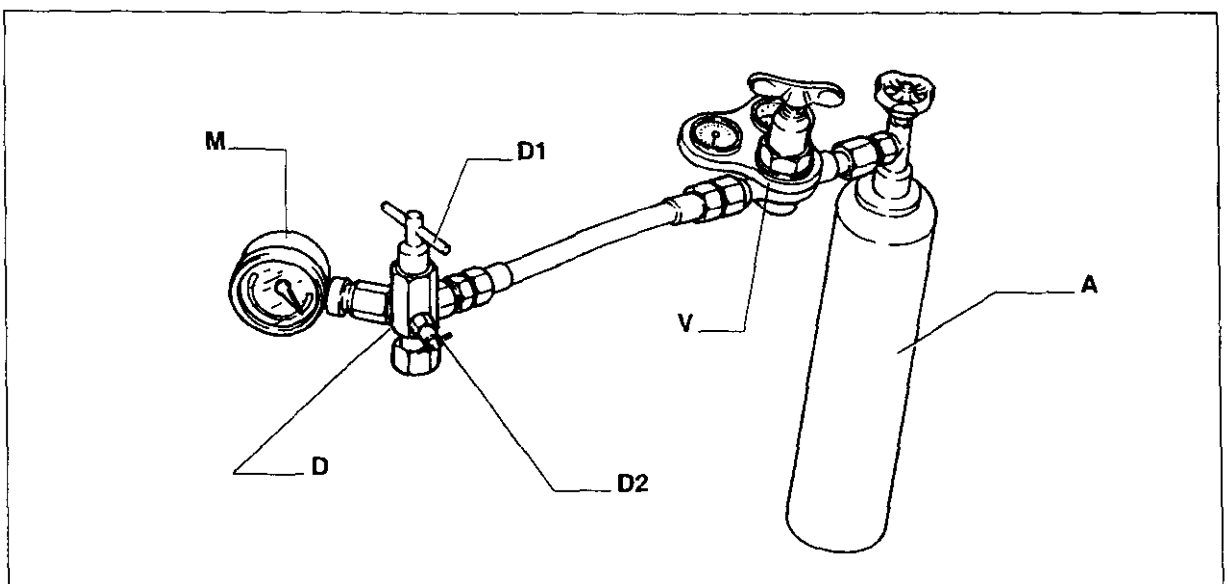


Fig. 6-45

A. Nitrogen bottle - **D.** Tool - **D1.** Handle - **D2.** Discharge valve - **M.** Pressure gauge.

6.9 SUPPLEMENTARY HYDRAULIC FUNCTION (Variant)

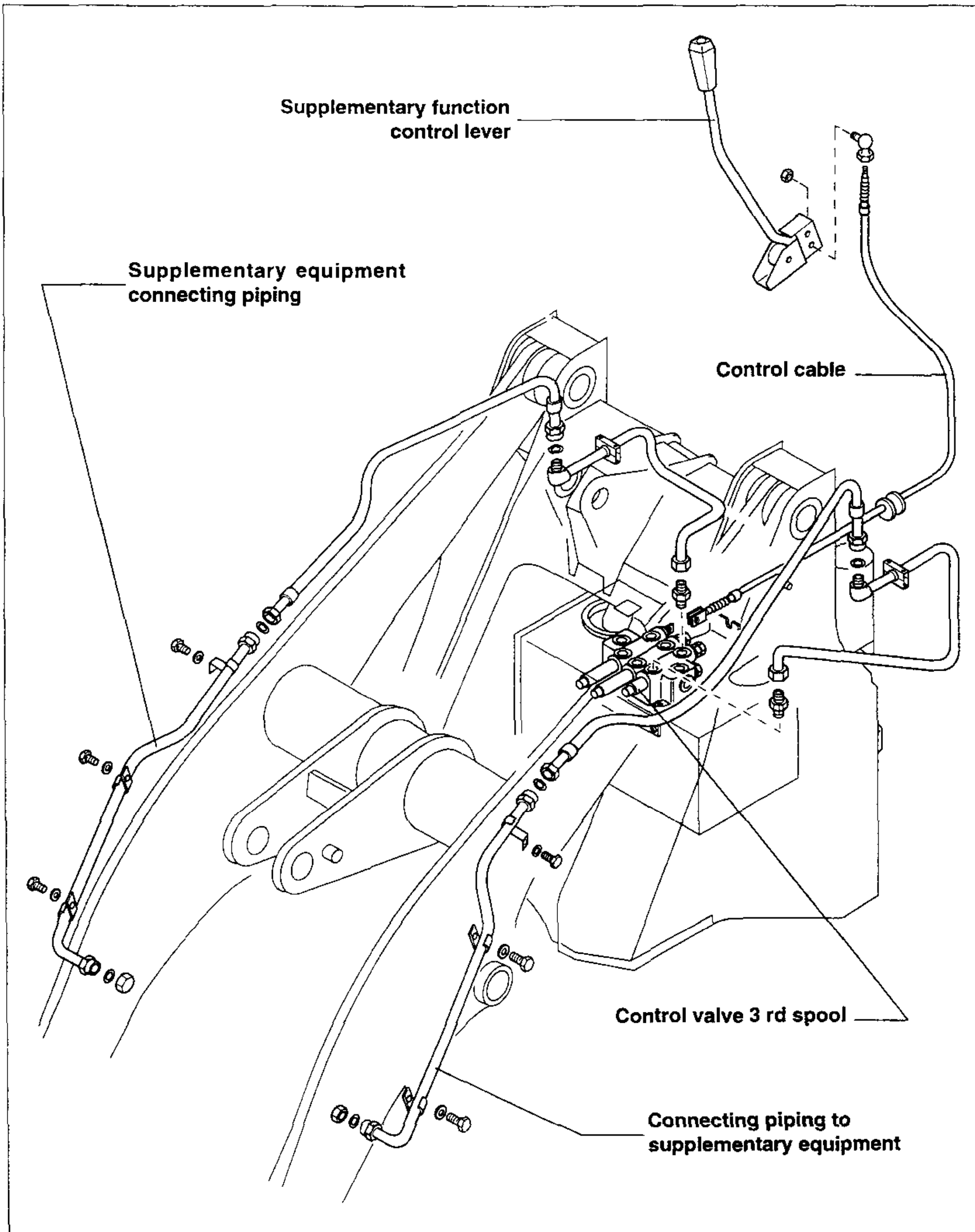


Fig. 6-46 Configuration of supplementary hydraulic function (mechanical control version).

SECTION 7

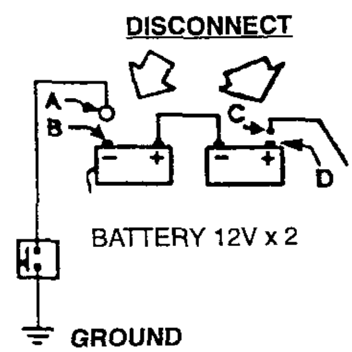
ELECTRICAL SYSTEM

CONTENTS

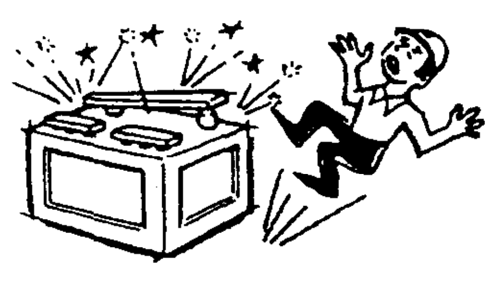
SAFETY RULES

WARNING: When working on the electrical system, always wear safety glasses and remove rings, wrist watches or any other metal jewellery.

WARNING: Prior to any maintenance or repair of electrical components, disconnect the GROUNDING CABLE "**A**" from the negative post "**B**" of the battery. DISCONNECT CABLE "**C**" FROM POSITIVE POST "**D**".



WARNING: NEVER PLACE METAL OBJECTS on the battery to avoid short-circuits.



WARNING: BATTERY GASES ARE FLAMMABLE.
Never get near batteries with open flames or sparks. During recharging, the generation of gases is higher.

WARNING: BATTERY GASES ARE DANGEROUS if contacting the skin or other materials.

7.1 GENERAL LAY-OUT OF ELECTRICAL SYSTEM

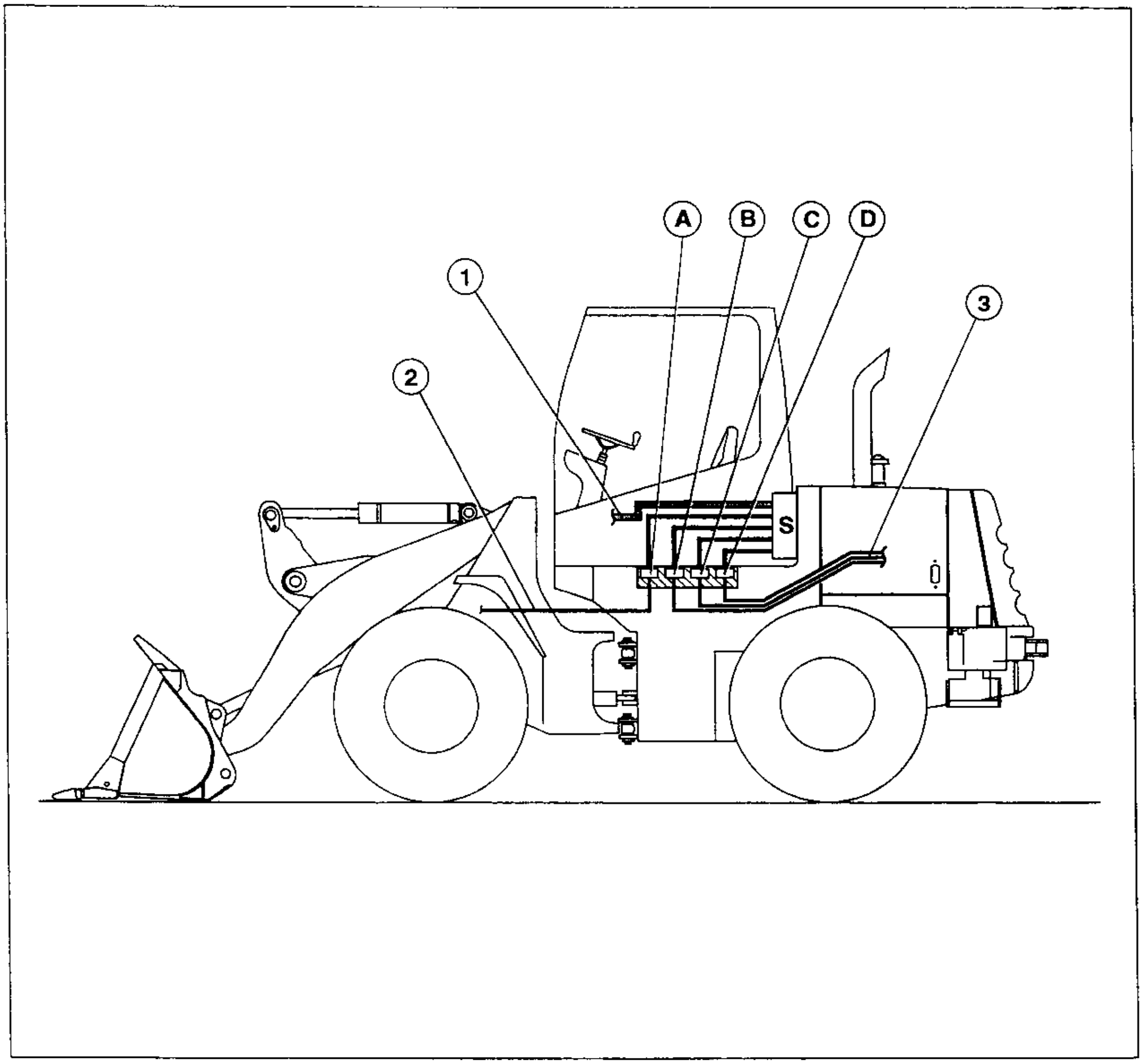
The electric wirings are divided into three main groups:

1. Cab wiring group, identified by different colours connected to all the electrical components in the cab.

2. Front frame wiring group identified by numbers, connected to all the electrical components involving the front frame.

3. Rear frame wiring group, identified by numbers, connected to all the electrical components involving the rear frame.

The three groups of main wirings are connected among themselves by four connectors **(A-B-C-D)** located in the area under the cab floor. All wires are connected to the logic board **(S)** located inside the rear panel behind the operator's seat.



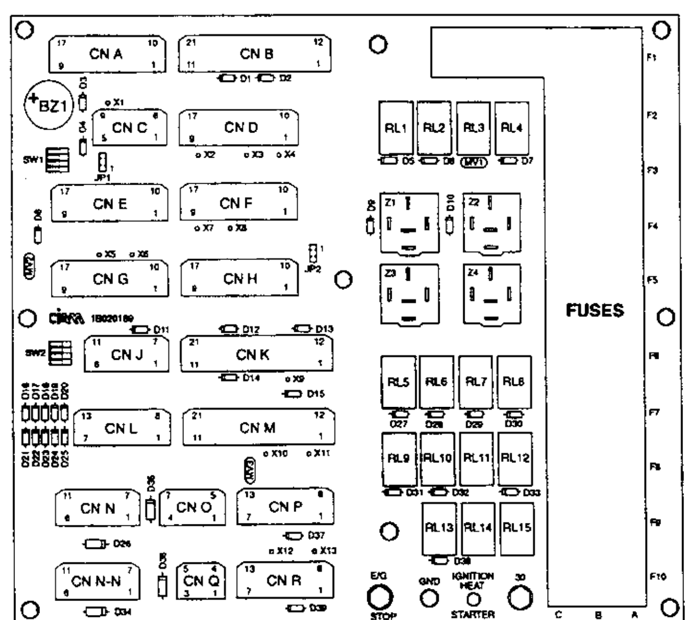
A-B-C-D. Connectors - **S.** Logic board - **1.** Cab wiring - **2.** Front frame wiring - **3.** Rear frame wiring.

