

FOREWORD

This repair manual covers the inspection, adjustment and repair procedures for the overhaul of the engine, chassis and materials handling system of the TOYOTA SKID STEER LOADER 2SGK6, 2SDK6, 2SDK7 and 2SDK8.

You are encouraged to become thoroughly familiar with this manual so as to make the most of the outstanding performance and durability features of these loaders and to perform the proper servicing to maintain them in tip-top running condition.

This repair manual contains the latest information available as of March, 1986. For any changes thereafter, you are asked to consult the Parts & Service News. Toyota reserves the right to make changes in specifications without incurring any obligation and without previous notice.

For your reference, we herewith indicate the titles of relevant manuals.

TOYOTA 4P ENGINE REPAIR MANUAL (No. 95721)

TOYOTA 2J, 2J-T ENGINE REPAIR MANUAL (No. 95727)

TOYOTA 3T84H ENGINE REPAIR MANUAL (No. 95731)

TOYOTA MOTOR CORPORATION

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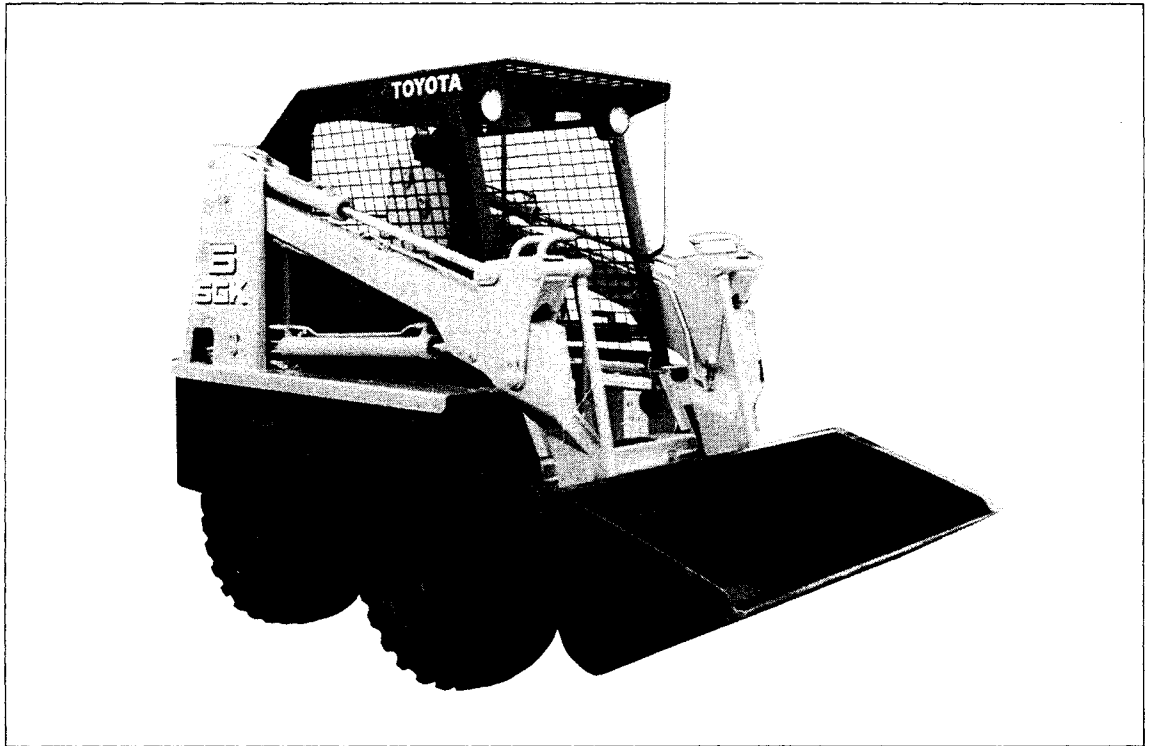
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GENERAL

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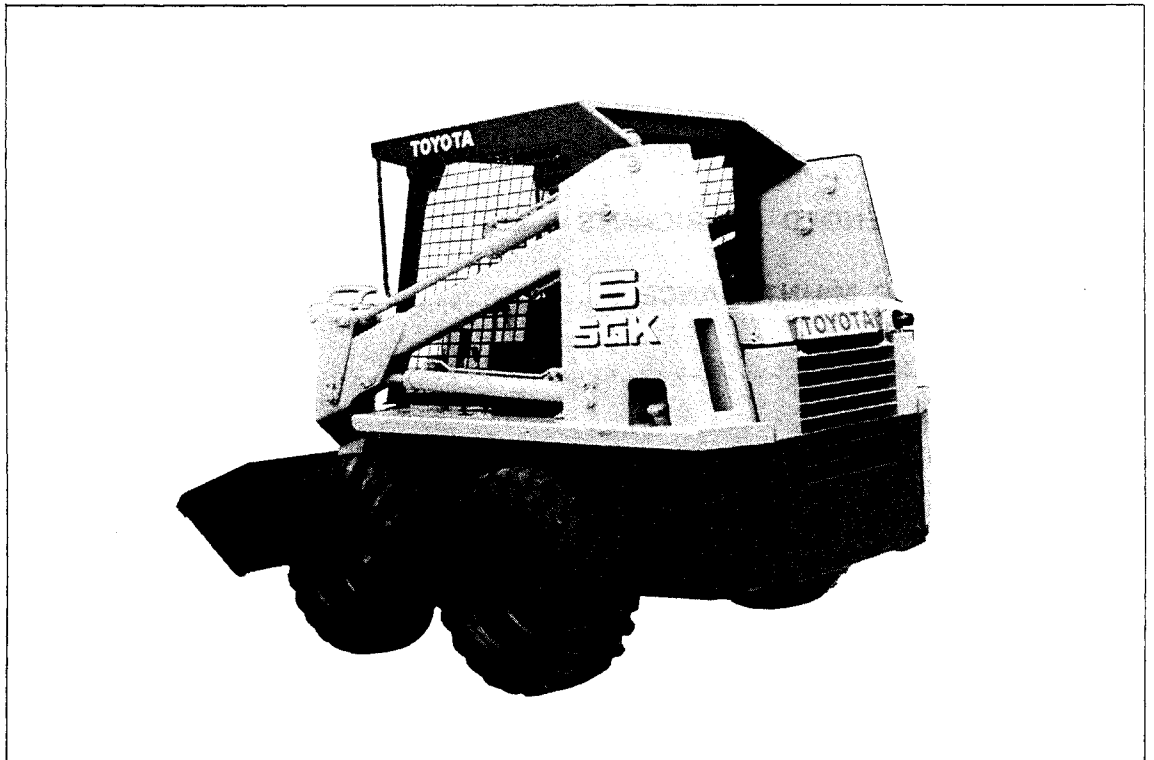
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VEHICLE EXTERIOR VIEWS



Front View

SAE45-4



Rear View

SAE45-15

VEHICLE MODELS

Model	Engine	Operating Load	Bucket Capacity	Machine Weight
2SGK6	TOYOTA 4P	460 kg (1000 lbs)	0.28 m ³ (10.0 ft ³)	2100 kg (4630 lbs)
2SDK6	YANMAR 3T84H	460 kg (1000 lbs)	0.28 m ³ (10.0 ft ³)	2100 kg (4630 lbs)
2SDK7	TOYOTA 2J	520 kg (1150 lbs)	0.31 m ³ (11.0 ft ³)	2200 kg (4850 lbs)
2SDK8	TOYOTA 2J	600 kg (1320 lbs)	0.34 m ³ (12.0 ft ³)	2490 kg (5490 lbs)

ABBREVIATION

Abbreviation (Code)	Measuring
ABDC	After bottom dead center
ASSY	Assembly
ATDC	After top dead center
BBDC	Before bottom dead center
BTDC	Before top dead center
CCA	Cold cranking amperes
HST	Hydrostatic transmission
LH	Left hand
OHV	Over head valve
OPT	Option
OR	Off road
PR	Ply rating
RH	Right hand
SAE	Society of Automotive Engineers (USA)
SST	Special service tool
SUB-ASSY	Sub-assembly
T =	Tightening torque
OT	No gear teeth

TIPS ON OPERATION

1. Safe operations
 - (1) Carry out inspections and servicing with the lift arm lowered and the bucket on the ground. If such work must be performed with the lift arm in the air, support it with the lift arm lock pin, or use the safety block or safety pillar to prevent the arm from lowering.
 - (2) Always use rigid racks or stands when jacking up the vehicle.
 - (3) When lifting with a wire rope, make sure the rope is sufficiently strong.
2. SST & measuring tools

Have the mechanic tools, SST and measuring tools on hand.
3. Order & arrangement
 - (1) Always arrange things in an orderly manner for easy operations.
 - (2) Disassembly of the hydraulics should be done with clean tools in a clean area.
4. Troubleshooting

Do not immediately disassemble when trouble occurs; first determine whether or not disassembly is necessary. For example, with the HST, the pump should not be immediately turn down simply because there is trouble with the travel system. Troubleshoot the cause in the steering levers, the final reduction gear, the change oil pressure, the hydraulic oil and so on.

RIGHT ORDER OF OPERATION

1. Disassembly

Mark or punch mating marks in a feasible location so as to facilitate disassembly of a complex unit. Also, if you are repairing electricals, be sure to disconnect the cables from the battery terminals. Always start with (—) terminal without fail when disconnecting cables from the battery terminals.
2. Inspections during disassembly

In removing each and every part, check for the installed condition, deformation, breakage, roughness or damage.
3. Assembly and installation
 - (1) Always adhere to the tightening torques listed. If none are given, follow the "Standard Tightening Torques."
 - (2) When reassembling after disassembly, use Toyota Genuine Parts to replace packings, gaskets and O-rings.
 - (3) Apply a seal packing in terms of the gasket position, and coat the sliding surfaces at the specified locations with the recommended oil; apply the recommended grease and also coat oil seal lips with MP grease, when assembling.







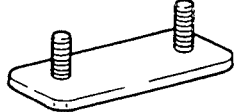
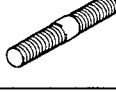
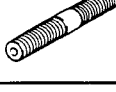
STANDARD BOLT & NUT TIGHTENING TORQUE

Standard bolt and nut tightening torques are not indicated; therefore tightening torque must be judged as below:

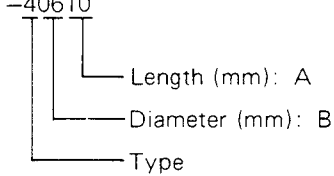
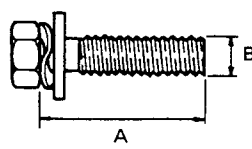
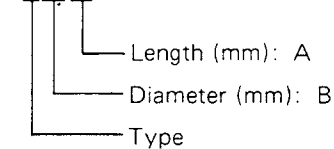
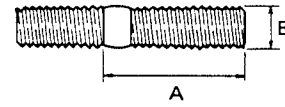
- Find out the type of the bolt from the list below.
Then, find the bolt tightening torque from the table.
- The nut tightening torque can be judged from the bolt type. (See the table.)

List of Bolt Types and Strength

1. Judging by part

Shape and description			Type
Hexagon bolt		Number in relief or hallmark on the head	4 = 4T 5 = 5T 6 = 6T 7 = 7T
Standard bottom surface		No mark	4T
Hexagon bolt (Collared bottom)		No mark	4T
Hexagon bolt (Standard bottom surface)		Two relief lines on the head	5T
Hexagon bolt (Collared bottom)		Two relief lines on the head	6T
Hexagon bolt		Three relief lines on the head	7T
Welded bolt			4T
Welding bolt		No mark	4T
Stud bolt		Approximately 2 mm (0.08") hollow on either or both ends	6T


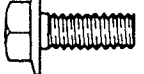
2. Judging by part No.

Hexagon bolt	<p>Sample number 91111-40610</p>  
Stud bolt	<p>Sample number 92132-40614</p>  

BAHS28

BAHS25

Standard Bolt Tightening Torque

Type	Diameter mm	Pitch mm	Standard tightening torque kg-cm (ft-lb)	
			Standard seat 	Seat with flange 
4 T	6	1.0	55 (4.0)	60 (4.3)
	8	1.25	130 (9.4)	140 (10.5)
	10	1.25	260 (18.8)	290 (20.9)
	12	1.25	480 (34.7)	540 (39.0)
	14	1.5	760 (54.9)	850 (61.4)
	16	1.5	1,150 (83.0)	—
5 T	6	1.0	65 (4.7)	—
	8	1.25	160 (11.6)	—
	10	1.25	330 (23.8)	—
	12	1.25	600 (43.3)	—
	14	1.5	930 (67.1)	—
	16	1.5	1,400 (101.1)	—
6 T	6	1.0	80 (5.8)	90 (6.5)
	8	1.25	195 (14.1)	210 (15.2)
	10	1.25	400 (28.9)	440 (31.8)
	12	1.25	730 (52.7)	810 (58.5)
	14	1.5	1,100 (79.4)	1,250 (90.3)
7 T	6	1.0	110 (7.9)	120 (8.7)
	8	1.25	260 (18.8)	290 (20.9)
	10	1.25	530 (38.3)	590 (42.6)
	12	1.25	970 (70.0)	1,050 (75.8)
	14	1.5	1,500 (108.3)	1,700 (122.7)
	16	1.5	2,300 (166.1)	—

BAHS26

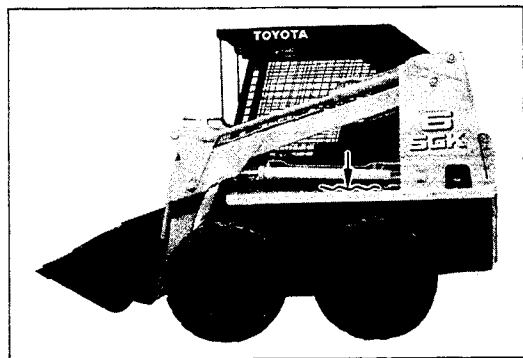
STANDARD HIGH-PRESSURE HOSE FITTING TIGHTENING TORQUE

1. When connecting a high-pressure hose, always clean the hose fitting and the opposing nipple with a clean cloth. Check that there are no dents in the contacting surfaces.
2. When connecting a high-pressure hose, always tighten so that the hose fitting and nipple lie in a straight line and not off-center.

Nominal screw diameter	Standard tightening torque kg-m (ft-lb)		Hose inside diameter
	Standard torque	Torque range	
7/16 – 20 UNF	1.65 (11.9)	1.6 ~ 1.7 (11.6 ~ 12.3)	6
9/16 – 18 UNF	3.30 (23.8)	3.1 ~ 3.5 (22.4 ~ 25.3)	9
3/4 – 16 UNF	5.50 (39.7)	5.2 ~ 5.8 (37.5 ~ 41.9)	12
7/8 – 14 UNF	7.80 (56.3)	7.5 ~ 8.1 (54.2 ~ 58.5)	12
1-1/16 – 12 UNF	11.00 (79.4)	10.5 ~ 11.5 (75.8 ~ 83.0)	19
1-5/16 – 12 UNF	15.00 (108.3)	13.9 ~ 16.1 (100.4 ~ 116.2)	25
PF 1/4	3.30 (23.8)	3.1 ~ 3.5 (22.4 ~ 25.3)	9
PF 3/8	5.50 (39.7)	5.2 ~ 5.8 (37.5 ~ 41.9)	9
PF 1/2	7.80 (56.3)	7.5 ~ 8.1 (54.2 ~ 58.5)	12
PF 3/4	11.00 (79.4)	10.5 ~ 11.5 (75.8 ~ 83.0)	19
PF 1	15.00 (108.3)	13.9 ~ 16.1 (100.4 ~ 116.2)	25

FRAME SERIAL NUMBER

1. Frame Serial Number Location



Frame Serial Number Location

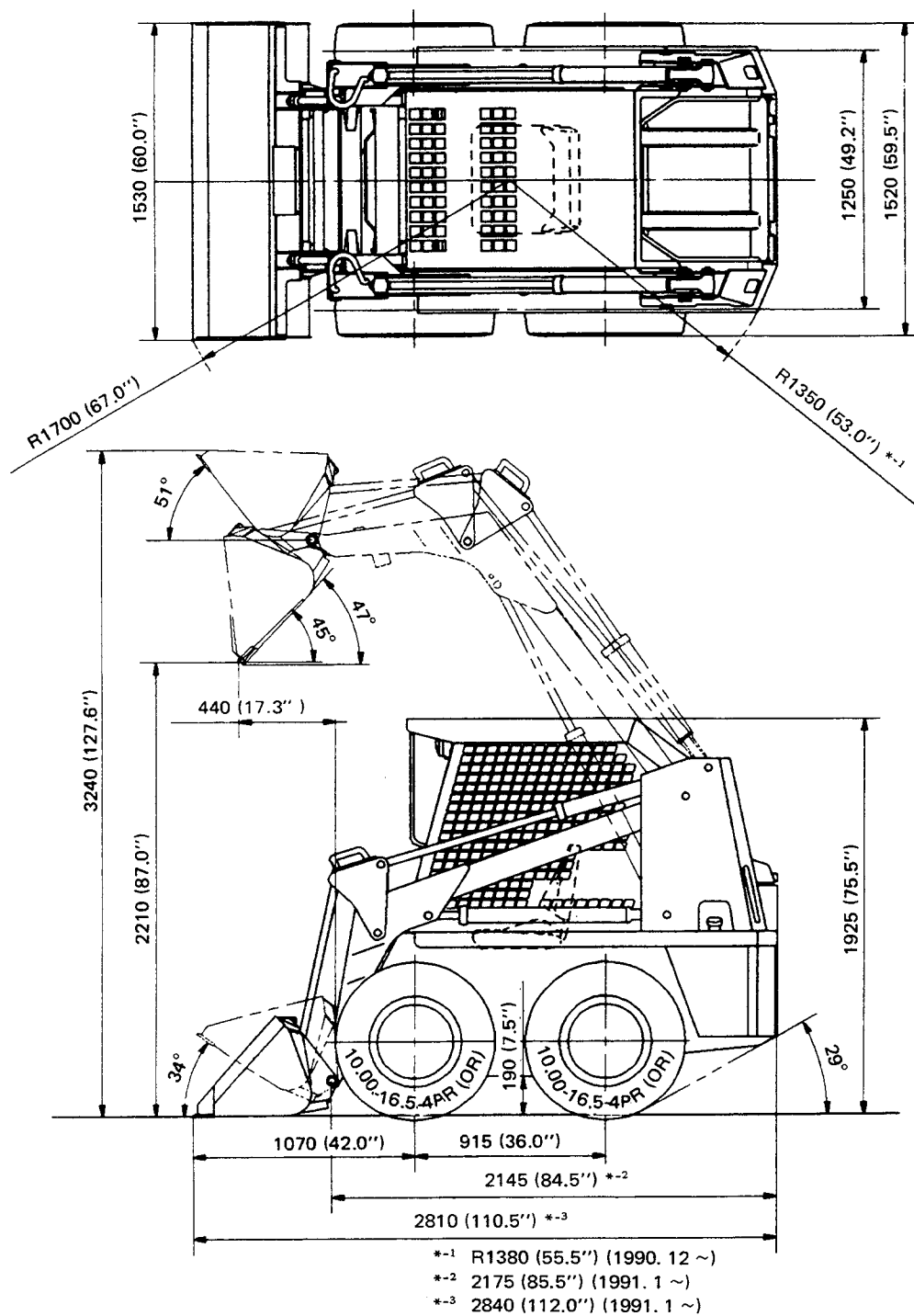
SAE45-13

2. Frame Numbering System

Vehicle model	Serial number
2SGK6	2SGK6-10011
2SDK6	2SDK6-10011
2SDK7	2SDK7-10011
2SDK8	2SDK8-10011



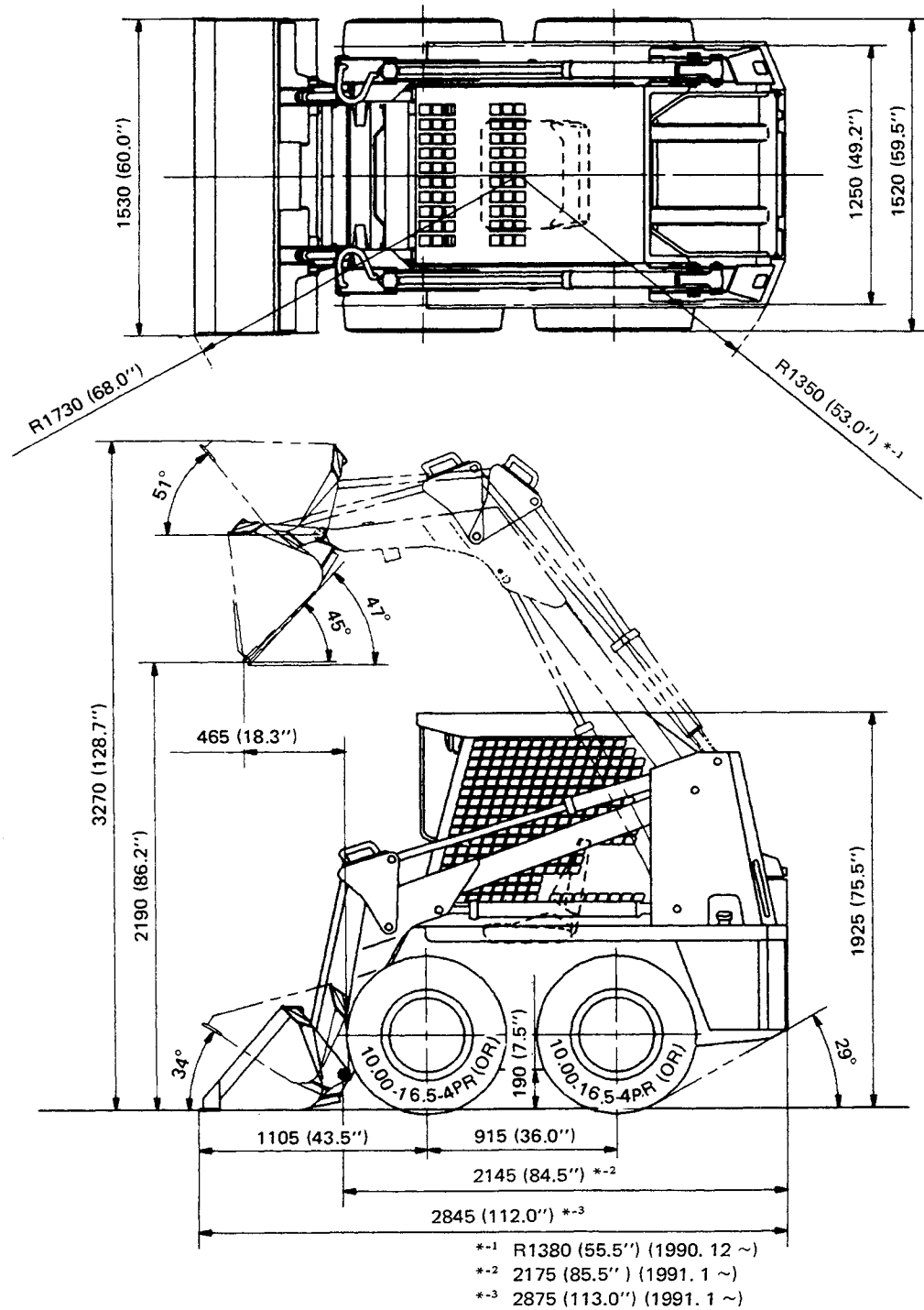
MODEL: 2SDK6



Vehicle Dimensions (2SDK6)

SAEM2

MODEL: 2SDK7



Vehicle Dimensions (2SDK7)

SAEM3

SAEM4

GENERAL SPECIFICATIONS

Vehicle		2SGK6	2SDK6	2SDK7	2SDK8
Item					
Performance					
Tipping load (SAE)	kg (lbs)	920 (2000)	←	1040 (2290)	1200 (2640)
Operating load (SAE)	kg (lbs)	460 (1000)	←	520 (1150)	600 (1320)
Bucket capacity	m ³ (cu-ft)	0.28 (10.0)	←	0.31 (11.0)	0.34 (12.0)
Dump height (at 45°)	mm (in)	2210 (87.0)	←	2190 (86.2)	2160 (85.0)
Reach-fully raised (at 45°)	mm (in)	440 (17.3)	←	465 (18.3)	490 (19.3)
Dump angle (max)	deg	47	←	←	←
Raising time (Full load)	sec	4.0	←	←	←
Lowering time (No load)	sec	2.5	←	←	←
Dump time (Full load)	sec	2.5	←	←	←
Travel speed km/h (mph)	Forward	10 (6.2)	←	←	←
	Reverse	10 (6.2)	←	←	←
Clearance circle (Bucket)	mm (in)	1700 (67.0)	←	1730 (68.0)	1750 (69.0)
Traction (Full load)	kg (lbs)	2000 (4400)	←	2100 (4650)	2400 (5300)
Gradeability %	Forward	30	←	←	←
	Reverse	58	←	←	←
Engine					
Model		TOYOTA 4P	YANMAR 3T84H	TOYOTA 2J	←
Cylinder	Bore mm (in)	76.6 (3.02)	84 (3.31)	88 (3.46)	←
	Stroke mm (in)	81.0 (3.19)	85 (3.35)	102 (4.02)	←
Piston displacement	cc (cu-in)	1493 (91)	1413 (86)	2481 (151)	←
Rated horsepower	PS/rpm	30/2400	28/2500	40/2500	50/2500
	HP/rpm	38/2600 Gross	27/2500 Net	38/2500 Net	47/2500 Net
Rated torque	kg-m/rpm	10.5/1800	8.5/2000	12.0/2200	14.5/2200
	ft-lbs/rpm	77/2600 Gross	59/2000 Net	83/2200 Net	100/2200 Net
Dimensions					
Overall length (with bucket)	mm (in)	2810 (110.5) ^{*-1}	← ^{*-2}	2845 (112.0) ^{*-3}	2880 (113.5) ^{*-4}
Overall width (without bucket)	mm (in)	1520 (59.5)	←	←	←

Vehicle		2SGK6	2SDK6	2SDK7	2SDK8
Item					
Bucket width	mm (in)	1530 (60.0)	←	←	←
Overall height (operator guard)	mm (in)	1925 (75.5)	←	←	←
Wheel base	mm (in)	915 (36.0)	←	←	←
Tread	Front	1250 (49.2)	←	←	←
	Rear	1250 (49.2)	←	←	←
Ground clearance		190 (7.5)	←	←	←
	Center	300 (11.8)	←	←	←
Machine weight (include a full fuel tank and bucket)	kg (lbs)	**5 2100 (4630)	**6 ←	**7 2200 (4850)	**8 2490 (5490)
Controls — Hydrostatic					
Steering		Forward, Reverse, Variable Travel Speed and Steering Controlled by Two Hand Lever			
Drive		Two Hydrostatic Transmission with Infinity Variable Speed			
Fuel System					
Fuel tank capacity	ℓ (US/UK gal)	52 (14/11)	←	←	←
Brake					
Foot brake (OPT) **9		Mechanical	←	←	←
Hand brake		Mechanical	←	←	←
Battery					
Voltage/Capacity	V/AH	12/35	12/80	←	←
	CCA	332	622	←	←
Tires					
Tire size	Front	10.00-16.5-4PR (OR)	←	←	←
	Rear	10.00-16.5-4PR (OR)	←	←	←

* Specifications and design are subject to change without notice.

*-1 2840 (112.0) (1991. 1 ~)

*-2 2840 (112.0) (1991. 1 ~)

*-3 2875 (113.0) (1991. 1 ~)

*-4 2910 (114.5) (1991. 1 ~)

*-5 2130 (4690) (1991. 4 ~)

*-6 2130 (4690) (1991. 4 ~)

*-7 2230 (4920) (1991. 4 ~)

*-8 2520 (5550) (1991. 4 ~)

RECOMMENDED LUBRICANTS & CAPACITIES

Location \ Model			2SGK6	2SDK6	2SDK7	2SDK8	
Engine	Type	STD	Motor oil API classification over SD SAE20, 30	Diesel engine oil API classification over CC SAE10W-30	←	←	
		OPT (*Cold area)	Motor oil API classification over SD SAE10W-30, SAE7.5W-30	Diesel engine oil API classification over CC SAE5W-30	←	←	
	Capacity		4ℓ (1.06 US gal)	←	7ℓ (1.85 US gal)	←	
Oil tank	Type	STD, OPT (*Cold area)	Auto fluid [ATF TYPE F]	←	←	←	
	Capacity		25ℓ (6.6 US gal) **	←	←	←	
Reduction gear unit	Type	STD, OPT (*Cold area)	Diesel engine oil API classification over CC SAE10W-30	←	←	←	
		Capacity		RH	16ℓ (4.22 US gal)	←	←
			LH	16ℓ (4.22 US gal)	←	←	←
Pneumatic governor	Type				Diaphragm oil	←	
	Capacity				2 to 3 drops	←	
Lubrication points	Type		Multipurpos grease	←	←	←	
	Capacity		Proper amount	←	←	←	
Fuel tank	Type		Gasoline	Diesel fuel	←	←	
	Capacity		52ℓ (14 US gal)	←	←	←	
Engine cooling system	Type	STD	Long life coolant 30%	←	←	←	
		OPT (*Cold area)	Long life coolant 50%	←	←	←	
	Capacity			6.2ℓ (1.64 US gal)	5.5ℓ (1.45 US gal)	9.6ℓ (2.53 US gal)	9.9ℓ (2.61 US gal)

*: For use at a minimum temperature of -15°C to -25°C in a cold season.

** : Precisely, capacity 25ℓ (6.6 US gal) must contain 1.5ℓ (0.4 US gal) of specified HST additive & Part No. 38999-42800-71.

PERIODIC MAINTENANCE

INSPECTION METHOD

I : Inspect and correct and replace as required. T : Tighten C : Clean

L : Lubricate M ; Measure and correct and adjust as required.

INSPECTION PERIOD

Carry out according to operating hours or months, whichever is soonest.

Inspection Period		Every	1	3	6	12	Months
		Every	170	500	1000	2000	Hours
ENGINE							
Basic components	Starting condition and unusual noise	I	←	←	←		
	Rotating condition during idling	M	←	←	←		
	Rotating condition during acceleration	M	←	←	←		
	Exhaust condition	I	←	←	←		
	Air cleaner element	C	←	←	←		
	Valve clearance	M*				M	
	Compression					M	
Blow by gas Reduction Device	Clogging and damage of PCV valve and piping	I	←	←	←		
Governor	Maximum no-load speed	M	←	←	←		
Lubrication system	Oil leakage	I	←	←	←		
	Oil level	I	←	←	←		
	Clogging and fouling of oil filter	I	←	←	←		
Fuel system	Fuel leakage	I	←	←	←		
	Carburetor link mechanism operation	I	←	←	←		
	Fouling and damage of fuel filter element	I	←	←	←		
	Clogging of feed pump stainer	C	←	←	←		
	Injection timing				M	←	
	Injection nozzle injection pressure and condition					M	
Cooling system	Radiator cooling water level and leakage	I	←	←	←		
	Rubber hose deterioration	I	←	←	←		
	Radiator cap condition	I	←	←	←		
	Fan belt tension and damage	I	←	←	←		

*: For new vehicle

Item		Inspection Period						Months
		Every	1	3	6	12		Hours
		Every	170	500	1000	2000		
POWER TRANSMISSION SYSTEM								
HST pump and motor	Oil leak	I	←	←	←			
	HST pump and motor operation, abnormal sound	I	←	←	←			
	HST charge pressure measurement		M	←	←			
	HST working pressure measurement		M	←	←			
Reduction gear unit	Oil leak	I	←	←	←			
	Oil level	I	←	←	←			
	Reduction gear operation, abnormal sound	I	←	←	←			
	Chain bush engaged portion deformation		I	←	←			
	Sprocket deformation, damage		I	←	←			
RUNNING EQUIPMENT								
Wheels	Tire air pressure	M	←	←	←			
	Tire cuts, damage and uneven treads	I	←	←	←			
	Loose hub bolts and hub nuts	T	←	←	←			
	Tread depth	M	←	←	←			
	Metal fragments, stones or other foreign objects in tires	I	←	←	←			
	Rim, side ring and disc wheel damage	I	←	←	←			
	Wheel bearing unusual noise and looseness	I	←	←	←			
Axle	Deformation, crack and damage					I		
STEERING SYSTEM								
Steering control lever	Looseness	I	←	←	←			
	Operation condition	I	←	←	←			
Link rod	Bending and damage	I	←	←	←			
	Installed portion looseness	I	←	←	←			
BRAKE SYSTEM								
Brake pedal	Play and reserve	M	←	←	←			
	Braking effect	I	←	←	←			
Parking brake	Pull margin	I	←	←	←			
	Braking effect	I	←	←	←			
	Rod and cable looseness and damage	I	←	←	←			
	Ratchet wear and damage					I		
Disk brake	Brake disk and pad wear and damage					M		

Item \ Inspection Period		Every	1	3	6	12	Months
		Every	170	500	1000	2000	Hours
MATERIALS HANDLING EQUIPMENT							
Bucket	Bucket edge damage, wear	I	←	←	←		
	Bucket deformation, damage and crack	I	←	←	←		
	Bucket welded portion crack					I	
Lift arm and link	Lift arm and link deformation, damage and crack	I	←	←	←		
	Lift arm welded portion crack					I	
Bucket bracket	Stop lever, link and pin damage	I	←	←	←		
	Bucket bracket deformation, damage and crack	I	←	←	←		
	Bucket bracket welded portion crack					I	
Various kinds of attachments	Any abnormality and installed state of each part	I	←	←	←		
HYDRAULIC EQUIPMENT							
Cylinder	Cylinder installed portion looseness	T	←	←	←		
	Cylinder and piston rod damage	I	←	←	←		
	Rising speed, dumping speed	M	←	←	←		
	Cylinder operating condition, natural drop, natural forward tilt	M	←	←	←		
	Cylinder oil leak	I	←	←	←		
	Pin and cylinder bearing wear damage	I	←	←	←		
Oil pump	Oil leak, abnormal sound	I	←	←	←		
Hydraulic oil tank	Oil amount and dirt	I	←	←	←		
	Oil leak	I	←	←	←		
	Tank and strainer		C	←	←		
Operating pedal	Each connecting portion looseness	I	←	←	←		
	Pedal function	I	←	←	←		
	Pedal lock function	I	←	←	←		
Oil control valve	Oil leak	I	←	←	←		
	Safety valve function	I	←	←	←		
	Relief pressure measurement					M	
Hose, piping	Oil leak, looseness measurement	I	←	←	←		
ELECTRIC EQUIPMENT							
Ignition system	Distributor cap cracking	I	←	←	←		
	Damage of contact breaker arm and point	I	←	←	←		

Item		Inspection Period					Months
		Every	1	3	6	12	Hours
		Every	170	500	1000	2000	
Ignition system	Contact breaker point gap		M	←	←	←	
	Spark plug burning and gap		I	←	←	←	
	Ignition timing				M	←	
	Distributor side terminal burning		I	←	←	←	
	Wear and damage of distributor cap center terminal		I	←	←	←	
	Plug cord internal disconnection					I	
Starter	Pinion gear meshing		I	←	←	←	
Charger	Charging function		I	←	←	←	
Electric wiring	Wire harness damage and connector looseness		I	←	←	←	
	Fuses		I	←	←	←	
Pre-heater	Glow plug heat coil breakage				I	←	
	Thermo-start plug function				I	←	
Battery	Specific gravity				M	←	
SAFETY DEVICE AND OTHERS							
Operator guard and side guard	Installed portion looseness		T	←	←	←	
	Deformation, crank, damage		I	←	←	←	
Direction indicator	Operation and installed state		I	←	←	←	
Alarm unit	Operation and installed state		I	←	←	←	
Lamp unit	Operation and installed state		I	←	←	←	
Reverse alarm	Operation and installed state		J	←	←	←	
Back mirror	Dirt and damage		I	←	←	←	
	Back reflection state		I	←	←	←	
Instruments	Each instrument operation		I	←	←	←	
Seat	Looseness, damage		I	←	←	←	
Seat Belt	Slackness, damage		I	←	←	←	
Body	Frame, cross member, etc. damage, crack					I	
	Bolt looseness					T	
Others	Each part grease up		L	←	←	←	

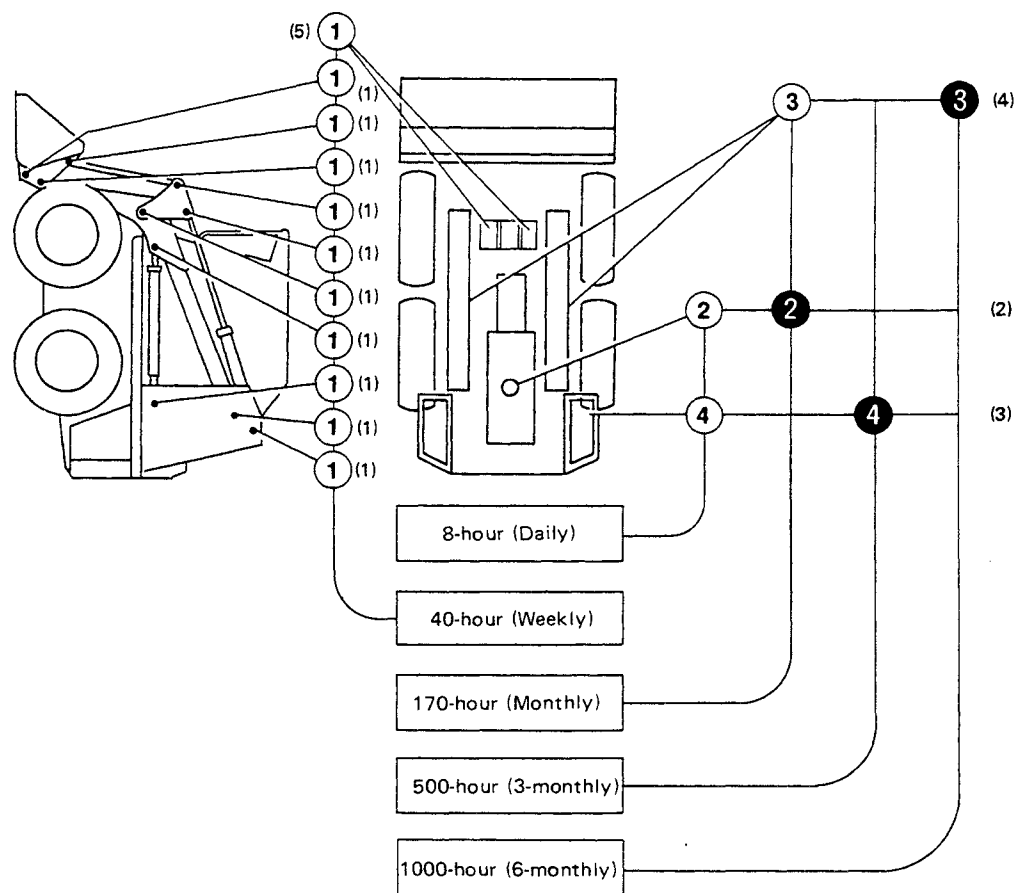
PERIODIC REPLACEMENT PARTS AND LUBRICANTS

REPLACEMENT PERIOD

Carry out according to operating hours or months, whichever comes soonest.

