SHOP MANUAL

KOMATSU

D150A-1
D155A-1

MACHINE MODEL	SERIAL No.
D150A-1	**8408 and up**
D155A-1	**15001 and up**

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	61-21-2	⑥
	61-22	①
	61-23	①
	61-23-1	①
	61-23-2	①
	61-24	①
	61-25	①
	61-25-1	①
	61-25-2	①
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	61-27	①
	61-27-1	①
	61-27-2	①
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	61-29	⑥
	61-29-1	⑥
	61-29-2	⑥
	61-30	⑥
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	62- 9	⑥
	62-10	⑥
	62-11	⑥
	62-12	⑤
	62-13	⑤
	62-13-1	⑤
	62-14	⑤
	62-15	⑤
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⚠ IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe methods of operation. Some of these operations require the use of tools specially designed by Komatsu for the purpose.

To prevent injury to workers, the symbols ⚠ and ⚠ are used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

⚠ SAFETY

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
    Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (—) terminal first.
14. When raising heavy components, use a hoist or crane.
    Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity.
    Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips on to the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
    Replace any damaged parts with new parts.
    - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
    When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

FOREWORD

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into chapters for each main group of components; these chapters are further divided into the following sections.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.

Troubleshooting charts correlating "Problems" to "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your KOMATSU distributor for the latest information.

HOW TO READ THE SHOP MANUAL

VOLUMES

Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

Chassis volume: Issued for every machine model
Engine volume: Issued for each engine series
Electrical volume :
Attachments volume :
} Each issued as one volume to cover all models

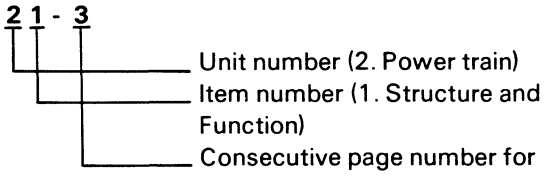
These various volumes are designed to avoid duplicating the same information. Therefore to deal with all repairs for any model, it is necessary that chassis, engine, electrical and attachment volumes are ready.

DISTRIBUTION AND UPDATING

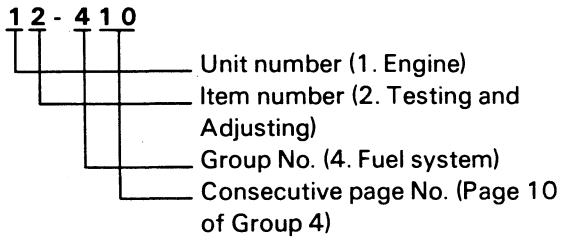
Any additions, amendments or other changes will be sent to KOMATSU distributers. Get the most up-to-date information before you start any work.

FILING METHOD

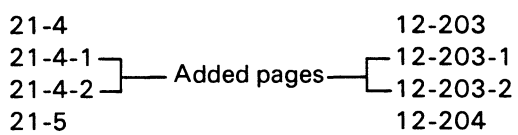
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):



   Example 2 (Engine volume):



3. Additional pages: Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.
   Example:



REVISED EDITION MARK (①②③····)

When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

REVISIONS

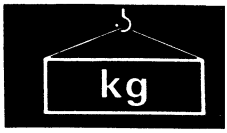
Revised pages are shown at the LIST OF REVISED PAGES on the between the title page and SAFETY page.

SYMBOLS

So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

Symbol	Item	Remarks
⚠	Safety	Special safety precautions are necessary when performing the work.
⚠		Extra special safety precautions are necessary when performing the work because it is under internal pressure.
★	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.
kg	Weight	Weight of parts or systems. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
kgm	Tightening torque	Places that require special attention for the tightening torque during assembly.
	Coat	Places to be coated with adhesives and lubricants etc.
	Oil, water	Places where oil, water or fuel must be added, and the capacity.
	Drain	Places where oil or water must be drained, and quantity to be drained.

HOISTING INSTRUCTIONS



⚠ Heavy parts (25 kg or more) must be lifted with a hoist etc. In the **Disassembly and Assembly** section, every part weighing 25 kg or more is indicated clearly with the symbol kg

1. If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
   - Check for removal of all bolts fastening the part to the relative parts.
   - Check for existence of another part causing interference with the part to be removed.

2. Wire ropes

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

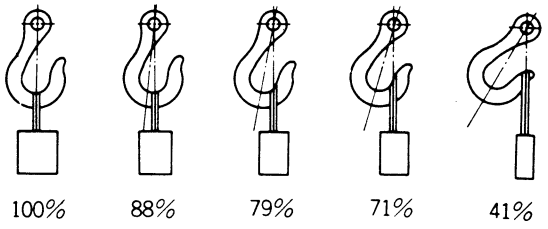
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

Rope diameter (mm)	Allowable load (tons)
10	1.0
11.2	1.4
12.5	1.6
14	2.2
16	2.8
18	3.6
20	4.4
22.4	5.6
30	10.0
40	18.0
50	28.0
60	40.0

The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.

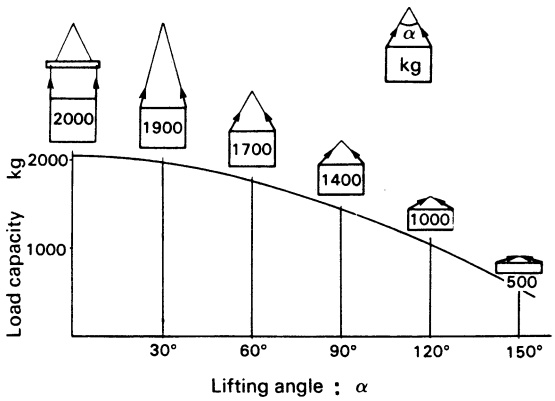


FS0064

3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles.
When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



FS0065

kgm

STANDARD TIGHTENING TORQUE

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS

The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in sections of **"Disassembly and Assembly"**.

Thread diameter of bolt (mm)	Width across flat (mm)	(T)	(H)
		kgm	Nm
6	10	1.35±0.15	13.2±1.4
8	13	3.2±0.3	31.4±2.9
10	17	6.7±0.7	65.7±6.8
12	19	11.5±1.0	112±9.8
14	22	18.0±2.0	177±19
16	24	28.5±3	279±29
18	27	39±4	383±39
20	30	56±6	549±58
22	32	76±8	745±78
24	36	94.5±10	927±98
27	41	135±15	1320±140
30	46	175±20	1720±190
33	50	225±25	2210±240
36	55	280±30	2750±290
39	60	335±35	3280±340

This torque table does not apply to the bolts with which nylon packings or other non-ferrous metal washers are to be used, or which require tightening to otherwise specified torque.

★ **Nm (newton meter): 1Nm ≒ 0.1 kgm**

2. TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

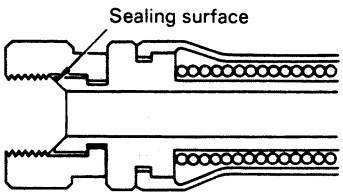
Use these torques for split flange bolts.

Thread diameter of bolt (mm)	Width across flats (mm)	Tightening torque	
		kgm	Nm
10	14	6.7±0.7	65.7±6.8
12	17	11.5±1	112±9.8
16	22	28.5±3	279±29

kgm

3. TIGHTENING TORQUE FOR NUTS OF FLARED

Use these torques for nut part of flared.



FS0068

Thread diameter of nut part (mm)	Width across flats of nut part (mm)	Tightening torque	
		kgm	Nm
14	19	2.5±0.5	24.5±4.9
18	24	5±2	49±19.6
22	27	8±2	78.5±19.6
24	32	14±3	137.3±29.4
30	36	18±3	176.5±29.4
33	41	20±5	196.1±49
36	46	25±5	245.2±49
42	55	30±5	294.2±49

COATING MATERIALS

The recommended coating materials prescribed in Komatsu Shop Manuals are listed below.

Nomenclature	Komatsu code	Applications
Adhesives	LT-1A	Used to apply rubber pads, rubber gaskets, and cork plugs.
	LT-1B	Used to apply resin, rubber, metallic and non-metallic parts when a fast, strong seal is needed.
	LT-2*	Preventing bolts, nuts and plugs from loosening and leaking oil.
	LT-3	Provides an airtight, electrically insulating seal. Used for aluminum surfaces.
Liquid gasket	LG-1	Used with gaskets and packings to increase sealing effect.
	LG-3	Heat-resistant gasket for precombustion chambers and exhaust piping.
	LG-4	Used by itself on mounting surfaces on the final drive and transmission cases. (Thickness after tightening: 0.07 – 0.08 mm)
	LG-5	Used by itself to seal grease fittings, tapered screw fittings and tapered screw fittings in hydraulic circuits of less than 50 mm in diameter.
Antifriction compound (Lubricant including molybdenum disulfide)	LM-P	Applied to bearings and taper shafts to facilitate press-fitting and to prevent sticking, burning or rusting.
Grease (Lithium grease)	G2-LI	Applied to bearings, sliding parts and oil seals for lubrication, rust prevention and facilitation of assembling work.
Vaseline	—	Used for protecting battery electrode terminals from corrosion.

*LT-2 is also called LOCTITE in the shop manuals.

ELECTRIC

ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires.
This wire code table will help you understand WIRING DIAGRAMS.
Example: 5WB indicates a cable having a nominal number 5 and white coating with black stripe.

CLASSIFICATION BY THICKNESS

Nominal number	Copper wire			Cable O.D. (mm)	Current rating (A)	Applicable circuit
	Number strands	Dia. of strands (mm)	Cross section (mm^2)			
0.85	11	0.32	0.88	2.4	12	Starting, lighting, signal etc.
2	26	0.32	2.09	3.1	20	Lighting, signal etc.
5	65	0.32	5.23	4.6	37	Charging and signal
15	84	0.45	13.36	7.0	59	Starting (Glow plug)
40	85	0.80	42.73	11.4	135	Starting
60	127	0.80	63.84	13.6	178	Starting
100	217	0.80	109.1	17.6	230	Starting

CLASSIFICATION BY COLOR AND CODE

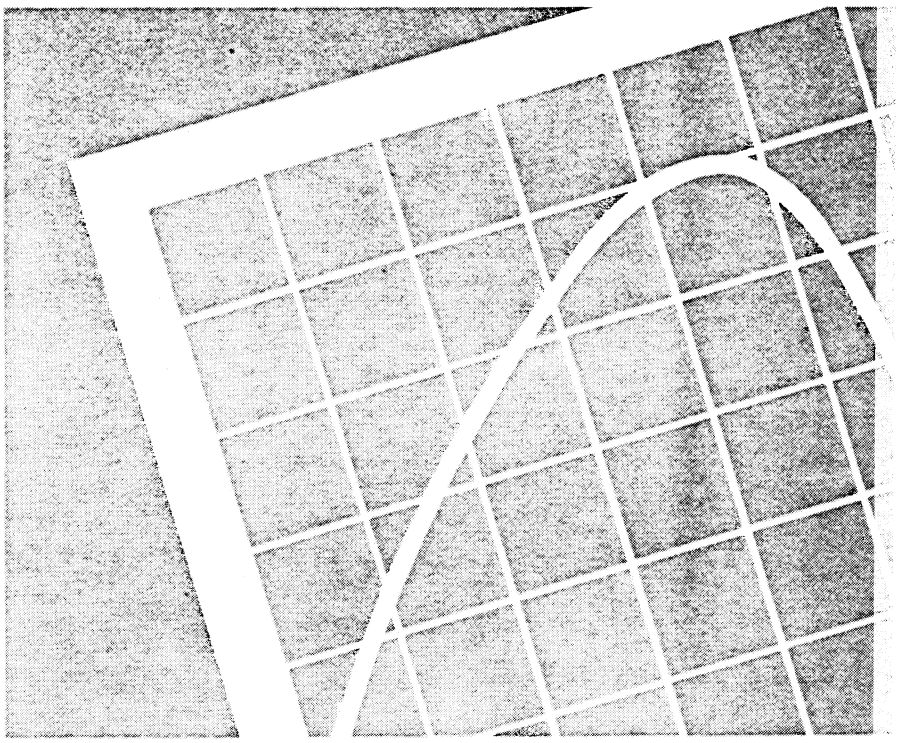
Priority	Classification \ Circuits		Charging	Ground	Starting	Lighting	Instrument	Signal	Other
1	Primary	Code	W	B	B	R	Y	G	L
		Color	White	Black	Black	Red	Yellow	Green	Blue
2	Auxiliary	Code	WR	–	BW	RW	YR	GW	LW
		Color	White & Red	–	Black & White	Red & White	Yellow & Red	Green & White	Blue & White
3		Code	WB	–	BY	RB	YB	GR	LR
		Color	White & Black	–	Black & Yellow	Red & Black	Yellow & Black	Green & Red	Blue & Red
4		Code	WL	–	BR	RY	YG	GY	LY
		Color	White & Blue	–	Black & Red	Red & Yellow	Yellow & Green	Green & Yellow	Blue & Yellow
5		Code	WG	–	–	RG	YL	(GB)	(LB)
		Color	White & Green	–	–	Red & Green	Yellow & Blue	(Green & Black)	(Blue & Black)
6		Code	–	–	–	RL	YW	(GL)	–
		Color	–	–	–	Red & Blue	Yellow & White	(Green & Blue)	–

SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

01 GENERAL

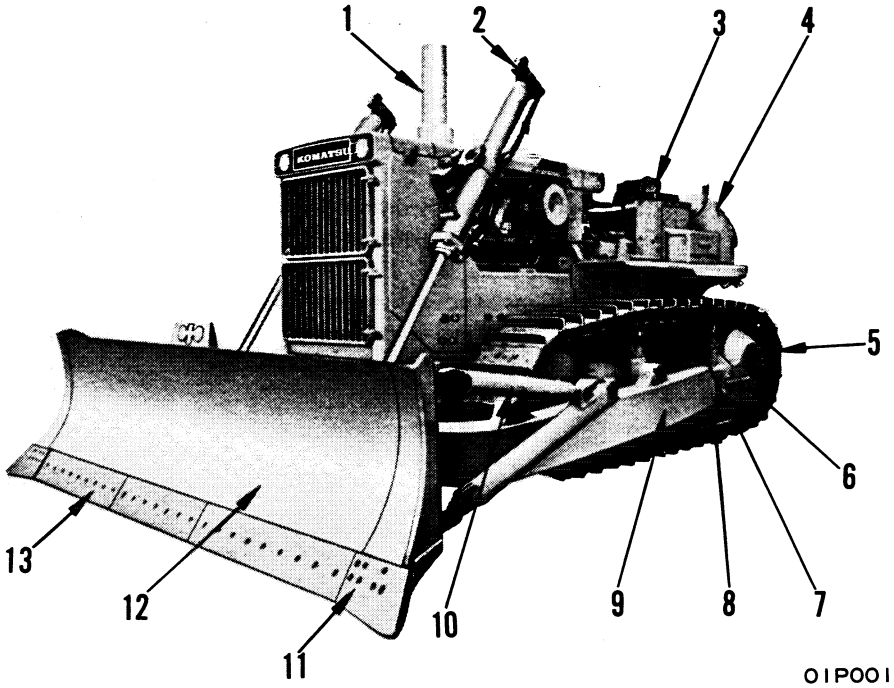


GENERAL

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Positions of serial numbers 01-18
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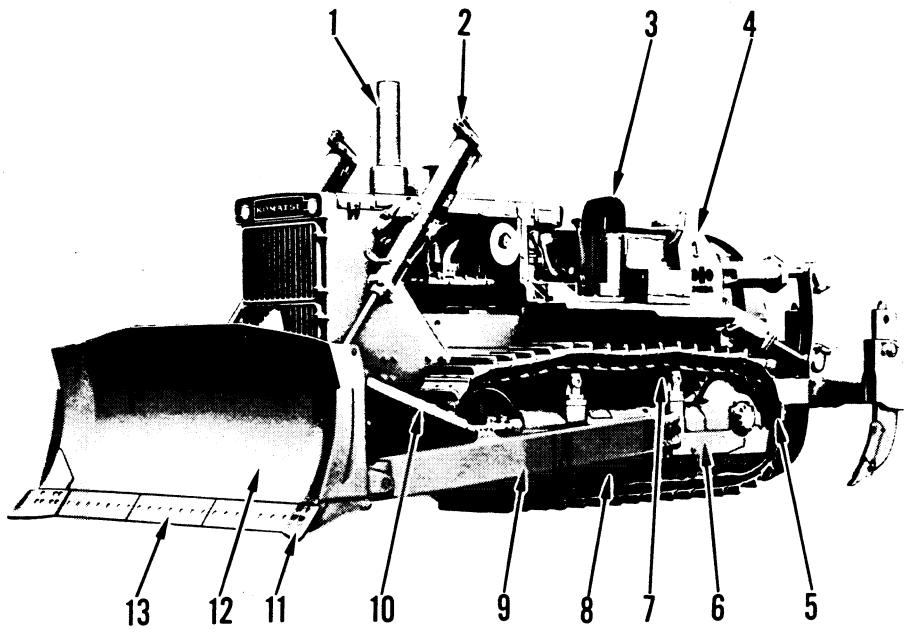
GENERAL VIEWS

D150A C8408 ~ C8420



01P001

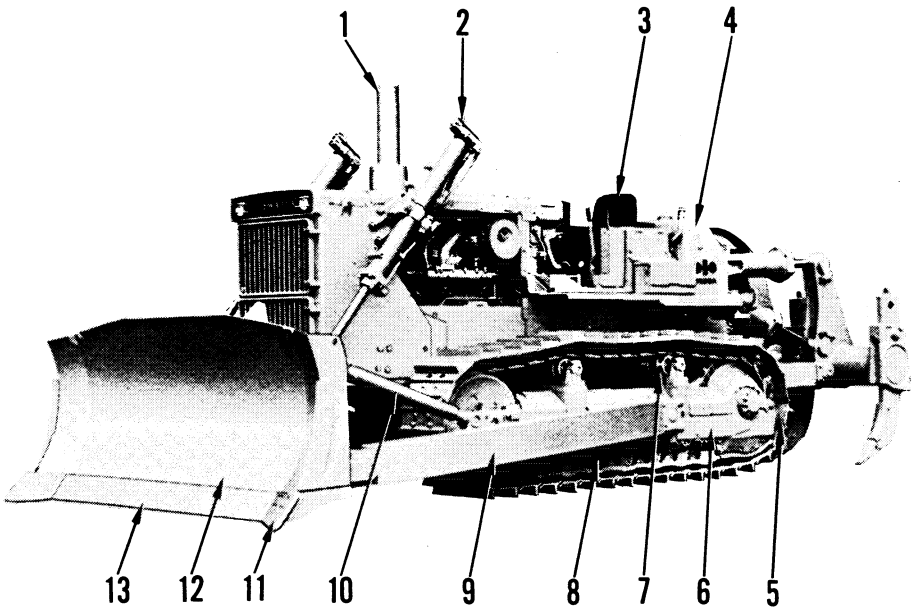
D150A C8421 ~ 8453



01P002

1. Exhaust pipe
2. Blade lift cylinder
3. Operator's seat
4. Fuel tank
5. Track shoe
6. Track frame
7. Carrier roller
8. Track roller guard
9. C-frame, Straight frame
10. Brace
11. End bit
12. Blade
13. Cutting edge

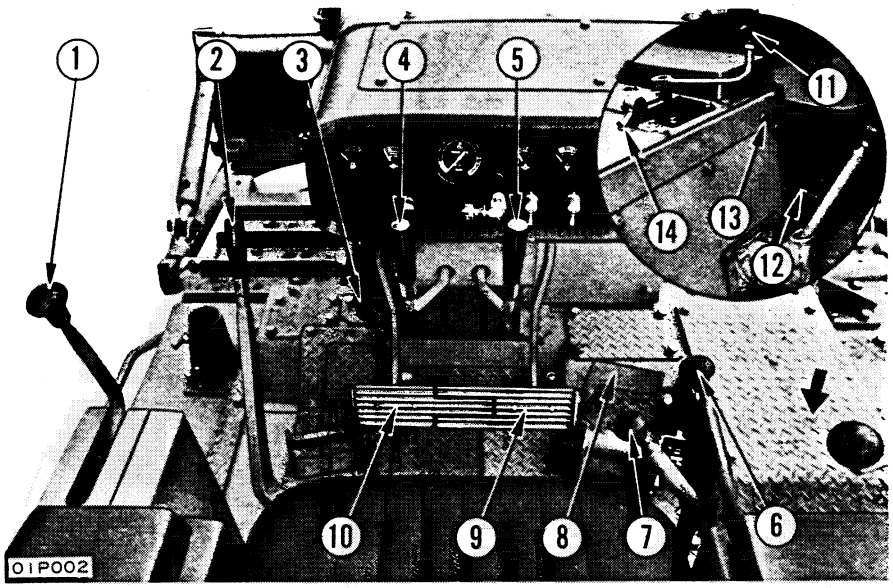
D150A C8454 and up



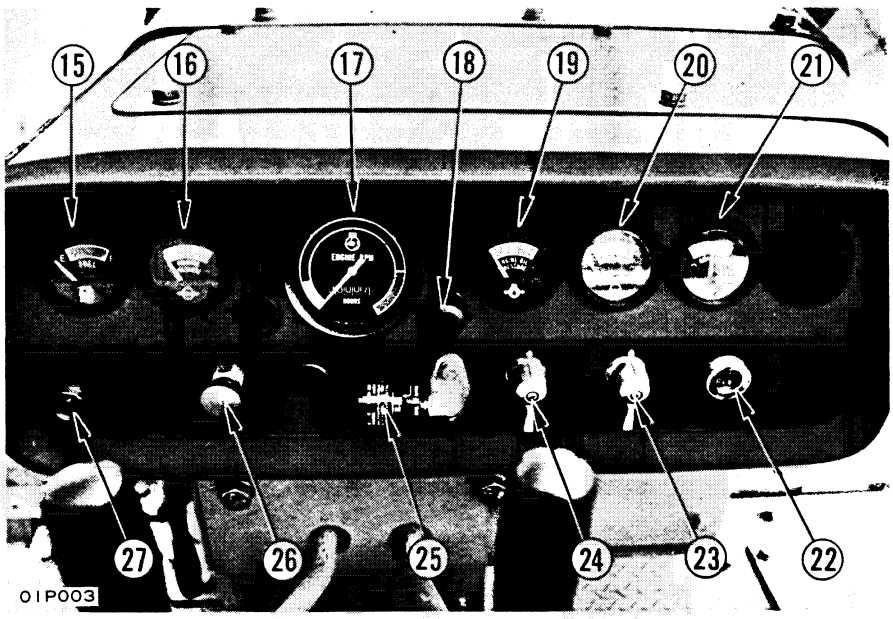
01P003

1. Exhaust pipe
2. Blade lift cylinder
3. Operator's seat
4. Fuel tank
5. Track shoe
6. Track frame
7. Carrier roller
8. Track roller guard
9. Straight frame
10. Brace
11. End bit
12. Blade
13. Cutting edge

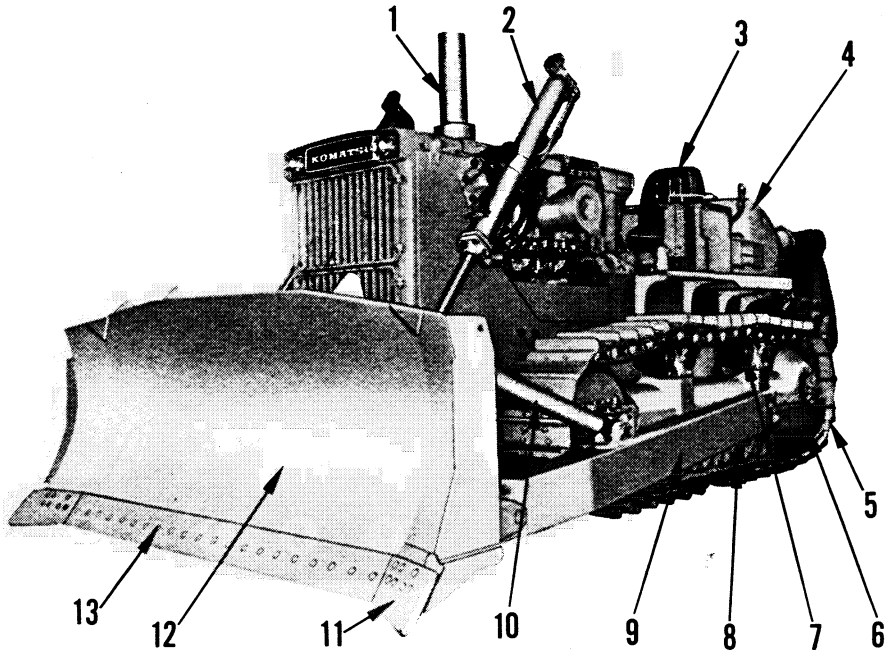
1. Fuel control lever
2. Main clutch lever
3. Compression release lever
4. Steering lever (left)
5. Steering lever (right)
6. Gear shift lever
7. Forward-reverse lever
8. Decelerator pedal
9. Brake pedal (right)
10. Brake pedal (left)
11. Blade control lever
12. Brake lock lever
13. Horn button
14. Safty lever (for blade control lever)



15. Fuel gauge
16. Priming pump fuel pressure gauge
17. Engine tachometer
18. Heater signal
19. Engine oil pressure gauge
20. Engine water temperature gauge
21. Ammeter
22. Starting switch
23. Pre-heater switch
24. Lamp switch
25. Dust indicator
26. Priming pump
27. Engine oil filter caution lamp

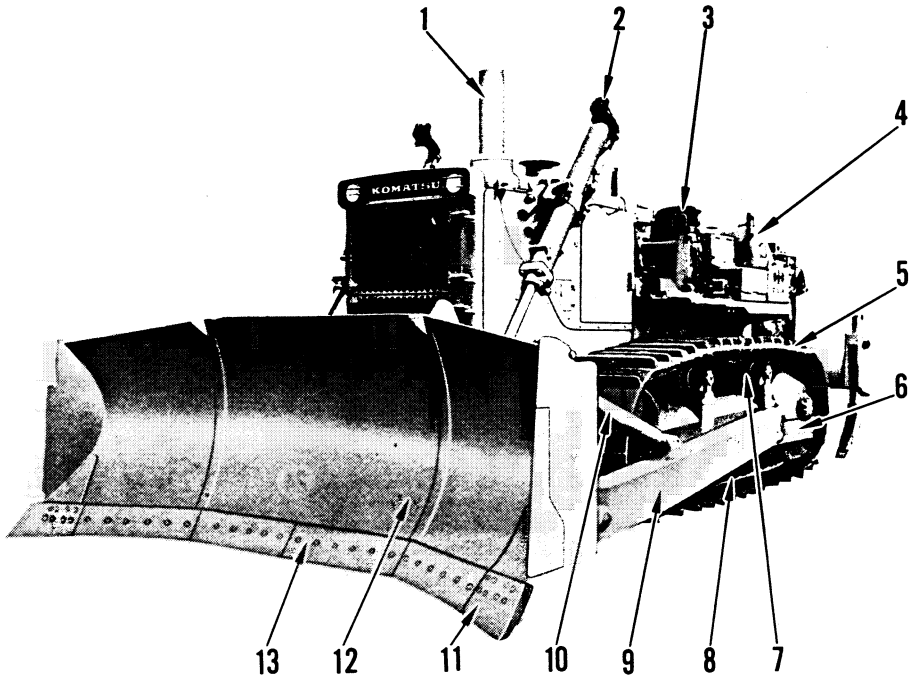


D155A T15001 ~ T17000



01P004

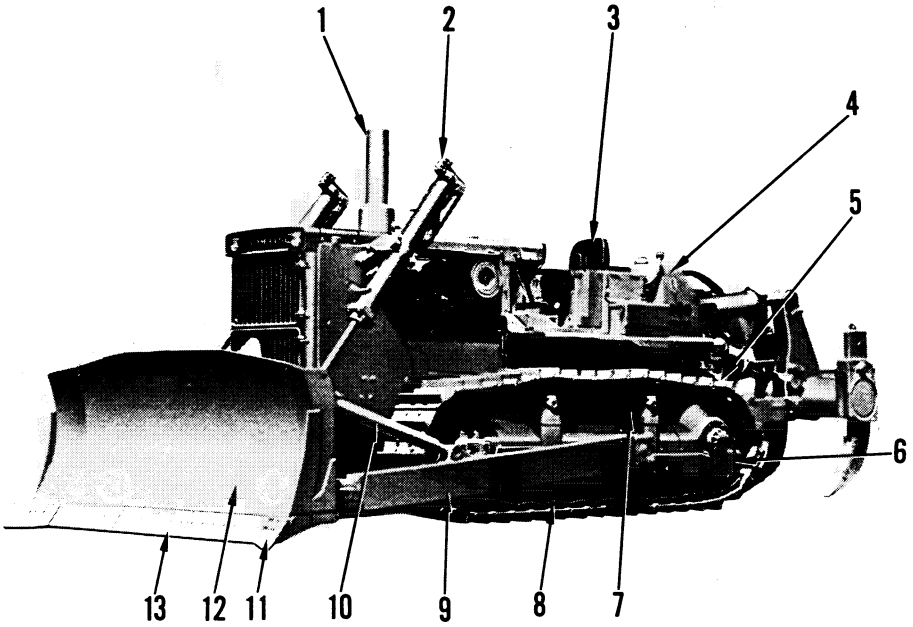
D155A T17001 ~ T19000



01P005

1. Exhaust pipe
2. Blade lift cylinder
3. Operator's seat
4. Fuel tank
5. Track shoe
6. Track frame
7. Carrier roller
8. Track roller guard
9. Straight frame
10. Brace
11. End bit
12. Blade
13. Cutting edge

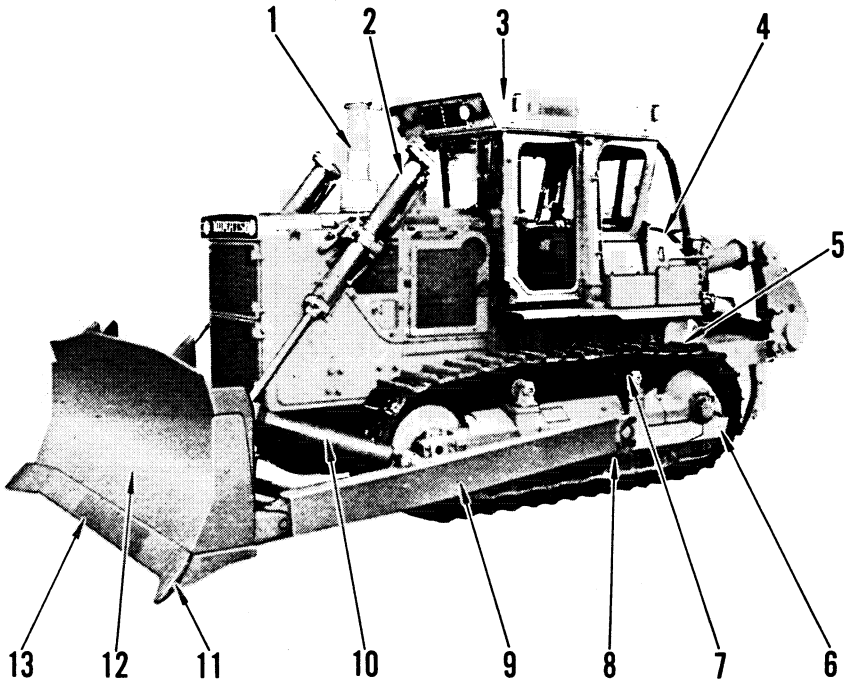
D155A 19001 ~ 25000



01P006

1. Exhaust pipe
2. Blade lift cylinder
3. Operator's seat
4. Fuel tank
5. Track shoe
6. Track frame
7. Carrier roller
8. Track roller guard
9. Straight frame
10. Brace
11. End bit
12. Blade
13. Cutting edge

D155A 25001 and up

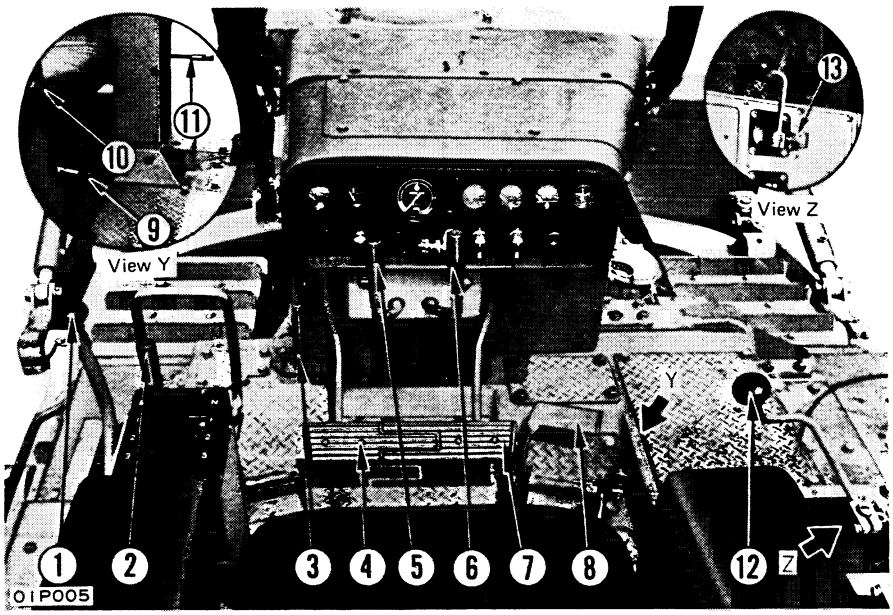


175P002-3

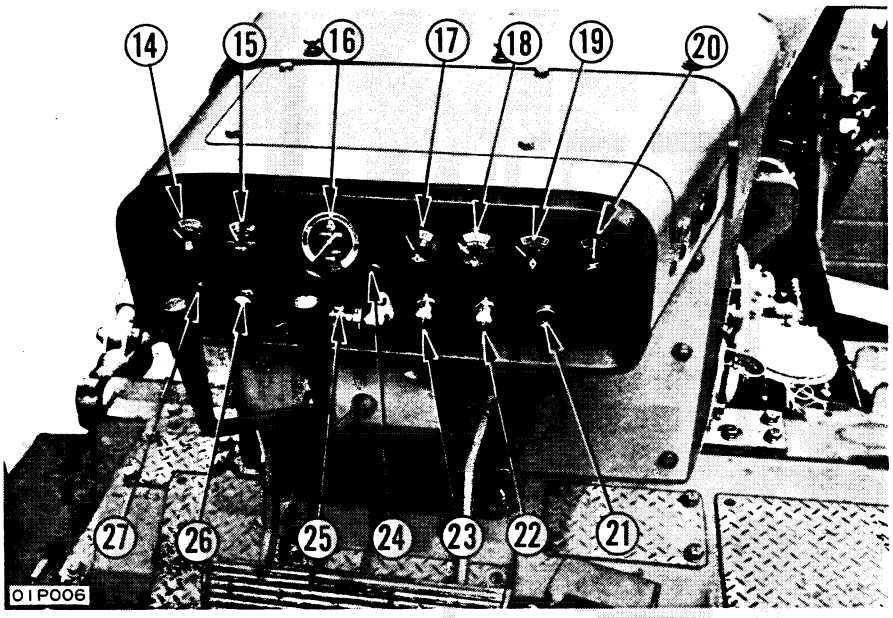
1. Exhaust pipe
2. Blade lift cylinder
3. ROPS cab
4. Fuel tank
5. Track shoe
6. Track frame
7. Carrier roller
8. Track roller guard
9. Straight frame
10. Brace
11. End bit
12. Blade
13. Cutting edge

D155A 15001 ~ 25000

1. Fuel control lever
2. Gear shift lever
3. Compression release lever
4. Brake pedal (left)
5. Steering lever (left)
6. Steering lever (right)
7. Brake pedal (right)
8. Decelerator pedal
9. Brake lock lever
10. Horn button
11. Safety lever
12. Blade control lever
13. Safety lever
    (for blade control lever)

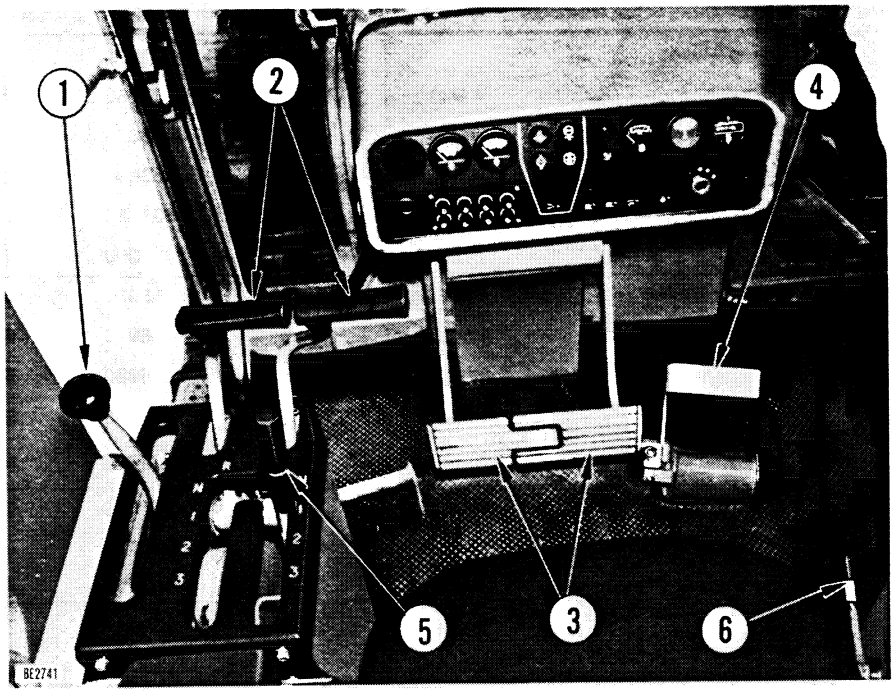


14. Fuel gauge
15. Priming pump fuel pressure gauge
16. Engine tachometer
17. Engine oil pressure gauge
18. Engine water temperature gauge
19. Torque converter oil temperature gauge
20. Ammeter
21. Starting switch
22. Pre-heater switch
23. Lamp switch
24. Heater signal
25. Dust indicator
26. Priming pump
27. Engine oil filter caution lamp

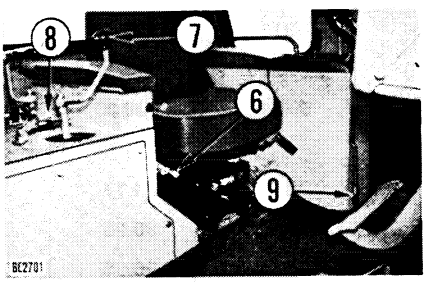


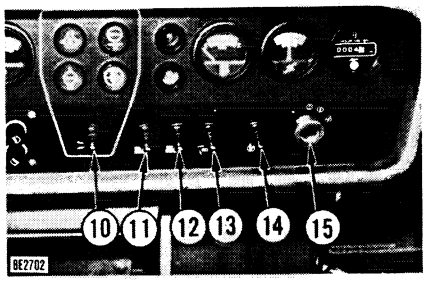
D155A 25001 and up

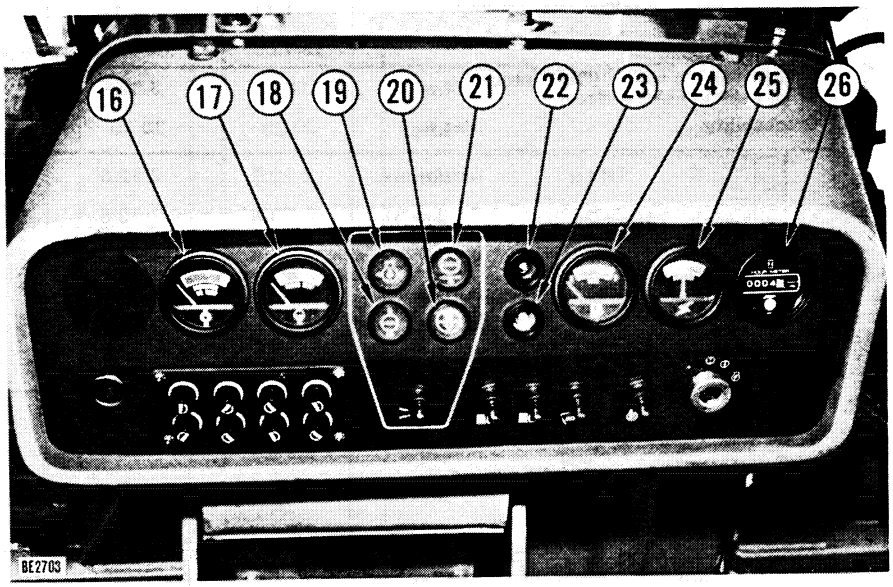
With ROPS cab



1. Fuel control lever
2. Steering lever
3. Brake pedal
4. Decelerator pedal
5. Gear shift lever
6. Brake lock lever
7. Blade control lever
8. Safety lock (for blade control lever)
9. Safety lever (for gear shift lever)
10. Warning check switch
11. Rear lamp switch
12. Head lamp switch
13. Panel lamp switch
14. Preheater switch
15. Starting switch
16. Torque converter oil temperature gauge
17. Engine water temperature gauge
18. Engine water temperature warning lamp
19. Engine oil pressure warning lamp
20. Air filter warning lamp
21. Radiator water level warning lamp
22. Engine oil filter warning lamp
23. Preheater indicator lamp
24. Fuel gauge
25. Ammeter
26. Service meter







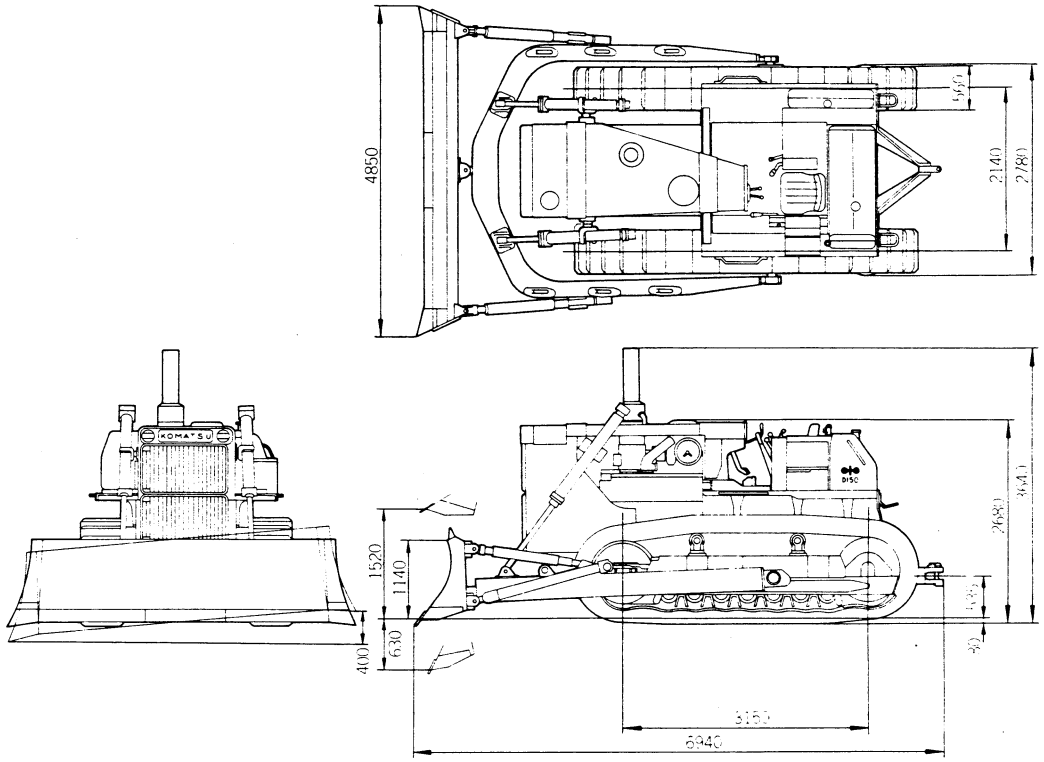
SPECIFICATIONS

Machine model				D150A		D155A		
				1		1		
Machine Serial Numbers				8408 ~ 8420	8421 ~	15001 ~ 17000	17001 ~ 25000	25001 ~
Weight	Operating weight							(incl ROPS cabin)
	• Tractor		(kg)	27270	23150	27270	27270	27150
	• Angledozer		(kg)	33770	33670	33770	33670	35795
	• Straight-tiltdozer		(kg)	33800	33690	33800	33690	35815
	• Straight-tiltdozer with multi ripper		(kg)	39220	38850	39220	38850	40975
	• Straight-tiltdozer with giant ripper		(kg)	38740	38290	38740	38290	40415
Dimensions	Overall length	• Tractor	(mm)	5420	5420	5420	5420	5420
		• Angledozer	(mm)	6940	6940	6940	6940	6940
		• Straight-tiltdozer	(mm)	6880	6880	6880	6880	6880
		• Straight-tiltdozer with variable multi ripper	(mm)	8560	8560	8560	8560	8560
		• Straight-tiltdozer with variable giant ripper	(mm)	8945	8945	8945	8945	8945
	Overall width	• Tractor	(mm)	2780	2810	2780	2810	2810
		• Angledozer	(mm)	4850	4850	4850	4850	4850
		• Straight-tiltdozer	(mm)	4130	4130	4130	4130	4130
	Overall height	• To the top of exhaust pipe	(mm)	3640	3640	3640	3640	3725
		• To the top of pre-cleaner cover	(mm)	2680	2680	2680	2680	2695
	Track gauge		(mm)	2140	2140	2140	2140	2140
	Length of track on ground		(mm)	3150	3150	3150	3150	3150
	Shoe width (STD)		(mm)	560	560	560	560	560
	Ground clearance		(mm)	500	500	500	500	500
	Ground pressure		(kg/cm^2)					
	• Track			0.77	0.77	0.77	0.77	0.77
	• Angledozer			0.95	0.95	0.95	0.95	1.01
	• Straight-tiltdozer			0.95	0.95	0.95	0.95	1.01
	• Straight-tiltdozer with variable multi ripper			1.11	1.10	1.11	1.10	1.16
	• Straight-tiltdozer with variable giant ripper			1.09	1.08	1.09	1.08	1.14
Performance	Min. turning radius (Outer radius of track contact surface)		(m)	3.8	3.8	3.8	3.8	3.8
	Gradeability		(deg.)	30	30	30	30	30
	Number of gear stage	Forward 1st	(km/h)	2.5	2.5	0 ~ 3.7	0 ~ 3.7	0 ~ 3.7
		Forward 2nd	(km/h)	3.5	3.5	0 ~ 6.8	0 ~ 6.8	0 ~ 6.8
		Forward 3rd	(km/h)	4.9	4.9	0 ~ 11.8	0 ~ 11.8	0 ~ 11.8
		Forward 4th	(km/h)	6.4	6.4	–	–	–
		Forward 5th	(km/h)	8.9	8.9	–	–	–
		Forward 6th	(km/h)	12.9	12.9	–	–	–
		Reverse 1st	(km/h)	3.6	3.6	0 ~ 4.5	0 ~ 4.5	0 ~ 4.5
		Reverse 2nd	(km/h)	5.0	5.0	0 ~ 8.2	0 ~ 8.2	0 ~ 8.2
		Reverse 3rd	(km/h)	6.8	6.8	0 ~ 13.7	0 ~ 13.7	0 ~ 13.7
		Reverse 4th	(km/h)	9.0	9.0	-	–	–
	Stability (Forward, Reverse, Left, Right)		(deg.)	35	35	35	35	35

	Machine model	D150A		D155A		
		1		1		
	Machine Serial Numbers	8408 ~ 8420	8421 ~	15001 ~ 17000	17001 ~ 25000	25001 ~
Power train	Main clutch	Wet, multiple disc inertia brake, hand operated with hydraulic booster.		–		
	Torque converter	–		3 element single stage and single phase		
	Transmission	Helical gear, constant mesh, hand operated, forced lubrication. Forward 6 speeds Reverse 4 speeds		Planetary gear and multiple disc clutch, hydraulically actuated, forced lubrication Forward 3 speeds Reverse 3 speeds		
	Bevel gear shaft	Spiral bevel gear, splash lubrication				
	Steering clutch	Wet, multi-disc, hydraulic with spring type				
	Steering brake	Wet contracting band with clutch booster Interconnected with steering clutch				
	Final drive	Spur gear, double reduction				
Under-carriage	Carrier roller	2, each side				
	Track roller	7, each side (D, D, D, S, D, D, S)				
	Track	Assembled, single grouser, 41 each side, shoe pitch 228.85 mm, width 560 mm (STD)				
Hydraulic system	Max. oil pressure	140 kg/cm² Gear pump				
	Cylinder	Double acting, piston type				
Work equipment	Straight Tilt Blade	Length x height: 4130 mm x 1590 mm Max. tilting adjustment: 1000 mm				
	Variable Giant Ripper	Variable digging angle type Digging angle; 34°25' ~ 60° Max. digging depth: 1240 mm				

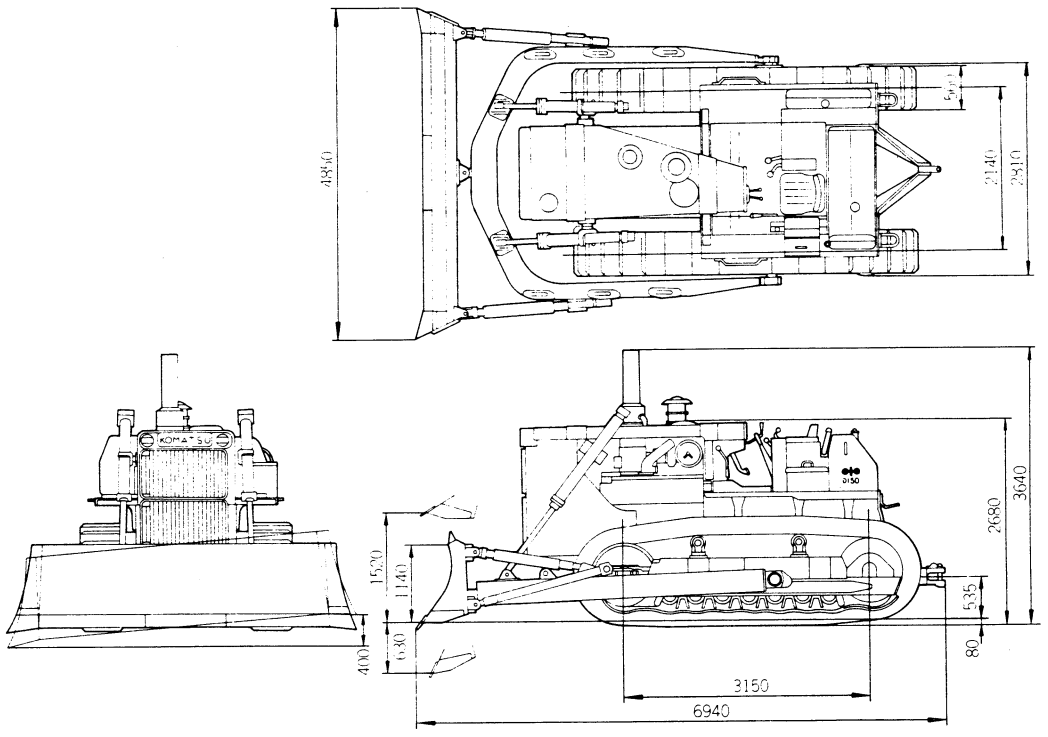
GENERAL ASSEMBLY DRAWING

D150A ANGLEDOZER 8408 ~ 8420



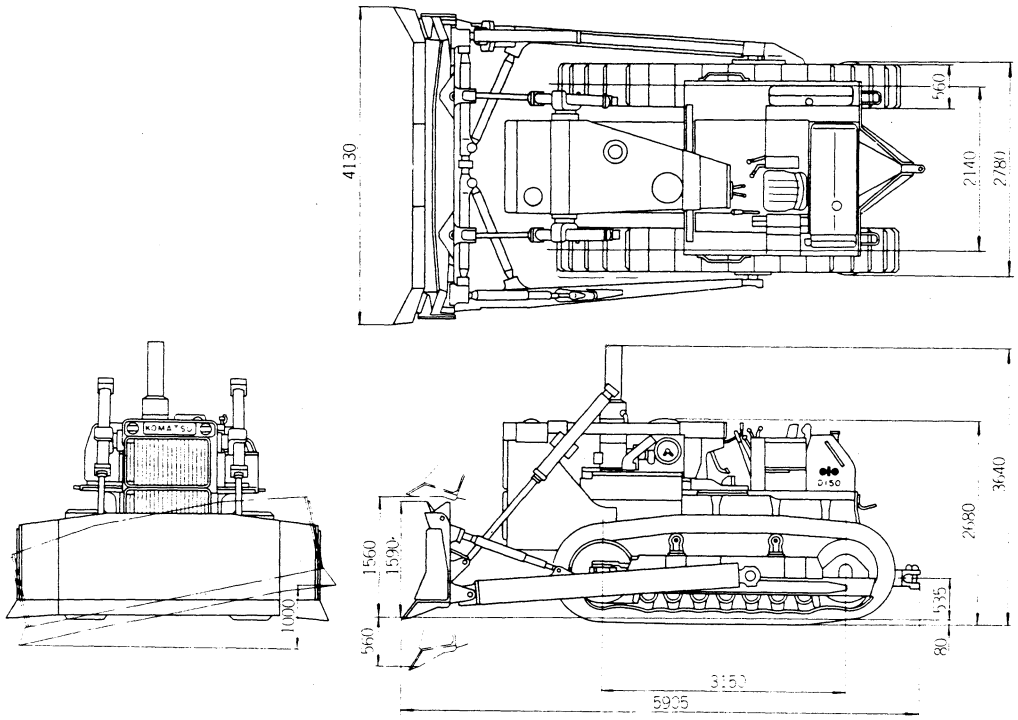
01F010

D150A ANGLEDOZER 8421 and up



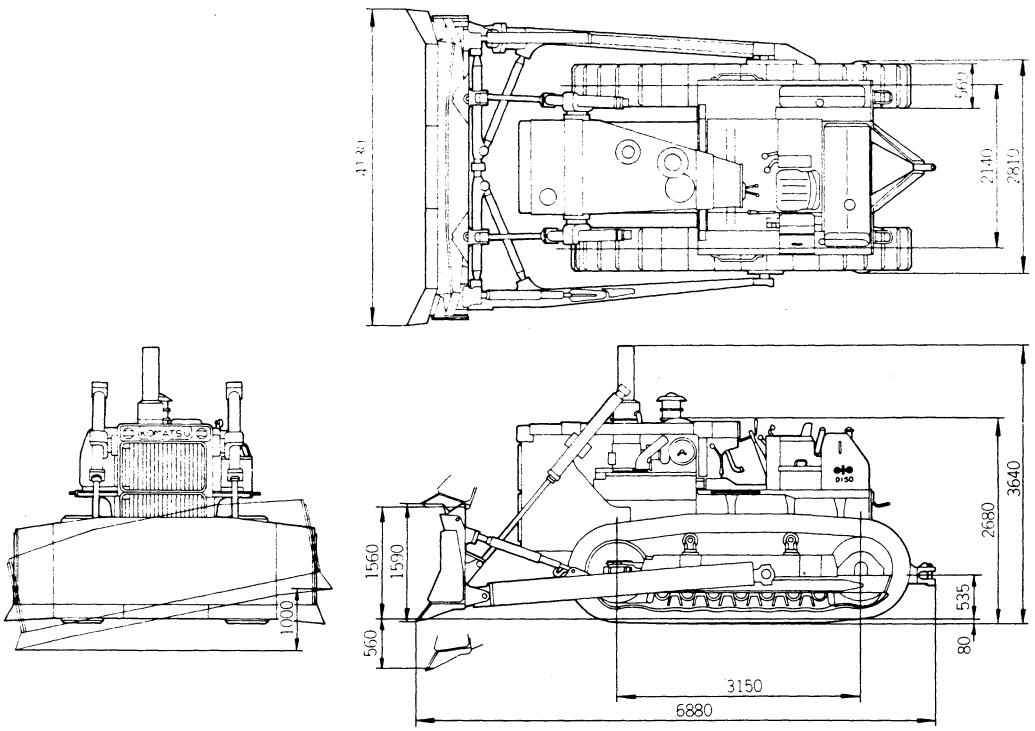
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D150A STRAIGHT-TILTDOZER C8408 ~ C8420



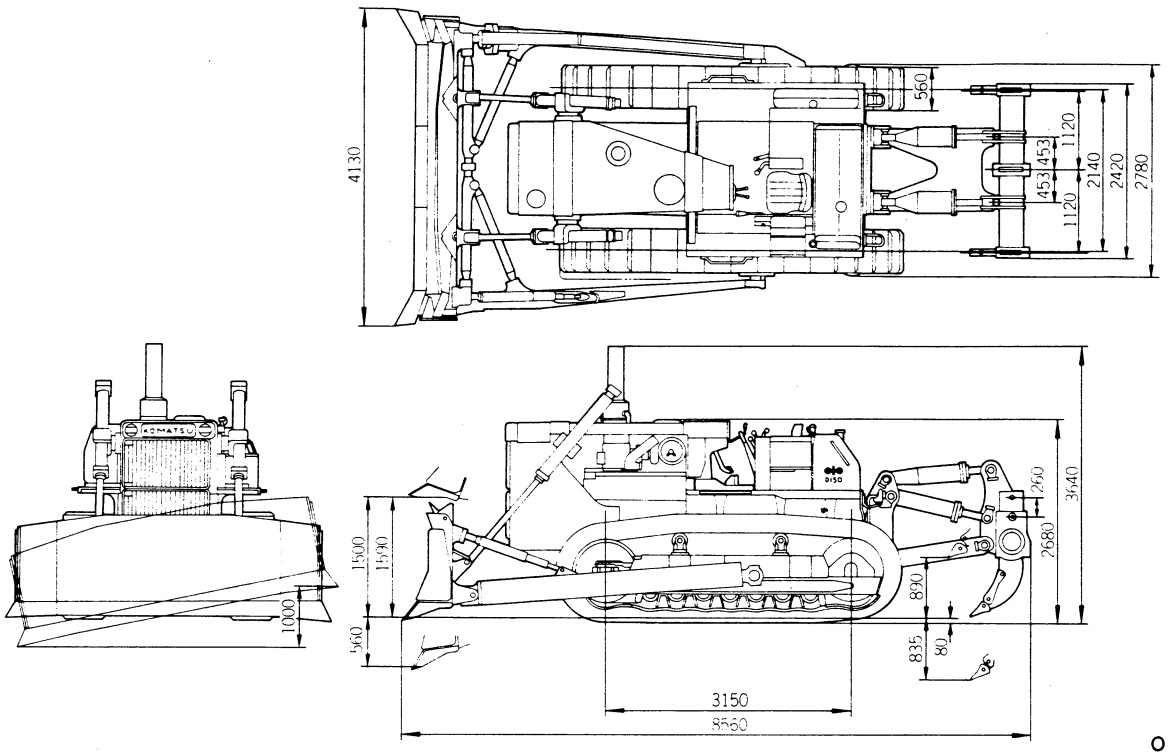
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D150A STRAIGHT-TILTDOZER C8421 and up



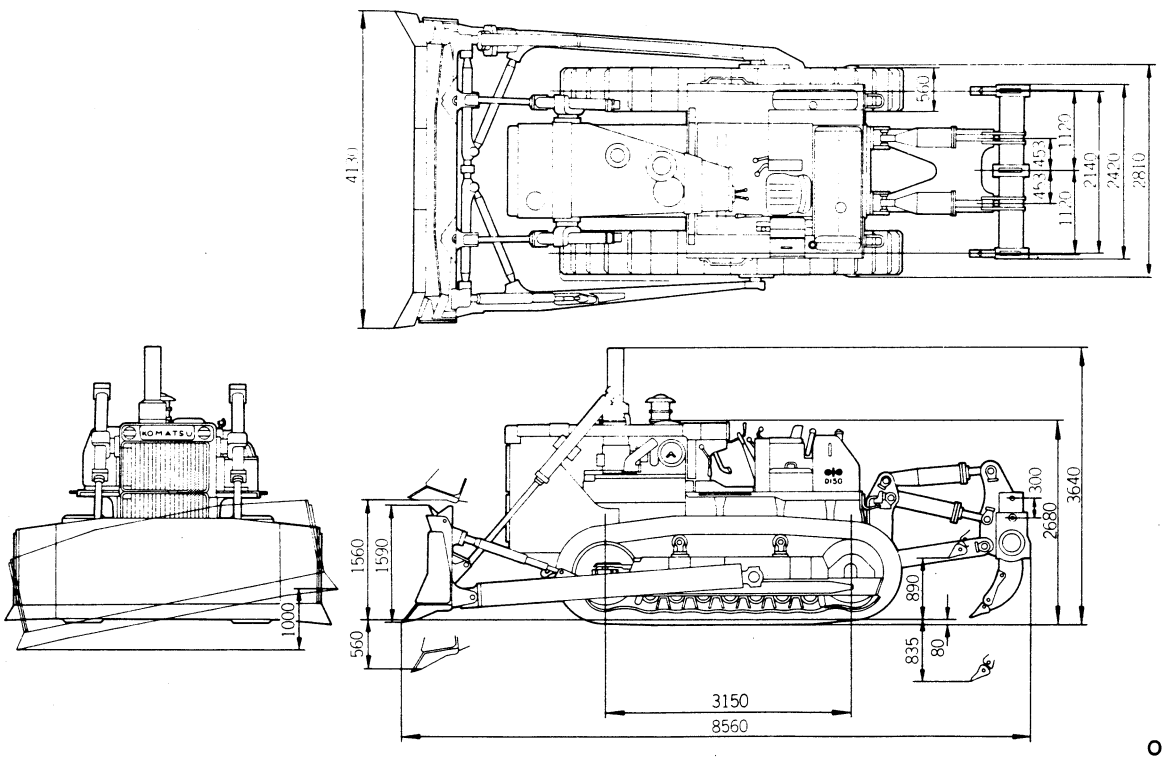
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D150A STRAIGHT-TILTDOZER WITH VARIABLE MULTI RIPPER C8408 ~ C8420



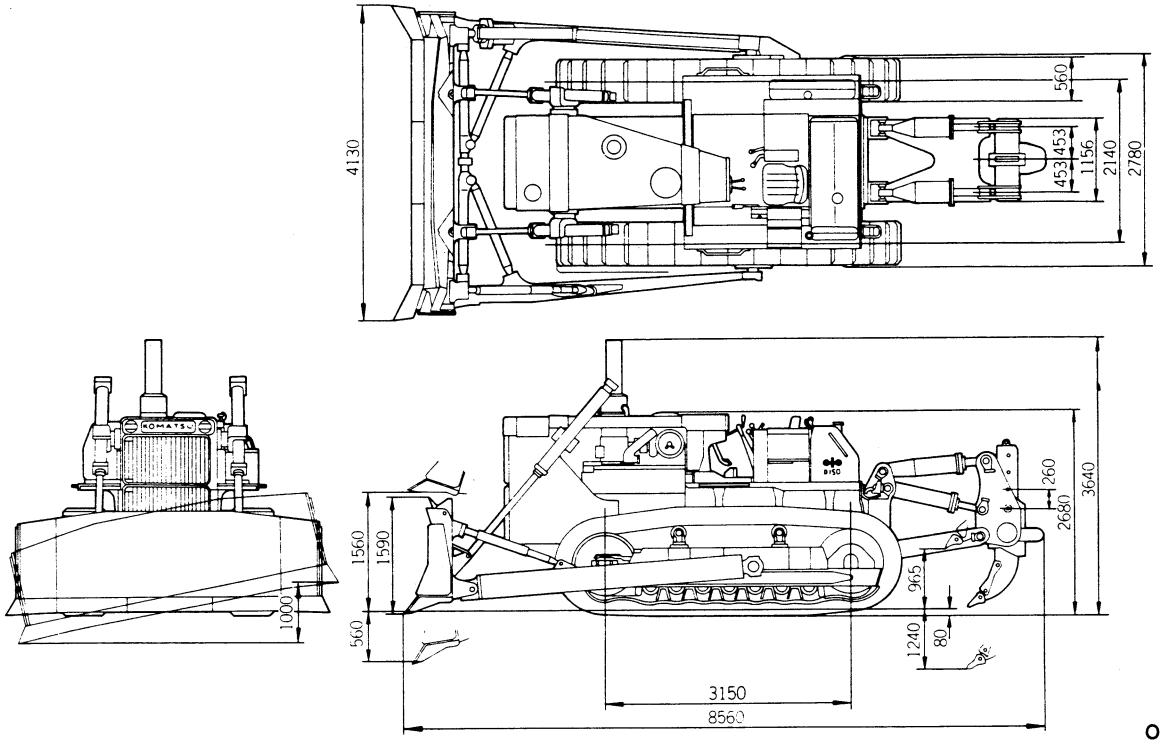
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D150A STRAIGHT-TILTDOZER WITH VARIABLE MULTI RIPPER C8421 and up



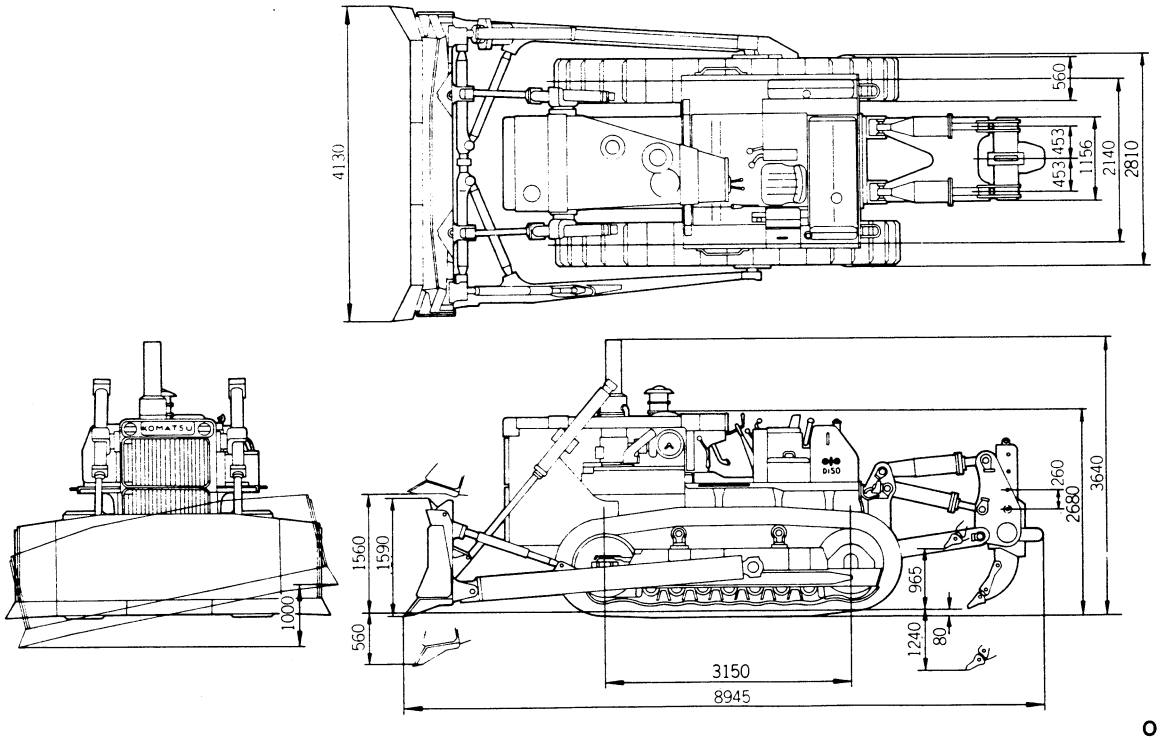
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D150A STRAIGHT-TILTDOZER WITH VARIABLE GIANT RIPPER 8408 ~ 8420



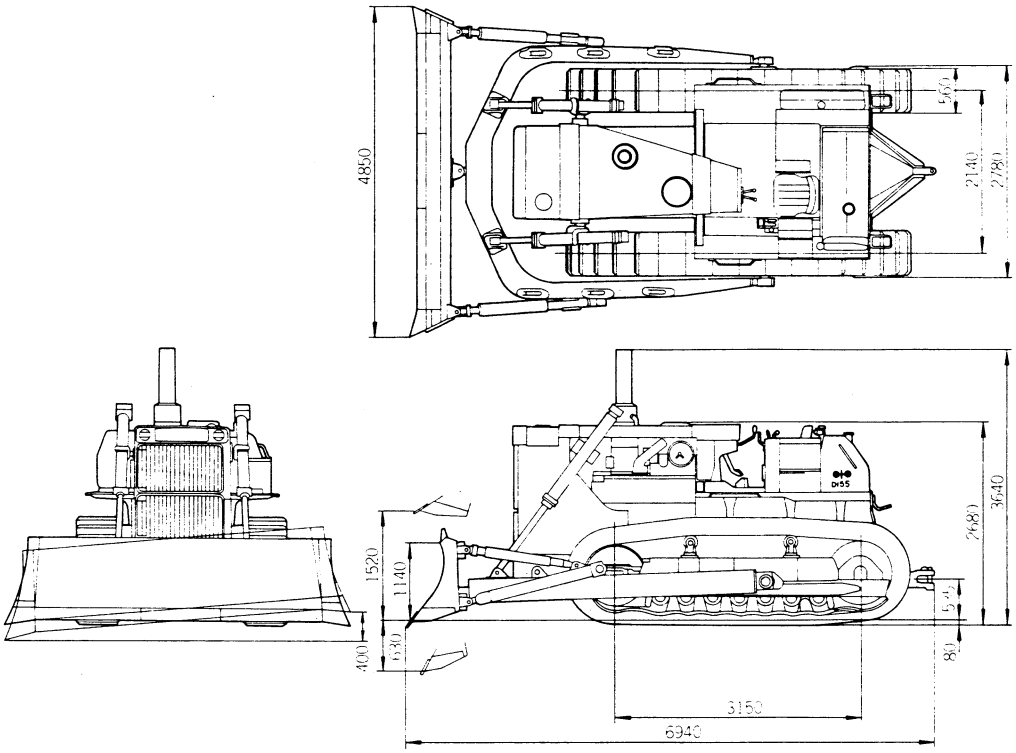
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D150A STRAIGHT-TILTDOZER WITH VARIABLE GIANT RIPPER 8421 and up



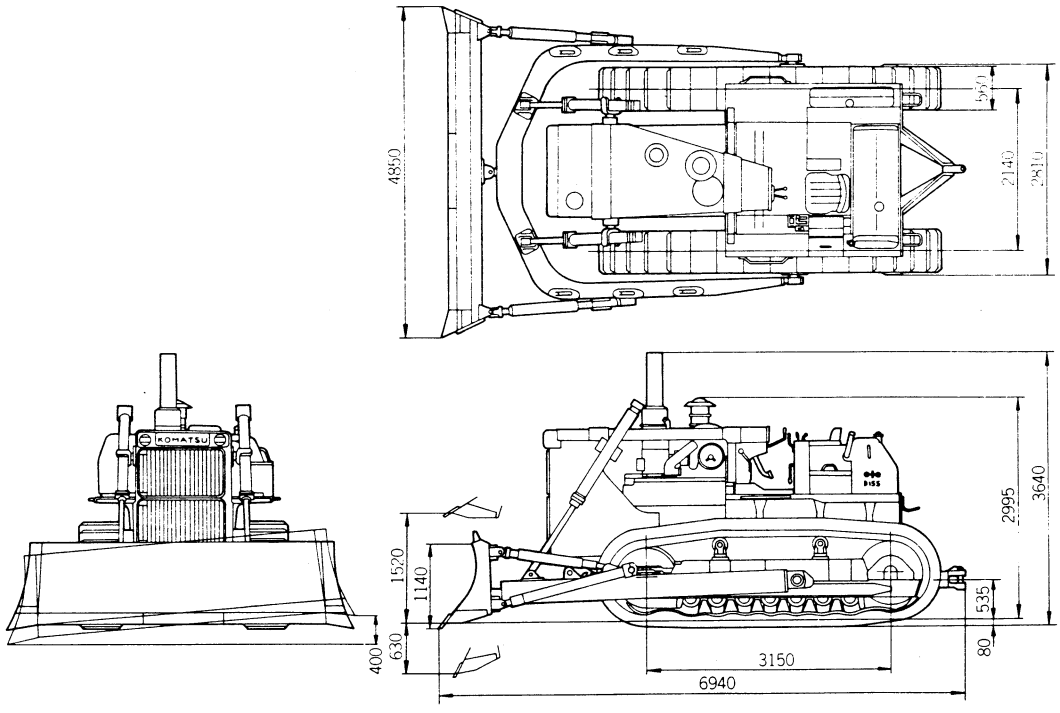
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D155A ANGLEDOZER 15001 ~ 17000



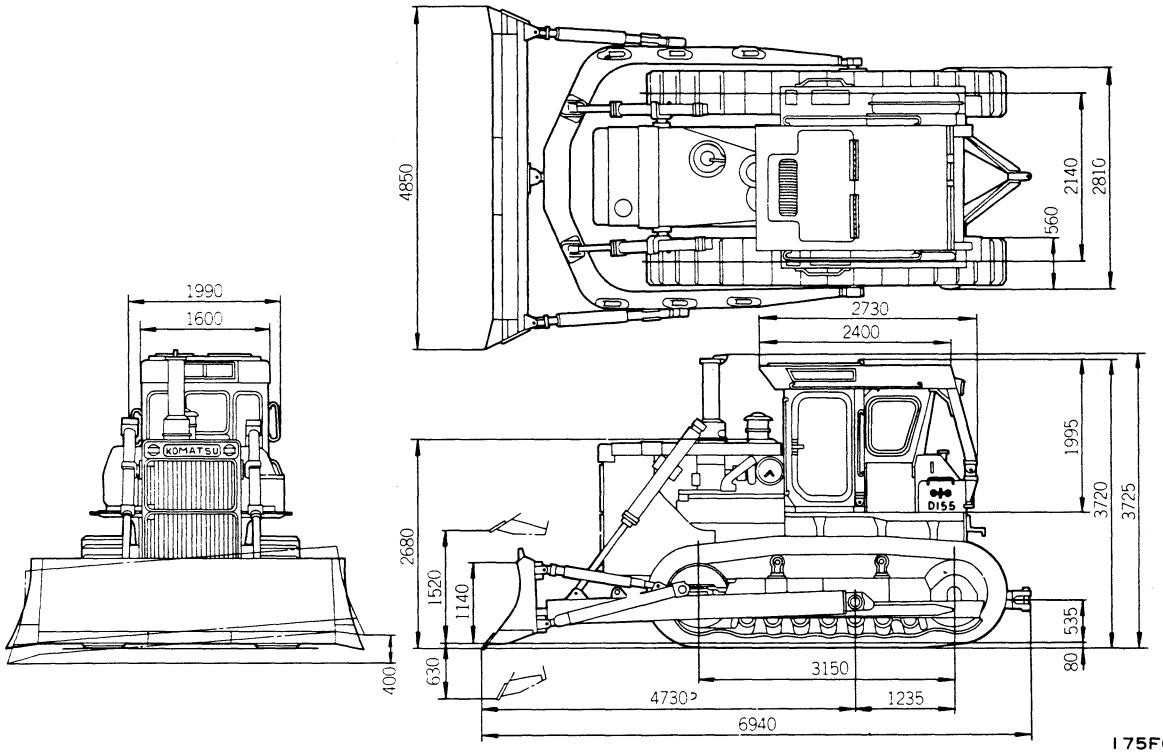
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D155A ANGLEDOZER 17001 ~ 25000



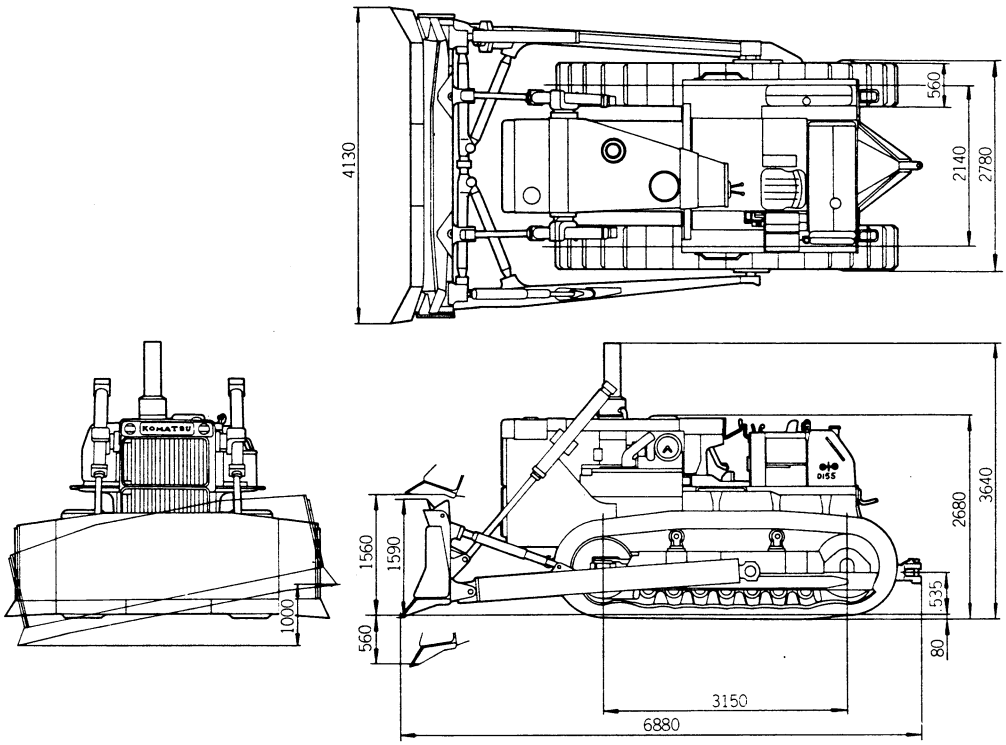
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D155A ANGLEDOZER 25001 and up



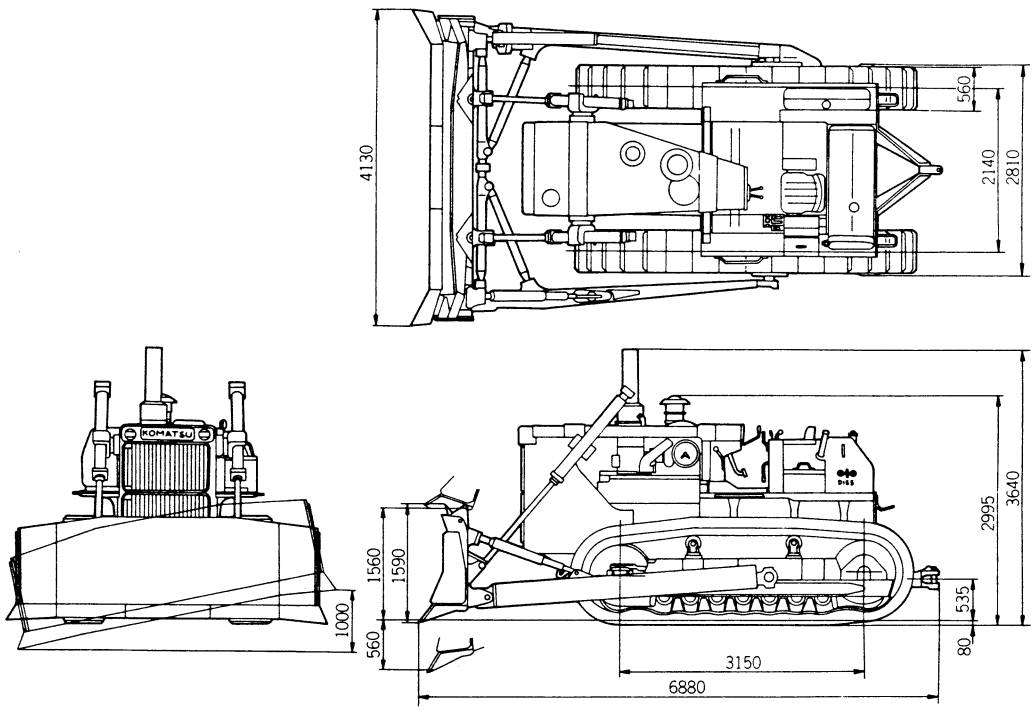
175F005-2

D155A STRAIGHT-TILTDOZER 15001 ~ 17000



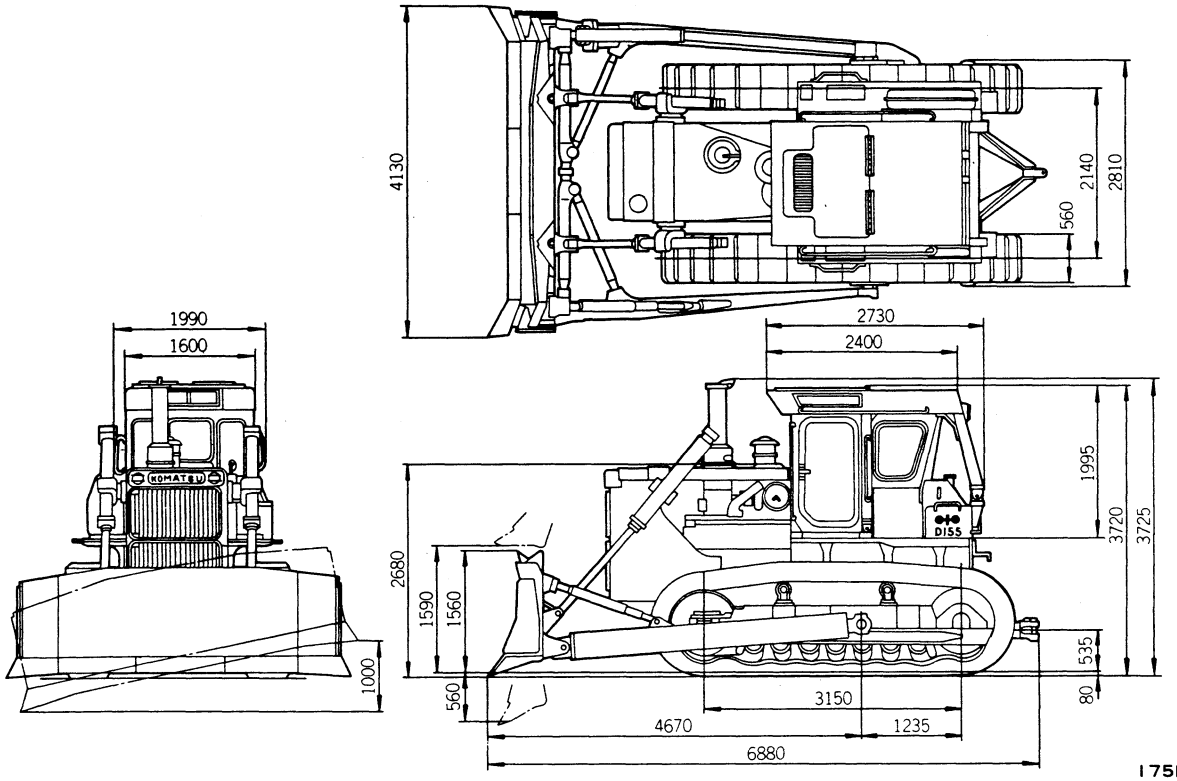
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D155A STRAIGHT-TILTDOZER 17001 ~ 25000

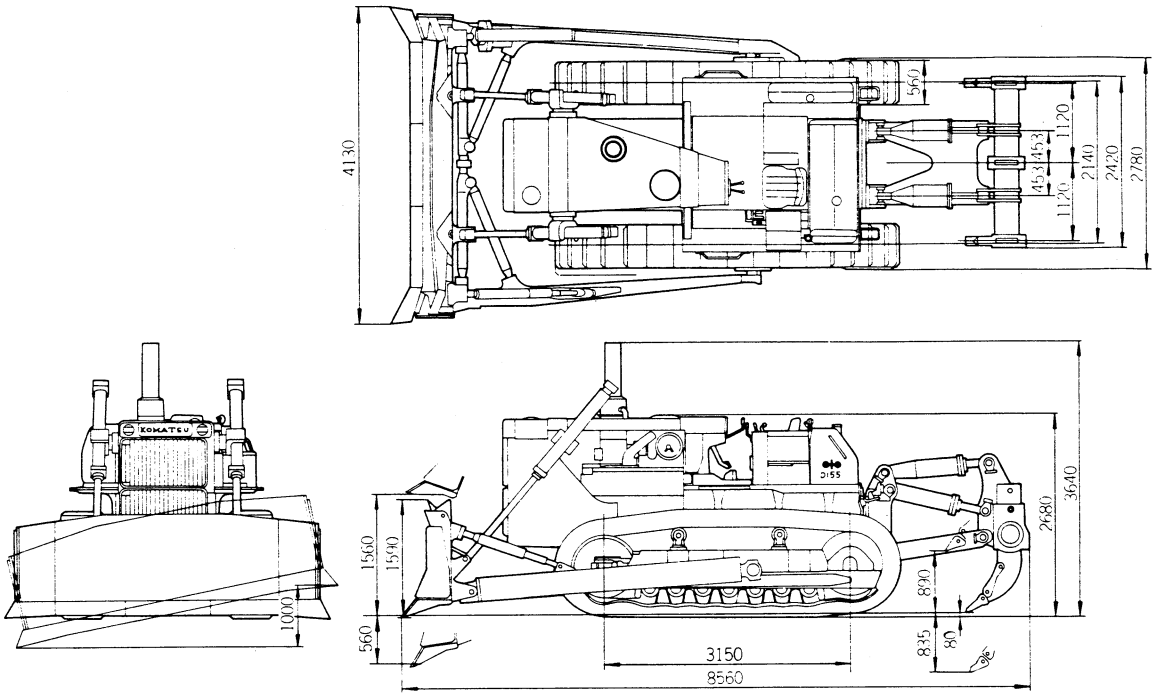


01F020

D155A STRAIGHT-TILTDOZER 25001 and up

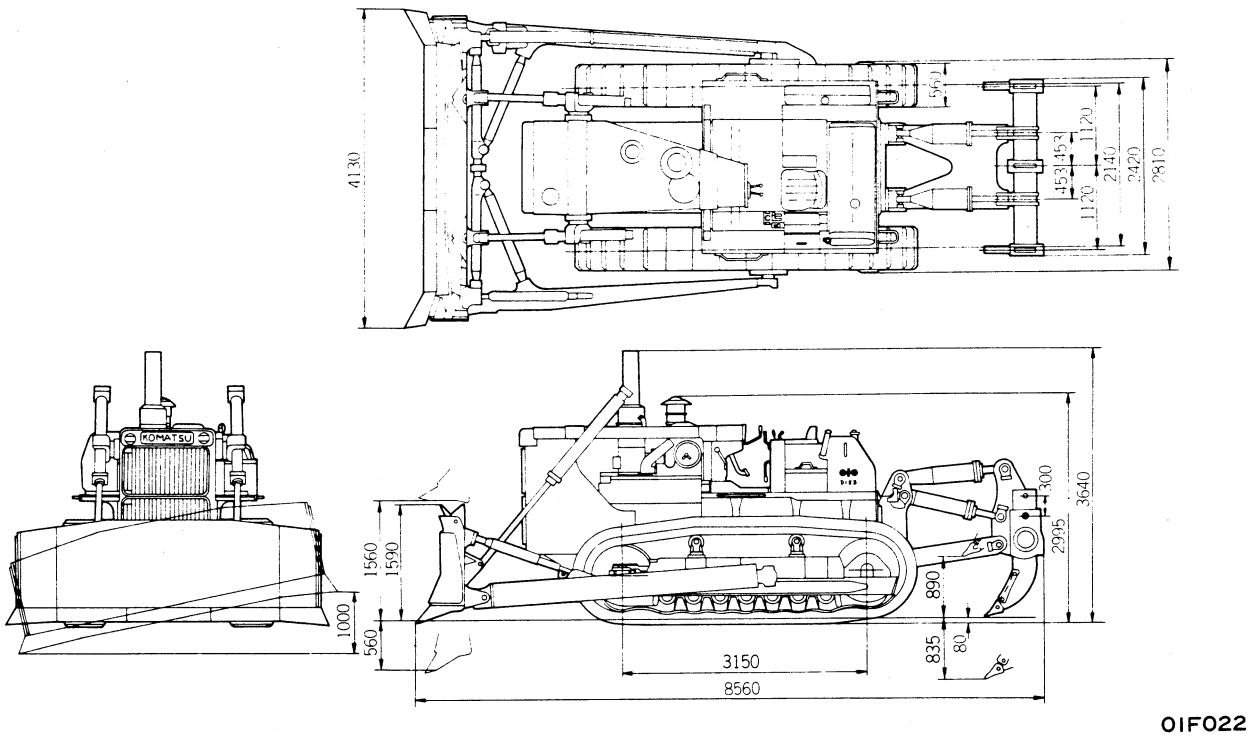


D155A STRAIGHT-TILTDOZER WITH VARIABLE MULTI RIPPER 15001 ~ 17000



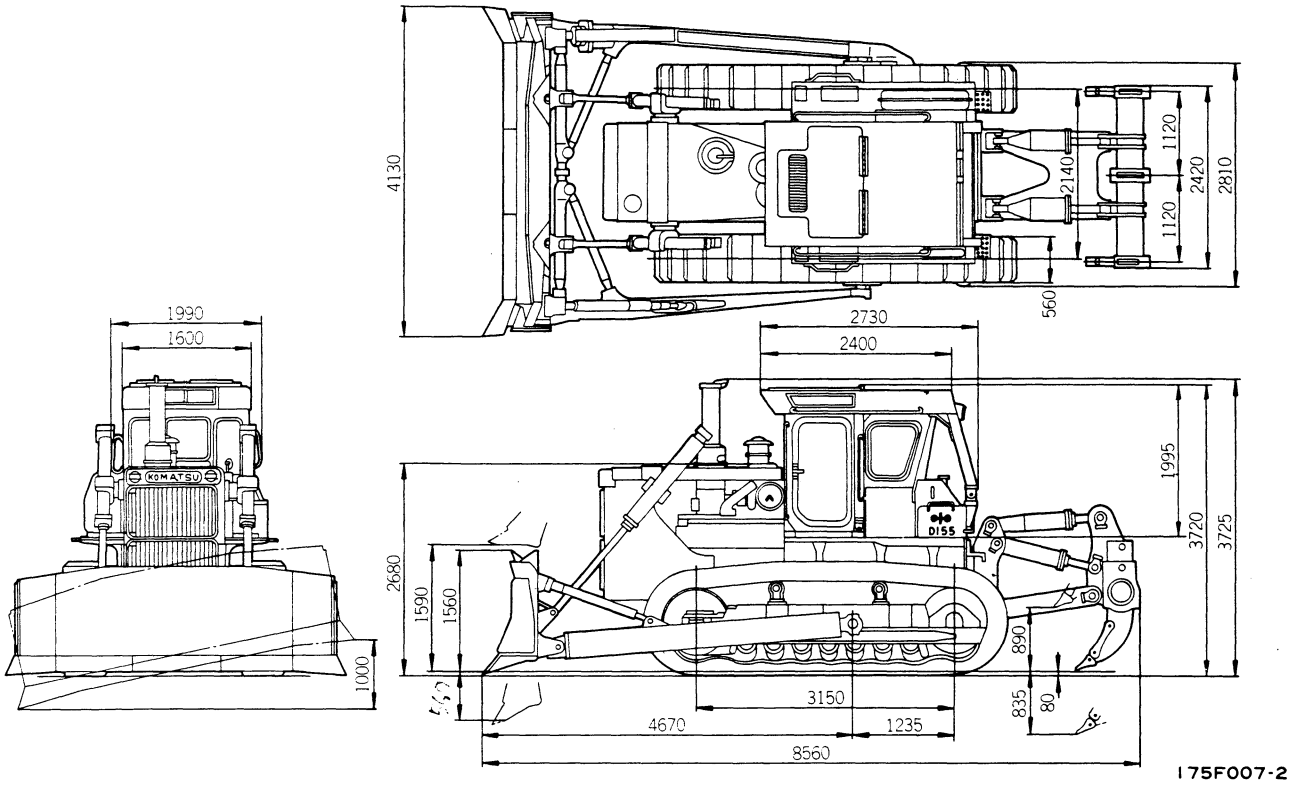
01F021

D155A STRAIGHT-TILTDOZER WITH VARIABLE MULTI RIPPER 17001 ~ 25000

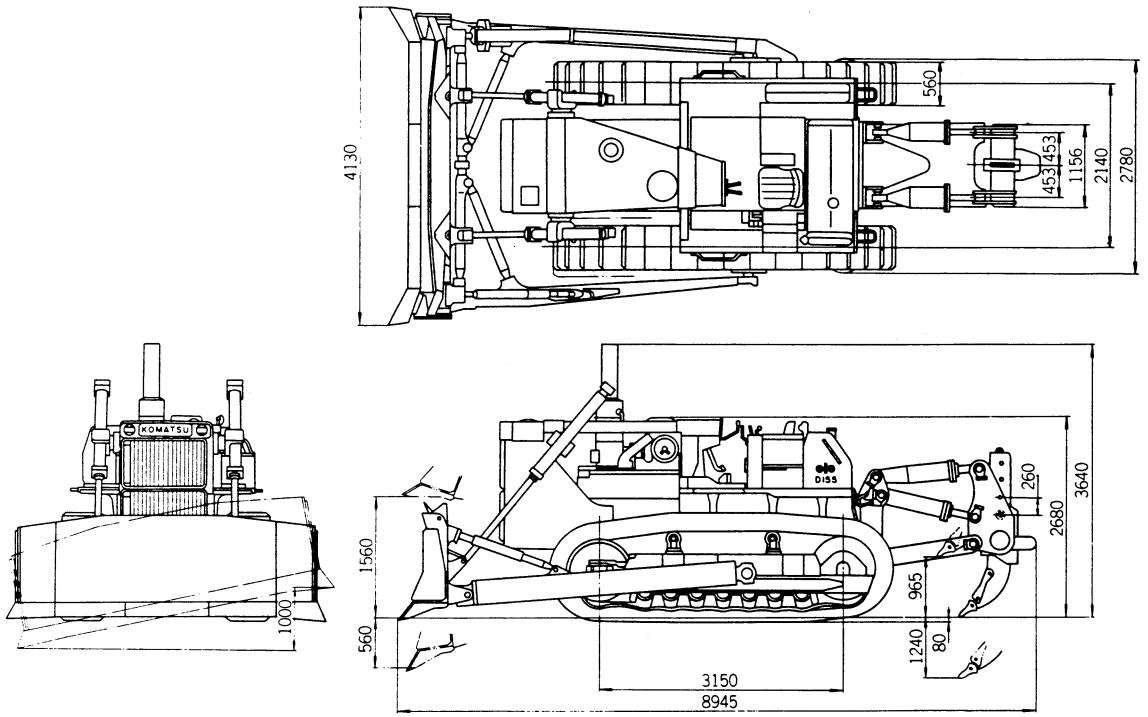


01F022

D155A STRAIGHT-TILTDOZER WITH VARIABLE MULTI RIPPER 25001 and up

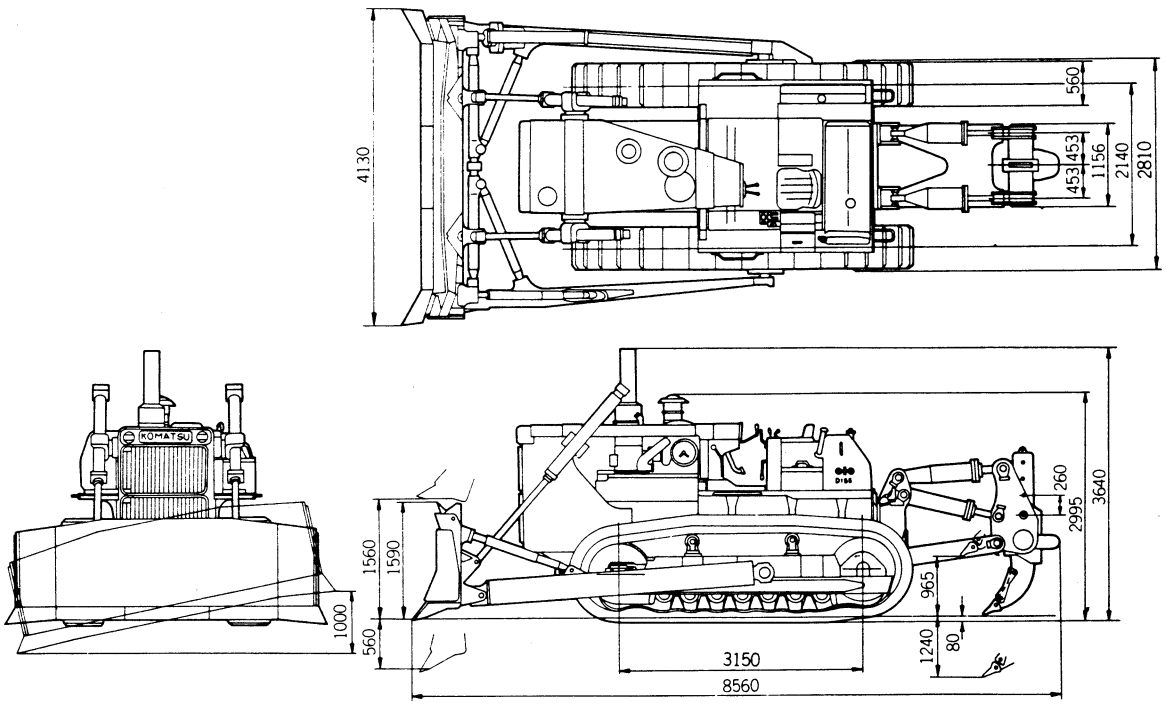


D155A STRAIGHT-TILTDOZER WITH VARIABLE GIANT RIPPER 15001 ~ 17000



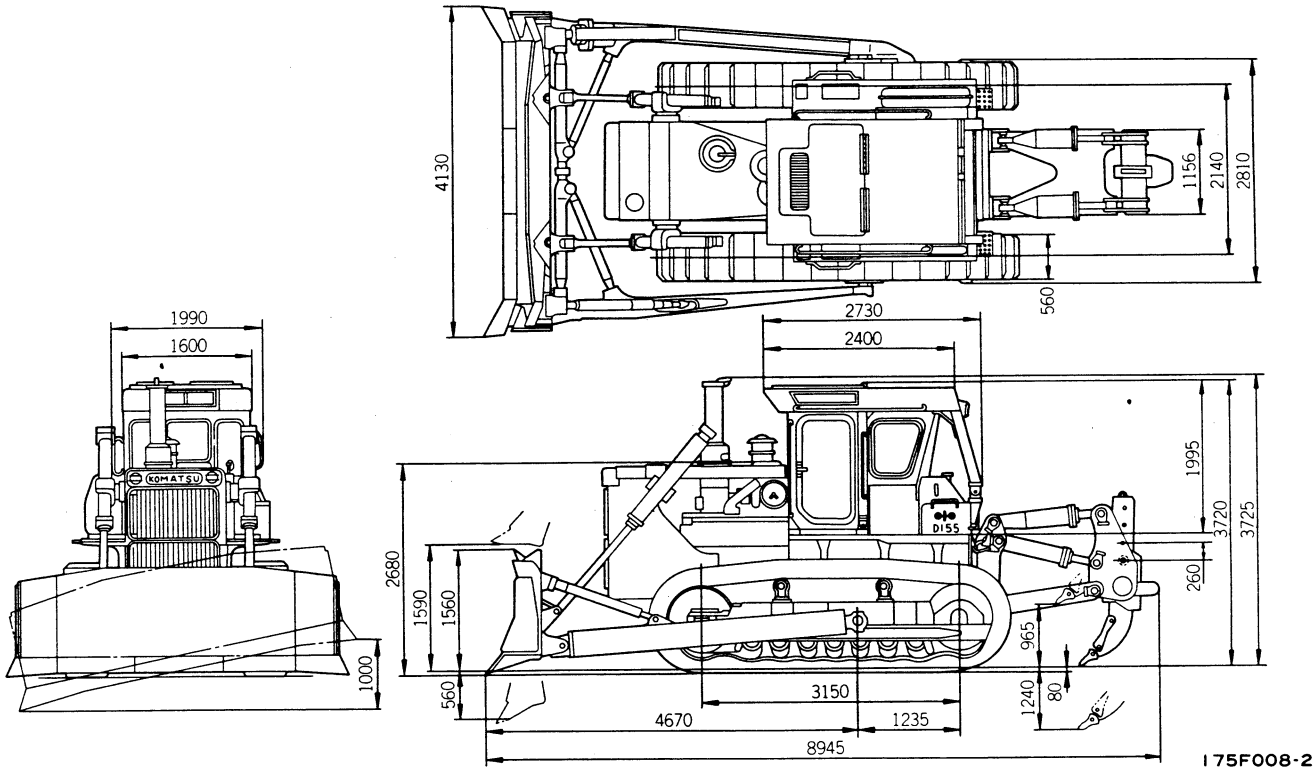
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D155A STRAIGHT-TILTDOZER WITH VARIABLE GIANT RIPPER 17001 ~ 25000

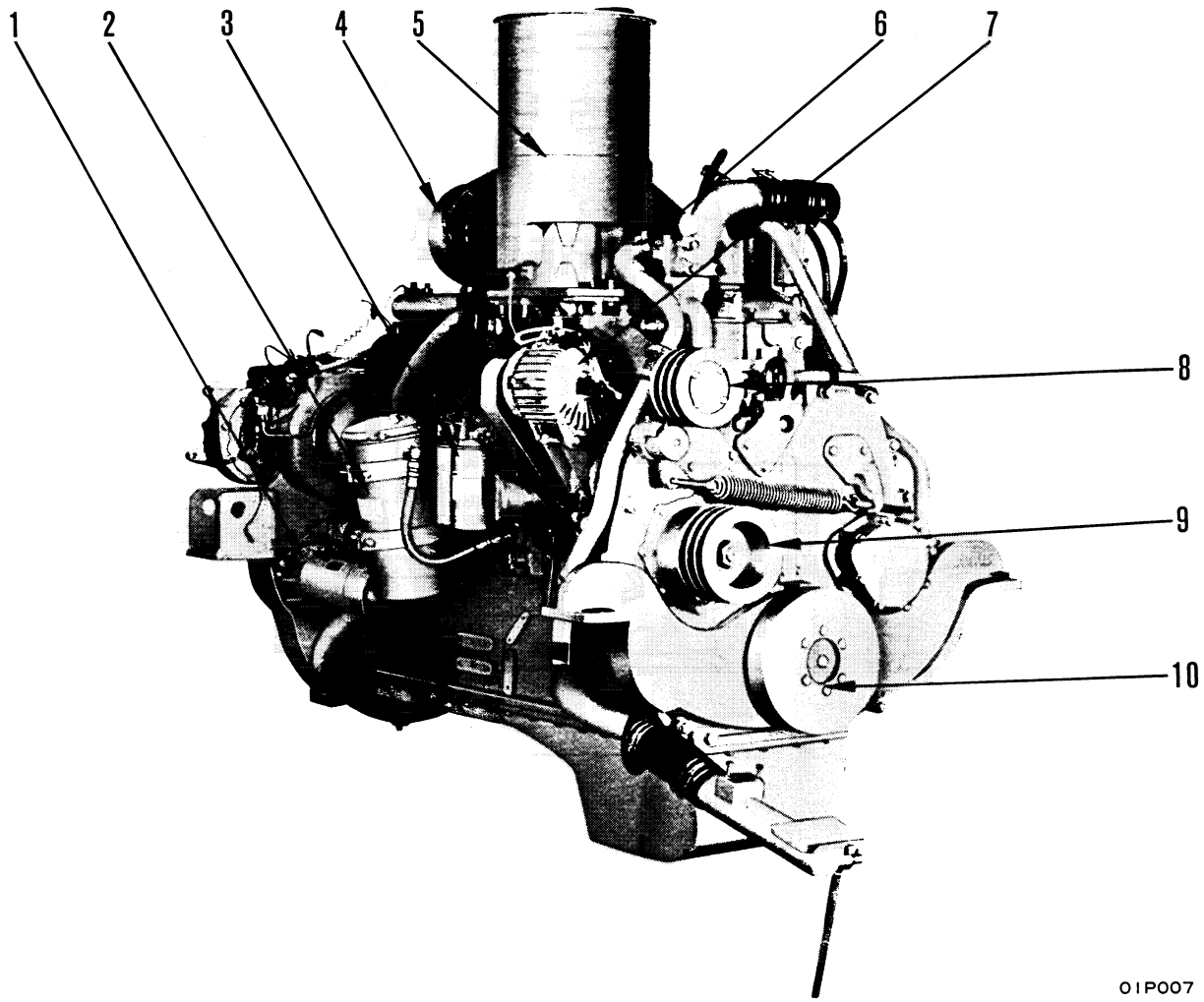


01F002

D155A STRAIGHT-TILTDOZER WITH VARIABLE GIANT RIPPER 25001 and up



ENGINE ASSEMBLY DRAWING



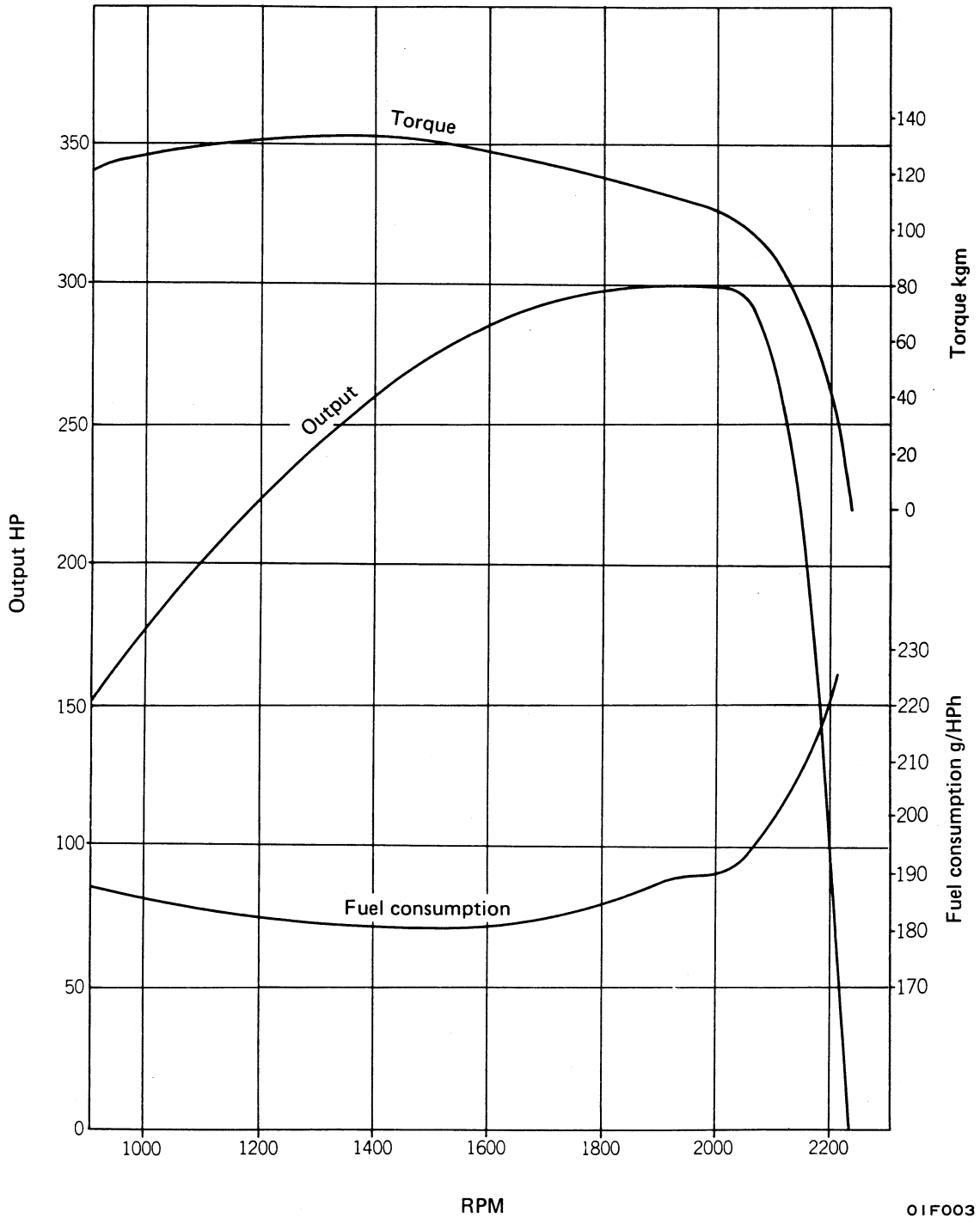
1. Starting motor
2. Bypass oil filter
3. Corrosion resistor
4. Turbocharger
5. Muffler
6. Thermostat housing
7. Alternator
8. Tension pulley
9. Accessory drive pulley
10. Vibration damper

ENGINE SPECIFICATIONS

Model			D150A		D155A	
			1		1	
Machine Serial Number			8408 ~ 8420	8421 ~	15001 ~ 17000	17001 ~
Engine model			S6D155-4A		S6D155-4D	
			4-cycle, straight vertical, water cooling, direct injection type, turbocharged, diesel engine			
No. of cylinders – bore x stroke		(mm)	6 – 155 x 170			
Piston displacement		(cc)	19260			
Firing order			1 – 5 – 3 – 6 – 2 – 4			
Dimension	Overall length (Tension pulley to rear support)	(mm)	1,893		1,880	
	Overall width (Front support)	(mm)	1,190			
	Overall height (Exhaust pipe to oil pan)	(mm)	2,796			
Performance	Flywheel horsepower	(HP)	300		320	
	Rated RPM	(rpm)	2000		2000	
	Max. torque	(kgm/rpm)	134/1400		144/1400	
	Max. rotating speed	(no load)	2,230 ± 50		2,230 ± 50	
	Min. rotating speed	(no load)	600 ± 50			
	Fuel consumption ratio	(g/HP.H)	180			
Dry weight		(kg)	2600		2580	
Fuel pump			Bosch PES-PD type			
Governor			Bosch RSUV centrifugal type all speed governor			
Lubrication system			Gear pump forced lubrication			
Oil filter			Full-flow filter and bypass filter used jointly			
Starting motor			24V 11 kW			
Alternator			24V 35A			
Battery			12V, 200Ahx2	12V, 170Ahx2	12V, 200Ahx2	12V, 170Ahx2
Turbocharger			KTR 130			

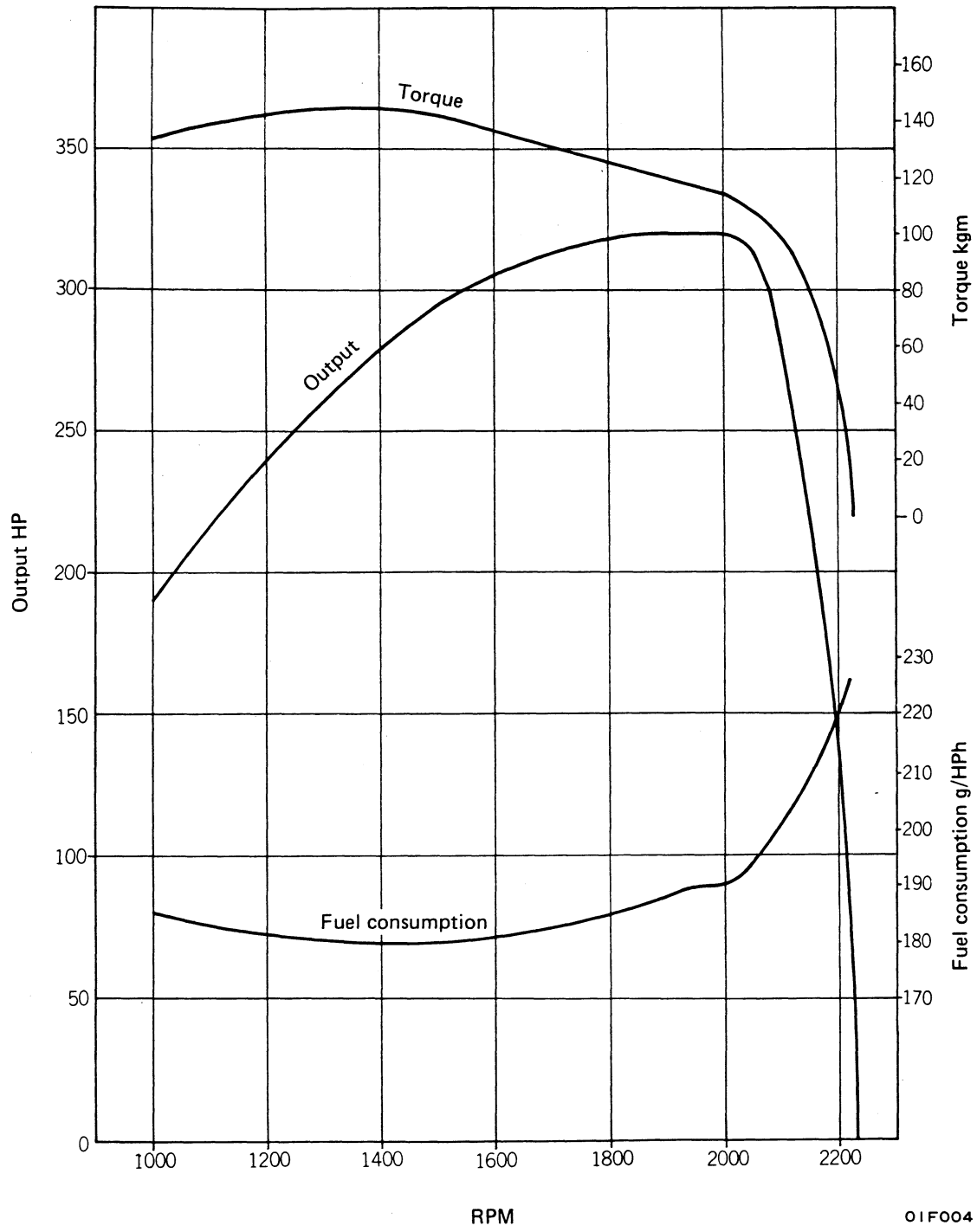
S6D155-4A D150A-1

Rated horse power	300HP/2,000rpm
Maximum torque	134kgm/1,400 rpm
Minimum fuel consumption	below 180g/HPh



S6D155-4D D155A-1

Rated horse power	320HP/2,000rpm
Maximum torque	144kgm/1,400 rpm
Minimum fuel consumption	below 180g/HPh



WEIGHT TABLE

Model		D150A-1		
Serial number		8408~8420	8421~8453	8454~
Engine, main clutch ass'y		2,905	2,900	
• Engine ass'y (with P.T.O.)		2,600	2,200	
• Main clutch ass'y		225	210	
Engine torque converter ass'y				
• Engine ass'y (with P.T.O.)			–	
• Torque converter ass'y				
Radiator guard, blade lift cylinder ass'y		1,100	1,100	
• Radiator guard		690	690	
• Radiator ass'y		420	435	
• Lift cylinder ass'y	(each)	400	400	
Fuel tank ass'y	(Full)	710	720	
Universal joint ass'y			20	
Transmission ass'y			660	
TORQFLOW transmission ass'y				
• Control valve ass'y			–	
Bevel gear shaft, steering clutch ass'y			–	
• Steering clutch, brake band ass'y	(each)		160	
• Bevel gear shaft			35	
• Bevel gear			35	
Steering control valve ass'y			60	
Brake band, link ass'y	(each)		50	
Final drive case ass'y	(each)		185	
1st gear, 2nd pinion ass'y	(each)		100	
2nd gear, sprocket hub ass'y	(each)		300	

Unit: kg

D155A-1			
15001~17000	17001~19000	19001 ~ 25000	25001 ~
2,870	2,880		
2,580	2,580		
210	225		
1,550	1,570		
690	690		
420	435		
400	400		
700	720		
20			
–			
900			
–			
160			
35			
40			
60			12
50			
185			
100			
300			

Model			D150A-1		
Serial number			8408~8420	8421~8453	8454~
Sprocket ass'y		(each)	310		
Steering case, main frame ass'y			3,140	3,000	
• Steering case, main frame			2,840	2,700	
• Sprocket shaft		(each)	145	145	
Track shoe ass'y	Single grouser shoe ass'y	(560 mm, each)	2,290		
	Extreme service shoe ass'y	(560 mm, each)	2,520		
	Scoria disposal shoe ass'y	(560 mm, each)	2,545		
Track group ass'y (with yoke)		(each)	3,570	3,590	3,580
• Idler ass'y (with yoke)		(each)	450	450	450
• Track roller ass'y		(single)	130	130	130
		(double)	140	140	140
• Carrier roller ass'y		(each side)	70	70	65
• Recoil spring ass'y		(each)	285	285	285
• Track frame		(each)	1,310	1,330	1,330
Equalizer bar			335	340	
Engine underguard			360	300	
Transmission underguard			270	175	
Floor frame ass'y			400		
P.T.O. ass'y			80		
• Hydraulic pump ass'y			45		
• Transmission, main clutch pump ass'y			15		
• Steering pump ass'y			25		
Hydraulic tank ass'y			330	360	
• Control valve ass'y			95	95	

Unit: kg

D155A-1			
15001~17000	17001~19000	19001 ~ 25000	25001 ~
310			
3,140	3,000		
2,840	2,700		
145	145		
2,290			
2,520			
2,545			
3,570	3,590	3,580	3,580
450	450	450	450
130	130	130	130
140	140	140	140
70	70	65	65
285	285	285	285
1,310	1,330	1,330	1,330
335	340		
360	300		
270	175		
400			
80			
45			
15			
25			
330	360		
95	95		

Model		D150A-1		
Serial number		8408~8420	8421~8453	8454~
Blade lift cylinder ass'y	(each)	200		
Blade tilt cylinder ass'y	(each)	245		
Ripper lift cylinder ass'y	(each)	250	265	
Ripper tilt cylinder ass'y	(each)	300	290	
Angledozer ass'y		4,100		
• Angle blade		2,000		
• C-frame		2,100		
Straight tiltdozer ass'y		4,500	4,300	
• Straight blade		2,500	2,220	
• Straight frame	(each)	660	660	
• Tilt cylinder ass'y		245	245	
Variable multi-ripper ass'y		5,560		
• Shank ass'y	(each)	285		
• Lift cylinder ass'y	(each)	250		
• Tilt cylinder ass'y	(each)	300		
Variable giant ripper ass'y		4,740		
• Shank ass'y	(each)	450		
• Lift cylinder ass'y	(each)	250		
• Tilt cylinder ass'y	(each)	300		
• Pin puller cylinder ass'y		10		
Ripper bracket	(each)	325	290	

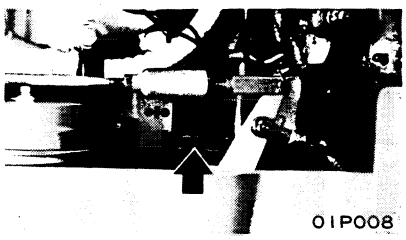
Unit: kg

D155A-1			
15001~17000	17001~19000	19001 ~ 25000	25001 ~
200			
245			
250	265		
300	290		
4,100			
2,000			
2,100			
4,500	4,300		
2,500	2,220		
660	660		
245	245		
5,560			
285			
250			
300			
4,740			
450			
250			
300			
10			
325	290		

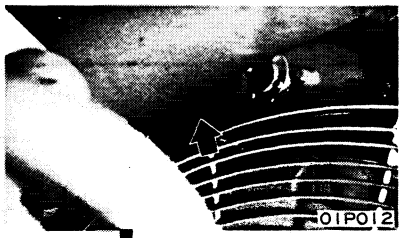
POSITIONS OF SERIAL NUMBERS (ENGINE)

D150A 8408 and up
D155A 15001 and up

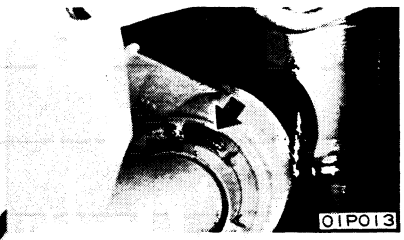
- Engine No.



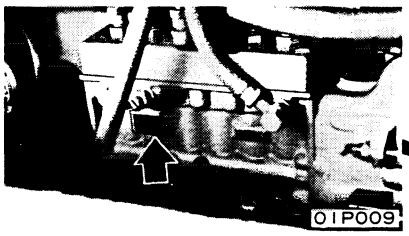
- Radiator



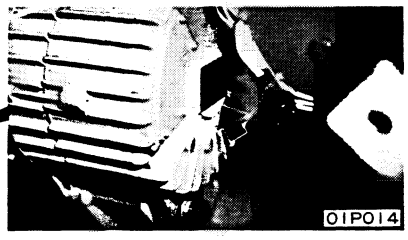
- Turbocharger

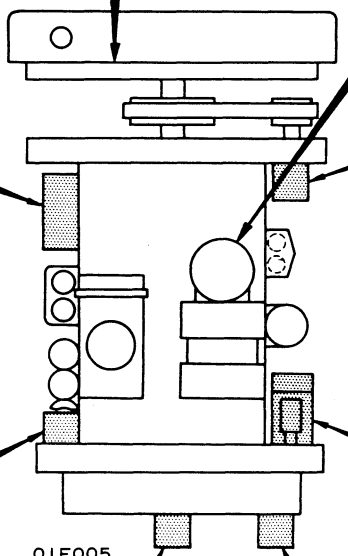


- Injection pump No.

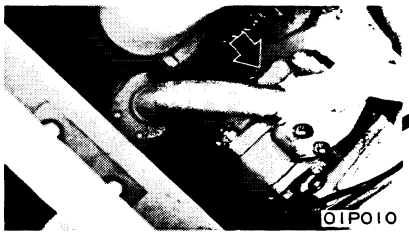


- Alternator No.

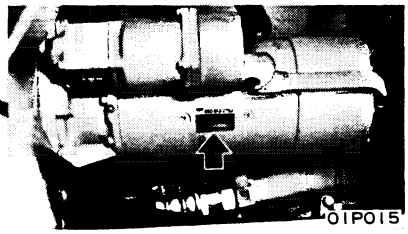


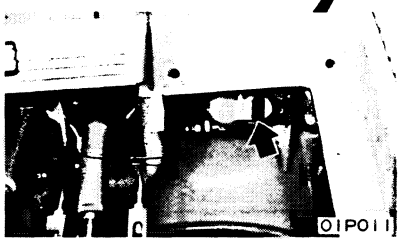


- Steering pump No.

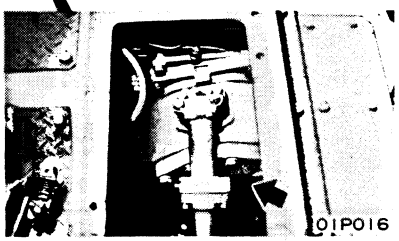


- Starting motor No.





- Main clutch pump No.
- Transmission pump No.



- Hydraulic pump No.

POSITIONS OF SERIAL NUMBERS(BODY)

D150A 8408 and up
D155A 15001 and up

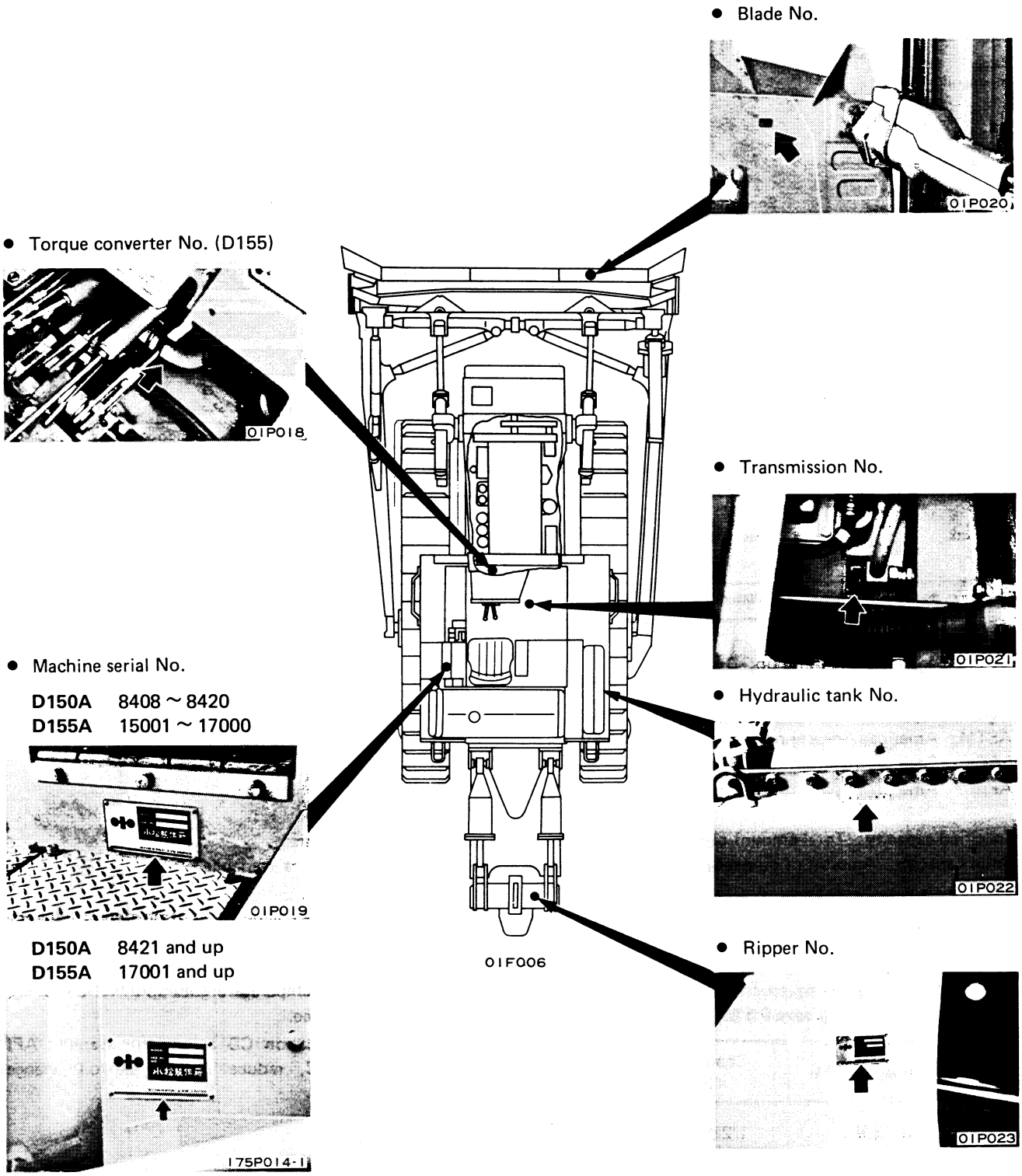


TABLE OF OIL AND COOLANT QUANTITIES (D150A-1)

PROPER SLELECTION OF FUEL, COOLANT AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE 14 32 50 68 86°F / −10 0 10 20 30°C	CAPACITY (ℓ) Specified amount	CAPACITY (ℓ) Refill capacity
Engine oil pan	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	75	57
• Steering clutch transmission case	Engine oil	SAE 30	175	149
• Main clutch case	Engine oil	SAE 10W	30	22
• Final drive case (each)	Engine oil	SAE 30	55	55
• Recoil spring case (each)	Engine oil	SAE 30	15 ★ (# 8408 – 8420)	15 ★ (# 8408 – 8420)
Hydraulic system • Tiltdozer	Engine oil	SAE 10W / SAE 10W-30 / SAE 15W-40	153	103
Hydraulic system • Angledozer	Engine oil	SAE 10W / SAE 10W-30 / SAE 15W-40	164	103
• Idler (each)	Gear oil	GO 140	0.39 – 0.45	–
• Track roller (each)	Gear oil	GO 140	0.39 – 0.45	–
• Carrier roller (each)	Gear oil	GO 140	0.63 – 0.72	–
Fuel tank	Diesel fuel	※ / ASTM D975 No. 2	600	–
Cooling system	Water	Add antifreeze	165	–

※ ASTM D975 No. 1

★ Serial No. 8421 and up: Dry type

NOTE:
ASTM: American Society of Testing and Material
SAE: Society of Automotive Engineers
API: American Petroleum Institute

Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

(1) When fuel sulphur content is less than 0.5%, change oil in the oil pan every periodic maintenance hours described in this manual.
Change oil according to the following table if fuel sulphur content is above 0.5%.

Fuel sulphur content	Change interval of oil in engine oil pan
0.5 to 1.0%	1/2 of regular interval
Above 1.0%	1/4 of regular interval

(2) When starting the engine in an atmospheric temperature of lower than 0°C, be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10°C more or less in the day time.

(3) Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.

TABLE OF OIL AND COOLANT QUANTITIES (D155A-1)

PROPER SLELECTION OF FUEL, COOLANT AND LUBRICANTS

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE 14 32 50 68 86°F −10 0 10 20 30°C	CAPACITY (ℓ) Specified amount	CAPACITY (ℓ) Refill capacity
Engine oil pan	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	71	57
Steering clutch case, transmission, torque converter and bevel gear case	Engine oil	SAE 30 / SAE 10W	185	136
• Final drive case (each) • Recoil spring case (each)	Engine oil	SAE 30	55 15 ★(#15001 – 17000)	55 15 ★(#15001 – 17000)
Hydraulic system • Tiltdozer • Angledozer	Engine oil	SAE 10W / SAE 10W-30 / SAE 15W-40	153 164	103 103
• Ider (each) • Track roller (each) • Carrier roller (each	Gear oil	GO 140	0.39 – 0.45 0.39 – 0.45 0.63 – 0.72	– – –
Fuel tank	Diesel fuel	※ / ASTM D975 No. 2	600	–
Cooling system	Water	Add antifreeze	165	–

※ ASTM D975 No. 1

★ Serial No. 17001 and up: Dry type.

NOTE:
ASTM: American Society of Testing and Material
SAE: Society of Automotive Engineers
API: American Petroleum Institute

Specified capacity: Total amount of oil including oil for components and oil in piping.
Refill capacity: Amount of oil needed to refill system during normal inspection and maintenance.

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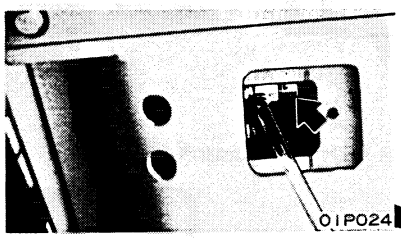
(3) Use API classification CD as engine oil and if API classification CC, reduce the engine oil change interval to half.

OIL AND WATER FILLING AND DRAIN POINTS (ENGINE)

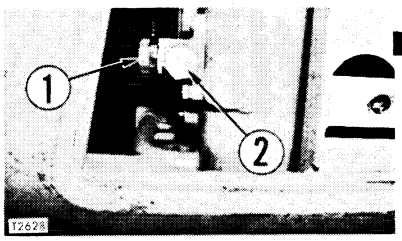
(This subject is also described in the operation and maintenance manual)

D150A C8408 and up
D155A T15001 and up

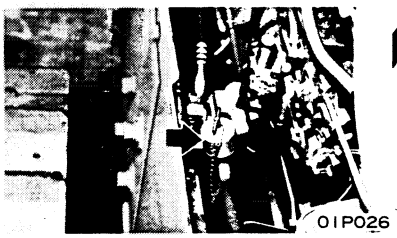
- Cooling water drain

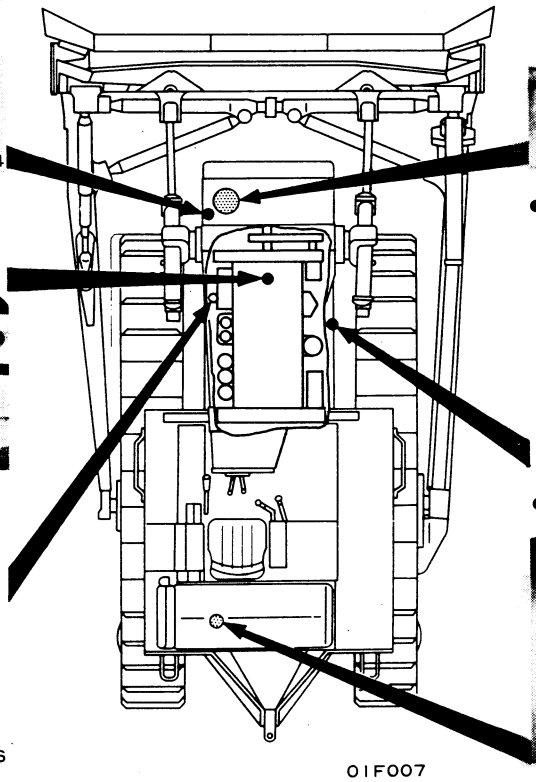


- Engine oil drain

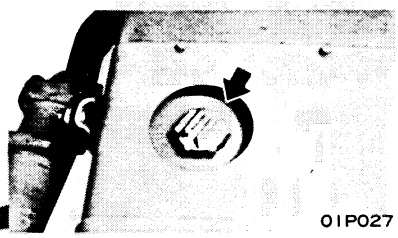


- Engine oil filling port

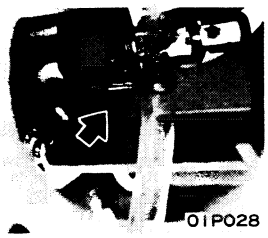




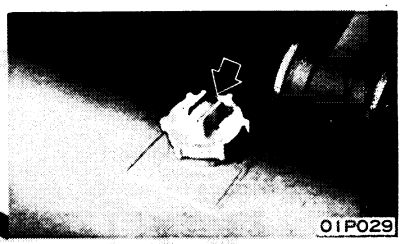
- Cooling water filling port



- Cooling water drain (oil coller)



- Fuel filling port



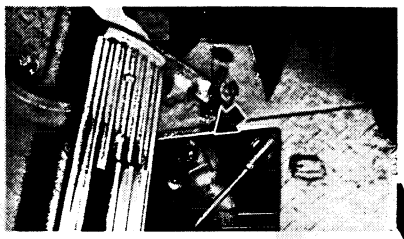
- Fuel drain



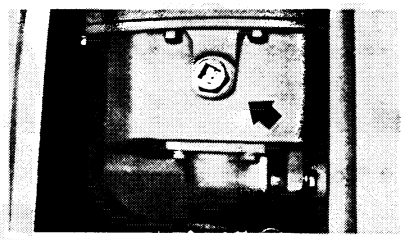
OIL AND WATER FILLING AND DRAIN POINTS (BODY)

D150A 8408 and up

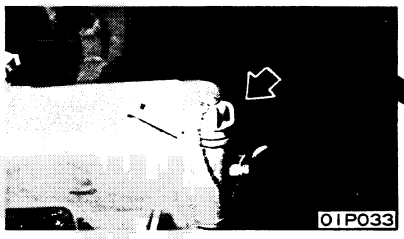
- Main clutch filling port



- Main clutch drain



- Steering case filling port

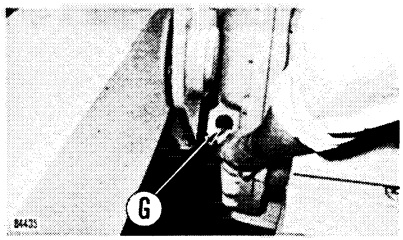


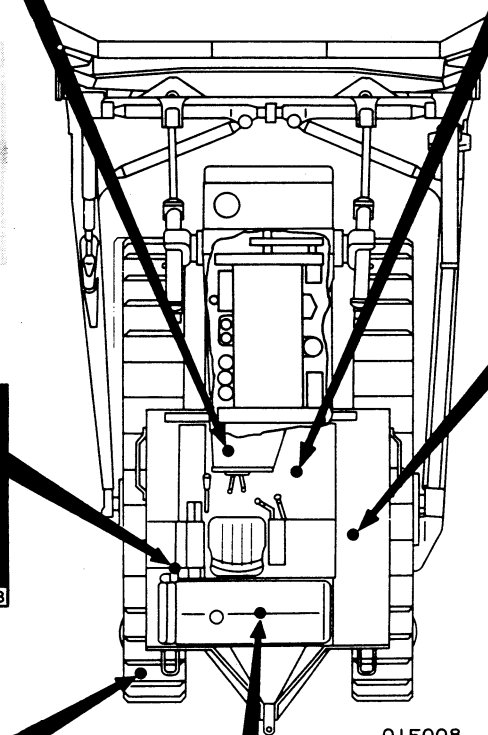
- Final drive filling port

8408 ~ 8453

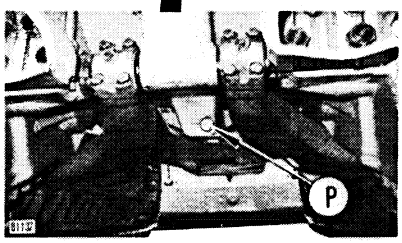


8454 and up

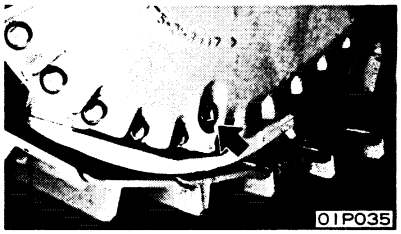




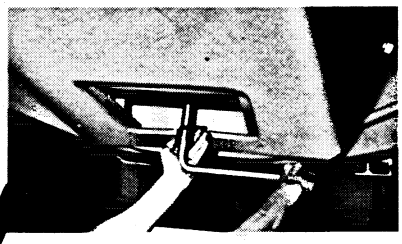
- Steering case drain



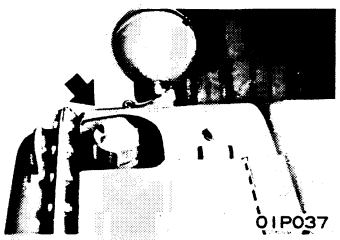
- Final drive drain



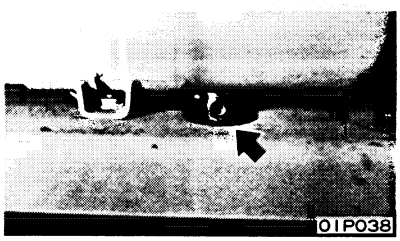
- Transmission drain



- Hydrualic tank filling port

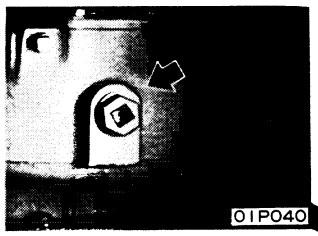


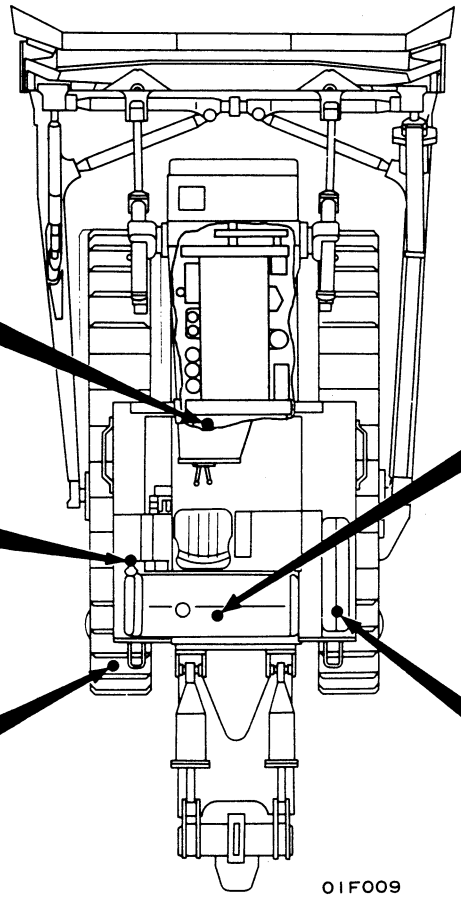
- Hydraulic tank drain



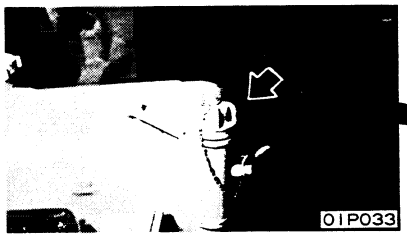
D155A 15001 and up

- Torque converter drain

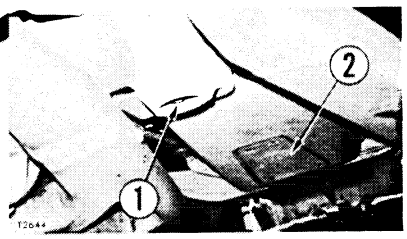




- Steering case filling port



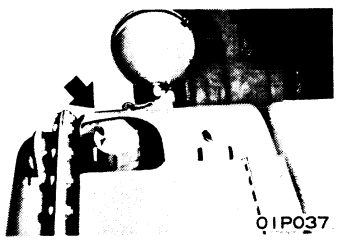
- Steering case drain



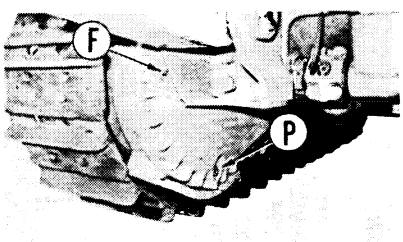
- Final drive filling port
  15001 ~ 19000



- Hydraulic tank filling port

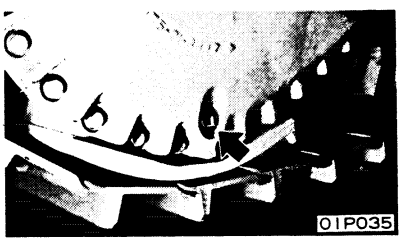


19001 and up

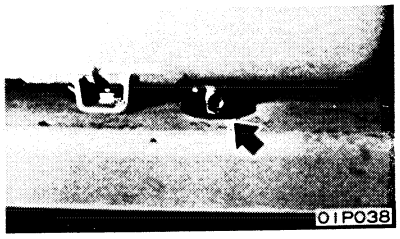


T2648

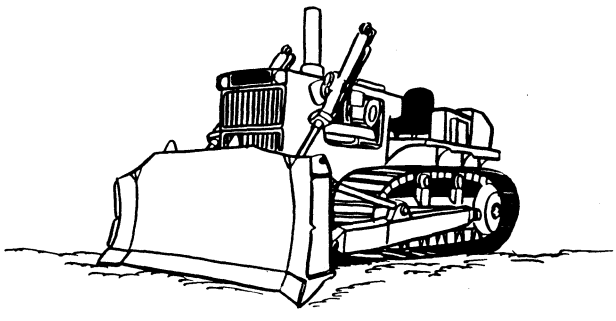
- Final drive drain



- Hydraulic tank drain



MEMO



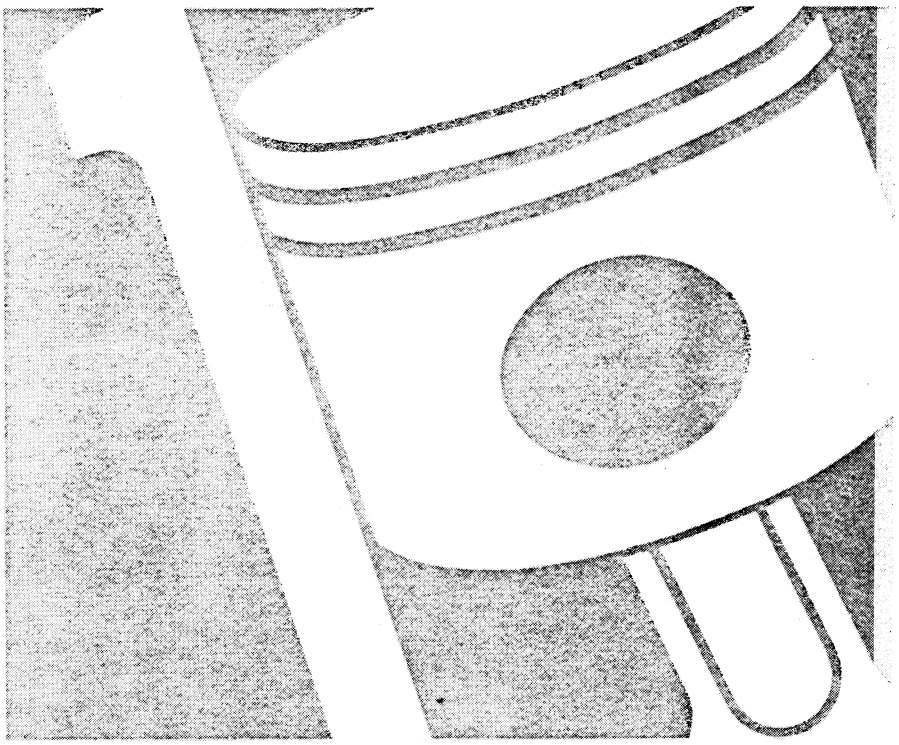
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

11 ENGINE

STRUCTURE AND FUNCTION

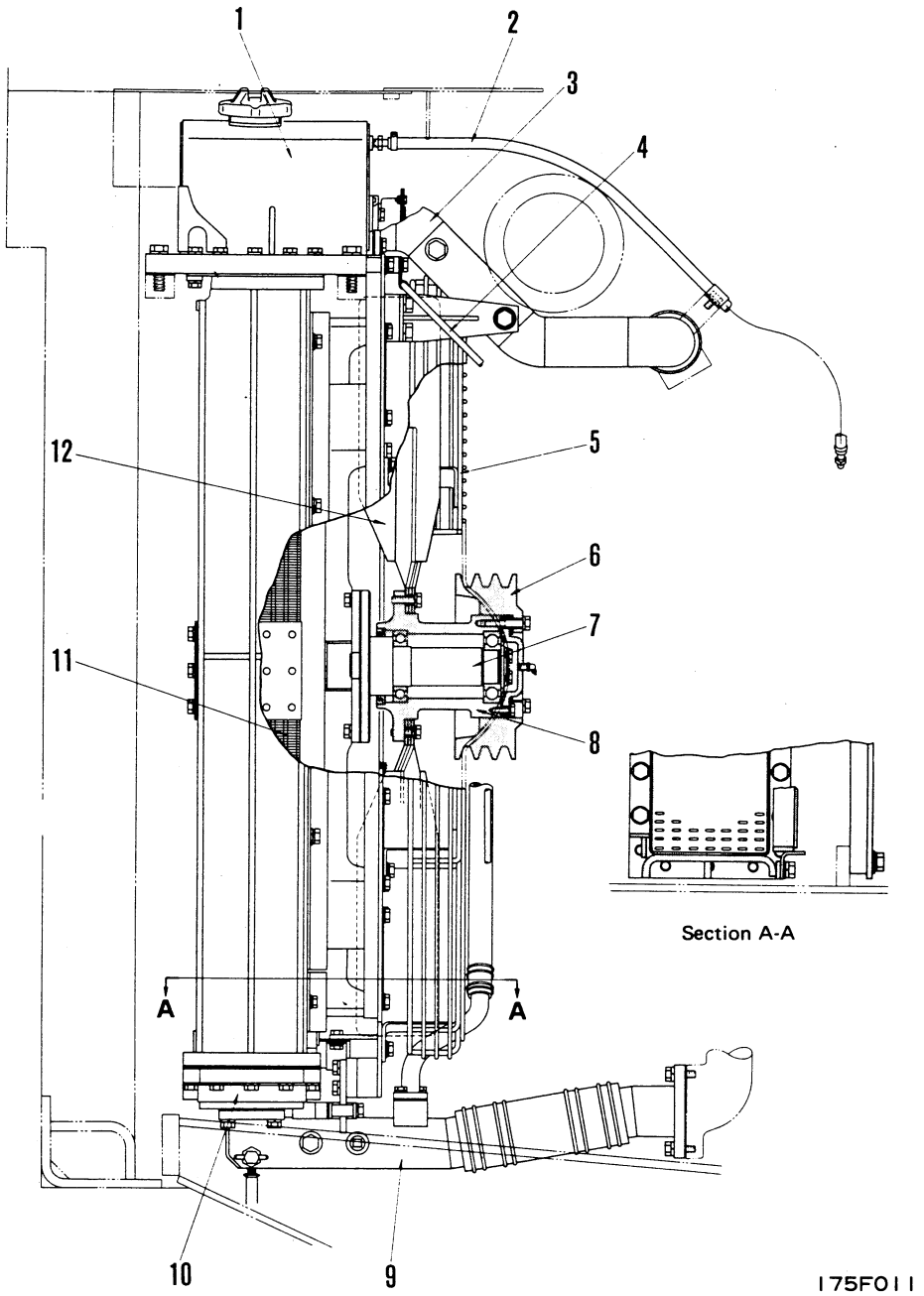


STRUCTURE AND FUNCTION

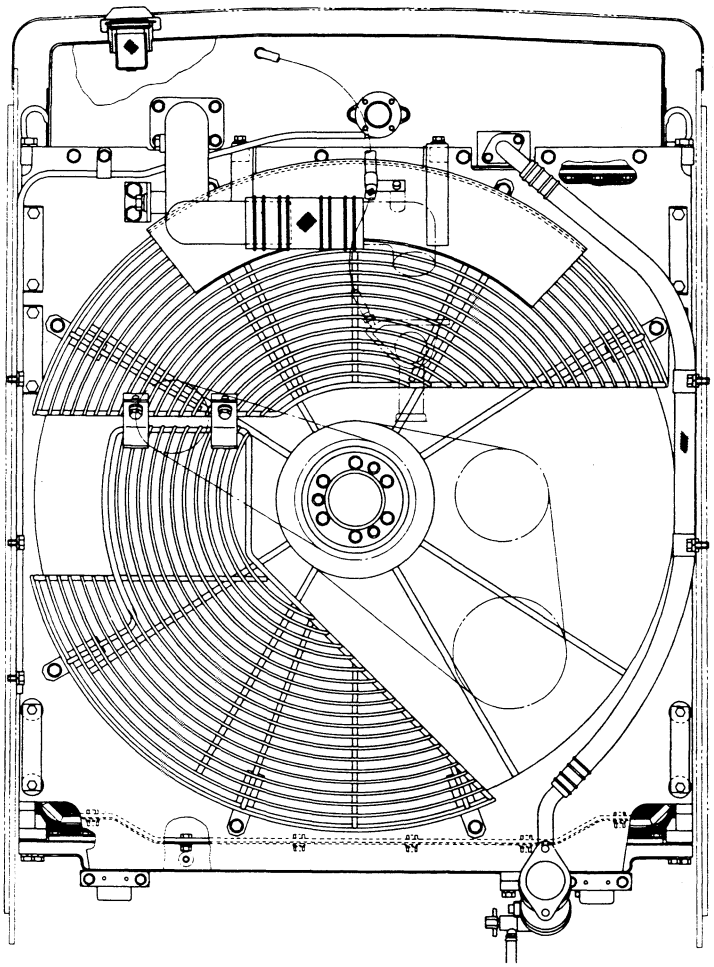
Radiator, fan 11-2
Oil cooler 11-4
P.T.O. (Power take-off) 11-5
Engine control 11-6
Fuel piping 11-7

RADIATOR, FAN

D150A 5508 ~ 8513
D155A 15001 ~ 25000



1. Upper tank
2. Hose
3. Inlet tube
4. Hose
5. Fan guard
6. Pulley
7. Shaft
8. Boss
9. Outlet tube
10. Lower tank
11. Radiator core
12. Fan



175F012

The radiator is made up of upper tank (1), radiator core (11), and lower tank (10).

Cooling water, after flowing through the engine thermostat, is temporarily stored in the upper tank in order to remove air in the water. It then flows from the inlet tube (3) to the lower tank (10) through the radiator core. As cooling water flows from the inlet tube (3) to lower tank (10), its heat is dissipated so that the temperature falls to 85 to 95°C which is the best for engine.

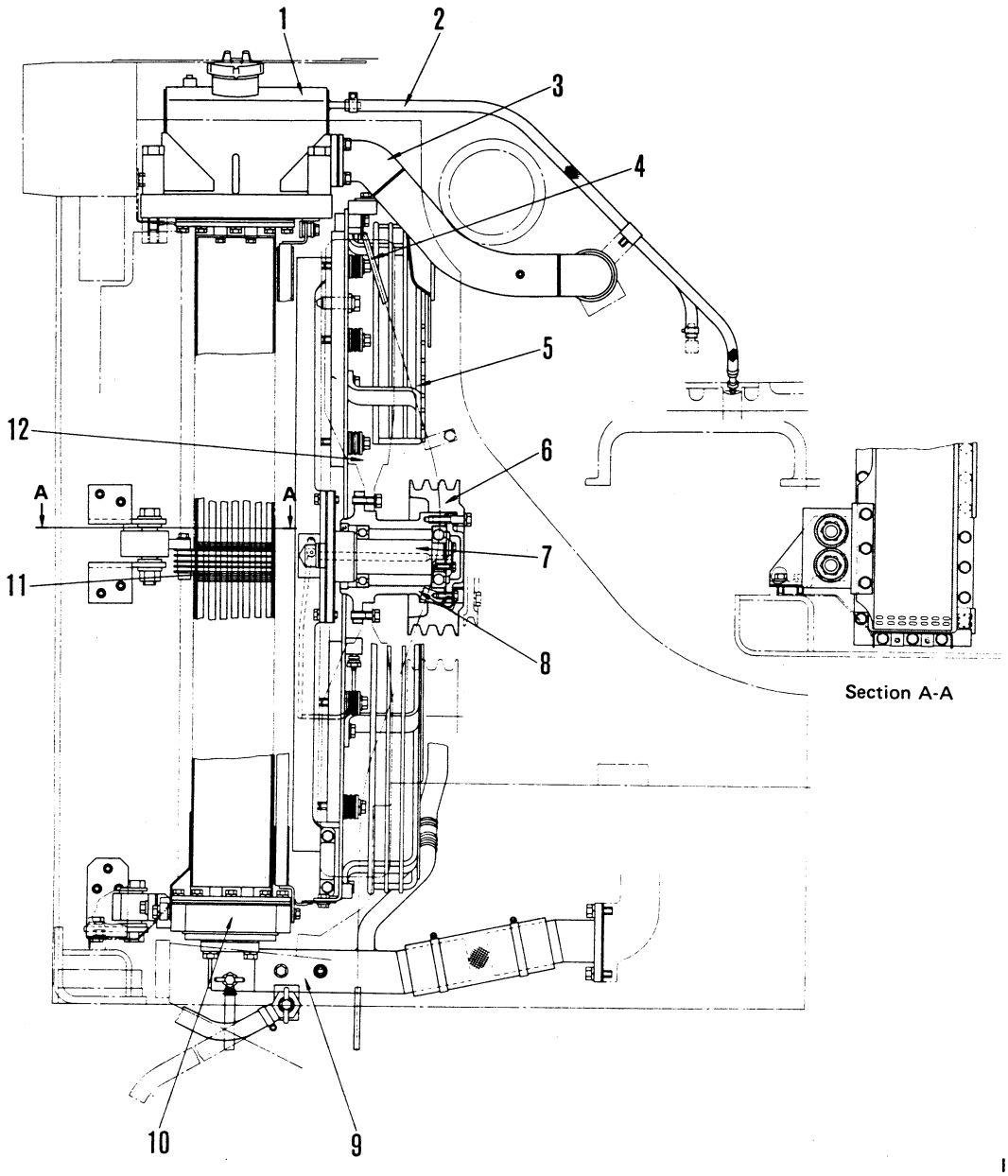
The core consists of multiple flat drawn tubes and fin for raising the heat radiation efficiency, and is classified as D type, G type, and K type according to the tube arrangement system. In this model D150, 155A, D type is used in which tubes are arranged in series.

Cooling water in the lower tank, now at a lower temperature as a result of heat radiation, is returned to the engine block by the water pump. Pressure valve, which is equipped to upper tank, prevents air bubbles from entering cooling water by keeping upper tank pressure at less than 0.75 kg/cm^2 of gauge pressure and avoiding boiling of cooling water at more than 100°C.

Hose between upper tank and tube (9) of water pump suction side plays the role of supplying cooling water from upper tank to prevent production of air bubbles at the suction side of water pump.

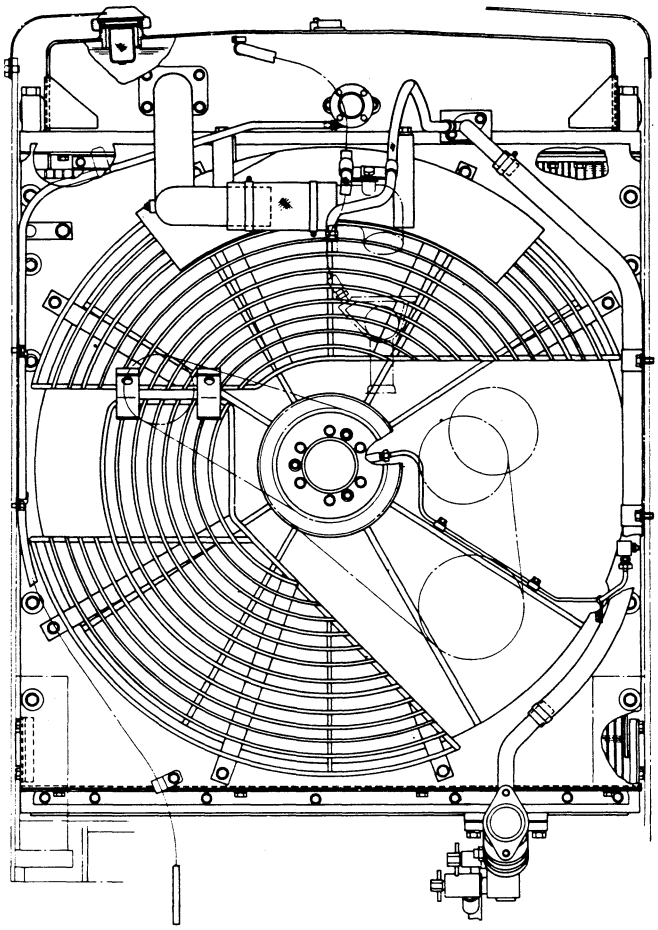
Radiator fan (12), which is driven by fan belt running between the fan and the pulley to the engine, impels air to the radiator core, increasing heat radiation efficiency. In model D150, 155A, the discharge method is employed, in which air is blown toward the radiator.

D150A 8514 and up
D155A 25001 and up



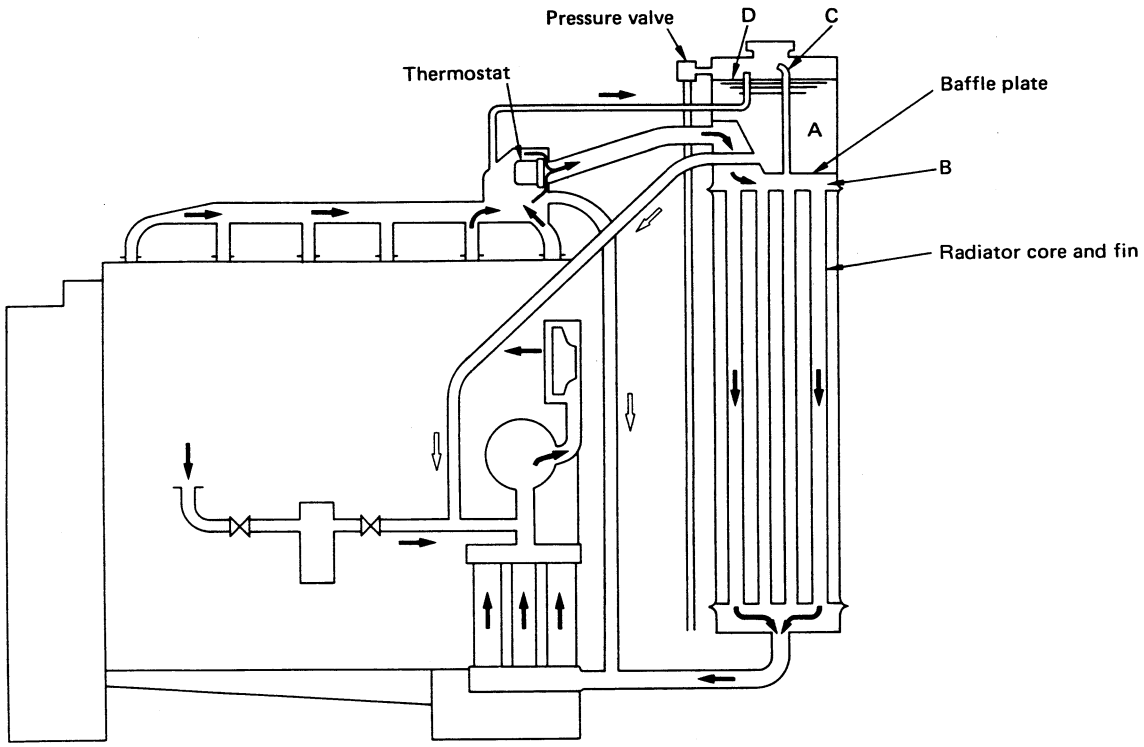
175F011-1

1. Upper tank
2. Hose
3. Inlet tube
4. Hose
5. Fan guard
6. Pulley
7. Shaft
8. Boss
9. Outlet tube
10. Lower tank
11. Radiator core
12. Fan



175F012-1

STRUCTURE AND FUNCTION



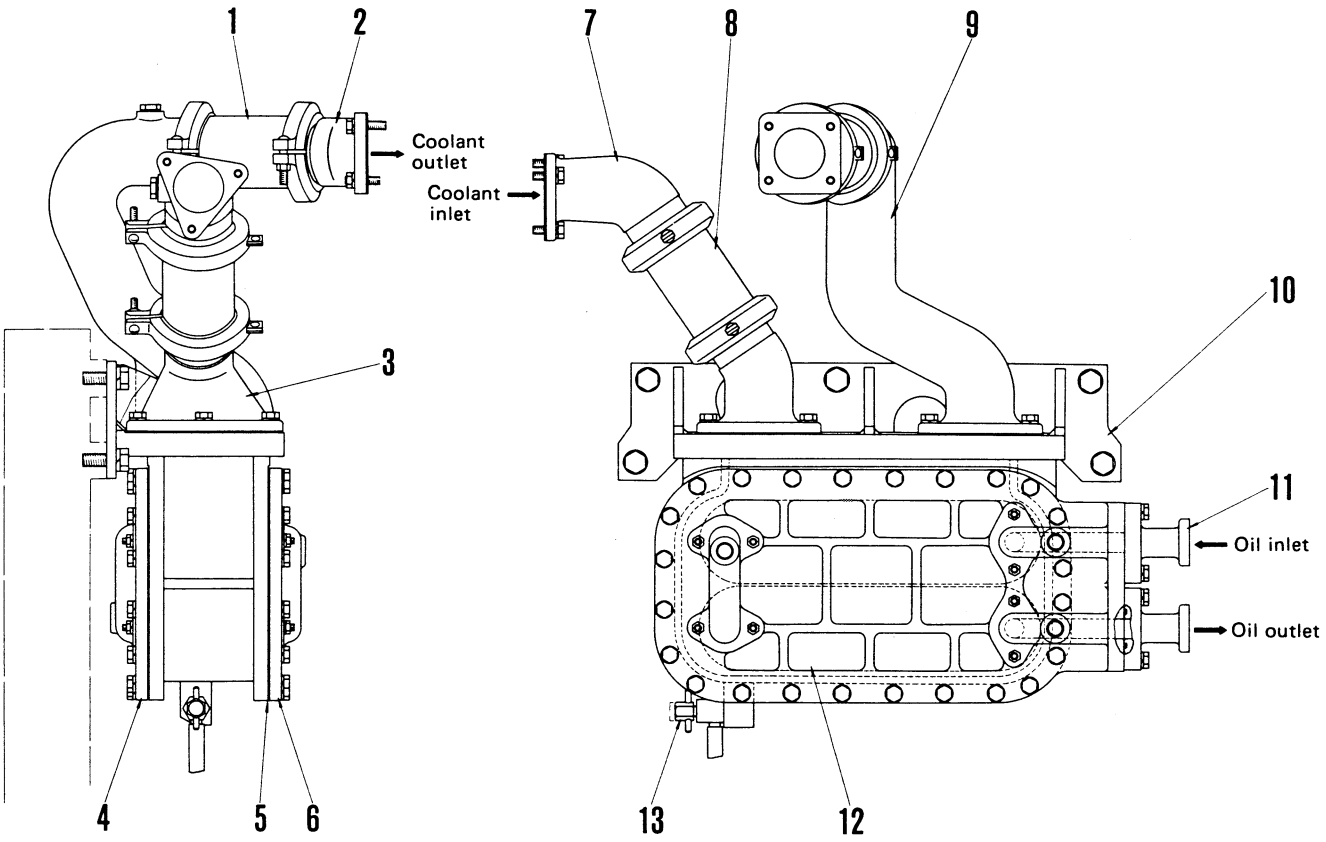
The bubbles contained in the coolant are called, "Aeration" and the excessive aeration will have an adverse effect on the engine as described below;

1) Aeration lowers water pump performance and reduces coolant circulation, causing the engine to become overheated.
2) Aeration causes corrosion inside the engine (such as in the cylinder liner).
3) When coolant temperature rises, aeration will cause coolant to overflow, because the mixed air expands more quickly than water.
4) Aeration reduces the heat transfer surface area (Radiator core), resulting in lowered cooling efficiency.

This system is intended to prevent the aeration.
To prevent aeration, a baffle plate is provided in the upper tank to divide it into chamber **A** and chamber **B**.
When flowing into the radiator from the engine side, coolant encounters the baffle plate where bubbles are separated, and then flows into the radiator core. The separated air passes through a thin pipe **C** and escapes into the air space in chamber **A** of the upper tank.
Air breather line **D** in the upper tank also functions to permit air bubbles to escape out of the engine water jacket.
Consequently, coolant in the chamber **A** of the upper tank contains little air. When bubbles are generated on the suction side of the water pump during engine operation, the baffle plate will also assist in supplying more coolant.

The pressure valve combined with the vacuum valve pressurize the coolant in excess of the specified 0.75 kg/cm^2 and the coolant will not boil even if it is heated to aproximately 108°C.

OIL COOLER

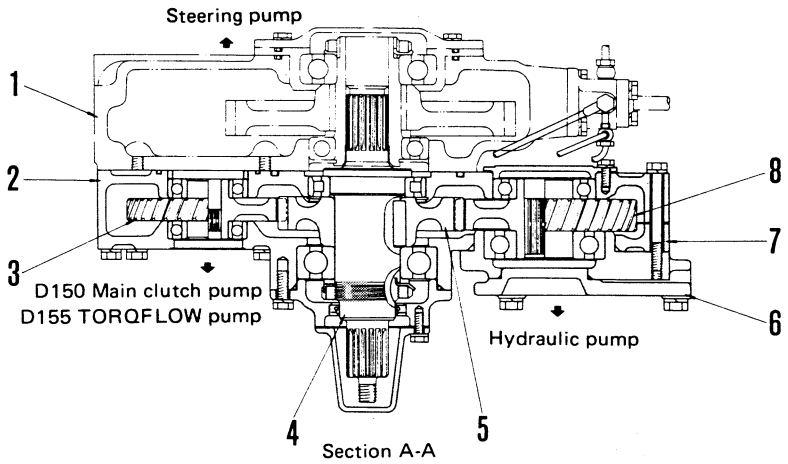


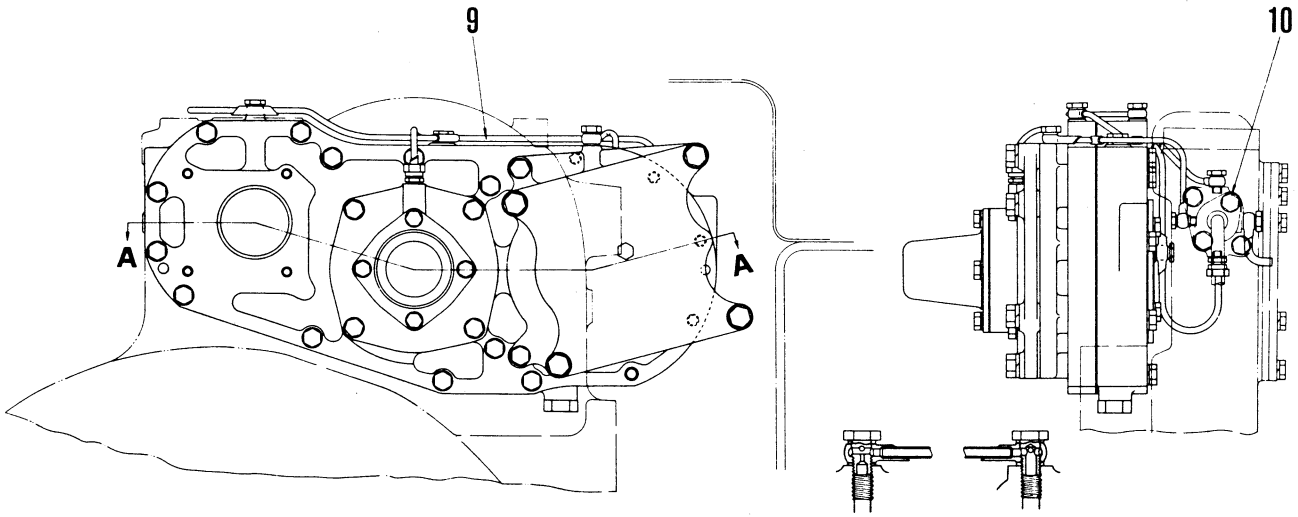
1. Coupling
2. Tube
3. Tube
4. Cover
5. Gasket
6. Cover
7. Tube
8. Coupling
9. Tube
10. Housing
11. Tube
12. Cooler
13. Drain plug

P.T.O(POWER TAKE-OFF)

The P.T.O. system, installed on the engine flywheel, consists of main shaft (4) (connected to the spline on which the gear engaging with the external teeth of the engine flywheel is installed), drive gear (5) on the main shaft, and two driven gears (3) and (8).

On the boss spline of gear (8), a hydraulic pump is mounted, while on the boss spline of gear (3) TORQ-FLOW pump or main clutch pump is mounted.
The steering pump is mounted on the front face of the flywheel housing.
As for lubrication of P.T.O., lubricant from backway hose of oil cooler, being devided with block (10) lubricates each gear and bearing.



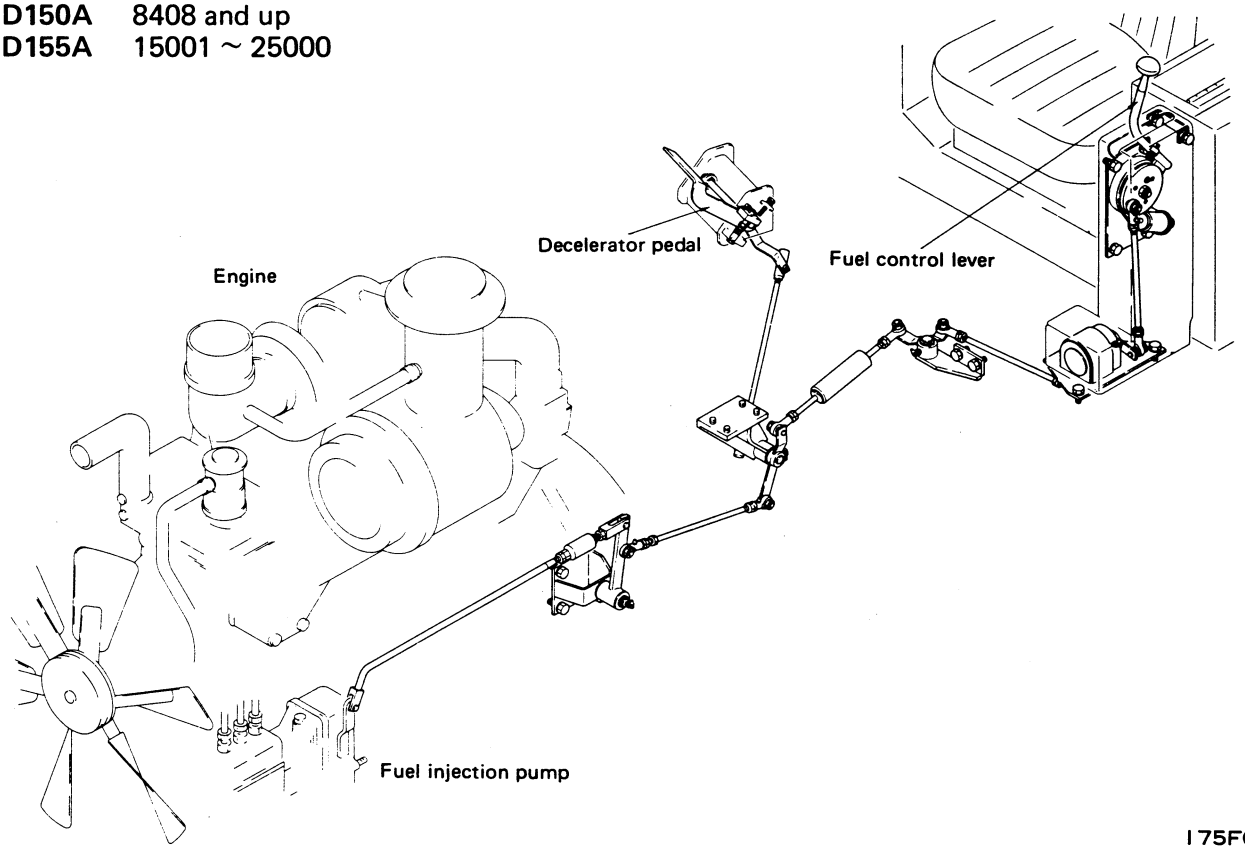


Detail of lubricating oil inlet and outlet 21F007

1. Flywheel housing
2. P.T.O. case
3. Driven gear
4. Shaft
5. Drive gear
6. Cover
7. Case
8. Driven gear
9. Tube
10. Block

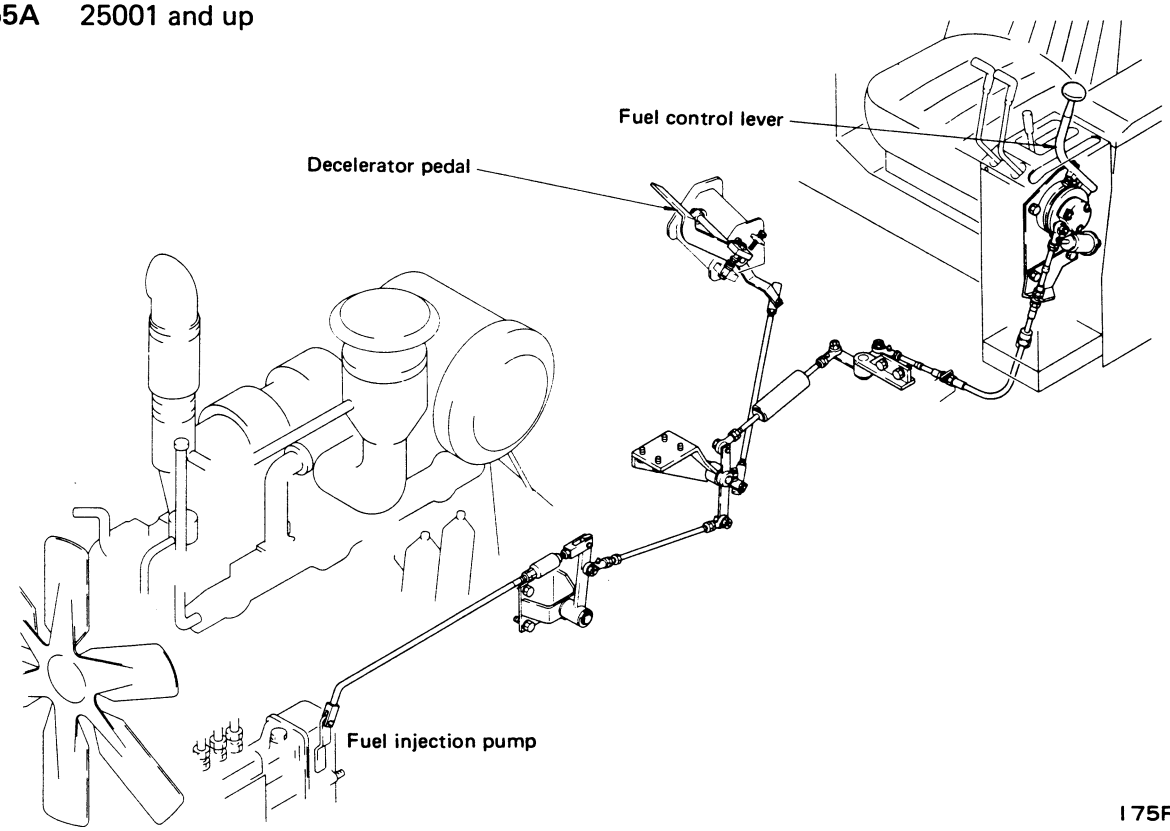
ENGINE CONTROL

D150A 8408 and up
D155A 15001 ~ 25000



175F015

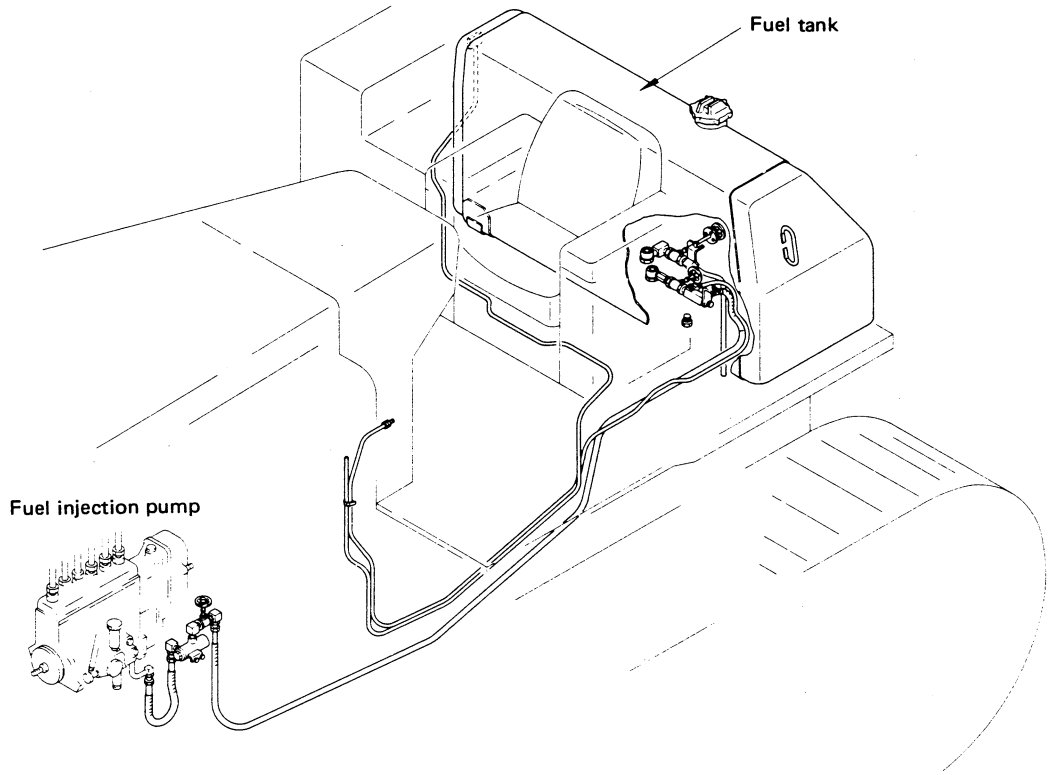
D155A 25001 and up



175F015-1

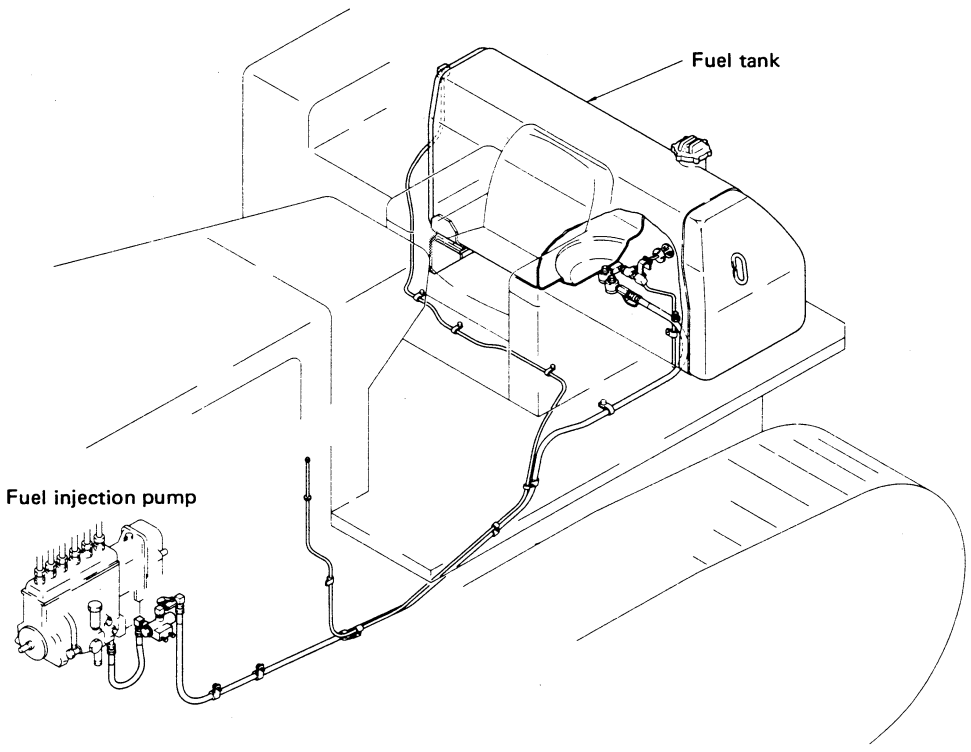
FUEL PIPING

D150A 8408 and up
D155A 15001 ~ 25000



I75F016

D155A 25001 and up



I75F016-1

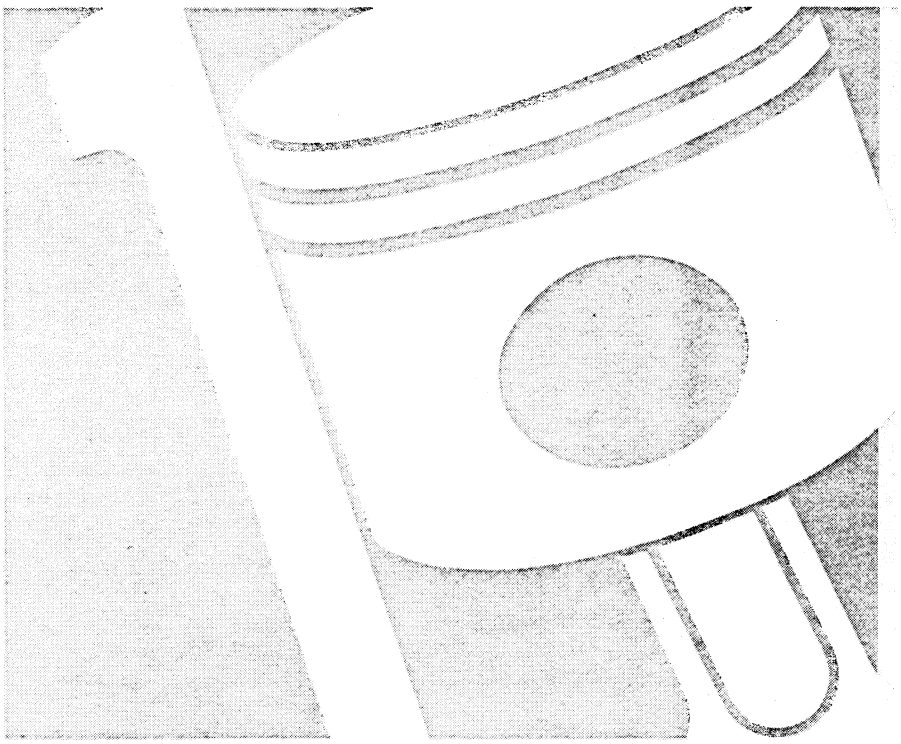
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

12 ENGINE

TESTING AND ADJUSTING



TESTING AND ADJUSTING

★ **Described herein are testing and adjusting machine with engine mounted. For testing and adjusting engine itself, refer to the Shop Manual of Komatsu engine 155-4 series.**

Testing and adjusting tool list 11- 2
Testing and adjusting, trouble shooting criteria 11- 2-1
General instructions
- Measuring engine speed 12- 4
- Cranking method 12- 5

Intake and exhaust system
- Checking air cleaner element for clogging 12- 6
- Inspection of turbocharger 12- 7
- Adjustment of valve clearance 12- 8
- Checking exhaust color 12- 9

Engine body
- Measuring blow-by 12-10
- Measuring compression pressure 12-11

Lubrication system
- Checking oil 12-12
- Measuring oil pressure and temperature 12-13

Fuel system
- Checking fuel 12-14
- Checking fuel control lever position 12-14
- Air-bleeding of fuel circuit 12-15
- Checking fuel delivery timing 12-15



Test and adjust after parking machine on level ground and confirming safety pins and blocks.
When you work in group, enforce signals and never let unauthorized persons approach the machine.
Be careful not to be caught by rotating parts or be burnt by heated parts.

TESTING AND ADJUSTING TOOL LIST

No.	Inspection and measuring item	Faultfinding tool	Part No.	Remarks
1	Engine speed	Tachometer	799-203-8000	Digital reading, pressure sensing type 60-19999 rpm
2	Battery S.G.	Battery coolant test	795-500-1000	1.100 ~ 1.300
3	Freezing temperature of cooling water			−5°C ~ −50°C
4	Water temperature, oil temperature, air intake temperature	Thermistor temperature gauge	790-500-1300	0 ~ 200°C
5	Exhaust temperature			0 ~ 1,000°C
6	Lubricating oil pressure	Engine pressure measuring kit	799-203-2002	0 ~ 10 kg/cm²
7	Fuel pressure			0 ~ 20 kg/cm²
8	Intake pressure, Exhaust pressure			0 ~ 1,500 mmHg
9	Blowby pressure			0 ~ 1,000 mmH_2O
10	Air intake resistance			−1,000~0mmH_2O (negative pressure)
11	Compression pressure	Compression gauge	795-502-1203	0 ~ 70 kg/cm²
12	Blowby pressure	Blowby checker	795-201-1502	0 ~ 500 mmH_2O
13	Valve clearance	Feeler gauge	795-125-1310	0.3, 0.5 mm
			795-125-1320	0.4, 0.6 mm
14	Exhaust color	Handy smoke checker	799-201-9000	Dirtiness 0 ~ 70% (Dirtiness % x 1/10 ≒ Bosch scale)
15	Water and fuel content in oil	Engine oil checker	799-201-6000	Provided with 0.1 and 0.2% water content standard samples
16	Fuel injection pressure	Nozzle tester	Commercially available	0 ~ 300 kg/cm²
17	Fuel injection nozzle spray condition			
18	Cooling water quality	Water quality tester	799-202-7001	pH, nitrite ion concentration
19	Pressure valve performance	Radiator cap tester	799-202-9000	0 ~ 2 kg/cm²
20	Leakage in cooling water system			
21	Radiator blockage (air speed)	Anemometer	799-202-2001	0 ~ 40 m/s
22	Engine cranking	Cranking kit	799-610-1000	DC24V
		Barring tool	795-100-1210	
23	Electrical circuits	Tester	Commercially available	Current, voltage, resistance

TESTING AND ADJUSTING, TROUBLE SHOOTING CRITERIA

Engine model				S6D155-4			
Machine Serial No.				D150A-1 (Engine Serial No.10011~14280)		D150A-1 (Engine Serial No.14281 and up)	
Classification	Item	Condition, etc.	Unit	Standard	Tolerance	Standard	Tolerance
Performance	Engine speed	Max. idling speed	rpm	2,230 ± 50	2,230 ± 50	2,230 ± 50	2,230 ± 50
		Min. idling speed	rpm	625 ± 25	625 ± 25	625 ± 25	625 ± 25
Intake and exhaust system	Exhaust color	Quick acceleration	Bosch scale	7.0 max.	7.0 max.	7.0 max.	7.0 max.
		High idling	Bosch scale	3.5 max.	3.5 max.	3.5 max.	3.5 max.
	Valve clearance	Intake valve	mm	0.3 (No.~11745) 0.4 (No.11746~)	–	0.4	–
	Warm (cold)	Exhaust valve	mm	0.3 (No.~11745) 0.6 (No.11746~)	–	0.6	–
Engine body	Compression pressure	Oil temperature 40° ~ 60° C	kg/cm²	27 min. (No. ~14256) 24 min. (No. 14257~)	27 min. (No. ~14256) 24 min. (No. 14257~)	24 min.	24 min.
		(Engine speed)	(rpm)	(180 ~ 210)	(180 ~ 210)	(180 ~ 210)	(180 ~ 210)
	Blow-by pressure	High idling at 60° C or above of oil temperature	mm H_2O	200 max.	400	200 max.	400
Lubrication system	Oil pressure	High idling	kg/cm²	3.5 ~ 4.5	3.5 ~ 4.5	3.5 ~ 4.5	3.5 ~ 4.5
	(SAE30, 80° C or above)	Low idling	kg/cm²	1.5 min.	1.5 min.	1.5 min.	1.5 min.
	Oil temperature	All speeds (Oil in oil pan)	°C	80 ~ 100	120	80 ~ 100	120
Fuel system	Fuel injection timing	B.T.D.C.	0	37 (No. 10011~14256) 33 (No. 14257~19999)	–	33 (No. 14257~19999) 40 (No. 20001~20597) 38 (No. 20598~)	–

Engine model				S6D155-4			
Machine Serial No.				D155A-1 (Engine Serial No.10011~12297)		D155A-1 (Engine Serial No.12298~14256)	
Classification	Item	Condition, etc.	Unit	Standard	Tolerance	Standard	Tolerance
Performance	Engine speed	Max. idling speed	rpm	2,230 ± 50	2,230 ± 50	2,230 ± 50	2,230 ± 50
		Min. idling speed	rpm	625 ± 25	625 ± 25	625 ± 25	625 ± 25
Intake and exhaust system	Exhaust color	Quick acceleration	Bosch scale	7.0 max.	7.0 max.	7.0 max.	7.0 max.
		High idling	Bosch scale	3.5 max.	3.5 max.	3.5 max.	3.5 max.
	Valve clearance	Intake valve	mm	0.3 (No.~11745) 0.4 (No.11746~)	–	0.4	–
	Warm (cold)	Exhaust valve	mm	0.3 (No.~11745) 0.6 (No.11746~)	–	0.6	–
Engine body	Compression pressure	Oil temperature 40° ~ 60° C	kg/cm²	27 min.	27 min.	27 min.	27 min.
		(Engine speed)	(rpm)	(180 ~ 210)	(180 ~ 210)	(180 ~ 210)	(180 ~ 210)
	Blow-by pressure	High idling at 60° C or above of oil temperature	mmH_2O	200 max.	400	200 max.	400
Lubrication system	Oil pressure (SAE30, 80° C or above)	High idling	kg/cm²	3.5 ~ 4.5	3.5 ~ 4.5	3.5 ~ 4.5	3.5 ~ 4.5
		Low idling	kg/cm²	1.5 min.	1.5 min.	1.5 min.	1.5 min.
	Oil temperature	All speeds (Oil in oil pan)	°C	80 ~ 100	120	80 ~ 100	120
Fuel system	Fuel injection timing	B.T.D.C.	0	37	–	33 (No. 12298 ~ 19999)	–

Engine model				S6D155-4	
Machine Serial No.				D155A-1 (Engine Serial No. 14257~)	
Classification	Item	Condition, etc.	Unit	Standard	Tolerance
Performance	Engine speed	Max. idling speed	rpm	2,050 ± 50	2,050 ± 50
		Min. idling speed	rpm	625 ± 25	625 ± 25
Intake and exhaust system	Exhaust color	Quick acceleration	Bosch scale	9.0 max.	9.0 max.
		High idling	Bosch scale	4.0 max.	4.0 max.
	Valve clearance	Intake valve	mm	0.4	–
	Warm (cold)	Exhaust valve	mm	0.6	–
Engine body	Compression pressure	Oil temperature 40°C ~ 60°C	kg/cm²	24 min.	24 min.
		(Engine speed)	(rpm)	(180 ~ 210)	(180 ~ 210)
	Blow-by pressure	High idling at 60°C or above of oil temperature	mmH₂O	200 max.	400
Lubrication system	Oil pressure (SAE30, 80°C or above)	High idling	kg/cm²	3.5 ~ 4.5	3.5 ~ 4.5
		Low idling	kg/cm²	1.5 min.	1.5 min.
	Oil temperature	All speeds (Oil in oil pan)	°C	80 ~ 100	120
Fuel system	Fuel injection timing	B.T.D.C.	0	33 (No. 12298~19999) 40 (No. 20000~20764) 38 (No. 20765~)	–

海事承認(along TEL あり)

ENG回転数の設定

大工向合せ結果：2150±50rpm
Max. Hi idling

63.12.22

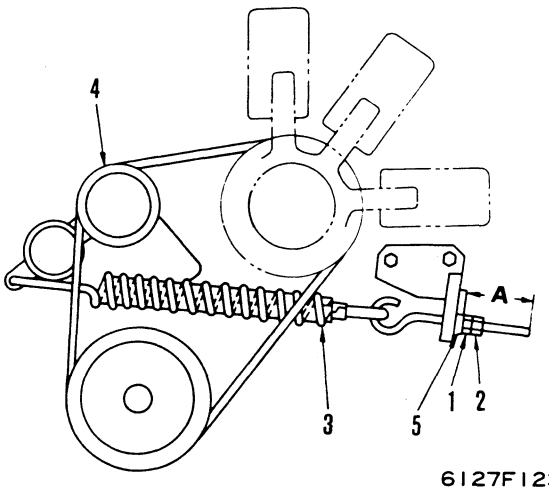
⇩

サ技に訂正依頼発行
依頼すること。

ENG号機

ENG SHOPとちがうNO.手配うんぬん

FAN BELT TENSION



6127F123A

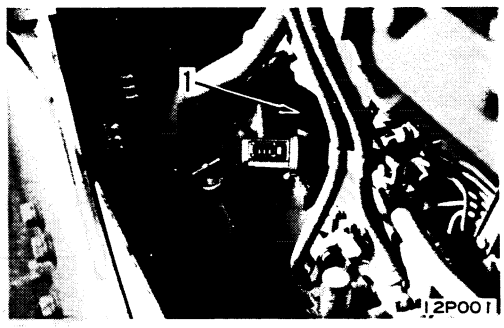
1. Adjustment nut
2. Lock nut
3. Tension spring
4. Tension pulley
5. Washer
6. Protrusion of adjustment screw

Engine model	Application	Engine serial No.	Protrusion A (mm)
S6D155-4	D150A-1	10014 ~ 10277	91 ± 5
		10278 ~ 24804	96 ± 5
		24805 ~ 24973	121 ± 5
		24974 ~	85 ± 5
	D155A-1	10016 ~ 10337	91 ± 5
		10338 ~ 24804	96 ± 5
		24805 ~ 25817	121 ± 5
		25818 ~ 28423	110^{0}_{-5}
		28424 ~	85 ± 5

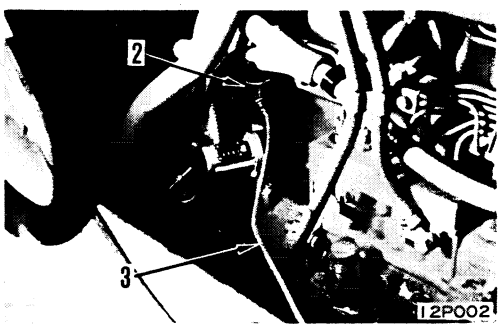
GENERAL INSTRUCTIONS

MEASURING ENGINE SPEED

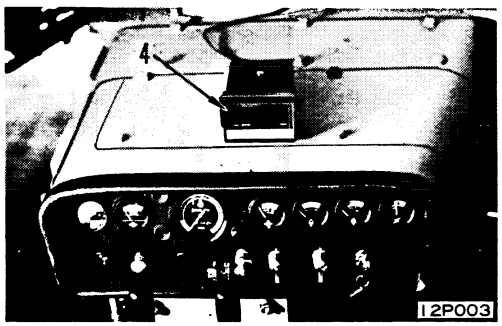
1. **Disconnect service meter cable**
- Disconnect service meter cable (1).



2. **Connect tachometer**
- Connect tachometer adapter (2) and connect cable (3) to body (4).

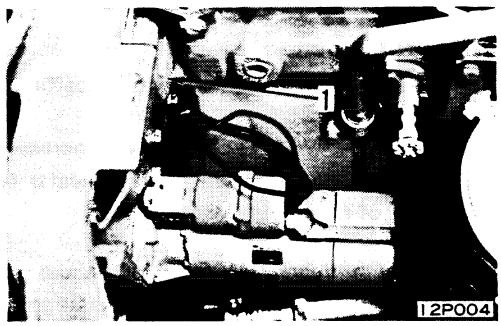


3. **Measuring engine speed**
- Switch on the tachometer and measure engine speed.
  - ★ Read carefully operation manual attached to tachometer.

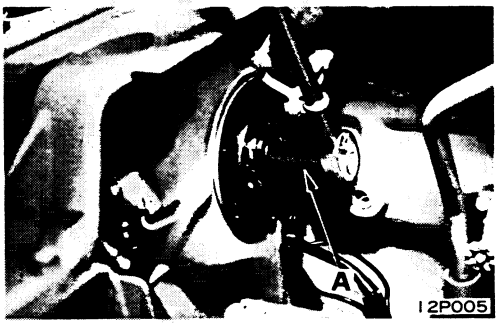


CRANKING METHOD

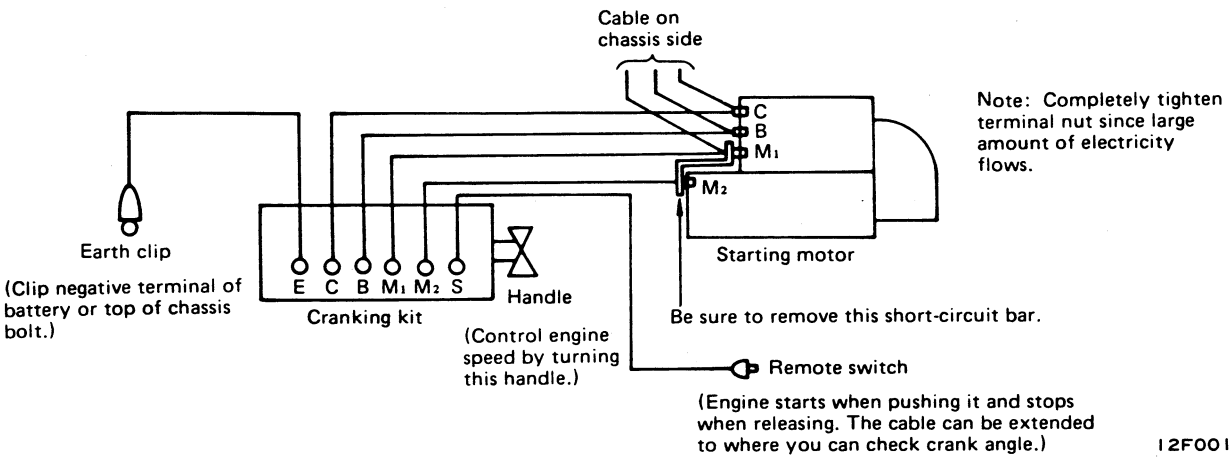
1. **When using baring tool**
   1) Remove PTO cover (1).



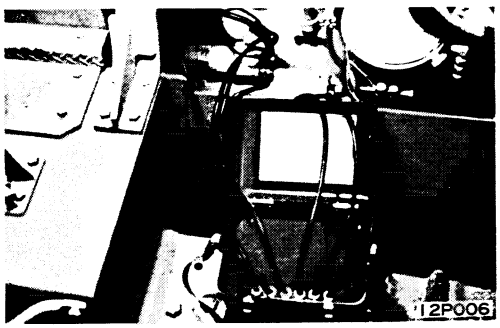
   2) Install baring tool **A** with PTO and baring tool splines meshing.
   Rotate baring tool with handle to crank the engine.
   Baring tool No. 795-100-1210



2. **When using cranking kit**
   1) Connect cranking kit as follows.



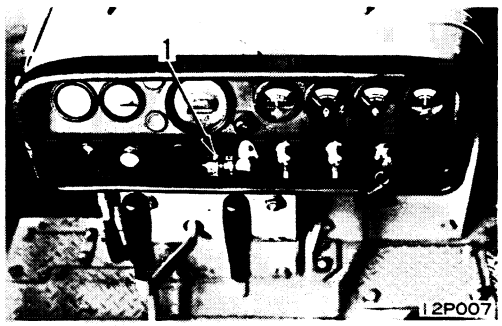
   2) Before turning the engine, set fuel control lever to ENGINE STOP and compression release lever to RELEASE (D150A: 8408 and up, D155A: 15001 – 25000)
   3) Turn the handle fully clockwise and push remote switch. Turn the handle counterclockwise with observing engine speed decreasing.
   Stop the handle at arbitrary engine speed.
   ★ Engine may not start easily while inching, because of poor charging of battery. In that case, control the handle again.
   Cranking kit No. 795-610-1000



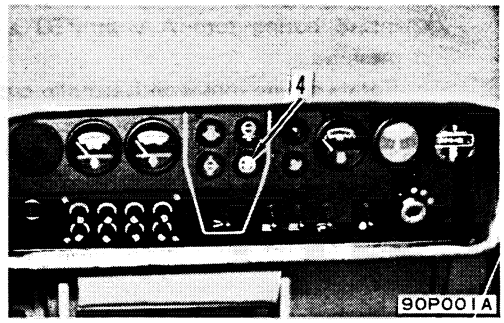
INTAKE AND EXHAUST SYSTEM

CHECKING AIR CLEANER ELEMENT FOR CLOGGING

1. **Checking dust indicator**
   Check to see whether dust indicator (1) reaches service level (red) or not.
   ★ Dust indicator rises with increase of intake resistance due to clogging of element. It indicates red at 635 mm water column of negative pressure.



   (Serial numbers: D155A 25001 and up)
   Checking the warning lamp of air filter
   Check whether the warning lamp (4) is ON while the engine is operation or starting switch is ON.



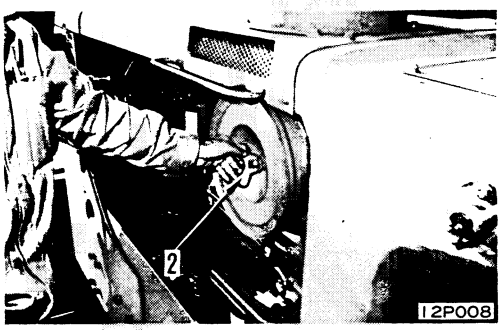
2. **Checking the element**
   Whenever the dust indicator shows red or the exhaust fumes turn black, the element should be checked as follows:

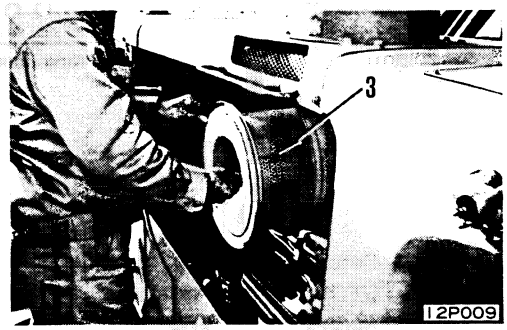
   (Serial numbers: D155A 25001 and up)
   If the air filter warning lamp is ON, or the exhaust fumes turn black, the element should be checked as follows:

   1) Loosen the wing nut (2).
   2) Pull out the outer element (3) and take out the inner element. Check them for clogging. If the elements are dirty or clogged, clean them.

   ★ After cleaning the element, press the indicator reset button to return the red piston to its original position.
   (For serial numbers: D155A up to 25000
   D150A 5508 and up

Serial number D155A 25001 and up

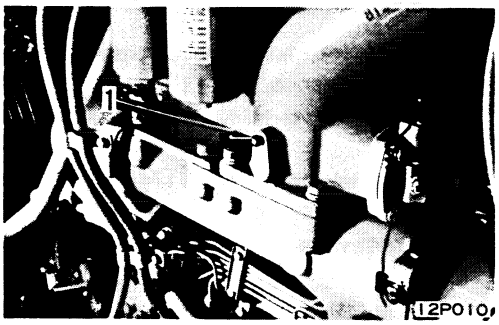


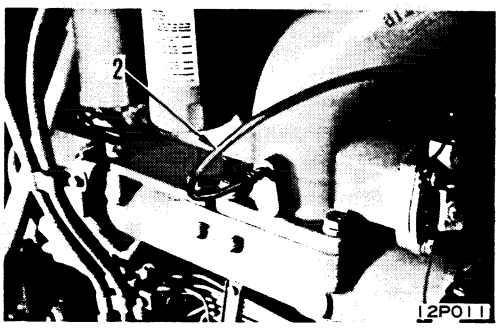


INSPECTION OF TURBOCHARGER

1. **Checking booster pressure**
   1) Remove intake connector plug (PT 1/8) (1). Connect pressure gauge (0 ~ 2000mm Hg) or manometer to intake connector through tube (2).
   2) Run engine at full speed and read pressure indication.

   ★ Standard booster pressure: 700mm Hg

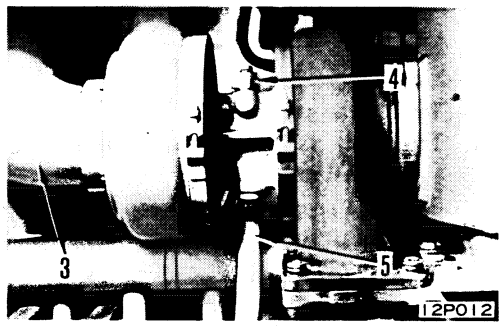




2. **Testing turbocharger**

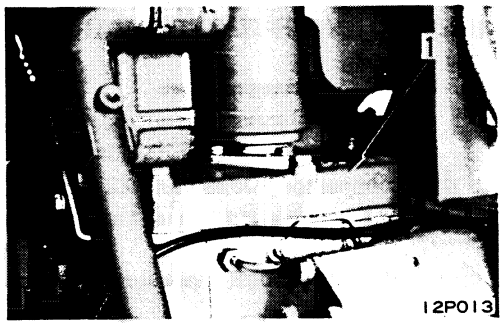
- Remove intake connector (3). Manually turn impeller to check for smooth rotation of it.

★ When dragging is felt even though rotor play in radial and axial directions is normal, remove lubrication pipe (4) and drain pipe (5). While manually turning rotor, pour diesel oil into lubrication oil inlet port (from which lubrication pipe is removed) to wash turbocharger interior.



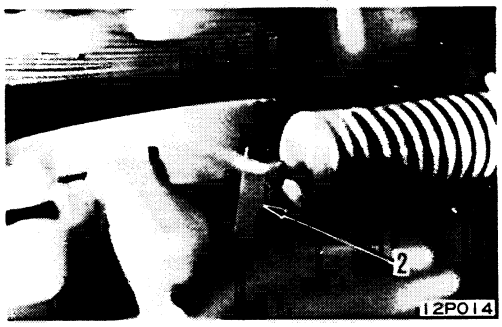
ADJUSTMENT OF VALVE CLEARANCE

★ Adjust clearance between crosshead and rocker arm.
★ Valve clearance
Engine serial No. up to 11745: Intake 0.3 mm
Exhaust 0.5 mm
Engine serial No. 11746 and up: Intake 0.4 mm
Exhaust 0.6 mm
★ Adjust valve clearances while engine is hot.

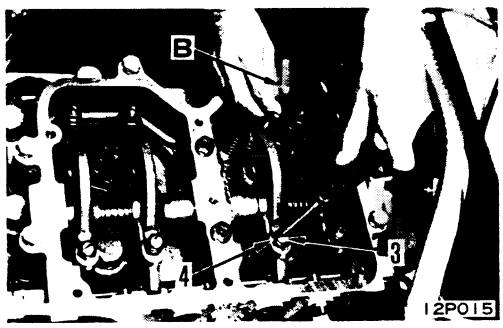


1. Dismounting cylinder head cover
Remove head cover (1) from cylinder which includes valves to be adjusted.

2. Setting crank position
● Rotate crankshaft in normal direction to align pointer (2) with TOP marking for the cylinder.
Confirm that the cylinder is at the top dead center position, where intake valve and exhaust valve close.
When the cylinder is not at that position, rotate crankshaft once more.
★ Valves for each cylinder are exhaust, intake, intake and exhaust valve from the front of engine.

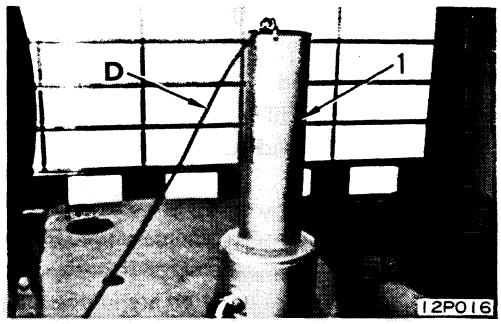


3. Testing and adjusting
● To adjust valve clearance, loosen locknut (4) and back off adjustment screw (3).
Insert feeler gauge **B** between valve and rocker arm; turn screw down until rocker arm just touches gauge. (Confirm that gauge can be moved without much resistance.)
● Tighten locknut at that position of adjustment screw.
kgm Locknut: 9.5 ~ 12.5kg.m
★ Engine firing order is 1–5–3–6–2–4. Test and adjust intake and exhaust valves for each cylinder, according to firing order, after turning crankshaft at 120° in normal direction of rotation.

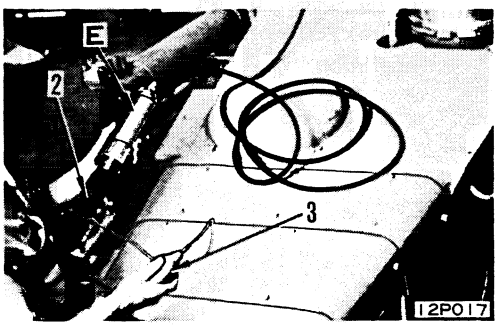


CHECKING EXHAUST COLOR

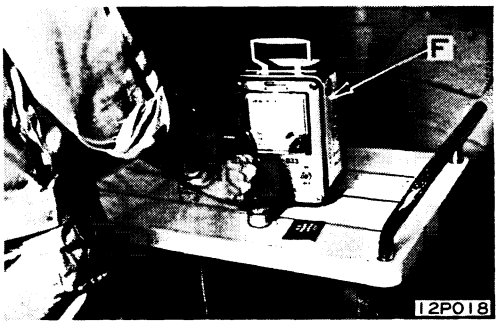
Measuring by bosch smoke meter



1. **Setting suction pump**
- Fit probe **D** to exhaust pipe (1) and insert filter paper in intake pump **E**.



2. **Sampling on filter paper**
- Fully retract piston (2) and operate release valve (3) to sample smoke color on filter paper.

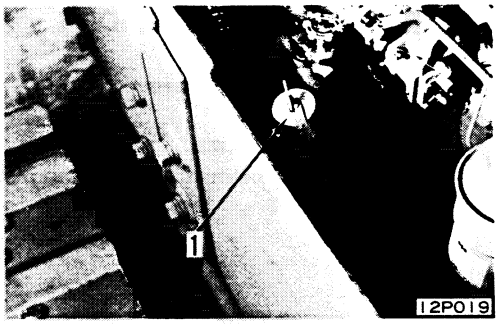


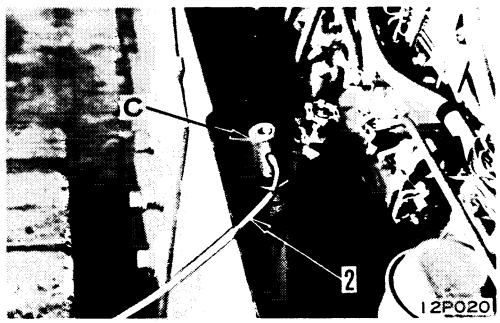
3. **Measuring**
- Take out sample filter paper and put it on tester **F** to read tester indication.

★ Read carefully operation manual attached to smoke meter.

ENGINE BODY

MEASURING BLOW-BY





Measuring method

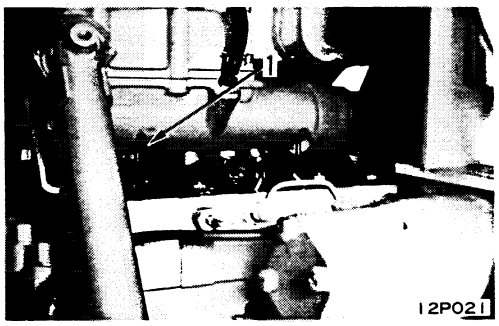
- Remove oil filler cap (1). Connect blow-by checker adapter **C** to oil filler and tube (2) to pressure gauge (0 ~ 1000mmHg) or manometer.
- ★ Check blow-by while engine is in rated horsepower operation.
- ★ In the field, operate engine under full-stalling condition to gain approximate measurement. If both rated horsepower operation and full-stalling operation are impossible, operate engine at high-idling speed. Blow-by measurement high-idling speed will be approx. 80% of blow-by to be obtained under rated horsepower operation.

MEASURING COMPRESSION PRESSURE

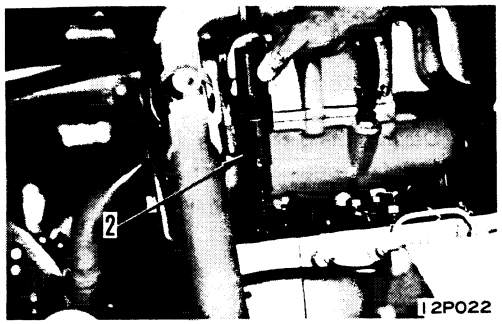
★ For performance test and trouble-shooting, measure compression pressure if worn pistons, piston rings and cylinder liners are suspected.

1. **Adjusting valve clearance**
- Set valve clearance to 0.4mm for intake valves and to 0.6mm for exhaust valves. Refer to topic ADJUSTMENT OF VALVE CLEARANCE for adjustment procedure.

2. **Removing fuel tube**
- Remove fuel tube (1) from cylinder to be checked.

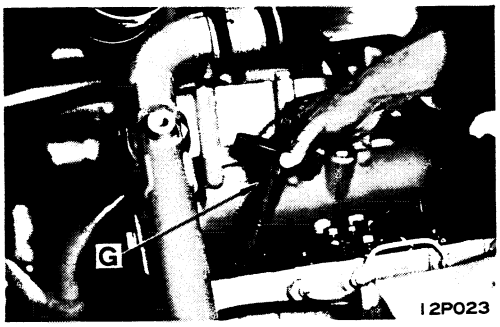


3. **Removing fuel injection nozzle**
- Remove fuel injection nozzle (2).

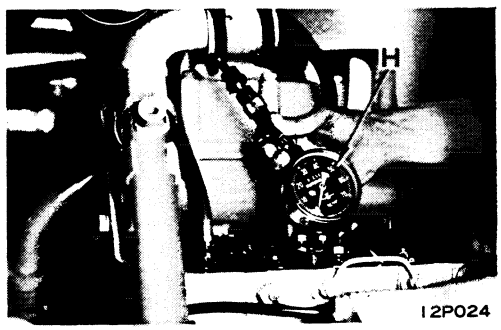


4. **Installing adaptor**
- Install adaptor **G**.
  Adaptor tool No. for S6D155-4: 795-502-1240
5. **Connecting pressure gauge**
- Connect pressure gauge **H** to adaptor.

6. **Measuring**
- Place fuel control lever at NON-INJECTION position, crank the engine with starting motor, and measure compression pressure.

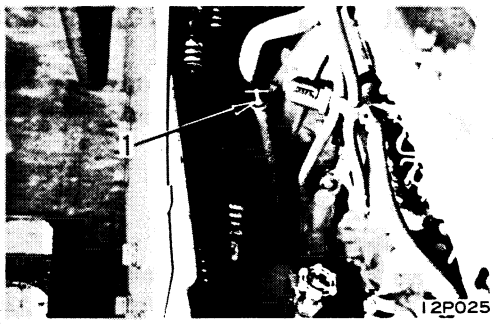


★ Compression pressure test must satisfy the following:
  Engine speed: 180 ~ 210 rpm
  Oil temperature: 40 ~ 60°C
  Compression pressure: 24kg/cm^2 minimum



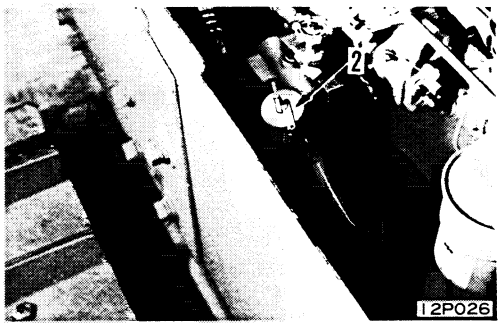
LUBRICATION SYSTEM

CHECKING OIL



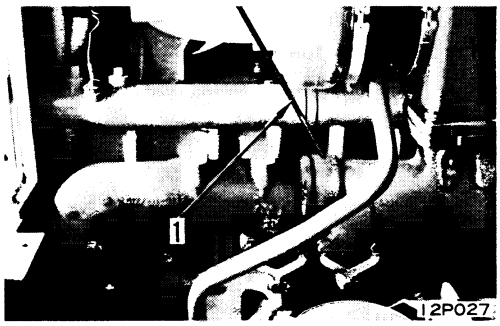
1. Checking oil level

- Check oil level gauge (1) to see whether the gauge indicates, any oil level between H and L markings on ENGINE STOP side of gauge rod.
- ★ Check oil level before starting the engine, using ENGINE STOP side of gauge rod.
- ★ Oil level may be checking during low-idling operation of engine, using ENGINE IDLING side of gauge rod. In this case, remove oil filler cap (2) to discharge internal pressure of the engine.



2. Checking water mixed in oil

- ★ Excessive mixing of water can be judge by such abnormal conditions as rising of oil level, clouding of oil or lowering of water level.
- During idling the engine, let oil drops attached to oil level gauge (1) fall onto exhaust maniflod; check to see whether hot manifold repels water or not.

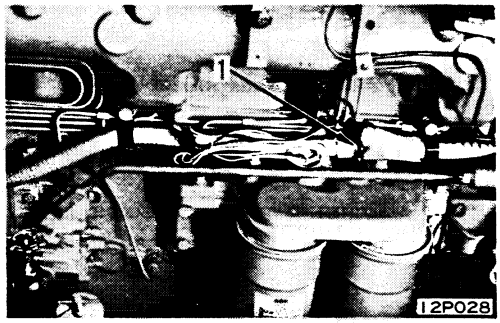


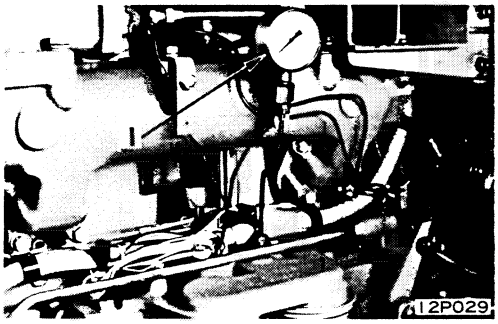
MEASURING OIL PRESSURE AND TEMPERATURE

1. Measuring oil pressure

- Disconnect oil pressure taking-out tube (1) from oil filter assembly and connect oil pressure gauge **I** to that port.
- ★ Connect oil pressure gauge to oil filter with necessary care to minimize influence of engine vibration.

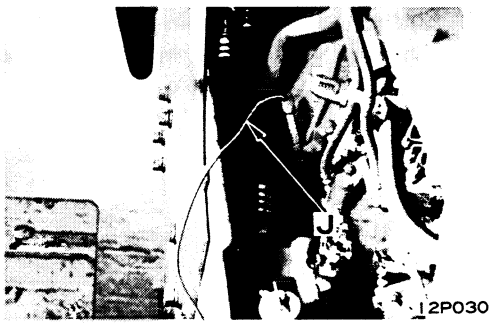
⚠ Stop engine when installing or removing oil pressure gauge.

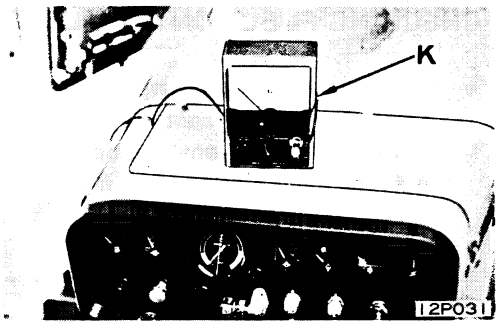




2. Measuring oil temperature

- Remove oil level gauge and insert sensor **J** of thermistor into gauge guide. Connect sensor to thermistor body **K** and measure oil temperature.



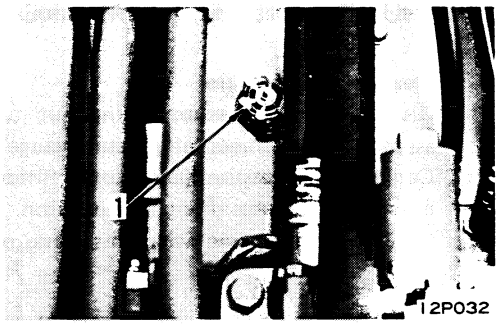


FUEL SYSTEM

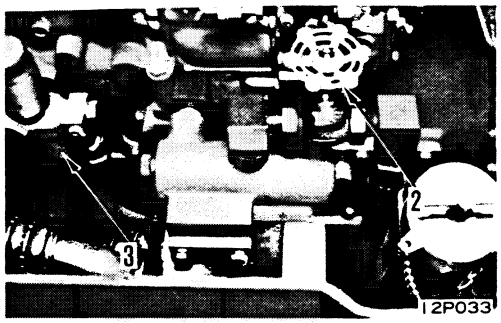
CHECKING FUEL

Checking dust and water mixed in fuel

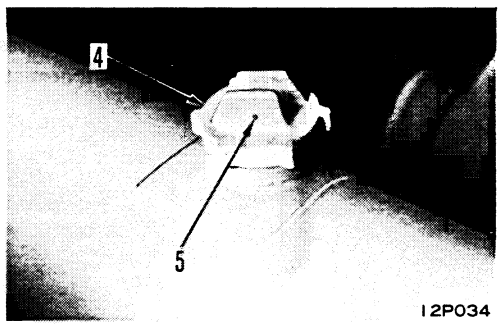
1) Fuel tank
Drain fuel from drain cock (1) under fuel tank and check drained fuel for mixing with dust or water.
★ Sediment and water accumulated in the bottom of fuel tank must be drained periodically (every 50 hours).



2) Feed pump strainer
Close fuel cock (2) and remove feed pump strainer (3). Check strainer for clogging.

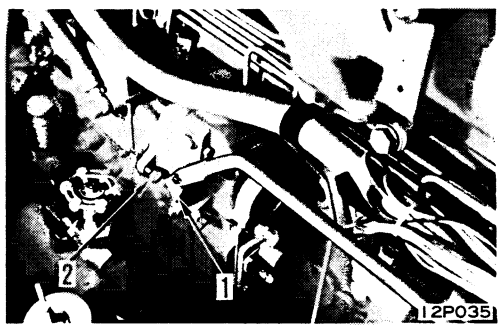


3) Checking air vent hole in fuel tank cap
Check air vent hole (5) in cap (4) for clogging.
★ Clogged hole will cause negative pressure inside fuel tank and feeding of fuel will be intermitted.



CHECKING FUEL CONTROL LEVER POSITION

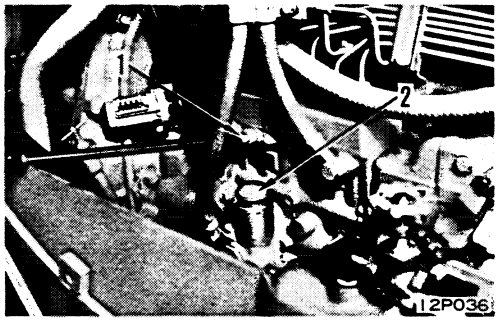
- Fully pull out control lever and check to see whether fuel injection pump lever (1) contacts stopper bolt (2) or not.
- If lever does not contact stopper bolt, check lever linkage for deformation or interference with other parts.



AIR-BLEEDING OF FUEL CIRCUIT

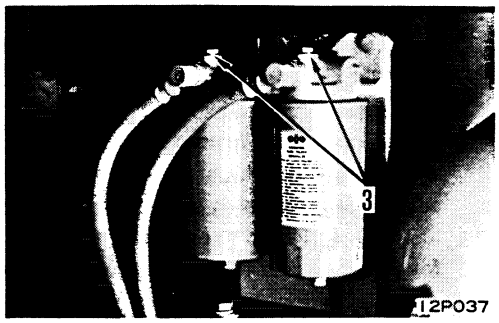
1. **Air-bleeding of fuel injection pump**

- Loosen air vent plug (1) on fuel injection pump with screwdriver. Operate priming pump (2) until no air bubbles come out of air vent plug hole.
- After bleeding air, retighten plug.



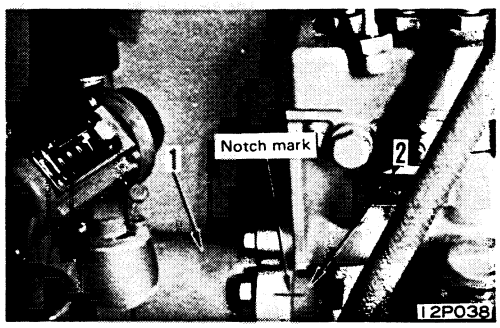
2. **Air-bleeding of fuel filter**

- Loosen air vent plug (3) on fuel filter.
  Operate priming pump (2) until no air bubbles come out of air vent plug hole.
- Tighten plug securely.



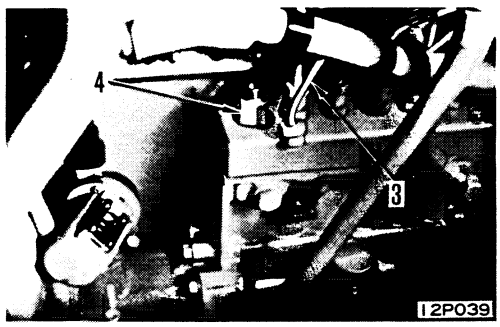
CHECKING FUEL DELIVERY TIMING

★ Check to see whether notch in pump flange (2) is in alignment with that in drive case (1) or not.

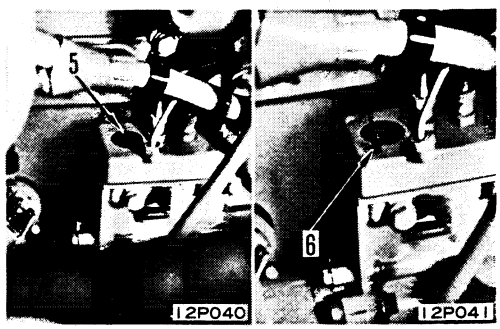


★ If notches are out of alignment or when pump assembly is replaced, perform delivery check using the following procedure:

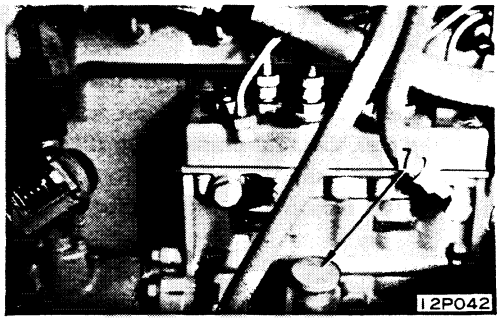
1) Disconnect No. 1 injection pipe (3) from injection pump and remove delivery holder (4).



2) Pull out delivery spring (5) and delivery valve (6).
3) Reinstall delivery holder removed in step 1).



4) While operating fuel priming pump (7), crank engine slowly in normal direction of rotation.
   ★ Refer to "Cranking method", GENERAL INSTRUCTIONS for engine cranking procedure.



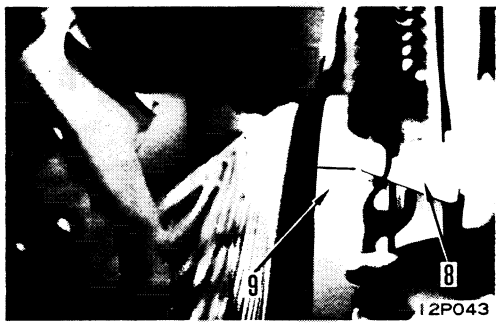
5) Confirm that spilling of fuel from delivery holder stops when pointer (8) comes into alignment with marking (38° IJ) on damper (9).

★ Fuel injection timing: 38° BTDC

★ If spilling of fuel from delivery holder stops even when pointer and damper marking are out of alignment with each other, adjust delivery timing by moving fuel injection pump.

★ Move injection pump toward block to put delivery timing foward and apart from block to put delivery timing back.

★ After adjusting delivery timing, remove delivery holder, install delivery valve and spring, and fasten delivery holder.
   kgm Delivery holder: 11~12kg.m



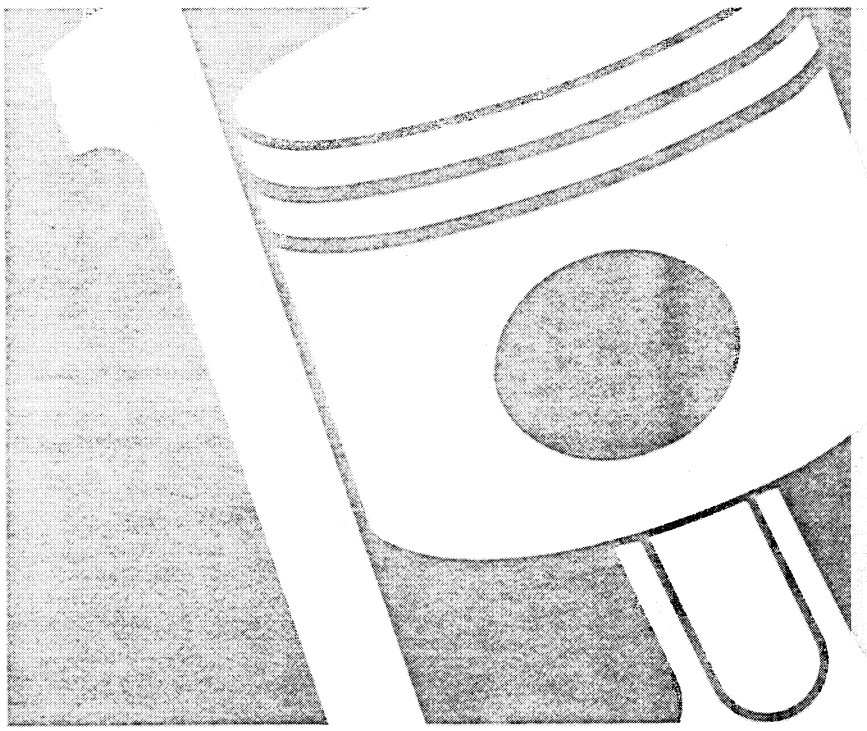
SHOP MANUAL

D150,155

SERIAL NO. D150A-1 8408~
D155A-1 15001~

13 ENGINE

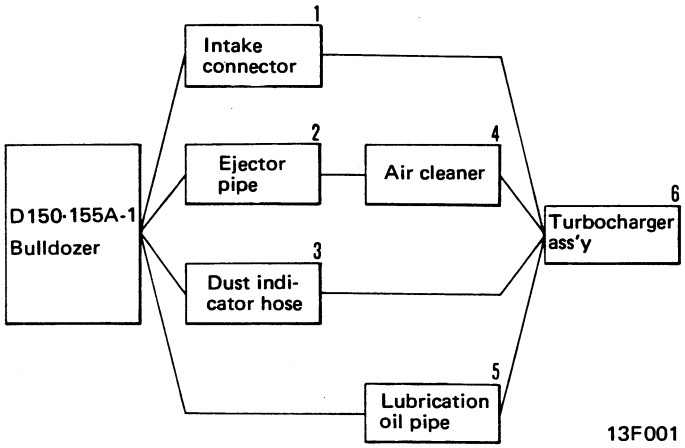
DISASSEMBLY AND ASSEMBLY



DISASSEMBLY AND ASSEMBLY

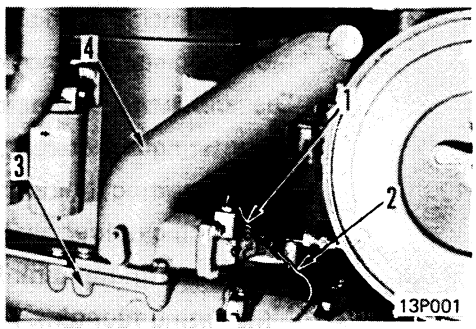
Dismounting turbocharger 13- 2
Mounting turbocharger 13- 4
Dismounting engine oil cooler 13- 6
Mounting engine oil cooler 13-10
Dismounting torque converter oil cooler 13-13-1
Mounting torque converter oil cooler 13-13-4
Dismounting nozzle holder 13-14
Mounting nozzle holder 13-16
Dismounting fuel injection pump 13-18
Mounting fuel injection pump 13-20
Dismounting and mounting fan belt 13-24
Dismounting water pump 13-26
Mounting water pump 13-28
Dismounting starting motor 13-30
Mounting starting motor 13-32
Dismounting alternator 13-34
Mounting alternator 13-36
Dismounting cylinder head 13-38
Mounting cylinder head 13-46
Dismounting fuel tank 13-53-1
Mounting fuel tank 13-53-3
Dismounting radiadtor guard 13-53-11
Mounting radiator guard 13-53-15
Dismounting radiator 13-53-19
Mounting radiator 13-53-23
Dismounting engine 13-54
Mounting engine 13-62
Dismounting chassis related parts on engine 13-72
Mounting chassis related parts from engine 13-74

DISMOUNTING TURBOCHARGER

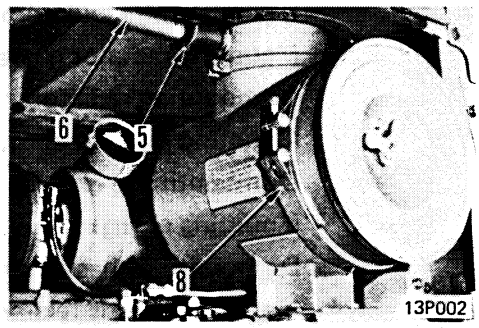


⚠ Start working after engine cools off.

1. **Intake connector**
   1) Remove intake air heater wire (1) and fuel tube (2)
   2) Remove bolts securing intake connector (4) to intake manifold (3); remove intake connector.

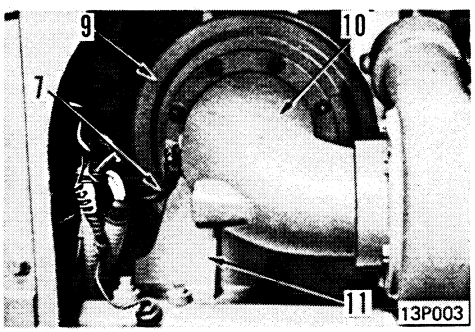


2. **Ejector pipe**
   Loosen hose clamp (5) and disconnect ejector pipe (6) from air cleaner.

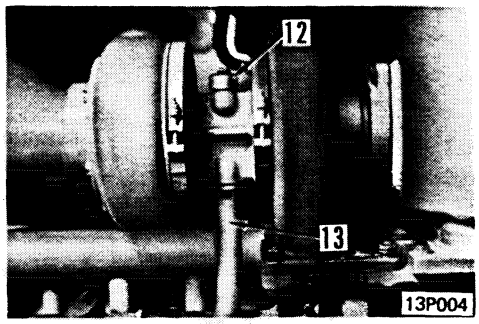


3. **Dust indicator hose**
   Remove dust indicator hose (7).

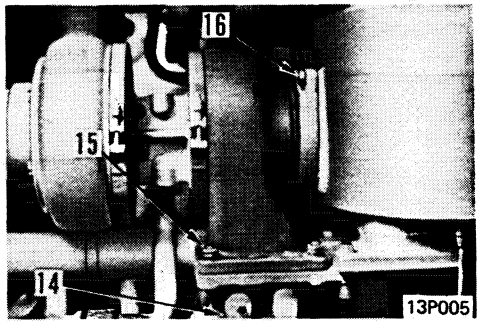
4. **Air cleaner**
   1) Remove air cleaner clamp band (8).
   2) Remove nut connecting air cleaner (9) to intake connector (10).
   3) Remove bracket (11) for intake connector.

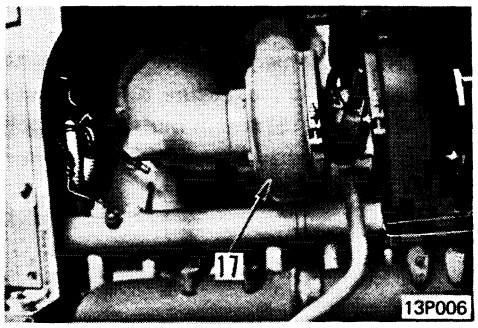


5. **Lubrication oil pipe**
   1) Disconnect lubrication oil inlet flange (12) from turbocharger.
      ★ Pay attention not to lose spacer for oil inlet flange.
   2) Disconnect lubrication oil outlet flange (13) from turbocharger.

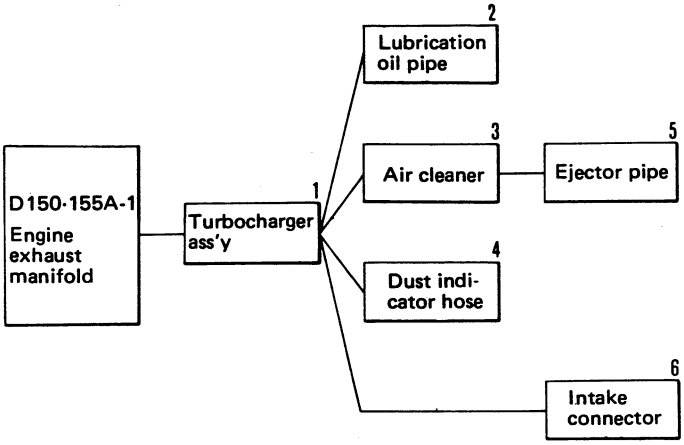


6. **Turbocharger assembly**
   Remove nuts (15) securing turbocharger to exhaust manifold (14) and bolts (16) securing turbocharger to muffler. Dismount turbocharger assembly (17) slinging it with crane.
   kg Turbocharger: **35 kg**



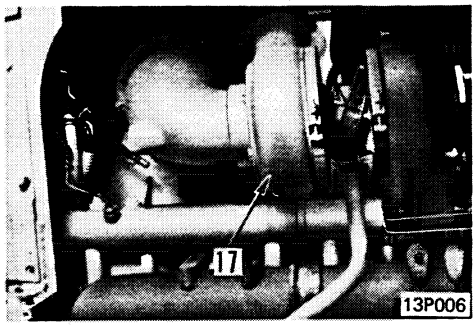


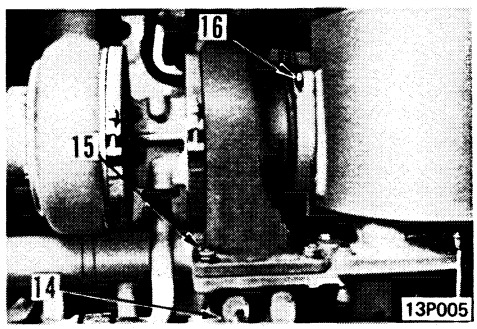
MOUNTING TURBOCHARGER



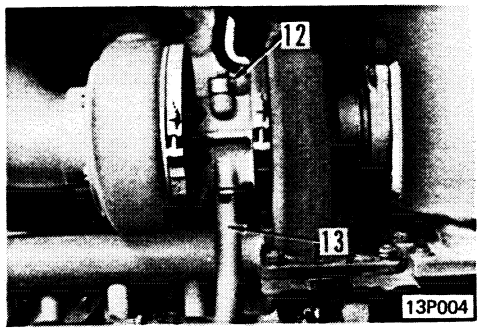
13F002

1. **Turbocharger assembly**
   Lift turbocharger assembly (17), with gasket setted, into position with crane. Secure turbocharger to exhaust manifold (14) with nuts (15) and to muffler with bolts (16).
   Exhaust manifold joint nut: **6 ± 1 kg.m**

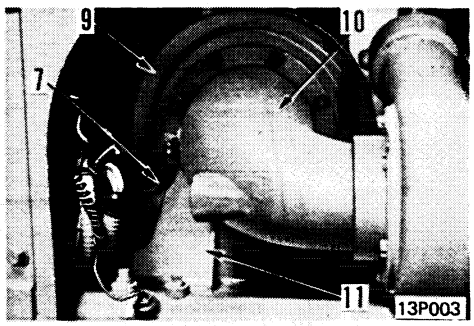




2. **Lubrication oil pipe**
   Connect lubrication oil inlet flange (12) and outlet flange (13), with gasket on each flange, to turbocharger.
   ★ When connecting inlet flange, put spacer between flange and turbocharger.

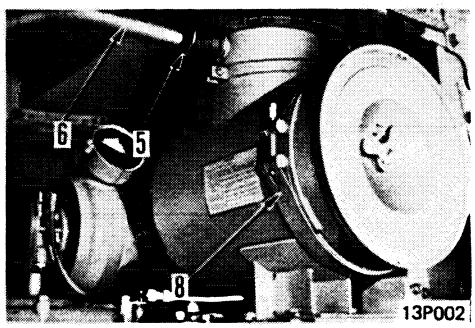


3. **Air cleaner**
   1) Install intake connector bracket (11) and tighten nut connecting air cleaner (9) to intake connector (10).
   2) Install air cleaner clamp band (8).

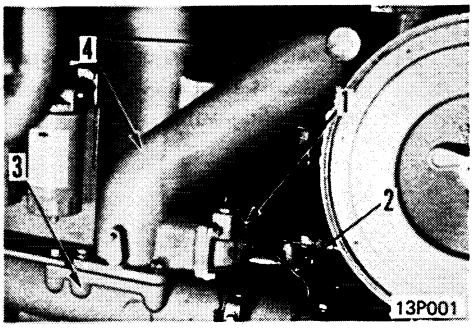


4. **Dust indicator hose**
   Install dust indicator hose (7).

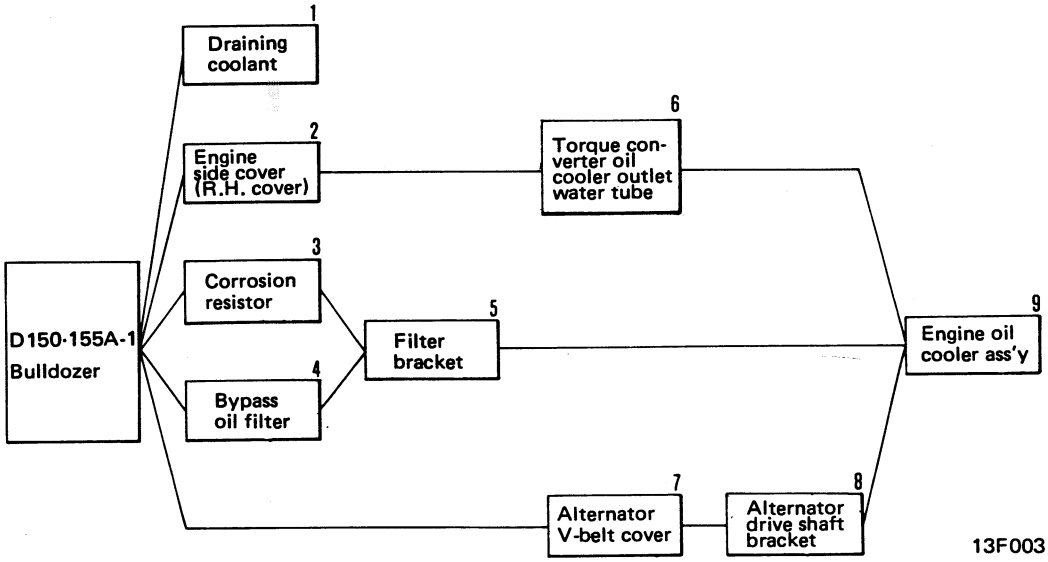
5. **Ejector pipe**
   Connect ejector pipe (6) to air cleaner and tighten hose clamp (5).



6. **Intake connector**
   1) Insert intake connector (4) into turbocharger and connect intake connector to intake manifold (3) with bolts.
      ★ Apply grease (G2-LI) to O-ring installed on insertion portion of intake connector. Be careful not to jam O-ring between intake connector and turbocharger.
   2) Connect intake air heater wire (1) and fuel tube (2).

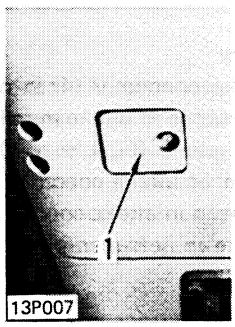


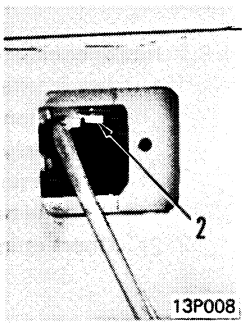
DISMOUNTING ENGINE OIL COOLER



1. Draining coolant

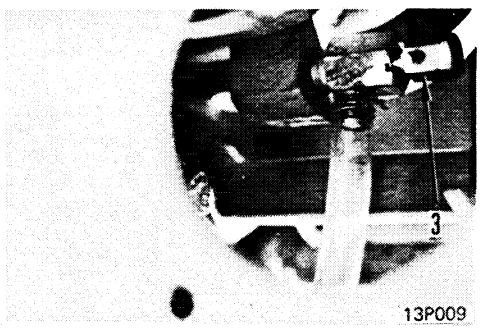
1) Remove inspection cover (1) from radiator under guard to gain access to coolant drain hose. Open drain cock (2) to drain cooling water.





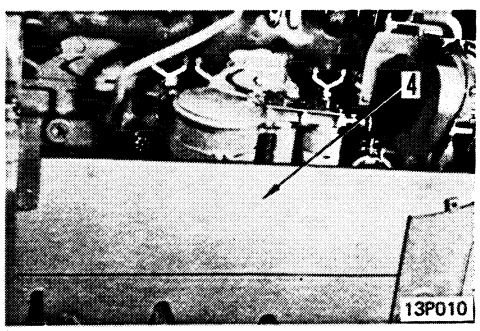
2) Take out torque converter cooler water drain hose through inspection window located on the right side of engine lower guard. Open drain cock (3) to drain water.

★ Cooling water draining quantity: approx. **150 liters**

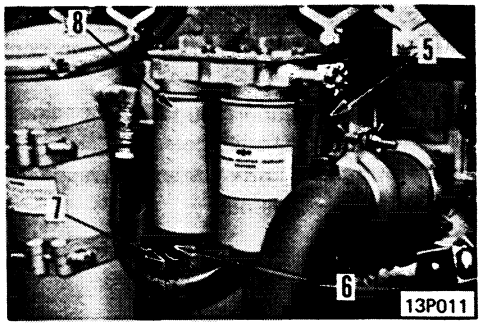


2. Engine side cover (R.H. cover)

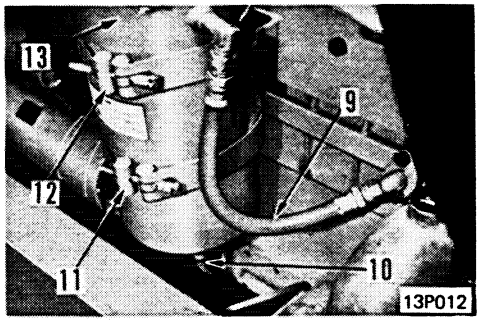
Remove cover (4).



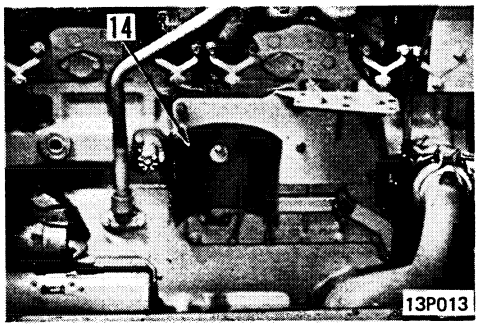
3. **Corrosion resistor**
   1) Remove corrosion resistor inlet hose (5).
   2) Disconnect corrosion resistor outlet hose (6) from corrosion resistor and remove pipe clamp (7).
   3) Remove bolts fastening corrosion resistor (8) to its bracket; remove corrosion resistor.
      ★ Before changing cooling water, replace the corrosion resistor element without fail.



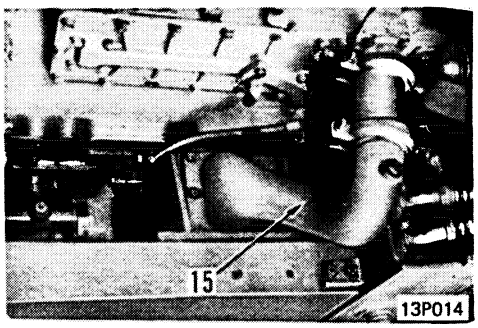
4. **Bypass oil filter**
   1) Disconnect bypass oil filter inlet hose (9) from engine oil cooler and outlet hose (10) from joint on the filter side.
      ★ If outlet hose cannot easily be disconnected from its joint, try it after removing filter clamp bands (11) and (12).
   2) Remove bypass oil filter clamp bands (11) and (12). Then, remove bypass oil filter (13).



5. **Filter bracket**
   Remove filter bracket (14).

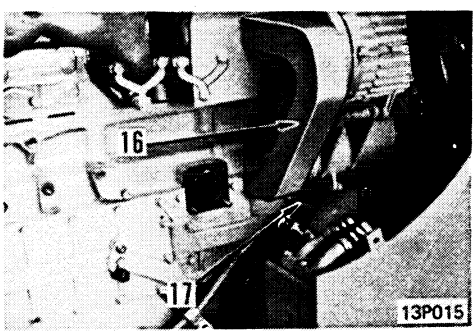


6. **Torque converter oil cooler outlet water tube**
   Remove bolts on the torque converter oil cooler side and engine oil cooler side; remove torque converter oil cooler outlet tube (15).

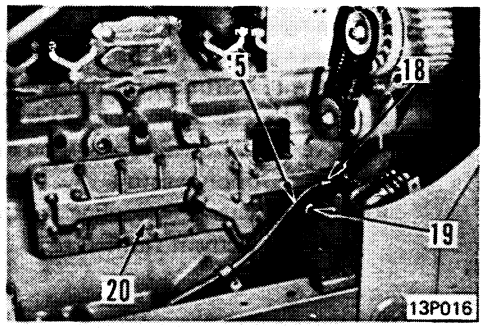


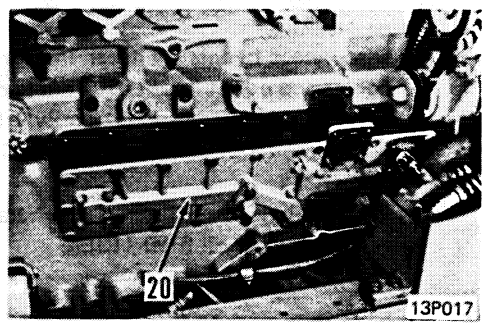
7. **Alternator V-belt cover**
   Remove cover (16).

8. **Alternator drive shaft bracket**
   Remove bracket (17).

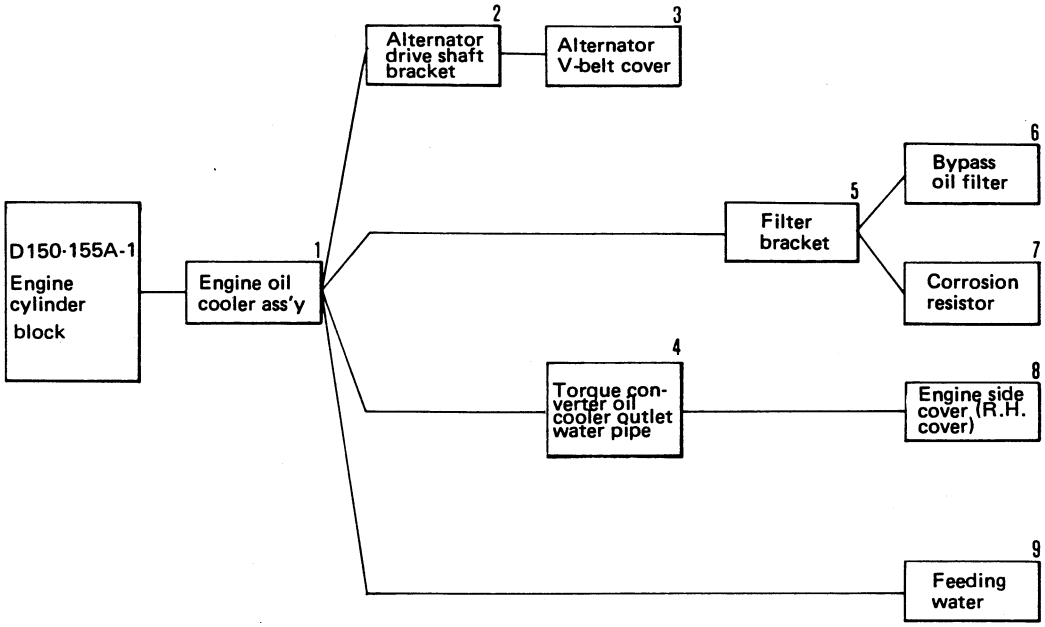


9. **Engine oil cooler assembly**
   1) Remove clamp (18) fastening corrosion resistor inlet hose (5).
   2) Loosen drain plug (19) on engine oil cooler and drain cooling water from cooler.
   3) Remove bolts fastening engine oil cooler assembly (20); remove assembly.



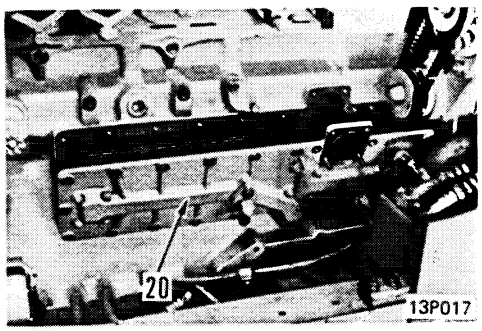


MOUNTING ENGINE OIL COOLER

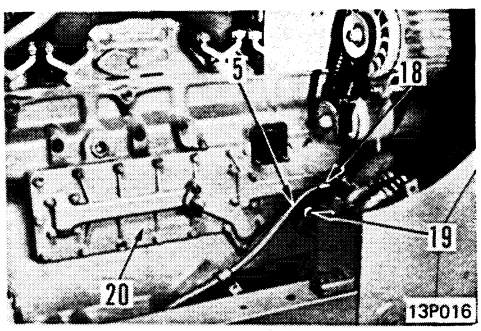


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1. **Engine oil cooler assembly**
   1) Apply gasket sealant (LG-1) to gasket and attach it to oil cooler housing.
   2) Install engine oil cooler assembly (20) on cylinder block with mounting bolts.
   3) Install clamp (18) for corrosion resistor inlet hose (5). Tighten drain plug (19).



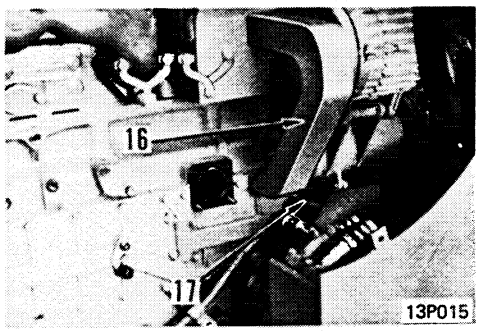
13P017



13P016

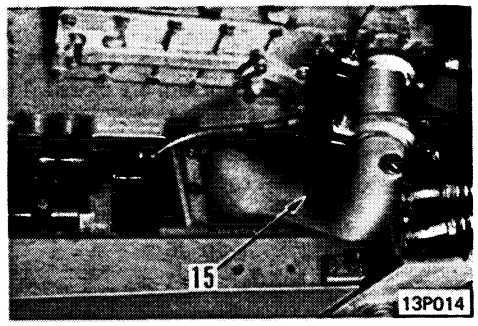
2. **Alternator drive shaft bracket**
   Install bracket (17).

3. **Alternator V-belt cover**
   Install cover (16).

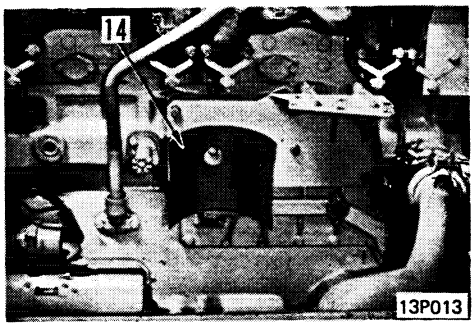


13P015

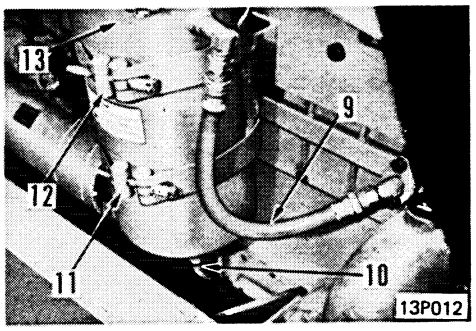
4. **Torque converter oil cooler outlet water pipe**
   1) Put gaskets on both flange end faces of torque converter oil cooler outlet water pipe.
   2) Connect water pipe (15) to torque converter oil cooler and engine oil cooler.



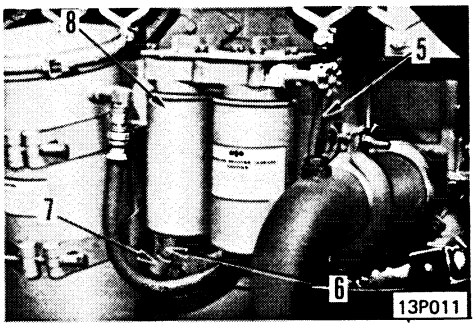
5. **Filter bracket**
   Install filter bracket (14).



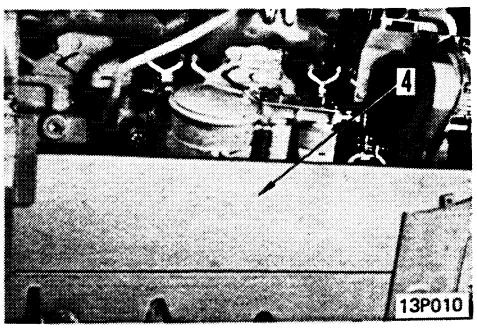
6. **Bypass oil filter**
   1) Install bypass oil filter (13) with clamp bands (11) and (12).
   2) Connect bypass oil filter outlet hose (10) to filter and inlet hose (9) to engine oil cooler.



7. **Corrosion resistor**
   1) Install corrosion resistor (8) on its bracket.
   2) Connect corrosion resistor outlet hose (6) to corrosion resistor and install pipe clamp (7).
   3) Install corrosion resistor inlet hose (5).
      ★ When changing coolant, replace element.

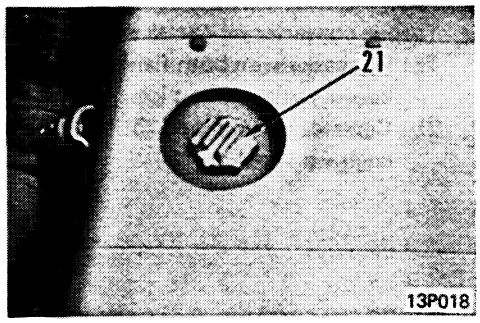


8. **Engine side cover (R.H. cover)**
   Install engine side cover (4).



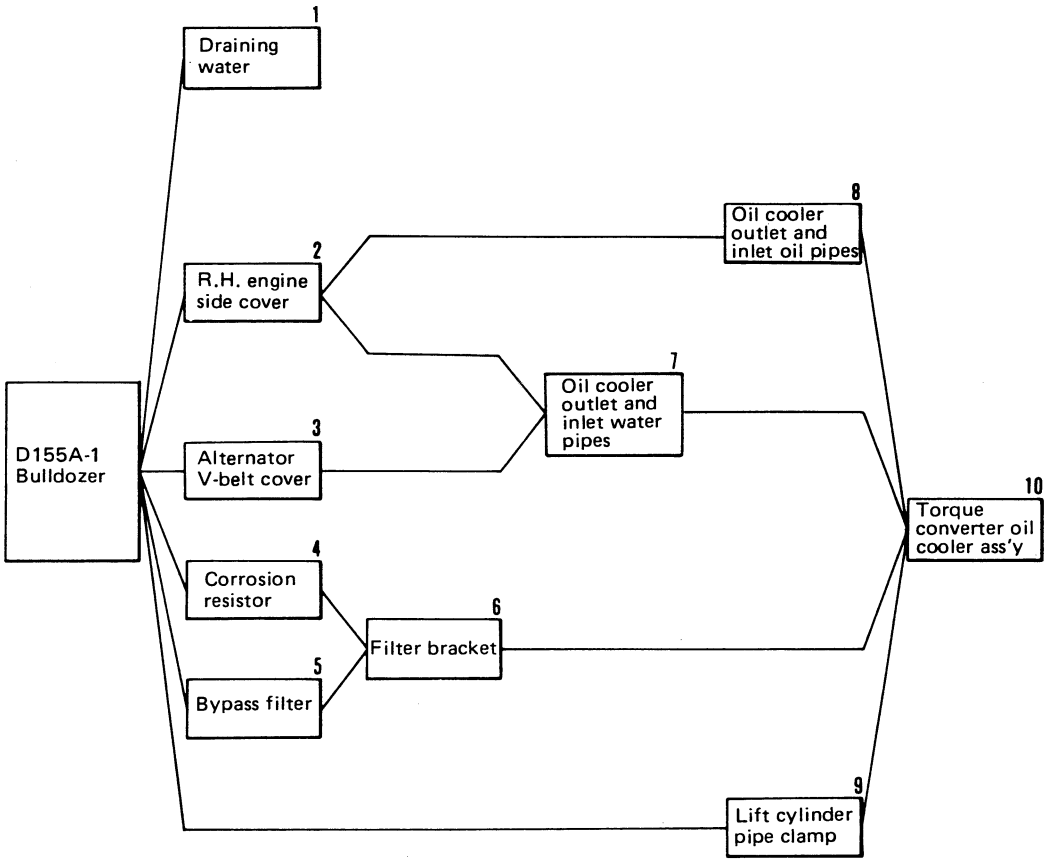
9. Feeding water

1) Confirm that drain cocks on the radiator bottom and on the oil cooler bottom are closed. Install inspection cover on radiator under guard.
2) Remove water filler cap (21) and pour coolant into radiator.
   ★ Coolant capacity: approx. **150 liters**



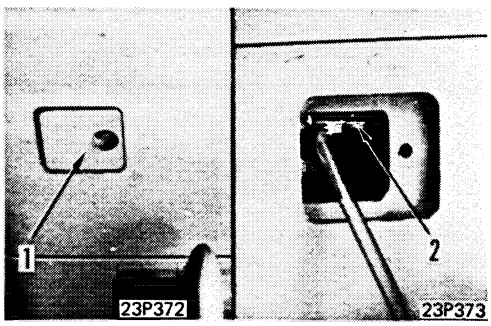
DISMOUNTING TORQUE CONVERTER OIL COOLER

D155A



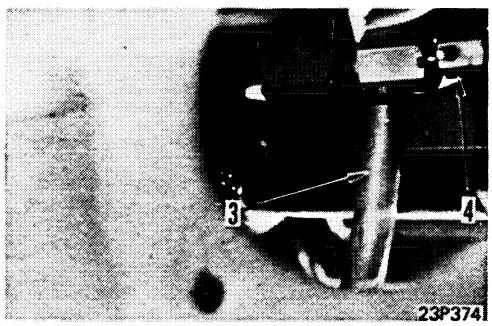
1. Draining water

1) Remove inspection cover (1) from the radiator under guard. Pull out the cooling water drain hose, and open drain valve (2) to drain the cooling water.

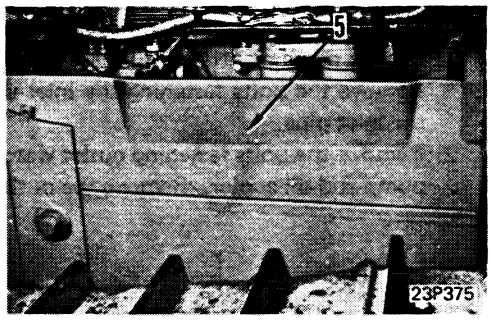


2) Pull out oil cooler cooling water drain hose (3) through the inspection window at the right side of the engine under guard, and open drain valve (4) to drain the cooling water.

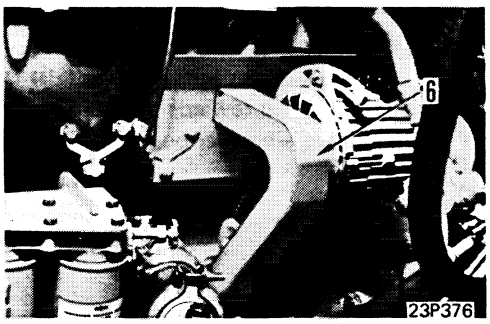
Quantity of drain water: **approx. 150** ℓ



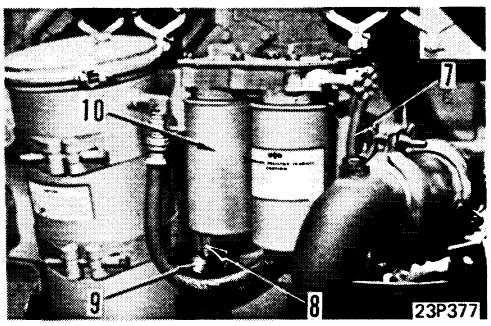
2. **R.H. engine side cover**
   Remove R.H. engine side cover (5).



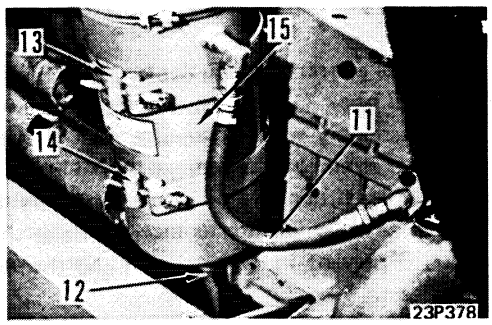
3. **Alternator V-belt cover**
   Remove alternator V-belt cover (6).



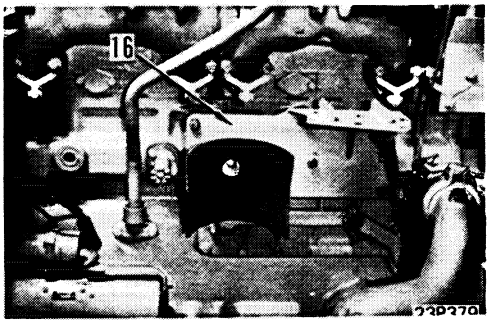
4. **Corrosion resistor**
   1) Disconnect corrosion resistor inlet hose (7).
   2) Disconnect outlet hose (8) from the corrosion resistor, and remove pipe clamp (9).
   3) Remove the bolts securing corrosion resistor (10) to the bracket, then remove the corrosion resistor.



5. **Bypass filter**
   1) Disconnect bypass filter inlet hose (11) from the coupling on the engine oil cooler. Disconnect outlet hose (12) from the filter.
      ★ If it is hard to remove the outlet hose, first remove filter clamp bands (13) and (14).
   2) Remove bypass filter clamp bands (13) and (14).
      Remove bypass filter (15).

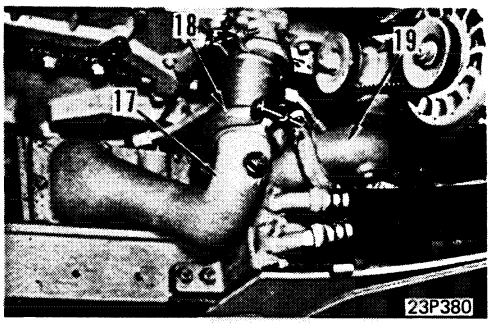


6. **Filter bracket**
   Remove filter bracket (16).



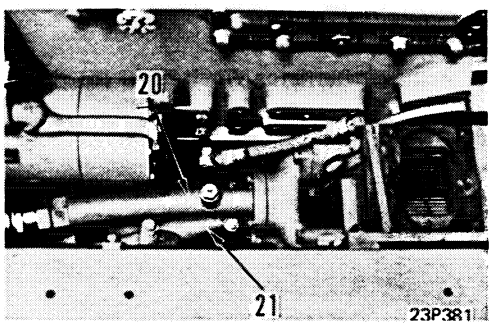
7. Cooler inlet and outlet water pipes

1) Loosen coupling (18) for inlet water pipe (17).
   Remove the bolts fastening the inlet water pipe, then remove the inlet pipe.
2) Remove the bolts fastening outlet water pipe (19) to the water pump and oil cooler. Remove the outlet pipe.



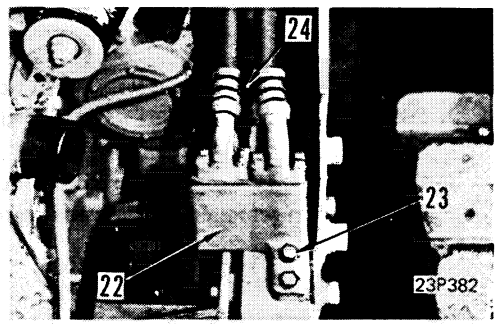
8. Cooler inlet and outlet oil pipes

1) Disconnect cooler inlet oil tube (20) from the flange, and keep the tube pulled towards the starting motor.
2) Disconnect oil cooler outlet tube (21) from the flange.



9. Blade lift cylinder piping clamp

Remove bolts (23) and clamps (24).

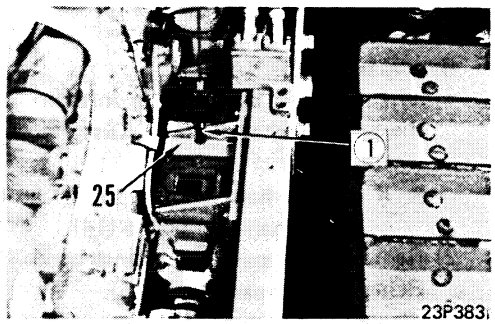


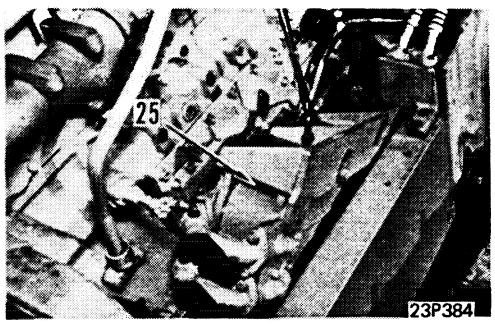
10. Torque converter oil cooler assembly

Install hook ① to torque converter oil cooler assembly (25), lift the assembly with a crane, remove the five bolts fastening the oil cooler assembly, the remove the assembly.

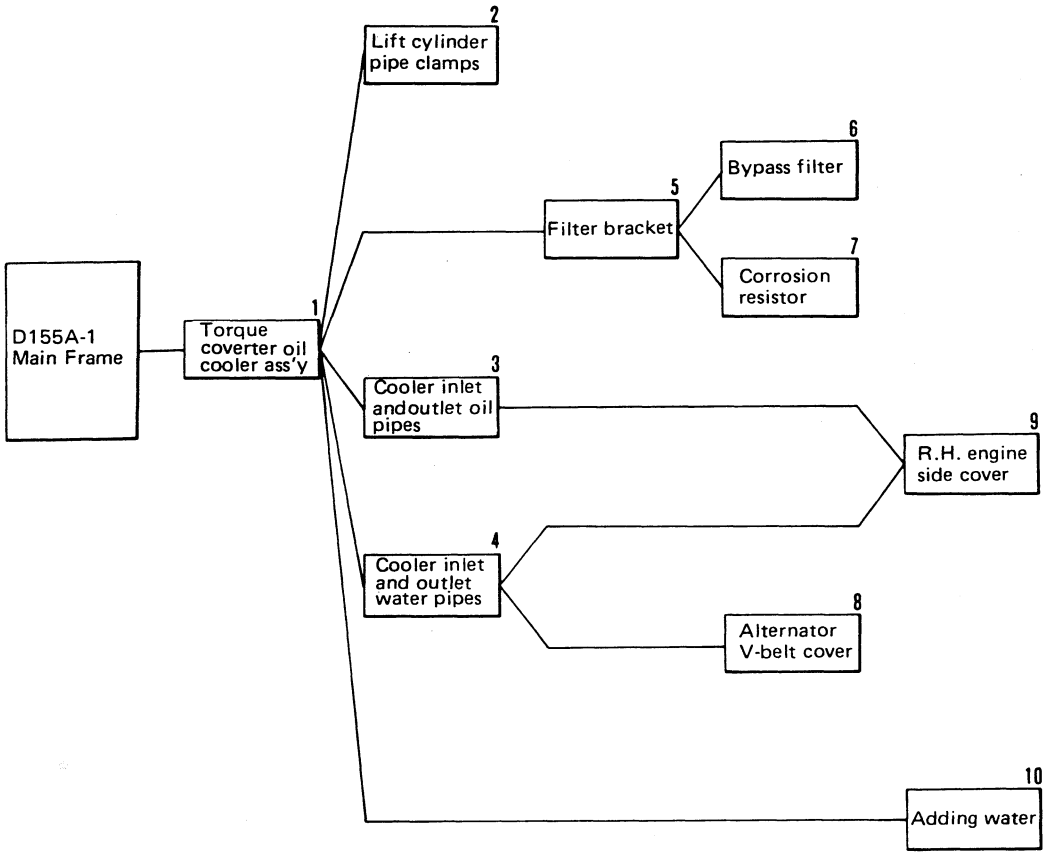
★ When lifting the oil cooler assembly, raise the blade cylinder pipe to avoid interference. Raise the rear part of the assembly to prevent its two ends and the valve from coming into contact.

kg Torque converter oil cooler assembly: **115 kg**





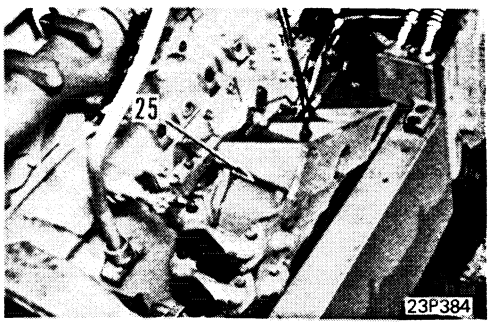
MOUNTING TORQUE CONVERTER OIL COOLER D155A

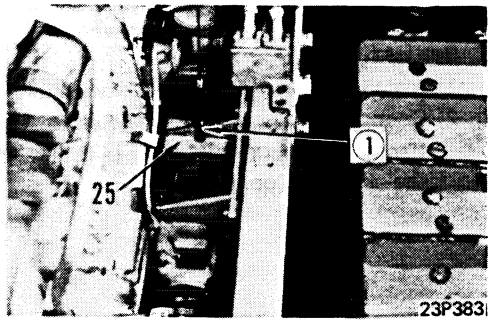


1. Torque converter oil cooler assembly

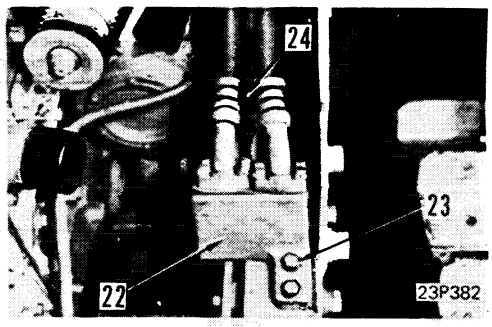
Attach hook ① to torque converter oil cooler assembly (25), lift it with a crane, set the assembly at the mounting position, and tighten the mounting bolts.

★ Tighten the mounting bolts with the cooler assembly slightly lifted up.

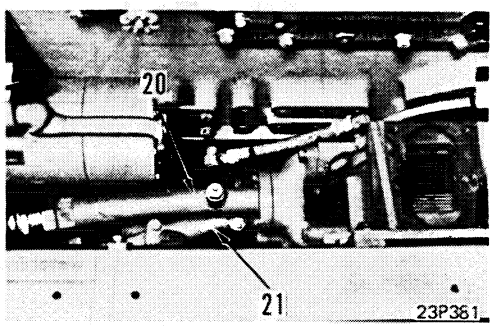




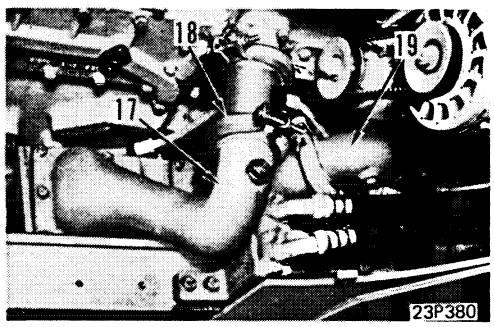
2. **Blade lift cylinder pipe clamps**
   Install clamps (24) to blade lift cylinder piping (22) and tighten mounting bolts (23).



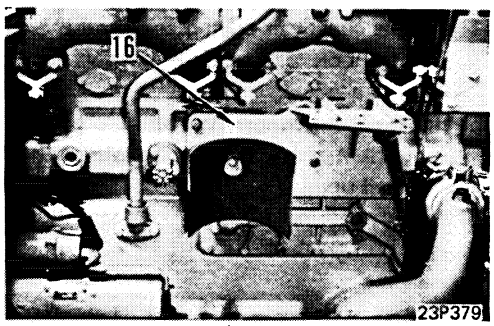
3. **Cooler inlet and outlet oil pipes**
   1) Fit an O-ring to the flange surface on oil cooler outlet tube (21), and connect the tube to the cooler.
   2) Fit an O-ring to the flange surface on cooler inlet oil tube (20), and connect the tube to the cooler.



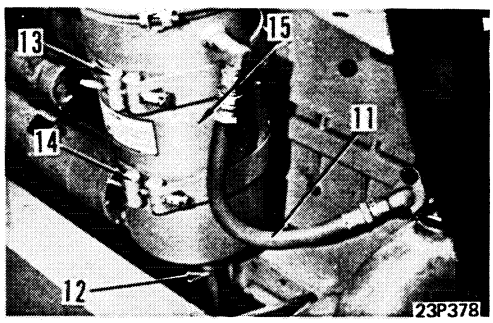
4. **Cooler inlet and outlet water pipes**
   1) Fit gaskets to both flange surfaces on outlet water pipe (19), and connect the pipe to the water pump and to the cooler.
   2) Fit clamps (18) to inlet water pipe (17) and a gasket to the flange surface on the cooler side, and install the water pipe to the cooler.
   3) Tighten clamps (18).



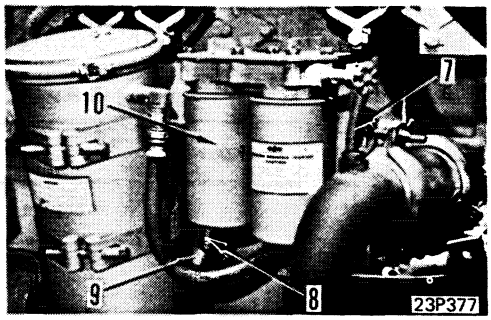
5. **Filter bracket**
   Install filter bracket (16).



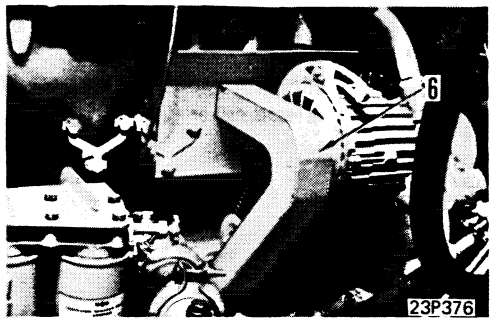
6. **Bypass filter**
   1) Install bypass filter (15) with clamp bands (13) and (14).
   2) Connect bypass filter outlet hose (12), fit a gasket to the flange surface on inlet hose (11), and connect the inlet hose to the engine oil cooler.



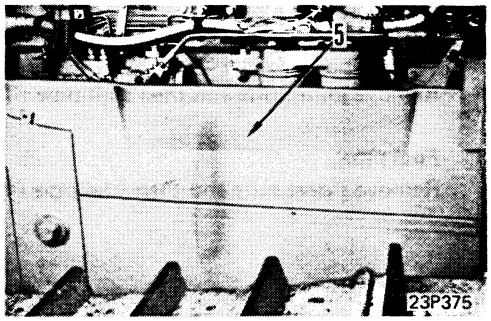
7. **Corrosion resistor**
   1) Install corrosion resistor (10) to the bracket.
   2) Connect corrosion resistor outlet hose (8) to the corrosion resistor, and fit piping clamp (9).
   3) Connect corrosion resistor inlet hose (7).



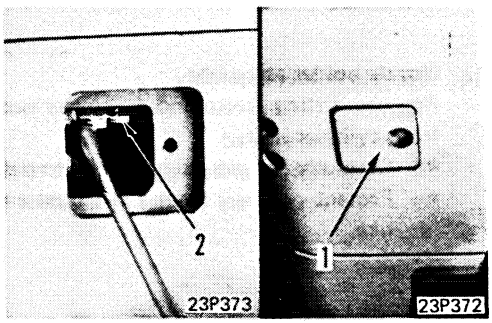
8. **Alternator V-belt cover**
   Install alternator V-belt cover (6).

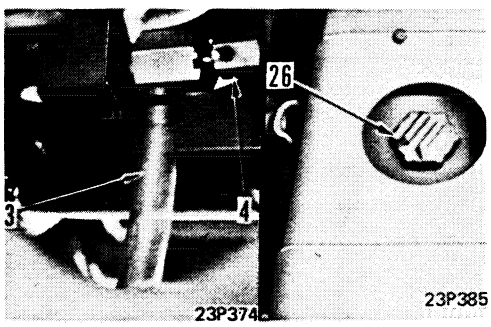


9. **R.H. engine side cover**
   Install R.H. engine side cover (5).

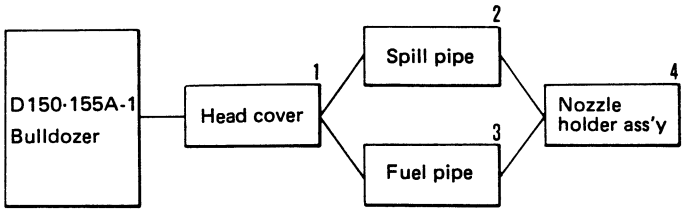


10. **Adding water**
    1) Make sure that both radiator drain valve (2) and drain valve (4) at the lower part of the oil cooler are closed, and fit inspection cover (1) to the radiator under guard.
    2) Remove water filler cap (26) and fill the radiator with water.
       Water capacity: **approx. 150** ℓ



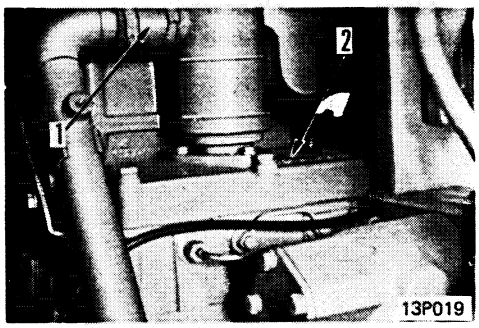


DISMOUNTING NOZZLE HOLDER



13F005

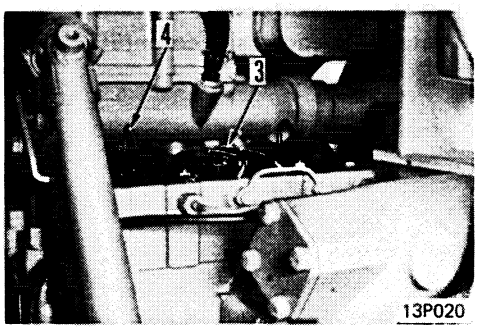
1. **Head cover**
   1) Loosening hose band; remove hose (1).
   2) Remove head cover (2).



13P019

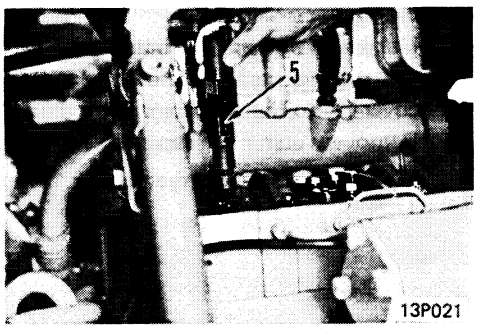
2. **Spill pipe**
   Remove joint bolts and then spill pipe (3).

3. **Fuel pipe**
   Remove sleeve nuts and then fuel pipe (4).



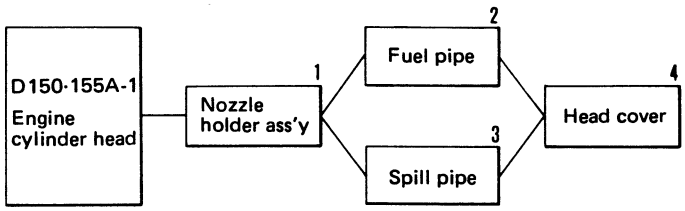
13P020

4. **Nozzle holder assembly**
   Remove fitting bolts and remove nozzle holder assembly (5) from cylinder head.
   ★ Carefully handle assembly not to damage nozzle holder end.
   ★ Protect nozzle holder from dust entering with tape or the like.



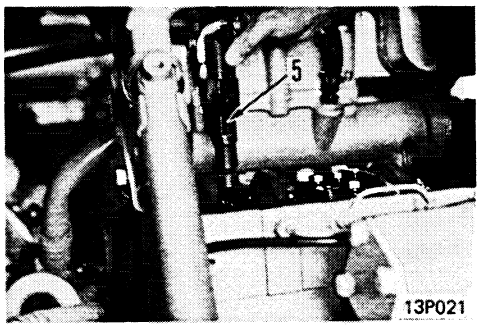
13P021

MOUNTING NOZZLE HOLDER



13F006

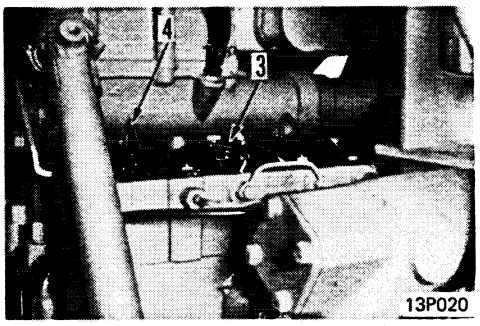
1. **Nozzle holder assembly**
   Put nozzle holder assembly in fitting part of cylinder head and tighten bolts.
   kgm Nozzle holder: **3.0 ~ 3.5 kg.m**



13P021

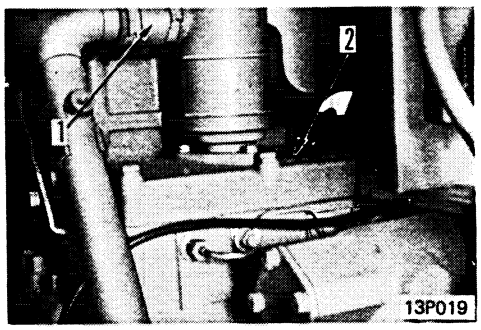
2. **Fuel pipe**
   Install fuel pipe (4) and tighten sleeve nuts.
   kgm Sleeve nut: **2.0 ~ 2.5 kg.m**

3. **Spill pipe**
   Install spill pipe (3) and tighten joint bolts with gasket on both sides.



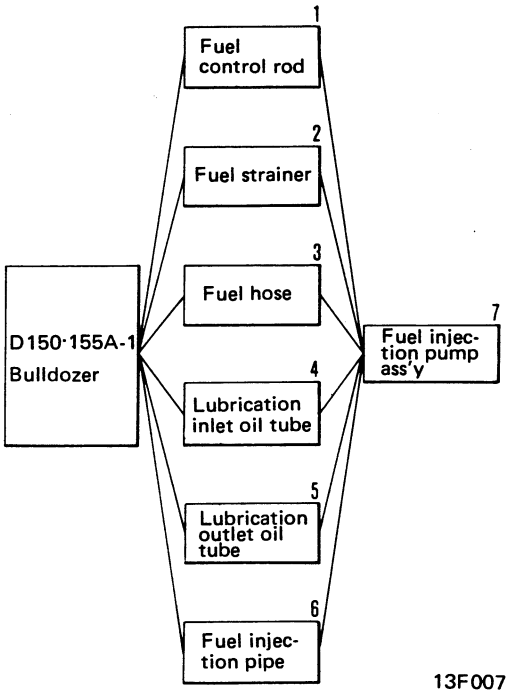
13P020

4. **Head cover**
   1) Putting gaskets on mounting surface of head cover, install head cover (2).
   2) Connecting hose (1), tighten hose band.

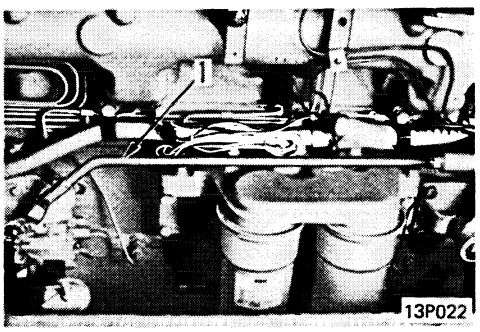


13P019

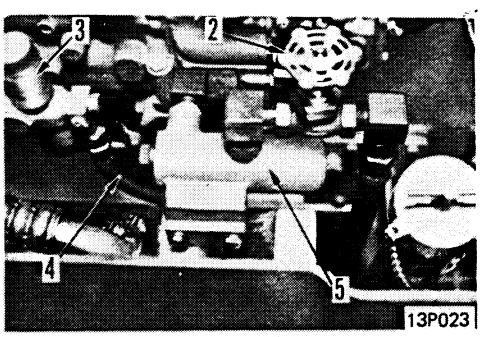
DISMOUNTING FUEL INJECTION PUMP



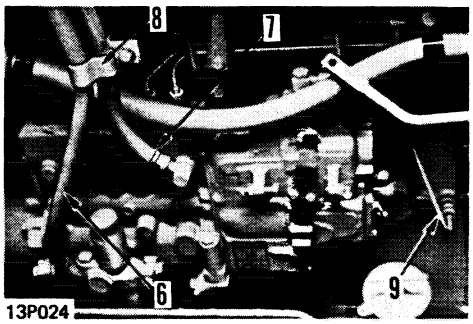
1. **Fuel control rod**
   Disconnect fuel control rod (1) from injection pump.



2. **Fuel strainer**
   1) Close fuel feed cock (2).
   2) Disconnect hose (4) from fuel feed pump (3).
   3) Remove bolts fastening fuel strainer (5); keep strainer suspended.

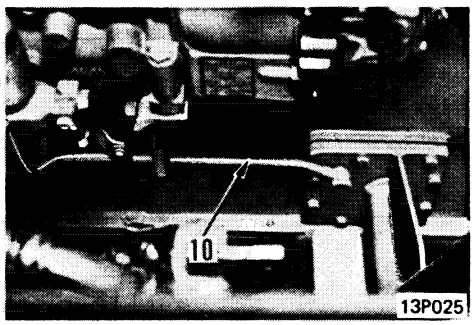


3. **Fuel hose**
   1) Disconnect hoses (6) and (7) from fuel injection pump.
   2) Remove hose clamp (8) and keep hoses held up.

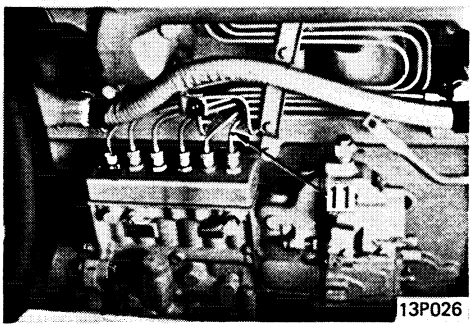


4. **Lubrication inlet oil tube**
   Remove lubrication inlet oil tube (9).

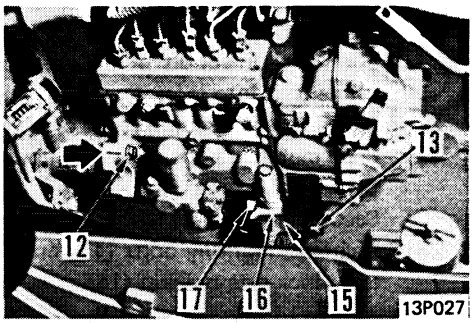
5. **Lubrication outlet oil tube**
   Remove lubrication outlet oil tube (10).

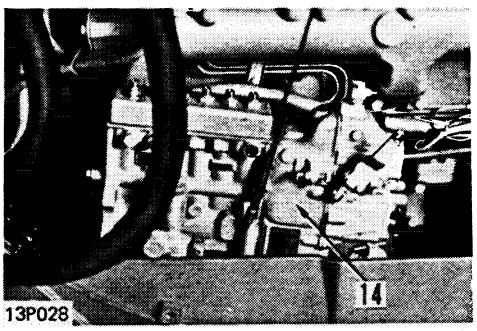


6. **Fuel injection pipe**
   Remove all the sleeve nuts and disconnect all injection pipes (11) from the top of injection pump.
   ★ Cover injection pump inlet and outlet parts to prevent dust from attaching.

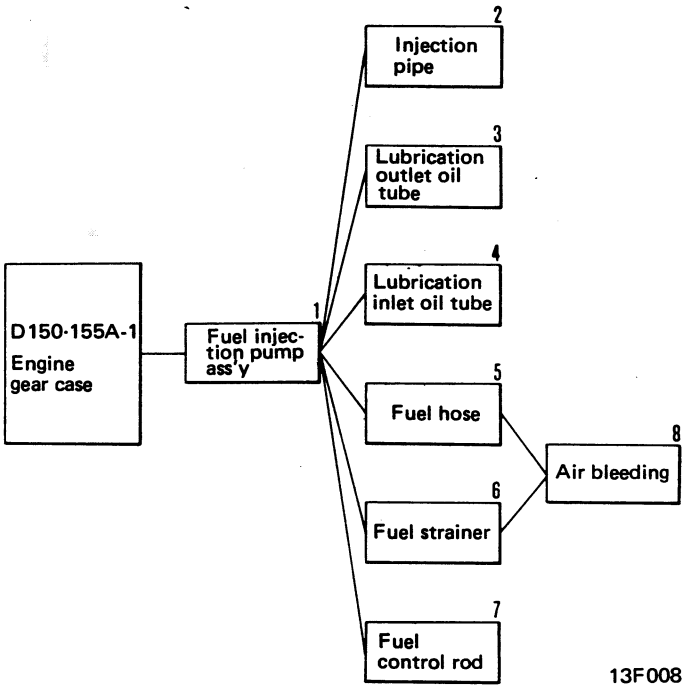


7. **Fuel injection pump assembly**
   Remove pump mounting bolts (12) and (13). Sling pump assembly (14) with crane and remove it together with its bracket (15).
   ★ Check for existence of match marks on injection pump and drive housing. If necessary, put match marks across mating parts.
   kg Fuel injection pump assembly: **35 kg**



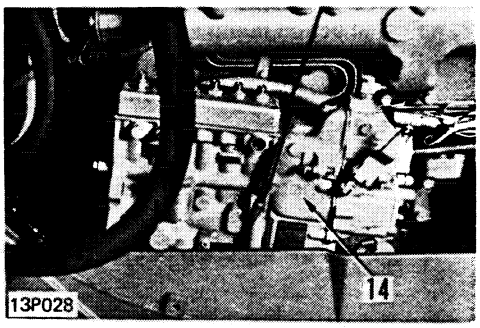


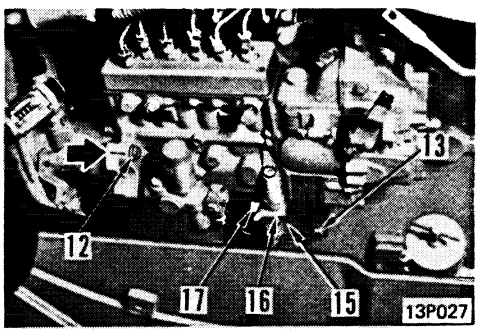
MOUNTING FUEL INJECTION PUMP



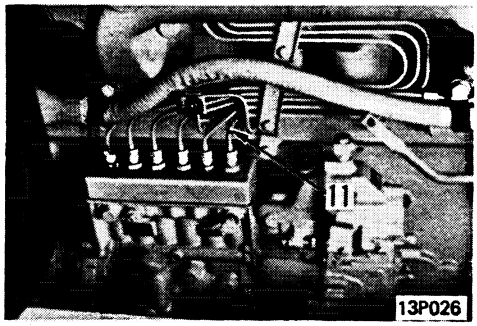
1. Fuel injection pump assembly

1) Sling fuel injection pump assembly (14) with crane and spline-fit it into mounting position.
   ★ Coat the circumference of O-ring with grease (G2-LI)
2) Plate match marks on injection pump and drive housing and tighten mounting bolts (12).
3) Secure bracket (15) with bolts (13).
4) Tighten mounting bolts (17) on pump-side on bracket (16) and block-side bracket (15).



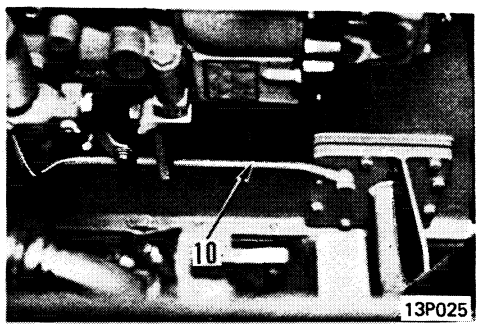


2. **Injection pipe**
   Connect injection pipe (11) to the top of fuel injection pump.
   kgm Sleeve nut: **2.3 ~ 2.5 kg.m**

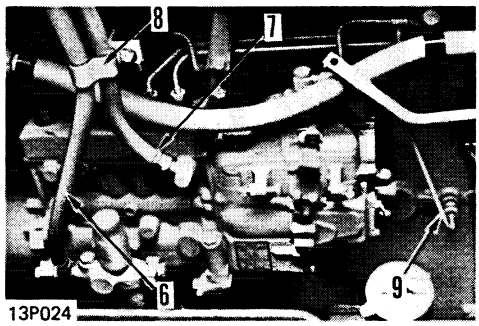


3. **Lubrication outlet oil tube**
   Install lubrication outlet oil tube (10).

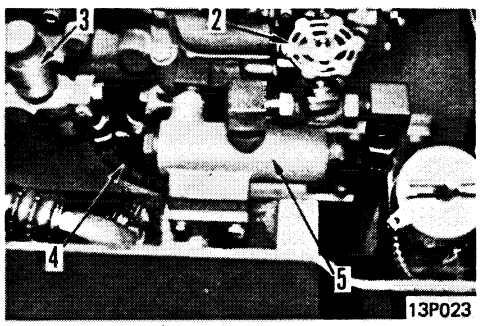
4. **Lubrication inlet oil tube**
   Install lubrication inlet oil tube (9).



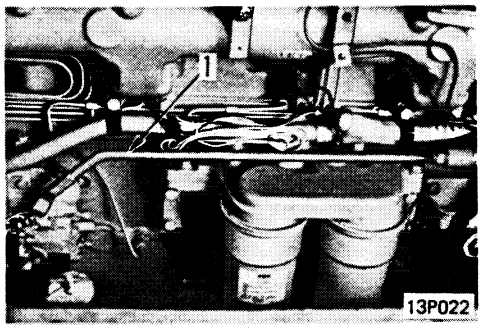
5. **Fuel hose**
   1) Connect hoses (6) and (7) coming from fuel filter to injection pump.
   2) Install hose clamp (8).



6. **Fuel strainer**
   1) Install fuel strainer (5).
   2) Connect hose (4) to fuel feed pump (3).
   3) Open fuel feed cock (2).

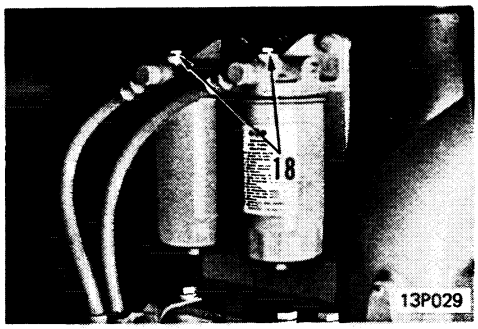


7. **Fuel control rod**
   Connect fuel control rod (1) to fuel injection pump.

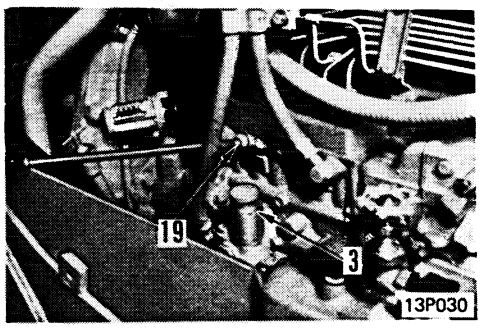


8. Air bleeding

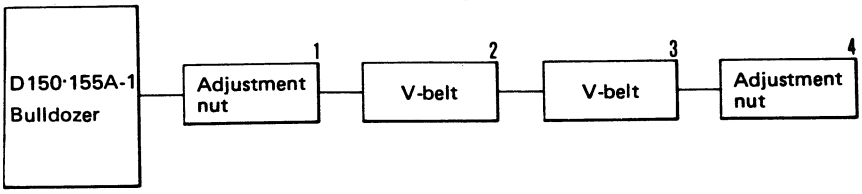
1) Loosen air bleeding plug (18) for fuel filter and operate fuel feed pump (3) until fuel free from air bubbles comes out of plug hole. Securely tighten plug.



2) Loosen air bleeding plug (19) for fuel injection pump and operate fuel feed pump (3) until fuel free from air bubbles comes out of plug. Tighten plug.

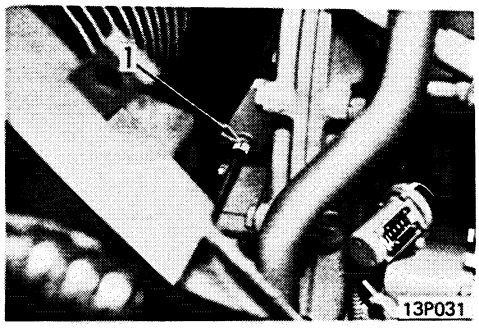


DISMOUNTING AND MOUNTING FAN BELT

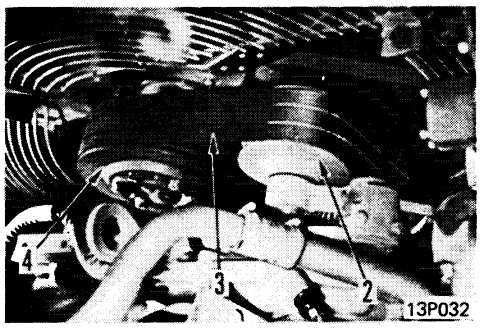


13F009

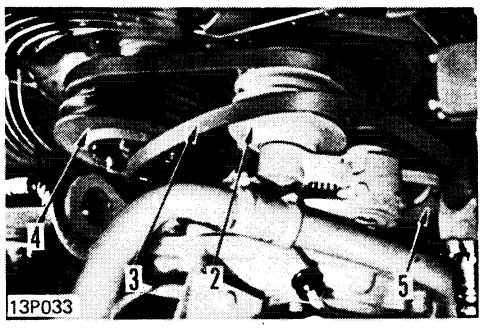
1. **Adjustment nut**
   Loosen tension pulley adjustment nut (1).



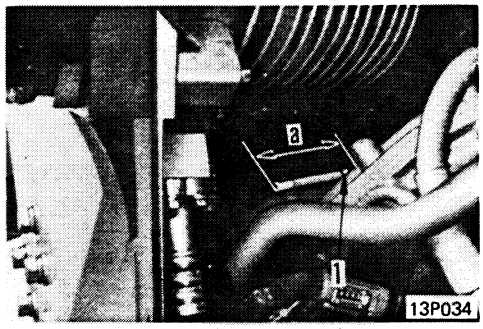
2. **V-belt**
   Push tension pulley (2) and remove three V-belts (3) from fan pulley (4), tension pulley (2) and accessory pulley (5) respectively.
   ★ Carefully push tension pulley to prevent it from rotating.



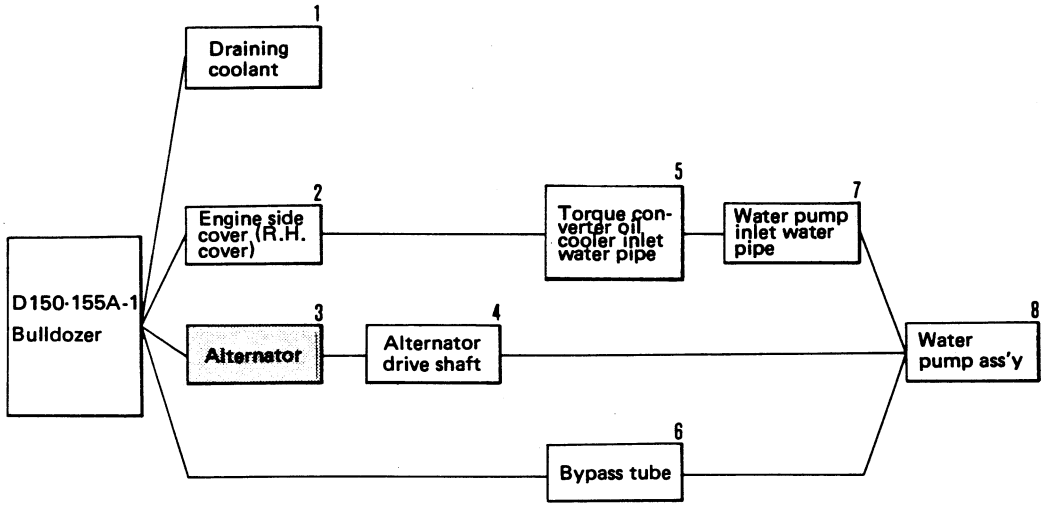
3. **V-belt**
   Push tension pulley (2) and assemble three V-belts (3) on fan pulley (4), tension pulley (2) and accessory pulley (5) respectively.
   ★ Carefully push tension pulley to prevent it from rotating.



4. **Adjustment nut**
   Turn tension pulley adjustment nut (1) down until distance "a" between bolt end face and bracket becomes 130 mm.



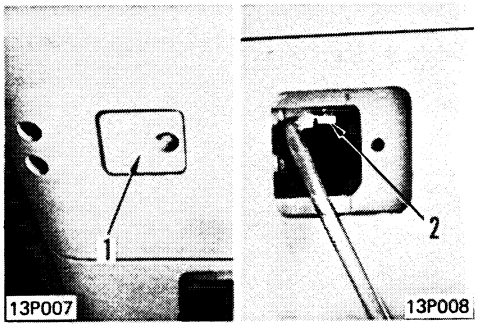
DISMOUNTING WATER PUMP



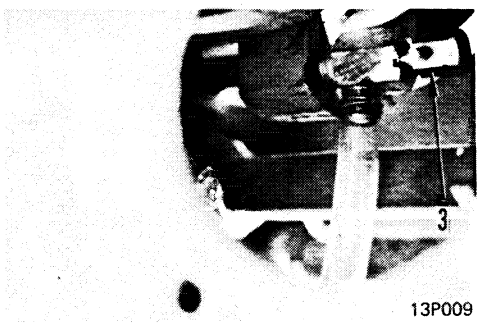
13F010

1. Draining coolant

1) Remove inspection cover (1) from radiator under guard and take out coolant drain hose. Open drain cock (2) to drain coolant.

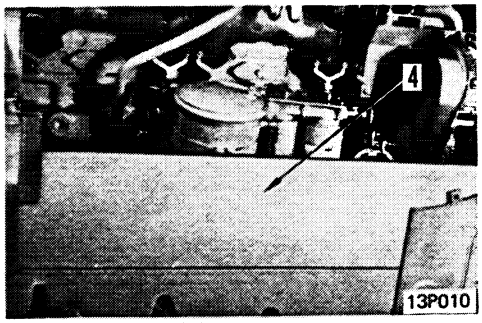


2) Take out torque converter cooler cooling water drain hose through inspection window located on the right side of engine under guard.
Open drain cock (3) to drain water.
★ Cooling water amount to be drained: approx. 150 liters



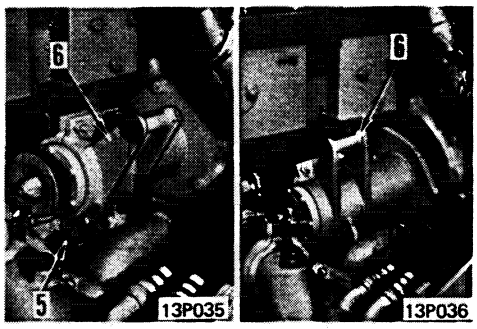
2. Engine side cover (R.H. cover)

Remove cover (4).

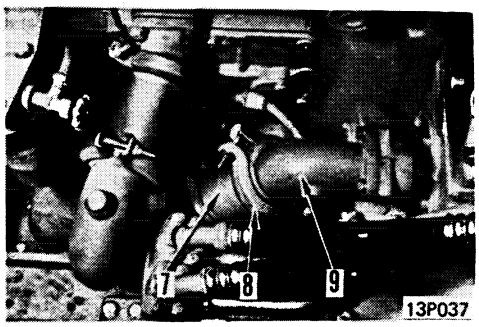


3. **Alternator**
   Refer to the DISMOUNTING ALTERNATOR section;

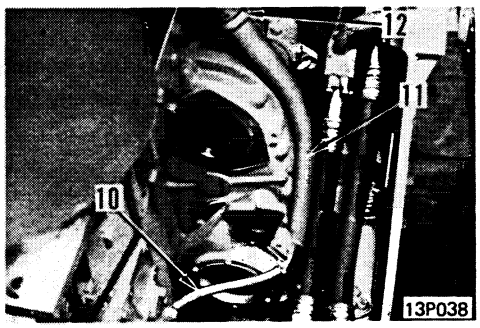
4. **Alternator drive shaft**
   1) Remove bolts from bracket (5) and gear case; remove alternator drive shaft assembly (6).
   2) Remove bracket (5).
   kg Alternator drive shaft assembly: **25 kg**



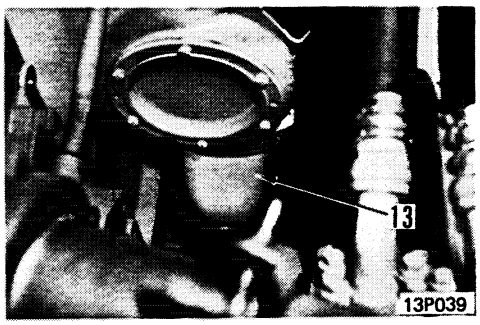
5. **Torque converter oil cooler inlet water pipe**
   1) Remove clamp (8) from coupling (7).
   2) Remove bolts securing torque converter oil cooler inlet water pipe (9) to water pump; remove water pipe and coupling.



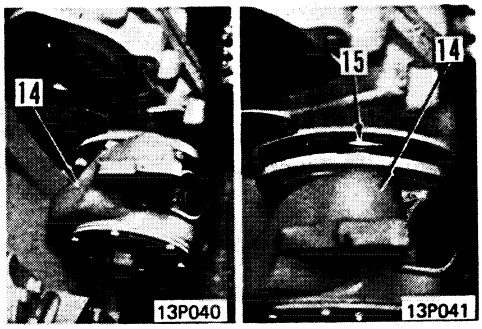
6. **Bypass tube**
   1) Loosen clamp and disconnect hose (10) leading to corrosion resistor from bypass tube (11).
   2) Loosen clamp (12), remove bolts securing bypass tube (11) to water pump, and remove bypass tube (11).



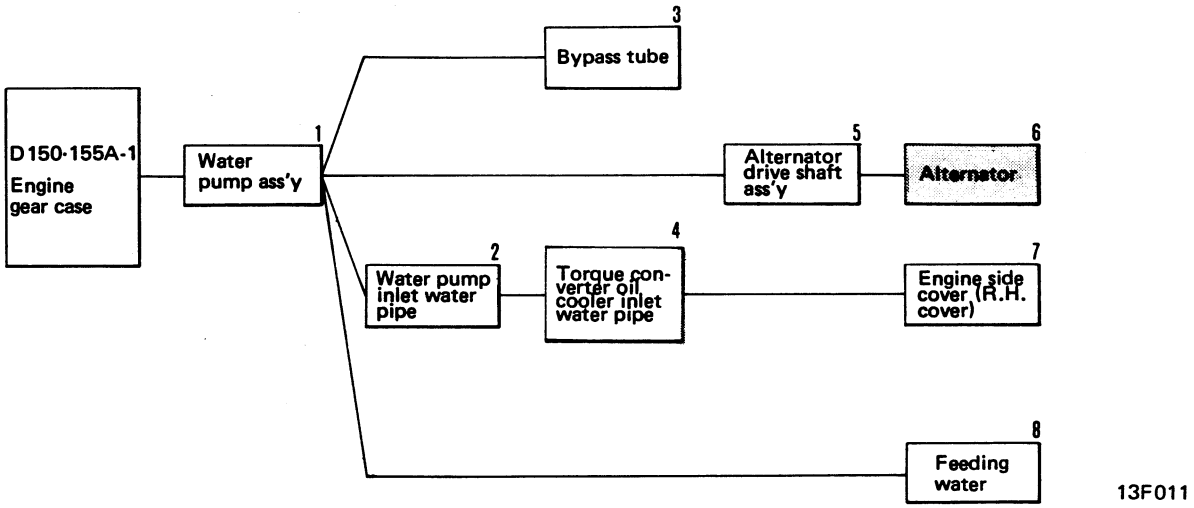
7. **Water pump inlet water pipe**
   Remove water pipe (13).



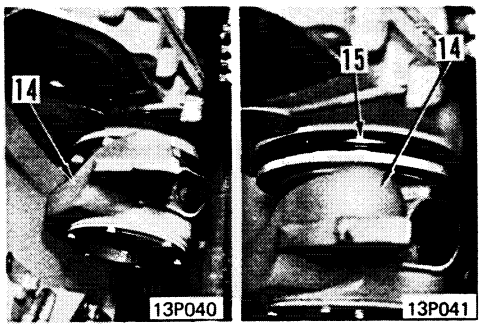
8. **Water pump assembly**
   Remove mounting nut. Remove water pump assembly (14).
   kg Water pump assembly: **20 kg**



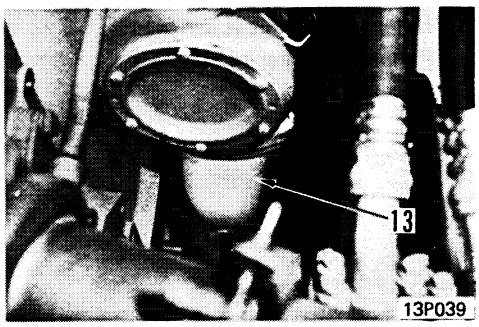
MOUNTING WATER PUMP



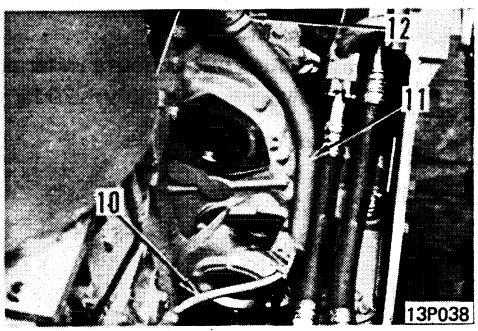
1. **Water pump assembly**
   Install O-ring (15) on water pump assembly (14) and coat O-ring with grease (G2-LI). Secure assembly to gear case with nut.



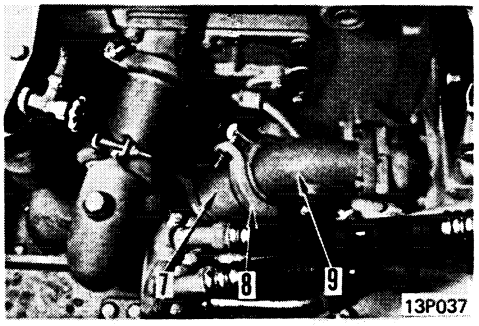
2. **Water pump inlet water pipe**
   Connect water pump inlet water pipe (13) with gasket to water pump.



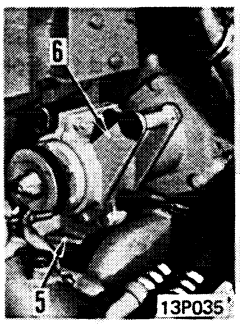
3. **Bypass tube**
   1) Connect bypass tube (11), with gasket on flange end face, to water pump. Secure tube to engine with clamp (12).
   2) Connect hose (10) coming from corrosion resistor to bypass tube joint and secure hose with clamp.

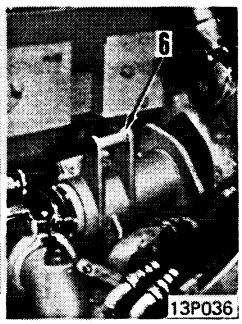


4. **Torque converter oil cooler inlet water pipe**
   1) Connect torque converter oil cooler inlet water pipe (9), with gasket on flange end face and coupling (7), to water pump.
   2) Install clamp (8) for coupling (7).



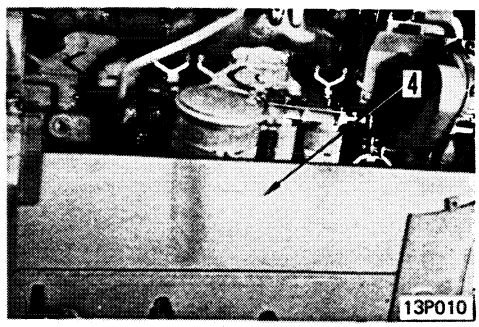
5. **Alternator drive shaft assembly**
   1) Install bracket (5).
   2) Set alternator drive shaft assembly (6) in gear case. Secure drive shaft to bracket (5) and gear case with bolts.



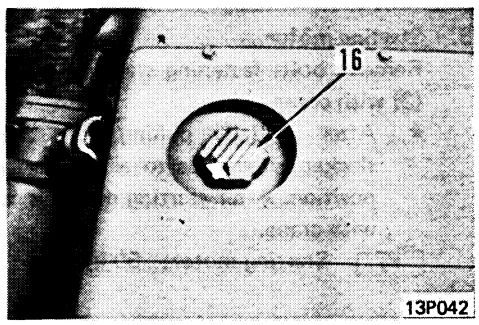


6. **Alternator**
   Refer to the MOUNTING ALTERNATOR section.

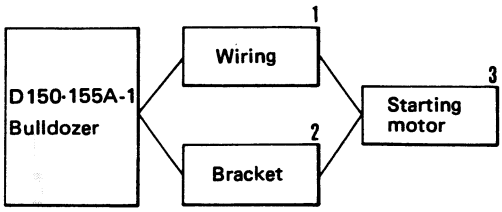
7. **Engine side cover (R.H. cover)**
   Install engine side cover (4).



8. **Feeding water**
   1) Confirm that drain cocks on the radiator bottom and on the torque converter oil cooler bottom are closed. Install inspection cover on radiator under guard.
   2) Remove water filler cap (16) and pour coolant into radiator.
      ★ Coolant capacity: approx. **150 liters**
      ★ When changing cooling water, replace corrosion resistor element.



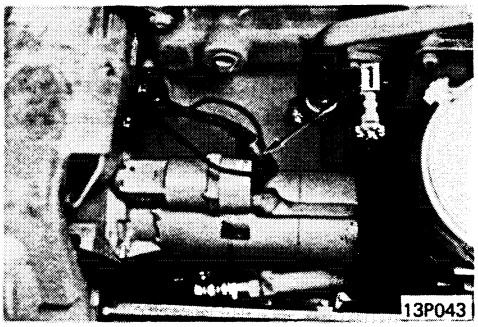
DISMOUNTING STARTING MOTOR



13F012

1. Wiring

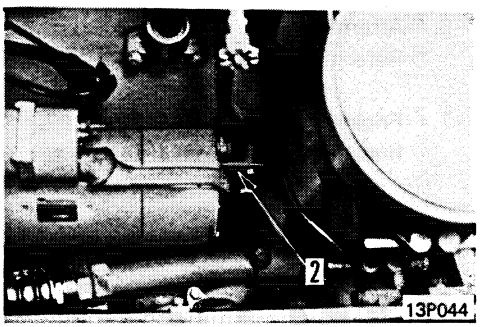
Disconnect starting motor cord (1) from terminal.



2. Bracket

Remove bracket (2).

★ Two fine-thread bolts are used for fastening starting motor side bracket. Be careful not to confuse them with other bolts.

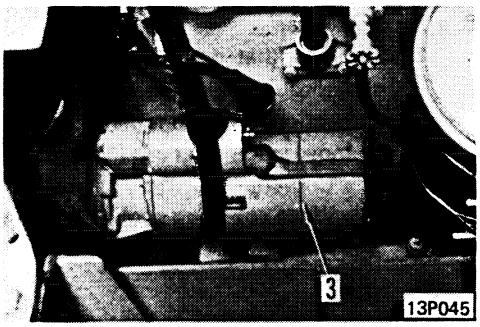


3. Starting motor

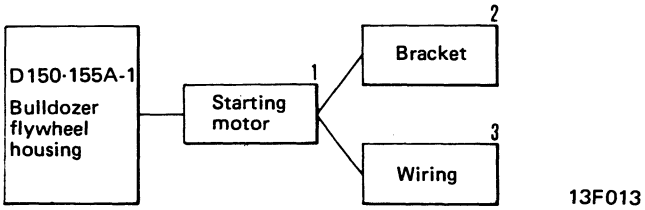
Remove bolts fastening starting motor; lift off staring motor (3) with crane.

★ After partially pulling out starting motor, temporarily slacken sling rope to allow starting motor to fall off the position. After starting motor is completely removed, lift it with crane.

kg Starting motor: **50 kg**



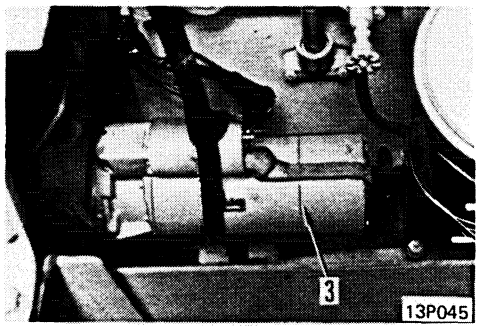
MOUNTING STARTING MOTOR



13F013

1. Starting motor

Lift starting motor (3), with O-ring installed, into position on flywheel housing with crane.

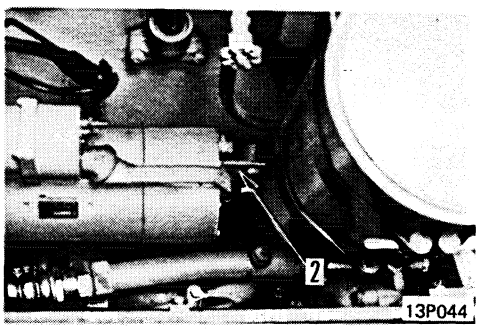


13P045

2. Bracket

Install bracket (2).

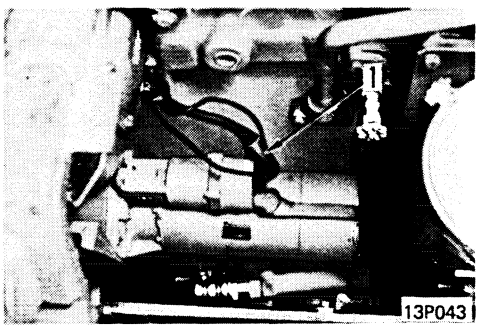
★ Two fine-thread bolts are used for fastening starting motor side bracket. Be careful not to confuse them with other bolts.



13P044

3. Wiring

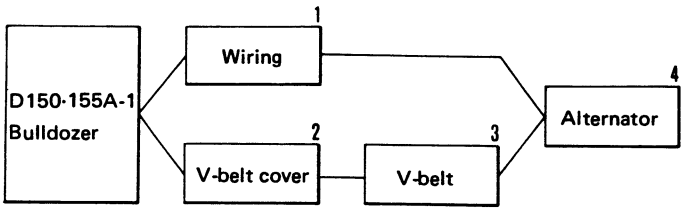
Connect starting motor cord (1) to terminal.



13P043

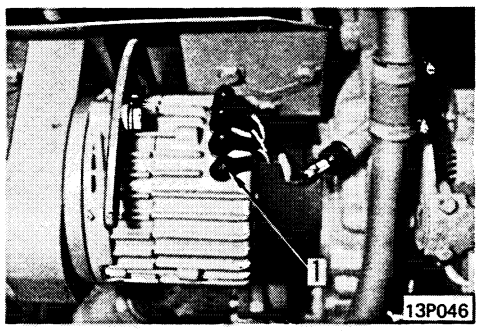
DISMOUNTING ALTERNATOR 

DISMOUNTING ALTERNATOR

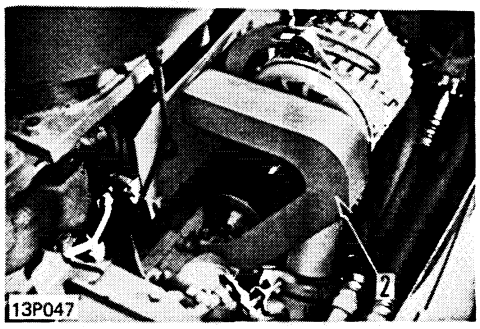


13F014

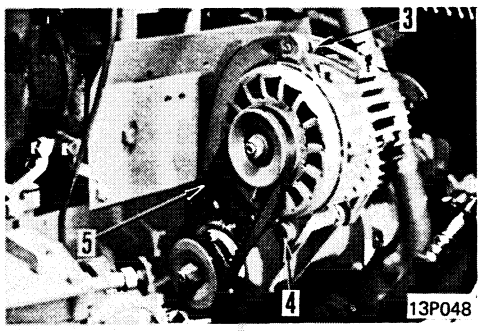
1. **Wiring**
   Disconnect alternator wires (1) from terminal.



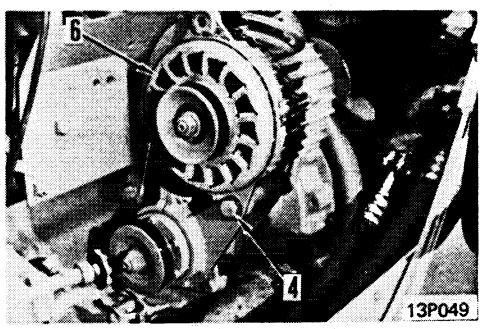
2. **V-belt cover**
   Remove V-belt cover (2).



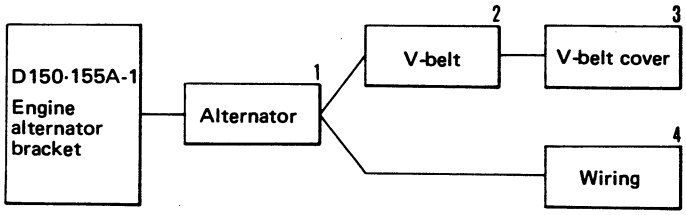
3. **V-belt**
   Remove adjustment bolt (3) and loosen support bolt (4). Push alternator toward engine and remove V-belt (5).



4. **Alternator**
   Remove support bolt (4). Remove alternator (6).

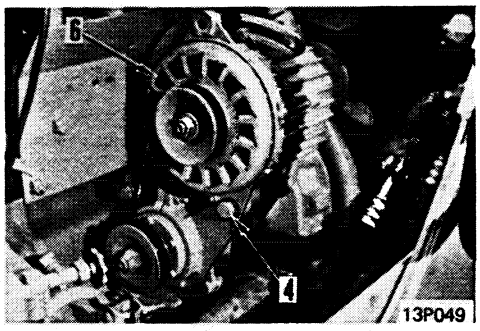


MOUNTING ALTERNATOR

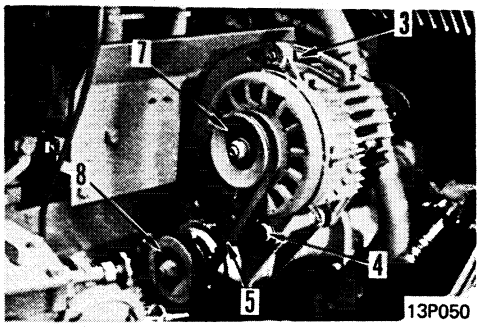


13F015

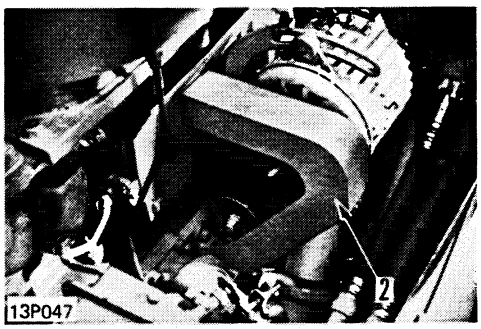
1. **Alternator**
   Place alternator (6) into position and loosely tighten support bolt (4).



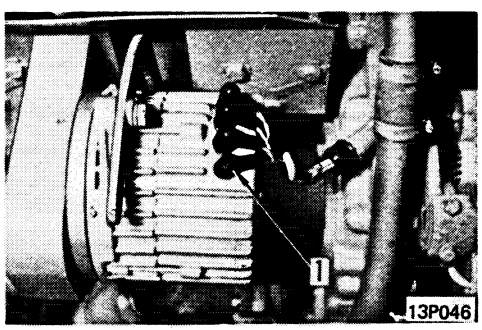
2. **V-belt**
   1) Install adjustment bolt (3). Lay V-belt (5) on alternator pulley (7) and drive pulley (8).
   2) Push the belt with finger until it yields approx. 15 mm at the middle between alternator pulley (7) and drive pulley (8). Tighten adjustment bolt (3) while belt is held as above and fully tighten support bolt (4).



3. **V-belt cover**
   Install V-belt cover (2).

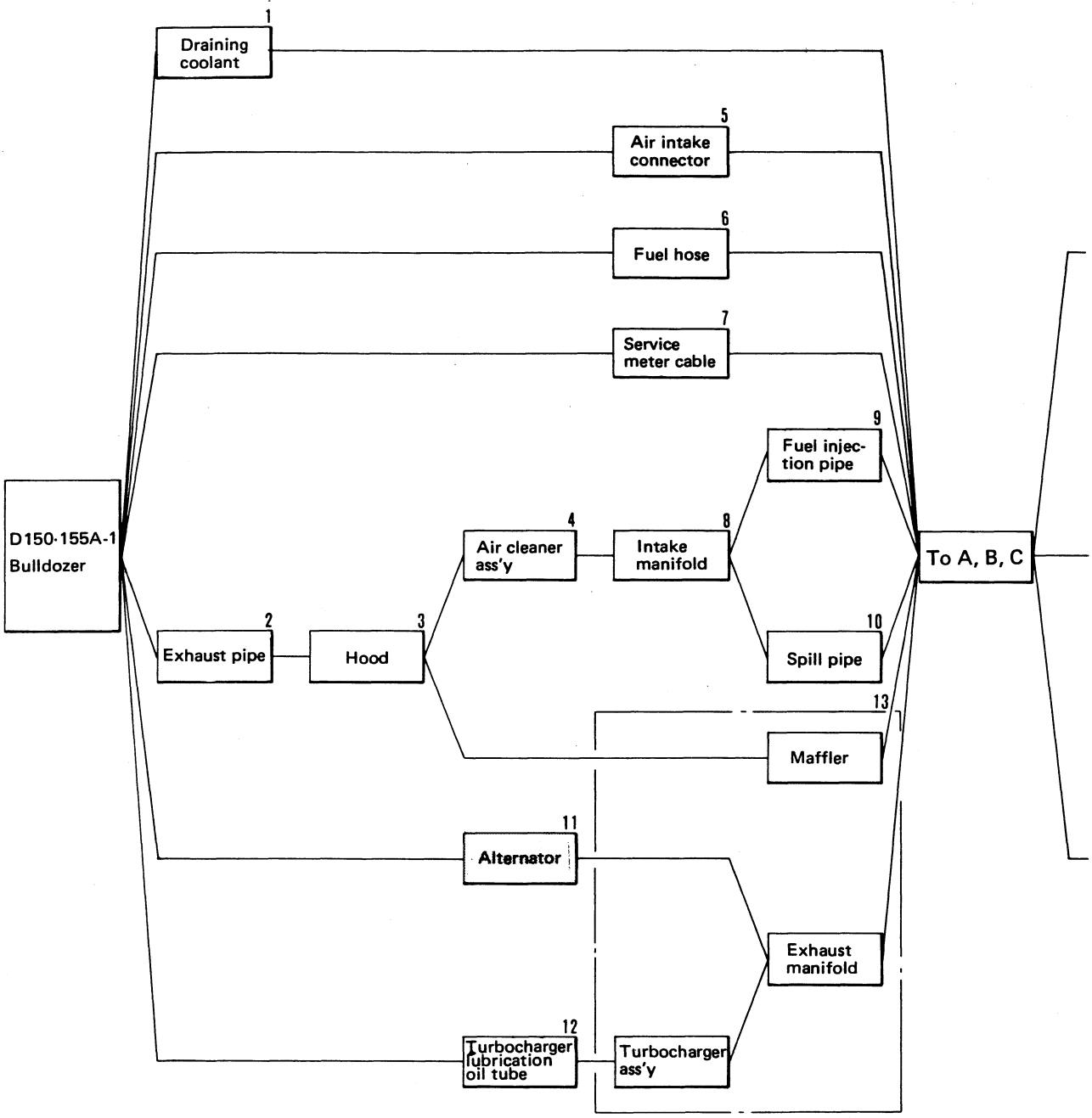


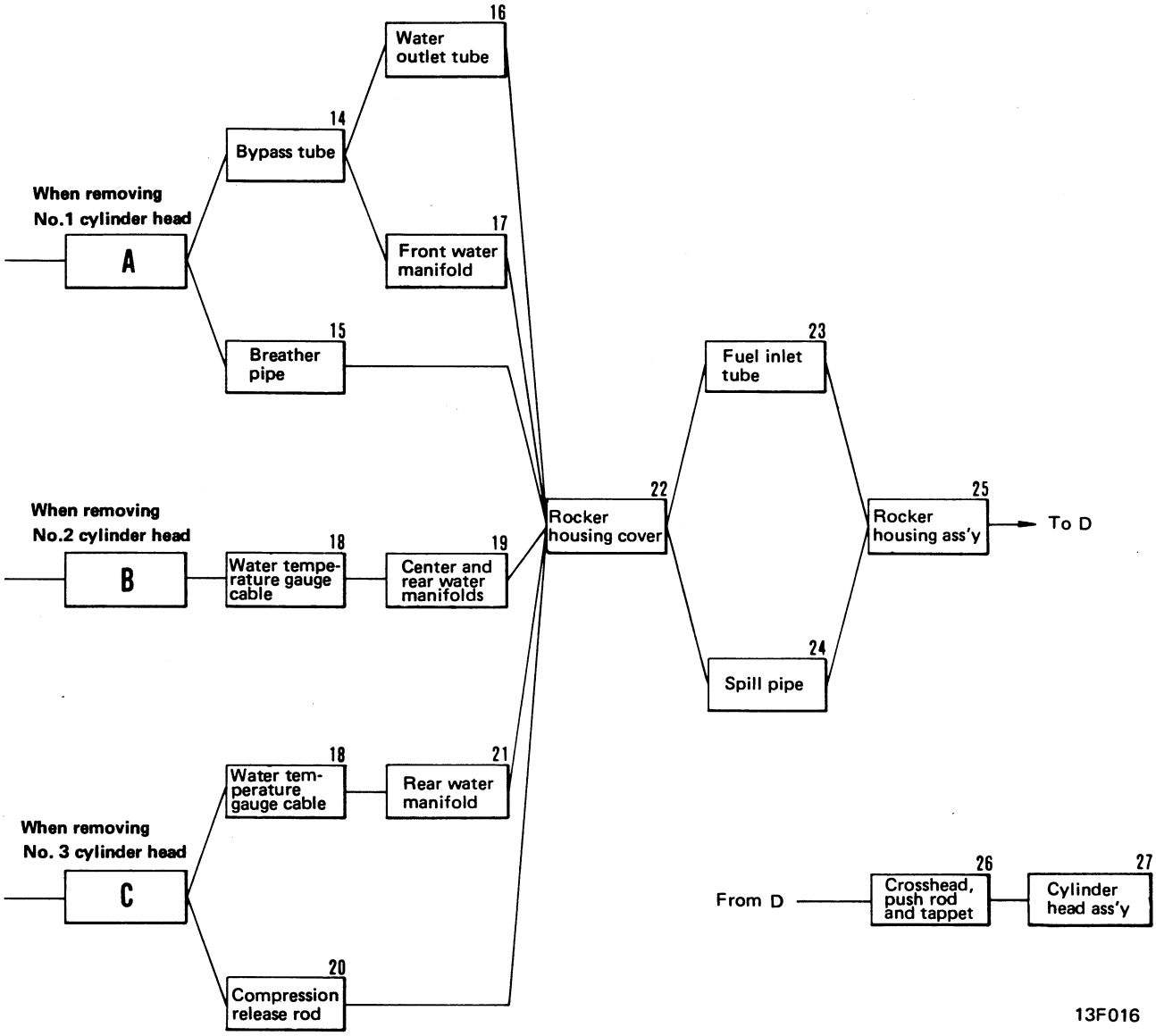
4. **Wiring**
   Connect alternator wires (1) to terminal.
   ★ Connect white/red cord (thick) to terminal B,
   white cord to terminal F,
   white/red cord (thin) to terminal N,
   black/red cord to terminal E.



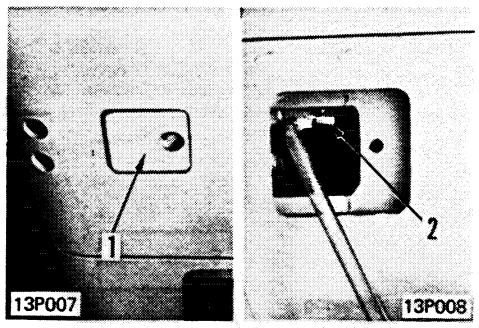
DISMOUNTING CYLINDER HEAD

DISMOUNTING CYLINDER HEAD

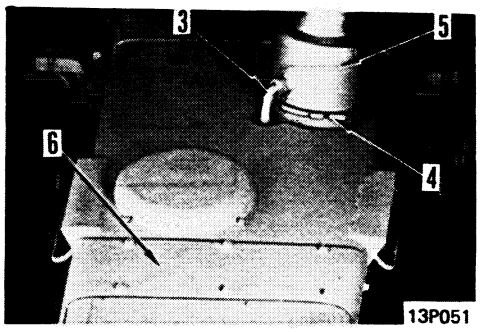



When removing
No.1 cylinder head
A
When removing
No.2 cylinder head
B
When removing
No. 3 cylinder head
C
14
Bypass tube
16
Water outlet tube
17
Front water manifold
15
Breather pipe
18
Water temperature gauge cable
19
Center and rear water manifolds
18
Water temperature gauge cable
21
Rear water manifold
20
Compression release rod
22
Rocker housing cover
23
Fuel inlet tube
24
Spill pipe
25
Rocker housing ass'y
To D
From D
26
Crosshead, push rod and tappet
27
Cylinder head ass'y
13F016

1. **Draining coolant**
   Remove inspection cover (1) from radiator under guard and take out cooling water drain hose. Open cock (2) to drain coolant.
   ★ Coolant capacity: approx. **150 liters**



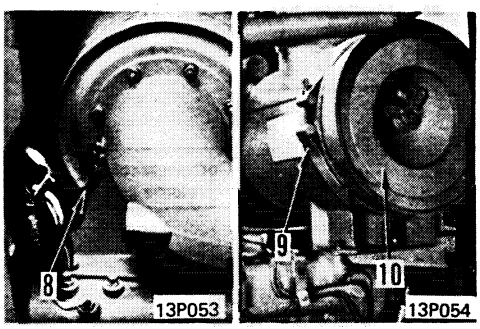
2. **Exhaust pipe**
   Disconnect ejector pipe (3) from exhaust pipe (5). Remove clamp (4) fastening exhaust pipe; remove exhaust pipe.



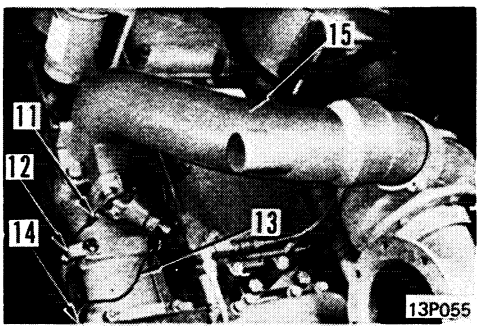
3. **Hood**
   1) Remove cover (6).
   2) Remove catches from the inside of hood. Lift off hood (7) with sling tool ①.



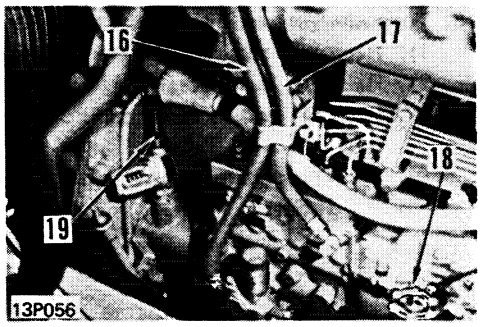
4. **Air cleaner assembly**
   1) Disconnect hose (8) from dust indicator.
   2) Remove band (9).
   3) Remove air cleaner mounting nuts (nuts connecting air cleaner to air intake connector) and remove air cleaner assembly (10).



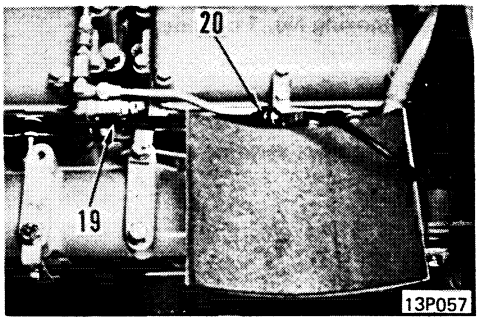
5. **Air intake connector**
   1) Remove air intake heater cord (11) and clamp (12).
   2) Remove air intake heater fuel tube (13) and clamp (14).
   3) Remove air intake connector (15).



6. **Fuel hose**
   Disconnect fuel hoses (16) and (17) from fuel injection pump.
   ★ Be sure to close fuel cock (18) before removing fuel hoses.

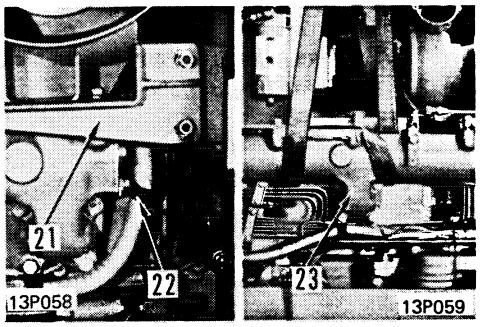


7. **Service meter cable**
   Disconnect service meter cable from service meter side (19) and from joint (20) on the half-way of cable.

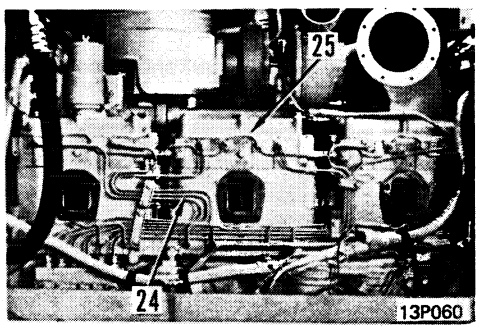


8. **Intake manifold**
   1) Remove nuts and remove bracket (21).
   2) Remove harness clamp (22) and remove intake manifold assembly (23).

9. **Fuel injection pipe**
   Disconnect fuel injection pipe (24), for cylinder head to be removed, from rocker housing.

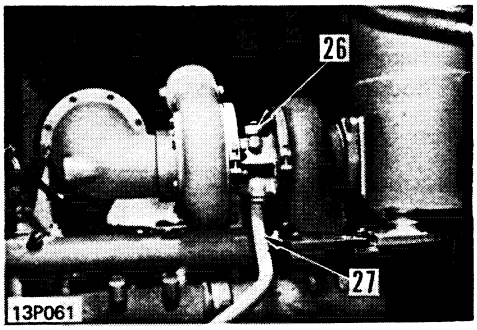


10. **Spill pipe**
    Disconnect spill pipe (25), for cylinder head to be removed, from rocker housing.



11. **Alternator**
    Refer to the DISMOUNTING ALTERNATOR section.

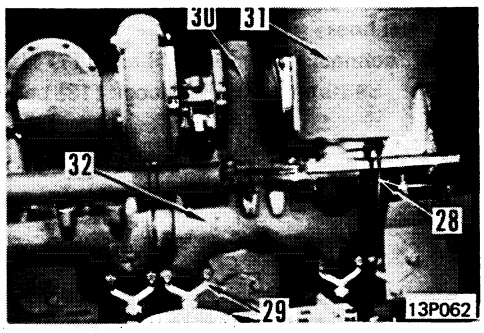
12. **Turbocharger lubrication oil tube**
    1) Remove turbocharger oil feed tube (26).
    2) Remove turbocharger drain tube (27).



13. Turbocharger, muffler and exhaust manifold assembly

1) Remove sleeve nut disconnect drain tube (28).
2) Raise up lockplates (29). Lift off turbocharger (30), muffler (31) and exhaust manifold (32), together, using sling tool.

kg Turbocharger, muffler and exhaust manifold assembly; **125 kg**



When removing No. 1 cylinder head.

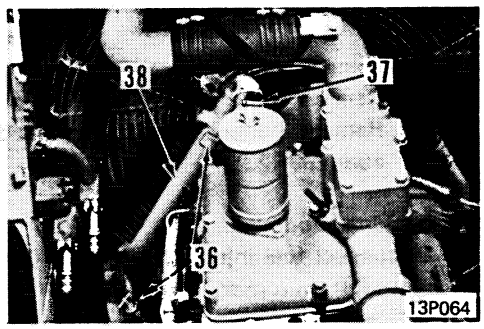
14. Bypass tube

1) Loosen hose clamp (33) and remove tube (34).
2) Remove aeration hose (35).



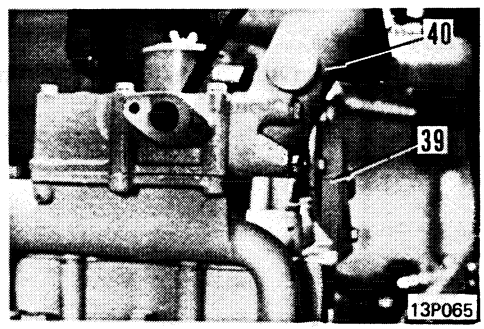
15. Breather pipe

1) Remove clamp (36) and loosen clamp of hose (37).
2) Remove hose (37) and breather pipe (38).



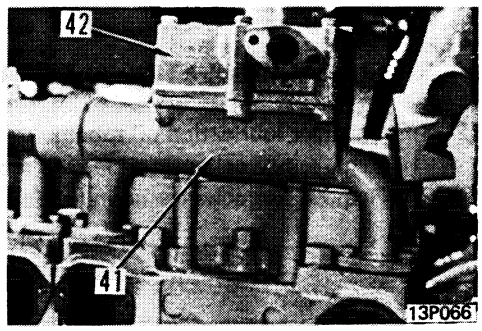
16. Water outlet tube

Remove bracket (39) and disconnect water outlet tube (40).



17. Front water manifold

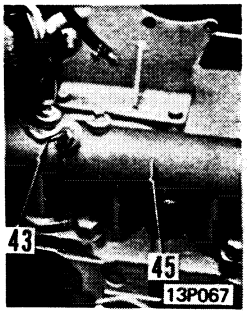
Remove water manifold (41) together with thermostat housing (42).



When removing No. 2 cylinder head.

18. Water temperature gauge cable
Disconnect cable (43) from its connector.

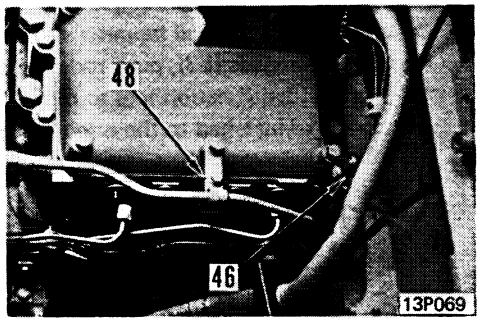
19. Center and rear water manifolds
Remove center manifold (44) and rear manifold (45).



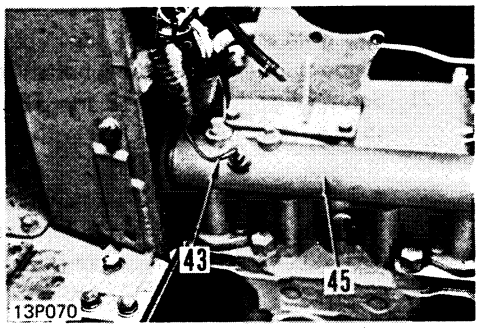


When removing No. 3 cylinder head.

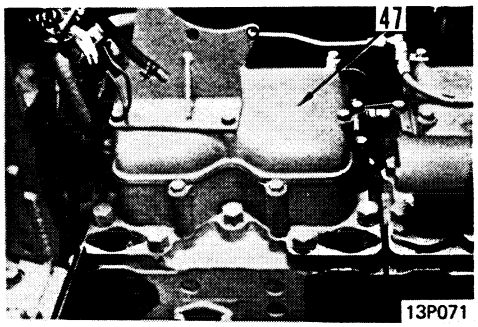
20. Compression release rod
Remove nut and disconnect rod (46) from cylinder head.



21. Rear water manifold
Disconnect water temperature gauge cable (43) from its connector.
Remove rear water manifold (45).

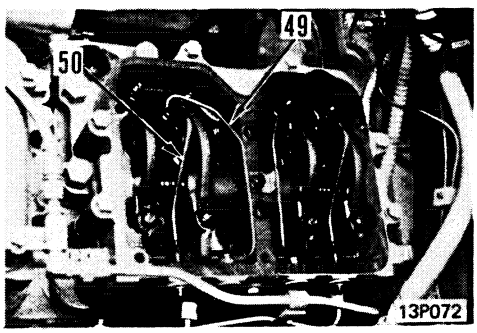


22. Rocker housing cover
Remove bracket, clamp (48), etc. on the top of rocker housing to be removed cover (47). Remove cover.



23. Fuel inlet tube
Remove sleeve nut and disconnect fuel inlet tube (49).

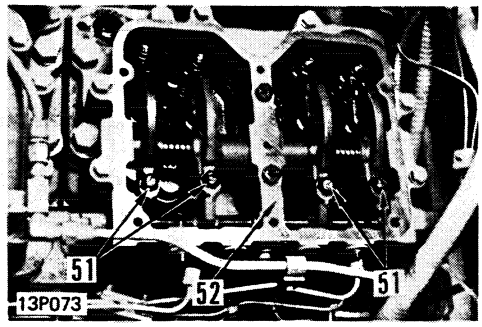
24. Spill pipe
Remove joint bolt and disconnect spill pipe (50).



25. Rocker housing assembly

★ Before removing rocker housing assembly, loosen lock nuts and unscrew intake and exhaust valve clearance adjust screw nuts (51).

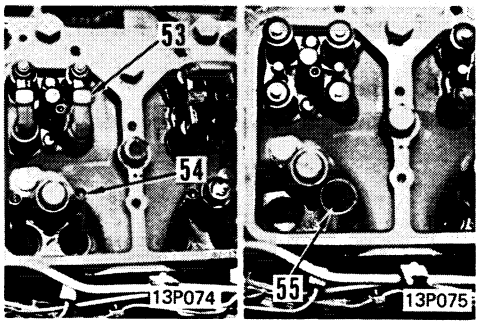
Remove eight bolts and rocker housing assembly (52).



26. Crosshead, push rod and tappet

Remove crossheads (53), push rods (54) and tappets (55).

★ Attach identification tags to removed parts so that the parts can be re-installed to the original places without confusion.

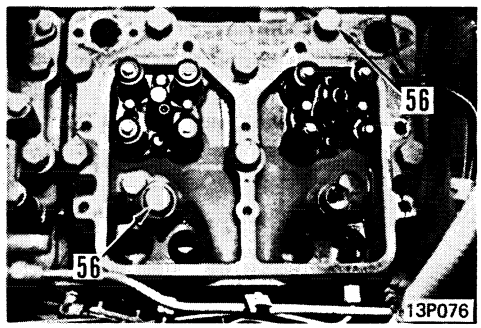


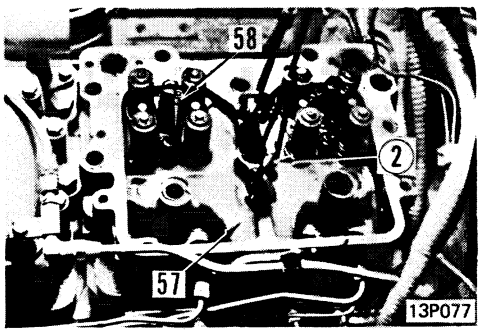
27. Cylinder head assembly

1) Remove 10 head mounting bolts (56).
2) Screw sling bolt ② (12 mm, P=1.75) in head assembly (57). Lift off head together with nozzle assembly (58) with crane.

★ Place cylinder head assembly on approx. 50 mm long block or side faced to protect it from damaging.

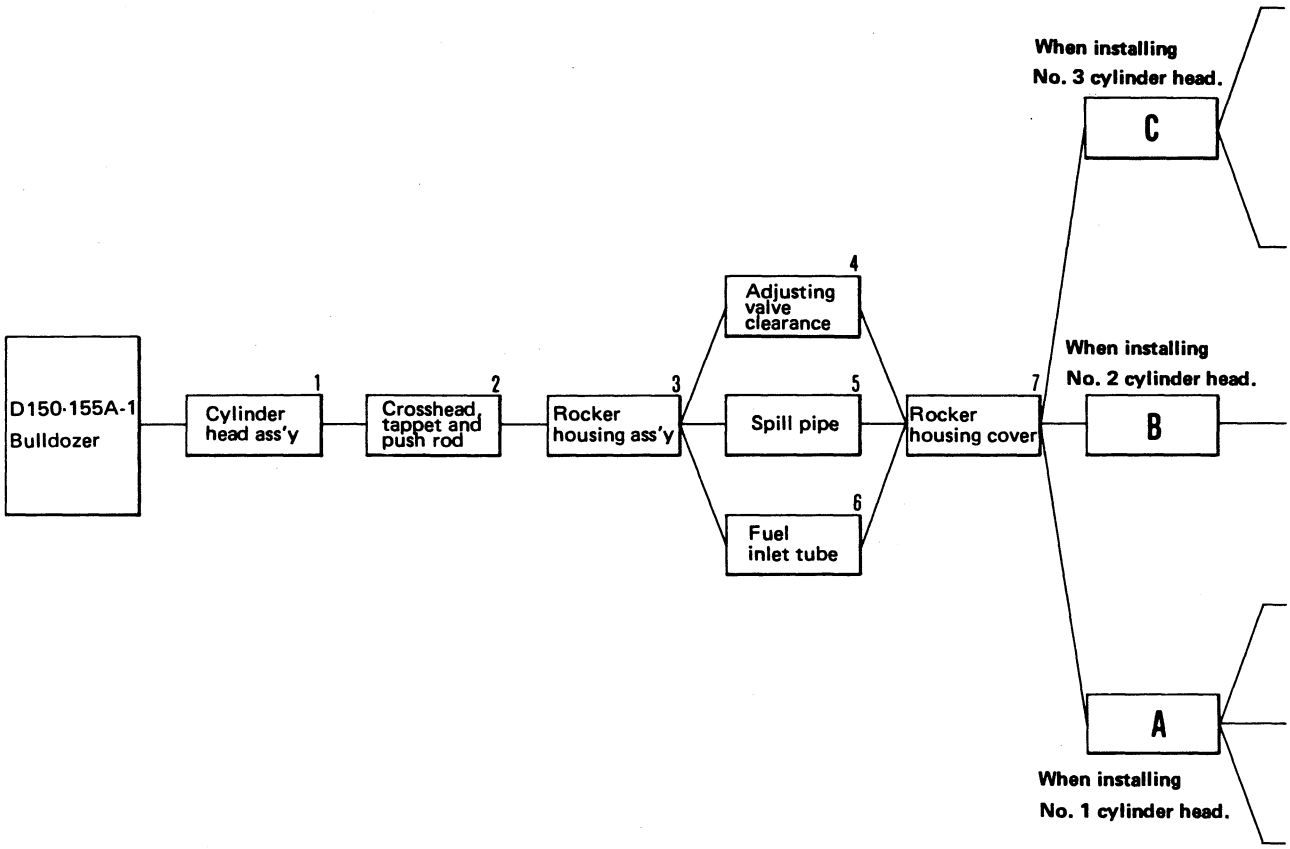
kg Cylinder head assembly: **80 kg**

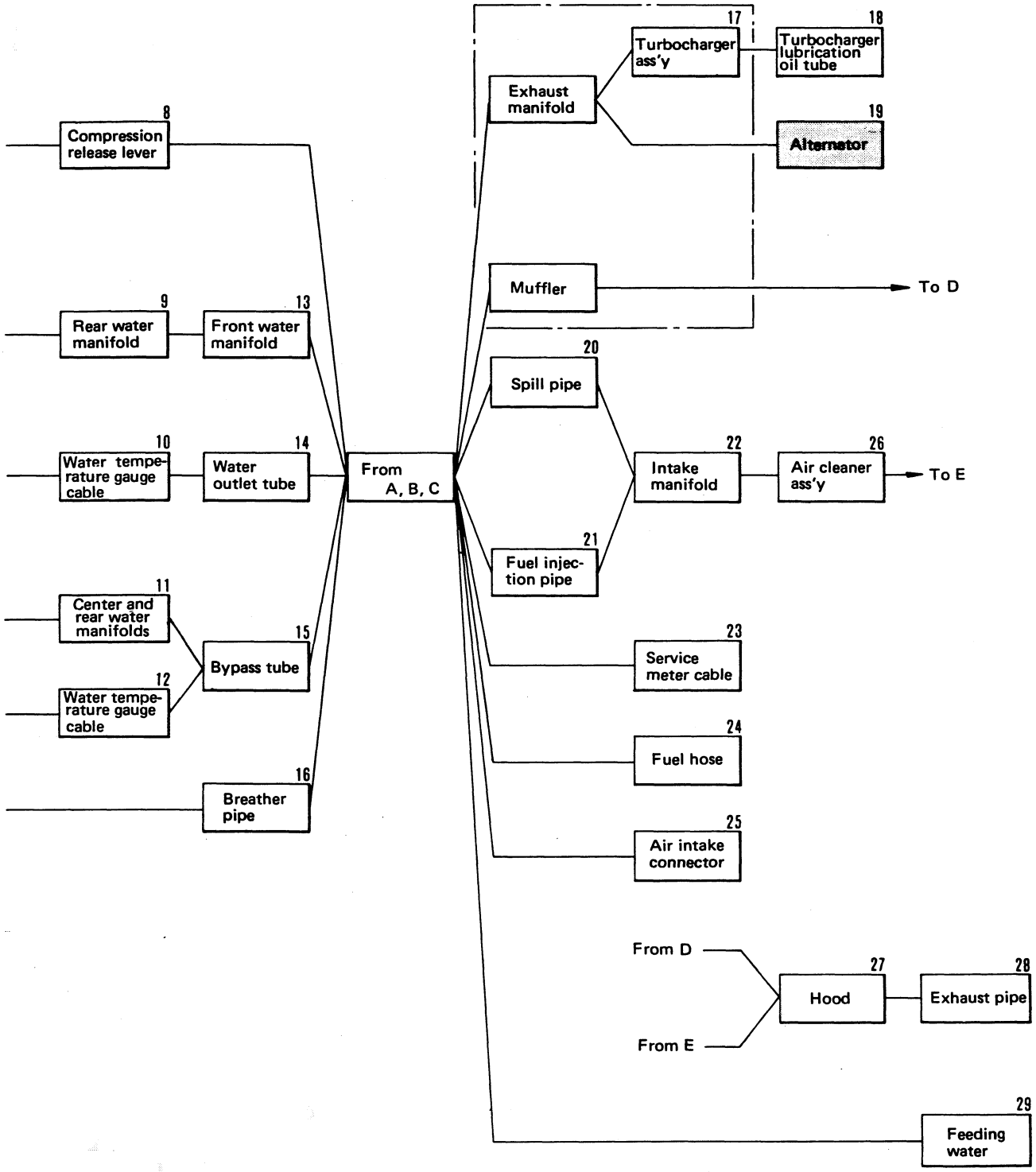




MOUNTING CYLINDER HEAD 

MOUNTING CYLINDER HEAD




8
Compression release lever
9
Rear water manifold
13
Front water manifold
10
Water temperature gauge cable
14
Water outlet tube
11
Center and rear water manifolds
12
Water temperature gauge cable
15
Bypass tube
16
Breather pipe
From A, B, C
17
Turbocharger ass'y
18
Turbocharger lubrication oil tube
Exhaust manifold
19
Alternator
Muffler
To D
20
Spill pipe
22
Intake manifold
26
Air cleaner ass'y
To E
21
Fuel injection pipe
23
Service meter cable
24
Fuel hose
25
Air intake connector
From D
From E
27
Hood
28
Exhaust pipe
29
Feeding water

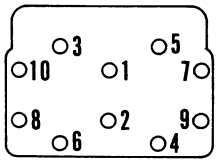
13F017

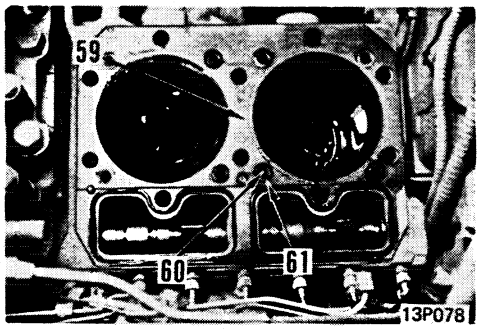
1. Cylinder head assembly

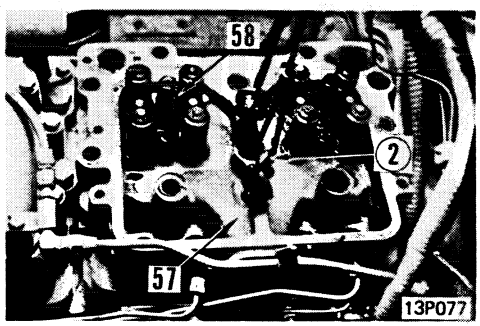
1) Install cylinder head gasket (59) with retainers (60) and grommets (61).
   ★ Install gasket with its carved mark faced to head (up).
2) Screw hanging bolt in cylinder head assembly (57). Sling cylinder head with crane together with nozzle assembly (58) into position.
3) Apply oil to threaded parts of 10 head mounting bolts (56) and tighten them as follows.

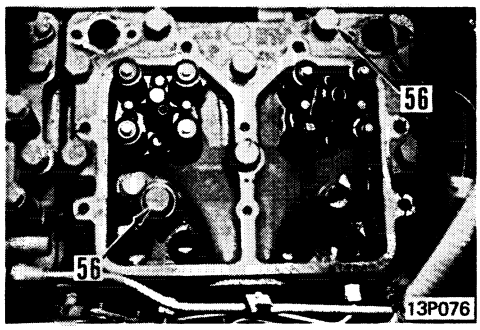
kgm Cylinder head mounting bolts

1st time	26 ~ 32 kg.m
2nd time	41 ~ 47 kg.m
3rd time	54 ~ 56 kg.m







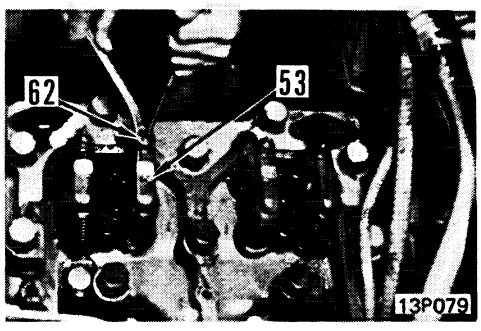


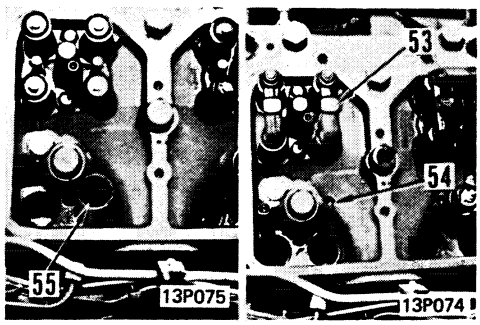
2. Crosshead, tappet and push rod

1) Install crossheads (53) and properly adjust each of them in the following procedure:
   • Loosen lock nut (62)
   • Lightly depress crosshead center with a finger, tighten adjustment screw until it comes into contact with valve. Further give
     ★ 20° turn to a new screw.
     ★ 30° turn to a used screw and then tighten lock nut.

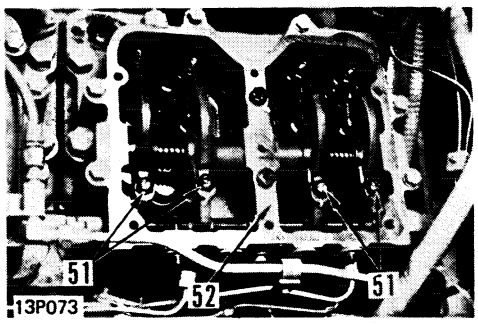
kgm Lock nut: **3.5 ~ 4.5 kg.m**

2) Install tappets (55) coated with engine oil (SAE 30, class CD).
3) Install push rods (54).

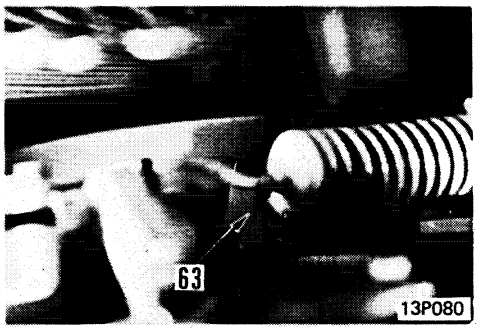


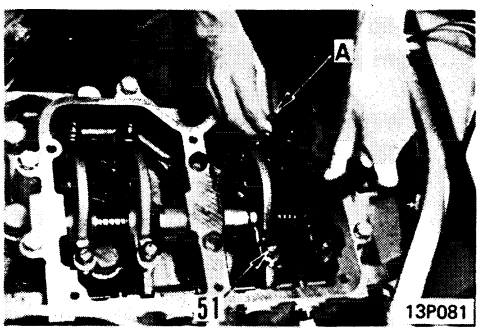


3. **Rocker housing assembly**
Install gasket on cylinder head top surface. Install rocker housing assembly (52) and tighten eight bolts by turns, starting with inside bolts and ending with outside bolts.
★ When securing rocker housing to cylinder head, confirm that rocker lever adjustment screw (51) is fit fully in each push rod socket without fail.



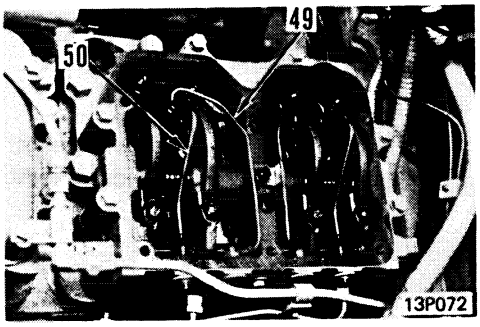
4. **Adjusting valve clearance**
★ Clearance between crosshead and rocker lever must be adjusted to 0.4 mm for intake valve and 0.6 mm for exhaust valve.
1) Place compression release lever in "compression release" position to crank. Bar engine in direction of rotation until "1.6 TOP" mark on cranking damper is in line with pointer (63). Return compression release lever to "decompression" position.
2) In this position, No. 1 cylinder piston is at T.D.C. if both intake and exhaust valves are closed for No. 1 cylinder. Adjust the following valves to get proper clearance respectively:
Exhaust valves of No.1 cylinder
Intake valves of No.2 and No.4 cylinders
Exhaust valves of No.3 and No.5 cylinders
3) To adjust each valve clearance, loosen lock nut and unscrew adjustment screw (51). Thickness gauge A between crosshead and rocker lever; turn screw allowing gauge to move without excessive resistance. Lock adjustment screw A in this position with lock nut.
4) Then, rotate crankshaft one turn and adjust the other
★ If any confusion is suspected with this method, adjust valves in accordance with engine firing order (1-5-3-6-2-4).





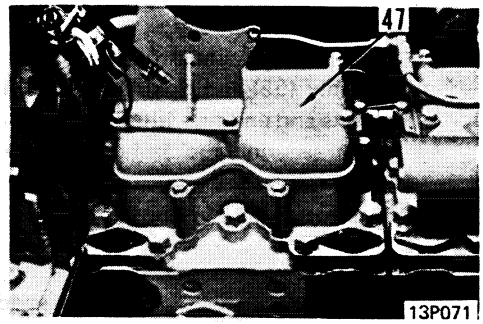
5. **Spill pipe**
Install pipe (50) with joint bolts and seal gaskets on their both sides.

6. **Fuel inlet tube**
Install tube (49) with sleeve nut.



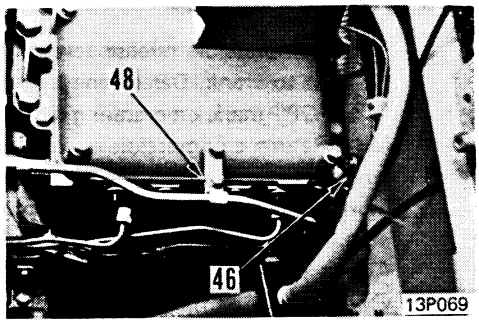
7. **Rocker housing cover**
   1) Apply addhesive (LT-1A) to rocker housing cover (47) and put cork gasket on it.
   2) Install cover.
   3) Install bracket, clamp (48) etc. on the top of cover.

   kgm Cover: **3.0 ~ 3.5 kg.m**



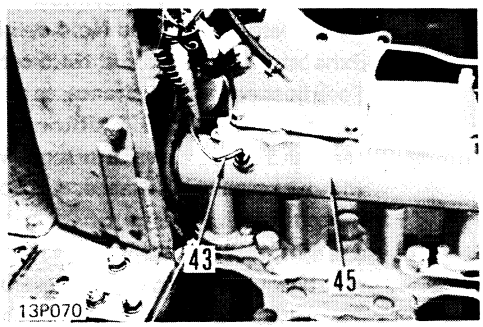
When installing No. 3 cylinder head.

8. **Compression release lever**
   Connect rod (46) and tighten nut.



9. **Rear water manifold**
   Install manifold (45) with retainer and gasket.

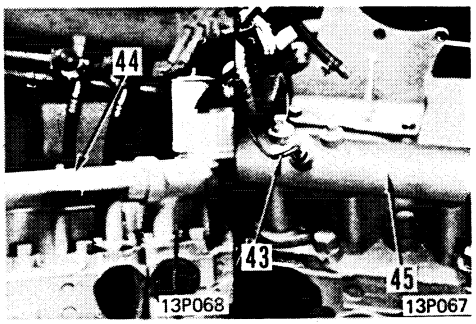
10. **Water temperature gauge cable**
    Connect cable (43) to its connector.



When installing No. 2 cylinder head.

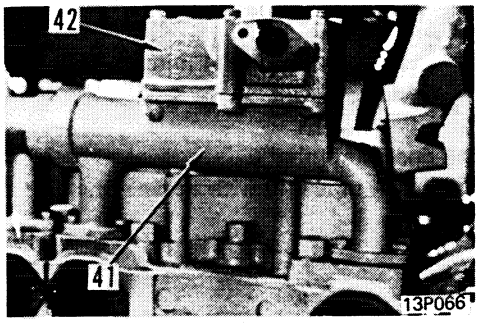
11. **Center and rear water manifolds**
    Install center water manifold (44) and rear water manifold (45) together with retainers and gaskets.

12. **Water temperature gauge cable**
    Connect cable (43) to its connector.

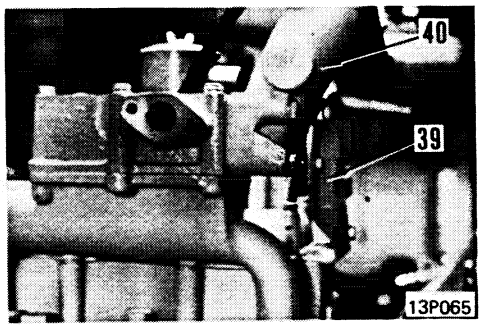


When installing No. 1 cylinder head

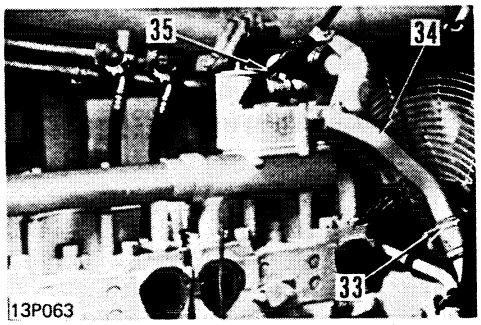
13. **Front water manifold**
    After installing retainer and gasket, install front water manifold (41) together with thermostat housing (42).



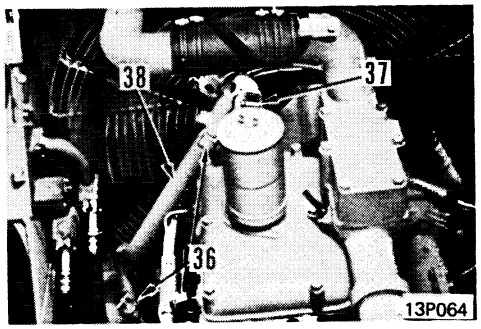
14. Water outlet tube
Connect tube (40) to cylinder head and install bracket (39).



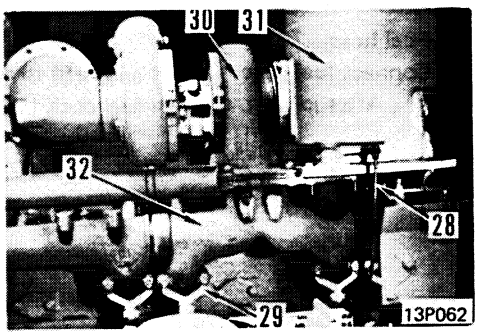
15. Bypass tube
1) Install tube (34) with gasket and tighten hose clamp (33).
2) Install aeration hose (35).



16. Breather pipe
Secure pipe (38) to hose (37) with clamp (36).

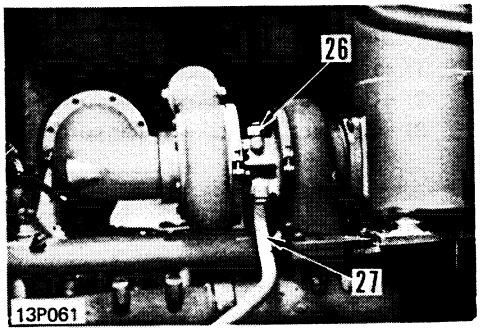


17. Turbocharger, muffler and exhaust manifold assembly
1) Install turbocharger (30), muffler (31) and exhaust manifold (32). Bring the assembly into position.
2) Lock them with lock plate (29)
3) Install drain tube (28) with sleeve nut.



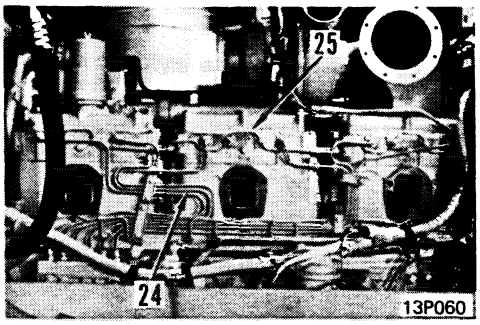
18. Turbocharger lubrication oil tube
1) Install turbocharger drain tube (27) with gasket.
2) Fit gasket on both sides of orifice and install turbocharger lubrication oil tube (26).

19. Alternator
Refer to the MOUNTING ALTERNATOR section

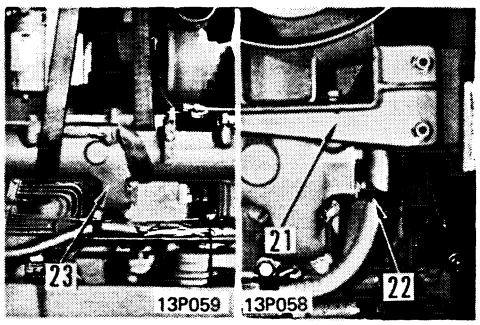


20. Spill pipe
Secure spill piep (25) to rocker housing with joint bolt with gasket on both sides.

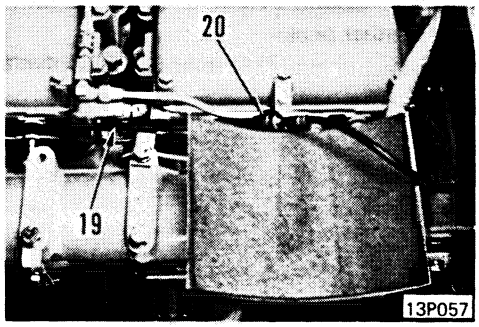
21. Fuel injection pipe
Connect fuel injection pipe (24) to rocker housing.



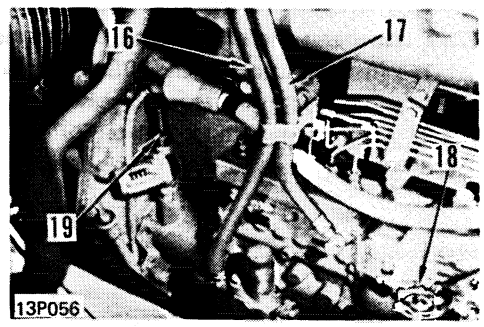
22. Intake manifold
1) Install gasket and install intake manifold assembly (23).
2) Tighten nuts fastening bracket (21).
3) Install harness clamp (22).



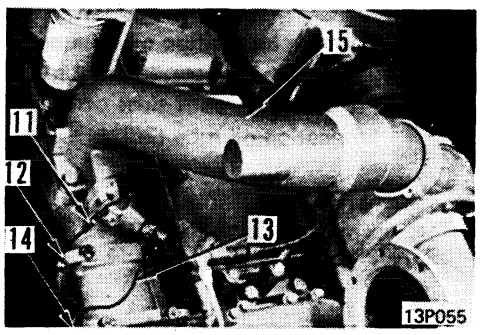
23. Service meter cable
Connect cable to service meter (19) and to joint (20).



24. Fuel hose
Connect fuel hoses (17) and (16) to fuel injection pump.
★ After joining, open fuel cock (18).

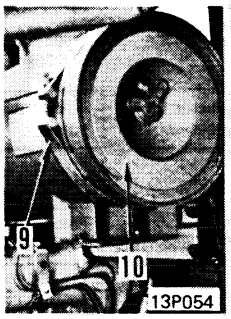


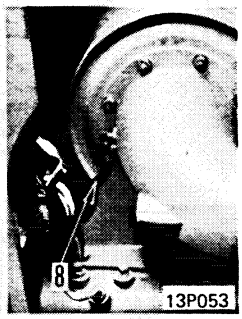
25. Air intake connector
1) Install air intake connector (15) with gasket.
2) Connect air intake heater fuel tube (13) and clamp (14).
3) Connect air intake heater cord (11) and clamp (12).



26. Air cleaner assembly

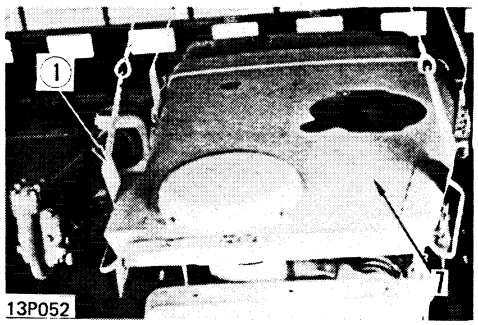
1) Secure air cleaner (10) to bracket with band (9) and eight nuts.
2) Connect dust indicator hose (8) to air cleaner.





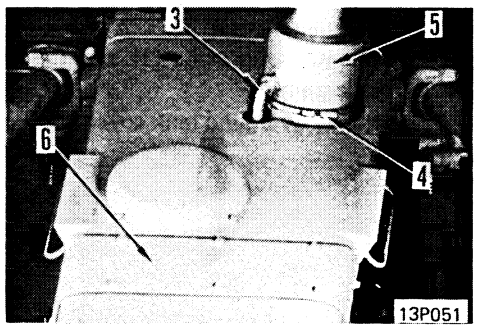
27. Hood

1) Install hook (7) on position using sling tool ① . Lock catches inside hood.
2) Install cover (6).



28. Exhaust pipe

1) Install exhaust pipe (5) with gasket and tighten clamp (4).
2) Connect ejector pipe (3) to exhaust pipe with gasket installed.

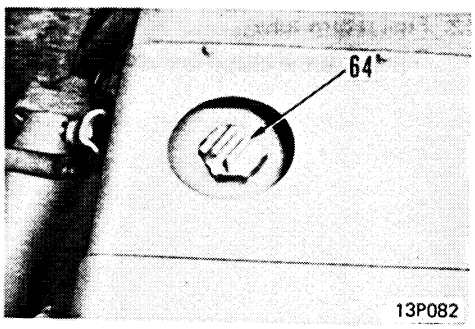


29. Feeding water

After confirming that drain cock is closed, open radiator cap (64) and feed coolant into radiator.

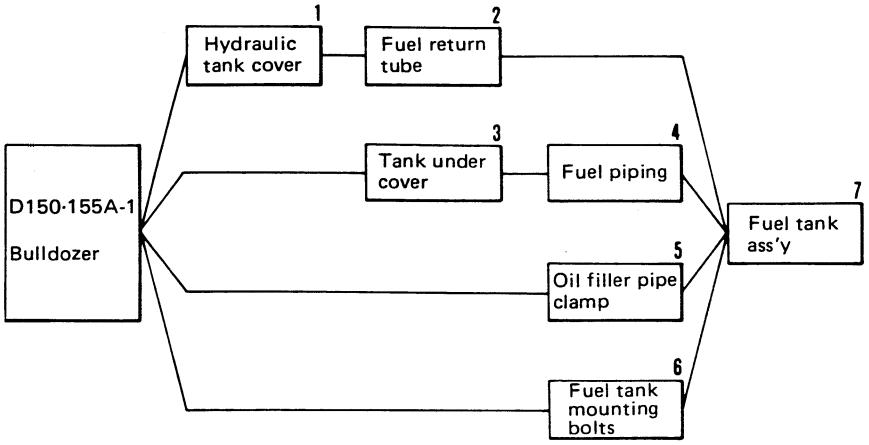
★ When changing coolant, replace corrosion resistor element.

Coolant capacity: **approx. 150** ℓ



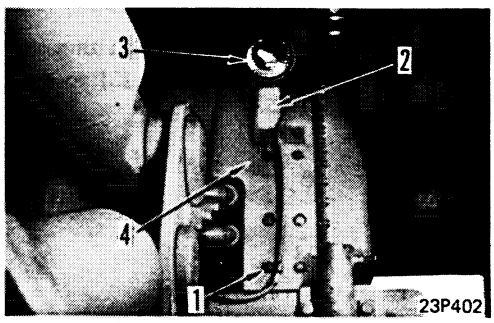
DISMOUNTING FUEL TANK

D150A 8408 and up
D155A 15001 – 25000



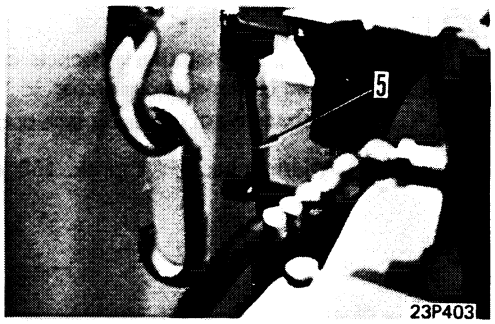
23F074

1. Hydraulic tank cover
1) Remove clamp bolts (1) and then bracket (2) together with rear lamp (3).
2) Remove hydraulic tank cover (4).



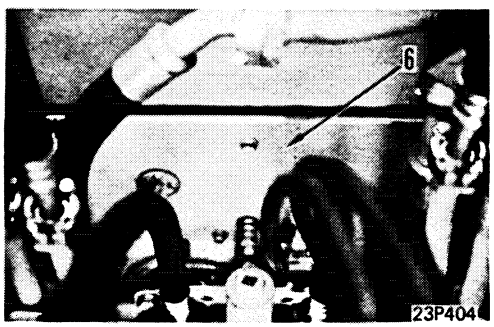
23P402

2. Fuel return tube
Remove the clamp and disconnect tube (5).



23P403

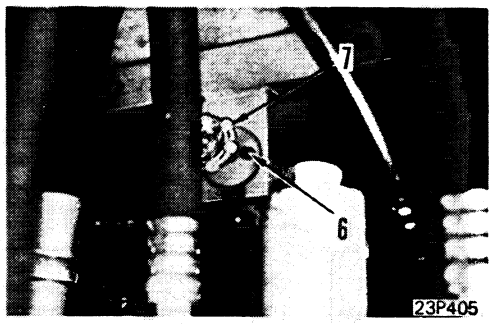
3. Tank under cover
Remove cover (6).



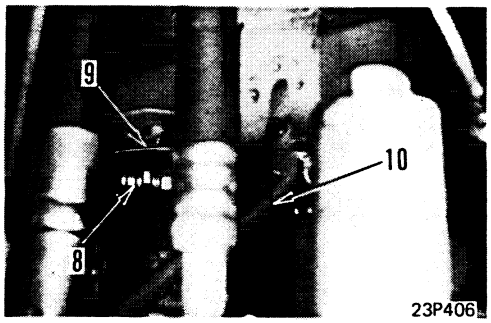
23P404

4. Fuel piping

1) Completely close the fuel tank outlet valve.
2) Remove bolt (6) and detach drain valve (7) from the support.

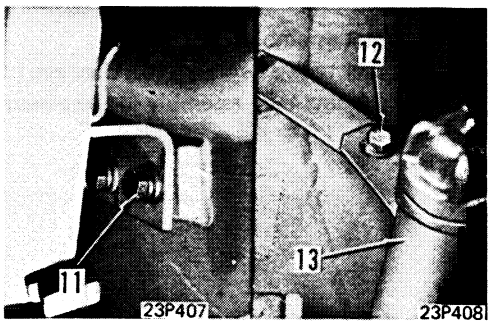


3) Disconnect fuel outlet hose (8) and priming pump tube (9), and pull out drain hose (10) from the clamp.



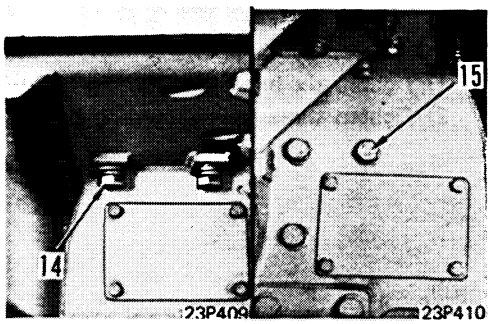
5. Steering clutch case oil filler pipe clamp

Remove oil filler pipe mounting bolts (11) and (12), and remove oil filler pipe (13) from the tank.



6. Fuel tank mounting bolts

1) Remove three bolts (14) securing the L.H. tank from the underside of the fender.
2) Remove six bolts (15) securing the bracket from the underside of the fender.

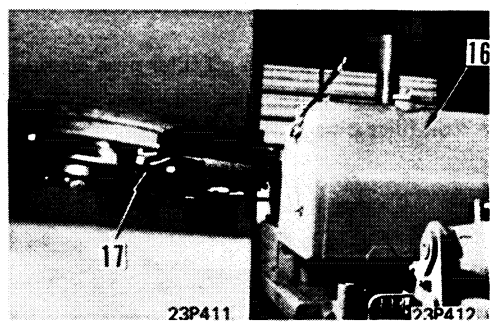


7. Fuel tank assembly

1) Lift fuel tank assembly (16) and shift it backward, and disconnect fuel gauge cable (17).
2) Lift off the fuel tank assembly.

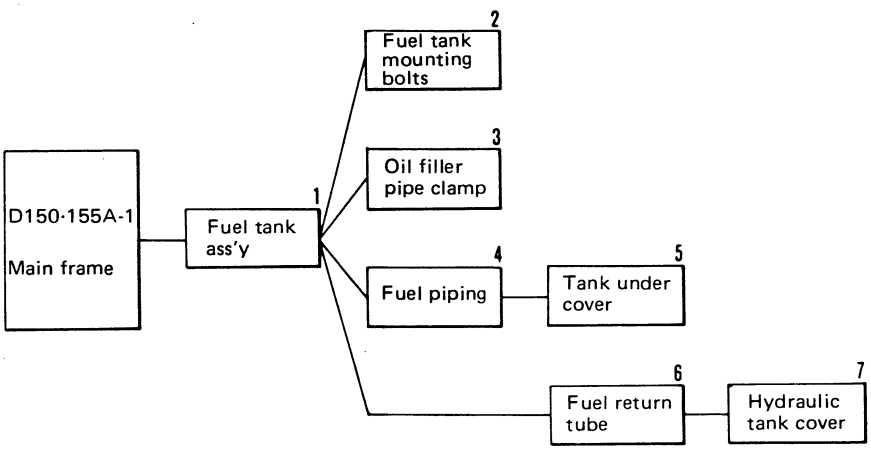
kg Fuel tank assembly: **220kg**

★ To protect the valve on the lower part of the fuel tank from damage, put the tank assembly on a wooden block at least 150 mm thick.