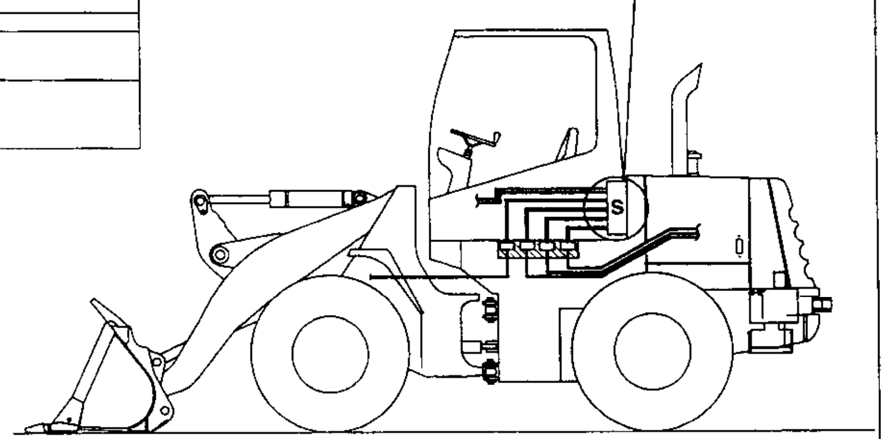
7.2 LOGIC BOARD

The logic board is located inside the rear panel behind the operator's seat. To reach it, loosen the two retaining knobs.
Al the components of the machine are connected to the board by the "CN" connections.
Also, the fuses, the solenoid switches ("RL" relays), timers "Z" the cab buzzer and two switches "SW1" and "SW2" to divert the gearshift control from manual to mechanic and viceversa, are located.

7.2.1 CONNECTIONS - RELAYS - TIMERS - BUZZER

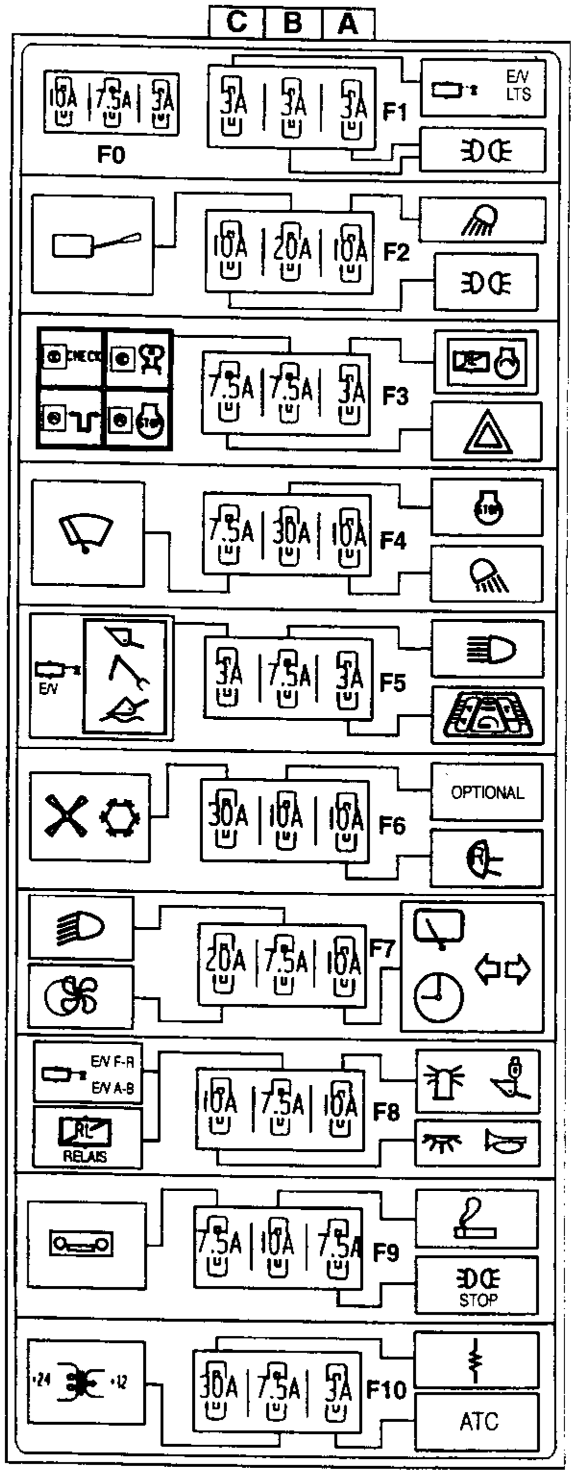
CONNECTIONS CN	CN A	LINE CAB 17 WAY VIOLET
	CN B	LINE SWITCH 21 WAY BLACK
	CN C	LINE ENGINE 9 WAY WHITE
	CN D	LINE SWITCHES 17 WAY BROWN
	CN E	LINE ATC UNIT 17 WAY WHITE
	CN F	LINE MONITOR PANEL & LIGHTS & DIRECTION SWITCH 17 WAY RED
	CN G	LINE MONITOR PANEL 17 WAY YELLOW
	CN H	LINE ENGINE 19 WAY BLACK
	CN J	LINE SWITCHES 11 WAY GREEN
	CN K	LINE ENGINE 21 VIOLET
	CN L	LINE OP INSTRUMENT 13 WAY LIGHT BLUE
	CN M	LINE ENGINE 21 WAY WHITE
	CN N	LINE MANUAL GEARSHIFT 11 WAY WHITE
	CN O	LINE GEARSHIFT DIVERTER 7 WAY WHITE
	CN P	LINE ENGINE 13 WAY YELLOW
	CN Q	LINE VOLTAGE REDUCTION 5 WAY WHITE
	CN R	STARTING HEATER UNIT 13 WAY
	CN N-N	LINE ATC GEARSHIFT 11 WAY WHITE
RELAYS RL	RL1	RELAY HORN
	RL2	RELAY LIGHTS DIVERTER
	RL3	RELAY STARTING AND ANTI REPEAT
	RL4	RELAY STARTING NEUTRALISER FROM PANEL+NEUTRAL
	RL5	RELAY CONDITIONER FAN OPERATION
	RL6	RELAY EV-B2 OPERATION
	RL7	RELAY DEFROSTING
	RL8	RELAY BACK-UP ALARM AND LIGHTS
	RL9	RELAY EV.A - EV.B POWER SUPPLY
	RL10	RELAY TRANSMISSION CUT-OFF
	RL11	RELAY VC2 POWER SUPPLY OPERATION
	RL12	RELAY VC2 POWER SUPPLY OPERATION
	RL13	RELAY EV.CTS OPERATION
	RL14	RELAY VC1 POWER SUPPLY
	RL15	RELAY VC1 POWER SUPPLY
TIMERS Z	Z1	STEERING ALARM TIMER
	Z2	CHECK TIMER
	Z3	FLASHER UNITS
	Z4	TIMER E/G STOP
BUZZER	BZ1	DASHBOARD ALARM BUZZER





S. Logic board.

7.2.2 FUSES



F0	A	SPARE FUSE
	B	SPARE FUSE
	C	SPARE FUSE
F1	A	FUSE, REAR RIGHT HEAD LIGHT
	B	FUSE, REAR LEFT HEAD LIGHTS
	C	FUSE, EV. CTS SWITCH POWER
F2	A	FUSE, FRONT WORK LIGHTS
	B	FUSE, GEARSHIFT SWITCH LIGHTS
	C	FUSE, HEAD LIGHTS SWITCH POWER
F3	A	FUSE, 50 FROM DASHBOARD-SOL. R4
	B	FUSE, CHECK BUZZER-STARTER UNIT-STARTER HEATER UNIT-ELECTRIC STOP
	C	FUSE, EMERGENCY LIGHTS
F4	A	FUSE, REAR WORK LIGHTS
	B	FUSE, ENGINE STOP SOLEN. - INITIAL CRANK
	C	FUSE, FRONT WIPER
F5	A	FUSE, FRONT INSTRUMENT - INSTRUMENT OPER.-BUZZER CHECK
	B	FUSE, LOW BEAM LIGHTS
	C	FUSE, SENSORS-EVENT. FLOAT-EVENT. MAX. KICKOUT-EVENT. BUCKET
F6	A	FUSE, BACK UP LIGHTS - HORN - R8 SOLENOID
	B	FUSE, REAR WINDSHIELD HEATER
	C	FUSE, FAN POWER FROM R5
F7	A	FUSE, REAR WIPER - TURNING LIGHTS - +15 CLOCK
	B	FUSE, LOW BEAM LIGHTS
	C	FUSE, FAN SWITCH
F8	A	FUSE, ROTARY BEACON FOURTH FUNCTION SWITCH
	B	FUSE, SOLENOIDS R14 - R15 - R12 - R11 - EV. A - EV. F - EV. R
	C	FUSE, CEILING LIGHT - HORN - SOLENOID R1
F9	A	FUSE, STOP LIGHTS
	B	FUSE, CIGARETTE LIGHTER
	C	FUSE, 12V RADIO AND SOCKET
F10	A	FUSE + PEDAL SENSOR ATC UNIT
	B	FUSE, VOLTAGE REDUCTION POWER
	C	FUSE, + 30 STARTER HEATER UNIT

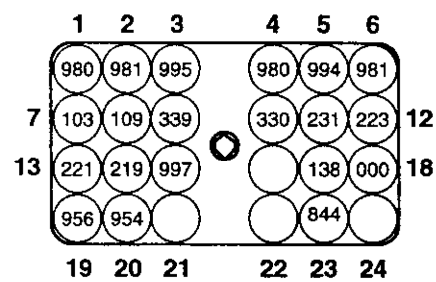
7.3 CONNECTORS

The connectors (**A-B-C-D**) are located in the lower part of the cab, connecting the main wiring to the logic board (**S**).
The coloured wires arrive from the upper side, the numbered wires from the lower side.
On connectors **A-B-C** (fig. connectors) there are 24 connecting points, whereas on connector **D** (fig. connector **D**) there are 18. The description and the function of each wire on the connector has a corresponding number/colour, as it can be found in the description of each connector.

CONNECTOR A

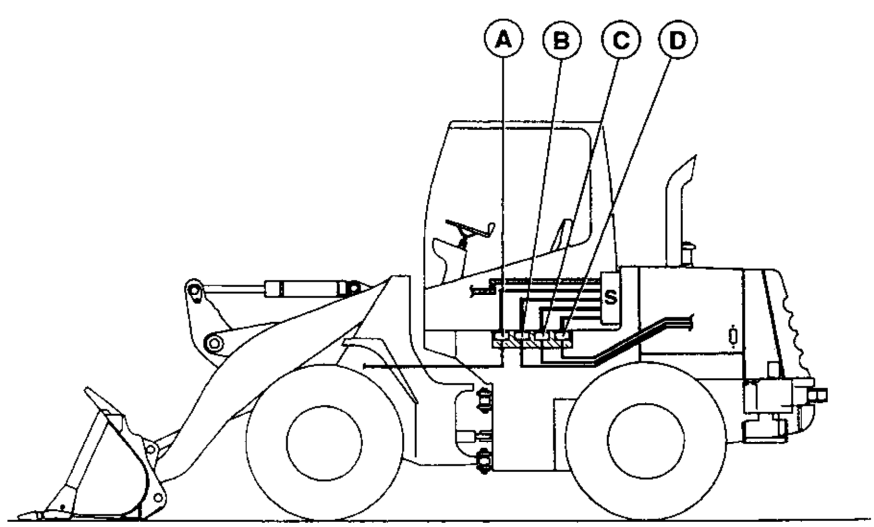
Reference on connector	Description - Function	Colour	Wire
1)	SIGNAL BOOM KICKOUT	–	980
2)	SIGNAL BUCKET POSITIONER	–	981
3)	POWER BOOM KICKOUT PROXIMITY	S–N	995
4)	SIGNAL BOOM KICKOUT	S–G	980
5)	POWER BUCKET POSIT. PROX.	V–B	994
6)	SIGNAL BUCKET POSITIONER	V–N	981
7)	RIGHT TURNING LIGHT	A	103
8)	LEFT TURNING LIGHT	L	109
9)	LEFT HEAD LIGHT	G	339
10)	RIGHT HEAD LIGHT	G–N	330
11)	LEFT LOW BEAM	H	231
12)	RIGHT LOW BEAM	H–N	223
13)	RIGHT HIGH BEAM	V	221
14)	LEFT HIGH BEAM	V–R	219
15)	EVENTUAL 4TH FUNCTION	A–G	997
16)	*	–	–
17)	HORN POWER	C–N	138
18)	GND	N	000
19)	EVENTUAL LTS	Z–N	956
20)	GND EVENTUAL LTS	B–N	954
21)	*	–	–
22)	*	–	–
23)	EMERGENCY STEERING PRESS.		844
24)	*	–	–

* NOT CONNECTED



Symbol of wires

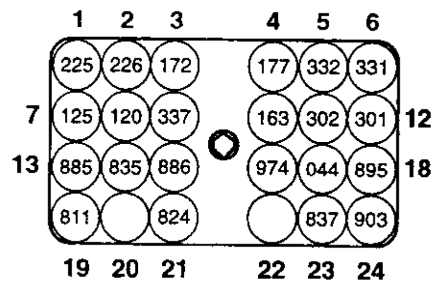
C =	Orange	N =	Black
A =	Light blue	S =	Pink
B =	White	R =	Red
L =	Blue	V =	Green
G =	Yellow	Z =	Violet
H =	Grey		



A-B-C-D. Connectors

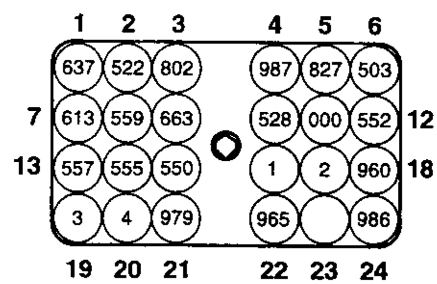
CONNECTOR B

Reference on connector	Description - Function	Colour	Wire
1)	RIGHT REAR WORK LIGHT	G	225
2)	LEFT REAR WORK LIGHT	C	226
3)	RIGHT STOP LIGHT	G-V	172
4)	LEFT STOP LIGHT	B-G	177
5)	LEFT HEAD LIGHT	G	332
6)	RIGHT HEAD LIGHT	G-N	331
7)	RIGHT TURNING LIGHT	A	125
8)	LEFT TURNING LIGHT	L	120
9)	LICENCE PLATE LIGHT	L-G	337
10)	BACKUP ALARM	C-N	163
11)	RIGHT BACKUP	A-G	302
12)	LEFT BACKUP LIGHT	R-V	301
13)	FRONT WINDSHIELD WASHER		885
14)	EMERG. STEERING PRESSURE OUTPUT	A-B	835
15)	REAR WINDSHIELD WASHER	–	886
16)	TRANSM. CUTOFF PRESSURE	V-B	974
17)	GND CLOCK	G-R	044
18)	PRE-HEAT. SOLEN. POWER	Z-N	895
19)	GND	N	000
20)	–	–	–
21)	COMPRESSOR	V-N	890
22)	EVAPORATOR FAN	Z	
23)	EVAPORATOR FAN	R	837
24)	ELECTRIC STOP	R-N	903