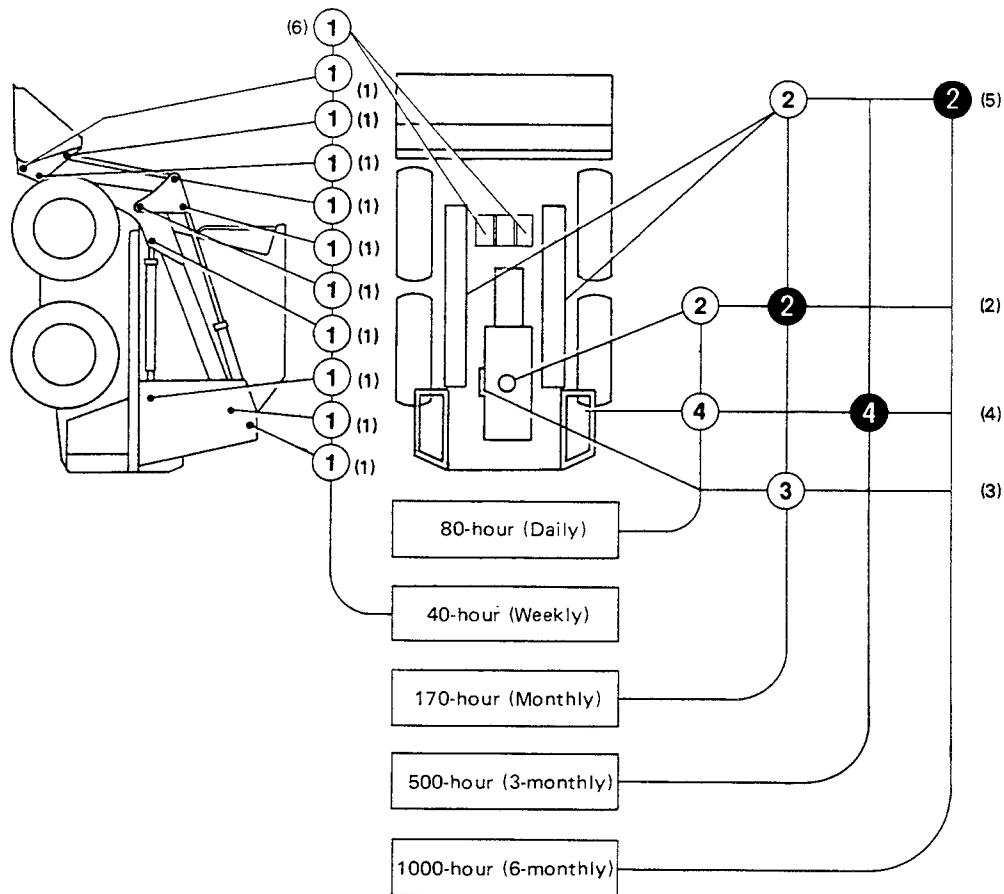
Replacement Item	50 hrs	Monthly services (170 hrs.)	3-month services (500 hrs.)	6-month services (1000 hrs.)	Annual services (2000 hrs.)	Remarks
Engine Oil		•	←	←	←	
Engine Oil Filter		• (New vehicle)	•	←	←	
Coolant (Excluding LLC)			•	←	←	Replace LLC every 2 years
Air Cleaner Element					•	Replace every 6-times cleaning
Fuel Filter				•	←	
Fuel Filter Element				•	←	
Hydraulic Oil			•	←	←	
Reduction Gear Unit Oil				•	←	
HST Oil Filter	• (New vehicle)	NOTE: After 2nd time, replace every 500 hours (or 1 year)				Replace by warning lamp and buzzer indication
Spark Plug				•	←	
Distributor Point				•	←	
Fuel Hose						• Replace every 2 years
Hose for Loading						• Replace every 2 years
Hose for HST						• Replace every 2 years

LUBRICATION



- : Inspect
- : Replace
- 1. Multipurpos grease
- 2. Motor oil
- 3. Diesel engine oil
- 4. Auto fluid

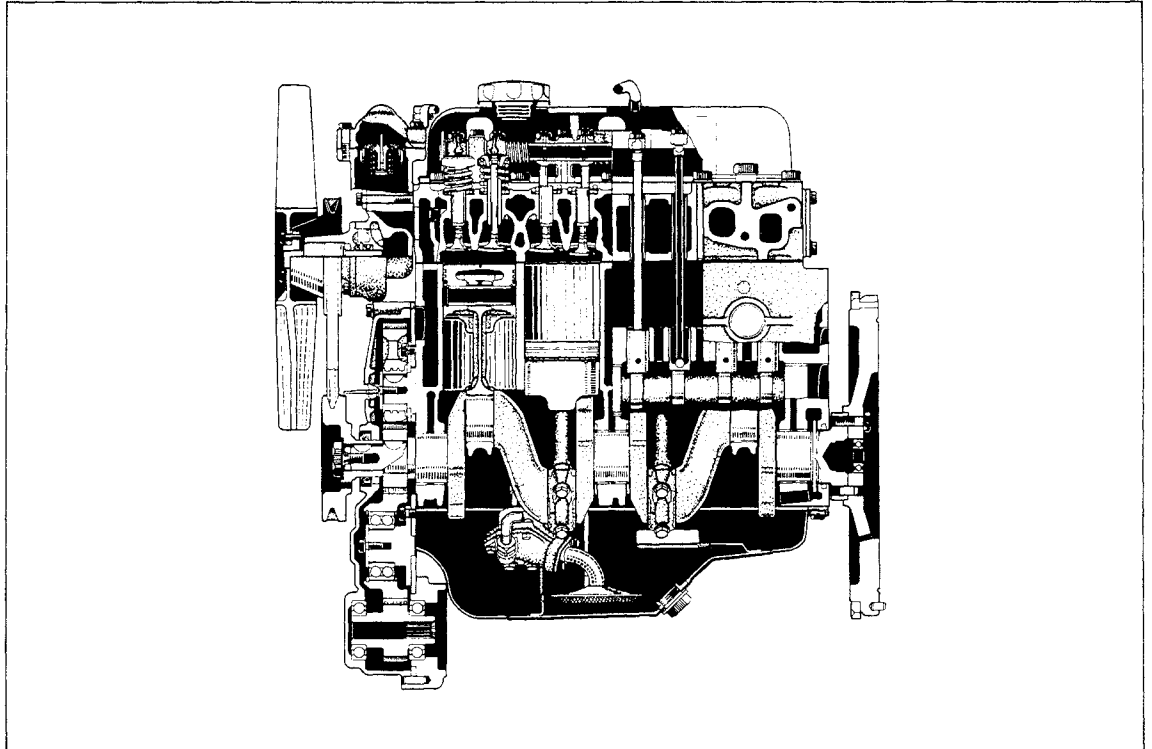
- (1) Arm and cylinder each portion joint pin
- (2) Engine crank case
- (3) Hydraulic oil tank
- (4) Reduction gear unit
- (5) Pedal lock shaft



ENGINE

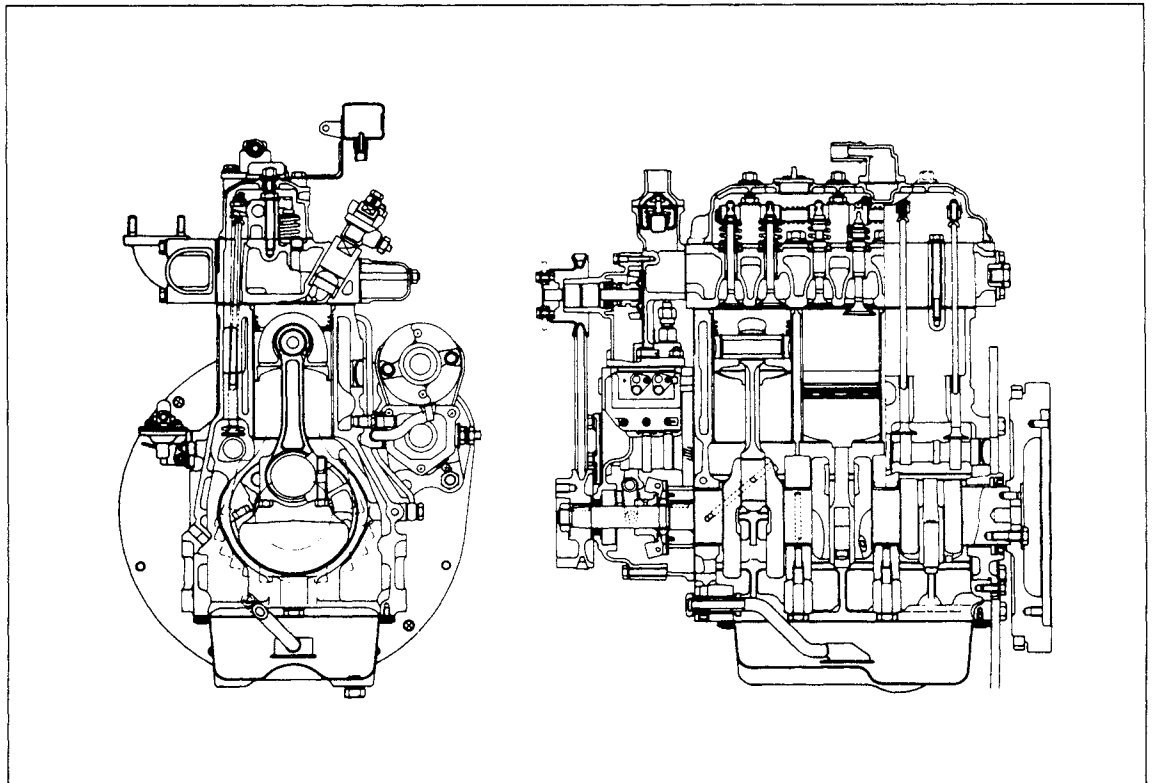
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2J ENGINE ASSY REMOVAL & INSTALLATION	1-17
3T84H ENGINE ASSY REMOVAL & INSTALLATION	1-27
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GENERAL



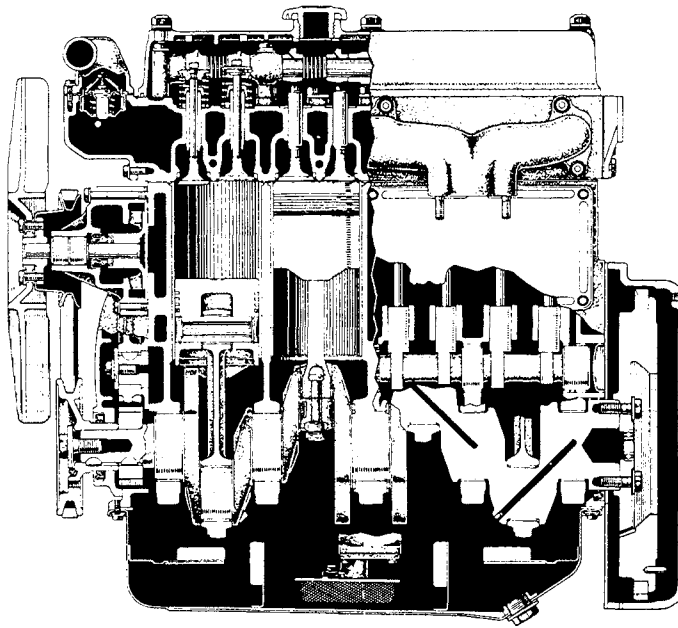
4P Engine Sectional View

SAEL1



3T84H Engine Section View

SAES1



2J Engine Sectional View

JAAM7

SPECIFICATIONS

Vehicle			2SGK6	2SDK6	2SDK7	2SDK8
Item						
Engine model			Toyota 4P	Yanmar 3T84H	Toyota 2J	←
No. of cylinders & arrangement			Gasoline, 4-cycle	Diesel, 4-cycle	←	←
Combustion chamber			Wedge type	Vortex type	←	←
Valve system			Gear drive, overhead type	←	←	←
Bore x stroke	mm (in.)		76.6 × 81.0 (3.02 × 3.19)	84.0 × 85.0 (3.31 × 3.35)	88.0 × 102.0 (3.46 × 4.02)	←
Total displacement	cc (cu-in)		1493 (91)	1413 (86)	2481 (151)	←
Compression ratio			8.5	21.0	←	←
Compression pressure	kg/cm ² -rpm (psi-rpm)		11 – 250 (156 – 250)	35 – 250 (498 – 250)	27 – 260 (384 – 260)	←
Rated output	PS/rpm (HP/rpm)		30/2400 (38/2600 Gross)	28/2500 (27/2500 Net)	40/2500 (38/2500 Net)	50/2500 (47/2500 Net)
Maximum torque	kg-m/rpm (ft-lbs/rpm)		10.5/1800 (77/2600 Gross)	8.5/2000 (59/2000 Net)	12.0/2200 (83/2200 Net)	14.5/2200 (100/2000 Net)
Fuel consumption ratio (full load)	g/PS-H (rpm)		210 (2000)	195 (2500)	198 (1600)	197 (1000)
Engine dimensions (L × W × H)			622 × 530 × 641 (24.5×20.9×25.2)	614 × 446 × 691 (24.2×17.6×27.2)	678 × 568 × 803 (26.7×22.4×31.6)	←
Service weight kg (lbs)			138 (304)	149 (329)	214 (472)	←
Valve opening & closing timing	Intake	Open	20° B.T.D.C	20° B.T.D.C	16° B.T.D.C	←
		Close	50° A.B.D.C	50° A.B.D.C	44° A.B.D.C	←
	Exhaust	Open	58° B.B.D.C	50° B.B.D.C	52° B.B.D.C	←
		Close	12° A.T.D.C	20° A.T.D.C	14° A.T.D.C	←
Valve clearance	Intake		0.2 (0.008) (hot)	0.2 (0.008) (cold)	0.2 (0.008) (hot)	←
	Exhaust		0.36 (0.014) (hot)	0.2 (0.008) (cold)	0.36 (0.014) (hot)	←
Ignition timing B.T.D.C/rpm			8°/650			
Ignition order			1–3–4–2			
Injection timing – B.T.D.C/static				21°	13°	←
Ignition sequence				1–3–2	1–2–4–3	←
Maximum no-load speed	rpm		2600	2650	2600	←
Idling speed	rpm		650	800	750	700

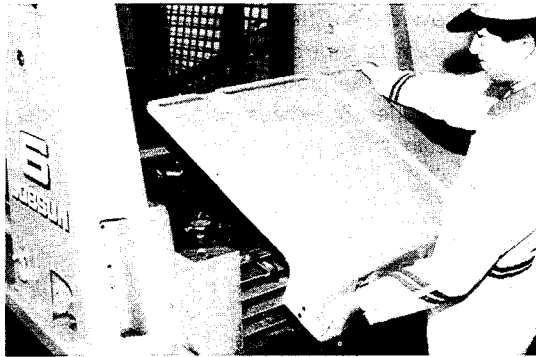
4P ENGINE ASSY REMOVAL & INSTALLATION

REMOVAL

1. Remove the engine hood.

- (1) Set bolts (6 pcs.)

- (2) Engine hood



Engine Hood

SAE35-4

2. Disconnect the battery earth cable.

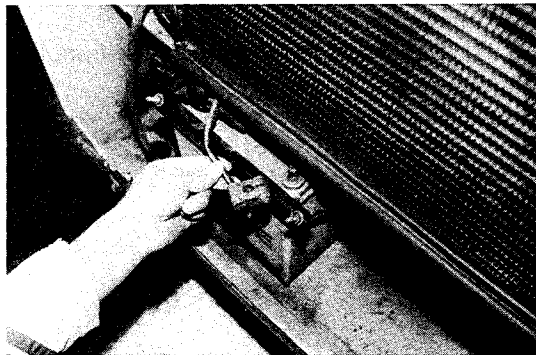
- (1) Open the rear grille.

- (2) Disconnect the battery earth cable.

3. Drain the coolant.

- (1) Prepare a coolant receiving container.

- (2) Loosen the radiator drain cock.



Disconnecting the Battery Earth Cable

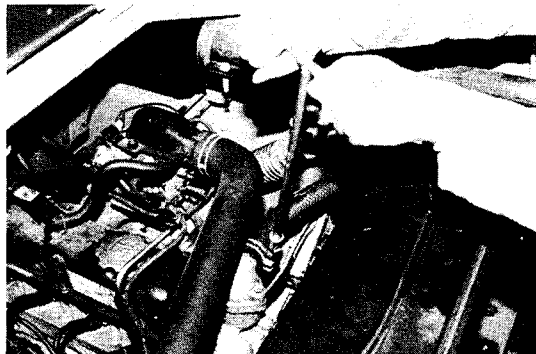
SAE35-6

4. Remove the radiator.

- (1) Disconnect the radiator inlet and outlet hoses on the engine side.

- (2) Remove the wiring from the clamp on top of the radiator.

- (3) Reservoir tank



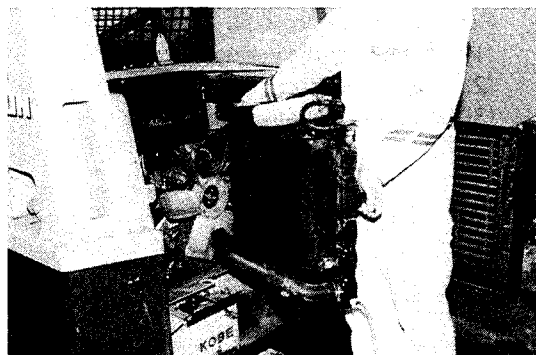
Disconnecting the Hoses

SAE35-8

- (4) Set bolts (2 pcs.)

- (5) Radiator with hoses

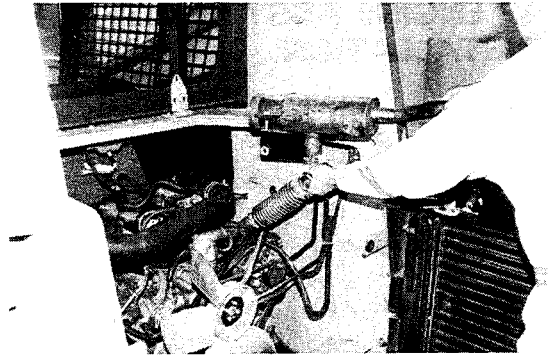
- (6) Rubber cushion



Radiator

SAE35-10

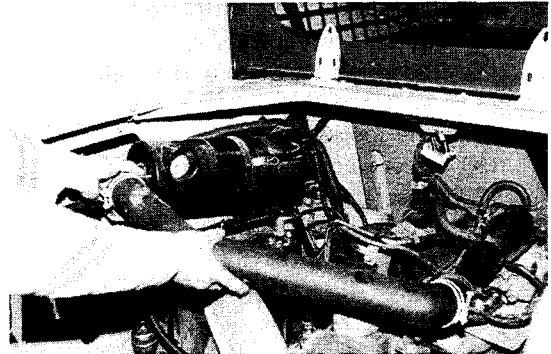
5. Remove the muffler and exhaust pipe.
 - (1) Exhaust pipe set nuts (4 pcs.)
 - (2) Muffler set bolts (2 pcs.)
 - (3) Muffler & exhaust pipe (with muffler clamp)



Muffler Assy & Exhaust Pipe

SAE35-18

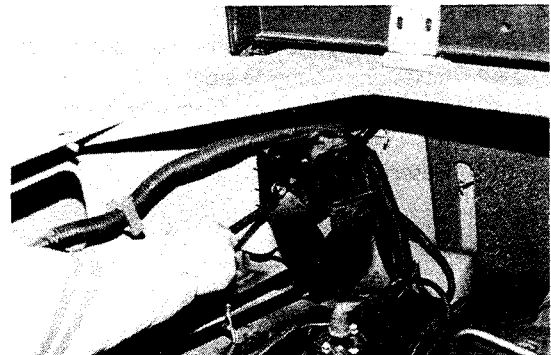
6. Remove the air cleaner
 - (1) Disconnect the air cleaner hose from the engine.
 - (2) Disconnect the wiring to the vacuum sensor.
 - (3) Air cleaner band clamp bolt
 - (4) Air cleaner with hose



Air Cleaner

SAE35-21

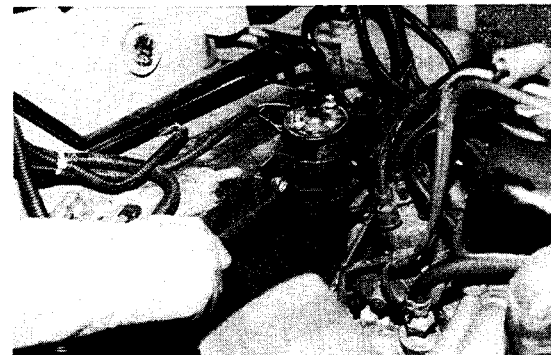
7. Remove the air cleaner bracket.
 - (1) Set bolts (2 pcs.)
 - (2) Air cleaner bracket



Air Cleaner Bracket

SAE35-22

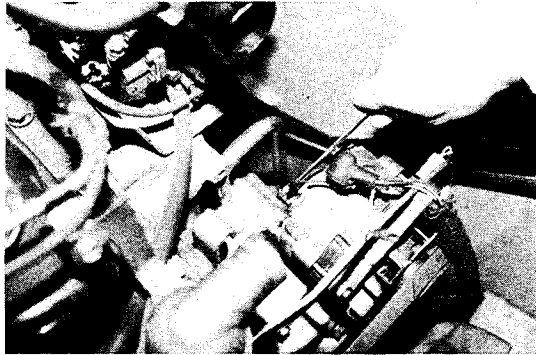
8. Remove the ignition coil.
 - (1) Disconnect the wiring
 - (2) Bracket set bolt
 - (3) Ignition coil with bracket



Ignition Coil

SAE35-23

9. Disconnect the wirings.
- (1) Wiring to alternator
 - (2) Wiring to water temperature sender gauge
 - (3) Wiring to engine oil pressure switch
 - (4) Wiring to carburetor



Disconnecting the Wiring (Alternator)

SAE35-24

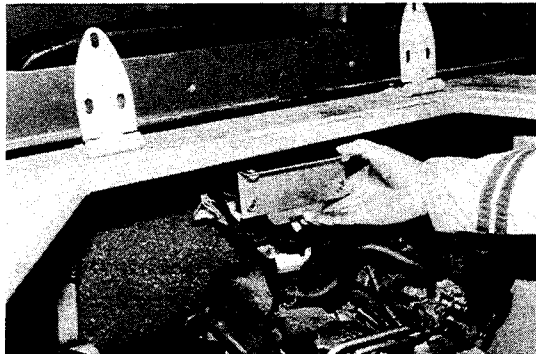
- (5) Wiring to starting motor
- (6) Wiring to distributor



Disconnecting the Wiring (Starting Motor)

SAE35-28

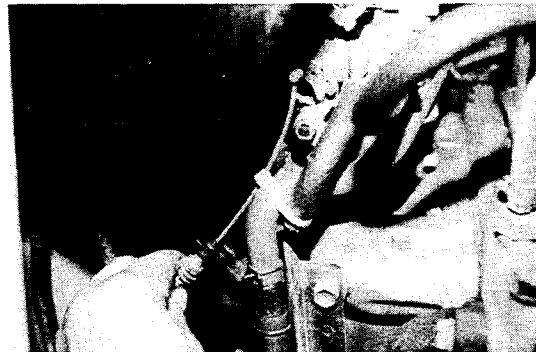
10. Remove the voltage regulator.
- (1) Disconnect the wiring
 - (2) Set bolts (2 pcs.)
 - (3) Voltage regulator



Voltage Regulator

SAE35-26

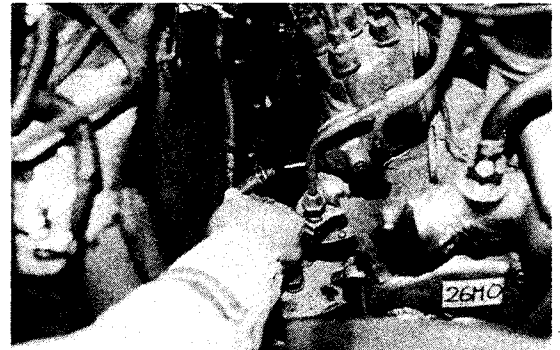
11. Disconnect the accelerator wire.



Disconnecting the Accelerator Wire

SAE35-29

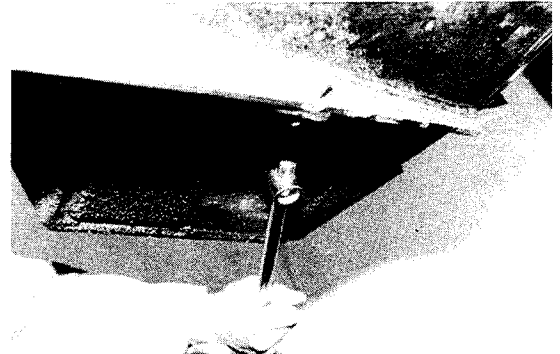
12. Disconnect the fuel hose.



Disconnecting the Fuel Hose

SAE35-30

13. Drain the hydraulic oil.
 - (1) Prepare an oil receiving container.
 - (2) Drain plug



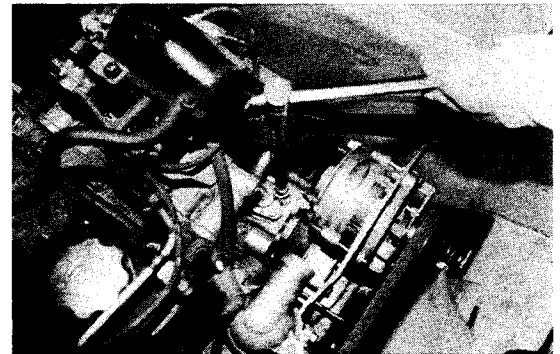
Draining the Hydraulic Oil

SAE35-31

14. Disconnect the oil pump piping.
 - (1) Outlet hose (oil pump side)
 - ① Set bolts (4 pcs.)
 - ② Flange
 - (2) Suction pipe (oil pump side)
 - ① Set bolts (4 pcs.)

Caution:

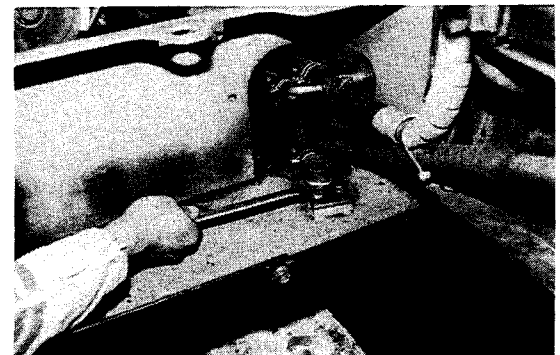
Fit nylon caps or other covers to the hose, pipe and oil pump ports to prevent entrance of foreign matters.



Disconnecting the Oil Pump Piping

SAE35-32

15. Remove the engine oil drain from the frame.
 - (1) Set bolts (2 pcs.)
 - (2) Engine oil drain



Engine Oil Drain

SAE35-34

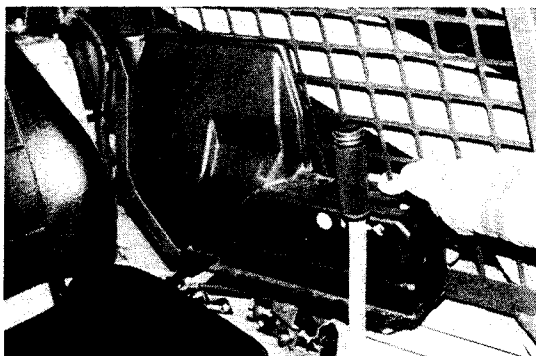
16. Remove the operator guard.

(1) Duct LH

- ① Set screws (6 pcs.)
- ② Accelerator lever knob
- ③ Duct LH

(2) Disconnect the wirings.

- ① Main harness
- ② Wiring to horn
- ③ Wiring to pedal lock solenoid
- ④ Earth cable

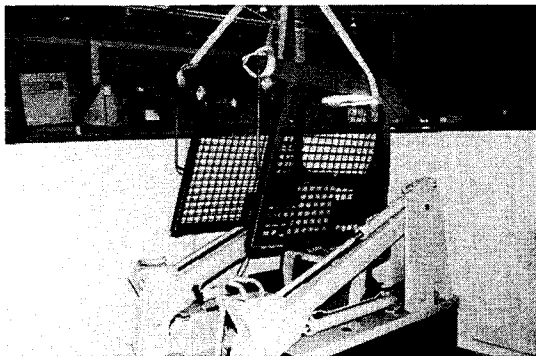


Duct LH

SAE42-27

(3) Set bolts (4 pcs.)

(4) Operator guard



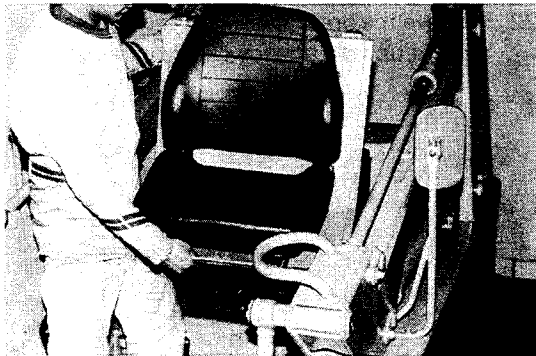
Operator Guard

SAE36-10

17. Remove the driver's seat.

- (1) Set bolts (6 pcs.)
- (2) Disconnect the wiring.
- (3) Driver's seat

18. Disconnect the wiring for the backup lamp switch.



Driver's Seat

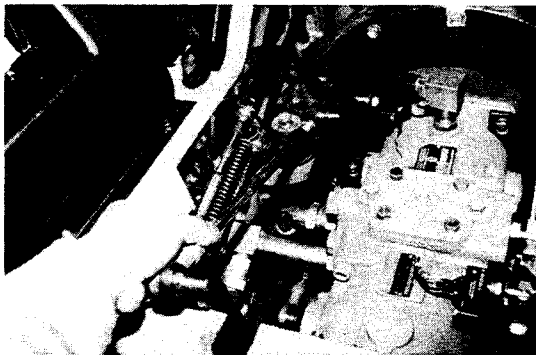
SAE42-35

19. Remove the steering link RH.

20. Disconnect the steering link LH.

Caution:

Disconnect the steering link LH on the HST pump side.



Steering Link RH

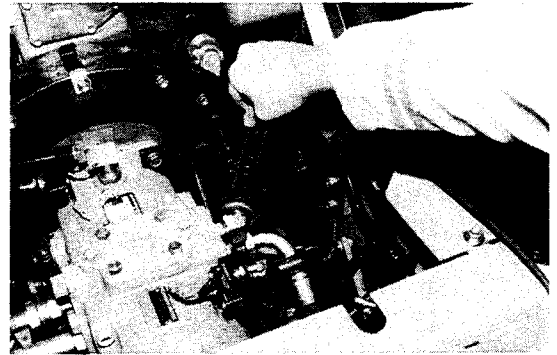
SAE36-1

21. Disconnect the HST piping.

Caution:

Fit nylon cap or other covers to the hoses and elbows to prevent entrance of foreign matters.

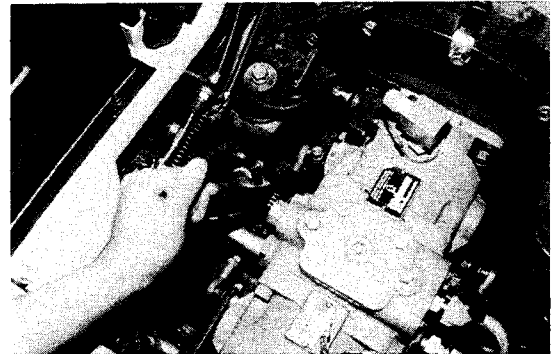
- (1) Charge hose
- (2) Drain pipe



Disconnecting the Charge Hose

SAE36-3

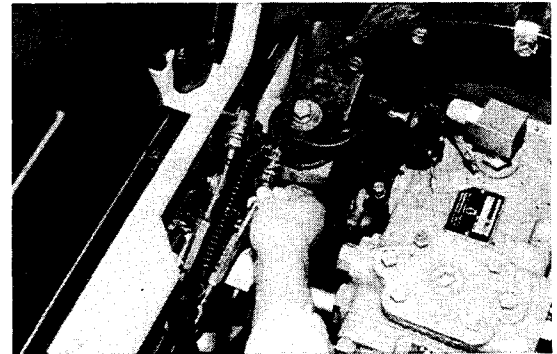
- (3) High pressure hoses (4 pcs.)



Disconnecting the High Pressure Hoses

SAE36-5

22. Remove the brake wire from the bracket and move it upward (the lower side wire only).

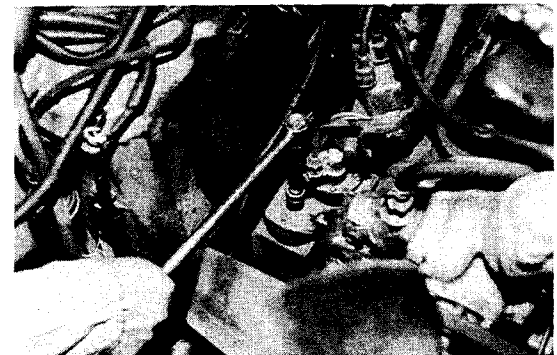


Moving the Brake Wire

SAE36-6

23. Remove the engine with HST pump.

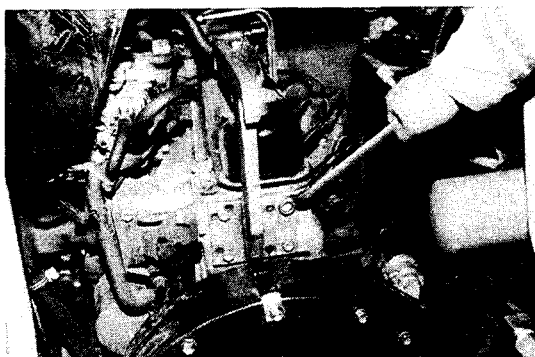
- (1) Mounting set nuts (4 pcs.)
- (2) Disconnect the earth cable.



Mounting Set Nuts

SAE36-8

- (3) Remove the rear head plate and install the SST (engine hook).
SST 09010-20120-71

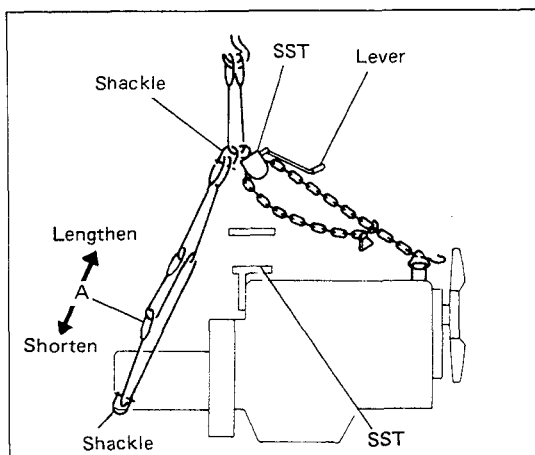


Installing the SST (Engine Hook)

SAE36-9

- (4) Remove the engine with HST pump according to the following steps:

- ① Remove the set bolts on the left side of the spring holder bracket FR and set wires using shackles. Use two wires, 1.5 m (59 in.) and 1 m (39 in.), and set the 1.5 m (59 in.) wire to the pump.
- ② The pump side wire shall be so set as to allow length adjustment. (See the figure at right.)
- ③ Set the chain hook on one side of the engine sling device (SST 09090-04000) to the engine hanger. Set the other chain hook to the chain fitted to the engine hanger.



Setting the Wires and Engine Sling Device (SST)

SAES13

- ④ Adjust the wire and chain lengths so that the hoist hook comes right above the frame member.

[Wire length adjustment]

Moving the wire eye A upward lengthens the wire length, and moving it downward shortens the wire length.

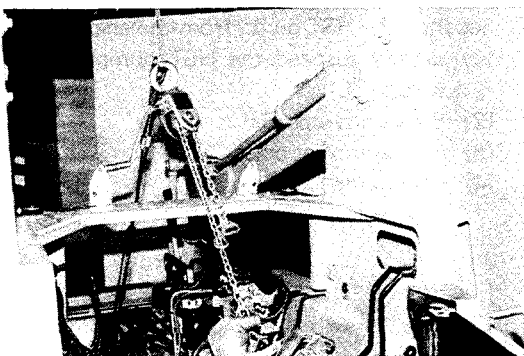
[Chain length adjustment]

Rotate the engine sling device lever for the length adjustment.