MOUNTING FUEL TANK

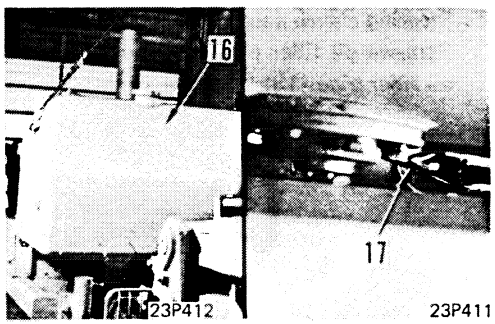
D150A 8408 and up
D155A 15001 – 25000



23F075

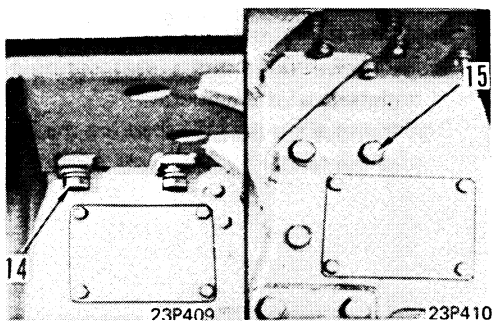
1. Fuel tank assembly

Sling fuel tank assembly (16), connect fuel gauge cable (17), then place the fuel tank assembly in the mounting position.



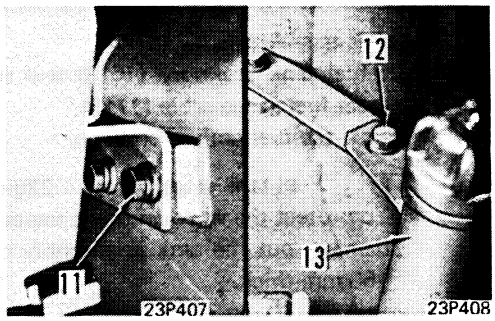
2. Fuel tank mounting bolts

1) Tighten six bracket mounting bolts (15) on the R.H. fender.
2) Tighten three tank mounting bolts (14) on the L.H. fender.

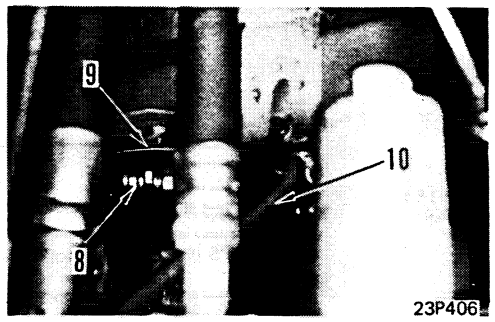


3. Steering clutch case oil filler pipe clamp

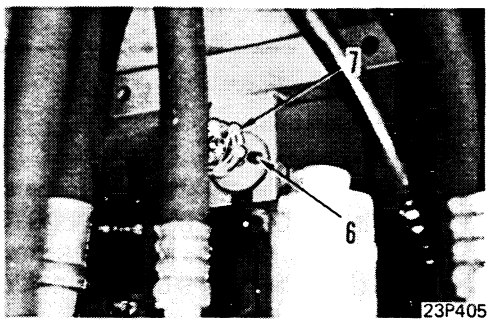
Tighten oil filler pipe mounting bolts (11) and (12), and connect oil filler pipe (13) to the tank.



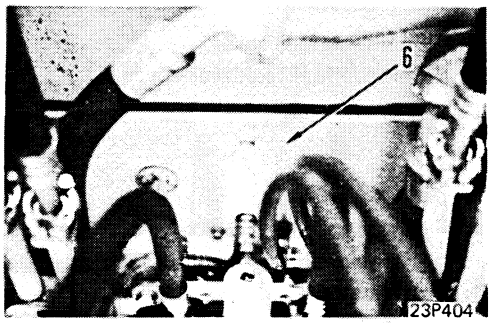
4. **Fuel piping**
   1) Connect fuel outlet hose (8) and priming pump tube (9), and insert drain hose (10) into the clamp.



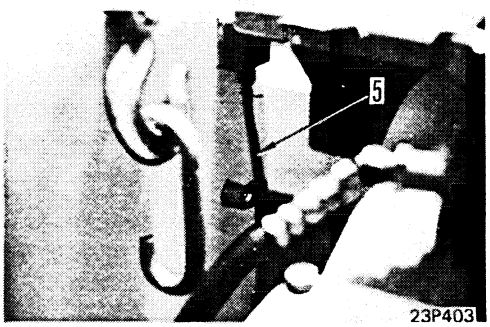
   2) Connect drain valve (7) to the support, and tighten bolt (6).
      ★ Fully open the fuel tank outlet valve.



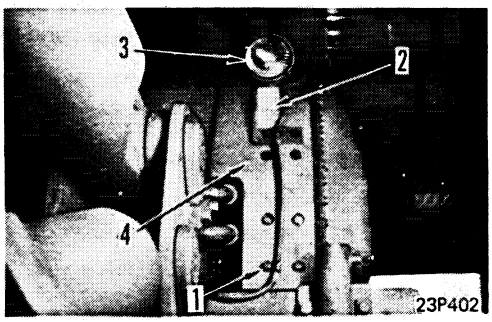
5. **Tank under cover**
   Install cover (6).



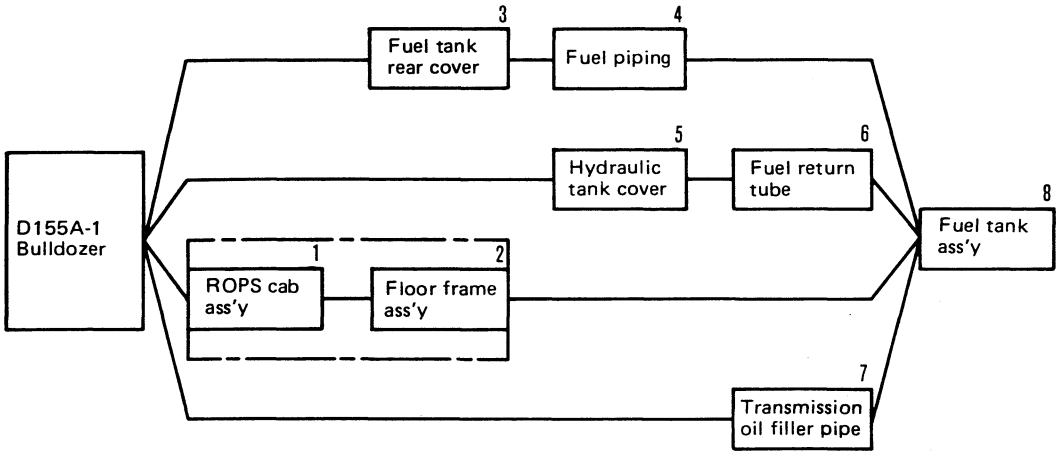
6. **Fuel return tube**
   Connect tube (5) and tighten the clamp.



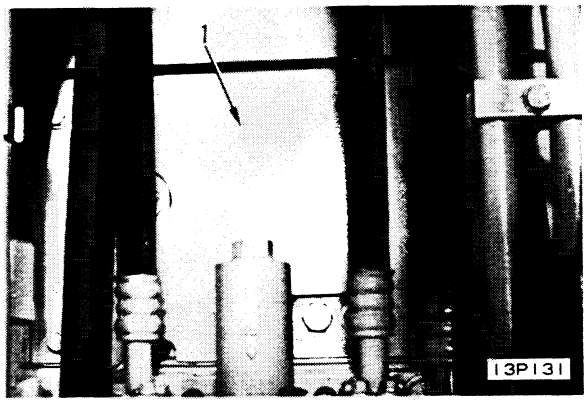
7. **Hydraulic tank cover**
   1) Install hydraulic tank cover (4).
   2) Install bracket (2) together with rear lamp (3), and tighten clamp bolts (1).



DISMOUNTING FUEL TANK D155A 25001 and up

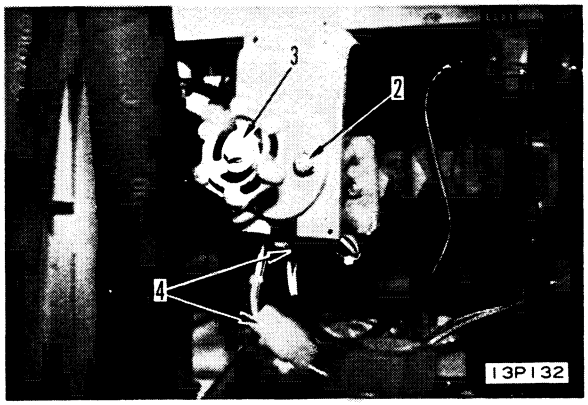


1. **ROPS cab assembly**
2. **Floor frame assembly**
   To tilt the ROPS cab and floor frame assembly, see TILTING ROPS CAB AND FLOOR FRAME ASSEMBLY. To remove the ROPS cab assembly, see DISMOUNTING ROPS CAB ASSEMBLY.

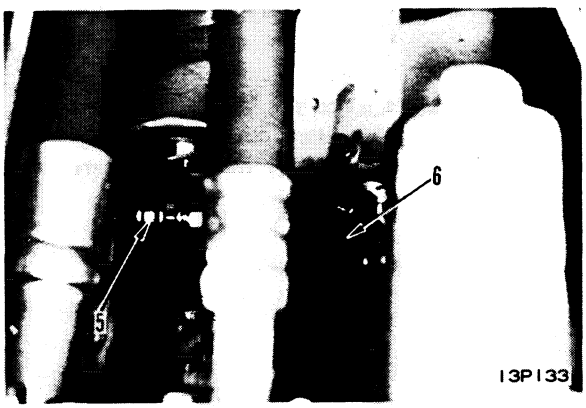


3. **Fuel tank rear cover**
   Remove fuel tank rear cover (1).

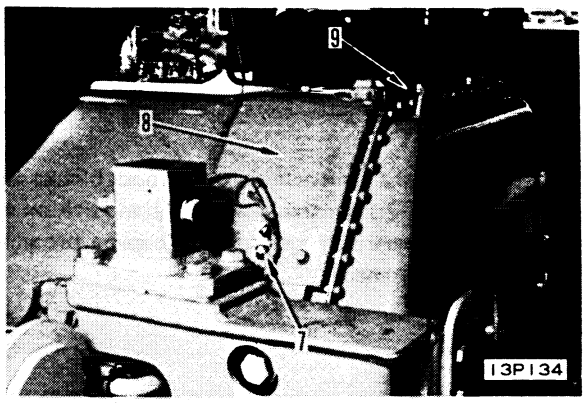
4. **Fuel piping**
   1) Remove bolt (2), and detach drain valve (3) from the support.
   2) Disconnect the fuel gauge cable from connector (4).



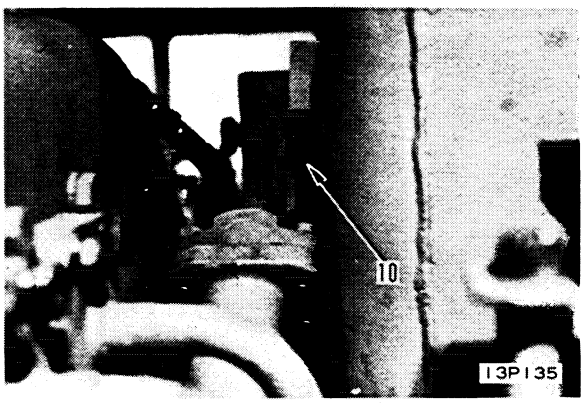
   3) Close the fuel tank outlet valve to the full.
   4) Disconnect fuel outlet hose (5), and pull out drain hose (6) from the clamp.



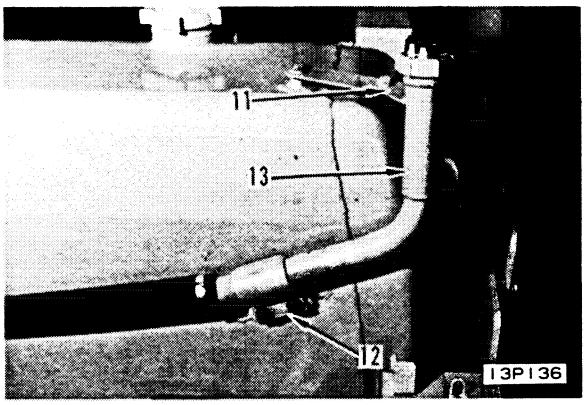
5. **Hydraulic tank covers**
   Remove the bolt from clamp (7), and then hydraulic tank covers (8) and (9).



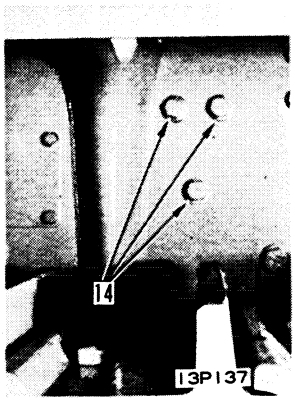
6. **Fuel return tube**
   Remove the clamp, and disconnect fuel return tube (10).

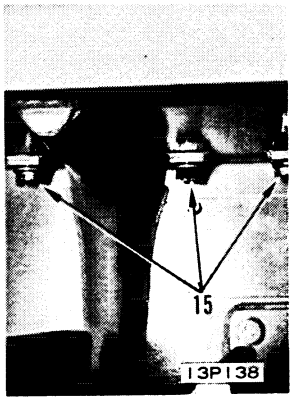


7. **Transmission oil filler pipe**
   Remove brackets (11) and (12), and remove oil filler pipe (13) from the fuel tank.



8. **Fuel tank assembly**
   1) Remove six R.H. mounting bolts (14) and three L.H. mounting bolts (15) from the underside of the fender.

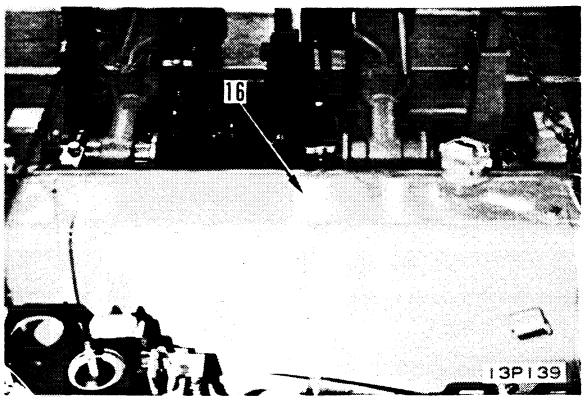




2) Slowly lift off fuel tank assembly (16), taking care not to let it hit any nearby part.

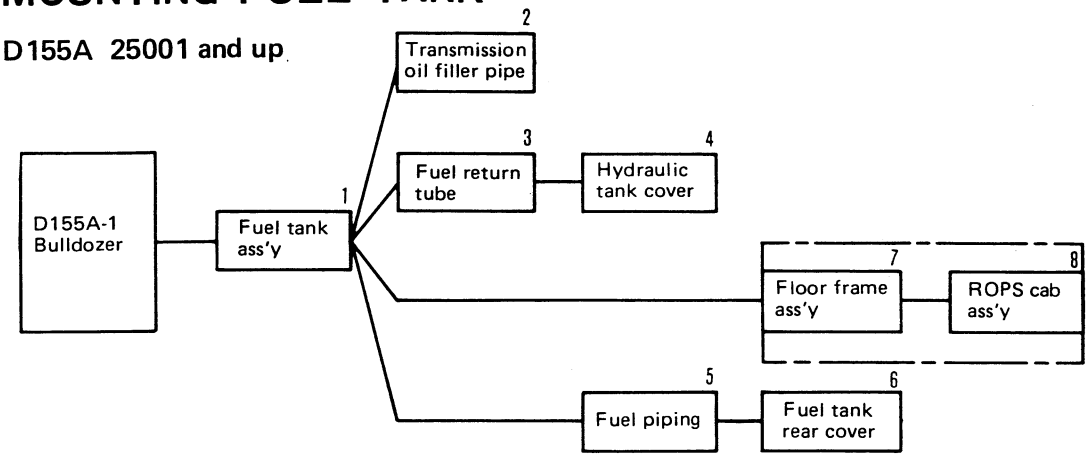
kg Fuel tank assembly: **220kg**

★ Place the tank assembly on wooden blocks of at least 150 mm thick so that the valve on the lower part of the fuel tank can be protected from damage.



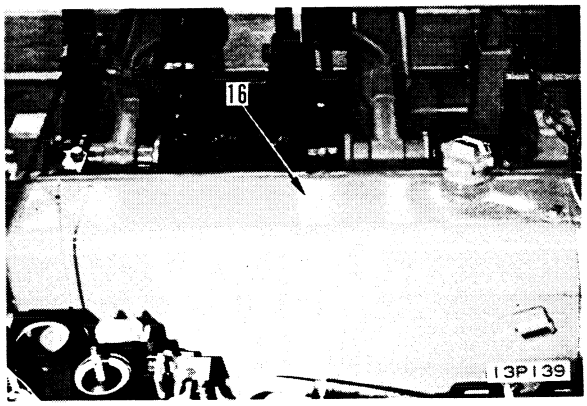
MOUNTING FUEL TANK

D155A 25001 and up

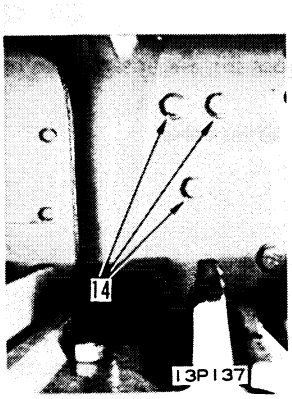


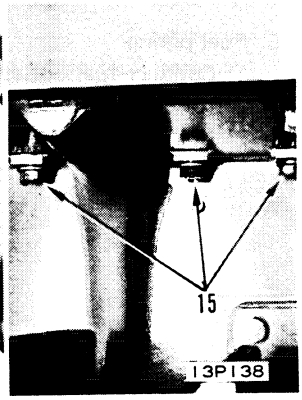
1. Fuel tank assembly

1) Slowly lower fuel tank assembly (16), taking care not to let it hit any nearby part, and place it in the mounting position.



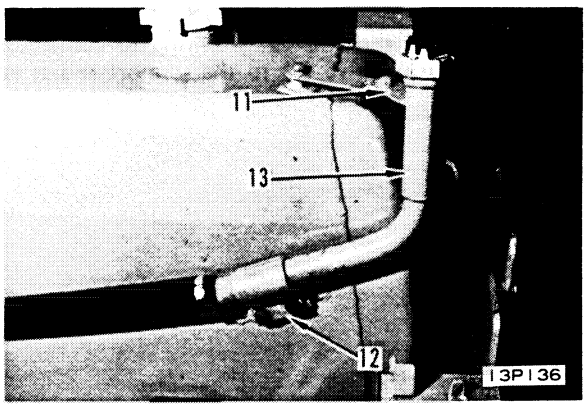
2) Tighten six R.H. mounting bolts (14) and three L.H. mounting bolts (15) on the underside of the fender.



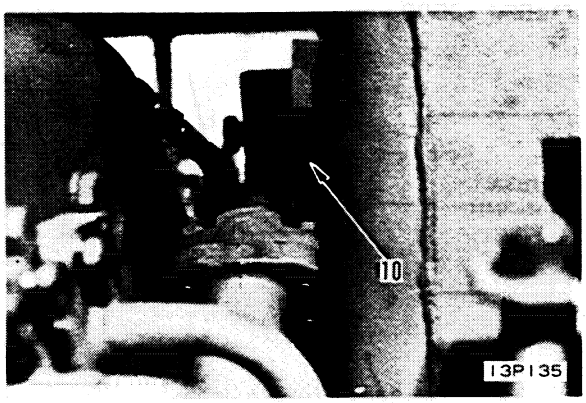


2. Transmission oil filler pipe

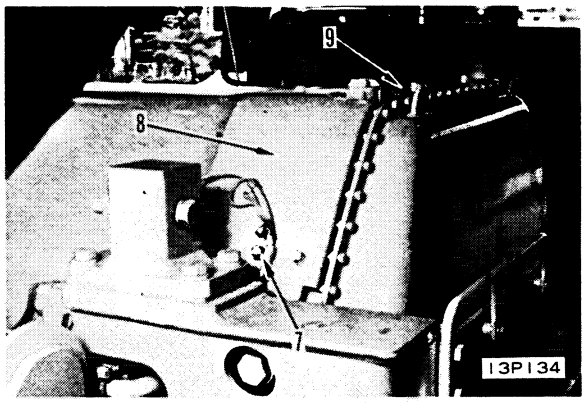
Tighten mounting bolts (11) and (12), and install oil filler pipe (13) to the fuel tank assembly.



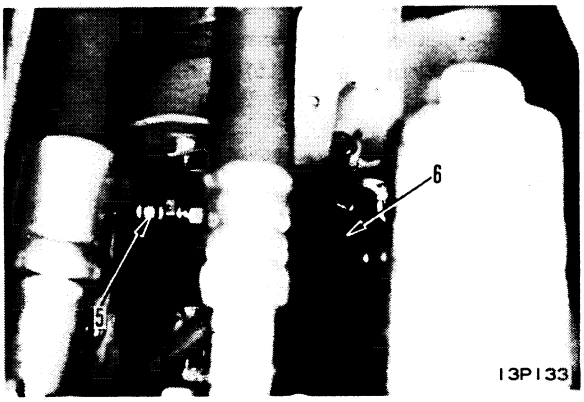
3. **Fuel return tube**
   Connect fuel return tube (10), and install the clamp.



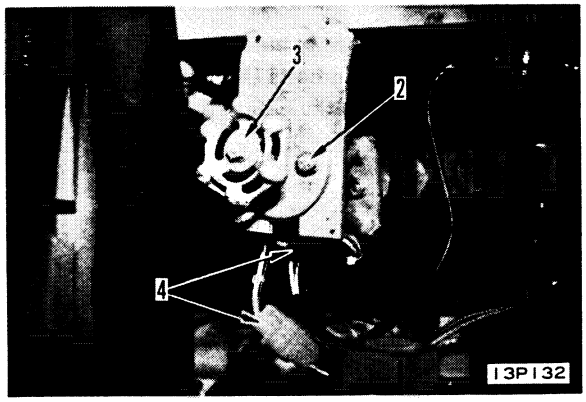
4. **Hydraulic tank covers**
   Install hydraulic tank covers (8) and (9), and tighten the covers together with clamp (7) for the rear lamp wiring.



5. **Fuel piping**
   1) Connect fuel outlet hose (5), and insert drain hose (6) into the clamp.
   2) Fully open the fuel outlet valve.



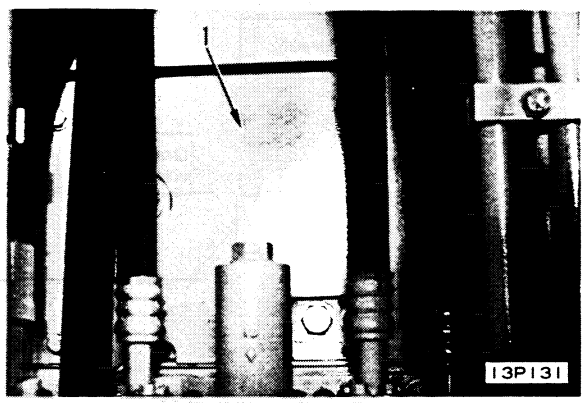
   3) Connect the fuel gauge wiring to connector (4).
   4) Install drain valve (3) to the support and tighten bolt (2).



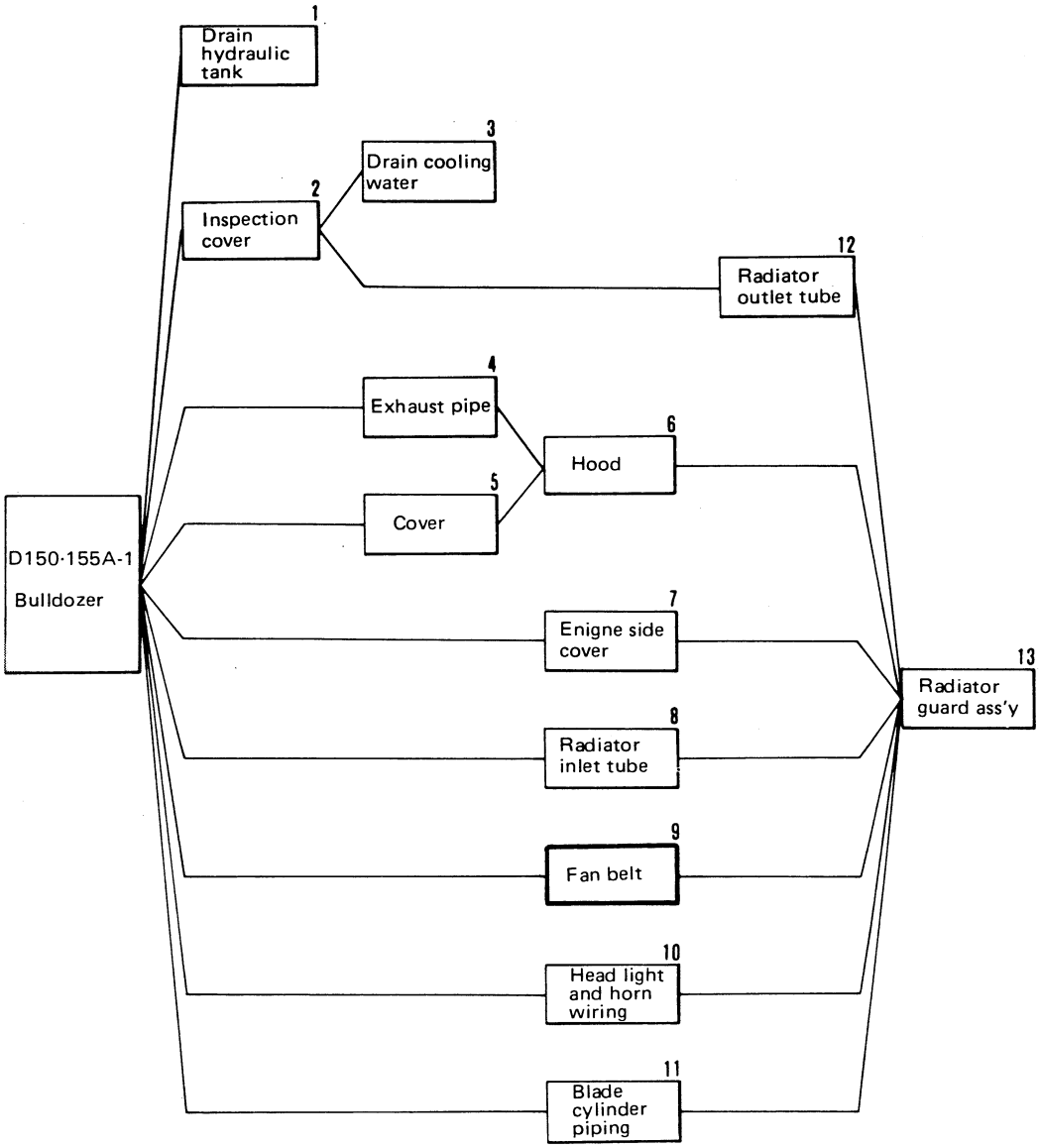
6. **Fuel tank rear cover**
   Install fuel tank rear cover (1).

7. **Floor frame assembly**

8. **ROPS cab assembly**
   To return the ROPS cab and floor frame assembly to its original position, see RETURNING ROPS CAB AND FLOOR FRAME ASSEMBLY TO ORIGINAL POSITION to mount the ROPS cab, see MOUNTING ROPS CAB.



DISMOUNTING RADIATOR GUARD



23F078

Special tool required

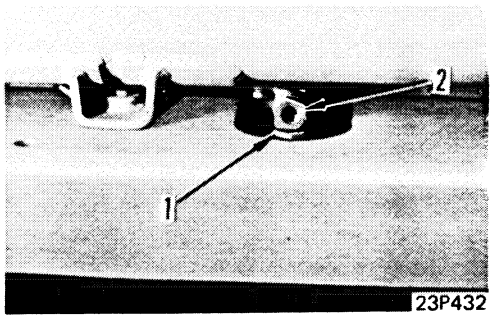
Part number	Part name	Q'ty
790-401-1400	Lifting tool	1

1. Drain hydraulic tank

Remove drain plug (1) and open drain valve (2) to drain the hydraulic oil.

Hydraulic tank capacity: **164 ℓ (For tiltdozer)**
153 ℓ (For angledozer)

★ Draining is necessary only when removal of the radiator guard assembly follows the removal of the engine assembly. It is not necessary when only the radiator guard is removed.

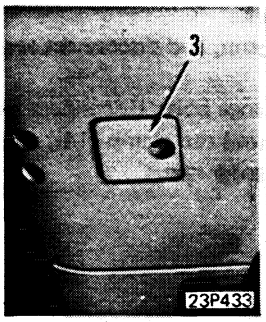


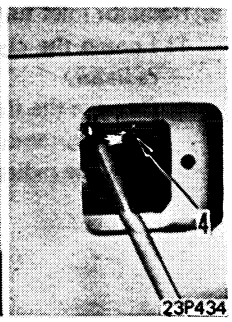
23P432

2. Inspection cover
Remove inspection cover (3).

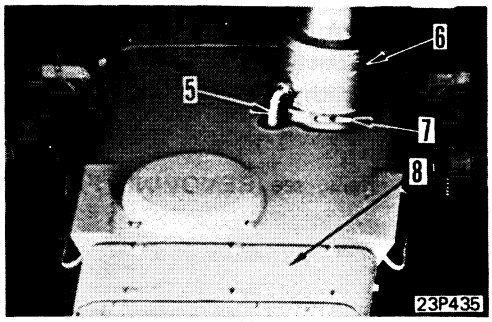
3. Drain the cooling water
Open drain valve (4) to drain the cooling water.
★ If the coolant contains antifreeze, dispose of it correctly. Reuse the coolant as long as it is resistant to corrosion.

Cooling water capacity: **150 ℓ**





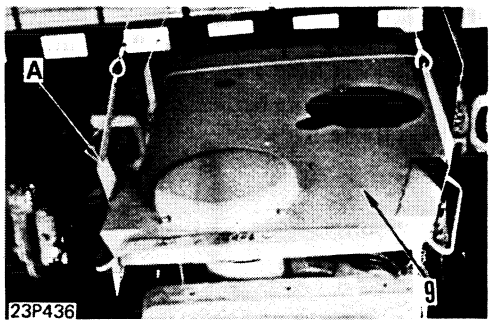
4. Exhaust pipe
1) Remove the flange bolts, and remove ejector pipe (5) from exhaust pipe (6).
2) Remove clamp (7) and exhaust pipe (6).
★ Also remove the gasket from the exhaust pipe mounting section.



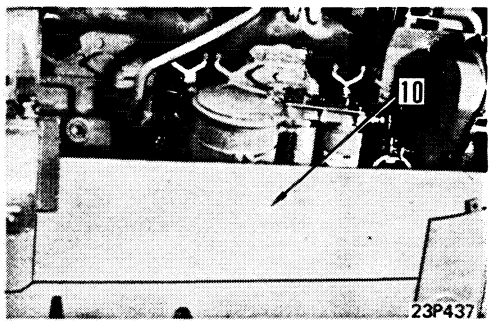
5. Cover
Remove cover (8).

6. Hood
Unhook the R.H. and L.H. hood latches, and lift off hood (9) with the aid of lifting tool A.

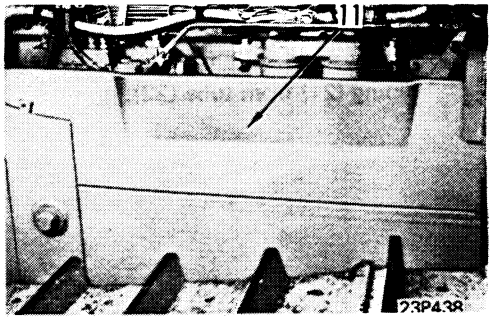
kg Hood: **60 kg**



7. R.H. and L.H. engine side covers
1) Remove R.H. engine side cover (10).

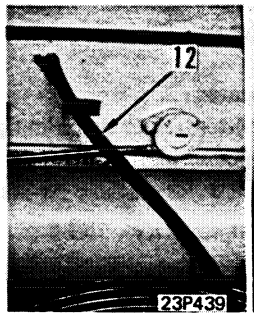


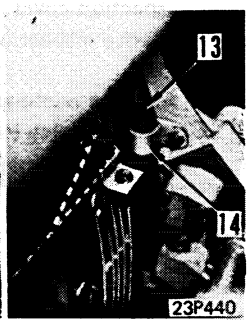
2) Remove L.H. engine side cover (11).



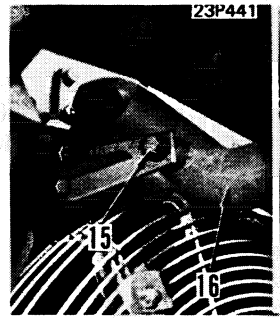
8. Rediator inlet tube

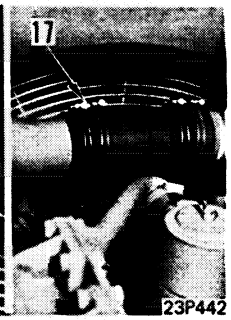
1) Loosen the clamp, and disconnect aeration hose (12) from the radiator.
2) Remove the flange bolts, disconnect bypass tube (13) from the radiator, remove hose clamp (14), and remove the bypass tube from the radiator guard.





3) Remove clamp bolt (15) and the flange bolts, disconnect radiator inlet tube (16) from the radiator, and loosen clamp (17) to remove the tube.



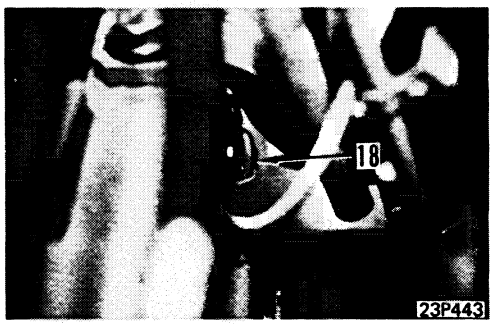


9. Fan belt

For details, see REMOVING FAN BELT. (ENGINE section)

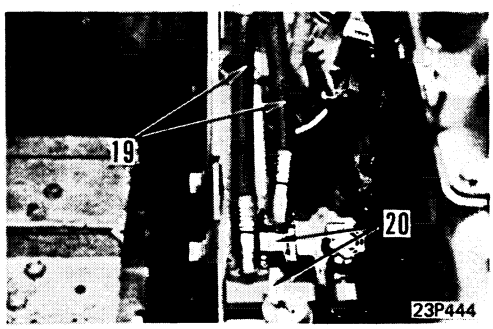
10. Head light and horn wiring

Disconnect head light and horn wiring (18) from the connectors, remove the wire harness clamps, and remove the harness from the main frame.

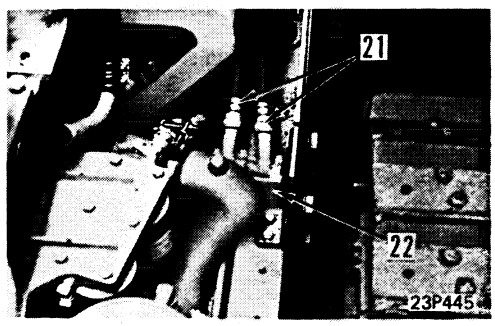


11. R.H. and L.H. blade cylinder piping

1) Remove the split flange, and disconnect L.H. blade cylinder piping (19) from tube (20).

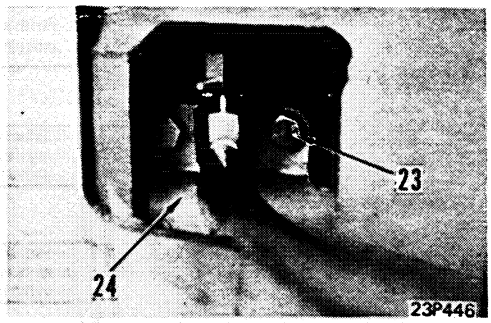


2) Remove the split flange, and disconnect R.H. blade cylinder piping (21) from tube (22).



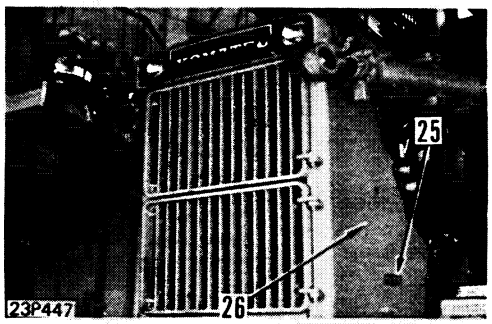
12. Radiator outlet tube

Remove flange bolts (23), and disconnect radiator outlet tube (24) from the lower tank.



13. Radiator guard assembly

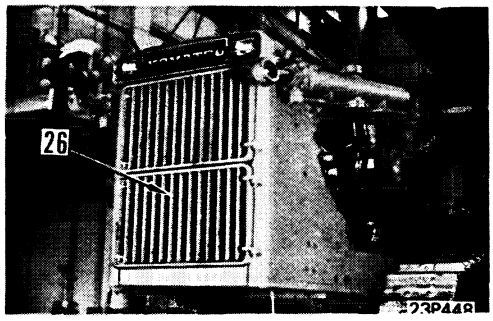
1) Sling radiator guard assembly with four ropes hooked to the cylinder stays and cylinder mounting brackets, and remove R.H. and L.H. mounting bolts (25).



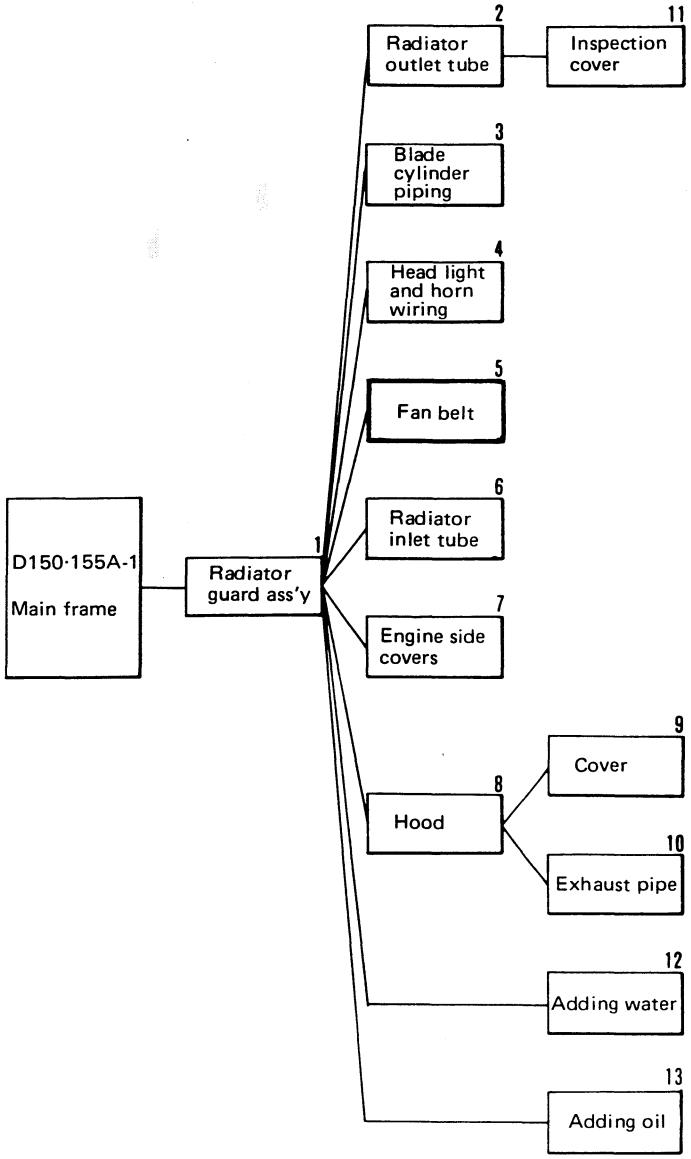
2) Dismount radiator guard assembly (26) by shifting it toward the front of the machine body.

kg Radiator guard assembly: **2200 kg**

★ After dismounting the radiator guard assembly, remove the gasket from between the radiator outlet tube and the radiator lower tank.



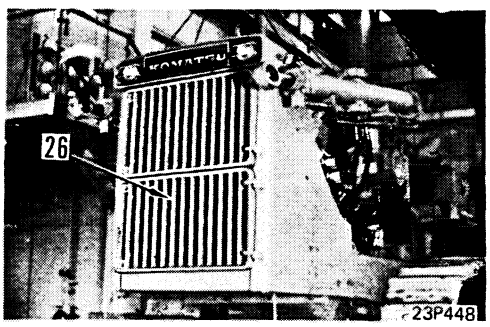
MOUNTING RADIATOR GUARD

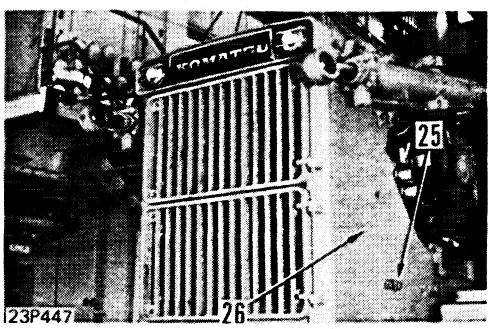


23F079

Special tool required

Part number	Part name	Q'ty
790-401-1400	Lifting tool	1





1. Radiator guard assembly

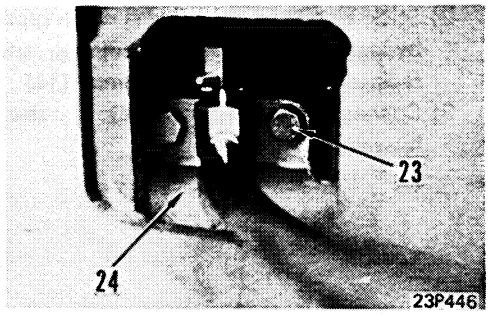
Sling radiator guard assembly (26) with a crane and install it to the main frame. Tighten R.H. and L.H. mounting bolts (25).

★ Sling the radiator guard assembly horizontally.

kgm Mounting bolts: **84 – 105 kgm**

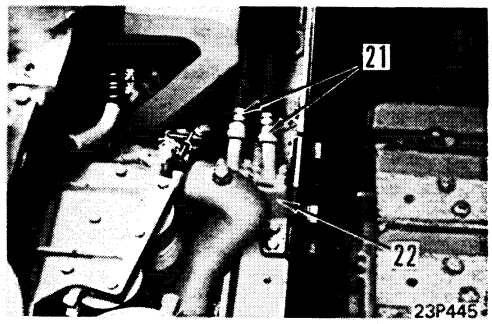
2. Radiator outlet tube

Stick a gasket to the flange with liquid gasket (LG-1), and connect radiator outlet tube (24) to the lower tank with mounting bolts (23).

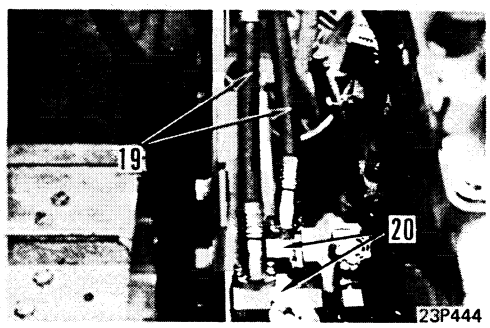


3. R.H. and L.H. blade cylinder piping

1) Fit an O-ring to the flange, and use a split flange to connect R.H. blade cylinder piping (21) to tube (22).



2) Fit an O-ring to the flange, and use a split flange to connect L.H. blade cylinder pipe (19) to tube (20).

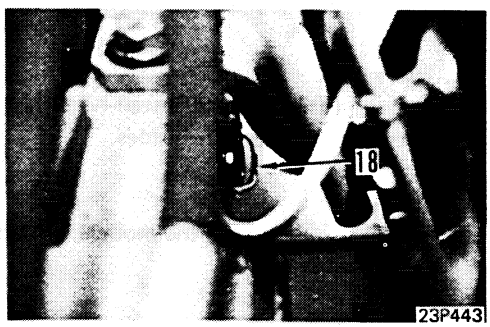


4. Head light and horn wiring

Secure the wire harness to the main frame with clamps, and connect head light and horn wiring (18) to the connectors.

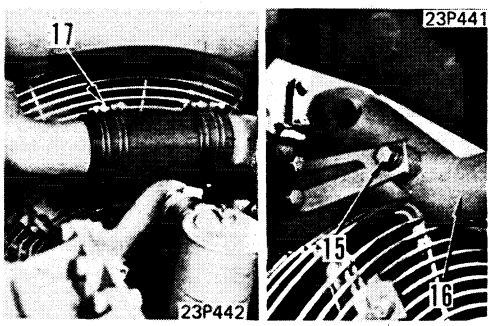
5. Fan belt

For details, see "INSTALLING FAN BELT" (ENGINE section)

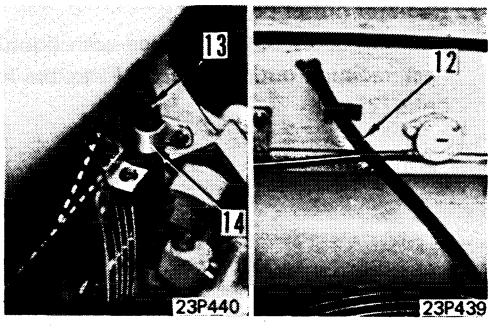


6. Radiator inlet tube

1) Stick a gasket to the flange with liquid gasket (LG-1), install radiator inlet tube (16) to the radiator by inserting it into the hose, and secure the inlet tube with clamp bolt (15) and clamps (17).

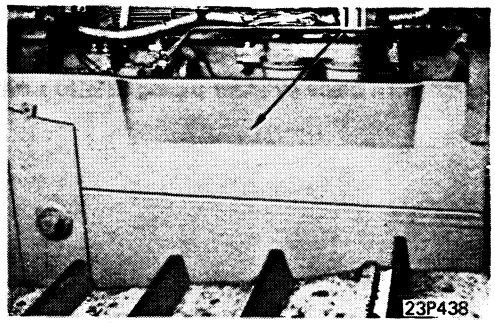


2) Stick a gasket to the flange with liquid gasket (LG-1), connect bypass tube (13) to the radiator, and secure the tube to the radiator guard with hose clamp (14).
3) Connect aeration hose (12) to the radiator, and secure the hose with clamps.

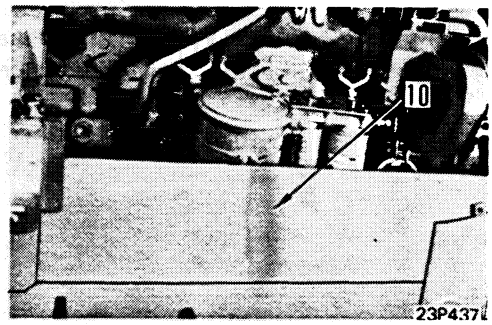


7. R.H. and L.H. engine side covers

1) Install L.H. engine side cover (11).



2) Install R.H. engine side cover (10).

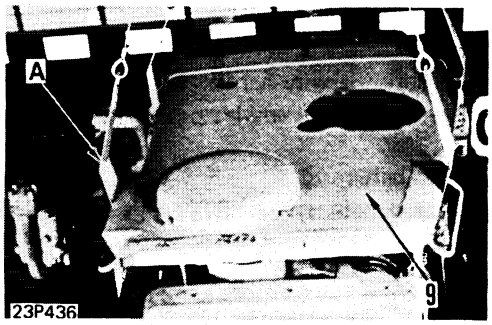


8. Hood

Use the lifting tool to install hood (9), and secure the hood with hooks on R.H. and L.H. sides.

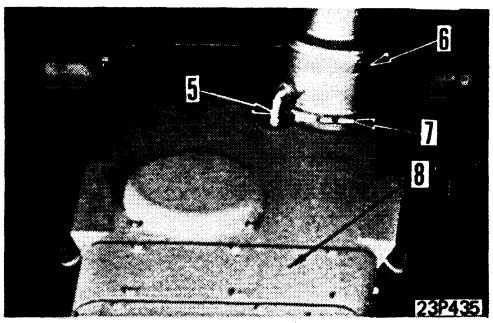
9. Cover

Install cover (8) with the mounting bolts for the hood.



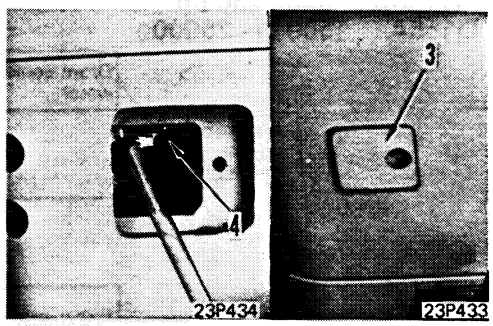
10. Exhaust pipe

1) Fit a gasket onto the mounting section, install exhaust pipe (6), and secure the exhaust pipe with clamp (7).
   ★ When installing the exhaust pipe, align it with the KOMACLONE tube.
2) Fit a gasket to the flange, and connect ejector pipe (5) to exhaust pipe (6).



11. Inspection cover

Close drain valve (4) and install inspection cover (3).



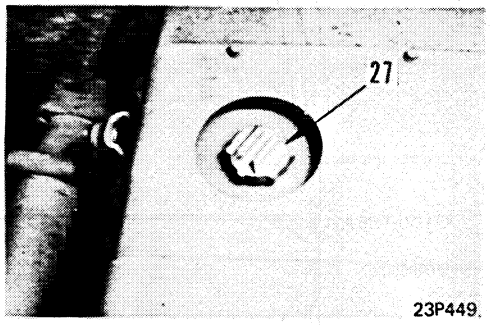
12. Adding water

Add water through filler (27).

★ Use soft water as the coolant.

★ Add water slowly until it overflows the water filler.
If water is added quickly, the filler may overflow, making it appear as if the radiator is completely filled up.

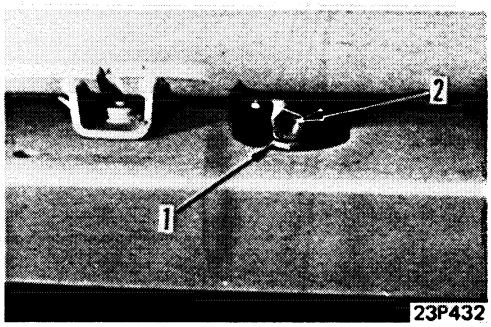
★ Do not remove the strainer from the water filler while adding water.



13. Adding oil

1) Close drain valve (2). Fit an O-ring and install drain plug (1).

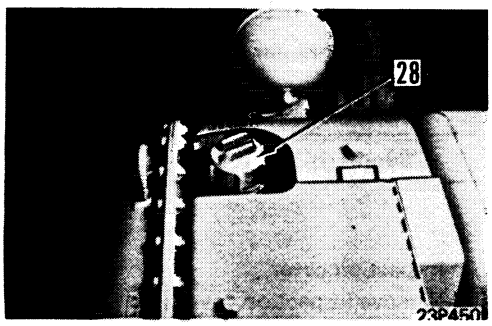
kgm Drain plug: **13 – 18 kgm**



2) Add E010-CD oil through oil filler (28).

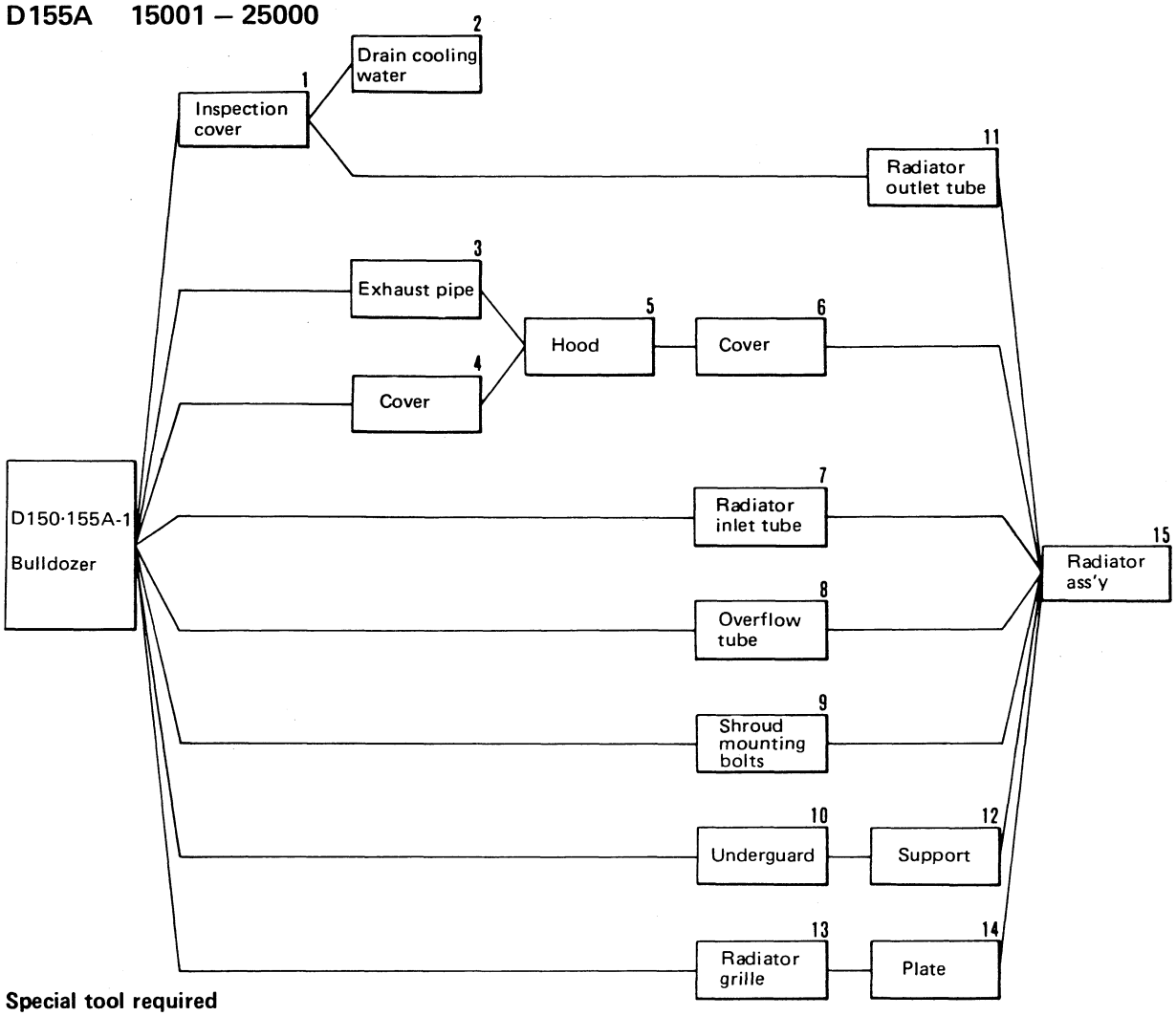
★ While adding the oil to the tank, check the oil level with the oil gauge on the hydraulic tank cover.
After adding oil, start the engine to circulate the oil throughout the system, then check the oil level again.

★ Do not remove the strainer from the oil filler while adding oil to the tank.



DISMOUNTING RADIATOR

D150A 8408 and up
D155A 15001 – 25000

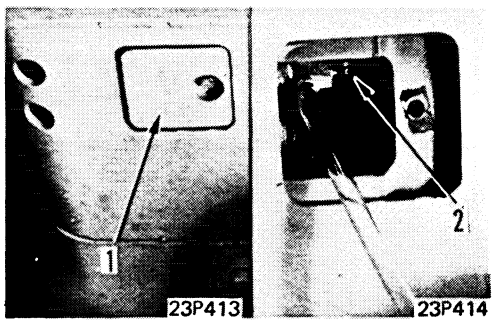


23F076

Special tool required

Part number	Part name	Q'ty
790-401-1400	Lifting tool	1

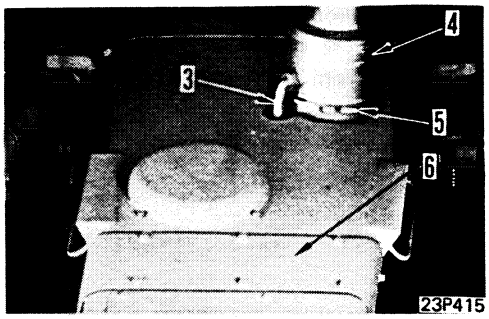
1. Inspection cover
Remove inspection cover (1).



2. Cooling water drain
Open drain valve (2) and drain the cooling water.
★ If the coolant contains antifreeze, dispose of it correctly. Reuse the coolant as long as it is resistant to corrosion.

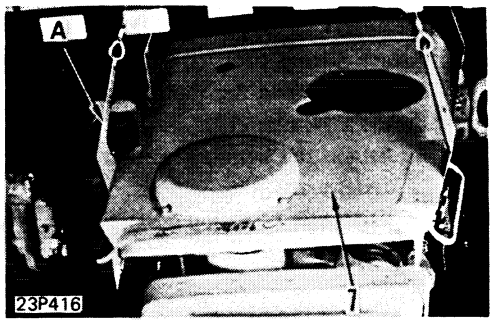
Cooling water capacity: **150** ℓ

3. **Exhaust pipe**
   1) Remove the flange bolts and disconnect ejector pipe (3) from exhaust pipe (4).
   2) Remove clamp (5) and exhaust pipe (4).
      ★ Also remove the exhaust pipe gasket.

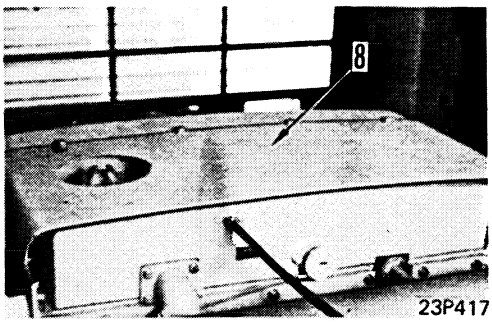


4. **Cover**
   Remove cover (6).

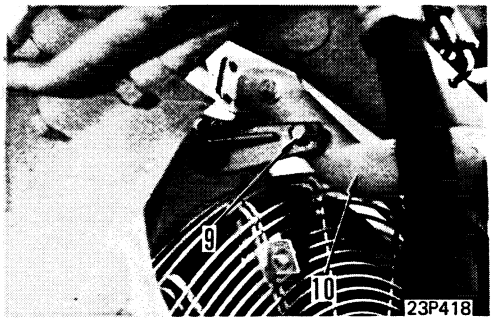
5. **Hood**
   Unhook the hood latches on the R.H. and L.H. sides, and lift off hood (7) with lifting tool A.
   kg Hood: **60 kg**



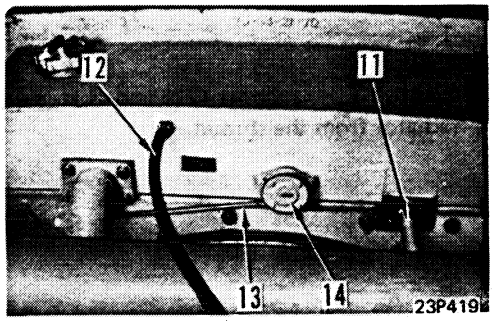
6. **Cover**
   Remove radiator cover (8).



7. **Radiator inlet tube**
   1) Remove clamp bolt (9) and the flange bolt, and disconnect radiator inlet tube (10) from the radiator.
   2) Remove the flange bolt and the clamp, and disconnect bypass tube (11) and aeration hose (12) from the radiator.

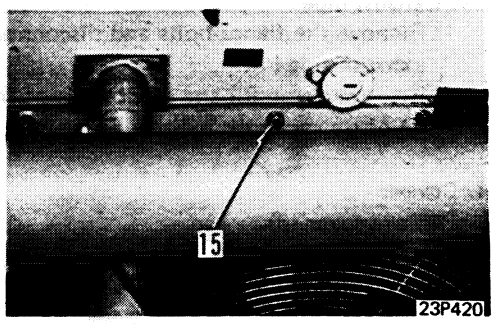


8. **Overflow tube**
   Remove the clamp and disconnect overflow tube (13) from pressure valve (14).



9. Shroud mounting bolts

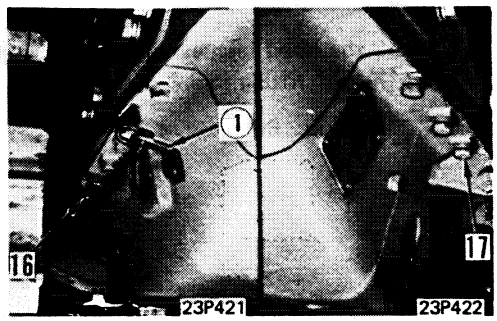
Remove radiator shroud mounting bolts (15) and detach the shroud from the radiator.



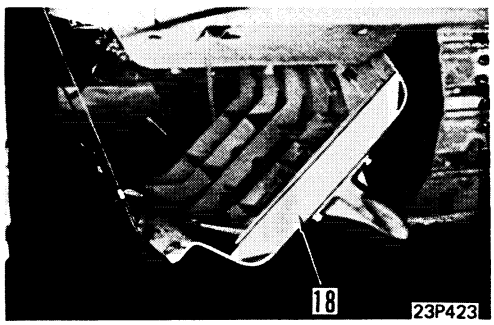
10. Underguard

1) Attach lifting tool ① to the underguard and sling it with a crane. Remove the mounting bolts on the R.H. side (16) and on the L.H. side (17).

★ Attach the lifting tool to the lifting bolt on the side of the underguard.
(Diameter of lifting bolt: 24 mm, width across flats: 36 mm)

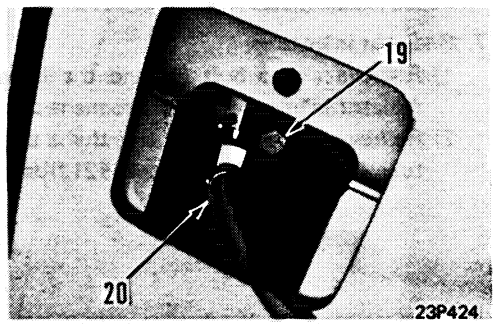


2) Slowly lower the crane hoist cable to let engine underguard (18) open.



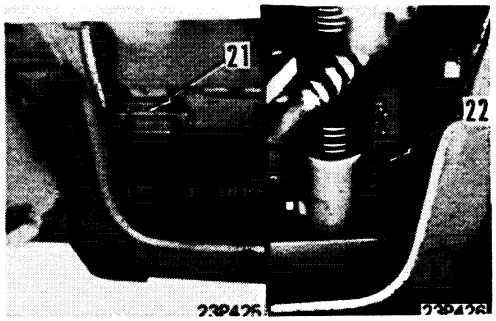
11. Radiator outlet tube

Remove flange bolt (19), and disconnect radiator outlet tube (20) from the lower tank.



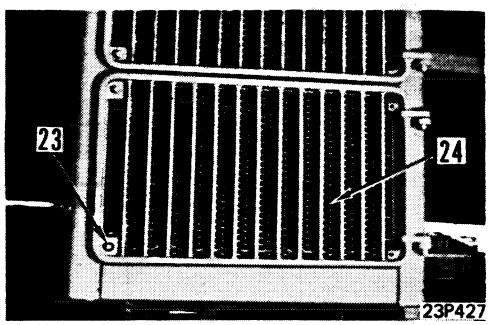
12. Support

Remove L.H. support (21) and R.H. support (22). Remove the radiator from the shroud.



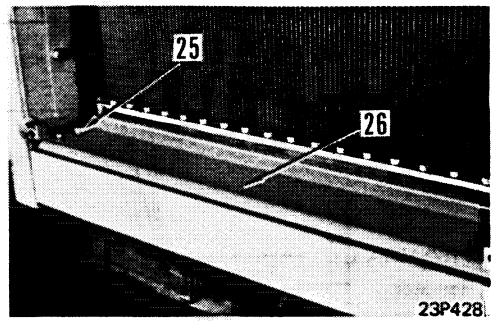
13. Radiator grille

Remove mounting bolts (23) and open lower radiator grille (24).



14. Plate

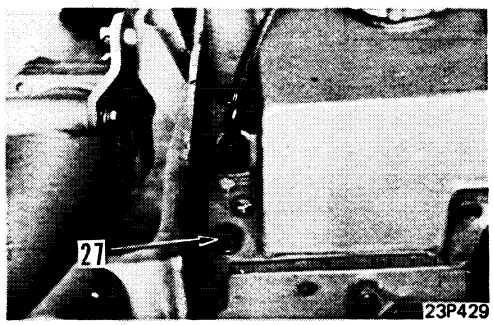
Remove mounting bolts (25) and plate (26).

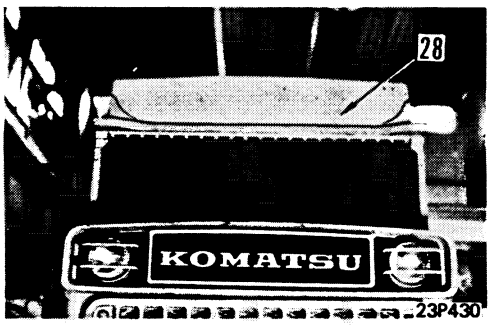


15. Radiator assembly

Remove mounting bolts (27), and slowly lift off radiator assembly (28), taking care not to let it hit any nearby part.

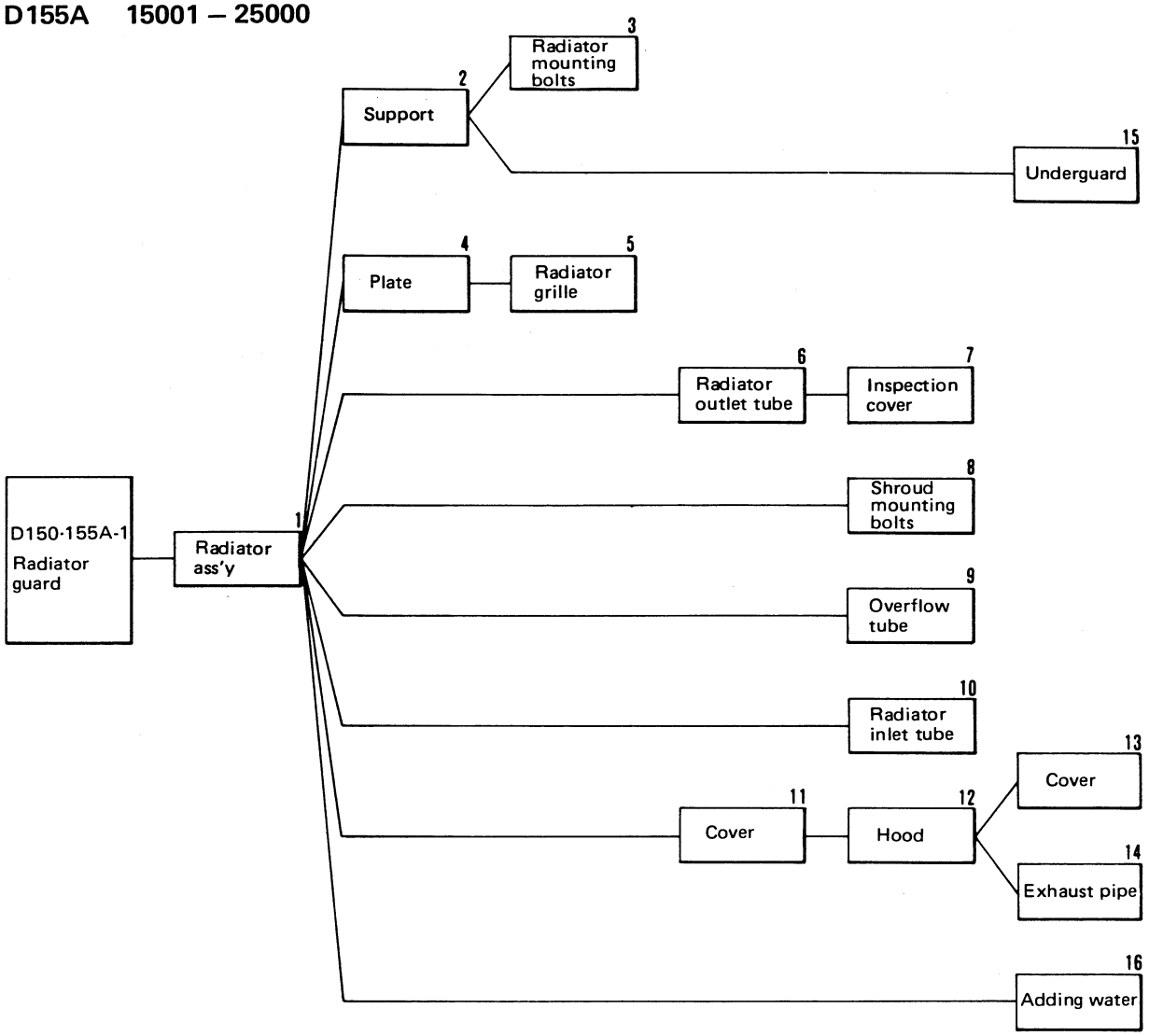
kg Radiator assembly: **350 kg**





MOUNTING RADIATOR

D150A 8408 and up
D155A 15001 – 25000



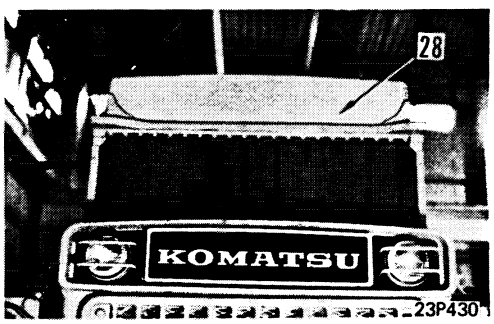
23F077

Special tool required

Part number	Part name	Q'ty
790-401-1400	Lifting tool	1

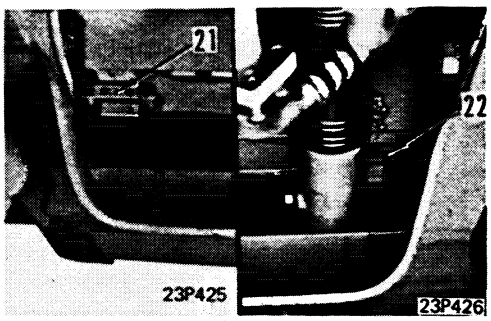
1. Radiator assembly

Slowly lower radiator assembly (28) onto the mounting position, taking care not to let it hit the nearby parts.



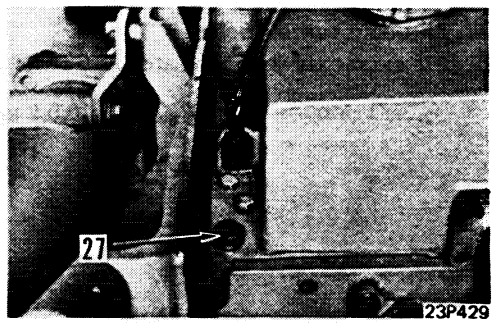
23P430

2. Support
Install L.H. support (21) and R.H. support (22), and place the radiator on the shroud.

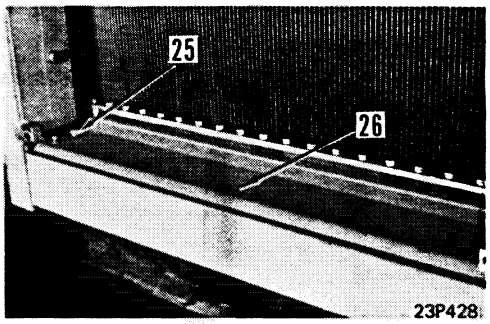


3. Radiator
Apply thread tightener (LT-2) to the screw portion of mounting bolts (27), and secure the radiator with the mounting bolts.

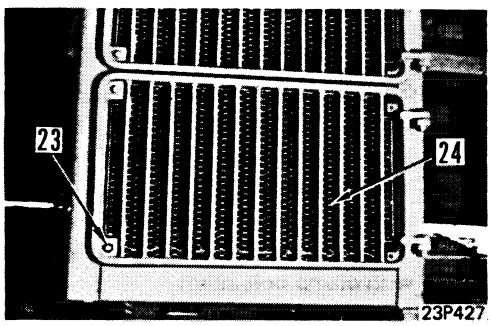
kgm Mounting bolts: **35 – 43.5 kgm**



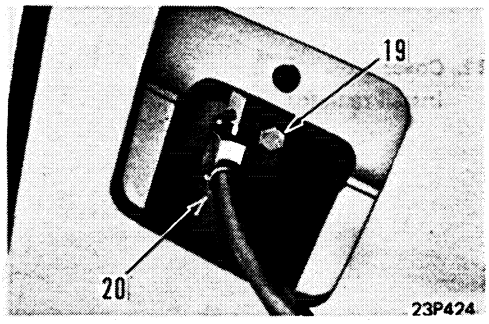
4. Plate
Install plate (26) with bolts (25).



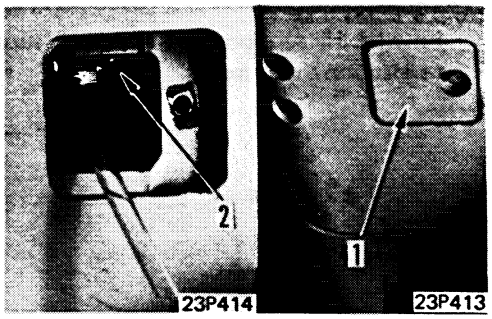
5. Radiator grille
Shut lower radiator grille (24), and tighten mounting bolts (23).



6. Radiator outlet tube
Stick a gasket to the flange with liquid gasket (LG-1), and connect radiator outlet tube (20) to the lower tank with mounting bolts (19).

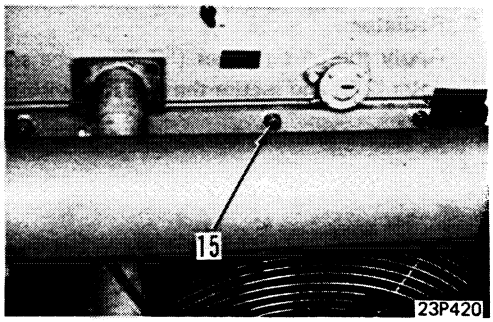


7. Inspection cover
Close drain valve (2) and install inspection cover (1).

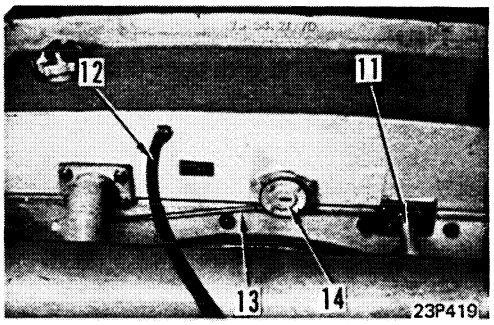


8. Shroud mounting bolts
Fit the shroud to the radiator with bolts (15).

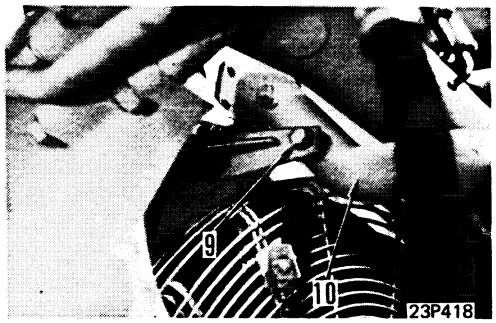
kgm Mounting bolts: **7.5 — 10.5 kgm**



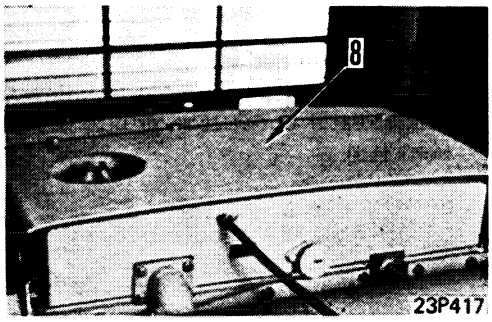
9. Overflow tube
Connect overflow tube (13) to pressure valve (14), and clamp the tube with wire.



10. Radiator inlet tube
1) Stick a gasket to the flange with liquid gasket (LG-1), and connect bypass tube (11) to the radiator.
2) Connect aeration hose (12) to the radiator, and secure the hose with a clamp.
3) Stick a gasket to the flange with liquid gasket (LG-1), connect radiator inlet tube (10) to the radiator, and secure the tube with clamp bolt (9).



11. Cover
Install radiator cover (8).



12. Hood

Use lifting tool A to install hook (7), and hook the hood latches on the R.H. and L.H. sides.

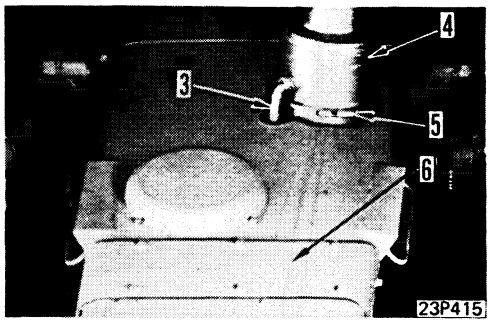


13. Cover

Install cover (6) with the hood mounting bolts.

14. Exhaust pipe

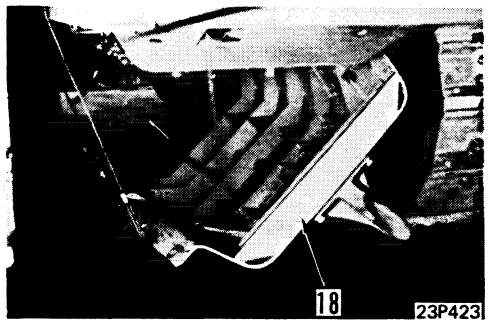
1) Fit a gasket to the mounting surface, install exhaust pipe (4), and secure it with clamp (5).
   - ★ When installing the exhaust pipe, align it with the KOMA-CLONE tube.
2) Fit a gasket to the flange, and connect ejector pipe (3) to exhaust pipe (4).



15. Underguard

1) Fit lifting tool ① to engine underguard (18), and close the underguard by slowly lifting it with a crane.

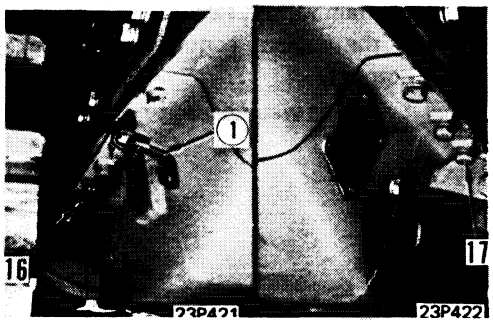
   ⚠ Do not get underneath the suspended underguard.



2) Align the bolt holes, apply thread tightener (LT-2) to the screw portions of mounting bolts, and install the underguard by tightening six R.H. mounting bolts (16) and five L.H. mounting bolts (17).

   kgm Mounting bolts: **84–105 kgm**

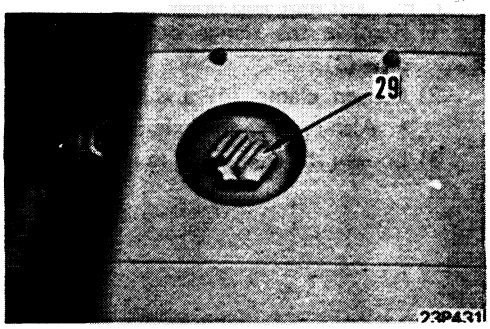
3) Remove lifting tool ①.



16. Adding water

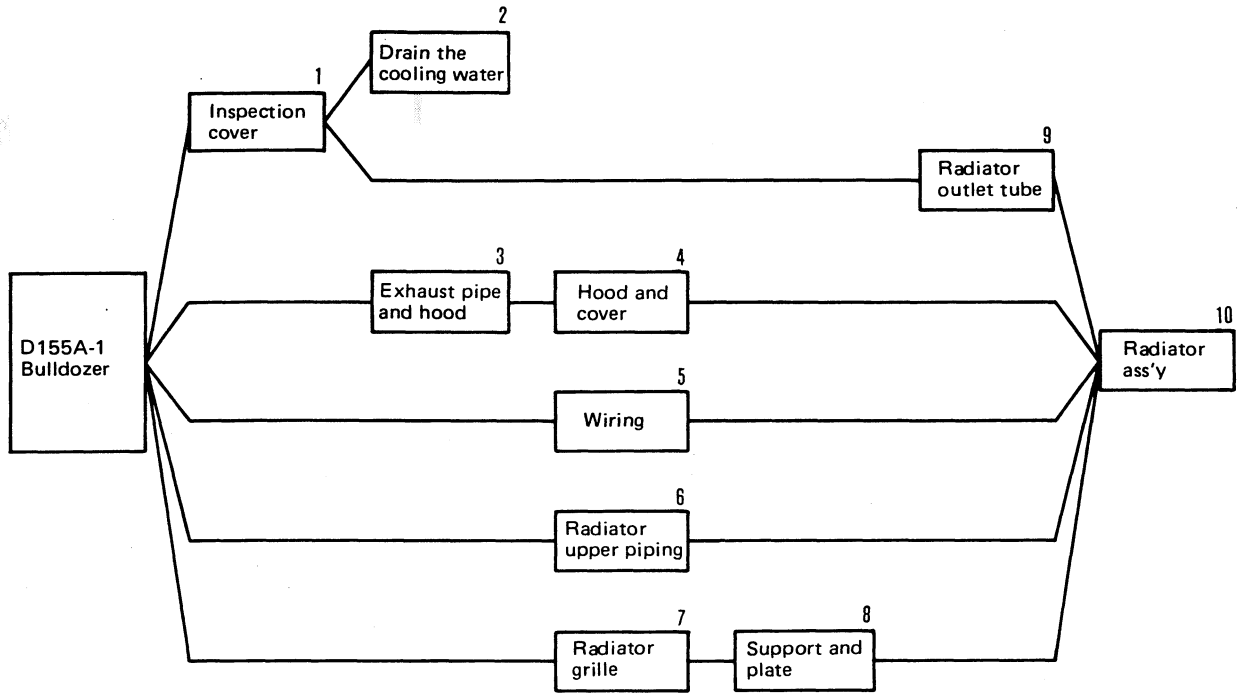
Add water through water filler (29).

- ★ Use soft water as the coolant.
- ★ Add water slowly until it overflows the water filler. If water is added quickly, the filler may overflow, making it appear as if the radiator is completely filled up.
- ★ Do not remove the strainer from the water filler while adding water.



DISMOUNTING RADIATOR

D155A 25001 and up



1. Inspection cover

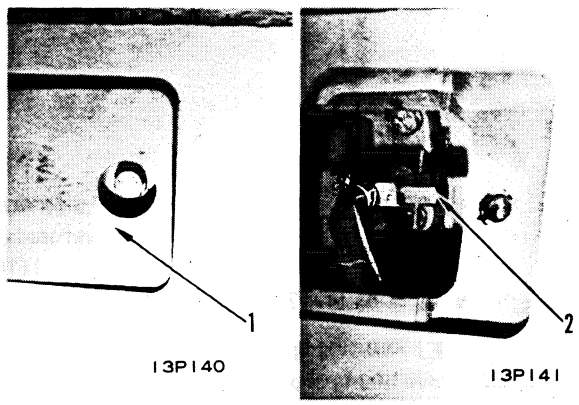
Remove inspection cover (1).

2. Cooling water drain

Open drain valve (2) and drain the cooling water.

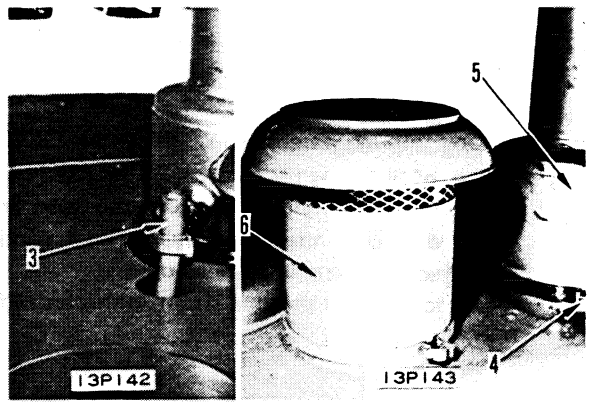
★ If the coolant contains antifreeze, dispose of it correctly.

Cooling water capacity: **150 ℓ**



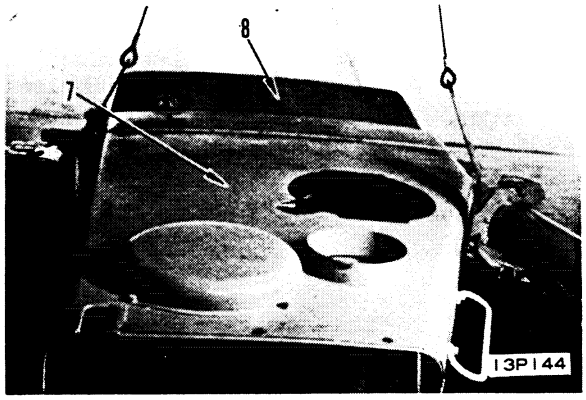
3. Exhaust pipe and hood

1) Remove the flange bolts and disconnect ejector pipe (3).
2) Loosen clamp (4) and remove exhaust pipe (5).
   ★ Also remove the exhaust pipe gasket.
3) Loosen the clamp and remove air cleaner hood (6).



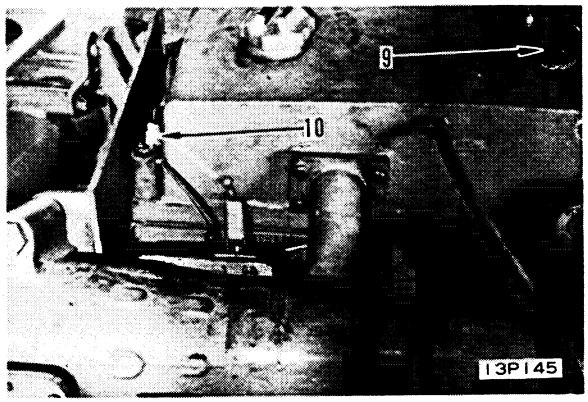
4. Hood and radiator cover

1) Unhook the hood latches on the R.H. and L.H. sides, and lift off hood (7) with a lifting tool.
2) Remove radiator cover (8).



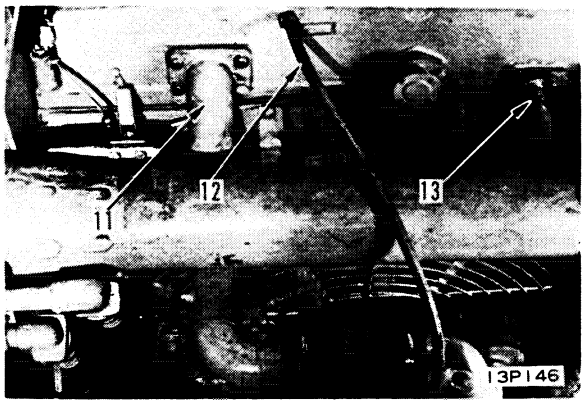
5. Wiring

Disconnect level sensor (9) and head lamp wiring (10) from the connectors.



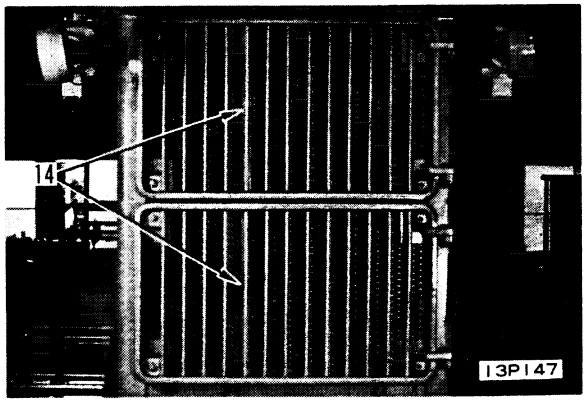
6. Radiator upper piping

1) Disconnect radiator inlet tube (11) from the radiator.
2) Disconnect aeration hose (12).
3) Disconnect bypass tube (13).



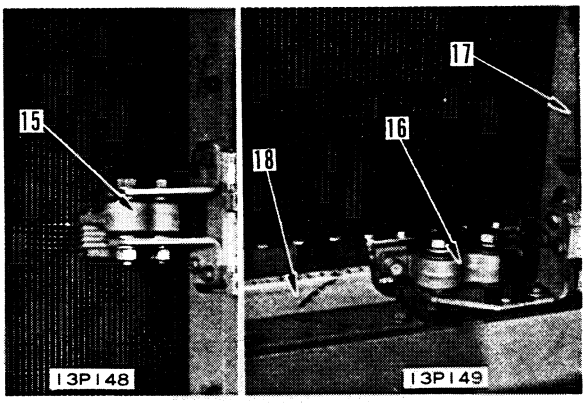
7. Radiator grille

Remove the mounting bolts and open radiator grille (14).



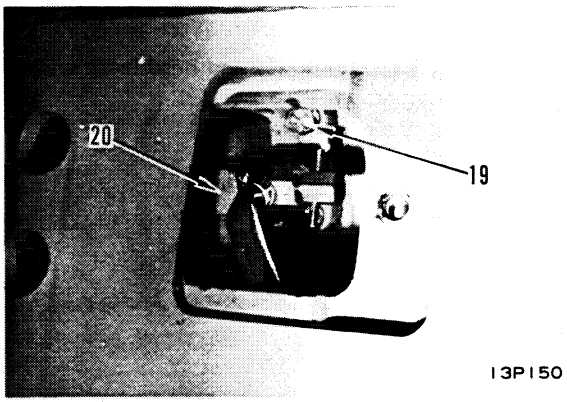
8. Support and plate

1) Remove front supports (15) on the R.H. and L.H. sides.
2) Remove lower supports (16) on the R.H. and L.H. sides.
3) Remove R.H. and L.H. plates (17) and lower plate (18).



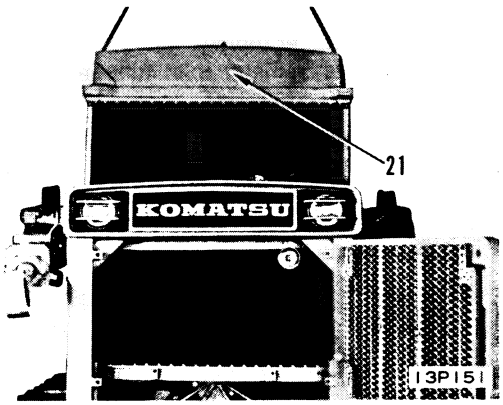
9. Radiator outlet tube

Remove four mounting bolts (19) and disconnect radiator outlet tube (20).



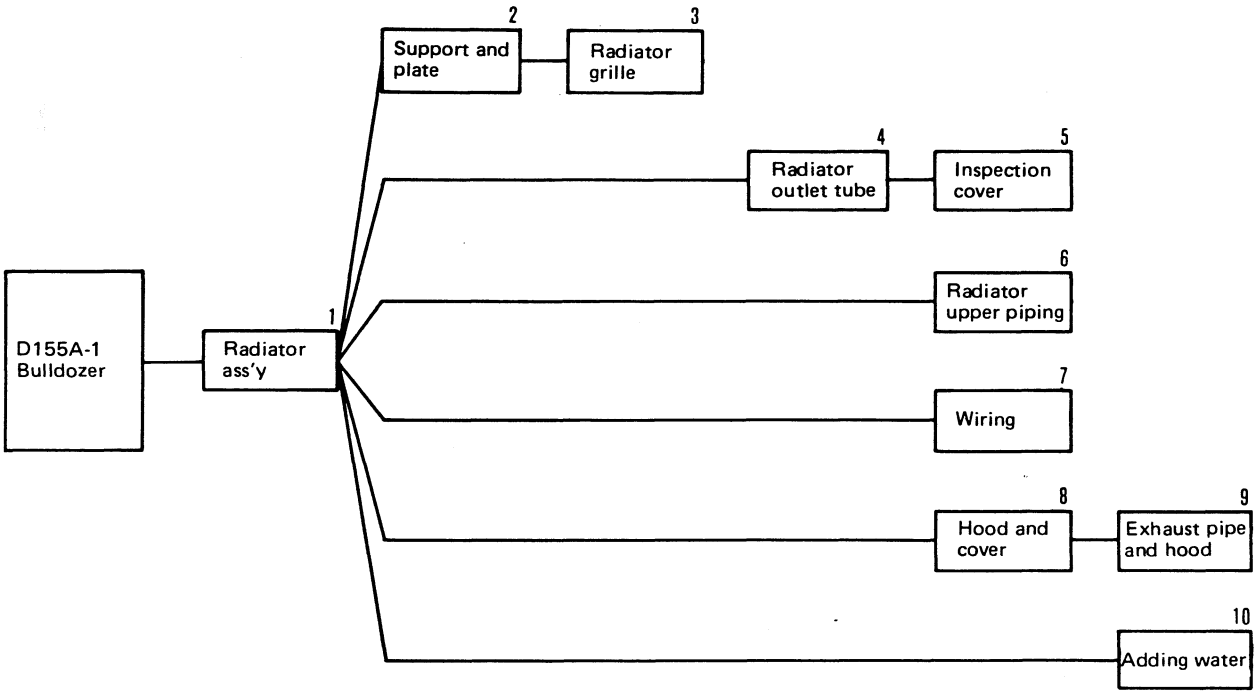
10. Radiator assembly

Remove the radiator upper mounting bolts, and slowly lift off radiator assembly (21), taking care not to let it hit the nearby parts.



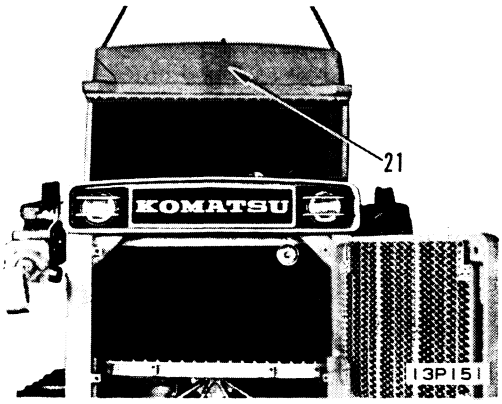
MOUNTING RADIATOR

D155A 25001 and up



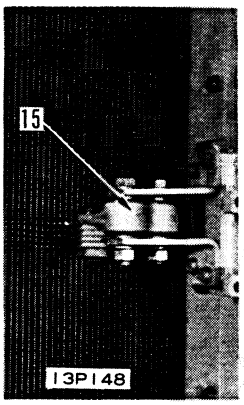
1. Radiator assembly

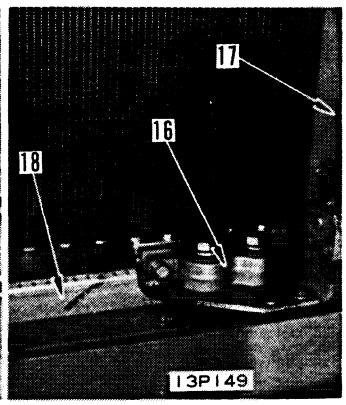
Slowly lower radiator assembly (21) onto the mounting position, taking care not to let it hit any nearby parts, then tighten the upper mounting bolts.



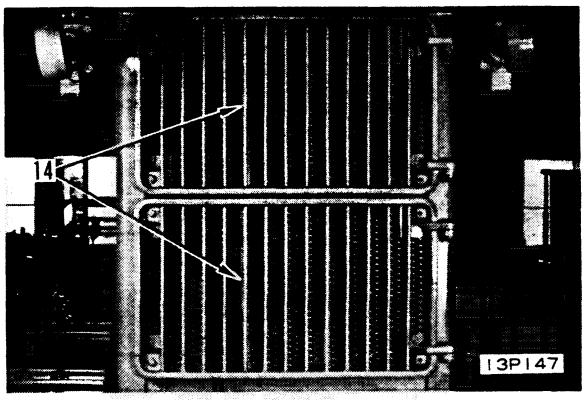
2. Support and plate

1) Install R.H. and L.H. plates (17) and lower plate (18).
2) Install front supports (15) on the R.H. and L.H. sides.
3) Install lower supports (16) on the R.H. and L.H. sides.

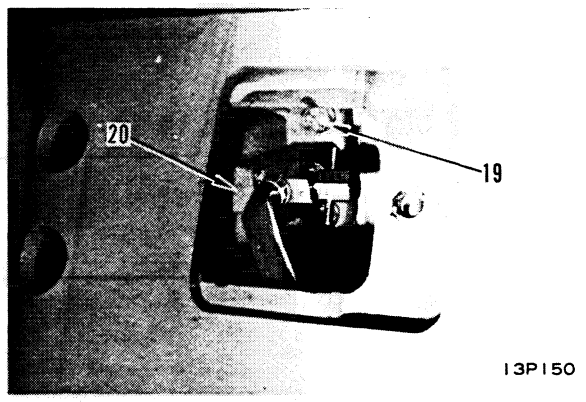




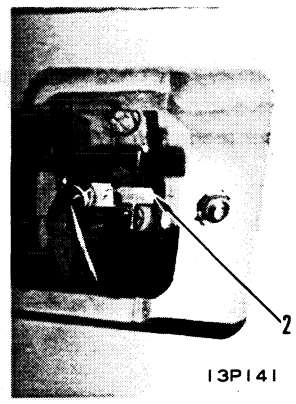
3. **Radiator grille**
   Shut radiator grille (14) and tighten the mounting bolts.

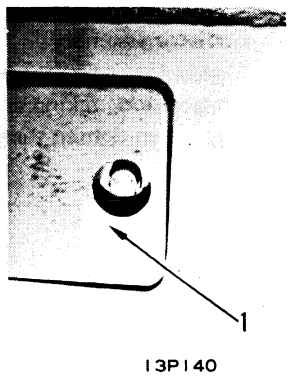


4. **Radiator outlet tube**
   Stick a gasket to the flange with liquid gasket (LG-1), and connect radiator outlet tube (20) to the lower tank with mounting bolt (19).

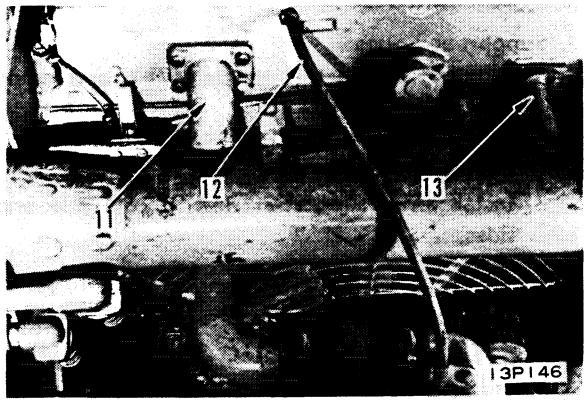


5. **Inspection cover**
   Close drain valve (2) and install inspection cover (1).



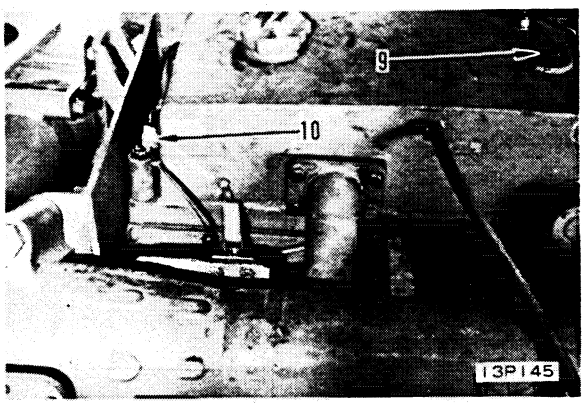


6. **Radiator upper piping**
   1) Connect bypass tube (13).
   2) Connect aeration hose (12).
   3) Connect radiator inlet tube (11).



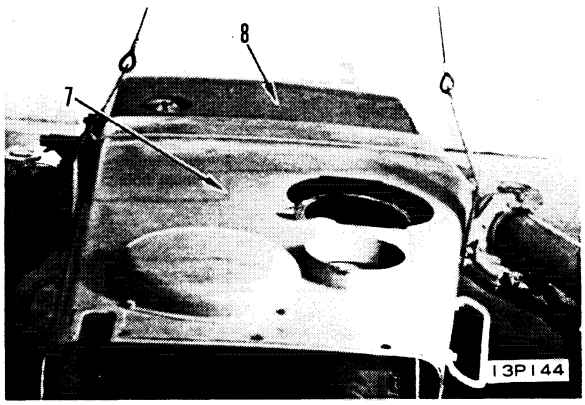
7. Wiring

Connect water temperature gauge wiring (9) and head lamp wiring (10) to the connectors.



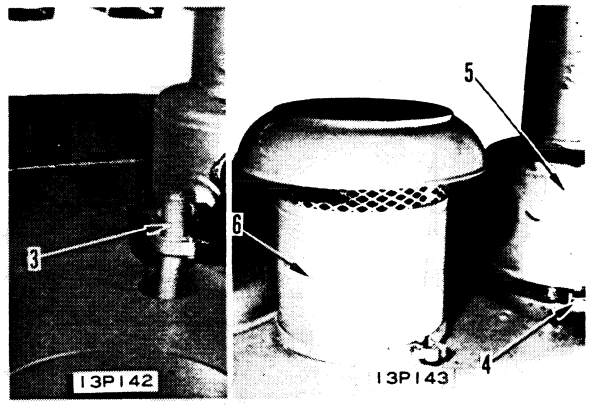
8. Hood and radiator cover

1) Install radiator cover (8).
2) Use a lifting tool to install hood (7), and hook the hood latches on the R.H. and L.L. sides.



9. Exhaust pipe and hood

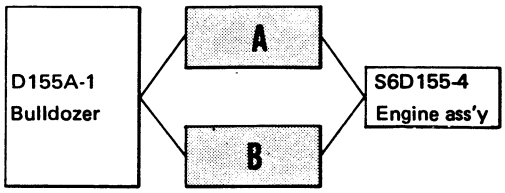
1) Install air cleaner hood (6) and tighten the clamp bolt.
2) Fit a gasket to the mounting surface, install exhaust pipe (5), and secure it with clamp (4).
   ★ When installing the exhaust pipe, align it with the KOMACLONE tube.
3) Fit a gasket to the flange and isntall ejector pipe (3).



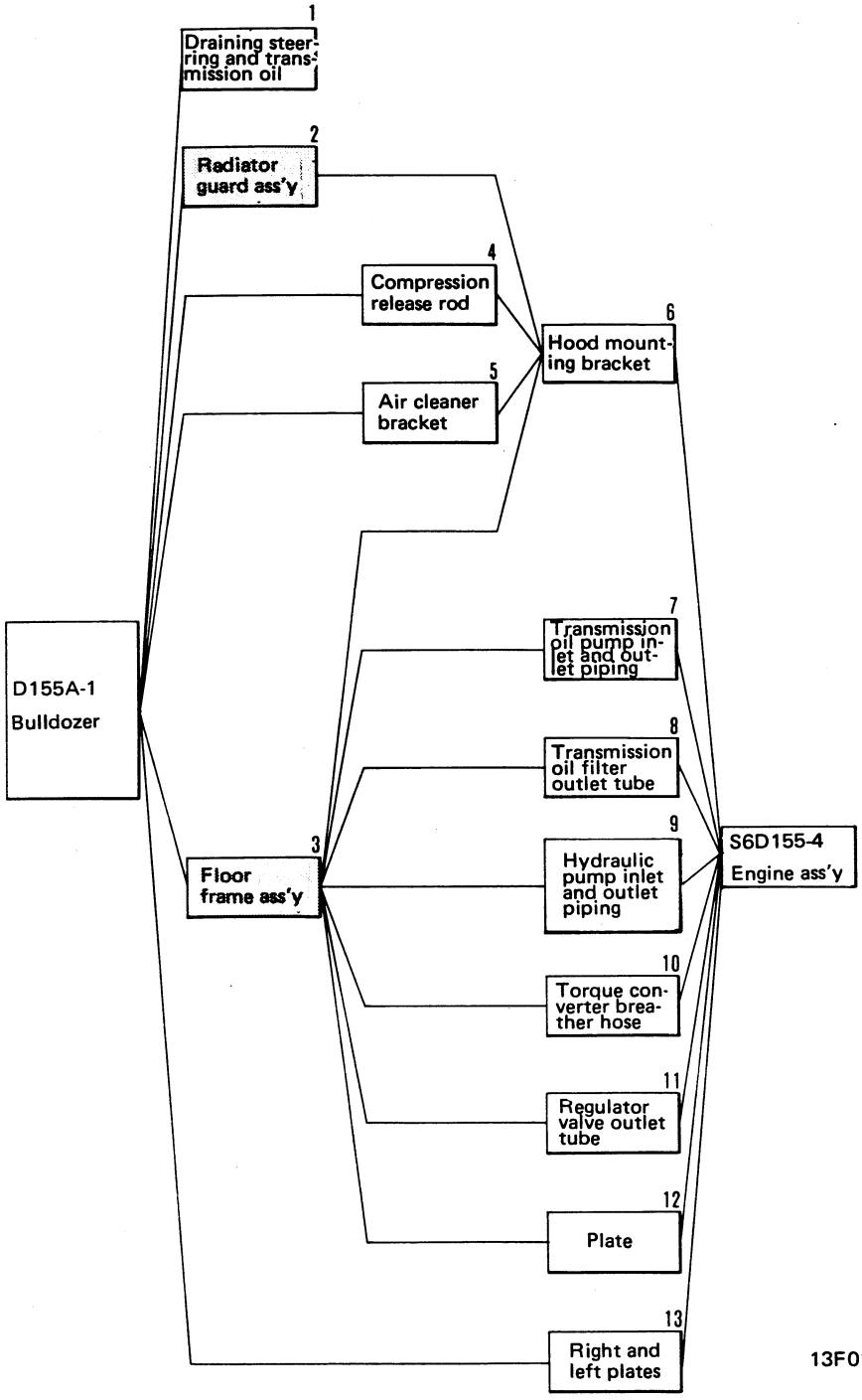
10. Adding water

Add water through the water filler.

DISMOUNTING ENGINE D155A 15001 – 25000

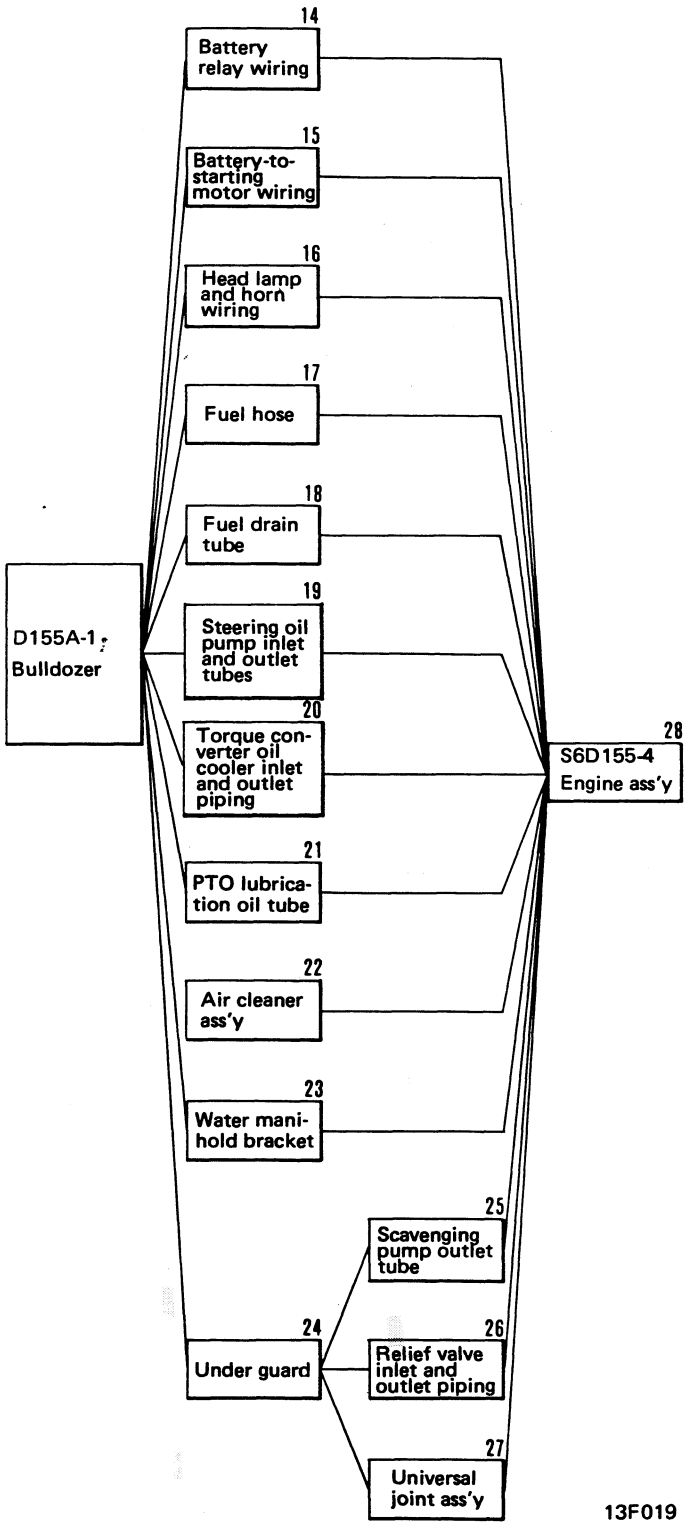


A network

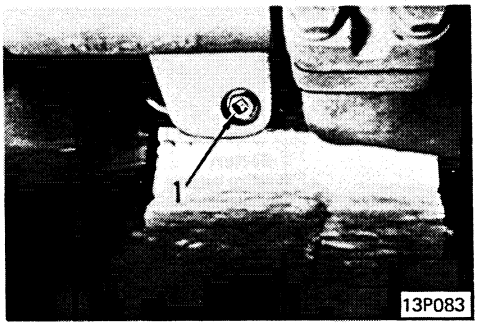


13F018

B network


14
Battery relay wiring
15
Battery-to-starting motor wiring
16
Head lamp and horn wiring
17
Fuel hose
18
Fuel drain tube
19
Steering oil pump inlet and outlet tubes
20
Torque converter oil cooler inlet and outlet piping
21
PTO lubrication oil tube
22
Air cleaner ass'y
23
Water manihold bracket
24
Under guard
25
Scavenging pump outlet tube
26
Relief valve inlet and outlet piping
27
Universal joint ass'y
28
S6D155-4 Engine ass'y
D155A-1, Bulldozer
13F019

1. **Draining steering and transmission oil**
   Remove drain plug (1) and drain steering and transmission oil.
   Steering and transmission case oil capacity: **185 ℓ**

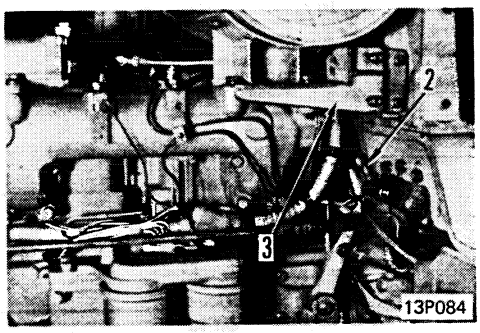


2. **Radiator guard assembly**
   Refer to the DISMOUNTING RADIATOR GUARD section.

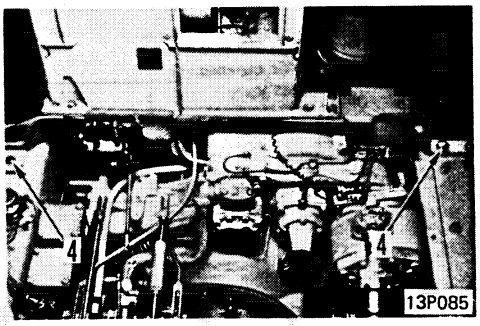
3. **Floor frame assembly**
   Refer to the DISMOUNTING FLOOR FRAME section.

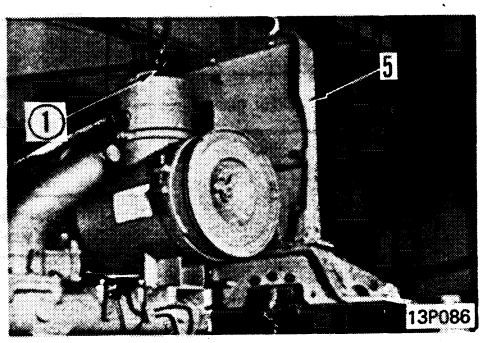
4. **Compression release rod**
   Remove locknut and disconnect compression release rod (2) from bracket.

5. **Air cleaner bracket**
   Remove bolts and nuts fastening bracket (3); remove bracket.



6. **Hood mounting bracket**
   Attach two hanging bolts ① (12 mm, P=1.75) to sling bracket with crane.
   Remove bolts (4), four bolts on each side, fastening hood mounting bracket; remove bracket (5).
   kg Hood mounting bracket: **95 kg**





7. **Transmission oil pump inlet and outlet piping**
   1) Remove split flange. Disconnect transmission oil pump inlet hose (6) from tube (7).
   2) Remove flange mounting bolts. Disconnect transmission oil pump outlet tube (8) from filter (9).

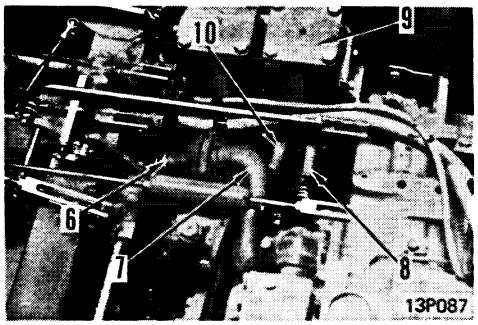
8. **Transmission oil filter outlet tube**
   Remove flange mounting bolts. Disconnect transmission oil filter outlet tube (10) from filter (9).

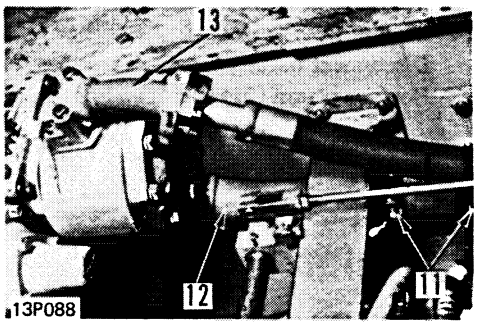
9. **Hydraulic pump inlet and outlet piping**
   1) Loosen coupling clamp (11), remove flange mounting bolts, and disconnect hydraulic pump inlet tube (12) from pump.
   2) Remove flange mounting bolts and disconnect hydraulic pump outlet tube (13) from pump.
      ★ After disconnection, keep tube pulled toward the rear of machine and temporarily clamped with wire.

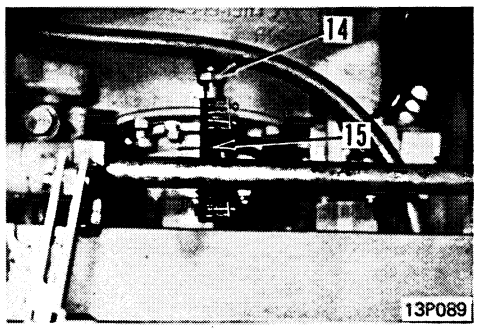
10. **Torque converter breather hose**
    Remove sleeve nuts (14) (on both torque converter side and transmission side) fastening torque converter breather tube (15); remove tube.

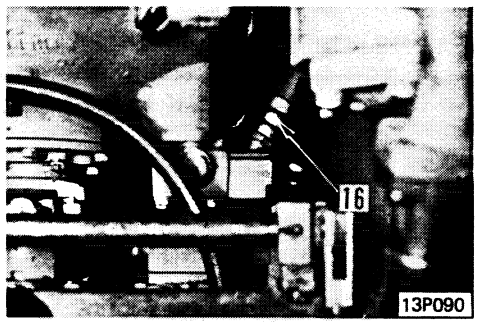
11. **Regulator valve outlet tube**
    Remove flange mounting bolts. Disconnect regulator valve outlet tube (16) from regulator valve.

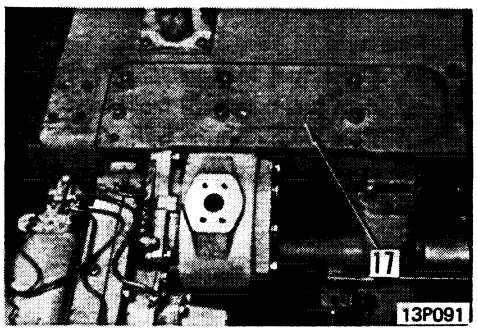
12. **Plate**
    Remove bolts fastening step plate (17); remove step plate.







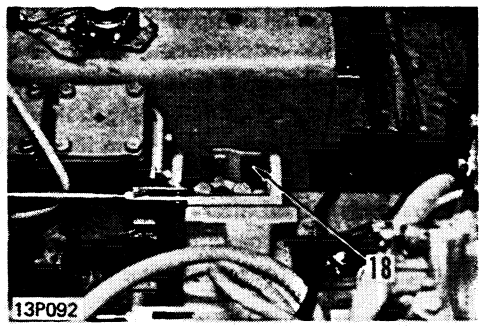




13. Right and left plates

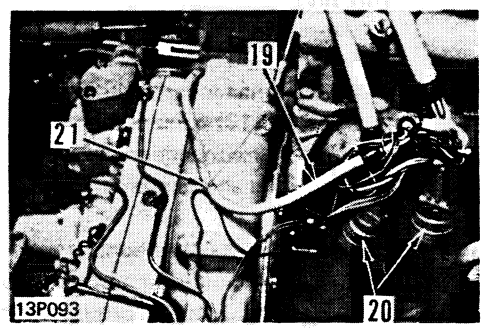
Remove engine side cover mounting plates (18). (Both right and left plates).

★ Each plate is secured with two bolts from the outside of fender.



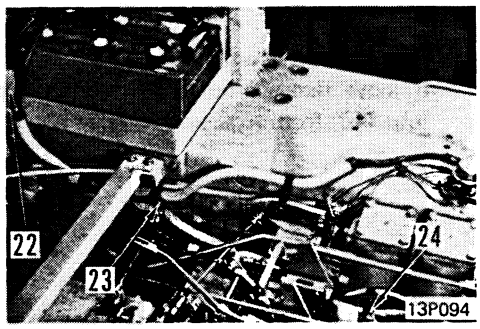
14. Battery relay wiring

Disconnect battery relay wire harness (19) from its connector (20). Remove clamp (21) and keep harness pulled toward machine body.



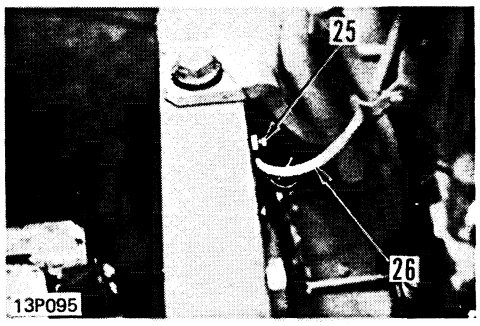
15. Battery-to-starting motor wiring

Remove wire harness (22) connecting battery to starting motor from positive terminal of battery. Remove clamps (23) and (24), and keep harness pulled toward engine.



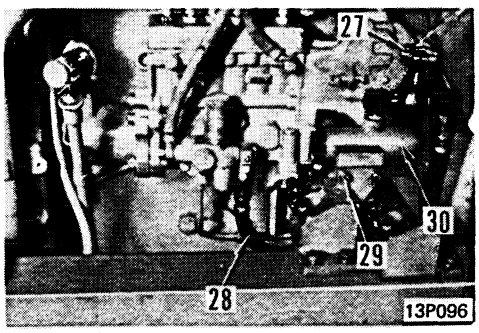
16. Head lamp and horn wiring

Remove clamp bolts (25). Disconnect head lamp and horn wiring (26) from main frame. Keep removed wire pulled toward engine.



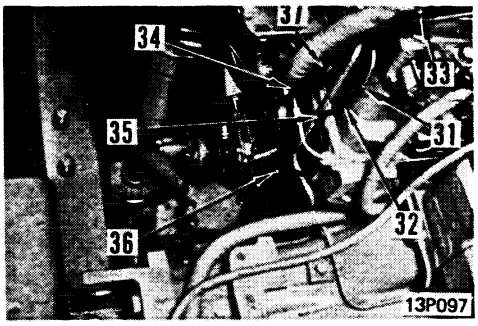
17. Fuel hose

1) Close fuel feed valve (27). Remove sleeve nut and disconnect fuel hose (28) from feed pump.
2) Remove mounting bolts (29) and keep strainer assembly (30) pulled toward the outside of main frame.



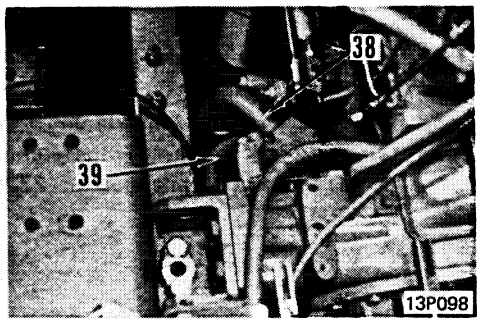
18. Fuel drain tube

1) Slip clamp (31) out of place and remove drain tube (32).
2) Remove tube clamps (33), (34), (35) and (36). Keep drain tube (32) and priming pump tube (37) pulled toward the outside of main frame.



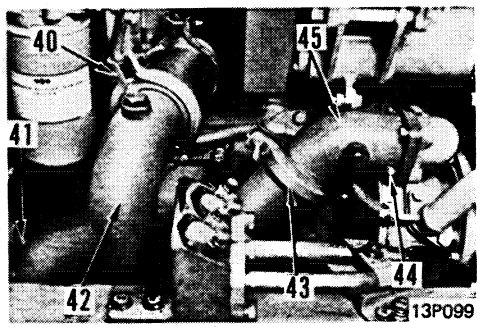
19. Steering oil pump inlet and outlet tubes

1) Remove split flange to disconnect hose from pump inlet tube (38). Then, remove bolts fastening flange of pump inlet tube (38); remove tube.
2) Remove bolts fastening flange and disconnect pump outlet tube (39) from pump.



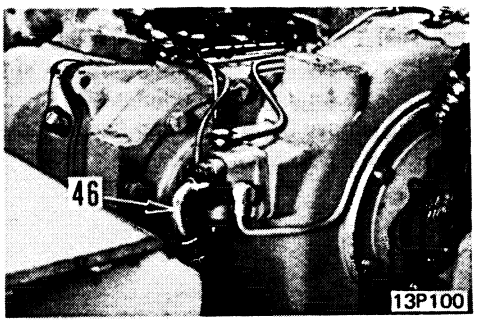
20. Torque converter oil cooler inlet and outlet piping

1) Remove coupling clamp (40). Remove bolts (41) fastening flange; remove torque converter cooler outlet water tube (42).
2) Remove coupling clamp (43). Remove bolts (44) fastening flange; remove torque converter cooler inlet water tube (45).



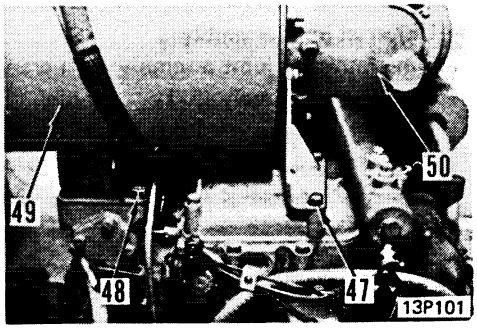
21. PTO lubrication oil tube

Remove flange mounting bolts. Disconnect PTO lubrication oil tube (46) from PTO housing.



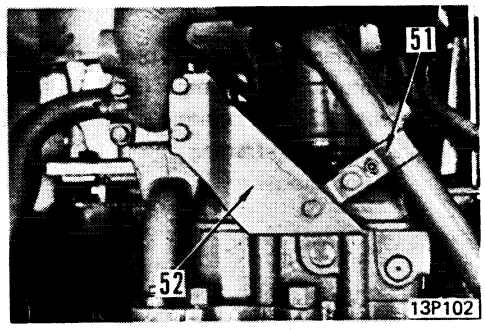
22. Air cleaner assembly

1) Remove bolts (47) and (48).
2) Sling air cleaner assembly (49) with crane, pull out air intake connector (50) from turbocharger, and dismount air cleaner assembly together with air intake connector.



23. Water manifold bracket

Remove clamp (51). Remove bolts fastening water manifold bracket (52); remove bracket.

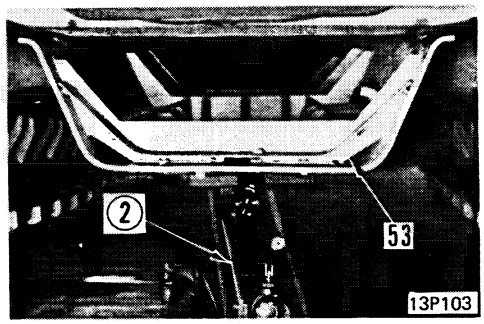


24. Under guard

Support transmission under guard (53) with transmission jack ②
Unscrew guard mounting bolts and remove under guard.

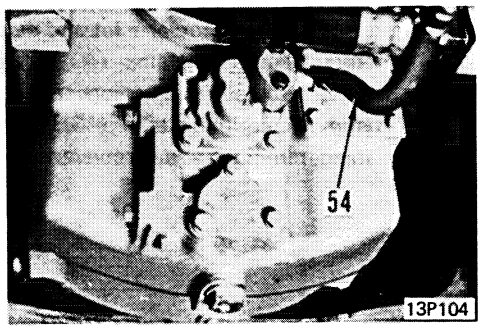
★ When removing transmission under guard, pull it forward while retracting jack to prevent interference with diagonal brace.

kg Transmission under guard: **270 kg**



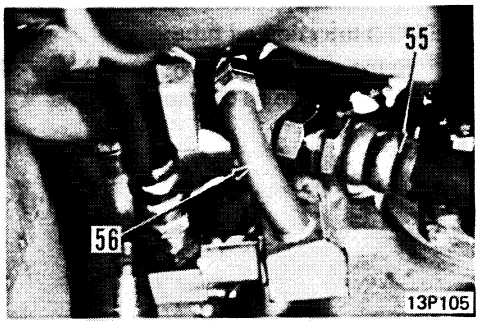
25. Scavenging pump outlet tube

Remove bolts fastening flange and disconnect scavenging pump outlet tube (54) from pump.



26. Relief valve inlet and outlet piping

1) Remove bolts fastening flange and disconnect relief valve outlet tube (55) from relief valve.
2) Remove bolts fastening flange and disconnect relief valve inlet tube (56) from relief valve.

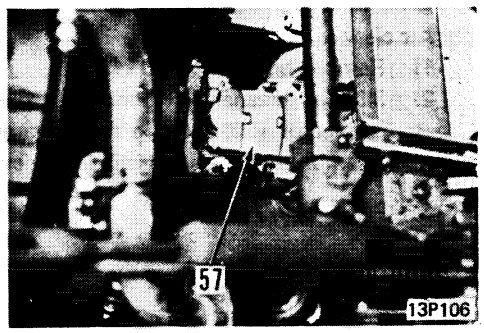


27. Universal joint assembly

Sling universal joint assembly with crane. Remove mounting bolts and lift off assembly (57).

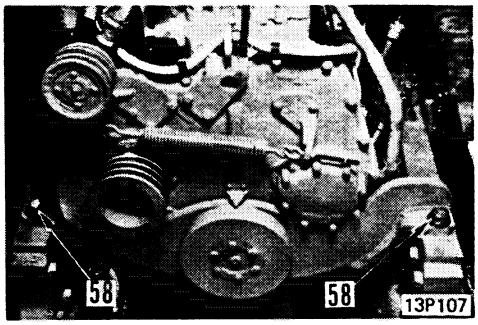
★ If removal is hard due to narrow clearance between couplings, remove bearing of either side before removing joint assembly.

kg Universal joint assembly: **20 kg**

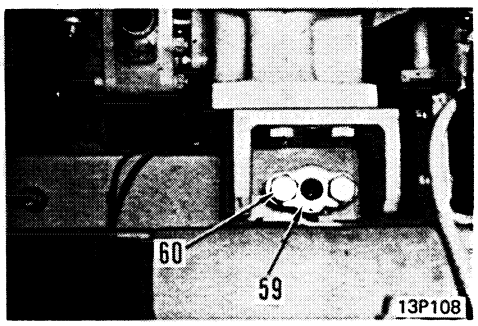


28. Engine assembly

1) Cut wires locking bolts (58), on the front side. Remove bolts.



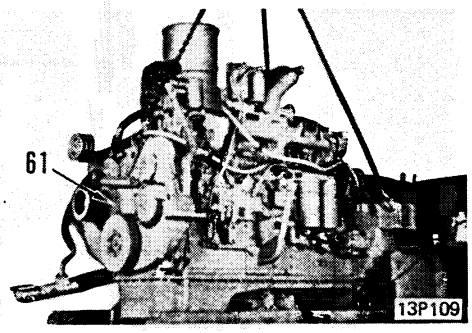
2) Bend down lock plates (59) and remove bolts (60), on the rear side.



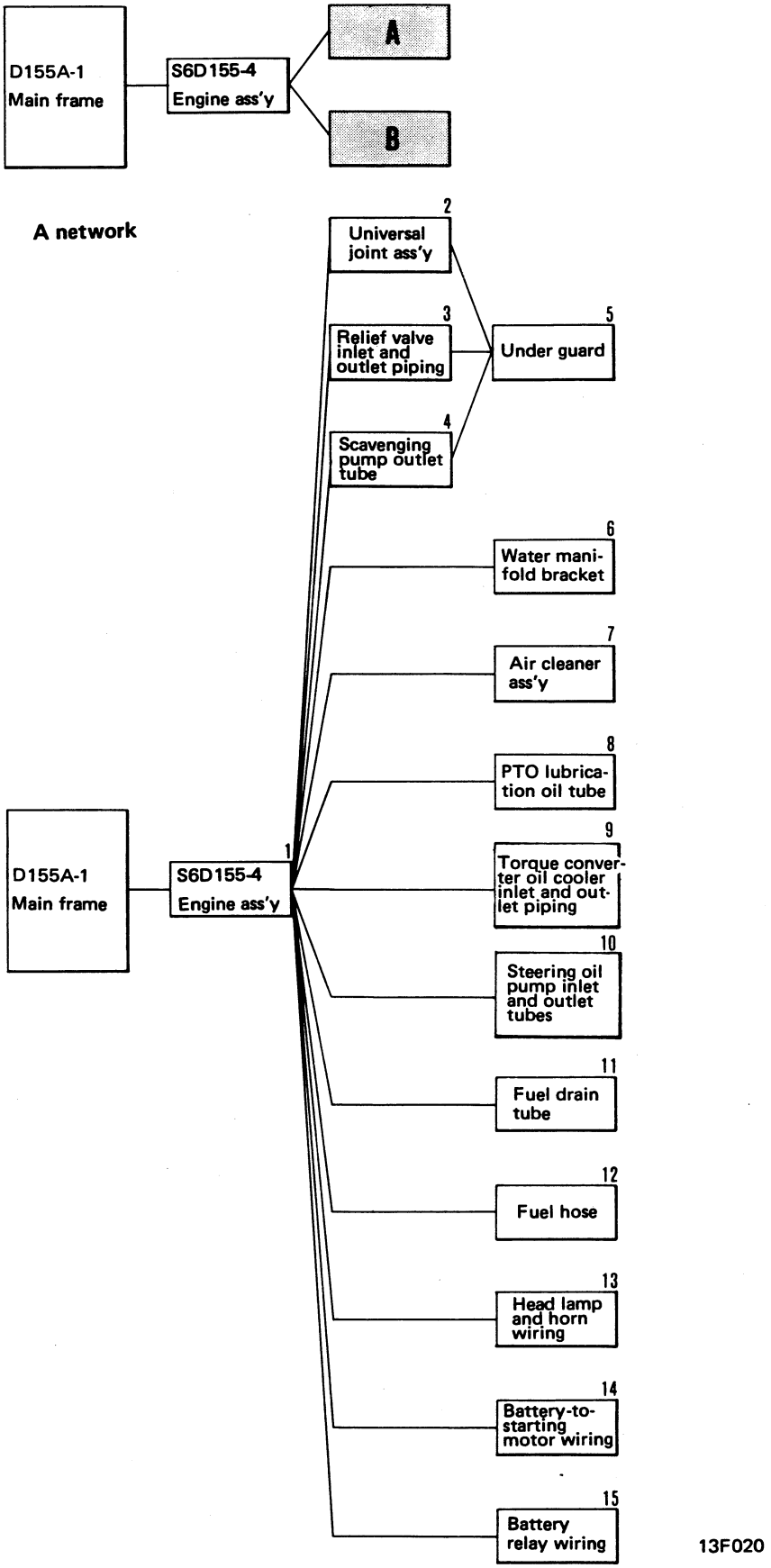
3) Sling engine at two rear mount brackets and a front hook. First separate rear mount bracket from frame and, then, lift off engine assembly (61).
   - ★ Sling engine assembly horizontally and lift it up vertically.

kg Engine assembly (with torque converter): **3100 kg**

   - ★ Keep each pack of shims, removed from engine mount locations, without confusion so that they can be installed at the original positions.

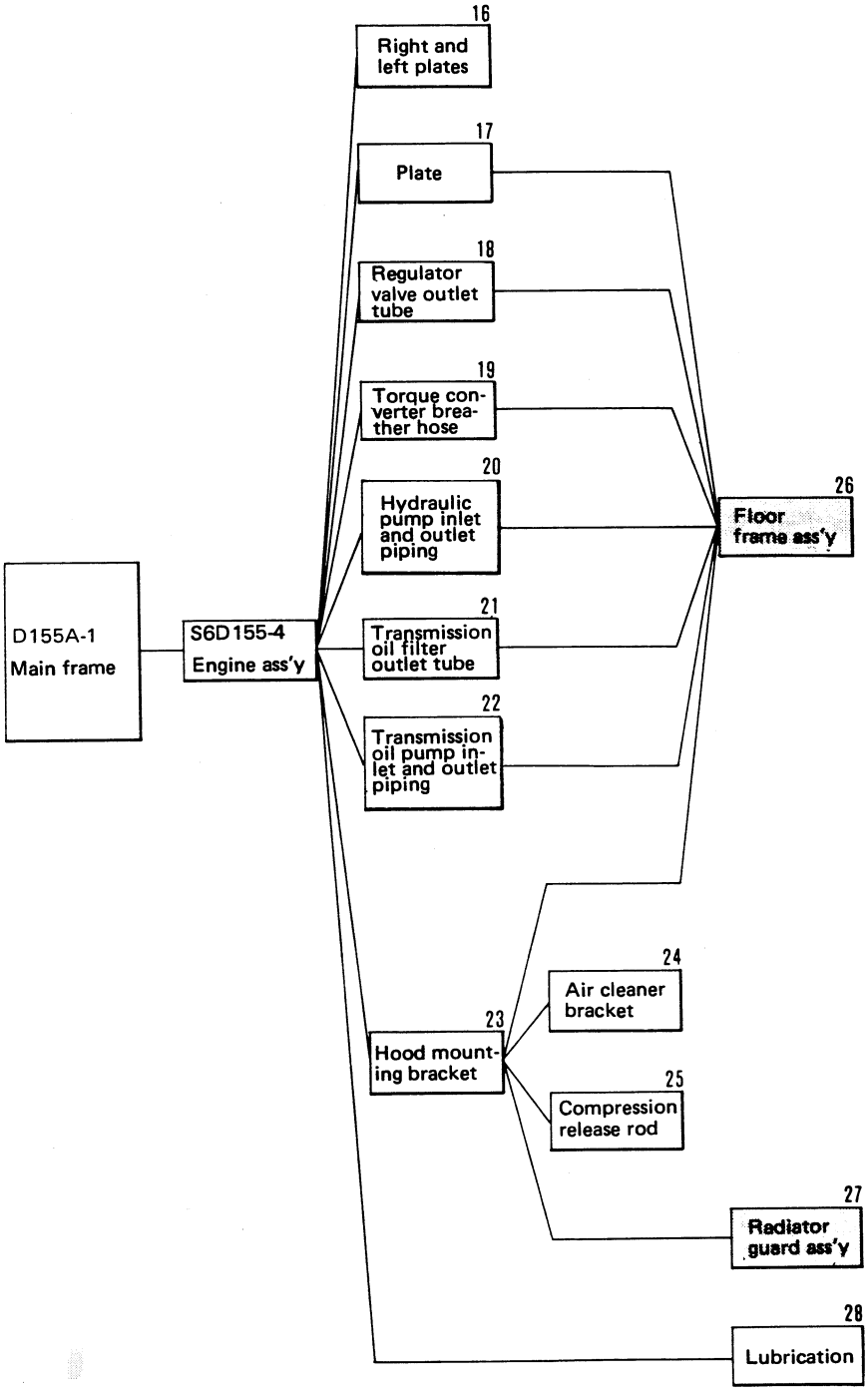


MOUNTING ENGINE D155A 15001 – 25000



13F020

B network



13F021

Special tools required

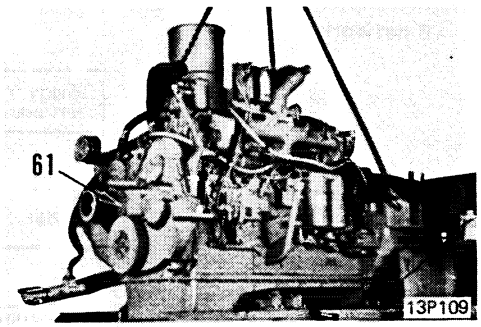
Special tools required		A
791-275-1000	Centerring tool	1

1. Engine assembly

1) Put shims on each engine mount, lift engine assembly (61) at three positions, and lower it onto frame.

★ Standard shim thickness: 2 mm (both front and rear mounts)

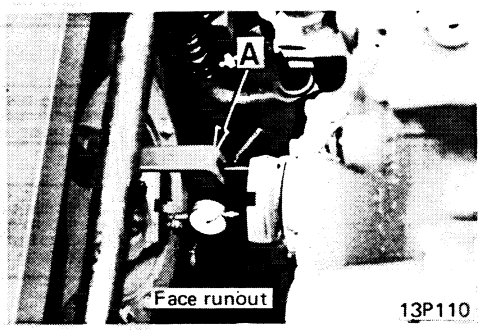
kgm Mounting bolt, front: **67.5 – 84.5 kgm**
rear: **67.5 – 84.5 kgm**

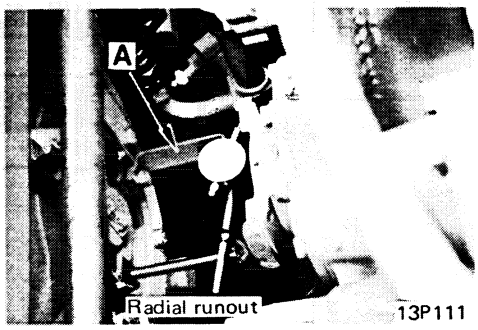


2) Use centering tool A to measure radial runout and face runout of torque converter yoke to transmission yoke. If a result exceeds the standard range, loosen engine mounting bolts and adjust thickness of shims at each engine mount.

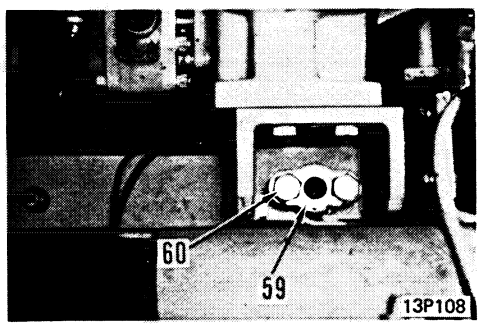
★ Standard range Radial runout: within 1.0 mm
Face runout: within 1.0 mm

Coat mounting bolts with thread tightener (LT-2)

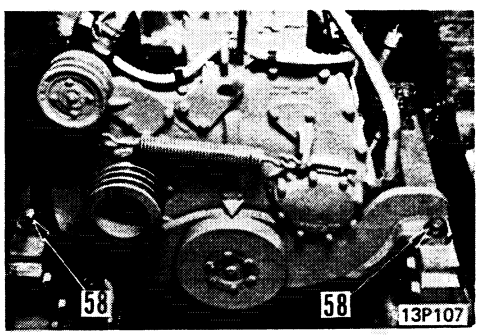




3) Lock mounting bolts (60) on the rear mounts (right and left sides) and bend lock plate (59).



4) Lock mounting bolts (58) on the front mounts (right and left sides) with wire.

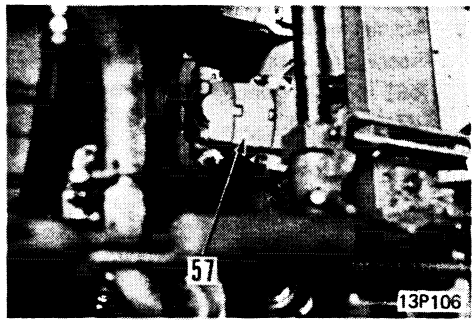


2. Universal joint assembly

Connect torque converter yoke and transmission yoke to each other with universal joint assembly (57).

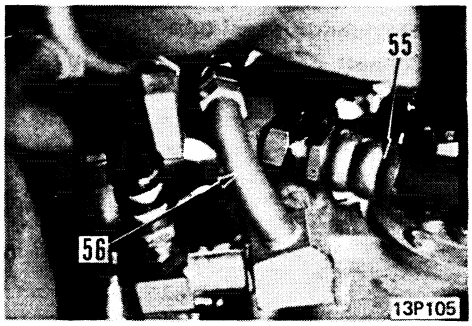
kgm Mounting bolts: **10 ~ 12.5 kg.m**

★ Confirm that bearing is securely fitted to each yoke.



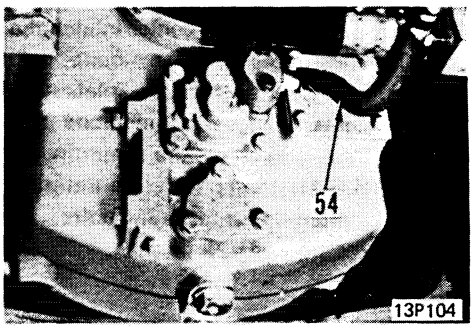
3. Relief valve inlet and outlet piping

1) Connect relief valve inlet tube (56) to relief valve with O-ring.
2) Connect relief valve outlet tube (55) to relief valve with O-ring.



4. Scavenging pump outlet tube

Connect scavenging pump outlet tube (54) to pump with O-ring.

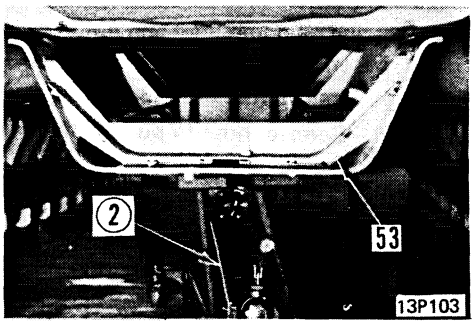


5. Under guard

Install transmission under guard (53) by supporting it with transmission jack ② .

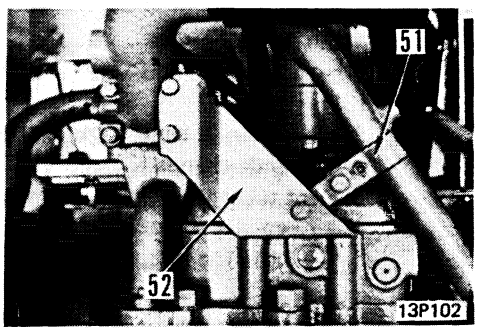
★ Raise the rear of under guard with jack, taking care to prevent interference with diagonal brace.

★ Coat mounting bolts with thread tightener (LT-2).

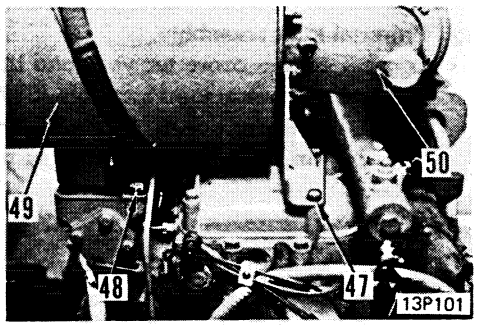


6. Water manifold bracket

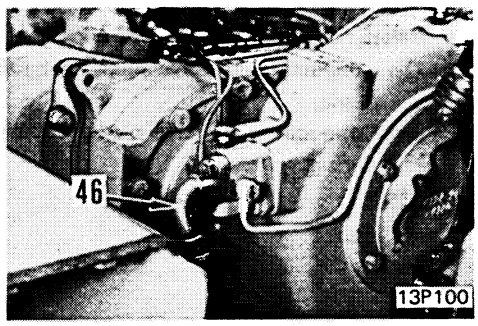
Install water manifold bracket (52). Fix breather tube with clamp (51).



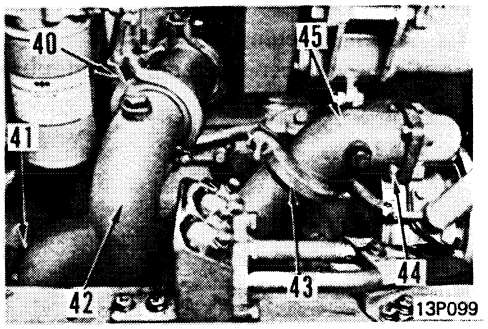
7. **Air cleaner assembly**
   Insert air intake connector of air cleaner assembly with O-ring (50) to turbocharger and install air cleaner with mounting bolts (47) and (48).



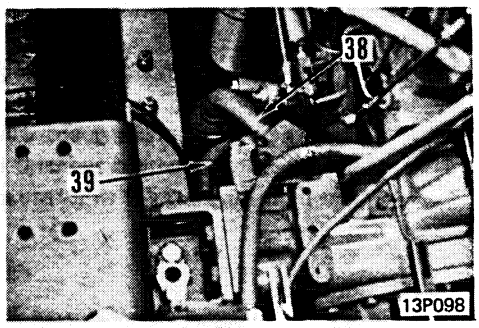
8. **PTO lubrication oil tube**
   Connect PTO lubrication oil tube (46) to PTO housing with O-ring inserted between flanges.



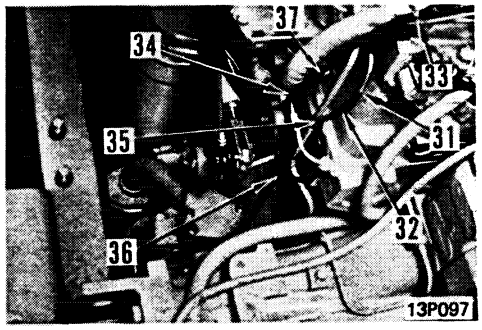
9. **Torque converter oil cooler inlet and outlet piping**
   1) Stick gasket on the mounting surface with gasket sealant (LG-1). Insert water inlet tube (45) into coupling and tighten flange fastening bolts (44). Secure clamp (43).
   2) Stick gasket on the mounting surface with gasket sealant (LG-1). Insert water outlet tube (42) into coupling and tighten flange fastening bolts (41). Secure clamp (40).



10. **Steering oil pump inlet and outlet tubes**
    1) Connect outlet tube (39) to pump with O-ring in flange.
    2) Connect inlet tube (38) to pump with O-ring in flange.
    3) Connect hose to pump inlet tube (38) with split flanges and O-ring.

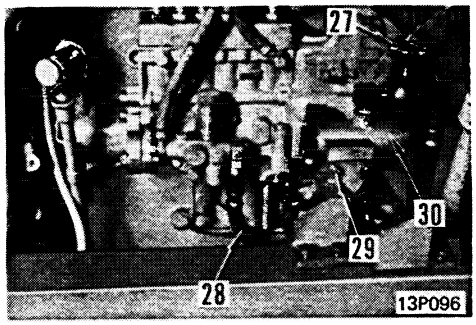


11. **Fuel drain tube**
    1) Connect drain tube (32) and secure it to engine with clamp (31).
    2) Secure drain tube (32) and priming pump tube (37) to engine with clamps (33), (34), (35) and (36). Be careful to prevent tubes from interfering with other parts.
       ★ Keep sleeve nut of priming pump tube placed at the installation side.



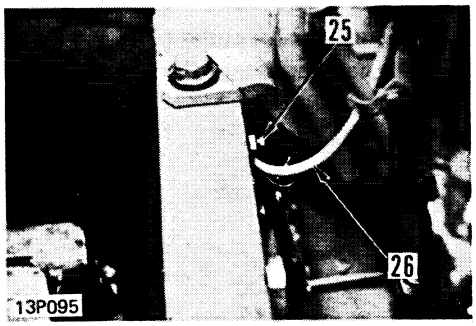
12. Fuel hose

1) Install strainer assembly (30) on frame with bolt (29).
2) Connect fuel hose (28) to feed pump with sleeve nut. Open fuel feed valve (27).



13. Head lamp and horn wiring

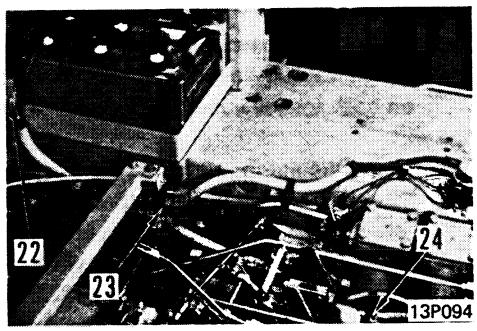
Secure head lamp and horn cord (26) to frame with clamping bolt (25).



14. Battery-to-starting motor wiring

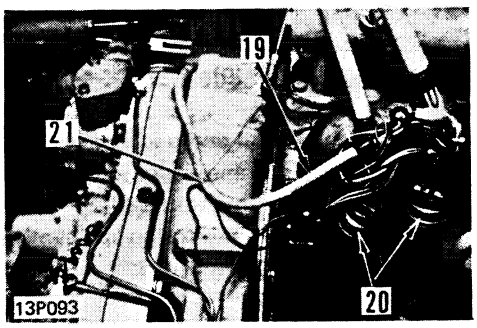
Connect wire harness (22) coming from starting motor to positive terminal of battery. Secure harness to engine with clamps (23) and (24).

★ Be careful to prevent harness from interfering with various rods, etc.



15. Battery relay wiring

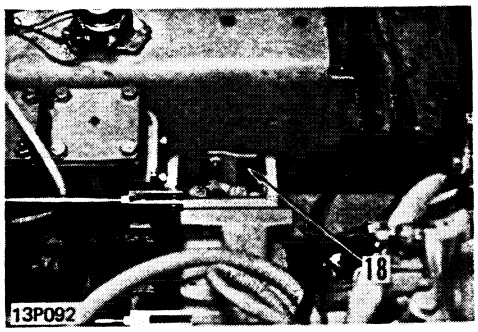
Connect battery relay wire harness (19) to its connector and secure it with clamp (21).



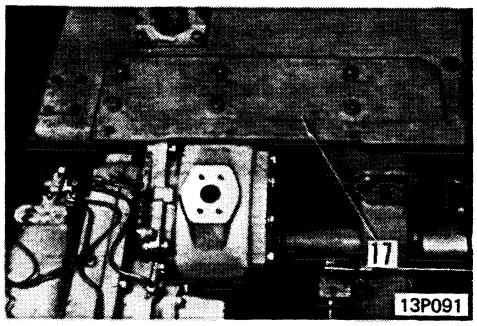
16. Right and left plates

Install engine side cover mounting plates (18) (right and left plates).

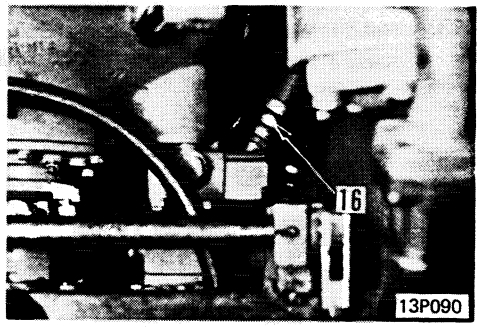
★ Tighten mounting bolts from the outside of fender.



17. Plate
Install step plate (17).

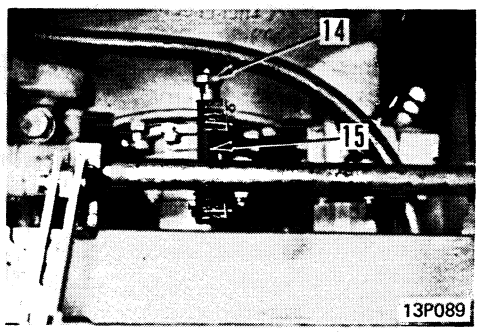


18. Regulator valve outlet tube
Connect regulator valve outlet tube (16), with O-ring in flange, to regulator valve.



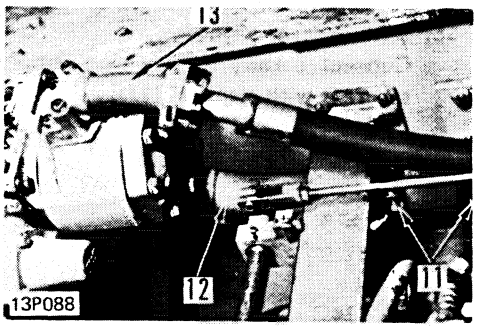
19. Torque converter breather hose
Install torque converter breather hose (15) with sleeve nut (14) on both torque converter side and transmission side.

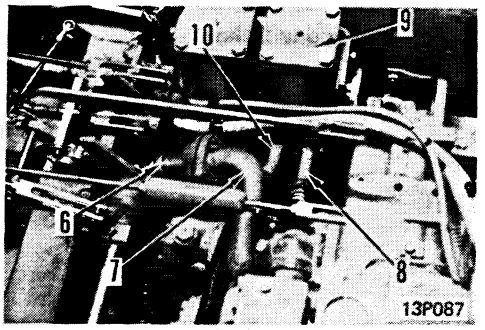
20. Hydraulic pump inlet and outlet piping
1) Connect hydraulic pump inlet tube (12), with O-ring in flange, to pump. Tighten coupling clamp (11).
2) Connect outlet tube (13), with O-ring in flange, to pump.
Mounting bolt: **10 ~ 12.5 kg.m**



21. Transmission oil filter outlet tube
Connect transmission oil filter outlet tube (10), with O-ring in flange, to filter (9).

22. Transmission oil pump inlet and outlet piping
1) Connect transmission oil pump outlet tube (8), with O-ring in flange, to oil filter (9).
2) Connect transmission oil pump inlet hose (6), with O-ring in flange, to tube (7).



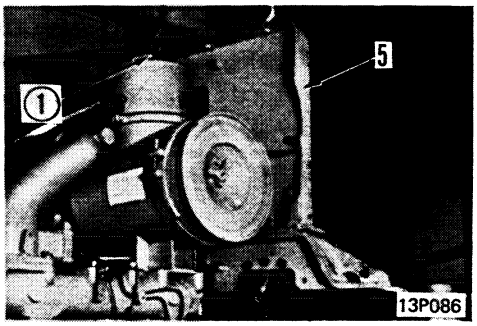


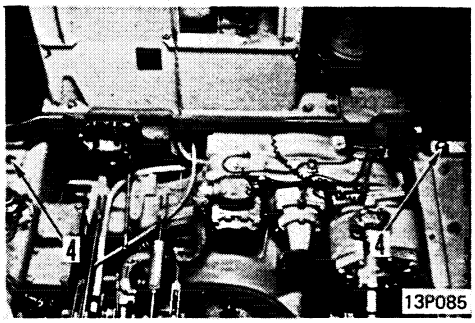
23. Hood mounting bracket

Lift hood mounting bracket (5) onto fender. Tighten mounting bolts (4).

★ Install two left bolts from the underside of fender.

kgm Mounting bolt: **25 ~ 31.5 kg.m**



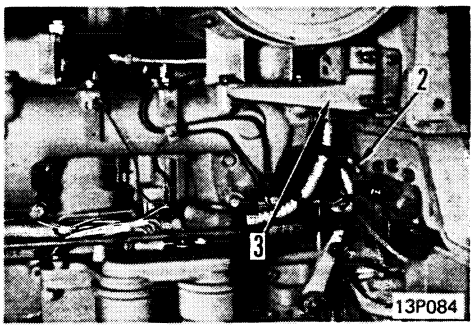


24. Air cleaner bracket

Install air cleaner bracket (3) with bolts and nuts.

25. Compression release rod

Connect compression release rod (2) at its bracket side end and secure with locknut.



26. Floor frame assembly

Refer to the MOUNTING FLOOR FRAME section.

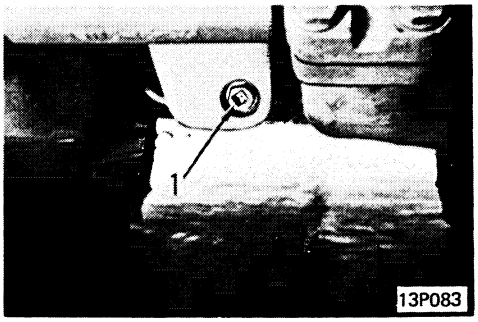
27. Radiator guard assembly

Refer to the MOUNTING RADIATOR GUARD section.

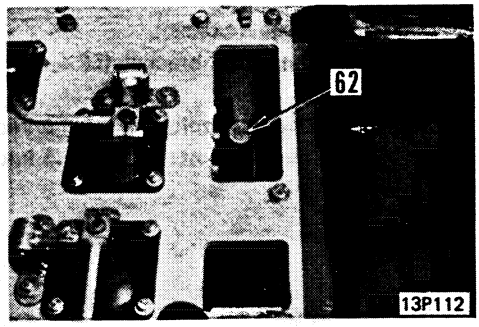
28. Lubrication

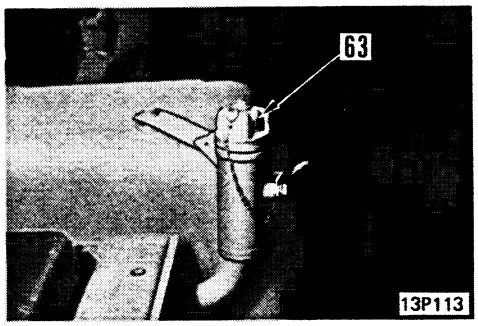
1) Install drain plug (1) with O-ring.

kgm Drain plug: **13 ~ 18 kg.m**

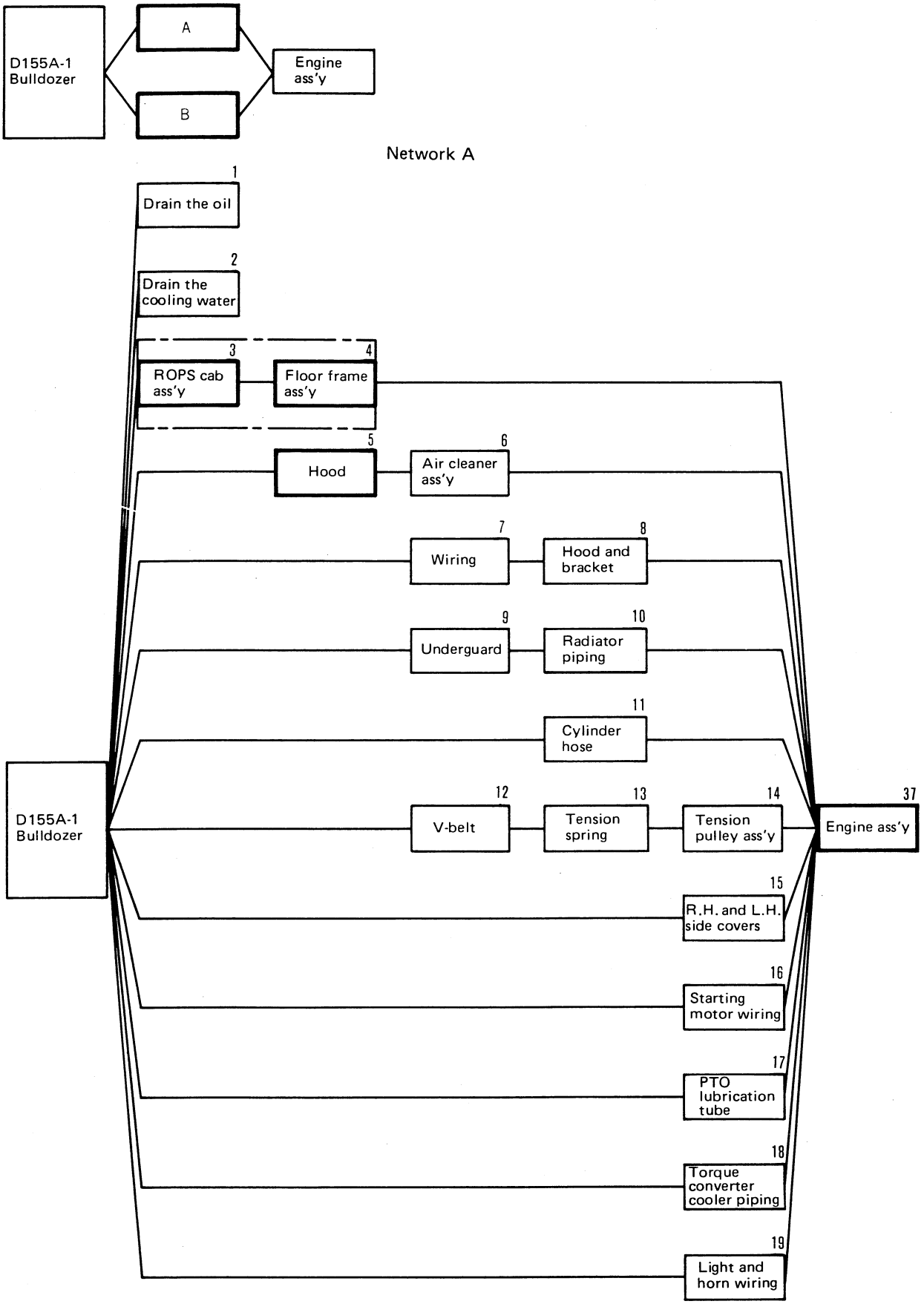


2) Refill with oil (SAE 30, class CD) through oil filler (63) while checking the oil level with level gauge (62).
   ★ After refilling, start engine and check the oil level again.

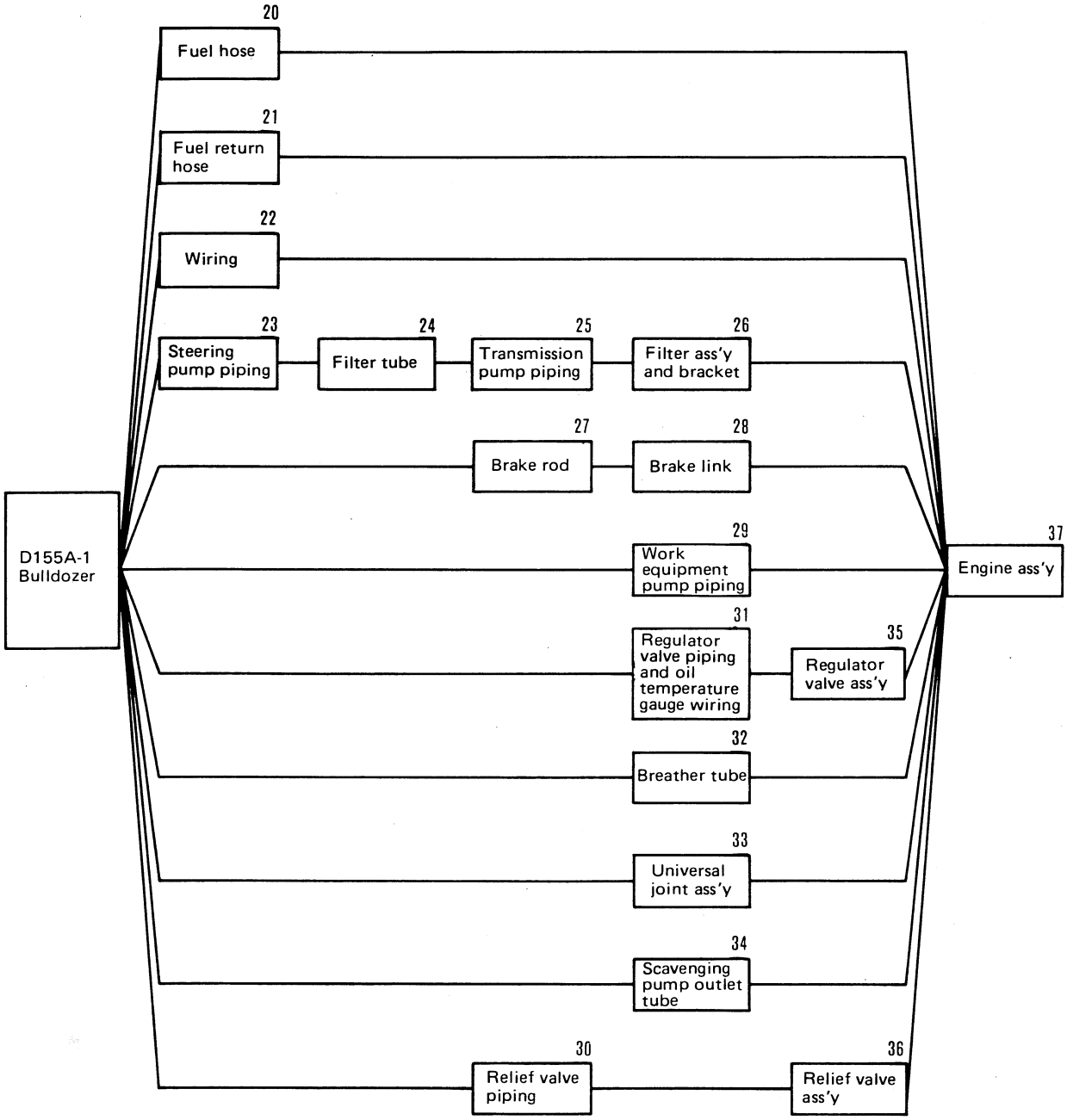




DISMOUNTING ENGINE D155A 25001 and up

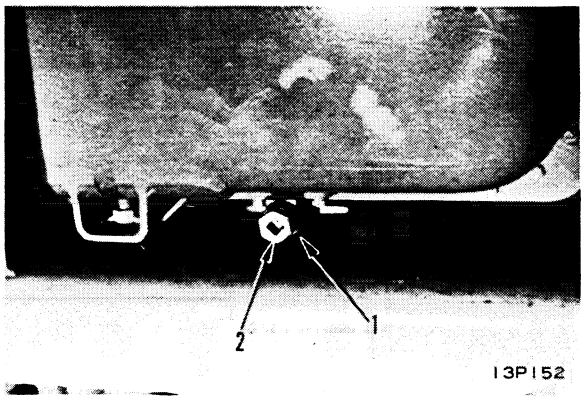


Network B


20
Fuel hose
21
Fuel return hose
22
Wiring
23
Steering pump piping
24
Filter tube
25
Transmission pump piping
26
Filter ass'y and bracket
27
Brake rod
28
Brake link
D155A-1 Bulldozer
29
Work equipment pump piping
37
Engine ass'y
31
Regulator valve piping and oil temperature gauge wiring
35
Regulator valve ass'y
32
Breather tube
33
Universal joint ass'y
34
Scavenging pump outlet tube
30
Relief valve piping
36
Relief valve ass'y

1. Draining the oil

Remove drain plug (1), open drain valve (2), and drain the hydraulic oil.

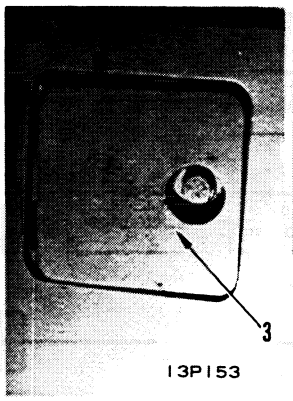


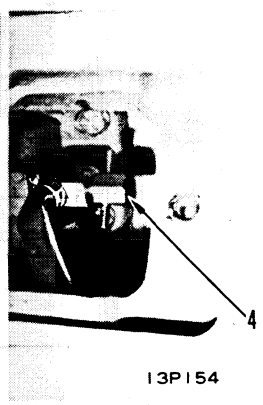
2. Draining the cooling water

Remove inspection cover (3), open drain valve (4), and drain the cooling water.

★ If the coolant contains antifreeze, dispose of it correctly.

Cooling water capacity: **150** ℓ





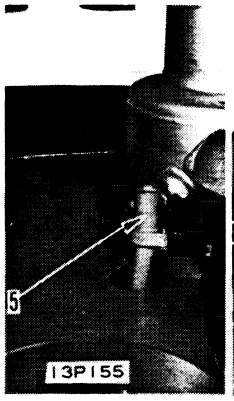
3. ROPS cab assembly

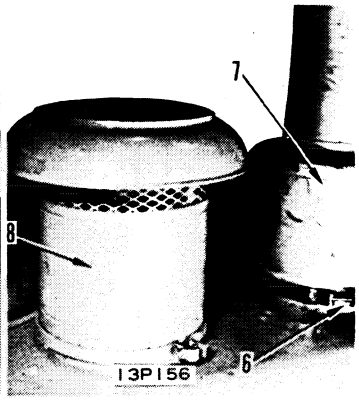
4. Floor frame assembly

To return the ROPS cab assembly to its original position, see RETURNING ROPS CAB TO ORIGINAL POSITION. To remove the ROPS cab and floor frame assembly, see DISMOUNTING ROPS CAB AND FLOOR FRAME ASSEMBLY.

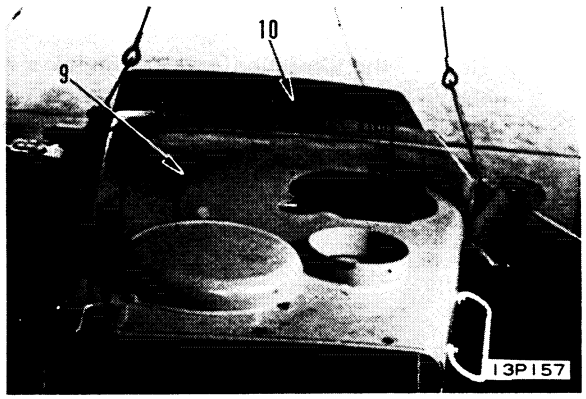
5. Hood

1) Remove ejector pipe (5).
2) Loosen clamp (6) and remove exhaust pipe (7).
   ★ Also remove the exhaust pipe gasket.
3) Loosen the clamp and remove air cleaner hood (8).



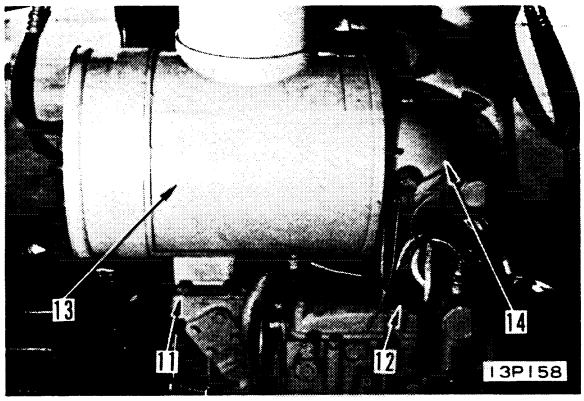


4) Unhook the hood latches on the R.H. and L.H. sides, and lift off hood (9) with slings.
5) Remove radiator cover (10).



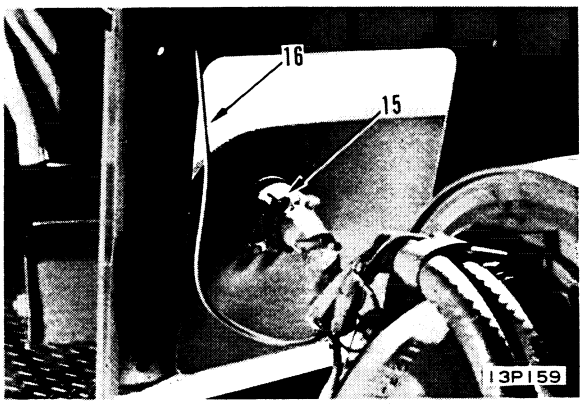
6. Air cleaner assembly

1) Remove four mounting bolts (11) and two bolts (12).
2) Sling air cleaner assembly (13) with a crane, and pull out intake connector (14) from the turbocharger.



7. Wiring

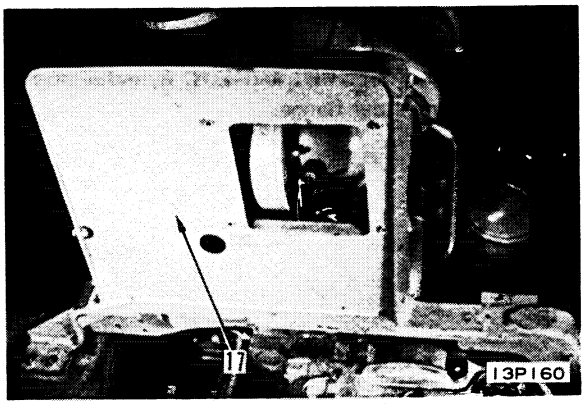
1) Disconnect wiring harness (15) from the connector.
2) Disconnect ground cable (16) from the hood bracket.



8. Hood bracket

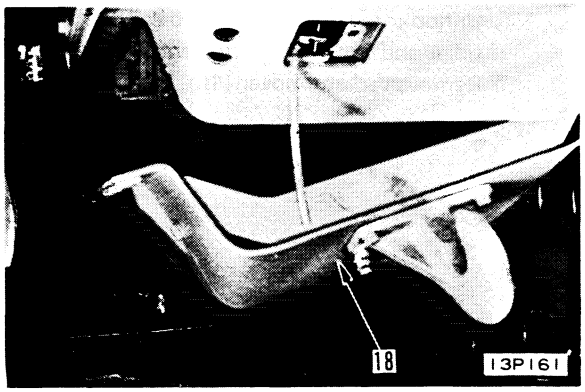
Temporarily lift hood bracket (17) with a crane. Remove it by removing the mounting bolts.

kg Hood bracket: **85 kg**



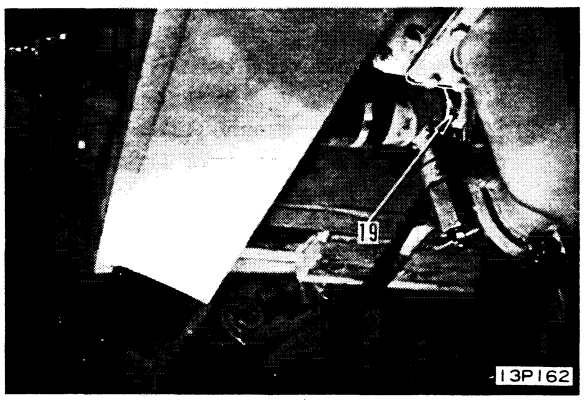
9. Underguard

1) Remove the inspection cover and hook a wire to the underguard.
2) Open underguard (18) by operating the crane.

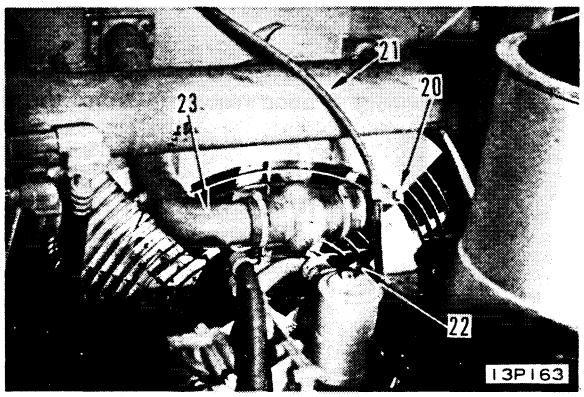


10. Radiator piping

1) Disconnect radiator outlet tube (19) from the water pump.

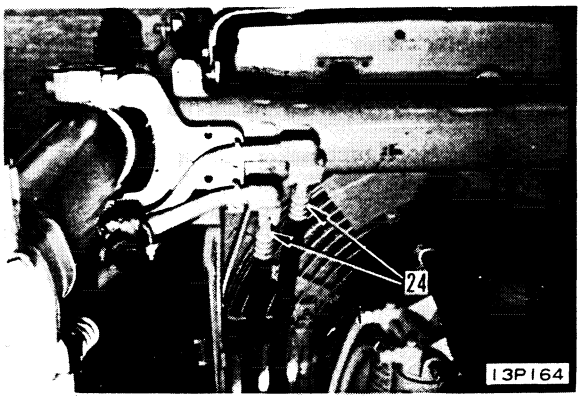


2) Remove clamp bolt (20) and disconnect aeration hose (21).
3) Remove bracket (22) and radiator inlet tube (23).



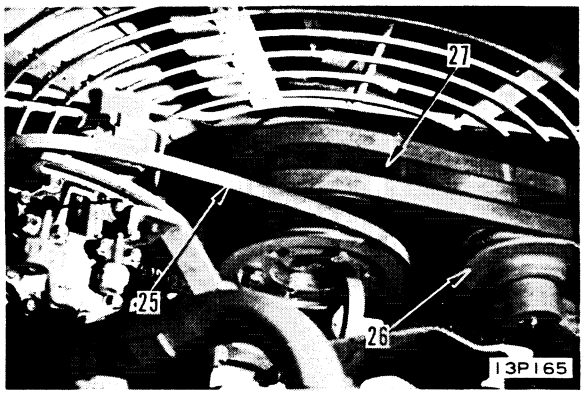
11. Cylinder hose

Disconnect four R.H. and L.H. cylinder hoses (24) from the cylinder flange.



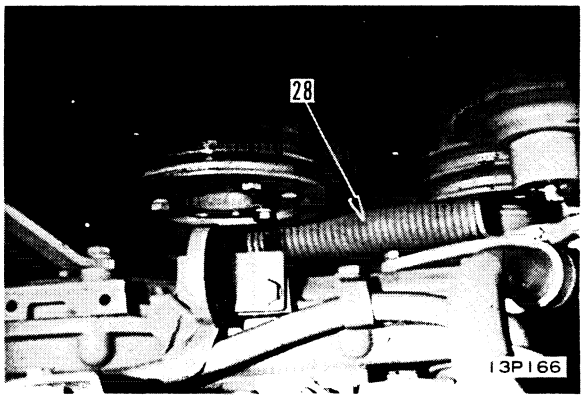
12. V-belt

1) Loosen the adjustment plate and remove compressor V-belt (25).
2) Loosen the adjustment plate and remove three V-belts (27) by pushing tension pulley (26).



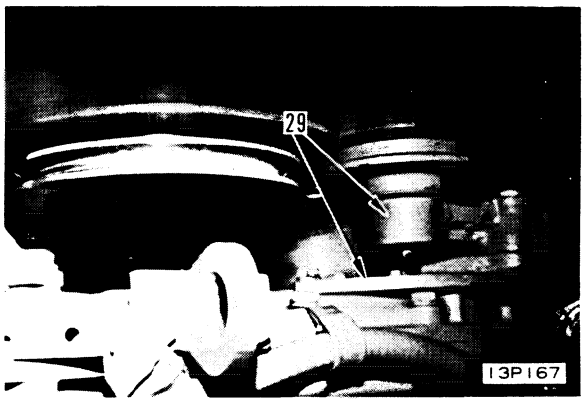
13. Tension spring

Loosen the adjustment bolt and remove tension spring (28).



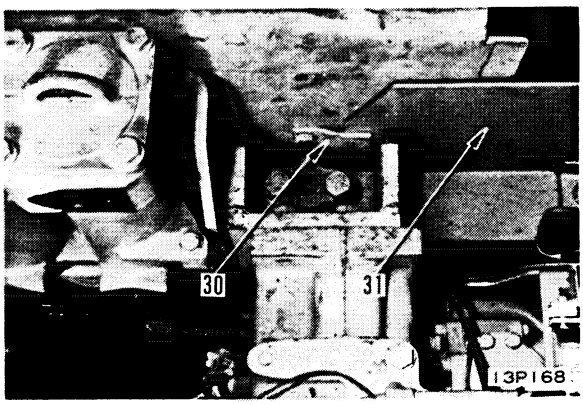
14. Tension pulley assembly

Remove tension pulley assembly (29) together with the bracket.



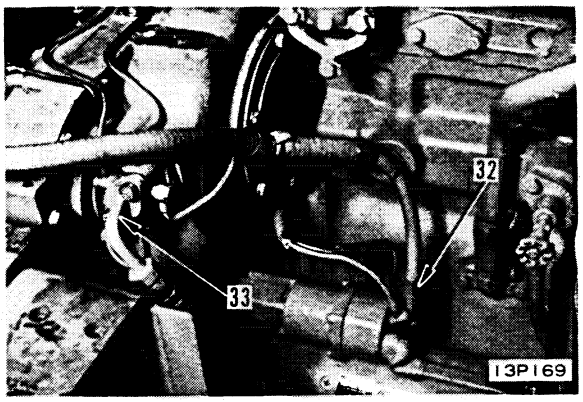
15. R.H. and L.H. side covers

Remove mounting plates (30) on the R.H. and L.H. sides. Remove side covers (31) on both sides.

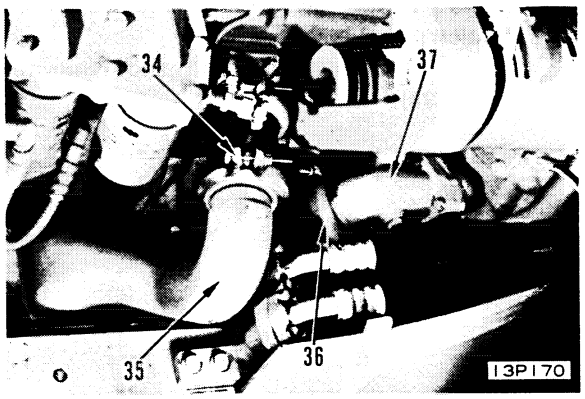


16. Starting motor wiring
Disconnect starting motor wiring (32) from the terminal.

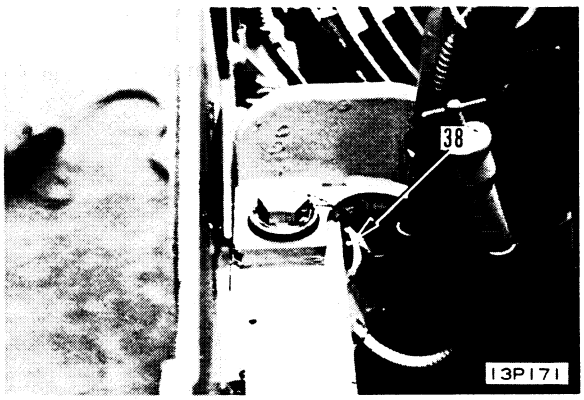
17. PTO lubrication tube
Disconnect PTO lubrication tube (33).



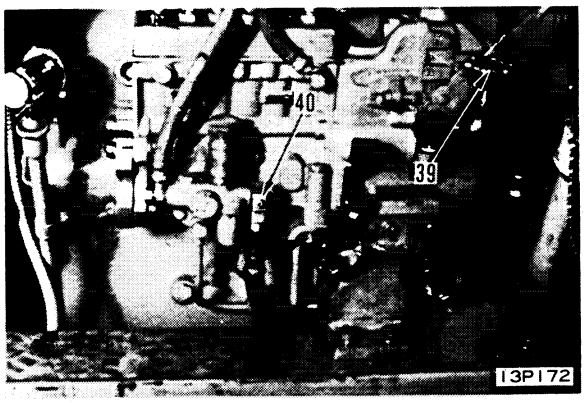
18. Torque converter cooler piping
1) Remove coupling clamp (34) and cooler outlet water pipe (35).
2) Remove coupling clamp (36) and cooler inlet water pipe (37).



19. Light and horn wiring
Disconnect light and horn wiring (38) from the connector.

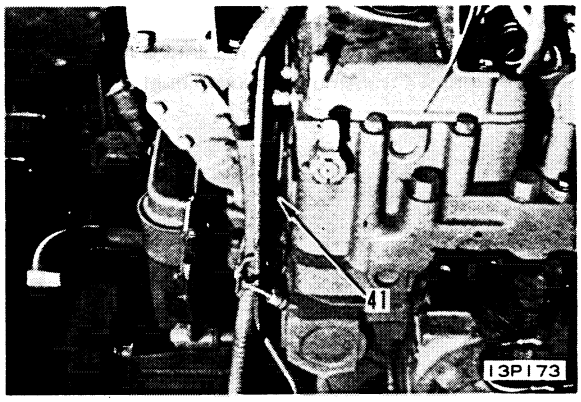


20. Fuel hose
Close fuel supply valve (39) and disconnect fuel hose (40) from the feed pump.



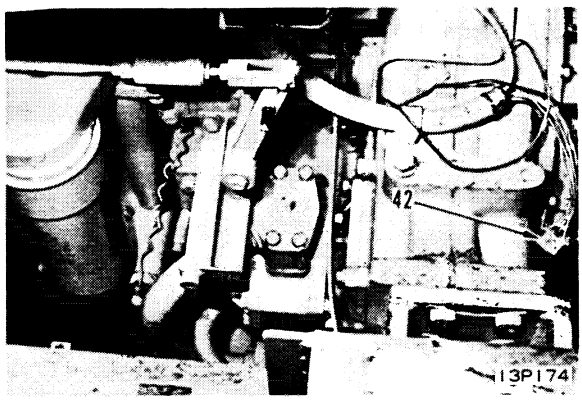
21. Fuel return hose

Shift the clamp out of the way and disconnect fuel return hose (41).



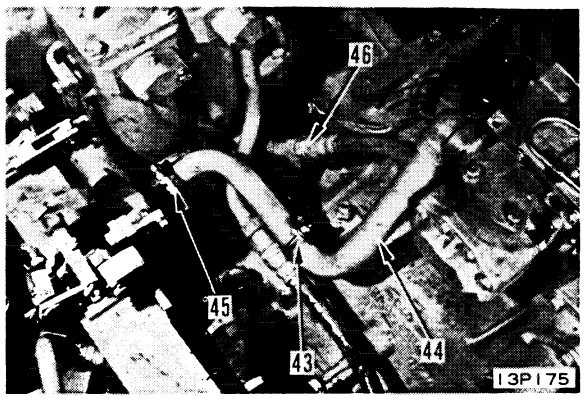
22. Wiring

Disconnect main switch wiring (42) from the connector.



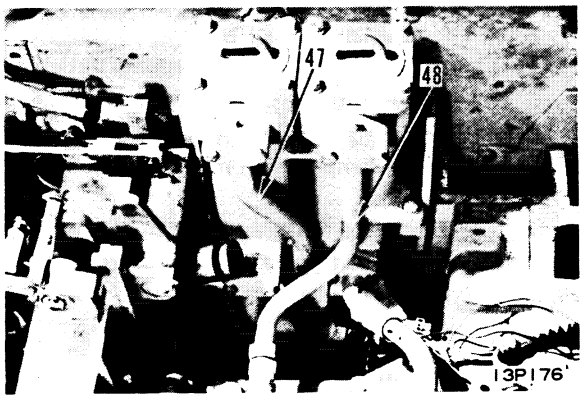
23. Steering pump piping

1) Remove U-bolt (43), disconnect steering pump inlet tube (44) from the pump, and remove the tube by loosening clamp (45).
2) Remove steering pump outlet hose (46).

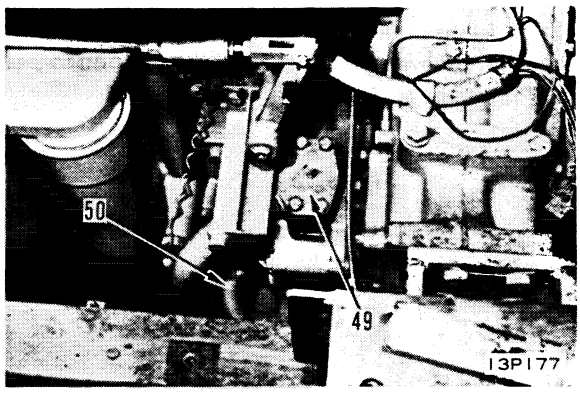


24. Filter tube

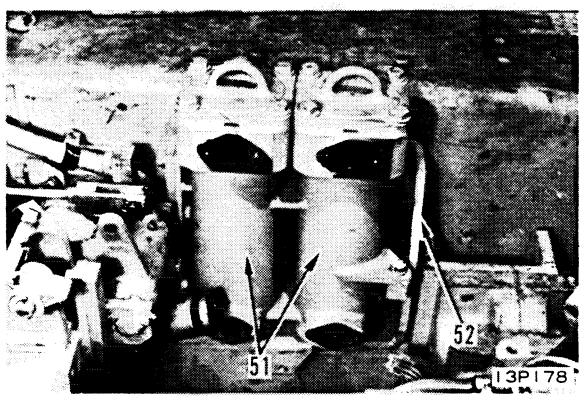
1) Disconnect tube (47) which connects the oil filter to the interlocking valve of the steering brake.
2) Disconnect tube (48) which connects the oil filter and the transmission control valve.



25. Transmission pump piping
1) Disconnect transmission pump outlet tube (49).
2) Remove transmission pump inlet tube (50).

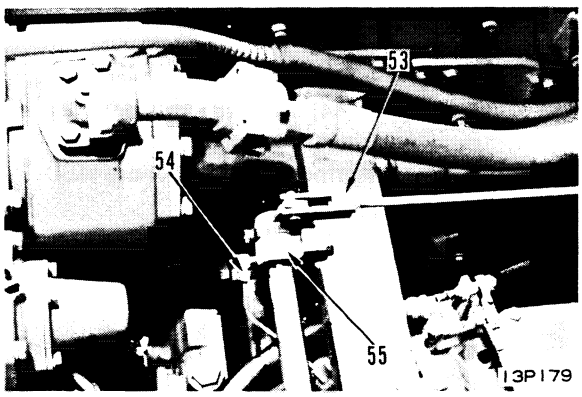


26. Filter assembly and bracket
1) Remove oil filter assembly (51).
2) Remove oil filter bracket (52).

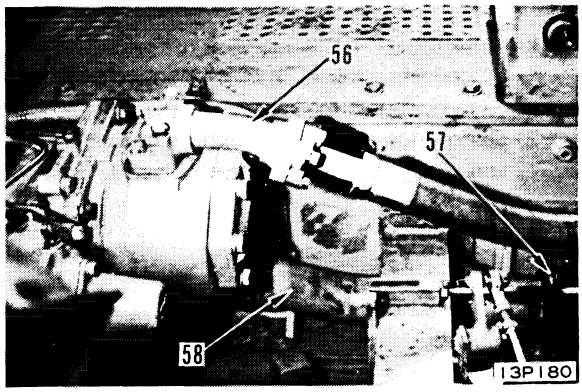


27. Brake rods
1) Disconnect R.H. and L.H. brake rods (53).
2) Disconnect R.H. and L.H. grease tubes (54).

28. Brake link
Remove brake link (55).

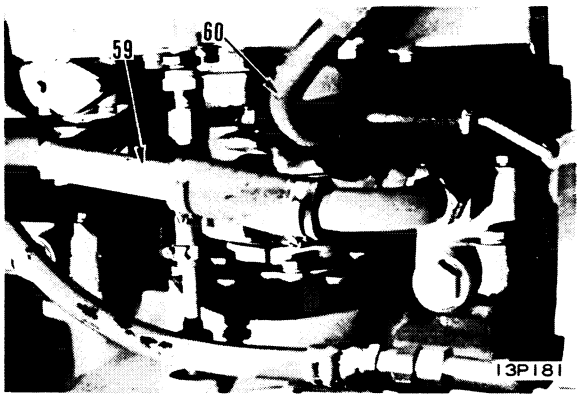


29. Work equipment pump piping
1) Disconnect work equipment pump outlet hose (56).
   ★ Draw up the disconnected hose to the rear part of the machine with a wire.
2) Loosen clamp (57) and disconnect pump inlet tube (58).
   ★ Cover the inlet and outlet of the pump with pieces of tape or plugs to prevent the entry of dust.



30. Relief valve piping

1) Loosen the hose clamp and remove relief valve outlet tube (59).
2) Remove relief valve inlet hose (60).

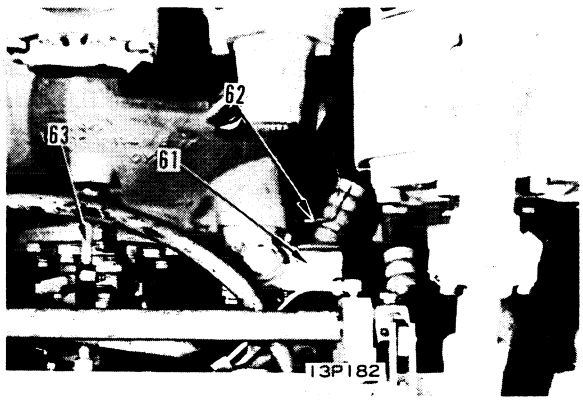


31. Regulator valve piping and oil temperature gauge wiring

1) Disconnect regulator valve outlet tube (61).
2) Disconnect wiring (62) for the torque converter oil temperature gauge from the sensor.

32. Breather tube

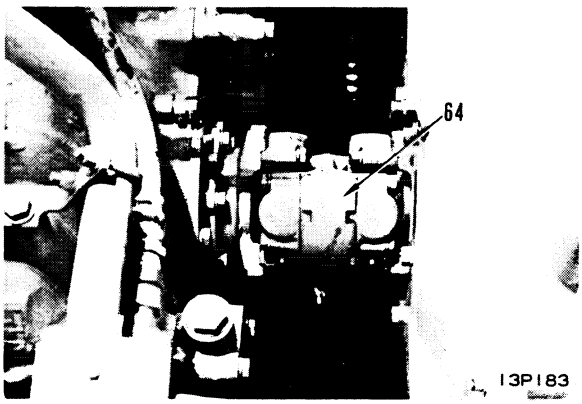
Remove breather tube (63).



33. Universal joint assembly

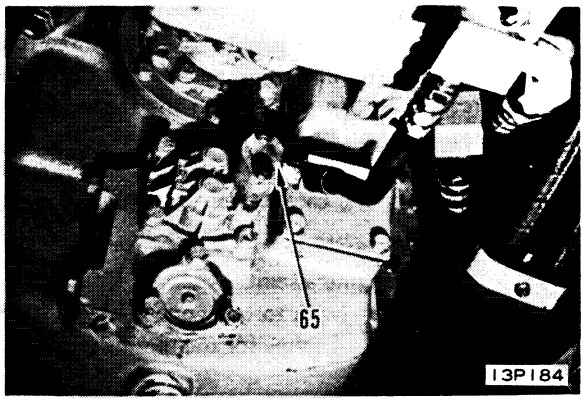
Remove universal joint assembly (64).

★ If it is difficult to remove the joint in the limited space around the coupling, remove one side of the bearing.



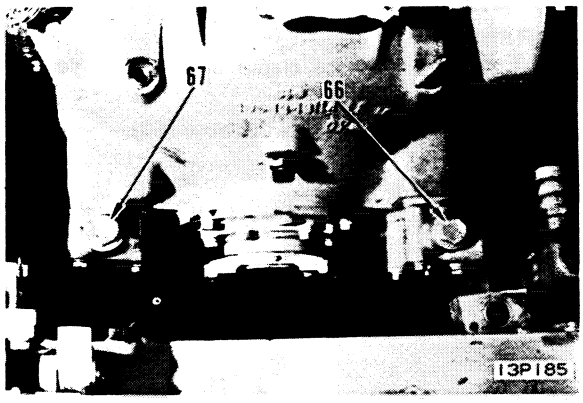
34. Scavenging pump outlet hose

Disconnect scavenging pump outlet hose (65) from the pump.

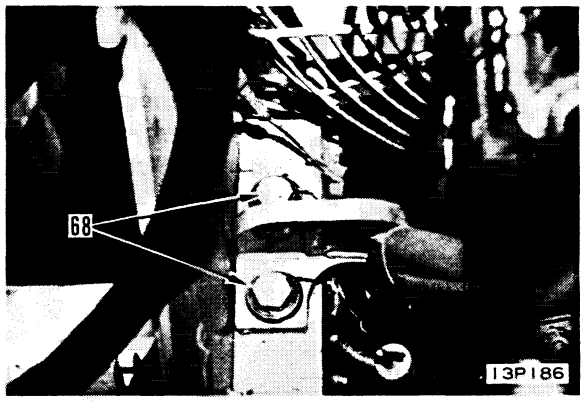


35. Regulator valve assembly
Remove regulator valve assembly (66).

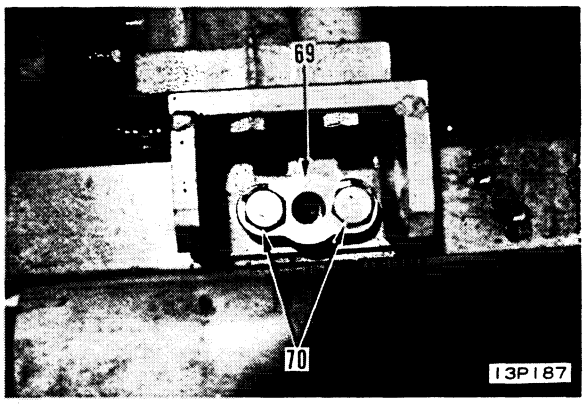
36. Relief valve assembly
Remove relief valve assembly (67).



37. Engine assembly
1) Cut off the lock wire, and remove four front mounting bolts (68) on the R.H. and L.H. sides.



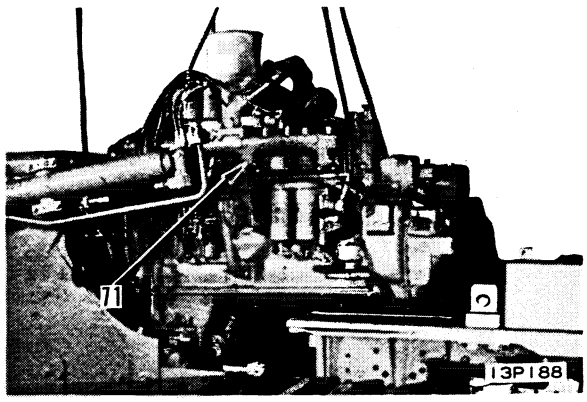
2) Straighten lock plate (69), and remove four rear mounting bolts (69) on the R.H. and L.H. sides.



3) Sling the engine assembly by hooking three ropes to the rear mount brackets and the front hook, lift the rear mount brackets from the frame, and lift off engine assembly (71).
★ When dismounting the engine assembly, slowly sling it, taking care not to let it hit any nearby parts.

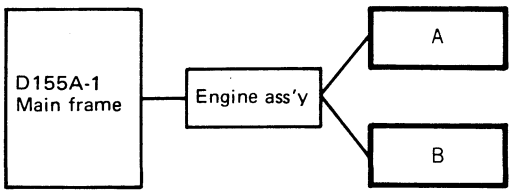
kg Engine assembly (with torque converter): **3,100 kg**

★ Keep all sets of shims for the mount section.

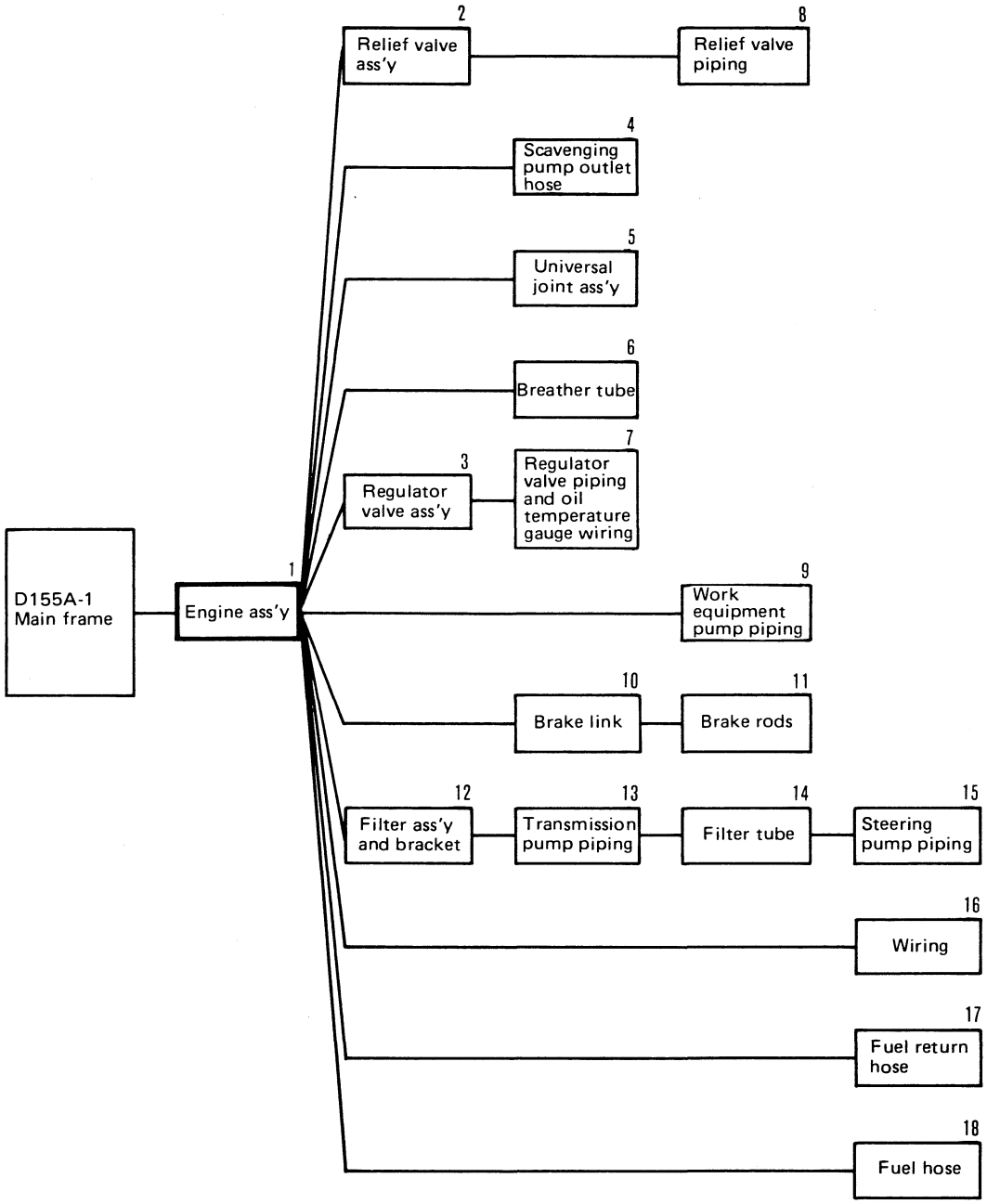


MOUNTING ENGINE

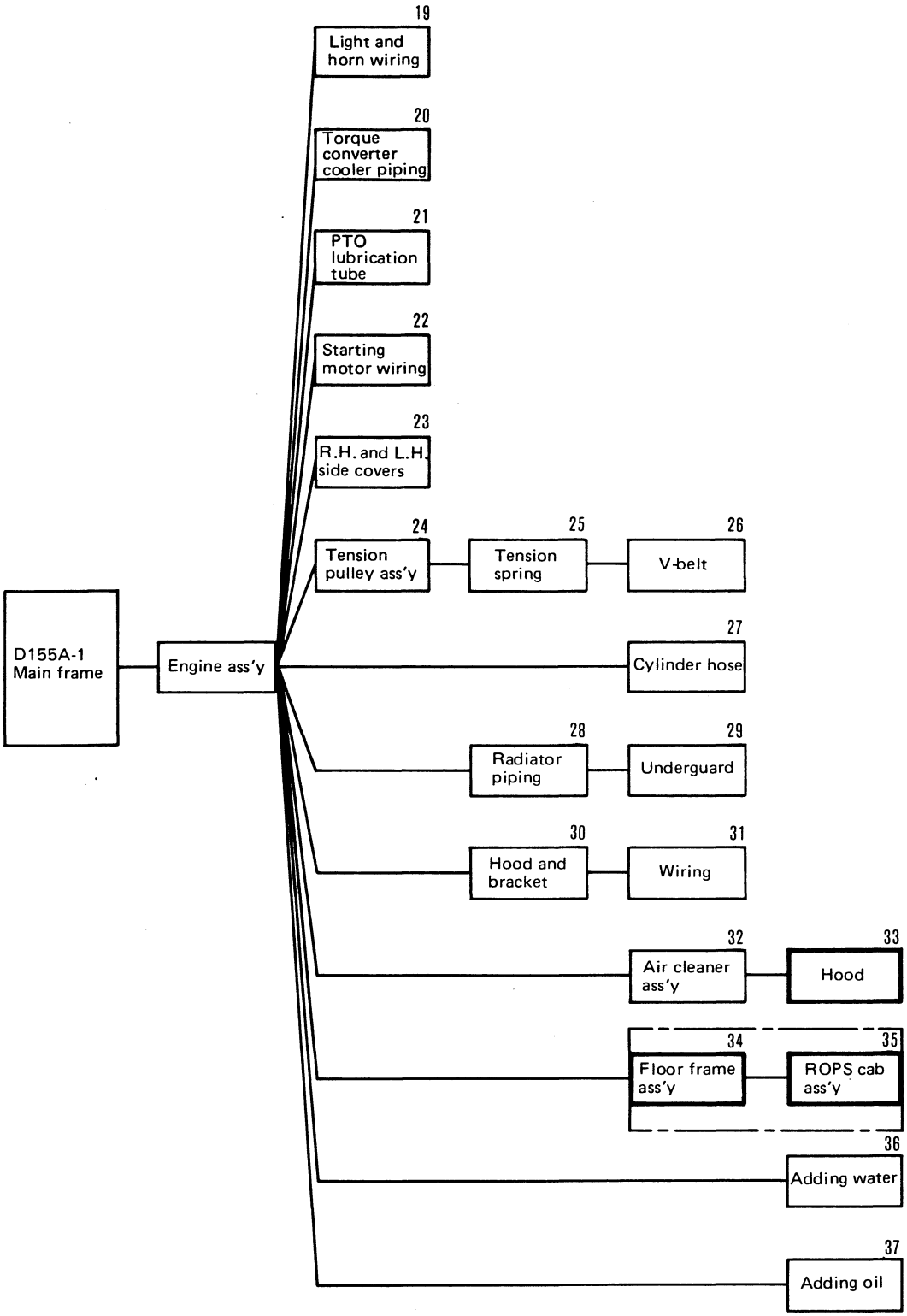
D155A 25001 and up



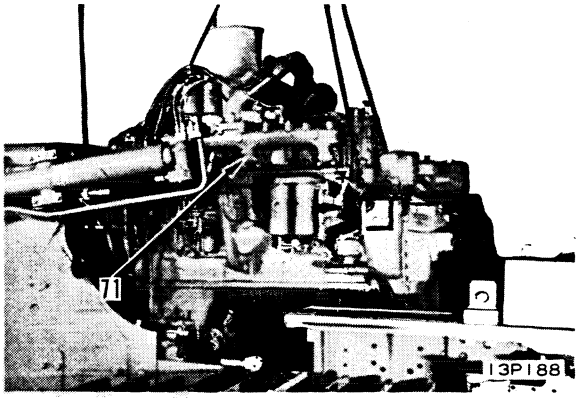
Network A



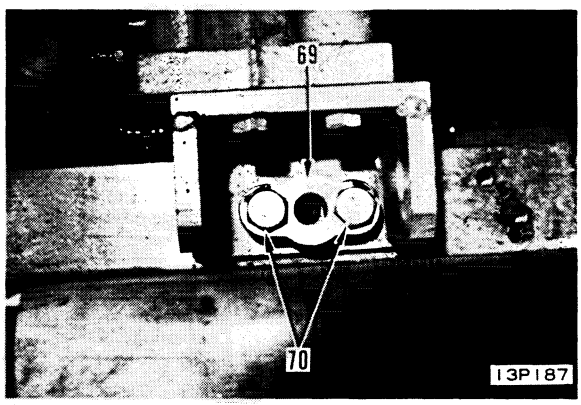
Network B


D155A-1
Main frame
Engine ass'y
19
Light and horn wiring
20
Torque converter cooler piping
21
PTO lubrication tube
22
Starting motor wiring
23
R.H. and L.H. side covers
24
Tension pulley ass'y
25
Tension spring
26
V-belt
27
Cylinder hose
28
Radiator piping
29
Underguard
30
Hood and bracket
31
Wiring
32
Air cleaner ass'y
33
Hood
34
Floor frame ass'y
35
ROPS cab ass'y
36
Adding water
37
Adding oil

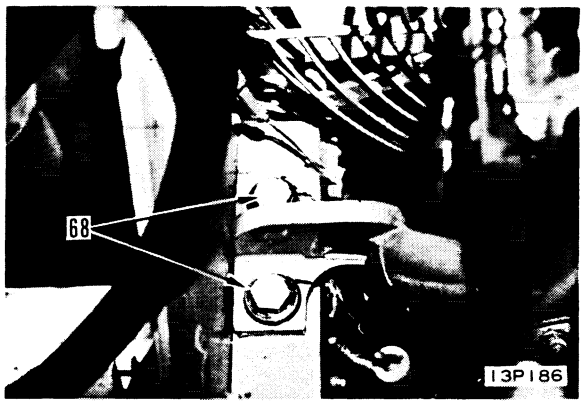
1. **Engine assembly**
   1) Fit shims to all four sides of each engine mount, sling engine assembly (71) with three ropes, and set it on the mounts.
      ★ Standard thickness of shim: 2 mm (for both the front and the rear mounts)



   2) Tighten four rear mounting bolts (70) on the R.H. and L.H. sides and lock the bolts by bending lock plates (69).

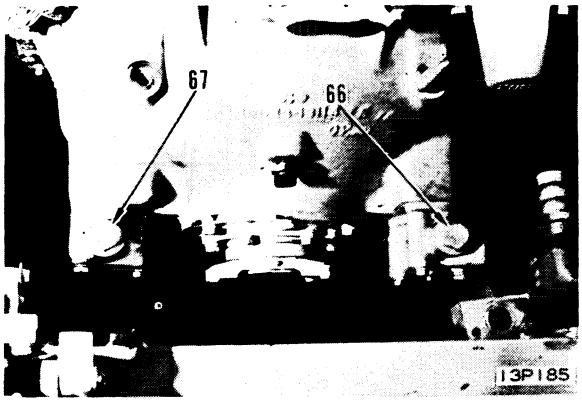


   3) Tighten four front mounting bolts (68) on the R.H. and L.H. sides and lock the bolts with wires.

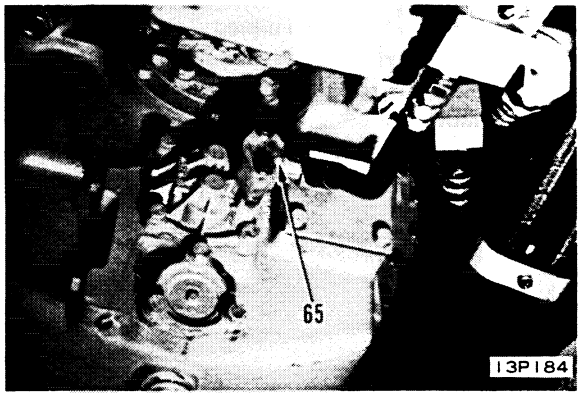


2. **Relief valve assembly**
   Fit an O-ring to the mounting surface and install relief valve assembly (67).

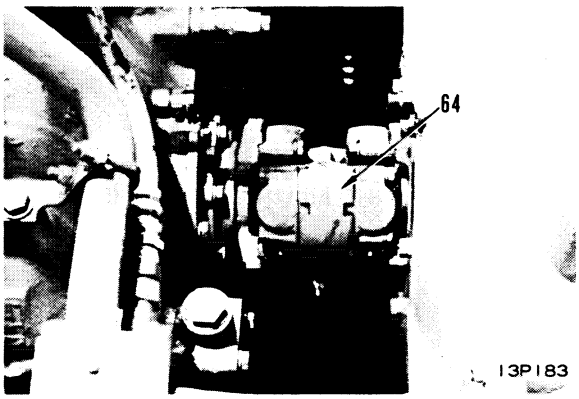
3. **Regulator valve assembly**
   Fit an O-ring to the mounting surface and install regulator valve assembly (66).



4. **Scavenging pump outlet hose**
   Fit an O-ring to the mounting surface and connect scavenging pump outlet hose (65).

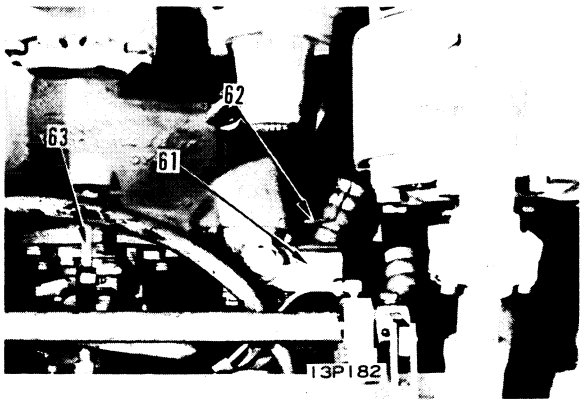


5. **Universal joint assembly**
   Install universal joint assembly (64).
   kgm Mounting bolt: **11 ± 1 kgm**

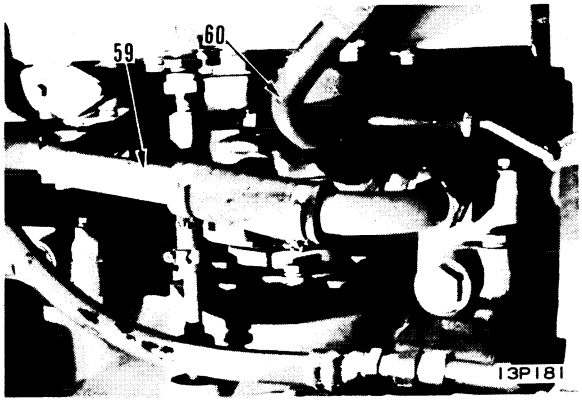


6. **Breather tube**
   Install breather tube (63).

7. **Regulator valve piping and oil temperature gauge wiring**
   1) Connect torque converter oil temperature gauge wiring (62) to the sensor.
   2) Fit an O-ring to the mounting surface and connect regulator valve outlet tube (61).

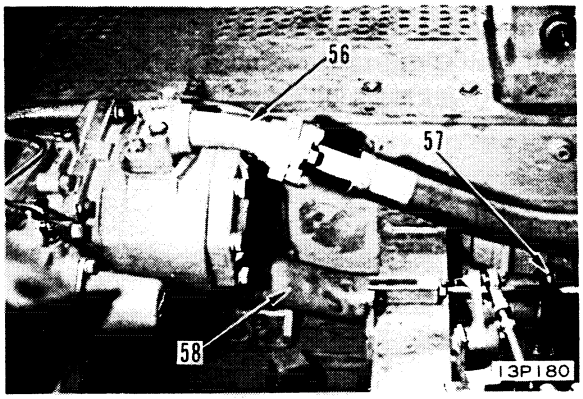


8. **Relief valve piping**
   1) Install relief valve inlet hose (60).
   2) Fit an O-ring to the mounting surface, install relief valve outlet tube (59), and tighten the hose clamp.



9. Work equipment pump piping

1) Fit an O-ring to the mounting surface, connect work equipment pump inlet tube (58), and tighten clamp (57).
2) Fit an O-ring to the mounting surface, and connect pump outlet hose (56).

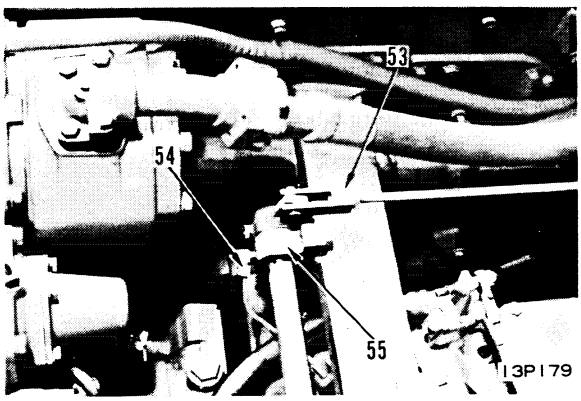


10. Brake link

Install brake link (55).

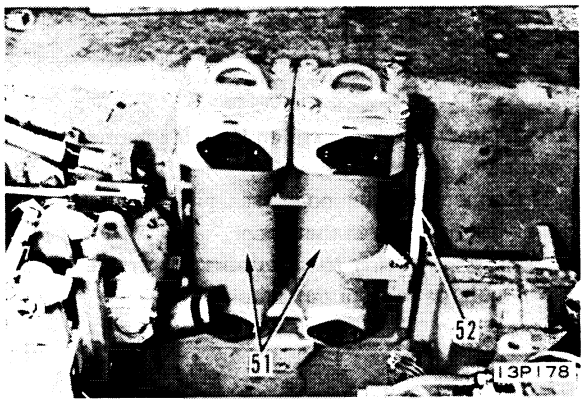
11. Brake rods

1) Connect R.H. and L.H. grease tubes (54).
2) Connect R.H. and L.H. brake rods (53).



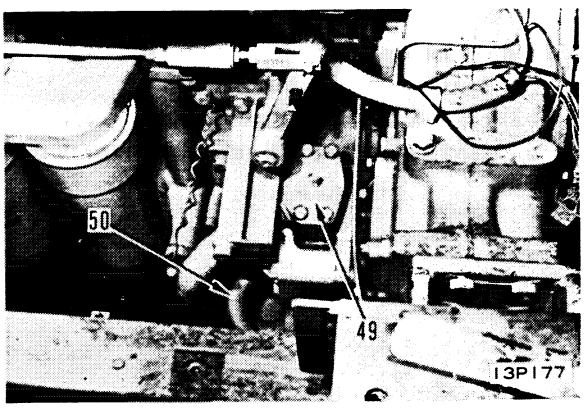
12. Filter assembly and bracket

1) Install oil filter bracket (52).
2) Install oil filter assembly (51).



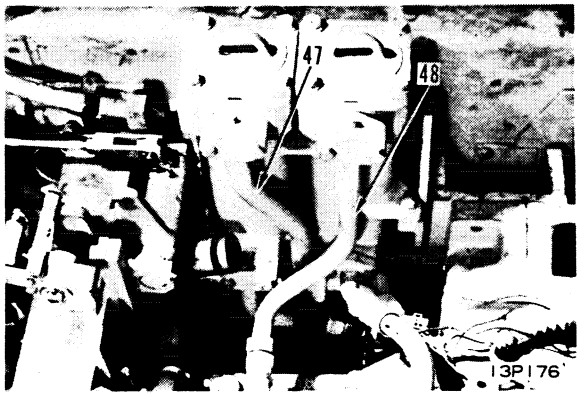
13. Transmission pump piping

1) Fit an O-ring to the mounting surface and install transmission pump inlet tube (50).
2) Fit an O-ring to the mounting surface and connect transmission pump outlet tube (49).



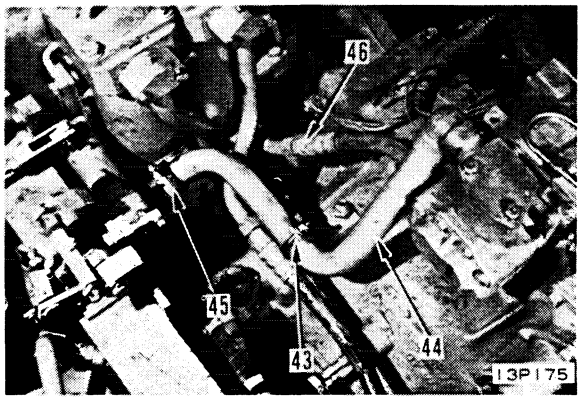
14. Filter tube

1) Fit an O-ring to the mounting surface and connect tube (48) between the oil filter and the transmission control valve.
2) Fit an O-ring to the mounting surface and connect tube (47) between the oil filter and the steering-brake interlocking valve.



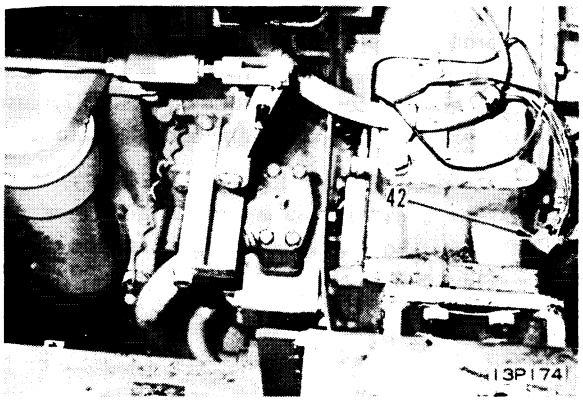
15. Steering pump piping

1) Fit an O-ring to the mounting surface and install steering pump outlet hose (46).
2) Fit an O-ring to the mounting surface, connect steering pump inlet tube (44), tighten clamp (45), and secure the tube with U-bolt (43).



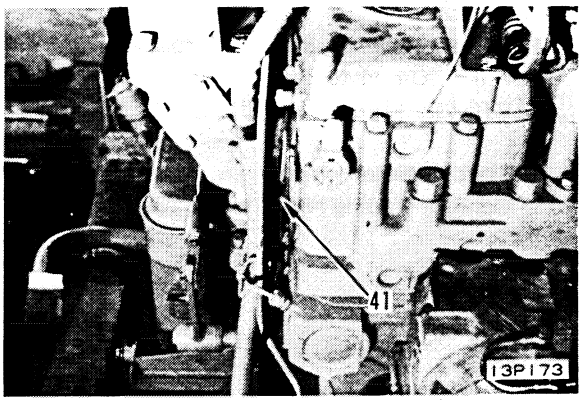
16. Wiring

Connect main switch wiring (42) to the connector.

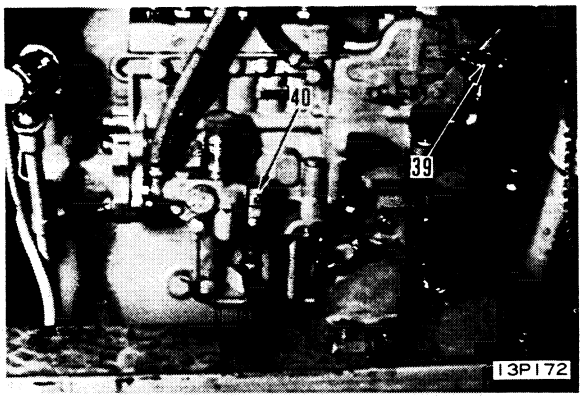


17. Fuel return hose

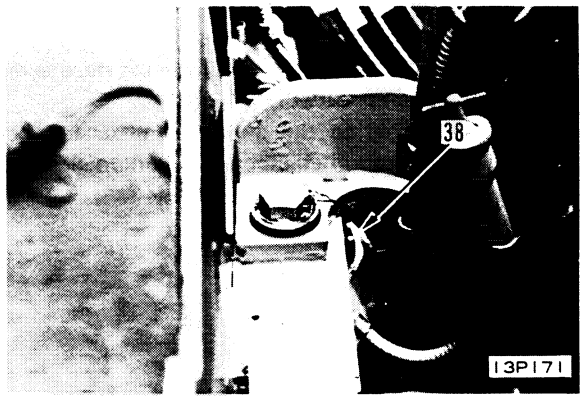
Connect fuel return hose (41) and secure the hose with clamps.



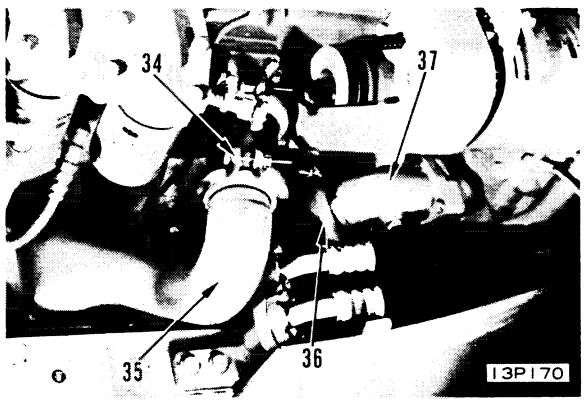
18. Fuel hose
Connect fuel hose (40) to the feed pump and open fuel supply valve (39).



19. Light and horn wiring
Connect light and horn wiring with connectors.

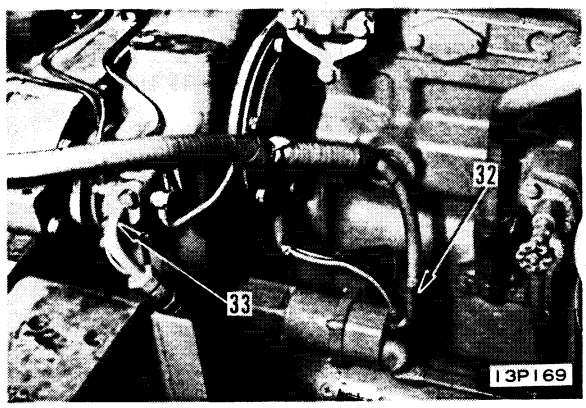


20. Torque converter cooler piping
1) Fit a gasket to the mounting surface of torque converter cooler inlet water hose (37), insert the hose to the coupling, and tighten clamp (36).
   Gasket: **Liquid gasket (LG-1)**
2) Fit a gasket to the mounting surface of outlet water hose (35), insert the hose to the coupling, and tighten clamp (34).
   Gasket: **Liquid gasket (LG-1)**



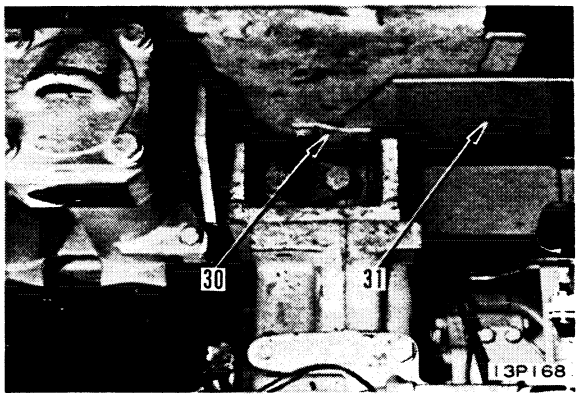
21. PTO lubrication tube
Fit an O-ring to the mounting section and connect PTO lubrication tube (33).

22. Starting motor wiring
Connect starting motor wiring (32) to the terminal.



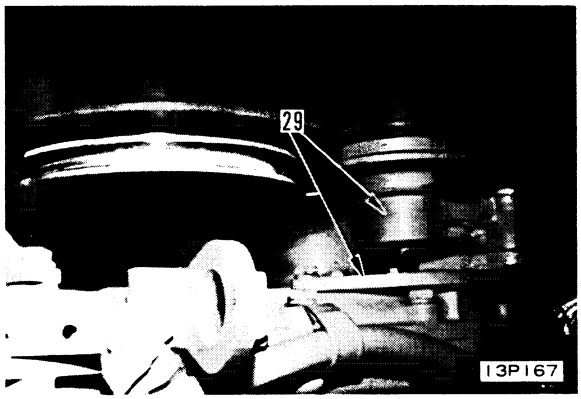
23. R.H. and L.H. side covers

Install R.H. and L.H. side covers (31) and secure the covers with mounting plates (30) on the R.H. and L.H. sides.



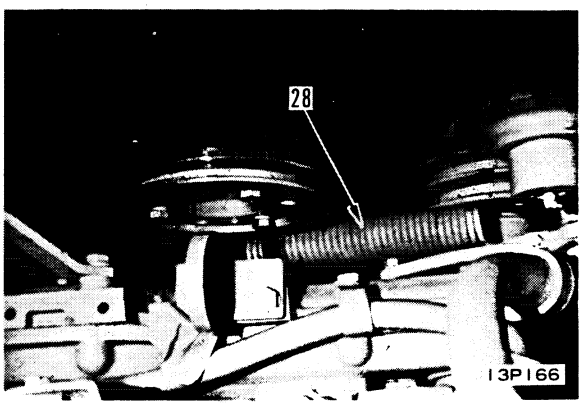
24. Tension pulley assembly

Install tension pulley assembly (29).



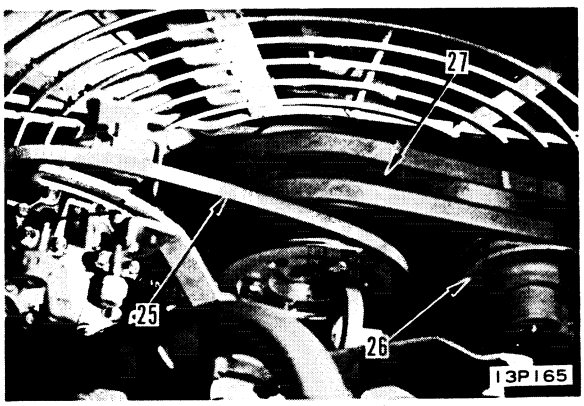
25. Tension spring

Install tension spring (28).



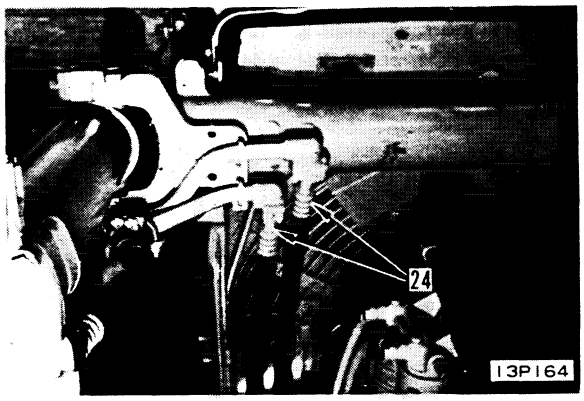
26. V-belts

1) Install three V-belts (27) by pushing tension pulley (26).
2) Tighten the adjustment nut to adjust the clearance between the end surface of the nut and the tip of the bolt to 80 to 90 mm, and tighten the lock nut.
3) Install compressor V-belt (25) and adjust and tighten the adjustment plate.



27. Cylinder hose

Fit O-rings to the mounting surfaces and connect four cylinder hoses (24) on the R.H. and L.H. sides.

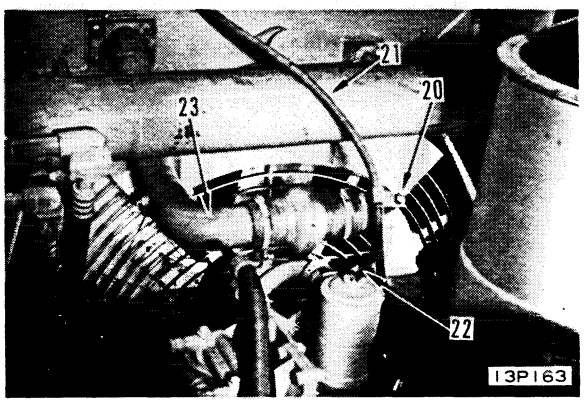


28. Radiator piping

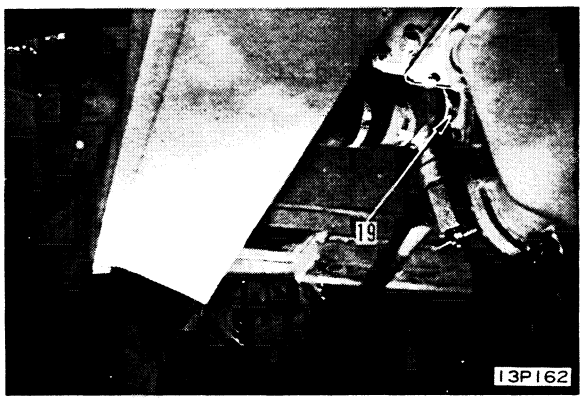
1) Coat the mounting surface with liquid gasket, install rediator inlet tube (23), and secure the tube with bracket (22).

   Gasket: **Liquid gasket (LG-1)**

2) Connect aeration hose (21) and tighten clamp bolt (20).



3) Connect radiator outlet tube (19).

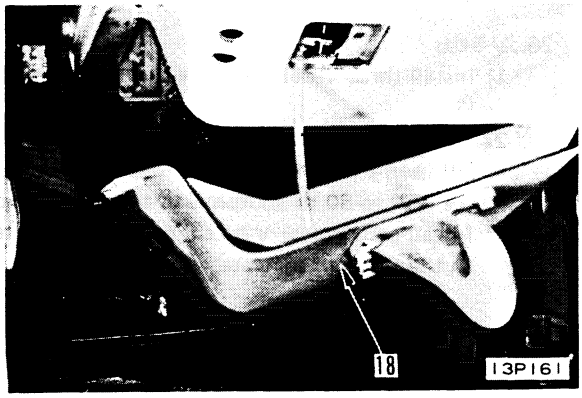


29. Underguard

1) Close underguard (18) by operating a crane and tighten the mounting bolts.

   Mounting bolts: **Thread tightener (LG-2)**

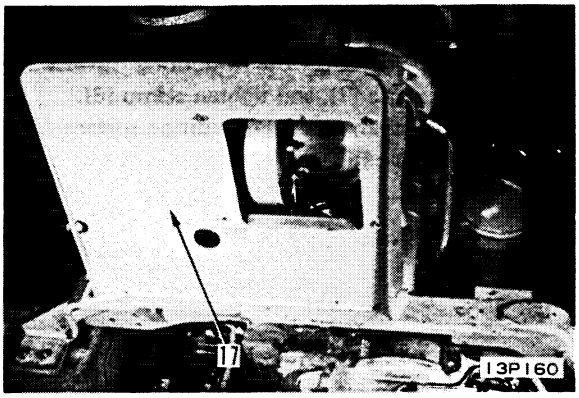
2) Remove the wire and install the inspection cover.



30. Hood bracket

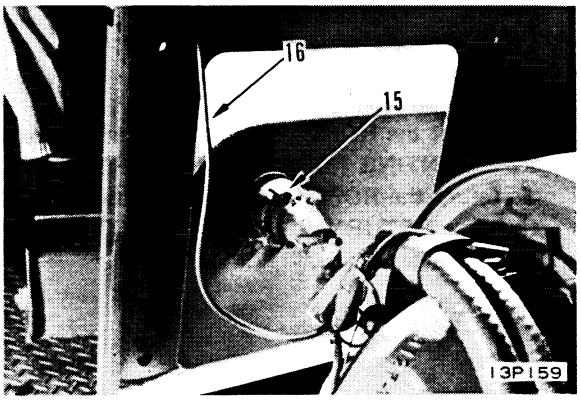
Install hood bracket (17) to the fender by slinging with a crane, and tighten four mounting bolts on the R.H. and L.H. sides.

kgm Mounting bolts: **28 ± 3 kgm**



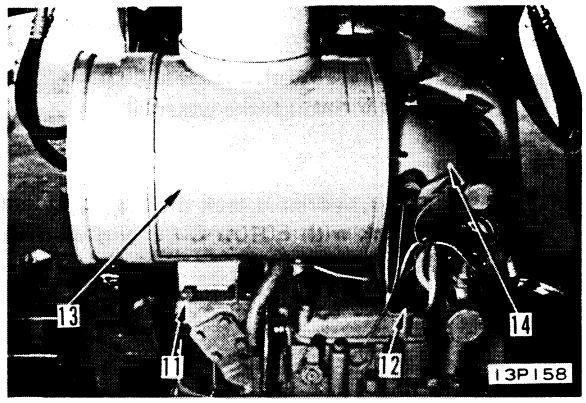
31. Wiring

1) Connect ground cable (16).
2) Connect wiring harness (15) to the connector.



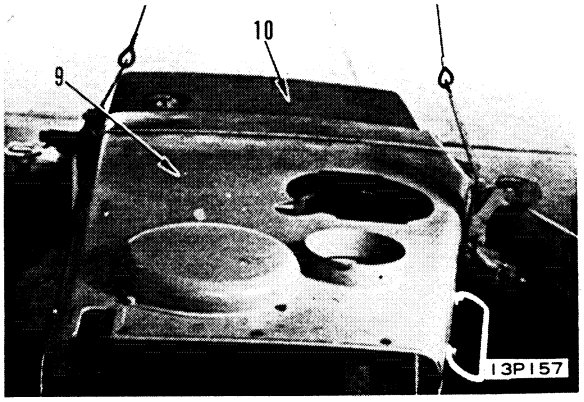
32. Air cleaner assembly

Sling air cleaner assembly (13) with a crane, fit an O-ring to intake connector (14), insert the intake connector into the turbocharger, and install the air cleaner assembly with two mounting bolts (12) and four bolts (11).

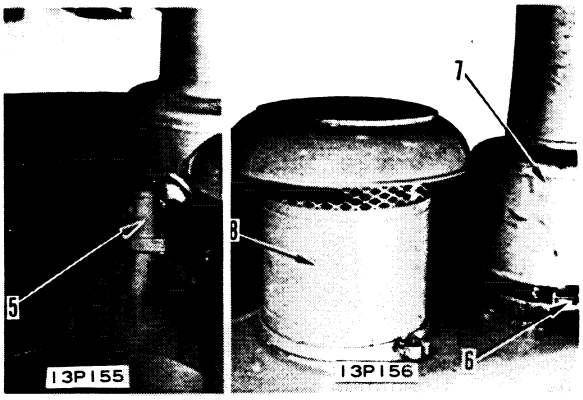


33. Hood

1) Install radiator cover (10).
2) Install hood (9) by slinging with a crane, and hook the hood latches on the R.H. and L.H. sides.



3) Install air cleaner hood (8) and tighten the clamp.
4) Apply gasket to the mounting surface, install exhaust pipe (7), and tighten clamp (6).
5) Apply gasket to the mounting surface and install ejector pipe (5).



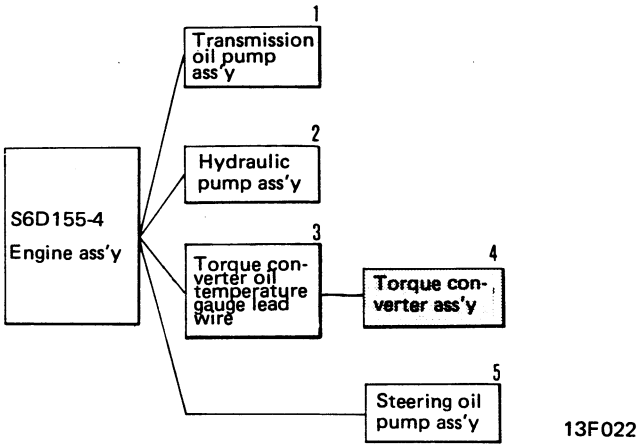
34. Floor frame assembly

35. ROPS cab assembly
To install the ROPS cab and floor frame assemblies, see MOUNTING ROPS CAB AND FLOOR FRAME.
To return the ROPS cab assembly to its original position, see RETURNING ROPS CAB TO ORIGINAL POSITION.

36. Adding water
Make sure the drain valve is closed, then fill the radiator with water through the water filler.

37. Adding oil
Make sure the hydraulic tank drain plug is tightened, then fill the tank with E010W-CD engine oil through the oil filler.

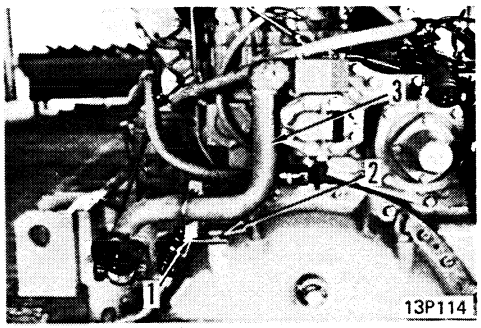
DISMOUNTING CHASSIS RELATED PARTS FROM ENGINE D155A



13F022

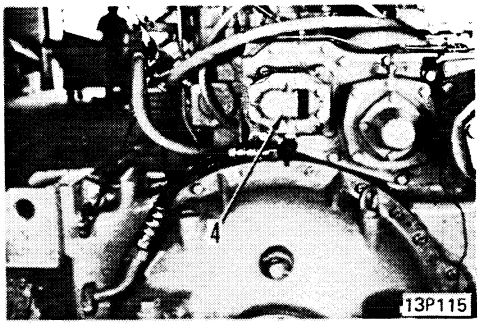
1. Transmission oil pump assembly

1) Remove bolts (2) fastening clamp bracket (1). Remove transmission oil pump inlet tube (3) by unscrewing tube flange fastening bolts.



2) Remove transmission oil pump assembly (4) together with pump outlet tube.

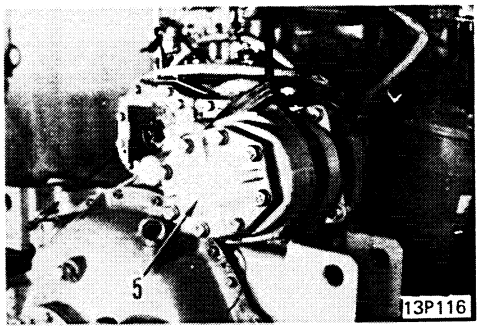
kg Transmission oil pump assembly: **15 kg**



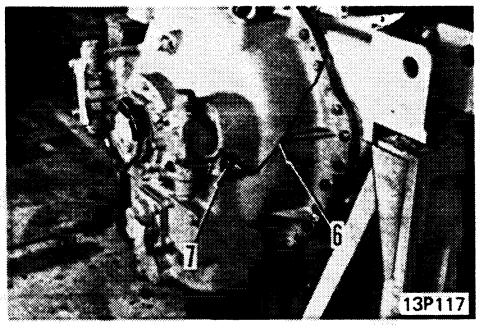
2. Hydraulic pump assembly

Lift off hydraulic pump assembly (5) with crane.

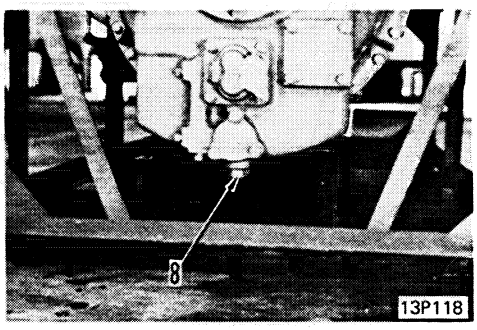
kg Hydraulic oil pump assembly: **50 kg**



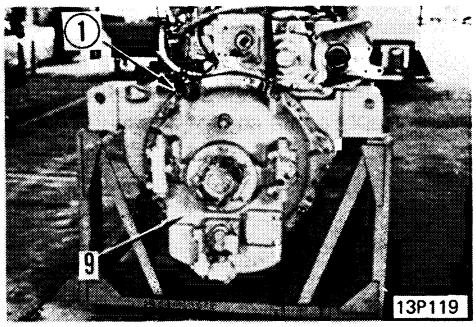
3. **Torque converter oil temperature gauge lead wire**
   Disconnect oil temperature gauge lead wire (6) from sensor (7).



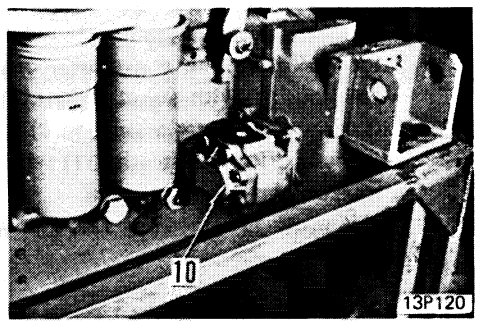
4. **Torque converter assembly**
   1) Remove drain plug (8) and drain oil from torque converter case.



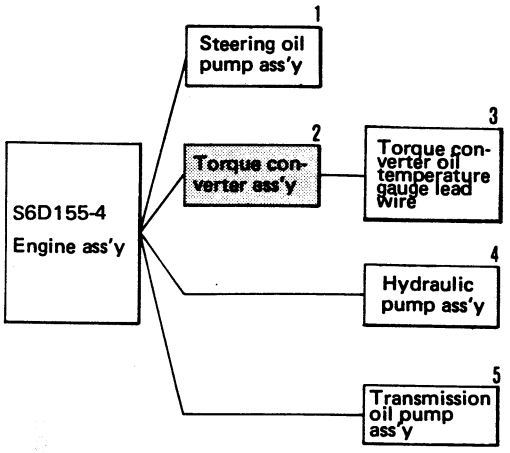
   2) Attach hanging bolt ① (16 mm, P=2.0) to torque converter assembly (9) from engine using jack bolts.
   kg Torque converter assembly: **235 kg**



5. **Steering oil pump assembly**
   Lift off steering oil pump assembly (10) with crane.
   kg Steering oil pump assembly: **25 kg**



MOUNTING CHASSIS RELATED PARTS ON ENGINE D155A

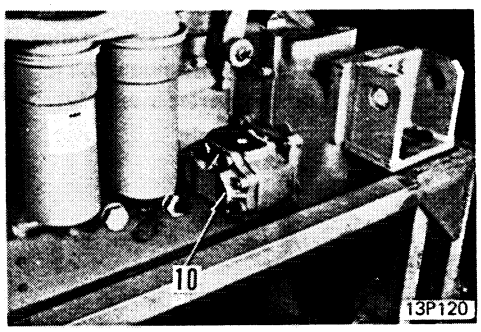


13F023

1. Steering oil pump assembly

Lift steering oil pump assembly (10). Spline-fit the pump to the mating part with O-ring and mount the oil pump.

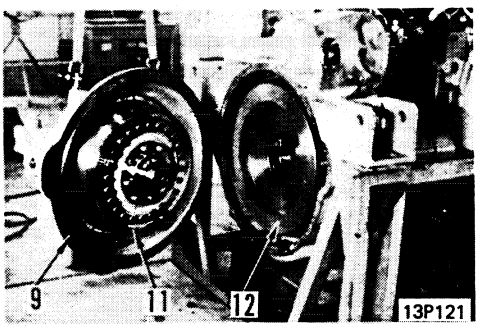
★ Apply a thin coat of grease (G2-LI) to splines.

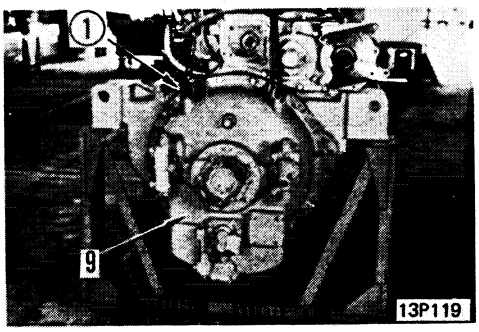


2. Torque converter assembly

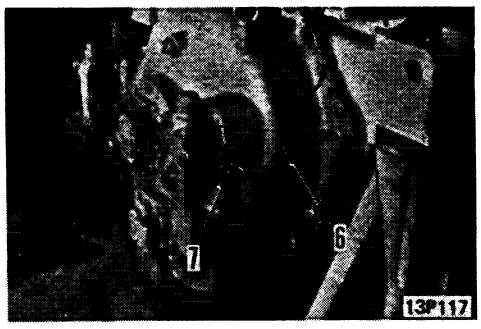
1) Stick gasket to the converter mounting surface (on flywheel housing) with gasket sealant LG-1.
2) Lift torque converter assembly (9) into position with crane and mesh drive gear teeth (11) with flywheel gear (12) as torque converter is installed.

kgm Mounting bolt: **10 – 12.5 kgm**

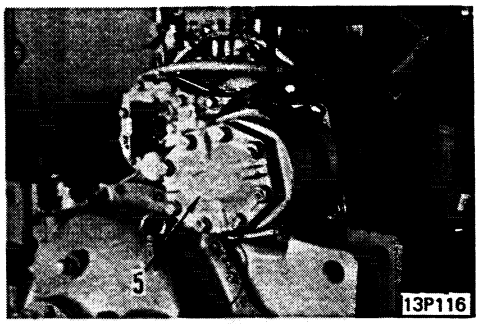




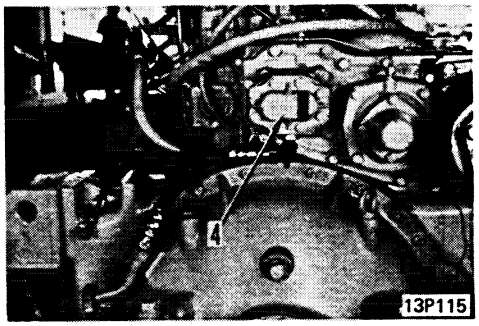
3. **Torque converter oil temperature gauge wire**
   Connect wire (6) to sensor (7).



4. **Hydraulic pump assembly**
   Lift hydraulic pump assembly (5). Spline-fit pump to the matin mating part with O-ring and mount hydraulic pump.
   ★ Apply a thin coat of grease (G2-LI) to splines.

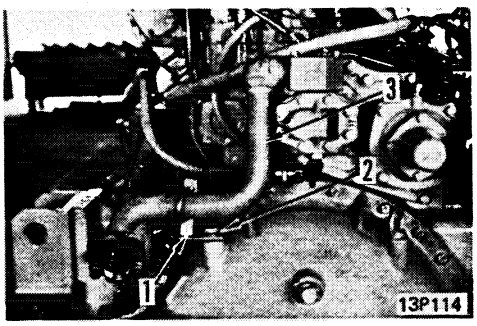


5. **Transmission oil pump assembly**
   1) Spline-fit transmission oil pump assembly (4) (with pump outlet tube) to the mating part with O-ring.
      ★ Apply a thin coat of grease (G2-LI) to splines.



   2) Connect transmission oil pump inlet tube (3), with O-ring in flange, to pump.

   3) Install clamp bracket (1) with bolts (2) and secure transmission oil pump inlet tube with clamp.



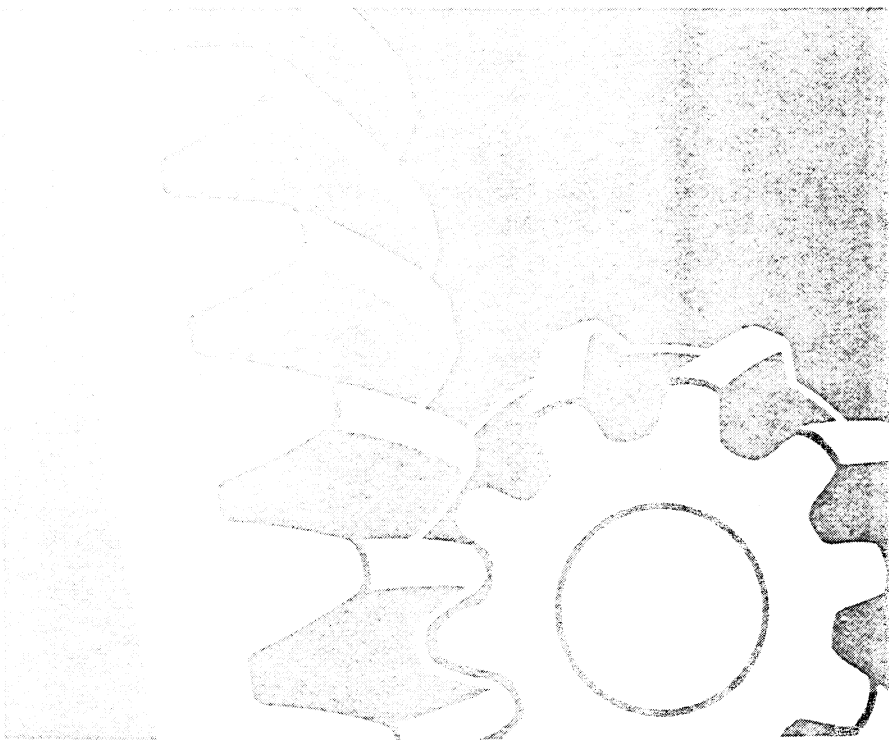
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

21 POWER TRAIN

STRUCTURE AND FUNCTION

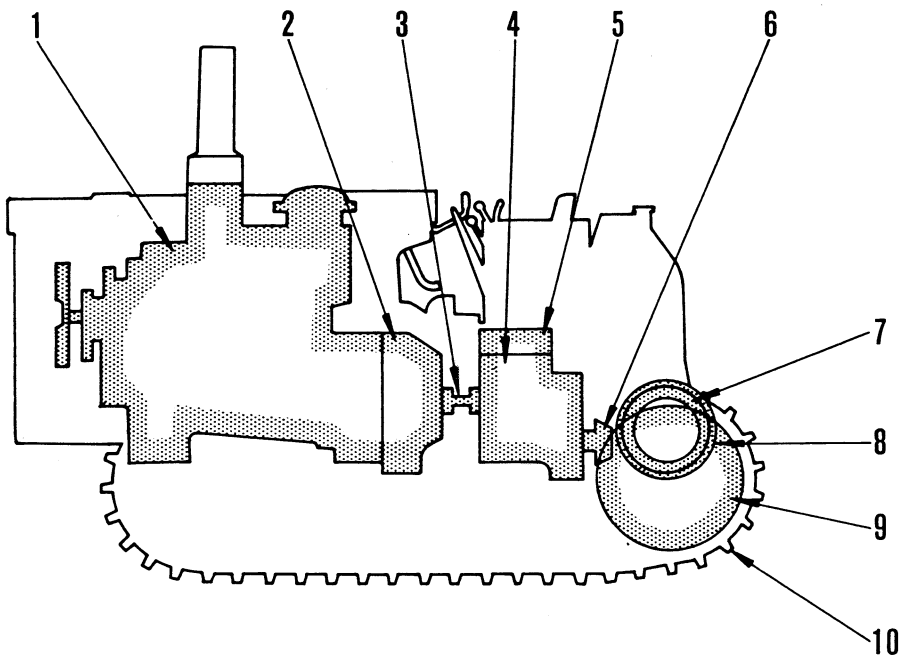


STRUCTURE AND FUNCTION

General 21- 2
Main clutch (D150A) 21-10
Inertia brake 21-14
Main clutch hydraulic 21-15
Main clutch hydraulic booster 21-16
Hydraulic system 21-18
Hydraulic circuit 21-18
Main clutch pump 21-19
Transmission (D150A) 21-20
Interlock 21-25
Double mesh preventive device 21-27
Lubrication valve 21-27-1
Torque converter (D155A) 21-27-2
Transmission (D155A) 21-32
Power transmission line 21-38
TORQFLOW hydraulic piping 21-42
TORQFLOW hydraulic system 21-44
TORQFLOW hydraulic circuit 21-45
Transmission lubrication relief valve 21-50
Transmission control valve 21-51
Transmission pump 21-59
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Transmission oil filter 21-61
Bevel gear shaft and steering clutch 21-62
Steering and brake piping 21-66
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Steering hydraulic circuit 21-71
Brake hydraulic system 21-74
Brake hydraulic circuit 21-75
Steering brake and booster 21-78
Steering control valve 21-82
Steering and brake piping 21-88
Steering and brake hydraulic system 21-90
Steering and brake hydraulic circuit 21-91
Steering brake and booster 21-92
Steering control valve 21-98
Steering pump 21-103
Steering oil filter 21-104
Final drive 21-105

GENERAL

D150A



Driving power from the diesel engine (1) is transmitted to the main clutch (2) through the flywheel.
Power engaged at the main clutch is transmitted from the main clutch shaft through the universal joint (3) to the main shaft of the transmission (4).
Power obtained through selection of a proper gear within the transmission according to load fluctuations is transmitted to the bevel pinion (S) at the rear end of the transmission case.
Power transmitted to the rear of the power train by way of engine → main clutch → transmission is directed into the right and left directions by the bevel pinion and the bevel gear (T).
The steering clutches (7) provided at both ends of the bevel gear shaft intercept and control the direction of power from the bevel gear shaft to the final drive.
The direction is changed by operating the steering control valve provided at the steering case top to cut off power of the steering clutch on the side intended for travelling. The turning radius is determined by the steering brake (8) mounted on the periphery of the steering clutch brake drum.
Power from the steering clutch is transmitted to the final drive flange, being transmitted under sequential reduction by way of the 1st pinion (U) → 1st gear (V) → 2nd pinion (W) → 2nd gear (X) to turn the sprocket (9).
The revolution of the sprocket drives the track (10) to cause the machine to travel.

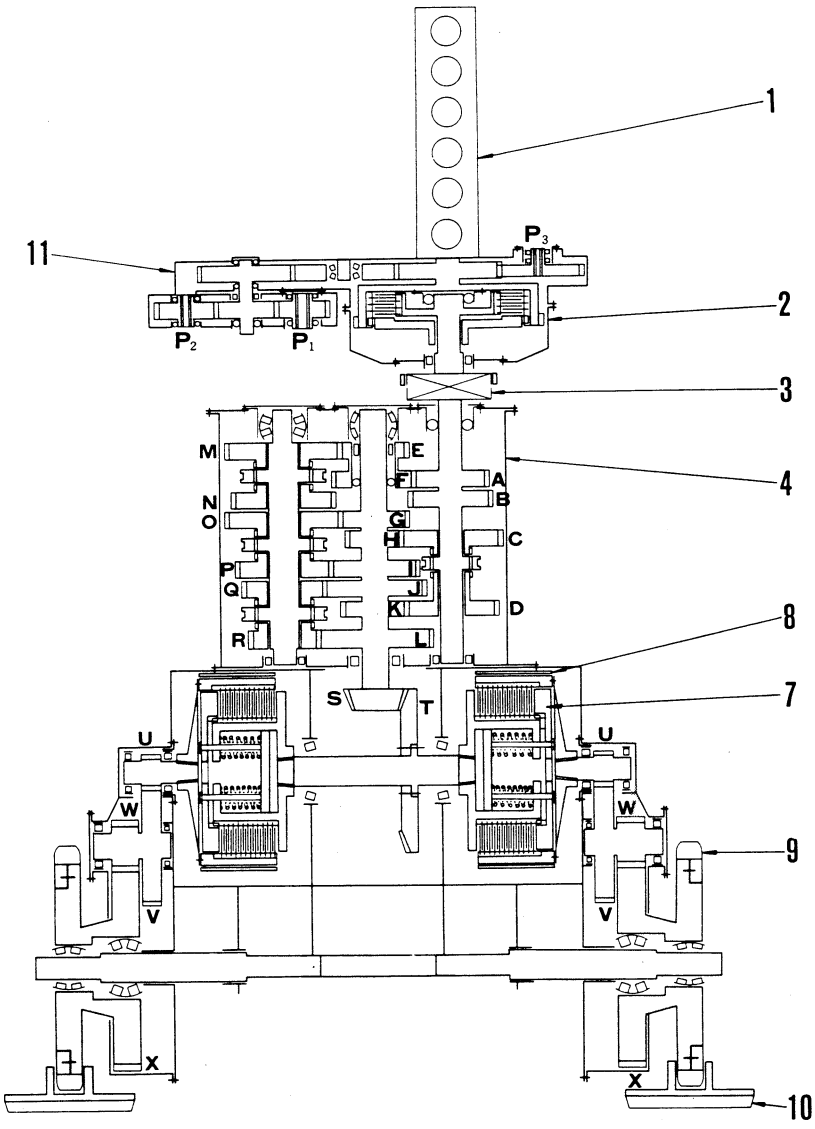
1. Engine
2. Main clutch
3. Universal joint
4. Transmission
5. Transmission control lever case
6. Bevel pinion
7. Steering clutch
8. Steering brake
9. Sprocket
10. Track
11. P.T.O.

P_1 : Work equipment pump
P_2 : Main clutch pump
P_3 : Steering pump

A: Main shaft forward gear (30)
B: Counter shaft forward driven gear (37)
C: Counter shaft forward gear (31)
D: Intermediate shaft forward gear (44)
E: Main shaft reverse gear (32)
F: Intermediate shaft reverse gear (40)
G: Intermediate shaft 1st gear (27)
H: Counter shaft 1st gear (48)
I: Intermediate shaft 2nd gear (33)
J: Counter shaft 2nd gear (42)
K: Intermediate shaft 3rd gear (39)
L: Counter shaft 3rd gear (36)
M: Intermediate shaft 4th gear (44)
N: Counter shaft 4th gear (31)
O: Main shaft forward 5th gear (35)
P: Counter shaft 5th gear (31)
Q: Main shaft forward 6th gear (41)
R: Counter shaft 6th gear (25)
S: Bevel pinion (18)
T: Bevel gear (49)
U: Final drive 1st pinion (12)
V: Final drive 1st gear (45)
W: Final drive 2nd pinion (12)
X: Final drive 2nd gear (55)

Gear speed and power transmission route

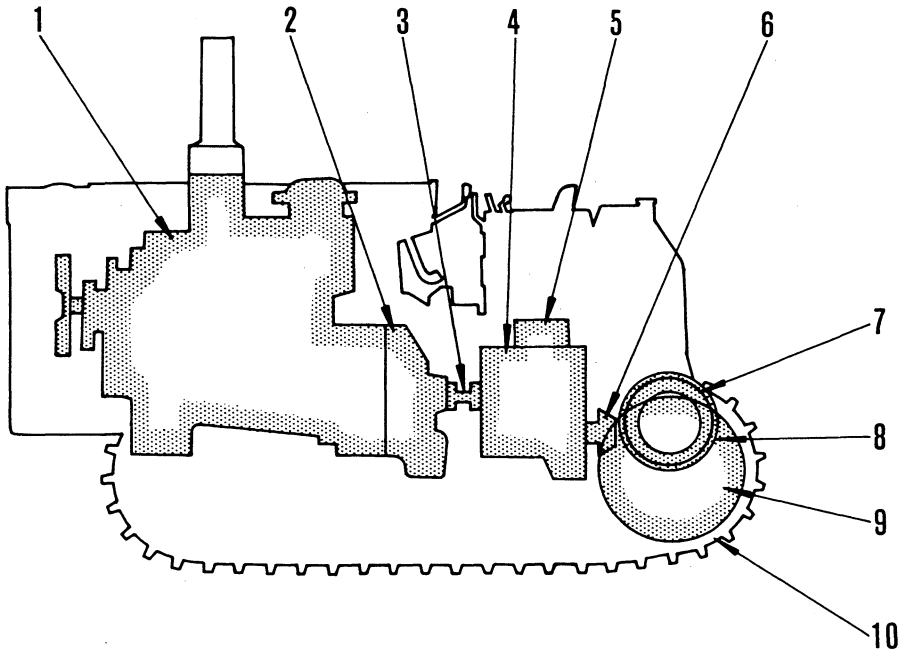
Forward & reverse	Gear speed	Gear train (transmission)
Forward	1st	A → B → C → D → G → H
	2nd	A → B → C → D → I → J
	3rd	A → B → C → D → K → L
	4th	A → B → C → D → M → N
	5th	O → P
	6th	Q → R
Reverse	1st	E → F → G → H
	2nd	E → F → I → J
	3rd	E → F → K → L
	4th	E → F → M → N



21F002

GENERAL

D155A



Driving power from the diesel engine (1) is transmitted to the drive case of the torque converter (2) through the engine flywheel.
The drive case revolves with the pump wheel and power from the engine turns the turbine wheel with oil according to load fluctuations to turn the turbine shaft.
Turbine shaft power is transmitted through the universal joint (3) to the input shaft of the transmission (4). Power selected by a clutch within the transmission on operation of the transmission control valve (5) provided at the transmission case top according to load fluctuations is transmitted to the bevel pinion (P) at the rear end of the transmission.
Power transmitted by way of engine → torque converter → transmission to the rear of power train is directed into the right and left directions by the bevel pinion and the bevel gear (Q).

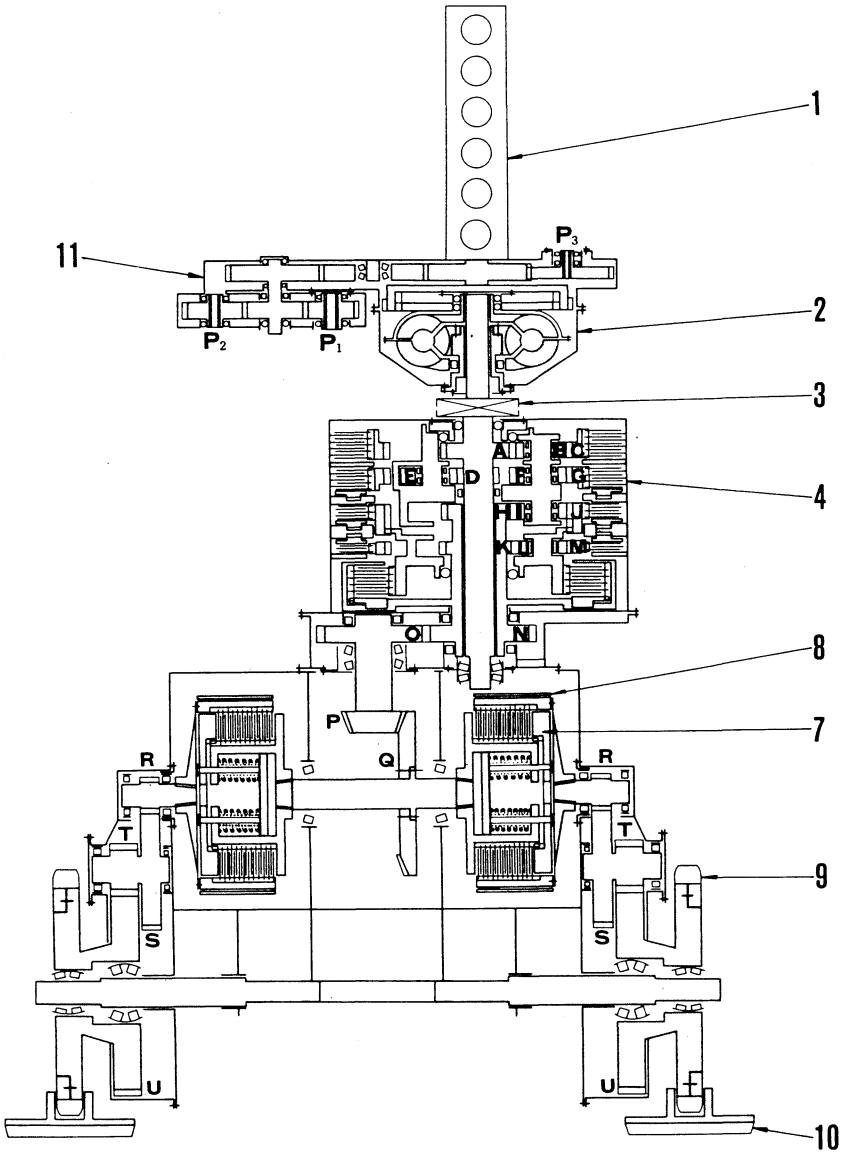
The steering clutches (7) mounted at both ends of the bevel gear shaft intercept and control the direction of power from the bevel gear shaft to the final drive. The direction is changed by operating the steering control valve provided at the steering case top to cut off power of the steering clutch on the side intended for travelling. The turning radius is determined by the steering brake (8) mounted on the periphery of the steering clutch brake drum.
Power from the steering clutch is transmitted to the final drive flange, being transmitted under sequential reduction by way of the 1st pinion (R) → 1st gear (S) → 2nd pinion (T) → 2nd gear (U) to turn the sprocket (9).
The revolution of the sprocket drives the track (10) to cause the machine to travel.

Gear speed and power transmission route

Forward & reverse	Gear speed	Clutch engaged (transmission)
Forward	1st	No. 1 · No. 5
	2nd	No. 1 · No. 4
	3rd	No. 1 · No. 3
Reverse	1st	No. 2 · No. 5
	2nd	No. 2 · No. 4
	3rd	No. 2 · No. 3

1. Engine
2. Torque converter
3. Universal joint
4. Transmission
5. Transmission control valve
6. Bevel pinion
7. Steering clutch
8. Steering brake
9. Sprocket
10. Track
11. P.T.O.

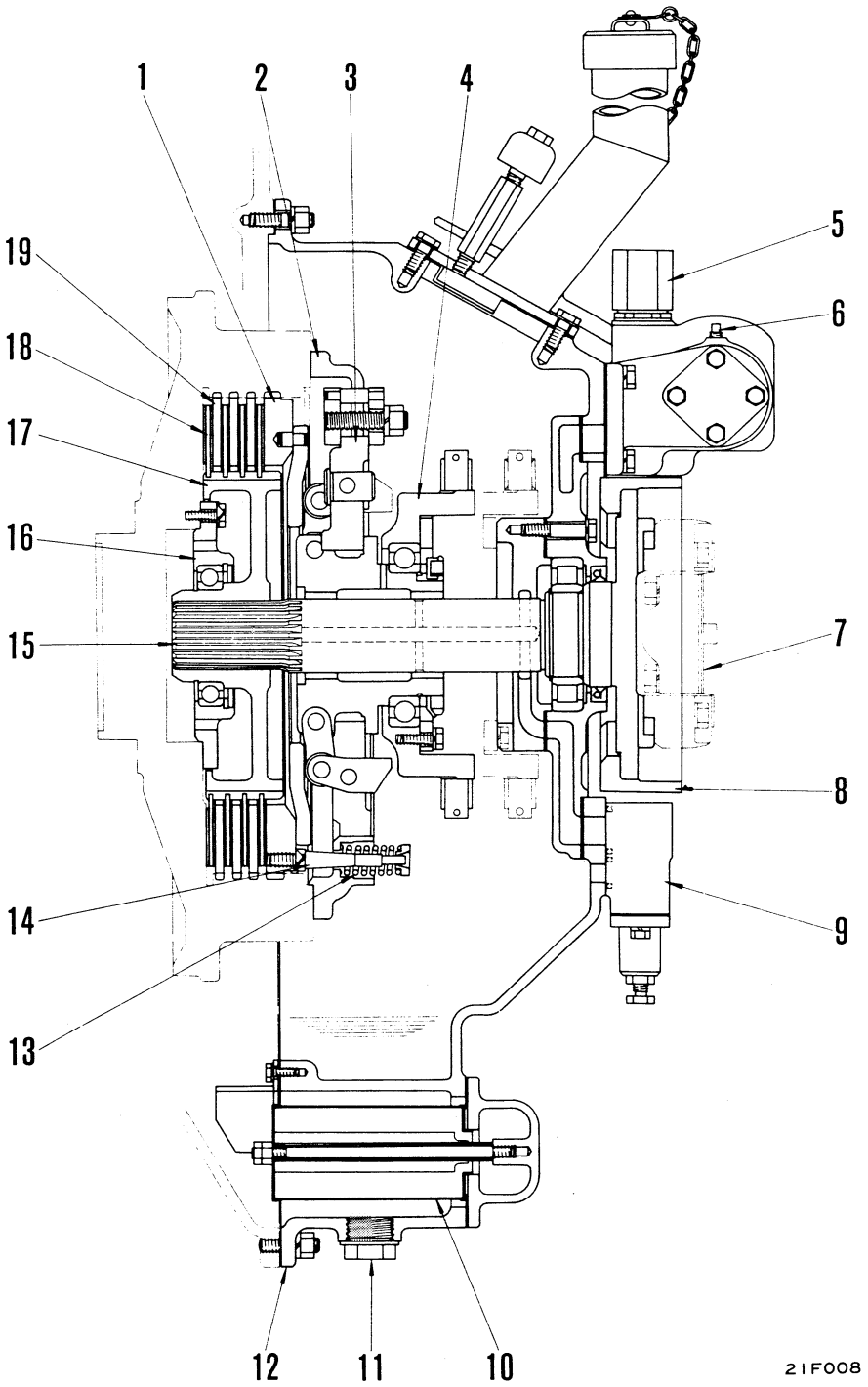
P_1 : Work equipment pump
P_2 : TORQFLOW pump
P_3 : Steering pump



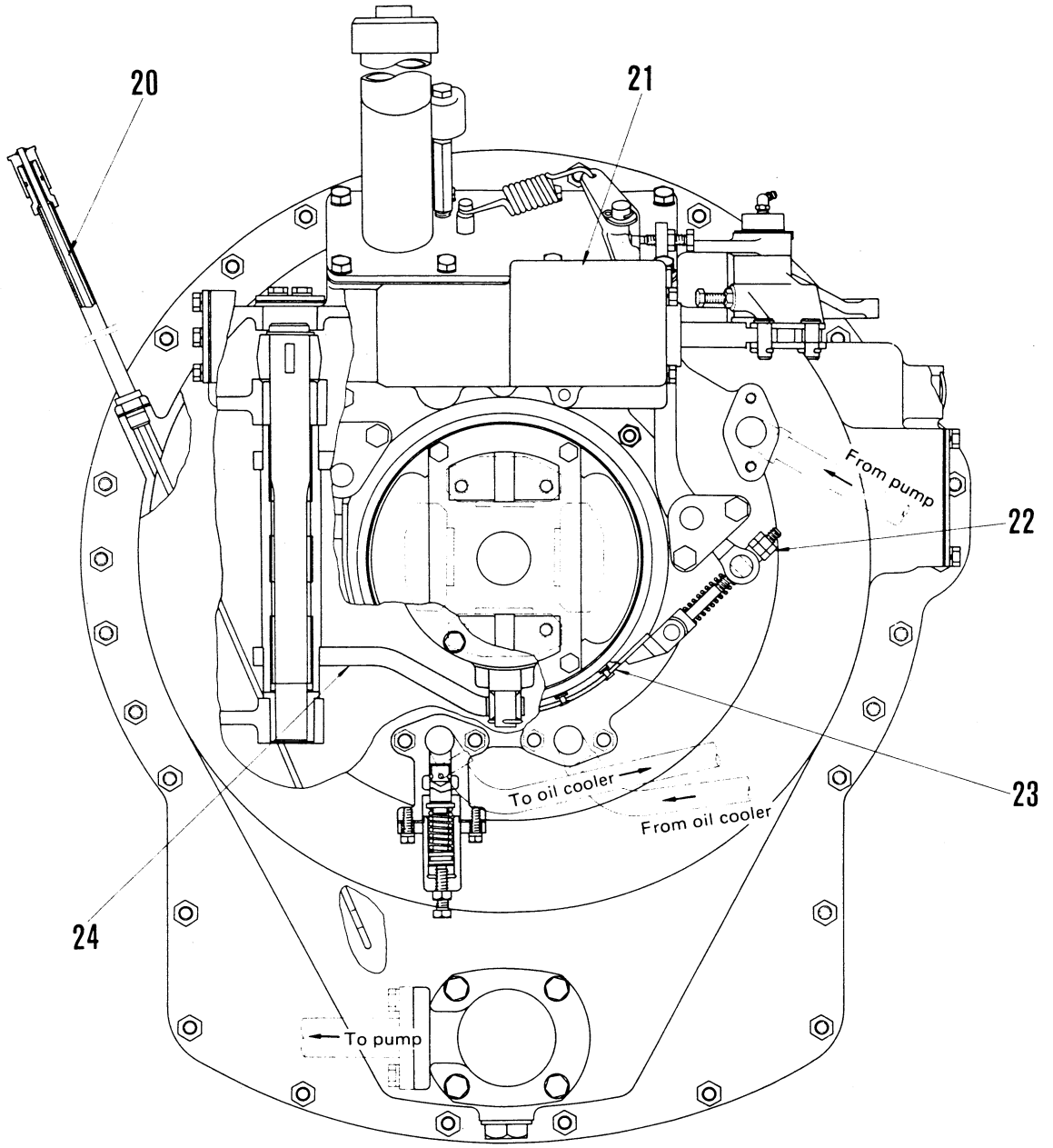
21F004

A: No. 1 sun gear (33)
B: No. 1 planetary pinion (24)
C: No. 1 ring gear (81)
D: No. 2 sun gear (21)
E: No. 2 planetary pinion (23)
F: No. 2 planetary pinion (24)
G: No. 2 ring gear (81)
H: No. 3 sun gear (33)
I: No. 3 planetary pinion (24)
J: No. 3 ring gear (81)
K: No. 4 sun gear (40)
L: No. 4 planetary pinion (19)
M: No. 4 ring gear (81)
N: Transfer drive gear (30)
O: Transfer driven gear (24)
P: Bevel pinion (21)
Q: Bevel gear (49)
R: Final drive 1st pinion (12)
S: Final drive 1st gear (45)
T: Final drive 2nd pinion (12)
U: Final drive 2nd gear (55)

MAIN CLUTCH D150A



1. Pressure plate
2. Clutch cover
3. Adjustment ring nut
4. Release collar
5. Booster relief valve
6. Booster oil pressure pick-up plug (PT 1/8)
7. Universal joint
8. Inertia brake drum
9. Oil cooler relief valve ass'y
10. Strainer
11. Drain plug
12. Main clutch housing



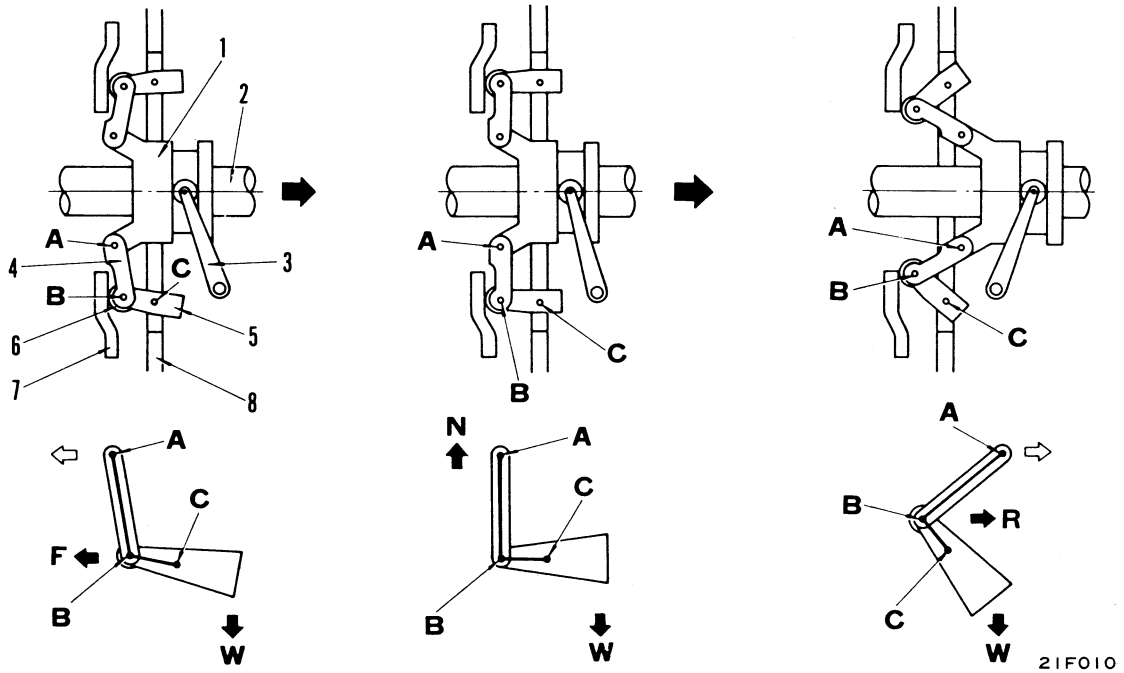
21F009

13. Return spring
14. Stud rod
15. Main clutch shaft
16. Bearing cage
17. Hub (driven plate guide)
18. Driven plate (disc)
19. Drive plate (plate)
20. Dipstick
21. Hydraulic booster ass'y
22. Inertia brake adjustment bolt
23. Inertia brake band
24. Shifter fork

D150A is equipped with a wet multidisc type friction clutch for on-off of engine power.
The disc friction clutch utilizes force of friction of the drive side plate (19) (hereinafter called PLATE) with external teeth cut in the outer circumference of the disc with the driven side plate (18) (hereinafter called DISC) with internal teeth cut in the inner circumference of the disc, for on-off of power to power train devices subsequent to the main clutch.
The plate is in engagement with internal teeth of the engine flywheel, revolving always with engine starting.
The disc is in engagement with external teeth of the hub (17) splined with the main clutch shaft (15), not revolving normally.
By pressing the disc against the plate, the turning effort of the plate is transmitted to the disc and the main clutch ENGAGED; the main clutch is DISENGAGED if the pressing force is eliminated.

The disc is made of sintered alloy high in friction coefficient, being of a wet type with both contact surfaces lubricated to ensure durability and prevent overheating of main clutch.
On the other hand, as a means to press the disc against the plate, an over-center system is employed.
With an increase in engine power and in main clutch capacity, the pressing force should also be increased to prevnet slip.
The over-center system utilizing a toggle link and centrifugal force is employed so as to apply sufficient pressure causing no slip to the friction face without increasing main clutch operating power.

Overcenter system



1. Main clutch **"ENGAGED"** 2. Main clutch at **"DEAD POINT"** 3. Main clutch **"DISENGAGED"**

The collar (1) can slide over the main clutch shaft (2) by means of the release yoke (3).
It is coupled the link (4) with the weight link (5) and the roller (6) provided at the point of contact (B) of the link with the weight link is pressing the pressure plate (7).

The weight link is fitted at the contact point (C) to the clutch cover (8) (adjustment ring nut) and since the clutch cover is installed by the bolts to the flywheel, (1) and (4) to (8) are always revolving on starting of the engine.

1. **Main clutch ENGAGED**
   Operate the release yoke (3) to shift the collar (1) to the left (towards the engine flywheel) and the contact point (A) of collar with link (4) will shift to the left and the contact point (B) of link with weight link (5) will be pulled towards the center of the main clutch shaft (2).
   Opposite to the contact point (B) being pulled towards the center of the main clutch shaft, the weight link moves, with the contact point (C) as the center, in a direction departing from the center.
   If, under such condition (1), (2) and (4) to (8) revolve, the weight link is pulled in the direction " ⬇ " under centrifugal force (W) and the contact point (B) tends to further approach the main clutch shaft center; therefore, the contact point (A) approaches the flywheel and the force (F) to press the pressure plate (7) works in the direction " ⬅ ", whereby plate and disc are pressed against each other, resulting in the condition of the main clutch ENGAGED.

2. **Main clutch at DEAD POINT**
   In a condition in which the link (4) is perpendicular to the main clutch shaft (2), revolutions of (1), (2) and (4) to (8) generate centrifugal force (W) in the direction " ⬇ " with respect to the weight link (5), but since the contact points (A) and (B) are perpendicular to the main clutch shaft, the force (N) to push the collar (1) is applied in the direction " ⬆ ". Such condition is called DEAD POINT.

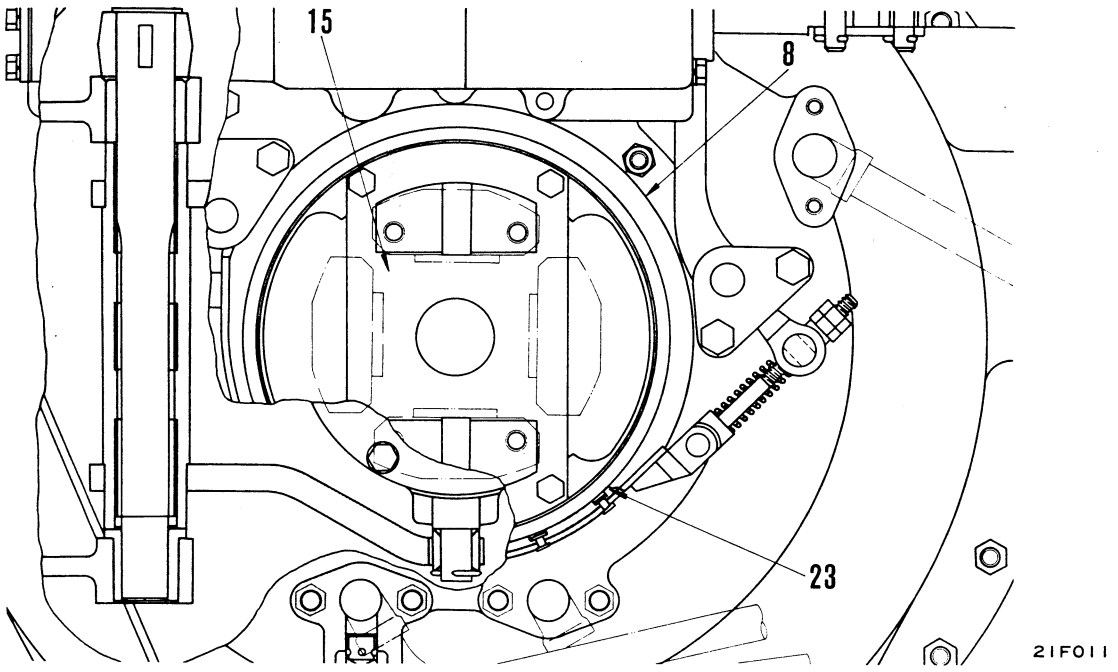
Adjustment of main clutch
With an increase in wear of plate and disc, slip of the main clutch occurs.
Slip of the main clutch means reducing plate-to-disc pressing force and therefore, to restore sufficient pressing force by causing the contact point (C) of the weight link (5) to approach the pressure plate (7), remove the lock nut and the lock plate and screw in the adjustment ring nut mounted on the clutch cover (8) towards the flywheel side.

3. **Main clutch DISENGAGED**
   Operate the release yoke (3) to shift the collar (1) to the right (toward the universal joint) and the contact point (A) of collar with link (4) will move to the right and the contact point (B) of link with weight link (5) will be pulled towards the center of the main clutch shaft (2).
   Oppositely to the contact point (B) being pulled towards the main clutch shaft center, the weight link moves, with the contact point (C) as the center, in a direction departing from the center.
   If (1), (2) and (4) to (8) revolve under such condition, the weight link is pulled in the direction " ⬇ " under centrifugal force (W) and the contact point (B) tends to further approach the main clutch shaft center, for which reason the force (R) tending to cause the contact point (A) to depart from the flywheel in the direction " ➡ " acts and reduces the force to press the plate against the disc to zero and, under action of the return spring of the pressure plate (7), there is no more frictional force between plate and disc, resulting in the condition of the main clutch DISENGAGED.

INERTIA BRAKE

Since the bulldozer is quite great in a travelling resistance, if the main clutch is disengaged and the transmission shift in a neutral position, the machine stops at that point and revolution of the output shaft is also stopped. However, even if power is cut off, the main clutch shaft continues to revolve due to inertia, with the transmission input shaft connected with a universal joint being also revolved.

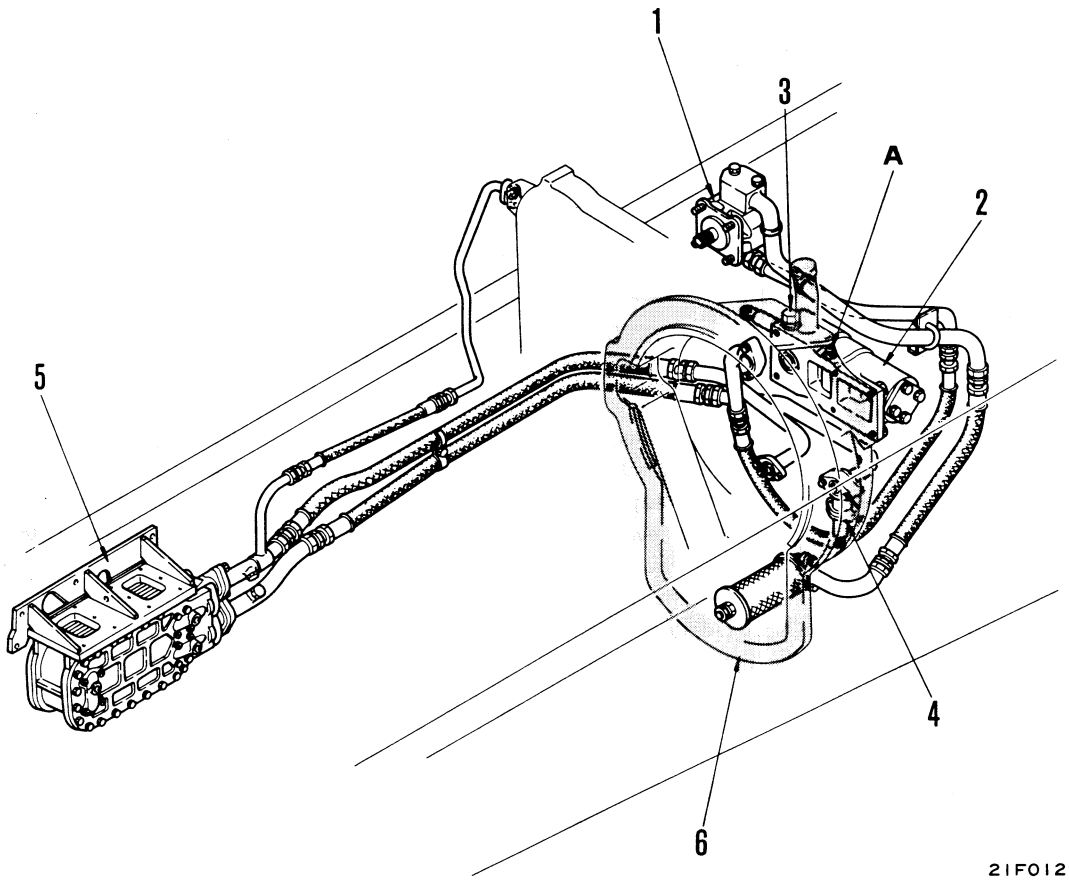
If speed change is made by sliding of gears on the rotating input shaft and the stationary output shaft, such troubles as gear noise and breakage of gear chamber portion, etc. will arise.
To prevent such troubles, D150A is equipped with a brake band contraction type of inertia brake on rear of main clutch.



The inertia brake is so constructed as to interlock with the main clutch lever at the operator's seat and if the main clutch lever is thrown down, first the main clutch is disengaged and if the main clutch lever is further thrown down, the brake drum (8) fixed to the main clutch shaft (15) is bound with the brake band (23) to prevent revolution of the main clutch shaft by inertia and ensure smooth transmission gear change.

MAIN CLUTCH HYDRAULIC D150A

Main clutch hydraulic is composed of major components such as strainer, main clutch pump (1), main clutch booster (2), main relief valve (3), lubrication relief valve (4) and oil cooler (5).



Oil in main clutch housing is filtered with strainer, sucked with main clutch pump (1) of gear type and delivered to main clutch booster (2).
Main clutch booster is controlled by main clutch lever. When "ON" – "OFF" operation of main clutch is completed, circuit pressure rises. When the pressure reaches 42.2 kg/cm^2, it is relieved with main relief valve (3), thus oil flows to lubrication circuit (oil cooler circuit) from booster.

Lubrication relief valve (4) is provided in lubrication circuit for the protection of oil cooler (5) and lubrication circuit. If pressure rises over 4 kg/cm^2, oil escapes directly to main clutch housing (6).

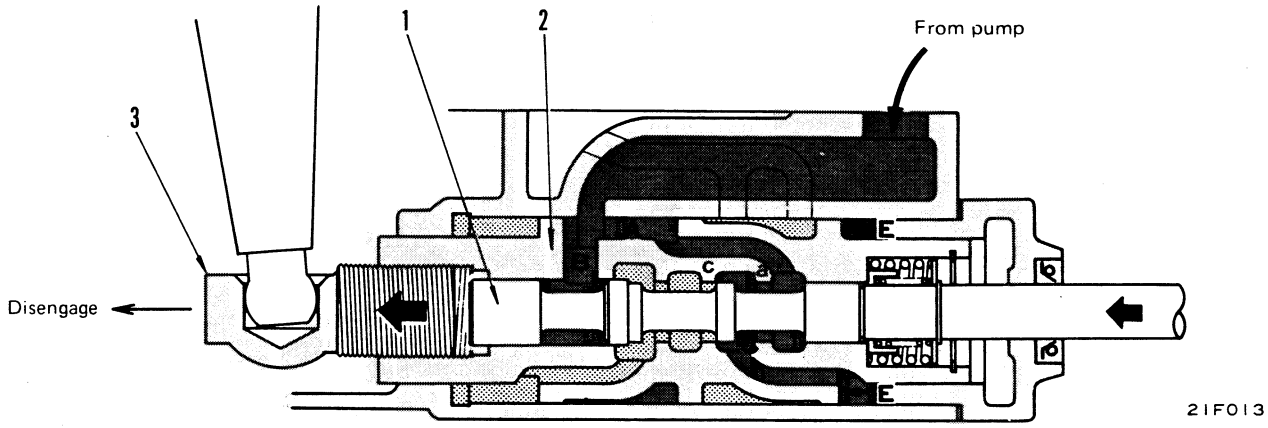
1. Main clutch pump (FAL045)
2. Main clutch booster
3. Main relief valve
4. Lubrication relief valve
5. Oil cooler
6. Main clutch housing

A. Booster oil pressure pickup plug (PT 1/8)

MAIN CLUTCH HYDRAULIC BOOSTER D150A

D150A is equipped with a hydraulic booster for reduce the main clutch lever control power.

1. Main clutch ENGAGED → DISENGAGED



Bring down the main clutch lever at the operator's seat forward to switch the main clutch from ENGAGED to DISENGAGED. Thereupon the booster spool (1) is moved via rod and lever in the direction of arrow (⬅).

When the booster spool moves in the direction " ⬅ ". pressure oil at the port (A) flows through the clearance "a" between it and the booster sleeve to the port (C) and then into the port (E) of the booster sleeve.

Pressure oil flowing to the port (E) pushes the booster sleeve in the direction " ⬅ " and moves the main clutch yoke (3) intergrated solidly with the booster sleeve in the direction DISENGAGED.

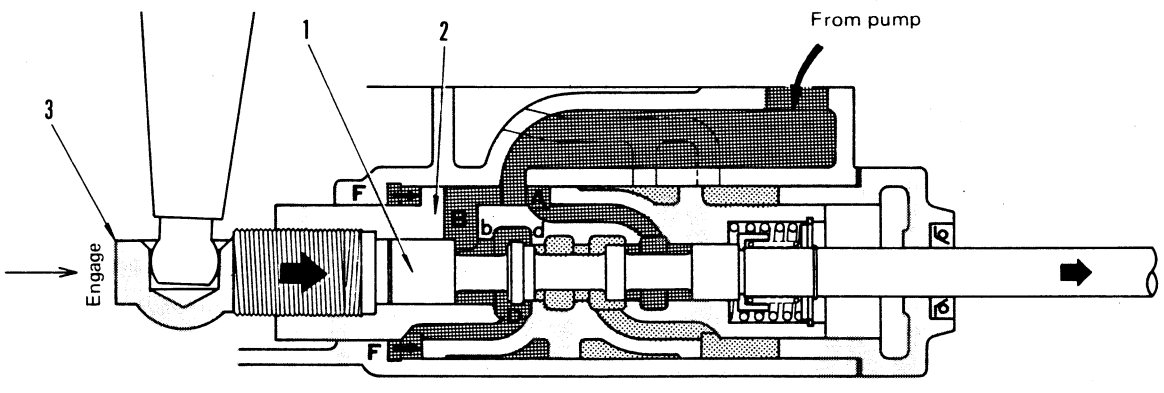
If the booster sleeve moves in the direction " ⬅ ", the clearance "a" with respect to booster spool is reduced and reversely a clearance "c" will be produced on the opposite side.

If the clearance "c" is formed, pressure oil escapes through the port (C) and no more pushes the booster sleeve and therefore a formation of the clearance "c" is prevented by moving the booster spool in the direction " ⬅ ".

Since such movements are effected in a short-time follow-up sequence, the main clutch is DISENGAGED smoothly.

Accordingly, only such force as is sufficient to move the booster spool to prevent formation of the clearance "c" is required of the main clutch lever and therefore, when the hydraulic booster is provided, quite a small control power suffices.

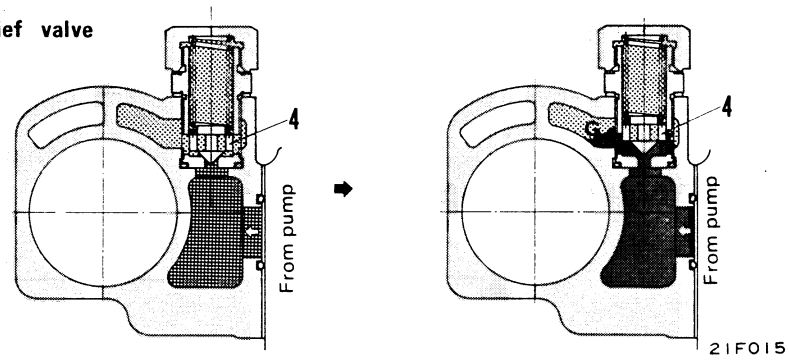
2. Main clutch DISENGAGED → ENGAGED



Pull back the main clutch lever at the operator's seat to switch the main clutch from DISENGAGED to ENGAGED and the booster spool (1) will be moved via rod and lever in the direction of arrow " ➡ ".
Pressure oil from the main clutch pump flows from the port (B) through the clearnace "b" to the port (D) and then into the port (F). Pressure oil flowing into the port (F) presses the booster sleeve (2) in the direction " ➡ " and moves the main clutch yoke (3) integrated with the booster sleeve in the direction ENGAGED.
On move of the booster sleeve in the direction " ➡ ", the clearance "b" with respect to the booster spool is reduced and conversely a clearance "d" will be produced on the opposite side.

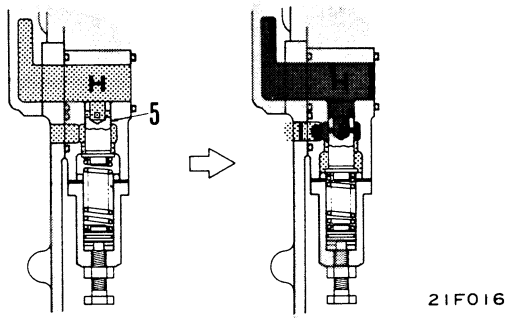
If the clearance "d" is produced, pressure oil escapes through the port (D) and no more presses the booster sleeve. Therefore, the booster spool is moved in the direction " ➡ " to prevent formation of the clearance "d".
Movements of booster spool and booster sleeve take place in a short-time follow-up sequence, the main clutch is ENGAGED smoothly.

Main clutch hydraulic booster & main relief valve



The main relief valve is provided so as to prevent excessive pressure rise in the circuit after completion of main clutch ENGAGED or DISENGAGED".
If pressure oil from the main clutch pump fills up the port and circuit pressure exceeds 42.2kg/cm^2, the needle valve (4) is pushed open to allow escape into the main clutch case through the port (G), thus maintaining the main clutch booster circuit at 42.2kg/cm^2.

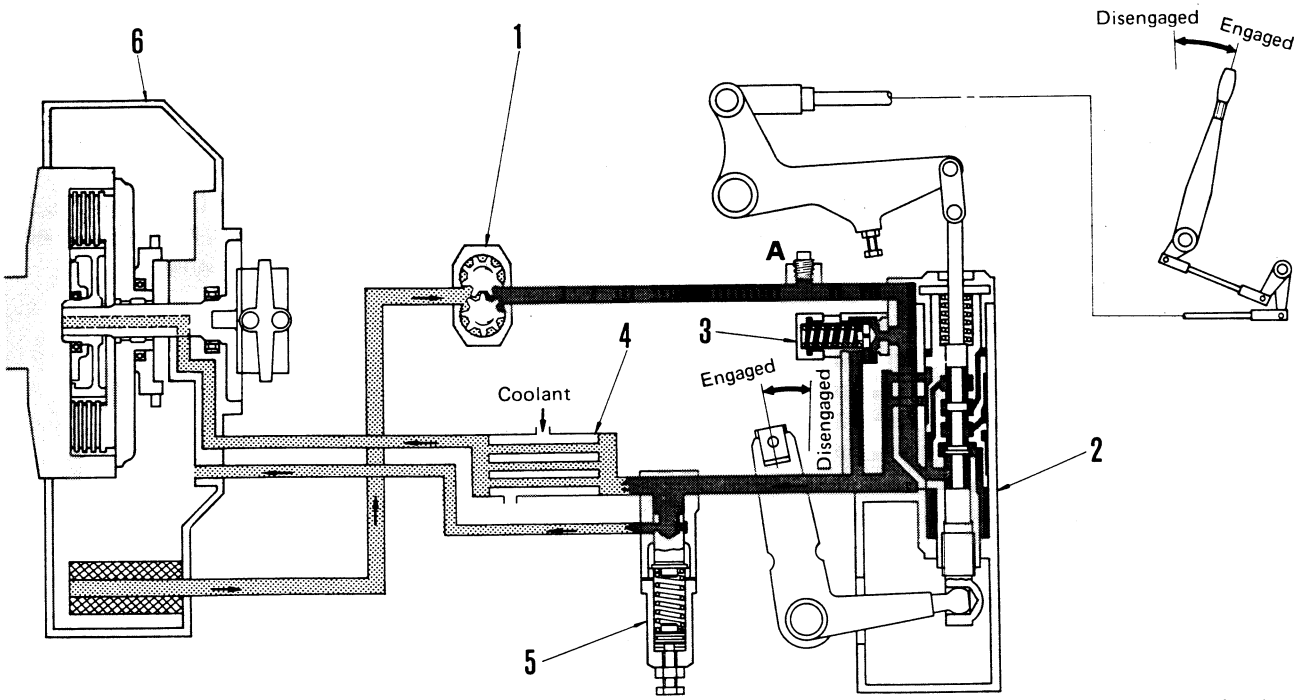
Main clutch oil cooler & lubricating relief valve



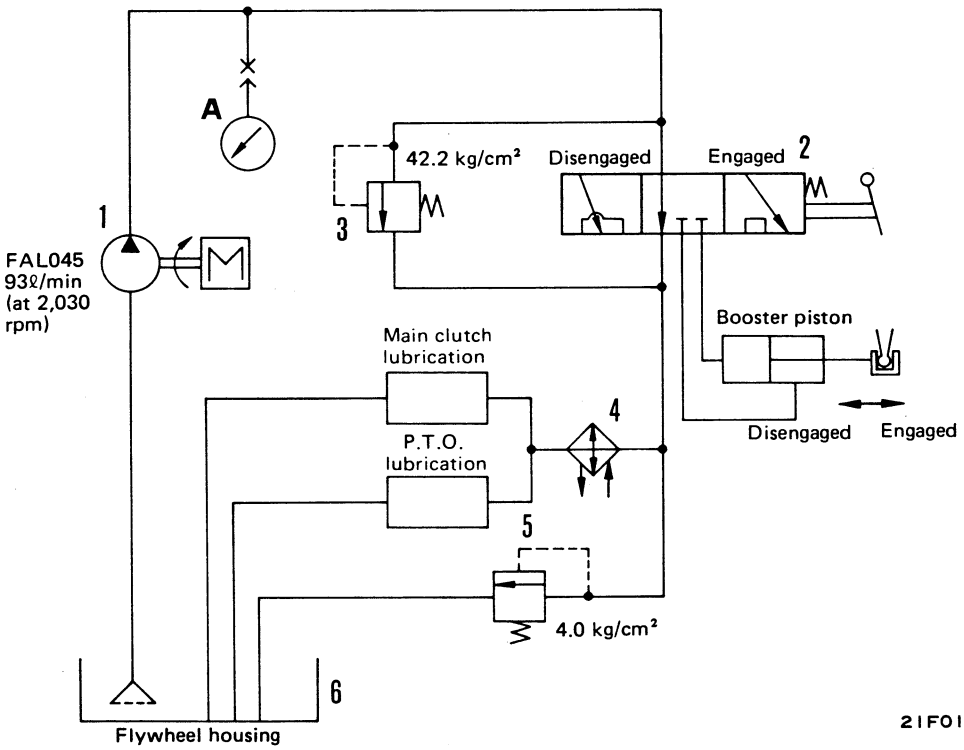
Oil relieved from the main clutch hydraulic booster passes through the main clutch oil cooler and flows into the main clutch lubricating circuit.
To protect the oil cooler and the lubricating circuit, a relief valve is provided in the circuit.

Oil relieved into the port (G) of the hydraulic booster flows through the main clutch case into the port (H) of the relief valve.
When pressure at the port (H) exceeds 4kg/cm^2, the valve (5) is pushed and oil is drained through the valve escape hole and the port (1) into the main clutch case.

HYDRAULIC SYSTEM D150A



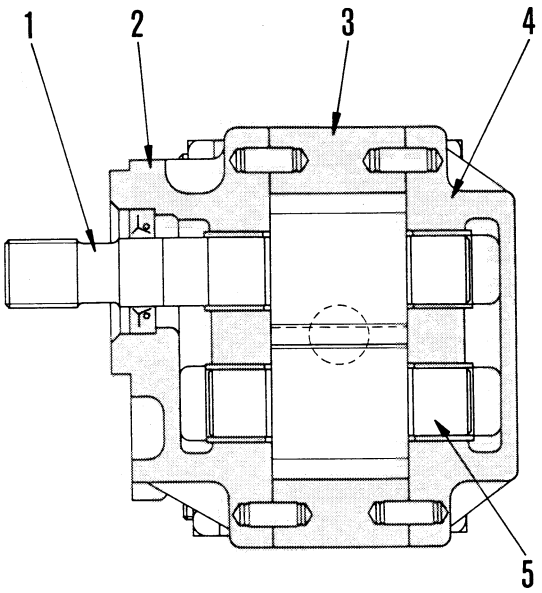
HYDRAULIC CIRCUIT D150A

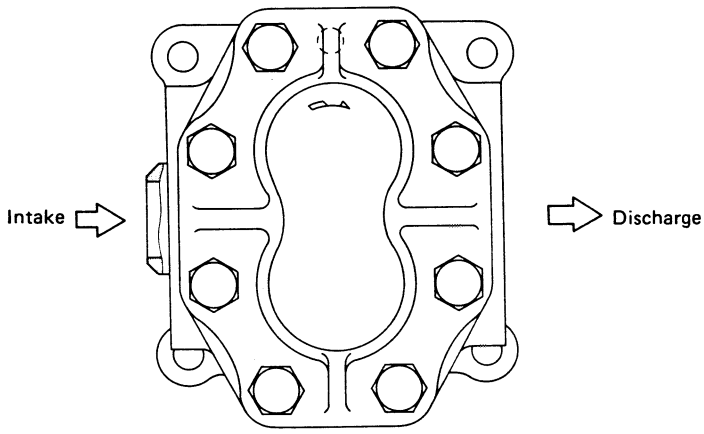


1. Main clutch pump (FAL045)
2. Main clutch booster
3. Main relief valve
4. Oil cooler
5. Lubricating relief valve
6. Flywheel housing

A. Plug for main clutch booster pressure (PT 1/8)

MAIN CLUTCH PUMP D150A



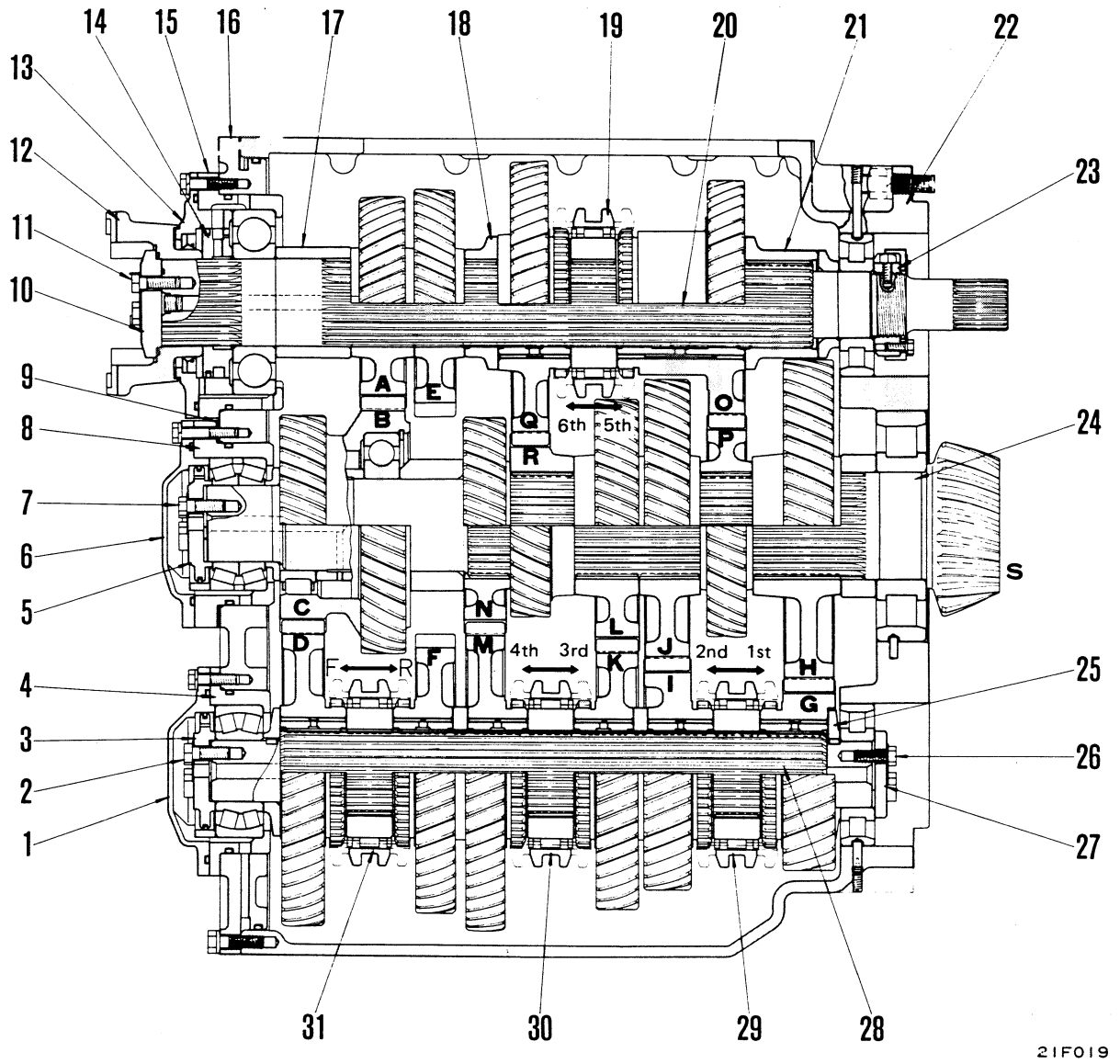


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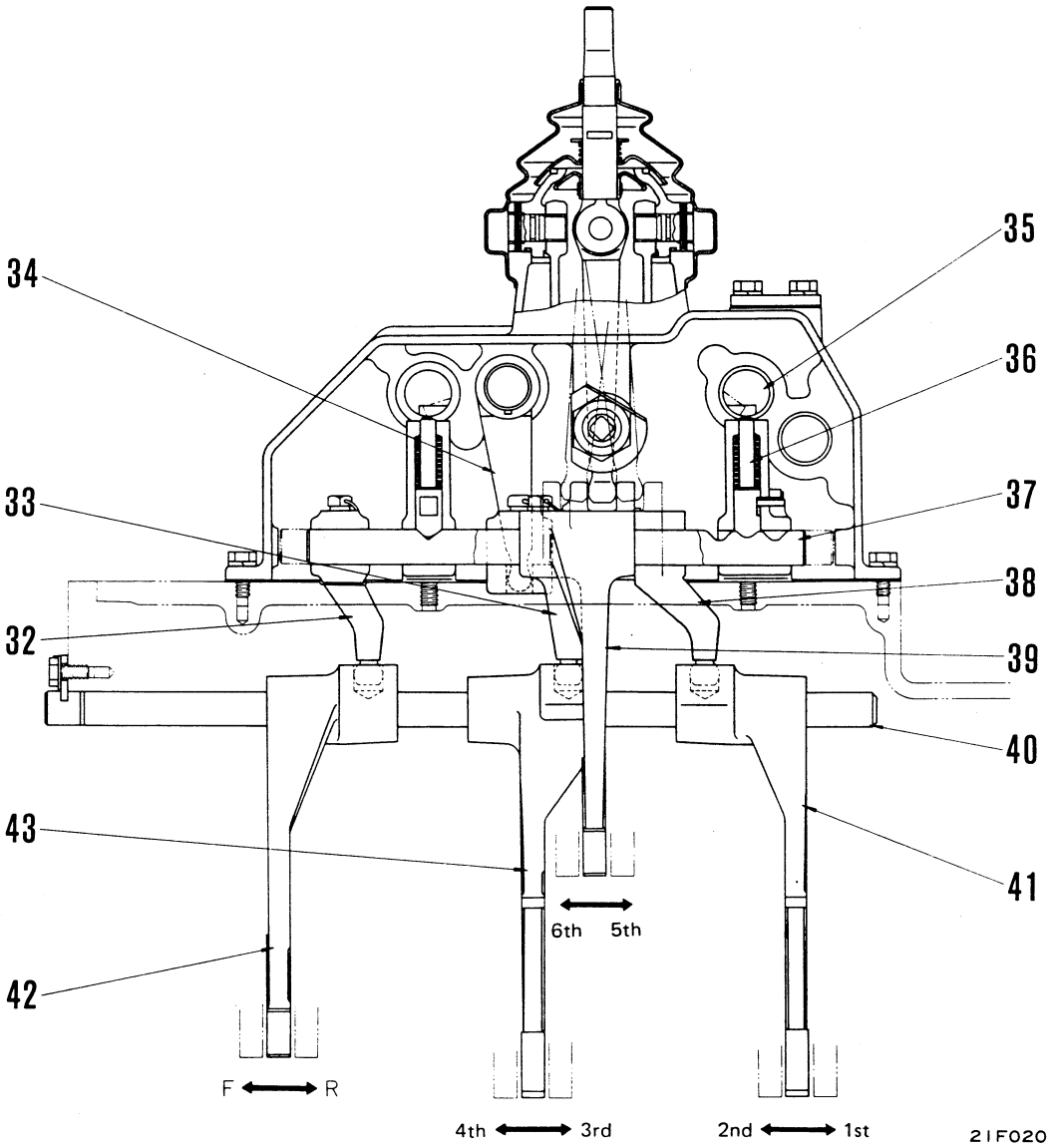
1. Drive gear
2. Bracket
3. Gear case
4. Housing
5. Driven gear

Type: FAL045
Flow: 93 ℓ/min (at 2030 rpm)

TRANSMISSION D150A



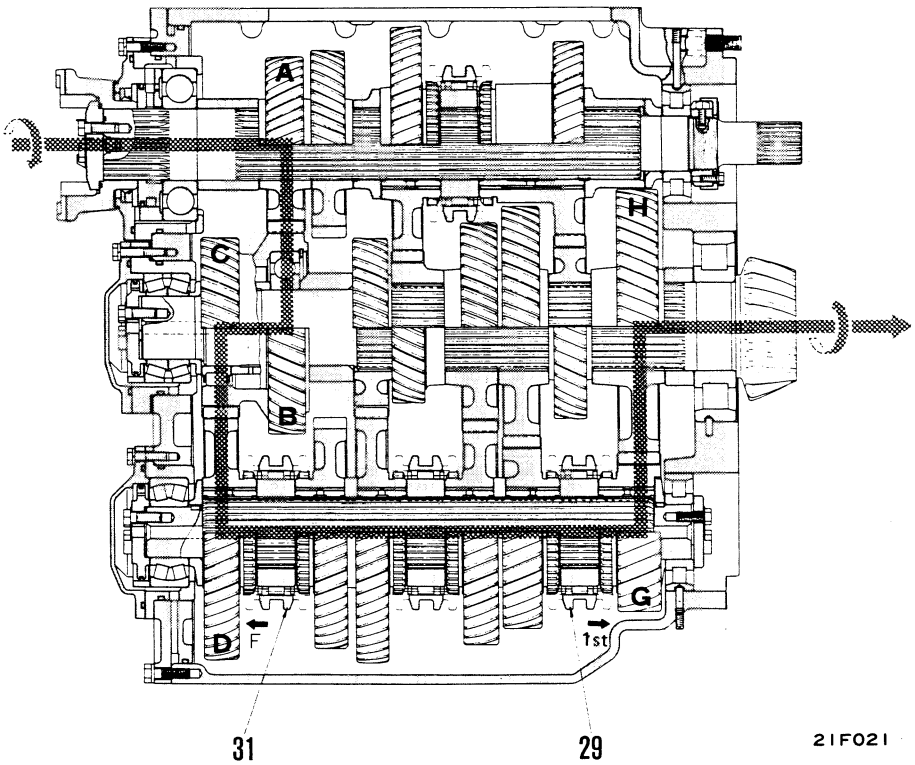
A: Main shaft forward gear (30)
B: Counter shaft forward driven gear (37)
C: Counter shaft forward gear (31)
D: Intermediate shaft forward gear (44)
E: Main shaft reverse gear (32)
F: Intermediate shaft reverse gear (40)
G: Intermediate shaft 1st gear (27)
H: Counter shaft 1st gear (48)
I: Intermediate shaft 2nd gear (33)
J: Counter shaft 2nd gear (42)
K: Intermediate shaft 3rd gear (39)
L: Counter shaft 3rd gear (36)
M: Intermediate shaft 4th gear (44)
N: Counter shaft 4th gear (31)
O: Main shaft forward 5th gear (35)
P: Counter shaft 5th gear (31)
Q: Main shaft forward 6th gear (41)
R: Counter shaft 6th gear (25)
S: Bevel pinion (18)



1. Intermediate shaft cover
2. Bolt
3. Holder
4. Intermediate shaft bearing cage
5. Holder
6. Counter shaft cover
7. Bolt
8. Counter shaft bearing cage
9. Shim (for gear tooth contact adjustment)
10. Holder
11. Bolt
12. Coupling
13. Cover
14. Holder
15. Main shaft bearing cage
16. Front cover
17. Spacer
18. Spacer
19. 5th-6th coupling gear
20. Main shaft
21. Spacer
22. Transmission case
23. Nut
24. Counter shaft
25. Collar
26. Bolt
27. Holder
28. Intermediate shaft
29. 1st-2nd coupling gear
30. 3rd-4th coupling gear
31. Forward-Reverse coupling gear
32. Forward-Reverse shifter arm
33. 3rd-4th gear shifter arm
34. 5th-6th gear shifter arm
35. Interlock shaft
36. Interlock plunger
37. Shifter arm shaft
38. 1st-2nd gear shifter arm
39. 5th-6th gear shifter fork shaft
40. Shifter fork shaft
41. 1st-2nd gear shifter fork
42. Forward-Reverse gear shifter fork
43. 3rd-4th gear shifter fork

D150A is equipped with a 6 forward speed-4 reverse speed constant mesh type of transmission for machine speed change.

Porward 1st speed



The main shaft forward gear (A) fixed to the spline of the main shaft (input shaft) is in constant mesh with the forward gear (B) idling on the counter shaft. The gear (C) integral with the forward gear (B) is in constant mesh with the forward gear (D) idling on the intermediate shaft.

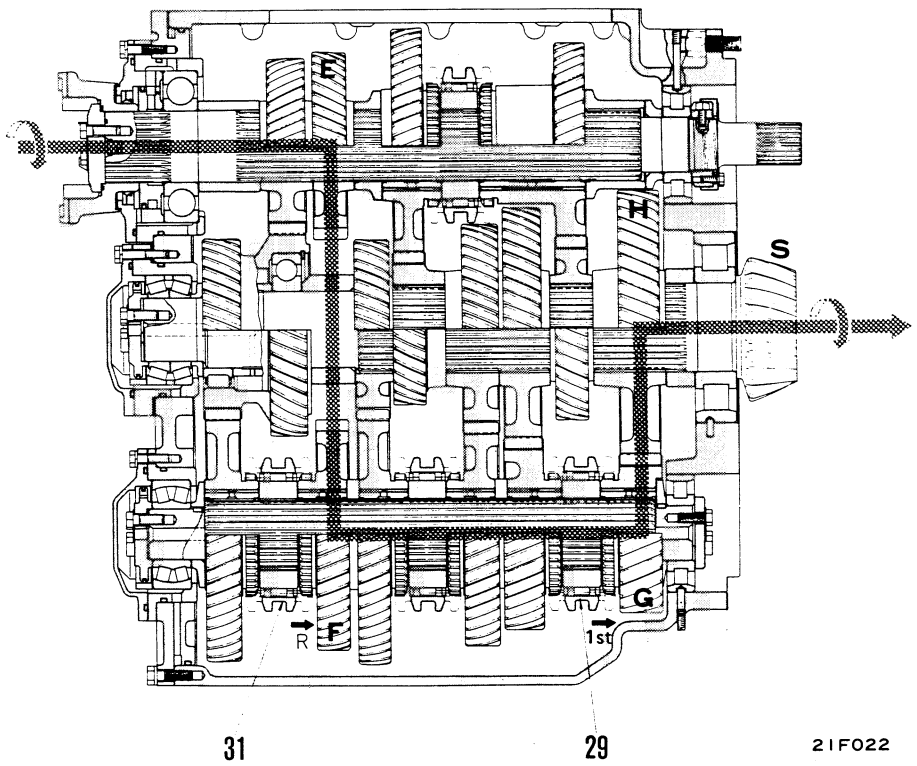
If power from the input coupling turns the main shaft, gears up to the forward gear (D) on the intermediate shaft revolve constantly.

Operate the gear shift lever (F—R) at the operator's seat and slide the intermediate shaft coupling gear (31) towards the forward side (make "⬅ F" in the figure) by means of the shifter fork to bring the external gear at the boss of the forward gear (D) into mesh with the internal teeth of the coupling gear. Since internal teeth of the coupling gear are in mesh with external teeth of the guide gear and the guide gear is fixed with a spline on the intermediate shaft, revolutions of the input shaft are transmitted to the intermediate shaft.

On the other hand, operate the gear shift lever at the operator's seat and slide the intermediate shaft coupling gear (29) towards the 1st speed side (Mark 1st speed ➡ in the figure) by means of the shifter fork to bring internal teeth of the coupling gear into mesh with external gear at the boss of the first gear (G). The 1st gear mounted in an idling condition on the intermediate shaft joins the coupling gear solidly and revolutions of the intermediate shaft are transmitted to the 1st gear via the guide gear fixed with a spline on the intermediate shaft.

The intermediate shaft 1st gear and the counter shaft 1st gear fixed with a spline on the counter shaft are in constant mesh and if the intermediate shaft 1st gear revolves, the countershaft also revolves simultaneously and power is transmitted to the bevel pinion (S).

Reverse 1st speed



The main shaft reverse gear (E) fixed to the spline of the main shaft (input shaft) is in constant mesh with the intermediate shaft reverse gear (F) idling on the intermediate shaft and when power from the input coupling turns the main shaft, the intermediate shaft reverse gear revolves constantly. Operate the gear shift lever (F—R) at the operator's seat and slide the intermediate shaft coupling gear (31) towards the reversing side (mark " ➡ R" in the figure) by means of the shifter fork to bring the external gear at the boss of the reversing gear into mesh with internal teeth of the coupling gear.

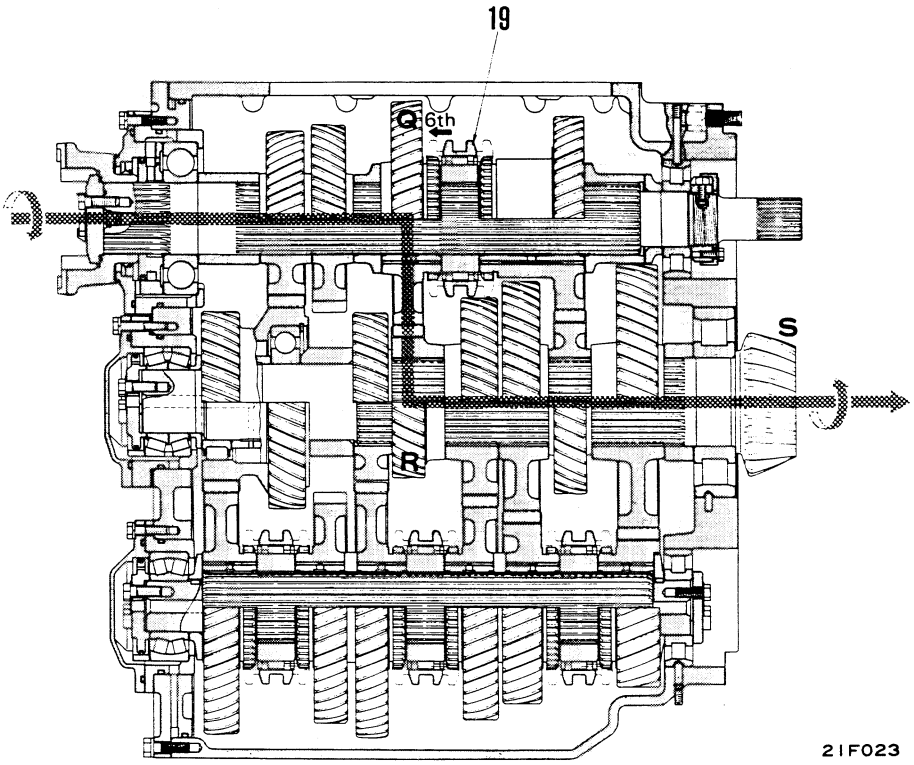
Since internal teeth of the coupling gear are in mesh with external teeth of the guide gear and the guide gear is fixed with a spline on the intermediate shaft, revolutions of the input shaft are transmitted to the intermediate shaft.

On the other hand, similar to the case of the forward 1st speed described above, operate the gear shift lever at the operator's seat and slide the intermediate shaft coupling gear (29) towards the 1st speed side (mark 1st speed ➡ in the figure) by means of the shifter fork to cause the counter shaft to revolve.

2nd - 4th speed

Though power is transmitted at time of forward drive and reversing in the manner as described above, at 2nd-4th speed, fix the gears (I), (K) and (M) idling on the intermediate shaft to the intermediate shaft by sliding the coupling gear and power will be transmitted to the gears (J), (K) and (N) being fixed with spline on the counter shaft and in constant mesh, with the respective gear shifts being achieved.

Forward 6th speed



Slide the coupling gear (19) to left side (mark 6th speed ⬅ in the figure) to join the main shaft forward 6th gear (Q) idling on the main shaft with the guide gear fixed with a spline on the main shaft, for simultaneous revolution with the main shaft.

Since the main shaft forward 6th gear is in constant mesh with the countershaft forward 6th gear (R) fixed with a spline on the countershaft, main shaft revolutions are transmitted to the countershaft and power is transmitted to the bevel pinion (S).

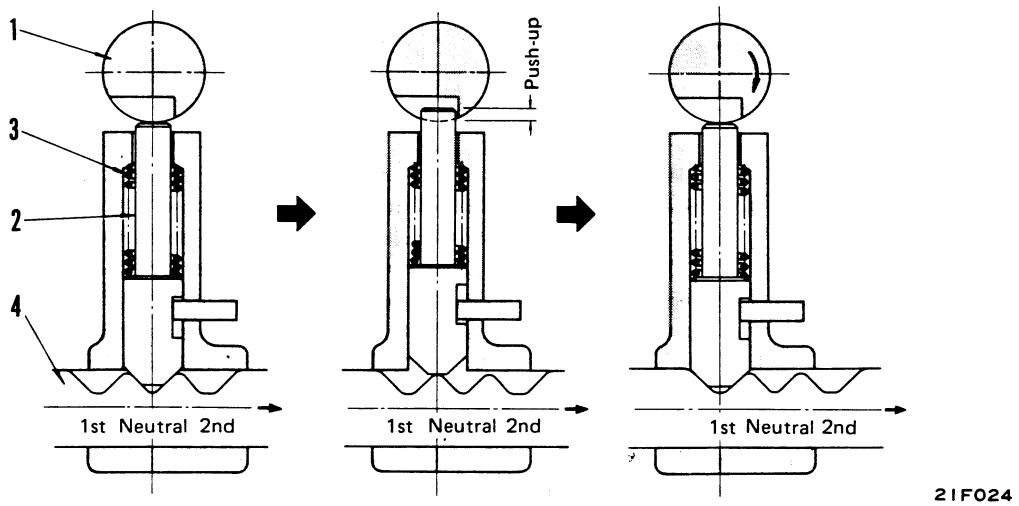
As if clear from the left mentioned, in the case of a constant mesh type, the gears on the main, intermediate and counter shafts are idling in constant mesh. For forward and reversing and selection of gears, the coupling gears on the respective shafts are caused to slide to join the gears with the respective shafts for power transmission. Accordingly, it has the advantages that gear selection can be made simply by short slide of the coupling gear and, owing to constant mesh, helical gears can be employed to improve durability.

INTERLOCK

In the D150A transmission system, 18 gears are caused to be engaged selectively by means of two control levers to effect 6 forward and 4 reverse shifts. Therefore, an interlock is provided to prevent gear damage due to incomplete mesh or gear come-off.

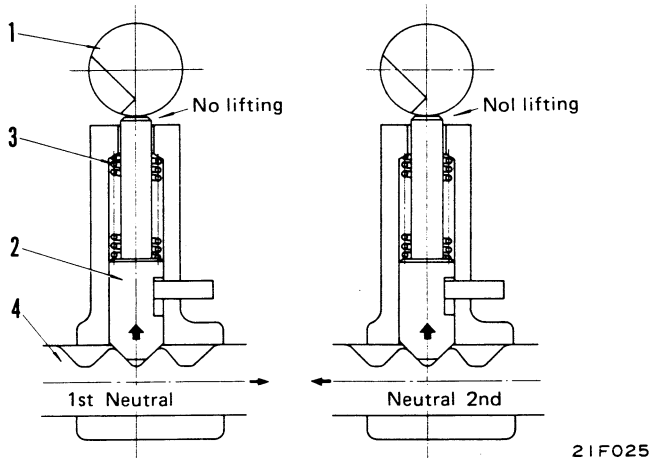
The interlock consists of the interlock shaft (1), interlock plunger (2), interlock spring (3) and shifter fork shaft (4).

1. **Gearshift lever NEUTRAL → 1ST SPEED, main clutch lever DISENGAGED**



In case the gearshift lever is in the NEUTRAL position, the plunger (2) is in the depression NEUTRAL of the fork shaft (4).
When the main clutch lever is DISENGAGED, the notch of the interlock shaft (1) to interlock with the main clutch lever is in alignment with the rear end of the plunger.
If one tries to shift the gearshift lever from NEUTRAL to 1ST SPEED, the plunger is lifted by the fork shaft, but the extent of such lift is relieved in the notch portion of the interlock shaft, making it possible for the shifter fork to move from NEUTRAL to 1ST SPEED.

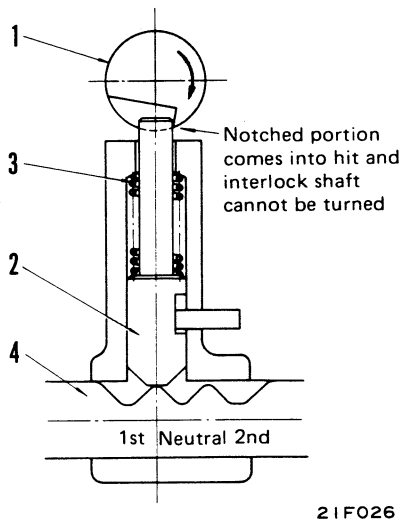
2. Gearshift lever NEUTRAL → 1ST SPEED, main clutch lever ENGAGED



In case the gearshift lever is in NEUTRAL position, the plunger (2) is in the depression NEUTRAL of the fork shaft (4).
When the main clutch lever in ENGAGED, the notch position of the interlock shaft (1) interlocking with the main clutch lever is not in alignment with the rear end of the plunger.

Even if one tries to shift the gear shift lever from NEUTRAL to 1ST SPEED to lift the plunger from the fork shaft depression, there is no escape groove on the interlock shaft side and the shifter fork shaft cannot move from NEUTRAL to 1ST SPEED position. Accordingly, gear shift is impossible unless the main clutch lever is in DISENGAGED position.

3. Gearshift lever BETWEEN GEARS, main clutch lever DISENGAGED → ENGAGED



In case the gearshift lever is in between 1ST SPEED and 2ND SPEED (1st and 2nd speed are in a half-meshed condition), the plunger (2) is not in the fork shaft (4) depression, being in a lifted position.

When the main clutch lever is DISENGAGED, the notched position of the interlock shaft (1) interlocking with the main clutch lever is in alignment with rear end of the plunger.
If one tries to shift the main clutch lever from DISENGAGED to ENGAGED, the plunger hits against the interlock shaft notch in that the plunger is not returned by the spring (3), and the interlock shaft cannot turn and accordingly the main clutch will not be shifted from DISENGAGED to ENGAGED. The interlock device thus prevents the main clutch from being engaged in a half-meshed condition so as to avoid damage to the transmission gear.

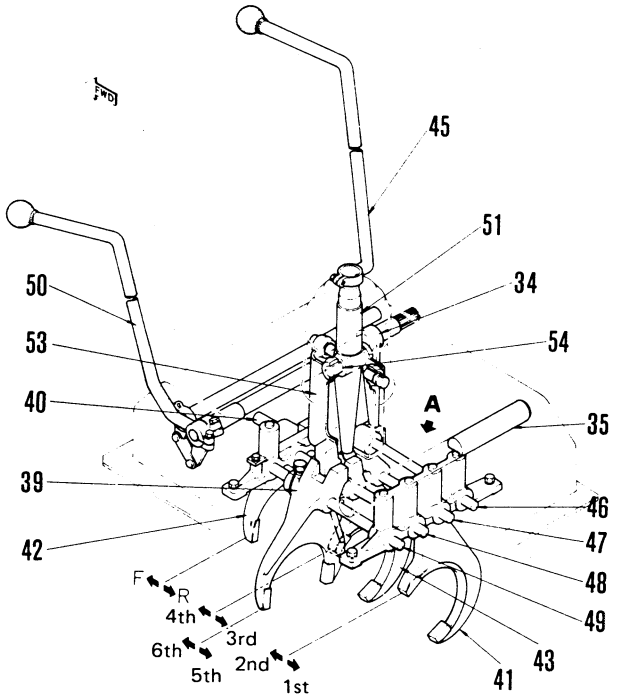
As above, at gears having completed gearshift, to prevent gear disengagement during travel, the fork shaft is locked with interlock shaft and plunger and at the same time, gearshift is made possible when the main clutch is completely disengaged.

DOUBLE MESH PREVENTIVE DEVICE

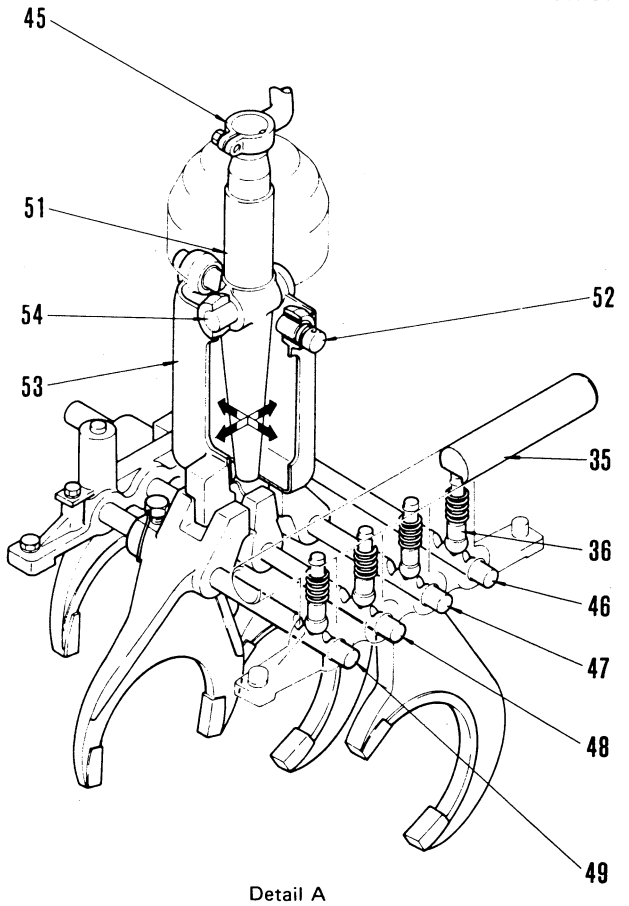
A double mesh preventive device is provided to completely lock other shift forks when effecting gear shift between a pair of gears, so as to make simultaneous shifting of more than 2 pairs of gear impossible.

To effect shifting, the gear shift lever (45) moves the change lever (51) left and right (to select a shifter fork shaft for any of 1st & 2nd, 3rd and 4th or 5th and 6th gear) or back and forth (to select a gear for any of 1st & 2nd, 3rd and 4th or 5th and 6th speed). The gate (53) is provided, which moves left and right with the pin (54) as the fulcrum simultaneously when the gear shift lever is moved left and right.

The gate is provided with a projection which fits into the depressions in the 1st-2nd gear shifter arm (38), 3rd-4th gear shifter arm (33) and 5th-6th gear shifter fork (39); when the gear shift lever is positioned at the 1st-2nd gear shifter arm, the gate projection fits into the 3rd-4th shifter arm and 5th-6th shifter fork. The gate is provided with a notch making it possible for the change lever to move back and forth, with the pin (54) as the fulcrum, only at a position clear of the projection so that 1st or 2nd gear can be selected. That is, this device utilizes the gate projection as a stopper so as to prevent, when selecting 1st or 2nd gear, a follow-up movement of the 3rd-4th or 5th-6th gear shifter arm or shifter fork.



21F027

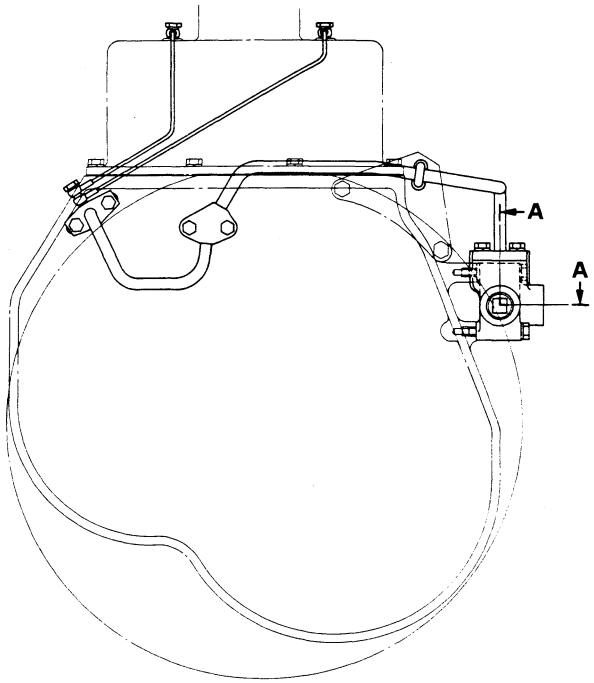


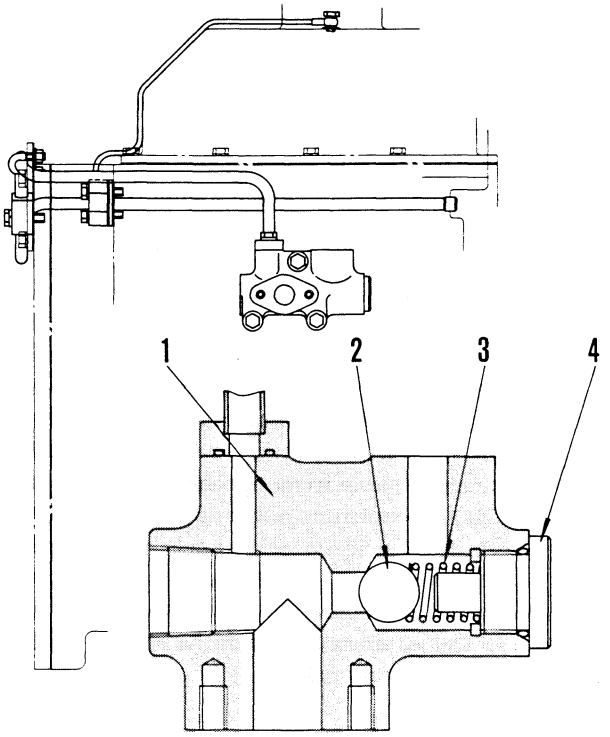
Detail A

21F028

45. Gear shift lever
46. 1st, 2nd shifter arm shaft
47. 3rd, 4th shifter arm shaft
48. F. R shifter arm shaft
49. 5th, 6th shifter arm shaft
50. Forward-Reverse lever
51. Change lever
52. Gate pin
53. Gate
54. Change lever pin

TRANSMISSION LUBRICATION VALVE D150A





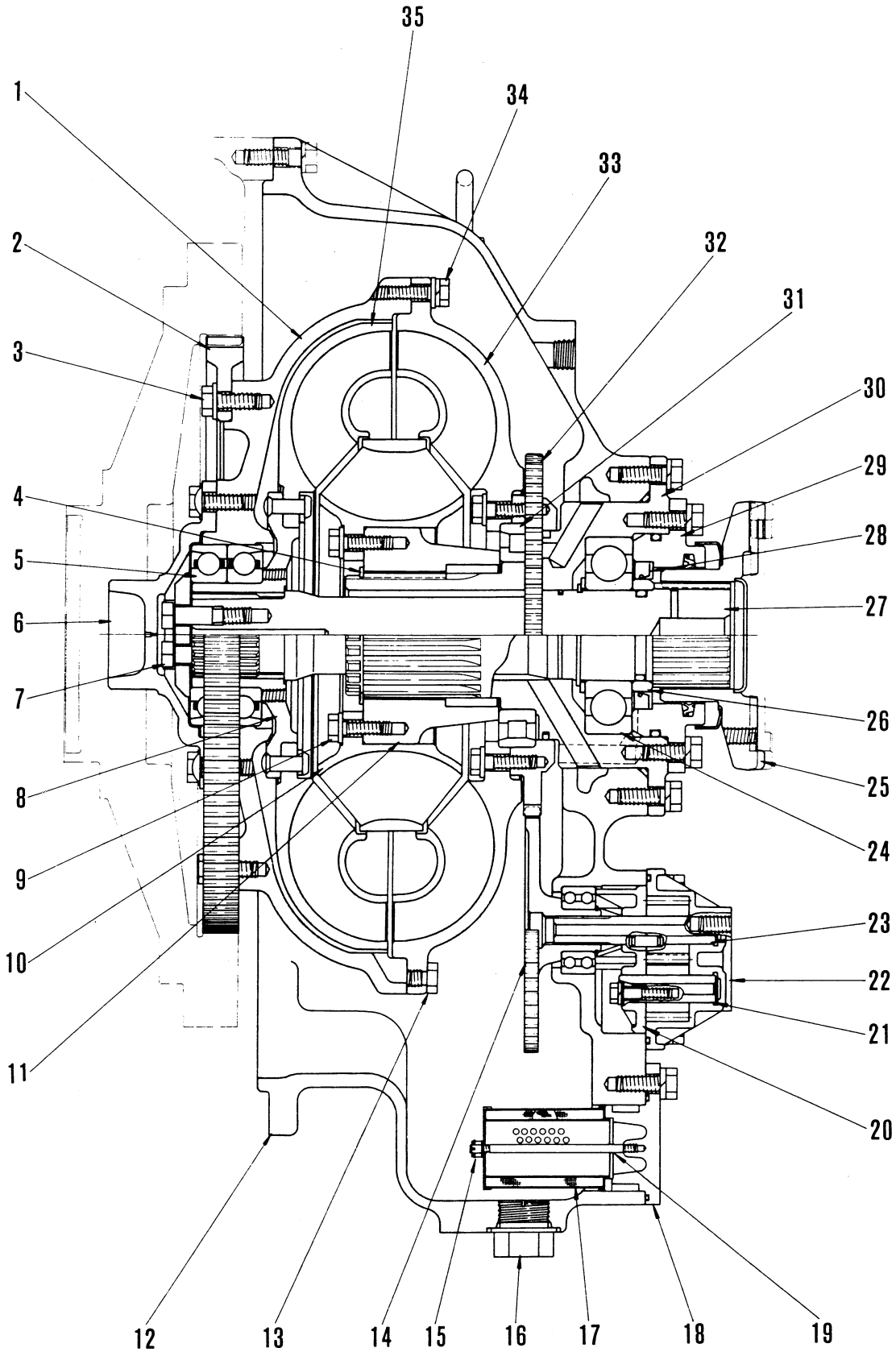
Section A-A

21F112

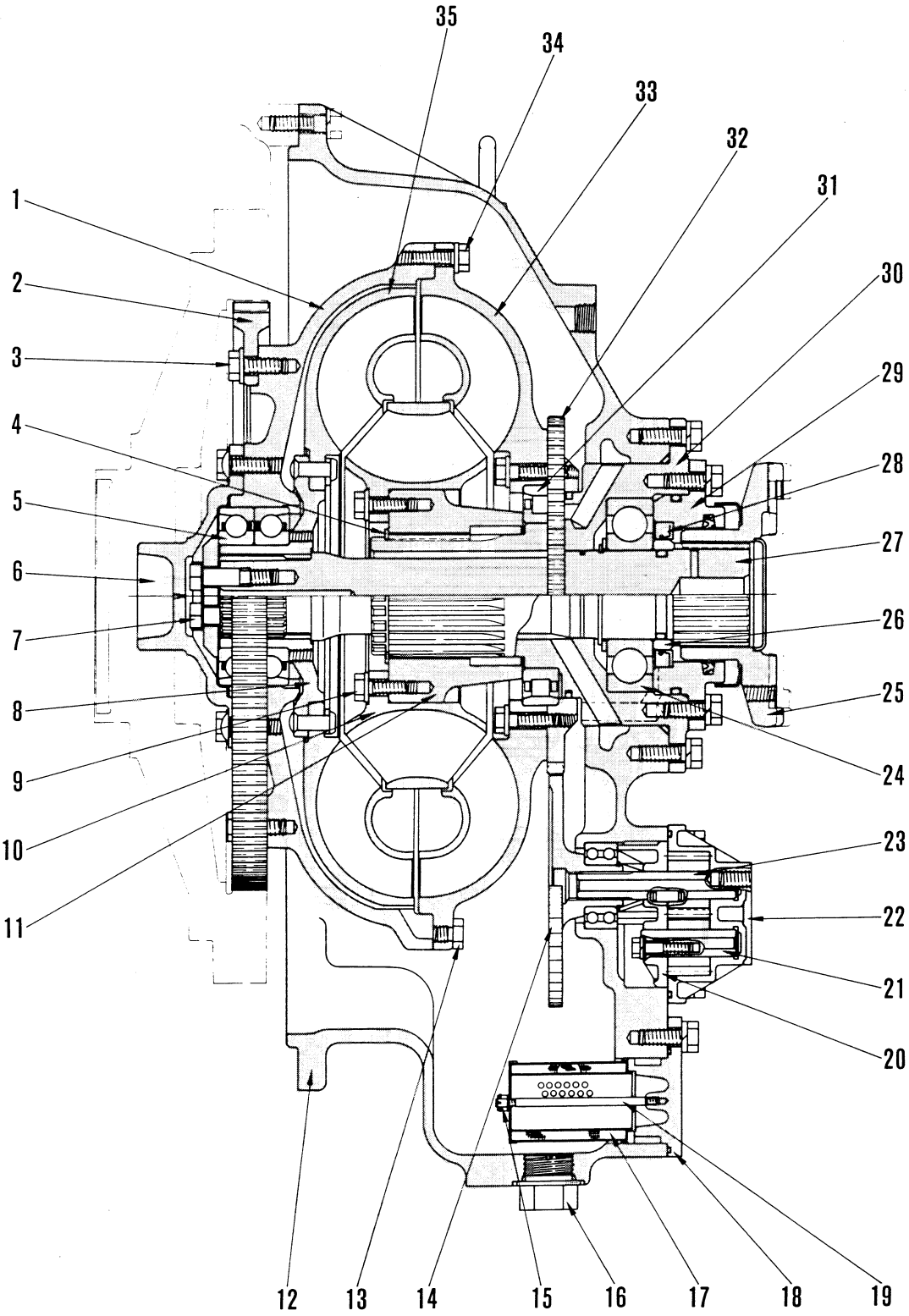
1. Valve body
2. Ball
3. Spring — Free length: 51.8 mm; Installation length: 30.0 mm; Installation load: 3 ± 0.3 kg
4. Plug

Cracking pressure: 1.5 kg/cm^2

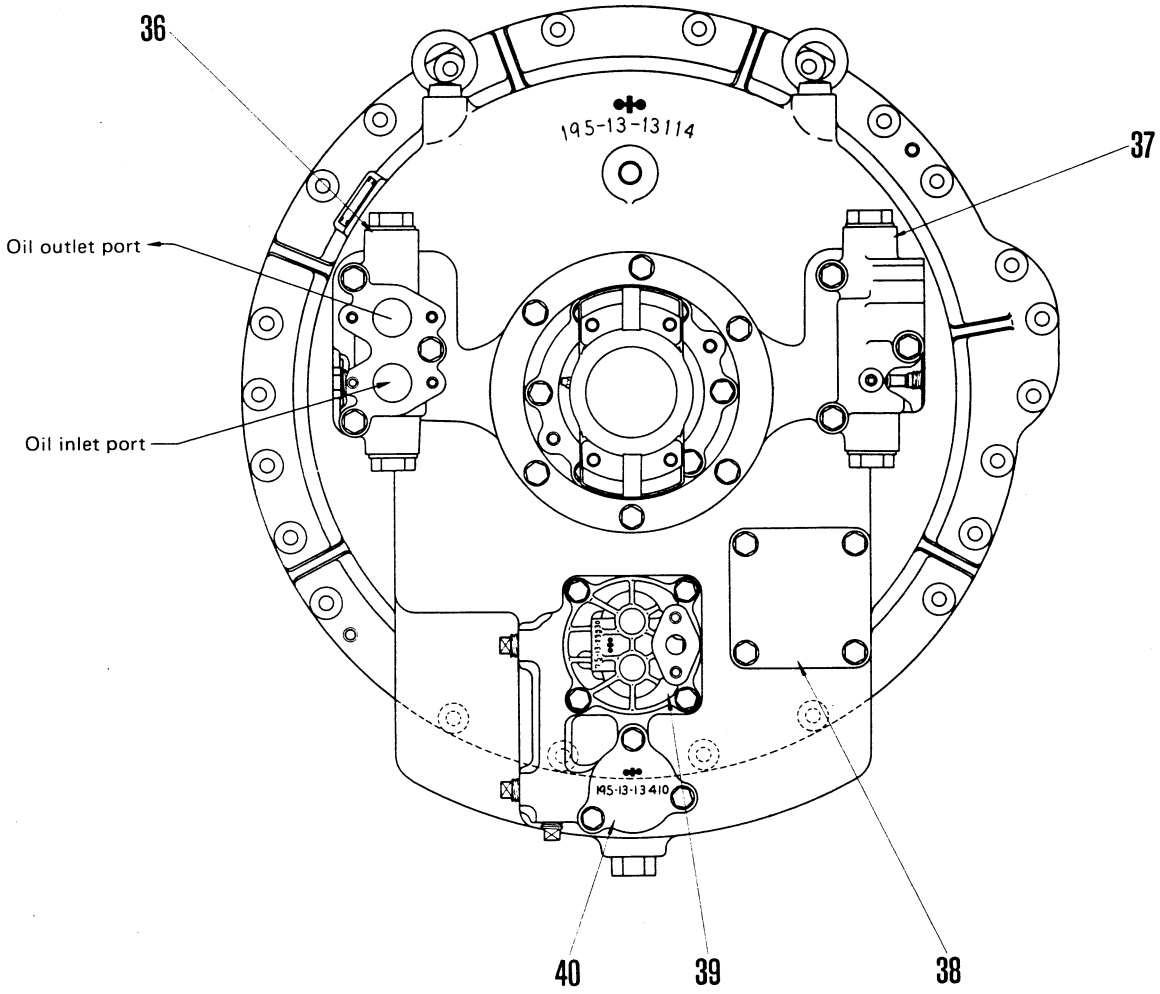
TORQUE CONVERTER D155A TCS43C K4001 and up



TORQUE CONVERTER D155A TCS43E18598 and up



21F029-1



21F030

1. Drive case
2. Drive gear
3. Bolt
4. Snap ring
5. Pilot bearing
6. Pilot
7. Bolt
8. Boss
9. Bolt
10. Stator
11. Stator boss
12. Housing
13. Drain plug
14. Drive gear
15. Nut
16. Drain plug
17. Strainer
18. Cover
19. Stud
20. Cover
21. Driven gear Ass'y
22. Pump case
23. Drive gear Ass'y
24. Stator shaft bearing
25. Coupling
26. Seal seat
27. Turbine shaft
28. Oil seal
29. Cover
30. Stator shaft
31. Bearing
32. Drive gear
33. Pump
34. Bolt
35. Turbine
36. Relief valve
37. Regulator valve
38. Cover
39. Scavenging pump
40. Strainer

Model D155A is equipped with the three element, one stage, single phase torque converter which uses fluid to carry out automatic torque conversion, depending upon machine load, while transmitting power from the engine. The principle components of the torque converter are the pump (33) for converting mechanical energy from the engine into kinetic energy of fluid, the turbine (35) for reconverting the transmitted kinetic energy into mechanical energy, and the stator (10) for guiding the fluid flow.

When drive gear (2), meshing with the internal teeth of the flywheel, is rotated by engine starting, pump (24), constituting a unit with the drive gear and drive case (1), and mounted on stator shaft (30) with the bearing, is rotated.

By this rotation, the fluid is thrown outward from the pump along the pump blades by centrifugal force, and flows helically to the turbine.

The fluid is impelled with force against the blades of the turbine and changes its direction toward stator (10). The reaction developed at the blades by this action causes the turbine to rotate, and power is transmitted by turbine shaft (27).

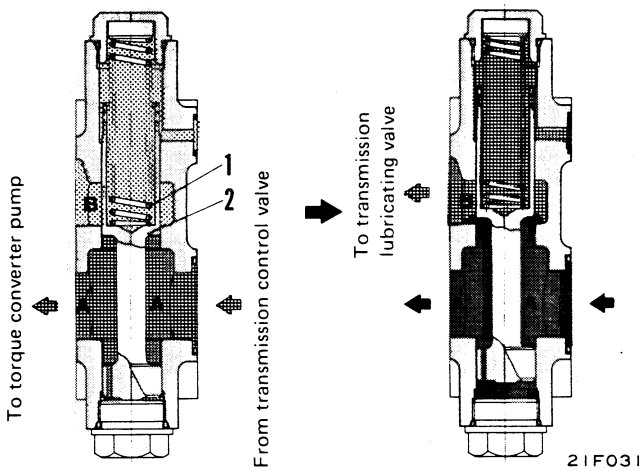
The fluid at the turbine is directed from the central part of the turbine to the stator where its direction is changed, and finally returned to the central part of the pump.

In short, while the fluid flows in the order of pump → turbine → stator → pump, power is continuously delivered from the pump to the turbine shaft, from which it is then transmitted to the universal joint.

The stator used in model D155A is fixed securely on the stator shaft spline, and does not rotate.

The torque converter (comprising, as already mentioned, one pump, one turbine, and one fixed stator) is referred to as a three element, one stage, single phase torque converter.

TORQUE CONVERTER RELIEF VALVE



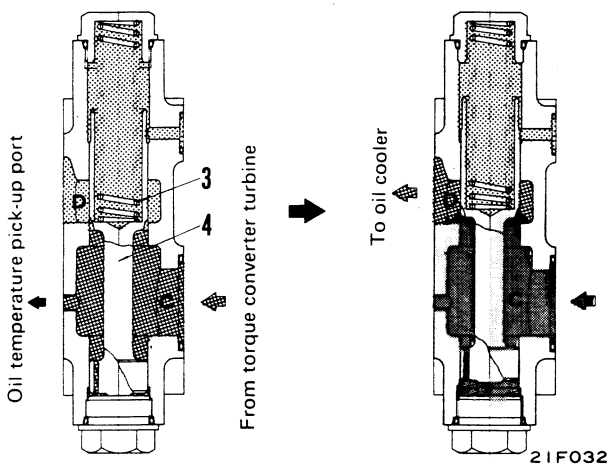
This relief valve controls the hydraulic pressure of the fluid so that abnormally high pressure is not applied to the torque converter. The hydraulic pressure, which is at 20 ± 2 kg/cm^2 when relieved from the modulating relief valve of the transmission valves, is further reduced to $8.7\ ^{+0.3}_{0}$ kg/cm^2 by this relief valve.

The fluid from the transmission control valve flows through port (A) and the passage in the torque converter housing to the pump.

When port (A) is filled up and hydraulic pressure to the pump reaches 7 ± 0.1 kg/cm^2, the fluid compresses spring (1), pushing up spool (2), and flows through port (B) into the flow circuit of the transmission lubrication relief valve.

★ Cracking pressure: $8.7\ ^{+0.3}_{0}$ kg/cm^2

TORQUE CONVERTER REGULATOR VALVE



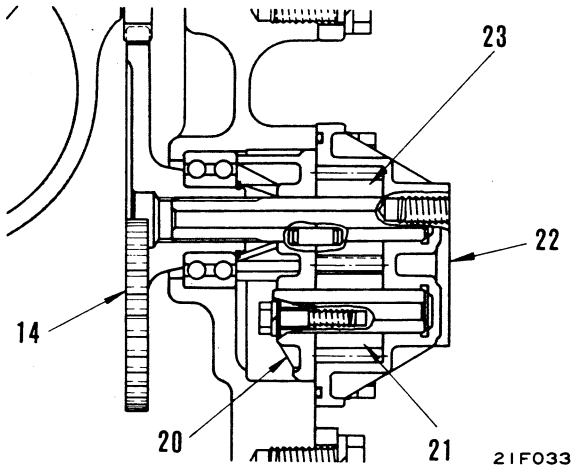
This regulator valve, incorporated into the outlet circuit of the torque converter, maintains hydraulic pressure inside the torque converter below 4.5 ± 0.5 kg/cm^2 to protect the torque converter and ensure optimum performance.

Fluid from the torque converter flows through the passage in the torque converter housing to port (C) until the port is filled up.

When hydraulic pressure in port (C) reaches 4.5 ± 0.5 kg/cm^2, the fluid compresses spring (3), pushing up spool (4), and flows through port (D) into the oil cooler circuit.

★ Set pressure
- 2.5 ± 1.0kg/cm^2 at 50ℓ/min.
- 3.5 ± 0.5kg/cm^2 at 100ℓ/min.
- 4.5 ± 0.5kg/cm^2 at 200ℓ/min.

SCAVENGING PUMP



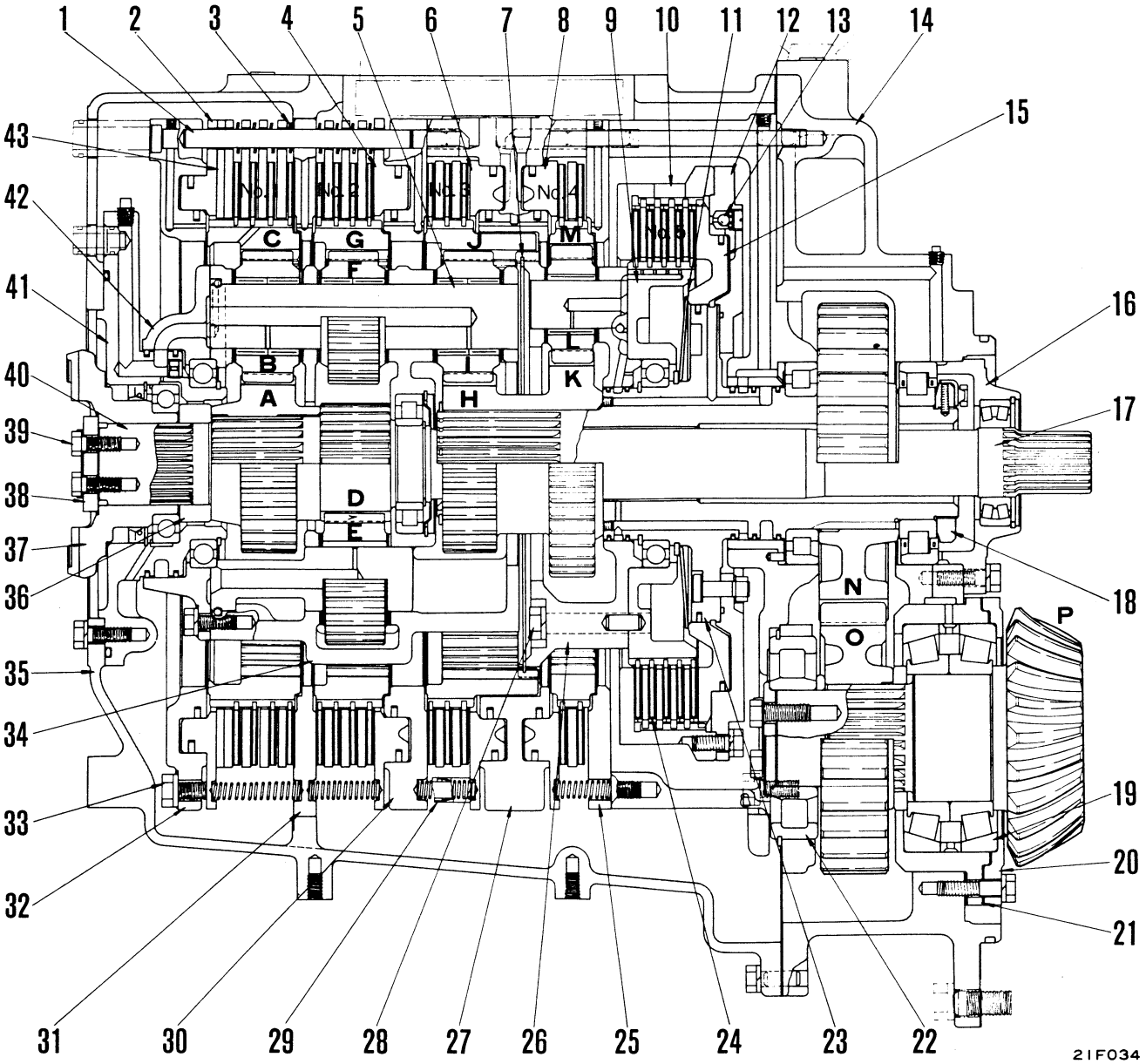
Oil oozing out from between contacting faces of pump, turbine, and stator and PTO lubricating oil is drained into the torque converter housing after lubricating each sliding part.

Oil collected in the torque converter housing is recirculated through strainer (17) to the steering case by means of scavenging pump (39) which is driven by gears (32) provided on the back face of the torque converter pump.

14. Driven gear
20. Cover
21. Driven gear
22. Pump case
23. Drive gear

TRANSMISSION

Model D155A is equipped with planetary type transmission (F3, R3) and is a combination of planetary gear system and disc clutch.
For each revolution direction and rpm, two of 5 disc clutches of the planetary gear system are hydraulically locked by acutating the control valve.
No. 1 clutch is for Forward, No. 2 for Reverse, No. 3 for 3rd speed, No. 4 for 2nd speed, and No. 5 for 1st speed.



1. Pin
2. No. 1 clutch piston
3. Washer spring
4. No. 2 clutch piston
5. Shaft
6. No. 3 clutch piston
7. Snap ring
8. No. 4 clutch piston
9. Gear
10. Drum
11. Spring
12. No. 5 housing
13. Check ball
14. Rear case
15. No. 5 clutch piston
16. Cage
17. Shaft
18. Nut
19. Bearing
20. Cover
21. Bearing cage
22. Bearing
23. Shaft
24. Wave spring
25. Plate
26. No. 4 carrier
27. No. 3 and 4 housings
28. Bolt
29. Sleeve
30. No. 2 housing
31. Plate
32. No. 1 housing
33. Tie bolt

A. Primary sun gear (33 teeth)
B. Primary planetary pinion (24 teeth)
C. Primary ring gear (81 teeth)
D. Secondary sun gear (21 teeth)
E. Secondary planetary pinion (23 teeth)
F. Secondary planetary pinion (24 teeth)
G. Secondary ring gear (81 teeth)
H. Third sun gear (33 teeth)
I. Third planetary pinion (24 teeth)
J. Third ring gear (81 teeth)
K. Fourth sun gear (42 teeth)
L. Fourth planetary pinion (19 teeth)
M. Fourth ring gear (81 teeth)
N. Transfer drive gear (30 teeth)
O. Transfer driven gear (24 teeth)
P. Bevel pinion (21 teeth)

34. No. 1, 2 and 3 carriers
35. Transmission case
36. Spacer
37. Coupling
38. Holder
39. Bolt
40. Shaft
41. Case
42. Cage
43. Plate

- No.1 clutch
  - Serial No. 15001 – 29764: 5 plates, 4 discs
  - Serial No. 29765 and up: 3 plates, 4 discs
- No. 2 Clutch: 3 plates, 4 discs
- No. 3 Clutch: 2 plates, 3 discs
- No. 4 Clutch: 1 plate, 2 discs
- No. 5 Clutch: 4 plates, 5 discs

★ In five No. 1 clutch plates, the plate facing piston is different in thickness from others.

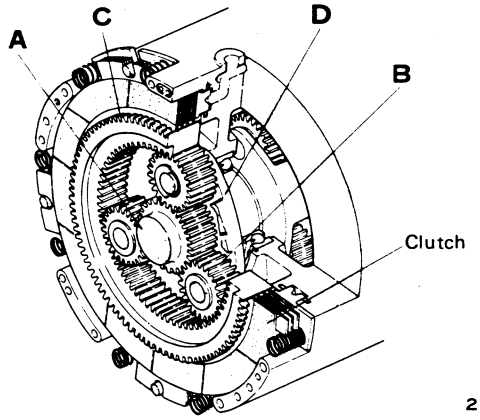
Speed stages and power transmitting line

Forward / reverse	Speed stage	Clutch to be engaged
Forward	1st	No. 1 • No. 5
	2nd	No. 1 • No. 4
	3rd	No. 1 • No. 3
Reverse	1st	No. 2 • No. 5
	2nd	No. 2 • No. 4
	3rd	No. 2 • No. 3

PLANETARY GEAR SYSTEM

PLANETARY GEAR SYSTEM

The planetary gear system is composed of sun gear (A), planetary pinion (B), ring gear (C), and carrier (D).
The planetary pinion is supported on the carrier and meshes with sun gear and ring gear.



21F035

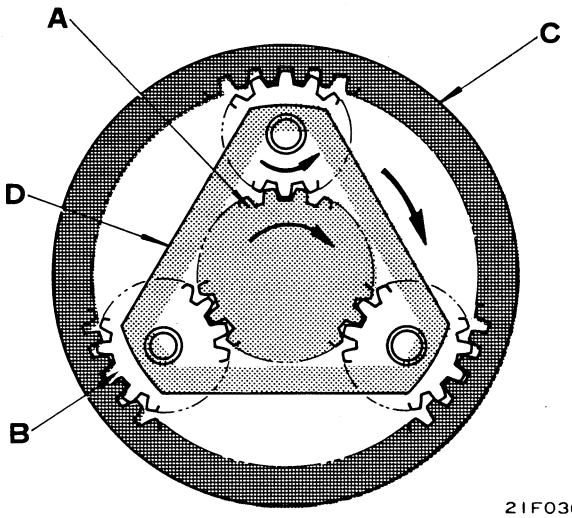
A. Sun gear
B. Planetary pinion
C. Ring gear
D. Planetary carrier

WHEN THE RING GEAR IS FIXED

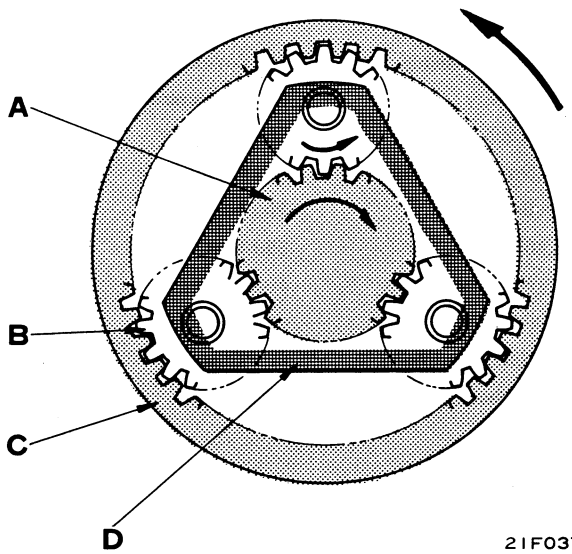
The torque of sun gear (A) is transmitted to planetary pinion (B).
As ring gear (C) meshing with the planetary pinion is locked, the pinion cannot rotate at the same position. The planetary pinion, therefore, rotates around the sun gear along the ring gear. The torque of the sun gear is transmitted to the carrier (D) to drive it in the same direction as the sun gear rotates.

WHEN THE CARRIER IS LOCKED

The torque of sun gear (A) is transmitted to planetary pinion (B).
As carrier (D) is locked, the planetary pinion meshing with the sun gear rotates at its position.
The ring gear (C) meshing with the planetary pinion is driven in the opposite direction to that of the rotation of the sun gear; thus the torque of the sun gear is delivered to the ring gear. No. 1, 3 and 4 clutches in model D155A are based on the combination of sun gear → planetary pinion → ring gear (or carrier). In the case of No. 1 clutch, the sun gear acts as a torque source and transmits torque to the carrier.
In the case of No. 3 and 4 clutches, the carrier acts as a torque source and transmits torque to No. 3 and 4 sun gears.



21F036



21F037

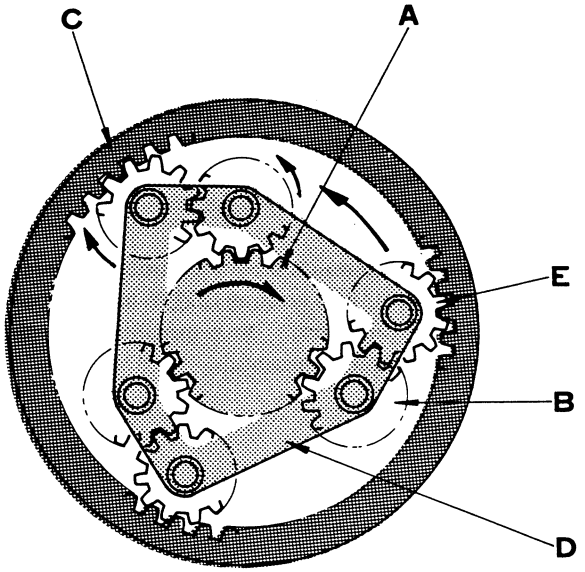
CHANGING DIRECTION OF ROTATION

The combination in which another planetary pinion (E) is incorporated between planetary pinion (B) and ring gear (C) is also used. Sun gear (A) rotates while the ring gear is locked.

As the ring gear is locked, planetary pinion (E) cannot revolve at the same place, but rotates around the sun gear along the ring gear.

In this case, the torque of the sun gear is transmitted to the carrier to drive it in the opposite direction to the rotation of the sun gear.

This combination of sun gear → planetary pinion → planetary pinion → ring gear (or carrier) is used in model D155A for the No. 2 clutch, by which the machine is reversed.

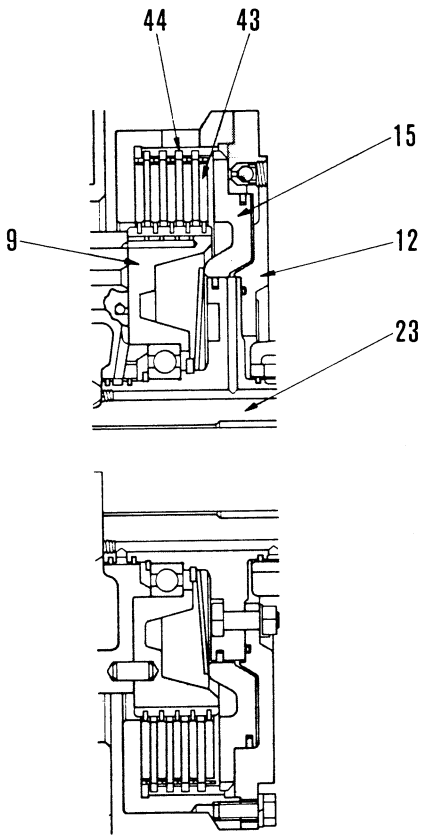


21F038

ROTARY CLUTCH

No. 5 clutch in model D155A is a rotary type clutch different from clutches No. 1 to No. 4.

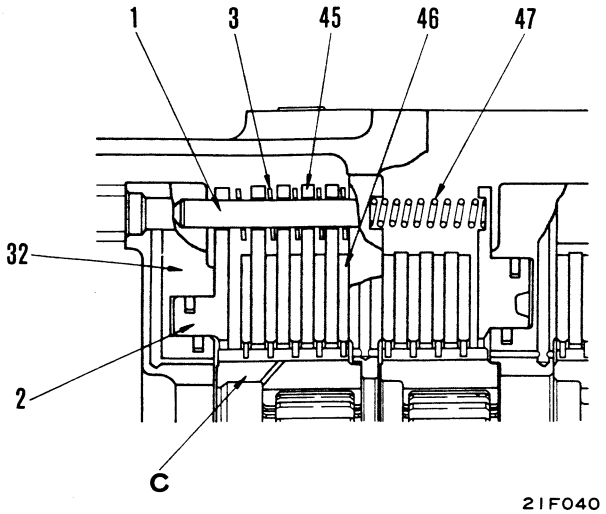
In this type of clutch, where clutch drum (12) is bolted to output shaft (23), piston (15) presses disc (43) and plate (44) to the drum. The frictional force developed by their contact enables the power transmission from gear (9) (connected with No. 4 carrier) to the clutch drum. This rotary type clutch is generally used as a 1st speed clutch having a large transmitting torque.



21F039

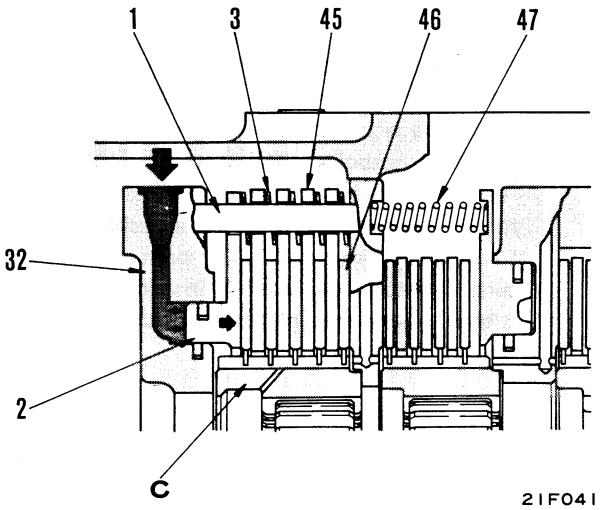
LOCKING RING GEAR (CARRIER)

For locking the ring gear the disc clutch is incorporated. It comprises a piston (2), plate (45), disc (46), pin (1), piston return spring (47) and washer spring (3).
The disc's internal teeth engage with the ring gear's external teeth.
The plate, whose notch on the outside diameter engages with pin (1) on housing (32), is locked against the rotating direction. The piston also is locked against the rotating direction.



21F040

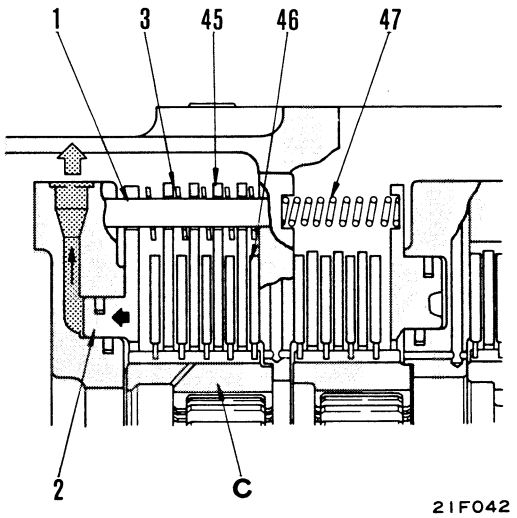
- **Clutch Engaged (Locked)**
  Fluid from the control valve flows under pressure through the port in housing (32) to the back of piston (2). The piston presses disc (46) and plate (45) together, and the frictional force developed stops the disc revolution, thus locking ring gear (C) meshing with the disc's internal teeth.



21F041

- **Clutch Disengaged (Free)**

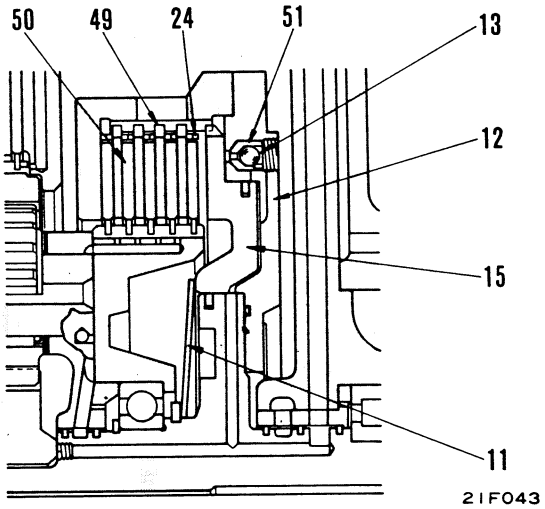
  With shut off of the fluid supply from the control valve, piston (2) returns to the initial position under the force of piston return spring (47), thus relieving the frictional force between plate (45) and disc (46), bringing the ring gear (C) in neutral. Spring washers (3) provided between pin (1) plates ensure quick return of the piston at clutch disengagement as well as smooth disengagement of disc and plate, thus preventing reverse revolution of the disc.



21F042

No. 5 CLUTCH (BALL CHECK VALVE)

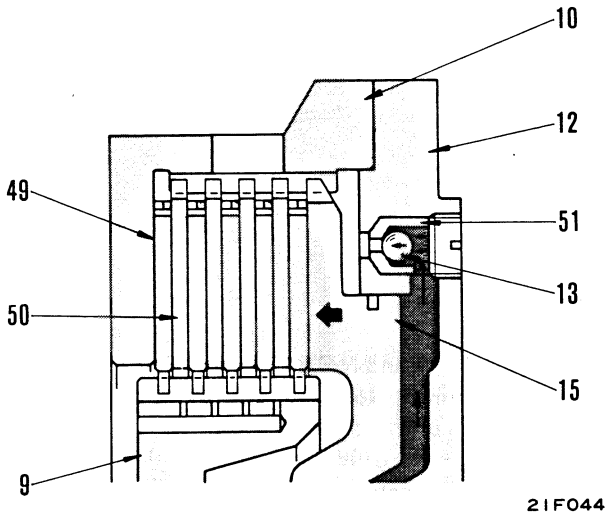
A rotary type clutch is employed for No. 5 clutch in model D155A.
The fluid at the bottom of cylinder (12) remains under centrifugal force due to the revolution even when the clutch is disengaged. The disc spring (11) cannot overcome this force to instantly return piston (15), and the clutch is partially engaged.
Because of this, the partially engaged condition persists even when the operator puts the gear lever in neutral, thus causing difficulty in continuing the gear shift operation. Ball check valve (13) mounted on the piston of the rotary clutch functions to avoid this kind of function.



21F043

- **Clutch Engaged (Locked)**

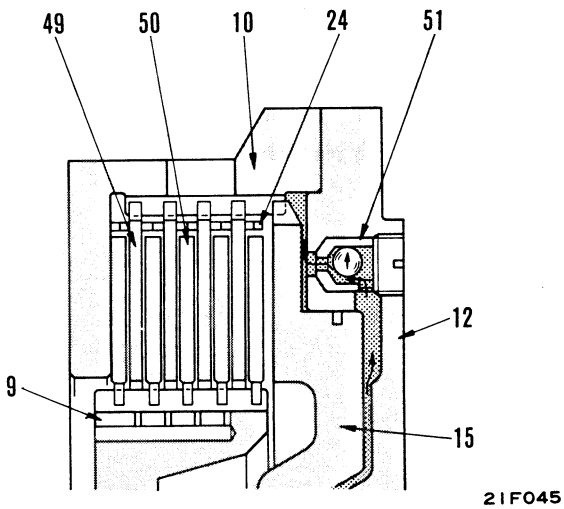
  The fluid from the control valve is supplied under pressure through the port of housing (12) to the back of piston (15). Then, ball check valve (13) closes the valve seat (51) port, and the piston presses disc (50) to plate (49), engaging the disc's internal teeth and gear's external teeth, the plate's external teeth and the drum's internal teeth, thus effecting clutch engagement.



21F044

- **Clutch Disengaged (Free)**

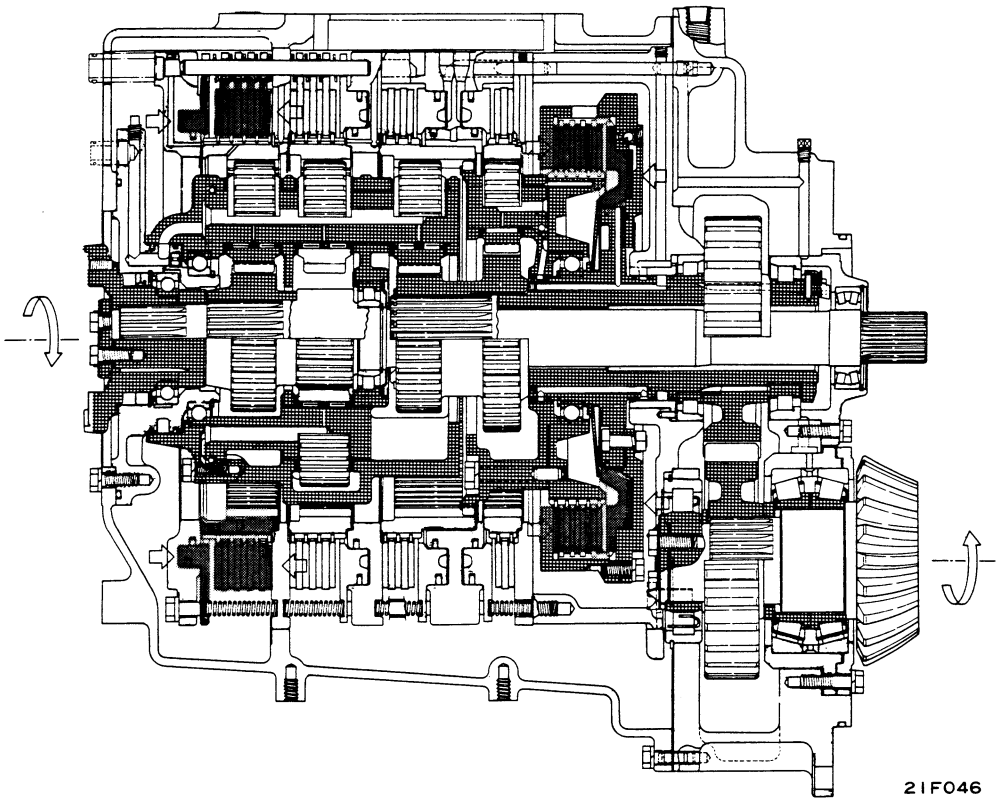
  With the shut off of fluid supply from the control valve, ball check valve (13) is displaced outward under centrifugal force due to the revolution, allowing fuel at the back of piston (15) to be discharged from valve seat (51) through the gap in the ball check valve. As a result, the fuel centrifugal force is completely eliminated, piston is returned by disc spring (11).
  Wave spring (24) between plates (49) and the plate helps the piston to return to the initial position, thus preventing the reverse rotation of the disc by achieving smooth disengagement of disc (50) and plate when the clutch is disengaged.



21F045

POWER TRANSMITTING LINE

FORWARD 1ST SPEED



Engage No. 1 and No. 5 clutches, to lock No. 1 ring gear and to connect No. 5 gear directly with the output shaft (forming a unit with No. 4 carrier).

Torque is delivered from No. 1 sun gear (A) to No. 1 planetary pinion (B).

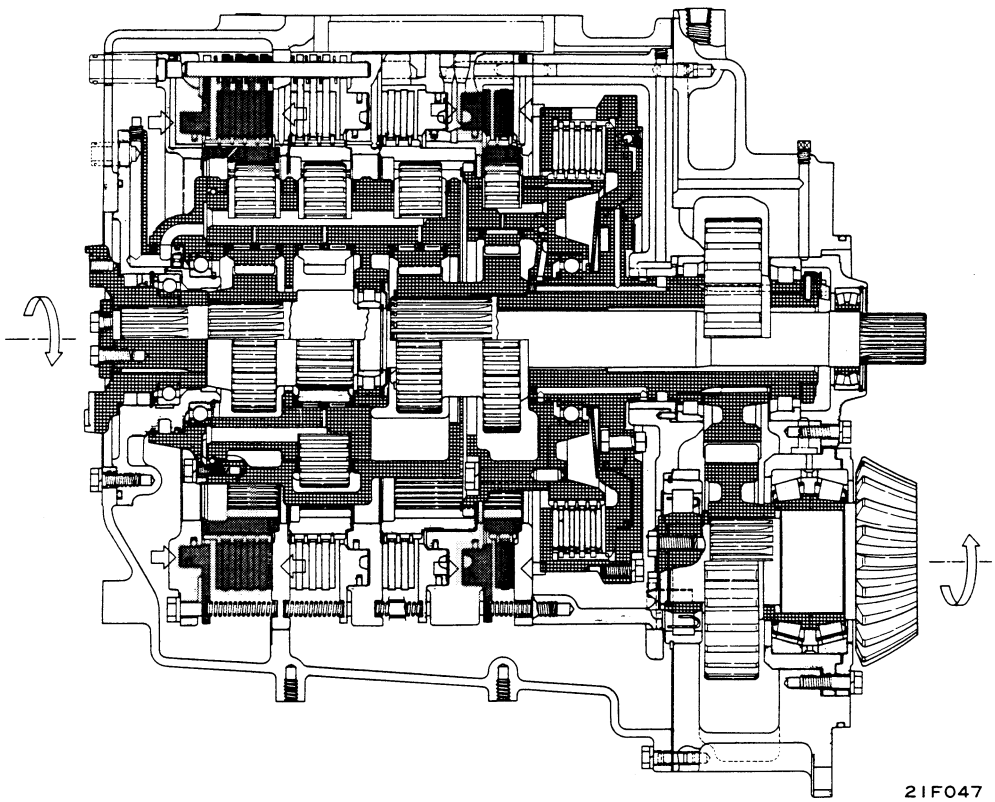
As No. 1 ring gear (C) is locked No. 1 planetary pinion around No. 1 sun gear, thus No. 1 carrier (34) (forming a unit with No. 2, 3 carriers) transmits the torque in the same direction as that of No. 1 sun gear.

Engagement of No. 5 clutch brings No. 5 clutch drum (10), No. 5 gear (9), No. 5 carrier (26), and No. 3 ring gear (J) into engagement.

Torque of No. 1 carrier (Forming a unit with No. 2, 3 carriers) drives No. 3, 4 sun gears, No. 5 clutch, No. 4 carrier, No. 3 ring gear, and the torque in the same direction as that of No. 1 gear is delivered to the output shaft (23).

The power transmitted from transfer drive gear (O) on the output shaft to transfer driven gear (P) is delivered to pinion gear (Q) as torque, opposite to the input direction.

FORWARD 2ND SPEED



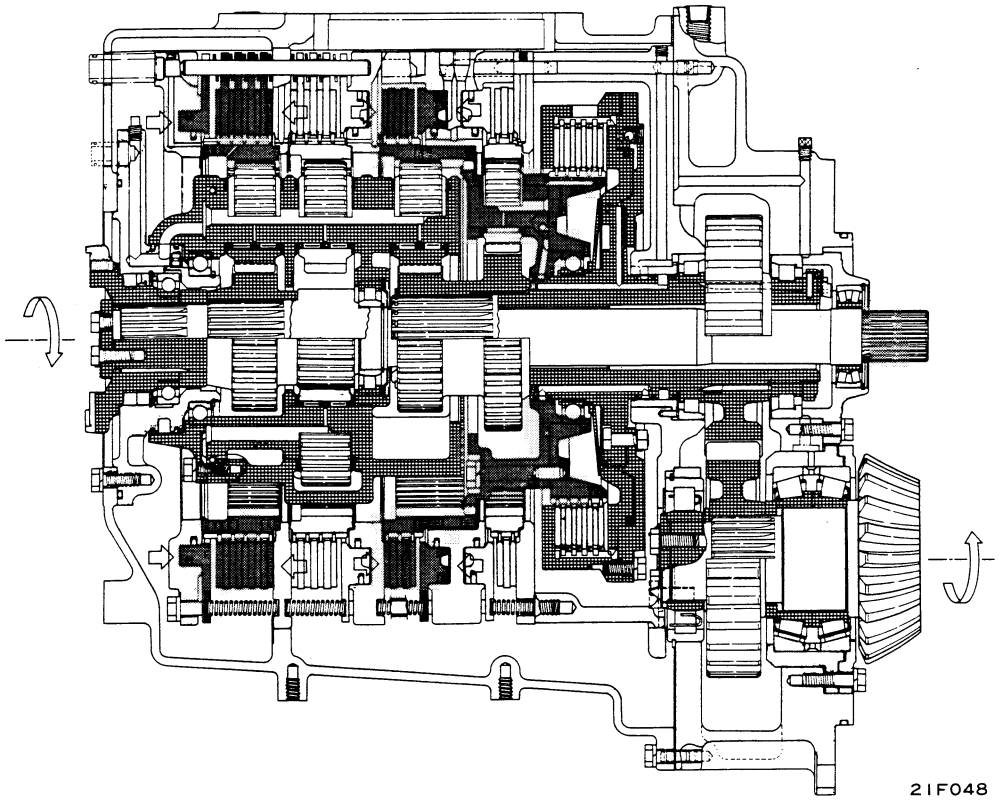
Engage No. 1 and No. 4 clutches, to lock No. 1 and No. 4 ring gears.

Torque is transmitted from No. 1 sun gear (A) to No. 1 planetary pinion (B).

As No. 1 ring gear (C) is locked, No. 1 planetary pinion rotates around No. 1 sun gear, thus delivering the torque in the same direction as that of No. 1 sun gear to No. 1 carrier (34) (forming a unit with No. 2, 3 carriers).

Furthremore, as No. 4 ring gear (M) is locked, the torque of No. 1 carrier is transmitted through No. 4 sun gear (K) forming a unit with No. 3 sun gear (H) to output shaft (23), while allowing No. 4 planetary pinion (L) to rotate around No. 4 ring gear.