CONNECTOR C

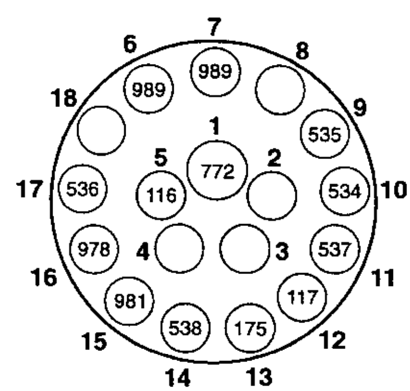
Reference on connector	Description - Function	Colour	Wire
1)	D+	G	637
2)	ALTERNATOR W	G-N	522
3)	STARTER RELAY SWITCH	G-V	802
4)	POWER FOR EVENT. B	–	987
5)	START. HEATER TEMP. SENS.	C-N	827
6)	ENGINE OIL LOW PRESSURE	B	503
7)	BRAKE ACCUMULATOR LOW PRESSURE	A	613
8)	TRANSM. OIL TEMPERATURE	B-V	559
9)	AIR CLEANER SWITCH	C-B	663
10)	COOLANT HIGH TEMPRAT.	V-N	528
11)	GND	N	000
12)	COOLANT TEMP. GAUGE	R-V	552
13)	FUEL LEVEL	Z	557
14)	RESERVE INDICAT. - OPTION	Z-B	555
15)	TRANSM. OIL TEMP. GAUGE	A-G	550
16)	EV. A	A-R	1
17)	EV. B	A-B	2
18)	POWER FOR EV. A	A-N	960
19)	EV. F	L-G	3
20)	EV. R	Z-N	4
21)	POWER FOR EV. F	S	979
22)	EV. FUEL START. HEATER 1°	–	965
23)	EV. FUEL START. HEATER 2°	–	
24)	POWER FOR EV. R	–	986



CONNECTOR D

Reference on connector	Description - Function	Colour	Wire
1)	60A	R	772
2)	OP. SENSOR	–	–
3)	OP. SENSOR	–	–
4)	OP. SENSOR	–	–
5)	HORN (PEDAL BUTTON SIGNAL)	–	116
6)	1ST STAT. HEATER (25AMP)	R	989
7)	2ND STAT. HEATER (25AMP)	R	963
8)	EL. STOP (IN. CRANK 25 AMP)	B	964
9)	GROUND 1ST SPEED SENSOR	N	535
10)	SPEED SENSOR 1	L	534
11)	SPEED SENSOR 2	G-R	537
12)	STOP LIGHTS SWITCH POWER	R	117
13)	STOP LIGHTS SWITCH OUTPUT	R-N	175
14)	ACC. PEDAL SENS. SEGN. INP.	B-N	538
15)	ACC. PEDAL SENS. SEGN. POW.	B	960
16)	PARK. BRAKE PRESS. SW.	–	969
17)	GROUND 2ND SPEED SENS. SIGNAL	–	536
18)	*	–	–

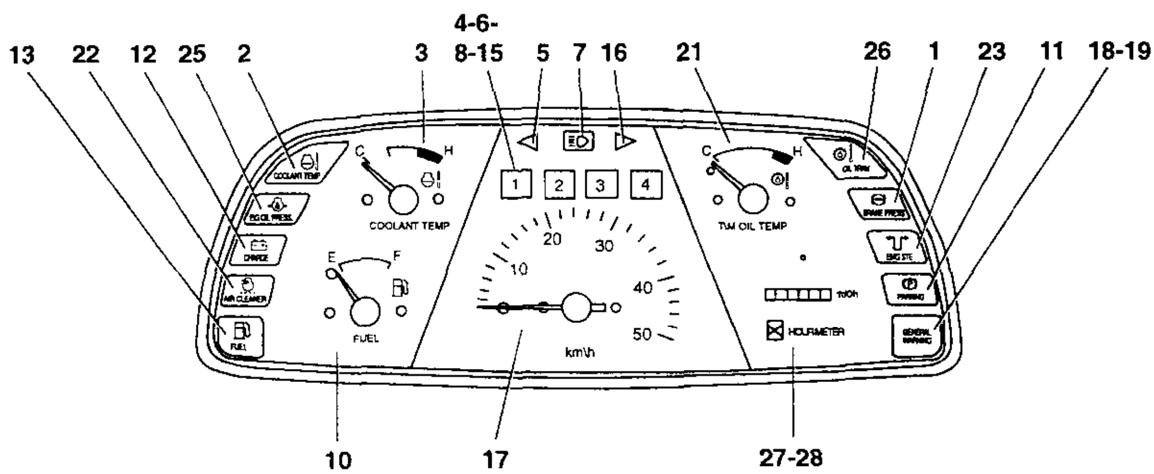
* NOT CONNECTED

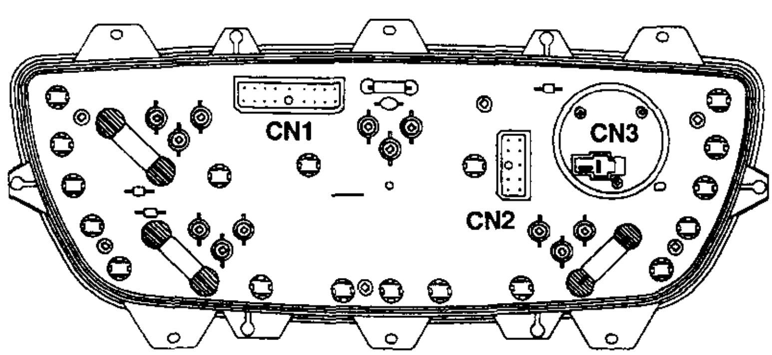


7.4 METERS AND SWITCHES CLUSTER

The operating status monitor system monitors the loader operating status by means of the sensors and switches installed on the loader and siplays the information on the cluster guage unit in the operator's compartment to inform the operator of the current operating status of the loader.

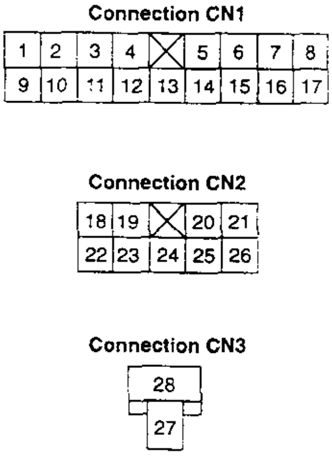
The cluster guage unit consists of meters including the speedometer, monitor lamps (warning lamps) which indicates whether or not each system is operating properly, and indicator lamps.

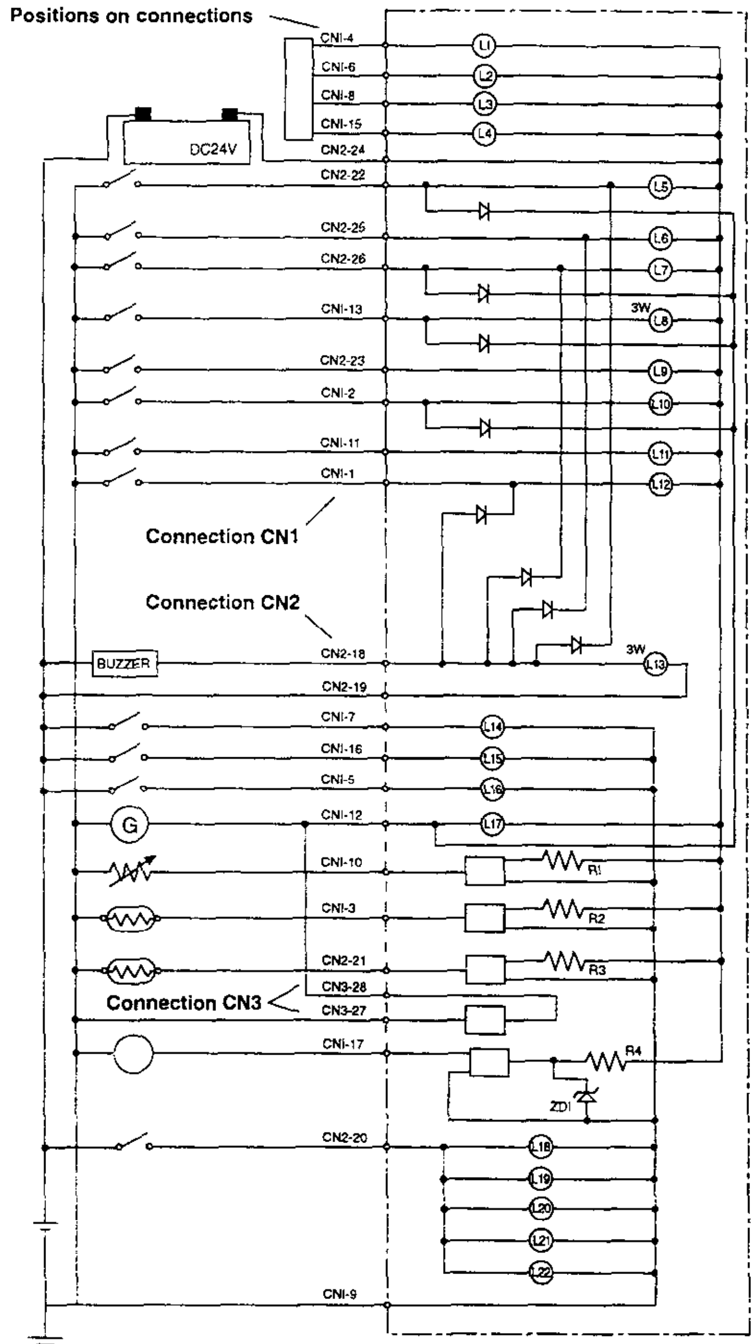




CONNECTION CN1	1	Indicat. accumul. oil low pressure
	2	Indicat. engine coolant high temperature
	3	Indicat. coolant temperature
	4	Light, instrument cluster
	5	Light, left turning
	6	Light, instrument cluster
	7	High beams
	8	Light, instrument cluster
	9	Ground
	10	Fuel level
	11	Indicator, parking brake
	12	Indicator, battery charge
	13	Indicator, fuel reserve
	14	Not connected
	15	Light, instrument cluster
	16	Light, right turning
	17	Speedometer

CONNECTION CN2	18	Buzzer
	19	General indicator
	20	Instrument cluster lights
	21	Indicat. transmission oil temperature
	22	Indicat. air cleaner clogging
	23	Indicat. emergency steering
	24	Batteries
	25	Indicat. engine oil low pressure
	26	Indicat. transm. oil high temperature
CONNECTION CN3	27	Hourmeter (ground)
	28	Hourmeter (battery)

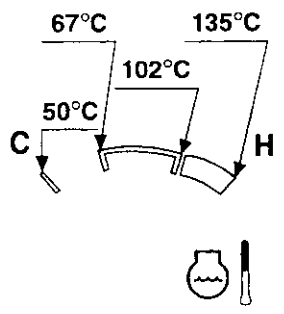
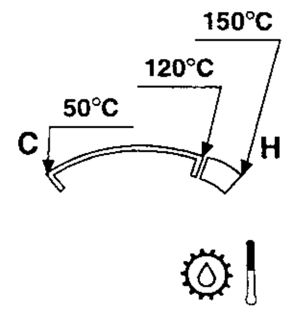
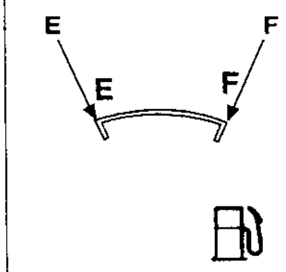




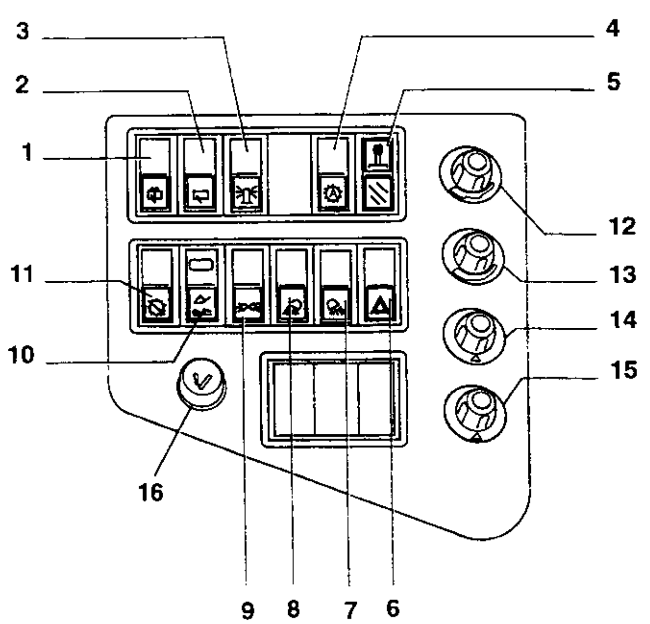
Electric diagram of instrument and switch panel

FM : FUEL METER
WTM : ENGINE WATER TEMPERATURE GAUGE
OTM : TRANSMISSION OIL TEMPERATURE GAUGE
EHM : ENGINE HOUR METER
SM : SPEEDOMETER
L1-L13 : MONITOR LAMPS
L14 - L18 : INSTRUMENT LAMPS

7.4.1 INDICATORS ON INSTRUMENT CLUSTER

Meter	Engine water temperature gauge		Transmission oil temperature gauge		Fuel meter	
Scala						
Measurement point	67°C ↗	102°C ↗	50°C ↗	120°C ↗	E ↙	F ↗
Standard value	49.8Ω	16.8Ω	91.7Ω	10.4Ω	80Ω	10Ω

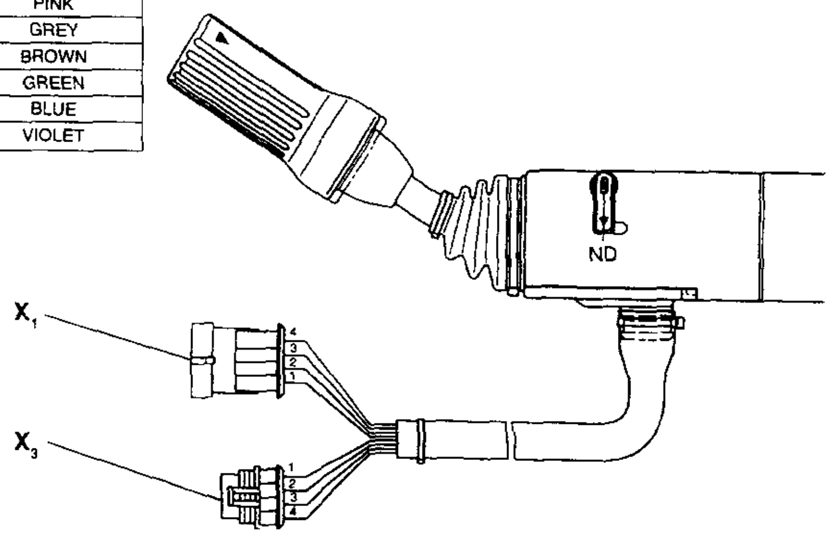
7.5 SWITCH PANEL



1. Front windshield washer button - 2. Rear wiper switch - 3. Rotary beacons switch - 4. Automatic transmission switch - 5. Pre-heater indicator - 6. Emergency lights switch - 7. Rear work lights switch - 8. Front work lights switch - 9. Head lights and low beam switch - 10. L.T.S. ON switch - 11. Transmission cut-off switch - 12. Fan switch - 13. Warm-cold switch - 14. Air re-circulation switch - 15. Conditioner switch - 16. Cigarette lighter.