- ⑤ Hoist the engine with HST pump.

Caution:

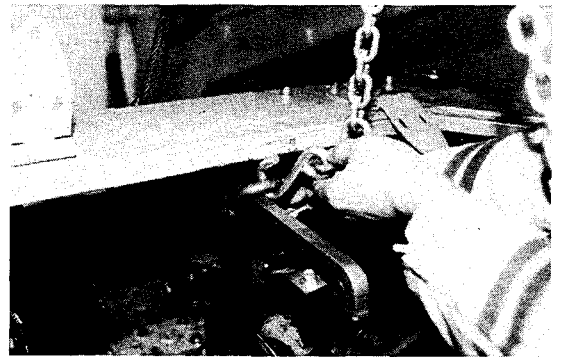
Be sure that all wirings and pipings are disconnected.



Hoisting the Engine

SAE36-16

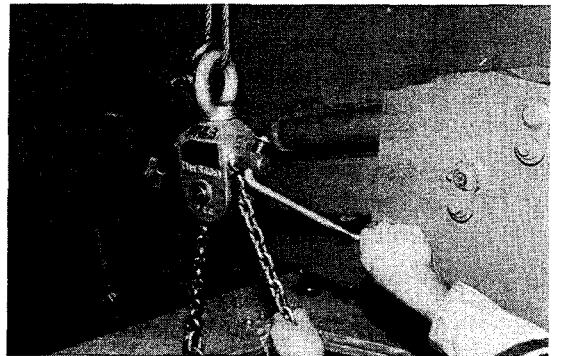
- ⑥ Move the engine with HST toward the rear, and stop the movement when the engine hook (SST 09010-20120-71) comes behind the frame member.
- ⑦ Apply the free chain hook of the engine sling device (SST 09090-04000) to the engine hook via a shackle.



Applying the Chain to the Engine Hook (SST)

SAE36-21

- ⑧ Operate the lever on the engine sling device (SST) to bring up the HST pump side and loosen the wire tension.

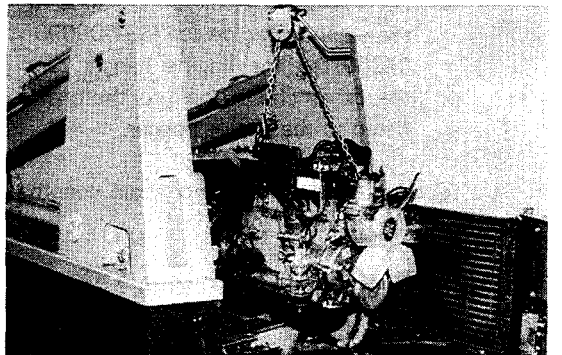


Operating the Engine Sling Device Lever

SAE37-5

- ⑨ Disconnect the wire from the shackle on the hoist side to make the engine with HST pump be suspended with the sling device (SST) only.
- ⑩ Operate the lever on the engine sling device until the engine with HST pump becomes horizontal.
- ⑪ Remove the engine with HST pump.

24. Place the engine with HST pump in stable state.

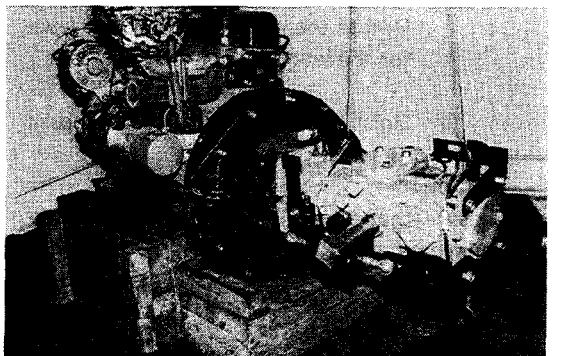


Engine with HST Pump

SAE36-24

25. Separate the HST pump from the engine.

- (1) Lightly suspend the HST pump with a wire rope.
- (2) Back up switch RH
- (3) HST pump set bolts
- (4) HST pump



Separating the HST Pump from the Engine

SAE36-28

- | | |
|---|---|
| <p>26. Remove the HST pump support.</p> <p>27. Remove the damper.</p> <p>Caution:
For removal of the HST pump support and damper, see the 2J Engine Removal section.</p> | <p>28., Remove the flywheel and end plate.</p> <ul style="list-style-type: none"> (1) Set bolts (2) Flywheel (3) Set bolts (4) End plate <p>29. Remove the oil pump</p> <ul style="list-style-type: none"> (1) Set bolts (2) Oil pump |
|---|---|

INSTALLATION

The installation procedure is the reverse of the removal procedure.

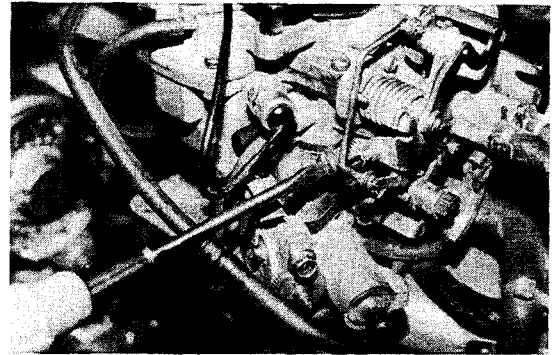
Caution:

- Flywheel set bolt tightening torque
T = 5.8 ~ 6.6 kg-m (41.9 ~ 47.7 ft-lbs)
- Coat and seal (about 10 cc) molybdenum disulfide grease at the spline portion and in the seal cap of the HST pump and damper before installing the HST pump to the engine.
- Connect the battery earth cable after checking correct connection of all electrical wirings.
- Before starting the engine, always check the hydraulic oil, coolant and engine oil levels. If insufficient, always fill to the specified levels.
- When starting the engine, set the steering control lever to the neutral position and warm up the engine and HST pump at the idling speed.
- Start the engine (at a low speed) and check that the steering lever neutral position is correct. If incorrect, adjust the position at the spring holder. See the STEERING-Steering Neutral Adjustment section for the adjustment procedure.
- Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air bleeding from Hydraulic circuit section.

ENGINE ADJUSTMENT (4P ENGINE)

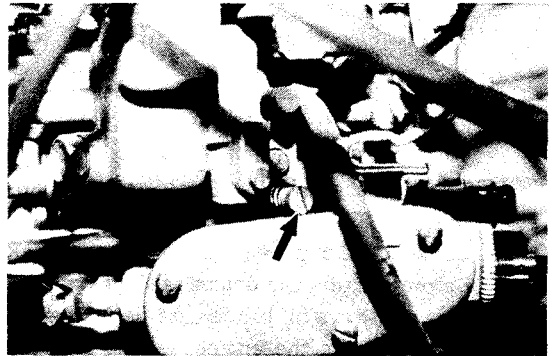
Idling Speed Adjustment

1. Warm up the engine.
(Coolant temperature: 75 ~ 85°C)
2. Remove the plug from the intake manifold, and install a vacuum gauge.
3. Install the engine tachometer.
4. Idling speed adjustment
 - (1) Turn the throttle adjusting screw to adjust the speed to a little above the idling speed.
 - (2) Turn the idle adjusting screw to adjust to the state where the engine runs in the most stable state (best idle = maximum vacuum).
 - (3) Adjust the throttle adjusting screw and idle adjusting screw alternately for adjustment to the state where the engine runs smoothly at the idling speed with the vacuum stabilized at the maximum.
Idling speed: 650 ± 50 rpm
Vacuum: 400 ~ 500 mmHg



Adjusting the Throttle Adjusting Screw

SAE36-36



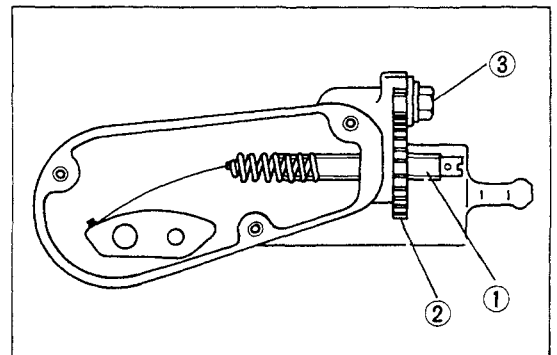
Adjusting the Idle Adjusting Screw

SAE36-35

Maximum No-load Speed Adjustment

Note:

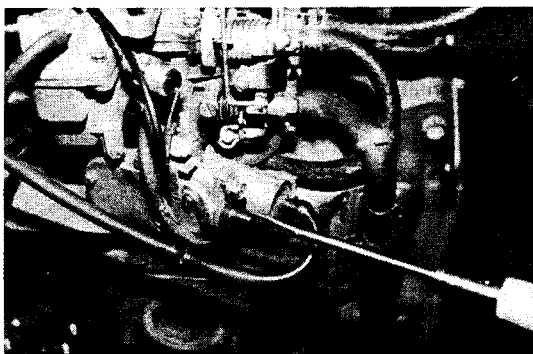
When adjusting the governor, turn screw ③ about 1/2 to 1 turn with a 10 mm (0.39 in.) wrench to make screw ② turn easily. After adjustment, tighten screw ③ with a torque of about 3 kg-m (21.7 ft-lbs) to lock screw ② from turning.



Governor Construction

SAES15

1. Fully push the accelerator lever forward.
2. Adjust the maximum no-load speed to the standard value according to the following procedure:
 Maximum no-load speed: 2550 ~ 2650 rpm
 Speed during dump relief: 2350 ~ 2450 rpm



Maximum No-Load Speed Adjustment

SAE37-2

- (1) Adjust to the specified maximum no-load speed.

	Max. no-load speed over specified rpm	Max. no-load speed below specified rpm
Screw ①	Counterclockwise turn	Clockwise turn
Screw ②	Hold	Hold

- (2) Full relief (with dump pedal)

	Relief down over 200 rpm	Relief down below 200 rpm
Screw ①	Turn counterclockwise	OK (no adjustment)
Screw ②	Turn clockwise	

- (3) Hunting at full relief

	Hunting for over 5 seconds	Hunting for less than 5 seconds
Screw ①	Approx. 1/8 clockwise turn	OK (no adjustment)
Screw ②	Approx. 1/8 counterclockwise turn	

- (4) Hunting at max. no-load speed

	Hunting exceeding ± 20 rpm	Hunting within ± 20 rpm
Screw ①	Clockwise turn	OK (no adjustment)
Screw ②	Counterclockwise turn	

- (5) Hunting at idling

	Hunting exceeding ± 20 rpm	Hunting within ± 20 rpm
Idle adjusting screw	Slightly turn clockwise or counterclockwise	OK (no adjustment)

- (6) Repeat steps (1) to (5) above for adjustment to the standard value.
 Also check that the carburetor throttle valve is fully opened when the accelerator lever is pushed fully forward.
- (7) Block screw (1) with a wire and seal it after the end of the adjustment.

Caution:

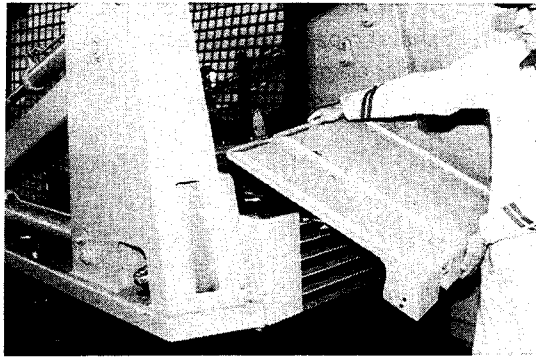
Check if the accelerator lever stopper is adjusted correctly. If incorrect, adjust the stopper and then the engine. For the accelerator lever stopper adjustment procedure, see the ENGINE-Accelerator section.

2J ENGINE ASSY REMOVAL & INSTALLATION

REMOVAL

1. Remove the engine hood.

- (1) Set bolts (6 pcs.)
- (2) Engine hood



Engine Hood

SAE13-1

2. Disconnect the battery earth cable.

- (1) Open the rear grille.
- (2) Disconnect the battery earth cable.

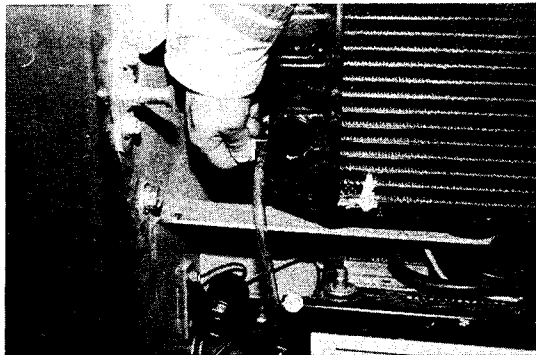


Disconnecting the Battery Earth Cable

SAE13-2

3. Drain the coolant.

- (1) Prepare a coolant receiving container.
- (2) Loosen the radiator drain cock.

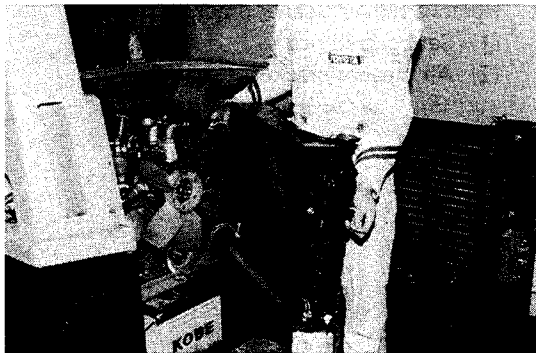


Draining the Coolant

SAE13-3

4. Remove the radiator.

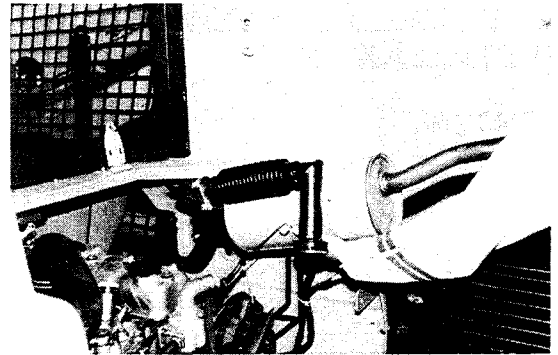
- (1) Disconnect the wiring from the clamp on top of the radiator.
- (2) Disconnect the radiator inlet and outlet hoses on the engine side.
- (3) Reservoir tank
- (4) Set bolts (2 pcs.)
- (5) Radiator with hose
- (6) Rubber cushion



Radiator

SAE13-9

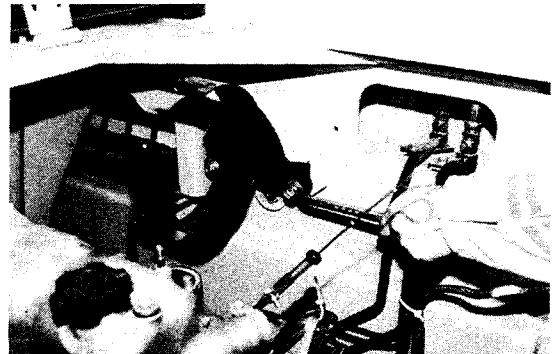
5. Remove the muffler and exhaust pipe.
 - (1) Exhaust pipe set nuts (4 pcs.)
 - (2) Muffler clamp bolt
 - (3) Muffler and exhaust pipe



Muffler & Exhaust Pipe

SAE13-12

6. Remove the muffler clamp
 - (1) Set bolts (2 pcs.)
 - (2) Spacer
 - (3) Cushion
 - (4) Muffler clamp
 - (5) Cushion



Muffler Clamp

SAE13-13

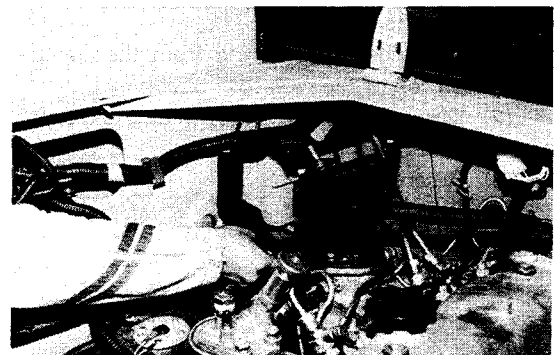
7. Remove the air cleaner.
 - (1) Disconnect the wiring to the vacuum sensor.
 - (2) Disconnect the air cleaner hose on the engine side.
 - (3) Clamp bolt
 - (4) Air cleaner with hose



Air Cleaner

SAE13-18

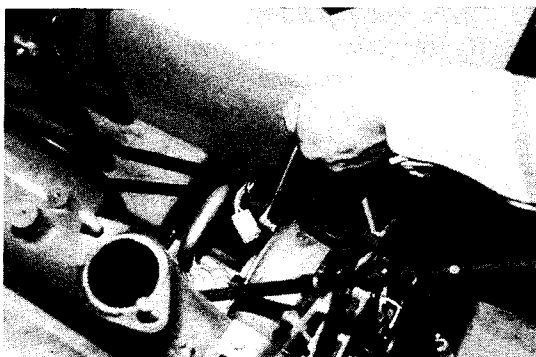
8. Remove the air cleaner bracket.
 - (1) Set bolts (2 pcs.)
 - (2) Air cleaner bracket



Air Cleaner Bracket

SAE13-21

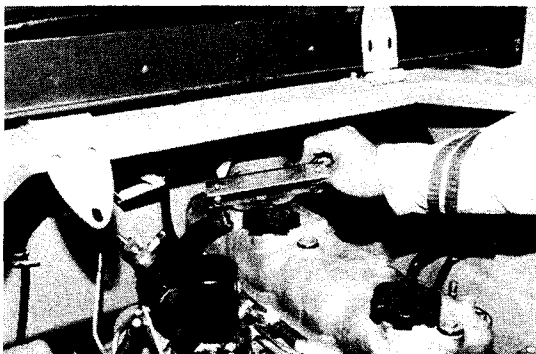
9. Disconnect the wirings.
- (1) Wiring to alternator
 - (2) Wiring to engine oil pressure switch
 - (3) Wiring to water temperature sender gauge.
 - (4) Wiring to glow plug



Disconnecting the Wiring (Alternator)

SAE13-23

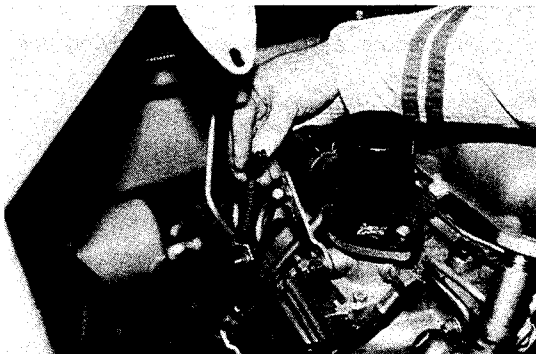
10. Remove the voltage regulator.
- (1) Disconnect the wiring.
 - (2) Set bolts (2 pcs.)
 - (3) Voltage regulator



Voltage Regulator

SAE13-31

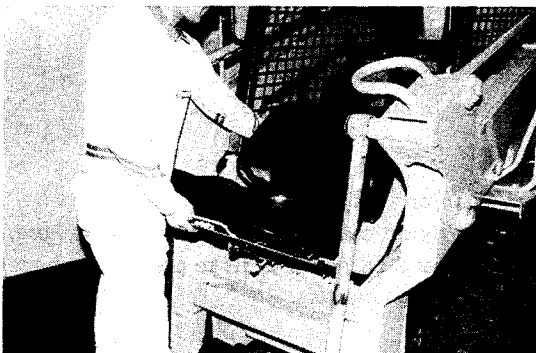
11. Disconnect the accelerator wire.
- (1) Cotter pin and plate washer
 - (2) Pin
 - (3) Clamp set nut



Disconnecting the Accelerator Wire

SAE13-32

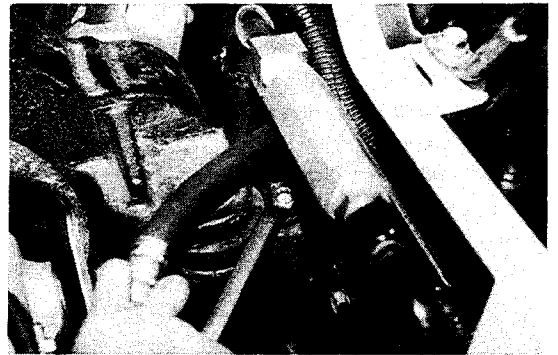
12. Remove the driver's seat.
- (1) Wiring to the seat switch
 - (2) Set bolts (6 pcs.)
 - (3) Driver's seat



Driver's Seat

SAE13-35

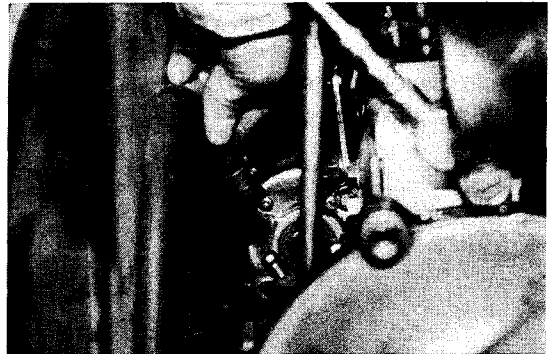
13. Disconnect the wirings.
 - (1) Wiring to starting motor
 - (2) Body earth cable
 - (3) Wiring to EDIC system



Disconnecting the Wiring
(Body Earth Cable)

SAE14-5

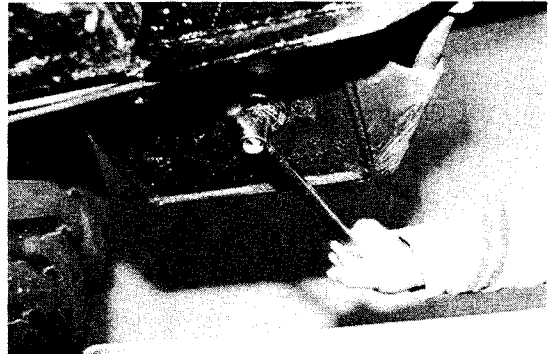
14. Disconnect the fuel hose on the engine side.



Disconnecting the Fuel Hose

SAE14-6

15. Drain the hydraulic oil.
 - (1) Prepare a hydraulic oil receiving container.
 - (2) Drain plug



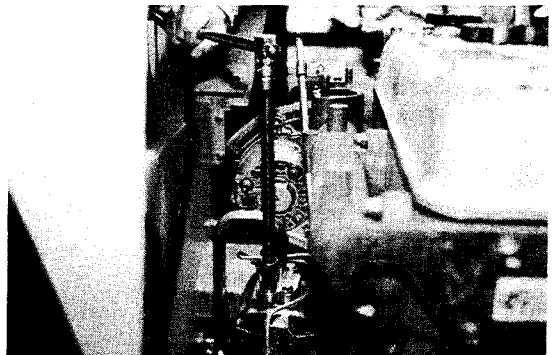
Draining the Hydraulic Oil

SAE14-8

16. Disconnect the oil pump piping.
 - (1) Outlet hose (oil pump side)
 - ① Set bolts (4 pcs.)
 - (2) Suction pipe (oil pump side)
 - ① Set bolts (4 pcs.)

Caution:

Fit nylon caps or other covers to the hose, pipe and oil pump ports to prevent entrance of foreign matters.



Disconnect the Oil Pump Piping

SAE14-10

17. Remove the engine oil drain from the frame.
 - (1) Set bolts (2 pcs.)
 - (2) Engine oil drain.

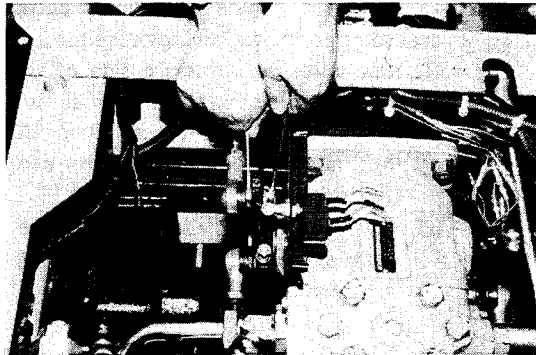
18. Disconnect the backup lamp switch wiring.



Engine Oil Drain

SAE14-21

19. Disconnect the steering link on the HST pump side.
 - (1) Steering link RH
 - (2) Steering link LH



Disconnecting the Steering Link LH

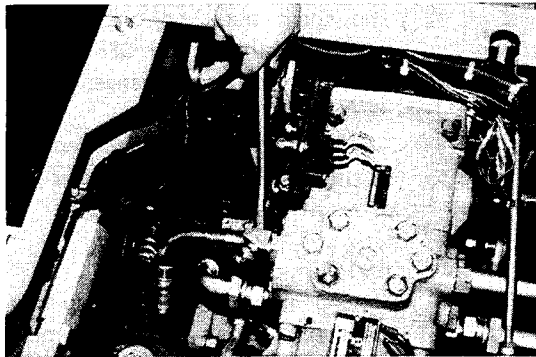
SAE14-19

20. Disconnect the HST piping.

Caution:

Fit nylon caps or other covers to the hoses and elbows to prevent entrance of foreign matters.

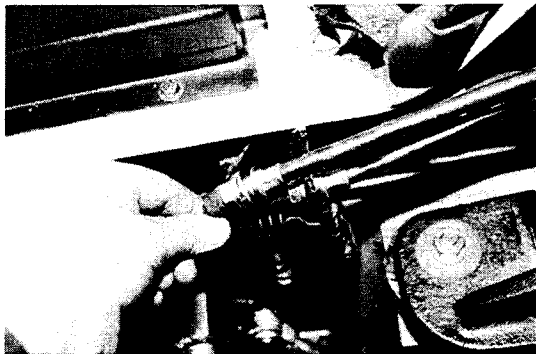
- (1) Charge hose
- (2) Drain pipe
- (3) High pressure hoses (4 pcs.)



Disconnecting the High Pressure Hoses

SAE14-20

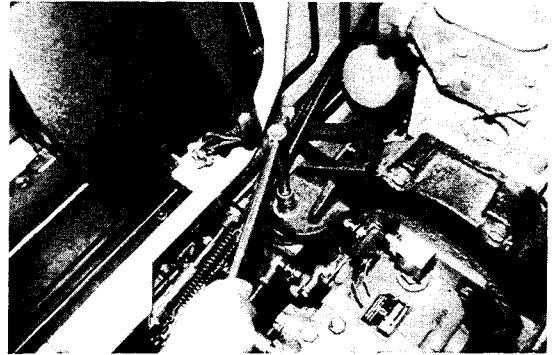
21. Remove the brake wire from the bracket and move it upward (the lower side wire only).



Moving the Brake Wire

SAE16-22

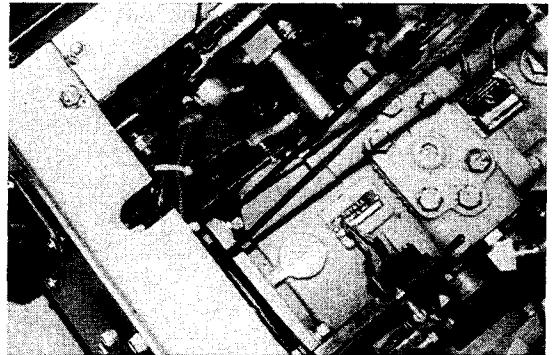
22. Remove the engine with HST pump.
 (1) Mounting set nuts (4 pcs.)



Mounting Set Nuts

SAE14-22

- (2) Remove the engine with HST pump according to the following procedure.
- ① Set wires to the right side of the spring holder bracket FR. Use two wires, 1.5 m (59 in.) and 1 m (39 in.), and set the 1.5 m (59 in.) wire to the pump.
 - ② The 1 m (39 in.) wire shall be so set as allow length adjustment (See the figure at right).



Setting Wires to the Spring Holder Bracket

SAE16-25

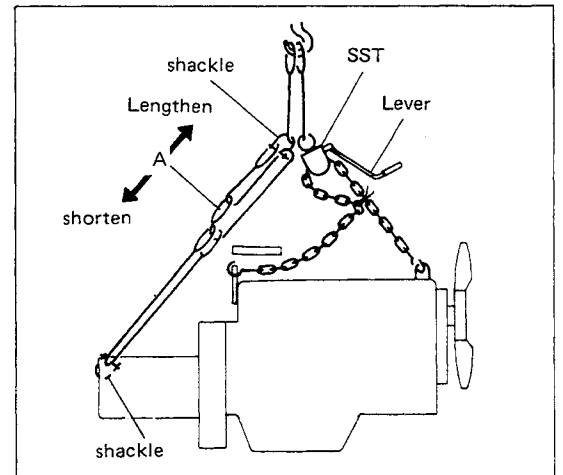
- ③ The chain hook on one side of the engine sling device (SST 09090-04000) to the engine hanger on the rear side.
- ④ Adjust the wire and chain lengths so that the hoist hook comes right above the frame member.

[Wire length adjustment]

Moving the wire eye A upward lengthens the wire length, and moving it downward shortens the wire length.

[Chain length adjustment]

Turn the engine sling device lever for length adjustment.



Setting the Wire and Engine Sling Device (SST)

SAES16

Caution:

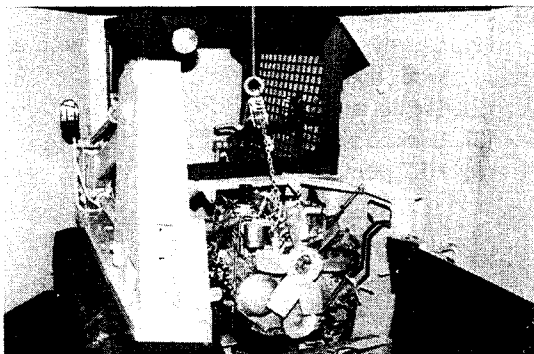
Set the free chain hook to the front side engine hanger and tie it to the other chain with a string as illustrated.

- ⑤ Hoist the engine with HST pump.

Caution:

Be sure that all wiring and pipings are disconnected.

- ⑥ Move the engine with HST pump to the rear, and stop the movement where the wire comes into contact with the frame member.



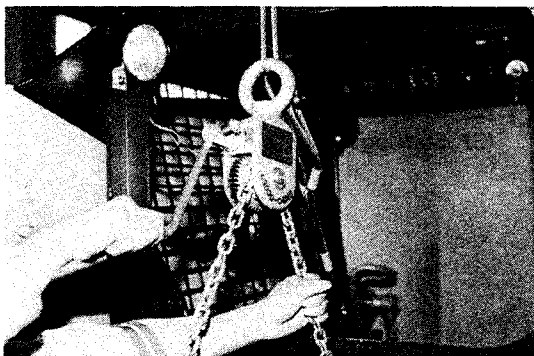
Hoisting the Engine

SAE16-29

- ⑦ Untie the string fixing the chain. Operate the lever on the engine sling device (SST) so that the HST pump comes to the upper side, and loosen the wire tension.

Caution:

With the chain applied to the front side engine hanger in taut state, operate the lever.



Operating the Engine Sling Device Lever

SAE16-30

- ⑧ Disconnect the wire from the shackle on the hoist side to make the engine with HST pump be suspended with the sling device (SST) only.
- ⑨ Operate the lever on the engine sling device until the engine with HST pump becomes horizontal.

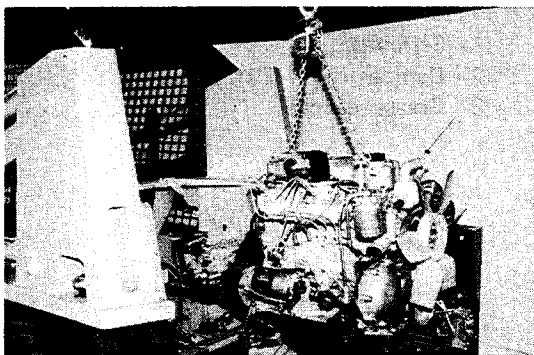


Disconnecting the Wire

SAE16-33

- ⑩ Remove the engine with HST pump.

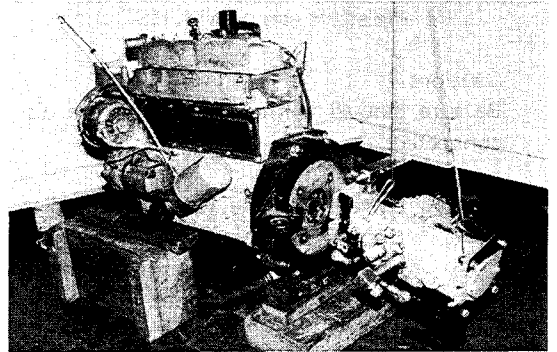
23. Place the engine with HST pump in stable state.



Engine with HST Pump

SAE16-36

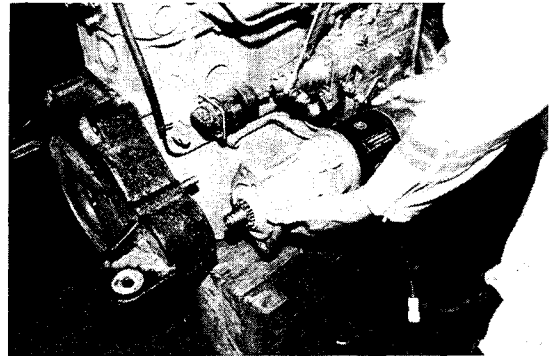
24. Separate the HST pump from the engine.
 - (1) Lightly suspend the HST pump with a wire rope.
 - (2) Set bolts (4 pcs.)
 - (3) Backup switch bracket
 - (4) HST pump



HST pump

SAE14-27

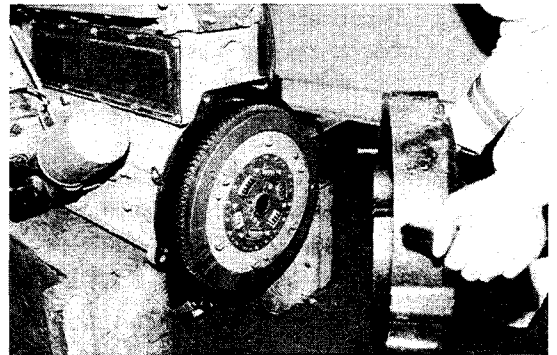
25. Remove the starting motor from the HST pump support.
 - (1) Set bolt (1 pc.)
 - (2) Set nut (1 pc.)
 - (3) Starting motor



Starting Motor

SAE14-29

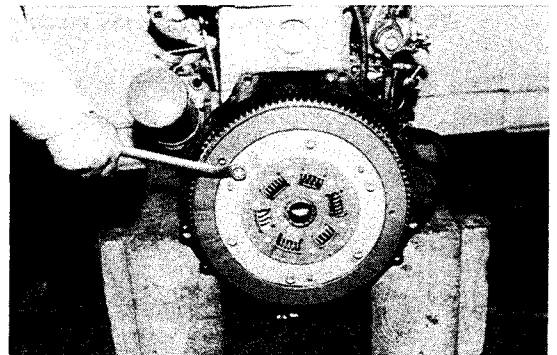
26. Remove the HST pump support.
 - (1) Set bolts (8 pcs.)
 - (2) HST pump support



HST Pump Support

SAE14-30

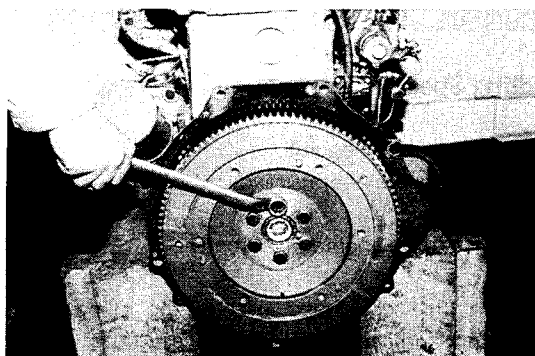
27. Remove the damper.
 - (1) Set bolts
 - (2) Damper
 - (3) Grease seal cap



Damper

SAE14-36

28. Remove the flywheel.
 - (1) Set bolts (6 pcs.)
 - (2) Flywheel
29. Remove the end plate.
 - (1) Set bolts
 - (2) End plate
30. Remove the oil pump.
 - (1) Set bolts (2 pcs.)
 - (2) Oil pump



Flywheel

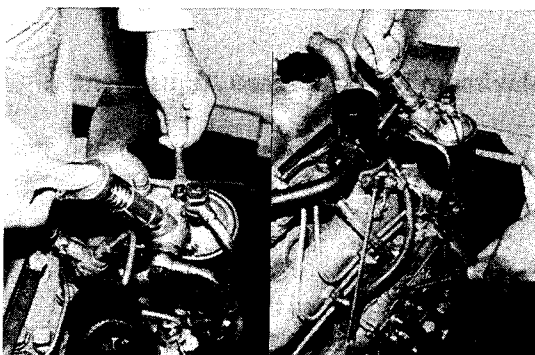
SAE15-2

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

- Flywheel set bolt tightening torque
 $T = 10 \sim 11 \text{ kg-m (72.2} \sim 79.4 \text{ ft-lbs)}$
- Coat and seal (about 10 cc) molybdenum disulfide grease at the spline portion and in the seal cap of the HST pump and damper before installing the HST pump to the engine.
- Connect the battery earth cable after checking correct connection of all electrical wirings.
- Bleed the air from the fuel system.
 Move the priming pump up and down and loosen the air vent plug at the fuel filter. After perfect air bleeding, tighten the air vent plug. Then operate the priming pump and loosen the air vent plug at the injection pump for air bleeding. After perfect air bleeding, tighten the air vent plug.
- Before starting the engine, always check the hydraulic oil, coolant and engine oil levels. If insufficient, always fill to the specified levels.
- When starting the engine, set the steering control lever to the neutral position and warm up the engine and HST pump at the idling speed.
- Start the engine (at a low speed) and check that the steering lever neutral position is correct. If incorrect, adjust the position at the spring holder. See the STEERING-Steering Neutral Adjustment section for the adjustment procedure.
- Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit section.