FORWARD 3RD SPEED

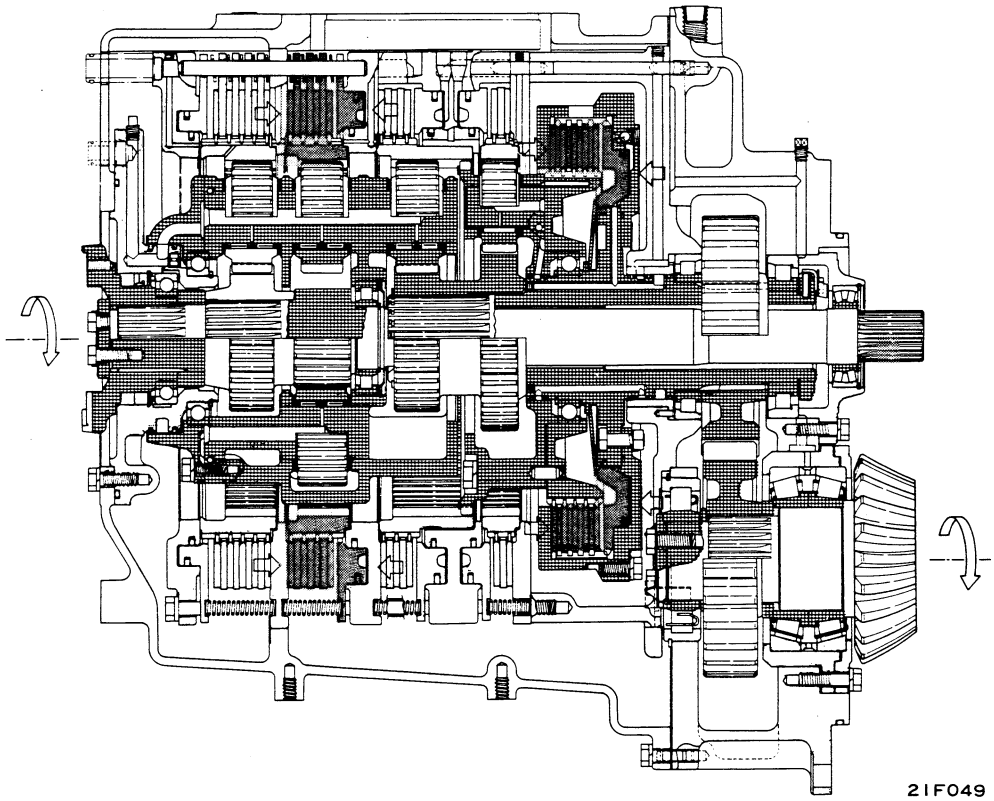


Engage No. 1 and No. 3 clutches, and lock No. 1 and No. 3 ring gears.

Torque is delivered from No. 1 sun gear (A) to No. 1 planetary pinion (B).
As No. 1 ring gear (C) is locked, No. 1 planetary pinion revolves around No. 1 sun gear, thus delivering the torque in the same direction as No. 1 sun gear revolution to No. 1 carrier (34) (forming a unit with No. 2, 3 carriers).

Furthermore, as No. 3 ring gear (J) is locked, the revolution of No. 1 carrier causes No. 3 planetary pinion (I) to rotate around No. 3 sun gear along No. 3 ring gear.
The torque of No. 1 carrier rotates No. 3 sun gear and is delivered to output shaft (23).

REVERSE 1ST SPEED



Engage No. 2 and No. 5 clutches, to lock No. 2 ring gear, and directly connect No. 5 gear (forming a unit with No. 4 ring) with the output shaft.

The torque is transmitted from No. 2 sun gear (D) to No. 2 planetary pinion (E) (for reversing), and further to No. 2 planetary pinion (F).

As No. 2 ring gear (G) is locked, No. 2 planetary pinion meshing with No. 2 ring gear and No. 2 planetary pinion meshing with No. 2 sun gear cannot rotate at its position, but rotates around No. 2 sun gear along No. 2 ring gear.

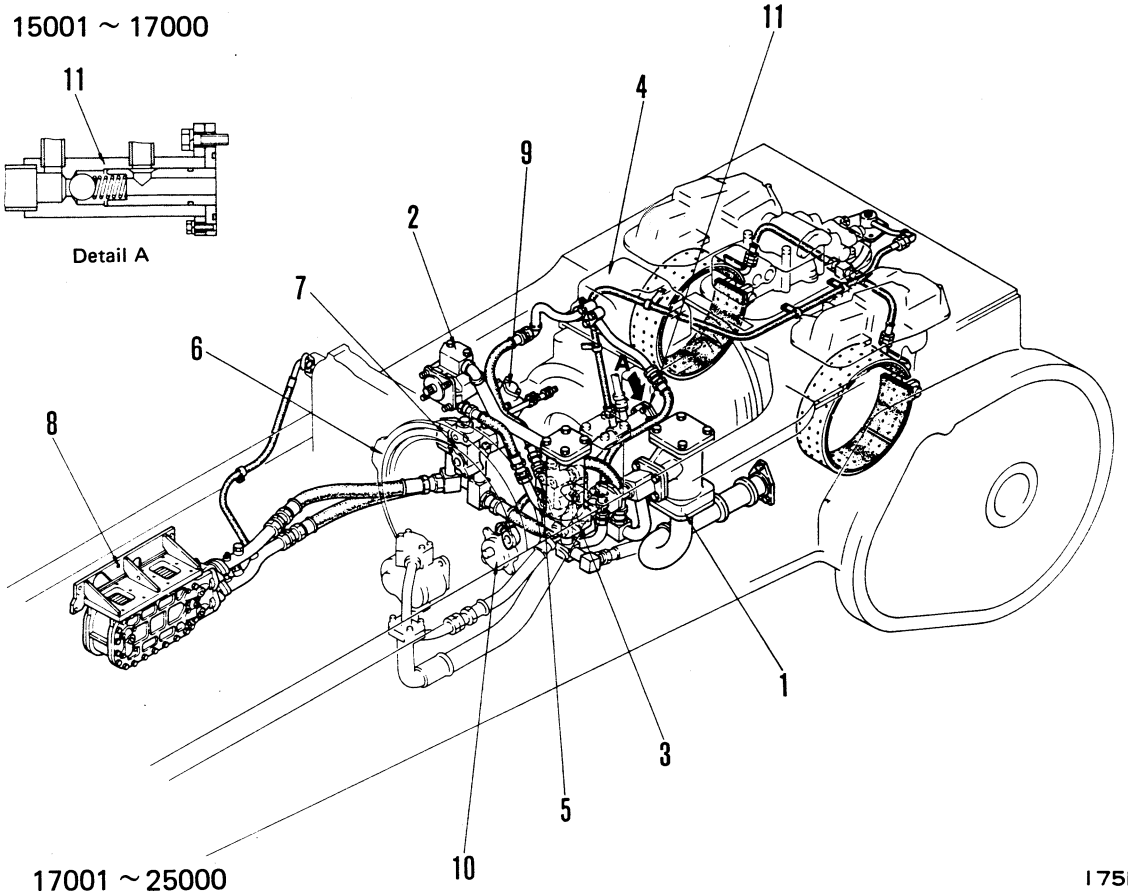
In this case, the torque of No. 2 sun gear drives 2 carrier (forming a unit with No. 1, 3 carriers), and its rotating direction is different from the case of the forward 1st speed; that is, opposite to the rotation of No. 2 sun gear, as No. 2 planetary pinion for reversing is interposed.

Therefore, the power is transmitted in the reverse direction.

The same may be applied for the reverse 1st, 2nd, 3rd speeds as for forward 1st, 2nd, and 3rd speeds.

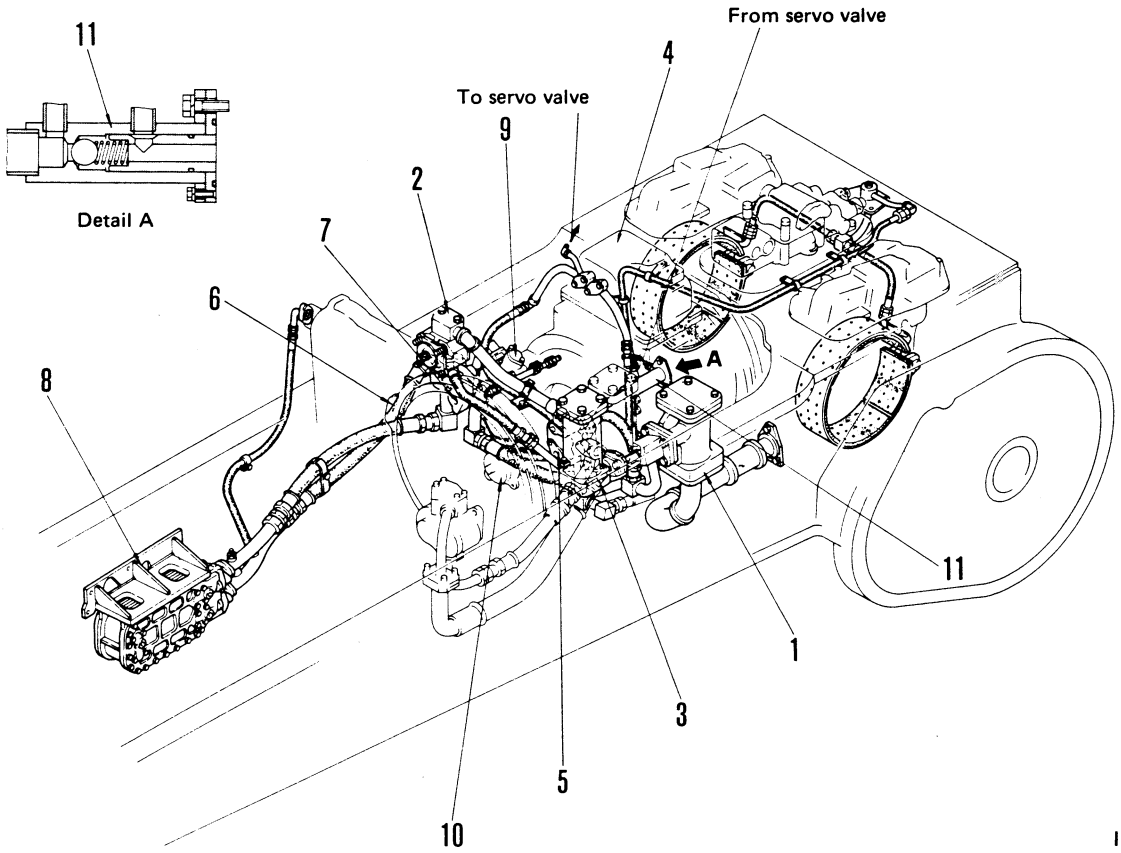
TORQFLOW HYDRAULIC PIPING

D155A 15001 ~ 17000



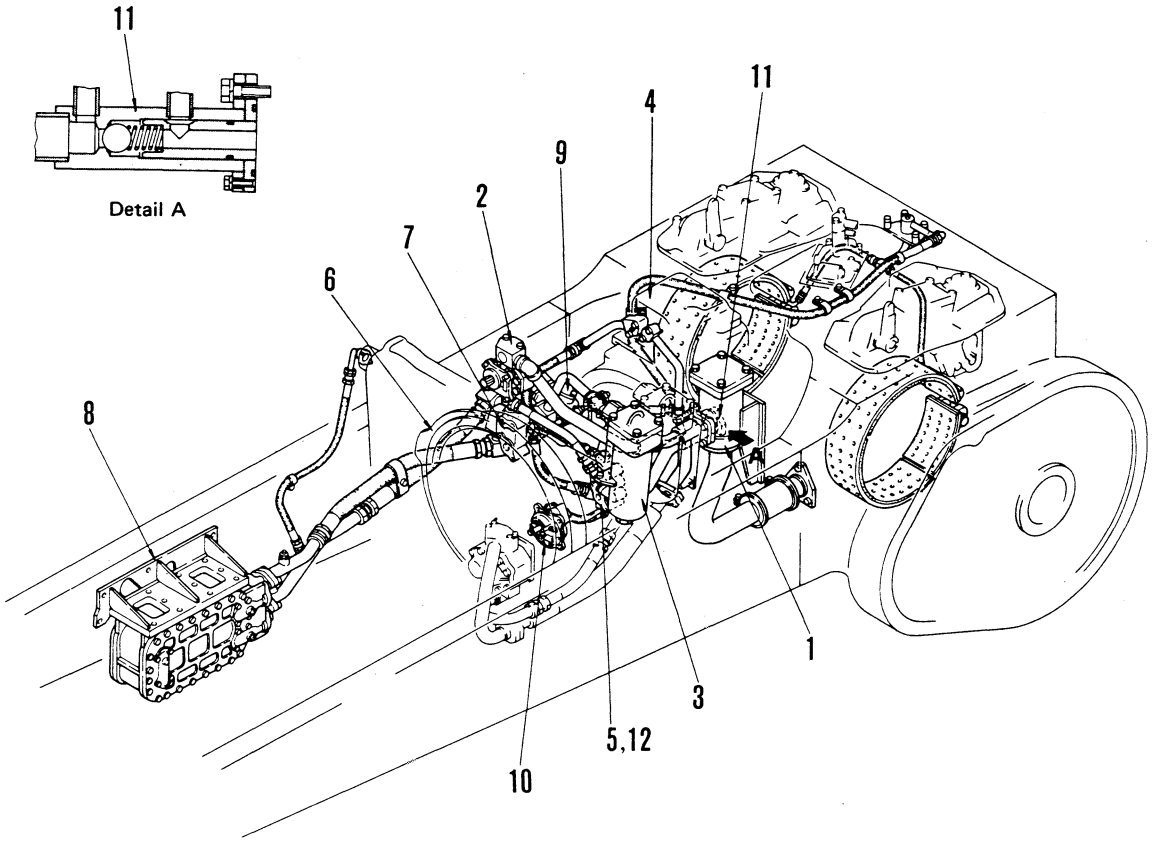
I75F073

D155A 17001 ~ 25000



I75F073-1

D155A 25001 and up



I75F073-2

1. Magnet strainer
2. Transmission pump
3. Oil filter
4. Transmission control valve
5. Torque converter relief valve
6. Torque converter
7. Torque converter regulator valve
8. Oil cooler
9. Transmission lubricating relief valve
10. Torque converter scavenging pump
11. Brake lubrication valve
12. Steering main relief valve

The principle components comprising the TORQFLOW hydraulic circuit are the magnet strainer (1), TORQFLOW pump (2), oil filter (3), transmission control valve (4), torque converter relief valve (5), torque converter (6), torque converter regulator valve (7), oil cooler (8), transmission lubricating relief valve (9), and torque converter scavenging pump (10).

Fluid in the steering case is sucked up to TORQFLOW pump (2) through magnet strainer (1), and supplied to transmission control valve (4) through oil filter (3). The transmission control valve is divided into the modulating relief valve group and the torque converter relief valve group. The fluid relieved to a pressure of 20 kg/cm^2 from the modulating relief valve is supplied to torque converter relief valve (5).

The torque converter relief valve is set at 7 ± 0.1 kg/cm^2 and controls fluid pressure to be fed to the torque converter. The fluid delivered through this valve is then directed to the lubrication circuit. The fluid is then directed out of the torque converter to torque converter regulator valve (7).

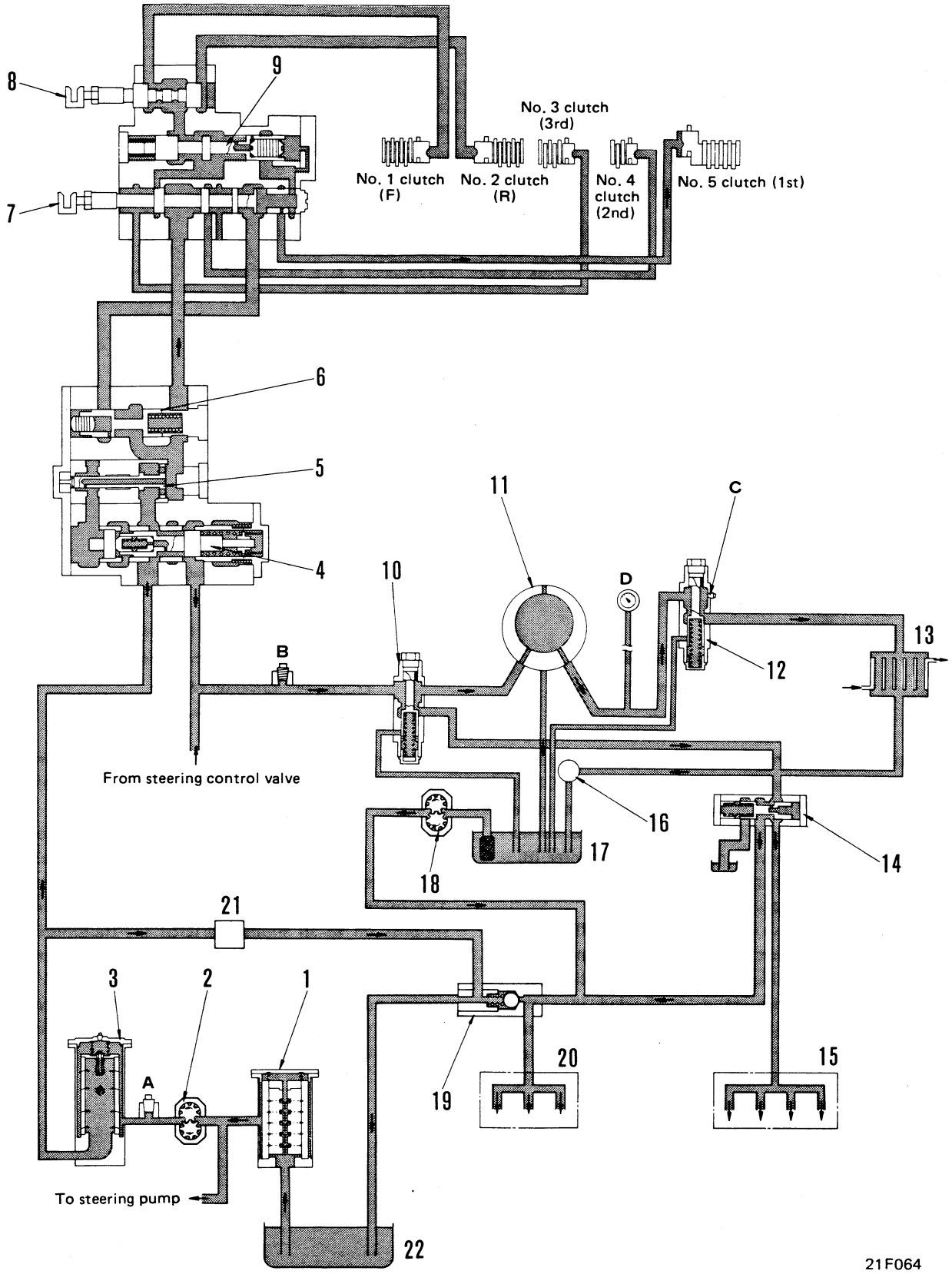
The regulator valve is set at 4.5 ± 0.5 kg/cm^2, and maintains the torque converter inside pressure at this level.

Fluid of 4.5 ± 0.5 kg/cm^2 supplied by the regulator valve is directed through oil cooler (8), where it is cooled, to transmission lubricating relief valve (9). The lubricating relief valve is set at 1.5 kg/cm^2, and supplies oil to all sliding parts of the transmission. Oil relieved from this valve is returned to the steering case. Oil used for lubricating torque converter (6) or oil oozing out of each contracting face of the converter is returned from the converter to the steering case by means of scavenging pump (10).

TORQFLOW HYDRAULIC SYSTEM

D155A 15001 – 25000

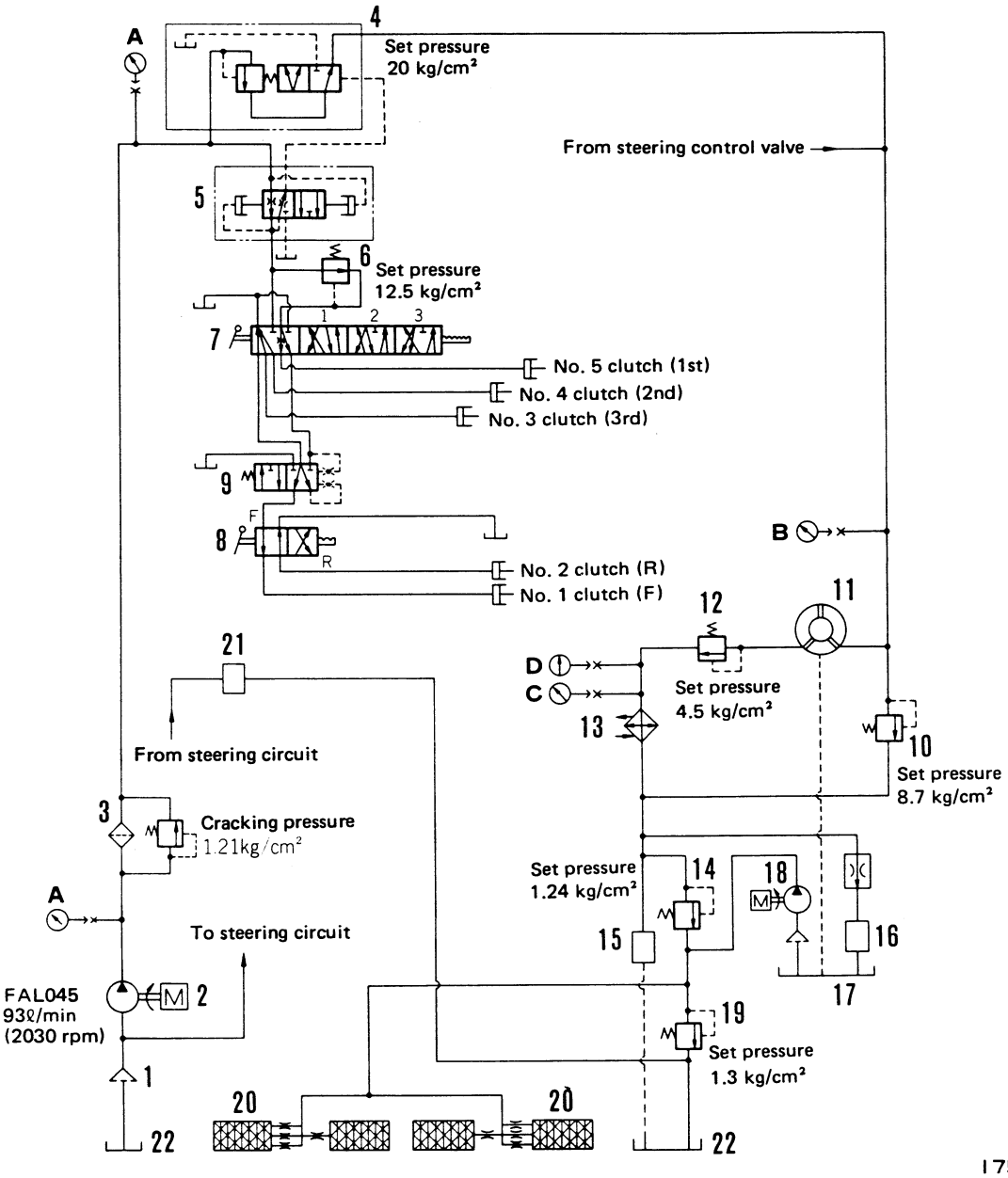
NEUTRAL



21F064

TORQFLOW HYDRAULIC CIRCUIT

D155A 15001 – 25000



I75F075-1

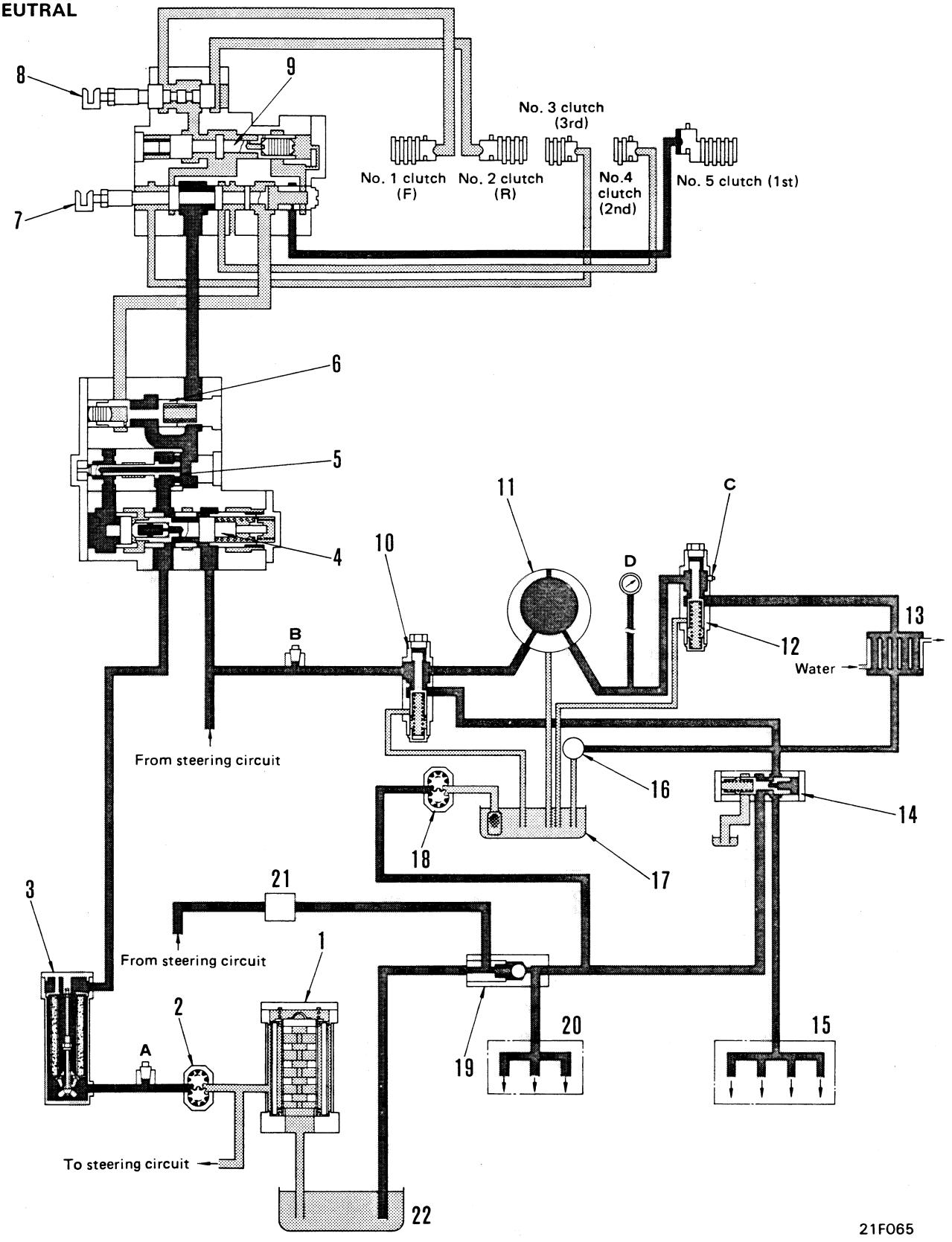
1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
5. Quick return valve
6. Reducing valve
7. Speed valve
8. Directional valve
9. Safety valve
10. Torque converter relief valve
11. Torque converter
12. Regulator valve
13. Oil cooler
14. Transmission lubrication valve
15. Transmission lubrication
16. P.T.O. lubrication
17. Torque converter case
18. Scavenging pump
19. Brake lubrication valve
20. Brake lubrication
21. Servo valve
22. Steering case

A. Plug for transmission clutch pressure (PT1/8)
B. Plug for relief pressure (PT1/8)
C. Plug for regulator pressure (PT1/8)
D. Oil temperature gauge

TORQFLOW HYDRAULIC SYSTEM

D155A 25001 – 29764

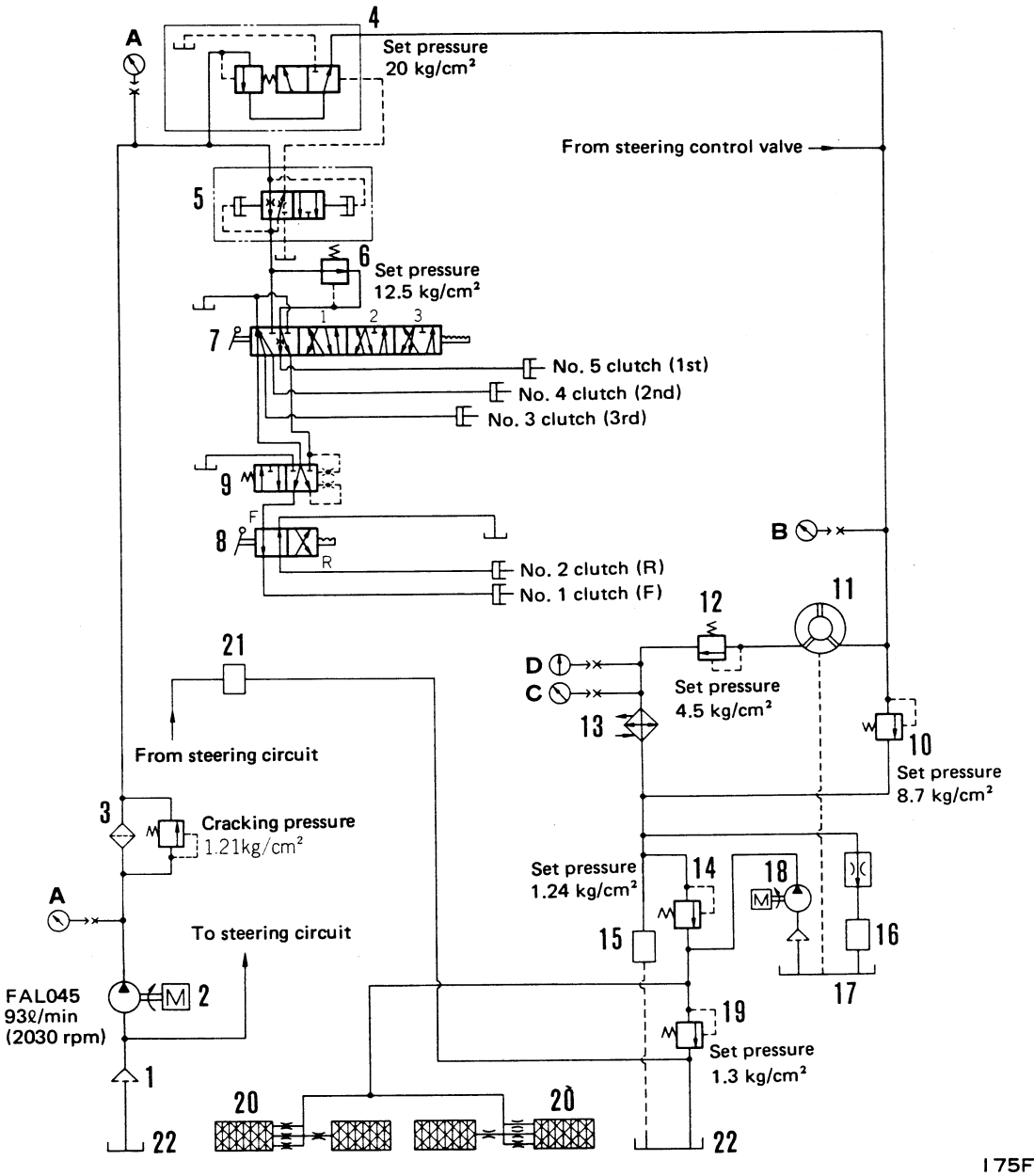
NEUTRAL



21F065

TORQFLOW HYDRAULIC CIRCUIT

D155A 25001 – 29764



I75F075-1A

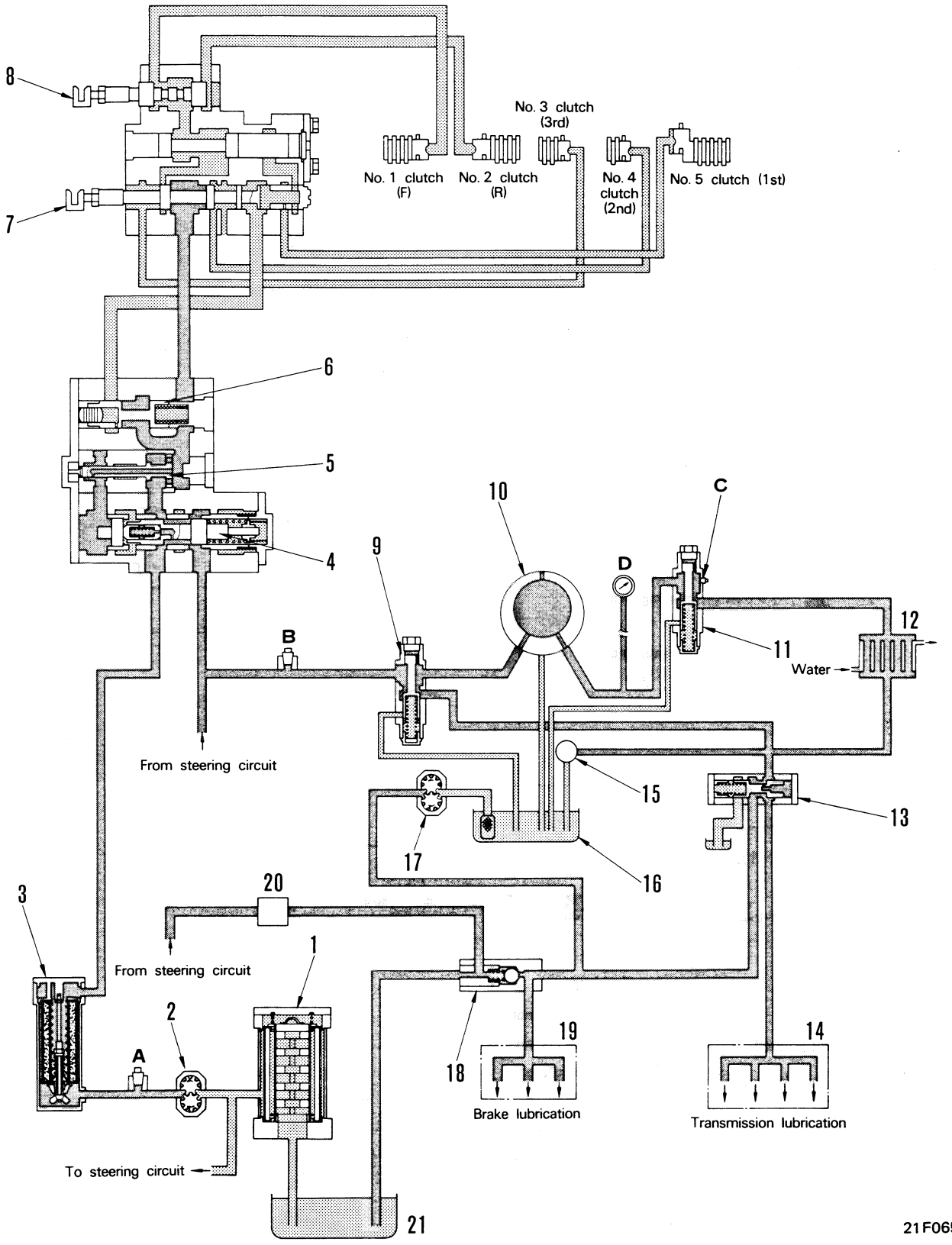
1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
5. Quick return valve
6. Reducing valve
7. Speed valve
8. Directional valve
9. Safety valve
10. Torque converter relief valve
11. Torque converter
12. Regulator valve
13. Oil cooler
14. Transmission lubrication valve
15. Transmission lubrication
16. P.T.O. lubrication
17. Torque converter case
18. Scavenging pump
19. Brake lubrication valve
20. Brake lubrication
21. Servo valve
22. Steering case

A. Plug for transmission clutch pressure (PT1/8)
B. Plug for relief pressure (PT1/8)
C. Plug for regulator pressure (PT1/8)
D. Oil temperature gauge

TORQFLOW HYDRAULIC SYSTEM

D155A 29765 and up

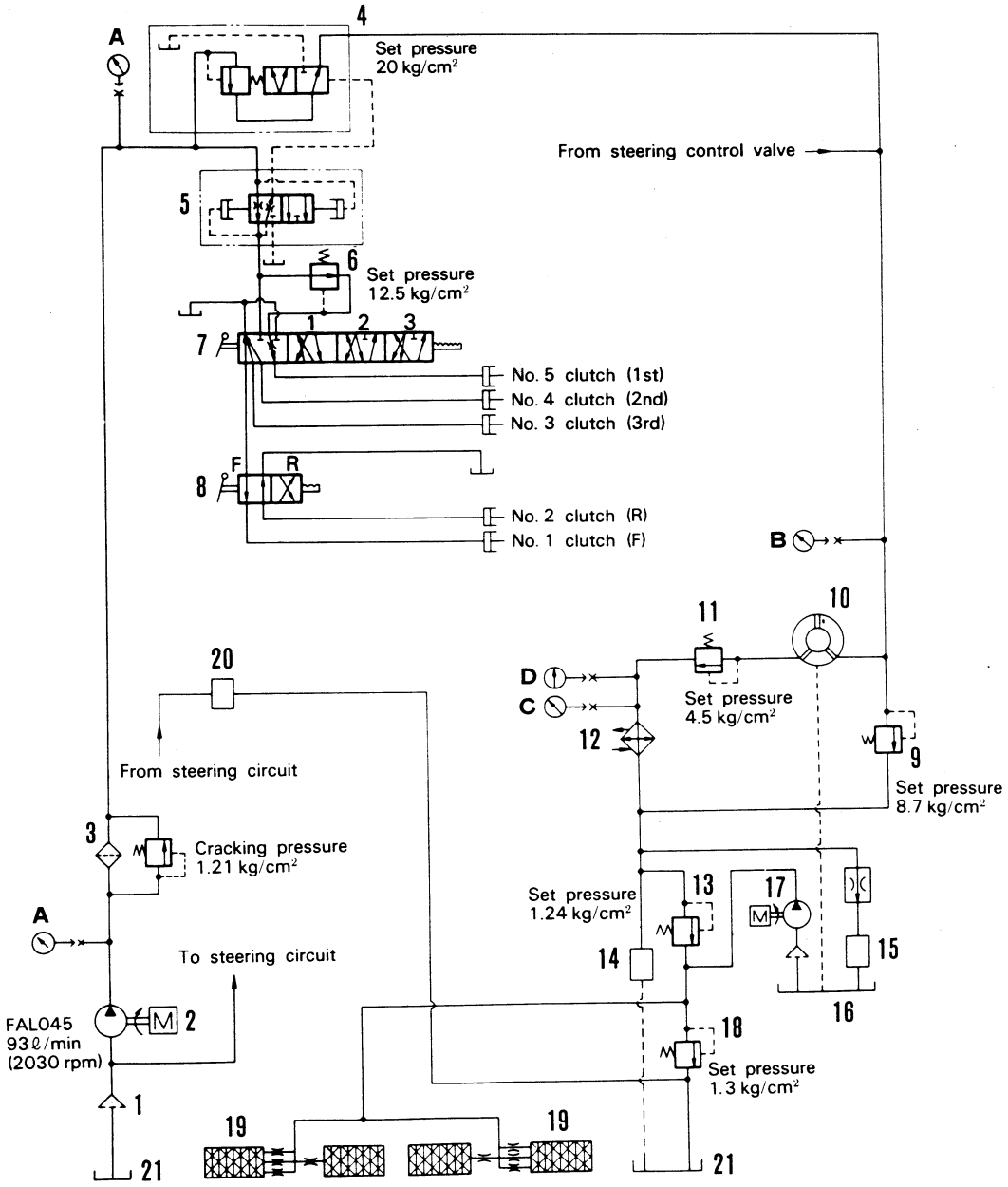
NEUTRAL



21F065-1

TORQFLOW HYDRAULIC CIRCUIT

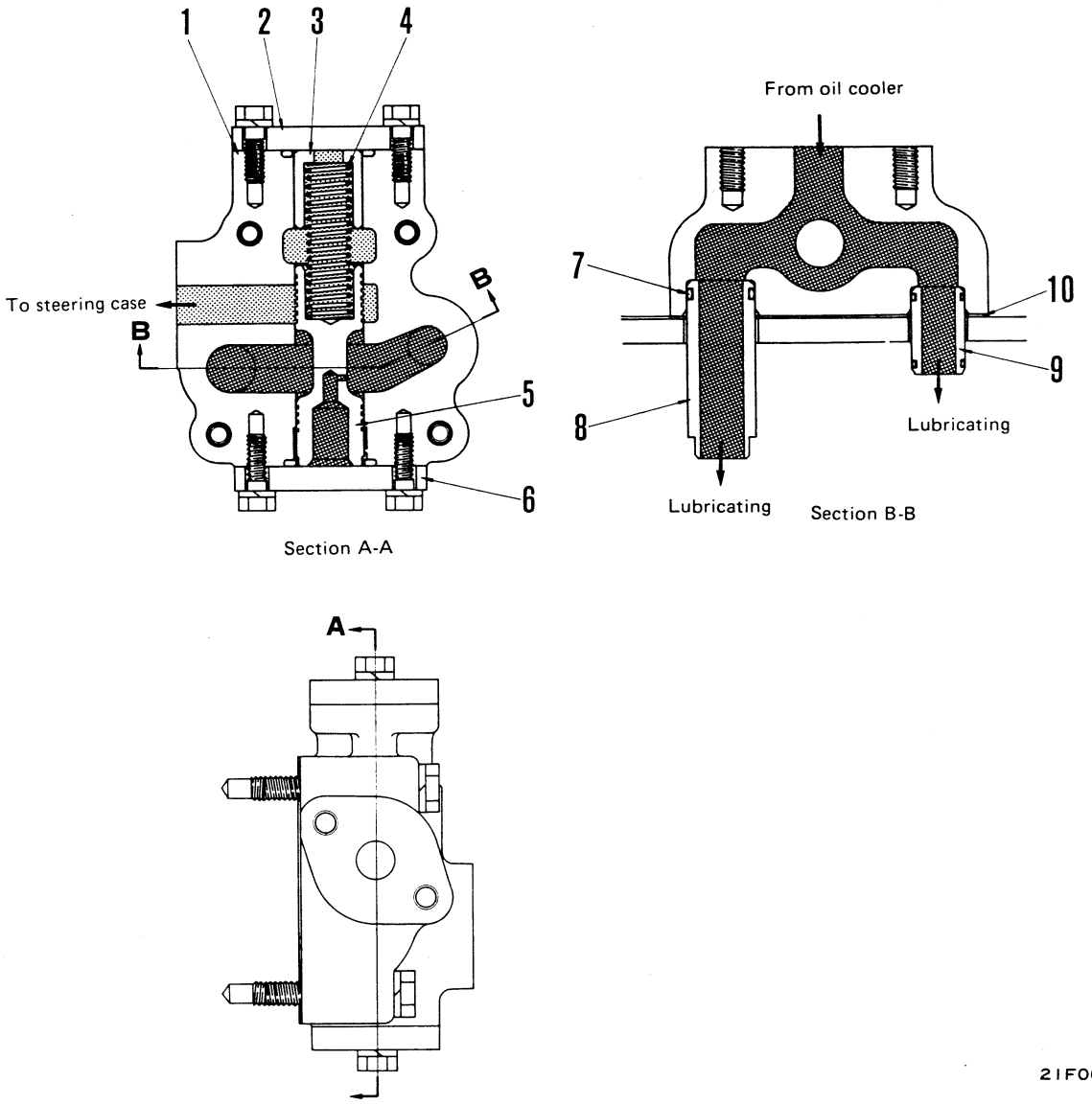
D155A 29765 and up



175F075-1B

1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
5. Quick return valve
6. Reducing valve
7. Speed valve
8. Directional valve
9. Torque converter relief valve
10. Torque converter
11. Regulator valve
12. Oil cooler
13. Transmission lubrication valve
14. Transmission lubrication
15. PTO lubrication
16. Torque converter case
17. Scavenging pump
18. Brake lubrication valve
19. Brake lubrication
20. Servo valve
21. Steering case
    - A. Plug for transmission clutch pressure (PT 1/8)
    - B. Plug for relief pressure (PT1/8)
    - C. Plug for regulator pressure (PT1/8)
    - D. Oil temperature gauge

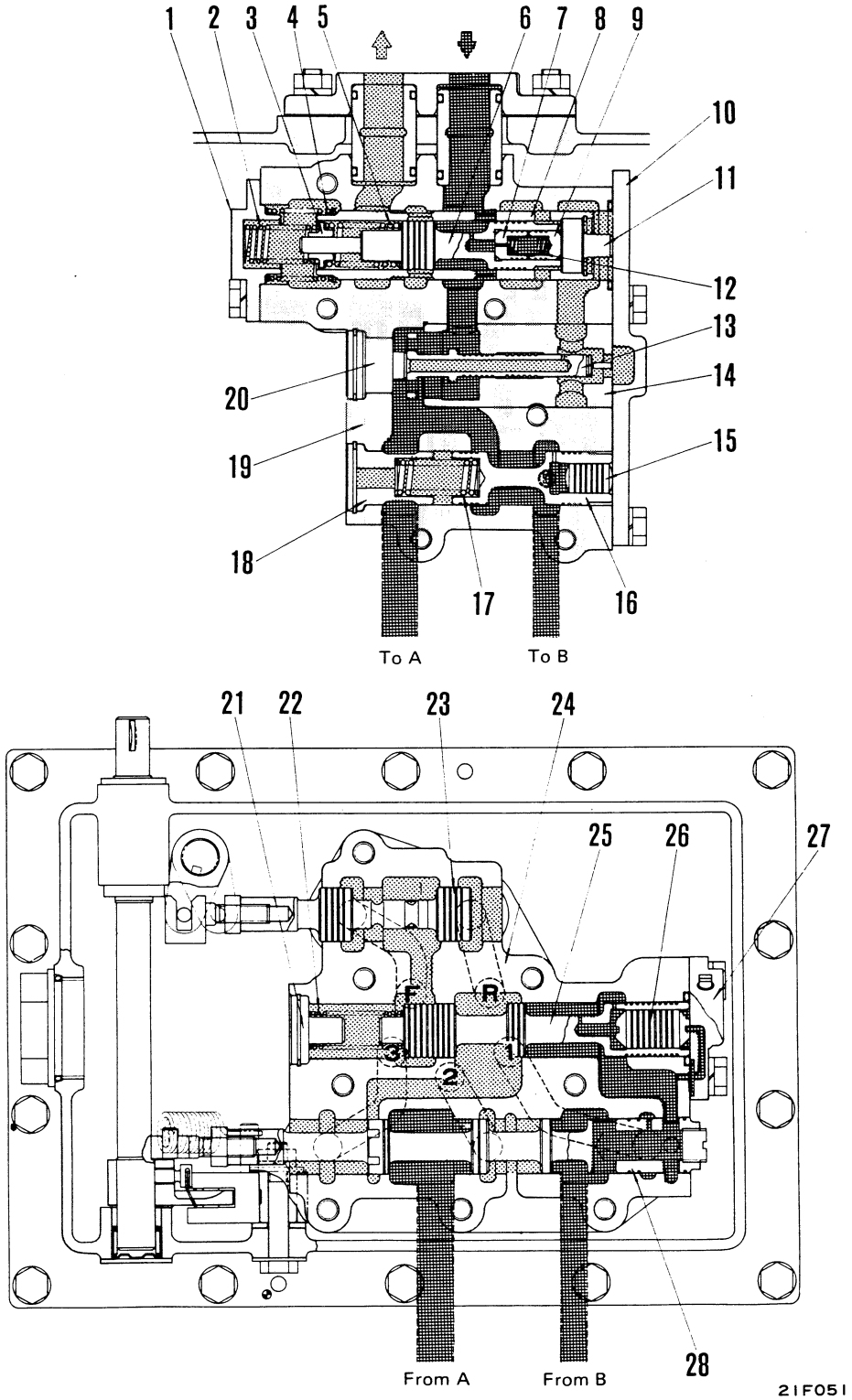
TRANSMISSION LUBRICATION RELIEF VALVE



1. Valve body
2. Cover
3. Valve guide
4. Valve spring
5. Lubricating valve
6. Cover
7. O-ring
8. Sleeve
9. Sleeve
10. Gasket

TRANSMISSION CONTROL VALVE

D155A Serial No. 15001 – 29764



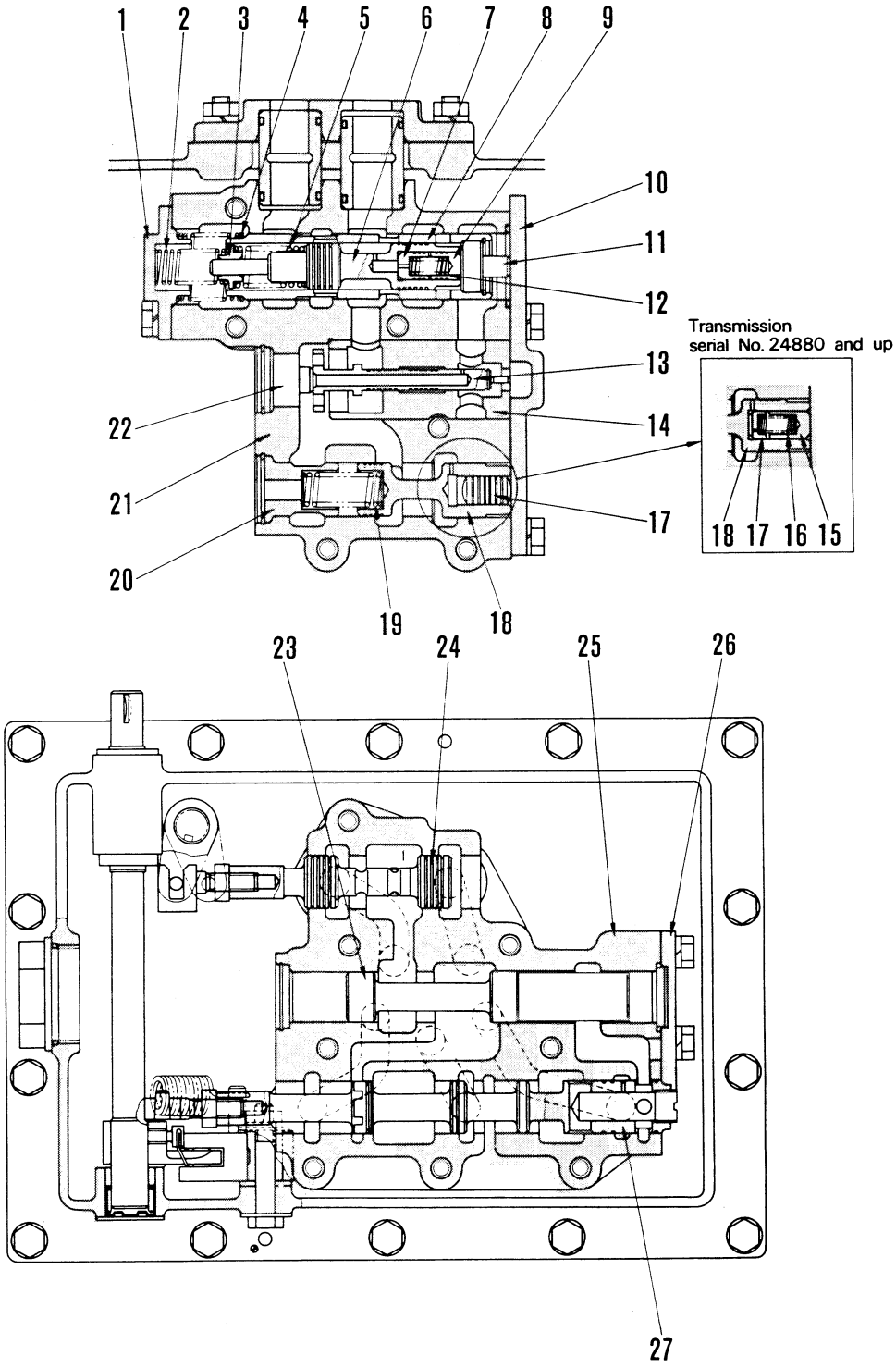
1. Stopper cover
2. Modulating valve spring (small)
3. Spring seat
4. Modulating sleeve spring
5. Modulating valve spring
6. Modulating valve
7. Piston valve (A)
8. Modulating valve
9. Piston valve (B)
10. Cover
11. Stopper
12. Piston valve spring
13. Quick return valve
14. Sleeve
15. Piston
16. Reducing valve
17. Reducing valve spring
18. Stopper
19. Control valve body (A)
20. Stopper
21. Stopper
22. Safety valve spring
23. Directional valve spool
24. Control valve body (B)
25. Safety valve
26. Piston
27. Cover
28. Speed valve spool

1. To 1st speed clutch (No. 5)
2. To 2nd speed clutch (No. 4)
3. To 3rd speed clutch (No. 3)

F. To forward clutch (No. 1)
R. To reverse clutch (No. 2)

TRANSMISSION CONTROL VALVE

D155A Serial No. 29765 and up



1. Stopper cover
2. Modulating valve spring (small)
3. Spring seat
4. Modulating sleeve spring
5. Modulating valve spring
6. Modulating valve
7. Piston valve (A)
8. Modulating valve
9. Piston valve (B)
10. Cover
11. Stopper
12. Piston valve spring
13. Quick return valve
14. Sleeve
15. Piston
16. Piston spring
17. Piston
18. Reducing valve
19. Reducing valve spring
20. Stopper
21. Control valve body (A)
22. Stopper
23. Spacer
24. Directional valve spool
25. Control valve body (B)
26. Cover
27. Speed valve spool

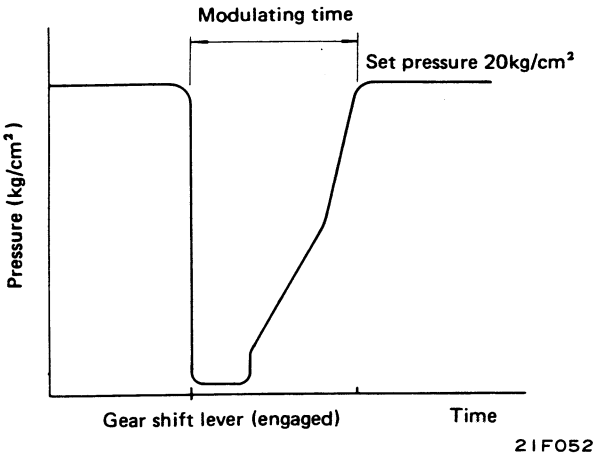
1. To 1st speed clutch (No.5)
2. To 2nd speed clutch (No.4)
3. To 3rd speed clutch (No.3)

F. To forward clutch (No. 1)

R. To reverse clutch (No. 2)

21F051-1

PRESSURE INCREASE (MODULATING TIME)



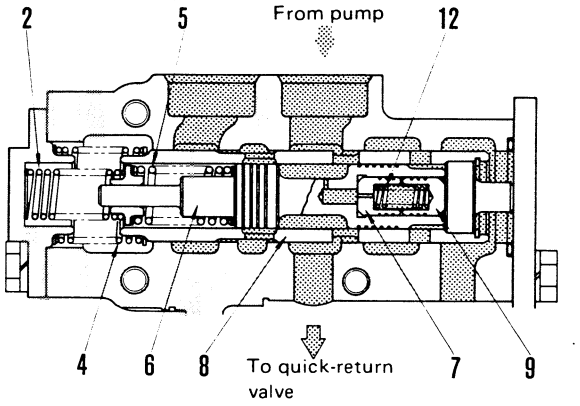
21F052

The graph shows the pressure increase with lapse of time at the modulating valve.

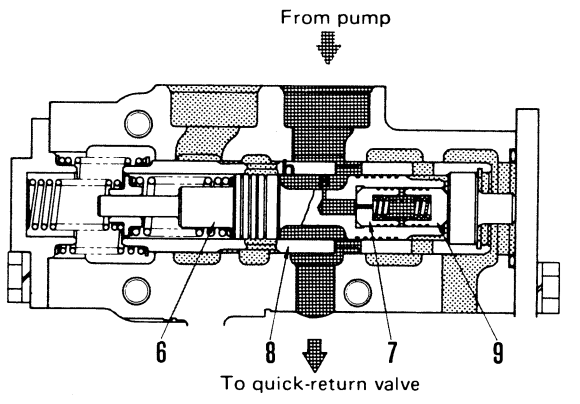
MODULATING RELIEF VALVE

The modulating relief valve consists of modulating valve (6), pistons (7) and (9), piston spring (12) modulating sleeve (8), valve springs (2) and (5), and sleeve spring (4), and functions in conjunction with quick return valve (13) pressure modulation and the main relieving.

When speed valve spool (28) and directional valve spool (23) are actuated to open the circuit from the TORQFLOW pump, fluid fills in the space between the pump and the clutch piston, and at the same time the pressure begins to increase.

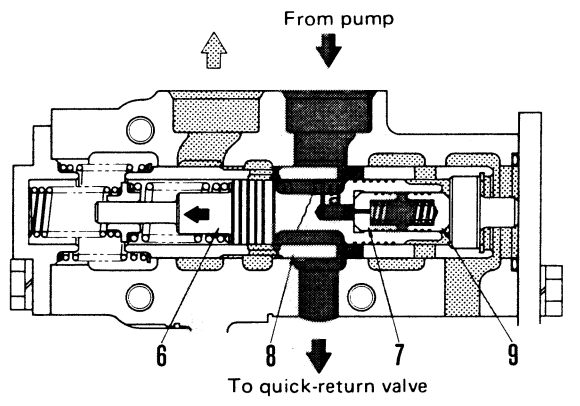


21F053



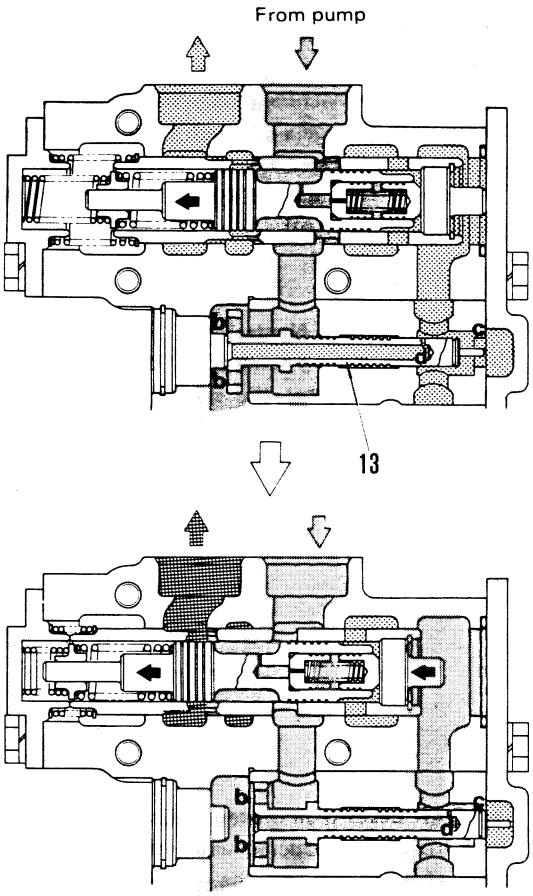
21F054

Fluid from the pump flows through orifice (a) of modulating valve (6) to be introduced between pistons (7) and (9), which causes the displacement of the modulating valve to the left, thus opening the port (h) connecting the modulating valve and modulating sleeve (8).



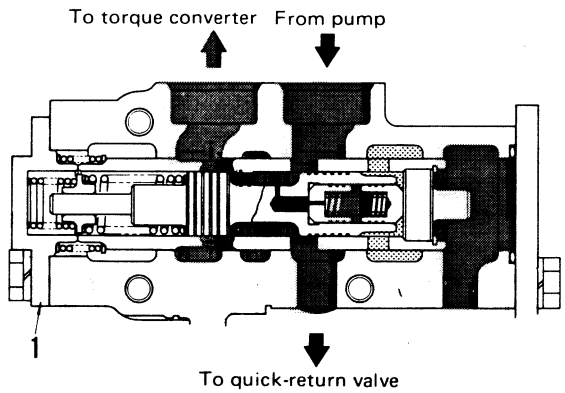
21F055

Fluid which flows through orifice (b) of quick return valve (13) causes the displacement of the quick return valve to the right, thus closing drain port (c) at the back of the modulating sleeve.
Fluid flowing through the central port of the quick return valve flows through orifice (d), developing the back pressure of the modurating sleeve.



21F056

Back pressure of the modulating sleeve increases with increasing pressure in the circuit. Displacement of the modulating sleeve to the left closes the port (h) leading to the modulating valve which follows the sleeve to the left. The pressure continues to increase as the sleeve moves to the left until it is stopped by stopper (1) at the left extremity.
The pressure increase stops when the fluid from the pump reaches the torque converter after flowing through the modulating valve, modulating sleeve and port (i).
The limit pressure set for model D155A is 20kg/cm^2.

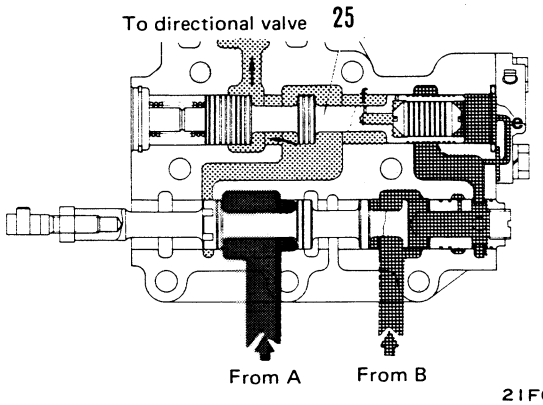


21F057

SAFETY VALVE
D155A Serial No. 15001 – 29764

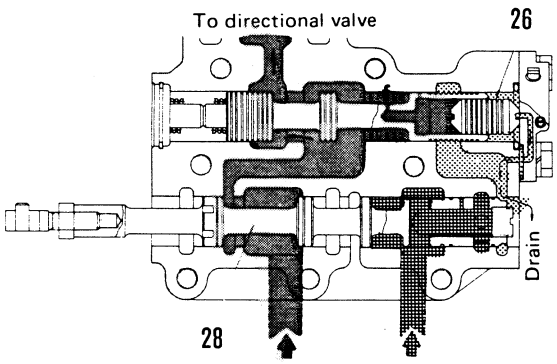
Safety valve (25) is incorporated in the system between speed valve (28) and directional valve (23). It prevents the machine from moving if the engine is started with the gears engaged. (That is, if the driver has forgotten to put the gear lever is neutral.)
The gear lever must be put in neutral before the machine can move off.

A. Gear Shift Lever in Neutral
Fluid from reducing valve (16) flowing through the speed valve displaces the safety valve completely when flowing through orifice (e), thus completing the circuit of reducing valve → speed valve → directional valve.



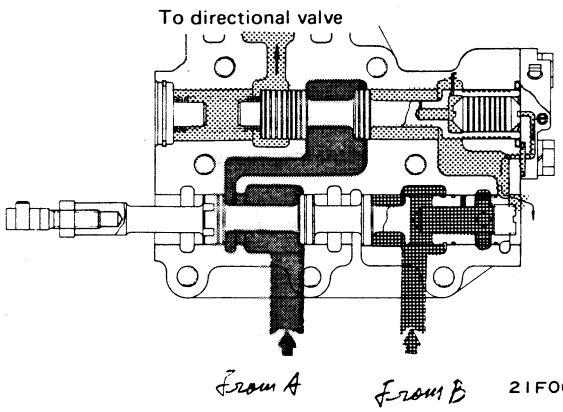
21F058

B. Gear Shift Lever then Moved to Engage Gears
Fluid from the reducing valve flows through the speed valve to the directional valve.
As the speed valve is shifted to any of the gear speeds, the fluid in the right section of the safety valve is discharged into the case through orifice (e). However, the fluid flowing through the safety valve orifice (f) actuates piston (26) which slides to the right, thus the safety valve remains in position and the circuit to the directional valve is opened.



21F059

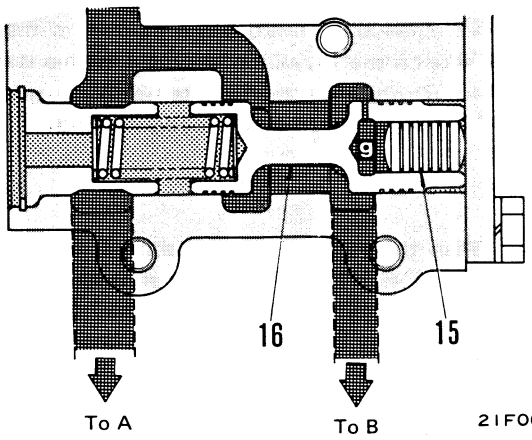
C. When the Engine is Started with the Gear Lever in any of the Speed Stages
When the gear lever engaged (that is, not in neutral), the reducing valve is not connected to orifice (e). In this condition, the safety valve is not moved to the left even when the engine is started. Therefore, the circuit from the reducing valve to the directional valve remains closed and the machine cannot move. It is necessary to actuate the valve (that is, to shift to neutral as described under section A) before moving the gear lever again into any gear engaged position.



21F060

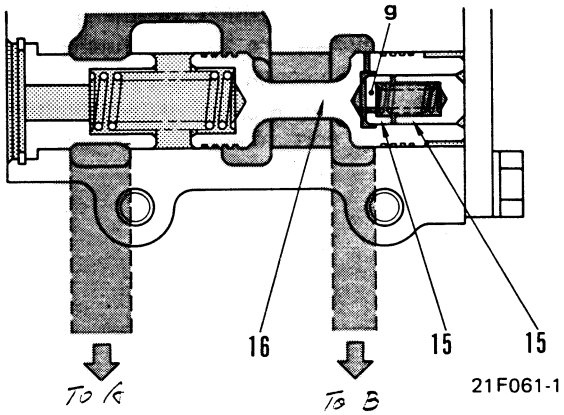
REDUCING VALVE

Reducing valve (16) is incorporated in the circuit between modulating valve (6) and speed valve (28), and keeps the oil pressure on the 1st clutch below 12.5kg/cm^2.
The pressure of the whole circuit is set at 20kg/cm^2 by means of the modulating relief valve. Only the circuit for the 1st clutch is regulated at 12.5kg/cm^2. When this pressure is reached, the 1st clutch circuit is closed.



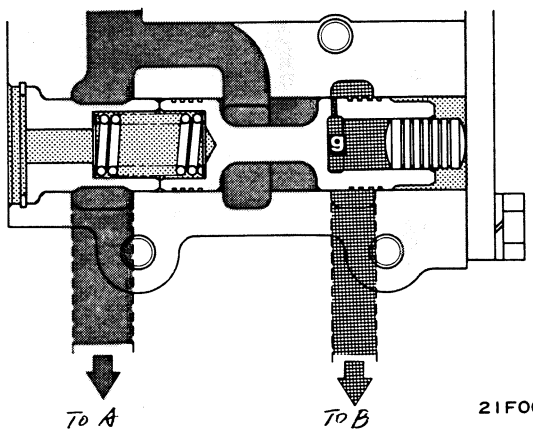
21F061

Transmission serial No. 24880 and up



21F061-1

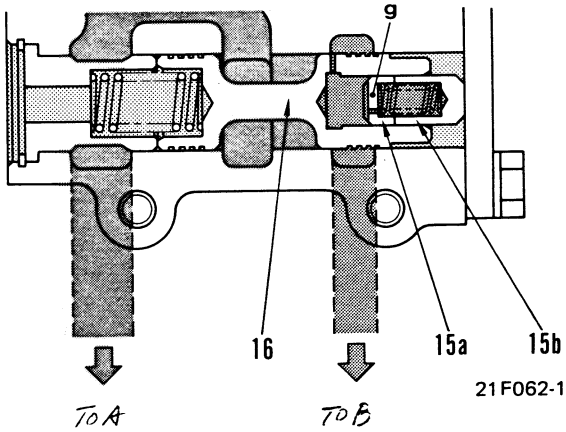
As the pressure in the 1st clutch circuit increases, piston (15) is shifted to the right by the fluid flowing through orifice (g) of the reducing valve, causing the reducing valve (16) to be moved to the left.
As the pressure on the 1st clutch increases further, the reducing valve is moved leftward to the limit, closing the circuit from the pump to the 1st speed circuit. Thus the oil pressure on the 1st clutch is maintained at 12.5kg/cm^2.



21F062

Transmission serial No. 24880 and up

Transmission serial No. 24880 and up
As the pressure in the 1st clutch circuit increases, piston (15b) is shifted to the right and piston (15a) is shifted to the left by the fluid flowing through orifice (g) of the reducing valve, causing the reducing valve (16) to be moved to the left.
As the pressure on the 1st clutch increases further, the reducing valve is moved leftward to the limit, closing the circuit from the pump to the 1st speed circuit. Thus the oil pressure on the 1st clutch is maintained at 12.5kg/cm^2.

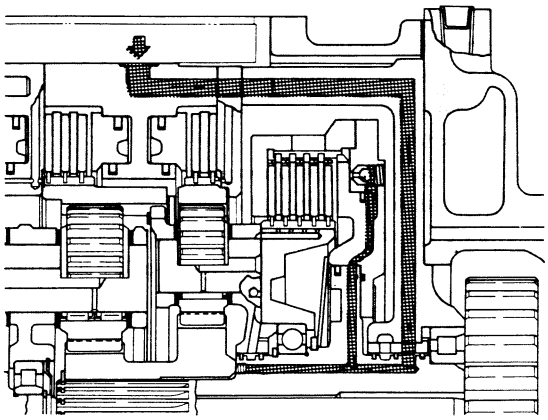


21F062-1

In the neutral position, the fluid from the pump works on the 1st clutch when the engine is started. This is to shorten the time taken to fill cylinders F and R with oil which assists engine starting.

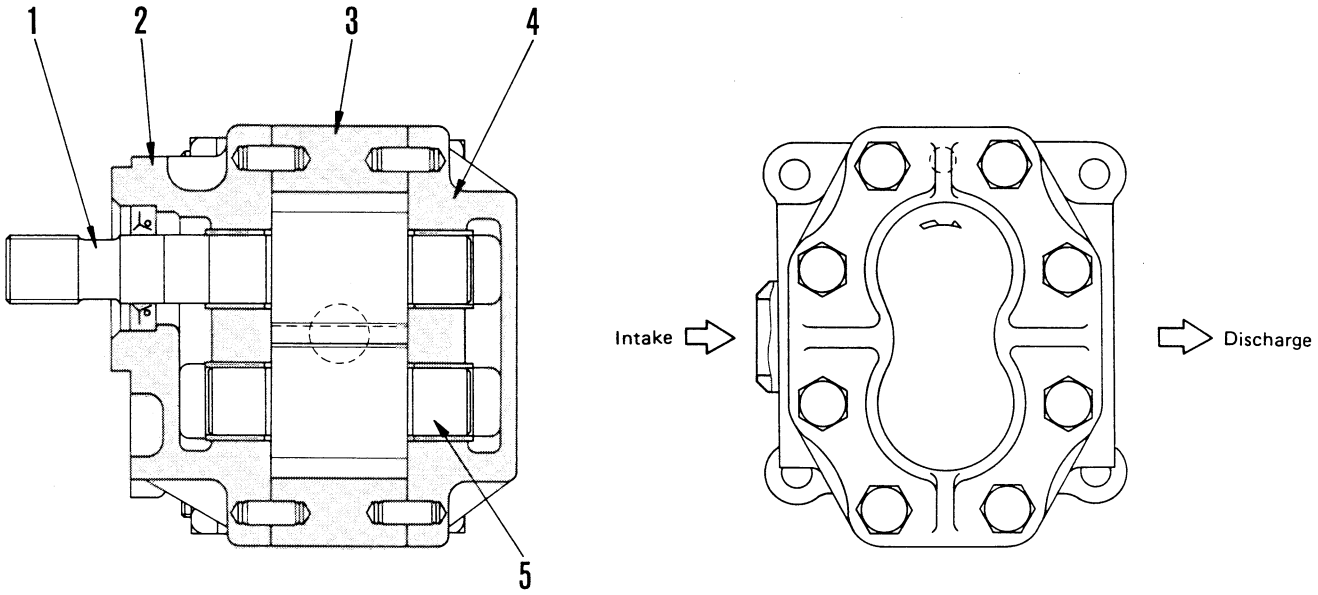
When the gear shift lever is shifted to **F1** position, enough fluid to fill **F** cylinder is supplied by the pump. When the lever is then shifted from **F1** to **F2** position, oil is supplied to only 2nd cylinder as **F** cylinder is already full. Thus the modulating time is shortened.

The reason for maintaining the oil pressure on the 1st clutch may be clearly understood by careful study of the construction of the transmission system. In short, since the 1st clutch is located farthest from the control valve, and it takes longer to fill this port because of its length from the cylinder, this port must be kept in the full condition.



21F063

TRANSMISSION PUMP D155A



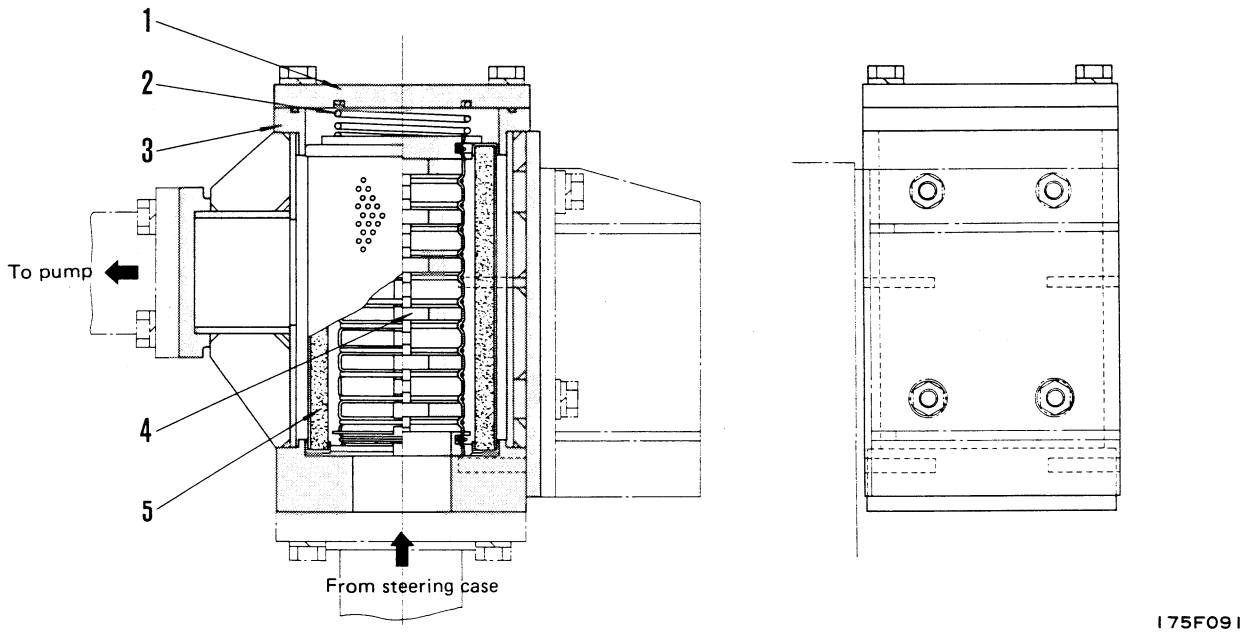
I75F090

1. Drive gear
2. Bracket
3. Gear case
4. Housing
5. Driven gear

- The delivery rate of transmission pump (FAL045) for D155A is set at 93ℓ/min. (at 2,030 rpm).
  The driving power required for the pump is available from the PTO unit at the rear end of the engine.

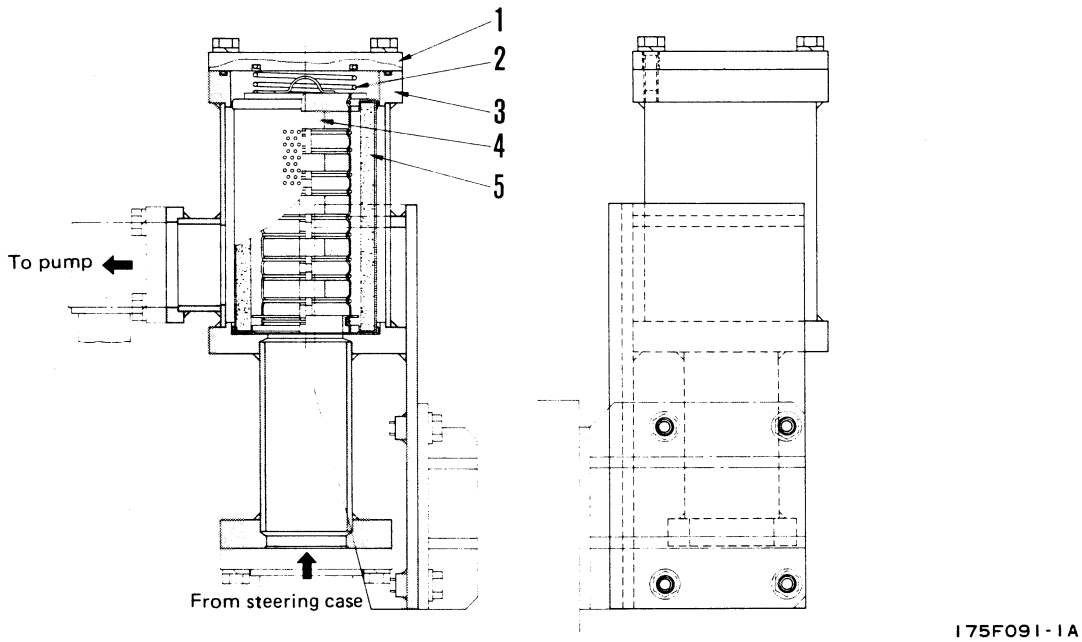
TRANSMISSION, STEERING OIL STRAINER

D150A Serial No. 8408 and up
D155A Serial No. 15001 – 25000



175F091

D155A Serial No. 25001 and up



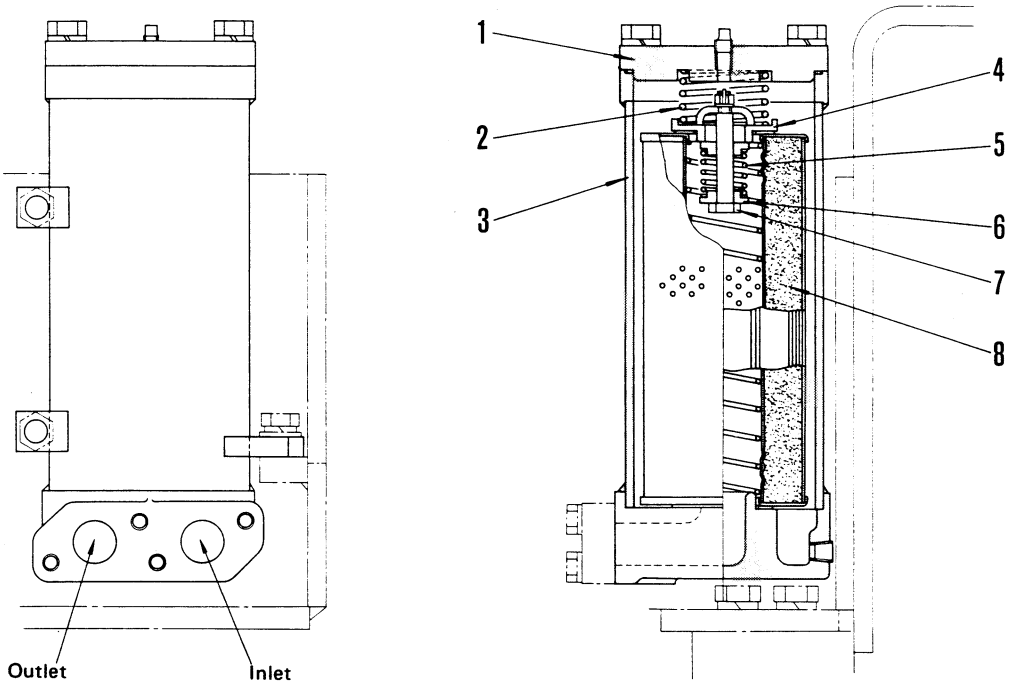
175F091-1A

1. Strainer cover
2. Spring
3. Strainer case
4. Magnet
5. Screen

- The maximum passage flow rate of oil strainers for D150A and D155A are set at 510ℓ/min.

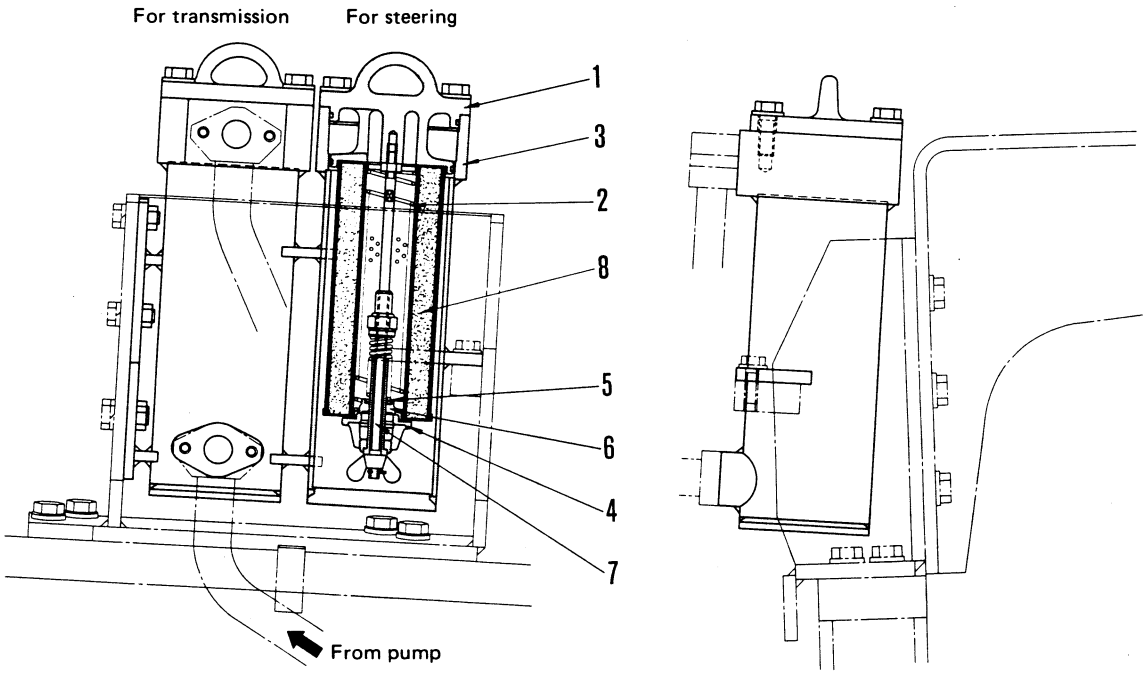
TRANSMISSION OIL FILTER

D155A Serial No. 15001 – 25000



175F092

D155A Serial No. 25001 and up

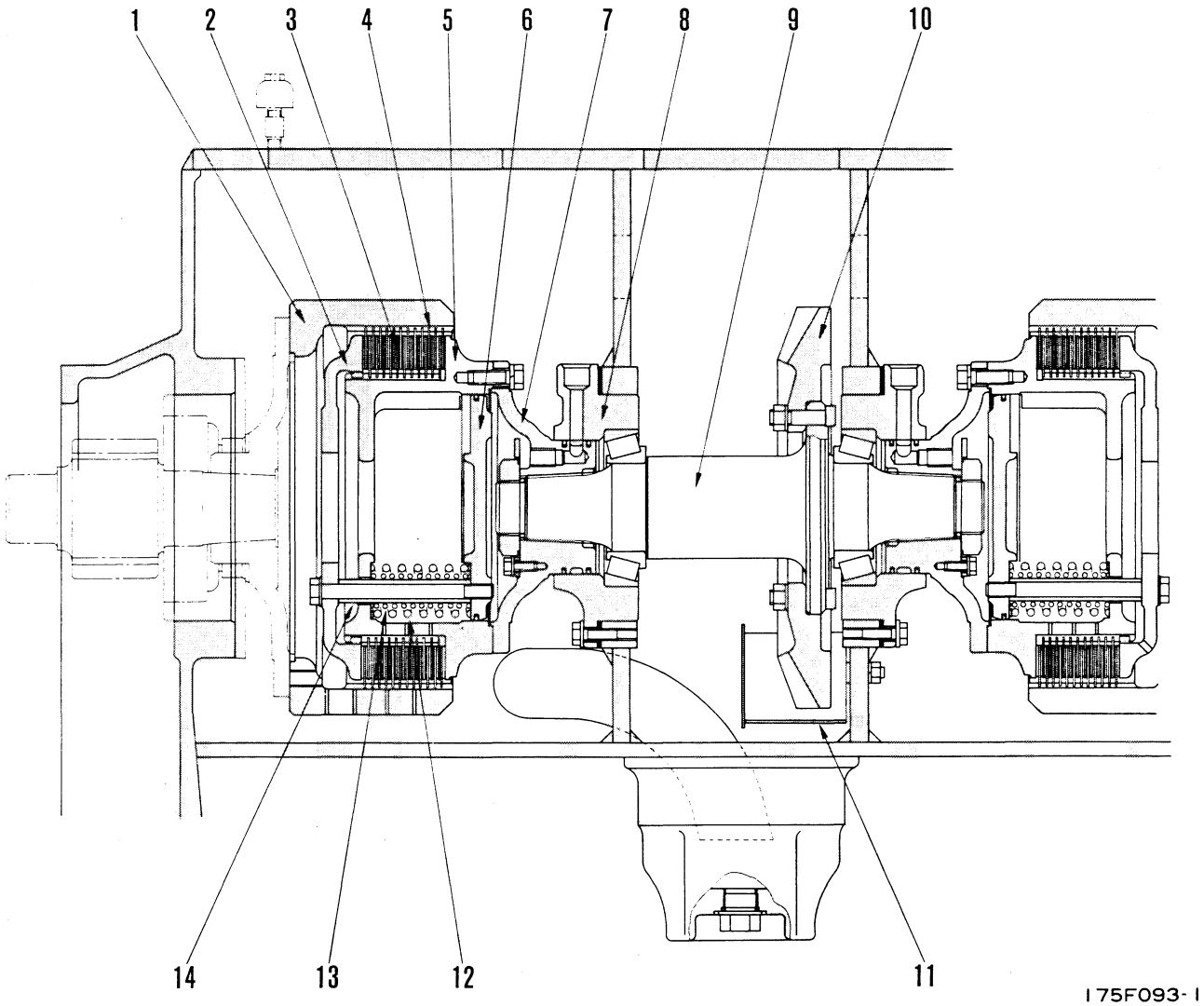


175F092-1

1. Filter cover
2. Spring
3. Filter case
4. Cage
5. Spring
6. Sleeve
7. Bolt
8. Element

- On oil filters for D155A, the cracking pressure is set at 1.2 kg/cm^2, the passage flow rate at 93ℓ/min., and filterability at 10 microns.

BEVEL GEAR SHAFT AND STEERING CLUTCH



1. Outer drum (Brake drum)
2. Pressure plate
3. Clutch plates (11 plates on one side)
4. Clutch discs (12 discs on one side)
5. Inner drum (clutch drum)
6. Clutch piston
7. Hub
8. Bearing cage
9. Bevel gear shaft
10. Bevel gear (49 teeth)
11. Cover
12. Clutch spring (large)
13. Clutch spring (small)
14. Collar

GENERAL

1. AXLE

The power transmitted from the engine to the torque converter or from the main clutch to the transmission is further transmitted by this axle into both the left and the right directions at 90° angles to each other through the bevel pinion on the rear end of the transmission output shaft and mating bevel gear (10) on the axle. The turning speed of these gears is reduced through this axle device.

The bevel pinion and the bevel gear are of the skew bevel gear type. A tapered roller bearing is installed in the steering case through bearing cage (8) with shims interposed between the cage and the gear so that the tooth contact with the pinion can be adjusted.

The axle hubs (7) for installing the steering clutch are forced onto each end of the shaft with the tapered serration. Oil ports are cut out in each axle hub and the bearing cage for actuating the steering clutch. The bevel gear is splash-lubricated with oil from the reservoir. The backlash between the bevel pinion and the bevel gear can be adjusted longitudinally by removing or adding shims on the bevel pinion bearing cage mounting surface in the transmission. The tooth contact between the gear and the pinion can be adjusted laterally by removing or adding on the axle bearing cage mounting surface. For details, see 23. MOUNTING AXLE AND BEVEL GEAR.

2. STEERING CLUTCH

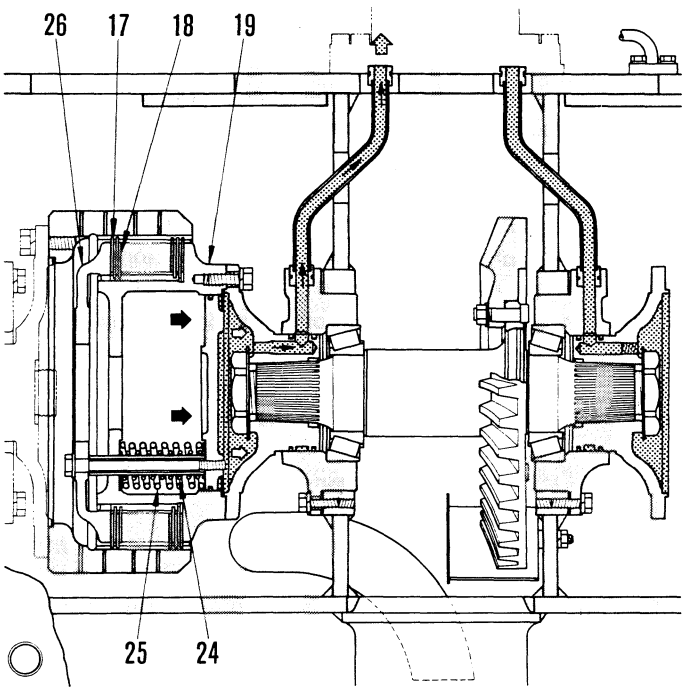
A steering clutch is installed on each end of the axle to change the machine's direction of travel by discontinuing or continuing the flow of power from the axle to the final drive.

Wet type, multiple-plate, spring loaded steering clutchs are used on D150A and D155A.

Each steering clutch consists of inner drum (5) bolted to axle hub (7) which is fixed to axle (9) with tapered serration, outer drum (1) bolted to the final drive 1st pinion flange, plates (3) engaged with the inner drum, disc (4) engaged with the outer drum, pressure plate (2) pressing the plates and the discs together, piston (6), clutch springs (12) and (13), and bolts securing the piston and the pressure plate together.

The plates of the steering clutch are the driving members and the discs are the driven members.

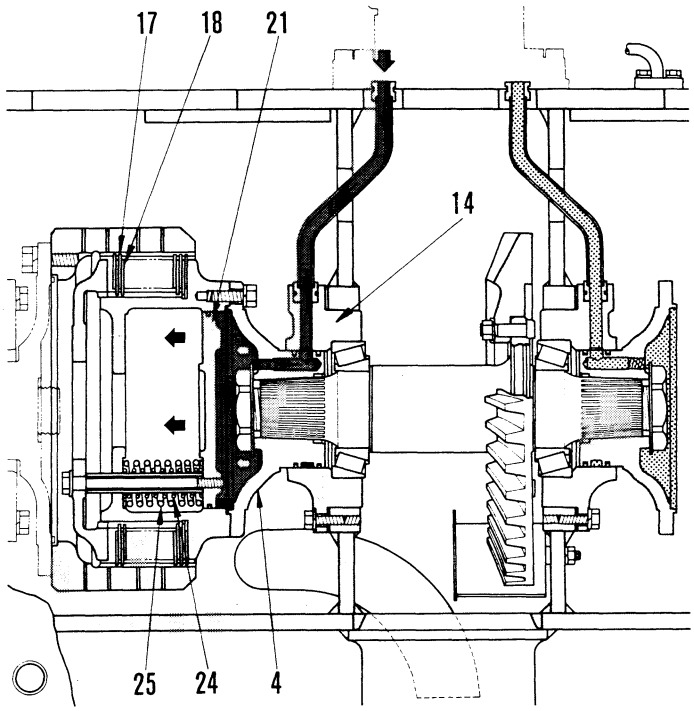
LEFT STEERING CLUTCH ENGAGED



21F070

Basically, pressure plate (26) under force of clutch spring (24) and (25), presses plate (18) and disc (17) against inner drum (19), and the frictional force developed by this transmits power from the inner drum to the outer drum.

LEFT STEERING CLUTCH DISENGAGED



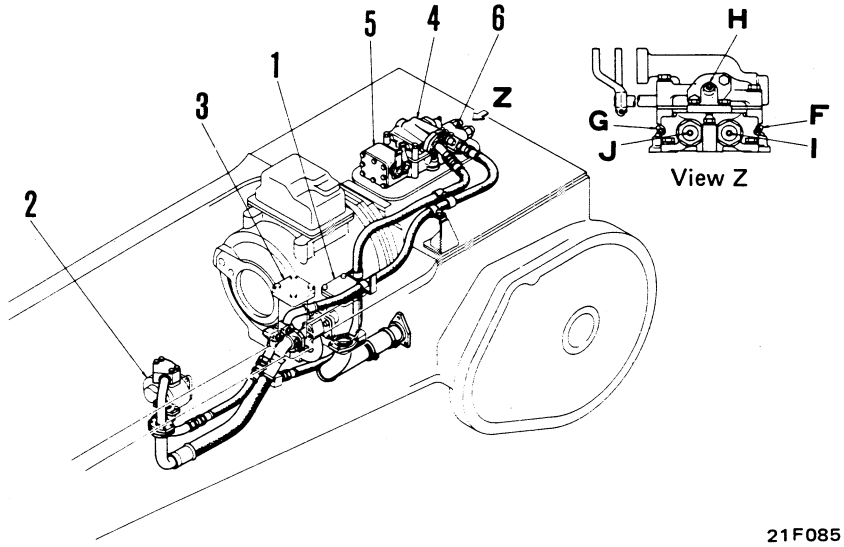
21F071

When the steering lever is pulled, fluid from the steering control valve is forced to flow through bearing case (14), and axle hub (4) to the right half of piston (21) and pushes the piston leftward, compressing clutch spring (24) and (25). Thus, pressure plate (26) is moved leftward, bringing the pressing force onto plate (18) and disc (17) to zero. As a result, the power supply to the final drive is stopped. When the steering lever is released, the discharge circuit of the steering control valve is opened, and the piston returns to the initial position under the force of the clutch spring. Thus the clutch engaged condition is attained, as shown in the above picture. When the left steering clutch is disengaged, power is delivered only to the right steering clutch, achieving the right turn.

STEERING AND BRAKE PIPING

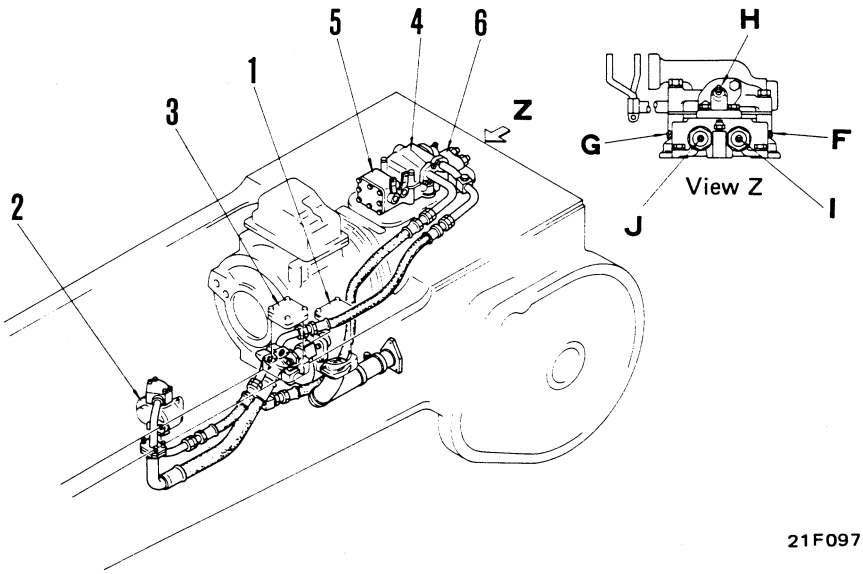
STEERING PIPING

D150A 8408 ~ 8420
D155A 15001 ~ 17000



21F085

D150A 8421 and up
D155A 17001 ~ 25000



21F097

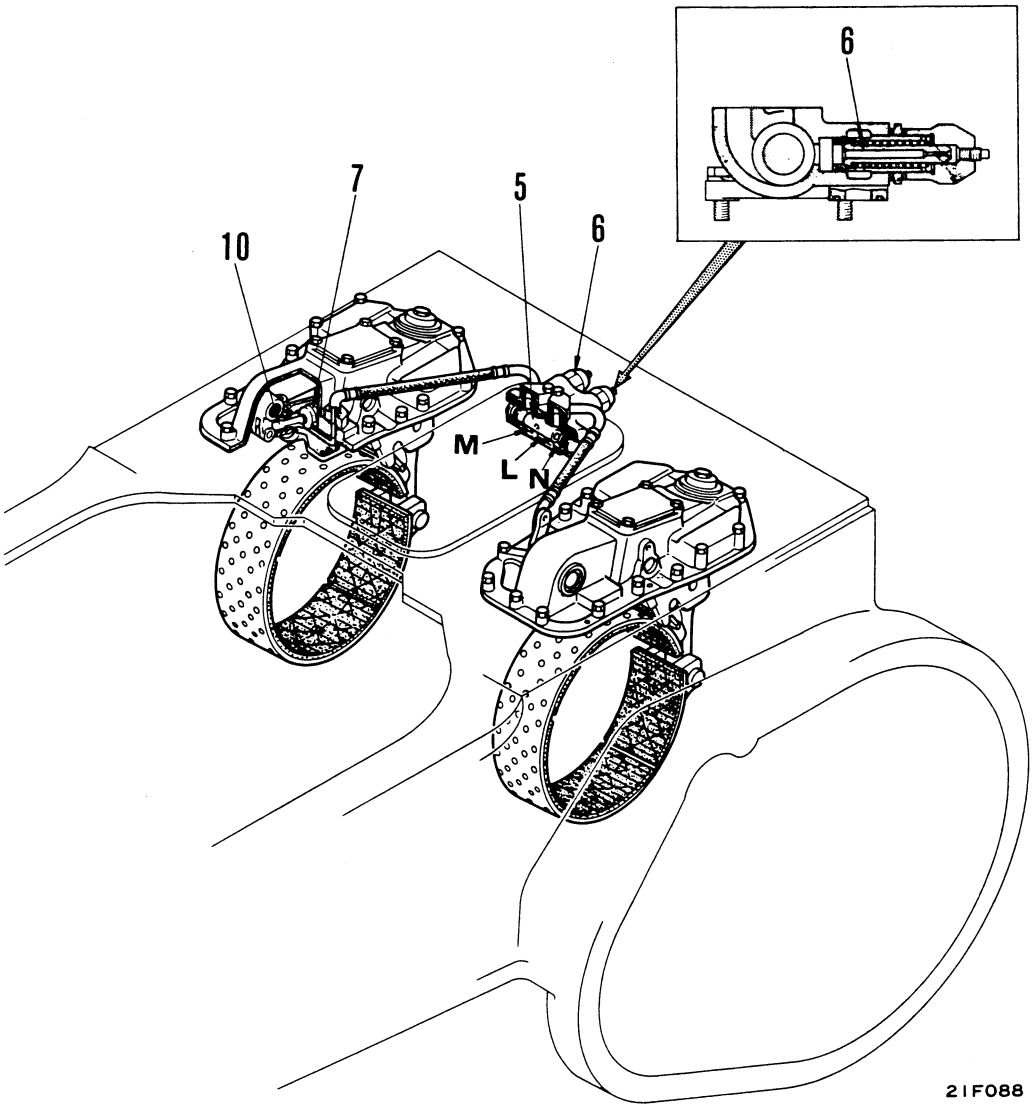
Oil in the steering case is sacked up by a gear type steering pump (2) through a magnet strainer (1) and sent to flow divider (4) through the oil filter (3).
The flow divider consists of the piston. The oil is distributed by the piston to steering system and brake system, and flows into control valve (5).
In brake system, the oil flows into both brake boosters through brake safety valve (6).

1. Magnet strainer
2. Steering pump (FAR100)
3. Steering filter
4. Flow divider
5. Control valve
6. Brake safety valve

F. Plug (for right clutch pressure PT 1/8)
G. Plug (for left clutch pressure PT 1/8)
H. Plug (for brake booster pressure PT 1/8)
I. Plug (for right brake pressure PT 1/8)
J. Plug (for left brake pressure PT 1/8)

BRAKE PIPING

D150A 8408 and up
D155A 15001 ~ 25000



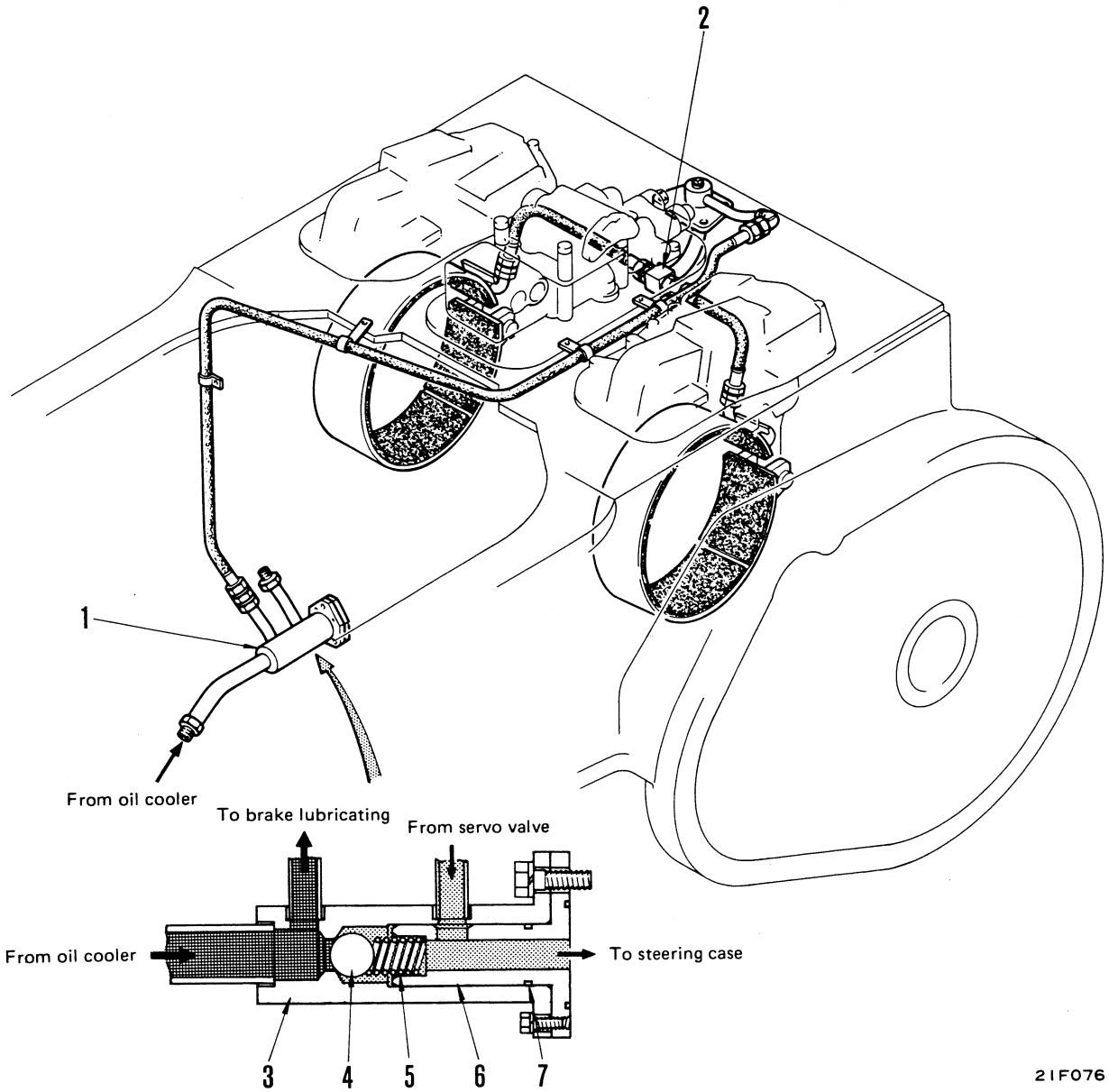
The brake hydraulic control consists of flow divider (5), brake relief valve (6), and brake booster valve (7).

BRAKE FORCED LUBRICATION PIPING

In case of D150, D155A, brake lining is lubricated and cooled by forced feeding with oil to prevent seizure and early wear.
Oil forcedly lubricates lining from right and left brake band, being divided into two streams at block (2) on upper side of steering case with check valve (1) provided in backway circuit from oil cooler to steering case.

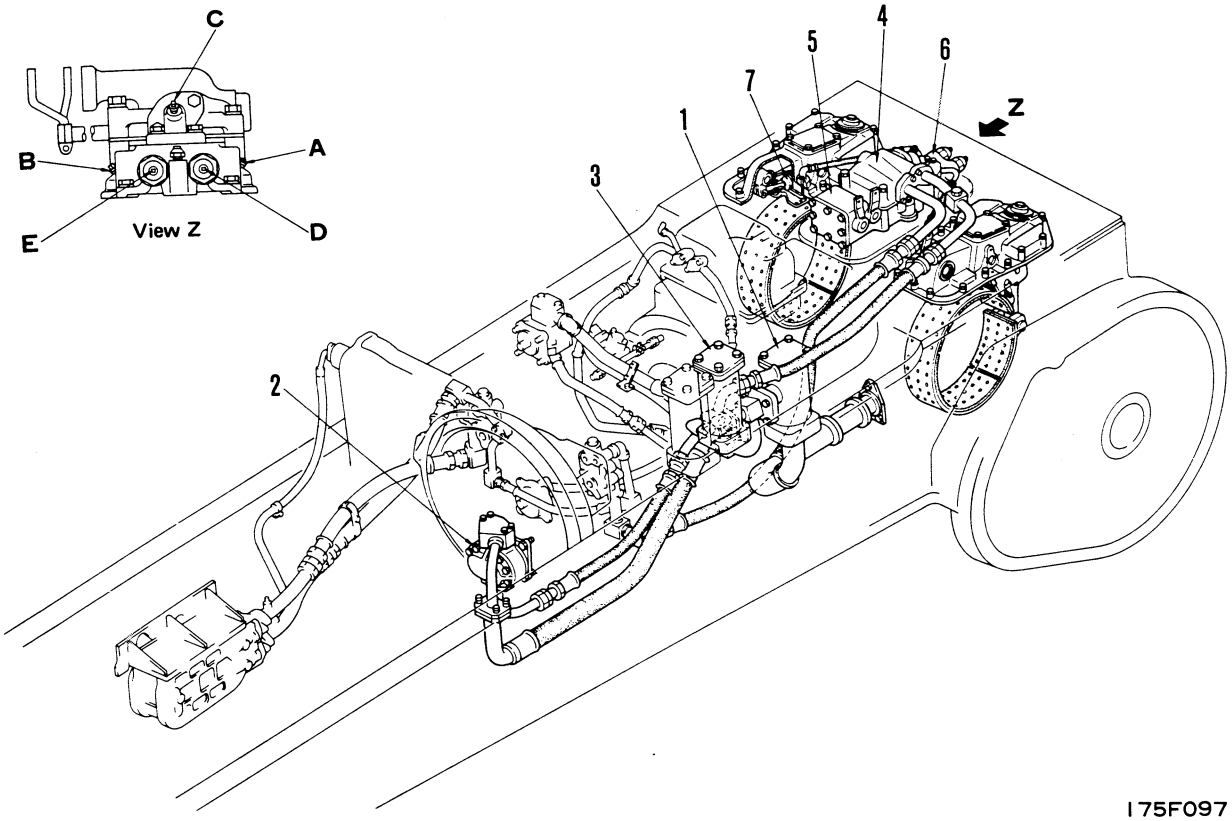
D150A 8408 ~ 8420
D155A 15001 ~ 17000

1. Check valve ass'y
2. Block
3. Tube
4. Check ball
5. Spring
6. Flange
7. O-ring



21F076

D150A 8421 and up
D155A 17001 – 25000



I75F097

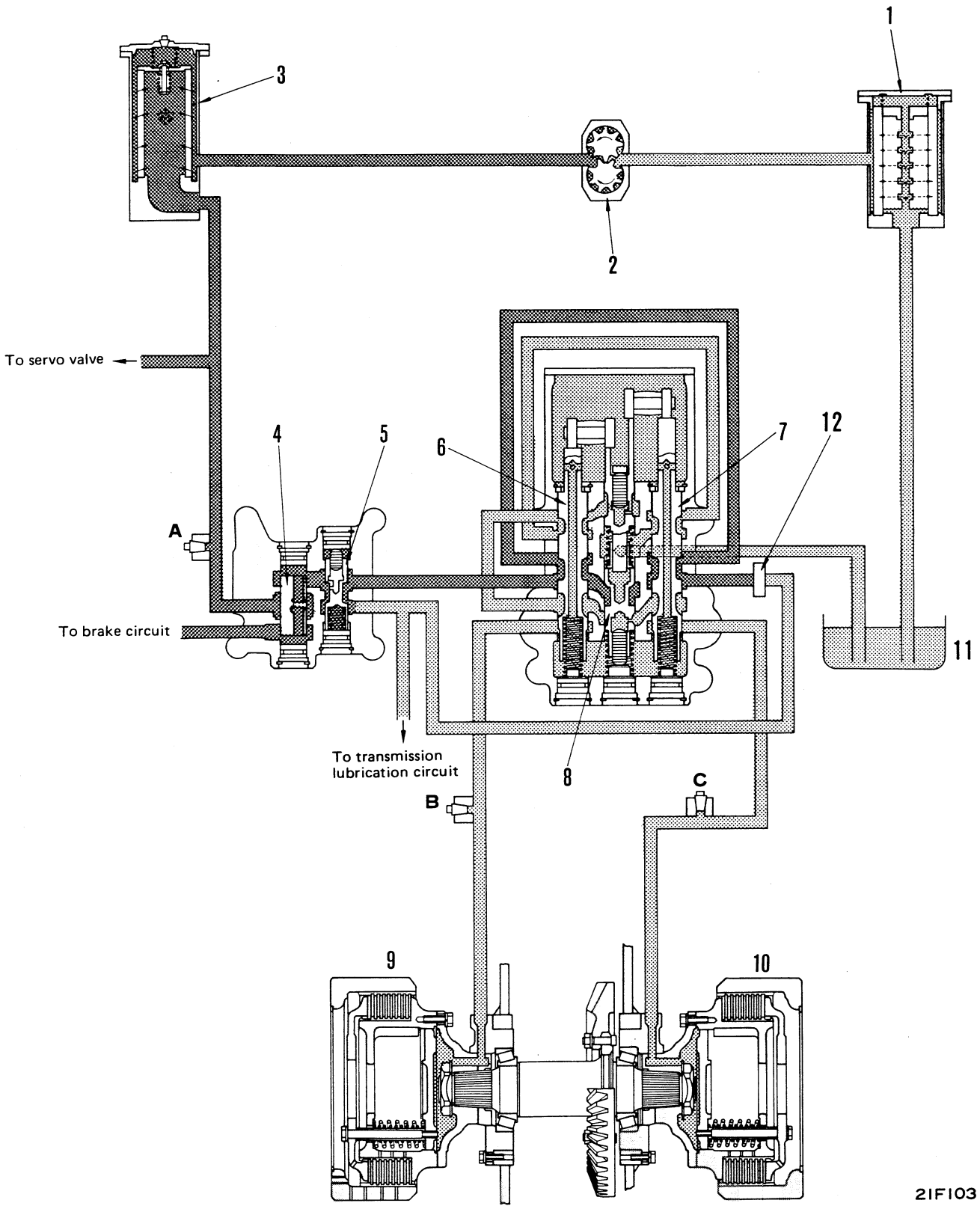
1. Oil strainer
2. Steering pump (FAR100)
3. Steering filter
4. Steering main relief valve and flow divider
5. Steering control valve
6. Brake relief valve
7. Brake booster

A. Plug for R.H. clutch pressure (PT1/8)
B. Plug for L.H. clutch pressure (PT1/8)
C. Plug for brake booster pressure (PT1/8)
D. Plug for R.H. brake pressure (PT1/8)
E. Plug for L.H. brake pressure (PT1/8)

STEERING HYDRAULIC SYSTEM

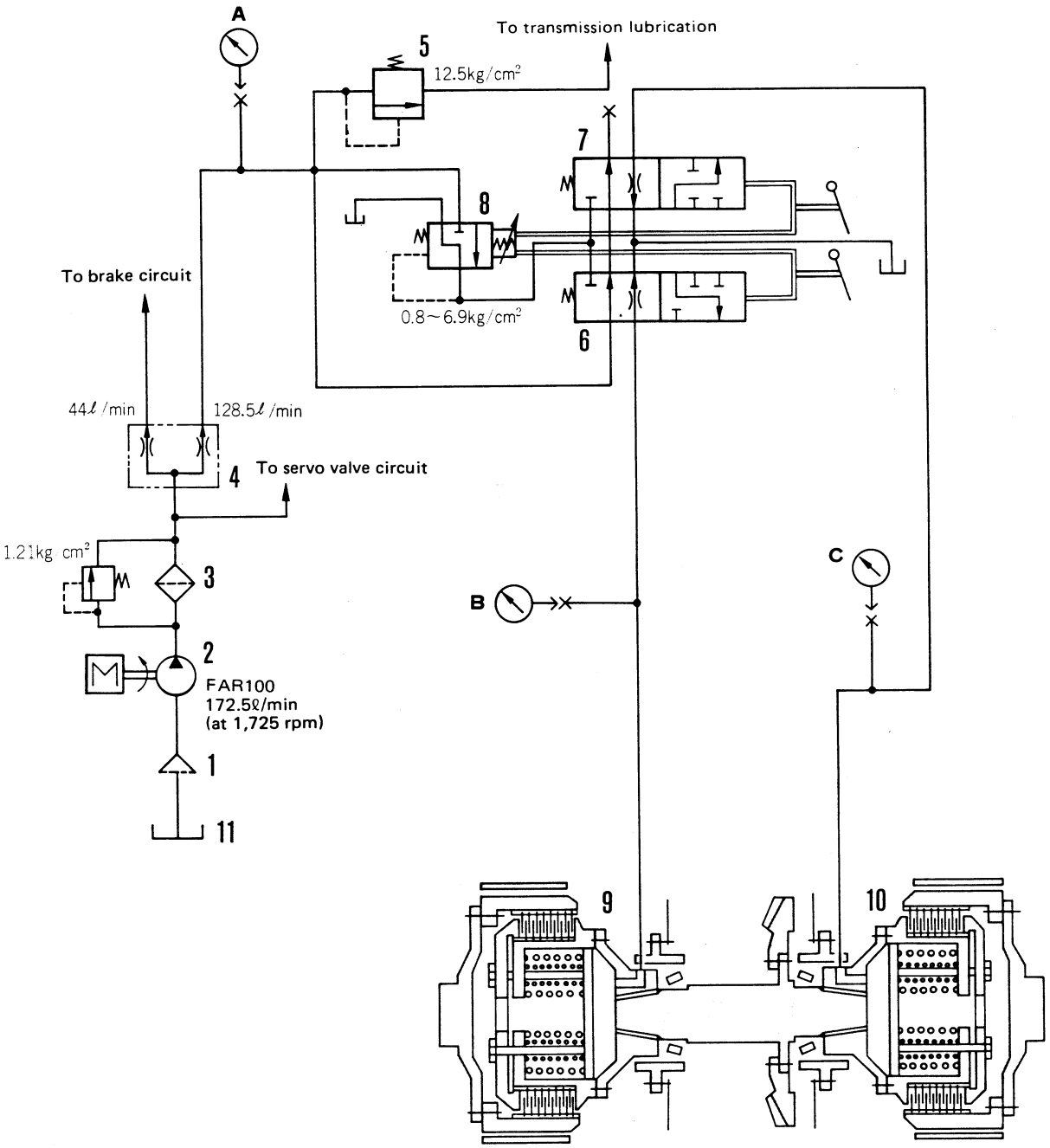
D150A 8408 and up

NEUTRAL



STEERING HYDRAULIC CIRCUIT

D150A 8408 and up



21F104A

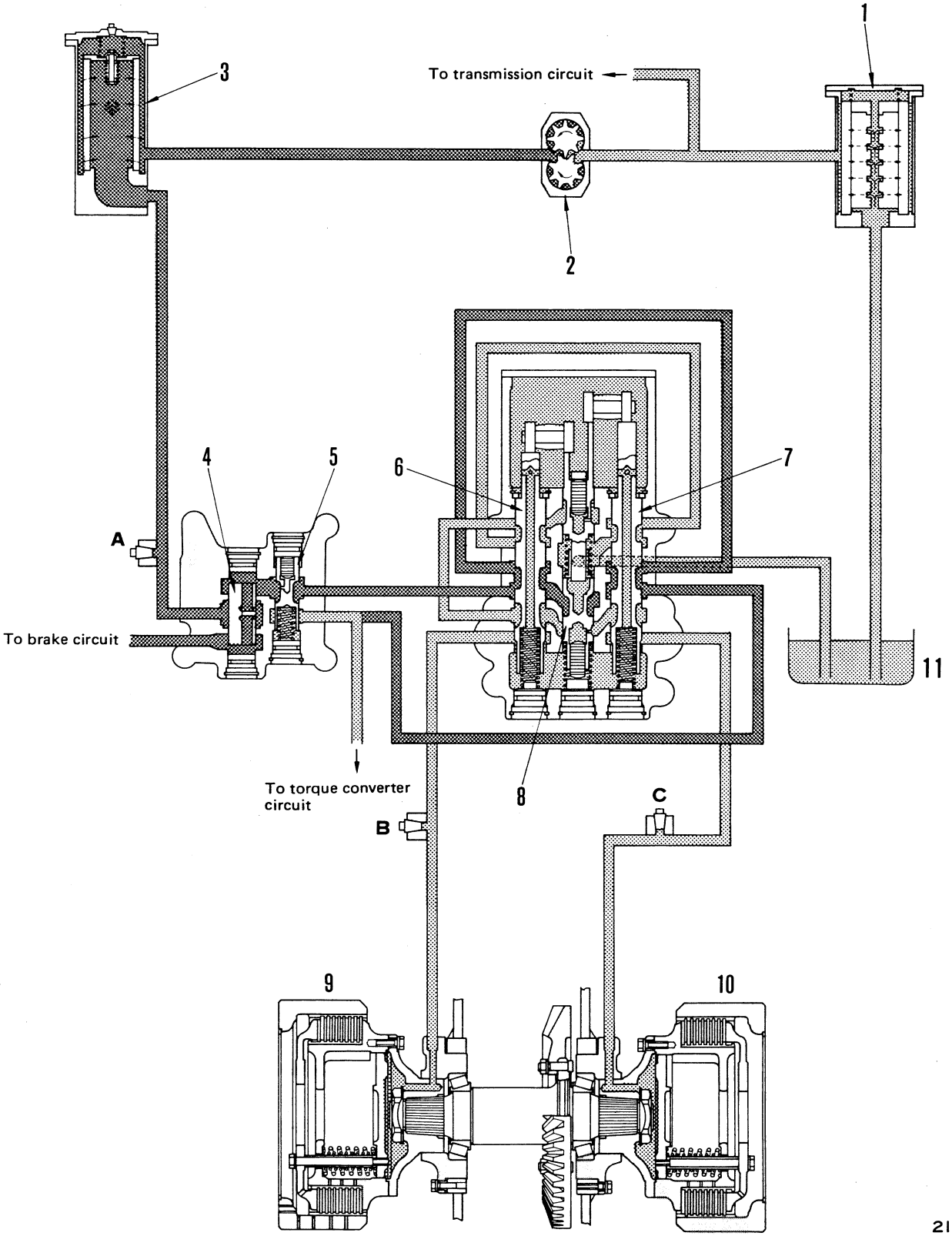
1. Magnet strainer
2. Steering pump (FAR100)
3. Steering filter
4. Flow divider
5. Main relief valve
6. Left clutch spool
7. Right clutch spool
8. Modulating valve
9. Left clutch piston
10. Right clutch piston
11. Steering case
12. Valve seat

A. Plug for clutch main pressure (PT 1/8)
B. Plug for right clutch pressure (PT 1/8)
C. Plug for left clutch pressure (PT 1/8)

STEERING HYDRAULIC SYSTEM

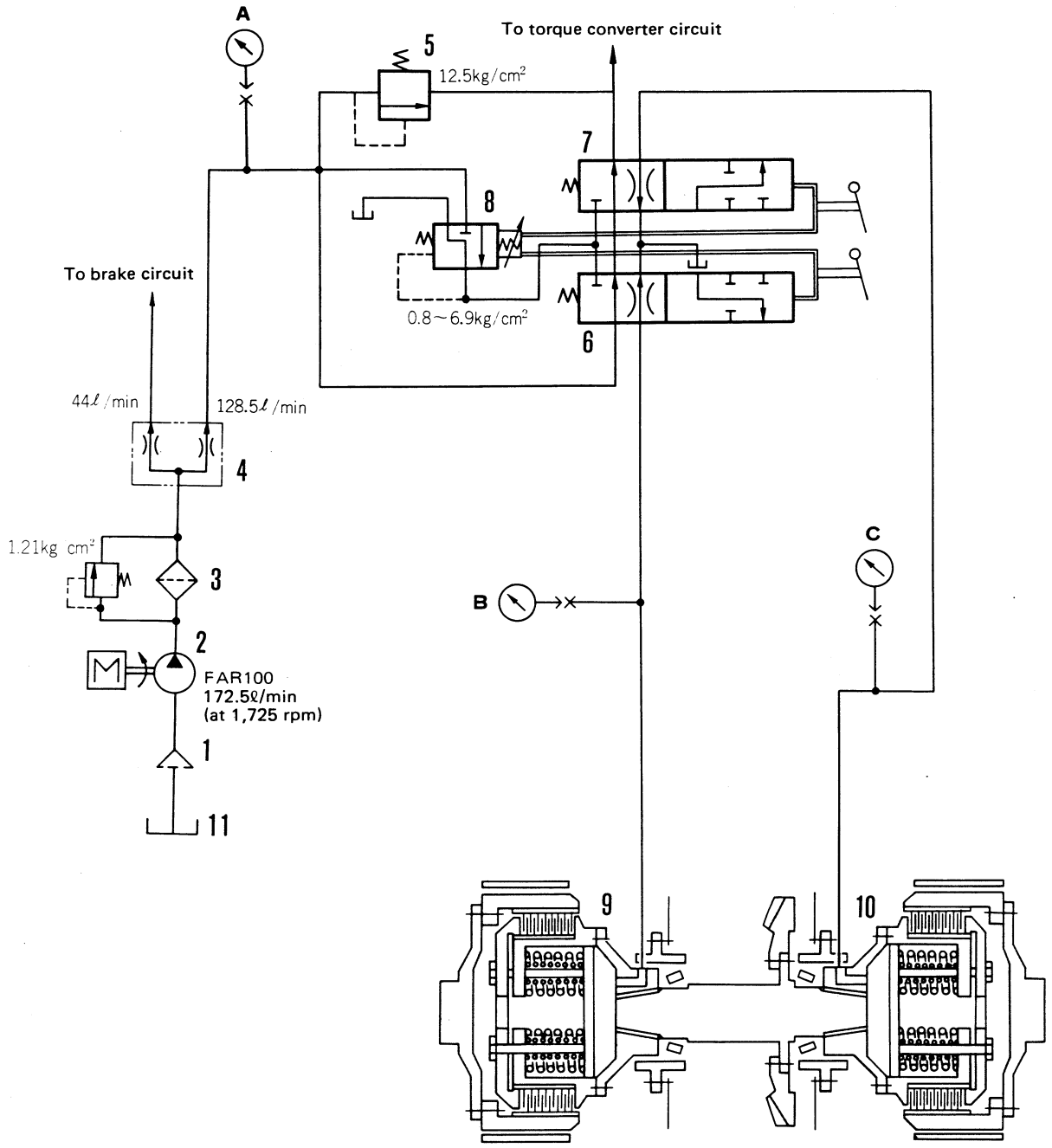
D155A 15001 – 25000

NEUTRAL



STEERING HYDRAULIC CIRCUIT

D155A 15001 – 25000



21F087A

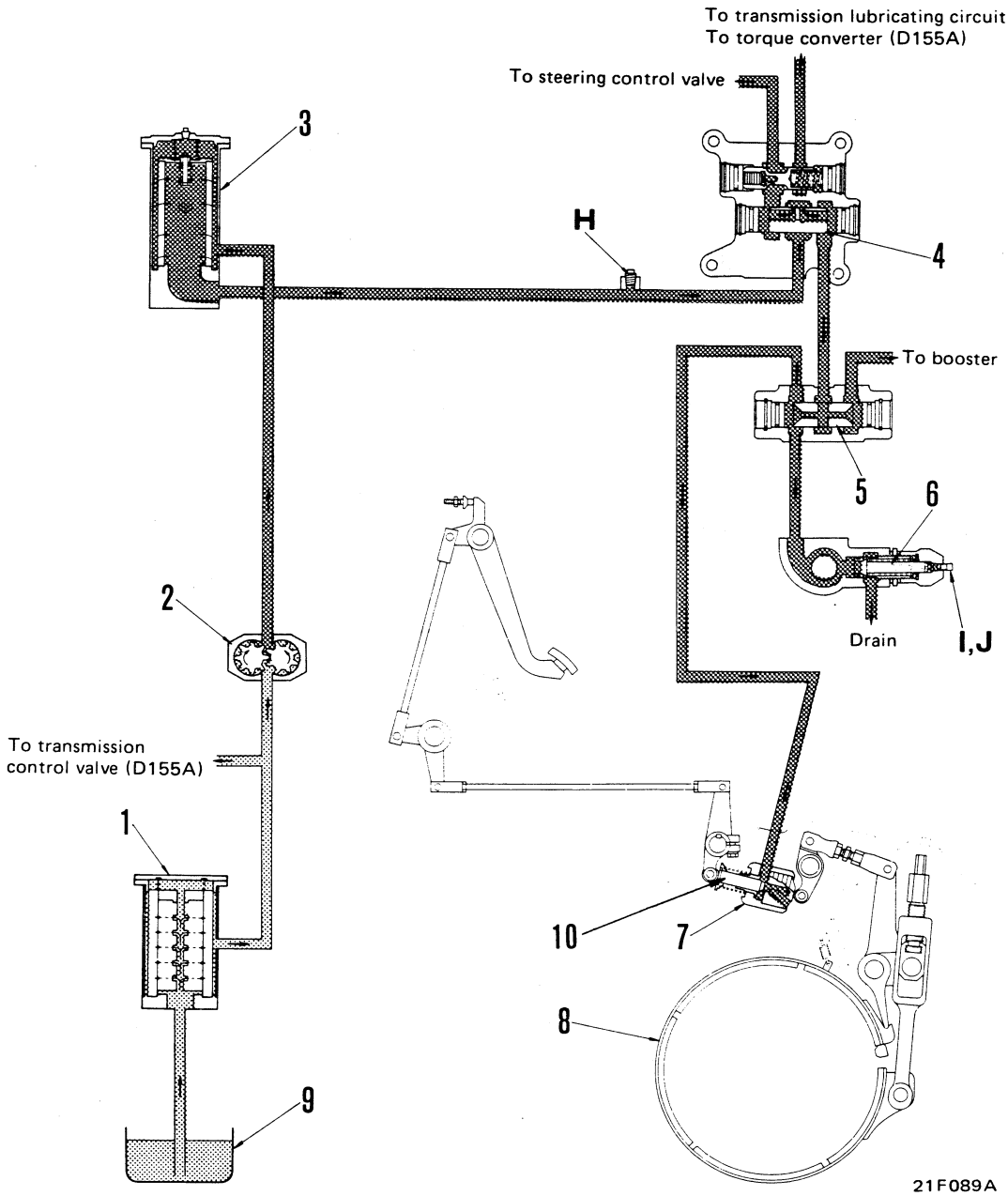
1. Magnet strainer
2. Steering pump (FAR 100)
3. Steering filter
4. Flow divider
5. Main relief valve
6. Left clutch spool
7. Right clutch spool
8. Modulating valve
9. Left clutch piston
10. Right clutch piston
11. Steering case

A. Plug for clutch main pressure (PT 1/8)
B. Plug for left clutch pressure (PT 1/8)
C. Plug for right clutch pressure (PT 1/8)

BRAKE HYDRAULIC SYSTEM

D150A 8408 and up
D155A 15001 – 25000

NEUTRAL

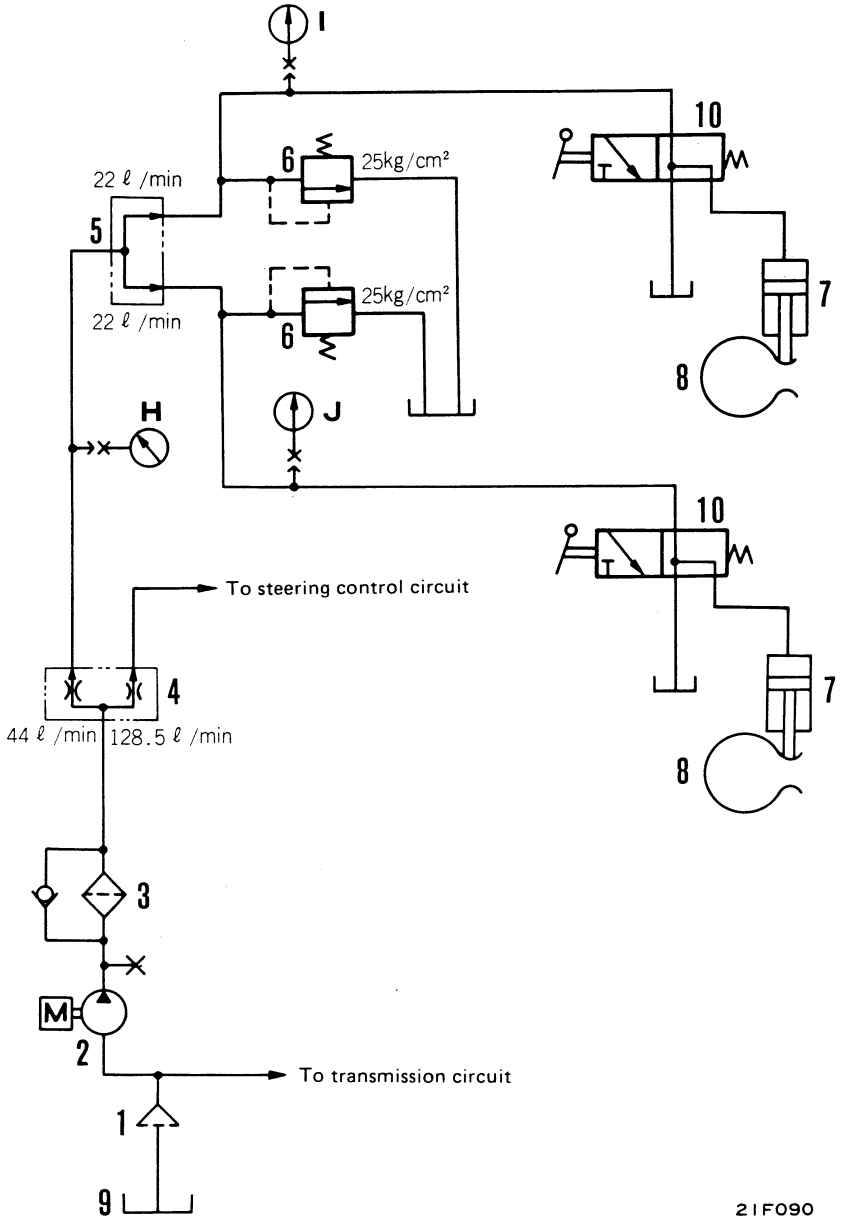


When the brake pedal is not depressed, the fluid from the flow divider (4) of the steering control valves is directed into "L" port of free piston (5). Fluid in the free piston flows through M and N ports into port of the brake booster valve.
As the brake pedal is not depressed, spool (10) stays where it is and the fluid flows through the piston (7) into the steering case.

BRAKE HYDRAULIC CIRCUIT

D150A 8408 and up
D155A 15001 – 25000

NEUTRAL



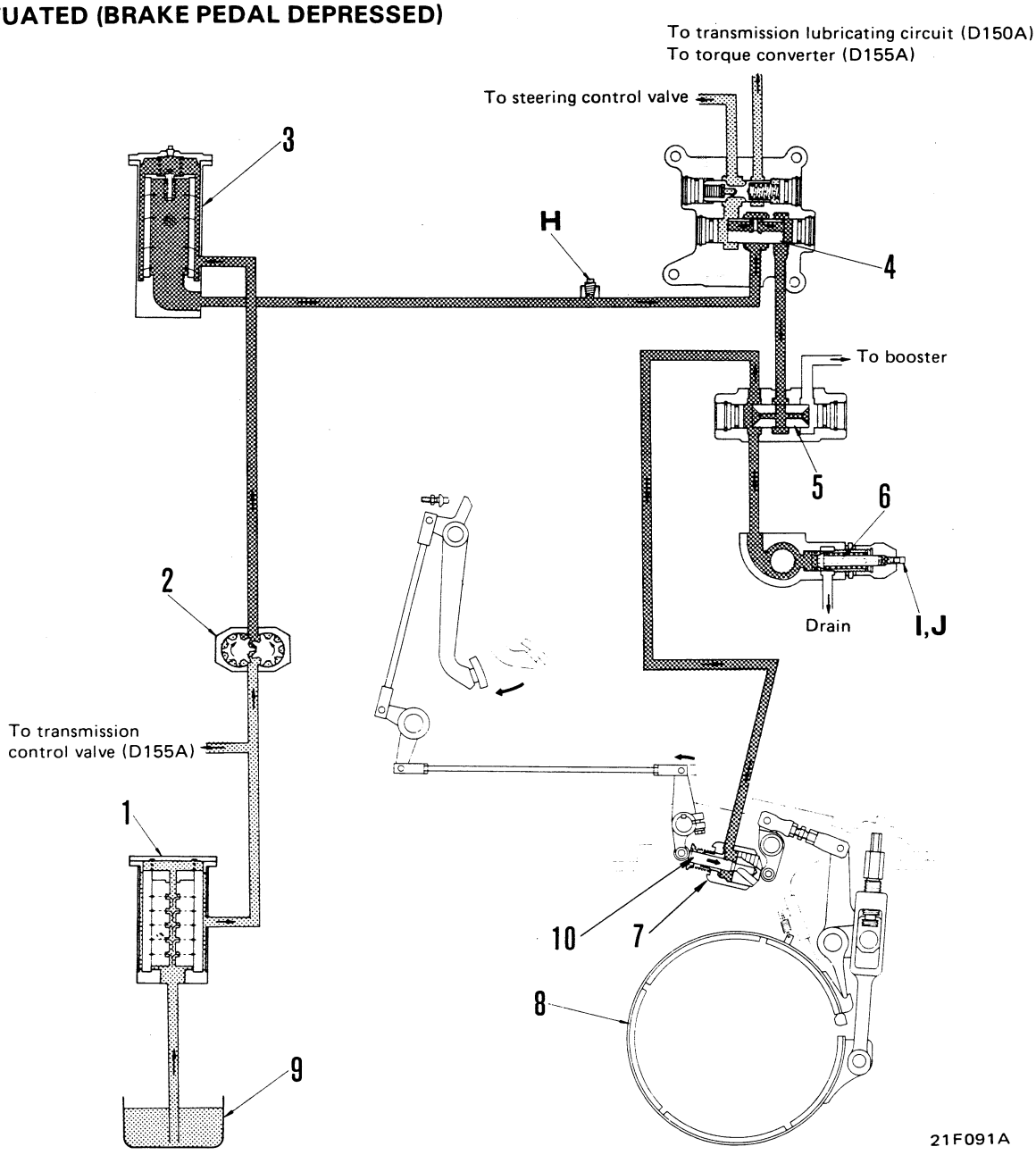
1. Magnet strainer
2. Steering pump (FAR100)
3. Steering filter
4. Flow divider
5. Flow divider
6. Brake relief valve
7. Brake booster
8. Steering brake
9. Steering case
10. Spool

H. Plug for brake booster pressure (PT 1/8)
I. Plug for right brake pressure (PT 1/8)
J. Plug for left brake pressure (PT 1/8)

BRAKE HYDRAULIC SYSTEM

D150A 8408 and up
D155A 15001 – 25000

ACTUATED (BRAKE PEDAL DEPRESSED)



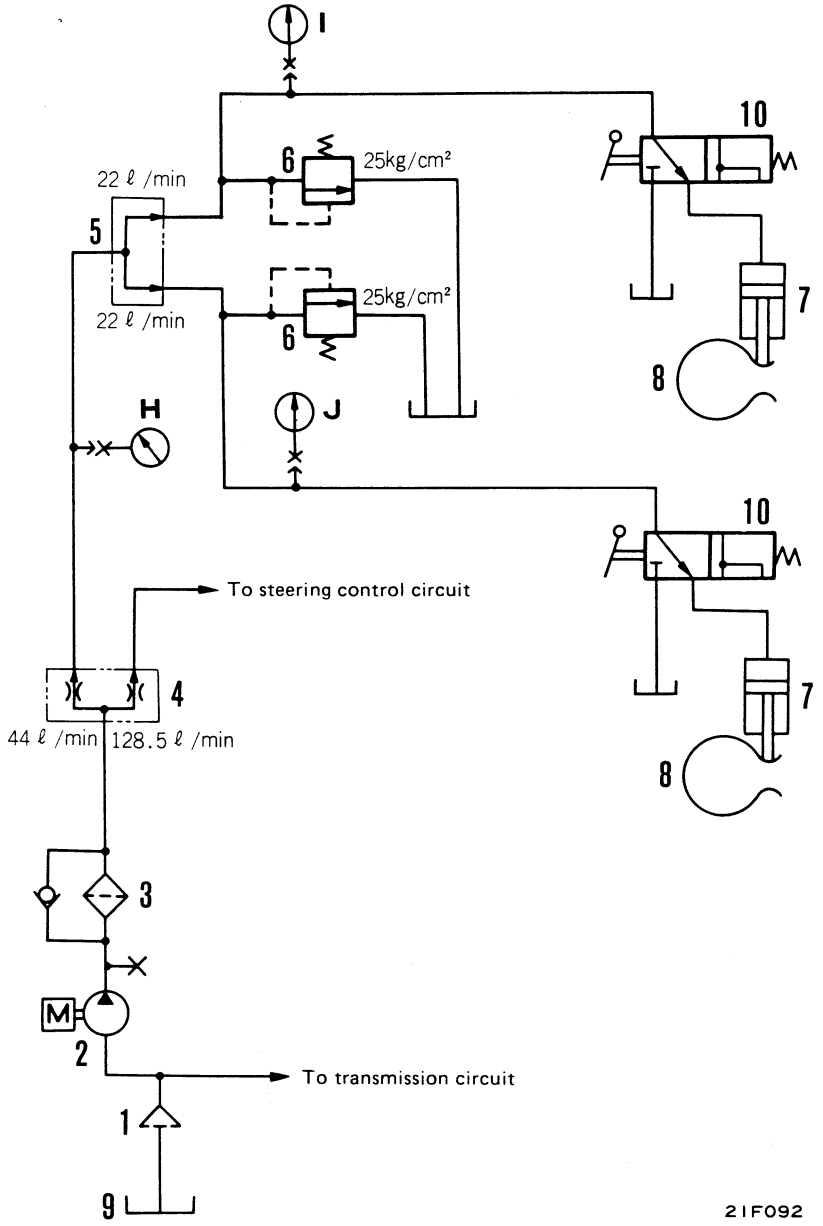
When the brake pedal is depressed, the clearance between spool (10) and the piston (7) is brought to zero, causing pressure in the circuit from the flow divider to the brake booster to be increased.
A pressure difference is developed between right and left ports M and N of free piston (5) by the pressure increase, and the free piston moves toward the side of the pedal which is not depressed, increasing the fluid volume into port.

With increasing pressure in N port, the piston moves, developing the clearance with the spool. However, depressing the pedal causes the spool to follow the movement of the piston, avoiding the clearance. Thus, the brake is actuated. When the brake is applied fully and the pressure in the circuit increases by contact of the spool against the piston, plunger relief valve (6) of the brake relief valve is forced to open, allowing the fluid to be drained through J port into the steering case.

BRAKE HYDRAULIC CIRCUIT

D150A 8408 and up
D155A 15001 – 25000

ACTUATED (BRAKE PEDAL DEPRESSED)

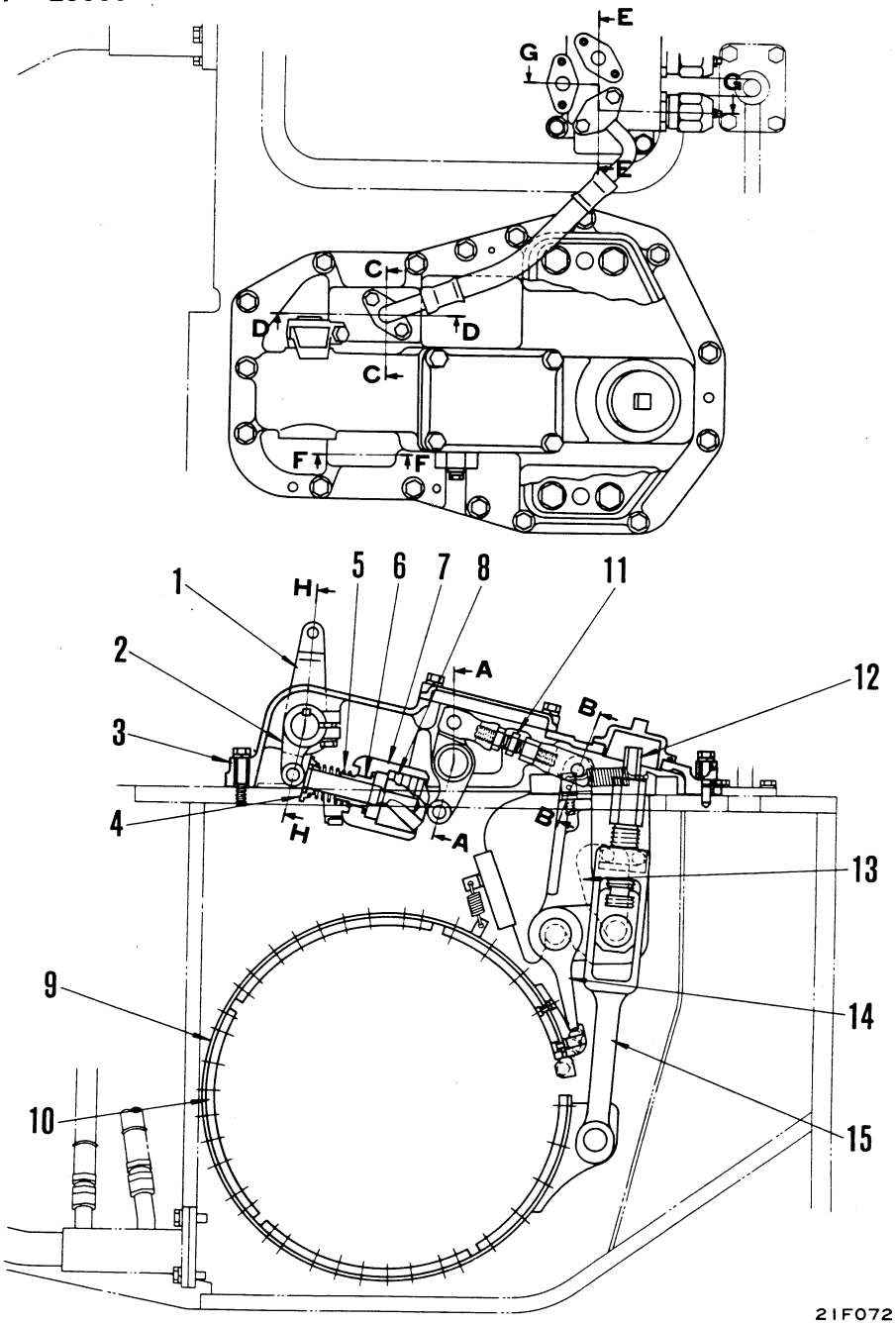


1. Magnet strainer
2. Steering pump (FAR100)
3. Steering filter
4. Flow divider
5. Flow divider
6. Brake relief valve
7. Brake booster
8. Steering brake
9. Steering case
10. Spool

H. Plug for brake booster pressure (PT 1/8)
I. Plug for right brake pressure (PT 1/8)
J. Plug for left brake pressure (PT 1/8)

STEERING BRAKE AND BOOSTER

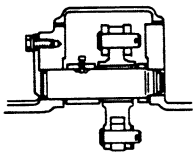
D150A 8408 and up
D155A 15001 – 25000



1. Lever
2. Lever
3. Brake cover
4. Retainer
5. Spring
6. Spool
7. Booster body
8. Piston
9. Brake band
10. Brake lining
11. Rod
12. Adjustment bolt
13. Lever
14. End
15. Rod
16. Spring
17. Relief valve plunger
18. Cap nut
19. Lock nut
20; Valve seat
21. Body
22. Selector valve

I,J. Plug for brake booster pressure (PT 1/8)

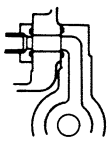
The steering brake employed in model D150A and D155A is an anchor type, contracting band brake, in which the band clamps the outer surface of the brake drum. This brake is a wet type using an oil bath.
Steering brake interlocks with steering lever and functions by brake pedals.
When parking machine, depress in the middle of right and left brake pedals and engage brake lock to lock brake pedals.



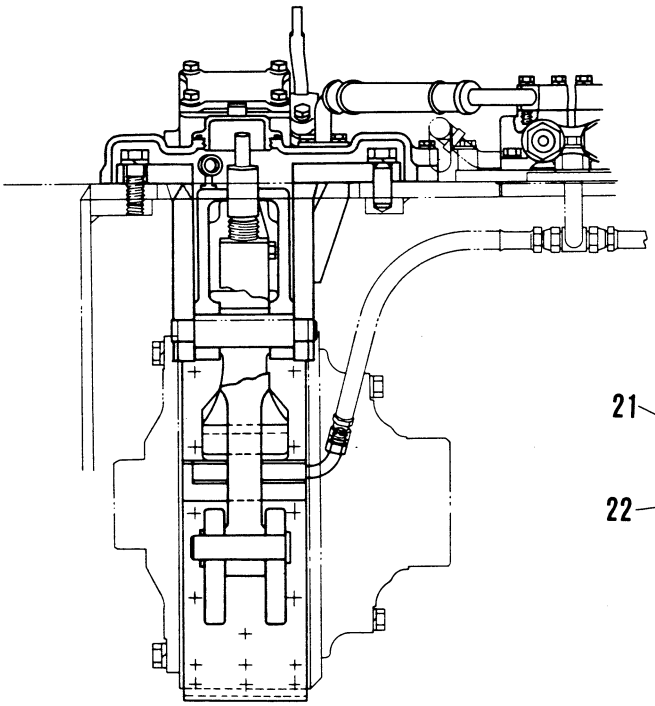
Section A-A

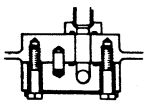


Section B-B

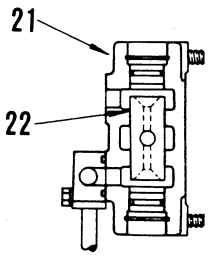


Section C-C

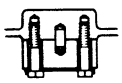




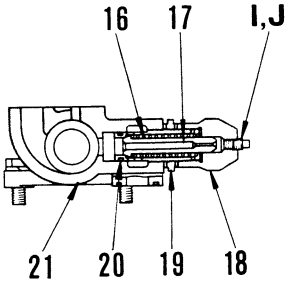
Section D-D



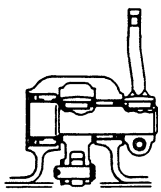
Section E-E

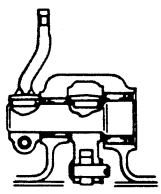


Section F-F



Section G-G





Right view

Section H-H

21F072

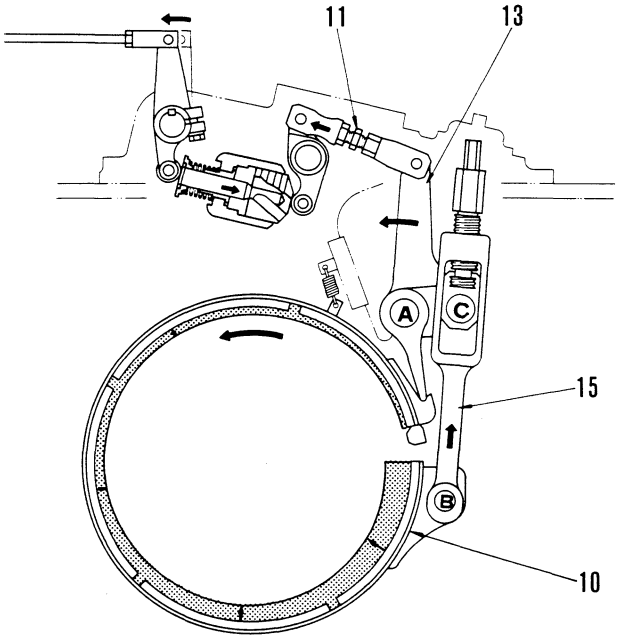
STEERING BRAKE ENGAGED

D150A 8408 and up
D155A 15001 – 25000

When the steering lever on the turning side is pulled, the steering clutch on the turning side is disengaged.
However, the power remains partially on the clutch and drives the track shoe on the turning side, resulting in a wide turning radius.
In order to improve on this, it is so designed as to apply a brake on the outer drum (brake drum) by pulling the lever further in order to shorten the turning radius.
Depressing the brake pedal causes lever (2) to press spool (6), thus closing the oil circuit from selector valve (23) at the position between the valve and piston (8).

With increasing pressure in the port connecting booster body (7) and the piston, the piston is moved to open the drain port.
Then, the brake pedal is further depressed by the amount corresponnding to the opening of the drain port to press the spool. When this procedure is continuously carried out, lever (24) at the front end of the piston is pressed, pulling rod (11) in the direction of the arrow, and the brake is applied by lever (13).

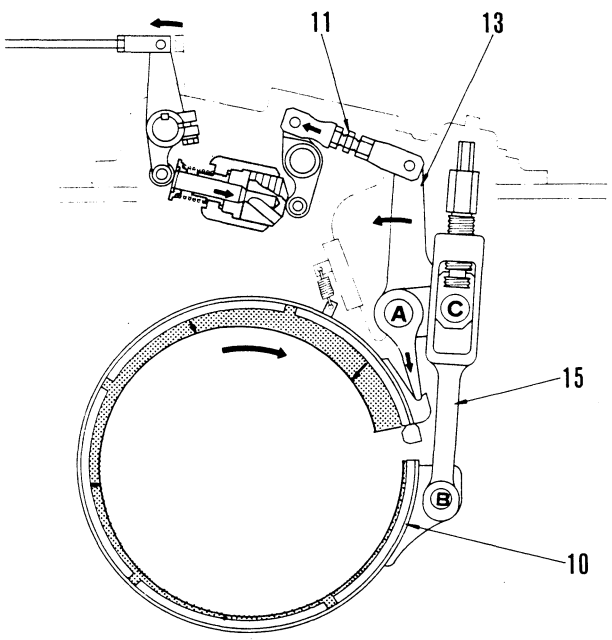
BRAKE OPERATION DURING FORWARD TURNING



21F074

Brake band (10) is supported at one end by (A) of lever (13)while another end is supported by (B) of rod (15).
Depressing the brake pedal causes rod (11) to be shifted, and pulling lever, as shown by arrows.
One end of the brake band moves downward while the other end moves upward, with (C) of the lever acting as a supporting point.
As the drum is rotating in the forward direction, the brake band clamps the drum, with (A) acting as a supporting point, while supporting point (C) at the opposite position is shifted from the drum.

BRAKE OPERATION DURING REVERSE TURNING

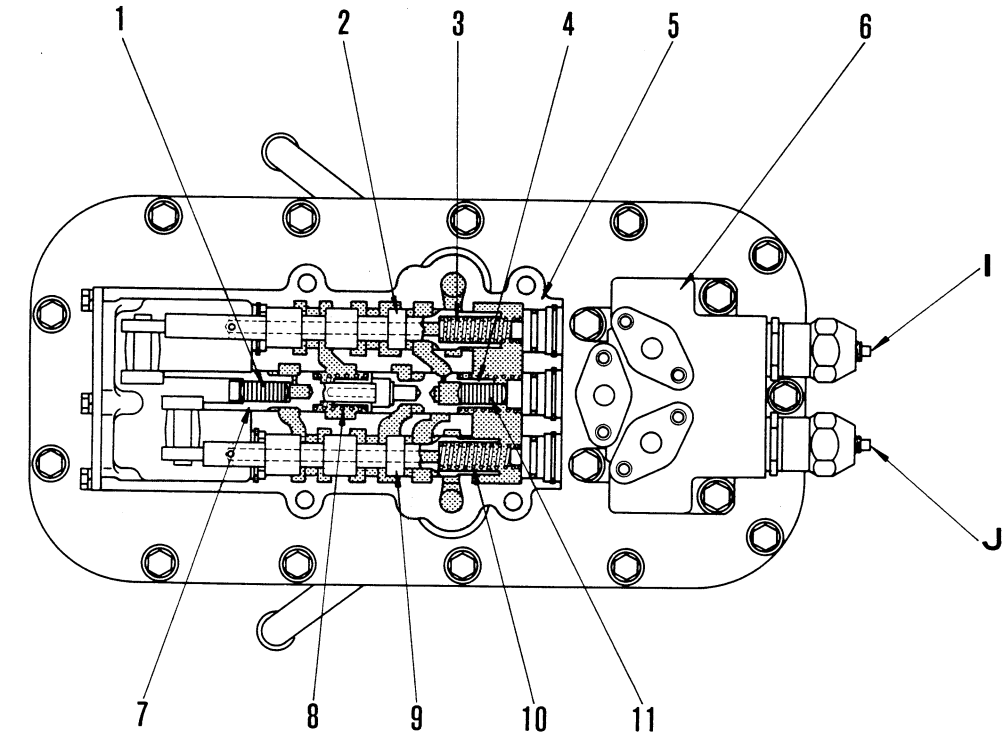


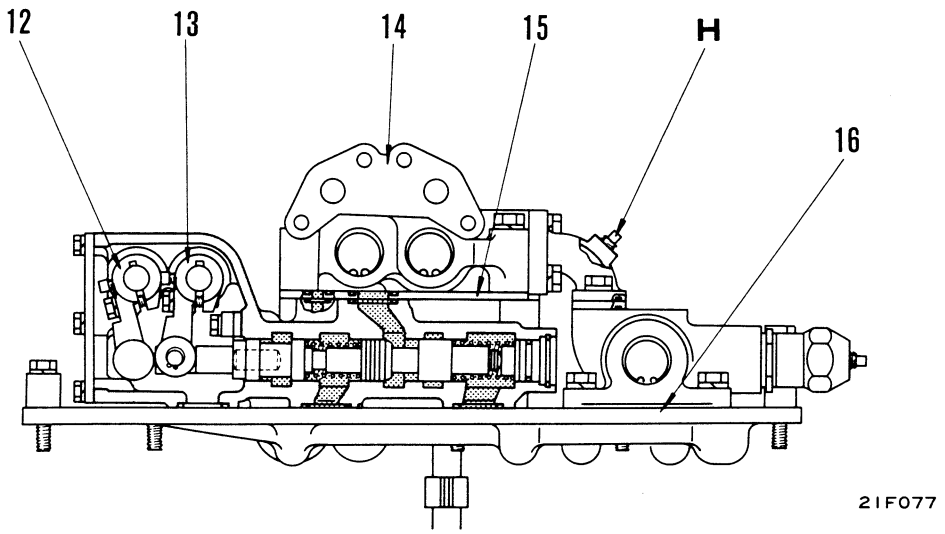
21F075

Depressing the brake pedal causes (A) to move upward and (B) downward.
As the drum is rotating in the reverse direction, the brake band clamps the drum, with (B) acting as a supporting point, while supporting point (A) at the opposite position is shifted from the drum.

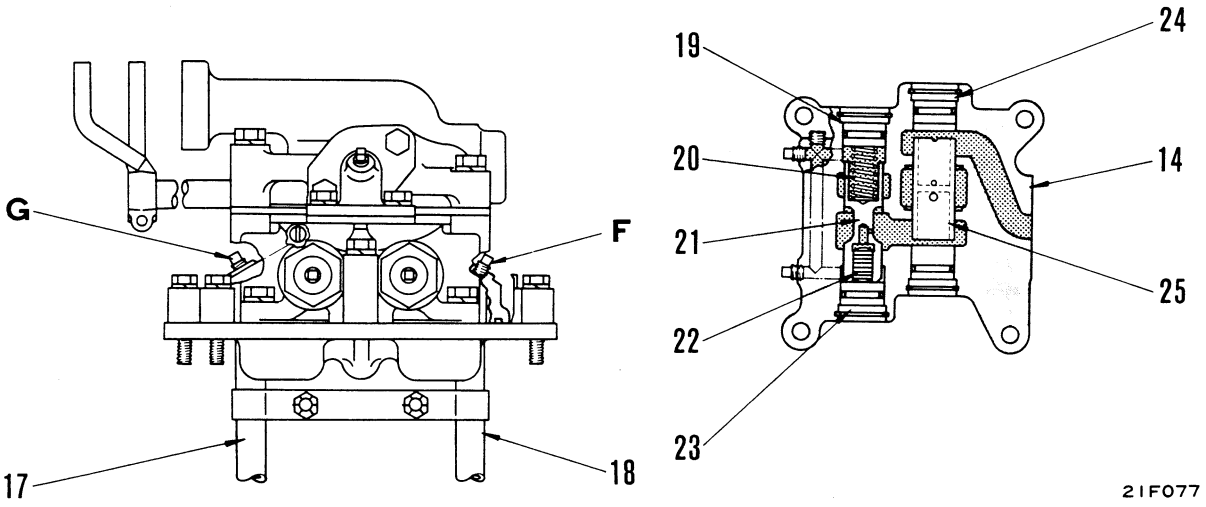
STEERING CONTROL VALVE

D150A 8408 and up
D155A 15001 – 25000





The steering control valve consists of flow divider (25) for distributing the fluid to the steering circuit and to the brake circuit, main relief vale (21) for adjusting the steering circuit at the set pressure (12.5kg/cm^2), the brake relief valve for adjusting the brake circuit at the set pressure (25kg/cm^2), valve spools (2) and (9) for directing the fluid flow to either the right or left steering clutch and valves (4), (7) for modulating steering clutch pressure.

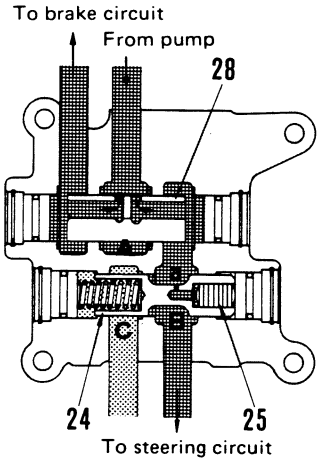


1. Piston
2. Spool (right)
3. Spring
4. Modulating valve
5. Valve body
6. Brake valve ass'y
7. Spool
8. Spring
9. Spool (left)
10. Spring
11. Piston
12. Lever (right)
13. Lever (left)
14. Valve body
15. Plate (D150A only)
16. Seat
17. Tube
18. Tube (right)
19. Stopper
20. Spring
21. Main relief valve
22. Piston
23. Stopper
24. Stopper
25. Flow divider

F. Plug (for right steering clutch pressure PT 1/8)
G. Plug (for left steering clutch pressure PT 1/8)
H. Plug (for brake main relief pressure PT 1/8)
I. Plug (for right brake pressure PT 1/8)
J. Plug (for left brake pressure PT 1/8)

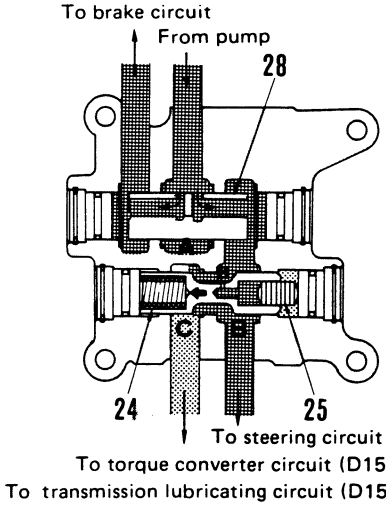
MAIN RELIEF VALVE

Fluid from the steering pump is directed into A port then distributed to the steering circuit and the brake circuit in the proportion of 3 : 1 by flow divider (28).



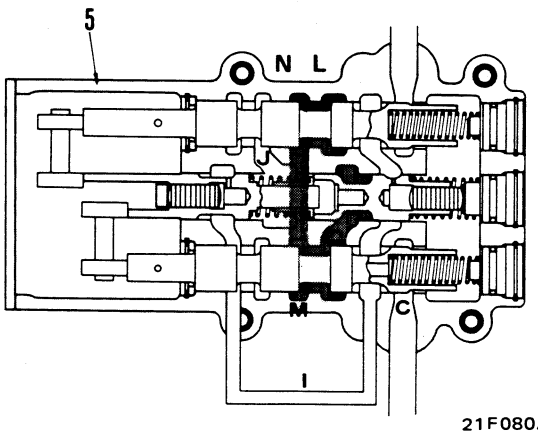
21F078

As the fluid from the control valve fills the port up to the clutch piston, the pressure in the steering circuit increases and the fluid in B port flows through orifice (a) of relief valve (24) into piston (25) to push it.
The pressure on the piston works as a reaction force on the relief valve (24) and moves it to the left. Thus, the fluid is drawn from B port to C port and then into the torque converter circuit (In D150A, into transmission lubricating circuit).
This relieving pressure of the circuit is set pressure (12.5 kg/cm^2) of the steering circuit.



21F079

RIGHT AND LEFT CLUTCH "ON" (CONTROL VALVE "HOLD")



21F080A

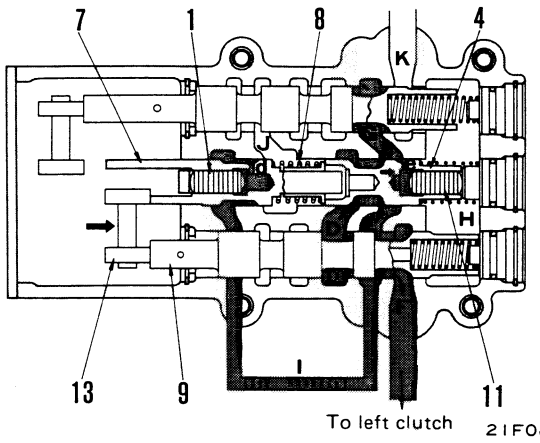
D150A only

Pressurized oil from pump passes through main relief valve (24) and enters D port in valve body (5). Pressurized oil in D port raises only circuit pressure as circuit to clutch piston is closed and consequently is relieved to C port from B port of main relief valve.
Consequently pressure is always relieved when steering lever is out of operation.

D155A only

Pressurized oil from pump passes through main relief valve (24) and enters **D** port in valve body. Pressurized oil in **D** port flows into **L** port passing through **M** port and **N** port.
Pressurized oil in **L** port flows to TORQFLOW circuit.

LEFT CLUTCH "OFF", RIGHT CLUTCH "ON" (LEFT LEVER PULLED)



When left steering lever is pulled, left spool (9) and spool (7) are moved in the direction ➡ with lever (13). When valve is moved, pressurized oil enters from orifice "d" of valve and reaction force pushing piston (1), together with lever control force, moves spool in the direction ➡ only stroke of left spool and push modulator valve (4) in the direction ➡ with the aid of spring (8) and guide.

Pressurized oil from pump enters D port of valve body through main relief valve and flows into E port and G port passing through clearance "b" between modulator valve and valve body.

As in modulator valve reaction force pushing piston (11) with pressurized oil flowing from G port after passing through orifice 'e' balances with reaction force of spool side, pressurized oil in "E" port flows to left clutch form F port, thus left clutch in released.

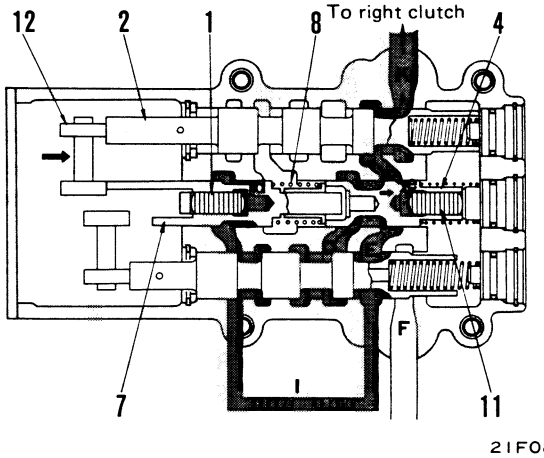
When left spool is moved halfway instead of to its stroke end, modulator valve pumps due to difference of pressure between "D" port and "E", "G" ports and clearance "b" is opened and closed intermittently, thus clutch becomes half-engaged.

When left steering lever is released, passage for pressurized oil in "D" port is closed and flow to left clutch is cut.

On the other hand, oil in left clutch piston circuit is returned with clutch piston spring and enters drain port "H" via clearance "c" between left spool and valve body and is drained there.

At the same time, modulator valve and valve return to "HOLD" position and pressurized oil enters drain port "J" via piping of seat (17) and is drained there.

LEFT CLUTCH "ON", RIGHT CLUTCH "OFF" (RIGHT LEVER PULLED)



When right steering lever is pulled, right spool (2) and spool (7) are moved in the direction ➡ with lever (12).

When valve is moved, pressurized oil enters from orifice "d" of valve and reaction force pushing piston (1), together with lever control force, moves spool in the direction ➡ only stroke of right spool and push modulator valve (4) in direction ➡ through the side of spring (8) and guide.

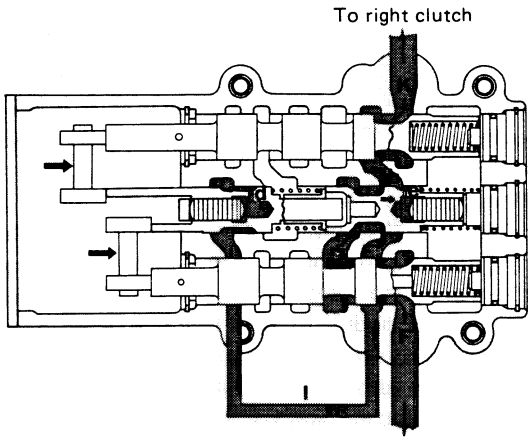
Pressuirized oil from pump enters "D" port of valve body through main relief valve and flows into "E" port and "G" port passing through clearance "b" between modulator valve and valve body.

As in modulator valve reaction force pushing piston (11) with pressurized oil flowing from "G" port after passing through orifice "e" balances with reaction force of spool side, pressuirzed oil in "G" port flows to right clutch from K port, thus right clutch is released.

When right spool is moved halfway instead of to its stroke end, modulator valve pumps due to the difference of pressure between "D" port and "E", "G" ports and clearnace "b" is opened and closed intermittently, thus clutch becomes half-engaged.

When right steering lever is released, passage for pressurized oil in "D" port in closed and flow to right clutch is cut.
On the other hand, oil in right clutch piston circuit is returned with clutch piston spring and enters drain port H via clearance between right spool and valve body and is drained there.
At the same time modulator valve and valve return to respective "HOLD" position and pressurized oil enters drain port "J" via piping of seat (17) and is drained there.

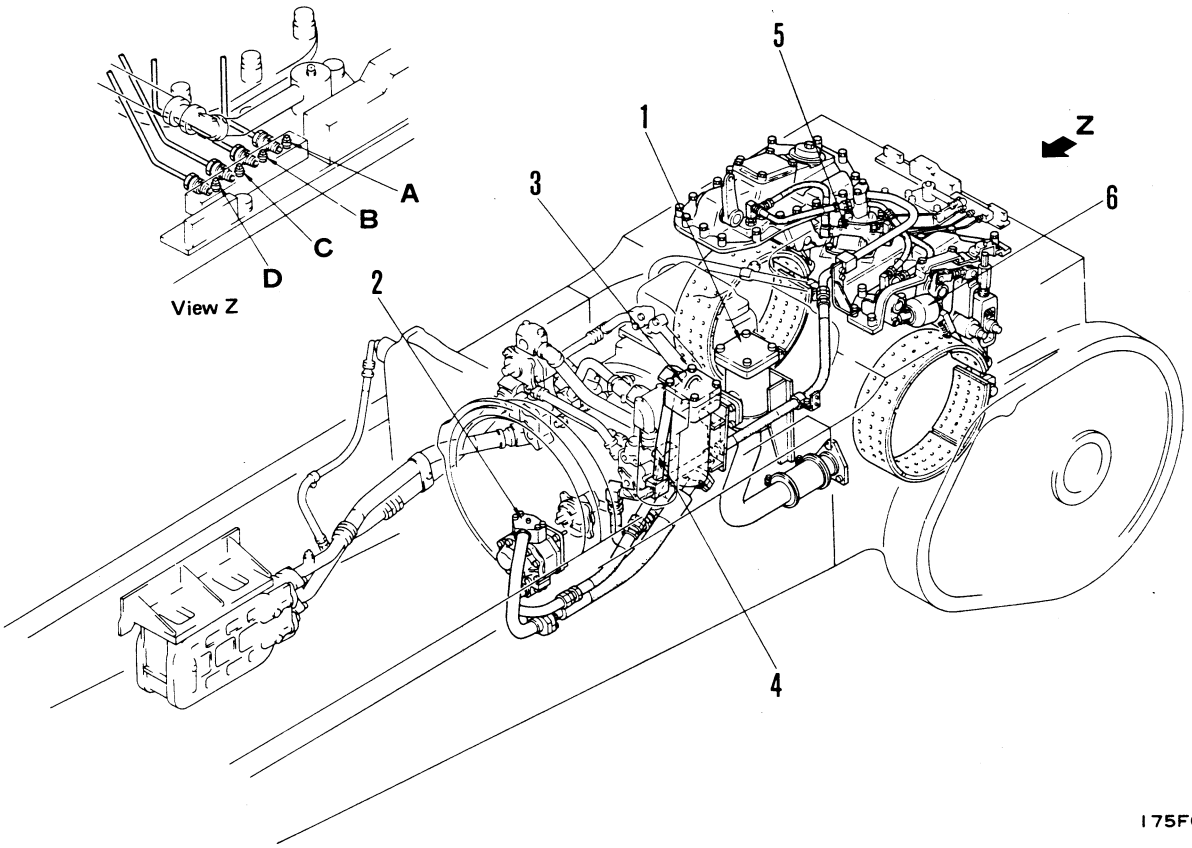
LEFT CLUTCH "OFF", RIGHT CLUTCH "OFF" (RIGHT AND LEFT LEVERS ARE PULLED)



When both right and left clutches are pulled, above operations of pulling right and left levers are performed at the same time, pressurized oil flows from port "F" and port "K" to left and right steering clutch pistons, thus both right and left clutches are released.

STEERING AND BRAKE PIPING

D155A 25001 and up



175F097-1

1. Magnetic strainer
2. Steering pump (FAR100)
3. Steering filter
4. Steering relief valve
5. Control valve

A. R.H. clutch pressure tap (PT 1/8)
B. L.H. clutch pressure tap (PT 1/8)
C. R.H. brake pressure tap (PT 1/8)
D. L.H. brake pressure tap (PT 1/8)

GENERAL

Oil in the steering case flows through magnetic strainer (1) to gear-type steering pump (2), which delivers oil through oil filter (3) to the steering control valve, brake boosters and relief valve (4).

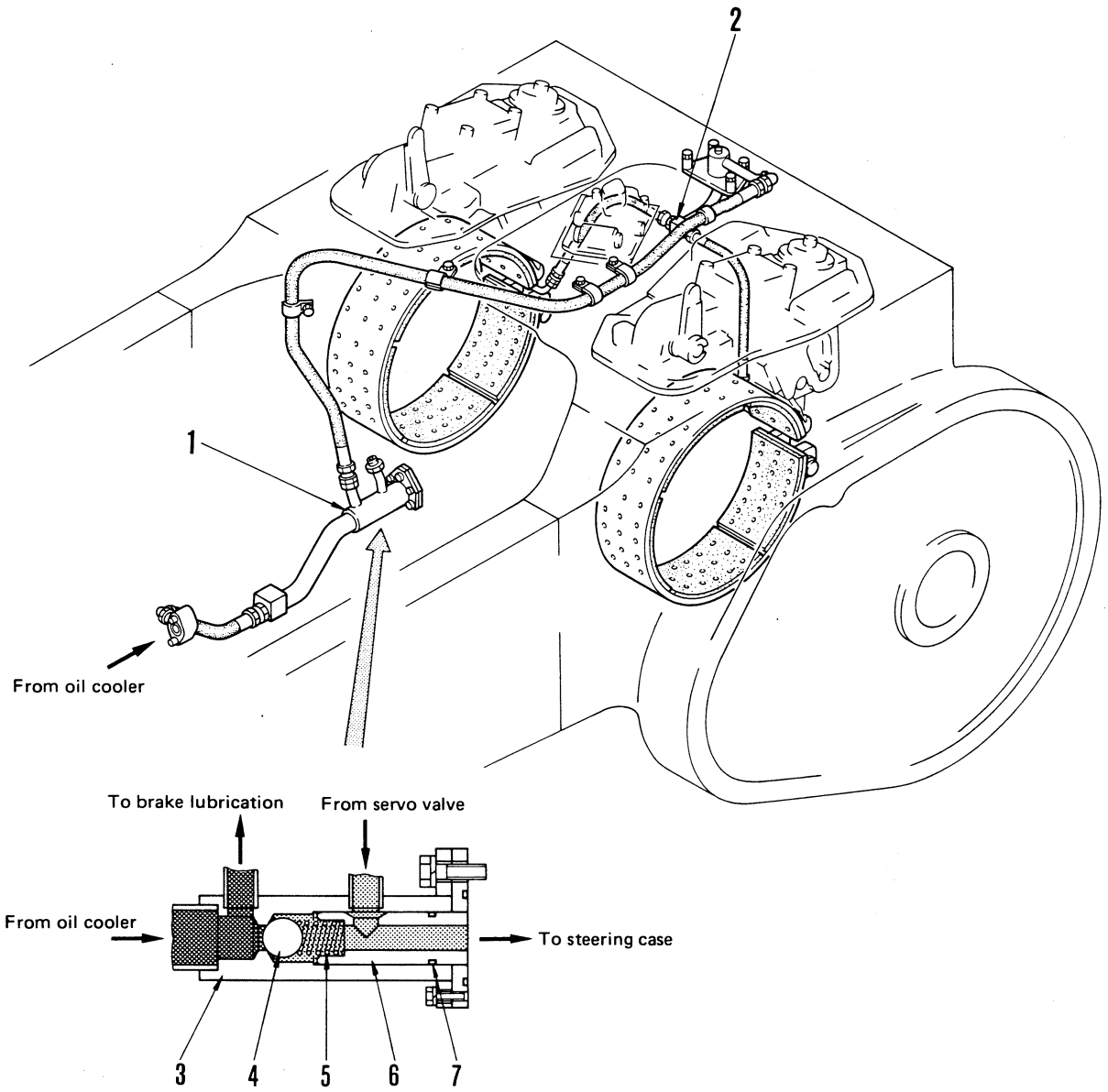
From the relief valve (set pressure 22 kg/cm^2), oil flows to the torque converter.

From steering control valve (5), oil flows to each steering clutch to disengage it when the corresponding steering lever is pulled to the "1st step". When the steering lever is pulled to the "2nd step", oil flows also to the corresponding brake booster and actuates the steering brake.

Regardless of the steering lever operation, the steering brake can be actuated by oil delivered to the brake booster when the brake pedal is depressed.

BRAKE FORCED LUBRICATION PIPING

D155A 25001 and up

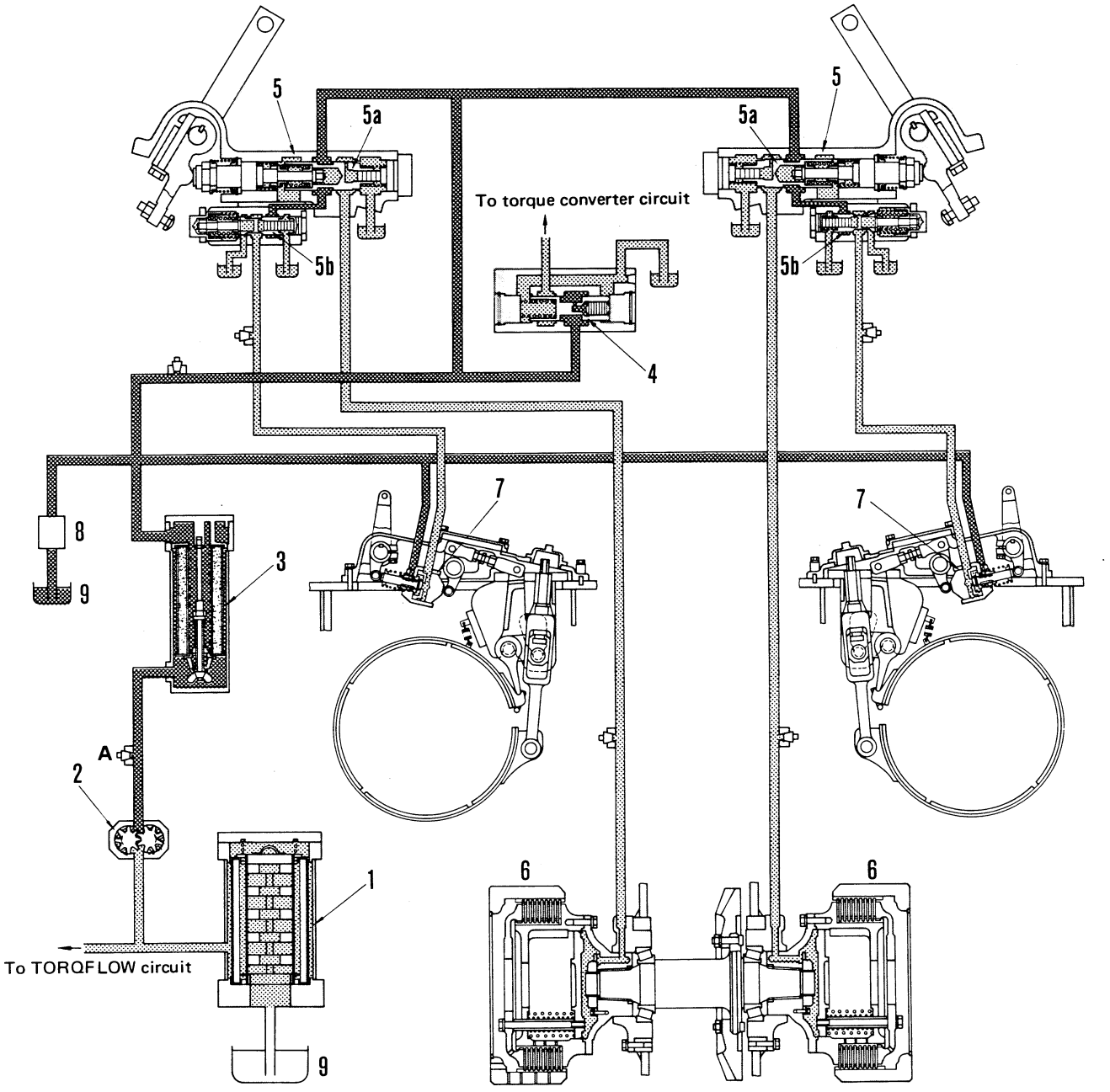


21F085-2

1. Check valve ass'y
2. Block
3. Tube
4. Check ball
5. Spring
6. Flange
7. O-ring

STEERING AND BRAKE HYDRAULIC SYSTEM

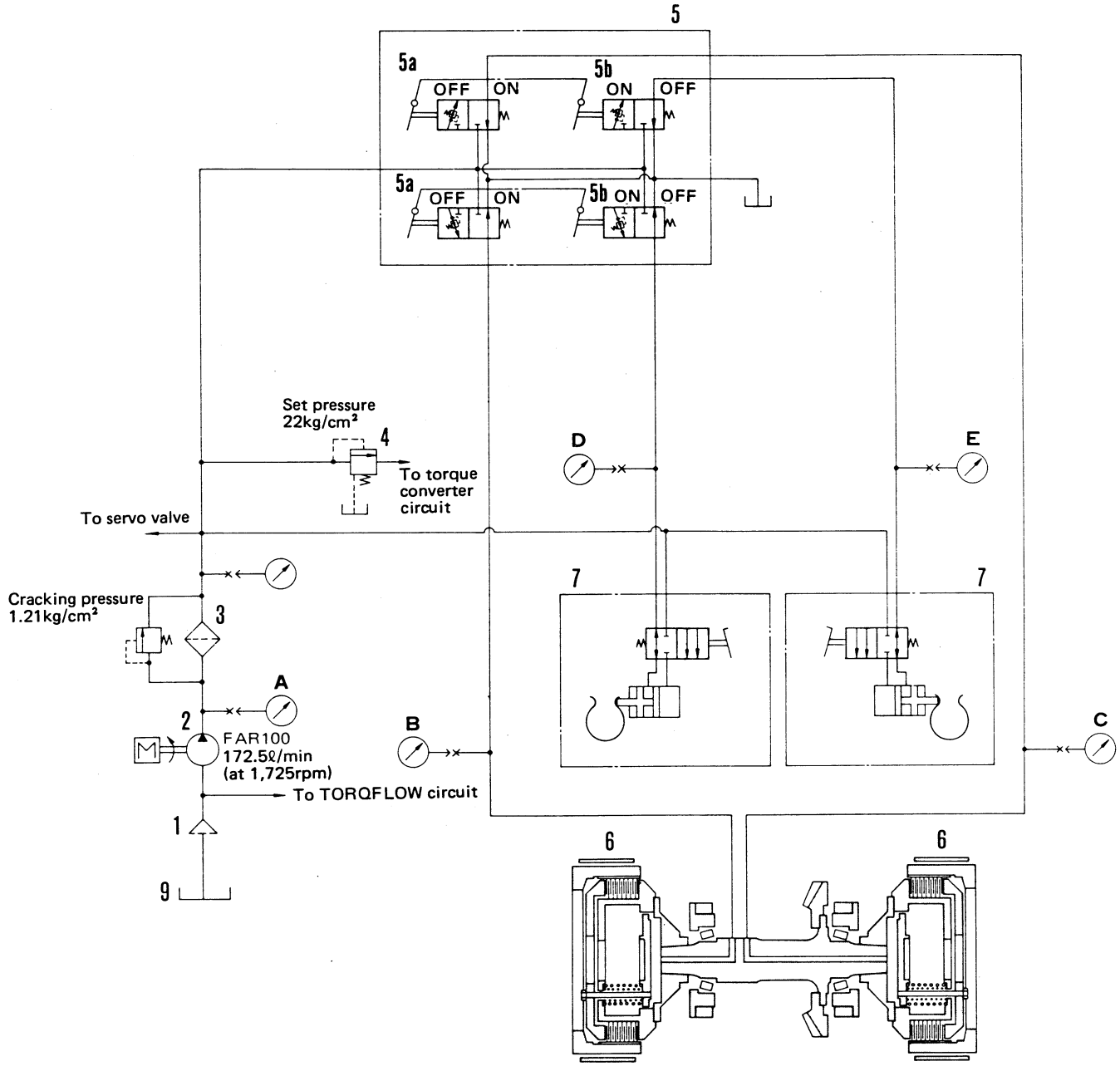
D155A 25001 and up



175F100-1

STEERING AND BRAKE HYDRAULIC CIRCUIT

D155A 25001 and up



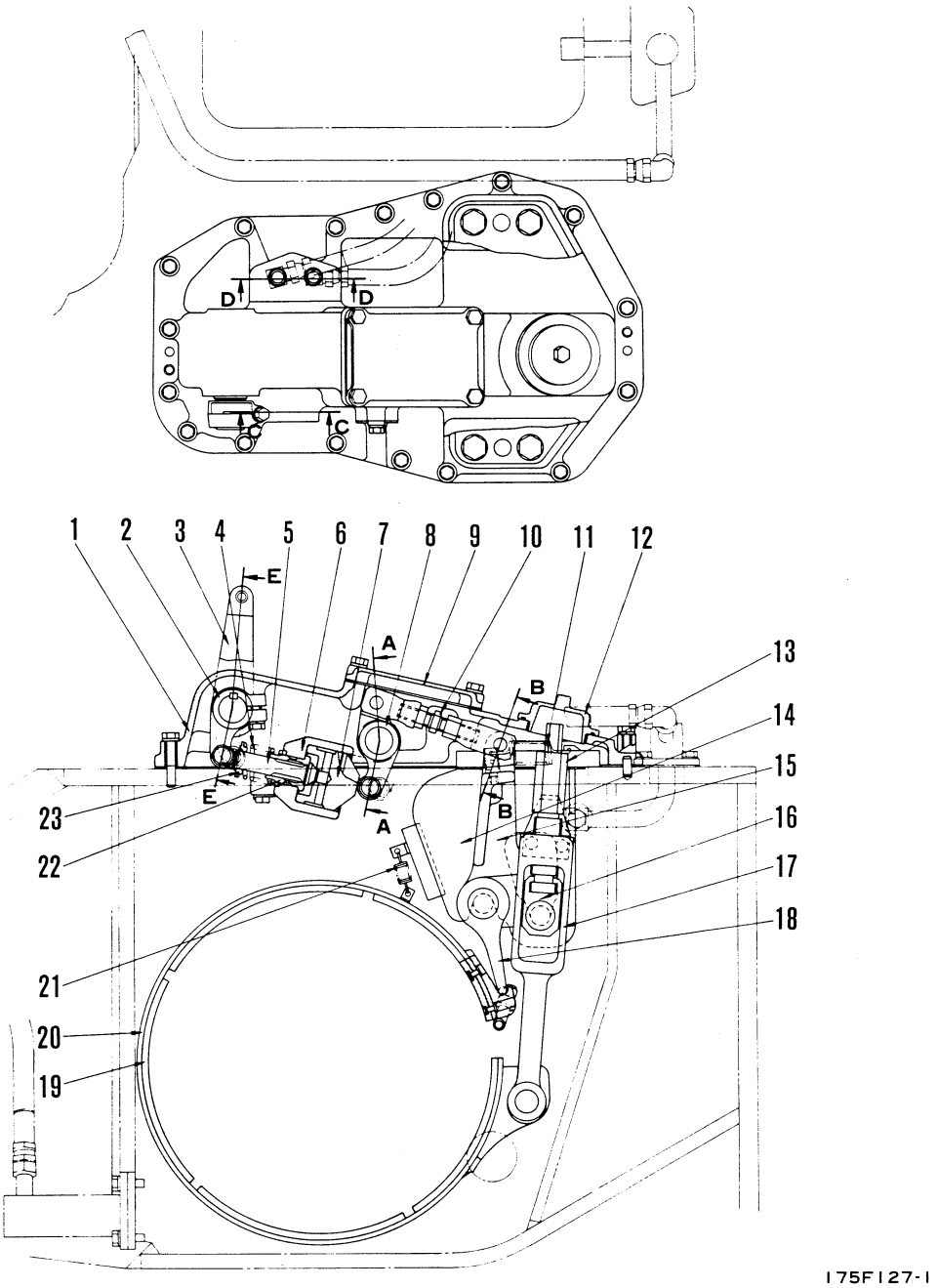
175F101-1A

1. Magnet strainer
2. Steering pump
3. Oil filter
4. Steering main relief valve
5. Steering control valve
   - 5a. Steering valve
   - 5b. Brake valve
6. Steering clutch
7. Brake booster
8. Servo valve
9. Steering case

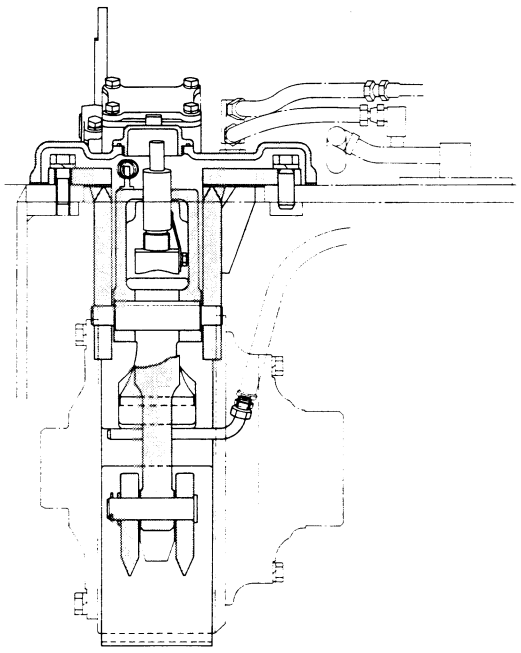
A. Plug for steering main relief pressure
B. Plug for L.H. clutch pressure
C. Plug for R.H. clutch pressure
D. Plug for L.H. brake booster
E. Plug for R.H. brake booster

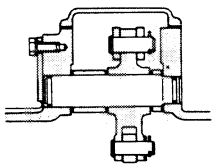
STEERING BRAKE AND BOOSTER

D155A 25001 and up



1. Brake cover
2. Lever
3. Lever
4. Booster spring
5. Booster spool
6. Booster body
7. Booster piston
8. Lever
9. Cover
10. Rod
11. Return spring
12. Cover
13. Adjustment bolt
14. Bracket
15. Lever
16. Block
17. Rod
18. End
19. Brake lining
20. Brake band
21. Relief spring
22. Bushing
23. Retainer

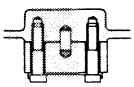




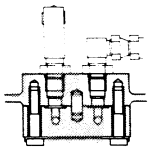
Section A-A



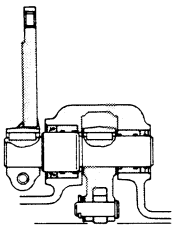
Section B-B



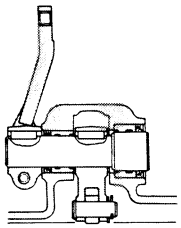
Section C-C



Section D-D



Section E-E



Section E-E

I75F127-1

The steering brake is an oil bath, anchor-type, contracting band brake which can tighten the outer circumference of the brake drum.

Each steering brake has two functions: One is the steering brake function which is interlocked with steering lever operation; the other is service brake operation used for braking the machine during travel.

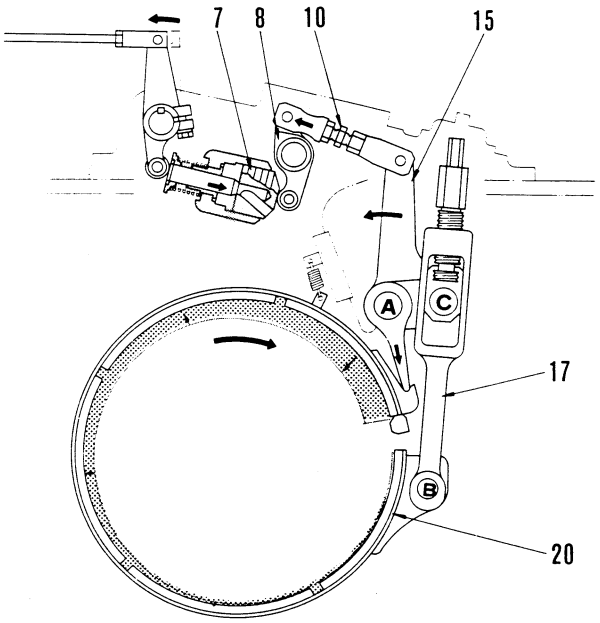
The steering brake can also be used as a parking brake by depressing the middle portion at which the right and left brake pedals overlap and applying the brake lock to keep the pedals depressed.

STEERING BRAKE ENGAGED

D155A 25001 and up

When either the right or left steering lever is pulled part way, the corresponding steering valve operates to disengage the steering clutch. Since some power transmission of the steering clutch remains because of the attendant rotation of the disengaged clutch, the machine will make a gradual turn. When the steering lever is pulled fully, the brake valve corresponding to the steering lever being pulled opens a passage through which oil flows to the brake booster and actuates the steering brake. Also, when a brake pedal is depressed, oil delivered to the brake booster actuates the steering brakes.

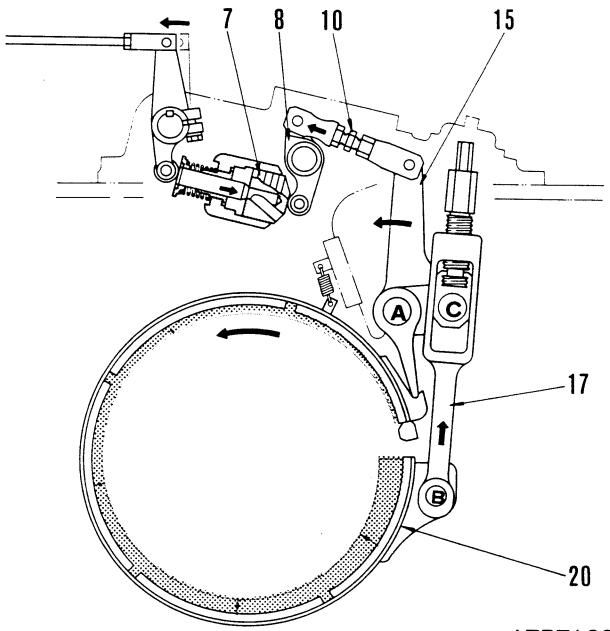
BRAKE OPERATION DURING FORWARD TURNING



175F128

One end of brake band (20) is held on lever (15) at **A** and the other end is on rod (17) at **B**. When the steering lever is pulled fully or the brake pedal is depressed, lever (8) pulls rod (10) and lever (15) in the direction of the arrow ← by piston (7).
As a result, points **A** and **B** tend to move downward and upward, respectively, around fulcrum **C** of the lever. Because of forward-travel turning, point **A** acts as a fulcrum to make the brake band fasten the brake drum, the opposite point **B** being pulled upward.

BRAKE OPERATION DURING REVERSE TURNING

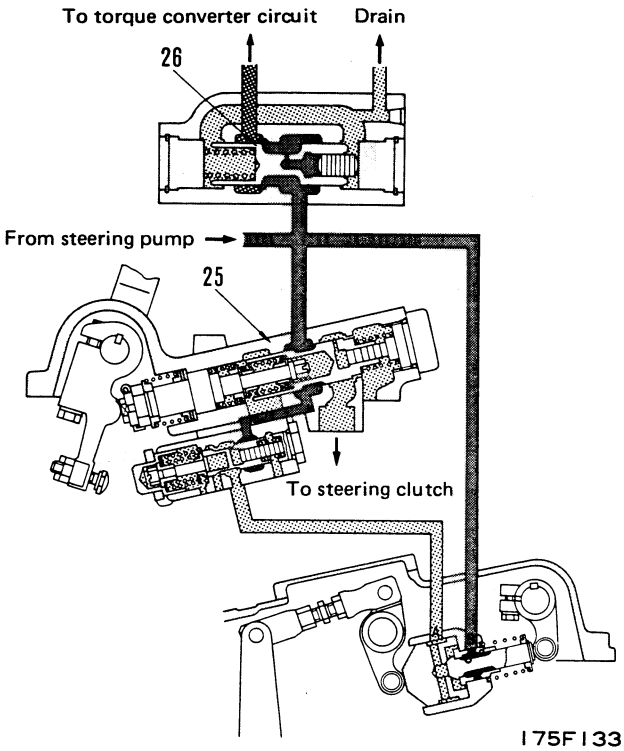


175F129

Like when turning in forward-travel, point **A** and **B** tend to move downward and upward, respectively, when the steering lever is pulled or the brake pedal is depressed. Because of reverse-travel turning, point **B** acts as a fulcrum to make the brake band fasten the brake drum, the opposite point **A** being pushed downward.

OPERATION OF HYDRAULIC BRAKE BOOSTER

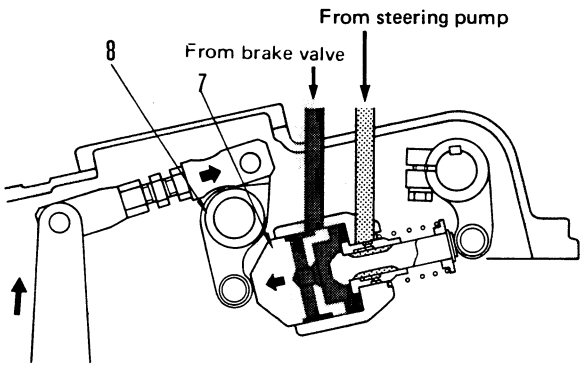
1. **When brake pedal is not depressed, and steering lever is not pulled (brake not applied).**
   If brake valve (25) operates, one oil line from the steering pump flows to port **A**, another oil line flows directly to port **B** without passing through steering valve.
   The steering lever is not being pulled, so valve (25) does not move. The oil does not flow to port **A**, but only flows to port **B**. It then passes through orifice (a) and flows to port **C**. However, the brake pedal is not being depressed, so the flow of oil at port **C** and port **D** is shut off. As a result, the hydraulic pressure rises, and when it exceeds the set pressure of the relief valve (26), it flows to the oil cooler, and the hydraulic pressure is maintained at 22 kg/cm^2.



175F133

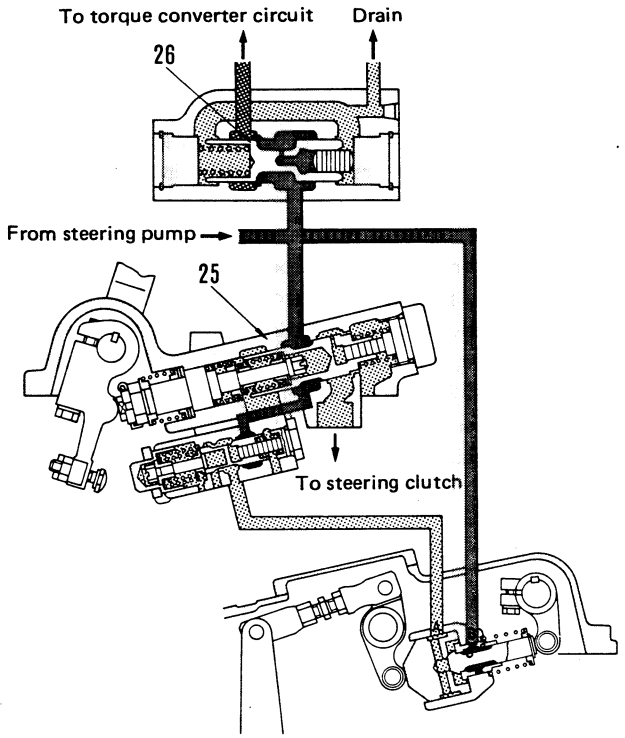
2. **When steering lever is pulled fully (brake applied)**
   Brake valv . (25) operates and oil flows to port **A**. When the hydraulic pressure in the circuit rises, the oil at port **A** pushes piston (7) to the left. Lever (8) moves and applies the brake.
   The hydraulic pressure at this point is 16.7 kg/cm^2.

★ For details of the operation of the steering valve, see page 21-99.



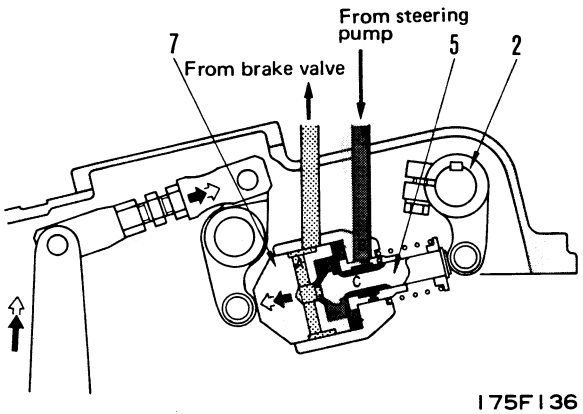
175F134

3. **When brake pedal is depressed (brake applied)**
When the brake pedal is depressed slightly, lever (2) pushes spool (5) to the left, and the flow of oil at port **C** and port **D** is connected. Because of this, the oil from the pump passes from port **B** and flows through orifice (a) to port **C** and **D**.



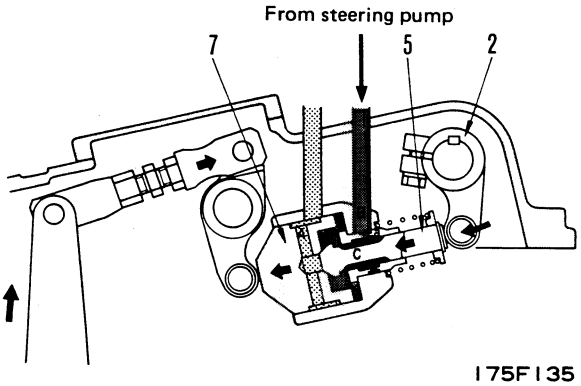
I75F133

When the hydraulic pressure at port **D** rises, it pushes piston (7) to the left and connects the flow of oil at port **D** and port **A**. The oil then drains from port **A** to the steering case. The brake pedal travels the same distance that piston (6) moves by slight depressing force. This movement of the piston (6) and pedal, and the oil flow is repeated over a short period (follow-up movement).



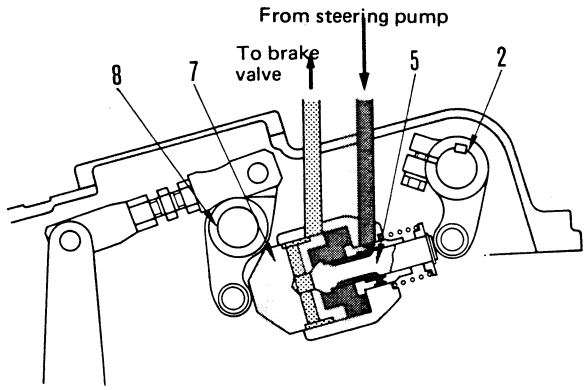
I75F136

Spool (5) moves further to the left and connects the flow of oil at port **B** and port **D**. The volume of oil flowing to port **D** increases and piston (7) moves faster. Piston (7) continues to push lever (8), then brake band contracts smoothly and the brake is applied.
In this way, the hydraulic pressure rises in two stages. At first, the oil pushes piston (7) lightly, and when the flow of oil at port **D** and port **B** is connected, it pushes strongly. This prevents the brake from being applied suddenly.



175F135

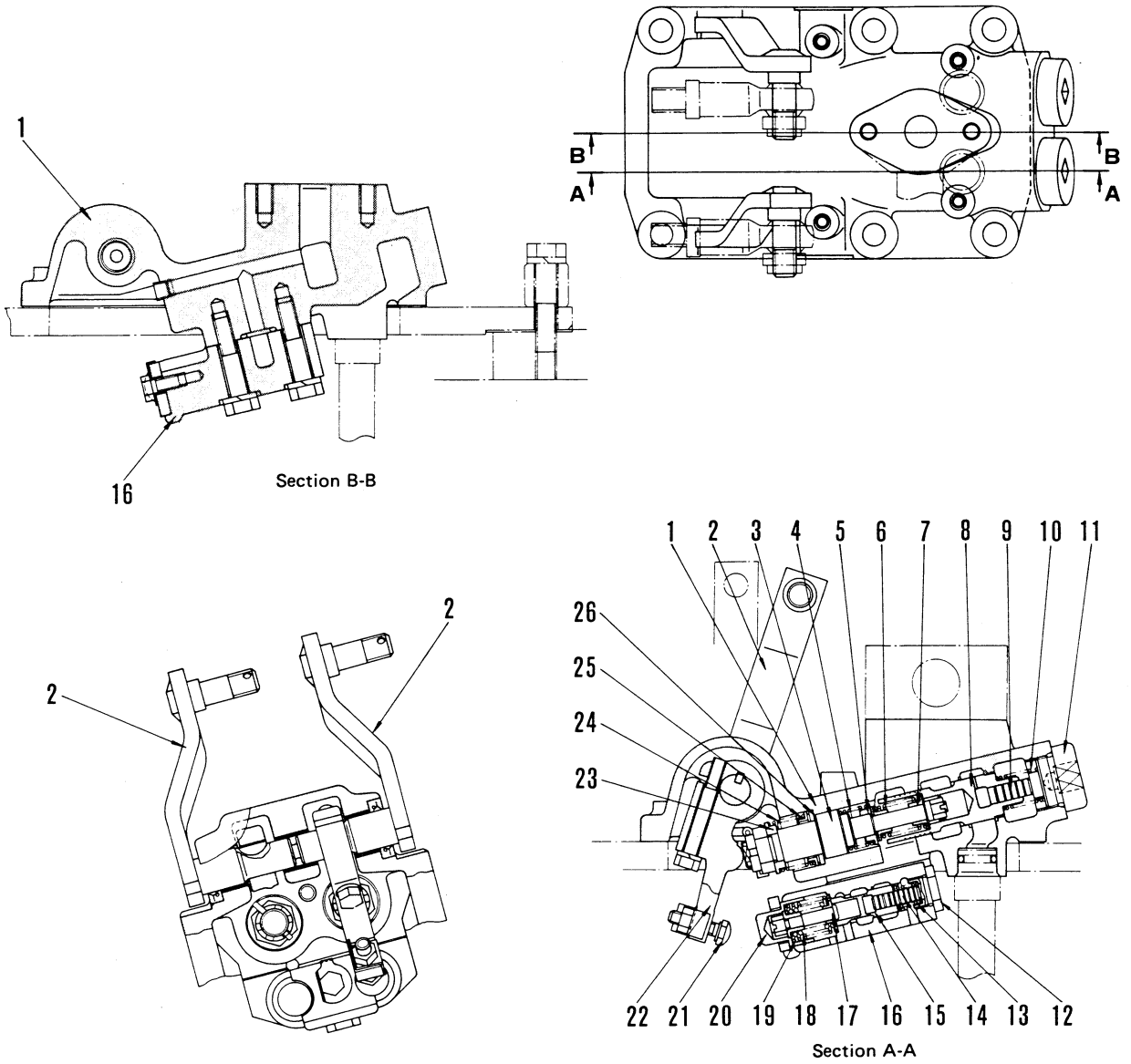
4. **When brake pedal is depressed fully (brake applied)**
When the brake pedal reaches the end of its travel, the flow of oil at port **D** and port **A** remains shut off, and the hydraulic pressure rises further. When the pressure reaches 22 kg/cm^2, the main relief valve functions and the oil flows into the lubrication circuit.



175F137

STEERING CONTROL VALVE

D155A 25001 and up



175F112

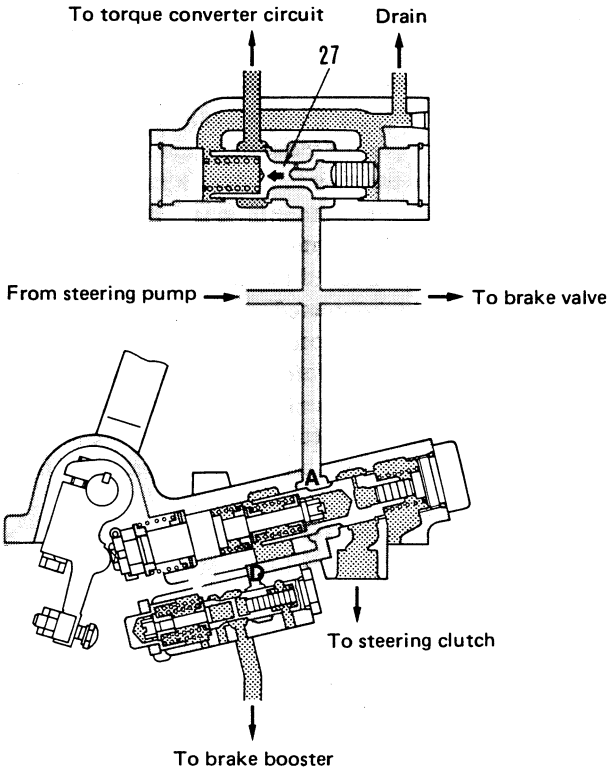
1. Valve body
2. Lever
3. Shaft
4. Spring
5. Stopper
6. Modulating spring
7. Stopper
8. Steering valve
9. Piston
10. Return spring
11. Plug
12. Plug
13. Return spring
14. Piston
15. Brake valve
16. Valve body
17. Shaft
18. Modulating spring
19. Return spring
20. Guide
21. Adjusting bolt
22. Lever
23. Stopper
24. Return spring
25. Stopper
26. Spacer

GENERAL DESCRIPTION

When the steering lever is pulled, the steering clutch is first released. Pulling the lever further causes the brake to be applied to stop the machine travel.
This system, called an interlocked steering clutch and brake, replaces the conventional system which exclusively relied on the control linkage.
From serial No. 25001, the conventional steering valve type has been discontinued. The steering valve and brake valve have been integrated to from the steering control valve using lever (22) for interlocked operation. The setting pressure upon completion of modulation of the steering valve and the setting pressure upon completion of modulation of the brake valve are both 16 to 17 kg/cm^2.
The steering main relief pressure is set at 22 kg/cm^2.

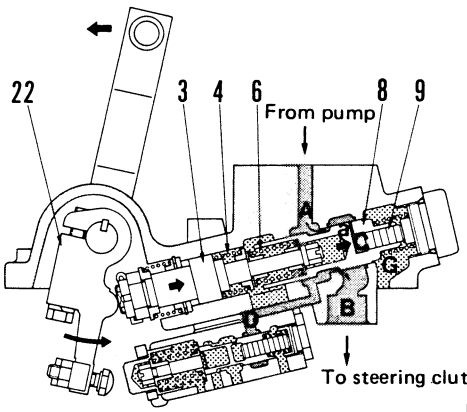
FUNCTION

1. **When the steering and brake valves are in neutral;**
   The oil from the steering pump enters main relief valve (27) and ports **A** and **D** of the steering control valve.
   Since the circuits to the steering clutch and brake booster are closed, only the oil pressure in the circuit rises.
   As a result, main relief valve (27) opens, and the oil flows to the torque converter circuit.
   If the steering lever at the operator's seat is not operated, oil is continuously relieved to keep the clutch applied and the brake released. The oil pressure in the circuit in this state is 22 kg/cm^2.

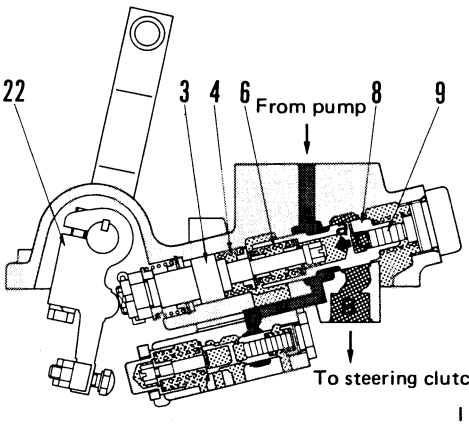


175F113

2. **When the oil pressure at the steering valve starts to rise;**
   When the steering lever is pulled, lever (22) pushes shaft (3) in th direction of the arrow → to compress the spring. The reaction force of compressed spring (6) pushes steering valve (8) in the direction of the arrow → to close the circuit between ports **B** and **G**. The path between ports **A** and **B** opens at the same time, and the oil flows to the steering clutch.
   When the circuit from the pump to the clutch is filled with oil the oil pressure starts to rise again.
   The oil entering port **C** through orifice "a" pushes piston (9), and the reaction force pushes back steering valve (8) in the direction of the arrow ← to compress spring (6) and close the path between ports **A** and **B**.
   In this state, the oil pressure in the circuit from port **B** to the clutch balances with the installed load of spring (6) to keep the oil pressure at a constant level. When the steering lever is pulled further, the installed load of spring (6) gradually increases to increase oil pressure in the circuit from port **B**. As a result, the clutch is partially applied.

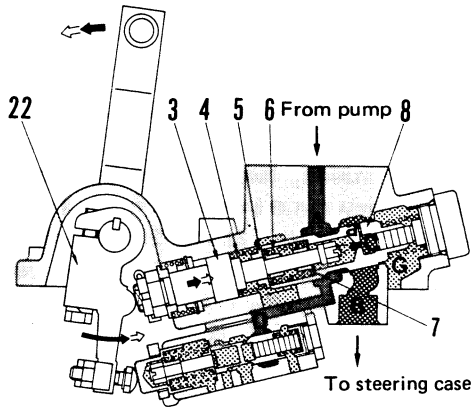


175F114

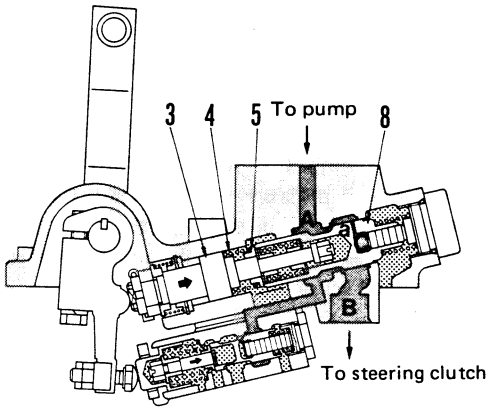


175F115

3. **When the oil pressure at the steering valve rises to the maximum level;**
When the steering lever is pulled further from the state explained in paragraph 2, stopper (7) comes into contact with steering valve (8) and spring (6) assumes the minimum installation height. In this state, shaft (3) starts to push steering valve (8) via spring (4) so taht the force required to operate the steering lever rises sharply.
When the steering lever is pulled further, shaft (3) compresses spring (4) to gradually increase the installation load and the oil pressure in the circuit after port **B**.
When the installation load of spring (4) is maximized and the oil pressure in the circuit becomes 16 kg/cm^2, the steering valve modulation ends and the clutch is released.

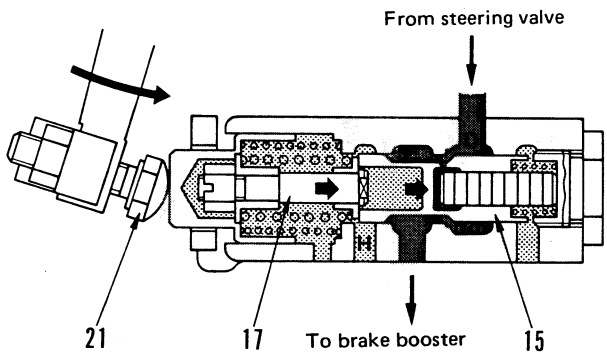


175F116

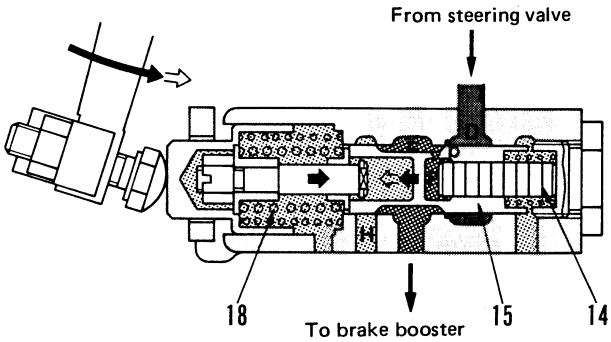


175F117

4. **When the oil pressure at the brake valve starts to rise;**
When the steering lever is pulled further from the state explained in paragraph 3, adjustment bolt (21) moves shaft (17) in the direction of the arrow → to push brake valve (15).
The path between ports **E** and **H** is closed and the path between ports **D** and **E** is opened so that the oil flows to the brake booster. On the other hand, the oil entering port **F** through orifice "b" pushes piston (14). The reaction force pushes back brake valve (15) in the direction of the arrow ← to contract spring (18) and close the path between ports **D** and **E**. In this state, the oil pressure in the circuit from port **E** to the booster balances the installation load of spring (18) to keep the oil pressure at a constant level.
When the steering lever is pulled further from this state, the installation load of spring (18) increases gradually and the oil pressure after port **E** rises to start operation of the brake.

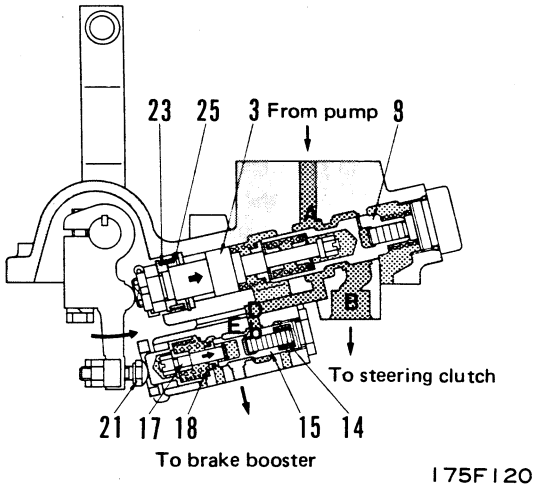


175F118

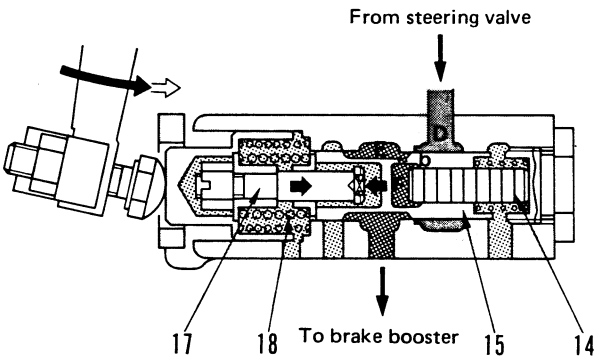


175F119

5. **When the oil pressure at the brake valve reaches the maximum level;**
When the steering lever is pulled to its stroke end, shaft (3) moves in the direction of the arrow → until it contacts stoppers (23) and (25). Steering valve (8) does not move any further. Adjustment bolt (21) moves shaft (17) in the direction of the arrow → to push brake valve (15). Shaft (17) does not reach the stroke end even when shaft (3) reaches the stroke end, and the oil entering port **F** via orifice "b" of brake valve (15) pushes piston (14).
The reaction force pushes back brake valve (15) in the direction of the arrow ← to compress spring (18) and close the path between ports **D** and **E**.
In this state, the oil pressure in the circuit from port **E** to the booster balances with the tension of spring (18), reaching the maximum installation load so that the oil pressure is kept at a constant level and the brake operation is completed.
The oil pressure in the circuit after port **E** in this state is 16.9 kg/cm^2.

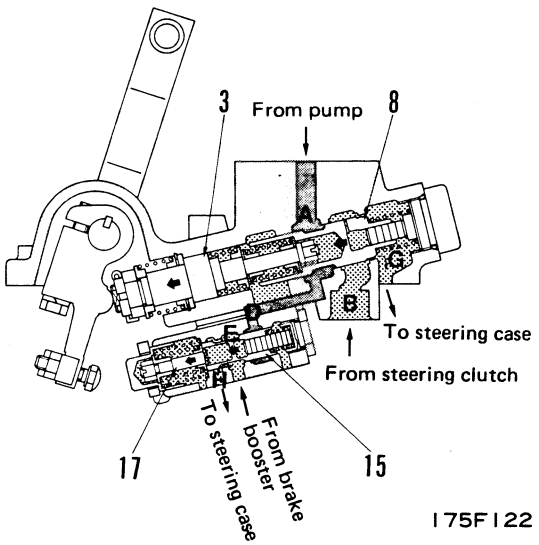


I75F120



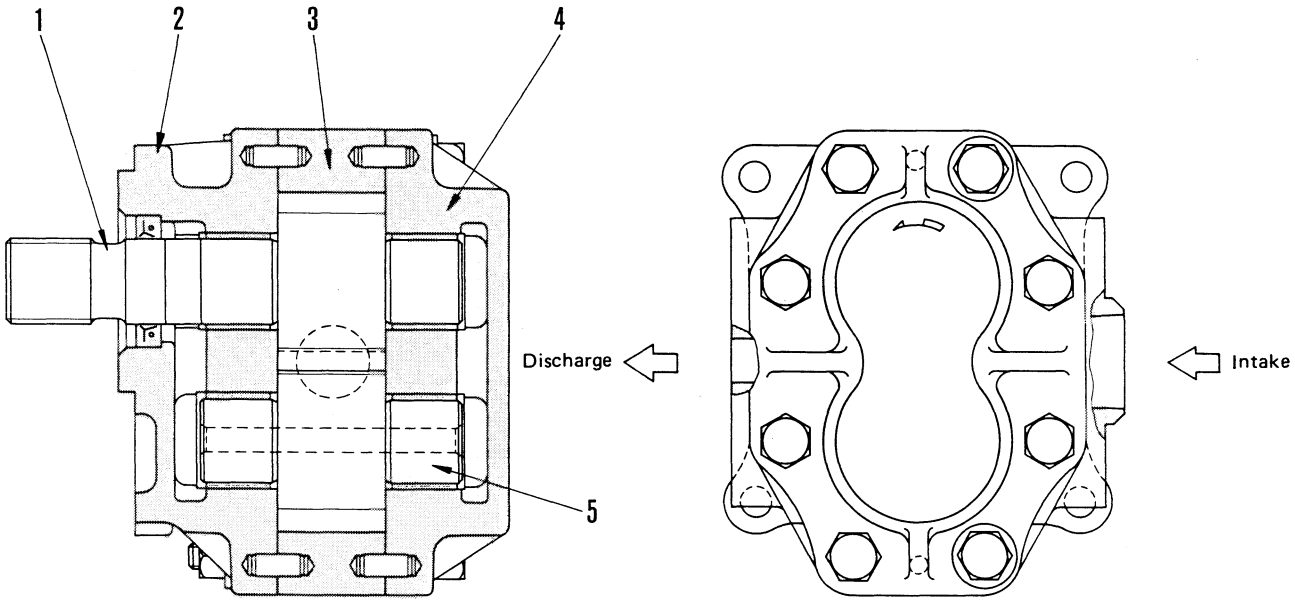
I75F121

6. **When steering and brake valves are in neutral;**
When the steering lever is released, the tension of each spring returns shaft (3), shaft (17), brake valve (15) and steering valve (8) in the direction of the arrow ←.
Steering valve (8) then closes the path between ports **A** and **B** and opens the path between ports **B** and **G** so that the oil in the steering clutch is drained to the steering case via port **G**.
Brake valve (15) closes the path between ports **D** and **E** and opens the path between ports **E** and **H** so that the oil in the brake booster is drained to the steering case via port **H**.



I75F122

STEERING PUMP



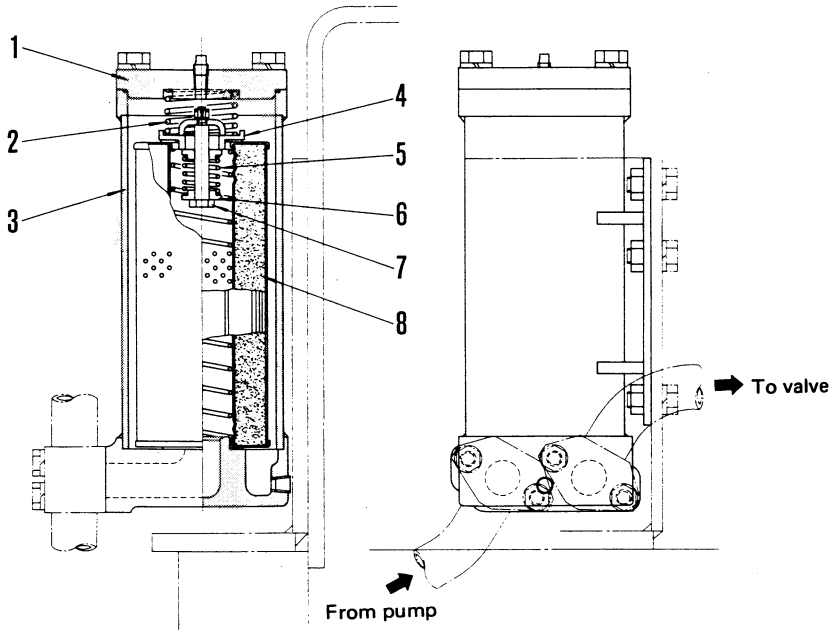
21F116

1. Drive gear
2. Bracket
3. Gear case
4. Housing
5. Driven gear

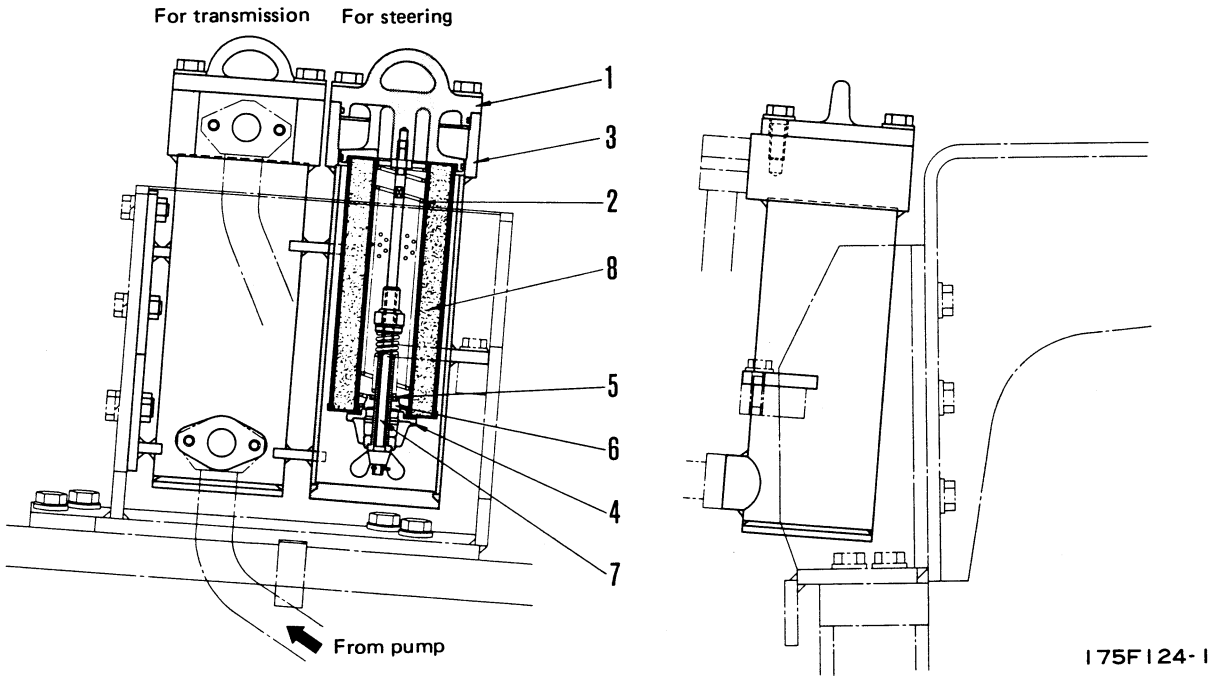
Pump type: FAR100
Flow: 172.5 ℓ/min (at 1,725 rpm)

STEERING OIL FILTER

D150A 8408 and up
D155A 15001 ~ 25000



D155A 25001 and up

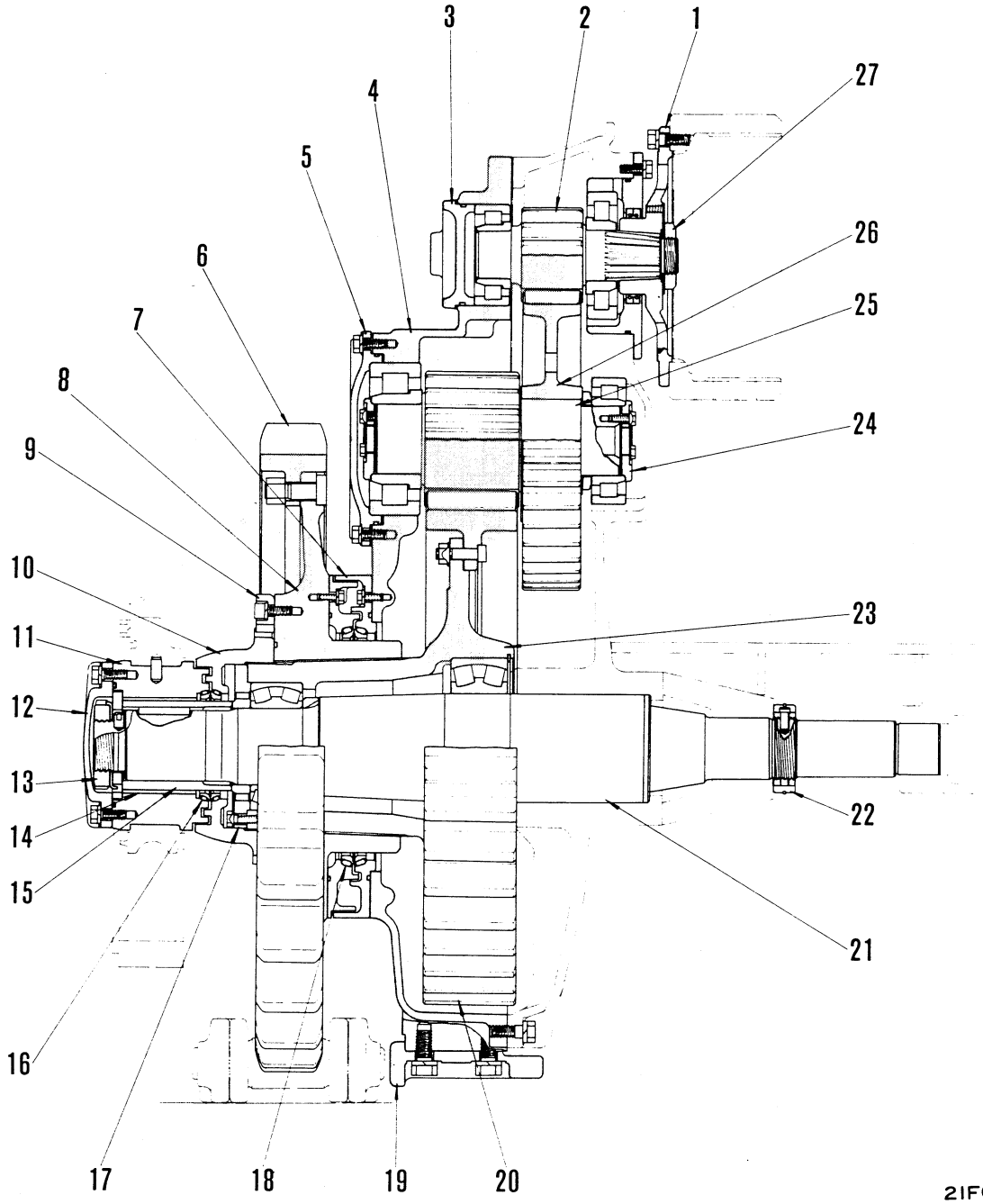


1. Filter cover
2. Spring — Installation length: 35.5 mm; Free length: ; Installation load: 10 kg
3. Filter case
4. Cage
5. Spring — Installation length: 26.0 mm; Free length: ; Installation load: 4.95 kg
6. Sleeve
7. Center bolt
8. Element

Cracking pressure: 1.21 kg/cm²
Flow: 172.5 ℓ/min

FINAL DRIVE

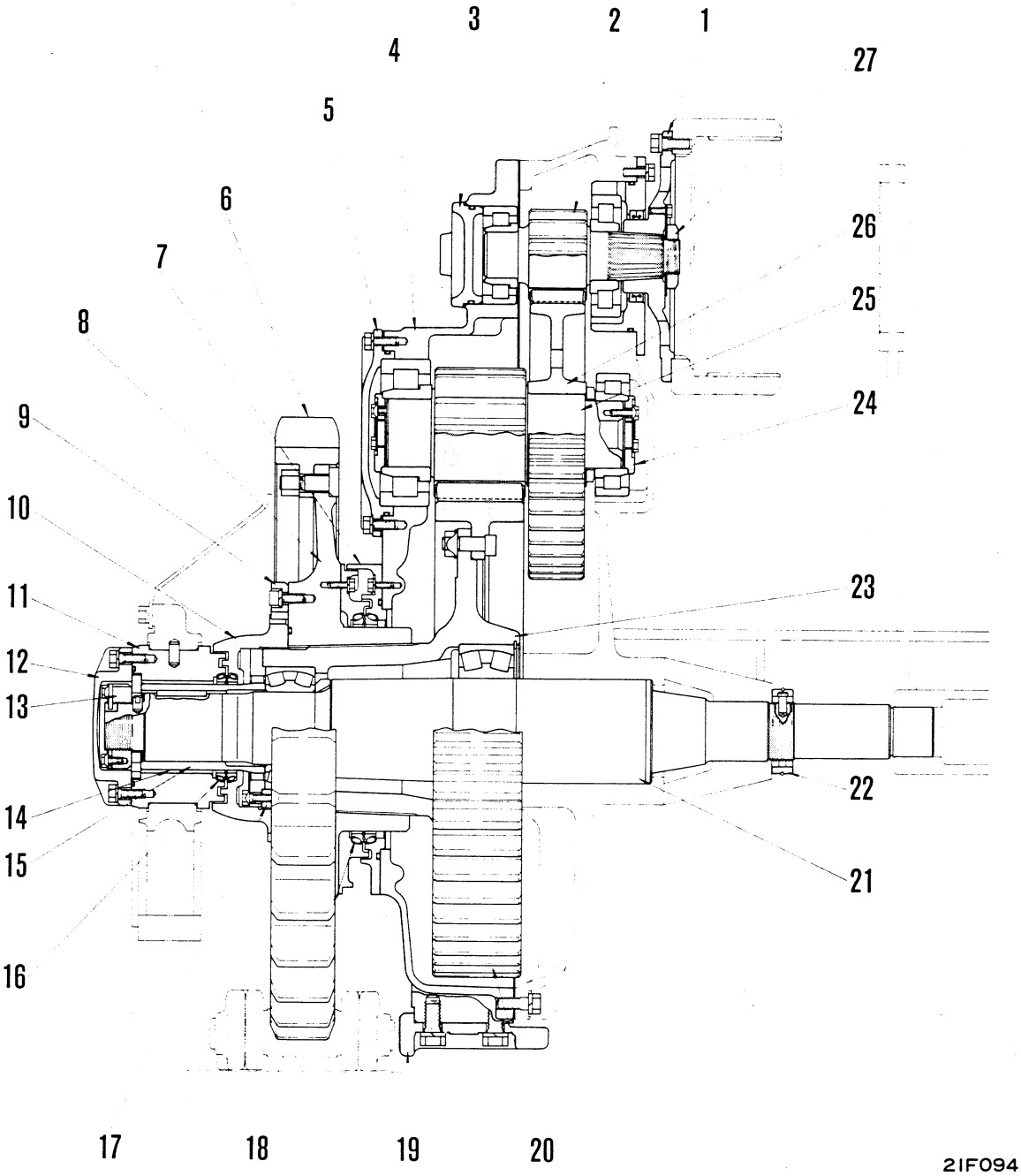
D150A 8408 ~ 8420
D155A 15001 ~ 17000



21F093

1. Final drive flange
2. Primary pinion (12 teeth)
3. Cover
4. Final drive case
5. Cover
6. Segment teeth
7. Seal guard
8. Sprocket boss
9. Stopper
10. Sprocket nut
11. Sprocket support
12. Cover
13. Nut
14. Bushing
15. Color
16. Floating seal
17. Retainer
18. Floating seal
19. Guard
20. Secondary gear (55 teeth)
21. Sprocket shaft
22. Nut
23. Sprocket hub
24. Holder
25. Secondary pinion (12 teeth)
26. Primary gear (45 teeth)
27. Flange nut

D150A 8421 and up
D155A 17001 and up



21F094

1. Final drive flange
2. Primary pinion (12 teeth)
3. Cover
4. Final drive case
5. Cover
6. Segment teeth
7. Seal guard
8. Sprocket boss
9. Stopper
10. Sprocket nut
11. Sprocket support
12. Cover
13. Nut
14. Bushing
15. Color
16. Floating seal
17. Retainer
18. Floating seal
19. Guard
20. Secondary gear (55 teeth)
21. Sprocket shaft
22. Nut
23. Sprocket hub
24. Holder
25. Secondary pinion (12 teeth)
26. Primary gear (45 teeth)
27. Flange nut

Model D150, 155A employes the two-step reduction method using spur gears, and splash lubrication the gear rotation is used.

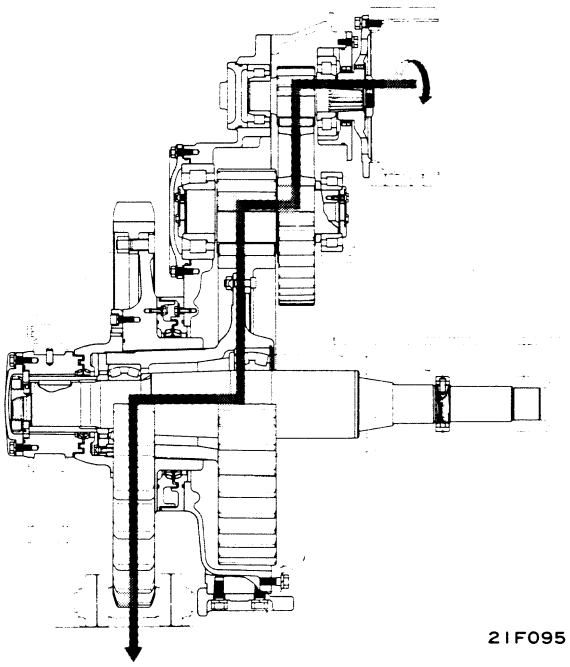
Power from the axle and steering system is transmitted through the clutch outer drum (brake drum) to fianl drive flange (1), rotating primaty pinion (2) on the flange.

The primary pinion engages with primary gear (26), rotating the secondary pinion (25) on the gear shaft.

Power is further transmitted from the secondary pinion to secondary gear (20) engaging with the secondary pinion, with speed reduction effected at the same time.

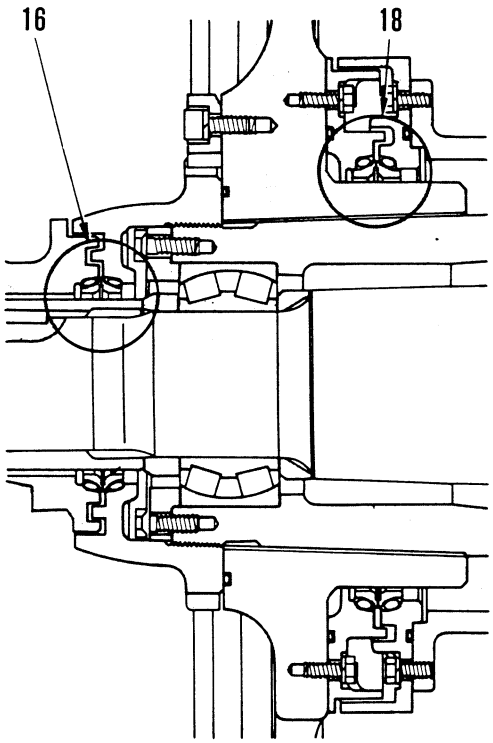
Due to the construction in which the secondary gear is bolted on final drive hub (23), into which sprocket boss (8) is pressed in by the tapper serration, the rotation of the secondary gear turns itself into the rotation of the sprocket boss.

Sprocket teeth (6), is tightened with nuts and bolts on sprocket boss.



21F095

Final drive case (4) functions as a lubricating oil tank for each gear. The rotating sliding parts of the sprocket are equipped with floating seals (16) and (18) in order to prevent entry of dust or mud, and oil leakage.



21F096

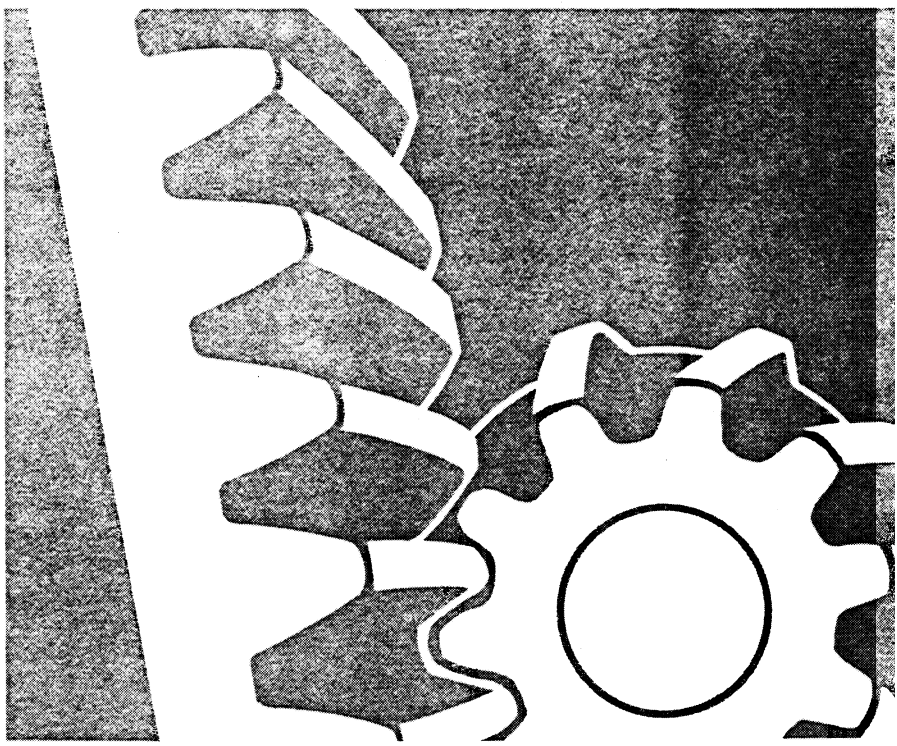
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

22 POWER TRAIN

TESTING AND ADJUSTING



TESTING AND ADJUSTING

General 22- 2
Main clutch hydraulic control 22- 4
TORQFLOW hydraulic control 22- 6
Steering hydraulic control 22- 8
Brake hydraulic control 22-10
Table of oil pressure measuring points 22-12
Measurement of oil pressure and temperature 22-15
Measurement procedure of oil pressure and temperature ... 22-20
Lever and pedal travel 22-24
Operating force 22-24
Table of standard 22-26

GENERAL

The following describes inspection and adjustment procedures for locating trouble in the power train and for checking after rebuilding.
When measurement of the hydraulic circuit is required, be sure to use measuring tool No. 790-301-1102.
In any inspection, it is advisable to oberve the sequence of VISUAL CHECK-OPERATION CHECK. Inspection using the measuring instruments is to be carried out last.

VISUAL CHECK

1. Check oil level
   (1) Main clutch case
   (2) Steering case
   (3) Final drive
2. Check for oil leakage and damages
   (1) Check for oil leakage or damage in the exposed oil line, connected parts, and external valves.
3. Check after adjustment
   (1) Check for damage in the main clutch, the transmission control linkage, and the control linkage between the steering and brake. Check also if the adjustment is carried out adequately.
   (2) Check the tension of the track shoe.
4. Check for dirty oil, blockage, foreign matter
   (1) Check for any blockage by foreign matter in the transmission and steering oil filter element and strainer.
   Take the following items into consideration:
   a. Adherence of iron powder or copper chips. — Due to transmission trouble.
   b. Existance of copper colored metal powder. — Due to clutch trouble.
   c. Lustrous metal powders are found on filter element. — Due to damaged gear pump.
   d. Aluminum powder found on filter element. — Due to trouble in torque converter.
   e. Rubber fragments found at filter element. — Due to damaged seal or hose.
   When metal or rubber fragments are found, clean all hydraulic system components and repair those damaged.

OPERATING CHECK

Start the engine and shift gear lever to each of the gear positions. It must click securely in place at all positions.
Check by operating machine both forward and reverse in all gears, one after another. If any abnormality is found gate it.



WARNING

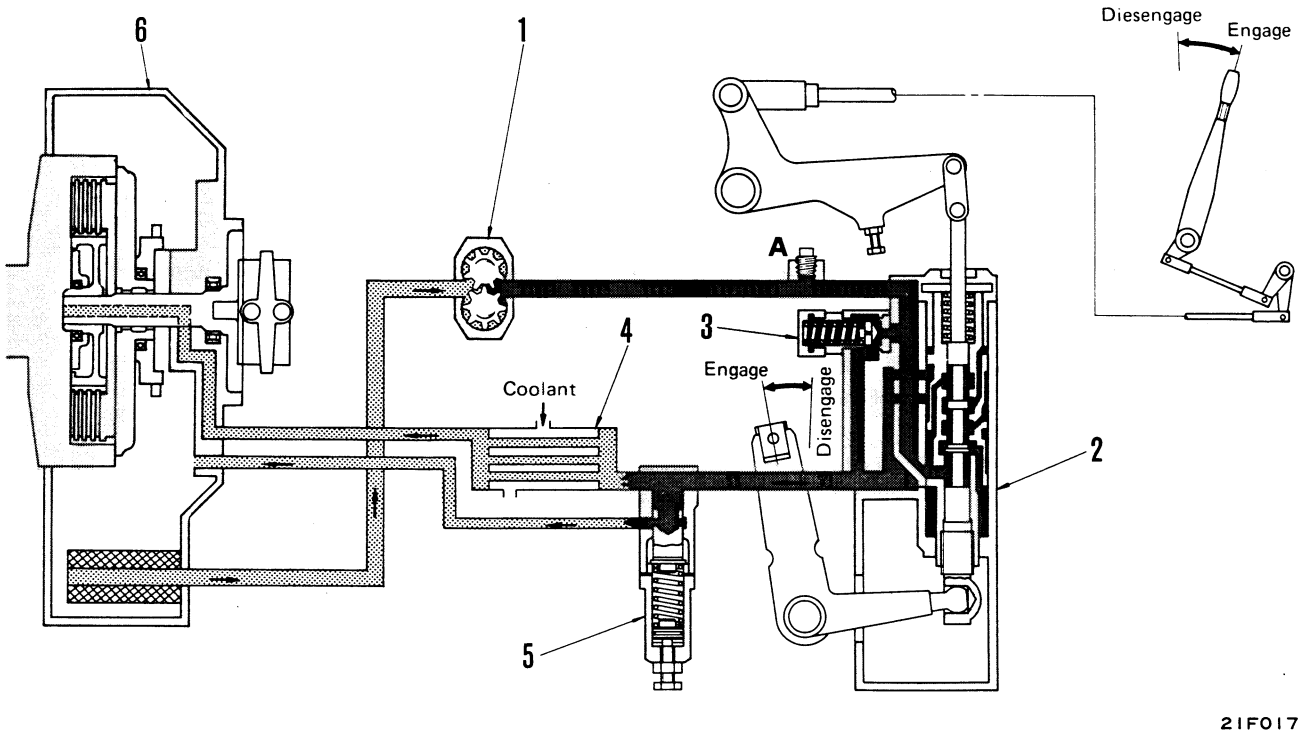
When only narrow and restricted space is available for carrying out inspection, be sure to apply the brake, and chock the front and rear wheels to prevent machine from moving while inspection is being done. Take care not to allow unauthorized persons, unconnected with the inspection to come close.

★ Before carrying out each inspection and adjustment on the hydraulic system, confirm that:
  (1) Oil temperature in the system is at the correct level.
  (2) Oil linkage is adequately adjusted.
  (3) Oil level is normal.

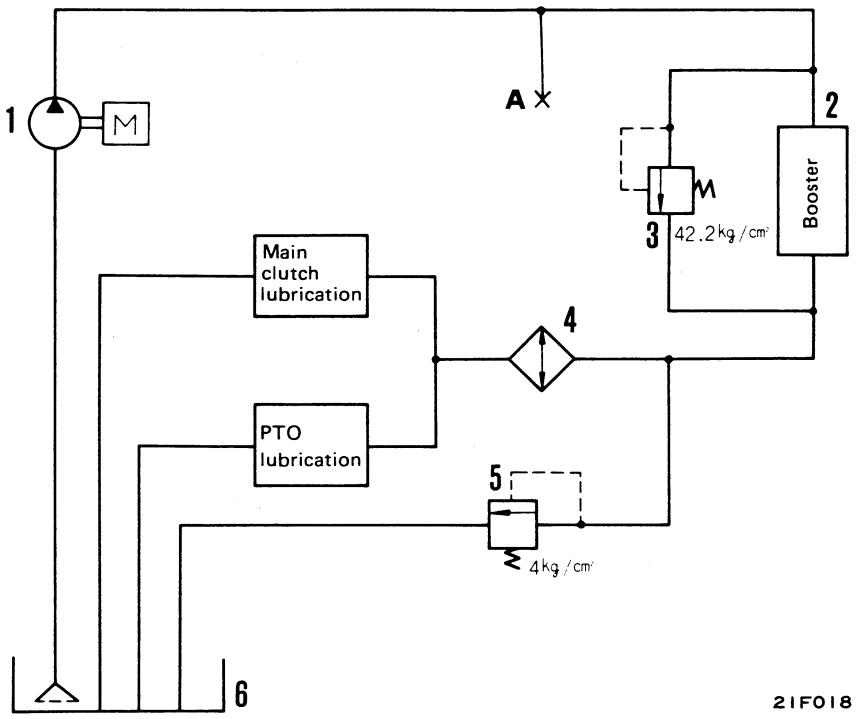
★ Never change fuel injection pump setting with engine on machine to get the above stall speed.
  Be sure to adjust fuel injection pump using test stand.

MAIN CLUTCH HYDRAULIC CONTROL

D150A 8408 and up



D150A 8408 and up



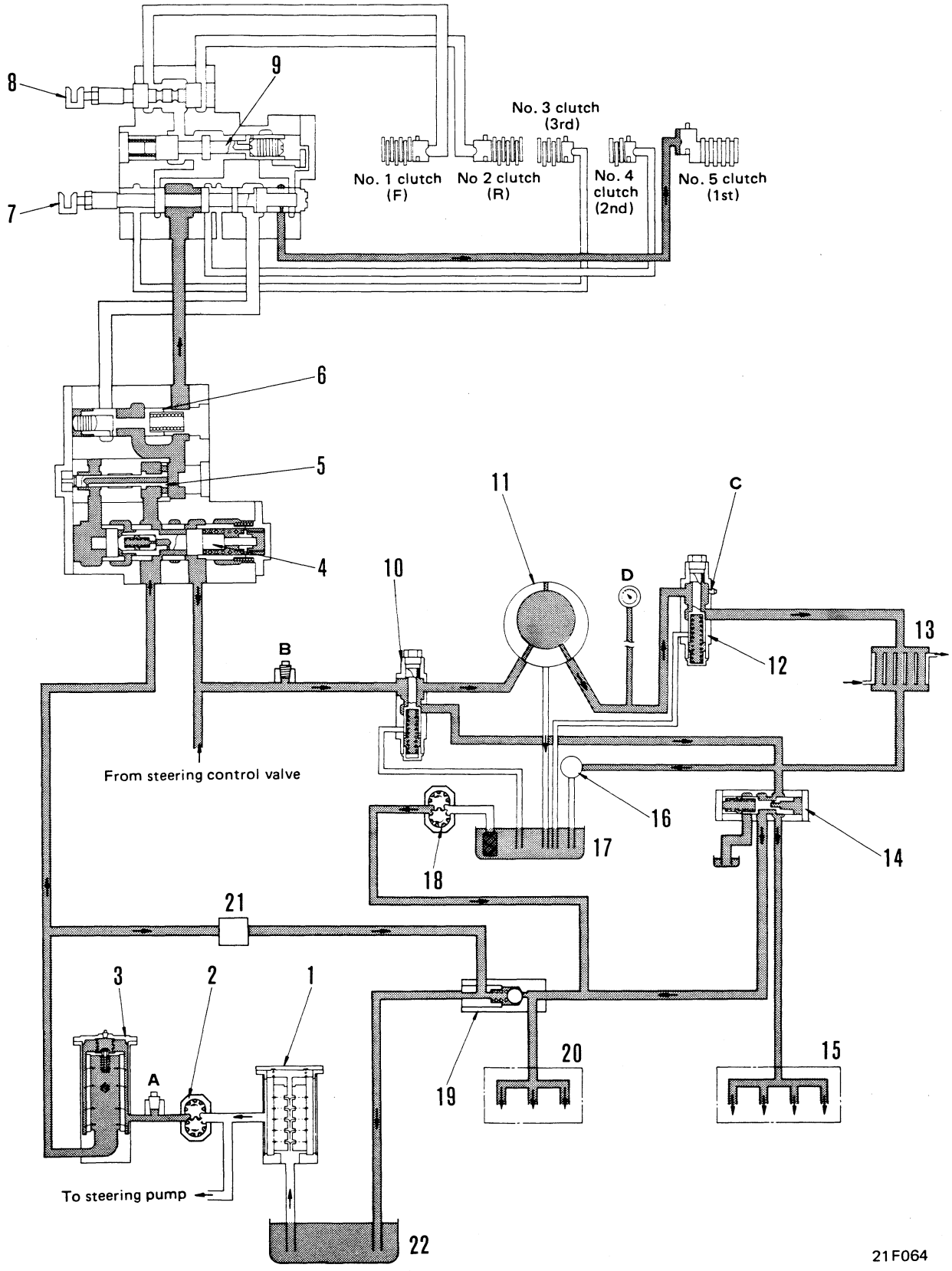
1. Main clutch pump
2. Main clutch booster
3. Main relief valve
4. Oil cooler
5. Lubrication relief valve
6. Flywheel case

A. Plug for main clutch booster pressure (PT 1/8)

TORQFLOW HYDRAULIC CONTROL

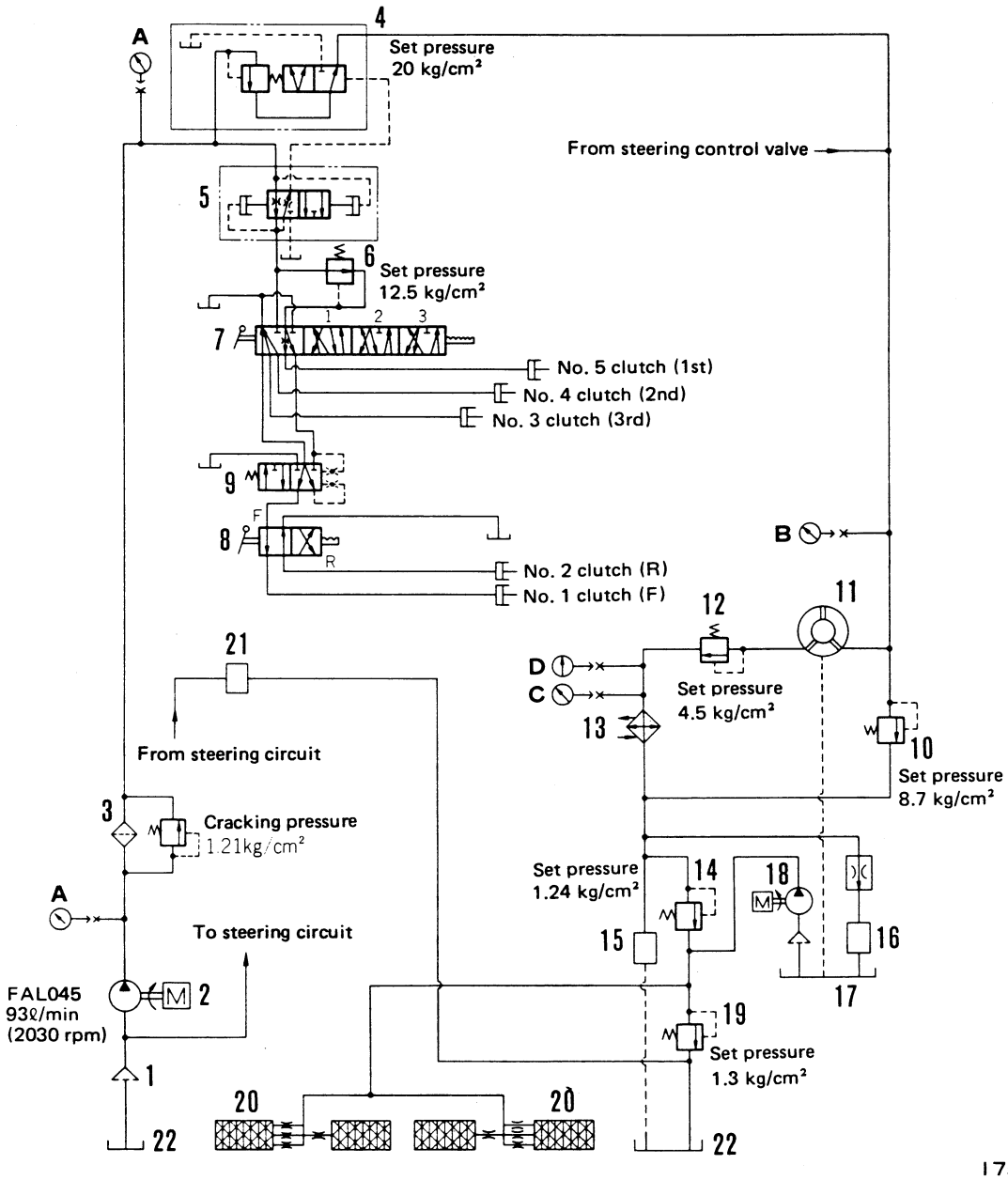
D155A 15001 ~ 25000

NEUTRAL



21F064

D155A 15001 – 25000



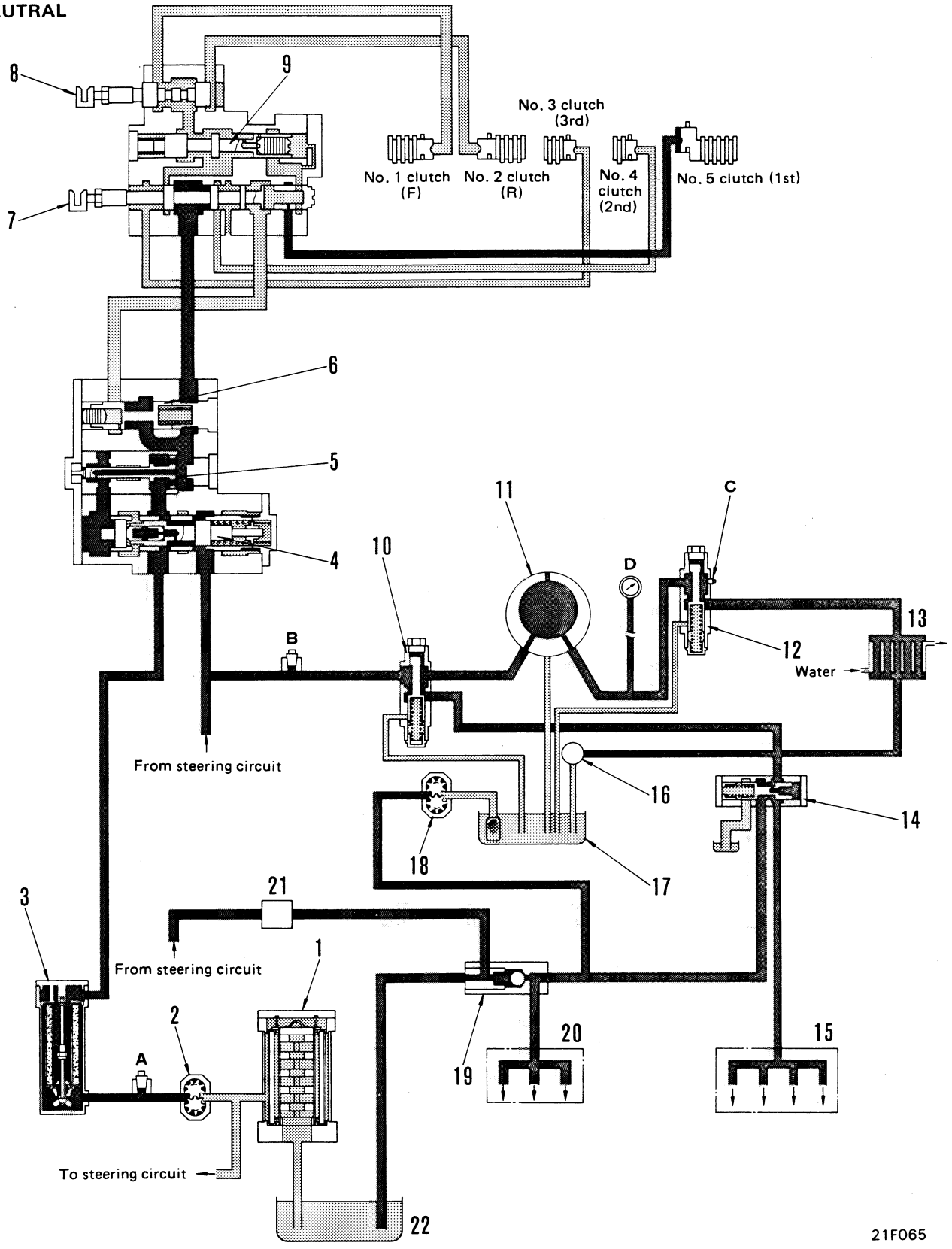
I75F075-1

1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
5. Quick return valve
6. Reducing valve
7. Speed valve
8. Directional valve
9. Safety valve
10. Torque converter relief valve
11. Torque converter
12. Regulator valve
13. Oil cooler
14. Transmission lubrication valve
15. Transmission lubrication
16. P.T.O. lubrication
17. Torque converter case
18. Scavenging pump
19. Brake lubrication valve
20. Brake lubrication
21. Servo valve
22. Steering case

A. Plug for transmission clutch pressure (PT1/8)
B. Plug for relief pressure (PT1/8)
C. Plug for regulator pressure (PT1/8)
D. Oil temperature gauge

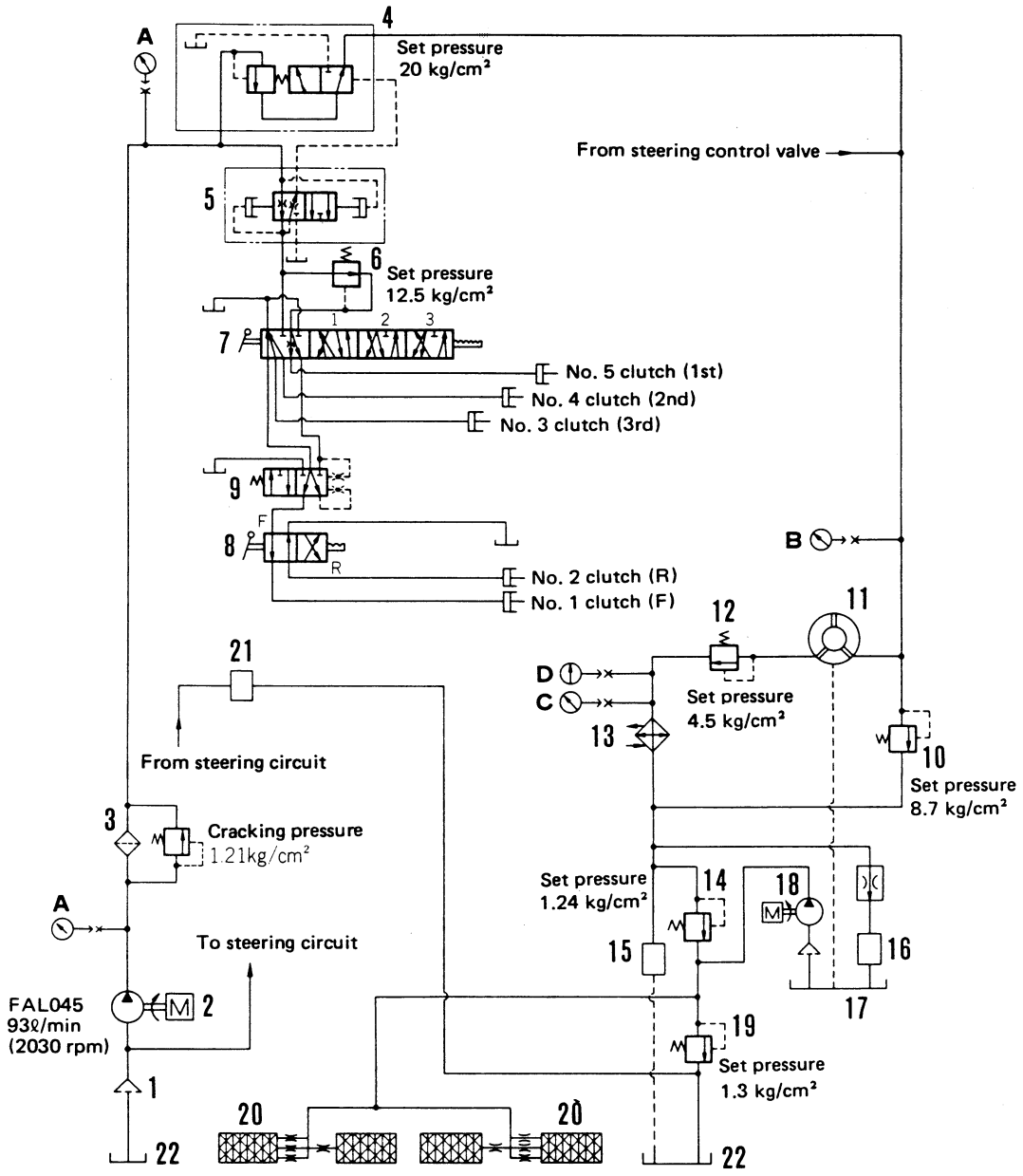
D155A 25001 – 29764

NEUTRAL



21F065

D155A 25001 – 29764

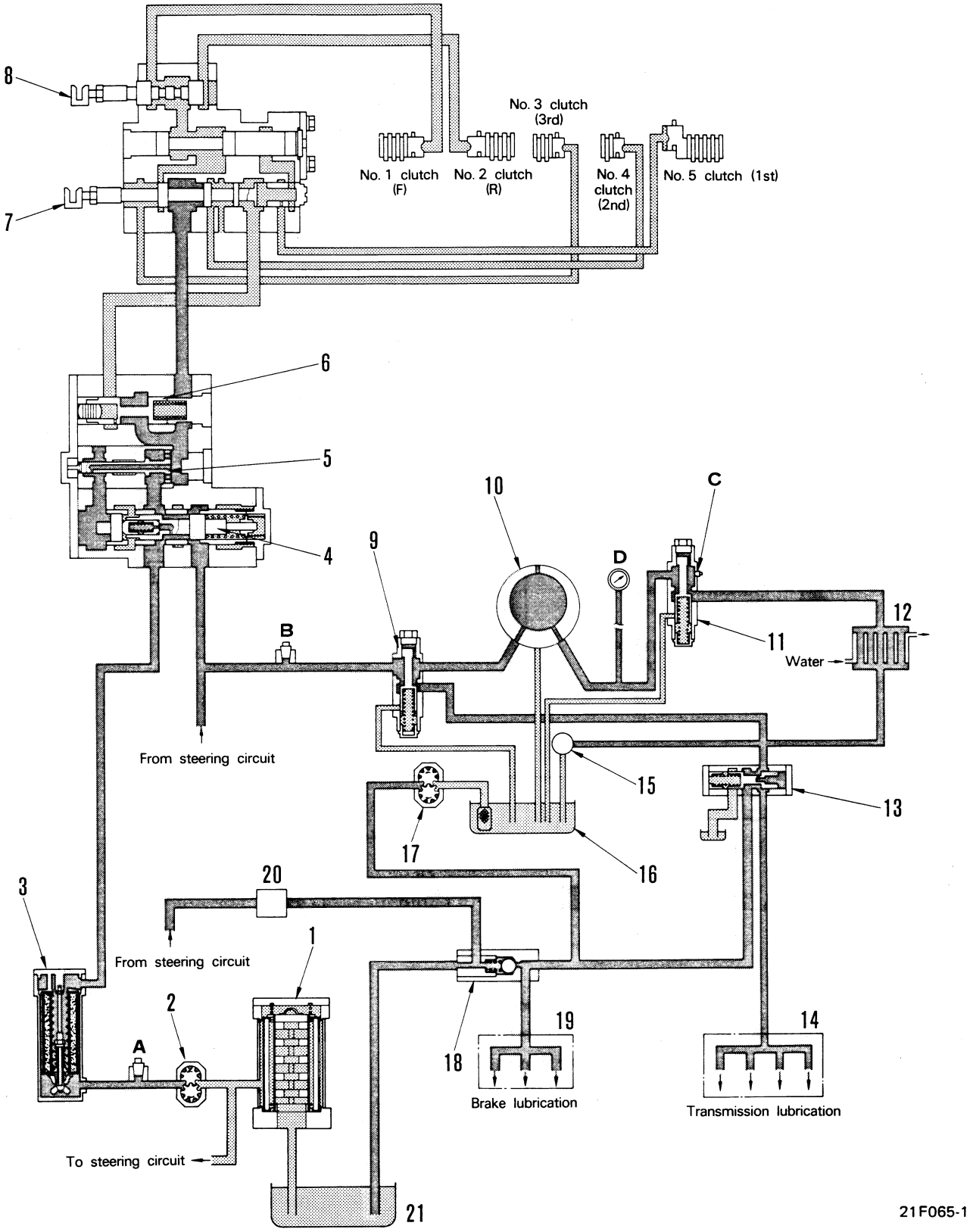


1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
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7. Speed valve
8. Directional valve
9. Safety valve
10. Torque converter relief valve
11. Torque converter
12. Regulator valve
13. Oil cooler
14. Transmission lubrication valve
15. Transmission lubrication
16. P.T.O. lubrication
17. Torque converter case
18. Scavenging pump
19. Brake lubrication valve
20. Brake lubrication
21. Servo valve
22. Steering case

A. Plug for transmission clutch pressure (PT1/8)
B. Plug for relief pressure (PT1/8)
C. Plug for regulator pressure (PT1/8)
D. Oil temperature gauge

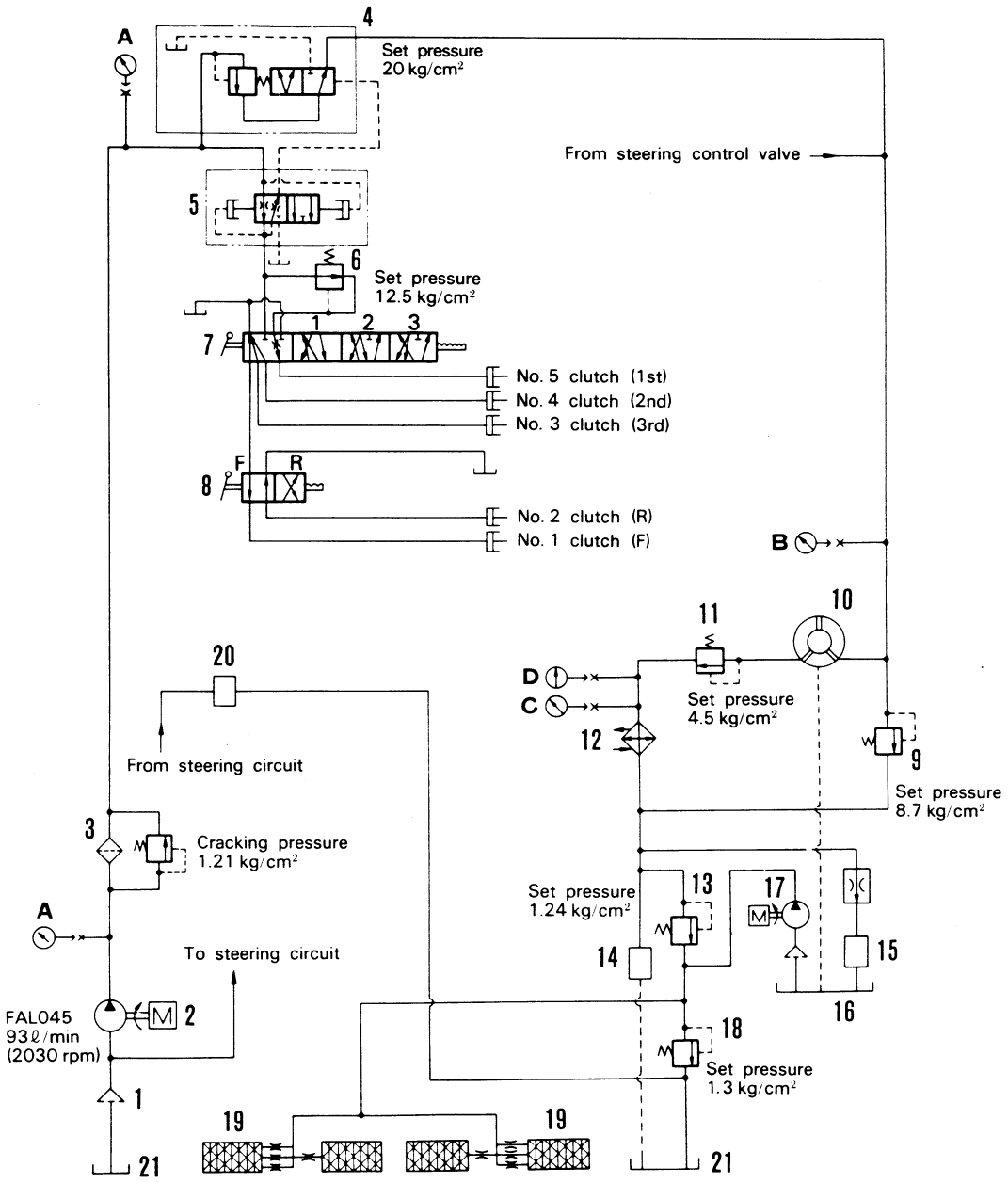
D155A 29765 and up

NEUTRAL



21F065-1

D155A 29765 and up



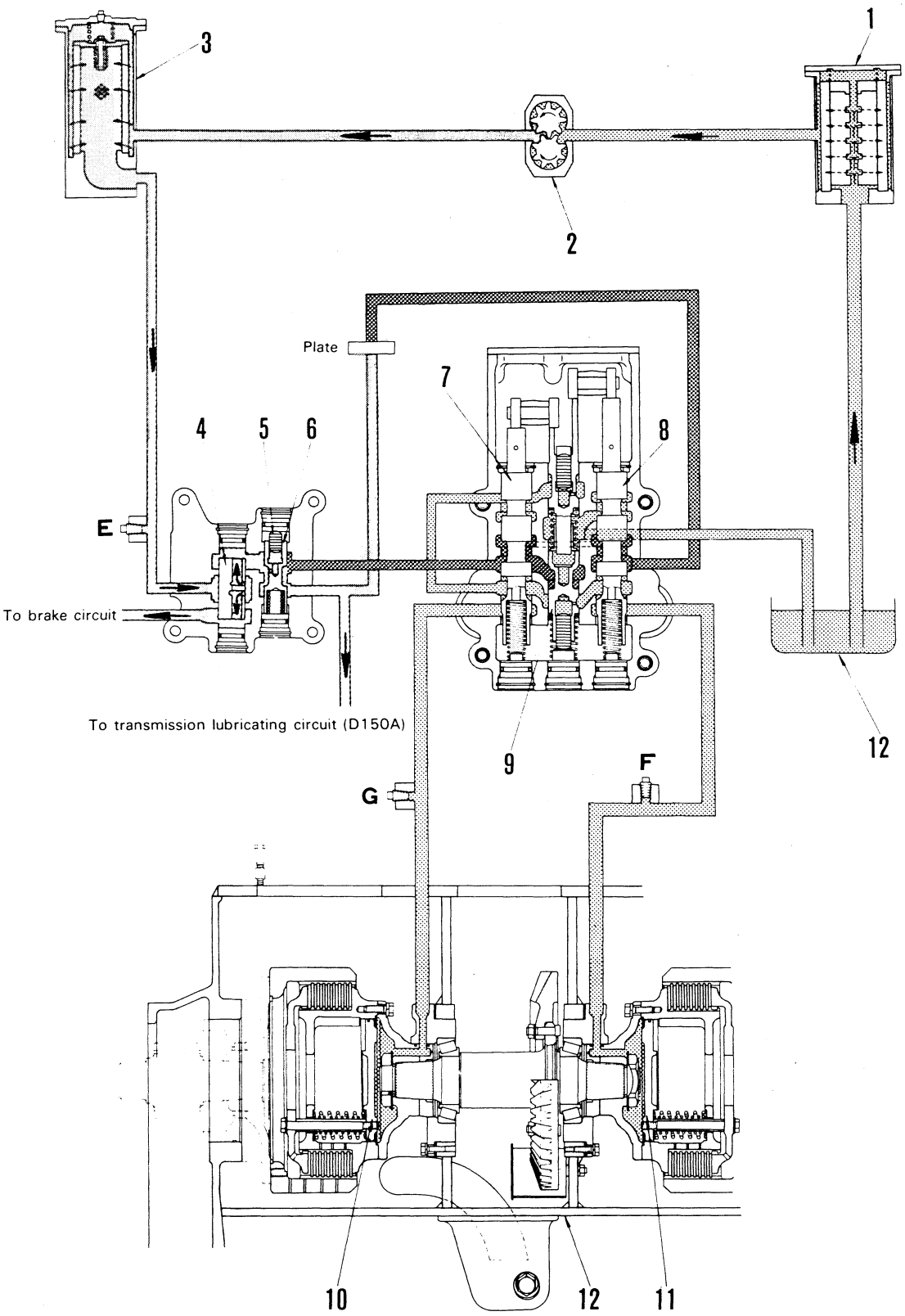
175F075-1B

1. Strainer
2. Transmission pump (FAL045)
3. Oil filter
4. Modulating valve
5. Quick return valve
6. Reducing valve
7. Speed valve
8. Directional valve
9. Torque converter relief valve
10. Torque converter
11. Regulator valve
12. Oil cooler
13. Transmission lubrication valve
14. Transmission lubrication
15. PTO lubrication
16. Torque converter case
17. Scavenging pump
18. Brake lubrication valve
19. Brake lubrication
20. Servo valve
21. Steering case
    - A. Plug for transmission clutch pressure (PT1/8)
    - B. Plug for relief pressure (PT1/8)
    - C. Plug for regulator pressure (PT1/8)
    - D. Oil temperature gauge

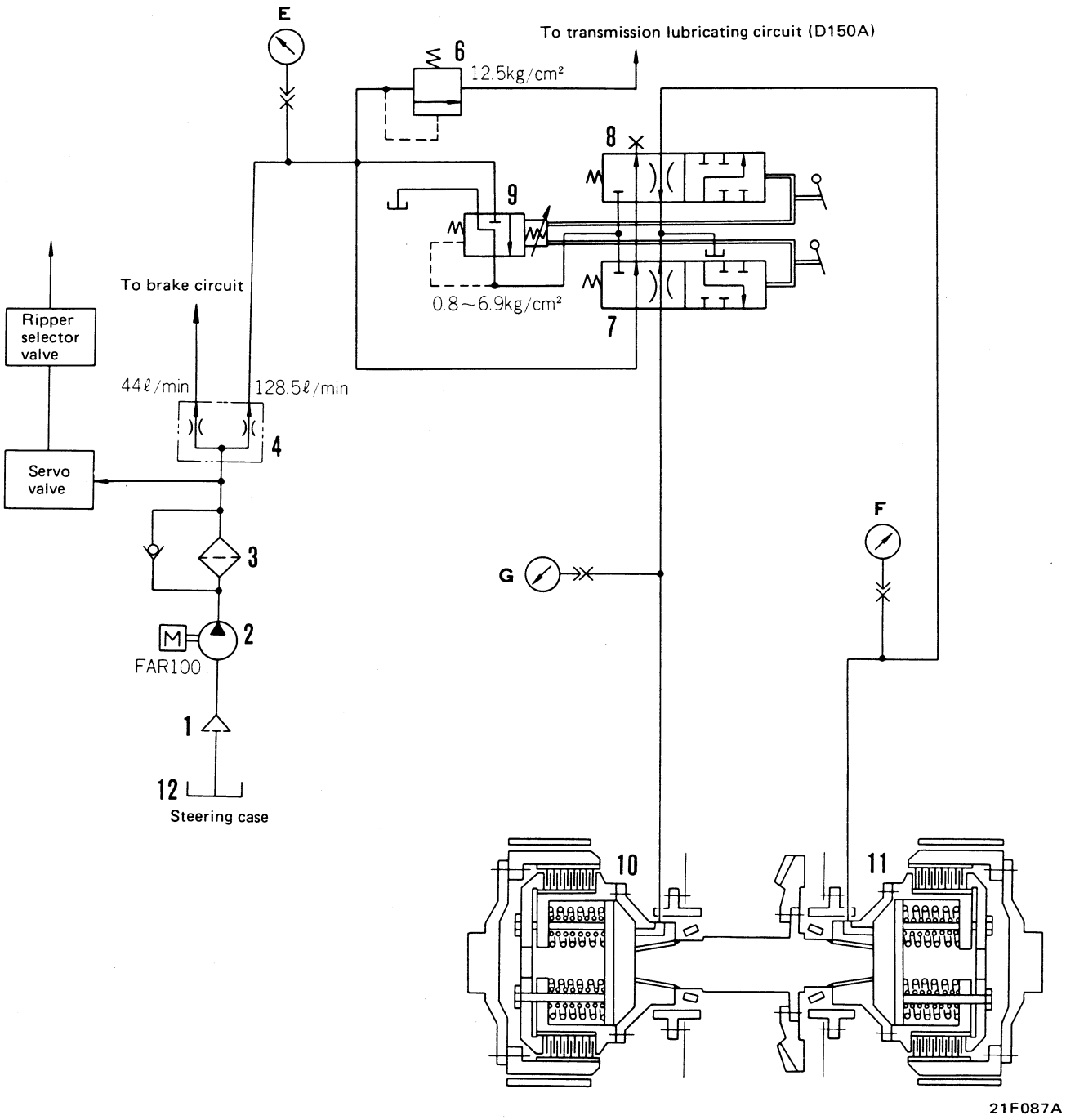
STEERING HYDRAULIC CONTROL

D150A 8408 and up

NEUTRAL



D150A 8408 and up

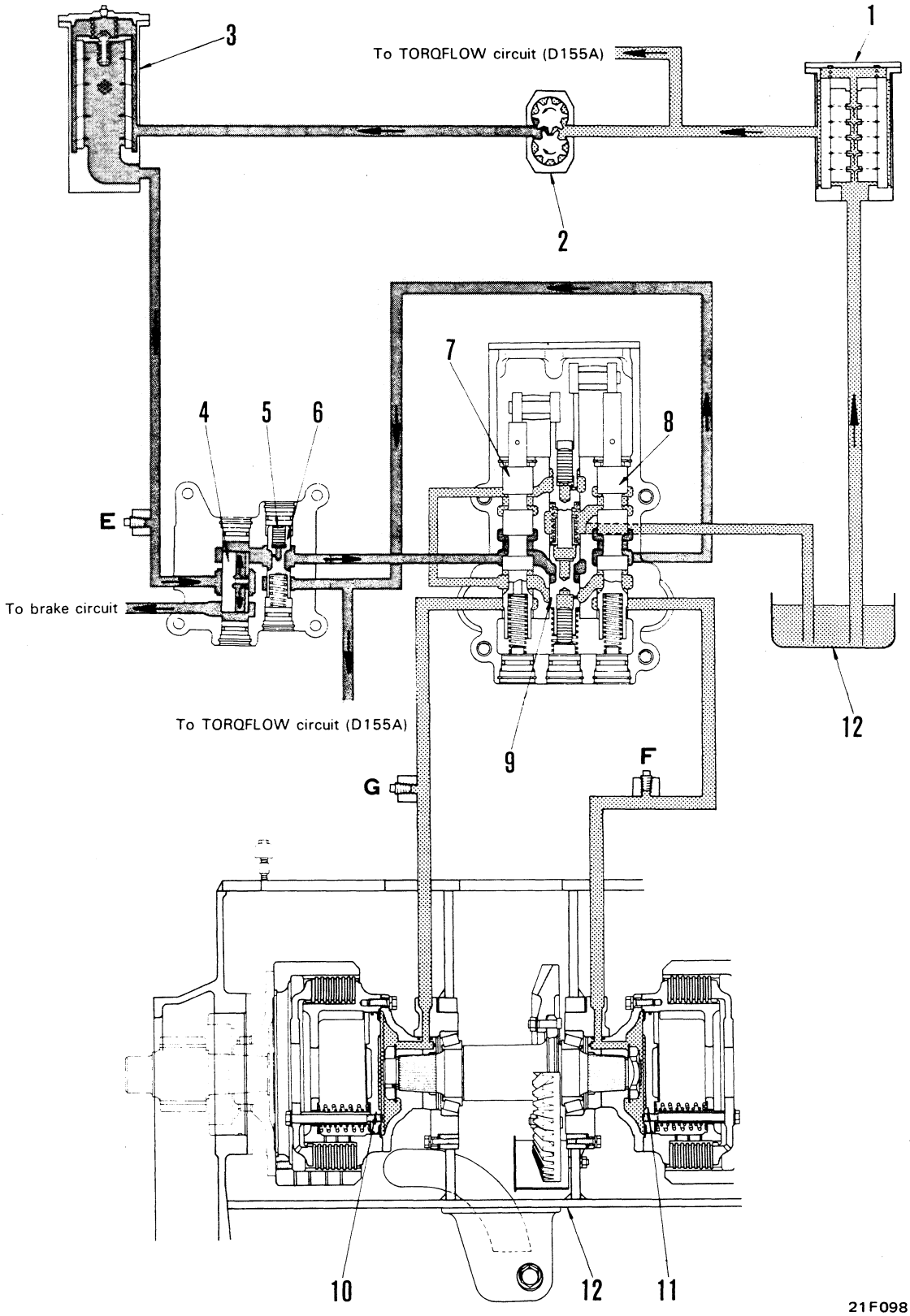


1. Magnetic strainer
2. Steering pump (FAR 100)
3. Steering filter
4. Distribution valve
5. Piston
6. Main relief valve
7. Clutch spool (LH)
8. Clutch spool (RH)
9. Modulating valve
10. Clutch (LH)
11. Clutch (RH)
12. Steering case

E. Plug for clutch main pressure (PT 1/8)
F. Plug for right clutch pressure (PT 1/8)
G. Plug for left clutch pressure (PT 1/8)

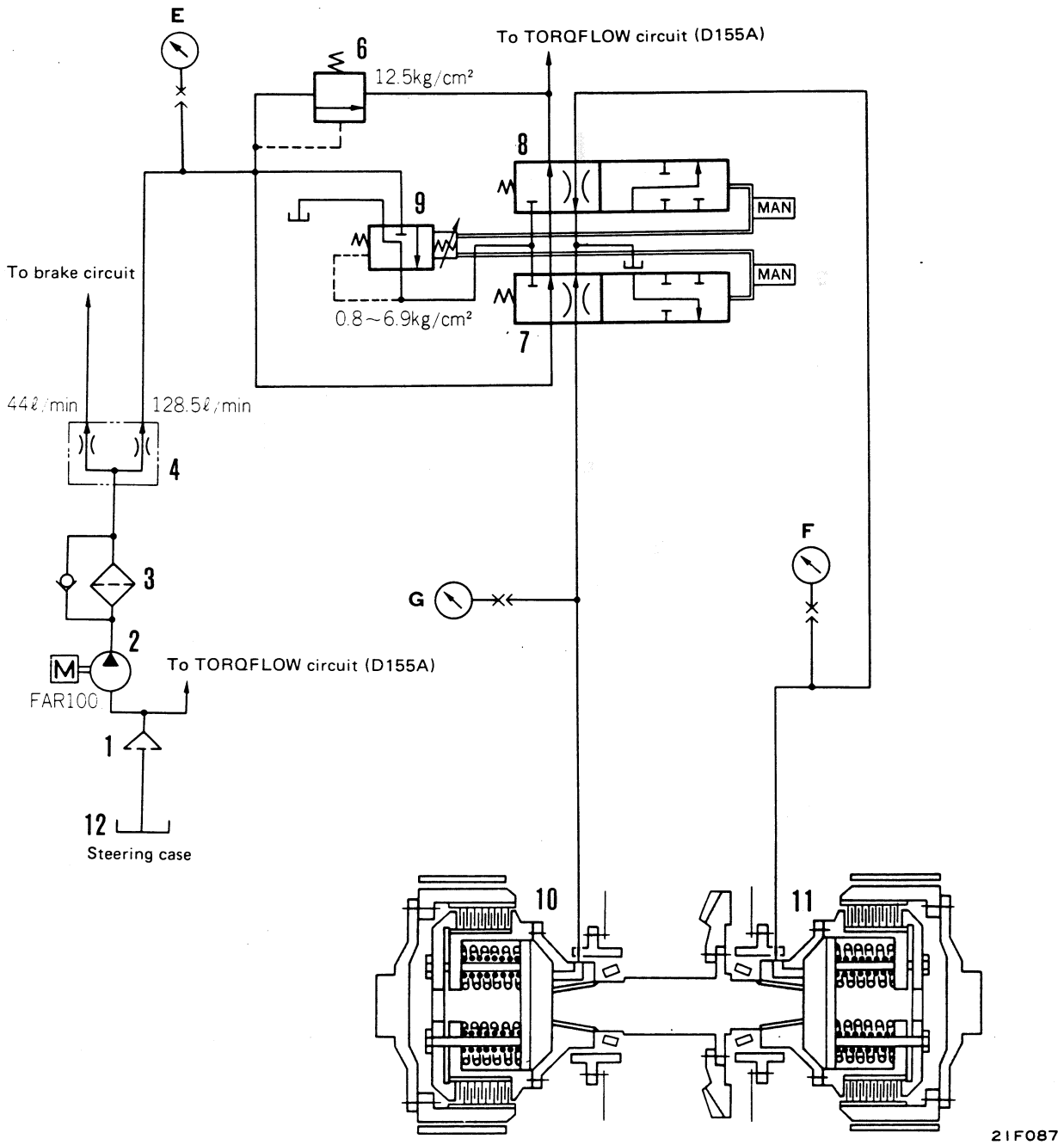
D155A 15001 ~ 25000

NEUTRAL



21F098

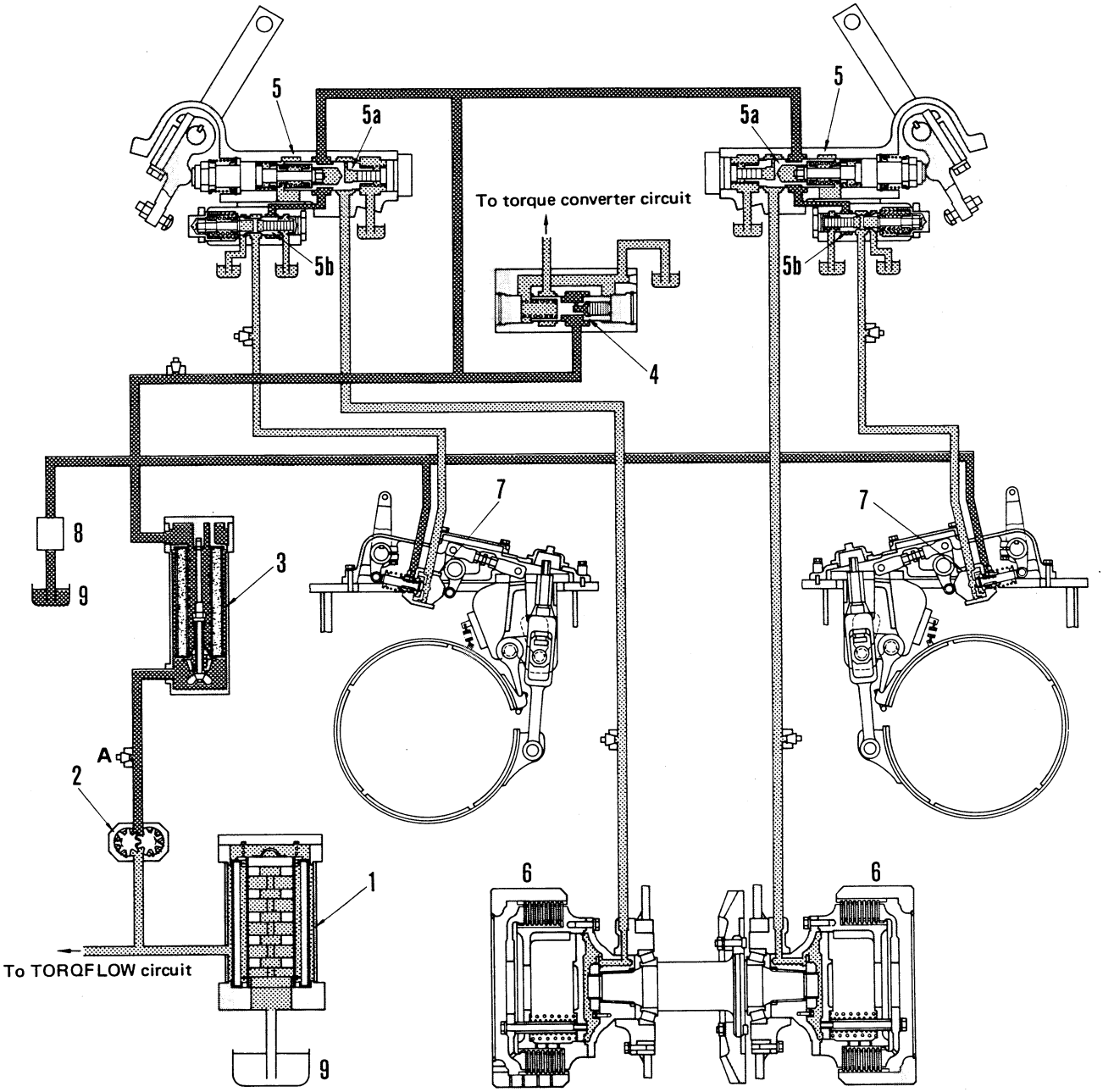
D155A 15001 ~ 25000



1. Magnetic strainer
2. Steering pump (FAR 100)
3. Steering filter
4. Distribution valve
5. Piston
6. Main relief valve
7. Clutch spool (LH)
8. Clutch spool (RH)
9. Modulating valve
10. Clutch (LH)
11. Clutch (RH)
12. Steering case

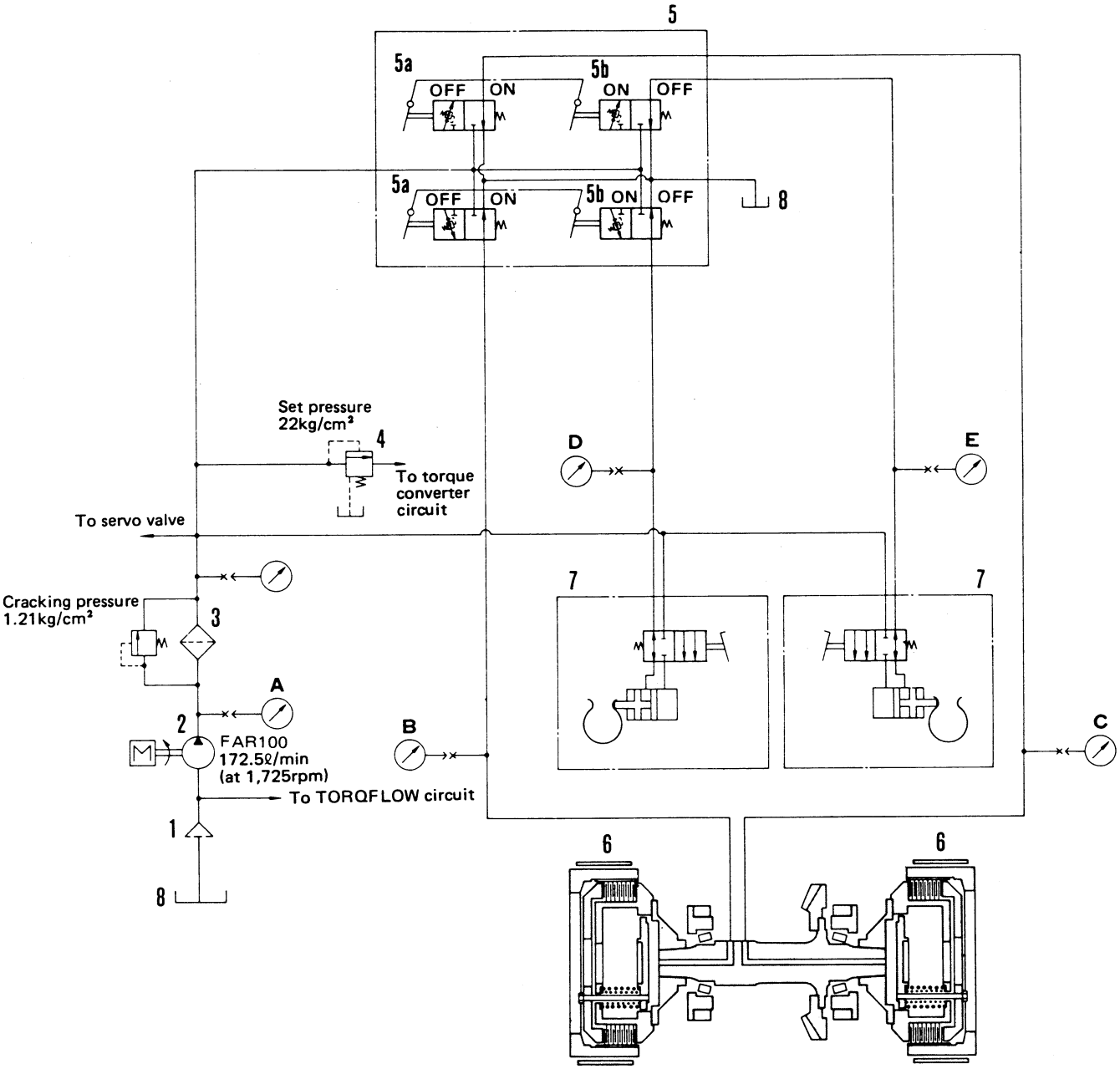
E. Plug for clutch main pressure (PT 1/8)
F. Plug for right clutch pressure (PT 1/8)
G. Plug for left clutch pressure (PT 1/8)

D155A 25001 and up



175F100-1

D155A 25001 and up



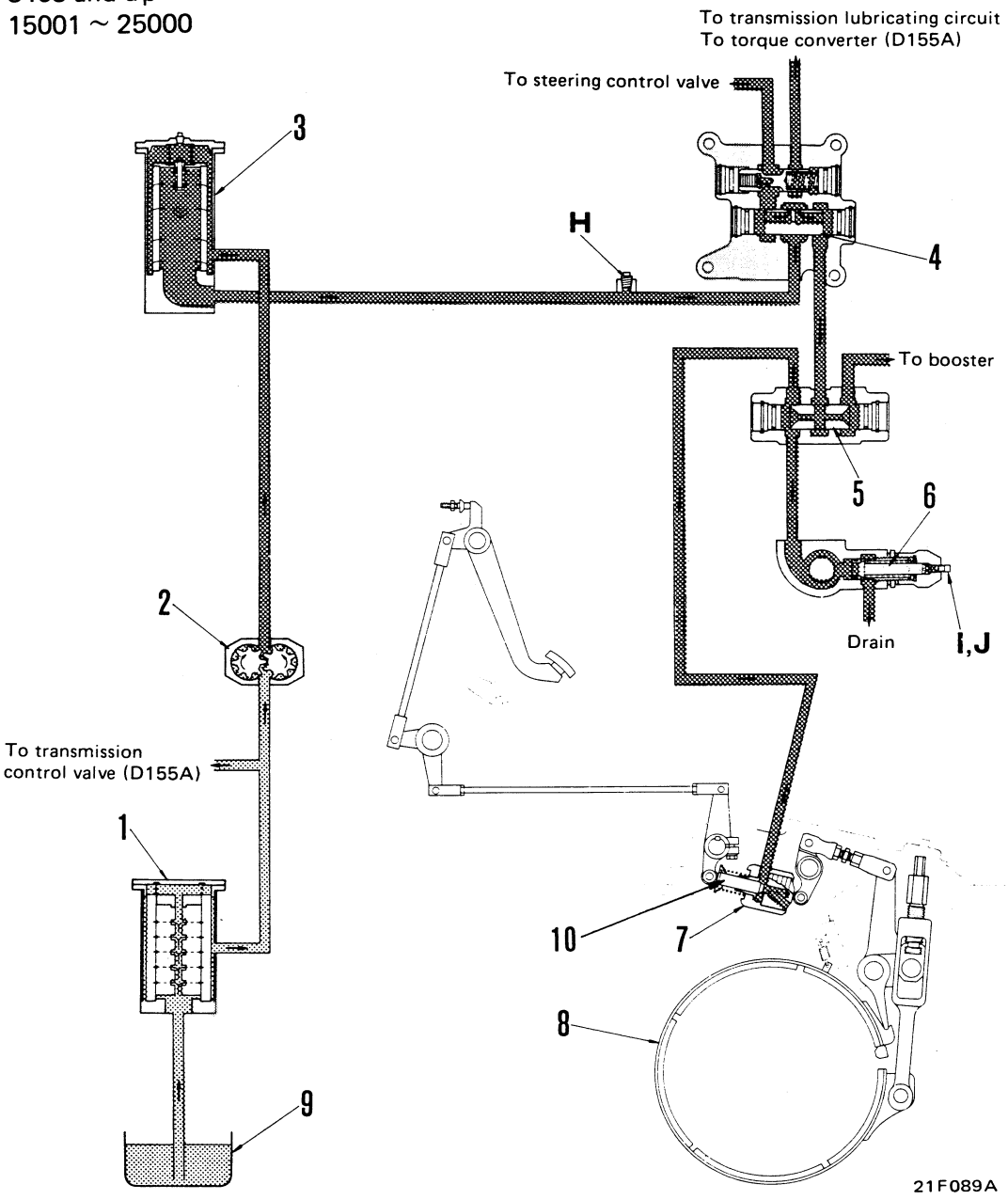
175F101-1A

1. Magnet strainer
2. Steering pump
3. Oil filter
4. Steering main relief valve
5. Steering brake control valve
5a. Steering valve
5b. Brake valve
6. Steering clutch
7. Brake booster
8. Steering case

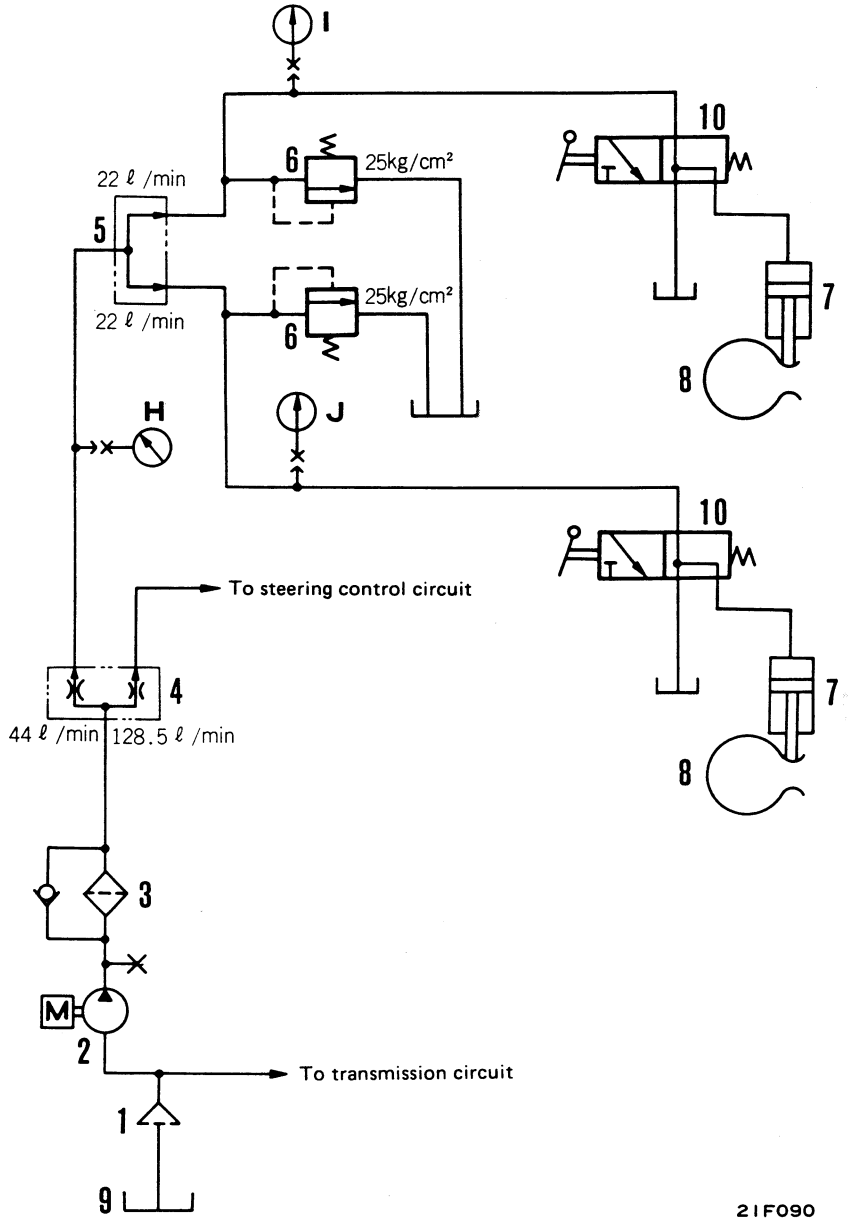
A. Plug for steering main relief pressure
B. Plug for L.H. clutch pressure
C. Plug for R.H. clutch pressure
D. Plug for L.H. brake booster
E. Plug for R.H. brake booster

BRAKE HYDRAULIC CONTROL

D150A 8408 and up
D155A 15001 ~ 25000



D150A 8408 and up
D155A 15001 ~ 25000

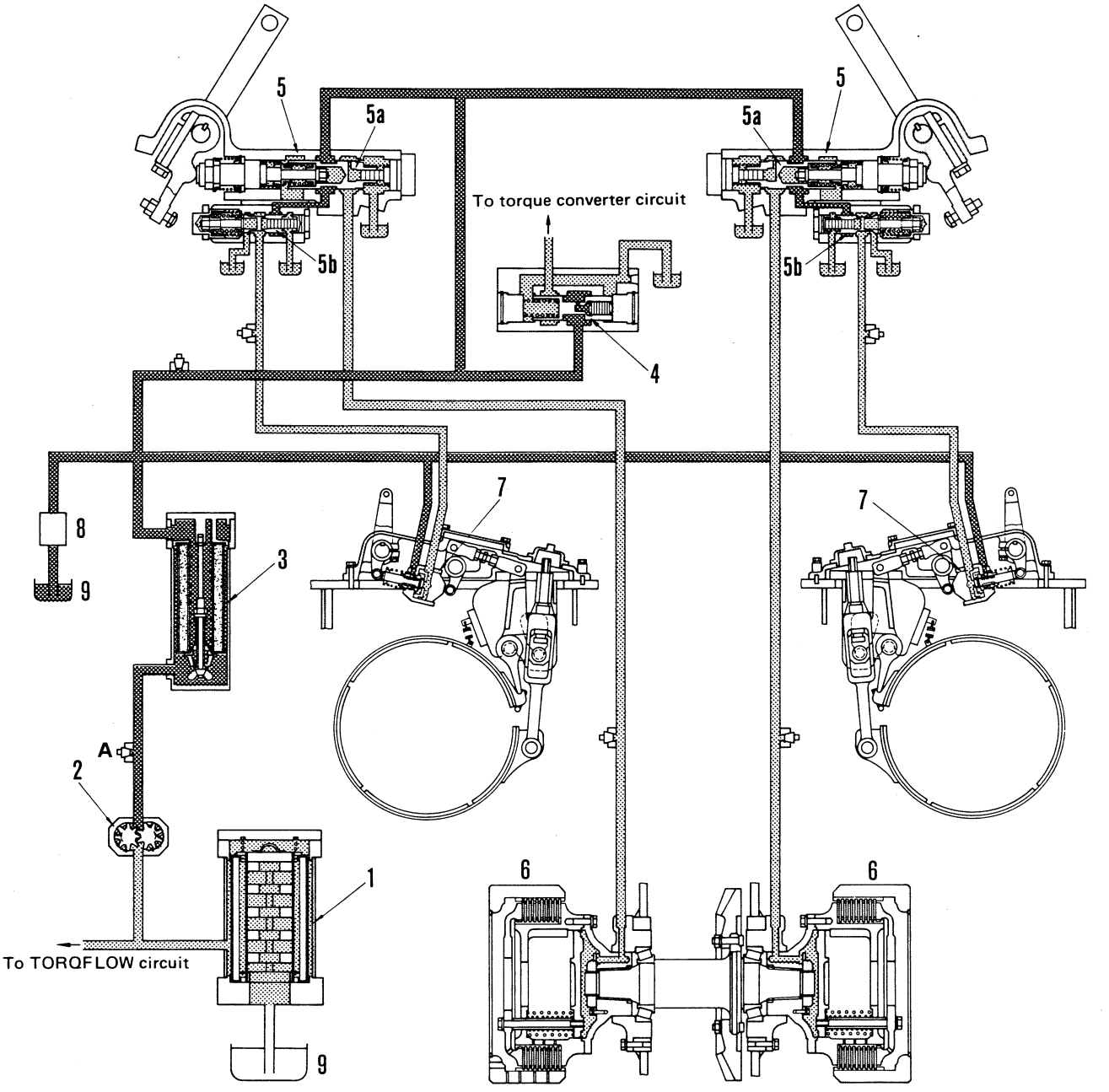


1. Magnetic strainer
2. Steering pump (FAR 100)
3. Steering filter
4. Flow divider
5. Flow divider
6. Brake relief valve
7. Brake booster
8. Steering brake
9. Steering case
10. Spool

H. Port for brake booster pressure (PT 1/8)
I. Port for right brake pressure (PT 1/8)
J. Port for left brake pressure (PT 1/8)

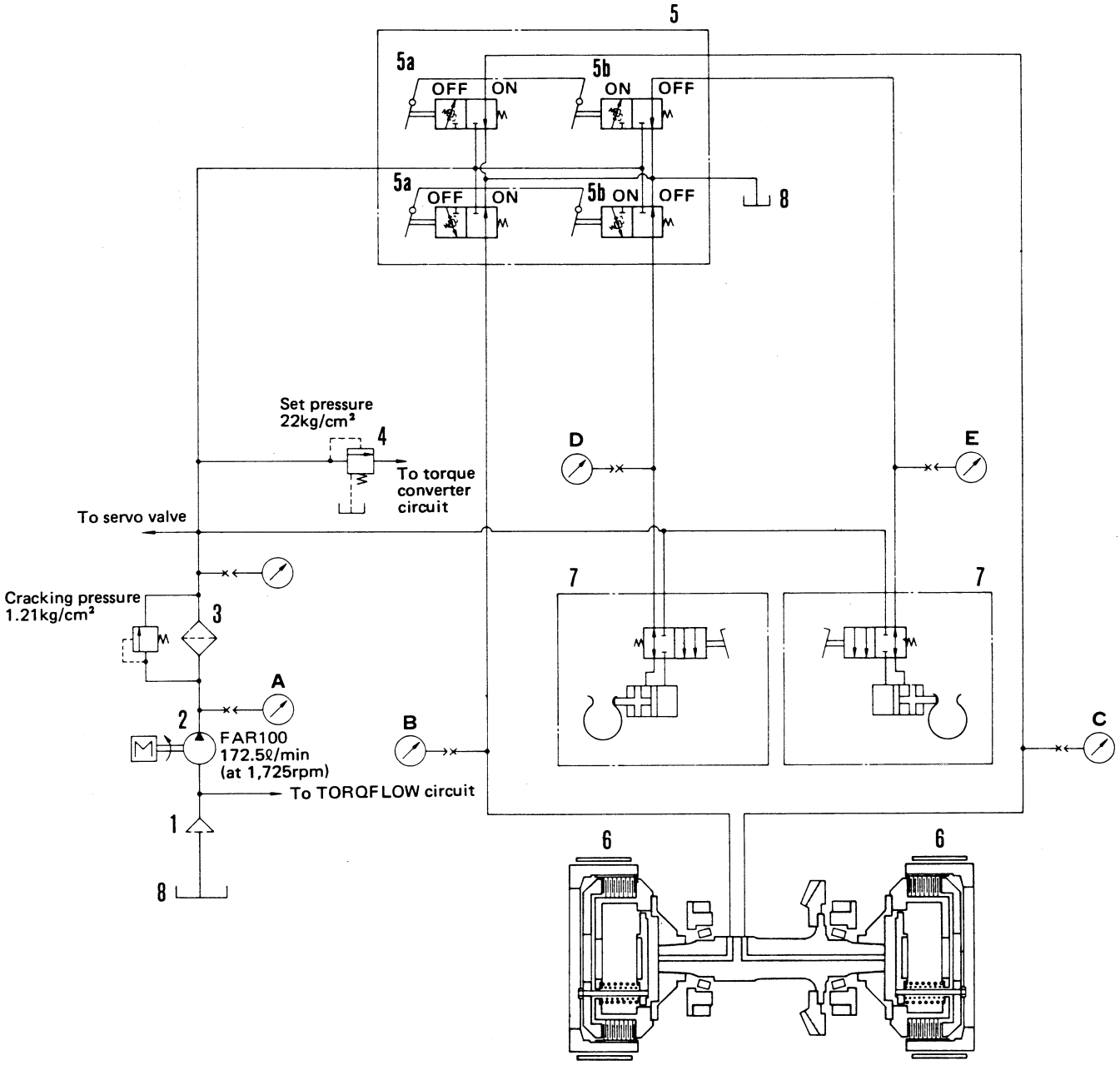
BRAKE HYDRAULIC CONTROL

D155A 25001 and up



175F100-1

D155A 25001 and up



175F101-1A

1. Magnetic strainer
2. Steering pump (FAR100)
3. Steering filter
4. Steering main relief valve
5. Steering control valve
   - 5a. Steering valve
   - 5b. Brake valve
6. Steering clutch
7. Brake booster
8. Steering case

A. Port for steering main relief pressure
B. Port for left clutch pressure
C. Port for right clutch pressure
D. Port for lfet brake booster pressure
E. Port for right brake booster pressure

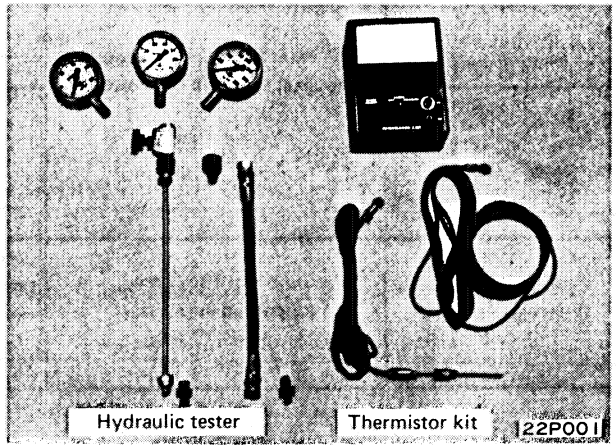
TABLE OF OIL PRESSURE MEASURING POINTS D150A

Item		Oil pressure to be measured	Test port plug size	Oil temperature (°C)	Set pressure (kg/cm²)		Measuring procedure	Remarks
					Full engine speed 2150 rpm	Slow engine speed 600 rpm		
Main clutch hydraulic	A	Main clutch booster pressure	PT 1/8	50 ~ 55	38 ~ 46		With clutch ENGAGED, pull the lever further and measure booster pressure.	Peak pressure arising at the time of clutch ENGAGED is oil pressure required for clutch ENGAGED.
	B	Main clutch lubricating relief pressure	07042-00108		4			
Transmission hydraulic	C	Transmission lubricating relief pressure	PT 1/8 07042-00108	50 ~ 55	1.5			
Steering hydraulic	E	Steering main relief pressure	PT 1/8 07042-00108	50 ~ 55	12 ~ 17	9 ~ 13	1. Make measurement with gear shift lever at N. 2. Measure oil pressure of the clutch DISENGAGED circuit and oil pressure of the ENGAGED circuit of clutch on the opposite side simultaneously.	
	F	Steering right clutch pressure						Oil pressure measurement with right clutch DISENGAGED and oil pressure measurement with left clutch ENGAGED can be made by pulling the right steering lever to the stroke end.
	G	Steering left clutch pressure						Oil pressure measurement with left clutch DISENGAGED and oil pressure measurement with right clutch engaged can be made by pulling the left steering lever to the stroke end.

Item		Oil pressure to be measured	Test port plug size	Oil temperature (°C)	Set pressure (kg/cm²)		Measuring procedure	Remarks
					Full engine speed 2150 rpm	Slow engine speed 600 rpm		
Brake hydraulic	H	Brake main relief pressure	PT 1/8 07042-00108	50 ~ 55	22 ~ 29	21 ~ 25		
	I	Right brake pressure						
	J	Left brake pressure						
	K	Brake lubricating relief pressure	PT 1/8 07042-00108		1.3			

MEASUREMENT OF OIL PRESSURE AND TEMPERATURE

1. **Oil pressure and temperature measuring tools**
   - Hydraulic tester **790-301-1102**
   - Thermistor kit **790-500-1300**



MEASUREMENT OF OIL PRESSURE AND TEMPERATURE

TABLE OF OIL PRESSURE MEASURING POINTS D155A

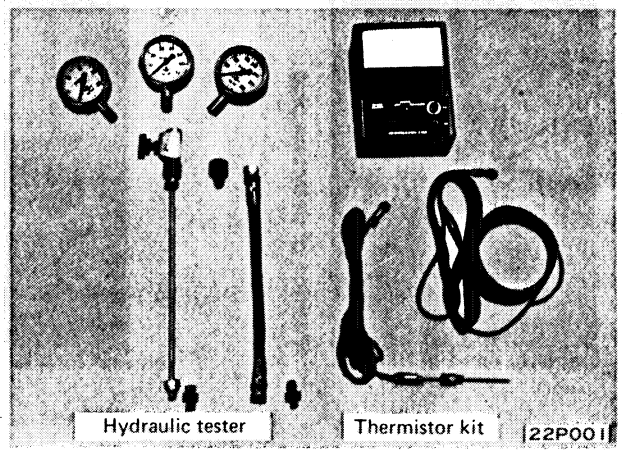
Item		Oil pressure to be measured	Test port plug size	Oil temperature (°C)	Set pressure (kg/cm2)		Measuring procedure	Remarks
					Full engine speed 2150 rpm	Slow engine speed 600 rpm		
TORQFLOW hydraulic	A	Torque converter relief pressure (inlet)	PT 1/8	70 ~ 80	7 ~ 9		Measure with gearshift lever at N.	
	B	Torque converter regulator pressure (outlet)	07042-00108		3 ~ 5	2 ~ 3		
	C	Transmission clutch pressure	PT 1/8	50 ~ 55	20 ~ 25	16 ~ 20	Measure with gearshift lever at N.	
	D	Transmission lubricating relief pressure	07042-00108		1.5			Normally, no measurement is required, but when making measurement to check up trouble, etc., provide a measuring flange in the circuit.
Steering hydraulic	E	Steering main relief pressure	PT 1/8	50 ~ 55	12 ~ 17	9 ~ 13	1. Measure with gearshift lever at N. 2. Measure oil pressure of the clutch DISENGAGED circuit and oil pressure of the opposite clutch ENGAGED circuit simultaneously.	
	F	Steering right clutch pressure	07042-00108					Oil pressure measurement with right clutch DISENGAGED and oil pressure measurement with left clutch ENGAGED can be made by pulling the right steering lever to the stroke end.
	G	Steering left clutch pressure						Oil pressure measurement with left clutch DISENGAGED and oil pressure measurement with right clutch ENGAGED can be made by pulling the left steering lever to the stroke end.

Item		Oil pressure to be measured	Test port plug size	Oil temperature (°C)	Set pressure (kg/cm²)		Measuring procedure	Remarks
					Full engine speed 2150 rpm	Slow engine speed 600 rpm		
Brake hydraulic	H	Brake main relief pressure	PT 1/8 07042-00108	50 ~ 55	22 ~ 29	21 ~ 25		
	I	Right brake pressure						
	J	Left brake pressure						
	K	Brake lubricating relief pressure	PT 1/8 07042-00108		1.3			

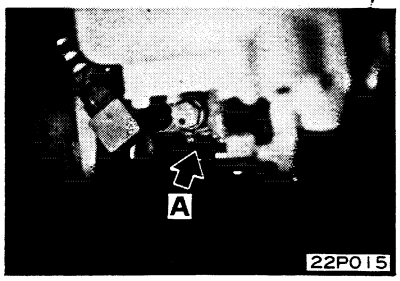
MEASUREMENT OF OIL PRESSURE AND TEMPERATURE

MEASURING OF OIL PRESSURE AND TEMPERATURE

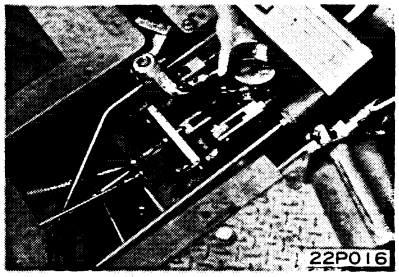
1. **Oil pressure and temperature measuring tools**
   - Hydraulic tester **790-301-1102**
   - Thermistor kit **790-500-1300**



2. **Oil pressure test points**
   - ★ TORQFLOW transmission circuit
   - A. Torque converter relief pressure

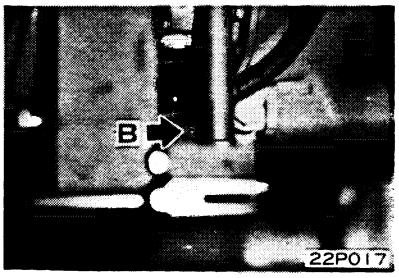


Position of detection plug

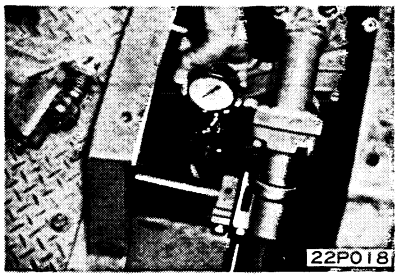


Installation the gauge →
Oil pressure measurement

B. Torque converter regulating pressure

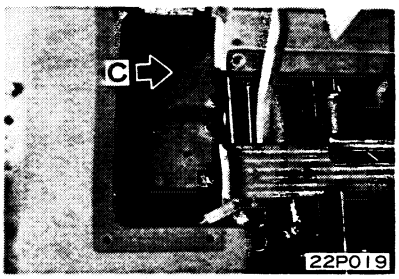


Position of detection plug

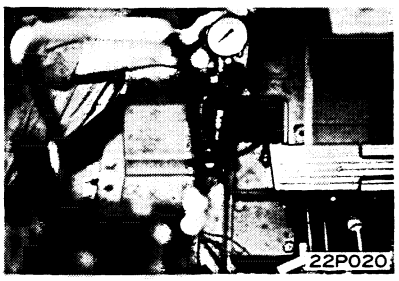


Installation the gauge →
Oil pressure measurement

C. TORQFLOW transmission clutch pressure

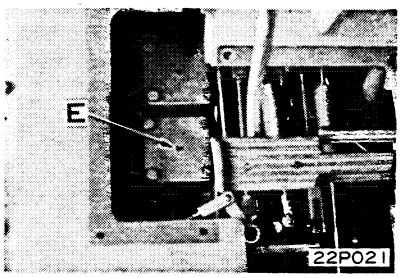


Position of detection plug

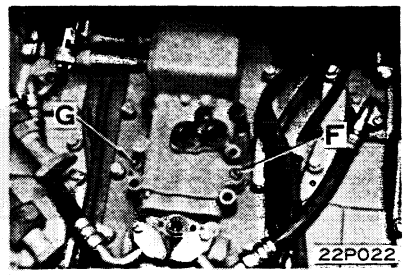


Installation the gauge →
Oil pressure measurement

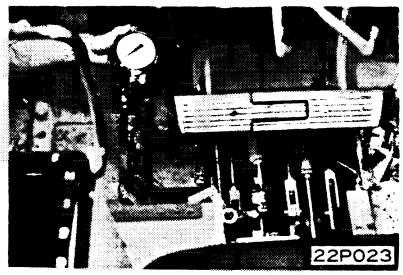
★ Steering clutch and brake oil circuit
E. Steering main relief pressure
F. Pressure at steering clutch, at right disengaged
G. Pressure at steering clutch, at left disengaged



Position of detection plug

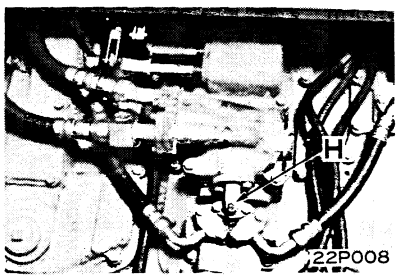


Position of detection plug

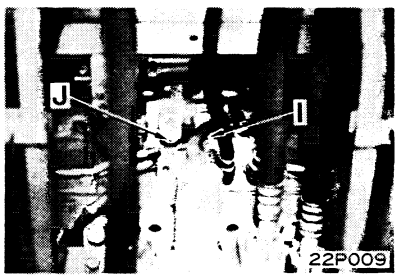


Installation the gauge →
Oil pressure measurement

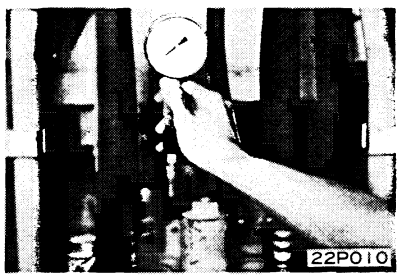
★ Brake hydraulic circuit
H. Brake main relief pressure
I. Right brake pressure
J. Left brake pressure



Position of detection plug

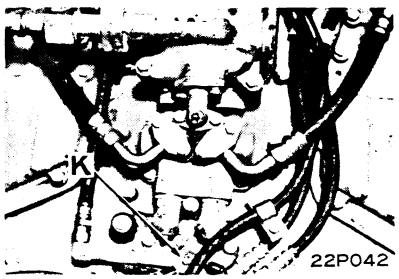


Position of detection plug

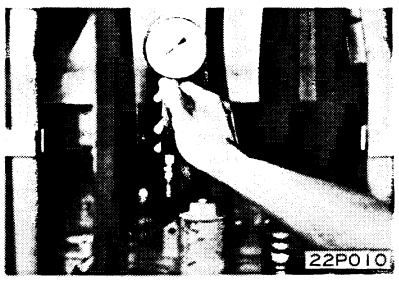


Installation the gauge →
Oil pressure measurement

K. Brake lubricating pressure



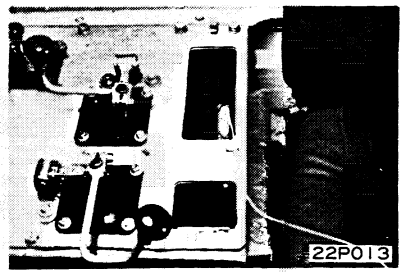
Position of detection plug

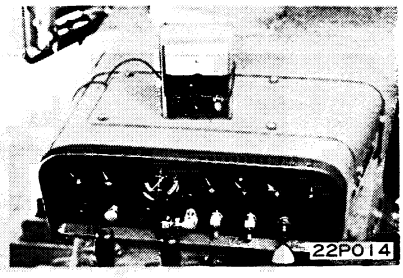


Installation the gauge →
Oil pressure measurement

3. Oil temperature test points

★ TORQFLOW, steering and brake circuit





PROCEDURE FOR MEASURING OIL PRESSURE AND TEMPERATURE

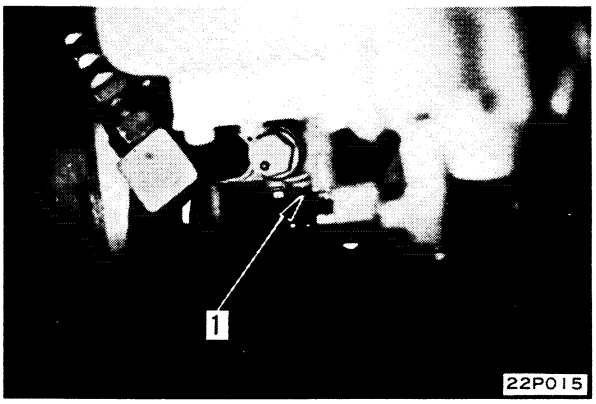
Oil pressure and oil temperature measuring instruments

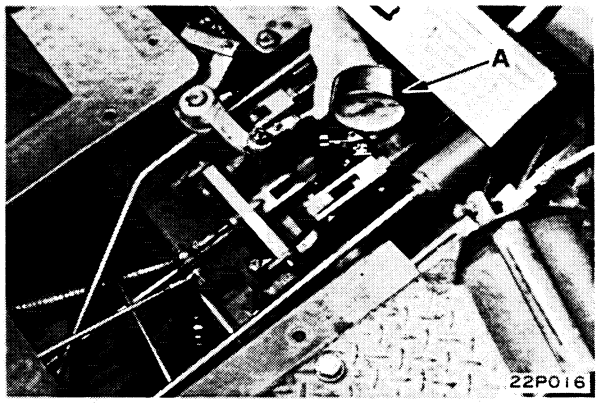
	Part No.	Part Name	Q'ty
A	799-101-5000	Hydraulic tester	1
B	790-500-1300	Thermistor kit	1

1. Torque converter relief pressure (D155A)

1) Installation of oil pressure gauge
   i) Stop the engine, remove the floor plate, and remove plug (1) (PT 1/8), from the torque converter relief valve.
   ii) Attach oil pressure gauge **A** (25 kg/cm^2) to the plug hole with an adapter and hose.

2) Measuring the oil pressure
   Put the gear shift lever in N, start the engine and measure the oil pressure while the engine is running at a low speed and at the full speed.
   ★ Oil temperature: 70 ~ 80°C
   ★ Be sure to lock the parking brake.

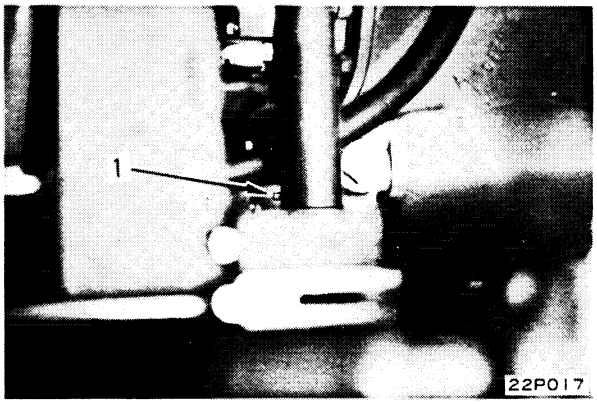


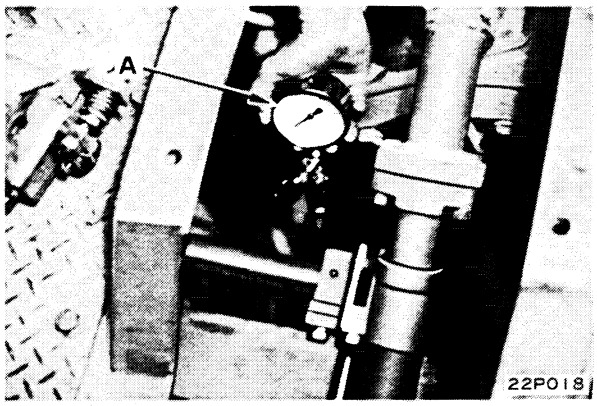


2. Torque converter regulator pressure (D155A)

1) Installation of oil pressure gauge
   i) Stop the engine, remove the floor plate, and remove plug (1) (PT 1/8) from the torque converter regulator valve.
   ii) Install oil pressure gauge **A** (25 kg/cm^2) to the plug hole with a 90° adapter and hose.

2) Measuring the oil pressure
   Put the gear shift lever in N, start the engine, and measure the oil pressure while the engine is running at a low speed and at the full speed.
   ★ Oil temperature: 70 ~ 80°C
   ★ Be sure to lock the parking brake.



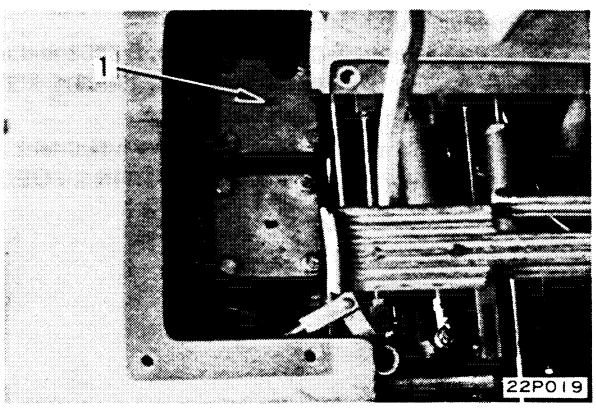


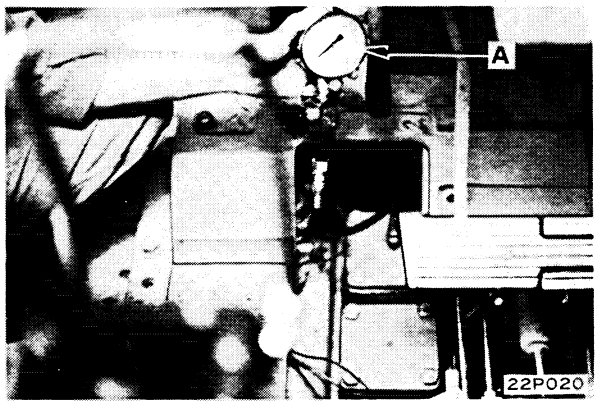
3. **TORQFLOW transmission modulating pressure (D155A)**

★ **Application: Serial No. 15001 ~ 25000**

1) Installation of oil pressure gauge
   i) Stop the engine, remove the floor plate, and remove plug (1) (PT 1/8) from the top of the filter.
   ii) Install oil pressure gauge **A** (70 kg/cm^2) to the plug hole with the adapter and hose.

2) Measuring the oil pressure
   Put the gear shift lever in N, start the engine, and measure the oil pressure while the engine is running at a low speed and at full speed.
   ★ Oil temperature: 70 ~ 80°C
   ★ Be sure to lock the parking brake.

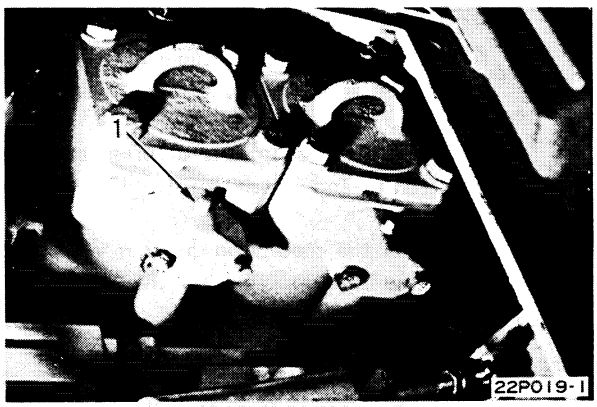


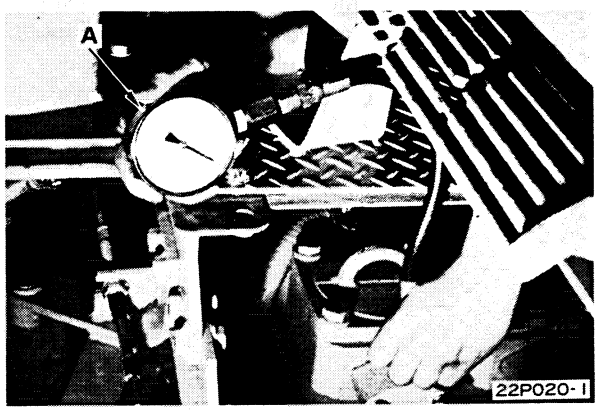


★ **Application: Serial No. 25001 and up**

1) Installation of oil pressure gauge
   i) Stop the engine, remove the floor plate, and remove plug (1) (PT 1/8) from the filter outlet piping.
   ii) Install oil pressure gauge **A** (70 kg/cm^2) to the plug hole with the adapter and hose.

2) Measuring the oil pressure
   Put the gear shift lever in N, start the engine, and measure the oil pressure while the engine is running at a low speed and at full speed.
   ★ Oil temperature: 70 ~ 80°C
   ★ Be sure to lock the parking brake.



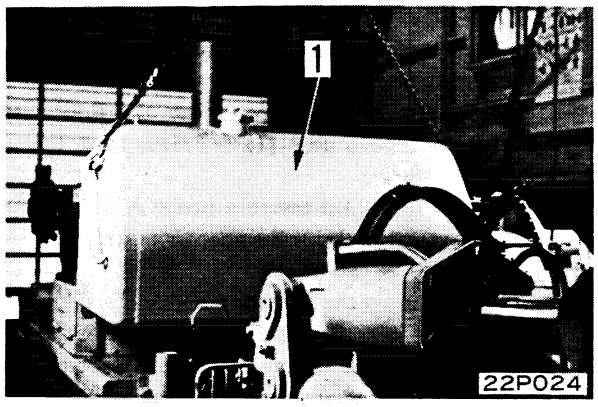


4. Steering clutch pressure

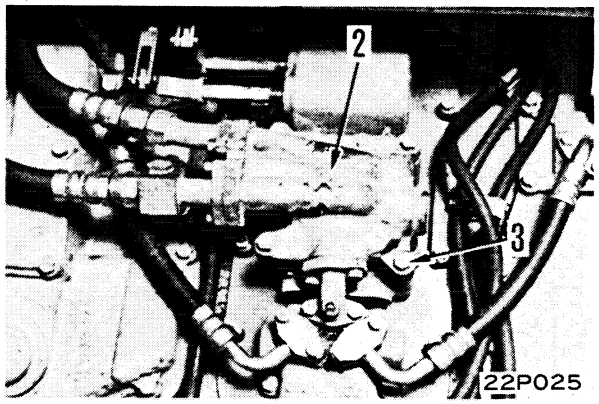
★ **Application: D150A Serial No. 8408 and up**
D155A Serial No. 15001 ~ 25000

1) Installation of oil pressure gauge

i) Stop the engine, and remove fuel tank (1).
For details, see DISMOUNTING FUEL TANK.



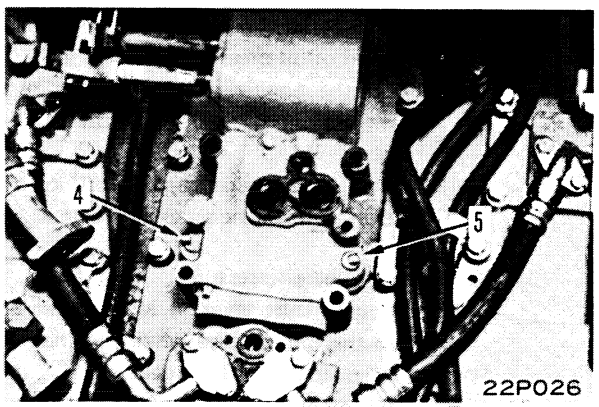
ii) Remove mounting bolt (3) for housing (2), and shift the housing out of the way.



iii) When measuring the L.H. steering clutch pressure, remove plug (4) (PT 1/8), and when measuring the R.H. steering clutch pressure, remove plug (5) (PT 1/8).

iv) Fit a 45° adapter to oil pressure gauge **A** with a hose, and install housing (2) removed in item ii).

v) Fill the measuring cylinder with fuel, and put the fuel supply hose in the fuel.

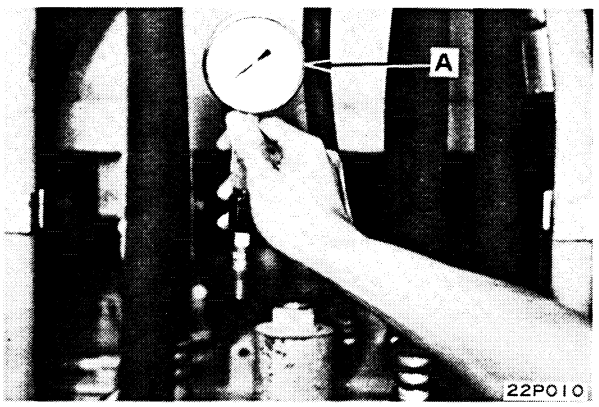


2) Measuring the oil pressure

Put the gear shift lever in N, start the engine, and pull the steering lever to "CLUTCH-DISENGAGE" position. Measure the oil pressure while the engine is running at a low speed and at full speed.

★ Oil temperature: 45 ~ 55°C

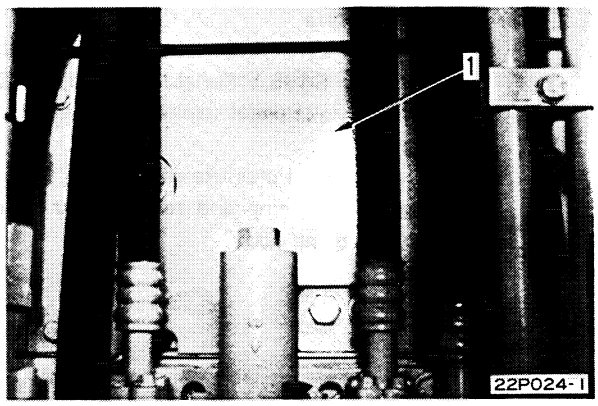
★ Be sure to lock the parking brake.



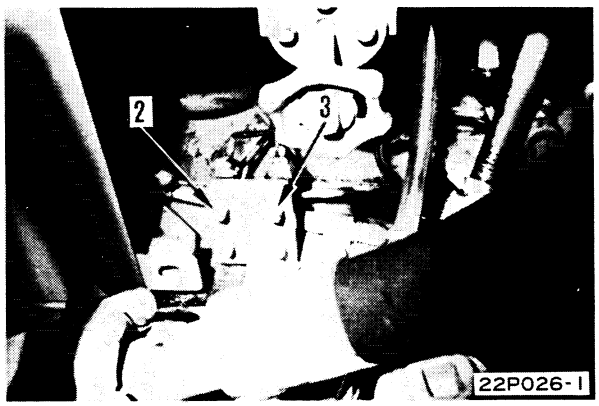
★ **Application: D155A Serial No. 25001 and up**

1) Installation of oil pressure gauge

i) Remove rear cover (1).



ii) Remove plug (2) (PT 1/8) when measuring the L.H. steering clutch pressure and plug (3) (PT 1/8) when measuring the R.H. steering clutch pressure.

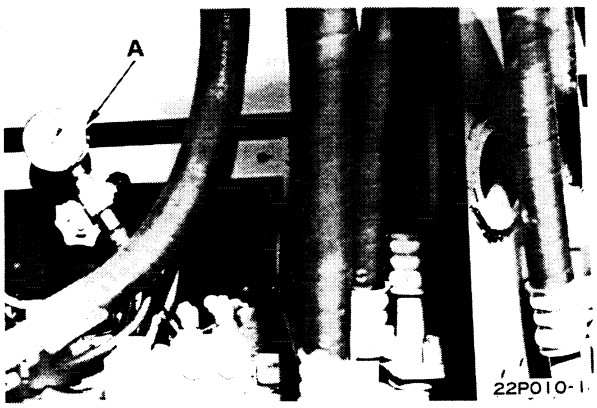


iii) Install oil pressure gauge **A** (25 kg/cm^2) to the plug hole with the adapter and hose.

iv) Put the gear shift lever in N, start the engine, pull the steering lever to "CLUTCH-DISENGAGE" position, and measure the oil pressure while the engine is running at a low speed and at the full speed.

★ Oil temperature: 45 ~ 55°C

★ Be sure to lock the parking brake.

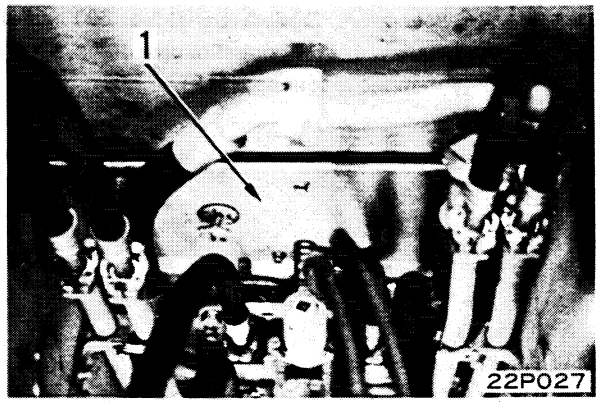


5. Brake relief pressure

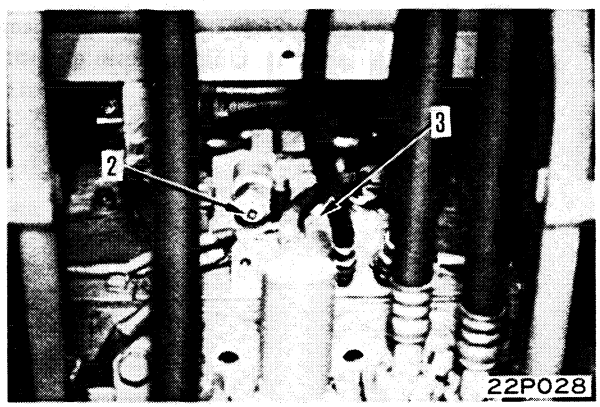
★ **Application: D150A Serial No. 8408 and up**
D155A Serial No. 15001 ~ 25000

1) Adjust the brake pedal stroke to the standard depth.

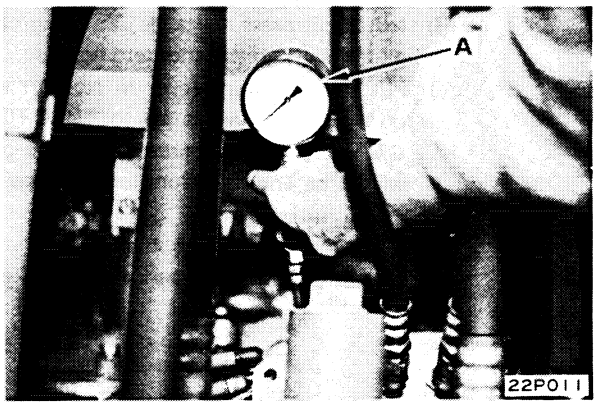
2) Installation of oil pressure gauge
   i) Stop the engine and remove rear cover (1) of the machine body.



   ii) Remove plug (2) (PT 1/8) when measuring the L.H. brake relief pressure and plug (3) (PT 1/8) when measuring the R.H. brake relief pressure.



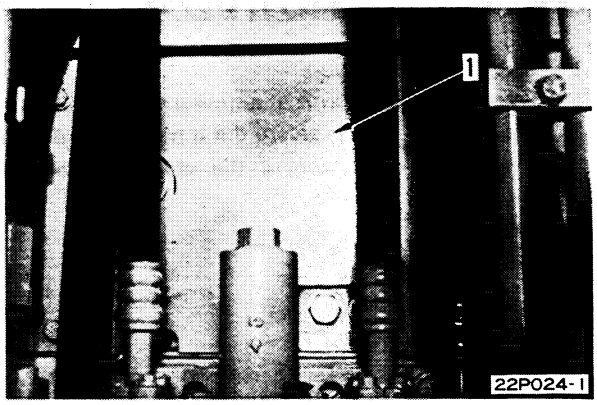
   iii) Install oil pressure gauge **A** (70 kg/cm^2) to the plug hole with the adapter and hose.



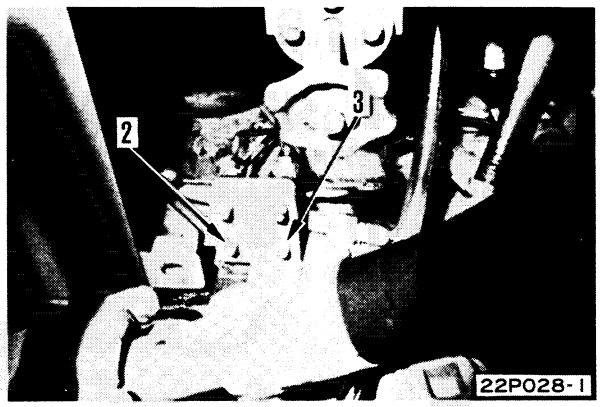
3) Measuring the oil pressure
   Put the gear shift lever in N and start the engine. Depress the brake pedal and measure the oil pressure while the engine is running at a low speed and also at full speed.
   ★ Oil temperature: 45 ~ 55°C
   ★ Be sure to lock the parking brake.

★ **Application: D155A Serial No. 25001 and up**

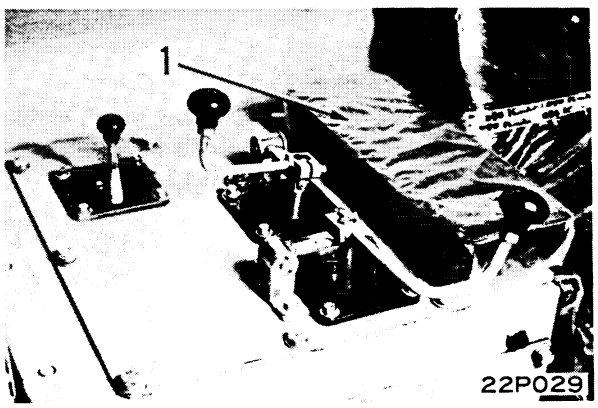
1) Adjust the brake pedal stroke to the standard depth.
2) Installation of oil pressure gauge
   i) Stop the engine and remove rear cover (1) of the machine body.
   ii) Remove plug (2) (PT 1/8) when measuring the L.H. brake relief pressure and plug (3) when measuring the R.H. brake relief pressure.
   iii) Install oil pressure gauge **A** (70 kg/cm^2) to the plug hole with the adapter and hose.



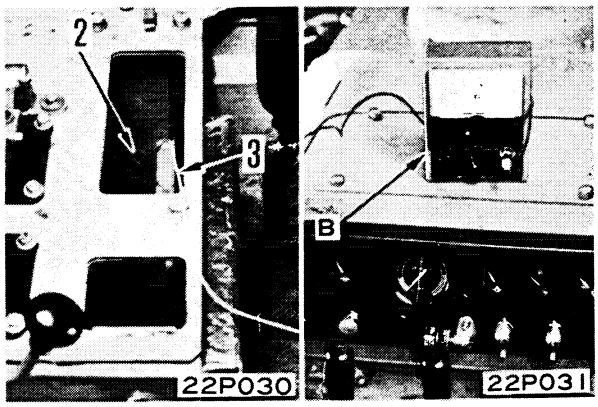
3) Measuring the oil pressure
   Put the gear shift lever in N, start the engine, depress the brake pedal, and measure the oil pressure while the engine is running at a low speed and at full speed.
   ★ Oil temperature: 45 ~ 55°C
   ★ Be sure to lock the parking brake.



6. **Oil temperature measurement in the TORQFLOW steering circuit**
   1) Take out R.H. armrest (1).

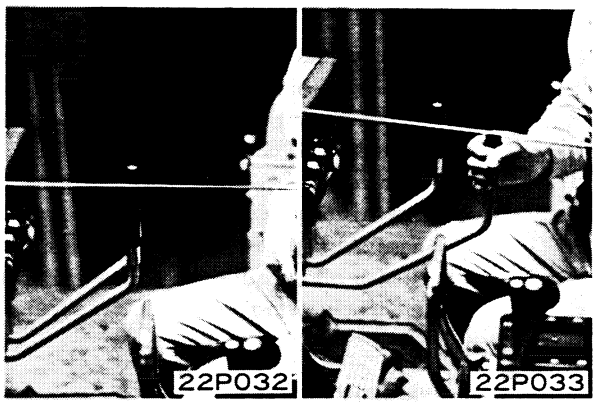


   2) Remove the level gauge, insert sensor (3) into dipstick hole (2), connect the sensor to thermistor **B**, and measure the oil temperature.

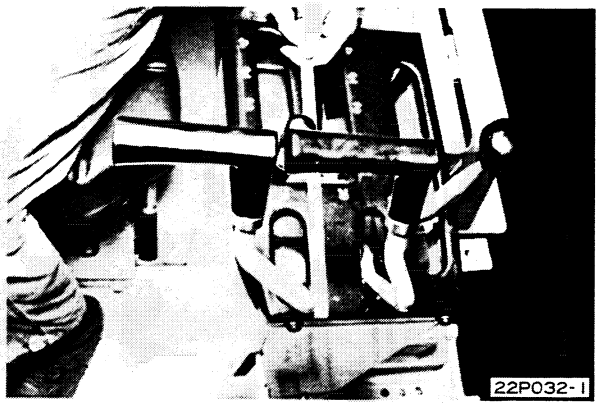


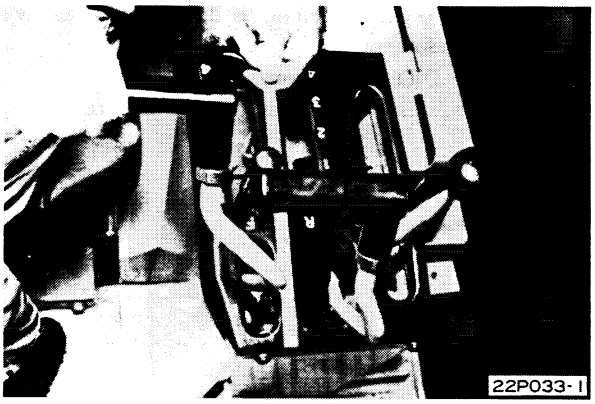
PRECEDURE FOR MEASUREMENT OF LEVER AND PEDAL TRAVEL

1. **Steering lever stroke**
   Start the engine, run it at a slow speed and put a scale on the steering lever. Measure the travel of the steering lever to the position where the clutch is completely disengaged.



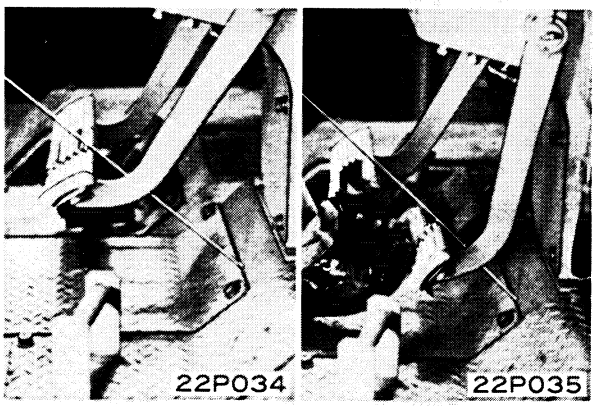
★ The above photos are for D150A, Serial No. 8408 and up and D155A, Serial No. 15001 ~ 25000





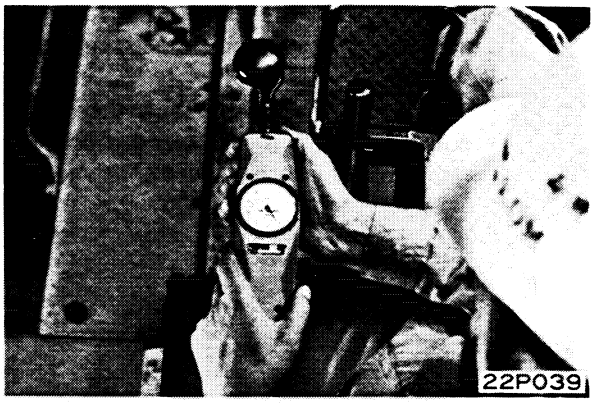
★ The above photo is for D155A, Serial No. 25001 and up

2. **Brake pedal stroke**
   Start the engine, run it at a slow speed, and put a scale on the brake pedal. Measure the travel of the pedal when it is depressed with a force of 12 kg.

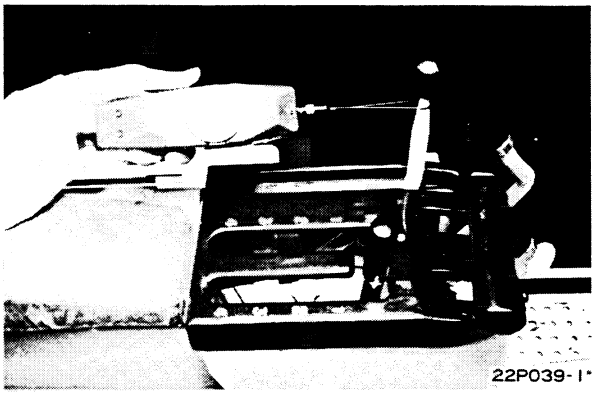


MEASUREMENT OF OPERATING FORCE

1. **Operating force of fuel control lever**
   1) Start the engine, and hook a push-pull scale to the lever knob.
   2) Measure the operating force required to shift the lever from SLOW position to FULL position at 1/2 to 2/3 of lever travel.
   3) Measure the operating force required to shift the lever from SLOW to STOP position.

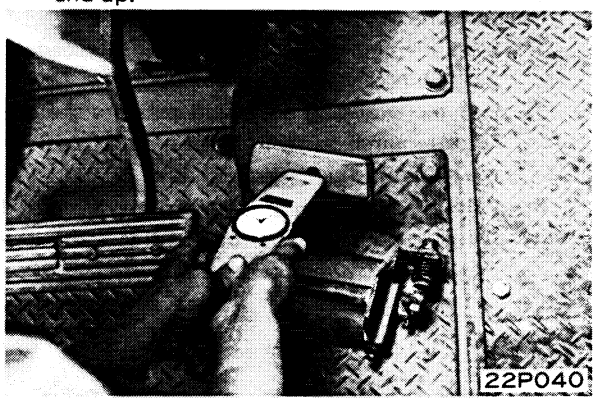


★ The above photo is for D150A, Serial No. 8408 and up, D155A, Serial No. 15001 ~ 25000

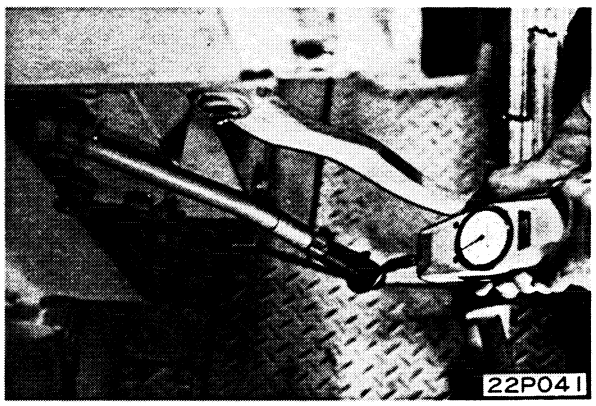


★ The above photo is for D155A, Serial No. 25001 and up.

2. **Operating force of decelerator pedal**
   1) Start the engine, pull the fuel control lever to FULL position, and attach a push-pull scale to the decelerator pedal.
   2) Depress the pedal with the scale and measure the operating force.

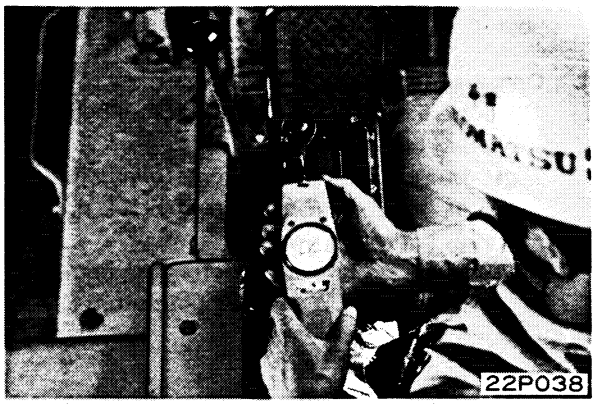


3. **Operating force of compression release lever**
   D150A Serial No. 8408 and up
   D155A Serial No. 15001 ~ 25000
   1) Stop the engine and hook a push-pull scale to the lever knob.
   2) Pull the push-pull scale to shift the lever from RUN to COMPRESSION RELEASE, and vice versa, and measure the operating force.

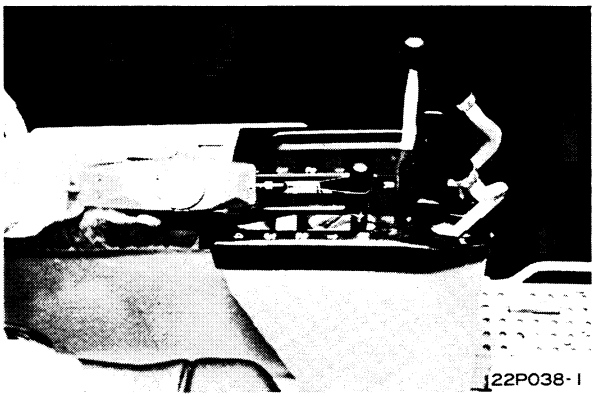


4. Operating force of gear shift lever (D155A)

1) Stop the engine and hook a push-pull scale to the lever knob.
2) Pull the push-pull scale to shift the lever from N position to each gear speed, and measure the operating force for each gear speed position.



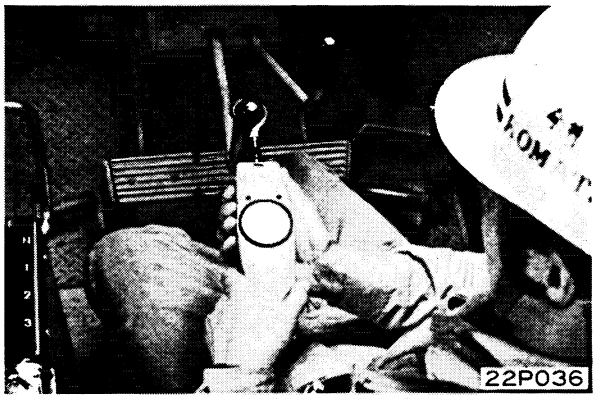
★ The above photo is for D155A, Serial No. 15001 ~ 25000.



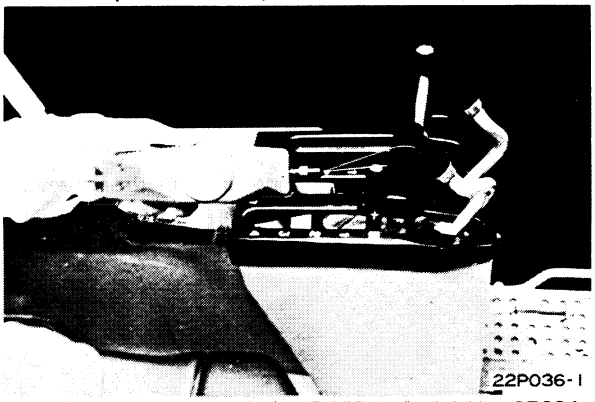
★ The above photo is for D155A, Serial No. 25001 and up.

5. Operating force of steering lever

1) Start the engine, run it at a slow speed, and hook a push-pull scale to the lever knob.
2) Pull the push-pull scale and measure the operating force required to pull the lever to a position where the clutch is disengaged.
3) Pull the push-pull scale a little more and measure the operating force required to pull the lever to a position where the brakes actuate.

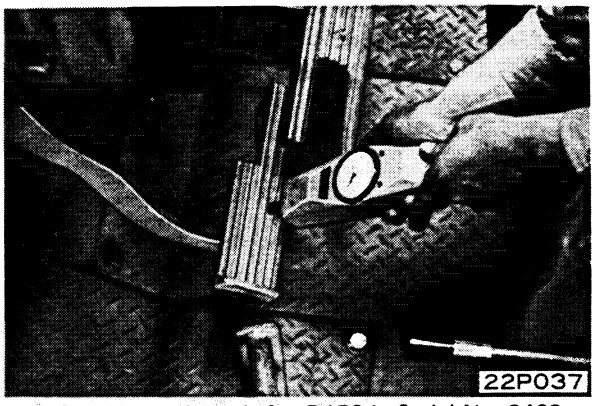


★ The above photo is for D150A, Serial No. 8408 and up and D155A, Serial No. 15001 ~ 25000

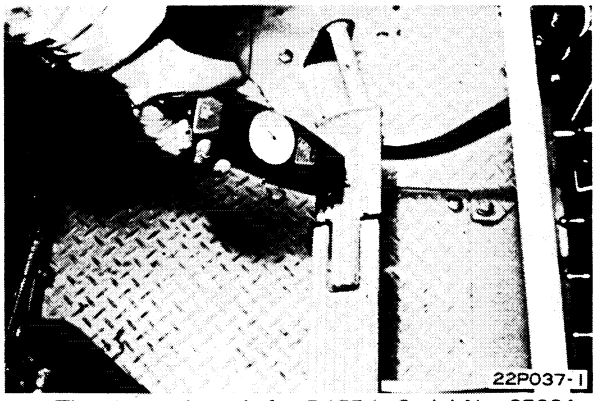


★ The above photo is for D155A, Serial No. 25001 and up.

6. **Operating force of steering brake pedal**
   1) Start the engine and keep it running at 1,000 rpm.
   2) Put a push-pull scale on the center of the pedal, shift the gear shift lever to FIRST speed, and depress the pedal. Measure the operating force at the instant that the engine starts to stall because of the application of the brake on one side.



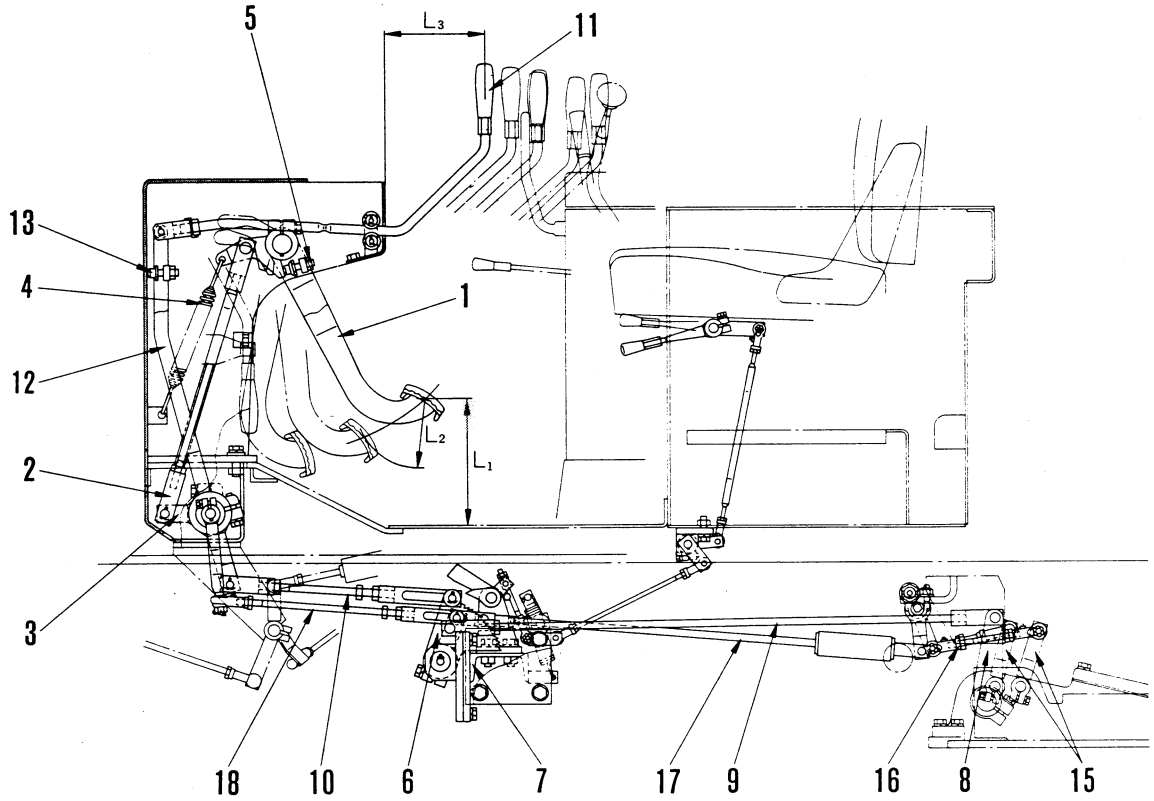
★ The above photo is for D150A, Serial No. 8408 and up and D155A, Serial No. 15001 ~ 25000.



★ The above photo is for D155A, Serial No. 25001 and up.

ADJUSTMENT PROCEDURE FOR STROKES

D150A Serial No. 8408 and up
D155A Serial No. 15001 ~ 25000



22F001

1. Adjustment of brake linkage

1) Connect rods (2), levers (3), and springs (4) to R.H. and L.H. brake pedals (1), and adjust bumper (5) so that the distance between the upper surface of the floor and pedal L_1 is 225 mm.
   ★ Adjust bumper (5) and rod (2) so that the R.H. and L.H. pedals and levers will be equally positioned.
2) Attach lever (6) to support (7), keep brake lever (8) pushing towards the back of the machine body, and connect rod (9).
   ★ Bend the cotter pin securely.
3) Connect lever (6) to lever (3) with rod (10) and turn the rod in the direction that will extend it until lever (6) is brought into contact with support (7). Turn back the rod by 2.5 revolutions to make it shorter, and confirm that the brake pedal has a free play of 12.5 to 20 mm.

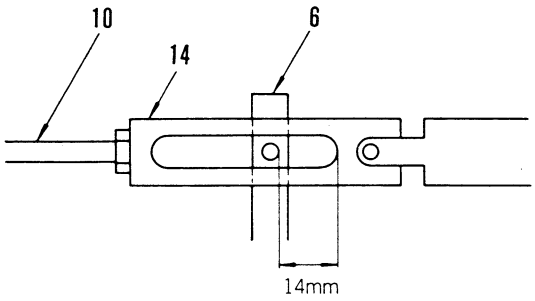
   kgm Lock nut: 18 ± 2 kgm

4) With the engine idling, use the lining clearance adjustment bolt to adjust brake pedal stroke L_2 to 160 ± 10 mm.
   ★ The difference in the brake pedal height between the R.H. and the L.H. side must be less than 5 mm.

★ In ordinary cases, the linkage can be adjusted by carrying out items 3) and 4) only.

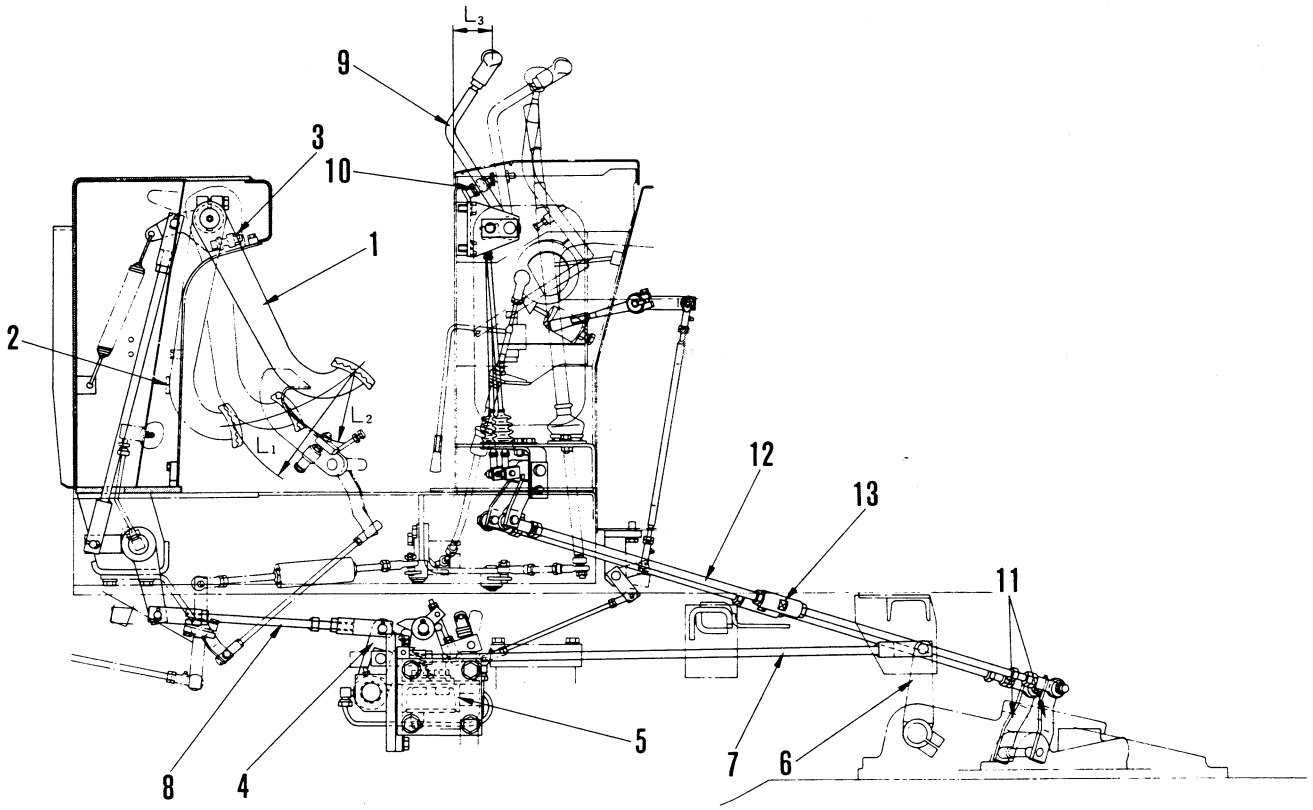
2. Adjustment of steering linkage

1) Adjust stopper (13) so that distance L_3 between the dashboard and the steering lever is kept at 178 ± 2 mm.
2) Connect lever (12) to lever (6) with rod (10), keeping a free play of 13 mm between yoke (14) and the pin on lever (6).
3) Connect rod (16) to lever (15), and connect rod (17) to lever (6) so that there is no free movement on the lever.
4) Confirm that the steering lever has a free play of zero to 5 mm.
   ★ If the free play is larger than 5 mm, turn rod (17) to reduce the free play zero.
   Turning the rod by one revolution will increase or decrease the lever stroke by approximately 5 mm.
5) Make sure that brake rod (9) will start actuating when the steering lever is pulled 42 to 48 mm.
   ★ If the lever stroke exceeds 48 mm, shorten rod (18) and at the same time lengthen rod (17) by an equal amount.
   ★ If the lever stroke is less than 42 mm, lengthen rod (18) and at the same time shorten rod (17) by an equal amount.



195F082

D155A Serial No. 25001 and up



22F003

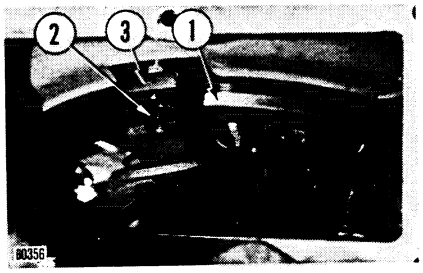
1. **Adjustment of brake linkage**
   1) Adjust stopper (3) so that stroke L_1 of brake pedal (1) is 230 mm from the position of the pedal at stopper (2).
   2) Place lever (4) in parallel with support (5), push lever (6) towards the front of the machine body until it comes into light contact with the spool in the brake housing, then connect rods (7) and (8).
   3) Check the brake pedal to see if it has a free play of 12.5 to 20 mm.
   4) With the engine idling, adjust the brake band lining so that the stroke L_2 of brake pedal (1) can be maintained at 160 ± 10 mm.

2. Adjustment of steering linkage

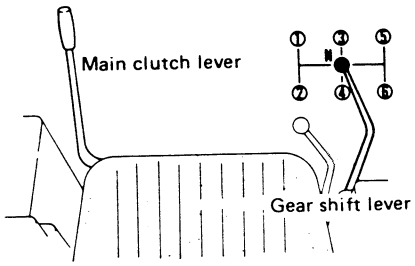
1) Set steering lever (9) so that it will come into contact with stopper (10) when distance L_3 is 68 mm from the front surface of the guide.
2) Push lever (11) towards the front of the machine until it comes into light contact with the spool in the steering valve, then connect rod (12).
3) If there is any free play in lever (9) after the rod is connected, eliminate the free play by adjusting turnbuckle (13).
4) Check the steering lever to see if its stroke is 124 ± 10 mm.

ADJUSTING MAIN CLUTCH (D150A)

1. **Adjusting lever operating force**
   1) Remove main clutch inspection cover, loosen lock nut (2), and then lock plate (3).
      8 Two lock plates are provided at diagonal positions.
   2) Set a spanner on weight link and turn adjustment ring (1) to adjust lever operating force to specified value.
      ★ Measured at center of lever knob with engine stop: 67 – 76 kg with engine ~~slow~~ idling: 6 – 8 kg



2. **Adjusting lever travel**
   ★ Measured at center of lever knob with engine slow idling.
   170 – 230 mm



3. **Check method of main clutch slip**
   1) Depressed brake pedal.
   2) Shift gear shift lever to F6.
   3) Engaged main clutch lever
      If engine stopped with in 3 see. Good
      If engine stopped more than 3 see.
      Main clutch slipping

TABLE OF MAINTENANCE STANDARDS

D150A 8408 and up

	Item	Test condition		Standard	Remarks
Pedal and lever travel (stroke)	Fuel control lever	At center of lever grip	Engine SLOW ~ FULL	175 ~ 235 mm	
			Engine SLOW ~ STOP	45 ~ 65 mm	
	Decelerator pedal	At center of pedal	Engine FULL ~ DECEL. SLOW	45 ~ 65 mm	800 rpm
			Engine FULL ~ SLOW	50 ~ 90 mm	550 ~ 650 rpm
	Compression release lever			252 ~ 332 mm	
	Main clutch lever	At center of lever grip		170 ~ 230 mm	Except 45 mm of inertia brake travel
	Gear shift lever	At center of lever grip	Operate back and forth	60 ~ 80 mm	
			Operate to right and left	60 ~ 100 mm	
	Forward-reverse control lever	At center of lever grip		125 ~ 155 mm	
	Steering lever	Engine SLOW, at center of pedal	Until brake starts actuating	40 ~ 50 mm	Free play: 1 ~ 6 mm
			Until clutch is completely disengaged	85 ~ 100 mm	
			Until brake works	150 ~ 170 mm	
	Brake pedal	Engine SLOW, at center of lever grip	Operating force: 13 ~ 16 kg	150 ~ 170 mm	
			Max. stroke	220 ~ 250 mm	
Operating force	Fuel control lever		Engine SLOW ~ FULL	11 ± 3 kg	
			Engine SLOW ~ STOP	16 ± 2 kg	
	Decelerator pedal		Engine FULL ~ DECEL. SLOW	12.5 ± 2.5 kg	800 rpm
			Engine FULL ~ SLOW	20 ± 5 kg	550 ~ 650 rpm
	Compression release lever			22.5 ± 2.5 kg	
	Main clutch lever	Engine STOP, DISENGAGE → ENGAGE, at lever tip		71 ± 5 kg	
	Gear shift lever	Engine STOP		5.5 ± 2.5 kg	
	Forward-reverse control lever	Engine STOP		3.5 ± 1.5 kg	
	Steering lever	Engine SLOW	Until clutch is disengaged	3.5 ± 1.5 kg	Difference between RH and LH: less than 2 kg
			Until brake works and machine starts turning	Max. 18 kg	
	Brake pedal	When traveling at F1 with engine at 1,000 rpm, the engine starts to stall when brake on one side is applied.		15 ± 2 kg	Difference between RH and LH: less than 2 kg
Oil pressure	Main clutch booster	Oil temperature: 45 ~ 55° C, Engine FULL		38 ~ 46 kg/cm²	
	Steering clutch	Oil temperature: 45 ~ 55° C	Engine SLOW	9 ~ 13 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	12 ~ 17 kg/cm²	
	Steering brake	Oil temperature: 45 ~ 55° C	Engine SLOW	21 ~ 25 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	22 ~ 29 kg/cm²	

D155A 15001 – 25000

	Item	Test condition		Standard	Remarks
Pedal and lever travel (stroke)	Fuel control lever	At center of lever grip	Engine SLOW ~ FULL	175 ~ 235 mm	
			Engine SLOW ~ STOP	45 ~ 65 mm	
	Decelerator pedal	At center of pedal	Engine FULL ~ DECEL. SLOW	45 ~ 65 mm	800 rpm
			Engine FULL ~ SLOW	50 ~ 90 mm	550 ~ 650 rpm
	Compression release lever	At center of lever grip		252 ~ 332 mm	
	Gear shift lever	At center of lever grip	Between gear speeds	32 ~ 52 mm	
			Between F and R	65 ~ 85 mm	
	Steering lever	Engine SLOW, at center of lever grip	Operation of interlocking brake lever	40 ~ 50 mm	Including a free play of 1 ~ 6 mm
			Until clutch is completely disengaged	85 ~ 100 mm	
			Until brake works	150 ~ 170 mm	
	Brake pedal	Engine SLOW at center of pedal	Operating force: 13 ~ 16 kg	150 ~ 170 mm	
			Max. stroke	220 ~ 250 mm	
Operating force	Fuel control lever		Engine SLOW ~ FULL	11 ± 3 kg	
			Engine SLOW ~ STOP	16 ± 2 kg	
	Decelerator pedal		Engine FULL ~ DECEL. SLOW	12.5 ± 2.5 kg	800 rpm
			Engine FULL ~ SLOW	20 ± 5 kg	550 ~ 650 rpm
	Compression release lever			22.5 ± 2.5 kg	
	Gear shift lever	Engine STOP	Between gear speeds	2 ~ 4.5 kg	
			Between F and R	3 ± 1 kg	
	Steering lever	Engine SLOW	Until the clutch is disengaged	3.5 ± 1.5 kg	Difference between RH and LH: less than 2 kg
			Until brake works and machine starts turning	Max. 18 kg	
	Brake pedal	When traveling at F1 with engine at 1,000 rpm, the engine starts to stall when brake on one side is applied.		15 ± 2 kg	Difference between RH and LH: less than 2 kg
Oil pressure	Torque converter Outlet	Oil temperature: 70 ~ 80° C	Engine SLOW	1 ~ 3 kg/cm²	
			Engine FULL	4 ~ 7 kg/cm²	
	Torque converter Inlet	Oil temperature: 70 ~ 80° C	Engine SLOW	2 ~ 5 kg/cm²	
			Engine FULL	7 ~ 10 kg/cm²	
	Transmission	Oil temperature: 70 ~ 80° C	Engine SLOW	16 ~ 20 kg/cm²	
			Engine FULL	20 ~ 25 kg/cm²	
	Steering clutch	Oil temperature: 45 ~ 55° C	Engine SLOW	9 ~ 13 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	12 ~ 17 kg/cm²	
	Steering brake	Oil temperature: 45 ~ 55° C	Engine SLOW	21 ~ 25 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	22 ~ 29 kg/cm²	

D155A 25001 and up

	Item	Test condition		Standard	Remarks
Pedal and lever travel (stroke)	Fuel control lever	At center of lever grip	Engine SLOW ~ FULL	140 ~ 200 mm	
			Engine SLOW ~ STOP	45 ~ 64 mm	
	Decelerator pedal	At center of pedal	Engine FULL ~ DECEL. SLOW	45 ~ 65 mm	800 rpm
			Engine FULL ~ SLOW	50 ~ 90 mm	550 ~ 600 rpm
	Compression release lever	At center of lever grip		252 ~ 332 mm	
	Gear shift lever	At center of lever grip	Between gear speeds	38 ~ 46 mm	
			Between F and R	60 ~ 80 mm	
	Steering lever	Engine SLOW, at center of lever grip	Operation of interlocking brake lever	40 ~ 50 mm	Including a free play of 1 ~ 6 mm
			Until clutch is completely disengaged	85 ~ 100 mm	
			Until brake works	116 ~ 136 mm	
	Brake pedal	Engine SLOW at center of pedal	Operating force: 13 ~ 16 kg	150 ~ 170 mm	
			Max. stroke	220 ~ 250 mm	
Operating force	Fuel control lever		Engine SLOW ~ FULL	11 ± 3 kg	
			Engine SLOW ~ STOP	16 ± 2 kg	
	Decelerator pedal		Engine FULL ~ DECEL. SLOW	12.5 ± 2.5 kg	800 rpm
			Engine FULL ~ SLOW	20 ± 5 kg	550 ~ 600 rpm
	Gear shift lever	Engine STOP	Between gear speeds	4.5 ± 1.5 kg	
			Between F and R	3 ± 1 kg	
	Steering lever	Engine SLOW	Until the clutch is disengaged	3.5 ± 1.5 kg	Difference between RH and LH: less than 2 kg
			Until brake works and machine starts turning	6.5 ± 1.5 kg	
	Brake pedal	When traveling at F1 with engine at 1,000 rpm, the engine starts to stall when brake on one side is applied.		15 ± 2 kg	Difference between RH and LH: less than 2 kg
Oil pressure	Torque converter Outlet	Oil temperature: 70 ~ 80°C	Engine SLOW	1 ~ 3 kg/cm²	
			Engine FULL	4 ~ 7 kg/cm²	
	Torque converter Inlet	Oil temperature: 70 ~ 80°C	Engine SLOW	2 ~ 5 kg/cm²	
			Engine FULL	7 ~ 10 kg/cm²	
	Transmission	Oil temperature: 70 ~ 80°C	Engine SLOW	16 ~ 20 kg/cm²	
			Engine FULL	20 ~ 25 kg/cm²	
	Steering clutch	Oil temperature: 45 ~ 55°C	Engine SLOW	5.5 ~ 7 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	13.5 ~ 17 kg/cm²	
	Steering brake	Oil temperature: 45 ~ 55°C	Engine SLOW	14 ~ 18 kg/cm²	Difference between RH and LH: less than 2 kg
			Engine FULL	15 ~ 19 kg/cm²	

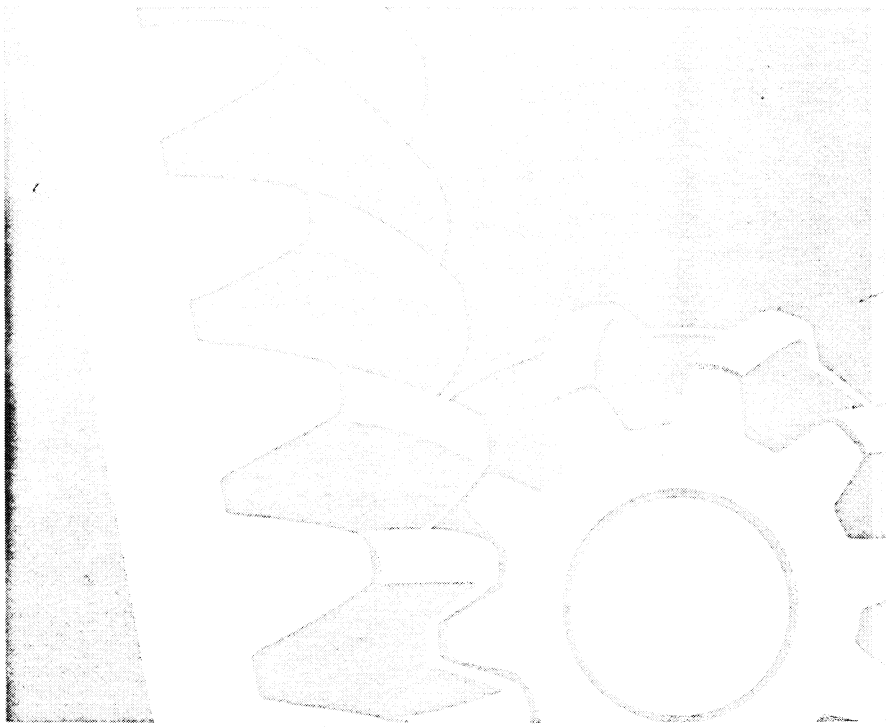
SHOP MANUAL

D150,155

SERIAL NO. D150A-1 8408~
D155A-1 15001~

23 POWER TRAIN

DISASSEMBLY AND ASSEMBLY

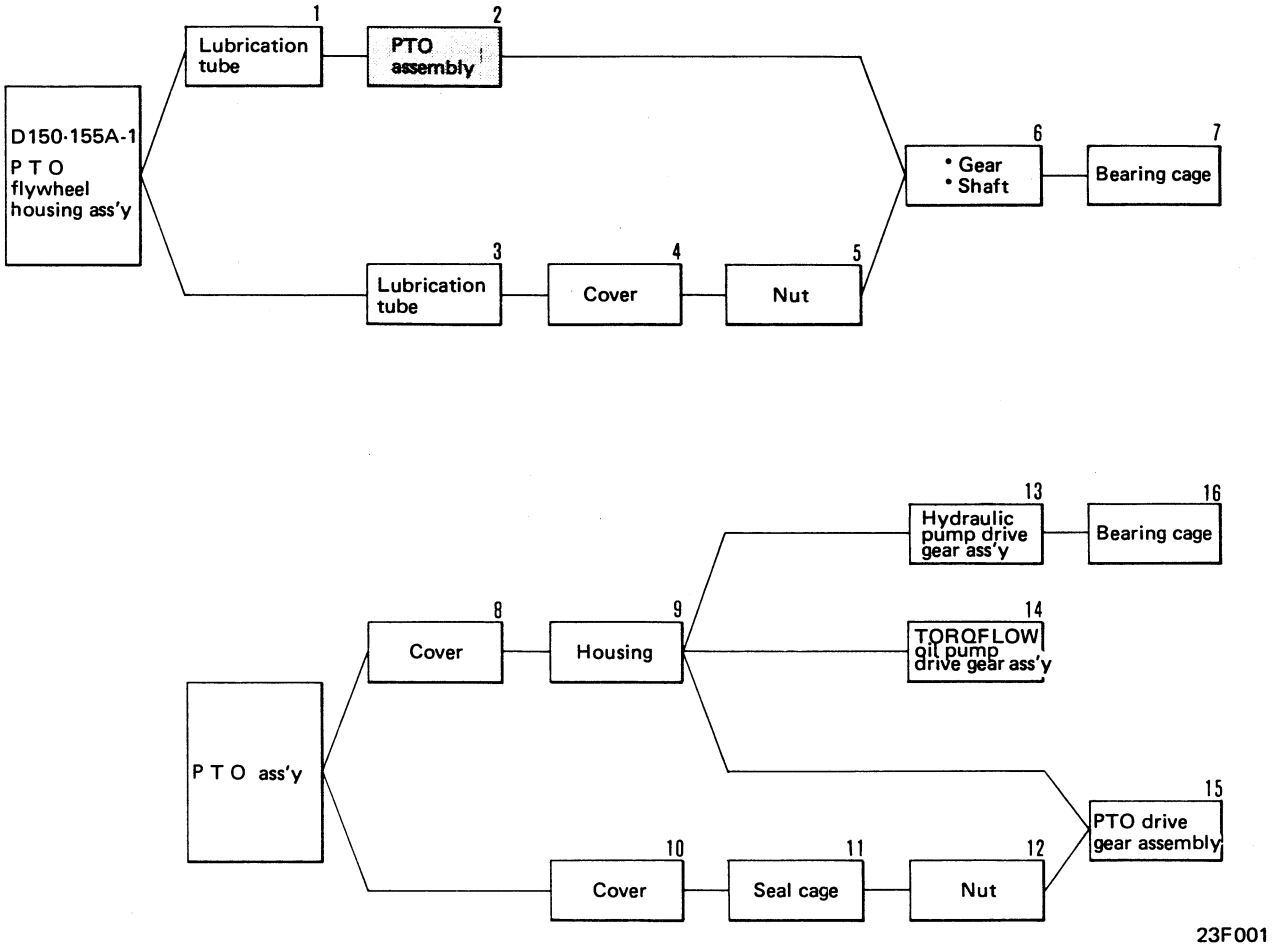


DISASSEMBLY AND ASSEMBLY

Disassembly of PTO and flywheel housing 23- 4
Assembly of PTO and flywheel housing 23- 8
Disassembly of main clutch assembly 23- 11- 1
Assembly of main clutch assembly 23- 11- 4
Disassembly of transmission assembly 23- 11- 9
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Mounting torque converter 23- 16
Disassembly of torque converter (1/2), (2/2) 23- 20
Assembly of torque converter (1/2), (2/2) 23- 28
Dismounting torque converter relief valve 23- 38
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Dismounting transmission lubrication valve 23- 94
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Dismounting bevel gear and bevel gear shaft 23-110
Mounting bevel gear and bevel gear shaft 23-114
Dismounting final drive 1st pinion 23-120
Mounting final drive 1st pinion 23-122
Dismounting steering control valve 23-126
Mounting steering control valve 23-128
Dismounting steering brake interlocking valve 23-128-2
Mounting steering brake interlocking valve 23-129
Disassembly of steering control valve 23-130
Assembly of steering control valve 23-132

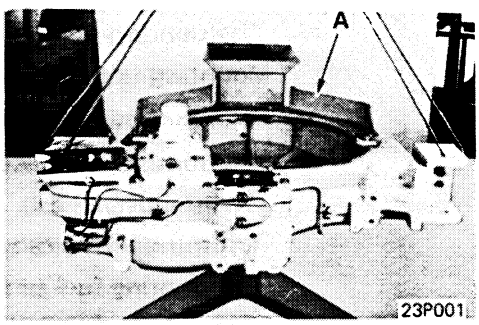
Disassembly of steering brake interlocking valve 23-133-1
Assembly of steering brake interlocking valve 23-133-1
Dismounting brake safety valve 23-134
Mounting brake safety valve 23-136
Disassembly of brake safety valve 23-138
Assembly of brake safety valve 23-138
Dismounting steering main relief valve 23-138-2
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Disassembly steering main relief valve 23-139
Assembly steering main relief valve 23-139
Dismounting brake booster 23-139-1
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Disassembly of brake booster 23-140
Assembly of brake booster 23-142
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Dismounting torque converter oil cooler 23-166
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Dismounting floor frame 23-181-1
Mounting floor frame 23-181-3
Dismounting ROPS cab 23-181-5
Mounting ROPS cab 23-181-8
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Dismounting fuel tank 23-182
Mounting fuel tank 23-184
Dismounting radiator 23-186
Mounting radiator 23-190
Dismounting radiator guard 23-194
Mounting radiator guard 23-198

DISASSEMBLY OF PTO AND FLYWHEEL HOUSING



Special tools required

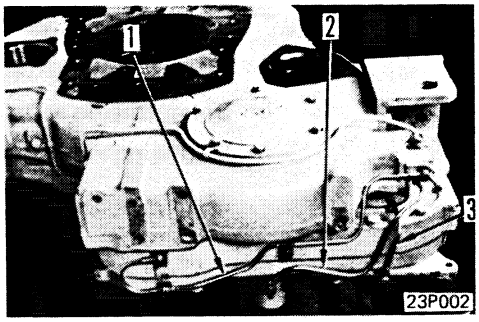
Special tools required		A	B
790-501-5000	Unit repair stand	1	
790-102-1400	• Bracket	1	
790-102-1800	Nut wrenches kit		1



1. Lubrication tube

1) Mount PTO and flywheel housing assembly on unit repair stand A.