7.6 GEARSHIFT SELECTOR

CONNECTIONS	WIRE	TERMINAL	COLOUR
X_1	1	VP	RED
	2	E	YELLOW
	3	F	PINK
	4	G	GREY
X_3	1	C	BROWN
	2	D	GREEN
	3	A	BLUE
	4	H	VIOLET



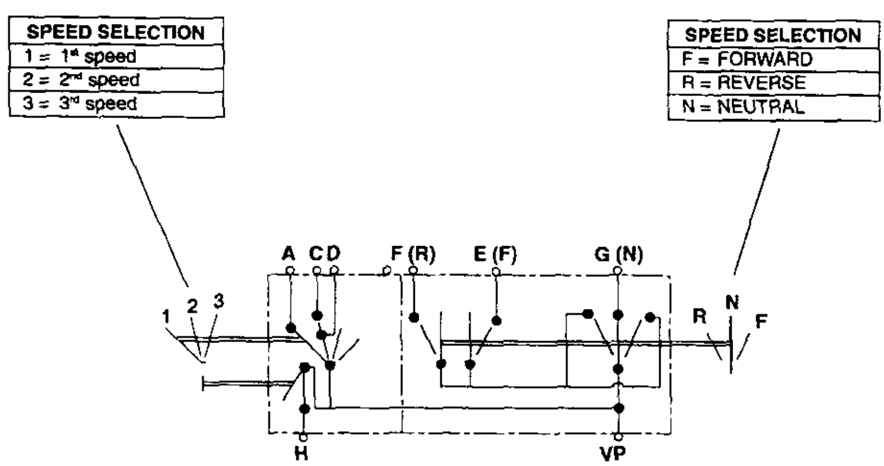


Diagram of electric gearshift selector

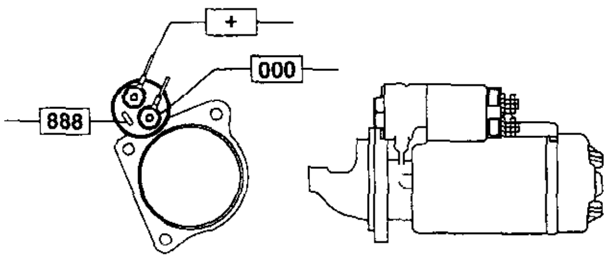
7.7 COMPONENTS ON MACHINE

1 – STARTER MOTOR

WIRES

+	To battery
888	To starter solenoid switch
000	Ground

LOCATION - Left rear side of engine under fuel filters

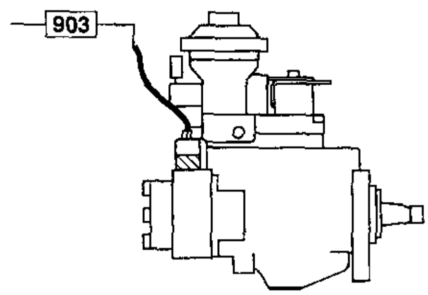


2 – ENGINE STOP SOLENOID

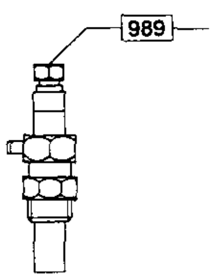
WIRES

903	To starter switch (**7**)

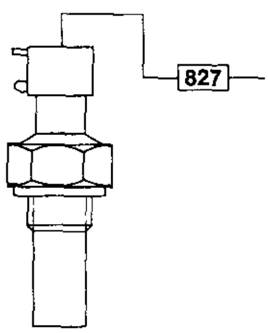
LOCATION - On injection pump



3 – STARTER HEATER



4 – THERMOSTAT FOR STARTER HEATER



5 – FUEL SOLENOID VALVE

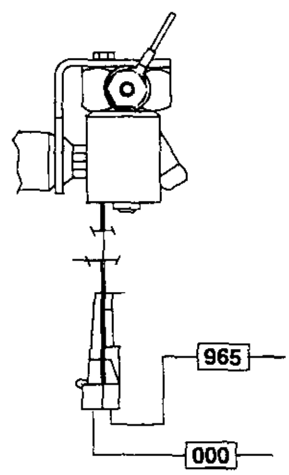
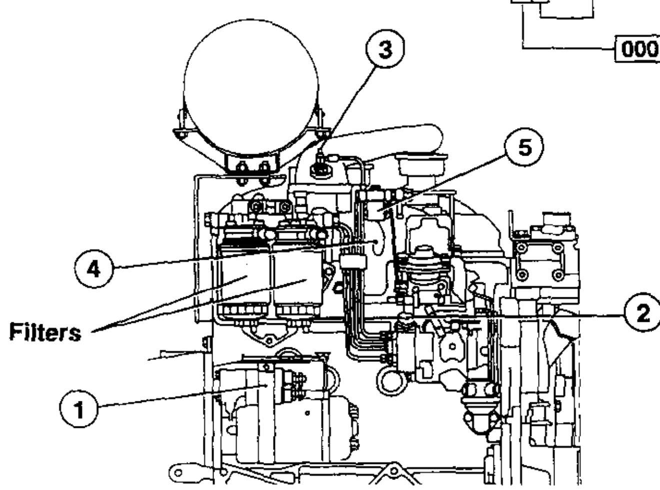
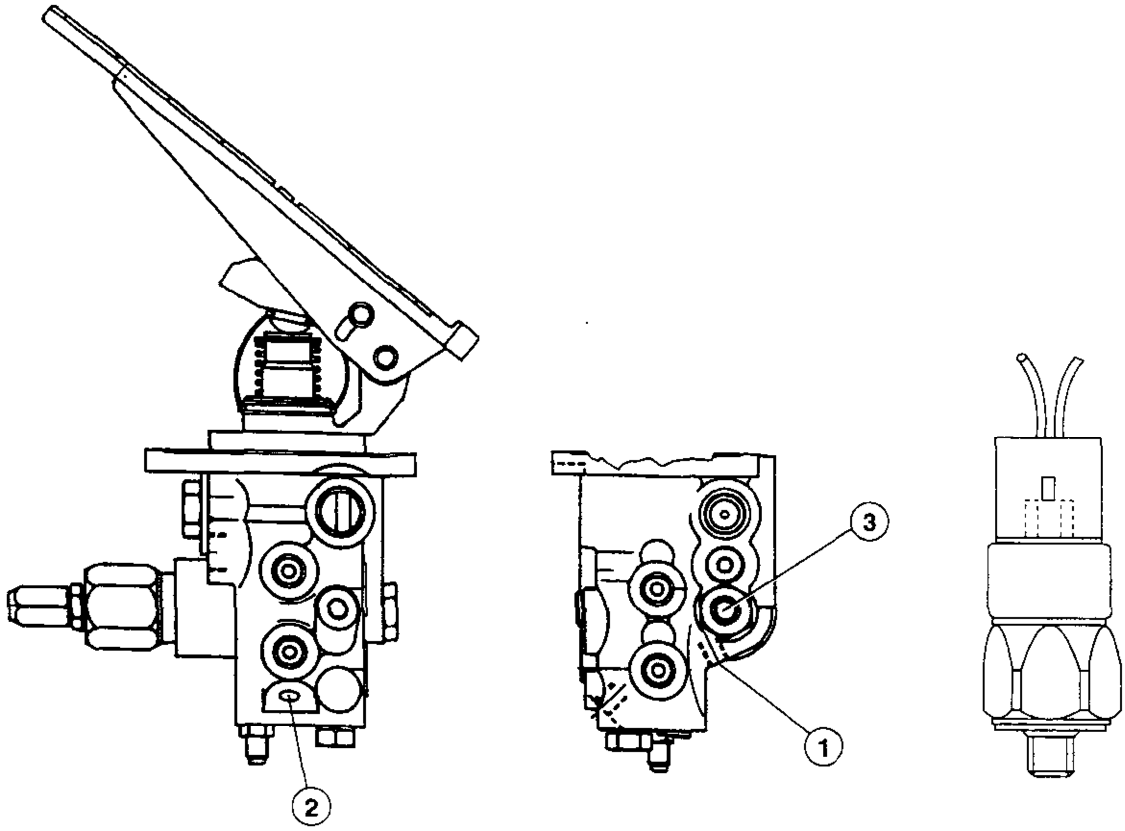


Illustration of components on engine

1. Starter motor
2. Engine stop solenoid valve
3. Heater starter
4. Thermostat for starter heater
5. Fuel solenoid valve



PRESSURE SWITCHES ON BRAKE PEDAL VALVE



1 – STOP LIGHTS CONTROL SWITCH

WIRES

117 To fuse F9A on logic board
175 To stop lights

TECHNICAL SPECIFICATIONS

Thread: M10 x 1
Setting: 1.8 ± 0.5 bar

2 – TRANSMISSION CUT-OFF SWITCH

WIRES

974 To switch for transmission cut-off arrangement
000 To ground

TECHNICAL SPECIFICATIONS

Thread: M10 x 1
Setting: 15 ± 1 bar
Tightening torque: 2 daNm

3 – BRAKES ACCUMULATOR OIL LOW PRESSURE SENSOR

WIRES

613 To instrument and switch cluster
000 To ground on front frame

TECHNICAL SPECIFICATIONS

Thread: R 1/8 tapered
Setting: 60 ± 5 bar

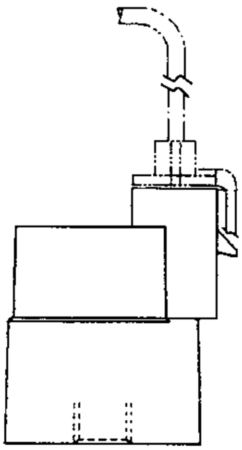
AIR CLEANER CLOGGING SENSOR

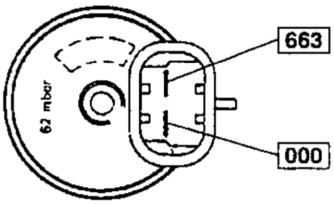
WIRES

663 To indicator on instrument cluster
000 To ground

TECHNICAL SPECIFICATIONS

Setting (closing of contact): 57 to 67 mbar
Tightening: tighten manually, without using tools





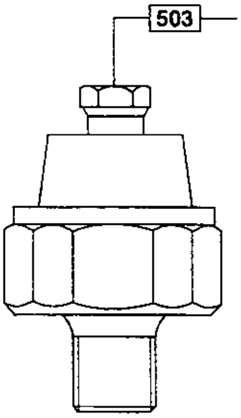
ENGINE OIL LOW PRESSURE SENSOR

WIRES

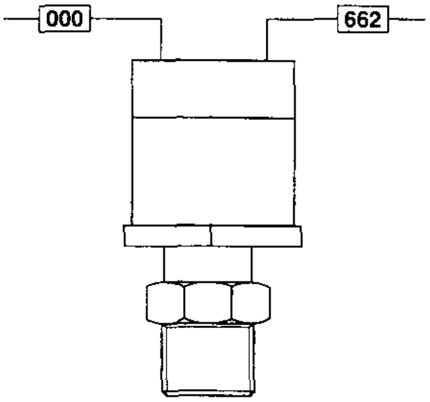
503 To instrument and switch cluster

TECHNICAL SPECIFICATIONS

Thread:	R 1/8 tapered
Setting:	0.5 ± 0.1 bar



PARKING BRAKE ENGAGED PRESSURE SWITCH



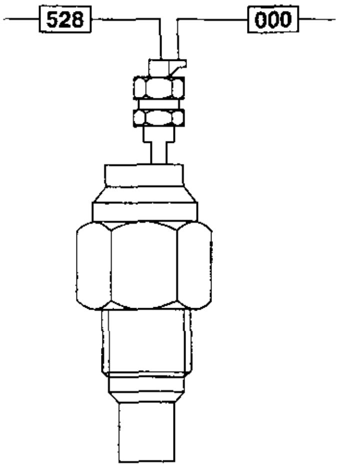
WIRES

662 To indicator on instrument cluster
000 To ground

TECHNICAL SPECIFICATIONS

Thread:	R 1/8 tapered
Setting:	12 ± 1 bar

COOLANT MAX. TEMPERATURE SWITCH



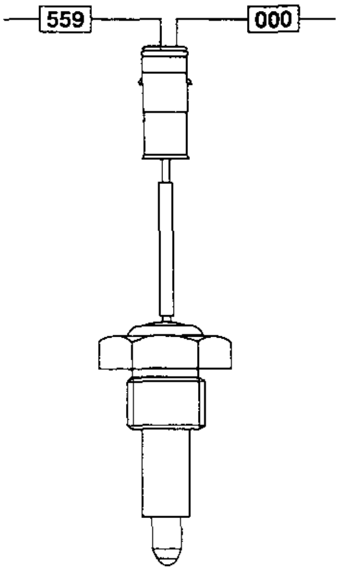
WIRES

528 To indicator on instrument cluster
000 To ground

TECHNICAL SPECIFICATIONS

Thread:	M16x1.5
Setting:	101 ± 1°C

TRANSMISSION OIL MAX. TEMPERATURE SWITCH



WIRES

559 To indicator on instrument and switch cluster
000 To ground

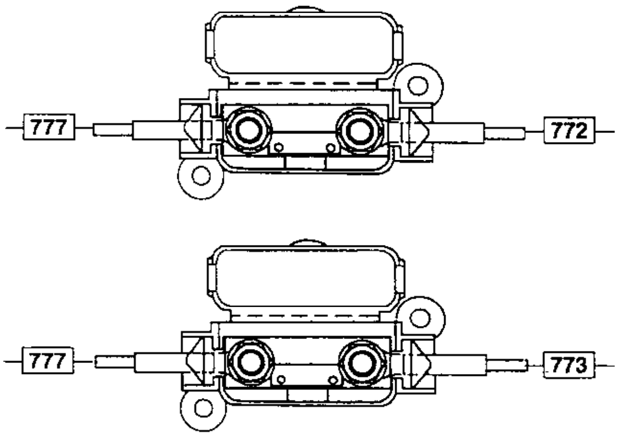
TECHNICAL SPECIFICATIONS

Thread:	M16x1.5
Setting:	122 ± 3°C
Tightening torque:	2 daNm

50 AMP "LINK" FUSES

WIRES

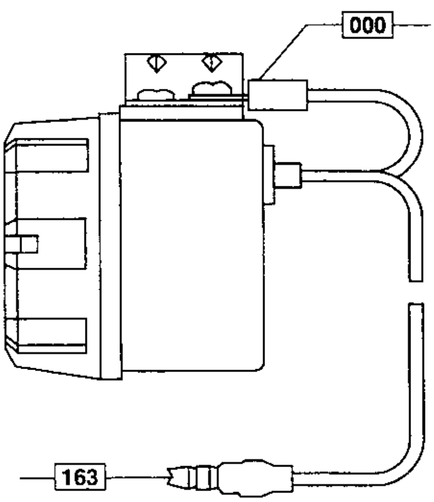
772 To diverter box
773 To alternator
777 To "+" of batteries