Air Bleeding

SAE16-17, 18

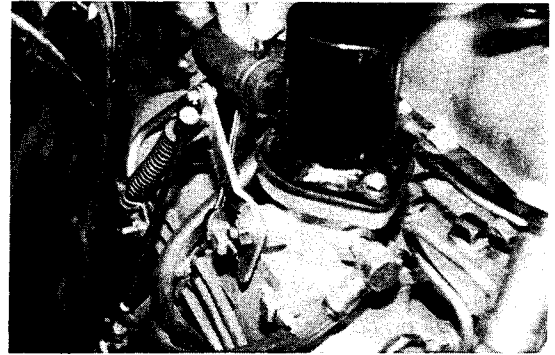
ENGINE ADJUSTMENT (2J ENGINE)

Idling Speed Adjustment

1. Warm up the engine.
(Coolant temperature 75 ~ 85°C)
2. Install the engine tachometer.
3. Set the accelerator lever to the idling position, and check the idling speed.
4. If the idling speed does not satisfy the standard value, adjust it to the standard level by turning the adjusting screw.
Standard idling speed:
750 ± 50 rpm (2SDK7)
700 ± 50 rpm (2SDK8)

Caution:

Check if the accelerator lever stopper is adjusted correctly. If incorrect, adjust the stopper and then the engine. For the accelerator lever stopper adjustment procedure, see the ENGINE-Accelerator section.



Idling Speed Adjustment

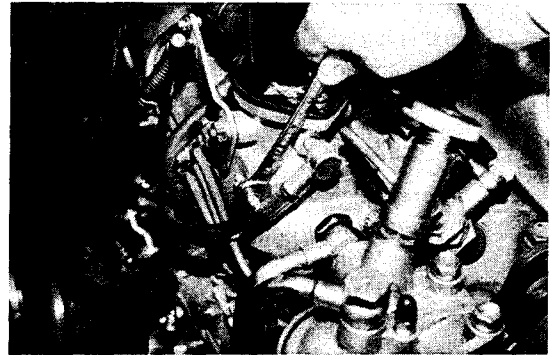
SAE33-7

Maximum No-load Speed Adjustment

1. After adjusting the idling speed, push the accelerator lever fully forward and check the maximum no-load speed.
2. If the speed does not satisfy the standard, adjust it by turning the adjusting screw.
Standard maximum no-load speed:
2600 ± 50 rpm (2SDK7)
2600 ⁺⁵⁰/₋₁₀₀ rpm (2SDK8)

Caution:

Check if the accelerator pedal stopper is adjusted correctly.



Maximum No-load Speed Adjustment

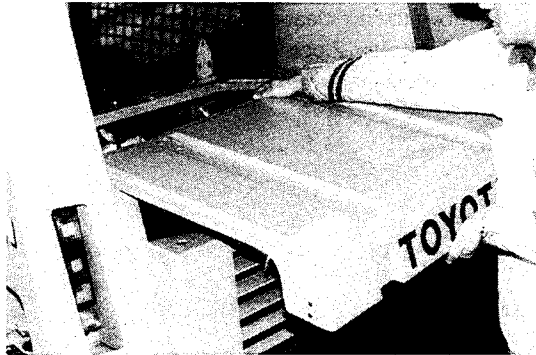
SAE33-5

3T84H ENGINE ASSY REMOVAL & INSTALLATION

REMOVAL

1. Remove the engine hood.

- (1) Set bolts
- (2) Engine hood

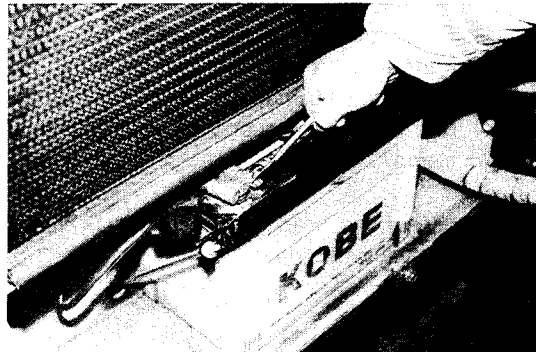


Engine Hood

SAE42-1

2. Disconnect the battery earth cable.

- (1) Open the rear grille.
- (2) Disconnect the battery earth cable.

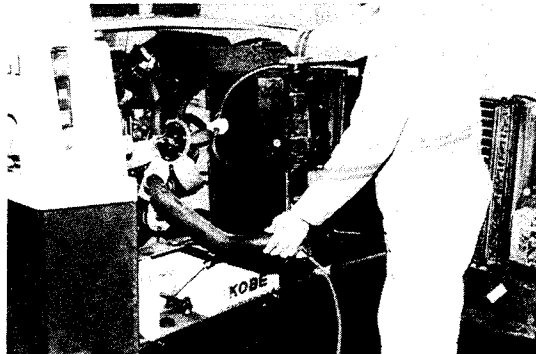


Disconnecting the Battery Earth Cable

SAE42-3

4. Remove the radiator.

- (1) Disconnect the inlet hose (on the engine side).
- (2) Disconnect the outlet hose (on the engine side).
- (3) Air cleaner hose clamp bracket
- (4) Disconnect the drain hose (engine block to radiator) on the radiator side.
- (5) Set bolts (2 pcs.)
- (6) Radiator with hose
- (7) Rubber cushion

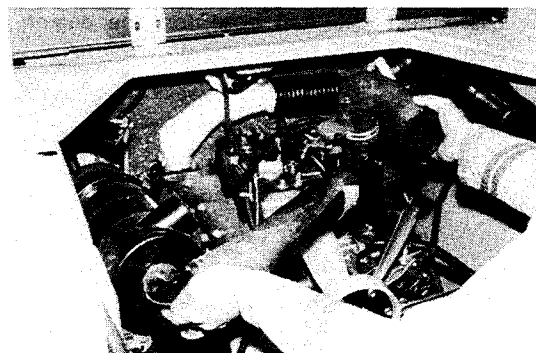


Radiator

SAE42-8

5. Remove the air cleaner.

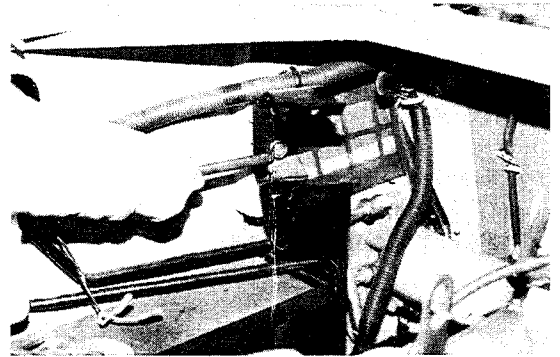
- (1) Disconnect the air cleaner hose (on the engine side).
- (2) Disconnect the wiring to the vacuum sensor.
- (3) Clamp bolt
- (4) Air cleaner with hose



Air Cleaner

SAE42-13

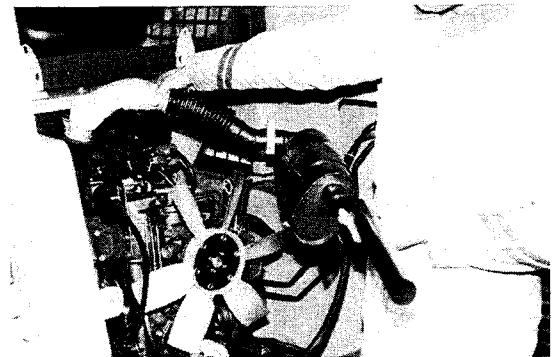
6. Remove the air cleaner bracket.
 - (1) Set bolts (2 pcs.)
 - (2) Air cleaner bracket



Air Cleaner Bracket

SAE42-14

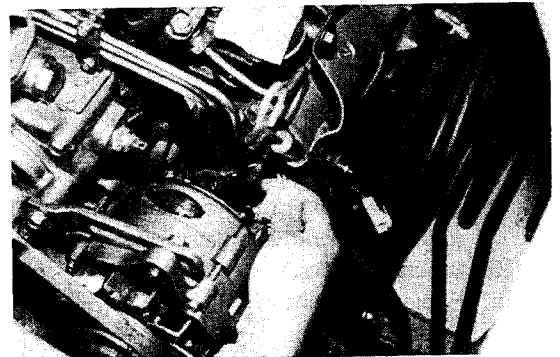
7. Remove the muffler and exhaust pipe.
 - (1) Exhaust pipe set nuts (4 pcs.)
 - (2) Muffler clamp set bolt
 - (3) Spacer and cushion
 - (4) Muffler and exhaust pipe with muffler clamp
8. Disconnect the head tank to fuel tank hose (on the fuel tank side).



Muffler & Exhaust Pipe

SAE42-17

9. Disconnect the wirings.
 - (1) Wiring to starting motor
 - (2) Wiring to engine oil pressure switch
 - (3) Wiring to alternator
 - (4) Wiring to thermostat plug.



Disconnecting the Wiring (Alternator)

SAE42-20

10. Disconnect the fuel hose (on the engine side).



Disconnecting the Fuel Hose

SAE42-22

11. Disconnect the accelerator wire.
 - (1) Cotter pin and plate washer
 - (2) Pin
 - (3) Remove the accelerator wire from the clamp.
12. Drain the hydraulic oil.
 - (1) Prepare a hydraulic oil receiving container.
 - (2) Drain plug



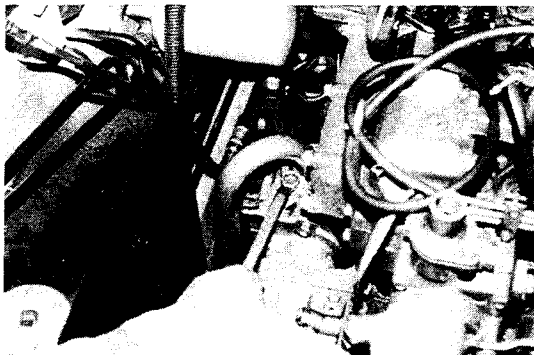
Disconnecting the Accelerator Wire

SAE42-23

13. Disconnect the oil pump piping.
 - (1) Suction pipe (on oil pump side)
 - ① Set bolts (4 pcs.)
 - (2) Outlet hose (on oil pump side)
 - ① Set bolts (4 pcs.)

Caution:

Fit nylon cap or other covers to the hose, pipe and oil pump ports to prevent entrance of foreign matters.



Disconnecting the Oil Pump Piping

SAE42-24

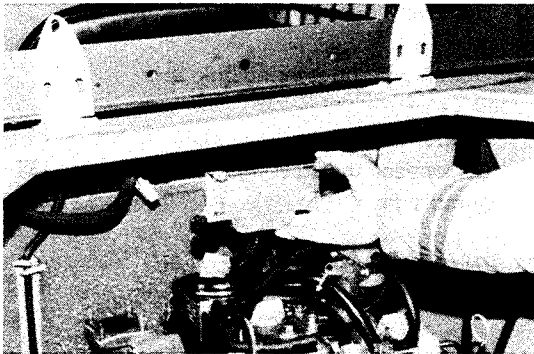
14. Remove the engine oil drain from the frame.
 - (1) Set bolts (2 pcs.)
 - (2) Engine oil drain



Engine Oil Drain

SAE42-25

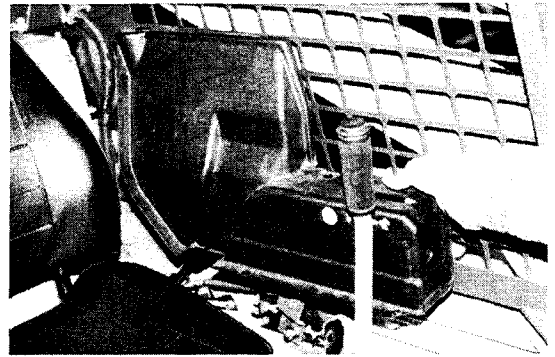
15. Remove the voltage regulator.
 - (1) Disconnect the wiring.
 - (2) Set bolts (2 pcs.)
 - (3) Voltage regulator



Voltage Regulator

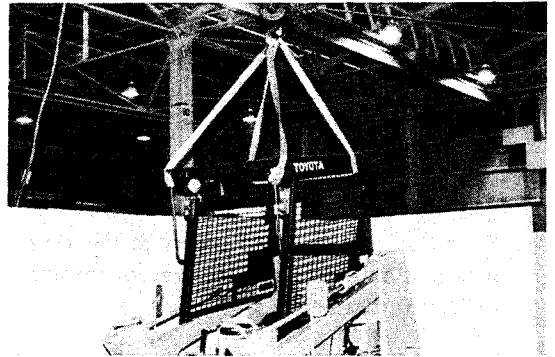
SAE42-26

16. Remove the operator guard.
 - (1) Duct LH
 - ① Set screws (6 pcs.)
 - ② Accelerator lever knob
 - ③ Duct LH
 - (2) Disconnect the wirings.
 - ① Main harness
 - ② Wiring to horn
 - ③ Wiring to pedal lock solenoid
 - ④ Earth cable
 - (3) Set bolts (4 pcs.)
 - (4) Operator guard



Duct LH

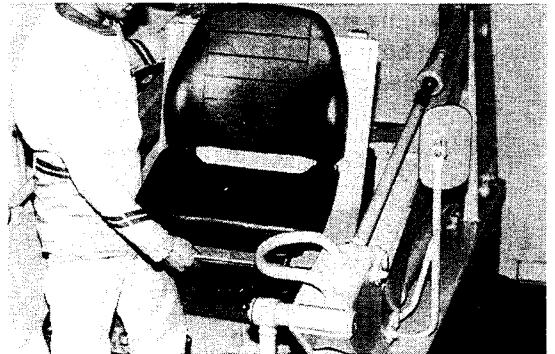
SAE42-27



Operator Guard

SAE42-33

17. Remove the driver's seat.
 - (1) Set bolts (6 pcs.)
 - (2) Disconnect the wiring.
 - (3) Driver's seat
18. Disconnect the wiring for the backup lamp switch.



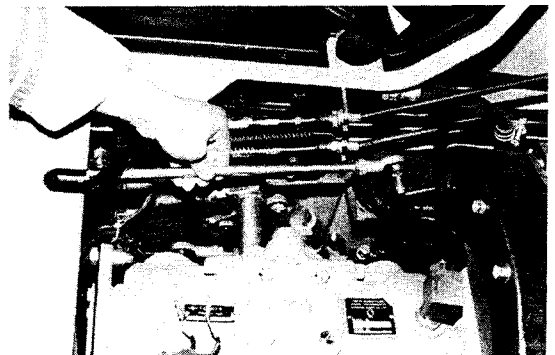
Driver's Seat

SAE42-35

19. Remove the steering link RH.
20. Disconnect the steering link LH.

Caution:
Disconnect the steering link LH on the HST pump side.

21. Remove the backup switch LH.



Steering Link RH

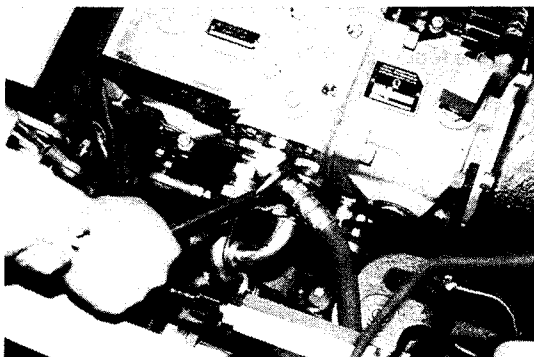
SAE42-36

22. Disconnect the HST piping.

Caution:

Fit nylon caps or other covers to hoses and elbows to prevent entrance of foreign matters.

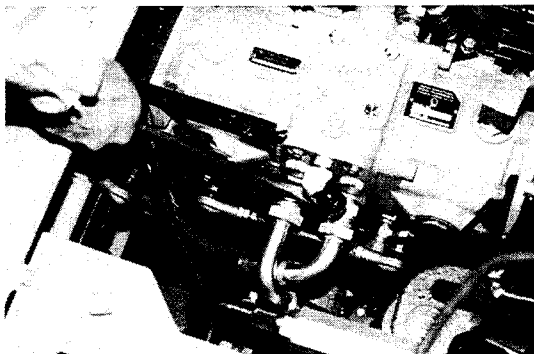
- (1) Drain pipe
- (2) Charge hose



Disconnecting the Charge Hose

SAE43-4

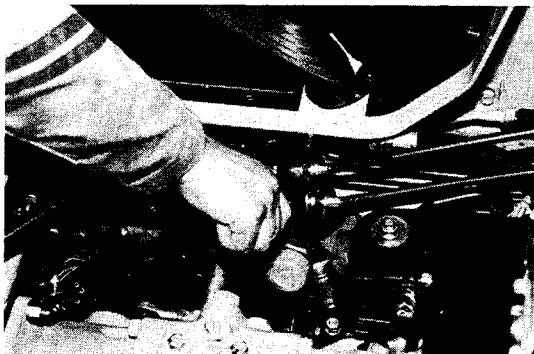
- (3) High pressure hose



Disconnecting the High Pressure Hose

SAE43-5

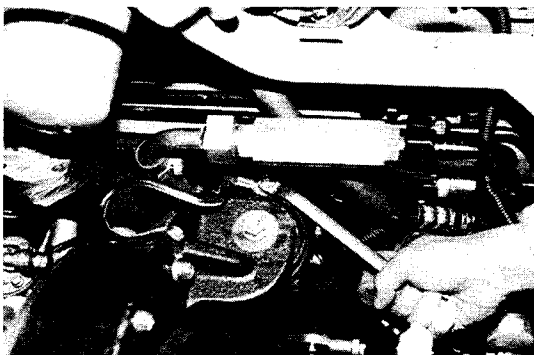
23. Remove the brake wire from the bracket, and move it upward (the lower side wire only).



Moving the Brake Wire

SAE43-6

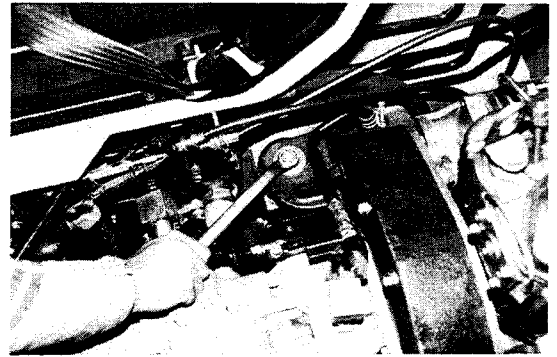
24. Disconnect the body earth cable.



Disconnecting the Body Earth Cable

SAE43-7

25. Remove the engine with HST pump.
 (1) Mounting set nuts (4 pcs.)

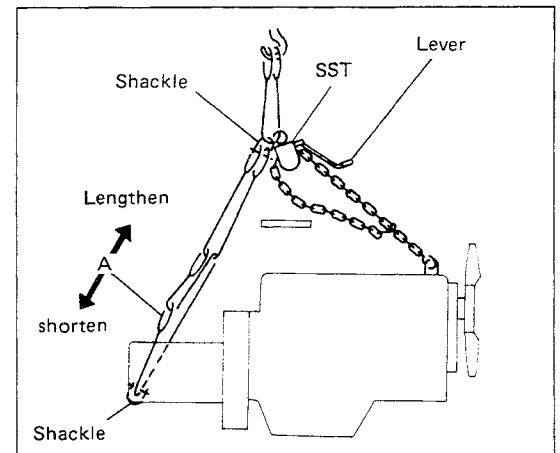


Mounting Set Nuts

SAE43-8

- (2) Remove the engine with HST pump according to the procedure described below.

- ① Set wires via shackles to the right side of the spring holder bracket FR. Use two wires, 1.5 m (59 in.) and 1 m (39 in.), and set the 1.5 m (59 in.) to the pump.
- ② The 1.5 m (59 in.) wire shall be so set as to allow length adjustment. (See the figure at right.)
- ③ Set the chain hook on one side of the engine sling device (SST 09090-04000) to the rear side engine hanger. Set the other chain hook to the chain fitted to the engine hanger.



Setting the Wires and Engine Sling Device (SST)

SAES14

- ④ Adjust the wire and chain lengths so that the hoist hook comes right above the frame member.

[Wire length adjustment]

Moving the wire eye A up ward lengthens the wire length, and moving it downward shortens the wire length.

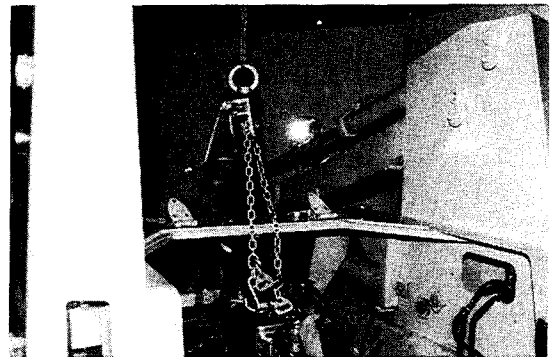
[Chain length adjustment]

Turn the engine sling device lever for length adjustment.

- ⑤ Hoist the engine with HST pump.

Caution:

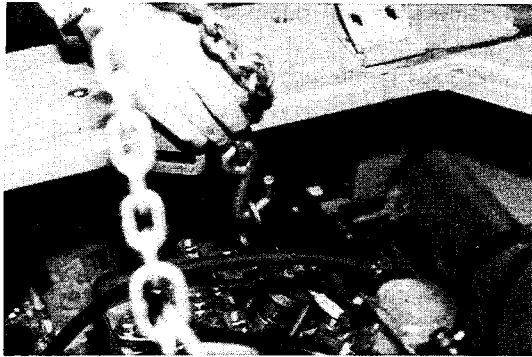
Be sure that all wirings and pipings are disconnected.



Hoisting the Engine

SAE43-15

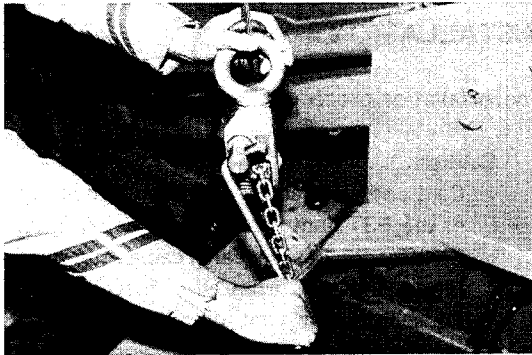
- ⑥ Move the engine with HSP pump to the rear, and stop the movement where the wire comes into contact with the frame member.
- ⑦ Set the free chain hook of the engine sling device (SST 09090-04000) to the front side engine hanger.
- ⑧ Operate the engine sling device (SST) lever to bring the HST pump up and loosen the wire tension.



Setting the Chain Hook to Front Engine Hanger

SAE43-17

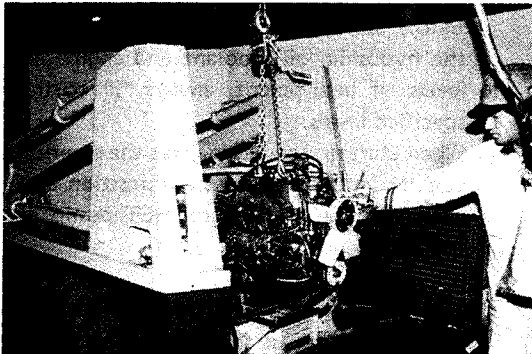
- ⑨ Disconnect the wire at the hoist side shackle, and suspend the engine with HST pump only with the engine sling device (SST).
- ⑩ Operate the lever on the engine sling device (SST) to bring up the HST pump side and loosen the wire tension.
- ⑪ Remove the engine with HST pump.



Operating the Engine Sling Device Lever

SAE43-18

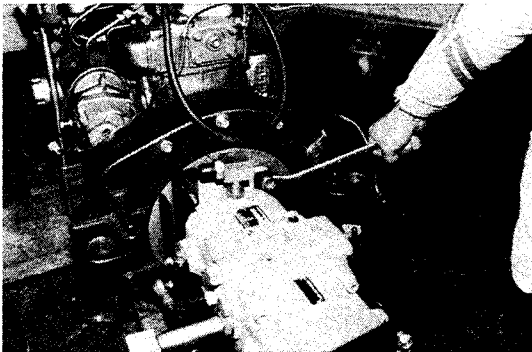
- 24. Place the engine with HST pump in stable state.



Engine with HST Pump

SAE43-20

- 25. Separate the HST pump from the engine.
 - (1) Slightly suspend the HST pump with a wire rope.
 - (2) Backup switch RH
 - (3) HST pump set bolt
 - (4) HST pump



Separating the HST Pump from the Engine

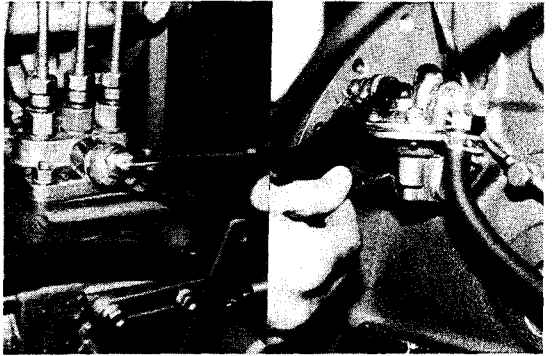
SAE43-27

26. Remove the HST pump support.
 - (1) Set bolt
 - (2) HST pump support
27. Remove the damper.
 - (1) Set bolt
 - (2) Damper
 - (3) Grease seal cap
28. Remove the oil pump.
 - (1) Set bolts
 - (2) Oil pump

INSTALLATION

The installation procedure is the reverse of the removal procedure.

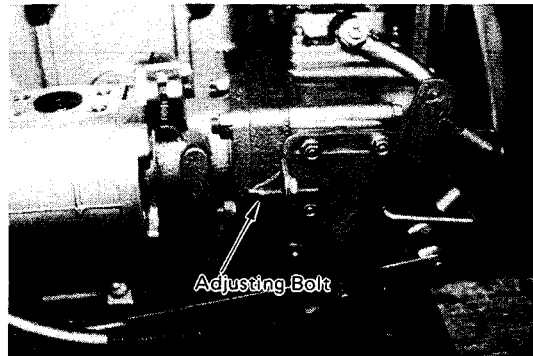
Caution:

- Coat and seal (about 10 cc) molybdenum disulfide grease at the spline portion and in the seal cap of the HST pump and damper before installing the HST pump to the engine.
 - Connect the battery earth cable after checking correct connection of all electrical wirings.
 - Bleed the air from the fuel system. Loosen the air vent plug of union bolt on the injection pump side and operate fuel pump lever up and down for air bleeding.
 - Before starting the engine, always check the hydraulic oil, coolant and engine oil levels. If insufficient, always fill to the specified levels.
 - When starting the engine, set the steering control lever to the neutral position and warm up the engine and HST pump at the idle speed.
- 
- SAD37-28, 27
- Start the engine (at a low speed) and check that the steering lever neutral position is correct. If incorrect, adjust the position at the spring holder. See the STEERING-Steering Neutral Adjustment section for the adjustment procedure.
 - Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit section.

ENGINE ADJUSTMENT (3T84H ENGINE)

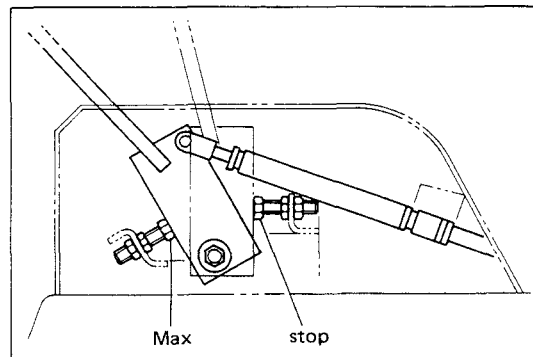
Maximum No-load Speed Adjustment

1. Warm up the engine.
(Coolant temperature 75 ~ 85°C)
2. Install the engine tachometer.
3. Loosen the accelerator lever stopper (max. side).
4. Push the accelerator lever fully forward, and check the maximum no-load speed.
5. If the speed does not satisfy the standard, adjust to the standard speed by turning the adjusting bolt.
Maximum no-load speed: 2650 ± 50 rpm
6. Tighten the lock nut after the adjustment, and seal it.
7. Adjust the accelerator lever stopper (max. side).



Adjusting the Maximum No-load Speed

SAE43-25



Accelerator Lever Stopper

SAES17

Note:

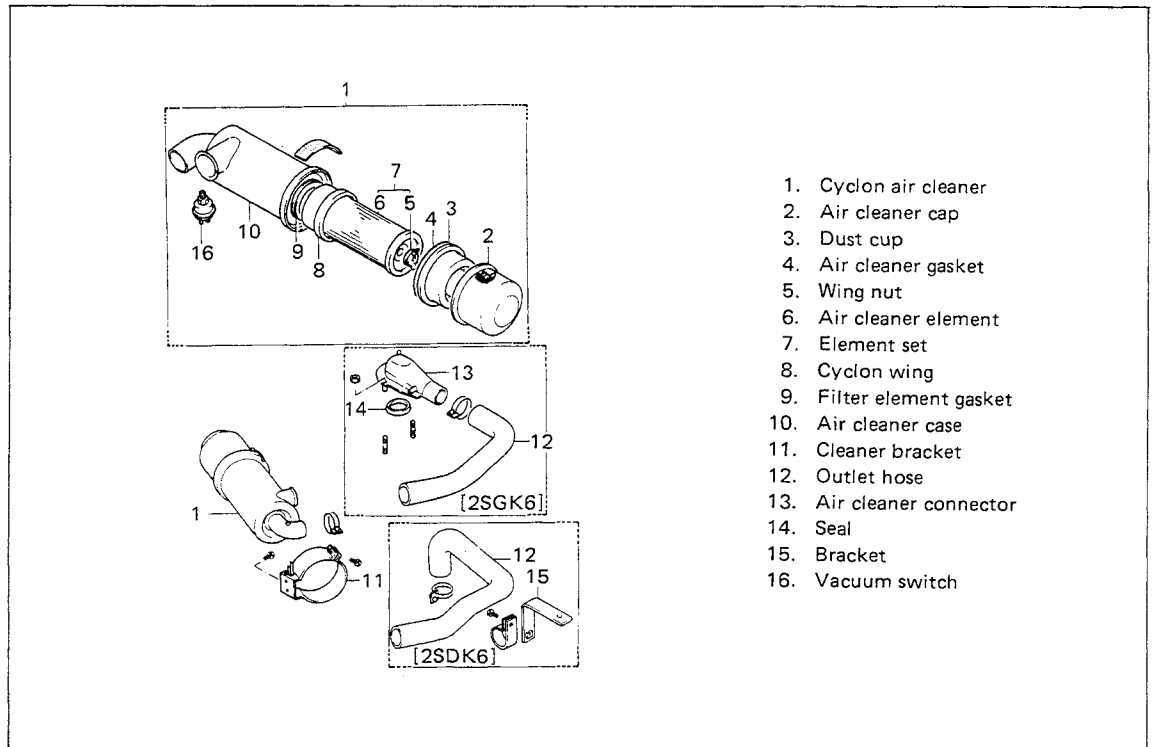
For the accelerator lever stopper adjustment, see the ENGINE-Accelerator section.

8. Slowly return the accelerator lever by pulling it to lower the engine speed gradually, and check if the idling speed is stabilized at 800 rpm or less.
9. Pull the accelerator lever fully backward, and check if the engine stops.

Caution:

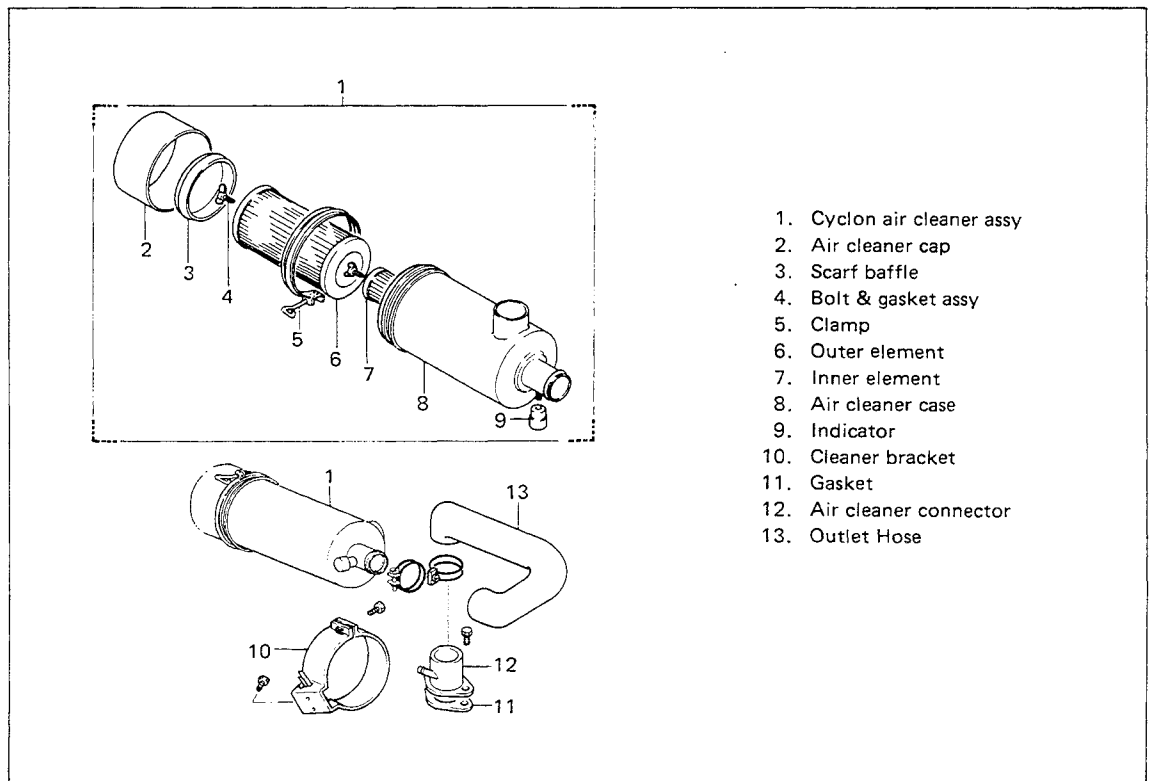
Check if the accelerator lever stopper (stop side) is adjusted correctly.

AIR CLEANER



Air Cleaner Components (2SGK6, 2SDK6)

SAEM9

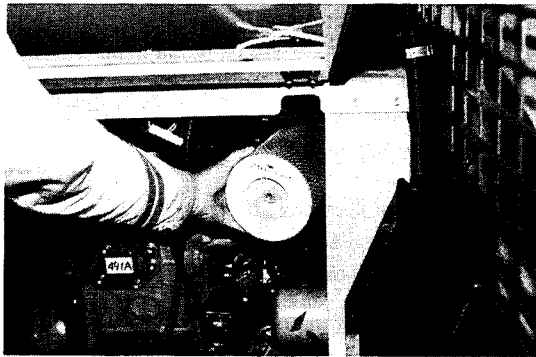


Air Cleaner Components (2SDK7, 2SDK8)

SAEM10

INSPECTION & CLEANING

1. Open the seat panel and remove the air cleaner cap.
2. Remove the element.



Removing the Element

SAE17-15

3. Remove the dust cup and remove the dirt accumulated in the air cleaner cap.

Caution:

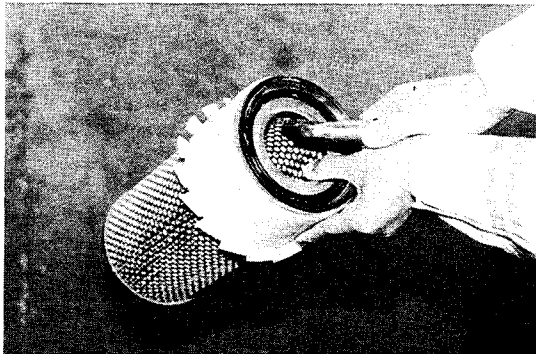
When installing the air cleaner cap, direct the arrow mark inscribed on the cap upward.



Cleaning the Air Cleaner Cap

SAD38-20

4. Clean the element.
 - (1) Generally blow the inside of the element with compressed air (7 kg/cm^2 or less) up and down along the pleats. If the element is heavily contaminated, it may be washed.
 - (2) Element washing method
Dissolve a neutral detergent in tepid water (at about 40°C), and immerse the element in the washing agent for about 30 minutes. Then take it out and rinse it well with clean, running water (at about 2.8 kg/cm^2 or less).



Cleaning the Element

SAD38-19

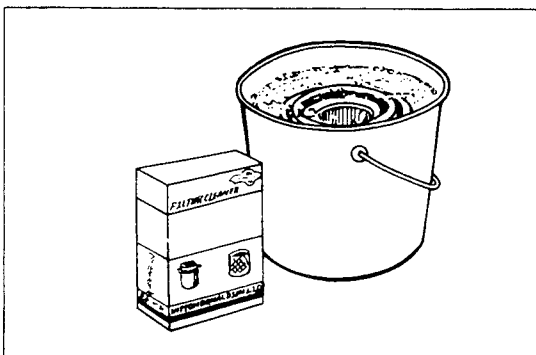
Caution:

Carefully handle the element during washing so as not to damage the filtering paper.

After washing, dry the element naturally or with a dryer (cold wind).

Caution:

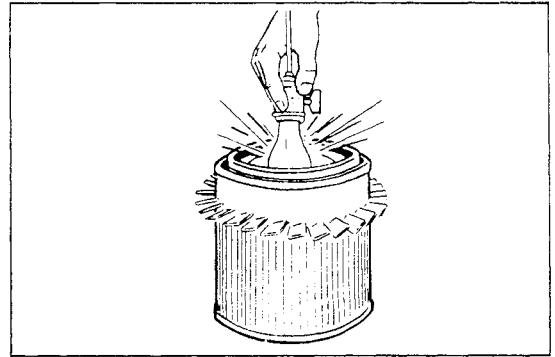
Never use compressed air or hot air for drying.