2) Remove PTO lubrication tubes (1), (2) and (3).

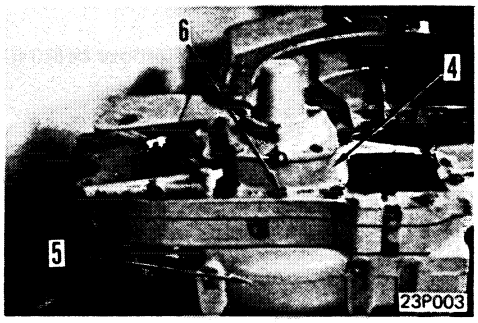


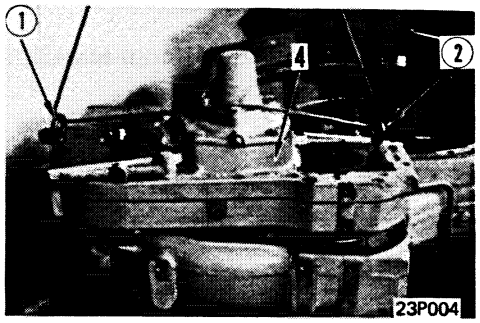
2. PTO assembly

Remove bolts (6) fastening PTO assembly (4) and flywheel housing (5).

Lift off PTO assembly (4) using crane rope hooked to hanging bolts ① (10 mm, P = 1.5) and ② (12 mm, P = 1.75).

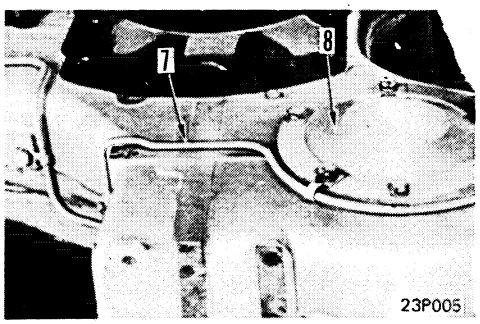
kg PTO assembly: **85 kg.**





3. Lubrication tube

Turn flywheel housing upside down. Remove lubrication tube (7). on flywheel housing PTO gear.

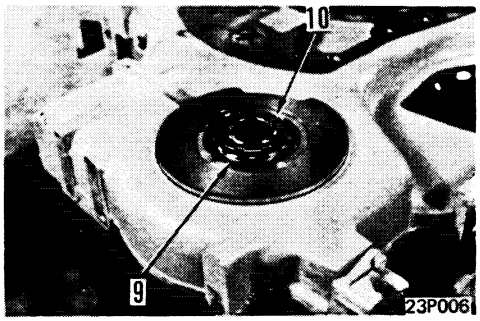


4. Cover

Remove cover (8).

5. Nut

Bend down lock plate (9) and remove nut (10) with wrench Ⓑ



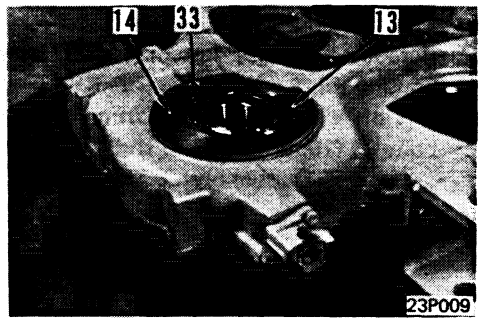
6. Gear, shaft

Turn flywheel housing upside down. Apply taps to the lower end of shaft (11) with copper hammer to remove shaft. Lift off gear (12) from flywheel housing.

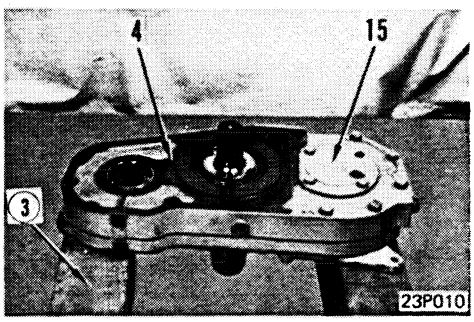




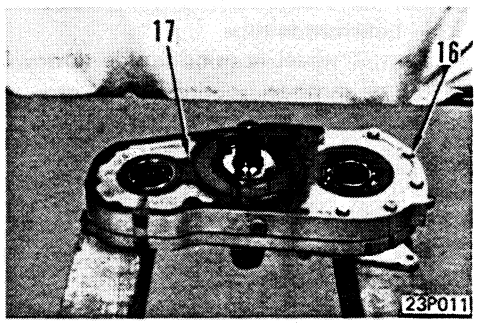
7. Bearing cage
Remove spacer (13). Remove bearing cage (14).



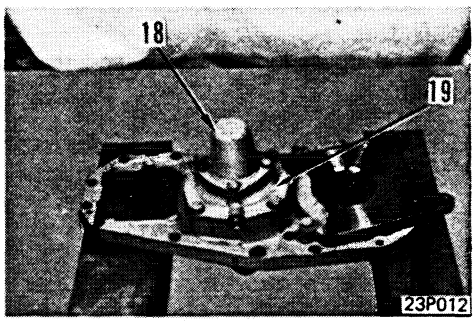
8. Cover
Set PTO assembly (4) on block ③ (H = 150 mm). Remove cover (15).



9. Housing
Remove bolts (16); remove housing (17).

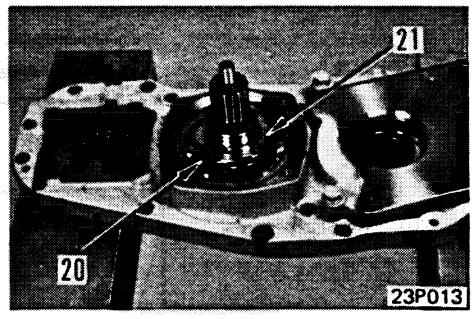


10. Cover
Remove cover (18).



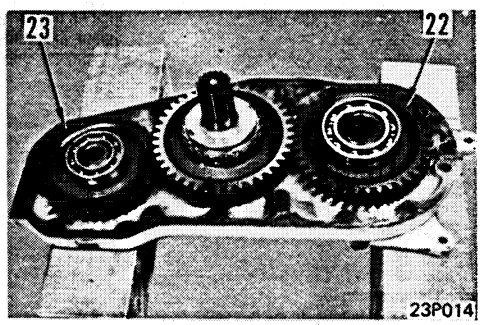
11. Seal cage
Remove seal cage (19).

12. Nut
Bend down lock plate (20) and remove nut (21) with wrench B.



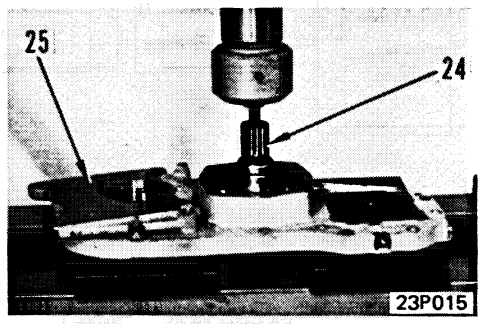
13. Hydraulic pump drive gear assembly
Remove hydraulic pump drive gear assembly (22) by prying it or giving it light taps with copper hammer from backside.

14. TORQFLOW oil pump drive gear assembly
Remove TORQFLOW pump drive gear assembly (23) by prying it or giving it taps with copper hammer from backside.

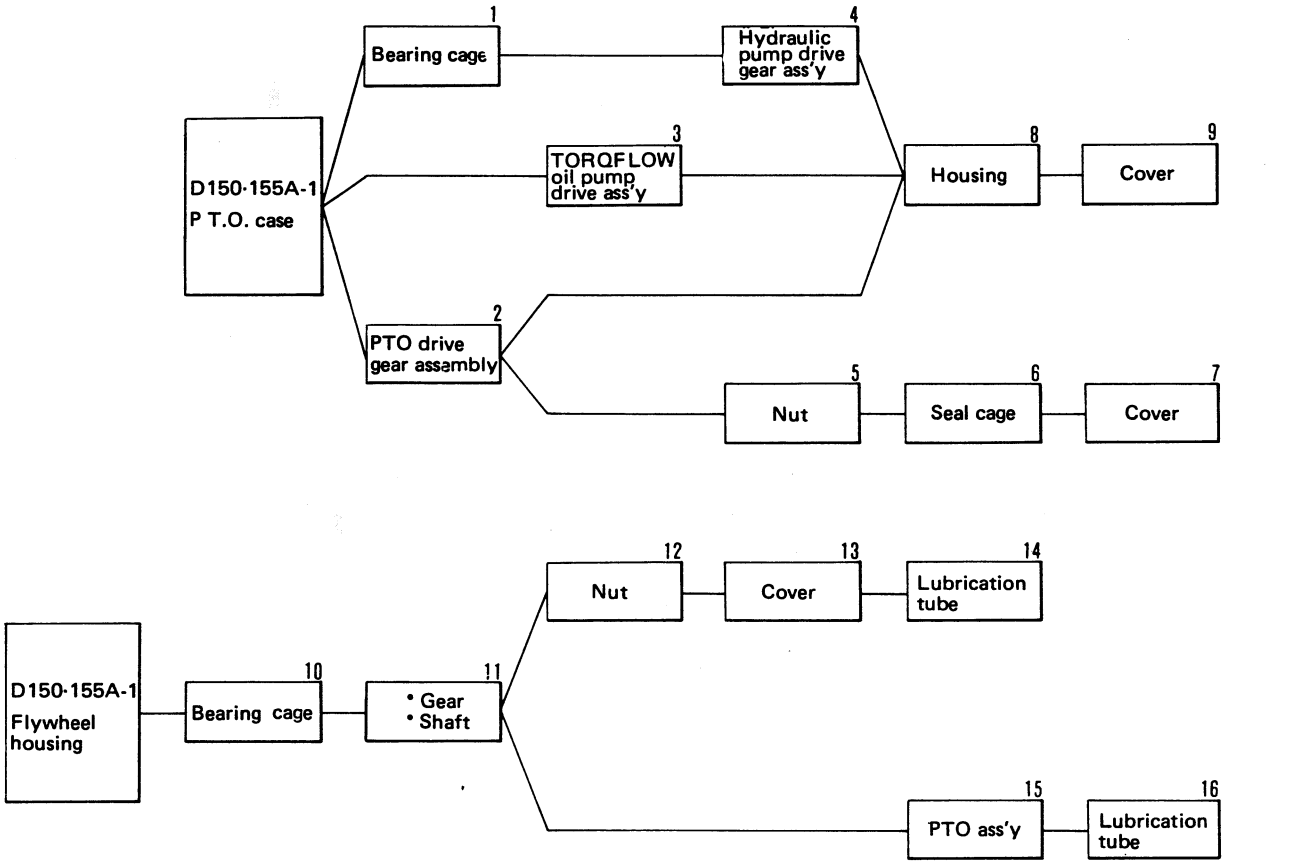


15. PTO drive gear assembly
Remove PTO drive gear assembly (24) using press.

16. Bearing cage
Remove bearing cage (25).



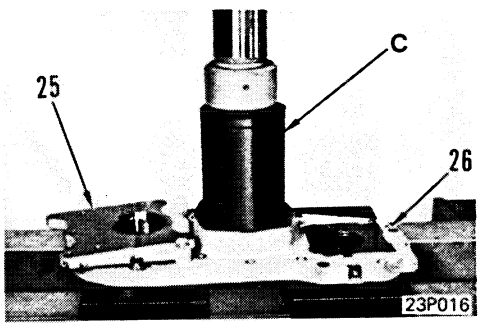
ASSEMBLY OF PTO AND FLYWHEEL HOUSING



23F002

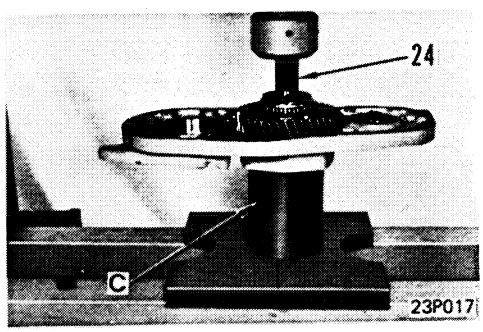
Special tools required

Special tools required		A	B	C
790-501-5000	Unit repair stand	1		
790-901-2110	Bracket		1	
790-102-1800	Nut wrench kit		1	
790-201-2000	Push tool kit			1

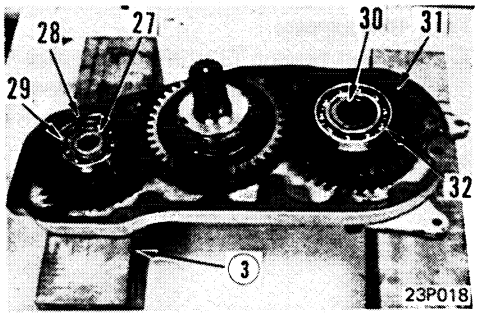


1. **Bearing cage**
   Install bearing cage (25), with O-ring installed, in PTO case.

2. **PTO drive gear assembly**
   1) Using push tool C, press-fit bearing into case (26).
   2) Using push tool C to support bearing, press-fit PTO drive gear assembly (24) in which bearing and gear are assembled into a unit.

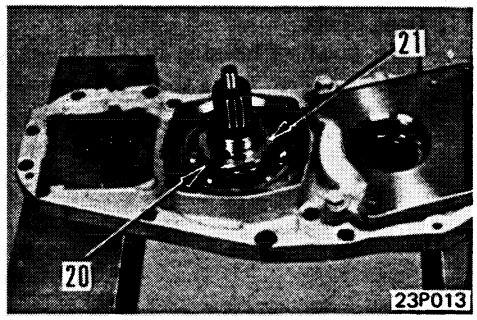


3. **TORQFLOW oil pump drive assembly**
   1) Set PTO case on block ③ (H = 150 mm).
   2) Assemble gear (28) and upper and lower bearings (29) on shaft (27).
   3) Drive assembled shaft into case with a copper hammer.



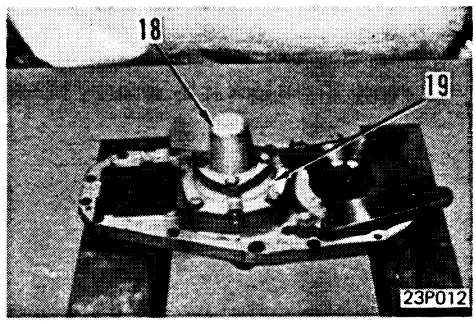
4. **Hydraulic pump drive gear assembly**
   1) Assemble gear (31) and upper and lower bearings (32) on shaft (30).
   2) Drive assembled shaft into case with a copper hammer.

5. **Nut**
   Tighten nut (21) with wrench B and lock it by securely bending lock plate (20).

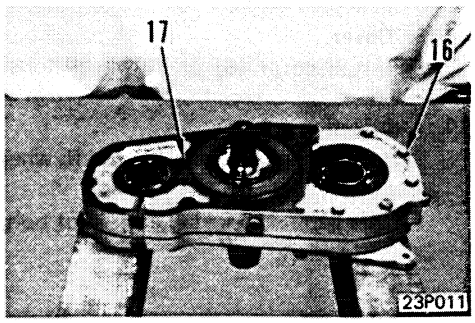


6. **Seal cage**
   Install seal cage (19) in cage with oil seal and O-ring.

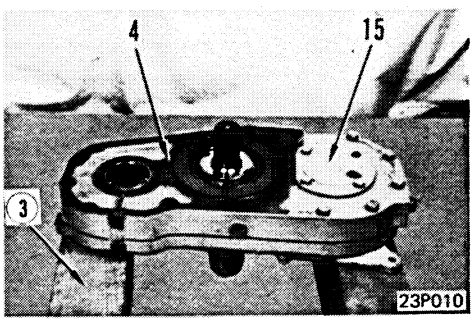
7. **Cover**
   1) Apply gasket sealant (LG-1) to mounting surface of seal cage cover (18) and put gasket on it.
   2) Install cover.



8. **Housing**
   Coat mounting surface PTO case with gasket sealant (LG-1), attach gasket, and install housing (17) with bolts (16).
   kgm Housing mounting bolt: **9.5 ~ 12.5 kg.m**



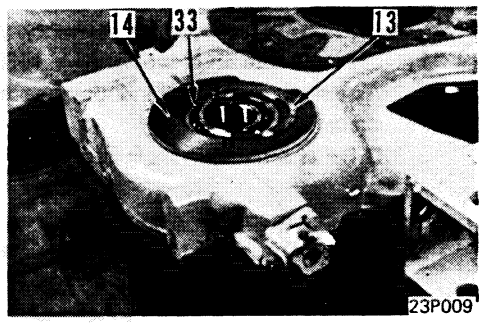
9. **Cover**
   1) Apply gasket sealant (LG-1) to mounting surface of seal cage cover (15) and put gasket on it.
   2) Install cover.



10. Bearing cage

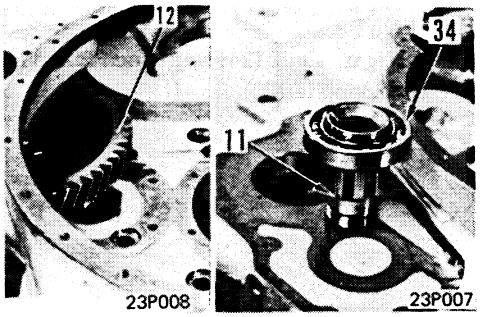
Install bearing (33) in bearing cage (14), fit bearing cage on flywheel housing with O-ring inserted, and install spacer (13).

★ Keep cage temporarily fitted to flywheel housing with bolts until shaft is driven into housing.



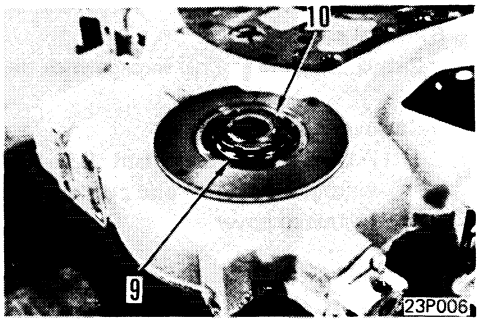
11. Gear, Shaft

Turn flywheel housing upside down. Position gear (12) in flywheel housing. Drive shaft (11), on which bearing (34) has previously installed, into housing with a copper hammer.



12. Nut

Turn flywheel housing upside down. Tighten nut (10) with wrench B and lock it by securely bending lock plate (9).



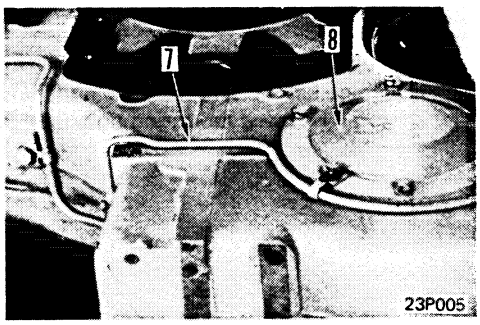
13. Cover

Install cover (8) on flywheel housing with O-ring inserted.

14. Lubrication tube

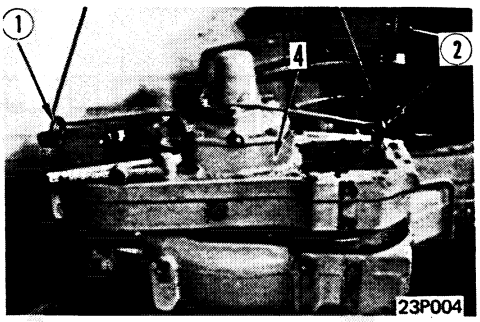
Install lubrication tube (7) for flywheel housing PTO gear with joint bolts.

★ Be careful to install each joint bolt together with two sheets of gasket.



15. PTO assembly

Using hanging bolts ① (10 mm, P = 1.5) and ② (12 mm, P = 1.75), lift PTO assembly (4). install PTO assembly, O-ring installed to it on flywheel housing (5) with bolts (6).

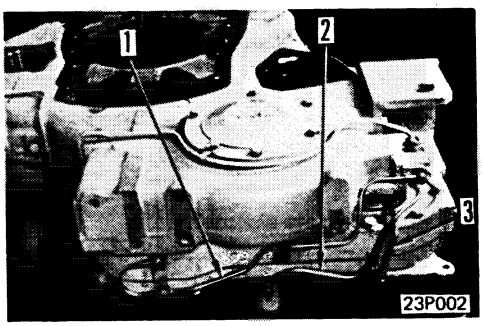




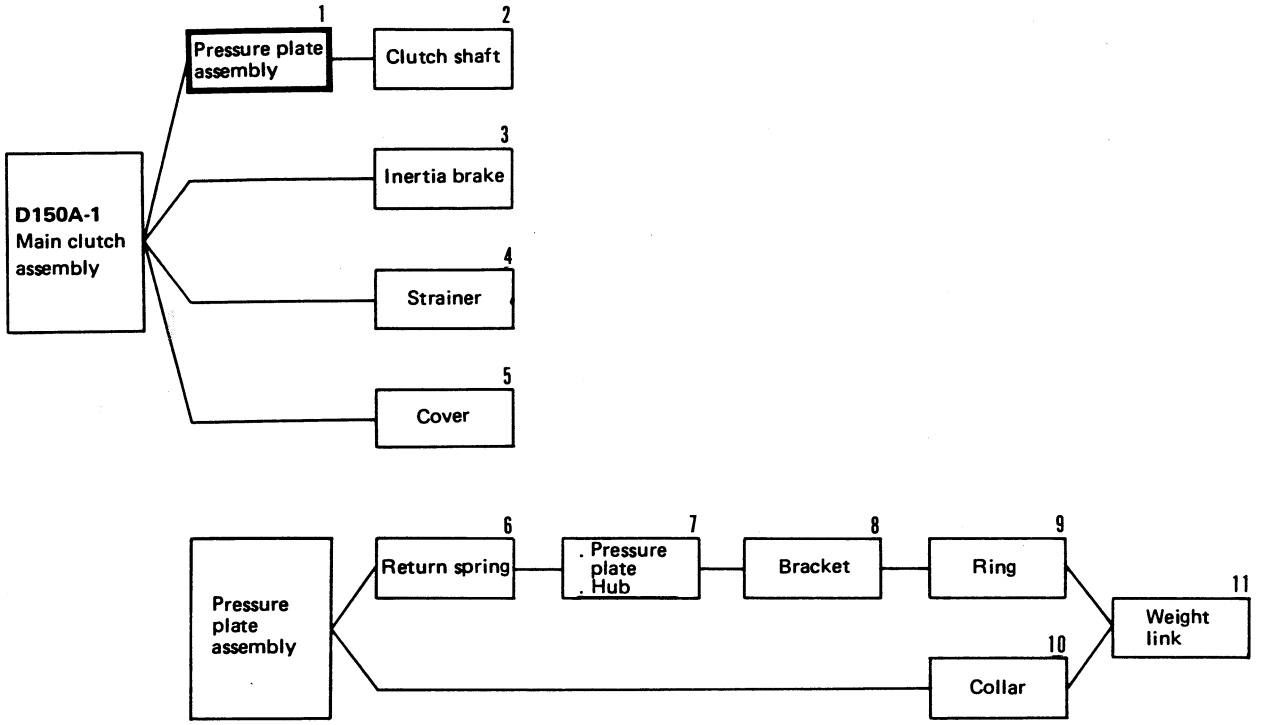
16. Lubrication tube

Install PTO lubrication tubes (1), (2) and (3) with joint bolts.

★ Be careful to install each joint bolt together with two sheets of gasket.

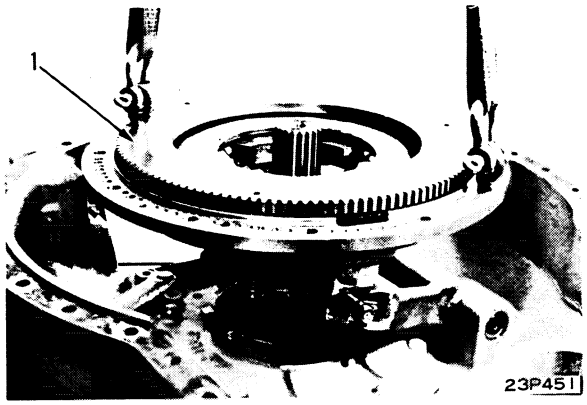


DISASSEMBLY OF MAIN CLUTCH ASSEMBLY D150



23F080

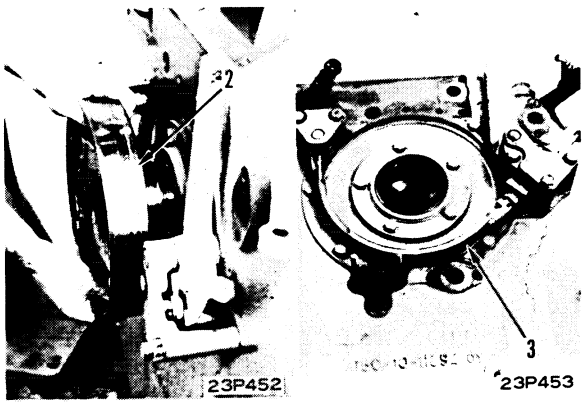
1. Pressure plate assembly
Lift pressure plate assembly (1) and remove it from clutch housing.



23P451

2. Clutch shaft
Extract clutch shaft (2).

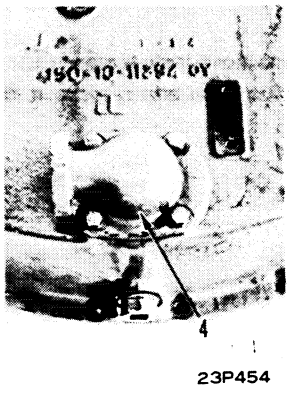
3. Inertia brake
Remove inertia brake (3).



23P452 23P453

4. Strainer
Remove strainer (4).

5. Cover
1) Remove cover (5).

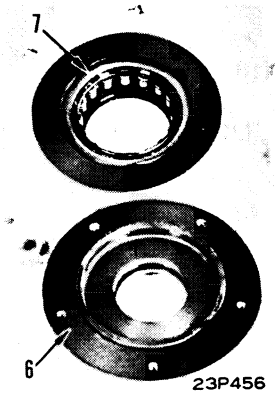


23P454

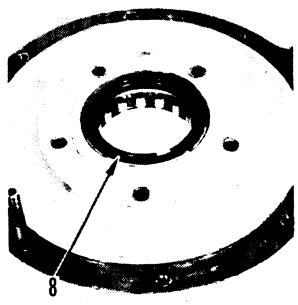


23P455

2) Take off retainer (6) and remove bearing (7) and oil seal (8).



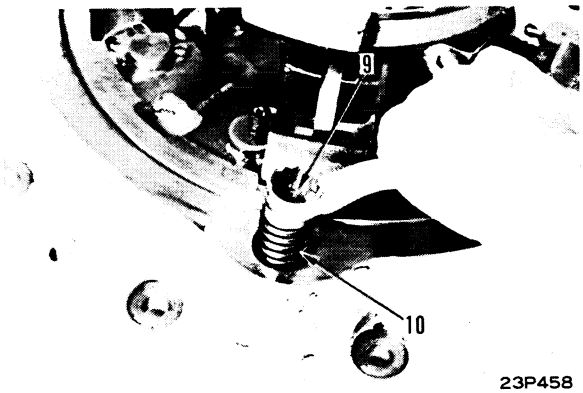
23P456



23P457

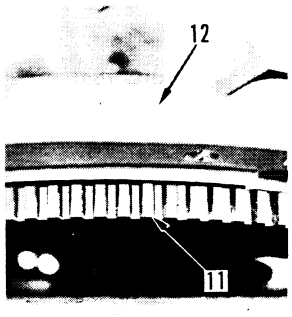
SUB-DISASSEMBLY OF PRESSURE PLATE ASSEMBLY

6. Return spring
Compress spring (10) to remove cotter (9), and remove spring.

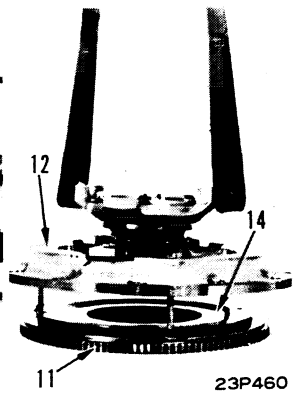


23P458

7. Pressure plate and hub
1) Put match marks on pressure plate (11) and bracket (12).
2) Lift out bracket (12) and disconnect pressure plate (11) and hub (14) from bracket.



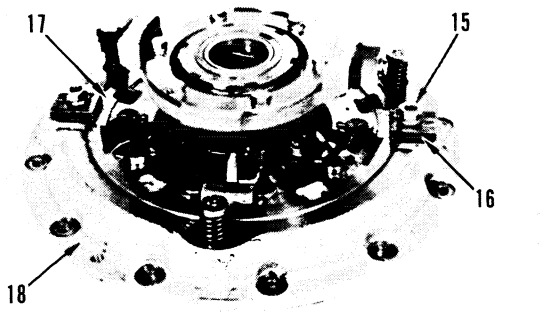
23P459



23P460

8. Bracket

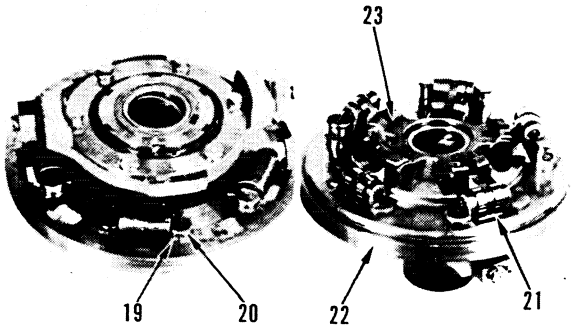
1) Remove nut (15) and remove lock plate (16).
2) Turn ring (17) anti-clockwise and remove it from bracket (18).



23P461

9. Ring

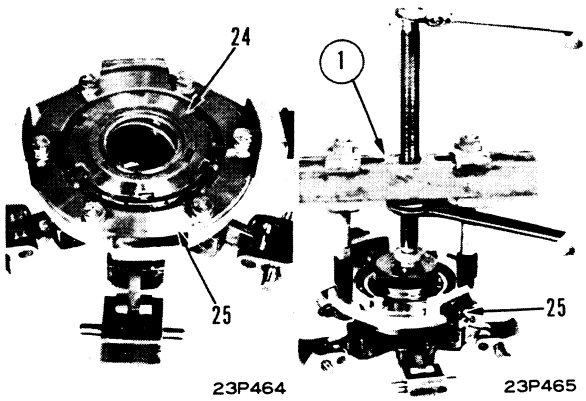
1) Remove cotter pin (19).
2) Remove bushing (20) from weight link (21), and separate it from ring (22) and weight link assembly (23).



23P462 23P463

10. Collar

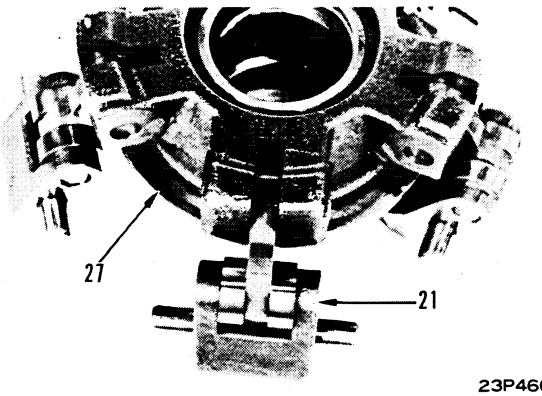
1) Remove nut (24).
2) Remove collar (25) with puller ①.



23P464 23P465

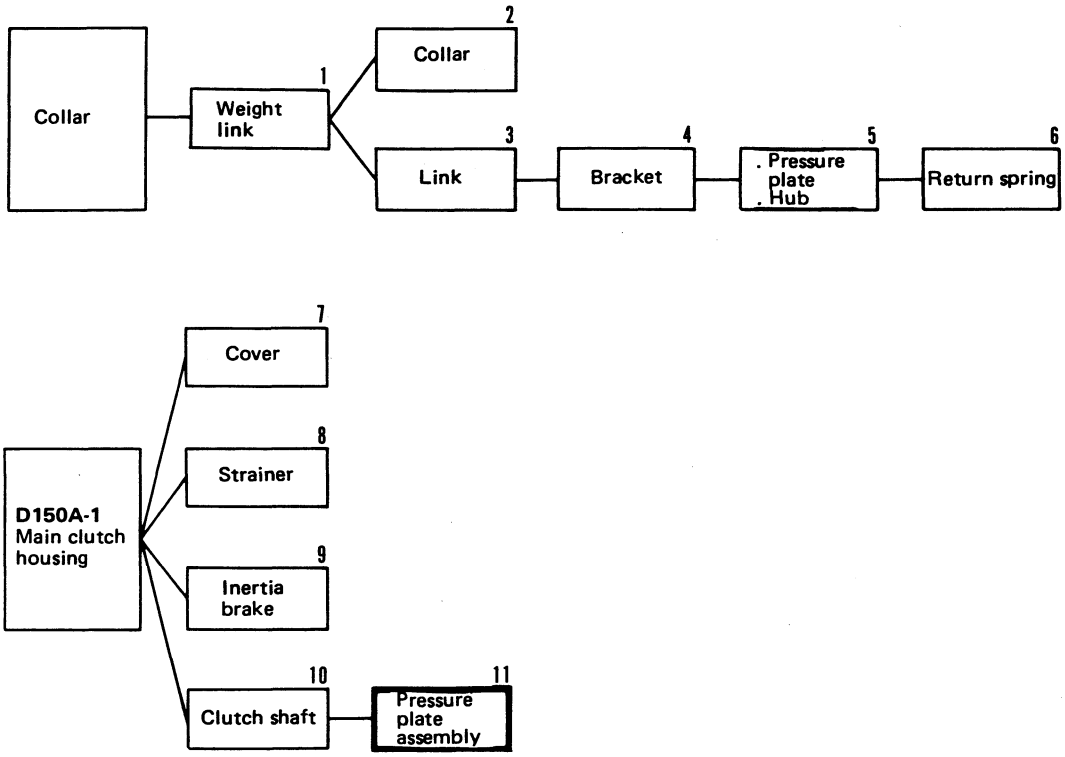
11. Weight link

Remove weight link (21) from collar (27).



23P466

ASSEMBLY OF MAIN CLUTCH ASSEMBLY D150

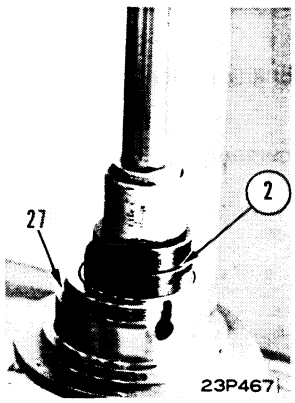


23F081

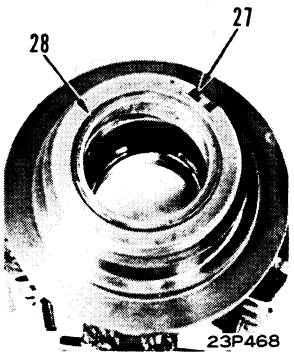
SUB-ASSEMBLY OF PRESSURE PLATE ASSEMBLY

1. Weight link

1) Press fit bushes (28) onto collar (27) from both sides using press tool ② (ϕ70 mm).

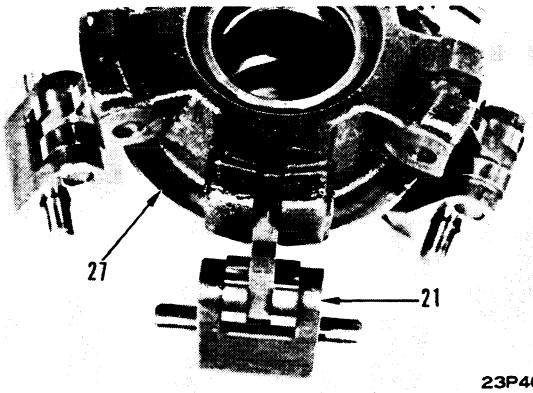


23P467



23P468

2) Fit weight link (21) onto collar (27).

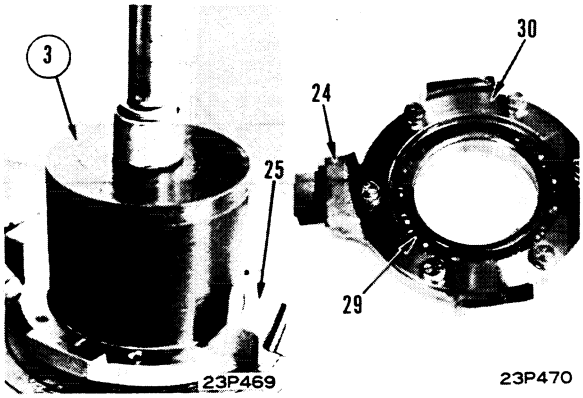


23P466

2. Collar

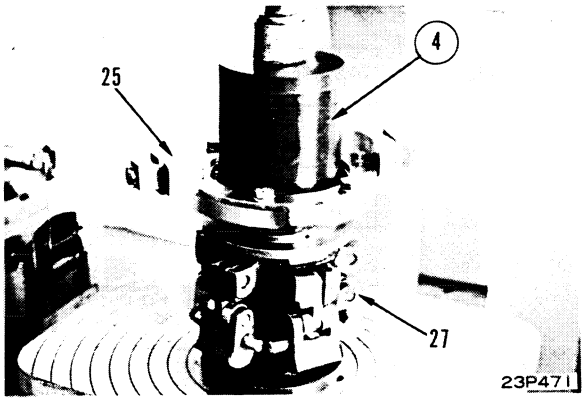
1) Press fit bearing (29) onto collar (25) with press tool ③ (ϕ150 mm), and install plate (30).

⊕ Bend lock plate securely.



2) Press fit collar (25) onto collar (27) with press tool (4) (internal dia. 100 mm).

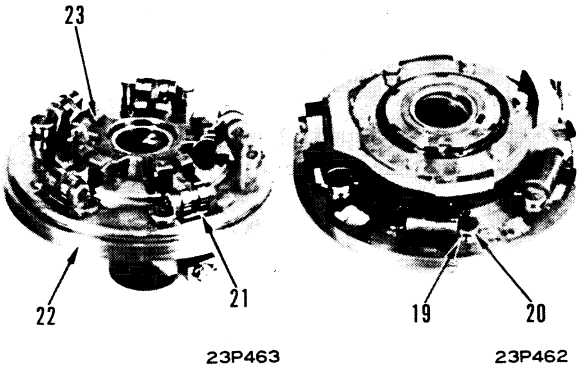
★ Fit collar by pushing inner race of bearing (29) which was press fit onto collar (25) in 1) above.



3. Link

Fit bush (20) to weight link (21), and install ring (22).
Fit cotter pin (19).

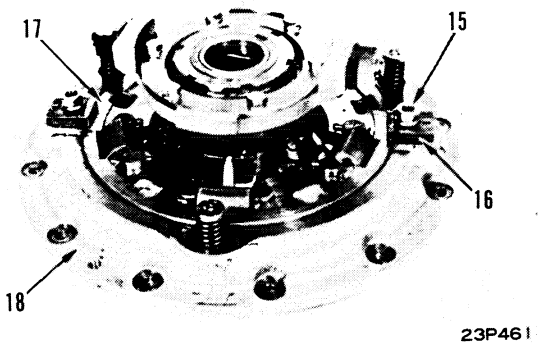
⊕ Bend cotter pin securely.



4. Bracket

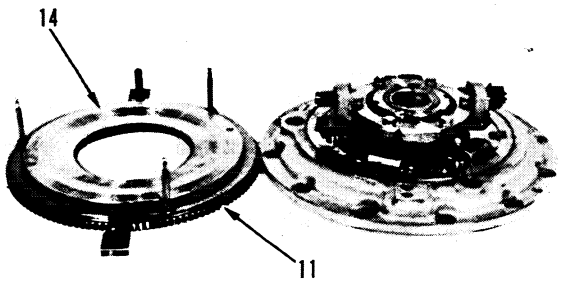
Install ring (17) on bracket (18) by turning it anti-clockwise, and temporarily mount lock plate (16) with nut (15).

★ Screw in ring until it is flush with bracket.



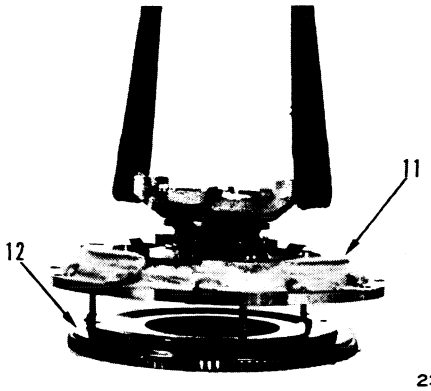
5. Pressure plate and hub

1) Place hub (14) on pressure plate (11).



23P472

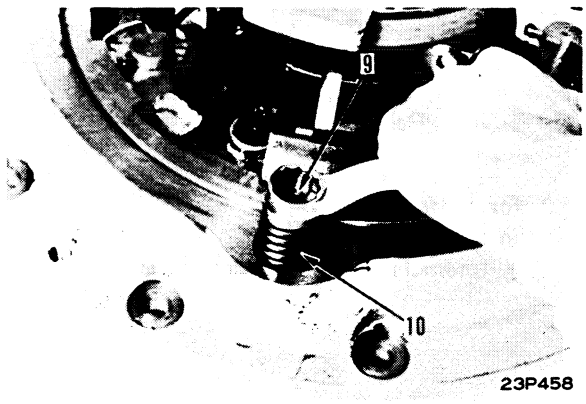
2) Assemble pressure plate (11) and bracket (12) after aligning match marks.



23P473

6. Return spring

Compress spring (10) to fit cotters (9), and fit spring.



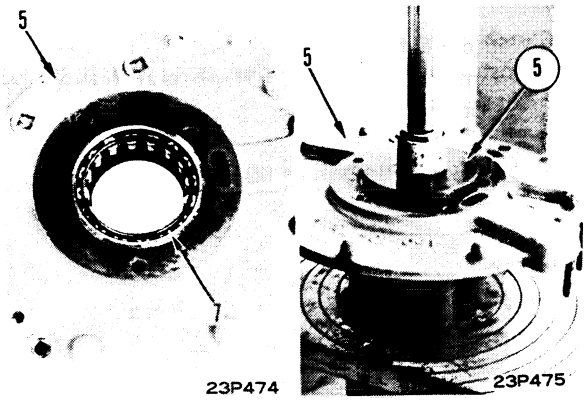
23P458

ASSEMBLY OF MAIN CLUTCH ASSEMBLY

7. Cover

1) Fit the following components on cover.

i) Press fit bearing (7) onto cover (5) with press tool ⑤ (φ125 mm).



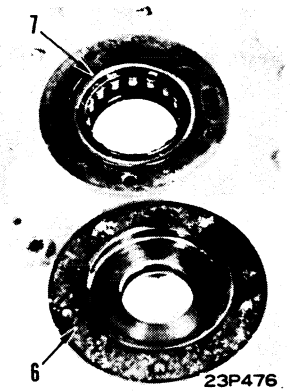
23P474 23P475

ii) Fit gasket and mount retainer (6).
★ Mounting bolts are inserted in opposite side of retainer mounting part.

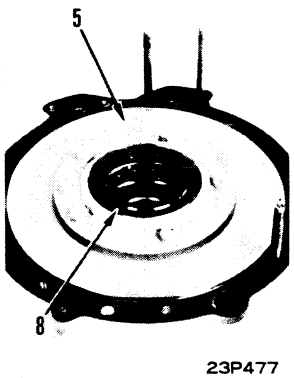
Gasket: Liquid gasket (LG-1)

iii) Press fit oil seal (8) into cover (5) with push tool (ϕ110 mm).

Oil seal lip face: Fill 40 to 60% of space with grease (G2-LI).



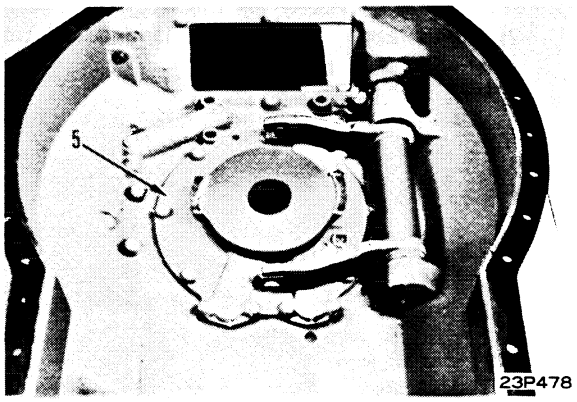
23P476



23P477

2) Fit gasket and mount cover (5) on main clutch housing.

Gasket: Liquid gasket (LG-1)

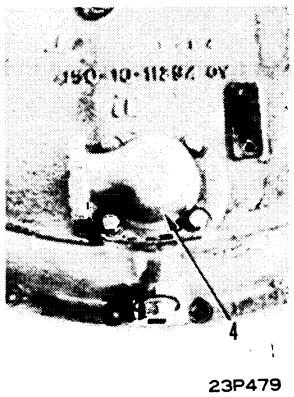


23P478

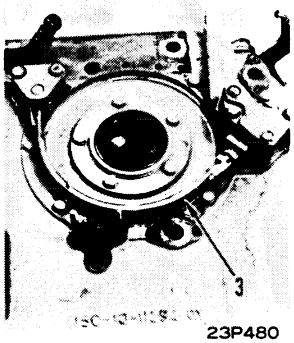
8. Strainer
Fit gasket and mount strainer (4).

Gasket: Liquid gasket (LG-1)

9. Inertia brake
Install inertia brake (3).
★ Internal dia of inner race: **70 mm**



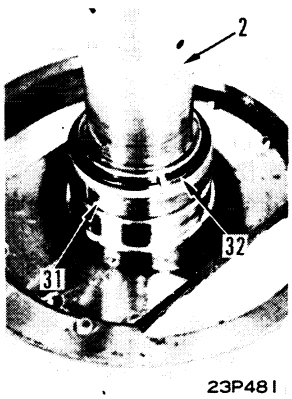
23P479



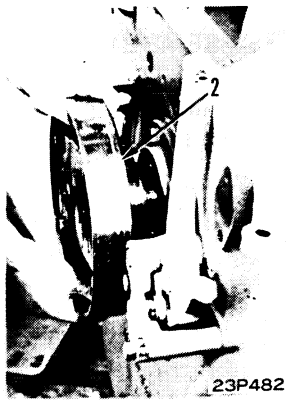
23P480

10. Clutch shaft
1) Install inner race (31) on clutch shaft (2), and fit snap ring (32).

2) Mount clutch shaft (2) on clutch housing.



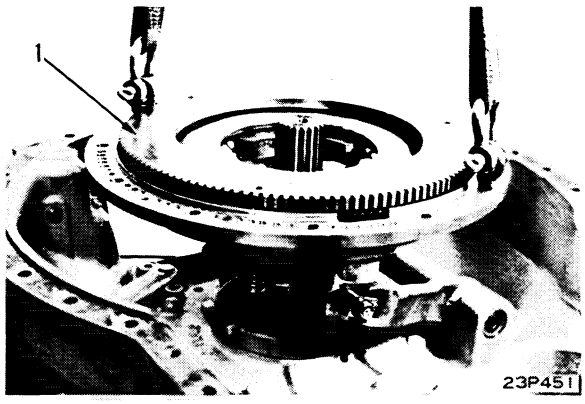
23P481



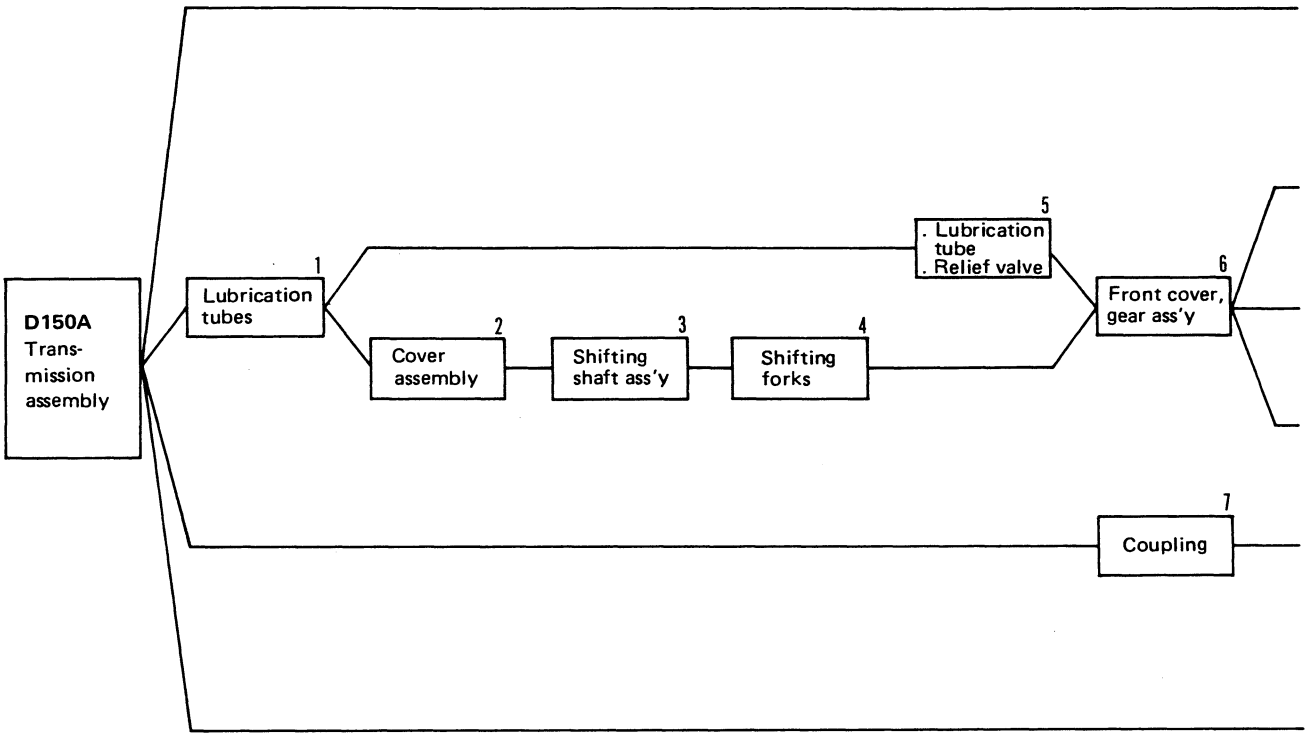
23P482

11. Pressure plate assembly

Install pressure plate assembly (1) after aligning it with clutch shaft.

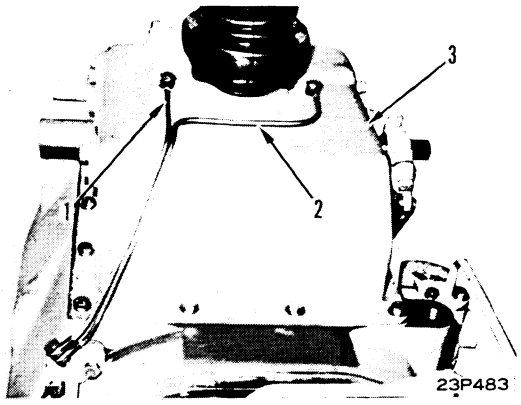


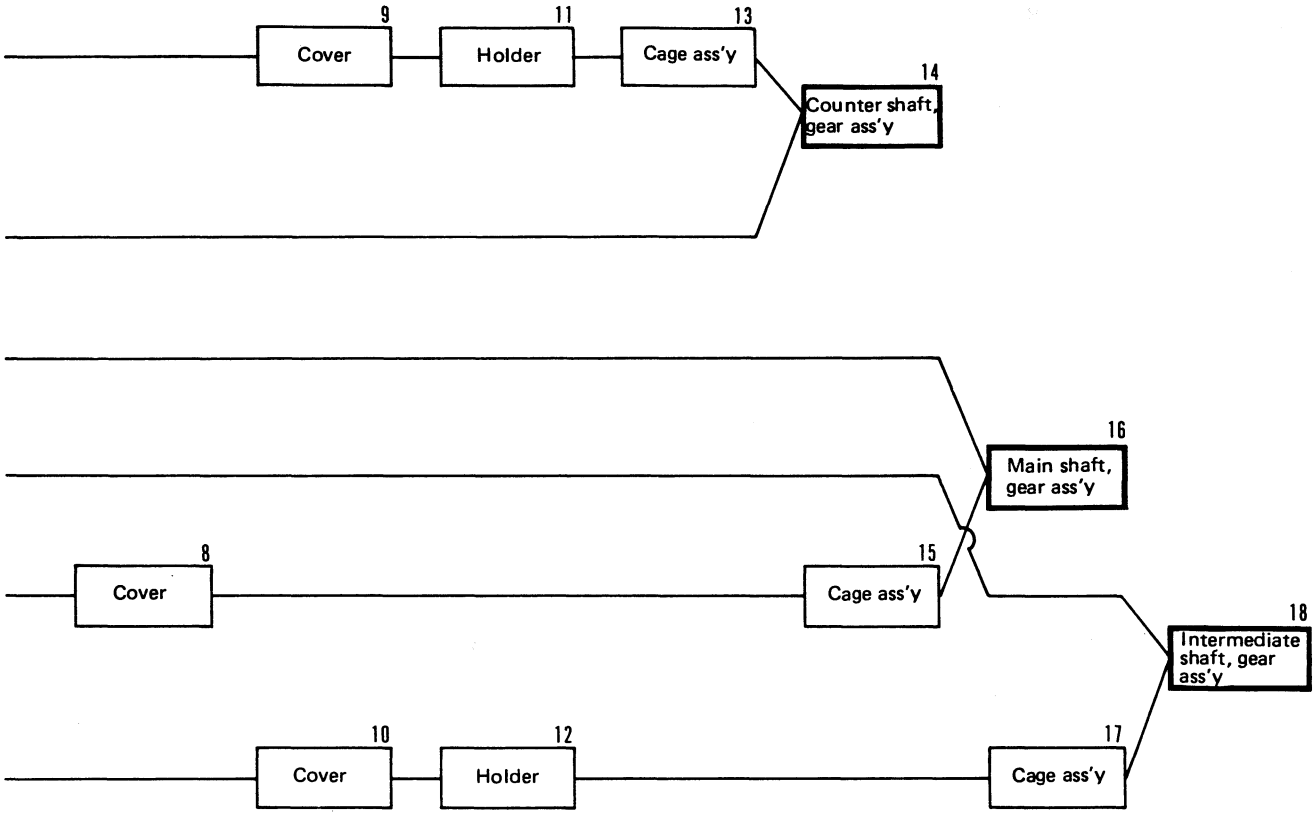
DISASSEMBLY OF TRANSMISSION ASSEMBLY D150



1. Lubrication tubes
Remove lubrication tubes (1) and (2).

2. Cover assembly
Remove cover assembly (3).

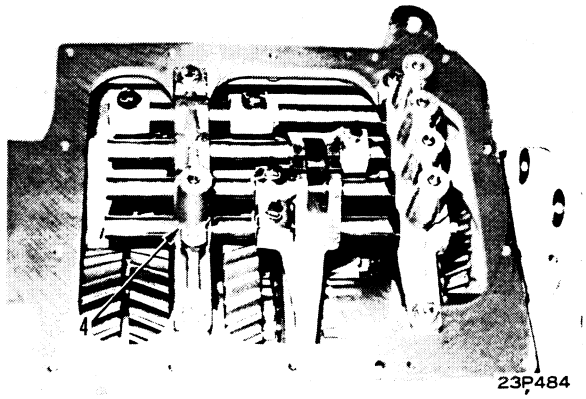




23F082

3. Shifting shaft assembly

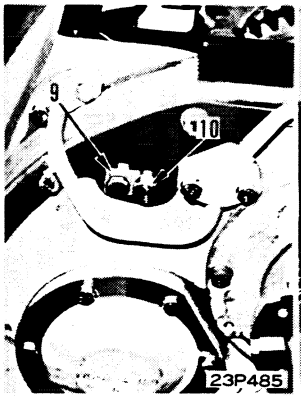
Remove shifting shaft assembly (4).

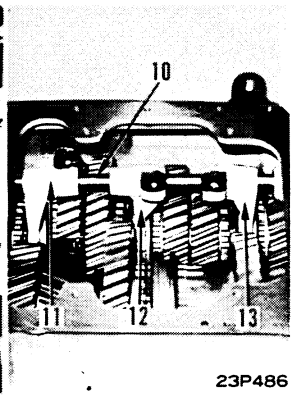


23P484

4. Shifting forks

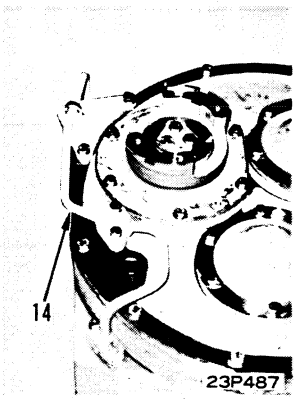
1) Remove lock (9).
2) Pull out shaft (10) and remove shifting forks (11), (12) and (13).

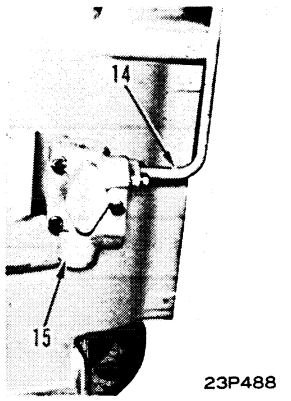




5. Lubrication tube, relief valve assembly

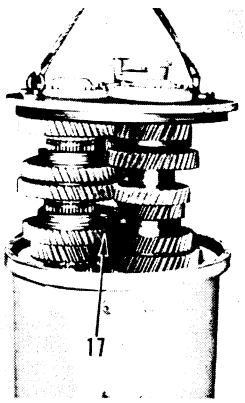
1) Set transmission assembly with coupling facing up.
2) Remove tube (14).
3) Remove relief valve assembly (15).



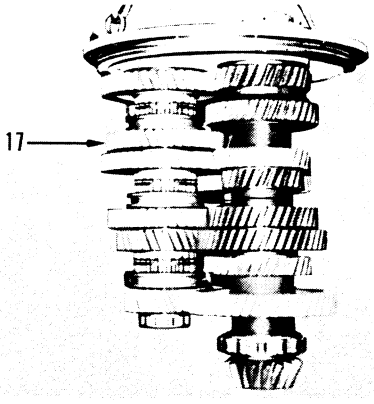


6. Front cover, gear assembly

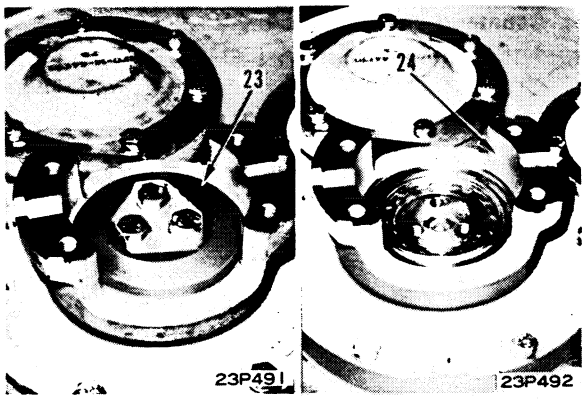
1) Remove mounting bolts of front cover.
2) Using two eye bolts (12 mm, P = 1.75), raise front cover, and remove front cover and gear assembly (17) from case.



3) Lower front cover and gear assembly (17) and set sideways on disassembly stand.



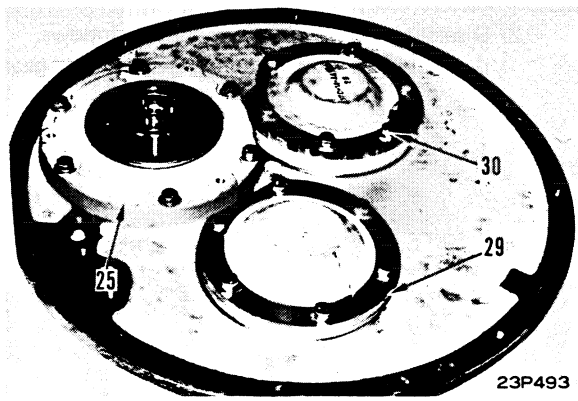
7. Coupling
1) Remove holder (23).
2) Remove coupling (24).



8. Cover
Screw in extraction bolt and remove cover (25).

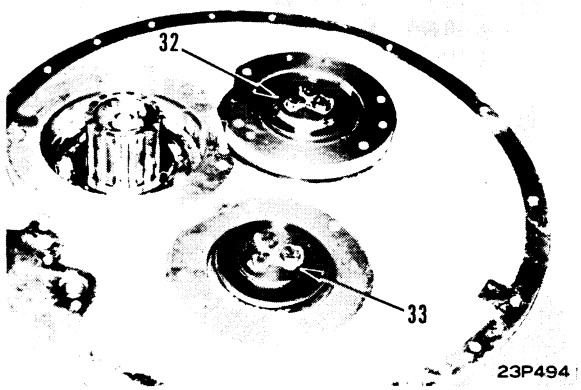
9. Cover
Remove cover (29).

10. Cover
Remove cover (30).

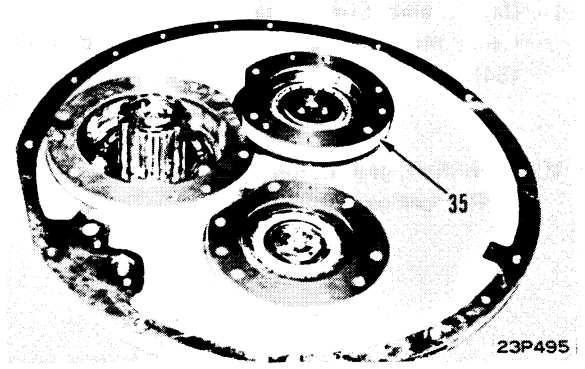


11. Holder (main shaft)
Remove holder (32).

12. Holder (intermediate shaft)
Remove holder (33).

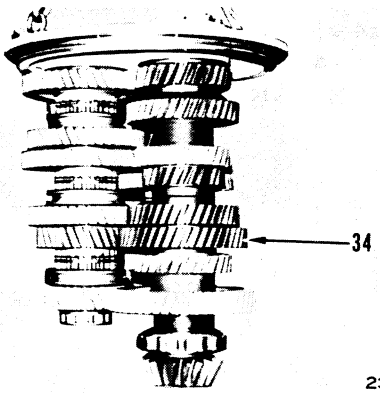


13. Cage assembly (countershaft)
1) Sling gear assembly (34).
2) Using three extraction bolts, remove cage assembly (35).
★ Check number of shims and keep in a safe place.



14. Counter shaft, gear assembly

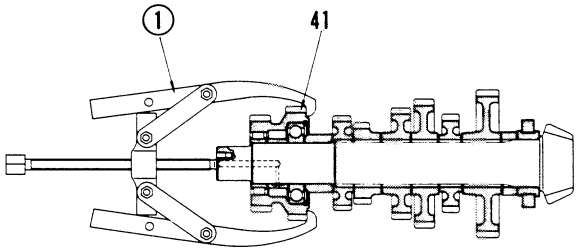
1) Remove gear assembly (34).



23P496

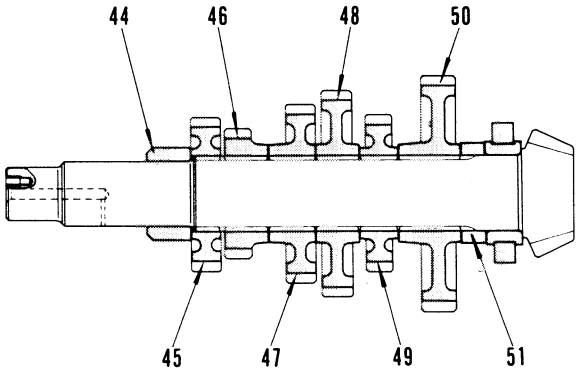
2) Disassemble gear assembly (34) as follows.

i) Using gear puller ①, remove forward gear (41).



23F083

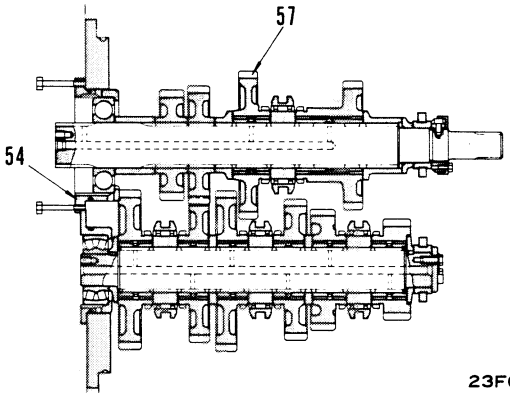
ii) Remove collar (44), 4th gear (45), 6th gear (46), 3rd gear (47), 2nd gear (48), 5th gear (49), 1st gear (50) and collar (51).



23F084

15. Cage assembly (main shaft)

Using three extraction bolts, remove cage assembly (54).

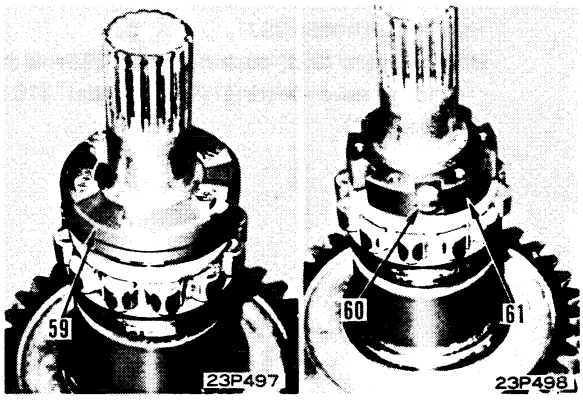


23F085

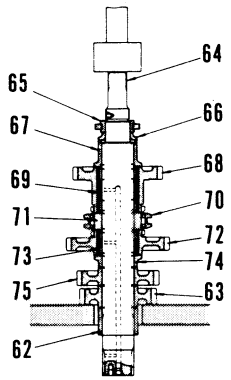
16. Main shaft, gear assembly

1) Remove gear assembly (57).

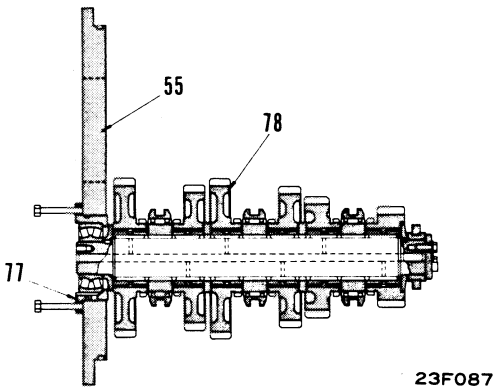
2) Disassemble main shaft and gear assembly as follows.
   i) Remove bracket (59), then remove pin (60).
   ii) Remove nut (61).



iii) Remove collar (62), hold forward gear (63), push main shaft (64) with press and remove bearing (65). Then remove collars (66) and (67), 5th gear (68), race (69), gears (70) and (71), 6th gear (72), race (73), collar (74), reverse gear (75) and forward gear (76).

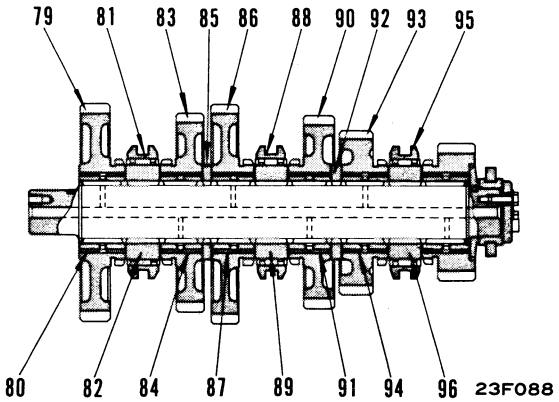


17. Cage assembly (intermediate shaft)
1) Sling front cover (55).
2) Using three extraction bolts, remove cage assembly (77).

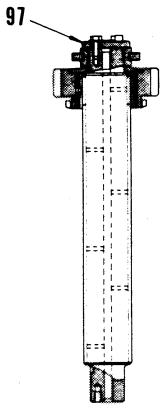


18. Intermediate shaft, gear assembly
1) Remove gear assembly (78) from front cover.

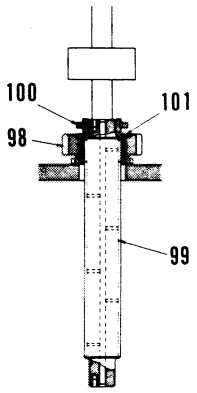
2) Disassemble intermediate shaft and gear assembly as follows.
   i) Remove forward gear (79), race (80), gears (81) and (82), reverse gear (83), race (84), collar (85), 4th gear (86), race (87), gears (88) and (89), 3rd gear (90), race (91), collar (92), 2nd gear (93), race (94), and gears (95) and (96).



ii) Remove holder (97).
iii) Hold gear (98), push out shaft (99) with press and remove bearing (100), collar (101) and race (104).

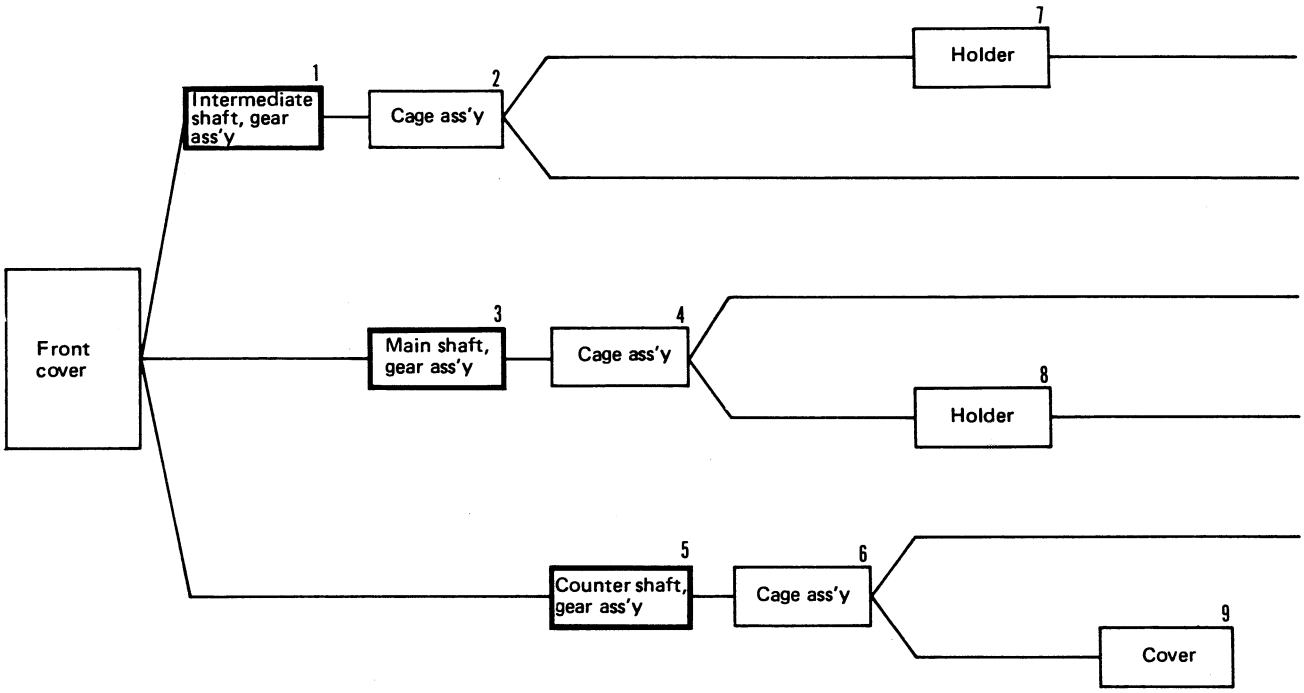


23F089



23F090

ASSEMBLY OF TRANSMISSION ASSEMBLY D150

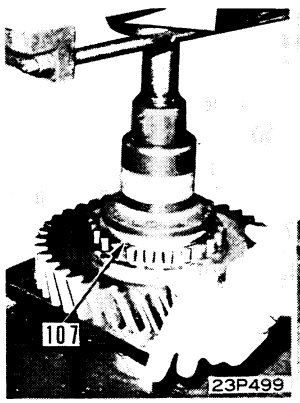


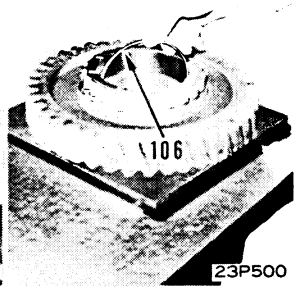
Preparatory work

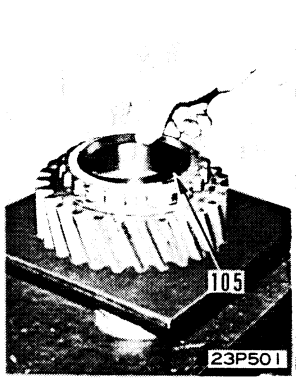
- Clean all parts, coat bearings with engine oil and coat sliding surfaces of races, etc. with grease before assembly.

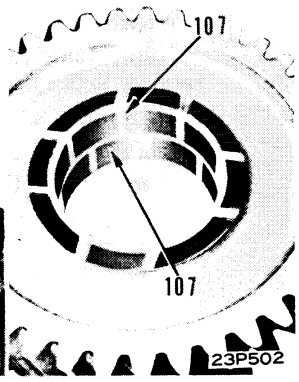
1. Intermediate shaft, gear assembly

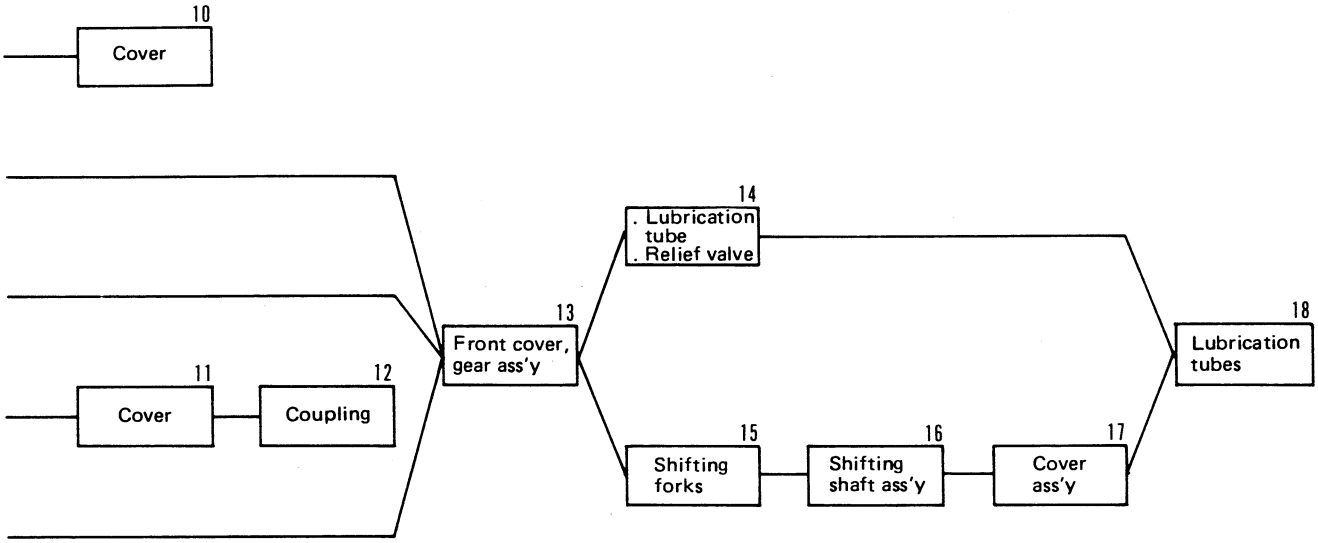
1) Assemble bushing (107) and collars (105),(106) on each gear.





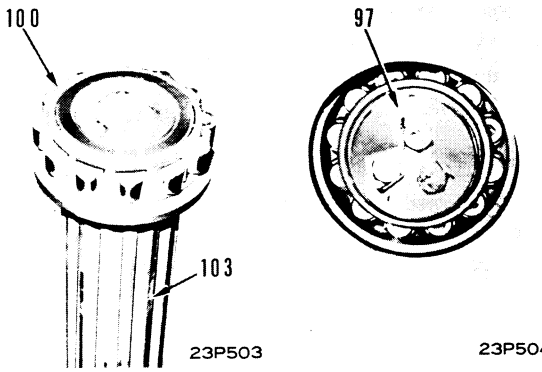




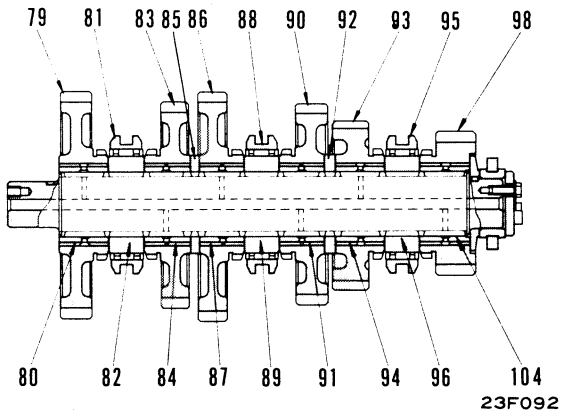


23F091

2) Assemble intermediate shaft and gear assembly as follows.
   i) Fit collar on intermediate shaft (103) and install bearing (100).
      ★ Shrink-fitting temperature: 100°C for 30 min.
   ii) Install holdr (97).
      ★ Bend lock plate securely.



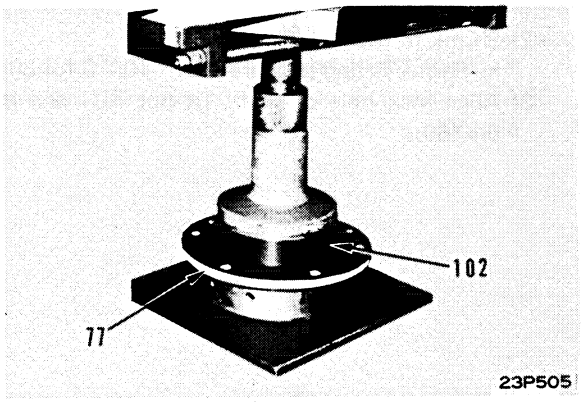
iii) Assemble race (104), 1st gear (98), gears (95), (96), race (94) 2nd gear (93), collar (92), race (91), 3rd gear (90), gears (88), (89), race (87), 4th gear (86), collar (85), race (84), reverse gear (83), gears (81), (82), race (80) and forward gear (79).



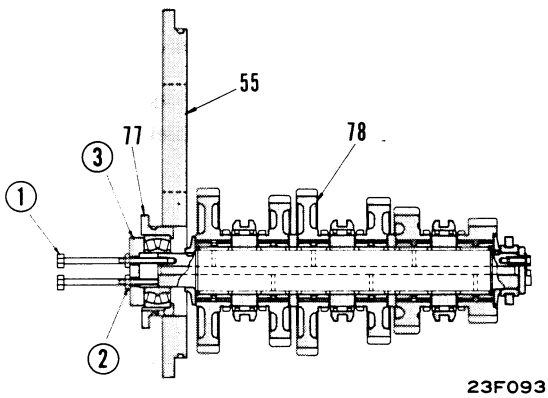
23F092

2. Cage assembly

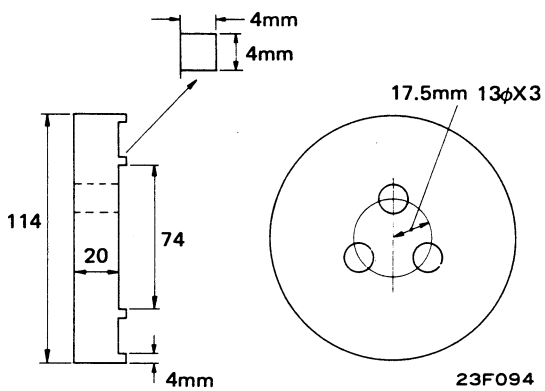
1) Install bearing (102) in cage (77).



2) Set intermediate shaft and gear assembly (78) sideways on assembly stand, raise front cover (55) and set in position.
3) Fit O-ring, align front cover assembly (55) with intermediate shaft and cage, and set in position.
4) Fit nuts ② and plates ③ on three extraction bolts ① (12 mm, P = 1.75), screw into intermediate shaft, tighten nut ② and install cage assembly (77).
   - ★ Nut ②: Anti-friction compound (LM-P)
   - ★ If the nut is stiff, tap plate ③ with a hammer to install.
   - ★ Align oil holes.



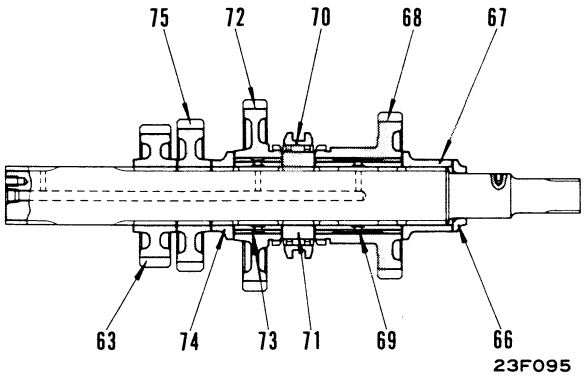
5) Manufacture plate with the following dimensions.



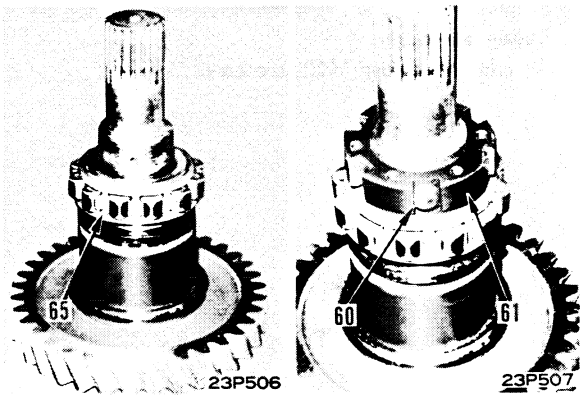
3. Main shaft, gear assembly

Assemble main shaft and gear assembly as follows.

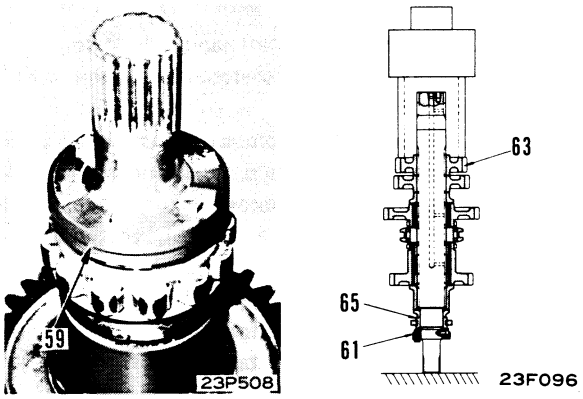
1) Install forward gear (63), reverse gear (75), collar (74), race (73), 6th gear (72), gears (71), (70), race (69), 5th gear (68) and collars (67), (66) on main shaft.
   - Install bushing and collars on 5th and 6th gears.
   - ★ For details, see item 1 – 1).



2) Shrink fit bearing (65).
   - ★ Shrink-fitting temperature: 100°C for 30 min.
3) Align lock hole of shaft, fit nut (61) and install pin (60).

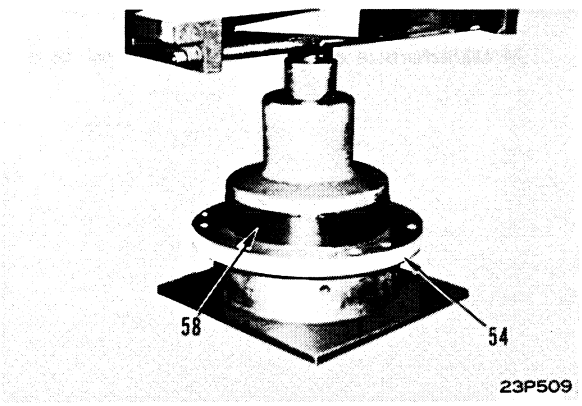


4) Install bracket (59).
   - ⊕ Bend lock plate securely.
5) Hold shaft, push forward gear (63) with press and push bearing (65) completely against nut (61).

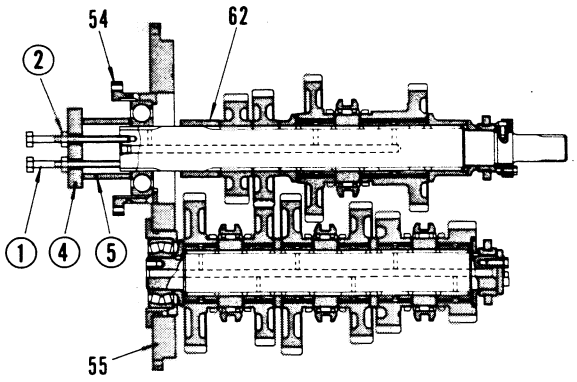


4. Cage assembly (main shaft)

1) Install bearing (58) in cage (54).

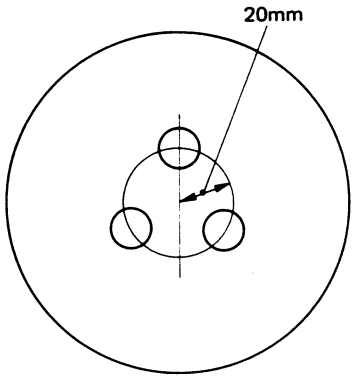


2) Assemble collar (62) on main shaft, align with intermediate shaft gear and front cover (55) and set on assembly stand.
3) Fit O-ring and set cage assembly (54) in position.
4) Assemble nuts ②, plates ④ and spacer ⑤ on three extraction bolts ① (12 mm, P = 1.75) and install on shaft.
5) Tighten nut ② and install cage assembly (54) on shaft.
   ★ If the nut is stiff, tap plate ④ with a hammer to install.
   ★ Align oil holes.



23F097

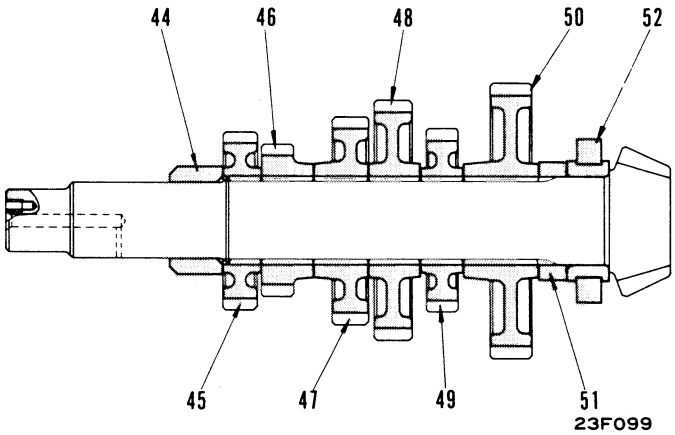
6) Manufacture plate with the following dimensions.



23F098

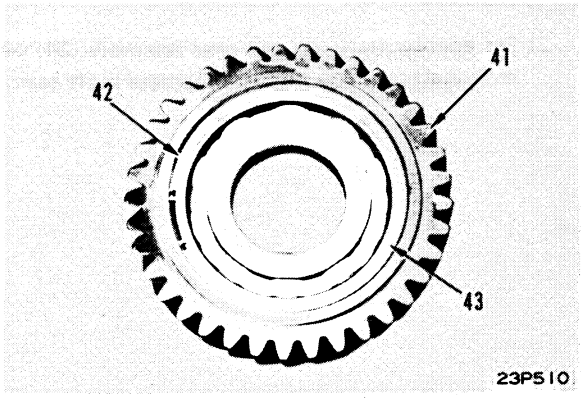
5. Countershaft, gear assembly

Assemble countershaft and gear assembly as follows.
1) Shrink fit bearing (52).
   ★ Shrink-fitting temperature: 100°C at 30 min.
2) Install collar (51).
3) Install 1st gear (50), 5th gear (49), 2nd gear (48), 3rd gear (47), 6th gear (46), 4th gear (45) and collar (44).



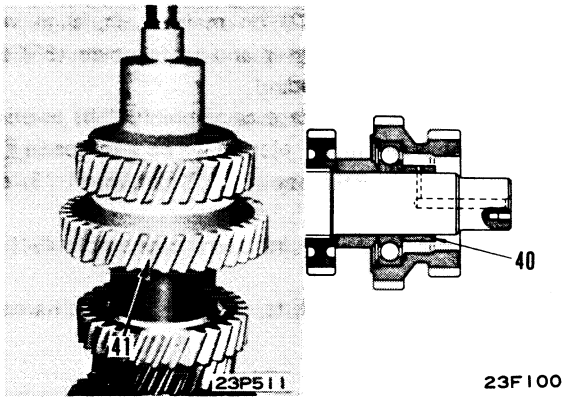
23F099

4) Press fit bearing (43) on forward gear (41), and install snap ring (42).

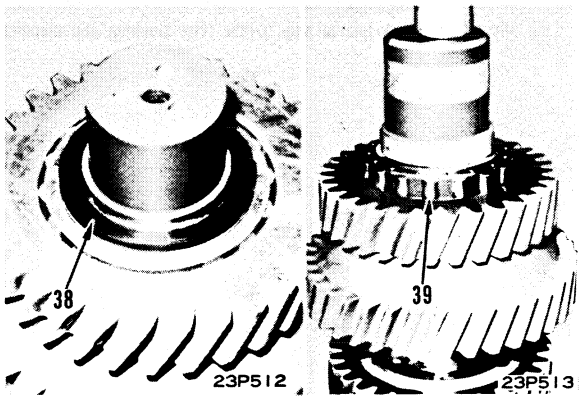


23P510

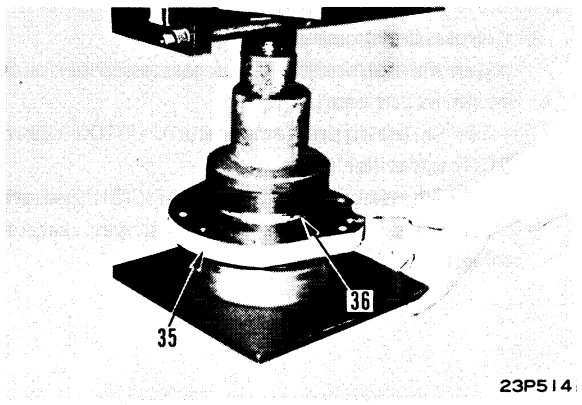
5) Push inner race and install forward gear (41).
6) Install collar (40).



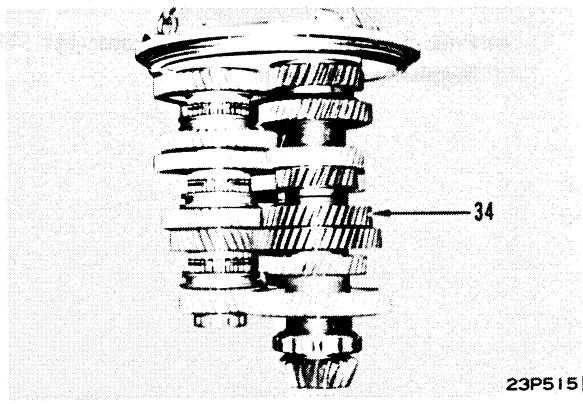
7) Install bearing (39).
8) Install collar (38).



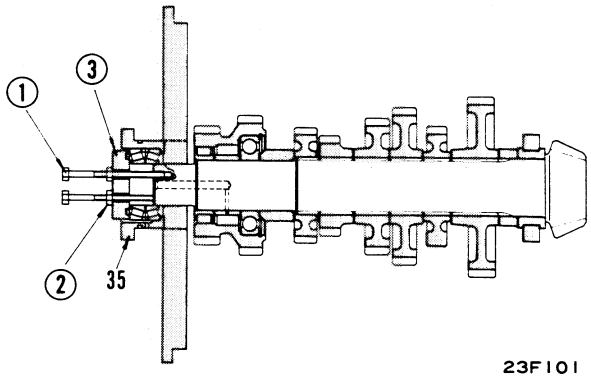
6. Cage assembly
1) Install bearing (36) in cage (35).



2) Set countershaft and gear assembly (34) on top of mainshaft gear and intermediate shaft gear.



3) Fit O-ring and set cage assembly (35) in position.
4) Fit nut ② and plate ③ on extraction bolt ①, and install extraction bolt in shaft.
5) Tighten nut ② and install cage assembly (35).
   ★ If the nut is stiff, tap plate ② with a hammber to install.
   ★ Leave enough space between the cage and front cover to install shims.
   ★ Align oil holes.

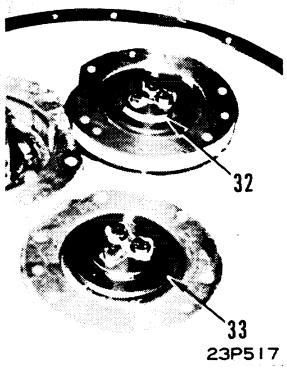


23F101

7. Holder
1) Install seal ring (34) holder (33).
2) Install holder (33).
   ⊕ Bend lock plate securely.



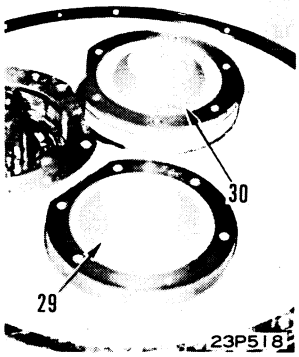
23P516



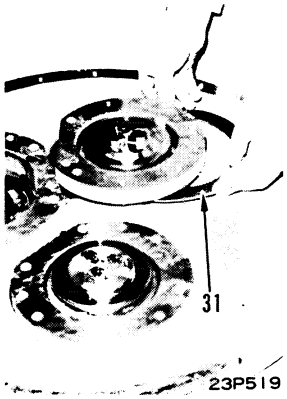
23P517

8. Holder
Fit seal ring and installl holder (32).
⊕ Bend lock plate securely.

9. Cover
1) Install shim (31).
2) Fit O-ring and install cover (30).



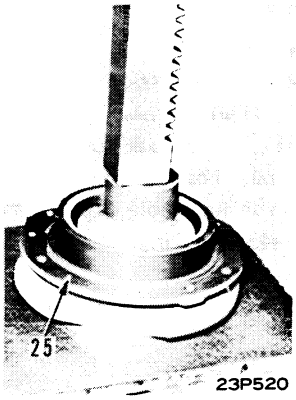
23P518



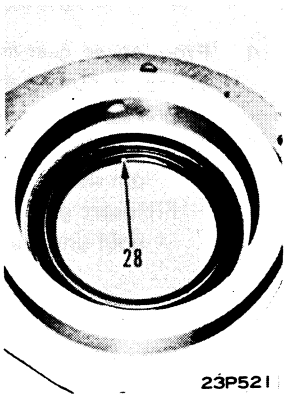
23P519

10. Cover
Fit O-ring and install cover (29).

11. Cover
1) Install oil seal (28) on cover (25).
   ★ Be careful of direction when installing.



23P520

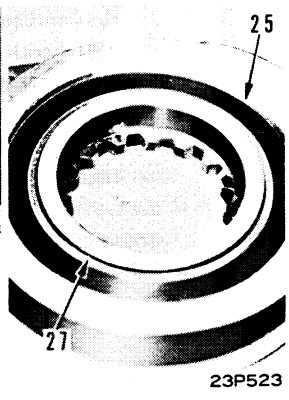


23P521

2) Fit seal ring (26) on holder (27) and install on cover (25).



23P522

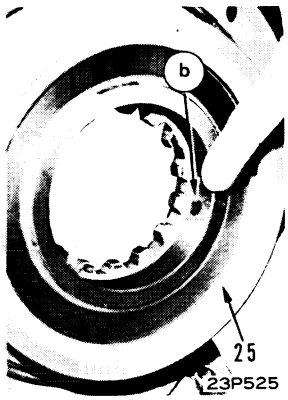


23P523

3) Align oil hole ⓐ of shaft with oil hole of holder ⓑ, fit O-ring and install cover (25).



23P524

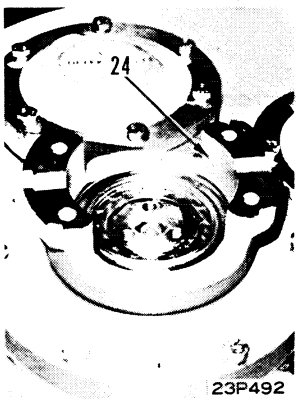


23P525

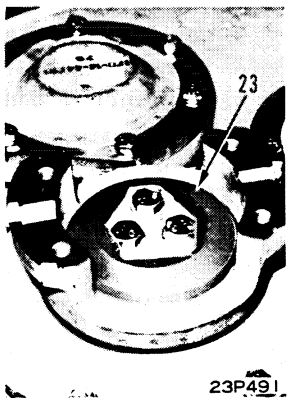
12. Coupling

1) Install coupling (24).
2) Fit O-ring and install holder (23).

⊕ Bend lock plate securely.



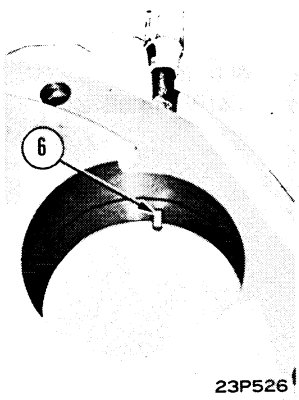
23P492



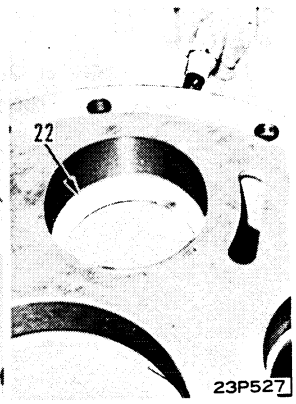
23P491

13. Front cover, gear assembly

1) Install outer race on transmission case as follows.
   i) Pass guide pin ⑥ through case.
   ii) Coal outer race (22), set lock hole to face guide pin side and install in case.
   iii) Insert guide pin in lock hole of outer race and hold until race stops moving.

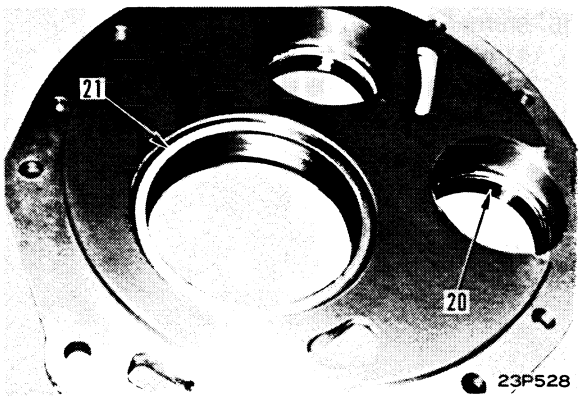


23P526



23P527

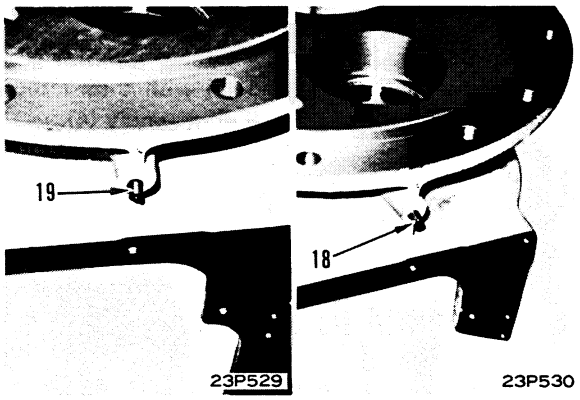
iv) Install outer races (21) and (20) in the same way.



v) Knock in lock pin (19) and install set screw.

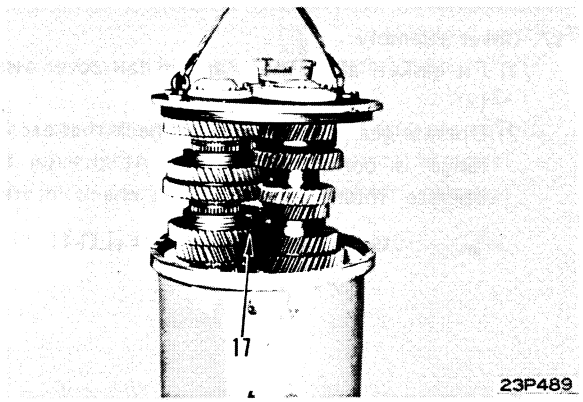
Set screw: Thread tightener (LT-2)

vi) Set front cover with mounting side facing up.



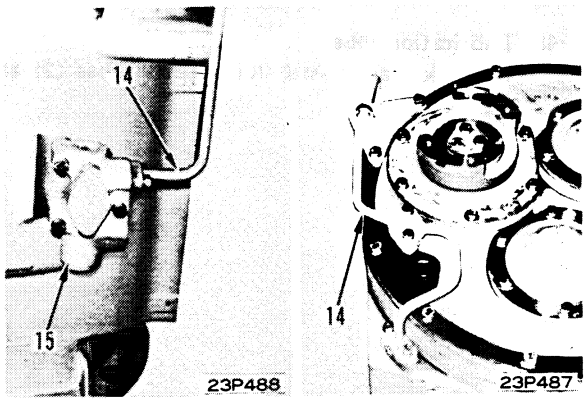
2) Fit O-ring on front cover, fit gasket on case side, raise gear assembly (17) and install.

Gasket: Gasket sealant (LG-1)



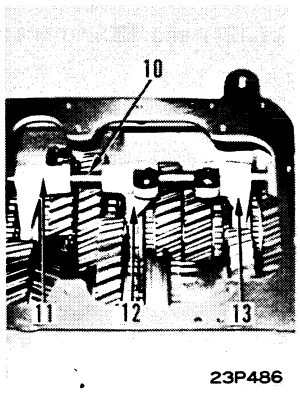
14. Relief valve assemlby, lubrication tube

1) Install relief valve assembly (15).
2) Fit O-ring and install tube (14).

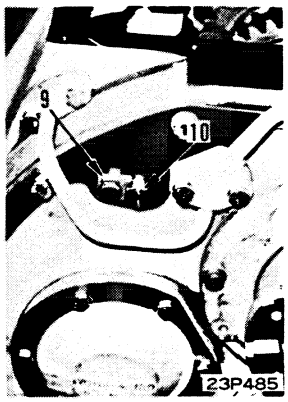


15. Shifting forks

1) Install shifting forks (13), (12) and (11).
2) Fit O-ring and install shaft (10).
3) Install lock (9).



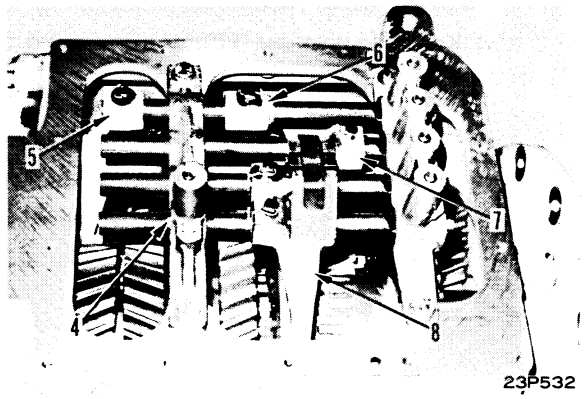
23P486



23P485

16. Shifting shaft assembly

Align 5th and 6th shifting forks (8) with gear, and shifting levers (7), (6) and (5) with their respective forks, then install shifting shaft assembly (4).

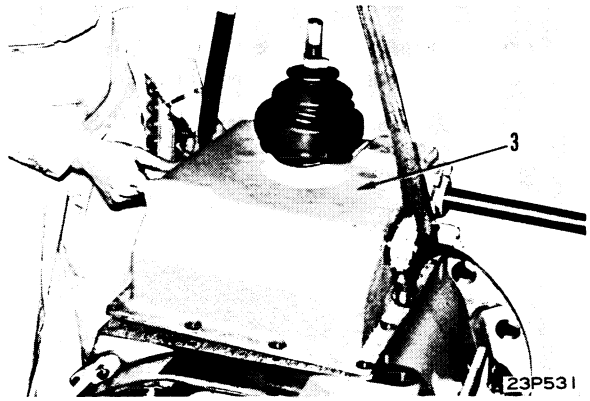


23P532

17. Cover assembly

1) Fit gasket, align levers and install cover assembly (3).
2) Operate gear shift lever and check that each speed range is correctly engaged. At the same time operate interlock shaft and check movement.

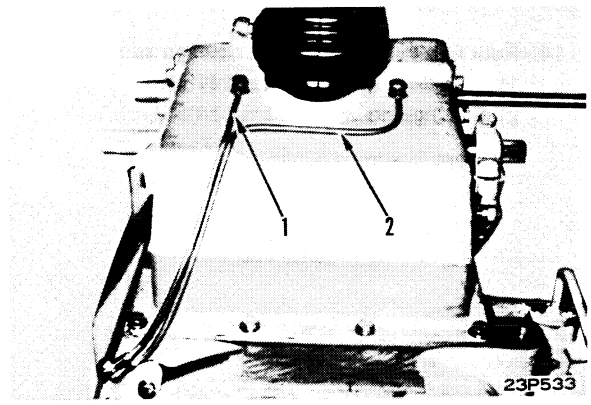
Gasket: Gasket sealant (LG-1)



23P531

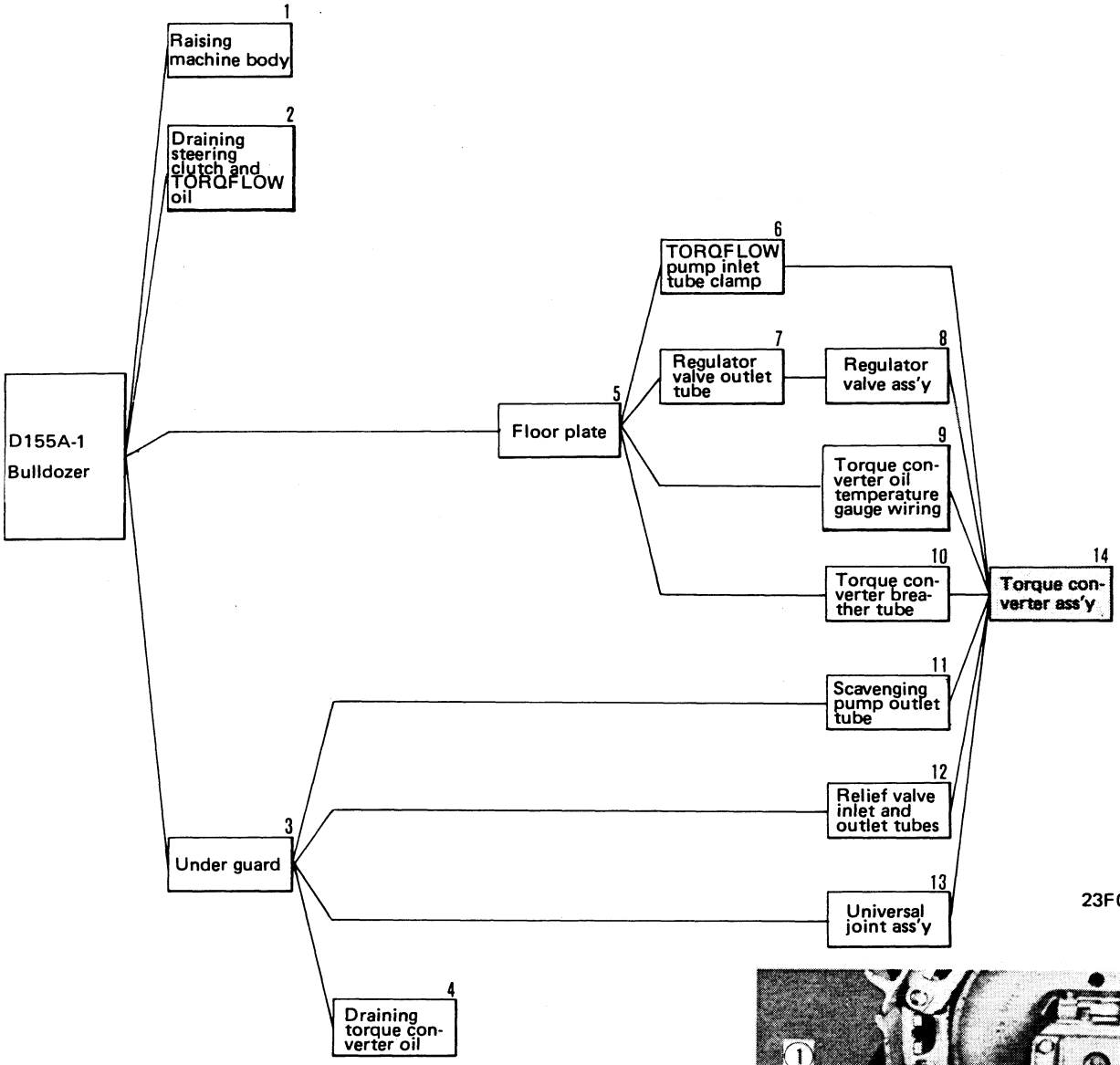
18. Lubrication tubes

Fit gasket and install lubrication tubes (2) and (1).



23P533

DISMOUNTING TORQUE CONVERTER D155A 15001 – 25000



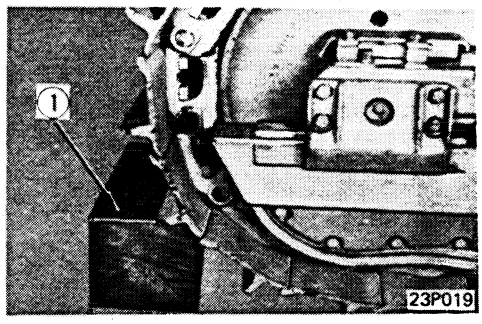
23F003

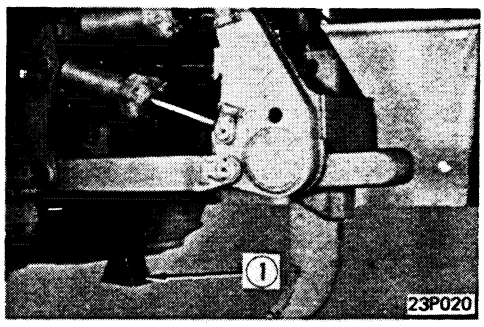
1. Raising machine body

1) Position two blocks ① in place on the ground so that tracks run on blocks when machine is moved forward.
2) Slowly move machine forward until tracks run on blocks. Raise the rear of machine body with ripper as a jack applying brake, insert block under rear end of each track, and lower the machine body to rest tracks on blocks.
3) Rest blade and ripper on the ground. Lock steering brake.

★ Use steel blocks of approx. 300 mm high.

★ Method for raising machine body varies with body specifications. For the machine equipped with both blade and ripper, it is possible to insert blocks under tracks after raising machine body by using blade and ripper as jacks.

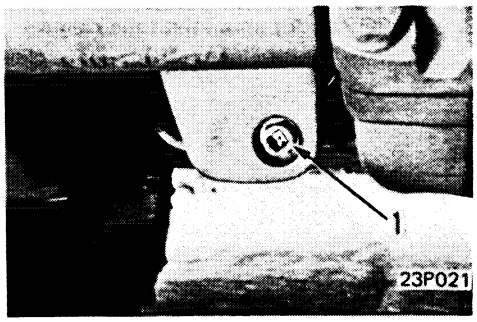




2. Draining steering clutch and TORQFLOW oil

Remove drain plug (1) and drain steering clutch and TORQFLOW oil.

★ Oil capacity: **185 liters**

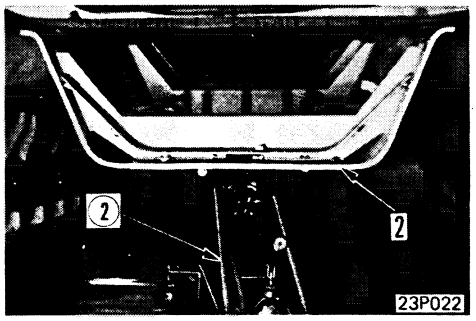


3. Under guard

Set transmission jack ② to support transmission under guard (2). Remove bolts fastening under guard; remove under guard.

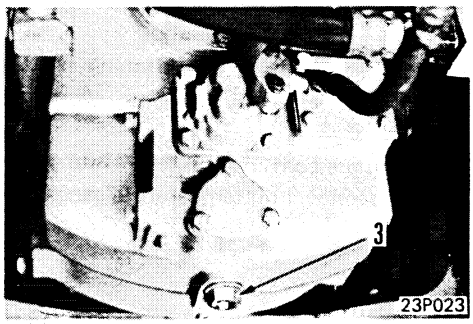
★ When removing under guard, move it forward, taking care to prevent interference with diagonal brace, while gradually retracting transmission jack.

kg Transmission under guard: **270 kg.**



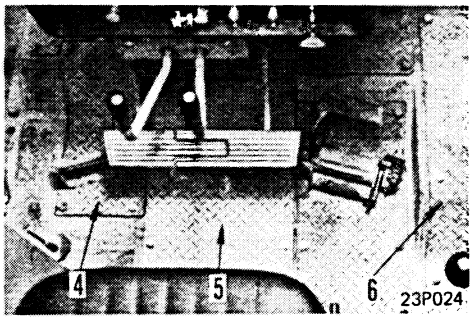
4. Draining torque converter oil

Remove drain plug (3) and drain oil from torque converter case.

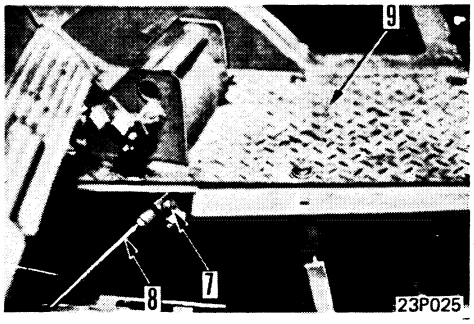


5. Floor plate

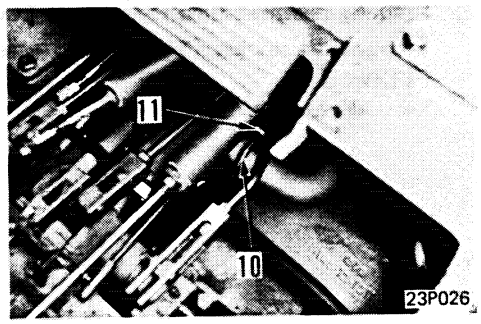
1) Remove floor plates (4), (5) and (6).



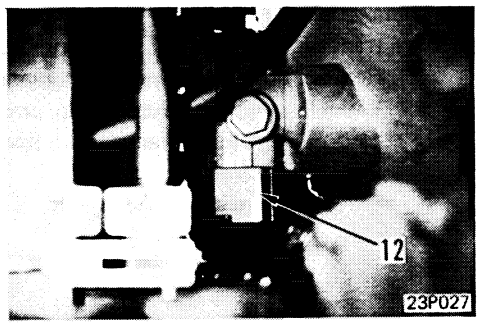
2) Remove lock nut (7) and disconnect decelerator pedal rod (8) from pedal. Remove floor plate (9).



6. **TORQFLOW pump inlet tube clamp**
Remove U-bolt clamp (10); remove clamp bracket (11).

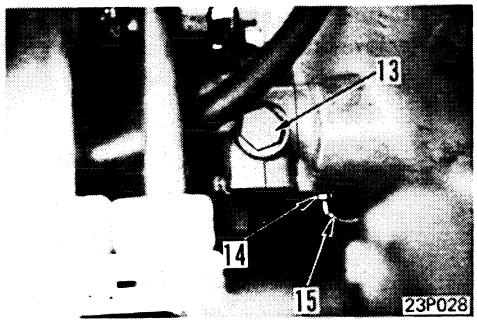


7. **Regulator valve outlet tube**
Remove flange fastening bolts and disconnect regulator valve outlet tube (12) from regulator valve.

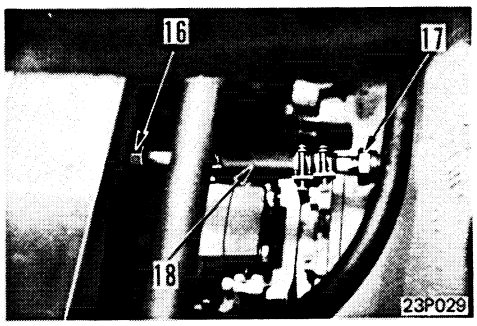


8. **Regulator valve assembly**
Remove three bolts fastening regulator valve assembly (13); remove assembly.

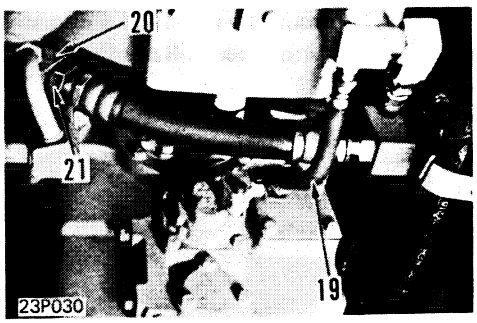
9. **Torque converter oil temperature gauge wire**
Disconnect oil temperature gauge wire (15) from sensor (14).



10. **Torque converter breather tube**
Remove sleeve nuts (16) and (17) fastening breather tube (18); remove tube.

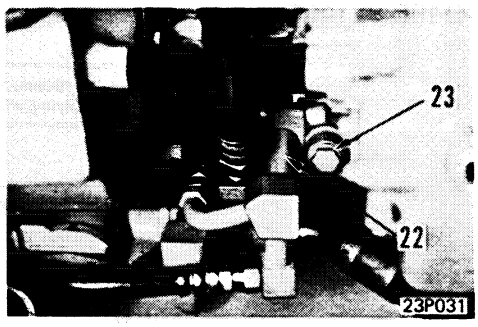


11. **Scavenging pump outlet tube**
Remove flange fastening bolts and disconnect outlet tube (19) from pump.



12. Relief valve inlet and outlet tubes

1) Remove flange fastening bolts and sleeve nut (20) fastening relief valve outlet tube (21); remove tube.
2) Remove flange fastening bolts and disconnect relief valve inlet tube (22) from relief valve (23).

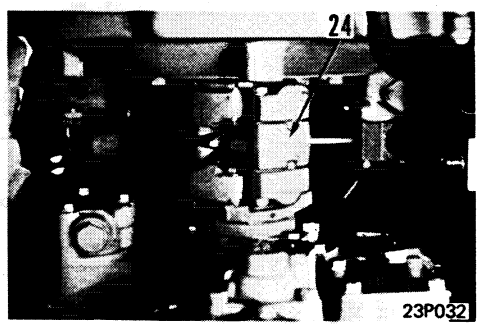


13. Universal joint assembly

Sling universal joint assembly (24) with crane. Remove mounting bolts and lift off assembly.

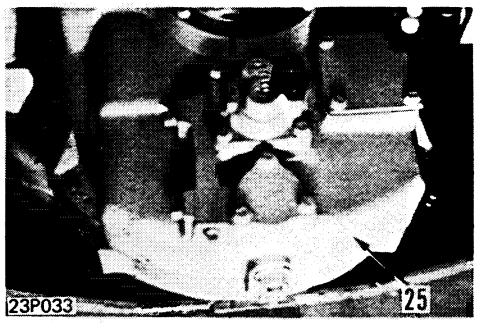
★ If it is difficult to remove assembly because of narrow coupling clearance, remove bearing from either coupling.

kg Universal joint assembly: **20 kg.**



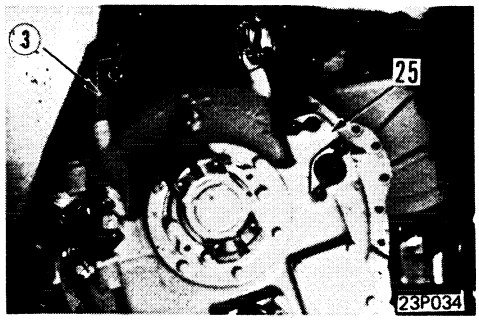
14. Torque converter assembly

1) Sling torque converter assembly with crane with two wire ropes.
   ★ Hook a rope to hanging bolt provided on converter and the other rope to hanging plate ③ attached to transmission oil pump inlet tube mounting bracket.



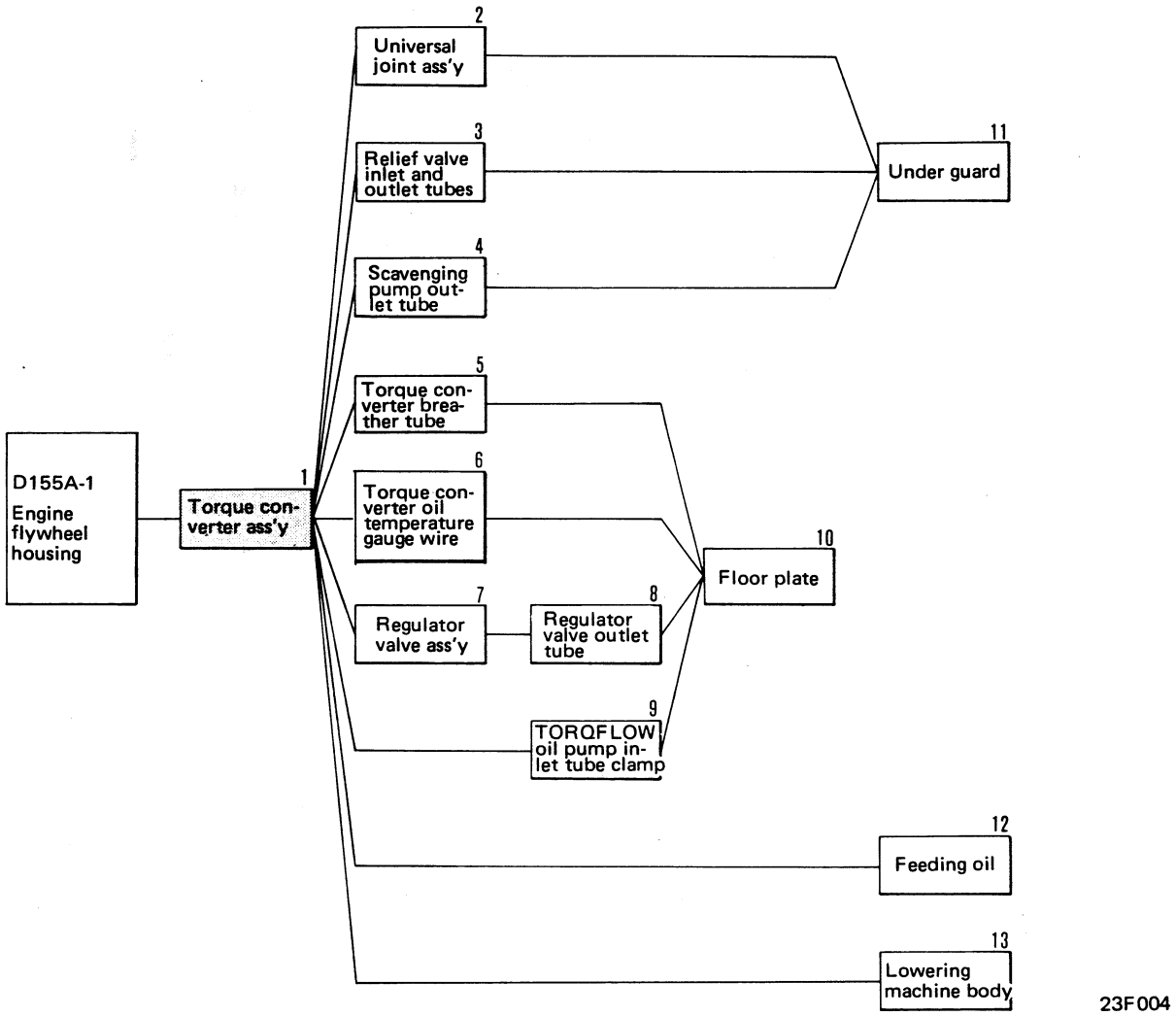
2) Remove torque converter mounting bolts. Remove converter assembly (25) using jack bolts by hanging.

kg Torque converter assembly: **235 kg.**

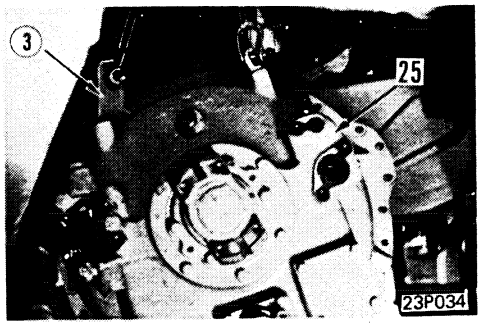


MOUNTING TORQUE CONVERTER

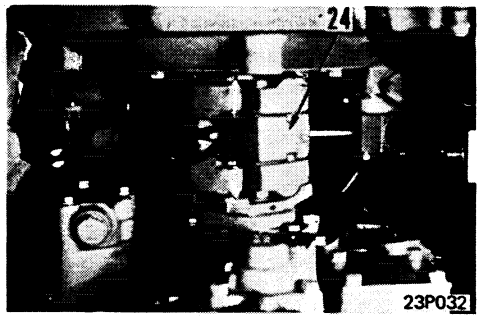
D155A 15001 – 25000



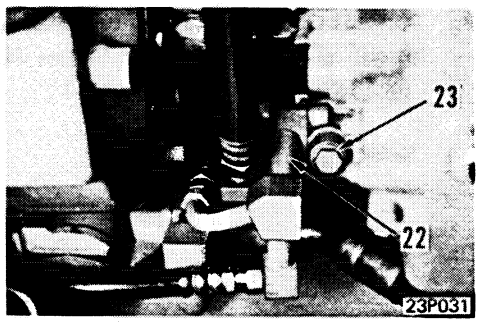
1. **Torque converter assembly**
   1) Attach gasket to mounting surface (flywheel housing side).
      Gasket: **Riquid gasket (LG-1).**
   2) Lift torque converter assembly (25) with crane and bring it in place so that drive gear and flywheel gear are meshed to each other.
      kgm Mounting bolt: **10 – 12.5 kgm**



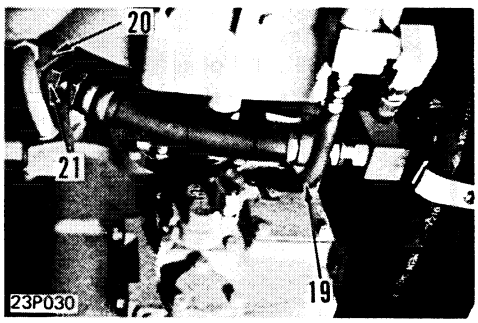
2. **Universal joint assembly**
Lift universal joint assembly (24) into position and tighten mounting bolts.
kgm Mounting bolt: **10 ~ 12.5 kg.m**
★ Be sure to confirm that bearing is firmly fitted to each coupling.



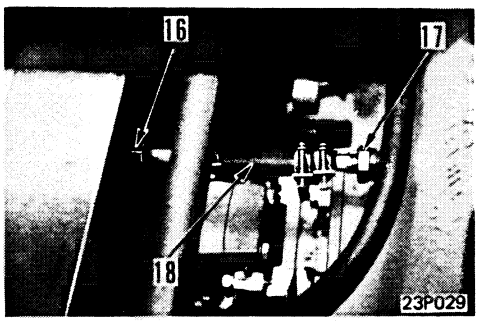
3. **Relief valve inlet and outlet tubes**
1) Connect relief valve inlet tube (22), with O-ring in flange, to relief valve (23).
2) Connect relief valve outlet tube (21), with O-ring in flange, to relief valve. Tighten sleeve nut (20).



4. **Scavenging pump outlet tube**
Connect scavenging pump outlet tube (19), with O-ring in flange, to pump.

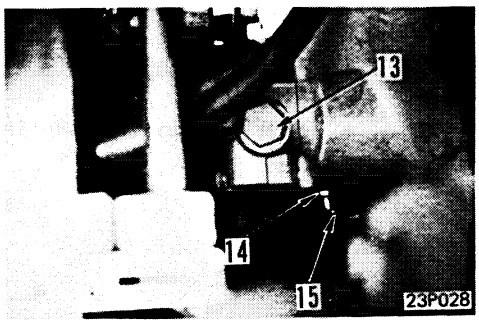


5. **Torque converter breather tube**
Connect breather tube (18) and tighten sleeve nuts (16) and (17).

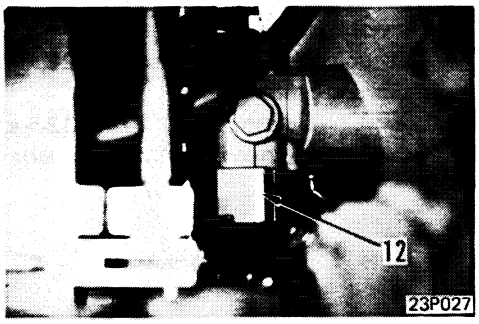


6. **Torque converter oil temperature gauge wire**
Connect oil temperature guage wire (15) to sensor (14).

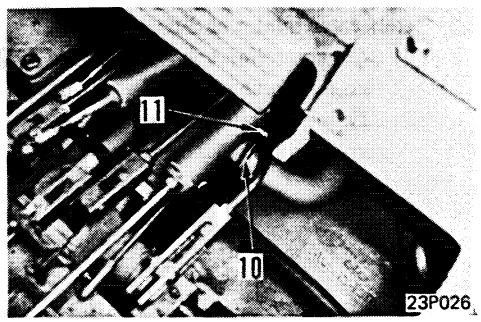
7. **Regulator valve assembly**
Install regulator valve assembly (13) with O-ring in mounting surface.



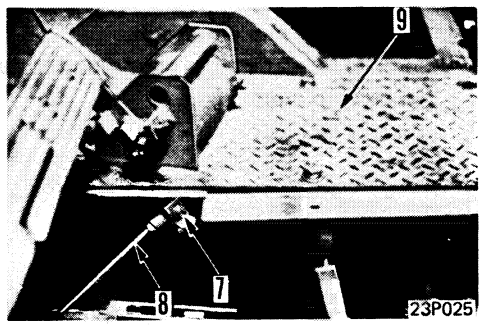
8. **Regulator valve outlet tube**
   Connect regulator valve outlet tube (12), with O-ring in flange, to regulator valve.



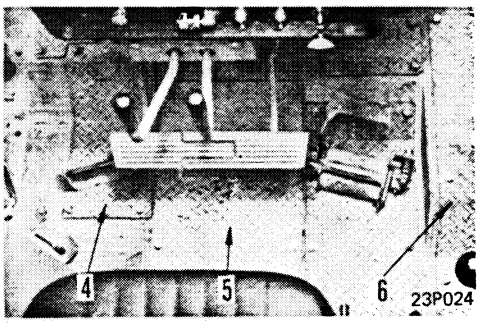
9. **TORQFLOW oil pump inlet tube clamp**
   Install clamp bracket (11). Secure TORQFLOW oil pump inlet tube to bracket with U-bolt (10).



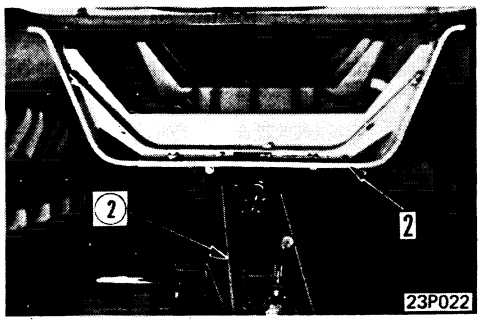
10. **Floor plate**
    1) Install floor plate (9), connect decelerator pedal rod (8) to pedal, and lock it with lock nut (7).



    2) Install floor plates (4), (5) and (6).



11. **Under guard**
    1) Raise transmission under guard (2) into position with transmission jack ②.
       ★ Coat mounting bolts with thread tightener (LT-2).

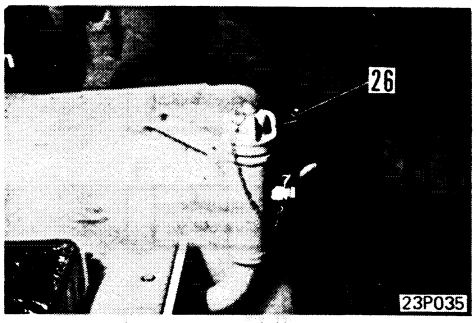


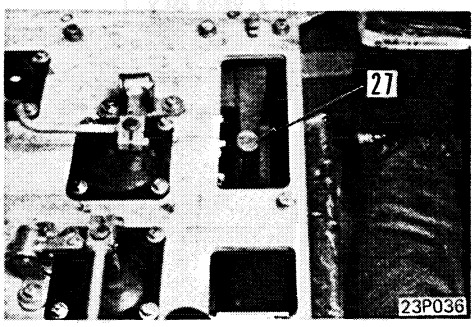
12. Feeding oil

Fill with oil through oil filler (26).

★ When feeding oil, remove right-hand rest arm of operator's seat.

Add oil until level gauge (27) indicates the specified level.
Then, run engine to circulate oil through various parts.
Check oil level again.



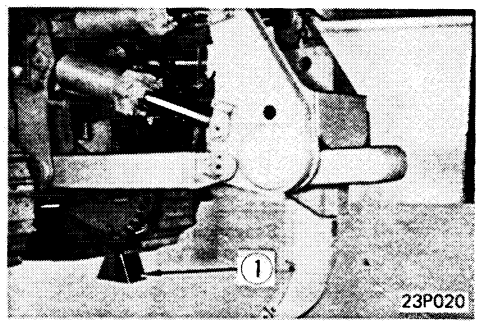


13. Lowering machine body

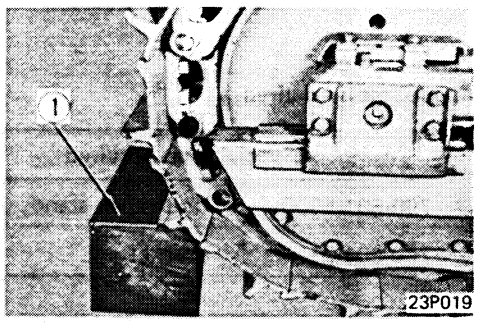
1) Raise machine body by using blade and ripper as jacks.
Remove two blocks ① out of the under side of shoes.

2) After lowering shoes, on the ground, slowly move the machine back (or forth) until the other end of shoes lowers on the ground.

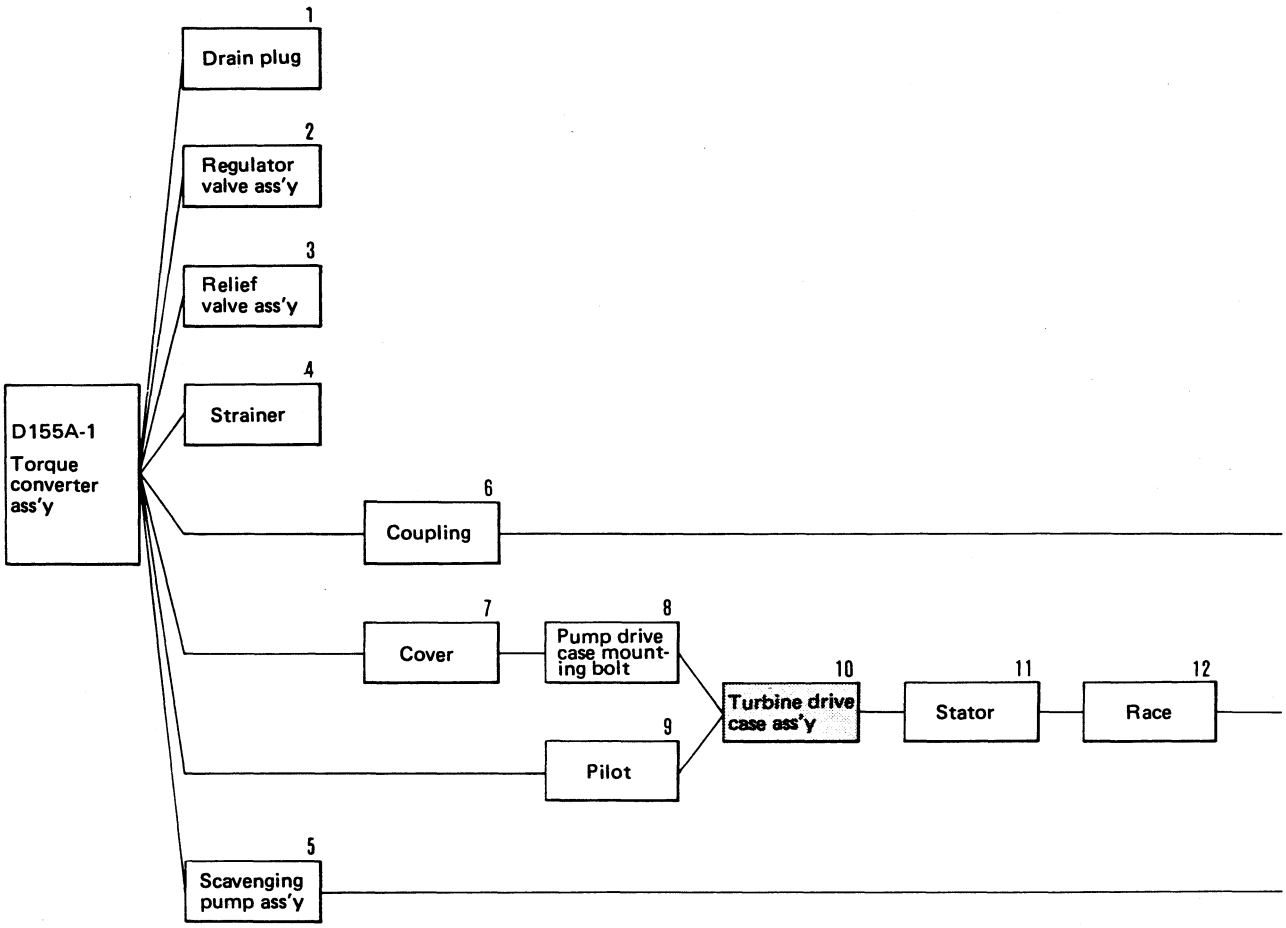
★ When moving machine back (or forth), keep blade and ripper raised fully to prevent them from interfering.



3) After machine shoes is lowered to the ground, rest blade and ripper on the ground and lock steering brake.



DISASSEMBLY OF TORQUE CONVERTER (1/2) D155A



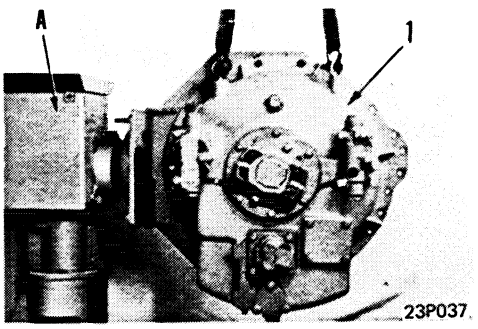
Special tools required

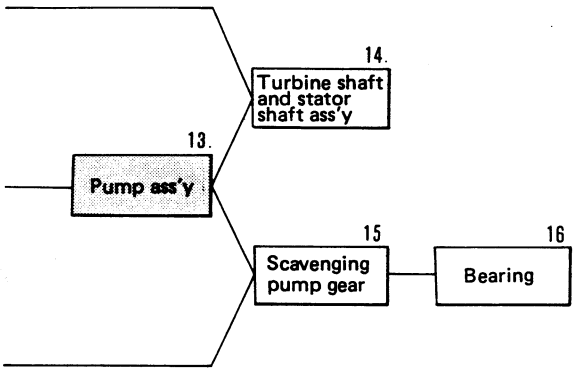
Special tools required		A
790-501-5000	Unit repair stand	1
790-901-2110	Bracket	1

Preparatory work

Lift torque converter assembly (1) with crane and set it on unit repair stand A.

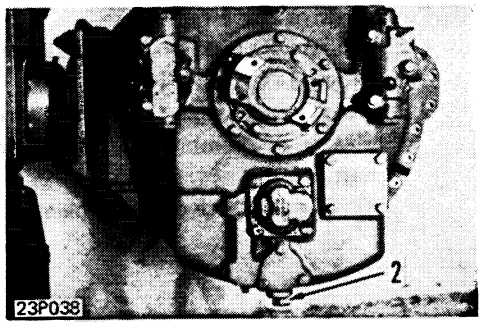
kg Torque converter assembly: **235 kg.**





1. Drain plug

Remove drain plug (2) and drain oil from torque converter case.

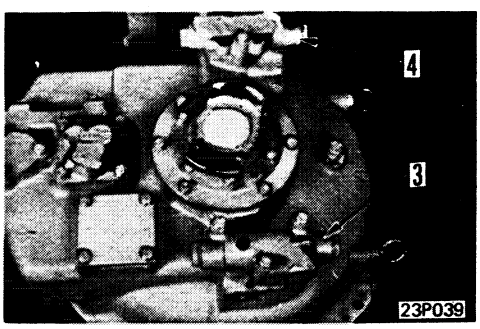


2. Regulator valve assembly

1) Turn repair stand to face the output side of torque converter upward.
2) Remove bolts fastening regulator valve assembly (3); remove assembly.

3. Relief valve assembly

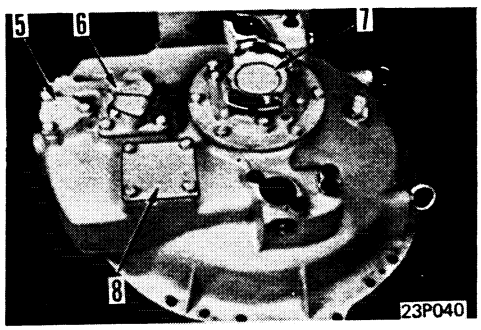
Remove bolts fastening relief valve assembly (4); remove assembly.



4. Strainer
Remove bolts fastening strainer (5); remove strainer.

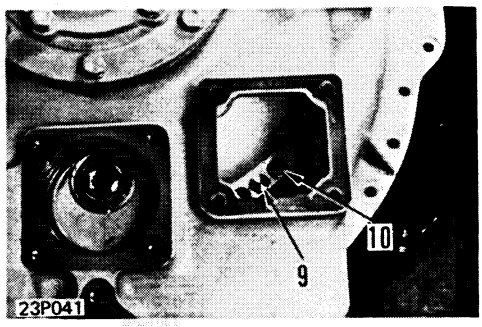
5. Scavenging pump assembly
Remove bolts fastening scavenging pump assembly (6); remove assembly.

6. Coupling
Pull out coupling (7) from turbine shaft.

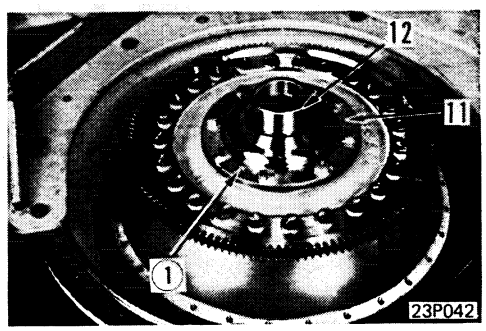


7. Cover
Remove cover (8).

8. Pump drive case mounting bolt
1) Remove two drain plugs (9). Drain oil from torque converter by rotating repair stand as necessary.
2) Remove bolts (10) fastening pump drive case.

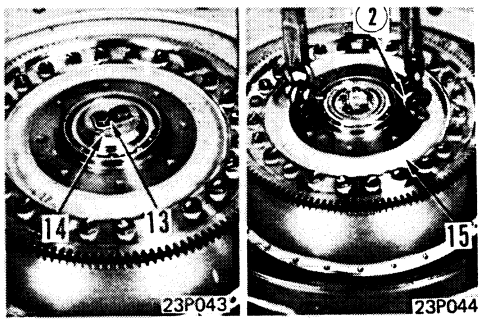


9. Pilot
1) Turn repair stand to face the input side of torque converter upward.
2) Bend down lock plates (11) and remove mounting bolts. Remove pilot (12) using jack bolts ① (12 mm, P = 1.75).

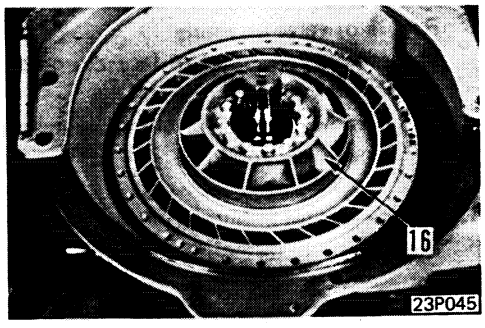


10. Turbine drive case assembly
1) Bend down lock plates (13) and remove bolts fastening holder (14); remove holder.
2) Attach two hanging bolts (12 mm, P = 1.75) to turbine drive case assembly (15). Lift off assembly from turbine shaft.

kg Turbine drive case assembly: **60 kg.**

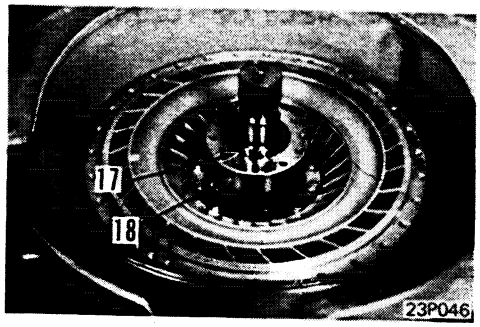


11. Stator
Remove bolts fastening stator (16); remove stator.



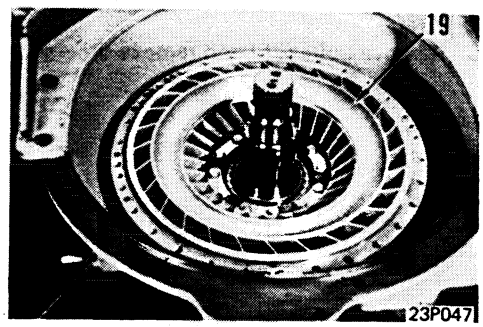
12. Race

Pry snap ring (17) and remove race (18) from stator shaft.



13. Pump assembly

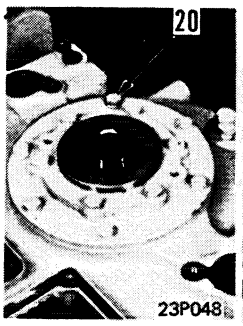
Remove pump assembly (19) from stator shaft.

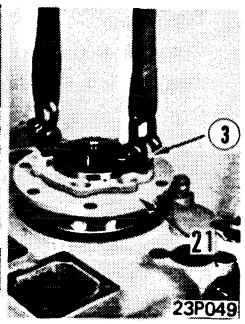


14. Turbine shaft and stator shaft assembly

1) Turn repair stand to face the output side of torque converter upward.
2) Remove mounting bolts (20).
3) Attach hanging bolts ③ (12 mm P = 1.75) and lift off turbine shaft and stator shaft assembly (21) from housing.

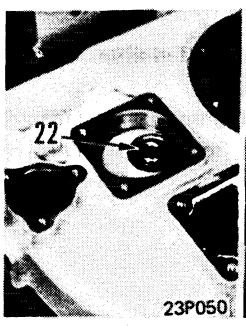
kg Turbine shaft and stator shaft assembly: **35 kg.**

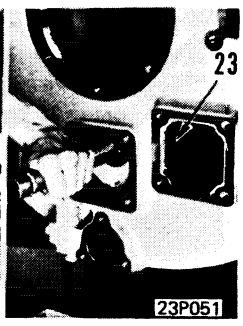




15. Scavenging pump gear

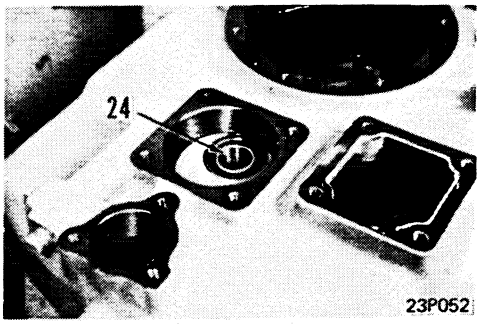
1) Remove snap ring (22).
2) Remove scavenging pump gear (23).
   ★ Turn repair stand as necessary for convenience of removal and take care not to damage gear spline.





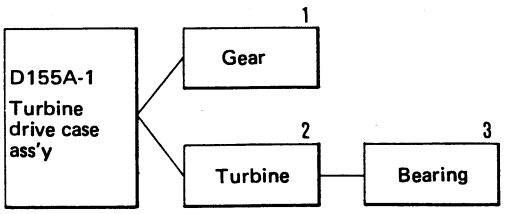
16. Bearing

Remove bearing (24).



DISASSEMBLY OF TORQUE CONVTER (2/2) D155A

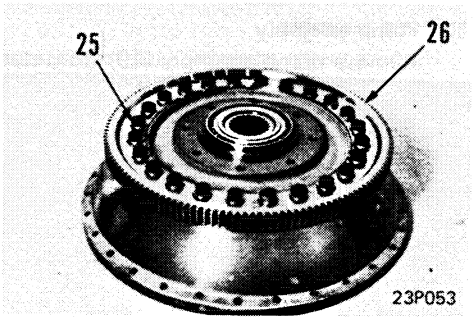
• DISASSEMBLY OF TURBINE • DRIVE CASE



23F006

1. Gear

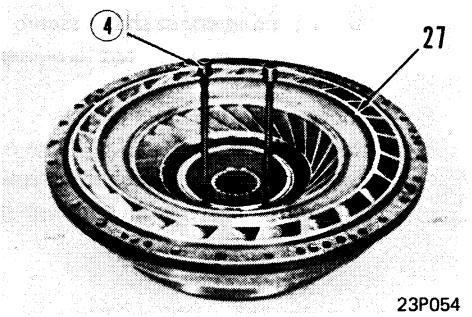
Remove bolts (25) and remove drive gear (26) from drive case.



23P053

2. Turbine

Remove turbine (27) from drive case using jack bolts ④ (10 mm P = 1.5, effective thread 100 mm or more).

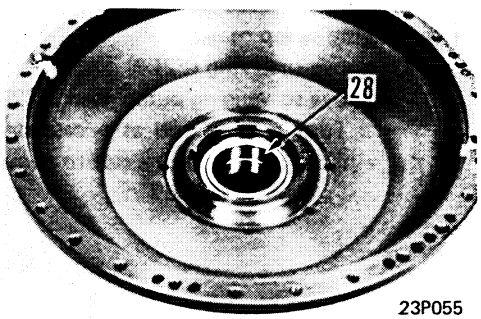


23P054

3. Bearing

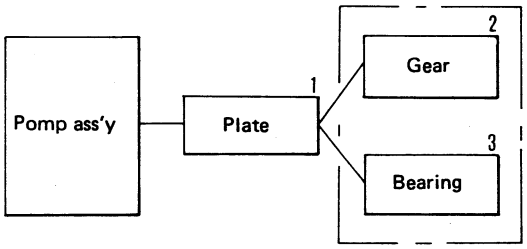
While drive case is lifted approx. 100 mm high, remove bearing (28) from drive case.

★ Approx. 100 mm of lifting height corresponds to allowance necessary for removal of bearing.



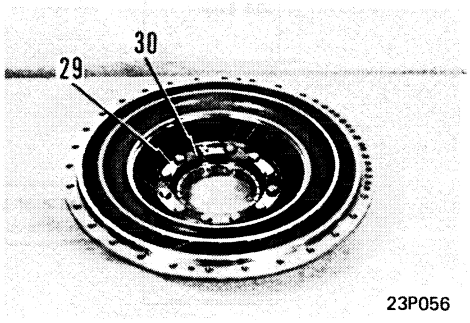
23P055

• DISASSEMBLY OF PUMP



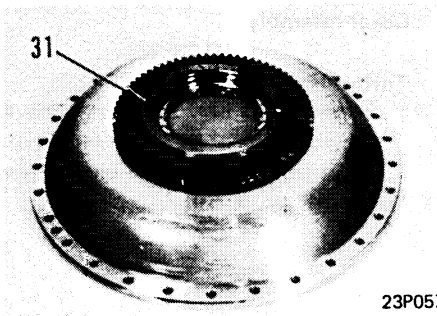
23F007

1. **Plate**
   Bend down lock plate (29), remove bolts fastening plate (30); remove plate.



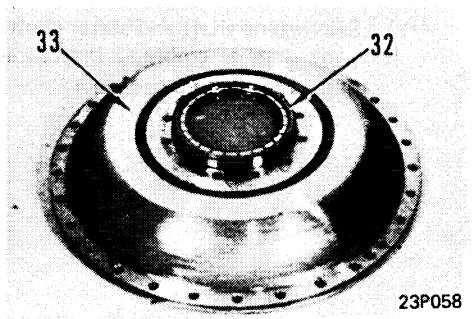
23P056

2. **Gear**
   Remove gear (31) from bearing.



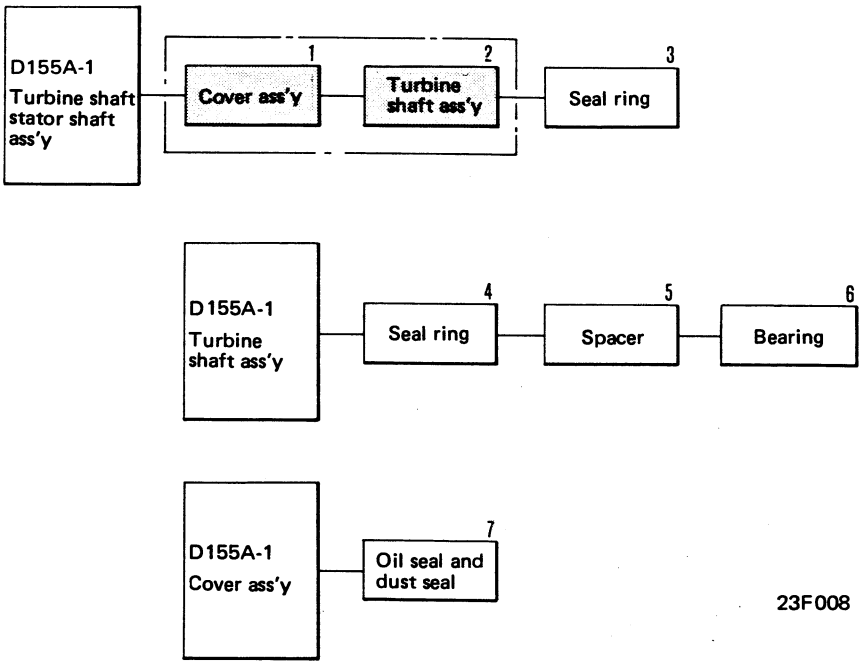
23P057

3. **Bearing**
   Remove bearing (32) from pump (33).



23P058

• DISASSEMBLY OF TURBINE SHAFT AND STATOR SHAFT



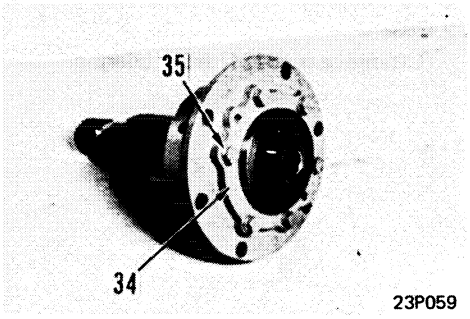
23F008

1. Cover assembly

2. Turbine shaft assembly

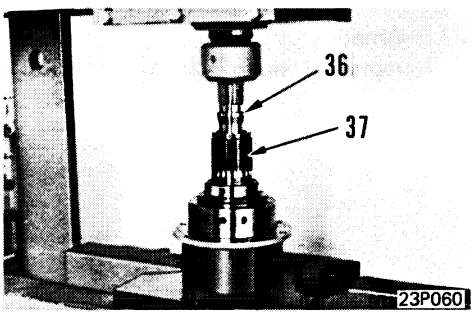
1) Remove bolts (35) fastening cover assembly (34).

★ Removal of cover assembly is made in the next step, although it is possible to remove it in this stage by using jack bolts.



23P059

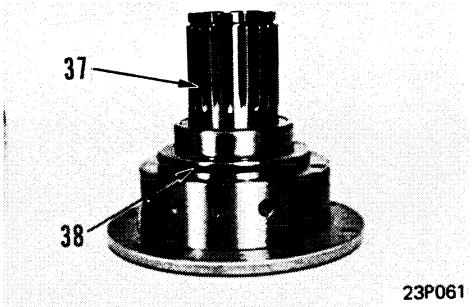
2) Set turbine shaft and stator shaft assembly in press. Pull out turbine shaft assembly (36) from stator shaft (37) together with cover assembly (34).



23P060

3. Seal ring

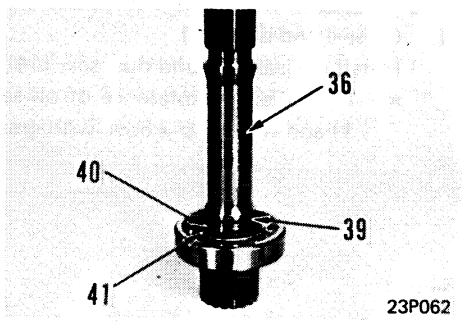
Remove seal ring (38) from stator shaft (37).



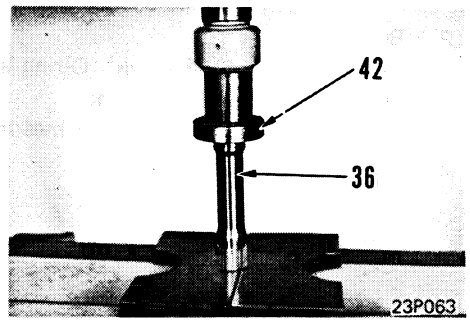
23P061

4. **Seal ring**
   Remove seal ring (39) from turbine shaft (36).

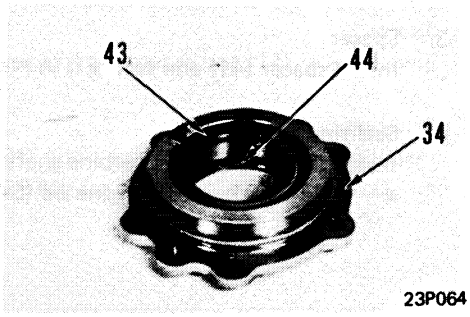
5. **Spacer**
   Remove snap ring (40) and spacer (41).



6. **Bearing**
   Set turbine shaft (with bearing) in press. Pull out bearing (42) from turbine shaft (36).

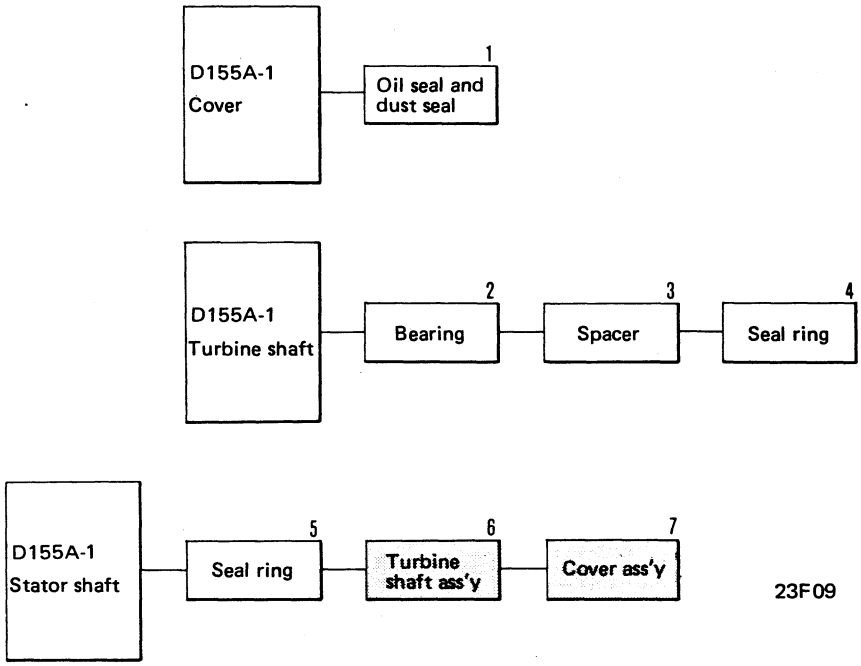


7. **Oil seal and dust seal**
   Pull out oil seal (43) and dust seal (44) from cover (34).



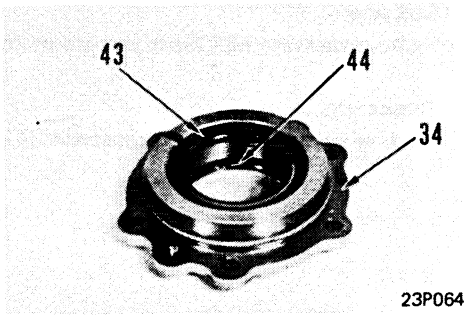
ASSEMBLY OF TORQUE CONVERTER (1/2) D155A

• ASSEMBLY OF TURBINE SHAFT AND STATOR SHAFT



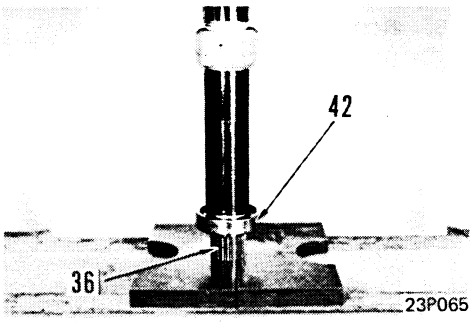
23F09

1. **Oil seal and dust seal**
   Install oil seal (43) and dust seal (44) in cover (34).
   ★ Coat the circumference of oil seal with gasket sealant (LG-1) and fill up lip groove with grease (G2-LI).



23P064

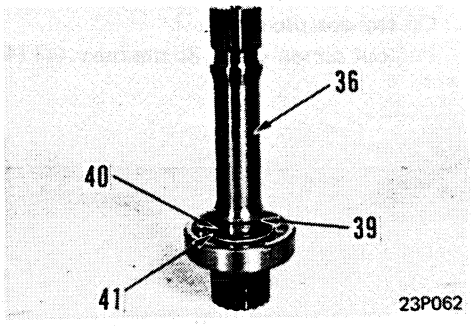
2. **Bearing**
   Set turbine shaft (36) with O-ring and seal seat, in press and press-fit bearing (42) onto shaft.
   ★ Press-fit bearing until it comes into close contact with ring end face.



23P065

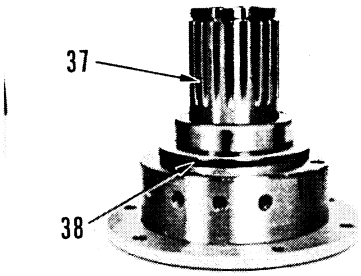
3. **Spacer**
   Install spacer (41) and secure it in place with snap ring (40).

4. **Seal ring**
   Install seal ring (39) on turbine shaft (36).
   ★ Coat seal ring with engine oil (SAE 30, class CD).



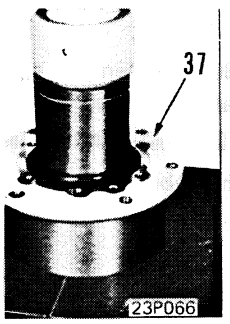
23P062

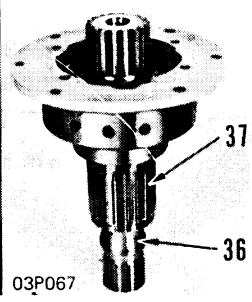
5. **Seal ring**
   Install seal ring (38) on stator shaft (37).
   ★ Coat seal ring with engine oil (SAE 30, class CD).



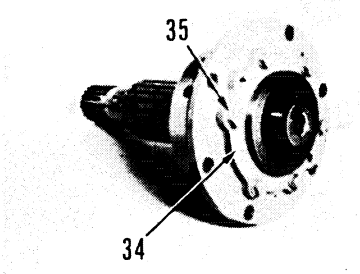
23P061

6. **Turbine shaft assembly**
   Set stator shaft (37) in press and install turbine shaft assembly (36).
   ★ When installing turbine shaft assembly, press-fit bearing outer race.



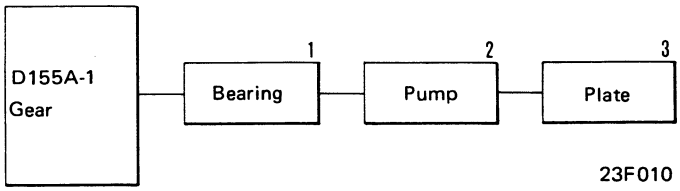


7. **Cover assembly**
   Install cover assembly (34) with O-ring fitted on mounting surface.
   kgm Mounting bolt: **9.5 – 12.5 kgm**



23P059

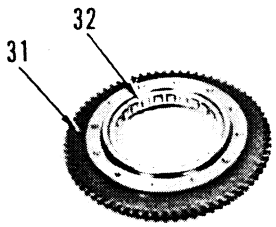
• ASSEMBLY OF PUMP



23F010

1. Bearing

Install bearing (32) in gear (31).

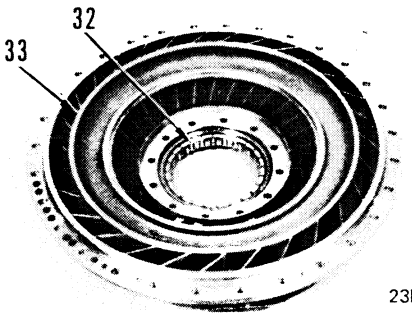


23P068

2. Pump

Install pump (33) on bearing (32).

★ Align bolts holes in pump with those in gear.



23P069

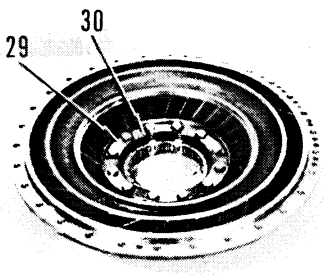
3. Plate

Install plate (30) to fasten pump, gear and bearing together.

Install lock plate (29) by securely bending it down.

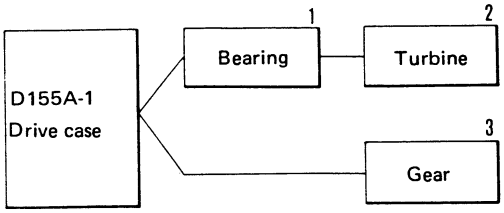
Mounting bolt: **Adhesive (LT-2)**

Mounting bolt: **6 – 7.5 kgm**



23P056

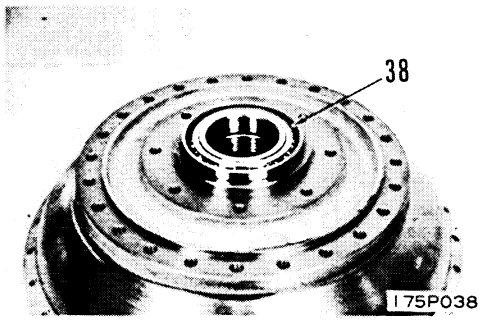
· ASSEMBLY OF TURBINE · DRIVE CASE



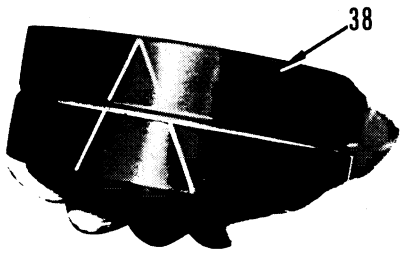
23F011

1. Bearing

Press fit bearing (38) using push tool (internal dia. 75 mm).



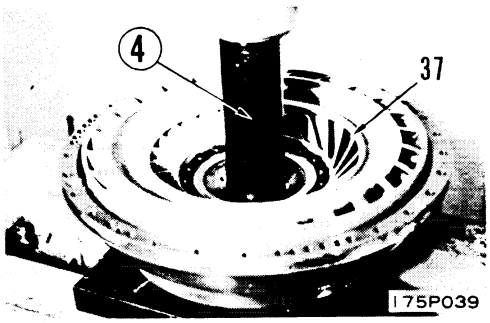
★ The drive case bearing is called AUGULAR BALL BEARING, being so constructed as to display its function in a back-to-back position, and therefore press fit it in by matching the match marks so as not to make a mistake in assembling.



08P244

2. Turbine

Press fit turbine (37) into drive case using push tool ④ (ϕ 75 mm).

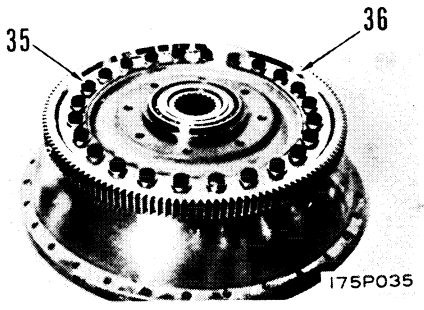


3. Gear

Fit gear (36) into drive case and tighten mounting bolts (35).

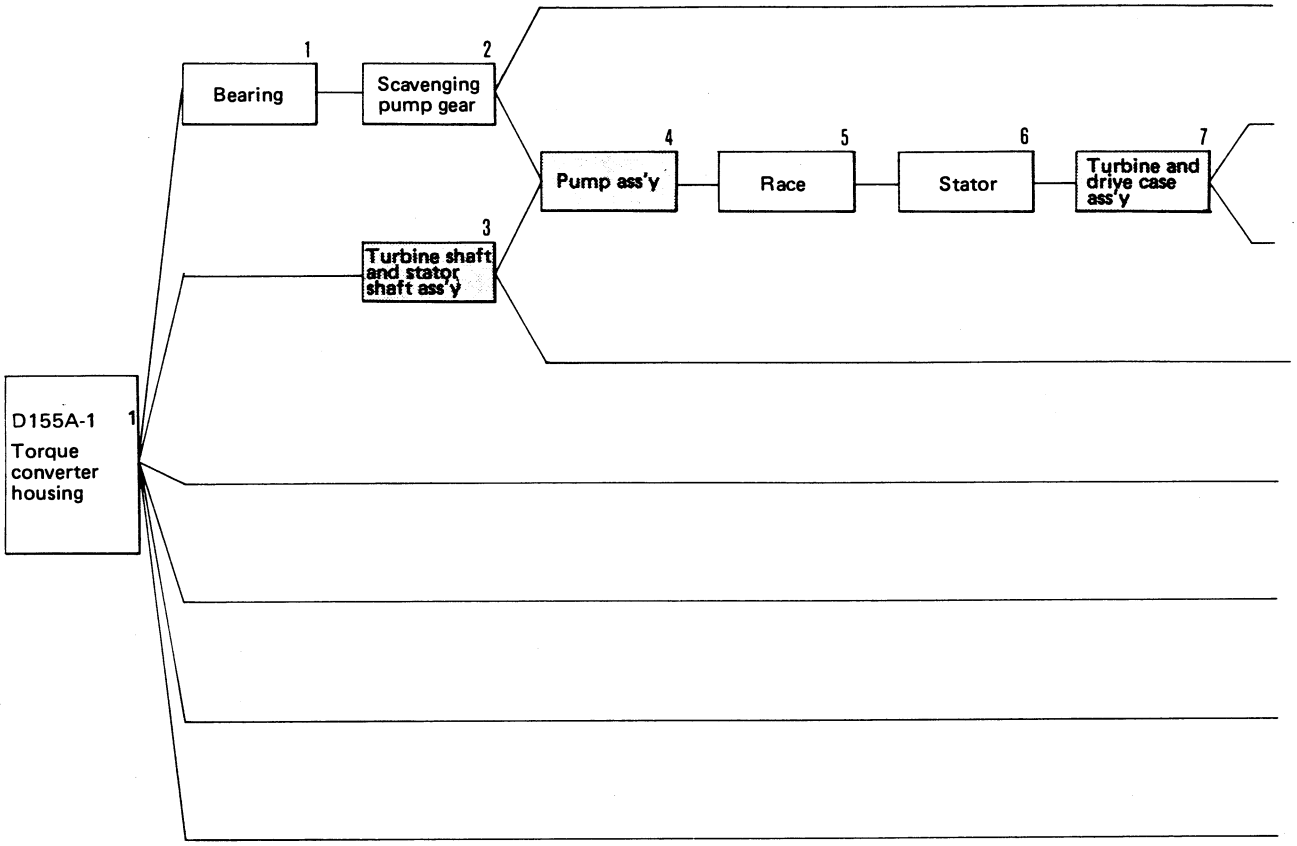
Mounting bolt: **Adhesive (LT-2)**

Mounting bolt: **11 ± 1.5 kgm**



ASSEMBLY OF TORQUE CONVERTER (2/2) D155A

• ASSEMBLY OF TORQUE CONVERTER



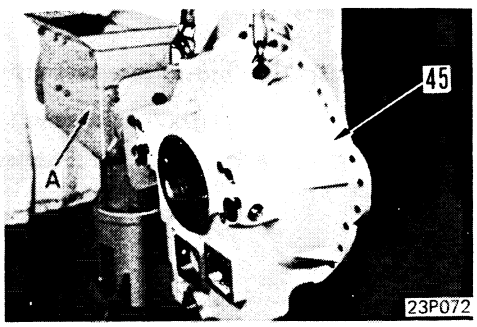
Special tools required

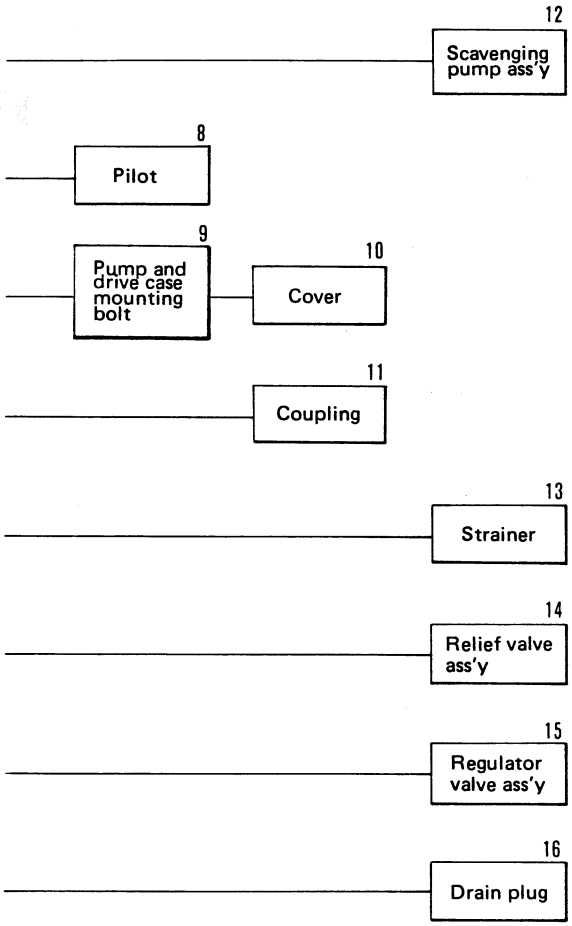
Special tools required		A
790-501-5000	Unit repair stand	1
790-901-2110	Bracket	1

Preparatory work

Sling torque converter housing (45) with crane and set it onto unit repair stand A.

kg Torque converter housing: **80 kg.**

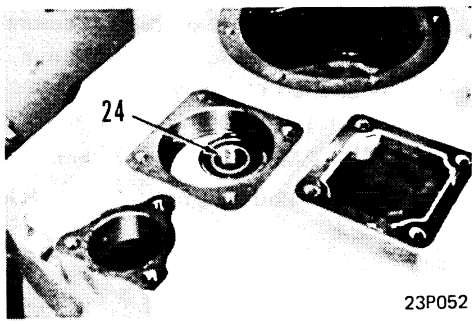




23F012

1. Bearing

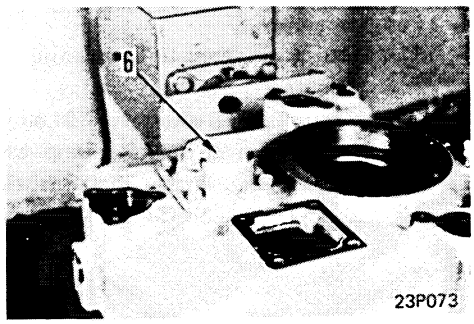
1) Turn repair stand to face the output side of torque converter upward.
2) Install bearing (24) in housing.



23P052

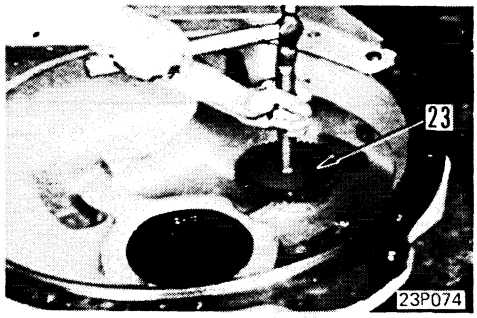
2. Scavenging pump gear

1) Temporarily install scavenging pump assembly (6) and keep bearing fixed in place.

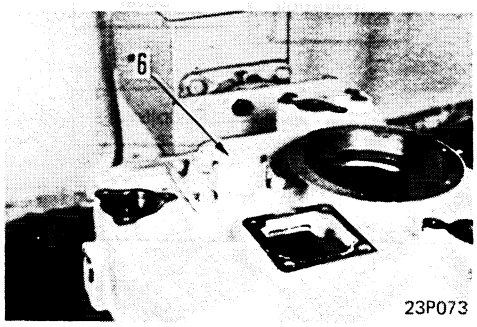


23P073

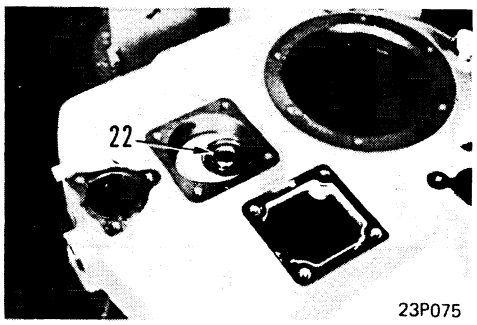
2) Turn repair stand to face the input side of torque converter upward.
3) Install scavenging pump gear (23) on bearing, by aligning splines in gear with those on pump assembly drive shaft.



4) Turn repair stand to face the output side of torque converter upward.
5) Remove scavenging pump assembly (6).



6) Secure pump gear to bearing with snap ring (22).

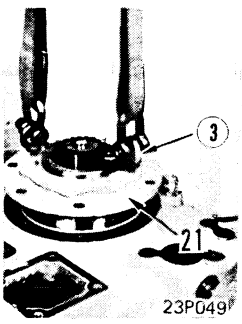


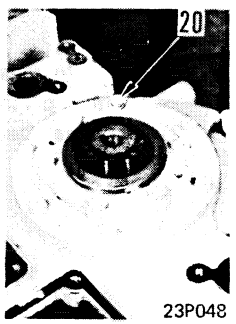
3. Turbine shaft and stator shaft assembly

Lift with hanging bolt ③ (12 mm, P = 1.75) turbine shaft and stator shaft assembly (21), with O-ring fitted in place, into position. Tighten mounting bolts (20).

Mounting bolt: **Adhesive (LT-2)**

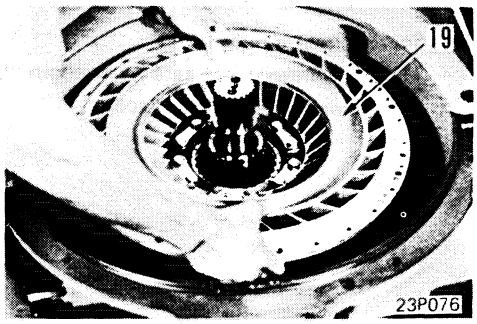
Mounting bolt: **9.5~12.5 kg.m**



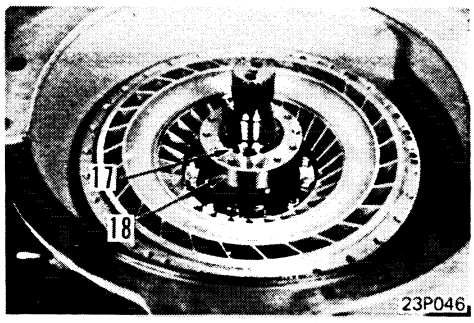


4. Pump assembly

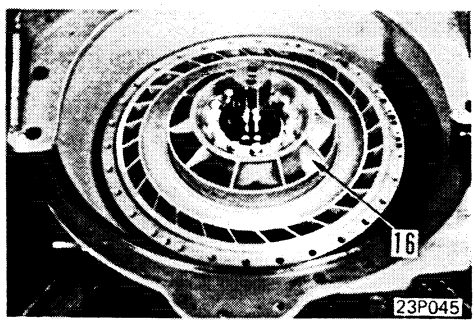
1) Turn repair stand to face the input side of torque converter upward.
2) Install pump assembly (19) on stator shaft.
   ★ When installing pump assembly, be careful not to damage stator shaft seal ring by coating seal ring with eingine oil (SAE 30, class CD).



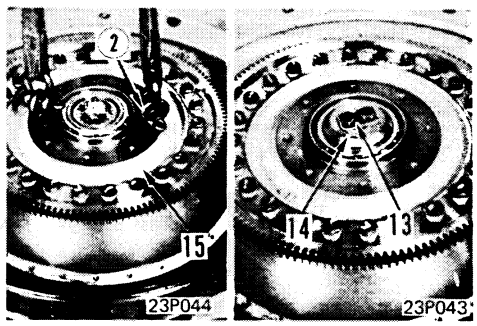
5. **Race**
Install race (18) on stator shaft and secure it with snap ring (17).



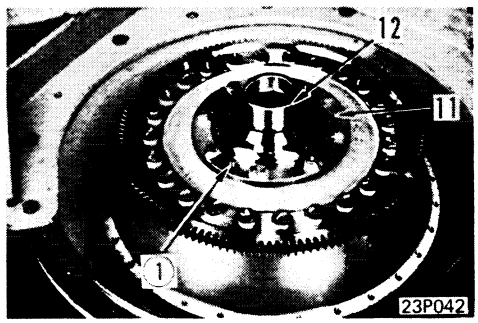
6. **Stator**
Install stotor (16) on race.
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt: **5.5~7.5 kg.m**



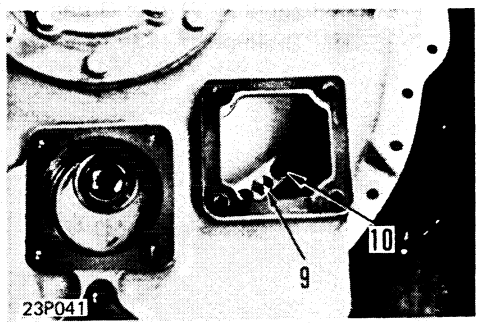
7. **Turbine and drive case assembly**
1) Sling turbine and drive case assembly (15) with hanging bolt ② (12 mm, P = 1.75) and spline-fit it to turbine shaft.
★ When installing assembly, check for proper mounting position (location of drain plug) of pump and drive case. It is good practice to temporarily install two or three bolts for this purpose.
2) Secure turbine and drive case assembly to turbine shaft with holder (14) and lock with lock plate (13) securely bent.
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt: **9.5~10 kg.m**



8. **Pilot**
Install pilot (12) and lock it with lock plate (11) securely bent.
★ Confirm that throttle hole in pilot is free from clogging.
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt: **9.5~12.5 kg.m**



9. **Pump and drive case mounting bolt**
1) Turn repair stand to face the output side of torque converter upward.
2) Secure pump to drive case with bolts (10) and install two drain plugs (9).
Mounting bolt: **Adhesive (LT-2)**
Mounting bolt: **5.0~6.0 kg.m**
Drain plug: **1.5~2.0 kg.m**

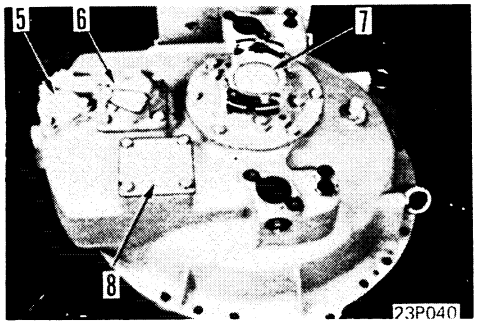


10. Cover
Attach gasket to the mounting surface of cover with gasket sealant (LG-1) and install cover (8).

11. Coupling
Spline-fit coupling (7) to turbine shaft.

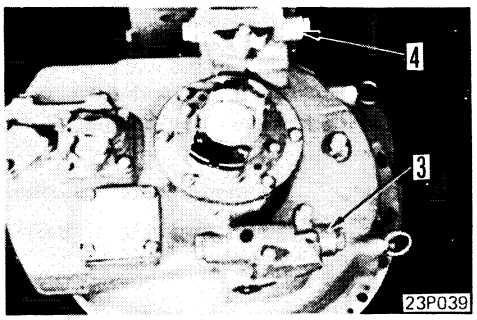
12. Scavenging pump assembly
Install scavenging pump assembly (6) with O-ring fitted in mounting surface.

13. Strainer
Install strainer (5) with O-ring fitted in place.

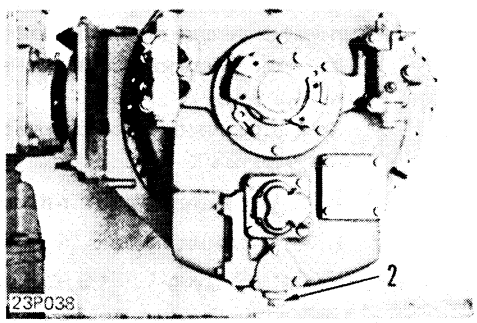


14. Relief valve assembly
Install relief valve assembly (4) with O-ring fitted in mounting surface.
kgm Mounting bolt: **8~11 kg.m**

15. Regulator valve assembly
Install regulator valve assembly (3) with O-ring fitted in mounting surface.
kgm Mounting bolt: **8~11 kg.m**

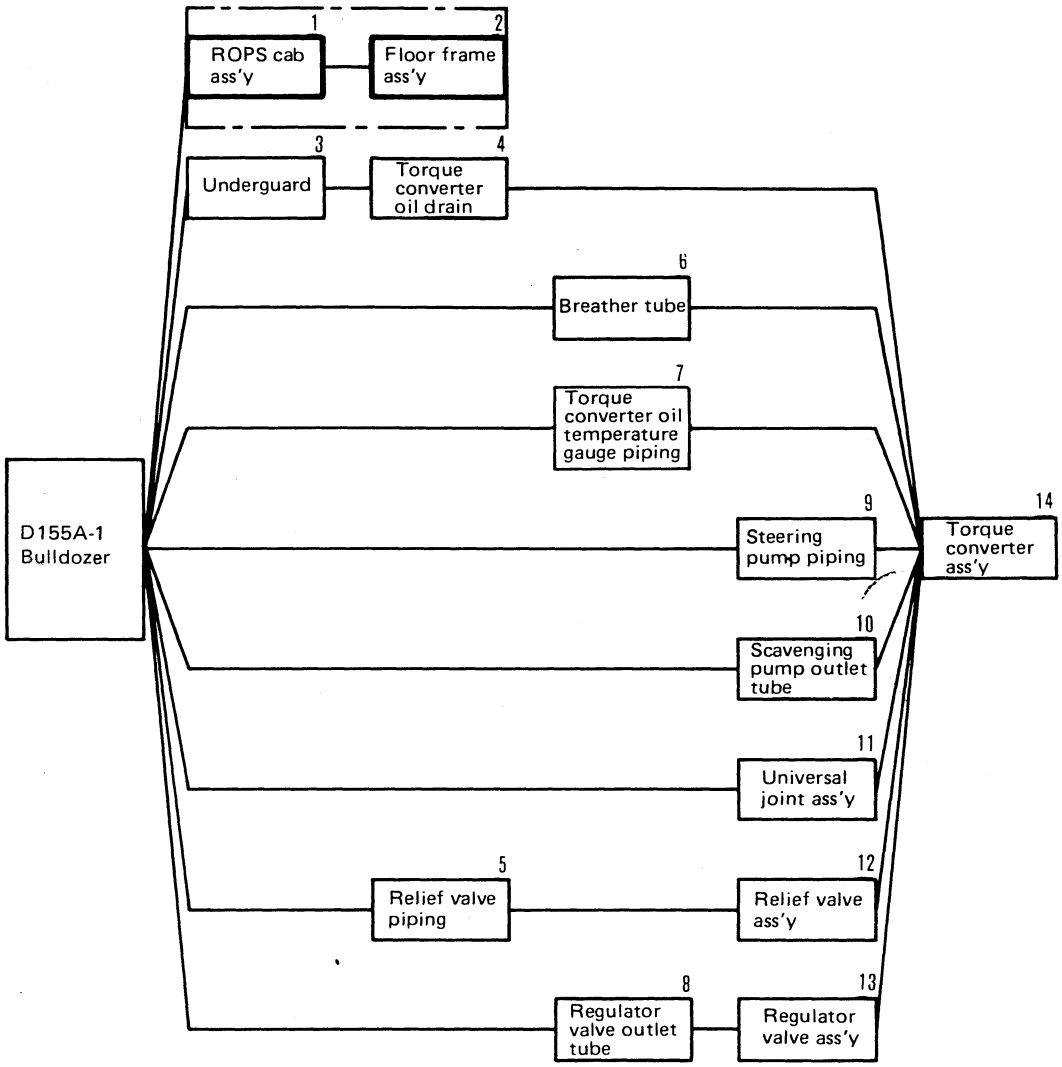


16. Drain plug
Install drain plug (2) with O-ring installed in place.
kgm Drain plug: **13~18 kg.m**



DISMOUNTING TORQUE CONVERTER

D155A 25001 and up

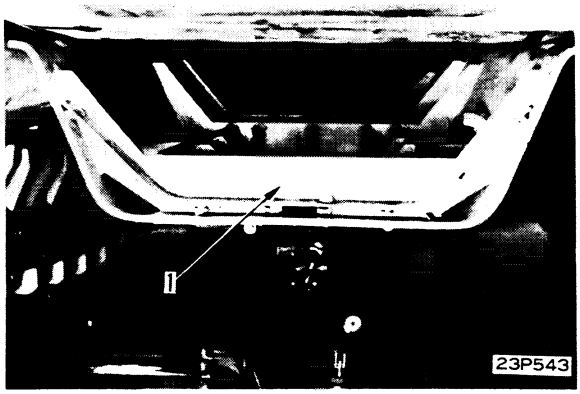


1. **ROPS cab assembly**

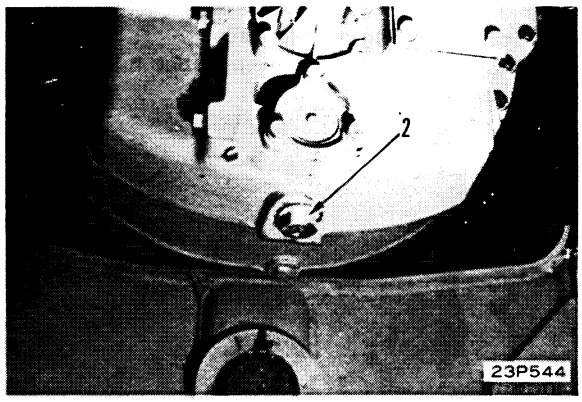
2. **Floor frame assembly**
   To tilt the ROPS cab, see TILTING ROPS CAB ASSEMBLY. To remove the ROPS cab and floor frame assembly, see DISMOUNTING ROPS CAB AND FLOOR FRAME ASSEMBLY.

3. **Underguard**
   Place a transmission jack in position, remove the mounting bolts, and remove underguard (1).
   ★ Temporarily sling the underguard by hooking wires to the bolts on the R.H. and L.H. sides. Remove the underguard by lowering the transmission jack, taking care to prevent interference with the diagonal brace.

   kg Underguard: **270 kg**

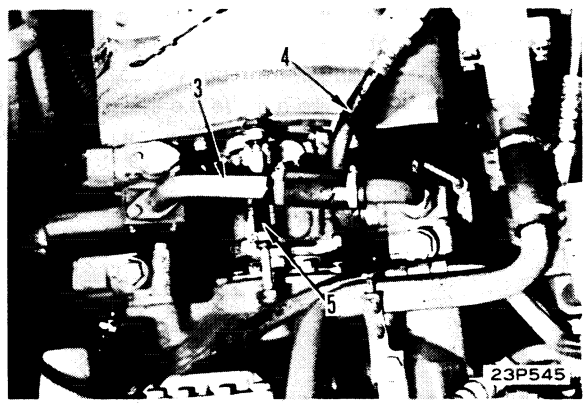


4. **Draining oil from the torque converter**
   Remove drain plug (2) and drain the oil from the torque converter case.



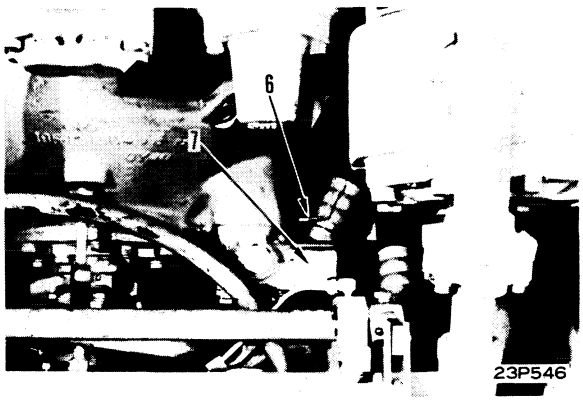
5. **Relief valve piping**
   1) Remove relief valve inlet tube (3).
   2) Remove relief valve outlet tube (4).

6. **Breather tube**
   Remove breather tube (5).



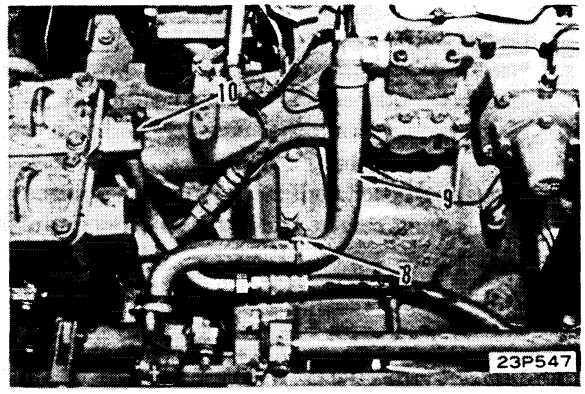
7. **Torque converter oil temperature gauge wire**
   Disconnect torque converter oil temperature gauge wire (6) from the sensor.

8. **Regulator valve outlet tube**
   Disconnect regulator valve outlet tube (7) from the regulator valve.



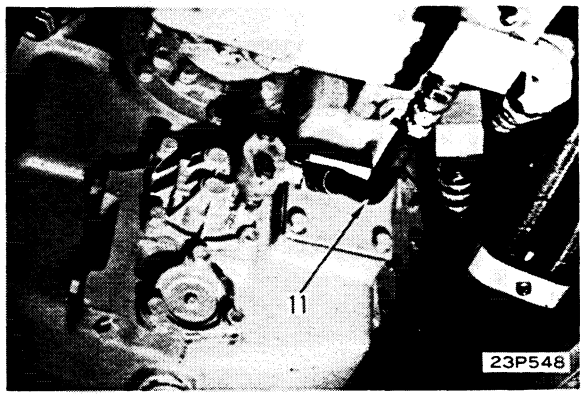
9. Steering pump piping

1) Remove clamp bracket (8) and steering pump inlet tube (9).
2) Disconnect tube (10) between the filter and the transmission control valve from the filter.



10. Scavenging pump outlet tube

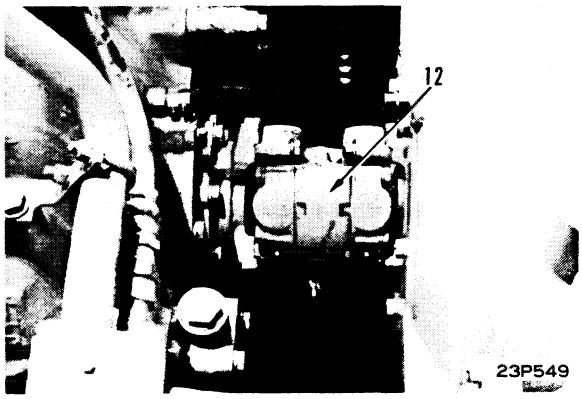
Disconnect scavenging pump outlet tube (11) from the pump.



11. Universal joint assembly

Remove universal joint assembly (12).

★ If it is difficult to remove the universal joint in the limited space around the coupling, remove the bearing on one side.

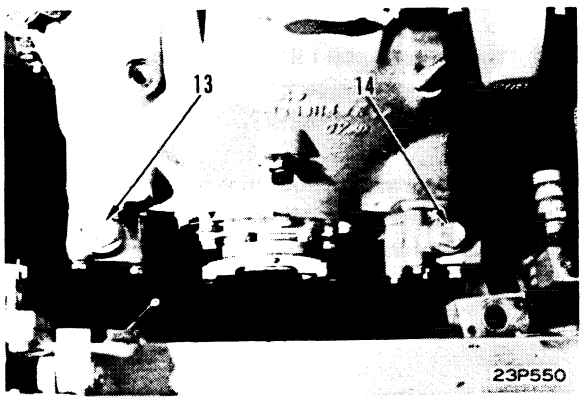


12. Relief valve assembly

Remove relief valve assembly (13).

13. Regulator valve assembly

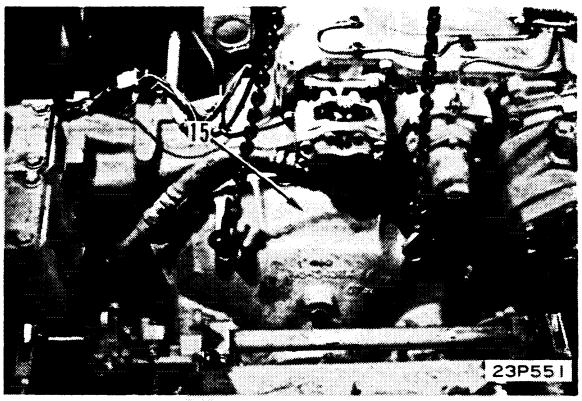
Remove regulator valve assembly (14).



14. Torque converter assembly

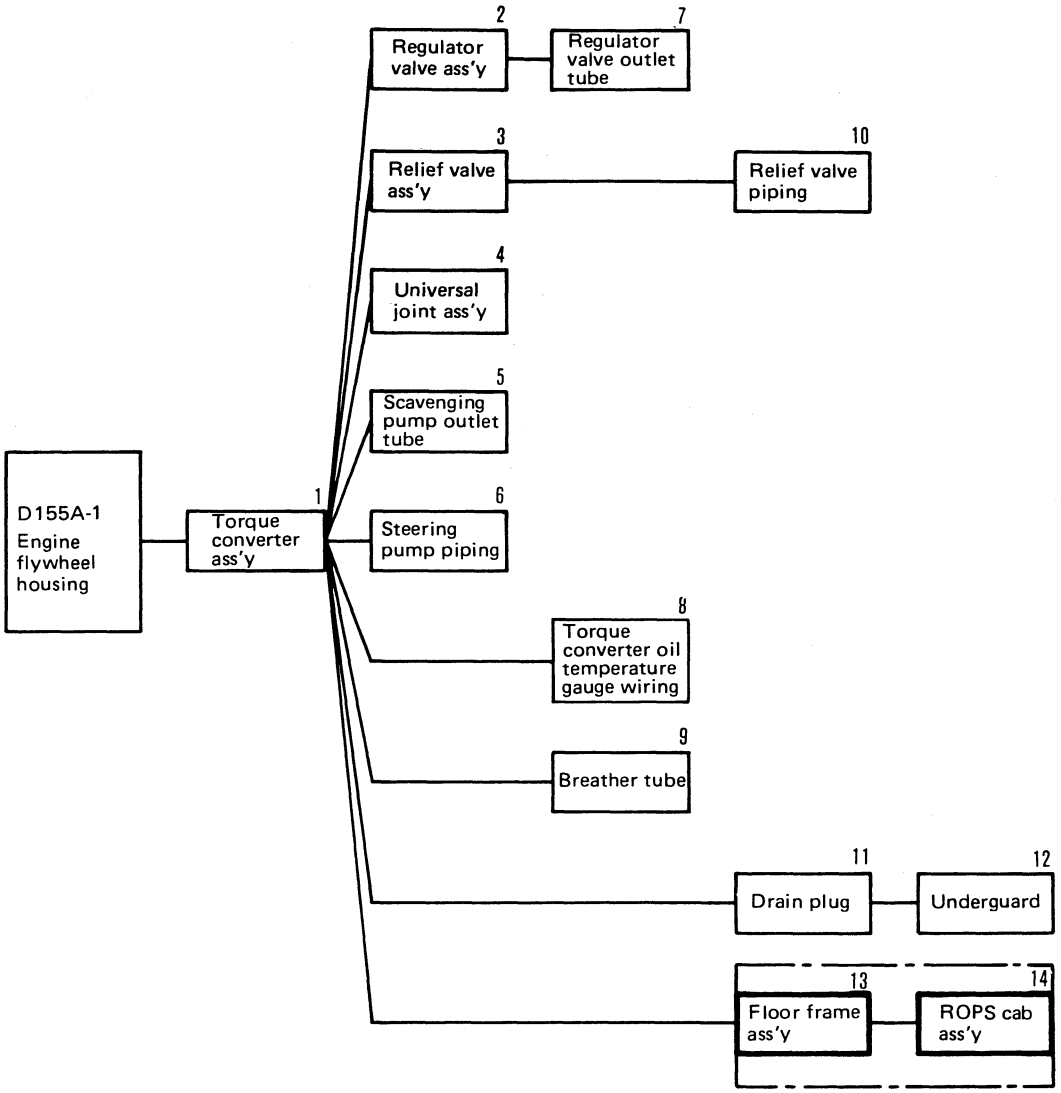
1) Temporarily lift torque converter assembly (15) with a crane.
2) Using forcing screws, lower and remove the torque converter assembly.

kg Torque converter assembly: **235 kg**



MOUNTING TORQUE CONVERTER

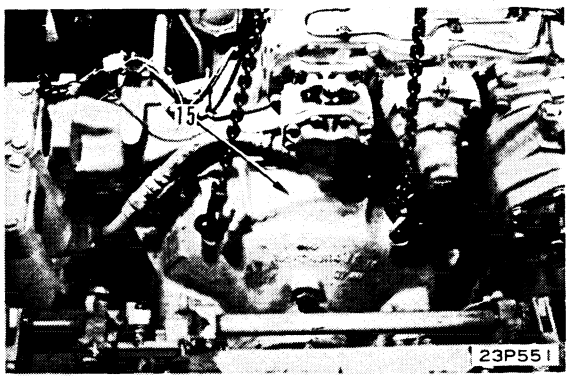
D155A 25001 and up



1. Torque converter assembly

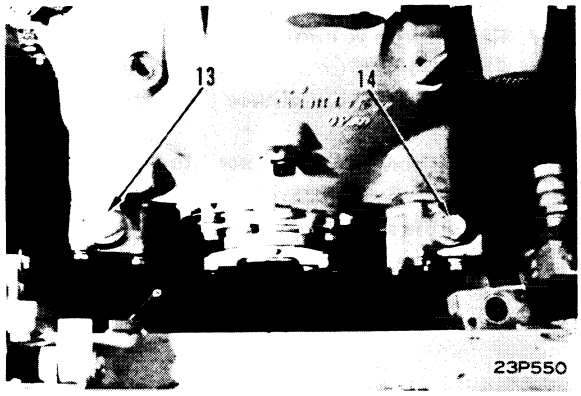
1) Stick a gasket to the mounting surface of the flywheel housing by coating with liquid gasket (LG-1).
2) Sling torque converter assembly (15) with a crane, and install the torque converter assembly with the drive gear meshed with the flywheel gear.

kgm Mounting bolt: **11 ± 1 kgm**



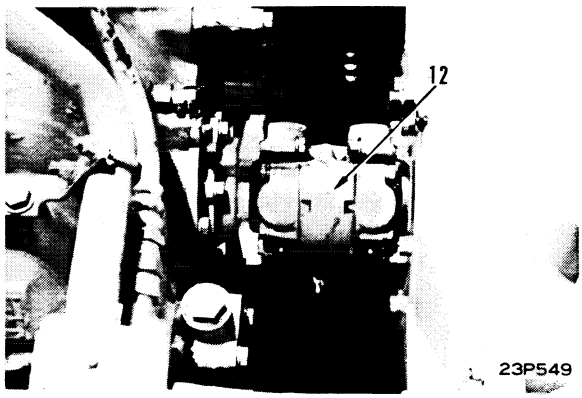
2. Regulator valve assembly
Fit an O-ring to the mounting surface and install regulator valve assembly (14).

3. Relief valve assembly
Fit an O-ring to the mounting surface and install relief valve assembly (13).

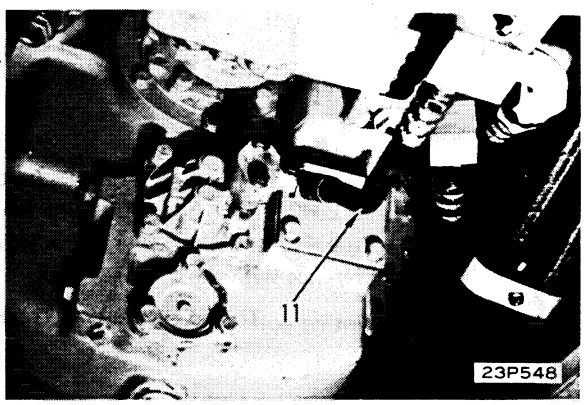


4. Universal joint assembly
Install universal joint assembly (12).

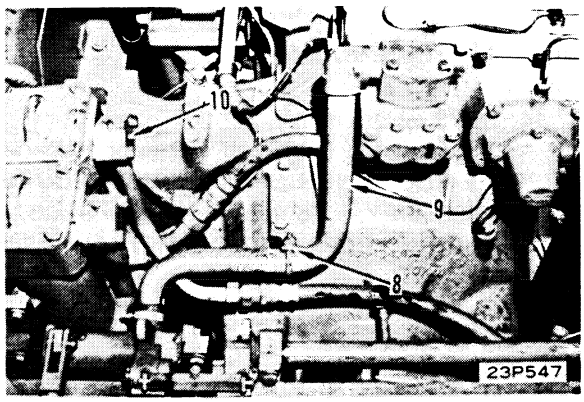
kgm Mounting bolt: **11 ± 1 kgm**



5. Scavenging pump outlet tube
Fit an O-ring to the flange surface and connect scavenging pump outlet tube (11).

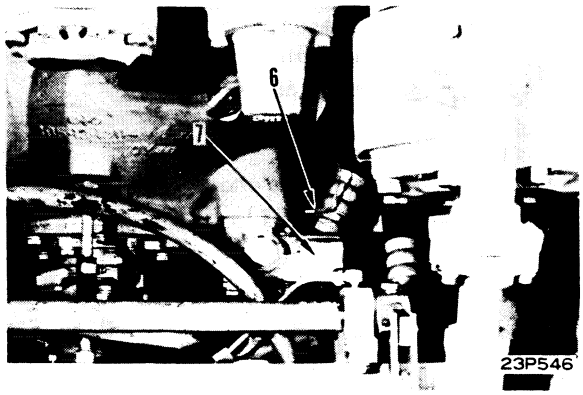


6. Steering pump piping
1) Fit an O-ring to the mounting surface and connect tube (10) between the filter and the transmission control valve.
2) Fit an O-ring to the mounting surface and install steering pump inlet tube (9) and clamp bracket (8).



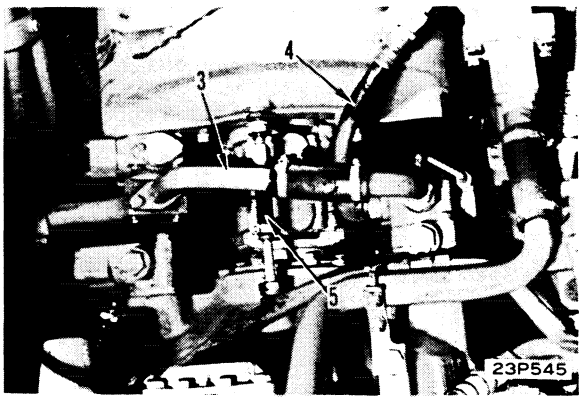
7. **Regulator valve outlet tube**
   Fit an O-ring to the mounting surface and connect regulator valve outlet tube (7) to the regulator valve.

8. **Torque converter oil temperature gauge wire**
   Connect torque converter oil temperature gauge wire (6) to the sensor.



9. **Breather tube**
   Install breather tube (5).

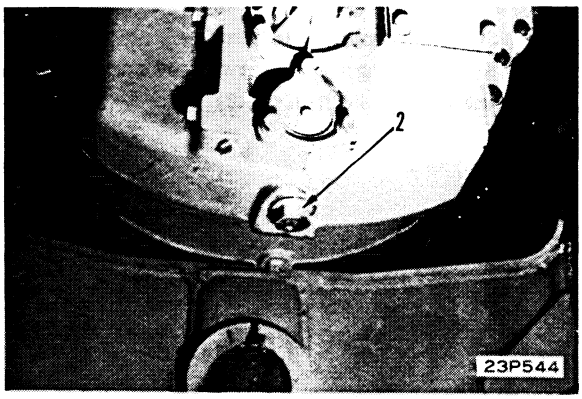
10. **Relief valve piping**
    1) Fit an O-ring to the mounting surface and install relief valve outlet hose (4).
    2) Fit an O-ring to the mounting surface and install relief valve inlet tube (3).



11. **Drain plug**
    Install drain plug (2) to the torque converter case.

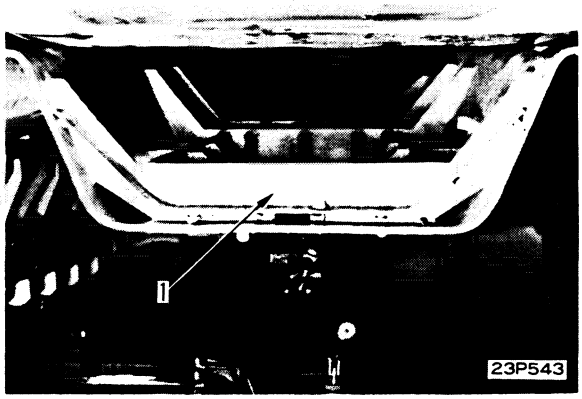
12. **Underguard**
    Lift underguard (1) with wires hooked to the bolts on the R.H. and L.H. sides. Install the underguard by jacking up the transmission jack, taking care to prevent interference with the diagonal brace.

    Mounting bolt: **Thread tightener (LG-2)**

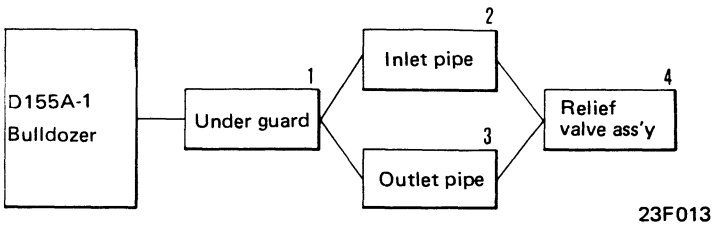


13. **Floor frame assembly**

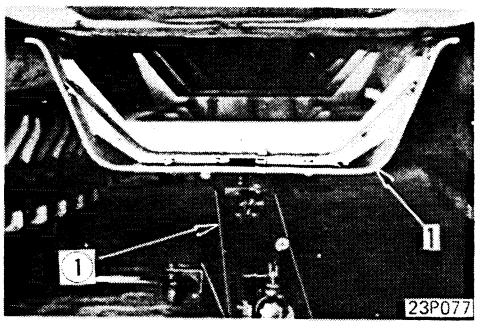
14. **ROPS cab assembly**
    To install the ROPS cab and floor frame assembly, see MOUNTING ROPS CAB AND FLOOR FRAME ASSEMBLY. To return the ROPS cab, see RETURNING ROPS CAB TO ORIGINAL POSITION.



DISMOUNTING TORQUE CONVERTER RELIEF VALVE D155A

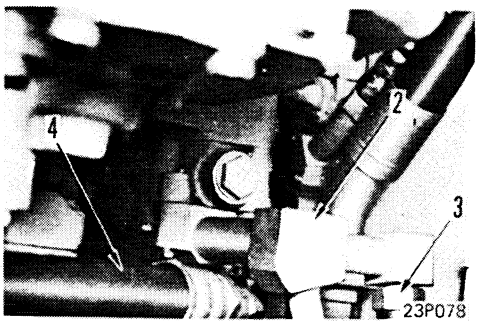


1. **Under guard**
   Support underguard (1) with jack ①. Remove bolts fastening under guard; remove under guard.
   kg Transmission under guard: **270 kg.**

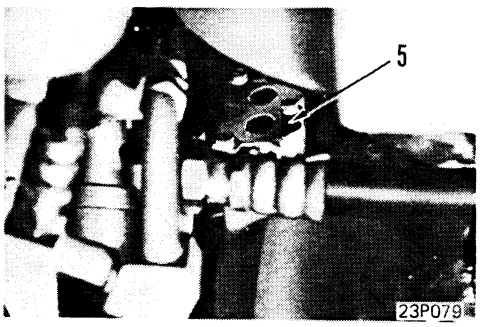


2. **Inlet pipe**
   Disconnect hose (3) comming from steering control valve from inlet pipe. Disconnect inlet pipe from relief valve.

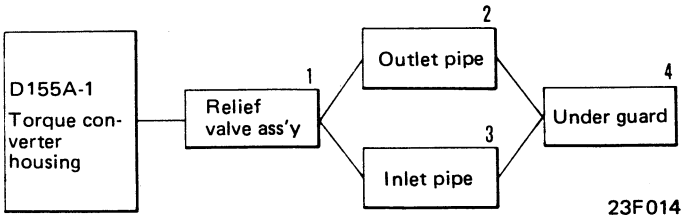
3. **Outlet pipe**
   Disconnect relief valve outlet pipe (4) from relief valve.



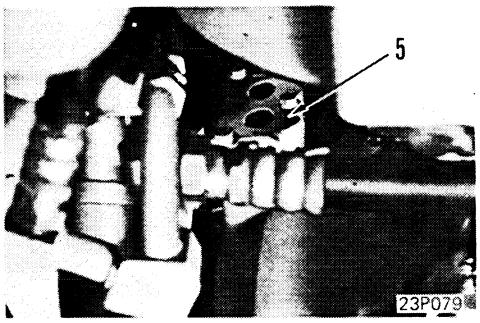
4. **Relief valve assembly**
   Remove three bolts fastening relief valve assembly (5); remove valve assembly.



MOUNTING TORQUE CONVERTER RELIEF VALVE D155A

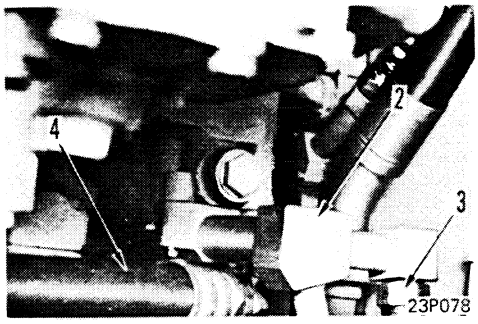


1. **Relief valve assembly**
   Install O-ring torque converter relief valve assembly (5) and install valve assembly with three bolts.

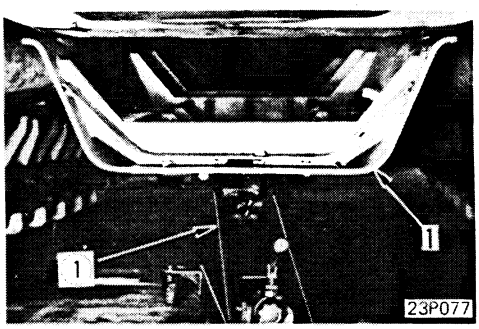


2. **Outlet pipe**
   Connect relief valve outlet pipe (4) with O-ring to relief valve.

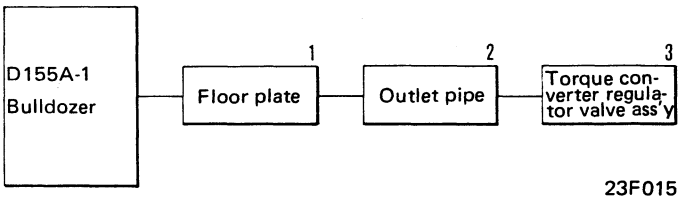
3. **Inlet pipe**
   Connect relief valve inlet pipe (2) with O-ring to relief valve. Connect hose (3) coming from steering control valve to relief valve.



4. **Under guard**
   Using transmission jack ① , install under guard (1) with bolts.

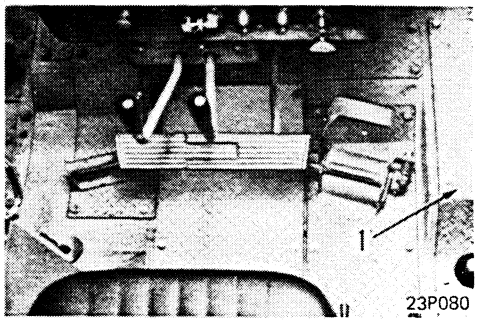


DISMOUNTING TORQUE CONVERTER REGULATOR VALVE D155A

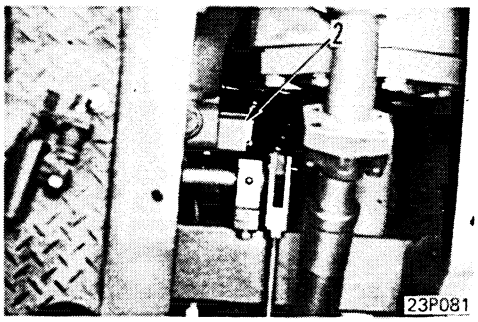


23F015

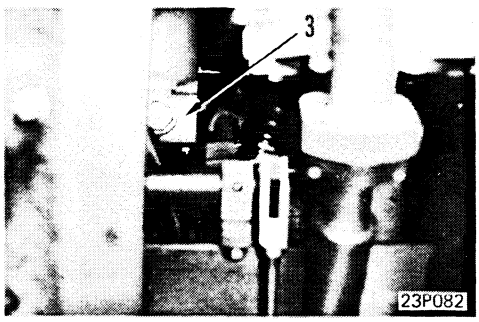
1. **Floor plate**
   Remove floor plate (1).



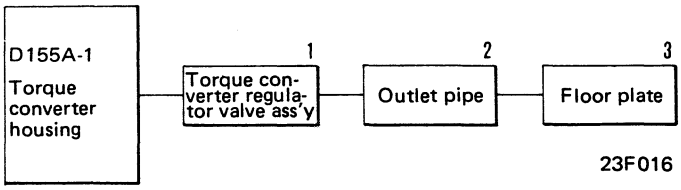
2. **Outlet pipe**
   Disconnect pipe (2), connecting torque converter regulator valve to cooler, from regulator valve.



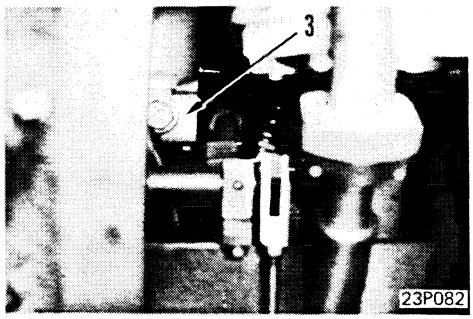
3. **Torque converter regulator valve assembly**
   Remove three bolts fastening torque converter regulator valve assembly (3); remove valve assembly.



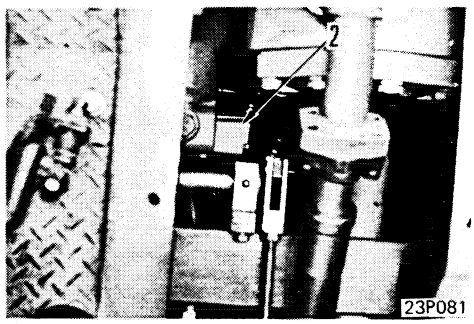
MOUNTING TORQUE CONVERTER REGULATOR VALVE D155A



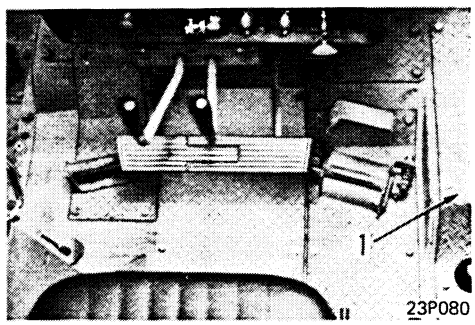
1. **Torque converter regulator valve assembly**
   Fit large and small O-rings to valve assembly. Install valve assembly with three bolts.



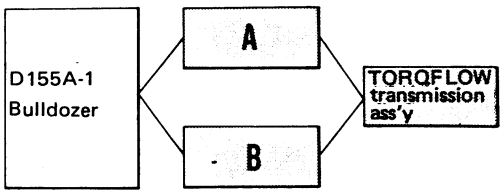
2. **Outlet pipe**
   Connect pipe (2) coming from cooler, with O-ring in flange face, to regulator valve.



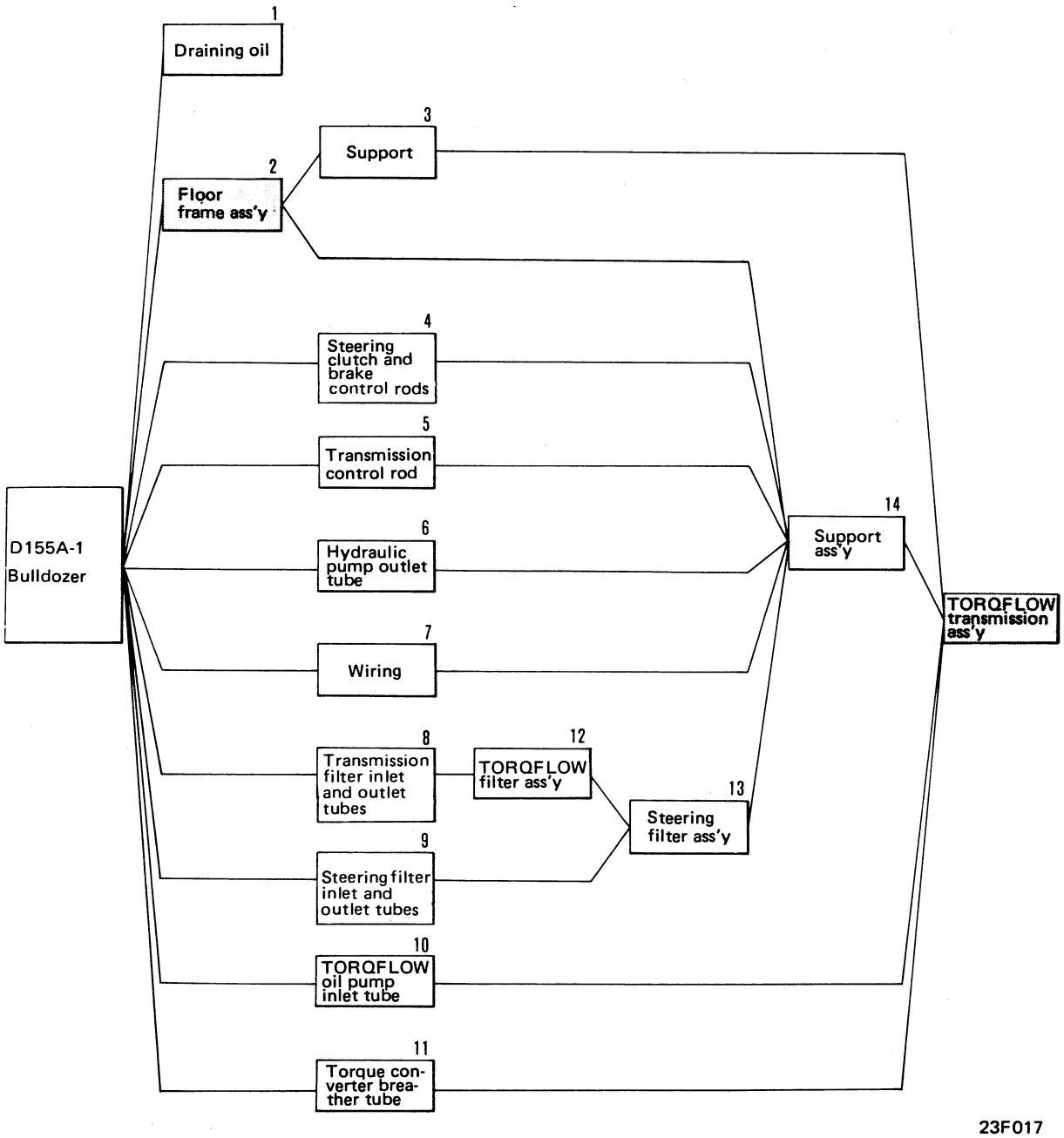
3. **Floor plate**
   Install floor plate (1).



DISMOUNTING TORQFLOW TRANSMISSION D155A 15001 – 25000

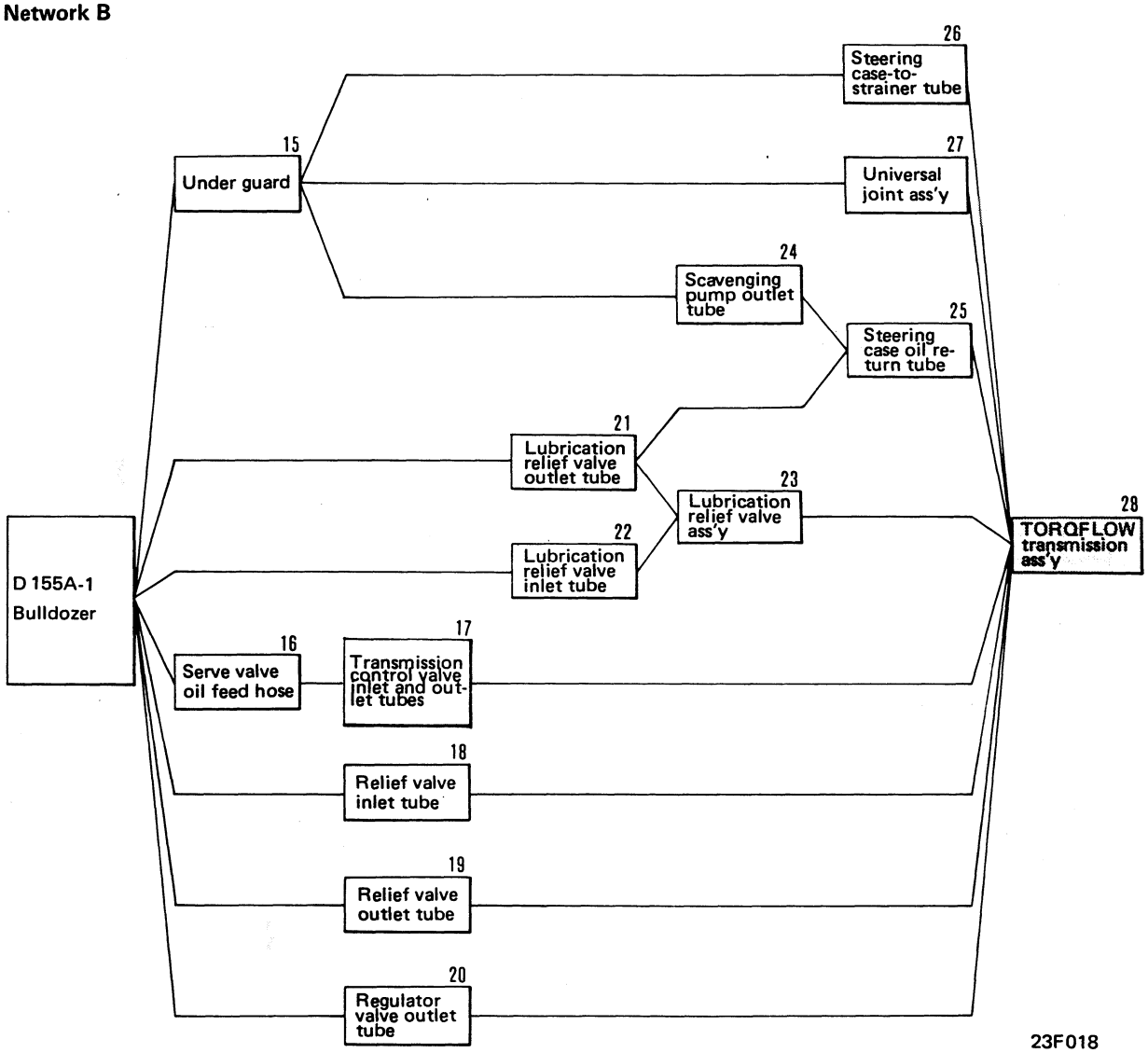


Network A



23F017

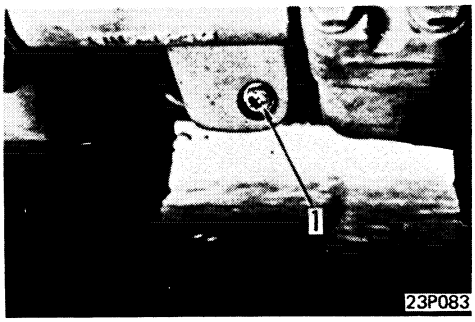
Network B


D 155A-1
Bulldozer
15
Under guard
16
Serve valve oil feed hose
17
Transmission control valve inlet and outlet tubes
18
Relief valve inlet tube
19
Relief valve outlet tube
20
Regulator valve outlet tube
21
Lubrication relief valve outlet tube
22
Lubrication relief valve inlet tube
23
Lubrication relief valve ass'y
24
Scavenging pump outlet tube
25
Steering case oil return tube
26
Steering case-to-strainer tube
27
Universal joint ass'y
28
TORQFLOW transmission ass'y
23F018

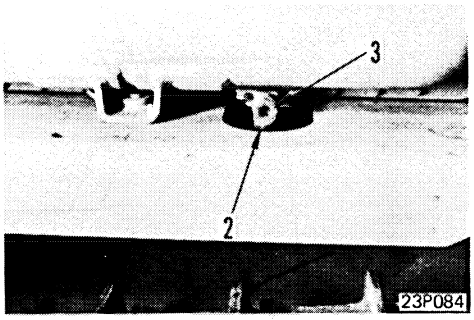
1. Draining oil

1) Remove drain plug (1) and drain steering and transmission oil.

Oil capacity: **185** ℓ



2) Remove drain plug (2) and open drain valve (3) to drain hydraulic oil.

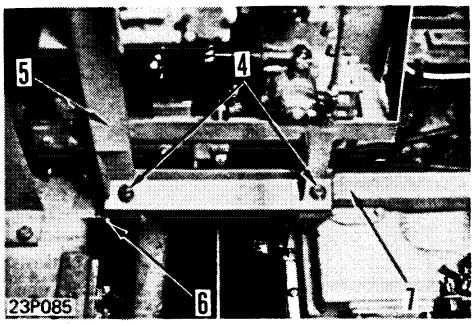


2. Floor frame assembly

Refer to DISMOUNTING FLOOR FRAME.

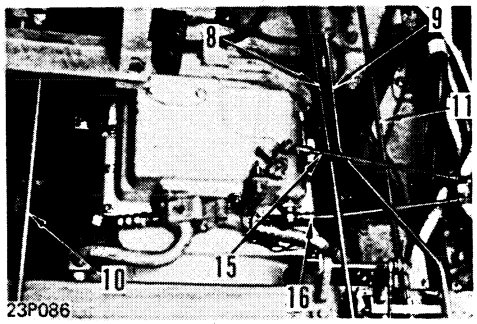
3. Support

1) Remove assembly mounting bolts (4) and sling servo frame assembly (5) with lever type chain block.
2) Remove bolts (6) (four bolts each side) fastening support (7); remove support.



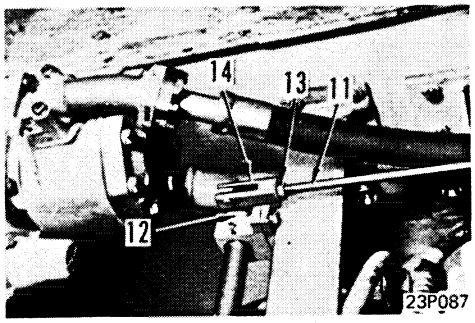
4. Steering clutch and brake control rods

1) Remove pins joining right and left clutch rods (8) and (9) and left brake rod (10) to the respective links; remove rods.
2) Disconnect right brake rod (11) from lever (12). After clearly marking assembly position, loosen lock nut (13) and remove yoke (14).
   - ★ Remove only the front yoke of right brake rod as it is difficult to remove the rear pin.
   - ★ Clearly mark assembly position of each rod removed (at front and rear ends).

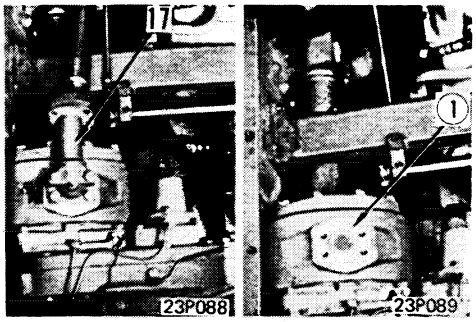


5. Transmission control rod

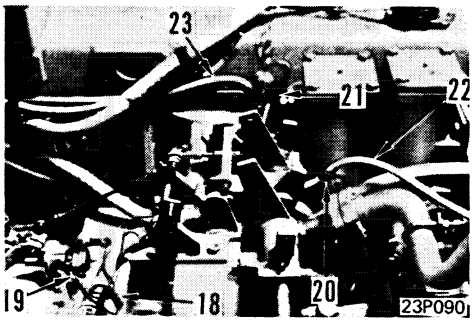
Remove lock nuts fastening transmission control rods (15) and (16); remove rods.



6. **Hydraulic pump outlet tube**
   Remove bolts and disconnect hydraulic pump outlet tube (17) from pump.
   ★ Keep disconnected tube pulled toward the rear of machine and clamped with wire.
   ★ Close pump discharge port with tape or plastic plug ① to prevent intrusion of dust.

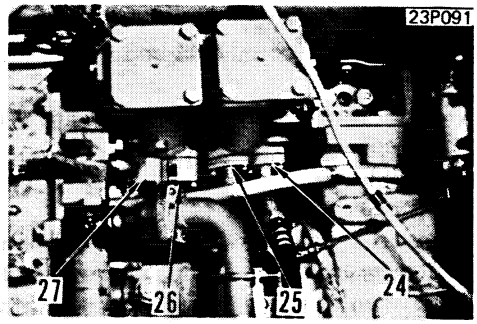


7. **Wiring**
   1) Remove clamp (18) and disconnect back alarm switch wire (19) from switch. Keep disconnected wire pulled toward the outside of machine.
   2) Remove clamps (20) and (21) and disconnect battery relay wire (22) and rear lamp wire (23) from connector. Keep disconnected wires pulled toward the outside of machine.

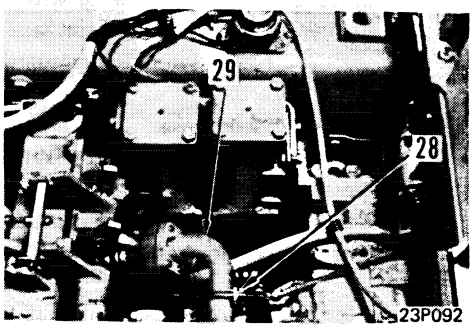


8. **Transmission filter inlet and outlet tubes**
   Remove flange fastening bolts and disconnect transmission oil inlet tube (24) and outlet tube (25) from filter.

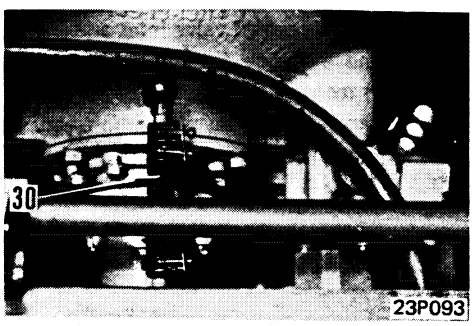
9. **Steering filter inlet and outlet tubes**
   Remove flange fastening bolts and disconnect steering oil filter inlet tube (26) and outlet (27) from filter.



10. **TORQFLOW oil pump inlet tube**
    Remove bolts fastening clamp bracket (28) to torque converter; remove bracket. Remove flange fastening bolts and disconnect TORQFLOW oil pump inlet tube (29) from pump.

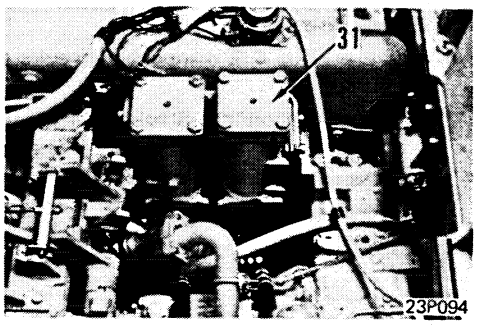


11. **Torque converter breather tube**
    Remove sleeve nut fastening breather tube (30); remove tube.
    ★ Remove tube mounting nipples both from torque converter and transmission.



12. TORQFLOW filter assembly

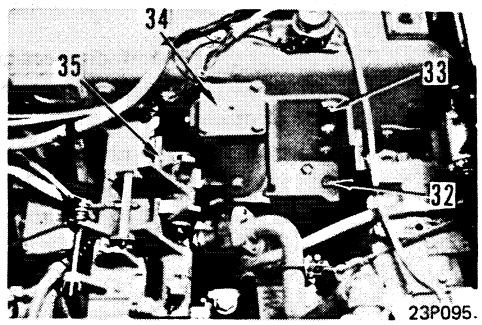
Remove bolts fastening TORQFLOW filter assembly (31); remove assembly.



13. Steering filter assembly

Remove bolts (32) and (33) fastening steering filter assembly (34); remove filter assembly with bracket.

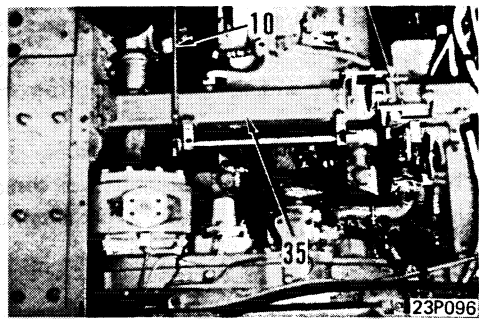
★ When it is difficult to remove filter assembly (because of interference with support assembly), remove eight bolts at R.H. and L.H. fastening support assembly (35) by sliding support assembly rearward.



14. Support assembly

Remove eight bolts, right and left, fastening support assembly (35).

Lift off assembly with crane while sliding it toward the front of machine.

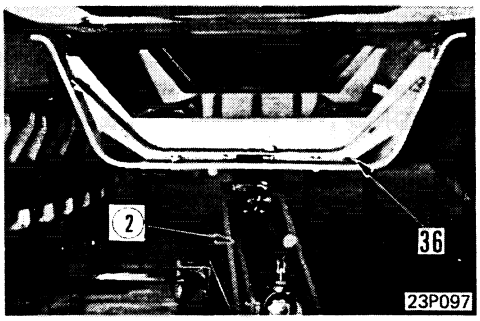


15. Under guard

Support under guard with transmission jack ② . Remove bolts fastening under guard (36); remove under guard.

★ When removing, move under guard forward, taking care to prevent it from interfering with diagonal brace, while gradually retracting transmission jack.

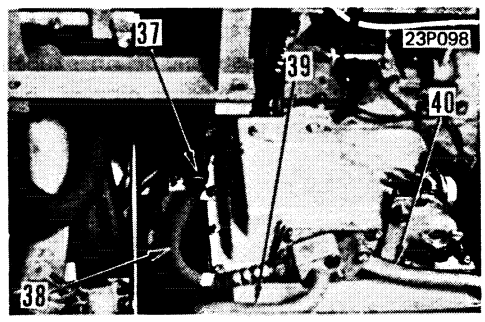
kg Transmission under guard: **270 kg.**



16. Servo valve oil feed hose

Remove clamp (37). Remove sleeve nut fastening servo valve oil feed hose; remove hose (38).

★ Loosen sleeve nut holding one nut stationary with a wrench while loosening the other.

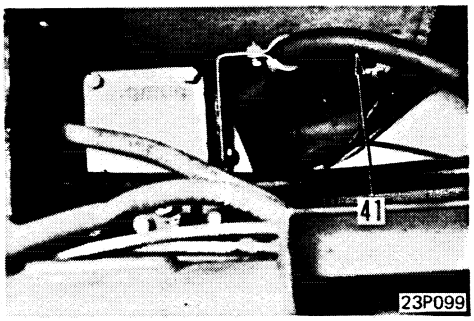


17. Transmission control valve inlet and outlet tubes

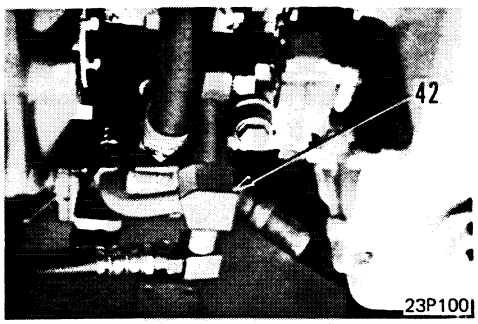
1) Remove flange fastening bolts and disconnect inlet tube (39) from valve.
2) Remove flange fastening bolts and disconnect outlet tube (40) from valve.

18. Relief valve inlet tube

1) Remove clamp bracket mounting bolts; remove house (41), connecting steering valve to relief valve, from strainer together with bracket.



2) Remove flange fastening bolts and disconnect relief valve inlet tube (42) from relief valve.



19. Relief valve outlet tube

Remove flange fastening bolts and disconnect relief valve outlet tube (43) from relief valve.

20. Regulator valve outlet tube

Remove flange fastening bolts and disconnect regulator outlet tube (44) from regulator valve.

21. Lubrication relief valve outlet tube

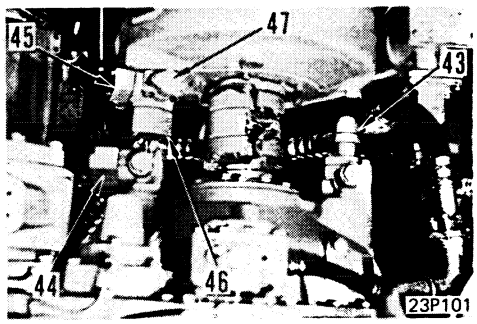
Remove flange fastening bolts and disconnect lubrication relief valve outlet tube (45) from valve.

22. Lubrication relief valve inlet tube

Remove flange fastening bolts and disconnect lubrication relief valve inlet tube (46) from valve.

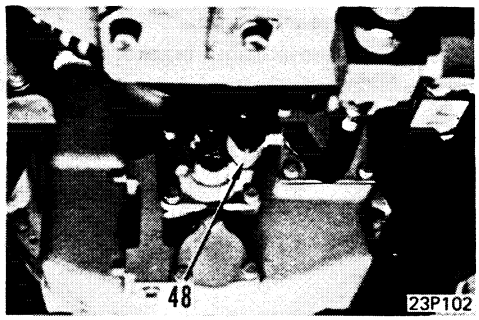
23. Lubrication relief valve assembly

Remove bolts fastening lubrication relief valve assembly (47); remove assembly.



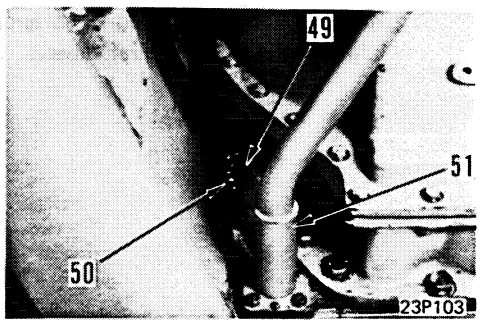
24. Scavenging pump outlet tube

Remove flange fastening bolts and disconnect scavenging pump outlet tube (48) from pump.

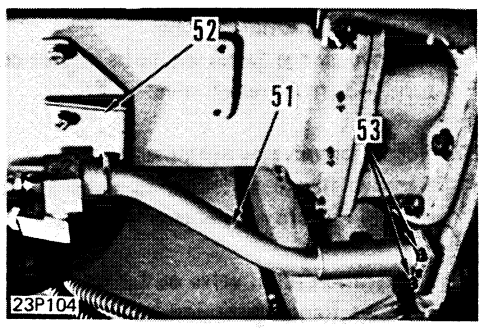


25. Steering case oil return tube

1) Remove sleeve nuts and disconnect brake band lubrication hose (49) and servo valve oil return hose (50) from steering case oil return tube (51).



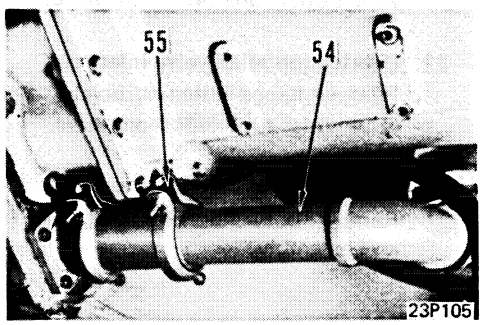
2) Remove bolts fastening clamp bracket (52) and flange fastning bolts (53). Remove steering case oil return tube (51).
   ★ Width across flats of flange fastening bolt: **17 mm.**



26. Steering case-to-strainer tube

Remove tube (54) connecting steering case to strainer by removing flange fastening bolts at the steering case side end and strainer side end.

★ Keep coupling clamp (55) slackened for convenience of installation.

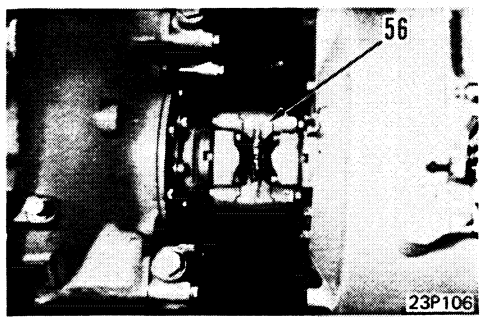


27. Universal joint assembly

Sling assembly with crane. Remove mounting bolts and lift off universal joint assembly (56).

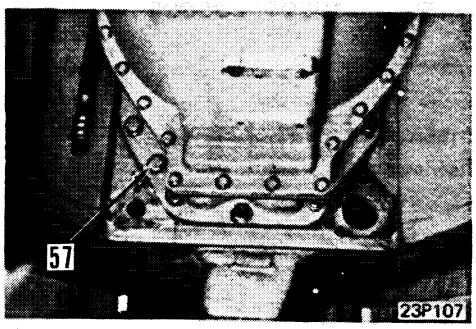
★ If it is difficult to remove assembly because of narrow coupling clearance, remove bearing from either coupling.

kg Universal joint assembly: **20 kg.**



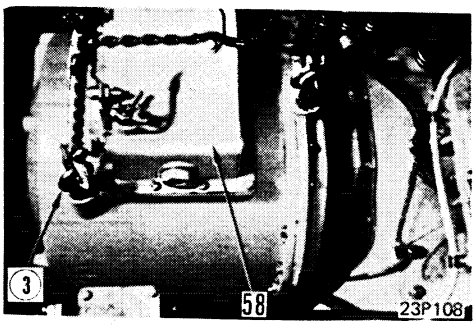
28. TORQFLOW transmission assembly

1) Attach hanging bolts ③ (24 mm, P = 3.0) to transmission and sling transmission from crane with three wire ropes. Remove six bolts (57) and five nuts.



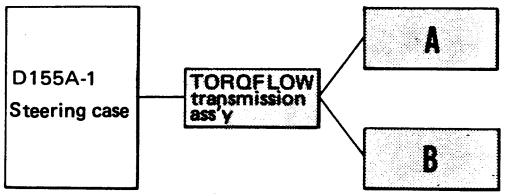
2) Lift off transmission assembly (58) from steering case with crane taking care to prevent assembly from interfering with the surroundings.

kg TORQFLOW transmission assembly: **950 kg.**

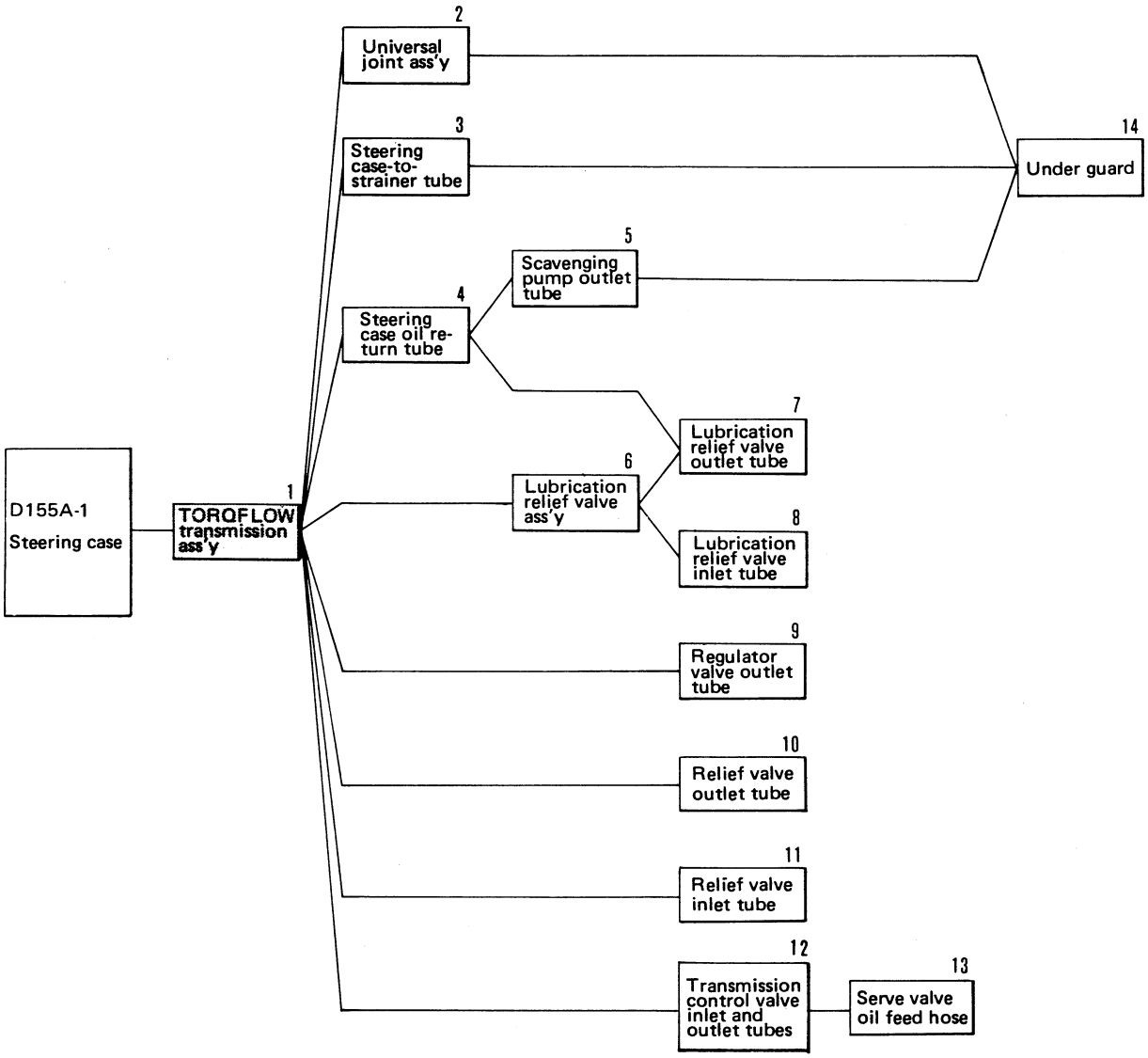


MOUNTING TORQFLOW TRANSMISSION

D155A 15001 – 25000

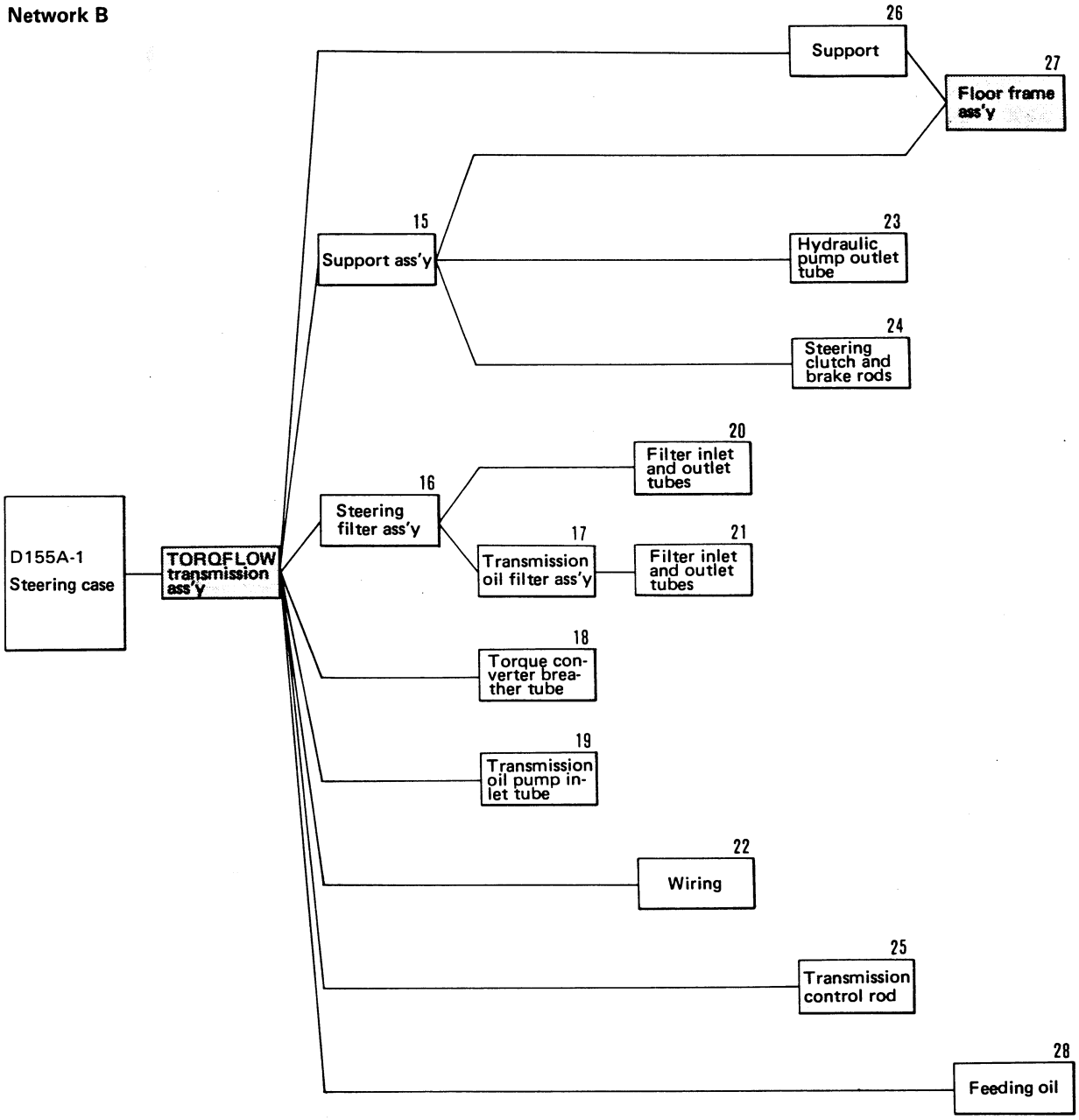


Network A



23F019

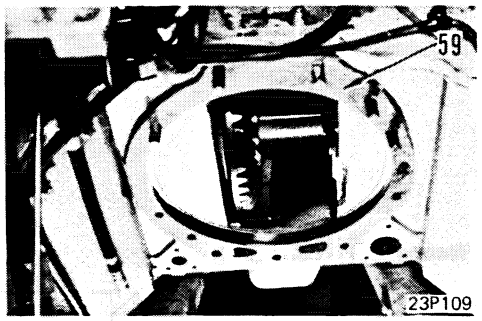
Network B



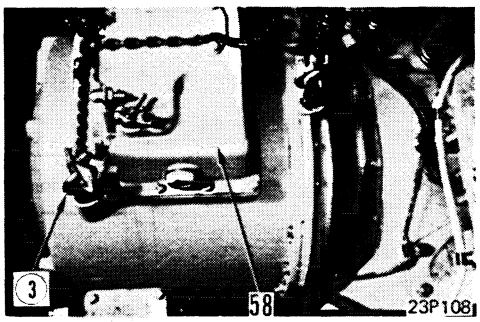
23F020

1. TORQFLOW transmission assembly

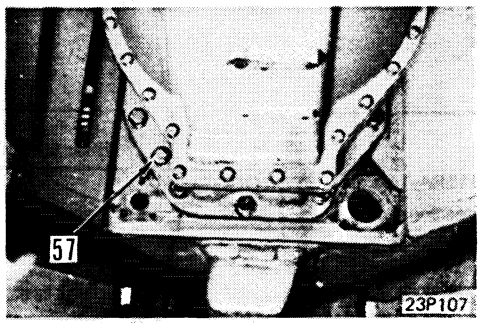
1) Attach gasket (59) mounting surface (on the steering case side) with gasket sealant (LG-1).



2) Attach O-ring mounting surface (on the transmission side) and lift TORQFLOW tansmission assembly (58) into the position on steering case with crane.
   ★ Carefully lower assembly to prevent inteference with the surroundings.



3) Secure assembly to steering case with six bolts (57) and five nuts.
   kgm Mounting bolts and nuts: **50 – 60 kgm**

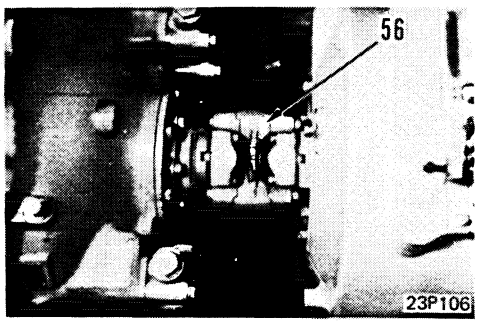


2. Universal joint assembly

Install universal joint assembly (56) between torque converter yoke and transmission yoke.

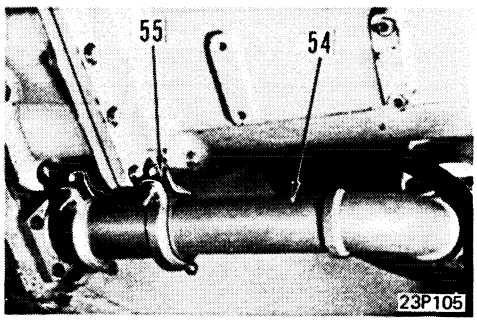
kgm Mounting bolt: **10 – 12.5 kgm**

★ Confirm that bearings are firmly fitted to torque converter side yoke and transmission side yoke.

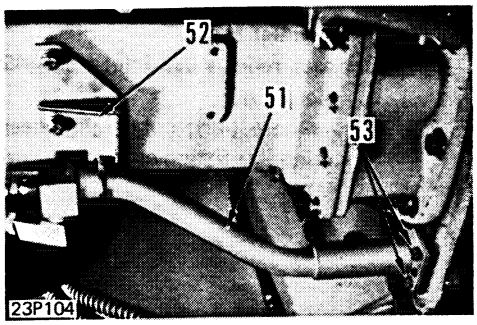


3. Steering case-to-strainer tube

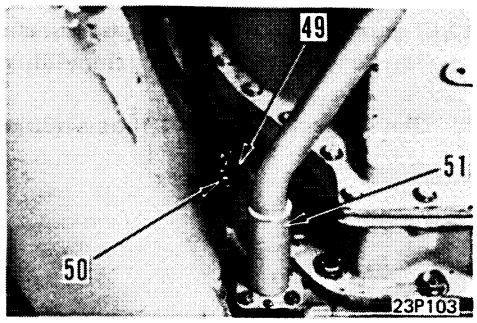
Connect one end of tube (54) to steering case with O-ring and the other end to strainer with O-ring. Tighten coupling clamp (55).



4. **Steering case oil return tube**
   1) Connect steering case oil return tube (51), with O-ring in flange, to steering case. Install clamp bracket (52) with bolts.

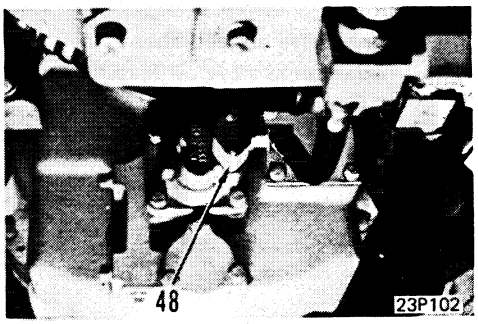


   2) Connect brake band lubrication hose (49) and servo valve oil return hose (50) to steering case oil return tube.
      ★ Install hoses with taking eare to prevent hoses from twisting.



5. **Scavenging pump outlet tube**
   Connect scavenging pump outlet tube (48), with O-ring in to pump.

6. **Lubrication relief valve assembly**
   Install lubrication relief valve assembly (47) with O-ring on sleeve and gasket on mounting surface.

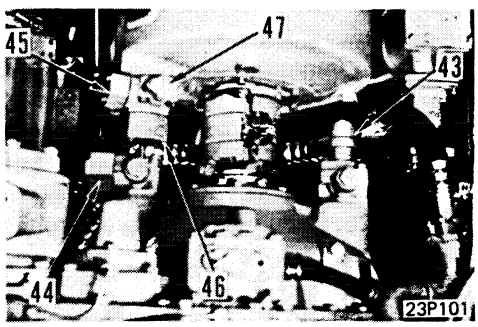


7. **Lubrication relief valve outlet tube**
   Connect lubrication relief valve outlet tube (45), with O-ring in flange, to valve.

8. **Lubrication relief valve inlet tube**
   Connect lubrication relief valve inlet tube (46), with O-ring in flange to valve.

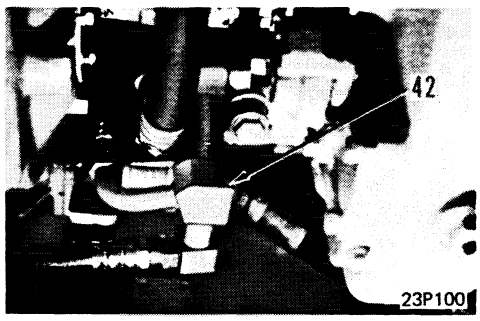
9. **Regulator valve outlet tube**
   Connect regulator valve outlet tube (44), with O-ring in flange, to regulator valve.

10. **Relief valve outlet tube**
    Connect relief valve outlet tube (43), with O-ring in flange, to relief valve.



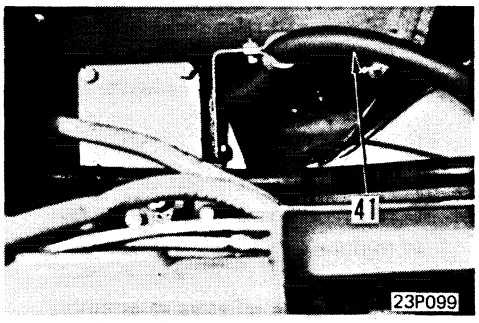
11. Relief valve inlet tube

1) Connect relief valve inlet tube (42), with O-ring in flange, to relief valve.
2) Secure hose (41), connecting steering valve to relief valve, to strainer by fitting clamp bracket on strainer.



12. Transmission control valve inlet and outlet tubes

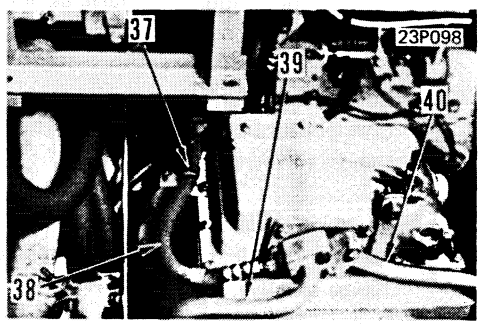
1) Connect valve outlet tube (40), with O-ring in flange, to valve.
2) Connect valve inlet tube (39), with O-ring in flange, to valve.



13. Servo valve oil feed hose

Install servo valve oil feed hose (38) with sleeve nut and install hose clamp (37) in place.

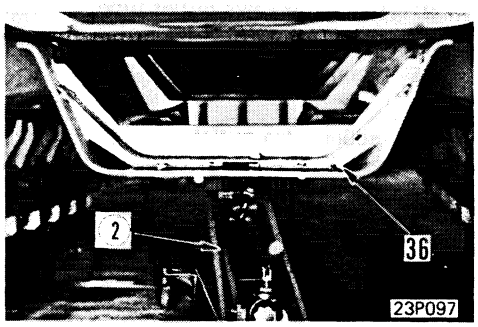
★ Install hose with taking care to prevent hose front twisting.



14. Under guard

Install transmission under guard (36) by using transmission jack ②.

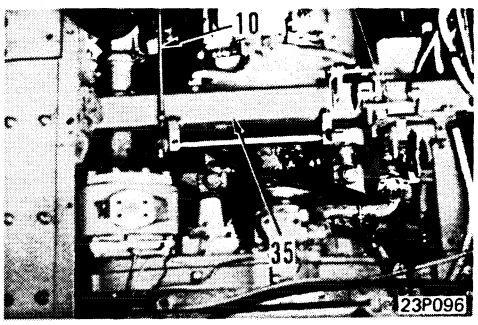
★ When installing, move transmission under guard rearward, taking care to prevent it from interfering with diagonal brace, while transmission jack is gradually protruded.
★ Coat mounting bolts with thread tightener (LT-2).



15. Support assembly

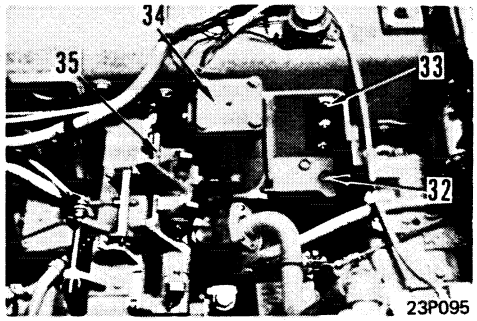
Insert support assembly (35) between fenders and slide in rearward until it is located in place.

★ Do not attempt to bolt until steering oil filter is installed. (Otherwise, it may become difficult to install steering filter assembly).
★ Position left brake rod (10) above support assembly. (installation of after-mentioned brake rod will become impossible).



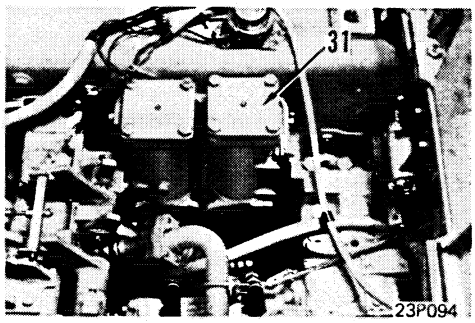
16. Steering filter assembly

1) Secure steering filter assembly (with bracket) (34) to frame and fender with bolts (32) and (33).
   ★ Move support assembly as necessary to prevent interference.
2) Secure support assembly (35) to fender with eight bolts, right and left.



17. Transmission oil filter assembly

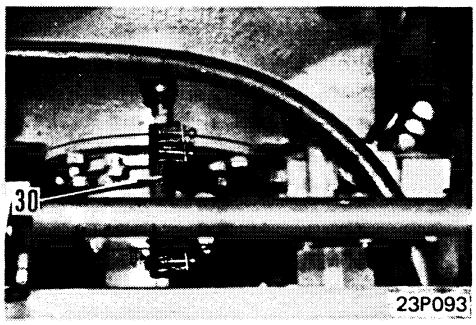
Secure filter assembly (31) to bracket with bolts.



18. Torque converter breather tube

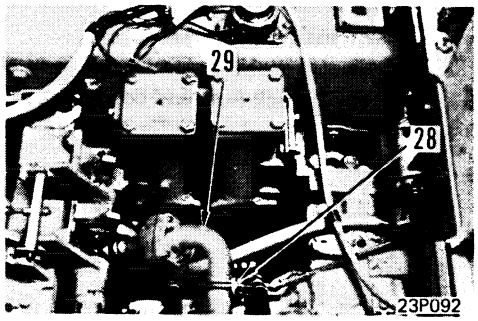
Install nipples on torque converter and transmission. Connect breather tube (30) to nipples.

★ Wind seal tape on to each nipple when installing.



19. Transmission oil pump inlet tube

Connect pump inlet tube (29), with O-ring in flange, to pump. Install clamp bracket (28) on torque converter.

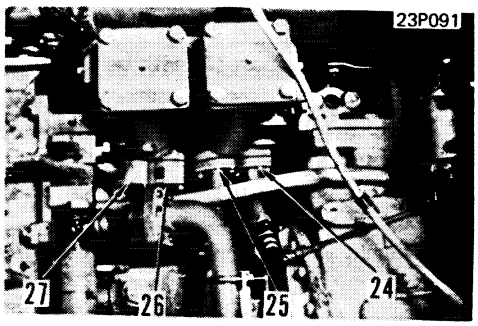


20. Steering filter inlet and outlet tubes

Connect steering oil filter outlet tube (27) and inlet tube (26), with O-ring in each flange, to filter.

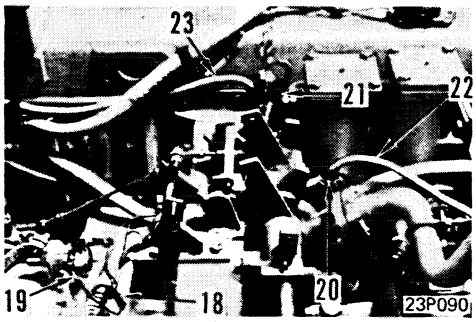
21. Transmission filter inlet and outlet tubes

Connect transmission oil filter outlet tube (25) and inlet tube (25), with O-ring in each flange, to filter.



22. Wiring

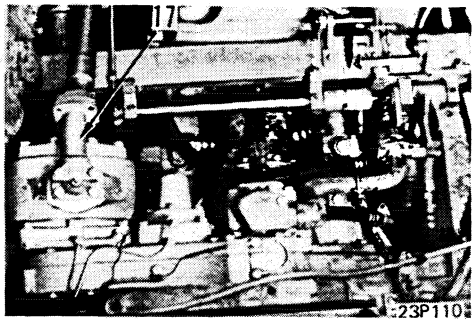
1) Connect battery relay wire (22) and rear lamp wire (23) to their connectors. Fasten wire with clamps (20) and (21).
2) Connect back-up alarm switch wire (19) to switch and secure it to control valve outlet tube with clamp (18).
   ★ Confirm interfers with any wiring parts.



23. Hydraulic pump outlet tube

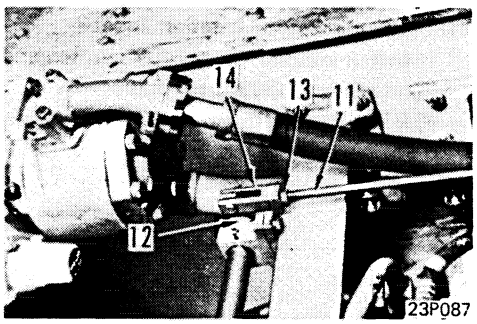
Connect hydraulic pump outlet tube (17), with O-ring in flange, to pump.

★ Be careful not to damage threads cut in aluminum pump body.



24. Steering clutch and brake rods

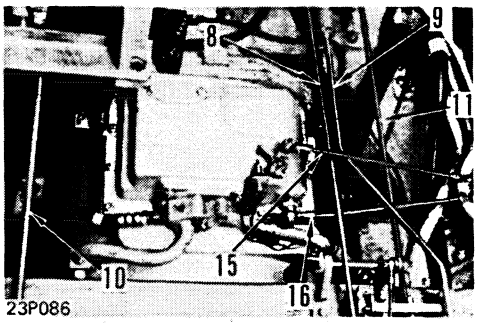
1) Locate yoke (14) to the assembly at the position marked before removing and lock it with lock nut (13) to that position. Connect right-hand brake rod (11) to lever (12).
2) Pin left-hand brake rod (10), left-hand clutch rod (8) and right-hand clutch rod (9) to the respective levers.



25. Transmission control rod

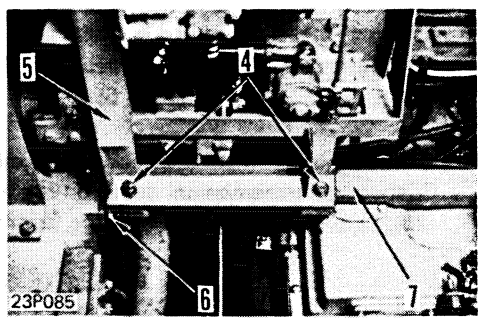
Connect transmission control rods (15) and (16) to valve side links with lock nuts and cotter pins.

★ The curved rod is for selector.
★ Securely bend cotter pins.



26. Support

1) Install support (7) with bolts (6).
2) Lift servo frame assembly (5) into position on support by loosening lever type chain block and tighten mounting bolts (4).

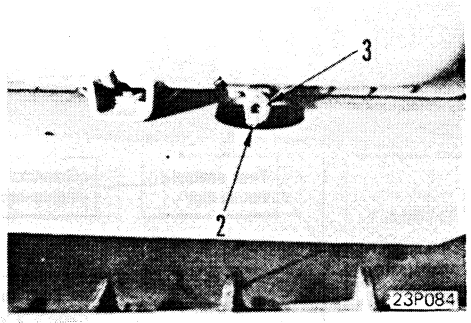


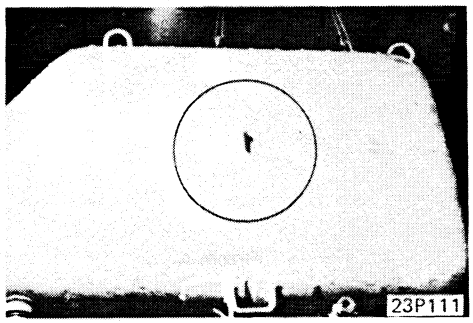
27. Floor frame assembly

Refer to MOUNTING FLOOR FRAME.

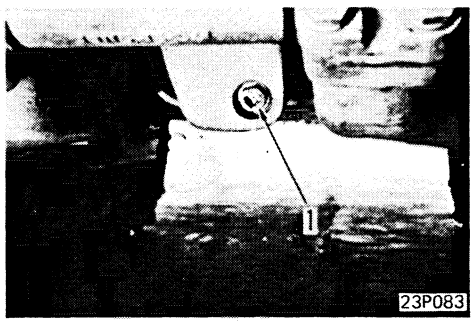
28. Feeding oil.

1) Install hydraulic oil drain plug (2) and close drain valve (3). Pour oil into oil filler until the specified oil level on oil level gauge is reached.
   ★ Use SAE 10, class CD engine oil.

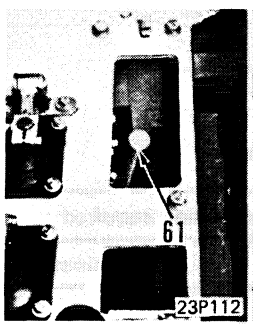


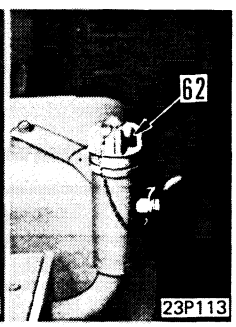


2) Refill steering and transmission cases with oil.
   (i) Install drain plug (1) with O-ring.
   kgm Drain plug: **13 – 18 kgm**

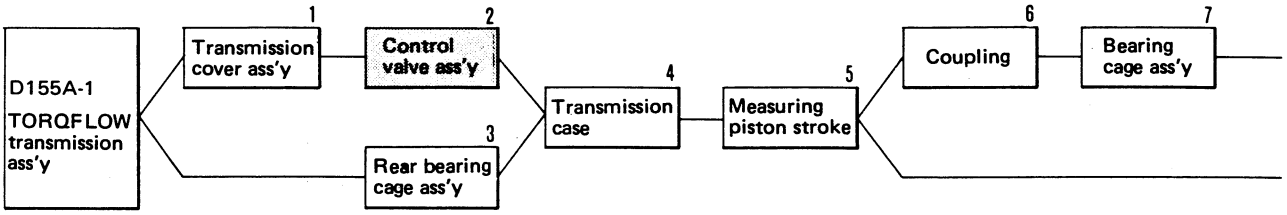


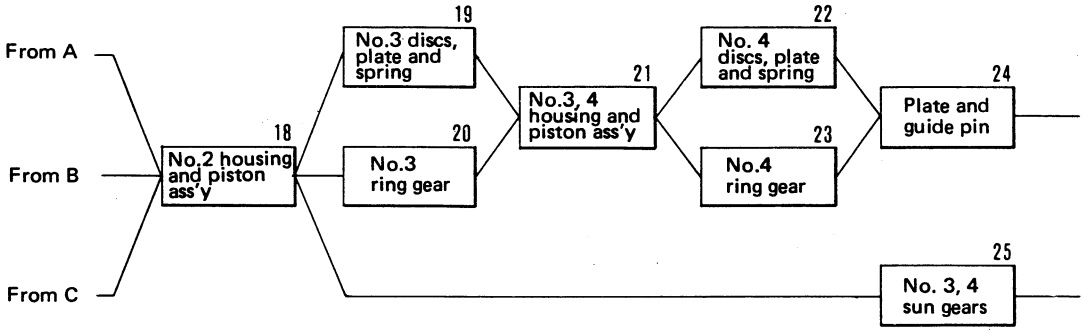
   (ii) Pour oil into oil filler (62) until the specified oil level on oil level gauge (61) is reached.
   ★ Use SAE 30, class CD engine oil.





DISASSEMBLY OF TORQFLOW TRANSMISSION (1/2) D155A



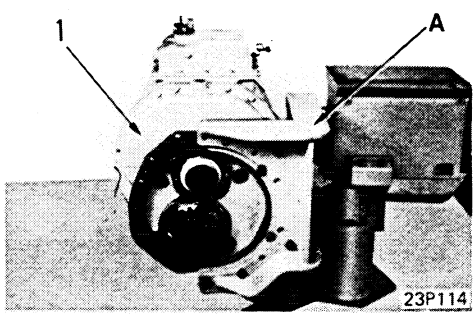


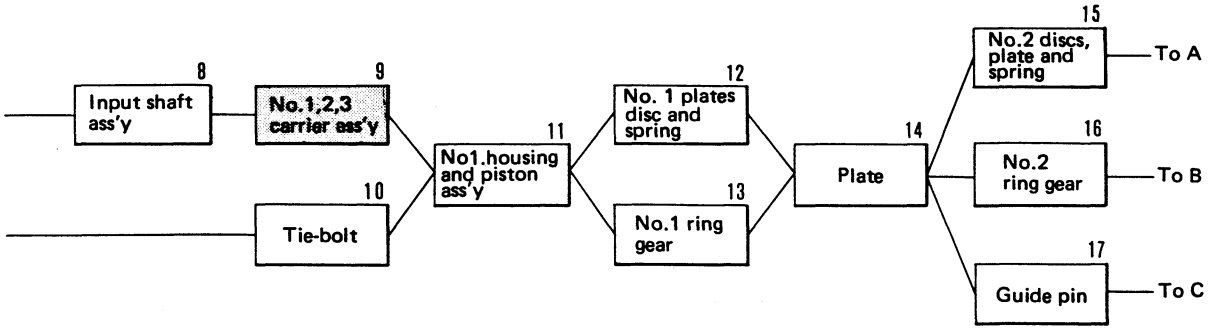
Special tools required

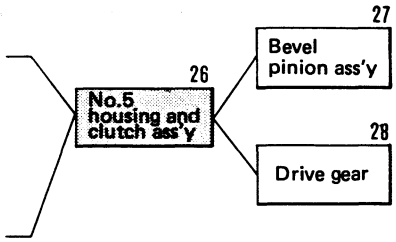
Special tools required		A	B	C
790-501-5000	Unit repair stand	1		
790-901-3210	Bracket	1		
790-901-3220	Plate	1		
799-301-1300	Air checker		1	
790-201-2000	Pushing tools kit			1

★ Set transmission assembly (1) on unit repair stand A.

kg Transmission assembly: **950 kg.**

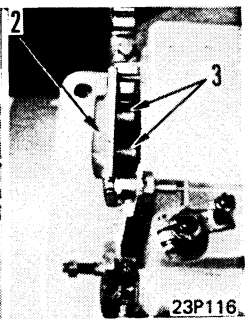






23F021

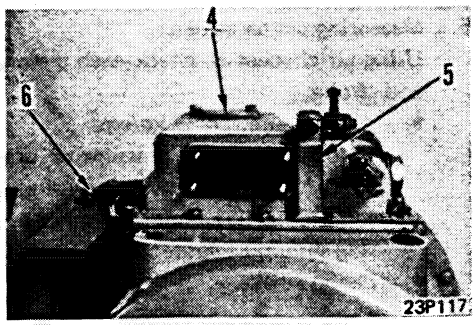




1. Transmission cover assembly

1) Remove cover (2) and sleeve (3).

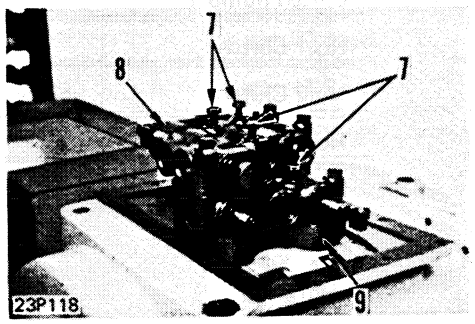
2) Remove cover (4), bracket (5) and clamp (6).



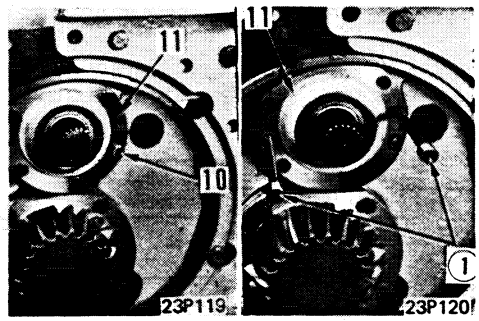
2. Control valve assembly

Remove bolt (7) fastening control valve assembly (8); remove valve assembly together with seat (9).

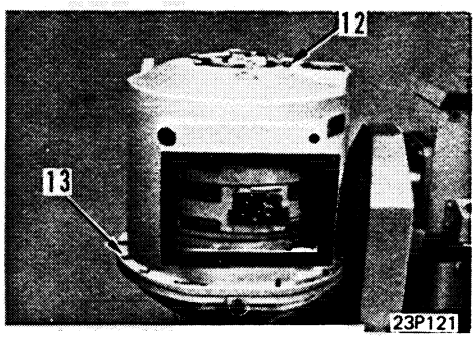
kg Control valve and seat assembly: **25 kg.**

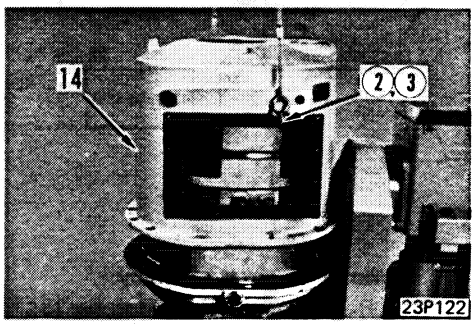


3. **Rear bearing cage assembly**
Remove cage mounting bolts (10). Using jack bolts ① (12 mm, P = 1.75), pull out bearing cage assembly (11).

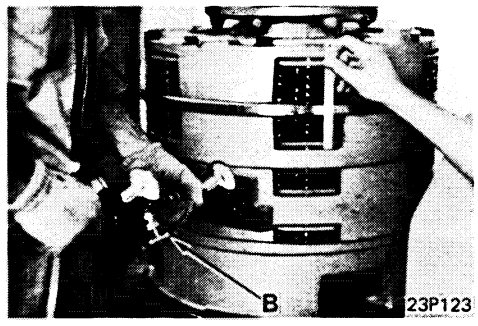


4. **Transmission case**
1) Turn unit repair stand to face the input shaft side of transmission case upward.
2) Remove bolts (12) securing bearing cage to transmission case.
3) Remove bolts (13) fastening transmission case to transfer case. Screw in hanging bolts ② (10 mm, P = 1.5) on the transmission valve cover side and hanging bolts ③ (10 mm, P = 2.0) on the transmission case bottom side. Lift off transmission case (14) upward.



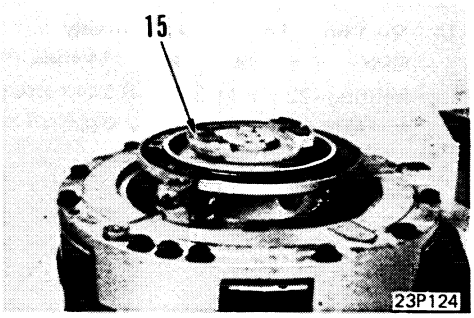


5. **Measuring piston stroke**
Using air checker B, check each piston for normal function and stroke.
★ Air pressure: **4~7 kg/cm²**
If lowering of air pressure or occuring of air bubbles from clearance between housing and piston is found, some defective condition such as biting of piston seal ring should be suspected.
★ Piston stroke

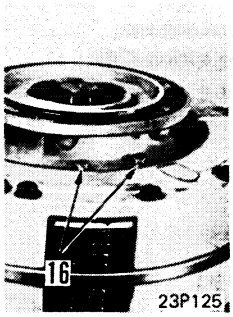


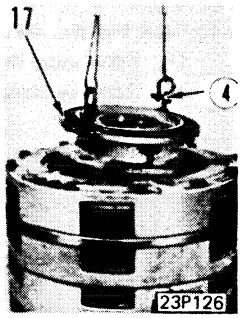
Clutch number	Stroke
No.1 Clutch	6 mm
No.2 Clutch	4 mm
No.3 Clutch	4 mm
No.4 Clutch	4 mm

6. **Coupling**
Bend down locks, remove bolts and pull out coupling (15).

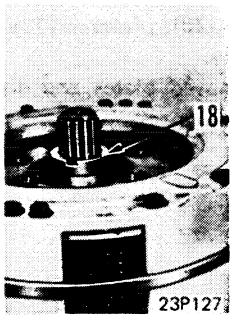


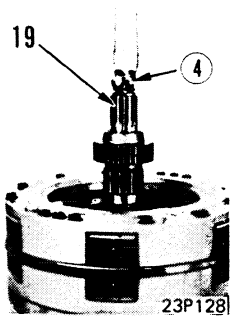
7. **Bearing cage assembly**
Remove mounting bolts (16), screw in hanging bolts ④ (12 P = 1.75), and lift off cage assembly (17).



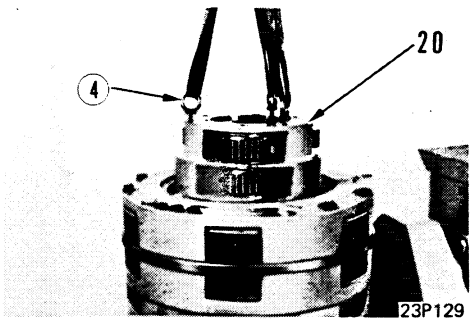


8. **Input shaft assembly**
Remove spacer (18), screw hanging bolts ④ (12 mm, P - 1.75) to input shaft assembly (19), and lift off assembly upward.
kg Input shaft assembly: **25 kg.**

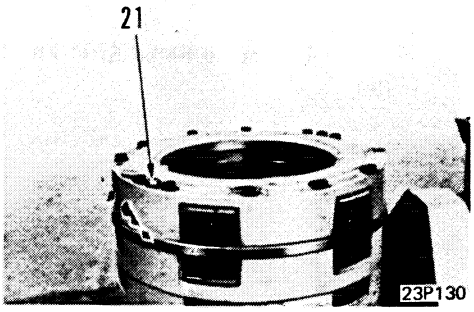




9. **No.1, 2, 3 carrier assembly**
Screw in hanging bolts ④ (12 mm, P = 1.75) and lift off carrier assembly (20) upward.
★ If gears do not disengage easily from one another, try rotating carrier as a whole.



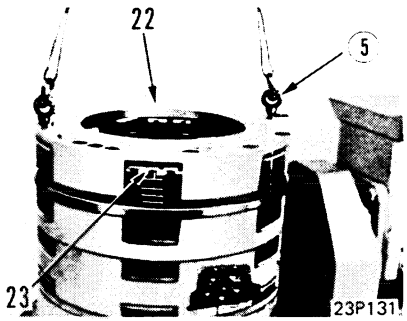
10. **Tie-bolt**
Remove tie-bolts (21).



11. No.1 housing and piston assembly

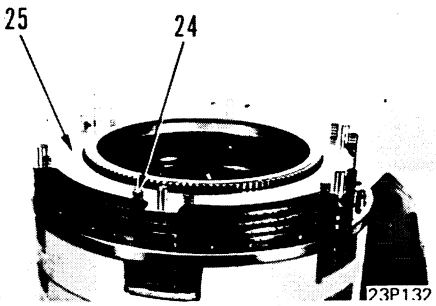
Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off No.1 housing (22) and piston (23) as an assembly.

★ When lifting assembly, hold No.1 piston by hand to prevent it from falling off.



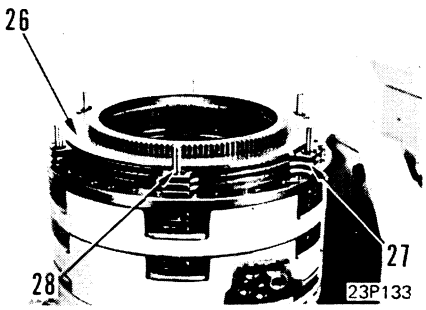
12. No.1 plates, disc and spring

1) Remove piston spring (24).
2) Remove spacer plate (25). (Serial No. 15001 – 29764)



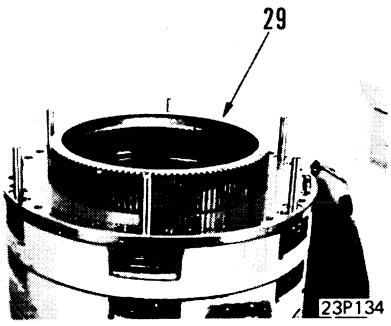
3) Remove discs (26), plates (27) and washer return springs (28) alternately.

★ Keep removed plates and discs horizontally or vertically to prevent them from distorting.



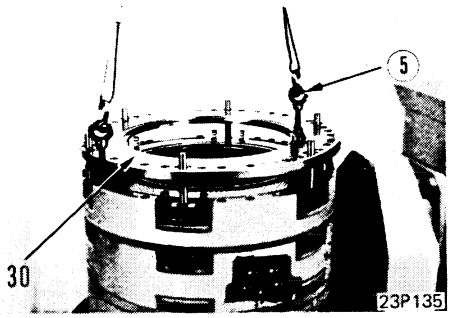
13. No.1 ring gear

Remove ring gear (29).

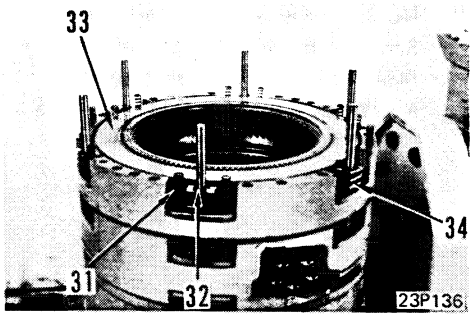


14. Plate

Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off plate (30).

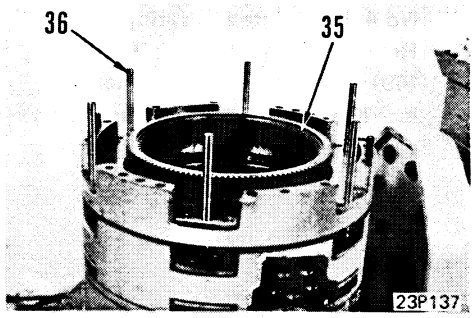


15. No.2 discs, plate and spring
Remove piston springs (31), washer return springs (32), discs (33) and plates (34) alternately.
★ Keep removed plates and discs horizontally or vertically to prevent them from distorting.

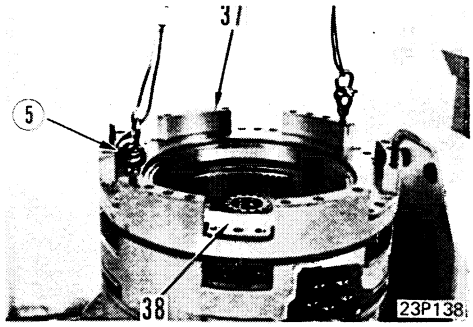


16. No.2 ring gear
Remove ring gear (35).

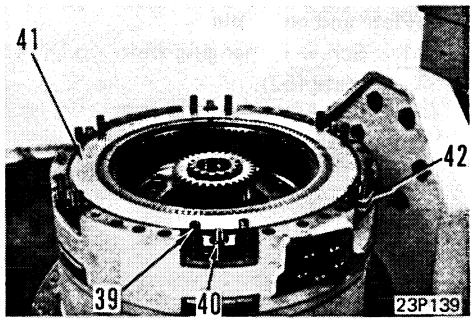
17. Guide pin
Remove guide pins (36).



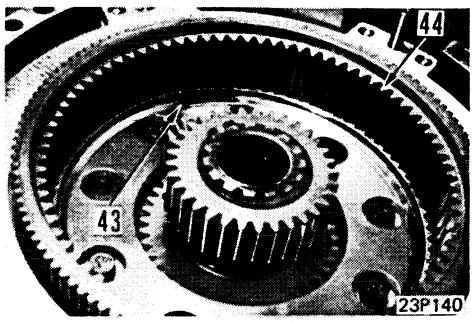
18. No.2 housing and piston assembly
Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off housing (37) and piston (38) as an assembly.



19. No.3 discs, plate and spring
Remove piston springs (39), washer return springs (40), discs (41) and plates (42) alternately.
★ Keep removed plates and discs horizontally or vertically to prevent distortion.



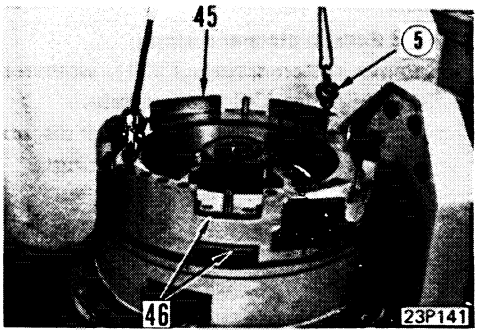
20. No.3 ring gear
Remove snap ring (43) and ring gear (44).



21. No.3, 4 housing and piston assembly

Screw in haging bolts ⑤ (14 mm, P = 2.0) and lift off housing (45) and piston (46) as an assembly.

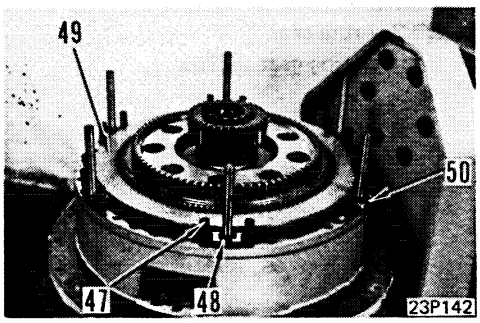
★ When lifting assembly, hold No.4 piston by hand to prevent it from falling off.



22. No.4 discs, plate and spring

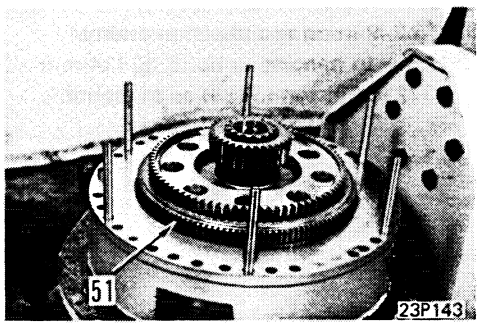
Remove piston springs (47), washer return springs (48), discs (49) and plates (50) alternately.

★ Keep removed discs and plates horizontally or vertically to prevent distortion.



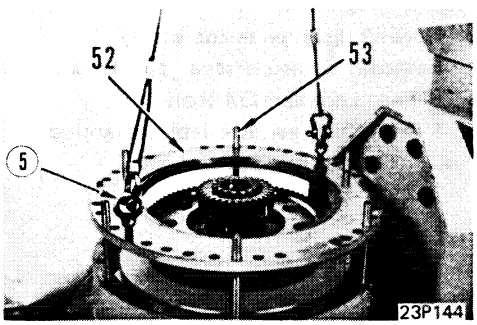
23. No.4 ring gear

Remove ring gear (51).



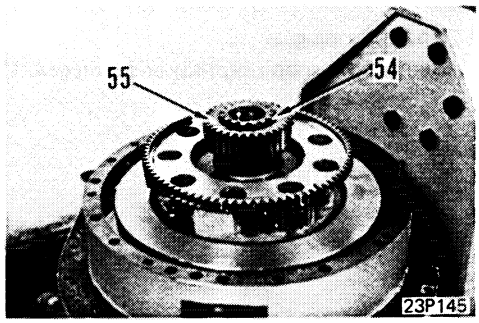
24. Plate and guide pin

1) Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off plate (52).
2) Pull out guide pins (53).



25. No.3, 4 sun gears

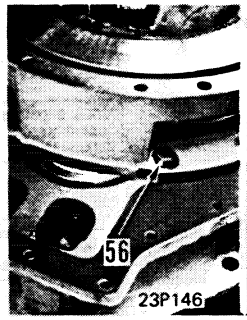
Remove snap ring (54) and No.3, 4 sun gears (55).

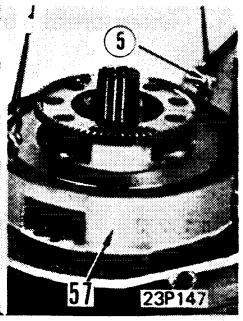


26. No.5 housing and clutch assembly

1) Remove housing mounting bolts (56).
2) Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off No.5 housing and clutch assembly (57) upward.

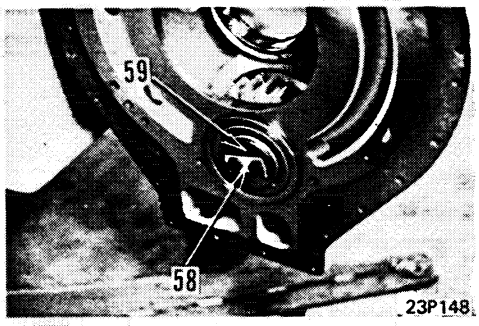
kg No.5 housing and clutch assembly: **190 kg.**





27. Bevel pinion assembly

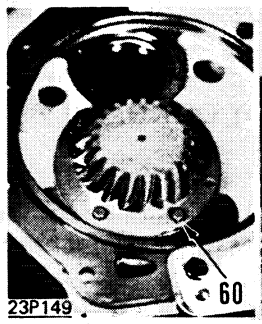
1) Bend down lock plate (58). Remove bolts fastening plate (59); remove plate.

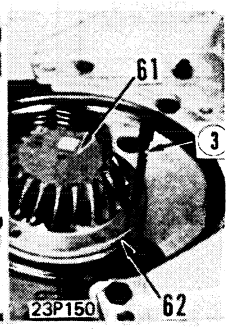


2) Turn repair stand to face the pinion side of transmission upward.
   Remove mounting bolts (60). Using jack bolts ① (12 mm, P = 1.75), remove pinion assembly (61) together with cage assembly (62).

kg Bevel pinion assembly: **40 kg.**

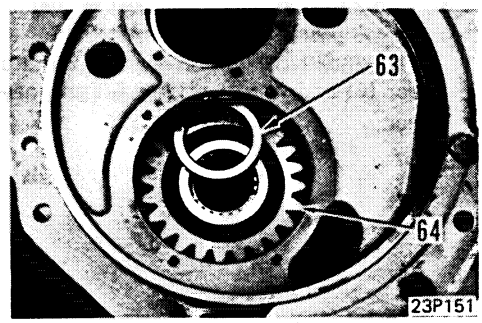
★ Tag pre-load adjustment shim and gear tooth contact adjustment shim to prevent them from confusion.





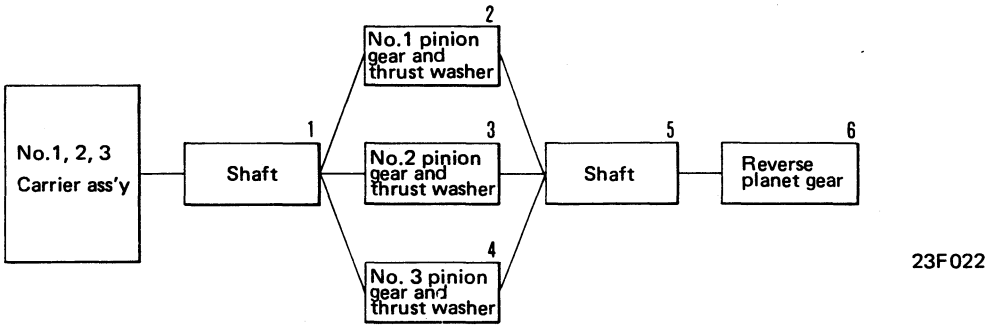
28. Drive gear

Remove spacer (63) and drive gear(64).



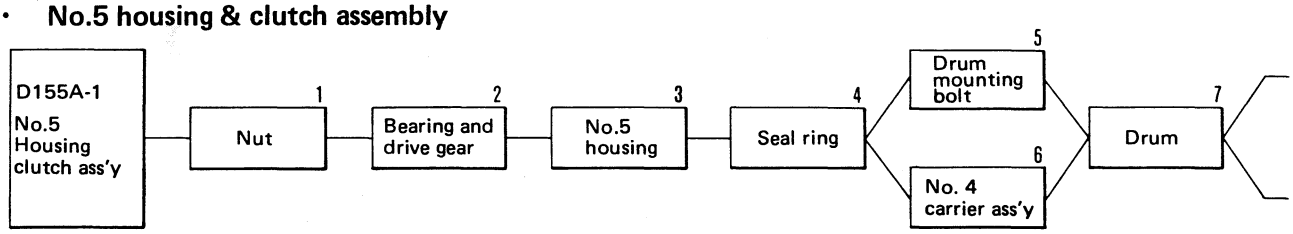
DISASSEMBLY OF TORQFLOW TRANSMISSION (2/2) D155A

- **Disassembly of No.1, 2, 3 carrier assembly**



23F022

- **No.5 housing & clutch assembly**



- **DISASSEMBLY OF NO. 1, 2, 3 CARRIER ASSEMBLY**

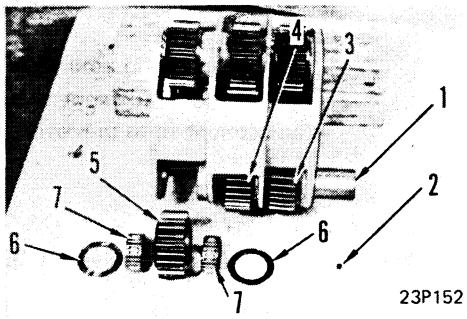
1. Shaft

Remove shaft (1) by driving it out with plastic hammer.

★ Be careful not to lose stopper ball (2).

2. No.1 pinion gear and thrust washer
3. No.2 pinion gear and thrust washer
4. No.3 pinion gear and thrust washer

Remove No.1 pinion gear (3), No.2 pinion gear (4), No.3 pinion gear (5) and, thrust washer (6) and needle bearing (7) for each gear.



23P152

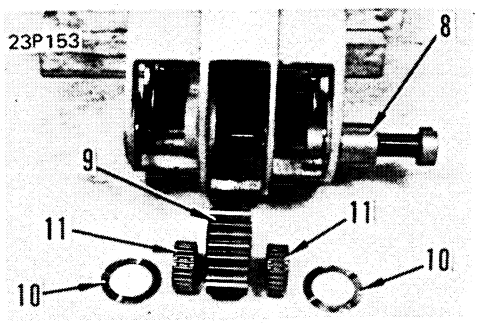
5. Shaft

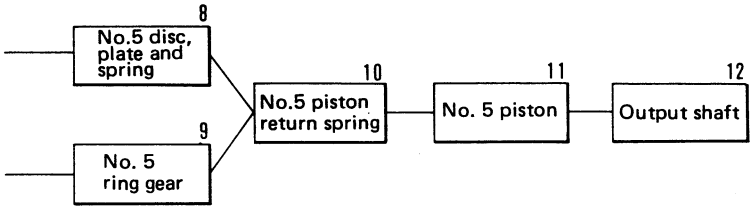
Drive shaft (8) out with plastic hammer.

★ Be careful not to lose stopper ball.

6. Reverse planet gear

Remove gear (9), thrust washers (10) and needle bearings (11).

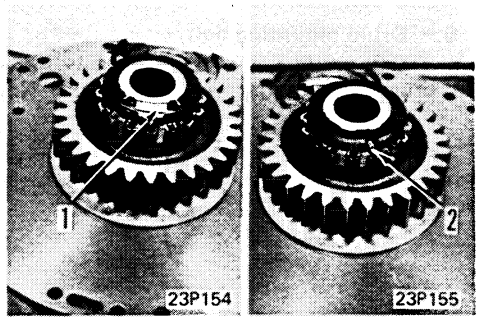




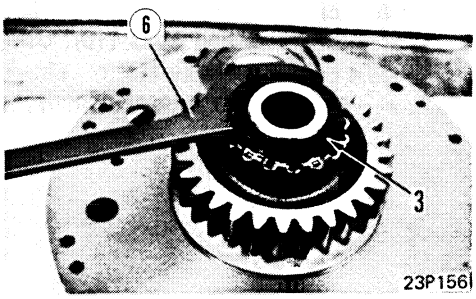
• NO. 5 HOUSING AND CLUTCH ASSEMBLY

1. Nut

1) Bend down lock plate (1), remove bolts, and pull pin (2) out.

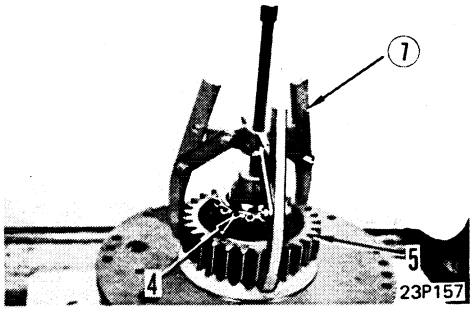


2) Using nut wrench ⑥ , remove nut (3).

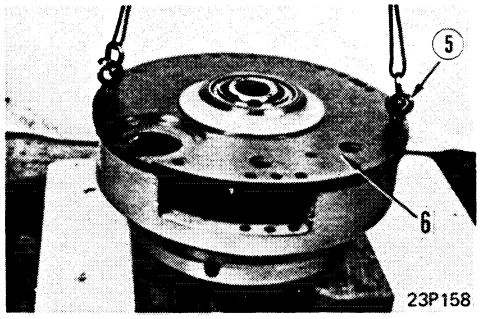


2. Bearing and drive gear

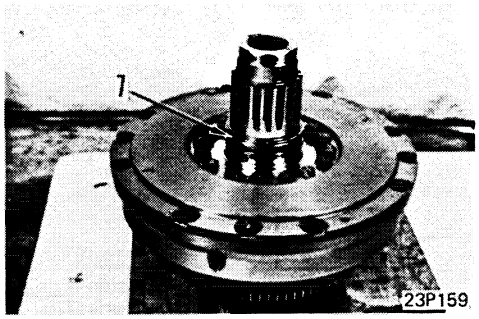
Using gear puller ⑦ , remove bearing inner race (4) and gear (5) as an assembly.



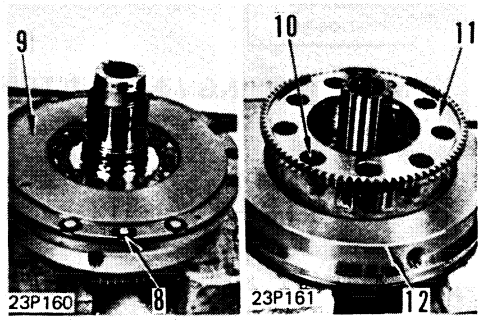
3. **No.5 housing**
Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift off No.5 housing (6).



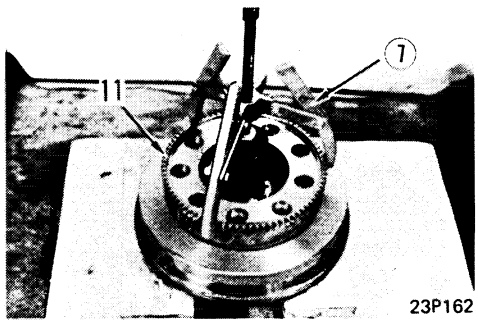
4. **Seal ring**
Remove seal rings (7).



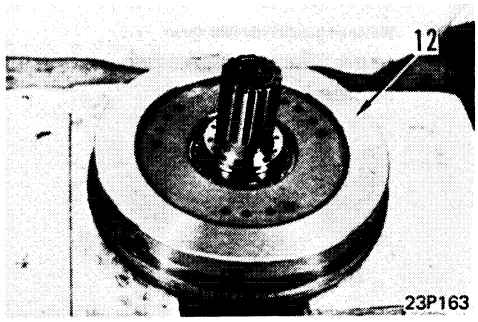
5. **Drum mounting bolt**
Remove drum mounting bolts (8), except two bolts to leave drum temporarily mounted. Turn No.5 clutch assembly (9) upside down.



6. **No.4 carrier assembly**
Remove mounting bolts (10). Using gear puller ⑦ , remove No.4 carrier assembly (11).
★ Carrier assembly is located in place with six dowel pins.



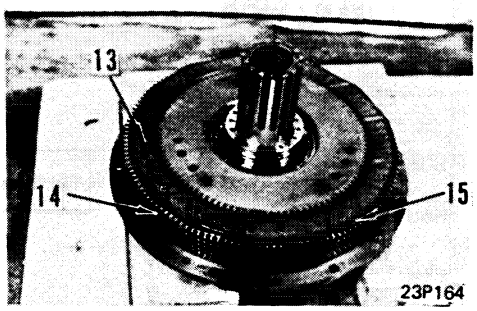
7. **Drum**
Remove two bolts temporarily fastening drum; lift off drum (12).



8. No.5 disc, plate and spring

Remove discs (13), plates (14) and wave washer springs (15) alternately.

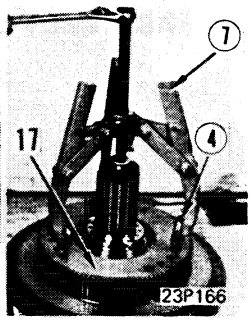
★ Keep removed discs and plates horizontally or vertically to prevent distortion.



9. No.5 ring gear

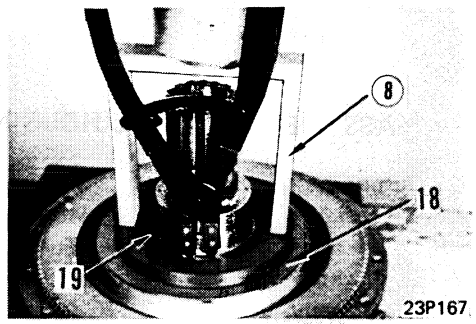
Pry snap ring (16). Screw in hanging bolts ④ (12 mm, P = 1.75) to ring gear (17), apply gear puller ⑦ to hook, and pull out ring gear together with ball bearing.





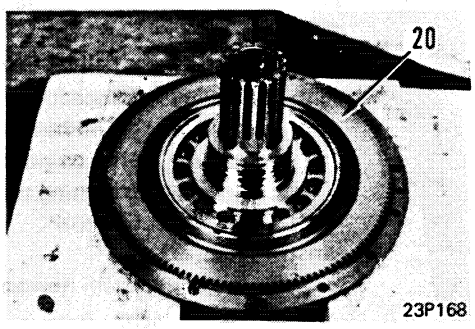
10. No.5 piston return spring

1) Compress return spring (18) using pusher ⑧ and press; remove snap ring (19).
2) Remove return spring.



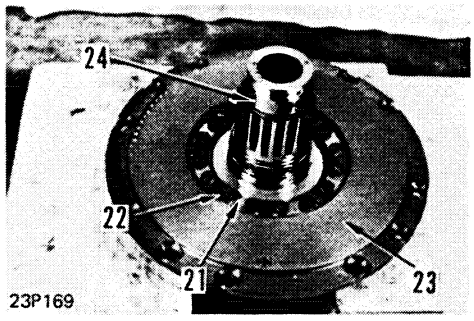
11. No.5 piston

Remove piston (20).



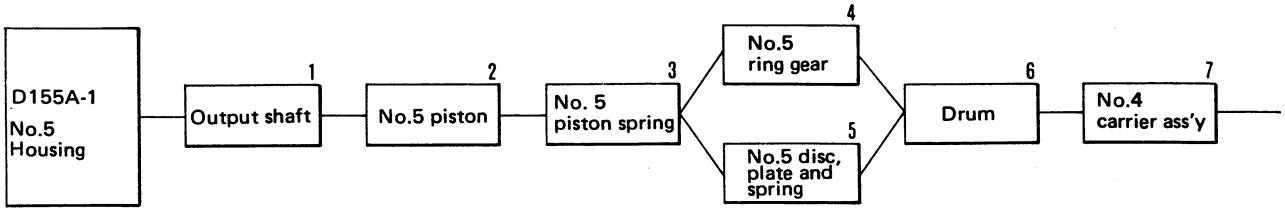
12. Output shaft

Bend down lock plates (21) and remove nuts (22). Take out output shaft (24) from clutch housing (23) and remove O-ring.

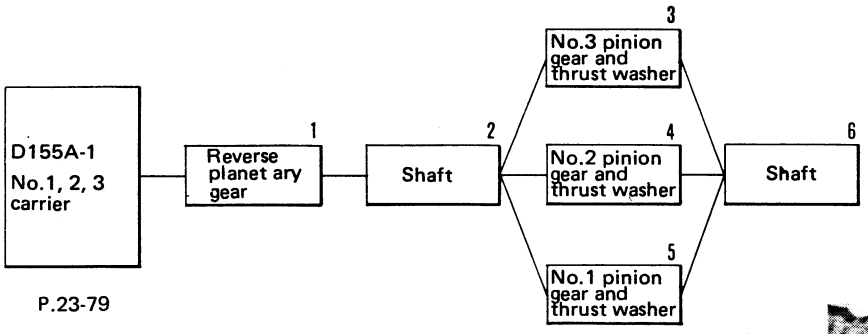


ASSEMBLY OF TORQFLOW TRANSMISSION (1/2) D155A

• ASSEMBLY OF NO. 5 HOUSING AND CLUTCH

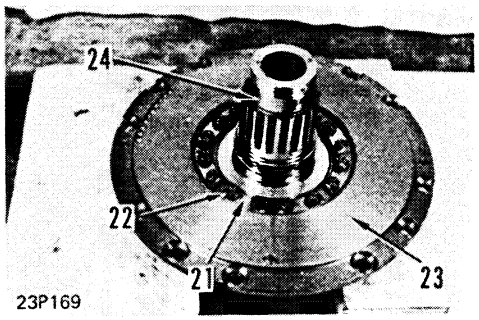


• ASSEMBLY OF NO. 1, 2, 3 CARRIER



P.23-79

23F025

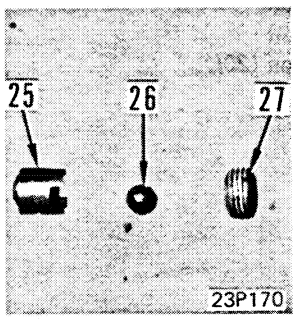


23P169

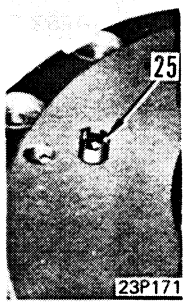
• ASSEMBLY OF NO. 5 HOUSING AND CLUTCH

1. Output shaft

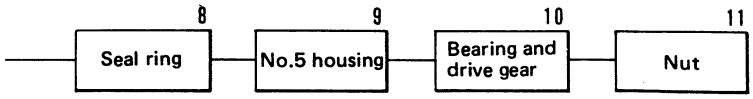
1) Install output shaft (24), with O-ring in mounting surface, on housing (23) with bolts. Turn housing upside down.
2) Tighten lock plates (21) and nuts (22). Bend lock plates securely.
   ★ Coat nut with thred tightener (LT-2).
   kgm Nut: **9.15 – 12.5 kgm**
3) When collar and check ball were disassembled, install them using the following procedure:
   - Install collar (25) on housing (23).
     ★ Be sure to match notch of collar to housing port, otherwise clutching time by becomes large.
   - Install check ball (26).
   - Install plug (27).
     ★ Coat plug with thread tightener (LT-2) and stake with punch.



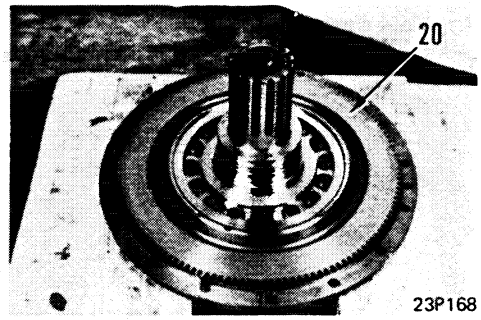
23P170



23P171



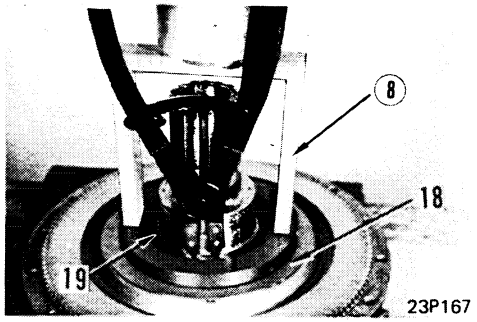
23F024



23P168

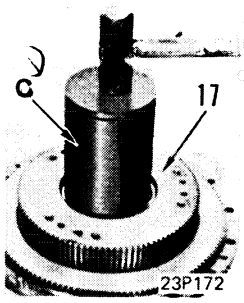
2. **No.5 piston**
   Install piston ring in piston (20) and install in housing.

3. **No.5 piston spring**
   Compress return spring (18) using pusher ⑧ and press. Fix it with snap ring (19).

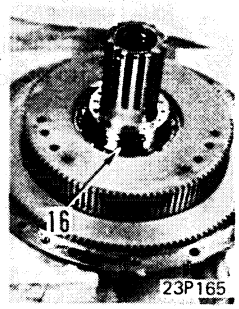


23P167

4. **No.5 ring gear**
   Keeping ball bearing inner race depressed with pushing tool C, fasten ring gear (17) with snap ring (16).

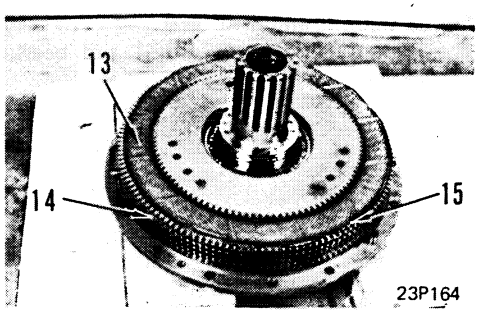


23P172



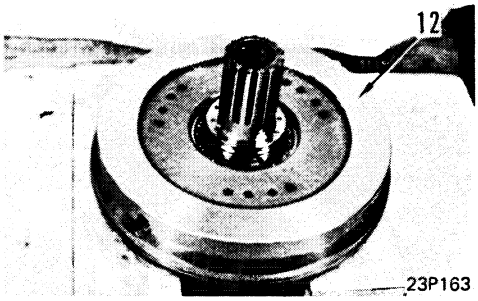
23P165

5. **No.5 disc, plate and spring**
   Alternately install discs (13), plates (14) and washer return springs (15), in that order, so that teeth of discs mesh with ring gear teeth.
   - ★ When installing, coat discs and plates with engine oil (SAE 30, class CD) and keep them free from dust.
   - ★ Assemble discs with nothes in internal teeth alined.



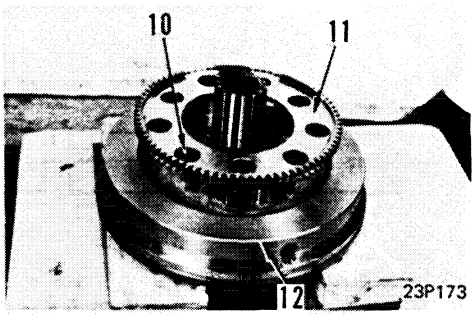
23P164

6. **Drum**
   Mesh external teeth of plate with internal teeth of drum (12).
   Turn drum upside down and tighten bolts (8).
   - ★ Coat drum mounting bolts with thread tightener (LT-2).
     kgm Mounting bolt: **10~12 kg.m**

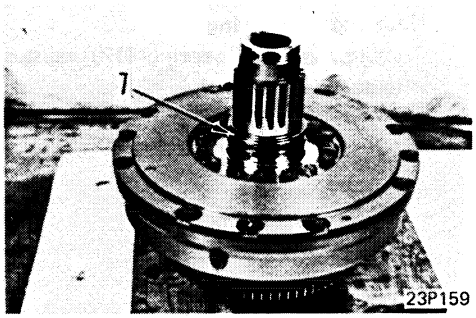


23P163

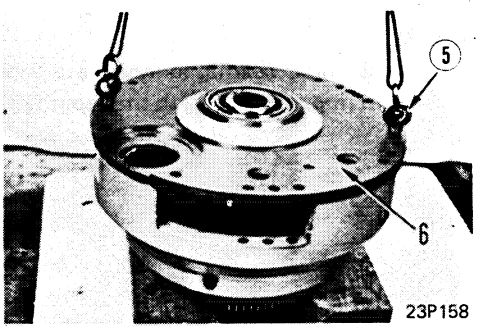
7. No.4 carrier assembly
Install carrier assembly (11) with bolts (10).



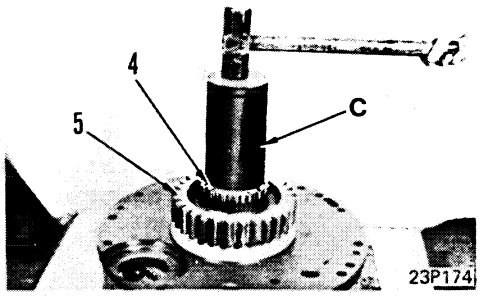
8. Seal ring
Install three seal rings (7).



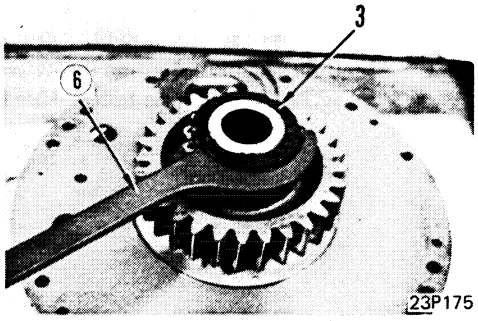
9. No.5 housing
Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift No.5 housing (6) into position, taking care not to damage seal ring.



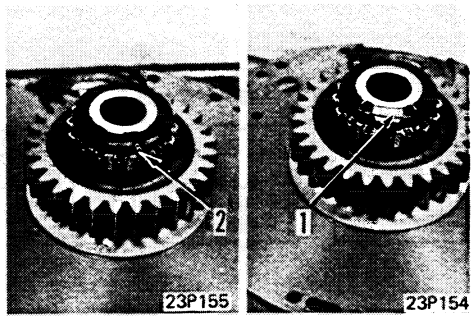
10. Bearing and drive gear
Press-fit drive gear (5) and bearing (4)with pushing tool C.



11. Nut
1) Tighten nuts (3) with nut wrench ⑥ .



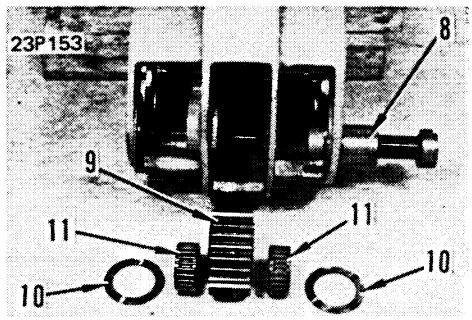
2) Install pin (2) with bolts and lock plate. Bend lock plate (1) securely.



• ASSEMBLY OF NO. 1, 2, 3 CARRIER

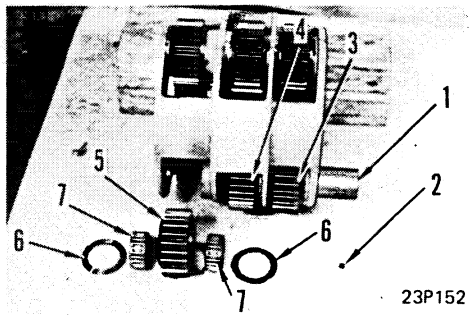
1. **Reverse planetary gear**
   Assemble needle bearing (11) in planetary gear (9) and install right and left thrust washers (10).

2. **Shaft**
   Drive in shaft (8) with plastic hammer and install stopper ball.
   ★ Coat bearing and shaft with engine oil (SAE 30, class CD) before installation.

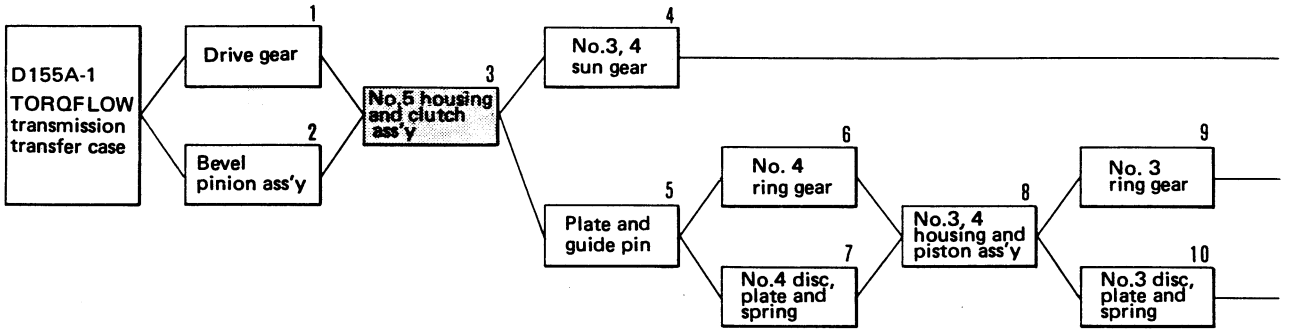


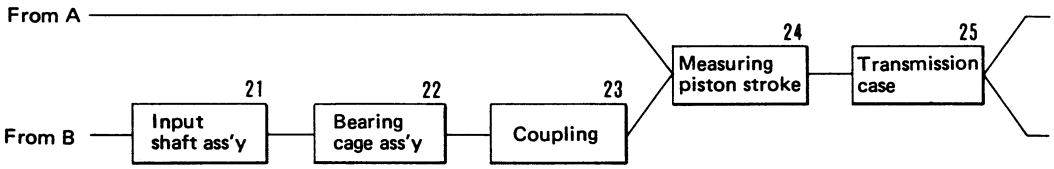
3. **No.3 pinion gear and thrust washer**
4. **No.2 pinion gear and thrust washer**
5. **No.1 pinion gear and thrust washer**
   Install needle bearing (7) in No.3 pinion gear (5), No.2 pinion gear (4) and No.1 pinion gear (3). Install right and left thrust washers (6).

6. **Shaft**
   Drive in shaft (1) with plastic hammer and install stopper ball (2).
   ★ Coat bearing and shaft with engine oil (SAE 30, class CD) before installation.



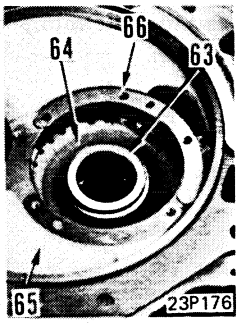
ASSEMBLY OF TORQFLOW TRANSMISSION (2/2) D155A

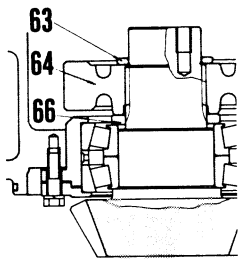




1. Drive gear

1) Set rear case (65) on unit repair stand A.
2) Install spacer (66), gear (64) and spacer (63) in rear case.
   ★ Install gear with its higher boss faced pinion.

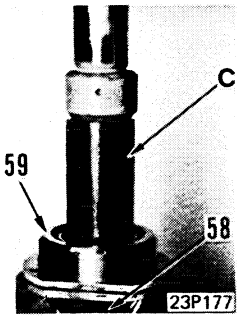


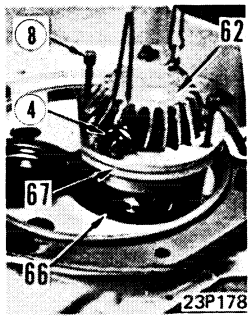


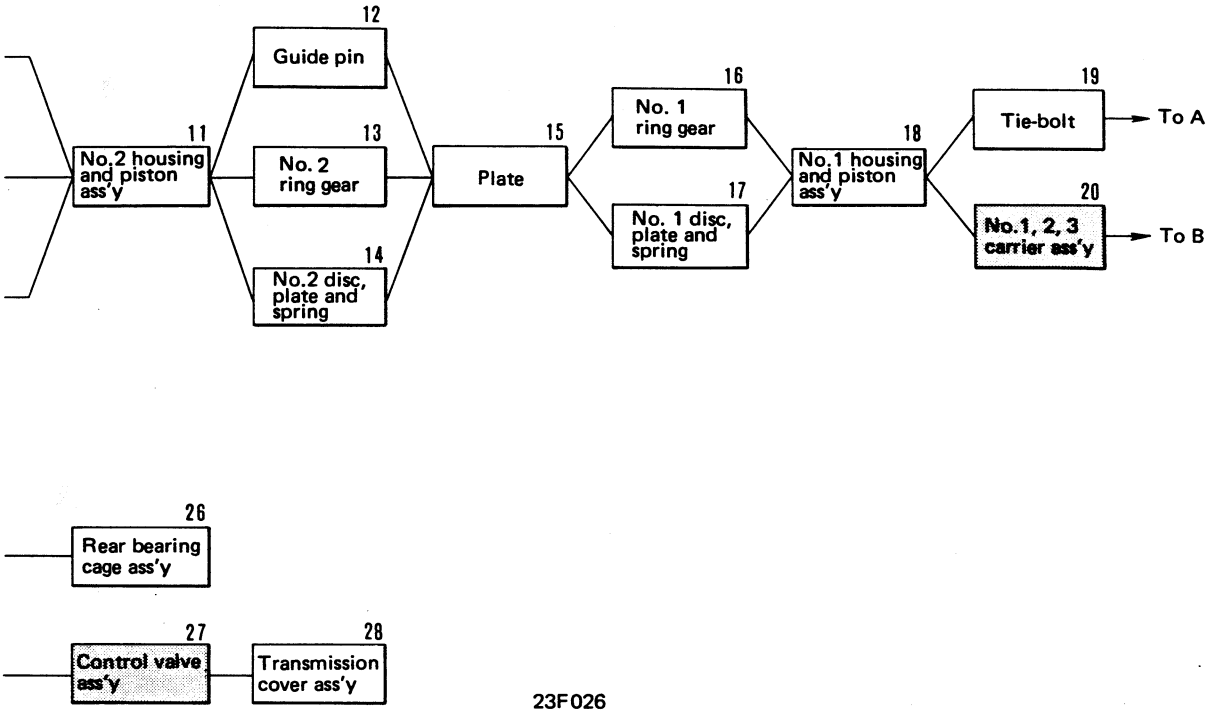
23F027

2. Bevel pinion assembly

1) When bearing cage was disassembled, install bearing cage (59) on bevel pinion (58), and press-fit bearing inner race with pushing tool C and press.
2) Screw in hanging bolts ④ (12 mm, P = 1.75) to bearing cage assembly (59).
   Install bevel pinion assembly (58) into position, using guide bolt ⑧.

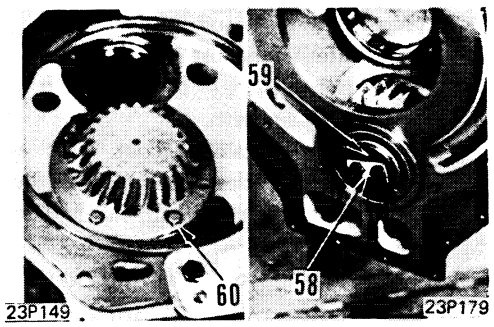






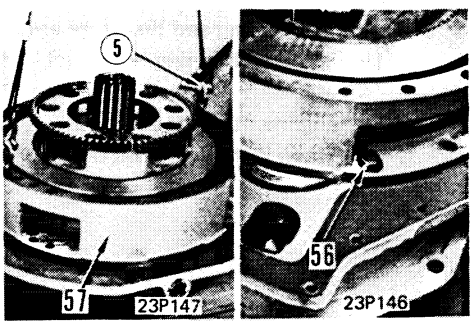
3) Install bevel pinion tooth contact adjustment shim and case with bolts (60).
4) Install plate (59) and lock plate (58) with bolts. Bend lock plates securely.

★ Confirm that bevel pinion is tightened so tight as it is rotated lightly by a hand and their no abnormal sound.

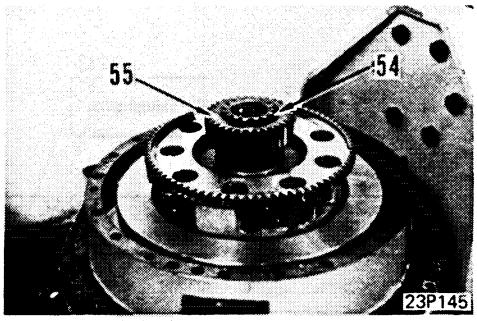


3. No.5 housing and clutch assembly

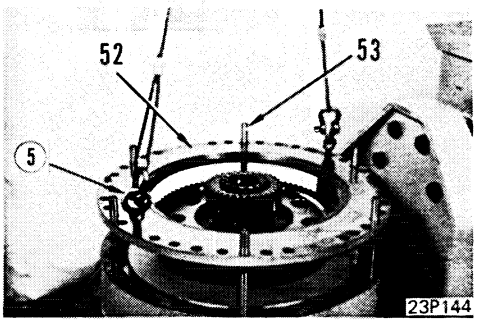
1) Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift No.5 housing and clutch assembly (57) upward onto rear case, bringing dowel pins into alignment with pin holes.
   ★ After installation, mesh drive gear to driven gear.
2) Tighten housing mounting bolts (56).



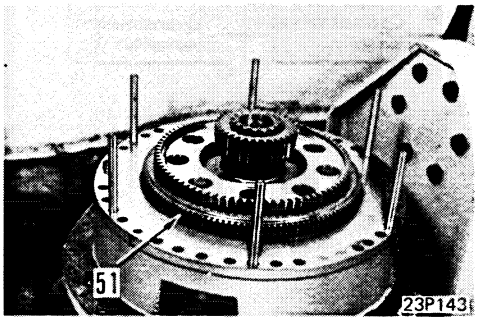
4. **No.3, 4 sun gear**
   Install No.3, 4 sun gear (55) and lock with snap ring (54).



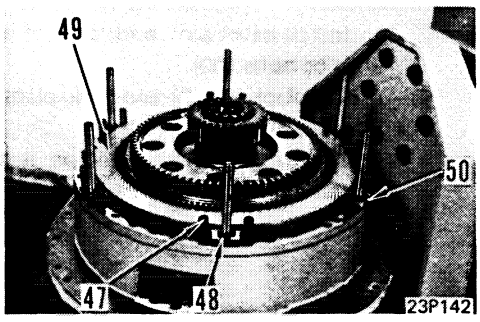
5. **Plate and guide pin**
   1) Install guide pins (53).
   2) Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift plate (52) into position, bringing dowel pins into alignment with pin holes.



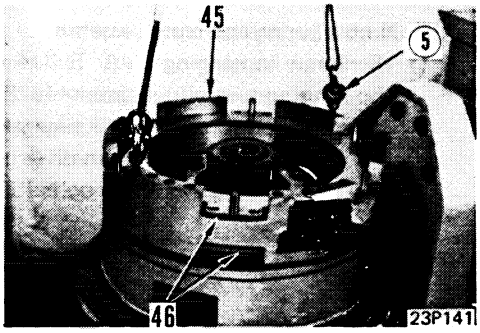
6. **No.4 ring gear**
   Install No.4 ring gear (51).



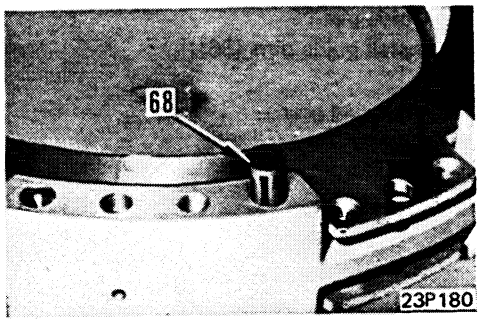
7. **No.4 disc, plate and spring**
   1) Alternately install discs (49), plates (50) and washer return springs (48), in that order, so that teeth of discs mesh with ring gear teeth.
   ★ When installing, coat discs and plates with engine oil (SAE 30, class CD) and keep them free from dust.
   ★ Assemble discs with notches in internal teeth arranged in line.
   2) Install piston springs (47) in grooves in plates.



8. **No.3, 4 housing and piston assembly**
   1) Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift housing (45) and piston (46) into position, bringing dowel pins into alignment with pin holes.
   ★ When installing, hold piston by hands to prevent falling off.

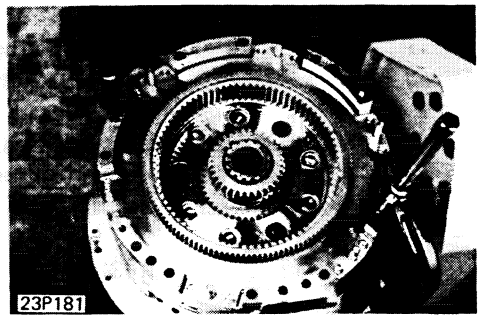


2) Insert sleeve (68) in each tie-bolt through hole.

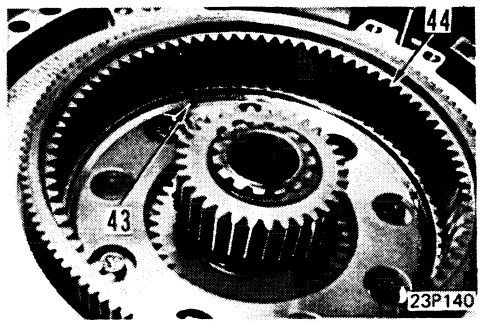


9. No.3 ring gear

1) Keep No.5 housing and clutch assembly into close contact with No.3, 4 housing and piston assembly so that snap ring can be securely fixed in place.
2) Install ring gear (44) and fasten it with snap ring (43).



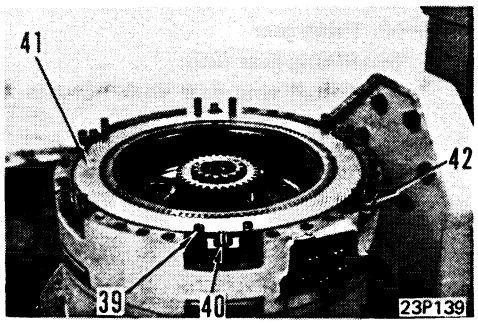
★ Install snap ring over No.4 carrier gear and No.3 ring gear. Confirm that No.3 ring gear is prevented from rising after installing snap ring.



10. No.3 disc, plate and spring.

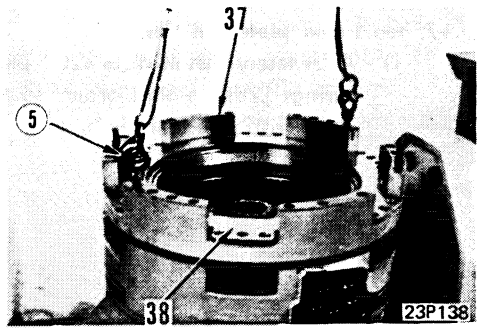
1) Alternately install discs (41), plates (42) and washer return spring (40), in that order, so that internal teeth of discs mesh with ring gear teeth.
★ When installing, coat discs and plates with engine oil (SAE 30, class CD) and keep them free from dust.
★ Assemble discs with notches in internal teeth alined.

2) Install piston springs (39) in grooves in piston.



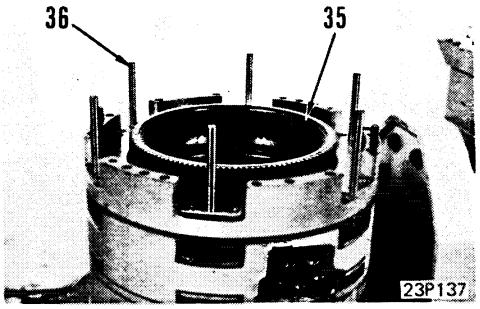
11. No.2 housing and piston assembly

Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift housing (37) and piston (38) into position, bringing dowel pins into alignment with pin holes.



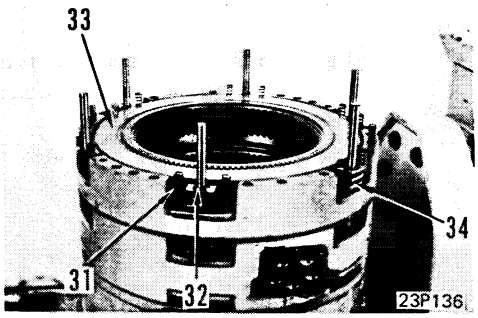
12. Guide pin
Install guide pins (36).

13. No.2 ring gear
Install ring gear (35).

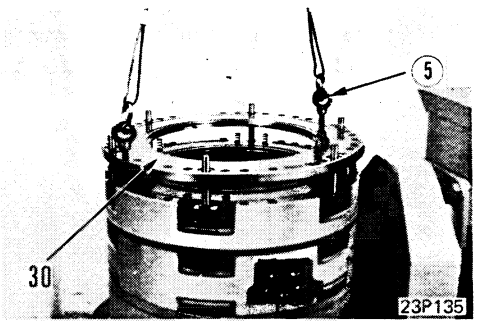


14. No.2 disc, plate and spring
1) Alternately install discs (33), plates (34) and washer return springs (32), in that order, so that internal teeth of discs mesh with ring gear teeth.
★ When installing, coat discs and plates with engine oil (ED30 -CD) and keep them free from dust.
★ Assemble discs with notches in internal teeth alined.

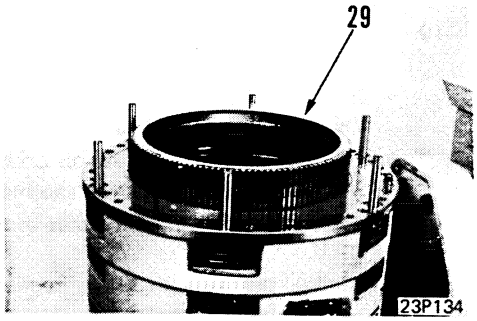
2) Install piston springs (31) in grooves in piston.



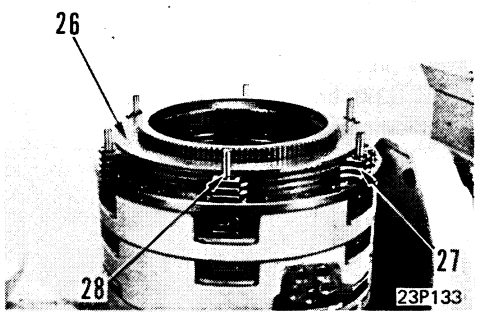
15. Plate
Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift plate (30) into position.



16. No.1 ring gear
Install ring gear (29).
★ Install ring gear with notches in internal teeth top (input side).



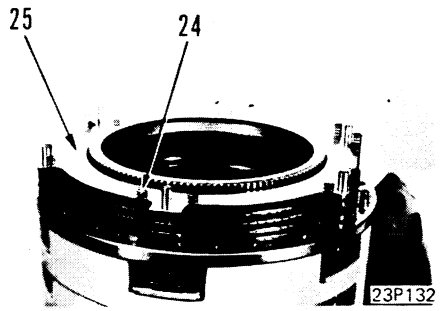
17. No.1 disc, plate and spring
1) Alternately install discs (26), plates (27) and washer return springs (28), in that order, so that internal teeth of discs mesh with ring gear teeth.



2) Install spacer plate (25). (Serial No. 15001 – 29764)
3) Install piston springs (24) in grooves in plate.

★ When installing, coat discs and plates with engine oil (SAE 30, class CD) and keep them free from dust.

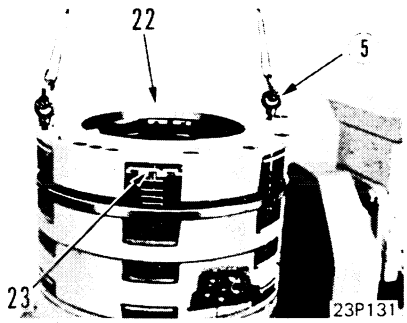
★ Assemble discs with notches in internal teeth arranged in line.



18. No.1 housing and piston assembly

Screw in hanging bolts ⑤ (14 mm, P = 2.0) and lift No.1 housing (22) and piston (23) into position, bringing dowel pins into alignment with pin holes.

★ Hold piston (23) by hands to prevent it from falling off.

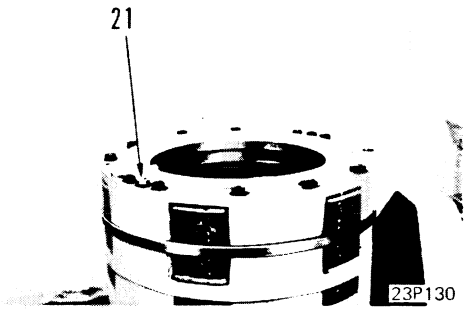


19. Tie-bolt

Tighten tie-bolts (21).

kgm Tie-bolt: **16~18 kg.m**

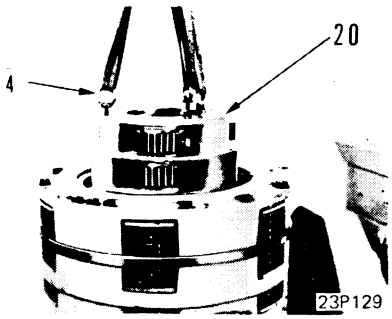
★ 14 tie-bolts include two shorter bolts. Be careful not to confuse the their installation positions.



20. No.1, 2, 3 carrier assembly

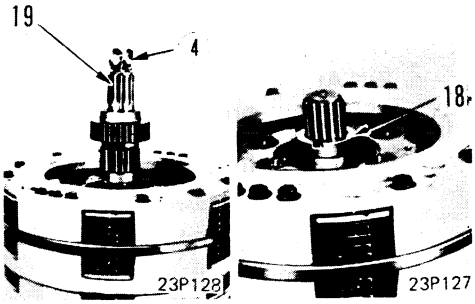
Screw in hanging bolts ④ (12 mm, P = 1.75) and lift carrier assembly (20) into position so that internal teeth of No.3 ring gear mesh with No.3 sun gear.

★ If gears do not mesh easily, try rotating the whole of carrier.



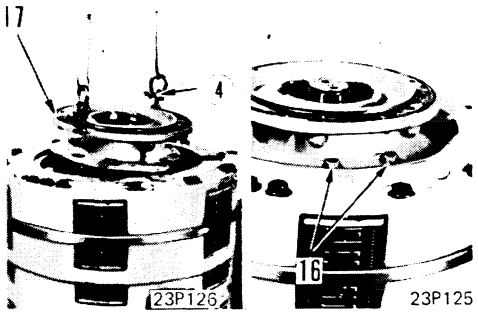
21. Input shaft assembly

1) Screw hanging bolts ④ (12 mm, P = 1.75) and lift input shaft assembly (19) into position so that its threads mesh with No.1 clutch sun gear.
2) With notch faced upward, install spacer (18).



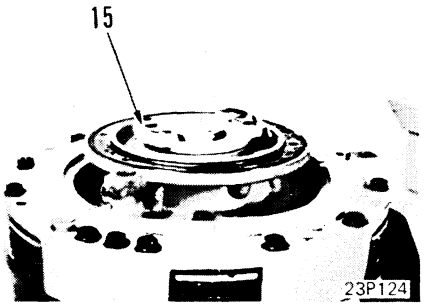
22. Bearing cage assembly

Screw in hanging bolts ④ (12 mm, P = 1.75) and lift cage assembly (17) into position. Tighten mounting bolts (16).



23. Coupling

Install coupling (15) with bolts and lock it with lock plates securely.



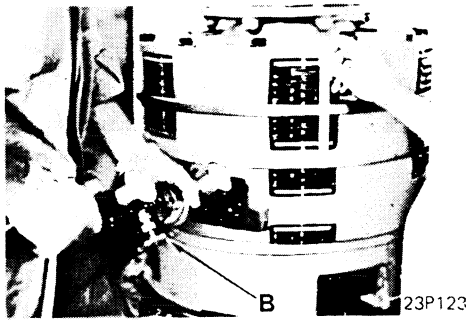
24. Measuring piston stroke

Using air checker B, check each piston for normal function and stroke.

★ Air pressure: **4~7 kg/cm²**

If lowering of air pressure or occuring of air bubbles from clearance between housing and piston is found, some defective condition such as biting of piston seal ring should be suspected.

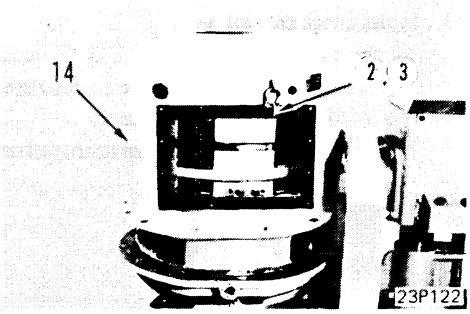
★ Stroke



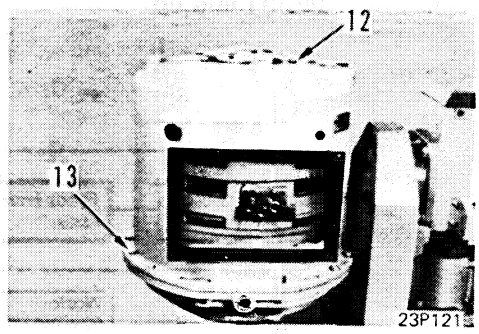
Clutch	Stroke
No.1	6 mm
No.2	4 mm
No.3	4 mm
No.4	4 mm

25. Transmission case

1) Turn unit repair stand to face input shaft upward.
2) Attach gasket to transfer case with gasket sealant (LG-1). Screw in hanging bolts ② (10 mm, P = 1.5) on the transmission valve cover side and hanging bolts ③ (14 mm, P-2.0) on the transmission case bottom side. Lift transmission case (14) upward into position.
3) Secure transmission case to transfer case with bolts (13).

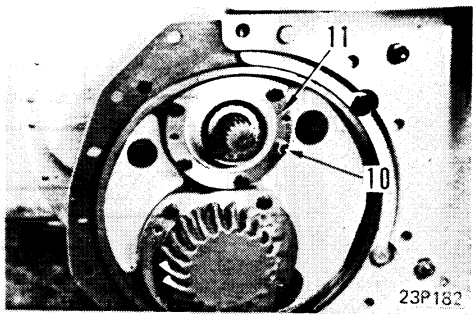


4) Secure transmission case to bearing cage with bolts (12).



26. Rear bearing cage assembly

Turn unit repair stand to face valve mounting face upward. Install bearing cage assembly (11) with bolts (10).

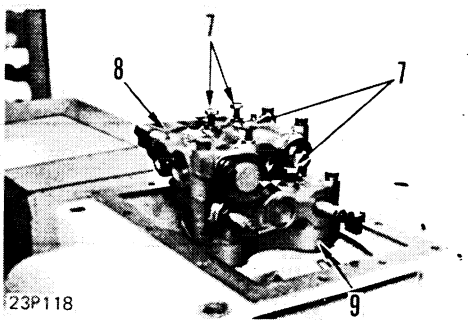


27. Control valve assembly

Install seat (9) and valve assembly (8) as an assembly, with O-ring in mounting surface, on transmission case. Tighten bolts (7).

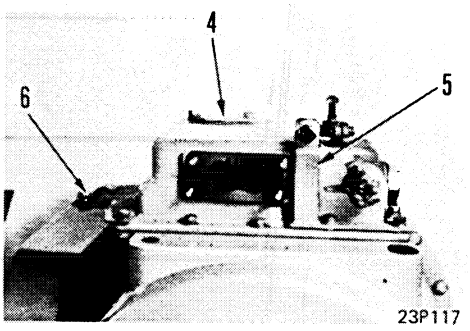
★ Tighten mounting bolts evenly.

kgm Control valve mounting bolt: **3.0 – 5.5 kgm**

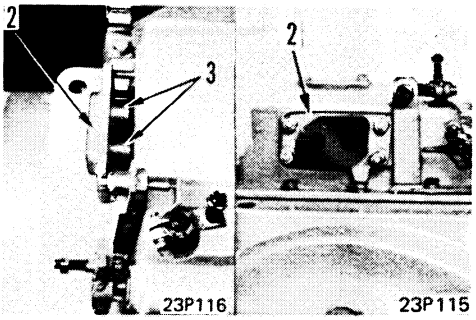


28. Transmission cover assembly

1) Attach gasket to cover (4) with gasket sealant (LG-1). Join spool yoke and lever to each other and install cover.
2) Install bracket (5) and clamp (6) with bolts.
   ★ When joining yoke, face notch in directional spool forward and notch in speed spool upward.

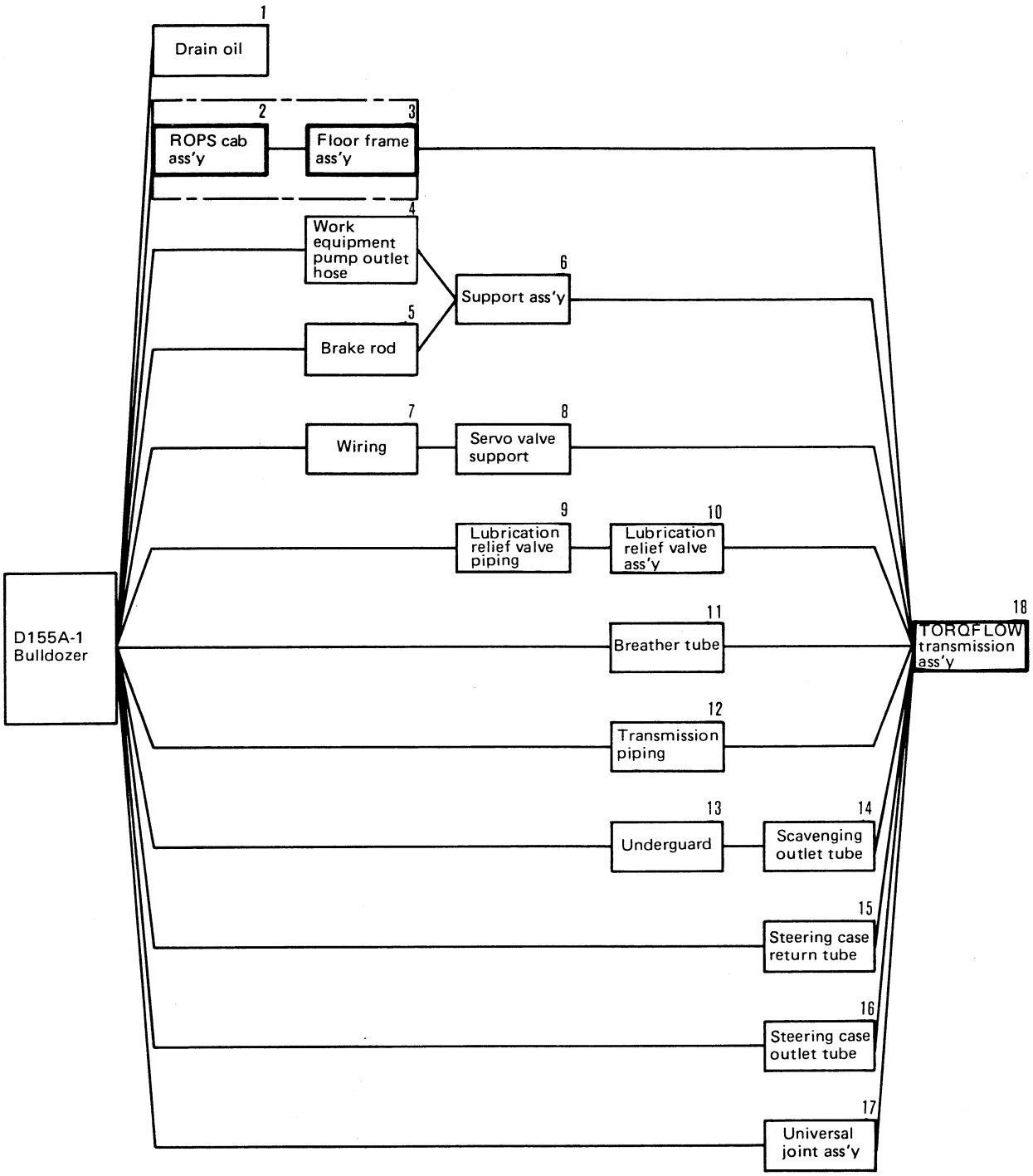


3) Connect sleeve (3), with O-ring on each side, to valve and install cover (2) with nuts.



DISMOUNTING TORQFLOW TRANSMISSION

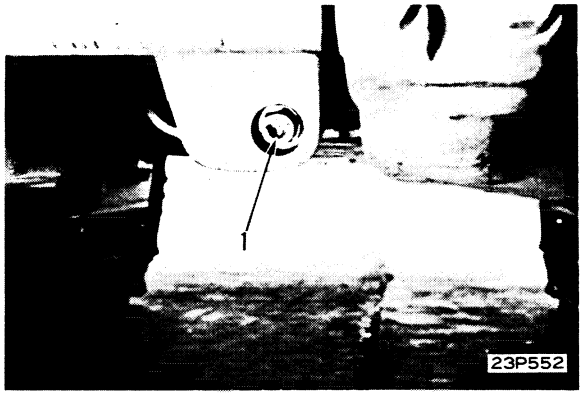
D155A 25001 and up



1. Drain oil

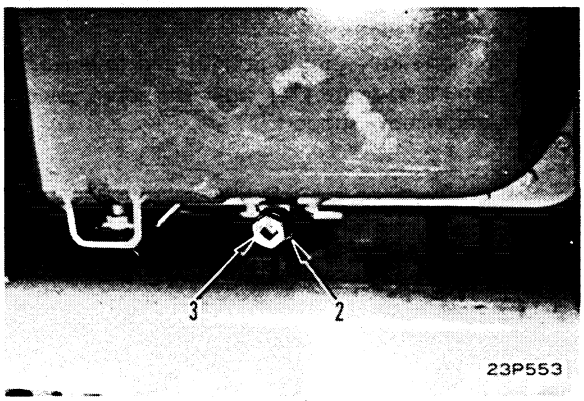
1) Remove drain plug (1) and drain the steering and transmission oil.

Oil capacity: **185 ℓ**



2) Remove drain plug (2) and open drain valve (3) to drain the hydraulic oil.

The oil capacity: **approx. 100 ℓ**



2. ROPS cab assembly

3. Floor frame assembly

To tilt the ROPS cab assembly, see TILTING ROPS CAB ASSEMBLY.

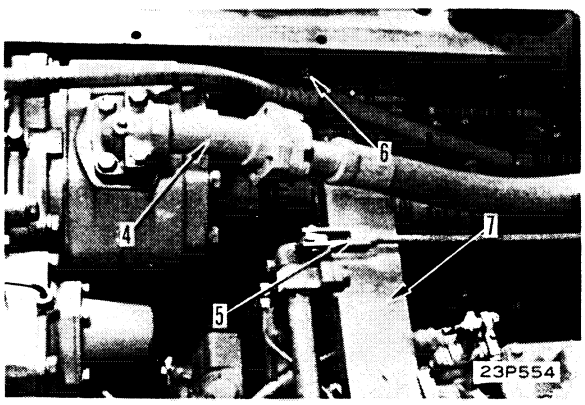
To remove the ROPS cab and floor frame assembly, see DISMOUNTING ROPS CAB AND FLOOR FRAME ASSEMBLY.

4. Work equipment pump outlet hose

Disconnect work equipment pump outlet hose (4).

★ Pull the disconnected hose rearward using a wire.

★ Stop up the pump discharge port with tape or a plug to prevent the entry of dust and dirt.



5. Brake rods

Remove R.H. and L.H. brake rods (5).

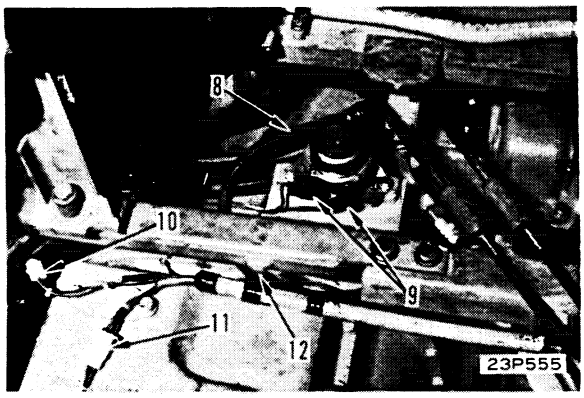
6. Support assembly

1) Remove clamp bolt (6).

2) Remove eight mounting bolts on the R.H. and L.H. sides, and lift off support assembly (7) with a crane.

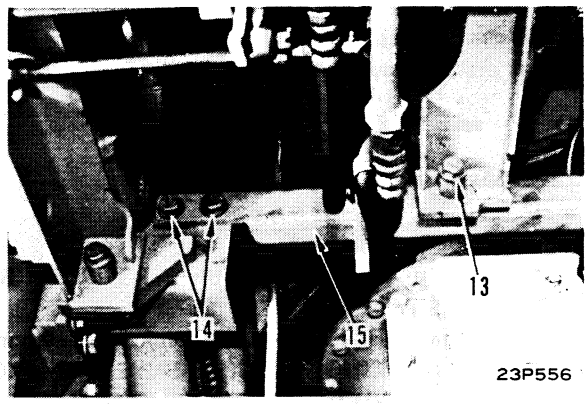
7. Wiring

1) Disconnect battery relay wiring (8) and (9).
2) Disconnect horn wiring (10) and back-up alarm switch wiring (11) from the connectors, and remove clamp bolt (12).



8. Servo valve support

Remove one mounting bolt (13) and four R.H. and L.H. mounting bolts (14) from the servo valve support, and remove support (15).



9. Lubrication relief valve piping

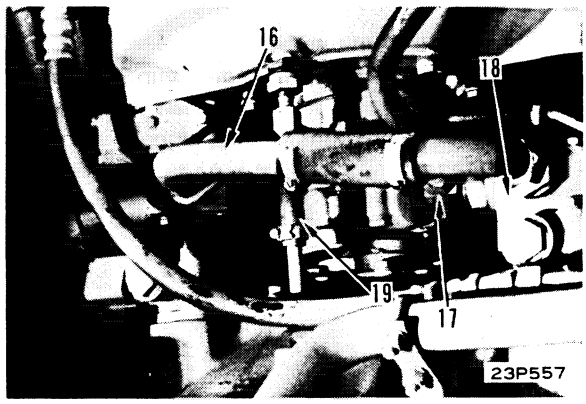
1) Disconnect lubrication relief valve inlet tube (16).
2) Disconnect lubrication relief valve outlet tube (17).

10. Lubrication relief valve assembly

Remove lubrication relief valve assembly (18).

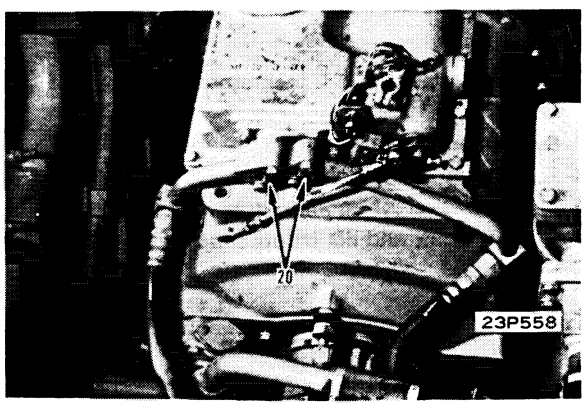
11. Breather tube

Remove breather tube (19).



12. Transmission piping

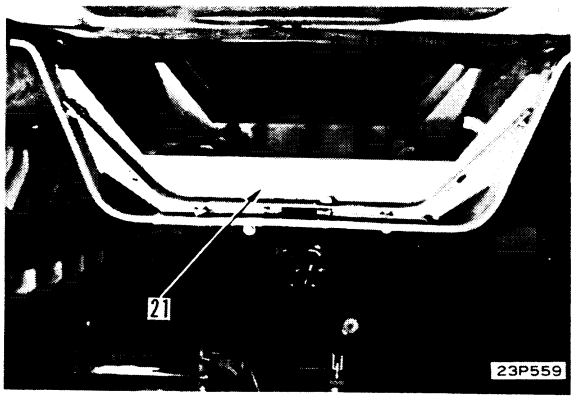
Disconnect transmission control valve tube (20).



13. Underguard

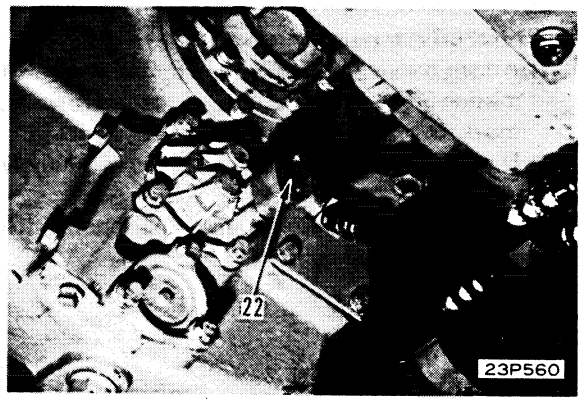
1) Place a transmission jack in position and remove the mounting bolts.
2) Temporarily lift underguard (21) with wires hooked to the bolts on the R.H. and L.H. sides, and remove the underguard by lowering the transmission jack, taking care to prevent interference with the diagonal brace.

kg Underguard: **270 kg**



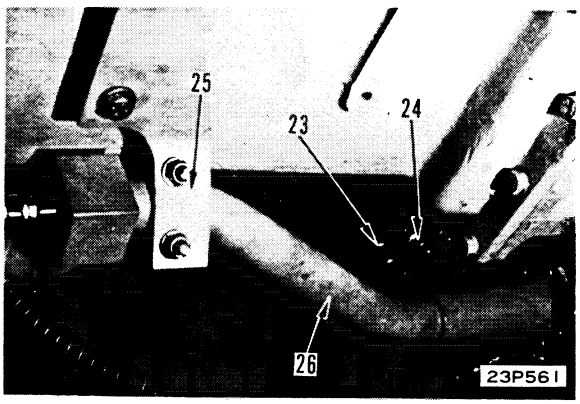
14. Scavenging pump outlet tube

Disconnect scavenging pump outlet tube (22) from the pump.



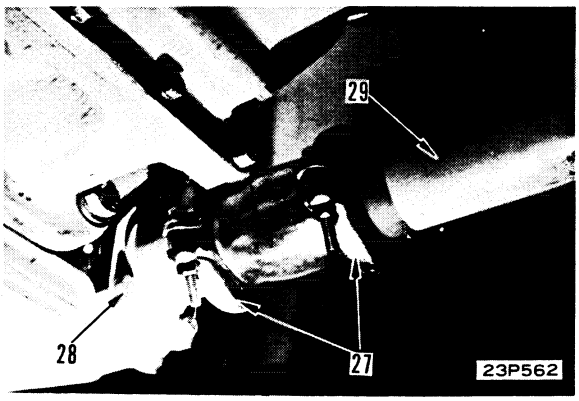
15. Steering case return tube

1) Disconnect steering brake hose (23) and servo valve return hose (24).
2) Remove clamp bracket (25) and steering case return tube (26).

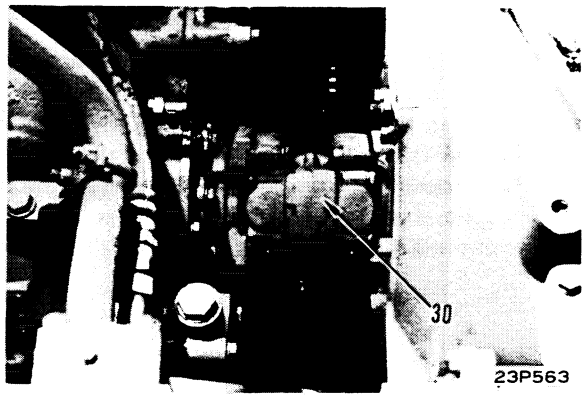


16. Steering case outlet tube

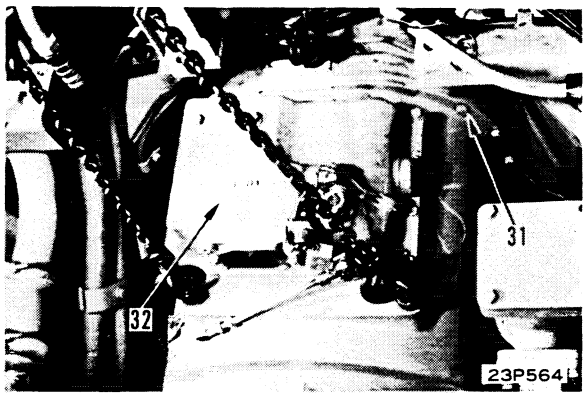
Loosen coupling clamp (27) and remove flange bolt (28) and tube (29).



17. Universal joint assembly
Remove universal joint assembly (30).

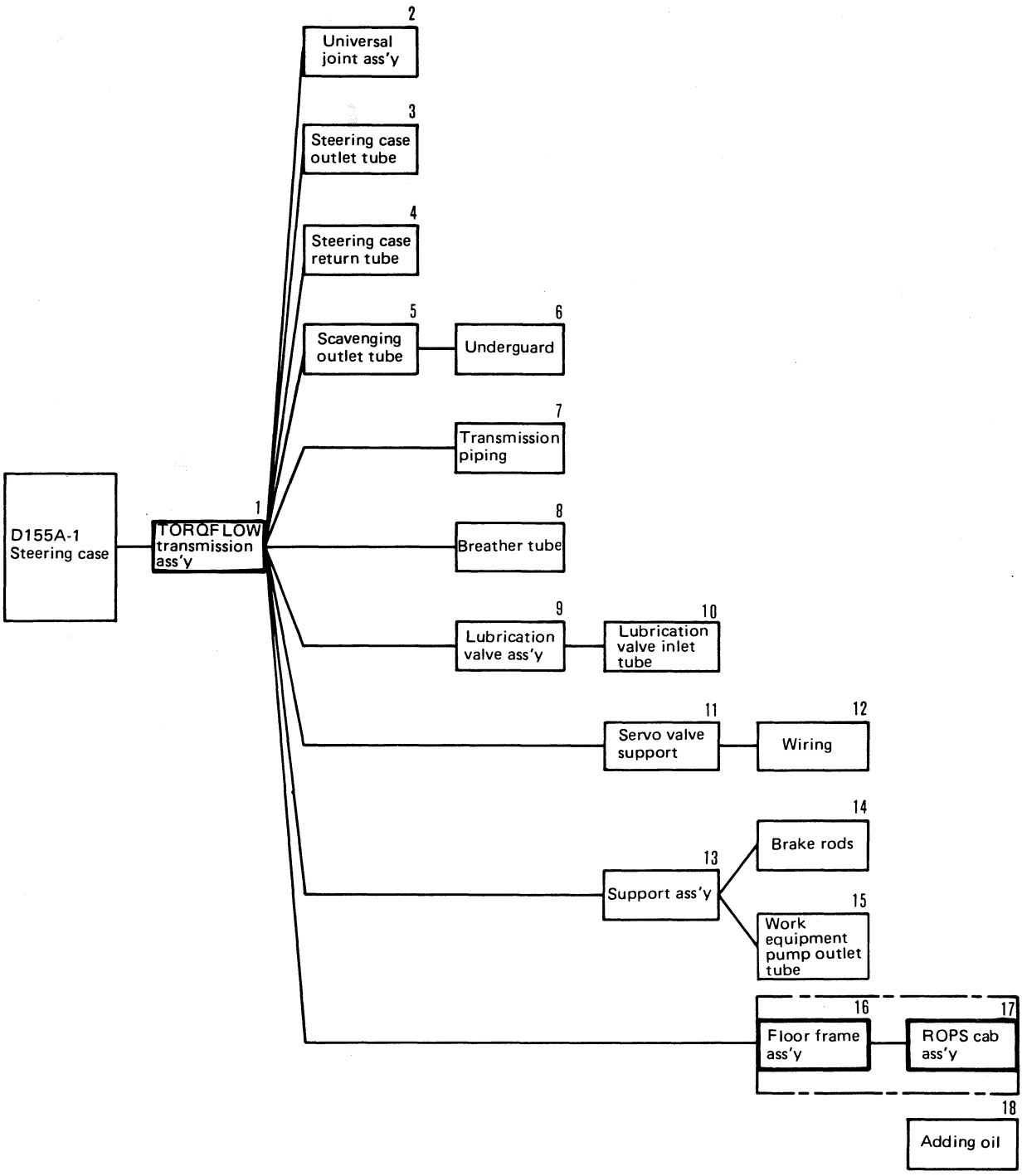


18. TORQFLOW transmission assembly
1) Attach hanging bolts (24 mm, P=3.0) to the transmission and lift the assembly using three ropes. Remove six mounting bolts (31) and five nuts.
2) Dismount TORQFLOW transmission assembly (32) with a crane.
★ Slowly lift the assembly, taking care not to let it hit any nearby parts.



MOUNTING TORQFLOW TRANSMISSION

D155A 25001 and up



1. TORQFLOW transmission assembly

1) Stick a gasket to the mounting surface on the steering case side.

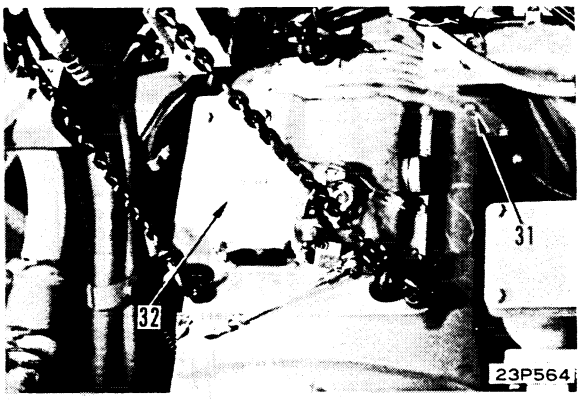
Gasket: **Liquid gasket (LG-1)**

2) Fit an O-ring to the mounting surface of the transmission, lower TORQFLOW transmission assembly (32) with a crane, and position it on the steering case.

★ Slowly lower the assembly, taking care not to let it hit any nearby parts.

3) Secure the assembly onto the steering case with six mounting bolts (31) and five nuts.

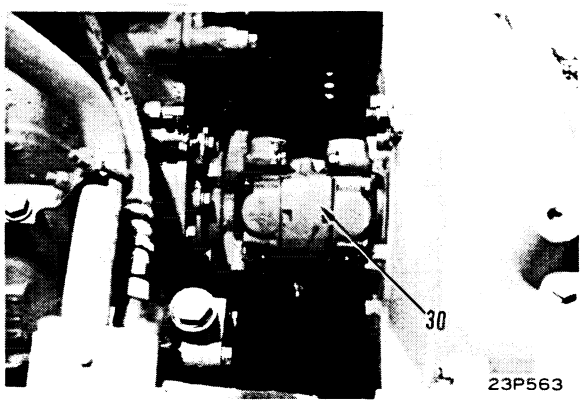
Mounting bolt and nut: **55 ± 5 kgm**



2. Universal joint assembly

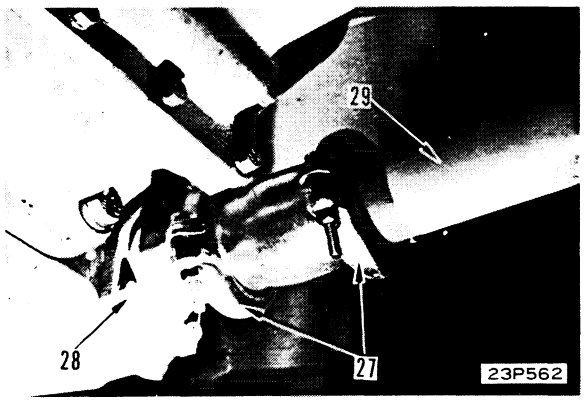
Install universal joint assembly (30).

Mounting bolt: **11 ± 1 kgm**



3. Steering case outlet tube

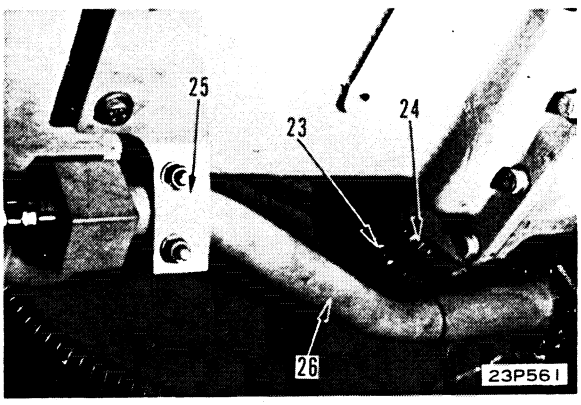
Fit O-rings to the mounting surfaces, install outlet tube (29), and tighten flange bolt (28) and coupling clamp (27).



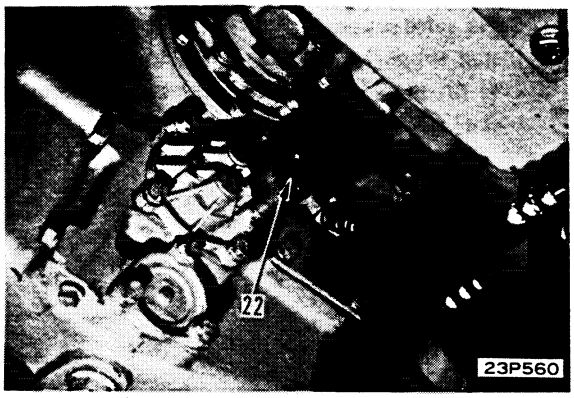
4. Steering case return tube

1) Fit an O-ring to the flange section, install steering return tube (26) to the steering case, and secure clamp bracket (25) with the mounting bolts.

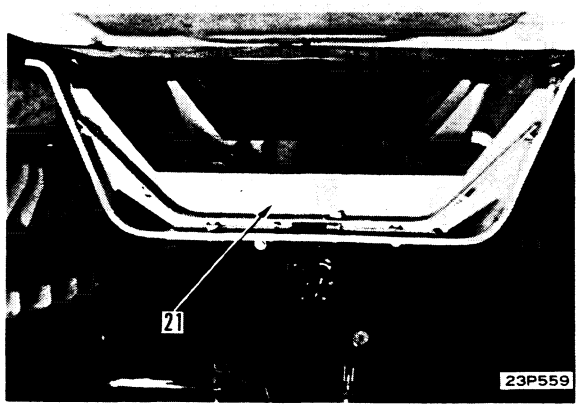
2) Connect steering brake hose (23) and servo valve return hose (24).



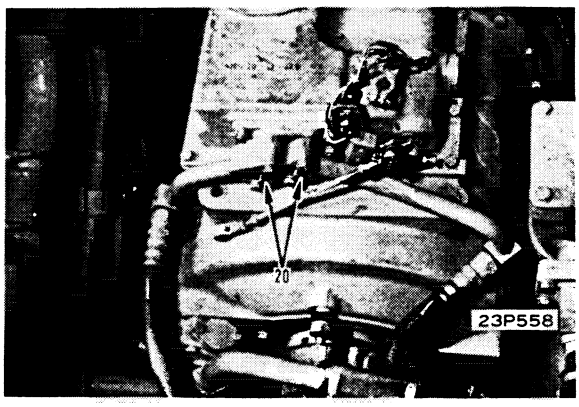
5. **Scavenging pump outlet tube**
   Fit an O-ring to the flange section, and connect scavenging pump outlet tube (22) to the pump.



6. **Underguard**
   Sling underguard (21) with wires hooked to the bolts on the R.H. and L.H. sides, and install the underguard by lifting it with a transmission jack, taking care to prevent interferance with the diagonal brace.



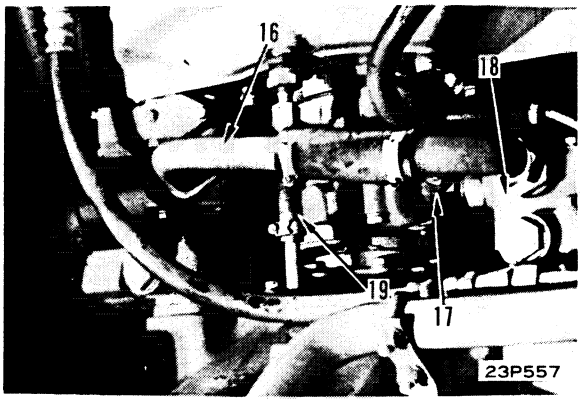
7. **Transmission piping**
   Fit an O-ring to the flange section and install transmission control valve tube (20).



8. **Breather tube**
   Install breather tube (19).

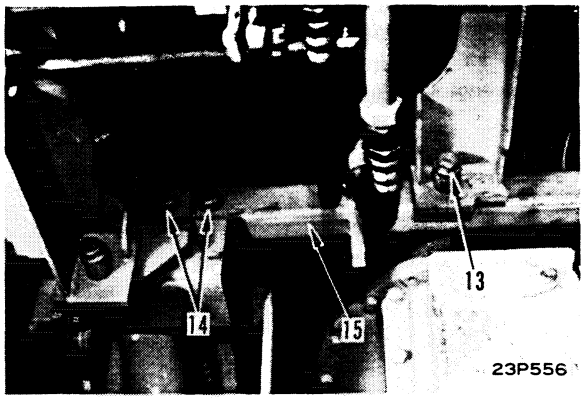
9. **Lubrication relief valve assembly**
   Fit an O-ring to the sleeve, a gasket to the mounting surface, and install lubrication relief valve assembly (18).

10. **Lubrication relief valve piping**
    1) Fit an O-ring to the flange section and connect lubricaaion relief valve outlet tube (17).
    2) Fit an O-ring to the flange section and connect lubrication relief valve inlet tube (16).



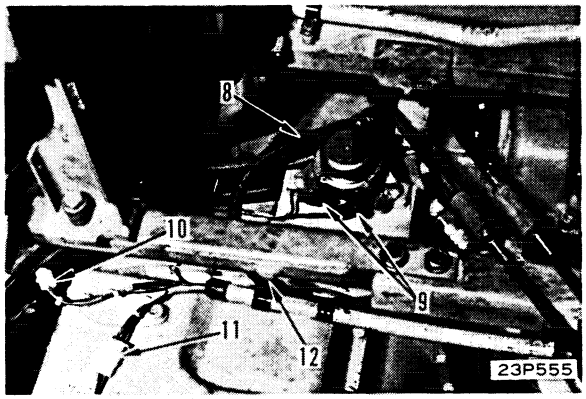
11. Servo valve support

Install support (15) and tighten four mounting bolts (14) on the R.H. and L.H. sides and one mounting bolt (13) on the servo valve support.



12. Wiring

1) Connect horn wiring (10) and back-up alarm switch wiring (11) to the connectors, and secure the wiring with clamp bolt (12).
2) Connect battery relay wiring (8) and (9).



13. Support assembly

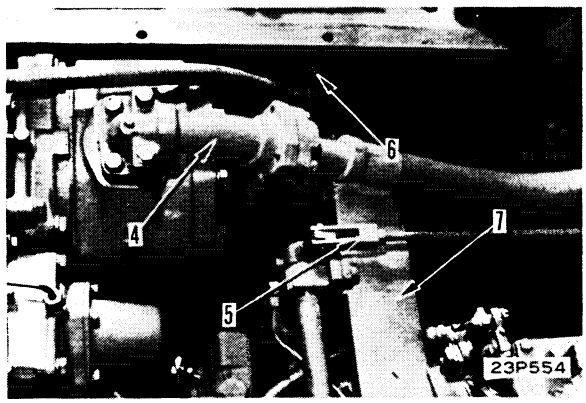
1) Lift the support assembly with a crane, bring it between the fenders, and locate it in position.
2) Tighten eight R.H. and L.H. mounting bolts.
3) Tighten clamp bolt (6).

14. Brake rods

Install R.H. and L.H. brake rods (5).

15. Work equipment pump outlet hose

Fit an O-ring to the flange section and connect work equipment pump outlet hose (4) to the pump.



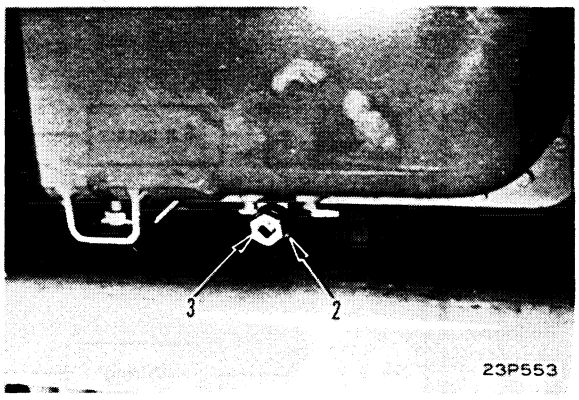
16. Floor frame assembly

17. ROPS cab assembly

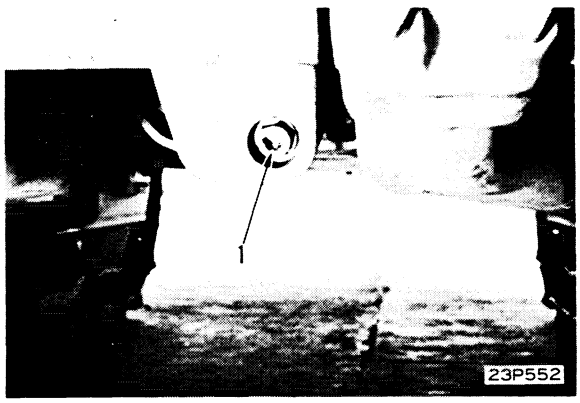
To install the ROPS cab and floor frame assembly, see MOUNTING ROPS CAB AND FLOOR FRAME ASSEMBLY. To return the ROPS cab assembly to its original position, see RETURNING ROPS CAB TO ORIGINAL POSITION.