BACK-UP ALARM

WIRES

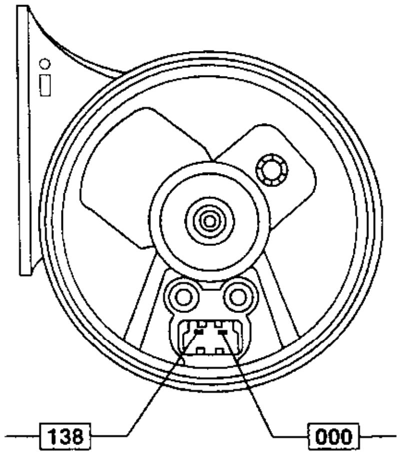
163 To back-up alarm
000 To ground



HORN

WIRES

138 To horn relay **80**
000 To ground



BUCKET POSITIONER PROXIMITY SENSOR

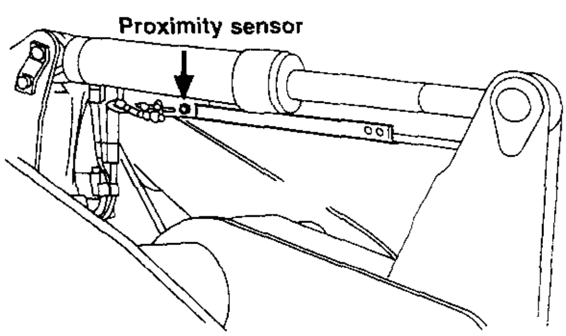
WIRES

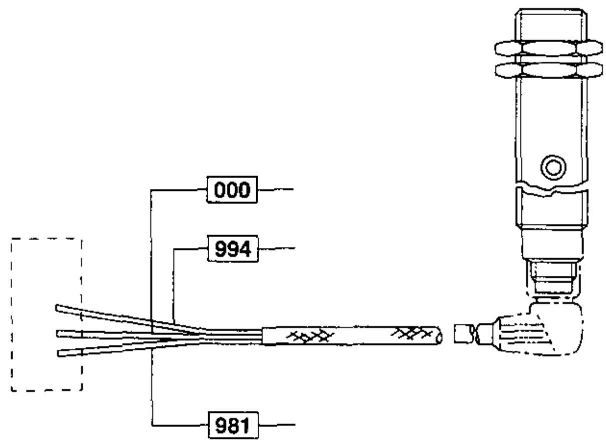
981 To bucket solenoid valve
994 To F5C fuse on logic board
000 To ground

TECHNICAL SPECIFICATIONS

Thread: M18x1
Tightening torque: 2.5 daNm

LOCATION - On end of bucket control right cylinder rod





BOOM KICK-OUT PROXIMITY SENSOR

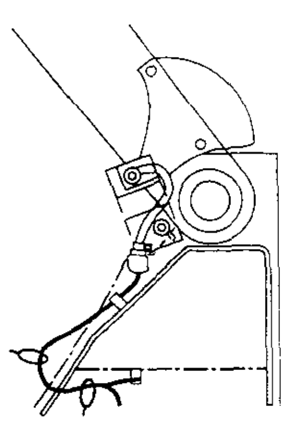
WIRES

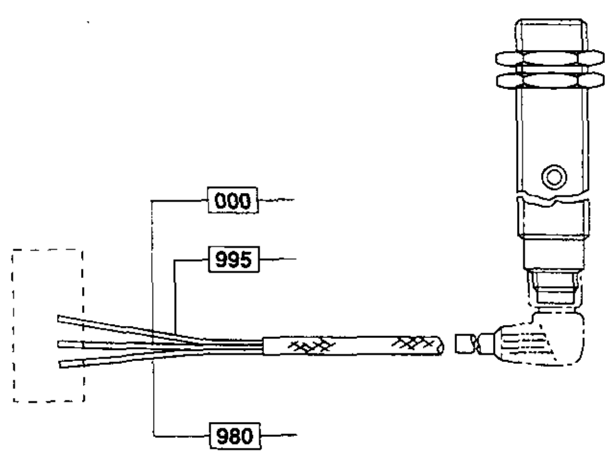
980 To boom solenoid valve
995 To F5C fuse on logic board
000 To ground on frame

TECHNICAL SPECIFICATIONS

Thread: M18x1
Tightening torque: 2.5 daNm

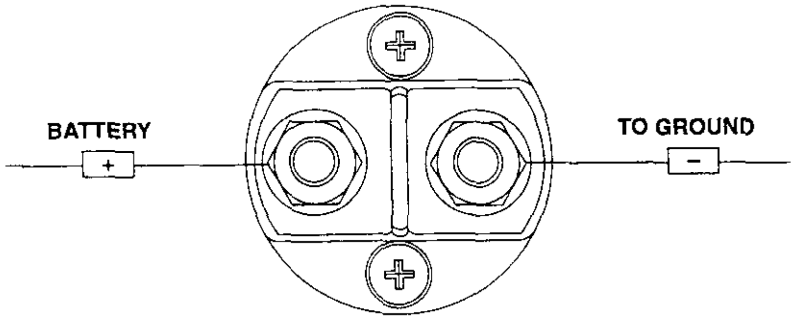
LOCATION - On front frame, at the upper end of left boom





MAIN SWITCH

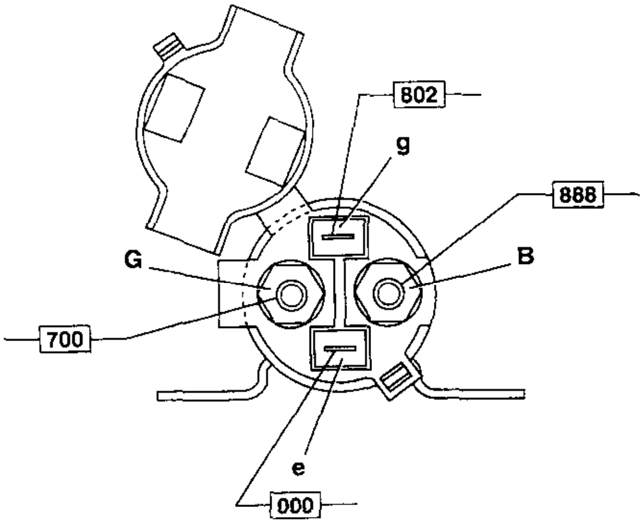
LOCATION - Rear end of machine



STARTER SOLENOID SWITCH

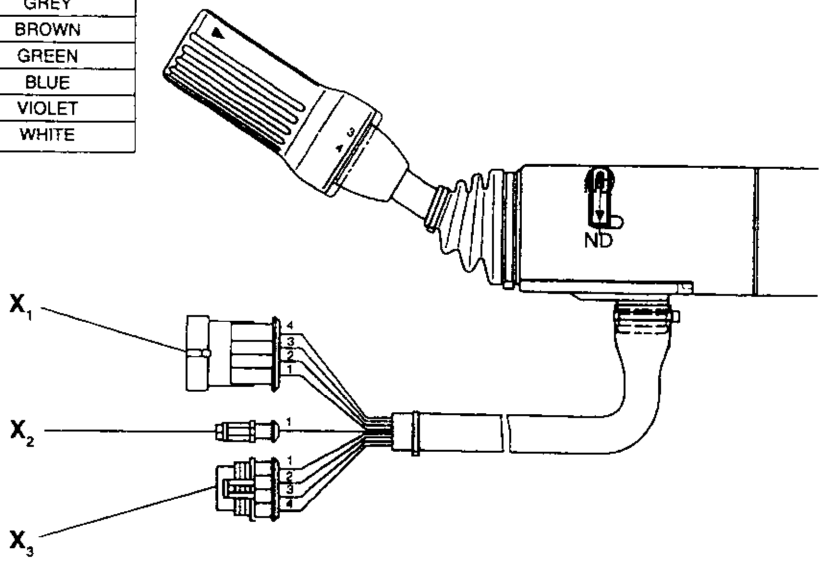
WIRES

700 Position **G** to starter switch
802 Position **g** to starter neutraliser solenoid switch
888 Position **B** to starter motor
000 Position **e** to ground



TRANSMISSION (AUTOMATIC) GEARSHIFT SELECTOR

CONNECT.	WIRE	TERMINAL	COLOUR
X_1	1	VP	RED
	2	E	YELLOW
	3	F	PINK
	4	G	GREY
X_3	1	C	BROWN
	2	D	GREEN
	3	A	BLUE
	4	H	VIOLET
X_2	1	B	WHITE



SPEED SELECTION
1 = 1st speed
2 = 2nd speed
3 = 3rd speed
4 = 4th speed

SPEED SELECTION
F = FORWARD
R = REVERSE
N = NEUTRAL

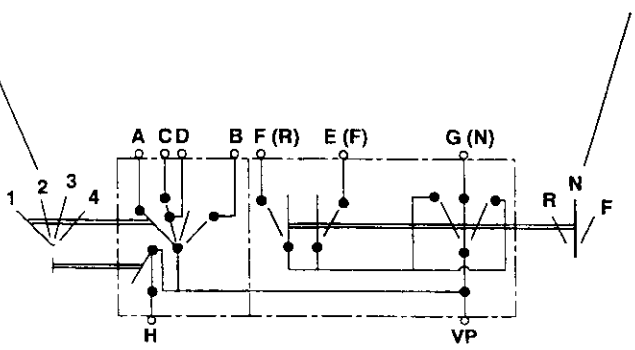
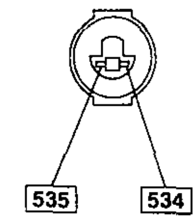


Diagram of electric gearshift selector

1st TRANSMISSION SPEED SENSOR

WIRES

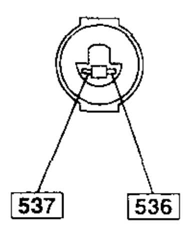
534 To ATC unit through connector **D**
535 To ground

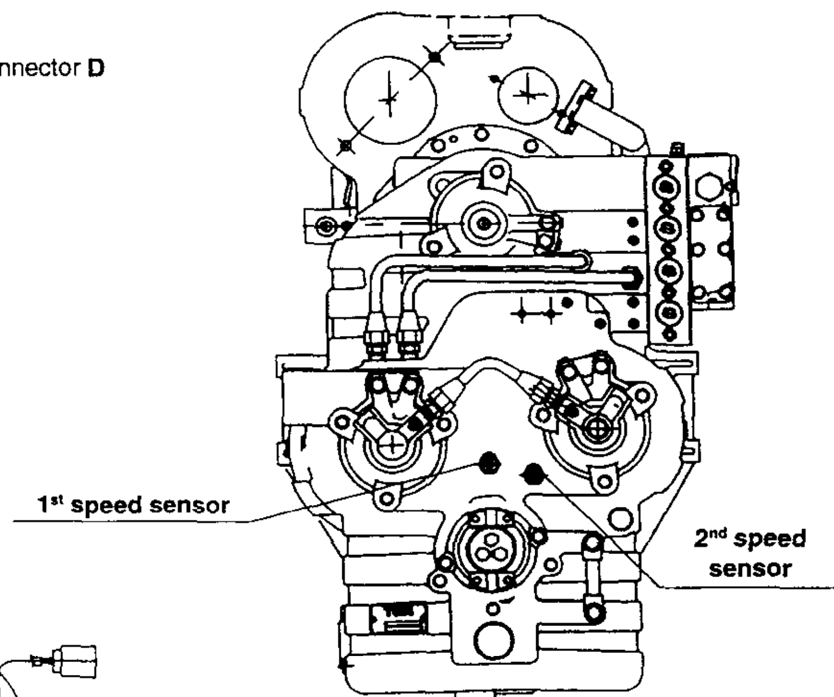


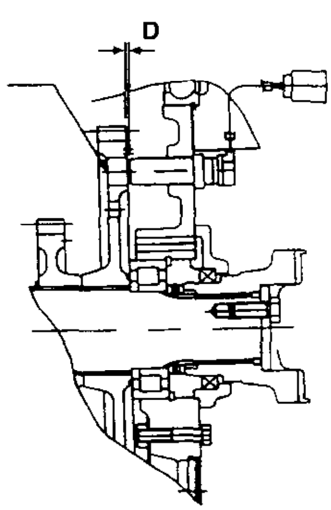
2nd TRANSMISSION SPEED SENSOR

WIRES

536 To ground
537 To ATC unit through connector **D**





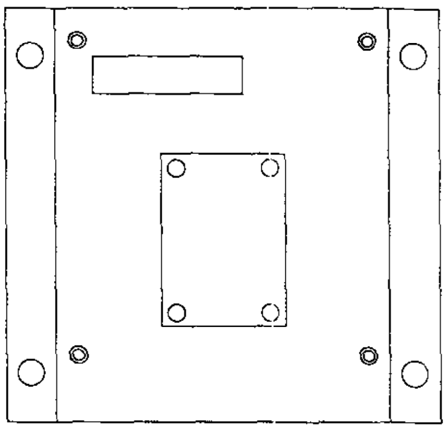


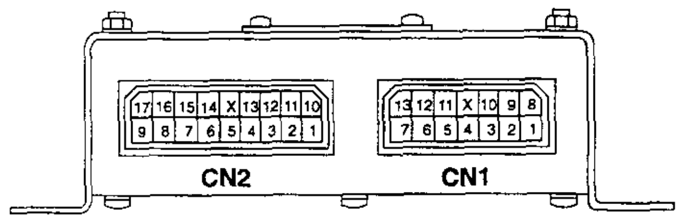
D = distance between sensor and transmission gear (refer to setting)

Note for the installation of the sensors: Apply LOCTITE 572 to 1st and 2nd sensor.