Washing the Element

SAES65

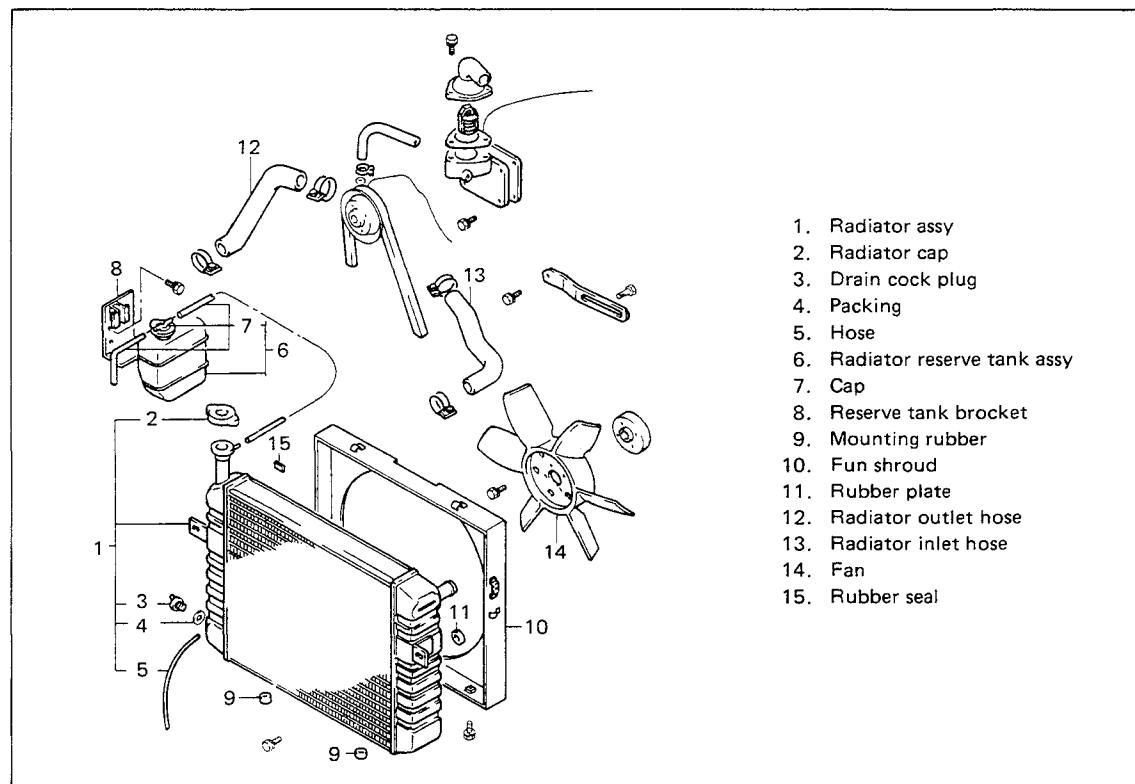
5. Element inspection
After cleaning, inspect any damage on the element by placing a lamp inside the element. If any pinhole or tear is found, replace it with a new one.
6. Element replacement
Replace the element after washing it 6 times or every 12 months.



Inspecting the Element

SAES66

RADIATOR



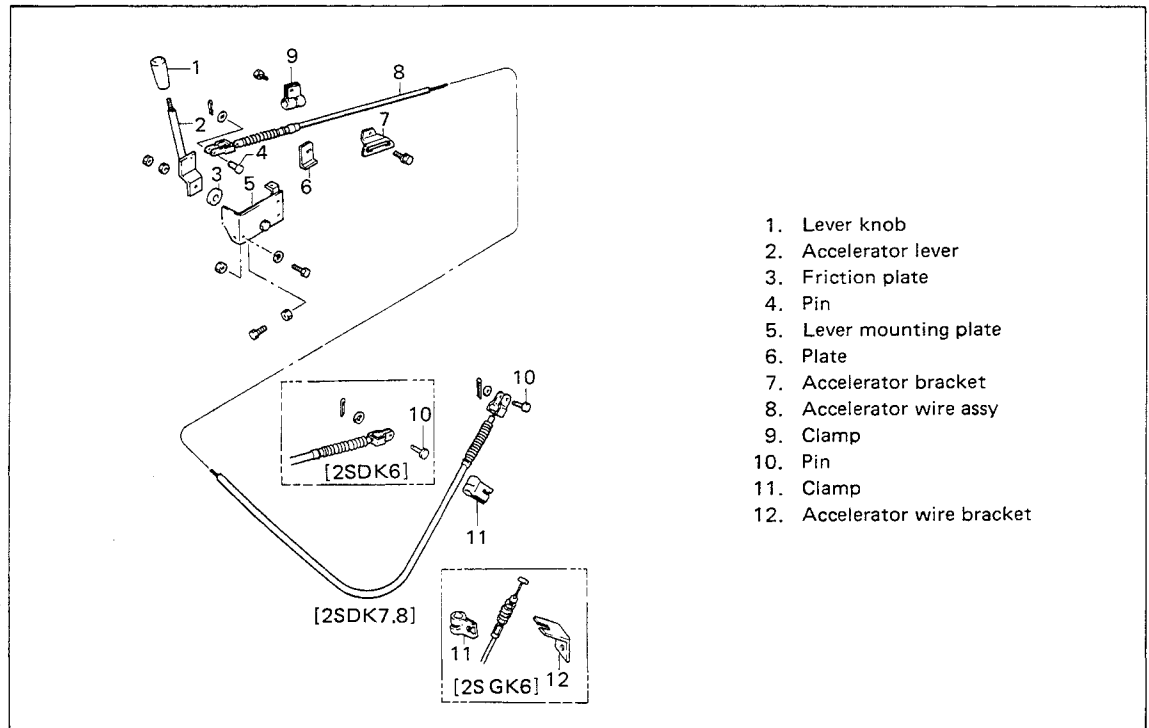
Radiator Components (2SDK7, 8)

SAEM18

SPECIFICATIONS

		2SGK6	2SDK6	2SDK7	2SDK8
Core type		Corrugated fin	←	←	←
Core dimensions	Width	454 (17.9)	←	430 (16.9)	←
	Height	510 (20.1)	←	500 (19.7)	←
	Thickness	32 (1.26)	←	48.5 (1.91)	65 (2.56)
Fin pitch	mm	5.0/2	6.0/2	←	5.0/2
Fin thickness	mm	0.08 (0.0031)	←	←	←
Cap valve opening pressure	kg/cm ² (psi)	0.9 (12.8)	←	←	←
Dry weight	kg	About 6 (13.2)	About 5.7 (12.6)	8.7 (19.2)	11.0 (24.3)
Radiator capacity	ℓ (US gal)	About 2 (0.53)	←	3.3 (0.87)	3.6 (0.95)
Coolant capacity	ℓ (US gal)	6.2 (1.64)	5.5 (1.45)	9.6 (2.53)	9.9 (2.61)

ACCELERATOR



Accelerator Components

SAEM19

Accelerator Lever Adjustment

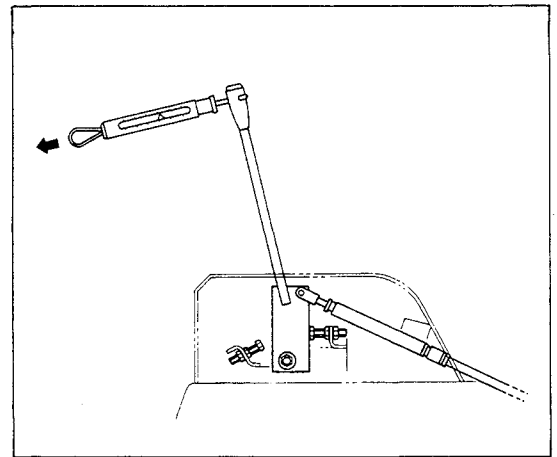
1. Adjust the accelerator lever operating force.
 - (1) Set a spring scale at 10 mm from the top end of the accelerator lever knob, and measure the lever operating force.

Accelerator lever operating force:
 3.5 ~ 5.0 kg (7.72 ~ 11.03 lbs)

Note:

Gently pull the spring scale in the vertical direction from the lever, and read the value when the lever starts to move.

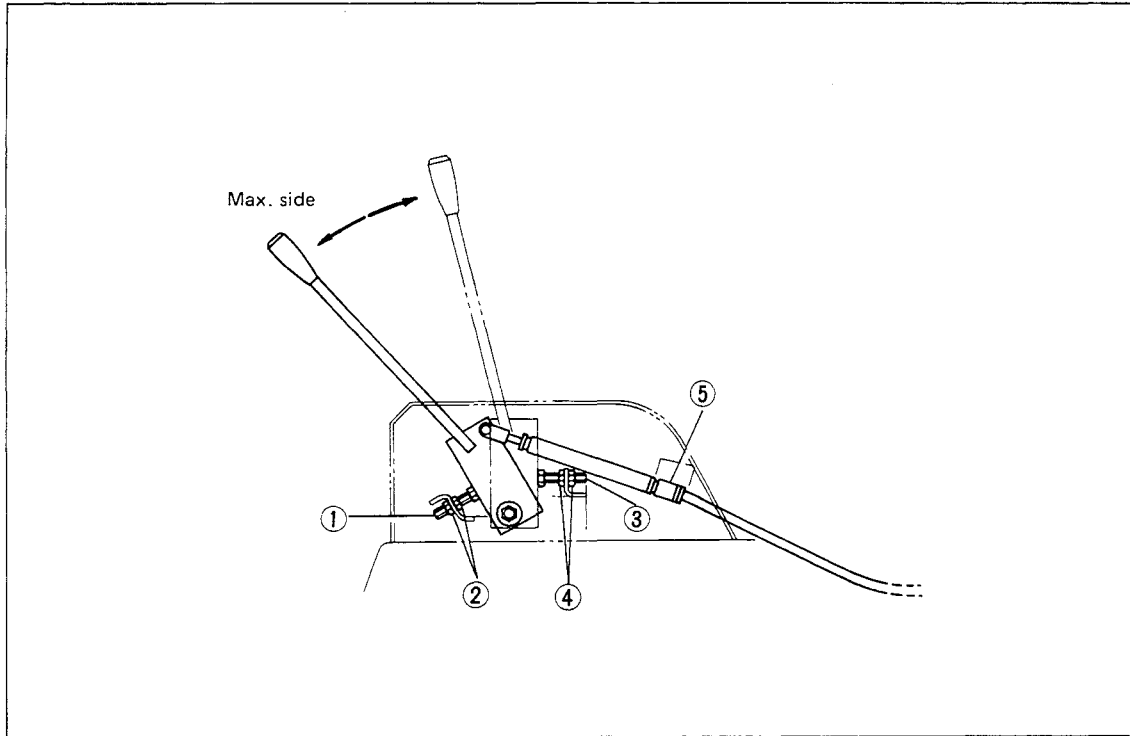
- (2) If the operating force is not within the specified range above, adjust the operating force by means of the accelerator level set nut.
- (3) After the adjustment, lock the locknut.



Measuring the Accelerator Lever Operating Force

SAES18

2. Adjust the accelerator lever stopper.



Adjusting the Accelerator Lever Stopper

SAEM20

[2J Engine Model]

- (1) Slowly push the accelerator lever forward (or pull it backward). When the engine side throttle adjust lever comes into contact with the adjusting screw, provide a slight clearance between stopper bolt ① (or ③) and the accelerator lever and lock locknut ② (or ④).

[4P Engine Model]

- (1) Slowly push the accelerator lever forward (or pull it backward). When the carburetor throttle valve is fully opened (or fully closed), provide a slight clearance between stopper bolt ① (or ③) and the accelerator lever and lock locknut ② (or ④).

[3T84H Engine Model]

- (1) Slowly push the accelerator lever forward. When engine side regulator handle No. 2 comes into contact with the adjusting bolt, provide a slight clearance between stopper bolt ① and the accelerator lever (to a degree not causing excessive wire elongation), and lock locknut ②.
- (2) Start the engine and slowly pull the accelerator lever backward. When the engine stops, provide a slight clearance between stopper bolt ③ and the accelerator lever (to a degree not causing excessive link deflection), and lock locknut ④.

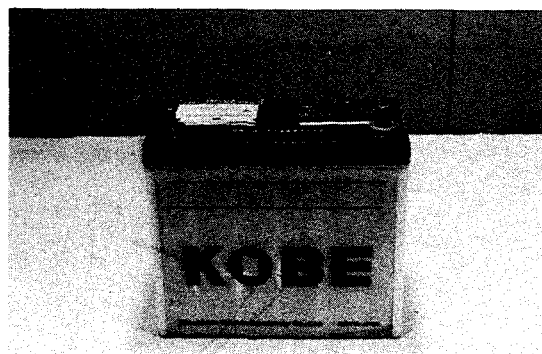
Caution:

If the accelerator lever is deviated to either the max. or stop side, adjust the lever stopper after adjusting the position of accelerator wire clamp ⑤.

BATTERY

Since a maintenance-free battery is adopted, no water addition is necessary until the end of its service life.

If the fluid level drops below the low level line, replace the battery.



Battery

SAE32-13

SPECIFICATIONS

Item \ Vehicle model		2SDK6, 2SDK7, 2SDK8	2SGK6
STD	Type	95D31L-MF	38B20L-MF
	Voltage (V)	12	12
	5-hour rating capacity (Ah)	64	28
	Specific gravity of electrolyte (at 20°C)	1.280	1.280
OPT	Type	130E41L-MF	55B24L-MF
	Voltage (V)	12	12
	5-hour rating capacity (Ah)	92	36
	Specific gravity of electrolyte (at 20°C)	1.280	1.280

INSPECTION

- Contamination, roughening or loosening of battery terminals
- Specific gravity of electrolyte
Measure the specific gravity of the electrolyte.
If it is 1.220 (at 20°C) or less, charge the battery.

Reference:

The specific gravity of the electrolyte assumes a standard electrolyte temperature of 20°C. The specific gravity at 20°C is calculated as follows when the specific gravity at an electrolyte temperature of t°C is St:

$$S_{20} = S_t + 0.0007 (t - 20)$$

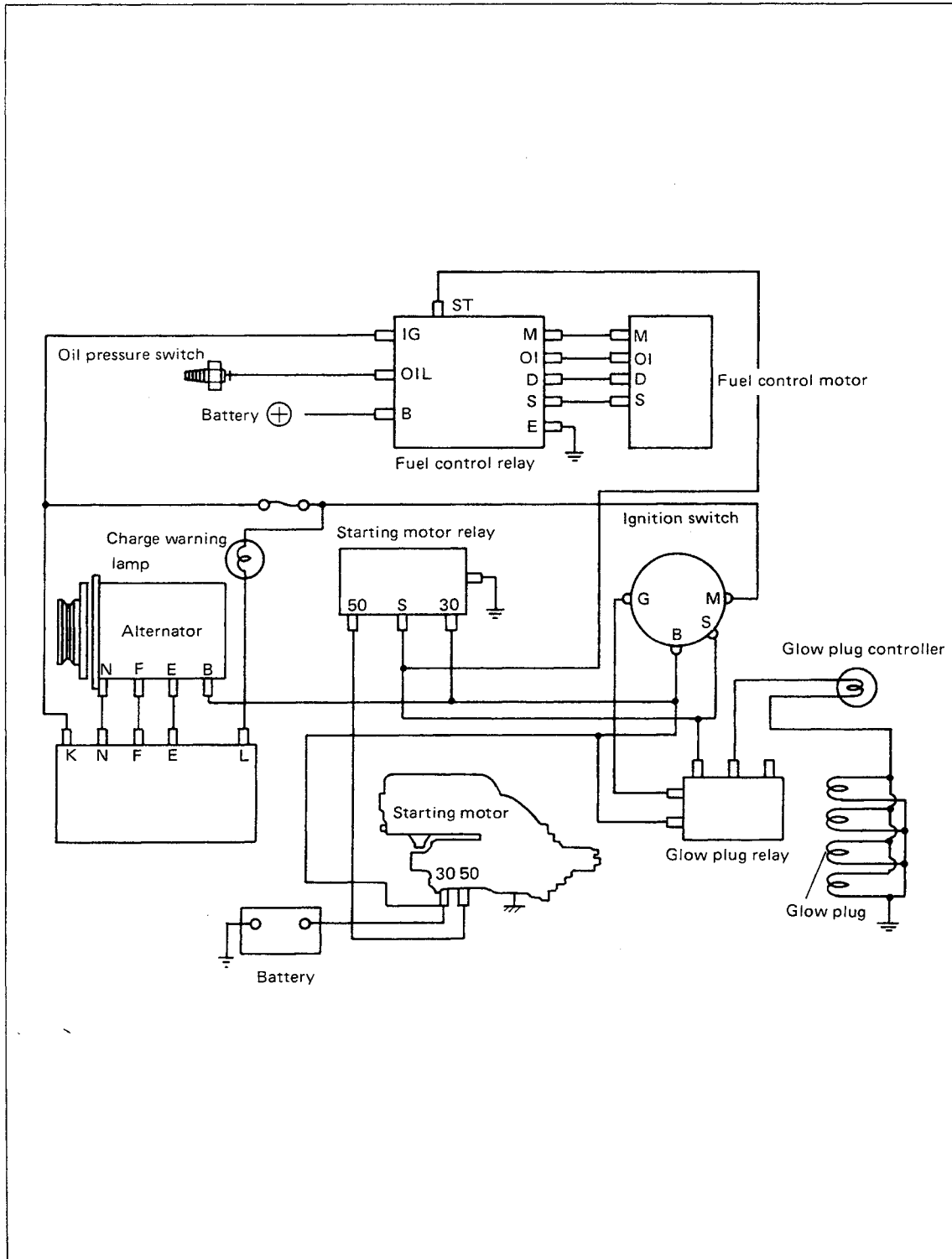
S₂₀ : Specific gravity converted to standard temperature of 20°C

S_t : Actually measured specific gravity at t°C

t : Electrolyte temperature (°C)

EDIC SYSTEM (2SDK7.8)

ENGINE ELECTRICAL CIRCUIT DIAGRAM



Engine Electrical Circuit Diagram

SAEM21

EDIC SYSTEM

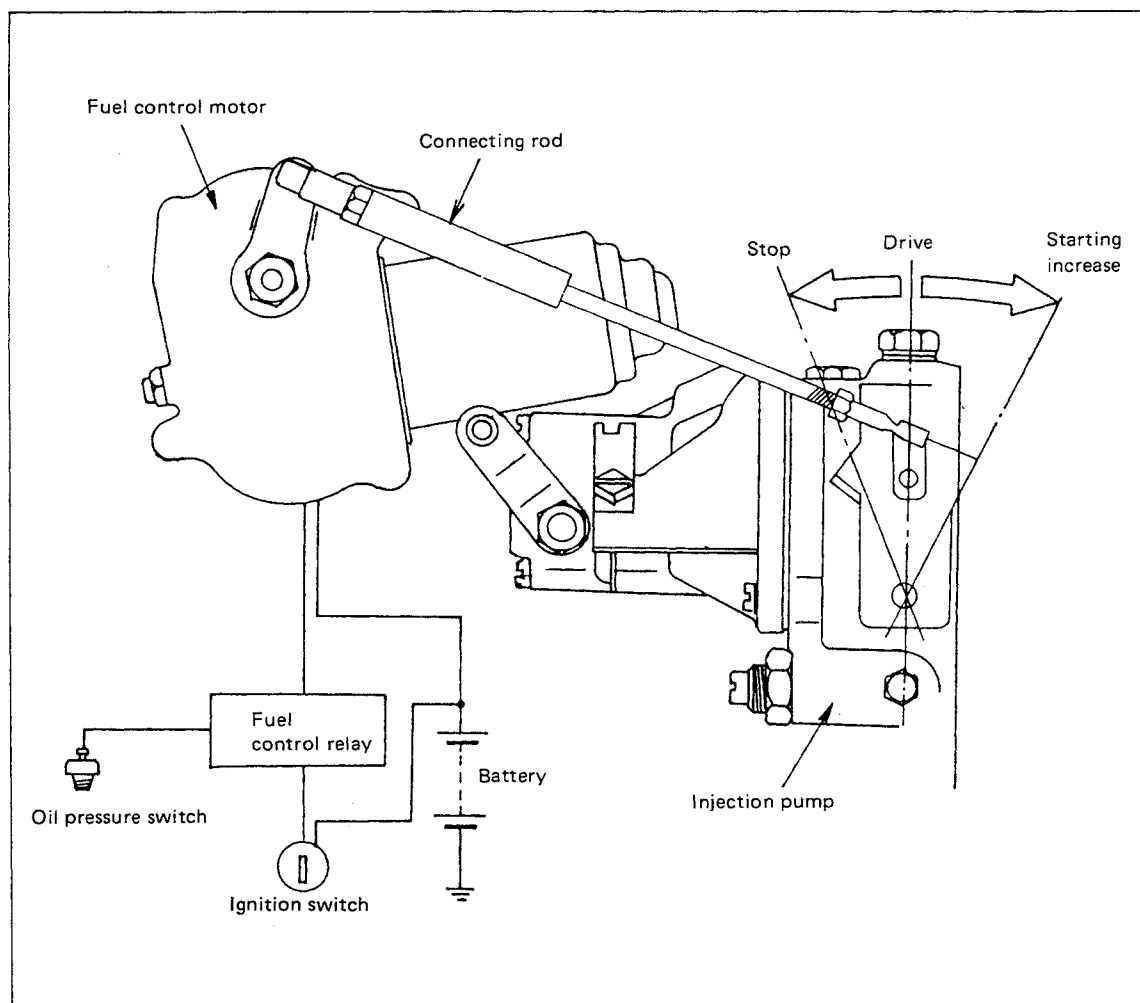
1. Features

- (1) Automatic increase of fuel injection rate at the time of starting (engine switch at START position) for easy starting.
- (2) Automatic stopping of fuel injection (fuel cut) upon engine switch setting to OFF position for engine stopping (setting the control rack to non-injection position)
- (3) Engine stopping by fuel cut upon engine revolution in reverse direction.

2. Construction

(1) EDIC configuration

The EDIC receives two types of information from the engine switch and oil pressure switch as inputs, and rotates the fuel control motor. The motor rotation moves the injection pump adjusting lever via the connecting rod. Its functions are as follows: ① Increasing fuel injection rate at the time of engine starting ② Stopping the engine by the engine switch ③ Preventing reverse engine revolution.



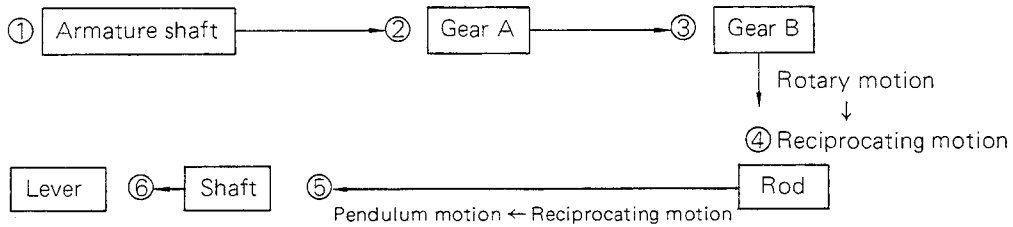
EDIC Configuration

JABM9

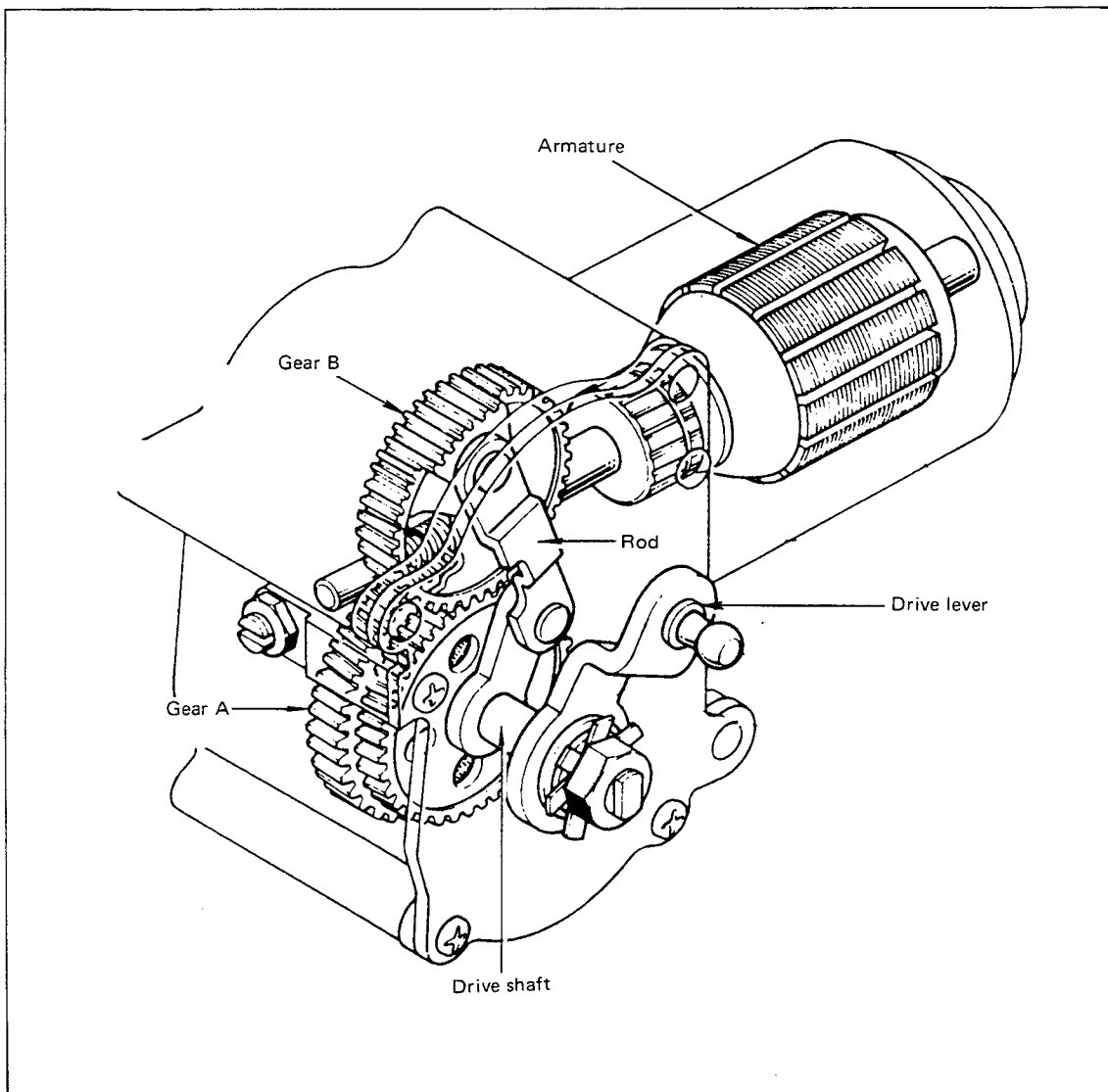
(2) Fuel control motor

The motor rotates only in one direction, and a mechanism to change the rotary motion to the reciprocating motion is incorporated in the motor.

The rotary motion of the motor armature is transmitted to the lever in the following sequence:



A limiter is also built in the motor. The fuel control relay and this limiter plate automatically causes the lever to stop at the starting increase, drive or stop position.



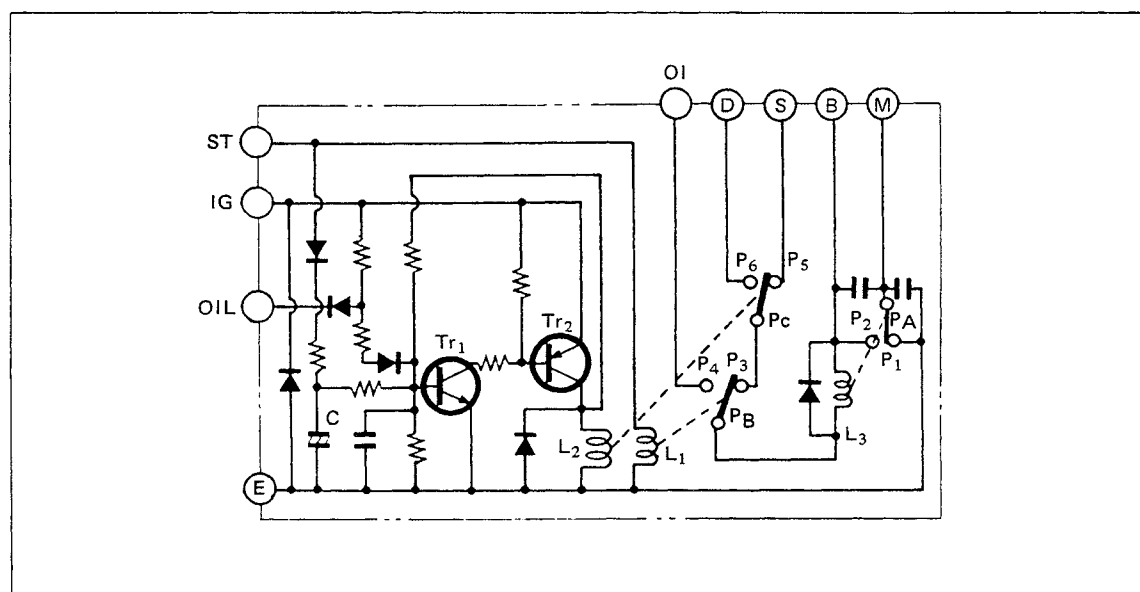
Fuel Control Motor

SAEM22

Fuel Control Motor Specifications

Item		Specifications
Rated voltage		12 V
At no load	Current	Under 1.8 A
	Speed	Over 65 rpm
At rated load	Current	Under 6 A
	Operating time	Under 1 sec.
In locked state	Current	Under 20 A
	Torque	Over 70 kg-cm
Time rating		Short time (within 1 minute)
Operating temperature range		-30° ~ 100°C
Operating voltage range		8 V ~ 16 V

(3) Fuel control relay

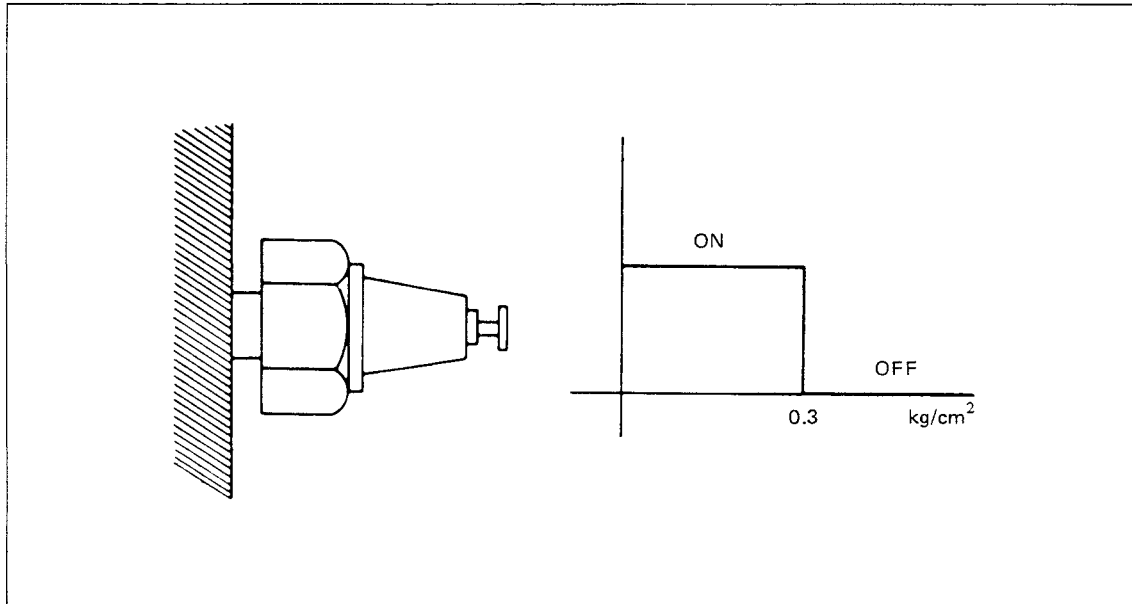


Fuel Control Relay

JABS5

The fuel control relay supplies the power to the fuel control motor. It detects the engine start signal, engine stop signal, or engine oil pressure switch signal, and carries out fuel increase at start, normal drive, or fuel cut at engine switch off or engine reverse rotation.

(4) Oil pressure switch



Oil Pressure Switch

JAAS41

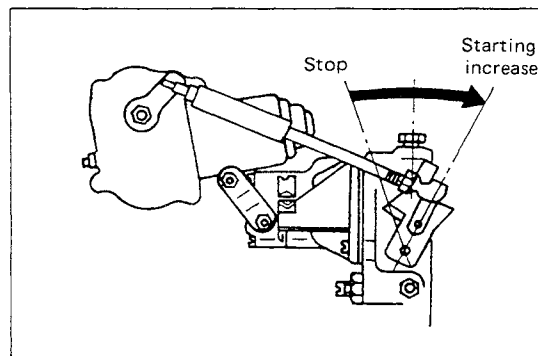
The oil pressure switch detects the engine oil pressure. It is turned off when the oil pressure is 0.3 kg/cm^2 (4.27 psi) or more, and turned on if the pressure is less than that. If the engine is running in the forward direction, the oil pressure is 0.3 kg/cm^2 (4.27 psi) or more and this switch is off. When the engine runs in the reverse direction, the oil pressure becomes less than 0.3 kg/cm^2 (4.27 psi) and this switch is turned on. When this signal is sent to the relay, the engine stops.

FUNCTION INSPECTION

Visually inspect the movement of the injection pump adjusting lever movement.

1. Starting increase

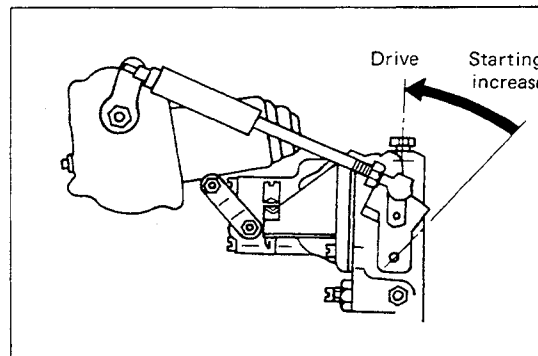
The adjusting lever must move to the increase position when the ignition switch is set to the START position.



JABS6

2. Drive

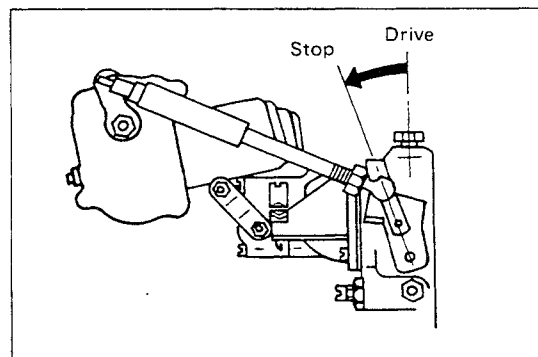
The adjusting lever must return to the drive position when the ignition switch is set from the START to the ON position after engine starting.



JABS7

3. Engine stop

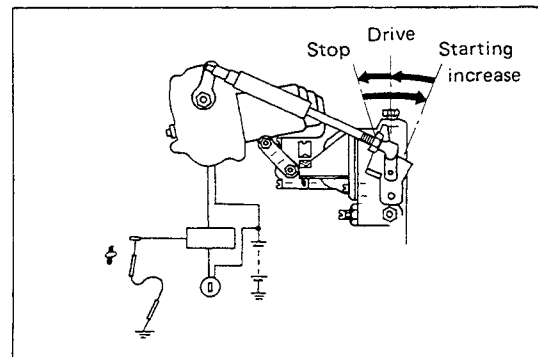
The adjusting lever must return to the stop position and the engine must stop when the ignition switch is set to OFF.



JABS9

4. Engine reverse revolution prevention

The adjusting lever must return to the stop position and the engine must stop when the oil pressure switch connector is disconnected and grounded after starting the engine.

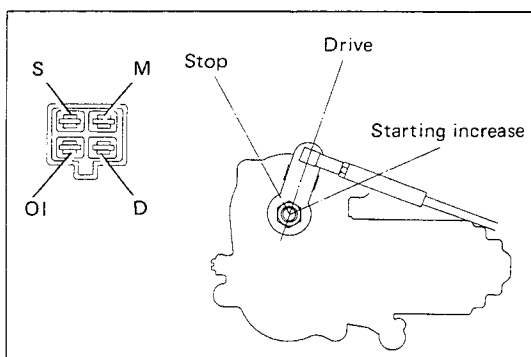


JABS8

FUEL CONTROL MOTOR INSPECTION

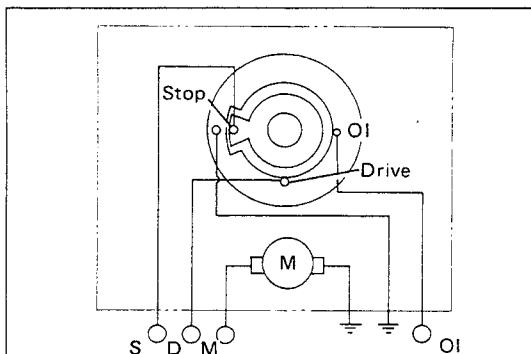
- When the battery voltage is applied between the connector M terminal and E (body earth), the motor must rotate.
- Inspect continuity (conductivity) between terminals.