18. Adding oil

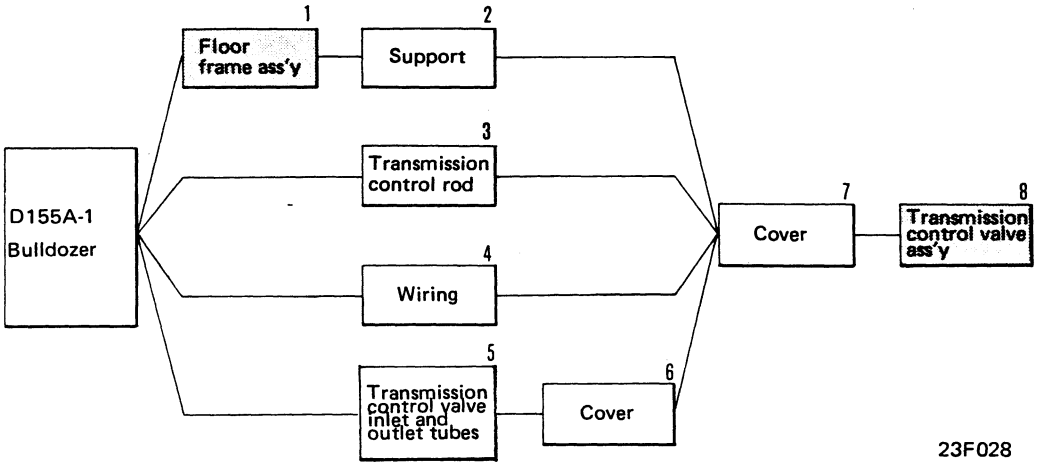
1) Install hydraulic tank drain plug (2) and close drain valve (3). Fill the tank with the oil through the oil filler while checking the oil level with the oil level gauge.
★ Oil: E010-CD



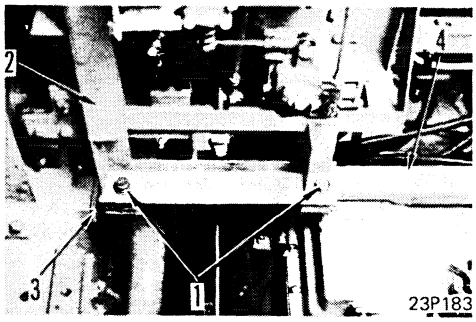
2) Fit an O-ring to drain plug (1). Add steering and transmission oil through the oil filler while checking the oil level with the oil level gauge.
★ Oil: E030-CD



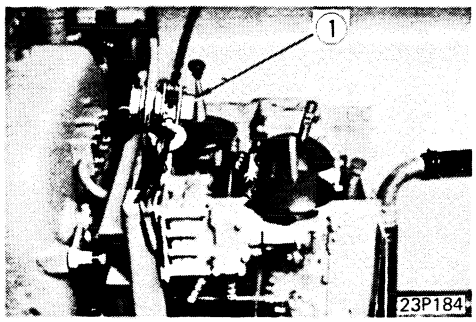
DISMOUNTING TRANSMISSION CONTROL VALVE D155A



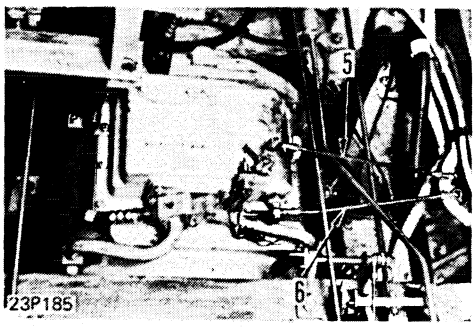
1. **Floor frame assembly**
   Refer to DISMOUNTING FLOOR FRAME.



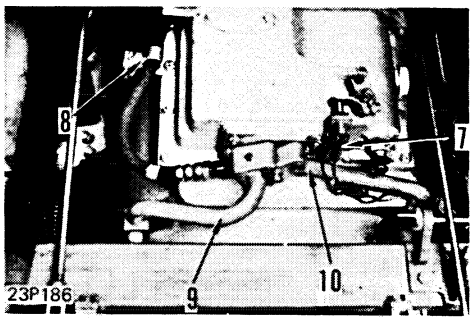
2. **Support**
   1) Remove bolts (1) fastening servo frame assembly. Sling servo frame assembly (2) with lever type chain block ①.
   2) Remove right and left bolts (3) fastening support (4); remove support.



3. **Transmission control rod**
   Remove lock nuts. Remove transmission control rods (5) and (6).

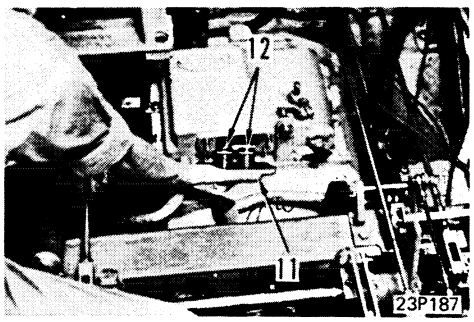


4. **Wiring**
Disconnect back-up alarm switch wire (7) from switch terminal.

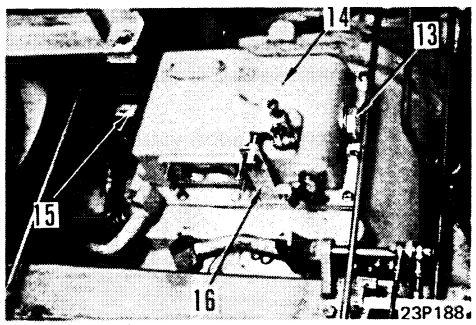


5. **Transmission control valve inlet and outlet tubes**
   1) Remove clamp (8) fastening servo valve oil feed hose. Remove flange fastening bolts and remove valve inlet tube (9) from cover.
   2) Remove flange fastening bolts and disconnect valve outlet tube (10) from cover.

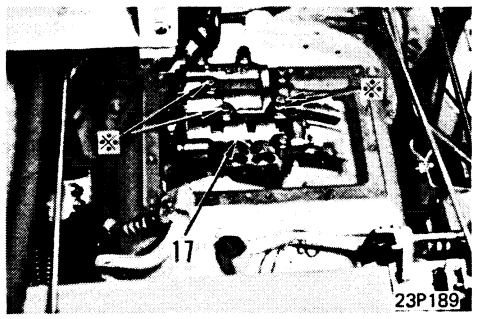
6. **Cover**
Remove nuts fastening cover (11); remove cover and sleeve (12).
   ★ When sleeve is left in valve, carefully remove sleeve to prevent O-ring from damaging.



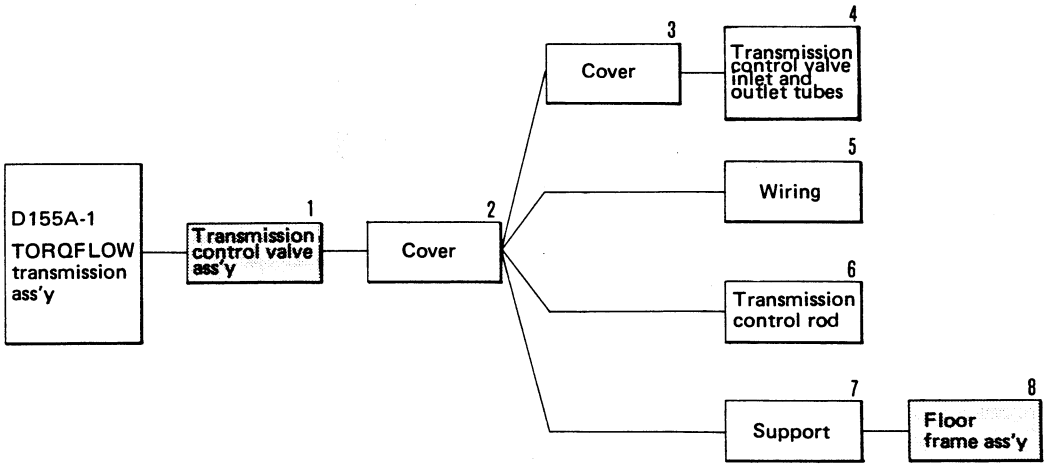
7. **Cover**
Loosen inspection plug (13). Remove bolts fastening cover (14); remove cover.
   ★ Bolts that fasten hose clamp (15) and bracket (16) together with cover are longer than other bolts. Be careful not to confuse them.



8. **Transmission control valve assembly**
Remove four bolts (marked *) fastening control valve assembly (17); remove assembly.
   kg Valve assembly: **25 kg.**



MOUNTING TRANSMISSION CONTROL VALVE D155A



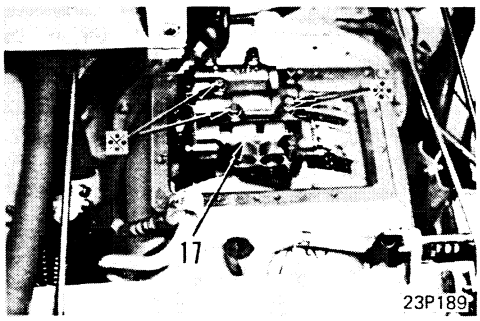
23F029

1. Transmission control valve assembly

Install control valve assembly (17) with O-ring fitted in mounting face.

★ Tighten mounting bolts evenly.

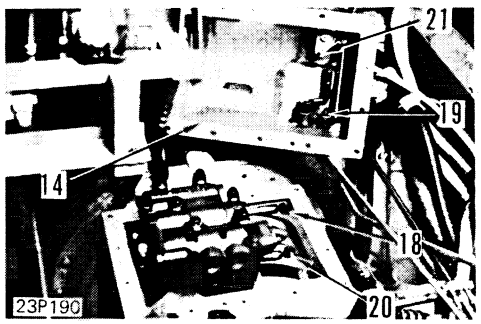
kgm Mounting bolt: **6 — 7.5 kgm**



23P189

2. Cover

1) Install cover (14) with gasket fitted on mounting face, aligning spool yoke (18) with cover lever (19) and spool yoke (20) with cover lever (21), respectively.



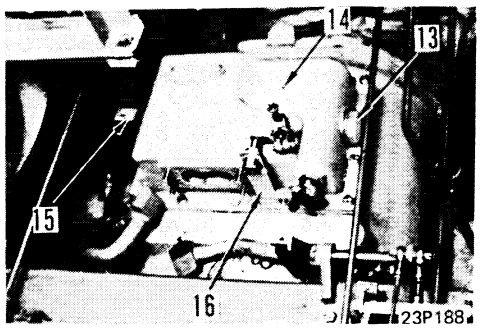
23P190

2) Remove inspection plug (13), confirm that levers is fitted to each spool yoke securely, and install cover (14).

★ Install hose clamp (15) and bracket (16) with cover mounting bolts. Three bolts used for this purpose are longer than other bolts; do not confuse them from other bolts.

★ Tighten mounting bolts evenly.

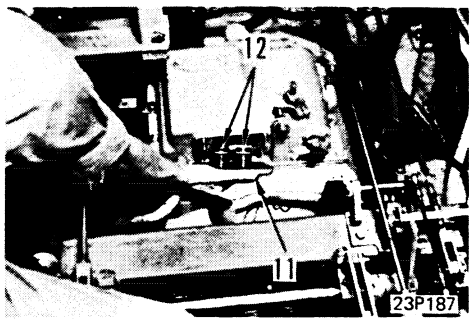
kgm Mounting bolt: **6 — 7.5 kgm**



23P188

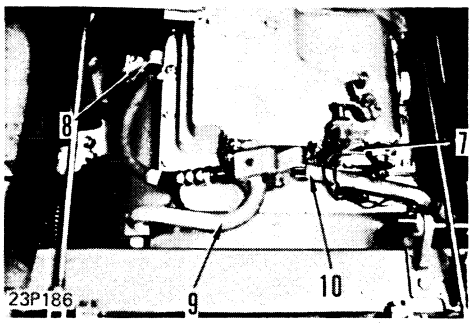
3) Install inspection plug (13) with O-ring.

3. **Cover**
   1) Fit sleeve (12), with O-ring, to cover (11).
      ★ Coat O-ring with grease (G2-LI).
   2) Install gasket to mounting face and install cover (11) with sleeve.

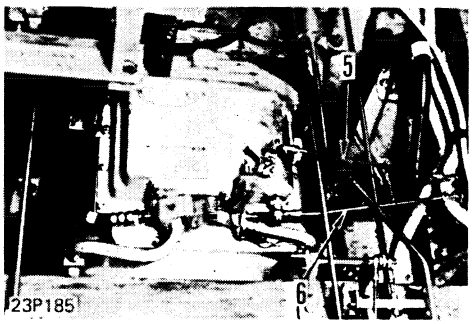


4. **Transmission control valve inlet and outlet tubes**
   1) Connect valve outlet tube (10), with O-ring in flange, to cover.
   2) Connect valve inlet tube (9), with O-ring in flange, to cover and fix servo valve oil feed hose with clamp (8).

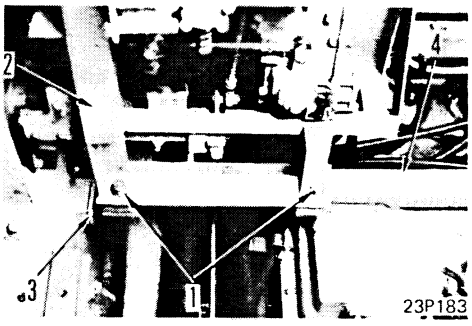
5. **Wiring**
   Connect back-up alarm switch wire (7) to switch terminal.



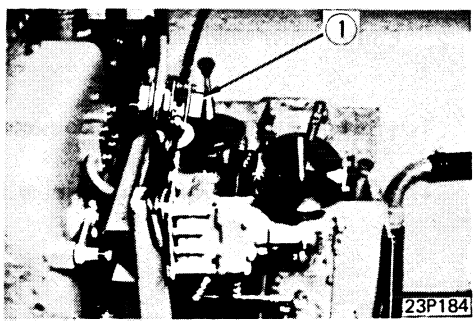
6. **Transmission control rod**
   Connect transmission control rods (5) and (6) to valve side links with lock nuts. Lock them with cotter pins.
   ★ Bent rod is for selector.
   ★ Surely bend cotter pins.



7. **Support**
   1) Install support (4) with mounting bolts (3).
   2) Slacken lever type chain block ① to rest support frame assembly (2) onto support. Tighten mounting bolts (1).

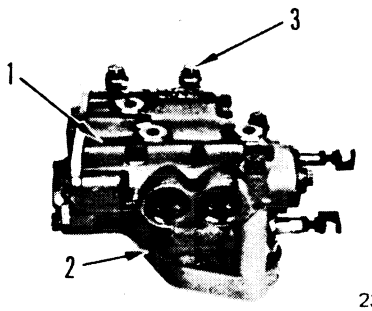


8. **Floor frame assembly**
   Refer to MOUNTING FLOOR FRAME.



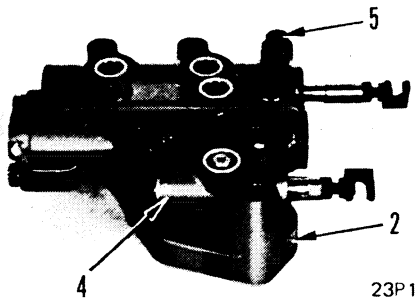
DISASSEMBLY OF TRANSMISSION CONTROL VALVE D155A

1. **Control valve assembly [A]**
   1) Remove bolt (3) fastening both control valve assembly [A] (1) and valve seat (2).
   2) Remove control valve assembly [A] (1).



23P191

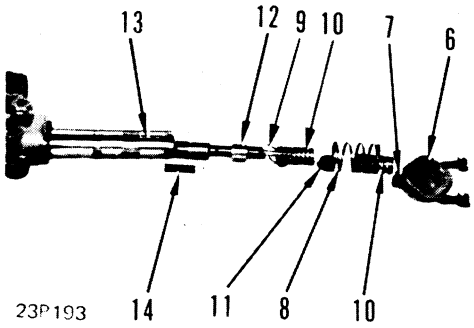
2. **Control valve assembly [B]**
   1) Remove bolts (5) fastening both control valve assembly [B] (4) and valve seat (2).
   2) Remove control valve assembly [B] (4).



23P192

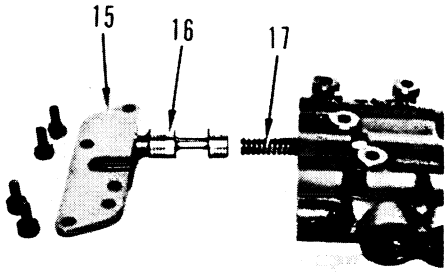
3. Modulating valve

1) Remove valve cover (6).
2) Remove shim (7), spring (8), washer spring (9) valve spring (10), seat (11), valves (12), sleeve (13) piston spring (14) and piston.



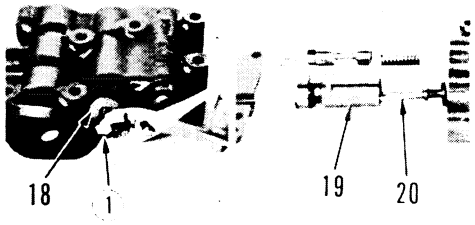
4. Reducing valve

1) Remove cover (15).
2) Remove valve (16), spring (17) and piston



5. Quick return valve

1) Pry snap ring and remove stopper (18).
   ★ When removing stopper (18), screw jack bolt ① (8mm, P = 1.25) and pull out stopper with pliers.
2) Remove sleeve (19) and valve (20).



6. Speed valve

Pull out spool (21).

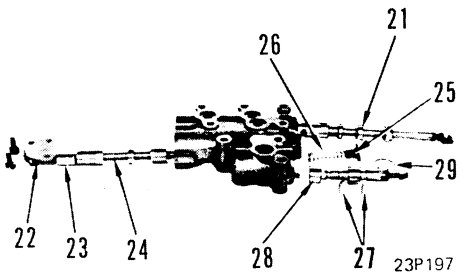
Serial No. 15001 – 29764

7. Safety valve

Remove cover (22) and pull out piston (23) and valve (24). Remove stopper (25) and pull out spring (26).

8. Directional valve

Remove detent (27) and pull out spool (28).



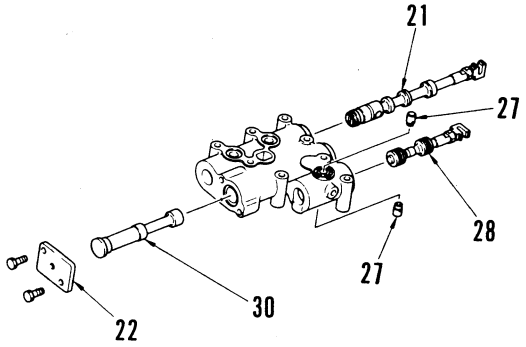
Serial No. 29765 and up

7. Spacer

Remove cover (22) and pull out spacer (30).

8. Directional valve

Remove detent (27) and pull out spool (28).



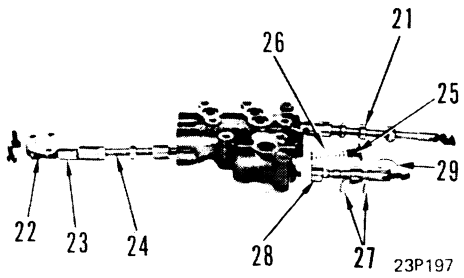
ASSEMBLY OF TRANSMISSION CONTROL VALVE D155A

Serial No. 15001 – 29764

1. **Directional valve**
   Position spool assembly (28) in valve body and install detent (27).
   - ★ Coat spool circumference with engine oil (SAE30, class CD) and insert it in valve body, rotating it as necessary.
   - ★ Coat detent circumference with grease (G2-LI) and insert it into valve body, taking care to prevent it from falling off.

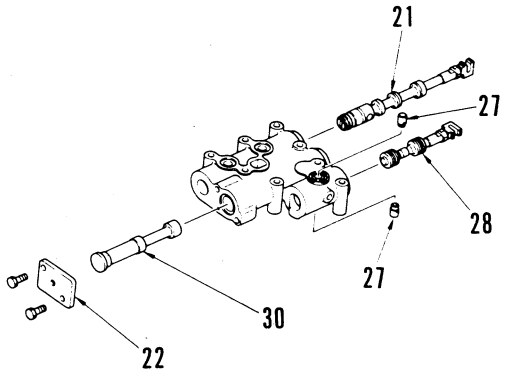
2. **Safety valve**
   Insert spring (26), valve (24) and piston (23) in that order, into valve body. Install cover (22) with O-ring and fasten stopper (25) with snap ring (29).
   - ★ Coat valve and piston circumference with engine oil (SAE 30, class CD).

3. **Speed valve**
   Position spool assembly (21) in valve body.
   - ★ Coat spool circumference with engine oil (SAE30, class CD) and insert it into valve body, rotating it as necessary.



Serial No. 29765 and up

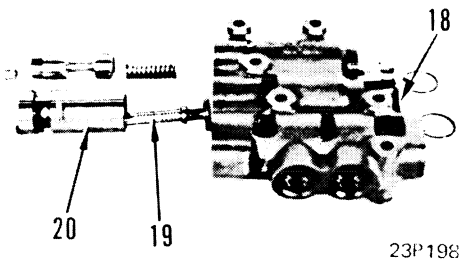
1. **Directional valve**
   Position spool assembly (28) in valve body and install detent (27).
   - ★ Coat spool circumference with engine oil (SAE30, class CD) and insert it in valve body, rotating it as necessary.
   - ★ Coat detent circumference with grease (G2-LI) and insert it into valve body, taking care to prevent it from falling off.



2. **Spacer**
   Insert spacer (30) in valve body, then install cover (22).
   - ★ Coat spacer circumference with engine oil (SAE30, class CD).

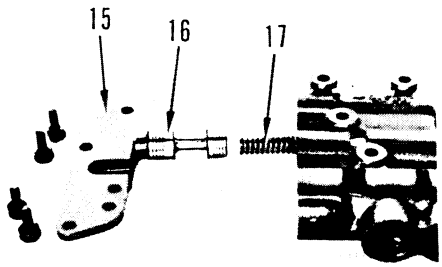
3. **Speed valve**
   Position spool assembly (21) in valve body.
   - ★ Coat spool circumference with engine oil (SAE30, class CD) and insert it into valve body, rotating it as necessary.

4. **Quick return valve**
   Insert sleeve (19) and valve (20), as an assembly, into valve body.
   - ★ Coat sleeve and valve with engine oil (SAE30, class CD).
   - ★ Install stopper (18) with O-ring and lock it with snap ring.



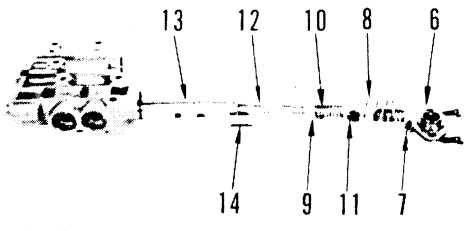
23P198

5. **Reducing valve**
   Position spring (17), valve (16) and piston in valve body.
   Install cover (15).
   - ★ Coat valve and piston with engine oil (SAE 30, class CD).



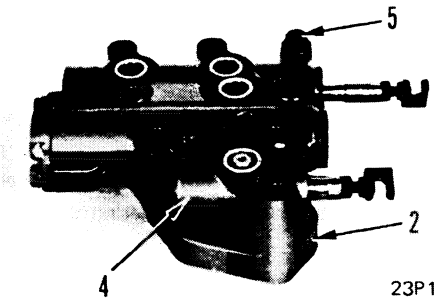
23P194

6. **Modulating valve**
   Position sleeve (13), valves (12), spring (14) washer (9), valve spring (10) seat (11) and sleep spring (8) in valve body. Adjust thickness of shim (7) and install valve cover (6).
   - ★ Coat valve with engine oil (SAE30, class CD).



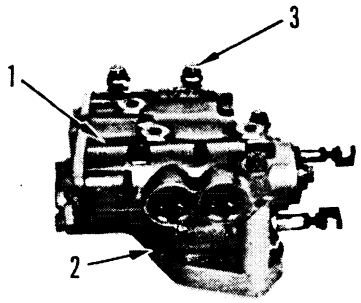
23P192

7. **Control valve assembly [B]**
Install valve seat (2) with O-ring and install control valve assembly [B] (4) with bolts (5).



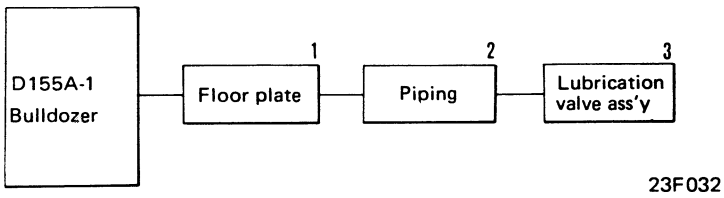
23P192

8. **Control valve assembly [A]**
Install control valve assembly [A] (1) with O-ring fitted on mounting face with bolts (3).
kgm Mounting bolt: **6 – 7.5 kgm**



23P191

DISMOUNTING TRANSMISSION LUBRICATION VALVE D155A



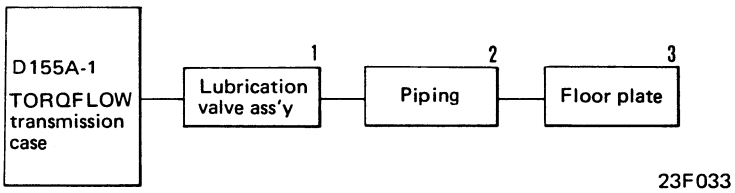
23F032

1. **Floor plate**
   Remove floor plate (1).

2. **Piping**
   Disconnect inlet pipe (2) and outlet pipe (3) from lubrication valve.

3. **Lubrication valve assembly**
   Remove bolts fastening lubrication valve (4) remove valve assembly.

MOUNTING TRANSMISSION LUBRICATION VALVE D155A



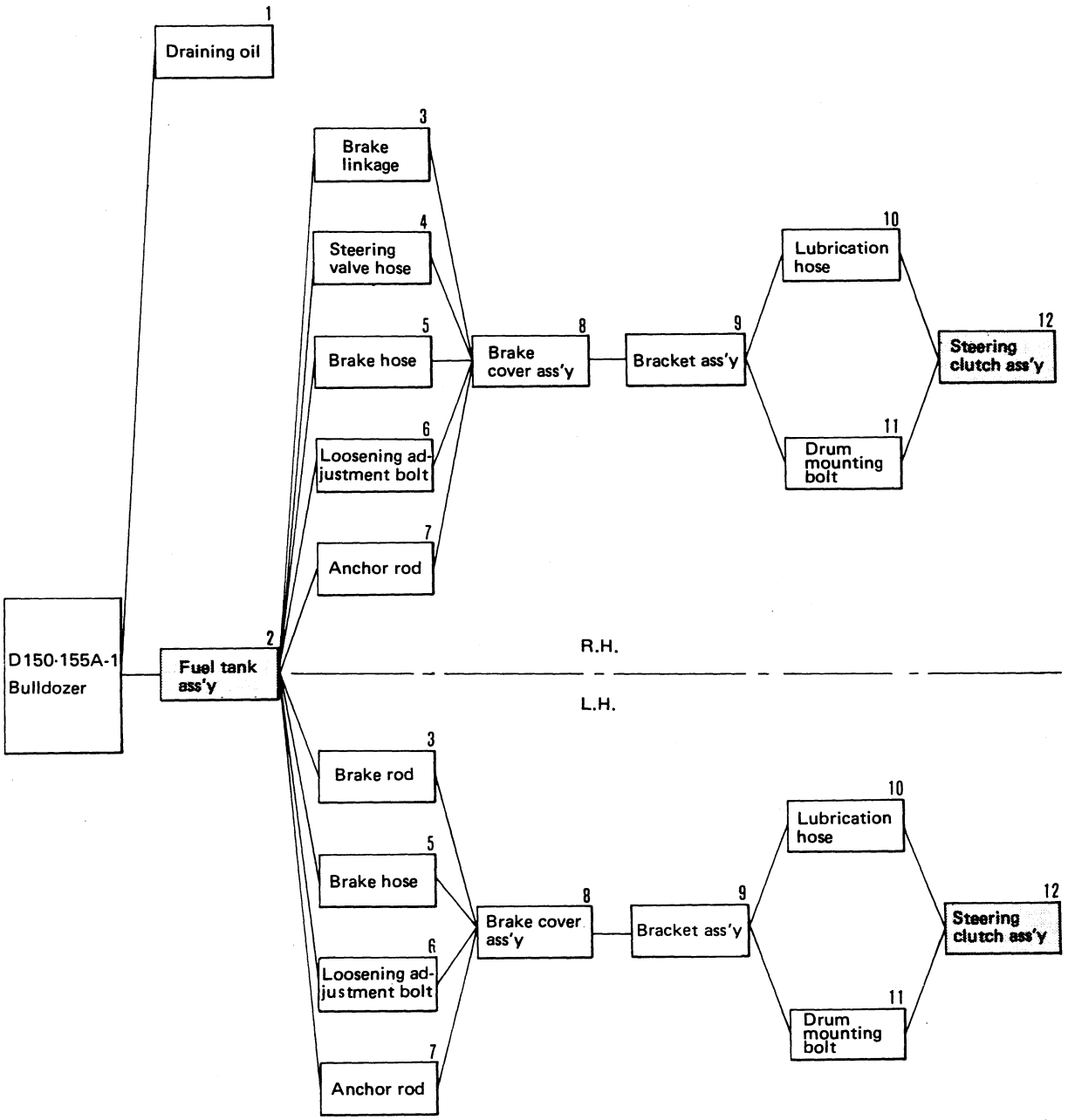
1. **Lubrication valve assembly**
   Fit O-ring to sleeve coming from transmission. Install lubrication valve (4) with gasket to transmission with bolts.

2. **Piping**
   Connect inlet pipe (2) and outlet pipe (3), with O-ring in each flange, to lubrication valve.

3. **Floor plate**
   Install floor plate (1).

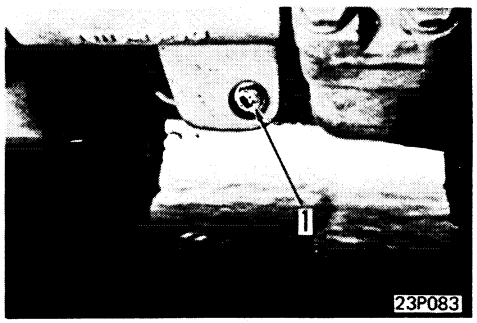
DISMOUNTING STEERING CLUTCH

D150A 8408 and up
D155A 15001 – 25000



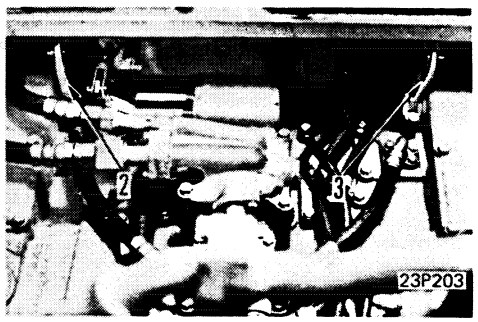
23F034

1. **Draining oil**
   Remove drain plug (1) and drain oil from steering case.

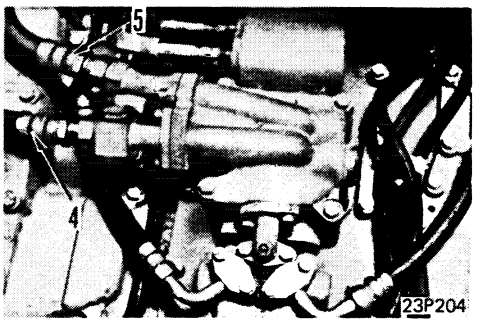


2. **Fuel tank assembly**
   Refer to DISMOUNTING FUEL TANK

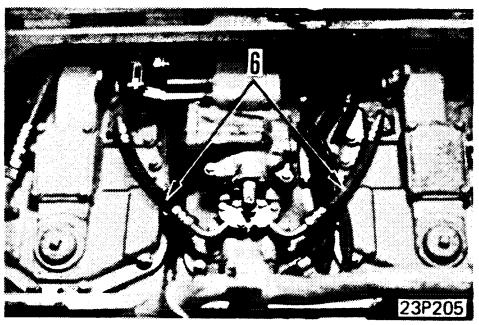
3. **Brake linkage**
   Disconnect left (2) and right (3) brake rods from linkage.



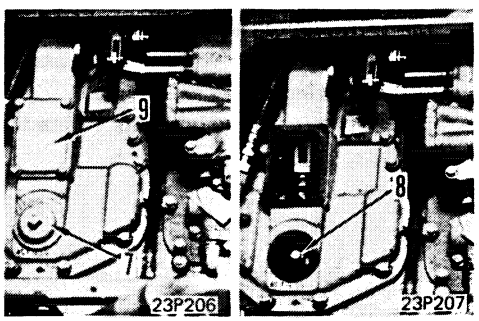
4. **Steering valve hose**
   ★ Only when removing L.H. steering assembly.
   Disconnect steering valve inlet hose (4) and outlet hose (5) from valve.



5. **Brake hose**
   Remove hose (6) connecting brake safety valve to brake booster.

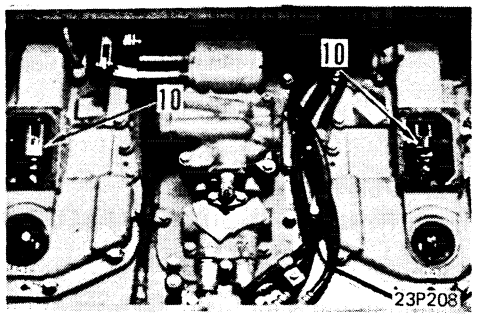


6. **Loosening adjustment bolt**
   1) Remove adjustment bolt cover (7) and fully loosen brake adjusting bolt (8).
   2) Remove booster housing cover (9).



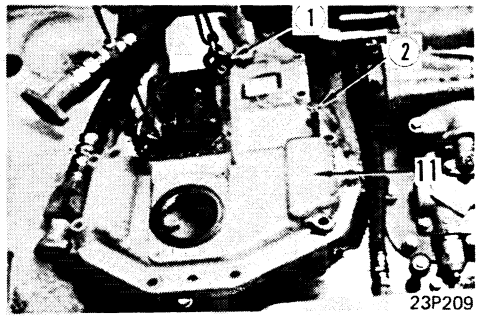
7. Anchor rod

Remove rod (10).



8. Brake cover assembly

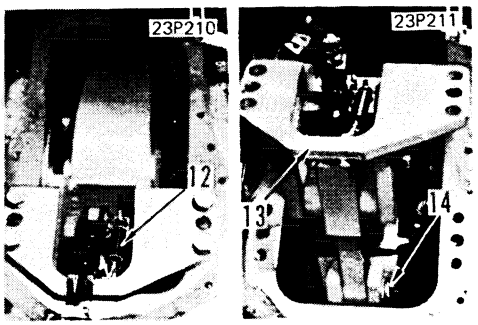
Attach hanging bolts ① (12 mm, P = 1.75) to cover, screw in jack bolts ② (12 mm, P = 1.75), and remove cover (11).



9. Bracket assembly

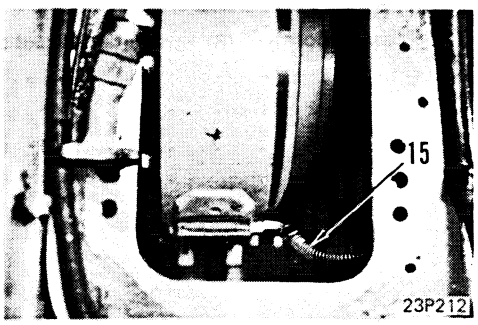
1) Remove brake lever return spring (12).
2) Remove bracket mounting bolts and sling bracket (13) from clutch case. Remove pin (14).

kg Bracket assembly: **45 kg.**



10. Lubricating hose

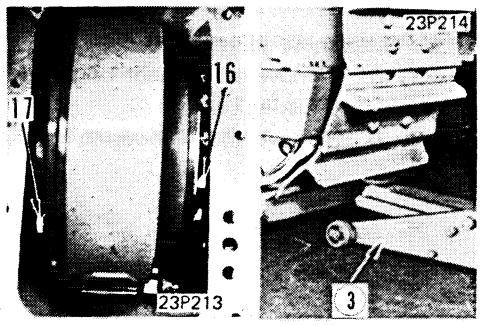
Remove brake lining lubricating hose (15).



11. Drum mounting bolt

Remove inner drum mounting bolts (16) and outer drum mounting bolts (17).

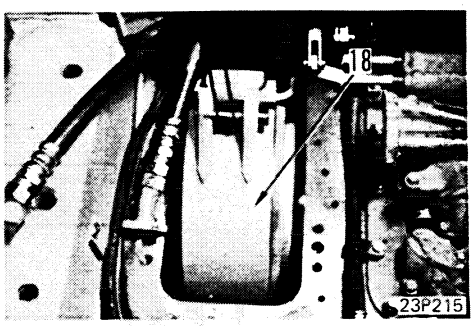
★ When removing bolts, rotate track with jack ③ .



12. Steering clutch assembly

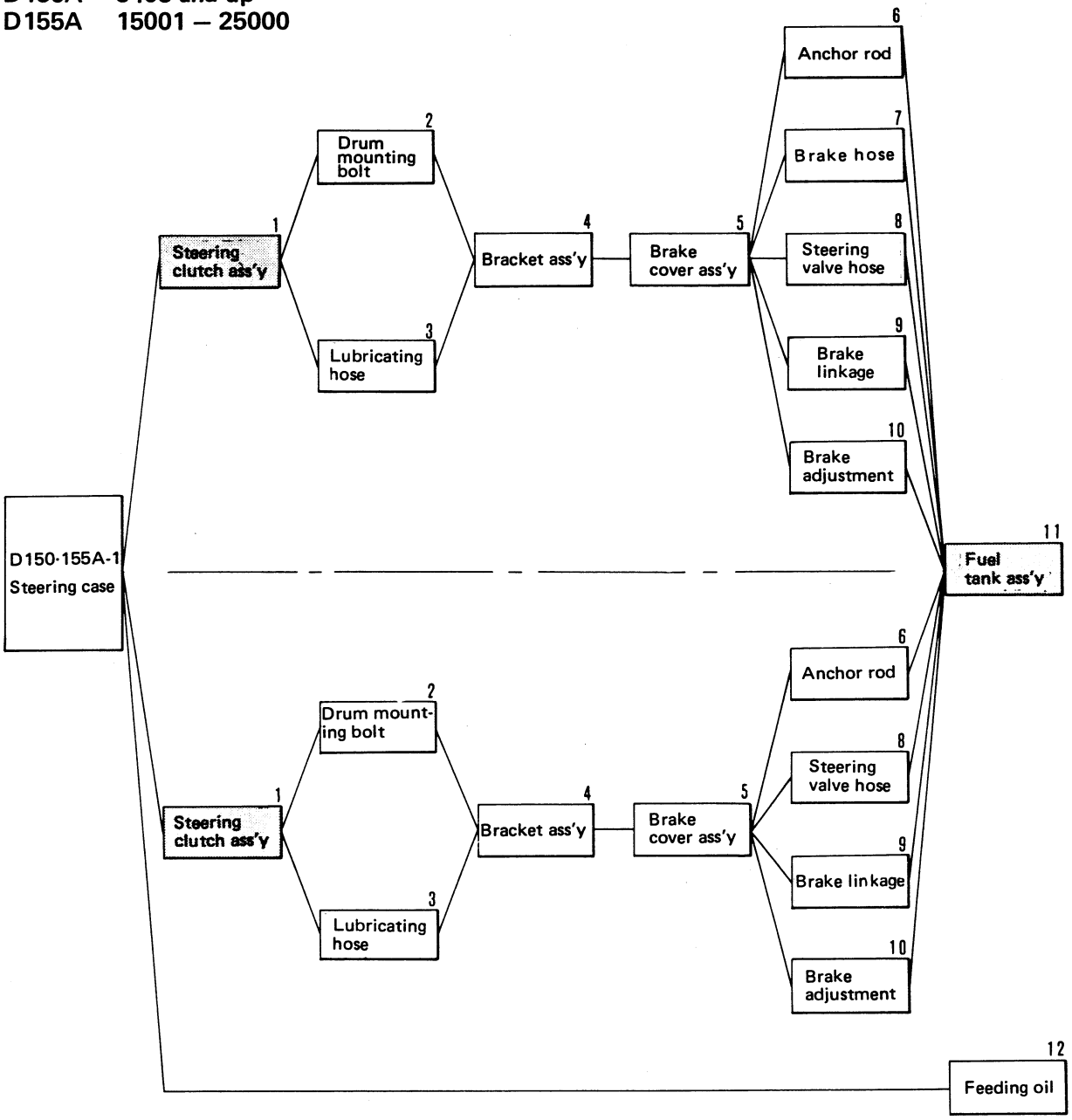
Attach hanging pins to clutch assembly (18) to sling it with crane. Move inner drum outside to release joining of center sunk portion. Lift of clutch assembly upward.

kg Clutch assembly: **170 kg.**



MOUNTING STEERING CLUTCH

D150A 8408 and up
D155A 15001 – 25000

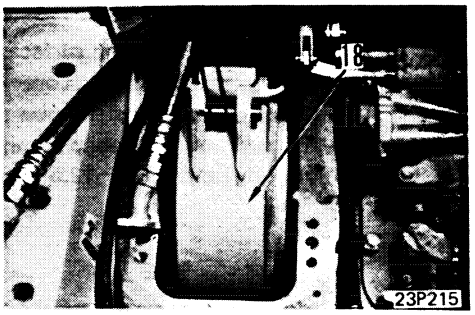


23F035

1. Steering clutch assembly

1) Attach hanging pins to clutch assembly (18) and lift assembly into position in steering case.
   ★ Properly position brake band so that pins are located on the rear side of machine when final drive falnge of L.H. clutch is faced to the left side of machine or when final drive flange of R.H. clutch is faced to the right side of machine.

2) Temporarily tighten two opposite bolts on both outer drum (17) and inner drum (16), and join center sunk portion, taking care to prevent mis-aligment.



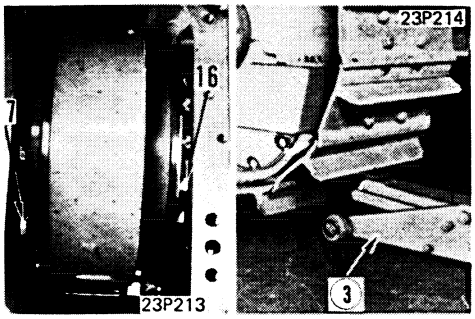
2. Drum mounting bolt

While rotating track using jack ③ , tighten outer drum mounting bolts (17) and inner drum mounting bolts (16).

kgm Inner drum mounting bolt: **25 ~ 31.5 kg.m**

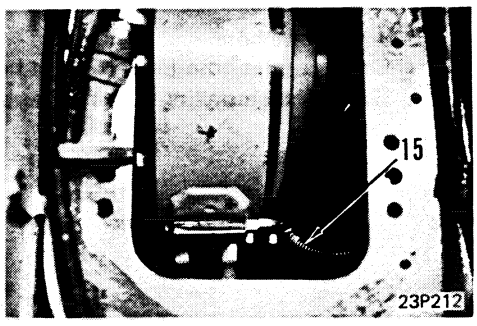
kgm Outer drum mounting bolt: **35 ~ 43.5 kg.m**

★ Mark tightened bolts with white paint to prevent neglect of tightening of any bolts.



3. Lubricating hose

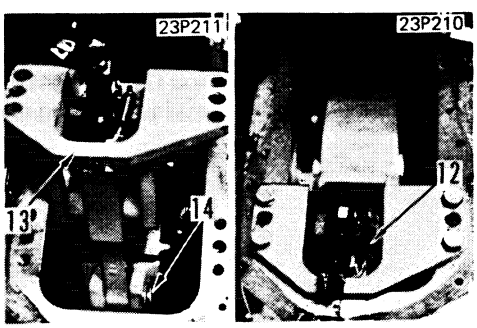
Connect brake lining lubricating hose (15) to clutch case.



4. Bracket assembly

1) Sling bracket (13). Install pin (14) and tighten bracket mounting bolts.
2) Install brake lever return spring (12).

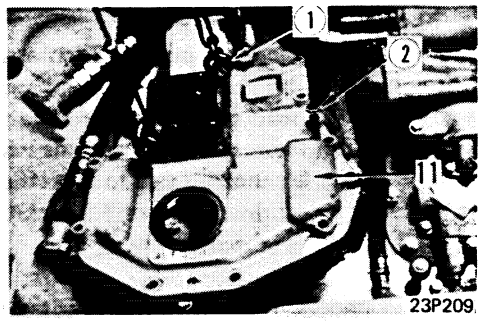
kgm Bracket mounting bolt: **50 ~ 62 kg.m**



5. Brake cover assembly

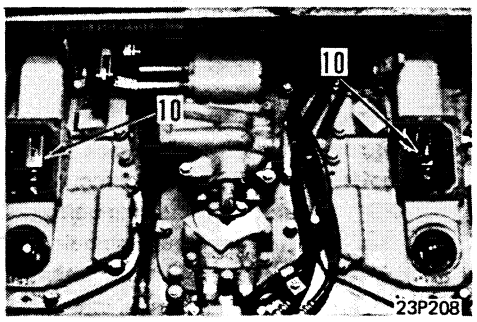
1) Attach gasket to mounting surface. Screw in hanging bolts ① (12 mm, P=1.75) and lift cover (11) into position. Raise brake bracket rod and install cover assembly in place.
2) Tighten cover mounting bolts evenly.

kgm Mounting bolt: **10 ~ 12.5 kg.m**



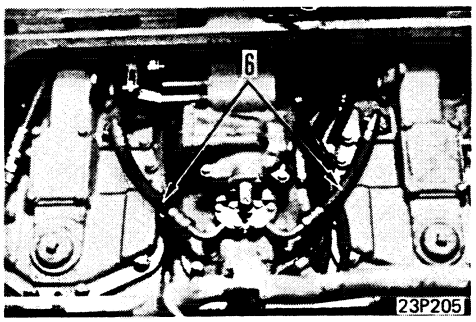
6. Anchor rod

Connect rod (10) to anchor.



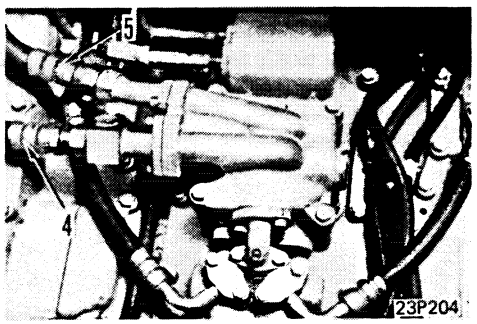
7. Brake hose

Install hose (6) between brake safety valve to brake booster.



8. Steering valve hose

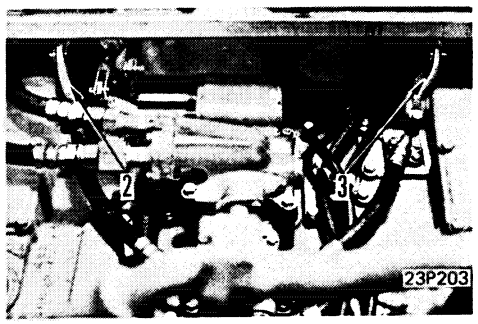
★ Connect inlet hose (4) and outlet hose (5) to steering valve. (Only when installing L.H. steering assembly)



9. Brake linkage

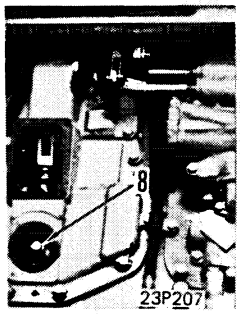
Connect left brake rod (2) and right brake rod (3) to linkage.

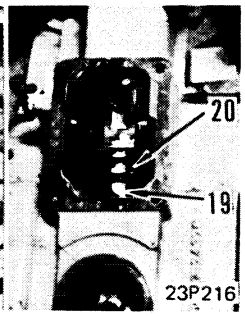
★ Surely bend cotter pins fastening rods.

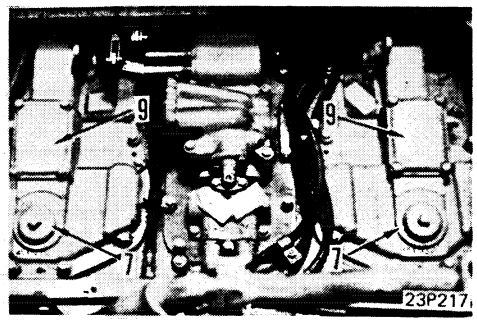


10. Brake adjustment

1) Fully tighten brake adjustment bolt (8).
2) Adjust turnbackle screw (19) to bring booster piston and lever end roller into close contact with each other.
3) Back off brake adjustment bolt 1-1/6 turns.
   ★ In this case, clearance between brake lining and drum should be 0.3 mm.
4) Tighten turnbackle lock nut (20) and confirm that brake adjustment bolt lock plate is locked.
5) Install adjustment bolt cover (7) and booster housing cover (9).





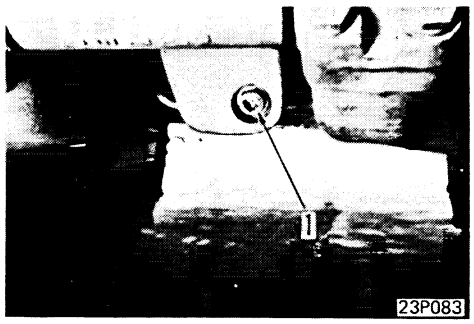


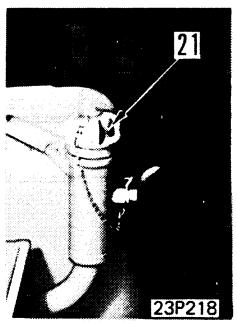
11. Fuel tank assembly

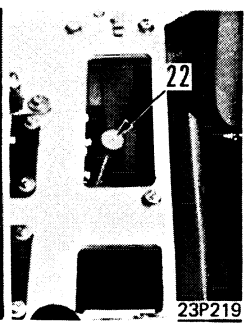
Refer to MOUNTING FUEL TANK.

12. Feeding oil

Confirm that drain plug (1) is closed. Pour engine oil (SAE30, class CD) into steering case through oil filler (21) to the specified level on level gauge (22).

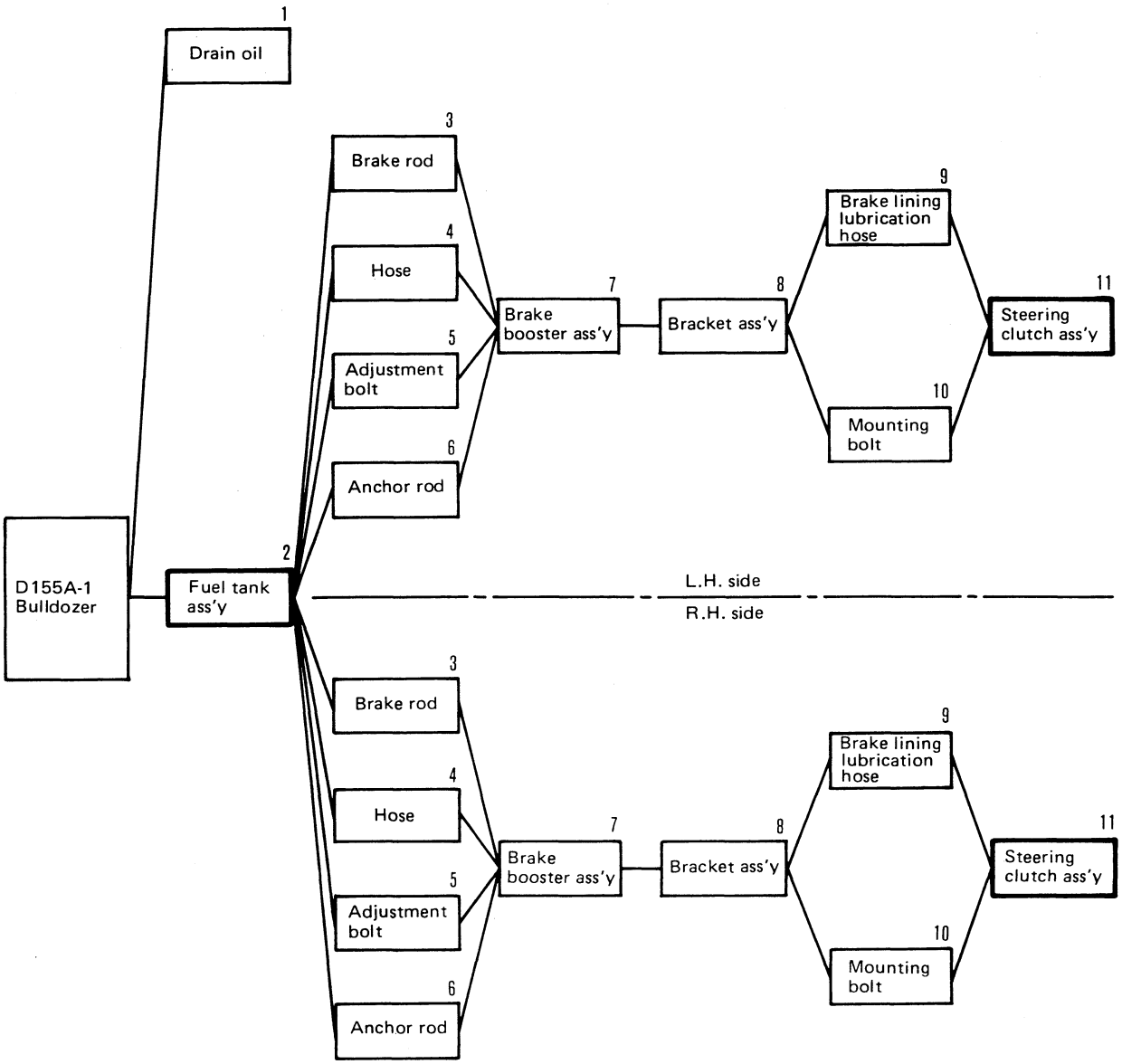




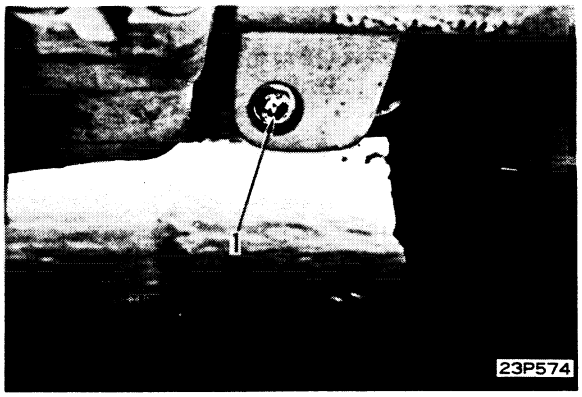


DISMOUNTING STEERING CLUTCH

D155A 25001 and up

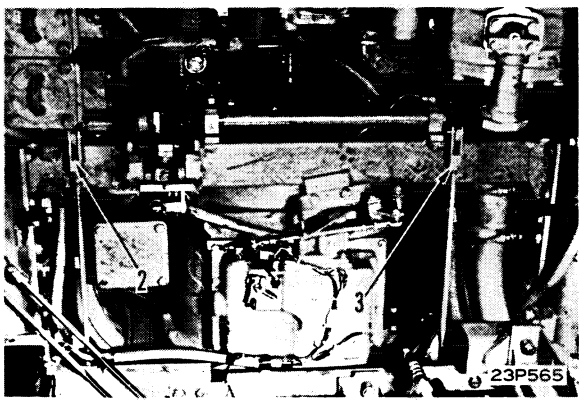


1. **Drain oil**
   Remove drain plug (1) and drain the oil from the steering case.

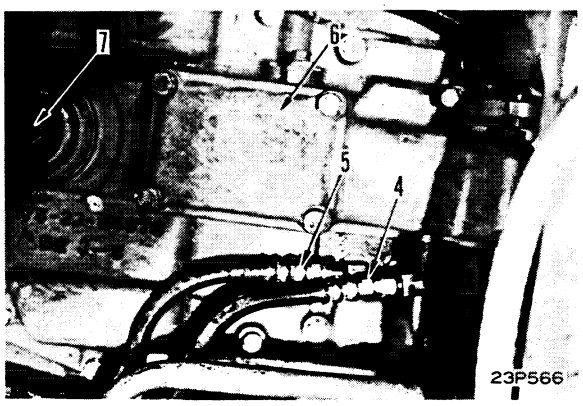


2. **Fuel tank assembly**
   Dismount the fuel tank assembly. For details, see DISMOUNTING FUEL TANK.

3. **Brake rods**
   Disconnect R.H. and L.H. brake rods (2) and (3).

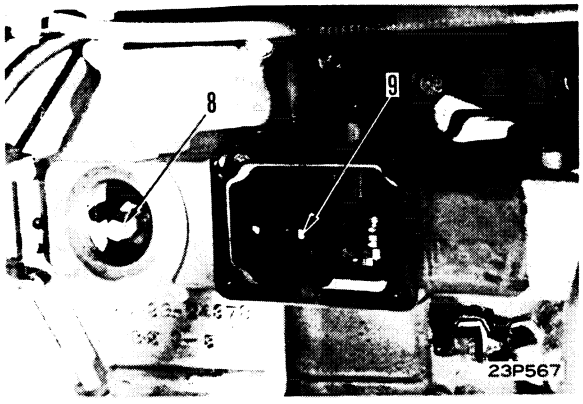


4. **Hose (only when removing the L.H. steering assembly)**
   1) Disconnect steering-brake interlocking valve inlet tube (4) and remove brake hose (5).
   2) Remove cover (6) and cap (7).



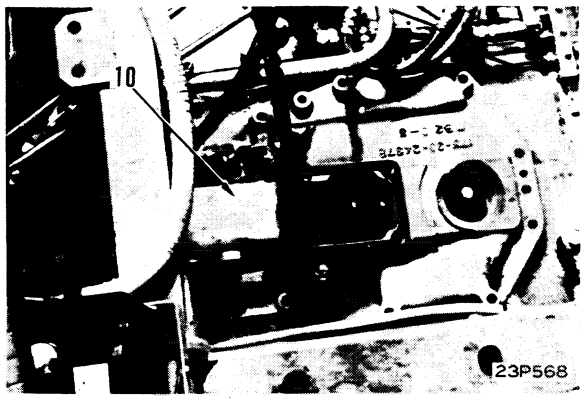
5. **Adjustment bolt**
   Fully loosen brake adjustment bolt (8).

6. **Anchor rod**
   Disconnect anchor rod (9).



7. Brake booster assembly

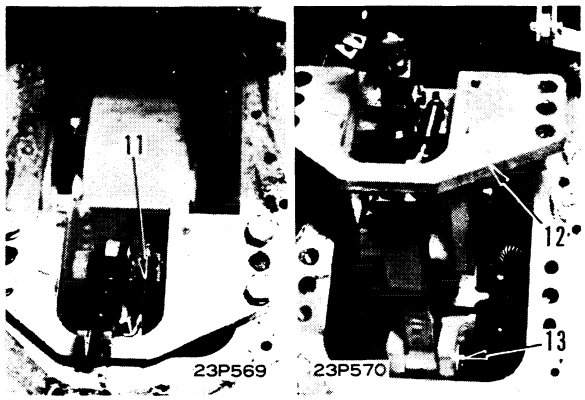
Use a forcing screw (12 mm, P=1.75) to lift off brake booster assembly (10).



8. Bracket assembly

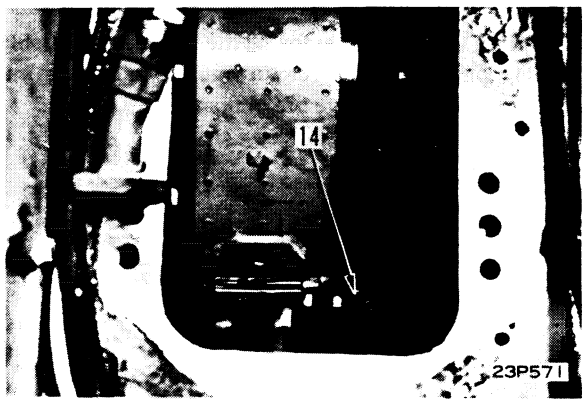
1) Remove return spring (11).
2) Sling bracket (12) and remove pin (13).

kg Bracket assembly: **45 kg**



9. Lubrication hose

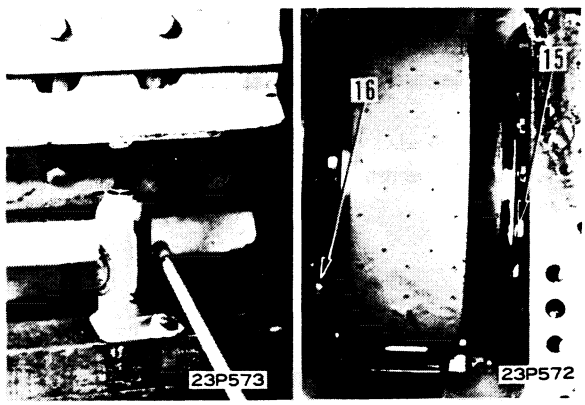
Disconnect brake lining lubrication hose (14).



10. Mounting bolts

Remove inner drum mounting bolts (15) and outer drum mounting bolts (16).

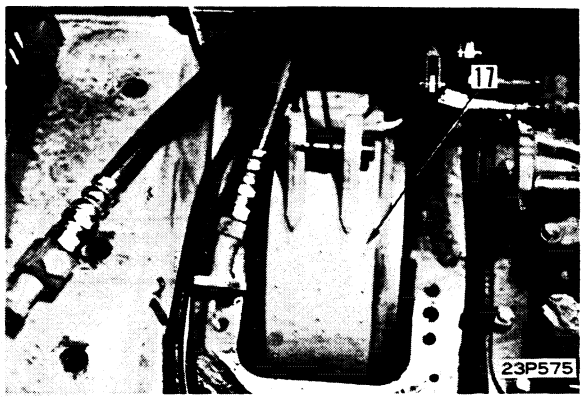
★ Remove the bolts while turning the track shoes with a jack.



11. Steering clutch assembly

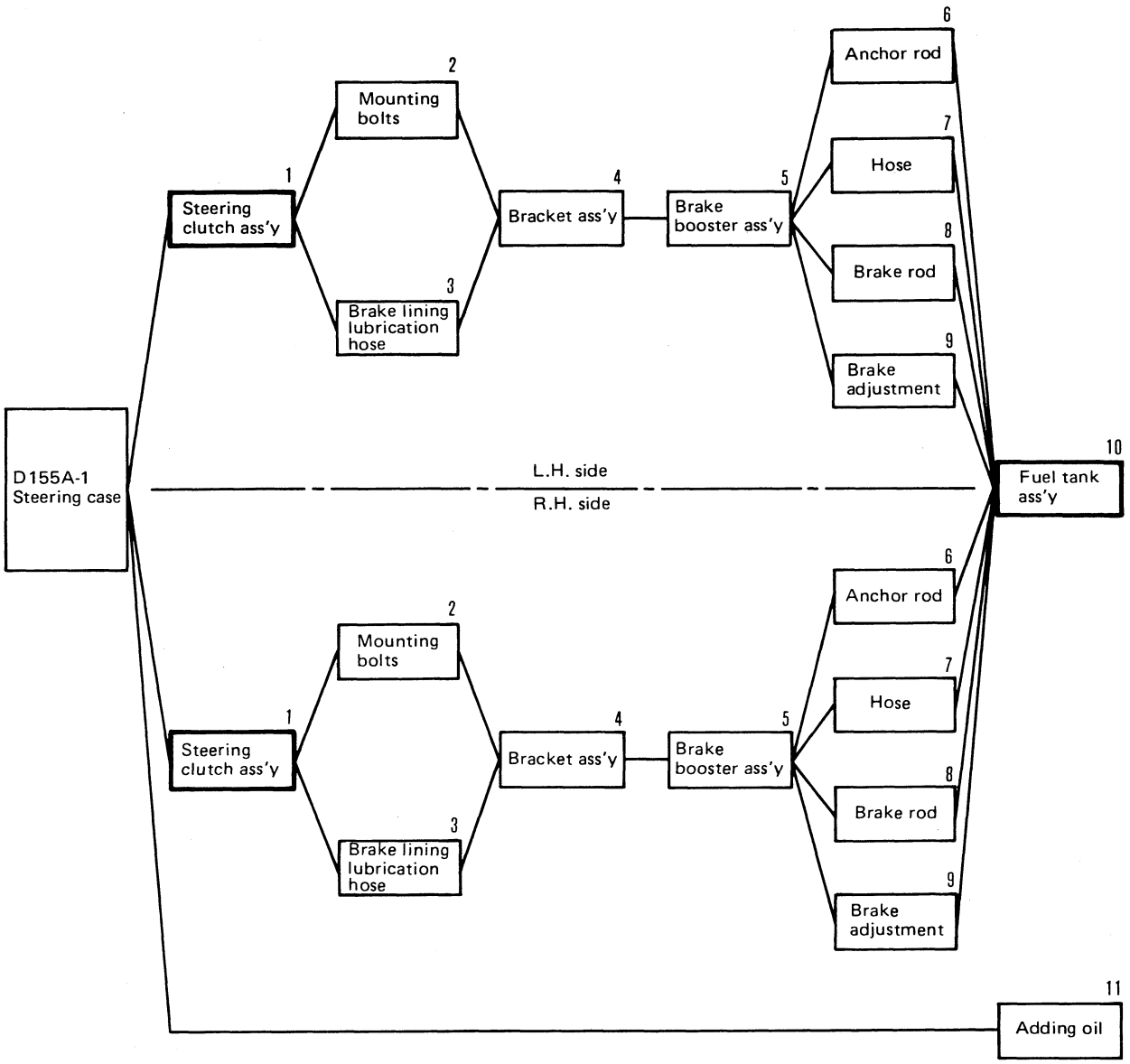
Install the pin to the brake band, sling the assembly with wires, detach the pilot portion by shifting the inner drum outward, and dismount clutch assembly (17) by lifting straight up.

kg Clutch assembly: **170 kg**



MOUNTING STEERING CLUTCH

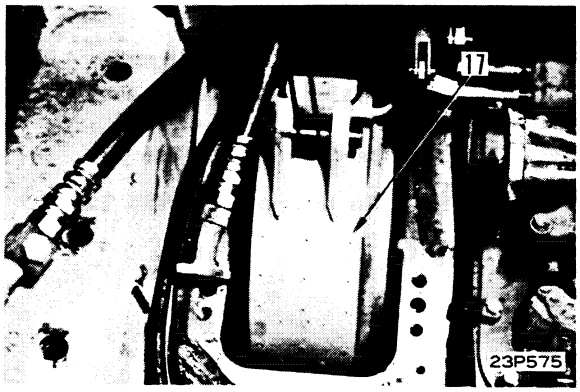
D155A 25001 and up



1. Steering clutch assembly

1) Fit the pin to the brake band, sling clutch assembly (17), and locate the assembly in the steering case.

★ Install the brake band so that the pin is positioned on the rear side of the assembly proper when the L.H. side clutch is placed with the final drive flange side facing leftward and the R.H. side clutch with the final drive flange side facing rightward.



2) Temporarily tighten two opposite bolts on both outer drum (16) and inner drum (15), align the pilot portions, and install the steering clutch assembly in the right position.

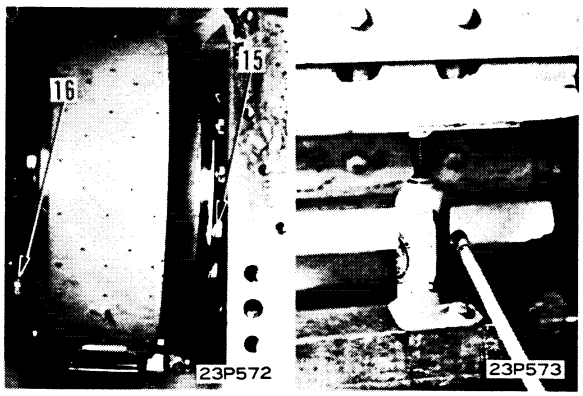
2. Mounting bolts

Tighten outer drum mounting bolts (16) and inner drum mounting bolts (15) while rotating the track shoes with a jack.

kgm Inner drum mounting bolts: **28 ± 3.5 kgm**

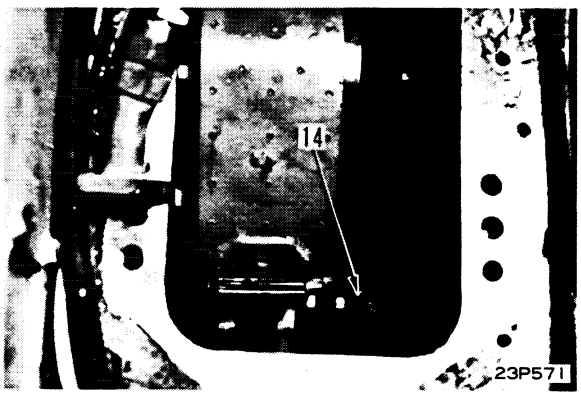
kgm Outer drum mounting bolts: **39 ± 4.5 kgm**

★ Mark every bolt with white paint after it is fully tightened so that no bolt will be left untightened.



3. Lubrication hose

Connect brake lining lubrication hose (14).

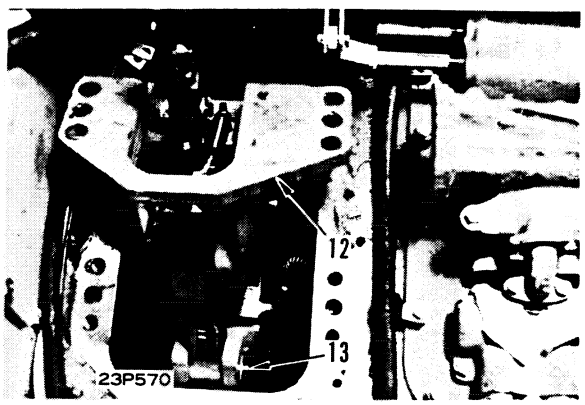


4. Bracket assembly

1) Sling bracket (13), insert pin (14), and tighten the bracket mounting bolts.

2) Install return spring (12).

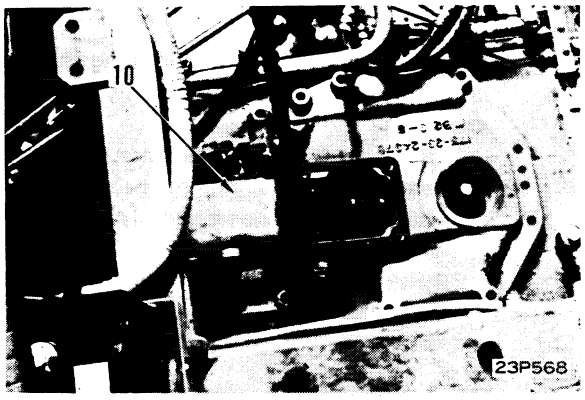
kgm Bracket mounting bolt: **56 ± 6.0 kgm**



5. Brake booster assembly

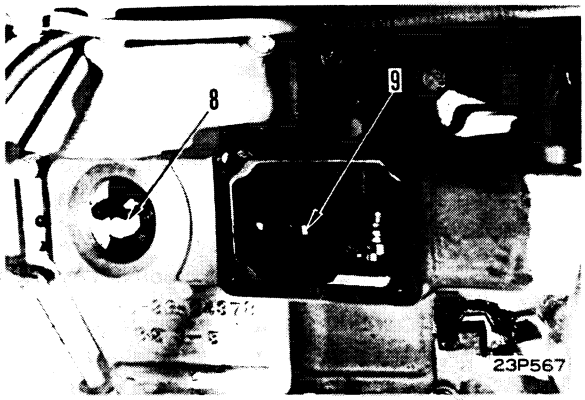
1) Fit a gasket to the mounting surface, sling brake booster assembly (10), and install the assembly lifting the rod of the brake bracket.
2) Tighten the mounting bolts evenly.

kgm Mounting bolt: **11.25 ± 1.25 kgm**



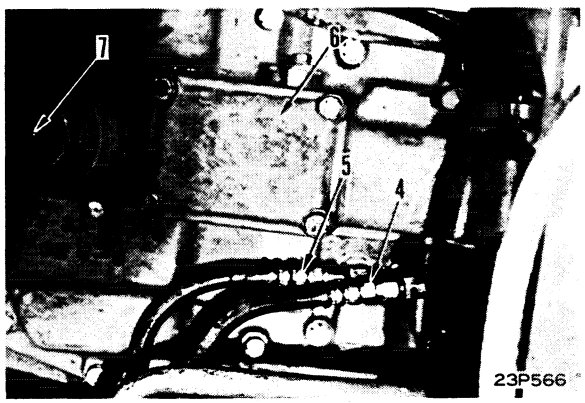
6. Anchor rod

Connect anchor rod (9).



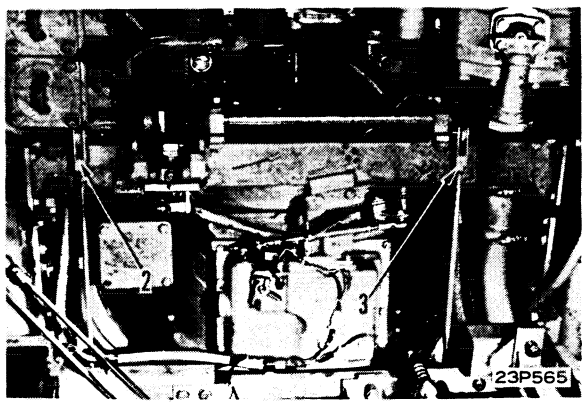
7. Hose

Install brake hose (5), and connect steering-brake interlocking valve inlet tube (4).



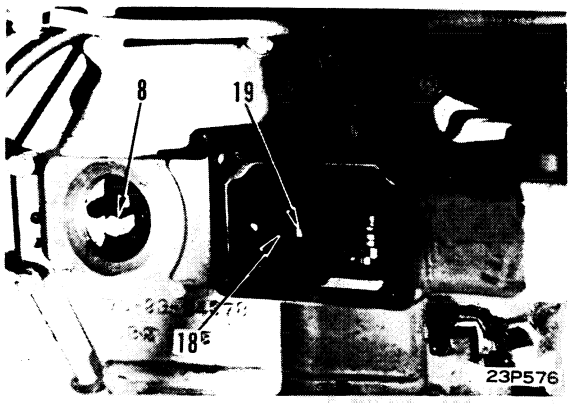
8. Brake rods

Connect brake rods (3) and (2) on the L.H. and R.H. sides.

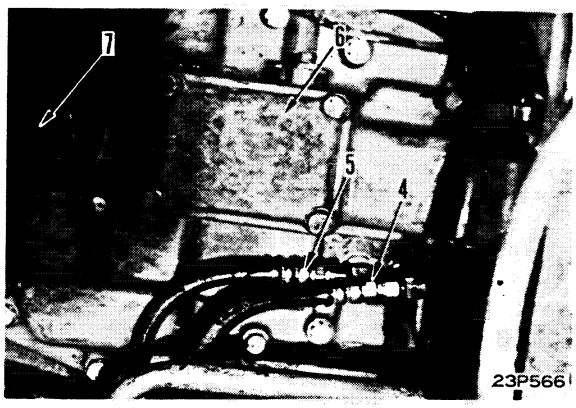


9. Brake adjustment

1) Tighten up brake adjustment bolt (8) until a sudden increase in the tightening torque is felt.
2) Turn adjusting turnbuckle bolt (18) until the booster piston comes into close contact with the roller on the lever tip.
3) Turn back the brake adjusting bolt by 1-1/6 revolution.
   ★ The clearance between the brake lining and the drum should be 0.3 mm at this stage.
4) Tighten lock nut (19) on the adjusting turnbuckle.
   ★ Check the lock plate on the brake adjustment bolt to see if it is securely locked.



5) Fit an O-ring to cap (7) and a gasket to cover (6).

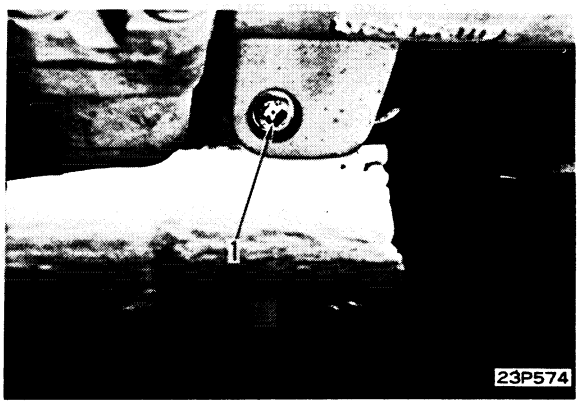


10. Fuel tank assembly

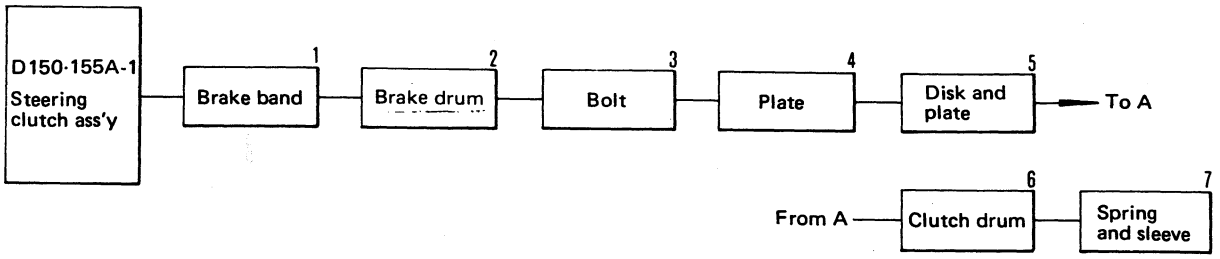
Mount the fuel tank assembly. For details, see MOUNTING FUEL TANK.

11. Adding oil

Make sure drain plug (1) is closed. Fill the clutch case with engine oil (E030-CD) through the oil filler up to the specified level on the level gauge.



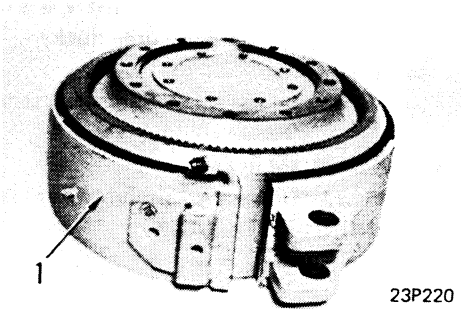
DISASSEMBLY OF STEERING CLUTCH



23F036

Special tools required

Special tools required		A
791-465-5000	Compressor	1
790-101-1101	Pump	1
790-101-2101	Puller (30 ton)	1

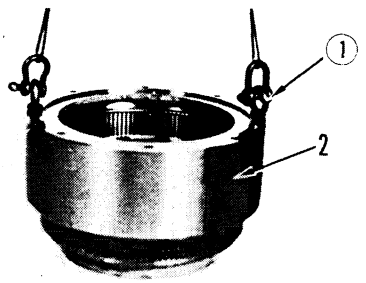


23P220

1. **Brake band**
   Remove band (1).

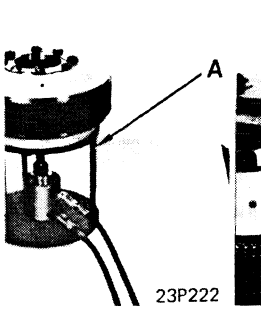
2. **Brake drum**
   Attach hanging bolts ① (16 mm, P=2.0) to brake drum (2) and sling brake drum.

   kg Brake drum: **50 kg.**

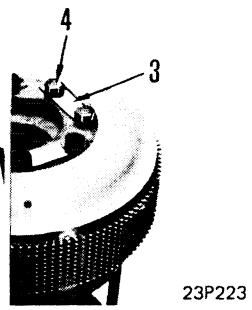


23P221

3. **Bolt**
   Set clutch assembly to special tool A. Bend lock plates (3) and expand special tool, puller, piston to protrude bolts (4) from clutch plate. Remove bolts.

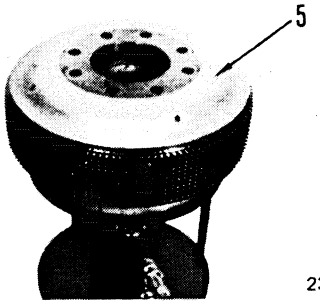


23P222



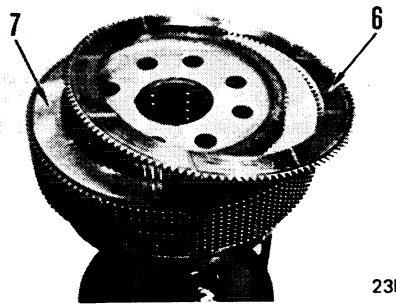
23P223

4. **Plate**
   Retract puller piston and remove pressure plate (5).



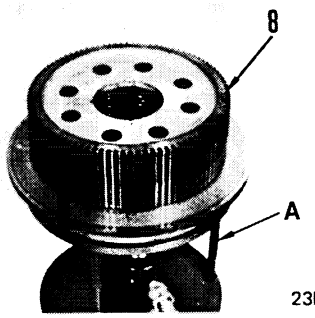
23P224

5. **Disk and plate**
   Remove disks (6) and plates (7).



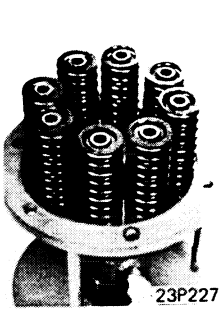
23P225

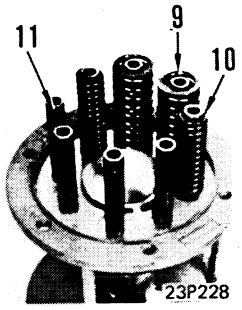
6. **Clutch drum**
   Remove joint bolts connecting clutch drum (8) to special tool A and remove clutch drum.



23P226

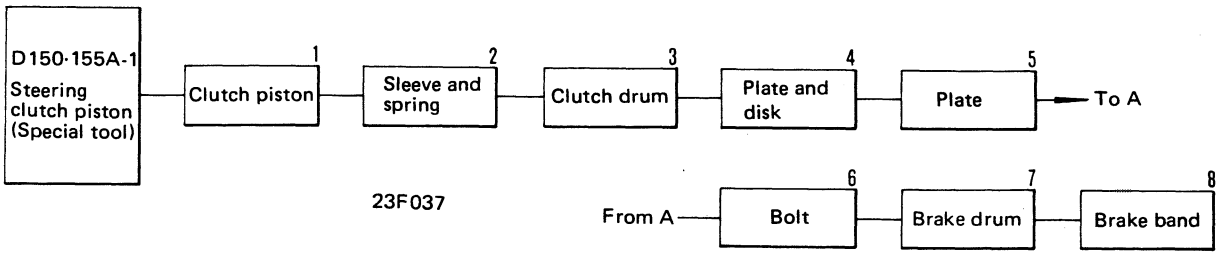
7. **Spring and sleeve**
   Remove large springs (9), small springs (10) and sleeves (11).


23P227



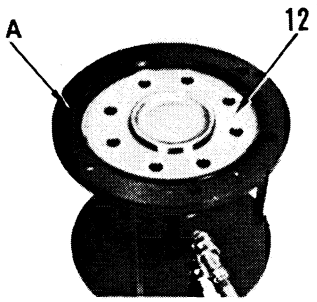
23P228

ASSEMBLY OF STEERING CLUTCH



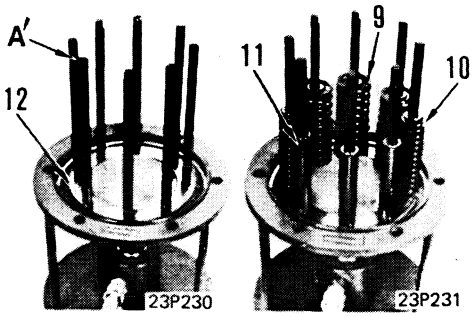
Special tools required

Special tools required		A
791-465-5000	Compressor	1
790-101-1101	Pump	1
790-101-2101	Puller (30 ton)	1



23P229

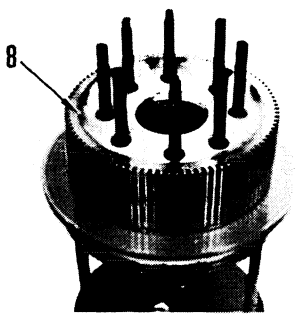
1. **Clutch piston**
   Fit seal ring to clutch pistons (12). Set special tool A on puller aligning their centers with each other.



23P230 23P231

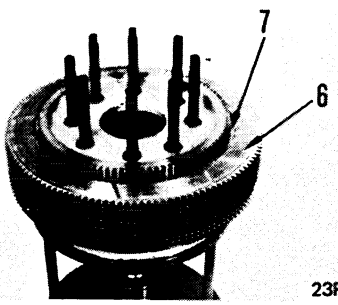
2. **Sleeve and spring**
   Fit guide bolts A' (assembly of 791-465-5000) to pistons (12). Position sleeves (11), small springs (10) and large springs (9).

3. **Clutch drum**
   Assemble clutch drum (8) and fit it to special tool with bolts.



23P232

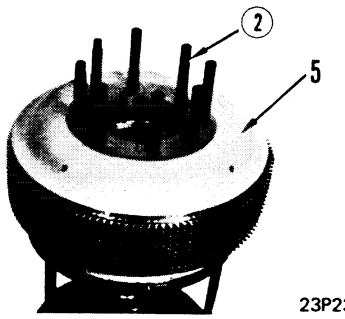
4. **Plate and disk**
   Install discs (6) and plates (7).



23P233

5. Plate

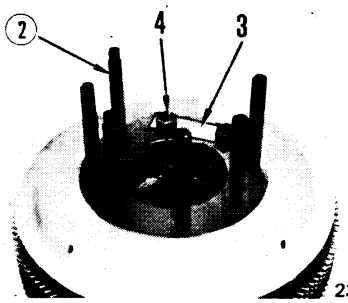
Install pressure plate (5) by aligning guide bolts with bolt holes in plate.



23P234

6. Bolt

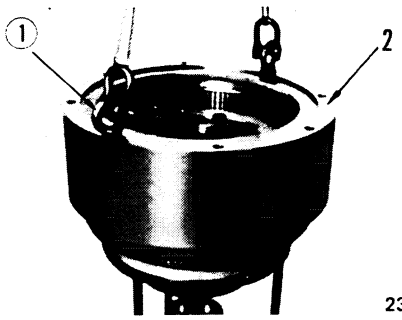
Remove guide bolts by expanding puller piston. Install lock plates (3) and bolts (4). Bend lock plates surely.



23P235

7. Drum

Expand puller piston to release contact between plates and disks. Sling brake drum (2) with crane using hanging bolt ① (16 mm, P=2.0), align teeth of discs with teeth inside the brake drum, and gradually lower the brake drum onto clutch drum. Take out clutch from special tool.

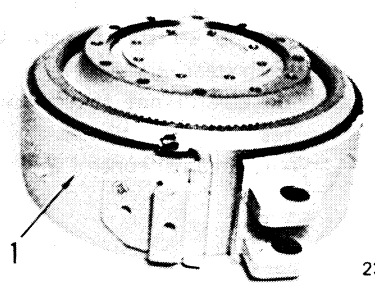


23P236

8. Brake band

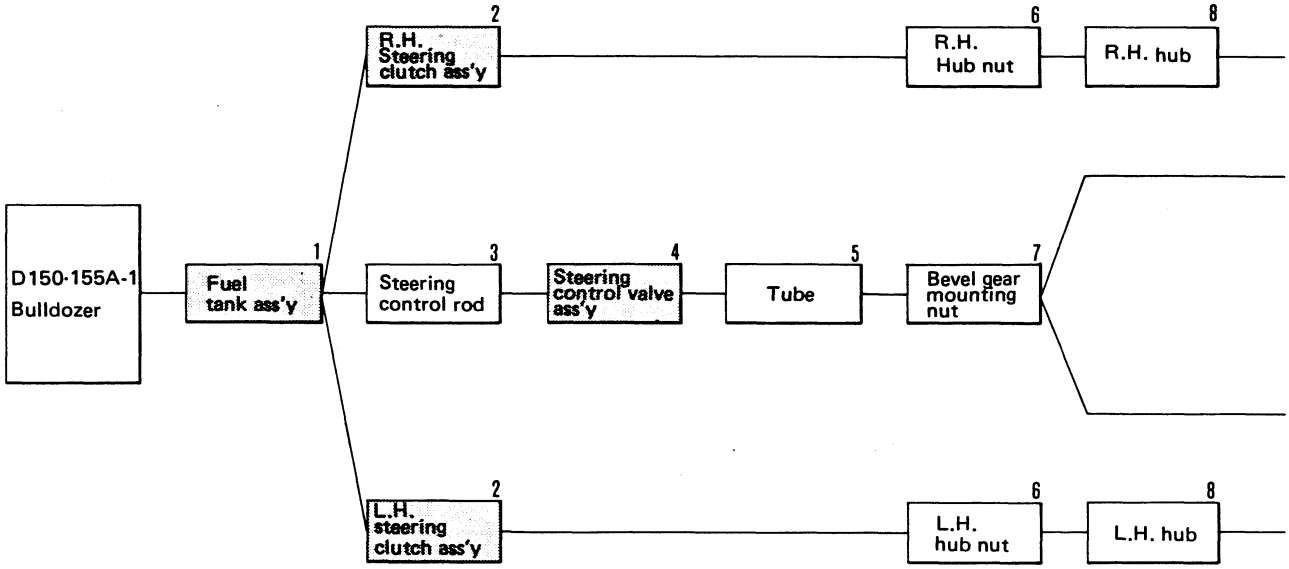
Install brake band (1).

★ Install brake band so that lubricating hose joint faces bevel gear shaft mounting side (piston side).



23P220

DISMOUNTING BEVEL GEAR AND BEVEL GEAR SHAFT



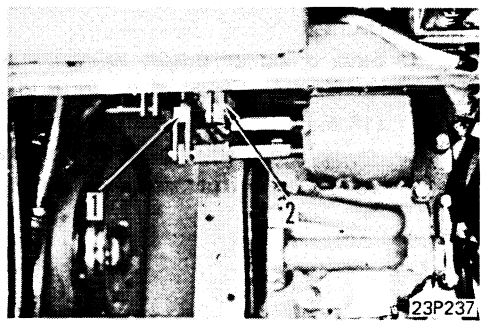
Special tools required

Special tools required		A	B
791-475-6000	Remover and installer	1	
791-465-1000	Remover		1
790-101-1101	Pump		1
790-101-1801	Puller (50 ton)		1

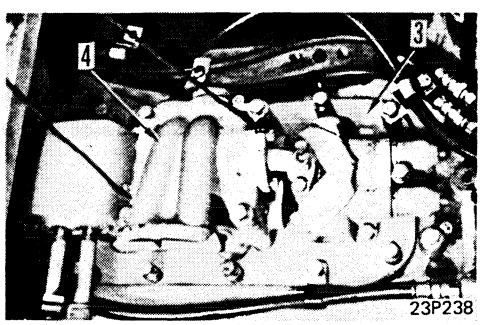
1. **Fuel tank assembly**
   Refer to DISMOUNTING FUEL TANK.

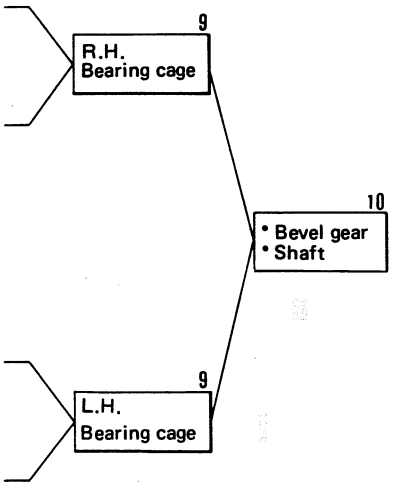
2. **Steering clutch assembly**
   Refer to DISMOUNTING STEERING CLUTCH.

3. **Steering control rod**
   Disconnect left control rod (1) and right control rod (2) from steering control valve.

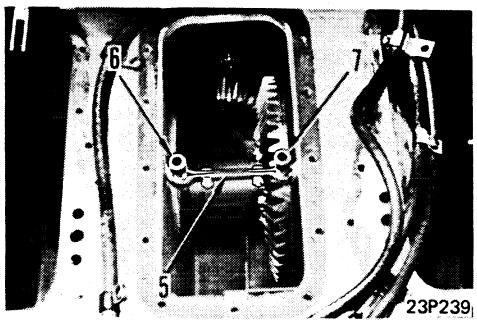


4. **Steering control valve assembly**
   Remove bolts fastening valve seat (3); remove valve seat together with steering valve (4).
   ★ Be careful not to confuse bolts which are used also for fastening hose clamps.
   kg Steering control valve and seat assembly: **65 kg**





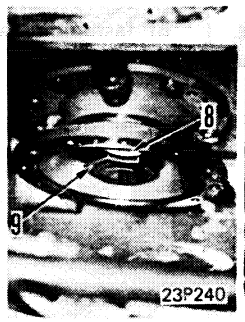
23F038



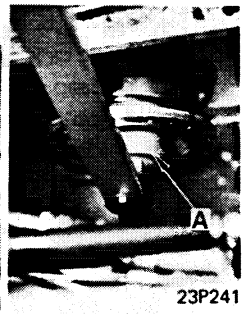
23P239

5. Tube

Remove clamp (5) fastening left clutch tube (6) and right clutch (7); remove tubes.



23P240



23P241

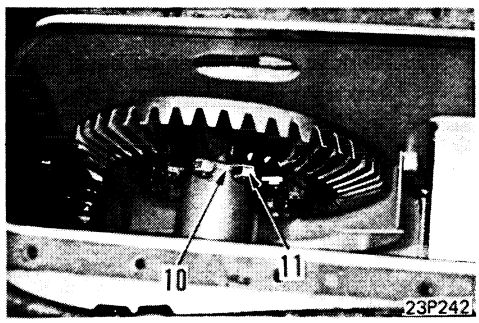
6. Hub nut

Bend down lockplate (8) and remove hub nut (9) with special tool A.

7. Bevel gear mounting nut

Insert bar through hub bolt hole to prevent bevel gear from rotating.

Bend down lockplate (10) and loosen bevel gear mounting nut (11).

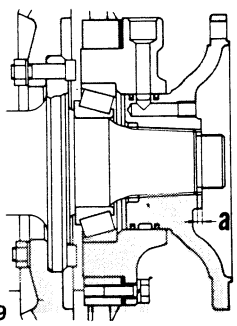


23P242

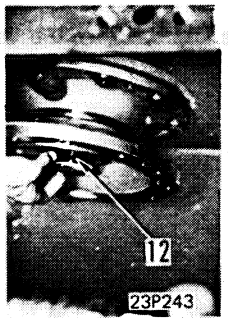
8. Hub

1) Remove gasket (12). Measure distance "a" between hub end face and bevel gear shaft step face.

★ Standard distance "a": 6 ± 0.5 mm



23F039

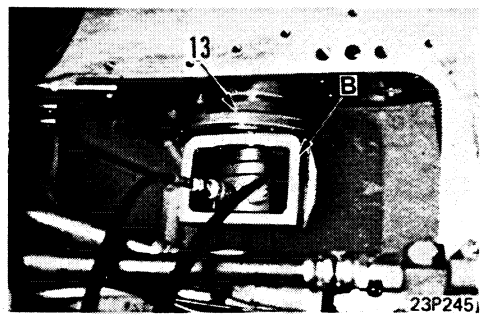


23P243



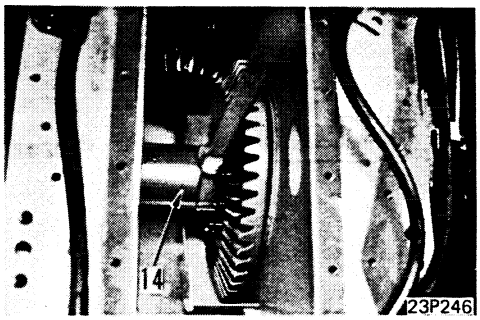
23P244

2) Remove hub (13) with special tool B.



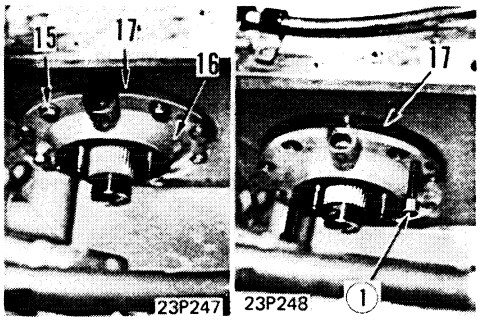
9. Bearing cage

1) Sling bevel gear shaft (14).



2) Remove bolts (15) fastening bearing cage (16). Remove bearing cage using jack bolts ① (14 mm, P=2.0).
   ★ Keep each pack of shims (17) for preload, backlash and tooth contact adjustment shim (17), with necessary identification about installation position, thickness and number of places.

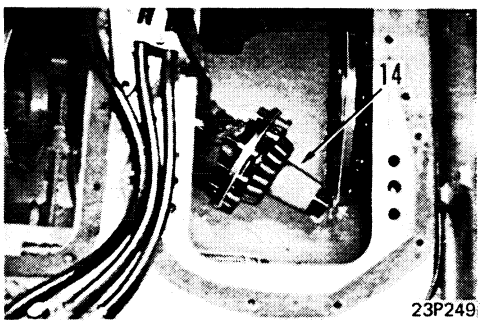
kg Bearing cage: **20 kg.**



10. Bevel gear, shaft

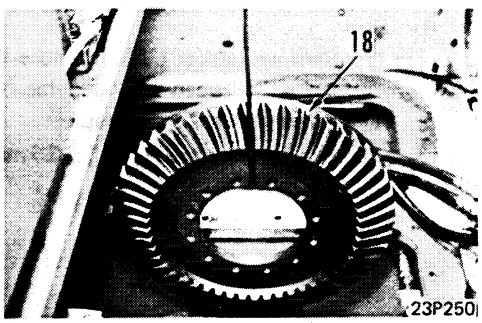
1) Remove bolts fastening bevel gear and pull out shaft (14) into right clutch housing. Lift off shaft with crane.

kg Bevel gear shaft: **40 kg.**



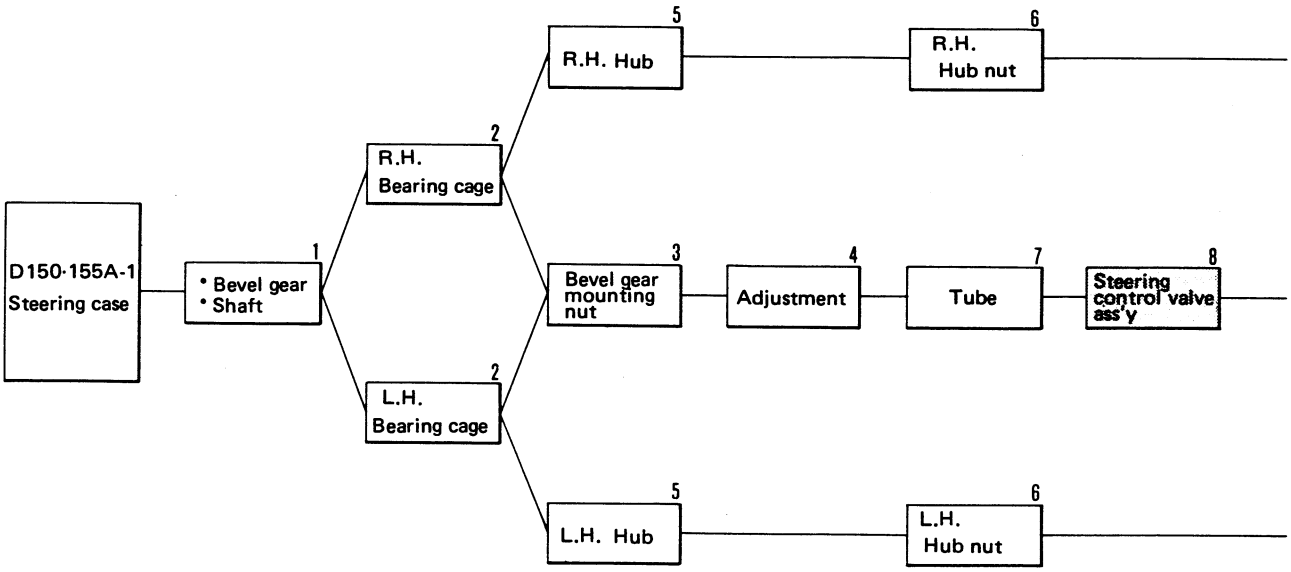
2) Lift off bevel gear (18) from bevel gear case.

kg Bevel gear: **35 kg**



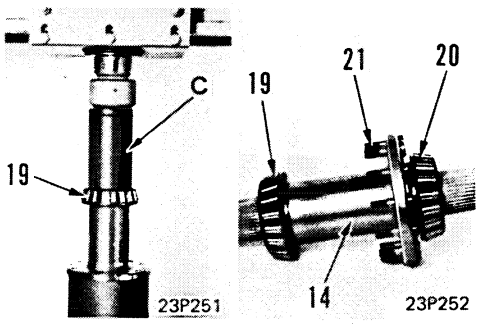
MOUNTING BEVEL GEAR AND BEVEL GEAR SHAFT

MOUNTING BEVEL GEAR AND BEVEL GEAR SHAFT

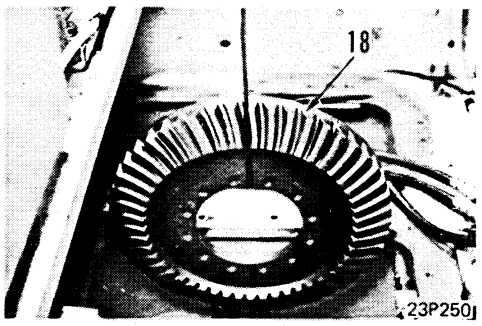


Special tools required

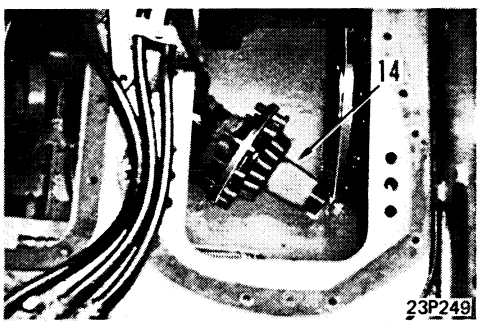
Special tools required		A	C	D
791-475-6000	Remover and installer	1		
790-201-2000	Push tool kit		1	
791-465-4000	Installer			1
790-101-1101	Pump			1
790-101-1801	Puller (50 ton)			1

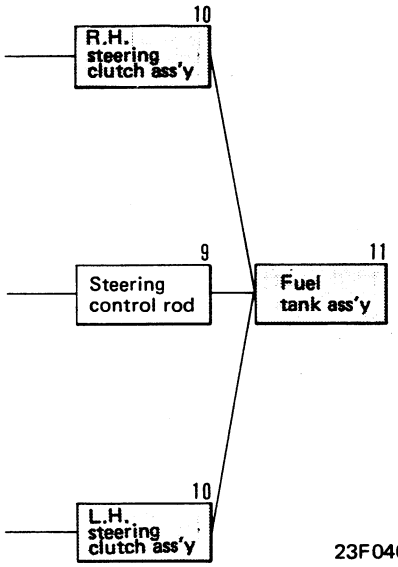


1. **Bevel gear, shaft**
   1) Press-fit bearings (19) and (20) onto shaft (14) using special tool, push tool (C). Assemble bevel gear mounting bolt (21).
   2) Lift bevel gear (18) into position in bevel gear case.



   3) Lift shaft (18) into position in right clutch housing. Insert it into bevel gear.
      ★ When bevel gear mounting bolt is pushed in, confirm that chamfered edge of bolt head is in close contact with shaft.





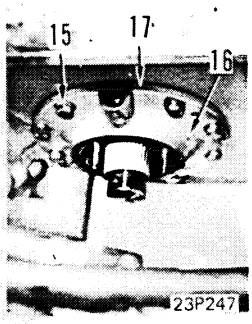
2. Bearing cage

1) Using guide bar ② (14 mm, P = 2.0), install bearing cage (15).

2) Set shim (17) into bearing cage and tighten mounting bolts (16).

kgm Bearing cage mounting bolt: **15 ~ 20 kg.m**

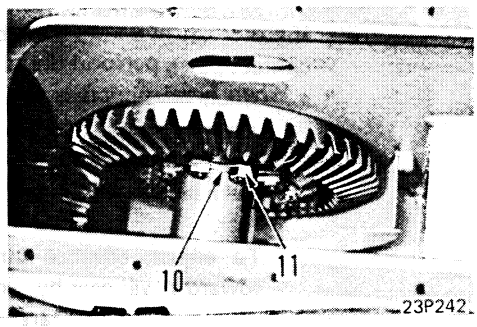




3. Bevel gear mounting nut

Temporarily fit hub to shaft and insert bar through hub bolt hole to prevent shaft from rotation. Tighten bevel gear mounting nut (11) and lock it with lockplate (10) securely.

kgm Bevel gear mounting nut: **23.5 ~ 31.5 kg.m**



4. Adjustment

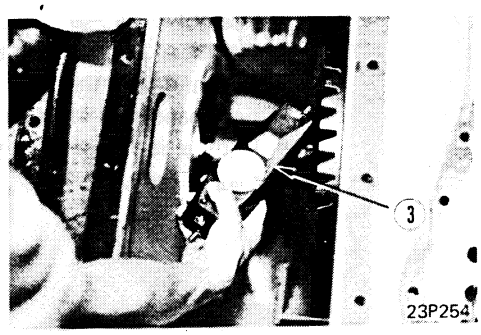
1) Adjustment of preload

i) Adjusting preload

Put push-pull scale ③ at a right angle to the tip of bevel gear tooth surface and measure bevel gear rotating force.

★ Standard value: **2 – 6 kg.**
(when bevel gear is not in mesh with bevel pinion.)

★ If measurement exceeds standard value, increase thickness of shim.
If measurement is smaller than standard value, decrease thickness of shim.



ii) Adjusting backlash
Insert a string of fuse (approx. 1.5 mm dia.) between bevel pinion (22) and bevel gear (18). Rotate bevel gear in direction of forward rotation and measure thickness of crushed fuse with micrometer.

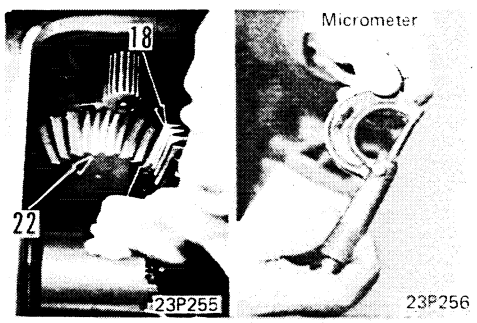
★ Position fuse at the center of bevel pinion tooth contact pattern (approx. 30% of tooth length from toe) and measure at least three points equally spaced around pinion.

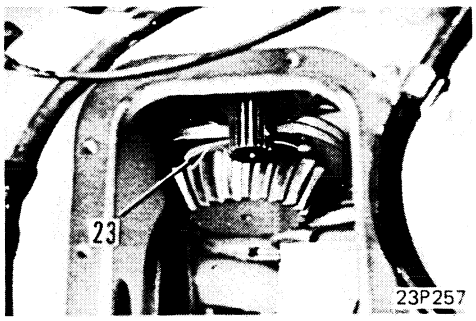
★ Standard value: **0.25 ~ 0.33 mm**

• When backlash is smaller than standard value
Decrease thickness of shim (23) on the bevel pinion side or decrease thickness of shim on the left-hand side of bevel gear and add the same thickness of shim to the right-hand side of bevel gear.

• When backlash is larger than standard value
Perform the above-mentioned adjustment of shim thickness in the opposite way.

⋆ When adjusting thickness of shim on the bevel gear side, be sure to equally adjust right and left shims to keep given preload unvaried.

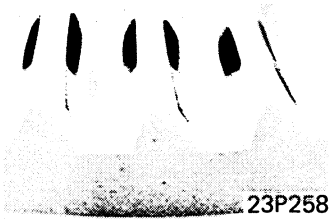




2) Adjustment of tooth contact

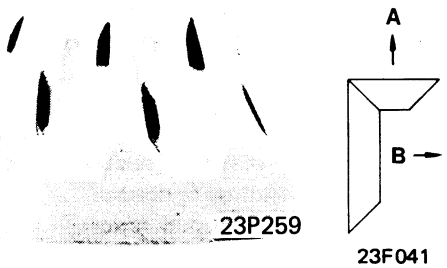
i) Apply a thin coat of red lead to bevel pinion tooth surface and rotate bevel gear back and forth.
Then, check bevel gear for tooth contact pattern.

★ It is desirable that pattern starts from near the toe and covers approx. 30% of tooth length in the middle of face width. When adjusted in such pattern condition, proper tooth contact of gear will be obtained under load.

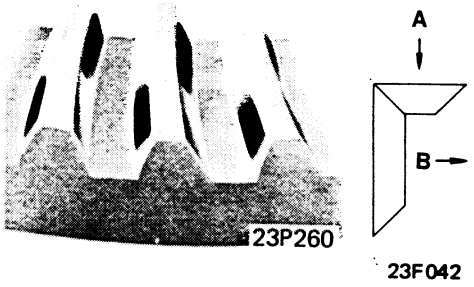


ii) If the result of inspection does not show normal tooth contact pattern, perform the following adjustment:

• When bevel pinion is positioned apart from bevel gear center line, pattern will appear at the toe side end of convex tooth surface of bevel gear and at the heel side end of concave tooth surface of bevel gear.
To adjust, advance pinion shaft in direction A toward bevel gear by removing necessary thickness of shim from clearance between bevel pinion assembly cage and transmission case; decrease thickness of shim on the lift-hand side of bevel gear and add the same thickness of shim to the right-hand side of bevel gear to advance bevel gear in direction B so that given gear backlash can be maintained unvaried.

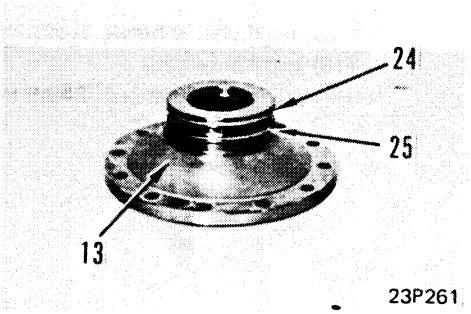


- When bevel pinion is positioned close to bevel gear center line, pattern will appear at the toe side end of concave tooth surface of bevel gear and at the gear.
  To adjust, advance pinion shaft in direction A and bevel gear in direction B, using the opposite of above-mentioned way.
  ★ When moving bevel gear back and forth, adjust equal thickness of shim on the right and left sides of bevel gear to maintain given preload unvaried.



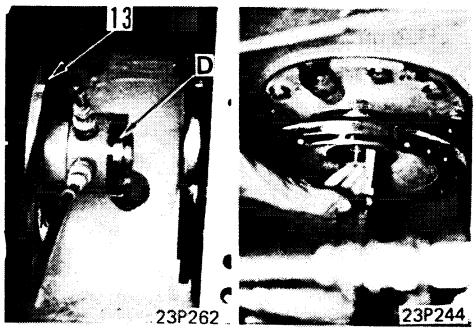
23F042

5. **Hub**
   1) Install seal rings (24) and (25) onto hub (13). Coat hub with engine oil (CAE 30, class CD).

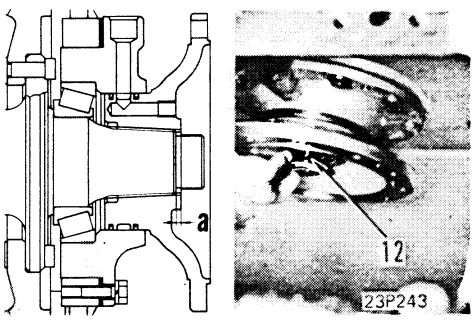


23P261

   2) Coat taper serration of hub (13) with anti-friction compound (LM-P). Install hub on bevel gear shaft, taking care not to damage seal ring, and press-fit with special tool D.
      ★ Hub press-fit force: **30 tons**

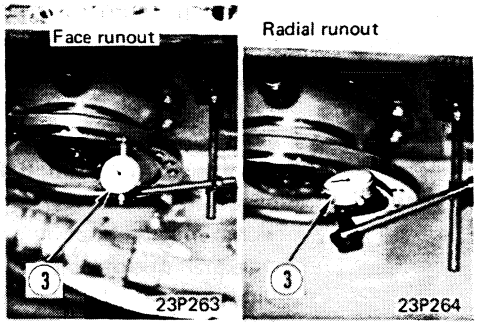


   3) Measure distance between hub end face and bevel gear shaft stepped face. After confirming that the measurement is within standard range, install gasket (12).
      ★ Standard distance "a": **6 ± 0.5 mm**

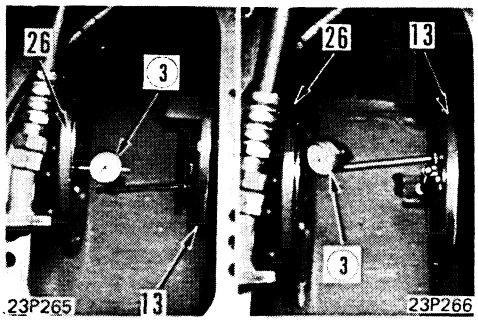


23F039

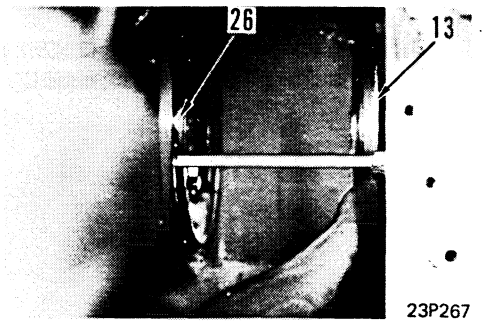
4) Check radial runout and face runout of hub with dial gauge ③.
   i) Check radial runout and face runout of hub alone.
      ★ Standard face runout: **0.15 mm**
      Radial runout: **0.15 mm**



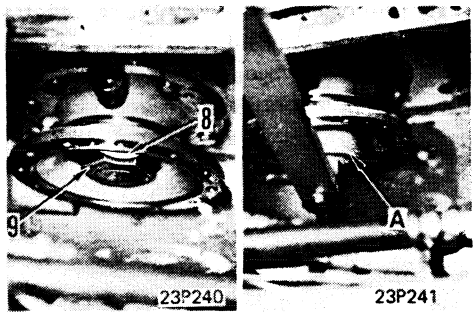
   ii) Check radial runout and face runout of hub (13) fitted to flange (26) with dial gauge ③.
      ★ Standard face runout: **0.15 mm**
      Radial runout: **0.15 mm**
      ★ When measuring runout, rotate a part to which dial gauge stand is attached. (It is favorable to attach dial gauge stand to hub. When stand is attached to flange, track must be rotated.)



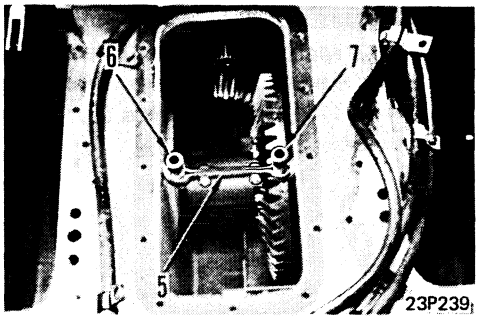
5) Measure distance between clutch mounting surfaces on hub (13) and flange (26).
   ★ Standard distance: **218.5 mm**



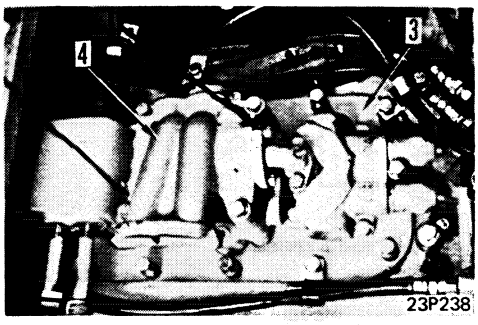
6. **Hub nut**
   Tighten hub nut (9) with special tool A and lock it with lock-plate (8) surely bent.
   kgm Hub nut: **65 ~ 75 kg.m**



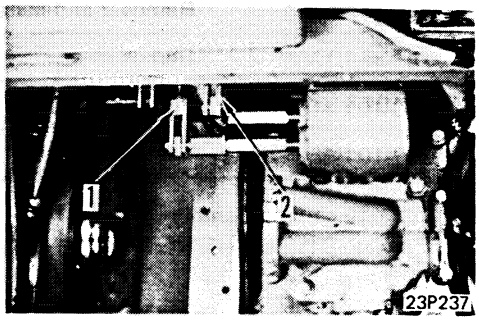
7. **Tube**
   Install tubes (6) and (7) with O-ring coated with grease (G2-LI) fitted to each end. Install clamp (5).



8. **Steering control valve assembly**
   1) Fit gasket between seat (3) and steering case coated with gasket sealant (LG-1) to steering case.
   2) Lift seat (3) and steering control valve (4) as an assembly into position and secure assembly to steering case with bolts coated with gasket sealant (LG-1).
      ★ Some bolts are used also for fastening pipe clamps. Do not confuse them.



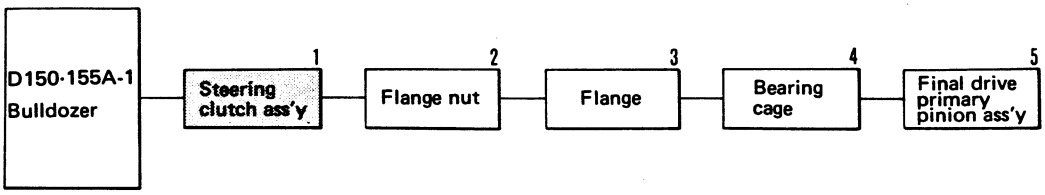
9. **Steering control rod**
   Connect left control rod (1) and right control rod (2) to steering control valve.
   ★ Surely bend cotter pins for connecting pins.



10. **Steering clutch assembly**
    Refer to MOUNTING STEERING CLUTCH.

11. **Fuel tank assembly**
    Refer to MOUNTING FUEL TANK.

DISMOUNTING FINAL DRIVE 1st PINION

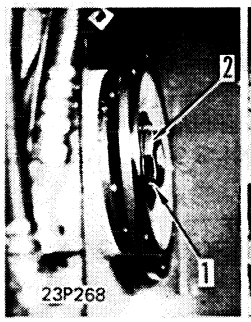


23F043

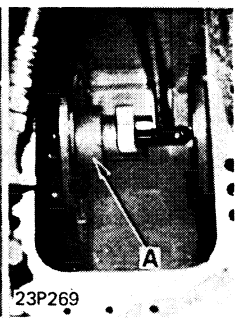
Special tools required

Special tools required		A	B
791-475-6000	Remover and installer	1	
791-465-1000	Remover		1
790-101-1101	Pump		1
790-101-1801	Puller (50 tona)		1

1. Steering clutch assembly
Refer to DISMOUNTING STEERING CLUTCH.



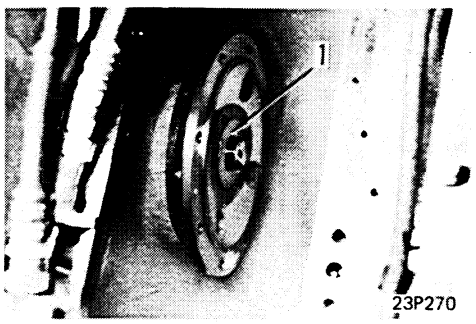
23P268



23P269

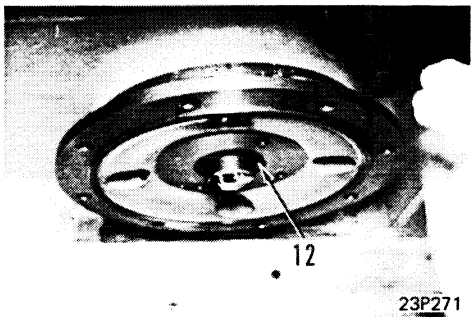
2. Flange nut
1) Bend down lock plate (1) and remove flange nut (2) with special tool A.

2) Remove lock plate (1).

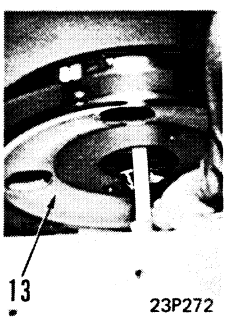


23P270

3. Flange
1) Remove gasket (3). Measure distance "a" between flange end face and pinion shaft stepped face.
★ Standard distance: **0 ± 0.5 mm**

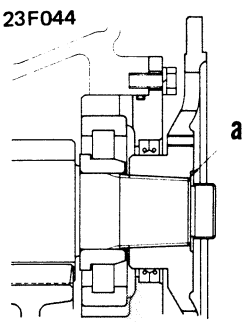


23P271

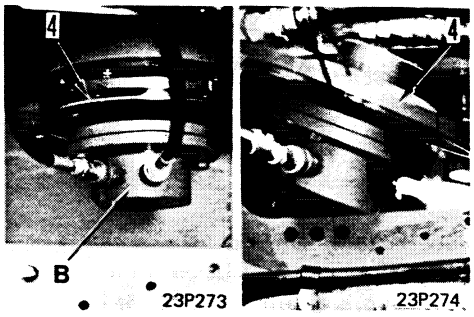


23P272

23F044

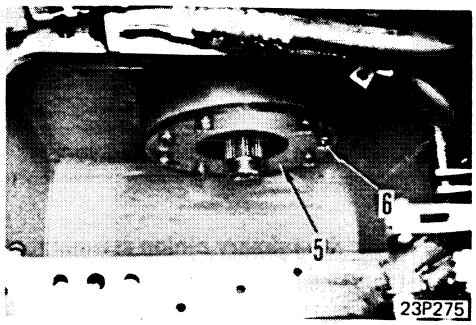


2) Remove flange (4) with special tool B.

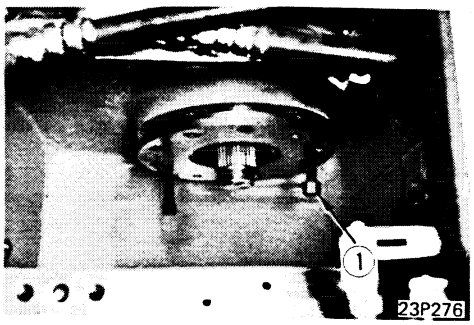


4. Bearing cage

1) Remove bolts (6) fastening bearing cage (5).

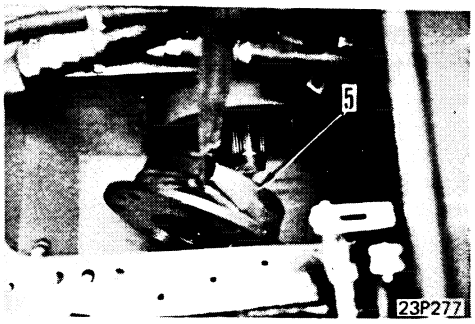


2) Using jack bolts ① (16 mm, P=2.0, ℓ=80 mm or more), remove bearing cage (5).



3) Lift off bearing cage (5).
   ★ If primary pinion is removed out of place together with bearing cage, separate pinion from bearing cage inside steering case.

kg Bearing cage: **25 kg**

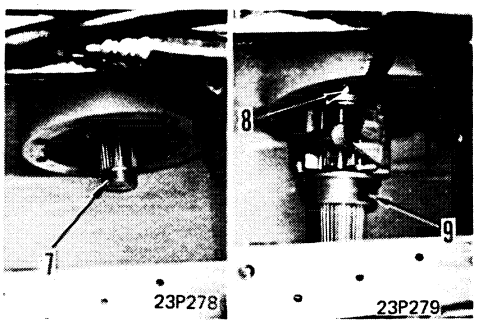


5. Final drive primary pinion assembly

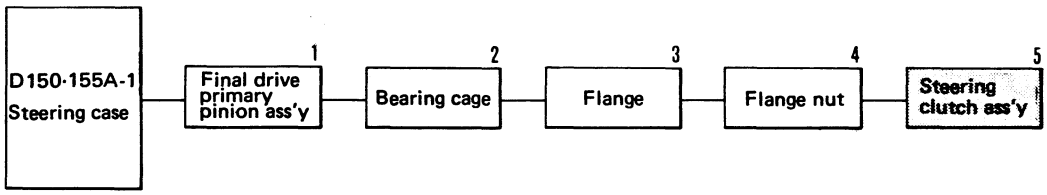
Pull out primary pinion assembly (7) inside steering case. Lift off assembly with crane.

★ Be careful not to damage bearing inner races (8) and (9) on pinion shaft and bearing cage contact surface of steering case.

kg Final drive primary pinion assembly: **25 kg.**



MOUNTING FINAL DRIVE 1st PINION



23F045

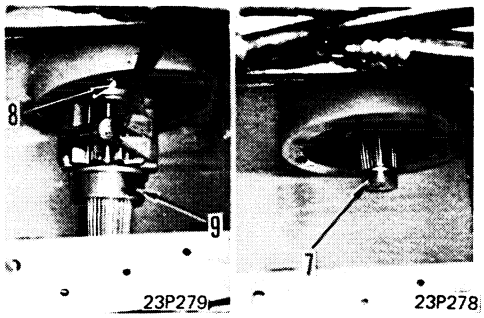
Special tools required

Special tools required		A	C
791-475-6000	Remover and installer	1	
791-465-4000	Installer		1
790-101-1101	Pump		1
790-101-1801	Puller (50 tons)		1

1. Final drive primary pinion assembly

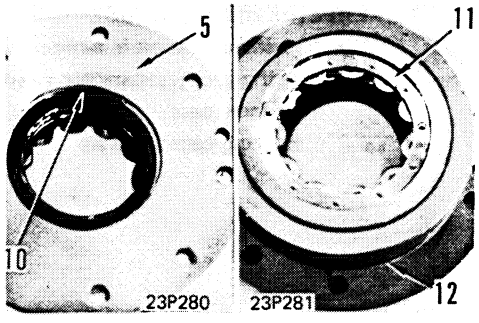
1) Install bearing inner races (8) and (9) in primary pinion assembly (7). Lift assembly with crane into position in steering case.

2) Insert pinion assembly into final drive case.
   ★ Confirm if bearing inner race on pinion shaft and bearing cage contact surface of steering case are scratched.

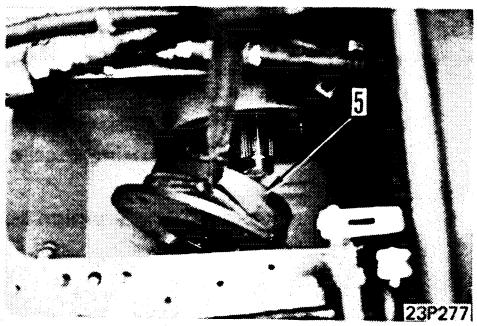


2. Bearing cage

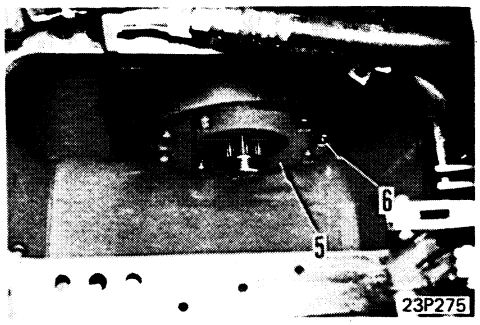
1) Fit oil seal (10), bearing (11) and O-ring (12) to bearing cage (5).
   ★ Confirm if oil seal lip surface is scratched by touching it by hands.



2) Coat O-ring with grease (G2-LI) and lift bearing cage (5) into position in steering case.

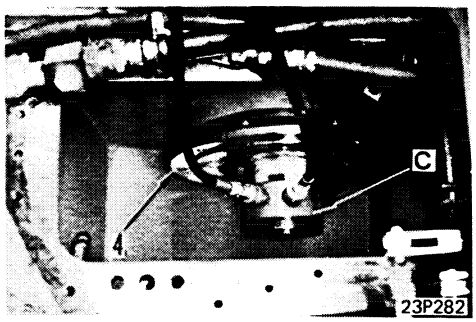


3) Secure bearing cage (5) to steering case with bolts (6) coated with thread tightener (LT-2).
kgm Mounting bolt: **23.5 ~ 31.5 kg.m**

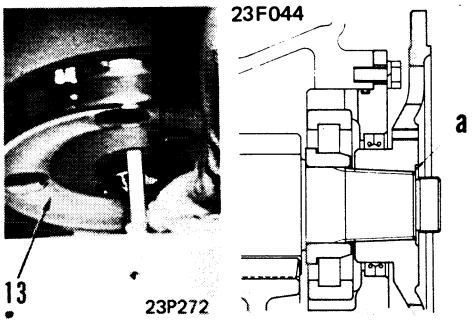


3. Flange

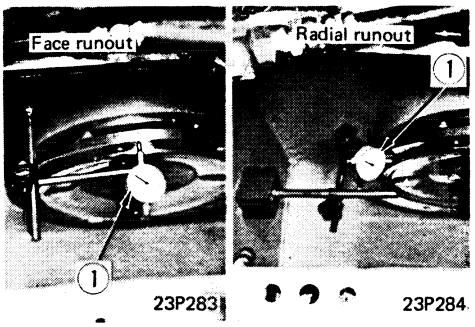
1) Coat splines of flange (4) with anti-friction compound (LM-P) and press-fit flange with special tool C.
★ Press-fit force: **30 tons**



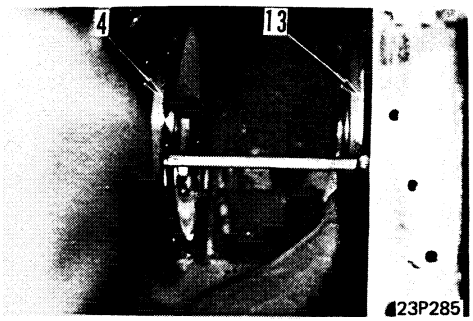
2) Measure distance "a" between flange end face and pinion shaft stepped face.
★ Standard distance "a": **0 ± 0.5 mm**



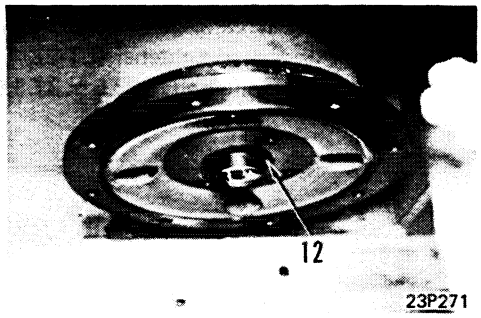
3) Measure radial runout and face runout of flange alone with dial guage ① .
★ Standard face runout: **within 0.08 mm**
Radial runout: **within 0.08 mm**



4) Measure distance between clutch mounting surfaces on flange (4) and hub (13).
★ Standard distance: **218.5 mm**

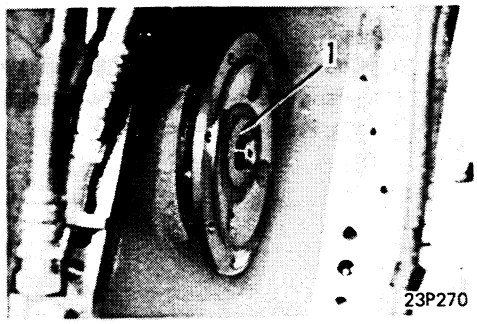


5) Install gasket (3).



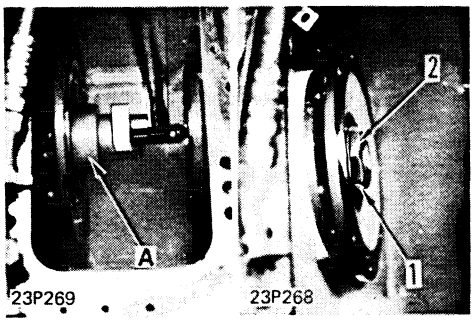
4. Flange nut

1) Install lock plate (1).



2) Tighten flange nut (2) with special tool A and lock with lock plate (1) surely bent.

kgm Flange nut; **150 ± 15 kg.m**

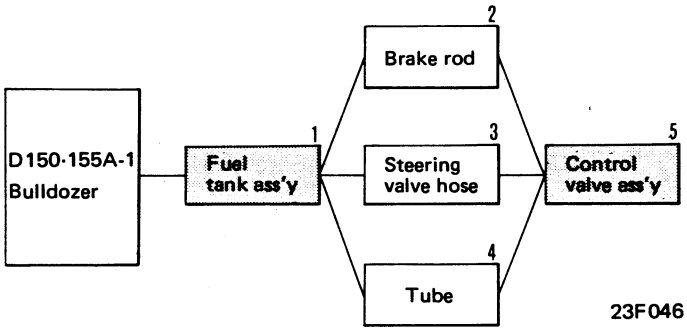


5. Steering clutch assembly

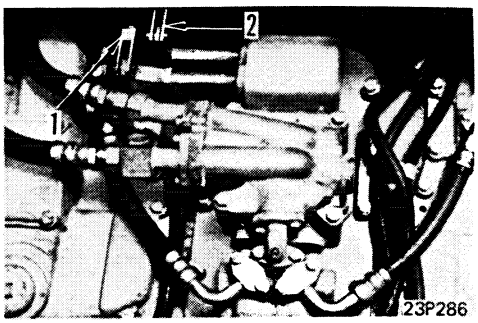
Refer to MOUNTING STEERING CLUTCH.

DISMOUNTING STEERING CONTROL VALVE

D150A 8408 and up
D155A 15001 – 25000

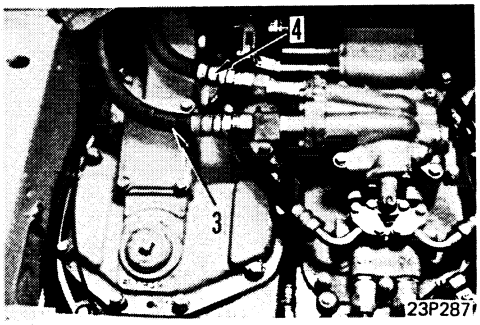


1. **Fuel tank assembly**
   Refer to DISMOUNTING FUEL TANK

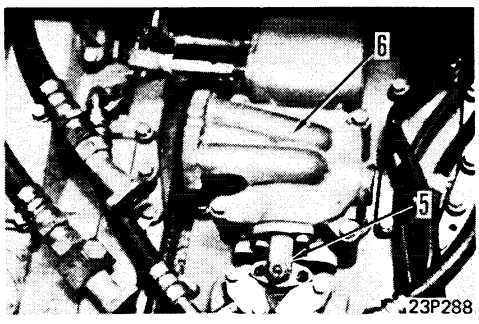


2. **Brake rod**
   Disconnect left steering brake rod (1) and right steering brake rod (2).

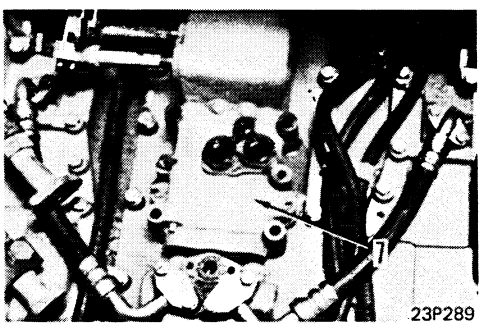
3. **Steering valve hose**
   Disconnect inlet hose (3) and outlet hose (4).



4. **Tube**
   Remove tube (5) connecting control valve to brake relief valve.

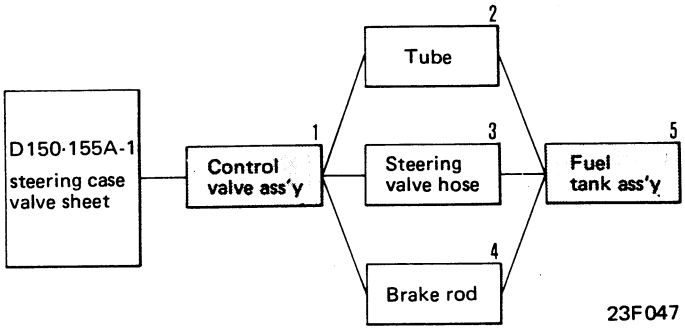


5. **Control valve assembly**
   1) Remove main relief valve assembly (6).
   2) Remove control valve assembly (7).
   kg Main relief valve assembly: **15 kg**
   Control valve assembly: **25 kg**



MOUNTING STEERING CONTROL VALVE

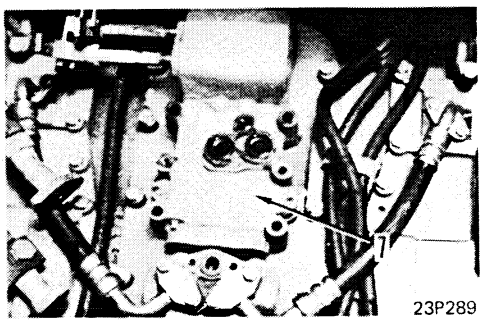
D150A 8408 and up
D150A 15001 – 25000



1. Control valve assembly

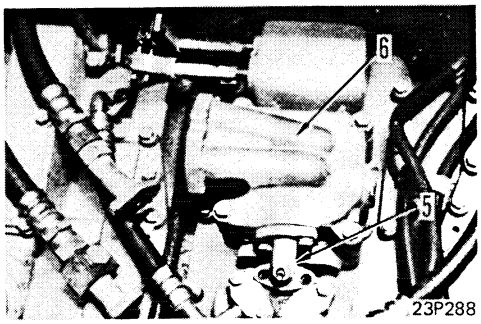
1) Install control valve assembly (7) with O-ring fitted to mounting surface.
2) Install main relief valve assembly (6) with O-ring fitted to mounting surface and tighten mounting bolts.

kgm Valve mounting bolt: **10 – 12.5 kgm**



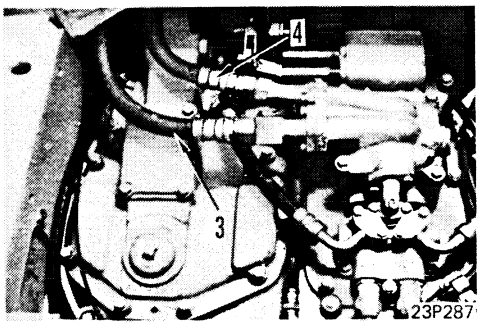
2. Tube

Install tube (5), with O-ring fitted to each mounting surface, between control valve and brake relief valve.



3. Steering valve hose

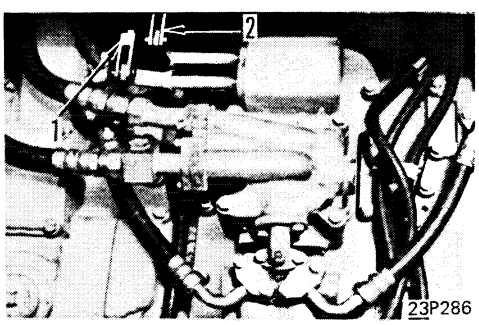
Connect inlet hose (3) and outlet hose (4) to steering valve.



4. Brake rod

Connect brake rods (2) and (1) to valve.

★ Surely bend cotter pins on rod mounting pins.



5. Fuel tank assembly

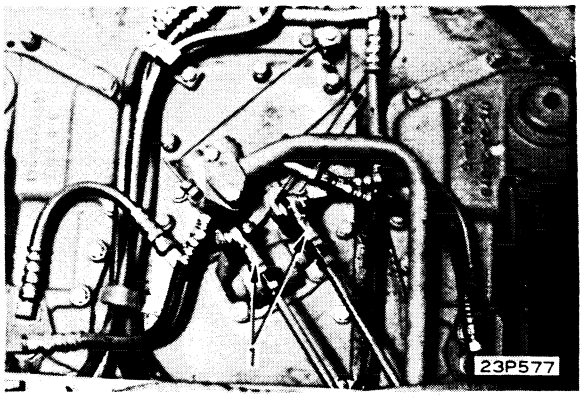
Refer to MOUNTING FUEL TANK.

DISMOUNTING STEERING BRAKE INTERLOCKING VALVE

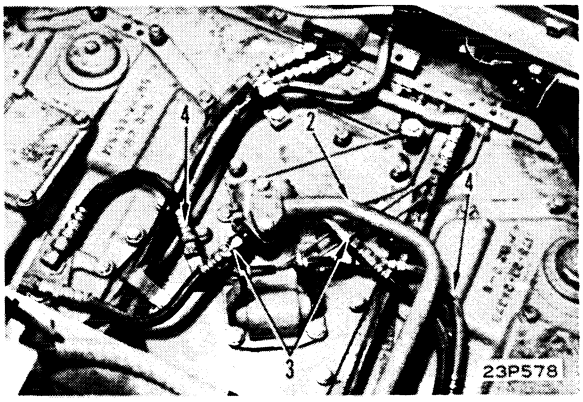
D155A 25001 and up

1. Dismount the fuel tank assembly. For details, see DISMOUNTING FUEL TANK ASSEMBLY.

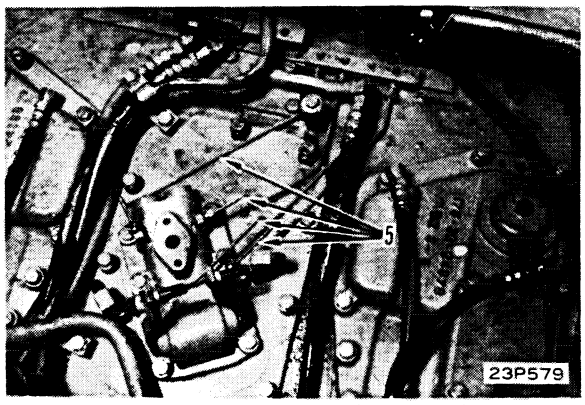
2. Disconnect two steering control rods (1).



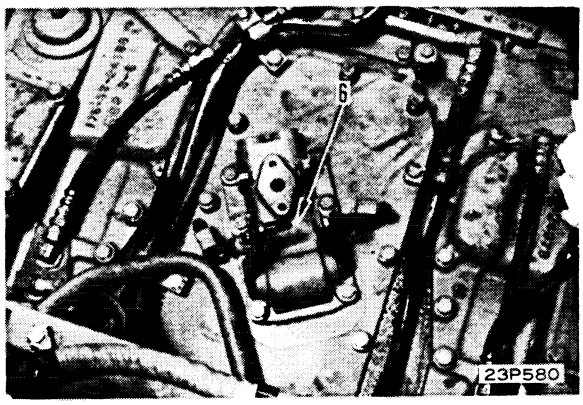
3. **Steering brake interlocking valve piping**
   1) Disconnect valve inlet tube (2).
   2) Disconnect outlet hose (3) and two brake hoses (4).



4. **Oil pressure measuring tubes**
   Disconnect four oil pressure measuring tubes (5).



5. **Steering brake interlocking valve assembly**
   Remove steering brake interlocking valve assembly (6).

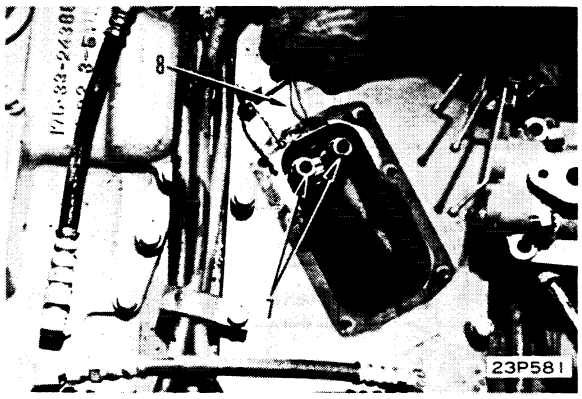


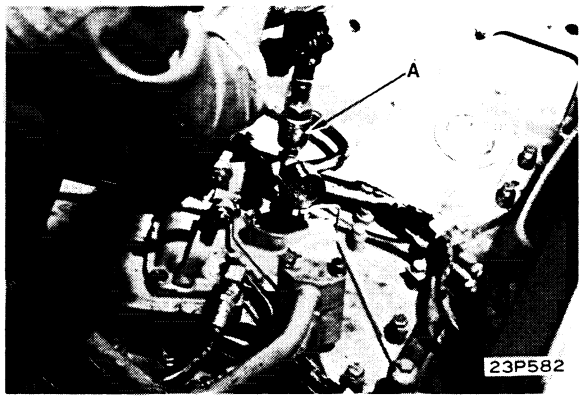
MOUNTING STEERING BRAKE INTERLOCKING VALVE

D155A 25001 and up

Special tool required

Part number	Description	A
799-301-1300	Air checker	1





1. **Steering brake interlocking valve assembly**
   Fit a gasket to the mounting surface, and align steering-brake interlocking valve assembly (6) with two steering tubes (7), and install it.
   ★ Align the tubes with the holes on the valve assembly by pulling the tubes forward with wires (8).

2. **Steering brake interlocking valve piping**
   1) Connect brake hoses (4) and outlet hose (3).
   2) Use air checker A to confirm that the tubes are properly fitted into the valve assembly.
      ★ Confirm that the air pressure is properly maintained when air pressure is applied and the steering lever is operated.
         ★ Air pressure: 3 – 5 kg/cm^2
      ★ If the tubes are not properly fitted, you can hear the air leaking.
   3) Connect valve tube (2).

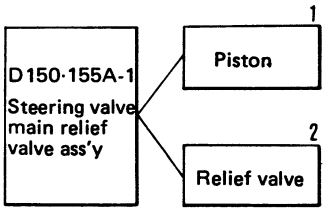
3. **Oil pressure measuring tubes**
   Connect four oil pressure measuring tubes (5).

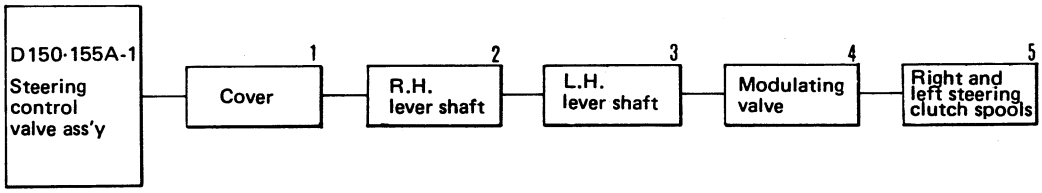
4. Connect R.H. and L.H. steering control rods (1).

5. Mount the fuel tank assembly. For details, see MOUNTING FUEL TANK ASSEMBLY.

DISASSEMBLY OF STEERING CONTROL VALVE

D150A 8408 and up
D155A 15001 – 25000



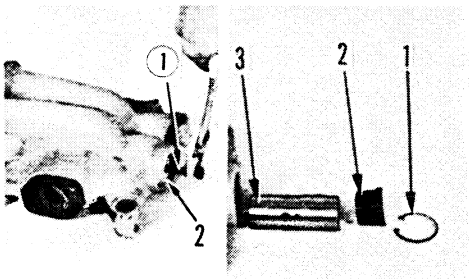


23F048

DISASSEMBLY OF MAIN RELIEF VALVE

1. Piston

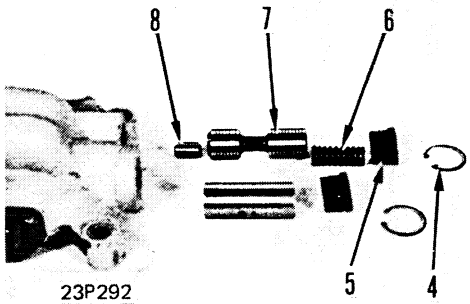
1) Remove snap ring (1). Screw jack bolt ① (8 mm, P = 1.25) in stopper (2). Pull jack bolt with pliers to pull out stopper and remove piston (3).



23P290 23P291

2. Relief valve

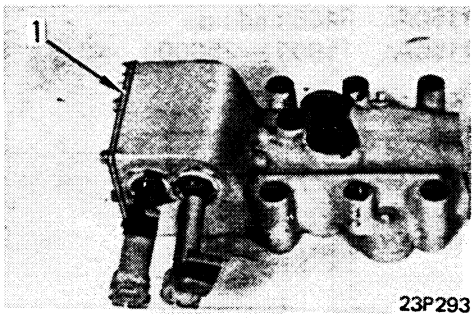
1) Remove snap ring (4). Screw jack bolt ① (8 mm, P = 1.25) in stopper (5). Pull jack bolt with pliers to pull out stopper and remove spring (6), valve (7) and piston (8).



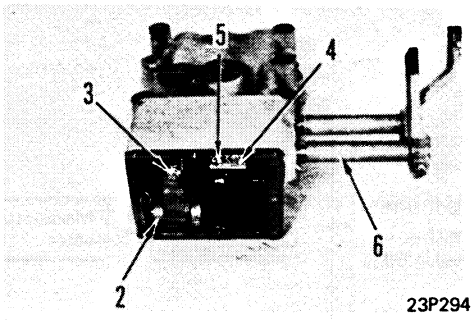
23P292

DISASSEMBLY OF STEERING CONTROL VALVE

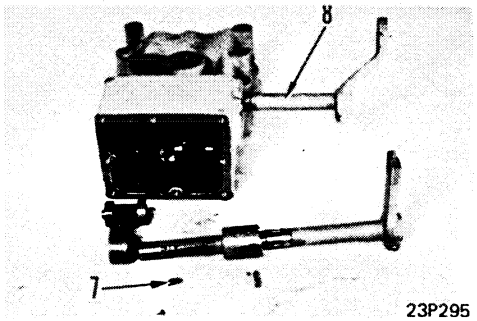
1. Cover
Remove cover (1).



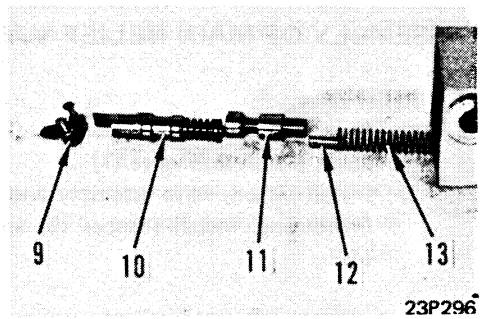
2. R.H. lever shaft
1) Remove bolts (3) fastening lever (2).
2) Cut wire and remove bolts (5) installing bushing (4). Pull R.H. lever shaft (6) out.
★ When removing lever shaft, lever mounting key (7) must be removed inside housing.



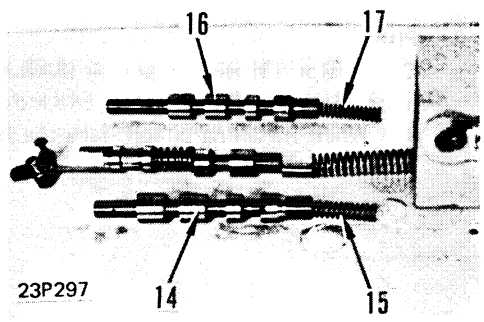
3. L.H. lever shaft
Pull L.H. lever shaft (8) using the same procedure as described for R.H. lever shaft.



4. Modulating valve
Remove plate (9). Remove spool (10), valve (11), piston (12) and spring (13).

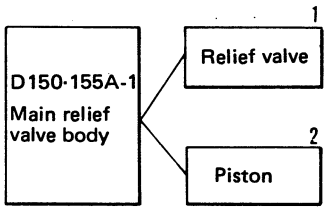


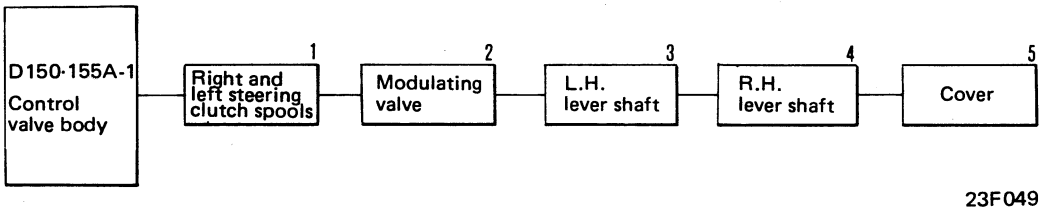
5. Right and left steering clutch spools
Remove L.H. spool (14), spring (15), R.H. spool (16) and spring (17).



ASSEMBLY OF STEERING CONTROL VALVE

D150A 8408 and up
D155A 15001 – 25000

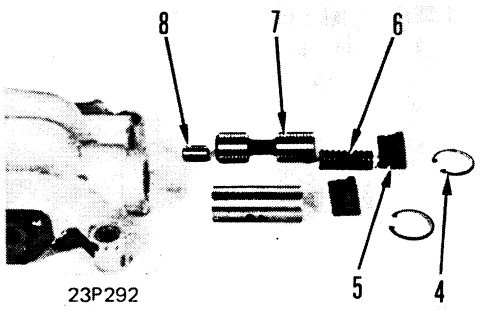




23F049

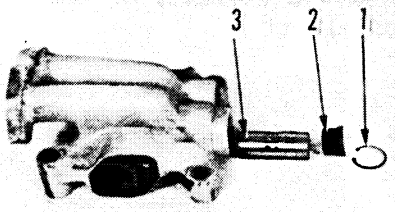
ASSEMBLY OF MAIN RELIEF VALVE

1. **Relief valve**
   1) Coat piston (8) with engine oil (SAE30, class CD) and insert piston into valve (7).
   2) Install piston, valve assembly and spring (6), in that order, in housing. Install stopper (5) and lock it with snap ring (4).



23P292

2. **Piston**
   Coat piston (3) with engine oil (SAE30, class CD). Install piston in housing. Install stopper (2) and lock it with snap ring (1).
   ★ When installing piston, face the larger oil hole toward piping installation side.



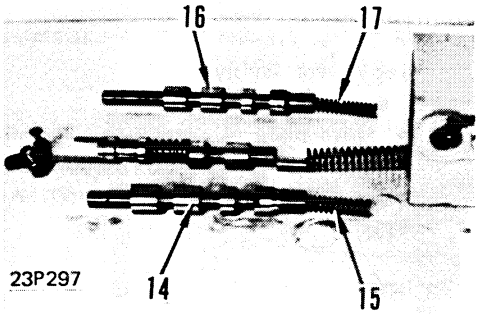
23P298

ASSEMBLY OF STEERING CONTROL VALVE

1. Right and left steering clutch spools

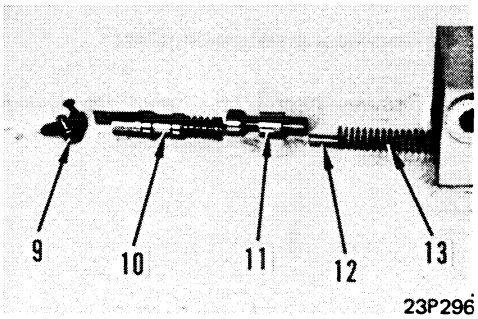
Apply engine oil (SAE30, class CD) to R.H. spool (16) and L.H. spool (14).

Attach springs (17) and (15) to the respective spools. Position spools in valve housing.



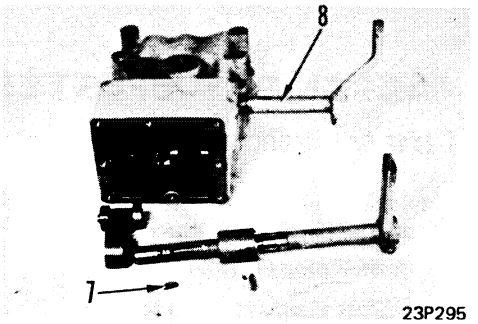
2. Modulating valve

1) Insert piston (12) coated with engine oil (SAE30, class CD) into valve (11). Install spring (13), valve and spool (10)in that order.
2) Install plate (9) with bolts.
   ★ When installing spools, place the spool with longer notch on the right (the left toward housing).



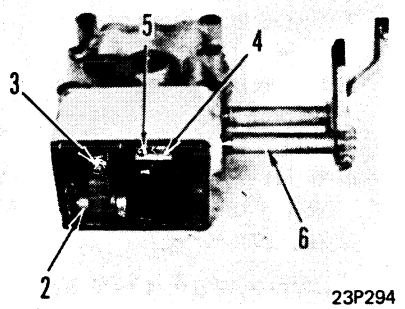
3. L.H. lever shaft

1) Insert lever shaft (8) into housing. Assemble shaft in bushing, tighten lock bolt and lock it securely with wire.
2) Install lever with bolts.



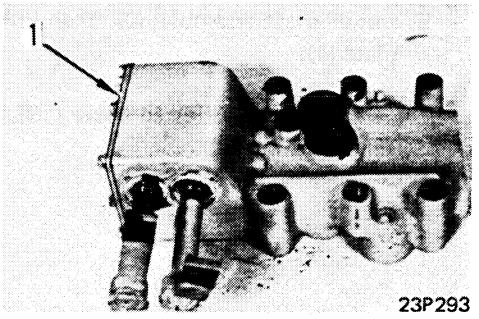
4. R.H. lever shaft

1) Insert lever shaft (6) into housing. Fit bushing (4) onto shaft. Tighten lock bolt (5) and surely lock it with wire.
2) Install lever (2) with bolts (3).
   ★ Position right and left levers so that the center of lever bolt hole is distant 31 mm from bushing end face.



5. Cover

Install cover (1) with gasket fitted on mounting surface.



DISASSEMBLY OF STEERING BRAKE INTERLOCKING VALVE

D155A 25001 and up

1. Remove brake control valve assembly (2) from steering valve assembly (1).
2. Remove plate (4), guide (5), and shaft assembly (6) from brake assembly (2). Remove plug (7), spring (8), valve (9), and piston (10) from brake valve assembly (2).
3. Remove bolt (11), pull out lever (12), and remove lever (13).
4. Remove shaft assembly (14).
5. Remove plug (15), then remove spring (16), valve (17), and piston (18).

ASSEMBLY OF STEERING BRAKE INTERLOCKING VALVE

D155A 25001 and up

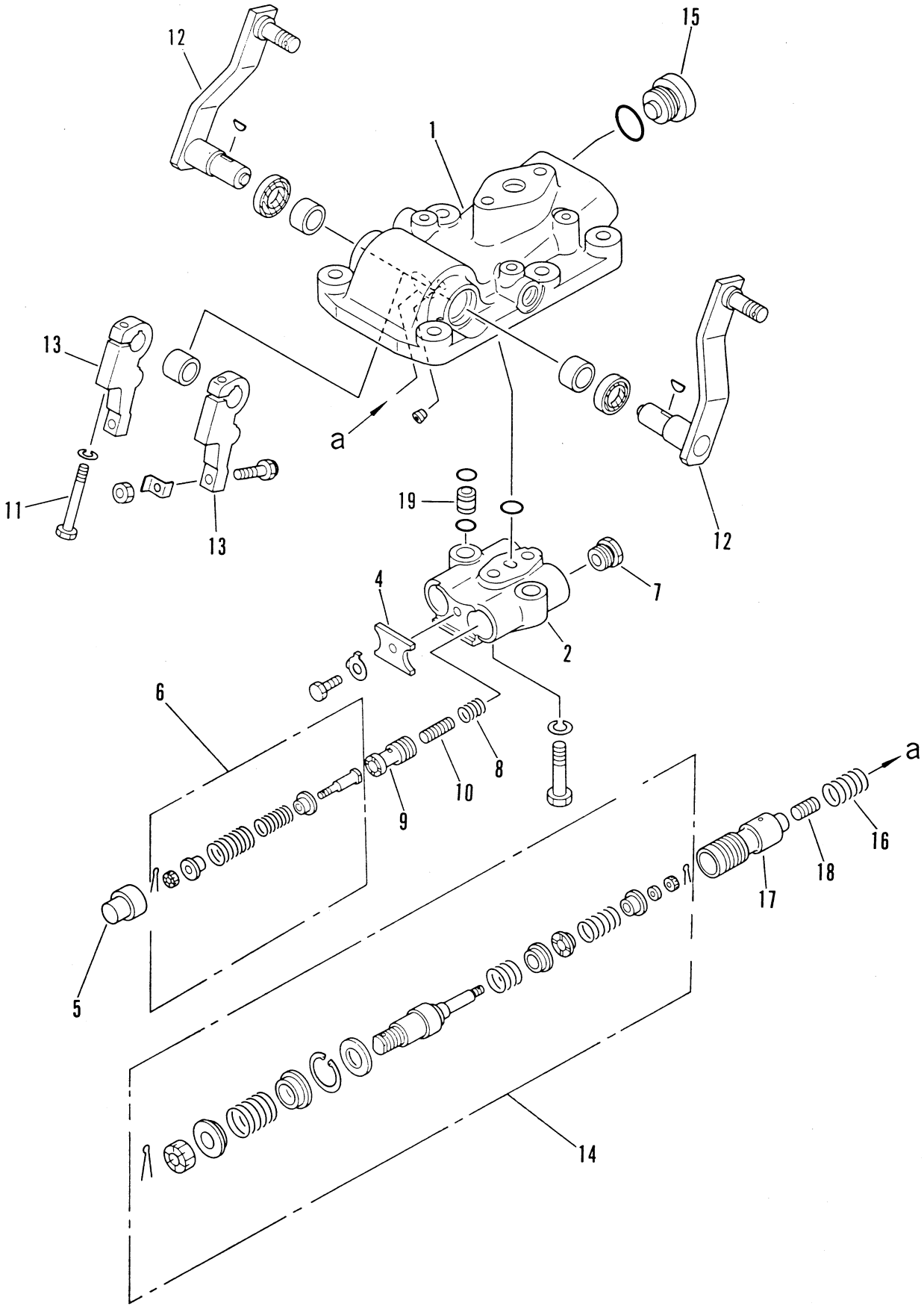
1. Insert piston (18) into valve (17), install the valve and spring (16) into the body, then fit an O-ring and install plug (15).

   kgm Plug: **11 ± 1.5 kgm**

2. Install shaft assembly (14).
3. Set lever (13) in position. Install lever (12) and tighten bolt (11).
4. Insert piston (10) into valve (9), install the valve and spring (8) to the body, then fit an O-ring and install plug (7).

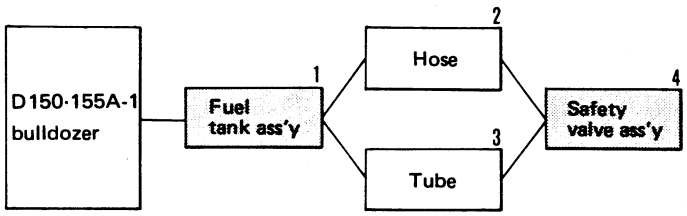
   kgm Plug: **4 ± 0.5 kgm**

5. Install shaft assembly (6), then install guide (5) and plate (4).
6. Fit an O-ring and install sleeve (19), then install brake valve assembly (2).


12
15
1
13
a
11
13
19
12
4
7
2
6
8
10
9
a
16
18
17
5
14

DISMOUNTING BRAKE SAFETY VALVE

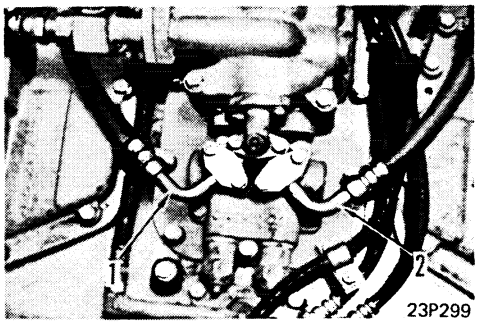
D150A 8408 and up
D155A 15001 – 25000



23F050

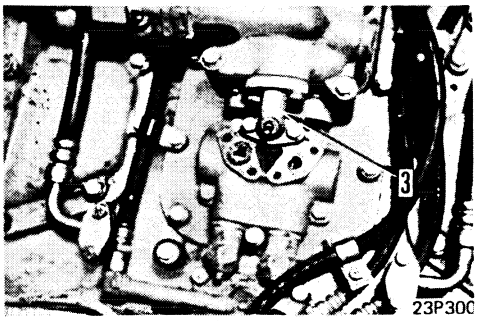
1. **Fuel tank assembly**
   Refer to DISMOUNTING FUEL TANK.

2. **Hose**
   Remove hoses (1) and (2) connecting brake booster to brake valve.



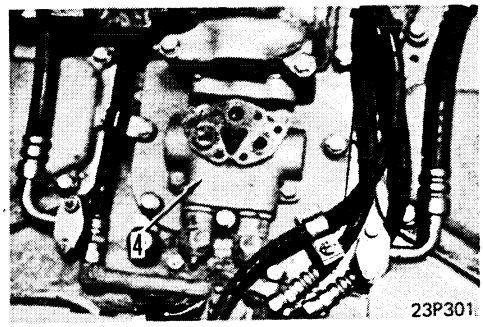
23P299

3. **Tube**
   Remove tube (3) connecting steering valve to brake valve.



23P300

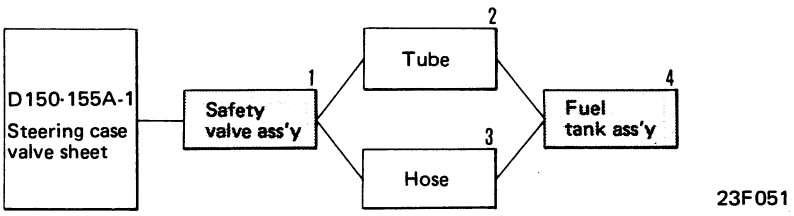
4. **Safety valve assembly**
   Remove valve assembly (4).



23P301

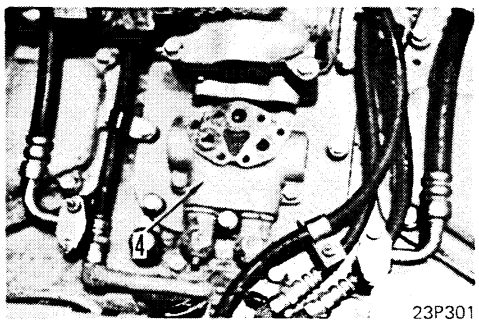
MOUNTING BRAKE SAFETY VALVE

D150A 8408 and up
D155A 15001 – 25000



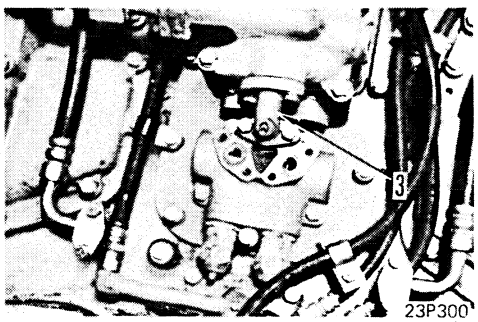
23F051

1. **Safety valve assembly**
   Install valve assembly (4) with O-ring fitted to mounting surface.



23P301

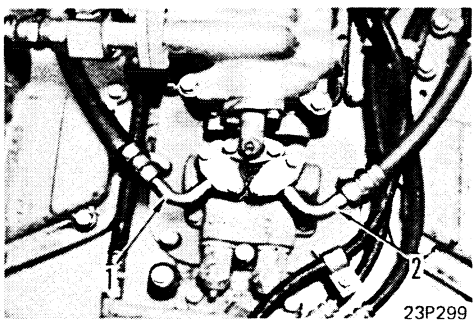
2. **Tube**
   Install tube (3), with O-ring in each mounting face, between steering valve and brake valve.



23P300

3. **Hose**
   Install hoses (1) and (2), with O-ring fitted to each mounting face, between brake booster and brake valve.

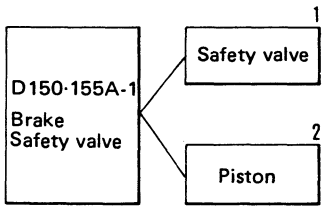
4. **Fuel tank assembly**
   Refer to MOUNTING FUEL TANK.



23P299

DISASSEMBLY OF BRAKE SAFETY VALVE

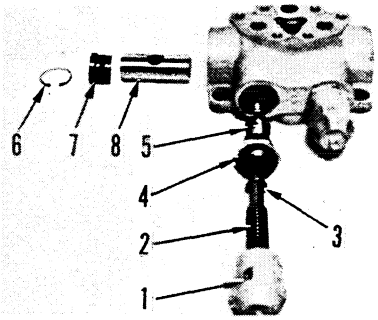
D150A 8408 and up
D155A 15001 – 25000



23F052

1. **Safety valve**
   1) Remove capnut (1). Remove spring (2) and plunger (3).
   2) Loosen lock nut (4) and remove seat (5).

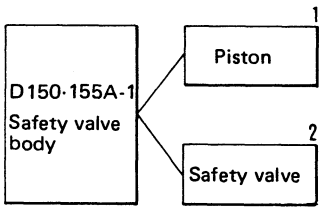
2. **Piston**
   Remove snap ring (6) and stopper (7). Remove piston (8).



23P302

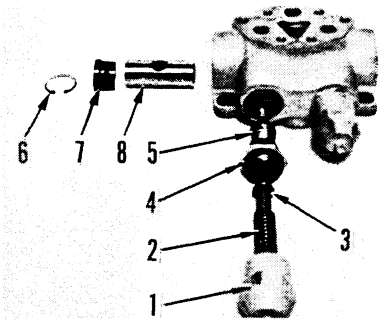
ASSEMBLY OF BRAKE SAFETY VALVE

D150A 8408 and up
D155A 15001 – 25000



23F053

1. **Piston**
   Coat piston (8) with engine (SAE30, class CD) and insert it into valve body. Install stopper (7) and fix it with snap ring (6).

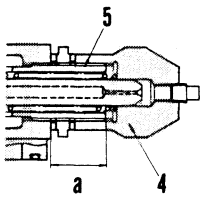


23P302

2. **Safety valve**
   1) Insert seat (5) into valve body. Tighten lock nut (4) to fix seat.
   2) Install plunger (3) and spring (2), and tighten capnut (1).
      ★ Properly adjust pressure so that distance "a" (the end face of plunger seat assembly from valve body end face) is 22 mm.



23P303

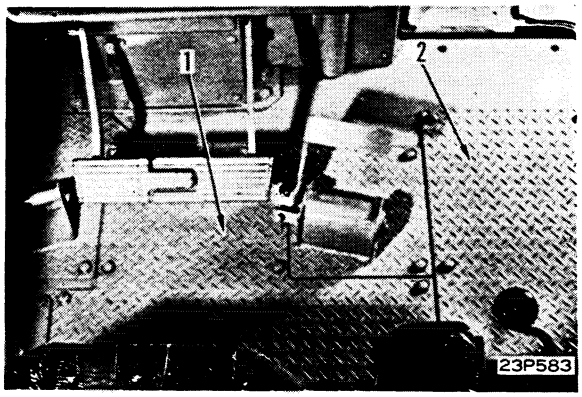


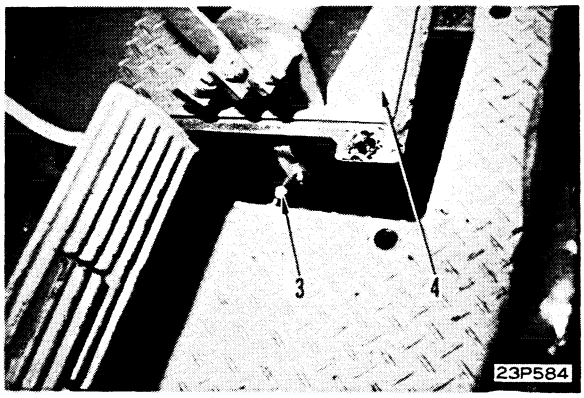
23F054

DISMOUNTING STEERING MAIN RELIEF VALVE

D155A 25001 and up

1. Remove floor plates (1) and (2).
2. Disconnect decelerator rod (3) and remove floor plate (4).
3. Disconnect relief valve inlet hose (5).
4. Disconnect breather tube (6).
5. Loosen the hose clamp on relief valve outlet tube (7), and remove relief valve assembly (8).

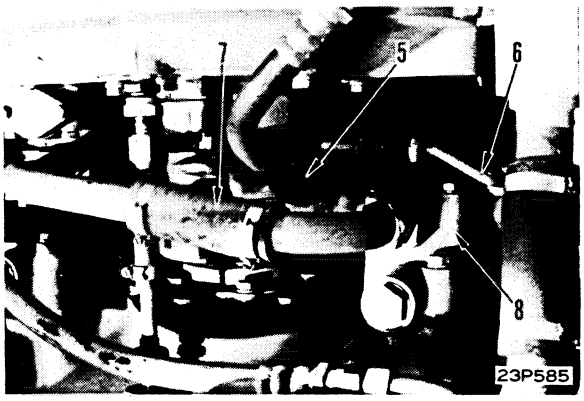




MOUNTING STEERING MAIN RELIEF VALVE

D155A 25001 and up

1. Fit an O-ring and install relief valve assembly (8). Tighten the hose clamp on the outlet tube.
2. Connect breather tube (6).
3. Connect relief valve inlet hose (5).
4. Connect decelerator rod (3) and install floor plate (4).
5. Install floor plates (2) and (1).

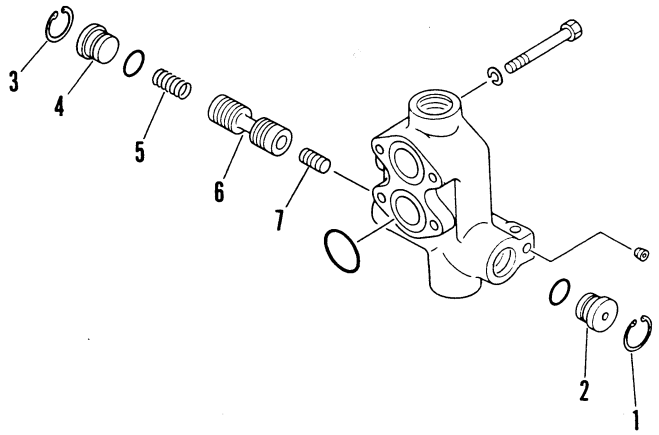


DISASSEMBLY OF STEERING MAIN RELIEF VALVE

D155A 25001 and up

1. Remove snap ring (1), screw a forcing screw (8 mm, P=1.25) into stopper (2), and pull out the stopper by pulling the forcing screw with a pair of pliers.

2. Remove snap ring (3), screw a forcing screw (8 mm, P=1.25) into stopper (4), and pull out spring (5), valve (6) and piston (7) by pulling the forcing screw with a pair of pliers.



ASSEMBLY OF STEERING MAIN RELIEF VALVE

D155A 25001 and up

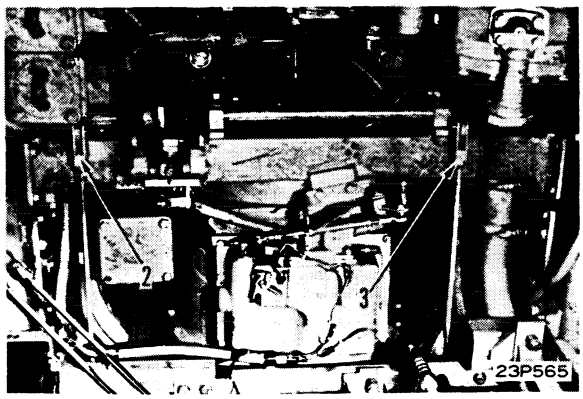
1. Coat piston (7) with engine oil (E030-CD), and insert the piston into valve (6).

2. Assembly the piston valve assembly, spring (5) and stopper (4) in that order to the housing, then install snap ring (3).

3. Install stopper (2) and snap ring (1).

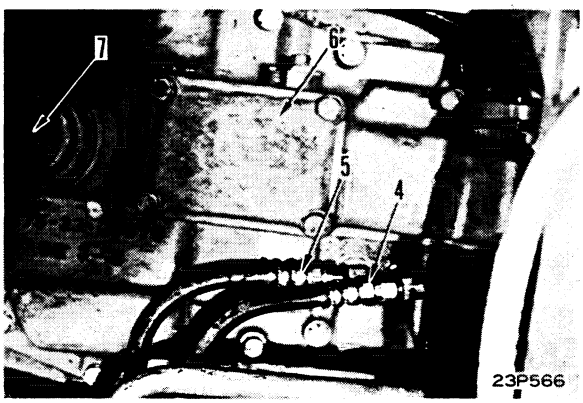
DISMOUNTING BRAKE BOOSTER

1. Dismount the fuel tank assembly. For details, see DISMOUNTING FUEL TANK ASSEMBLY.



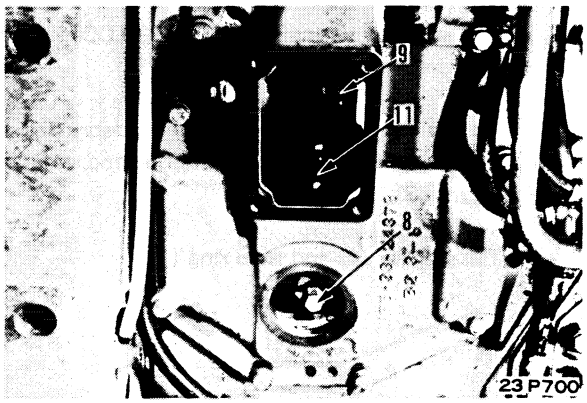
2. **Brake rods**
   Remove R.H. and L.H. brake rods (2), (3).

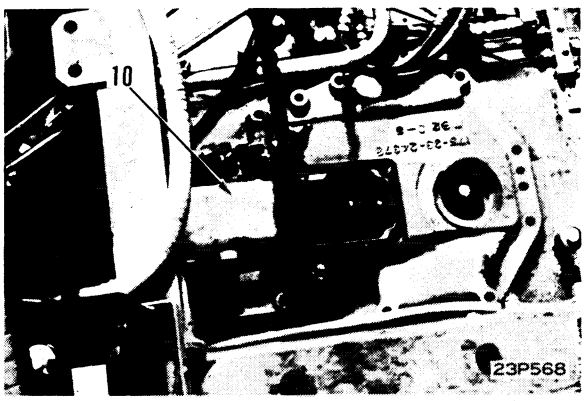
3. **Hose**
   1) Disconnect steering control valve inlet tube (4) and remove brake hose (5).
   2) Remove cover (6) and cap (7).



4. **Adjustment bolt**
   1) Completely loosen adjustment bolt (8) on the brake band.
   2) Pull out connecting pin (9) and disconnect anchor rod (11).

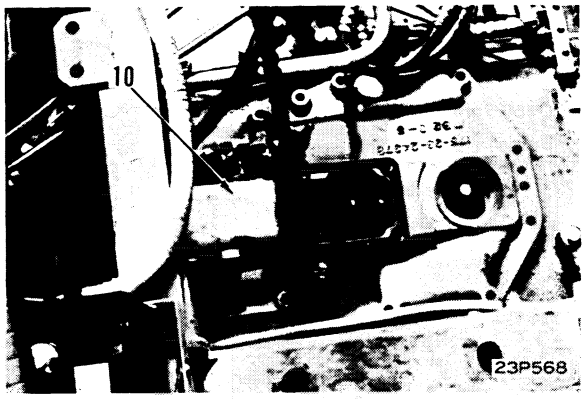
5. **Brake booster assembly**
   Use a forcing screw (12 mm, P=1.75) to lift off brake booster assembly (10).



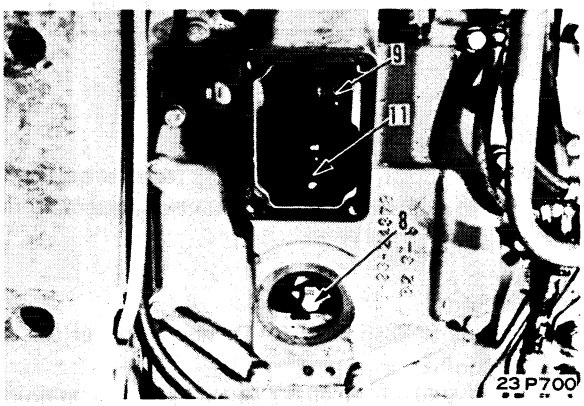


MOUNTING BRAKE BOOSTER

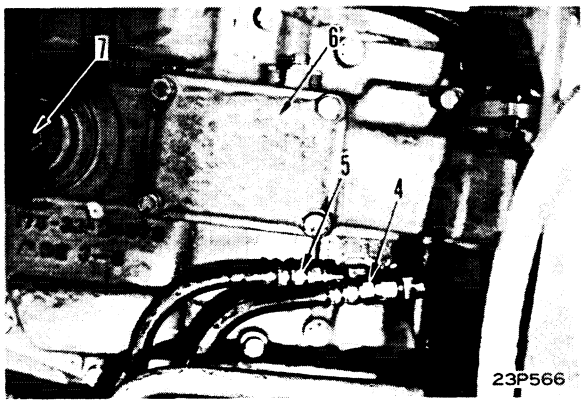
1. Fit a gasket to the mounting surface, lower brake booster assembly (10) with a sling, and install it.



2. **Adjustment bolt**
   1) Connect anchor rod (11) with connecting pin (9).
   2) Tighten adjustment bolt (8) on the brake band until the tightening torque comes to a sudden increase, then turn the bolt in the opposite direction by 1-1/6 revolution.
      ★ Measure the brake pedal stroke while the engine is idling.
      ★ Standard stroke: 150 – 170 mm

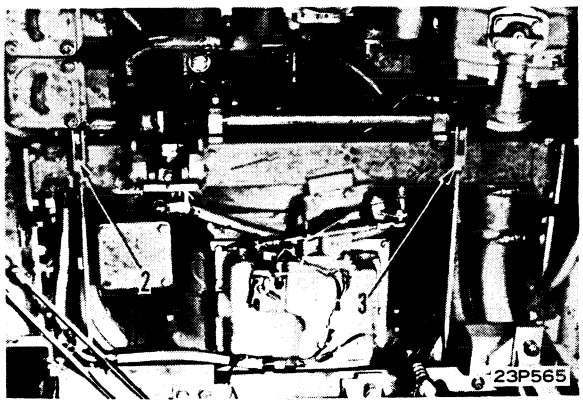


3. **Hose**
   1) Install cover (6) and cap (7).
   2) Install brake hose (5) and connect steering control valve inlet tube (4).

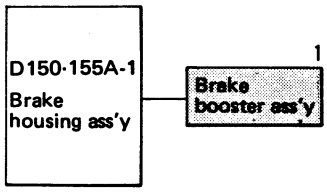


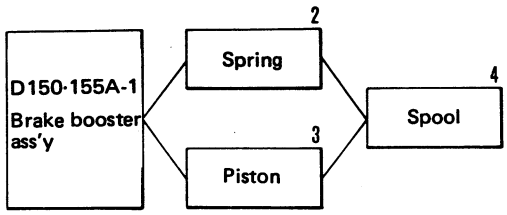
4. **Brake rod**
   Install R.H. and L.H. brake rod (2), (3).

5. Mount the fuel tank assembly. For details, see MOUNTING FUEL TANK ASSEMBLY.

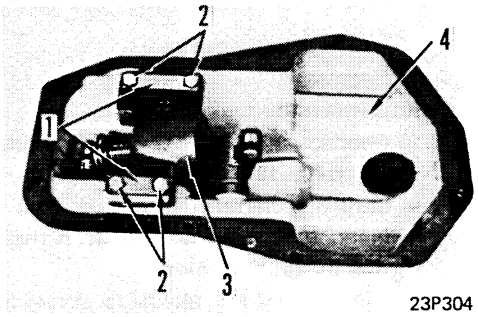


DISASSEMBLY OF BRAKE BOOSTER

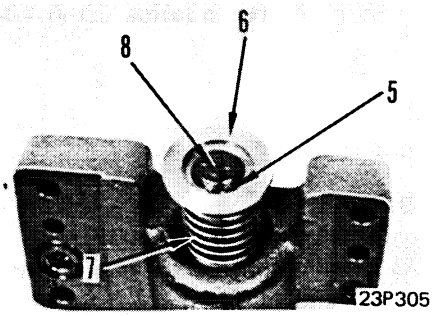




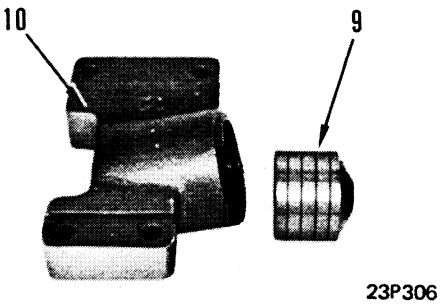
1. **Brake booster assembly**
   Bend down lock plate (1), remove bolts (2) fastening brake booster assembly (3), and take out assembly from housing (4).



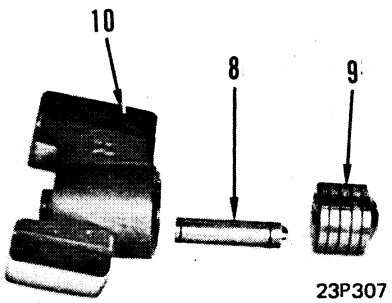
2. **Spring**
   Remove snap ring (5). Remove retainer (6) and spring (7) from spool (8).
   ⚠ When removing snap ring, be sure to hold retainer firmly to prevent retainer and spring from flying out.
   ★ Installed load of spring: **10 kg.**



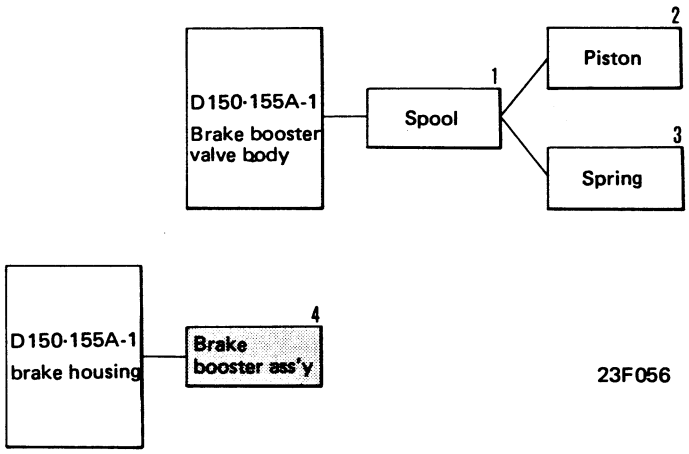
3. **Piston**
   Pull out piston (9) from valve body (10).
   ★ When pulling piston out, be careful not to damage piston and body sliding surfaces.



4. **Spool**
   Pull out spool (8) from valve body (10).



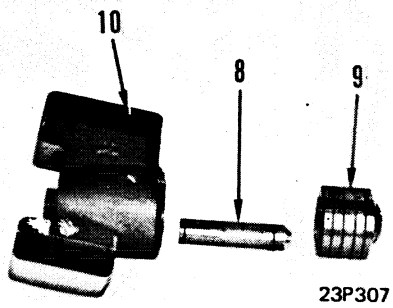
ASSEMBLY OF BRAKE BOOSTER



23F056

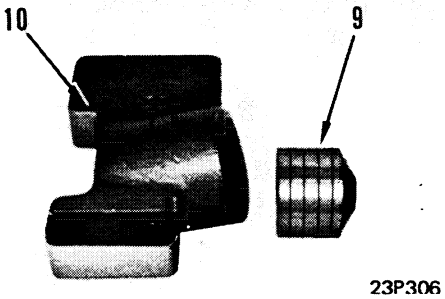
★ Before assembly, wash all parts clean and coat with engine oil (SAE30, class CD).

1. **Spool**
   Position spool (8) in valve body (10).
   ★ Do not confuse direction of installation; tapered seat face must be located on the piston side.



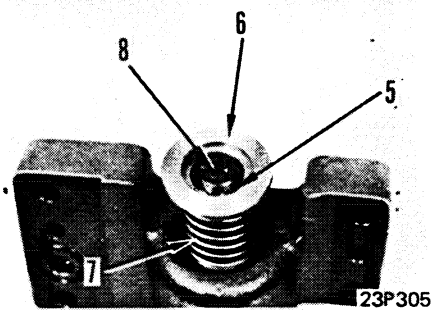
23P307

2. **Piston**
   Insert piston (9) in valve body (10).



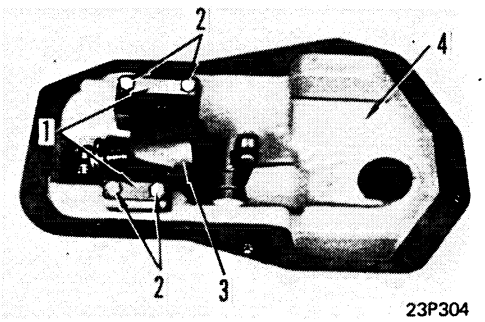
23P306

3. **Spring**
   Place valve body as shown in the figure below. Fit spring (7) and retainer (6) to spool and lock them with snap ring (5).



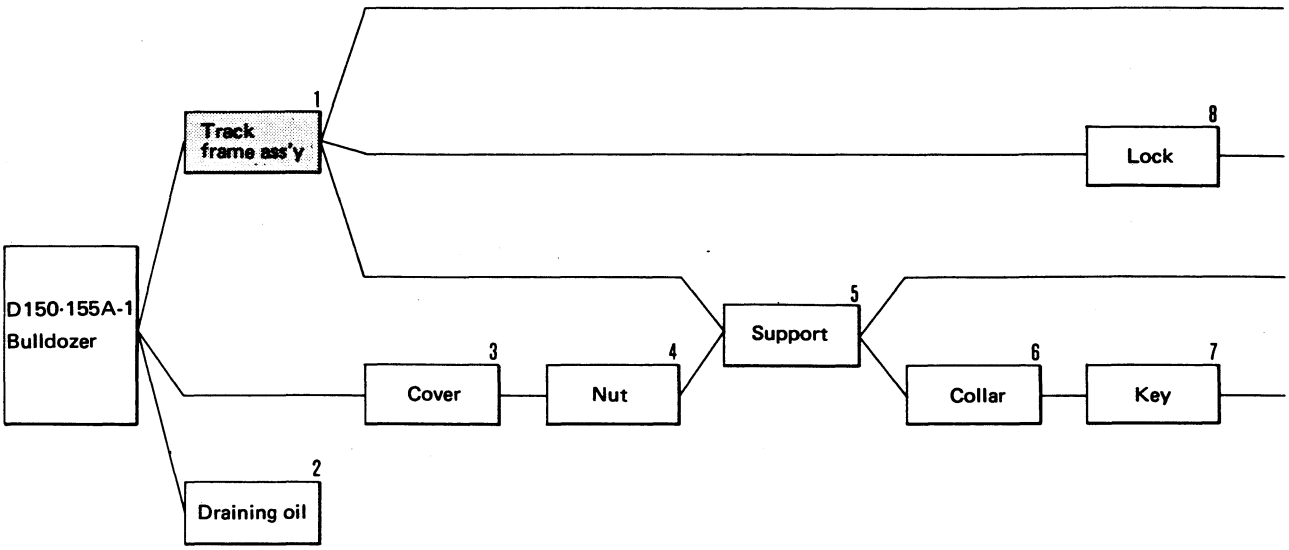
23P305

4. **Brake booster assembly**
   Install brake booster assembly (3), with O-ring fitted to mounting surface, on housing (4). Tighten mounting bolts (2) and lock them with lock plate (1) surely bent.



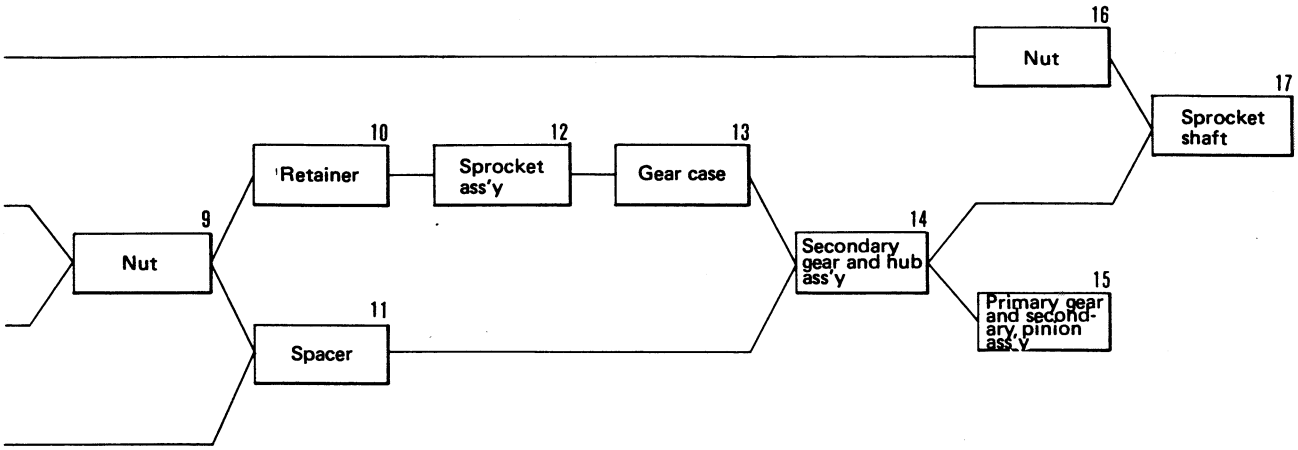
23P304

DISASSEMBLY OF FINAL DRIVE



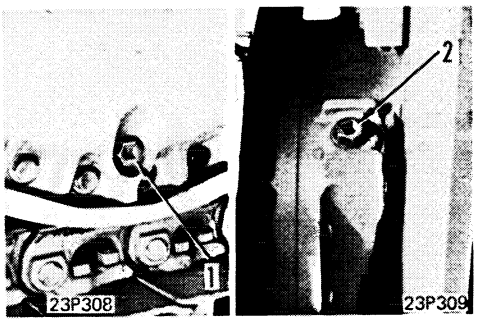
Special tools required

Special tools required		A	B	C	D	E	F	G
791-575-1300	Box	1						
791-575-1400	Wrench		1					
791-108-1370	Guide		1					
791-420-6130	Handle		1					
791-576-1000	Remover A			1				
790-101-1101	Pump			1		1		1
790-101-1600	Cylinder (70 tons)			1		1		
791-401-1800	Lifting tool				1			
791-575-3000	Remover					1		
791-551-1300	Wrench						1	
791-575-5000	Remover							1
790-101-4500	Cylinder (200 tons)							1



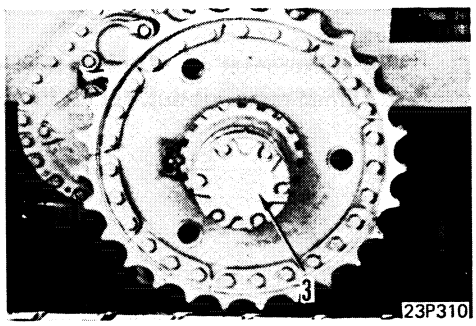
23F057

1. **Track frame assembly**
   Refer to DISMOUNTING TRACK FRAME.

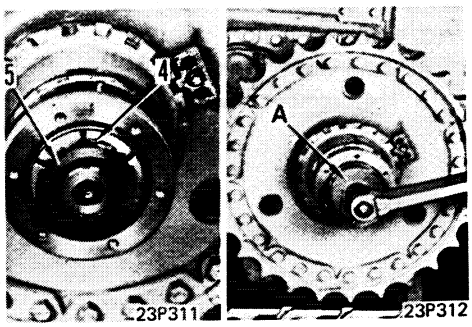


2. **Draining oil**
   Remove drain plug (1) and drain oil from final drive.
   ★ Oil capacity: **55 liters**
   ★ If draining from final drive is hard, it is advisable to remove oil filler plug (2).

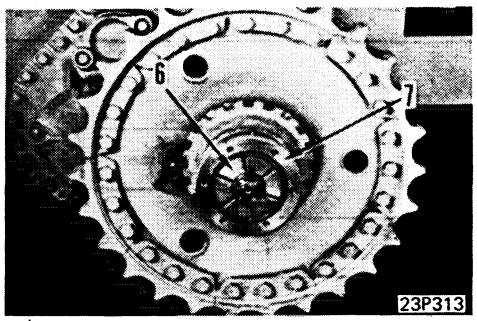
3. **Cover**
   Remove bolts fastening cover (3); remove cover.



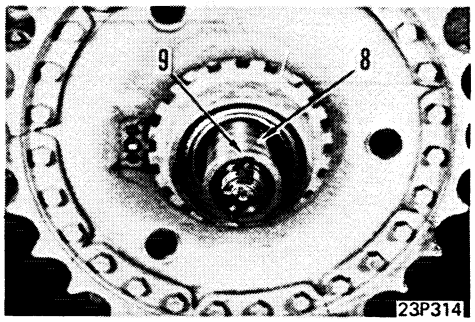
4. **Nut**
   Bend down lock washer (4), loosen nut (5) with special tool A, and remove lock washer (4).



5. **Support**
   1) Remove washer (6).
   2) Remove support (7).
      ★ Keep a set of floating seal removed from nut contact surface of support and sprocket so that it can be installed in the same condition as before removal.

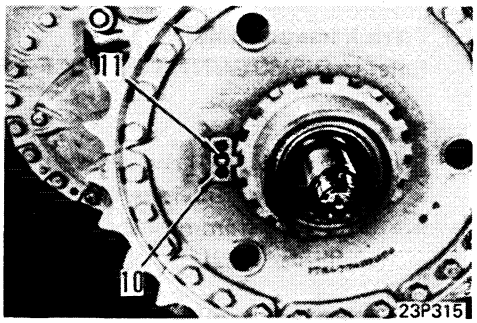


6. **Collar**
   Remove collar (8).

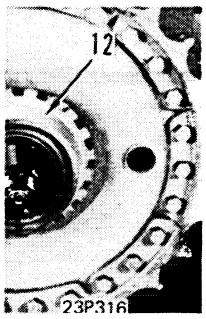


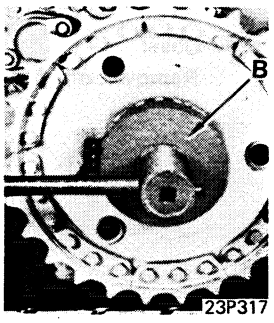
7. **Key**
   Remove key (9).

8. **Lock**
   Remove bolts (10) fastening lock (11); remove lock.

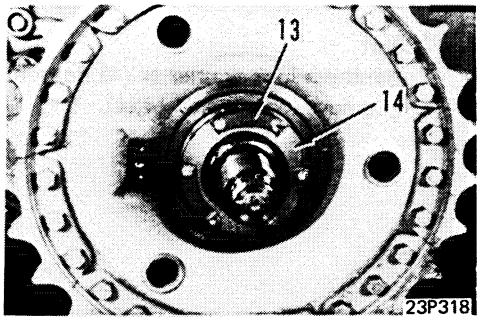


9. **Nut**
   Remove sprocket nut (12) with special tool B.
   ★ When removing nut, hold it firmly to prevent falling off.



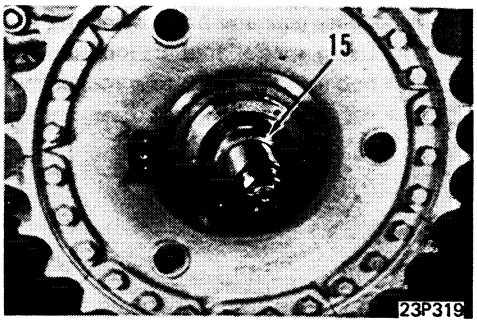


10. **Retainer**
    Bend down lock washer (13). Remove bolts fastening retainer (14), remove retainer.



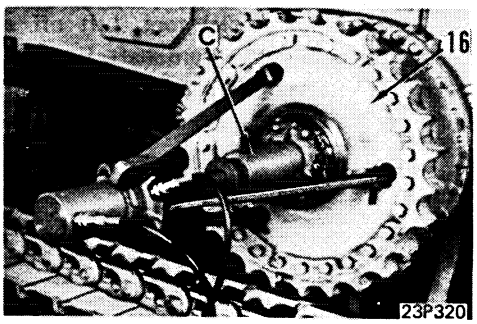
11. Spacer

Remove spacer (15).



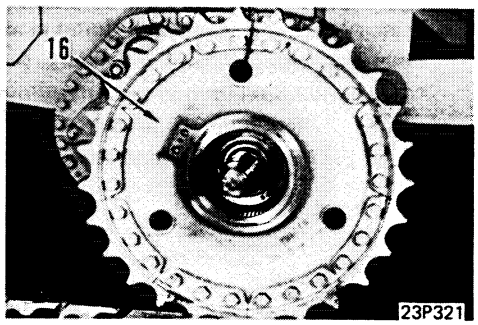
12. Sprocket assembly

1) Set special tool C to sprocket assembly (16) and loosen fitting of sprocket hub to sprocket assembly.



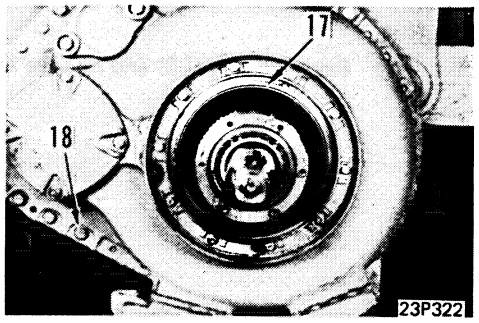
2) Remove special tool. Lift off sprocket assembly (16) with crane.

kg Sprocket assembly: **320 kg.**



13. Gear case

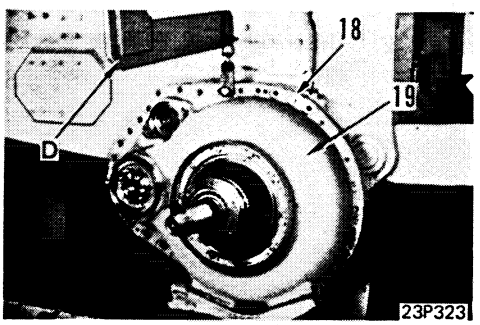
1) Remove floating seal (17) and store it together with floating seal removed from sprocket assembly.
2) Remove case mounting bolts (18), except two bolts at the upper side of case.
   ★ Number of mounting bolts: **36** bolts,



3) Sling case (19) with lifting tool D. Remove remaining bolts. Remove gear case using jack bolts (20 mm, P=2.0).

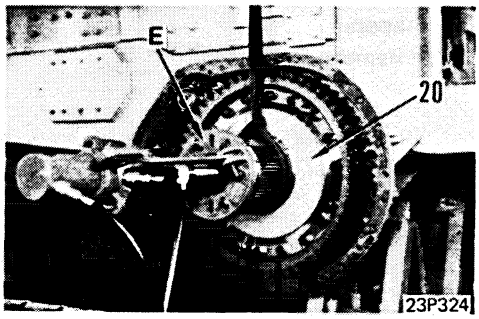
kg Gear case: **300 kg**

★ When removing gear case, be careful not to damage sprocket hub serration and threads.

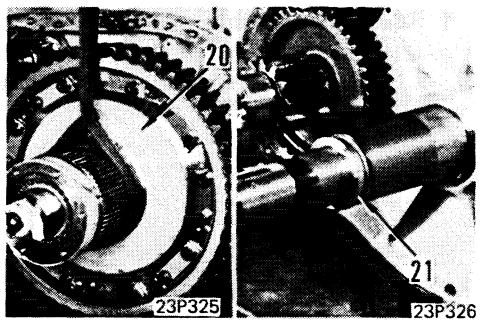


14. Secondary gear and hub assembly

1) Using special tool E, loosen fitting of secondary gear and hub assembly (20) to sprocket shaft.
   ★ Keep secondary gear and hub assembly slung with crane.

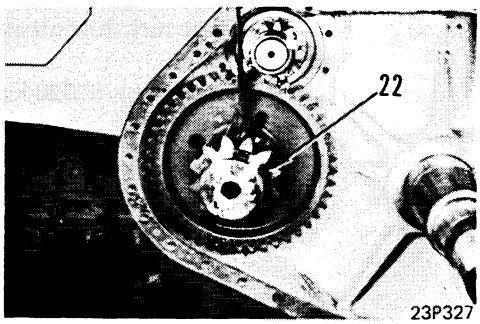


2) Remove special tool. Lift off secondary gear and hub assembly (20) from shaft. Remove spacer (21).
   Use nylon rope to prevent assembly from slipping off.
   Secondary gear and hub assembly: **335 kg.**



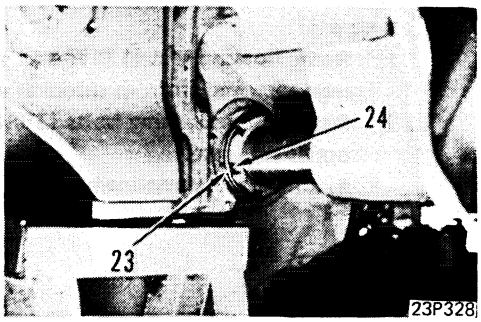
15. Primary gear and secondary pinion assembly

Sling primary gear and secondary pinion assembly (22) with crane by hooking rope to primary pinion. Lift off assembly.
   Use nylon rope to prevent assembly from slipping off.
   Primary gear and secondary pinion assembly: **115 kg**

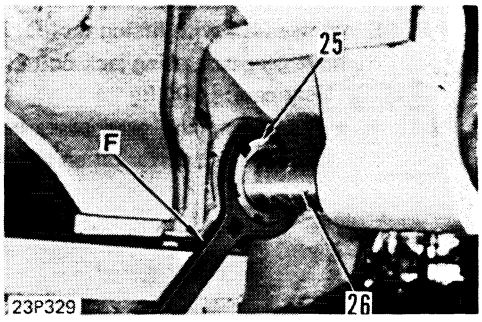


16. Nut

1) Pry snap ring (23) and remove lock pin (24).

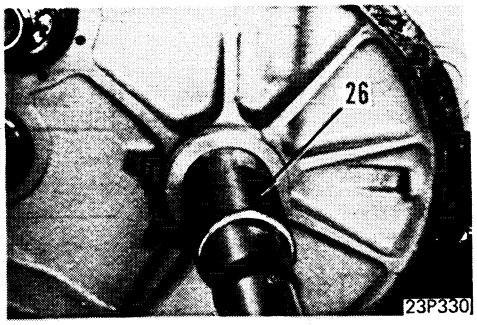


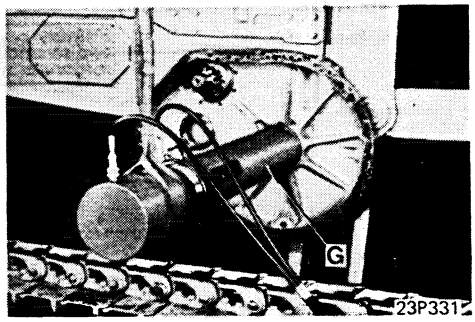
2) Unscrew nut (25) with special tool F from sprocket shaft (26).



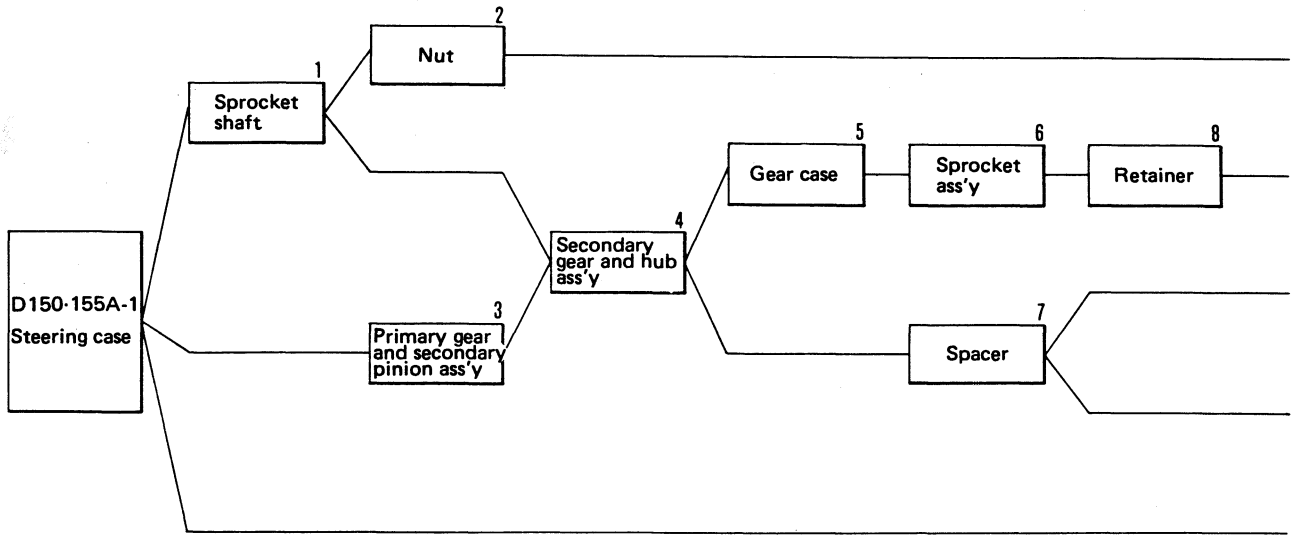
17. Sprocket shaft

Using special tool G, pull out sprocket shaft (26).





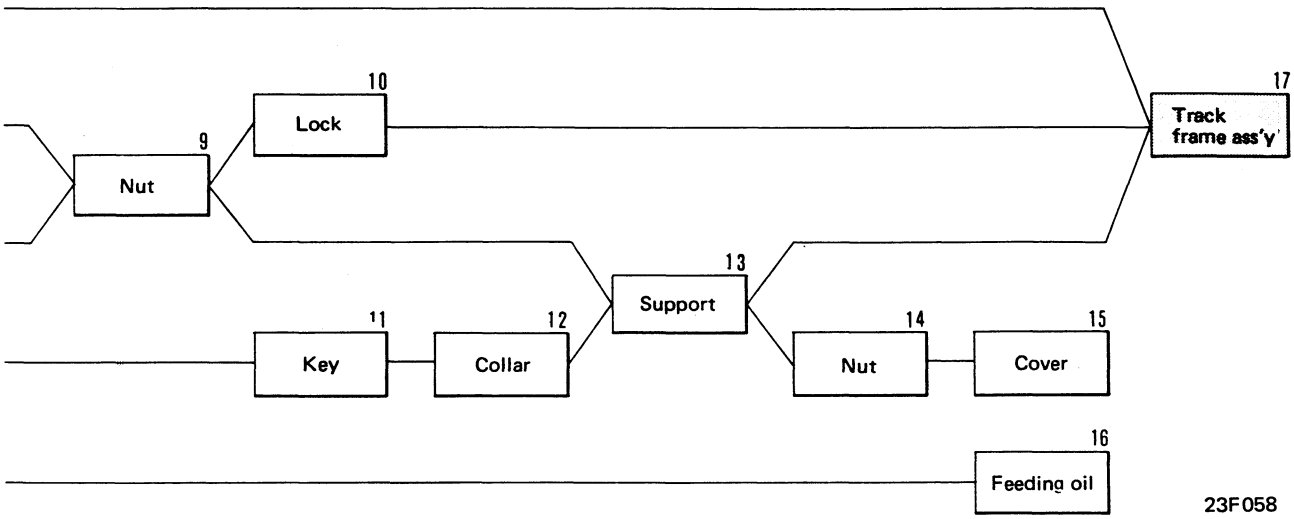
ASSEMBLY OF FINAL DRIVE



Special tools required

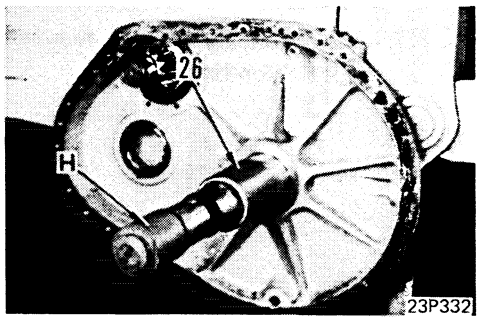
Special tools required		A	B	F	H	I	J	K	L
791-575-1300	Box	1							
791-575-1400	Wrench		1						
791-108-1370	Guide		1						
791-420-6130	Handle		1						
791-551-1300	Wrench			1					
791-575-6001	Installer				1				
791-575-4000	Installer					1			
790-101-1101	Pump					1			1
790-101-2101	Puller (30 tons)					1			
790-401-1800	Lifting tool						1		
791-560-1410	Installer							1	
791-575-2000	Installer A								1
790-101-1600	Cylinder (70 tons)								1

★ Before assembling, wash all parts clean and coat with fresh engine oil (SAE30, class CD).



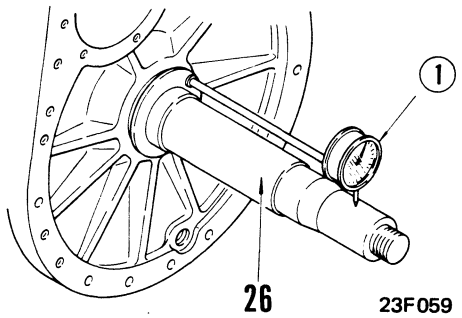
23F058

1. **Sprocket shaft**
   1) Set special tool H to the front end of sprocket shaft and press-fit sprocket shaft (26).
      - ★ Press-fit shaft with key groove facing upward.
      - ★ Coat fit-in portion of shaft with anti-friction compound (LM-P).
      - ★ In mid course of press-fitting, fit locknut and snap ring to shaft. (It is impossible to fit them press-fitted shaft.)
      - ★ Shaft press-fit pressure: **63 ~ 107 tons**
      - ★ Interference: **0.085 ~ 0.145 mm**



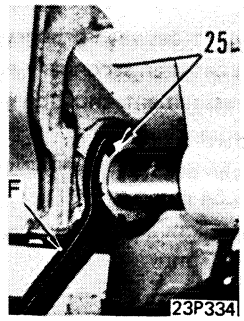
23P332

   2) After press-fitting sprocket shaft (26), attach dial gauge ① to shaft and measure bending of shaft at shaft end (maximum bend) to confirm that measurement is within specified limit.
      - ★ Permissible limit of bend: 1.0 mm max. (2 mm max.)
      - ★ If any bend exceeding the permissible limit, pull out shaft and repair it with press.

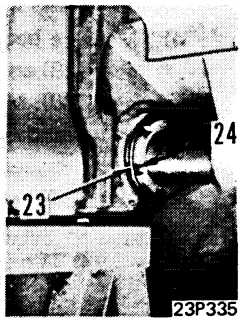


23F059

2. **Nut**
   1) Tighten nut (25) with special tool F.
      kgm Nut: **50 ~ 70 kg.m**
      - ★ Tighten nut to a torque within specified limit so that pin hole in sprocket shaft (26) aligns with pin hole in nut.
   2) Install lock pin (24) for shaft and nut and lock them with snap ring (23).

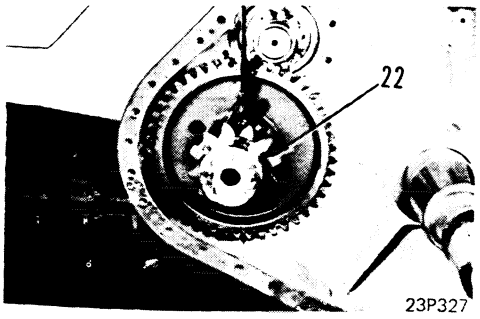


23P334

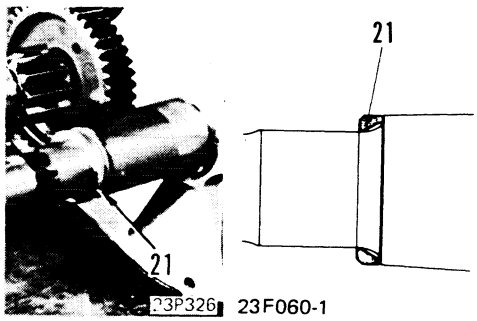


23P335

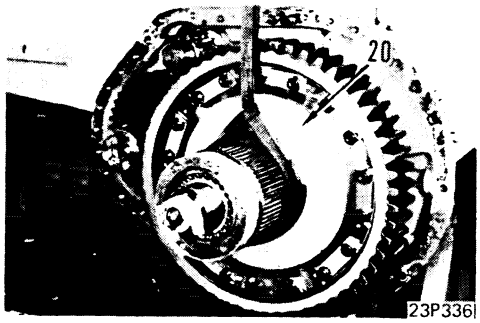
3. **Primary gear and secondary pinion assembly**
Expansion-fit bearing in final drive case and lift primary gear and secondary pinion assembly (22) into position.



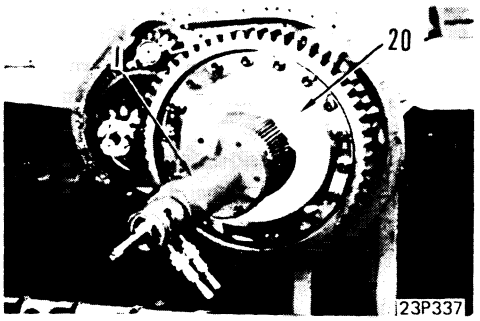
4. **Secondary gear and hub assembly**
1) Fit spacer (21) to sprocket shaft.
★ Do not confuse proper direction of installation of spacer. Inner chamfered edge of spacer must be faced toward the inside of machine.



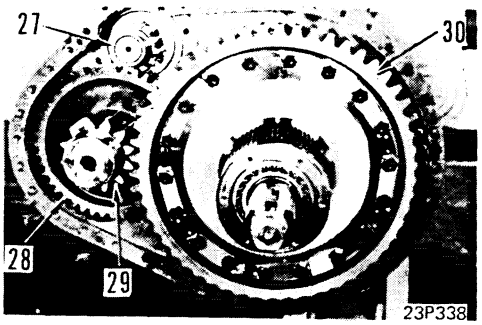
2) Lift secondary gear and hub assembly (20) with crane into position on sprocket shaft.



3) Set special tool I to sprocket shaft and press-fit secondary gear and hub assembly (20).
★ Fully press-fit assembly until hub assembly bearing contacts the step of sprocket shaft.
★ Press-fit pressure: **approx. 15 ton**

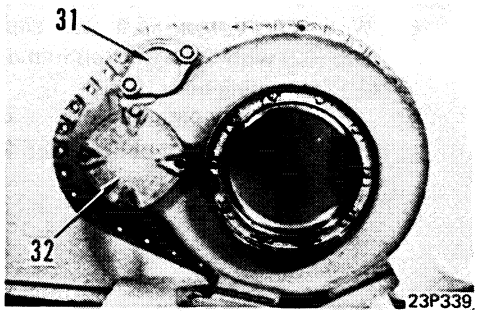


4) Measure backlash between primary pinion (27) and primary gear (28) and between secondary pinion (29) and secondary gear (30). Measurements must be within specified range.
★ Standard backlash
between primary gear and primary pinion:
0.27 ~ 0.64 mm
between secondary gear and secondary pinion:
0.31 ~ 0.77 mm

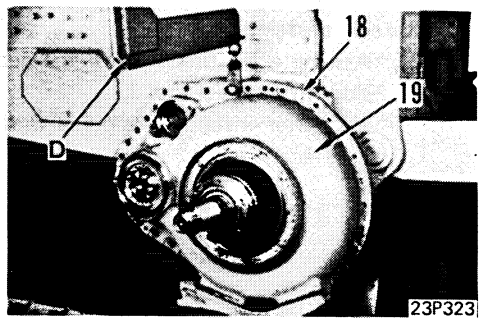


5. Gear case

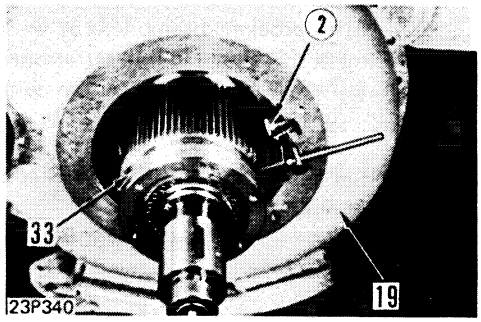
1) Remove primary pinion cover (31) and secondary pinion cover (32).
   ★ Be sure to keep a full shim pack removed.



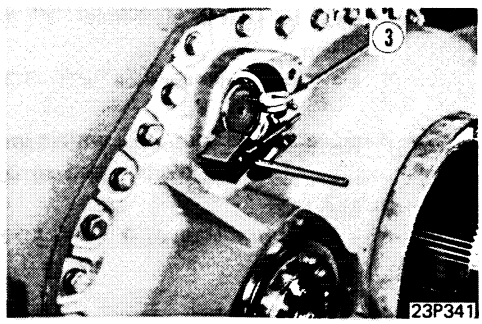
2) Attach gasket to mounting surface with gasket sealant (LG-1) and lift gear case (19) into position with lifting tool D and tighten bolts (18).
   kgm Mounting bolt: **45.5 ~ 62 kg.m**
   ★ Coat 10 bolts to be installed on the upper side of gear case with gasket sealant (LG-1).



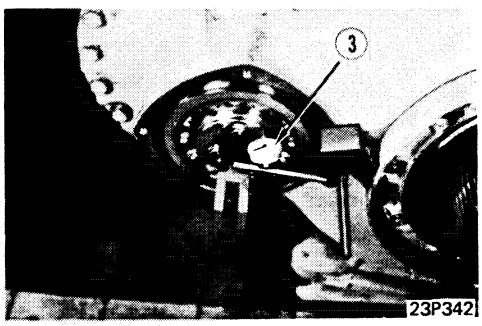
3) Attach dial gauge ② to sprocket hub (33) and measure radial runout of case (19). Measurement must be within the specified range.
   ★ Standard radial runout: **within 0.3 mm**



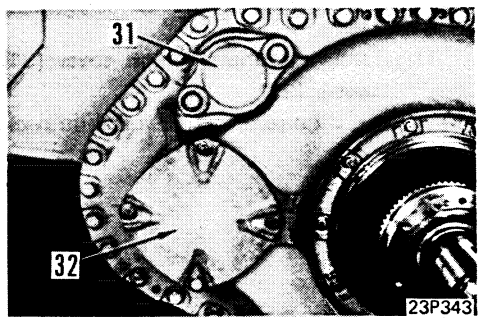
4) Attach dial guage ③ to gear case and measure end play of primary pinion. Select proper shim thickness, depending on measurement.
   ★ Standard shim thickness: **1.5 mm**
   ★ End play: **0.7 ~ 1.4 mm**



5) Attach dial gauge ③ to gear case and measure end play of secondary pinion. Select proper shim thickness, depending on measurement.
   ★ Standard shim thickness: **1.6 mm**
   ★ End play: **1.0 ~ 1.6 mm**

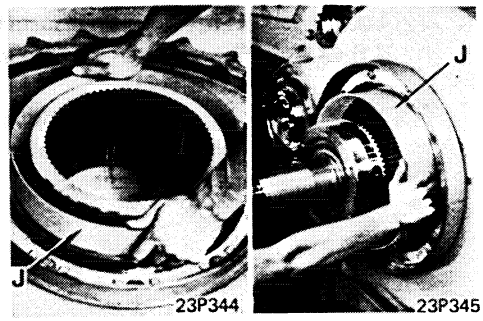


6) With shims selected in the preceding step, install covers (31) and (32) with O-rings fitted to mounting surfaces.
kgm Mounting bolts,
Primary pinion side: **45.5 ~ 62 kg.m**
Secondary pinion side: **23.5 ~ 31.5 kg.m**



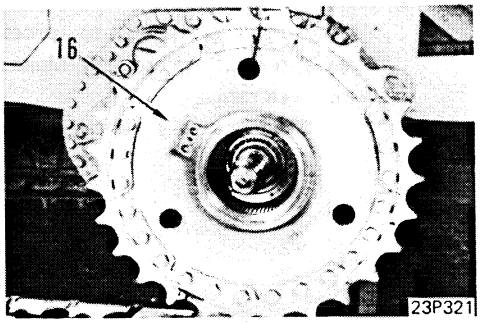
6. Sprocket assembly

1) Assemble floating seal on the gear case side and sprocket side with special tool J.
★ After installing, apply a thin coat of clean oil to seal face.



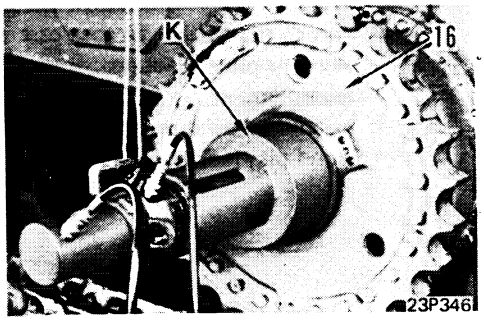
2) Lift sprocket assembly (16) with crane into position and mesh sprocket and hub serrations with each other.
★ Coat sprocket serration with anti-friction compound (LM-2).

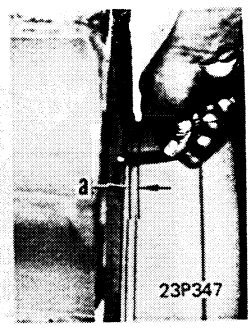
3) Set special tool K onto sprocket assembly (16) and press-fit assembly to hub.
★ Press-fit pressure: **50 ~ 60 tons**

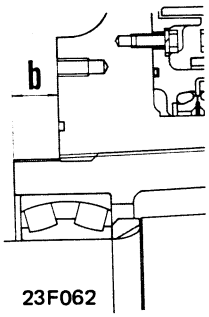


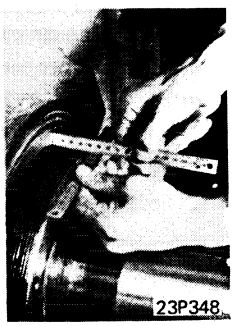
4) Use seal guide clearance "a" as a standard for press-fit depth.
★ Standard clearance "a": **3.3 ~ 5.3 mm**

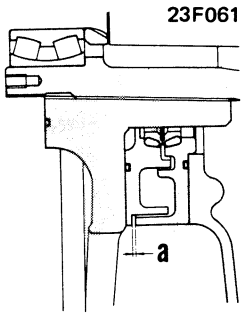
5) Remove special tool and confirm press-fit depth by measuring the distance "b" between sprocket assembly (16) and hub (33).
★ Standard distance "b": **40 ± 1 mm**



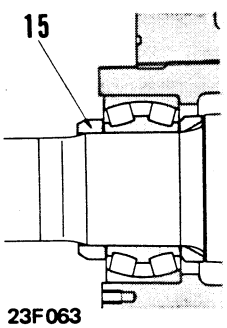




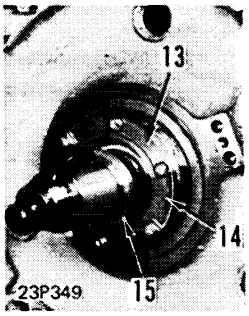




7. Spacer
Assemble spacer (15).
★ Be careful not to confuse direction of installation. Larger outside taper must be faced to the outside of machine.

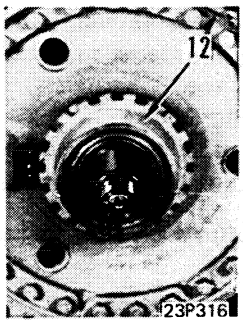


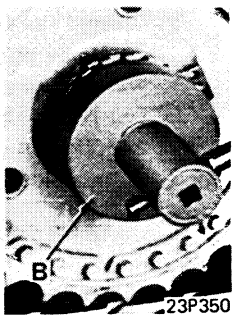
23F063



8. Retainer
Install retainer (14) and lock bolts with lock washer (13) surely bent.
kgm Mounting bolt: **15 ~ 20 kg.m**

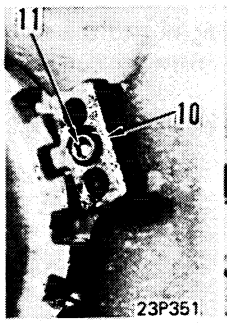
9. Nut
Install nut (12) with O-ring fitted to mounting surface (sprocket side) and tighten nut with special tool B.
kgm Nut: **150 ~ 200 kg.m**
★ Tighten nut to the specified torque, while taking it into consideration that nut must be locked at that position.

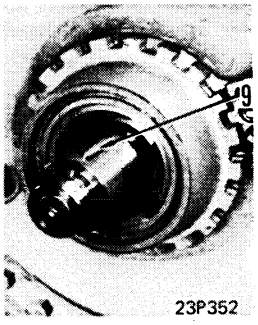




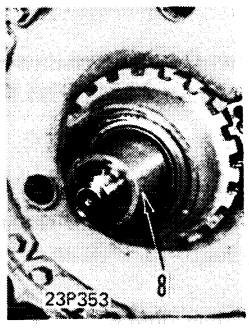
10. Lock
Install lock (10) with bolts (11) and lock nut (12).

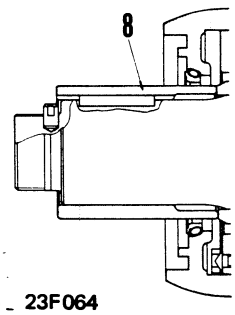
11. Key
Drive in key (9).





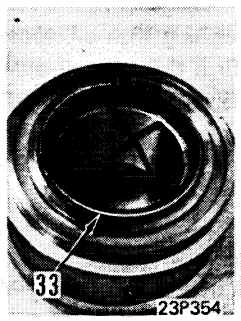
12. Collar
Install collar (8).
★ Face the larger inner diameter side of collar toward the inside of machine.

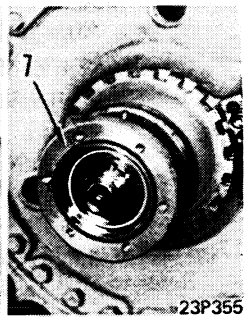




23F064

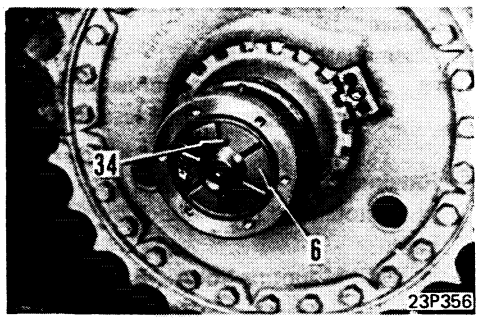
13. Support
Assemble floating seal (33) on both nut side and support side, and install support (7), taking care to prevent floating seals from falling off.
★ Apply a thin coat of oil to sealing surface of seal ring.





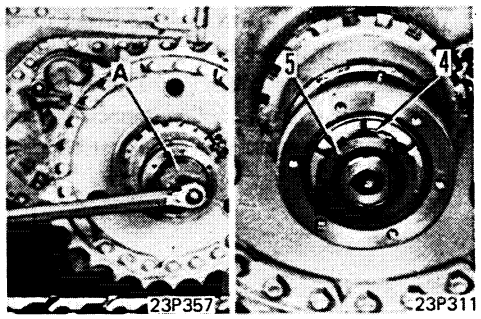
14. Nut

1) Install washer (6).
   ★ Be sure to confirm notches for dowel pins (34) mating.

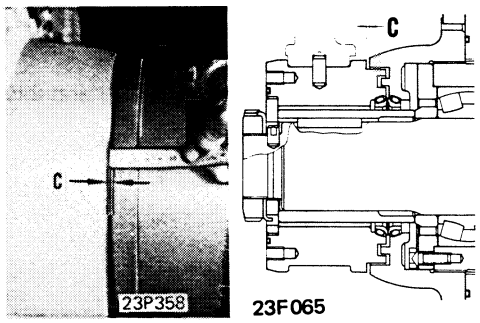


2) Install lockwasher (4) and nut (5) on sprocket shaft. Tighten nut with special tool A and lock nut with lockwasher surely bent.
   kgm Nut: **150 ~ 200 kg.m**
   ★ Tighten nut to the specified torque, while taking it into consideration that nut must be locked at that position.

Tighten nut to the specified torque, while taking it into

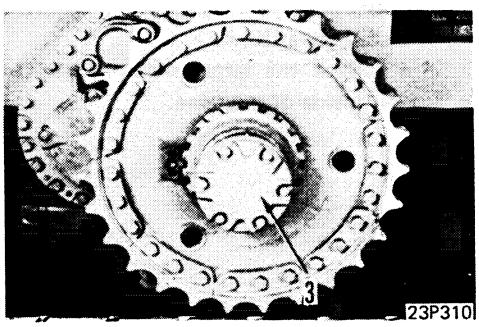


3) After tightening nut to the specified torque, confirm that clearance "c" between nut and support is within the specified range.
   ★ Standard clearance "c": **2.2 ~ 4.6 mm**



15. Cover

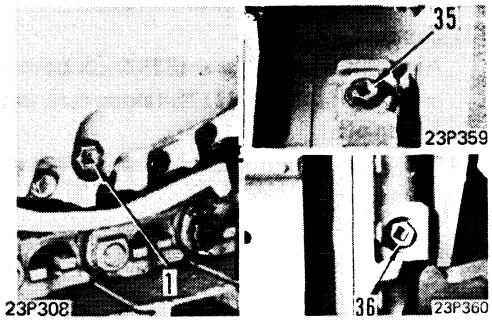
Install cover (3) with O-ring fitted to mounting surface.
kgm Mounting bolt: **23.5 ~ 31.5 kg.m**



16. Feeding oil

1) Install drain plug (1) with O-ring in mounting face.
   kgm Drain plug: **13 ~ 18 kg.m**

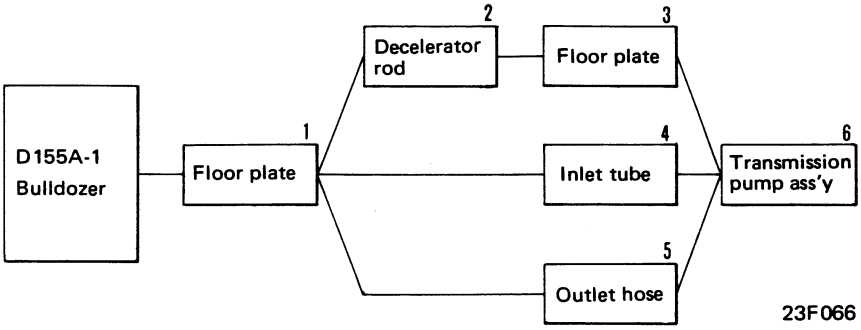
2) Remove oil filler plug (35) and refill with specified quantity of oil.
   ★ After refilling with oil, loosen oil level check plug (36) to confirm that a small quantity of oil spills out. If no oil spills, oil level is lower than the specified level; add oil.
   ★ Install oil level check plug and oil filler plug.
   kgm Plug: **13 ~ 18 kg.m**



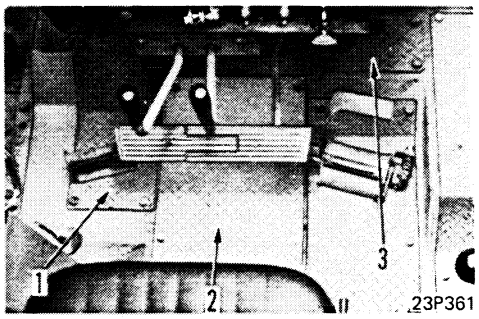
17. Track frame assembly

Refer to MOUNTING TRACK FRAME.

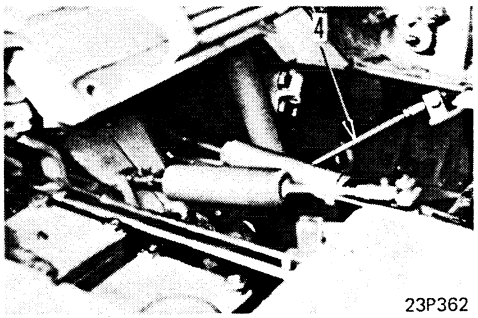
DISMOUNTING TORQFLOW PUMP D155A



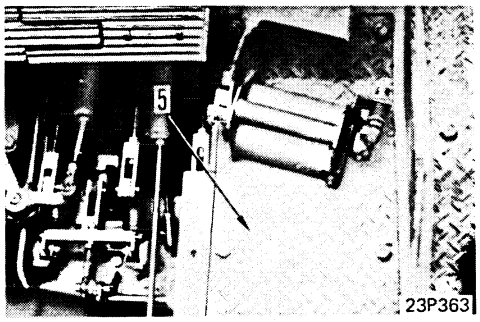
1. **Floor plate**
   Remove floor plates (1), (2) and (3).



2. **Decelerator rod**
   Remove decelerator rod (4).

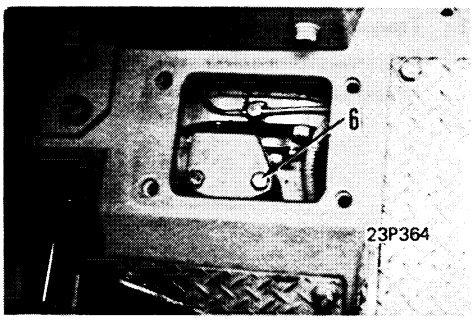


3. **Floor plate**
   Remove floor plate (5).

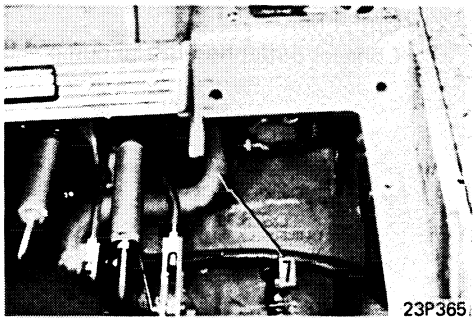


4. Inlet tube

1) Remove flange fastening bolts (6).

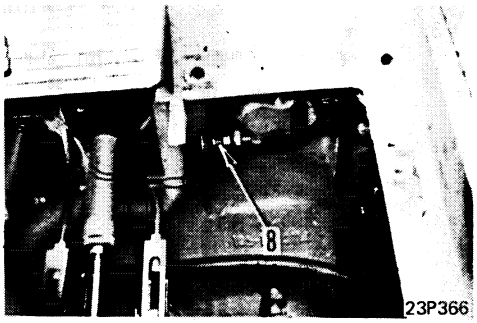


2) Remove U-clamp nuts and disconnect tube (7) from pump.
   ★ Temporarily clamp disconnected tube with wire.



5. Outlet hose

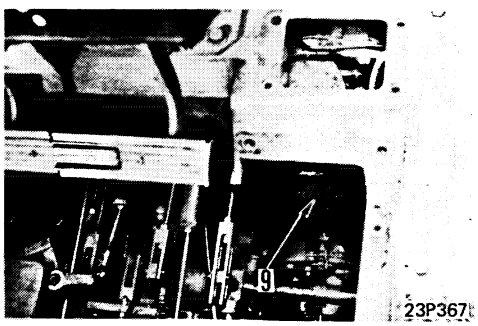
Remove sleeve nut and disconnect hose (8).



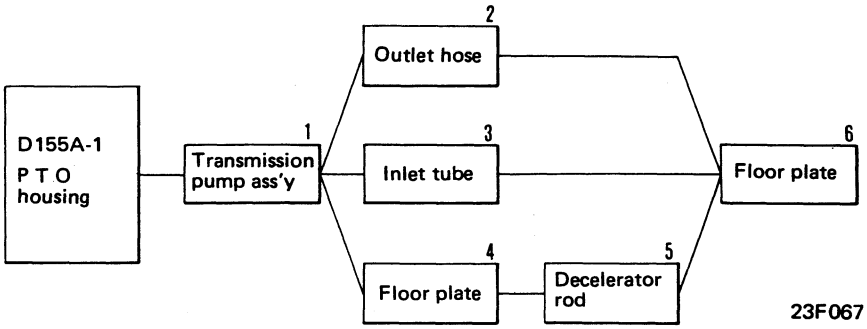
6. Transmission pump assembly

Remove bolts fastening pump assembly (9); remove assembly.

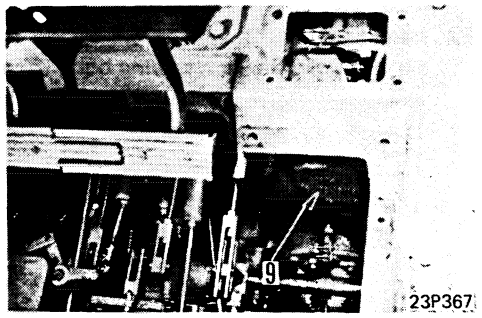
kg Transmission pump: **15 kg**



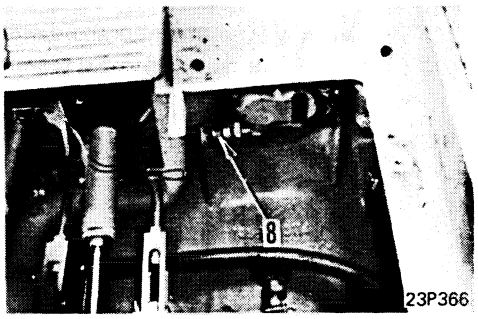
MOUNTING TORQFLOW PUMP D155A



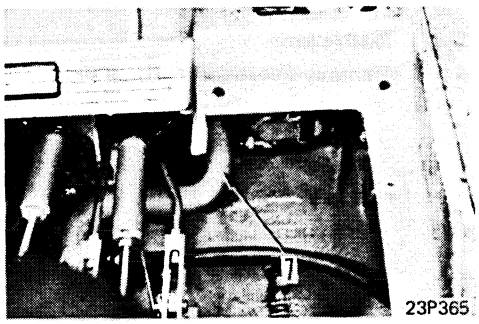
1. **Transmission pump assembly**
   Set pump assembly (9) with O-ring and driving shaft splines meshing and tighten bolts.



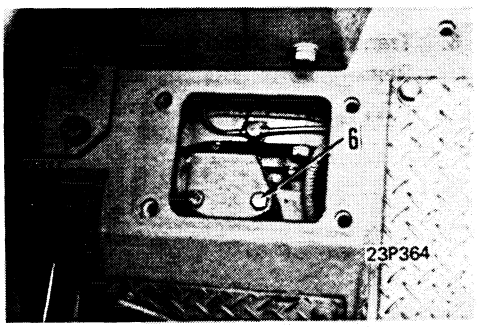
2. **Outlet hose**
   Connect outlet hose (8) to pump and tighten sleeve nut.



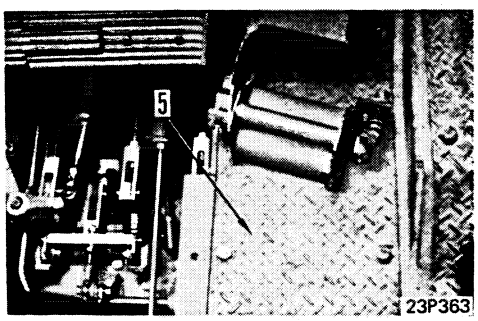
3. **Inlet tube**
   1) Connect tube (7), with O-ring in flange, to pump and tighten flange fastening bolts (6).



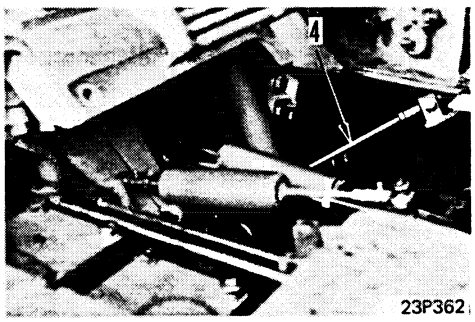
   2) Install U-clamp with nuts.



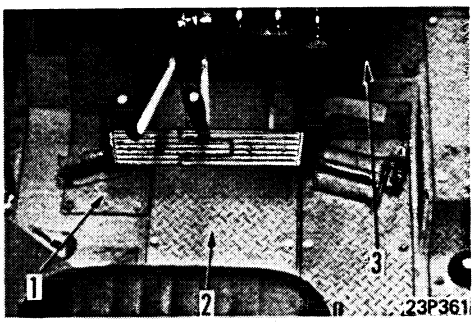
4. **Floor plate**
   Install floor plate (5).



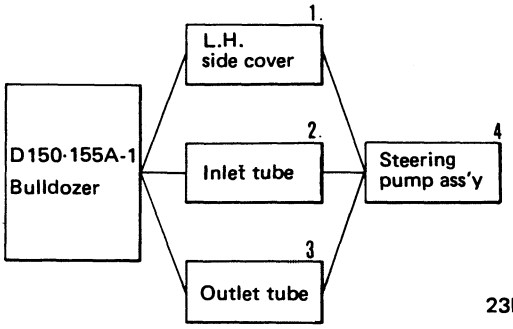
5. **Decelerator rod**
   Install decelerator rod (4).



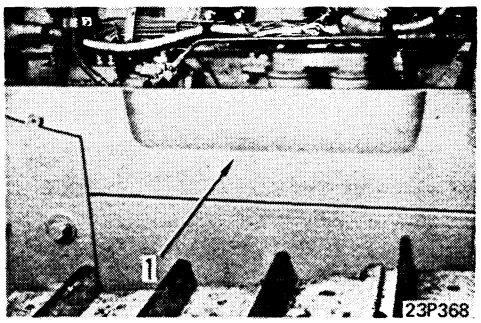
6. **Floor plate**
   Install floor plates (1), (2) and (3).



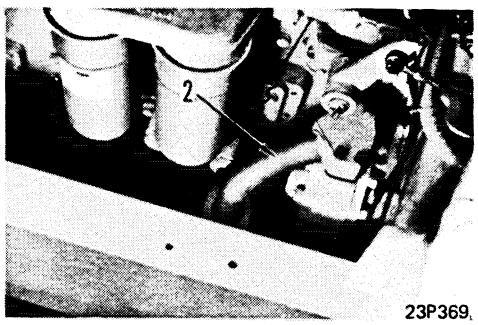
DISMOUNTING STEERING PUMP



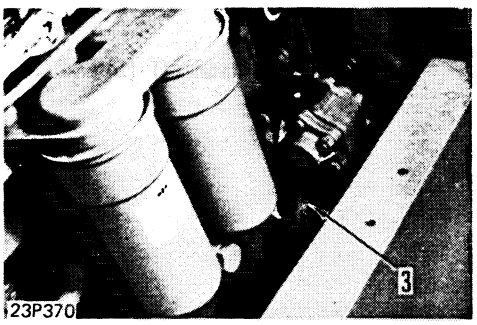
1. L.H. side cover
Remove cover (1).



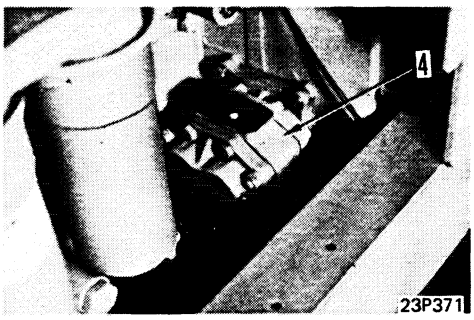
2. Inlet tube
Remove split flange and disconnect tube (2).



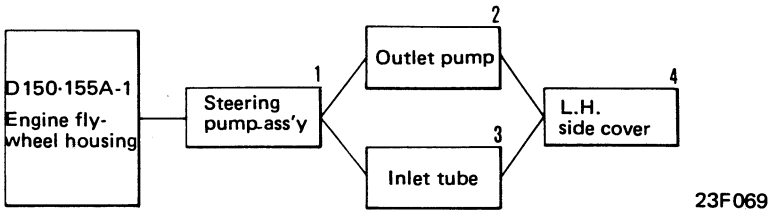
3. Outlet tube
Disconnect tube (3) from pump.



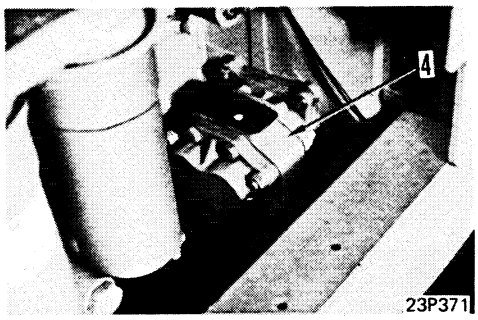
4. Steering pump assembly
Remove bolts fastening pump assembly (4); remove assembly.
kg Steering pump: **25 kg**



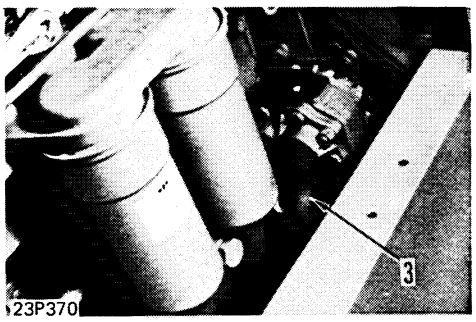
MOUNTING STEERING PUMP



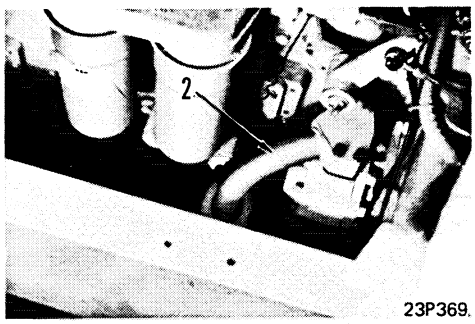
1. **Steering pump assembly**
   Set pump assembly (4) with O-ring and driving shaft splines meshing and tighten bolts.



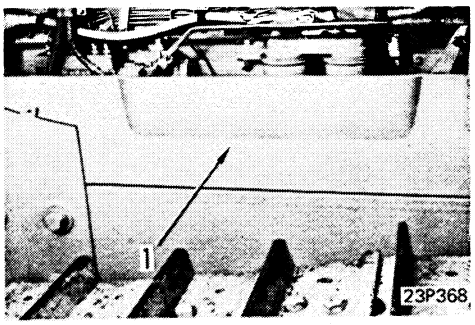
2. **Outlet pump**
   Connect tube (3) with O-ring to pump assembly.



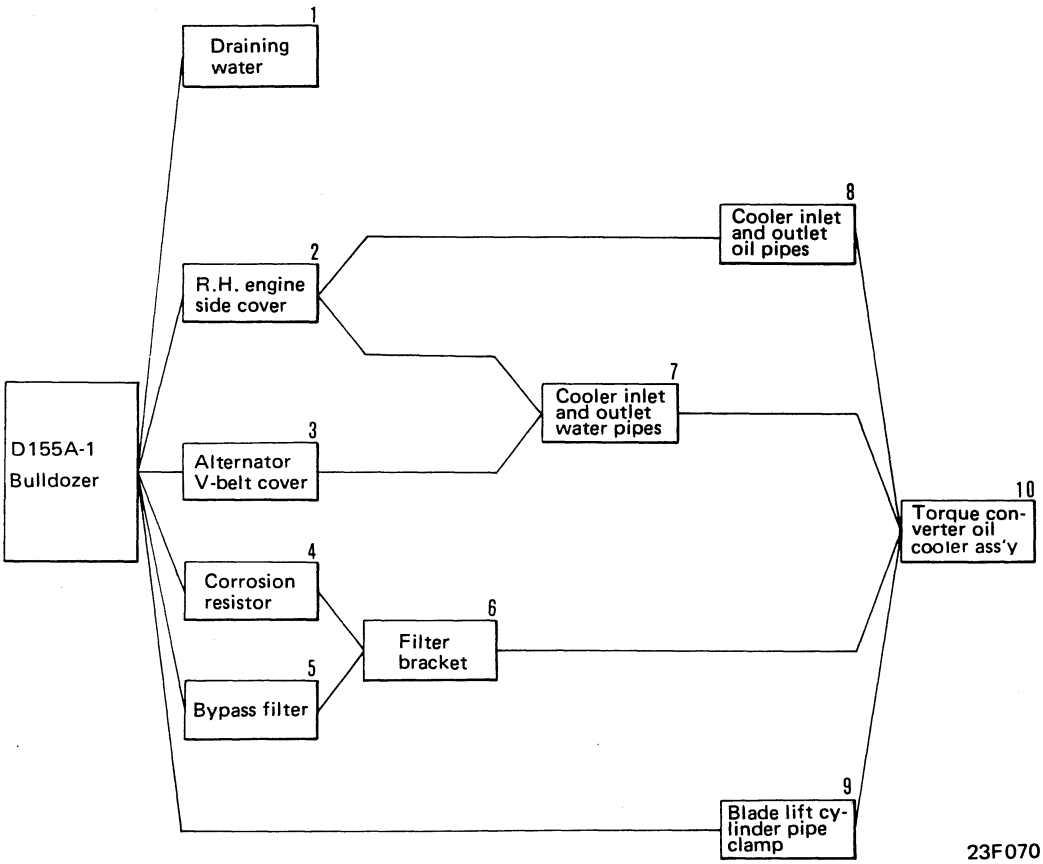
3. **Inlet tube**
   Connect tube (2) with O-ring to pump assembly.



4. **L.H. side cover**
   Install L.H. side cover (1).

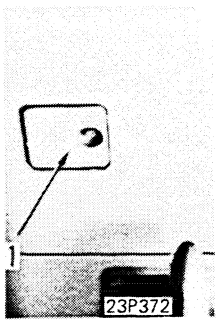


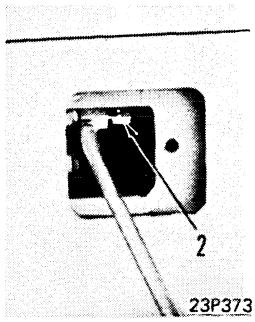
DISMOUNTING TORQUE CONVERTER OIL COOLER D155A



1. Draining water

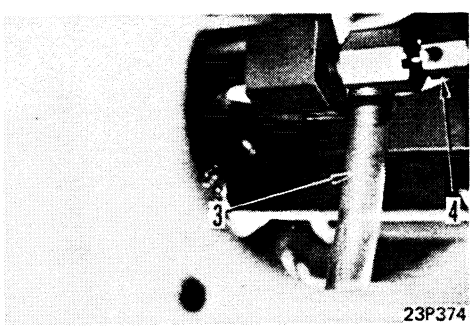
1) Remove inspection cover (1) from radiator under guard. Draw drain hose out and open drain cock (2) to drain cooling water.



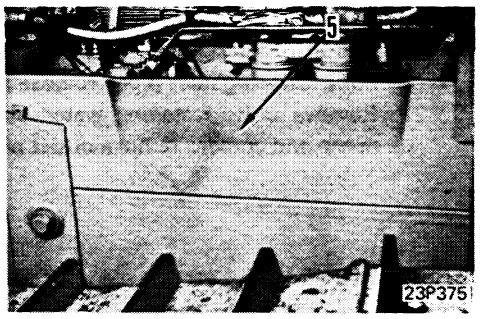


2) Pull out cooler water drain hose (3) through inspection window on the right side of engine under guard. Open cock (4) to drain water.

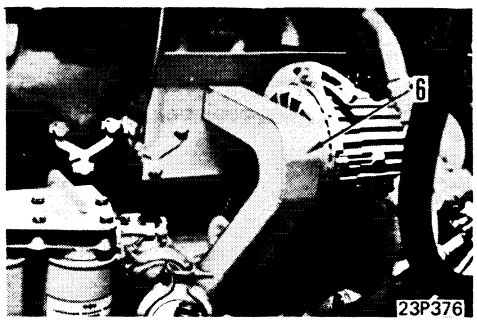
Quantity of drain water: **approx. 150 ℓ**



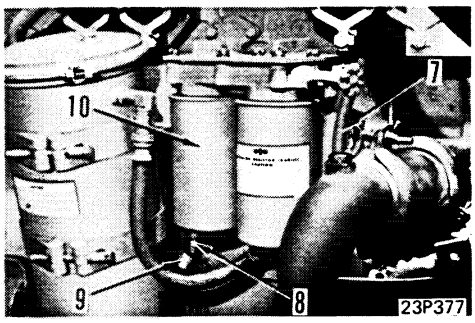
2. R.H. engine side cover
Remove R.H. engine side cover (5).



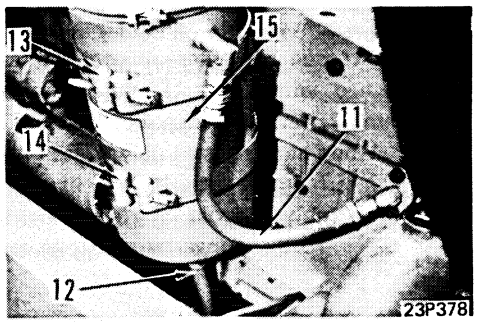
3. Alternator V-belt cover
Remove V-belt cover (6).



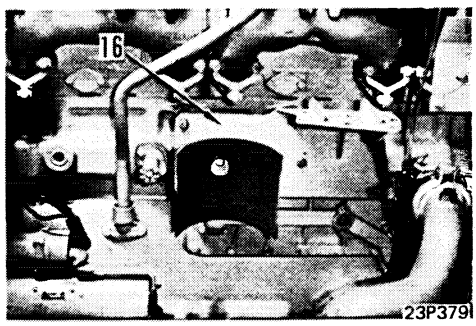
4. Corrosion resistor
1) Remove corrosion resistor inlet hose (7)
2) Disconnect outlet hose (8) from corrosion resistor and remove pipe clamp (9).
3) Remove bolts securing corrosion resistor (10) to bracket; remove corrosion resistor.



5. Bypass filter
1) Disconnect bypass filter inlet hose (11) from engine oil cooler. Disconnect outlet hose (12) from filter.
   ★ If disconnection of outlet hose from filter is difficult, perform it after removing filter clamp bands (13) and (14).
2) Remove bypass filter clamp bands (13) and (14). Remove bypass filter (15).

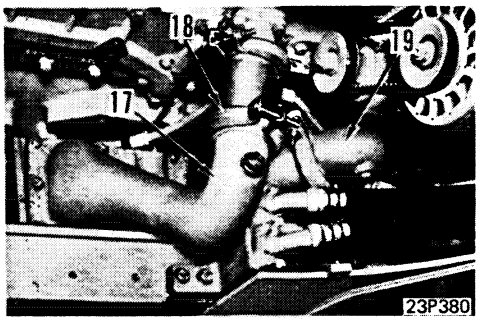


6. Filter bracket
Remove filter bracket (16).



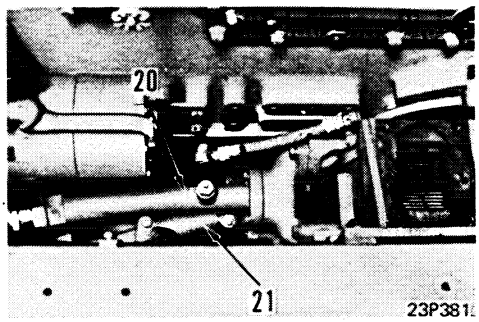
7. Cooler inlet and outlet water pipes

1) Loosen coupling (18) for water inlet pipe (17) and remove bolts fastening inlet pipe; remove inlet pipe.
2) Remove bolts fastening water outlet pipe (19) to water pump and cooler; remove outlet pipe.



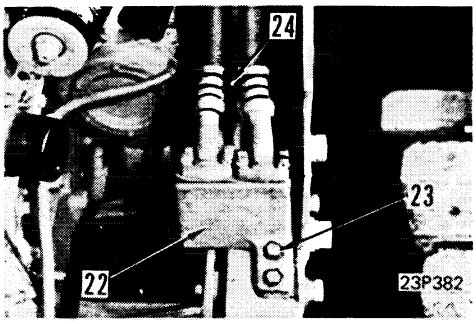
8. Cooler inlet and outlet oil pipes

1) Disconnect cooler oil inlet tube (20) and keep tube pulled to the starting motor side.
2) Disconnect cooler oil outlet tube (21).



9. Blade lift cylinder pipe clamp

Remove bolts (23) securing blade lift cylinder pipe (22) to clamp (24).

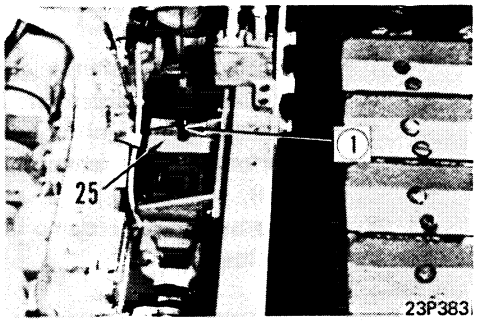


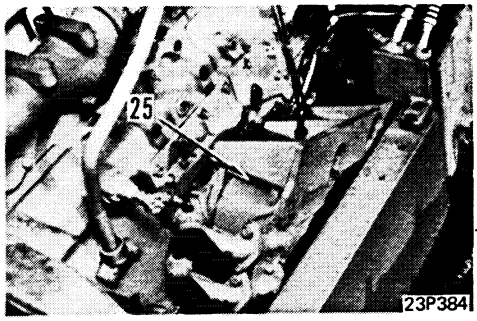
10. Torque converter oil cooler assembly

Sling torque converter oil cooler assembly (25) with hook ① attached with crane. Remove five bolts fatening oil cooler assembly; remove assembly.

★ When slinging assembly, raise blade cylinder pipe to avoid interference with it and lift up the rear end of cooler assembly to avoid interference with pipe and valve.

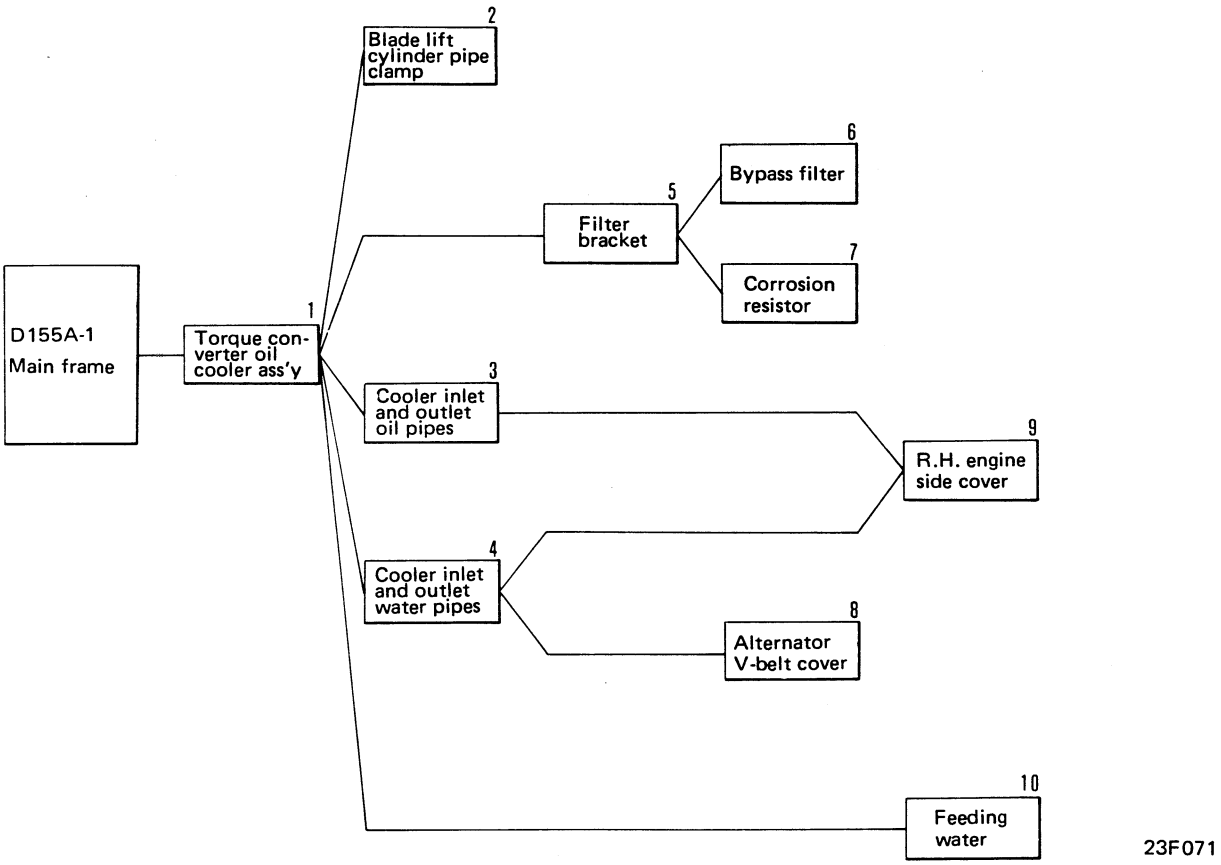
kg Torque converter oil cooler assembly: **115 kg**





MOUNTING TORQUE CONVERTER OIL COOLER

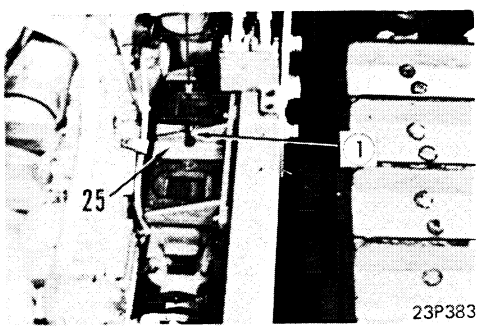
D155A



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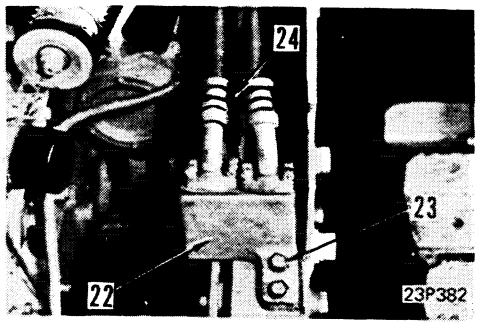
1. **Torque converter oil cooler assembly**
   Lift torque converter oil cooler assembly (25) with hook ① attached, with crane into position and install it with mounting bolts.
   ★ When tightening bolts, keep sling ropes rather tight.





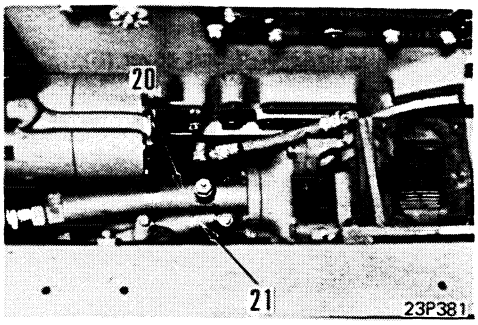
2. Blade lift cylinder pipe clamp

Install clamp (24) for blade lift cylinder pipe (22) with bolts (23).



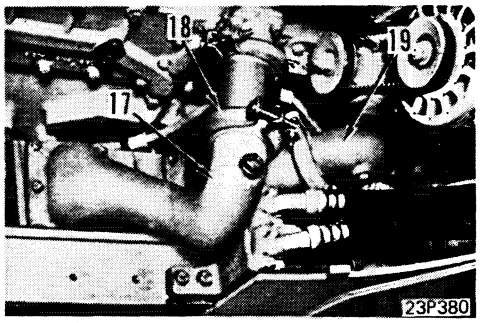
3. Cooler inlet and outlet oil pipes

1) Connect oil outlet tube (21), with O-ring in flange face, to cooler.
2) Connect oil inlet tube (20), with O-ring in flange face, to cooler.



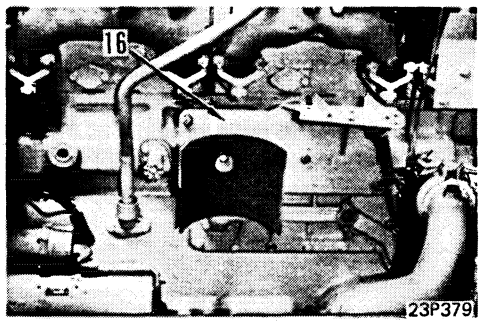
4. Cooler inlet and outlet water pieps

1) Install water outlet pipe (19), with gasket on each end face, between water pump and cooler.
2) Connect water inlet pipe (17) with coupling (18) to gasketed flange of cooler.
3) Tighten coupling (18).



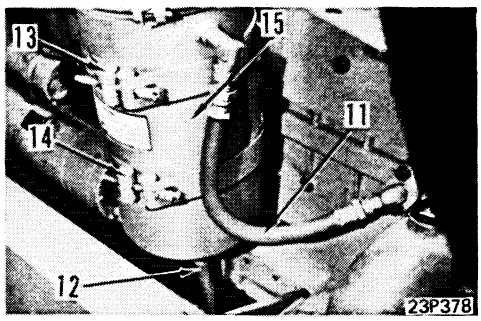
5. Filter bracket

Install filter bracket (16).



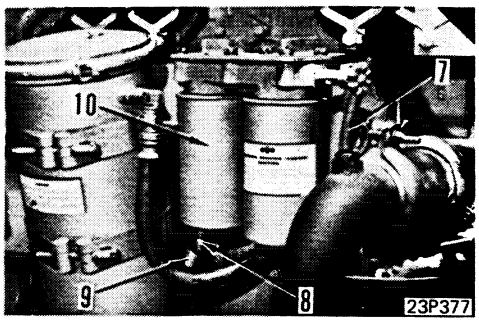
6. Bypass filter

1) Install bypass filter (15) with clamp bands (13) and (14).
2) Conenct outlet hose (12) to bypass filter. Connect inlet hose (11), with gasket on flange, to engine oil cooler.



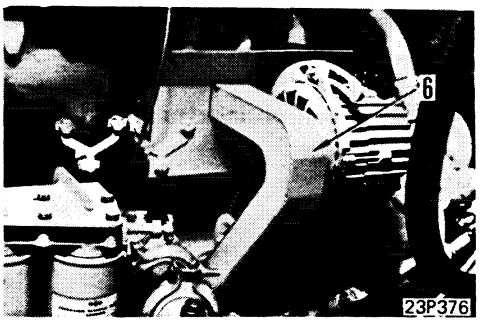
7. Corrosion resistor

1) Install corrosion resistor (10) on bracket.
2) Connect outlet hose (8) to corrosion resistor and install pipe clamp (9).
3) Connect inlet hose (7) to corrosion resistor.



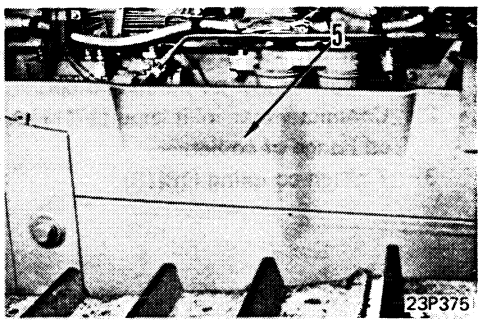
8. Alternator V-belt cover

Install alternator V-belt cover (6).



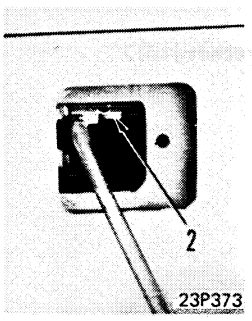
9. R.H. engine side cover

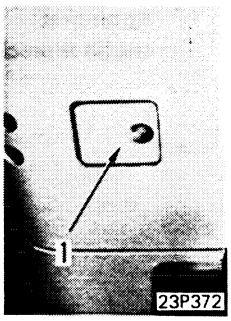
Install R.H. engine side cover (5).

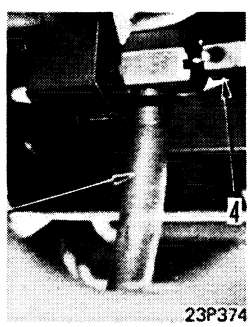


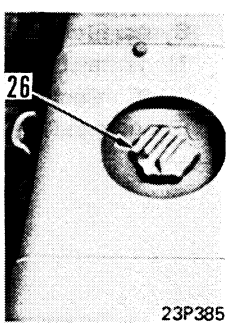
10. Feeding water

1) After confirming that drain cock (2) under radiator and drain cock (4) under oil cooler are closed, fit inspection cover to radiator under guard.
2) Remove water filler cap (26) and feed water.
   ★ Water capacity: **approx. 150 liters**



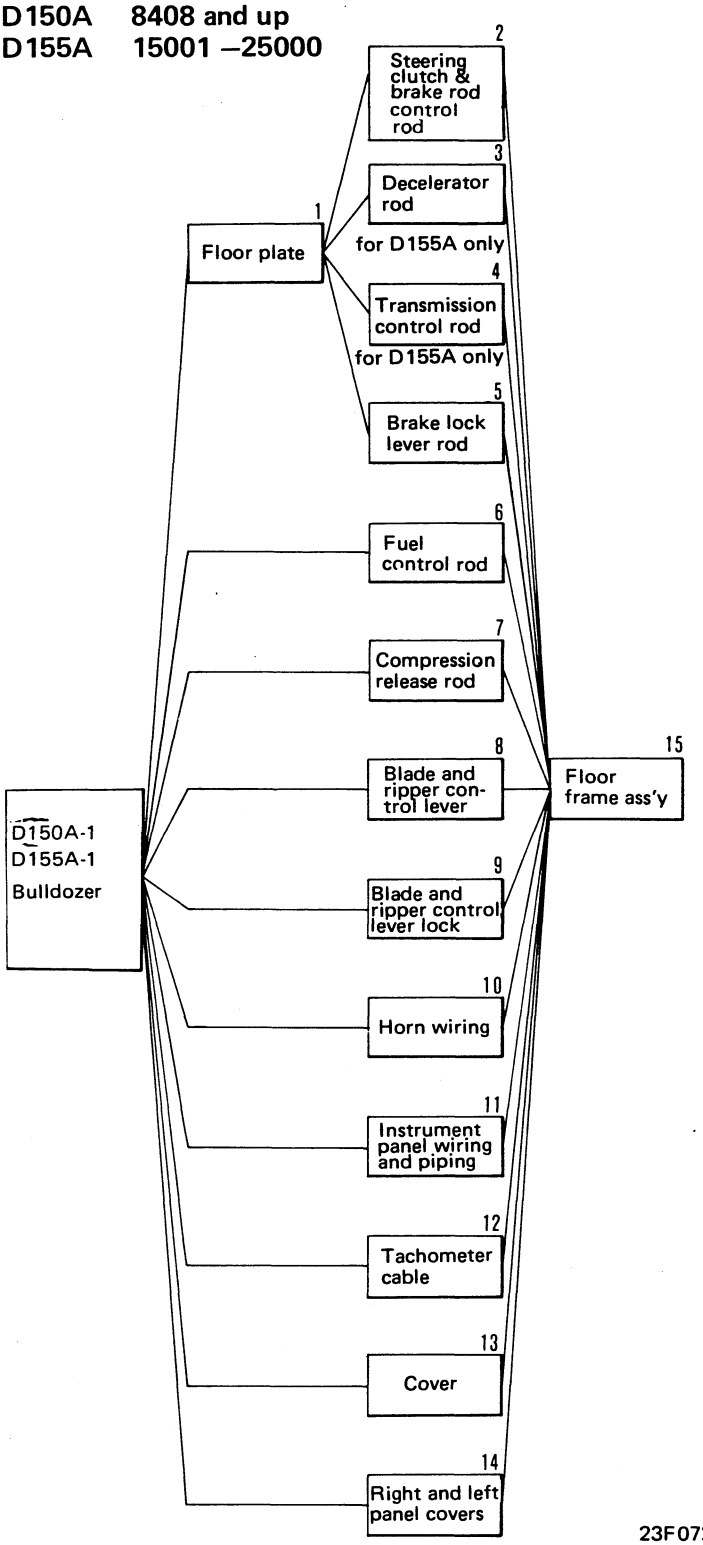




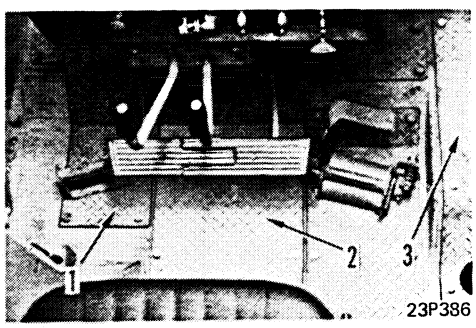


DISMOUNTING FLOOR FRAME

D150A 8408 and up
D155A 15001 –25000



23F072

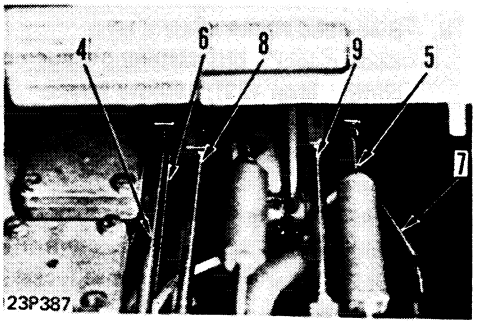


23P386

1. Floor plate
Remove floor plates (1), (2) and (3).

2. Steering clutch & brake control rod

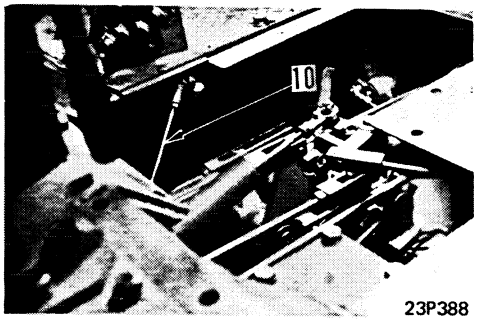
1) Remove joint pins to remove steering clutch rods (4) and (5) from floor frame.
2) Remove joint pins to remove steering brake rods (6) and (7) from floor frame. Remove brake rods (8) and (9).
   ★ After removing brake pedal rods (8) and (9), sling them from floor frame with wire rope.



3. Decelerator rod

Remove lock nut and disconnect decelerator rod (10) from pedal.

★ After removing rod, sling it from floor frame with wire rope, taking care to prevent interfering with steering clutch rods.

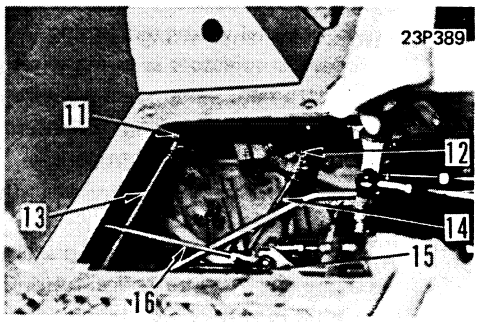


4. Transmission control rod

Remove lock nuts (11) and (12). Disconnect transmission control rods (13) and (14) from lever.

5. Brake lock lever rod

Remove lock nut (15) and disconnect brake lock lever rod (16) from lever.

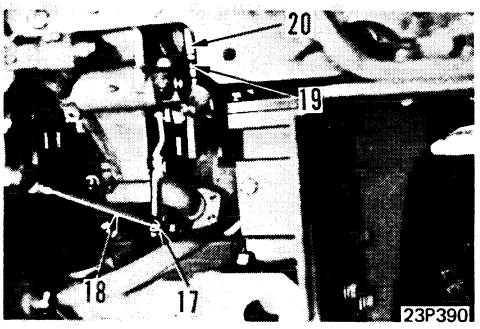


6. Fuel control rod

Remove lock nut (17) and remove fuel control rod (18) from floor frame.

7. Compression release rod

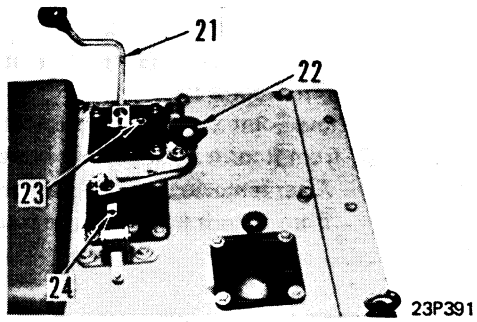
Remove lock nut (19) securing compression release rod (20) to floor frame; remove rod.



8. Blade and ripper control lever

Loosen lock bolts fastening blade control lever (21) and ripper control lever (22); remove levers.

★ Check for positions from which the levers are removed.



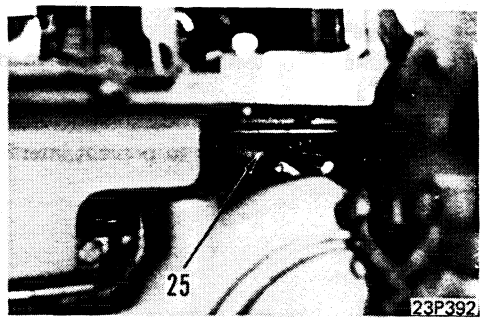
9. Blade and ripper control lever lock

Remove nuts fastening blade control lever lock (23) and ripper control lever lock (24); remove locks.

10. Horn wiring

Disconnect horn wire harness (25) and out nylon clamp.

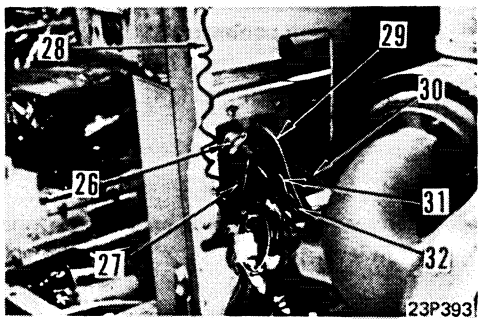
⚠ Disconnect battery cord from negative terminal.



11. Instrument panel wiring and piping

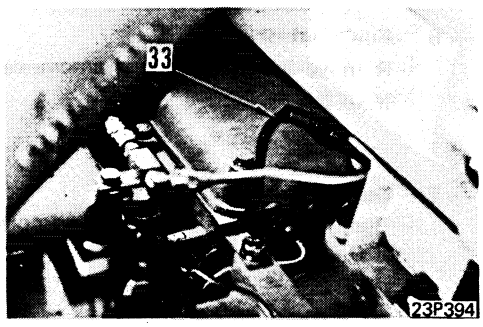
1) Loosen connectors securing wires assemblies (26) and (27) to instrument panel; remove wires assemblies.
2) Remove bolt securing ground connection wire (28) to panel; remove wire from panel.
3) Loosen clamp fastening dust indicator hose (29) to panel; remove hose from panel.
4) Remove sleeve nuts and disconnect priming tube (30), engine oil pressure gauge tube (31) and air intake heater tube (32) from panel.

★ Be sure to close fuel feed valve under fuel tank.



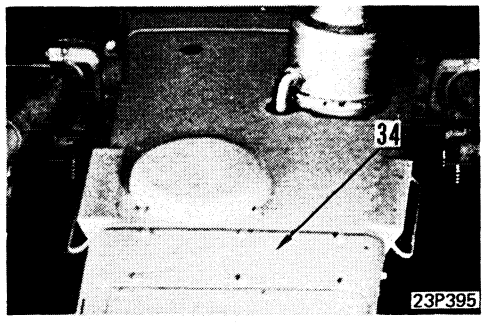
12. Tachometer cable

Remove sleeve nut fastening tachometer cable (33); remove cable.



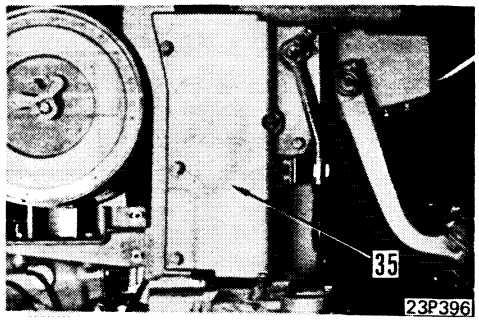
13. Cover

Remove bolts fastening cover (34); remove cover.

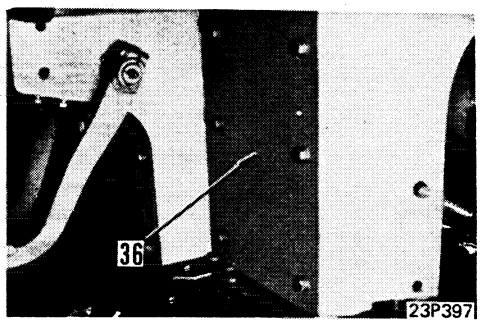


14. Right and left panel covers

1) Remove bolts fastening left panel cover (35); remove panel.

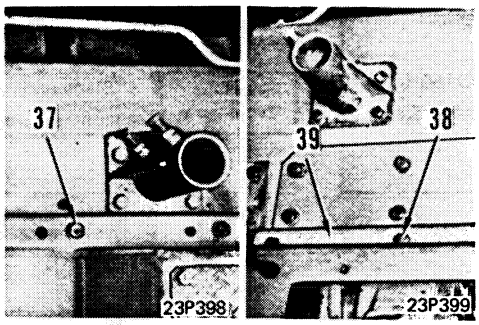


2) Remove bolts fastening right panel cover (36); remove panel.

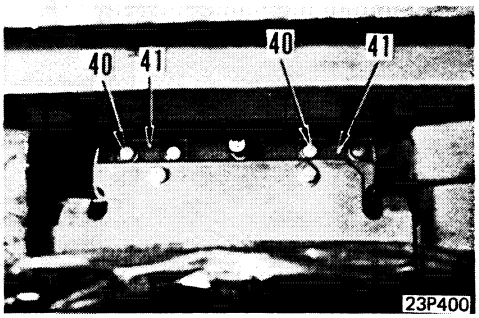


15. Floor frame assembly

1) Remove bolts (37).
2) Remove bolts (38). Remove cover (39).

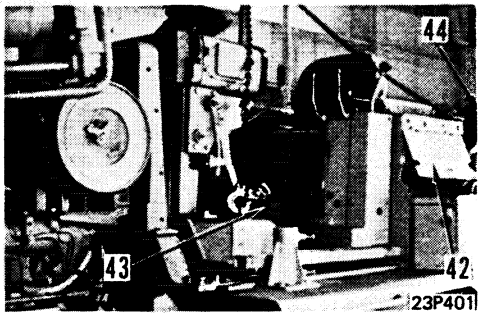


3) Remove rear mounting bolts (40). Remove plates (41).
   ★ Slide operator's seat forward and lay down backrest when removing plate mounting bolts.



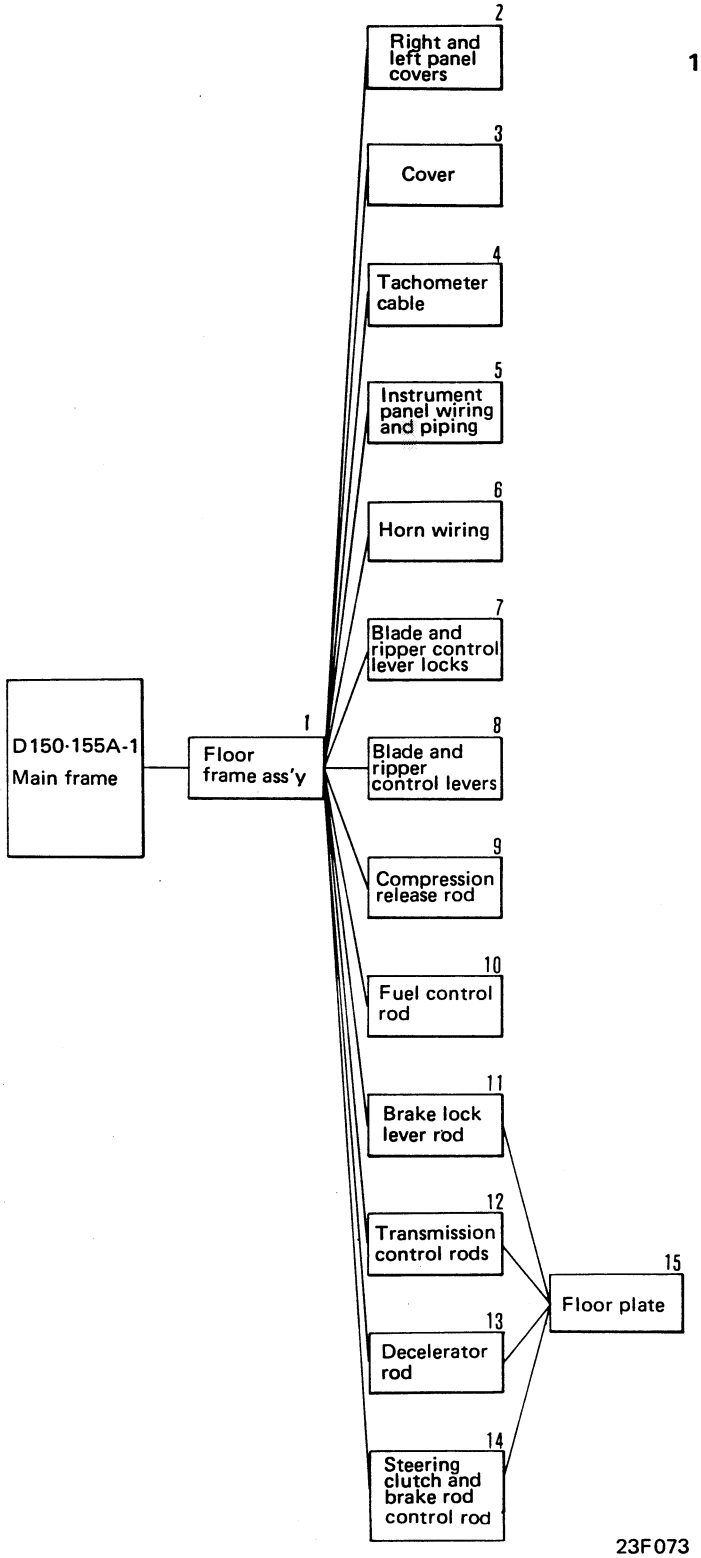
4) Open battery cover (42). Attach hanging bolts (12 mm, P=1.75) and (14 mm, P=2.0), two bolts each, to floor frame assembly (43).
   Gradually lift off assembly with four wires, taking care to prevent interfering with the surroundings.
   ★ Pull out tachometer cable from hood mounting bracket while floor frame is lifted.
   ★ Avoid interfering with steering and transmission oil filler tube (44) when lifting floor frame.

kg Floor frame assembly (with instrument panel); **450 kg**



MOUNTING FLOOR FRAME

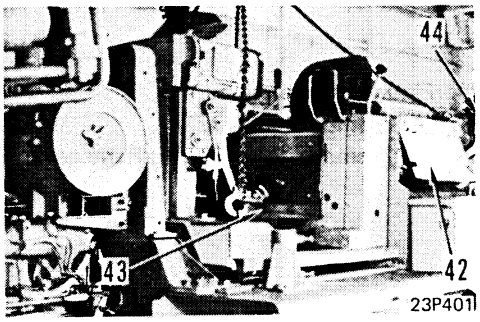
D150A 8408 and up
D155A 15001 – 25000



23F073

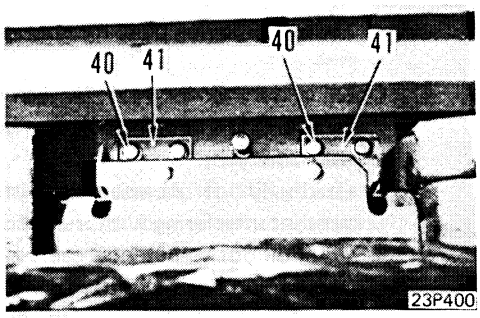
1. Floor frame assembly

1) Position two plates on left mount of floor frame and plate on rear mount.
2) Sling floor frame assembly (43) with ropes hooked to four hanging bolts and lift it into position on mount, taking care to prevent interference with the surroundings.
   - ★ Position floor frame assembly in place so that blade and ripper control levers are not restrained from normal operation.
   - ★ Lower floor frame assembly, while inserting tachometer cable into hood mounting bracket.
   - ★ Avoid interfering with steering and transmission oil pipe (44) while lowering floor frame assembly.
3) Close battery cover (42).



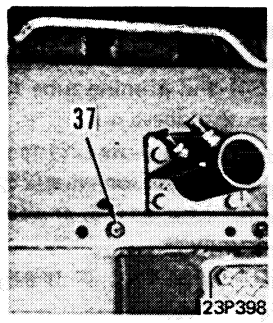
23P401

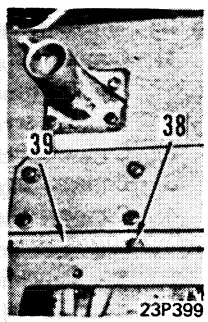
4) Position two plates (41) in place and tighten bolts (40).



23P400

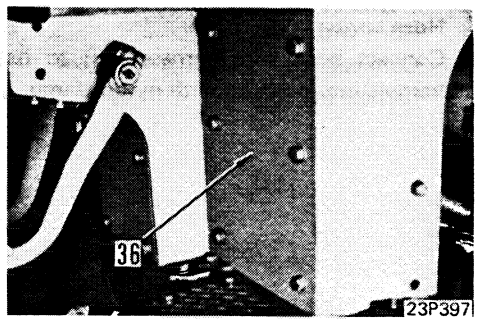
5) Position cover (39) in place and tighten bolts (38).
6) Tighten left hand mounting bolts (37).



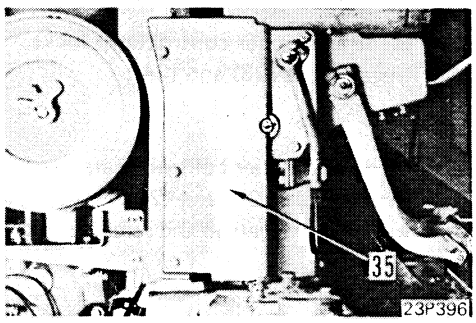


2. Right and left panel covers

1) Install R.H. panel cover (36).



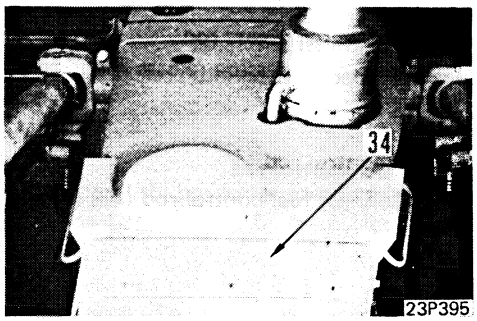
2) Install L.H. panel cover (35).



3. Cover

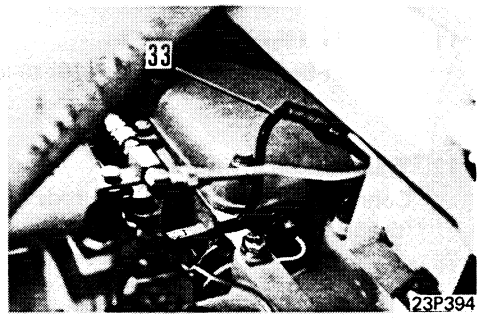
Install cover (34).

★ Install both cover and hood with bolts.



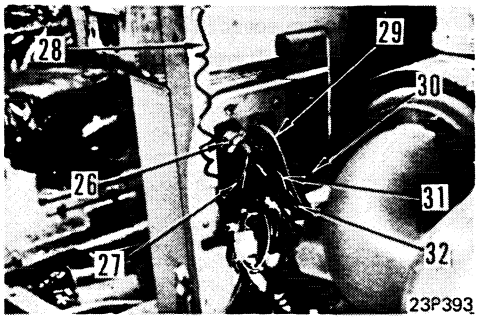
4. Tachometer cable

Connect tachometer cable (33) by tightening sleeve nut.



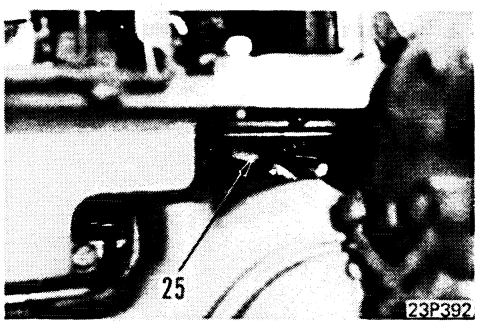
5. Instrument panel wiring and piping

1) Connect air intake heater tube (32), engine oil pressure gauge tube (31) and priming tube (30) to instrument panel with the respective sleeve nuts.
2) Connect dust indicator hose (29) to panel and fasten clamp.
3) Connect ground connection wire (28) to panel.
4) Connect wires assemblies (26) and (27) to panel and tighten connectors securely.
   ★ Connect battery cord to negative terminal and open fuel feed valve.



6. Horn wiring

Connect horn wire harness (25) to its connector and secure harness into position with nylon clamp.



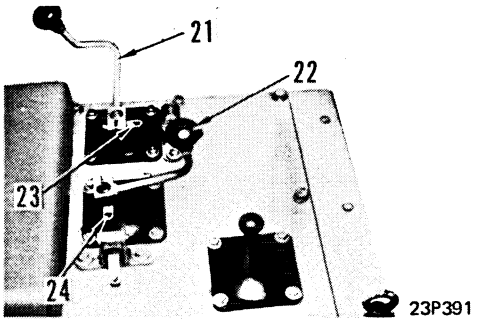
7. Blade and ripper control lever locks

Install locks (23) and (24).

8. Blade and ripper control levers

Install levers (21) and (22).

★ Install levers in the same positions as before removal.

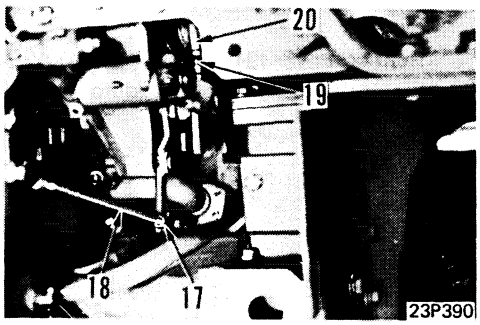


9. Compression release rod

Connect compression release rod (20) with nut (19).

10. Fuel control rod

Connect fuel control rod (18) with nut (17).

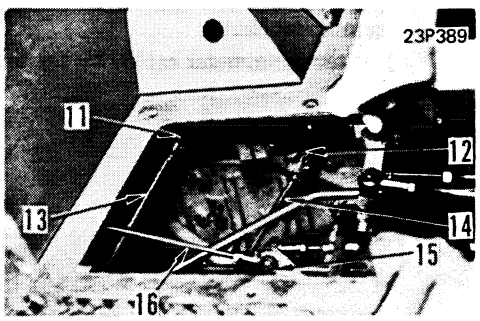


11. Brake lock lever rod

Connect brake lock lever rod (16) to lever with nut (15).

12. Transmission control rods

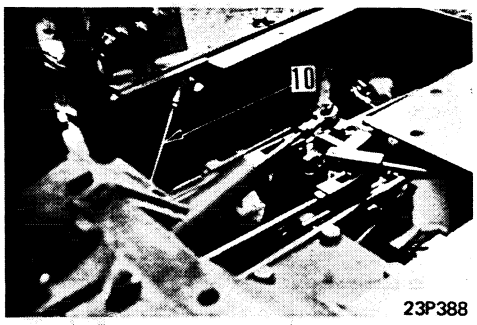
Connect transmission control rods (13) and (14) to the respective levers with nuts (11) and (12).



13. Decelerator rod

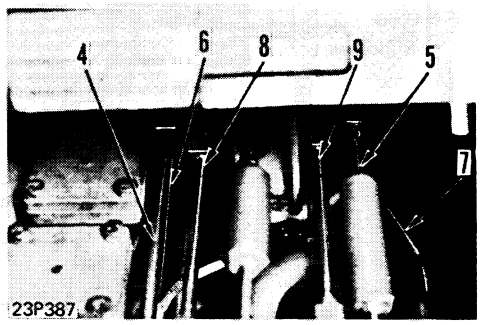
Connect decelerator rod (10) to pedal with nut.

★ Pass decelerator rod under right-hand steering clutch rod when installing rod.



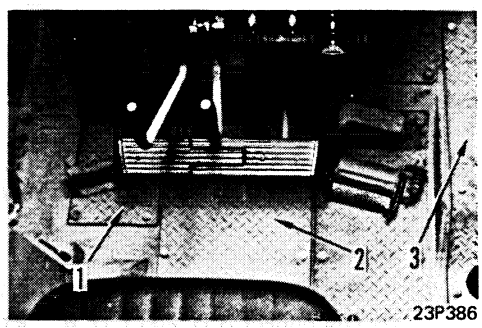
14. Steering clutch and brake control rod

1) Connect steering brake pedal rods (8) and (9) to shaft side link and brake rods (6) and (7) to floor frame side link. Lock them with pins.
   ★ Be sure to bend cotter pins securely.
2) Connect steering clutch rods (4) and (5) to floor frame side link and lock them with pins.
   ★ Be sure to bend cotter pins securely.



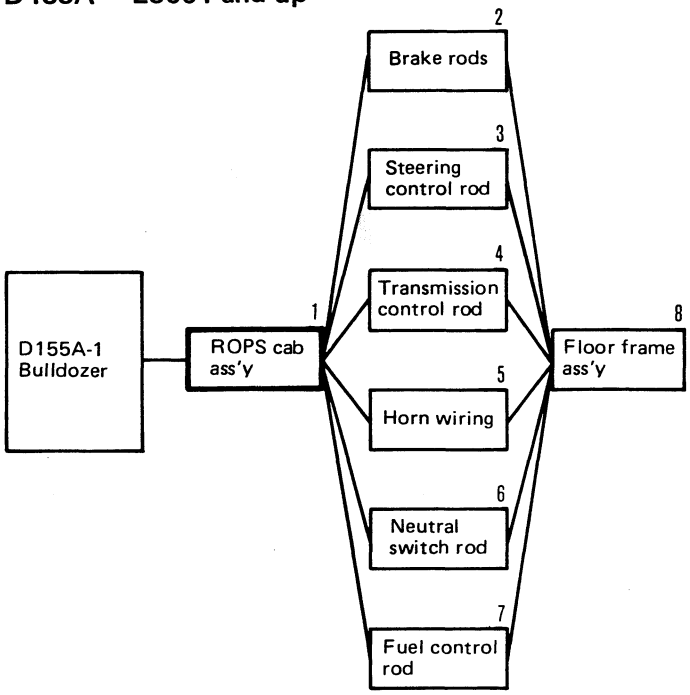
15. Floor plate

Install floor plates (1), (2) and (3).



DISMOUNTING FLOOR FRAME

D155A 25001 and up



1. ROPS cab assembly
Dismount the ROPS cab assembly. For details, see DISMOUNTING ROPS CAB ASSEMBLY.

2. Brake rods
1) Disconnect parking brake rod (1).
2) Disconnect R.H. and L.H. brake rods (2).

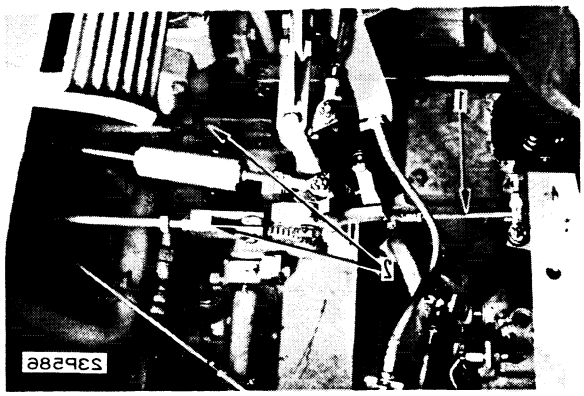
3. Steering control rods
Disconnect two steering control rods (3).

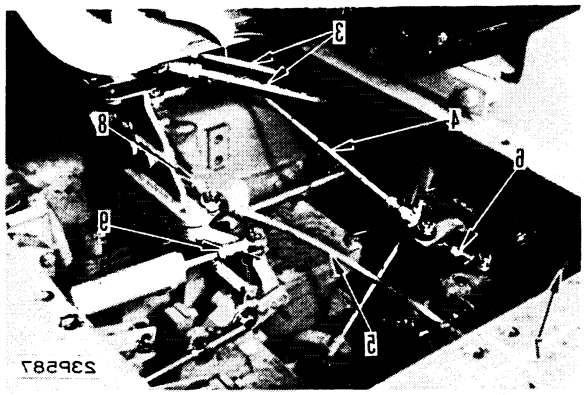
4. Transmission control rod
1) Disconnect gear shift lever rod (4).
2) Disconnect forward-reverse control cable (5).

5. Horn wiring
Disconnect horn wiring (6) from the connector.

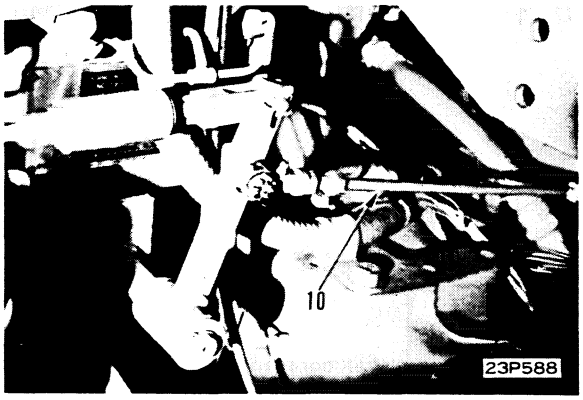
6. Neutral switch rod
Disconnect neutral switch rod (7).

7. Fuel control rods
1) Disconnect fuel control rods (8) and (9).





2) Disconnect fuel control rod (10).

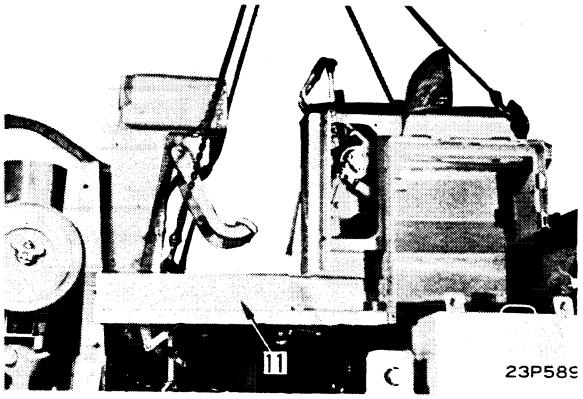


8. Floor frame assembly

Install four lifting bolts including two bolts (12 mm, P=1.75) and two bolts (14 mm, P=2.0), then lift off floor frame assembly (11).

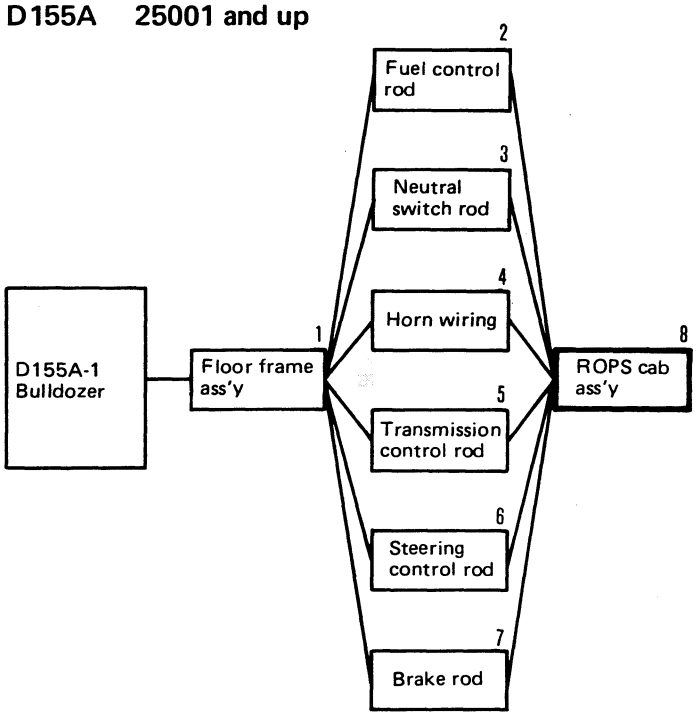
★ Lift off the assembly with care so that it doesn't hit the steering and transmission oil tubes or any other nearby parts.

kg Floor frame assembly: **400 kg**



MOUNTING FLOOR FRAME

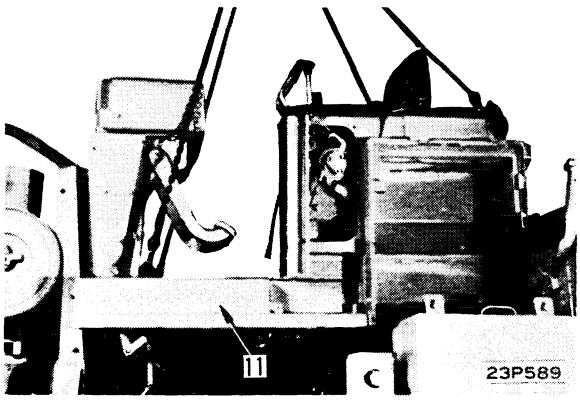
D155A 25001 and up



★ Securely bend the cotter pin for the connecting pin on each rod.

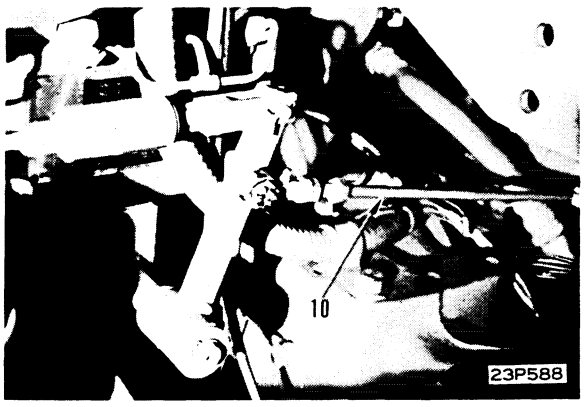
1. Floor frame assembly

Sling floor frame assembly (11) with four cables, then place the assembly in position by gradually lowering it with care so that it does not hit the steering and transmission oil tubes or any other nearby parts.

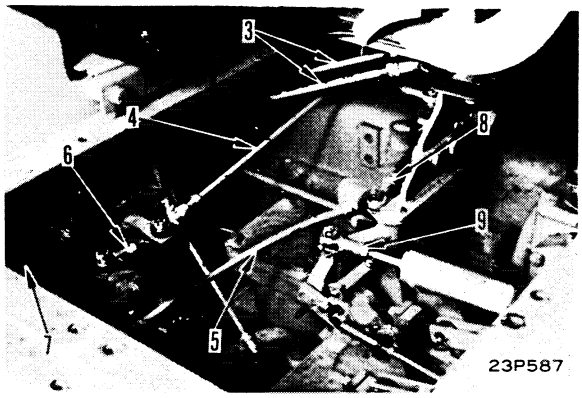


2. Fuel control rods

1) Connect fuel control rod (10).



2) Connect fuel control rods (8) and (9).



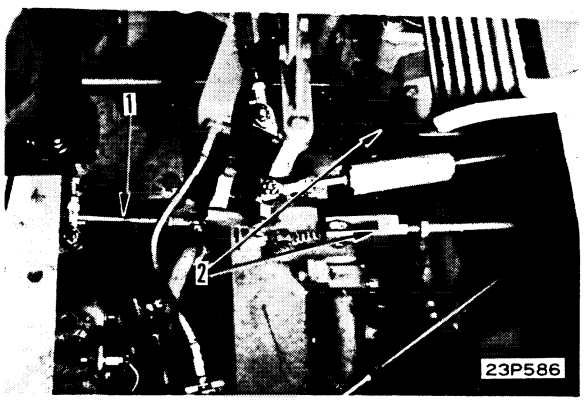
3. **Neutral switch rod**
   Connect neutral switch rod (7).

4. **Horn wiring**
   Connect horn wiring (6) to the connector.

5. **Transmission control rod**
   1) Connect forward-reverse control cable (5).
   2) Connect gear shift lever rod (4).

6. **Steering control rod**
   Connect two steering control rods (3).

7. **Brake rods**
   1) Connect R.H. and L.H. brake rods (2).
   2) Connect parking brake rod (1).



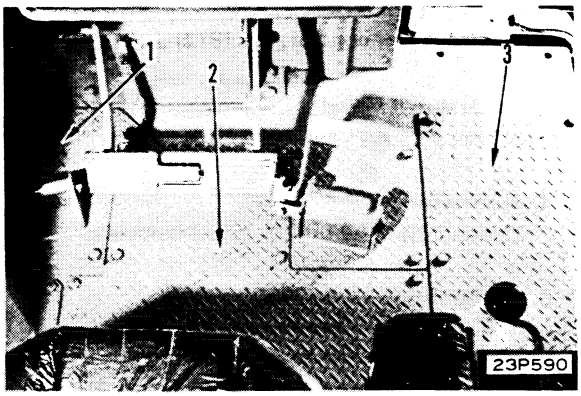
8. **ROPS cab assembly**
   Mount the ROPS cab assembly. For details, see MOUNTING ROPS CAB ASSEMBLY.

DISMOUNTING ROPS CAB

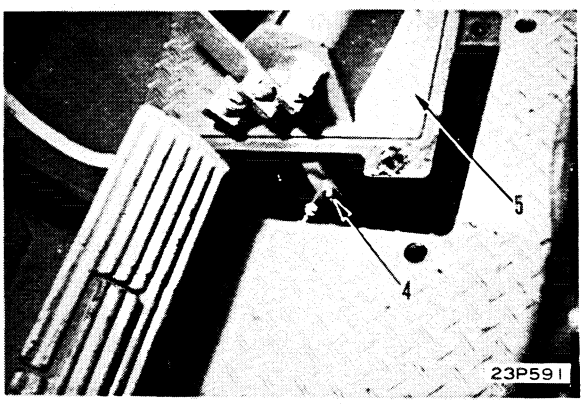
D155A 25001 and up

1. Floor plates

1) Remove floor plates (1), (2) and (3).

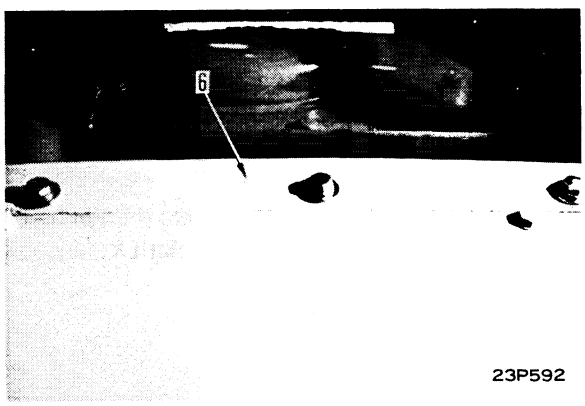


2) Disconnect decelerator rod (4), then remove floor plate (5).



2. Cover

Remove cover (6).

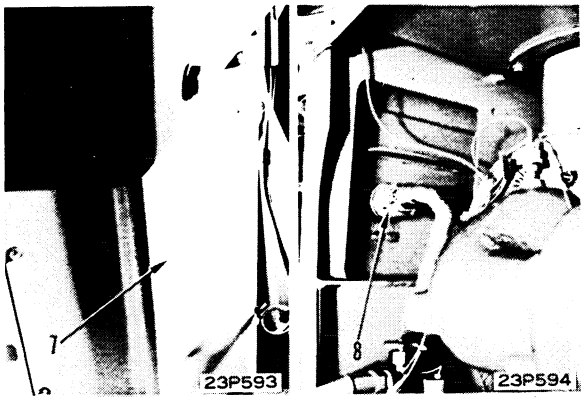


3. Cover

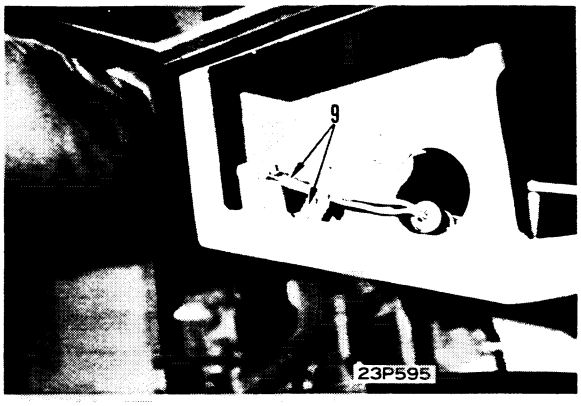
Remove cover (7).

4. Wiring harness

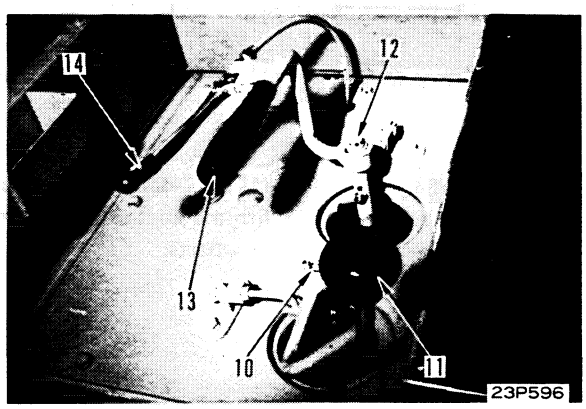
Disconnect wiring harness (8).



5. Horn wiring
Disconnect horn wiring (9).

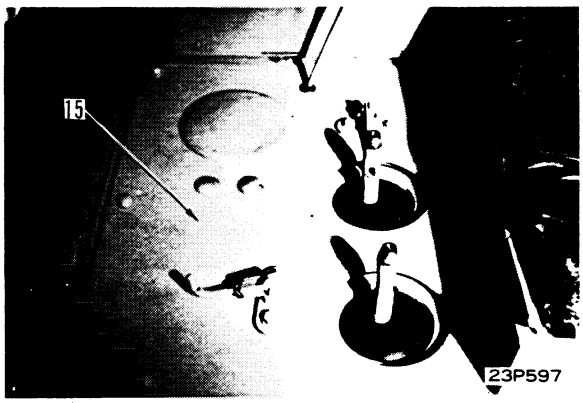


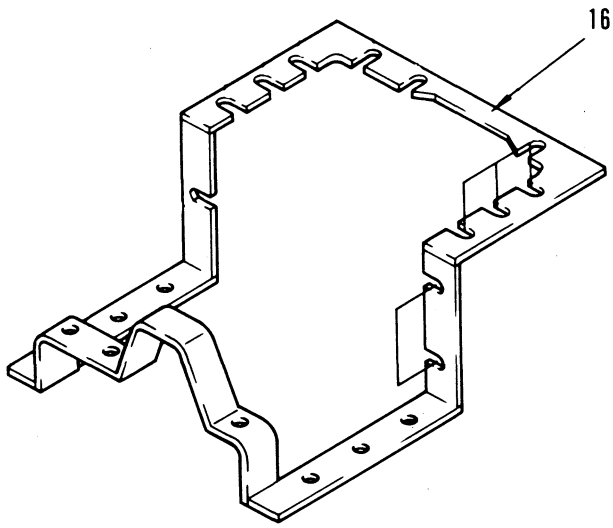
6. Ripper-blade control lever
1) Remove lock bolt (10) and blade control lever (11).
2) Remove lock bolt (12) and ripper control lever (13).
3) Disconnect the cable from lever (14).



7. Cover
Remove upper cover (15) of the servo valve.

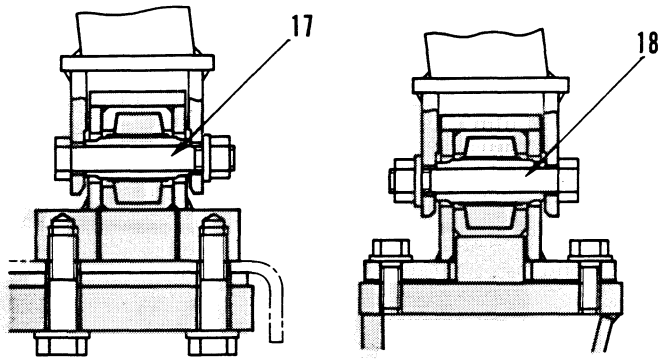
8. Rubber seal
Remove rubber seal (16) between the cab and the floor frame.



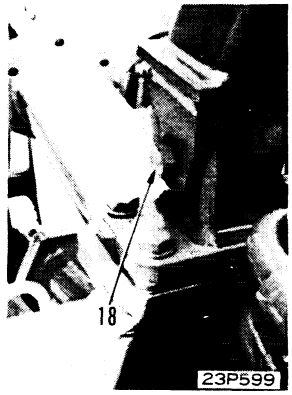


9. ROPS cab assembly

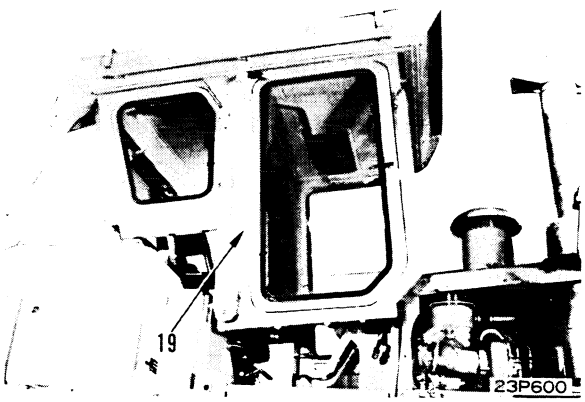
1) Remove front mount pin (17) and rear mount pins (18) on the R.H. and L.H. sides.







2) Connect wire ropes to the four lifting hooks on ROPS cab assembly (19). Dismount the cab by gradually lifting it with a crane. Take care not to let the cab hit any other parts.



MOUNTING ROPS CAB

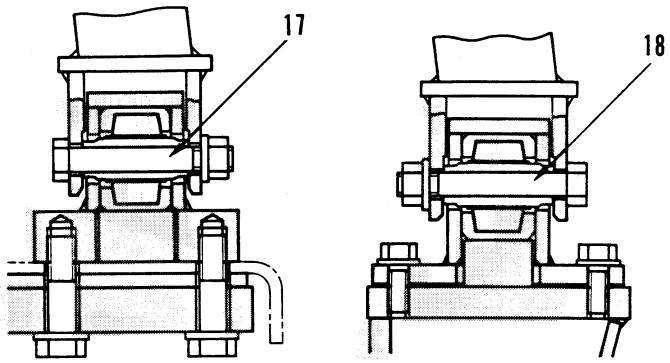
D155A 25001 and up

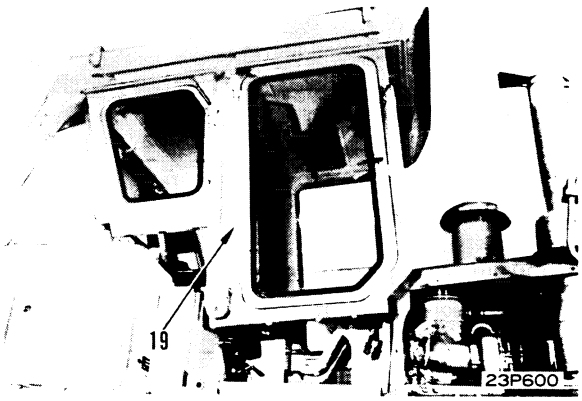
⚠ Use the following tightening torques to tightening the mounting bolts for the ROPS parts.

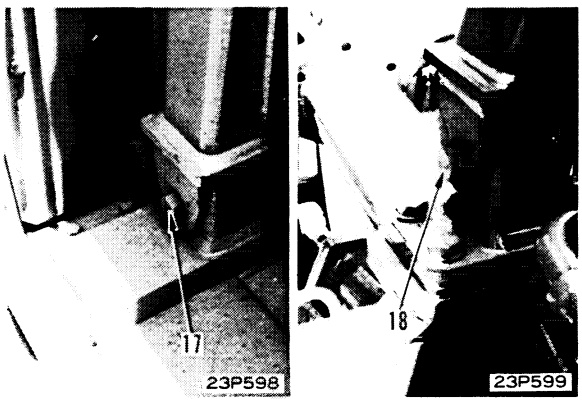
Nominal diameter of bolt: 12 mm	11.3 ± 1.2 kgm
Nominal diameter of bolt: 20 mm	56 ± 2 kgm
Nominal diameter of bolt: 24 mm	94.5 ± 10.5 kgm
Nominal diameter of bolt: 27 mm	135 ± 15 kgm
Nominal diameter of bolt: 30 mm	175 ± 20 kgm

1. ROPS cab assembly

1) Sling ROPS cab assembly (19) and set it in the mounting position.
2) Install R.H. and L.H. rear mount pins (18) and front mount pin (17) to secure the ROPS cab assembly.







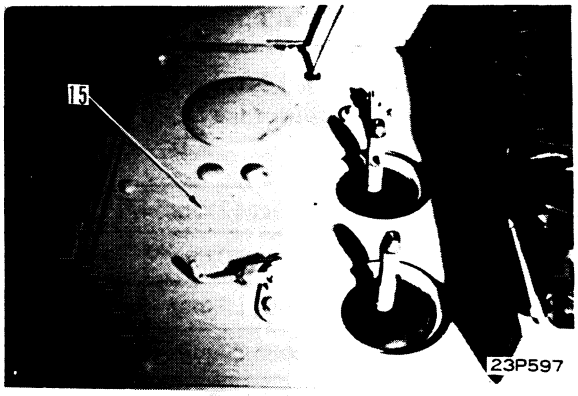
2. Rubber seal

Install rubber seal (16) between the cab and the floor frame.

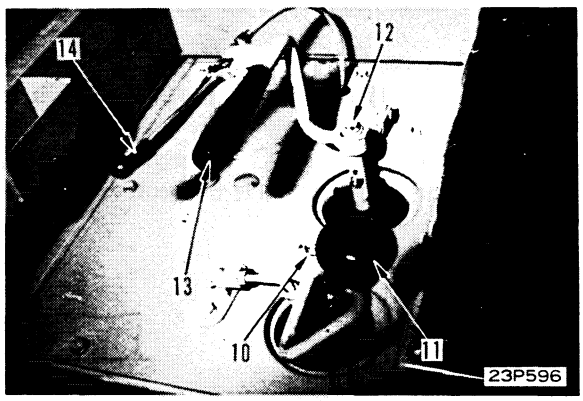
★ Cut off the rubber seal ends as required according to the cab size.

Cab side: **Adhesive agent (LT-1A)**

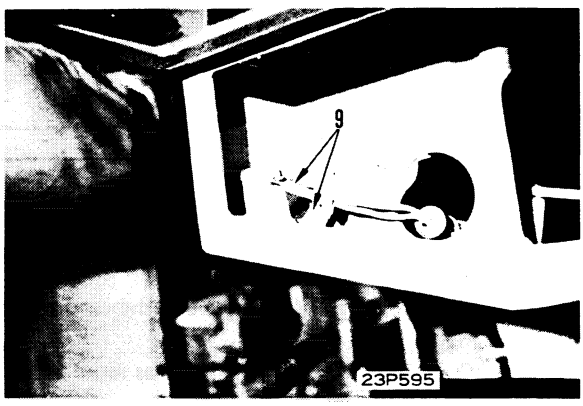
3. **Cover**
   Install servo valve upper cover (15).



4. **Ripper-blade control levers**
   1) Connect the cable to lever (14), install the lever to ripper control lever (13), and secure the ripper control lever with a pin.
      ★ Bend the cotter pin securely.
   2) Install the ripper control lever and secure it with lock bolt (12).
   3) Install blade control lever (11) and secure it with lock bolt (10).

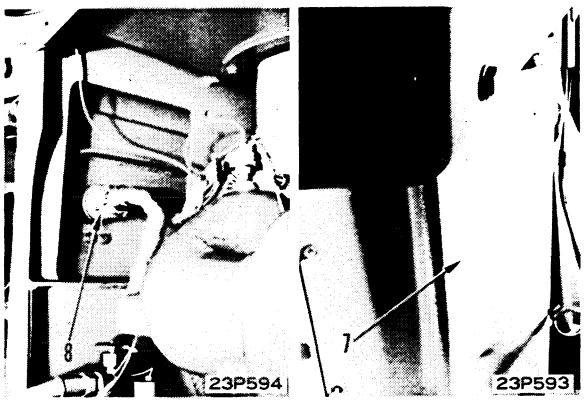


5. **Horn wiring**
   Connect horn wiring (9).

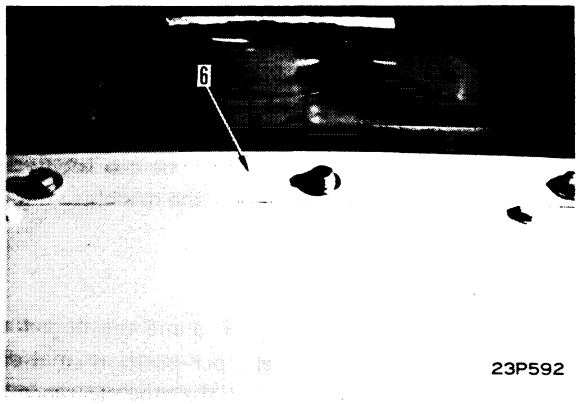


6. **Wiring harness**
   Connect wiring harness (8).

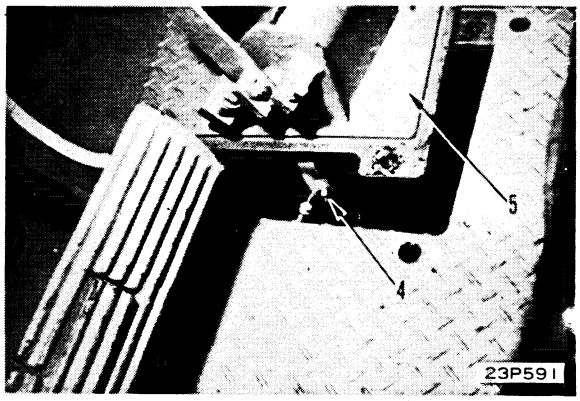
7. **Cover**
   Install cover (7).



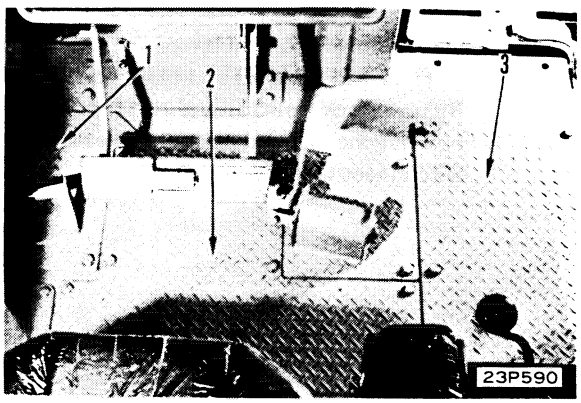
8. **Cover**
   Install cover (6).



9. **Floor plate**
   1) Install floor plate (5) and connect decelerator rod (4).



   2) Install floor plates (3), (2) and (1).



★ To adjust the ROPS cab, adjust each lever as described in TESTING AND ADJUSTING.

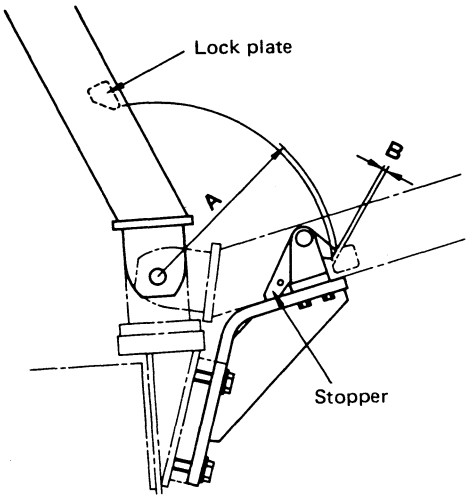
TILTING ROPS CAB

D155A 25001 and up

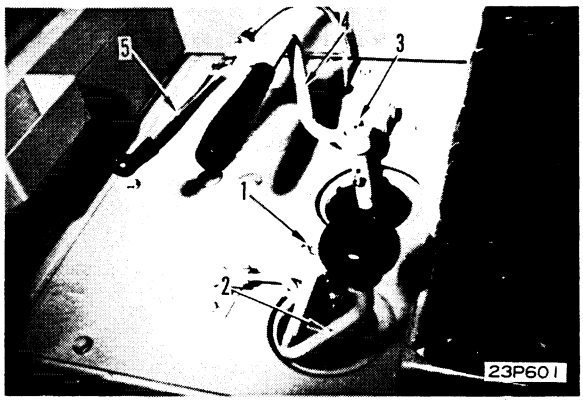
⚠ Observe all safety precautions while the crane is being used.
When the ROPS cab is being suspended, do not get on the bulldozer. While the cab is tilted, do not start the engine or move the machine.

- **Preparatory work**

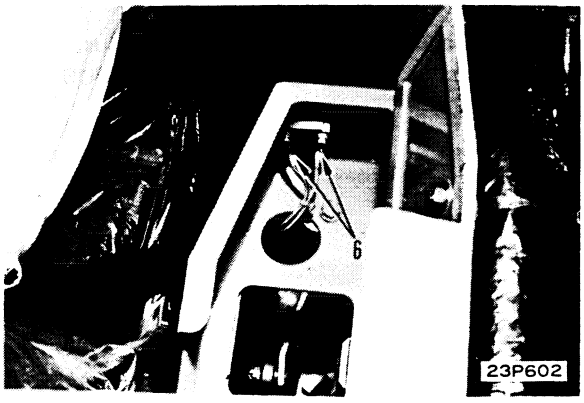
Before tilting the ROPS cab and the floor frame, use shims to adjust the stopper position so that dimension **A** is ± 1 mm so that the clearance between the lock plate and the stopper will be dimension **B** (standard clearance: 4 mm).



1. **Ripper and blade control levers**
   1) Remove lock bolt (1) and blade control lever (2).
   2) Remove lock bolt (3) and ripper control lever (4), pull out the pin, and disconnect lever (5).
   3) Disconnect the cable from the lever.

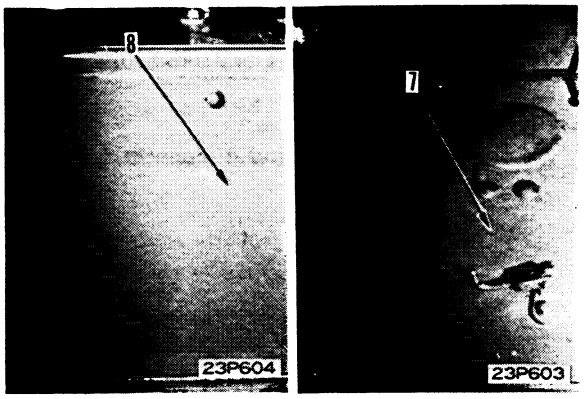


2. **Horn wiring**
   Open the armrest cover and disconnect horn wiring (6).



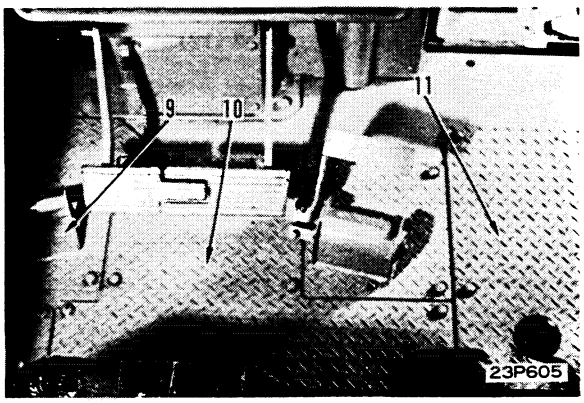
3. Cover

1) Remove the stopper and upper cover (7) of the servo valve.
2) Remove front cover (8) of the servo valve.

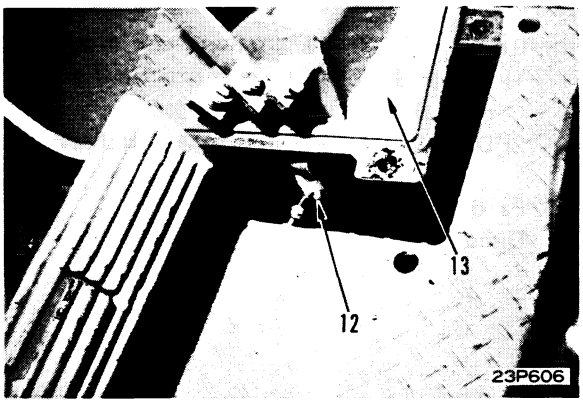


4. Floor plates

1) Remove floor plates (9), (10) and (11).

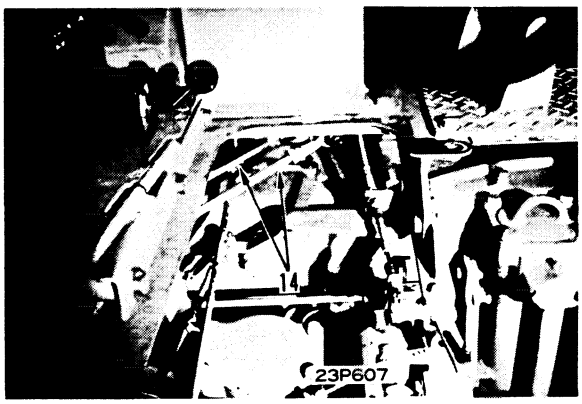


2) Disconnect decelerator rod (12) and remove floor plate (13).



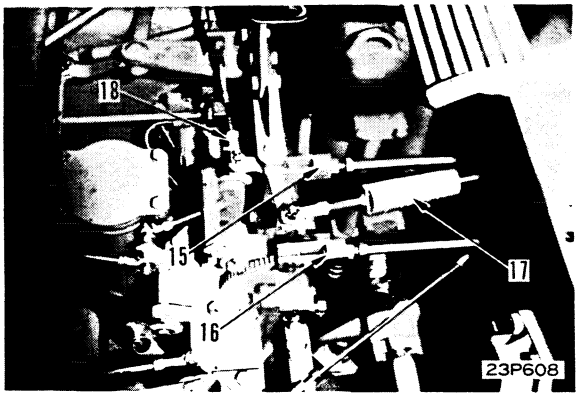
5. Steering rod

Disconnect R.H. and L.H. steering rods (14).

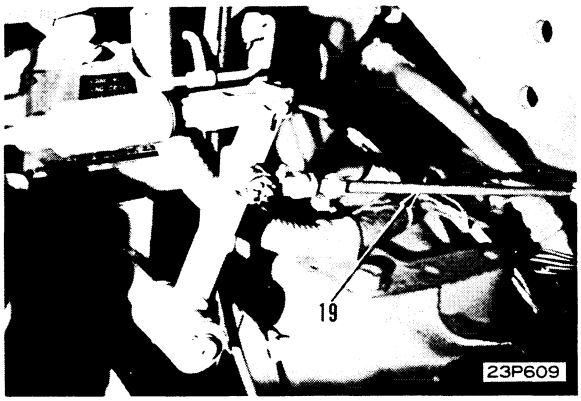


6. Brake rods
Disconnect R.H. and L.H. brake rods (15) and (16).

7. Fuel control rods
1) Loosen the lock nut and disconnect fuel control rods (17) and (18).

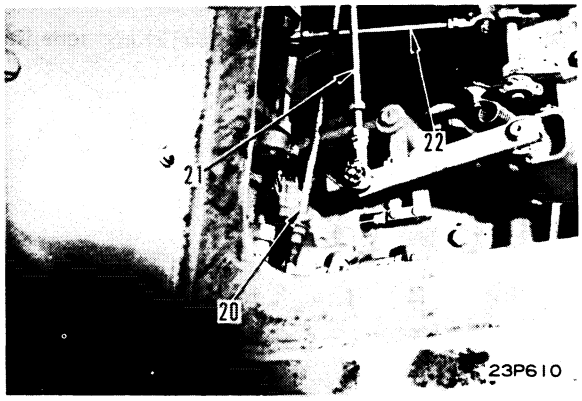


2) Disconnect fuel control rod (19).



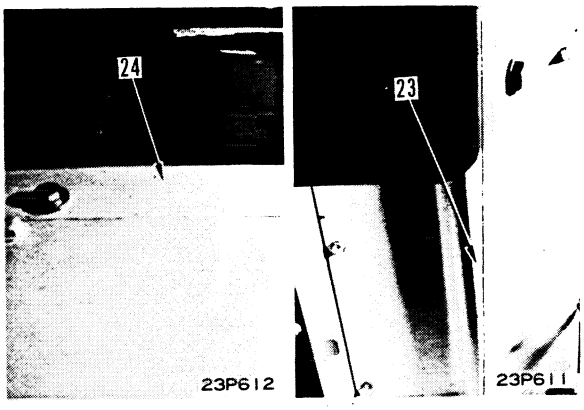
8. Gear shift lever rod and forward-reverse lever rod
1) Loosen the lock nut and disconnect gear shift lever rod (20).
2) Disconnect forward-reverse lever rod (21).

9. Parking brake rod
Disconnect parking brake rod (22).



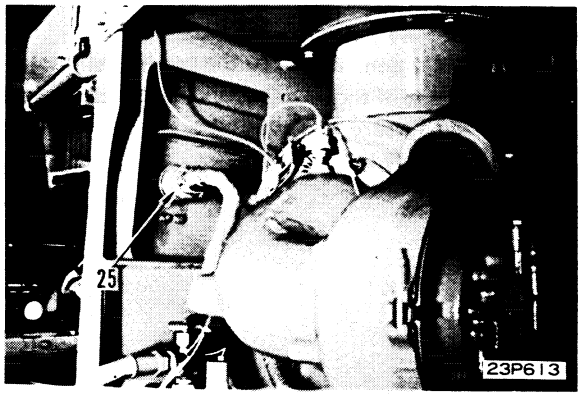
10. Cover
Remove cover (23).

11. Cover
Remove cover (24).



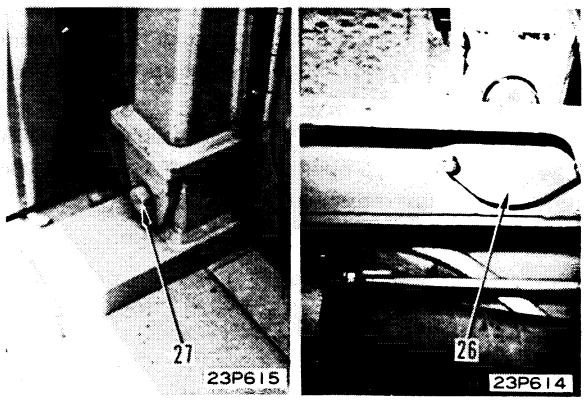
12. Wiring harness

Disconnect wiring harness (25).



13. Front side fastening bolts

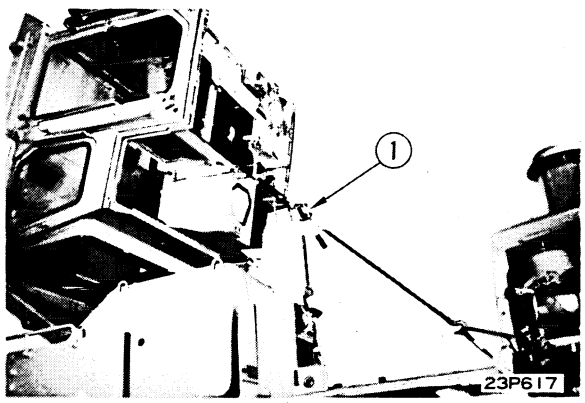
1) Remove cover (26).
2) Remove R.H. and L.H. front side fastening bolts (27).
   ★ If it is difficult to pull out a bolt, temporarily lift the ROPS cab and the floor frame assembly and loosen the bracket to facilitate removal of the bolt.



14. ROPS cab and floor frame assembly

1) Securely hook wires to the two lifting hooks on the front of the ROPS cab, and gradually tilt back the ROPS cab and the floor frame assembly.
   ★ Before tilting the cab, make sure that all connecting parts are disconnected.
   ★ Lock the cab doors and windows.
2) Tilt ROPS cab and floor frame assembly (28) with a crane until the lock plate on the cab is completely locked into the bracket.
   ★ When tilting the ROPS cab and floor frame assembly, operate lever block ① to prevent abrupt movements.



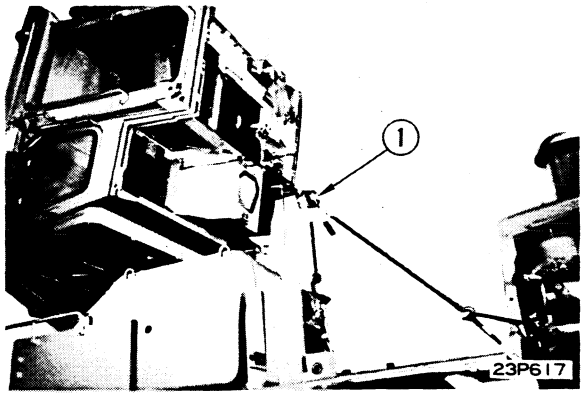


RETURNING ROPS CAB ASSEMBLY TO ITS ORIGINAL POSITION

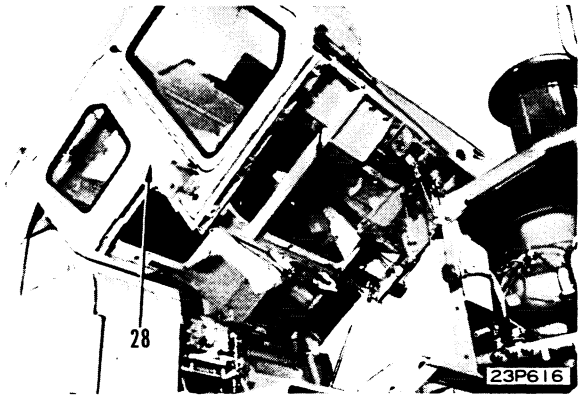
D155A 25001 and up

1. ROPS cab assembly

1) Securely connect wires to the two lifting hooks on the front of the ROPS cab, and unlock the cab.
   ★ Make sure the cab doors and windows are securely locked.



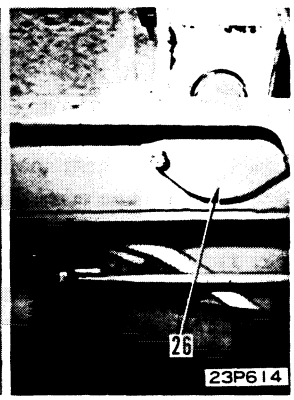
2) Gradually return ROPS cab and floor frame assembly (28) to its original position by using a crane.
   ★ When returning the ROPS cab and floor frame assembly, operate lever block ① to prevent abrupt movements.



2. Front side fastening bolts

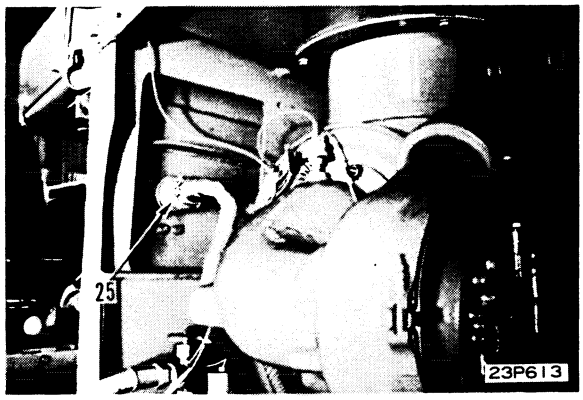
1) Tighten R.H. and L.H. front side fastening bolts (27).
2) Install cover (26).





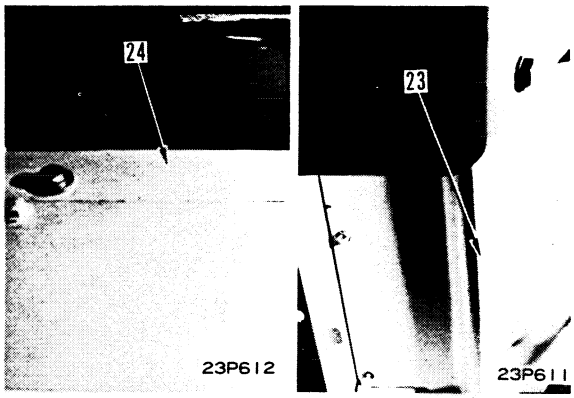
3. Wiring harness

Connect wiring harness (25).



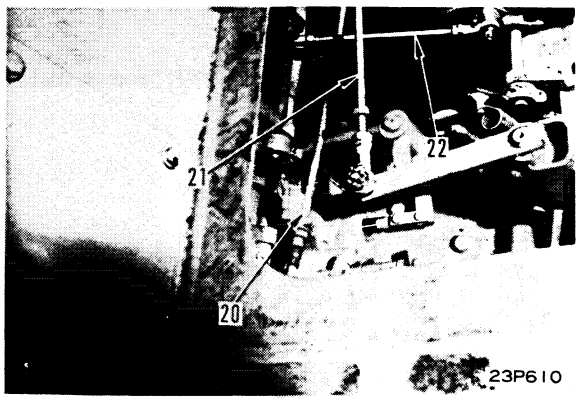
4. **Cover**
   Install cover (24).

5. **Cover**
   Install cover (23).

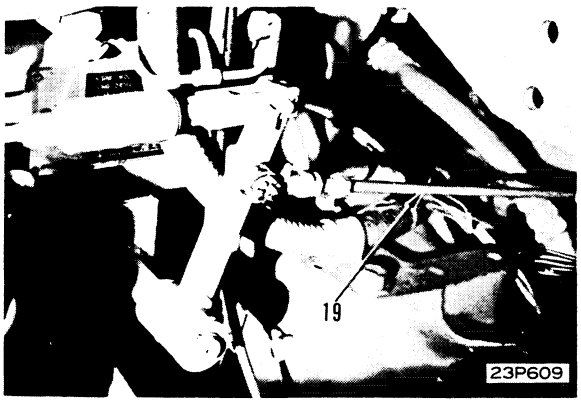


6. **Parking brake rod**
   Connect parking brake rod (22).

7. **Gear shift lever rod and forward-reverse lever rod**
   1) Connect gear shift lever rod (20) and tighten the lock nut.
   2) Connect forward-reverse lever rod (21).

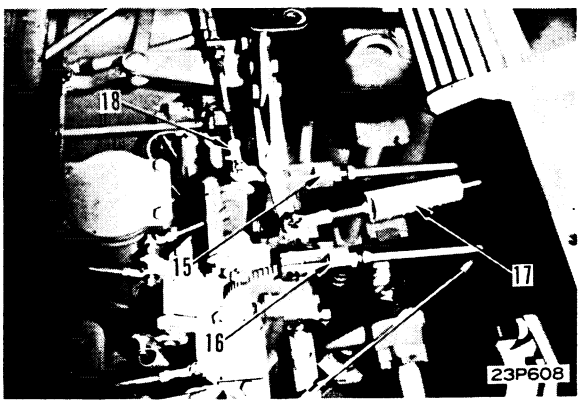


8. **Fuel control rods**
   1) Connect fuel control rod (19).



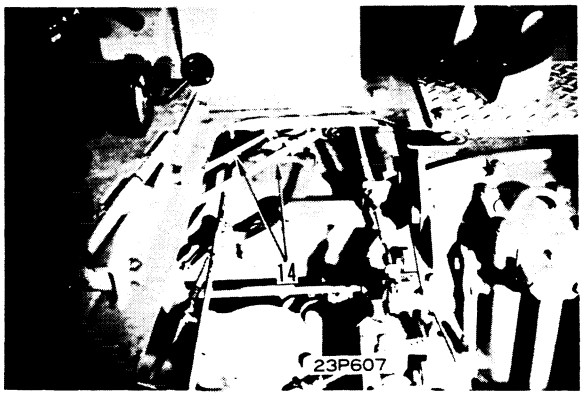
   2) Connect fuel control rods (17) and (18), and tighten the lock nuts.

9. **Brake rods**
   Connect R.H. and L.H. brake rods (15) and (16).



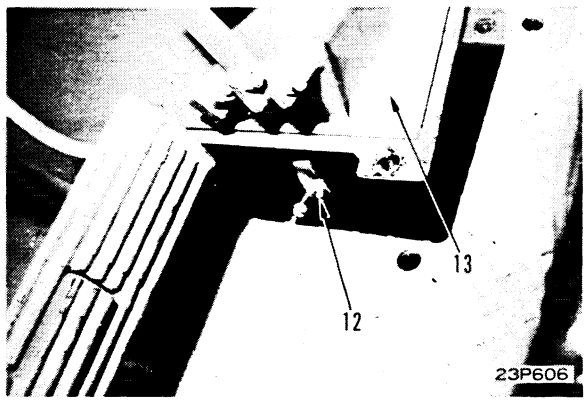
10. Steering rods

Connect R.H. and L.H. steering rods (14).

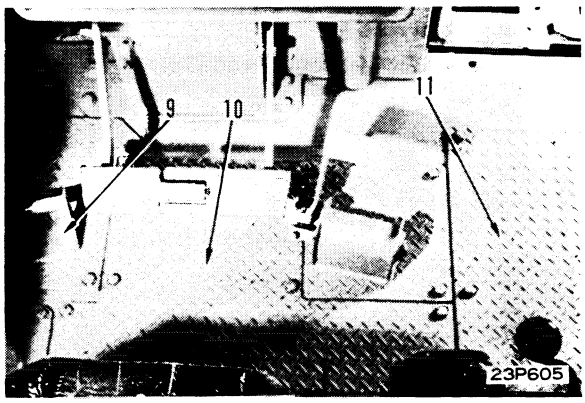


11. Floor plates

1) Connect decelerator rod (12) and install floor plate (13).

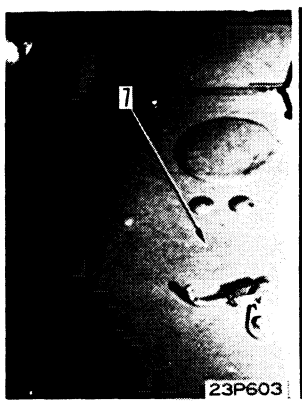


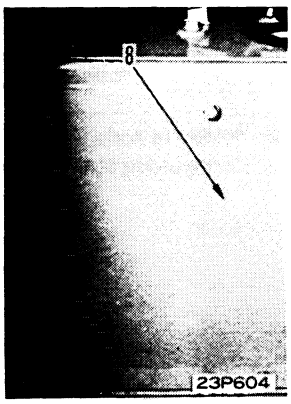
2) Install floor plates (9), (10) and (11).



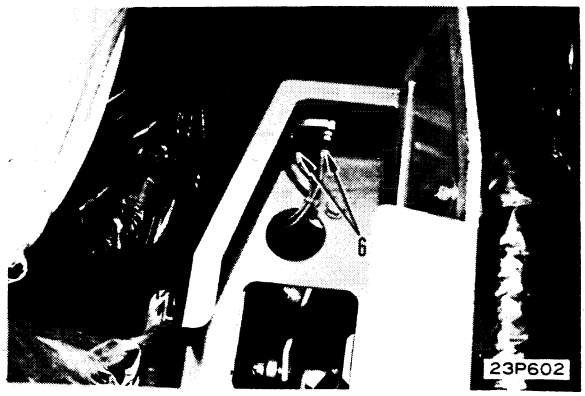
12. Covers

1) Install front cover (8) of the servo valve.
2) Install upper cover (7) of the servo valve and the stopper.

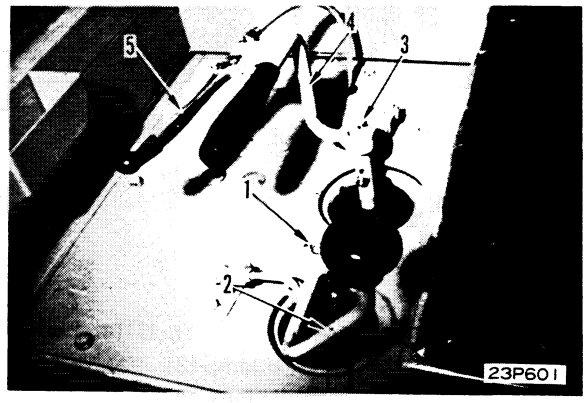




13. **Horn wiring**
Open the armrest cover and connect horn wiring (6).



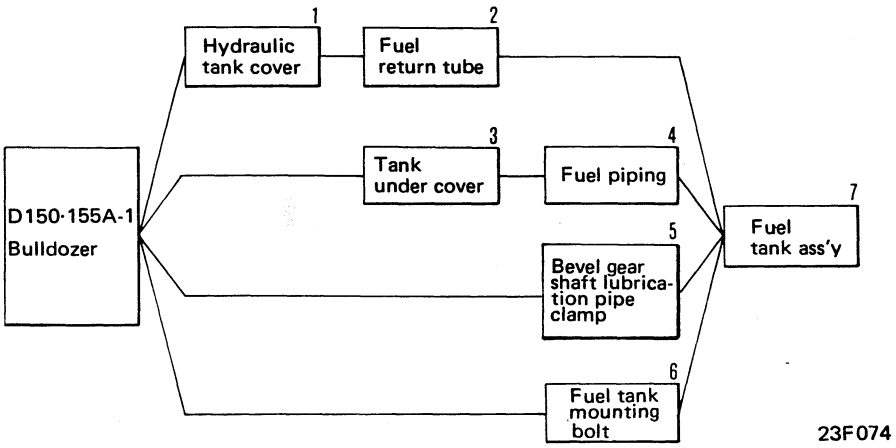
14. **Ripper and blade control levers**
1) Connect the cable to the lever.
2) Connect lever (5) with the pin, install ripper control lever (4), and tighten lock bolt (3).
3) Install blade control lever (2) and tighten lock bolt (1).



★ To adjust the ROPS cab, adjust each lever as described in TESTING AND ADJUSTING.

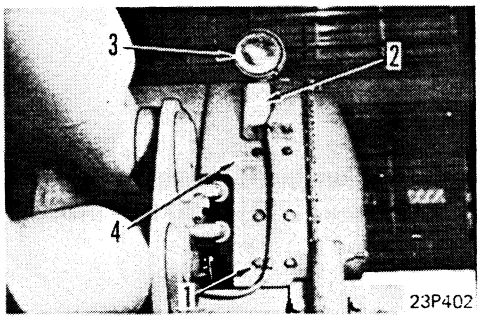
DISMOUNTING FUEL TANK

D150A 8408 and up
D155A 15001 – 25000



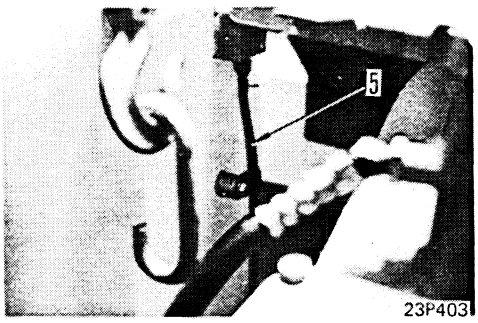
1. Hydraulic tank cover

1) Remove clamp securing bolt (1) and remove bracket (2) together with rear lamp (3).
2) Remove hydraulic tank cover (4).



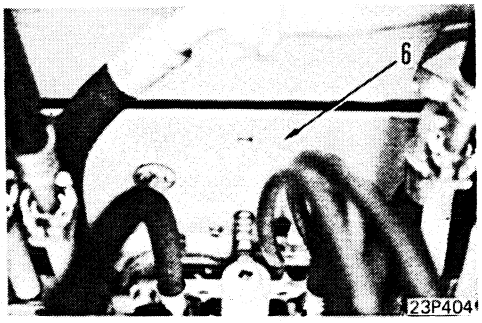
2. Fuel return tube

Remove clamp fastening tube (5). Remove tube.



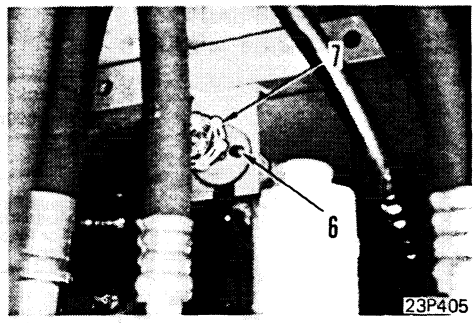
3. Tank under cover

Remove cover (6).

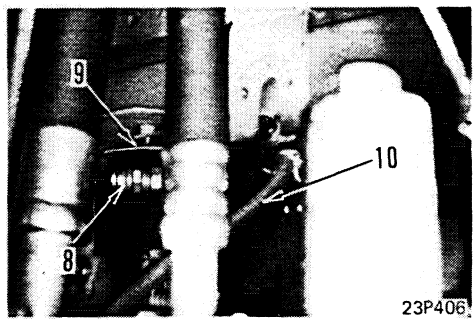


4. Fuel piping

1) Fully close fuel tank outlet valve.
2) Remove bolts (6) fastening drain valve (7); remove drain valve from support.

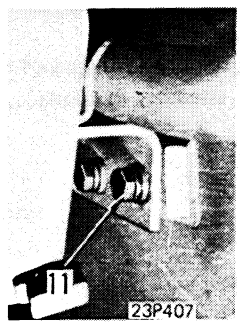


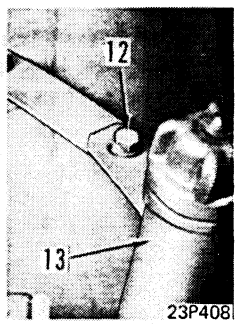
3) Remove fuel outlet hose (8) and priming pump hose (9). Pull out drain hose (10) from clamp.



5. Bevel gear shaft lubrication pipe clamp

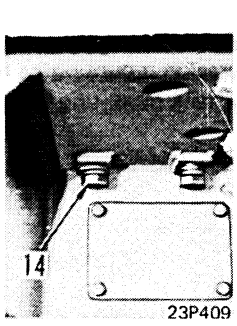
1) Remove bolts (11) and (12) securing pipe (13) to tank; remove pipe.

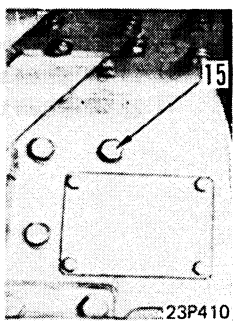




6. Fuel tank mounting bolt

1) Remove three left-hand bolts (14) fastening tank from the underside of fender.
2) Remove six right-hand bolts (15) fastening bracket from the fender side.



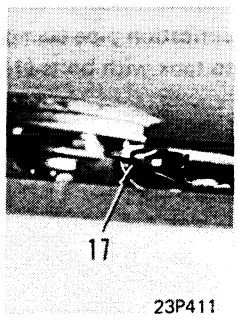


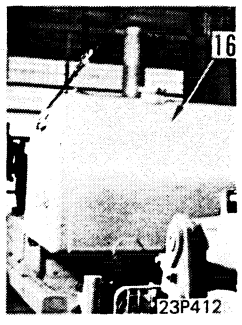
7. Fuel tank assembly

1) Sling fuel tank assembly (16) and disconnect fuel gauge cord (17) from tank, while pulling tank backward.
2) Lift off fuel tank assembly.

kg Fuel tank assembly: **220 kg.**

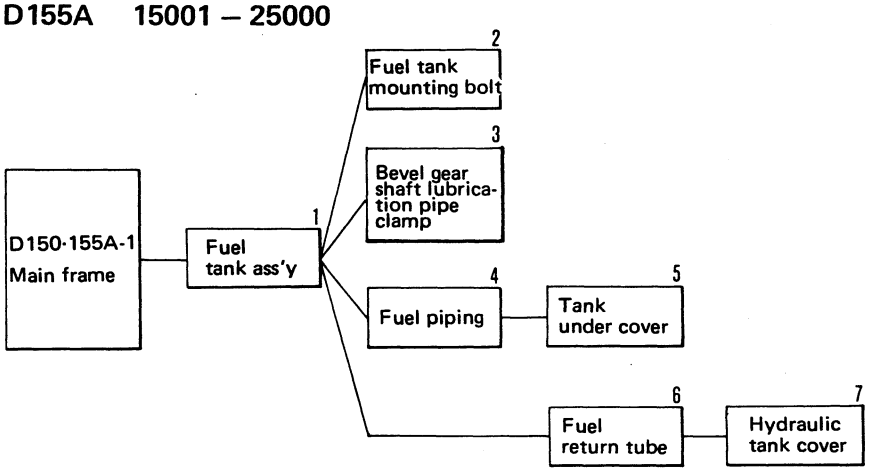
★ Place tank assembly on a block of 150 mm or more not to damage valve on the bottom of fuel tank.





MOUNTING FUEL TANK

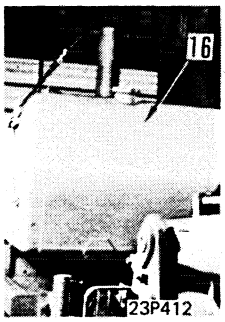
D150A 8408 and up
D155A 15001 – 25000



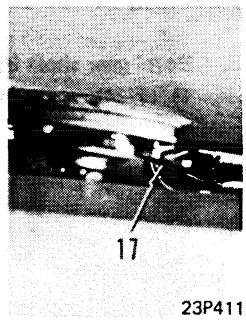
23F075

1. Fuel tank assembly

Sling fuel tank assembly (16) and connect fuel gauge cord (17) to tank. Then set assembly in place.



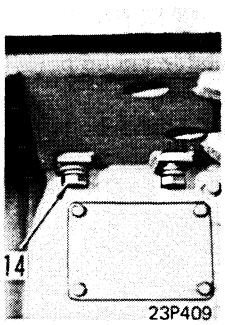
23P412



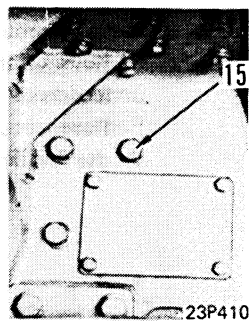
23P411

2. Fuel tank mounting bolt

1) Tighten six bracket mounting bolts (15).
2) Tighten three tank mounting bolts (14).



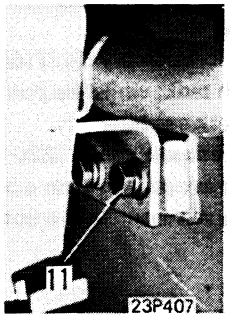
23P409



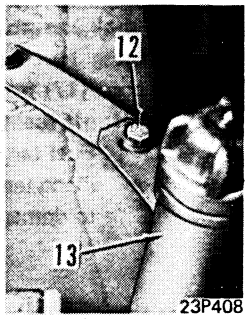
23P410

3. Bevel gear shaft lubrication pipe clamp

Secure pipe (13) to tank with bolts (11) and (12).



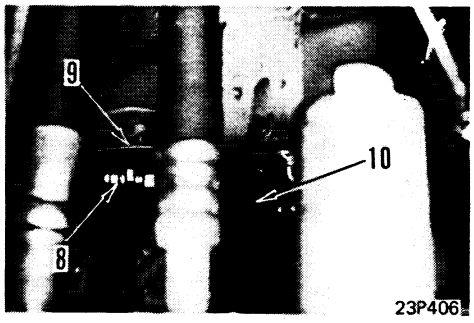
23P407



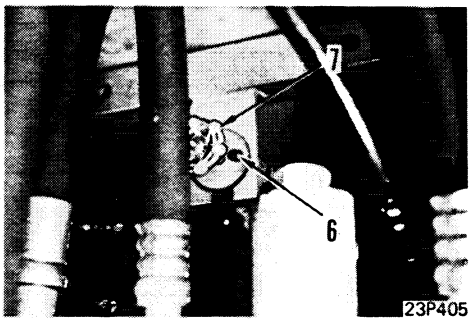
23P408

4. Fuel piping

1) Install fuel outlet hose (8) and priming pump tube (9). Insert drain hose (10) into clamp.

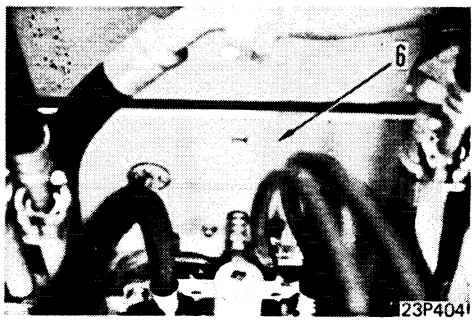


2) Secure drain valve (7) support with bolts (6).
3) Fully open fuel tank outlet valve.



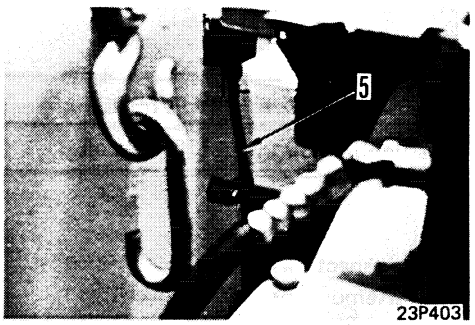
5. Tank under cover

Install cover (6).



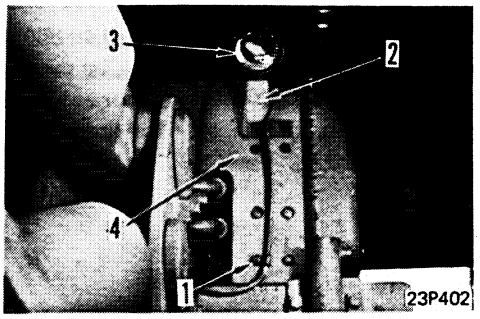
6. Fuel return tube

Install tube (5) and fasten clamp.



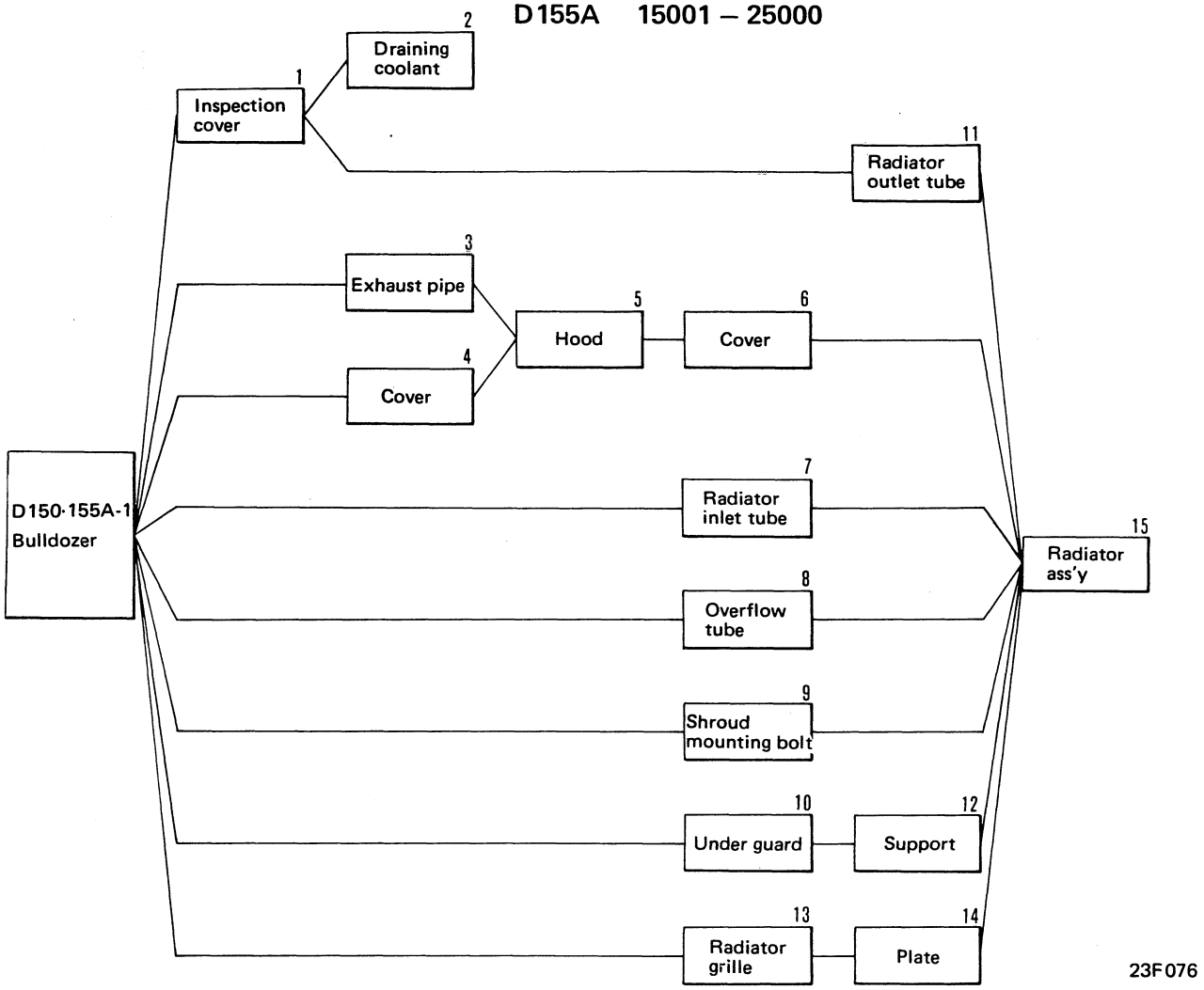
7. Hydraulic tank cover

1) Install hydraulic tank cover (4).
2) Install bracket (1) together with fit rear lamp (2) and install clamp bolts (1).



DISMOUNTING RADIATOR

D150A 8408 and up
D155A 15001 – 25000

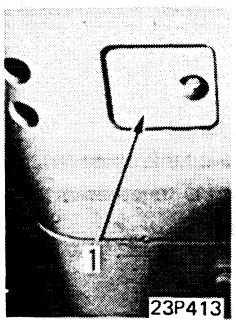


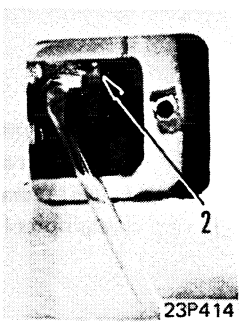
Special tools required

Special tools required		A
790-401-1400	Lifting tool	1

1. **Inspection cover**
   Remove inspection cover (1).

2. **Draining coolant**
   Open drain valve (2) and drain coolant.
   - ★ When antifreeze is used, be careful not to discharge it. Try to reuse corrosion resistor as long as it is efficacious.
   - ★ Coolant capacity: **150 liters**

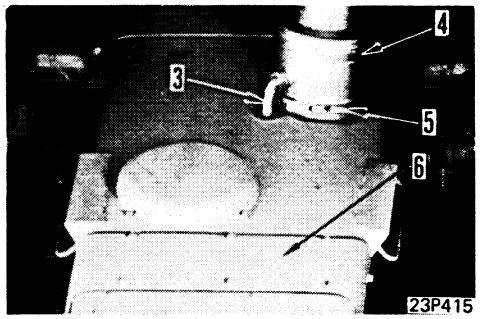




3. Exhaust pipe

1) Remove flange fastening bolts and disconnect ejector pipe (3) from exhaust pipe (4).
2) Remove clamp (5) fastening exhaust pipe (4); remove exhaust pipe.

★ Remove gasket from exhaust pipe mounting surface without fail.



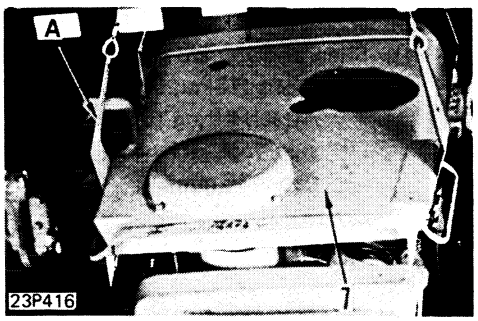
4. Cover

Remove cover (6).

5. Hood

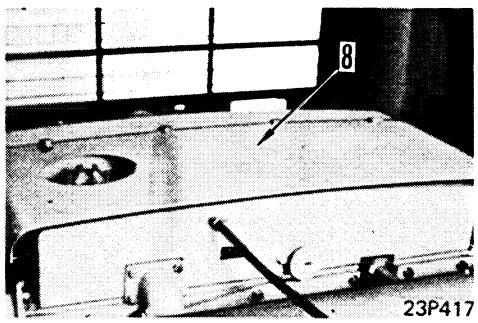
Remove right and left hood catch hooks. Lift off hood (7) using lifting tool A

kg Hood: **60 kg**



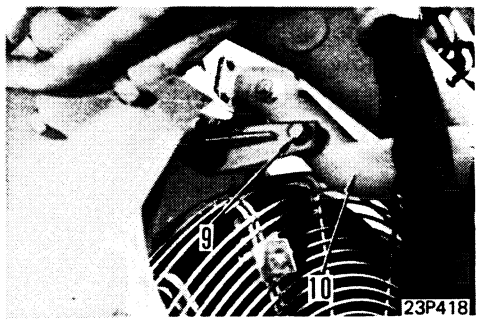
6. Cover

Remove radiator cover (8).



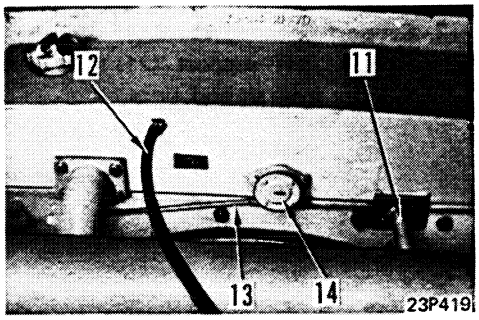
7. Radiator inlet tube

1) Remove clamp fastening bolts (9) and flange fastening bolts. Disconnect radiator inlet tube (10) from radiator.
2) Remove flange mounting bolts and clamp. Disconnect bypass tube (11) and aeration hose (12) from radiator.



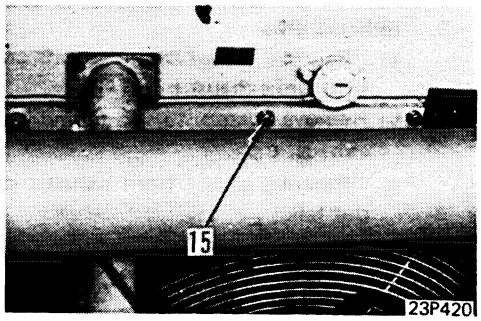
8. Overflow tube

Remove clamp fastening overflow tube (13): Disconnect tube from pressure valve (14).



9. Shroud mounting bolt

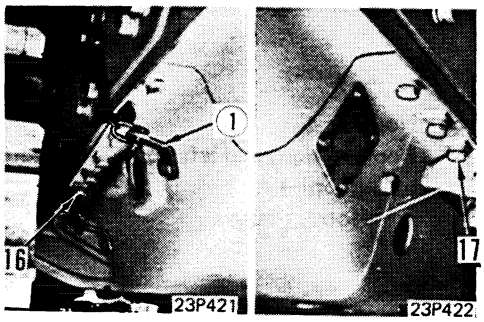
Remove shroud mounting bolts (15) from radiator and disconnect shroud from radiator.



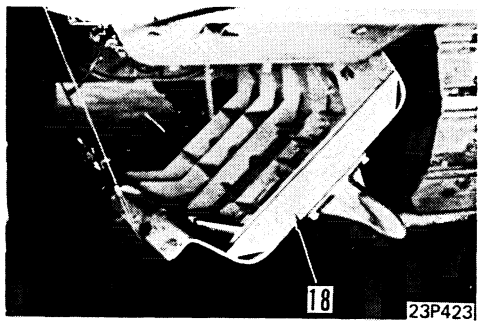
10. Under guard

1) Sling under guard with crane using lifting tool ① . Remove R.H. bolts (16) and L.H. bolts (17).

★ Attach lifting tool to hanging bolt on the under guard side face. (Hanging bolt dia.: **24 mm.** Width across flats: **36 mm).**

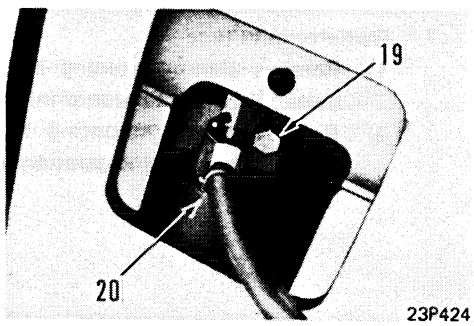


2) Open engine under guard (18) by gradually slackening crane rope.



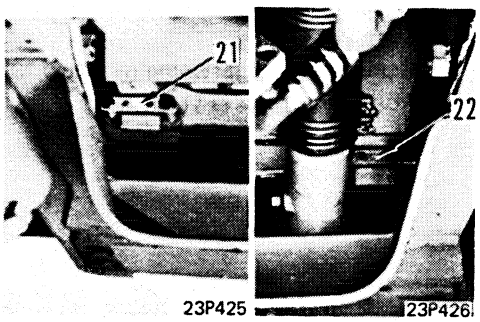
11. Radiator outlet tube

Remove flange mounting bolts (19) and disconnect radiator outlet tube (20) from lower tank.



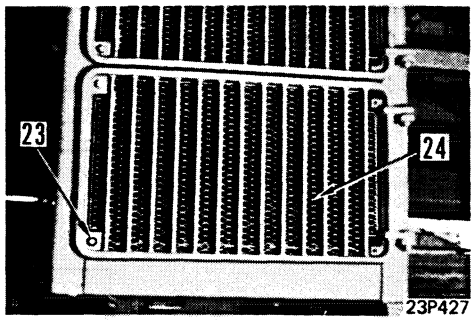
12. Support

Remove left support (21) and right support (22). Remove radiator from shroud.



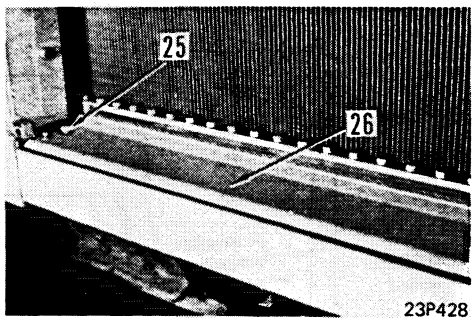
13. Radiator grille

Remove bolts (23) fastening lower radiator grille (24); remove grille.



14. Plate

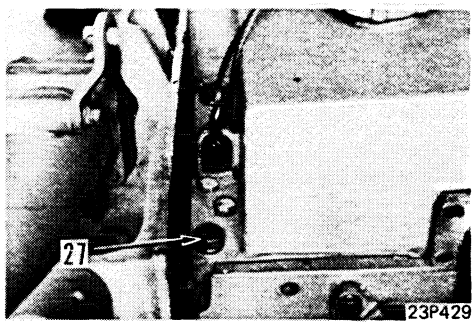
Remove bolts (25) fastening plate (26); remove plate.

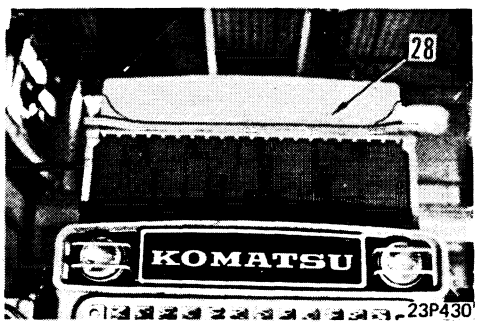


15. Radiator assembly

Remove mounting bolts (27). Lift off radiator assembly (28), taking care to prevent it from interfering with the surroundings.

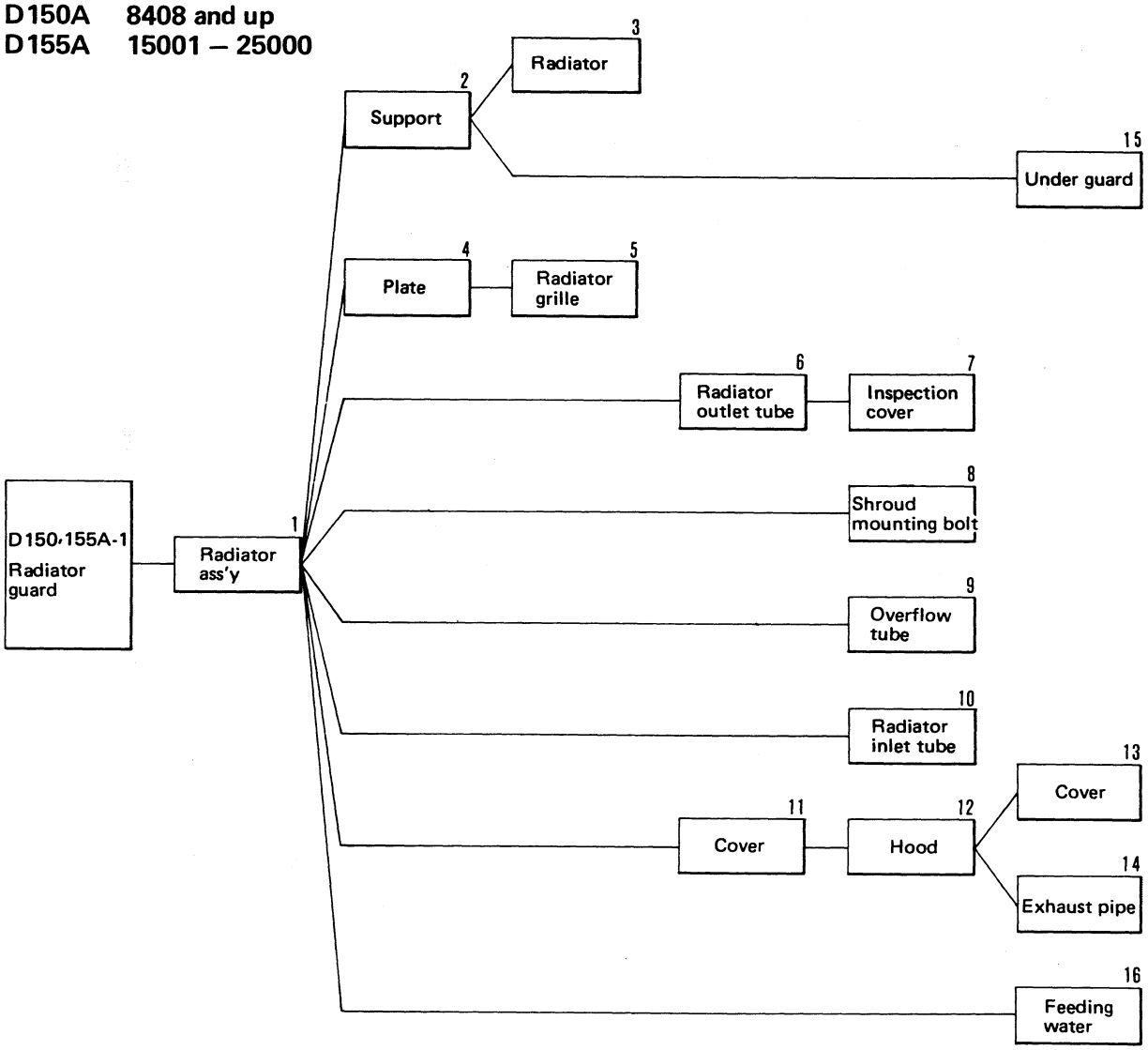
kg Radiator assembly: **350 kg.**





MOUNTING RADIATOR

D150A 8408 and up
D155A 15001 – 25000

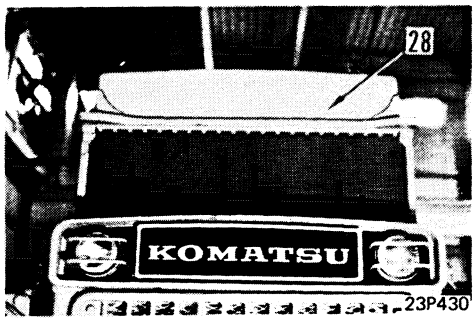


23F077

Special tools required

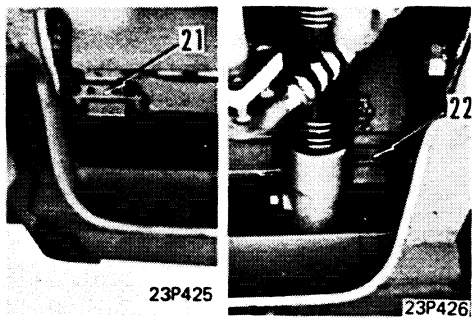
Special tools required		A
790-401-1400	Lifting tool	1

1. **Radiator assembly**
   Gradually lift radiator assembly (28), taking care to prevent it from interfering with the surroundings, into position on mount.

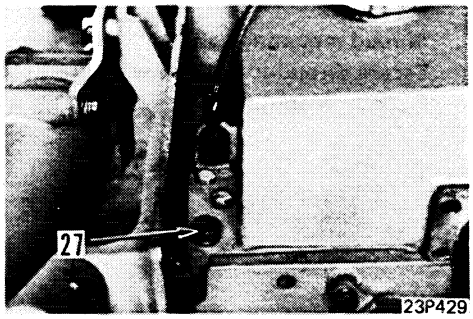


23P430

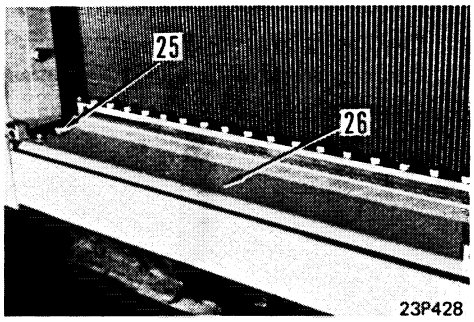
2. **Support**
Install left support (21) and right support (22) and connect radiator to shroud.



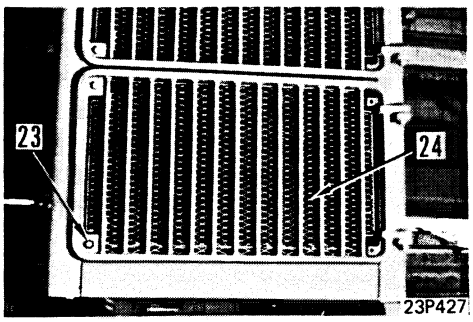
3. **Radiator**
Secure radiator to frame with bolts (27) coated with thread tightener (LT-2).
kgm Mounting bolt: **35 – 43.5 kgm**



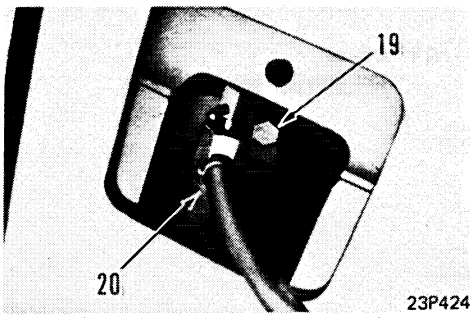
4. **Plate**
Install plate (26) with bolts (25).



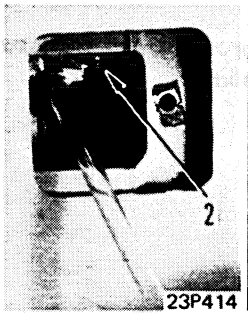
5. **Radiator grille**
Close lower radiator grille (24) with bolts (23).

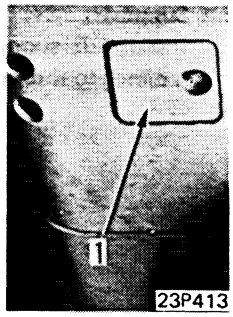


6. **Radiator outlet tube**
Attach gasket on tube flange with gasket sealant (LG-1). Connect radiator outlet tube (20) to lower tank with bolts (19).

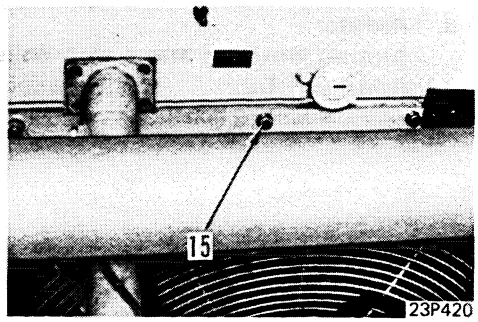


7. Inspection cover
Close drain valve (2) and install inspection cover (1)

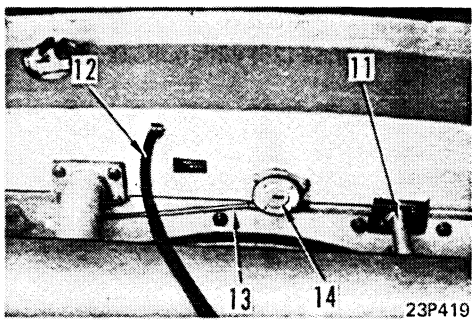




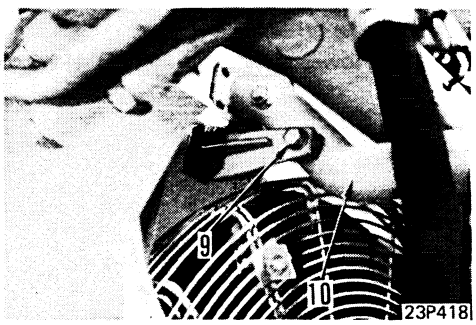
8. Shroud mounting bolt
Secure shroud to radiator with bolts (15).
kgm Mounting bolt: **7.5 – 10.5 kgm**



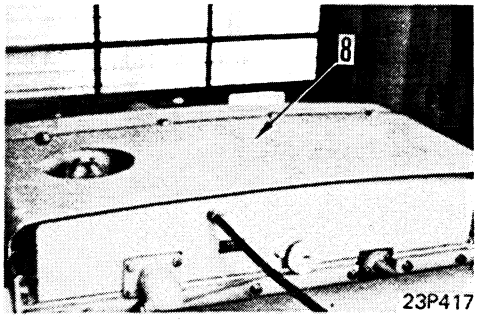
9. Overflow tube
Connect overflow tube (13) to pressure valve (14) and clamp it with wire.