Setting: In order to obtain a correct installation of the sensors, tighten them to contact the transmission gear, then loosen the sensor one and 1/2 turn.

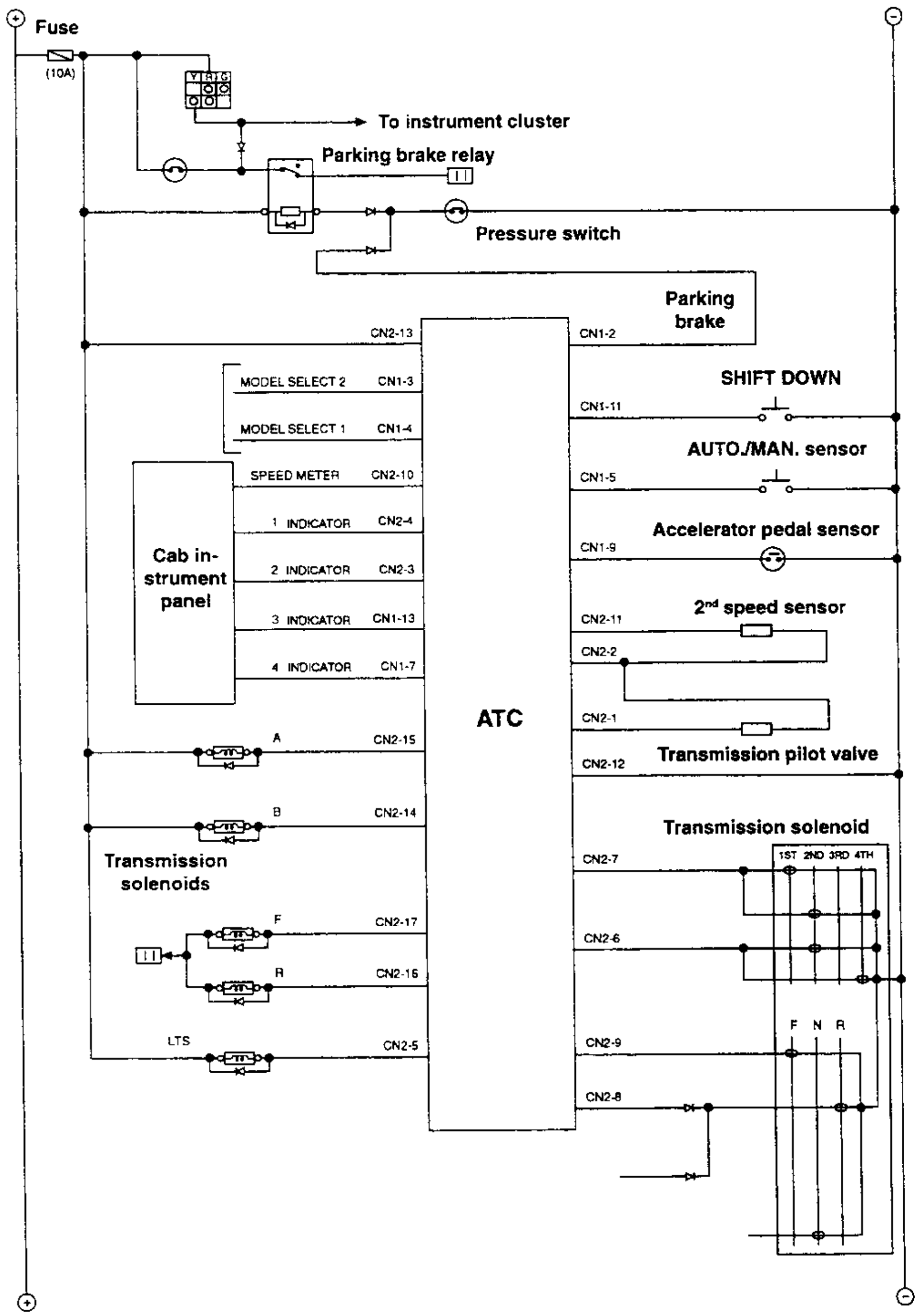
ATC (AUTOMATIC TRANSMISSION) ELECTRONIC UNIT





CN2	
Position	**Connection**
1	Speed sensor
2	Ground
3	2nd indicator
4	1st indicator
5	APS solenoid
6	Switch "B"
7	Switch "A'
8	Reverse selector
9	Forward selector
10	Tachometer
11	2nd speed sensor
12	Ground
13	Batteries
14	Solenoid "B"
15	Solenoid "A"
16	Solenoid "Reverse"
17	Solenoid "Forward"

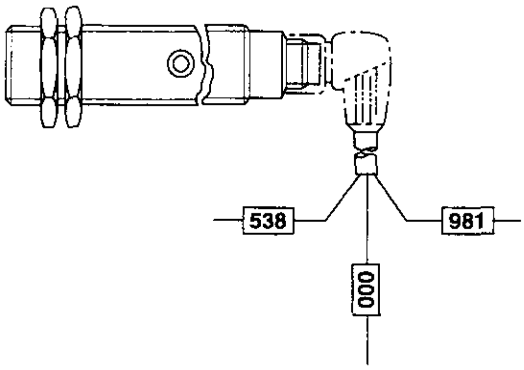
CN1	
Position	**Connection**
1	Ground
2	Switch, parking brake engaged
3	Selection "2"
4	Selection "1"
5	Selection AUTOM./MANUAL
6	Brakes
7	4th indicator
8	Pressure switch
9	Accelerator pedal sensor
10	Odometer (not available)
11	Shift down switch
12	
13	3rd indicator


Fuse
(10A)
Y R G
To instrument cluster
Parking brake relay
Pressure switch
Parking brake
CN2-13
CN1-2
MODEL SELECT 2 CN1-3
MODEL SELECT 1 CN1-4
SHIFT DOWN
CN1-11
AUTO./MAN. sensor
SPEED METER CN2-10
CN1-5
1 INDICATOR CN2-4
Accelerator pedal sensor
CN1-9
Cab in-strument panel
2 INDICATOR CN2-3
3 INDICATOR CN1-13
2nd speed sensor
CN2-11
CN2-2
4 INDICATOR CN1-7
ATC
CN2-1
A CN2-15
CN2-12
Transmission pilot valve
B CN2-14
Transmission solenoid
Transmission solenoids
CN2-7
1ST 2ND 3RD 4TH
F CN2-17
CN2-6
R CN2-16
F N R
LTS CN2-5
CN2-9
CN2-8

PROXIMITY SENSOR
(Accelerator pedal)

WIRES

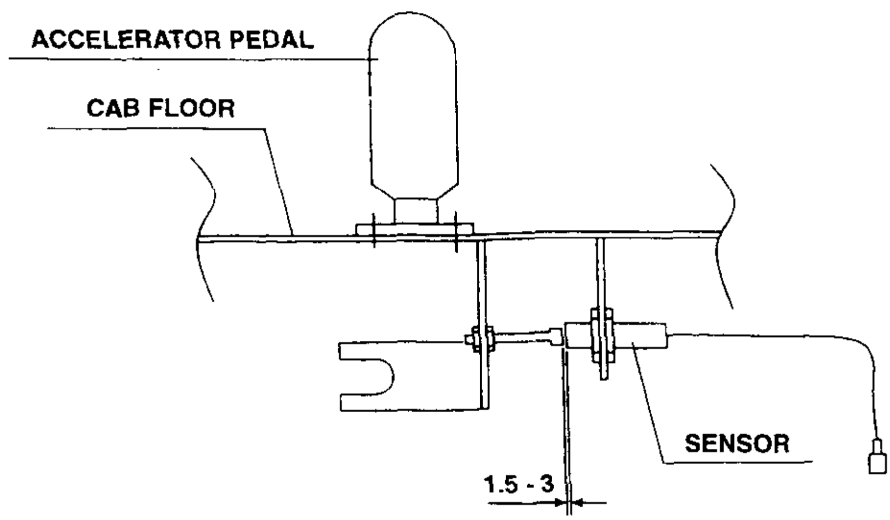
538 To ATC electronic unit
981 To F10A fuse on logic board
000 To ground



TECHNICAL SPECIFICATIONS

Thread: M18x1
Tightening torque: 2 daNm

LOCATION - Under accelerator pedal



SECTION 8

CAB

CONTENTS

8.1 GENERAL DESCRIPTION

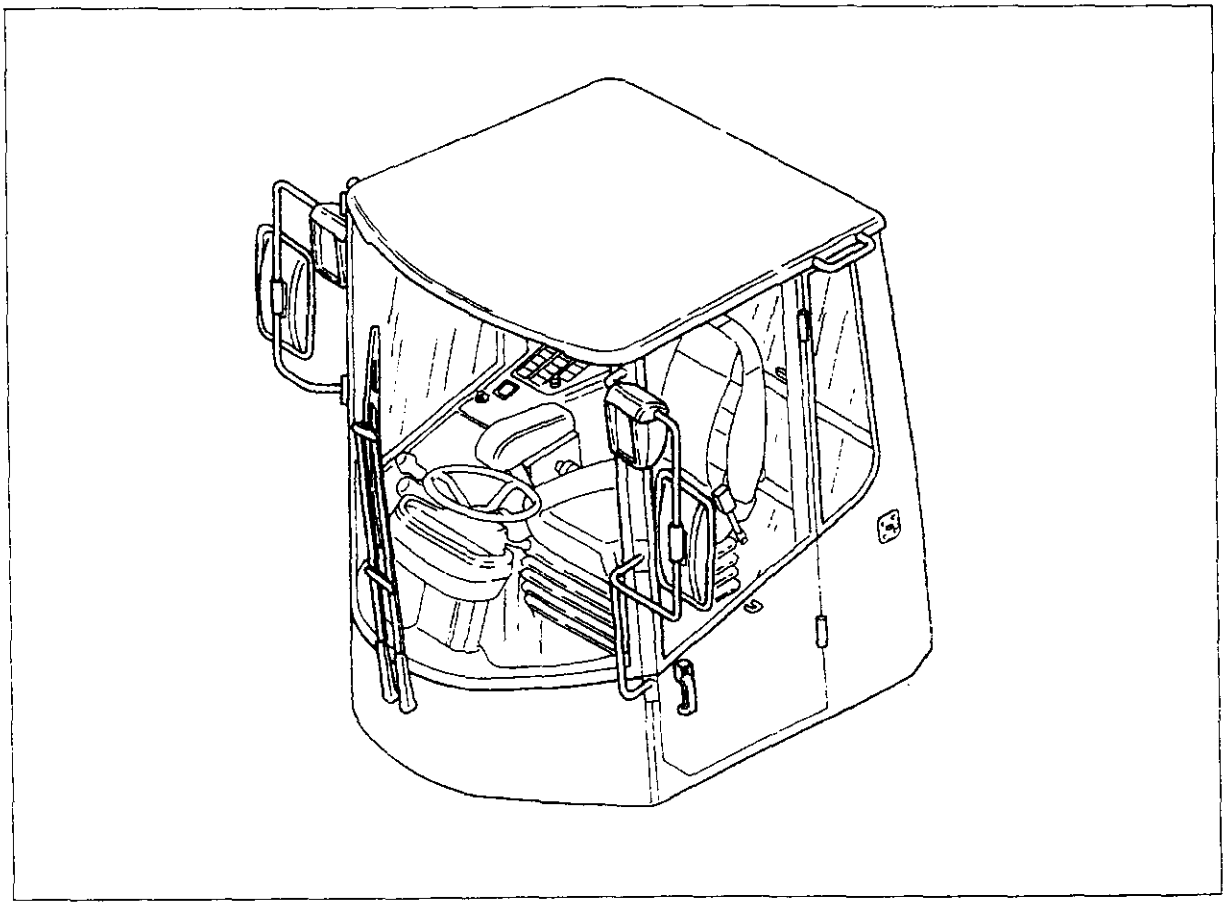


Fig. 8-1

The cab is a tested protection structure against roll-over hazard (**ROPS**).
The cab is complete with the driver's seat, steering column, controls and instruments to drive and operate the machine.
Other standard features are the heating system, demister, front and rear windscreen washer-wipers, ceiling light, clock/thermometer, loud-speakers, safety glasses, rear-view mirrors, sun visor, and emergency exit.
Access inside the cab is through the left-hand door. The right-hand door is used to gain access to the heater/air conditioning system compartment. Doors can be locked wide open and are fitted with a key lock.
The main components such as the hydraulic reservoir, hydraulic pump and control valve, steering control valves and cylinders, and drive shafts can be removed or repaired without disassembling the cab.

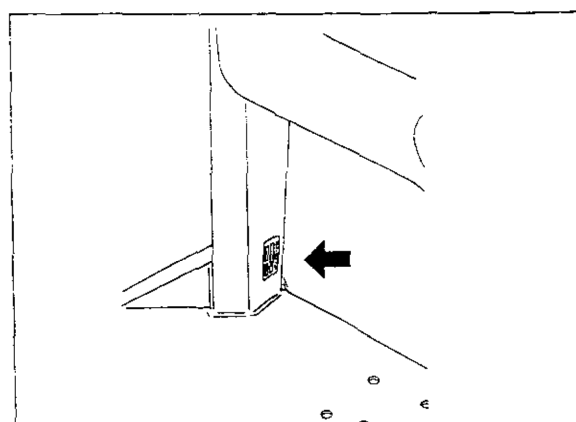


Fig. 8-2

The cab serial number is etched on a plate located on the inner side of the cab left-hand post.