Terminal Lever position	M	E (Body)	D	O	S
Starting increase	○	○	○	○	○
Drive	○	○	○	○	○
Stop	○	○	○	○	○



Motor

JABM14



Motor Wiring Diagram

JABS10

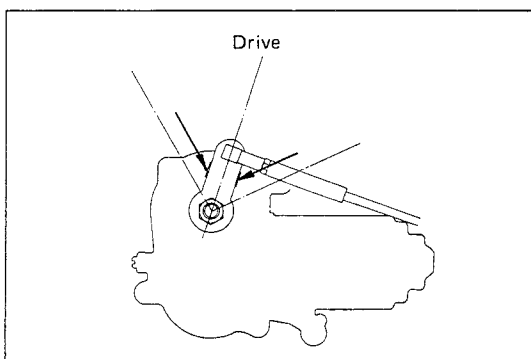
Key Points for Installation

- Fuel control motor set bolt tightening torque
 $T = 0.4 \sim 0.7 \text{ kg-m (2.89} \sim 5.05 \text{ ft-lbs.)}$
- Surely lock the connector. If locking is not sure, EDIC operation becomes faulty.
- Connecting rod length adjustment.
 - Set the fuel control motor lever to the drive position.
 - Disconnect the oil pressure switch terminal.
 - Set the ignition switch to ON to run the motor, and set the lever to the drive position.

Caution:

Preparatorily check that the motor lever is within the matchmark range.

- Adjust the rod length by turning the adjusting nut so that the injection pump lever becomes vertical.



Checking Matchmarks (Drive Position)

JABM14

FUEL CONTROL RELAY INSPECTION

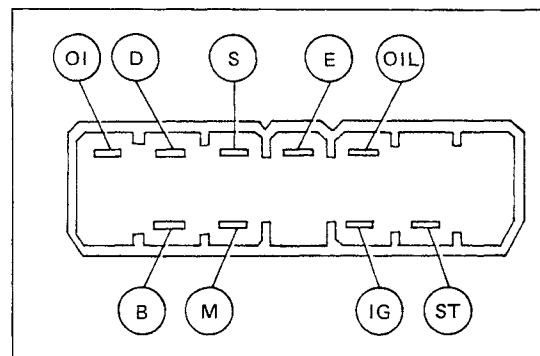
Measure the voltage applied to each terminal.

Caution:

Connect the relay connector before making the following measurement:

Operation		Terminal						
		ST	IG	M	OI	D	S	
Ignition switch	Engine							
START	ON	○	○	—	○	—	—	
ON	ON	—	○	—	—	○	—	
ON	OFF	—	○	—	—	—	○	
OFF	OFF	—	—	—	—	—	○	

Circle (○) denotes the battery voltage (about 12 V)

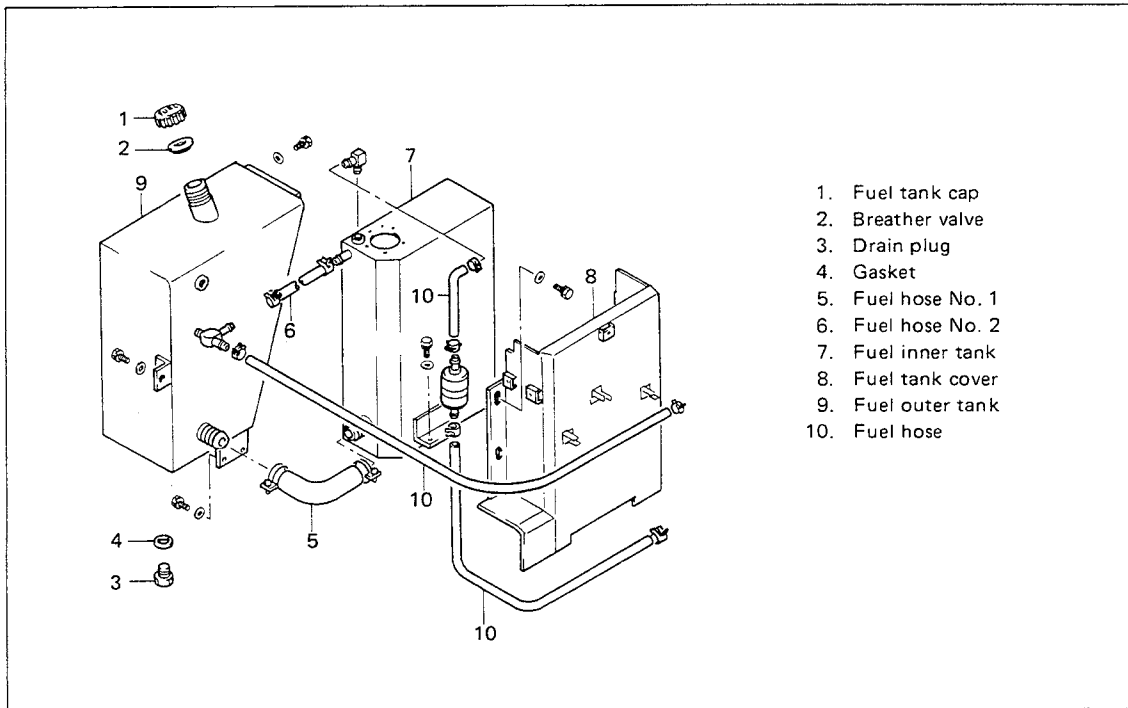


Relay Connector

JABM15

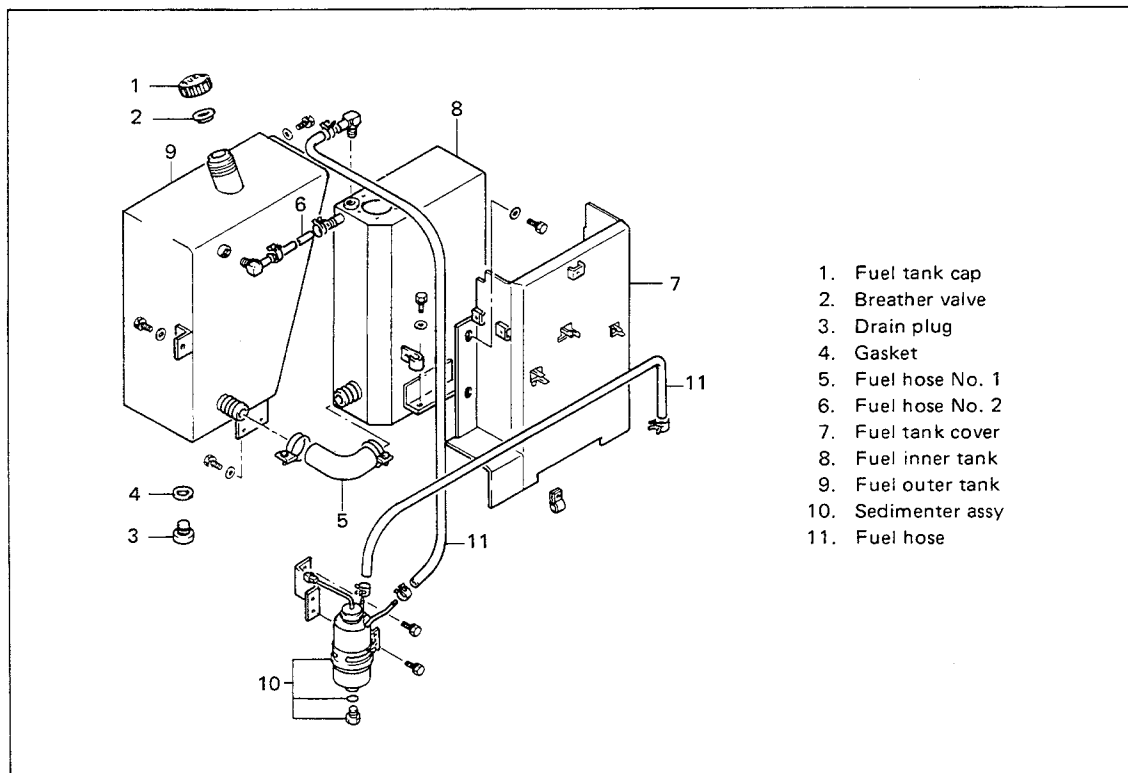
FUEL TANK

COMPONENTS



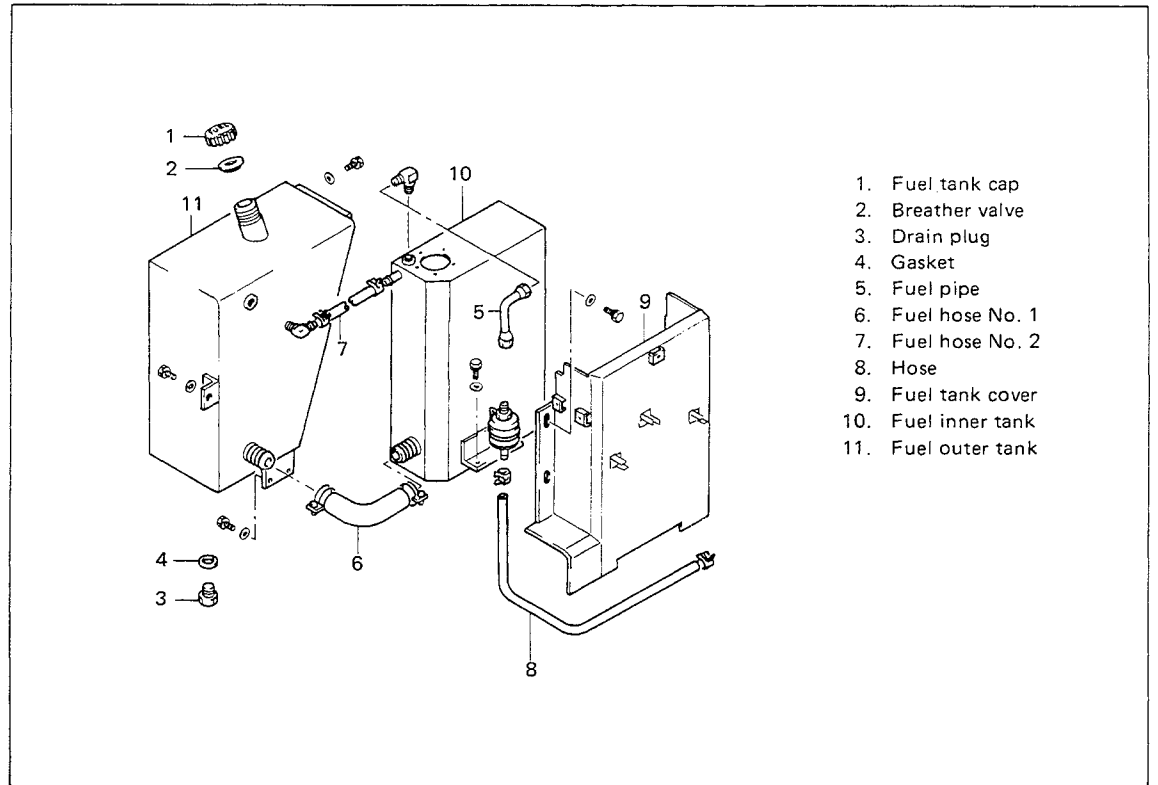
Fuel Tank Components (2SDK6)

SAEM51



Fuel Tank Components (2SDK7, 8)

SAEM52



Fuel Tank Components (2SGK6)

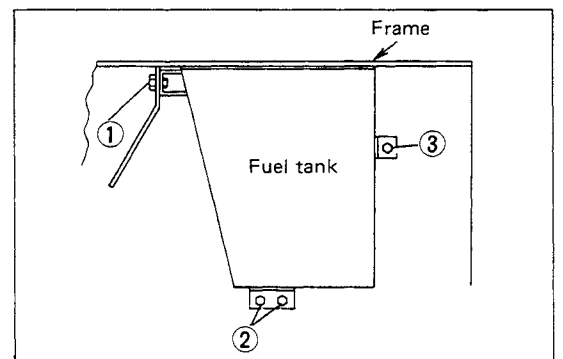
SAEM53

SPECIFICATION

Fuel tank capacity	52ℓ (14 US gal)
--------------------	-----------------

Caution for fuel tank installation

1. When installing the fuel outer tank, tighten the set bolts in the order shown in the figure at right.



Installing the Fuel Tank

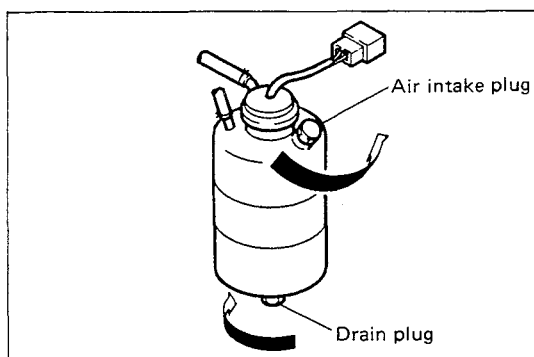
SAES61

Draining Water from Sedimenter

1. Prepare a receiving tray under the sediment.
2. Loosen the air inlet plug on top of the sediment.
3. Loosen the drain plug at the bottom of the sediment. Water flows out first and then fuel comes out. Tighten the drain plug when fuel starts to be discharged.
4. Tighten the air inlet plug.
5. Operate the priming pump and loosen the air vent plug to bleed air. After perfect air bleeding, tighten the air vent plug.

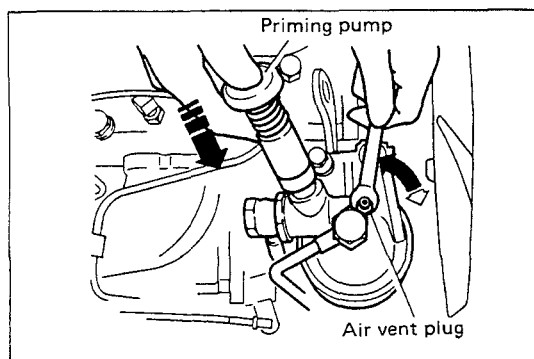
Caution:

Wipe off the fuel from the adjacent area.



Draining Water from Sedimenter (1)

SAES63



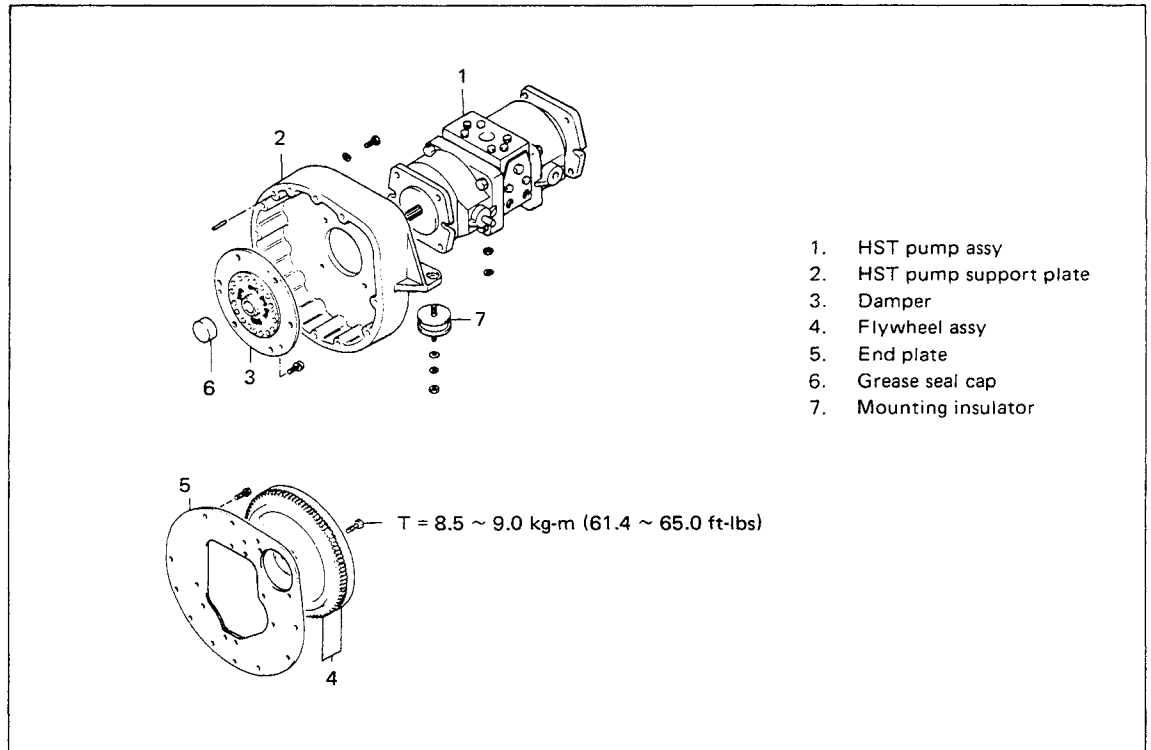
Draining Water from Sedimenter (2)

SAES64

HYDROSTATIC TRANSMISSION (HST)

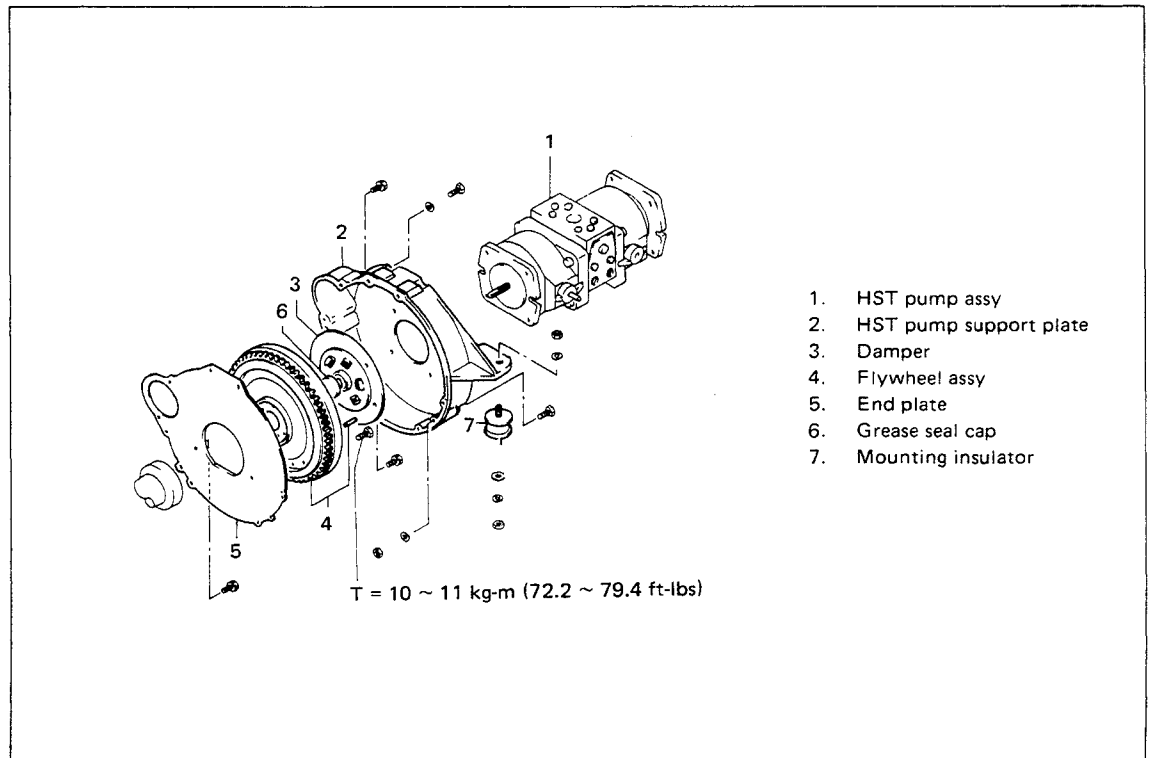
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HST PUMP	2-4
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HST PUMP MOUNTING



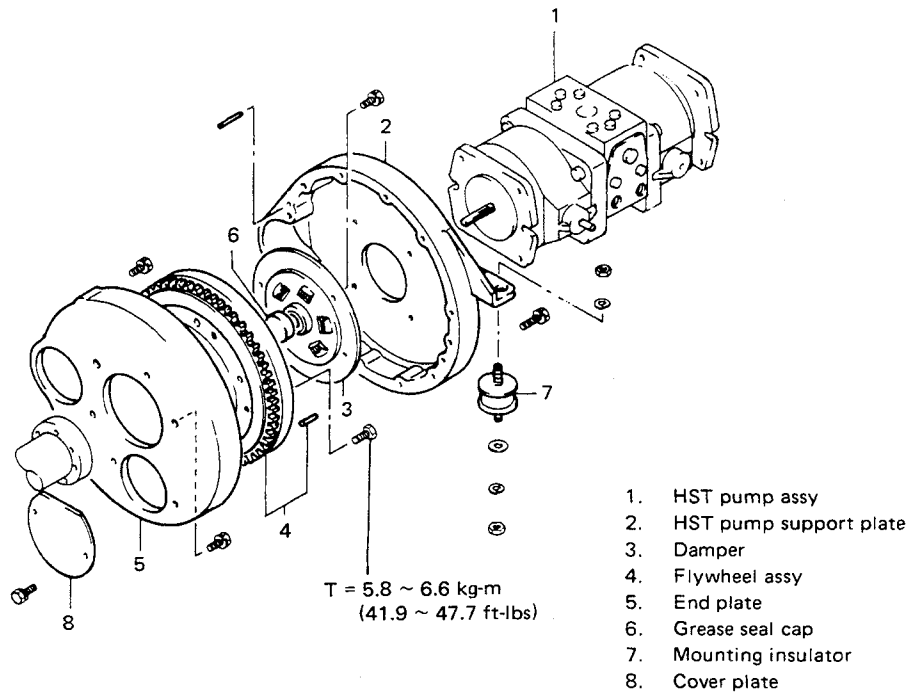
HST Pump Mounting Components (2SDK6)

SAEM31



HST Pump Mounting Components (2SDK7, 2SDK8)

SAEM32

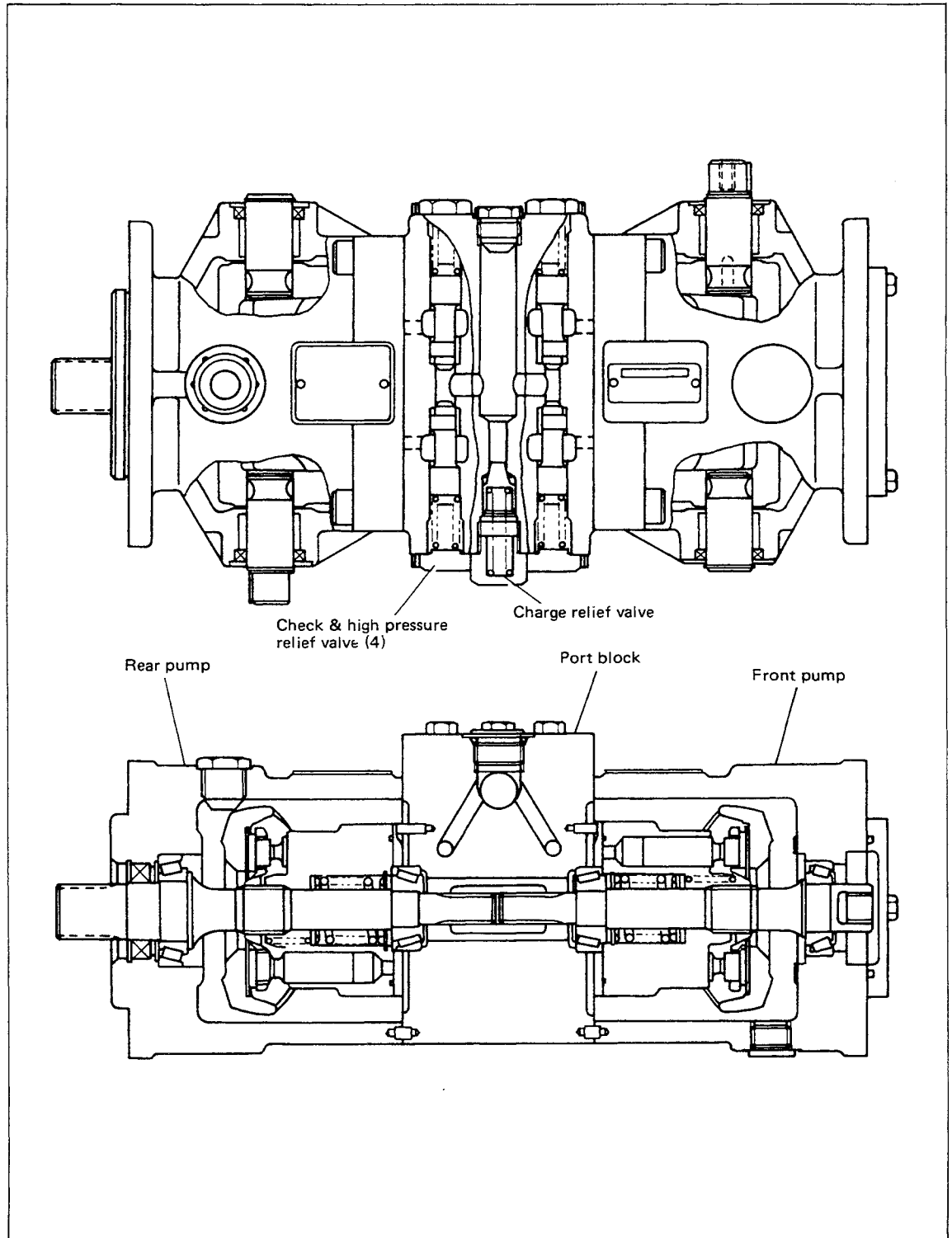


HST Pump Mounting Components (2SGK6)

SAEM33

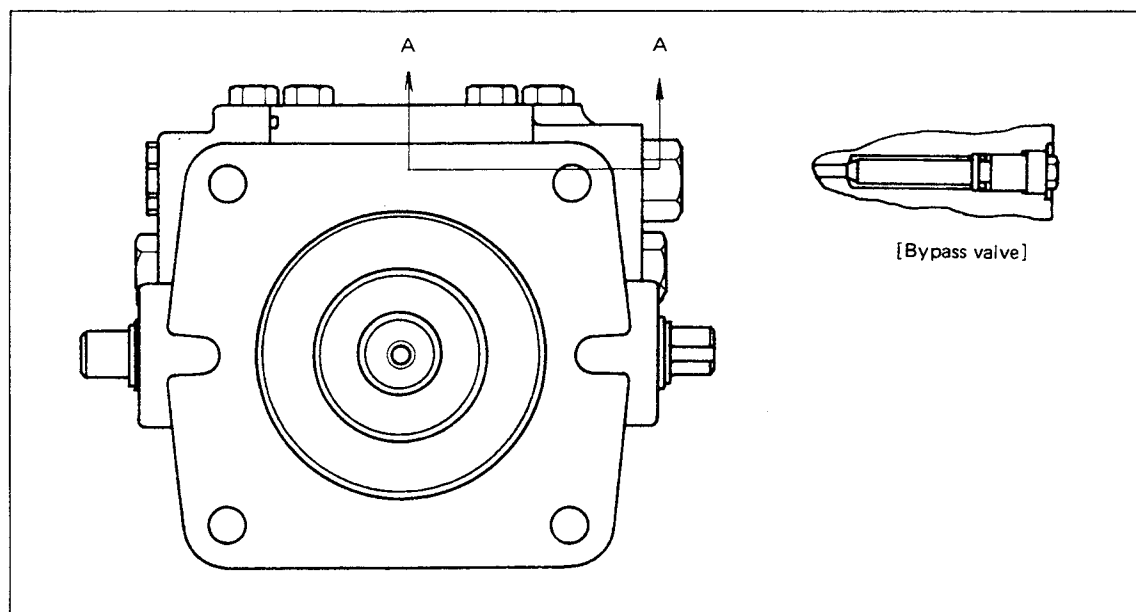
HST PUMP

GENERAL



HST Pump Sectional View

SAEM25



Bypass Valve Sectional View

SAES25

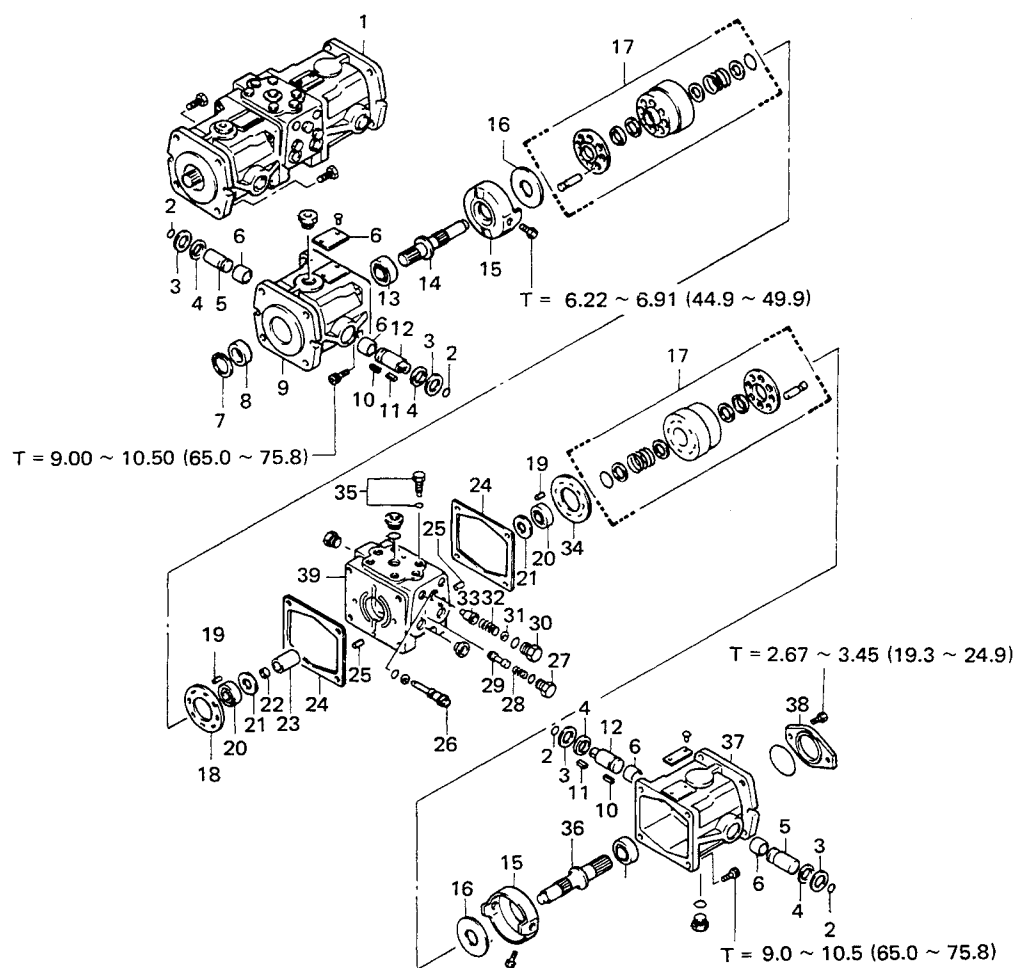
SPECIFICATIONS

Item	Model	
	2SGK6, 2SDK6, 2SDK7	2SDK8
Type	PV1818AR-N36D	PV1818AR-N41D
Name	Variable capacity piston pump (tandem type)	
Displacement	0 ~ 37.7 cc/rev x 2 (0 ~ 2.30 cu-in/rev x 2)	
Swash plate angle	0° ~ ± 18°	
Rotating direction	Clockwise as viewed from shaft end	
High-pressure relief valve setting	255 kgf/cm ² (at 5 to 6 ℓ/min.) (3630psi at 1.3~1.6usgal/min.)	290 kgf/cm ² (at 5 to 6 ℓ/min.) (4120psi at 1.3~1.6usgal/min.)
Charge pressure	3.5 ~ 4.0 kgf/cm ² (at 28 ℓ/min.) (49.8 ~ 56.9 psi at 74 usgal/min.)	
Weight	47 kgf (103.6 lbs)	

SERVICE STANDARDS

Charge pressure (1986. 3 ~ 1991. 5)	Engine idle	Over 2 kg/cm ² (28.4 psi)
	Engine max. rpm	Over 3.2 kg/cm ² (45.5 psi)
Charge pressure (1991. 5 ~)	Engine idle	Over 3.5 kg/cm ² (50 psi)
	Engine max. rpm	Over 4.7 kg/cm ² (67 psi)
Pump shaft axial play (front pump)	0.06 ~ 0.25 mm (0.0024 ~ 0.0098 in.)	
Pump shaft axial play (rear pump)	0.06 ~ 0.25 mm (0.0024 ~ 0.0098 in.)	
Pump housing set bolt tightening torque	9.0 ~ 10.5 kg-m (65.0 ~ 75.8 ft-lbs)	
Swash plate set bolt tightening torque	6.22 ~ 6.91 kg-m (44.9 ~ 49.9 ft-lbs)	
Front pump cover set bolt tightening torque	2.67 ~ 3.45 kg-m (19.3 ~ 24.9 ft-lbs)	

COMPONENTS

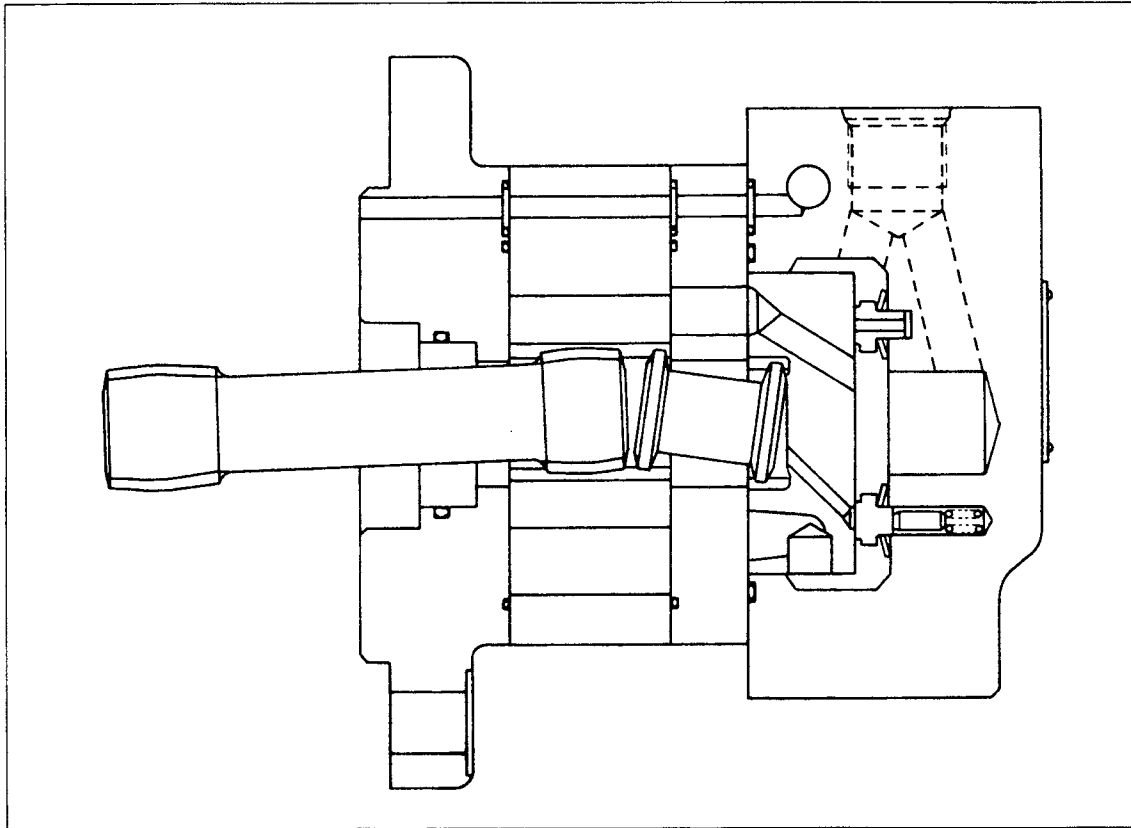


Tightening torque: kg-m (ft-lbs)

- | | | |
|--------------------|------------------------|------------------------------|
| 1. HST pump assy | 14. Rear pump shaft | 27. Spring seat cap |
| 2. Retaining ring | 15. Swash plate | 28. Spring |
| 3. Washer | 16. Thrust plate | 29. Relief valve |
| 4. Oil seal | 17. Cylinder block kit | 30. Plug |
| 5. Trunnion shaft | 18. Rear valve plate | 31. Shim |
| 6. Journal bearing | 19. Straight pin | 32. Spring |
| 7. Retaining ring | 20. Bearing | 33. Charge relief valve |
| 8. Oil seal | 21. Shim | 34. Front valve plate |
| 9. Rear housing | 22. Retaining ring | 35. Pressure check port plug |
| 10. Key | 23. Coupling | 36. Front pump shaft |
| 11. Key | 24. Gasket | 37. Front housing |
| 12. Trunnion shaft | 25. Straight pin | 38. Cover |
| 13. Bearing | 26. Bypass valve | 39. Port block |