10. Radiator inlet tube
1) Attach gasket to flange with gasket sealant (LG-1). Connect bypass tube (11) to radiator.
2) Connect aeration hose (12) radiator and clamp.
3) Attach gasket to flange with gasket sealant (LG-1). Connect radiator inlet tube (10) to radiator and tighten clamping bolts (9).

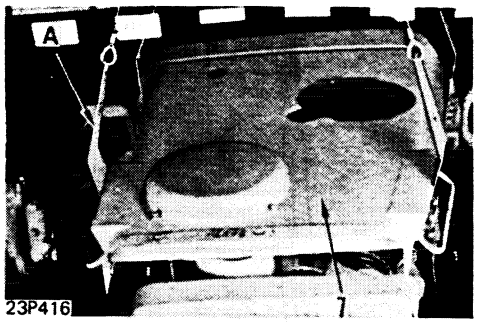


11. Cover
Install radiator cover (8).



12. Hood

Install hood (7) using lifting tool A and lock right and left catch hooks.

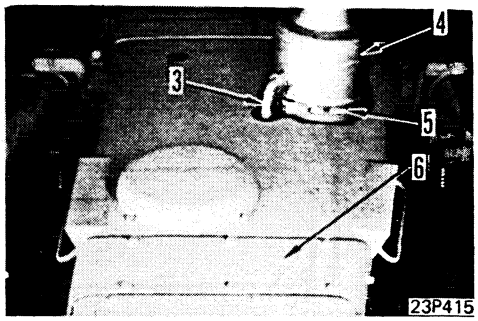


13. Cover

Install cover (6) using hood mounting bolts.

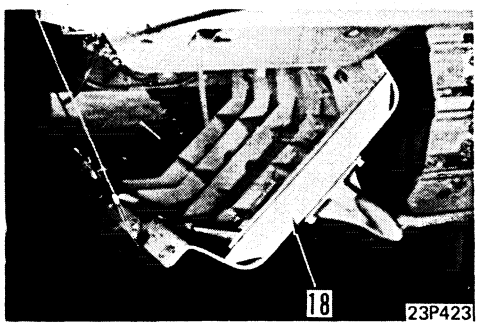
14. Exhaust pipe

1) Install exhaust pipe (4), with gasket on the mounting face, and fasten it with clamp (5).
   ★ When clamping the pipe, align it with KOMACLONE tube.
2) Connect ejector pipe (3), with gasket on flange, to exhaust pipe (4).

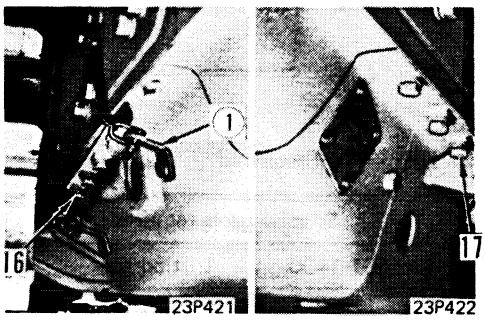


15. Under guard

1) Gradually lift engine under guard (18) with lifting tool ① attached with crane.
   ⚠ Do not stay under lifted under guard.



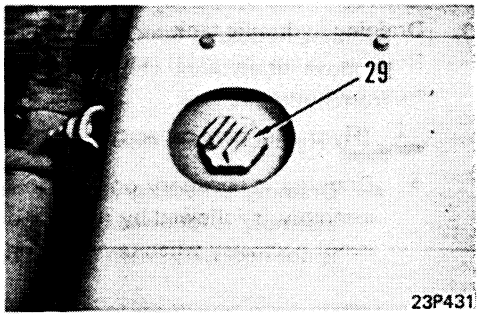
2) Align bolt holes and tighten mounting bolts (six right bolts (16) and five left bolts (17)) coated with thread tightener (LT-2).
   kgm Mounting bolt: **84 – 105 kgm**
3) Remove lifting tool ① .



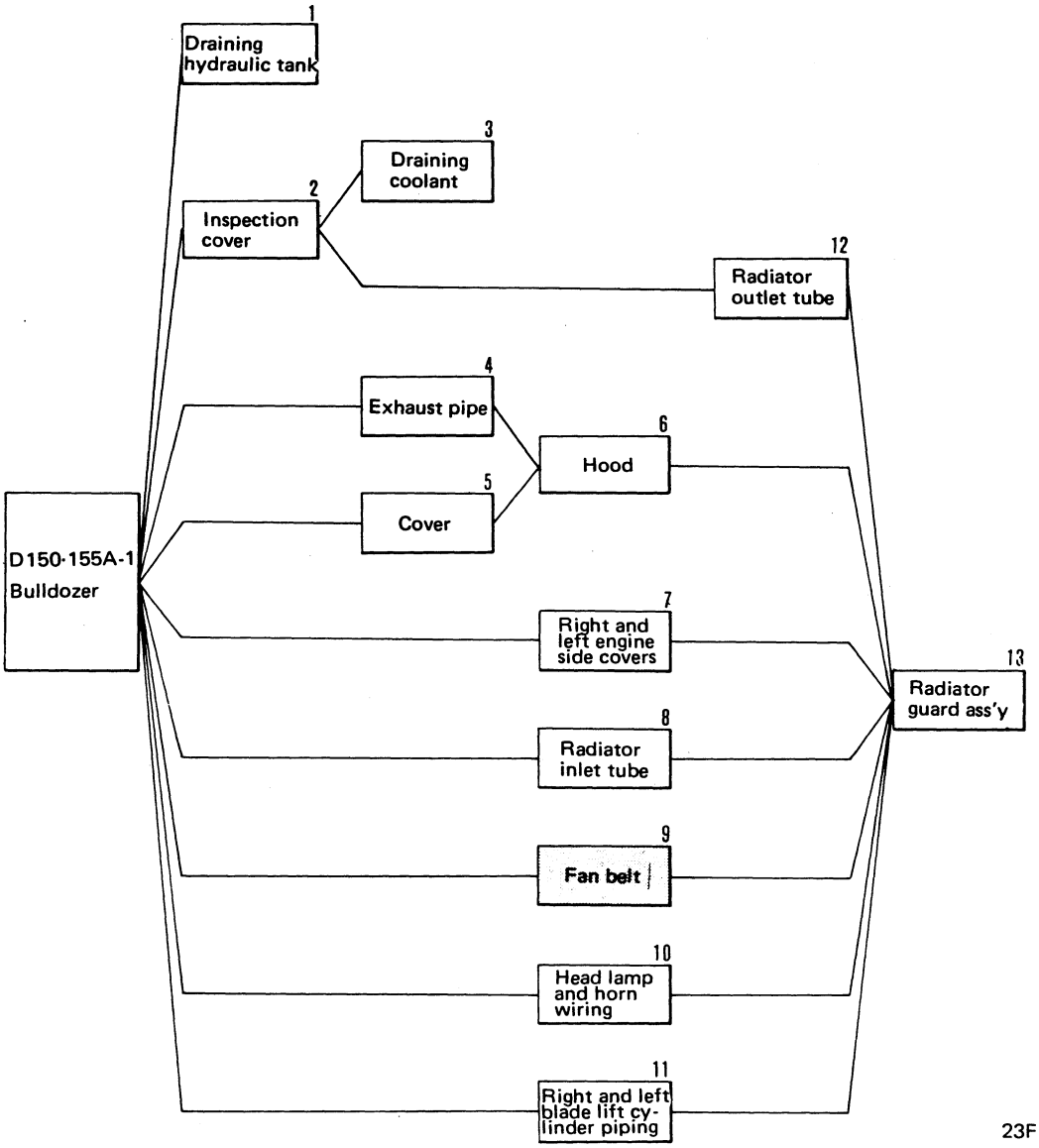
16. Feeding water

Pour coolant through radiator coolant filler (29).

★ Use only soft water.
★ Do not attempt to pour water quickly, but do it slowly until water overflows the filler opening. (Quick pouring may cause overflowing of water as if radiator is filled up with water).
★ Do not attempt to remove strainer from filler when pouring water.



DISMOUNTING RADIATOR GUARD



Special tool required

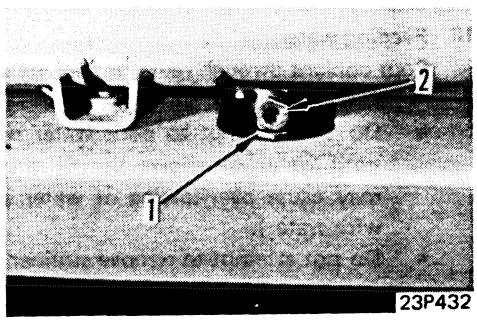
Special tools required		A
790-401-1400	Lifting tool	1

1. Draining hydraulic tank

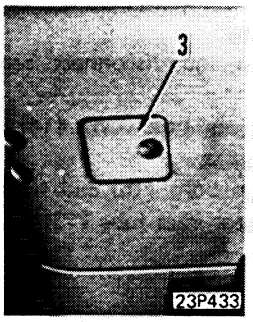
Remove drain plug (1) and open drain valve (2) to drain oil from hydraulic tank.

Hydraulic tank capacity: **164** ℓ

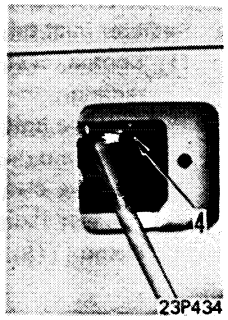
★ Draining is necessary only when removal of radiator guard assembly is followed by removal of the engine assembly but is not necessary when removing only radiator guard.



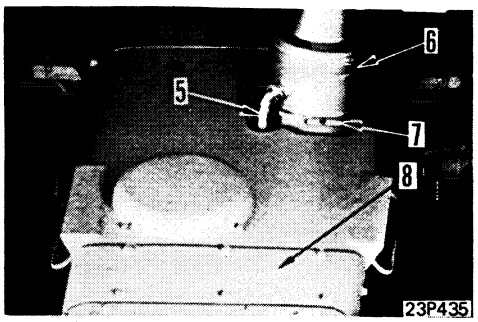
2. Inspection cover
Remove inspection cover (3).



3. Draining coolant
Open drain valve (4) and drain coolant.
- ★ When antifreeze is used, be careful not to discharge it. Try to reuse corrosion resistor as lons as it is efficacious.
- ★ Coolant capacity: **150 liters**

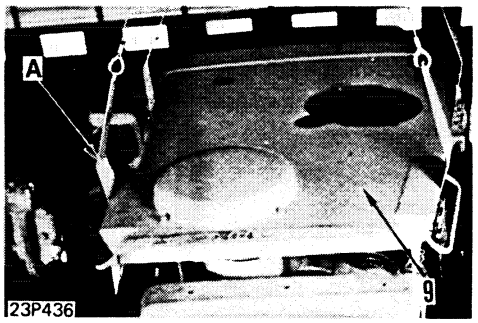


4. Exhaust pipe
1) Remove flange fastening bolts and disconnect ejector pipe (5) from exhaust pipe (6).
2) Remove clamp (7) fastening exhaust pipe (6); remove exhaust pipe.
   - ★ Remove gasket from exhaust pipe mounting surface without fail.

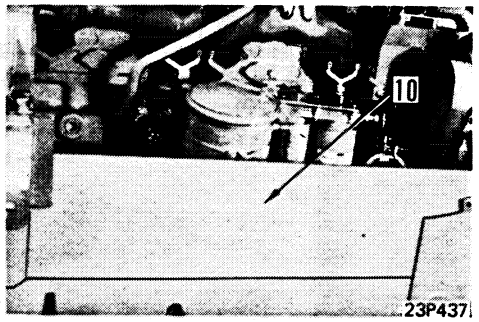


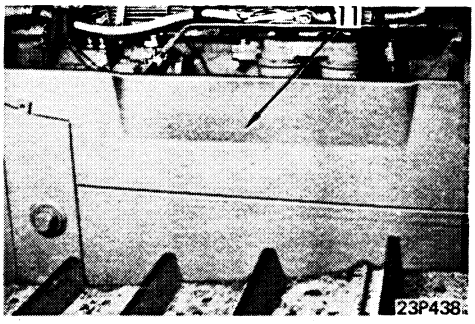
5. Cover
Remove cover (8).

6. Hood
Remove right and left hood catch hooks. Lift off hood (9) using lifting tool A.
kg Hood: **60 kg**



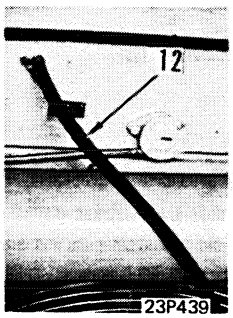
7. Right and left engine side covers
1) Remove right side cover (10).
2) Remove left side cover (11).

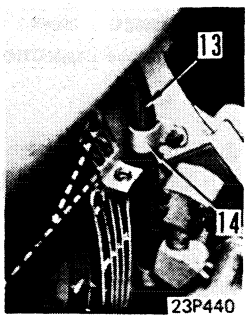




8. Radiator inlet tube

1) Loosen clamp and disconnect aeration hose (12) from radiator.
2) Remove bolts and hose clamp (14). Disconnect bypass tube (13) from radiator.
3) Remove clamp bolts (15) and flange fastening bolts. Disconnect radiator inlet tube (16) from radiator and remove clamp (17).

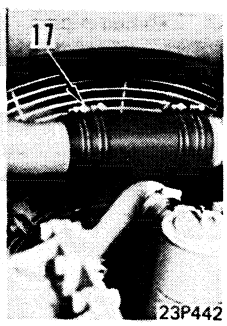




9. Fan belt

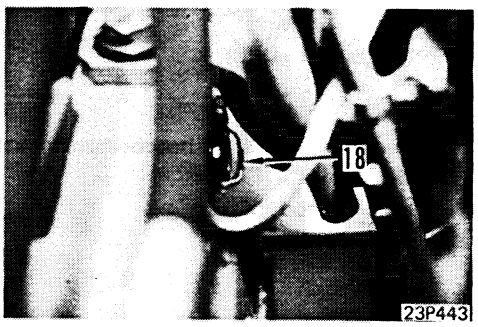
Refer to DISMOUNTING FAN BELT.





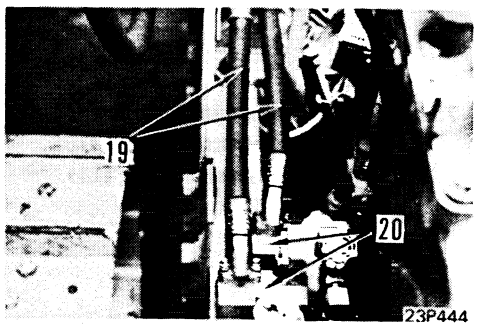
10. Head lamp and horn wiring

Disconnect head lamp and horn wire (18) from its connector. Remove wire harness clamp from main frame.

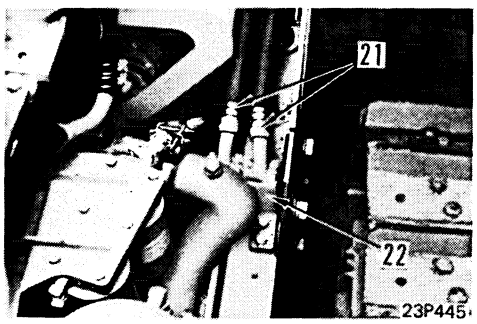


11. Right and left blade lift cylinder piping

1) Remove split flange and disconnect left cylinder pipe (19) from tube (20).

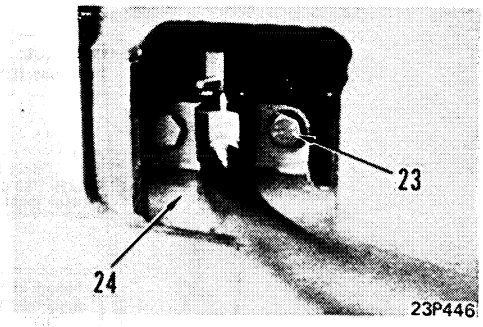


2) Remove split flange and disconnect right cylinder pipe (21) from tube (22).



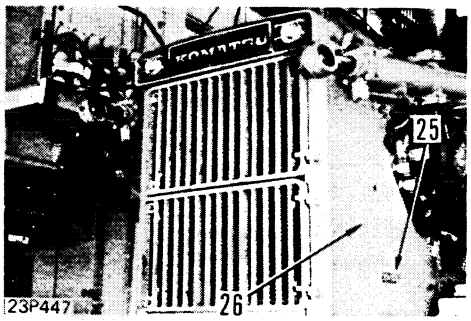
12. Radaitor outlet tube

Remove bolts (23) and disconnect radiator outlet tube (24) from lower tank.



13. Radiator guard assembly

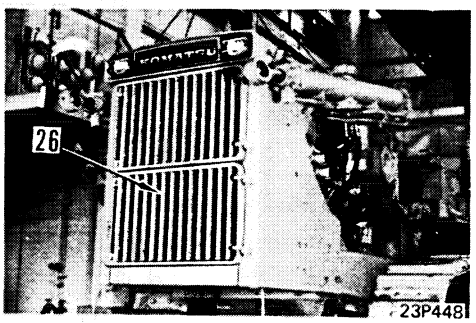
1) Sling radaitor guard assembly with four ropes hooked to cylinder stays and brackets, and remove radiator guard mounting bolts (25) (right and left).



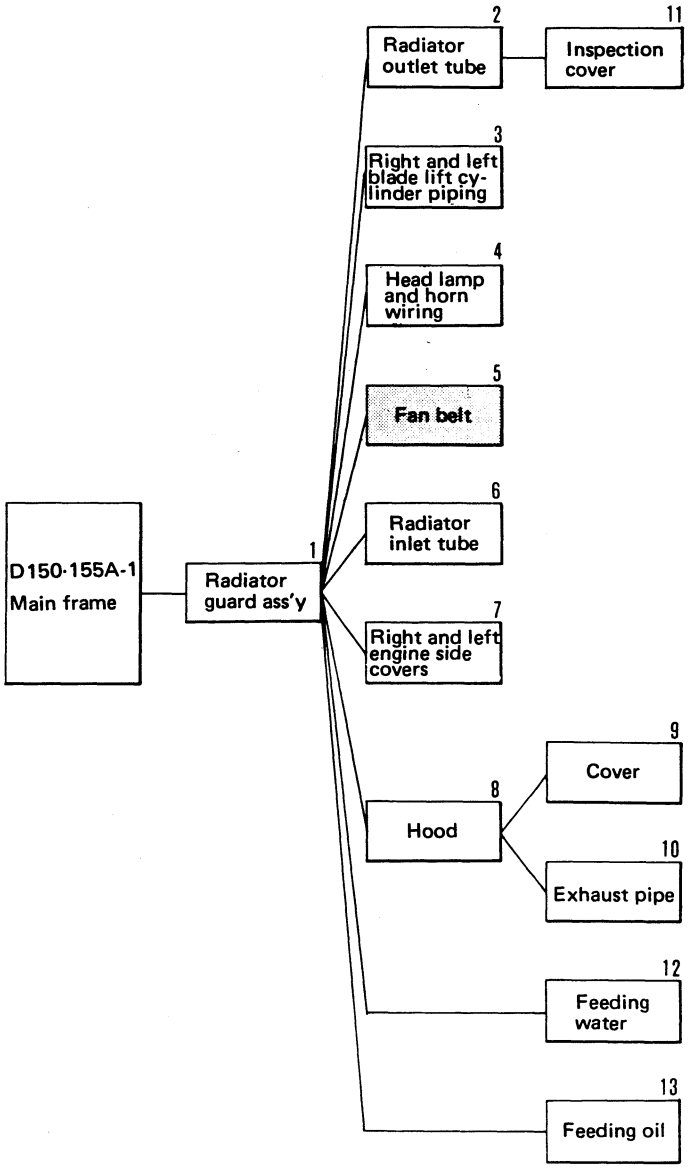
2) Move radiator guard assembly (26) forward off the radiator.

kg Radiator guard assembly: **2200 kg**

★ After removing radiator guard assembly, be sure to remove gasket, without fail, from the radiator outlet tube and contact surface of radiator lower tank.



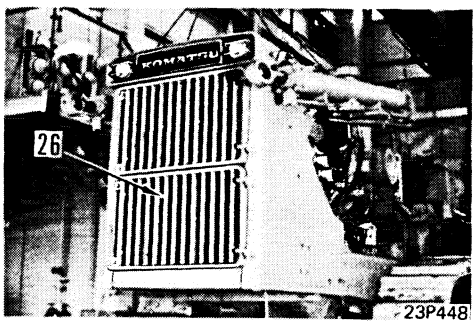
MOUNTING RADIATOR GUARD

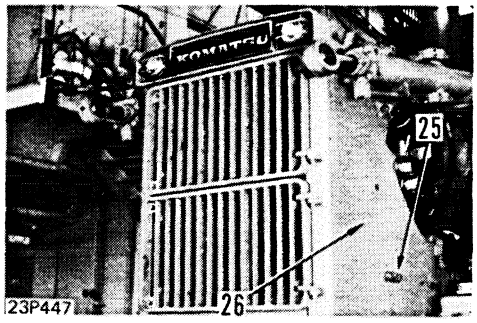


23F079

Special tools required

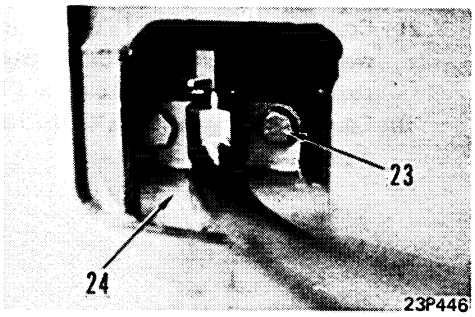
Special tools required		A
790-401-1400	Lifting tool	1



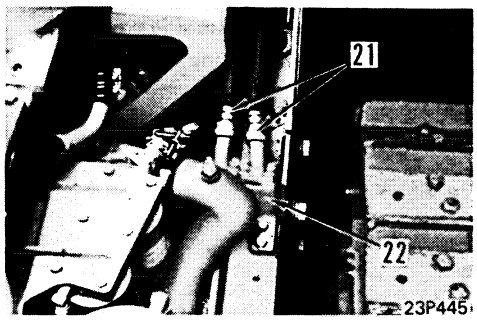


1. **Radiator guard assembly**
   Lift radiator guard assembly (26) with crane into position on main frame. Secure it to main frame with bolts (25) (right and left).
   ★ Sling radiator assembly horizontally.
   kgm Mounting bolt: **84 ~ 105 kg.m**

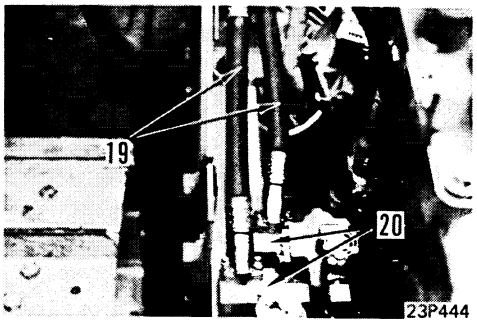
2. **Radiator outlet tube**
Connect radiator outlet tube (24), with gasket attached to flange with gasket sealant (LG-1), to radiator lower tank using four mounting bolts (23).



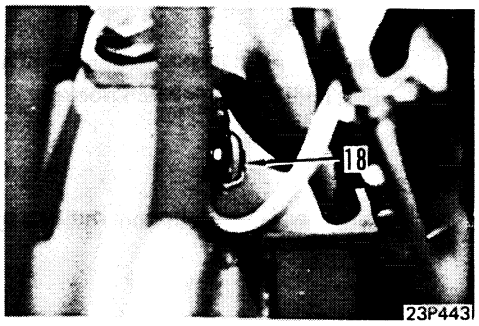
3. **Right and left blade lift cylinder piping**
1) Connect right blade lift cylinder pipe (21), with O-ring in flange, to tube (22) using split flange.



2) Connect left blade lift cylinder pipe (19), with O-ring in flange, to tube (20) using split flange.

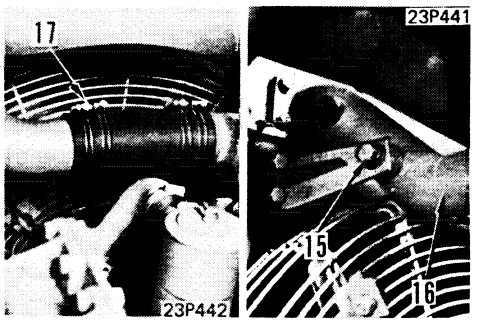


4. **Head lamp and horn wiring**
Secure wire harness to main frame with clamp and connect head lamp and horn wire (18) to its connect.

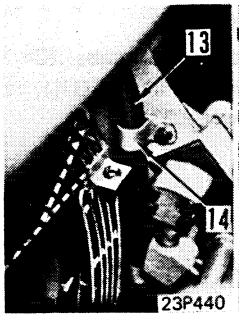


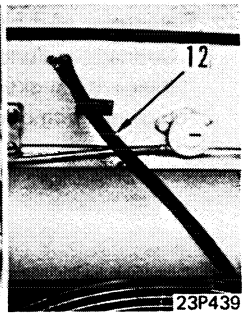
5. **Fan belt**
Refer to MOUNTING FAN BELT.

6. **Radiator inlet tube**
1) Connect radiator inlet tube (16) inserted in hose to radiator, with gasket attached to flange with gasket sealant (LG-1). Fasten tube with clamp bolts (15) and clamp (17).



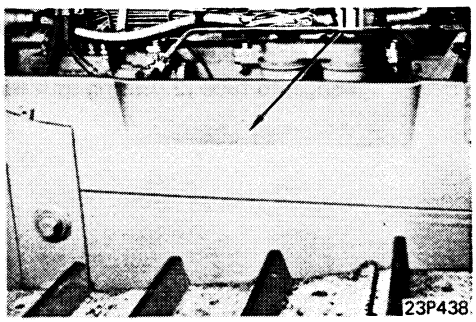
2) Connect bypass tube (13), with gasket attached to flange with gasket sealant (LG-1), to radiator. Secure tube to radiator guard with hose clamp (14).
3) Connect aeration hose (12) to radiator and secure it with clamp.



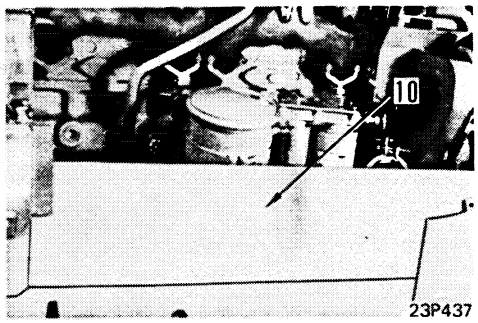


7. Right and left engine side covers

1) Install left engine side cover (11).

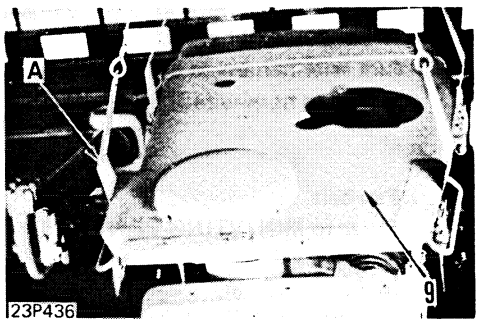


2) Install right engine side cover (10).



8. Hood

Lift hood (9) into position with lifting tool A and lock with right and left hook catch hooks.

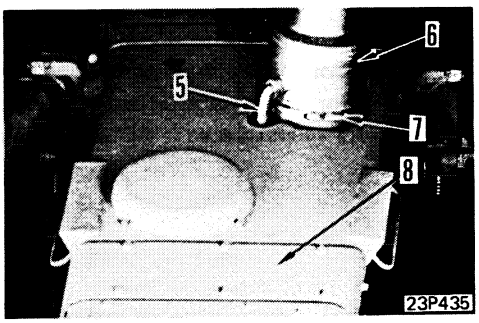


9. Cover

Install cover (8) with hood mounting bolts.

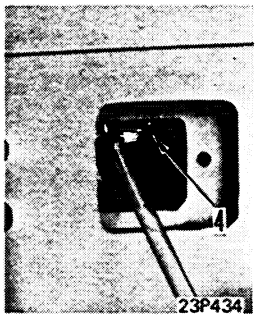
10. Exhaust pipe

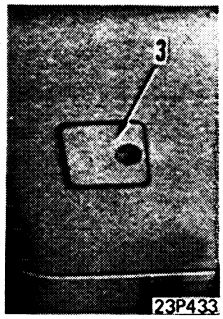
1) Install exhaust pipe (6), with gasket on contact surface, and fasten it with clamp (7).
   ★ When clamping the pipe, align it with KOMACLONE.
2) Connect ejector pipe (5), with gasket on flange, to exhaust pipe (6).



11. Inspection cover

Close drain valve (4) and install inspection cover (3).

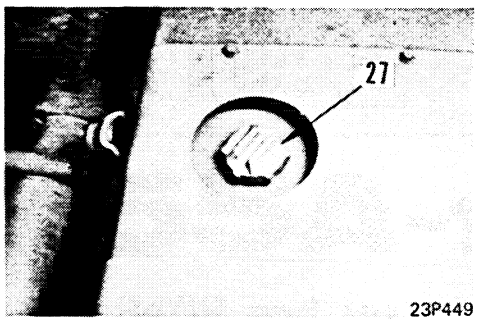




12. Feeding water

Fill up radiator with coolant through filler (27).

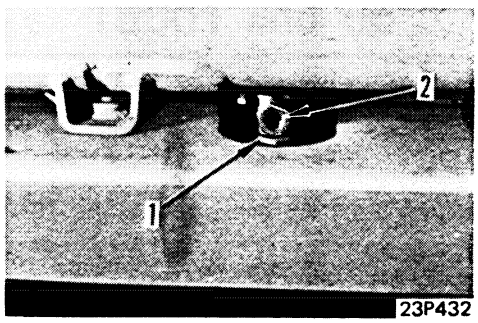
- ★ Use only soft water.
- ★ Do not attempt to pour water quickly, but do it slowly until water overflows filler opening. (Quick pouring may cause overflowing of water as if radiator is filled up with water.)
- ★ Do not attempt to remove strainer from filler when pouring water.



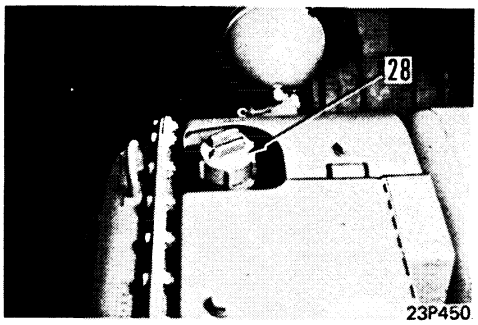
13. Feeding oil

1) Close drain valve (2) and install drain plug (1) together with O-ring.

kgm Drain plug: **13 – 18 kgm**



2) Refill with oil through oil filler (28). (SAE30, class CD)
   - ★ Check the oil level gauge on hydraulic tank cover when refilling. Run engine, after filling up tank, to circulate oil through various parts. Then, check oil level again. If necessary, add oil.
   - ★ Do not attempt to remove strainer from oil filler when feeding oil.



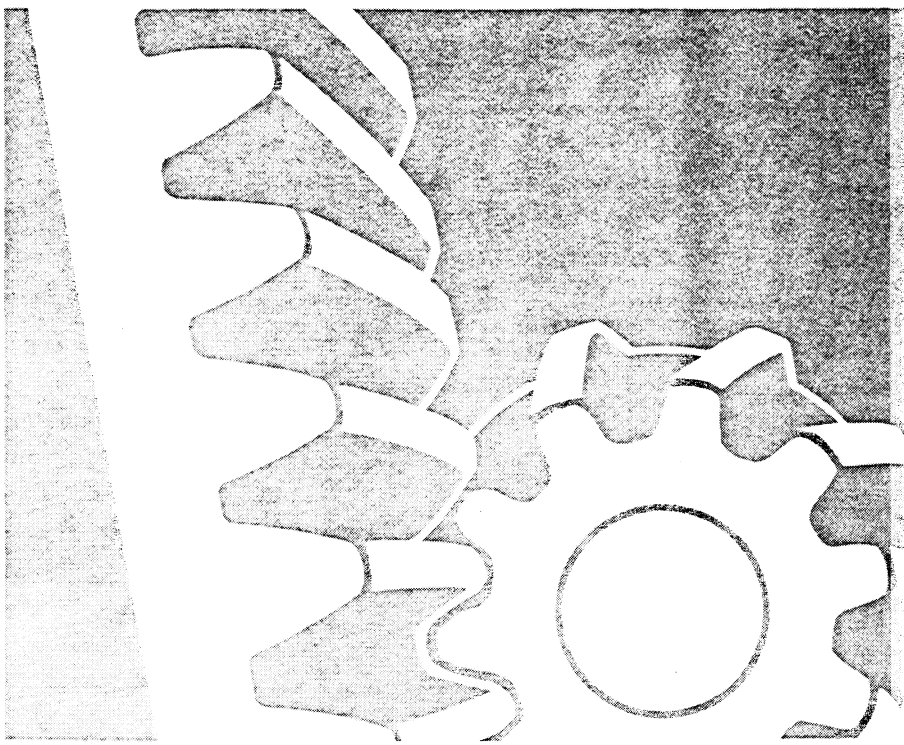
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

24 POWER TRAIN

MAINTENANCE STANDARD



TORQUE SPECIFICATIONS FOR NUTS AND BOLTS

Nuts and bolts should be tightened to torque values shown below.

Unit: kg.m

Nominal bolt dia. (mm)	Width across flats (mm)		
		Desired value	Allowable range
6	10	1.35	1.2~1.5
8	13	3.2	2.8~3.5
10	17	6.7	6~7.5
12	19	11.5	10~12.5
14	22	18	16~20.0
16	24	28.5	25~31.5
18	27	39	35~43.5
20	30	56	50~62.0
22	32	76	67.5~84.5
24	36	94.5	84~105
27	41	135	120~150
30	46	175	155~195
33	50	225	200~250
36	55	280	250~310
39	60	335	295~370

The above table indicates the cases where a torque wrench is employed.

MAINTENANCE STANDARD

MAIN CLUTCH

(1) Plate, gear, shaft 24- 2

(2) Main clutch booster 24- 4

(3) Inertia brake 24- 5

TORQUE CONVERTER (K1015 ~ 3724)

(1) Torque converter 24- 6

(2) Relief valve, regulator valve 24- 8

TORQUE CONVERTER (K3725~, K1001~)

(1) Torque converter 24-10

(2) Relief valve, regulator valve 24-12

TRANSMISSION

(1) Transmission case, gear 24-14

(2) Gear shift lever 24-16

TRANSMISSION

(1) Transmission 24-18

(2) Transmission control valve 24-20

(3) Transmission control valve spring 24-22

BEVEL GEAR SHAFT AND STEERING SYSTEM

(1) Bevel gear shaft and Bevel gear 24-24

(2) Steering clutch 24-26

(3) Steering brake 24-28

(4) Steering control valve 24-30

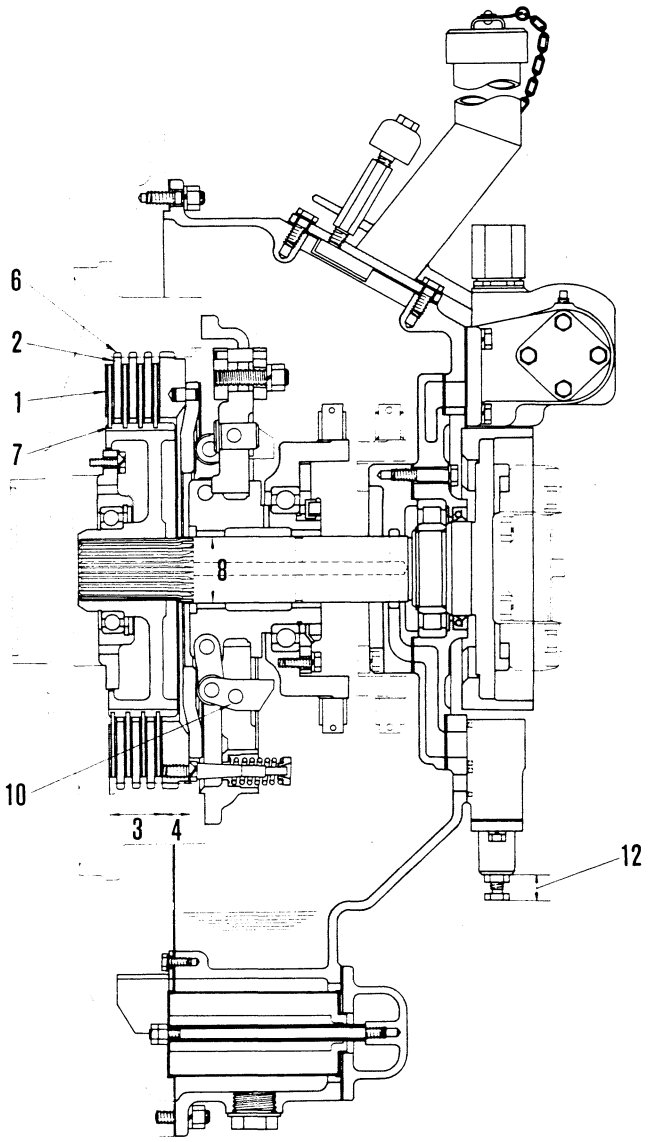
(5) Brake valve and Brake booster 24-32

FINAL DRIVE

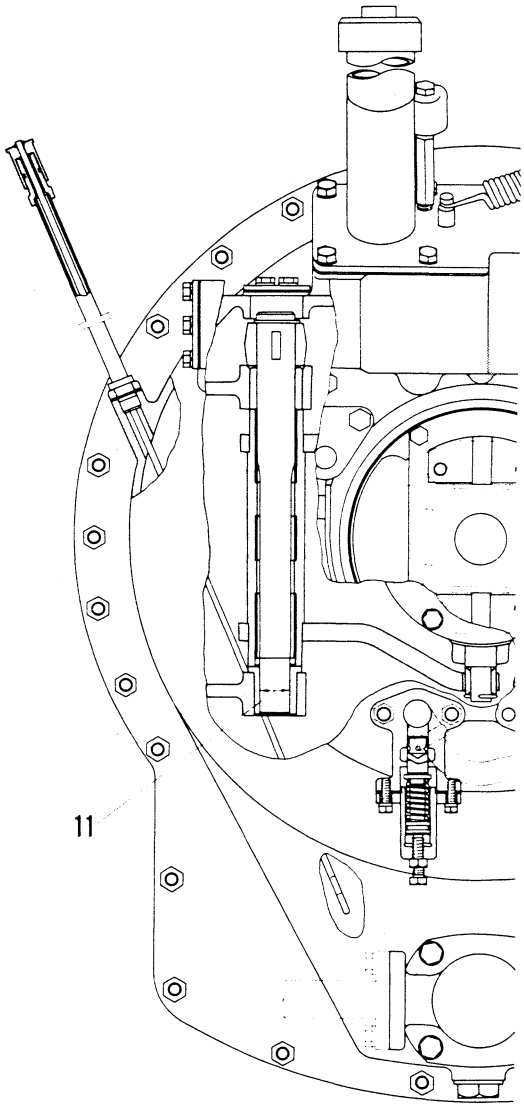
Final drive 24-34

MAIN CLUTCH

(1) Plate, gear, shaft



24F001



24F002

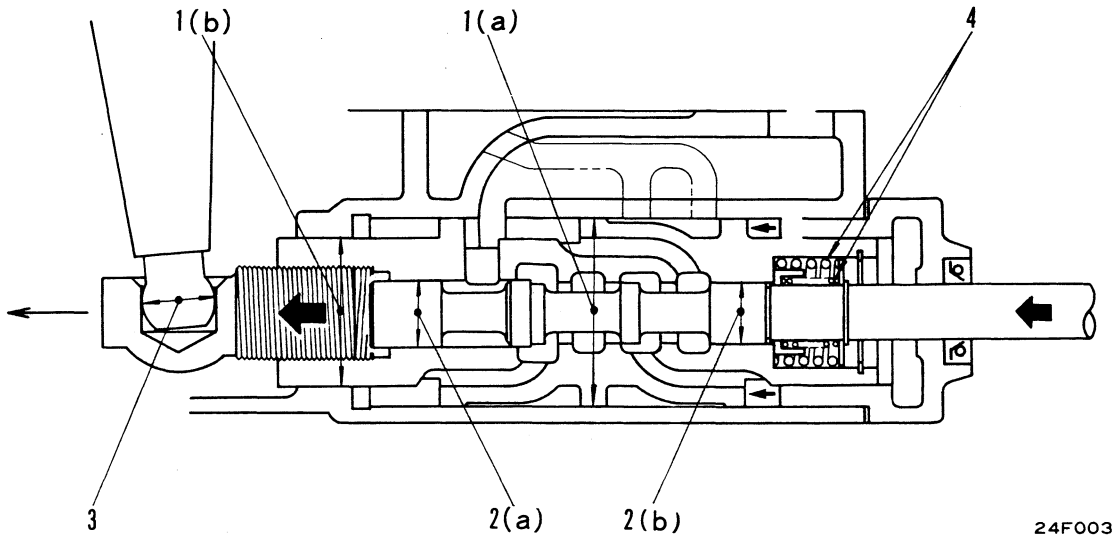
Unit: mm

No.	Check item	Criteria			Remedy
1	Drive plate thickness	Serial No.	Tolerance	Repair limit	Replace
		C5501~	6.5	5.6	
	Strain of drive plate	Serial No.	Tolerance	Repair limit	Correct or replace
		C5501~	0~0.25	0.3	

Unit: mm

No.	Check item	Criteria			Remedy
2	Thickness of driven plate (assembled thickness of lining)	Serial No.	Tolerance	Repair Limit	Replace
		C5501~	7.0	5.5	
	Strain of driven plate friction face	Serial No.	Tolerance	Repair limit	Correct or replace
		C5501~	0~0.3	0.5	
3	Total assembled thickness of drive plate & driven plate	Serial No.	Tolerance	Repair limit	Replace
		C5501~	47.5	27.7	
4	Thickness of pressure plate	Serial No.	Tolerance	Repair limit	Replace
		C5501~	23.5	22.5	
5	Strain of pressure plate	Serial No.	Tolerance	Repair limit	Correct or replace
		C5501~		0.5	
6	Backlash between flywheel internal teeth and plate	Serial No.	Standard clearance	Clearance limit	Replace
		C5501~	0.45~0.58	1.0	
7	Backlash between plate internal teeth and gear (driven plate guide)	Serial No.	Standard clearance	Clearance limit	Hard chrome plating or replace
		C5501~	0.45~0.58	1.0	
8	Clearance between main clutch shaft & bush	Serial No.	Standard size	Tolerance: Shaft / Hole	Standard clearance / Clearance limit	Replace bushing
		C5501~	60	−0.25 / −0.30	+0.074 / 0	0.25~ 0.374	0.5
9	Squareness & concentricity of flywheel housing installation surface	Serial No.	Item	Repair limit	Correct
		C5501~	Squareness Concentricity	0.03 (per 100 mm) 0.1	
10	Clearance between weight width & adjusting ring	Serial No.	Standard size	Tolerance: Shaft / Hole	Standard clearance / Clearance limit	Replace
		C5501~	50	−0.10 / −0.25	+0.1 / 0	0.1 ~ 0.35	1.0
11	Clearance between shifter for shaft & bushing	Serial No.	Standard size	Tolerance: Shaft / Hole	Standard clearance / Clearance limit	Replace bushing
		C5501~	(a) 34	−0.009 / −0.028	+0.025 / 0	0.009~ 0.053	1.0
			(b) 27	−0.020 / −0.041	+0.021 / +0	0.020~ 0.62	
12	Lubricating valve adjusting screw standard height	30.6 mm (set pressure 4.0 kg/cm²)					Adjust

(2) Main clutch booster

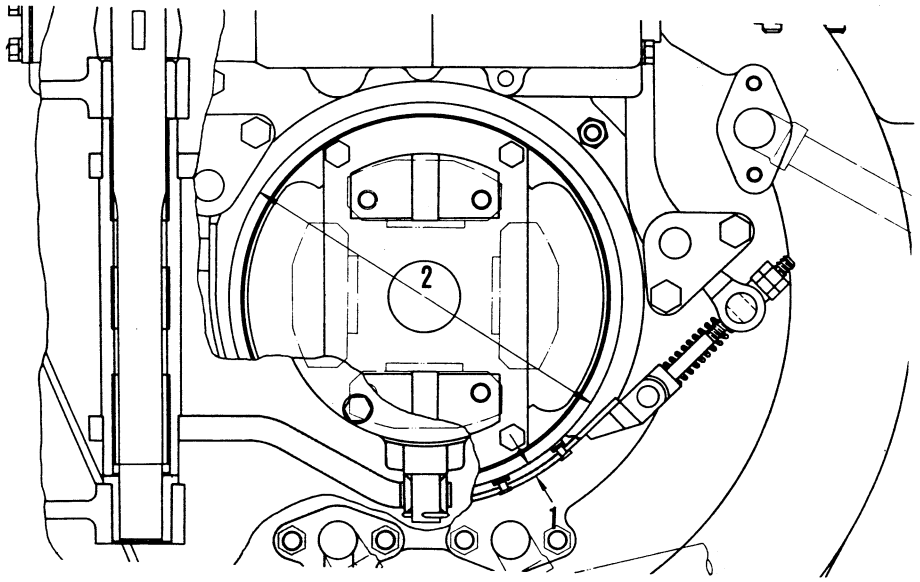


24F003

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between valve body and piston	Serial No.	Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	Replace
		C5501~	(a) 76	−0.02 −0.03	+0.03 0	0.02~ 0.06	0.1	
			(b) 60	−0.02 −0.03	+0.019 0	0.02~ 0.049		
2	Clearance between piston and spool	Serial No.	Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	
		C5501~	(a) 28	−0.02 −0.03	+0.014 0	0.02~ 0.044	0.1	
			(b) 25	−0.02 −0.03	+0.014 0			
3	Clearance between coupling and ball	Serial No.	Standard size	Tolerance Shaft	Tolerance Hole	Standard clearance	Clearance limit	
		C5501~	30 balls	−0.2 −0.3	+0.2 +0.1	0.3~0.5	1.0	
4	Booster spring	Serial No.	Standard size: Free length x O.D.	Standard size: Installed length	Standard size: Installed load	Repair limit: Free length	Repair limit: Load	
		C5501~	(Large) 54.4 x 44 (Small) 50.5 x 27.6	32 28.5	23 kg 11 kg	49.0 45.0	18.0 kg 8.8 kg	
5	Relief valve setting pressure	42.2 kg/cm² Oil temperature 50 ± 5°C						
6	Setting measure between coupling and spool	36.3 mm						Adjust

(3) Inertia brake



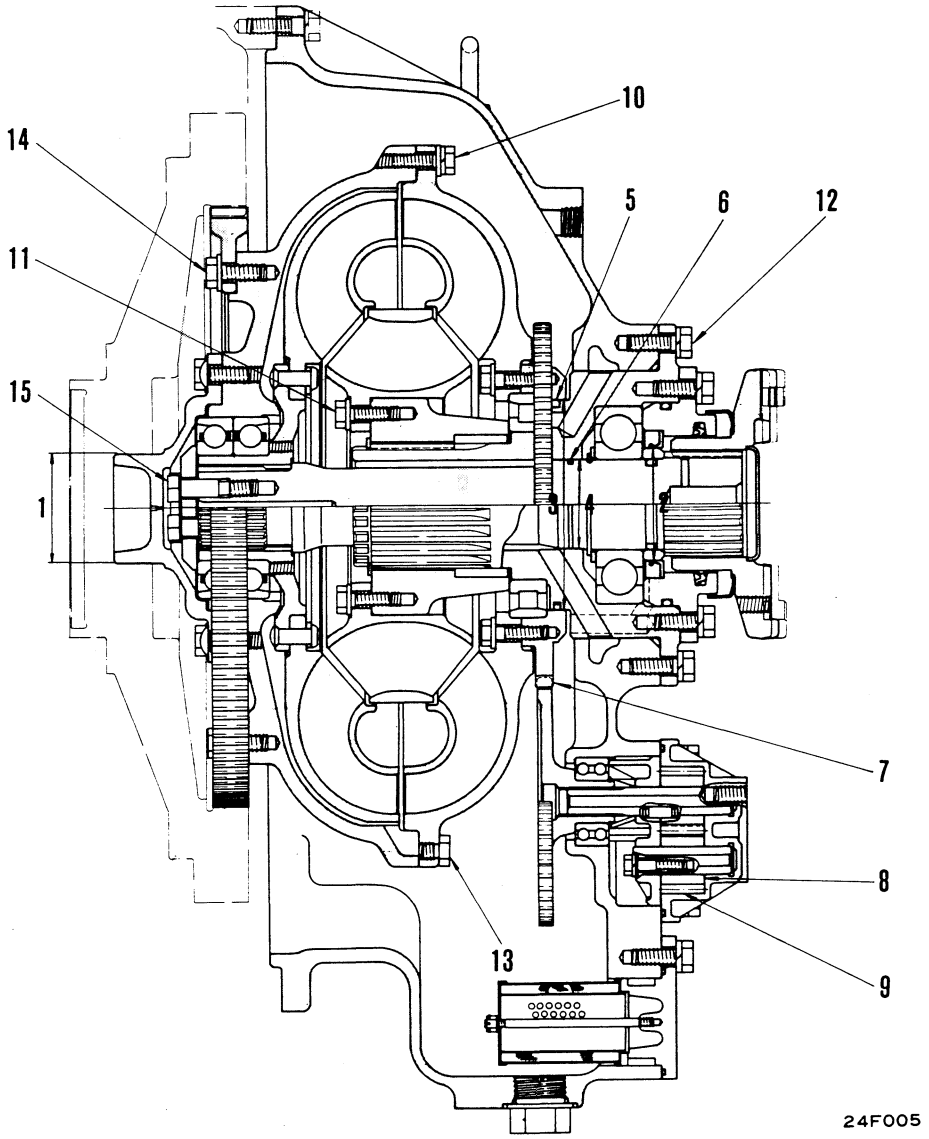
24F004

Unit: mm

No.	Check item	Criteria			Remedy
1	Assembled thickness of inertia brake lining	Serial No.	Standard size	Repair limit	Relining or replacement
		C5501~	6	3.7	
2	Outer diameter of inertia brake drum	Serial No.	Standard size	Repair limit	Replace drum
		C5501~	256	250	
3	Main clutch lever travel	250 ± 40 mm (exclusive inertia braking travel 45 mm)			Adjust
4	Main clutch lever operating force	6 ~ 7kg. ENGAGED ⇌ DISENGAGED, at more than middle engine speed (approximately 40kg when engine is stopped)			
5	Main clutch disengagement	Less than 3 sec.;	with engine at full speed and running at F1 on iron plate, time from main clutch disengagement to machine stop.		
6	Main clutch slip	Less than 3 sec.;	with engine at full speed and at F6, and with the brake depressed, the time required from ENGAGED → DISENGAGED switchover of main clutch till engine stop.		
7	Inertia brake effect	Less than 3 sec.;	with engine at full speed, time from instantaneous main clutch throw-out till coupling stop.		

TORQUE CONVERTER (TCS43-3A K1015 ~ 1677 / TCS43-3C K1678 ~ 2198 / TCS43-4A K2199 ~ 3724)

(1) Torque converter



Unit: mm

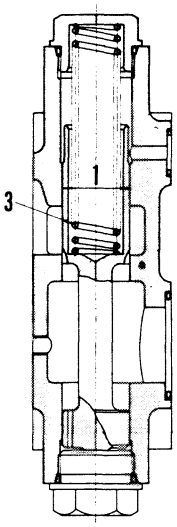
No.	Check item	Criteria			Remedy
		Torque converter No.	Standard size	Repair limit	
1	Outer diameter of pilot	K1015 – 3724	78	77.75	Hard chrome plating or replace
2	Seal seat outer diameter on seal contact surface	K1015 – 3724	80	77.9	
3	Gear inner diameter on seal ring contact surface	K1015 – 3724	150	150.3	

Unit: mm

No.	Check item	Criteria			Remedy
4	Inner diameter of stator shaft on seal ring contact surface	Torque converter No.	Standard size	Repair limit	Hard chrome plating or replace
		K1015 – 3724	60	60.1	
5	Stator shaft seal ring	K1015 – 3724	Width 4.5 Thickness 5.5	3.2 5.0	Replace
6	Turbine shaft seal ring	K1015 – 3724	Width 2.5 Thickness 2.5	2.0 2.2	
7	Backlash of scavenging pump drive gear	K1015 – 3724	0.16 – 0.43	0.5	
8	Side clearance of scavenging pump	K1015 – 3724	0.13	0.25	
9	Top clearance of scavenging pump	K1015 – 3724	0.15	0.30	
10	Tightening torque of pump-to-drive case fitting bolts	5.0 – 6.0 kgm			Adjust
11	Tightening torque of stator fitting bolts	6.0 – 7.5 kgm			
12	Tightening torque of stator shaft fitting bolts	10.0 – 12.5 kgm			
13	Tightening torque of pump drain plug	1.5 – 2.0 kgm			
14	Tightening torque of drive case-to-drive gear fitting bolts	10.0 – 12.5 kgm			
15	Tightening torque of stator shaft holder fitting reamer bolts	9.5 – 10.0 kgm			
16	RPM at time of torque converter stalling	T5501–7189 1800±50 rpm	T7190 – 15000 1600 ± 50 rpm		

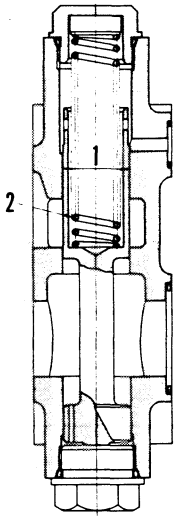
(2) Relief valve, regulator valve

Regulator valve



24F006

Relief valve



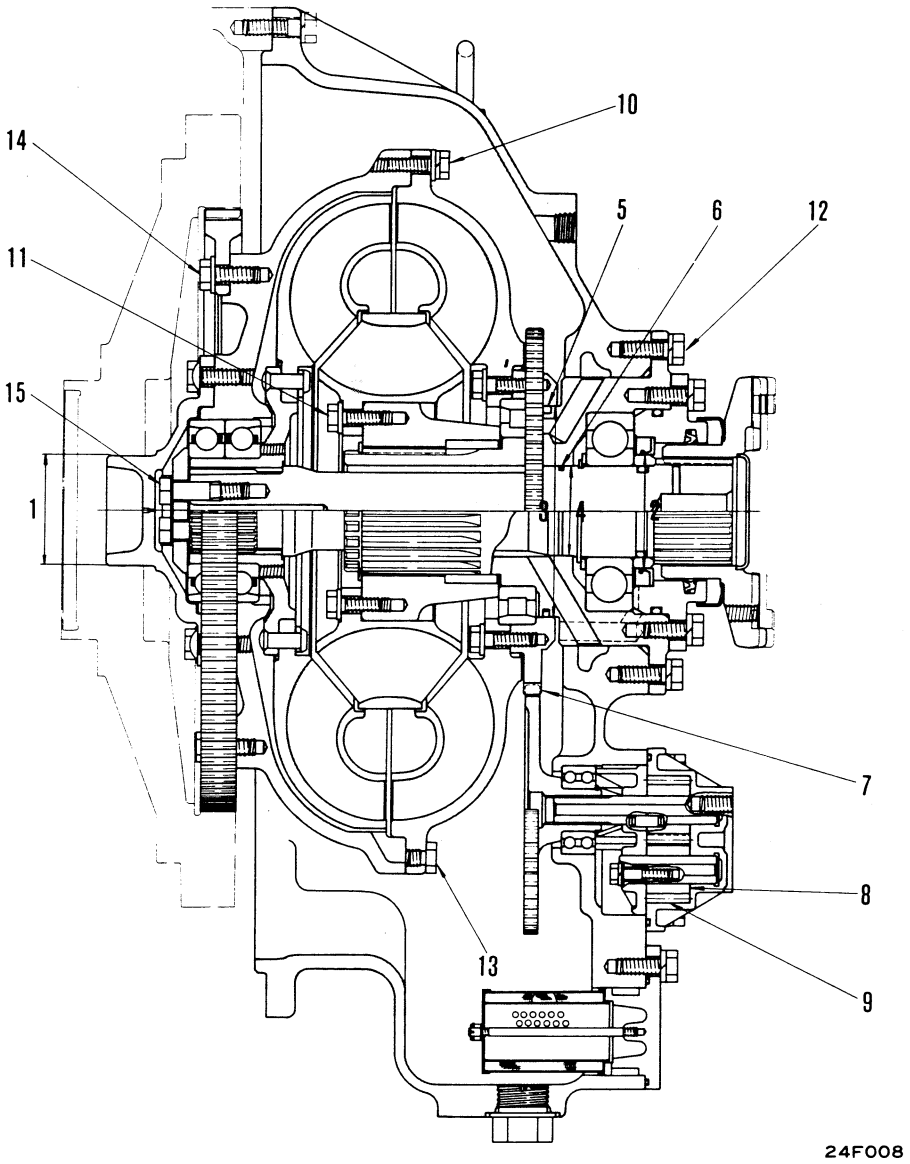
24F007

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between valve body and spool	Torque converter No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		K1015 ~ 3724	32	−0.050 −0.066	+0.025 0	0.050~ 0.091	0.20	
2	Relief valve spring	Torque converter No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		K1015 ~ 3724	137.7 x 24	110	44.4 kg	134.2	38.7 kg	
	Relief valve setting pressure	$8.7\ ^{+0.3}_{0}$ kg/cm² Oil temperature 75 ± 5°C						
3	Regulator valve spring	Torque converter No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		K1015 ~ 3724	126.6 x 23.5	110	17.3 kg	120	10.4 kg	
	Regulator valve setting pressure	2.5 ± 1.0 kg/cm² at 60 ℓ/min. 3.5 ± 0.5 kg/cm² at 100 ℓ/min. Oil temperature 75 ± 5°C 4.5 ± 0.5 kg/cm² at 200 ℓ/min.						

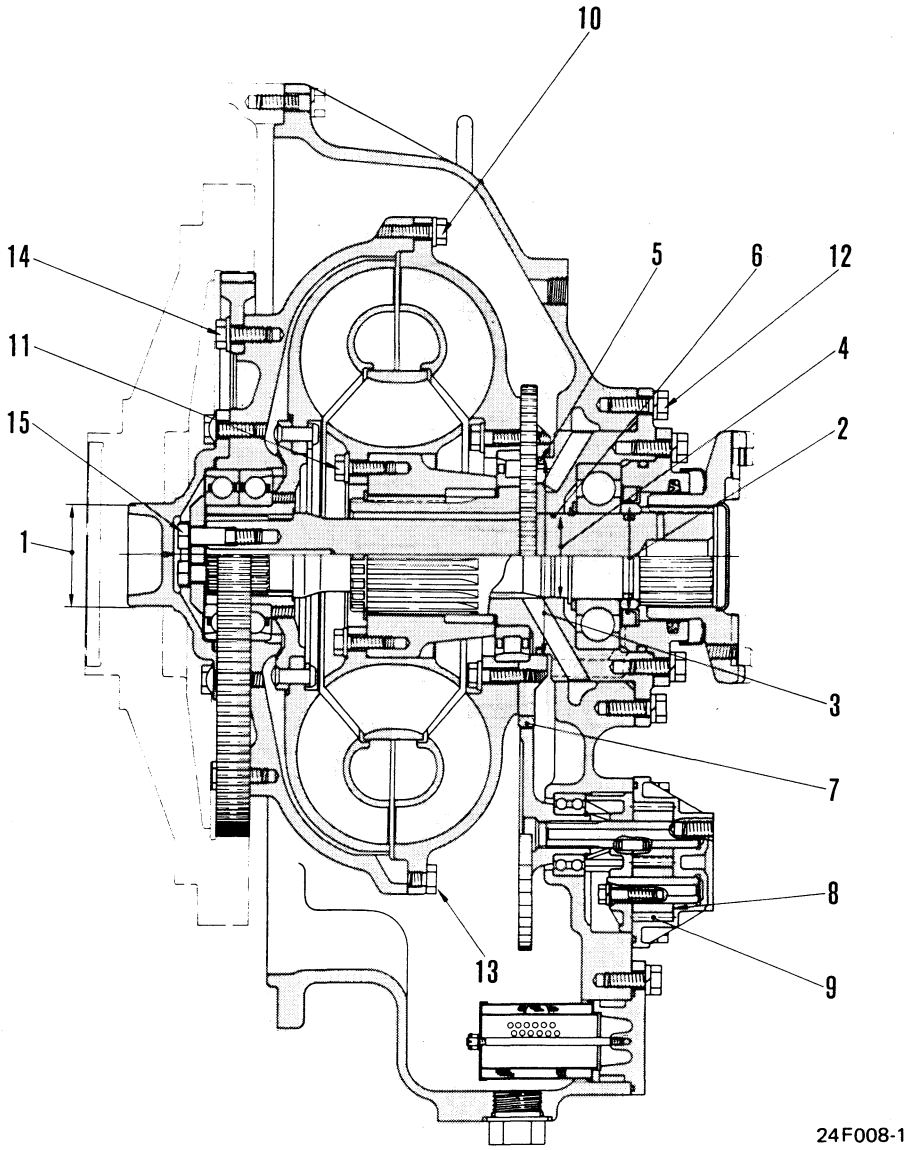
TORQUE CONVERTER (TCS43-4B K3275 and up / TCS43-4C K1001 and up)

(1) Torque converter



TORQUE CONVERTER TCS43E 18598 and up

(1) Torque converter



Unit: mm

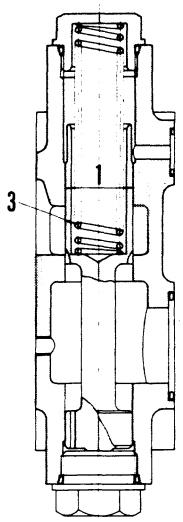
No.	Check item	Criteria			Remedy
		Torque converter No.	Standard size	Repair limit	
1	Outer diameter of pilot	K3275 – K1001 – 18598 –	78	77.75	Hard chrome plating or replace
2	Seal seat outer diameter on seal contact surface	K3275 – K1001 – 18598 –	80	77.9	
3	Gear inner diameter on seal ring contact surface	K3275 – K1001 – 18598 –	150	150.3	

Unit: mm

No.	Check item	Criteria			Remedy
		Torque converter No.	Standard size	Repair limit	
4	Inner diameter of stator shaft on seal ring contact surface	K3275 – K1001 – 18598 –	65	65.1	Hard chrome plating or replace
5	Stator shaft seal ring	K3275 – K1001 – 18598 –	Width 4.5 Thickness 5.5	3.0 5.0	Replace
6	Turbine shaft seal ring	K3275 – K1001 – 18598 –	Width 2.5 Thickness 2.7	2.0 2.5	
7	Backlash of scavenging pump drive gear	K3275 – K1001 – 18598 –	0.16 – 0.43	0.5	
8	Side clearance of scavenging pump	K3275 – K1001 – 18598 –	0.13	0.25	
9	Top clearance of scavenging pump	K3275 – K1001 – 18598 –	0.15	0.30	
10	Tightening torque of pump-to-drive case fitting bolts	5.0 – 6.0 kgm			Adjust
11	Tightening torque of stator fitting bolts	6.0 – 7.5 kgm			
12	Tightening torque of stator shaft fitting bolts	10.0 – 12.5 kgm			
13	Tightening torque of pump drain plug	1.5 – 2.0 kgm			
14	Tightening torque of drive case-to-drive gear fitting bolts	10.0 – 12.5 kgm			
15	Tightening torque of ~~steering~~ shaft holder fitting reamer bolts	9.5 – 10.0 kgm			
16	RPM at time of torque converter stalling	1600±50 rpm			

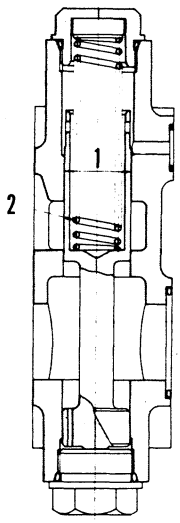
(2) Relief valve, regulator valve

Regulator valve



24F009

Relief valve



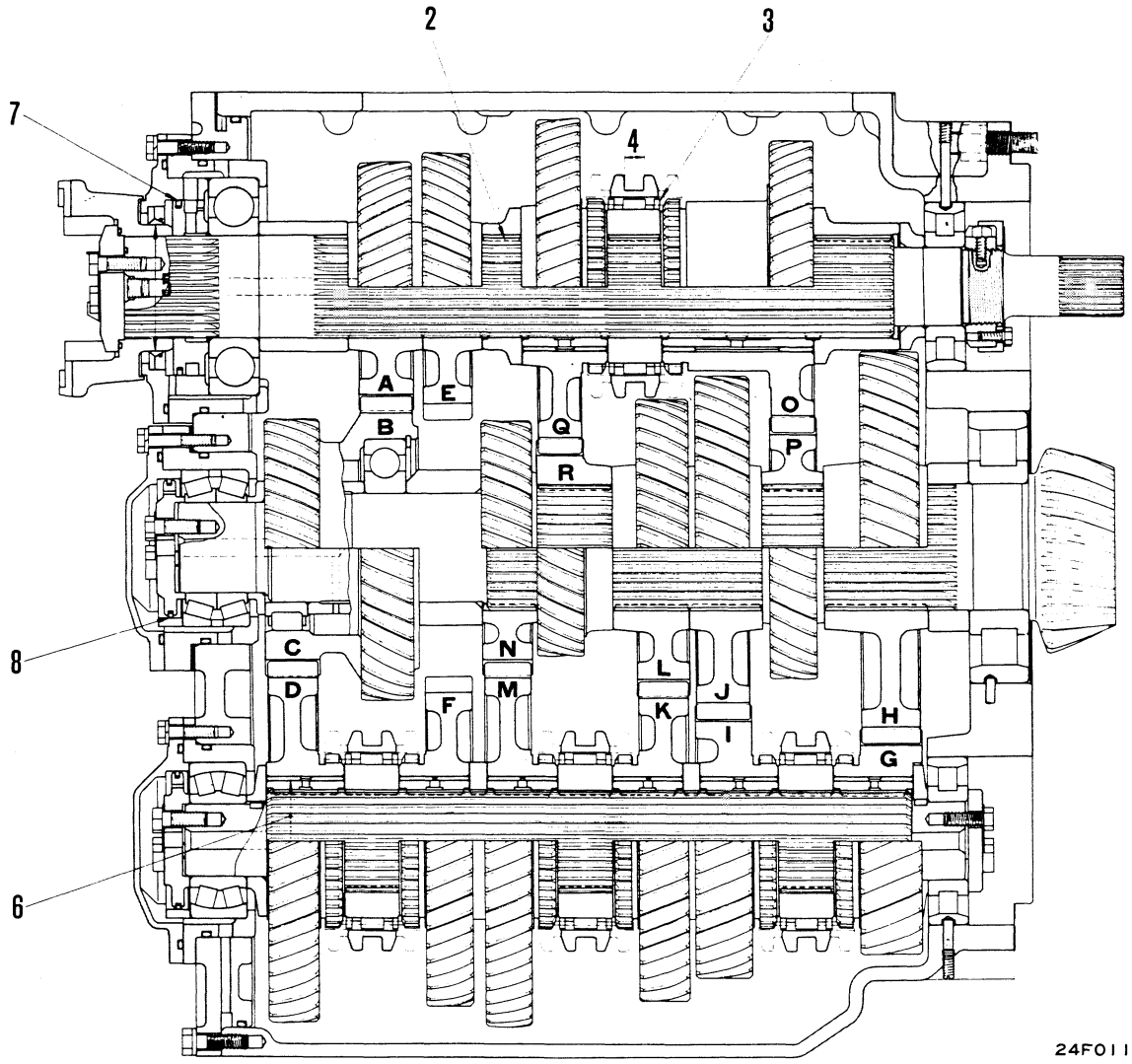
24F010

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between valve body and spool	Torque converter No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		K3275 – K1001 – 18598 –	32	−0.050 −0.066	+0.025 0	0.050~ 0.091	0.20	
2	Relief valve spring	Torque converter No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		K3275 – K1001 – 18598 –	137.7 x 24	98.0	63.5 kg	134.2	57.9 kg	
	Relief valve setting pressure	$8.7\ ^{+0.3}_{0}$ kg/cm² Oil temperature 75 ± 5°C						
3	Regulator valve spring	Torque converter No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		K3275 – K1001 – 18598 –	126.6x23.5	106.5	20.9 kg	120	14.0 kg	
	Regulator valve setting pressure	2.5 ± 1.0 kg/cm² at 60 ℓ/min. 3.5 ± 0.5 kg/cm² at 100 ℓ/min. Oil temperature 75 ± 5°C 4.5 ± 0.5 kg/cm² at 200 ℓ/min.						

TRANSMISSION

(1) Transmission case, gear



24F011

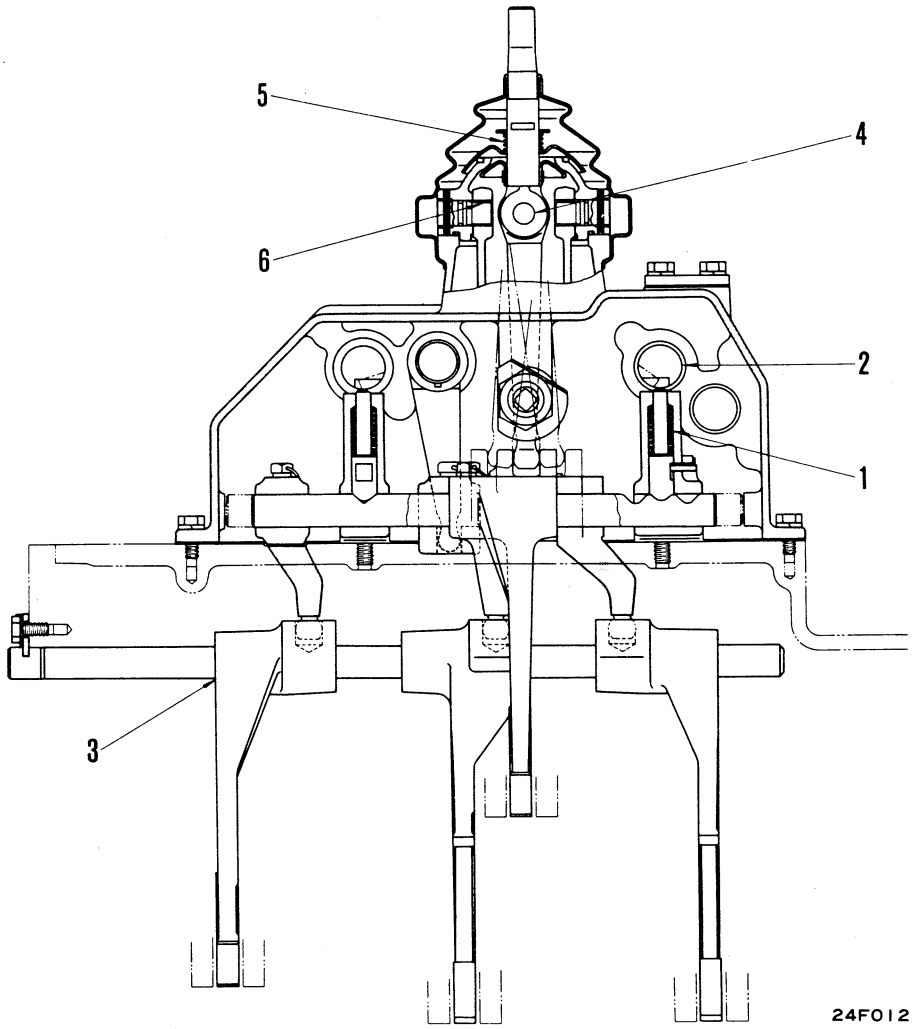
Unit: mm

No.	Check item	Criteria			Remedy
		Serial No.	Standard clearance	Clearance limit	
1	Backlash of each gear	C5501~	A-B, G-H, M-N, O-P, Q-R 0.22 ~ 0.53 C-D, I-J, K-L, E-F 0.23 ~ 0.57	1.0	Replace gear
2	Clearance between each gear and shaft spline in the rotating direction	C5501 ~			Replace
3	Backlash between constant mesh gear and clutch gear	C5501 ~			

Unit: mm

No.	Check item	Criteria						Remedy
4	Clearance between gear fork groove and shifter fork	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		C5501 ~	16			0.3~0.5	0.8	
5	Wear of main shaft coupling on oil seal contact surface	Serial No.	Standard size	Repair limit	Allowable limit			
		C5501 ~	105					
6	Clearance between bush & inner race	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C5501 ~	100					
7	Clearance between seal ring and ring groove	Serial No.	Standard size	Clearance limit				
		C5501 ~						
8	Clearance between seal ring and ring groove	C5501 ~						
9	Transmission lubricating oil pressure	1.5 kg/cm^2						
10	Relief valve spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		C5501~	51.8 x 21.8	30	3 kg	47.4	2.4 kg	
11	Plug tightening torque	11 ~ 15 kgm						

(2) Gear shift lever



Unit: mm

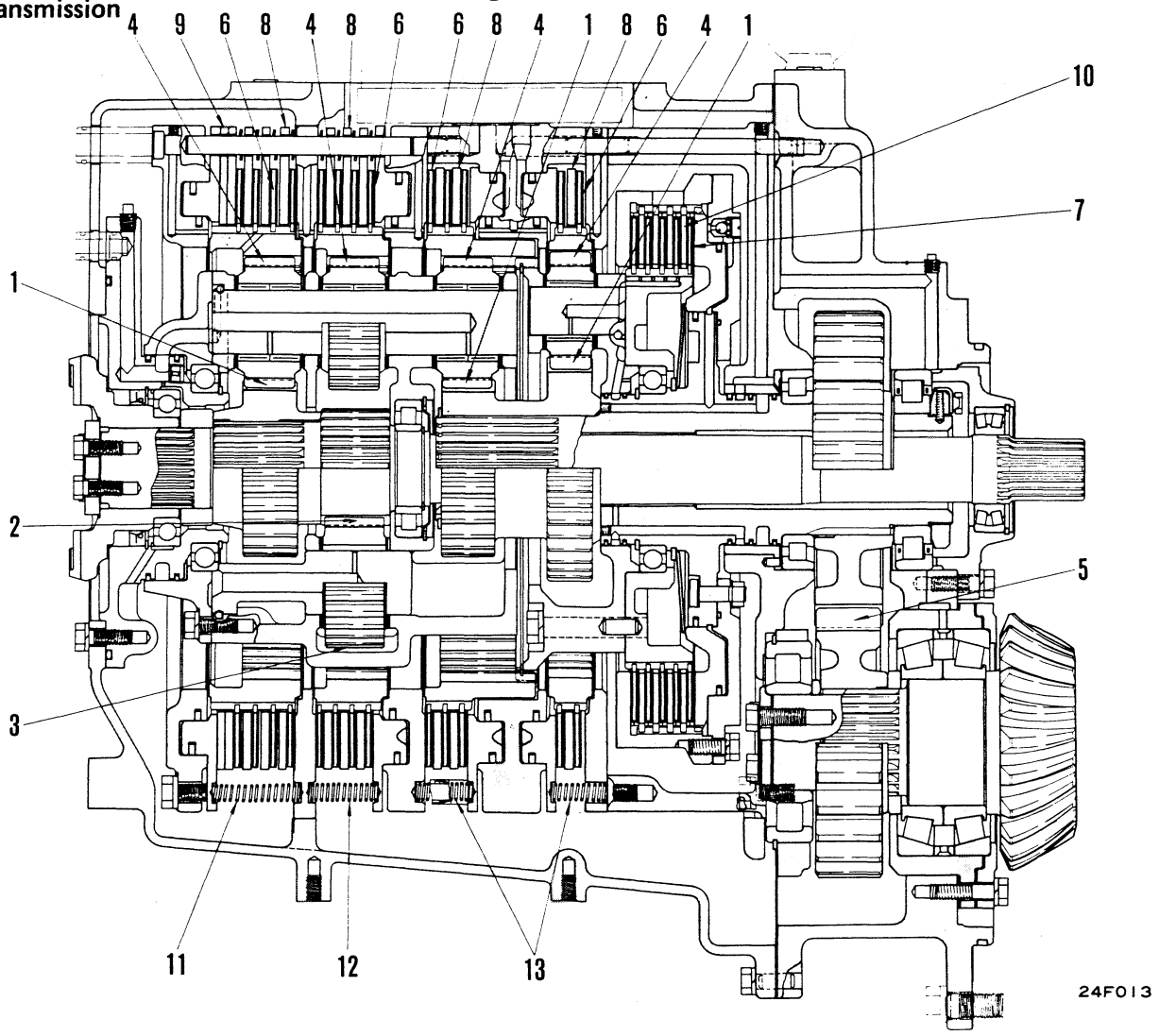
No.	Check item	Criteria						Remedy
1	Plunger (interlock) spring	Serial No.	Standard size			Repair limit		Replace
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		C5501~	41.3 x	34.6	6.9kg			
2	Clearance between interlock shaft and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C5501~	32	−0.025 −0.064	+0.039 0	0.025~ 0.103	0.15	
3	Clearance between shifter fork shaft and bushing	C5501~	24	−0.040 −0.061	+0.021 0	0.040~ 0.082	0.1	

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Clearance between gearshift lever supporting pin and bushing</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="5">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>C5501 ~</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Gearshift lever spring</td><td rowspan="2">Serial No.</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td></tr>
<tr><td>Free length x O.D.</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Load</td></tr>
<tr><td>C5501 ~</td><td>20 x</td><td>14</td><td>3.8 kg</td><td></td><td></td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between gate bushing and pin</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>C5501 ~</td><td>16</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">7</td><td>Gearshift lever travel</td><td colspan="6">100 ± 15 mm N → 1, 2, 3 . . . . . stroke
100 ± 15 mm Lateral travel at N-position</td><td rowspan="4"></td></tr>
<tr><td>Gearshift lever operating force</td><td colspan="6">Less than 7~12 kg (when engine is stopped)</td></tr>
<tr><td rowspan="2">8</td><td>Forward & reverse lever travel</td><td colspan="6">130 ± 20 mm</td></tr>
<tr><td>Forward & reverse lever operating force</td><td colspan="6">Less than 7~12 kg (when engine is stopped)</td></tr>
</table>

TRANSMISSION

(1) Transmission



Unit: mm

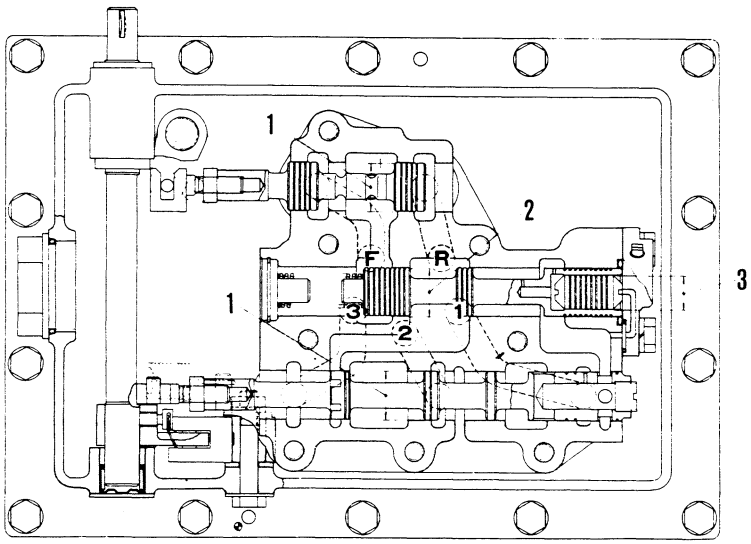
No.	Check item	Criteria			Remedy
		Serial No.	Standard clearance	Clearance limit	
1	Backlash between No. 1, 3 & 4 sun gears and planetary pinions	T5501~	0.14~0.37	0.75	Replace
2	Backlash between No. 2 sun gear and planetary pinion	T5501 ~	0.13~0.34	0.75	
3	Backlash between No. 2 planetary gear and planetary gear	T5501~	0.13~0.34	0.75	
4	Backlash between ring gear and planetary pinion	T5501 ~	0.16~0.48	0.75	

Unit: mm

No.	Check item	Criteria					Remedy
5	Transfer gear backlash	Serial No.	Standard clearance		Clearance limit		
		T5501–	0.21~0.51		0.75		
6	Thickness of No. 1, 2, 3 & 4 clutch discs	T5501–	5.4		4.6		
7	Thickness of No. 5 clutch disc	T5501–	5.4		4.6		
8	Thickness of No. 1, 2, 3 & 4 clutch plates	T5501–	7		6.2		
9	Thickness of No. 1 clutch spacer plate	T5501 – 24132	5.4				
10	Thickness of No. 5 clutch plate	T5501–	5		4.2		
11	No. 1 clutch spring	Serial No.	Standard size			Repair limit		Replace
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		T5501 – 24132	83.5 x 15.3	70	11.7 kg	78.5	10.5 kg	
		T24133 –	66 x 15.3	57.6	11.9 kg	62.0	10.5 kg	
12	No. 2 clutch spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		T5501–	66 x 15.3	56.6	13.3 kg	62.0	12.0 kg	
13	No. 3 & 4 clutch spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		T5501–	59 x	46.2	13.0 kg	55.5	12.0 kg	

(2) Transmission control valve

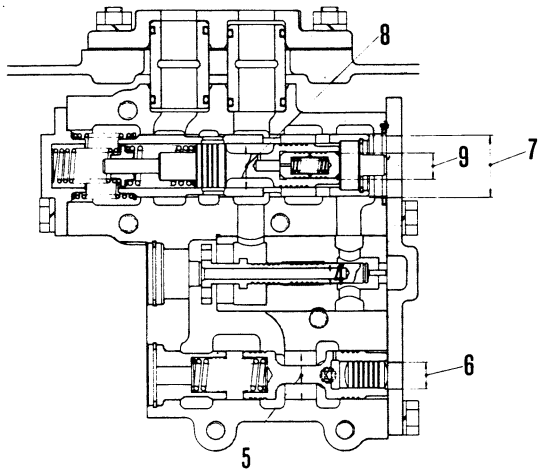
D155A Serial No. 15001 – 29764



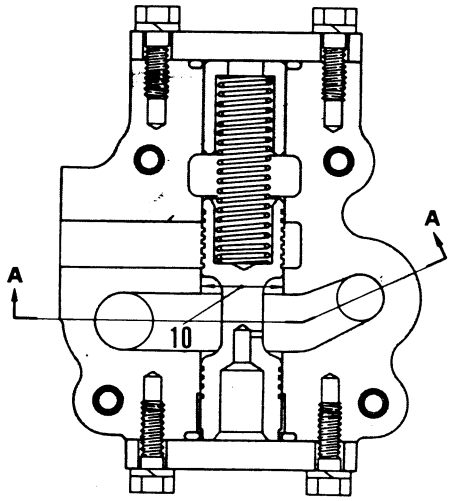
24F014

Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between directional spool as well as speed spool and valve body	T7190 – T24711	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	Replace ass'y
2	Clearance between safety valve and valve body	T7190 – T24711	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	
3	Clearance between piston and safety valve	T7190 – T24711	20	–0.02 –0.03	+0.021 0	0.02~ 0.051	0.056	
4	Clearance between quick-return valve and valve body	T7190 – T24711	12	–0.035 –0.045	+0.011 0	0.035~ 0.056	0.062	
5	Clearance between reducing valve and valve body	T7190 – T24711	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	



Section A–A 24F015



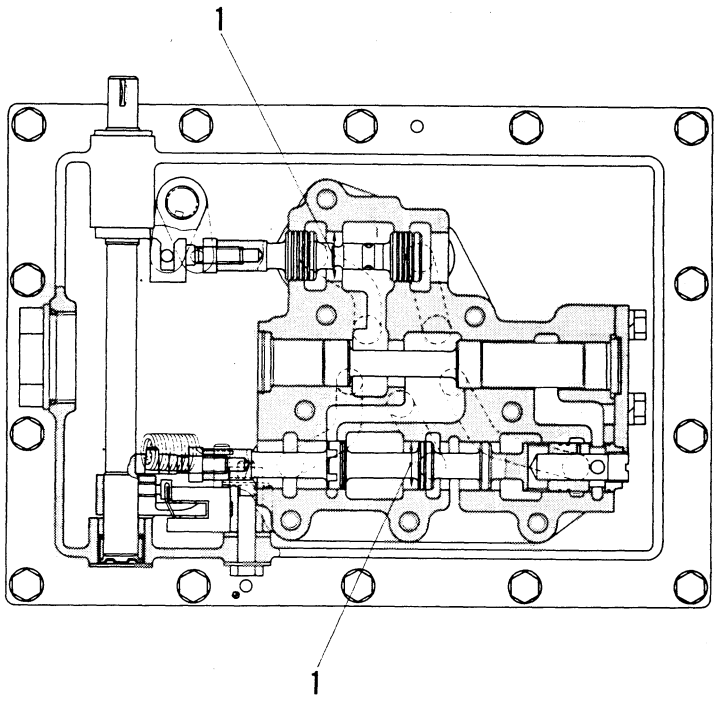
24F016

Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
6	Clearance between piston and reducing valve	T7190 – T24711	15	–0.02 –0.03	+0.018 0	0.035~ 0.048	0.053	Replace ass'y
7	Clearance between modulating valve and valve body	T7190 – T24711	35	–0.035 –0.045	+0.018 0	0.035~ 0.058	0.064	
8	Clearance between relief valve and modulating valve	T7190 – T24711	25	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	
9	Clearance between relief valve and piston	T7190 – T24711	15	–0.02 –0.03	+0.018 0	0.02~ 0.048	0.053	
10	Clearance between lubrication valve and valve body	T7190 – T24711	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.1	
–	No. 1 ~ No. 4 Clutch pressure	Engine, slow 16~20 kg/cm² Engine, full 20~25 kg/cm² Oil temperature 50~55°C						
	No. 5 clutch pressure	12.5 kg/cm² Oil temperature 50~55°C						
–	Transmission lubricating oil pressure	1.24 kg/cm²						

(2) Transmission control valve

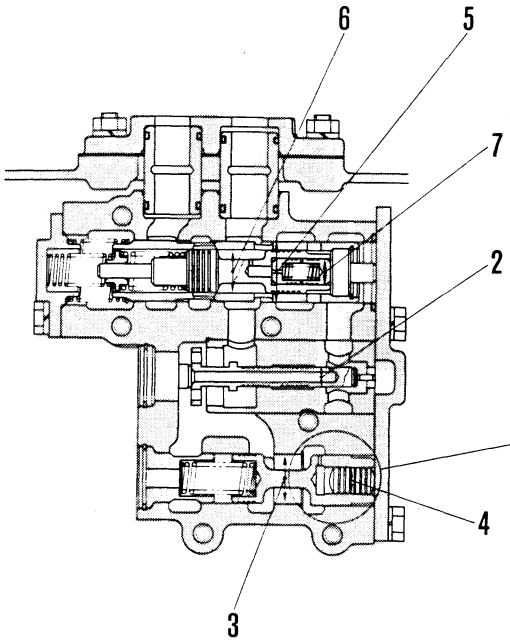
D155A Serial No. 29765 and up



24F014-1

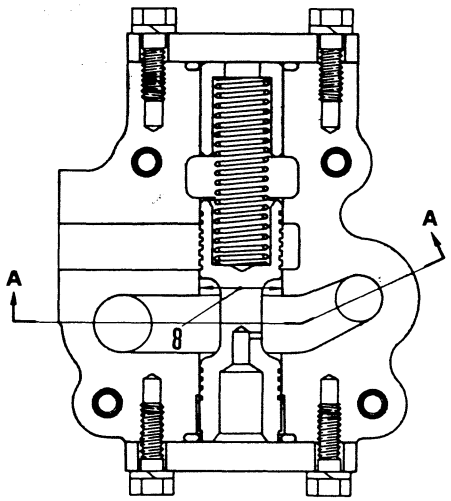
Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between directional spool as well as speed spool and valve body	T24712 –	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	Replace ass'y
2	Clearance between quick-return valve and valve body	T24712 –	12	–0.035 –0.045	+0.011 0	0.035~ 0.056	0.062	
3	Clearance between reducing valve and valve body	T24712 –	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	
4	Clearance between piston and reducing valve	T24712 –	15	–0.02 –0.03	+0.018 0	0.035~ 0.048	0.053	
5	Clearance between modulating valve and valve body	T24712 –	35	–0.035 –0.045	+0.018 0	0.035~ 0.058	0.064	



Section A—A

24F015-1



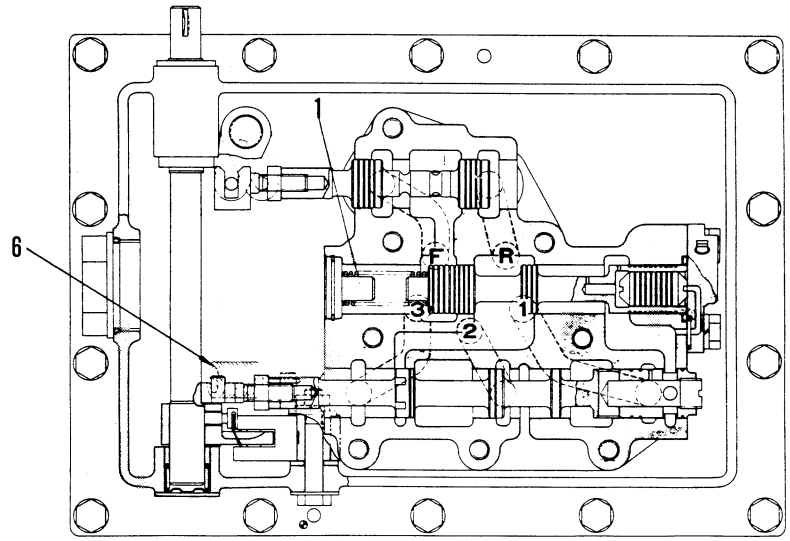
24F016-1

Unit: mm

No.	Check item	Criteria						Remedy
6	Clearance between relief valve and modulating valve	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		T24712 –	25	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.064	
7	Clearance between relief valve and piston	T24712 –	15	–0.02 –0.03	+0.018 0	0.02~ 0.048	0.053	
8	Clearance between lubrication valve and valve body	T24712 –	28	–0.035 –0.045	+0.013 0	0.035~ 0.058	0.1	
9	Reducing valve piston spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		T24880 –	35.0 x 8.5	21.0	1.33 kg	34.0	1.20 kg	
–	No. 1 ~ No. 4 Clutch pressure	Engine, slow 16~20 kg/cm² Oil temperature 50~55°C Engine, full 20~25 kg/cm²						
	No. 5 clutch pressure	12.5 kg/cm² Oil temperature 50~55°C						
–	Transmission lubricating oil pressure	1.24 kg/cm²						

(3) Transmission control valve spring

D155A Serial No. 15001 – 29764

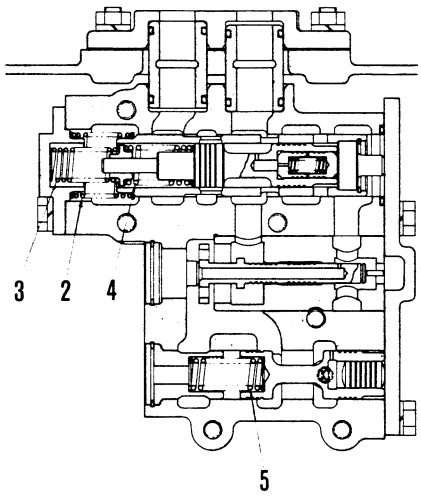


24F017

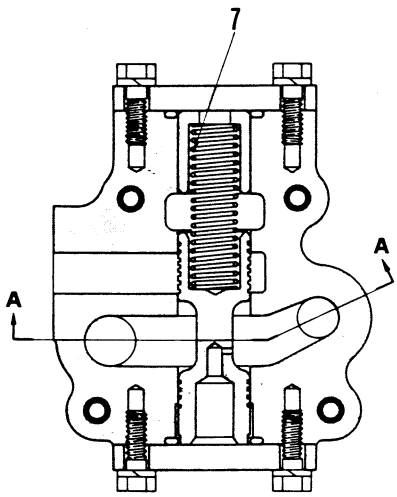
Unit: mm

No.	Check item	Criteria					Remedy
		Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Load
1.	Safety valve spring	T7190 – T24711	79 x 17.2	47	1.41 kg	75.8	1.34 kg
2.	Modulating valve spring	T7190 – T24711	53 x 37.9	35	8.65 kg	51.2	7.79 kg
3.	Relief valve spring (large)	T7190 – T24711	42.4 x 22.9	39.5	3.5 kg	42.1	3.15 kg
4.	Relief valve spring (small)	T7190 – T24711	41.5 x 22.5	40.5	3.5 kg	41.4	3.15 kg
5.	Reducing valve spring	T7190 – T24711	52 x 18.2	44.2	13.4 kg	51.2	12.1 kg
6.	Spool lever spring	T7190 – T24711	59.5 x 17.6	62	9.1 kg	59.8	8.2kg
7.	Lubrication valve spring	T7190 – T24711	87 x 18	61	7.6 kg	84.1	6.8kg

Replace



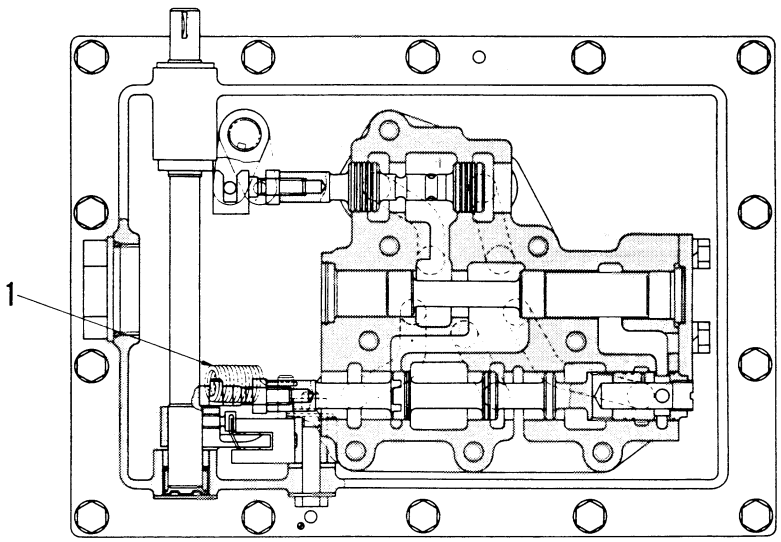
Section A–A 24F018



24F019

(3) Transmission control valve spring

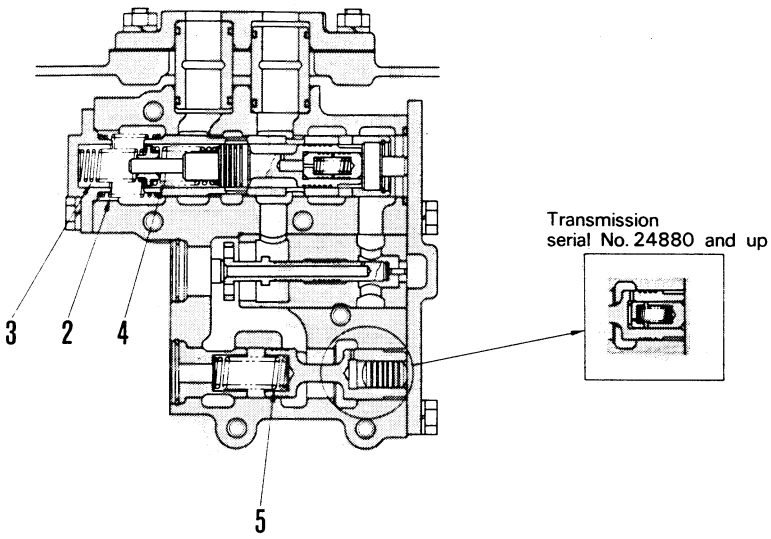
D155A 29765 and up



24F017-1

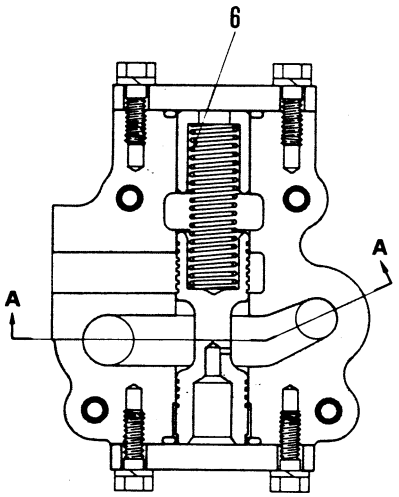
Unit: mm

No.	Check item	Criteria					Remedy
		Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
1.	Spool lever spring	T24712 –	59.5 x 17.6	62	9.1 kg	59.8	8.2 kg	Replace
2.	Modulating valve spring	T24712 –	53 x 37.9	35	8.65 kg	51.2	7.79 kg	
3.	Relief valve spring (large)	T24712 –	42.4 x 22.9	39.5	3.5 kg	42.1	3.15 kg	
4.	Relief valve spring (small)	T24712 –	41.5 x 22.5	40.5	3.5 kg	41.4	3.15 kg	
5.	Reducing valve spring	T24712 –	52 x 18.2	44.2	13.4 kg	51.2	12.1 kg	
6.	Lubrication valve spring	T24712 –	87 x 18	61	7.6 kg	84.1	6.8 kg	



Section A—A

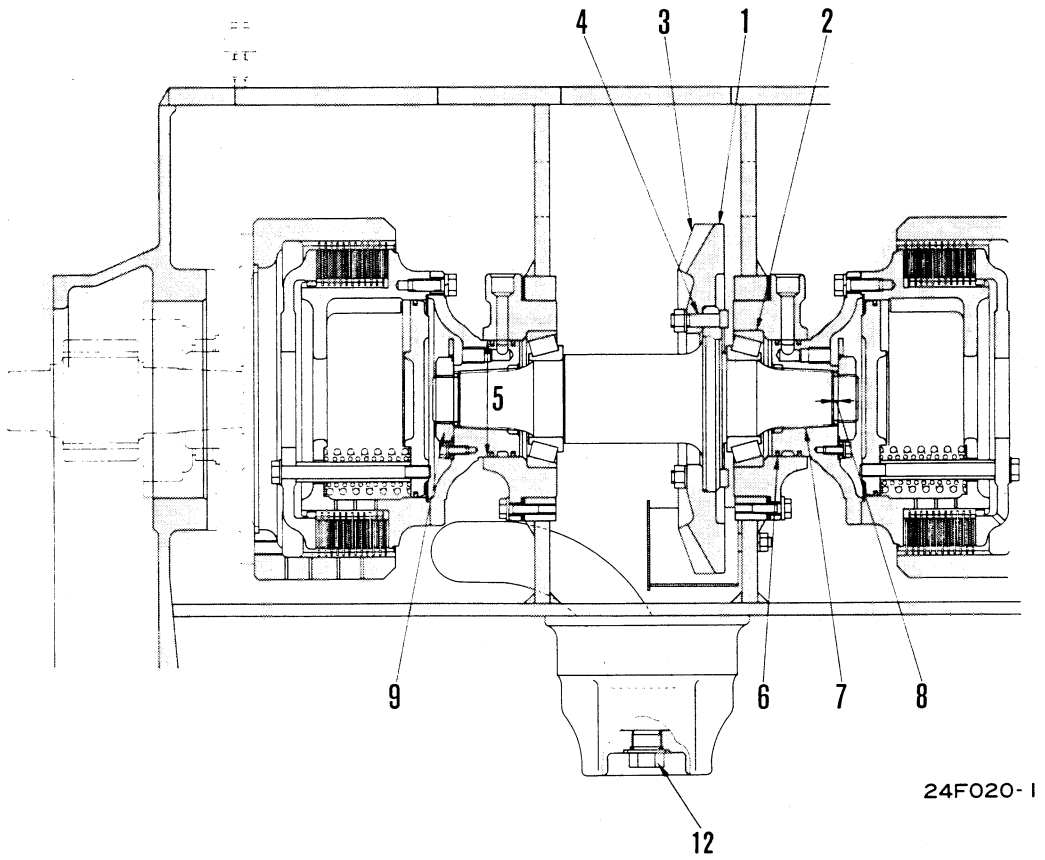
24F018-1



21F019-1

BEVEL GEAR SHAFT AND STEERING SYSTEM

(1) Bevel gear shaft and Bevel gear



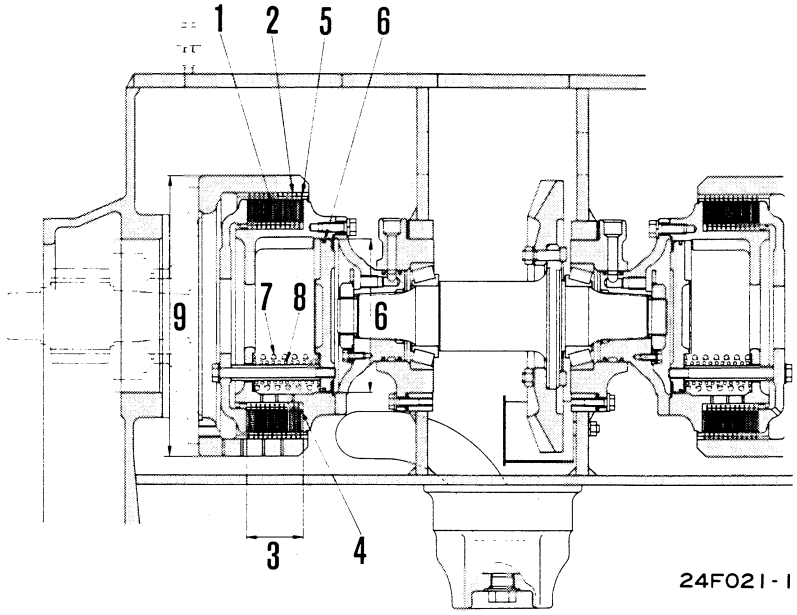
Unit: mm

No.	Check item	Criteria	Remedy
1	Bevel gear back deflection	Repair limit: 0.05 (to be measured after installation on the bevel gear shaft)	Correct or replace as an ass'y
2	Preload on bevel gear shaft taper roller bearing	Standard revolving torque: 2 ~ 6 kg (to be measured at tip of bevel gear when bevel gear is not in mesh with bevel pinion gear)	Adjustment
3	Backlash between bevel gear and pinion	Serial No. / Standard clearance / Clearance limit 5501~ / 5501~ / 0.25~0.33 / 0.75	Adjust or replace
4	Bevel gear reamer bolt fitting	Serial No. / Standard size / Tolerance (Shaft / Hole) / Standard clearance / Clearance limit 5501 ~ / 5501 ~ / 16 / 0 / −0.018 / +0.027 / 0 / 0 ~ 0.045 /	Replace
5	Inner diameter of bevel gear shaft flange on seal ring contact surface	Serial No. / Standard size / Repair limit 5501~ / 5501~ / 145 / 145.3	Replace

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="3">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">6</td><td>Seal ring width</td><td>Serial No.</td><td>Standard size</td><td>Repair limit</td><td rowspan="8">Replace</td></tr>
<tr><td></td><td>5501~
5501~</td><td>4.5</td><td>4.0</td></tr>
<tr><td></td><td>Width of bevel gear shaft seal ring groove</td><td>Serial No.</td><td>Standard clearance</td><td>Clearance limit</td></tr>
<tr><td></td><td></td><td>5501~
5501~</td><td>4.5</td><td>5</td></tr>
<tr><td>7</td><td>Bevel gear shaft hub press-fit force</td><td colspan="3">30 ton</td></tr>
<tr><td>8</td><td>Dimension after press-fit of bevel gear shaft hub</td><td colspan="3">6±0.5 mm</td></tr>
<tr><td>9</td><td>Bevel gear shaft nut tightening torque</td><td colspan="3">70 ± 5 kgm</td></tr>
<tr><td>10</td><td>Squareness of bevel gear shaft hub</td><td colspan="3">Repair limit: 0.15 mm</td></tr>
<tr><td>11</td><td>Concentricity of bevel gear shaft hub</td><td colspan="3">Repair limit: 0.15 mm</td></tr>
<tr><td>12</td><td>Drain plug tightening torque</td><td colspan="3">13 ~ 18 kgm</td></tr>
</table>

(2) Steering clutch



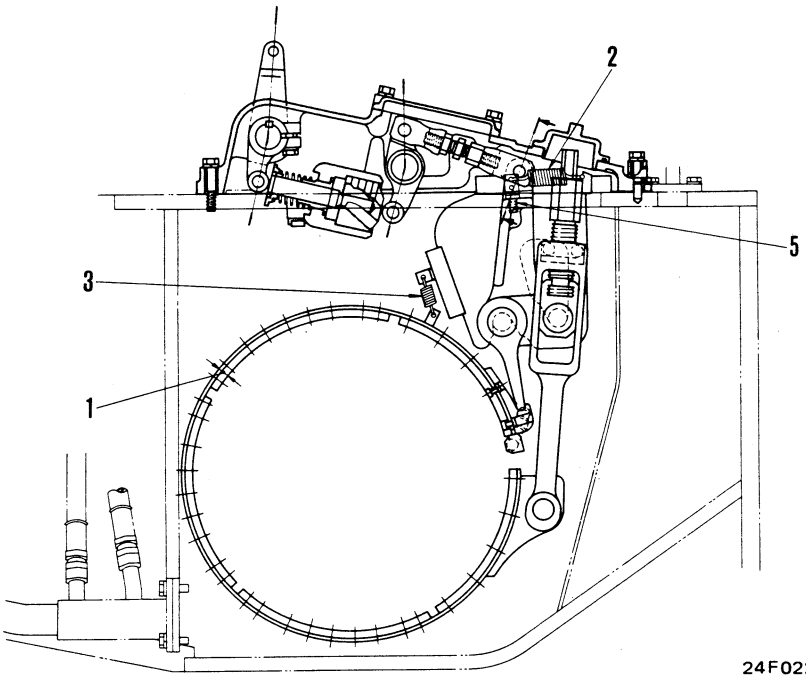
Unit: mm

No.	Check item	Criteria			Remedy
1	Thickness of drive plate	Serial No.	Standard size	Repair limit	Replace
		5501~ 5501~	2.9	2.0	
	Strain of drive plate	Serial No.	Tolerance	Repair limit	Correct or replace
		5501~ 5501~	Less than 0.2	0.3	
2	Thickness of driven plate	Serial No.	Standard size	Repair limit	Replace
		5501~ 5501~	4.7	3.7	
	Strain of driven plate	Serial No.	Tolerance	Repair limit	Correct or replace
		5501~ 5501~	Less than 0.2	0.3	
3	Total assembled thickness of drive plate and driven plate	Serial No.	Standard size	Repair limit	Replace
		5501~ 5501~	88.3	81.6	
4	Backlash between drive plate and clutch drum (inner)	Serial No.	Standard clearance	Repair limit	
		5501~ 5501~	0.3~0.4	1.0	
5	Backlash between driven plate and brake drum (outer)	5501~ 5501~	0.3~0.4	1.0	

Unit: mm

No.	Check item	Criteria					Remedy
6	Clutch drum (inner drum) inside diameter on seal ring contact surface	Serial No.		Standard size		Repair limit	Replace
		5501~ 5501~		245		245.5	
	Clearance between piston seal ring groove and seal ring	Serial No.		Standard clearance		Repair limit	
		5501 ~ 5501 ~		0.07~0.18		0.4	
7	Clutch spring (large)	Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Load
		5501~ 5501~	145.15x	104	254.1 kg	141	229.1 kg
8	Clutch spring (small)	5501~ 5501~	137.83x	104	146 kg	134.5	132 kg
9	Outside diameter of brake drum (outer drum)	Serial No.		Standard size		Repair limit	Correct or replace
		5501~ 5501~		450		445	
10	Squareness of brake drum	Serial No.		Tolerance		Repair limit	
		5501~ 5501~		Less than 0.3		0.5	
11	Eccentricity of brake drum	5501 ~ 5501 ~		Less than 0.15		0.3	
12	Steering lever travel	Serial No. ~ 25000	60 ± 5 mm				
	Steering lever operating force	~ 25000	3 ~ 6 kg (Under engine low idling, no applied steering brake) 13 ~ 15 kg (Under engine low idling, applied steering brake to turn)				
	Steering lever travel	25001 ~	Clutch off 1.5 – 2.5 kg x 65 – 75 mm				
	Steering lever operating force		Applied brake 5 – 8 kg x 120 – 130 mm				

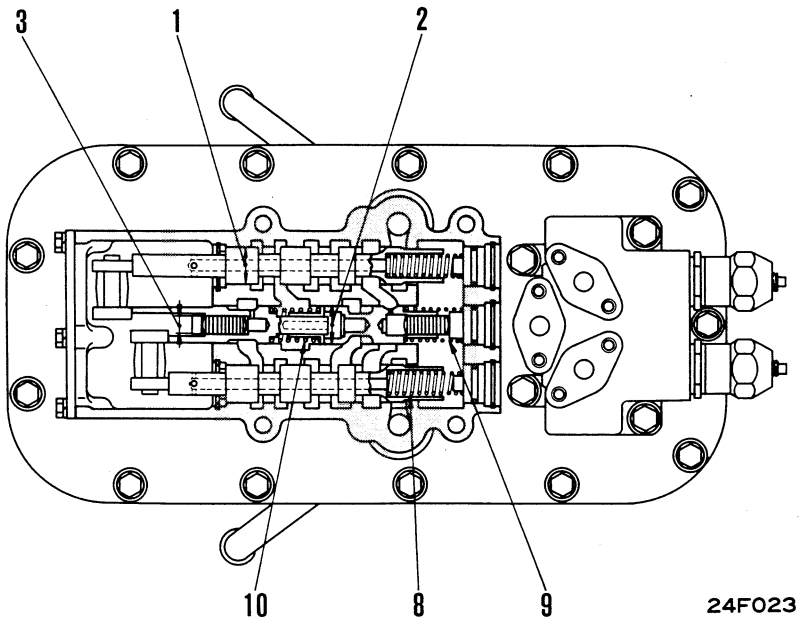
(3) Steering brake



Unit: mm

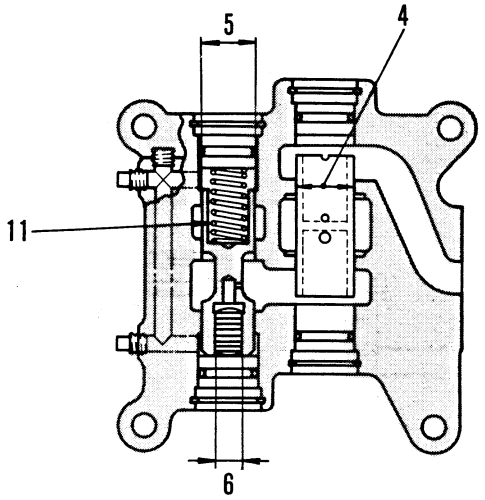
No.	Check item	Criteria					Remedy
1	Thickness of brake lining	Serial No.	Standard size		Repair limit		
		5501~ 5501~	9.5		5.5		
	Clearance between brake lining and drum	0.3 mm					
2	Brake band return spring	Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Load
		5501 ~ 5501 ~	78.3x23.2	97	20 kg	82	16 kg
3	Brake band lift spring	5501 ~ 5501 ~	42.4 x 18.3	47.4	4.54 kg	43.4	3.6 kg
4	Brake pedal travel	110 ~ 120mm (Under engine stopped) 160 ± 10mm (Under engine idling) Lateral travel difference shall be less than 10mm.					
	Brake pedal depressing force	12 ~ 15kg (lateral force difference shall be less than 2kg)					
5	Return spring hook tightening torque	2.3 ~ 3.5 kgm					

(4) Steering control valve



Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between spool and housing	8408 ~ 15001 ~ 25000	30	–0.034 –0.043	+0.013 0	0.034~ 0.056	0.1	
2	Clearance between modulating valve and housing	8408 ~ 15001 ~ 25000	30	–0.034 –0.043	+0.013 0	0.034~ 0.056	0.1	
3	Clearance between modulating valve and free piston	8408 ~ 15001 ~ 25000	15	–0.02 –0.03	+0.018 0	0.020~ 0.048	0.08	
4	Clearance between free piston and housing	8408 ~ 15001 ~ 25000	31	–0.020 –0.041	+0.07 0	0.020~ 0.048	0.1	
5	Clearance between main relief valve and housing	8408 ~ 15001 ~ 25000	28	–0.014 –0.025	+0.013 0	0.014~ 0.038	0.08	
6	Clearance between main relief valve and free piston	8408 ~ 15001 ~ 25000	15	–0.02 –0.03	+0.018 0	0.020~ 0.048	0.08	
7	Clearance between lever shaft and bush	8408 ~ 15001 ~ 25000	20	–0.020 –0.053	+0.108 –0.075	0.022 ~ 0.128		

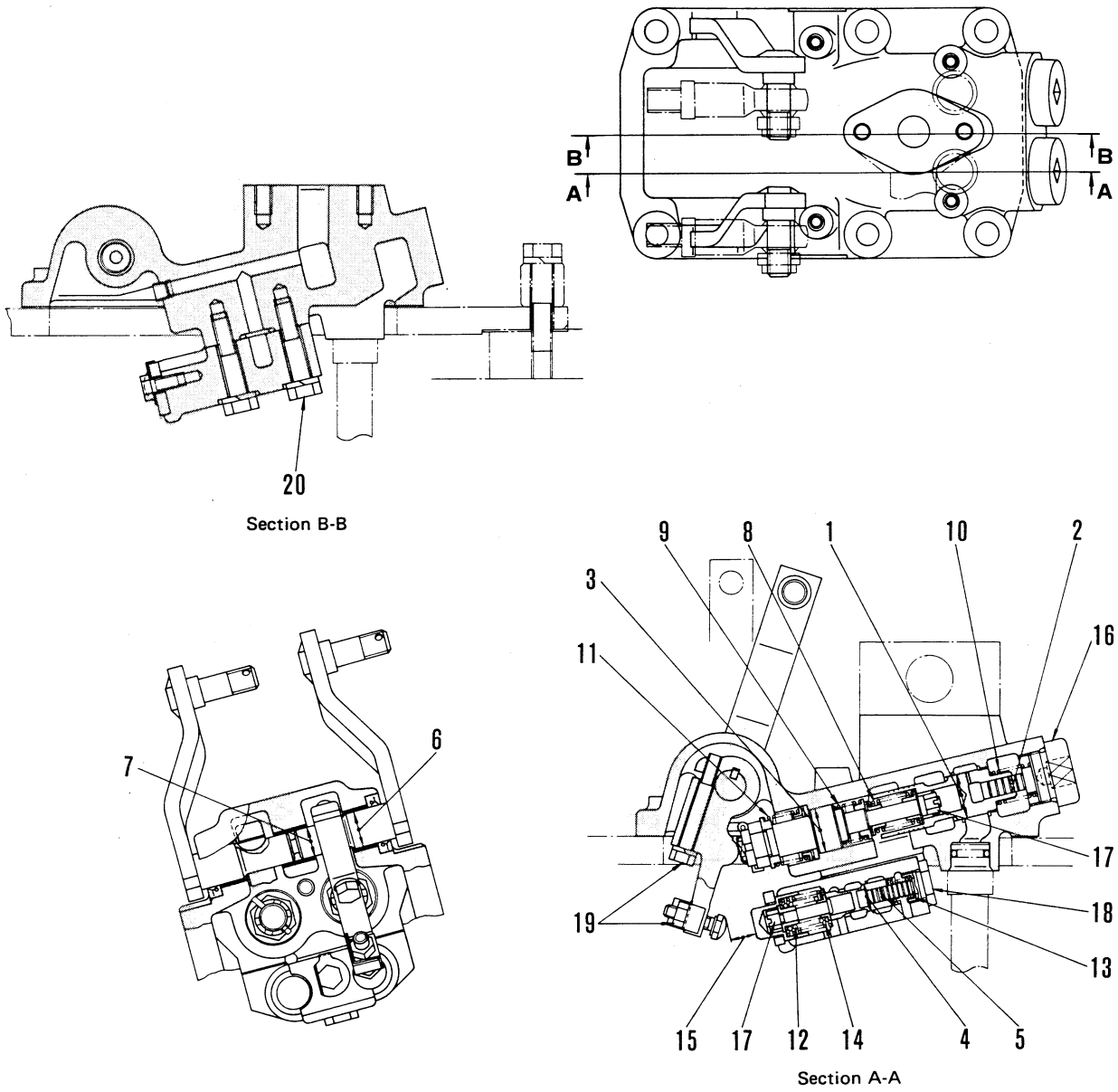


Unit: mm

No.	Check item	Criteria					Remedy
		Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Load
8	Spool return spring	8408 ~ 15001 ~ 25000	96.8 x 18	60	8		
9	Modulating valve spring	8408 ~ 15001 ~ 25000	106 x 26.8	46	2.89		
10	Modulating valve spring	8408 ~ 15001 ~ 25000	45.9 x 26.9	40	6.04		
11	Main relief valve spring	8408 ~ 15001 ~ 25000	46.5 x 18.9	40	12.5		
12	Steering clutch setting pressure	9 ~ 13 kg/cm² (Engine, slow) 12~17 kg/cm² (Engine, full)					

(4) Steering control valve

D155A 25001 and up

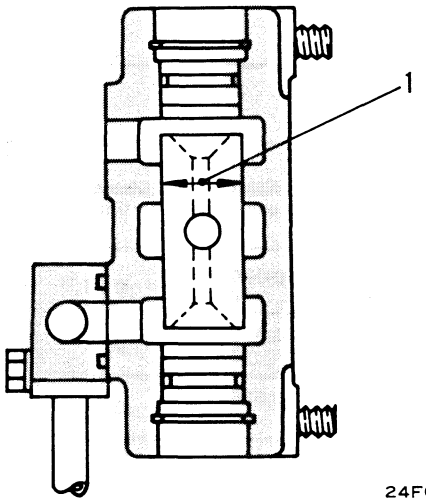


175F160

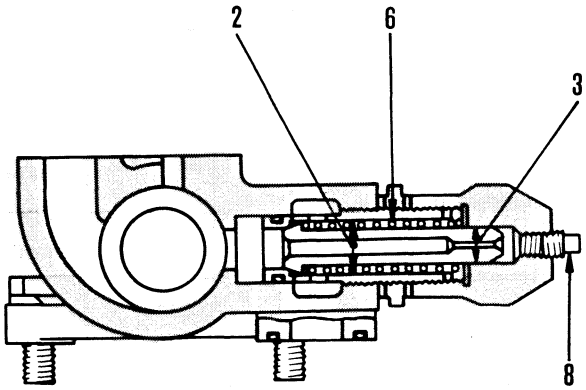
Unit: mm

No.	Check Item	Criteria						Remedy
1	Clearance between steering valve and valve body	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		25001 ~	26	−0.035 −0.045	+0.013 0	0.035 ~ 0.058	0.08	
2	Steering valve and piston	25001 ~	10	−0.030 −0.040	+0.015 0	0.030 ~ 0.055	0.08	
3	Steering valve shaft and valve body	25001 ~	26	−0.035 −0.045	+0.013 0	0.035 ~ 0.058	0.08	
4	Brake valve and valve body	25001 ~	16	−0.030 −0.035	+0.018 0	0.030 ~ 0.053	0.08	
5	Brake valve and piston	25001 ~	9	−0.030 −0.040	+0.015 0	0.030 ~ 0.055	0.08	
6	Lever shaft and bushing	25001 ~	22	+0.023 +0.002	+0.170 +0.086	0.063 ~ 0.168	0.2	
7	Lever shaft and bushing	25001 ~	18	+0.019 +0.001	+0.156 +0.086	0.067 ~ 0.155	0.2	
8	Steering modulating spring	Serial No.	Standard size			Repair limit		Replace
			Free length x O.D.	Installed length	Installed load	Free length	Installed load	
		25001 ~	36.0 x 19.0	27.2	6.02 kg	35.3	5.7 kg	
9	Steering valve spring	25001 ~	62.0 x 23.4	15.8	3.5 kg	60.9	3.2 kg	
10	Steering valve return spring	25001 ~	91.6 x 18.9	25.0	4.53 kg	90.6	4.3 kg	
11	Steering shaft spring	25001 ~	55.0 x 29.6	20.5	3.61 kg	54.0	3.3 kg	
12	Brake modulating spring	25001 ~	28.5 x 14.8	25.5	3.0 kg	28.0	2.8 kg	
13	Brake valve return spring	25001 ~	50.5 x 11.9	14.0	2.36 kg	49.5	2.2 kg	
14	Brake valve sleeve return spring	25001 ~	90.0 x 21.4	27.0	4.48 kg	88.5	4.15 kg	
15	Diameter between brake valve sleeve and adjustment bolt	13.7						Adjustment
16	Steering valve plug tightening torque	11 ± 1.5 kgm						Retighten
17	Shaft mounting nut tightening torque	0.25 ± 0.05 kgm						
18	Brake valve plug tightening torque	4 ± 0.5 kgm						
19	Adjustment bolt lock nut and lever mounting bolt tightening torque	3.2 ± 0.3 kgm						
20	Brake valve mounting bolt tightening torque	6.8 ± 0.7 kgm						

(5) Brake valve, brake booster



24F025

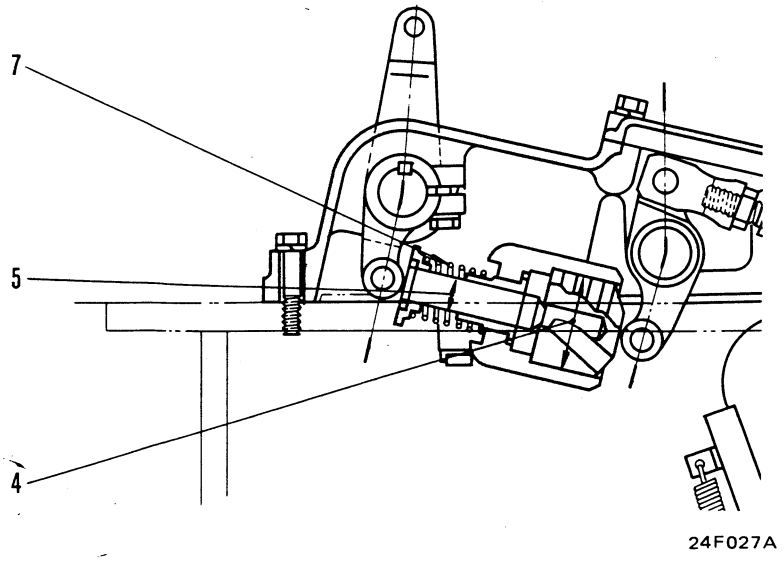


24F026

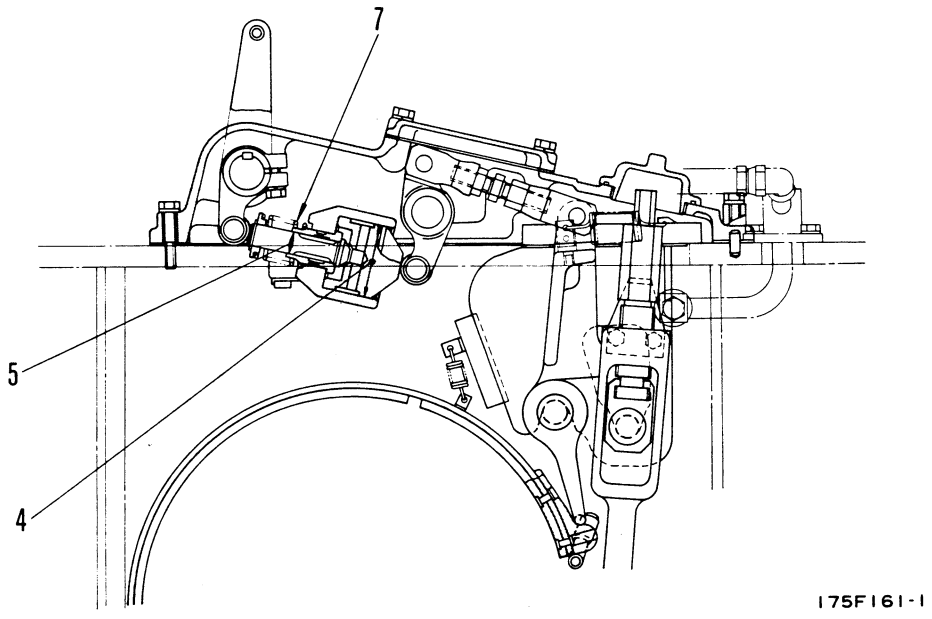
Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between free piston and valve body	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		5501~ 5501~	31	−0.016 −0.026	+0.07 0	0.016~ 0.096	0.1	
2	Clearance between valve seat and plunger	5501~ 5501~	21	−0.065 −0.098	+0.021 0	0.065~ 0.119	0.15	
3	Clearance between nut and plunger	5501~ 5501~	14	−0.016 −0.034	+0.027 0	0.016~ 0.061	0.1	
4	Clearance between booster housing and piston	5501 ~ 5501 ~ 25000 25001 ~	70 80	−0.030 −0.049	+0.030 0	0.030~ 0.079	0.1	
5	Clearance between sleeve and spool	5501 ~ 5501 ~ 25000 25001 ~	25	−0.005 −0.010	+0.064 +0.034	0.039~ 0.074	0.1	
6	Brake safety valve spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		5501 ~ 5501 ~ 25000	82.4 x 19.6	63	11.8 kg	80.4	10.6 kg	
7	Booster valve return spring	5501~ 5501~25000 25001~	89 x 46.5	58	10 kg	85.9	9.0 kg	
8	Brake oil pressure	21~25kg/cm² (Engine, slow) 22~29kg/cm² (Engine, full)	Left & right difference shall be less than 2kg/cm²					

D150A 8408 and up
D155A 15001 ~ 25000

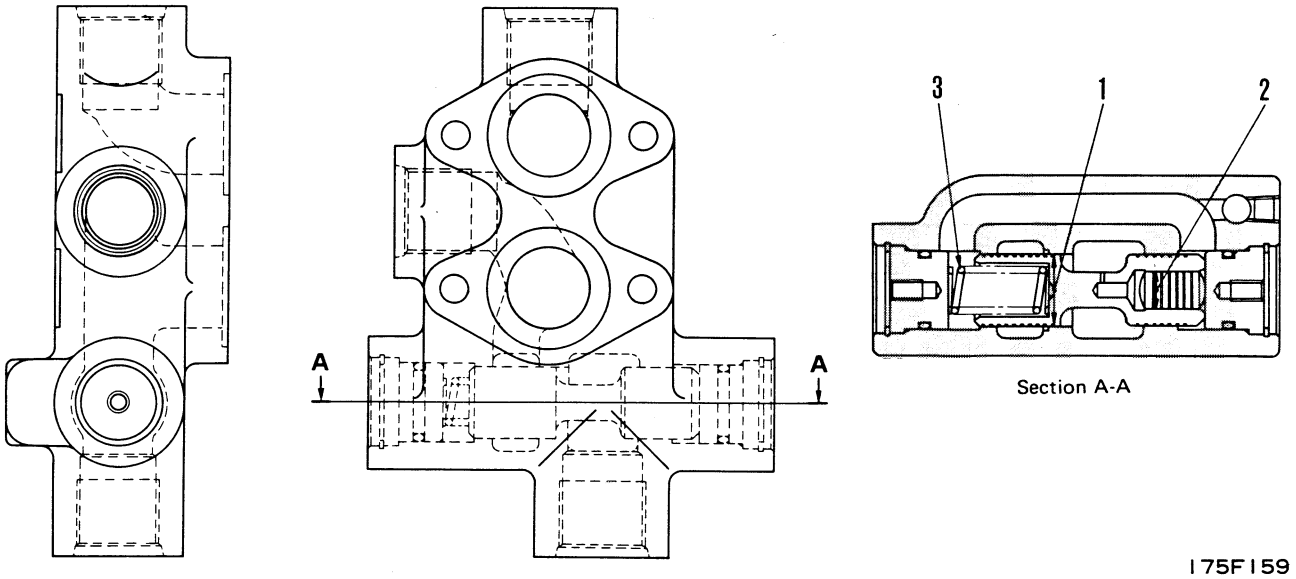


D155A 25001 and up



(6) Steering main relief valve

D155A 25001 and up

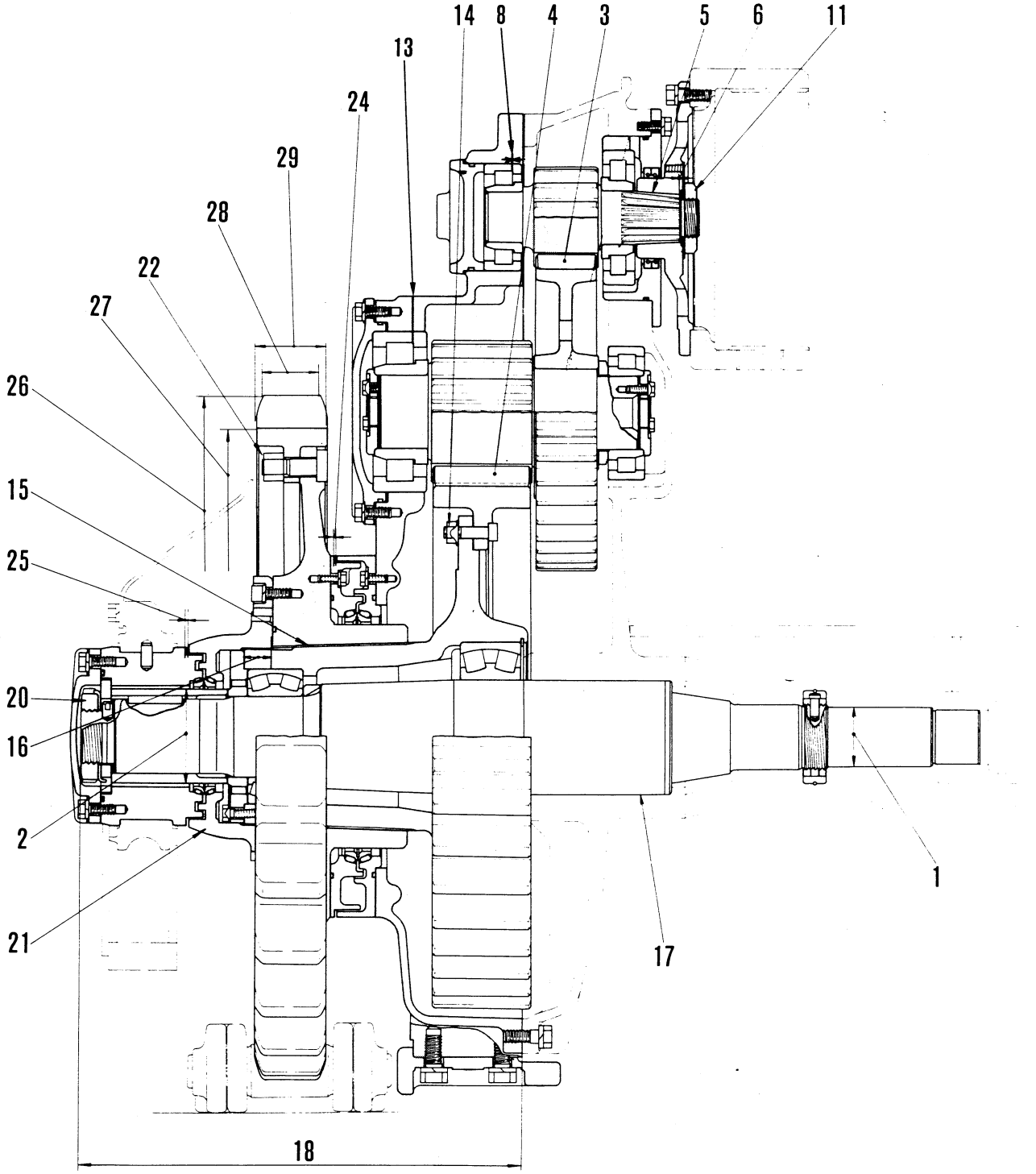


175F159

Unit: mm

No.	Check Item	Criteria						Remedy
1	Clearance between main relief valve and valve body	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		25001 ~	28	−0.014 −0.023	+0.013 0	0.014 ~ 0.036	0.08	
2	Clearance between main relief valve and piston	25001 ~	15	−0.020 −0.030	+0.018 0	0.020 ~ 0.048	0.08	
3	Main relief valve spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installation length	Installation load	Free length	Installation load	
		25001 ~	48.9 x 18.9	40	19.2 kg	48.0	18.2 kg	

FINAL DRIVE



24F028

Unit: mm

No.	Check Item	Criteria						Remedy
1	Clearance between sprocket shaft and diagonal brace bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
				Shaft	Hole			
		C8408 ~ T15001 ~	90	−0.036 −0.071	+0.035 0	0.036 ~ 0.106	0.5	
2	Clearance between support shaft collar and bushing	C8408 ~ T15001 ~	140	−0.145 −0.208	+0.080 −0.040	0.105 ~ 0.288	0.5	
3	Backlash between No. 1 pinion and No. 1 gear	Serial No.		Standard clearance		Repair limit		Replace
		C8408 ~ T15001 ~		0.27 ~ 0.68		1.5		
4	Backlash between No. 2 pinion and No. 2 gear			0.31 ~ 0.82		1.5		
5	Final drive flange and No. 1 pinion press-fit force	30 ~ 40 ton						Adjust
6	Dimension after press-fit of final drive flange	Clearance between flange bottom surface and shaft shoulder: 0 ± 0.5						
7	Concentricity of final drive case	0.3						
8	Final drive 1st pinion shaft side clearance	0.7 ~ 1.4						
9	Squareness of final drive flange	Axial runout of pinion flange in reference to bevel gear shaft flange shall be within 0.4mm.						
10	Concentricity of final drive flange	Axial runout of pinion flange in reference to bevel gear shaft flange shall be within 0.4mm.						
11	Final drive flange fitting nut tightening torque	8408 ~ 8453, 15001 ~ 18999 : 150 ± 15 kgm 8454 ~, 19001 ~ : 70 ± 5 kgm						
13	Side clearance of final drive 2nd pinion shaft	1.0 ~ 1.6						
14	No. 2 gear fitting nut tightening torque	70 ± 5 kgm						
15	Sprocket press-fit force	70 ~ 80 ton						
16	Dimension from sprocket hub end to sprocket boss end	40 ± 1						
17	Sprocket shaft press-fit force	15 ~ 54 ton						

Unit: mm

<table>
<tr><th>No.</th><th>Check Item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td>18</td><td>Dimension from sprocket shaft to steering case</td><td colspan="4"></td><td>Adjust</td></tr>
<tr><td>19</td><td>Bend of sprocket shaft</td><td colspan="4">Repair limit: Less than 1.0</td><td>Replace</td></tr>
<tr><td>20</td><td>Sprocket shaft nut (top) tightening torque</td><td colspan="4">150 ~ 200 kgm</td><td rowspan="6">Adjust</td></tr>
<tr><td>21</td><td>Sprocket nut tightening torque</td><td colspan="4"></td></tr>
<tr><td>22</td><td>Sprocket tooth nut tightening torque</td><td colspan="4">110 ~ 130 kgm</td></tr>
<tr><td>23</td><td>Oil level and drain plug tightening torque</td><td colspan="4">14 ~ 18 kgm</td></tr>
<tr><td>24</td><td>Clearance of floating seal guard</td><td colspan="4">3.3 ~ 5.3</td></tr>
<tr><td>25</td><td>Clearance between sprocket nut and support</td><td colspan="4">2.2 ~ 4.6</td></tr>
<tr><td rowspan="2">26</td><td rowspan="2">Wear of sprocket teeth (top) diameter</td><td>Serial No.</td><td>Standard size</td><td>Tolerance</td><td>Repair limit</td><td rowspan="4">Rebulld or replace</td></tr>
<tr><td rowspan="2">5501 ~</td><td>1011</td><td></td><td></td></tr>
<tr><td>27</td><td>Wear of sprocket teeth (bottom) diameter</td><td>912.15</td><td></td><td></td></tr>
<tr><td rowspan="2">28</td><td rowspan="2">Wear of sprocket teeth (top) width</td><td colspan="2">Serial No.</td><td colspan="2">Standard size</td><td>Repair limit</td></tr>
<tr><td rowspan="2">5501 ~</td><td colspan="2">83</td><td></td></tr>
<tr><td>29</td><td>Wear of sprocket teeth (bottom) width</td><td colspan="2">103</td><td>95</td></tr>
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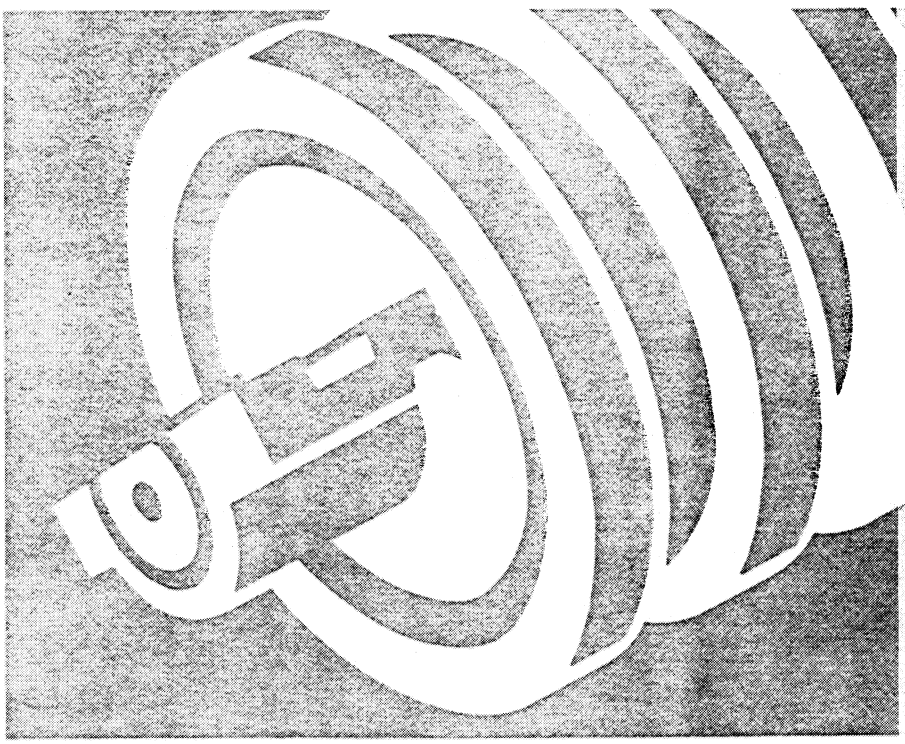
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

31 UNDERCARRIAGE

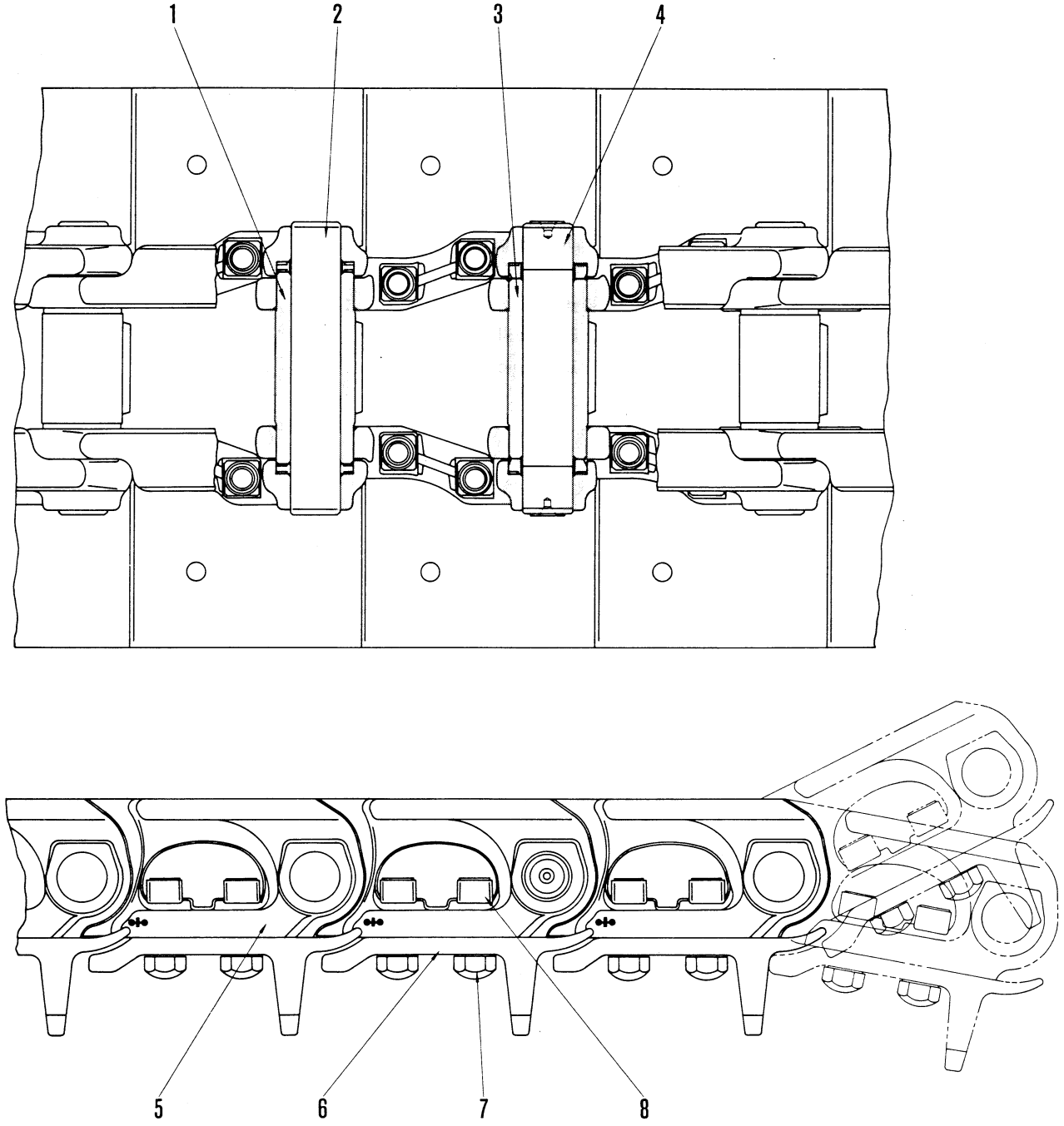
STRUCTURE AND FUNCTION



STRUCTURE AND FUNCTION

Track 31-2
Track (option) oil sealed track 31-3
Track group 31-4
Recoil spring 31-5
Idler 31-6
Track roller, carrier roller 31-7
Suspension 31-8

TRACK (MASTER PIN TYPE)

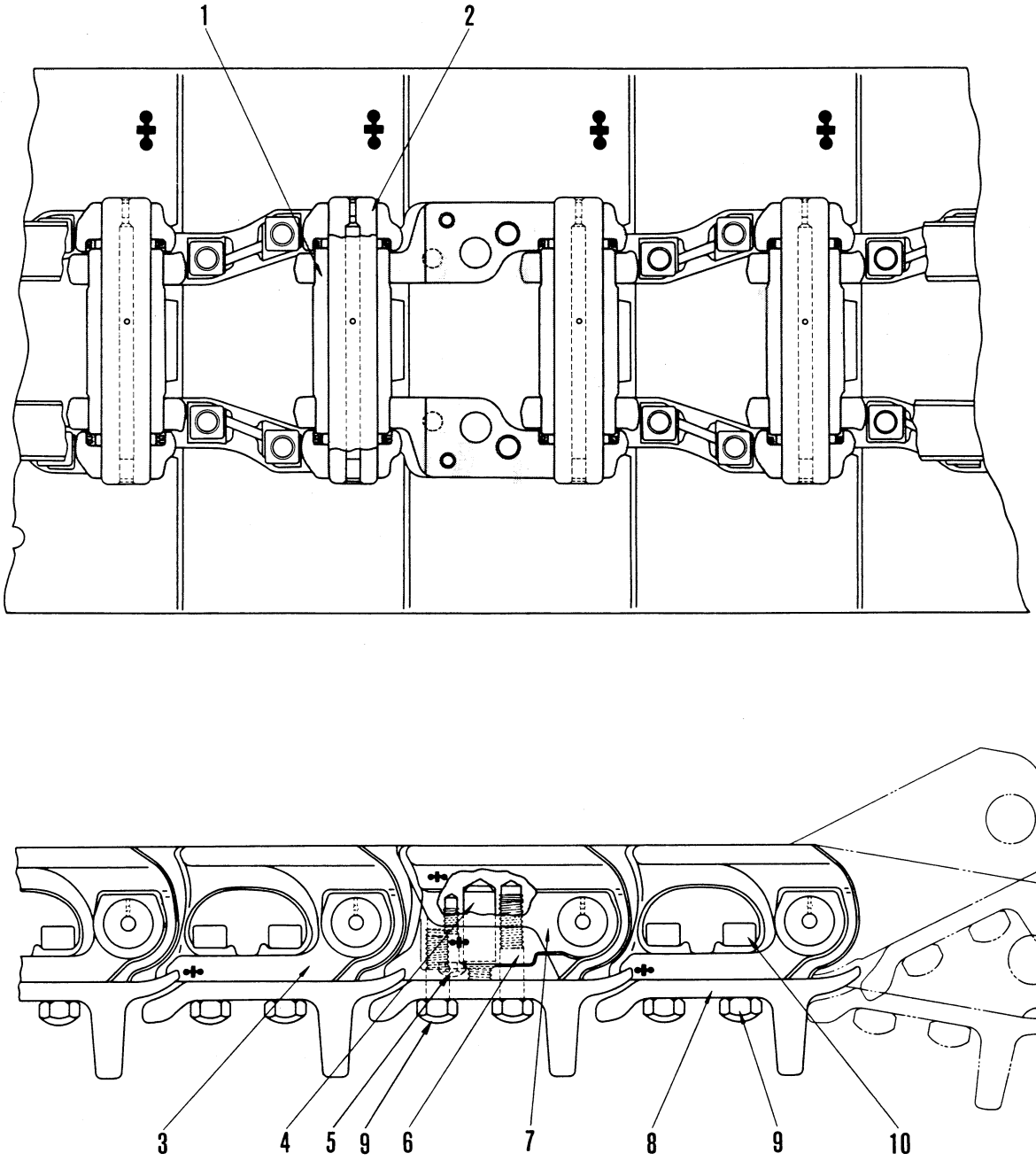


I75F175

1. Regular bushing
2. Regular pin
3. Master bushing
4. Master pin
5. Link
6. Track shoe (single)
7. Shoe bolt
8. Shoe nut

TRACK (MASTER LINK TYPE)

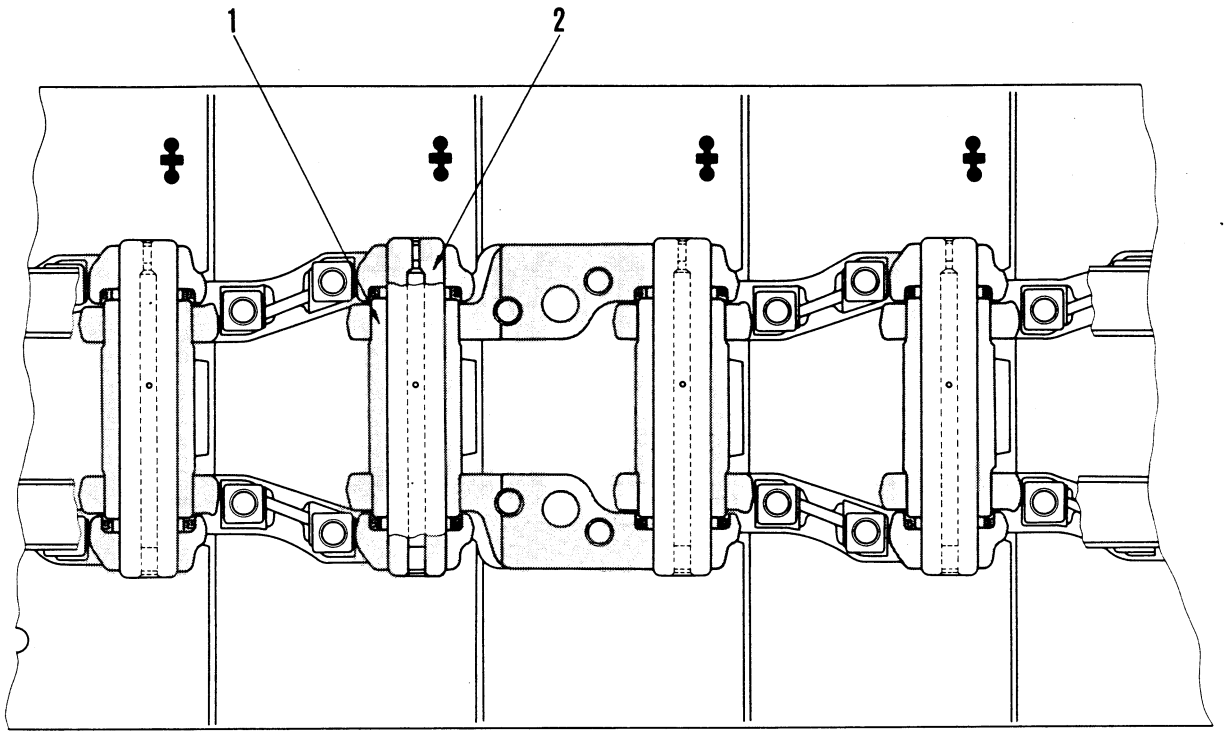
D150A 8408 ~ 8420
D155A 15001 ~ 17000

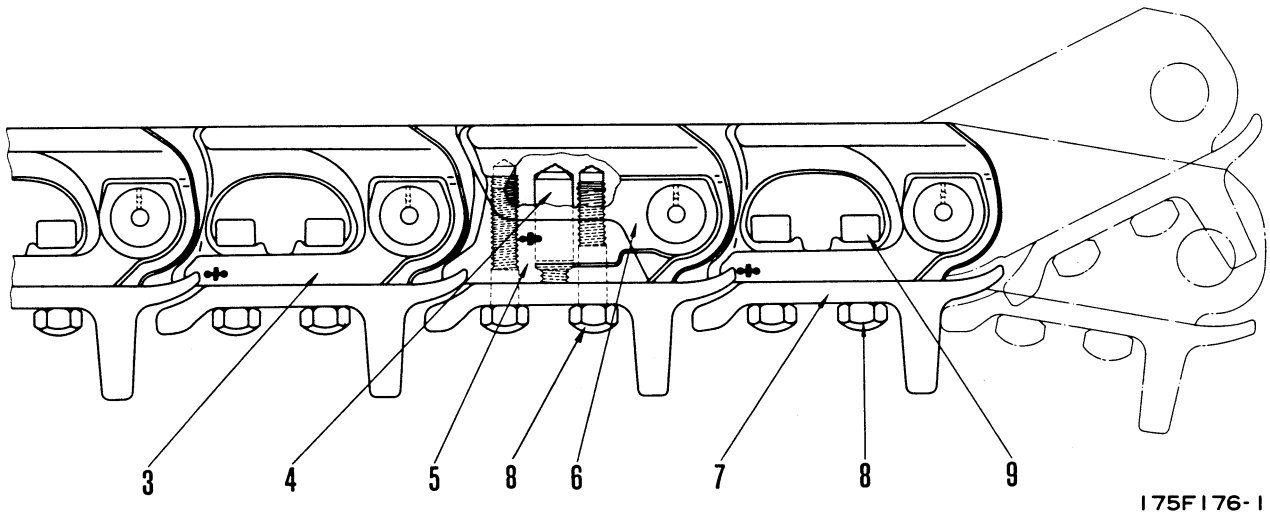


I75F176

1. Bushing
2. Pin
3. Regular link
4. Master link pin
5. Master link connecting bolt
6. Master link (shoe side)
7. Master link (pin side)
8. Track shoe (single)
9. Shoe bolt
10. Shoe nut

D150A 8421 ~ 8487
D155A 17001 ~ 20765

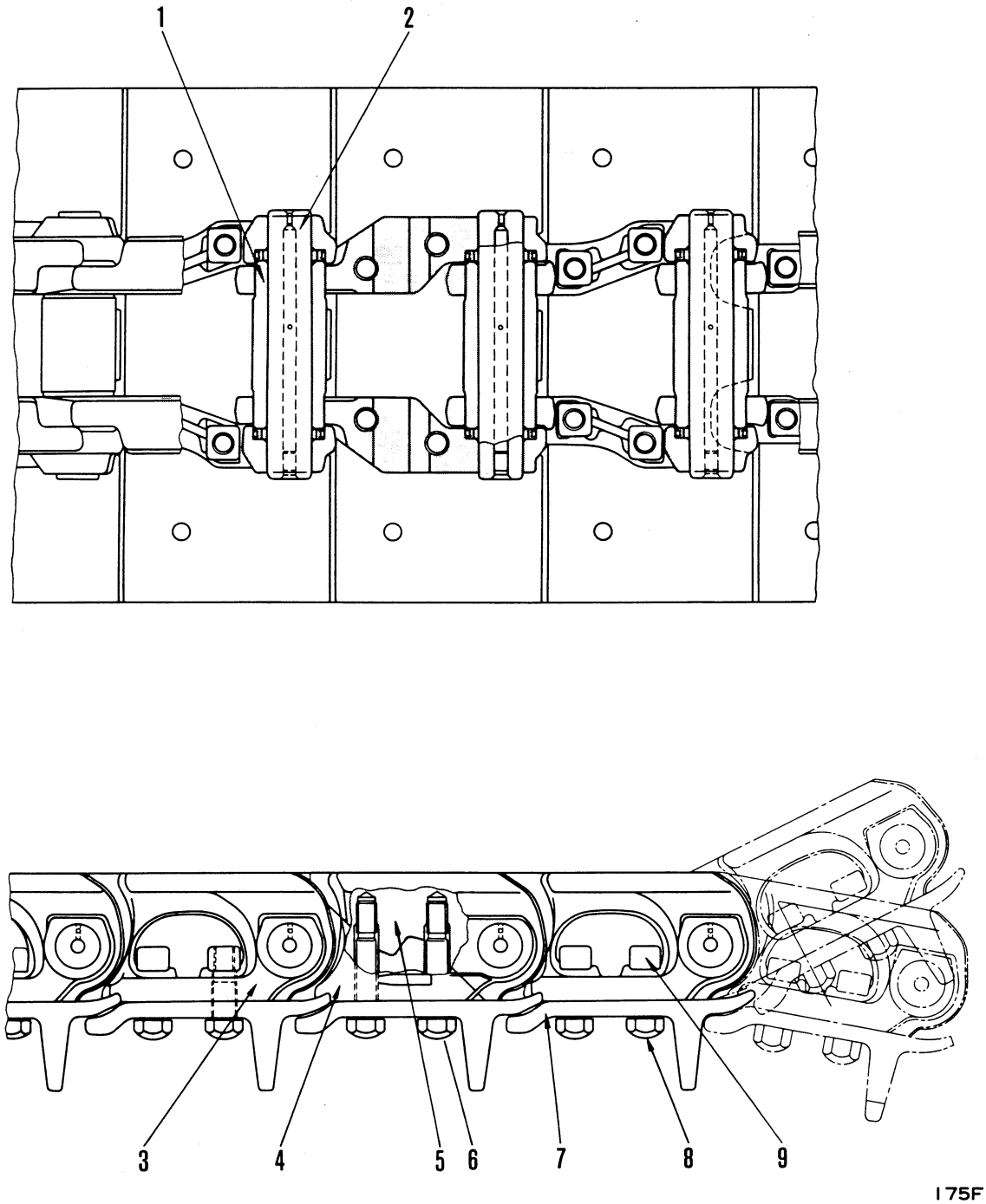




175F176-1

1. Bushing
2. Pin
3. Regular link
4. Master pin
5. Master link (shoe side)
6. Master link (pin side)
7. Track shoe (single)
8. Shoe bolt
9. Shoe nut

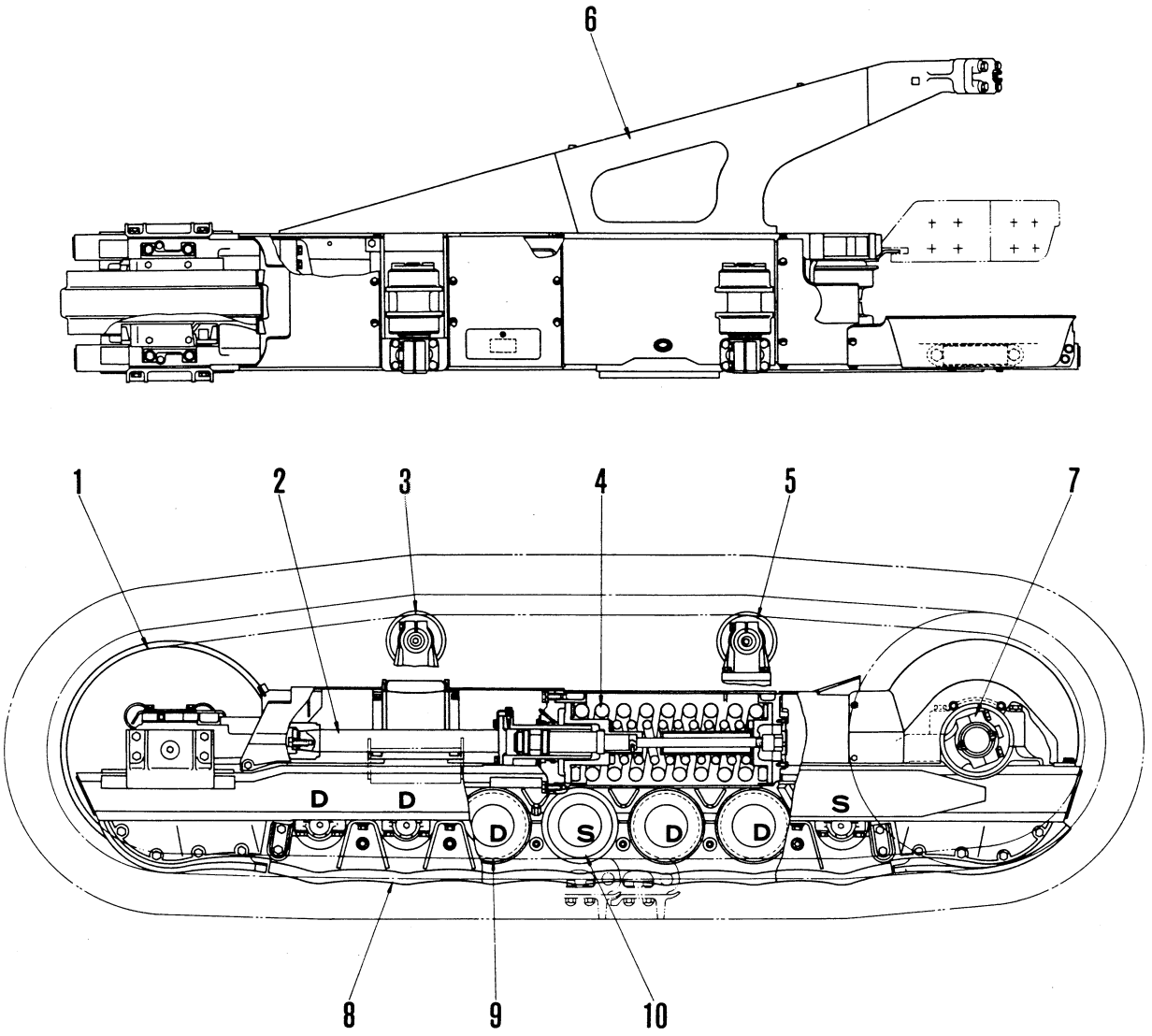
D150A 8488 and up
D155A 20766 and up



I75F176-2

1. Bushing
2. Pin
3. Regular link
4. Master link (shoe side)
5. Master link (pin side)
6. Shoe bolt for master link
7. Track shoe
8. Shoe bolt
9. Shoe nut

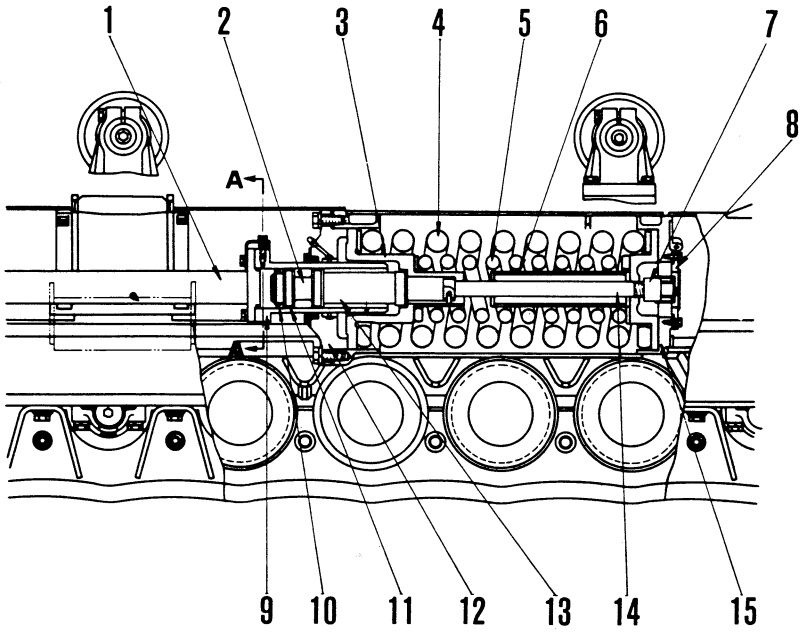
TRACK GROUP

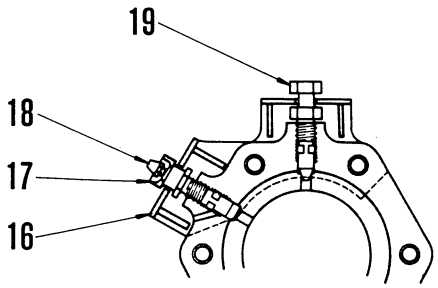


31F003

1. Idler
2. Rod
3. Carrier roller
4. Recoil spring
5. Carrier roller
6. Diagonal brace
7. Diagonal brace cap
8. Track roller guard
9. Track roller (D)
10. Track roller (S)

RECOIL SPRING



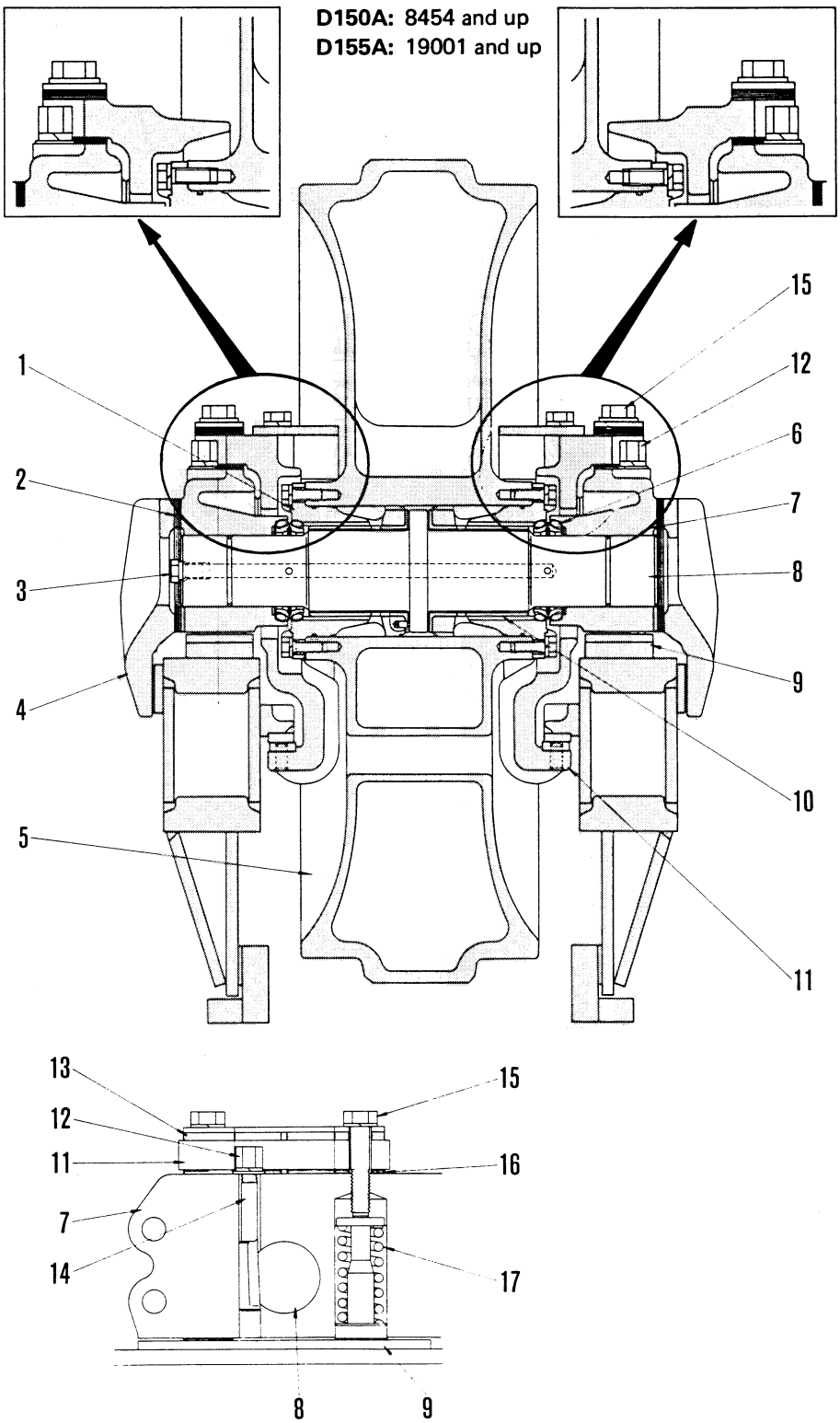


Section A-A

31F004

1. Rod
2. piston
3. Front pilot
4. Recoil spring (large)
5. Recoil spring (small)
6. Sleeve
7. Nut
8. Cover
9. Cylinder
10. Packing
11. Piston ring
12. Front cover
13. Spacer
14. Bolt
15. Rear pilot
16. Stopper
17. Lubricator
18. Grease fitting
19. Plug

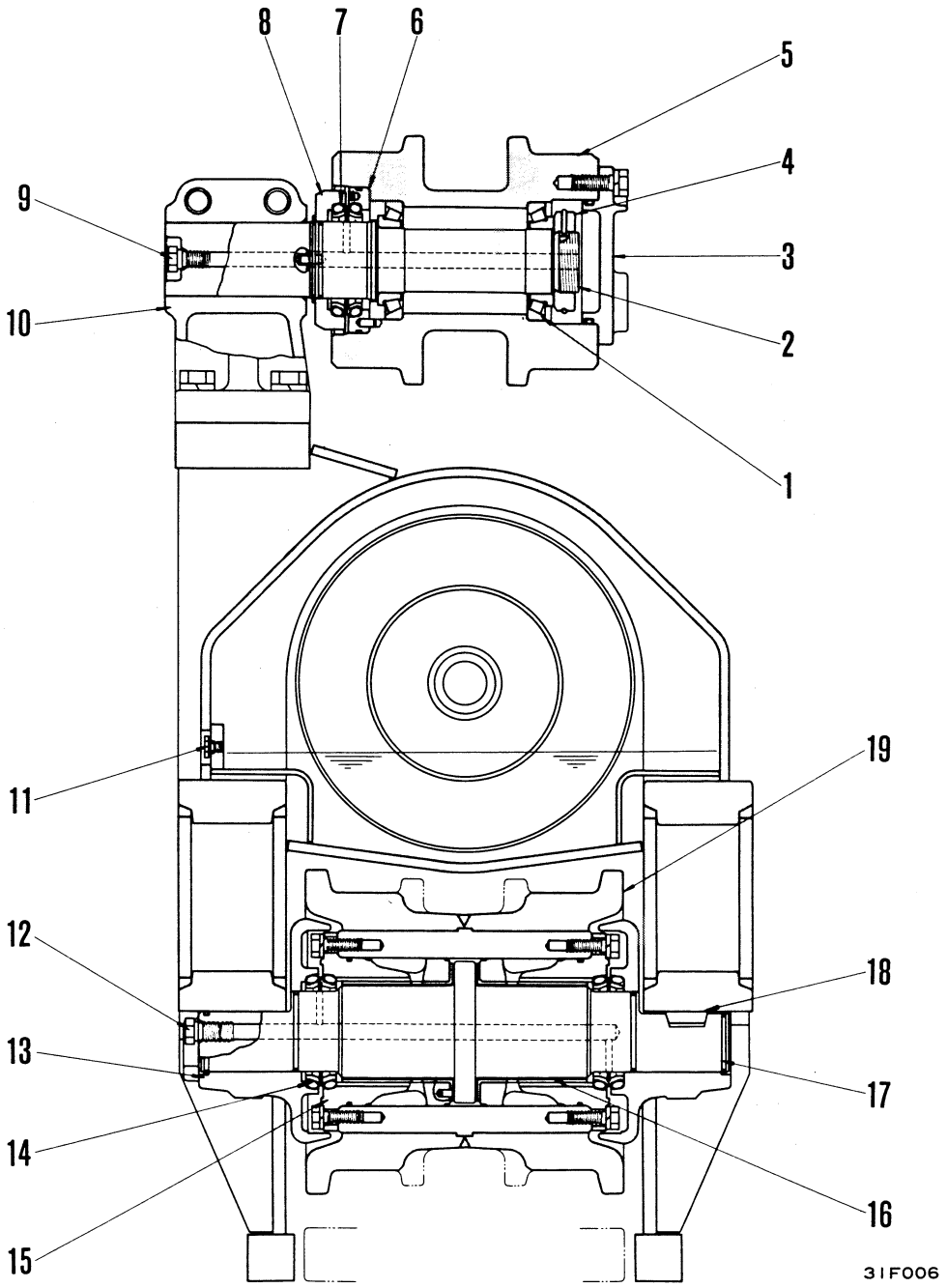
IDLER



175F173A-1

1. Bushing
2. Shim
3. Plug
4. Guide plate
5. Idler
6. Floating seal
7. Support
8. Shaft
9. Guide plate
10. Bushing
11. Guide
12. Nut
13. Shim
14. Bolt
15. Bolt
16. Shim
17. Lift spring

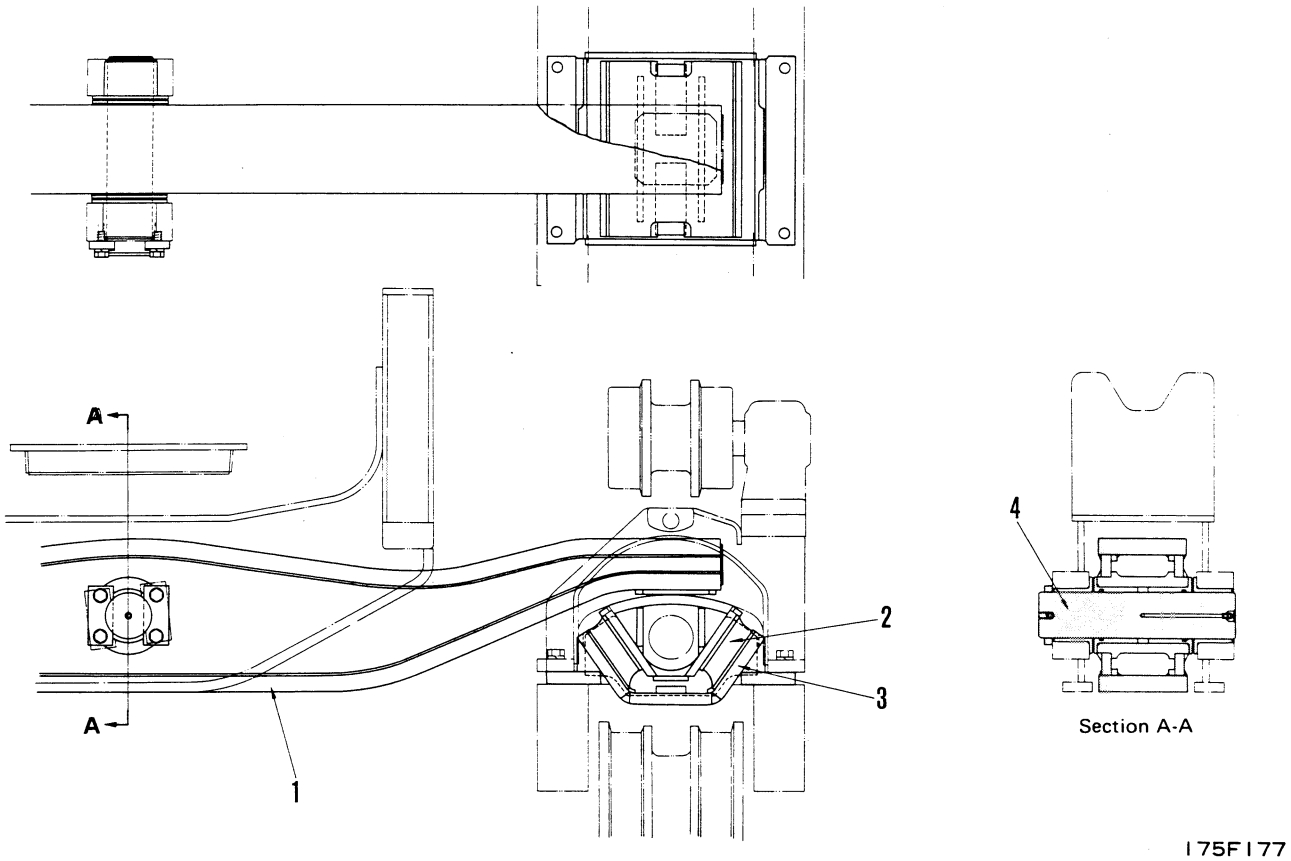
TRACK ROLLER, CARRIER ROLLER



1. Bearing
2. Shaft
3. Cover
4. Nut
5. Carrier roller
6. Seal guide
7. Floating seal
8. Seal guide
9. Plug
10. Support
11. Plug
12. Plug
13. Collar
14. Floating seal
15. Bushing
16. Bushing
17. Shaft
18. Lock plate
19. Track roller

SUSPENSION

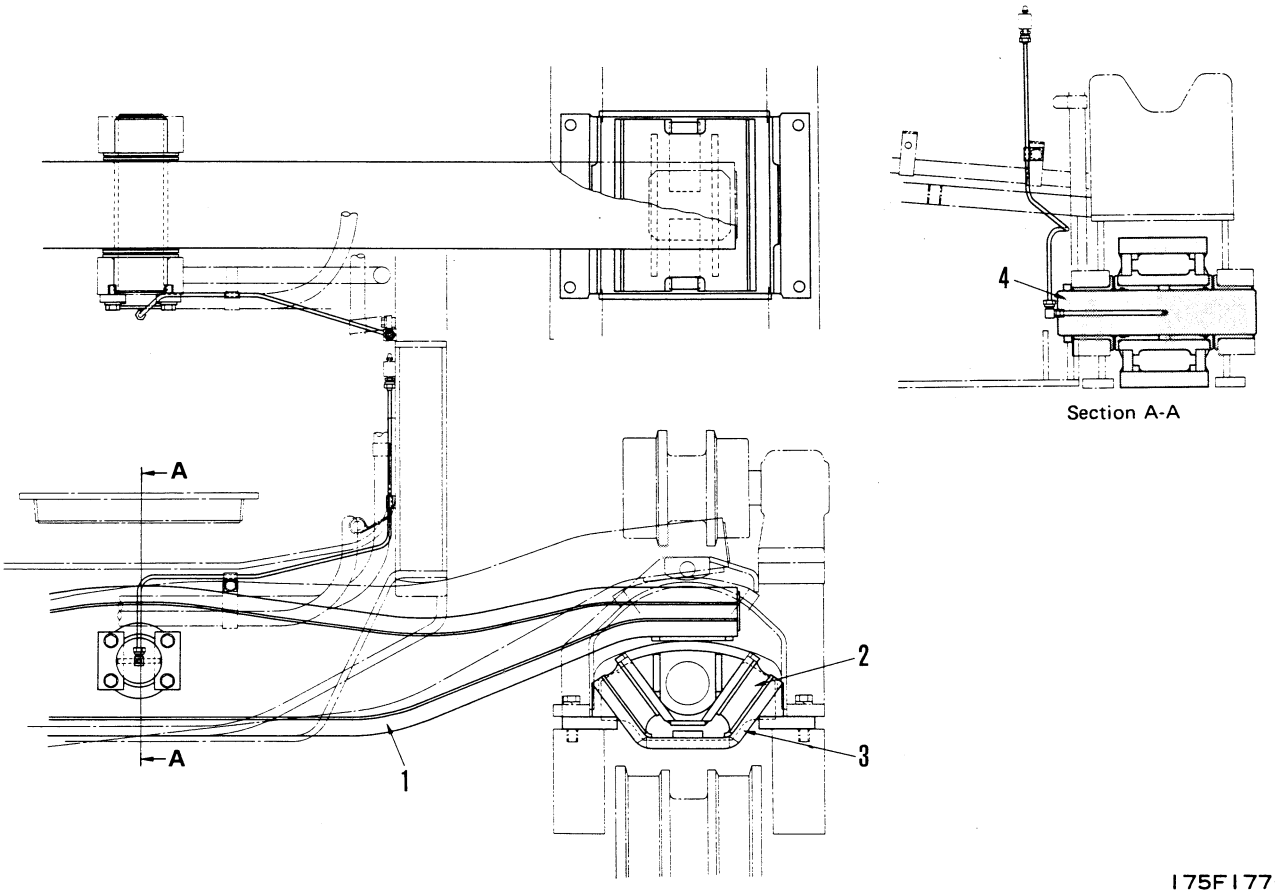
D150A 8408 and up
D155A 15001 ~ 25000



I75F177

1. Equalizer bar
2. Pad
3. Support
4. Center pin

D155A 25001 and up



175F177-1

1. Equalizer bar
2. Pad
3. Support
4. Center pin

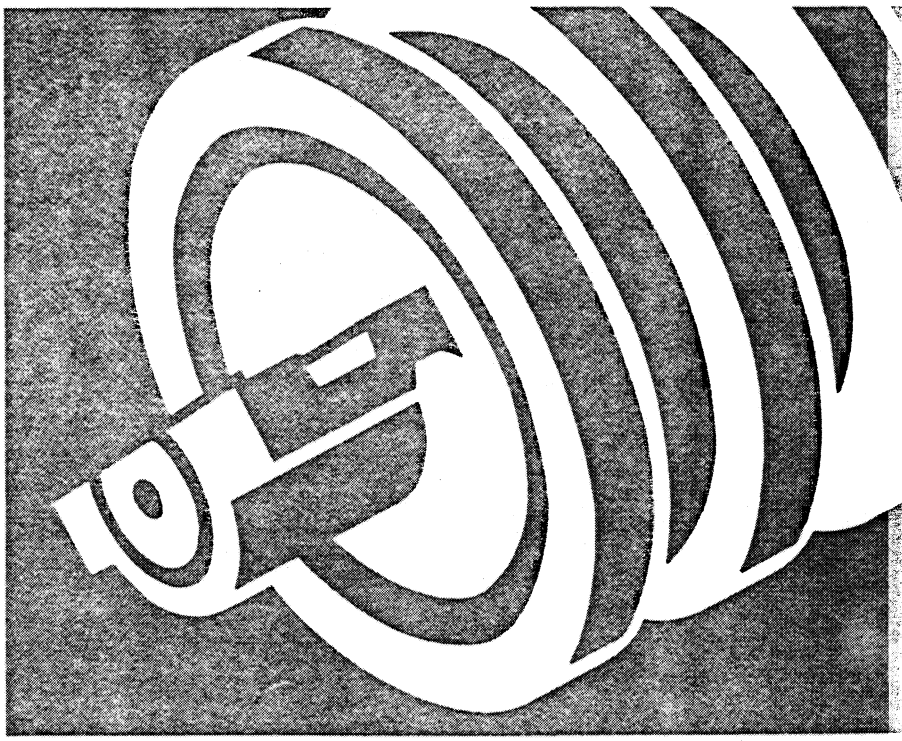
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

32 UNDERCARRIAGE

TESTING AND ADJUSTING



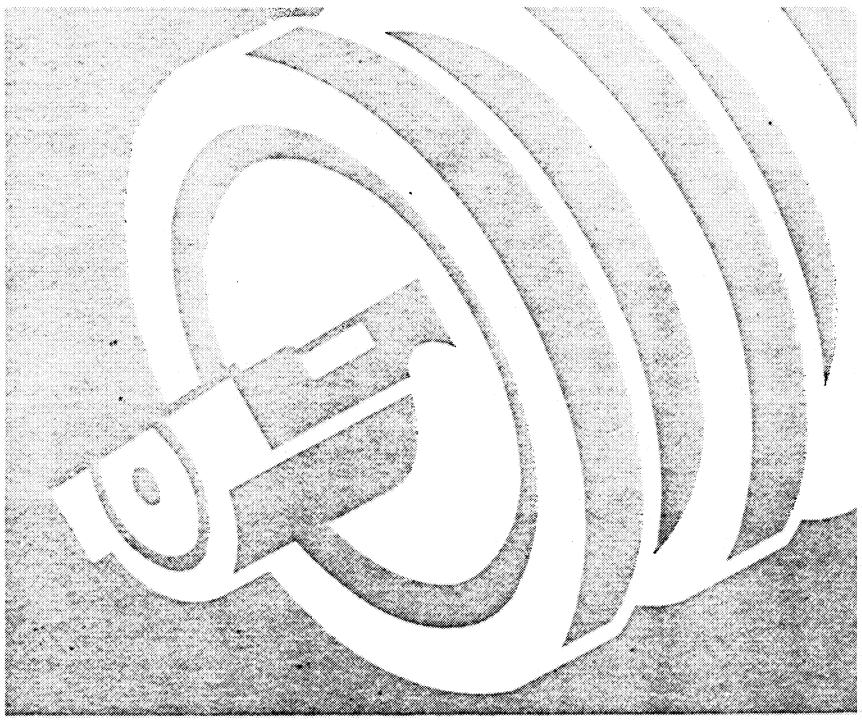
SHOP MANUAL

D150,155

SERIAL NO. D150A-1 8408~
D155A-1 15001~

33 UNDERCARRIAGE

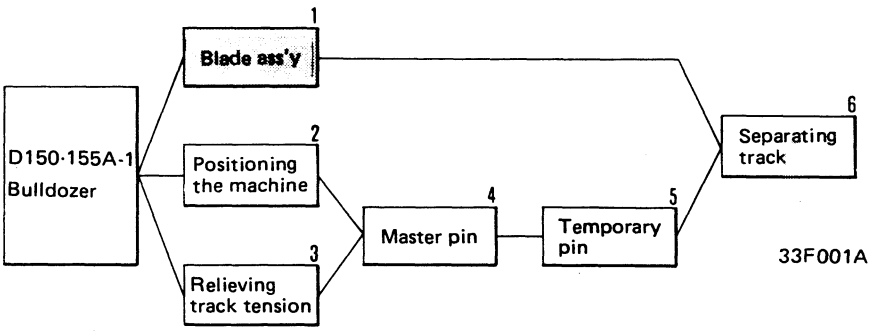
DISASSEMBLY AND ASSEMBLY



DISASSEMBLY AND ASSEMBLY

No.	Item	Page
1	Separation of track	33- 2
	Connection of track	33- 4
2	Dismounting carrier roller	33- 6
	Mounting carrier roller	33- 8
3	Dismounting track roller	33-10
	Mounting track roller	33-12
4	Dismounting idler	33-14
	Mounting idler	33-16
5	Dismounting recoil spring	33-18
	Mounting recoil spring	33-22
6	Disassembly of recoil spring	33-26
	Assembly of recoil spring	33-28
7	Dismounting track frame	33-30
	Mounting track frame	33-32

SEPARATION OF TRACK (MASTER PIN TYPE)



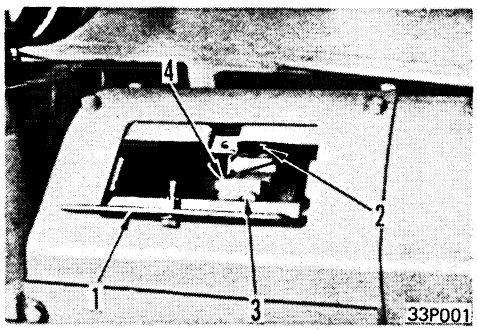
Special tools required

Special tools required		A
791-675-5000	Remover & installer	1
790-101-1101	Pump	1
790-101-4300	Cylinder (150 tons)	1

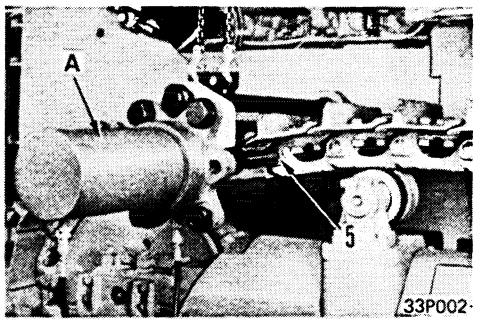
1. **Blade assembly**
   Refer to DISMOUNTING BLADE.

2. **Positioning the machine**
   Move the machine into yard wide enough to separate tracks and stop the machine with master pin of each track positioning in the middle of distance between idler and carrier roller.
   ★ Overall length of separated track: **approx. 9 m**

3. **Relieving track tension**
   Open cover (1) and loosen plug (2) to relieve track tension.
   When inspection cover (1) is opened, plug (2) for loosening track and lubricator (3) for tightening track are seen inside. When loosening, though stoppers (4) are provided both for plug (2) and lubricator (3), avoid staying in front of inspection window while working and limit loosening of plug within a turn.
   ★ If track tension is not relieved when plug is loosened, move machine back and forth to loosen track.



4. **Master pin**
   Set special tool A to master pin (5) and remove pin.
   ★ Lift special tool with a crane.

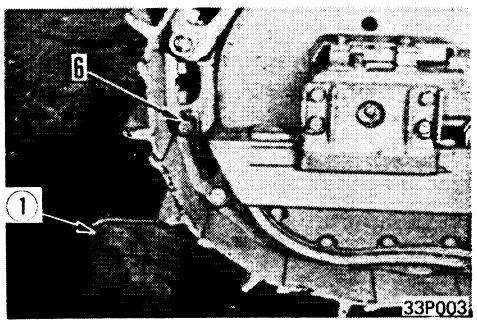


5. Temporary pin

Remove special tool. Move machine forward, with temporary pin inserted in place until track runs on block ① . Pull temporary pin (6) out.

★ Running machine onto block is necessary to relieve shoe tension in the position of temporary pin.

★ Height of block: Approx. 150 mm

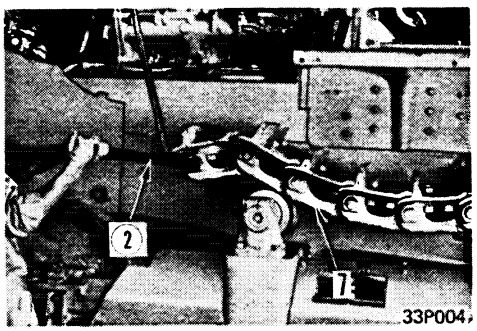


6. Separating track

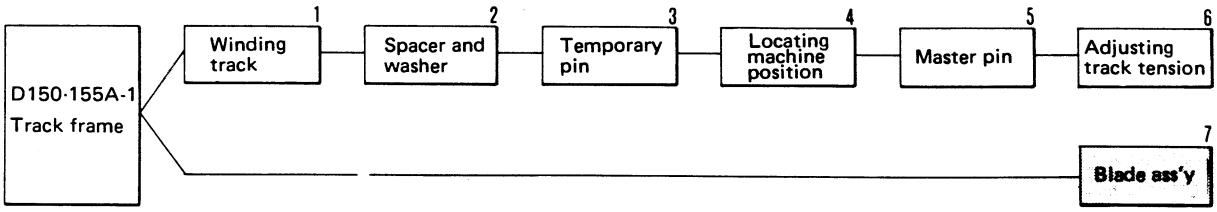
Put bar ② into the front link of separated track and lift the bar with a crane. Back machine slowly, allowing track (7) to ride over carrier rollers and off sprocket.

★ Move crane with movement of machine.

Be sure to perform work, step by step, after exchanging sign between cooperating workers.



CONNECTION OF TRACK (MASTER PIN TYPE)



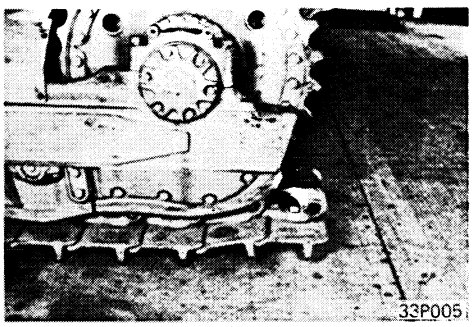
33F002

Special tools required

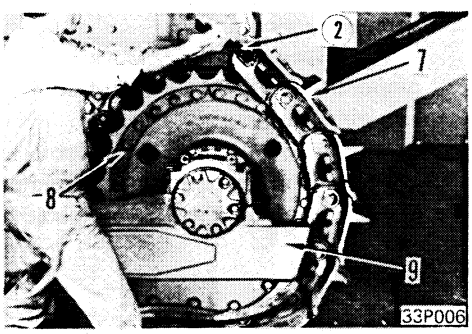
Special tools required	
791-675-5000	Remover & installer
790-101-1101	Pump
790-101-4300	Cylinder (150t)

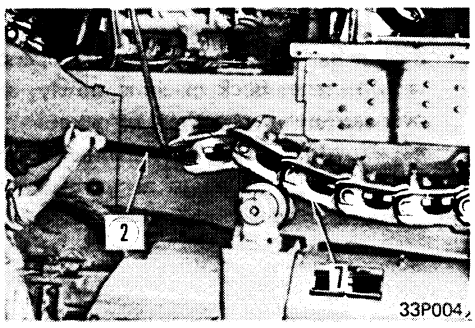
1. Winding track

1) With track end supported on block, back machine along track until sprocket is just ahead of last shove as seen in the picture.



2) Put bar ② into the last track and lift bar with a crane. Move machine forward slowly and guide track (7) over sprocket (8), so that track is installed along track frame (9).



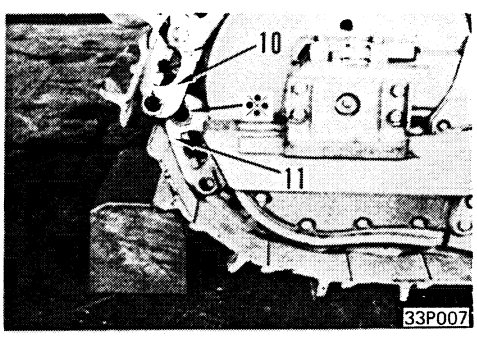


2. Spacer and washer

Put link (10), with spacer and washer installed in inner face of link, over link (11) to join links to each other.

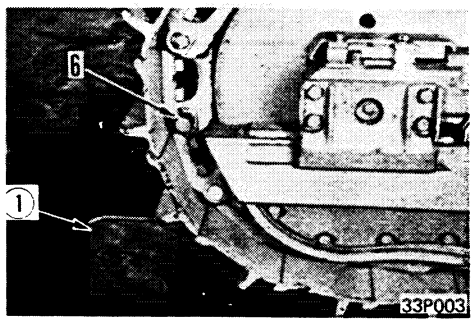
★ Install each pair of spacer and washer in inside and outside links, respectively.

★ When joining track, apply grease to the portion marked (※).

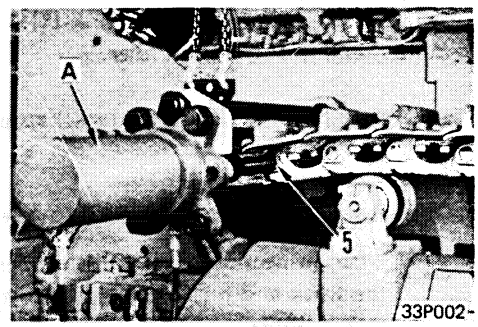


3. **Temporary pin**
   Mate holes of links and install temporary pin (6).

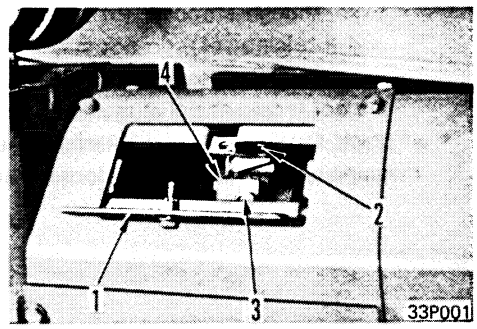
4. **Locating machine position**
   Back machine until temporary pin is located in the middle of distance between front idler and carrier roller.



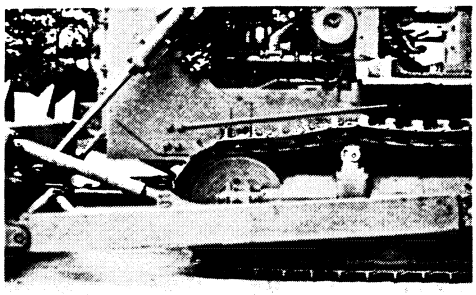
5. **Master pin**
   Using special tool A press-fit master pin (5) to connect shoes.
   - ★ Apply grease to master pin.
   - ★ Press-fit master pin so that each end of pin is protruded equally from links.



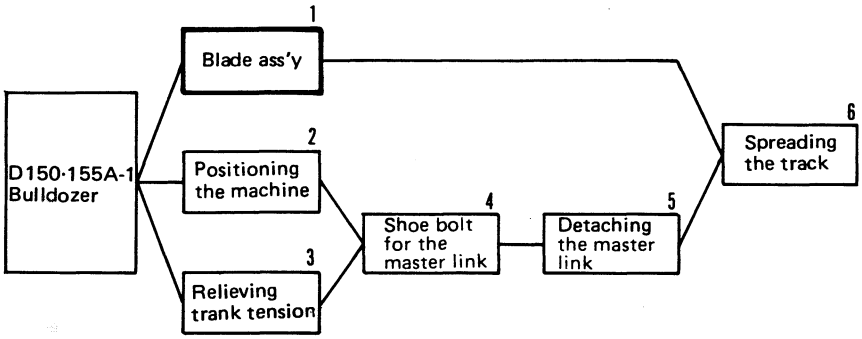
6. **Adjusting track tension**
   Open cover (1) and tighten plug (2). Apply grease to lubricator (3) until proper track tension can be obtained.
   kgm Plug : **5±0.25 kg.m**
   - ★ To adjust track tension, place a straightedge over front idler and carrier roller. Adjust track tension until 30 to 40 mm of clearance can be obtained between straightedge and grouser at the center of distance between idler and carrier roller.
   - ★ When difficulty is found in filling with grease, try moving machine back and forth in short distance.
   - ★ After adjustment, close cover (1).

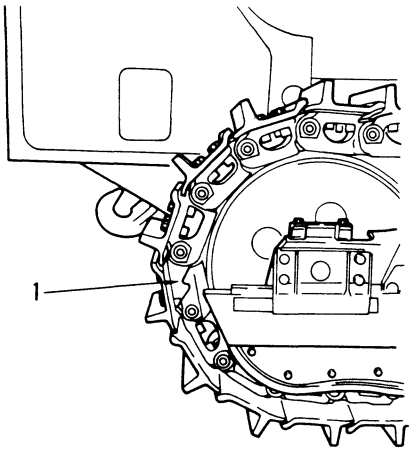


7. **Blade assembly**
   Refer to MOUNTING BLADE.


33P008

SEPARATION OF TRACK (MASTER LINK TYPE)





1. Blade assembly
See DISMOUNTING THE BLADE

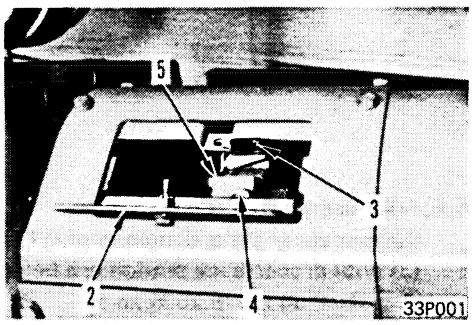
2. Positioning the machine
Move the machine into an area wide enough to separate the tracks. Stop the machine with master link (1) of each track aligned with the center line of the front idler.

★ Overall length of separated track: **approx. 9 m**

3. Relieving track tension
Open cover (2) and loosen plug (3) to relieve track tension.

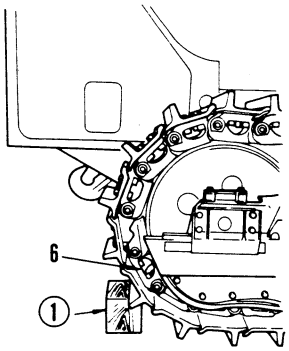
⚠ When inspection cover (2) is opened, plug (3) for loosening the track and lubricator (4) for tightening the track can be seen inside.
Even though stoppers (5) are provided for both plug (3) and lubricator (4), do not stand in front of the inspection window while loosening the plug.
Do not loosen the plug more than one turn.

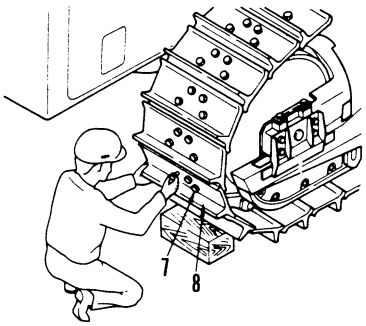
★ If track tension is not relieved when plug is loosened, move machine back and forth to loosen the track.



4. Shoe bolts for the master link

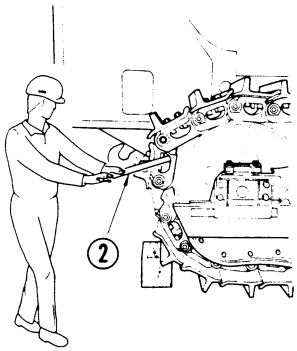
1) Put wooden block (1) under the grouser just below the master link (6).
2) Remove four shoe bolts (7) and shoe (8) from the master link.
   ★ Height of wooden block: **approx. 150 mm**





5. Detaching the master link

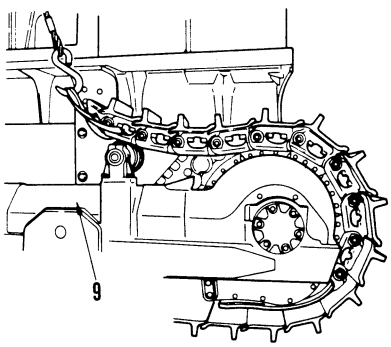
1) Drive the machine over a wooden block to relieve the tension of the master link.
2) Detach the master link with bar (2).

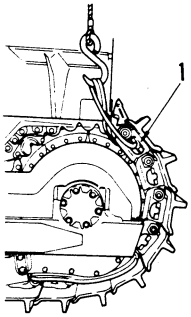


6. Spreading the track

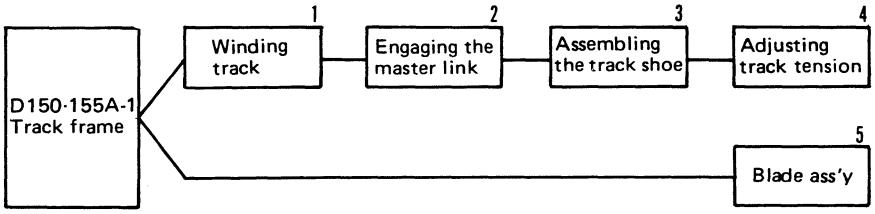
1) Lift the end of the track with a crane.
2) Slowly back the machine, allowing track frame (9) to ride over the carrier rollers and come off the sprocket.
   ★ Move the crane along with the machine as it travels.

   ⚠ Exchange signals with co-workers and work step by step.



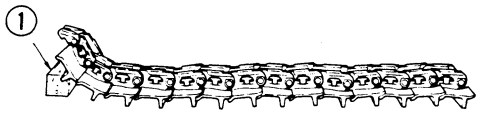


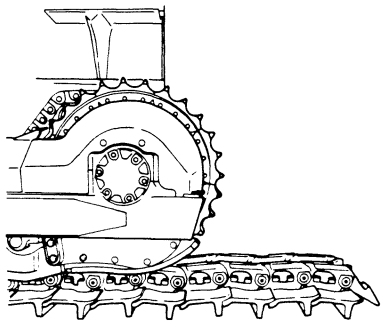
CONNECTION OF TRACK (MASTER LINK TYPE)



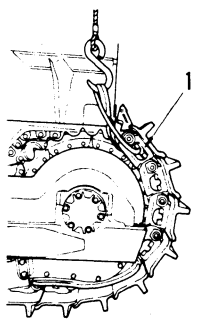
1. Winding track

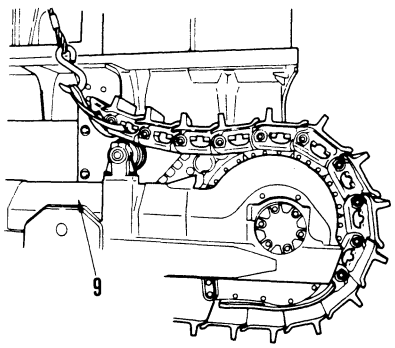
1) With the track end supported on wooden block (1), move the machine backward along the track until the sprocket is brought just ahead of four shoes, as shown in the illustration.
   ★ Height of wooden block: **approx. 150 mm**





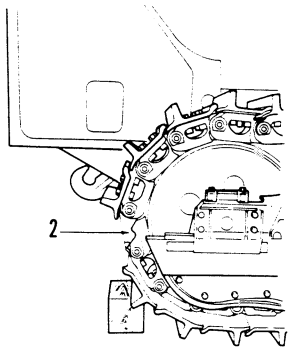
2) Lift link (1) with a crane. Slowly move the machine forward and guide the track to the sprocket so that the track is installed along the track frame (9).





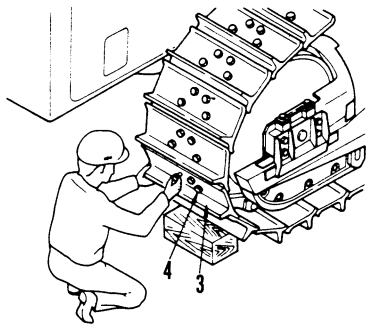
2. Engaging the master link

Make sure the teeth on both ends of master link (2) are engaged.



3. Assembling track shoe

1) Place shoe (3) in position on the master link.
2) Tighten bolts (4) to secure the shoe to the master link.
   ★ Tightening torque: See MAINTENANCE STANDARD

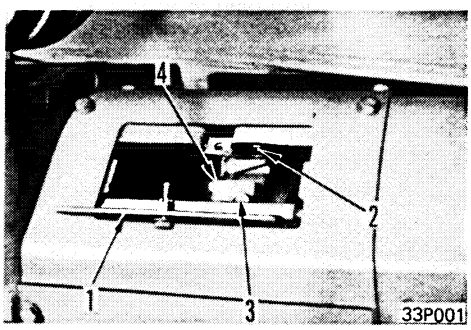


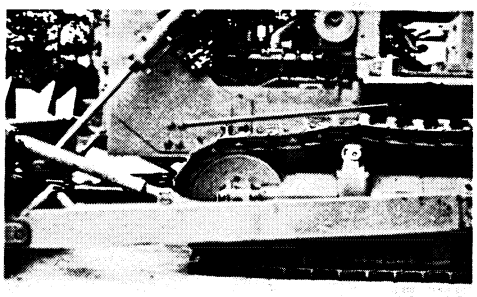
4. Adjusting track tension

Open cover (5) and tighten plug (6). Apply grease to lubricator (7) until the proper track tension is obtained.

kgm Plug: **5 ± 0.25 kgm**

★ To adjust the track tension, place a straightedge over the front idler and carrier roller. Adjust the track tension until 30 to 40 mm of clearance is obtained between the straightedge and grouser at the center of distance between the idler and carrier roller.
★ If it is difficult to add grease, move the machine a short distance back and forth.
★ After adjustment, close cover (5).



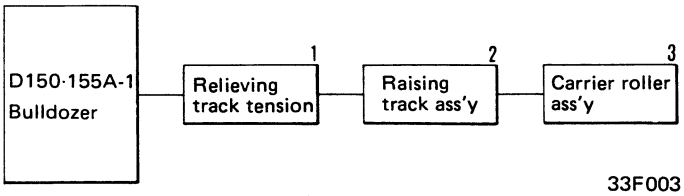


33P008

5. Blade assembly

See MOUNTING THE BLADE.

DISMOUNTING CARRIER ROLLER



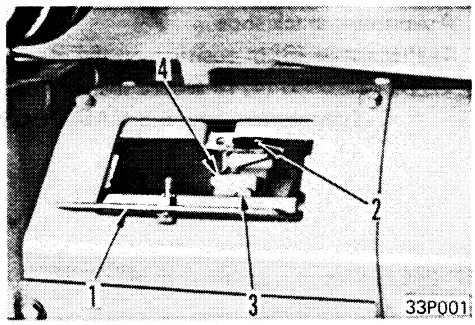
33F003

1. Relieving track tension

Open inspection cover (1) and loosen plug (2) to discharge grease to relieve shoe tension.

★ If grease does not ooze when plug is loosened, try moving machine back and forth in short distance.

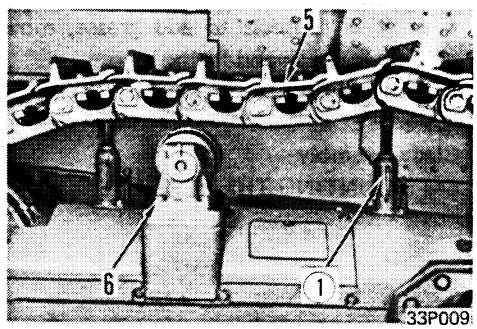
When inspection cover is opened, both plug (2) for loosening track and lubricator (3) for tightening track are accessible. For relieving track tension, be sure to loosen plug (located upper side) without confusion. To assure safety, avoid staying in front of inspection cover and be careful not to loosen plug more than one turn although both of plug and lubricator are provided with flying-out preventing stopper (4).



33P001

2. Raising track

Using jack ① set on track frame rear cover, raise track (5) enough to provide clearance between carrier roller and shoe link.

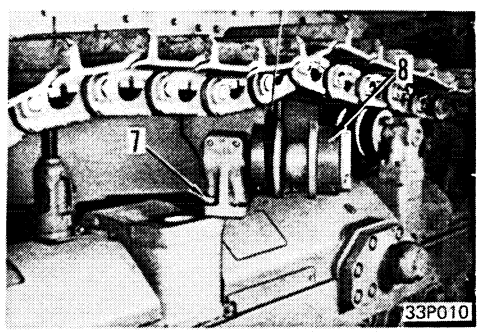


33P009

3. Carrier roller assembly

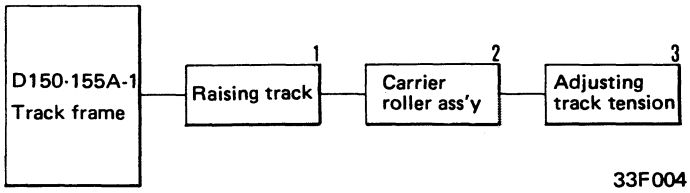
1) Sling carrier roller with wire rope and remove bolts (6).
   ★ Leave only front bolt (7) tightened loosely.
2) With carrier roller slung with wire rope, turn roller toward you, remove loosely bolt (7) and remove carrier roller assembly (8).
   ★ To facilitate alignment of carrier roller, put match marks across support and track frame.

kg Carrier roller support assembly: **70 kg.**

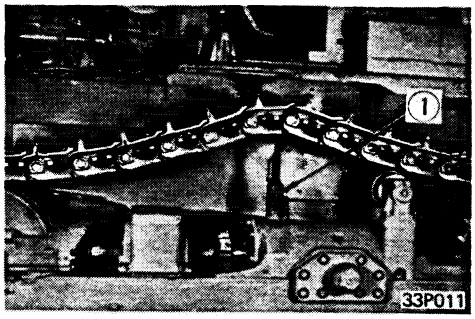


33P010

MOUNTING CARRIER ROLLER



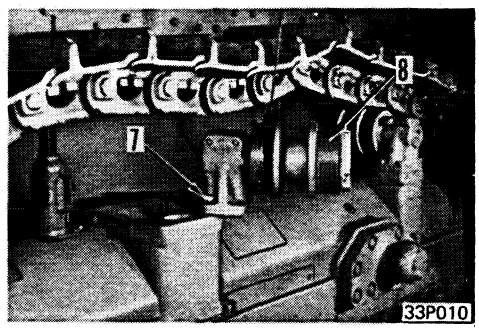
33F004



1. Raising track

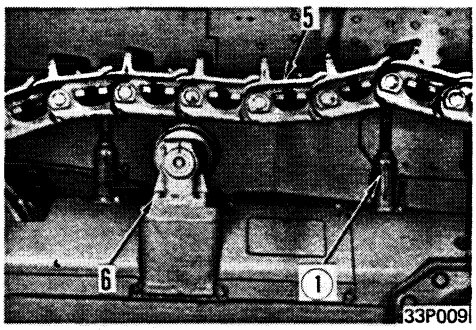
Using jack ① set on track frame rear cover, raise track (5) enough to provide clearance for installation of carrier roller.

★ Jack up track to provide approx. 350 mm of clearance between support mounting face and link.



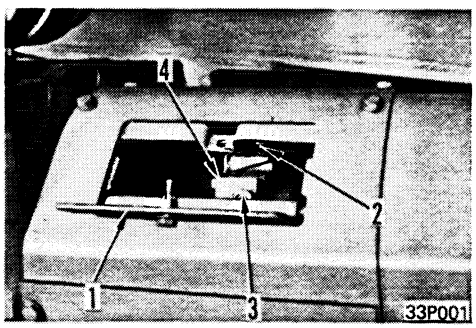
2. Carrier roller assembly

1) Sling carrier roller assembly (8) with wire rope and loosely tighten support mounting bolt (7).
2) Turn carrier roller assembly, while slackening sling rope a little as necessary, until match mark on support comes into alignment with match mark on track frame. Fully tighten mounting bolts (6).
   ★ Coat mounting bolts with thread tightener LT-2.
3) Remove wire rope and jack ① .



3. Adjusting track tension

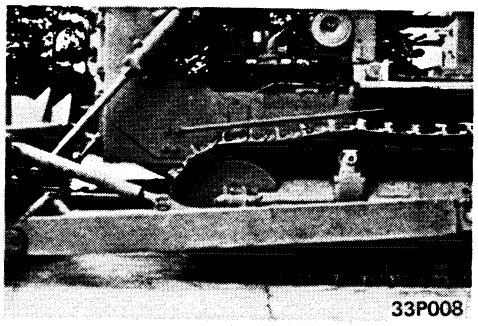
Open inspection cover (1) and apply grease to lubricator (3) through grease fitting until proper track tension can be obtained.



★ To adjust track tension, place a straightedge over idler and front carrier roller. Adjust track tension until 30 to 40 mm of clearance can be obtained between straightedge and shoe grouser at the center of distance between idler and carrier roller.

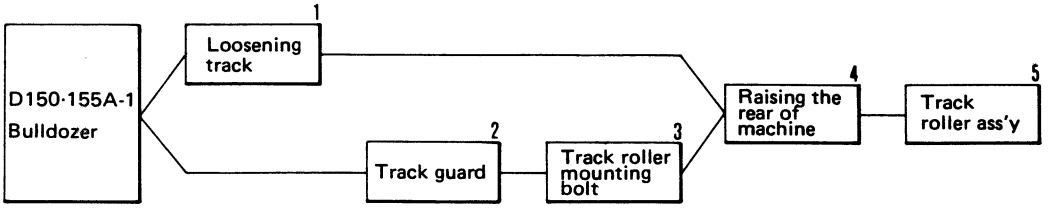
★ When difficulty is found in filling with grease, try moving machine back and forth in short distance.

★ After adjustment, close cover (1).



DISMOUNTING TRACK ROLLER

DISMOUNTING TRACK ROLLER



33F005

Special tools required

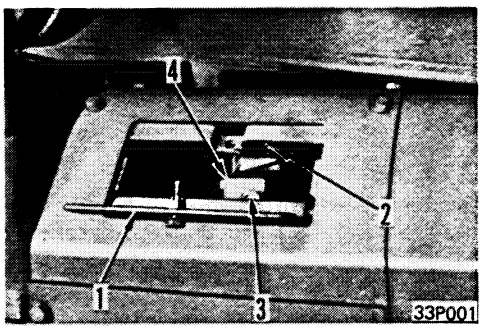
Special tools required		A
790-401-1700	Lifting tool	1
790-401-1760	Adapter	1

1. Loosening track

Open inspection cover (1). Loosen grease discharge plug (2) to relieve track tension.

★ If grease does not ooze when plug is loosened, try moving machine back and forth in short distance.

When inspection cover is opened, both plug (2) for loosening track and lubricator (3) for tightening track are accessible. For relieving track tension, be sure to loosen plug (located upper side) without confusion. To assure safety, avoid working in front of inspection cover and be careful not to loosen plug more than one turn although both of plug and lubricator are provided with flying-out preventing stopper.

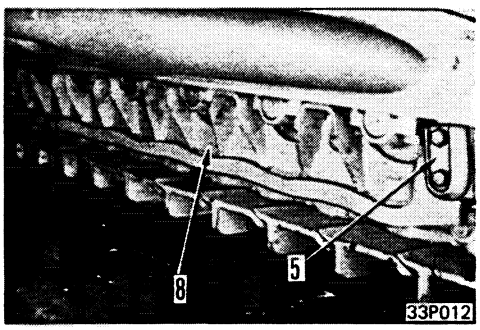


33P001

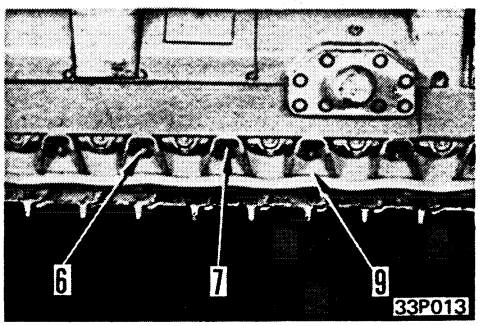
2. Track guard

Remove retainer (5), guard tension bolt (6) and guard mounting bolts (7). Remove inner track roller guard (8) and outer track roller guard (9).

kg Track roller guard: **100 kg.**

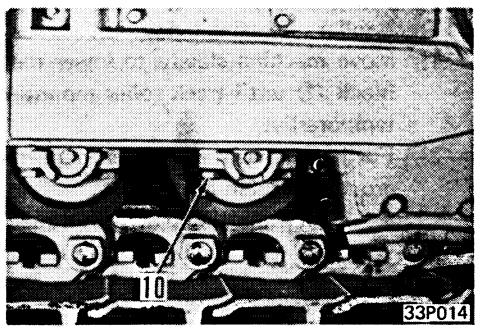


33P012



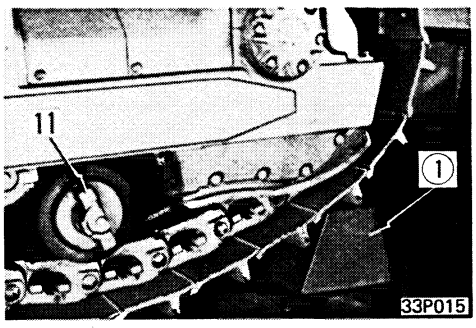
33P013

3. **Track roller mounting bolt**
   Remove bolts (10).



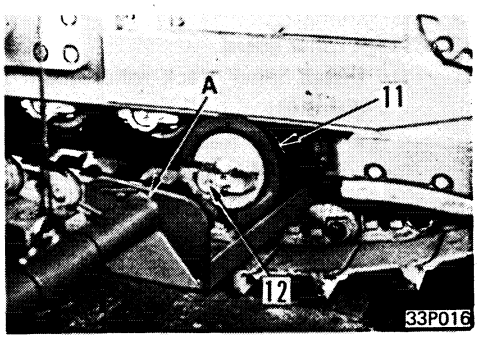
4. **Raising the rear of machine**
   Back machine until the rear end of track climbs up on block ① of approx. 300 mm high so that track roller assembly (11) can be left on track link.

   Be sure to lock the brake applied when the rear end of machine body is raised.

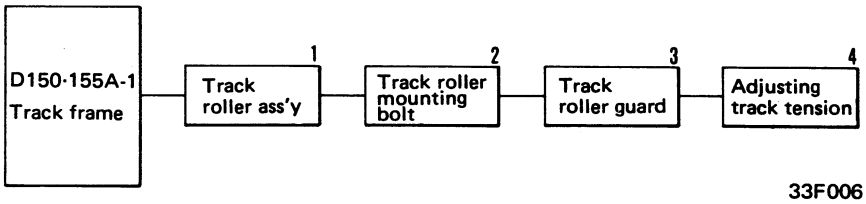


5. **Track roller assembly**
   Put special tool A under track roller assembly and pull out assembly.

   kg Track roller assembly: **130 kg.(S)**
   140 kg.(D)



MOUNTING TRACK ROLLER

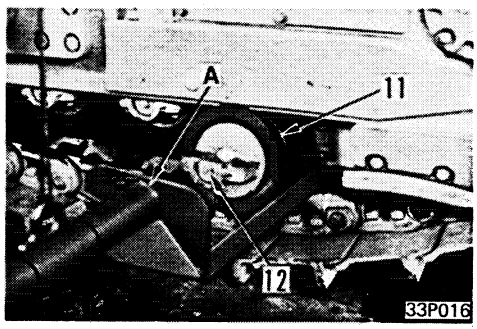


33F006

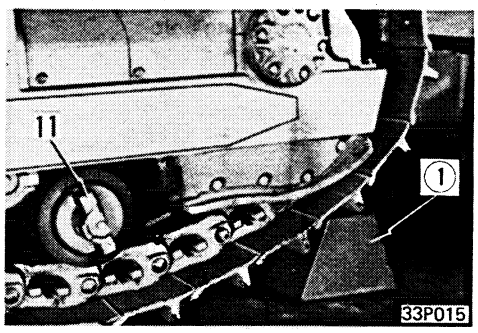
Special tools required

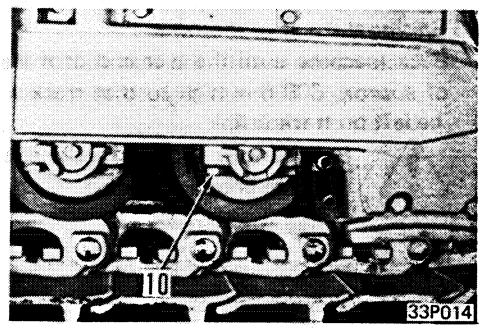
Special tools required		A
790-401-1700	Lifting tool	1
790-401-1760	Adapter	1

1. **Track roller assembly**
   Using special tool A, place track roller assembly (11) on track link so that lubrication plug (12) faces outside.

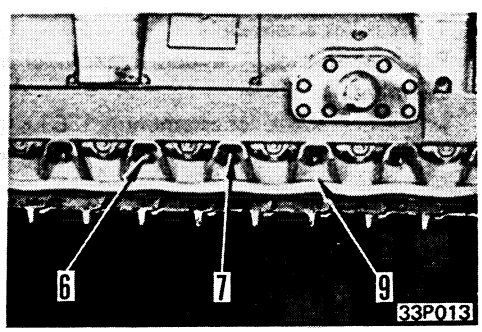


2. **Track roller mounting bolt**
   1) Move machine slowly to lower the rear end of track from block ① until track roller mounting bolts can be installed temporarily.
   2) Further move machine forward to lower track onto the ground. Tighten bolts (10).
      ★ Coat mounting bolt with thread tightener LT-2.
      kgm Mounting bolt: **84~104 kg.m**

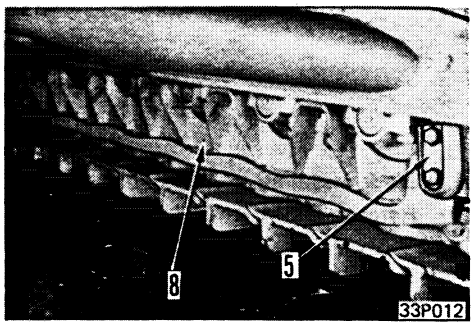




3. **Track roller guard**
   1) Install inner track roller guard (8) and outer track roller guard (9).
      ★ Install track roller guard tightening bolts (6) from the inside of machine and secure nuts from the outside.



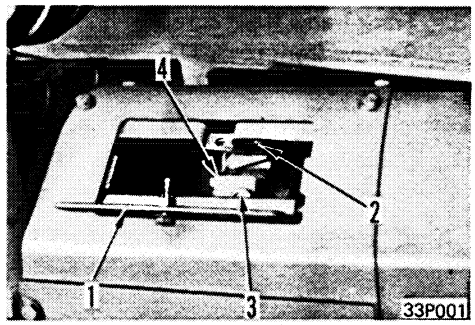
2) Install retainer (5).
★ Coat mounting bolts with thread tightener LT–2.

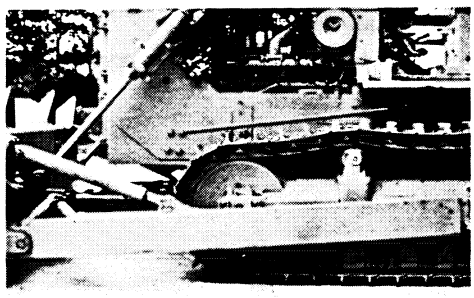


4. Adjusting track tension

Open inspection cover (1). After confirming that grease discharge plug (2) for loosening shoe tension is closed securely, apply grease to lubricator (3) through grease fitting until proper track tension can be obtained.

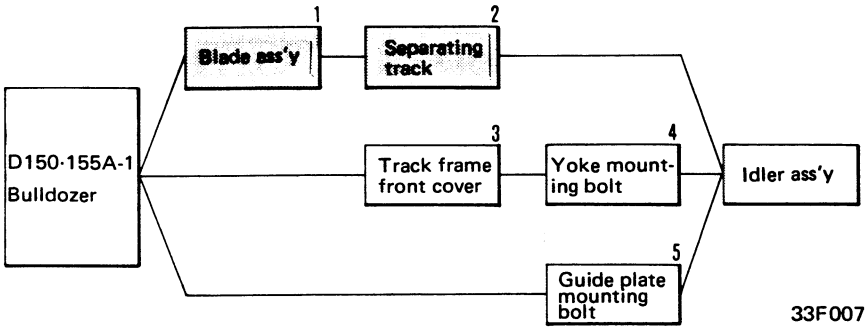
★ To adjust track tension, place a straightedge over idler and front carrier roller. Adjust track tension until 30 to 40 mm of clearance can be obtained between straightedge and shoe grouser at the center of distance between idler and carrier roller.





33P008

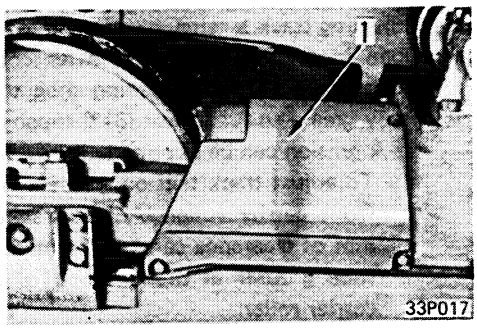
DISMOUNTING IDLER



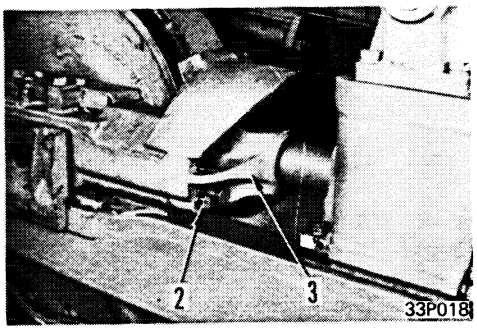
1. **Blade assembly**
   Refer to DISMOUNTING BLADE.

2. **Separating track**
   Refer to SEPARATION OF TRACK.

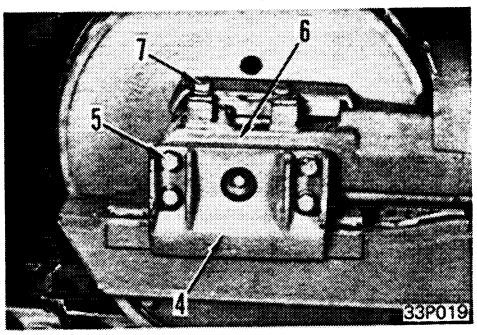
3. **Track frame front cover**
   Remove front cover (1).



4. **Yoke mounting bolt**
   Remove bolts (2); remove yoke (3).



5. **Guide plate mounting bolt**
   1) Loosen bolts (5) fastening guide plate (4) and remove shim (6).
      ★ Keep shims, R.H. and L.H. clearly classified.
   2) Loosen spring seat keep bolts (7).

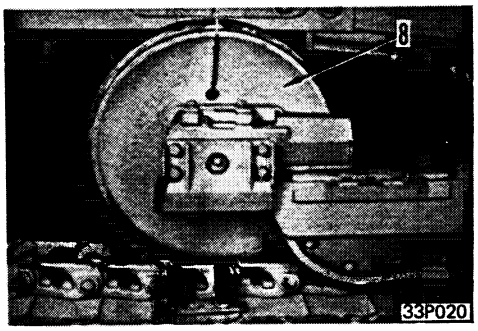


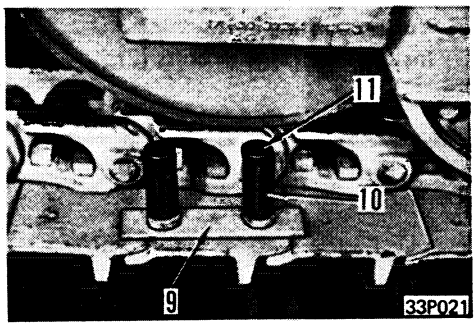
6. Idler assembly

Sling assembly (8) with sling rope passed through lifting hole in idler and slide idler assembly forward along track frame to remove it.

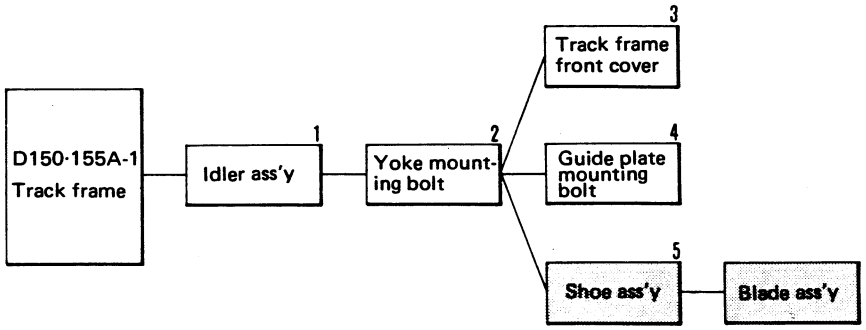
★ Spring seats (9), springs (10) and seats (11) are inserted between support and track frame.

kg Idler assembly: **450 kg.**





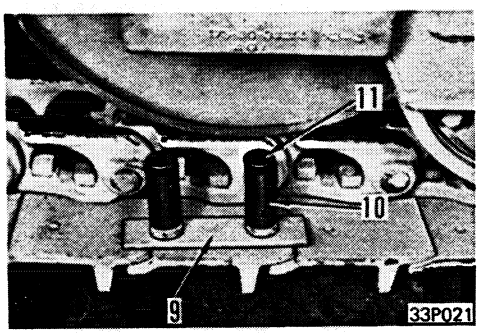
MOUNTING IDLER

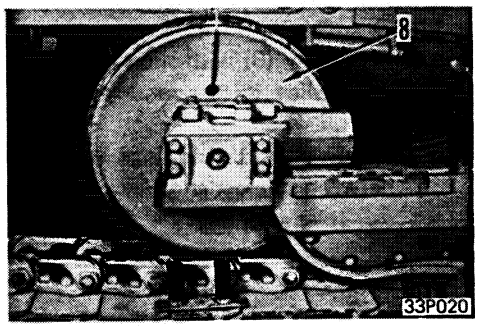


33F008

1. Idler assembly

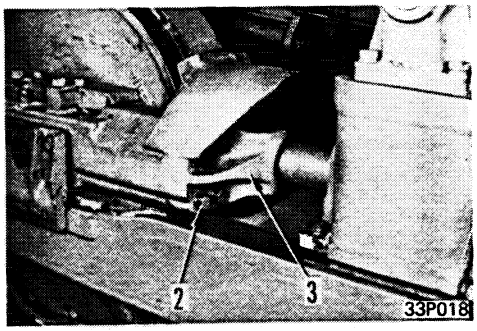
Sling idler with sling rope passed through lifting hole in idler.
Install spring seats (9), springs (10) and seats (11) in place.
Install idler assembly (8) in place by sliding it along track frame.





2. Yoke mounting bolt

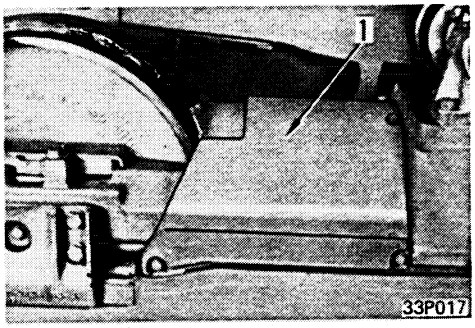
Install yoke (3) with bolts (2).



3. Track frame front cover

Install front cover (1).

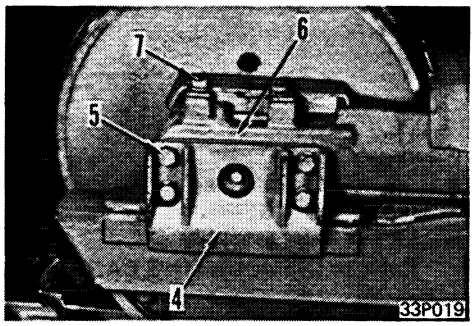
★ Coat cover mounting bolts with thread tightener LT–2.



4. **Guide plate mounting bolt**
   1) Tighten spring seat keep bolts (7).
   2) Install shim (6) inside guide plate (4) and tighten mounting bolts (5).

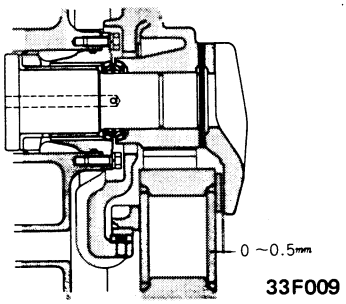
   kgm Guide plate mounting bolt: **67.5~84.5 kg.m**

   ★ Place idler assembly in the center of track frame and select shim which provides 0~0.5 mm ("a") clearance between guide plate and track frame.

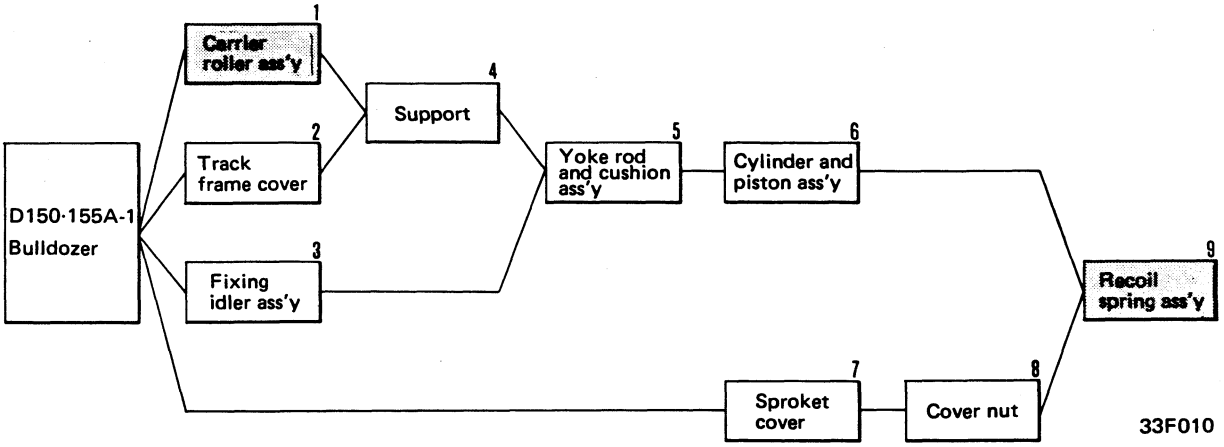


5. **Shoe assembly**
   Refer to ADJUSTING TRACK TENSION.

6. **Blade assembly**
   Refer to MOUNTING BLADE.

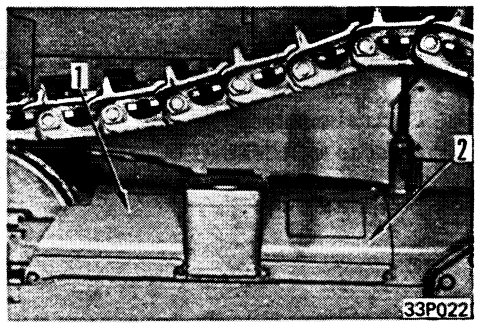


DISMOUNTING RECOIL SPRING

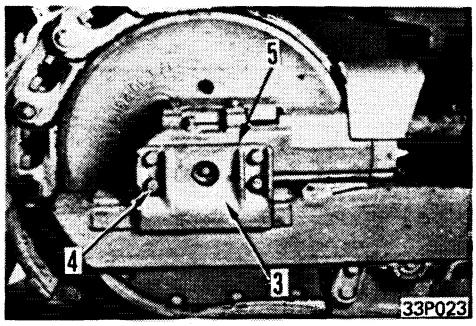


1. **Carrier roller assembly**
   Refer to DISMOUNTING CARRIER ROLLER.

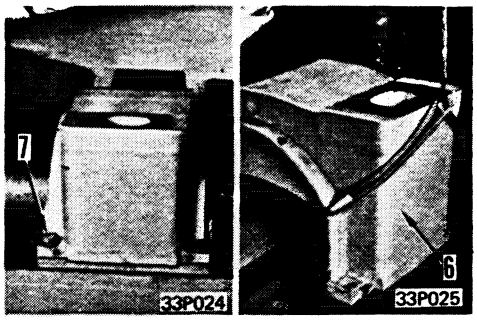
2. **Track frame cover**
   Remove covers (1) and (2).



3. **Fixing idler assembly**
   Loosen bolts (4) fastening inside and outside guide plates (3), remove clearance adjustment shim (5), and tighten bolts to fix idler.
   ★ Keep removed inside and outside shims with identification tags.

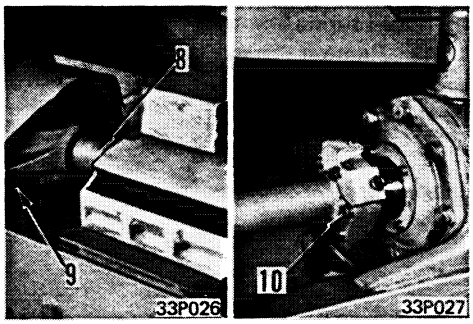


4. **Support**
   1) Jack up equalizer bar off support (6).
   2) Sling support with crane, remove bolts (7), and lift off support.

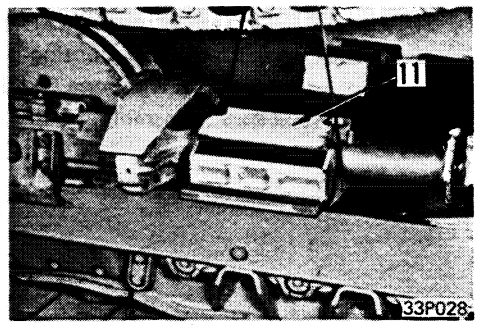


5. Yoke rod and cushion assembly

1) Remove bolts (9) and (10) fastening yoke rod assembly (8).

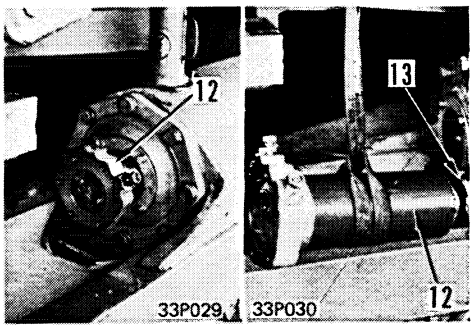


2) Disconnect yoke rod center sunk portion by pressing cylinder and sling yoke rod and cushion (11) together.



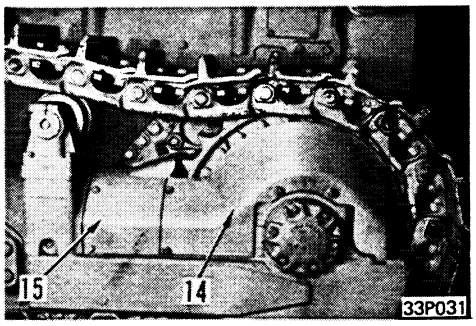
6. Cylinder and piston assembly

After pulling cylinder (12) slightly, sling it with lifting tool, and lift off cylinder and piston (13) as an assembly.



7. Sprocket cover

Remove covers (14) and (15).

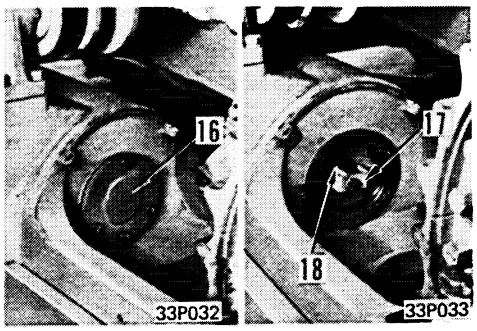


8. Cover nut

1) Remove cover (16).
2) Remove lock plate (17) and tighten nut (18).
   ★ When tightening nut, mark original position of nut so that cover can be installed in the same position as before removal.

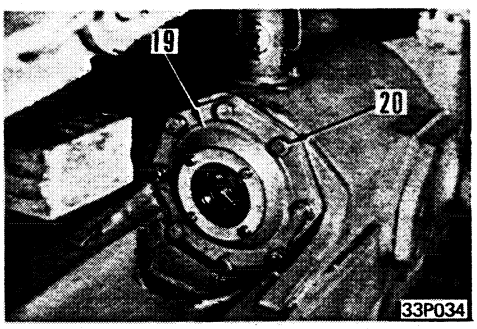


Be sure to tighten the nut before loosening front cover fostening bolts, or the front cover will spring out.



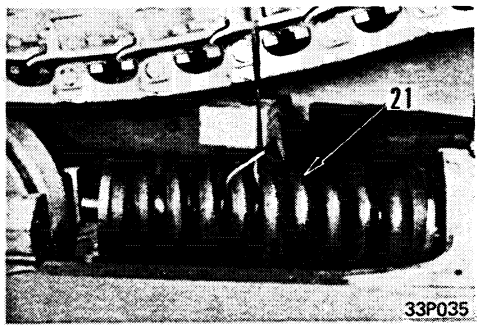
9. Recoil spring assembly

1) Remove cover (19) by loosening mounting bolts (20) alternately.



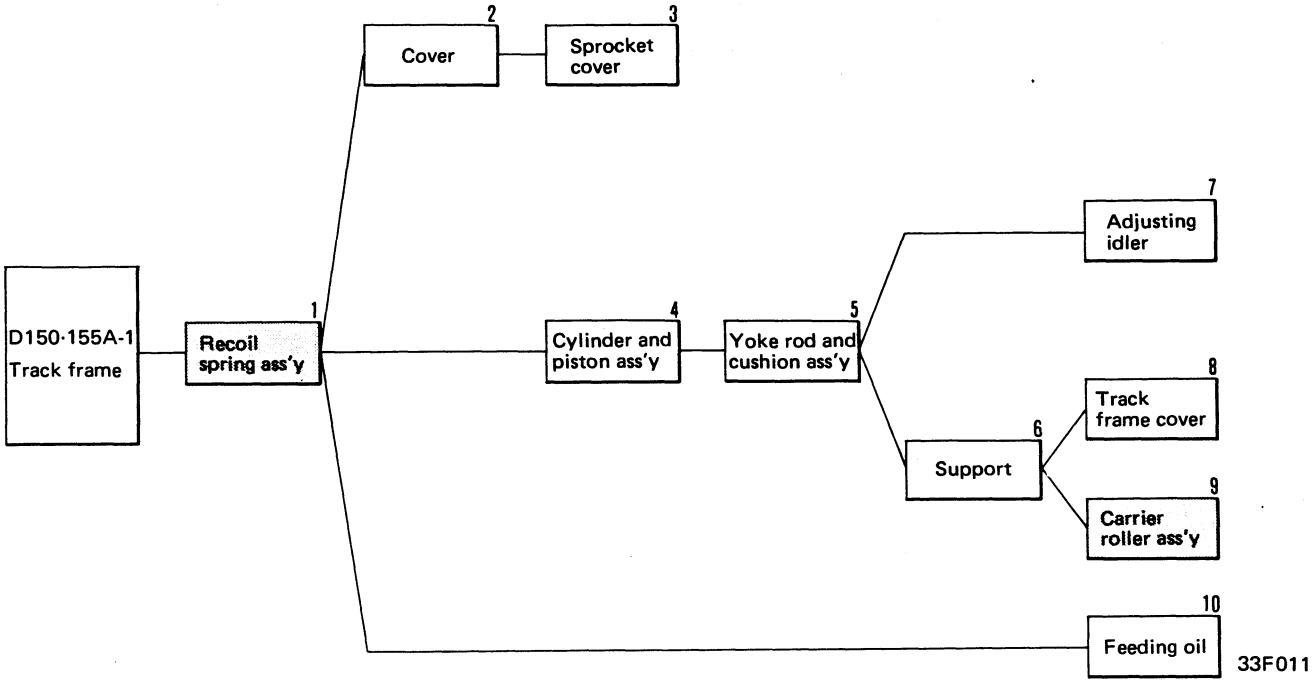
2) Push recoil spring assembly (21) at sprocket side end to remove spring from its mounting position. Sling the center of recoil spring with wire rope and lift it off.

kg Recoil spring assembly: **285 kg.**



MOUNTING RECOIL SPRING

MOUNTING RECOIL SPRING

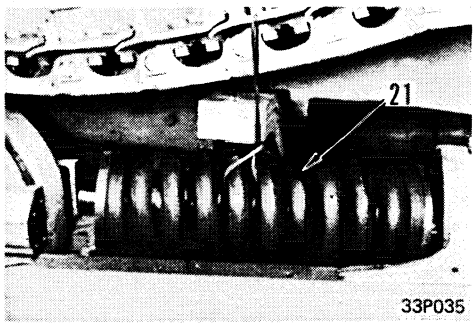


33F011

1. Recoil spring assembly

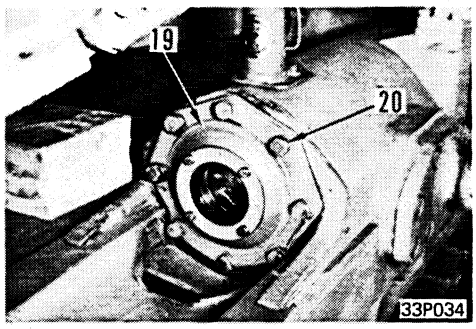
1) Sling the center of recoil spring assembly (21) with wire rope and install assembly in housing by pushing it along track frame.

★ When pushing assembly into housing, it will be necessary to guide it into position from sprocket side during about 10 mm of final travel in housing.



33P035

2) Install cover (19) with gasket on mounting surface and tighten mounting bolts (20) alternately.

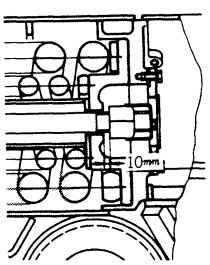


33P034

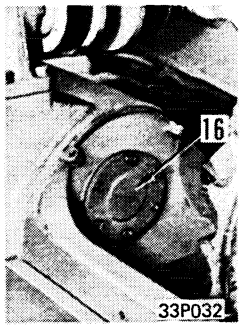
2. Cover

After confirming that nut (18) is at proper position and locked with lock plate (17), install cover (16) together with gasket.

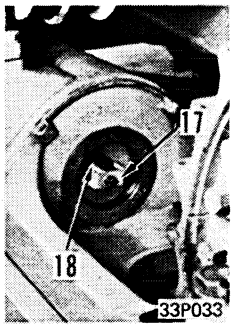
★ Lock nut in such position that provides 10 mm clearance "a" between nut end face and rear pilot.



33F012

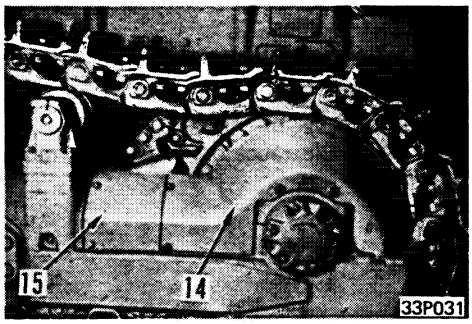


33P032

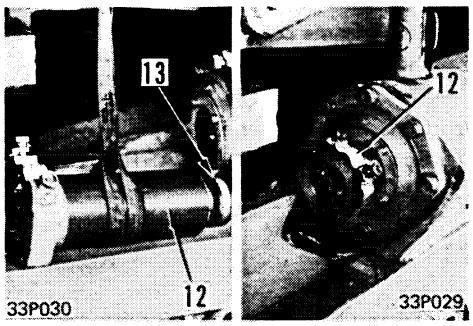


33P033

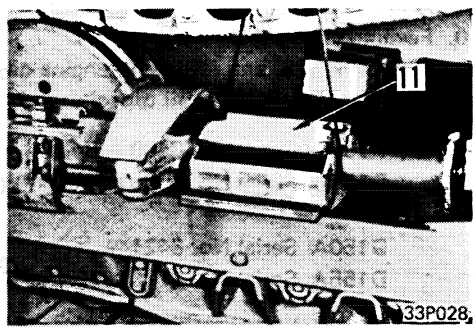
3. **Sprocket cover**
   Install sprocket covers (14) and (15).
   ★ Coat bolts with thread tightener LT-2.



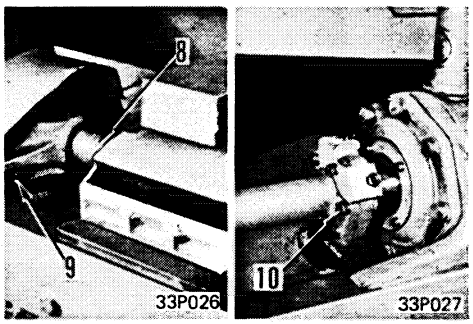
4. **Cylinder and piston assembly**
   Lift cylinder (12) and piston (13) as an assembly into position, taking care not to damage cover (19).



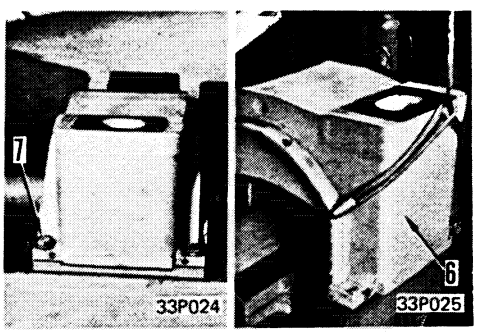
5. **Yoke rod and cushion assembly**
   1) Lift yoke rod and cushion assembly (11) as an assembly into position, bringing center sunk portion of yoke rod into engagement with the mating part.



   2) Tighten yoke rod assembly (8) mounting bolts (9) and (10).



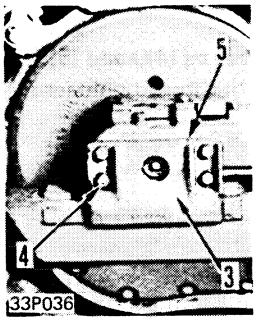
6. **Support**
   1) Lift support (6) into position on cushion and tighten mounting bolts (7).
   2) Remove jack from the underside of equalizer bar.

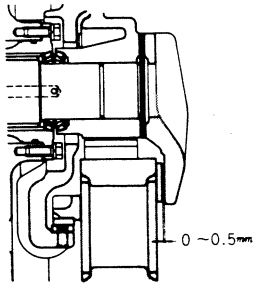


7. Adjusting idler

1) Loosen bolts (4) fastening inside and outside guide plates (3), install adjustment shims (5), and tighten mounting bolts again.

★ Clearance between track frame and plate "a": **0 ~ 0.5** mm





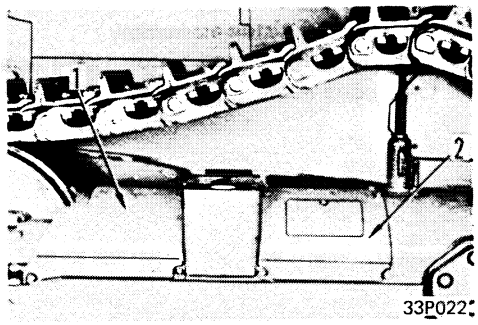
33F013

8. Track frame cover

Install covers (1) and (2).

9. Carrier roller assembly

Refer to MOUNTING CARRIER ROLLER.



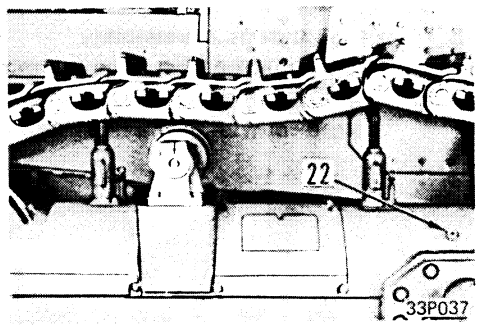
10. Feeding oil

Open plug (22) and refill with engine oil (SAE 30, class CD).

★ Recoil spring case oil capacity:

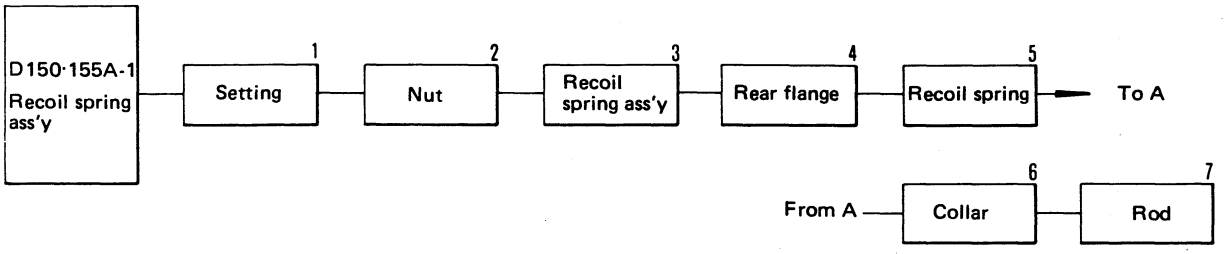
D150A Serial No. 8408 – 8420 : Approx. 15 ℓ
D155A Serial No. 15001 – 17000 : Approx. 15 ℓ

D150A Serial No. 8421 –
D155A Serial No. 17001 – } Dry type



DISASSEMBLY OF RECOIL SPRING

DISASSEMBLY OF RECOIL SPRING

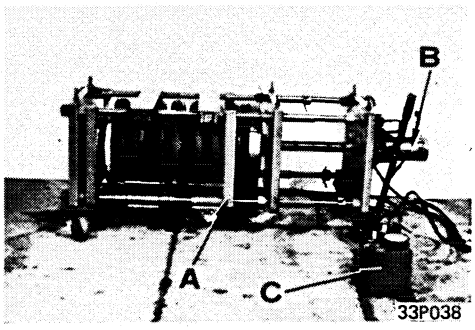


33F014

Special tools required

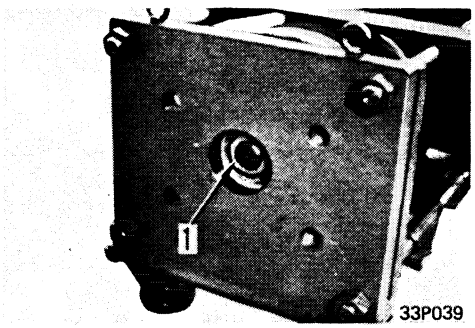
Special tools required		A	B	C
791-685-8080	Compressor	1		
790-101-1300	Cylinder (100 tons)		1	
790-101-1101	Pump			1

1. **Setting**
   Set recoil spring assembly in disassembly stand A with cylinder B and pump C with the front flange side to cylinder side.
   kg Recoil spring assembly: **285 kg**



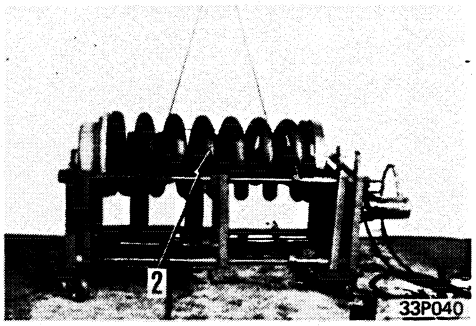
33P038

2. **Nut**
   Compress spring by applying oil pressure to cylinder until spring force on the rod end nut (1) can be removed. Then remove nut.



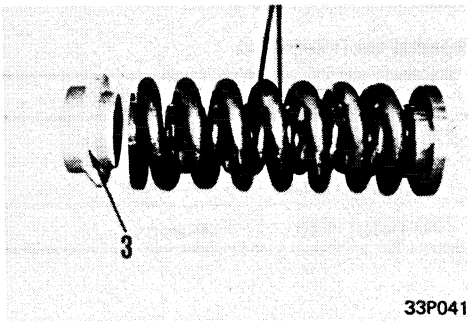
33P039

3. **Recoil spring assembly**
   Release oil pressure from cylinder to allow spring to expand free. Take out recoil spring assembly (2) from disassembly stand.



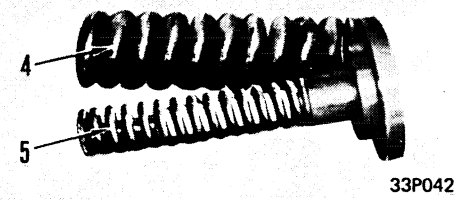
33P040

4. **Rear flange**
   Remove rear flange (3).



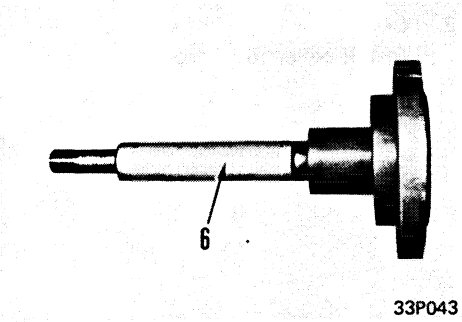
33P041

5. **Recoil spring**
   Remove recoil springs (4) and (5).



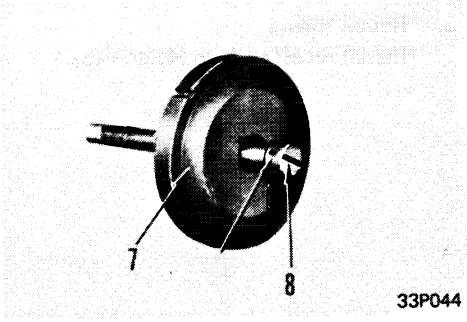
33P042

6. **Collar**
   Remove collar (6) from rod.



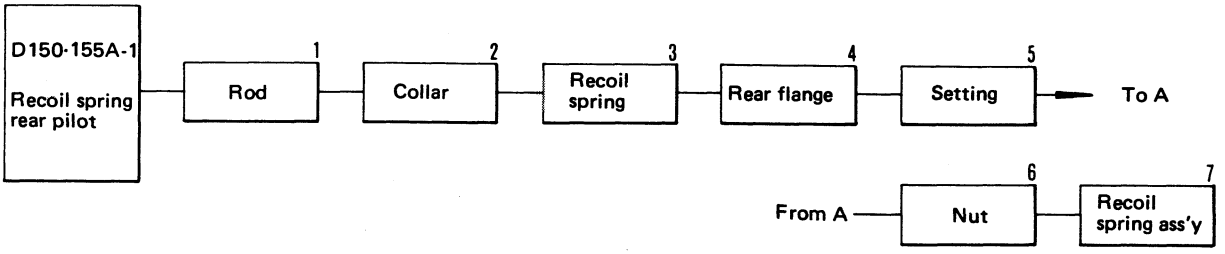
33P043

7. **Rod**
   Remove rod (8) from front flange (7).



33P044

ASSEMBLY OF RECOIL SPRING

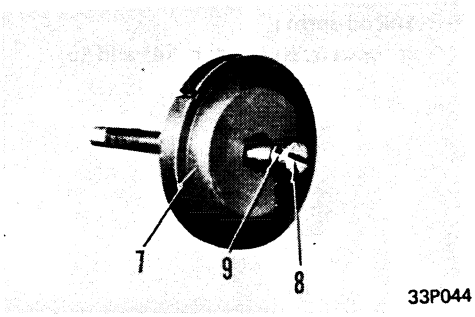


33F015

Special tools required

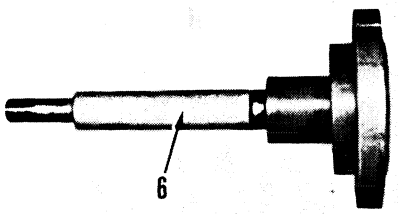
Special tools required		A	B	C
791-685-8000	Compressor	1		
790-101-1300	Cylinder		1	
790-101-1101	Pump			1

1. **Rod**
   Install rod (8) in front flange (7), and lock with dowel pin (9) to prevent rod from loosening.



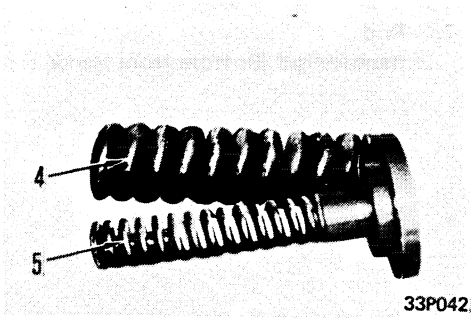
33P044

2. **Collar**
   Install collar (6) on rod.



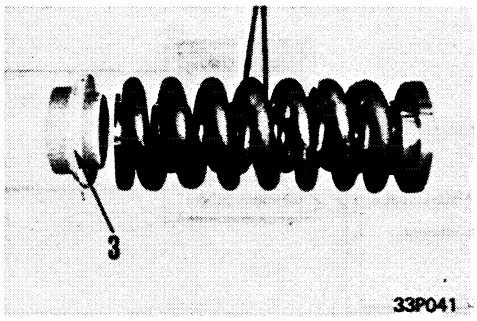
33P043

3. **Recoil spring**
   Install recoil springs (4) and (5).

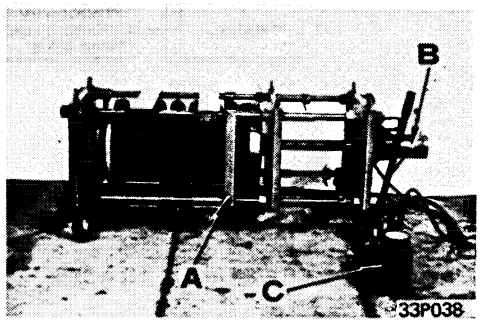


33P042

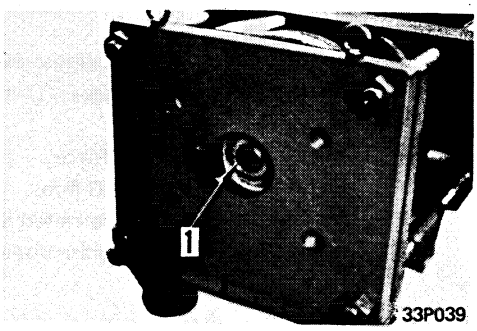
4. **Rear flange**
Install rear flange (3).



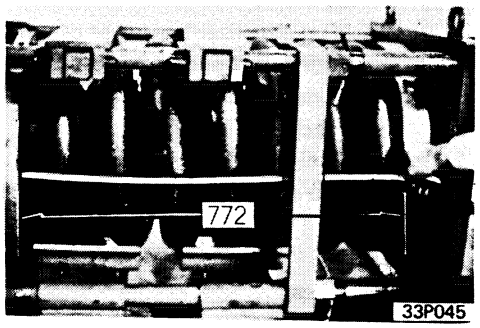
5. **Setting**
Set recoil spring assembly (2) in assembly stand A with cylinder B and pump C with front flange side to cylinder side.
kg Recoil spring assembly: **285 kg**



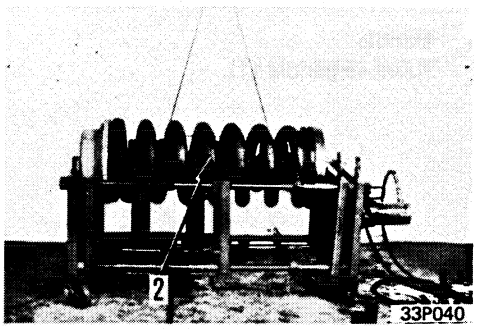
6. **Nut**
Compress spring by applying oil pressure to cylinder and install nut (1).
★ When increasing oil pressure to compress spring, properly guide the front end of rod to prevent it from interfering with assembly stand.



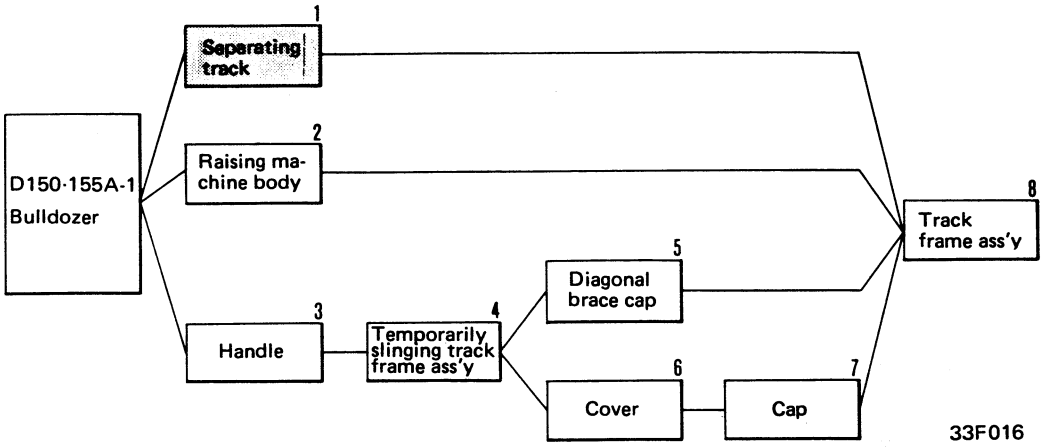
★ Set the recoil spring assembly to 772 mm (installed length 769 mm plus 3 mm) between front flange and rear flange. When recoil spring assembly is installed, to set the spring to 769mm of installed length when tightening the front cover mounting bolts.



7. **Recoil spring assembly**
After gradually releasing oil pressure of cylinder, take out recoil spring assembly (2) from assembly stand A.



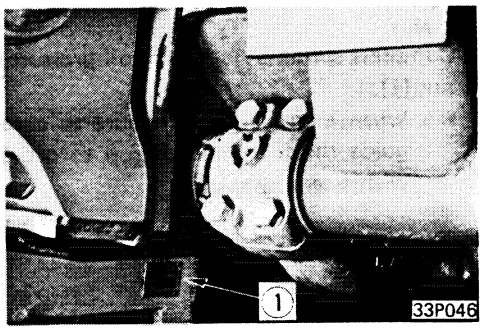
DISMOUNTING TRACK FRAME



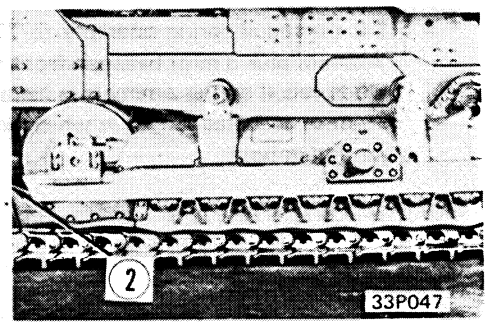
1. Separating track
Refer to SEPARATION OF TRACK.

2. Raising machine body

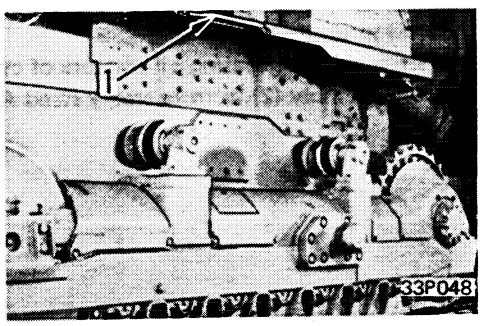
1) Jack up the underside of steering case and support right and left steering cases on blocks ① to raise the rear side of machine.
   - ★ Jack : 30-ton rating force
   - ★ Height of blocks: 800 mm
   - ★ Machine body may be raised with ripper, if equipped. In this case, lay iron plate under ripper points.



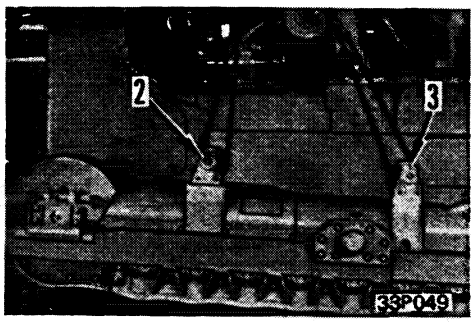
2) Jack up equalizer bar lower center and support front end of radiator guard bottom on block ② to raise the front side of machine.
   - ★ Jack: 30 ton rating force
   - ★ Height of block: 1200 mm
   - ★ Be sure to stably support radiator guard on block.



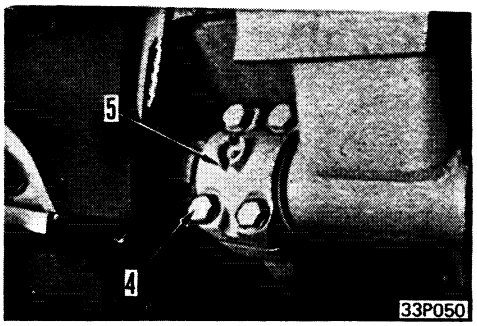
3. Handle
Remove handle (1).



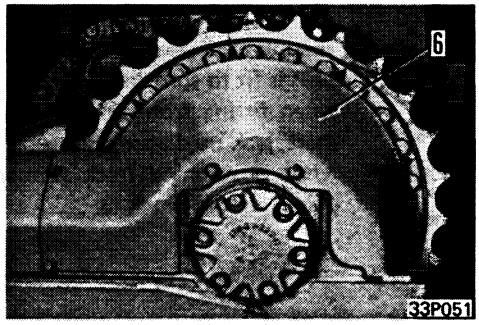
4. **Temporarily slinging track frame assembly**
   Temporarily sling track frame assembly with chains hooked to front and rear carrier rollers (2) and (3).
   ★ Sling track frame with its rear end lower than the front end.



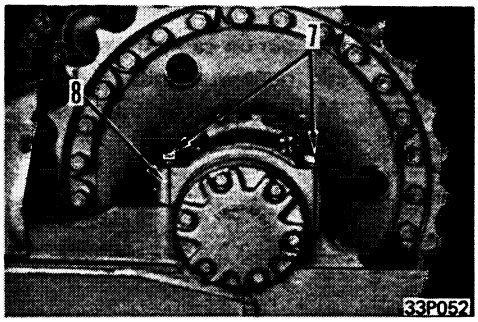
5. **Diagonal brace cap**
   Remove bolts (4) fastening diagonal brace cap (5); remove cap.
   ★ Before removing, put match marks to cap and diagonal brace.



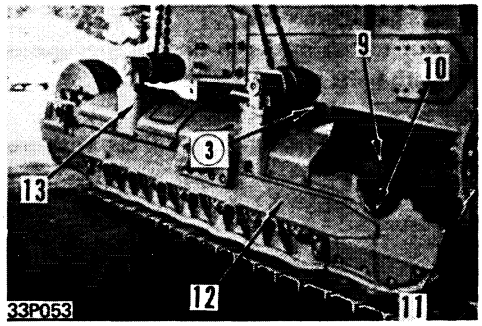
6. **Cover**
   Remove cover (6).
   ⚠ Be sure to hold cover firmly when removing the last bolt to prevent cover from falling off.



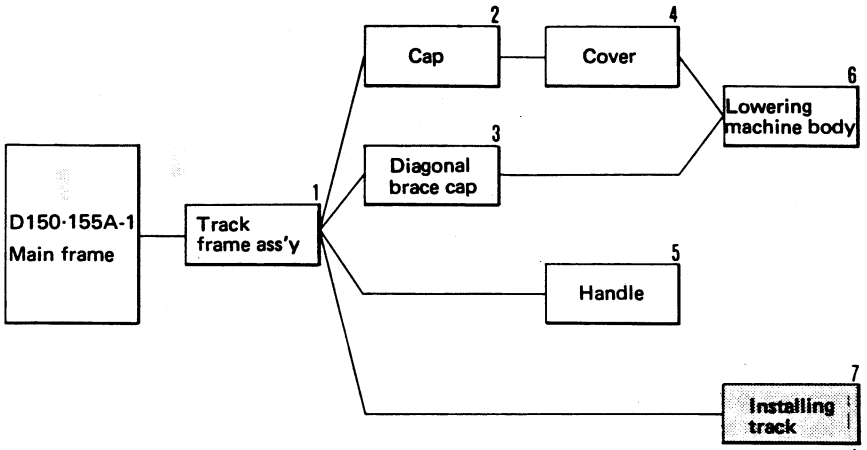
7. **Cap**
   Remove bolts (7) fastening cap (8); remove cap.



8. **Track frame assembly**
   1) While slinging track frame with crane, disconnect the front end of diagonal brace (9) from sprocket shaft and track frame support (10) from support (11).
   2) Pull track frame assembly (12) toward the outside of machine to pull support (13) out from equalizer bar and lift off assembly toward obliquely forward direction.
      ★ Insert block ③ between equalizer bar and frame to prevent equalizer bar from rising.
      kg Track frame assembly: **3800 kg**



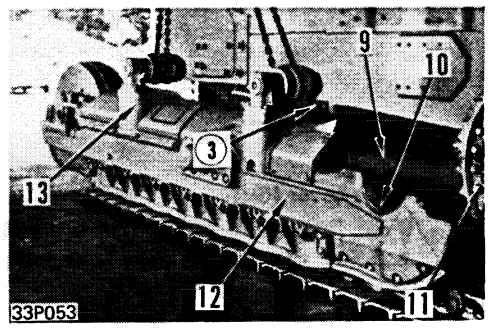
MOUNTING TRACK FRAME



33F017

1. Track frame assembly

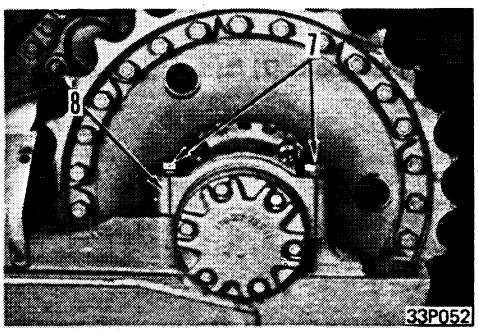
1) Sling track frame assembly (12) with crane. Bring support (13) onto equalizer bar, while inserting diagonal brace (9) into the back of sprocket.
2) Lift track frame assembly into position so that track frame (10) is supported on support (11) and front end of diagonal brace (9) is fit to sprocket shaft.
   - ★ When fitting front end of diagonal brace to sprocket shaft, jack up diagonal brace.
   - ★ After positioning track frame and diagonal brace in place, remove block ③ .



2. Cap

Align dowel pin on cap with pin hole in support and secure cap (8) to track frame with bolts (7).

kgm Mounting bolt: **155 ~ 195 kg.m**

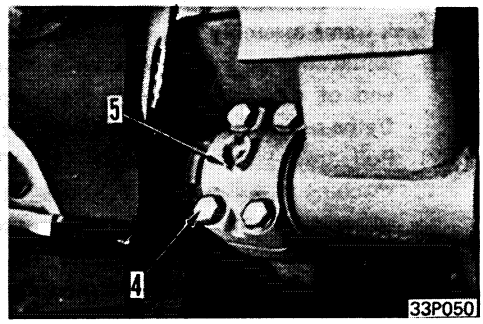


3. Diagonal brace cap

Put match marks in line and secure cap (5) to diagonal brace with bolts (4).

kgm **84 ~ 105 kg.m**

★ After installing cap, fill cap with grease.



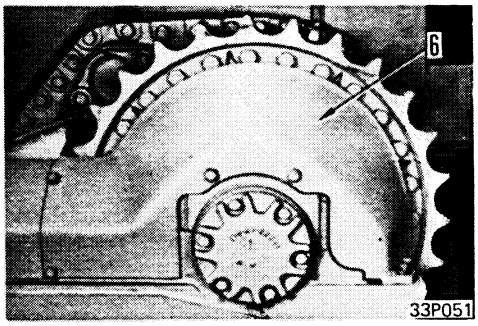
4. Cover

Install cover (6).

Coat mounting bolts with thread tightener (LT-2).

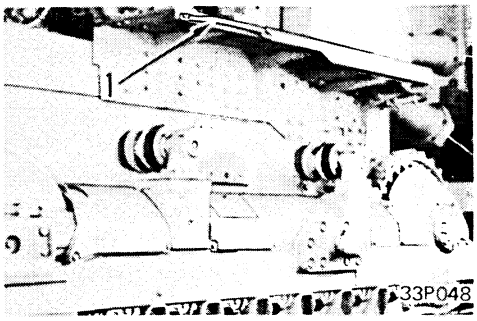
Mounting bolt 16 mm: **23.5 – 31.5 kgm**

14 mm: **15 – 20 kgm**



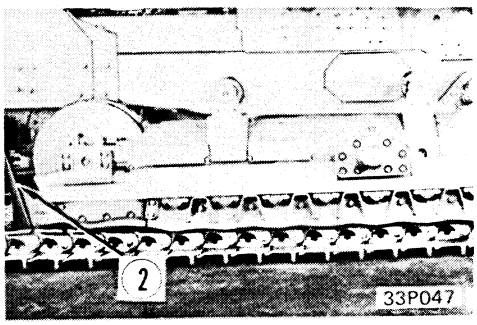
5. Handle

Install handle (1).



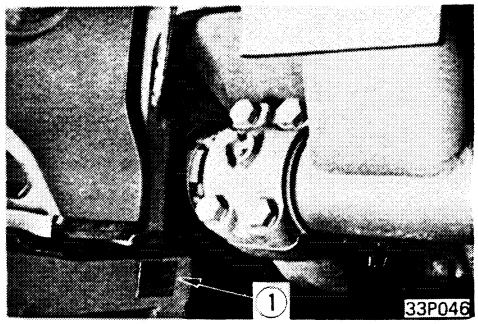
6. Lowering machine body

1) Jack up the underside center of equalizer bar and remove block ② from the underside of radiator guard to lower the front side of machine.
2) Jack up steering case and remove right and left blocks ① from the underside of steering case to lower the rear side of machine.
   - ★ Machine body may be raised with ripper, to remove block, if equipped.
   - ★ When lowering the rear side of machine, position sprocket in place between inner and outer links.



7. Installing track

Refer to CONNECTION OF TRACK.



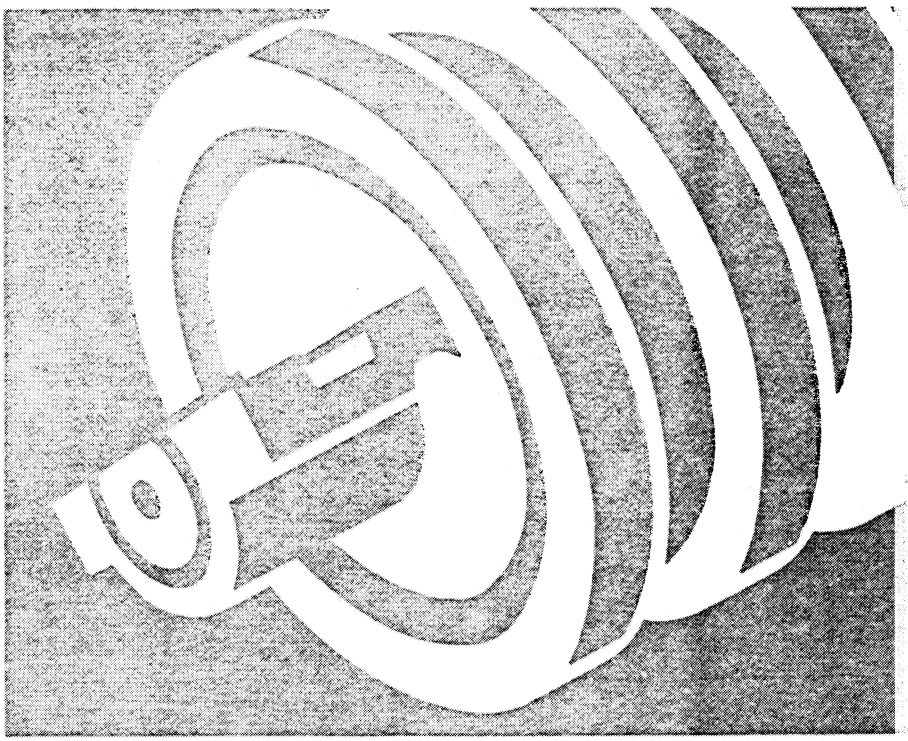
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

34 UNDERCARRIAGE

MAINTENANCE STANDARD



TORQUE SPECIFICATIONS FOR NUTS AND BOLTS

Nuts and bolts should be tightened to torque values shown below.

Unit: kg.m

Nominal bolt dia. (mm)	Width across flats (mm)		
		Desired value	Allowable range
6	10	1.35	1.2~1.5
8	13	3.2	2.8~3.5
10	17	6.7	6~7.5
12	19	11.5	10~12.5
14	22	18	16~20.0
16	24	28.5	25~31.5
18	27	39	35~43.5
20	30	56	50~62.0
22	32	76	67.5~84.5
24	36	94.5	84~105
27	41	135	120~150
30	46	175	155~195
33	50	225	200~250
36	55	280	250~310
39	60	335	295~370

The above table indicates the cases where a torque wrench is employed.

MAINTENANCE STANDARD

UNDERCARRIAGE

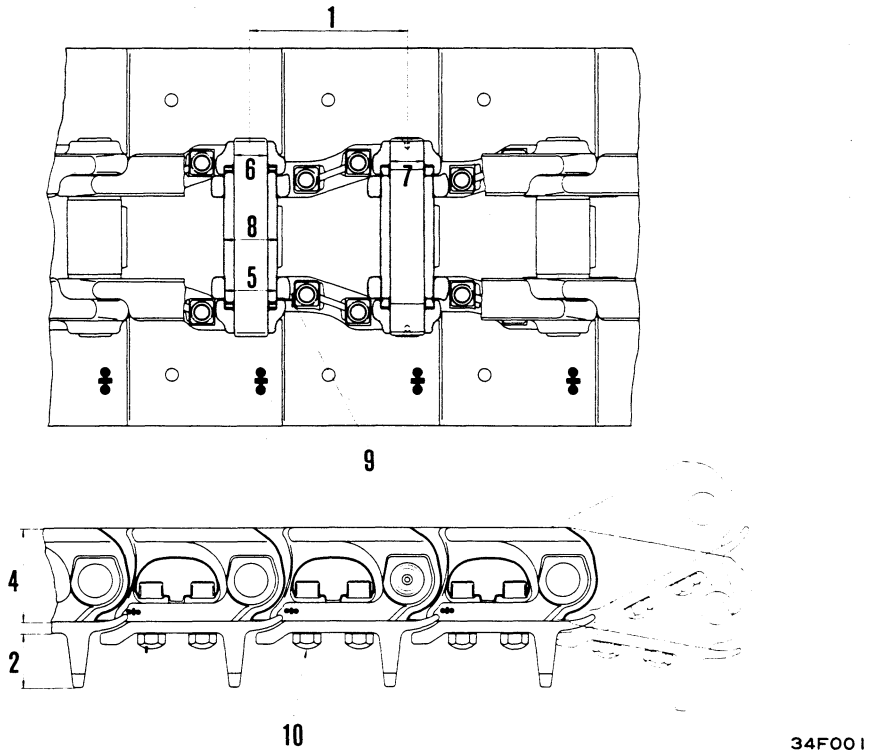
(1) Track 34- 2

Undercarriage

(1) Track (Oil sealed track): Option 34- 4
(2) Idler 34- 6
(3) Track roller 34- 8
(4) Carrier roller 34-10
(5) Track frame 34-11
(6) Recoil spring 34-12

UNDERCARRIAGE

(1) Track (MASTER PIN TYPE)



Unit: mm

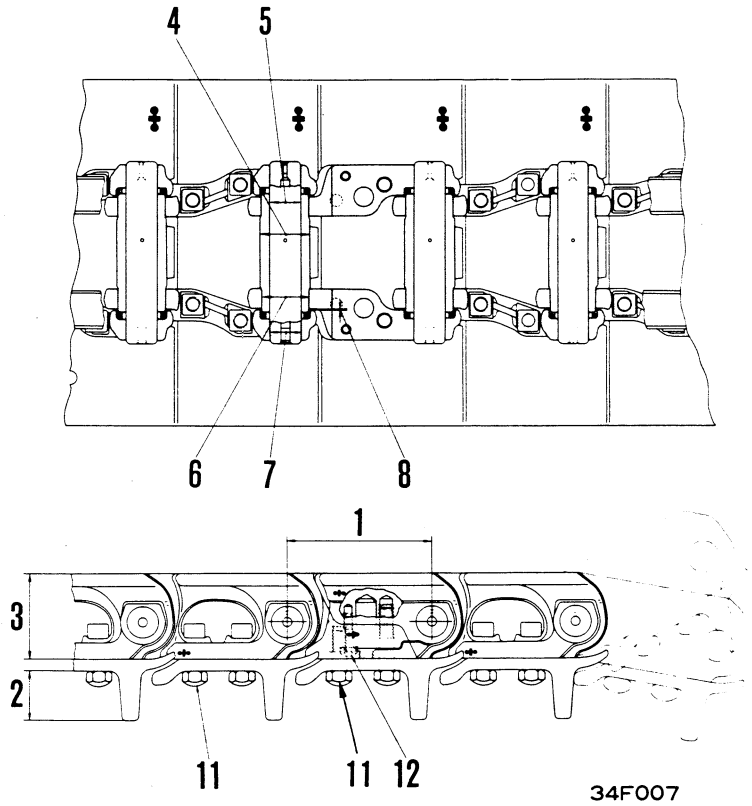
No.	Check Item	Criteria					Remedy
1	Link pitch	Serial No.	Standard size		Repair limit		Turn or replace
			Nominal	Measure	Impact loading	Normal loading	
		5501 ~ 5501 ~	228.6	228.85	231.85	233.85	
2	Grouser height (STD single shoe)	8329 ~ 10263 ~	80		30		Lug welding, rebuild grouser or replace
3	Grouser height (OP: rock shoe)	8329 ~ 10263 ~	80		30		
4	Link height	8329 ~ 10263 ~	138		125		Rebuild or replace
5	Interference between link and bushing	Serial No.	Standard size	Tolerance		Standard interference	Repair limit	Replace
				Shaft	Hole		
		8329~ 10263~	77	+0.344 +0.304	+0.074 0	0.230 ~ 0.344	0.100
	Bushing press-fit force	12.3 ~ 18.3 ton					

Unit: mm

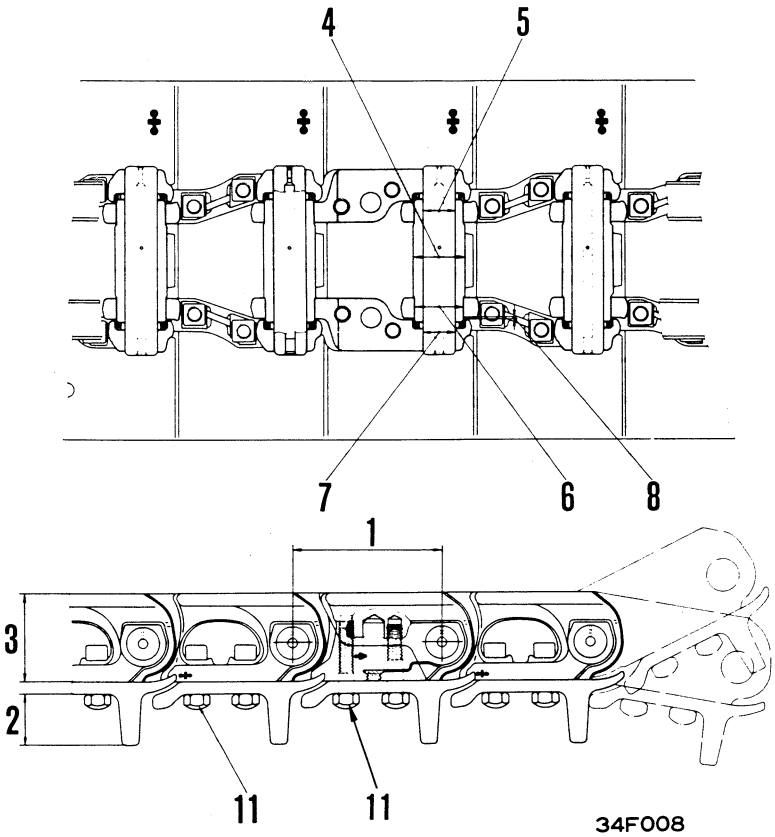
<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">6</td><td>Interference between link and regular pin</td><td>Serial No.</td><td>Standard size</td><td>Tolerance
Shaft</td><td>Tolerance
Hole</td><td>Standard interference</td><td>Repair limit</td><td rowspan="2">Replace</td></tr>
<tr><td>7041 ~
7041 ~</td><td>48.5</td><td>+0.434
+0.334</td><td>+0.062
0</td><td>0.272 ~
0.434</td><td>0.140</td></tr>
<tr><td></td><td>Regular pin press-fit force</td><td colspan="6">21.4 ~ 37.0 ton</td></tr>
<tr><td rowspan="2">7</td><td>Interference between link and master pin</td><td>Serial No.</td><td>Standard size</td><td>Tolerance
Shaft</td><td>Tolerance
Hole</td><td>Standard interference</td><td>Repair limit</td><td rowspan="2">Correct or replace</td></tr>
<tr><td>7041 ~
7041 ~</td><td>48.5</td><td>+0.230
+0.200</td><td>+0.062
0</td><td>0.138 ~
0.230</td><td>0.080</td></tr>
<tr><td></td><td>Master pin press-fit force</td><td colspan="6">21.4 ~ 37.0</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Outside diameter of bushing</td><td colspan="2">Serial No.</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="2">Turn or replace</td></tr>
<tr><td colspan="2">7041 ~
7041 ~</td><td colspan="2">79.0</td><td>Impact loading
76</td><td>Normal loading
74.0</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Clearance at link fitting surface</td><td>Serial No.</td><td colspan="2">Standard clearance (one side)</td><td colspan="2">Standard clearance (both side)</td><td>Repair limit</td><td rowspan="2">Replace</td></tr>
<tr><td>8329 ~
10263 ~</td><td colspan="2">0 ~ 1.4</td><td colspan="2">0 ~ 2.8</td><td>8</td></tr>
<tr><td>10</td><td>Shoe bolt tightening torque</td><td colspan="6">100 ~ 120 kgm</td><td>Retighten</td></tr>
</table>

(2) Track (Master link type)

D150A 8408 ~ 8420
D155A 15001 ~ 17000



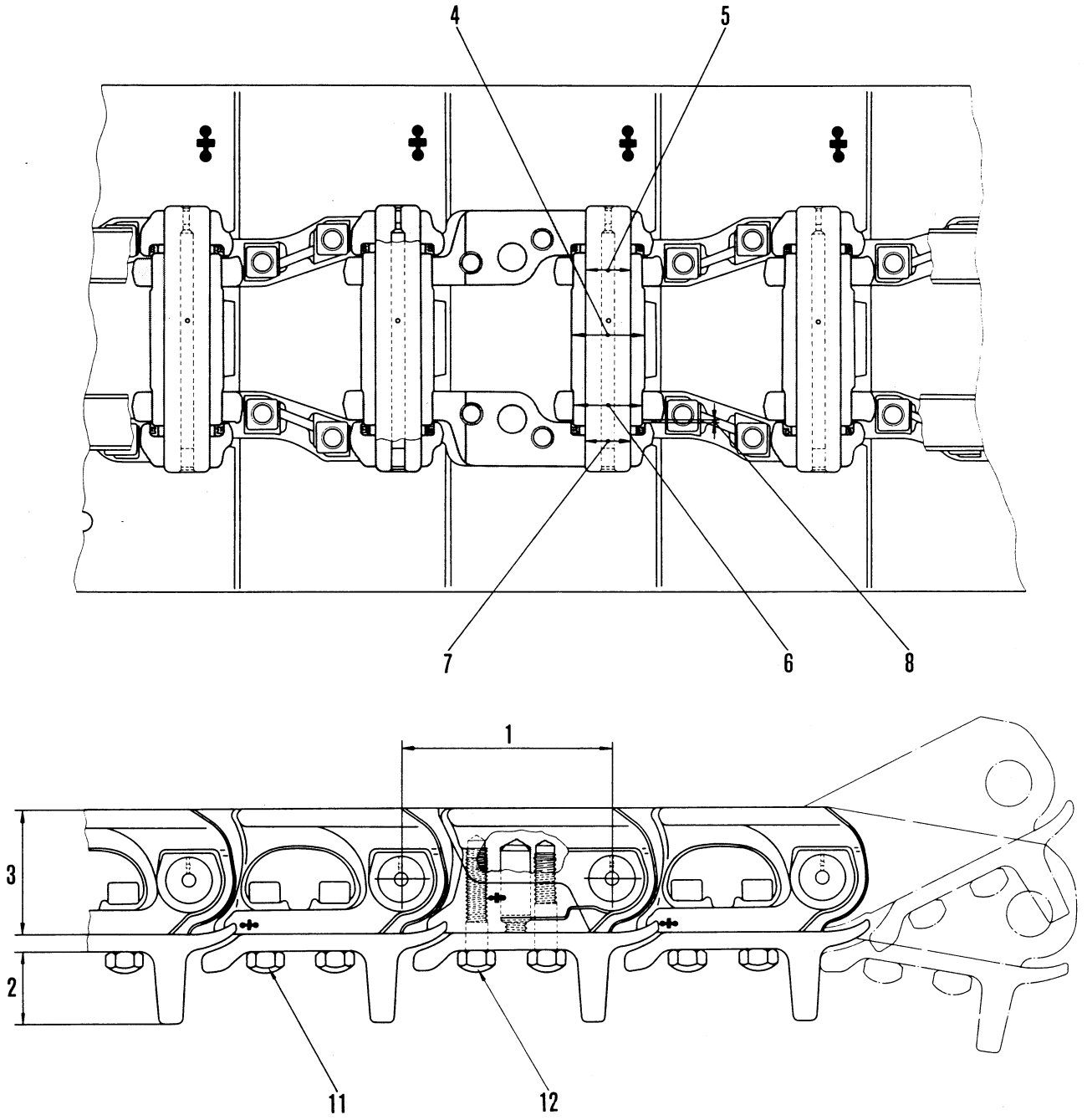
D150A 8421 ~ 8487
D155A 17001 ~ 20765



Unit: mm

<table>
<tr><th>No.</th><th>Item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Link pitch</td><td colspan="2">Serial No.</td><td colspan="2">Tolerance</td><td colspan="2">Repair limit</td><td rowspan="2">Turn or replace</td></tr>
<tr><td colspan="2" rowspan="4">8408 ~ 8420
15001 ~ 17000</td><td colspan="2">228.85</td><td colspan="2">231.85 (Severe job site)
233.85 (Standard job site)</td></tr>
<tr><td>2</td><td>Height of grouser</td><td colspan="2">80</td><td colspan="2">30</td><td>Lug welding, build-up welding, or replace</td></tr>
<tr><td>3</td><td>Height of link</td><td colspan="2">138</td><td colspan="2">125</td><td>Build-up welding or replace</td></tr>
<tr><td>4</td><td>O.D. of bushing</td><td colspan="2">79</td><td colspan="2">74.0 (Severe job site)
71.5 (Standard job site)</td><td>Turn or replace</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">Clearance between pin and bushing</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="6">Replace</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>8408~8420
15001~17000</td><td>48.5</td><td>+0.434
+0.334</td><td>+1.164
+0.664</td><td>0.230 ~
0.830</td><td></td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Interference between bushing and link</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td rowspan="2">8408~8420
15001~17000</td><td>77</td><td>+0.344
+0.304</td><td>+0.074
0</td><td>0.230 ~
0.344</td><td>0.1</td></tr>
<tr><td>7</td><td>Interference between pin and link</td><td>48.5</td><td>+0.434
+0.334</td><td>+0.062
0</td><td>0.272 ~
0.434</td><td>0.14</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Clearance between the mating surfaces of links</td><td colspan="2">Serial No.</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td></tr>
<tr><td colspan="2">8408 ~ 8420
15001 ~ 17000</td><td colspan="2">One side 0 ~ 1.4
Both sides 0 ~ 2.8</td><td colspan="2">Both sides 8</td></tr>
<tr><td>9</td><td>Pressing force of bushings</td><td colspan="6">12.3 ~ 18.3 ton</td><td rowspan="2">Adjust</td></tr>
<tr><td>10</td><td>Pressing force of pins</td><td colspan="6">21.4 ~ 37.0 ton</td></tr>
<tr><td>11</td><td>Tightening torque of shoe bolts</td><td colspan="6">110 ± 10 kgm</td><td rowspan="2">Tighten</td></tr>
<tr><td>12</td><td>Tightening torque of master link connecting bolts</td><td colspan="6">35 ± 4 kgm</td></tr>
</table>

D150A 8421 ~ 8487
D155A 17001 ~ 20765

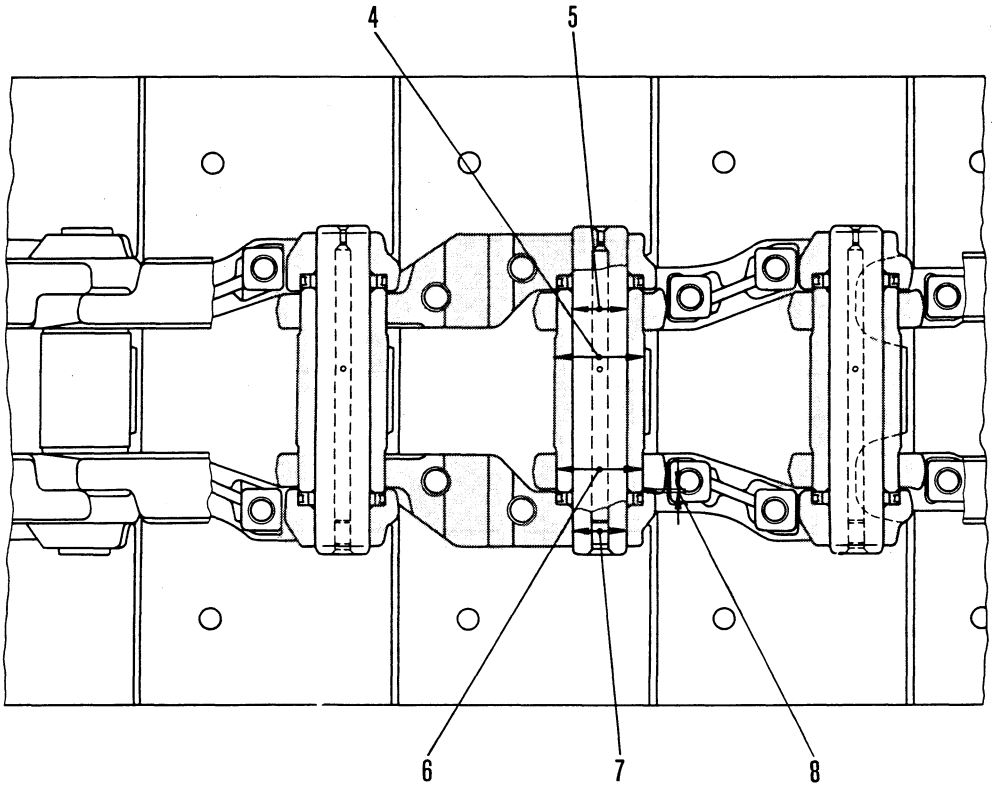


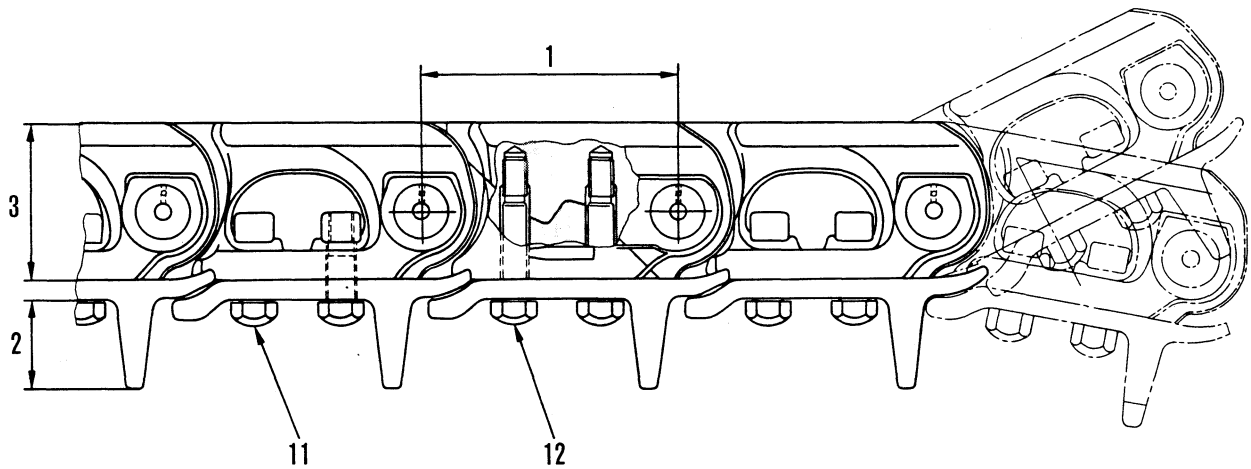
175F187-1A

Unit: mm

No.	Check Item	Criteria						Remedy
1	Link pitch	Serial No.		Standard size		Repair limit		Turn or replace
		8421 – 8487 17001 – 20765		228.85		Impact loading: 231.85	Normal loading: 233.85	
2	Grouser height (STD single shoe)	8421 – 8487 17001 – 20765		80		25		Lug welding, rebuild or replace
3	Link height	8421 – 8487 17001 – 20765		138		125		Rebuild or replace
4	Outside diameter of bushing	Serial No.		Standard size		Repair limit		Turn or replace
		8421 – 8487 17001 – 20765		79.0		Impact loading: 74.0	Normal loading: 71.5	
5	Clearance between pin and bushing	Serial No.	Standard size	Tolerance: Shaft	Tolerance: Hole	Standard clearance	Clearance limit	Replace
		8421 – 8487 17001 – 20765	48.5	+0.434 +0.334	+1.164 0.664	0.230 ~ 0.380		
6	Interference between link and bushing	8421 – 8487 17001 – 20765	77	+0.344 +0.304	+0.074 0	0.230 ~ 0.344	0.100	Replace
7	Interference between link and pin	Serial No.	Standard size	Tolerance: Shaft	Tolerance: Hole	Standard interference	Interference limit	Replace
		8421 – 8487 17001 – 20765	48.5	+0.434 +0.334	+0.062 0	0.272 ~ 0.434	0.138	
8	Clearance at link fitting surface	Serial No.	Standard clearance (one side)	Standard clearance (both sides)	Clearance limit			Replace
		8421 – 8487 17001 – 20765	0 ~ 1.1	0 ~ 2.2	8			
9	Bushing press-fit force	12.3 ~ 18.3 ton						Retighten
10	Pin press-fit force	21.4 ~ 37.0 ton						
11	Shoe bolt tightening torque	110 ± 10 kgm						
12	Master link coupling bolt tightening torque	110 ± 10 kgm						

D150A 8488 and up
D155A 20766 and up



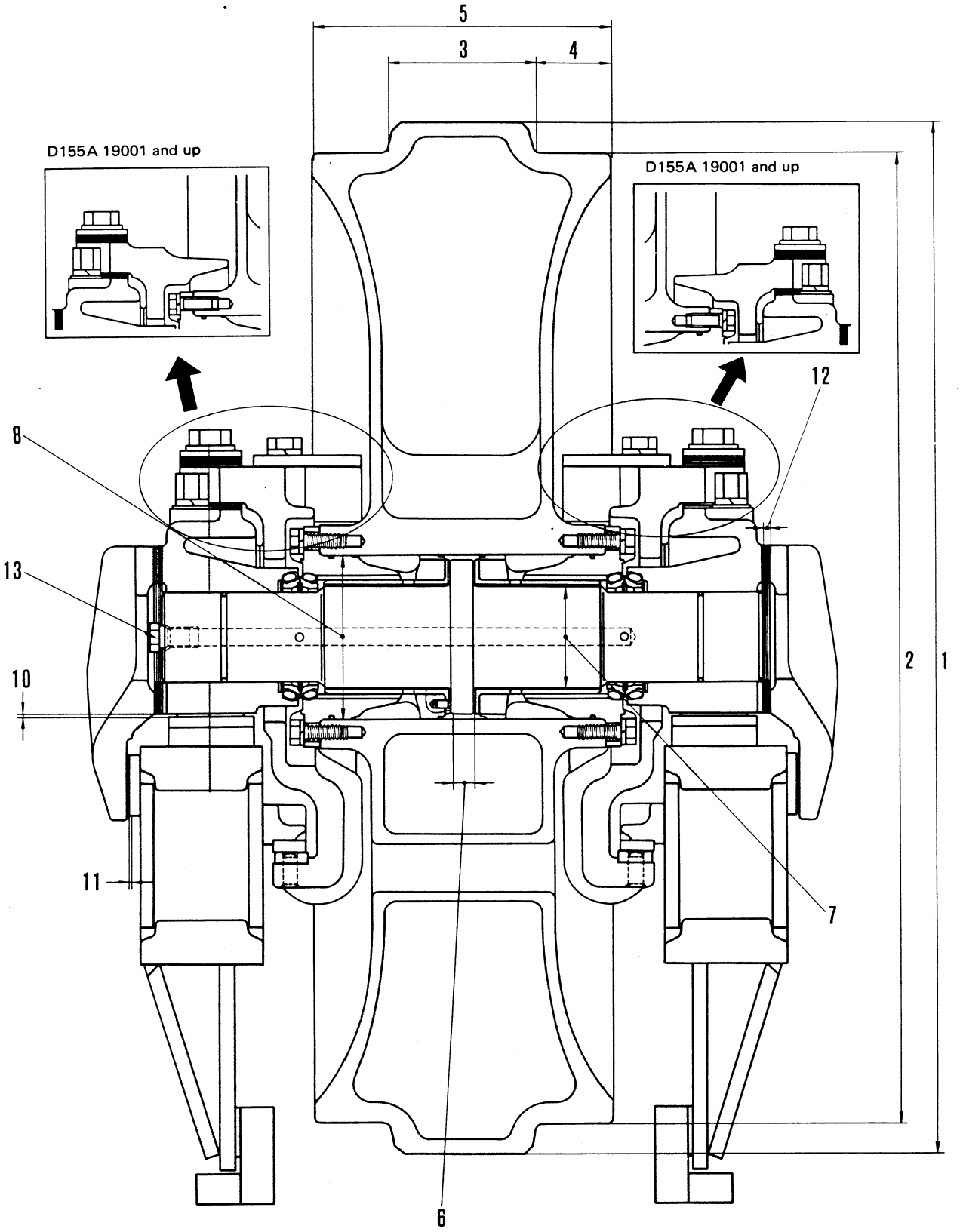


175F187-2

Unit: mm

No.	Check Item	Criteria						Remedy
1	Link pitch	Serial No.		Standard size		Repair limit		Turn or replace
		8488 ~ 20766 ~		228.85		Impact loading	Normal loading	
2	Grouser height (STD single shoe)	8488 ~ 20766 ~		80		30		Lug welding, rebuild or replace
3	Link height			138		125		Rebuild or replace
4	Outside diameter of bushing	Serial No.		Standard size		Repair limit		Turn or replace
		8488 ~ 20766 ~		79.0		Impact loading	Normal loading	
						74.0	71.5	
5	Clearance between pin and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		8488 ~ 20766 ~	48.5	+0.434 +0.334	+1.164 0.664	0.230 ~ 0.380	0.530	
6	Interference between link and bushing		77	+0.344 +0.304	+0.074 0	0.230 ~ 0.344	0.100	
7	Interference between link and pin	Serial No.	Standard size	Tolerance		Standard interference	Interference limit	Replace
				Shaft	Hole			
		8488 ~ 20766 ~	48.5	+0.434 +0.334	+0.062 0	0.272 ~ 0.434	0.140	
8	Clearance at link fitting surface	Serial No.	Standard clearance (one side)	Standard clearance (both sides)	Clearance limit			Replace
		8488 ~ 20766 ~	0 ~ 1.4	0 ~ 2.8	8			
9	Bushing press-fit force	12.3 ~ 18.3 ton						Retighten
10	Pin press-fit force	21.4 ~ 37.0 ton						
11	Shoe bolt tightening torque	First tighten to 45 ± 5 kgm, then tighten another 120 ± 10°						
12	Shoe bolt for master link tightening torque	First tighten 45 ± 5 kgm, 2nd, tighten another 120 $^{+20^\circ}_{0}$ Then, confirm the torque. The final torque should be at least 120 kgm.						

(2) Idler

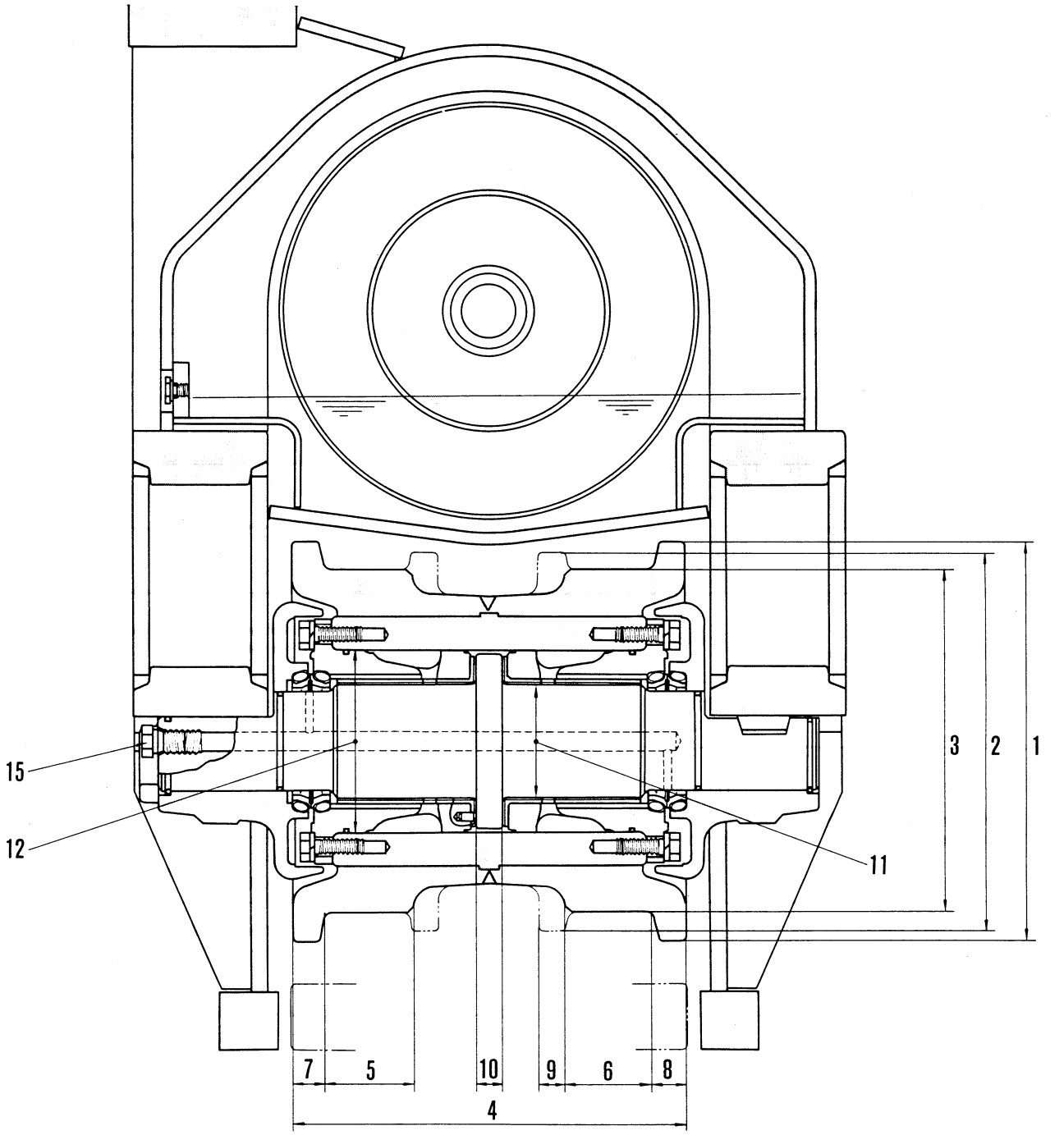


175F183-1

Unit: mm

<table>
<tr><th>No.</th><th>Check Item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Serial No.</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Rebuild or replace</td></tr>
<tr><td colspan="2" rowspan="6">8408 ~
15001 ~</td><td colspan="2">850</td><td colspan="2"></td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">800</td><td colspan="2">781</td></tr>
<tr><td>3</td><td>Width of flange</td><td colspan="2">120</td><td colspan="2"></td></tr>
<tr><td>4</td><td>Width of tread</td><td colspan="2">60</td><td colspan="2">69</td></tr>
<tr><td>5</td><td>Total width</td><td colspan="2">240</td><td colspan="2"></td></tr>
<tr><td>6</td><td>Shaft collar width</td><td colspan="2">20</td><td colspan="2">19</td><td rowspan="4">Replace</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Clearance between shaft and bushing</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>8408 ~
15001 ~</td><td>85</td><td>−0.210
−0.260</td><td>+0.255
+0.220</td><td>0.43 ~
0.51</td><td>1.5</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Interference between idler and outer bushing</td><td rowspan="2">Serial No.</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard interference</td><td rowspan="2">Interference limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>8408 ~
15001 ~</td><td>135</td><td>+0.130
+0.080</td><td>+0.10
−0.05</td><td>0.02 ~
0.180</td><td>−0.30</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Shaft play in axial direction</td><td colspan="2">Serial No.</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td></tr>
<tr><td colspan="2" rowspan="3">8408 ~
15001 ~</td><td colspan="2">0.51 ~ 0.74</td><td colspan="2">1.5</td></tr>
<tr><td>10</td><td>Clearance between guide plate and support</td><td colspan="2">2.0</td><td colspan="2"></td><td>Rebuild or replace</td></tr>
<tr><td>11</td><td>Clearance between guide plate and side plate</td><td colspan="2">0.5 ~ 1.0</td><td colspan="2">3</td><td>Adjust or replace</td></tr>
<tr><td>12</td><td>Thickness of shim</td><td colspan="6">6.0</td><td>Adjust</td></tr>
<tr><td>13</td><td>Filler plug tightening torque</td><td colspan="6">21 ± 5 kgm</td><td>Retighten</td></tr>
<tr><td>14</td><td>Oiling quantity</td><td colspan="6">390 ~ 450 cc (GO140B)</td><td>Oiling</td></tr>
</table>

(3) Track roller

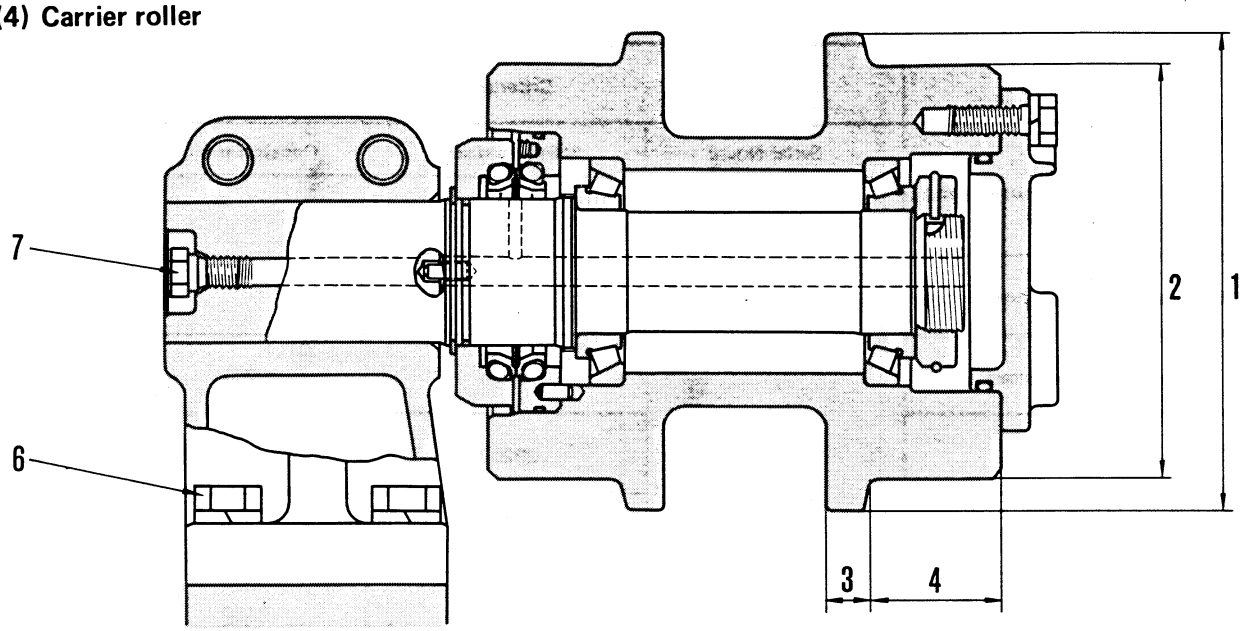


34F004

Unit: mm

No.	Check Item	Criteria						Remedy
1	Outside diameter of outer flange	Serial No.		Standard size		Repair limit		Rebuild or replace
		8408 ~ 15001 ~		298				
2	Outside diameter of inner flange			282				
3	Outside diameter of tread			255		230		
4	Total width			292				
5	Width of tread (single flange)			65		74		
6	Width of tread (double flange)			62		80		
7	Width of flange (single flange)			24		15		
8	Width of flange (double flange, outer)			24		15		
9	Width of flange (double flange, inner)			22		13		
10	Shaft collar width			20		19		Replace
11	Clearance between shaft and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		8408 ~ 15001 ~	85	−0.210 −0.260	+0.255 +0.220	0.43 ~ 0.515	1.5	
12	Interference between roller and outer bushing	Serial No.	Standard size	Tolerance		Standard interference	Interference limit	
				Shaft	Hole			
		8408 ~ 15001 ~	135	+0.130 +0.080	+0.063 0	0.017 ~ 0.130	0.30	
13	Shaft play in axial direction	Serial No.		Standard clearance		Clearance limit		
		8408 ~ 15001 ~		0.50 ~ 0.76		1.5		
14	Track roller ass'y fitting bolt tightening torque	84 ~ 104 kgm						Adjust
15	Oil filler plug tightening torque	21 ± 5 kgm						
16	Oiling quantity	390 ~ 450 cc (GO 140B)						Oiling

(4) Carrier roller

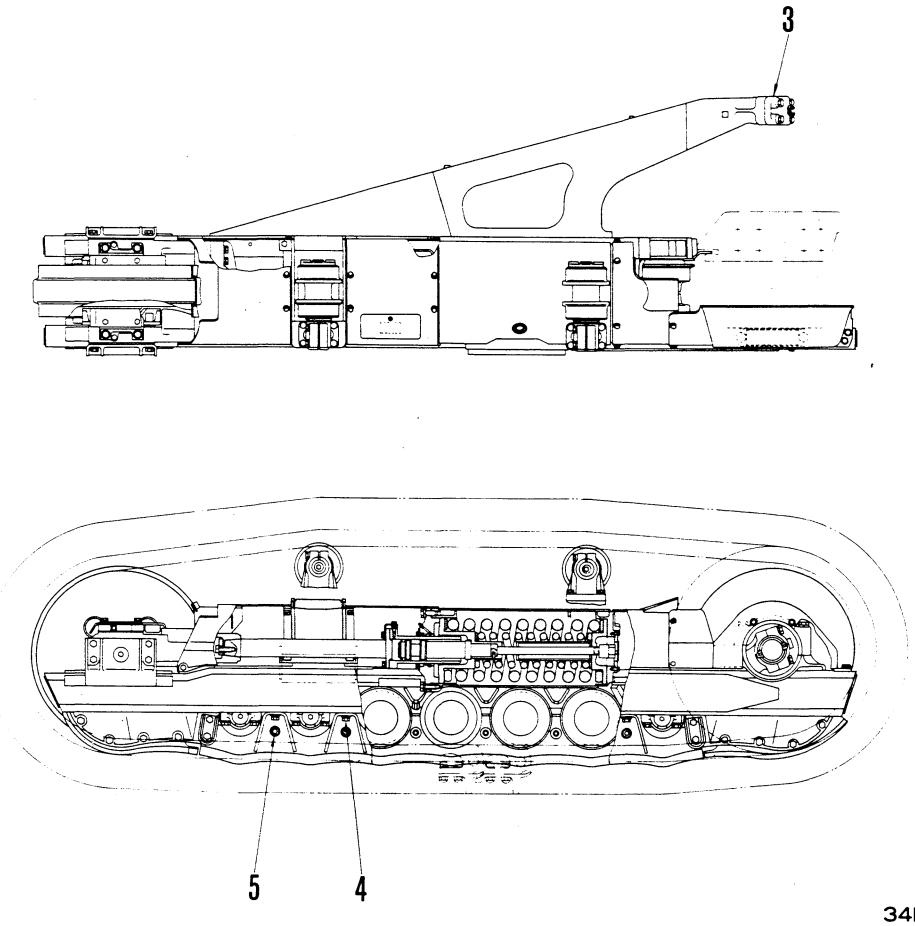


34F005

Unit: mm

No.	Check Item	Criteria			Remedy
1	Outside diameter of flange	Serial No.	Standard size	Repair limit	Rebuid or replace
		8408 ~ 8453 15001 ~ 19000	230		
		8454 ~ 19001 ~	220		
2	Outside diameter of tread	8408 ~ 8453 15001 ~ 19000	200	181	
		8454 ~ 19001 ~	190	171	
3	Width of flange	8408 ~ 15001 ~	21	14	
4	Width of tread	8408 ~ 15001 ~	63	72	
5	Shaft play in axial direction	Serial No.	Standard clearance	Clearance limit	Nut adjustment or bearing change.
		8408 ~ 15001 ~	0.10 ~ 0.13	0.20	
6	Support mounting bolt tightening torque	50 ~ 62 kgm			Adjust
7	Filler plug tightening torque	21 ± 5 kgm			
8	Oiling quantity	630 ~ 720 cc (GO140B)			Oiling

(5) Track frame

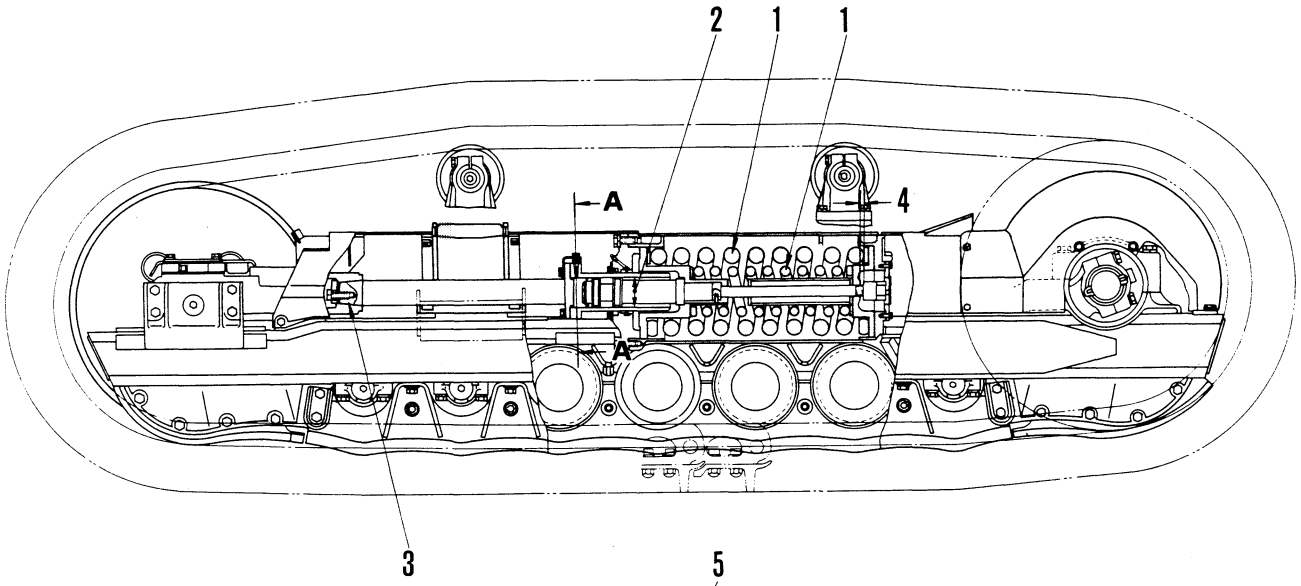


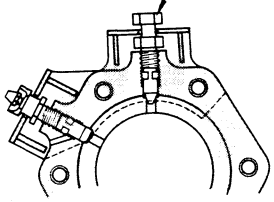
34F001

Unit: mm

No.	Check Item	Criteria						Remedy
1	Deformation of track frame	Serial No.		Item		Repair limit		Repair or replace.
		8408 ~ 15001 ~		Curve Torsion Opening at idler mounting yoke end		7 (per level length of 3,000) 3 (per level length of 300) 5		
2	Center distance between left and right track frames	Serial No.		Standard size		Repair limit		
		8408 ~ 15001 ~		2000		Difference in front and rear less than 15		
3	Clearance between sprocket shaft and diagonal brace bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		8408 ~ 15001 ~	90	−0.036 −0.071	+0.035 0	0.036 ~ 0.106	0.5	
4	Track roller guard mounting bolt tightening torque	84 — 105 kgm						Adjust
5	Spacer bolt mounting nut tightening torque	84 — 105 kgm						

(6) Recoil spring





Section A-A

34F002

Unit: mm

No.	Check Item	Criteria						Remedy
1	Recoil spring	Serial No.	Standard size			Repair limit		Replace
			Free length x O.D.	Installed length	Installed load	Free length	Load limit	
		8408 ~ 15001 ~	(large) 1008 x 304 (small) 693.5 x 172	769 564	22200 kg 7000 kg	985 675	20000 kg 6260 kg	
2	Clearance between adjustment cylinder and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		8408 ~ 15001 ~	130	−0.036 −0.090	+0.070 0	0.036 ~ 0.160	0.5	
3	Idler yoke press fit force	40 ton						Adjust
4	Clearance between rear pilot and nut	10 mm						
5	Lubricator tightening torque	5 ± 0.25 kgm						

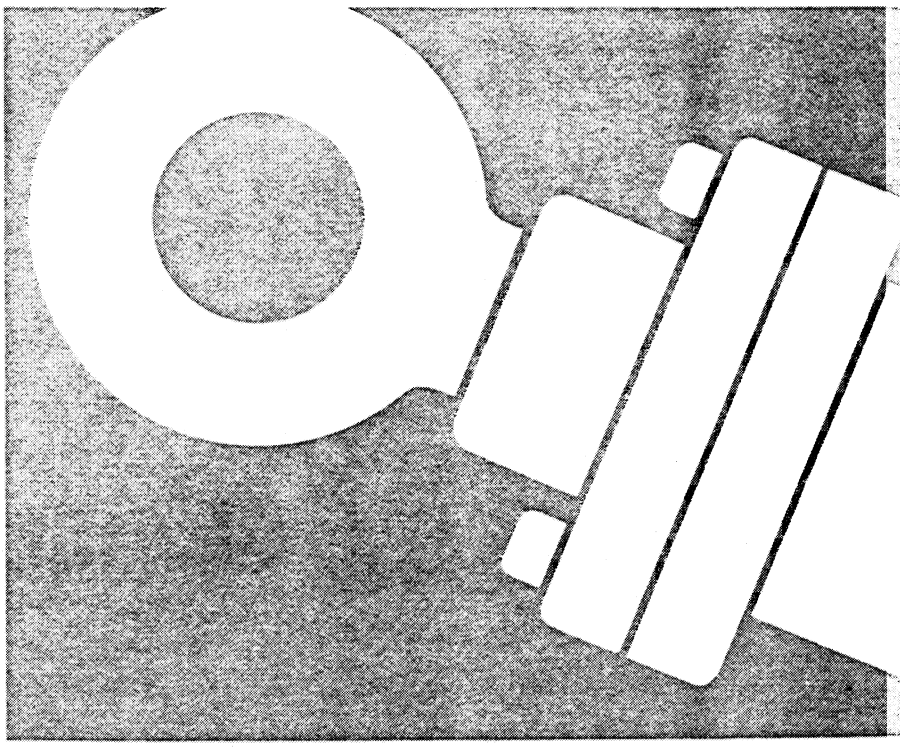
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

61 HYDRAULIC SYSTEM

STRUCTURE AND FUNCTION



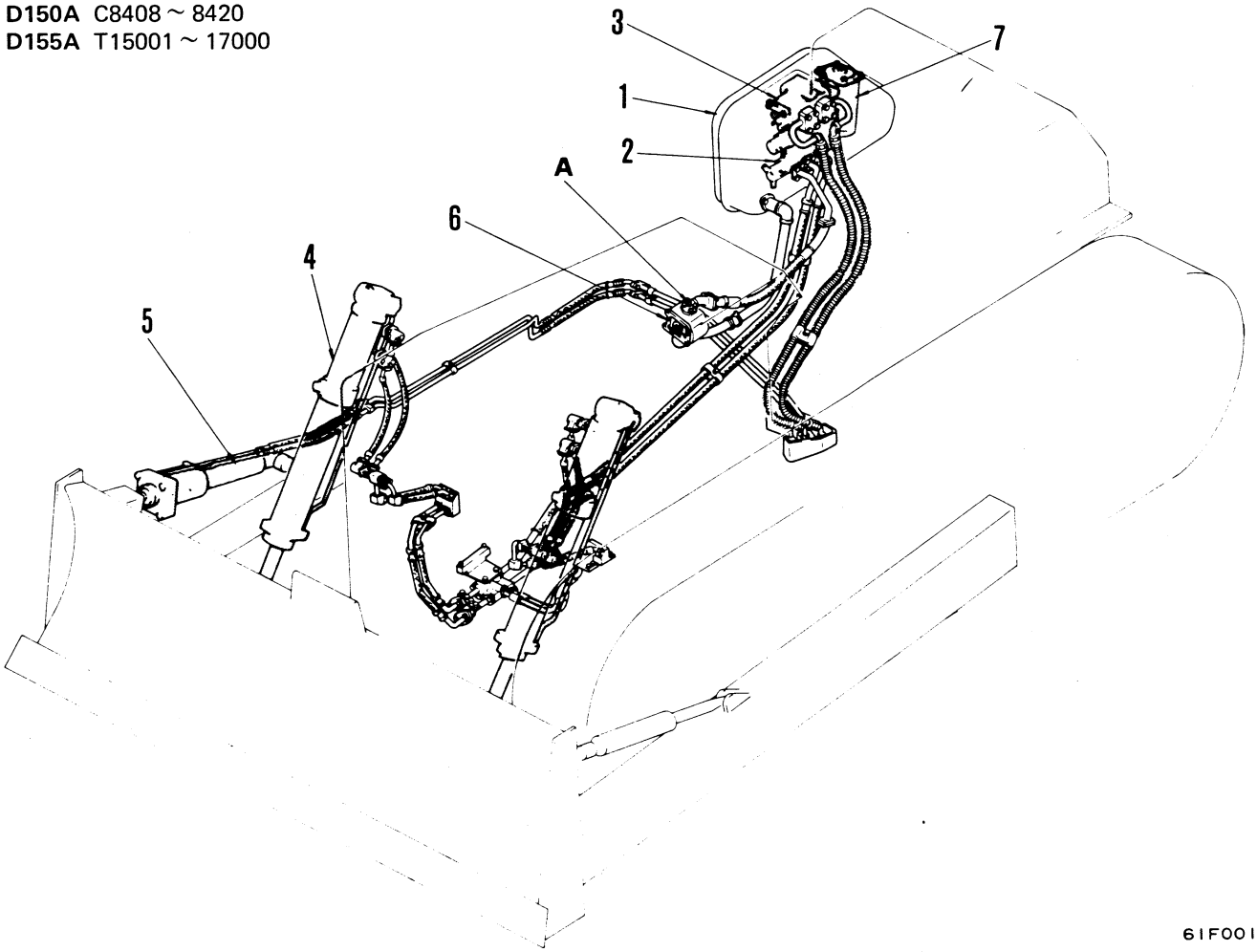
STRUCTURE AND FUNCTION

Hydraulic piping 61- 2
Hydraulic tank 61- 6
Hydraulic control valve 61- 8
Blade tilt control valve 61- 9
Ripper selector valve and pilot check valve 61-10
Pin puller valve 61-12
Pilot valve 61-12- 4
Rotary servo valve 61-12- 6
Servo valve hydraulic control (D150A) 61-12-10
Servo valve hydraulic circuit (D150A) 61-12-10
Servo valve hydraulic control (D155A) 61-12-11
Servo valve hydraulic circuit (D155A) 61-12-11
Safety valve 61-13
Cylinder 61-14
Piston valve 61-16
Quick drop valve 61-17
Hydraulic control 61-18
Pin puller 61-29- 1

HYDRAULIC CONTROL

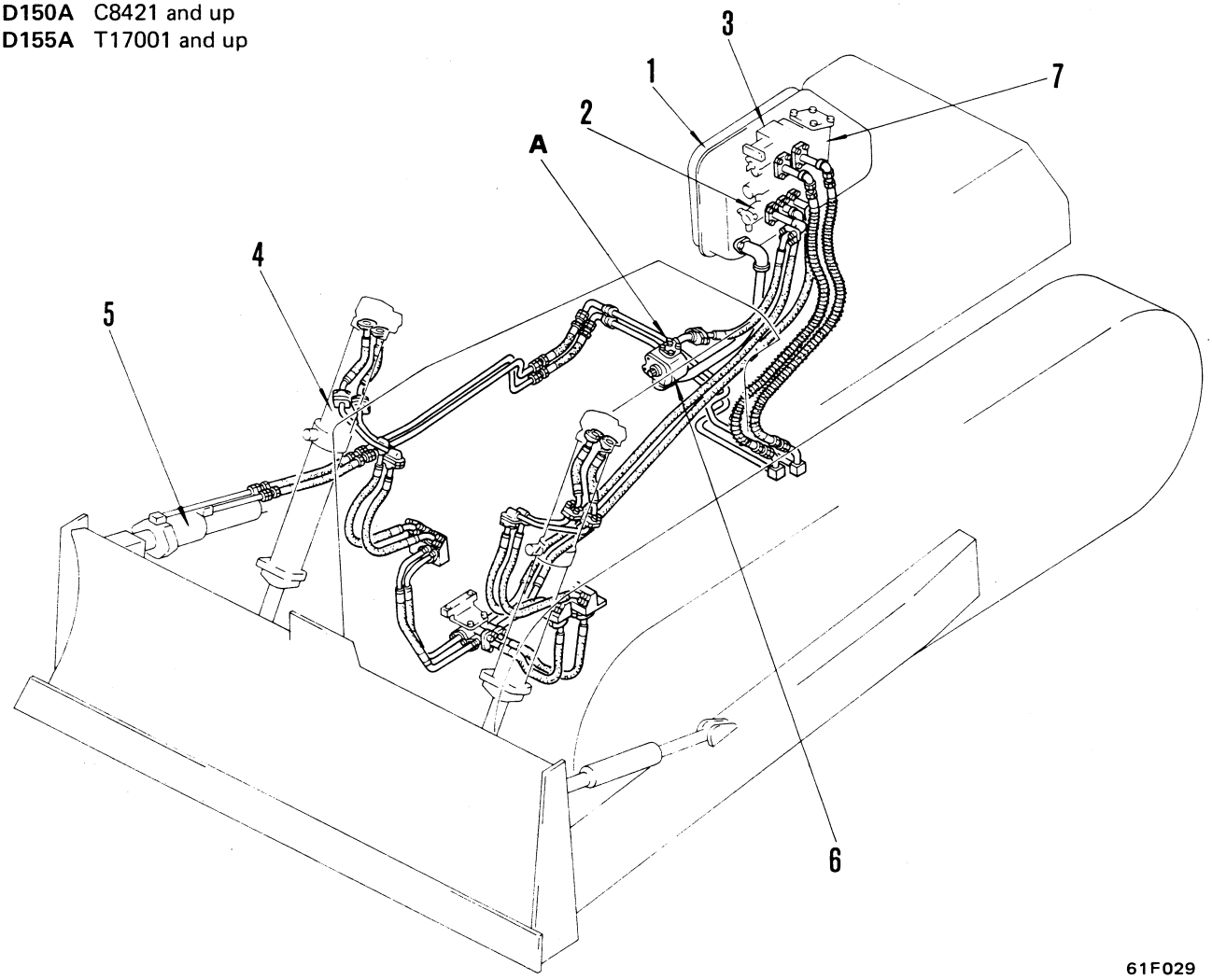
Work equipment hydraulic device of D150, 155A is largely devided into blade system, ripper system and operation system.
Blade system is composed of hydraulic tank (1), blade lift valve (2) built in hydraulic tank, blade tilt valve (3), blade lift cylinder (4), blade tilt cylinder (5), work equipment pump (6), hydraulic filter (7) and piping which connects these components.

D150A C8408 ~ 8420
D155A T15001 ~ 17000



61F001

D150A C8421 and up
D155A T17001 and up



61F029

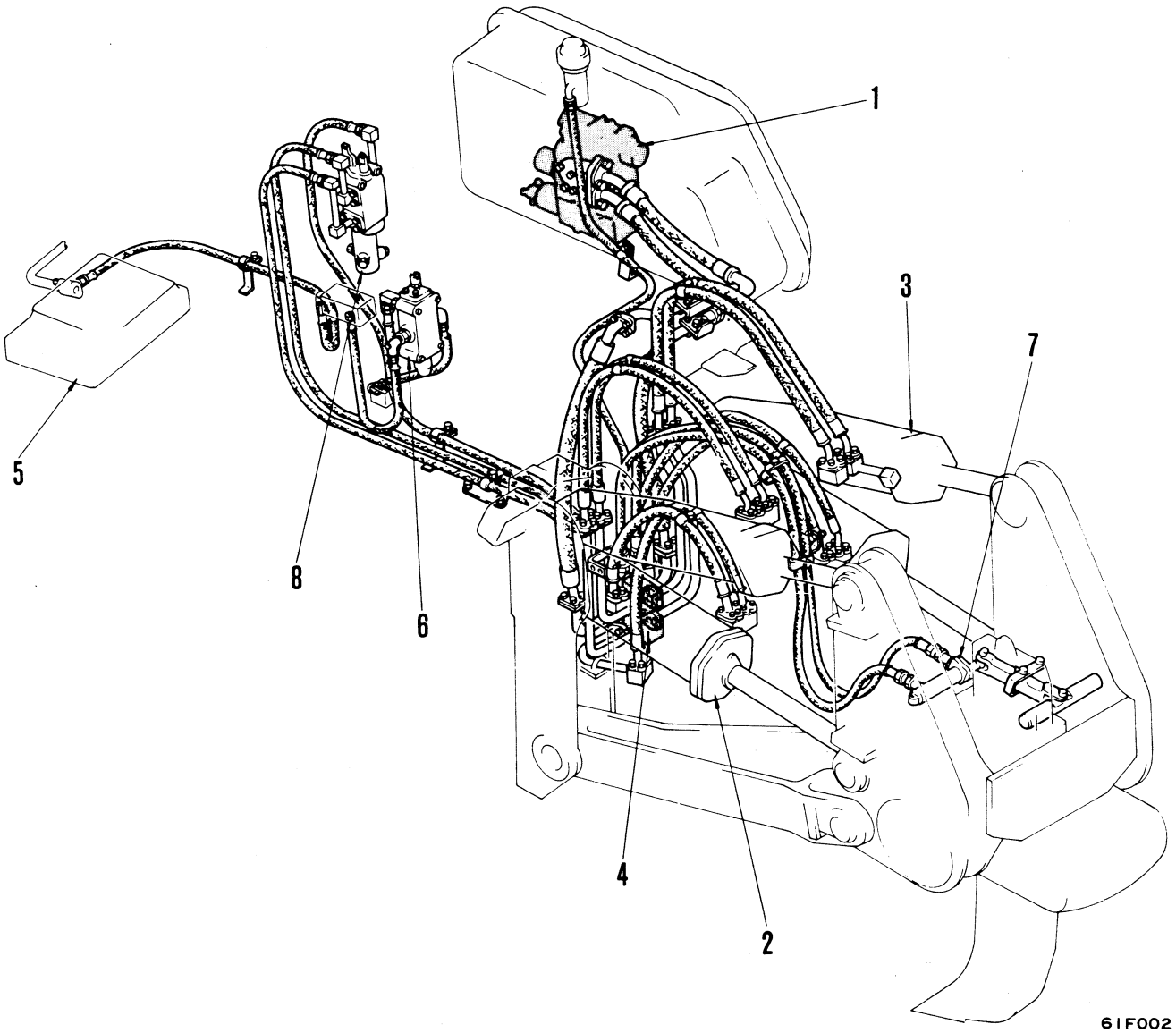
1. Hydraulic tank
2. Blade lift valve
3. Blade tilt valve
4. Blade lift cylinder
5. Blade tilt cylinder
6. Work equipment pump
7. Hydraulic filter

A. Plug for main relief pressure

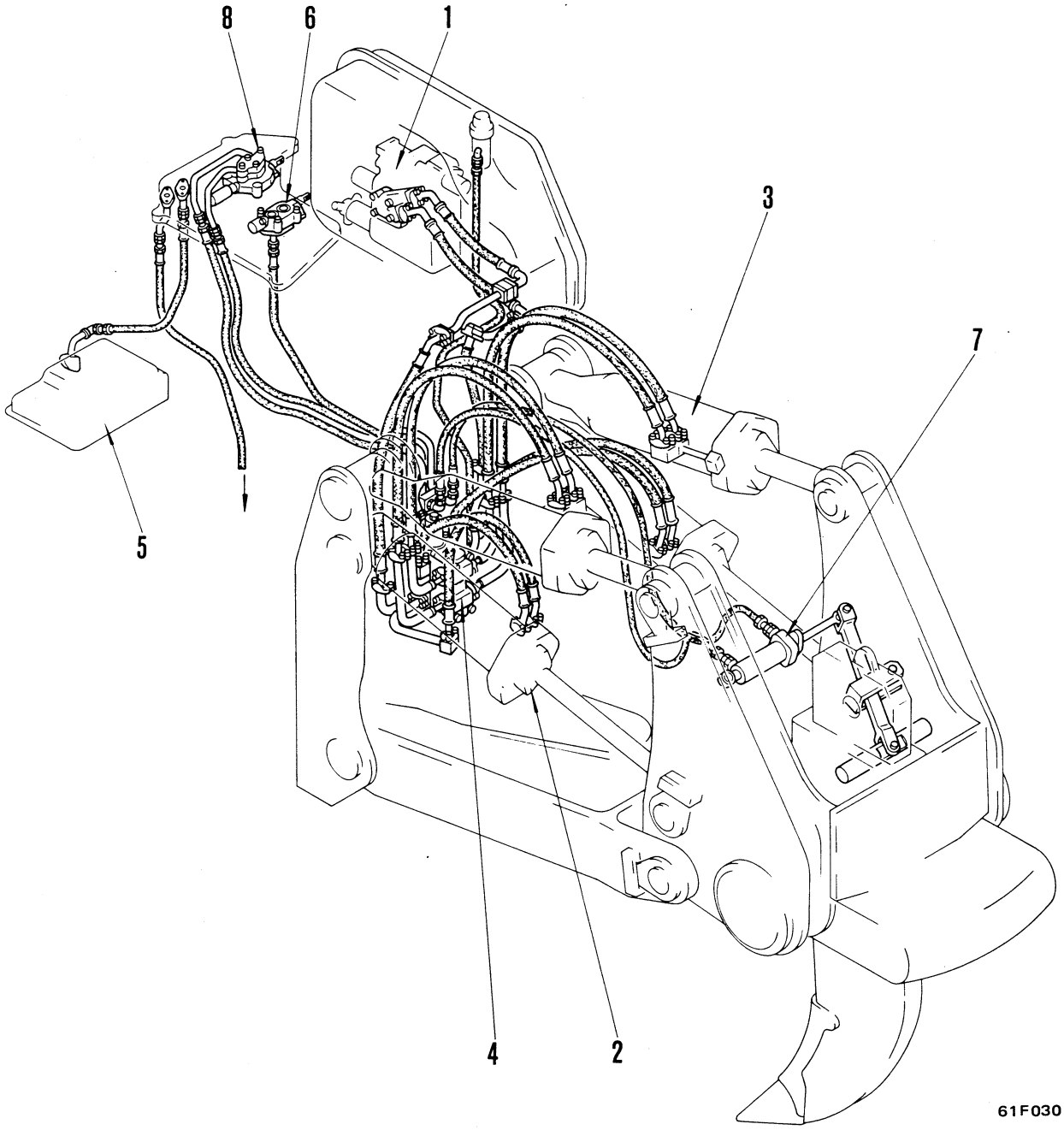
Ripper system is composed of ripper valve (1) built in hydraulic tank, selector valve (4) which distributes oil from ripper valve to ripper lift cylinder (2) and ripper tilt cylinder (3), pilot valve (6) which controls selector valve with oil in TORQFLOW circuit (D155A; steering circuit), pin puller cylinder (7) which is operated with oil in TORQFLOW circuit (D150A; steering circuit), pin puller valve (8) and piping which connects these components.

While in case of D155A TORQFLOW circuit oil pressure from transmission control valve (5) is used, in case of D150A, steering circuit oil pressure from steering control valve (9) is used and relief valve (10) is connected with pin puller circiuit.

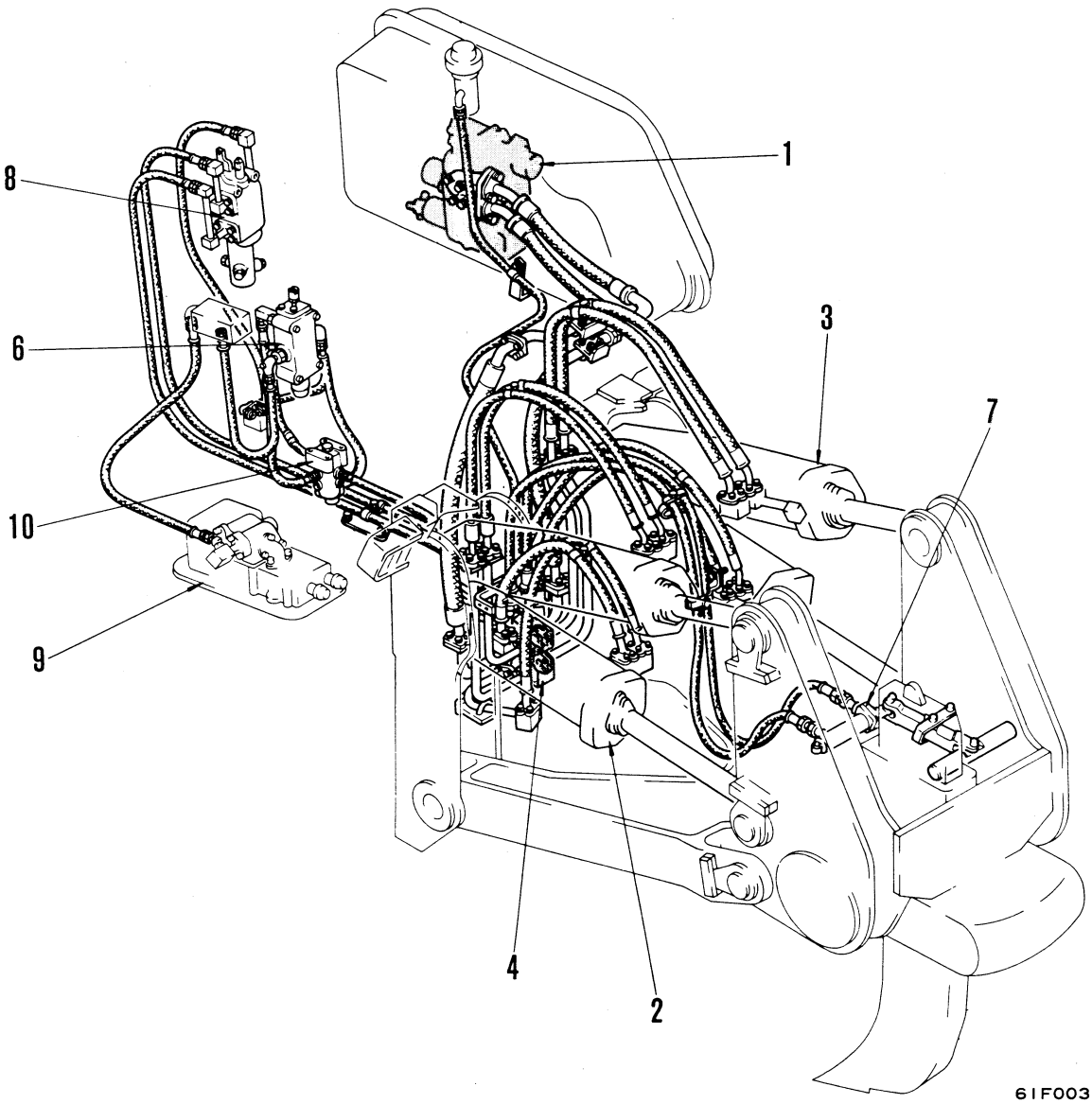
D155A (T15001 ~ 17000)



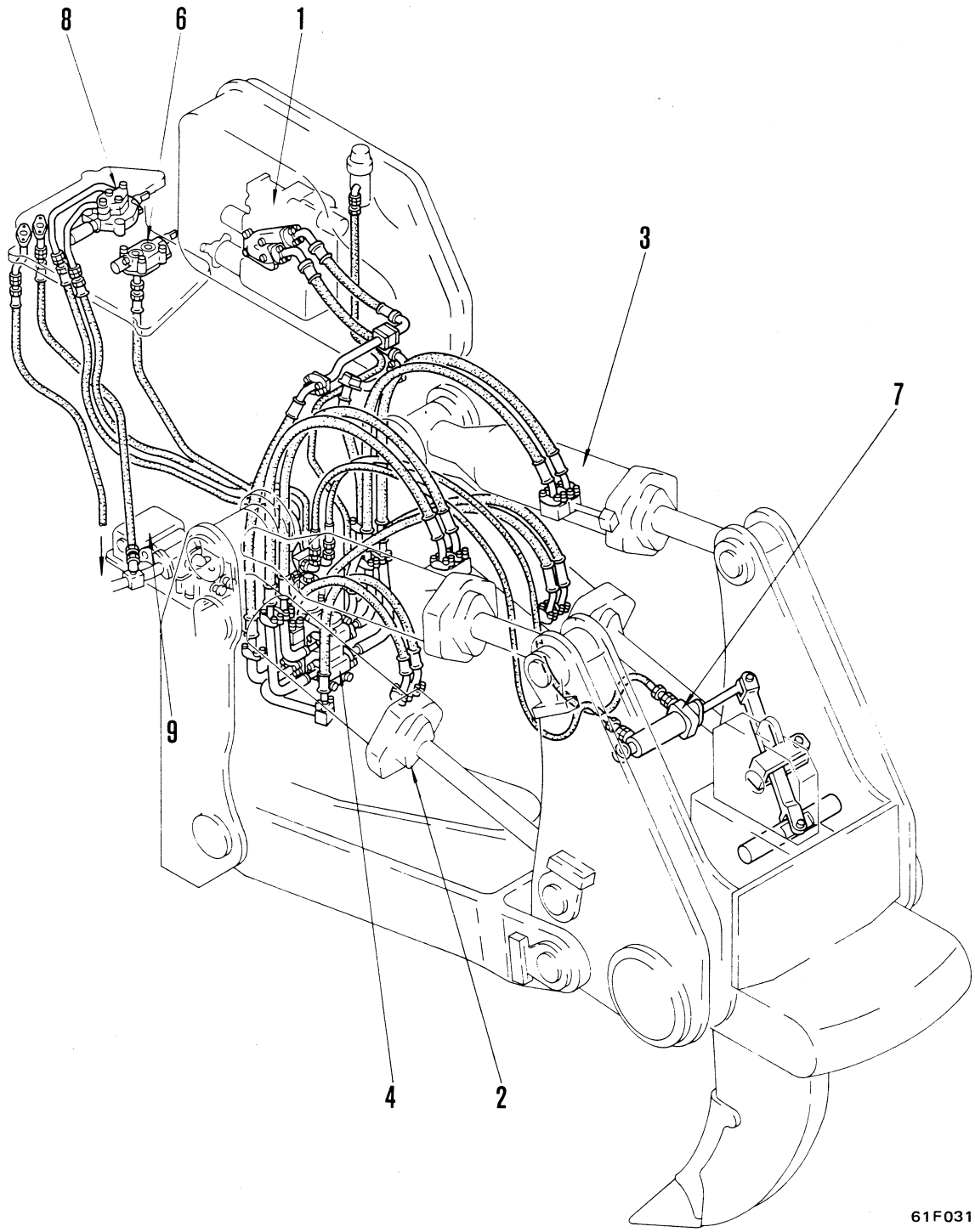
D155A T17001 and up



D150A (C8408 ~ 8420)

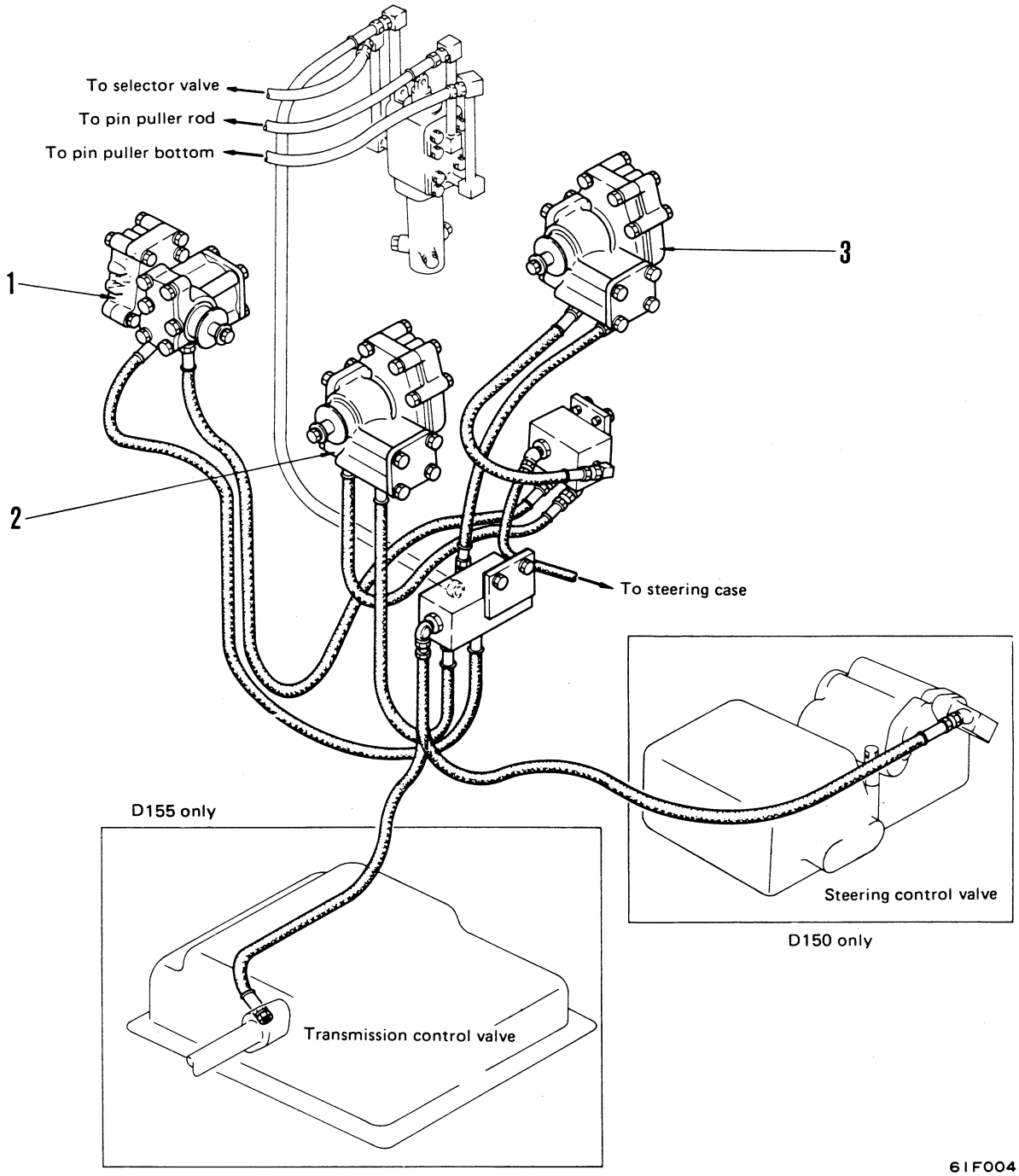


D150A C8421 and up

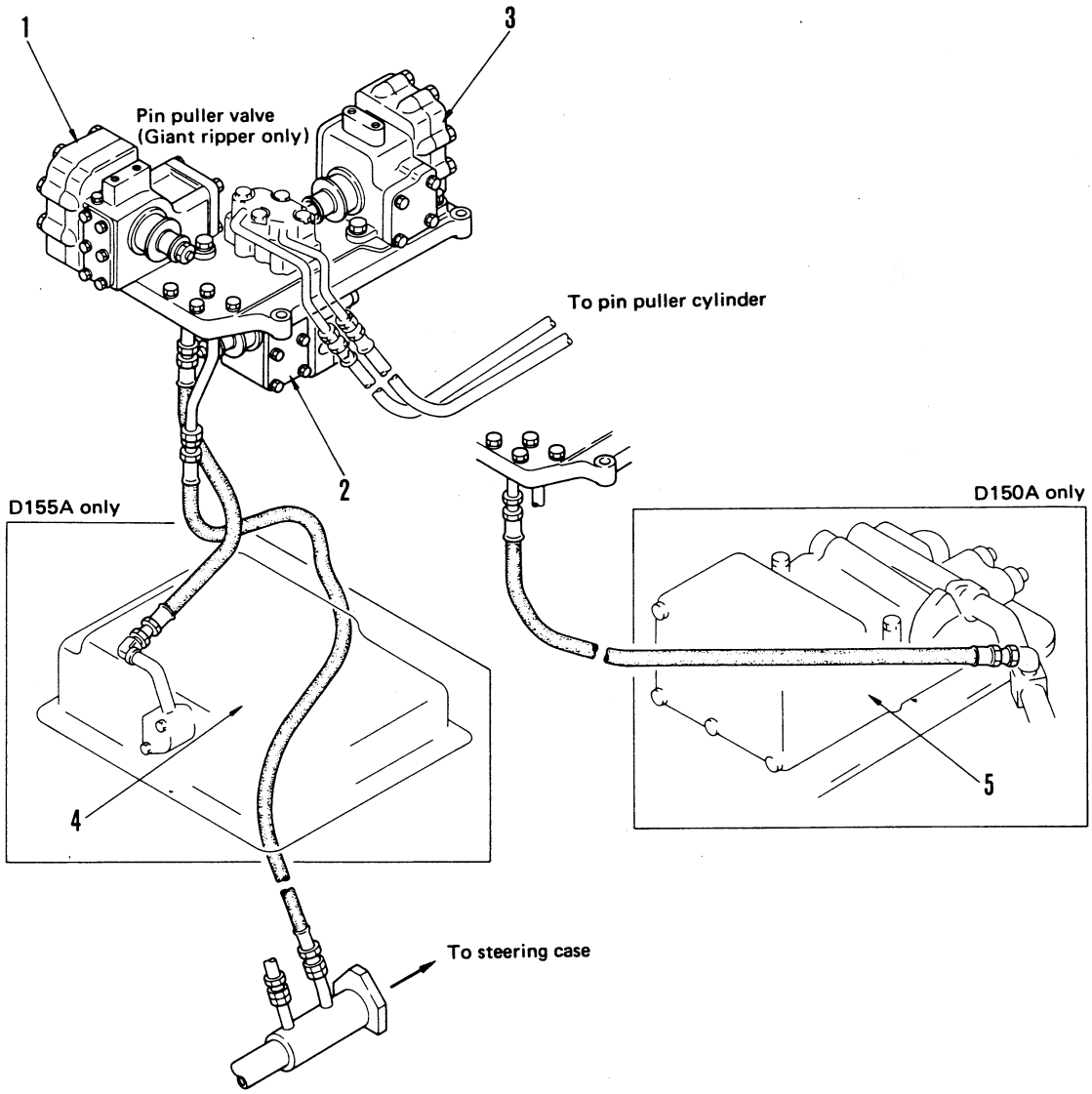


In order to decrease operating force of valve in hydraulic tank, operation system has lift survo valve (1), tilt survo valve (2) and ripper survo valve (3) which use TORQFLOW circuit oil pressure in D155A and steering circuit oil pressure in D150A respectively.

D150A C8408 ~ 8420
D155A T15001 ~ 17000

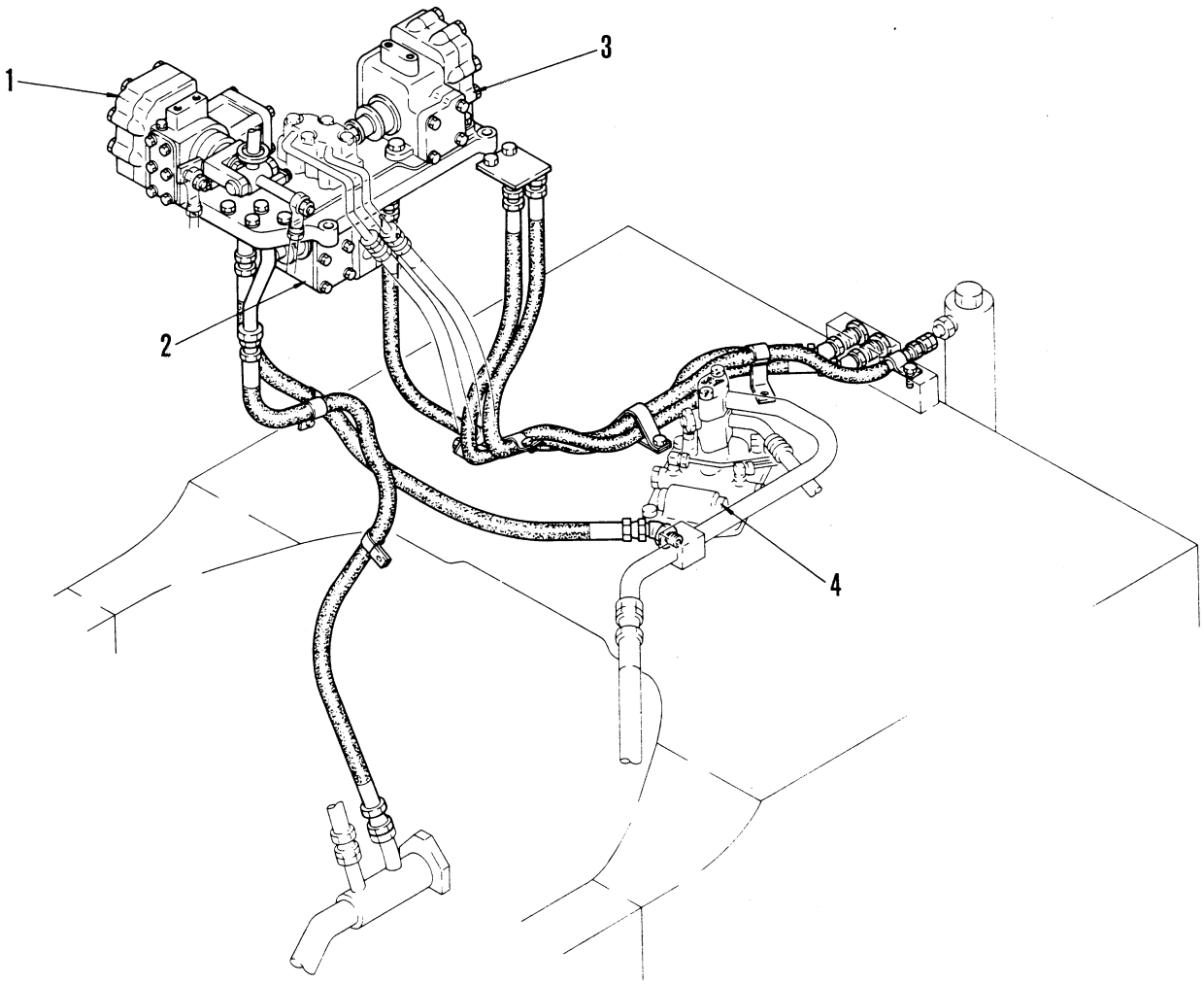


D150A 8421 and up
D155A 17001 ~ 25000



175F196-1

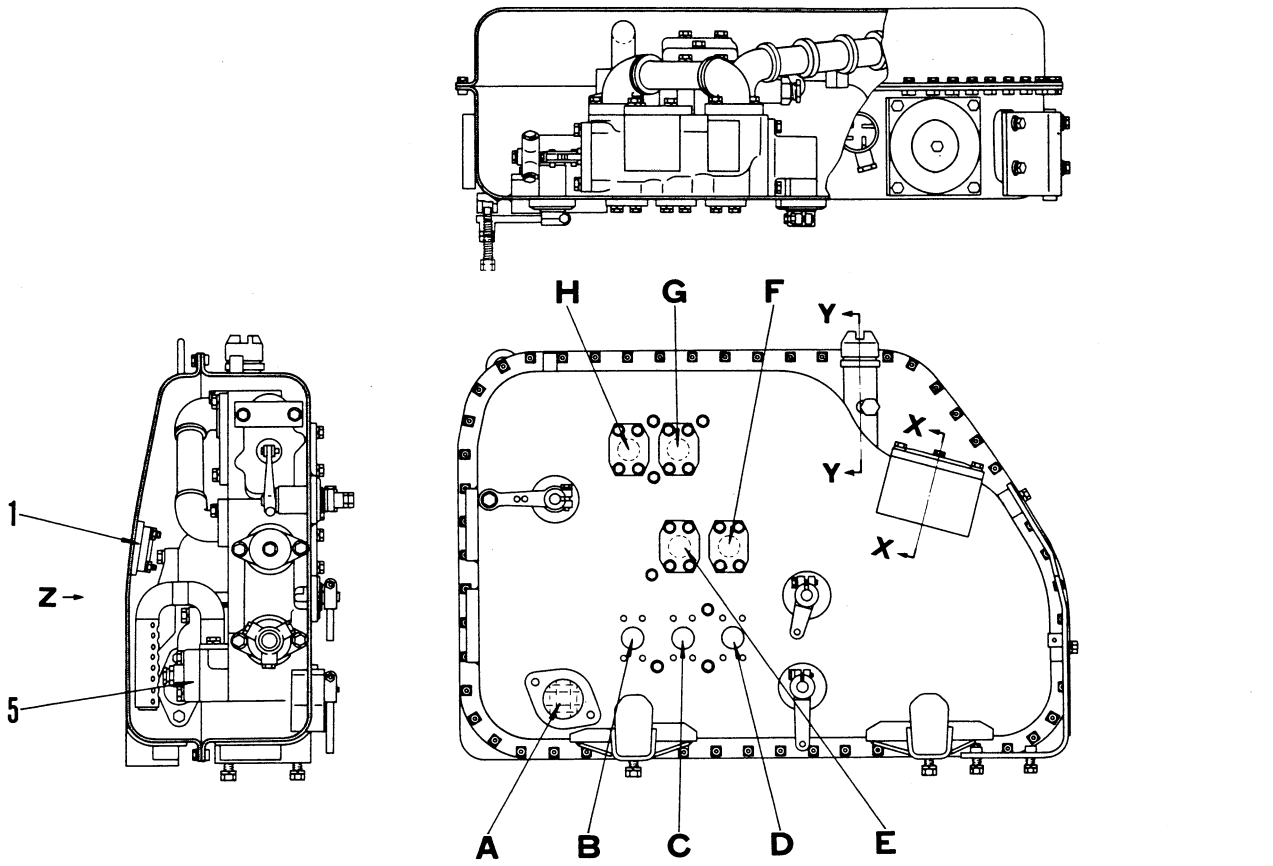
D155A 25001 and up

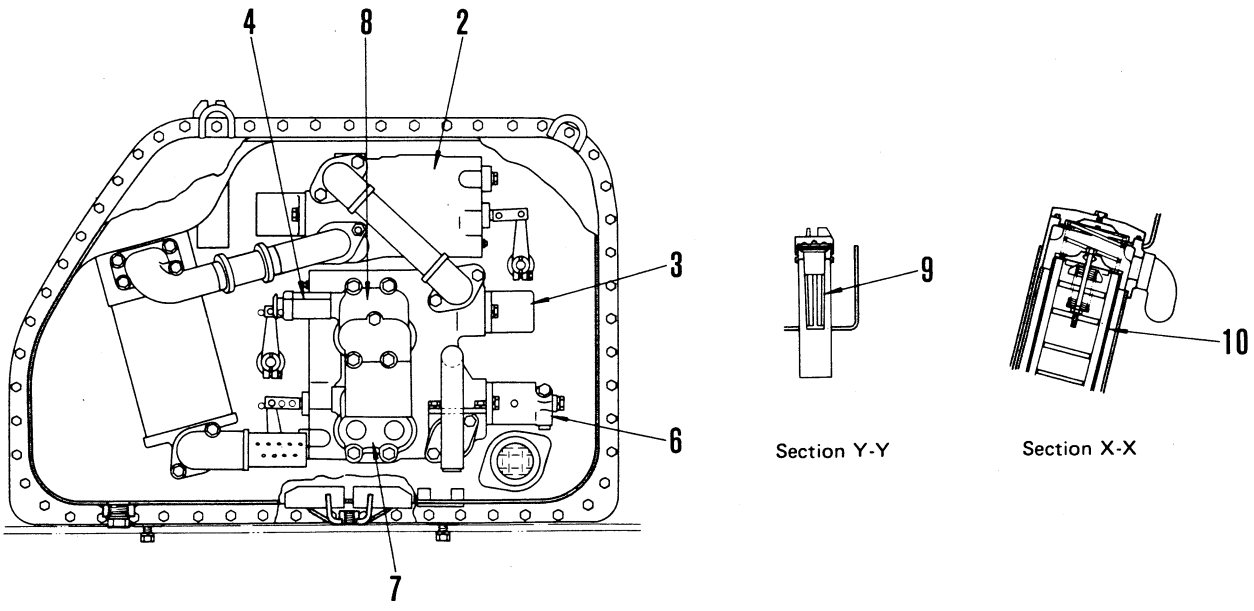


175F196-2

1. Servo valve for blade lift
2. Servo valve for blade tilt
3. Servo valve for ripper
4. Steering-brake interconnecting valve

HYDRAULIC TANK





View Z

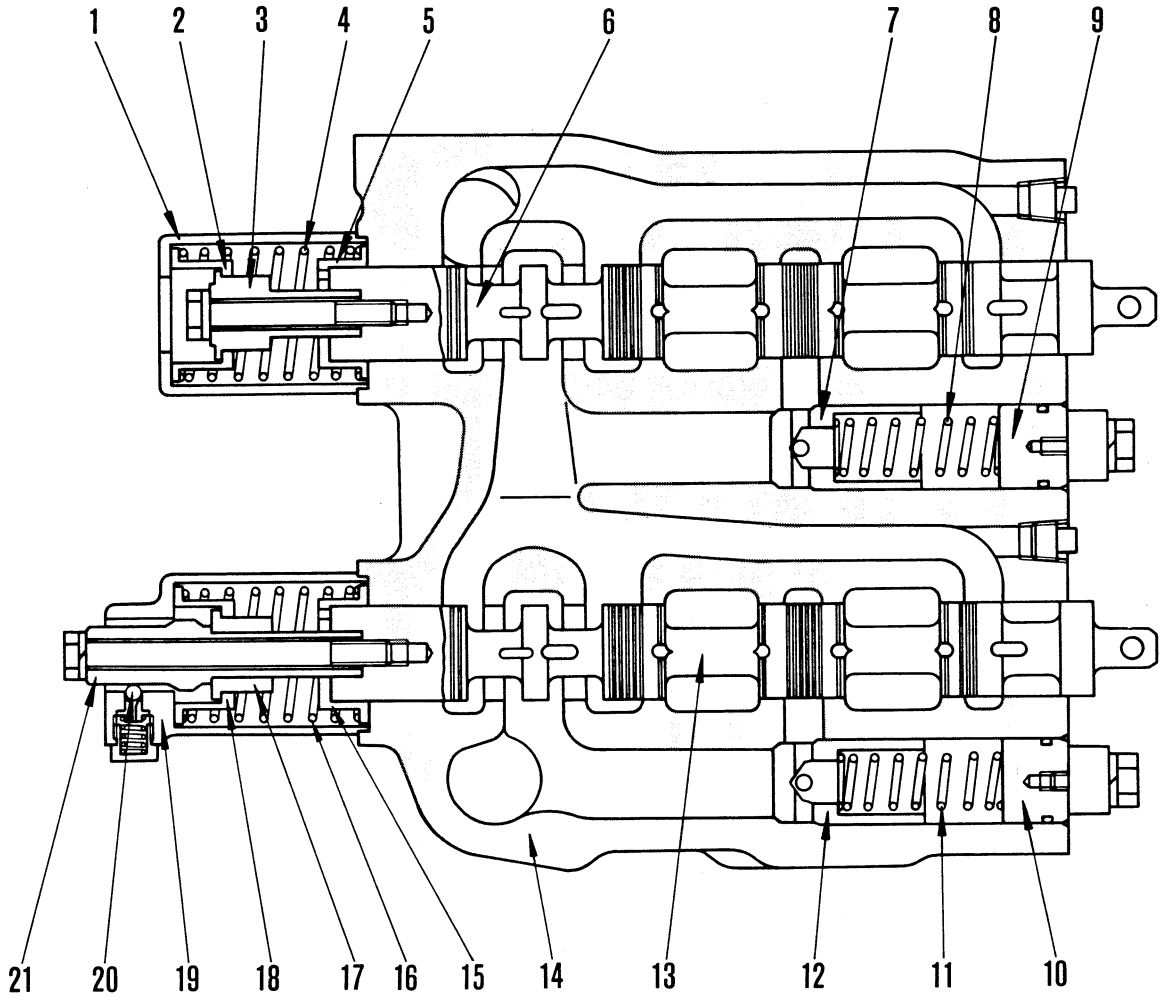
61F005

1. Oil level gauge
2. Tilt control valve
3. Ripper control valve
4. Ripper safety valve
5. Main relief valve
6. Lift control valve
7. Blade suction valve
8. Ripper suction valve
9. Strainer
10. Filter

A. To hydraulic pump
B. From hydraulic pump
C. To blade lift cylinder head
D. To blade lift cylinder bottom
E. To ripper cylinder head
F. To ripper cylinder bottom
G. To blade tilt cylinder bottom
H. To blade tilt cylinder head

HYDRAULIC CONTROL VALVE

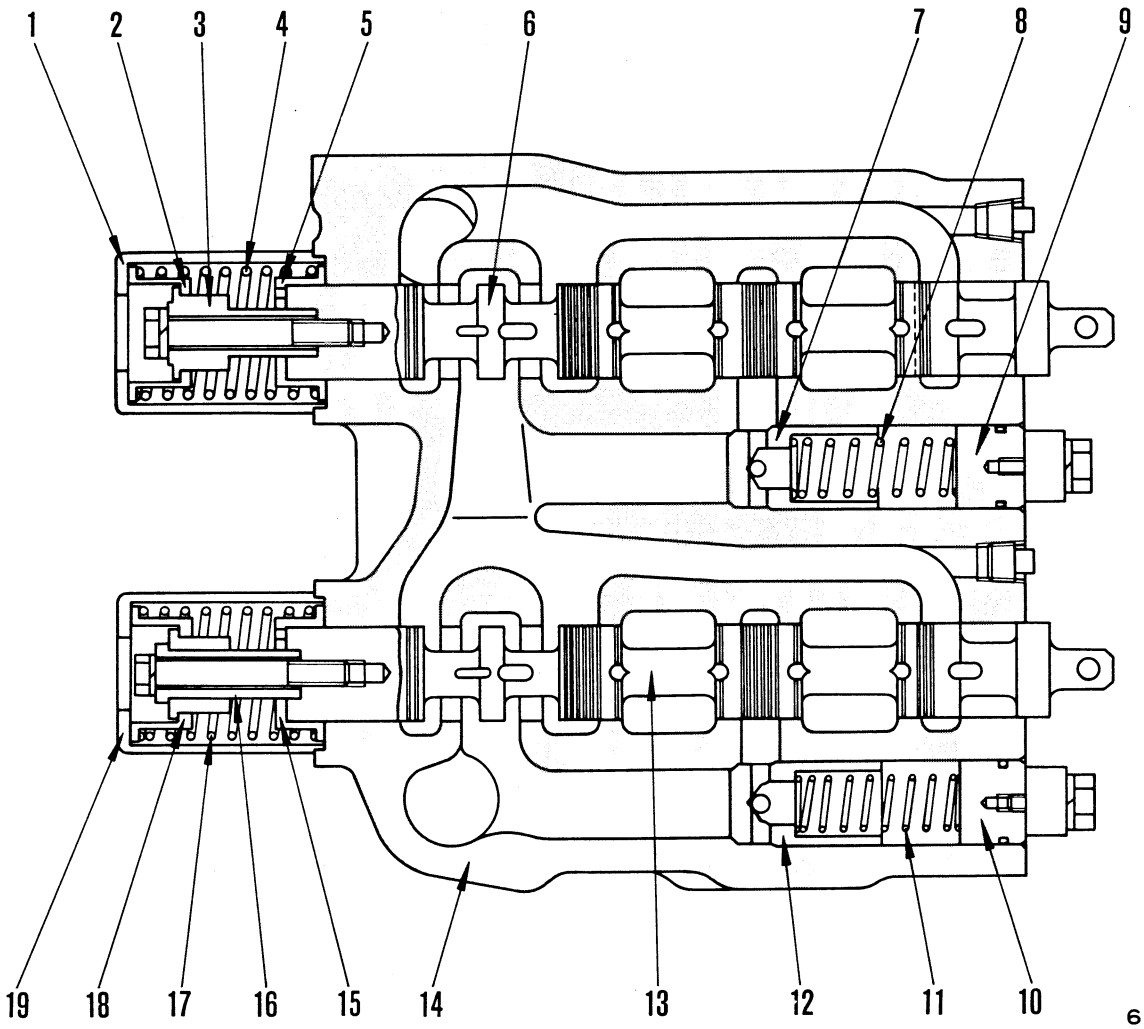
(1) Blade lift and ripper valve D150A C8408 ~ C8420
D155A T15001 ~ T17000



6IF014

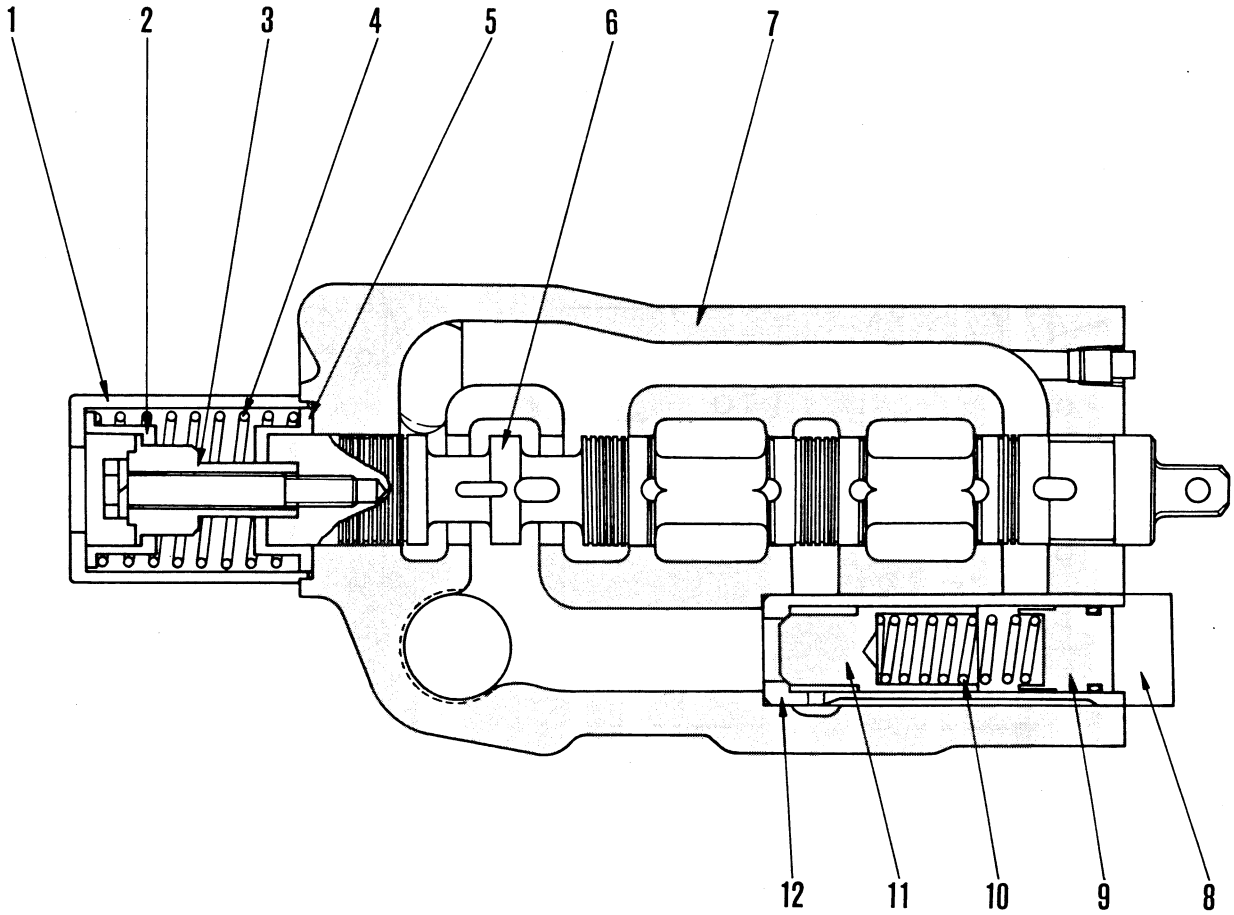
1. Case
2. Retainer
3. Collar
4. Spring
5. Retainer
6. Spool
7. Check valve
8. Spring
9. Seat
10. Seat
11. Spring
12. Check valve
13. Spool
14. Valve body
15. Retainer
16. Spring
17. Collar
18. Retainer
19. Case
20. Detent ball
21. Detent

(1) Blade lift and ripper valve D150A C8421 and up
D155A T17001 and up



1. Case
2. Retainer
3. Coller
4. Spring
5. Retainer
6. Spool
7. Check valve
8. Spring
9. Seat
10. Seat
11. Spring
12. Check valve
13. Spool
14. Valve body
15. Retainer
16. Collar
17. Spring
18. Retainer
19. Case

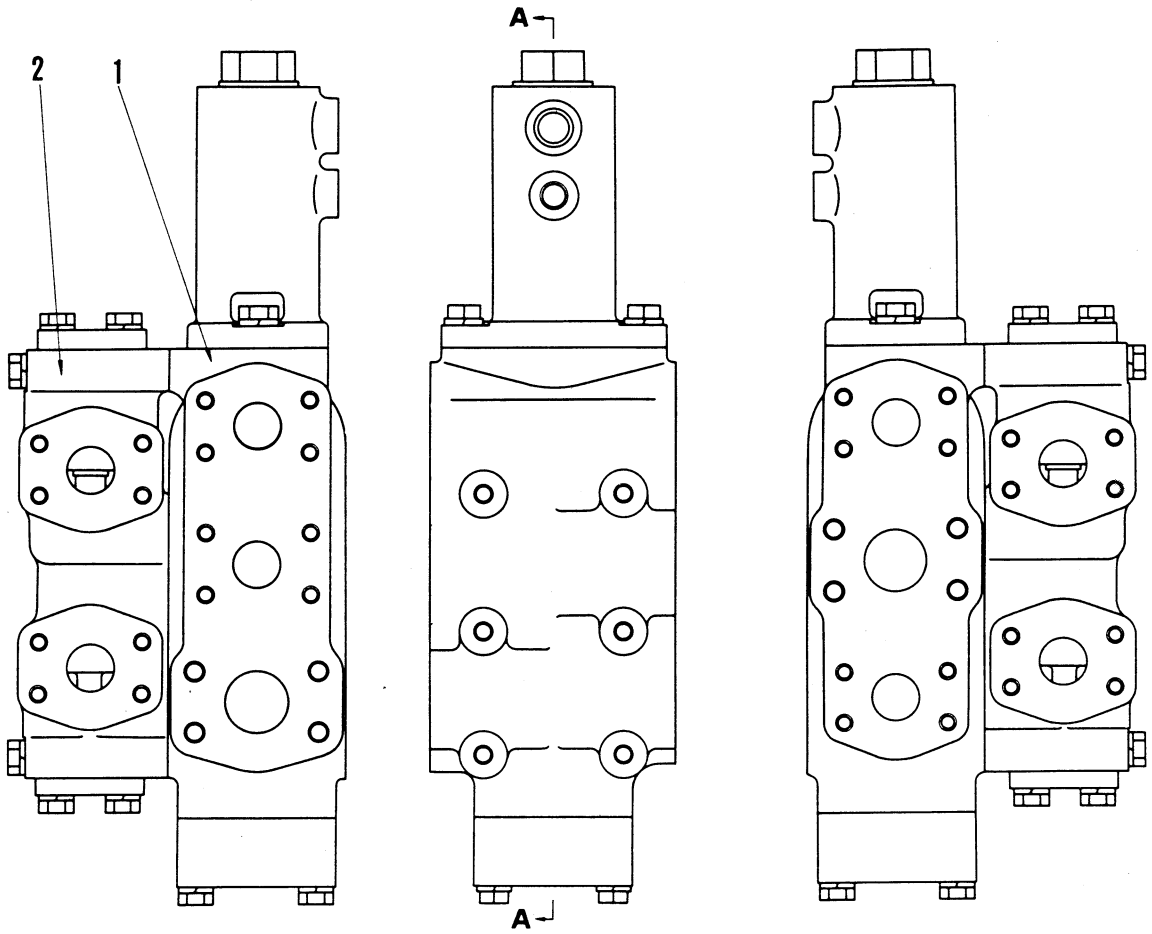
(2) Blade tilt control valve



61F016

1. Case
2. Retainer
3. Collar
4. Spring
5. Retainer
6. Spool
7. Valve body
8. Plate
9. Seat
10. Spring
11. Check valve
12. Collar

RIPPER SELECTOR VALVE AND PILOT CHECK VALVE



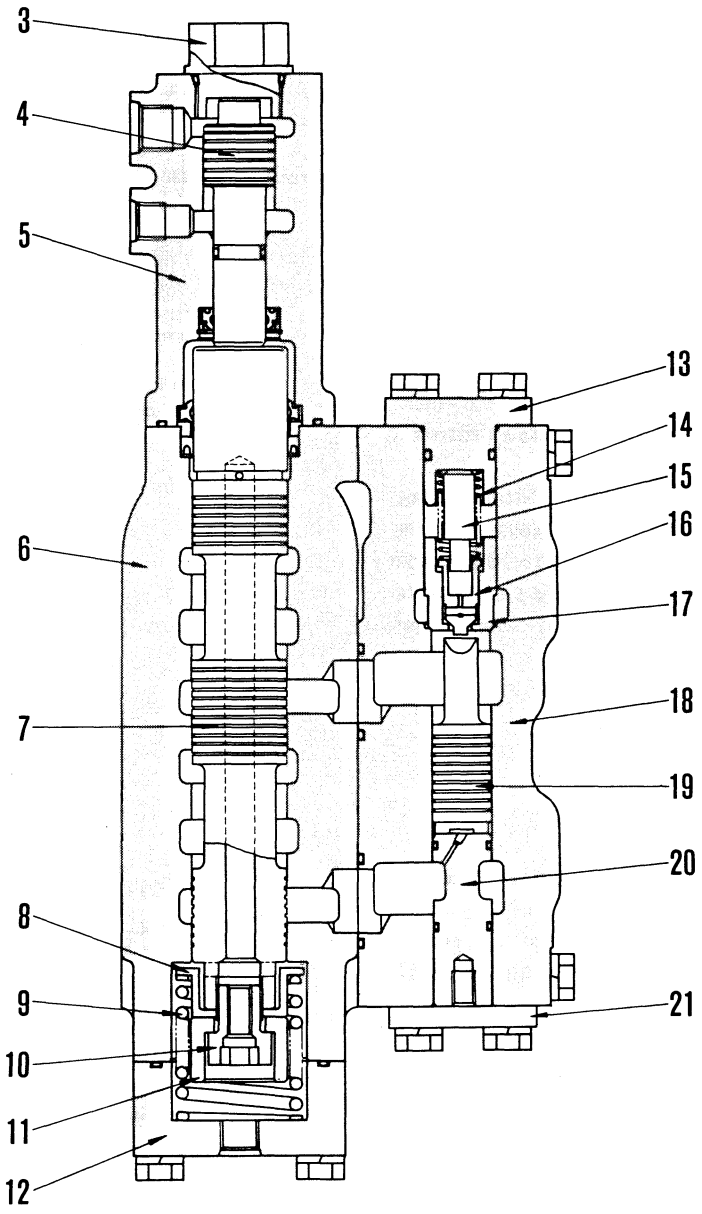
1. Ripper selector valve
2. Pilot check valve
3. Plug
4. Spool
5. Valve body
6. Valve body
7. Spool
8. Retainer
9. Spring
10. Plug
11. Retainer
12. Cover
13. Plug
14. Spring
15. Guide
16. Check valve
17. Check valve
18. Valve body
19. Piston
20. Plug
21. Cover

STRUCTURE AND FUNCTION

Ripper Selector Valve

The ripper selector valve is interposed between the ripper control valve and the two hydraulic circuits (the ripper lift cylinder circuit and the ripper tilt cylinder circuit). The selector valve at its original spool position connects with the ripper lift cylinder circuit. When the spool is moved, the selector valve connects with the ripper tilt cylinder circuit.

Therefore, the ripper selector valve acts as a two-circuit changeover valve. For this changeover operation, the selector valve is provided with a pilot check valve using steering circuit (or, in the case of D155A, TORQFLOW circuit) oil pressure.



Section A–A 61F026

Pilot Check Valve

The pilot check valve is at the inlet of the ripper tilt cylinder circuit and prevents the oil in the bottom of the tilt cylinder from flowing in reverse.

When ripping with the ripper tilt lever in the HOLD position, the ripper shank tip is subjected to an external force in the direction of the increase in digging angle. As the force acts on the tilt cylinder piston rod, the oil pressure on the bottom of the cylinder increases. If no pilot check valve is provided, oil will leak from the periphery of selector valve spool (7). The cylinder piston rod retracts with oil leakage to cause a gradual increase in the digging angle, and hinder normal ripping operations. With the pilot check valve installed, oil on the cylinder bottom can not flow in reverse, and thus a constant cutting angle is maintained.

FUNCTION OF RIPPER SELECTOR VALVE

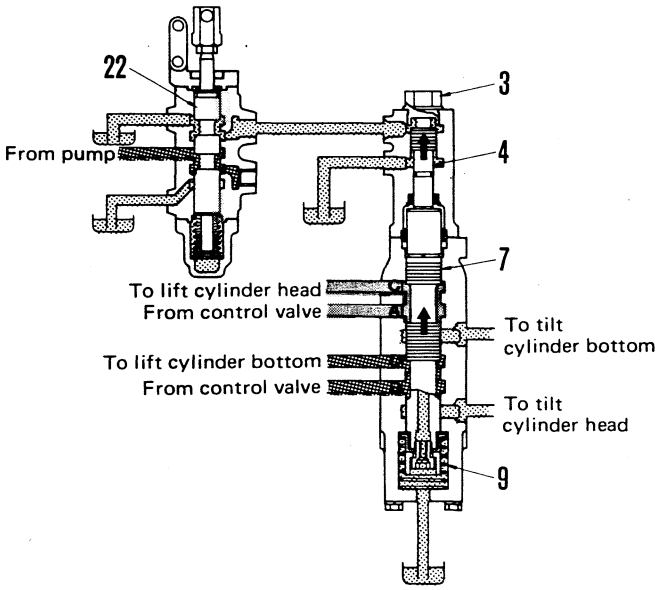
1. **Connecting the circuit of the ripper lift cylinder to the ripper control valve**

   As long as the ripper lifting/tilting changeover lever is not operated, the ripper selector valve spool (7) is pushed by the expansion force of spring (9) in the direction shown by the arrow ⬆ and, in turn, spool (4) is pushed against plug (3).