8.2 WINDSCREEN WIPERS AND WASHERS

The front windscreen wiper motor (1) is located at the front of the steering column. The front windscreen wiper has two intermittent working speeds: 35 strokes per min (slow) and 55 strokes per min (fast).
A dog-leg mechanism transforms the motor shaft rotary motion into 45° strokes of the wiping arm.

The rear windscreen wiper motor (**2**) is located under the cab trim behind the driver's seat, on the right-hand side. The rear windscreen motor has but one speed (approx. 54 strokes per min).
Internal gears provide an 80° oscillation of the wiping arm.

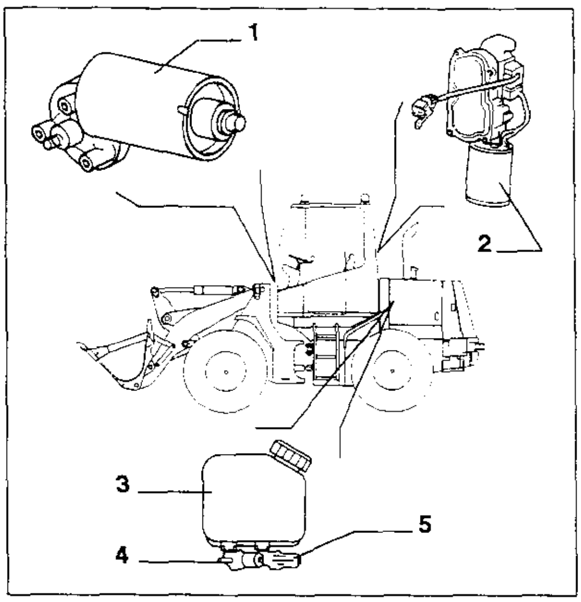


Fig. 8-3

The windscreen washer fluid bottle (**3**) is located inside the engine compartment, on the left-hand side. The bottle is fitted with two pumps (**4**) and (**5**) for the front and rear windscreens, respectively.

Specifications

Bottle capacity .... 2.5 lt.
Rated voltage 24V
Absorbed current .... ≤2A
Max. flow .... ≥3 lt./min

Note 1 - Before setting the wiper blades in motion, operate the windscreen washer to minimise the risk of scratching the glass.

Note 2 - Use the cleaning fluid **DP1** diluted with water dependent upon working temperature. A 50% detergent/water solution does not freeze down to -10°C. Below this temperature, use cleaning fluid only.

Pump hoses are connected to the nozzles located at the sides of the wiping arms.

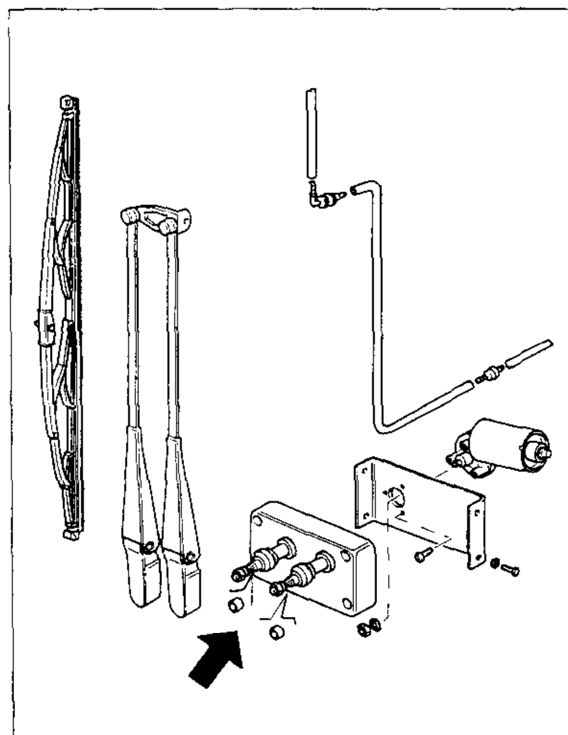


Fig. 8-4

In case of motor or arm assembly replacement, it will be necessary to reassemble the arm assembly to the drive part correctly to centre the wiping action over the glass width.
To this aim, select the most suitable position for the arm on the knurled drive part shown by the arrow in the figure.

8.3 HEATER

8.3.1 GENERALITIES

The cab heater is placed in a special compartment, on the cab right-hand side.
The associated switches are located on the control console and are used to:

- *adjust air temperature;*
- control air flow intensity;
- admit air from the outside or recirculate the air inside the cab.

In case of air intake from the outside, air is drawn in through the filter **A**. If air is being recirculated, internal cab air is driven through the filtering panel **B**.
Both filter **A** and filtering panel **B** should be replaced periodically.

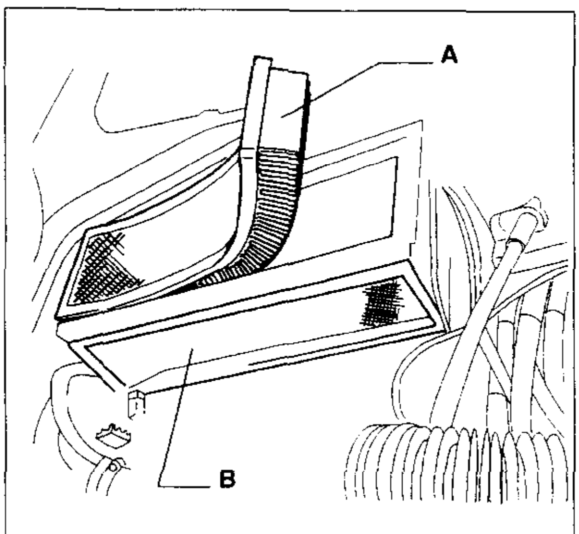


Fig. 8-5

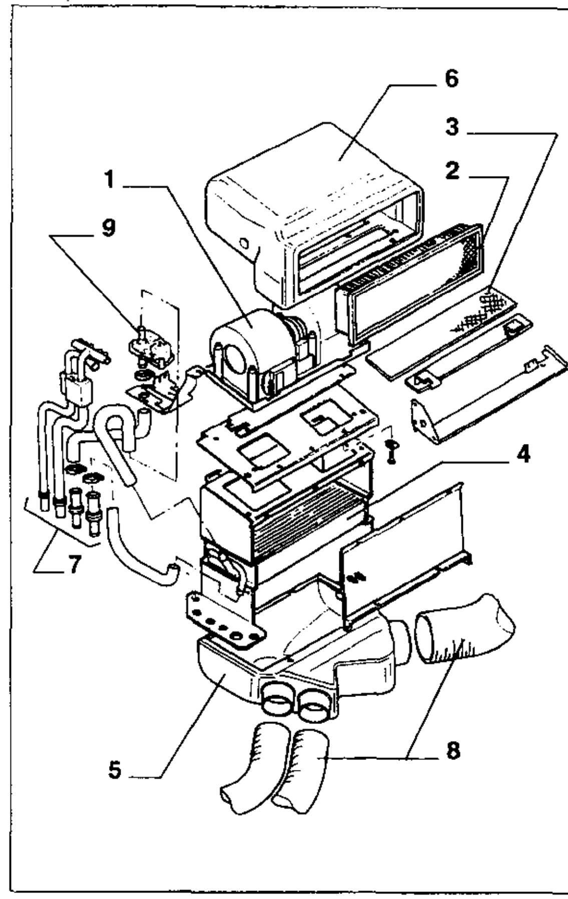


Fig. 8-6

8.3.2 MAIN COMPONENTS AND SPECIFICATIONS

The heater main components are:

1. Electrical fan
2. Outside air filter
3. Filtering panel
4. Heat exchanger
5. Shroud
6. Housing
7. Water lines
8. Air ducting
9. Feed valve

Specifications

Heat value .... 10,000 Kcal/h
Air flow .... 575 ± 10% m³/h
Absorbed power .... 400 W
Working temperature range .... –15 + 50°C

8.4 GLASSES

8.4.1 CHARACTERISTICS

All cab glasses are differential hardening type. Glasses should be ordered from FIAT-HITACHI. They should be kept clean at all times to guarantee good visibility. When cleaning the glasses, pre-wash them with a water and detergent solution or other proprietary product using a squeegee to reduce abrasion and make cleaning easier.

NOTICE - Never use hot water over cold glasses.

All glasses fitted to the cab have been subjected to differential hardening and have a 5 ± 0.2 mm thickness. They are firmly bonded to their seats by means of a polyurethane sealant.

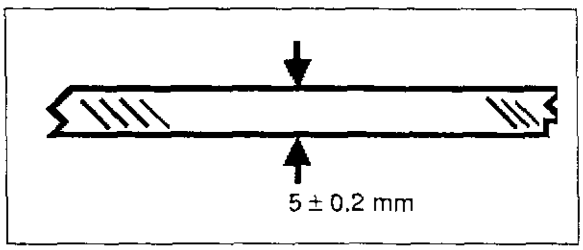


Fig. 8-7

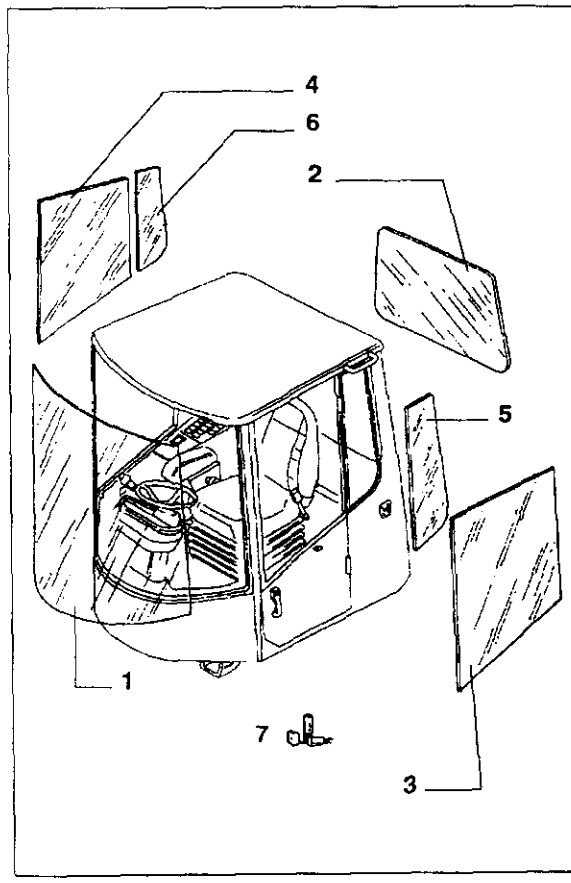


Fig. 8-8

1. Front windscreen
2. Rear windscreen
3. Door glass
4. RH side glass (emergency exit)
5. LH rear glass
6. RH rear glass
7. Bonding kit

8.4.2 DISASSEMBLY AND ASSEMBLY

Disassembly

1. Push a pointed object through the adhesive from inside the cab and insert the wire
2. Using the wire, cut the adhesive all around the glass. Lift out the glass using two suction cups.
3. Using a knife, cut off the adhesive left on the body to leave a smooth bevel of approximately 1 or 2 mm, which should be kept clean as it will be the bonding base for the polyurethane adhesive. Should the paint be partially damaged, apply some glass primer as a protection against corrosion.

Note - Work only in well ventilated premises. The polyurethane adhesive does not contain low molecular weight (monomolecular) volatile isocyanates. Therefore, there is no danger of irritation for the respiratory tract. However, all precautions required when using chemicals should be observed. Avoid contact with the eyes and skin.

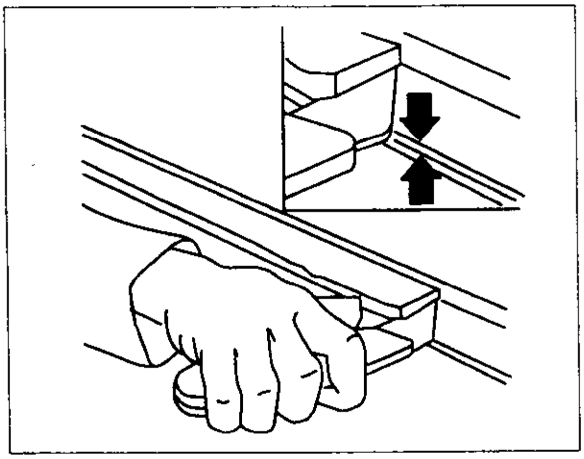


Fig. 8-9

WARNING

Always wear gloves and use special suction cups with handles when replacing the glasses.
Do not strike the glasses to remove.

Preparing the replacement glass

1. Place the glass momentarily in position and mark with adhesive tape to position it correctly during final bonding.

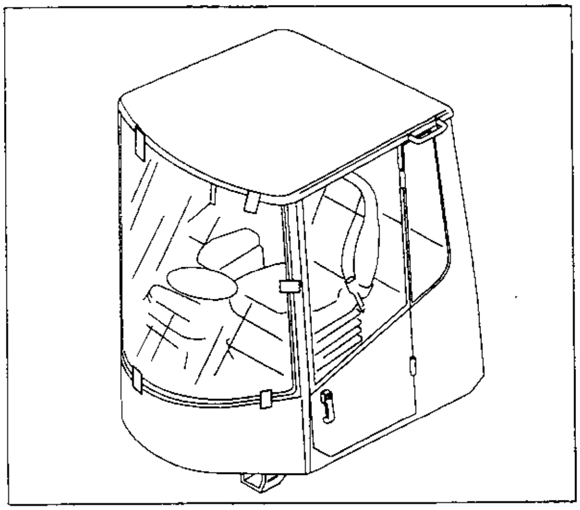


Fig. 8-10

2. Thoroughly clean the glass edge using the special cloth moistened in the degreaser supplied.

Important - After degreasing, wipe the degreased part using a clean dry cloth.

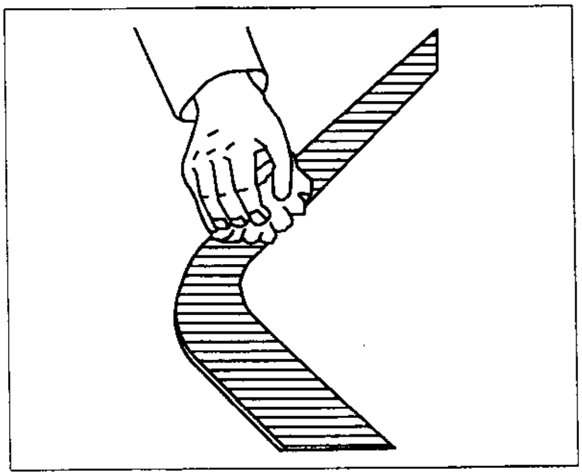


Fig. 8-11

3. Shake well the glass activator bottle before use (at least 1 minute after ball separation from the sediment). Apply an even continuous bead of activator along the black stencil using the applicator supplied.