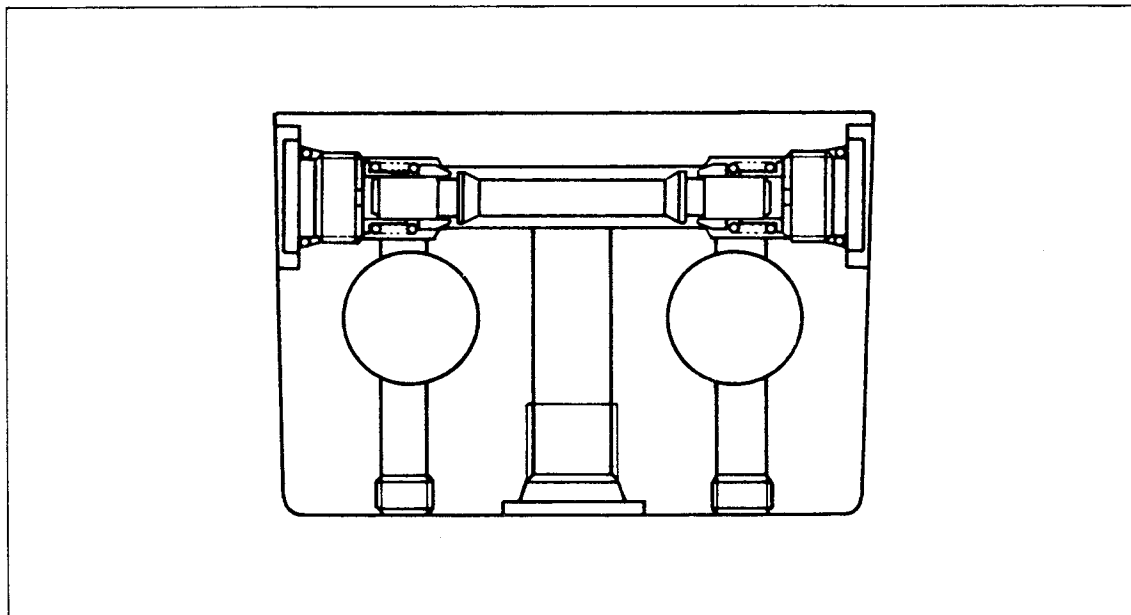
HST MOTOR

GENERAL



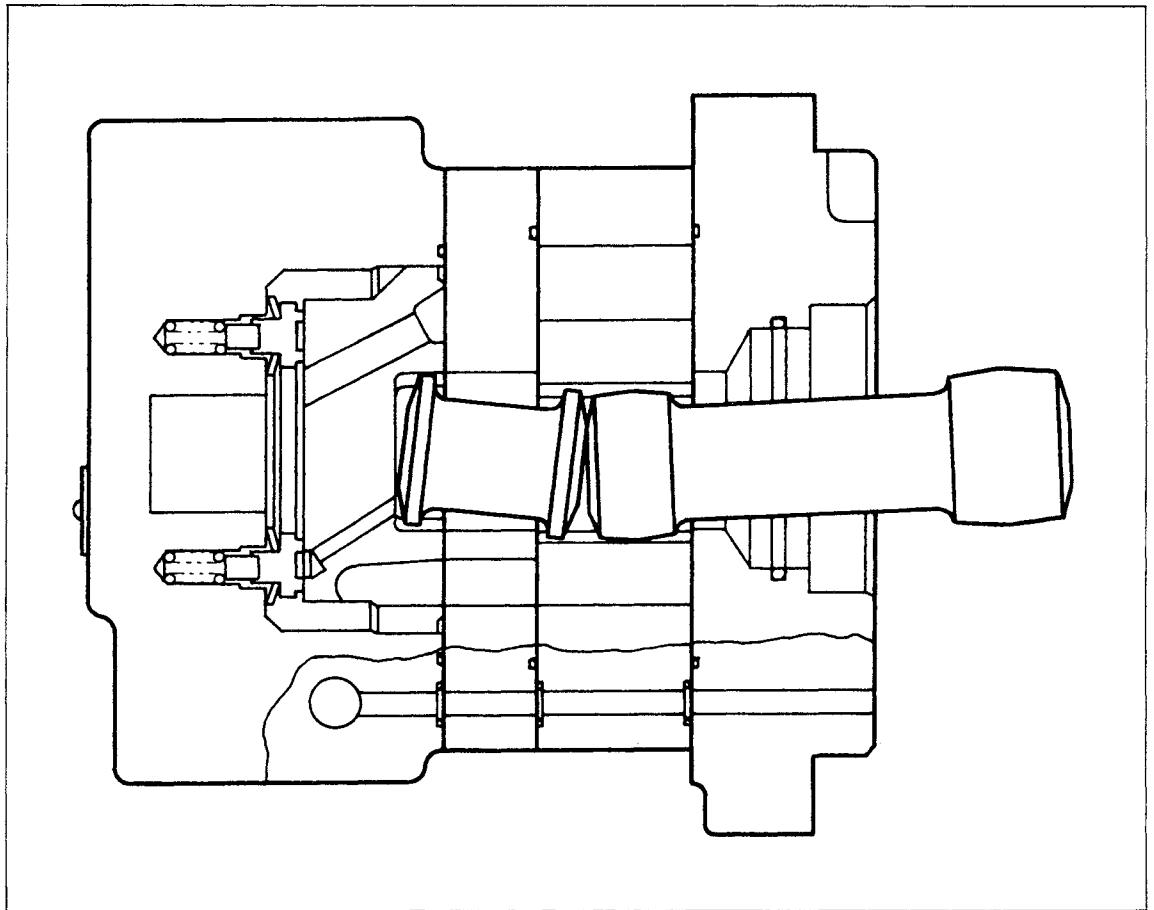
HST Motor Sectional View (2SGK6, 2SDK6, 7)

SAEM27



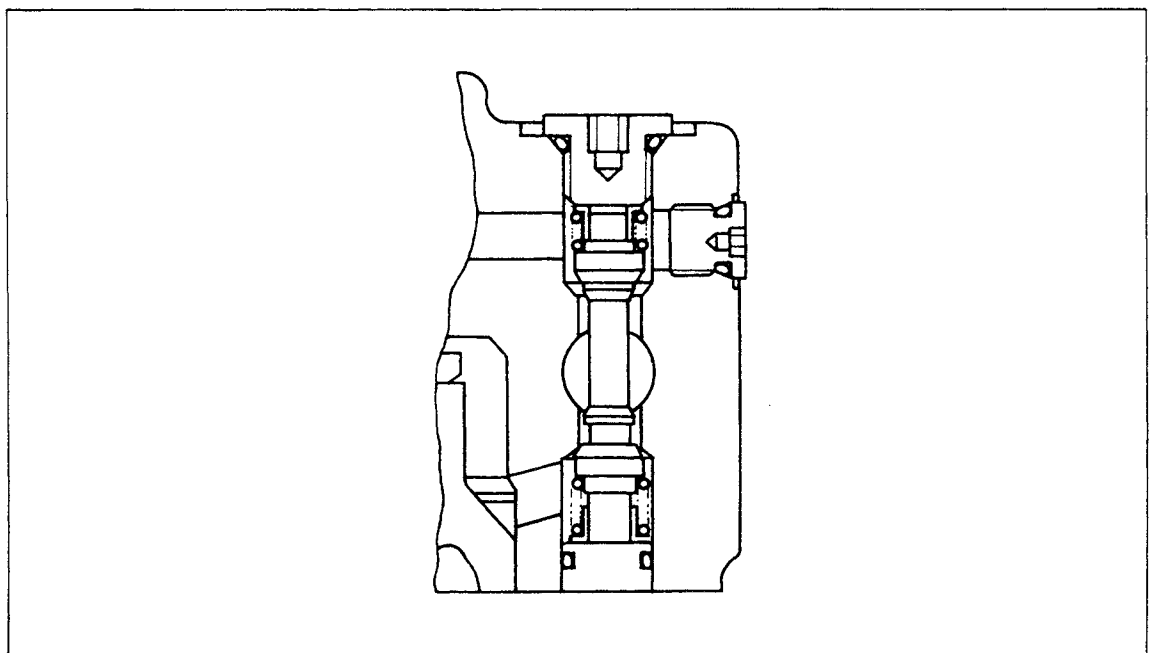
Shuttle Valve Sectional View (2SGK6, 2SDK6, 7)

SAES26



HST Motor Sectional View (2SDK8)

SAEM28



Shuttle Valve Sectional View (2SDK8)

SAES27

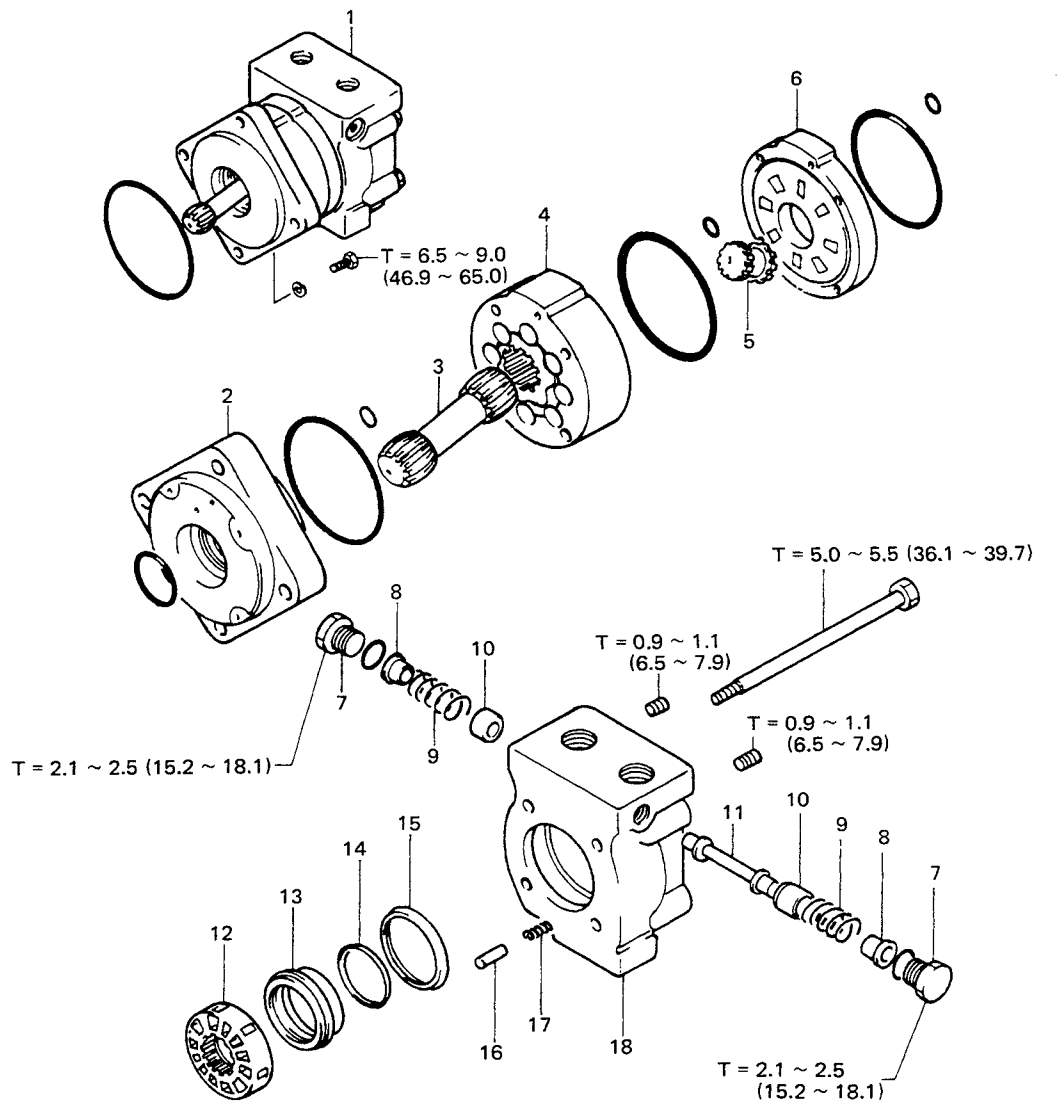
SPECIFICATIONS

Item	Model	
	2SGK6, 2SDK6, 2SDK7	2SDK8
Type	2-160	4-160
Name	Low -speed high-torque motor with shuttle valve (internal gear motor)	
Displacement	158 cc/rev (9.64 cu-in/rev)	162 cc/rev (9.88 cu-in/rev)
Max. working pressure	255 kgf/cm ² (3626 psi)	290 kgf/cm ² (4124 psi)
Max. output torque	51kgf-m (250kgf/cm ² , 120 rpm) (368.7ft-lbs at 3555psi, 120rpm)	58kgf-m (280kgf/cm ² , 180 rpm) (419.3 ft-lbs at 3982psi, 180rpm)
Max. output speed	540 rpm	520 rpm
Rotating direction	Counterclockwise and clockwise	←
Shuttle valve cracking pressure	6.5 ± 2.0kgf/cm ² (92.4 ± 28.4psi)	←
Weight	7.9 kgf (17.4 lbs)	13.8 kgf (30.4 lbs)

SERVICE STANDARDS

Item	Model	
	2SGK6, 2SDK6, 2SDK7	2SDK8
Shuttle valve plug tightening torque	2.1 ~ 2.5 kgf-m (15.2 ~ 18.1 ft-lbs)	←
Valve housing set bolt tightening torque	5.0 ~ 5.5 kgf-m (36.1 ~ 39.7 ft-lbs)	6.2 ~ 7.6 kgf-m (44.8 ~ 54.9 ft-lbs)
HST motor set bolt tightening torque	6.5 ~ 9.0 kgf-m (46.9 ~ 65.0 ft-lbs)	←

COMPONENTS



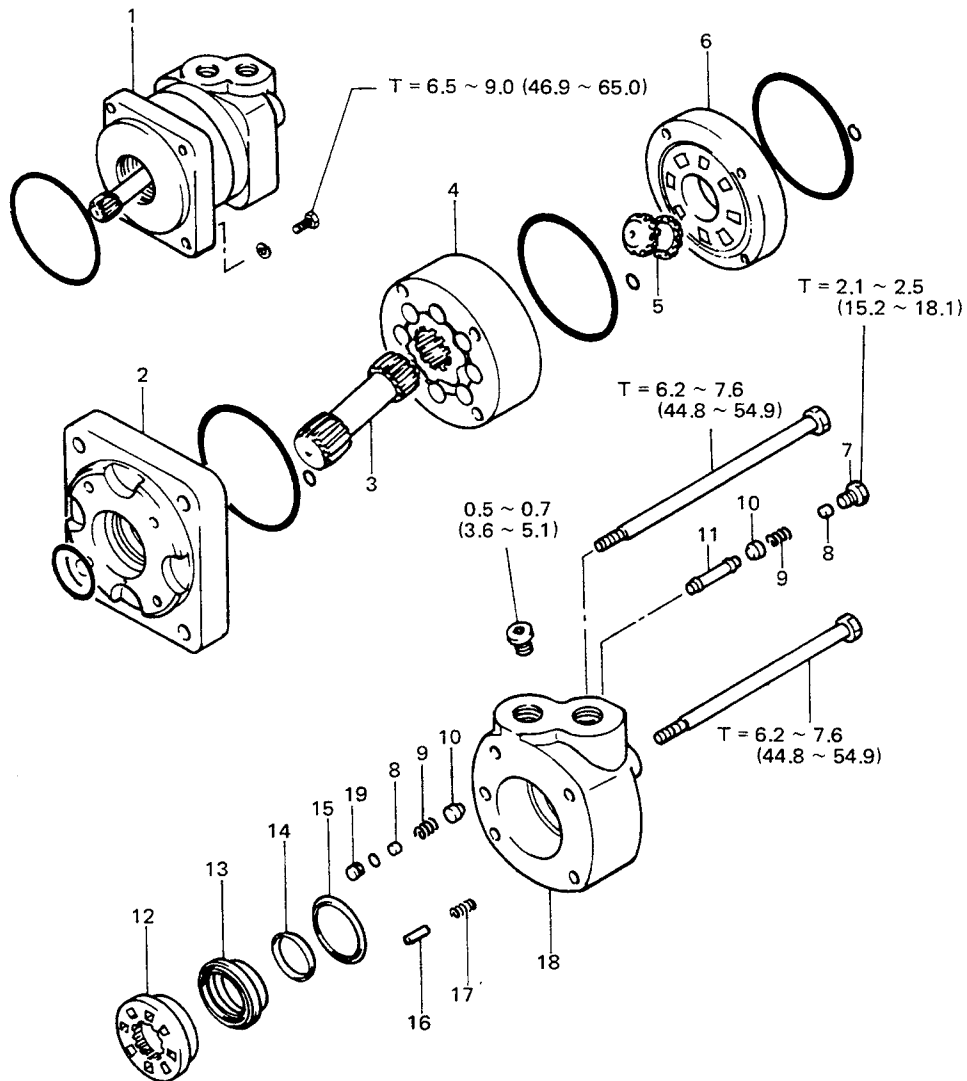
Tightening torque unit: kg-m (ft-lbs)

1. HST motor assy
2. Mounting flange
3. Drive
4. Gyroller set
5. Valve drive
6. Valve plate
7. Plug
8. Sleeve
9. Spring
10. Poppet

11. Piston
12. Valve
13. Balance plate
14. Inner face seal
15. Outer face seal
16. Pin
17. Spring
18. Valve housing

HST Motor Components (2SGK6, 2SDK6, 7)

SAEM29

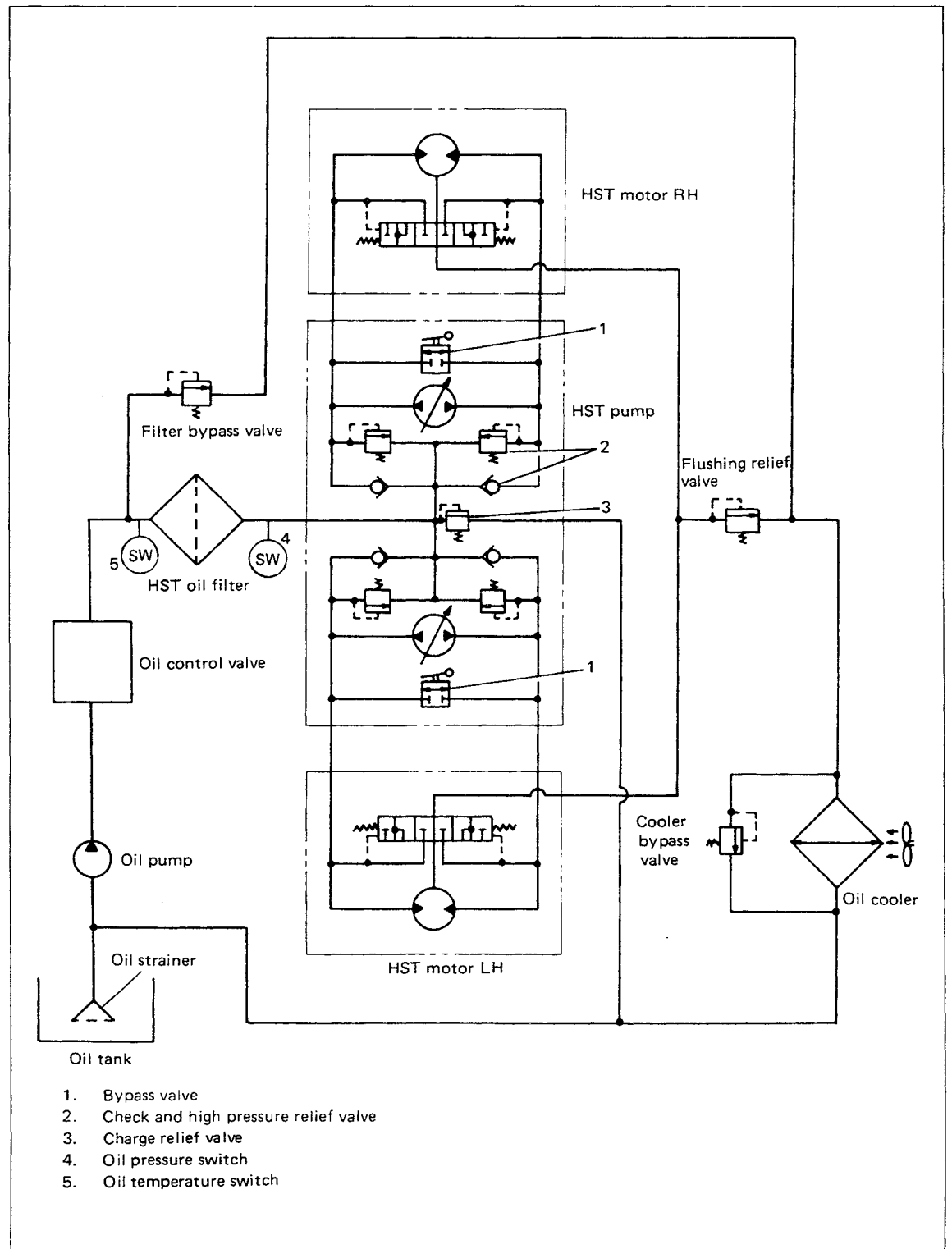


Tightening torque unit: kg-m (ft-lbs)

- | | |
|--------------------|---------------------|
| 1. HST motor assy | 11. Piston |
| 2. Mounting flange | 12. Valve |
| 3. Drive | 13. Balance plate |
| 4. Gyroller set | 14. Inner face seal |
| 5. Valve drive | 15. Outer face seal |
| 6. Valve plate | 16. Pin |
| 7. Plug | 17. Spring |
| 8. Sleeve | 18. Valve housing |
| 9. Spring | 19. Plug |
| 10. Poppet | |

HYDRAULIC CIRCUIT SCHEMATIC

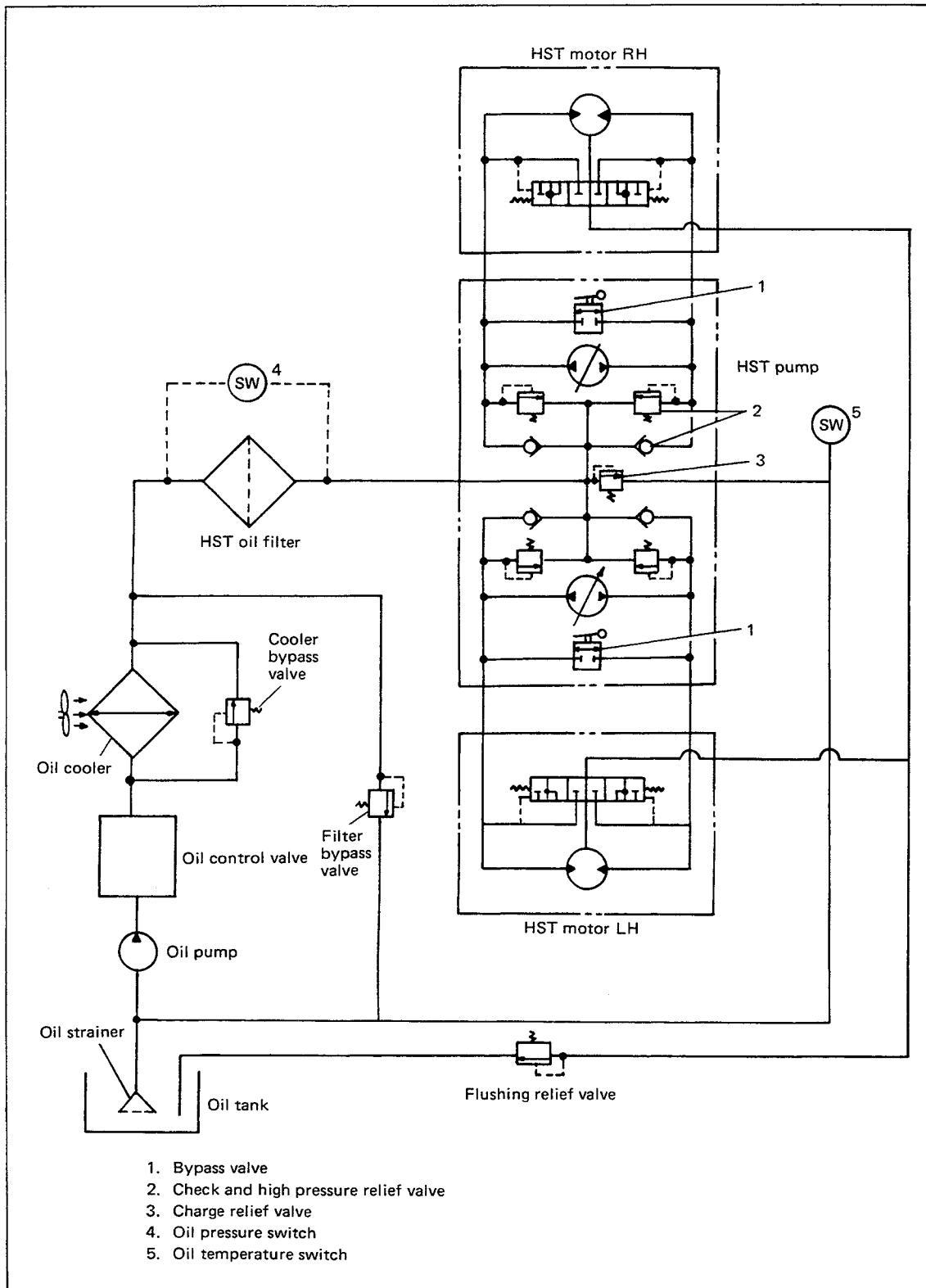
(1986.3 ~ 1991.5)



Hydraulic Circuit Schematic

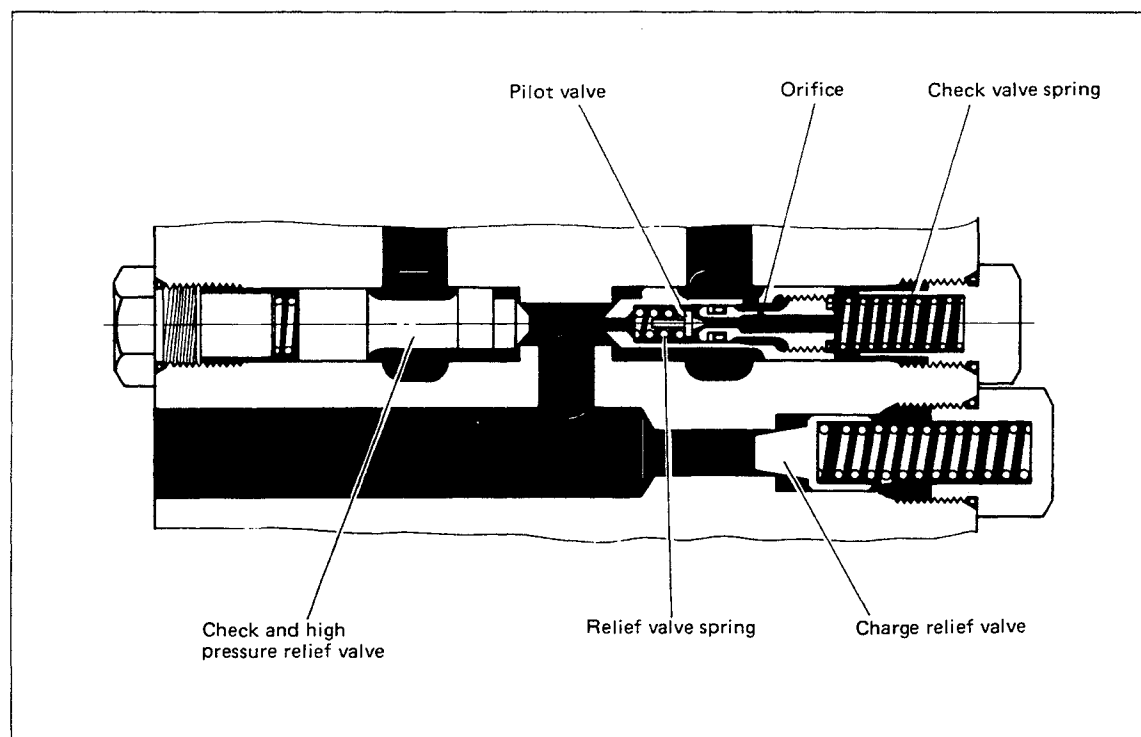
SAEM34

(1991.5 ~)



Hydraulic Circuit Schematic

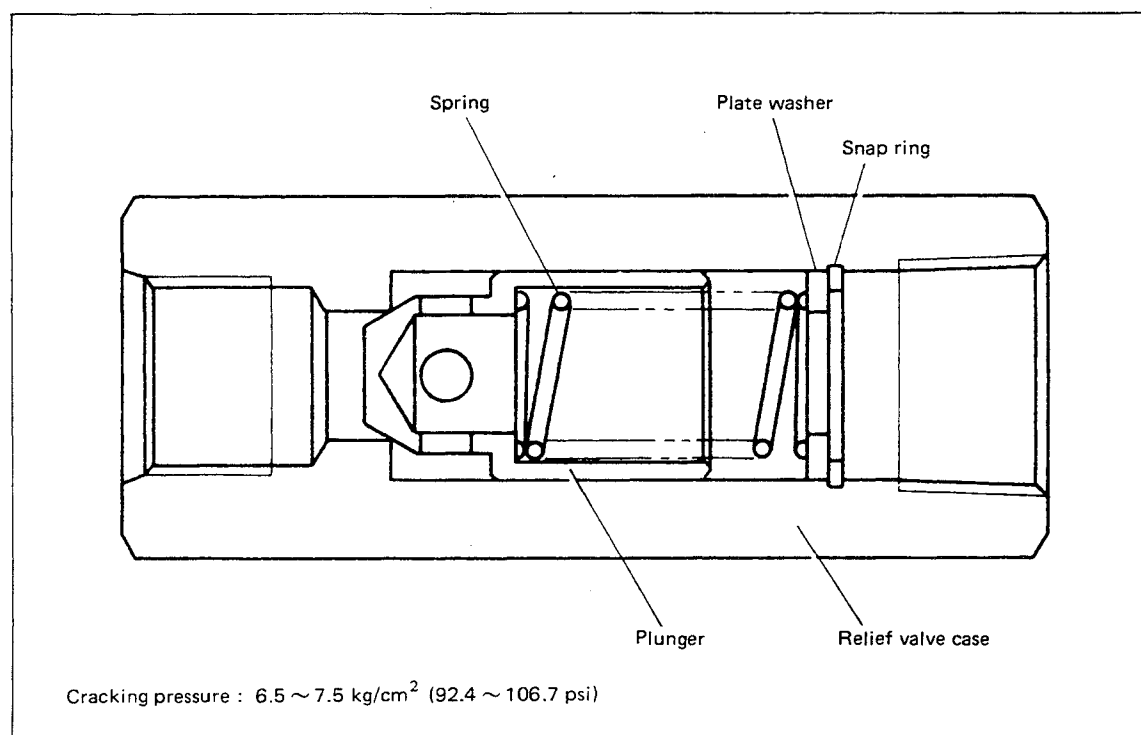
Check & High Pressure Relief Valve and Charge Relief Valve



Check & High Pressure Relief Valve and Charge Relief Valve Sectional View

SAEM56

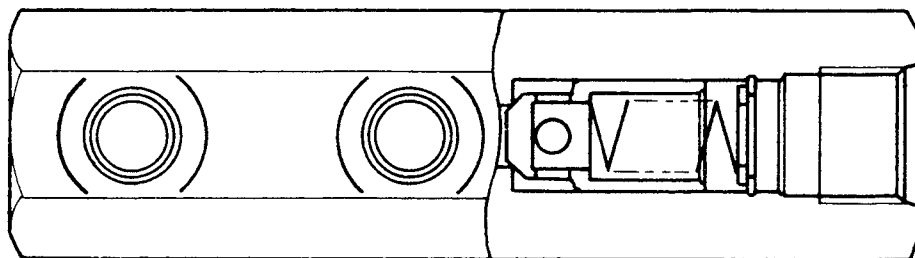
Oil Filter Bypass Valve (1986. 3 ~ 1991. 5)



Oil Filter Bypass Valve Sectional View

SAES29

Flushing Relief Valve

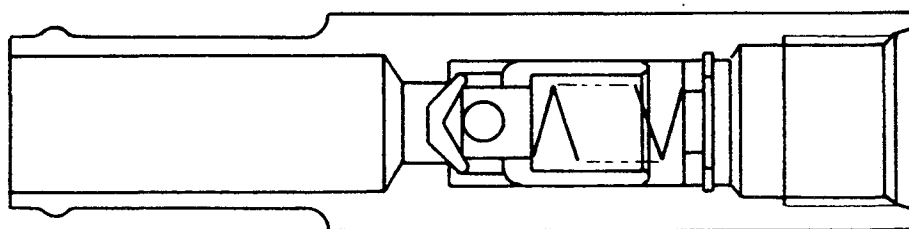


Cracking pressure: 2SGK6, 2SDK6.7 5 kg/cm² (71.1 psi)
 2SDK8 3 kg/cm² (42.7 psi)

Flushing Relief Valve Sectional View

SAES30

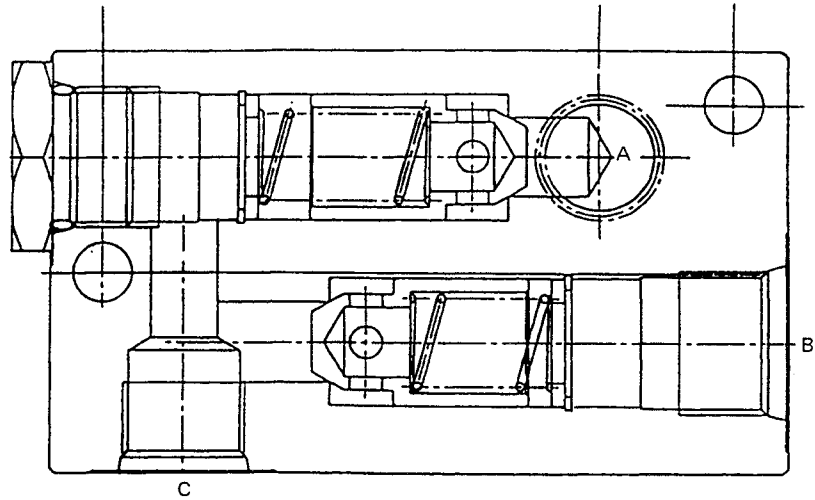
Oil Cooler Bypass Valve (1986. 3 ~ 1991. 5)



Cracking pressure: 1.0 kg/cm² (14.2 psi)

Oil Cooler Bypass Valve Sectional View

SAES67

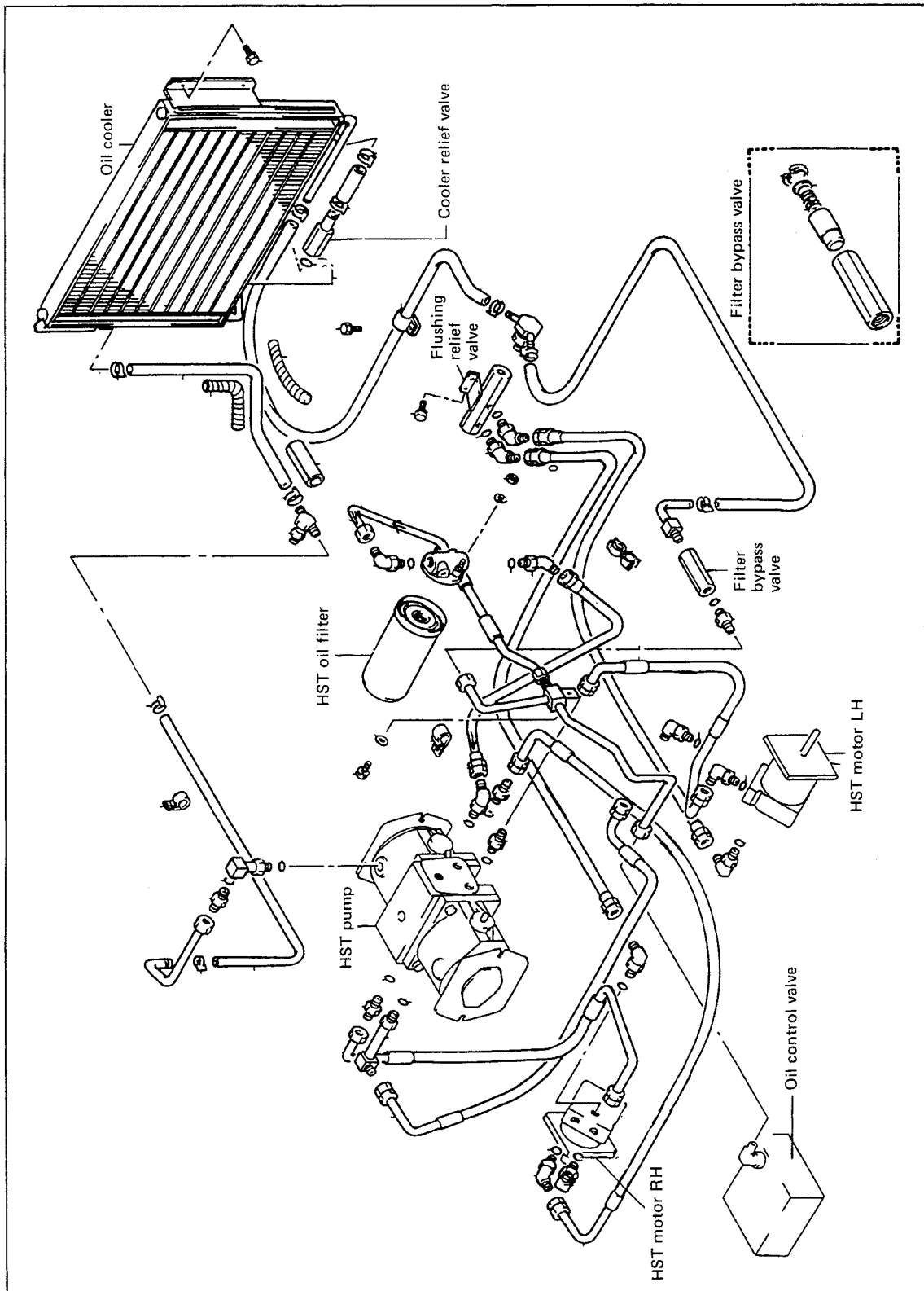
**Relief Valve
(1991. 5 ~)**

Cracking pressure:

A to C port	2.5 kg/cm ² (36 psi)
C to B port	9.0 kg/cm ² (128 psi)