   Under this condition, when the ripper control lever is placed in the LIFT position, oil from the ripper control valve enters port **C** through port **A** and flows to the lift cylinder head to contract the piston rod.

   Meanwhile, oil at the bottom of the lift cylinder enters port **B** through port **D** and flows into the drain port of the ripper control valve.

   Therefore, as long as the ripper lifting/tilting changeover lever is not operated, the selector valve connects the lift cylinder circuit to the ripper control valve. The ripper lifting/tilting changeover lever is provided to operate the pilot valve (page 61-12-4).



61F027

2. **Connecting the circuit of the ripper tilt cylinder to the ripper control valve**

   When the ripper lifting/tilting changeover lever is operated, pilot valve spool (22) moves in the direction shown by the arrow ⬇.

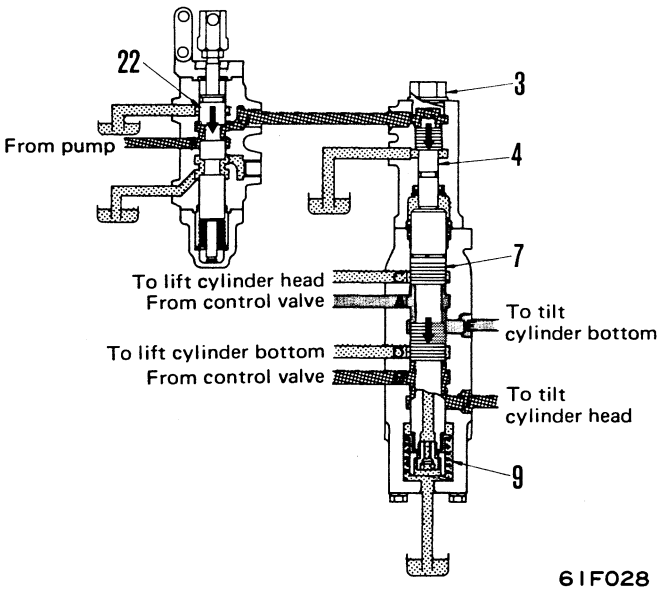
   Since the pilot valve is in the steering oil circuit (or, in the case of D155A, the TORQFLOW oil circuit), oil from the pump enters port **J** through port **I** and flows into port **G** of the selector valve to move the spool (4) in the direction shown by the arrow ⬇.

   Spool (4), in turn, moves selector valve spool (7) in the same direction to compress spring (9).

   Under this condition, when the ripper control lever is placed in the digging angle DECREASE position, oil from the ripper control valve enters port **E** through port **A** and flows to the tilt cylinder bottom to make the piston rod protrude. Meanwhile, at the tilt cylinder head side enters port **B** through port **F** and flows to the ripper control valve drain port.

   Therefore, when the ripper lifting/tilting changeover lever is operated, the selector valve connects the tilt cylinder circuit to the ripper control valve.

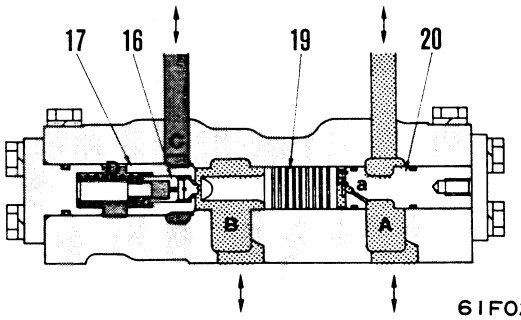
   To operate the ripper lifting/tilting changeover lever, it is necessary to grasp both the ripper control lever and the ripper lifting/tilting changeover lever.



61F028

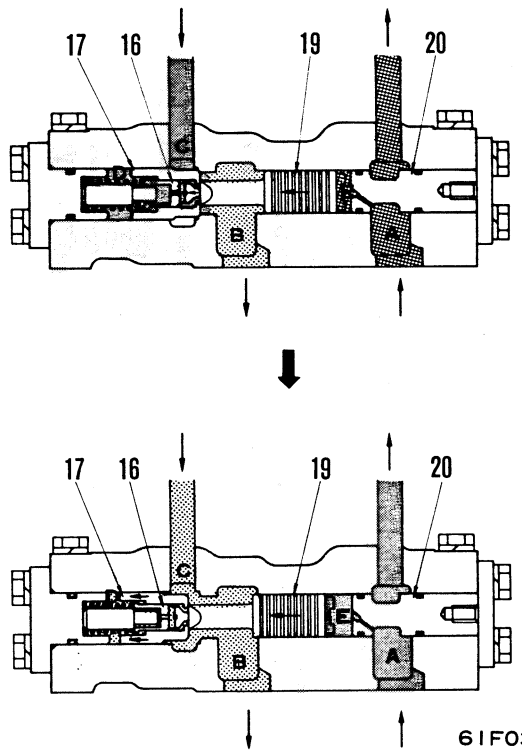
FUNCTION OF PILOT CHECK VALVE

Port **A** of the pilot check valve is connected to the ripper tilt cylinder head. It leads to port **E** through orifice **a**.
Port **B** connects with port **C** and port **D** when the check valve is opened.
Port **C** is connected with the bottom of the ripper tilt cylinder.
It leads to port **D** through the orifice.



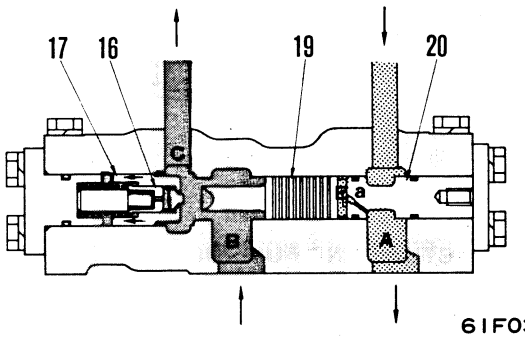
61F029

1. **Ripper digging angle INCREASE**
   When both the ripper control lever and the ripper lifting/tilting changeover lever are placed in the digging angle INCREASE position, oil from the control valve enters port **A** and flows to the tilt cylinder head. As soon as the cylinder head circuit is filled with oil, the oil pressure starts rising.
   With the increase in oil pressure, the oil passing through orifice **a** enters port **E** and pushed piston (19) in the direction shown by the arrow ⬅.
   Pistong (19) first pushes check valve (16), opening the passage between port **D** and port **B**, to relieve the oil pressure at the bottom of the cylinder. Then, the piston pushes check valve (17).
   Since the outer diameter of check valve (17) is larger than that of piston (19), the piston pressure is not large enough to push the check valve. To open check valve (17), threfore, it is necessary to use check valve (16) to relieve the back pressure of check valve (17) before opening check valve (17).



61F030

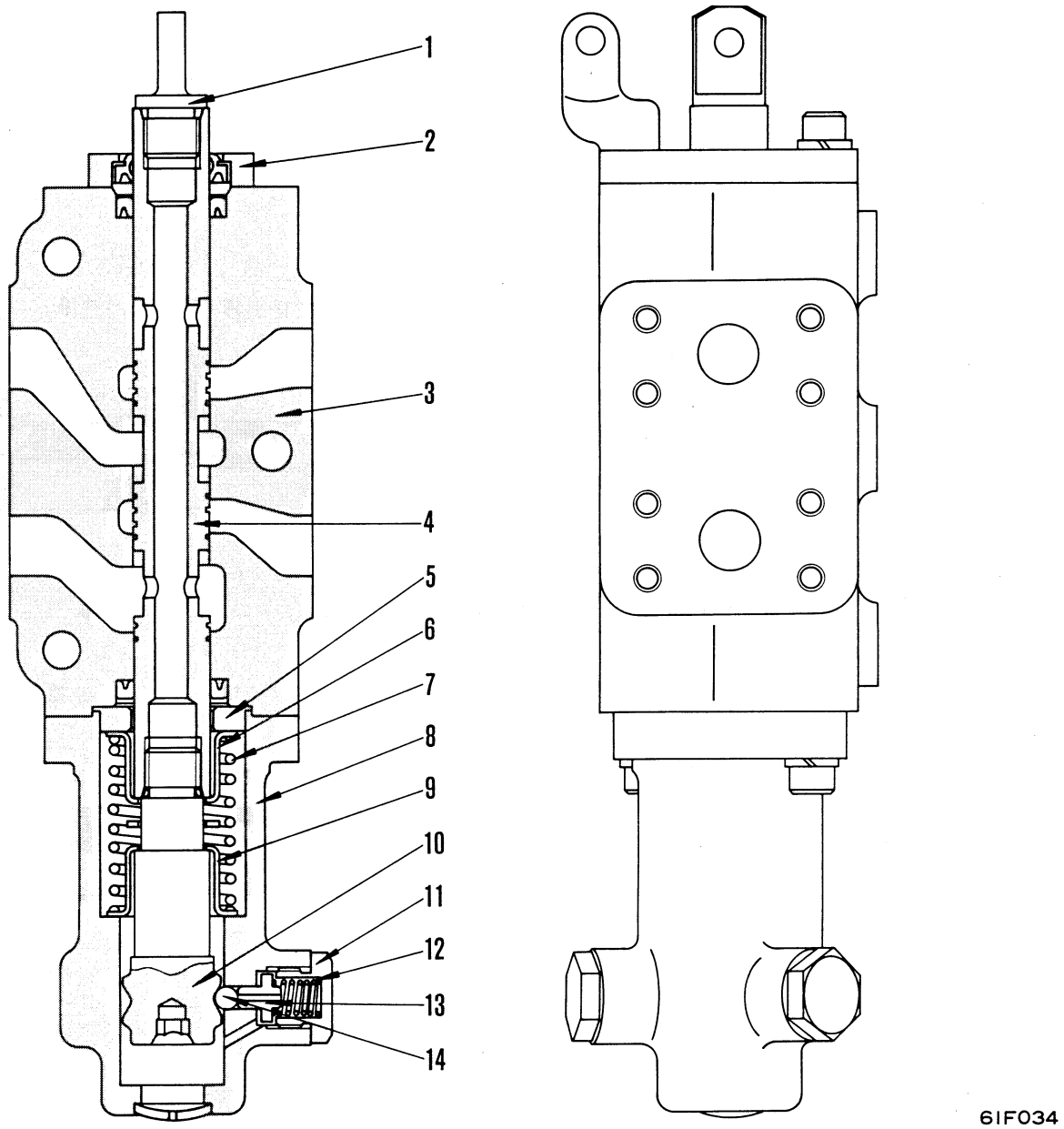
2. **Ripper digging angle DECREASE**
   When both the ripper control lever and the ripper lifting/tilting changeover lever are placed in the digging angle DECREASE position, oil from the control valve enters port **B**.
   After the oil pressure becomes large enough to compress spring (14), check valves (16) and (17) open and oil flows through port **C** to the bottom of the tilt cylinder. Oil from the tilt cylinder head enters port **A** and flows to the control valve drain port.



61F031

PIN PULLER VALVE

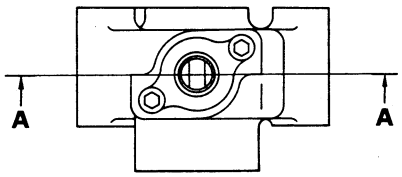
D150A C8408 ~ C8420
D155A T15001 ~ T17000

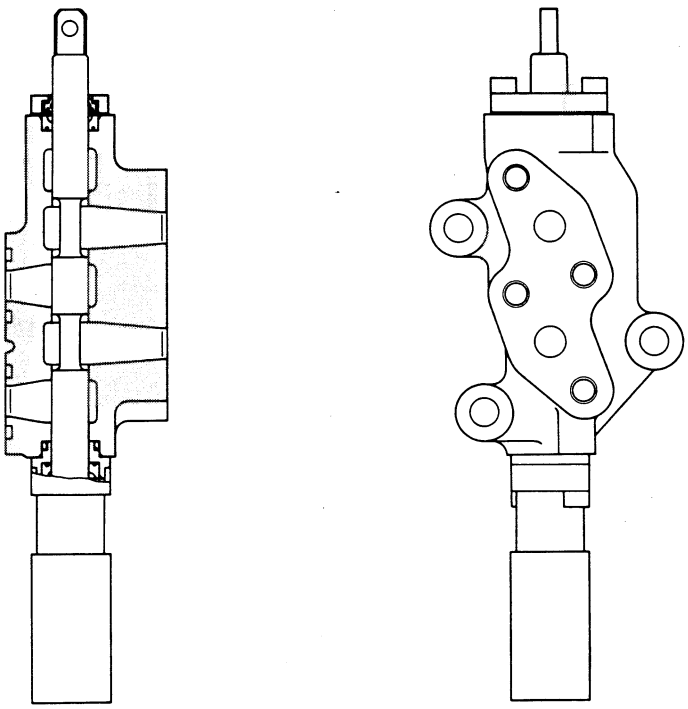


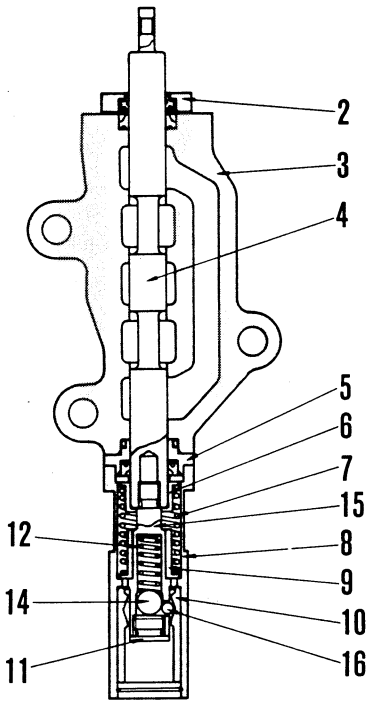
STRUCTURE AND FUNCTION

For the giant ripper, the pin puller control lever is used to withdraw or insert the shank mounting pin when changing the shank position. The pin puller control lever is for controlling the pin puller cylinder and the link. The pin puller cylinder is actuated by the steering circuit oil (for D150A) or TORQFLOW circuit oil (for D155A), which is fed through the pin puller valve.
The pin puller valve includes a built-in detent mechanism which serves to keep the cylinder operating even if the control lever is released during pin puller operation.

D150A 8421 and up
D155A 17001 and up







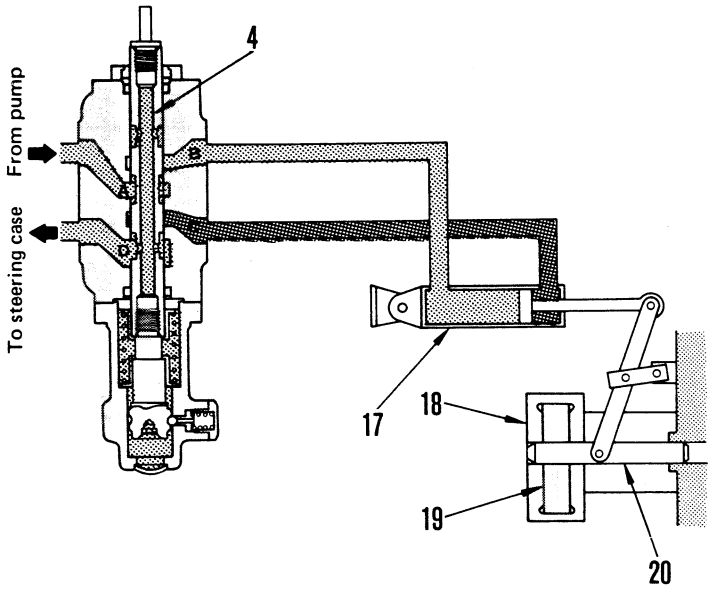
Section A-A

61F035

1. Plug
2. Cover
3. Valve body
4. Spool
5. Spacer
6. Retainer
7. Spring
8. Case
9. Retainer
10. Detent
11. Plug
12. Detent spring
13. Guide
14. Detent ball
15. Plug
16. Detent ball

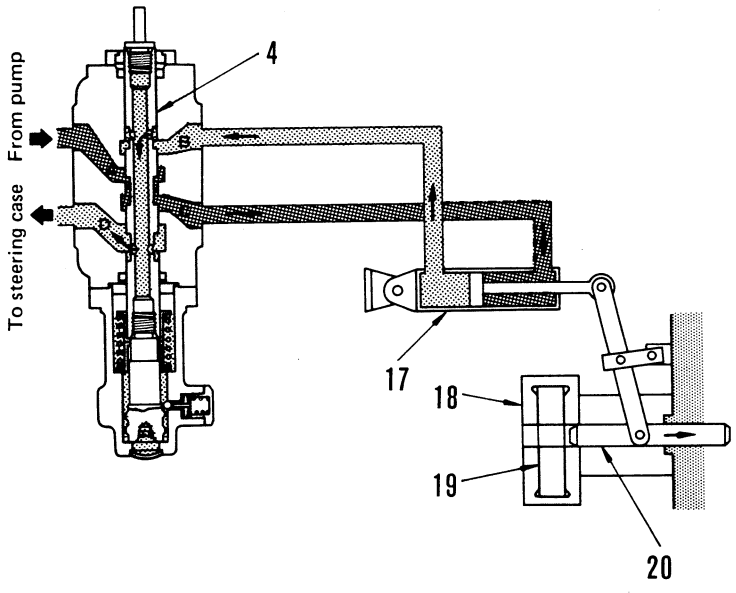
FUNCTION

1. **Pin puller control lever – "HOLD"**
   Oil from the pump enters the pin puller valve at port **A**.
   Oil from pin puller cylinder (17) leaves the pin puller valve at port **D** and drains into the steering case.
   At the HOLD position of the pin puller control lever, port **A** is disconnected from port **B** and port **C**, while port **D** is disconnected from port **B** and port **C**.
   This prevents oil from entering and leaving the cylinder, thus causing the piston rod to remain at its current position.



61F036

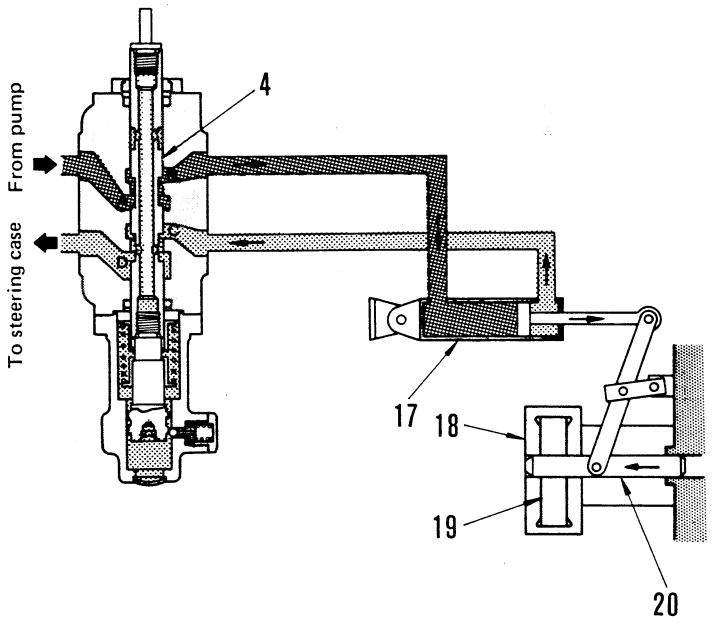
2. **Pin puller control lever – "EXTRACTION"**
   When the pin puller control lever is placed in the EXTRACTION position, spool (4) moves in the direction shown by the arrow ⬇.
   As port **A** connects with port **C**, oil from the pump flows to the head of pin puller cylinder (17) to retract the piston rod. This causes the link to extract shank mounting pin (20) from the shank.
   The detent mechanism at the tip of spool (4) serves to keep the pin puller control lever in the EXTRACTION position even after the lever is released.



61F037

17. Pin puller cylinder
18. Beam
19. Shank
20. Shank mounting pin

3. **Pin puller control lever – "INSERT"**
When the pin puller control lever is placed in the INSERT position, spool (4) moves in the direction shown by the arrow ⬆.
As port **A** connects with port **B**, oil from the pump flows to the bottom of pin puller cylinder (17) to make the piston rod protrude.
This causes the link to insert shank mounting pin (20) into the shank.
The detent mechanism at the tip of spool (4) serves to keep the pin puller control lever in the INSERT position even after the lever is released.

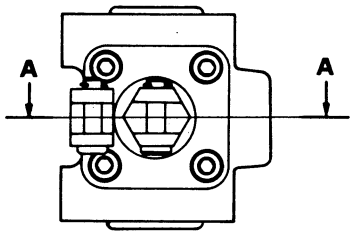


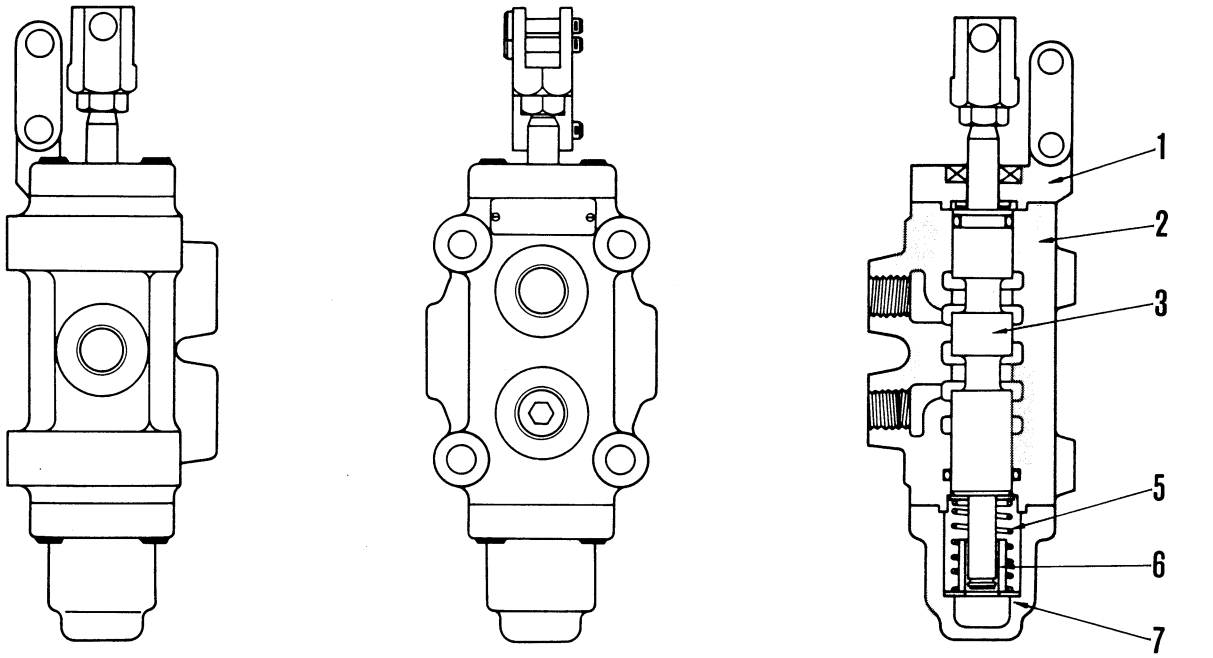
61F038

17. Pin puller cylinder
18. Beam
19. Shank
20. Shank mounting pin

PILOT VALVE

D150A C8408 ~ C8420
D155A T15001 ~ T17000





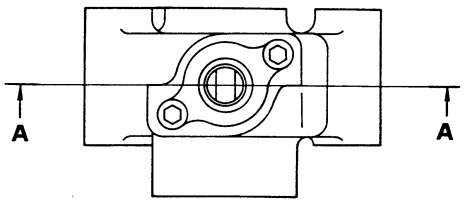
Section A–A

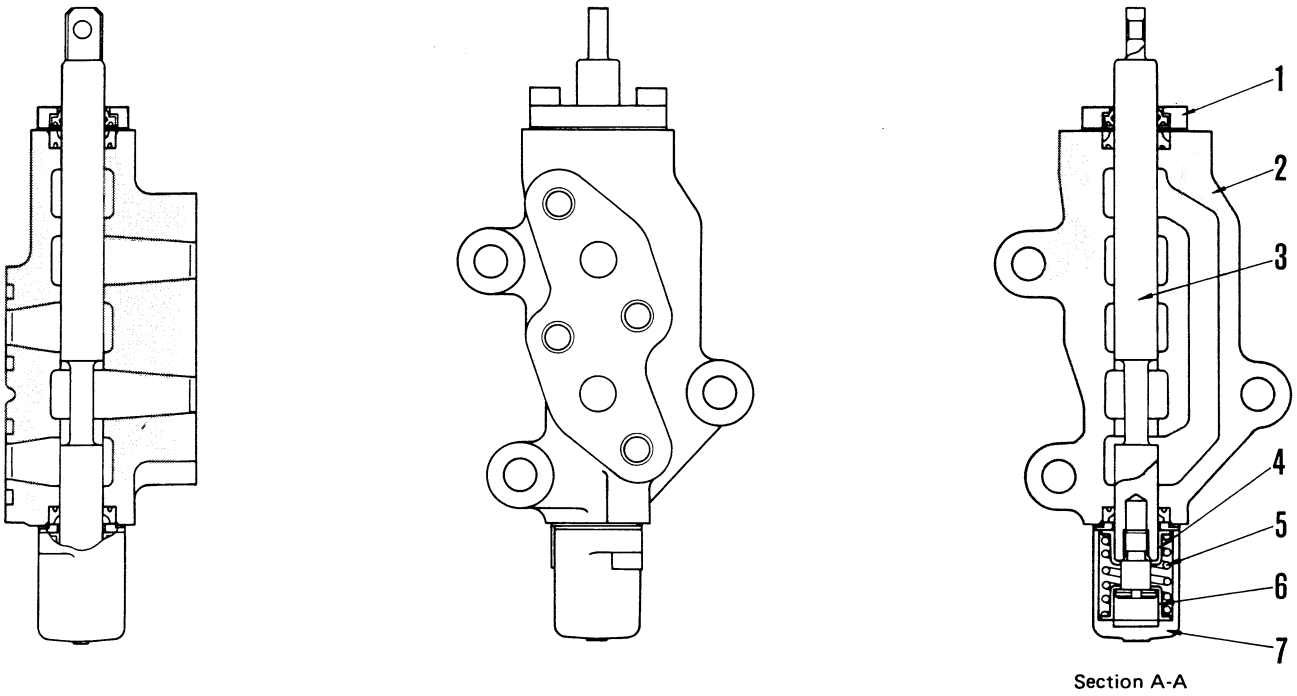
61F032

STRUCTURE AND FUNCTION

The pilot valve uses hydraulic pressure in the steering oil circuit (or, in the case of D155A, the TORQFLOW oil circuit) to move the ripper selector valve spool so that the ripper control valve is connected to either the ripper lift cylinder circuit or the ripper tilt cylinder circuit.
Spool (3) is linked to the ripper lifting/tilting changeover lever on the front of the operator's seat.

D150A C8421 and up
D155A T17001 and up





Section A-A

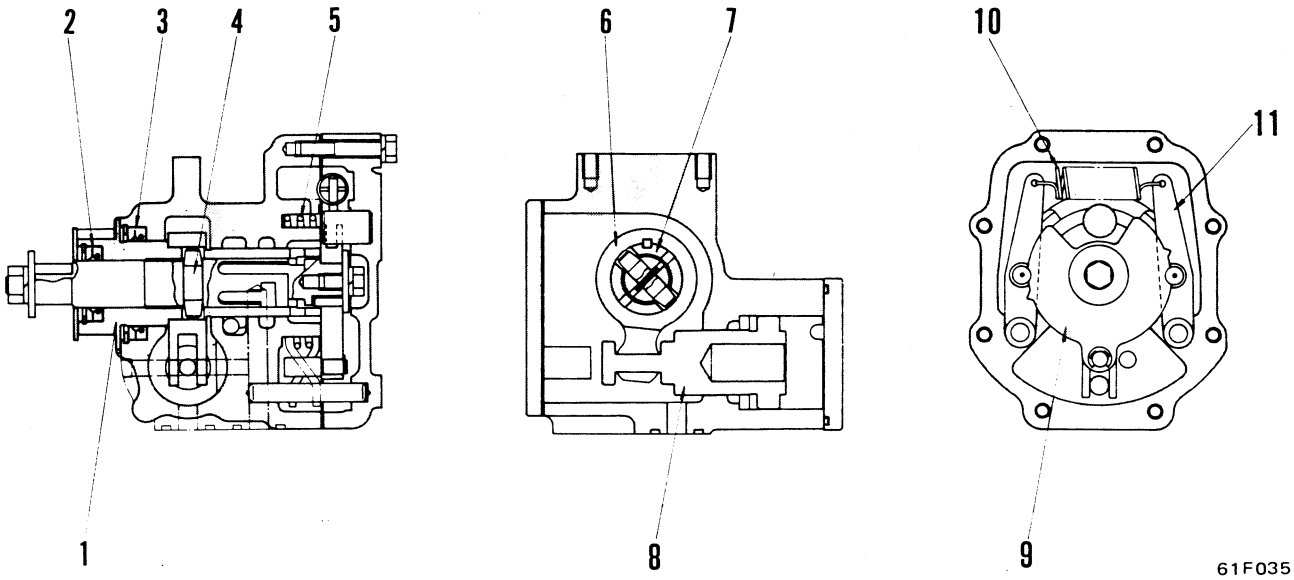
61F033

1. Cover
2. Valve body
3. Spool
4. Retainer
5. Spring
6. Retainer
7. Case

ROTARY SERVO VALVE

(1) BLADE LIFT

D150A C8421 and up
D155A T17001 and up

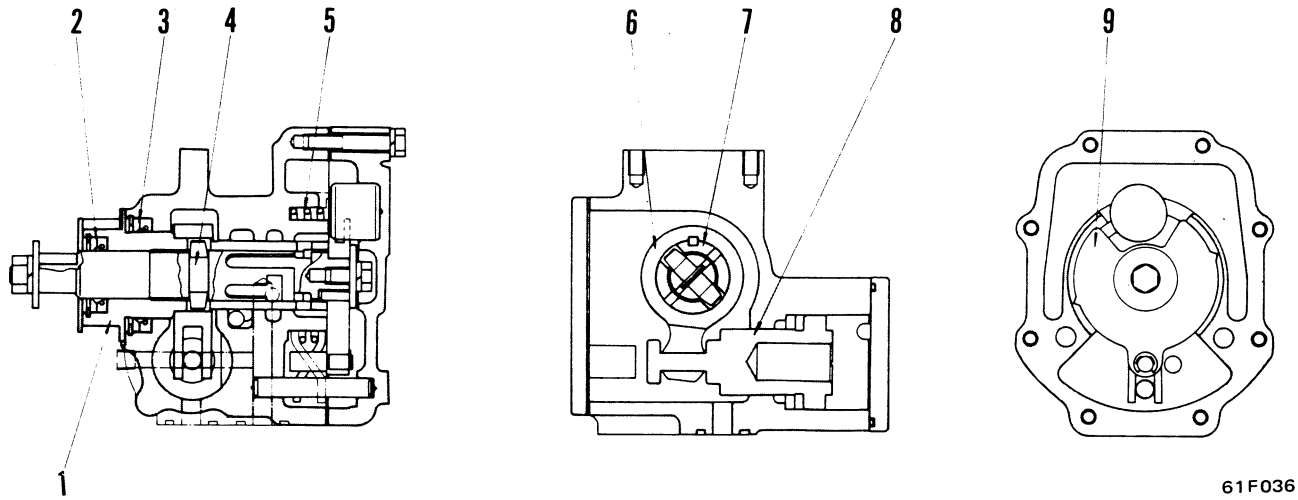


61F035

1. Sleeve
2. Oil seal
3. Oil seal
4. Pin
5. Spring
6. Lever
7. Rotor
8. Piston
9. Detent
10. Spring
11. Lever

(2) BLADE TILT AND RIPPER

D150A C8421 and up
D155A T17001 and up

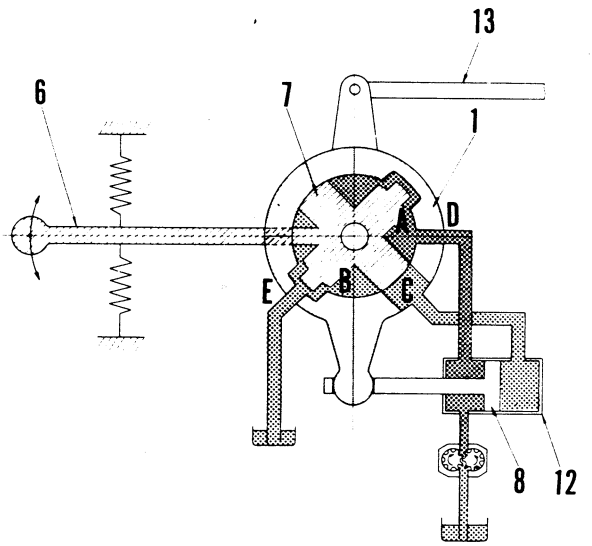


61F036

The rotary valve decreases the operating force of the control valve. It is possible to inching-control under changes of the oil pressure, oil temperature or load (main valve operating force).
It also comes equipped with a pin (4) which allows the control valve to be operated manually during emergencies (stop of the oil pressure or engine).
The rotary servo valve is composed of the following: the valve body, sleeve (1), pin (4), lever (6), rotor (7), piston (8), and cylinder (12) which uses the valve body. The blade lift rotary servo valve also comes equipped with a detent (9) used for float control.

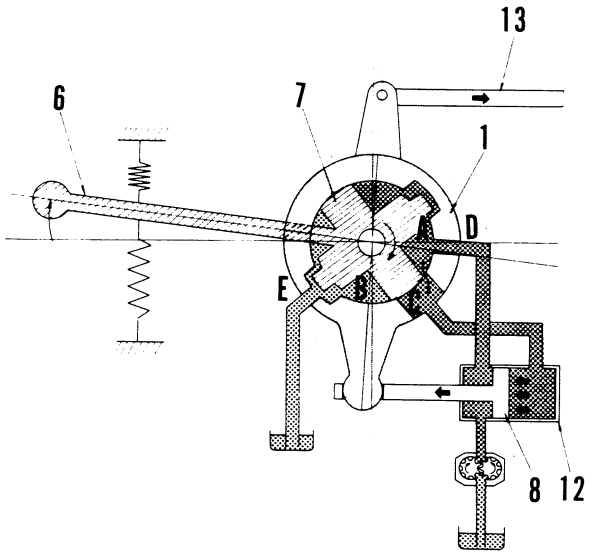
(3) FUNCTION

1) Neutral

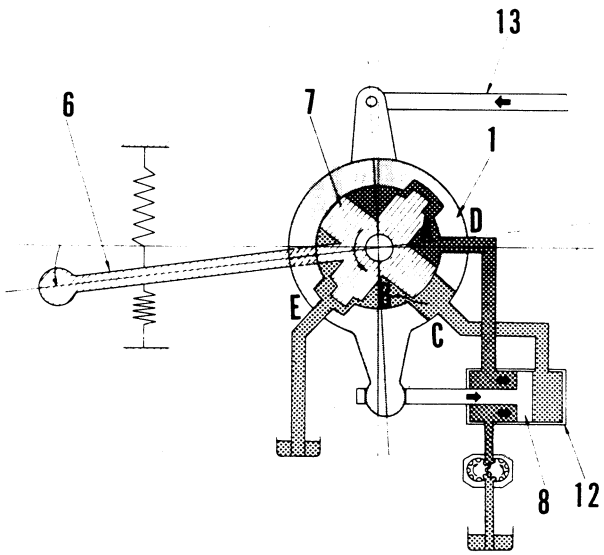


61F037

Putting the input lever (6) on the "HOLD" position closes the passage between ports A and C (or B and C) by the rotor (7) directly connected to the input lever. Cylinder (12) is then sealed off and piston (8) returns to the neutral position and stops. Sleeve (1) and the output shaft (13) connected to the sleeve also at the neutral position.



61F038



61F039

2) Clockwise

Shifting the input lever (6) to ↷ direction (right) turns the rotor (7) connected to it clockwise (→ direction) and opens the passage between ports A and C. The pressurized oil from the pump flows from port D to A, then to C and to the bottom of cylinder (12).

The pressurized oil which has flowed into the cylinder bottom pushes the bottom because of the difference in area of the bottom and head resulting in pushing the piston (8) to ← direction.

The piston then pushes the lever of the sleeve (1) causing the sleeve to turn, and the output shaft (6) connected to the sleeve is moved to → direction (clockwise).

The rotor (7) also turns to → direction (clockwise) until the sleeve being pushed by the piston reaches the position where the passage between ports A and C closes. The pressurized oil is then shut off from the cylinder bottom and the sleeve stops in that position.

3) Counterclockwise

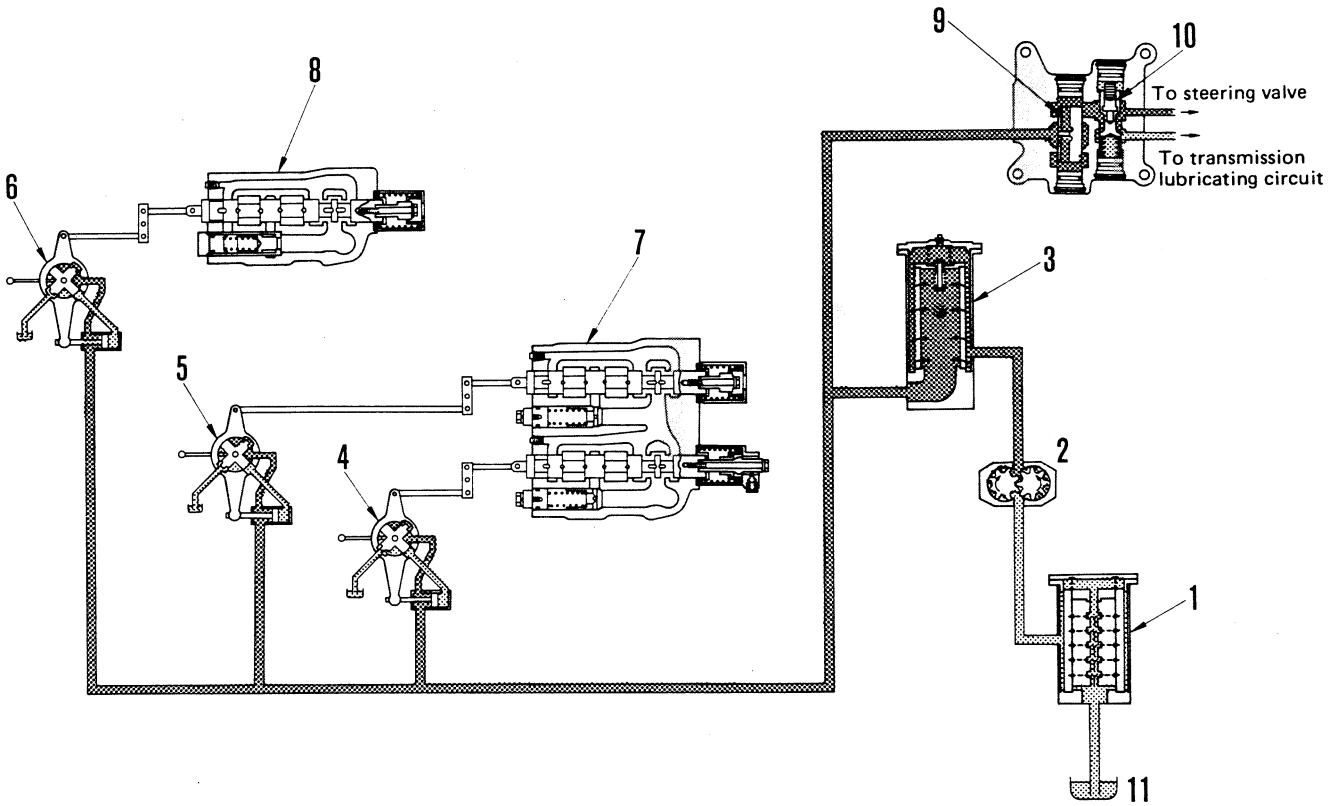
Shifting the input lever (6) to the ↶ direction (left) turns the rotor (7) connected to it to the ← direction (counterclockwise) and opens the passage between ports B and C. The drain circuit is then connected and the oil from the bottom of the cylinder (12) flows from port C to B and is drained out via port E. Oil pressure at the cylinder bottom drops since the bottom is connected to the drain circuit. Pressurized oil from the pump pushes the head side of cylinder and pushes the piston to the → direction.

The piston pulls the lever of the sleeve (1) when it is pushed, turning the sleeve and moving the output shaft (13) connected to the sleeve to the ← direction (counterclockwise).

The rotor (7) also turns in the ← direction (counterclockwise) until the sleeve (1) pulled by the piston reaches the position where the passage between ports B and C closes. The sleeve stops at that position without the oil being drained from the cylinder bottom.

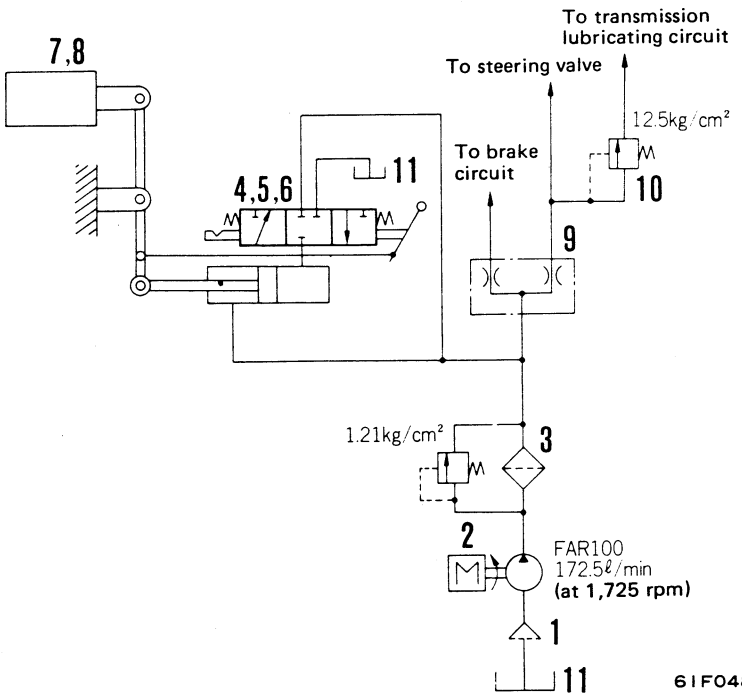
The above operation is repeated successively until the control valve spool connected to the output shaft (13) enters the designated position.

SERVO VALVE HYDRAULIC CONTROL D150A



61F047

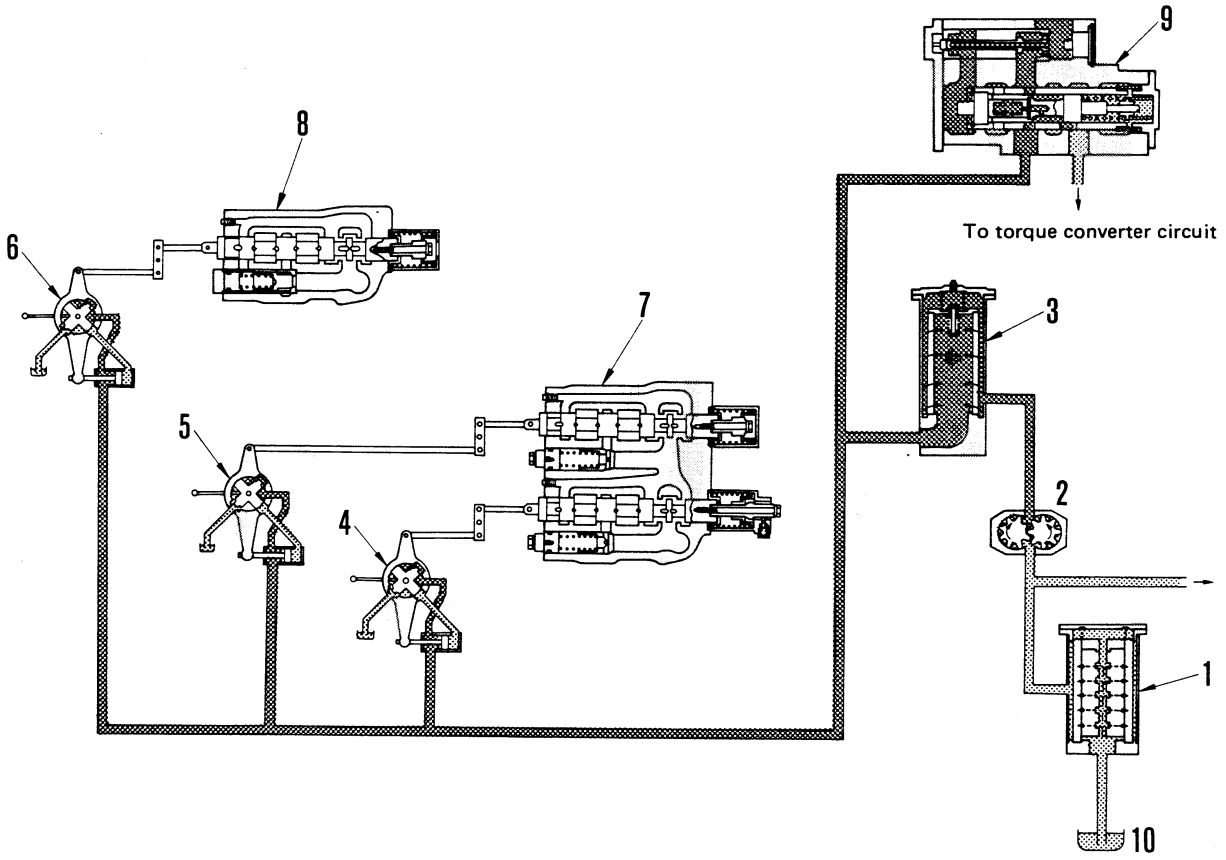
SERVO VALVE HYDRAULIC CIRCUIT D150A



61F048A

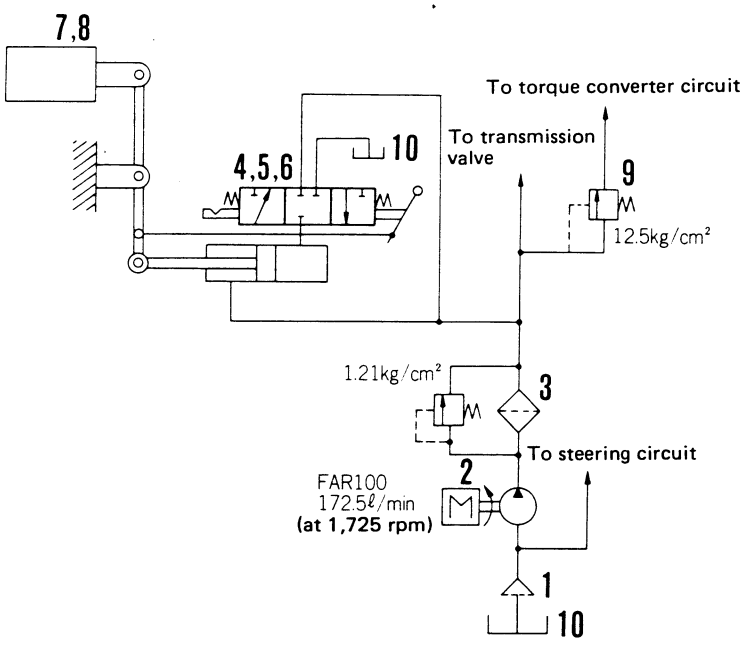
1. Strainer
2. Steering pump
3. Oil filter
4. Rotary servo valve (for blade lift operation)
5. Rotary servo valve (for ripper operation)
6. Rotary servo valve (for blade tilt operation)
7. Blade lift and ripper control valve
8. Blade tilt control valve
9. Flow divider
10. Steering main relief valve
11. Steering case

SERVO VALVE HYDRAULIC CONTROL D155A 15001 ~ 25000



61F049

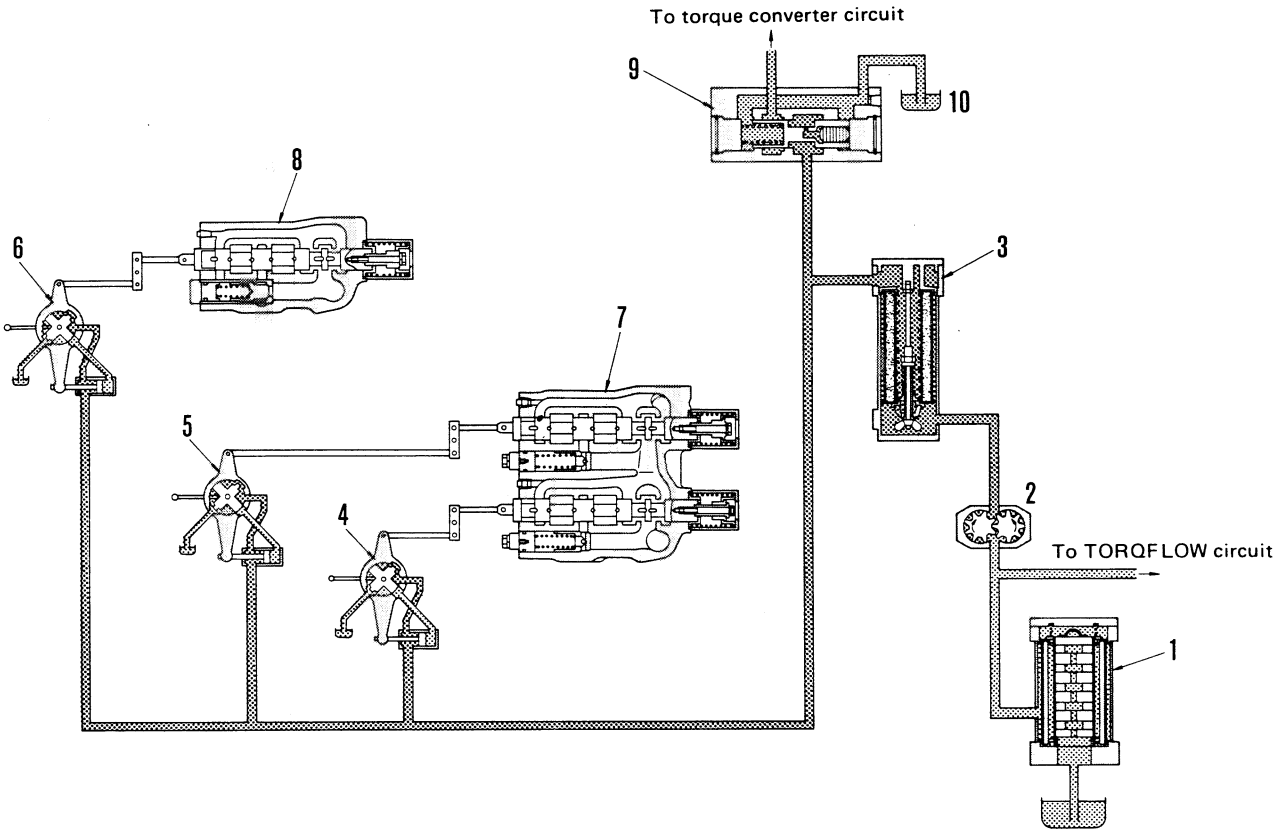
SERVO VALVE HYDRAULIC CIRCUIT D155A 15001 ~ 25000



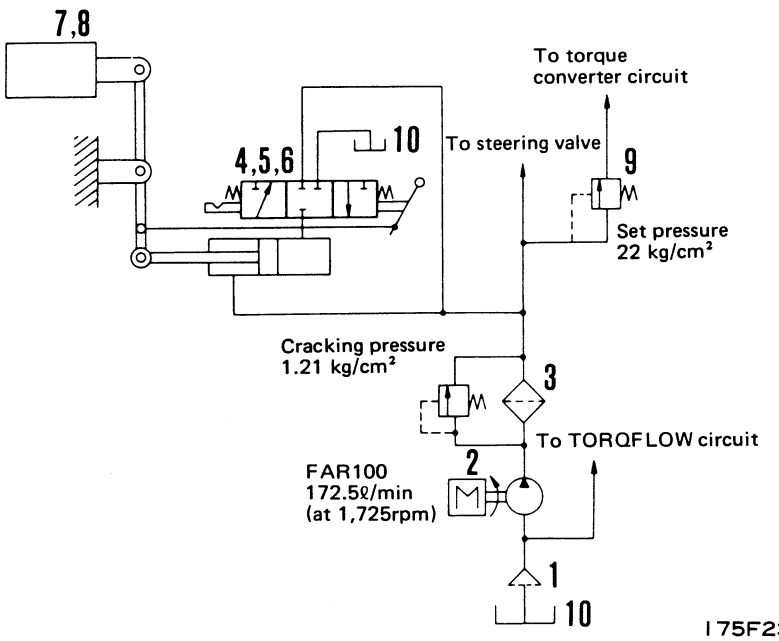
61F050A

1. Strainer
2. Transmission pump
3. Oil filter
4. Rotary servo valve (for blade lift operation)
5. Rotary servo valve (for ripper operation)
6. Rotary servo valve (for blade tilt operation)
7. Blade lift and ripper control valve
8. Blade tilt control valve
9. Modulating main relief valve
10. Steering case

D155A 25001 and up



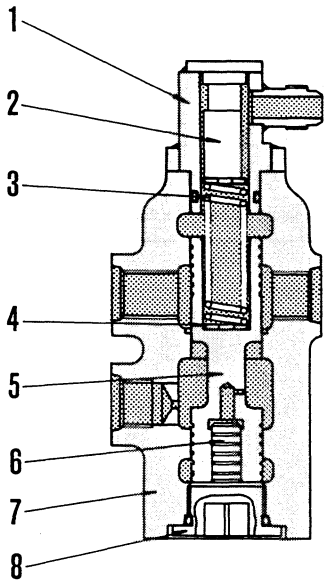
I75F236-1



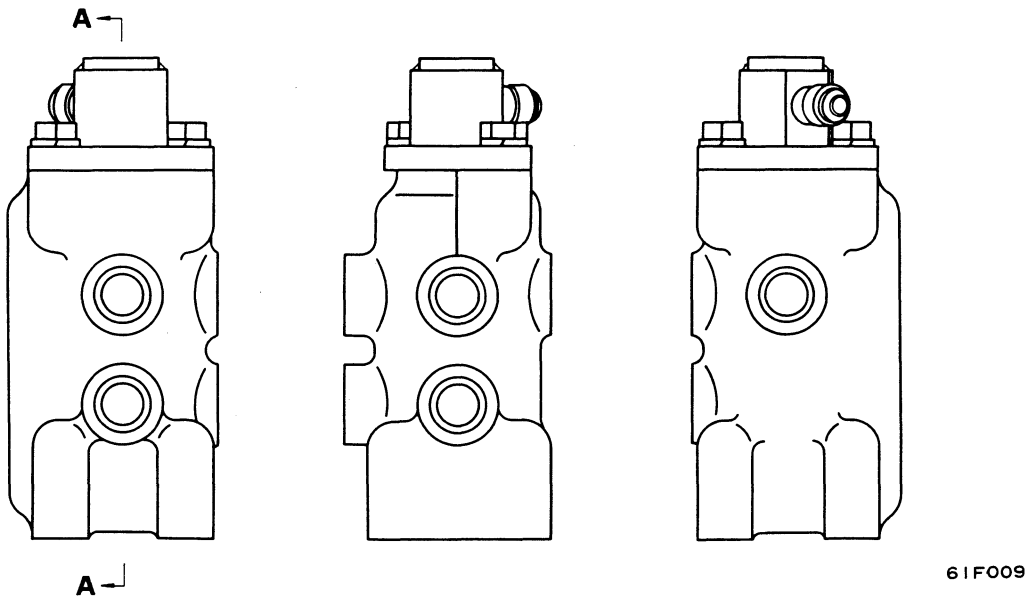
I75F237-1

1. Strainer
2. Steering pump
3. Oil filter
4. Rotary servo valve (for blade lift operation)
5. Rotary servo valve (for ripper opreation)
6. Rotary servo valve (for blade tilt operation)
7. Blade lift and ripper control valve
8. Blade tilt control valve
9. Steering main relief valve
10. Steering case

SAFETY VALVE



Section A–A

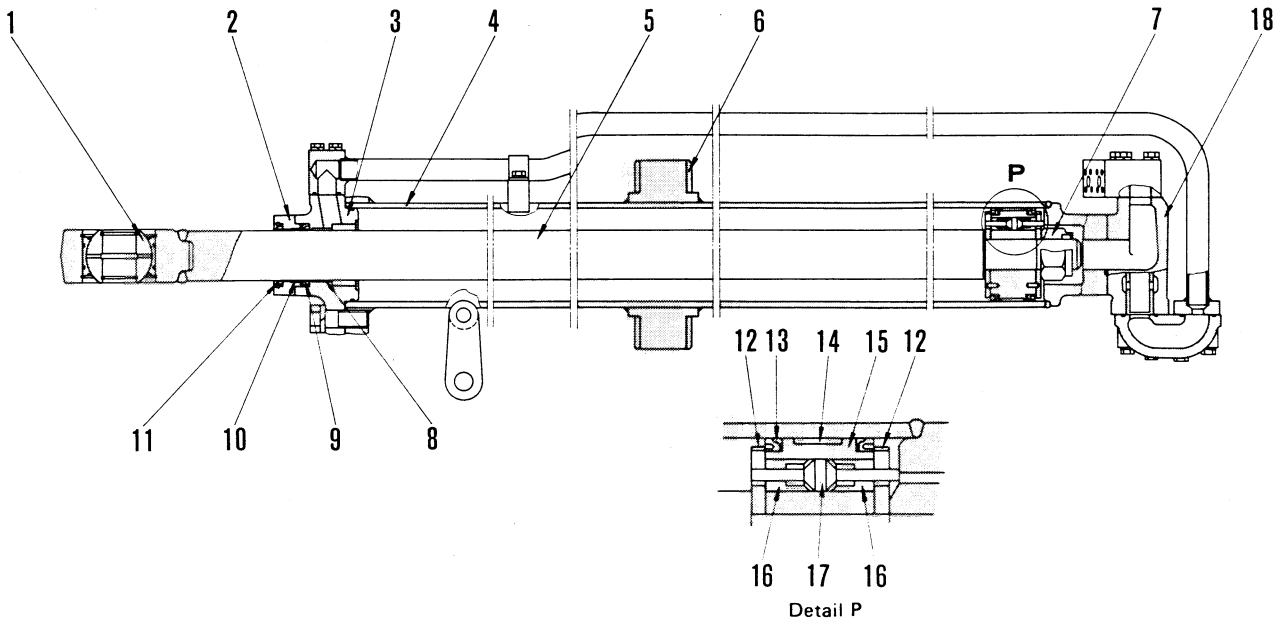


61F009

1. Elbow
2. Retainer
3. Spring
4. Washer
5. Relief valve
6. Piston
7. Valve body
8. Plug

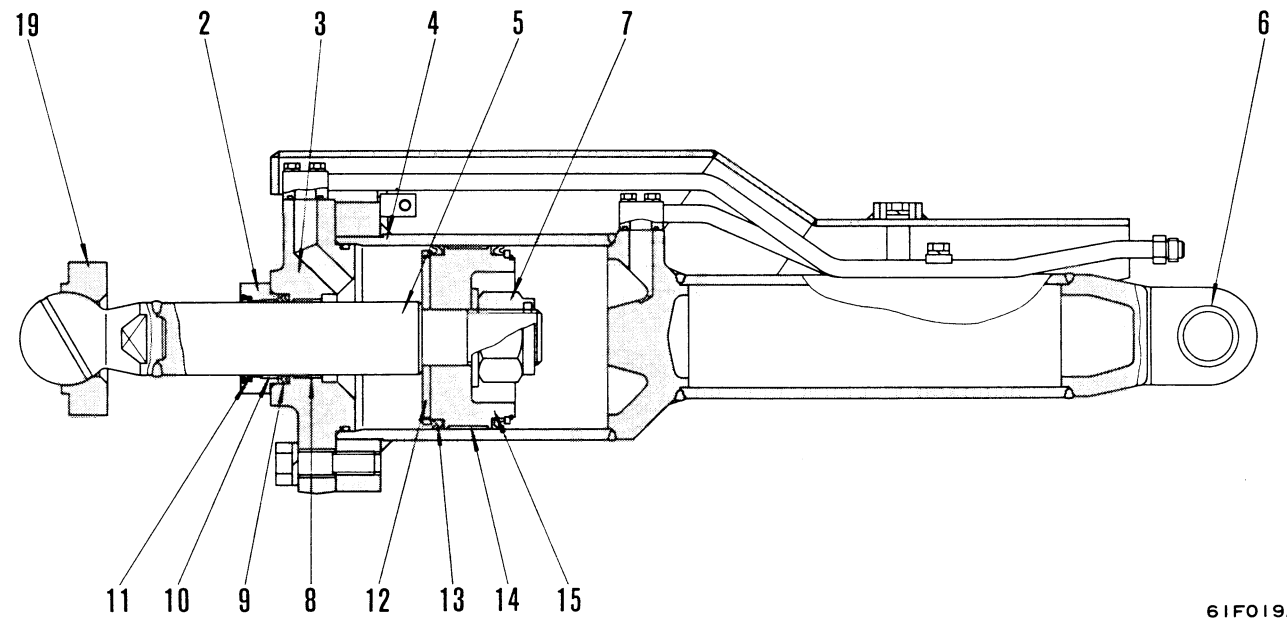
CYLINDER

BLADE LIFT CYLINDER



61F018A

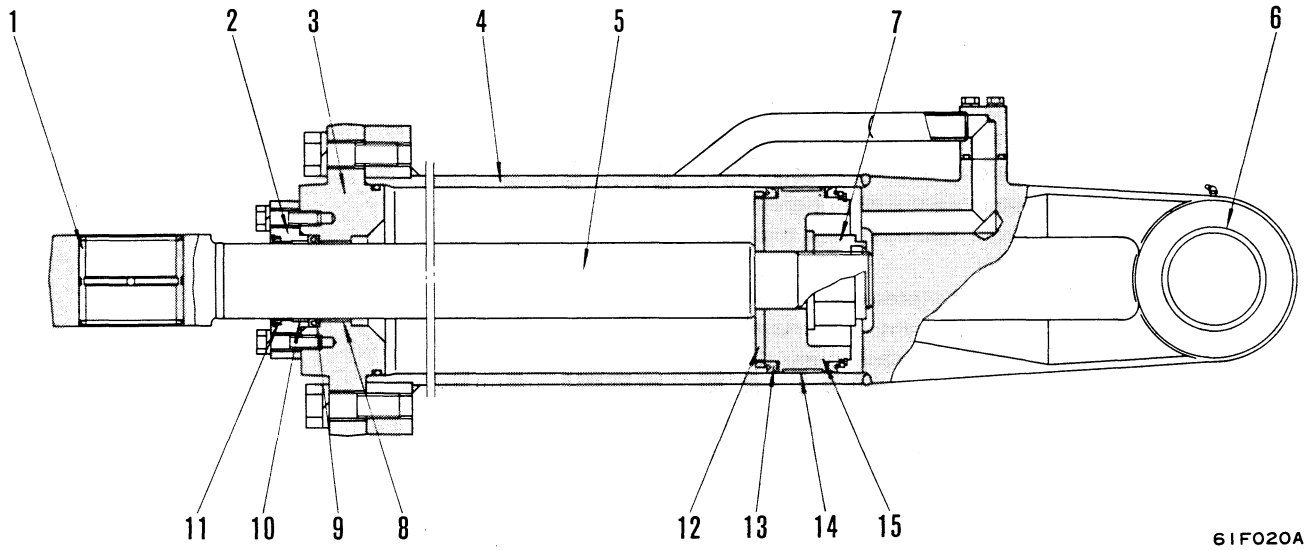
BLADE TILT CYLINDER



61F019A

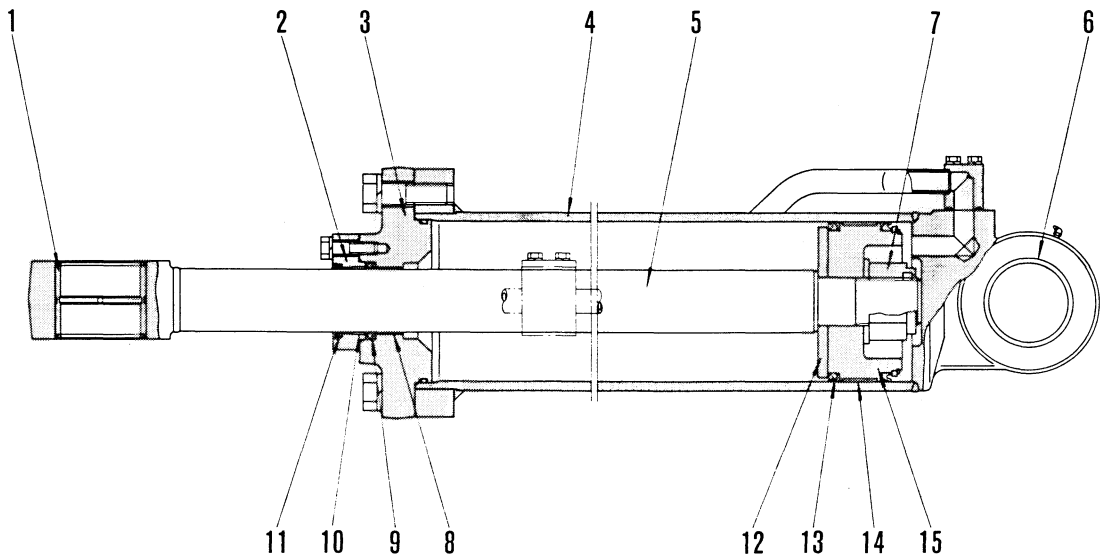
1. Bushing
2. Gland
3. Cylinder head
4. Cylinder
5. Piston rod
6. Bushing
7. Piston nut
8. Bushing
9. Packing
10. Bushing
11. Dust seal
12. Retainer
13. U-packing
14. Wear ring
15. Piston
16. Seat
17. Valve
18. Quick drop valve assembly
19. Cap

RIPPER LIFT CYLINDER



61F020A

RIPPER TILT CYLINDER



61F056

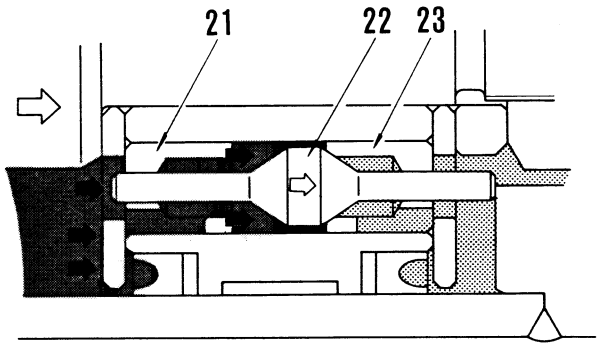
Unit: mm

Item	Blade lift	Blade tilt	Ripper lift	Ripper tilt
Outside diameter of piston rod	75	90	90	90
Inside diameter of cylinder	140	225	225	225
Stroke	1,346	160	540	500
Maximum stroke	2,380	1,468	1,840	1,850
Minimum stroke	1,030	1,308	1,300	1,350
Width across flats of piston nut	70	95	95	95

PISTON VALVE

The piston valve is installed to the piston of the blade lift cylinder, and when the piston rod reaches its stroke end, it actuates to relieve oil fed from the hydraulic pump.
When the piston rod, while stroking rapidly, is allowed to stop at its stroke end, the surge pressure generates temporarily in the hydraulic circuit. As oil is sent more to the cylinder, the pressure in the circuit goes up too high, which causes the main relief valve in the control valve to start relieving the oil.
The occurrence of such surge pressure and frequent relief action at the stroke end are not favorable to the hydraulic circuit. So, in this valve mechanism, the tip of the piston valve is designed to contact the cylinder bottom or head just before the piston reaches its stroke end so that oil can be purged through around the piston valve.

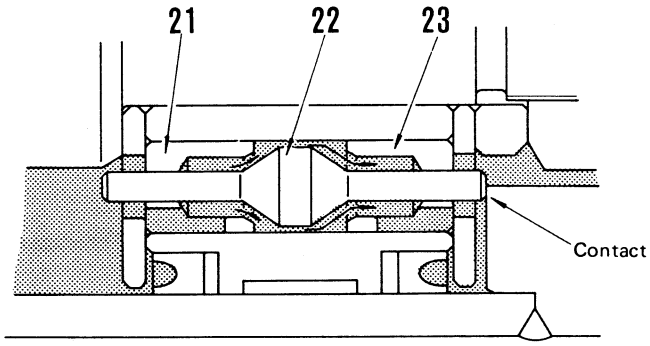
Piston moving



61F014

Oil from the pump is pressurized to the piston (12) and the piston valve (22). The piston valve is pushed to the direction shown by arrow in the figure to move toward the piston valve seat (23). Then the tapered portion of the seat has been sealed to raise the pressure in the cylinder, allowing the piston rod (8) to shift toward the direction shown by arrow.

Piston valve working



61F015

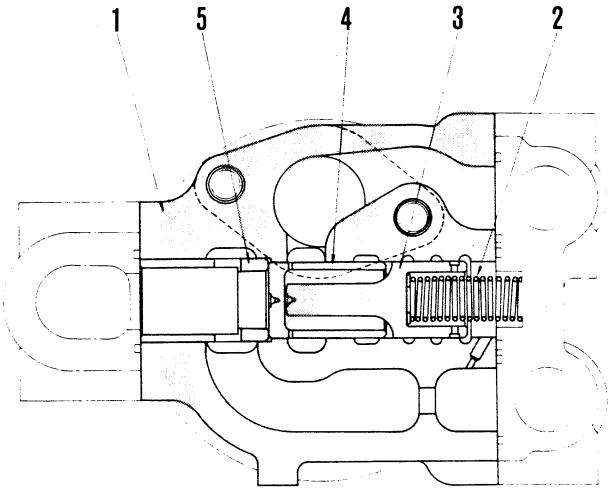
Just before the rod (8) reaches its stroke end, the tip of the piston valve (22) contacts the cylinder bottom or head. The piston valve stops in that position, while the piston rod goes further.
At the same time, the oil under pressure in the cylinder which had been sealed by the piston valve starts to be released through the piston valve seat (23), and oil pressure inside the cylinder no longer goes up.
Consequently, the pressure in the circuit does not surge, and the main relief in the control valve does not actuate as well, and oil circulates merely through the piston valve.

QUICK DROP VALVE

STRUCTURE

A quick drop valve is composed of the valve body (1), spring (2), spool (3), check valve (4) and collar (5). The function of the quick drop valve is to reduce the vacuum produced inside the cylinder, resulting in an increase in the blade lowering speed, and reducing the time loss until the digging operation starts.
The blade lowering speed is decided by pump discharge colume, thus greater lowering speed can be obtained by installation of the quick drop valve.

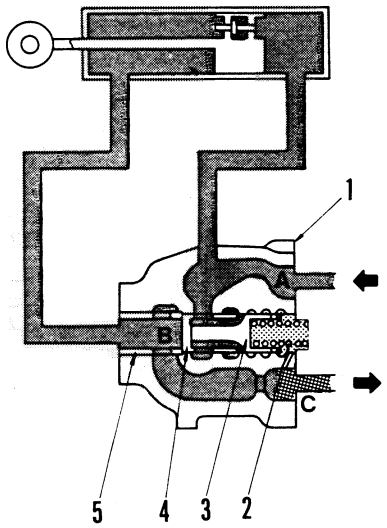
1. Valve body
2. Spring
3. Spool
4. Check valve
5. Collar



61F023

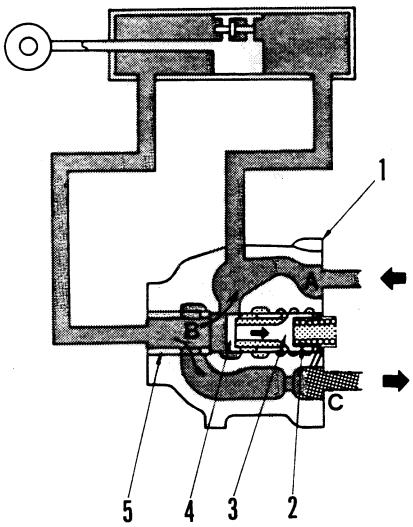
OPERATION

1. **When starting blade lowering:**
   When putting the work equipment control lever in the "L" position, oil from the control valve flows into the cylinder bottom side through port **A** and pushes the piston.
   At the same time, oil in the cylinder head side is pushed out by the piston, enters the valve port **B** and flows into the tank.



61F024

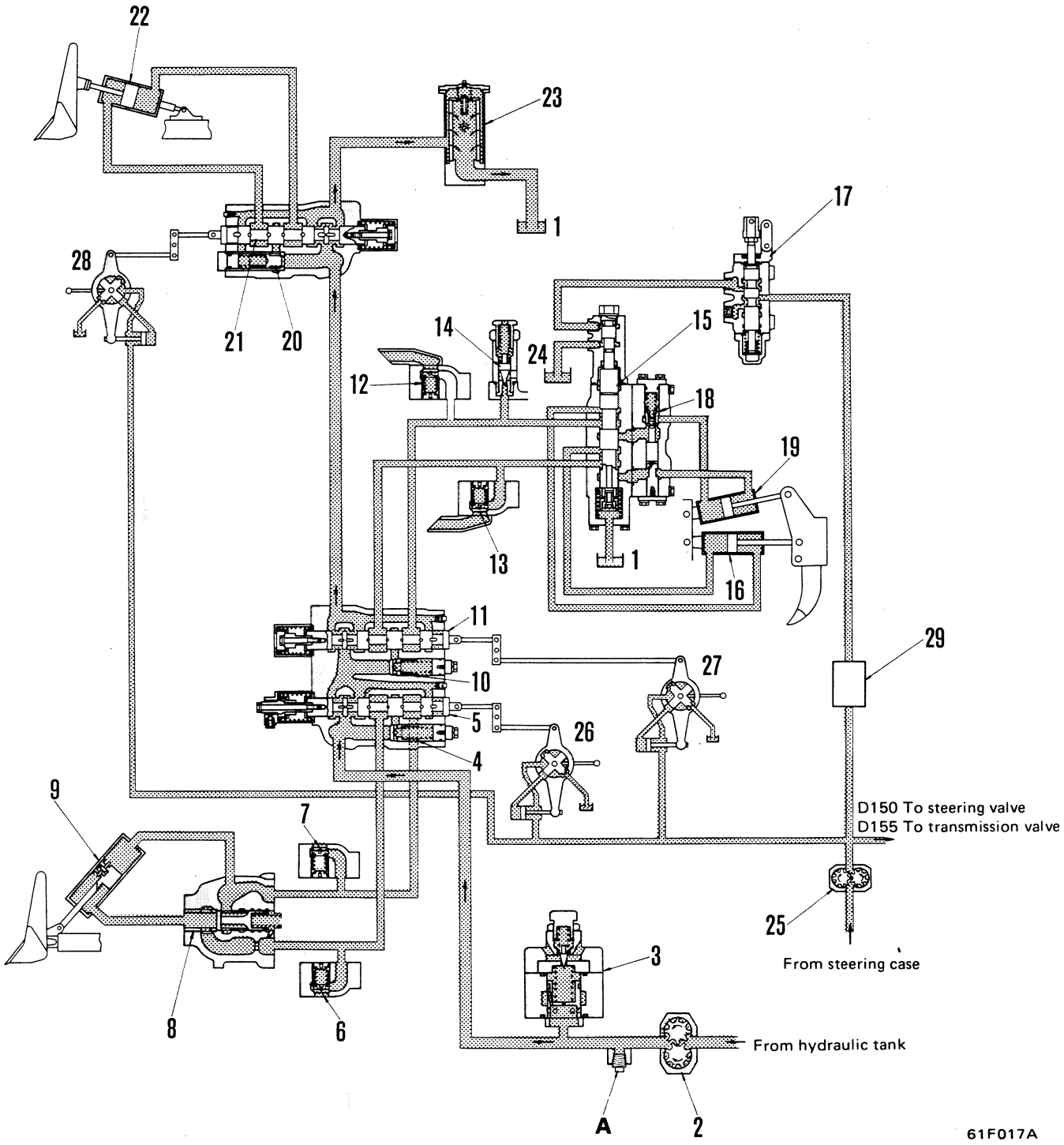
2. **When blade is lowering:**
   Oil pushed out from the head side flows into port **C** through port **B**.
   At this time there is a pressure difference produced between the before and after sides of the orifice because of a throttle in the oil passage. When this pressure difference is larger than the force of the spring (2), the spring is shortened and the spool (3) and the valve (4) are moved to the right.
   Part of the oil which flows into the tank from the cylinder head side, flows into the passage connected to the cylinder bottom side. As a result this oil flows into the cylinder bottom side together with oil flowing from the control valve.
   As seen from the above explanation the blade lowering speed is increased, with installation of the quick drop valve, because oil flows into the cylinder side, resulting in reducing the vacuum produced inside the cylinder bottom



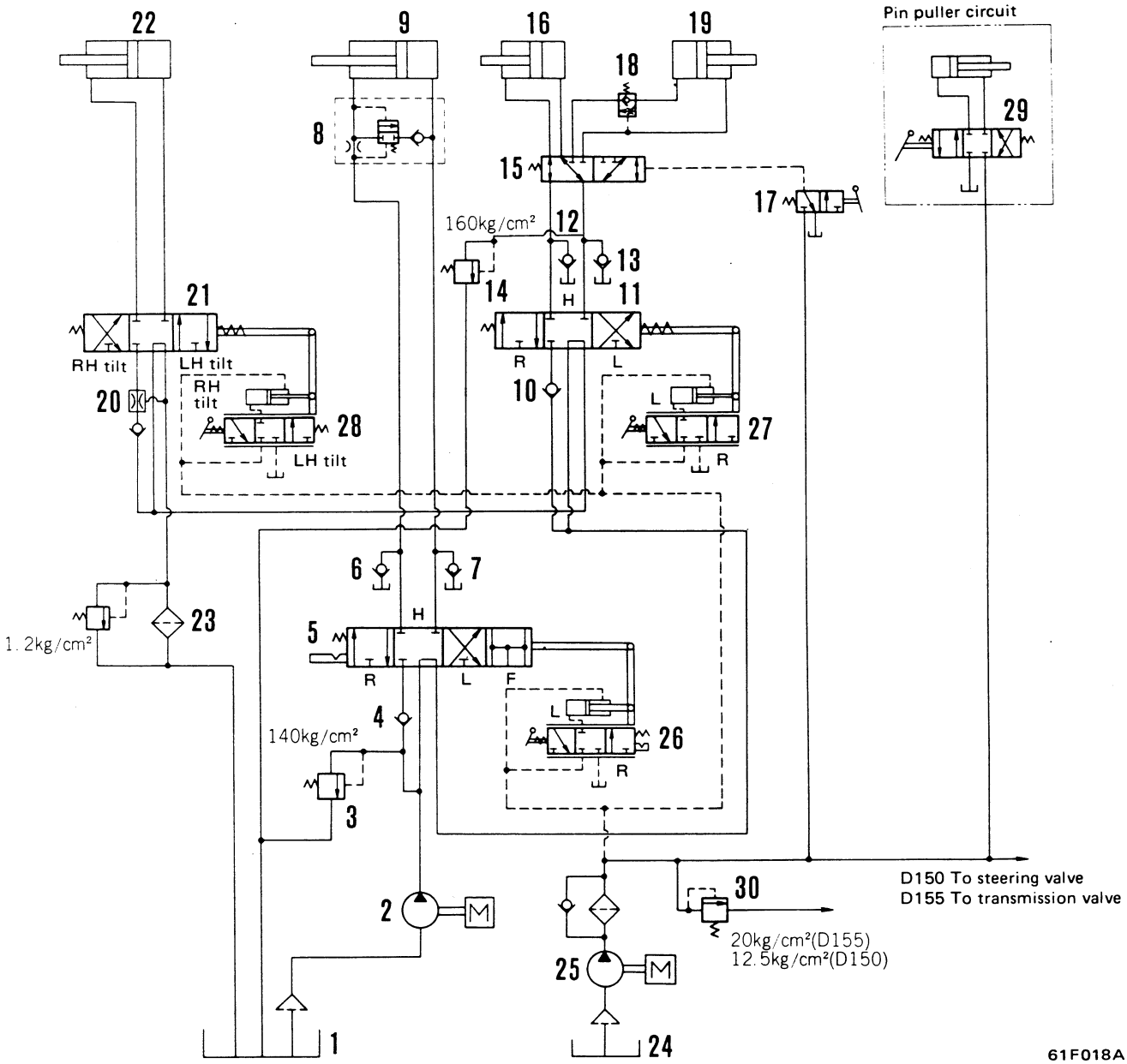
61F025

HYDRAULIC CONTROL

NEUTRAL D150A C8408 ~ 8420
D155A T15001 ~ 17000



D150A 8408 ~ 8420
D155A 15001 ~ 17000

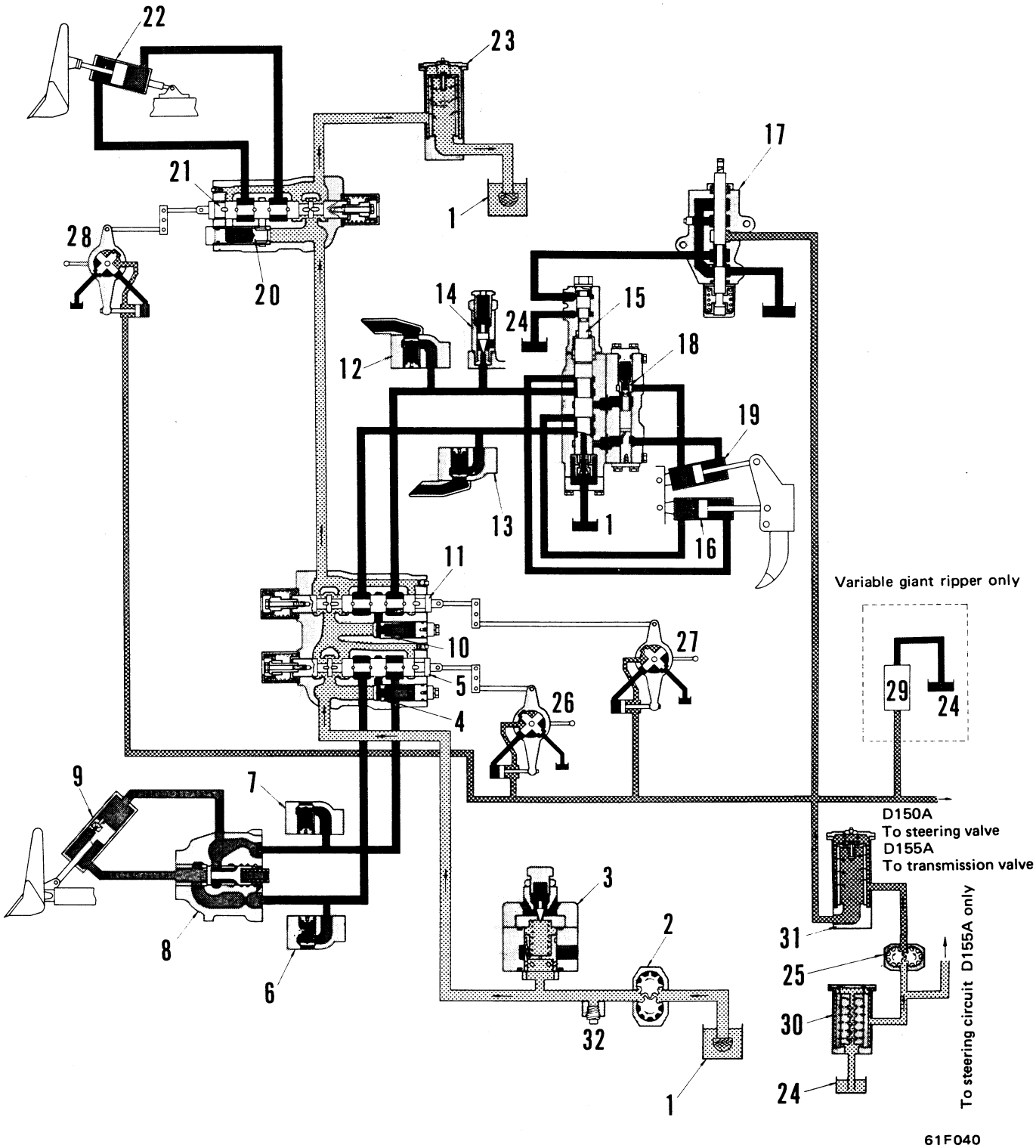


1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve

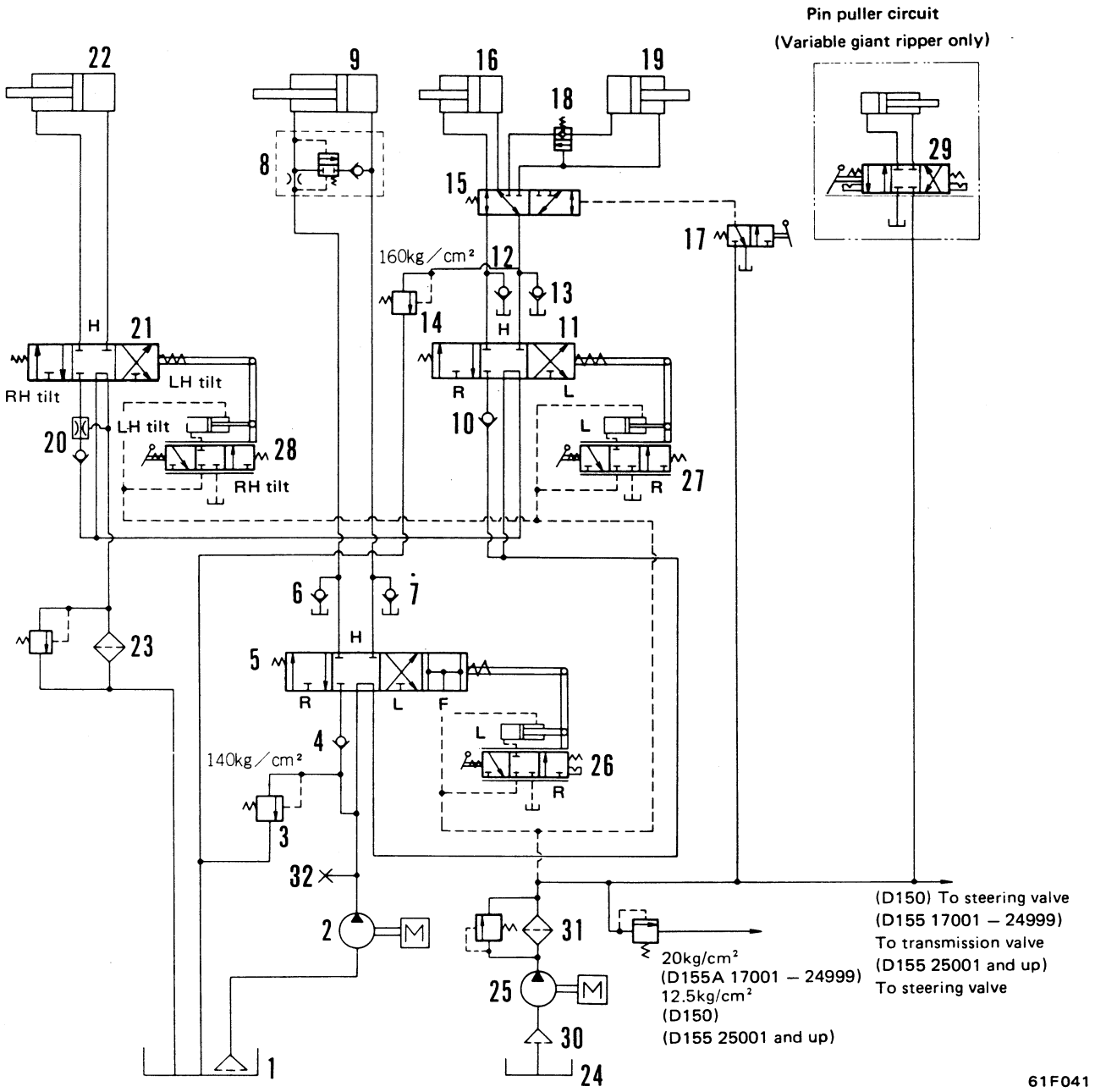
A. Main relief pressure pickup plug (PT 1/8)

NEUTRAL

D150A 8421 and up
D155A 17001 and up



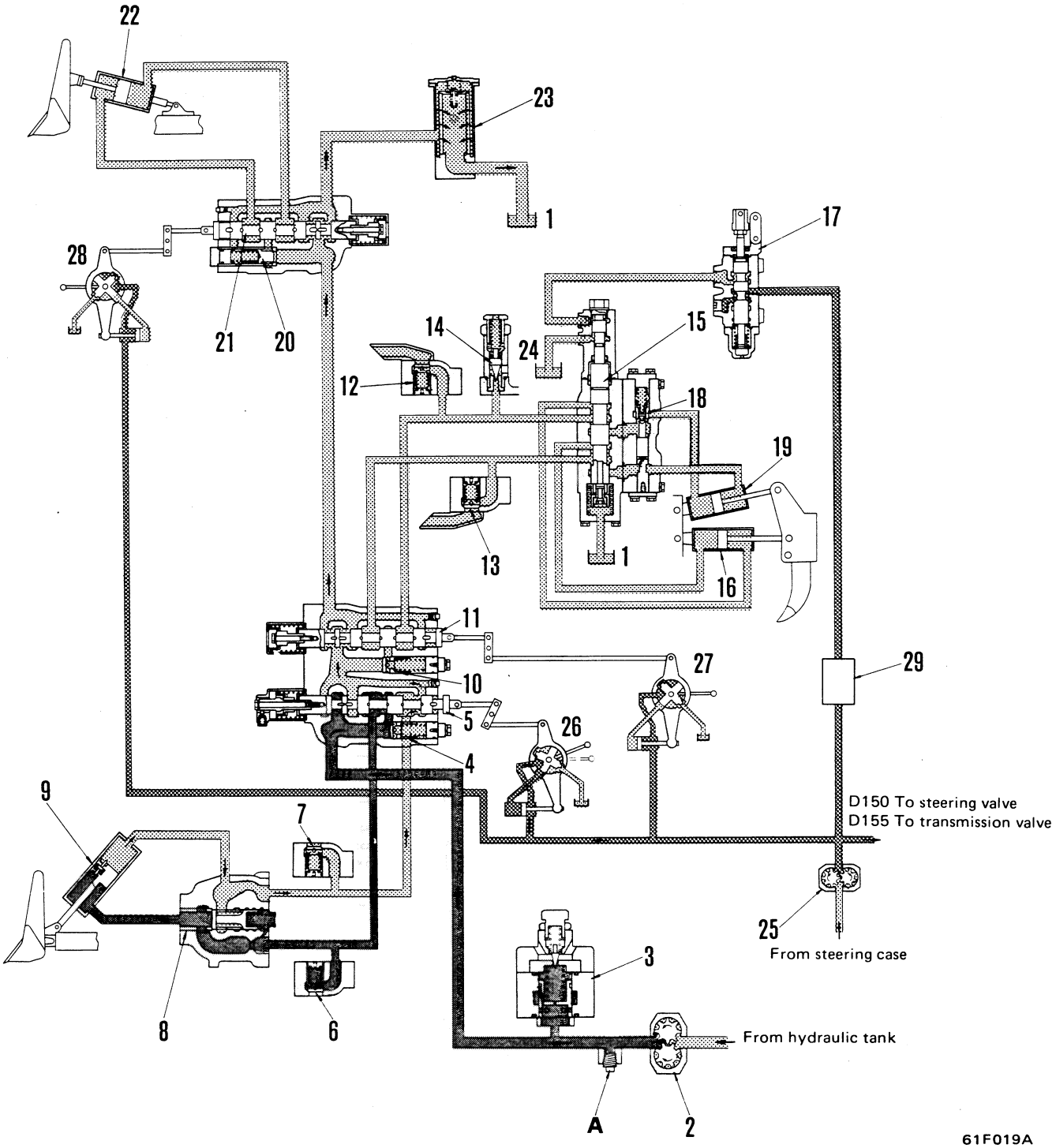
D150A 8421 and up
D155A 17001 and up



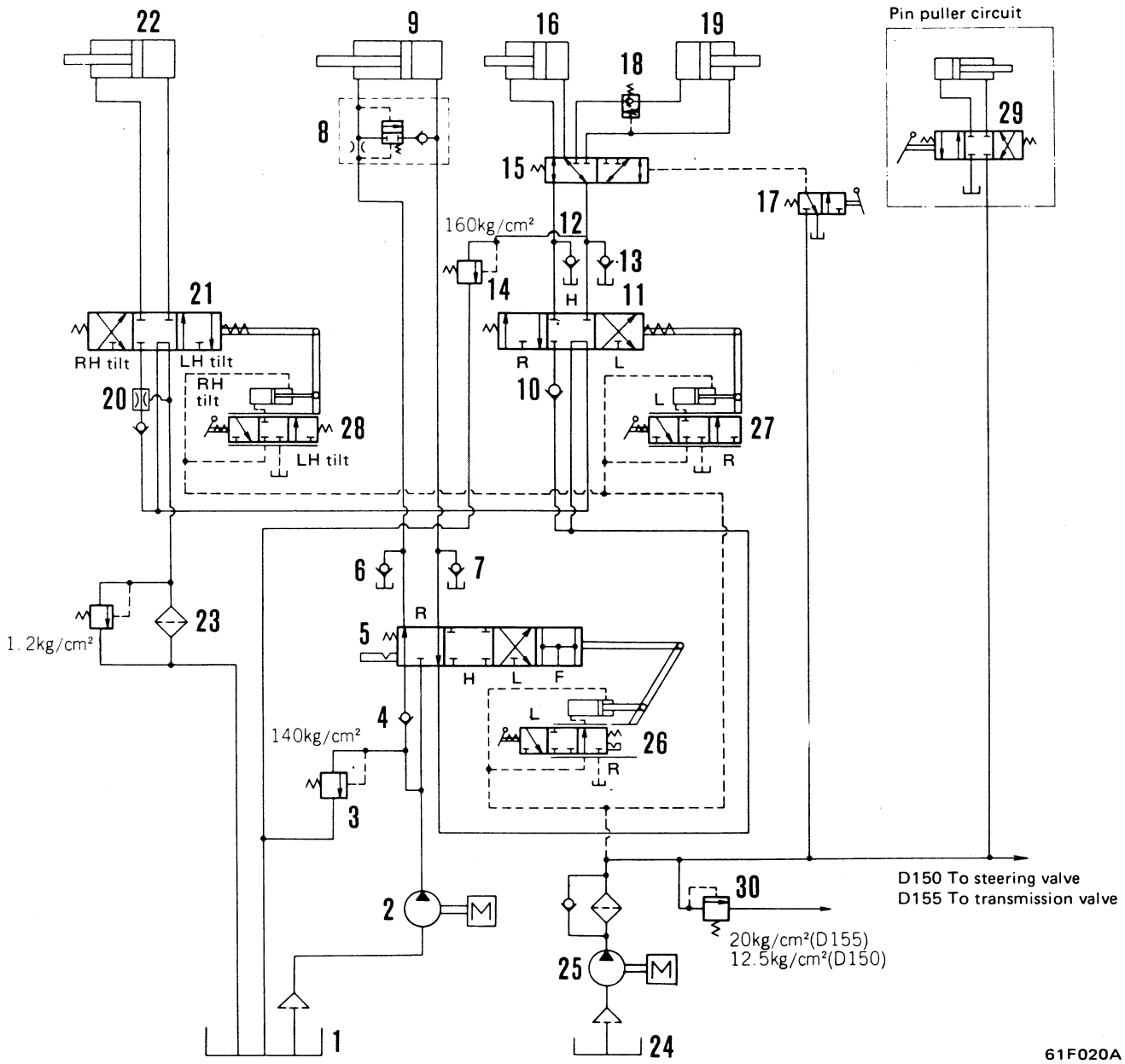
1. Hydraulic tank
2. Hysraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve (raise)
7. Suction valve (lower)
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve (raise)
13. Suction valve (lower)
14. Safety valve (raise)
15. Selector valve
16. Ripper lift cylinder
17. Pilot valve
18. Tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. Transmission pump (FAR045)(D155A 17001 – 24999)
    Steering pump (FAR100) (D150A 8421 and up)
    (D155A 25001 and up)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve
30. Magnet strainer
31. Oil filter
32. Main relief pressure pick-up plug (PT 1/8)

BLADE LIFT OPERATION

D150A 8408 ~ 8420
D155A 15001 ~ 17000



D150A C8408 ~ 8420
D155A T15001 ~ 17000

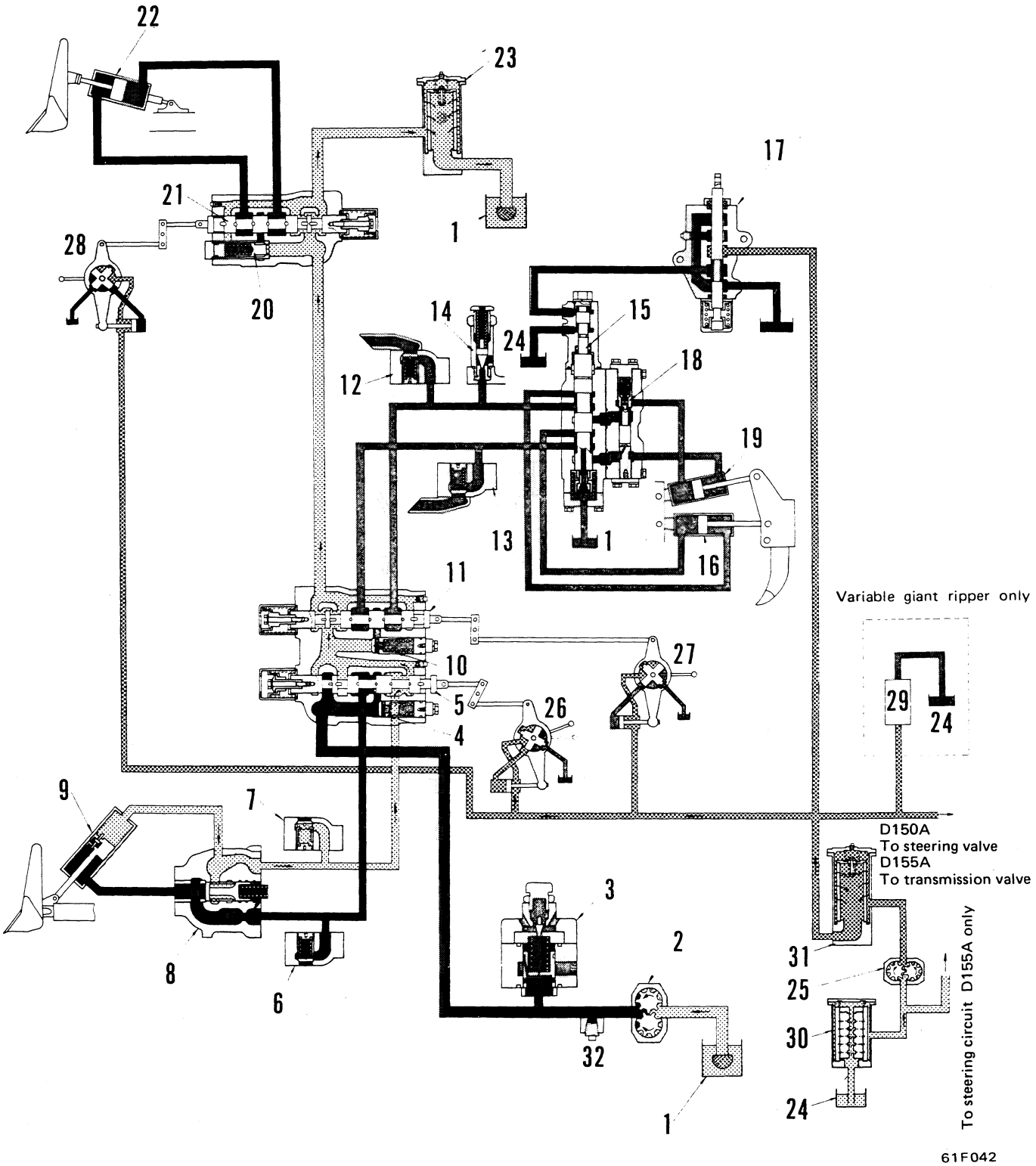


1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve

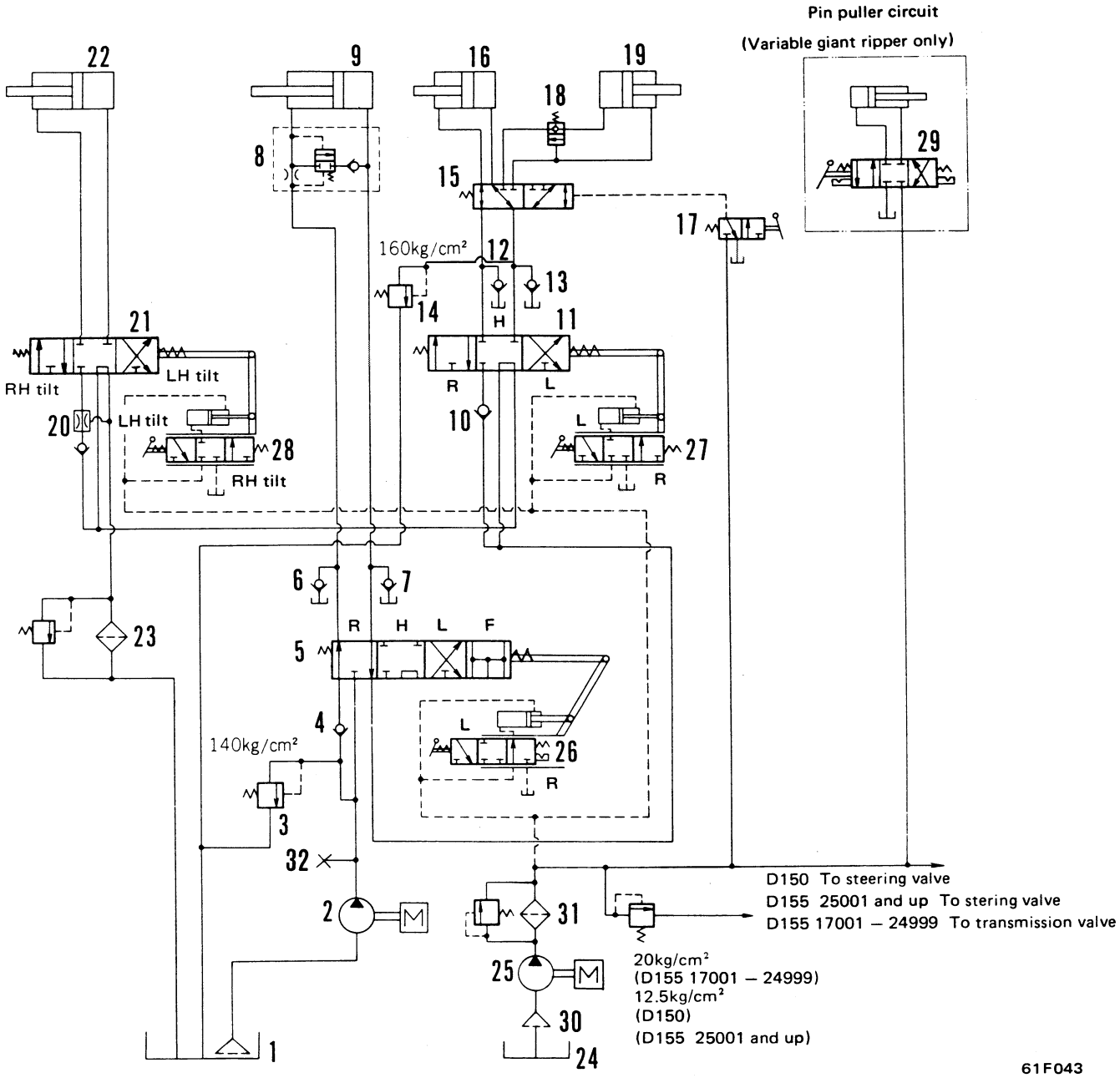
A. Main relief pressure pickup plug (PT 1/8)

BLADE LIFT OPERATION

D150A C8421 and up
D155A T17001 and up



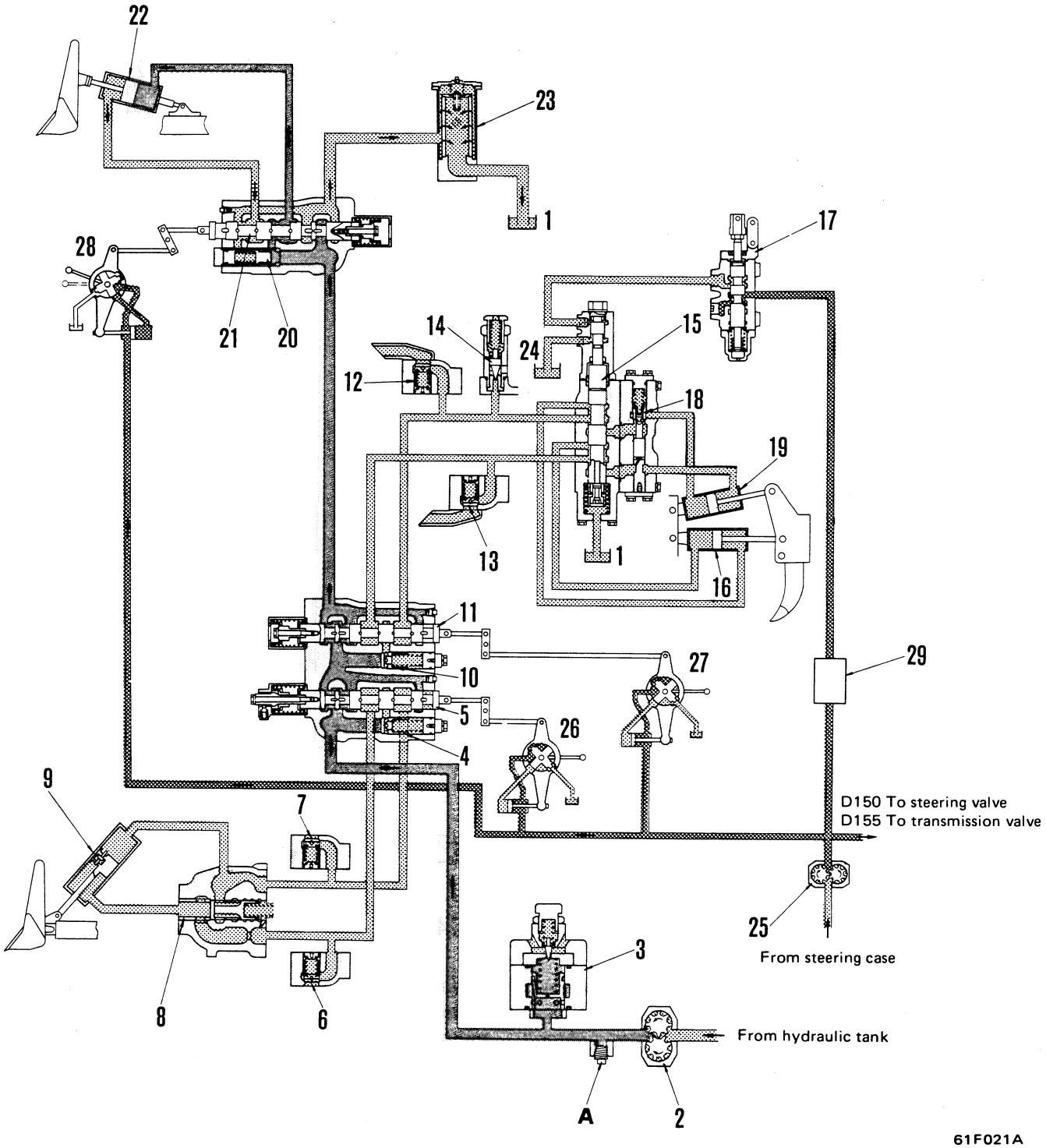
D150A 8421 and up
D155A 17001 and up



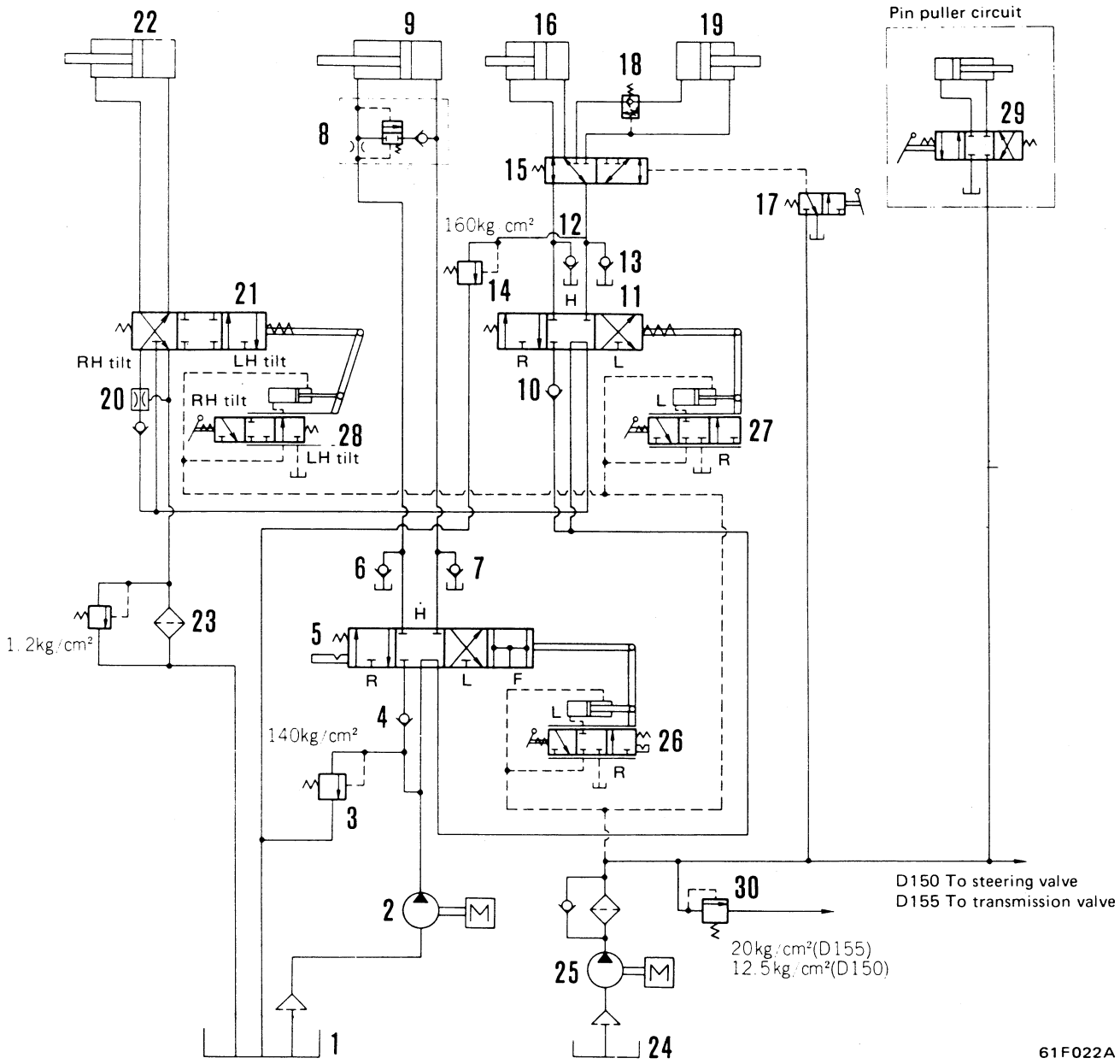
1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve (raise)
7. Suction valve (lower)
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve (raise)
14. Safety valve (raise)
15. Selector valve
16. Ripper lift cylinder
17. Pilot valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. Transmission pump (FAR045) (D155A 17001 – 24999)
    Steering pump (FAR100) (D150A 8421 and up)
    (D155A 25001 and up)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve
30. Magnetic strainer
31. Transmission filter

BLADE TILT OPERATION

D150A C8408 ~ 8420
D155A T15001 ~ 17000



D150A C8408 ~ 8420
D155A T15001 ~ 17000

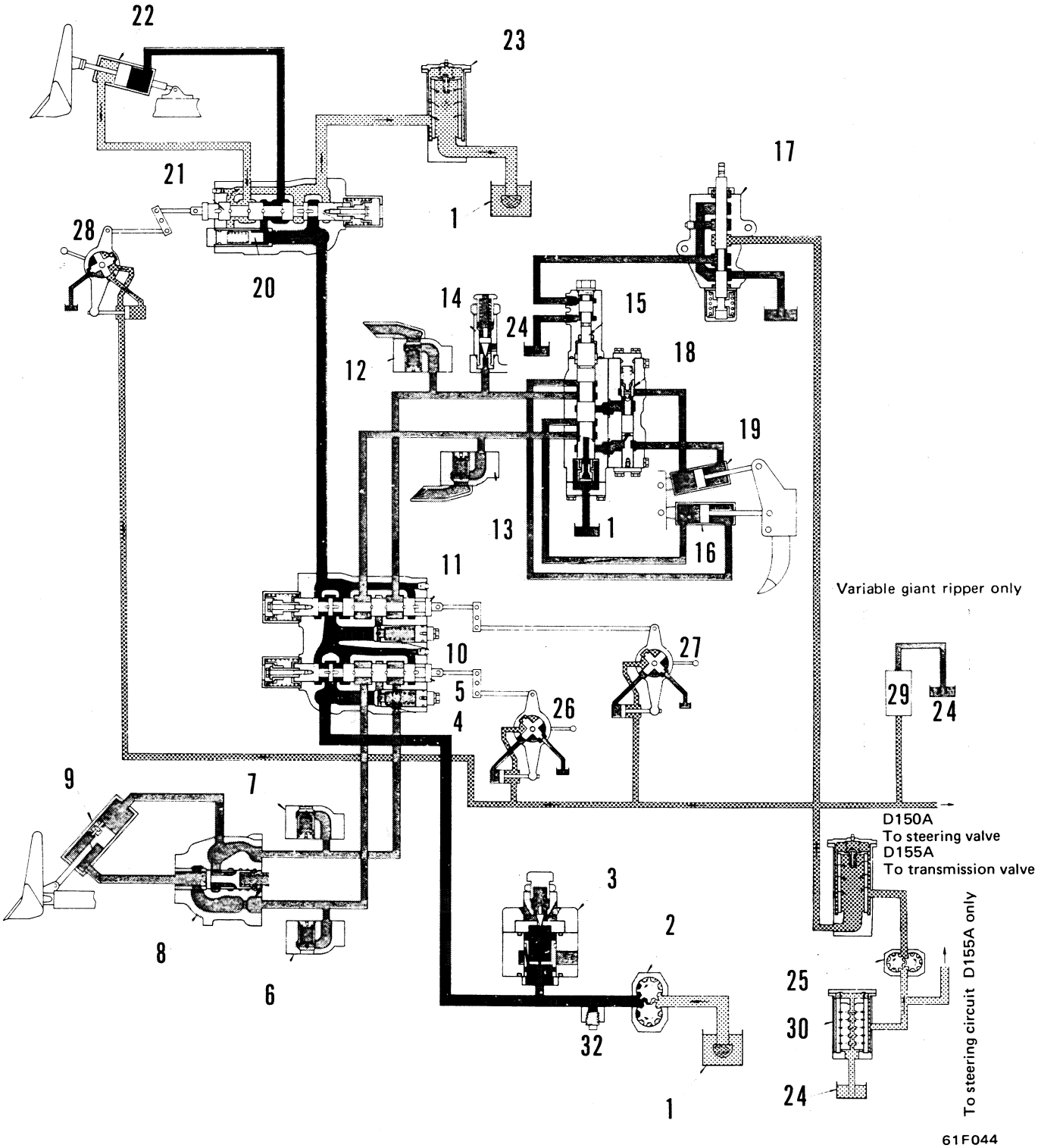


1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve

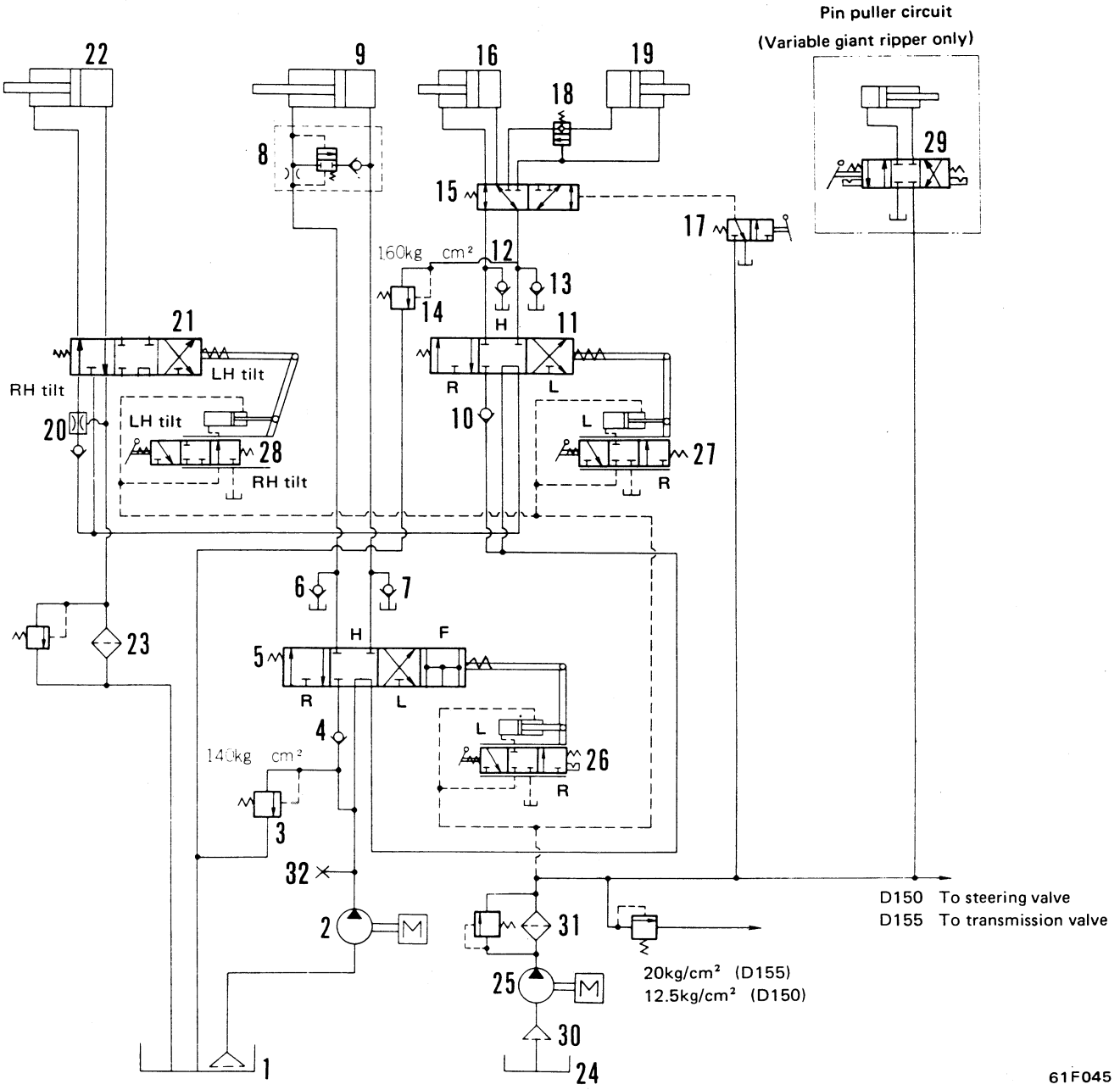
A. Main relief pressure pickup plug (PT 1/8)

BLADE TILT OPERATION

D150A C8421 and up
D155A T17001 and up



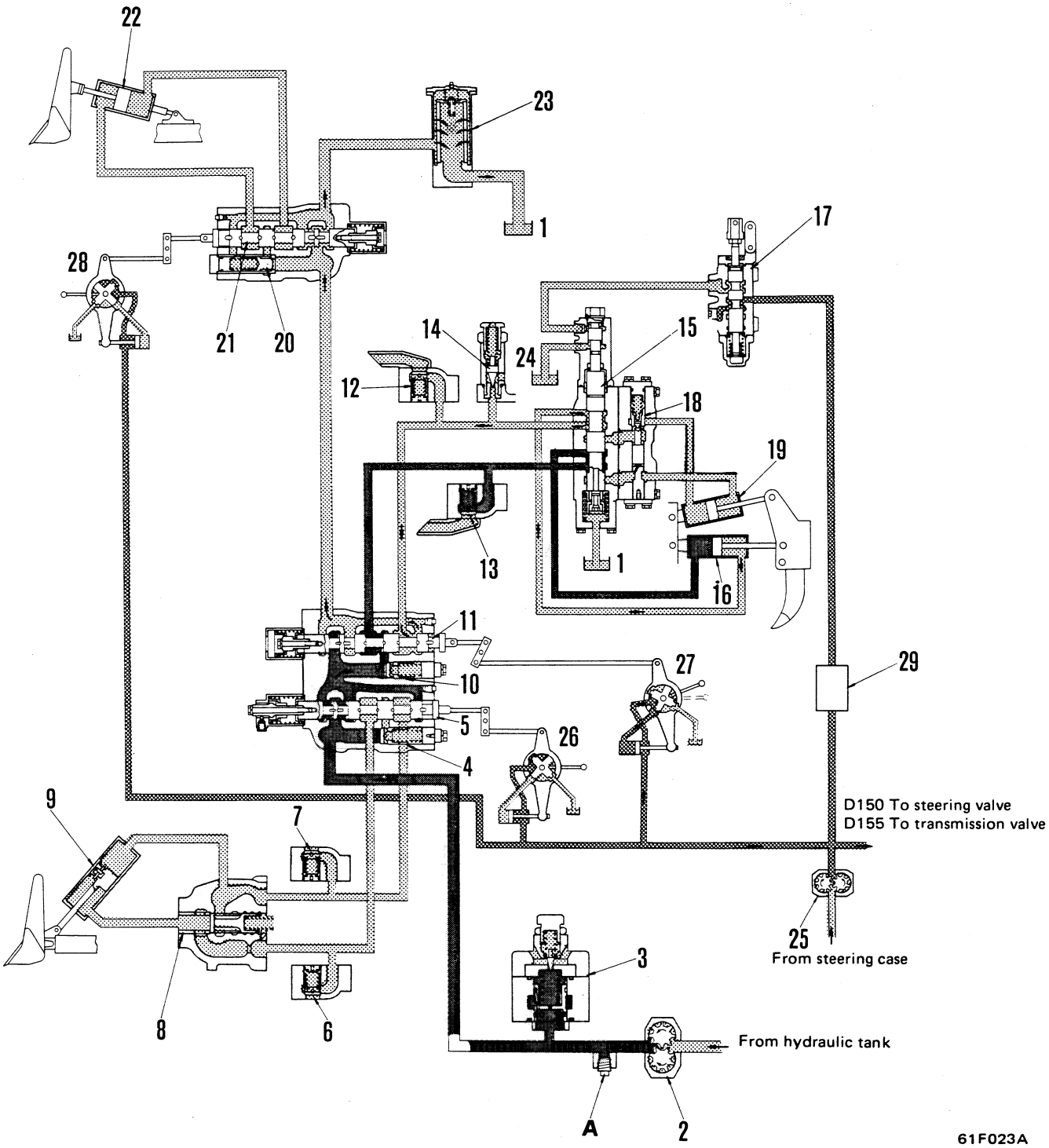
D150A C8421 and up
D155A T17001 and up



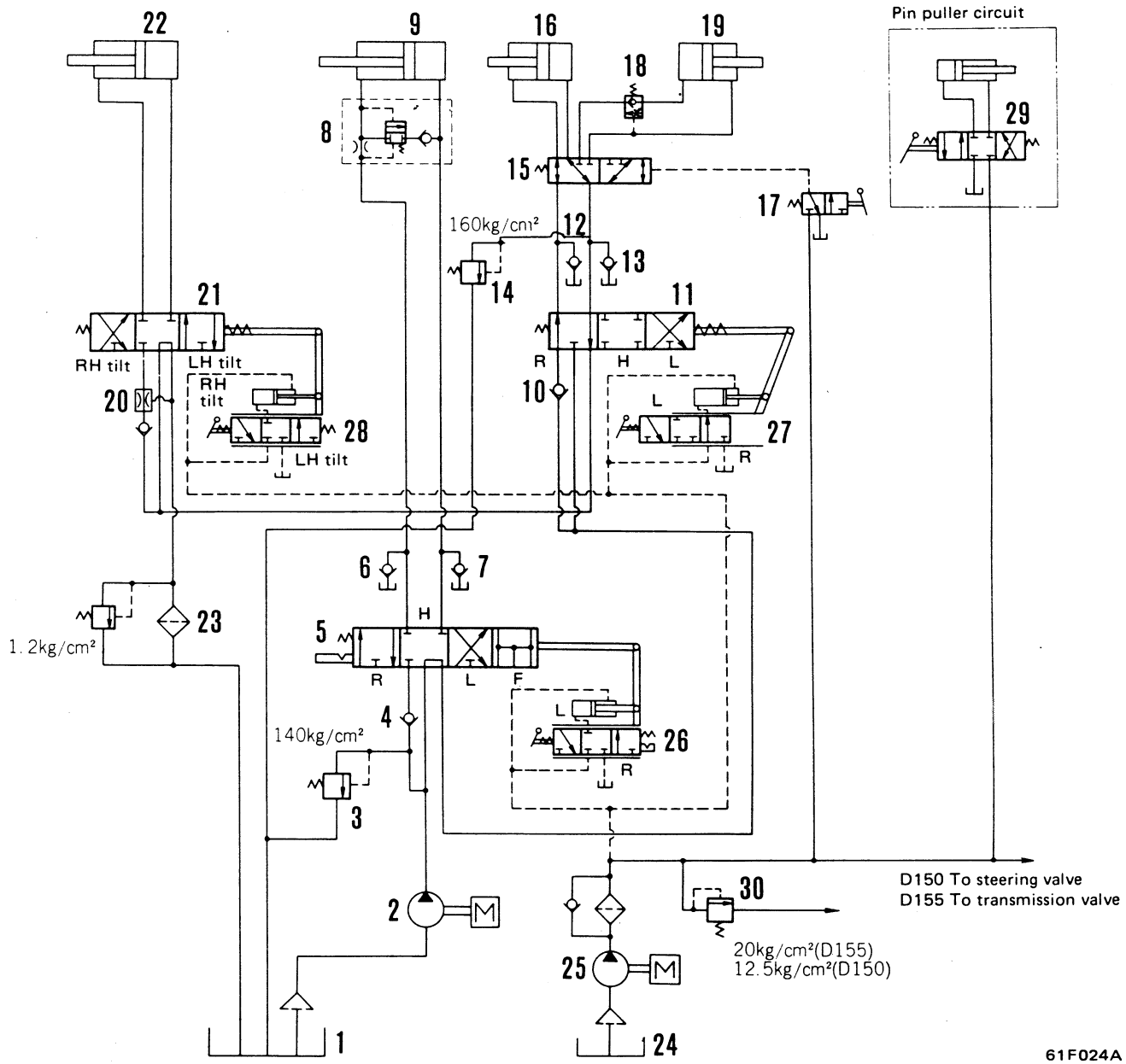
1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve (raise)
7. Suction valve (lower)
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve (raise)
13. Suction valve (lower)
14. Safety valve (raise)
15. Selector valve
16. Ripper lift cylinder
17. Pilot valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. Transmission pump (D155 FAR080)
    Steering pump (D150 FAR100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve
30. Magnetic strainer
31. Transmission filter

RIPPER LIFT OPERATION

D150A C8408 ~ 8420
D155A T15001 ~ 17000



D150A C8408 ~ 8420
D155A T15001 ~ 17000

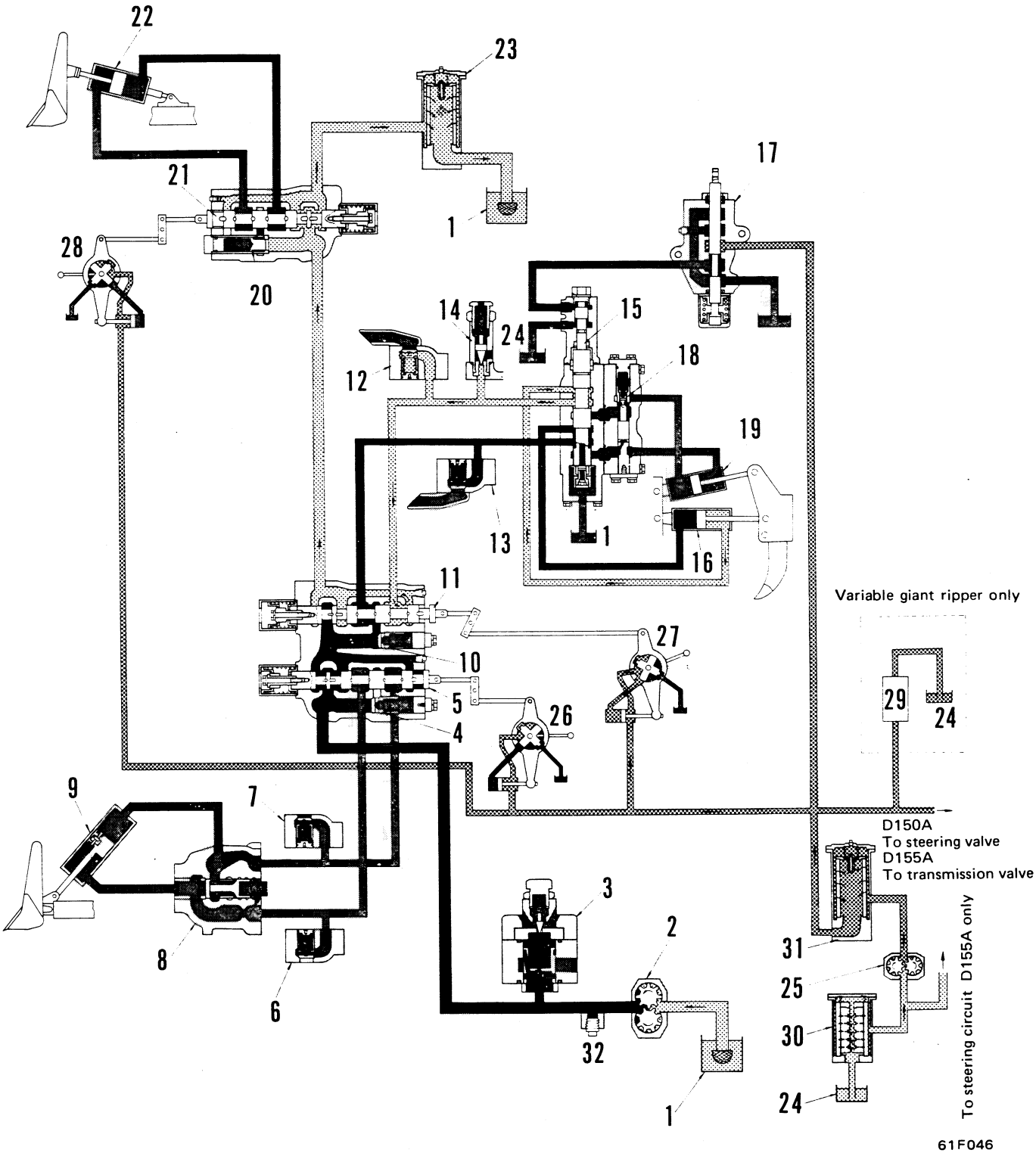


1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve

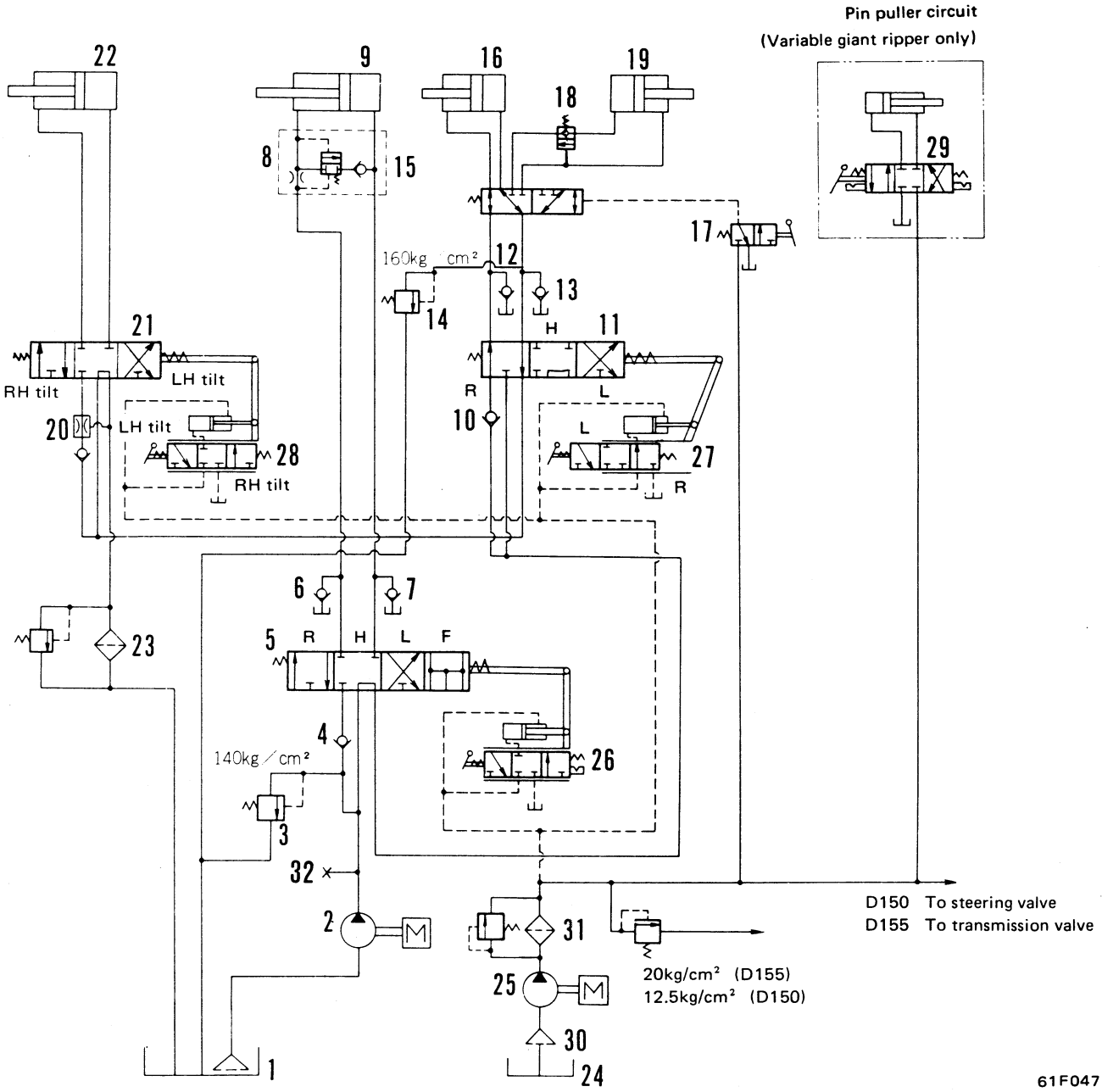
A. Main relief pressure pickup plug (PT 1/8)

RIPPER LIFT OPERATION

D150A C8421 and up
D155A T17001 and up



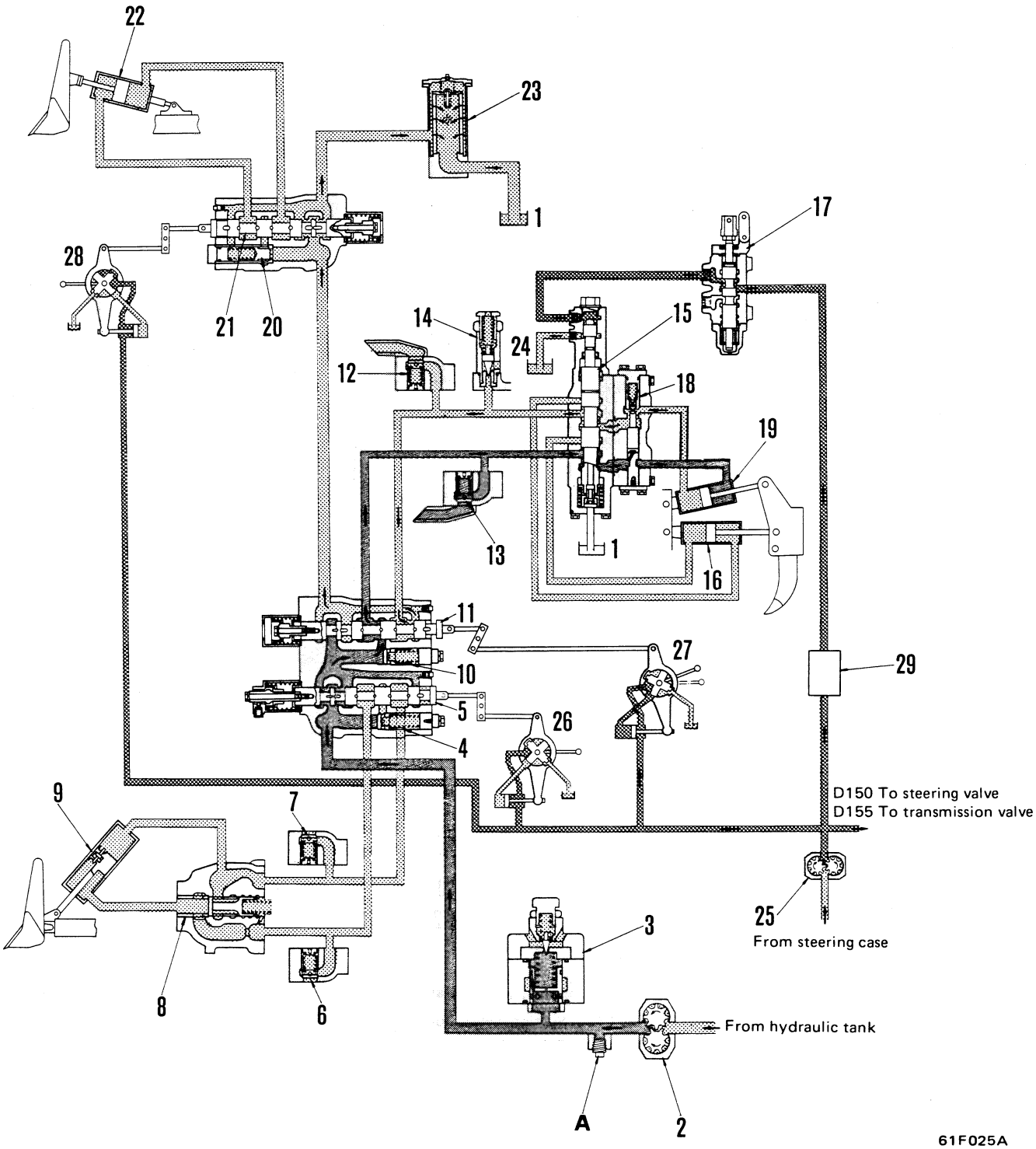
D150A C8421 and up
D155A T17001 and up



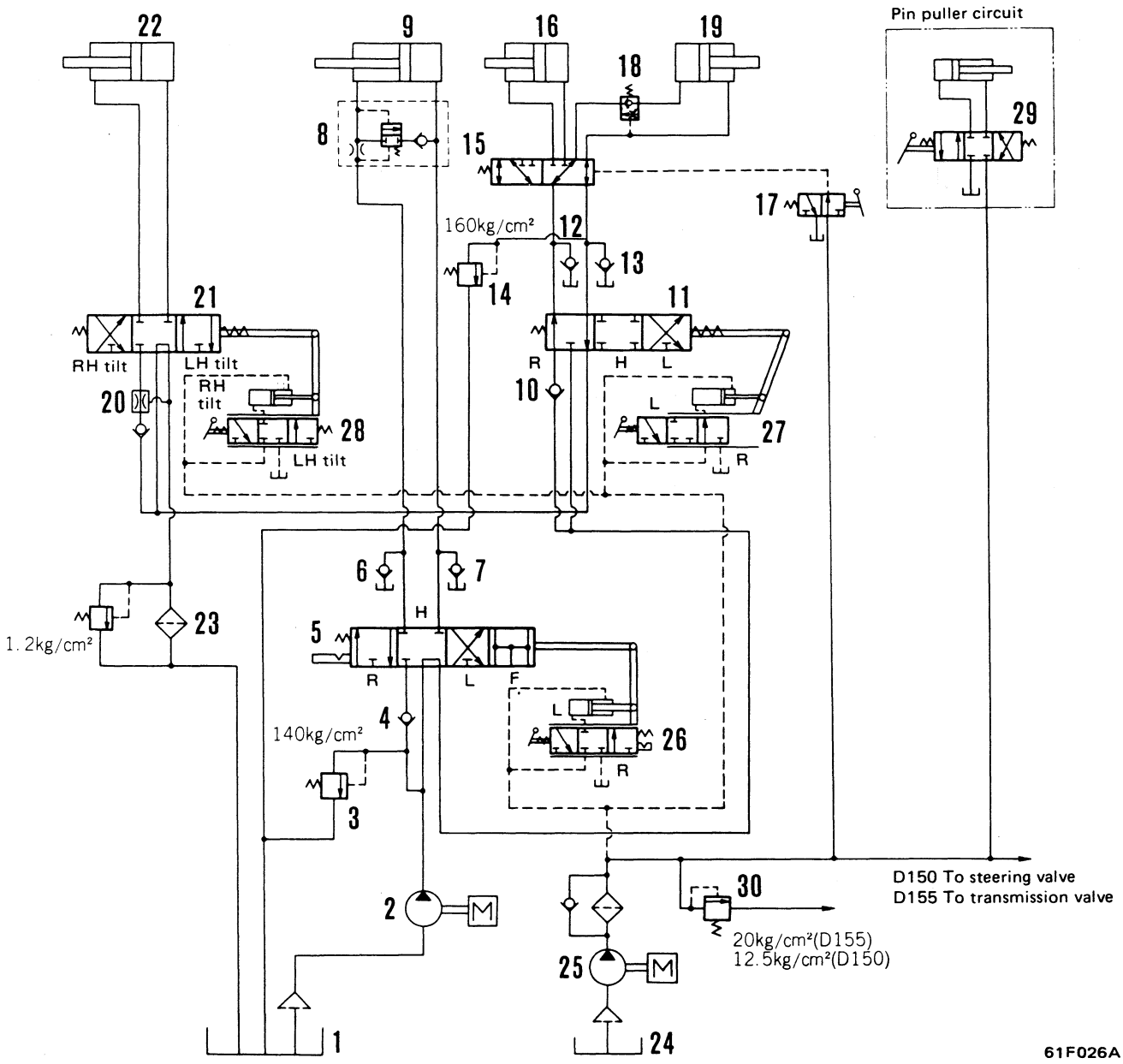
1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve (raise)
7. Suction valve (lower)
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve (raise)
13. Suction valve (lower)
14. Safety valve (raise)
15. Selector valve
16. Ripper lift cylinder
17. Pilot valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. Transmission pump (D155 FAR080)
    Steering pump (D150 FAR100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve
30. Magnetic strainer
31. Transmission filter

RIPPER TILT OPERATION

D150A C8408 ~ 8420
D155A T15001 ~ 17000



D150A C8408 ~ 8420
D155A T15001 ~ 17000

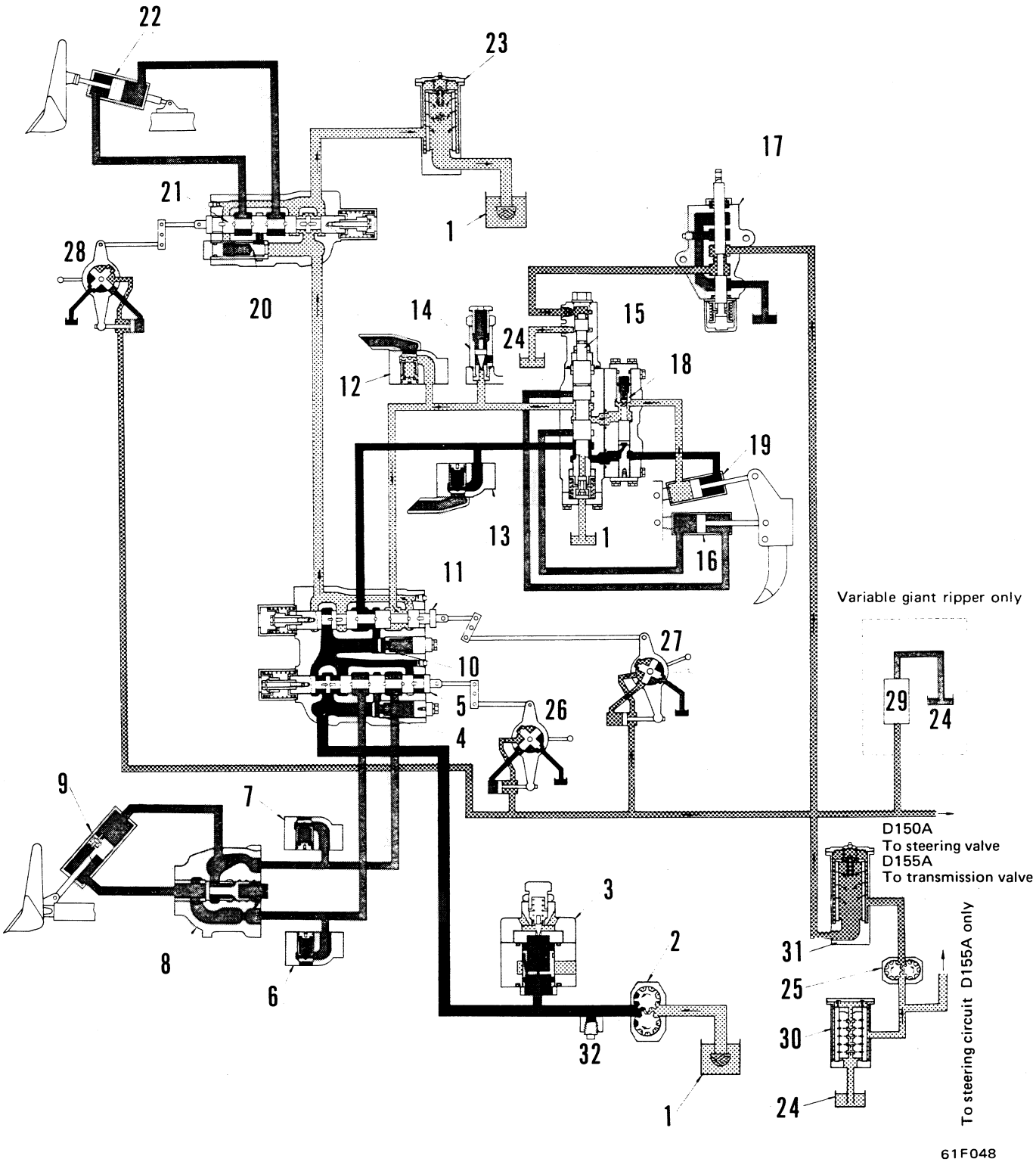


1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve

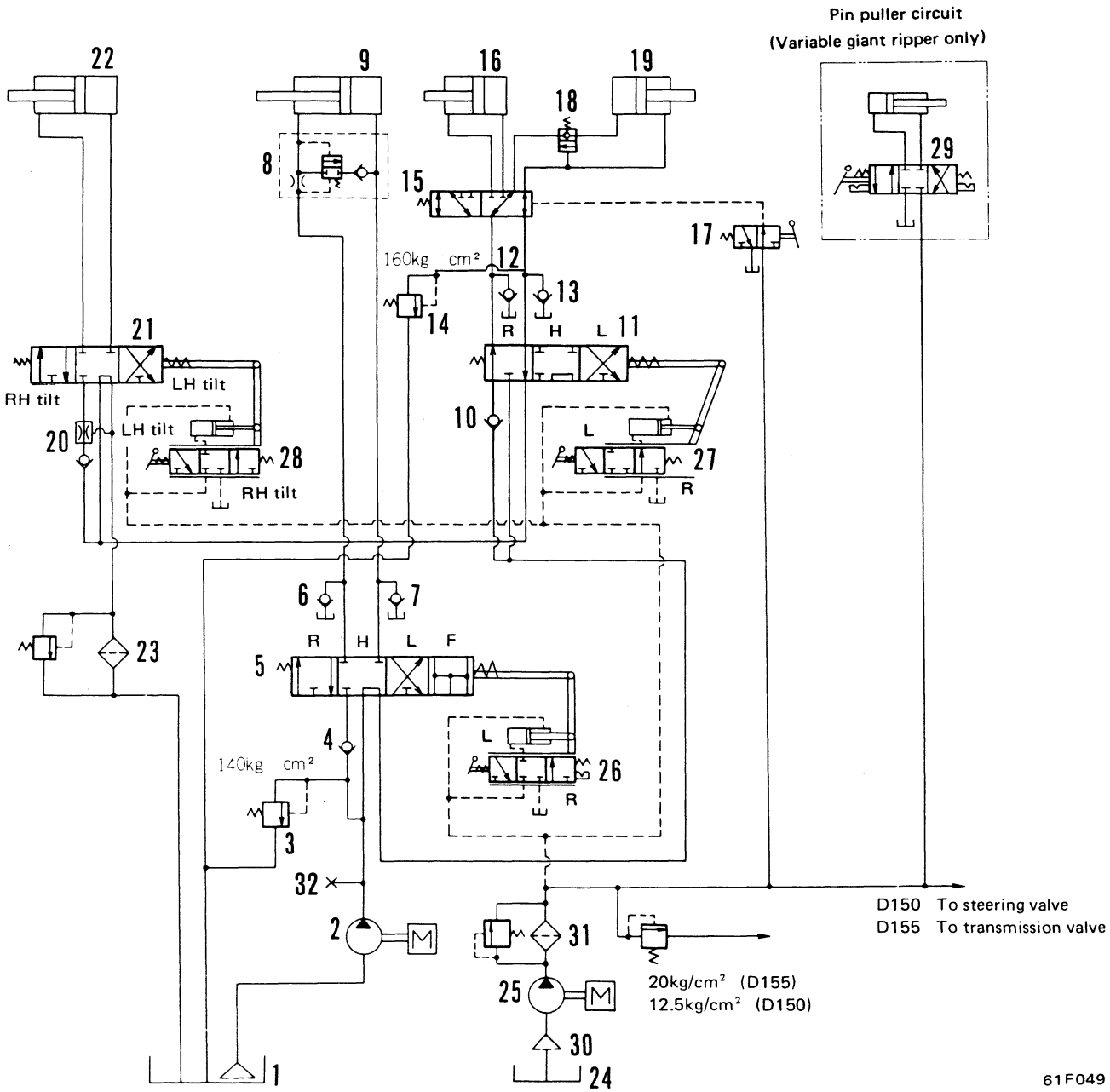
A. Main relief pressure pickup plug (PT 1/8)

RIPPER TILT OPERATION

D150A C8421 and up
D155A T17001 and up



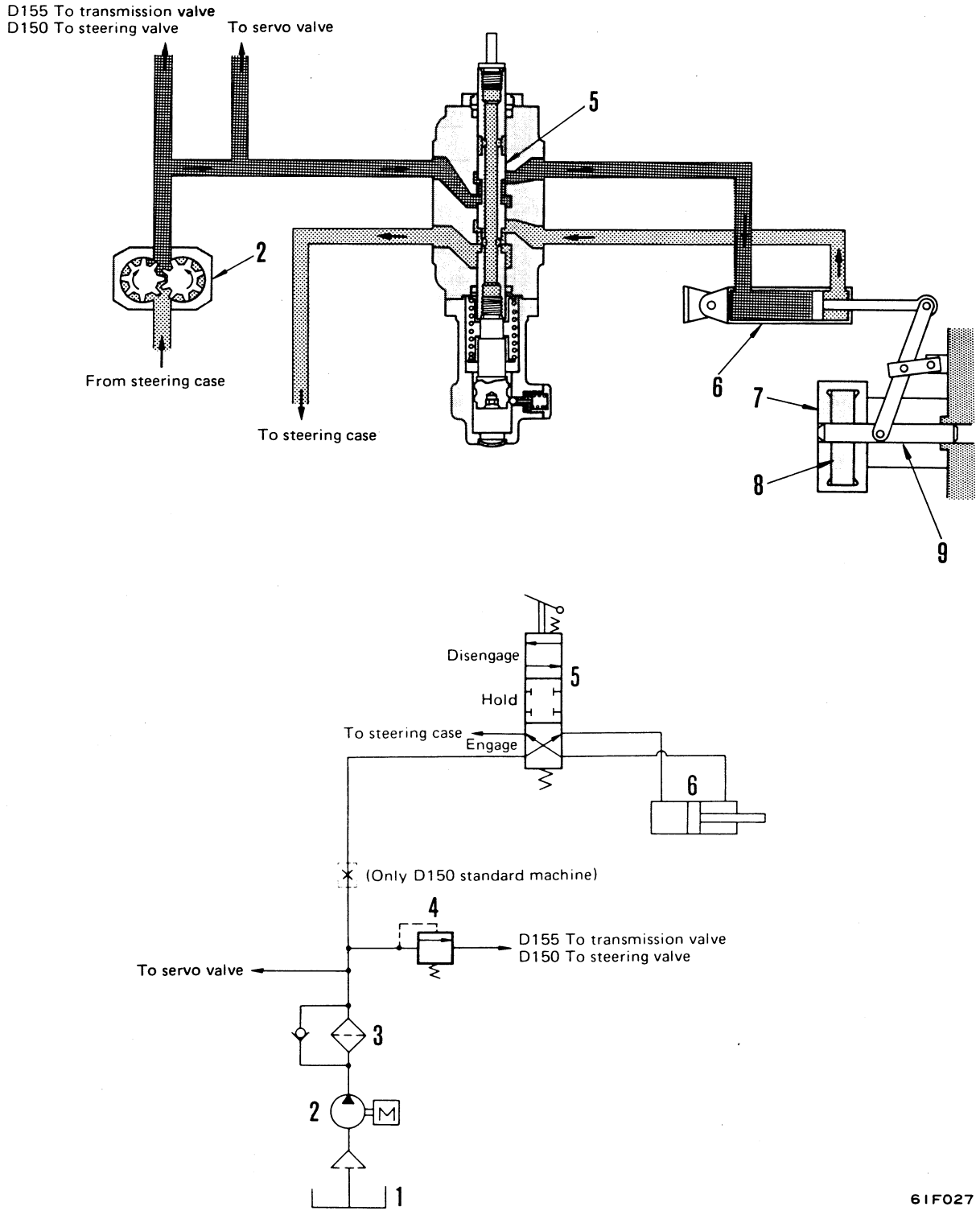
D150A 8421 and up
D155A 17001 and up



1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Lift spool
6. Suction valve (raise)
7. Suction valve (lower)
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve (raise)
13. Suction valve (lower)
14. Safety valve (raise)
15. Selector valve
16. Ripper lift cylinder
17. Pilot valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. Transmission pump (D155 FAR080)
    Steering pump (D150 FAR100)
26. Lift servo valve
27. Ripper servo valve
28. Tilt servo valve
29. Pin puller valve
30. Magnetic strainer
31. Transmission filter

PIN INSERTING OPERATION

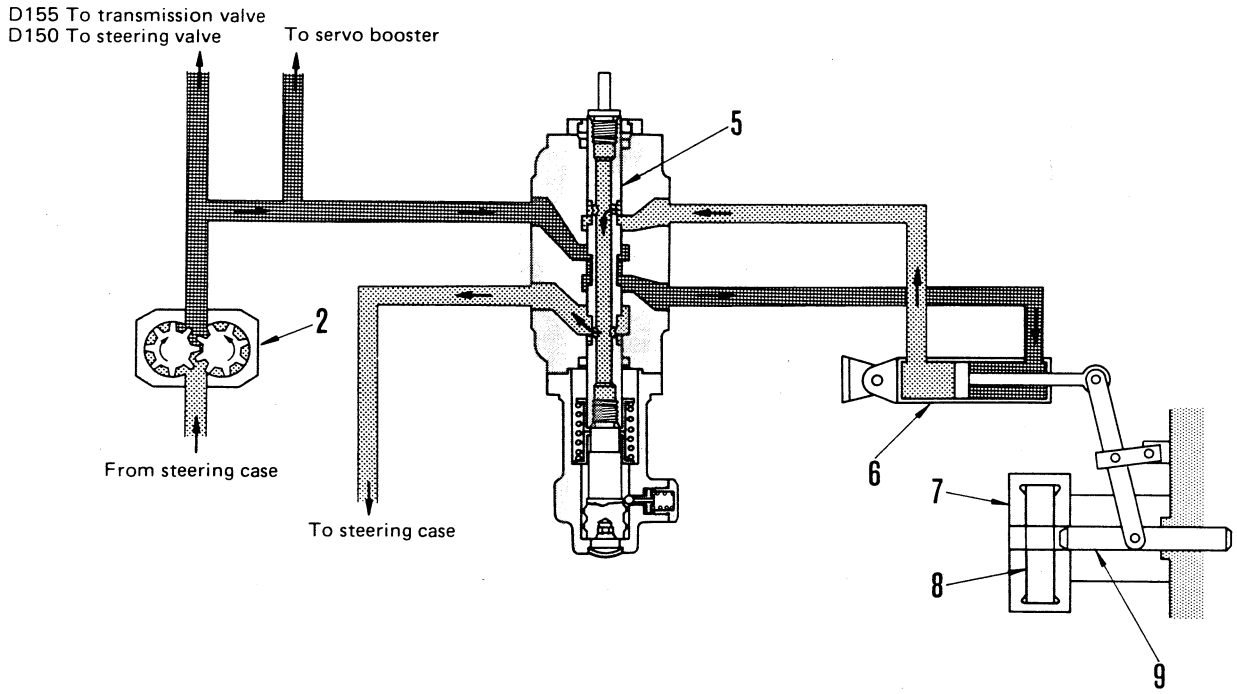
D150A 8402 – 8420
D155A 15001 – 17000

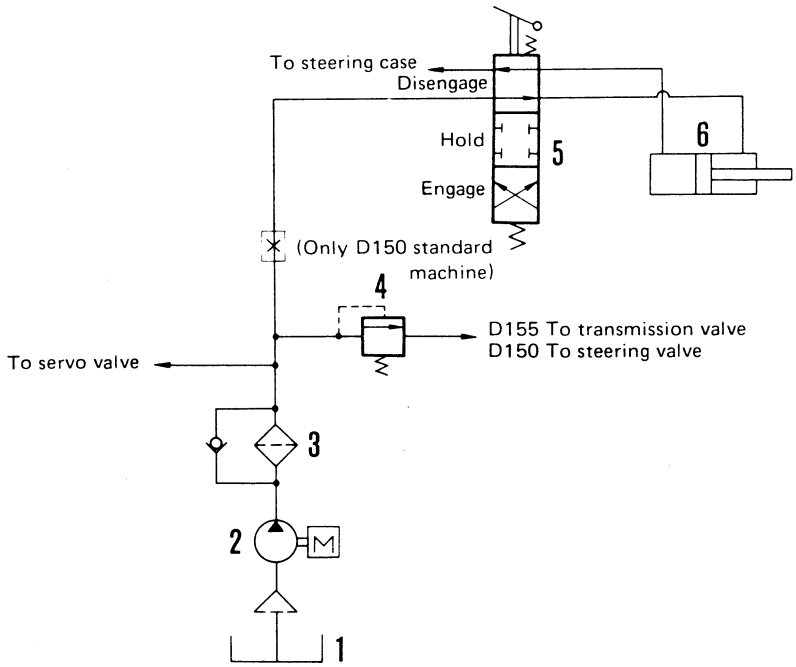


1. Steering case
2. TORQFLOW pump (D155 FAL045)
   Steering pump (D150 FAR100)
3. Oil filter
4. Transmission modulating relief valve (D155)
   Steering relief valve (D150)
5. Pin puller valve
6. Pin puller cylinder
7. Beam
8. Shank
9. Pin

PIN PULLING OUT OPERATION

D150A 8408 ~ 8420
D155A 15001 ~ 17000



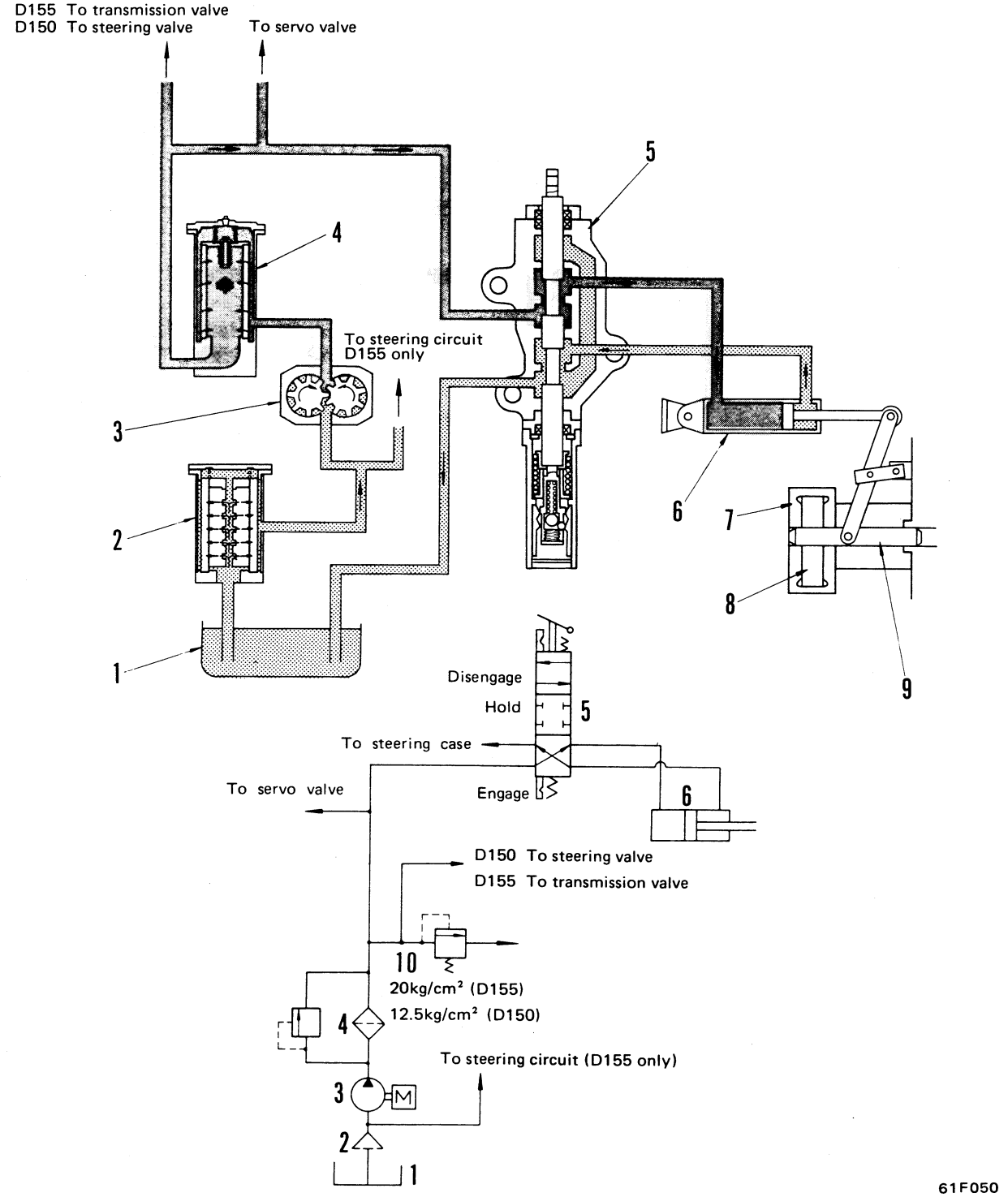


61F028

1. Steering case
2. TORQFLOW pump (D155 FAL045)
   Steering pump (D150 FAR 100)
3. Oil filter
4. Transmission modulating relief valve (D155)
   Steering relief valve (D150)
5. Pin puller valve
6. Pin puller cylinder
7. Beam
8. Shank
9. Pin

PIN INSERTING OPERATION

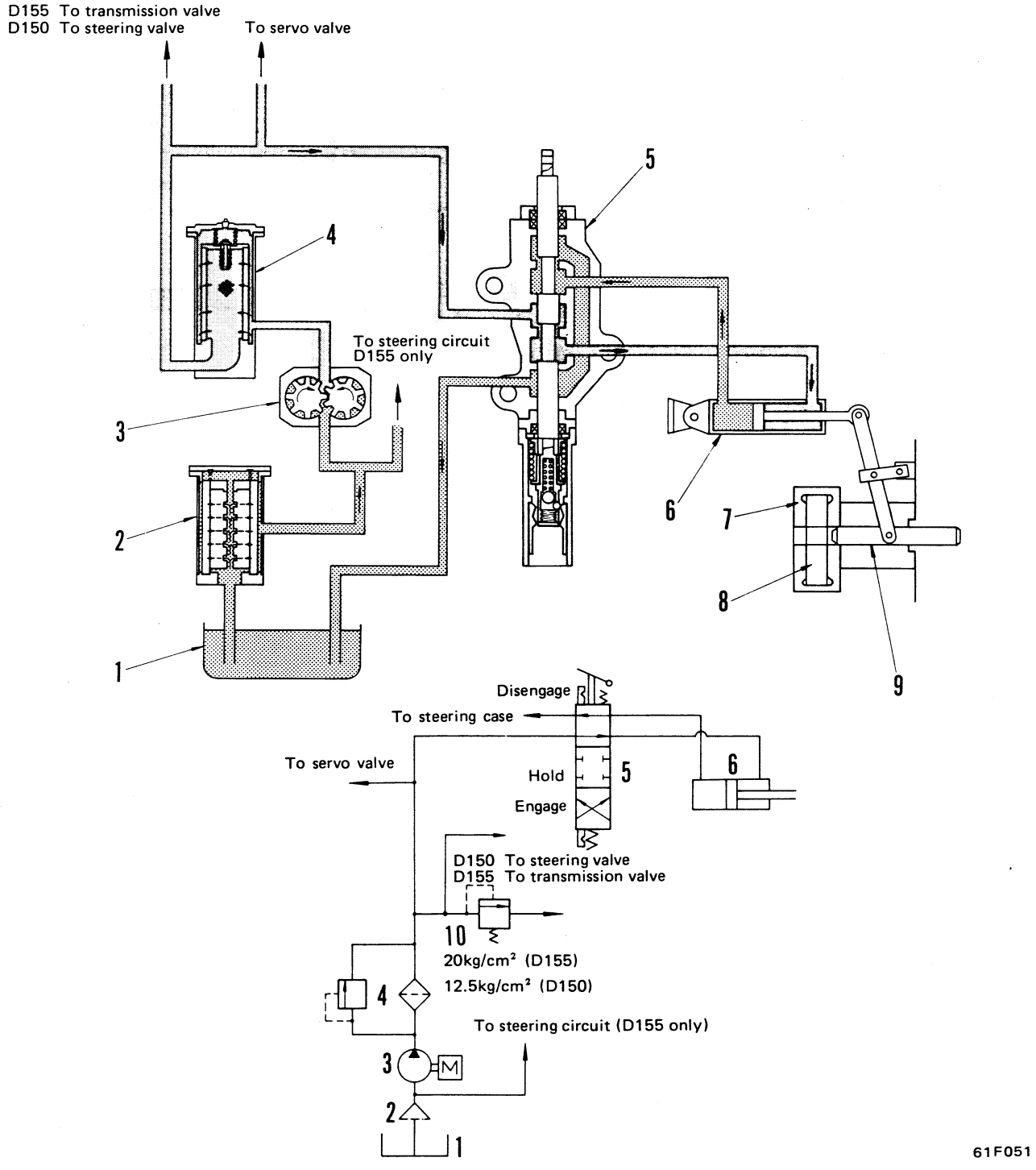
D150A 8421 ~ 8460
D155A 17001 ~ 25000



1. Steering case
2. Magnetic strainer
3. Transmission pump (D155 FAR045)
   Steering pump (D150 FAR100)
4. Oil filter
5. Pin puller valve
6. Pin puller cylinder
7. Beam
8. Shank
9. Pin
10. Transmission relief valve (D155)
    Steering relief valve (D150)

PIN PULLING OUT OPERATION

D150A 8460 and up
D155A 17001 ~ 25000

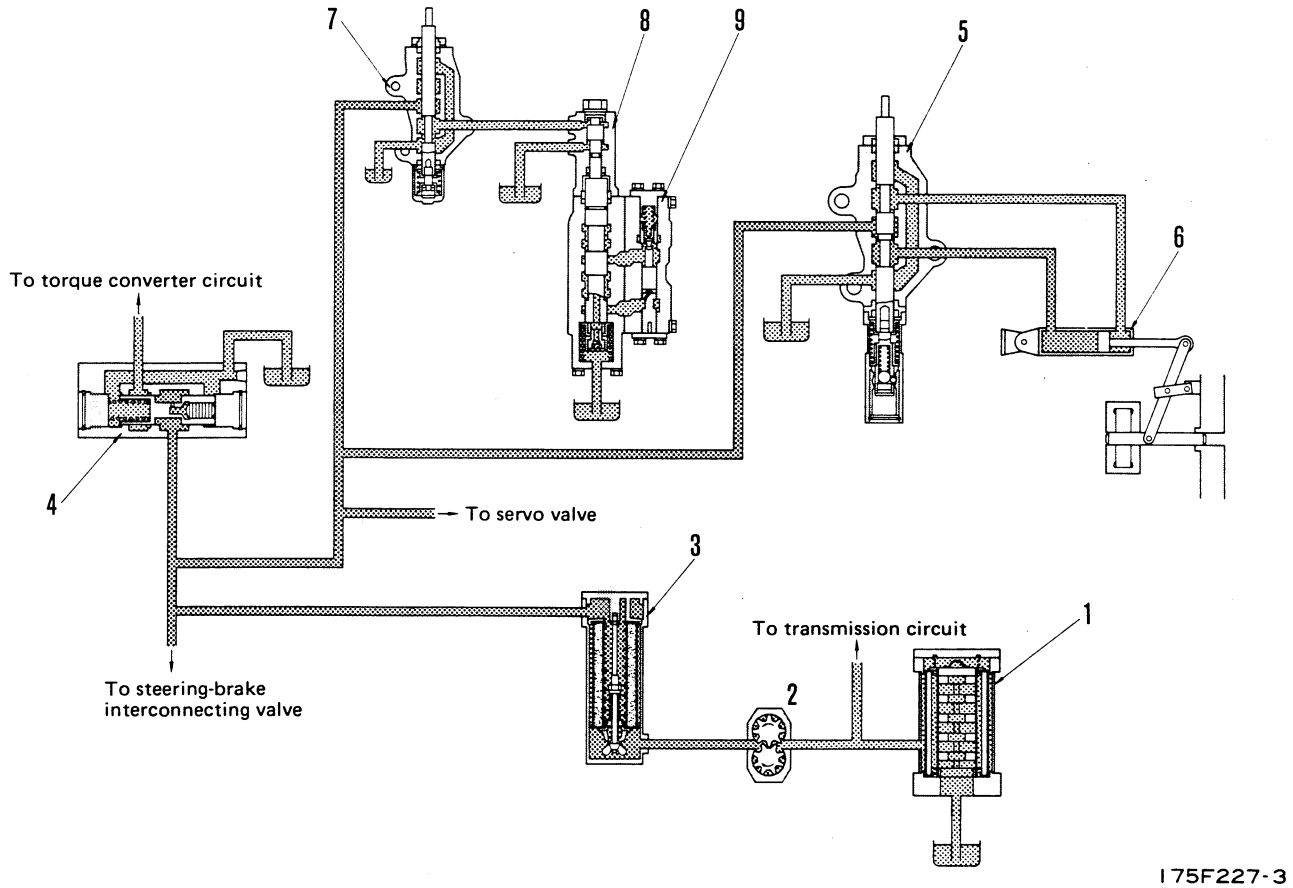


61F051

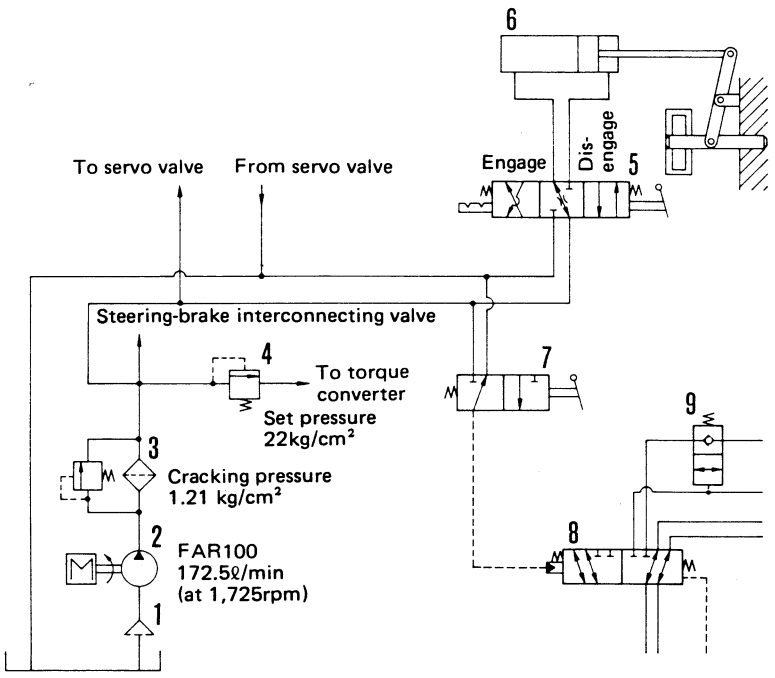
1. Steering case
2. Magnet strainer
3. Transmission pump (D155 FAR045)
   Steering pump (D150 FAR100)
4. Oil filter
5. Pin puller valve
6. Pin puller cylinder
7. Beam
8. Shank
9. Pin
10. Transmission relief valve (D155)
    Steering relief valve (D150)

PIN PULLER (HOLD)

D155A 25001 and up



I75F227-3



1. Strainer
2. Steering pump
3. Oil filter
4. Steering main relief valve
5. Pin puller valve
6. Pin puller cylinder
7. Pilot valve
8. Selector valve
9. Pilot check valve
10. Steering case

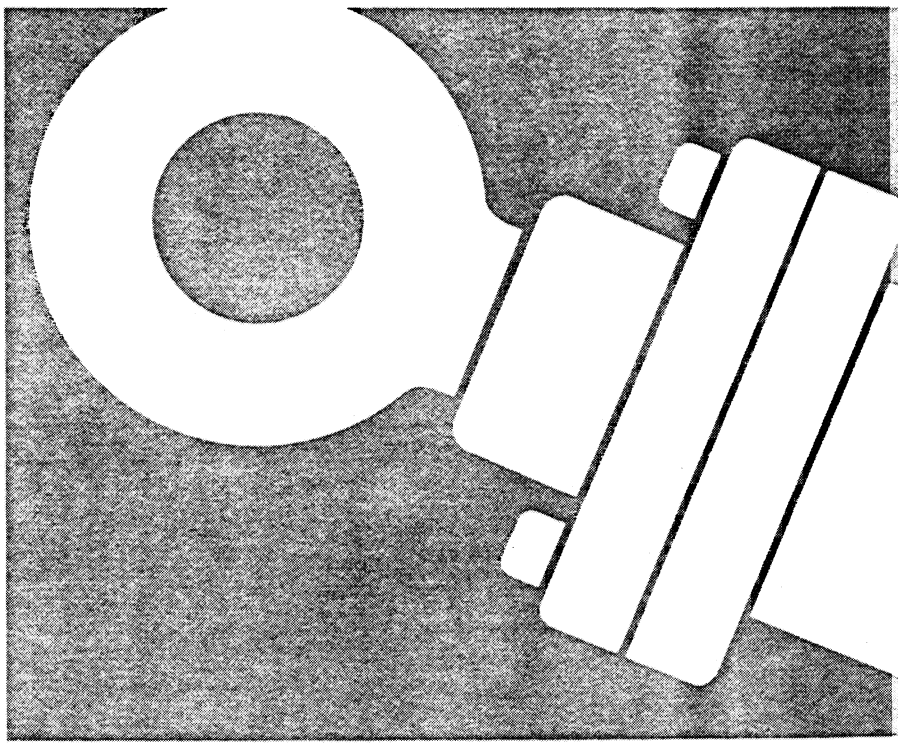
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

62 HYDRAULIC SYSTEM

TESTING AND ADJUSTING



TESTING AND ADJUSTING

General description 62- 2
Hydraulic control 62- 4
Pin puller control 62- 6
Table of oil pressure measuring points 62- 8
Measurement of oil pressure and temperature 62- 9
Measurement procedure of oil pressure and temperature . . . 62-10
Measuring the hydraulic pump delivery 62-11
Measurement of operating force 62-13
Table of maintenance standard 62-14

GENERAL DESCRIPTION

When the hydraulic system is to be analyzed and studied, attention should always be paid to the fact that REGULAR OIL FLOW and SPECIFIED OIL PRESSURE are necessary for satisfactory operation. The oil flow is pump ejected, related to the revolutions of the engine, and oil pressure is generated by controlling oil flow.
A systematic inspection for the hydraulic system consists of the following three stages.

1. **Visual check**
2. **Operation test**
3. **Pressure test**

Tests for the hydraulic system can be performed by using oil pressure measuring tool No. 790-301-1102. In any case, it is necessary to first carry out a visual check, then the operation test, and finally measurement by instruments.
When the basis of the hydraulic system, described below, are borne in mind, it is hoped that detection of defective parts will be easy, and diagnosis will be accurate.

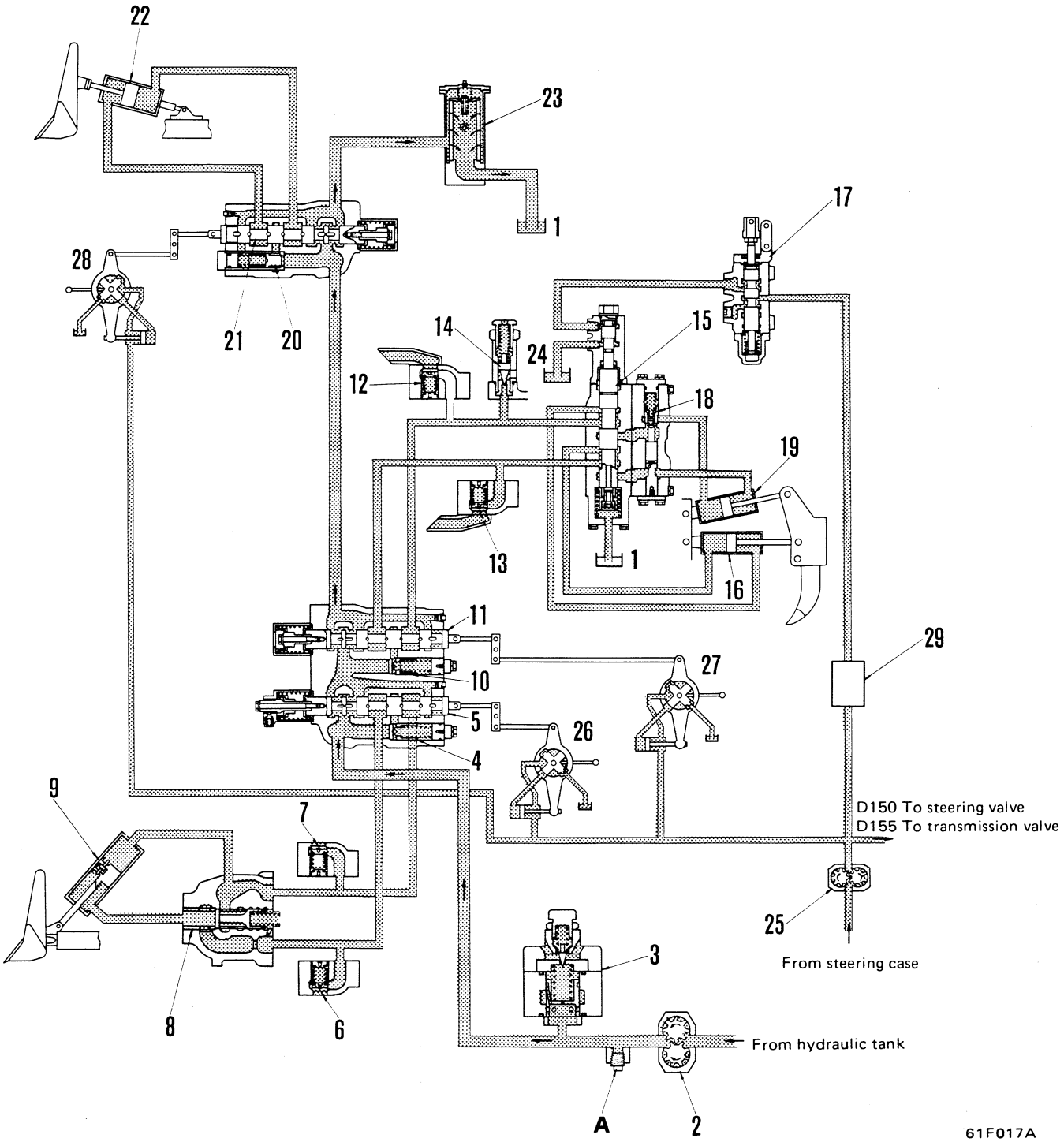


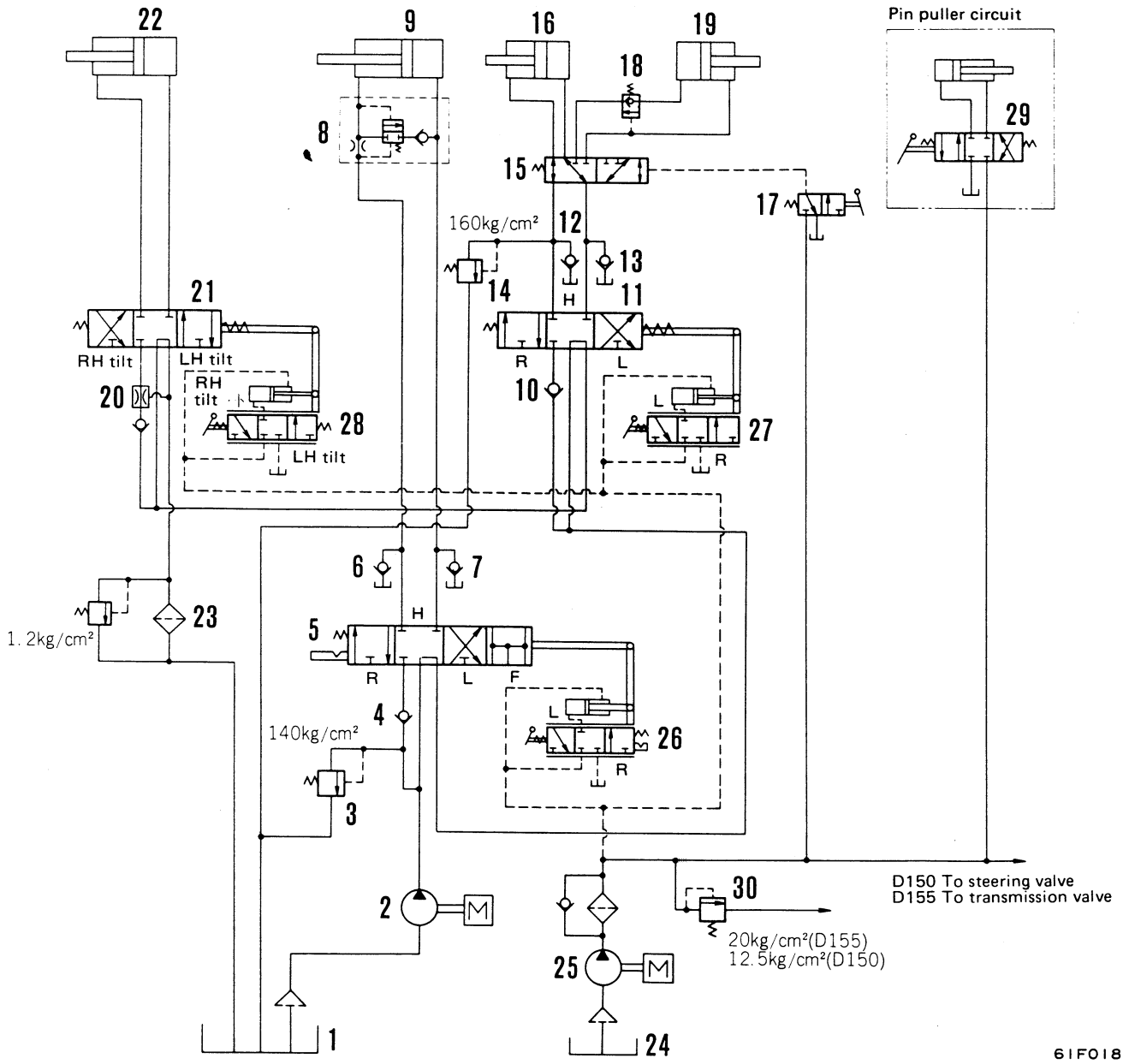
WARNING

When the hydraulic system is under test or being adjusted, the machine should be moved from the work site and unauthorized persons should be kept away. Only one person should ride on the machine and all others should stay to one side of the machine within the operator's visibility.

1. **Visual check**
   For trouble detection, first conduct visual check.
   Stop the engine, put the operating device on the ground and check the following items.
   1. Oil quantity.
   2. Remove filter element and check for foreign matter.
      If a magnet is used, ferrous metal, non-ferrous metal or non metal sealing materials (piston ring and O-ring seals, etc) can be identified.
   3. Check for external leakage on all piping and cylinders.
   4. Check for damage or leakage on all piping and joints.
   5. Check for bending, cracks or other damage to control linkage.
2. **Operation test**
   The operation test on the hydraulic system allows detection of internal leakage, damage to valves or pumps.

HYDRAULIC CONTROL

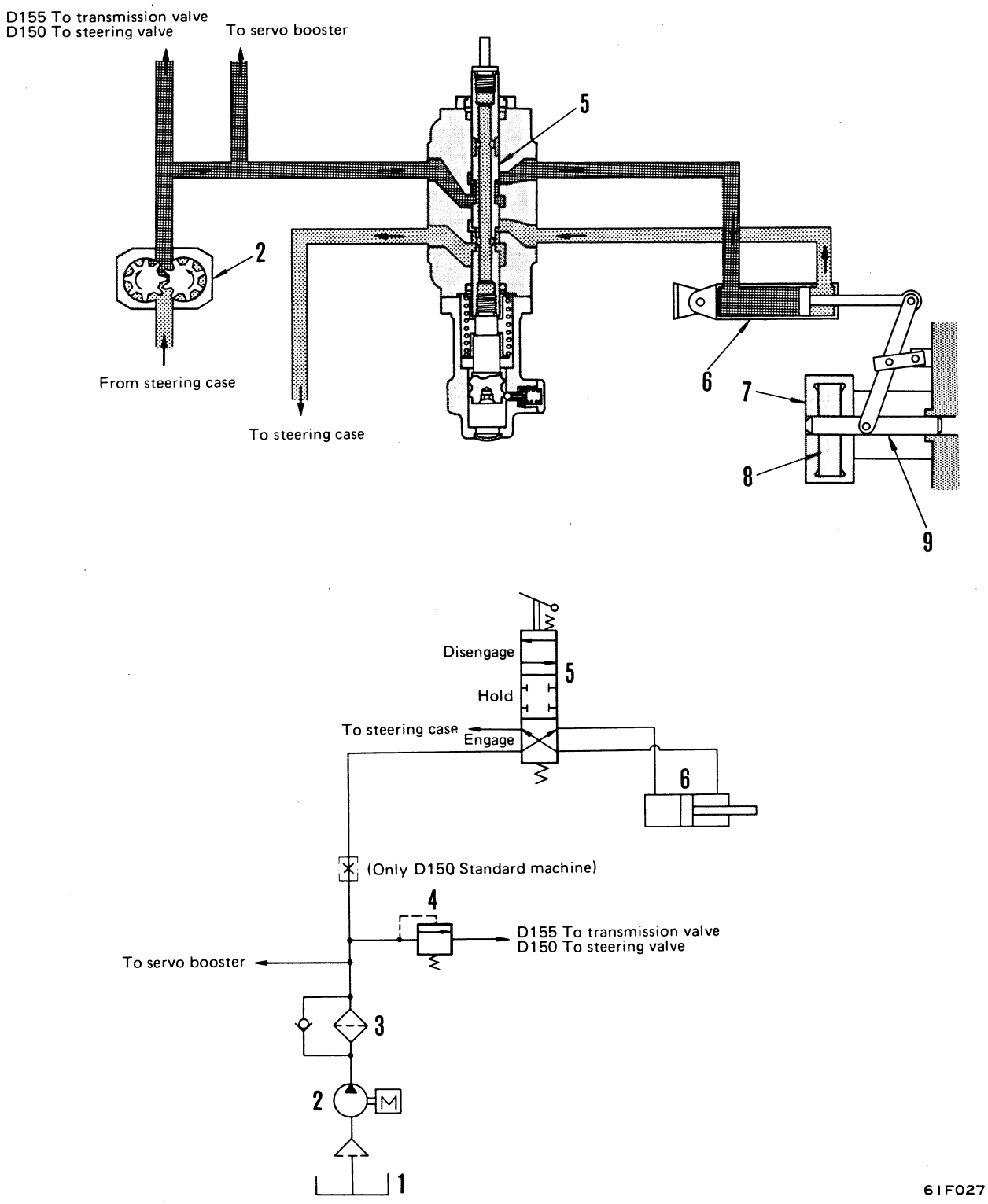




1. Hydraulic tank
2. Hydraulic pump (PAL200)
3. Main relief valve
4. Check valve
5. Blade lift spool
6. Suction valve for raise
7. Suction valve for lower
8. Quick drop valve
9. Blade lift cylinder
10. Check valve
11. Ripper spool
12. Suction valve for raise
13. Suction valve for lower
14. Safety valve for raise
15. Selector valve
16. Ripper lift cylinder
17. Actuator valve
18. Ripper tilt safety valve
19. Ripper tilt cylinder
20. Flow check valve
21. Blade tilt spool
22. Blade tilt cylinder
23. Oil filter
24. Steering case
25. TORQFLOW pump (D155 FAL 045)
    Steering pump (D150 FAR 100)
26. Blade lift servo booster
27. Ripper servo booster
28. Blade tilt servo booster
29. Pin puller valve

A. Main relief pressure pickup plug (PT 1/8)

PIN PULLER CONTROL

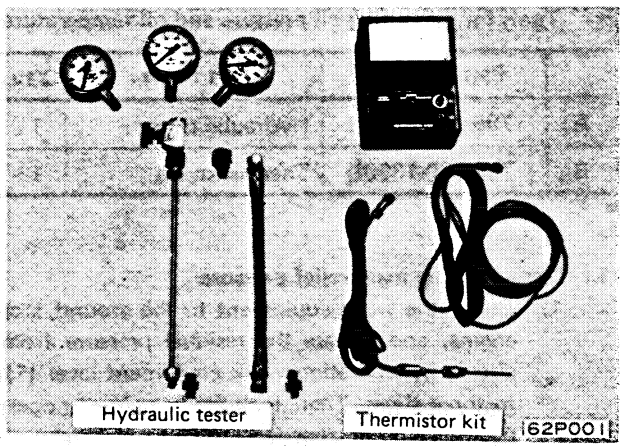


1. Steering case
2. TORQFLOW pump (D155A FAL045)
   Steering pump (D150A FAR100)
3. Oil filter
4. Transmission modulating relief valve (D155A)
   Steering relief valve
5. Pin puller valve
6. Pin puller cylinder
7. Beam
8. Shank
9. Pin

MEASUREMENT OF OIL PRESSURE AND TEMPERATURE

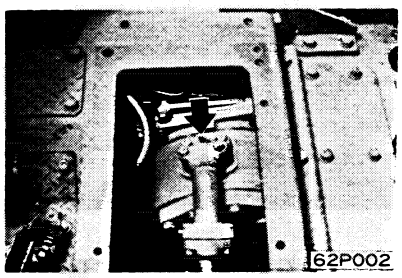
1. **Oil pressure and temperature measuring tools**
   - Hydraulic tester 799-101-5000
   - Thermistor kit **790-500-1300**

   (Refer to Shop Manual "Disassembly and Assembly" for detail.)

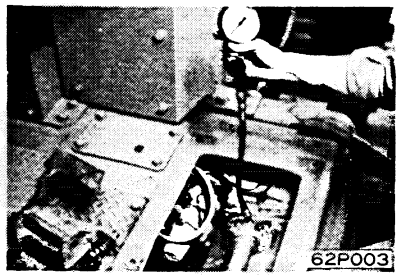


2. **Oil pressure test points**

   A. Main relief pressure

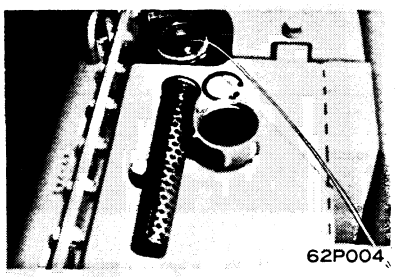


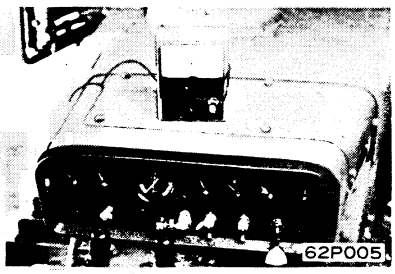
Position of detection plug



Installing the gauge (250kg/cm^2) → Oil pressure measurement

3. **Oil temperature test points**





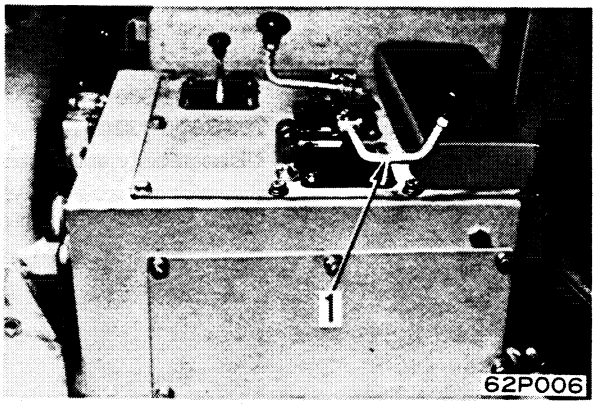
MEASUREMENT PROCEDURE OF OIL PRESSURE AND TEMPERATURE

★ **Tools for measuring oil pressure and oil temperature**

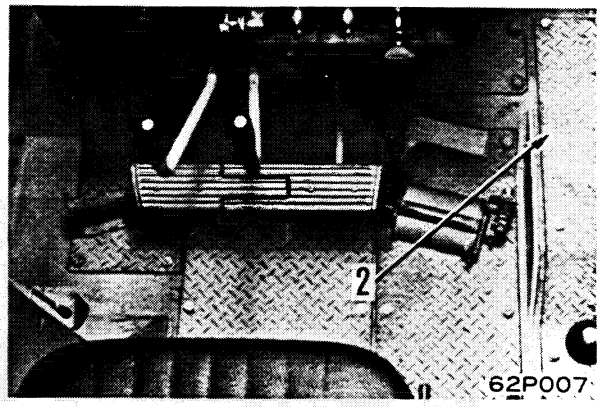
	Part number	Part name	Q'ty
A	799-101-5000	Hydraulic tester	1
B	790-500-1300	Thermistor kit	1

1. Measuring the main relief pressure

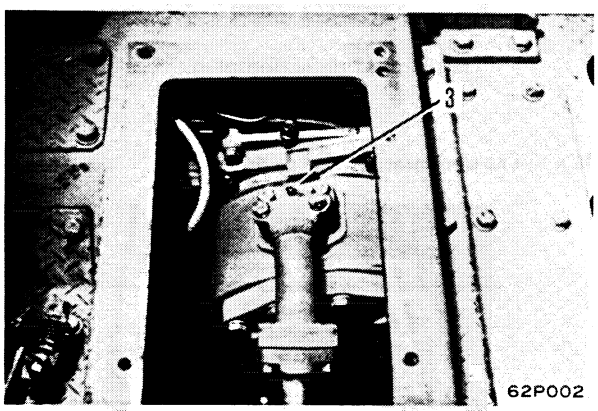
1) Lower the work equipment to the ground, stop the engine, and release the residual pressure from the circuit by operating work equipment lever (1) two to three times. Then, lock the lever in any operating position (other than FLOAT) to close the circuit between the hydraulic tank (control valve) and the work equipment pump.



2) Remove floor plate (2).

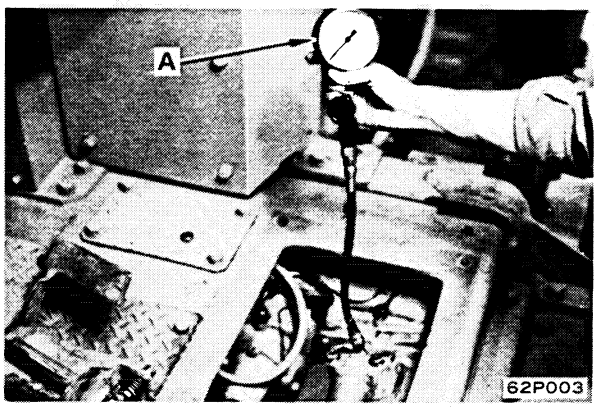


3) Remove pressure sensing plug (3) (PT1/8) from the outlet tube of the work equipment pump.



4) Install oil pressure gauge **A** (350 kg/cm^2) with a hose and adapter.

5) Measuring the oil pressure
Return the operating lever to NEUTRAL position and start the engine. Move the work equipment lever to bring the cylinder to be measured to the stroke-end position, and measure the oil pressure with the engine running both at a slow speed and at full speed.
   - ★ Oil temperature during measurement:
     45 – 55°C
   - ★ Be sure to lock the parking brake.



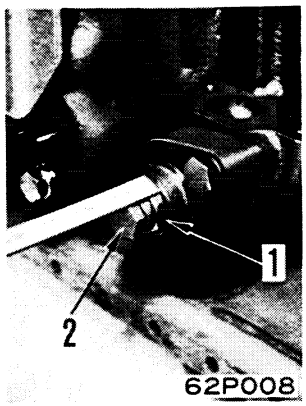
2. Oil pressure adjusting procedure

Adjust oil pressure, if necessary, using the following procedure:

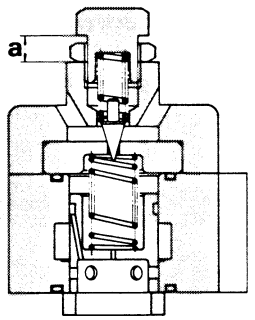
1) Drain oil from hydraulic tank and remove tank cover.
2) Loosen lock nut (2) fastening adjustment screw (3) on main relief valve (1). Turn adjustment screw clockwise to increase oil pressure.
   Turn adjustment screw counterclockwise to decrease oil pressure.

★ Change of oil pressure per rotation of screw: 29.2 kg/cm^2

★ Standard dimension "a": 15.2 mm



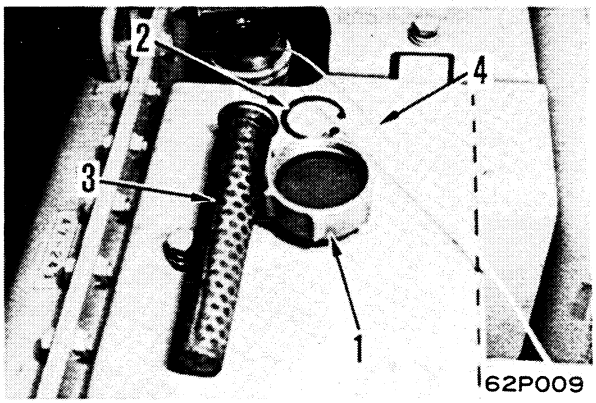
62P008



62F001

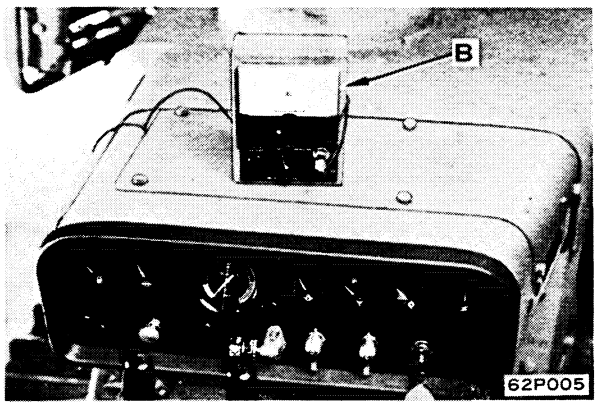
3. Oil temperature measuring procedure

1) Remove hydraulic tank cap (1). Remove snap ring (2) and strainer (3) from oil filler. Insert sensor (4) into tank through oil filler.



62P009

2) Connect sensor to thermistor **B** and measure oil temperature.



62P005

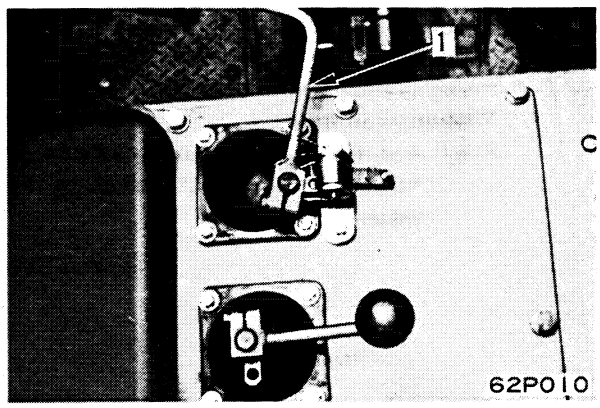
MEASURING THE HYDRAULIC PUMP DELIVERY

1. Oil flow rate test tool

Flow meter 790-303-1001

2. Setting tester

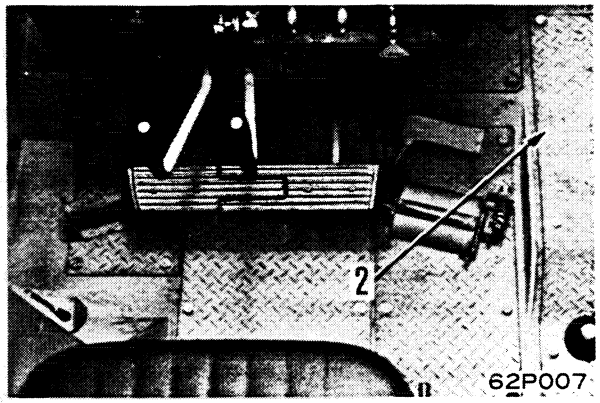
1) Lower blade or ripper onto ground and stop the engine. Operate blade ripper control lever two or three times to expel residual pressure from oil circuit. Place control lever at operating position (other than FLOAT) and lock at that position.



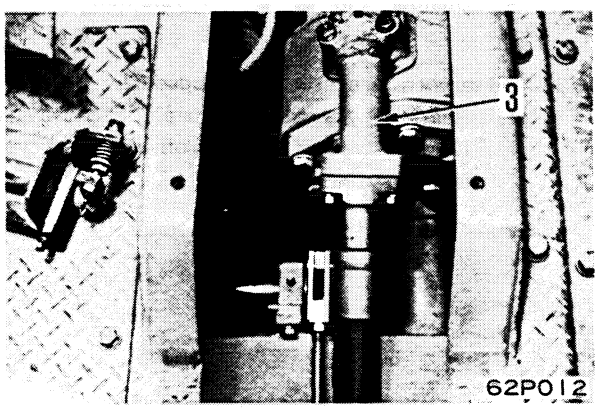
62P010

2) Loosen oil filler cap (1) to discharge air pressure from hydraulic tank.

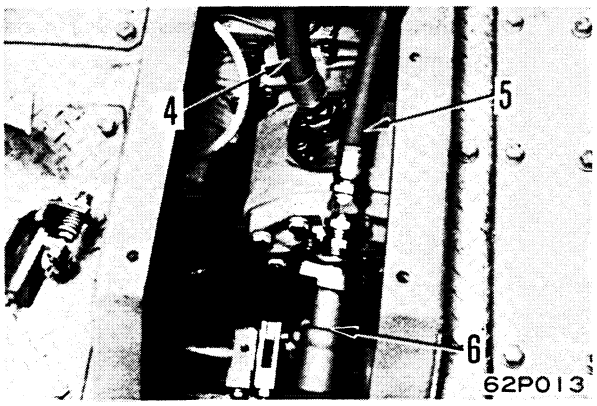
3) Remove floor plate (2).



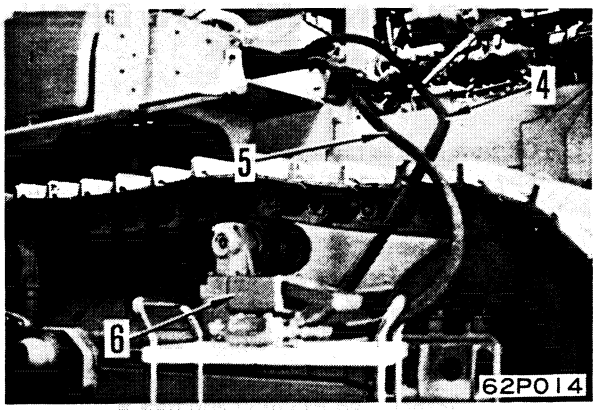
4) Remove pump outlet tube (3).



5) Connect flow meter inlet hose (4) to pump.
6) Connect flow meter outlet hose (5) to hose (6).

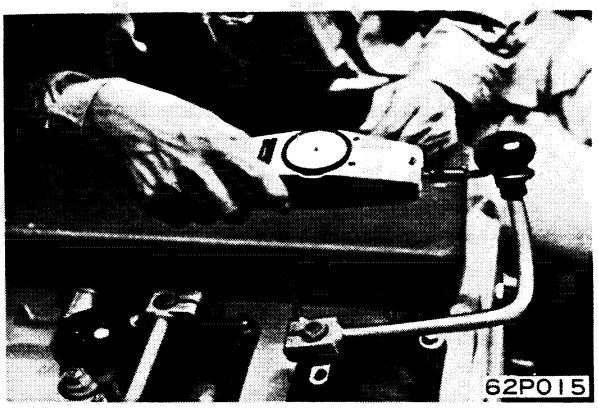


7) Connect hoses (4) and (5) to flow meter (6) and return control valve to neutral position. Start the engine and perform air-bleeding.
Measure oil flow rate.
★ For flow rate measuring procedure, refer to "Instruction manual" attached to the flow meter.

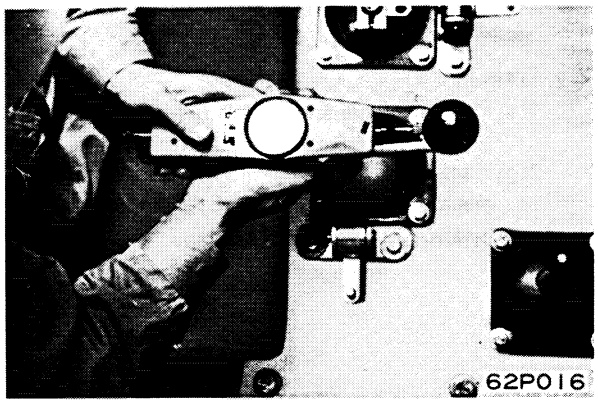


MEASUREMENT OF OPERATING FORCE

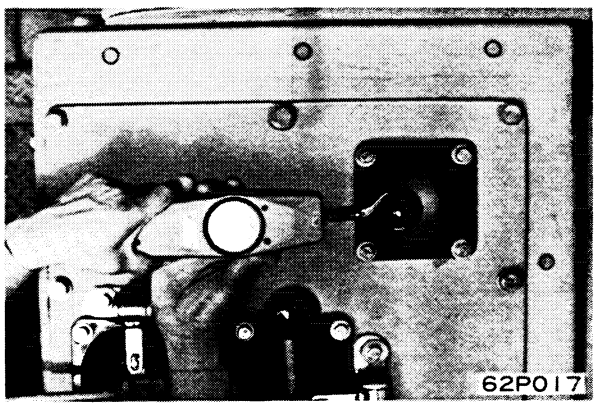
1. **Blade control lever**
   1) With engine running at full speed, hook push-pull scale to blade control lever knob.
   2) Move control lever back and forth with push-pull scale to measure lever operating force to RAISE, LOWER and FLOAT positions. Move lever right and left with push-pull scale to measure operating force to R.H. TILT and L.H. TILT position.



2. **Ripper control lever**
   1) With engine running at full speed, hook push-pull scale to ripper lever knob.
   2) Move control lever back and forth with push-pull scale to measure lever operating force to RAISE, LOWER and FLOAT position.

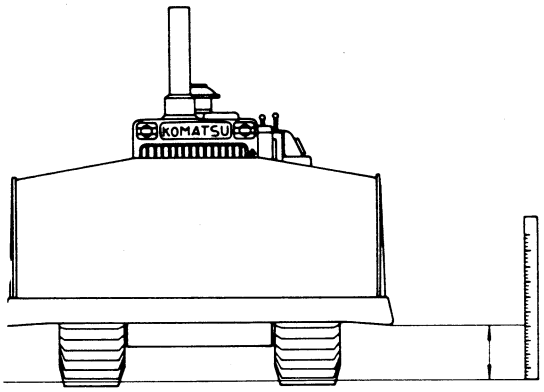


3. **Pin puller lever**
   1) With engine running at full speed, hook push-pull scale to pin puller lever knob.
   2) Pull pin puller lever with push-pull scale to measure operating force.



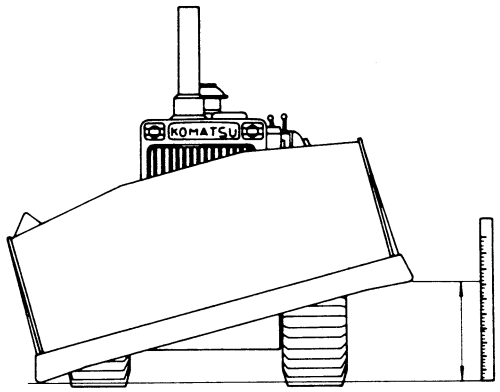
MEASUREMENT OF HYDRAULIC DRIFT RATE OF WORK EQUIPMENT

1. **Raised**
   1) Start engine and raise blade (or other equipment) approximately 800 mm above ground, then stop engine.
   2) Place control lever in "HOLD" position and leave machine standing for 15 minutes, then measure blade hydraulic drift rate.



195F162

2. **Tilted**
   1) Start engine and tilt blade maximum to left bringing right side to ground, then stop engine.
   2) Place control lever in "HOLD" position and leave machine standing for 15 minutes, then measure hydraulic drift rate of blade.



195F163

TABLE OF MAINTENANCE STANDARD

Item			Test condition			Standard	Remark
Travel	Blade control lever		At center of lever knob	NEUTRAL → RAISE		52 ~ 72mm	
				NEUTRAL → LOWER		52 ~ 72mm	
				RAISE → FLOAT		52 ~ 72mm	
				NEUTRAL → R. H. TILT		34 ~ 44mm	
				NEUTRAL → L.H. TILT		34 ~ 44mm	
	Ripper lever		At center of lever knob	NEUTRAL → RAISE		47 ~ 67mm	
				NEUTRAL → LOWER		47 ~ 67mm	
				NEUTRAL → TILT (back and force)		39 ~ 53mm	
	Pin puller lever		At center of lever knob	FREE → LOCK		25 ~ 35mm	
Operating force	Blade control lever		When cylinder piston rod is moved to each stroke end at slow engine speed	NEUTRAL → RAISE		1.75 ± 0.75kg	
				NEUTRAL → LOWER		3 ± 1kg	
				LOWER → FLOAT		6.5 ± 1kg	
				FLOAT → NEUTRAL		1.6 ~ 6.5 kg	
				NEUTRAL → TILT (right and left)		2.0 ~ 3.6 kg	
	Ripper lever		When cylinder piston rod is moved to each stroke end at slow engine speed.	NEUTRAL → RAISE		2.3 ± 0.5kg	
				NEUTRAL → LOWER		2.3 ± 0.5kg	
				NEUTRAL → TILT (back and forth)		4.5 ± 0.5kg	
	Pin puller lever		When cylinder piston rod is moved to each stroke end at full engine speed	FREE → LOCK		4.5 ± 2.5kg	
Oil pressure	Work equipment		Oil temperature 45 ~ 55°C		SLOW	133 ~ 140kg/cm²	Standard pressure 140kg/cm²
					FULL	138 ~ 147kg/cm²	
Performance	Blade	Blade speed	• Oil temperature: 45 ~ 55°C • Without blade load • Between ground and maximum lift	RAISE	SLOW	11 ~ 18 sec.	Slow engine speed: 600 rpm
					FULL	3 ~ 5 sec.	
				LOWER	SLOW	1.5 ~ 2.5 sec.	
					FULL	0.5 ~ 1.5 sec.	
				FLOAT	SLOW	0.5 ~ 1.5 sec.	
					FULL	0.5 ~ 1.5 sec.	
		Hydraulic drift rate of blade	Stop engine at 45 ~ 55°C of oil temperature and measure lowering of blade at blade center 800mm raised above ground.			100mm/15 min max.	
		Hydraulic drift rate of machine body	After jacking machine body with blade on ground, stop engine. Oil temperature: 45 ± 5°C Measure lowering of idler center.			50mm/15 min max.	
	Blade (tilt)	Tilting speed	• Oil temperature 50 ± 5°C • Without blade load • Measure time spent for tilting blade from one side to the other side.	L.H. TILT	SLOW	3 ~ 5 sec.	Slow engine speed: 600 rpm
					FULL	2.5 ~ 4.5 sec.	
				R.H. TILT	SLOW	2 ~ 4.5 sec.	
					FULL	1.5 ~ 3.5 sec.	
		Hydraulic drift rate of blade	Jack machine body with tilted blade and stop engine at 45 ~ 55°C of oil temperature. Measure time spent for lowering of machine body onto ground.		L.H. TILT	7 minutes	
					R.H. TILT	5 minutes	

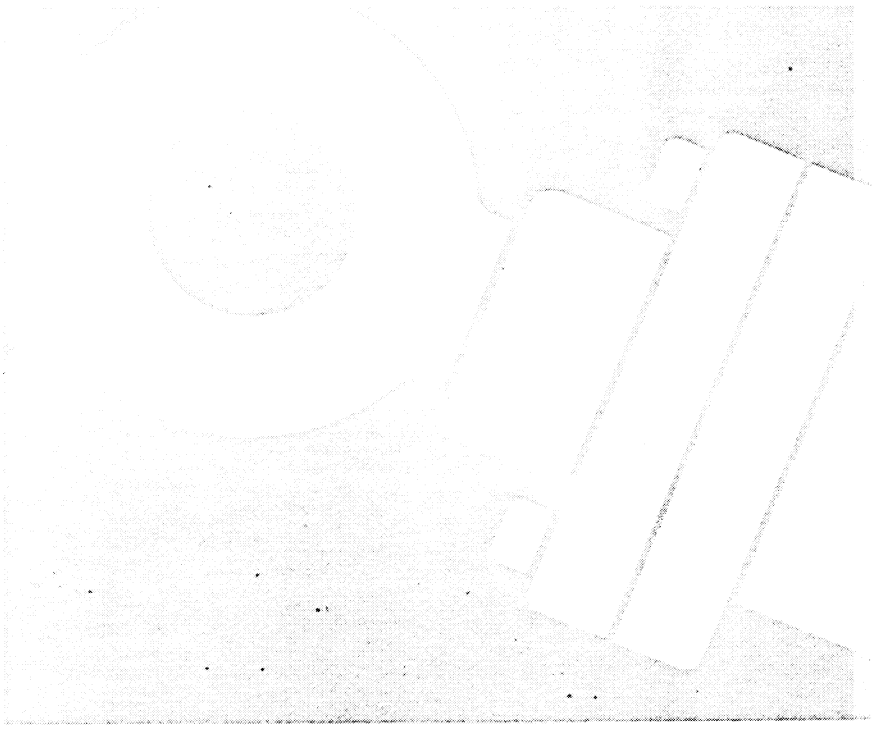
Item			Test condition			Standard	Remarks
Performance	Ripper	Ripper speed	Oil temperature: 45 ~ 55°C Shank hole: Lowest stage Point: from the ground to the upper limit	Multishank ripper	Lift — Engine SLOW	10 ~ 18 sec.	
					Lift — Engine FULL	3.5 ~ 4.5 sec.	
					Lower — Engine SLOW	3 ~ 4.5 sec.	
					Lower — Engine FULL	3.5 ~ 4.5 sec.	
				Giant ripper	Lift — Engine SLOW	16 sec.	
					Lift — Engine FULL	3 ~ 4 sec.	
					Lower — Engine SLOW	3 ~ 4 sec.	
					Lower — Engine FULL	3 ~ 4 sec.	
			Oil temperature: 45 ~ 55°C Shank hole: Lowest stage Tilt cylinder Extent → Retract (Increase) Retract → Extent (Decrease)	Increase in angle	Engine SLOW	18 ~ 22 sec.	
					Engine FULL	4 ~ 6 sec.	
				Decrease in angle	Engine SLOW	21 ~ 25 sec.	
					Engine FULL	5 ~ 7 sec.	
		Pin puller speed	Oil temperature: 45 ~ 55°C No load applied to pin Engine-FULL			Less than 5 sec.	
		Hydraulic drift	Oil temperature: 40 ~ 50°C Engine STOP Ripper point: 500 mm above the ground			Less than 80mm/15 min.	
		Sinkage of machine body	Oil temperature: 40 ~ 50°C, Engine STOP Sinkage of the machine observed at the center of the sprocket when the machine is propped up with the ripper and blade.			Less than 400mm/15 min.	

SHOP MANUAL

D150,155

SERIAL NO. D150A-1 8408~
D155A-1 15001~

63 HYDRAULIC CONTROL SYSTEM
DISASSEMBLY AND ASSEMBLY



DISASSEMBLY AND ASSEMBLY

No.	Item	Page
1	Dismounting hydraulic pump	63- 4
	Mounting hydraulic pump	63- 6
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	Mounting hydraulic tank	63- 12
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	Assembly of blade tilt control valve	63- 30
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	Assembly of ripper selector valve	63- 66
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	Assembly of blade lift cylinder	63- 82
15	Dismounting blade tilt cylinder	63- 88
	Mounting blade tilt cylinder	63- 90
16	Disassembly of blade tilt cylinder	63- 92
	Assembly of blade tilt cylinder	63- 98

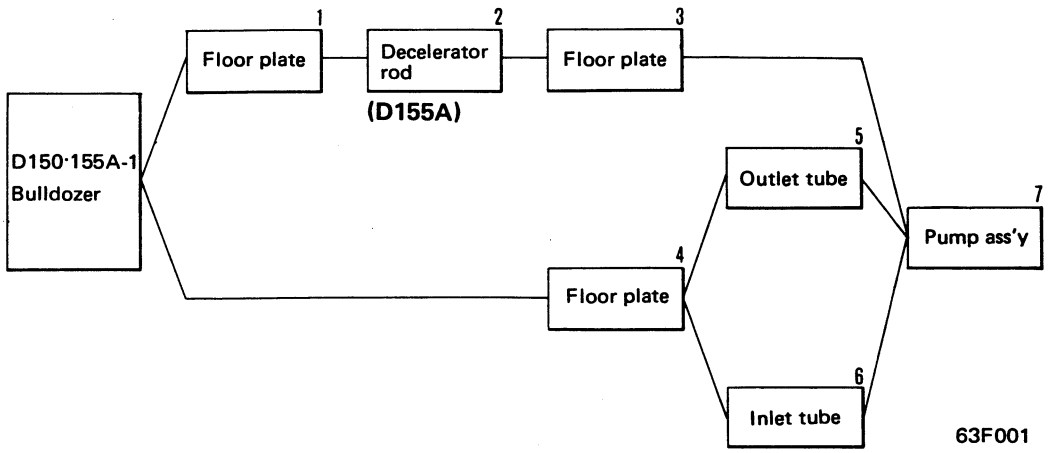
No.	Item	Page
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	Mounting ripper lift cylinder	63-106
18	Dismounting ripper tilt cylinder	63-108
	Mounting ripper tilt cylinder	63-110
19	Disassembly of ripper cylinder	63-112
	Assembly of ripper cylinder	63-118
20	Dismounting ripper pin puller cylinder	63-124
	Mounting ripper pin puller cylinder	63-126

★ Take the following method for air bleeding when you start to operate hydraulic cylinders after reassembling cylinders, pumps and pipings.

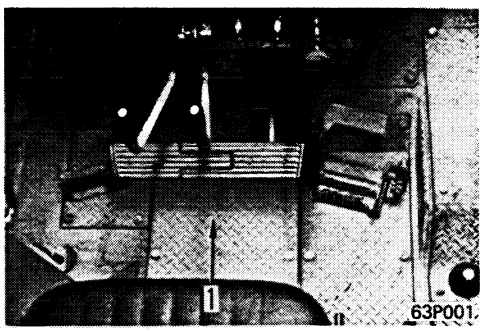
1. Start engine, keep idling.
2. Operate hydraulic cylinder 4 – 5 cycles, but do not exceed beyond 100 mm of stroke end.
3. Continue to operate cylinder 3 – 4 cycles until stroke end.
4. After finishing above steps, keep normal engine speed.

NOTE: After long storage, same procedure is required.

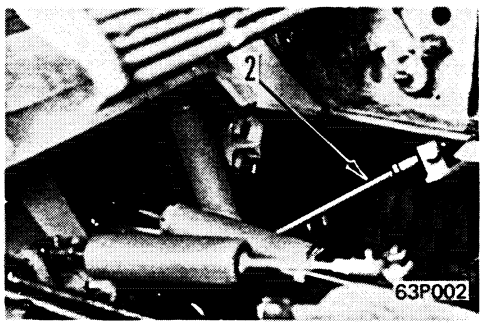
DISMOUNTING HYDRAULIC PUMP



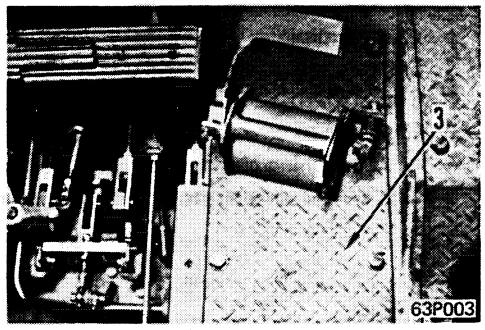
1. **Floor plate**
   Remove floor plate (1).



2. **Decelerator rod (D155A)**
   Disconnect decelerator rod (2).

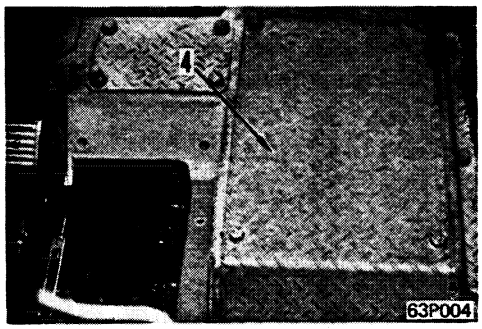


3. **Floor plate**
   Remove floor plate (3).



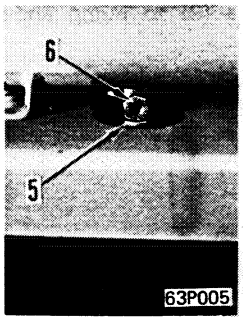
4. Floor plate

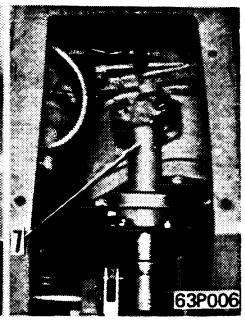
Remove floor plate (4).



5. Outlet tube

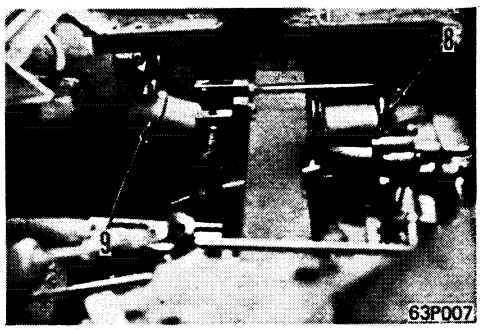
1) Remove drain plug (5) and open drain valve (6) to drain oil from hydraulic tank.
2) Remove flange fastening bolts and disconnect tube (7) from pump.
   ★ Temporarily clamp removed tube with wire.





6. Inlet tube

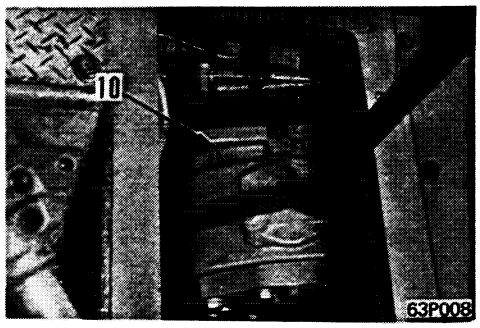
1) Loosen nut securing coupling (8).
2) Remove flange fastening bolts and disconnect tube (9) from pump.



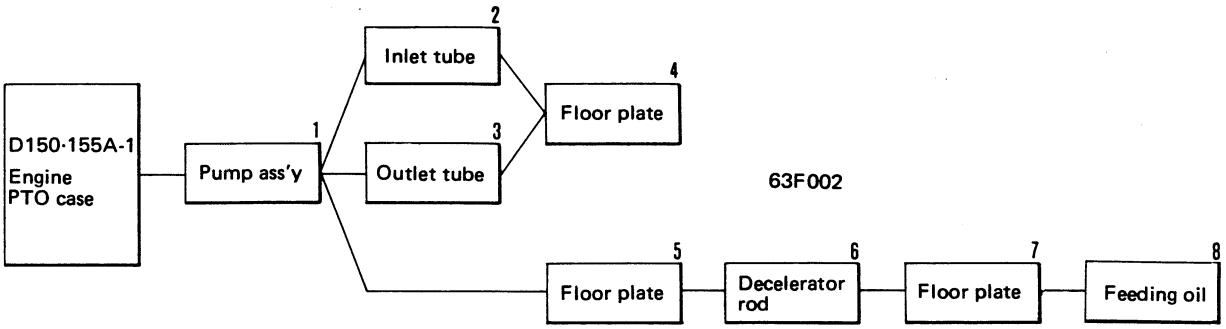
7. Pump assembly

Remove bolts fastening pump assembly (10); lift off assembly winding rope.

kg Pump assembly: **50 kg**

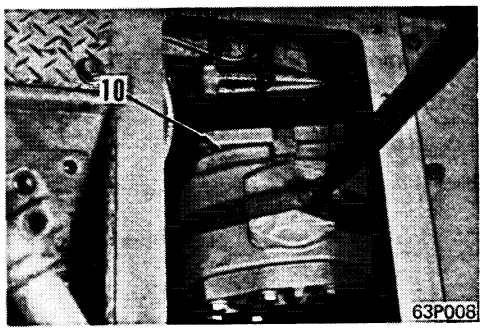


MOUNTING HYDRAULIC PUMP

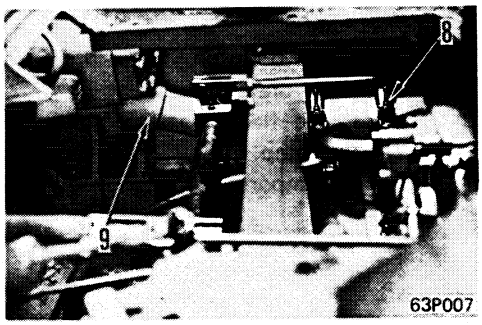


(D155A)

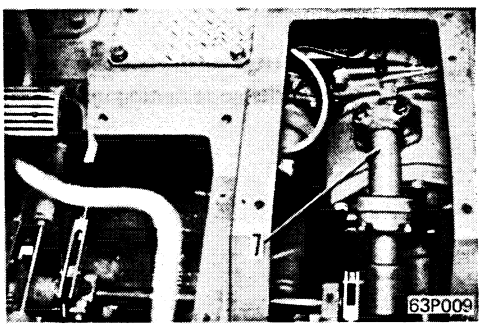
1. **Pump assembly**
   Lift pump assembly (10) with O-ring into position so that driving and driven shaft splines mesh with each other.



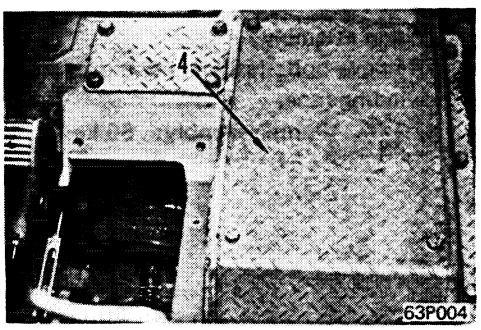
2. **Inlet tube**
   1) Connect tube (9) to pump and tighten flange fastening bolts.
   2) Secure coupling (8) with nut.



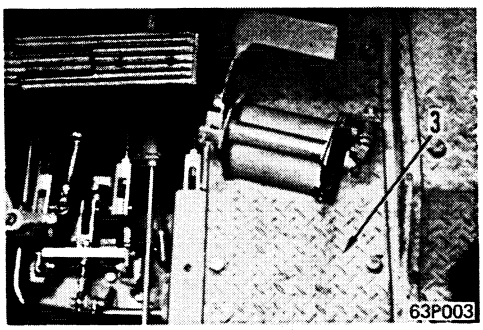
3. **Outlet tube**
   Connect tube (7) to pump and tighten flange fastening bolts.



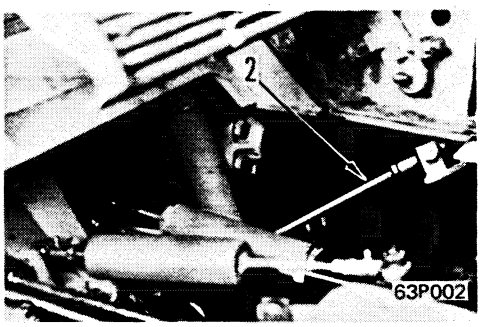
4. **Floor plate**
   Install floor plate (4).



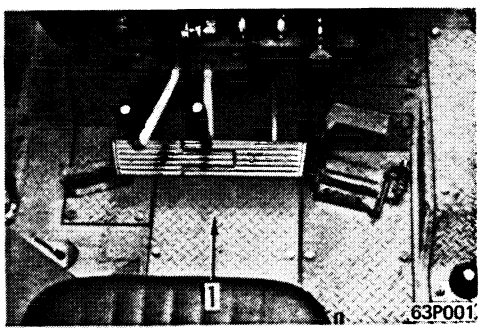
5. **Floor plate**
   Install floor plate (3).



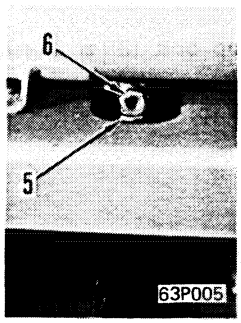
6. **Decelerator rod (D155A)**
   Connect decelerator rod (2).

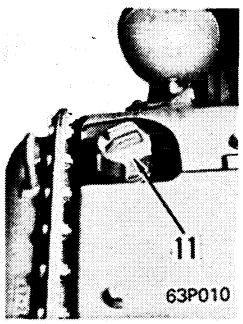


7. **Floor plate**
   Install floor plate (1).

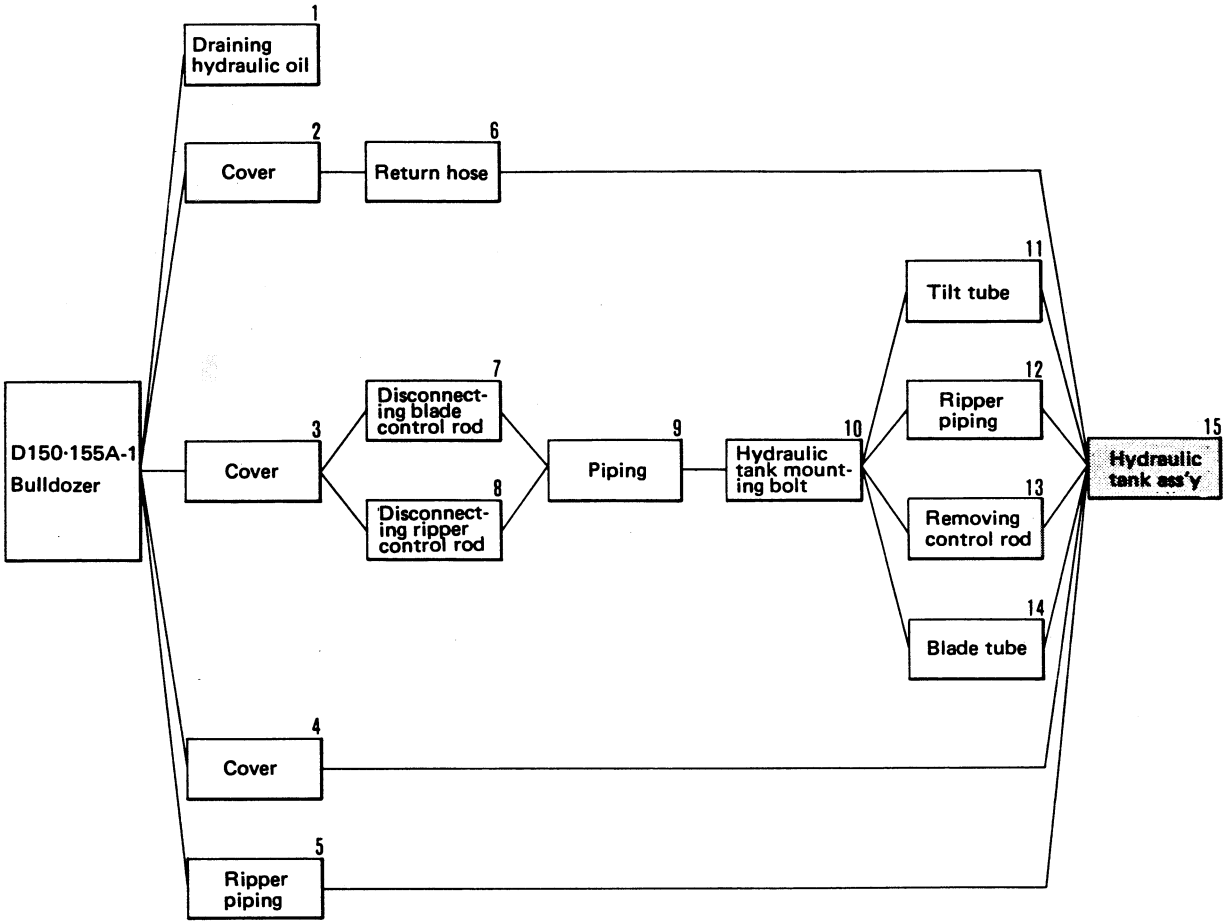


8. **Feeding oil**
   After confirming that drain plug (5) and drain valve (6) are tightened, feed oil through oil filler (11).





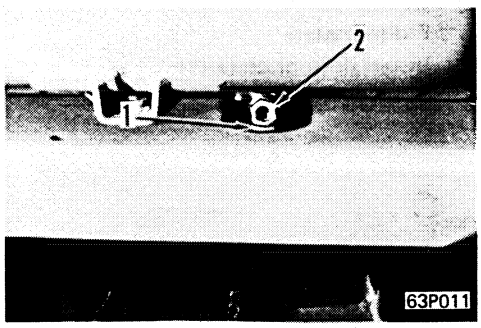
DISMOUNTING HYDRAULIC TANK



63F003

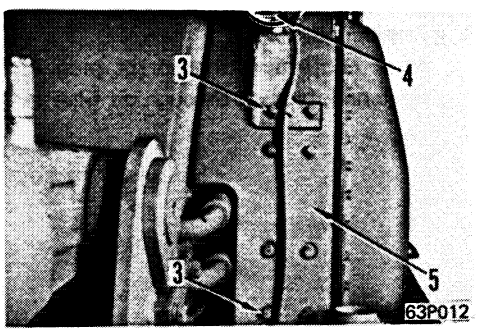
1. Draining hydraulic oil

Remove drain plug (1) and loosen drain valve (2) to drain oil from hydraulic tank.

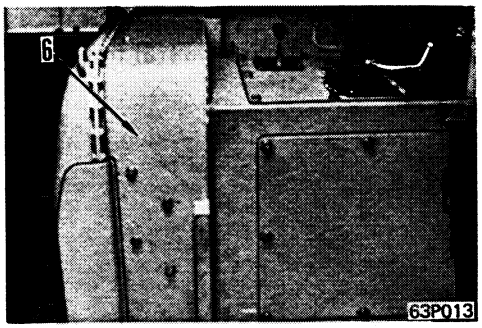


2. Cover

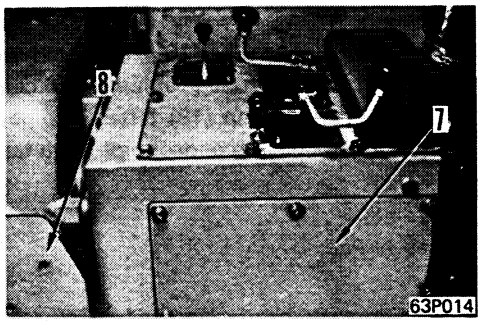
1) Remove clamp bolt (3) and rear lamp (4) together with bracket.
2) Remove cover (5).



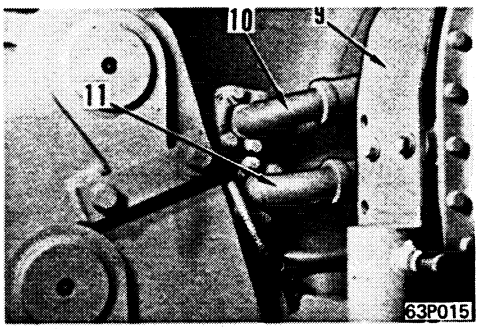
3. **Cover**
   Remove cover (6).



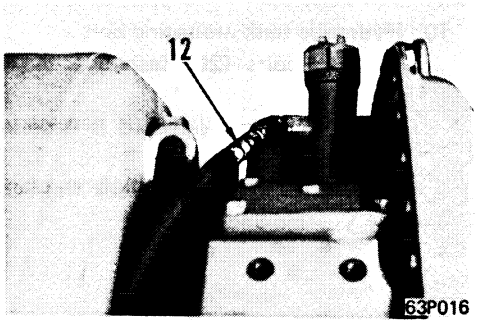
4. **Cover**
   Remove cover (7) together with bracket (8).



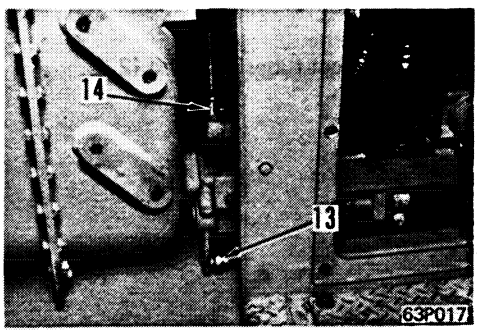
5. **Ripper piping**
   1) Remove bracket (9).
   2) Remove split flanges fastening outlet pipe (10) and inlet pipe (11) to selector valve; remove pipes.



6. **Return hose**
   Remove sleeve nut fastening return hose (12) from selector valve; remove hose.

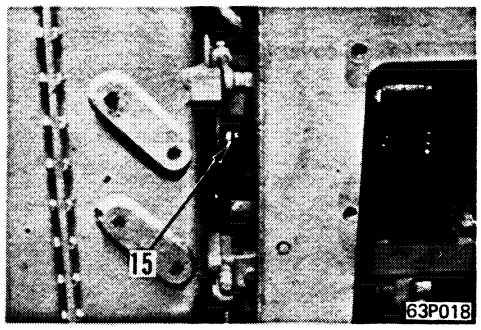


7. **Disconnecting blade control rod**
   1) Disconnect blade lifting control rod (13) from lever.
   2) Remove blade tilting contorl rod (14).



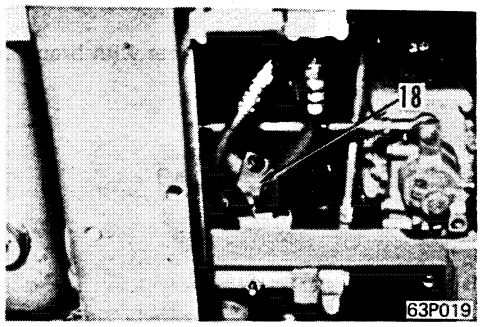
8. Disconnecting ripper control rod

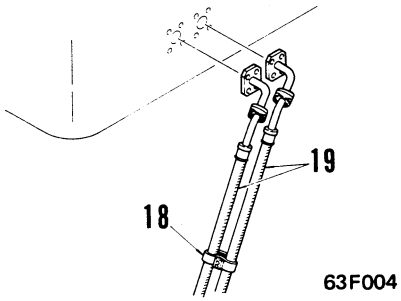
Disconnect control rod (15) from lever.

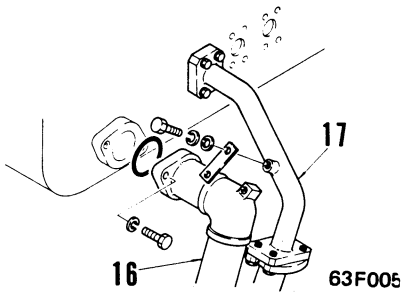


9. Piping

1) Disconnect tube (16) leading to hydraulic pump from tank.
2) Disconnect tube (15) leading to control tank from pump.
3) Remove clamp (18) fastening pipe (19) leading to blade lift cylinders; disconnect pipe from tank.





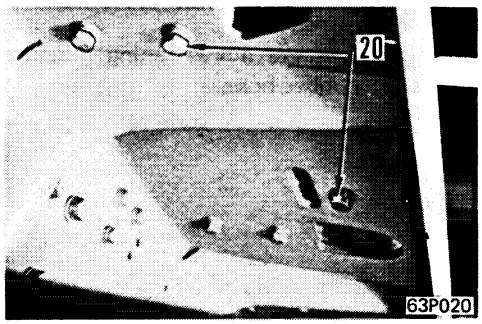


10. Hydraulic tank mounting bolt

Remove bolts (20) fastening tank assembly and slide tank outward.

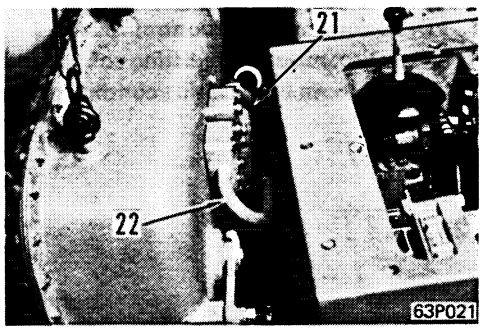
★ Sliding tank outward is necessary to remove tilt cylinder piping.

Sling hydraulic tank from crane temporarily before removing bolts.



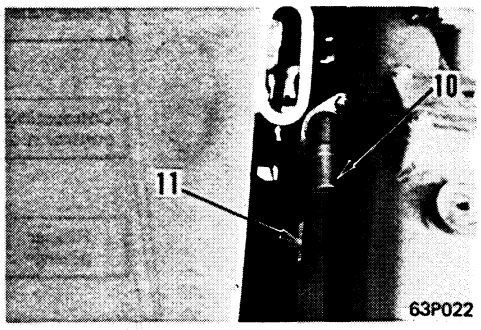
11. Tilt tube

Disconnect tubes (21) and (22).



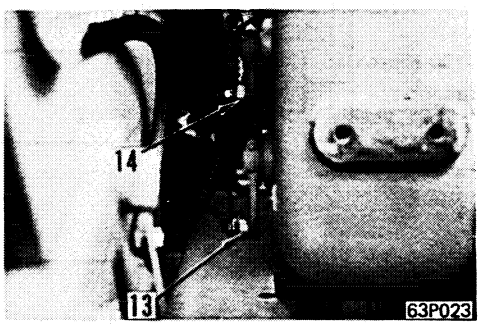
12. Ripper piping

Disconnect outlet pipe (10) and inlet pipe (11).



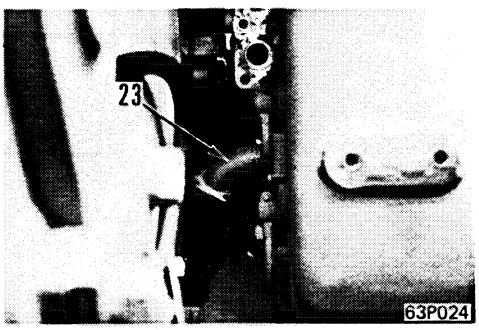
13. Removing control rod

1) Remove blade lifting control rod (13).
2) Remove ripper control rod (14).



14. Blade tube

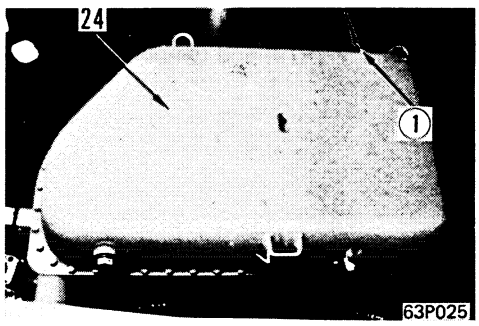
Disconnect tube (23) to tank from pump



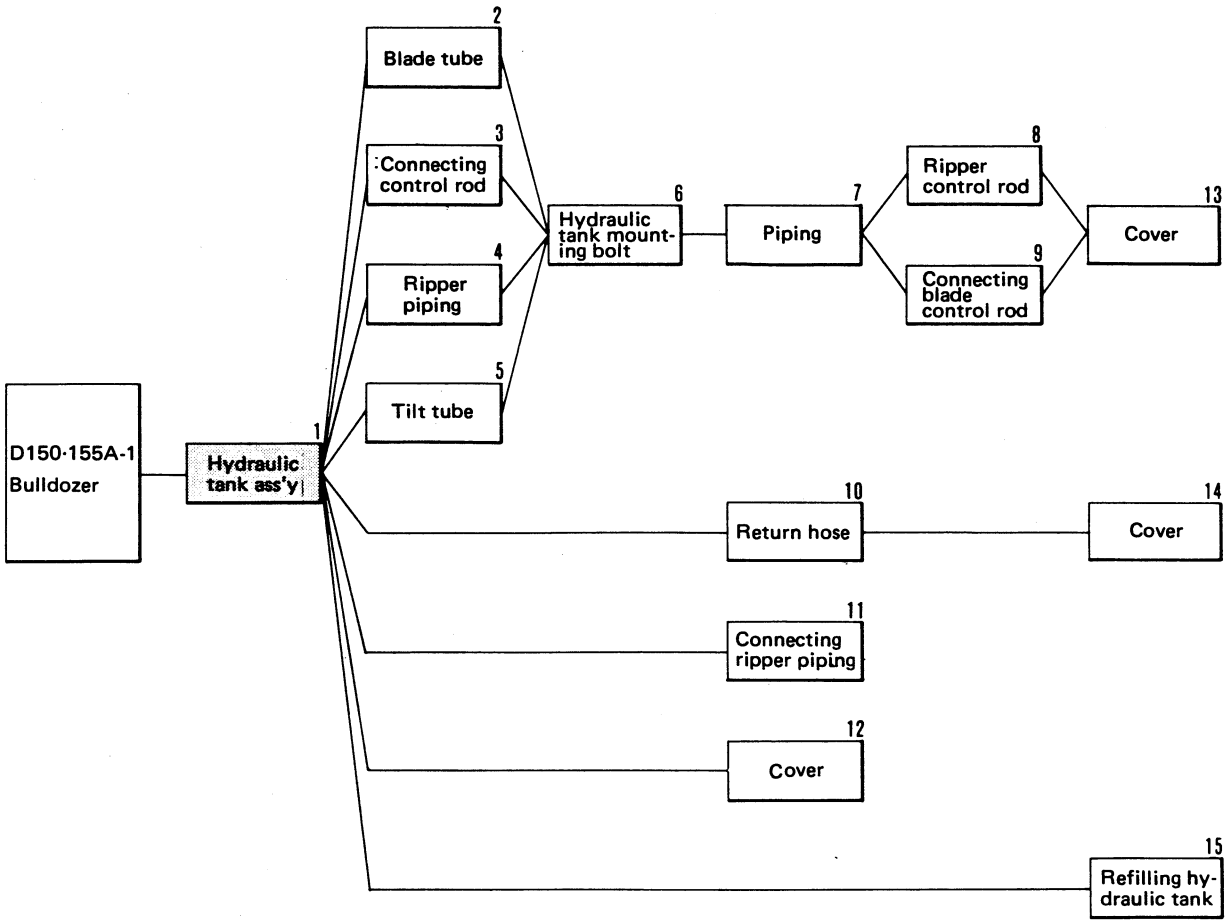
15. Hydraulic tank assembly

Lift off tank assembly (24) from machine body by using hanging tool ① (12 mm, P=1.75)

kg Hydraulic tank assembly: **340 kg**
(incl. control valve assembly)

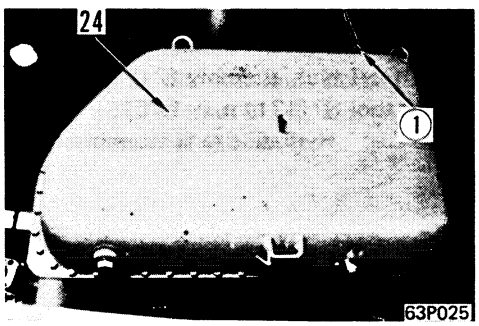


MOUNTING HYDRAULIC TANK



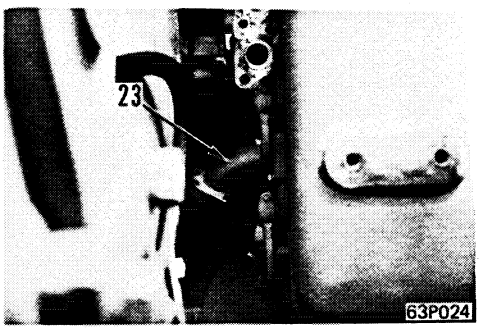
63F006

1. **Hydraulic tank assembly**
   Lift tank assembly (24) with crane using hanging tool ① (12 mm, P=1.75) and temporarily fit it on machine body.



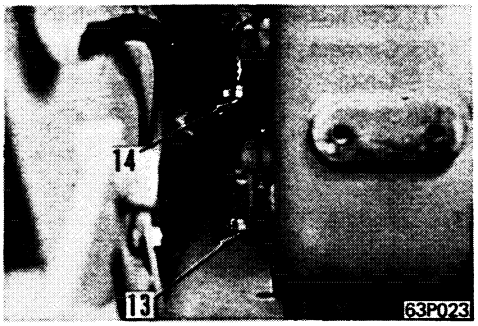
63P025

2. **Blade tube**
   Connect tube (23) with O-ring to tank.

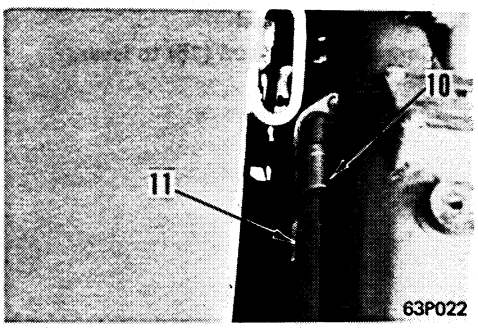


63P024

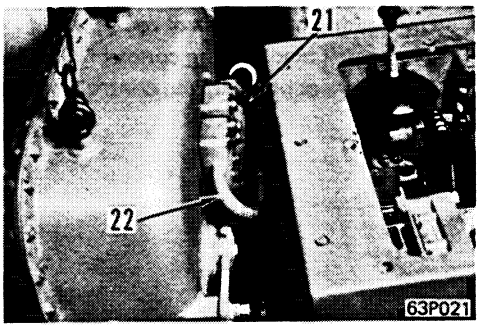
3. **Connecting control rod**
   1) Install ripper control rod (14).
   2) Install blade lifting control rod (13).



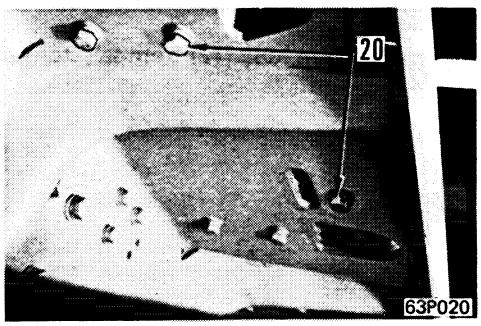
4. **Ripper piping**
   Connect inlet pipe (10) and outlet pipe (11) with O-rings to tank.



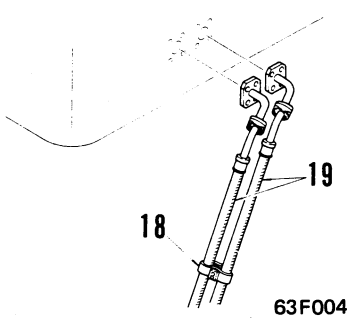
5. **Tilt tube**
   Connect tubes (21) and (22) with O-rings to tank.

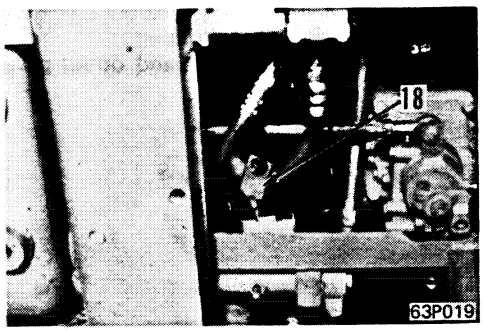


6. **Hydraulic tank mounting bolt**
   Slide tank assembly inward and tighten mounting boots (20).

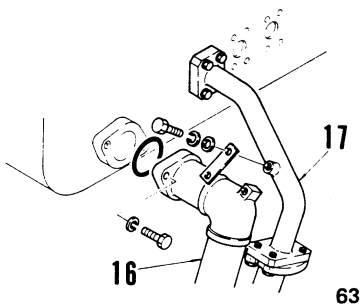


7. **Piping**
   1) Connect blade lift cylinder pipe (19) with O-ring to tank. Install clamp (18).

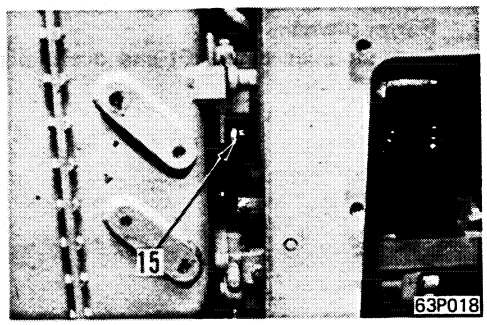




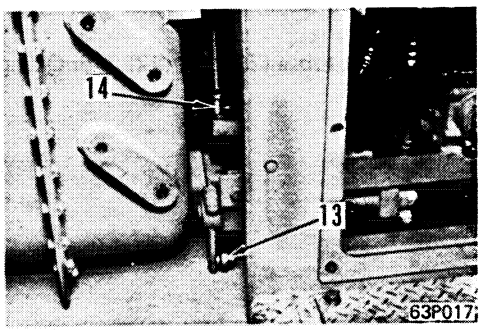
2) Connect tube (17) with O-ring to tank.
3) Connect tube (16), coming from pump, with O-ring to tank.



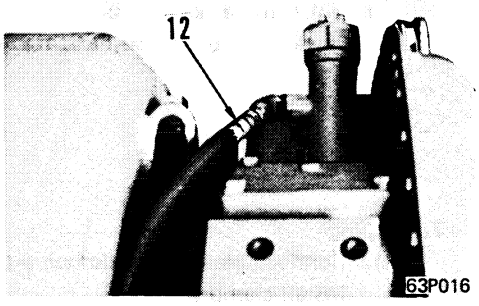
8. Ripper control rod
Connect control rod (15) to lever.



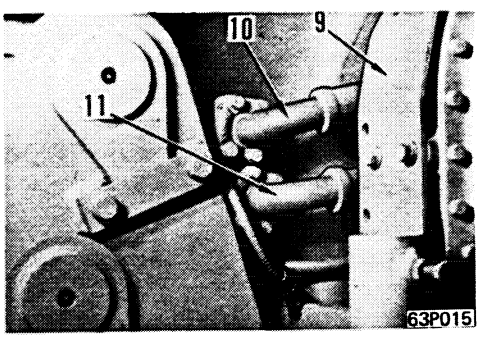
9. Connecting blade control rod
1) Install blade tilting control rod (14).
2) Connect blade lifting control rod (13) to lever.



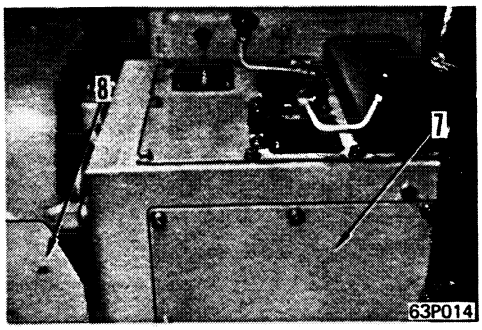
10. Return hose
Install return hose (12) from selector valve.



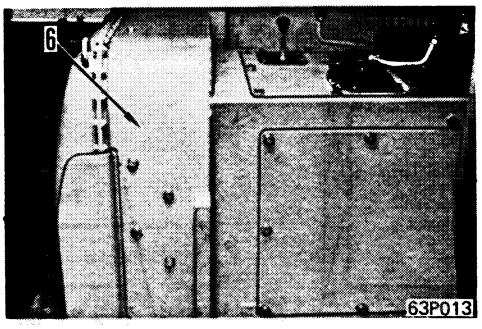
11. Connecting ripper piping
1) Install ripper inlet and outlet pipes (11) and (10) with O-rings.
2) Install bracket (9).



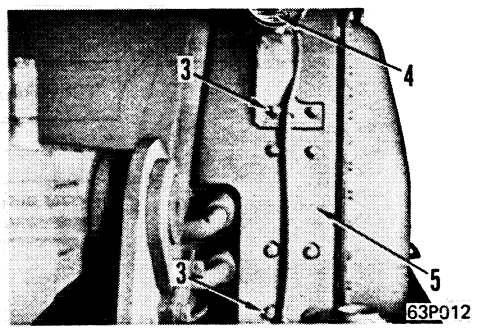
12. Cover
Install bracket (8) and cover (7).



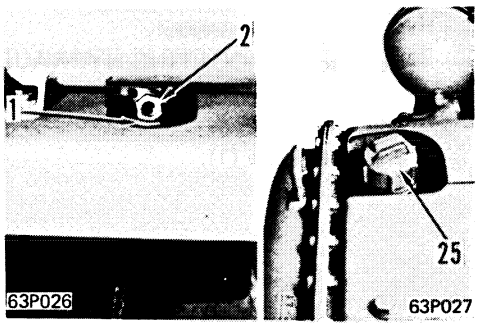
13. Cover
Install cover (6).



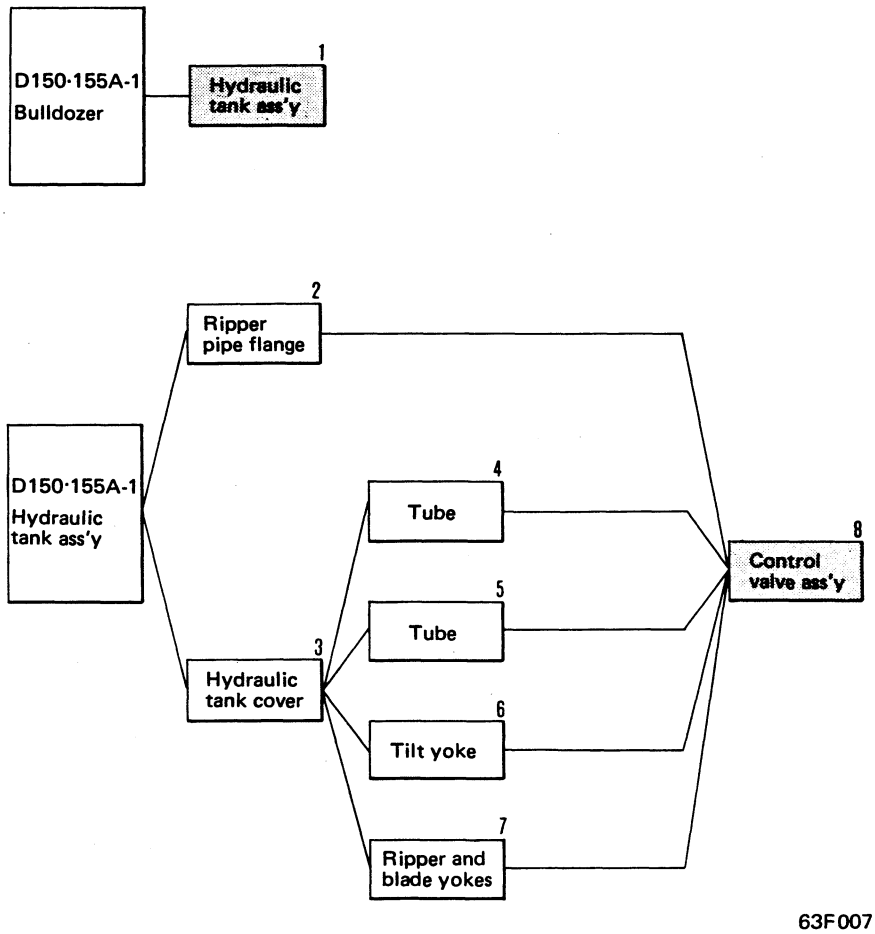
14. Cover
1) Install cover (5).
2) Install rear lamp (4) together with bracket and tighten clamp bolt (3).



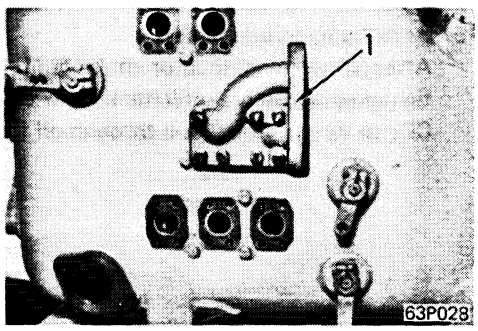
15. Refilling hydraulic tank
After confirming that drain plug (1) and drain plug (2) are tightened securely, refill tank with engine oil (SAE 10W, class CD) to the specified level through oil filler (25).



DISMOUNTING RIPPER AND BLADE CONTROL VALVE

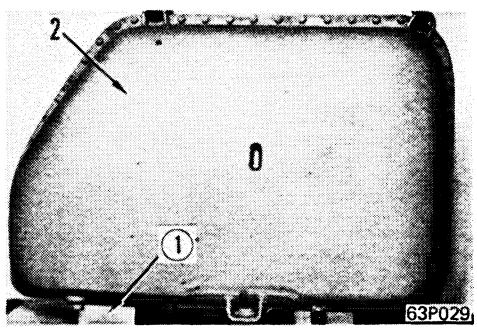


1. **Hydraulic tank assembly**
   Refer to DISMOUNTING HYDRAULIC TANK.



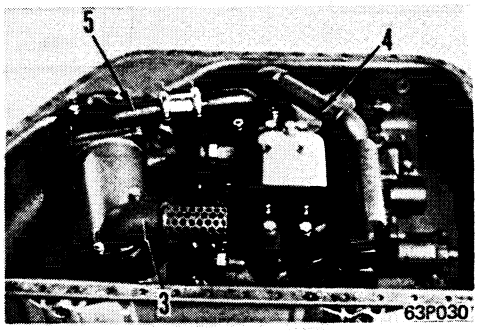
2. **Ripper pipe flange**
   Remove flange (1).

3. **Hydraulic tank cover**
   Remove tank cover (2).
   ★ Place tank on a stand (or black) ① of approx. 200 mm high.



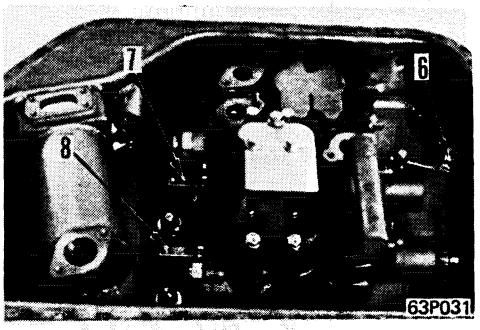
4. **Tube**
   1) Throw tank down sideways on stand ①.
   2) Remove baffle tube (3).

5. **Tube**
   Remove tube (4) and (5).

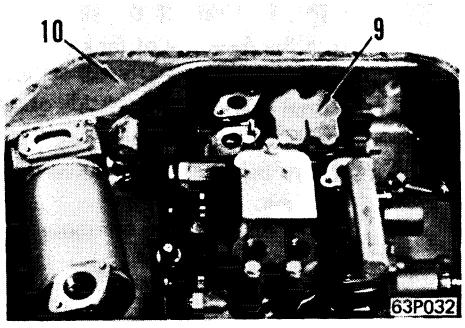


6. **Tilt yoke**
   Disconnect tilt yoke (6).

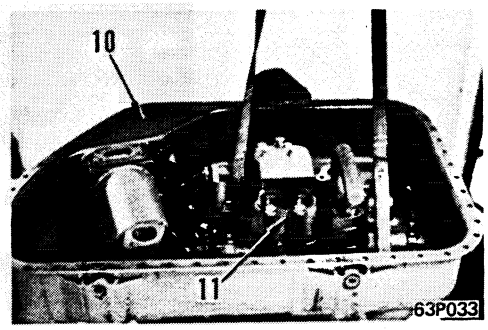
7. **Ripper and blade yokes**
   Disconnect ripper yoke (7) and blade yoke (8).



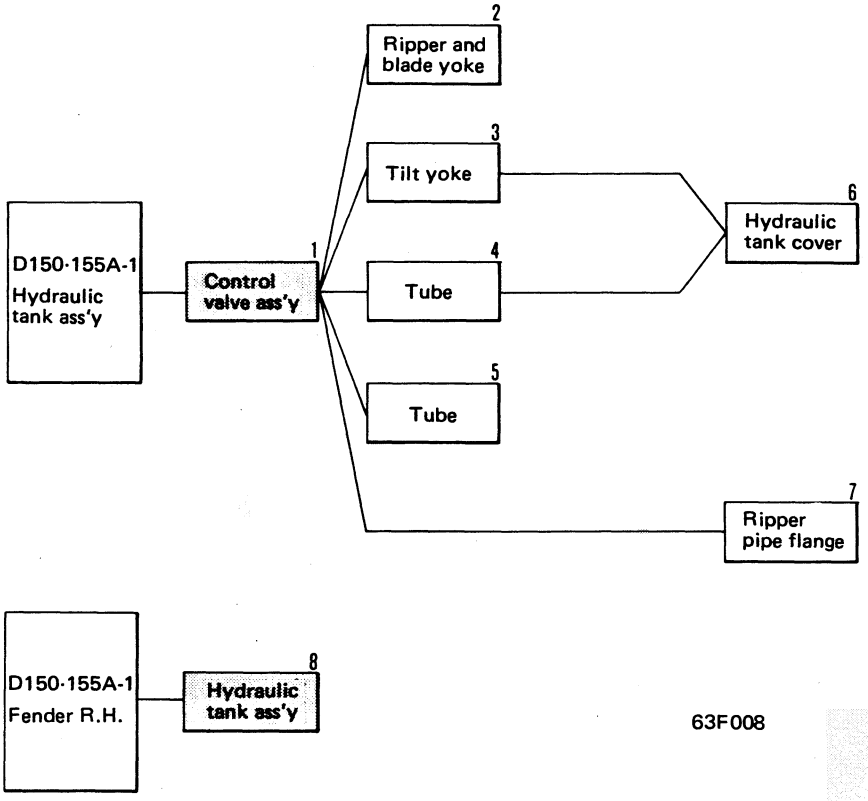
8. **Control valve assembly**
   1) Remove bolts securing tilt valve assembly (9) to tank (10) from the backside; remove assembly.
      ★ Do not put hanging tool directly to spool.
      kg Tilt valve assembly: **45 kg**



   2) Remove bolts securing blade and ripper valve assembly (11) to tank (10) from the backside; lift off assembly.
      ★ Do not put hanging tool directly to spool.
      kg Blade and ripper valve assembly: **110 kg**

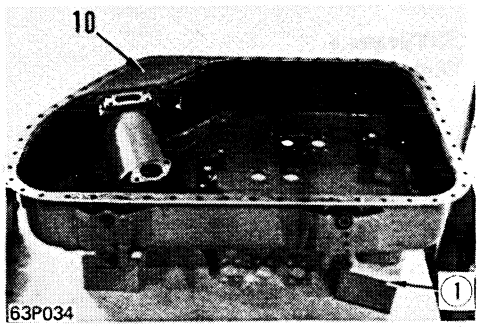


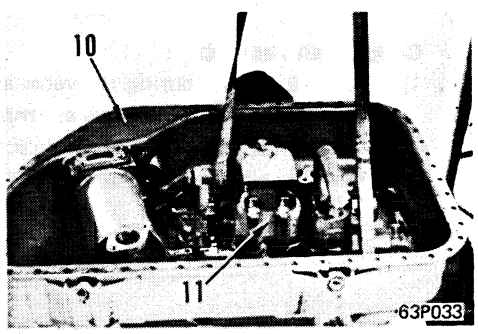
MOUNTING RIPPER AND BLADE CONTROL VALVE



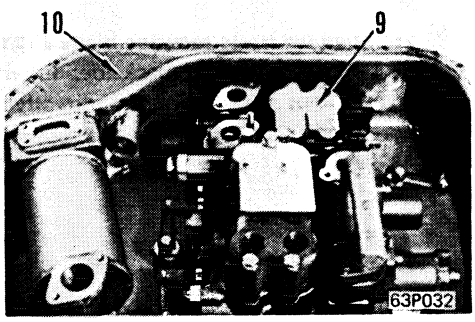
63F008

1. **Control valve assembly**
   1) Place tank (10) on a stand (or block) ① of approx. 200 mm high.
   2) Lift blade and ripper valve assembly (11) with O-ring into position on tank (10). Install assembly with bolts tightened from the backside of tank.
   3) Install tilt valve assembly (9) with O-ring on tank (10) and tighten bolts from the backside of tank.
      ★ When installing valve assembly on tank, align bolt holes by putting a screwdriver in holes from the backside of tank.
      ★ When lifting valve assembly, do not put hanging tool directly to spool.



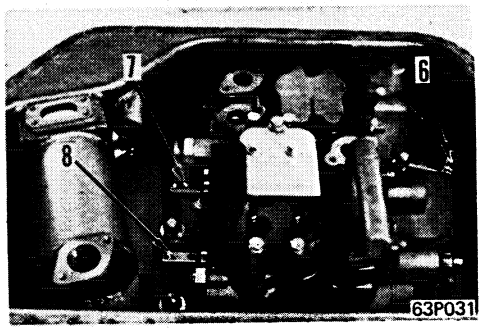






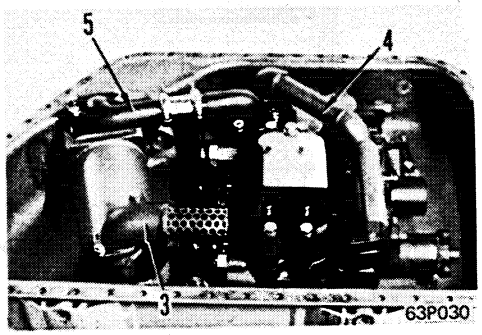
2. **Ripper and blade yoke**
   Connect ripper yoke (7) and blade yoke (8) to the respective valve spools with pins.

3. **Tilt yoke**
   Connect tilt yoke (6) to valve spool with pin.

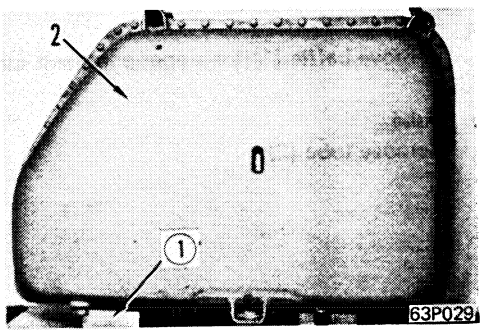


4. **Tube**
   Install tubes (4) and (5) with bolts.

5. **Tube**
   Install baffle tube (3) with bolts.

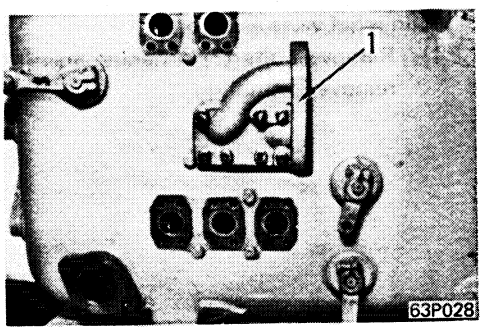


6. **Hydraulic tank cover**
   1) Raise up tank on stand ① .
   2) Fit gasket, coated with gasket sealant (LG-1) on both faces, on tank and fit tank cover (2) on gasket.

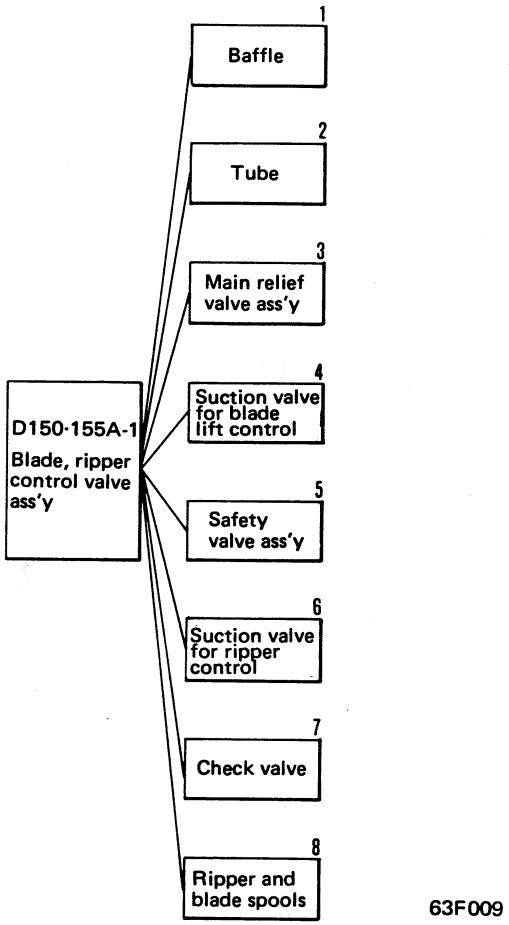


7. **Ripper pipe flange**
   Install flange (1) with O-ring on tank.

8. **Hydraulic tank assembly**
   Refer to MOUNTING HYDRAULIC TANK.



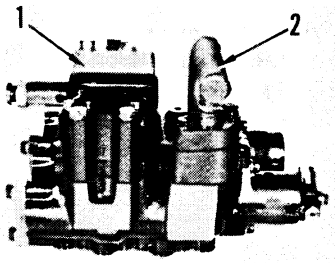
DISASSEMBLY OF RIPPER AND BLADE CONTROL VALVE



63F009

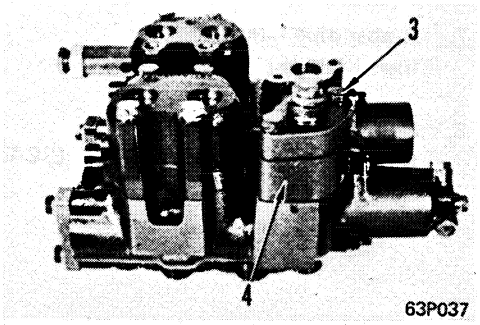
1. **Baffle**
   Remove baffle (1) for ripper control suction valve.

2. **Tube**
   Remove tube (2).



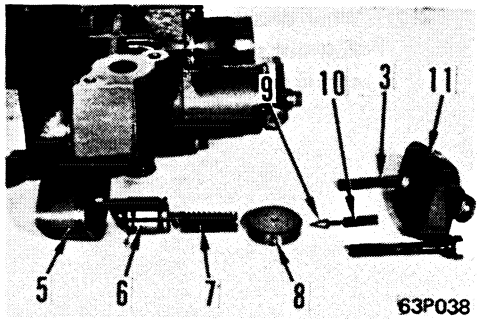
63P036

3. **Main relief valve assembly**
   1) Remove bolts (3) fastening main relief valve assembly (4); remove assembly.



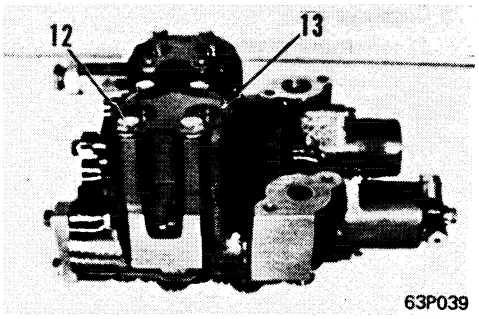
63P037

2) Take out main valve (6), spring (7) and valve seat (8) from valve body (5). Remove pilot valve (9), spring (10) and case (11).
★ Remove lock nut and adjustment screw only when required.

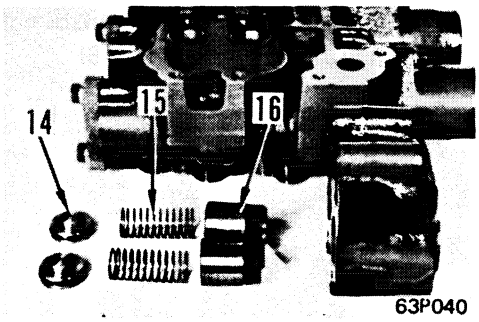


4. Suction valve for blade lift control

1) Remove bolts (12) fastening suction valve (13); remove valve.

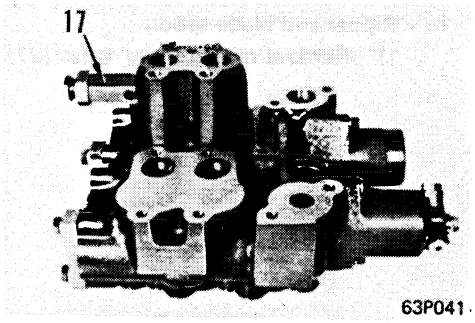


2) When disassembling suction valve
Pull out seat (14) using jack bolt (8 mm, P=1.25). Remove spring (15) and valve (16).



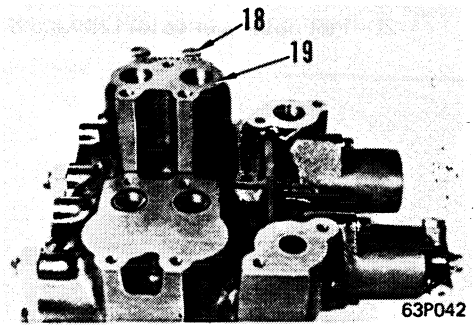
5. Safety valve assembly

Remove safety valve assembly (17).
★ Dont disassemble safty valve.

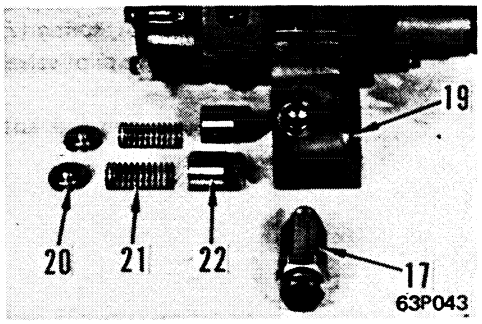


6. Suction valve for ripper control

1) Remove bolts (18) fastening suction valve (19); remove valve.

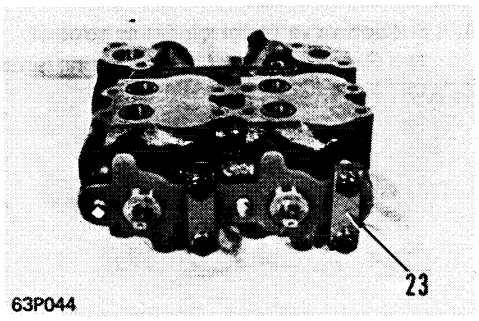


2) When disassembling suction valve
Pull out seat (20) using jack bolt (8 mm, P=1.25). Remove spring (21) and valve (22).

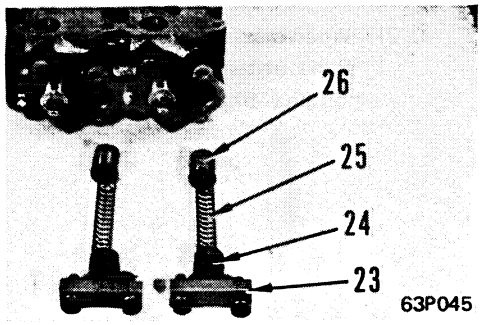


7. Check valve

1) Remove plate (23).

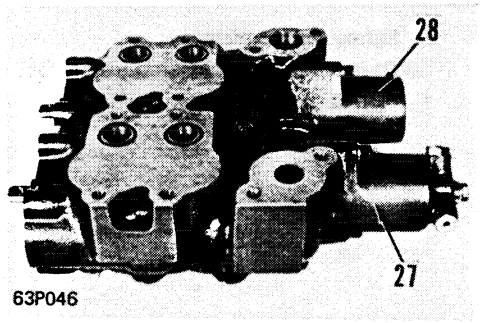


2) Pull out seal (24) using jack bolt (8 mm, P=1.25). Remove spring (25) and valve (26).

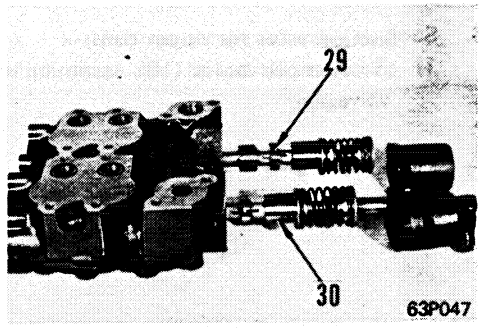


8. Ripper and blade spools

1) Remove return spring cases (27) and (28).

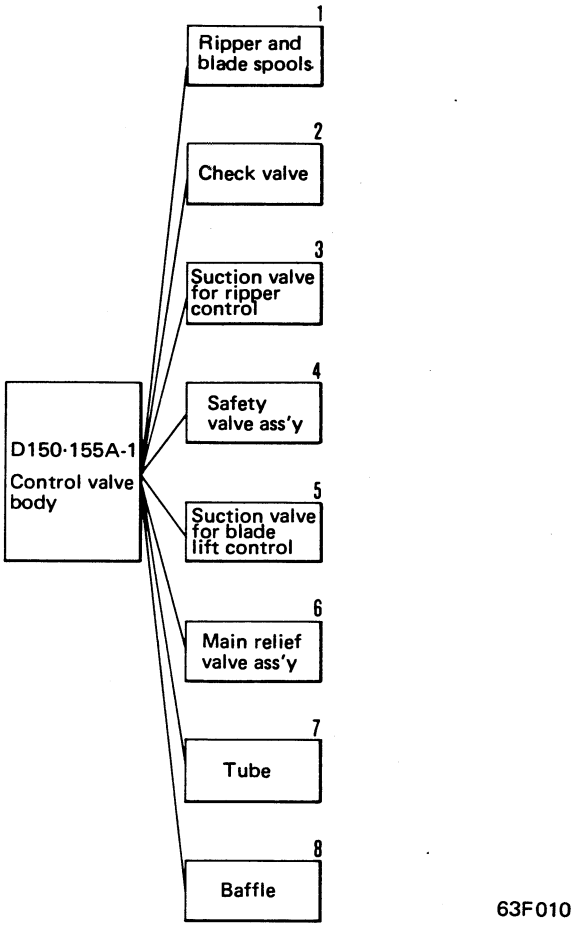


2) Pull out ripper spool (29) and blade spool (30).



ASSEMBLY OF RIPPER AND BLADE CONTROL VALVE

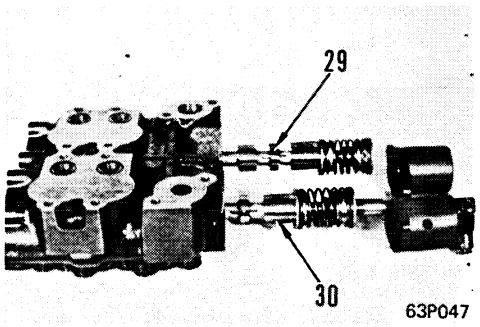
ASSEMBLY OF RIPPER AND BLADE CONTROL VALVE



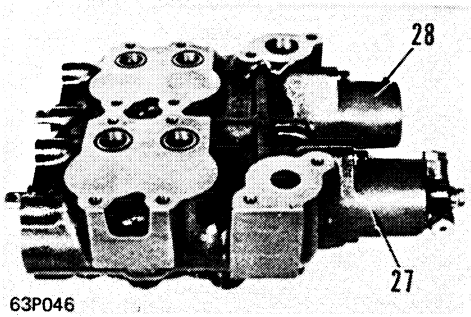
63F010

1. **Ripper and blade spools**
   Insert ripper spool (29) and blade spool (30) into valve body.
   Install return spring cases (27) and (28).

   ★ Apply engine oil (SAE10W class CD) to the outer circumference of spools before insertion.



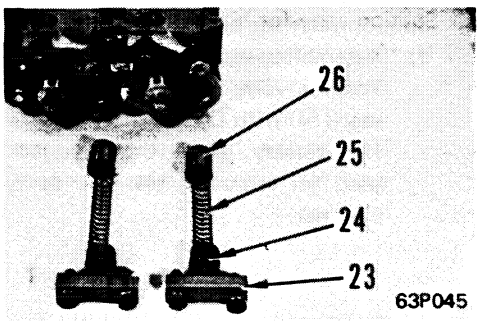
63P047



63P046

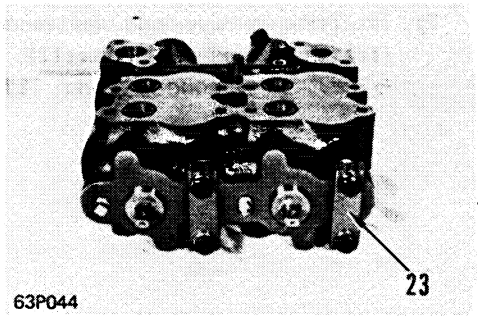
2. Check valve

1) Install valve (26) and spring (25) in valve body. Install seat (24) with O-ring.
If necessary, install the same jack bolt (8 mm, P=1.25) as used for removing seat and apply light taps to bolt with a hammer.



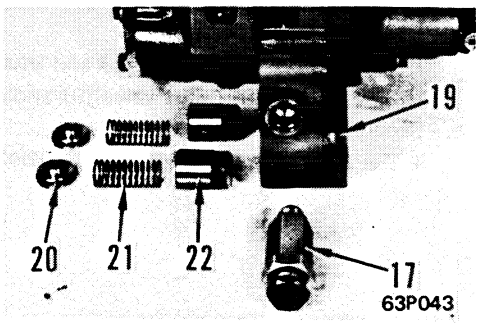
2) Install plate (23).

kgm Plate mounting bolt: **10 kg.m**



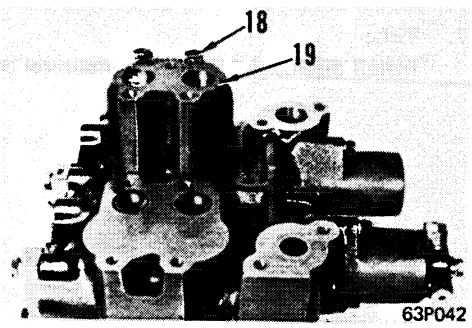
3. Suction valve for ripper control

1) Assembly suction valve
Position valve (22) and spring (21) in valve body and install seat (20) with O-ring.
If necessary, install the same jack bolt (8 mm, P=1.25) as used for removing seat and apply light taps to bolt with hammer.



2) Fit O-ring on valve body and secure suction valve assembly (19) to valve body with bolts (18).

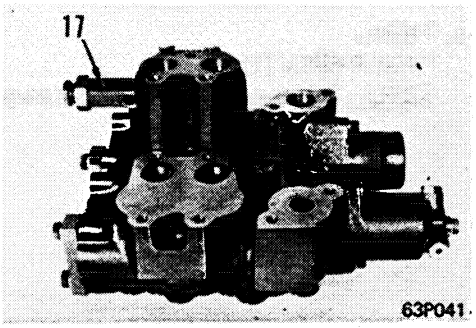
kgm Valve mounting bolt: **12 kg.m**



4. Safety valve assembly

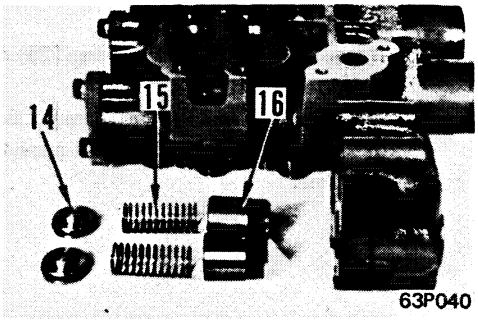
Install safety valve assembly (17).

kgm Safety valve assembly: **18 ~ 24 kg.m**

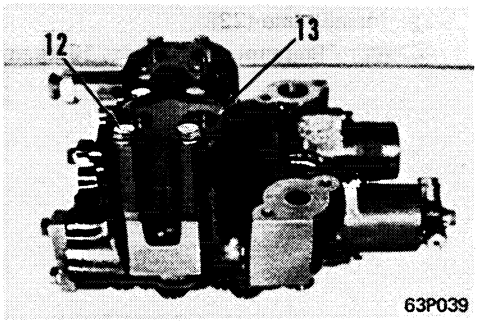


5. Suction valve for blade lift control

1) Assembling suction valve
Position valve (16) and spring (15) in valve body and install seat (14) with O-ring.
If necessary, install the same jack bolt (8 mm, P=1.25) as used for removing seat and apply light taps to bolt with hammer.

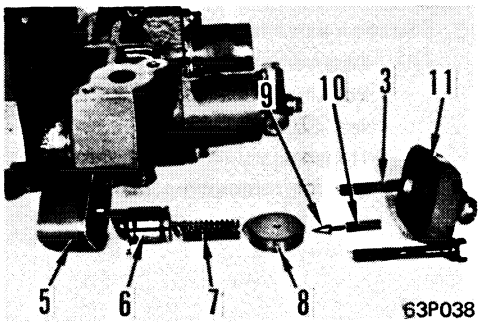


2) Fit O-ring on valve body and secure suction valve assembly (13) to valve body with bolts (12).
kgm Valve mounting bolt: **12 kg.m**



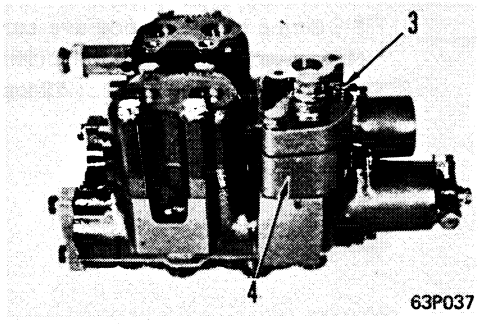
6. Main relief valve assembly

Fit O-ring on valve body (5) and install main valve (6), spring (7), valve seat (8), pilot valve (9) and spring (10) in valve body. Secure case (11).
kgm Main relief valve mounting bolt: **12 kg.m**



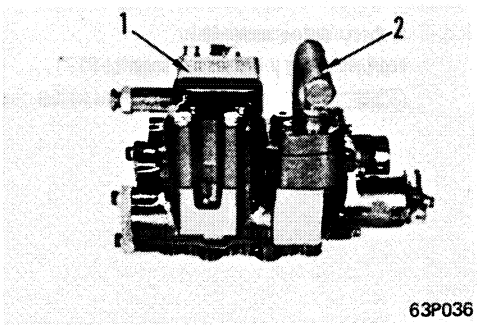
7. Tube

Install discharge tube (2) on main relief valve.



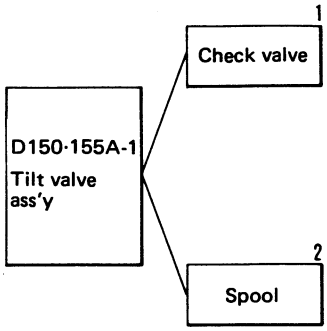
8. Baffle

Install baffle (1).
kgm Baffle mounting bolt: **12 kg.m**



DISASSEMBLY OF BLADE TILT CONTROL VALVE

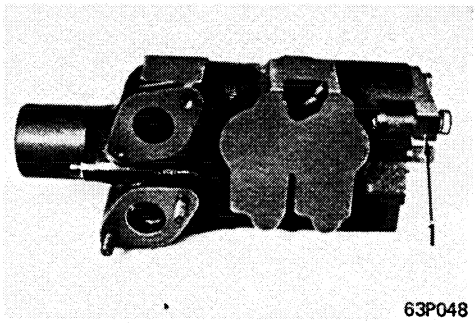
DISASSEMBLY OF BLADE TILT CONTROL VALVE



63F011

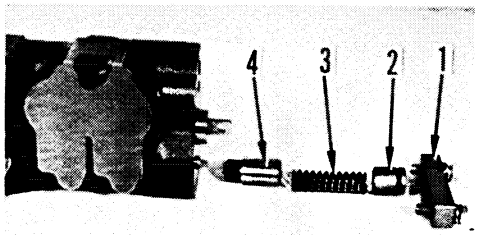
1. Check valve

1) Remove plate (1).



63P048

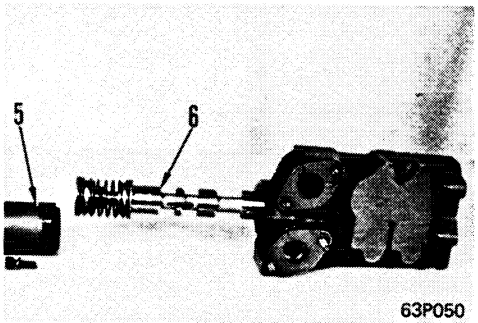
2) Turn jack bolt (8 mm, P=1.25) into seat (2) and pull bolt to remove seat. Remove spring (3) and valve (4).



63P049

2. Spool

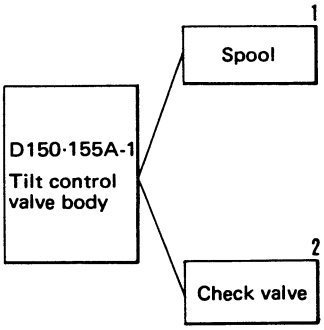
1) Remove return spring case (5).
2) Pull tilt spool (6) out.



63P050

ASSEMBLY OF BLADE TILT CONTROL VALVE

ASSEMBLY OF BLADE TILT CONTROL VALVE

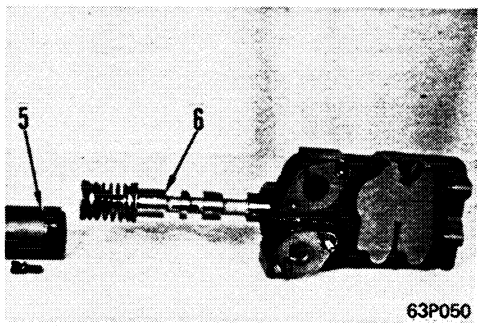


63F012

1. Spool

Insert tilt spool (6) in valve body and install return spring case (5).

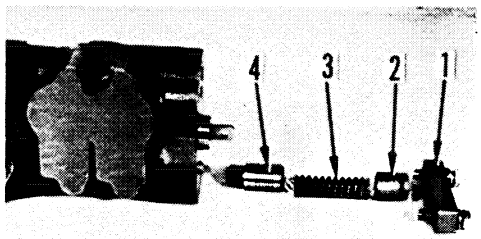
★ Apply engine oil (SAE 10W, class CD) to outer circumference of spool before insertion.



63P050

2. Check valve

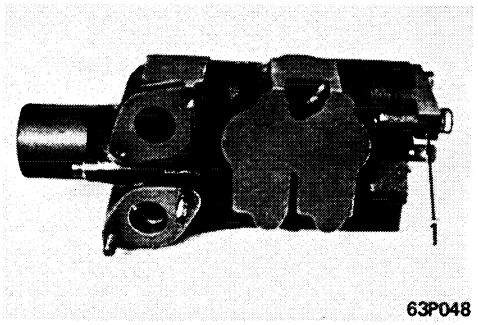
1) Position valve (4) and spring (3) in valve body and install seat (2) with O-ring.
If necessary, install the same jack bolt (8 mm, P=1.25) as used for removing seat and apply light taps to bolt with hammer.



63P049

2) Install plate (1).

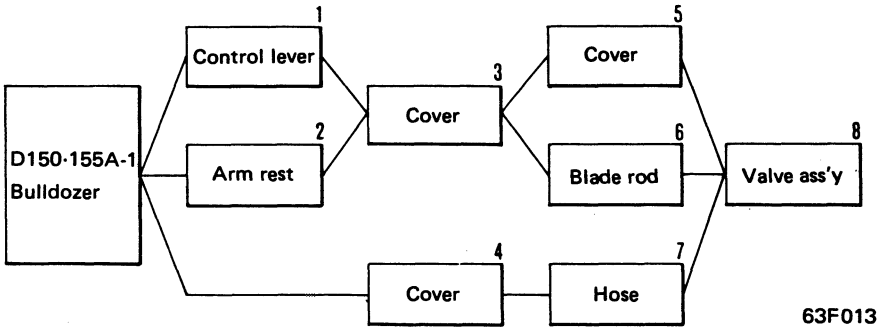
kgm Plate mounting bolt: **10 kg.m**



63P048

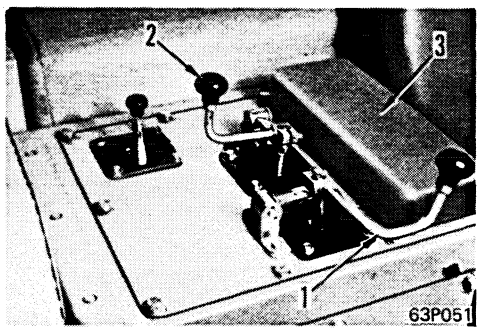
DISMOUNTING BLADE LIFT SERVO VALVE

DISMOUNTING BLADE LIFT SERVO VALVE



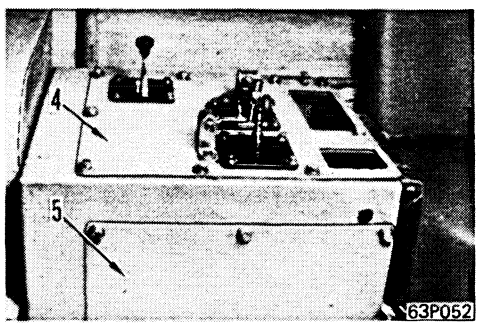
1. **Control lever**
   Remove blade control lever (1) and ripper control lever (2).

2. **Arm rest**
   Remove arm rest (3).

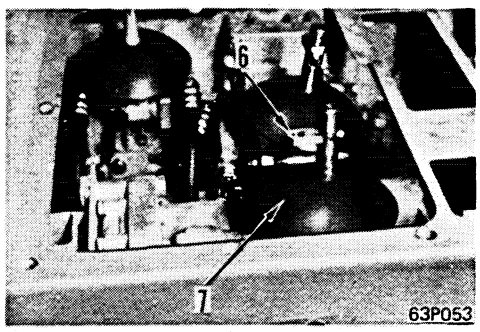


3. **Cover**
   Remove cover (4).

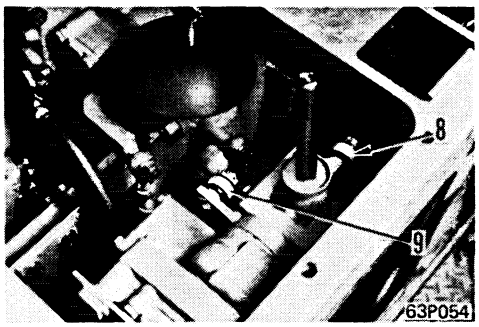
4. **Cover**
   Remove cover (5).



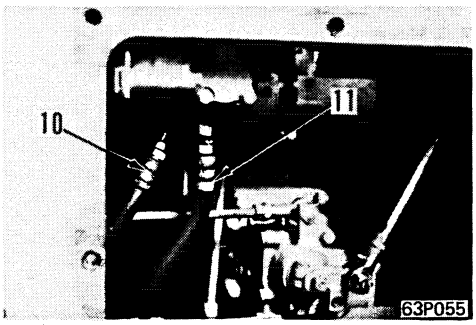
5. **Cover**
   Remove nut and lock (6).
   Remove cover (7) and spring.



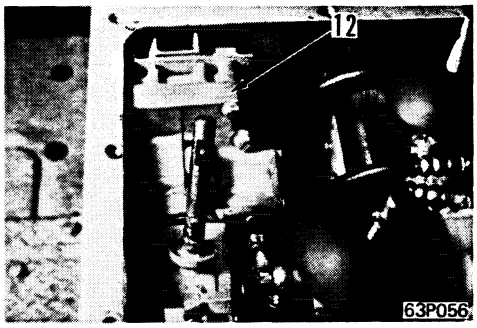
6. **Blade rod**
   Remove rods (8) and (9).



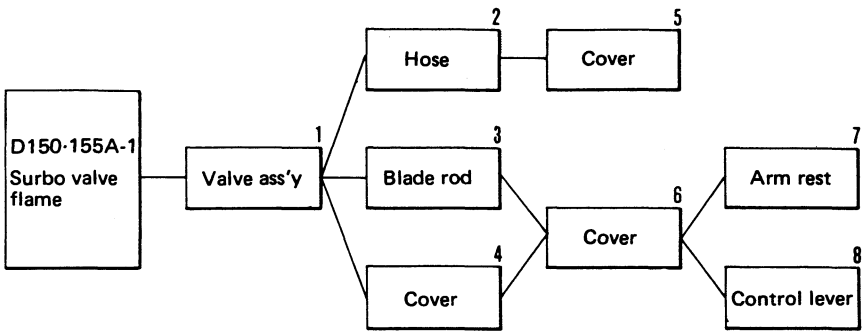
7. **Hose**
   Disconnect hoses (10) and (11).



8. **Valve assembly**
   Remove four bolts fastening valve assembly (12); remove assembly.

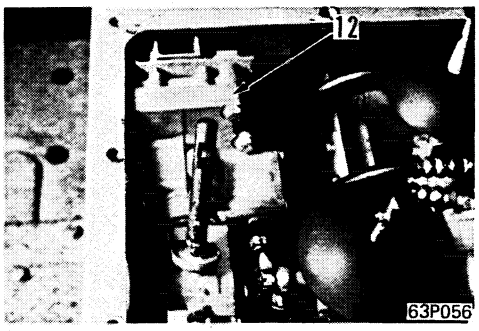


MOUNTING BLADE LIFT SERVO VALVE

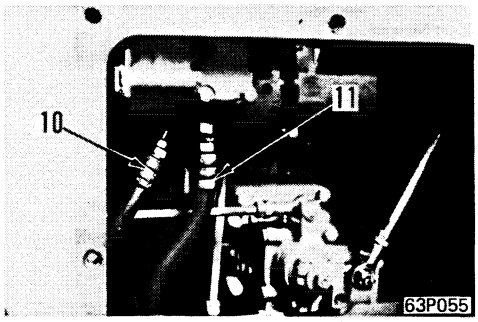


63F014

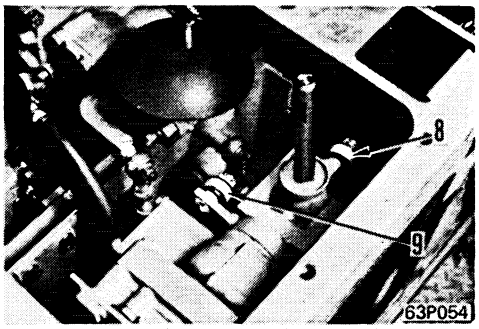
1. **Valve assembly**
   Install valve assembly (12) with bolts.
   kgm Valve mounting bolt: **6 ~ 7.5 kg.m**



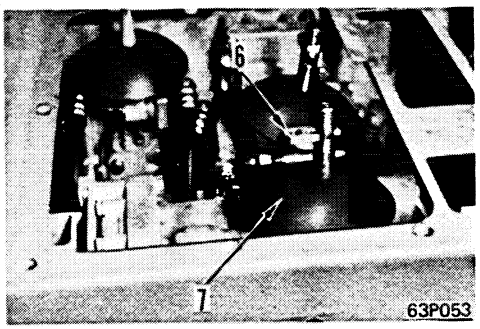
2. **Hose**
   Connect hoses (10) and (11).



3. **Blade rod**
   Install rods (8) and (9).

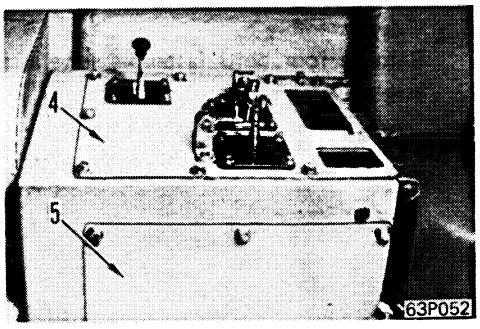


4. **Cover**
   Install spring and cover (7) and secure lock (6) with nut.



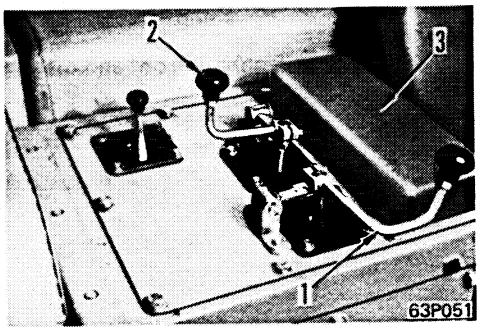
5. **Cover**
   Install cover (5).

6. **Cover**
   Install cover (4).

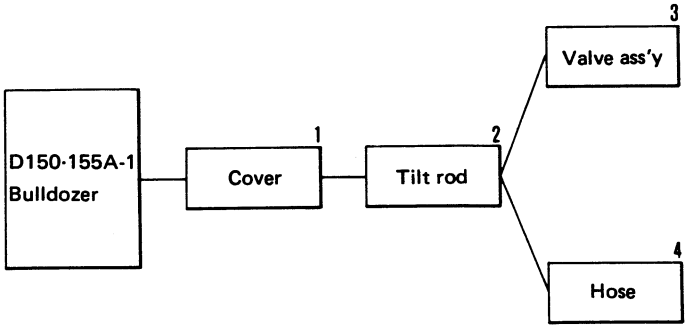


7. **Arm rest**
   Install arm rest (3).

8. **Control lever**
   Install ripper control lever (2) and blade control lever (1).

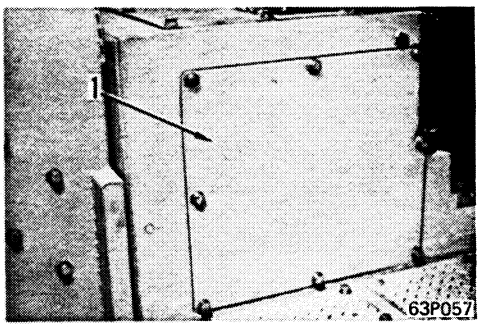


DISMOUNTING BLADE TILT SERVO VALVE

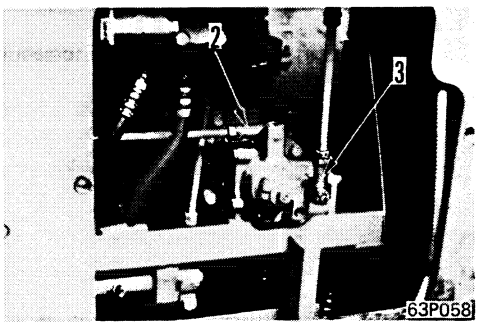


63F015

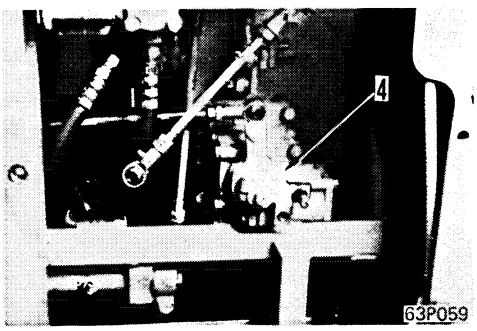
1. Cover
Remove cover (1).



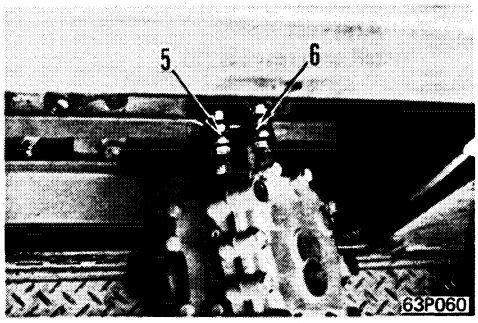
2. Tilt rod
Remove rods (2) and (3).



3. Valve assembly
Remove four bolts fastening valve assembly (4); remove valve assembly.

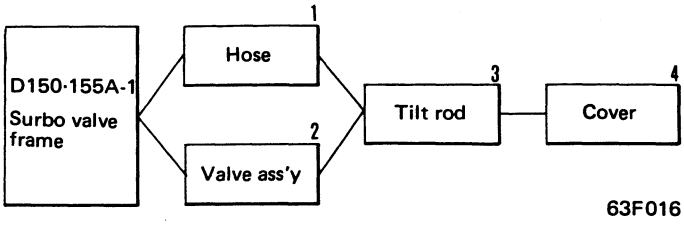


4. Hose
Pull valve assembly in front and disconnect hoses (5) and (6).

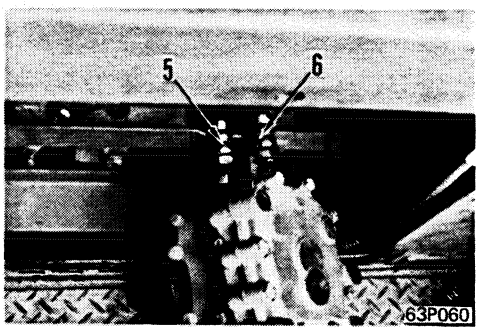


MOUNTING BLADE TILT SERVO VALVE

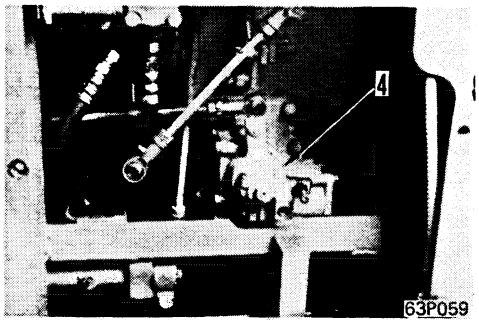
MOUNTING BLADE TILT SERVO VALVE



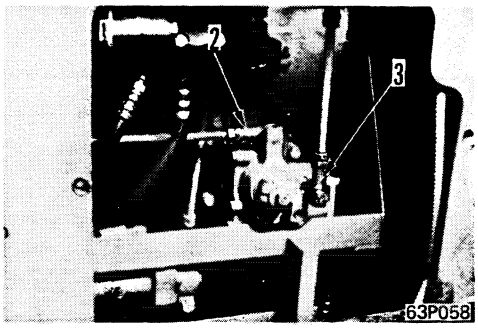
1. **Hose**
   Connect hoses (5) and (6) to valve assembly before installing valve assembly.



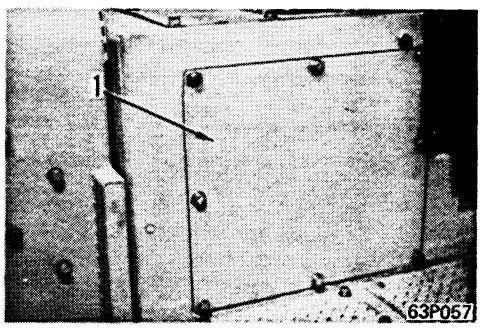
2. **Valve assembly**
   Install valve assembly (4) with four bolts.



3. **Tilt rod**
   Install rods (2) and (3).

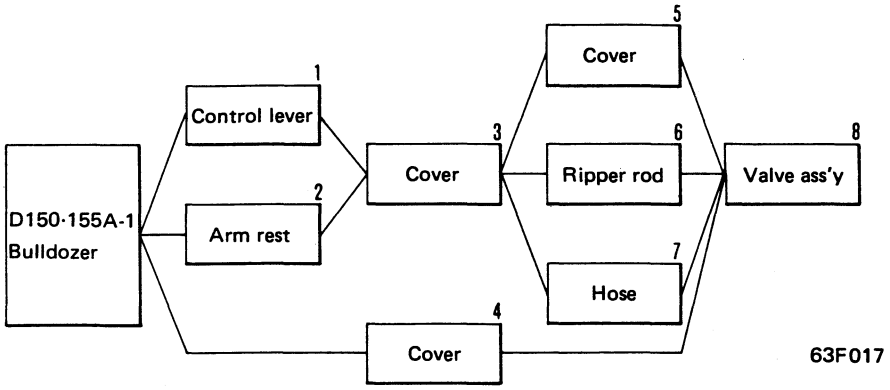


4. **Cover**
   Install cover (1).



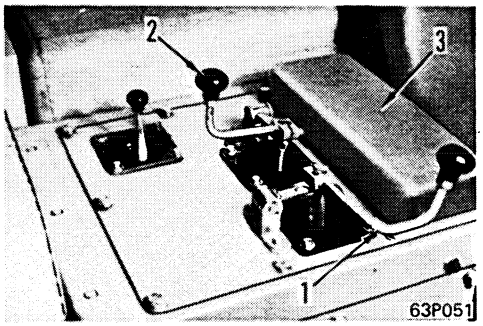
DISMOUNTING RIPPER SERVO VALVE

DISMOUNTING RIPPER SERVO VALVE



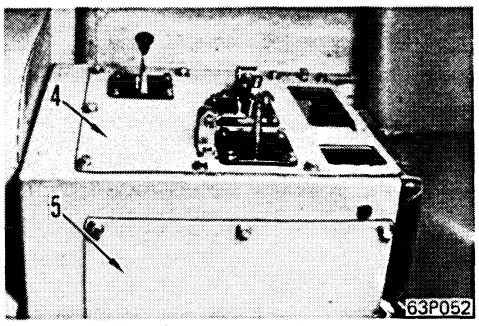
1. **Control lever**
   Remove blade control lever (1) and ripper control lever (2).

2. **Arm rest**
   Remove arm rest (3).

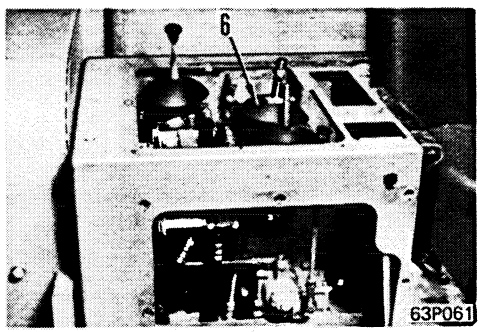


3. **Cover**
   Remove cover (4).

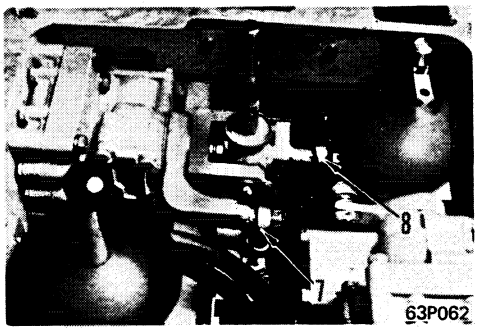
4. **Cover**
   Remove cover (5).



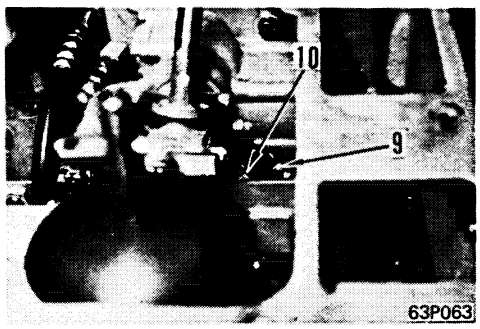
5. **Cover**
   Remove nut and lock.
   Remove cover (6) and spring.



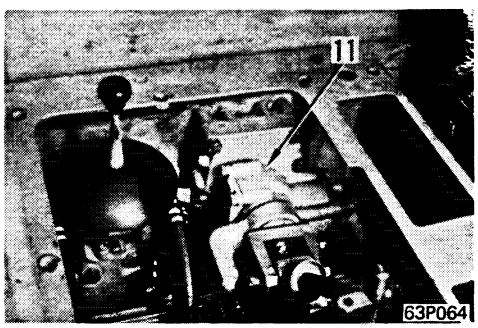
6. **Ripper rod**
Remove rods (7) and (8).



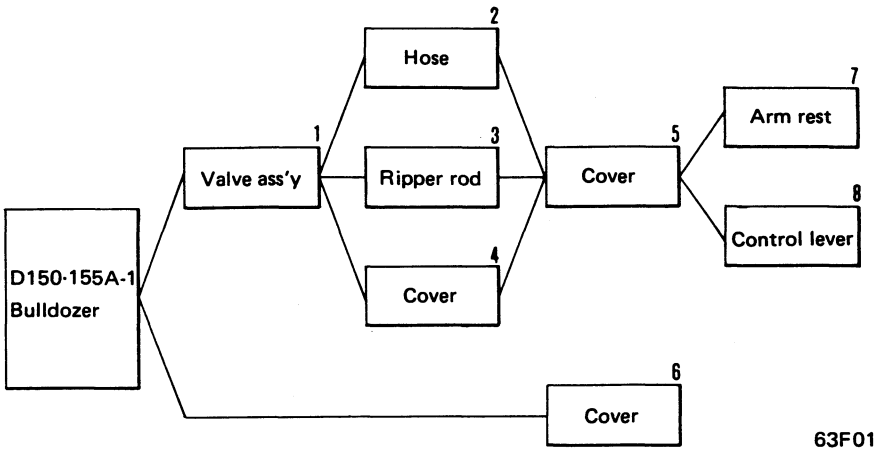
7. **Hose**
Disconnect hoses (9) and (10) from valve assembly.



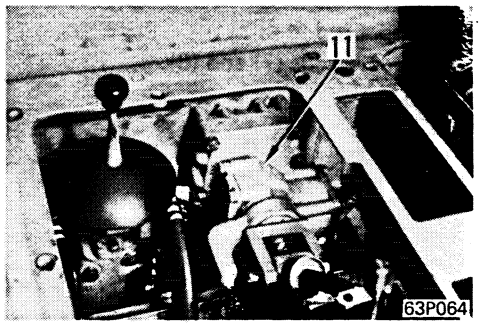
8. **Valve assembly**
Remove four bolts fastening valve assembly (11); remove assembly.



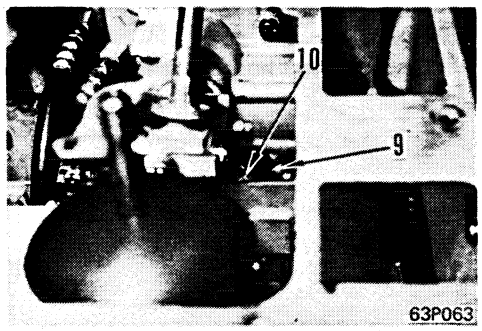
MOUNTING RIPPER SERVO VALVE



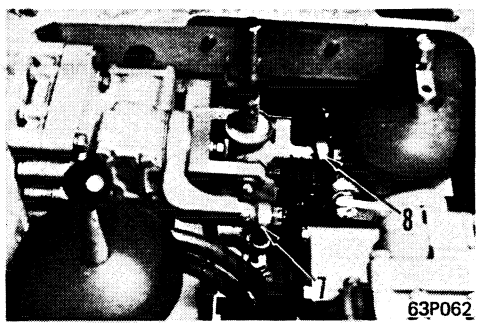
1. **Valve assembly**
   Install valve assembly (11) with four bolts.



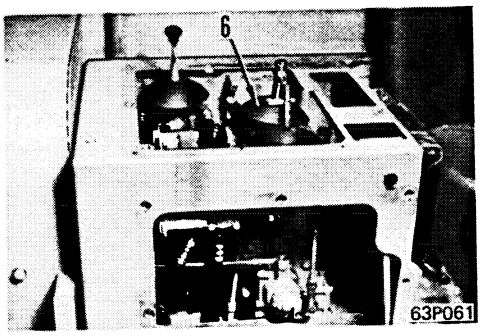
2. **Hose**
   Connect hoses (9) and (10) to valve assembly.



3. **Ripper rod**
   Install rods (7) and (8).

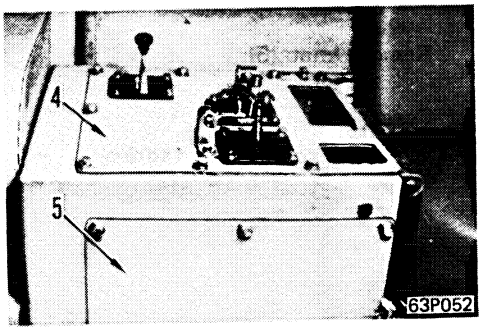


4. **Cover**
   Install spring, cover (6) and lock.



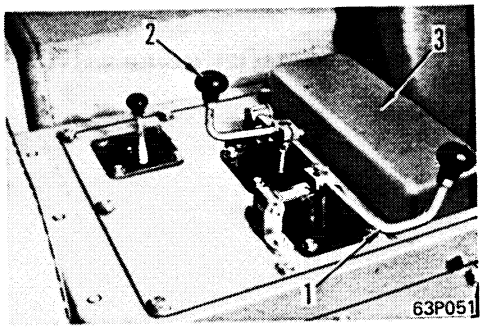
5. **Cover**
   Install cover (5).

6. **Cover**
   Install cover (4).

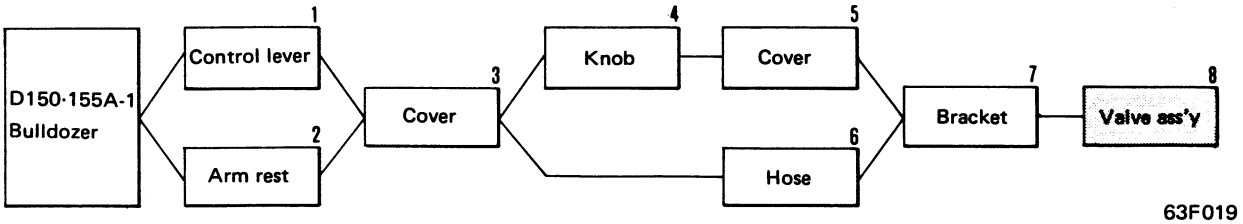


7. **Arm rest**
   Install arm rest (3).

8. **Control lever**
   Install blade control lever (1) and ripper control lever (2).



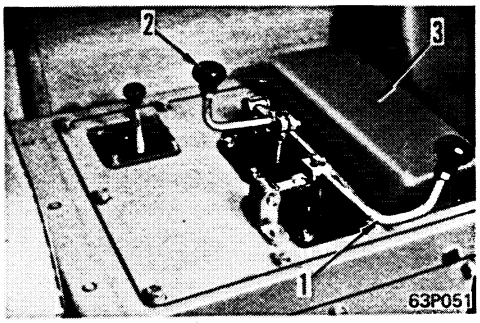
DISMOUNTING RIPPER PIN PULLER VALVE



63F019

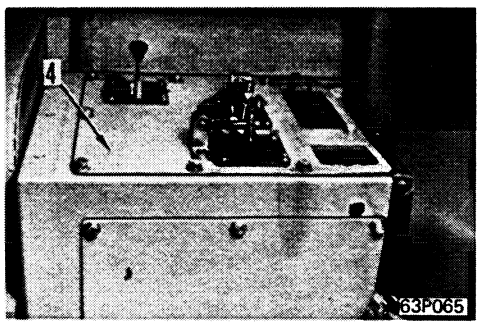
1. **Control lever**
   Remove blade control lever (1) and ripper control lever (2).

2. **Arm rest**
   Remove arm rest (3).



63P051

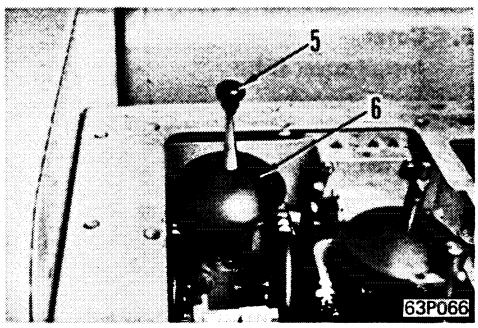
3. **Cover**
   Remove cover (4).



63P065

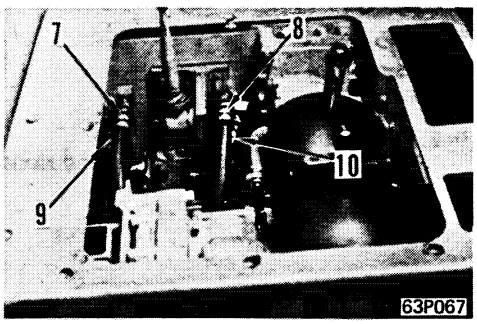
4. **Knob**
   Remove knob (5).

5. **Cover**
   Remove cover (6) and spring.



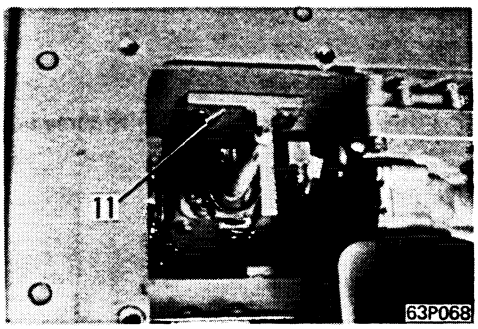
63P066

6. **Hose**
   Remove hoses (7), (8), (9) and (10).

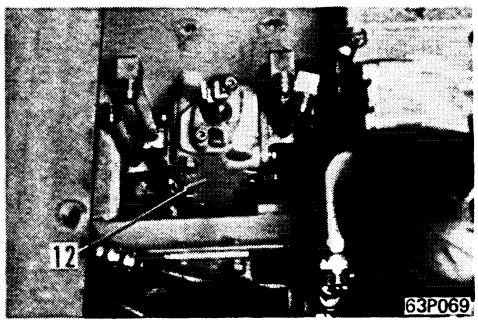


63P067

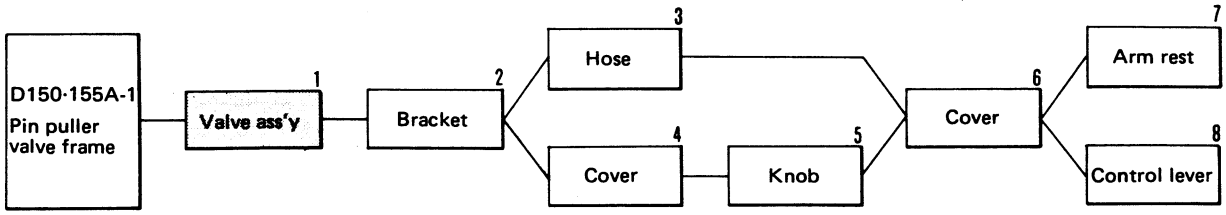
7. **Bracket**
   Remove bracket (11).



8. **Valve assembly**
   Remove three bolts fastening valve assembly (12); remove assembly.

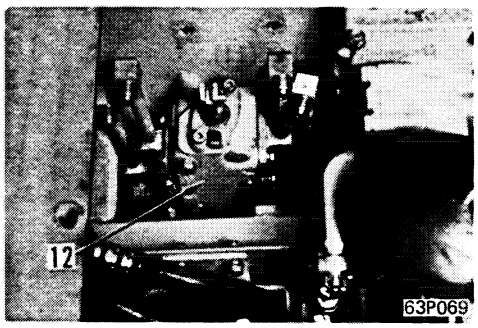


MOUNTING RIPPER PIN PULLER VALVE

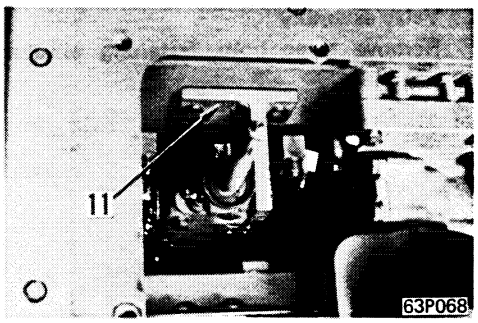


63F020

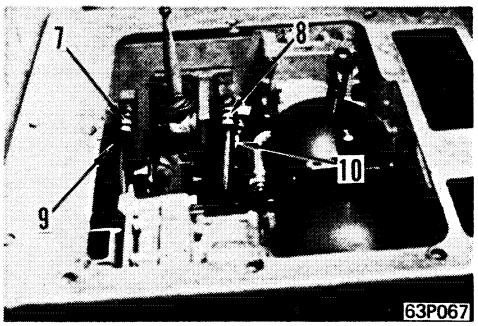
1. **Valve assembly**
   Install valve assembly (12) with three bolts.



2. **Bracket**
   Install bracket (11).

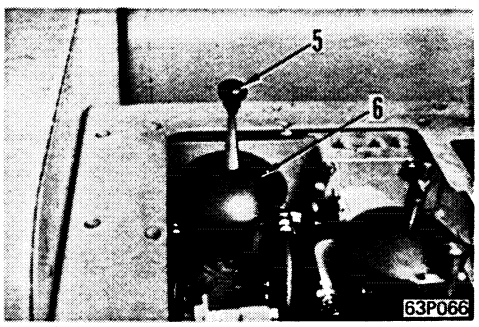


3. **Hose**
   Install hoses (10), (9), (8) and (7).

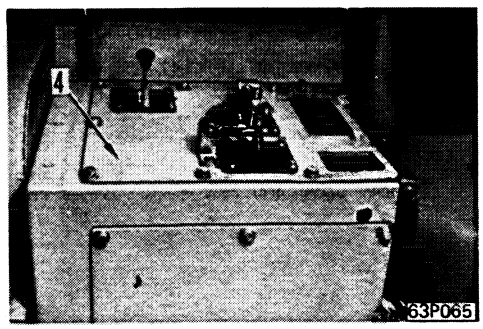


4. **Cover**
   Install spring and cover (6).

5. **Knob**
   Install knob (5).

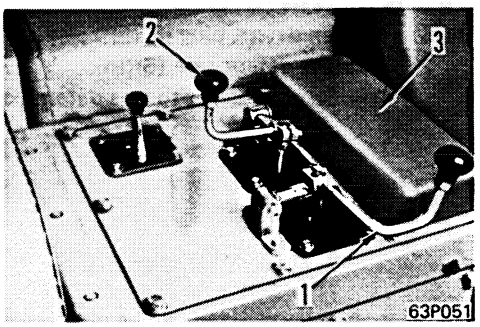


6. **Cover**
   Install cover (4).

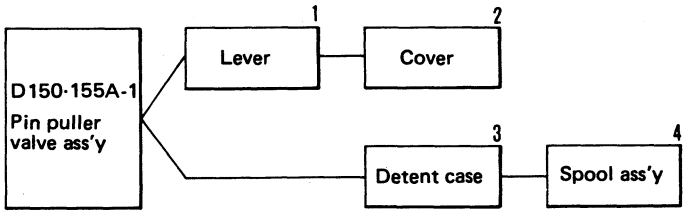


7. **Arm rest**
   Install arm rest (3).

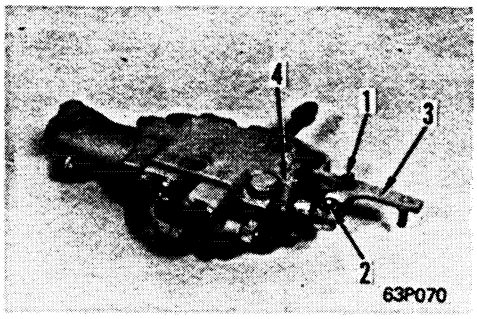
8. **Control lever**
   Install blade control lever (1) and ripper control lever (2).



DISASSEMBLY OF PIN PULLER VALVE

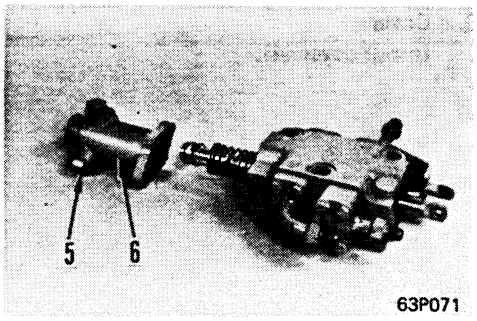


63F021



1. Lever

Disconnect lever (3) by removing cotter pin, washer, pin (1) and cotter pin, washer, pin (2).

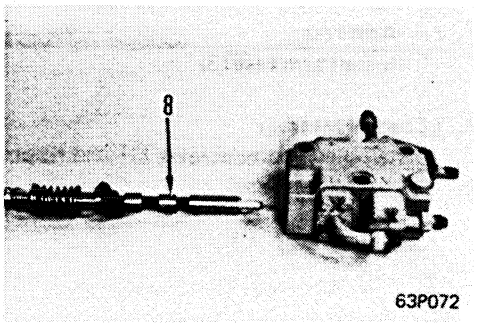


2. Cover

Remove cover (4).

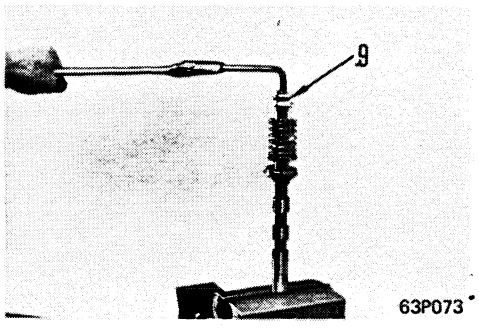
3. Detent case

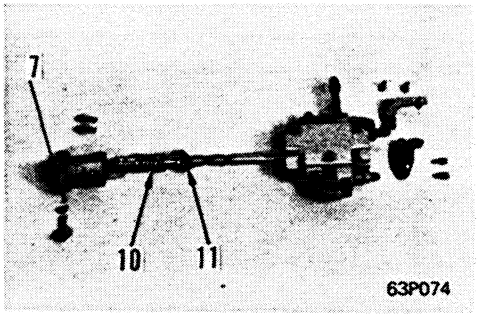
1) Loosen detent plug (5).
2) Remove detent case (6).
   ★ Be careful not to lose detent ball (7).



4. Spool assembly

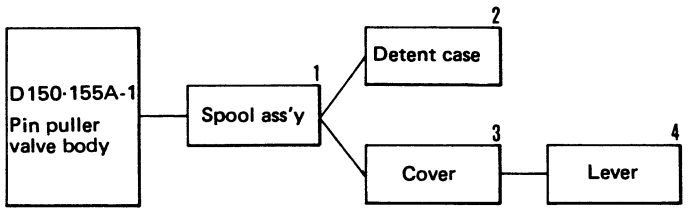
1) Pull out spool assembly (8) straight from valve body.
2) Grasp spool assembly in a vise. Loosen bolt (9) and remove spring (10) and oil seal (11).



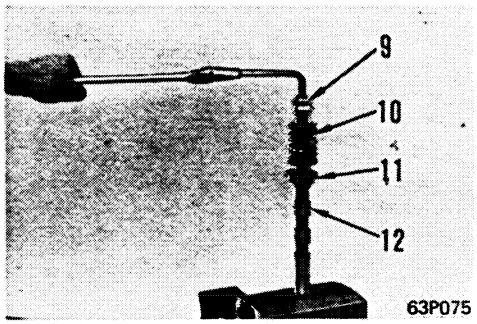


ASSEMBLY OF PIN PULLER VALVE

ASSEMBLY OF PIN PULLER VALVE



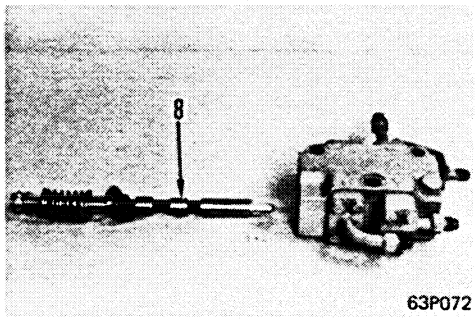
63F022



63P075

1. Spool assembly

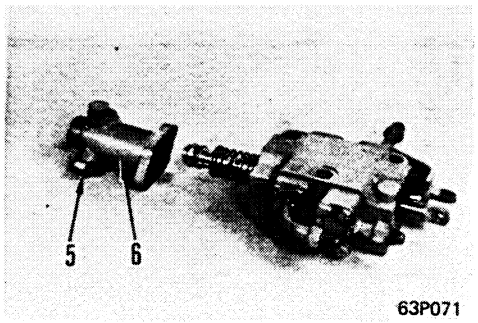
1) Grasp spool (12) in a vise. Assemble oil seal (11) and spring (10); secure with detent bolt (9).
2) Insert spool assembly (8) straight in valve body.
   - ★ Coat the circumference of spool with engine oil (SAE 10W, class CD).
   - ★ Coat the circumference of oil seal with grease (G2-L1).



63P072

2. Detent case

1) Install detent case (6).
   - ★ Coat mounting surface with gasket sealant (LG-2).
2) Tighten detent ball plug (5).



63P071

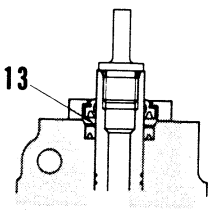
3. Cover

Fit cover (4).

- ★ Face tapered face of retainer plate (13) for oil seal to oil seal side.
- ★ Coat cover mounting surface with gasket sealant (LG-2).



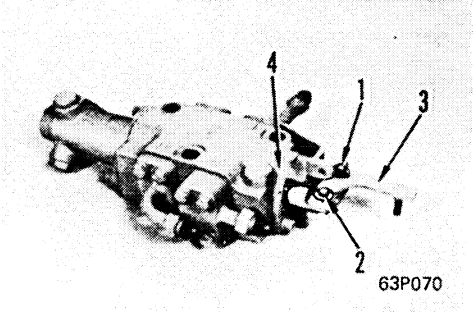
63P076



63F023

4. Lever

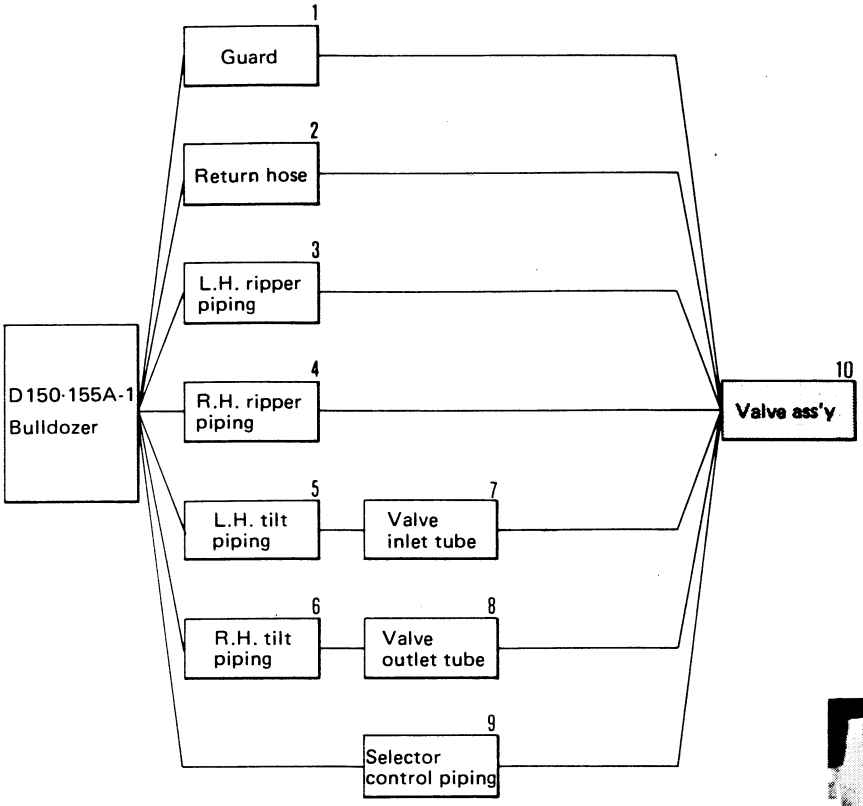
Connect lever (3) with pin, washer, cotter pin (1) and pin, washer cotter pin (2).



63P070

DISMOUNTING RIPPER SELECTOR VALVE

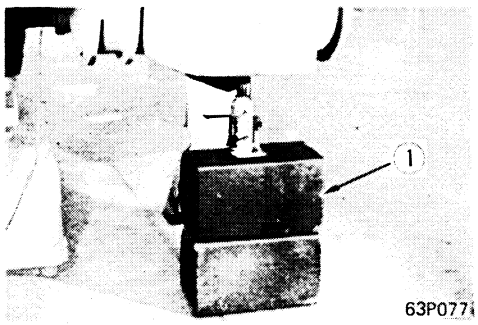
DISMOUNTING RIPPER SELECTOR VALVE



63F024

Preparatory work

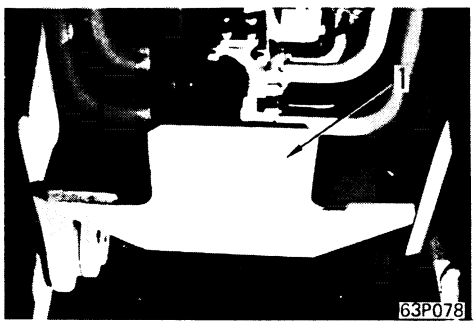
Support beam on block ① .



1. Guard

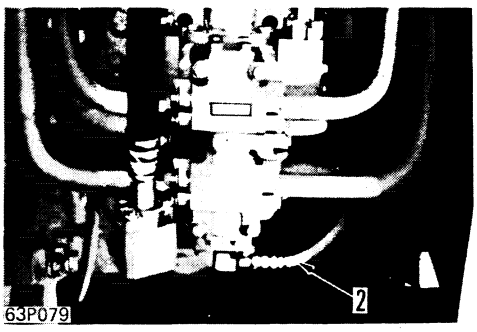
Remove four bolts fastening guard (1); remove guard.

kg Guard: **40 kg**

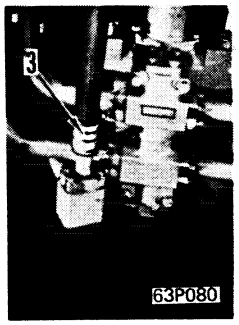


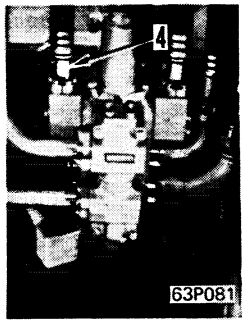
2. Return hose

Disconnect hose (2).

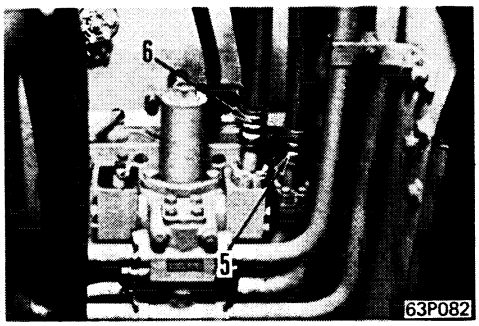


3. **L.H. ripper piping**
   1) Remove flange fastening bolts and disconnect hose (3).
   2) Remove flange fastening bolts and disconnect hose (4).

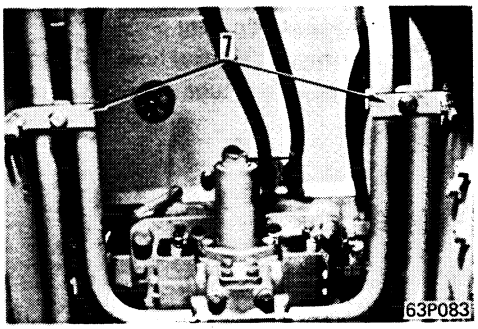




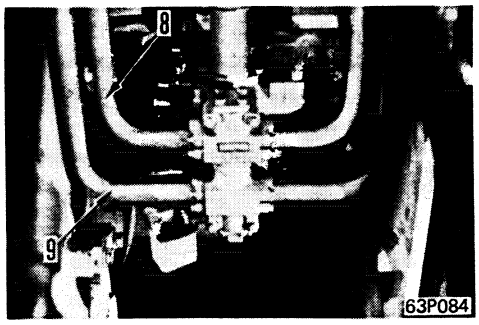
4. **R.H. ripper piping**
   1) Remove flange fastening bolts and disconnect hose (5).
   2) Remove flange fastening bolts and disconnect hose (6).



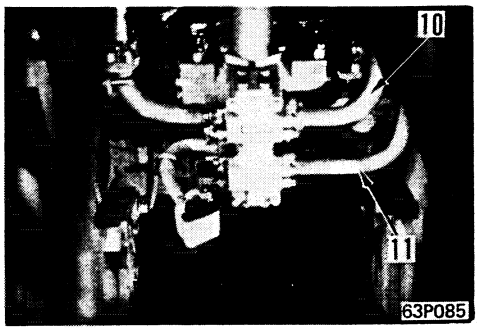
5. **L.H. tilt piping**
   1) Remove clamp (7).



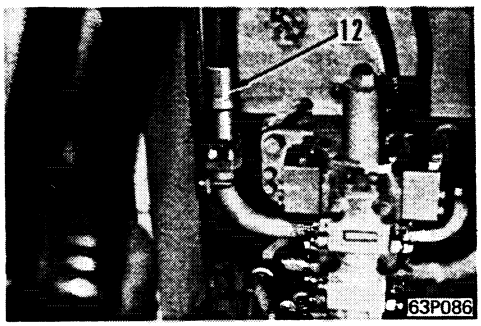
   2) Remove flange fastening bolts and disconnect tube (8) from valve assembly.
   3) Remove flange fastening bolts and disconnect tube (9) from valve assembly.



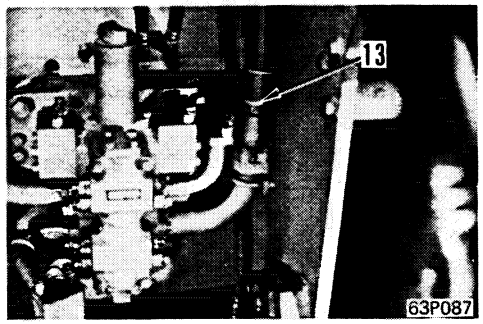
6. **R.H. tilt piping**
   1) Remove flange fastening bolts and disconnect tube (10) from valve assembly.
   2) Remove flange fastening bolts and disconnect tube (11) from valve assembly.



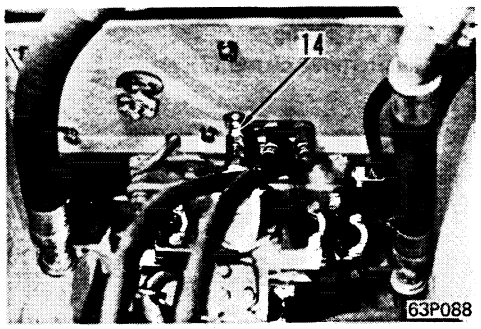
7. **Valve inlet tube**
Remove flange fastening bolts and disconnect hose (12) from valve assembly.



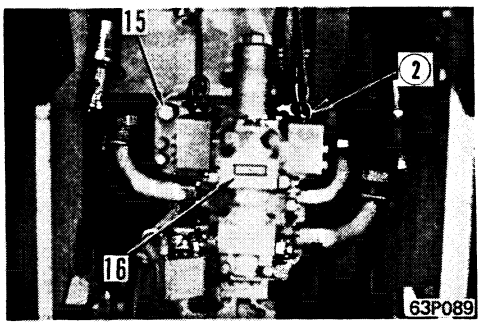
8. **Valve outlet hose**
Remove flange fastening bolts and disconnect hose (13) from valve assembly.



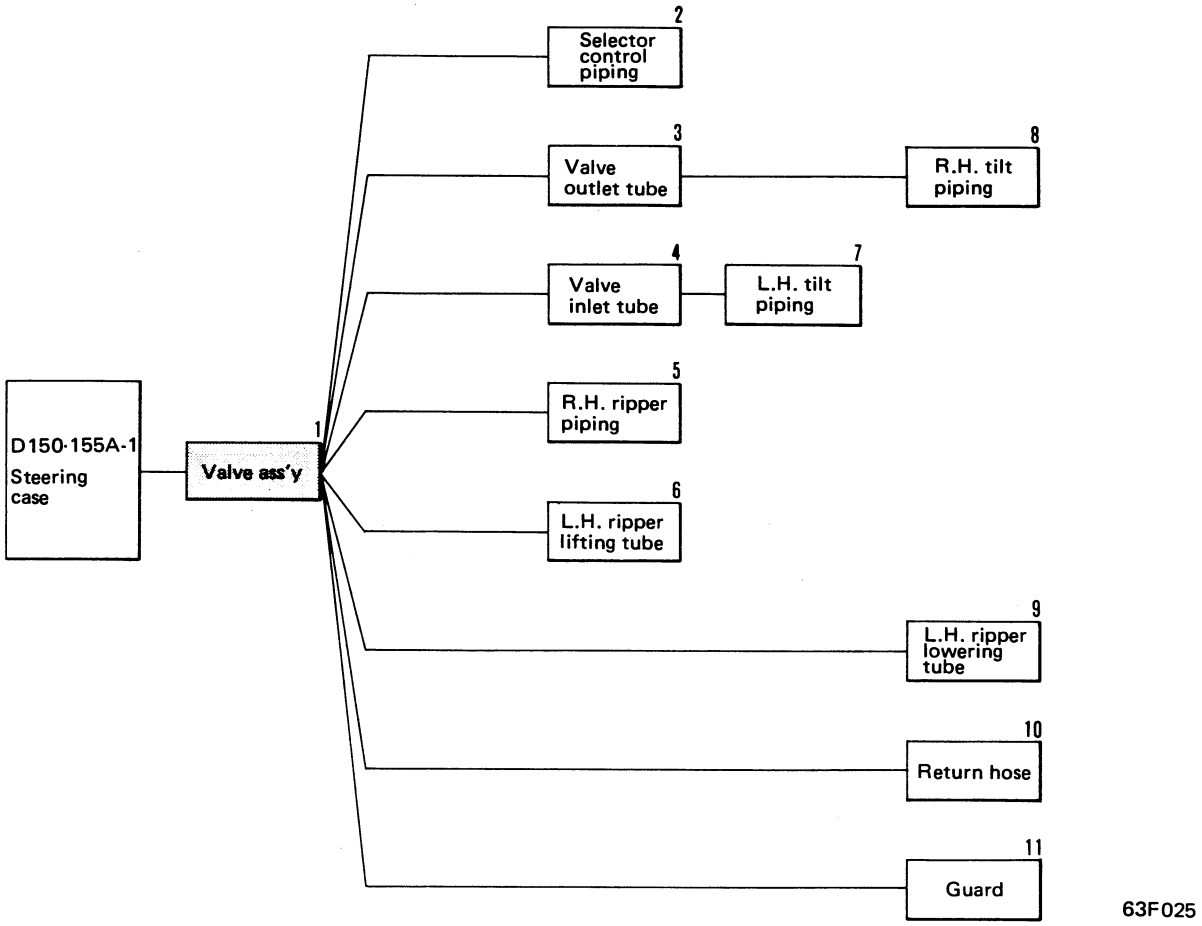
9. **Selector control piping**
1) Disconnect control hose (14) from valve assembly.
2) Remove leak tube provided under control tube.



10. **Valve assembly**
Sling valve assembly with hanging tool ② (10 mm, P=1.5), remove bolts (15) fastening bracket, and lift off valve assembly (16) together with bracket.
kg Valve and bracket assembly: **75 kg**

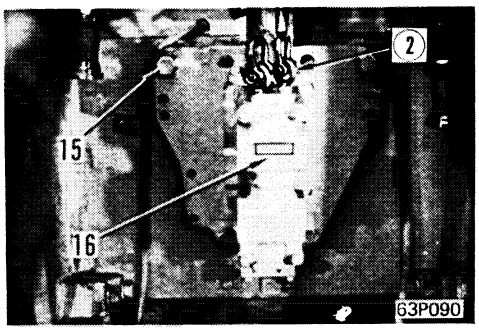


MOUNTING RIPPER SELECTOR VALVE



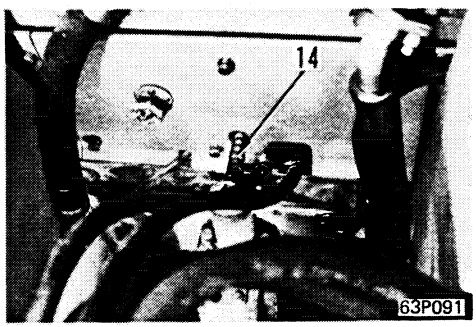
1. Valve assembly

1) Lift valve assembly (16) with hanging tool ② (10 mm, P=1.5) together with bracket into position and install with bolts (15).

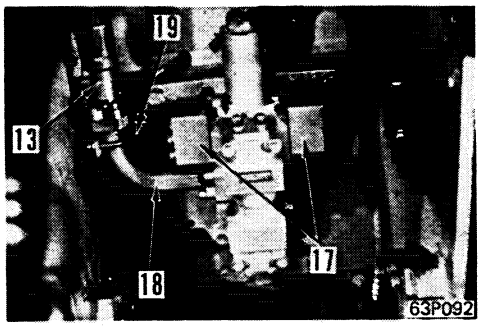


2. Selector control piping

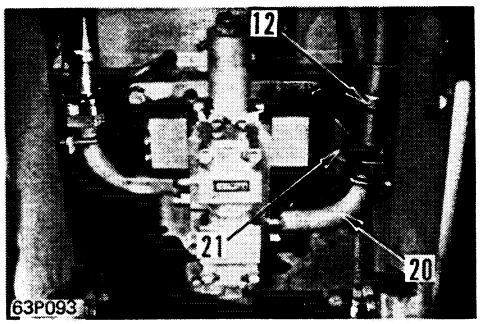
1) Install leak hose provided under control tube.
2) Connect control hose (14) to valve assembly.



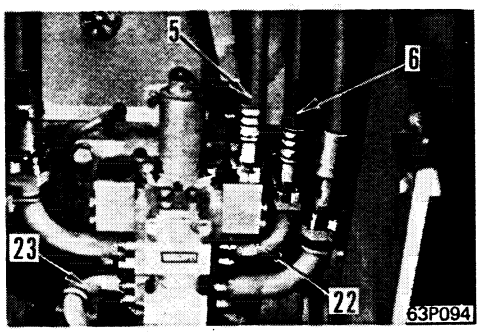
3. **Valve outlet tube**
   1) Install block (17).
   2) Temporarily install tube (18) with O-ring and bracket (19).
   3) Connect hose (13) with O-ring to valve assembly and fasten flange fastening bolts.
   4) Install tube (18) and bracket (19) with bolts securely.



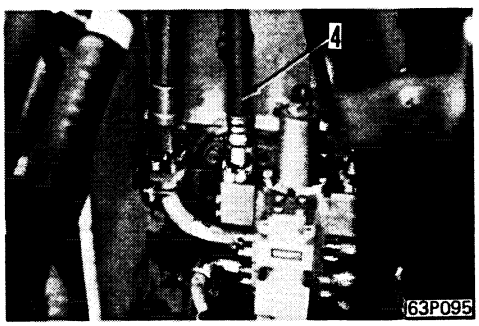
4. **Valve inlet tube**
   1) Temporarily install tube (20) with O-ring and bracket (21).
   2) Connect hose (12) with O-ring to valve assembly and fasten flange fastening bolts.
   3) Install tube (20) and bracket (21) with bolts securely.



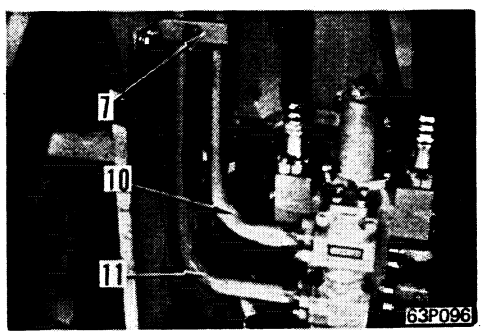
5. **R.H. ripper piping**
   1) Fit tubes (22) and (23) with O-rings to valve assembly. Loosely tighten flange bolts.
   2) Connect ripper lifting hose (6) with O-ring to valve assembly and tighten flange fastening bolts.
   3) Fully tighten flange fastening bolts for tube (22).
   4) Connect hose (5) with O-ring to valve assembly and tighten flange fastening bolts.



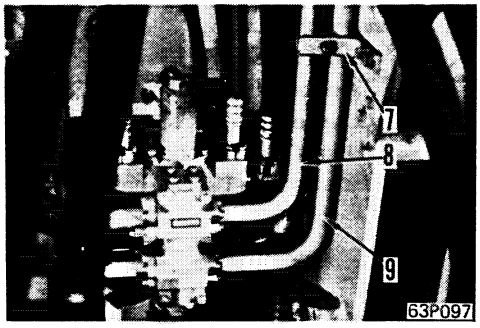
6. **L.H. ripper lifting tube**
   Connect hose (4) with O-ring to valve assembly and tighten flange fastening bolts.



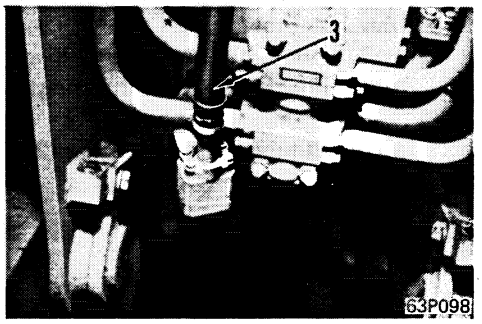
7. **L.H. tilt piping**
   1) Install tube (11) with O-ring and tighten flange fastening bolts.
   2) Install tube (10) with O-ring and tighten flange fastening bolts.
   3) Install clamp (7).



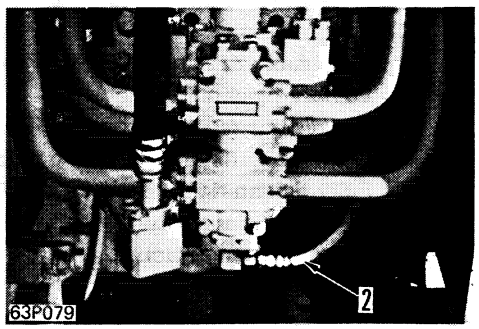
8. **R.H. tilt piping**
   1) Install tube (9) fastening with O-ring and tighten flange bolts.
   2) Install tube (8) with O-ring and tighten flange fastening bolts.
   3) Install clamp (7).



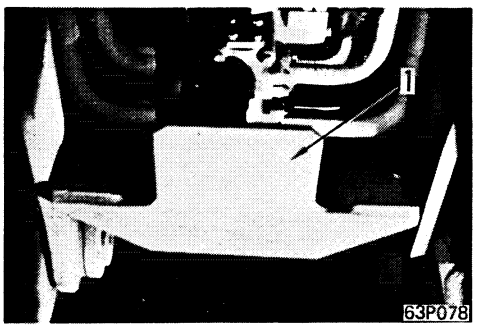
9. **L.H. ripper lowering tube**
   Connect tube (3) with O-ring to valve body and tighten flange fastening bolts.



10. **Return hose**
    Install return hose (2) and tighten sleeve nut.

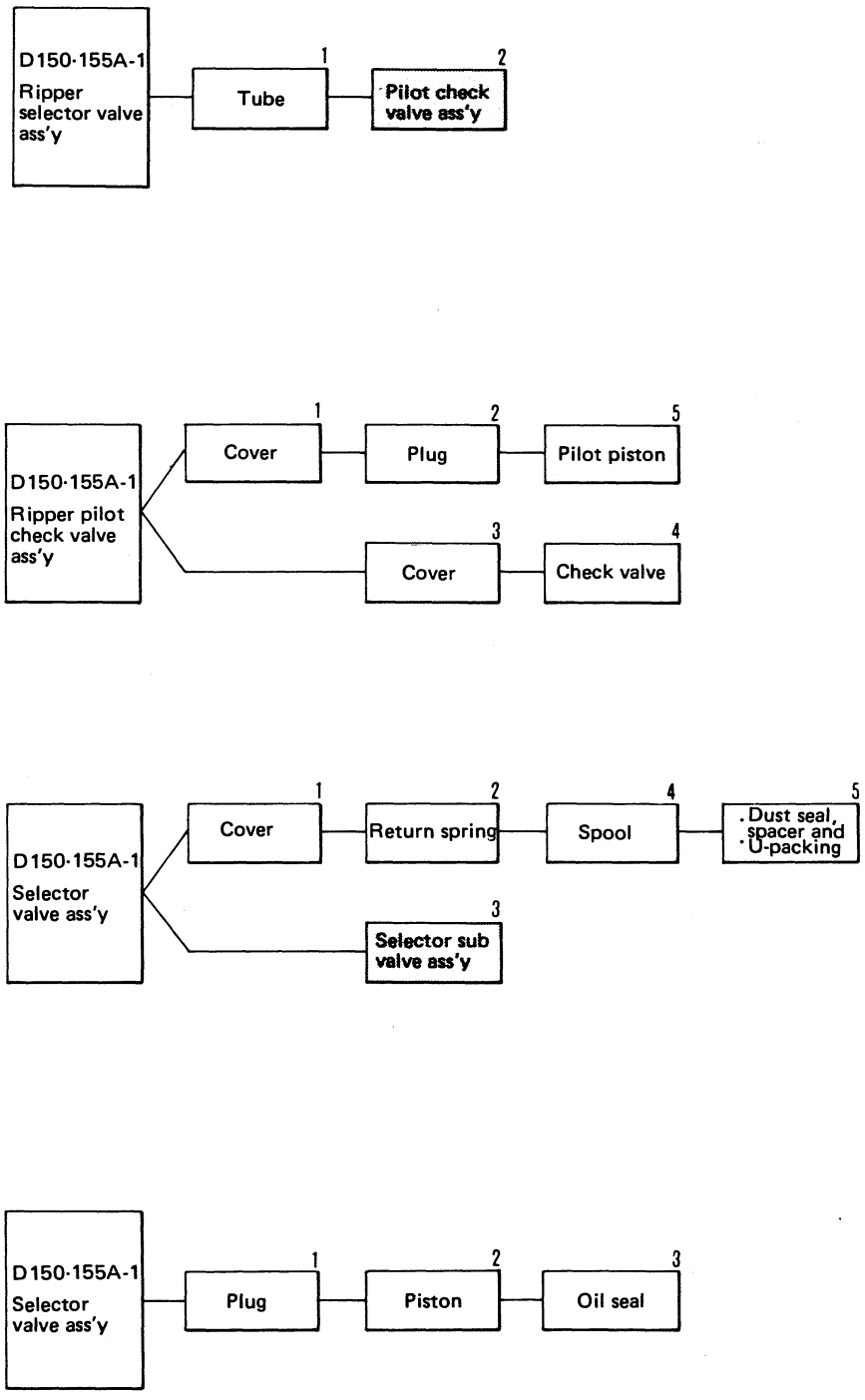


11. **Guard**
    Install guard (1) with four bolts.



DISASSEMBLY OF RIPPER SELECTOR VALVE

DISASSEMBLY OF RIPPER SELECTOR VALVE

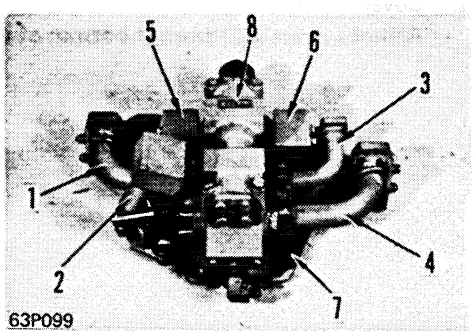


63F026

1. Tube

1) Remove the following tubes.
   - Hydraulic tank – valve tube (1)
   - Valve – hydraulic tank tube (4)
   - Lift cylinder head side L.H. Tube (5)
   - LIft cylinder head side R.H. tube (6)
   - Lift cylinder bottom side L.H. tube (2)
   - Lift cylinder bottom side R.H. tube (3)

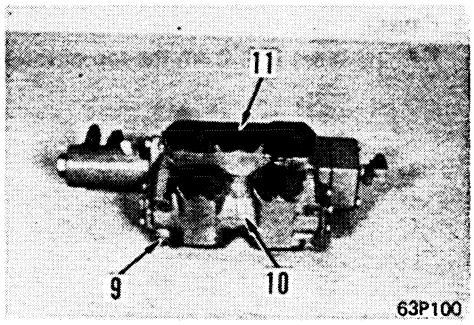
2) Remove bolt fastening bracket (7) from the backside and remove ripper selector valve assembly (8) from bracket.



2. Pilot check valve assembly

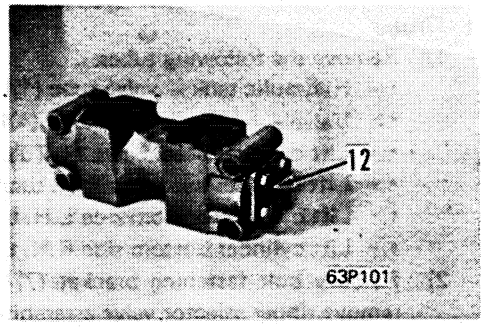
Remove mounting bolts (9) and separate pilot check valve assembly (10) and selector valve assembly (11) from each other.

★ Be sure to put match marks to R.H. and L.H. pilot check valve assemblies which are bisymmetric to prevent confusion.

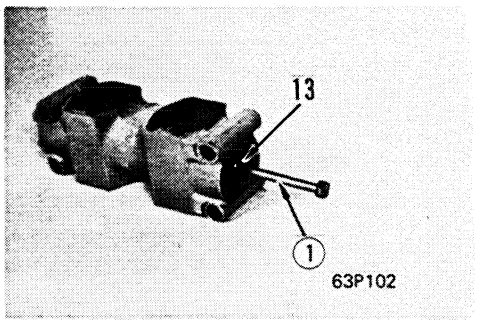


DISASSEMBLY OF PILOT CHECK VALVE

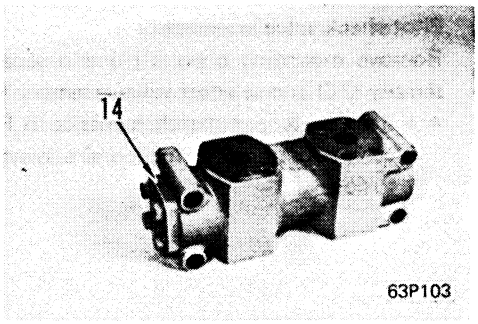
1. **Cover**
   Remove cover (12) from the bottom of valve body.



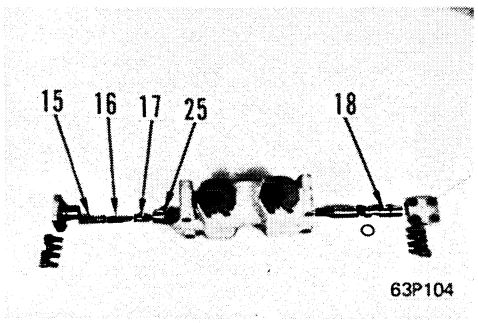
2. **Plug**
   Pull out plug (13) with jack bolt ① (10 mm, P=1.5)



3. **Cover**
   Remove cover (14) from the top of valve body.



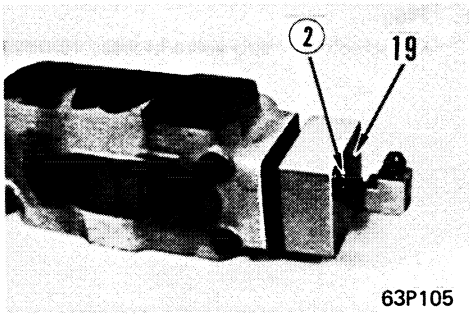
4. **Check valve**
   Remove spring (15), stopper (16), check valve (17) and check valve (25).



5. **Pilot piston**
   Pull out pilot piston (18).

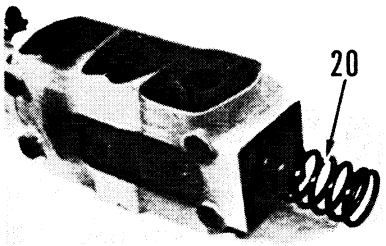
DISASSEMBLY OF SELECTOR MAIN VALVE

1. **Cover**
   Remove cover (19) from the bottom of valve body.
   Before removing cover, gradually loosen guide bolt ② (10 mm, P=1.5, ℓ=75) until return spring tension applied to cover is thoroughly eliminated.



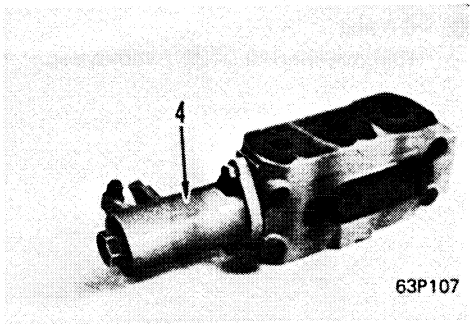
63P105

2. **Return spring**
   Remove return spring (20).



63P106

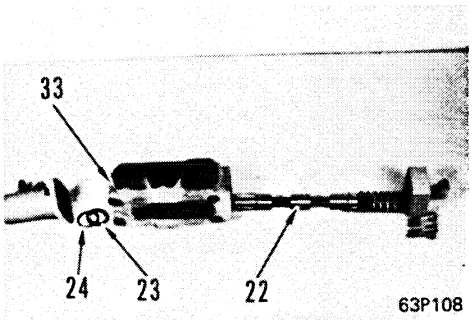
3. **Selector sub valve assembly**
   Remove selector sub valve assembly (21).



63P107

4. **Spool**
   Pull out spool (22).

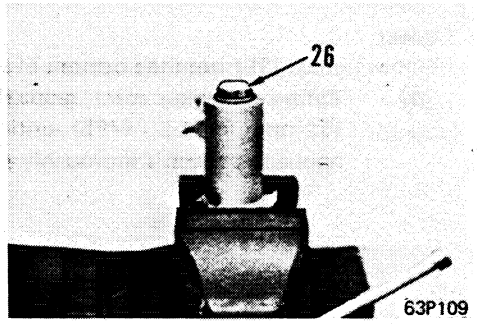
5. **Dust seal, spacer and U-packing**
   Remove dust seal (23), spacer (24) and U-packing (25).



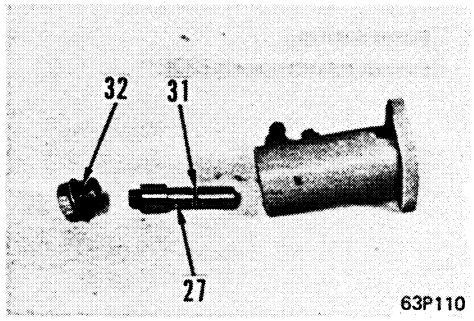
63P108

DISASSEMBLY OF SELECTOR SUB VALVE

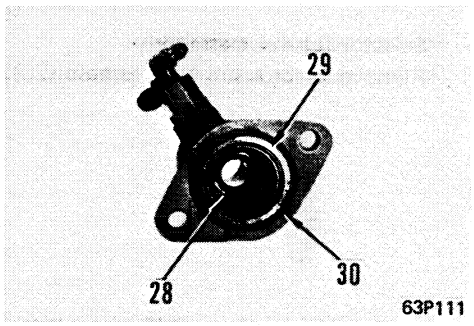
1. **Plug**
   Grasp selector sub valve in vise; remove plug (26).



2. **Piston**
   Remove piston (27).

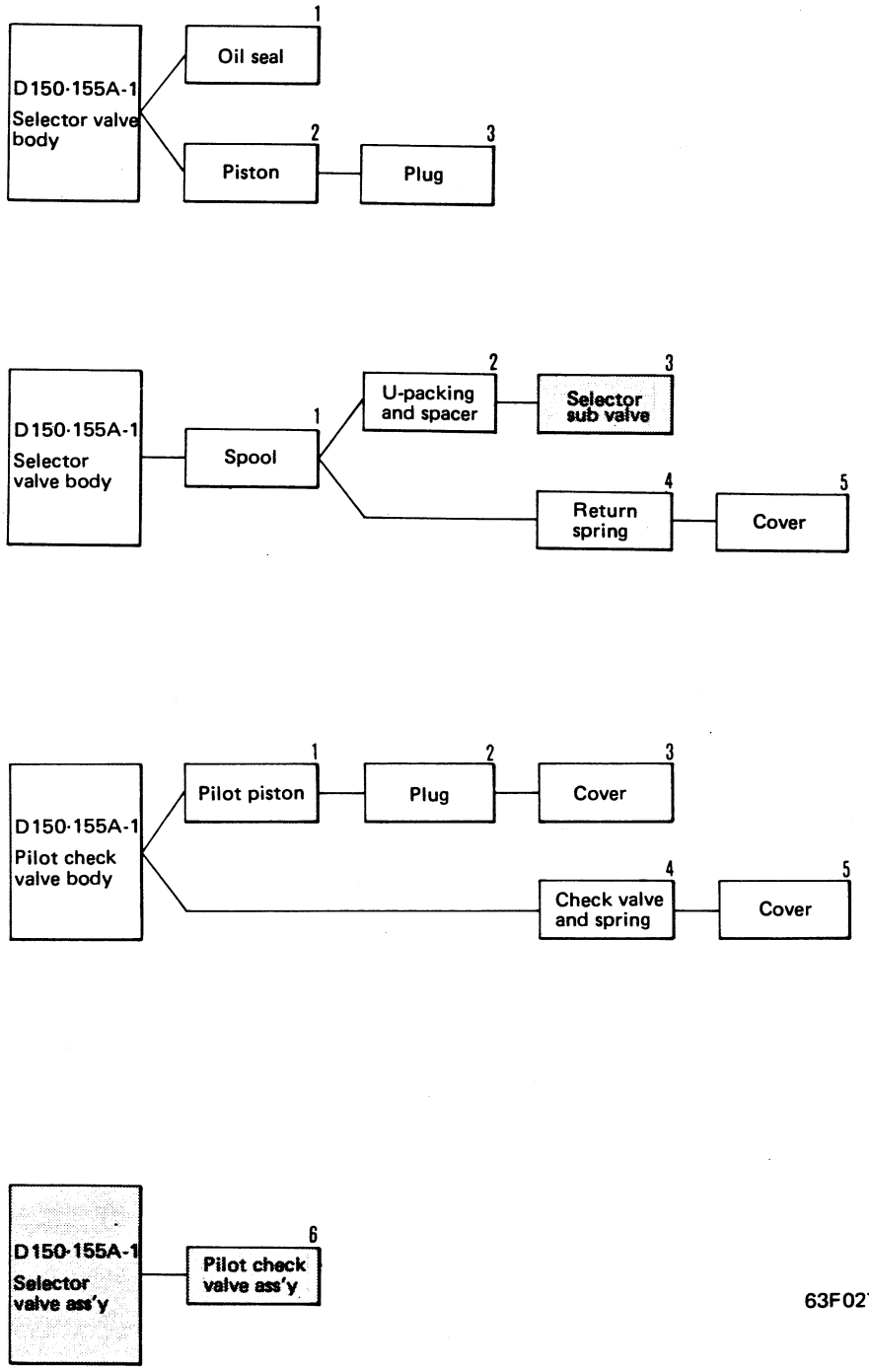


3. **Oil seal**
   Remove snap ring (28); remove spacer and oil seal (29).



ASSEMBLY OF RIPPER SELECTOR VALVE

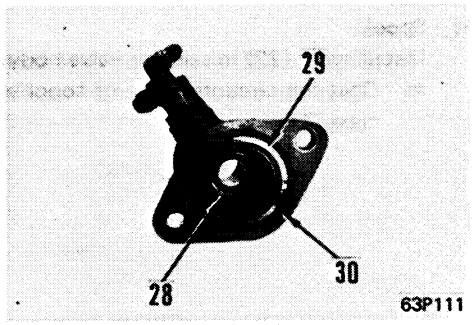
ASSEMBLY OF RIPPER SELECTOR VALVE



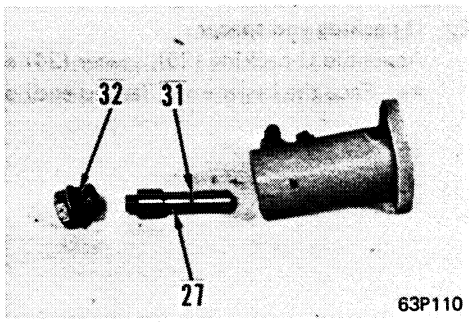
63F027

ASSEMBLY OF SELECTOR SUB VALVE

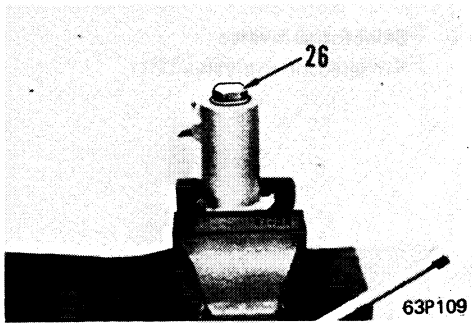
1. **Oil seal**
   Install oil seal and spacer (29) in selector sub valve body (30) with snap ring (28).



2. **Piston**
   Install O-ring (31) on piston (27) and insert piston into valve body.
   ★ Coat piston circumference with engine oil (SEA 10W, class CD).

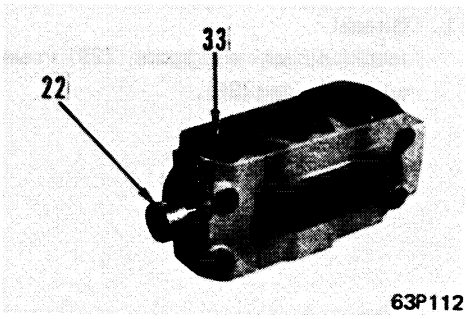


3. **Plug**
   Install O-ring (32) on plug (26) tighten valve body gripped in vise.



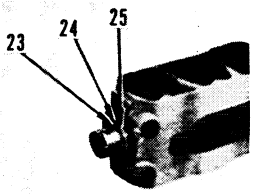
ASSEMBLY OF SELECTOR MAIN VALVE

1. **Spool**
   Install spool (22) in selector valve body (33).
   ★ Coat the circumference of spool with engine oil (SAE10W-class CD).

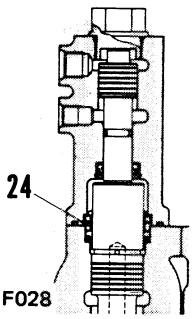


63P112

2. **U-packing and spacer**
   Assemble U-packing (25), spacer (24) and dust seal (23).
   ★ Face the larger end (flanged end) of spacer this side.

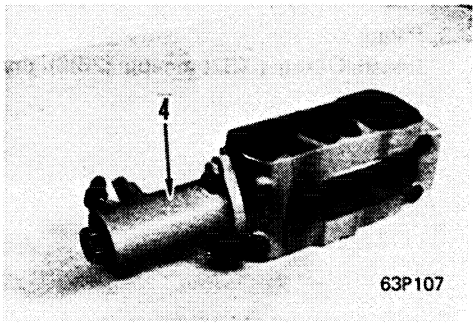


63P113



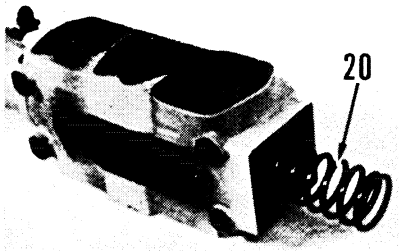
63F028

3. **Selector sub valve**
   Fit selector sub valve (21).



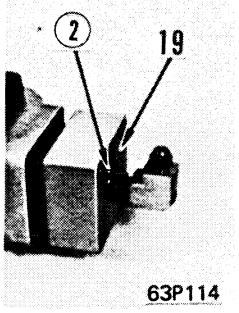
63P107

4. **Return spring**
   Install return spring (20).

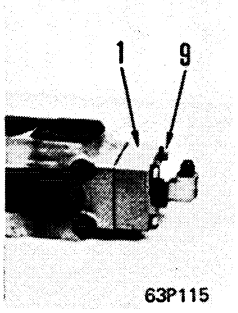


63P106

5. **Cover**
   Install cover (19) after loosening spring tension until screw of mounting bolt (33) is tightened with guide bolt ② (10 mm, P=1.5, ℓ=75).



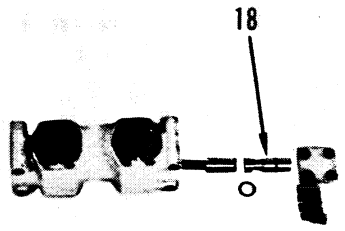
63P114



63P115

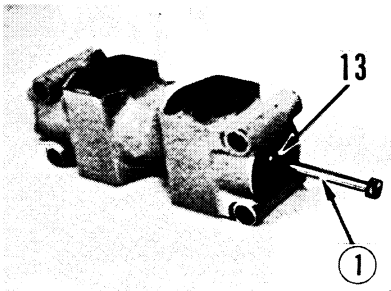
ASSEMBLY OF PILOT CHECK VALVE

1. **Pilot piston**
   Insert pilot piston (18) in place.
   ★ Coat the outer circumference of piston with engine oil (SAE10W, class CD).



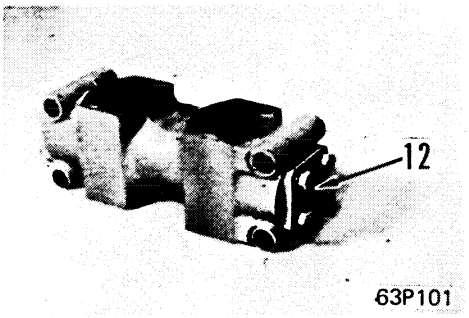
63P116

2. **Plug**
   Position O-ring on plug (13) and push plug in with pushing bolt ① (10 mm, P=1.6).



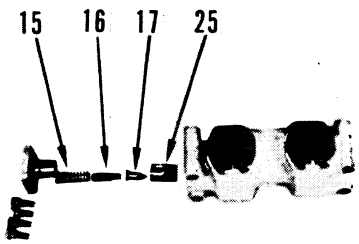
63P102

3. **Cover**
   Fit cover (12).



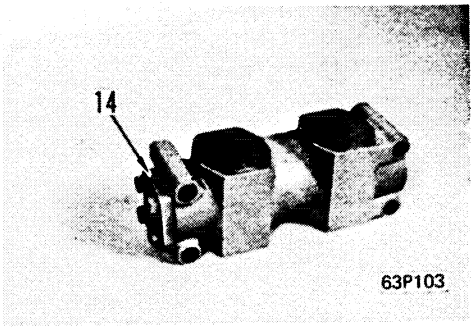
63P101

4. **Check valve and spring**
   Assemble check valve (25), check valve (17), stopper (16) and spring (15).
   ★ Coat the outer circumference of valve with engine oil (SAE 10W-class CD)



63P117

5. **Cover**
   Fit cover (14) together with O-ring.

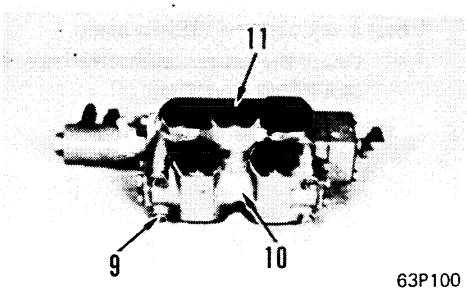


63P103

6. Pilot check valve assembly

Place pilot check valve assembly (10) on selector valve assembly (11), aligning match marks with each other; secure with bolts (9).

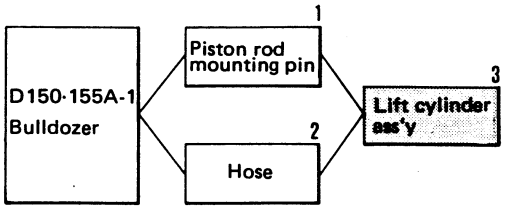
kgm Bolt: **6 ± 1 kg.m**



63P100

DISMOUNTING BLADE LIFT CYLINDER

DISMOUNTING BLADE LIFT CYLINDER

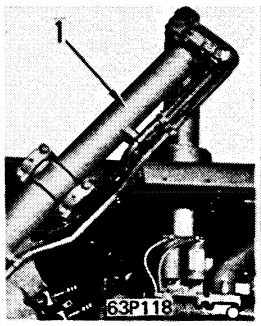


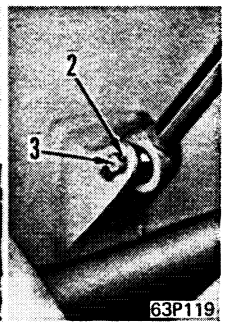
63F029

1. Piston rod mounting pin

Sling blade lift cylinder assembly (1) with crane. Remove lock pin (2) and pull out piston rod mounting pin (3). Start engine and fully retract piston rod. Stop engine and try moving control lever repeatedly to expel residual pressure from cylinder.

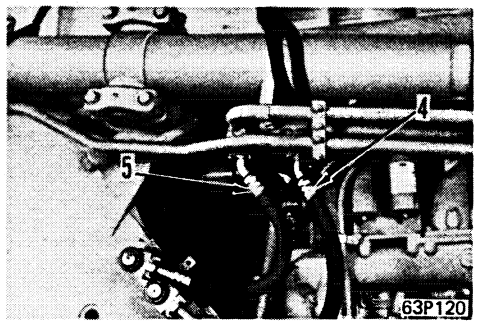
★ When piston rod is retracted, the center of gravity of cylinder will move toward cylinder bottom, causing a swing of cylinder.





2. Hose

Re-sling cylinder horizontally. Disconnect hoses (4) and (5) from cylinder.

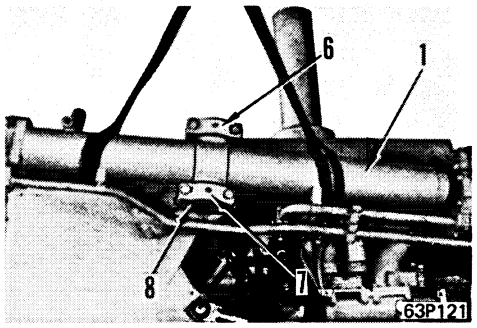


3. Lift cylinder assembly

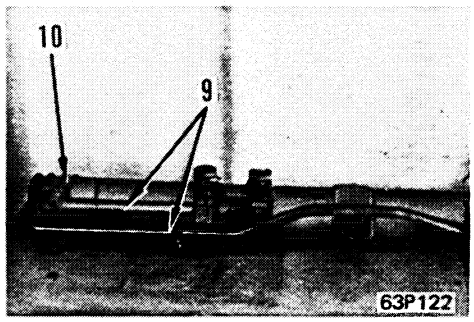
1) Remove caps (6) and (7); remove bearing (8); and lift off cylinder assembly (1).

★ Be careful to prevent bearing from falling off when caps are removed.

kg Blade lift cylinder assembly: **225 kg**

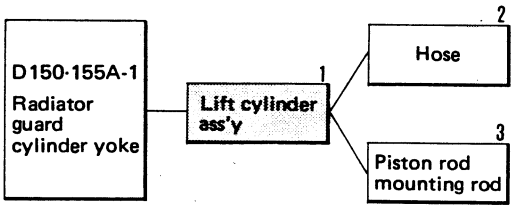


2) Remove cylinder tube (9); and remove quick drop valve assembly (10).



MOUNTING BLADE LIFT CYLINDER

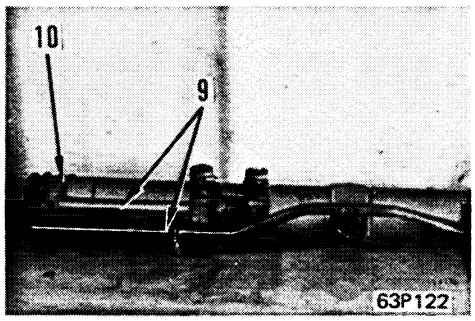
MOUNTING BLADE LIFT CYLINDER



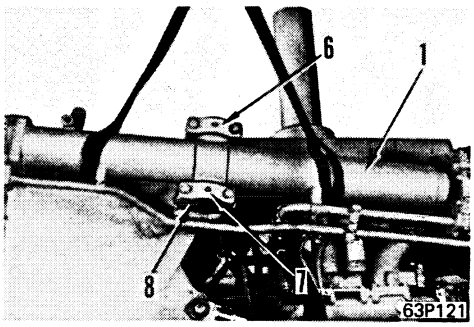
63F030

1. Lift cylinder assembly

1) Install quick drop valve assembly (10), with O-ring fitted to mounting surface, on cylinder.
2) Connect tube (9) to cylinder and to quick drop valve with O-ring fitted to each flanged end.

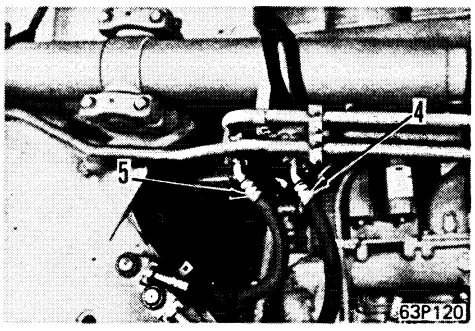


3) Lift cylinder assembly (1) into position on cylinder stay.
4) Position upper and lower bearings (8) and install caps (6) and (7).