Important - Once applied, allow the activator to dry for at least 10 minutes keeping the surface clean.

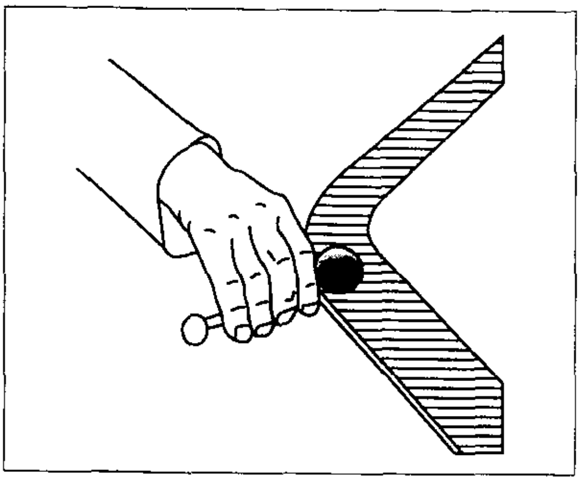


Fig. 8-12

4. Remove the sealant cartridge bottom cover and salts therein.

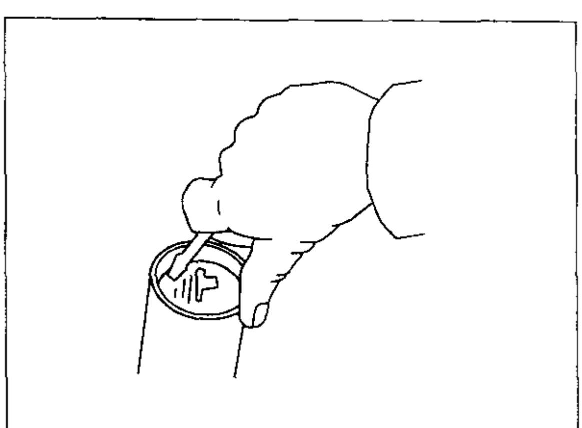


Fig. 8-13

5. Punch the membrane in the threaded connection.

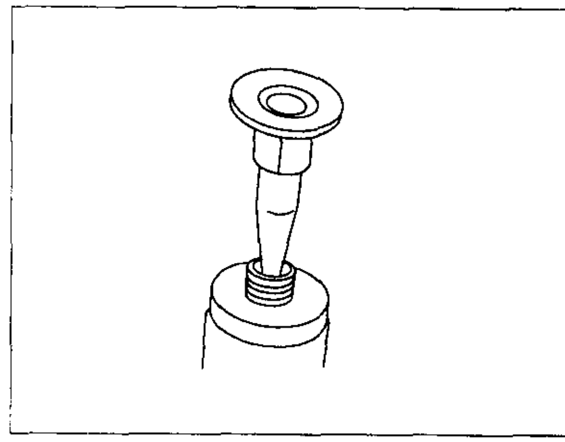


Fig. 8-14

6. Cut off the nozzle and apply a smooth continuous bead of BETASEAL sealant-adhesive along the edge of the body or windscreen keeping the gun vertical.

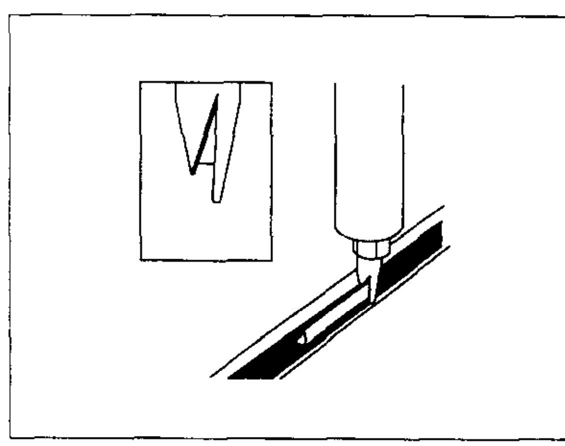


Fig. 8-15

Glass assembly

1. Position the glass in its seat slightly pressing it.

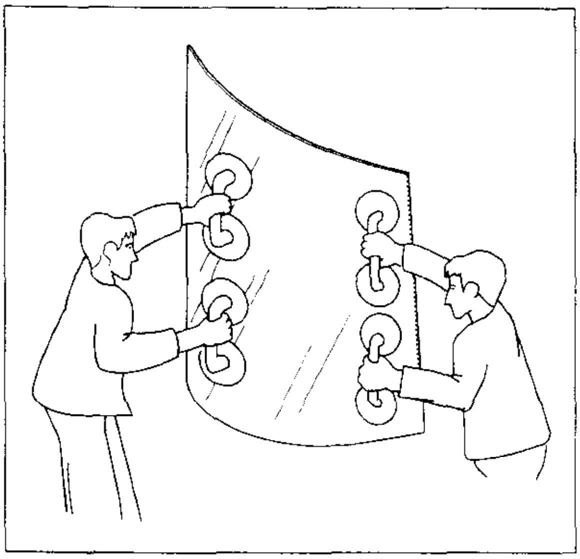


Fig. 8-16

Note - The glass must be fitted to the machine within maximum 15 minutes after applying the BETASEAL sealant-adhesive.

Note - Work only in well ventilated premises. The polyurethane adhesive does not contain low molecular weight (monomolecular) volatile isocyanates. Therefore, there is no danger of irritation for the respiratory tract. However, all precautions required when using chemicals should be observed. Avoid contact with the eyes and skin.

Note - The BETASEAL sealant-adhesive hardens with air moisture. Hardening depends upon ambient humidity and relative penetration degree. Therefore, machine downtime ranges from 2 to 3 hours at a temperature of 23°C. During this period the machine should not be submitted to any stress whatever.

WARNING

Any variation to instructions specified, such as use of materials after expire date or improper work procedures, may negatively affect the results of the operation. The manufacturer does not assume any responsibility for damages which may derive to persons and/or things.

8.5 REPAIR

8.5.1 CAB (REMOVAL/INSTALLATION)

Removal

Park the machine on level ground and block wheels securely to prevent motion.

Disconnect the battery isolator switch.

WARNING

Always disconnect the battery isolator switch before cleaning, repairing, overhauling or parking the machine.

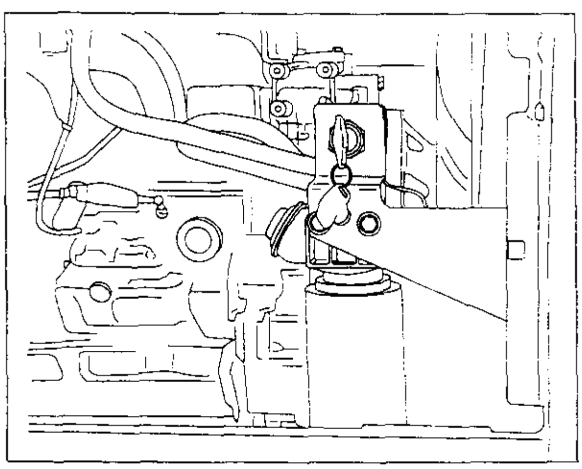


Fig. 8-17

Remove rear fenders and steps.

Remove protection panels at the cab bottom, on both sides.

Disconnect the cab to frame ground braid.

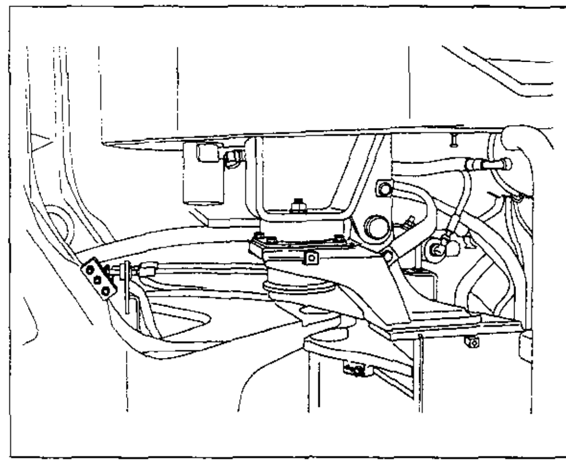


Fig. 8-18

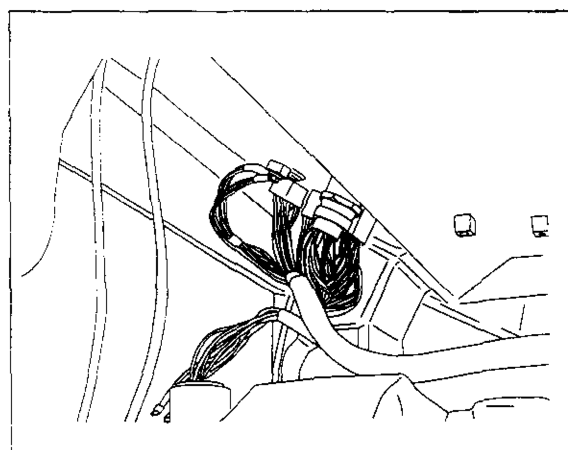


Fig. 8-19

Provide a suitable hoist above the cab and hook it to the lifting eyebolts. These should have been screwed in at the cab top beforehand (cab weight: 700 kg approx.). Take out any slack in the lifting chains.

WARNING

Always use hoists or similar devices of suitable capacity to lift or move heavy components. Ensure that the sling is perfectly made. Use lifting eyebolts if specified.

Loosen the cab to frame retaining bolts. Leave the rubber mounts on their supports.

Detach the throttle control linkage from the engine compartment and the parking brake linkage at the three-way valve on the cab left-hand side.

Close the heater supply taps.
Detach both heater hoses located at the cab rear right-hand side.

Slightly raise the cab taking care not to tension any electrical cables or hoses. Lifting height should be such to allow detachment of all lines and cables from machine assemblies.

WARNING

Do not work under or near an attachment of the machine or any of its parts which are not suitably supported and locked.

Note - Mark all lines and electrical cables before removal to assist correct reassembly.

Ensure all machine connections have been disconnected. Raise the cab and move it to one side.

Installation

Installation is carried out in reverse order of removal.

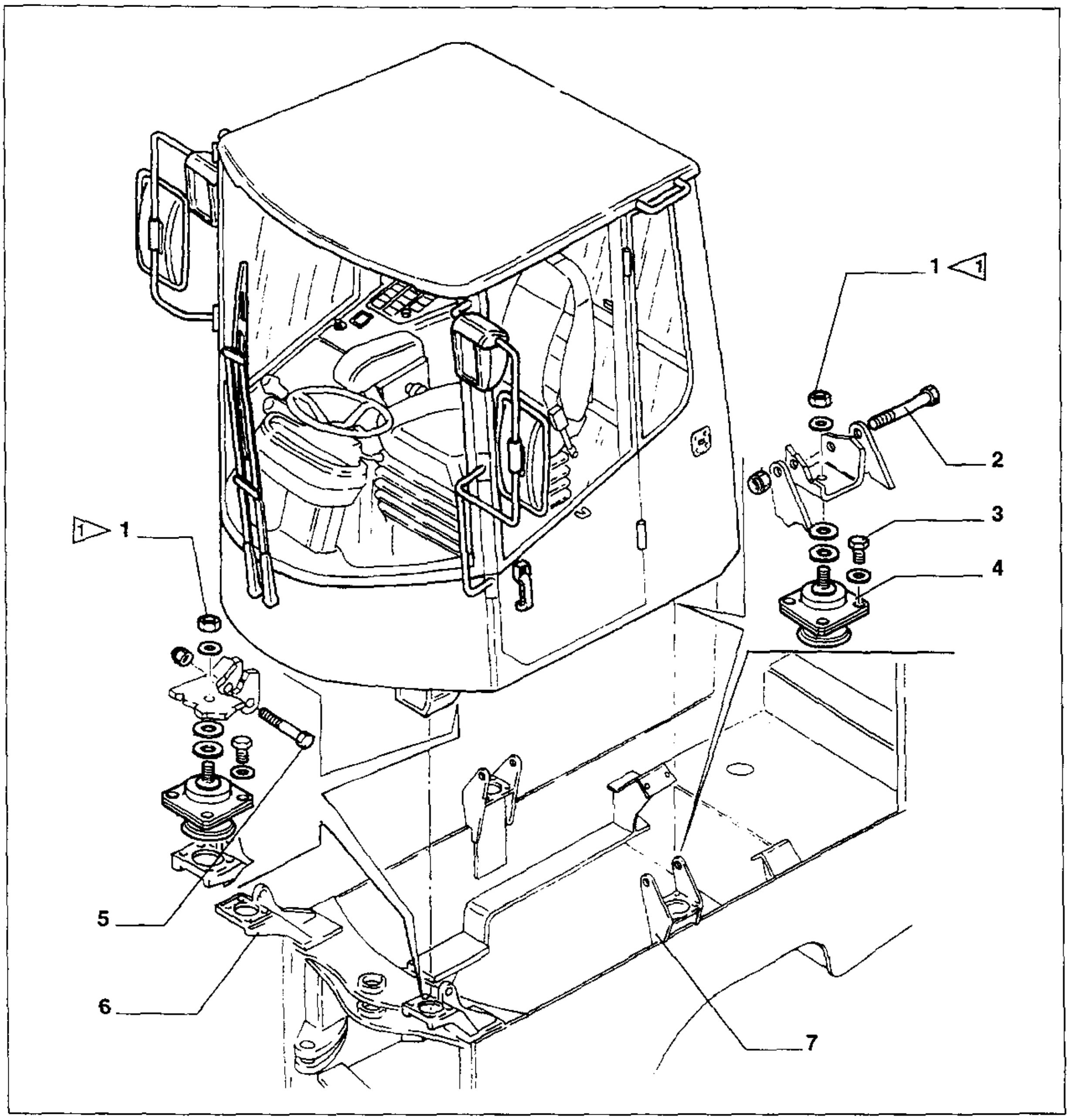


Fig. 8-20 Securing the cab to the machine

Note - 21 daNm

1. Cab retaining nut M16
2. Frame - ROPS rear retaining bolt M30
3. Rubber mount to frame bolt
4. Rubber mount
5. Frame - ROPS front retaining bolt M24
6. Cab front support
7. Cab rear support.

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