2. Hose

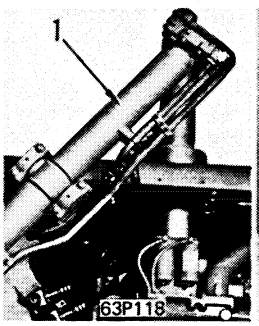
Connect hoses (4) and (5), with O-ring in each flange face, to cylinder.

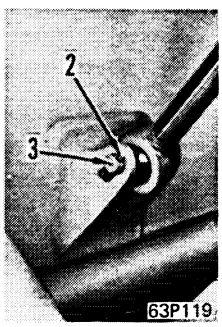


3. Piston rod mounting pin

Rearrange sling rope toward cylinder head to facilitate installation of piston rod mounting pin. Start engine and operate both blade lift cylinder control lever and crane to align piston holes. Put piston rod mounting pin (3) into holes and lock with lock pin (2).

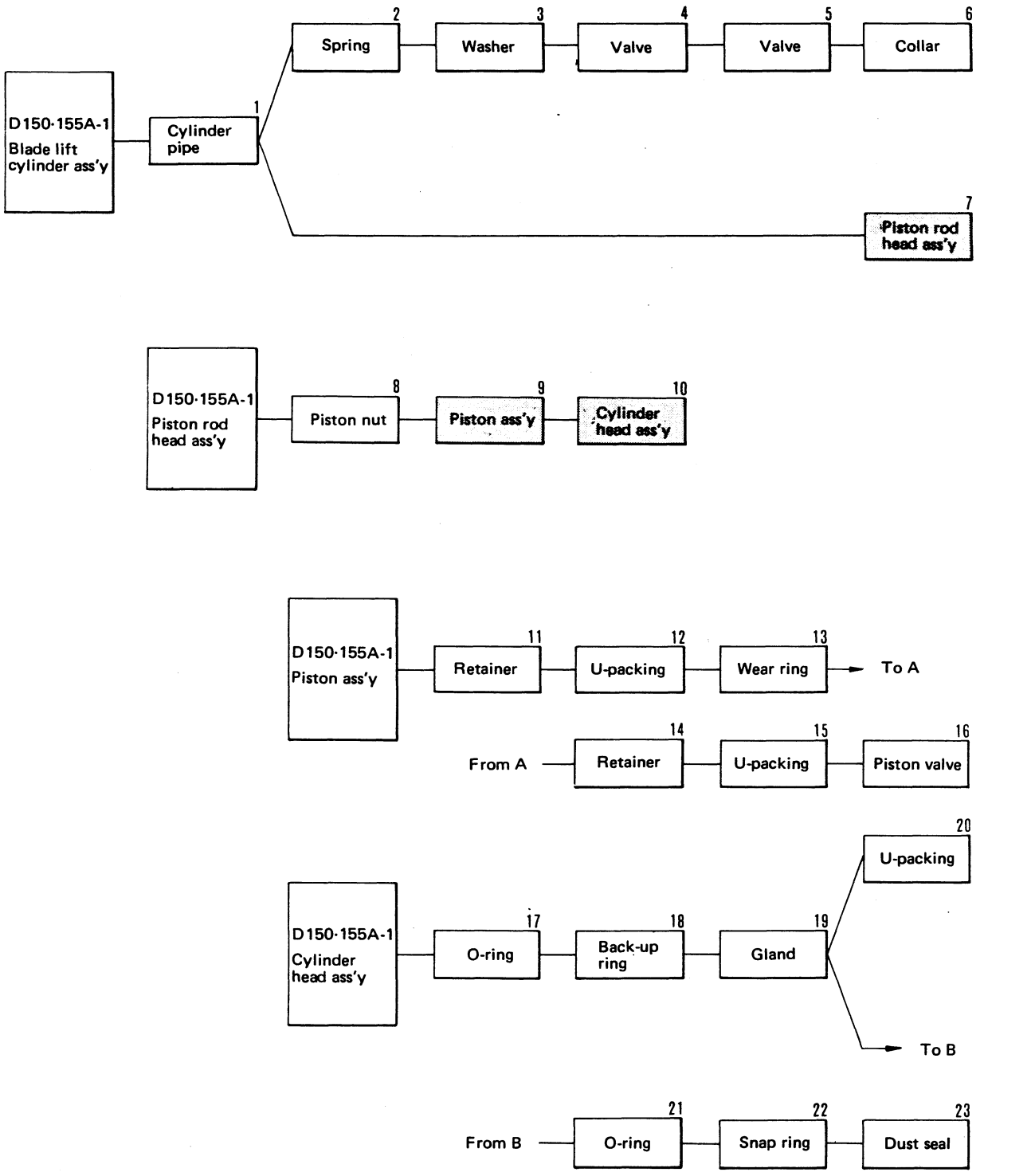
★ Coat the outer circumference of mounting pin with grease (G2-L1).





DISASSEMBLY OF BLADE LIFT CYLINDER

DISASSEMBLY OF BLADE LIFT CYLINDER



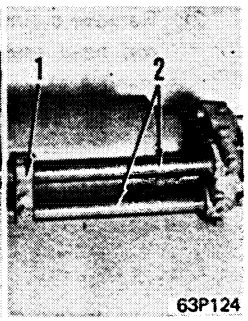
63F031

Special tools required

Special tools required		A	B
790-502-1000	Cylinder overhaul stand	1	
790-101-1101	Pump		1

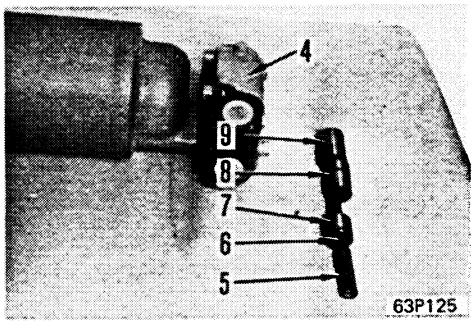
1. Cylinder piping
Remove clamp (1) and disconnect cylinder pipes (2) and (3).





2. Spring
Remove spring (5) from valve body (4).

3. Washer
Remove washer (6).



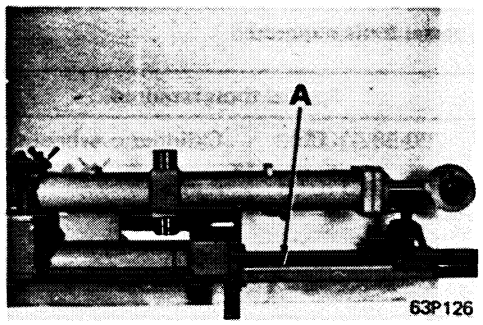
4. Valve
Remove valve (7) from valve body.

5. Valve
Remove valve (8) from valve body.

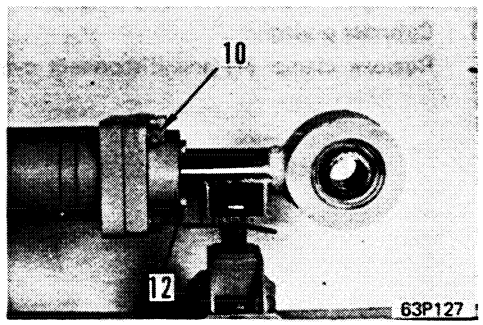
6. Collar
Remove collar (9) from valve body.

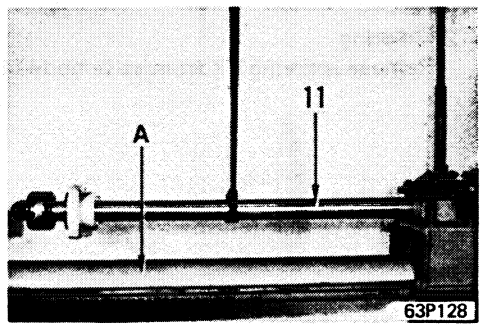
7. Piston rod head assembly

1) After loosening cylinder head mounting bolts, while blade lift cylinder is on machine, set cylinder on cylinder overhaul stand A.



2) Remove cylinder head mounting bolts (10). Pull out piston rod head assembly (11) and set it on cylinder overhaul stand A.
   - ★ To remove piston rod head assembly, hoist it off with wire rope.
   - ★ Prior to removal, loosen gland mounting bolts (12).



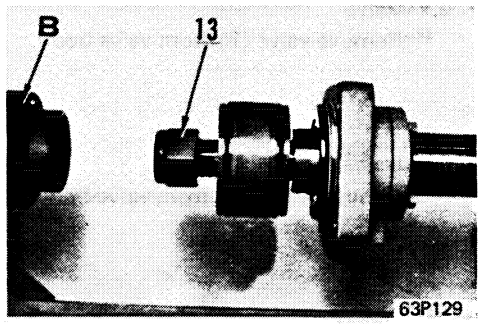


DISASSEMBLY OF PISTON ROD AND HEAD

8. Piston nut

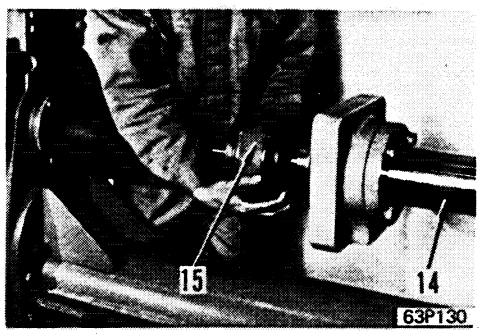
Remove piston nut (13) with pump B.

- ★ Width across flats of piston nut: **70 mm**

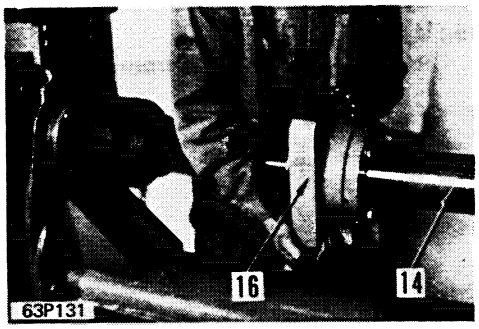


9. Piston assembly

Remove piston assembly (15) from rod (14).

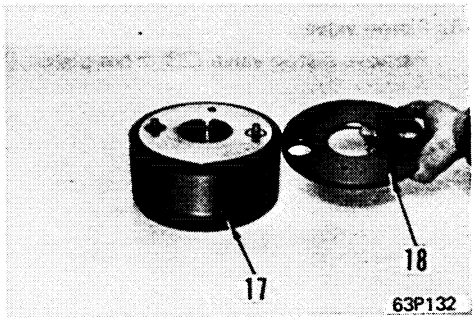


10. Cylinder head assembly
Remove cylinder head assembly (16) from rod (14).

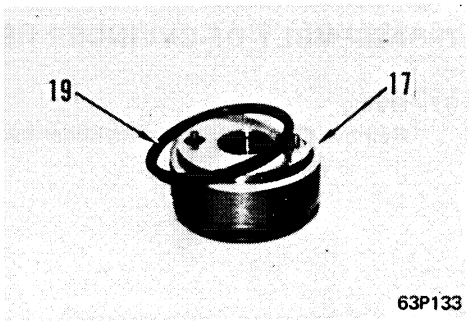


DISASSEMBLY OF PISTON

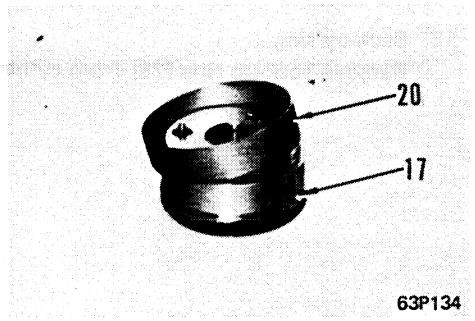
11. Retainer
Remove retainer (18) from piston (17).



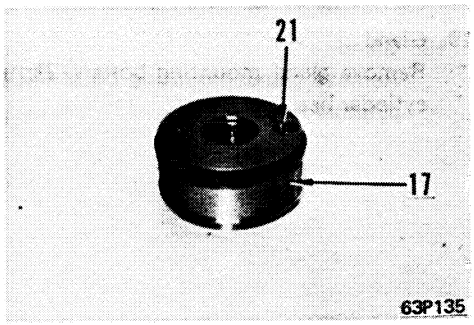
12. U-packing
Remove U-packing (19) from piston (17).



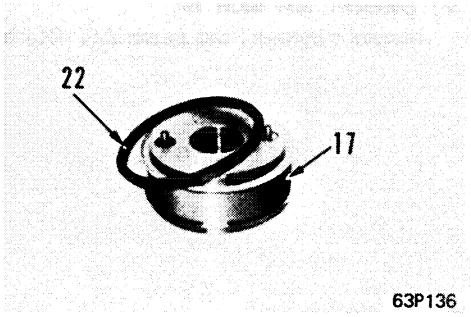
13. Wear ring
Remove wear ring (20) from piston (17).



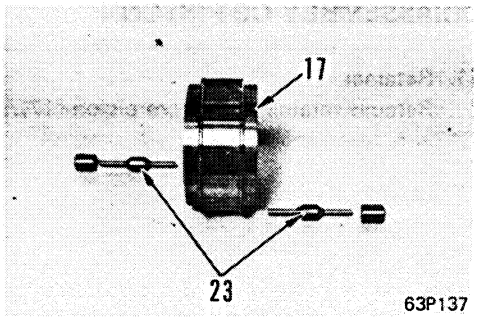
14. Retainer
Remove retainer (21) from piston (17).



15. U-packing
Remove U-packing (22) from piston (17).

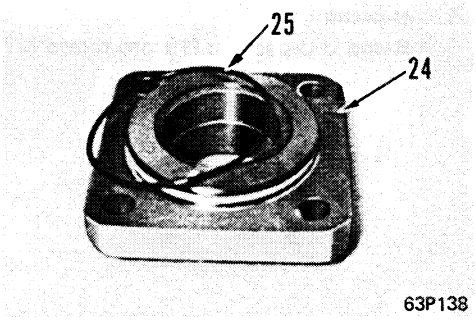


16. Piston valve
Remove piston valve (23) from piston (17).

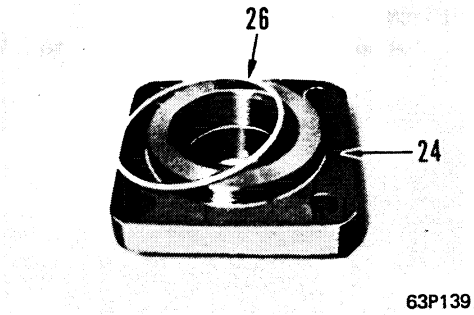


DISASSEMBLY OF CYLINDER HEAD

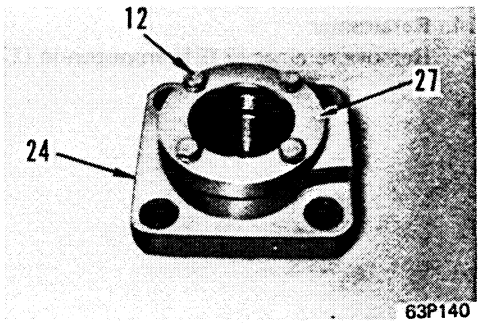
17. O-ring
Remove O-ring (25) from cylinder head (24).



18. Back-up ring
Remove back-up ring (26) from cylinder head (24).

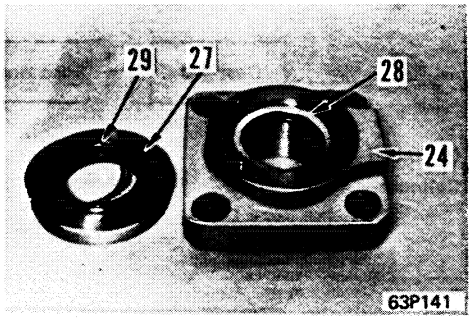


19. Gland
Remove gland mounting bolts (12); remove flange (27) from cylinder head (24).



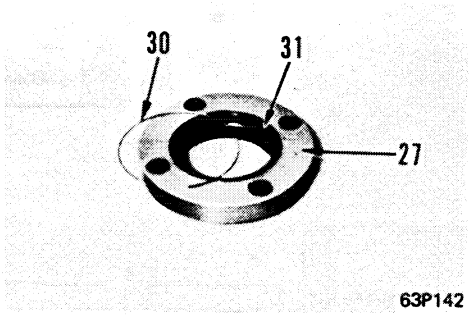
20. U-packing
Remove U-packing (28) from cylinder head (24).

21. O-ring
Remove O-ring (29) from gland (27).

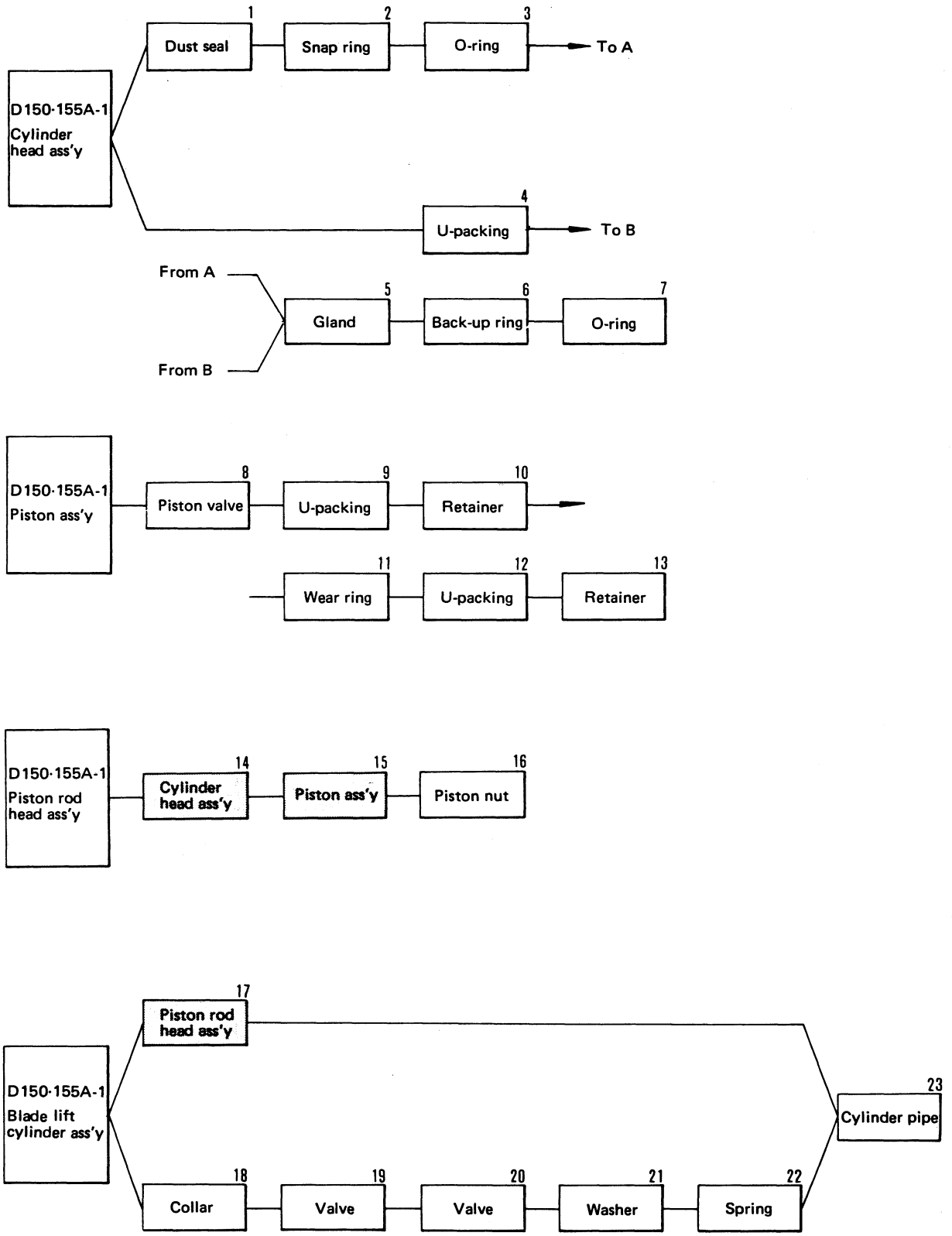


22. Snap ring
Remove snap ring (30) from gland (27).

23. Dust seal
Remove dust seal (31) from gland (27).



ASSEMBLY OF BLADE LIFT CYLINDER



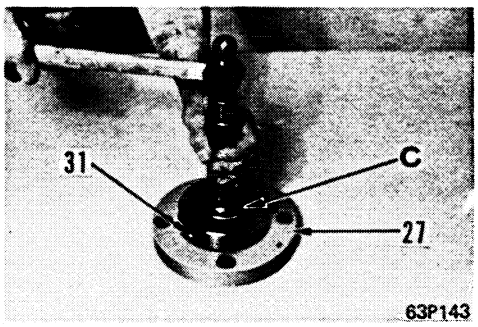
63F032

Special tools required

Special tools required		A	B	C
790-502-1000	Cylinder overhaul stand	1		
790-101-1101	Pump		1	
790-101-5201	Pushing tool kit			1

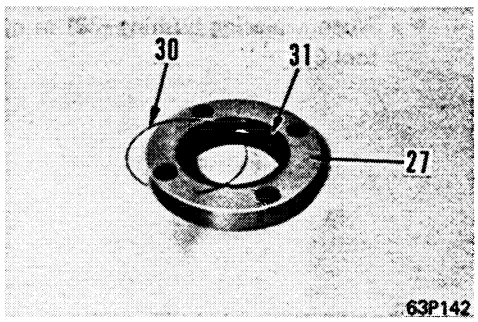
ASSEMBLY OF CYLINDER HEAD

1. **Dust seal**
   Press fit dust seal (31) onto gland (27) with pushing tool C.

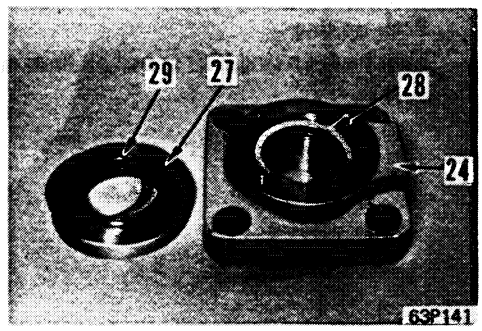


2. **Snap ring**
   Fit snap ring (30) on gland (27).

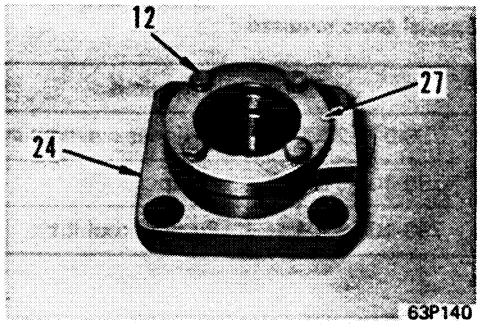
3. **O-ring**
   Position O-ring (29) on gland (27).



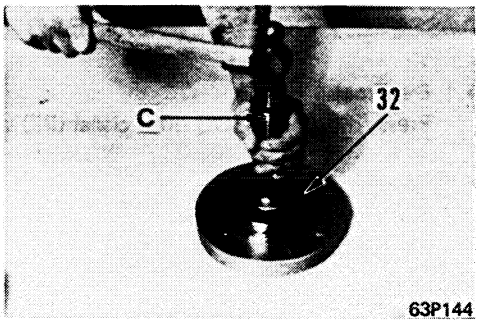
4. **U-packing**
   Position U-packing (28) on cylinder head (24).



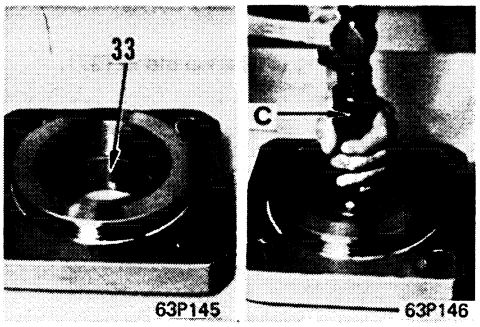
5. Gland
Secure gland (27) onto cylinder head (24) with bolts (12).



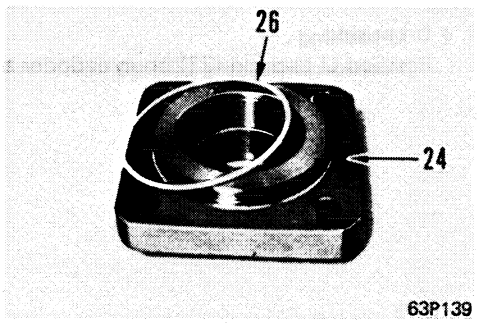
★ When replacing bushing (32) in gland, use pushing tool C.



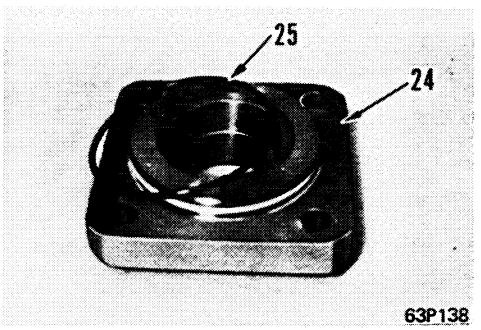
★ When replacing bushing (33) in cylinder head, use pushing tool C.



6. Back-up ring
Heat back up ring (26) in hot oil bath and fit it on cylinder head (24).



7. O-ring
Position O-ring (25) on cylinder head (24).

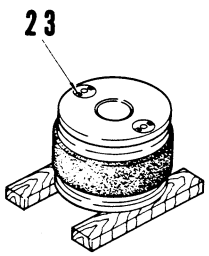


ASSEMBLY OF PISTON

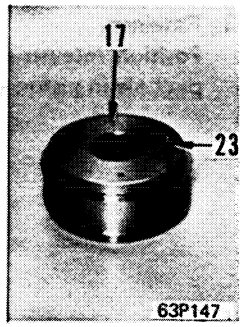
8. Piston valve

Assemble piston (17) and piston valve (23).

★ Inspection of piston valve seat contact surface.
Place piston on blocks. Pour oil at hole in upper valve seat, and check for no oil leakage from lower valve seat. Turn piston upside down and check the opposite valve seat contact as same manner.



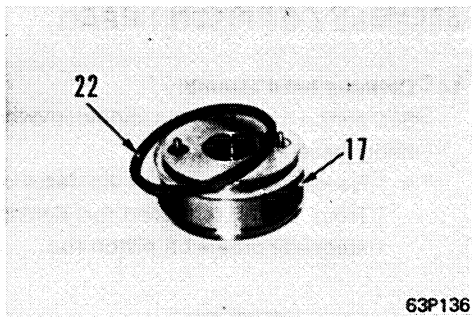
63F033



63P147

9. U-packing

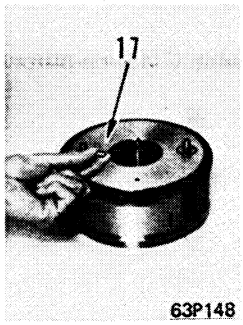
Position U-packing (22) on piston (17).



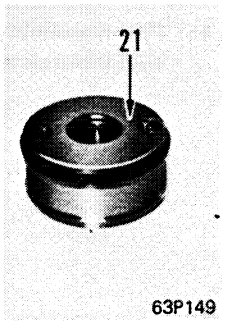
63P136

10. Retainer

Position retainer (21) in place with its dowel pin engaged with pin hole in piston (17).



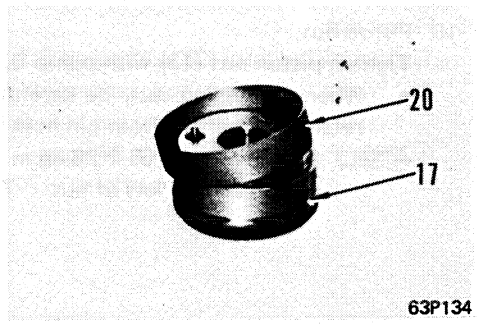
63P148



63P149

11. Wear ring

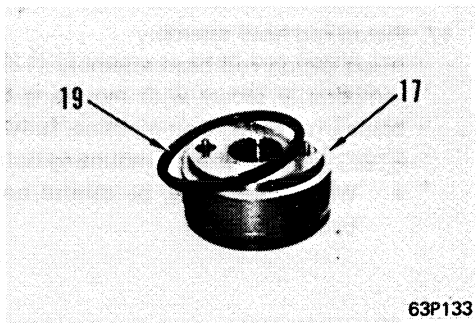
Fit-wear ring (20) on piston (17).



63P134

12. U-packing

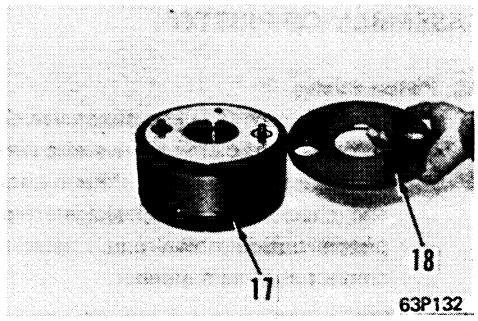
Position U-packing (19) on piston (17).



63P133

13. Retainer

Position retainer (18) in place with its dowel pin engaged with pin hole in piston (17).

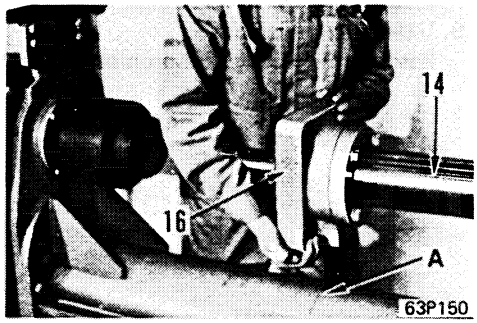


ASSEMBLY OF PISTON HEAD

14. Cylinder head assembly

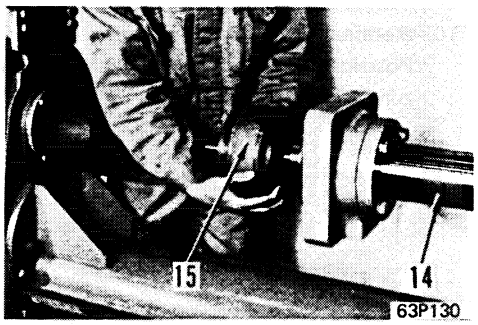
Set piston rod (14) on cylinder overhaul stand A. Install cylinder head assembly (16).

★ Be careful to prevent lip faces of dust seal and U-packing from being scratched or damaged by screw threads or stepped corners on piston rod.



15. Piston assembly

Install piston assembly (15) on piston rod (14).



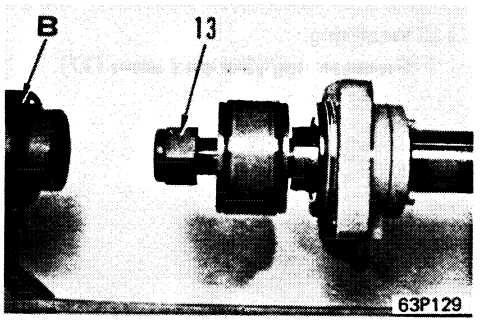
16. Piston nut

Tjghten piston nut (13) with pump B.

★ When tightening nut, be careful not to cause slipping of retainer dowel pin from pin hole in piston.

kgm Piston nut: **265 ± 26 kg.m**

Width across flats of nut: **70 mm**

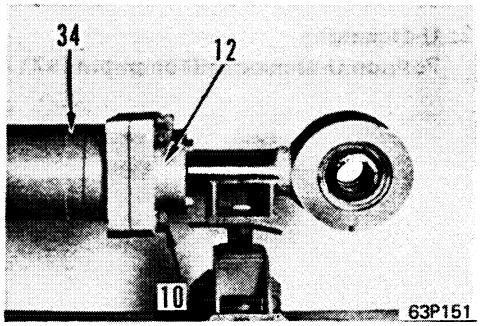


17. Piston rod head assembly

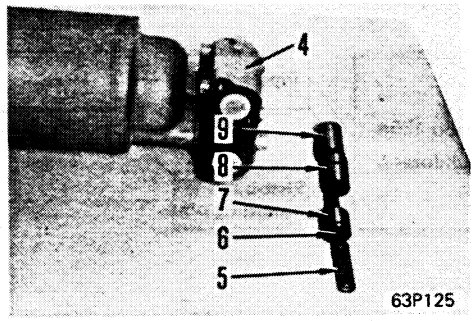
Insert piston rod head assembly (12) in cylinder body (34) and temporarily secure with mounting bolts (10). After mounting blade lift cylinders on machine, fully tighten bolts.

kgm Cylinder head mounting bolt: **95 ± 10 kg.m**

★ When assembling, be careful not to damage U-packing or back-up ring.



18. Collar
Fit collar (9) in valve body (4).

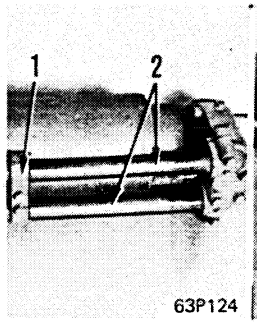


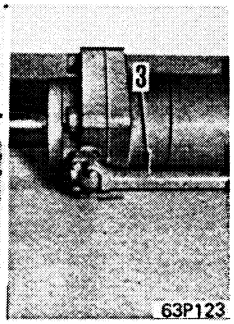
19. Valve
Fit valve (8) in valve body.

20. Valve
Fit valve (7) in valve body.

21. Washer
Fit washer (6) in valve (7).

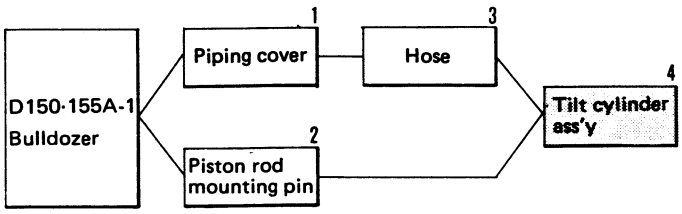
22. Spring
Fit spring (5) in valve body.



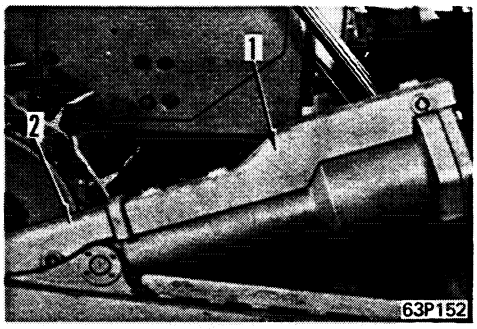


23. Cylinder piping
Secure lift cylinder pipes (2) and (3) with bolts. Secure clamp (1).

DISMOUNTING BLADE TILT CYLINDER

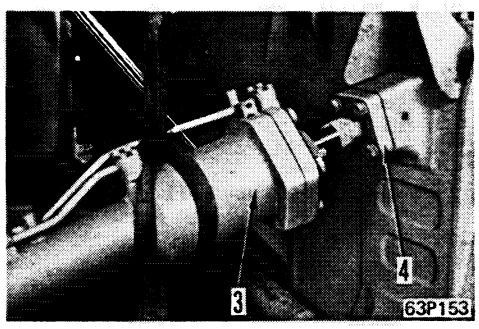


63F034



1. Piping cover

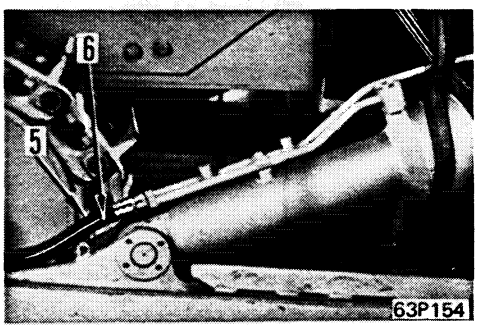
Remove piping covers (1) and (2).



2. Piston rod mounting pin

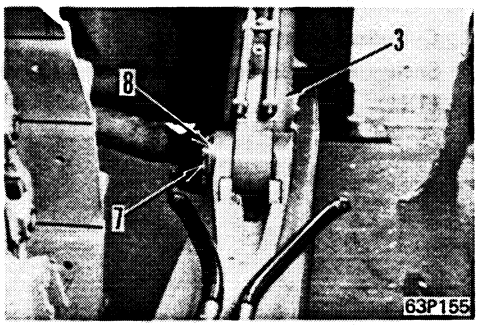
Sling tilt cylinder assembly (3) with crane. Remove bolt from piston mounting flange (4). Start engine and place blade control lever in the RIGHT TILT position to retract piston rod fully.

★ Record number of shims removed and thickness of a pack of shims.



3. Hose

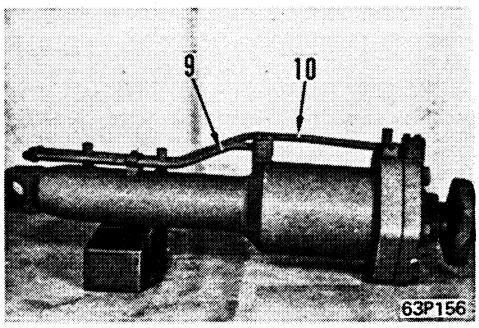
After stopping engine, repeatedly move blade control lever to right and left tilt positions to expel residual pressure from cylinder. Disconnect hoses (5) and (6) from cylinder.



4. Tilt cylinder assembly

1) Sling cylinder assembly (3) with crane. Remove lock plate (8) and pull out cylinder bottom side mounting pin (7). Lift off cylinder assembly.

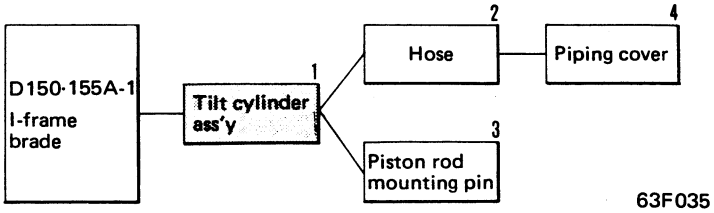
kgm Tilt cylinder assembly: **230 kg**

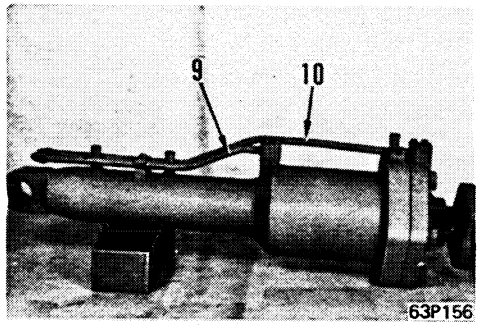


2) Remove tubes (9) and (10).

MOUNTING BLADE TILT CYLINDER

MOUNTING BLADE TILT CYLINDER



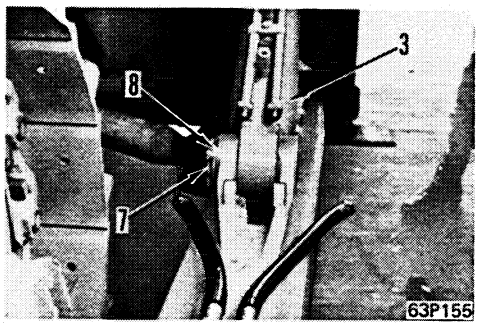


1. Tilt cylinder assembly

1) Connect tubes (9) and (10), with O-ring in each flange face, to tilt cylinder.

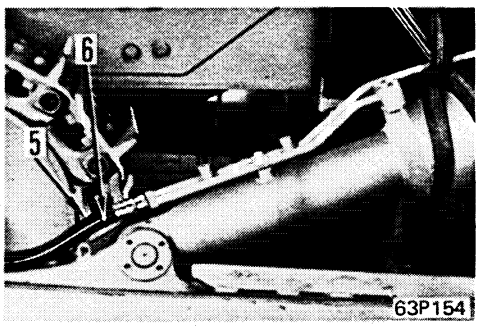
2) Lift tilt cylinder assembly into position on I-frame and align cylinder bottom mounting pin hole with pin hole in frame.

3) Put cylinder bottom mounting pin (7) into hole and lock with lock plate (8).



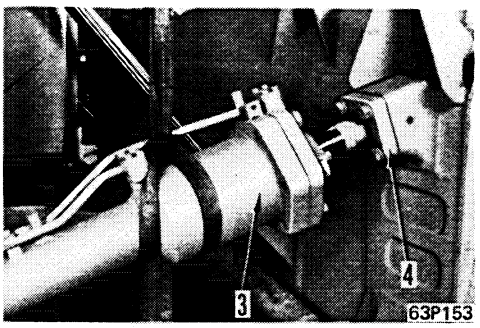
2. Hose

Connect hoses (5) and (6) to tubes.



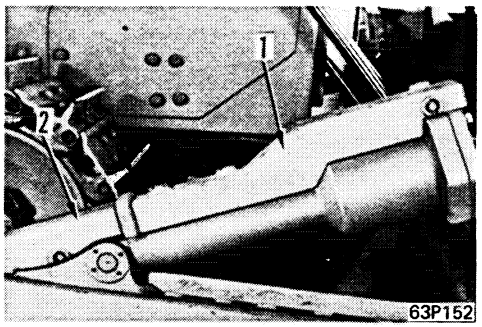
3. Piston rod mounting pin

Sling tilt cylinder assembly (3) with crane. Start engine and operate both crane and blade tilt control lever to align piston rod and blade joining pin holes. Install flange (4) with shims inserted between flange and blade.



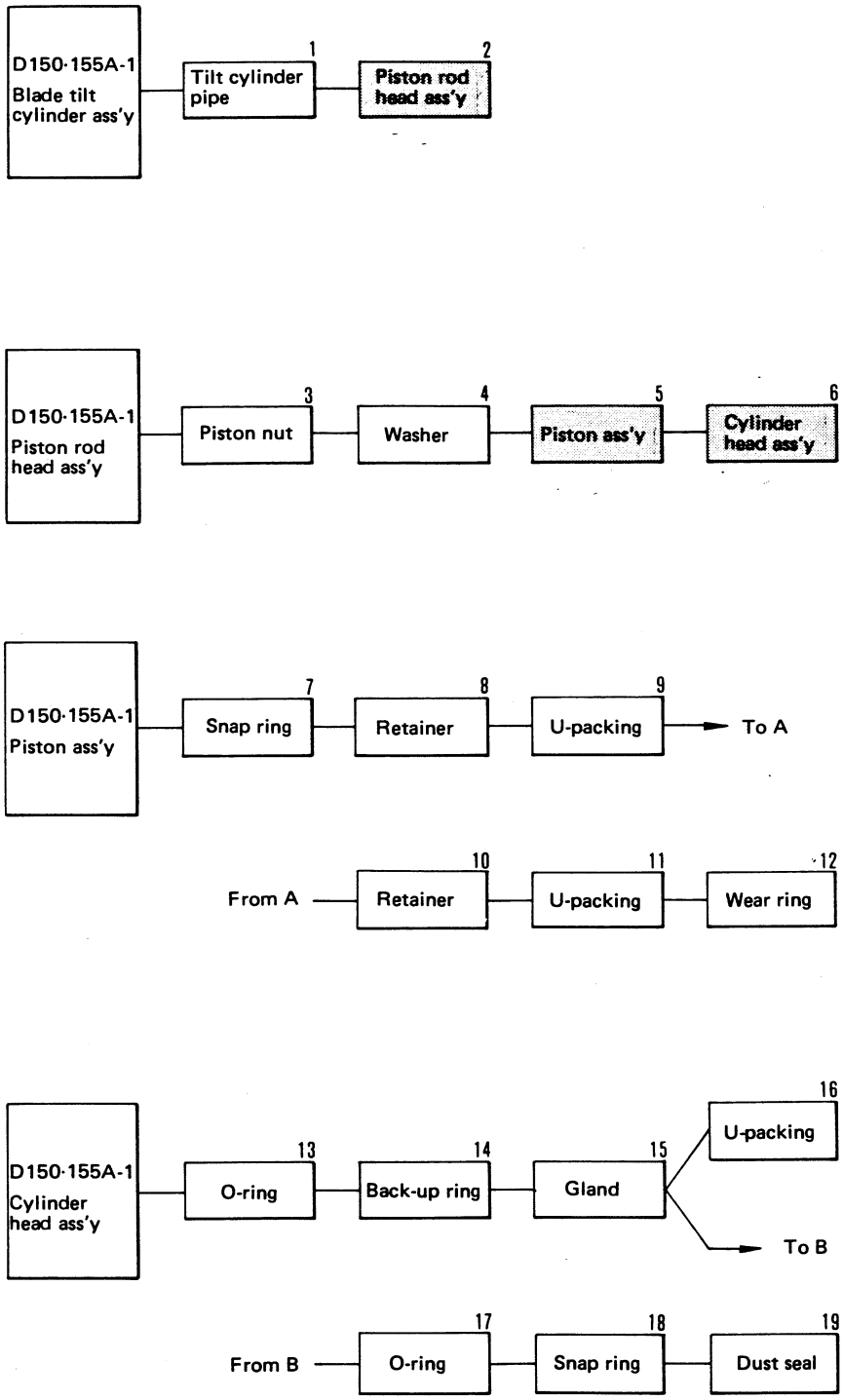
4. Piping cover

Install piping covers (1) and (2).



DISASSEMBLY OF BLADE TILT CYLINDER

DISASSEMBLY OF BLADE TILT CYLINDER



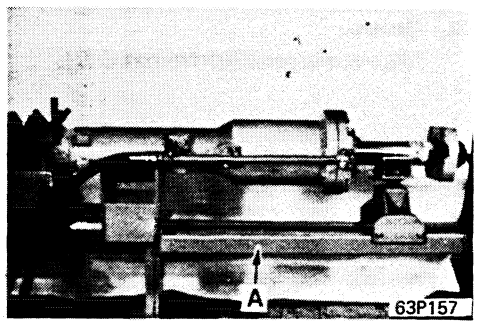
63F036

Special tools required

Special tools required		A	B
790-502-1000	Cylinder overhaul stand	1	
790-101-1101	Pump		1

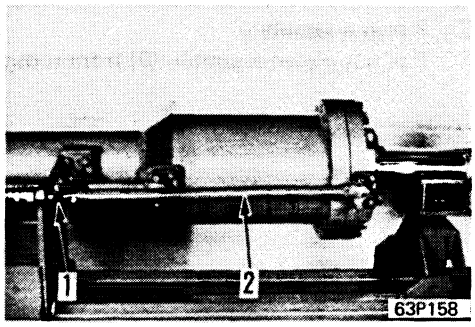
Preparatory work

After loosening cylinder head mounting bolts while tilt cylinder is on machine, set cylinder on cylinder overhaul stand A.



1. **Tilt cylinder pipe**

Remove clamp (1) and mounting bolt and disconnect cylinder head pipe (2).

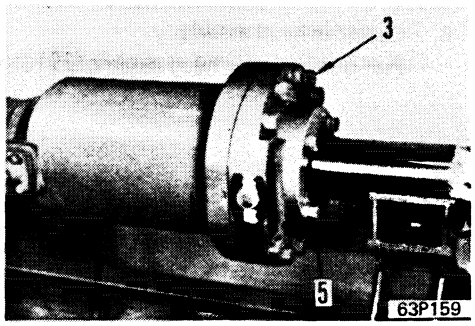


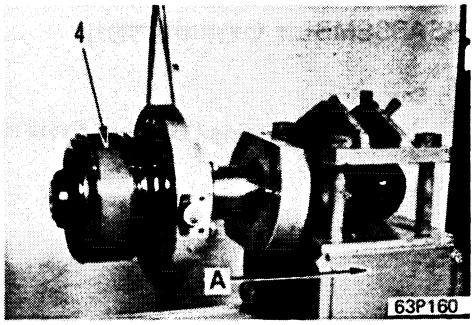
2. **Piston rod head assembly**

Remove cylinder head mounting bolts (3). Pull out piston rod and head assembly (4) and set it on cylinder overhaul stand A.

★ Remove assembly by pushing it with compressed air or by pulling it with wire rope. When using compressed air, leave two mounting bolts temporarily fitted and remove assembly gradually.

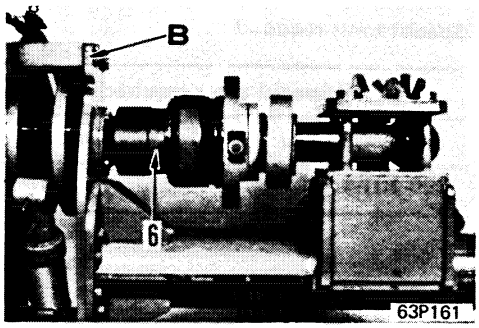
★ Prior to removal, loosen gland mounting bolts (5).



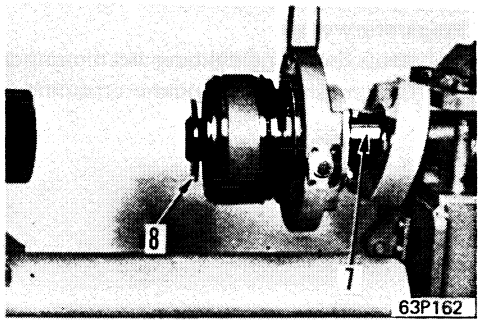


DISASSEMBLY OF PISTON ROD HEAD

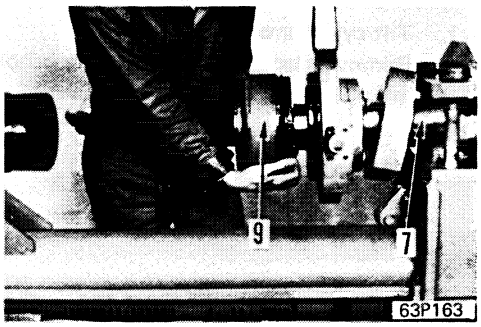
3. **Piston nut**
   Remove piston nut (6) with pump B.
   ★ Width across flats of piston nut: **95 mm**



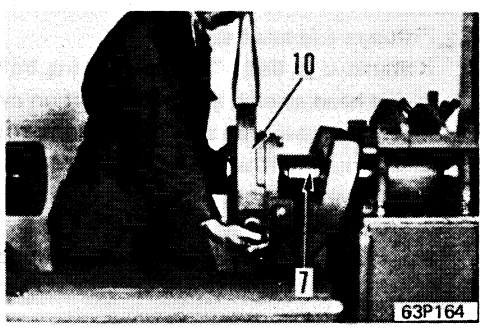
4. **Washer**
   Pull out washer (8) from rod (7).



5. **Piston assembly**
   Pull out piston assembly (9) from rod.

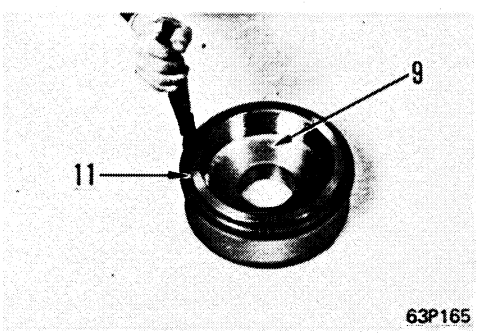


6. **Cylinder head assembly**
   Pull out cylinder head assembly (10) from rod.

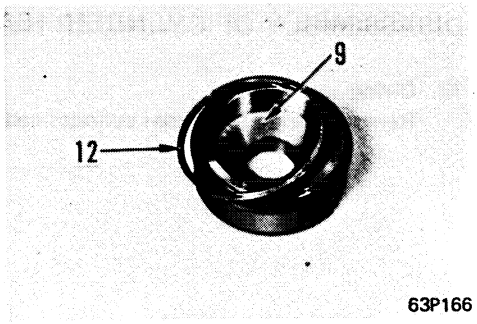


DISASSEMBLY OF PISTON

7. **Snap ring**
   Remove snap ring (11) from piston (9).

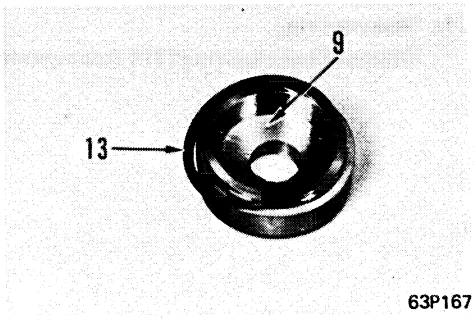


8. **Retainer**
   Remove retainer (12) from piston (9).



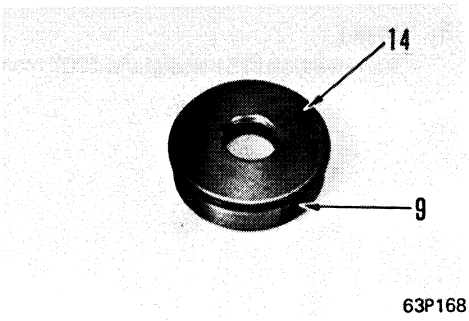
63P166

9. **U-packing**
   Remove U-packing (13) from piston (9).



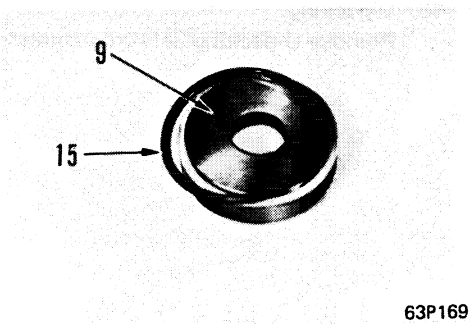
63P167

10. **Retainer**
    Remove retainer (14) from piston (9).



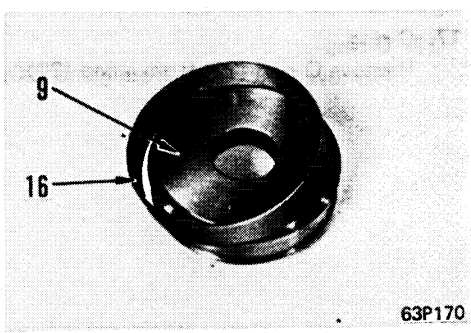
63P168

11. **U-packing**
    Remove U-packing (15) from piston (9).



63P169

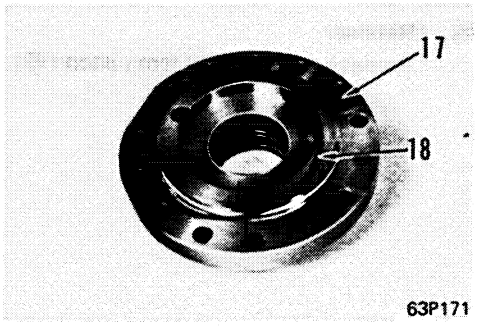
12. **Wear ring**
    Remove wear ring (16) from piston (9).



63P170

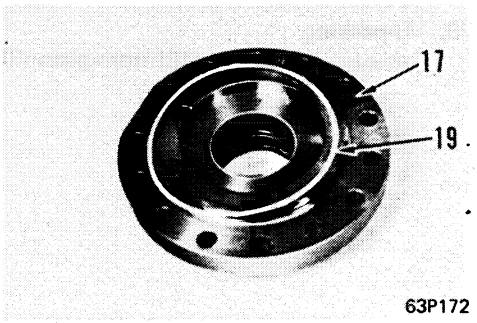
DISASSEMBLY OF CYLINDER HEAD

13. O-ring
Remove O-ring (18) from cylinder head (17).



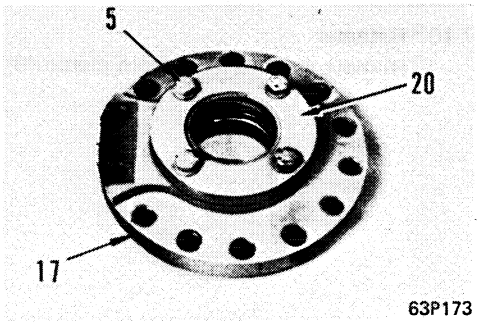
63P171

14. Back-up ring
Remove back-up ring (19) from cylinder head (17).



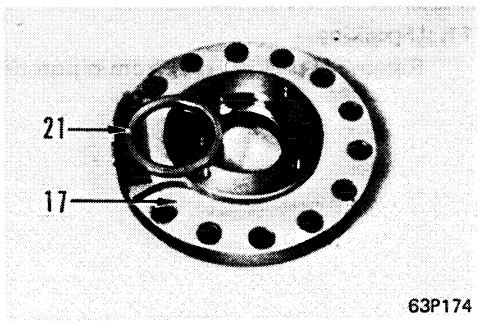
63P172

15. Gland
Remove bolts (5) and gland (20) from cylinder head (17).



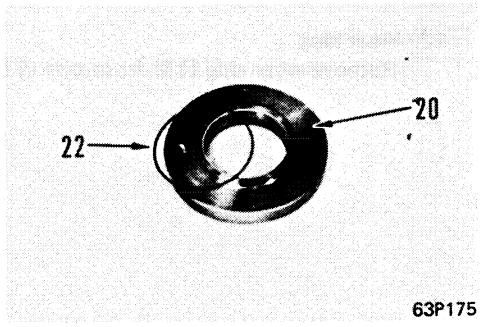
63P173

16. U-packing
Remove U-packing (21) from cylinder head (17).



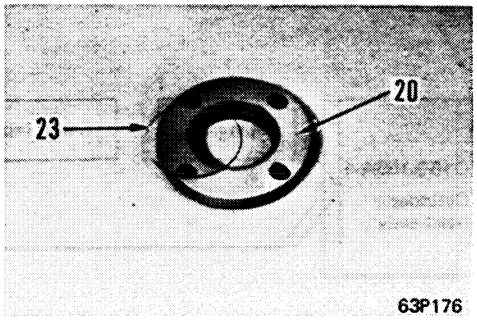
63P174

17. O-ring
Remove O-ring (22) from gland (20).

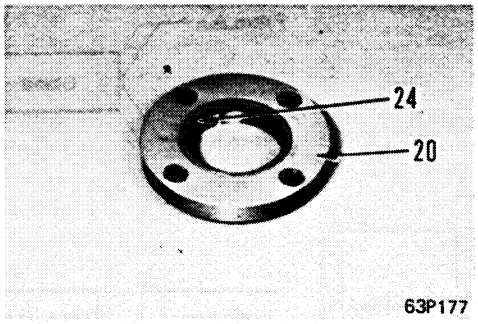


63P175

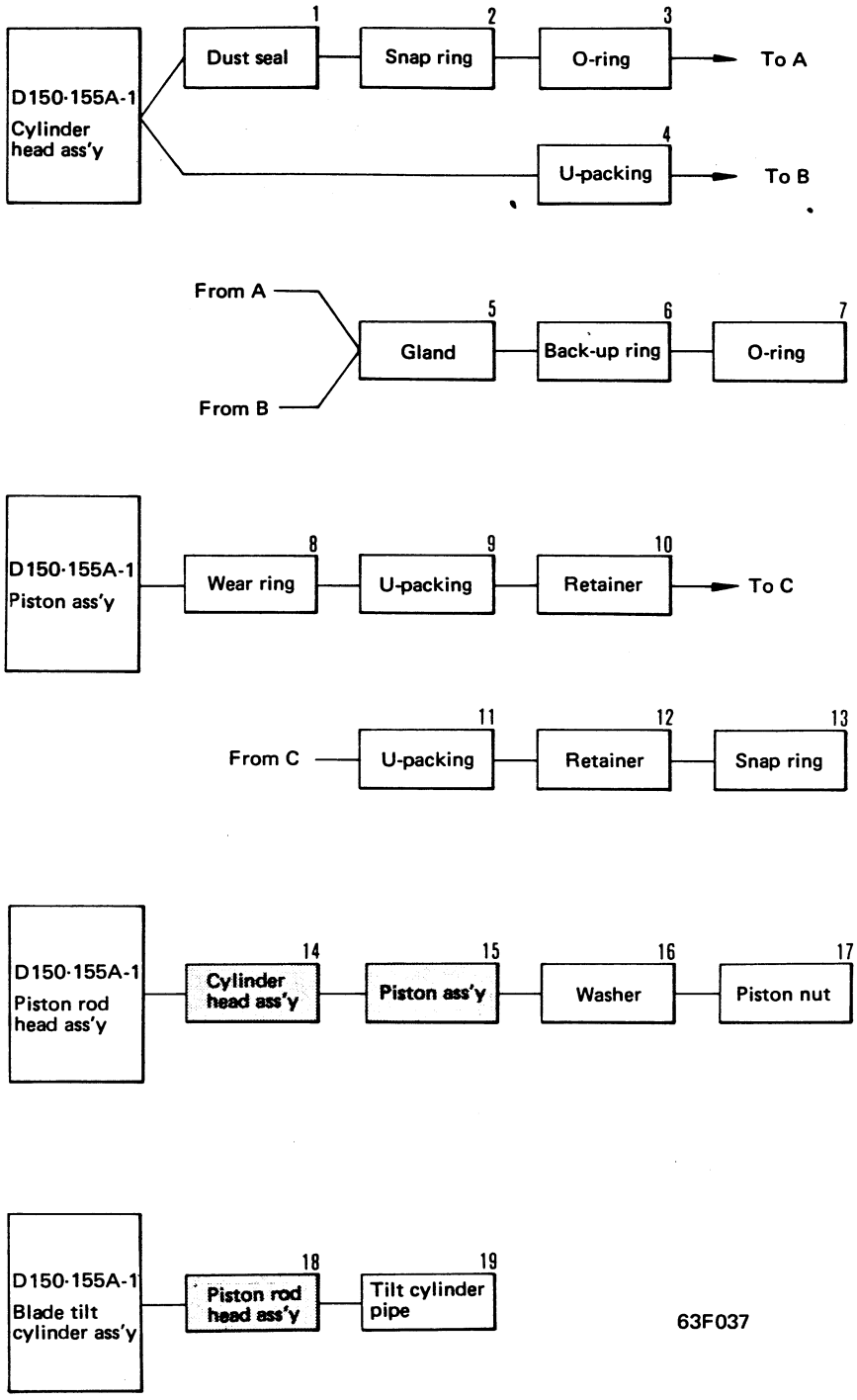
18. Snap ring
Remove snap ring (23) from galnd (20).



19. Dust seal
Remove dust seal (24) from gland (20).



ASSEMBLY OF BLADE TILT CYLINDER



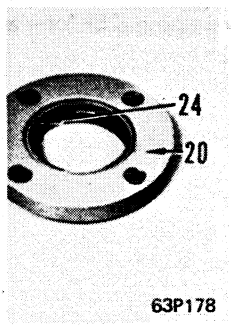
63F037

Special tools required

Special tools required		A	B	C
790-502-1000	Cylinder overhaul stand	1		
790-101-1101	Pump		1	
790-101-5201	Pushing tools kit			1

ASSEMBLY OF CYLINDER HEAD

1. **Dust seal**
   Press fit dust seal (24) onto gland (20) with pushing tool C.

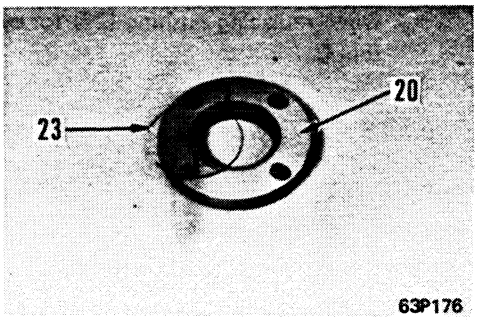


63P178



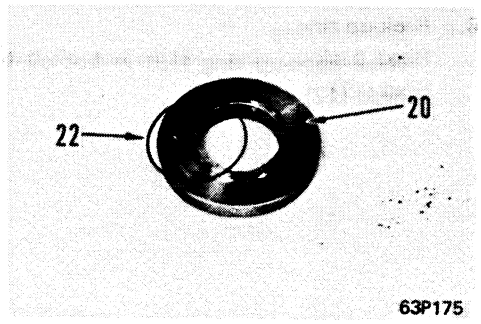
63P179

2. **Snap ring**
   Fit snap ring (23) on gland (20).



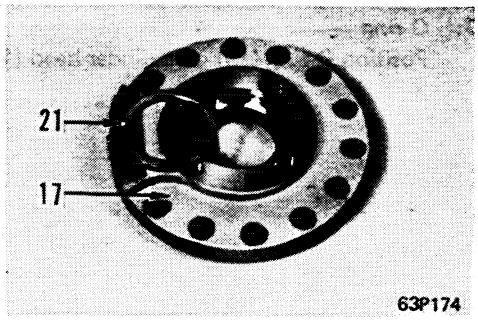
63P176

3. **O-ring**
   Position O-ring (22) on gland (20).



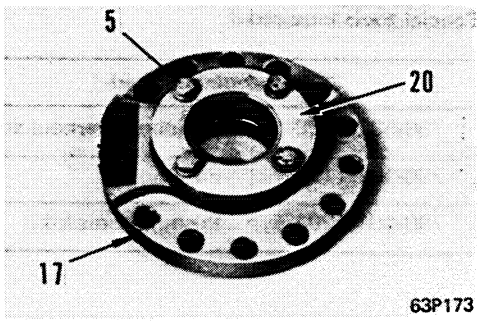
63P175

4. **U-packing**
   Fit U-packing (21) on cylinder head (17).

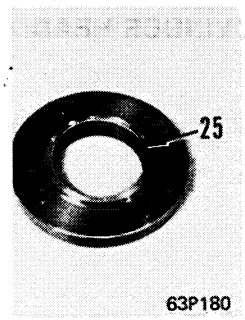


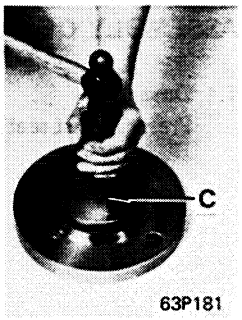
63P174

5. Gland
Secure gland (20) to cylinder head (17) with bolts (5).

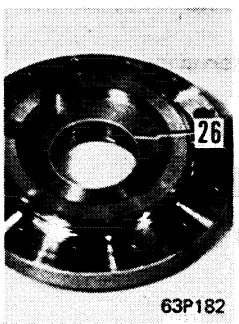


★ When replacing bushing (25) for gland, use pushing tool C.



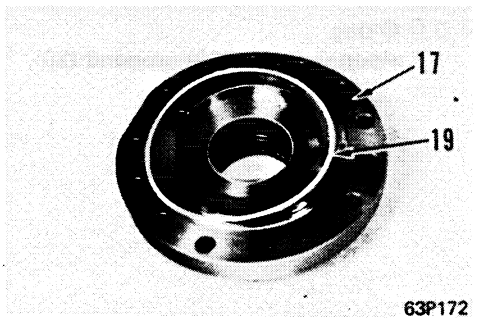


★ When replacing bushing (26) for cylinder head, use pushing tool C.

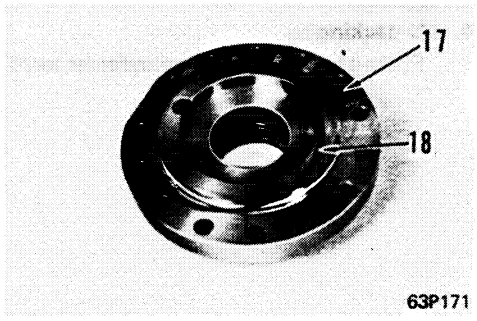




6. Back-up ring
Head back-up ring (19) in hot oil bath and fit it on cylinder head (17).

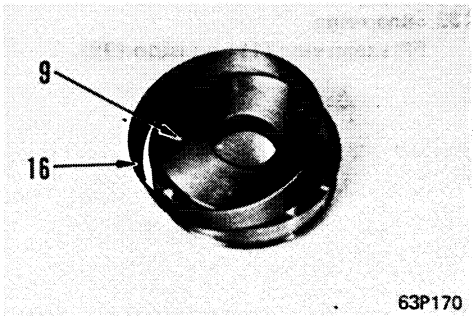


7. O-ring
Position O-ring (18) on cylinder head (17).

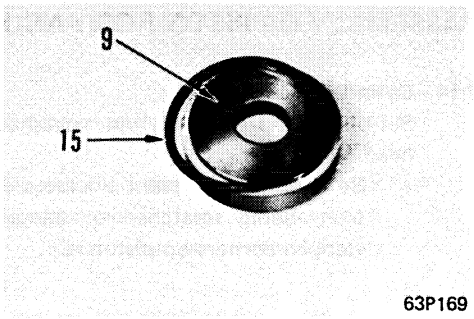


ASSEMBLY OF PISTON

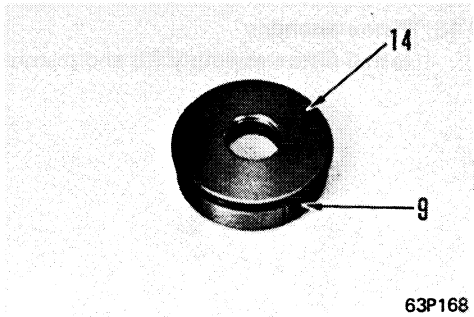
8. Wear ring
Install wear ring (16) on piston (9).



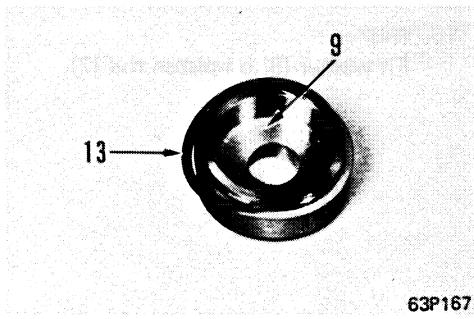
9. U-packing
Fit U-packing (15) on piston (9).



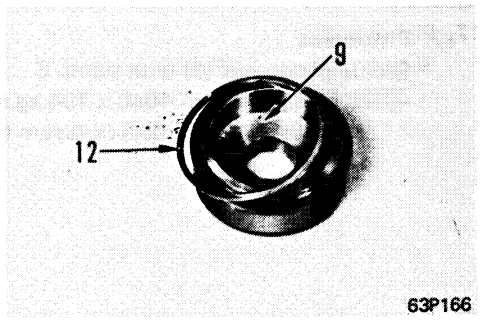
10. Retainer
Fit retainer (14) on piston (9).



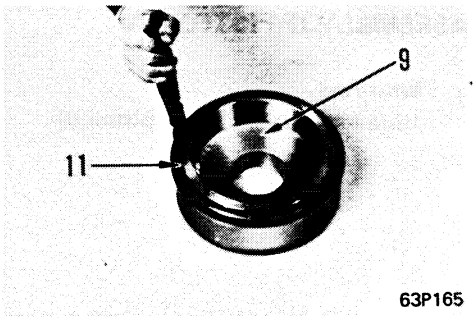
11. U-packing
Fit U-packing (13) on piston (9).



12. Retainer
Fit retainer (12) on piston (9).



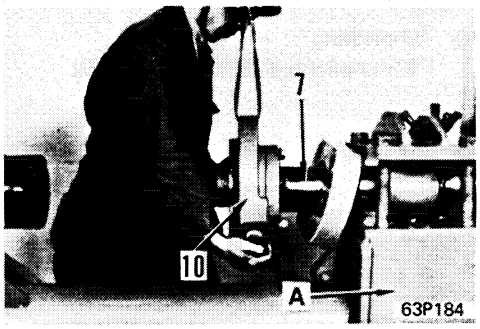
13. Snap ring
Fit snap ring (11) on piston (9).



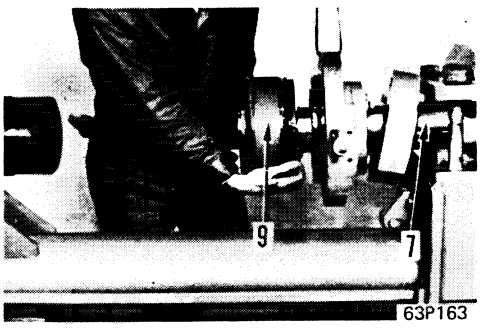
ASSEMBLY OF PISTON ROD AND HEAD

14. Cylinder head assembly
Set piston rod (7) on cylinder overhaul stand A. Install cylinder head (10).

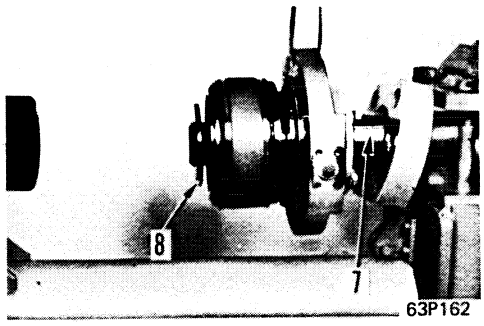
★ Be careful to prevent lip faces of dust seal and U-packing from being scratched or damaged by screw threads or stepped corners on piston rod.



15. Piston assembly
Install piston assembly (9) and piston rod.

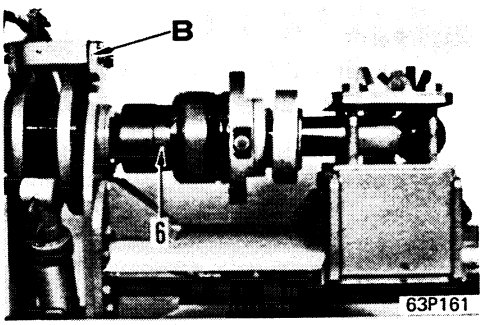


16. Washer
Fit washer (8) on piston rod (7).



17. Piston nut
Secure piston nut (6) with pump B.

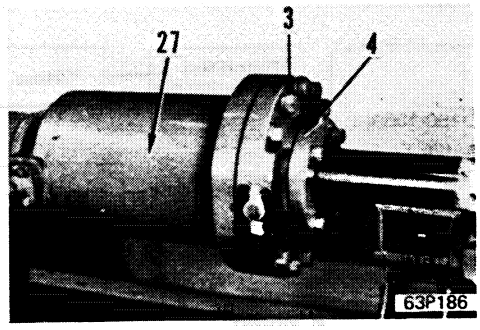
kgm Piston nut: **1040 ± 104 kg.m**
Width across flats of piston nut: **95 mm**



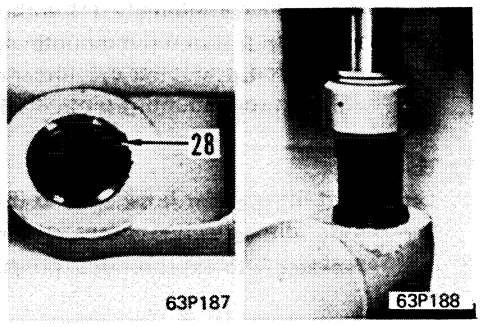
18. Piston rod head assembly

Insert piston rod head assembly (4) in cylinder body (27) and temporarily secure with mounting bolts (3). After mounting blade tilt cylinder on machine, securely tighten bolts.

kgm Cylinder head mounting bolts: **145 ~ 195 kg.m**

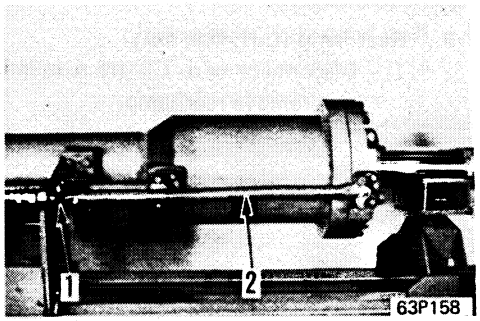


★ When replacing bushing (28) for cylinder body, press fit new bushing with pushing tool and press.

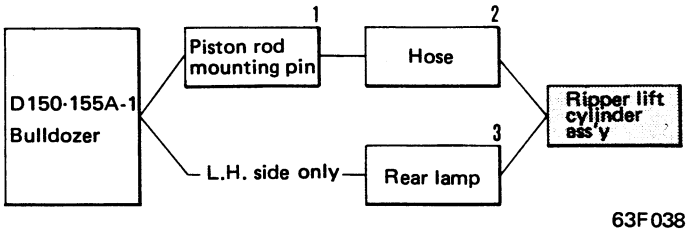


19. Tilt cylinder pipe

Install tilt cylinder tube (2) with bolts; install clamp (1).



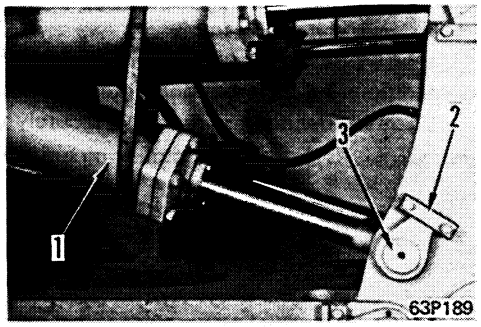
DISMOUNTING RIPPER LIFT CYLINDER



1. Piston rod mounting pin

Sling lift cylinder assembly (1) with crane. Remove lock plate (2) and pull out piston rod mounting pin (3). Start engine, fully retract piston rod, and lower cylinder on arm.

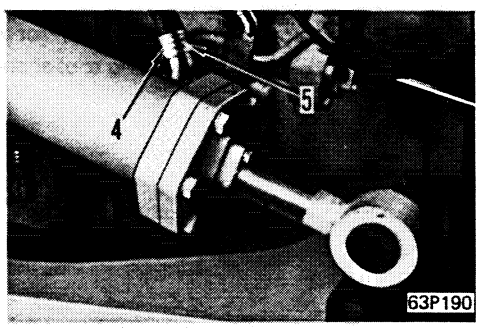
kg Piston rod mounting pin: **25 kg**



2. Hose

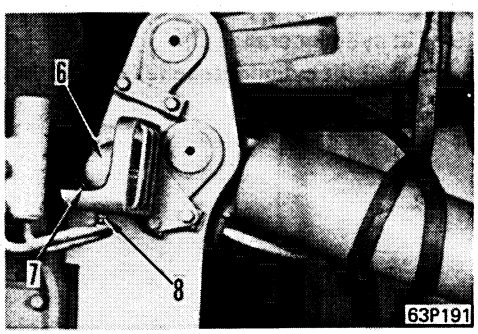
Disconnect lift cylinder hoses (4) and (5) from cylinder.

★ Before disconnecting hoses, move ripper control lever repeatedly to expel residual pressure from cylinder.

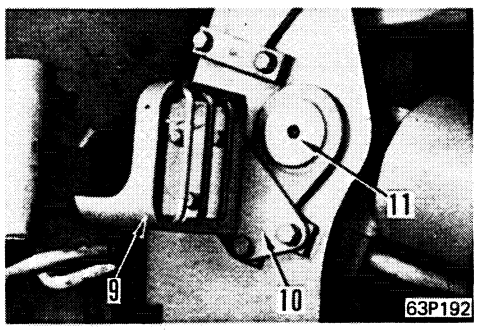


3. Rear lamp (L.H. side only)

1) Disconnect wire (7) from rear lamp (6). Remove nut (8) and remove rear lamp.



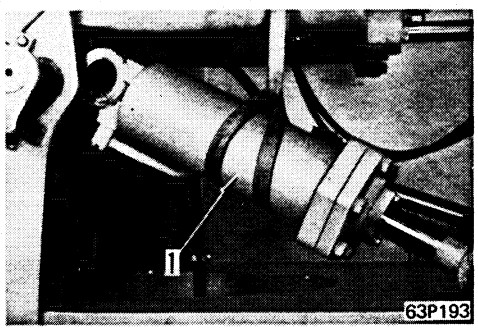
2) Remove rear lamp guard (9).



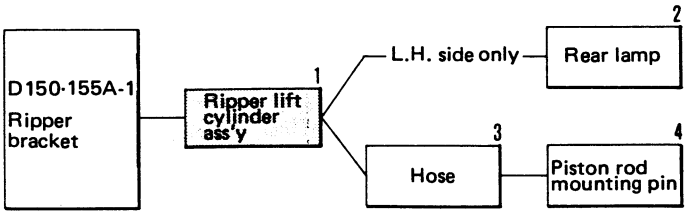
4. Ripper lift cylinder assembly

Sling cylinder assembly (1) with crane. Remove lock plate (10) and pull out cylinder bottom mounting pin (11). Lift off ripper lift cylinder assembly.

kg Lift cylinder bottom mounting pin: **30 kg**
Lift cylinder assembly: **310 kg**



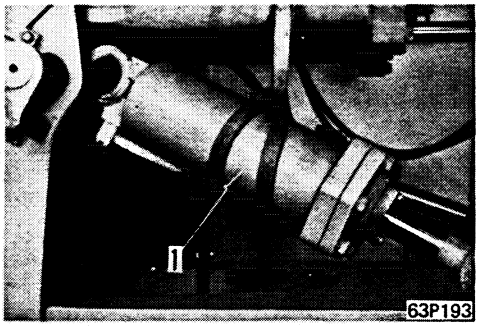
MOUNTING RIPPER LIFT CYLINDER

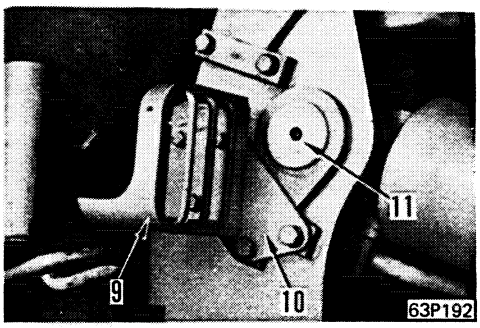


63F039

1. Ripper lift cylinder assembly

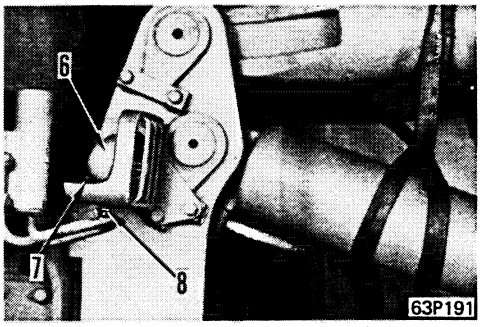
1) Lift cylinder assembly (1) into position.
2) Fit cylinder assembly (1) to bracket with bottom side mounting pin (11) and lock with lock plate (10). Lower cylinder assembly onto arm.
   ★ Coat the circumference of pin with grease (G2-LI).





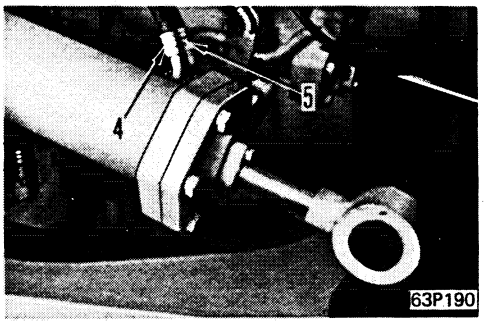
2. Rear lamp (L.H. side only)

1) Install rear lamp guard (9).
2) Install rear lamp (6) with nut (8) and connect wire (7) to rear lamp.



3. Hose

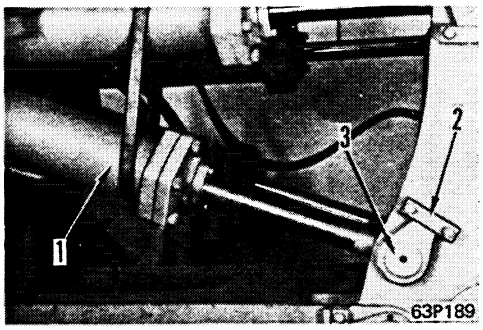
Connect hoses (4) and (5), with O-ring in each flange face, to cylinder.



4. Piston rod mounting pin

Sling lift cylinder assembly (1). Start engine and operate both ripper lifting control lever and crane to align piston rod pin hole with beam pin hole. Put pin (3) into holes and lock with lock plate (2).

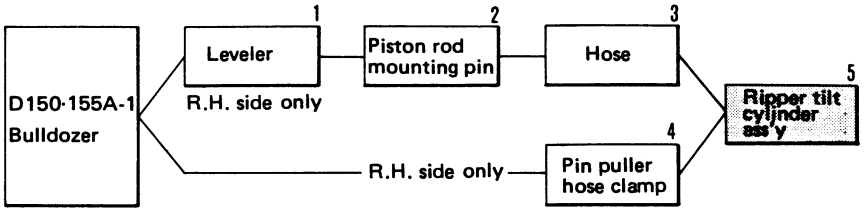
★ **Coat the circumference of pin with grease (G2-LI).**



DISMOUNTING RIPPER TILT CYLINDER

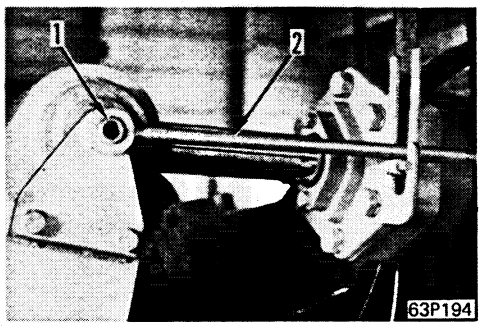


DISMOUNTING RIPPER TILT CYLINDER



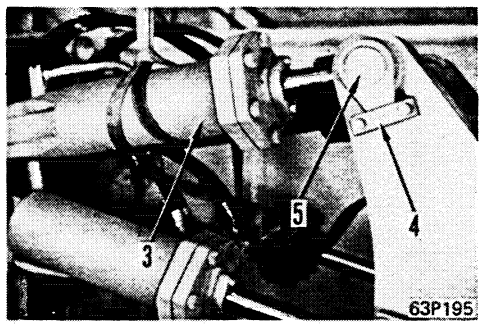
63F040

1. **Leveler (R.H. side only)**
   Remove snap ring (1) and remove leveler (2).

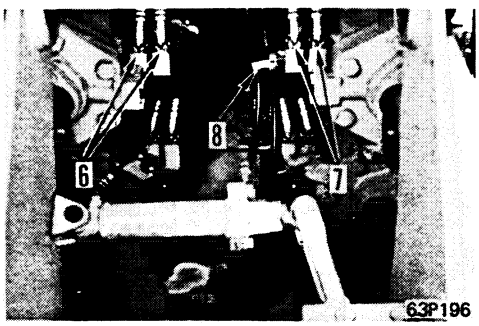


2. **Piston rod mounting pin**
   Sling tilt cylinder assembly (3) with crane. Remove lock plate (4) and pull out piston rod mounting pin (5). Start engine, retract piston rod fully, and lower cylinder assembly onto lift cylinder.
   kg Piston rod mounting pin: **25 kg**

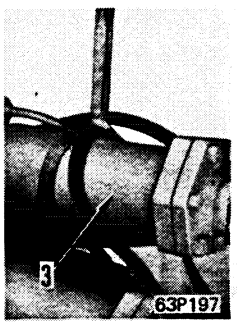
3. **Hose**
   Disconnect tilt cylinder hoses (6) and (7) from cylinder.
   ★ As tilt cylinder is connected to hydraulic circuit through selector valve which connects hydraulic circuit normally to lift cylinder, oil pressure remaining in tilt cylinder cannot be expelled by moving ripper control lever repeatedly after engine is stopped. Oil under pressure, therefore will spurt out when hoses are disconnected from cylinder. It will be effective for decreasing residual pressure to protrude piston rod a little after rod is once retracted fully and before engine is stopped.

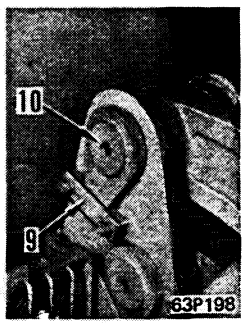


4. **Pin puller hose clamp (R.H. side only)**
   Remove pin puller hose clamp (8).

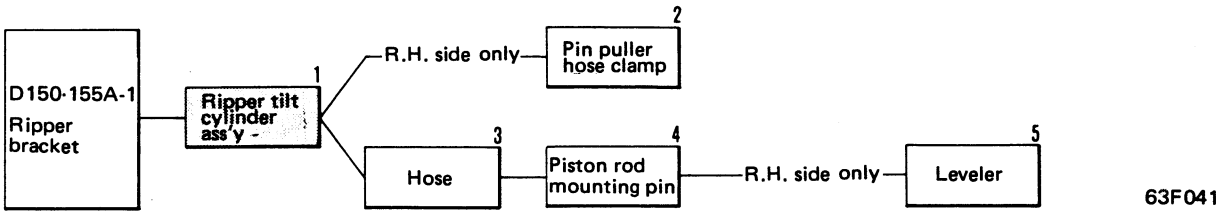


5. **Ripper tilt cylinder assembly**
   Sling tilt cylinder assembly (3) with crane. Remove lock plate (9) and pull out cylinder bottom mounting pin (10). Lift off cylinder assembly.
   kg Tilt cylinder bottom mounting pin: **30 kg**
   Tilt cylinder assembly: **310 kg**

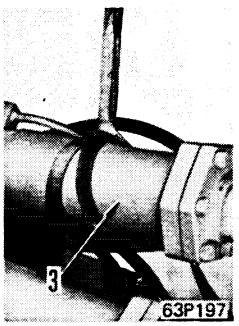


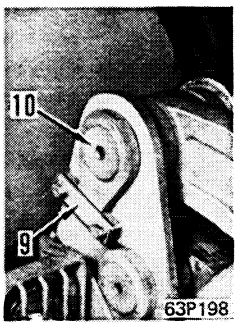


MOUNTING RIPPER TILT CYLINDER



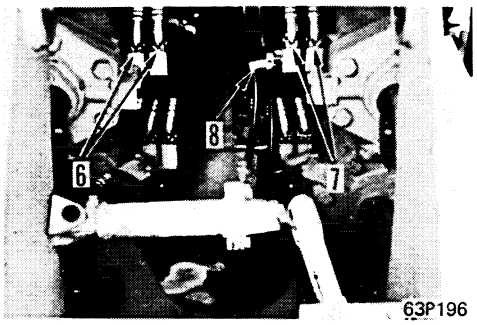
1. **Ripper tilt cylinder assembly**
   1) Lift tilt cylinder assembly (3) into position.
   2) Fit cylinder assembly (3) to bracket with cylinder bottom side mounting pin (10) and lock with lock plate (9). Lower cylinder assembly onto lift cylinder.
      ★ Coat the circumference of pin with grease (G2-LI).



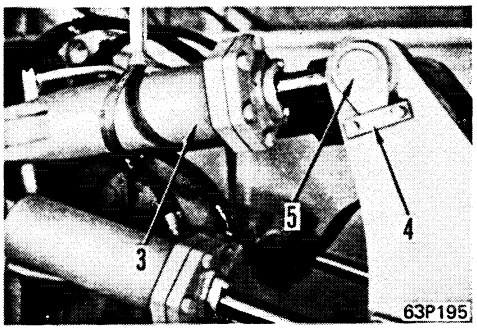


2. **Pin puller hose clamp (R.H. side only)**
   Install pin puller hose clamp (8).

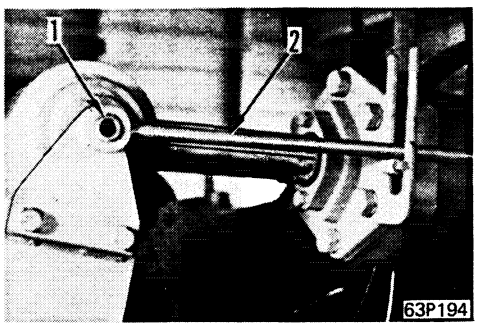
3. **Hose**
   Connect tilt cylinder hoses (6) and (7), with O-ring in each flange face, to tilt cylinder.



4. **Piston rod mounting pin**
   Sling cylinder assembly (3) with crane. Start engine and operate both ripper tilt control lever and crane to align piston rod pin hole with beam pin hole. Put pin (5) into holes and lock it with lock plate (4).
   ★ Coat the circumference of pin with grease (G2-LI).

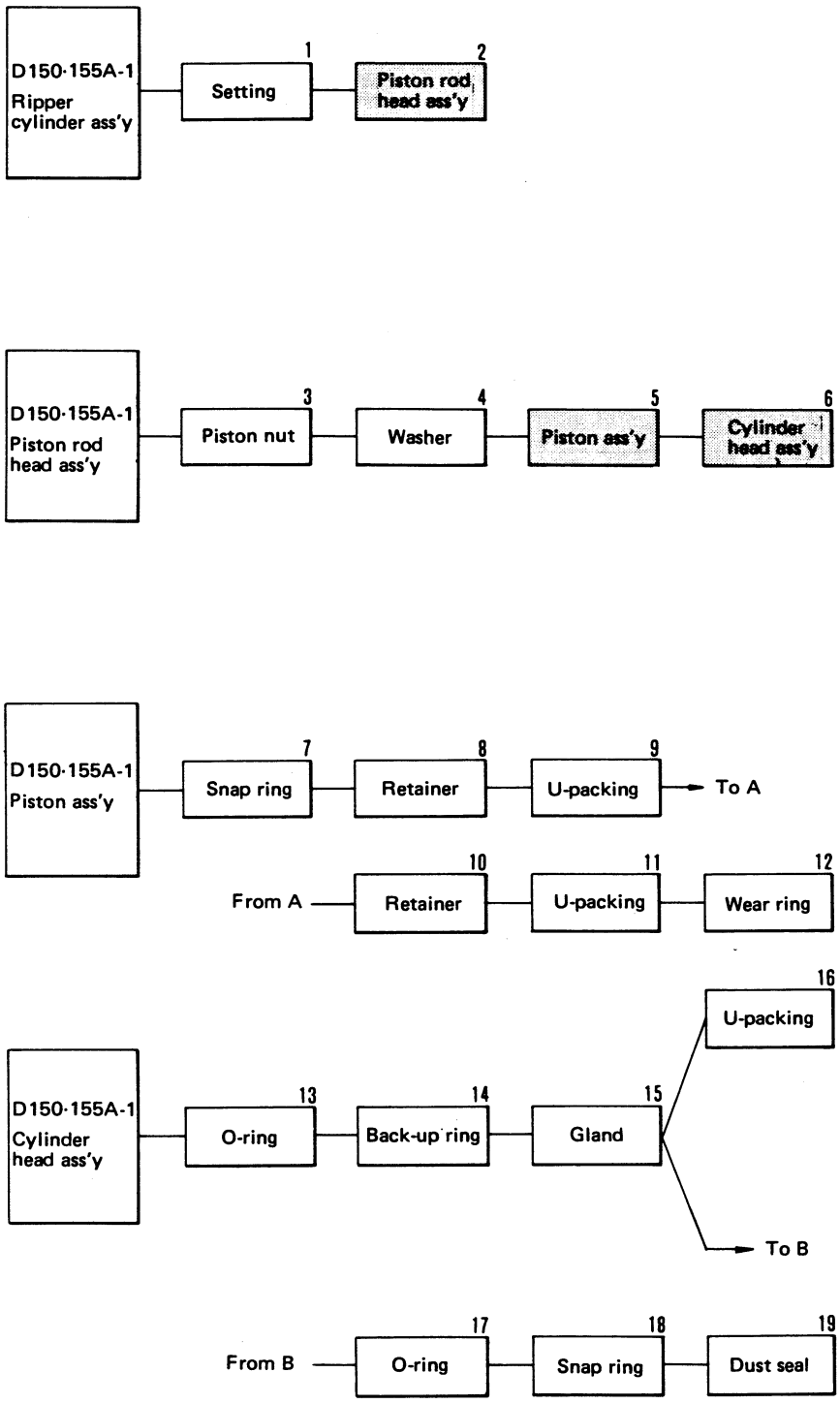


5. **Leveler (R.H. side only)**
   Install leveler (2) and lock it with snap ring (1).



DISASSEMBLY OF RIPPER CYLINDER

DISASSEMBLY OF RIPPER CYLINDER



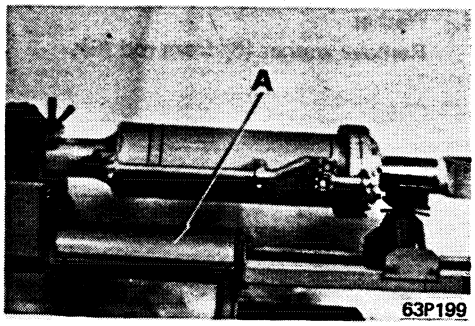
63F042

Special tools required

Special tools required		A	B
790-502-1000	Cylinder overhaul stand	1	
790-101-5201	Pump		1

1. Setting

After loosening cylinder head mounting bolts (1) while ripper cylinder is on machine, set cylinder on cylinder overhaul stand A.

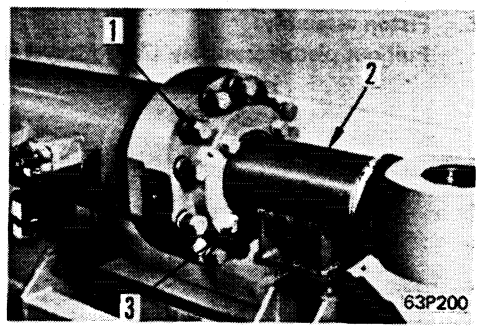


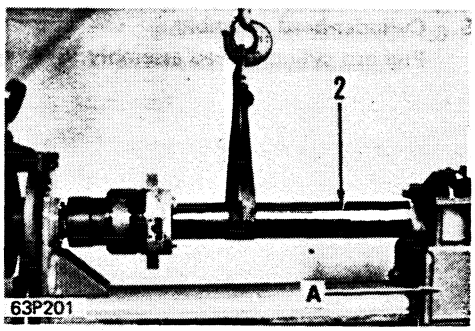
2. Piston rod head assembly

Remove cylinder head mounting bolts (1), pull out piston rod head assembly (2), and set it on cylinder overhaul stand A.

★ Remove assembly by pushing it with compressed air or by pulling it with wire rope. When using compressed air, leave two mounting bolts temporarily fitted and remove assembly gradually.

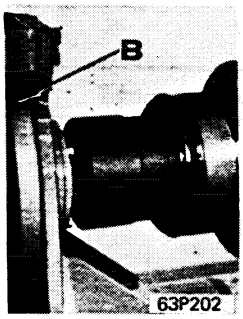
★ Prior to removal, loosen gland mounting bolts (3).



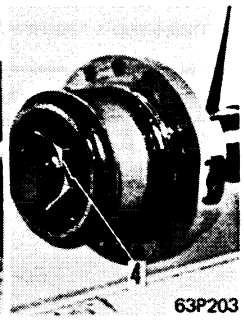


DISASSEMBLY OF PISTON ROD AND HEAD

3. **Piston nut**
   Remove piston nut (4) with pump B.
   ★ Width across flats of piston nut: **95 mm**

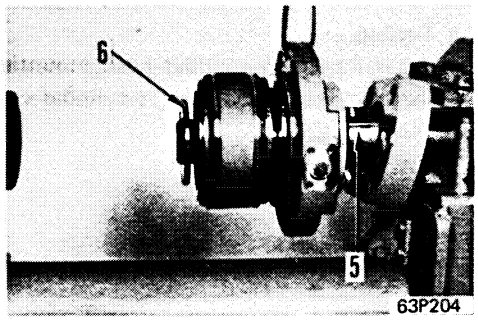


63P202



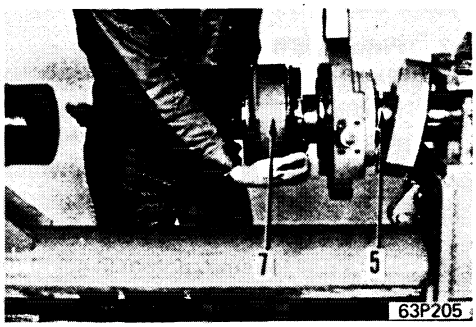
63P203

4. **Washer**
   Remove washer (6) from rod (5).



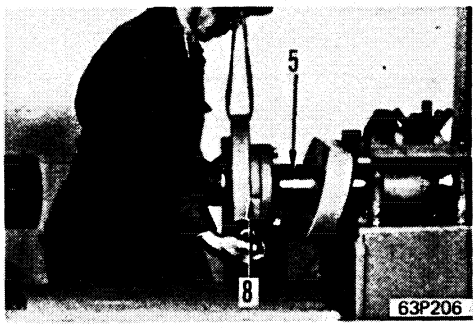
63P204

5. **Piston assembly**
   Pull out piston assembly (7) from rod (5).



63P205

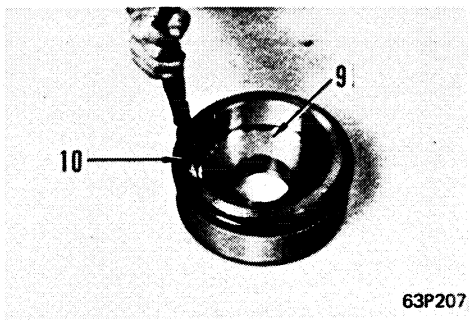
6. **Cylinder head assembly**
   Pull out cylinder head assembly (8) from rod (5).



63P206

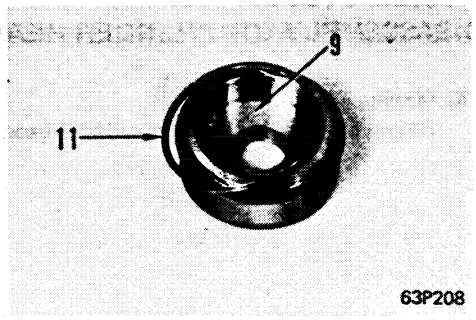
DISASSEMBLY OF PISTON

7. **Snap ring**
   Remove snap ring (10) from piston (9).

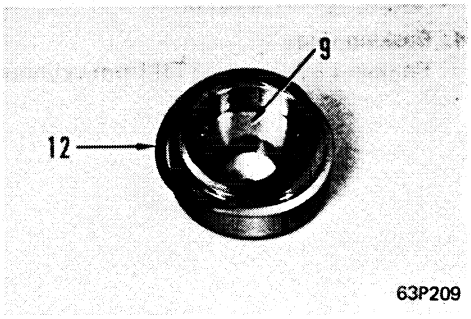


63P207

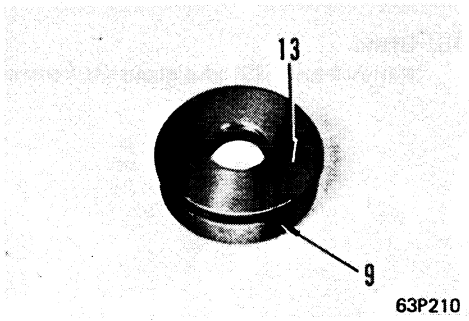
8. **Retainer**
   Remove retainer (11) from piston (9).



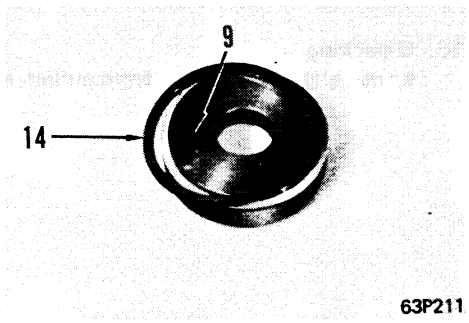
9. **U-packing**
   Remove U-packing (12) from piston (9).



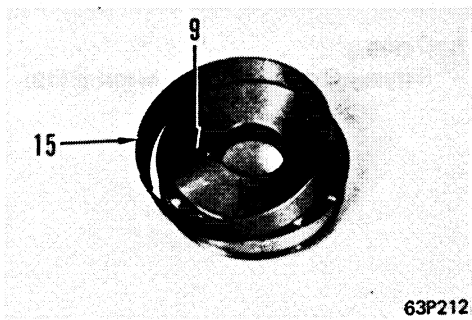
10. **Retainer**
    Remove retainer (13) from piston (9).



11. **U-packing**
    Remove U-packing (14) from piston (9).

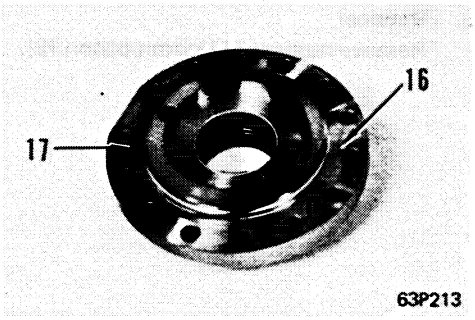


12. **Wear ring**
    Remove wear ring (15) from piston (9).

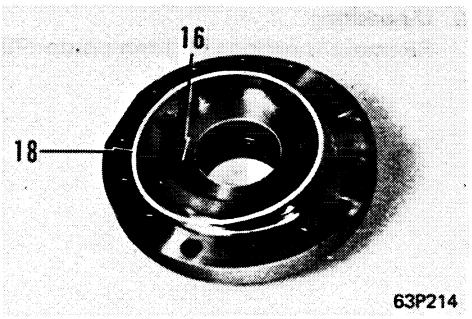


DISASSEMBLY OF CYLINDER HEAD

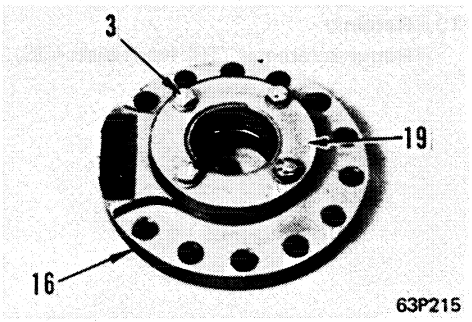
13. O-ring
Remove O-ring (17) from cylinder head (16).



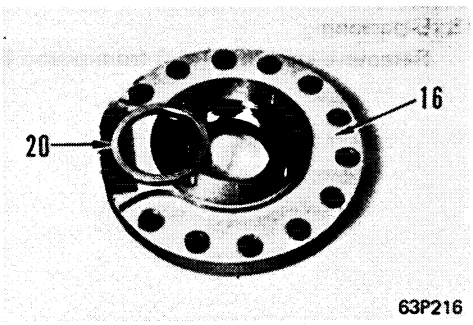
14. Back-up ring
Remove back-up ring (18) from cylinder head (16).



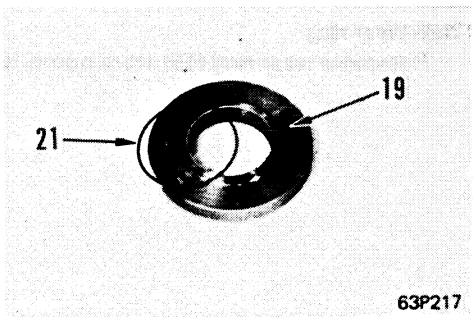
15. Gland
Remove bolts (3) and gland (19) from cylinder head (16).



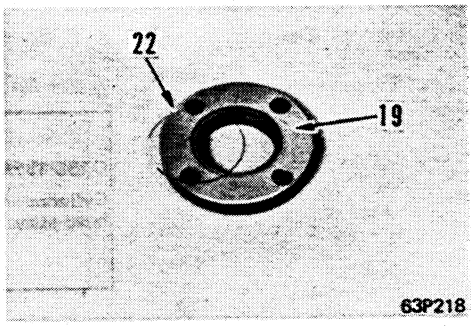
16. U-packing
Remove U-packing (20) from cylinder head (16).



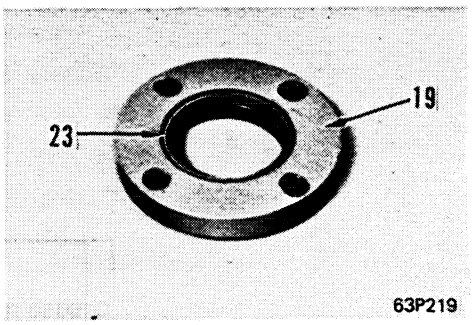
17. O-ring
Remove O-ring (21) from gland (19).



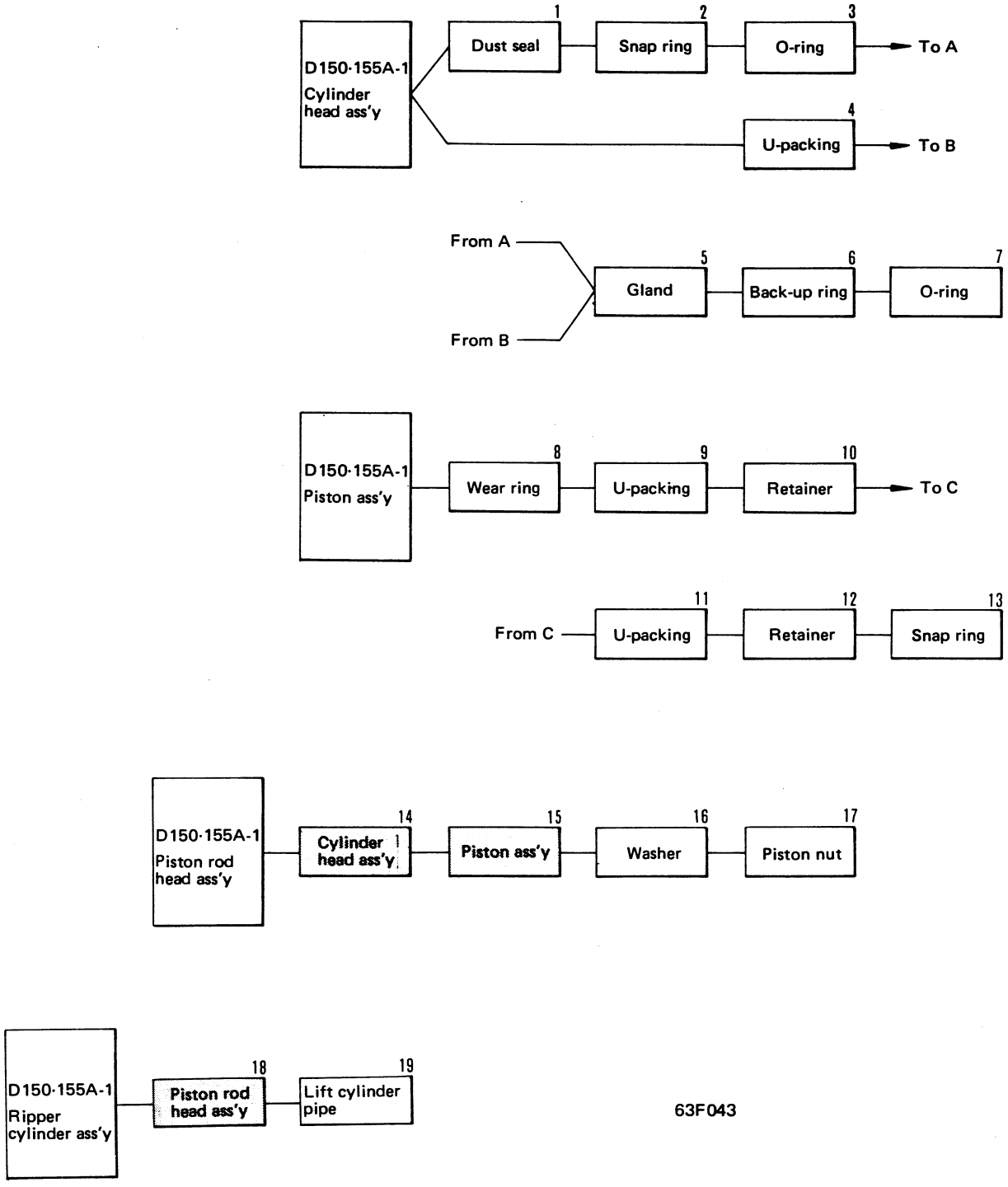
18. Snap ring
Remove snap ring (22) from gland (19).



19. Dust seal
Remove dust seal (23) from gland (19).



ASSEMBLY OF RIPPER CYLINDER



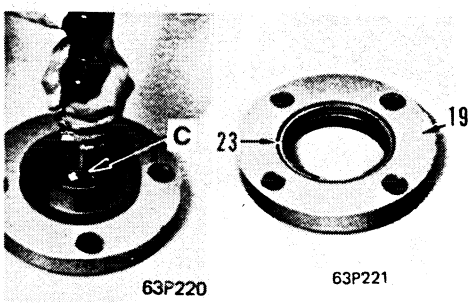
63F043

Special tools required

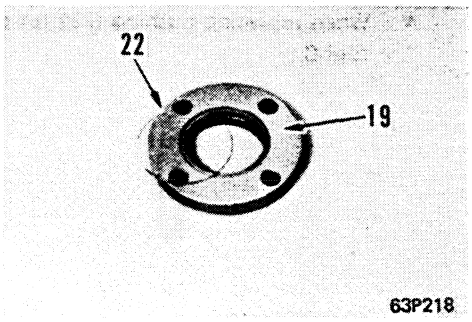
Special tools required		A	B	C
790-502-1000	Cylinder overhaul stand	1		
790-101-1101	Pump		1	
790-101-5201	Pushing tools kit			1

ASSEMBLY OF CYLINDER HEAD ASSEMBLY

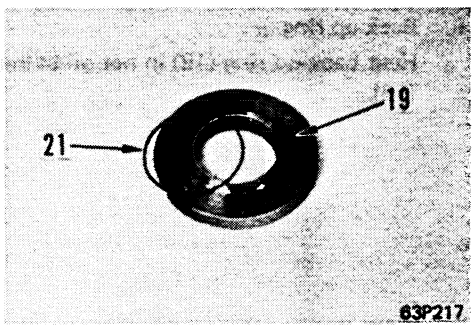
1. **Dust seal**
   Press-fit dust seal (23) into gland (19) with pushing tool C.



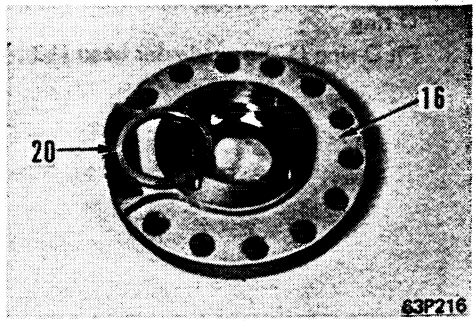
2. **Snap ring**
   Fit snap ring (22) on gland (19).



3. **O-ring**
   Fit O-ring (21) on gland (19).

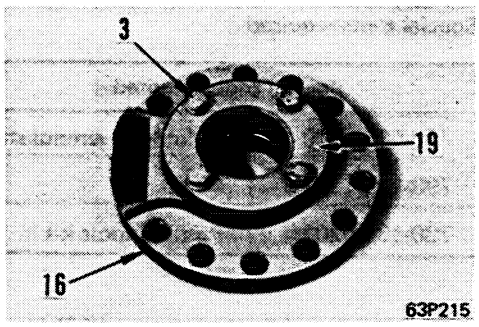


4. **U-packing**
   Fit U-packing (20) on cylinder head (16).

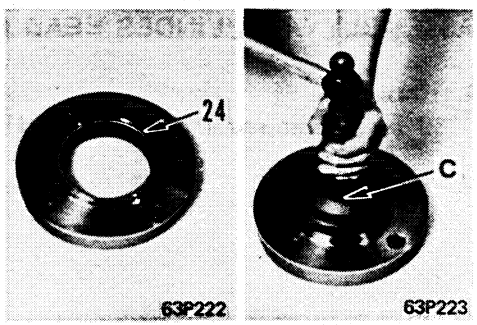


5. Gland

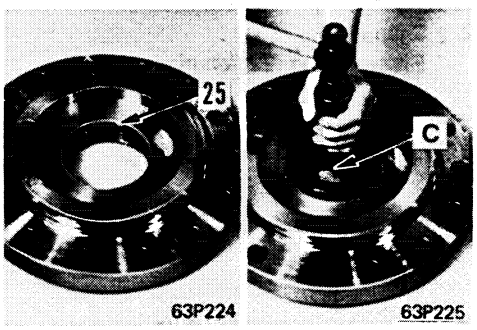
Secure gland (19) to cylinder head (16) with bolts (3).



★ When replacing bushing (24) for gland, use pushing tool C.

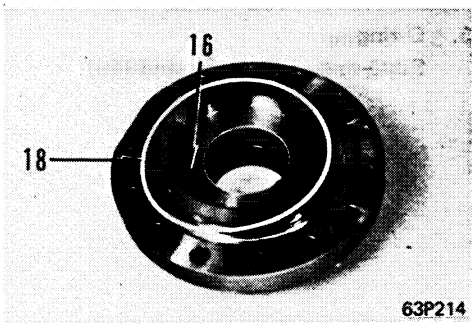


★ When replacing bushing (25) for cylinder head, use pushing tool C.



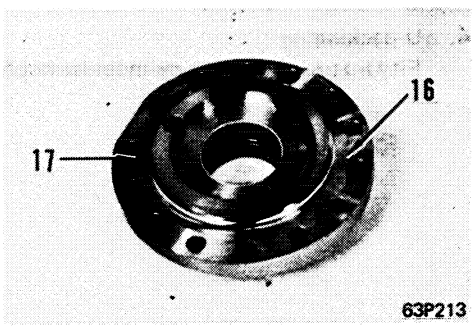
6. Back-up ring

Heat back-up ring (18) in hot oil bath and fit it to cylinder head (16).



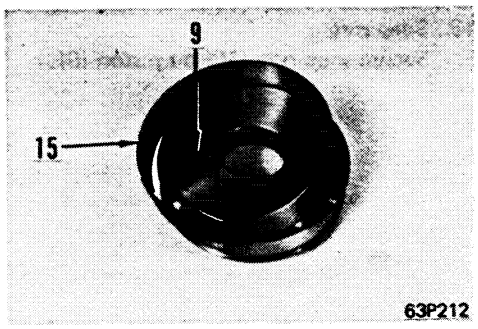
7. O-ring

Fit O-ring (17) on cylinder head (16).

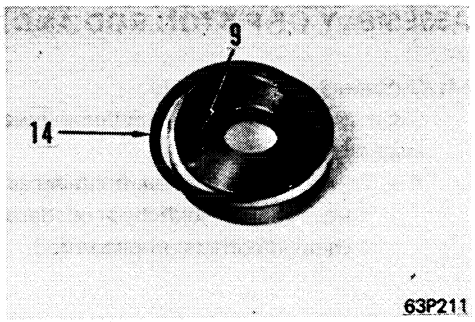


ASSEMBLY OF PISTON

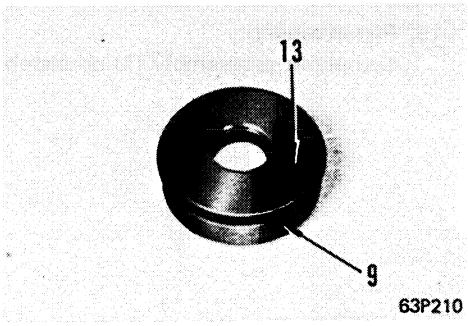
8. Wear ring
Fit wear ring (15) on piston (9).



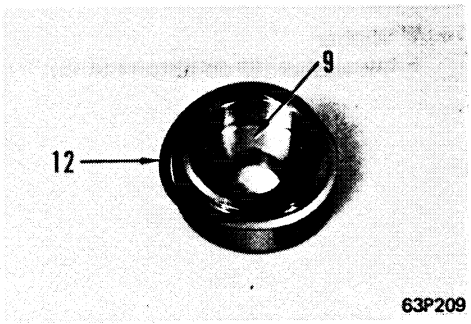
9. U-packing
Fit U-packing (14) on piston (9).



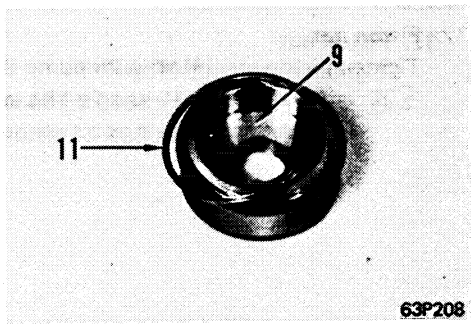
10. Retainer
Install retainer (13) on piston (9).



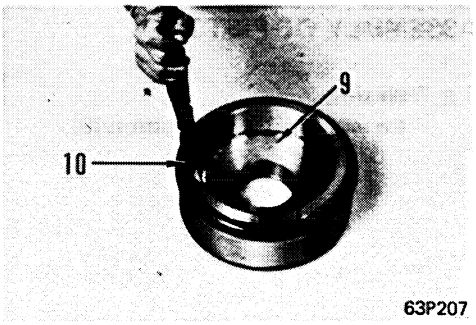
11. U-packing
Fit U-packing (12) on piston (9).



12. Retainer
Fit retainer (11) on piston (9).



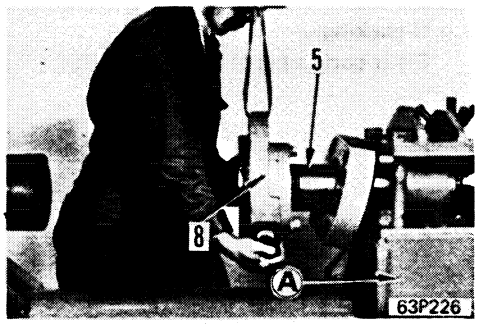
13. Snap ring
Secure snap ring (10) on piston (9).



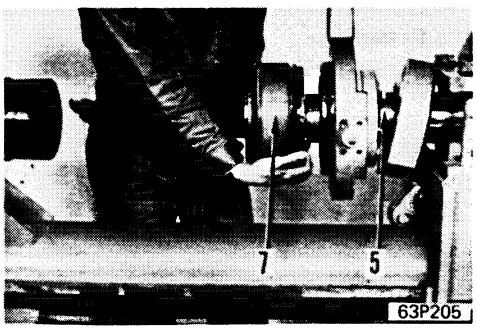
ASSEMBLY OF PISTON ROD AND HEAD ASSEMBLY

14. Cylinder head assembly
Set piston rod (5) on cylinder overhaul stand A. Install head assembly (8).

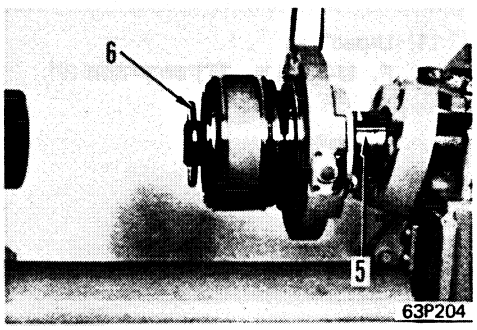
★ Be careful to prevent lip faces of dust seal and U-packing from being scratched or damaged by screw threads or stepped corners on piston rod.



15. Piston assembly
Install piston assembly (7) on piston rod (5).

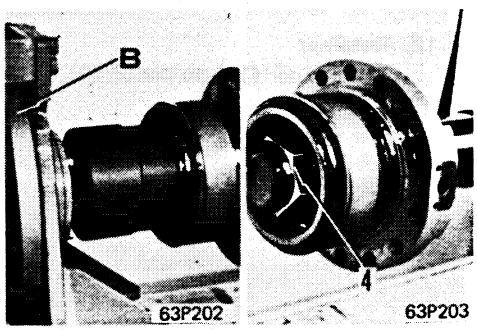


16. Washer
Fit washer (6) on piston rod (5).



17. Piston nut
Tighten piston nut (4) with pump B.

kgm Piston nut: **1040 ± 104 kg.m**
Width across flats of piston nut: **95 mm**

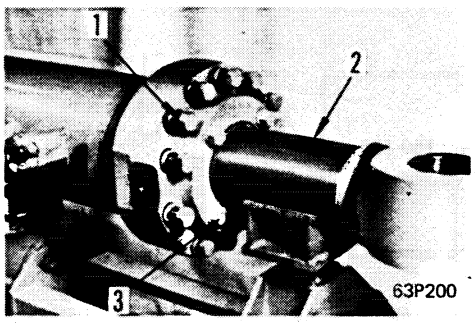


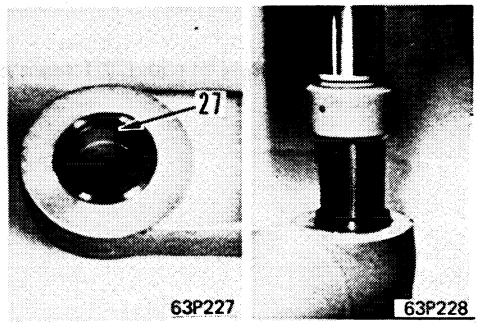
18. Piston rod and head assembly

Insert piston rod and head assembly (2) in cylinder body and temporarily secure with mounting bolts (1). After mounting ripper cylinder on machine, securely tighten bolts.

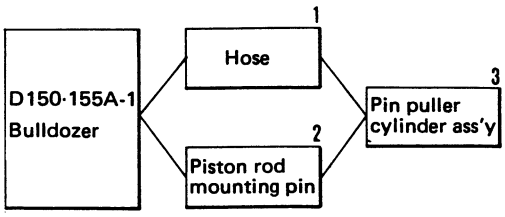
kgm Cylinder head mounting bolt: **155 ~ 195 kg.m**

★ When replacing bushing (26) for cylinder body, press fit new bushing with pushing tool and press.



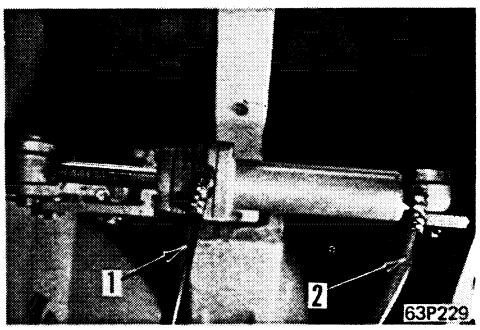


DISMOUNTING RIPPER PIN PULLER CYLINDER



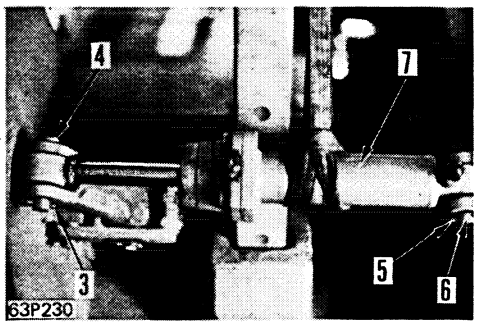
63F044

1. **Hose**
   Disconnect hoses (1) and (2) from cylinder head and bottom, respectively.



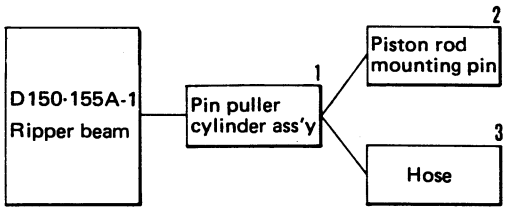
2. **Piston rod mounting pin**
   Remove cotter pin (3) fastening piston rod mounting pin (4); remove pin.

3. **Pin puller cylinder assembly**
   Remove cotter pin (5) fastening cylinder bottom mounting pin (6); remove pin. Remove pin puller cylinder assembly (7).
   kg Pin puller cylinder assembly: **20 kg**



MOUNTING RIPPER PIN PULLER CYLINDER

MOUNTING RIPPER PIN PULLER CYLINDER

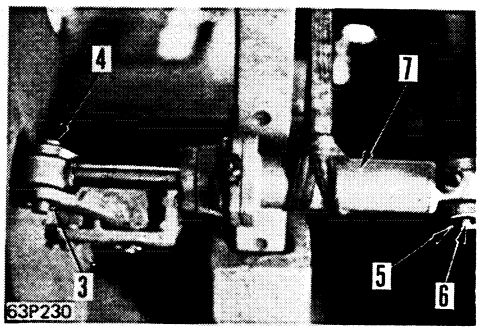


63F045

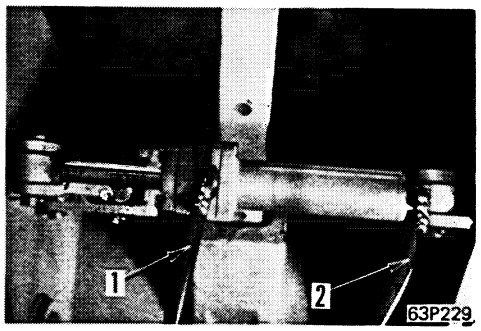
1. **Pin puller cylinder assembly**
   Position pin puller cylinder assembly (7) between beam and link. Install cylinder bottom mounting pin (6) and lock with cotter pin (5).
   ★ Coat the circumference of mounting pin with grease (G2-LI).

2. **Piston rod mounting pin**
   Install piston rod mounting pin (4) and lock with cotter pin (3).
   ★ Coat circumference of mounting pin with grease (G2-LI).

3. **Hose**
   Connect hoses (1) and (2) to cylinder head and bottom, respectively.



63P230



63P229

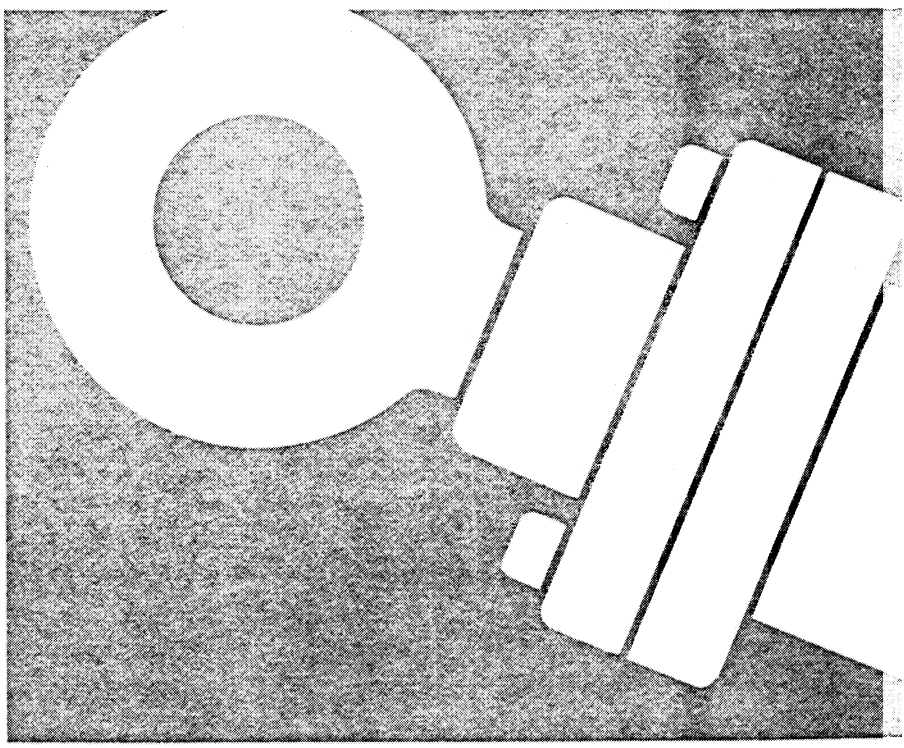
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

64 HYDRAULIC SYSTEM

MAINTENANCE STANDARD



TORQUE SPECIFICATIONS FOR NUTS AND BOLTS

Nuts and bolts should be tightened to torque values shown below.

Unit: kg.m

Nominal bolt dia. (mm)	Width across flats (mm)		
		Desired value	Allowable range
6	10	1.35	1.2~1.5
8	13	3.2	2.8~3.5
10	17	6.7	6~7.5
12	19	11.5	10~12.5
14	22	18	16~20.0
16	24	28.5	25~31.5
18	27	39	35~43.5
20	30	56	50~62.0
22	32	76	67.5~84.5
24	36	94.5	84~105
27	41	135	120~150
30	46	175	155~195
33	50	225	200~250
36	55	280	250~310
39	60	335	295~370

The above table indicates the cases where a torque wrench is employed.

MAINTENANCE STANDARD

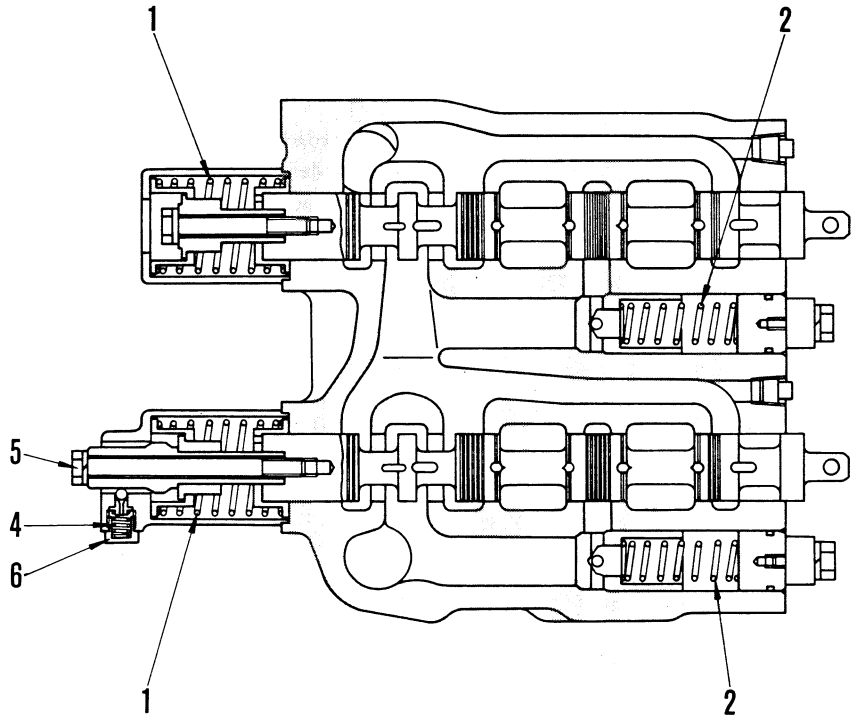
HYDRAULIC CONTROL VALVE
(1) Blade lift and ripper control valve 64-2
(2) Blade lift control valve 64-2-1
(3) Main relief valve 64-3
(4) Suction valve, safety valve 64-4
(5) Ripper selector valve 64-5
(6) Ripper pin puller valve 64-6
(7) Pilot valve 64-6-1

CYLINDER
(1) Blade lift cylinder 64-7
(2) Blade tilt cylinder 64-8
(3) Ripper lift cylinder
and ripper tilt cylinder 64-9

HYDRAULIC CONTROL VALVE

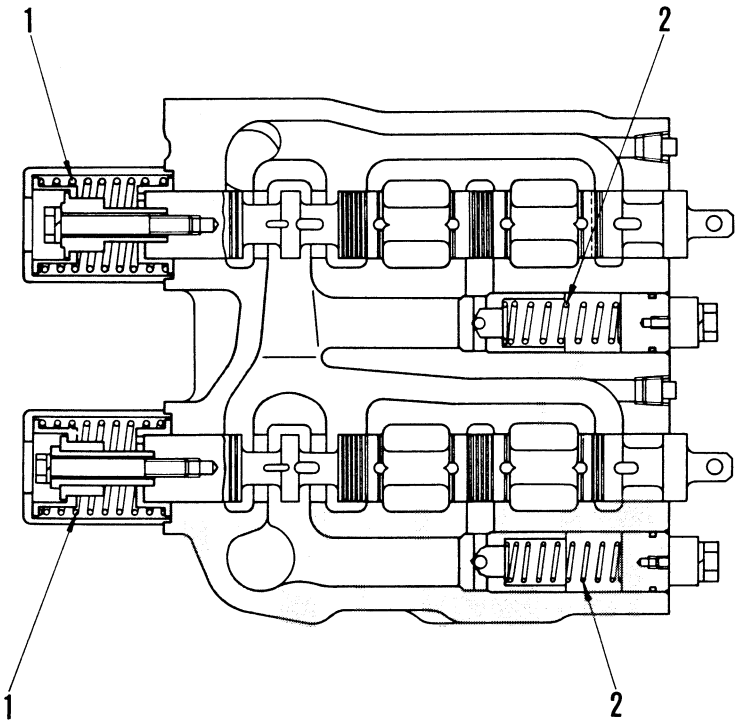
(1) Blade lift and ripper control valve

D150A C8408 ~ 8420
D155A T15001 ~ T17000



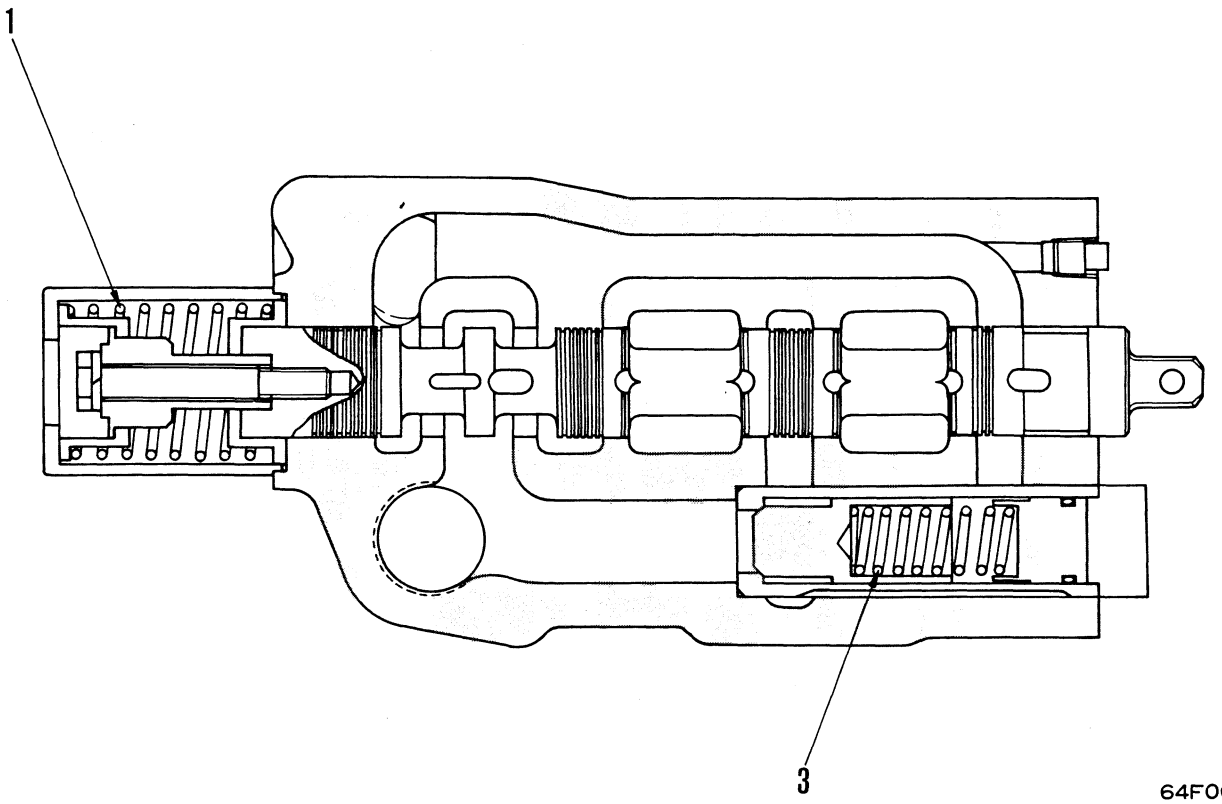
64F001

D150A C8421 and up
D155A T17001 and up



64F002

(2) Blade tilt control valve

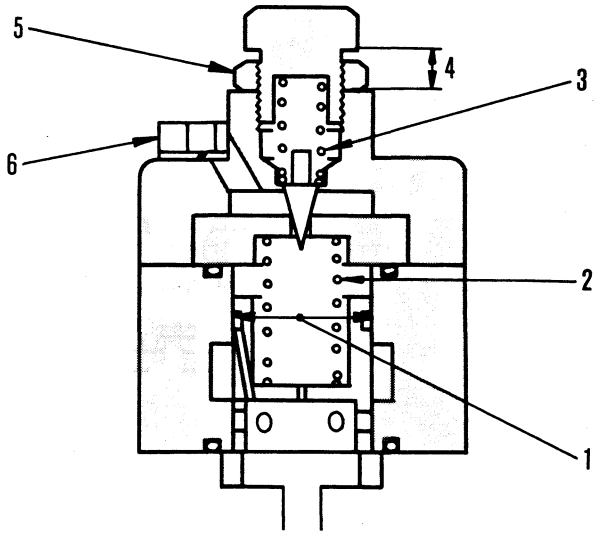


64F003

Unit: mm

No.	Check Item	Criteria					Remedy
		Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Installed load
1	Spool return spring	C8408 ~ T15001 ~	137 x	82	10.0 kg		9.0 kg
2	Check valve spring		135 x	75	3.0 kg		2.7 kg
3	Flow check valve spring		90 x	70	12.8 kg		11.5 kg
4	Detent spring	C8408~8420 T15001 ~ 17000					
5	Detent bolt tightening torque	C8408 ~ 8420 T15001 ~ 17000	11 ± 1.5 kg.m				Adjust
6	Detent plug tightening torque	C8408 ~ 8420 T15001 ~ 17000	8 ± 1 kg.m				

(3) Main relief valve

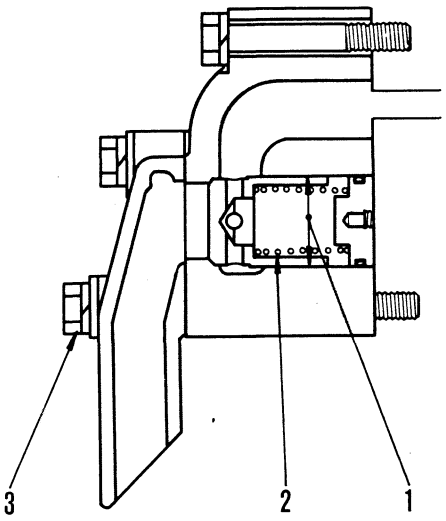


64F003

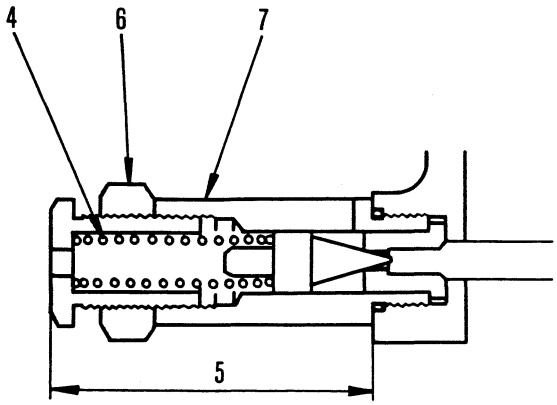
Unit: mm

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Check item</th><th colspan="6">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Clearance between main relief valve and valve body</td><td>Serial No.</td><td>Standard size</td><td colspan="2">Tolerance</td><td>Standard clearance</td><td>Clearance limit</td><td rowspan="4">Replace</td></tr>
<tr><td></td><td></td><td>Shaft</td><td>Hole</td><td></td><td></td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Main relief valve spring</td><td rowspan="2">Serial No.</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td></tr>
<tr><td>Free length x O.D.</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Load</td></tr>
<tr><td>1</td><td>Clearance between main relief valve and valve body</td><td>5501~</td><td>38</td><td>-0.018
-0.029</td><td>+0.016
0</td><td>0.020~
0.030</td><td>0.04</td></tr>
<tr><td>2</td><td>Main relief valve spring</td><td>5501~</td><td></td><td>41</td><td>10.0 kg</td><td></td><td>9 kg</td></tr>
<tr><td>3</td><td>Pilot valve spring</td><td>5501 ~</td><td></td><td>30</td><td>27.4 kg</td><td></td><td>24.7 kg</td><td></td></tr>
<tr><td rowspan="2">4</td><td>Set pressure</td><td colspan="7">140 kg/cm²</td><td rowspan="4"></td></tr>
<tr><td>Adjust plug standard size</td><td colspan="7">15.2 mm (adjust pressure per one turning 29.2 kg/cm²)</td></tr>
<tr><td>5</td><td>Lock nut tightening torque</td><td colspan="7">12 ~ 16.5 kgm</td></tr>
<tr><td>6</td><td>Mounting bolt tightening torque</td><td colspan="7">9 ~ 11 kgm</td></tr>
</table>

(4) Suction valve, safety valve



64F004

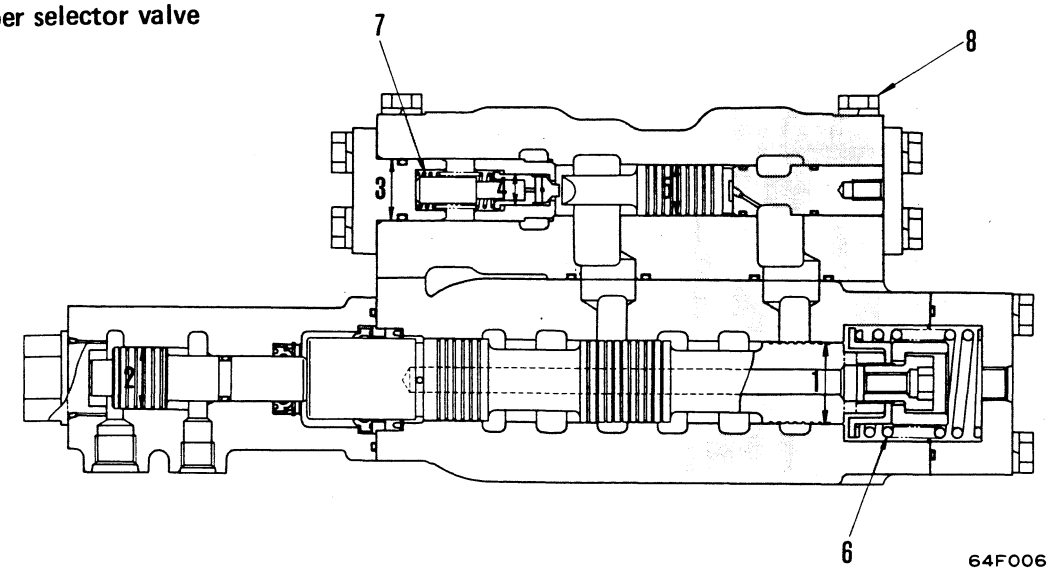


64F005

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between suction valve and vave body	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		5501 ~	45					
2	Suction valve spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		C8408 ~ T15001 ~	73x	52	0.84 kg		0.76 kg	
3	Mounting bolt tightening torque	9 ~ 10 kgm						
4	Safety valve spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		5501~	79 x	64.7	35.2 kg		31.7 kg	
5	Set pressure	160 kg/cm^2						
	Adjusting plug standard size	105.9 mm (adjust pressure per one turning 18.8 kg/cm^2)						
6	Lock nut tightening torque	18 ~ 24 kgm						
7	Valve body tightening torque	18 ~ 24 kgm						

(5) Ripper selector valve

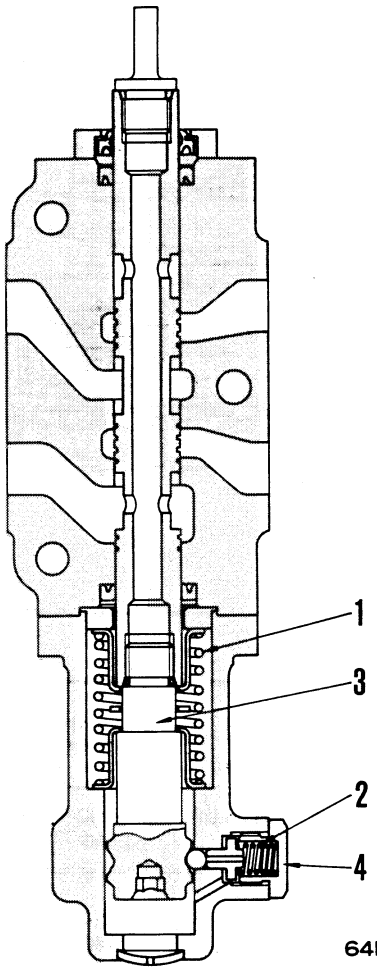


Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between main spool and valve body	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		5501~	40	-0.020 -0.030	+0.010 0	0.020~ 0.030		
2	Clearance between pilot spool and valve body	5501~	30	-0.020 -0.030	+0.010 0	0.020~ 0.030		
3	Clearance between check seat and valve body	5501~	30					
4	Clearance between check valve and check seat	5501~	15					
5	Clearance between pilot piston and valve body	5501~	25	-0.020 -0.053				
6	Main spool spring	Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
		5501~	69 x 52.5	61.4	38.8 kg	80	35.0 kg	
7	Check valve spring	5501~	50 x 18.6	36	2 kg	45	1.6 kg	
8	Tie bolt tightening torque	5 ~ 7 kgm						

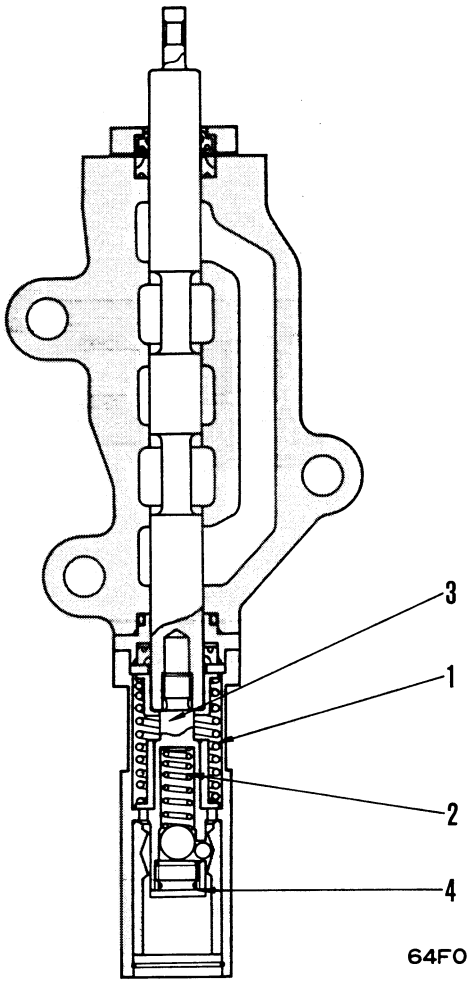
(6) Ripper pin puller valve (for giant ripper)

D150A C8408 ~ C8420
D155A T15001 ~ T17000



64F012

D150A C8421 and up
D155A T17001 and up



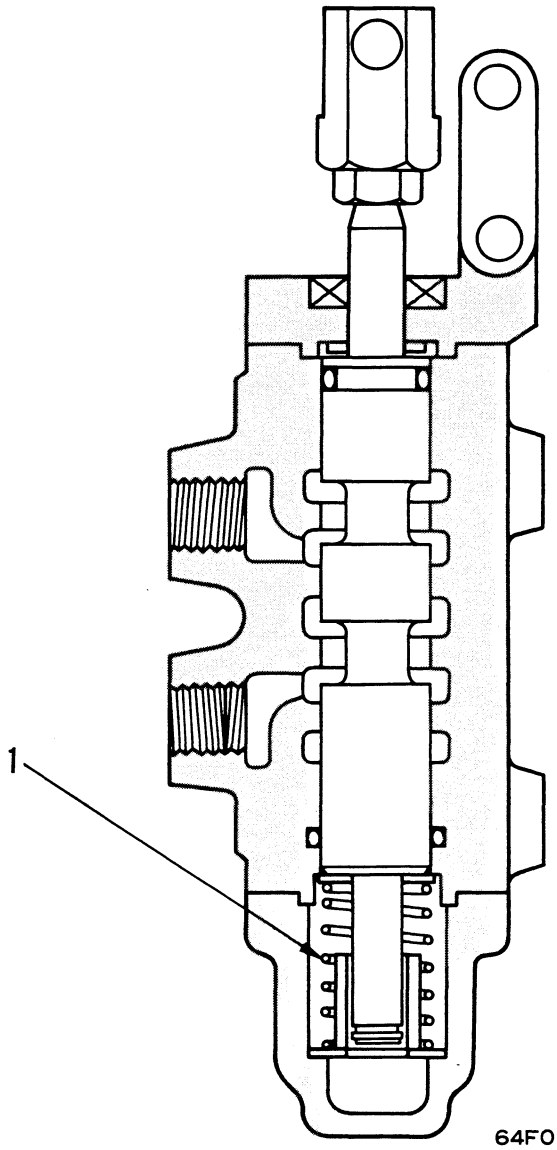
64F013

Unit: mm

No.	Check Item	Criteria					Remedy
		Serial No.	Standard size			Repair limit	
			Free length x O.D.	Installed length	Installed load	Free length	Installed load
1	Pin puller valve spring	C8408~8420 T15001~17000		52.0	14.0 kg		Replace
		C8421 ~ T17001 ~	53.3 x 23.3	33.5	10.0 kg		
2	Detent spring	C8408 ~ 8420 T15001 ~ 17000		17.0	2.7 kg		
		C8421 ~ T17001 ~	30.7 x 7.7	23.0	5.0 kg		
3	Detent tightening torque	C8408 ~ 8421 T15001 ~ 17000			C8421 ~ T17001 ~	1.5±0.5kg.m	Adjust
4	Detent plug tightening torque	C8408 ~ 8421 T15001 ~ 17000			C8421 ~ T17001 ~	2.5±0.5kg.m	

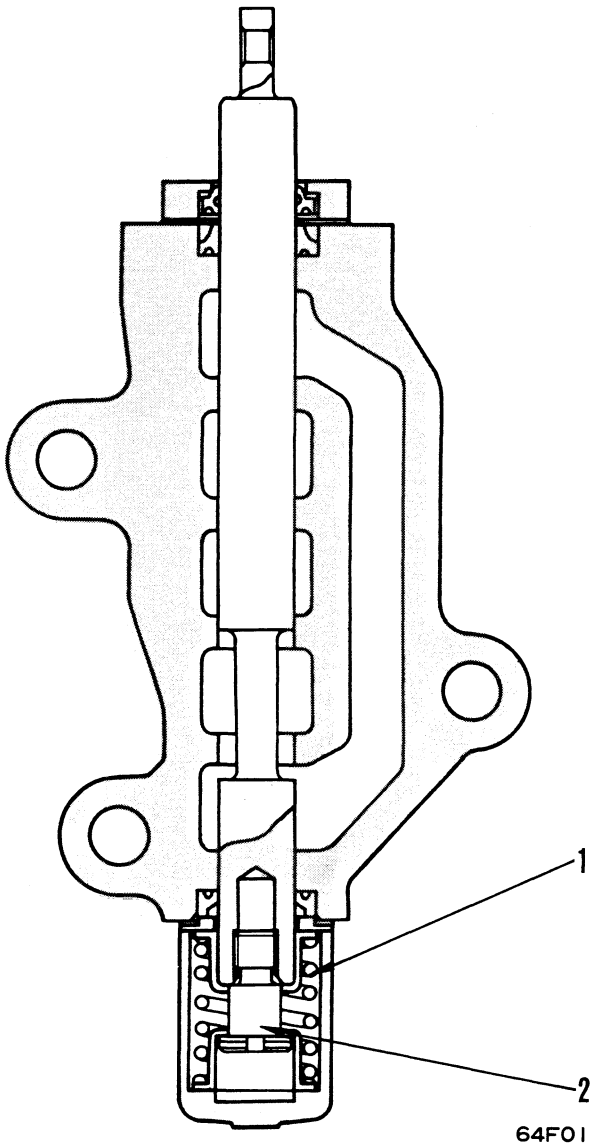
(7) Pilot valve

D150A C8408 ~ C8420
D155A T15001 ~ T17000



64F010

D150A C8421 and up
D155A T17001 and up



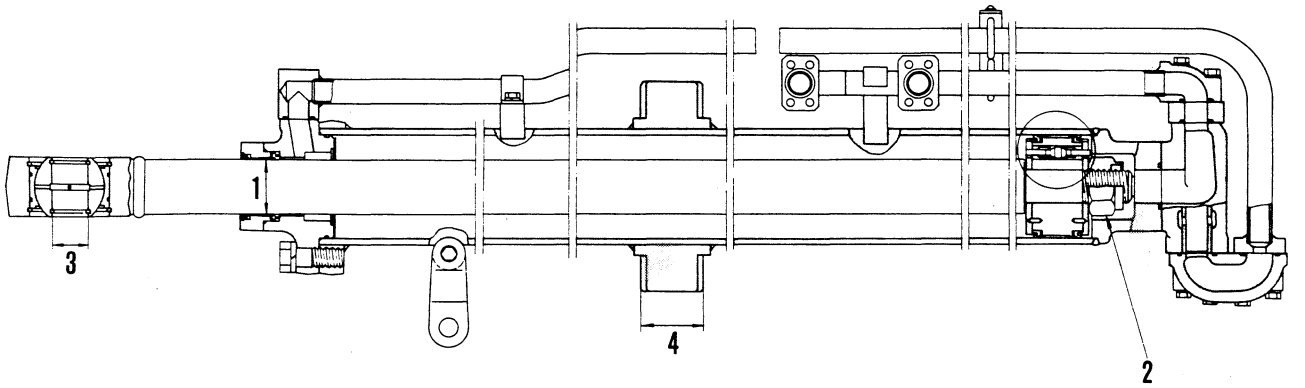
64F011

Unit: mm

No.	Check Item	Criteria					Remedy
		Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Installed load	
1	Pilot check valve spring	C8408 ~ 8420 T15001 ~ 17000	55.4 x 21.5	29.0	5.99 kg			Replace
		C8421 ~ T17001 ~	46.5 x 22.7	26.5	11.0 kg			
2	Plug tightening torque	C8408 ~ T17001 ~	1.5 ± 0.5 kg.m					Adjust

CYLINDER

(1) Blade lift cylinder

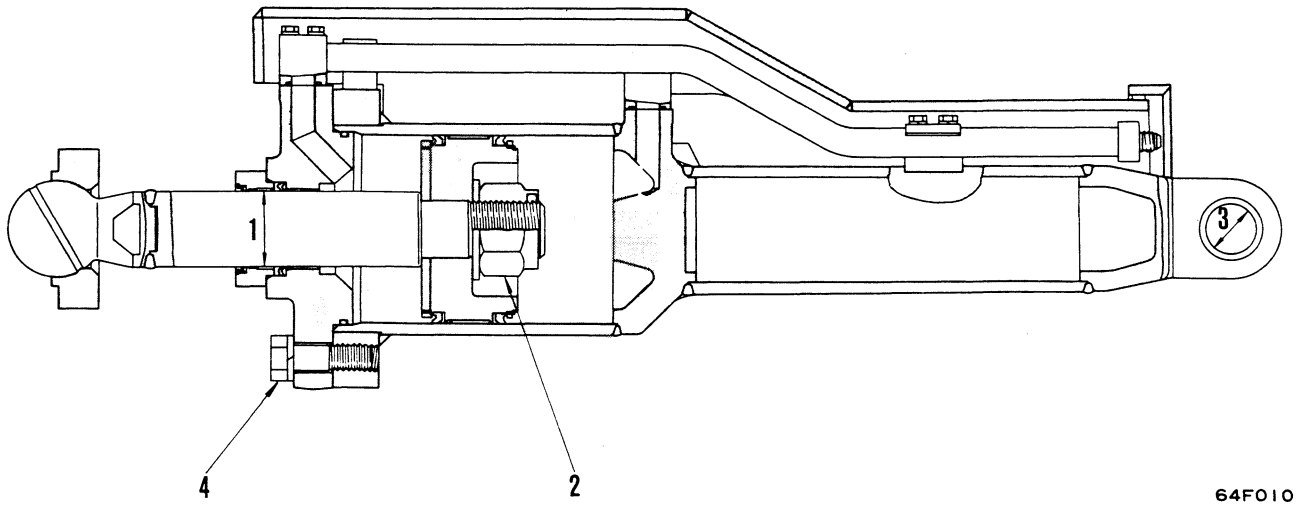


64F009

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between piston rod and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C8408~ T15001~	75	−0.100 −0.174	+0.291 +0.077	0.177 ~ 0.465		
2	Tightening torque for piston nut	207 ~ 253 kgm (Width across flats: 70 mm)						
3	Clearance between piston rod support shaft and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C8408 ~ T15001 ~	50	−0.120 −0.207				
4	Clearance between cylinder support shaft and bushing	C8408 ~ T15001 ~	85	−0.120 −0.207				

(2) Blade tilt cylinder

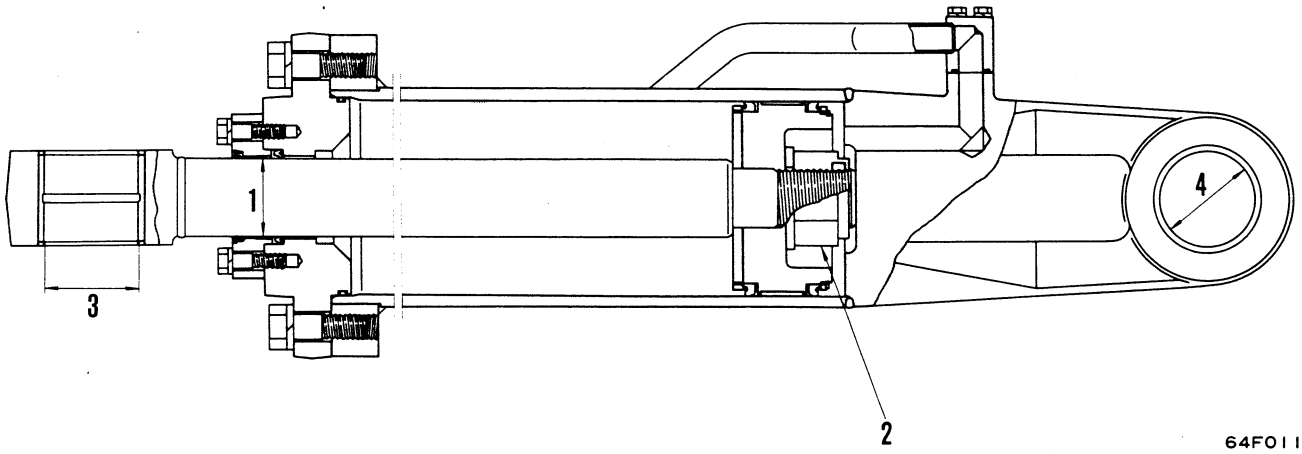


64F010

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between piston rod and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C8408 ~ T15001 ~	90		+0.270 +0.061			
2	Piston nut tightening torque	1040 ±104 kgm (width across flats 95 mm)						
3	Clearance between cylinder bottom bushing and pin	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
		C8408 ~ T15001 ~	60		+0.174 +0.100			
4	Cylinder head mounting bolt tightening torque	145 ~ 195 kgm						

(3) Ripper lift cylinder, ripper tilt cylinder

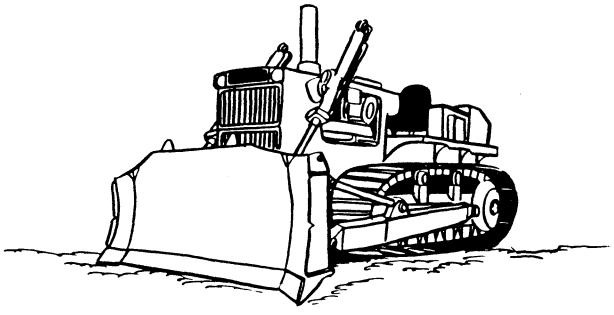


64F011

Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between piston rod and bushing	C8408 ~ T15001 ~	90		+0.270 +0.061			
2	Piston nut tightening torque	936 ~ 1144 kg.m (width across flats 95mm)						
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
3	Clearance between piston rod bushing and pin	C8408 ~ T15001 ~	110		+0.207 +0.120			
4	Clearance between cylinder bottom bushing and pin	C8408 ~ T15001 ~	110		+0.207 +0.120			

MEMO



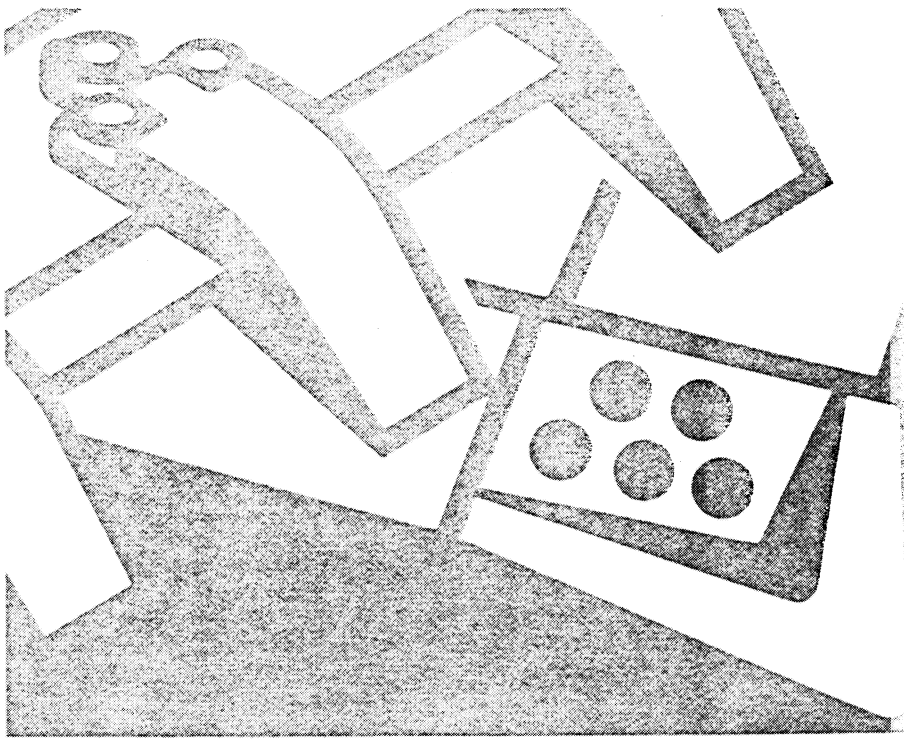
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

71 WORK EQUIPMENT

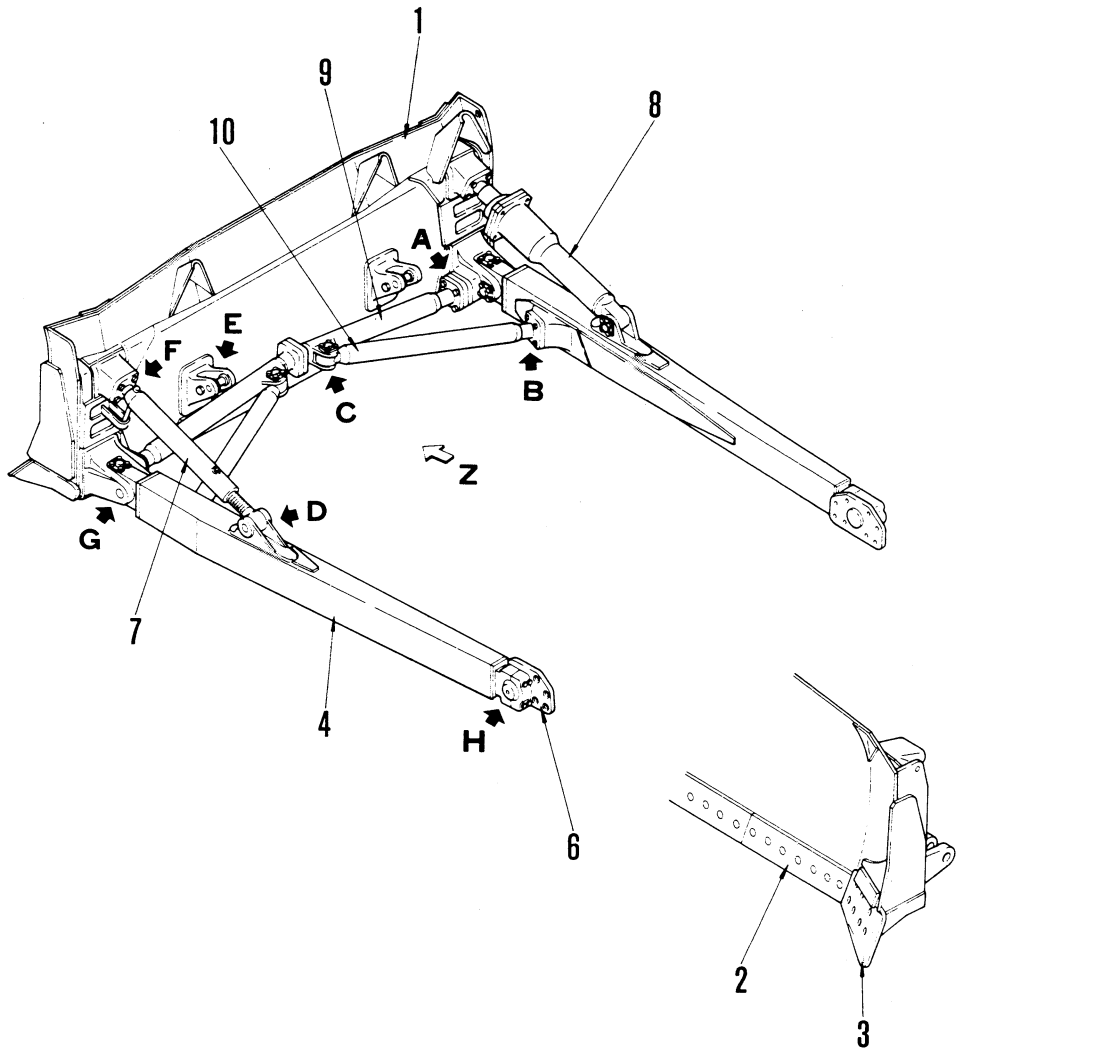
STRUCTURE AND FUNCTION

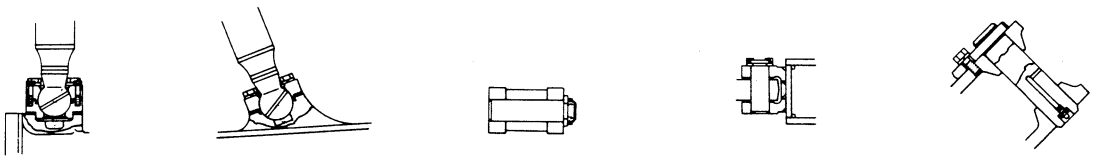


STRUCTURE AND FUNCTION

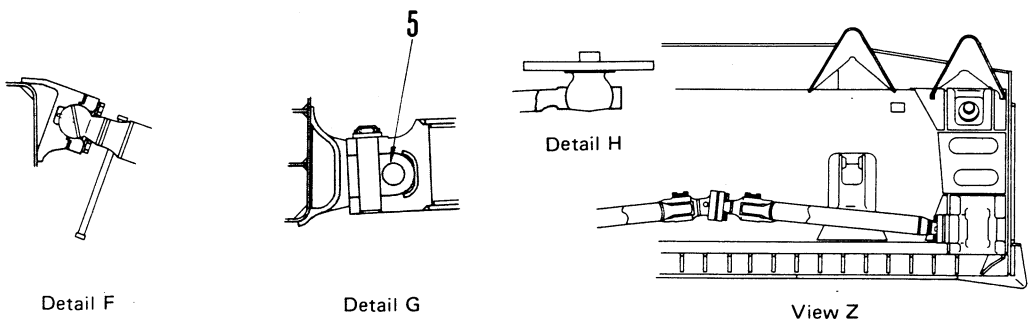
Straight tilt dozer 71-2
Multi ripper 71-4
Giant ripper 71-6

STRAIGHT TILT DOZER





Detail A Detail B Detail C Detail D Detail E



71F001

The working component consists of the work equipment and the hydraulic control which operates the equipment. Straight tilt dozer, angle dozer and U dozer are the 3 typical kinds in the work equipment classified.
In this manual, description is given to the straight tilt dozer.

Straight tilt dozer

The blade (1) with the front plate made of high tensile steel is tough enough to endure sever works.

The cutting edge (2) is 3-splitting type so that the edge can easily be reversed. The straight frame (4) made also of high tensil steel is constructed to be box-type, the front of which is stationed to the blade via joint block, and the rear of which is fixed to the truck frame by means of trunnion. The straight frame is moved up and down by the action of the blade lift cylinder.

The brace (7) supports both blade and straight frame on their left side, and the tilt cylinder (8) supports them on their right side.

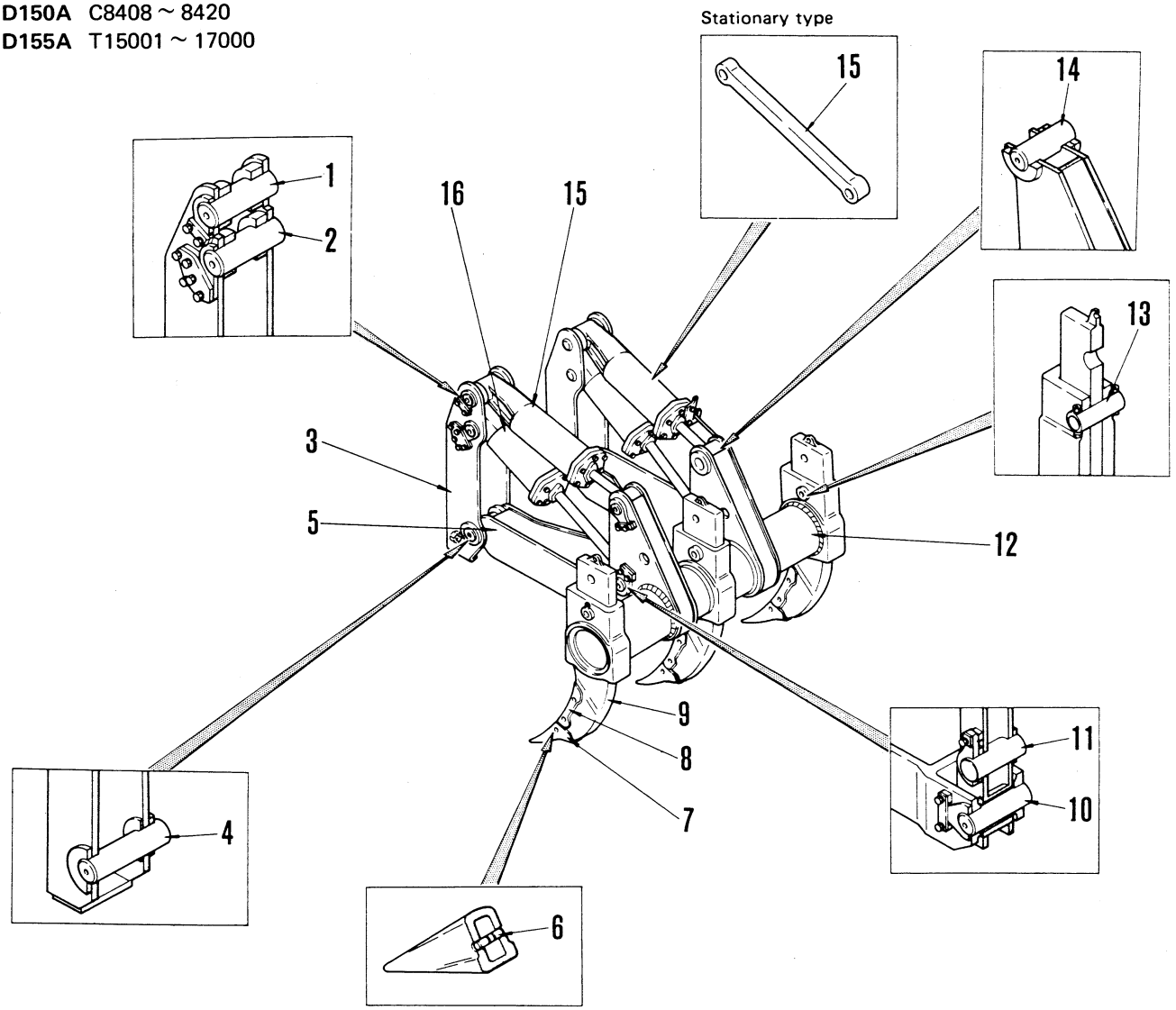
Blade lifting and tilting operation is done by the control lever located at the right side of the operator's seat. In addition, the relief mechanism for tilting operation is provided at the center just behind the blade.

★	Max. lift above ground:	1560mm
	Max. drop below ground:	560mm
	Max. tilting adjustment:	1000mm

1. Blade
2. Cutting edge
3. End bit
4. Straight frame
5. Pin
6. Trunnion
7. Brace
8. Tilt cylinder
9. Arm
10. Arm

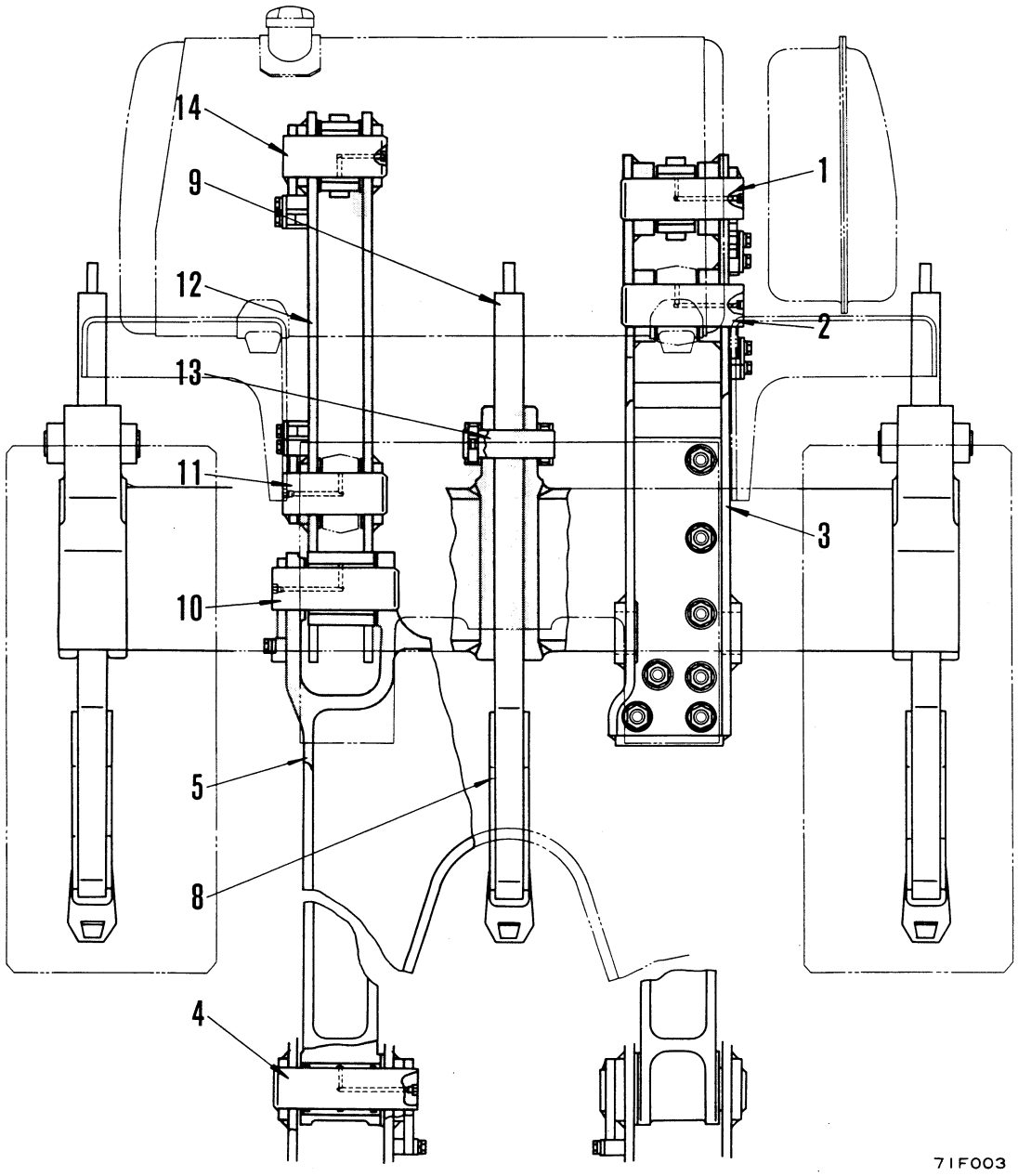
MULTI RIPPER

D150A C8408 ~ 8420
D155A T15001 ~ 17000

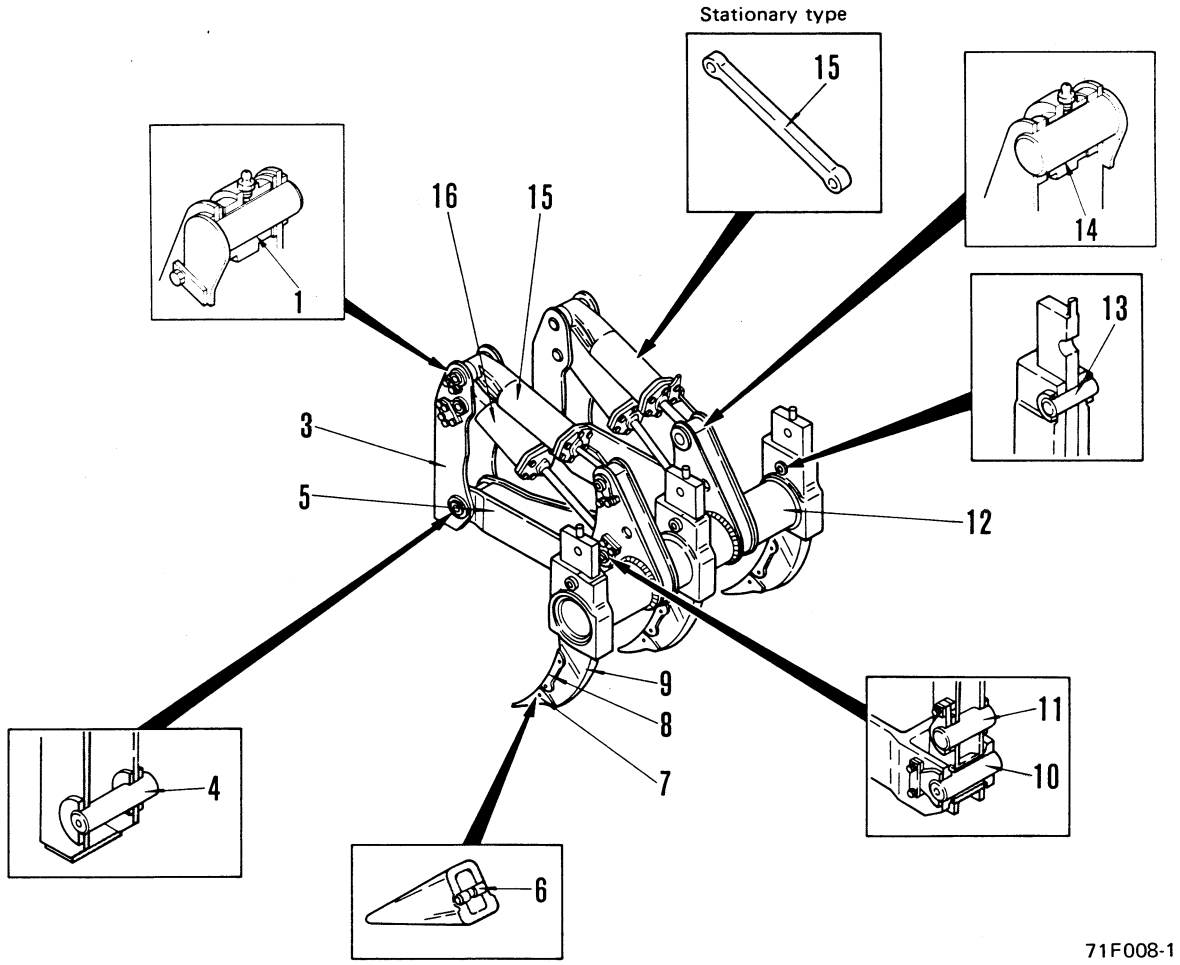


1. Tilt cylinder bottom pin
2. Lift cylinder bottom pin
3. Ripper bracket
4. Arm pin
5. Arm
6. Point pin
7. Point
8. Protector
9. Shank
10. Arm pin
11. Lift cylinder rod pin
12. Beam
13. Shank pin
14. Tilt cylinder rod pin
15. Tilt cylinder (variable type)
    Rod (stationary type)
16. Lift cylinder

D150A C8408 ~ 8420
D155A T15001 ~ 17000

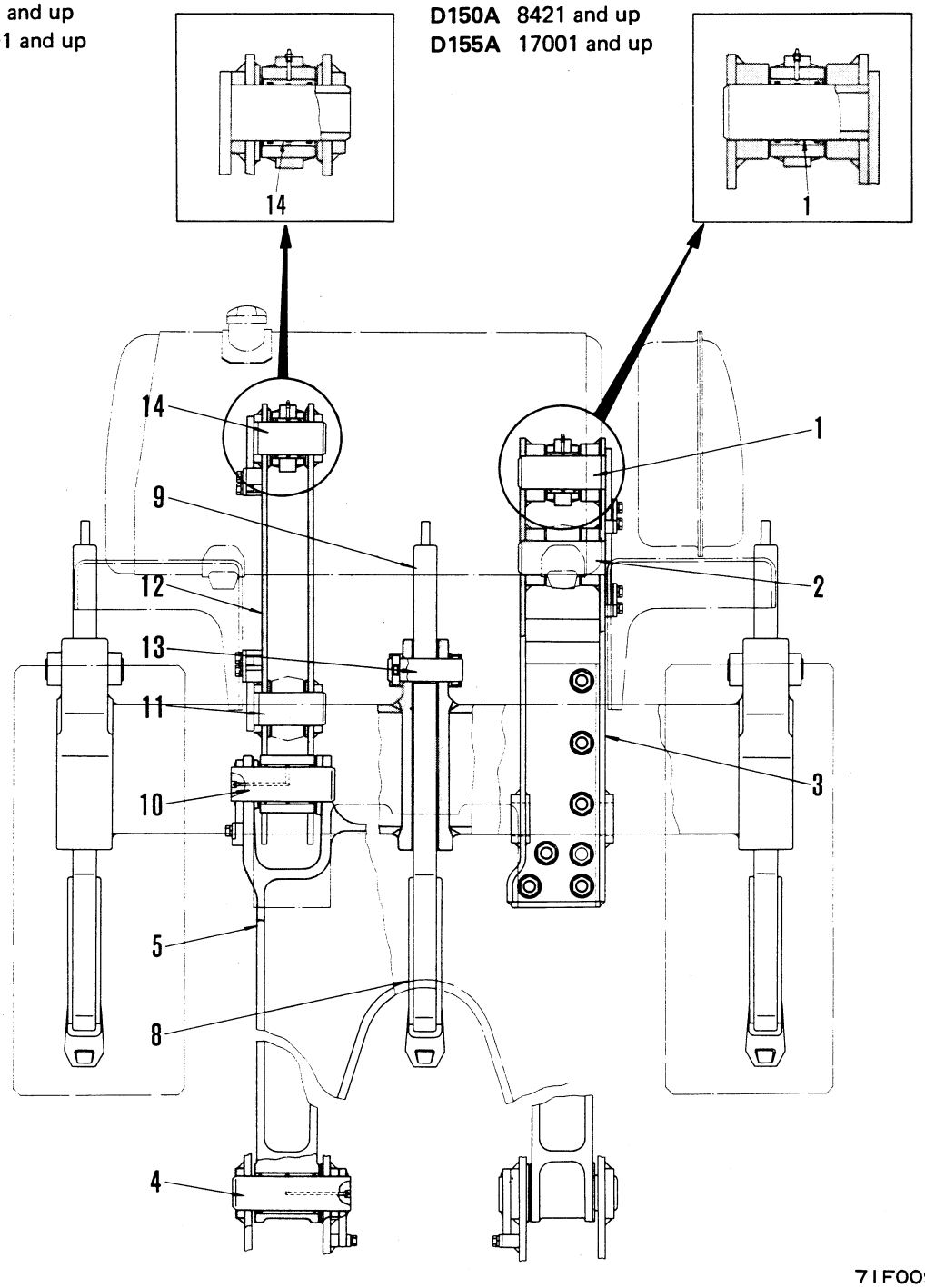


D150A 8421 and up
D155A 17001 and up



1. Tilt cylinder bottom pin
2. Lift cylinder bottom pin
3. Ripper bracket
4. Arm pin
5. Arm
6. Point pin
7. Point
8. Protector
9. Shank
10. Arm pin
11. Lift cylinder rod pin
12. Beam
13. Shank pin
14. Tilt cylinder rod pin
15. Tilt cylinder (variable type)
    Rod (stationary type)
16. Lift cylinder

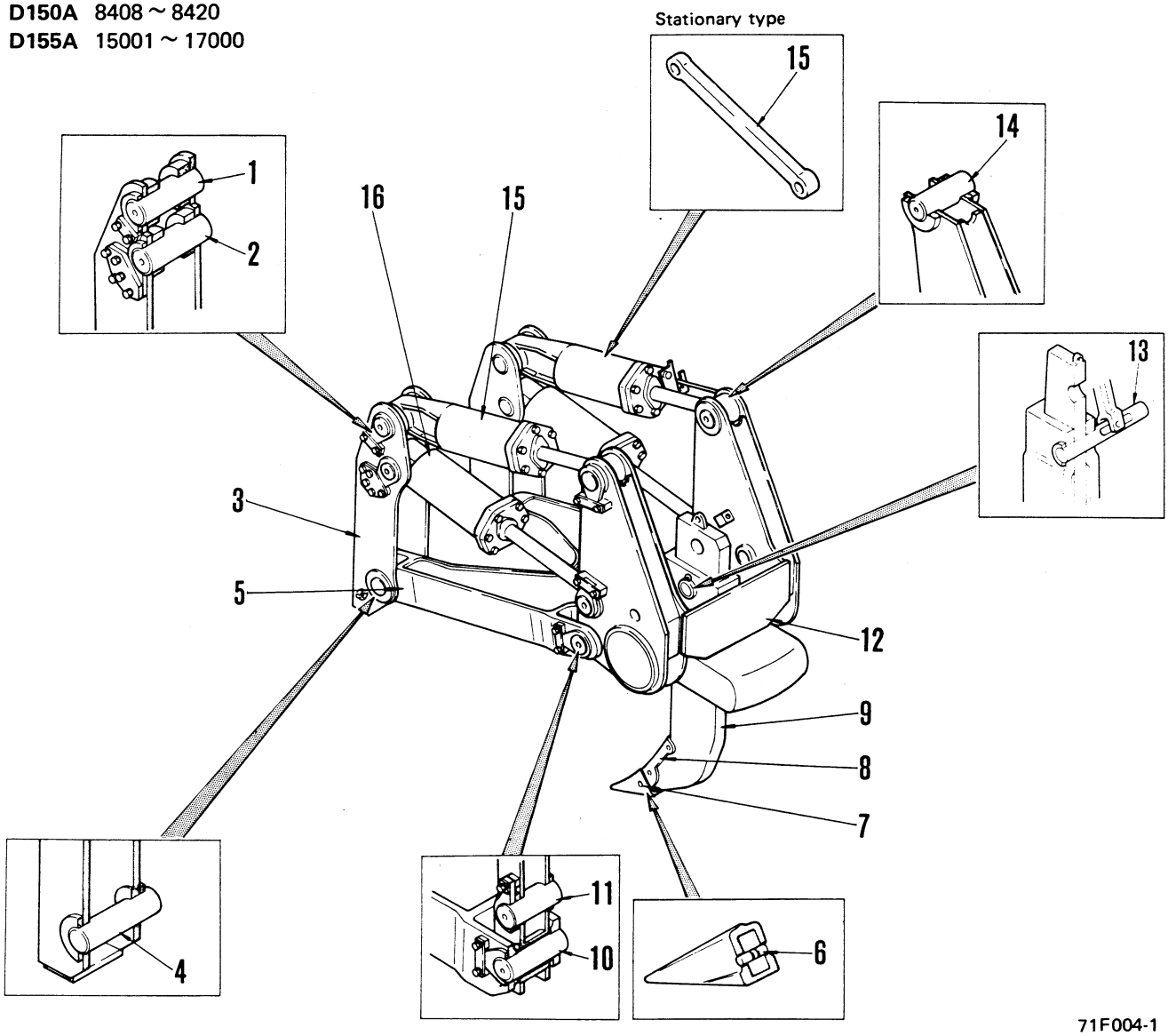
D150A 8421 and up
D155A 17001 and up



71F009-1

GIANT RIPPER

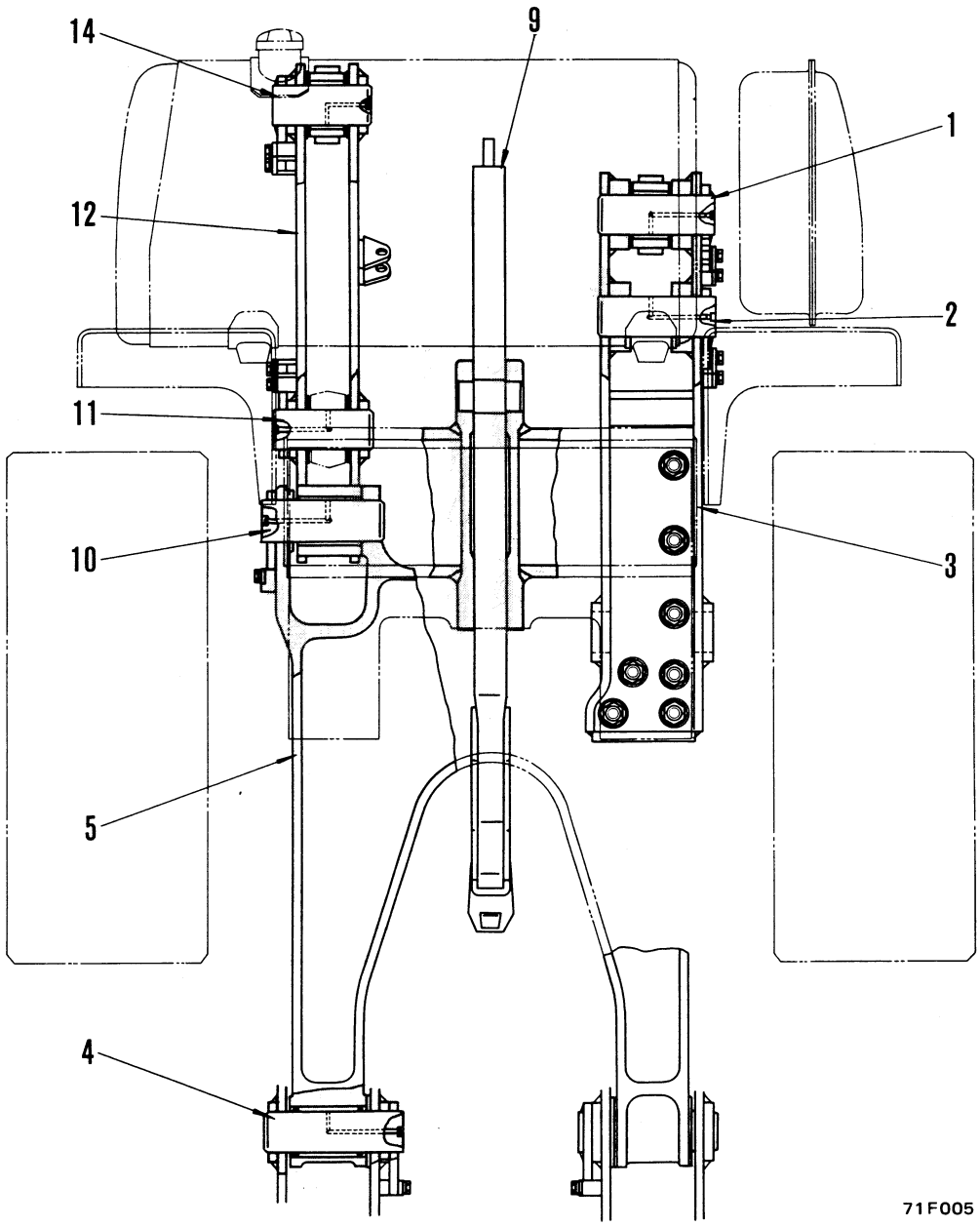
D150A 8408 ~ 8420
D155A 15001 ~ 17000



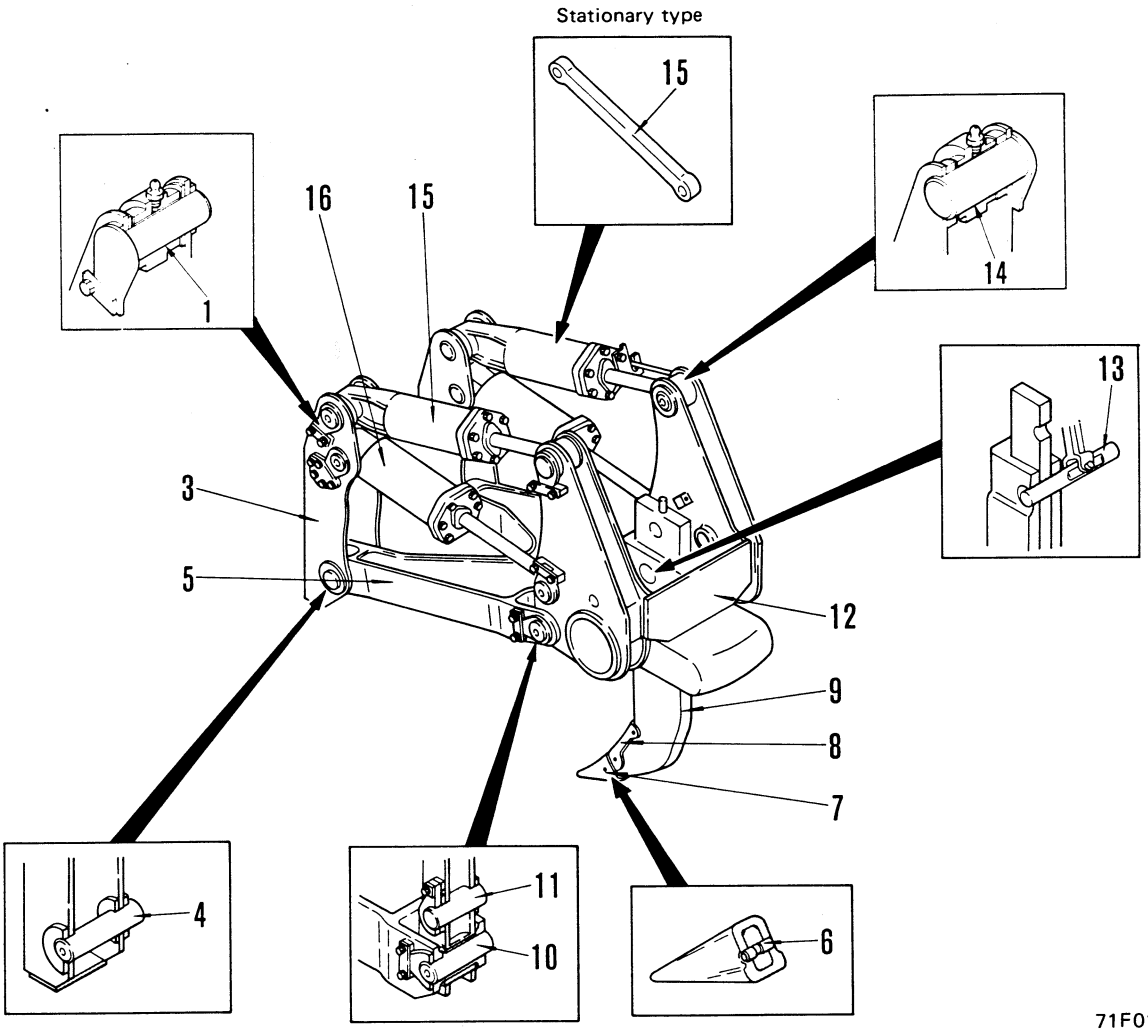
71F004-1

1. Tilt cylinder bottom pin
2. Lift cylinder bottom pin
3. Ripper bracket
4. Arm pin
5. Arm
6. Point pin
7. Point
8. Protector
9. Shank
10. Arm pin
11. Lift cylinder bottom pin
12. Beam
13. Shank pin
14. Tilt cylinder rod pin
15. Tilt cylinder (variable type)
    Rod (stationary type)
16. Lift cylinder

D150A C8408 ~ 8420
D155A T15001 ~ 17000

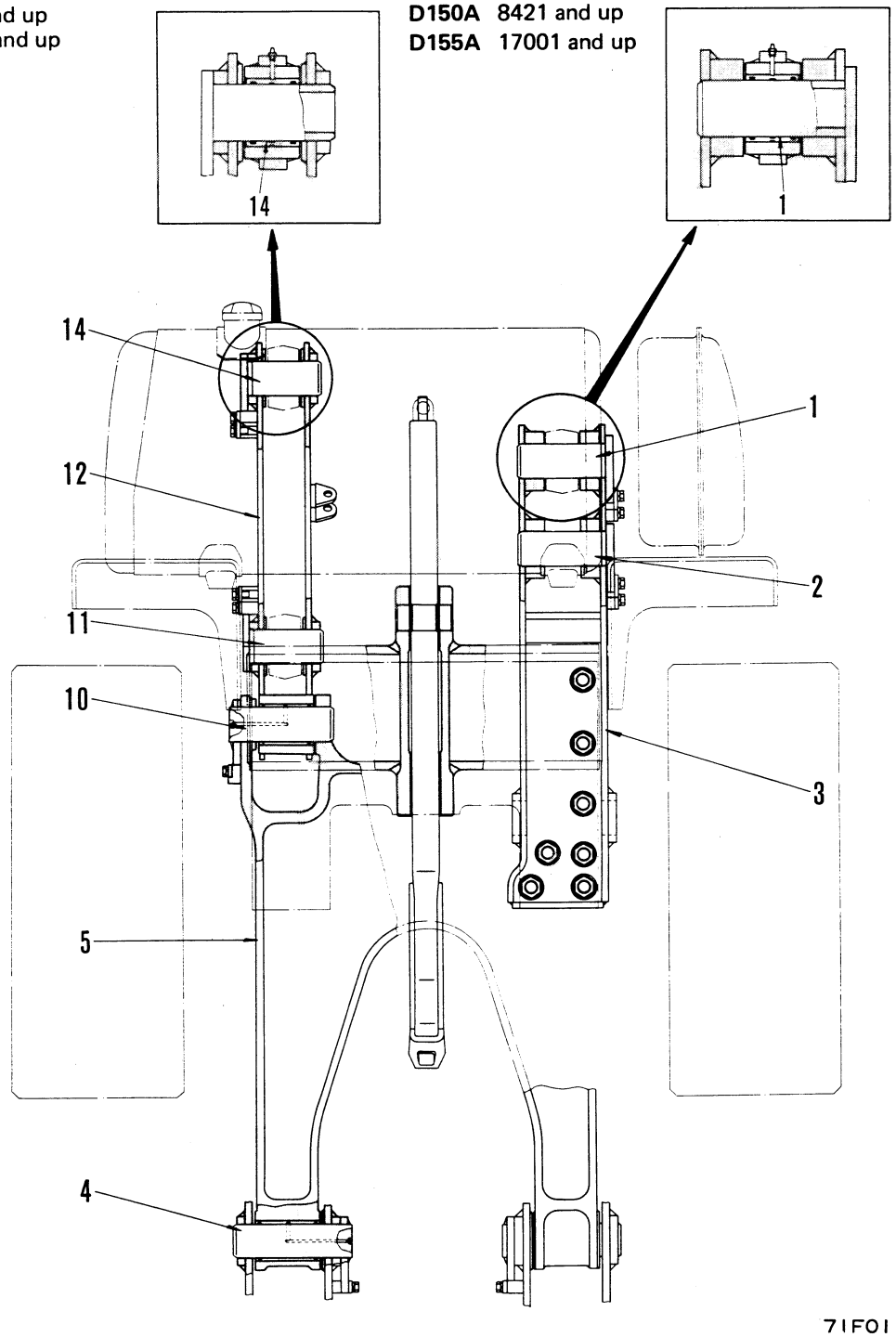


D150A 8421 and up
D155A 17001 and up



1. Tilt cylinder bottom pin
2. Lift cylinder bottom pin
3. Ripper bracket
4. Arm pin
5. Arm
6. Point pin
7. Point
8. Protector
9. Shank
10. Arm pin
11. Lift cylinder bottom pin
12. Beam
13. Shank pin
14. Tilt cylinder rod pin
15. Tilt cylinder (variable type)
    Rod (stationary type)
16. Lift cylinder

D150A 8421 and up
D155A 17001 and up



As hydraulic ripper, there are 4 typical kinds; stationary multi-ripper, variable multi-ripper, stationary giant ripper and variable giant ripper.

Stationary giant ripper DRD150-2B
Stationary multi ripper DRP150-1A

Arm (5) and rod (15) are installed by pins (1) and (4) to ripper bracket (3) attached to back side of steering case by nuts.

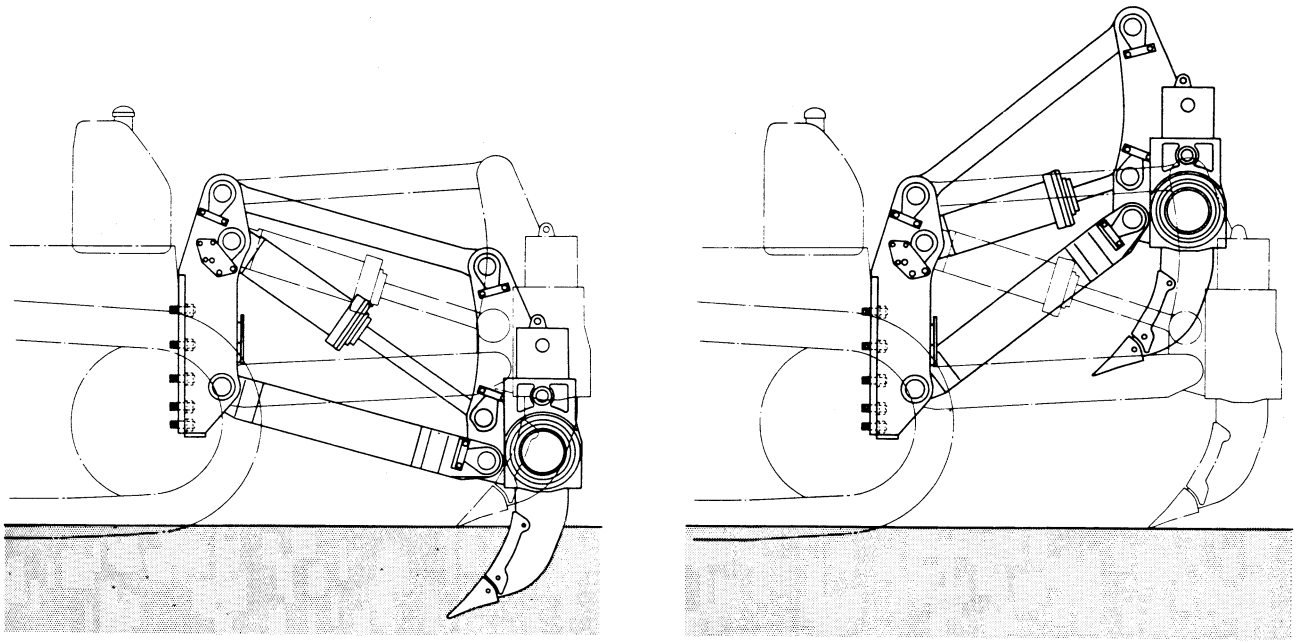
Beam (12) is installed to the ends of arm and rod by pin (10) and (14).

The shank (9) with the point (7) and the protector (8) attached to it is installed to the beam by the pin (6). One shank can be equipped to giant ripper and three shanks to multiripper. The ripper cylinder (16) allows the shank to move up and down (digging operation), the bottom side of which is stationed to ripper bracket by pin (2), and the rod side of which is stationed to the beam by the pin (11).

By utilizing the quadric link mechanism consisting of a parallelogram of pins (1), (4), (10) and (14), the reciprocal motion of the ripper cylinder rod is transduced to up-down movement of the ripper point, by which the digging depth of the point is controlled.

Digging depth is adjustable by changing shank pin (13) position on shank.

Since this linkage mechanism deforms parallelogram, shank angle is always the same regardless of shank depth.



71F006

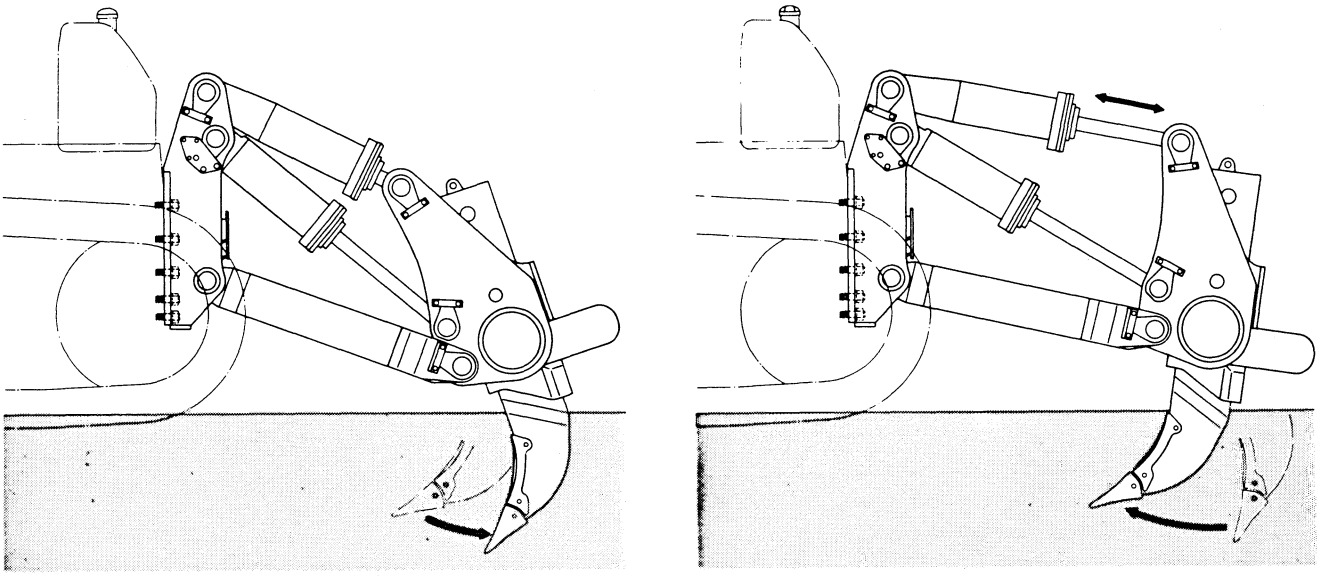
Variable giant ripper DRD150-2A
Variable multi ripper DRP150-2A

Arm (5) are installed by pins (4) to ripper bracket (3) attached to back side of steering case by nuts. Beam (12) is installed to the ends of arm by pin (10). The shank (9) with the point (7) and the protector (8) attached to it is installed to the beam by the pin (6). One shank can be installed on giant ripper and three shanks on multiripper.

The ripper lift cylinder (16) allows the shank to move up and down (digging operation), the bottom side of which is stationed to ripper bracket by pin (2) and the rod side of which is stationed to the beam by pin (11).

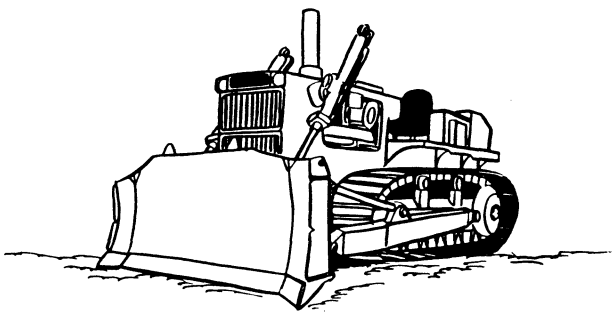
Ripper tilt cylinder (15) which changes excavation angle by shank (point) is fixed with its bottom side on ripper bracket with pin (2) and its rod side on beam with pin (14).

Digging depth is adjustable by putting shank pin (13) into desirable shank hole by operating pin puller cylinder.



71F007

MEMO



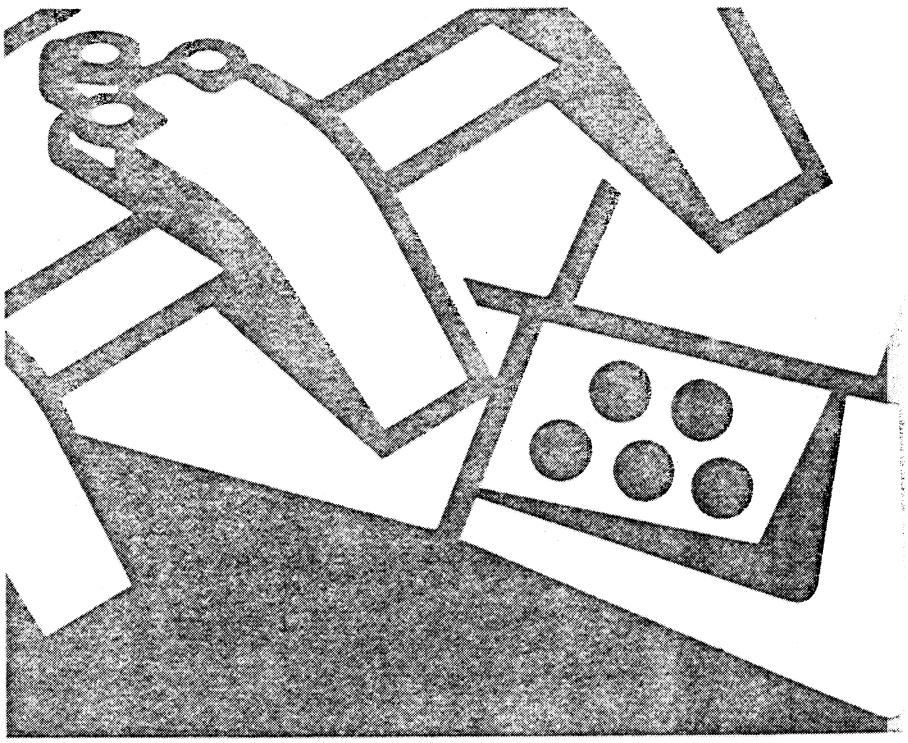
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

72 WORK EQUIPMENT

TESTING AND ADJUSTING

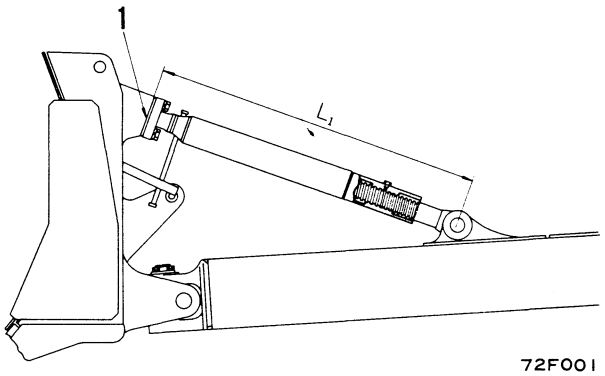


TESTING AND ADJUSTING

INSTALLATION AND ADJUSTMENT OF STRAIGHT TILT DOZER

1. Confirming horizontal state of blade

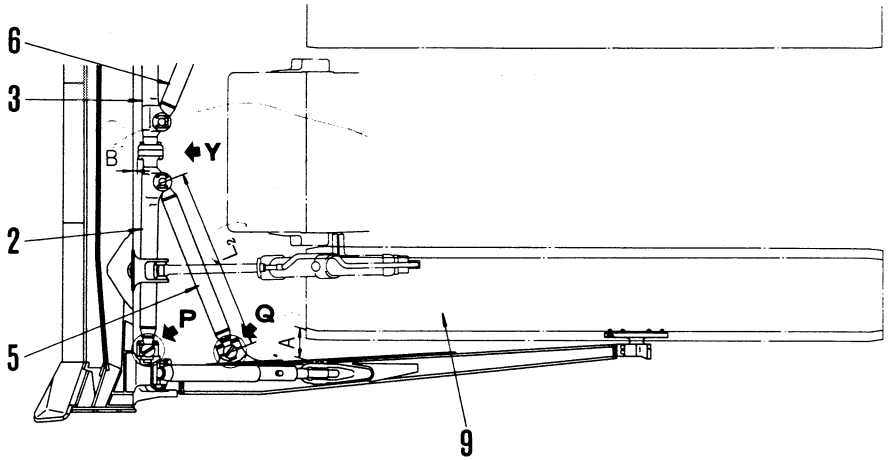
1) Set distance **L** between pins fixing tilt cylinder to 1388mm.
2) Set distance L1 between pins fixing left brace to 1388mm.
3) If blade is out of horizontal after above 1) and 2), fix distance between pins fixing cylinder and make blade horizontal by turning left brace.
   ★ Adjust shim (1) so that longitudinal play of brace becomes less than 1mm.
   Standard shim (1): 4mm

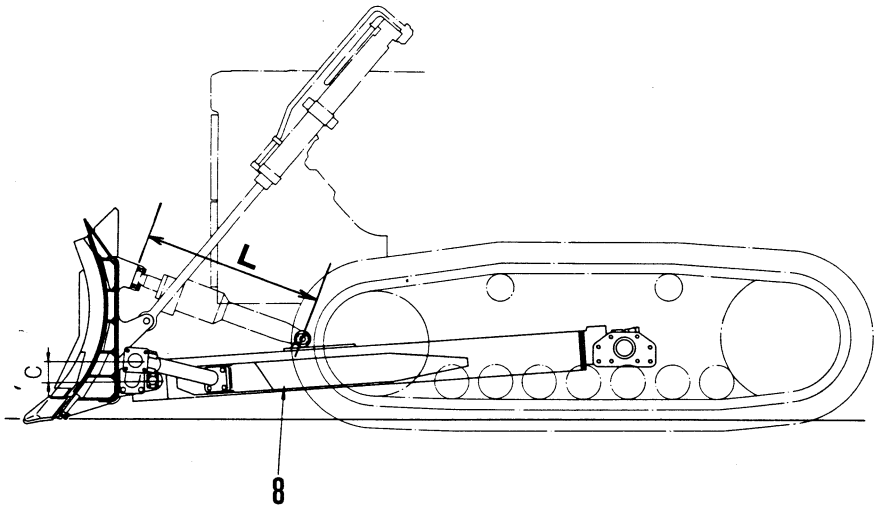


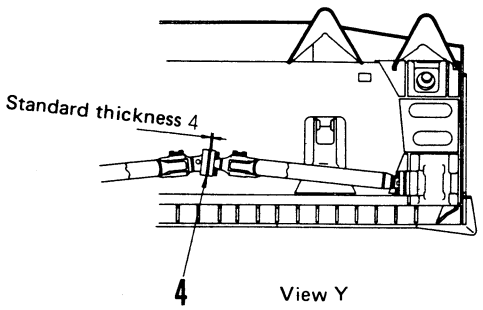
72F001

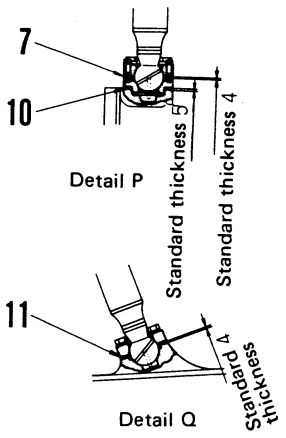
2. Confirming parallelism of frame

1) Install right and left front arms (2), (3) and adjust shims (4), so longitudial play becomes less than 1mm.
   Standard shims (4): 4mm
2) Install right and left skew arms (5), (6) and adjust shims (7), so longitudial play becomes less than 1mm.
   ★ Standard shims (7): 4mm
3) After above 1) and 2), adjust the clearance A to the dimension below between straight frame (8) and track (9) by pulling or pushing blade in ⇋ directions.
   ★ Clearance A: 222mm (equalized at right and left)
4) At the same time, adjust the clearance B between right and left front arms joint center ball bracket and the back of blade, and the height of center ball bracket to the following dimensions respectively.
   ★ Clearance B: 45mm and over
   Height C : 150mm
5) After location of center ball bracket, measure the clearance of shim (10), when right and left front arms are temporarily tightened on blade and after amount of shims is decided, tighten them fully.
   ★ Standard shims (10): 5mm
6) Adjust shims (11), so longitudinal play of right and left skew arms becomes less than 1mm.
   ★ Standard shims (11): 4mm
7) Confirm the distance L2 between pins fixing right and left skew arms.
   ★ Distance L2: 1367mm


6
3
B
Y
2
P
Q
5
A
9

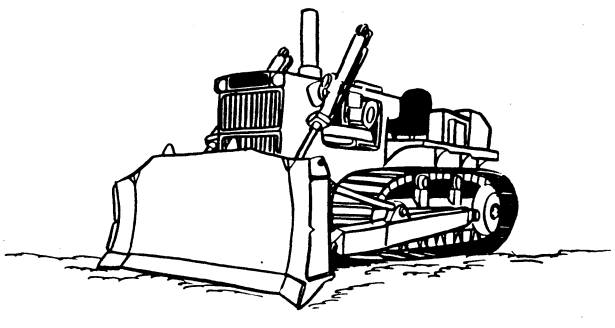

L
C
8


Standard thickness 4
4
View Y


7
10
Standard thickness 5
Standard thickness 4
Detail P
11
Standard thickness 4
Detail Q

72F002

MEMO



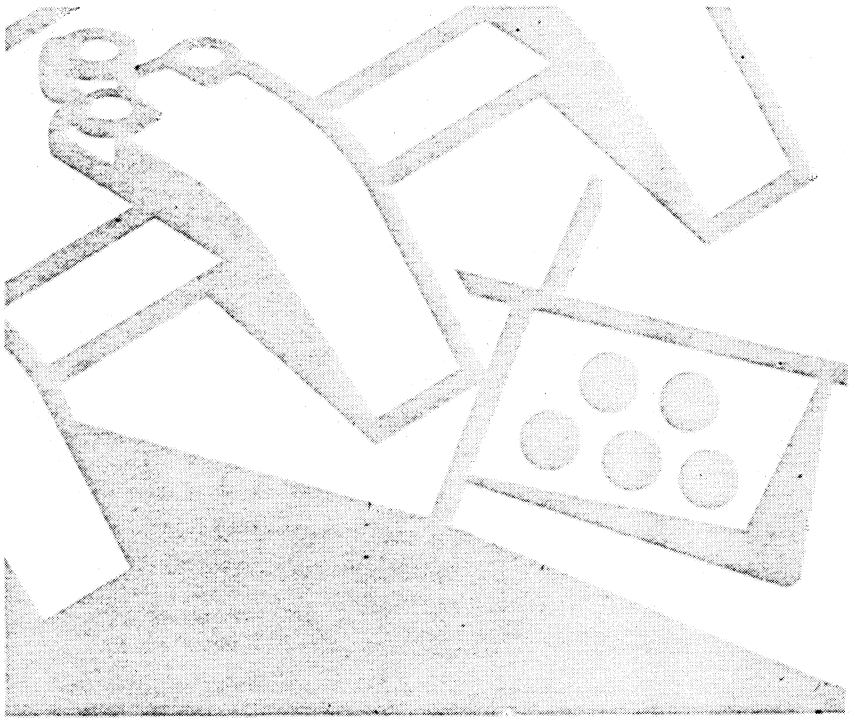
SHOP MANUAL

D150,155

SERIAL NO. D150A-1 8408~
D155A-1 15001~

73 WORK EQUIPMENT

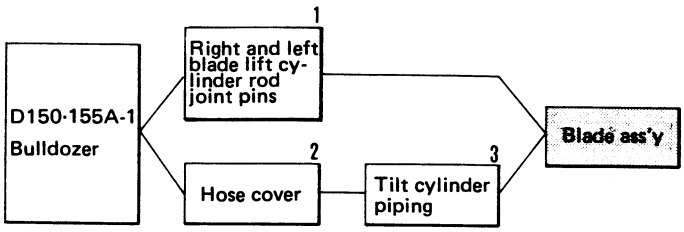
DISASSEMBLY AND ASSEMBLY



DISASSEMBLY AND ASSEMBLY

No.	Item	Page
1	Dismounting blade	73- 2
	Mounting blade	73- 4
2	Disassembly to blade	73- 6
	Assembly of blade	73-10
3	Disassembly of ripper	73-14
	Assembly of ripper	73-20

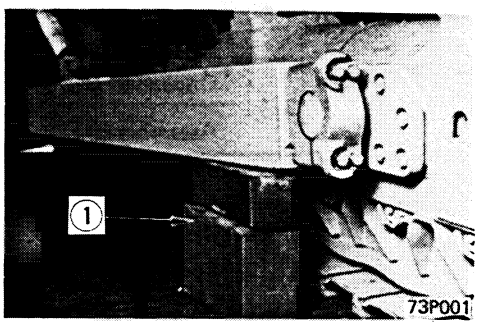
DISMOUNTING BLADE



73F001

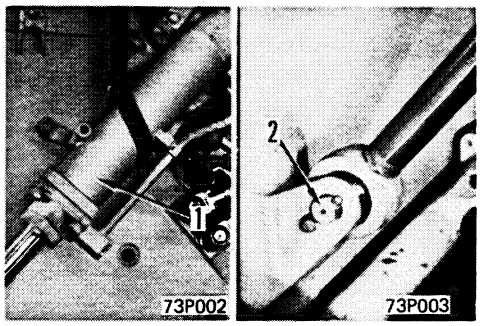
Preparatory work

- Rest blade on the ground and support right and left streight-frames on block ①.
- After stopping engine, move blade tilt control lever two or three times to expel residual pressure from piping.



1. Right and left blade lift cylinder rod joint pins

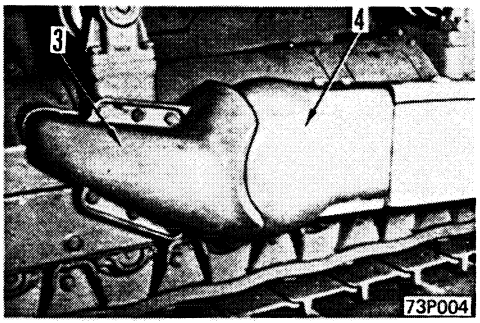
1) Sling blade lift cylinder (1) with crane and pull out joint pin (2) connecting cylinder rod and blade to each other.
2) Start engine and retract blade lift cylinder piston rod. Fix cylinder on machine body with lock pin.
   ★ When piston rod is retracted, center of gravity of cylinder will move toward cylinder bottom, causing a swing of cylinder.



2. Hose cover

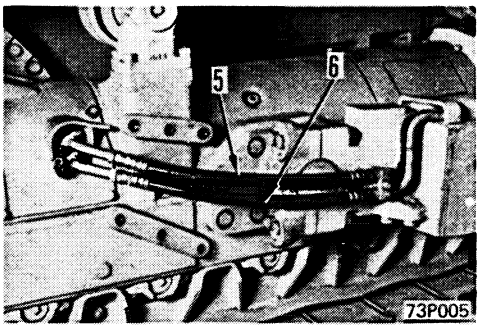
Remove blade tilt cylinder hose covers (3) and (4).

kg Hose Cover (3): **55 kg** (150A C8408~8420, 155A T15001~17000)
26 kg (150A C8421~, 155A T17001~)
(4): **55 kg** (150A C8408~8420, 155A T15001~17000)
48 kg (150A C8421~, 155A T17001~)

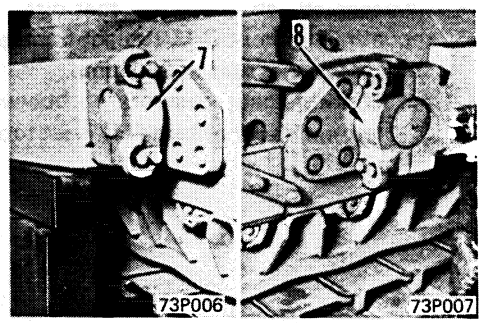


3. Tilt cylinder piping

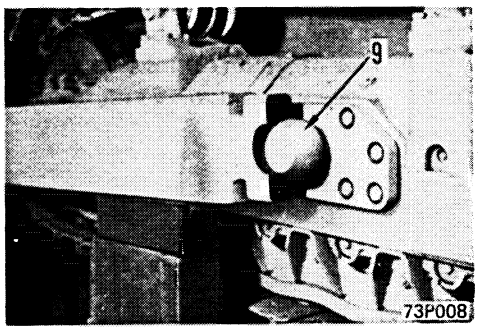
Disconnect hoses (5) and (6) from blade tilt cylinder.
Put blind plugs to tubes at both ends.



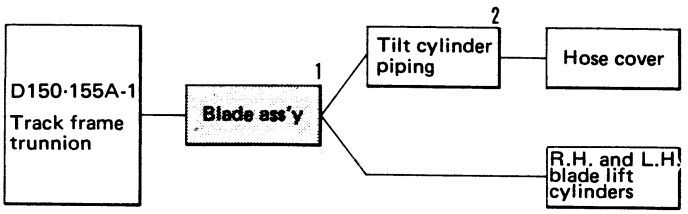
4. **Blade assembly**
   1) Remove L.H. trunnion cap (7).
   2) Remove R.H. trunnion cap (8).



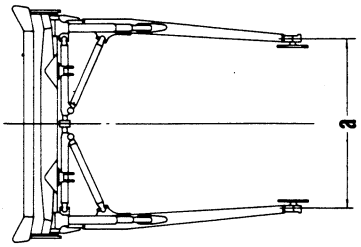
   3) Start engine and drive machine backward to disconnect blade assembly from track frame trunnion (9).



MOUNTING BLADE



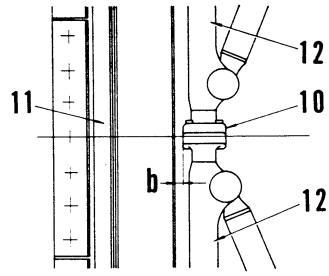
73F002



73F003

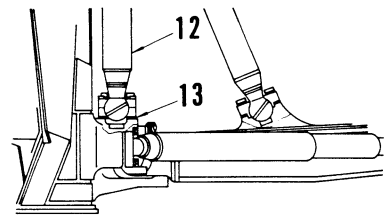
Preparatory work

- Arrange straight-frames so that distance "a" between trunnion mounting center of R.H. straight-frame and that of L.H. straight-frame is set to 2980 mm.
  - ★ Confirm that clearance "b" between arm flange (10) and rear end face of blade (11) is set to 45 mm.



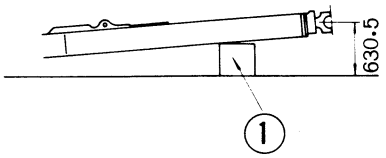
73F004

If any clearance above 45 mm is obtained, decrease thickness of shim (13) inserted between arm (12) and blade. If clearance is below 45 mm, increase thickness of shim (13).



73F005

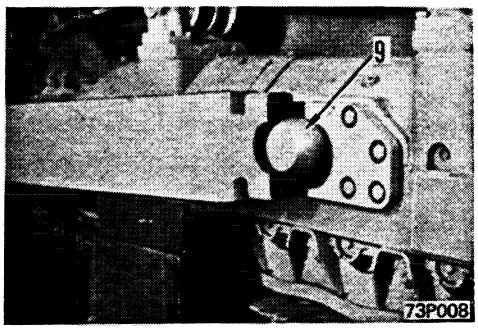
- Support right and left straight-frames on block ① so that center of trunnion mounting portion of frame is raised 630.5 mm above the ground.



73F006

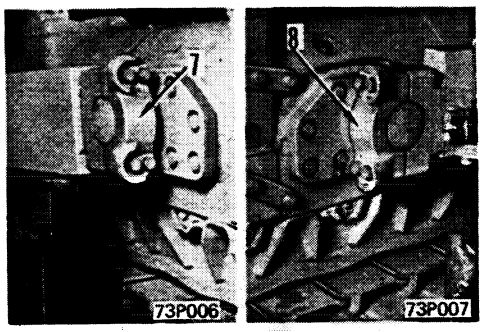
1. Blade assembly

1) Start engine. Slowly move machine forward until right and left trunnions (9) come into alignment with respective straight-frames.



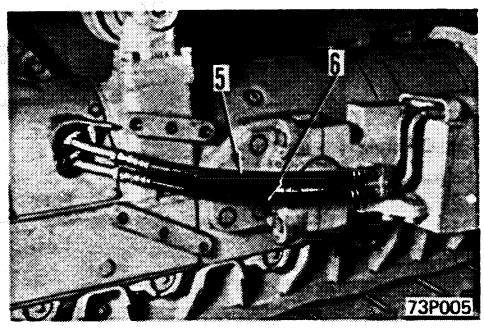
2) Install L.H. trunnion cap (7).
3) Install R.H. trunnion cap (8).

kgm Trunnion cap mounting bolt: **64.5 ~ 84.5 kg.m**



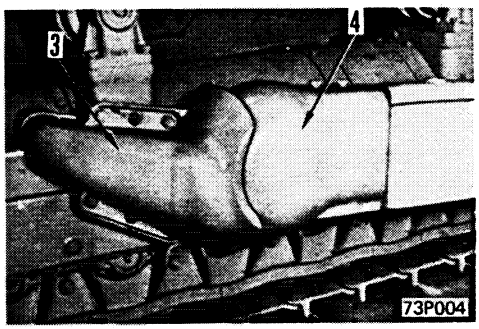
2. Tilt cylinder piping

Connect hoses (5) and (6) to blade tilt cylinder.



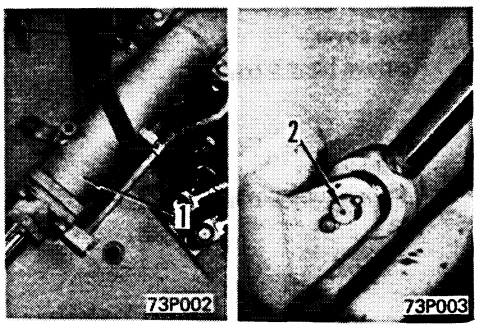
3. Hose cover

Install blade tilt cylinder hose covers (4) and (3).



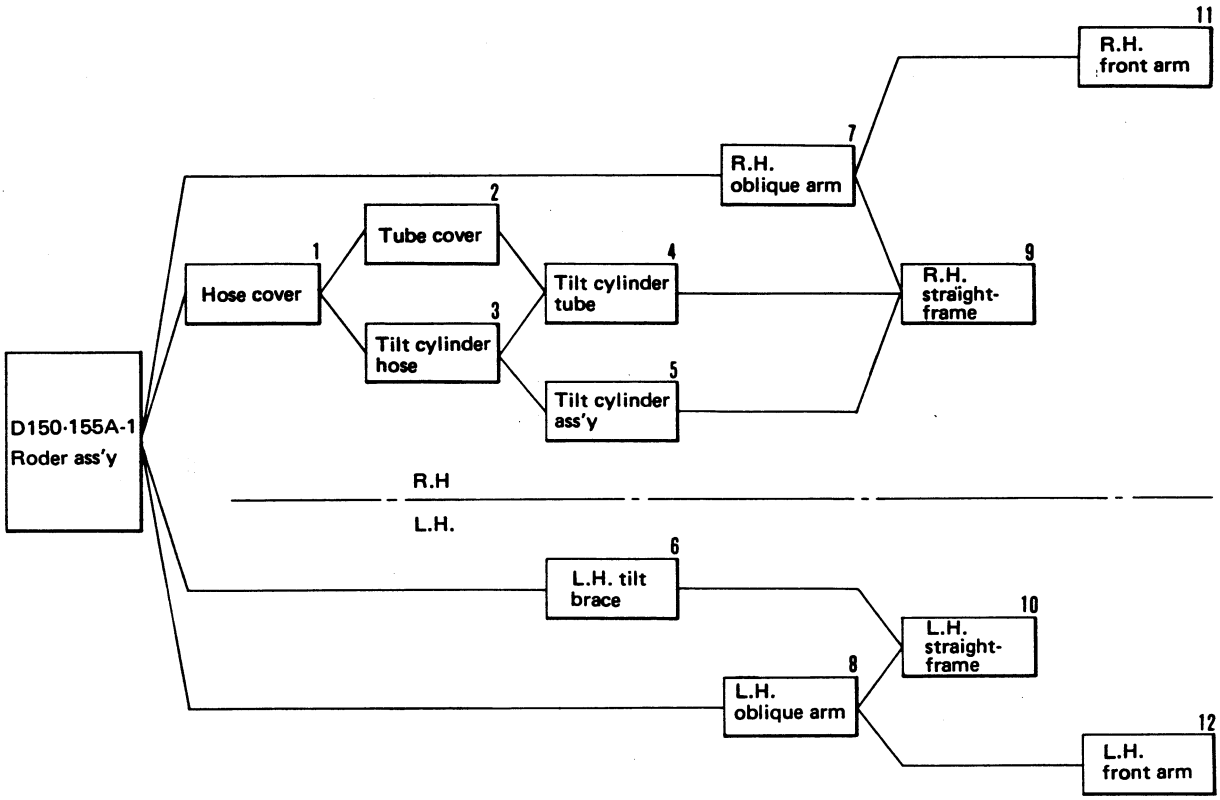
4. R.H. and L.H. blade lift cylinders

1) Sling cylinder (1) with crane and remove lock pin fastening cylinder to machine body.
   ★ Cylinder suspended with sling rope will swing because of center of gravity biased on cylinder bottom side. Be careful not to allow cylinder to collide with other parts.



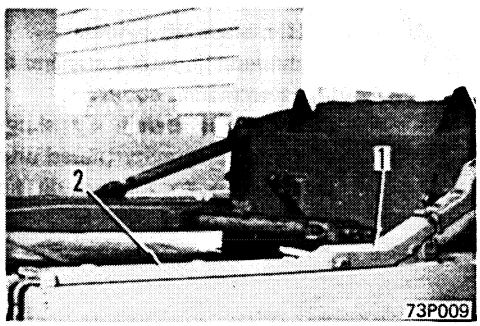
2) Start engine, protrude cylinder rod, and connect rod to blade with joint pin (2).

DISASSEMBLY OF BLADE



73F007

1. **Hose cover**
   Remove hose cover (1).

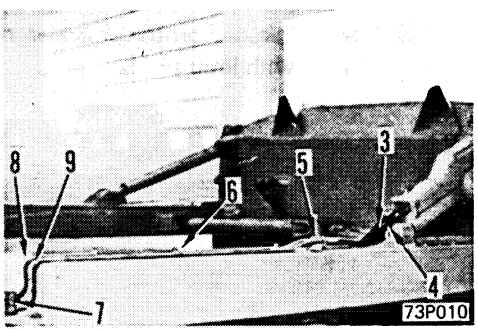


73P009

2. **Tube cover**
   Remove tube cover (2).

3. **Tilt cylinder hose**
   Remove hoses (3) and (4).

4. **Tilt cylinder tube**
   Remove clamps (5), (6) and (7) fastening tubes (8) and (9); remove tubes.

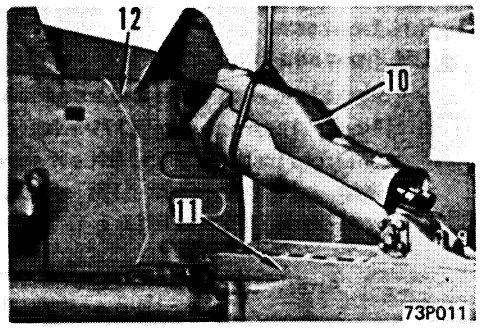


73P010

5. **Tilt cylinder assembly**
Sling tilt cylinder assembly (10) with crane. Disconnect cylinder from straight-frame (11) and blade (12). Lift off tilt cylinder.
★ Be sure to record number of shims removed from spherical joint to blade and thickness of a pack of shims.

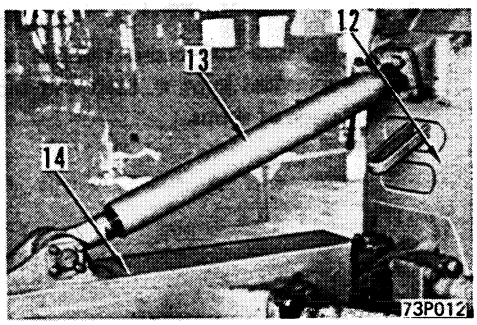
kg Tilt cylinder assembly: **270 kg** (150A C8408~8420, 155A T15001~17000)

245 kg (150A C8421~, 155A T17001~)



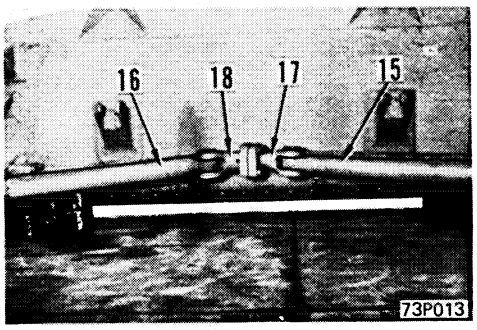
6. **L.H. Tilt brace**
Sling L.H. tilt brace (13) with crane. Disconnect brace from straight-frame (14) and blade (12). Lift off brace.
★ Be sure to record number of shims removed from spherical joint to blade and thickness of a pack of shims.

kg Tilt brace: **85 kg**



7. **R.H. oblique arm**
8. **L.H. oblique arm**
Sling R.H. oblique arm (15) and L.H. oblique arm (16) with crane Disconnect oblique arm from front arms (17) and (18) and from the respective straight-frames. Lift off center frames.
★ Be sure to record number of shims removed from spherical joint to straight-frame and thickness of a pack of shims.

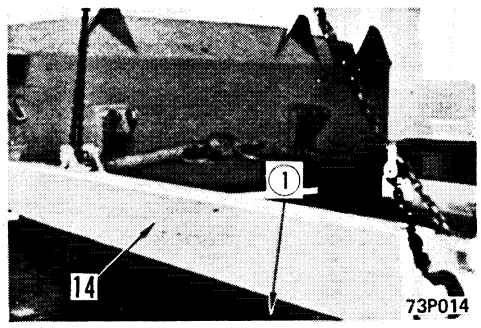
kg Oblique arm: **80 kg**
Front arm: **108 kg**

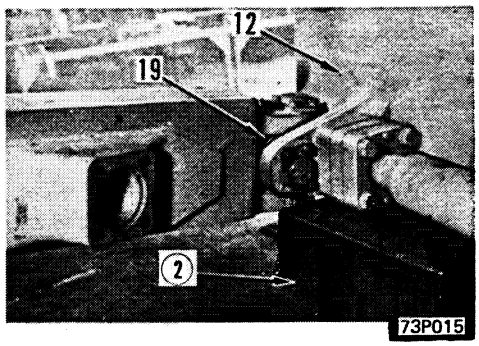


9. **R.H. straight-frame**
10. **L.H. straight-frame**
Sling straight-frame (14) with crane. Disconnect joint (19) from blade (12) and lift off straight-frame.

kg Straight-frame: **700 kg** (150A C8408~8420, 155A T15001~17000)

657 kg (150A C8421~, 155A T17001~)





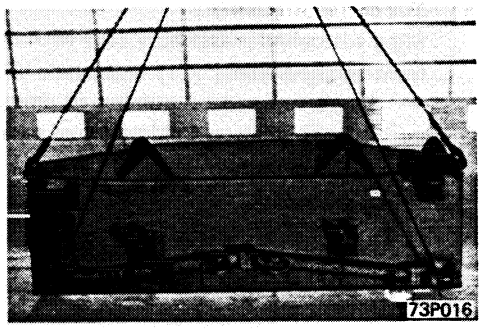
11. R.H. front arm
12. L.H. front arm

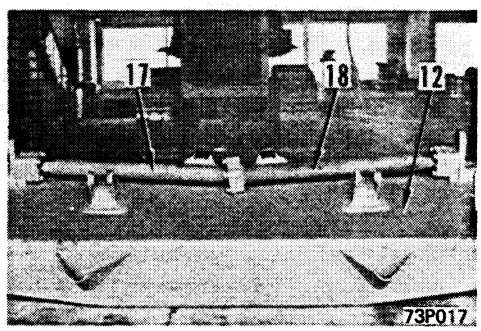
1) Sling blade with crane and turn blade front side down.
2) Sling R.H. front arm (17) with crane. Disconnect front arm from blade (12) and lift off arm.
3) Sling L.H front arm (18) with crane. Disconnect arm from blade (12) and lift it off.

kg Arm: **105 kg** (150A C8408~8420, 155A T15001~17000)

108 kg (150A C8421~, 155A T17001~)

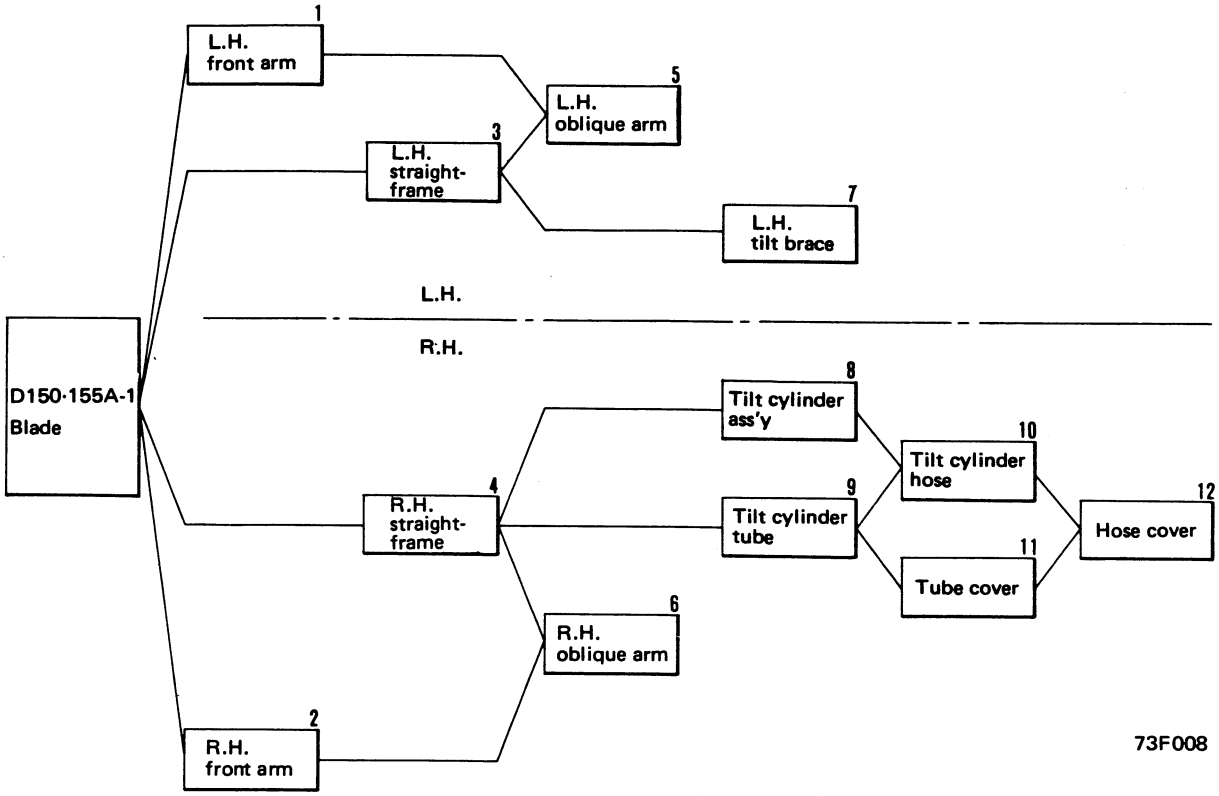
★ Be sure to record number of shims removed from spherical joint at each end of arm and thickness of a pack of shims.



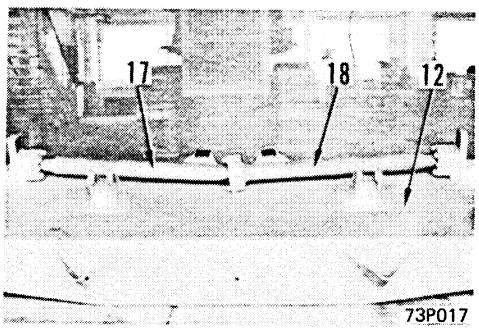


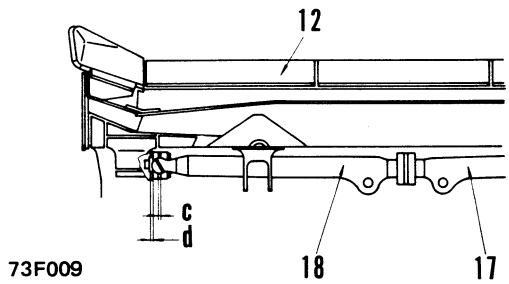
ASSEMBLY OF BLADE 

ASSEMBLY OF BLADE



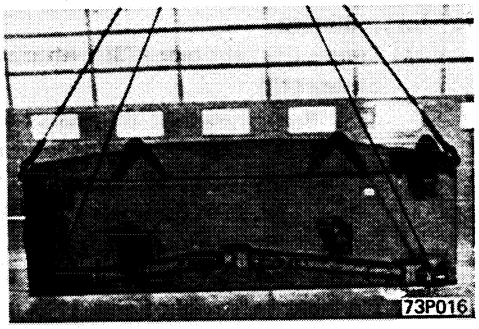
1. **L.H. front arm**
2. **R.H. front arm**
   1) Connect L.H. front arm (18) to blade (12).
   2) Connect R.H. front arm (17) to blade (12) and to L.H. front arm (18).
      - ★ Connect each joint with a pack of shims having the same thickness and composed of the same number of shims as before disassembly. Refer to the illustration below.
      - Adjustment of "c"
        Properly adjust shim thickness "c" so that spherical joint can rotate smoothly with its axial play kept within 1 mm.
        - ★ No shim thickness less than 3 mm is permitted.
      - Adjustment of "d"
        Temporarily put shim of 5 mm thick in place; and more accurate adjustment of shim thickness must be performed when attaching blade assembly to machine.

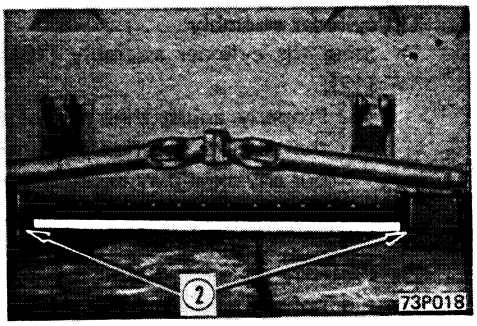


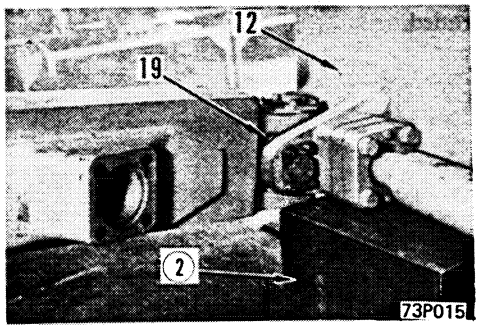


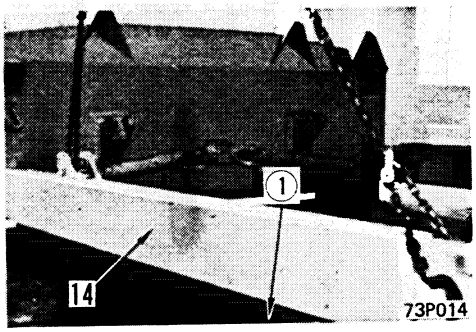
3. L.H. straight-frame

1) Sling blade with crane. Raise blade and support arm mounting portions on blocks ② .
2) Connect joint (19) to L.H. straight-frame (14). Sling straight-frame with crane and connect it to blade (12).
3) Place block ① under I-frame so that the center of trunnion mounting portion of I-frame is raised 630.5 mm above the ground.









4. R.H. straight-frame

Install R.H. straight-frame (11) using the same procedure as used for installation of L.H. straight-frame.

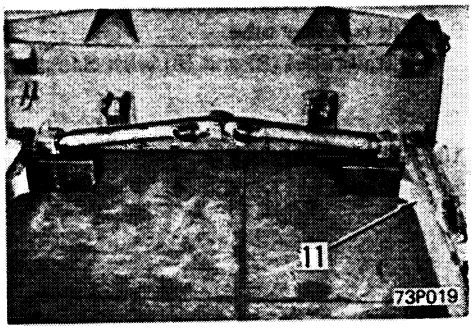
5. L.H. center brace

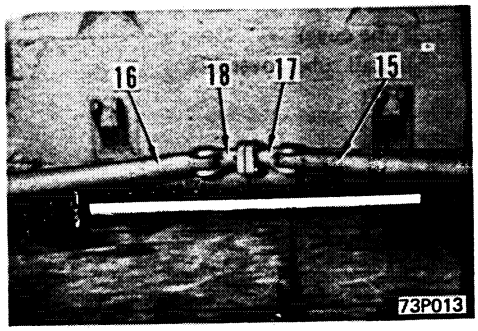
6. R.H. center brace

Sling L.H. oblique arm (16) and R.H. oblique arm (15) with crane. Install L.H. oblique arm between arm (18) and straight-frame (14).

Install R.H. oblique arm between arm (17) and straight-frame (11).

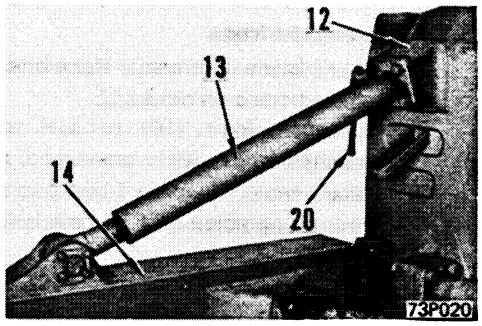
★ Properly adjust thickness of shim in spherical joint so that smooth rotation of joint can be maintained without any axial play exceeding 1 mm.
  ★ No shim thickness less than 3 mm is permitted. (Standard: 4 mm)
★ If pin holes do not come into alignment with connecting a brace to arm, try to swing straight-frame right or left.





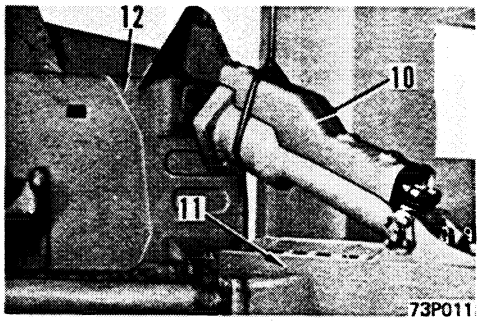
7. L.H. tilt brace

1) Sling L.H. tilt brace (13) with crane and connect brace to blade (12).
   - ★ Properly adjust thickness of shim in spherical joint so that smooth rotation of joint can be maintained without any axial play exceeding 1 mm.
     - ★ No shim thickness less than 3 mm is permitted. (Standard: 4 mm)
2) Turn brace with handle (20) to align brace pin hole with pin hole in straight-frame (14). Insert joint pin in holes.



8. Tilt cylinder assembly

1) Sling tilt cylinder assembly (10) and connect it to blade (12).
   - ★ Properly adjust thickness of shim in spherical joint so that smooth rotation of joint can be maintained without any axial play exceeding 1 mm.
     - ★ No shim thickness less than 3 mm is permitted. (Standard: 4 mm)
2) Protrude piston rod with a bar to align rod pin hole with pin hole in straight-frame (11). Insert joint pin in holes.
   - ★ Prepare a vessel suitable to receive oil which may spill from cylinder when piston rod is protruded.

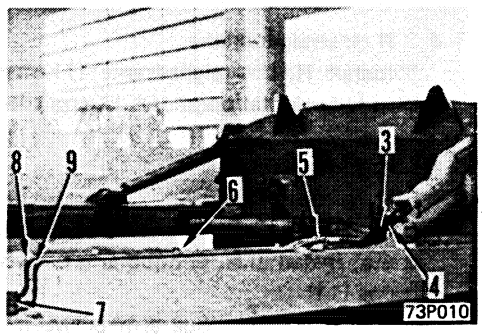


9. Tilt cylinder tube

Install tubes (8) and (9) with clamps (5), (6) and (7).

10. Tilt cylinder hose

Install hoses (3) and (4).

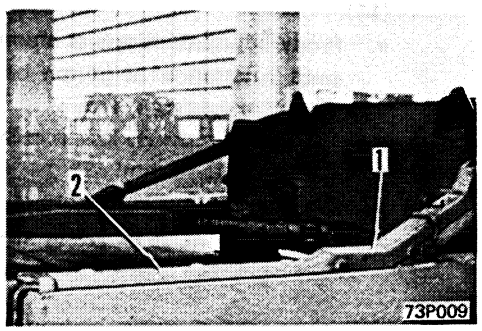


11. Tube cover

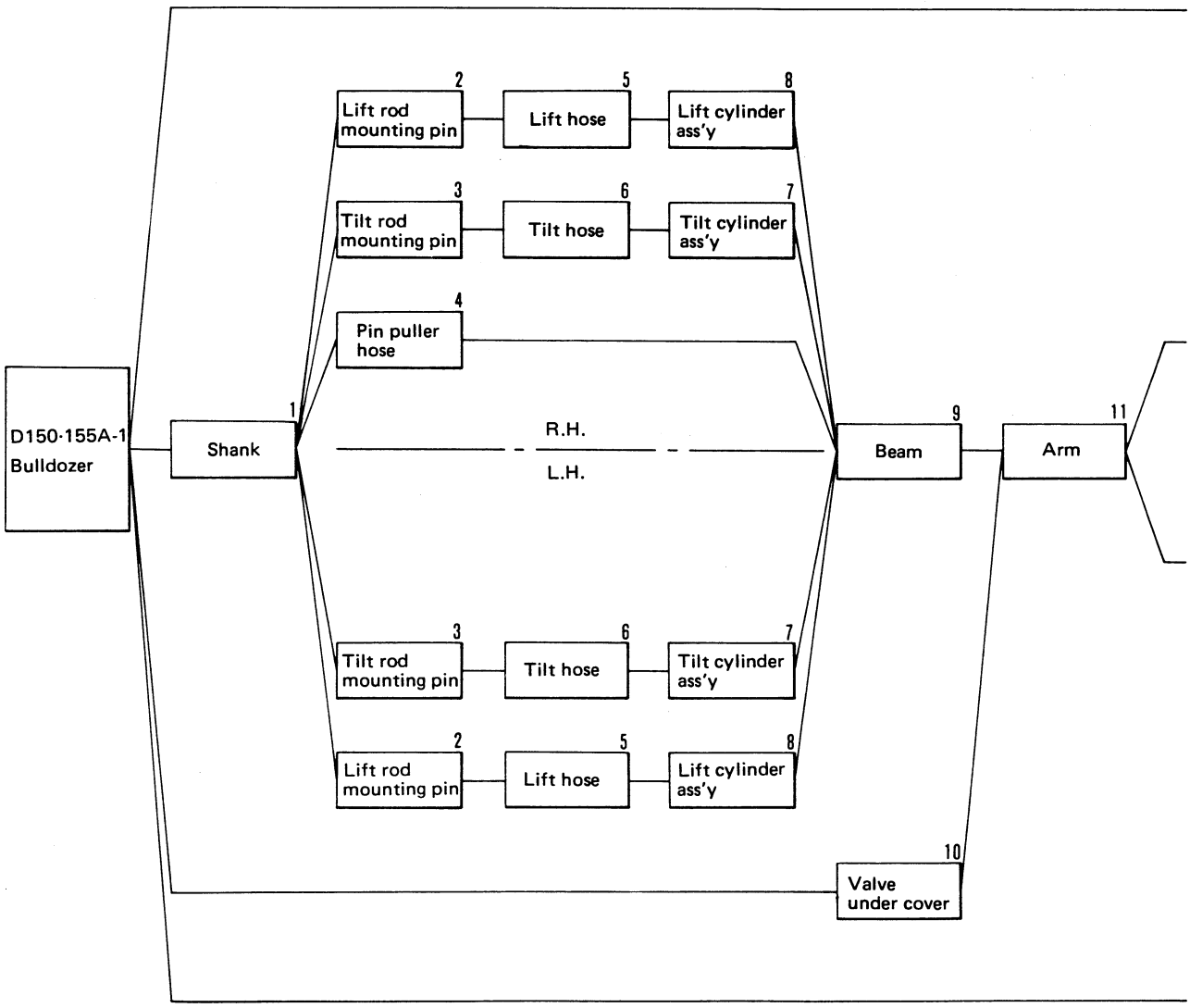
Install tube cover (2).

12. Hose cover

Install hose cover (1).



DISASSEMBLY OF RIPPER

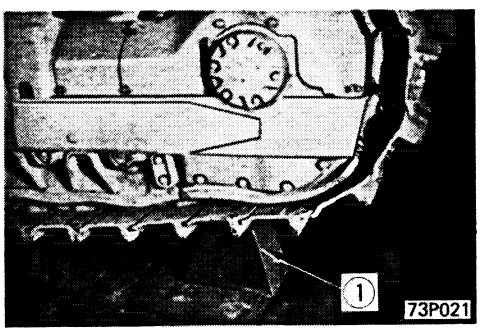


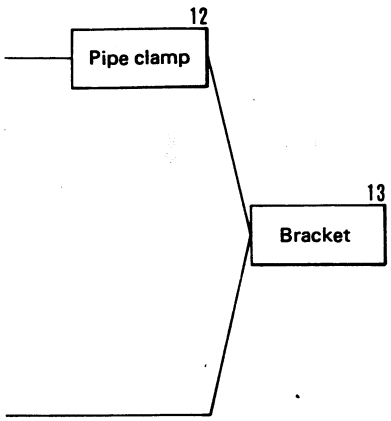
Special tools required

Special tools required		A
790-102-1100	Power wrench (16 times)	1

1. Shank

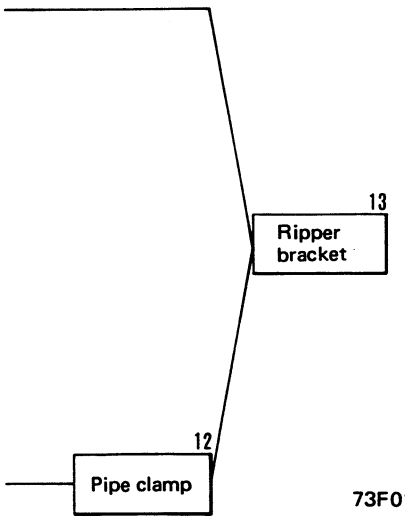
1) Raise rear side of machine by lowering ripper shanks onto the ground. Support shoe under sprocket shaft on block ① of approx. 300 mm high.





R.H.

L.H.

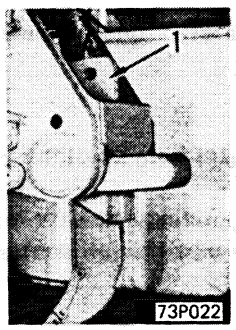


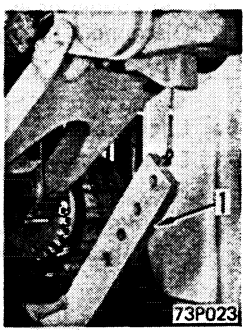
73F010

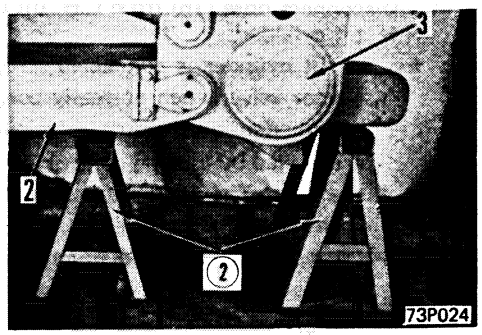
2) Sling shank with wire rope applied to hook at the tip of shank. Operate pin puller cylinder to pull out pin. Operate both ripper control lever and crane to remove shank (1).

kg Shank: **450 kg**

3) Support ripper assembly on blocks ② of approx. 700 mm high positioned under arm (2) and beam (3).



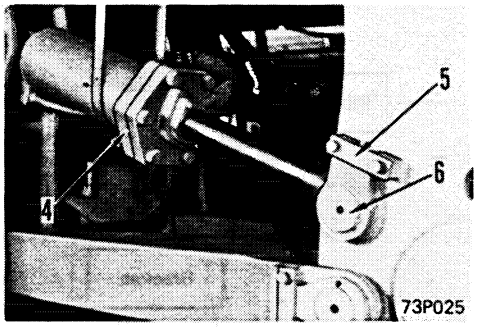




2. Lift rod mounting pin

Sling lift cylinder assembly (4) with crane. Remove lock plate (5) and pull out piston rod mounting pin (6). Start engine, retract piston rod fully, and lower cylinder assembly onto arm.

kg Lift rod mounting pin: **25 kg**

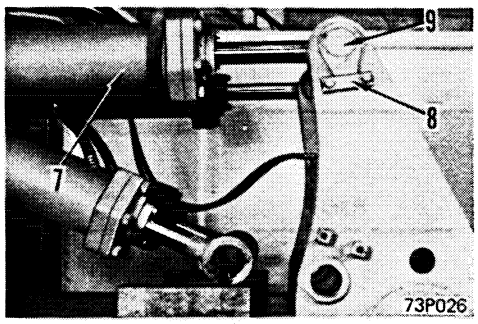


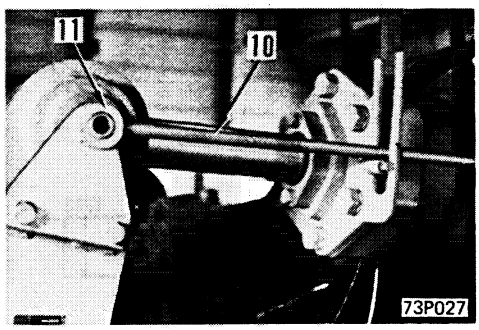
3. Tilt rod mounting pin

Sling tilt cylinder assembly (7) with crane. Remove lock plate (8) and pull out piston rod mounting pin (9). Start engine, retract piston rod fully, and lower cylinder assembly onto lift cylinder.

kg Tilt rod mounting pin: **14 kg**

★ R.H. tilt cylinder is provided with leveler (10). Before removing pin, remove snap ring (11) and leveler (10).





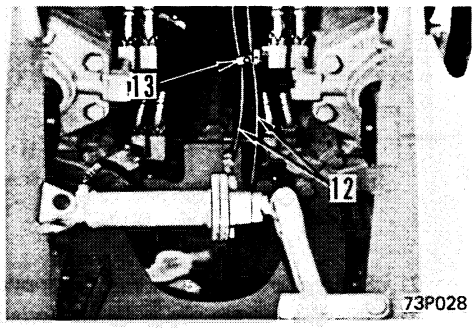
4. Pin puller hose

Disconnect hose (12) from pin puller cylinder. Remove clamp (13).

5. Lift hose

Disconnect hose (14) from L.H. lift cylinder and hose (15) from R.H. lift cylinder.

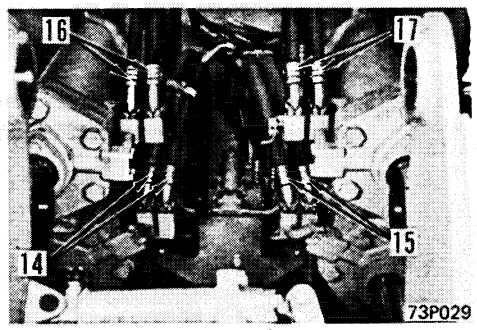
★ Before disconnecting hoses, try moving ripper control lever repeatedly to expel residual pressure from cylinders.



6. Tilt hose

Disconnect hose (16) from L.H. tilt cylinder and hose (17) from R.H. tilt cylinder.

★ As tilt cylinder is connected to hydraulic circuit through selector valve which normally connects hydraulic circuit to lift cylinder, oil pressure remaining in tilt cylinder cannot be expelled by moving control lever repeatedly after engine is stopped. Therefore, oil under pressure will spurt out whe when hoses are disconnected from cylinder. Before engine is stopped, protruding piston rod a little after rod is once retracted fully will be effective for decreasing residual pressure.



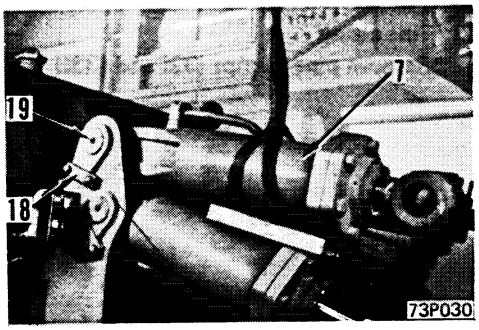
7. Tilt cylinder assembly

Sling tilt cylinder assembly (7). Remove lock plate (18), pull out cylinder bottom mounting pin (19), and lift off tilt cylinder assembly.

kg Tilt cylinder bottom mounting pin: **16 kg**

kg Tilt cylinder assembly: **310 kg** (150A C8406~8420, 155A T15001~17000)

283 kg (150A C8421~, 155A T17001~)



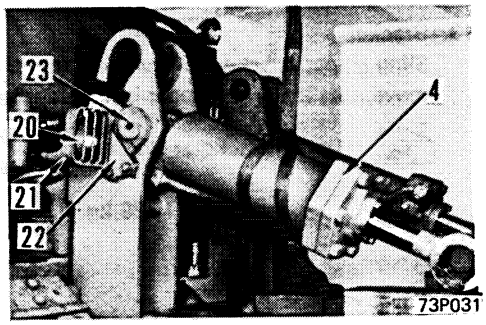
8. Lift cylinder assembly

1) Disconnect wire from rear lamp (20). Remove nut fastening rear lamp; remove rear lamp.
2) Remove rear lamp guard (21).
   ★ Remove rear lamp only when L.H. lift cylinder assembly is to be removed.
3) Sling lift cylinder assembly (4) with crane. Remove lock plate (22), pull out cylinder bottom mounting pin (23), and lift off lift cylinder assembly.

kg Lift cylinder bottom mounting pin: **16 kg**

kg Lift cylinder assembly: **290 kg** (150A C8408~8420, 155A T15001~17000)

270 kg (150A C8421~, 155A T17001~)



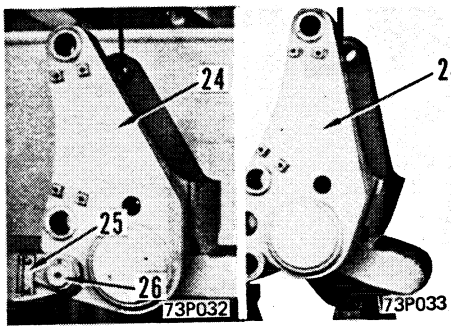
9. Beam

Sling beam (24) with crane. Remove lock plate (25), pull out beam mounting pin (26), and lift off beam.

kg Beam mounting pin: **29 kg**

kg Beam: **1135 kg** (150A C8408~8420, 155A T15001~17000)

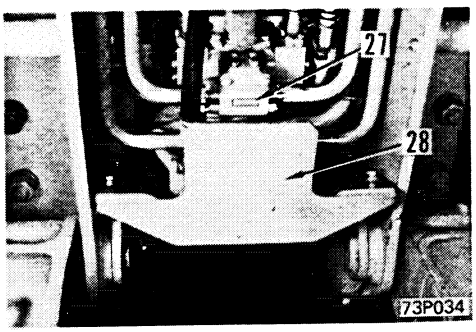
1186 kg (150A C8421~, 155A T17001~)



10. Valve under cover

Remove under cover (28) for ripper selector valve (27).

kg Valve under cover: **31 kg**



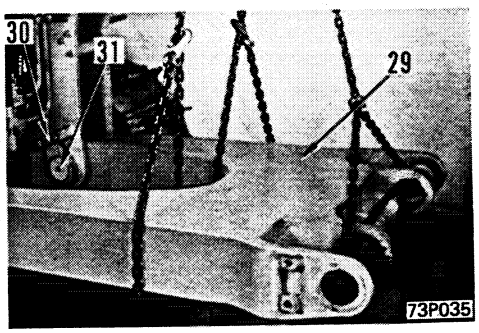
11. Arm

Sling arm (29). Remove lock plate (30), pull out arm mounting pin (31), and lift off arm.

kg Arm mounting pin: **33 kg**

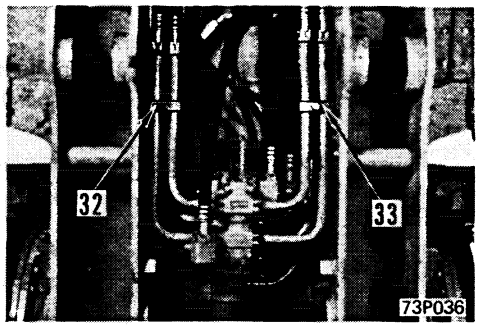
kg Arm: **475 kg** (150A C8408~8420, 155A T15001~17000)

690 kg (150A C8421~, 155A T17001~)



12. Pipe clamp

Remove pipe clamps (32) and (33).

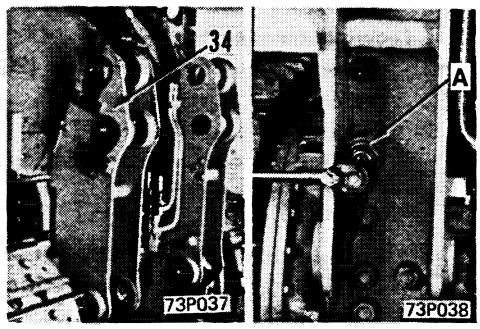


13. Bracket

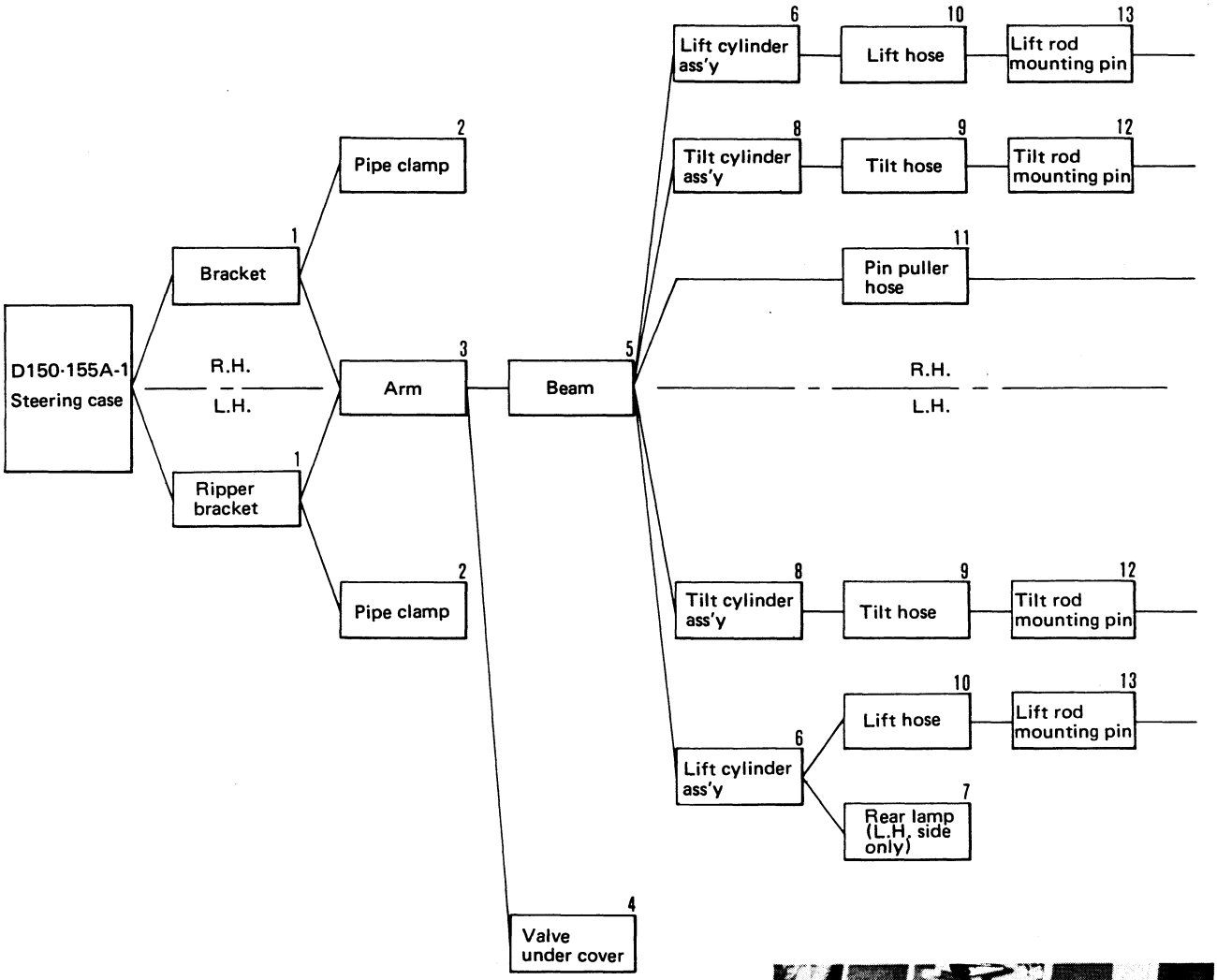
Sling ripper bracket (34) with crane. Using toggle wrench A, remove nuts fastening ripper bracket; remove bracket.

kg Ripper bracket: **350 kg** (150A C8408~8420, 155A T15001~17000)

290 kg (150A C8421~, 155A T17001~)

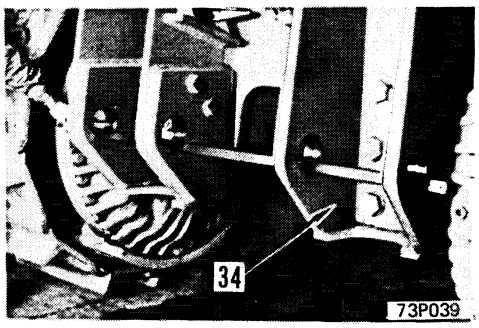


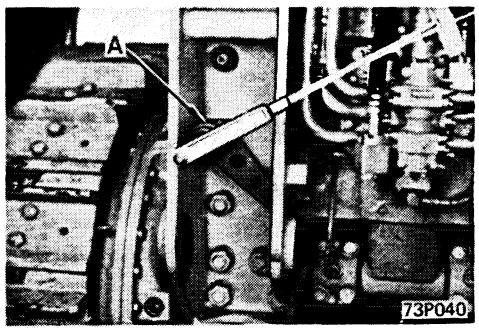
ASSEMBLY OF RIPPER



Special tools required

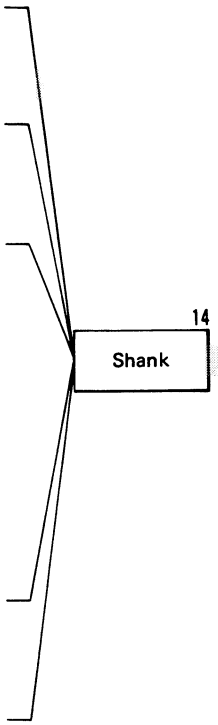
Special tools required		A
790-102-1100	Power wrench (16-times)	1



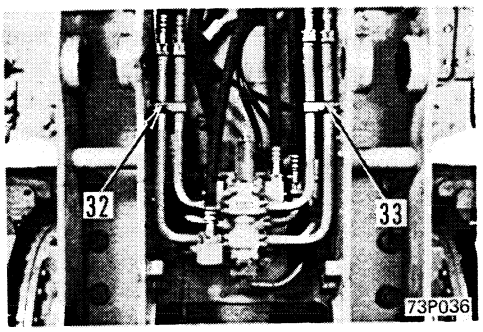


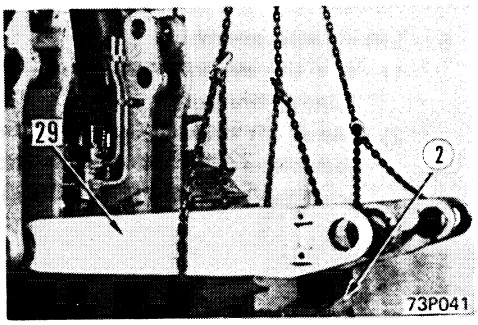
1. **Bracket**
   1) Lift ripper bracket (34) into position on steering case and loosely tighten nuts.
   2) Properly locate right and left arm mounting pin holes in bracket using straightedge (or scale).
   3) Using power wrench A, fully tighten bracket mounting nuts.

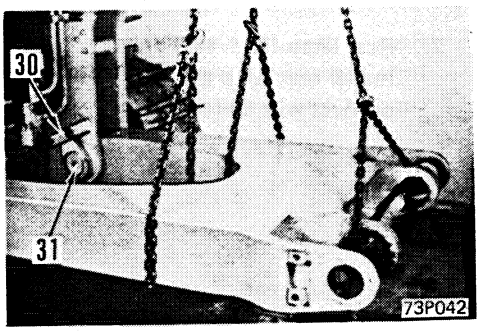
   kgm Mounting nut: **400 ± 40 kg.m**



73F011







2. Pipe clamp

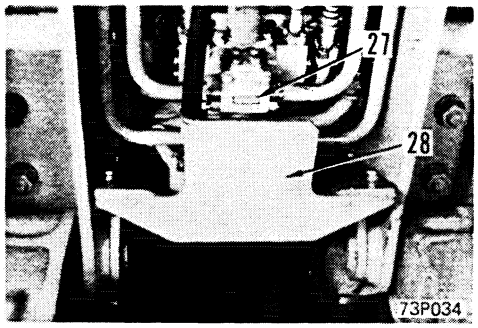
Install pipe clamps (32) and (33).

3. Arm

1) Lift arm (29) into position on ripper bracket.
2) Install right and left arm mounting pins (31) and lock them with lock plates (30).
   ★ Coat pin with grease (G2-LI).
3) Support arm on block ② of approx. 700 mm high.

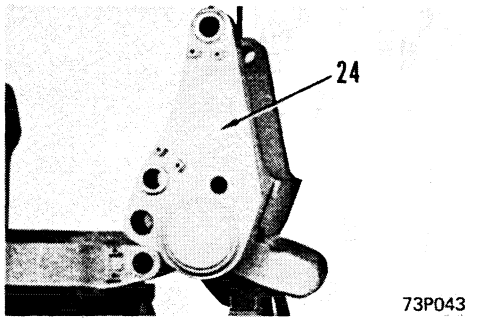
4. Valve under cover

Install under cover (28) for ripper selector valve (27).

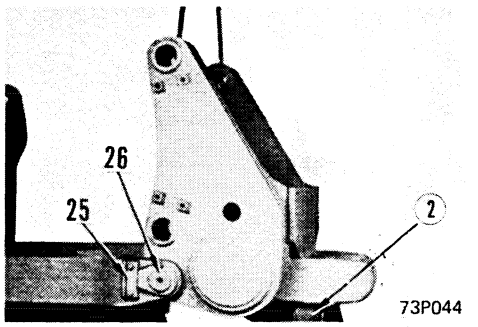


5. Beam

1) Lift beam (24) into position on arm.

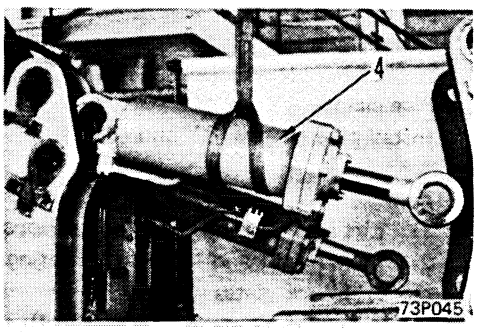


2) Install right and left beam mounting pins (26) and lock them with lock plates (25).
   ★ Coat pins with grease (G2-LI).
3) Support beam on block ② of approx. 700 mm high placed under beam.



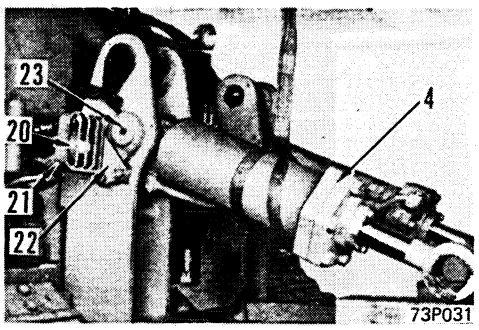
6. Lift cylinder assembly

1) Lift lift cylinder assembly (4) into cylinder bottom side joint on bracket.
2) Install lift cylinder bottom mounting pin (23), lock it with lock plates (22), and lower cylinder assembly (4) on arm.
   ★ Coat pin with grease (G2-LI).



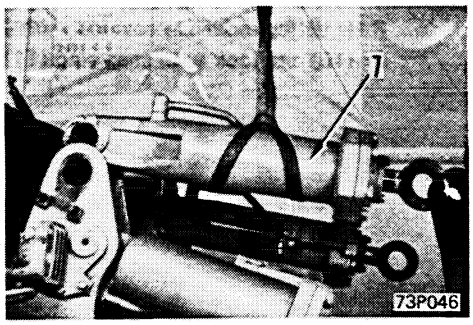
7. Rear lamp (L.H. side only)

Install rear lamp guard (21). Install rear lamp (20) with nuts and connect wire to rear lamp.

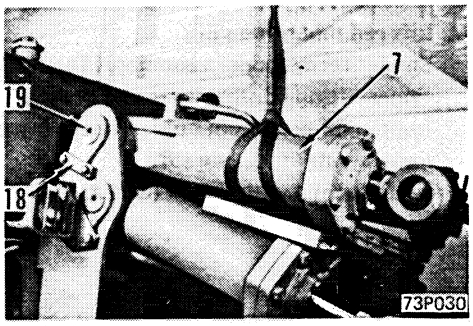


8. Tilt cylinder assembly

1) Lift tilt cylinder assembly (7) into tilt cylinder bottom side joint on bracket.

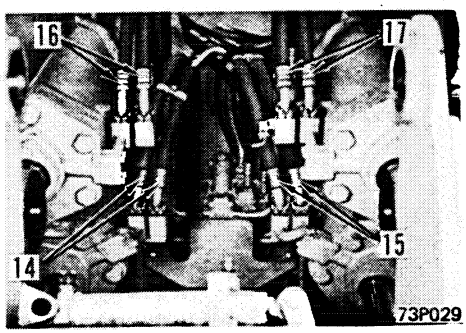


2) Install tilt cylinder bottom mounting pin (19), lock it with lock plate (18), and lower cylinder assembly (7) on lift cylinder.
   ★ Coat pin with grease (G2-LI).



9. Tilt hose

Connect L.H. tilt hose (16) and R.H. tilt hose (17), with O-ring in each flange face, to tilt cylinders.

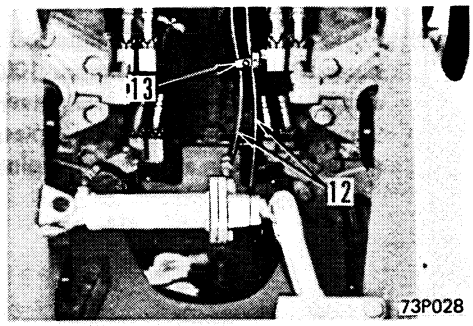


10. Lift hose

Connect L.H. Lift hose (14) and R.H. lift hose (15), with O-ring in each flange face, to lift cylinders.

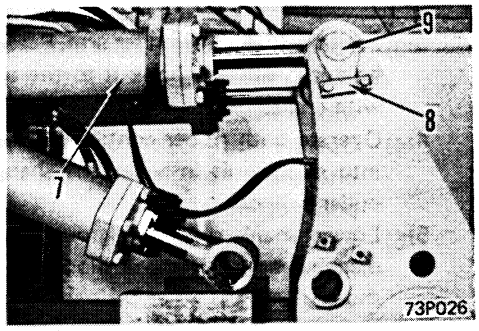
11. Pin puller hose

Connect hose (12) to pin puller cylinder and install clamp (13) on R.H. tilt cylinder.

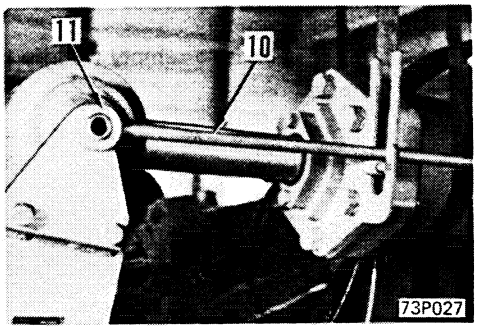


12. Tilt rod mounting pin

Sling tilt cylinder assembly (7). Start engine. Operate both ripper tilting control lever and crane to align tilt cylinder piston rod pin hole with pin hole in beam, insert pin (9) into holes, and lock it with lock plate (8).
   ★ Coat pin with grease (G2-LI).



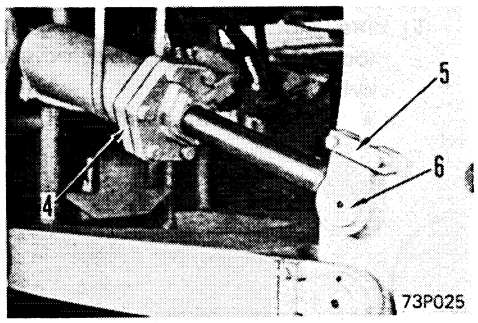
★ R.H. tilt cylinder is provided with leveler (10). Install leveler (10) and lock with snap ring (11).



13. Lift rod mounting pin

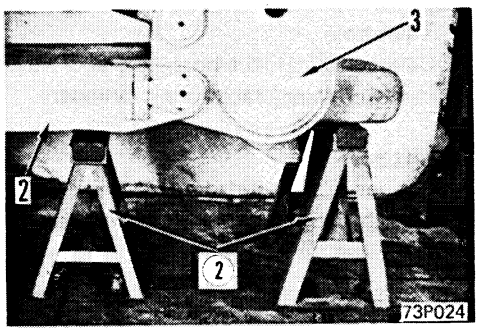
Sling lift cylinder assembly (4). Start engine. Operate both ripper lifting control lever and crane to align lift cylinder piston rod pin hole with pin hole in beam, insert pin (6) into holes, and lock it with lock plate (5).

★ Coat pin with grease (G2-LI).

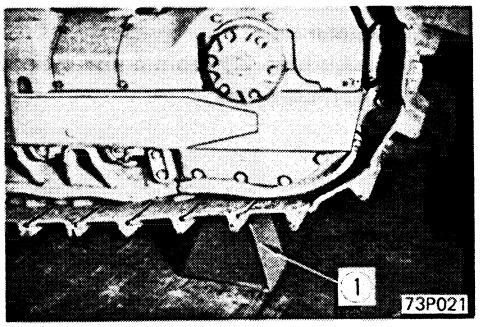


14. Shank

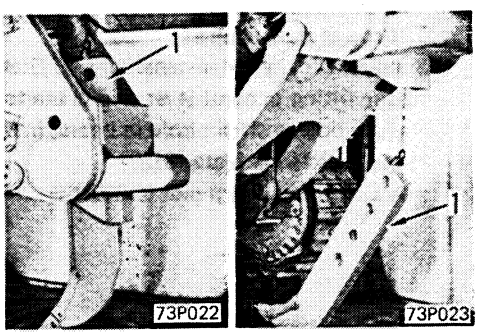
1) Start engine and raise ripper. Remove blocks ② from under arm (2) and beam (3).



2) Prepare two blocks ① (approx. 300 mm high) to support shoes. Place block of approx. 1000 mm high under each arm and lower ripper to raise the rear side of machine body. Support each shoe on block ① placed under sprocket shaft.
★ Machine can also climb the blocks ① by backing.



3) Position shank (1) under arm. Pass wire rope through shank hole in beam and hook it to the top of shank. Sling shank with crane.
4) Operate both ripper control lever and crane to insert shank into shank hole in beam. Fix shank into position with pin puller cylinder.
5) Lower shank onto the ground to raise the rear side of machine body. Remove blocks ① from the underside of shoes.



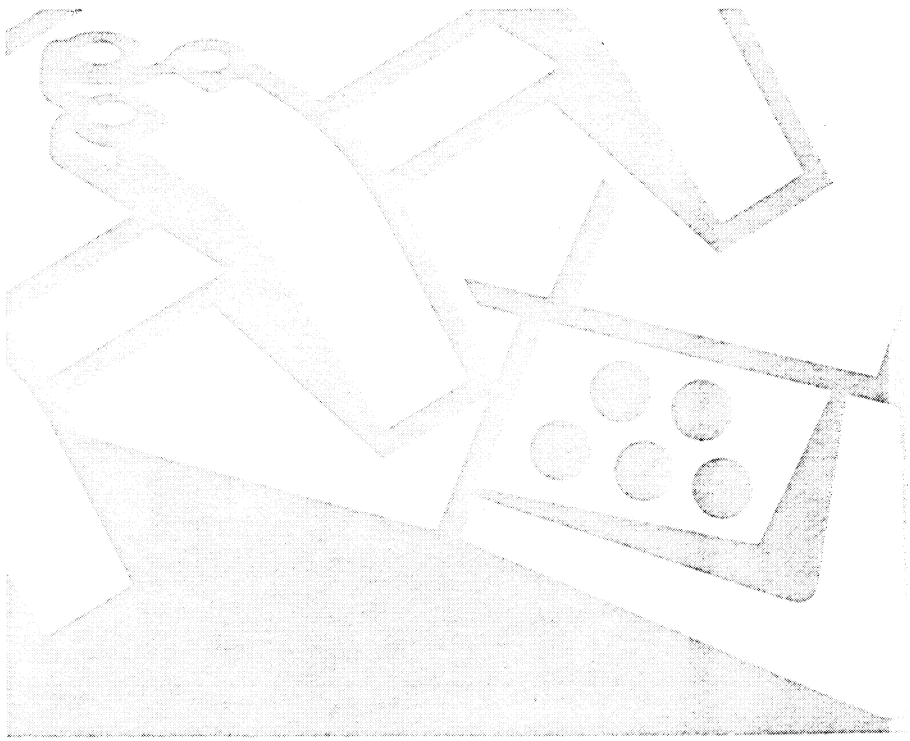
SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

74 WORK EQUIPMENT

MAINTENANCE STANDARD



TORQUE SPECIFICATIONS FOR NUTS AND BOLTS

Nuts and bolts should be tightened to torque values shown below.

Unit: kg.m

Nominal bolt dia. (mm)	Width across flats (mm)	Ⓣ	Ⓑ
		Desired value	Allowable range
6	10	1.35	1.2~1.5
8	13	3.2	2.8~3.5
10	17	6.7	6~7.5
12	19	11.5	10~12.5
14	22	18	16~20.0
16	24	28.5	25~31.5
18	27	39	35~43.5
20	30	56	50~62.0
22	32	76	67.5~84.5
24	36	94.5	84~105
27	41	135	120~150
30	46	175	155~195
33	50	225	200~250
36	55	280	250~310
39	60	335	295~370

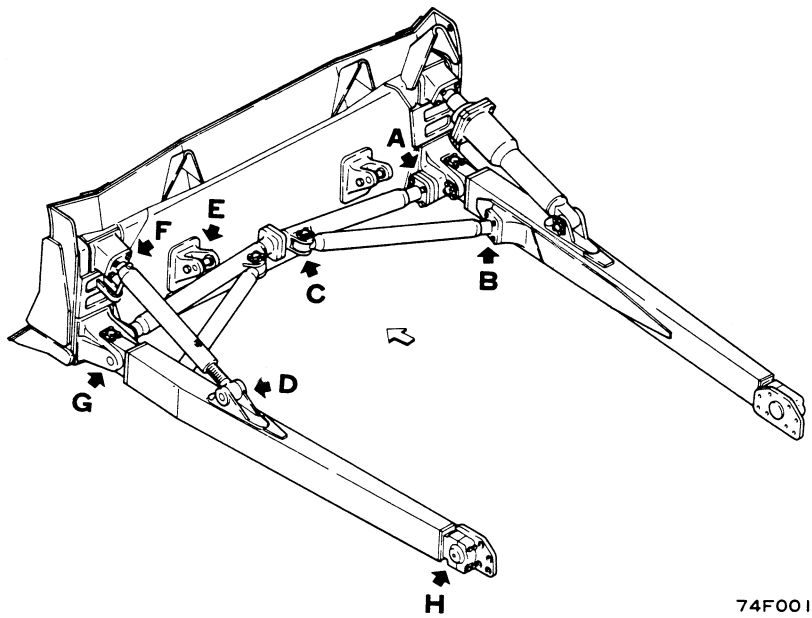
The above table indicates the cases where a torque wrench is employed.

MAINTENANCE STANDARD

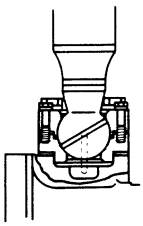
STRAIGHT TILT DOZER
(1) Blade, frame, arm and cylinder yoke 74-2
(2) Cutting edge and end bit 74-4
MULTI RIPPER 74-6
GIANT RIPPER 74-8

STRAIGHT TILT DOZER

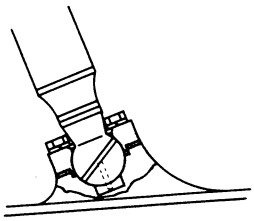
(1) Blade, frame, arm, cylinder yoke



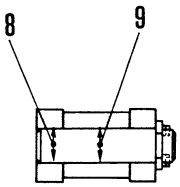
74F001



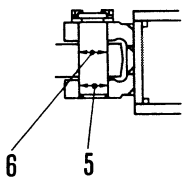
Detail A



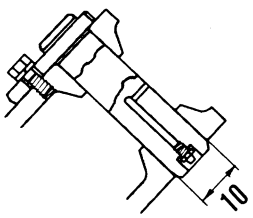
Detail B



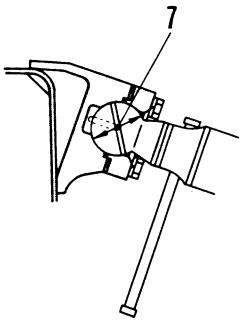
Detail C



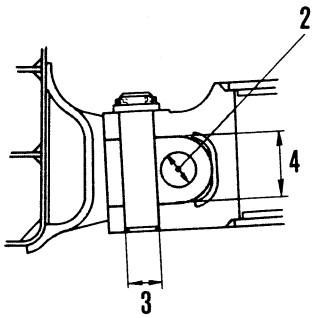
Detail D



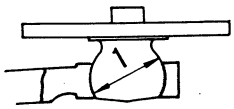
Detail E



Detail F



Detail G



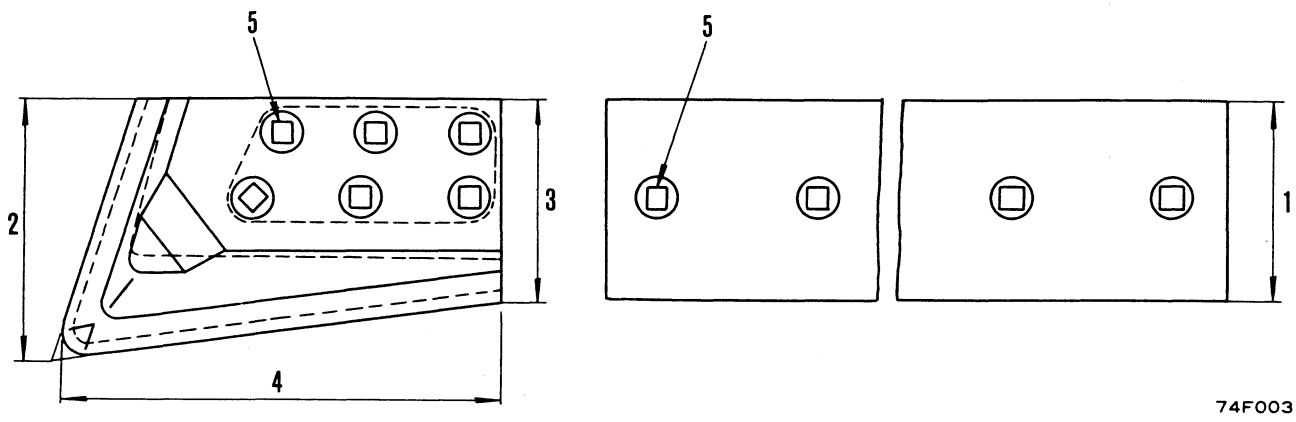
Detail H

74F002

Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Spherical clearance between trunnion cap and trunnion	C8408 ~ T15001 ~	160	−0.5 −1.0	+0.5 0	0.5~1.5	10	Replace
2	Clearance between frame pin and joint	C8408 ~ T15001 ~	70	−0.5 −0.6	+0.3 0	0.5~0.9	3	
3	Clearance between blade pin and joint	C8408 ~ T15001 ~	70	−0.5 −0.6	+0.3 0	0.5~0.9	3	
4	Clearance between blade bracket and joint, and between frame and joint	C8408~ T15001~	140	−0.2 −0.7	+0.8 +0.3	0.5~1.5	3	
5	Clearance between brace pin and bracket	C8408 ~ T15001 ~	60	−0.3 −0.5	+0.5 +0.2	0.5~1.0	2	
6	Clearance between brace pin and brace	C8408 ~ T15001 ~	60	−0.3 −0.5	+0.5 +0.3	0.6 ~ 1.0	2	
7	Clearance between arm spheres and cap	C6842 ~ T10263 ~	115	−0.2 −0.3	+0.3 0	0.2~0.6	1	Adjust or replace the shim
8	Clearance between arm pin and blade bracket	C8408 ~ T15001 ~	60	−0.3 −0.5	+0.5 +0.2	0.5 ~ 1.0	2	Replace
9	Clearance between arm pin and arm lever	C8408 ~ T15001 ~	60	−0.3 −0.5	+0.5 +0.3	0.6 ~ 1.0	2	Replace
10	Clearance between cylinder piston rod pin and bracket	C8408 ~ T15001 ~	50	−0.2 −0.3	+0.5 +0.1	0.3~0.8	2	
11	Clearance between cylinder yoke and bushing	C8408 ~ T15001 ~	125				0.5	
12	Clearance between cylinder yoke and bushing	C8408 ~ T15001 ~	100				0.5	
13	Clearance between lift cylinder support shaft and bushing	C8408 ~ T15001 ~	85	−0.120 −0.207			0.5	

(2) Cutting edge · End bit

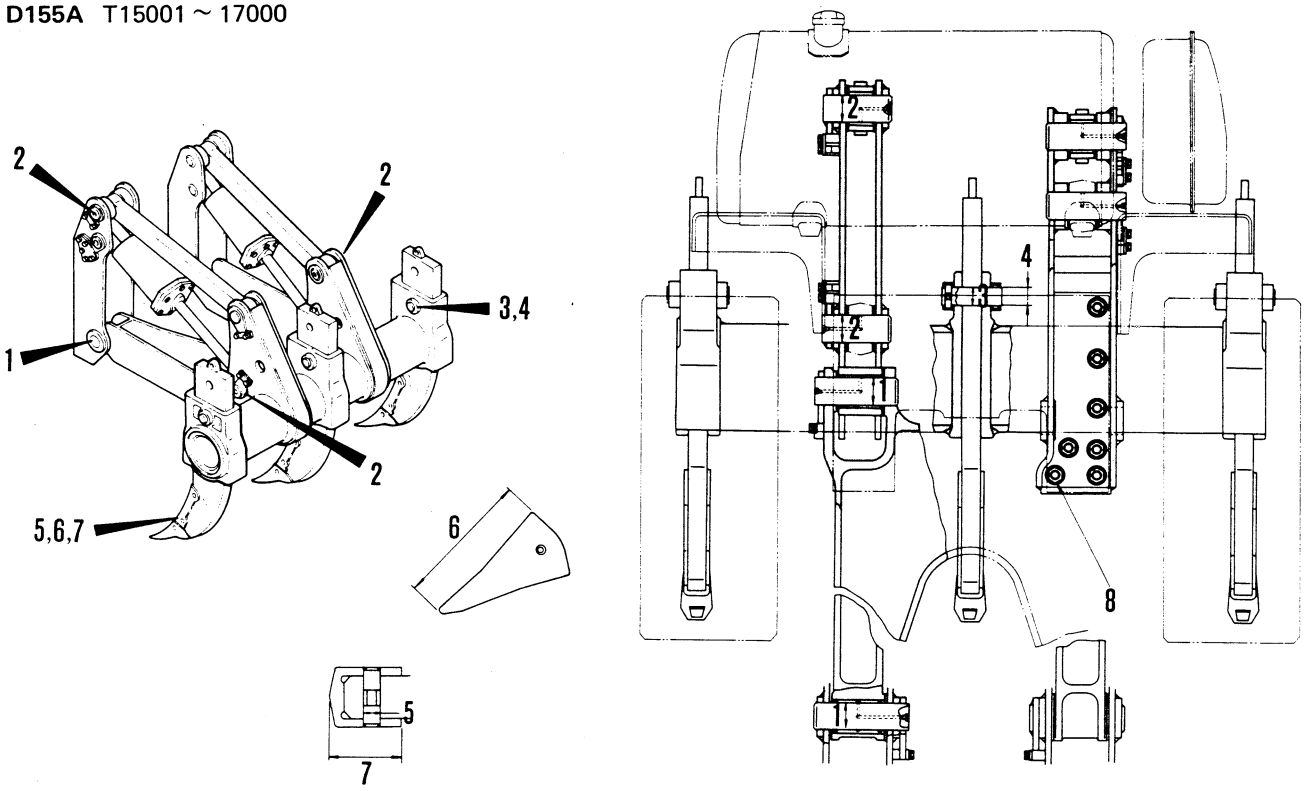


Unit: mm

No.	Check item	Criteria			Remedy
1	Cutting edge height	Serial No.	Standard size	Repair limit	Replace or turn (up to 175 after turned)
		C5501~ T5501~	254	215 (175 after turned)	
2	End bit (out side) height	C8329~ T10263~	315	235	Replace
3	End bit (inside) height	C5501~ T5501~	254	215	
4	End bit width	C8329~ T10263~	540	440	
5	Tightening torque for mounting bolts	5501~7190 7191~	64.2~86.8 kg.m 75.3~101.9 kg.m		

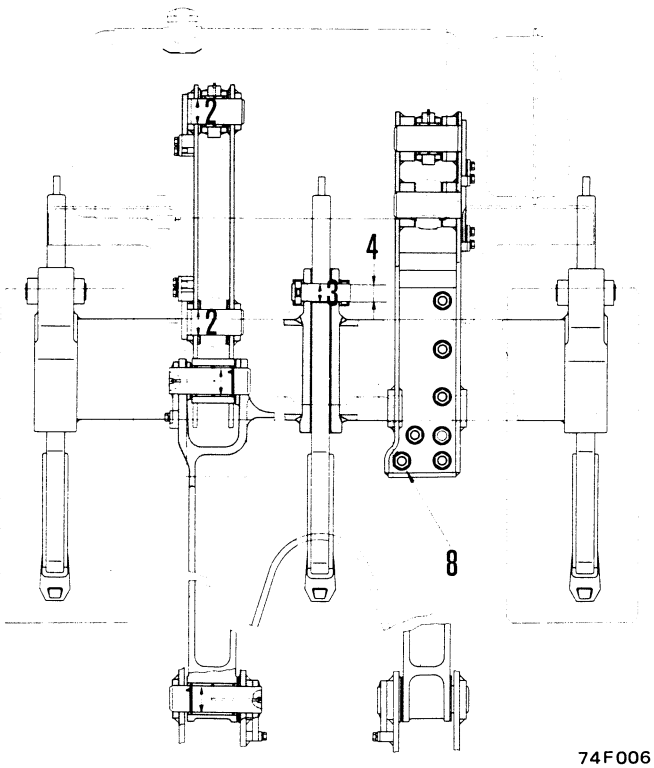
MULTI RIPPER

D150A C8408 ~ 8420
D155A T15001 ~ 17000



74F004

D150A C8421 and up
D155A T17001 and up



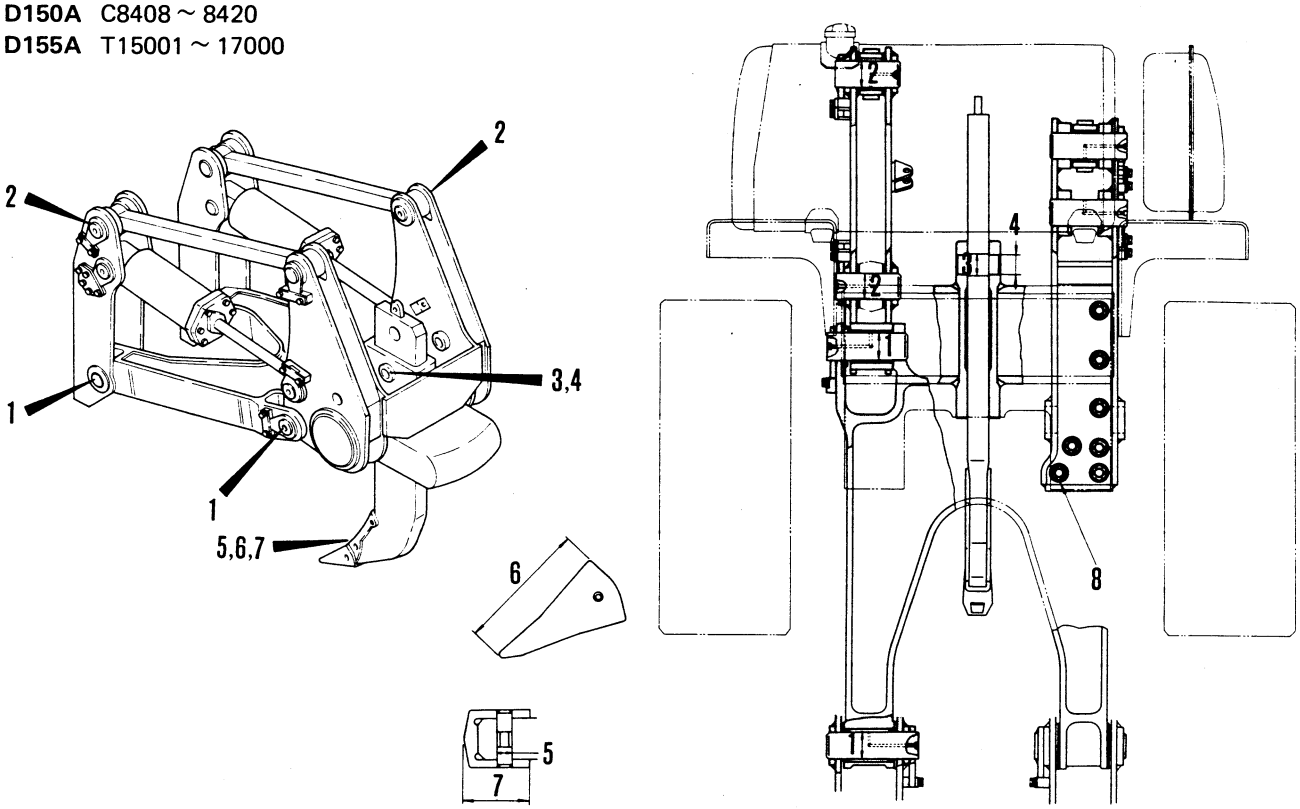
74F006

Unit: mm

No.	Check item	Criteria						Remedy
		Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	
				Shaft	Hole			
1	Clearance between arm mounting pin and bushing	5501~	110	−0.036 −0.090	+0.207 +0.120	0.156~ 0.297	1.5	Replace
2	Clearance between ripper cylinder and mounting pin	5501~	110	−0.036 −0.090	+0.207 +0.120	0.156~ 0.297	1.5	
3	Clearance between shank and mounting pin	5501~	75 80	+0.3 −0.3	+1.0 −1.0	3.7~6.3	15	
4	Clearance between shank holder and pin	5501~	75 76	+0.3 −0.3	+0.3 −0.3	0.4~1.6	10	
5	Clearance between point and pin	5501~	24.5 25	0 −0.1	+0.25 −0.20	0.3 ~ 0.85		
6	Point wear	Serial No.		Basic size		Service limit		
		5501~		335		225		
7	Protector wear	5501~		115		90		
8	Ripper bracket mounting nut tightening torque	360~440 kg.m						

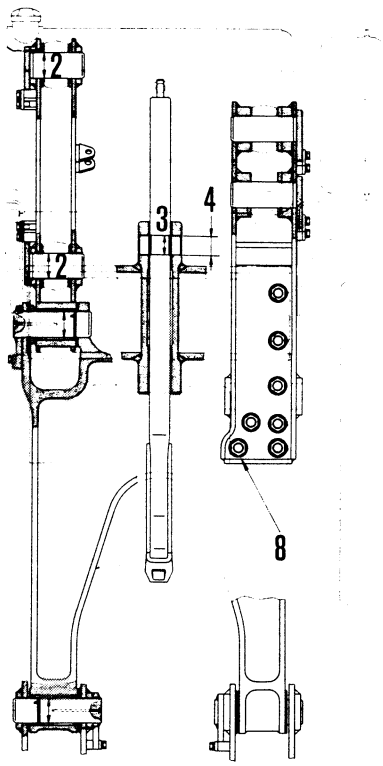
GIANT RIPPER

D150A C8408 ~ 8420
D155A T15001 ~ 17000



74F005

D150A C8421 and up
D155A T17001 and up

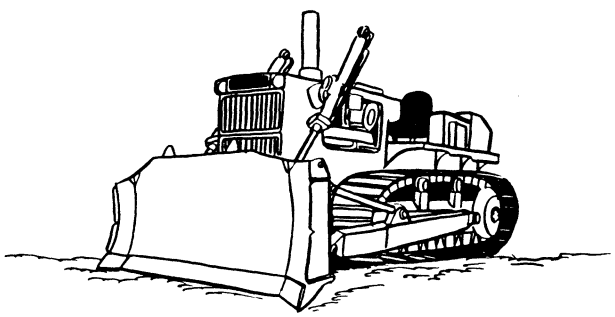


74F007

Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between arm mounting pin and bushing	Serial No.	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
				Shaft	Hole			
		5501~	110	−0.036 −0.090	+0.207 +0.120	0.156~ 0.297	1.5	
2	Clearance between ripper cylinder and mounting pin	5501~	110	−0.036 −0.090	+0.207 +0.120	0.156~ 0.297	1.5	
3	Clearance between shank and mounting pin	5501~	80 80	+0.3 −0.3	+1.0 −1.0	6.7~9.3	15	
4	Clearance between shank holder and pin	5501~	80 82	+0.3 −0.3	+0.3 −0.3	1.4~2.6	10	
5	Clearance betwen point mounting pin and point	5501~	24.8 25	0 −0.1	+0.25 −0.20	0.3 ~ 0.85		
6	Point wear	Serial No.		Standard size		Service limit		
		5501~		335		225		
7	Protector wear	5501~		115		90		
8	Ripper bracket mounting nut tightening torque	360~440 kg.m						

MEMO



SHOP MANUAL

D150,155A-1

Serial No. D150A-1 8408 and up
D155A-1 15001 and up

90 OTHERS

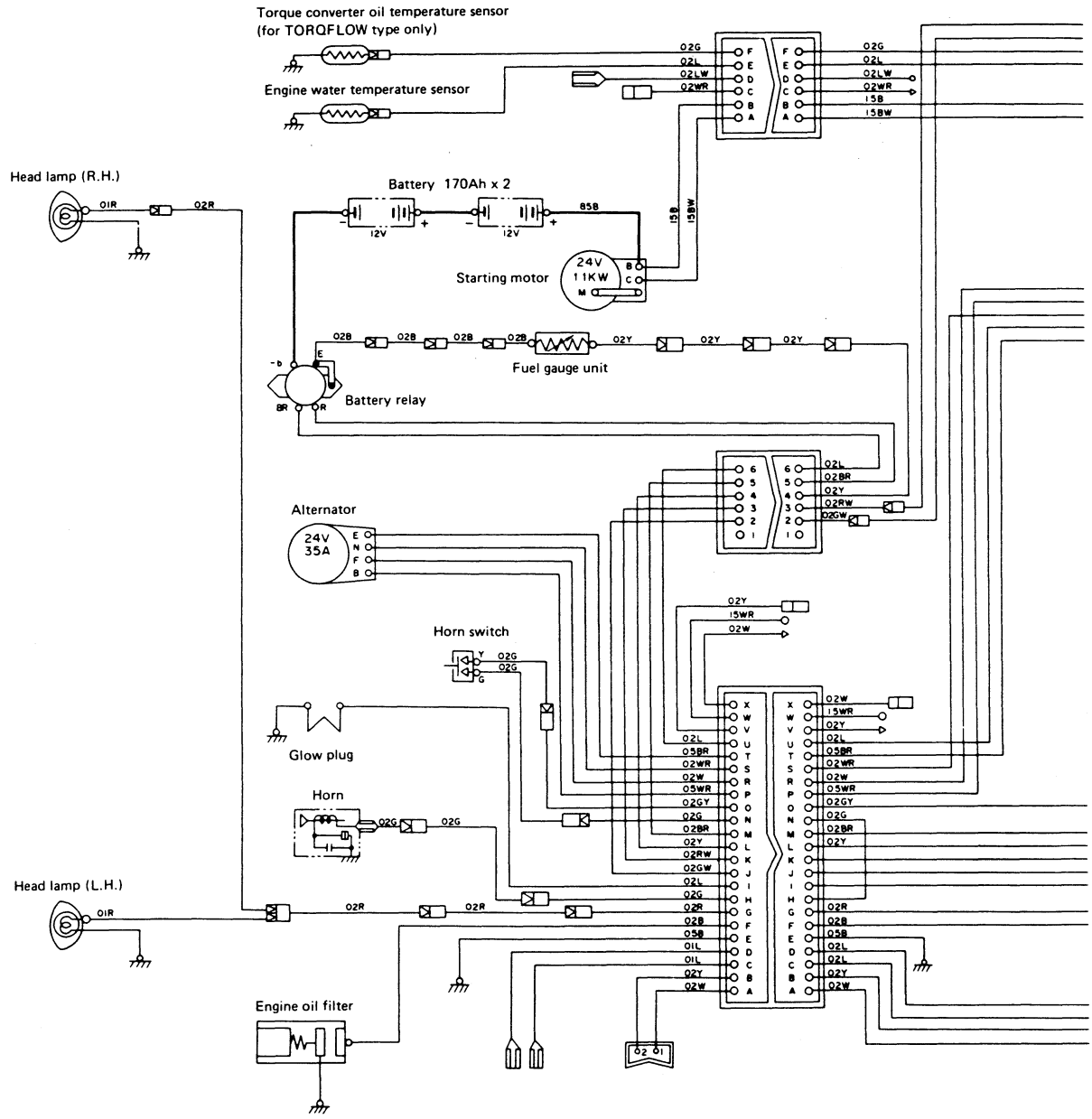
ELECTRICAL SYSTEM

ELECTRICAL SYSTEM

Electrical circuit diagram 90- 2
Electrical wiring diagram 90- 8
Warning module 90-11
Corrective action to be taken when
warning module is activated 90-12
A.P.S. (Automatic Priming System) 90-14

ELECTRICAL CIRCUIT DIAGRAM

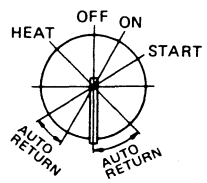
- D150, 155-1
- D150A C8408 ~ C8420
- D155A T15001 ~ T17000



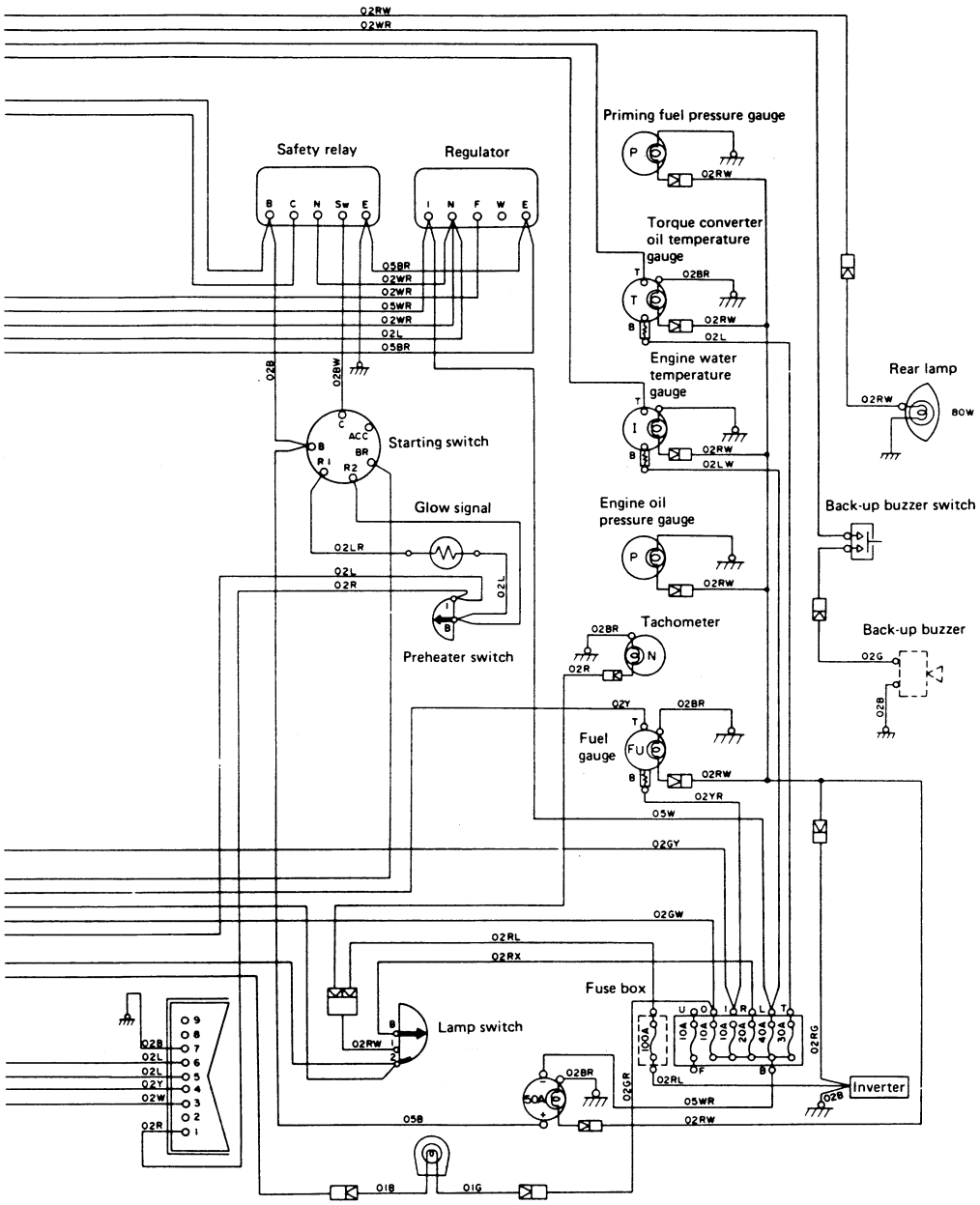
Starting switch connecting table

Terminal / Key position	B	BR	R1	R2	C	ACC
HEAT	○	○	○			○
OFF	○					
ON	○	○				○
START	○	○		○	○	○

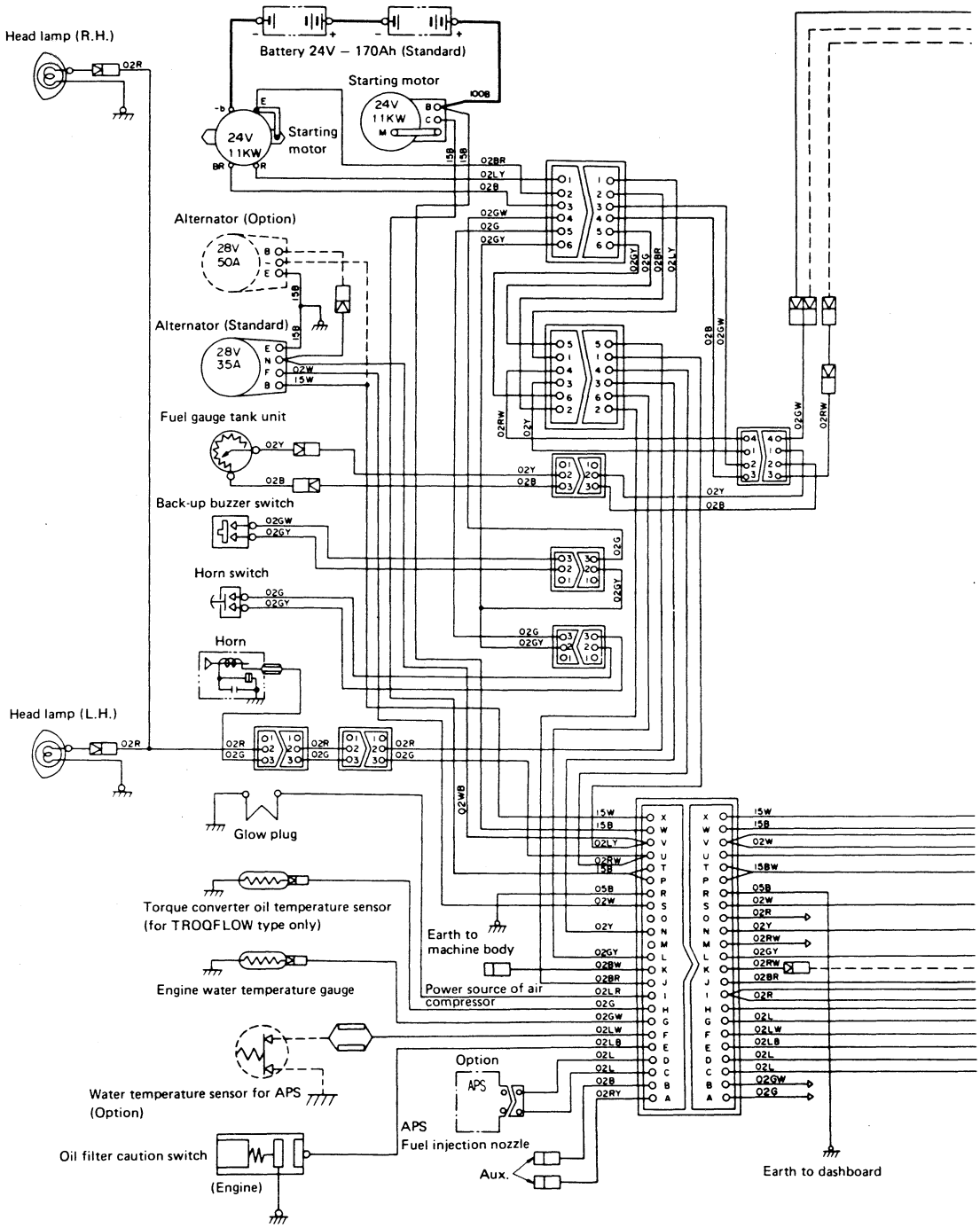
Starting switch key position



90F001


Safety relay
Regulator
Priming fuel pressure gauge
Torque converter oil temperature gauge
Engine water temperature gauge
Engine oil pressure gauge
Rear lamp
Back-up buzzer switch
Back-up buzzer
Starting switch
Glow signal
Preheater switch
Tachometer
Fuel gauge
Lamp switch
Fuse box
Inverter
02RW
02WR
05BR
02BR
02L
02LW
02LR
02R
02Y
02YR
05W
02GY
02GW
02RL
02RX
02B
02W
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02RG
02GR
05B
01B
01G
80W
50A
30A
20A
15A
10A
7.5A

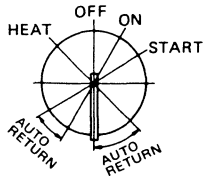
· D150, 155-1 · D150A C8421 and up
· D155A T17001 ~ T19000

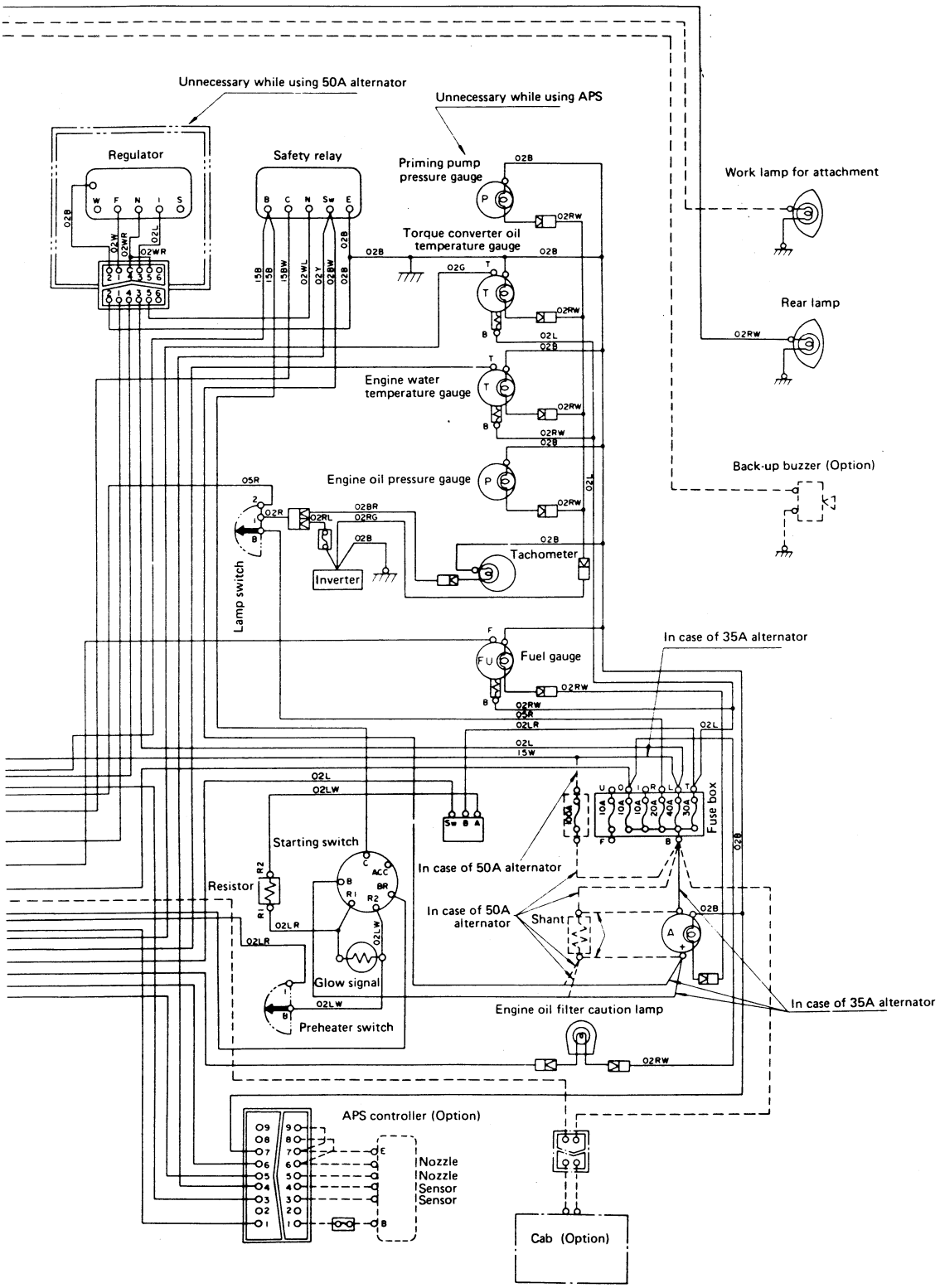


Starting switch connecting table

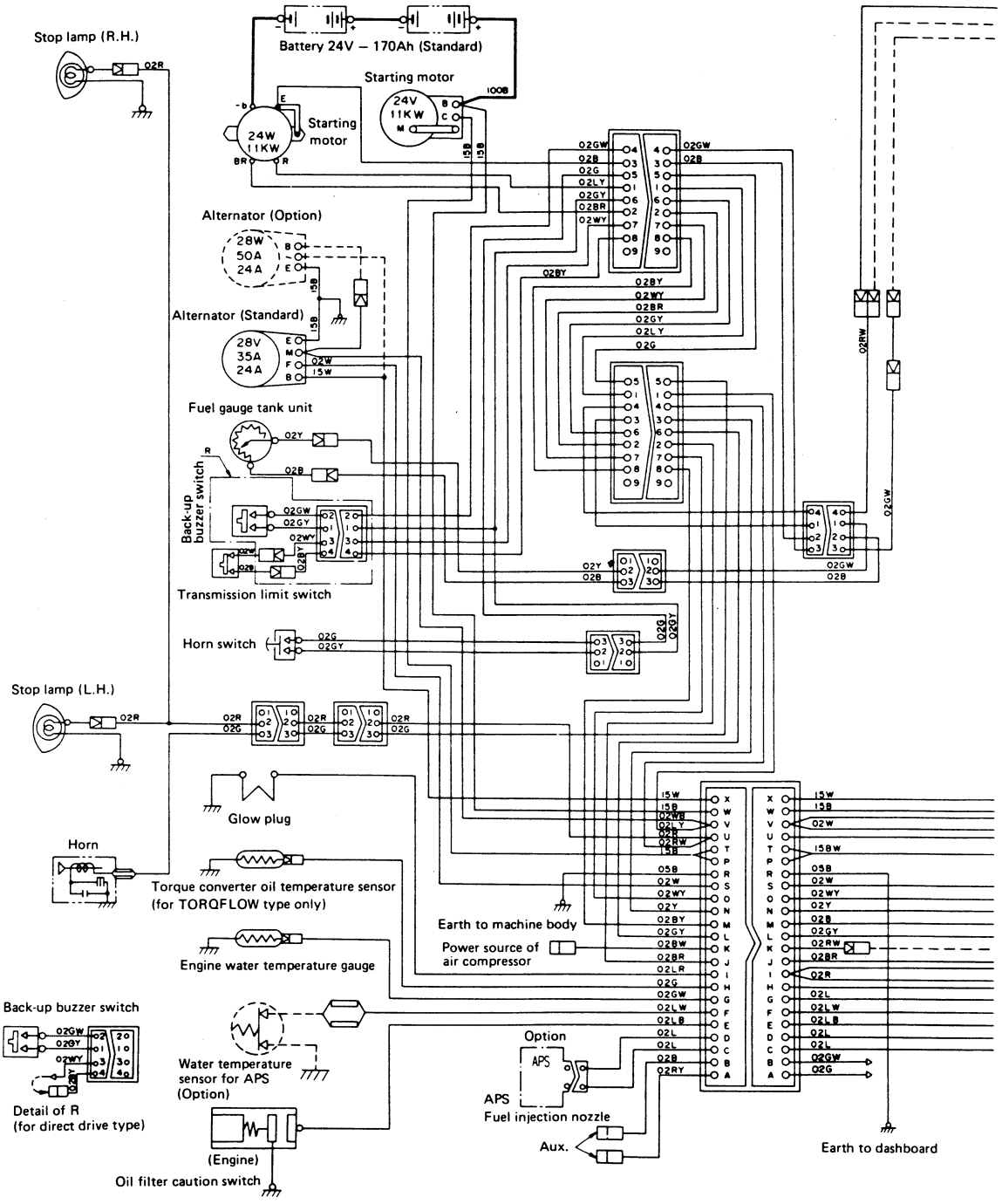
Terminal / Key position	B	BR	R1	R2	C	ACC
HEAT	○	○	○			○
OFF	○					
ON	○	○	○			○
START	○	○		○	○	○

Starting switch key position




Unnecessary while using 50A alternator
Unnecessary while using APS
Regulator
Safety relay
Priming pump pressure gauge
Work lamp for attachment
Torque converter oil temperature gauge
Rear lamp
Engine water temperature gauge
Back-up buzzer (Option)
Engine oil pressure gauge
Tachometer
Inverter
Lamp switch
In case of 35A alternator
Fuel gauge
Fuse box
Starting switch
In case of 50A alternator
Resistor
In case of 50A alternator
Shant
Glow signal
Engine oil filter caution lamp
In case of 35A alternator
Preheater switch
APS controller (Option)
Nozzle
Nozzle
Sensor
Sensor
Cab (Option)

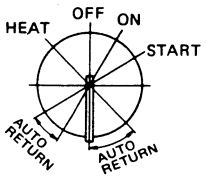
·D155A 19001 ~ 25000

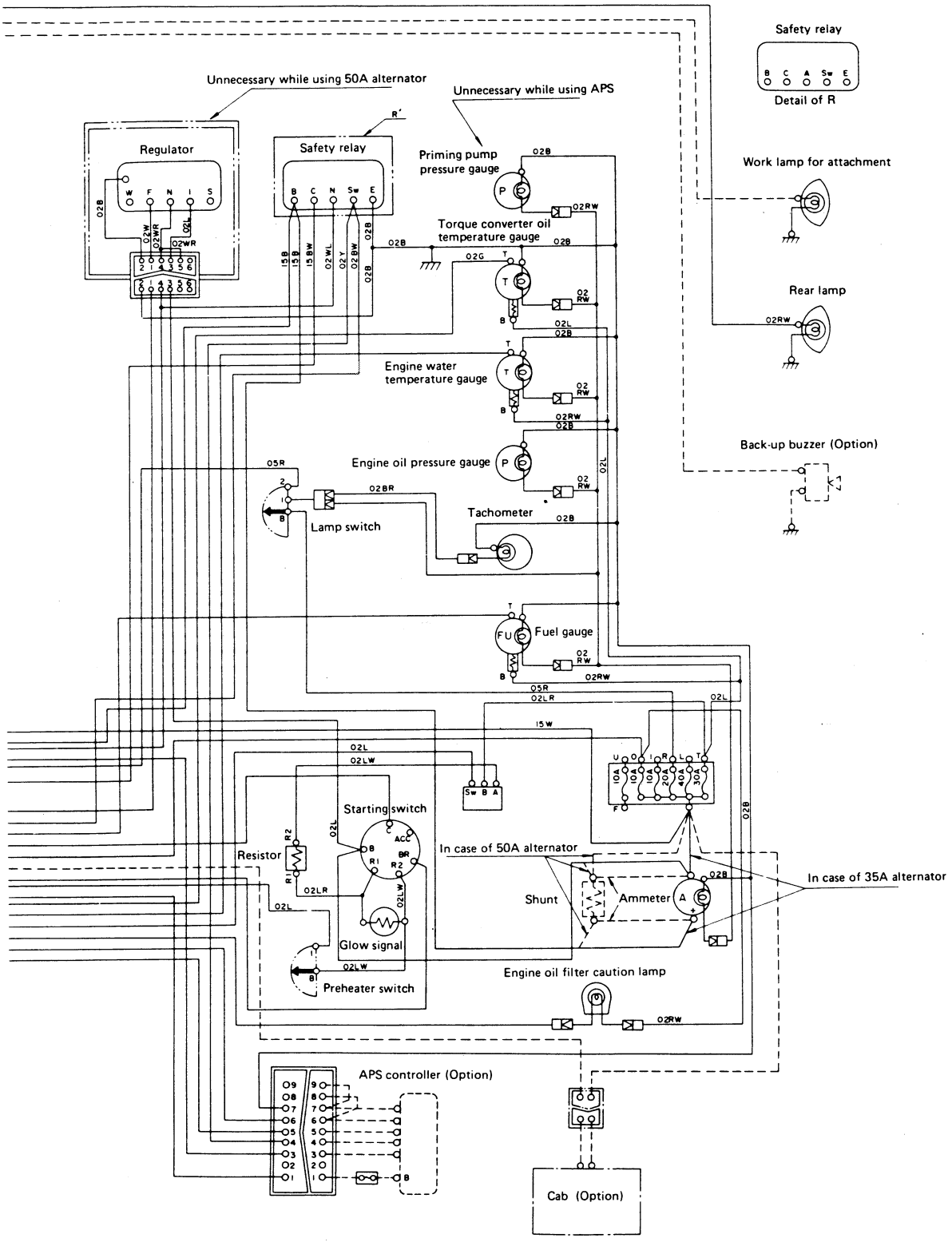


Starting switch connecting table

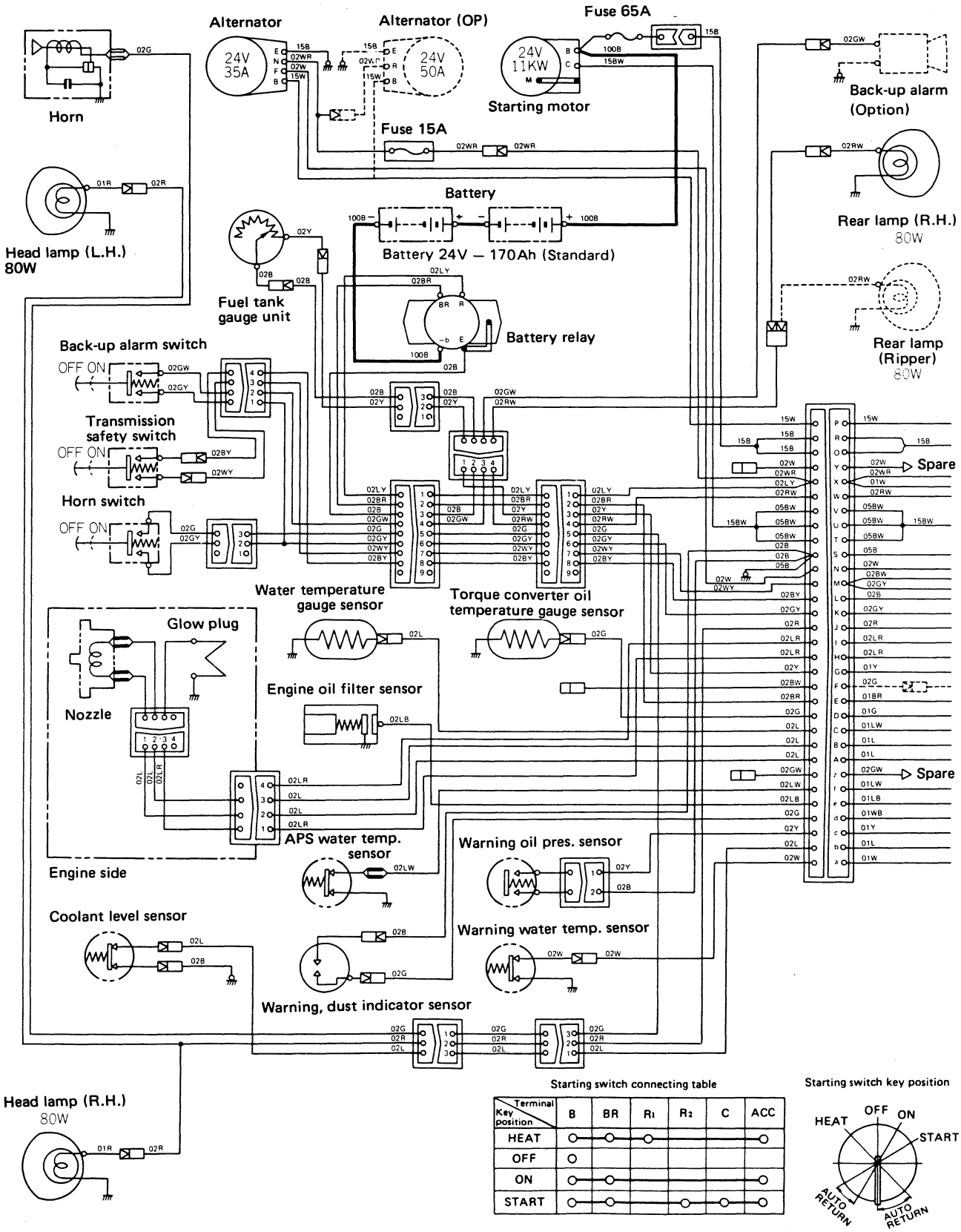
Terminal / Key position	B	BR	R1	R2	C	ACC
HEAT	○	○	○			○
OFF	○					
ON	○	○				○
START	○	○		○	○	○

Starting switch key position




Safety relay
B C A Sw E
Detail of R
Unnecessary while using 50A alternator
Unnecessary while using APS
Regulator
Safety relay
Priming pump pressure gauge
Work lamp for attachment
Torque converter oil temperature gauge
Rear lamp
Engine water temperature gauge
Back-up buzzer (Option)
Engine oil pressure gauge
Lamp switch
Tachometer
Fuel gauge
Starting switch
Resistor
In case of 50A alternator
In case of 35A alternator
Shunt
Ammeter
Glow signal
Engine oil filter caution lamp
Preheater switch
APS controller (Option)
Cab (Option)
90F003

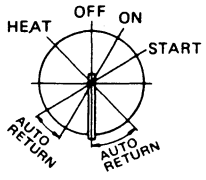
D155A 25001 and up

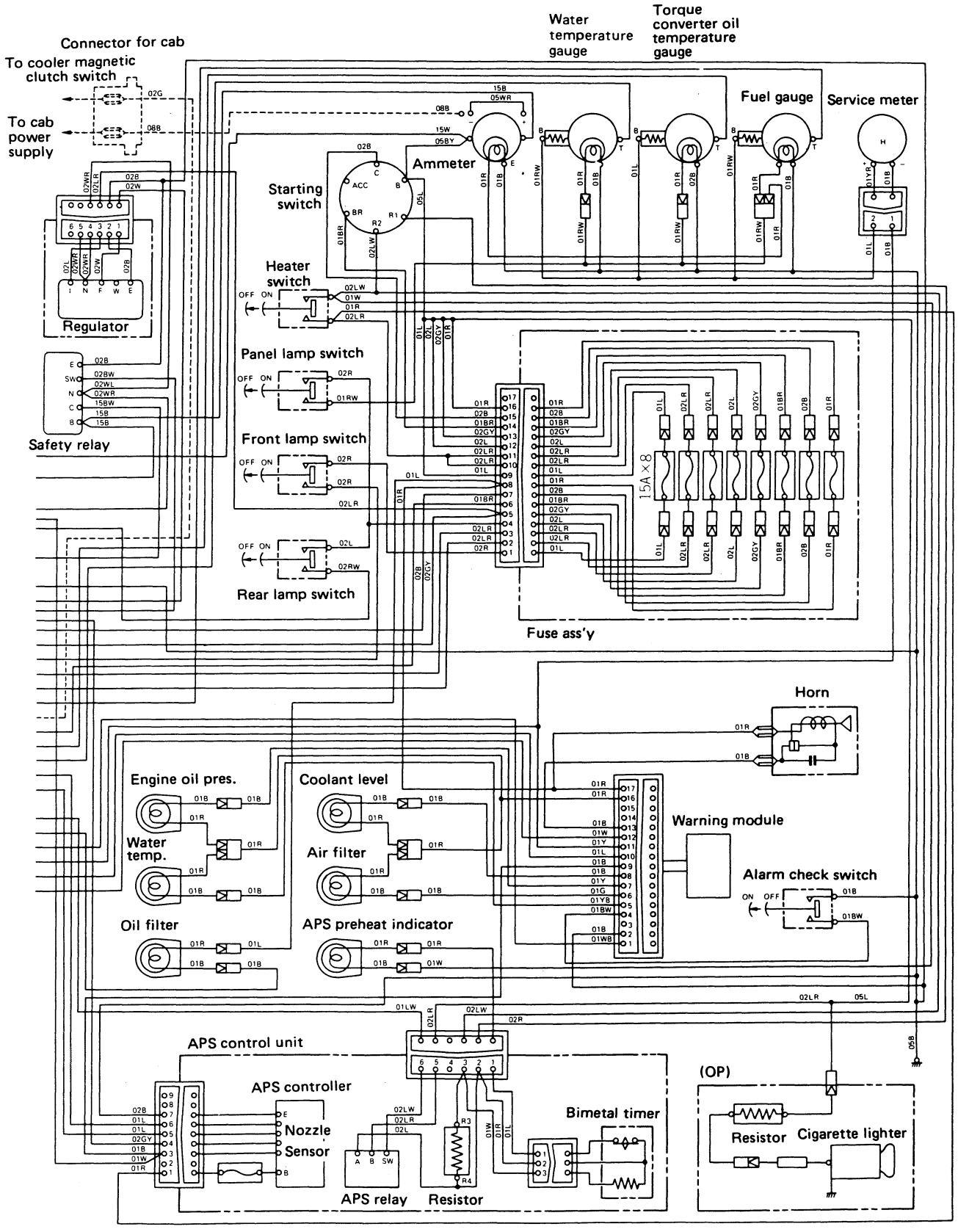


Starting switch connecting table

Terminal / Key position	B	BR	R1	R2	C	ACC
HEAT	○	○	○			○
OFF	○					
ON	○					○
START	○	○		○	○	

Starting switch key position

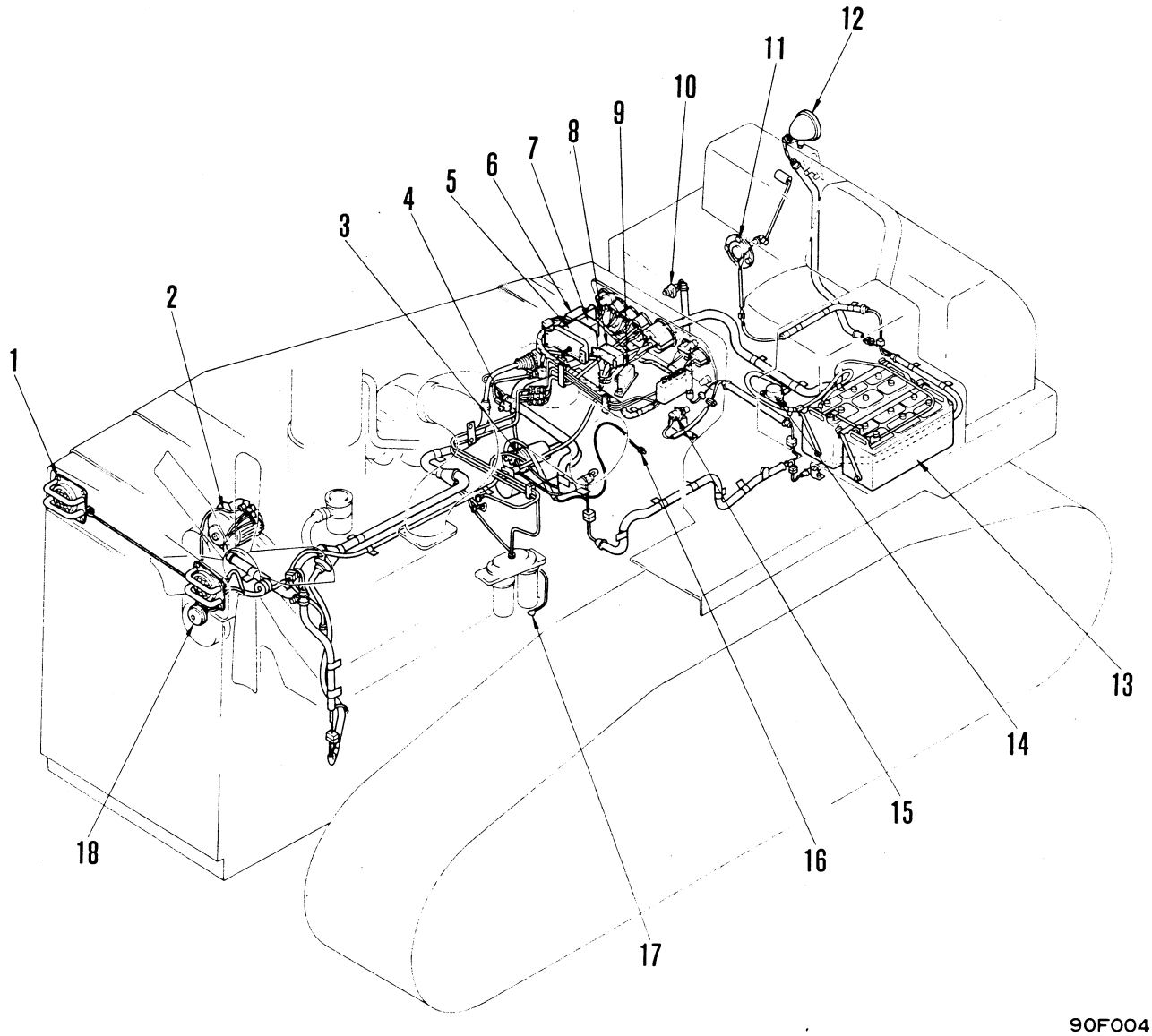



Connector for cab
To cooler magnetic clutch switch
To cab power supply
Water temperature gauge
Torque converter oil temperature gauge
Fuel gauge
Service meter
Ammeter
Starting switch
Heater switch
Panel lamp switch
Front lamp switch
Rear lamp switch
Regulator
Safety relay
Fuse ass'y
15A×8
Horn
Warning module
Alarm check switch
Engine oil pres.
Water temp.
Oil filter
Coolant level
Air filter
APS preheat indicator
APS control unit
APS controller
Nozzle
Sensor
APS relay
Resistor
Bimetal timer
(OP)
Resistor
Cigarette lighter

175F241-3

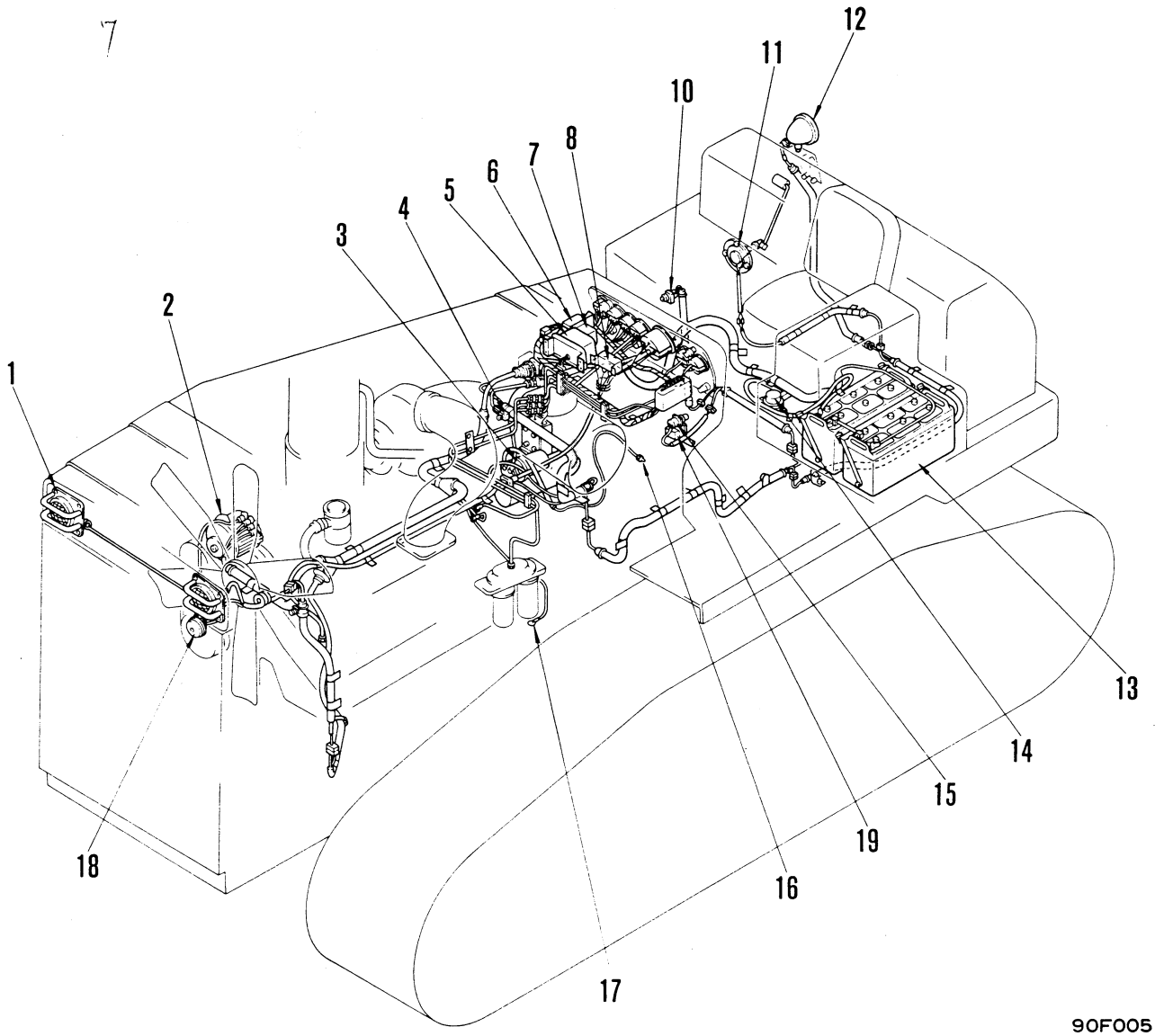
ELECTRICAL WIRING DIAGRAM

D150A 8408 ~ 8420
D155A 15001 ~ 17000



90F004

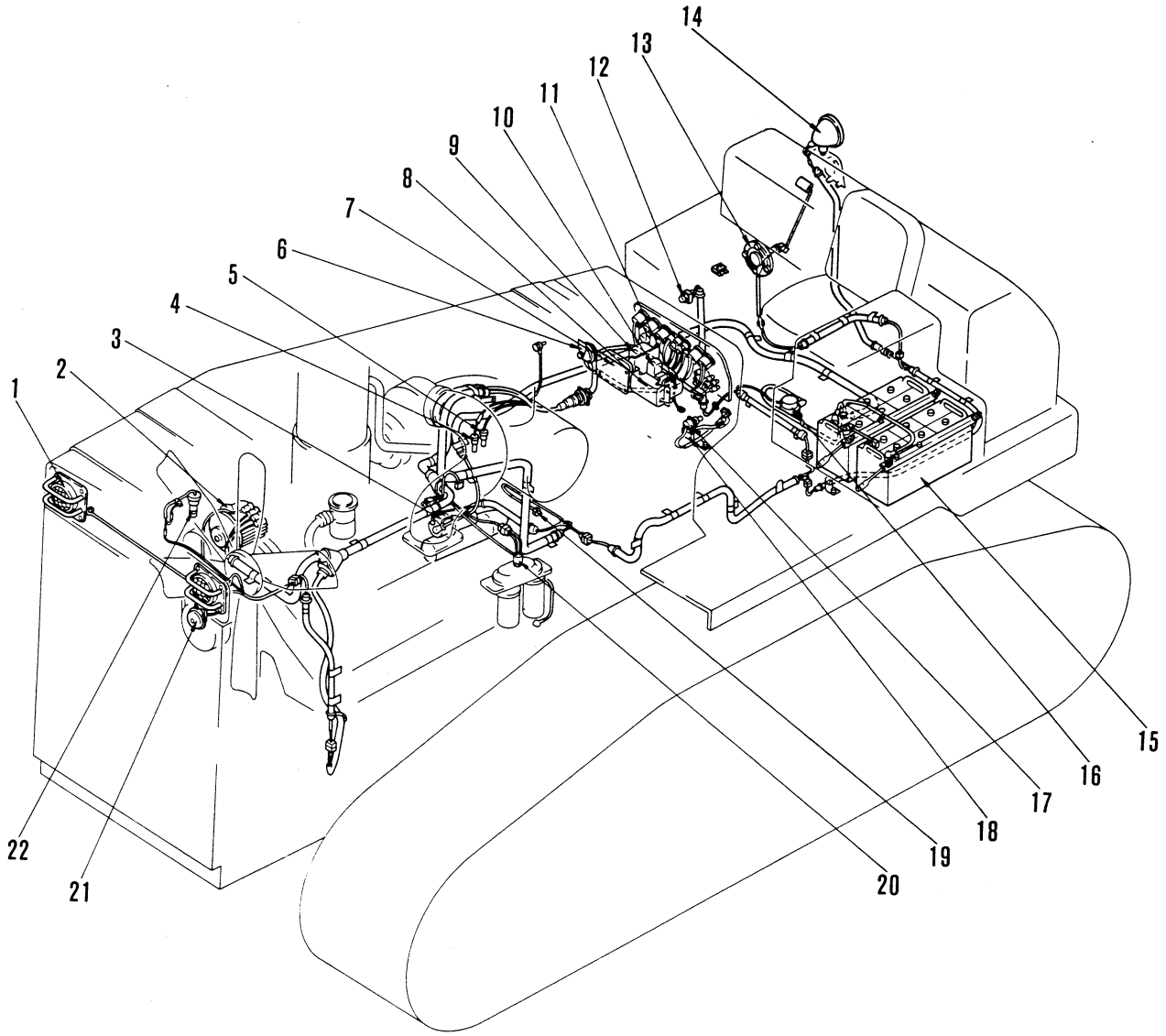
D150A 8420 and up
D155A 19001 ~ 25000



90F005

1. Head lamp
2. Alternator
3. Starting motor
4. Engine water temperature sensor
5. APS controller (option)
6. Safety relay
7. Regulator
8. Relay switch (option)
9. EL inverter D150A C8408 ~ C8420
   D155A T15001 ~ T17000
10. Horn switch
11. Fuel gauge unit
12. Rear lamp
13. Battery
14. Battery relay switch
15. Back-up buzzer switch
16. Torque converter oil temperature sensor
17. Engine oil pressure gauge outlet
18. Horn
19. Transmission safety switch (D155A T19001 and up)

D155A 25001 and up



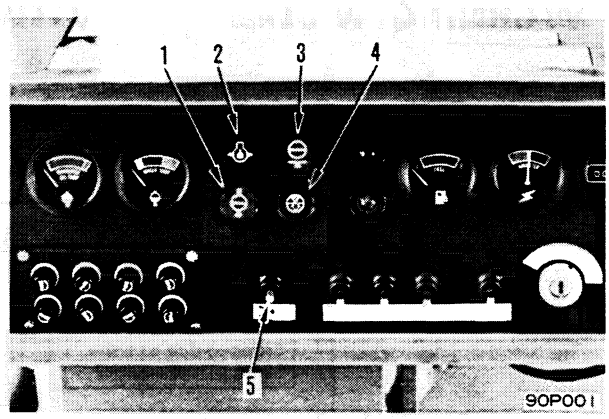
175F242-2

1. Head lamp
2. Alternator
3. Starting motor
4. Engine water temperature warning sensor
5. Engine water temperature sensor
6. Warning horn
7. Warning module
8. APS controller
9. Safety relay
10. Regulator
11. Relay switch
12. Horn switch
13. Fuel gauge unit
14. Rear lamp
15. Battery
16. Battery relay switch
17. Back up alarm switch
18. Transmission safety switch
19. Torque converter oil temperature sensor
20. Engine oil pressure warning switch
21. Horn
22. Radiator water level warning sensor

WARNING MODULE

GENERAL DESCRIPTION

- The warning module provides a specific warning through a flashing light and an intermittently sounding buzzer when any of the following problems occur while the machine is being operated.
  1) Excessive rise in engine water temperature
  2) Excessive drop in engine oil pressure
  3) Excessive lowering of radiator water level
  4) Clogging of air cleaner element
- Warning check switch (5) functions to check for burnt-out light bulbs and a faulty buzzer after the engine is started.
- The table below shows the normal functions of the warning lamps and buzzers.



1. Engine water temperature warning lamp
2. Engine oil pressure warning lamp
3. Radiator water level warning lamp
4. Warning lamp against clogged air cleaner
5. Warning check switch

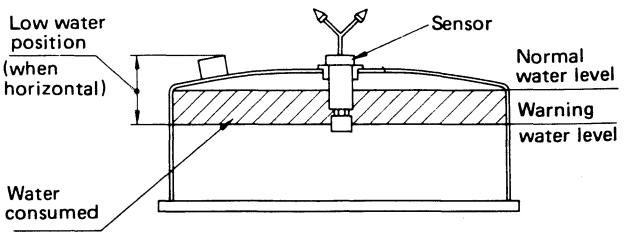
Switch operation		Warning lamp				Warning buzzer
Starting switch	Check switch	Engine water temperature	Engine oil pressure	Radiator water level	Clogged air cleaner	
ON (Before starting the engine)	OFF	○	○	○	○	X
START	OFF	X	○	○	○	Sounds for a while and stops
ON (After engine is started)	OFF	X	X	X	X	X
	ON (will start checking after the engine is started)	○	○	○	○	Sounds intermittently

★ If an abnormality occurs while the starting switch is ON or while the machine is in operation, a blinking lamp will indicate the location of the abnormality.

★ Symbol ○: Lamp comes on
Symbol X: Lamp goes off

The table below shows operating values of the warning module.

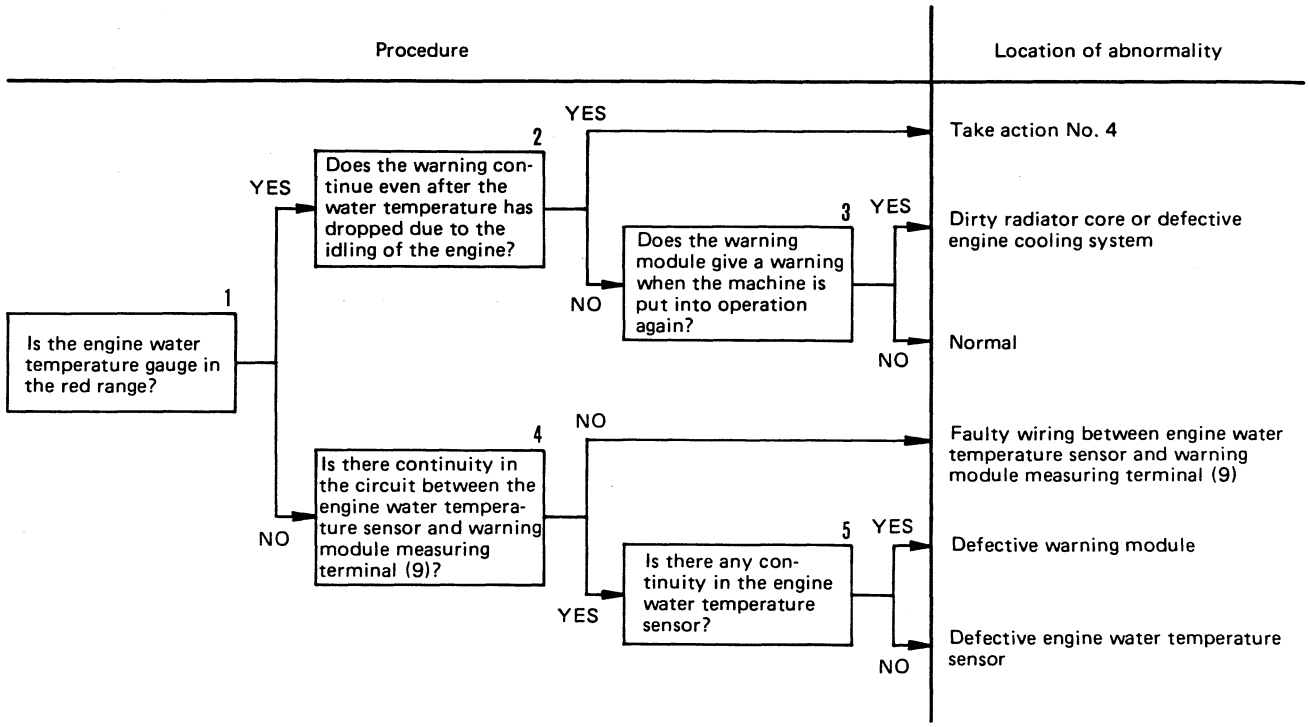
Type of warning		Warning threshold
Engine water temperature	When increasing	102 ± 3°C
	When decreasing	98 ± 3°C
Engine oil pressure		0.8 ± 0.3 kg/cm²
Radiator water level	Water consumed	12 ± 0.9ℓ
	Low water position	90 ± 3 mm
Clogged air cleaner		650 ± 50 mmH_2O



175F243

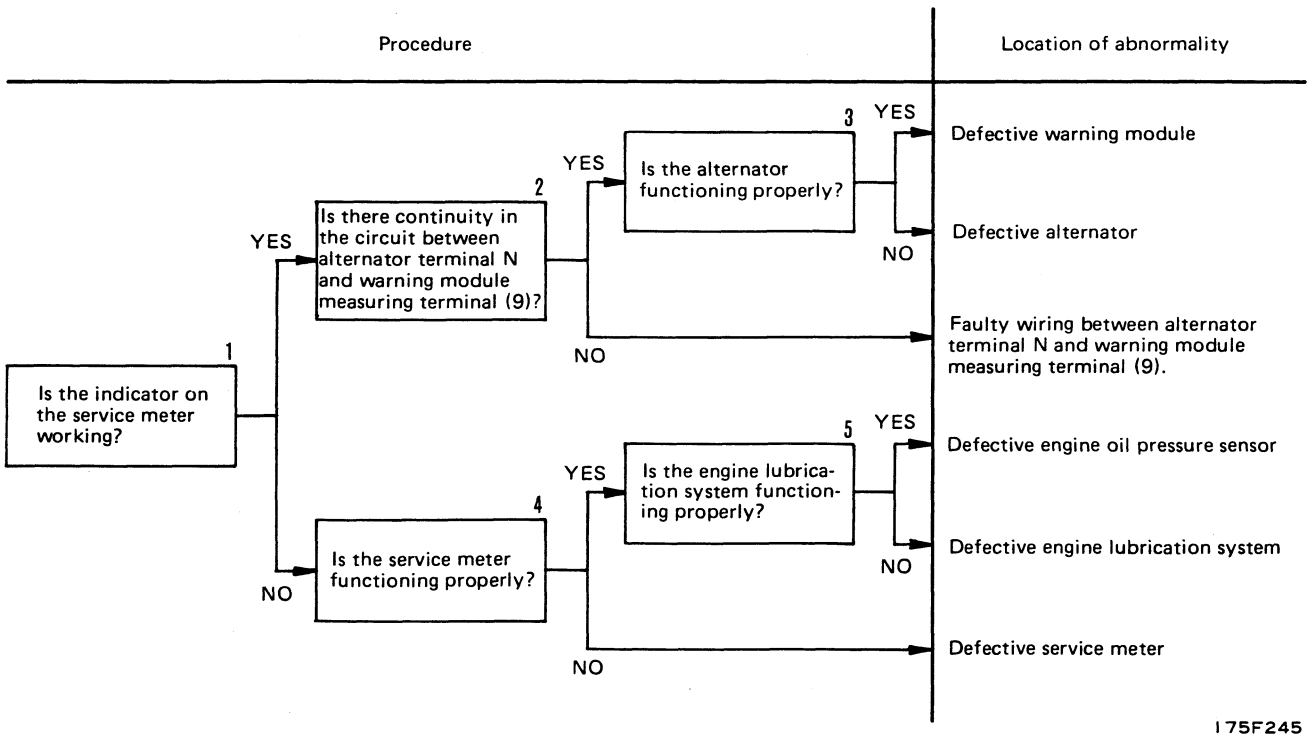
CORRECTIVE ACTION TO BE TAKEN WHEN WARNING MODULE IS ACTIVATED

1. Engine water temperature warning



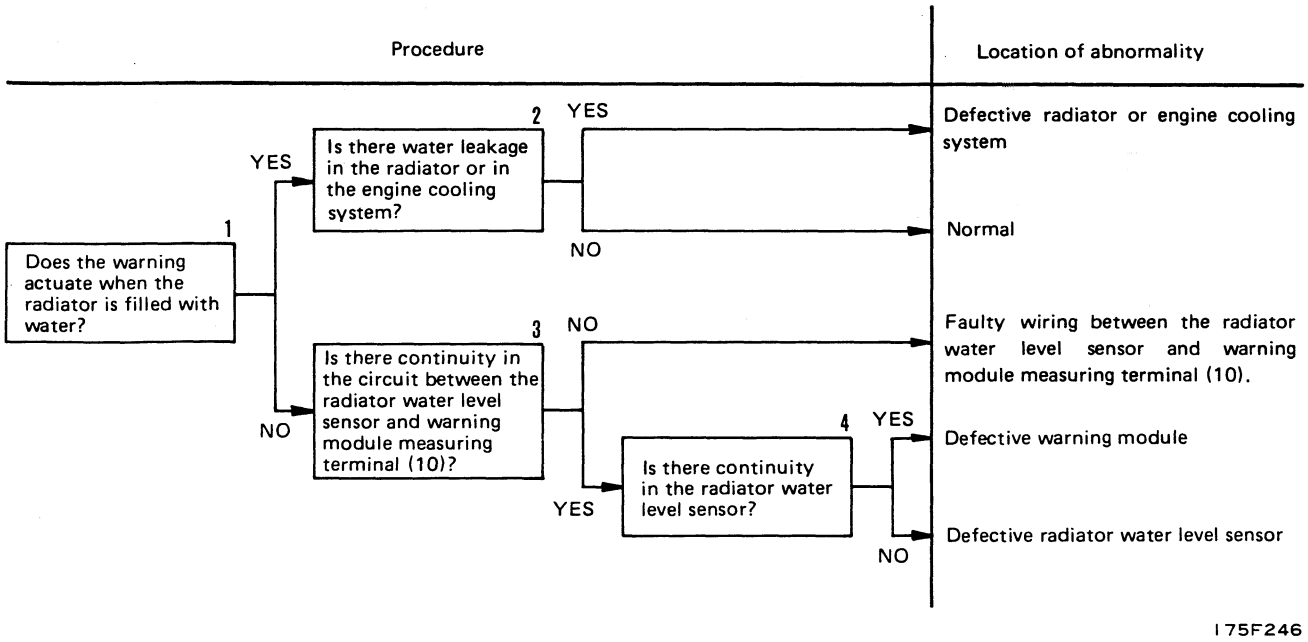
I75F244

2. Engine oil pressure warning



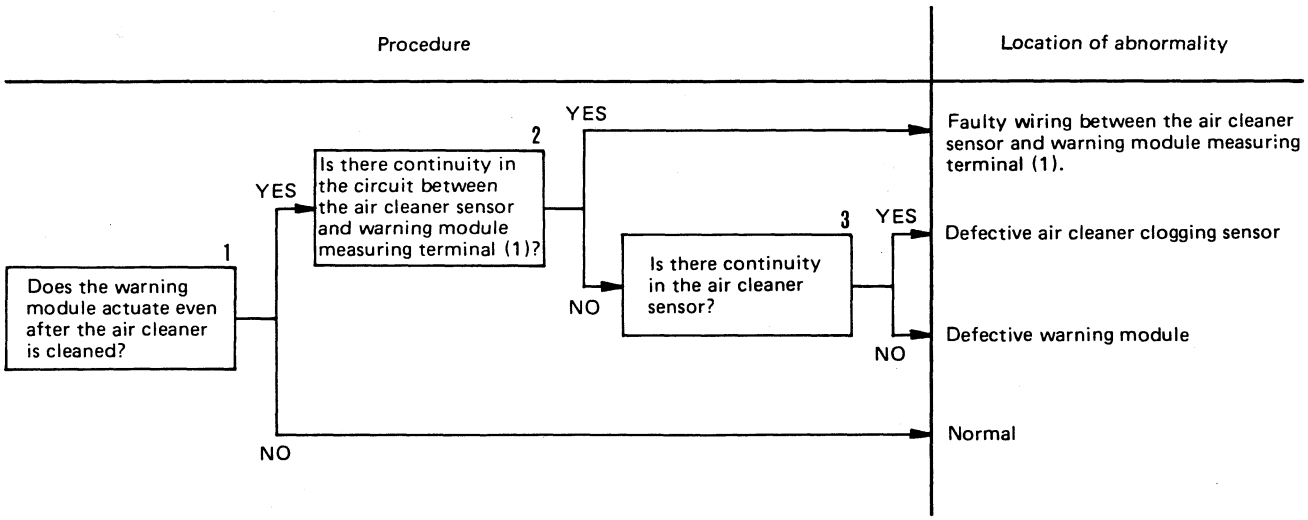
I75F245

3. Radiator water level warning



I75F246

4. Clogged air cleaner warning

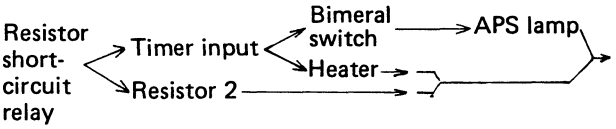


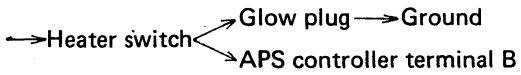
I75F247

A.P.S. (Automatic Priming System)

The operation of this system is described under the title "Starting the engine in cold weather (15°C or below)" in the Cold Weather Operation section of the operation manuel. The following are additional descriptions about the function of components related to this system.

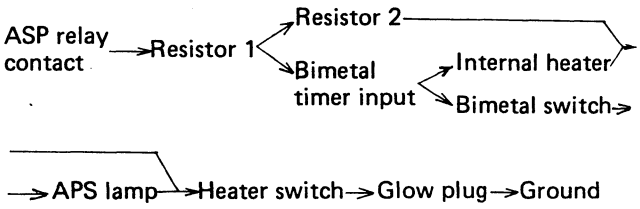
1. When the starting switch key is placed in ON position, a circuit (APS relay coil → APS water temperature sensor → Chassis (Grounding) is formed to conduct current through it. As a result, the APS relay contact is closed. However, the glow plugs are not heated and APS does not act because a disconnection remains at the heater switch contact in the following circuit: APS relay contact →





2. When the heater switch is turned on, the glow plugs will be actuated as current flows in the above-mentioned circuit. After about 80 seconds, the heated bimetal timer contact will open to cut out the current, the APS indicator lamp will go off and preheating by the glow plugs will be stopped. Since the internal heater is left actuated, the bimetal contact is kept opened even after the glow plugs stop heating. Then, the engine is started. Now, the APS controller supplies current to the nozzles and fuel starts to spray into the intake manifold. Intake air is heated by the combustion of the fuel spray. When the heater switch is turned off after engine rotation becomes smooth, the supply of current to the nozzles from the APS controller is stopped,and the function of APS ceases.

3. When the main circuit voltage turns from 24V of battery voltage to 29V of generator output voltage with the increase in engine speed during step 2., current will flow from the APS controller to the resistor short-circuit relay coil, causing the resistor relay contact to open. Now, the following circuit will be formed:



Due to the voltage drop by resistor 1, a reduced voltage of approx. 24V (from approx. 29V of generator output voltage) is applied to the glow plugs.

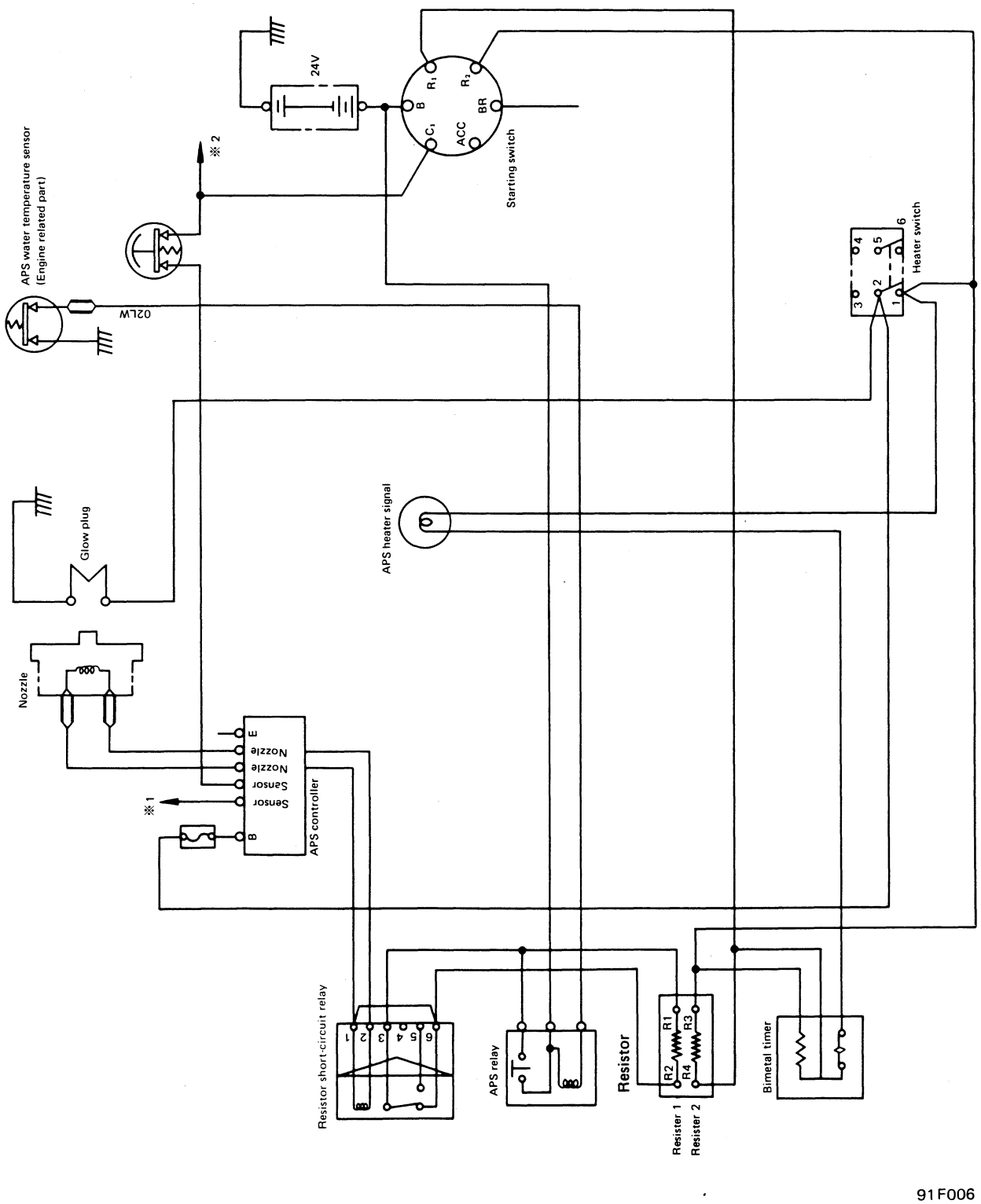
4. When the water temperature rises to 13°C, the contact of the APS water temperature sensor will open to cut out the current required to energize the APS relay coil. As a result, the contact in the APS relay is left opened, no current flows to the resistor short-circuit relay, and APS does not function.

5. If it is necessary to actuate the APS at a water temperature of 13°C or above, turn the starting switch key to HEAT while the heater switch is left in the ON position. Now, current from R_1 terminal of key switch does not flow through the APS relay and resistor, but flows in the following circuit:

Key switch terminal R_1 →
→ Bimetal timer contact → Heater signal lamp →
→ Internal heater →
→ Heater switch → Glow plug → Ground

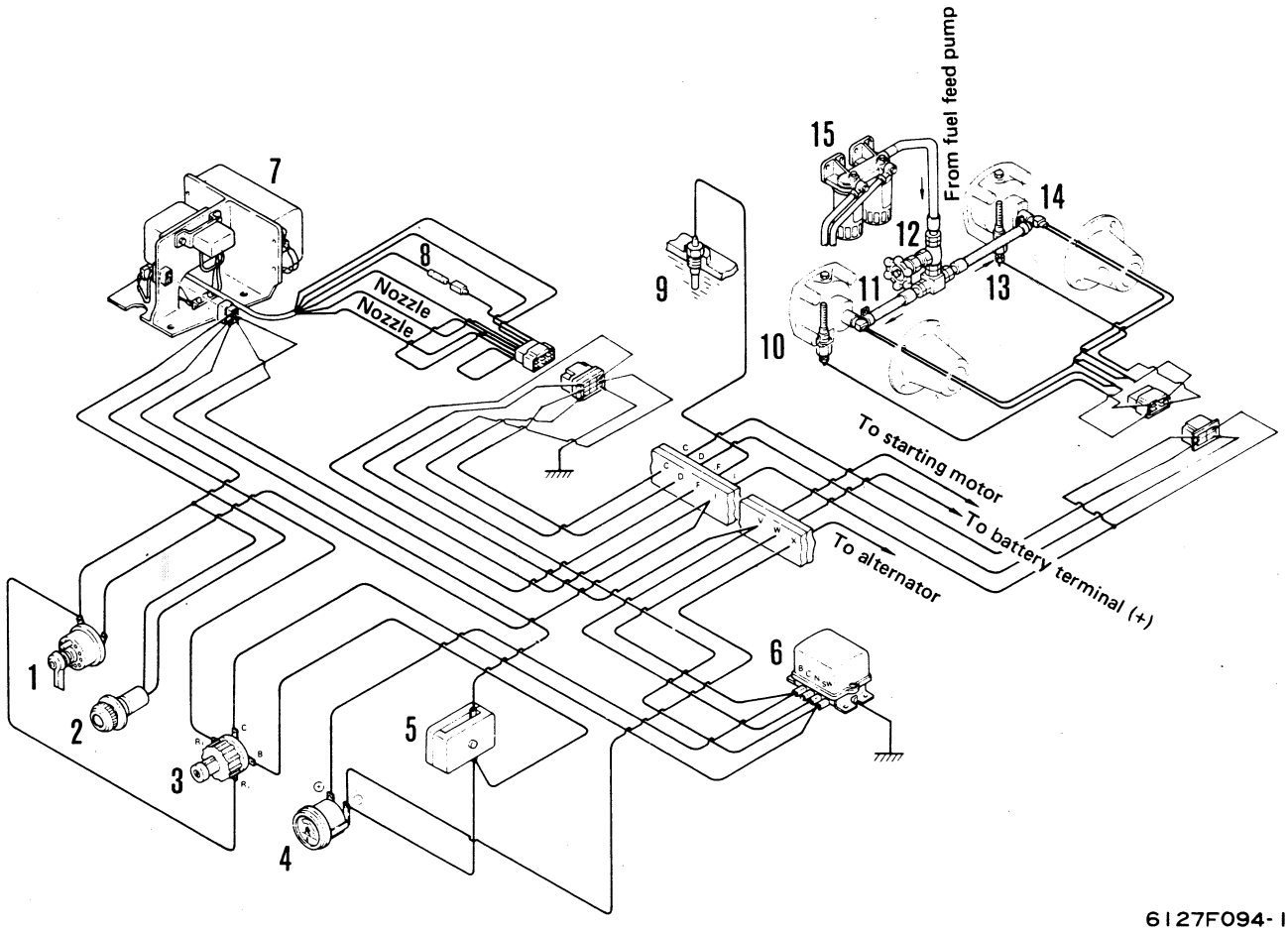
At the same time, current from terminal R_1 flows also to the APS controller. After preheating by this method, start up the engine. The APS controller will supply current to the nozzles and the spray of fuel into the intake manifold will start.
In addition, the connection between terminal 1 and terminal 6 of the resistor short-circuit relay is made for the purpose of absorbing surge voltage which will occur when the internal contactor opens.
To facilitate understanding of the above-mentioned descriptions, an APS circuit diagram, a schematic view of the electrical system and reprint from the Operation Manual are shown on the following pages.

A.P.S. ELECTRICAL WIRING DIAGRAM



91F006

A.P.S. SYSTEM



6127F094-1

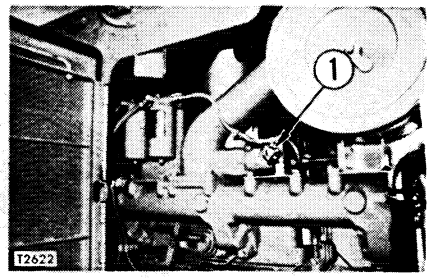
1. Heater switch
2. Heater signal
3. Key switch
4. Ammeter
5. Fuse box
6. Safety relay
7. APS controller unit
8. Fuse (5A)
9. Water temperature sensor
10. Glow plug
11. Nozzle
12. Fuel cock
13. Glow plug
14. Nozzle
15. Fuel filter

STARTING THE ENGINE IN COLD WEATHER (AT 15°C OR BELOW)

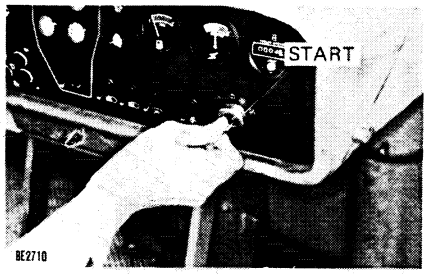
Refer to the section ENGINE HANDLING in OPERATING YOUR MACHINE of Operation Manual for engine starting precautions.

ENGINE START

1. Open the fuel valve (1) for the APS. (Automatic Priming System)
   ★ Keep the fuel valve (1) opened in winter which the APS is useful. (At 15°C or below)



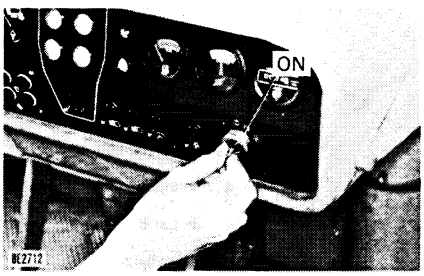
2. Turn starting key to (START) and run engine for 5 to 10 seconds.



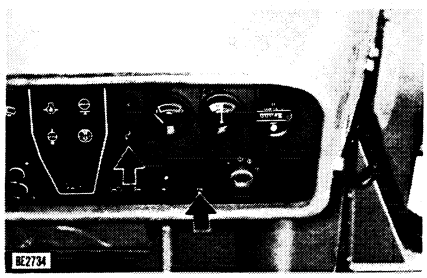
3. Put the fuel control lever in half-open position.



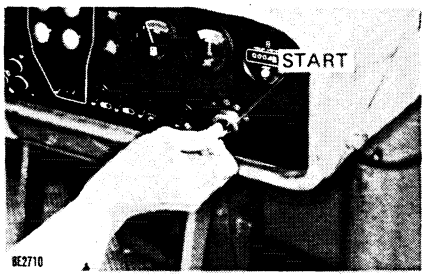
4. Turn starting key to (ON).



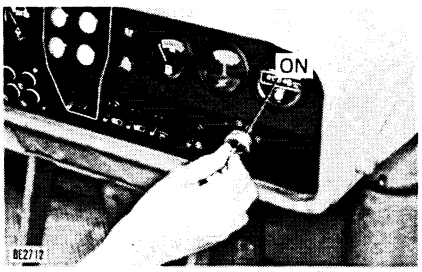
5. Put preheater switch in ON position and preheater indicator lamp becomes bright.
6. Wait for about 80 seconds until preheater indicator lamp goes off.



7. When the preheater indicator lamp goes off, turn the starting switch key to (START) position and start the engine.



8. When the engine starts, return key to (ON), (key returns automatically when unhanded).



9. When engine runs smoothly and the color of exhaust gas becomes normal, put the preheater switch in OFF position.

Necessary preheating time is as follows

Atmospheric temperature	Preheating time
15°C ~ 0°C	1 ~ 2 minutes
Below 0°C	3 ~ 5 minutes

★ After failure to start the engine, wait 2 minutes before repeating the steps 5 and 7.

★ Never attempt to turn the starting switch key to the START position without waiting for the preheater indicator lamp to become bright. Otherwise, the glow plug will become wet, resulting in the engine becoming difficult to ignite.

★ Do not forget to return the preheater switch to the OFF position! Leaving it in the ON position can lead to smoky exhaust, reduced output, and shortened service life for the glow plugs and the preheater indicator lamp.

★ After starting the engine, do not attempt to start the machine immediately, but continue warming up the engine satisfactorily. Start the machine first at the low gear speed and gradually increase the load.

★ When the ambient air temperature is at least 15°C and the water temperature is at least 13°C but the preheater indicator lamp fails to light, turn the starter switch to the (HEAT) position. If the preheater indicator lamp lights, the starting booster mechanism is working.

★ When the water temperature is at least 13°C but it is difficult to start the engine, use the starting booster mechanism in the manual mode:
   a) Turn the heater switch to the (ON) position.
   b) Turn the starting switch to the (HEAT) position and hold until the preheater indicator lamp goes out.
   c) Immediately turn the starting switch to the (START) position to start the engine.
   d) When the engine has started, turn the heater switch to the (OFF) position.