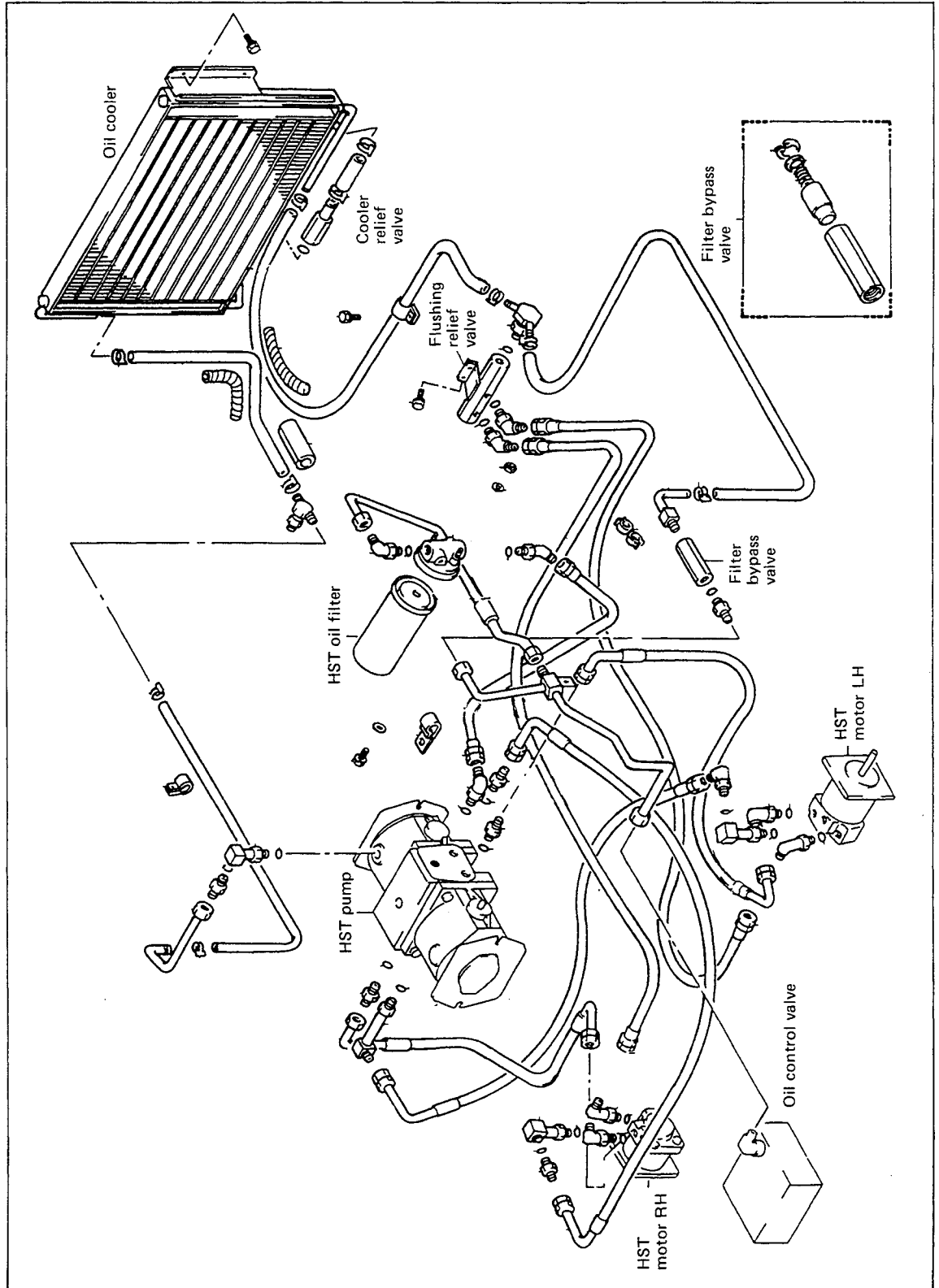
Relief Valve (Oil Filter & Oil Cooler Bypass
Valve) Sectional View

HST HYDRAULIC PIPING (1986.3 ~ 1991.5)



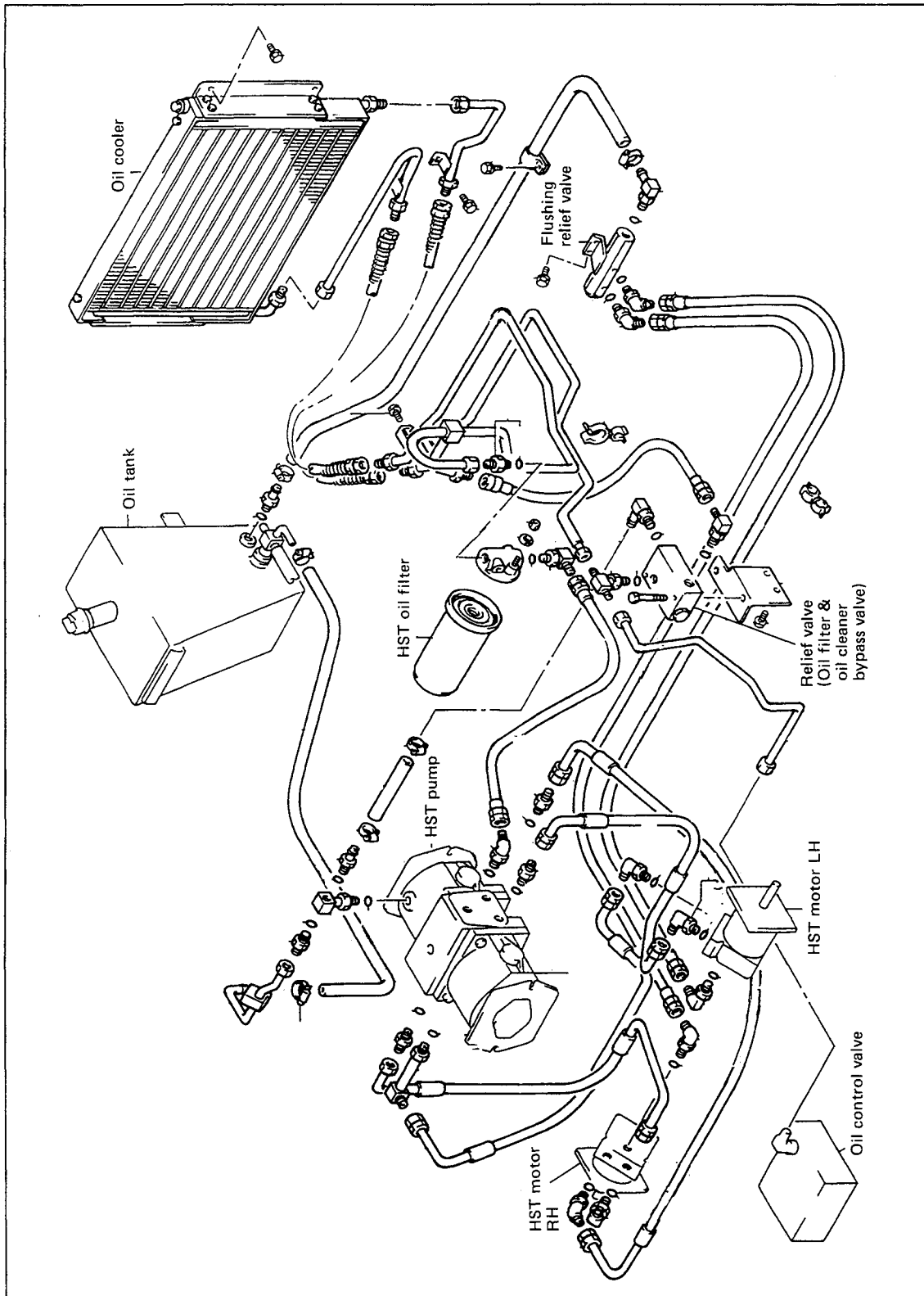
HST Hydraulic Piping (2SDK6, 7 2SGK6)

HST HYDRAULIC PIPING (1986.3 ~ 1991.5)

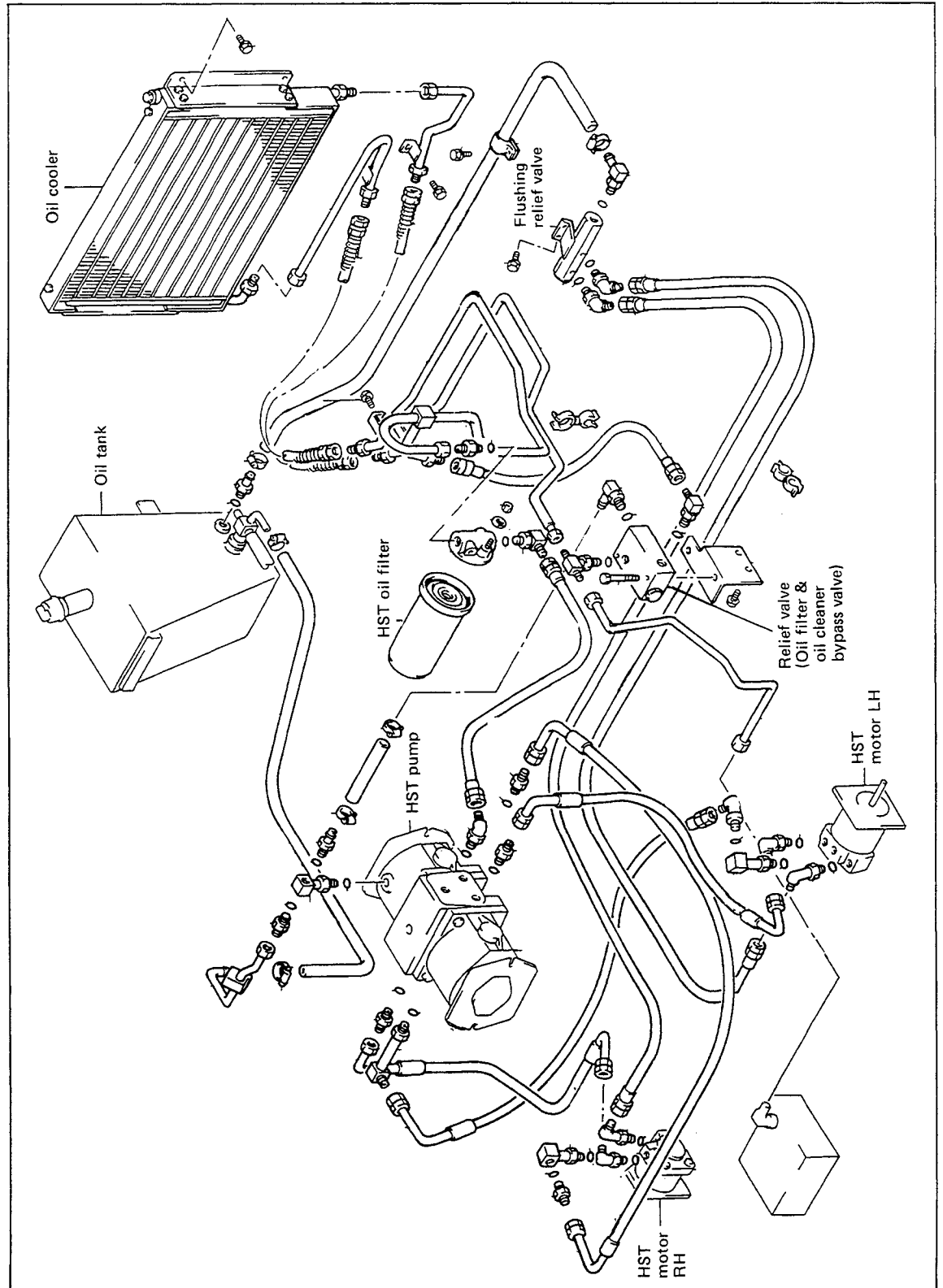


HST Hydraulic Piping (2SDK8)

HST HYDRAULIC PIPING (1991.5 ~)



HST Hydraulic Piping (2SDK6, 7 2SGK6)

HST HYDRAULIC PIPING (1991.5 ~)

HST Hydraulic Piping (2SDK8)

TROUBLE-SHOOTING

Problem	Checkpoint	Cause & Remedy
1. Vehicle does not move at all, or has no power.	<p>(1) Pump shaft revolving?</p> <p>(2) Oil level in oil tank</p> <p>(3) Oil foaming</p> <p>(4) Check for normal pump control shaft operation.</p> <p>(5) Check if the HST oil filter warning lamp comes on and goes off. Ignition switch ON: Lamp on. Engine starting : Lamp off.</p> <p>(6) Measure the charge pressure. Remove the plug from the charge pressure check port of the HST pump, and attach a 0 ~ 15 kg/cm² (0 ~ 213.3 psi) oil pressure gauge.</p>	<ul style="list-style-type: none"> ◦ If the shaft is not revolving, the pump shaft spline (of the engine) or damper is damaged → Replace ◦ Replenish as required. ◦ Bleed air from the hydraulic circuit. See "HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit" section for the air bleeding procedure. ◦ If it persists, tighten the gear pump section system connections, etc. ◦ Check linkage from steering lever to pump control shaft. Steering rod, joint end damage → Replace ◦ Normal if it lights during idling and goes off as engine rpm climbs. ◦ Warm up for a longer time in winter or in colder climates. ◦ Check for normal cylinder operation. ◦ Replace the HST oil filter. (Make sure that the filter is not damaged, and that there are no metal particles in the oil in the filter. If the filter is damaged, or there are any metal particles in the oil, overhaul the pump and motor. ◦ Check the charge relief valve. Replace if there is poor seating or rough operation. ◦ 1986. 3 ~ 1991. 5 Engine idle — Over 2 kg/cm² (28.4 psi) Engine Max. rpm — Over 3.2 kg/cm² (45.5 psi) ◦ 1991. 5 ~ Engine idle — Over 3.5 kg/cm² (50 psi) Engine Max. rpm — Over 4.7 kg/cm² (67 psi) Normal if there is the above charge oil pressure ◦ The pressure will drop slightly when the steering levers are operated, but if it drops below the value shown above, overhaul the pump and motor.

Problem	Checkpoint	Cause & Remedy
2. Moves only in one direction (left or right)	<p>(7) Check the check and high pressure relief valve.</p> <p>(8) Loose the pump bypass valve?</p> <p>(1) Does pump control shaft work normally either left or right?</p> <p>(2) Check the check and high pressure relief valve.</p> <p>(3) Is the HST hydraulic oil pressure warning lamp off?</p> <p>(4) Could the motor bypass valve be loose?</p>	<ul style="list-style-type: none"> ◦ Perfectly seated? Smooth action? Replace if defective. ◦ Tighten if loose. ◦ Check linkage from steering lever to pump control shaft ◦ Steering rod joint end damage. → Replace ◦ If steering sticks, remove the cause and replace the relief valve. ◦ Try switching the relief valves (left & right). If the side that failed to work now operates, change the valve because it is defective. ◦ Refer to (5), (6) above. ◦ Refer to (8) above.
3. Neutral position off.	<p>(1) Check the steering control linkage.</p>	<ul style="list-style-type: none"> ◦ Adjust the neutral positions of the steering levers. ◦ See "STEERING-Adjusting Neutral positions of Steering Control Levers" section.
4. Abnormal rise in oil temperature	<p>(1) Check level in oil tank.</p> <p>(2) Oil cooler clogged</p> <p>(3) HST oil filter clogged</p> <p>(4) Is the check and high pressure valve open?</p> <p>(5) Loose by pass valve?</p> <p>(6) RPM over specified level?</p> <p>(7) Drop in pump, motor performance.</p>	<ul style="list-style-type: none"> ◦ Relief if below required level. ◦ If foaming from air ingress, check the suction system and perform an air bleed. ◦ Clean or replace oil cooler. ◦ Replace oil filter. ◦ Remove cause of any sticking, then replace the relief valve. ◦ Tighten as required. ◦ Adjust engine rpm. See "ENGINE Assy-Adjustment" section. ◦ Check vehicle travel speed to ascertain drop in motor rpm. If too low, overhaul the pump and motor. ◦ Measure the charge pressure. If below the standard, overhaul the pump and motor.

Problem	Checkpoint	Cause & Remedy
5. Abnormal noise emitted	(1) Check level in oil tank (2) Houses, pipes vibrating? (3) Loose pump, motor installation? (4) Inspection of pump shaft soline and damper. (5) Poor engagement of reducer sprocket and chain?	<ul style="list-style-type: none"> ○ If below the specified level replenish. ○ If foaming from air ingress, check the suction system and perform an air bleed. ○ Check installation, repair. ○ Fix contact points resulting from pipe vibration. ○ Check installation point and tighten as required. ○ Worn pump shaft spline → Replace ○ Damper worn or damaged → Replace ○ Loose damper set bolt → Tighten ○ Replace sprocket, chain, obtain right engagement.
6. Slow acceleration, decelration.	(1) Check oil tank level. (2) Drop in pump, motor performance (3) Possible loss of engine power?	<ul style="list-style-type: none"> ○ Fill if required. ○ If foaming from air ingress, check suction system and perform an air bleed. ○ Check for lower motor rpm by means of travel speed. Overhaul the pump, motor if low. ○ Measure the chage pressure. If below the standard, overhaul the pump and motor. ○ Adjust engine rpm. ○ Engine adjustment.

HST PUMP ASSY

REMOVAL

Caution:

Carefully operate as entrance of dirt or foreign matters in the HST system will damage the system in a short period.

1. Remove the seat panel with driver's seat.
 - (1) Wiring to seat switch
 - (2) Set bolts (6 pcs.)
 - (3) Seat panel with driver's seat
2. Disconnect the steering link on the HST pump.
 - (1) Steering link RH
 - (2) Steering link LH.
3. Disconnect the backup lamp switch wiring.
4. Disconnect the piping.

Caution:

Fit nylon caps or other covers to hoses and elbows to prevent entrance of foreign matters.

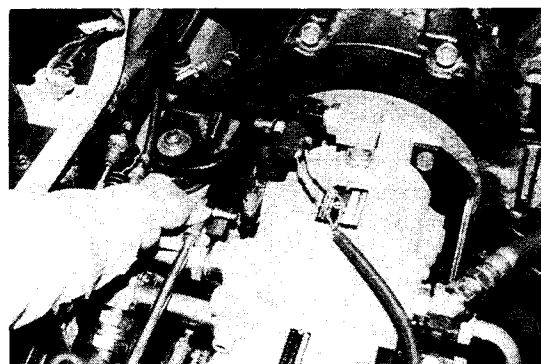
- (1) Charge hose
- (2) Drain pipe
- (3) High pressure hoses (four)

5. Remove the steering link RH.
6. Remove the spring holder LH.



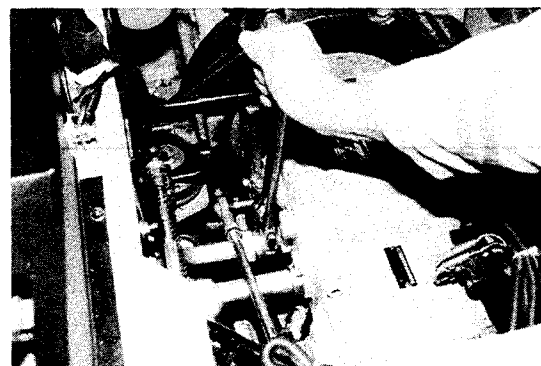
Seat Panel with Driver's Seat

SAE13-35



Steering Link

SAE26-7



High Pressure Hose

SAE26-8

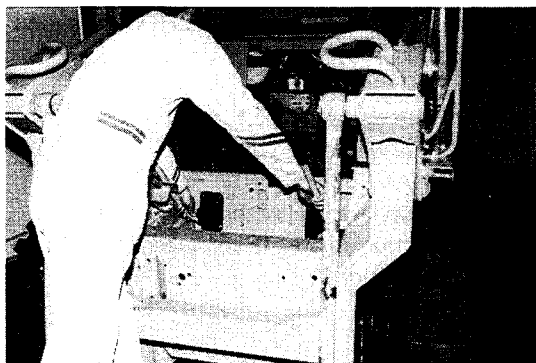


Disconnecting the Spring Holder

SAE26-3

7. Move the front cover with steering lever forward.

- (1) Set bolts (6 pcs.)
- (2) Move the front cover with lever.



Moving the Front Cover with Lever

SAE25-36

8. Remove the under cover.

- (1) Front under cover
 - ① Set bolts
 - ② Front under cover
- (2) Rear under cover
 - ① Set bolts
 - ② Rear under cover
- (3) Member
 - ① Set bolts
 - ② Member



Under Cover

SAE26-12

9. Lightly suspend the HST pump with a wire rope.

SST 09010-20110-71

10. Remove the HST pump.

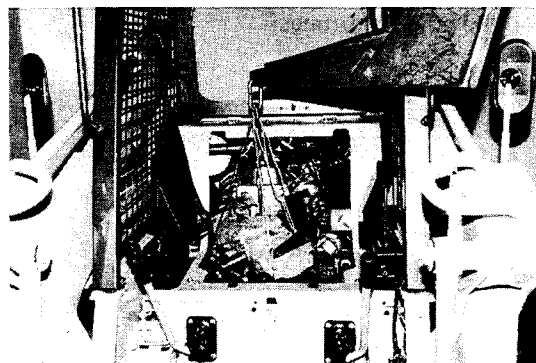
- (1) Set bolts (4 pcs.)



HST Pump (1)

SAE25-33

- (2) HST pump

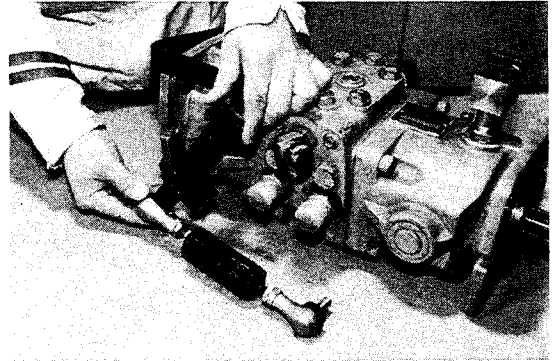


HST Pump (2)

SAE17-21

11. Remove the pump lever LH with spring holder.

- (1) Set bolts (2 pcs.)
- (2) Plate washer (1 pc.)
- (3) Plate washer (2 pcs.)
- (4) Key
- (5) Pump lever LH with spring holder
- (6) Friction plate (Remember chamfered side inside.)

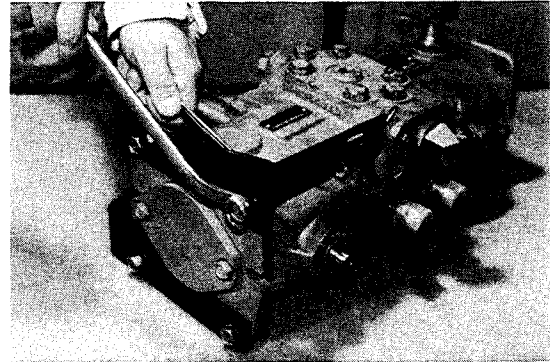


Pump Lever LH

SAE17-24

12. Remove the switch bracket.

- (1) Set bolts (2 pcs.)
- (2) Switch bracket

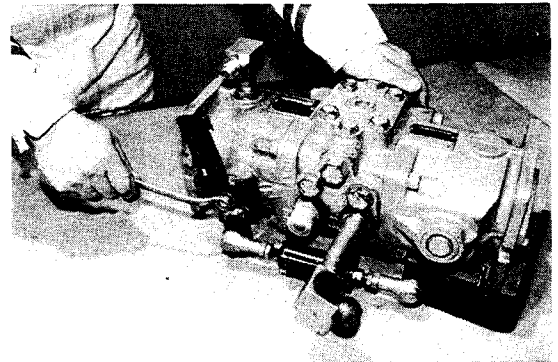


Switch Bracket

SAE17-26

13. Remove the pump lever RH with spring holder and bracket.

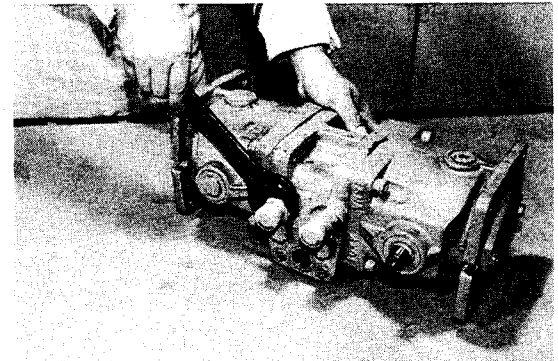
- (1) Set bolts (2 pcs.)
- (2) Bracket
- (3) Set bolts (2 pcs.)
- (4) Plate washer (1 pc.)
- (5) Plate washer (2 pcs.)
- (6) Key
- (7) Pump lever RH with spring holder and bracket
- (8) Friction plate (Remember chamfered side inside.)



Pump Lever RH

SAE17-30

14. Remove the fitting.



Fitting

SAE17-34

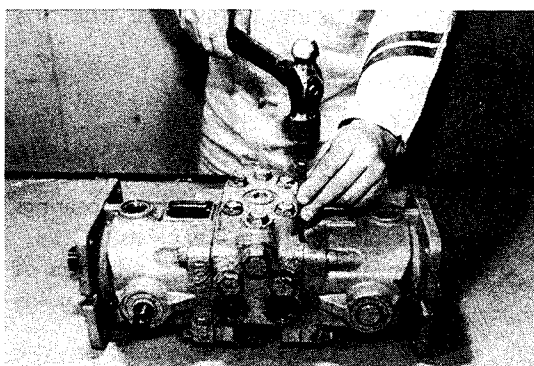
DESASSEMBLY

Important:

- When doing a pump overhaul, do so in a clean place on a clean table.
- Before disassembly, clean the pump assembly.
- Before beginning to disassemble the pump, punch aligning marks on the front pump, port block, and rear pump.
- Carefully operate as entrance of dirt or foreign matters in the HST system will damage the system in a short period.

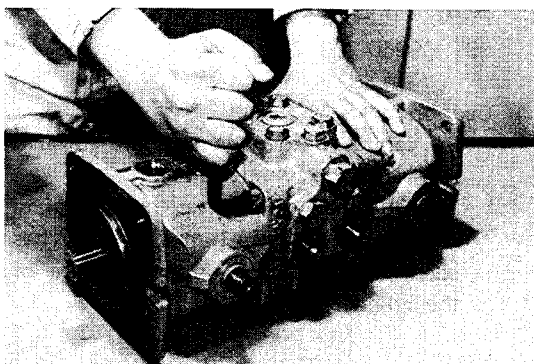
Rear Pump (Engine Side) Disassembly

1. Remove the rear pump.
 - (1) Socket head screws



Punching Match Marks

SAE18-7



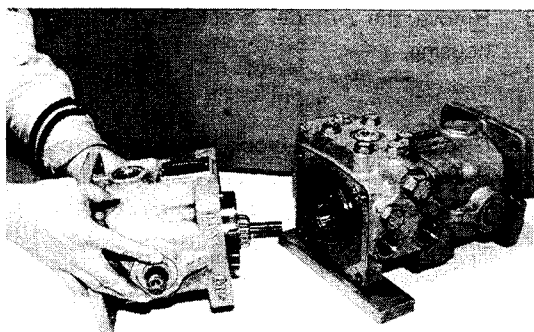
Socket Head Screws

SAE-18-12

- (2) Rear pump

Caution:

- If hard to disconnect, rap the circumference with a soft hammer lightly. Do not pry apart with a screwdriver in the housing seam.
- The valve plate may remain stuck to the cylinder block. Be careful so that it will not undergo damage.



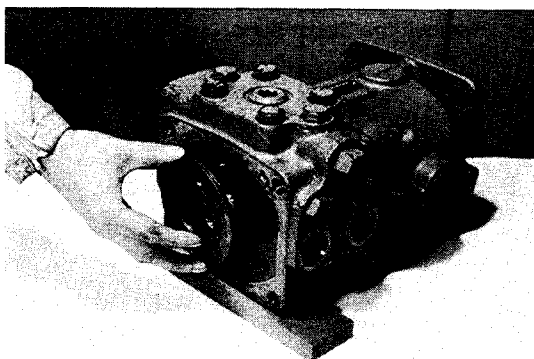
Rear Pump

SAE20-18

2. Remove the valve plate from the port block.

Caution:

The surface of the valve plate and port block has been precision machined. Be careful not to damage it.



Valve Plate

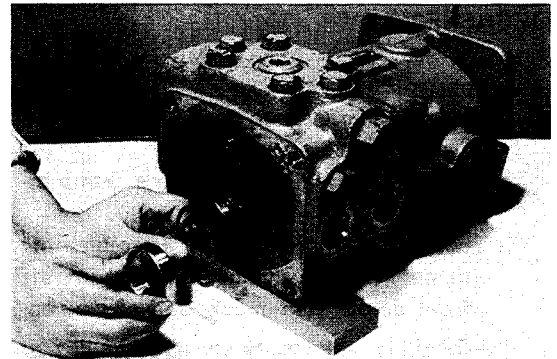
SAE20-19

3. Remove the bearing outer race from the port block.

- (1) Bearing outer race
- (2) Shim

Caution:

- There is no need to remove bearings unless some abnormality exists.
- Jot down the number and thickness of shims beneath the bearings as a guide for reassembly.



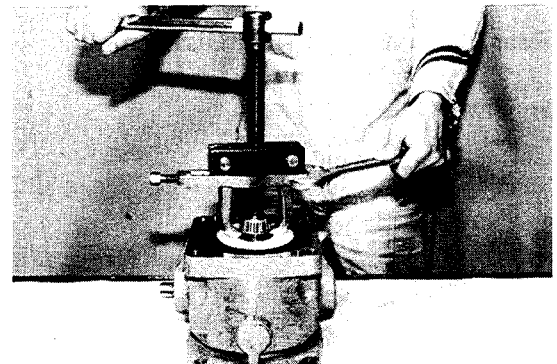
Bearing Outer Race, Shim

SAE20-20

4. Remove the bearing inner race.
SST 09950-20017

Caution:

- Be careful not to damage the finished surface of the cylinder block.
- The SST may be set after the resin plate (thickness: approx. 1 mm (0.04")) has been placed on the finished surface of the cylinder block.



Bearing Inner Race

SAE20-22

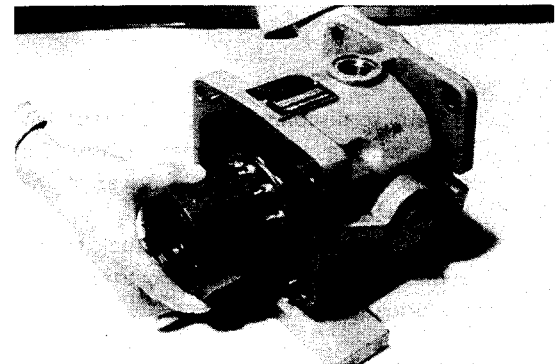
5. Remove the cylinder block kit from pump housing.

Note:

Grip the cylinder block, holding the pump shaft, then raise the flange side slightly and withdraw carefully as turning the pump shaft slowly.

Caution:

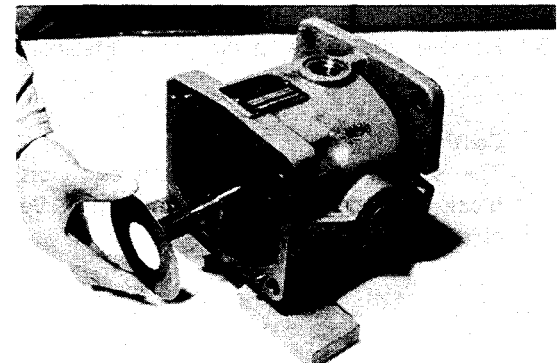
Be careful not to damage the cylinder block kit valve plate side surface and the slipper head surfaces (9 slippers).



Cylinder Block

SAE20-24

6. Remove the thrust plate.



Thrust Plate

SAE20-25

7. Remove the trunnion shafts.

- (1) Set bolts



Set Bolts

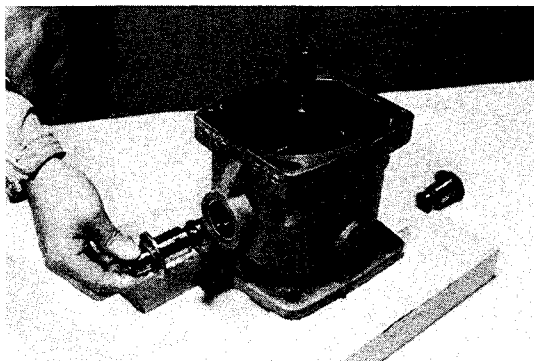
SAE20-27

- (2) Trunnion shafts with retaining rings.

Note:

Tap the middle of the trunnion shaft lightly from the housing inside, driving out the shaft.

- (3) Retaining rings
- (4) Washers

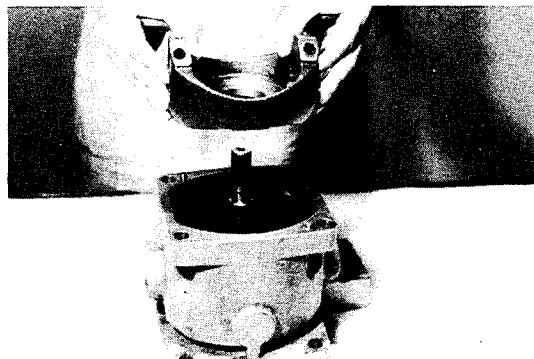


Trunnion Shaft

SAE20-28

8. Remove the swash plate.

- (1) Swash plate with key
- (2) Key



Swash Plate

SAE20-29

9. Remove the pump shaft with the bearing inner race.

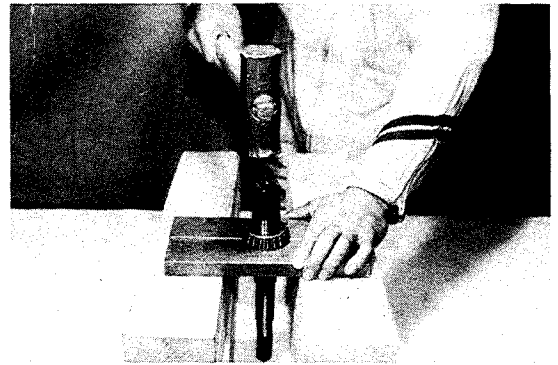


Pump Shaft with Bearing

SAE20-31

10. Remove the bearing inner race from pump shaft.
SST 09527-21011

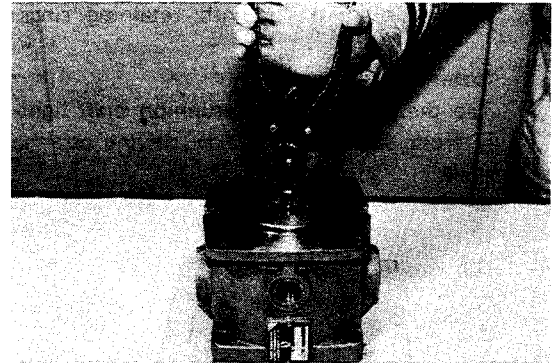
Caution:
Disassemble when a defect of the bearing or pump shaft is found as a result of inspection.



Bearing Inner Race

SAE20-33

11. Remove the oil seal
 - (1) Retaining ring



Retaining Ring

SAE20-35

- (2) Oil seal
SST 09608-30012



Oil Seal

SAE20-36

12. Remove the bearing outer race from pump housing.

Caution:
Unless there is some damage, the bearing need not be removed.



Bearing Outer Race

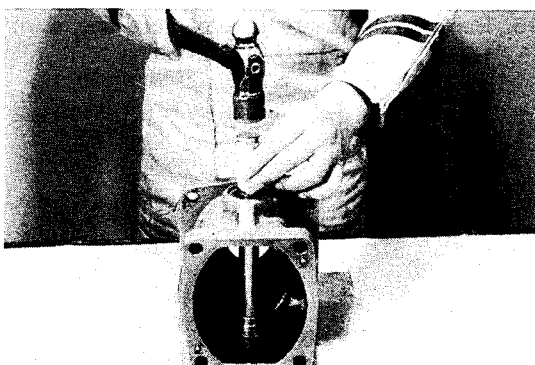
SAE21-3

13. Remove the oil seal and journal bearing.

- (1) Oil Seal
- (2) Journal bearing
SST 09620-30010

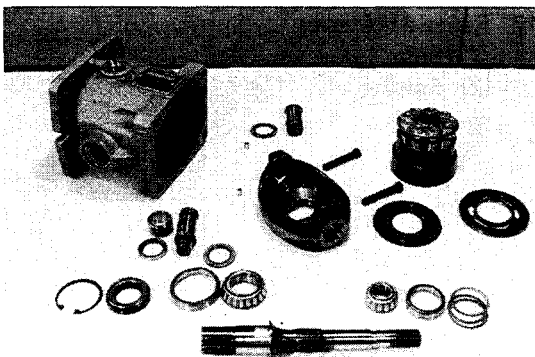
Note:

- Use a screwdriver when removing only the oil seal.
- When removing the Journal bearing, use an SST and remove it along with the oil seal.
- Remove the journal bearing only when it is changed.



Journal Bearing

SAE21-4



Disassembling the Rear Pump

SAE21-24

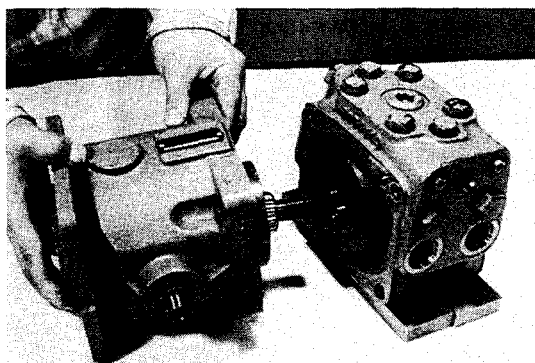
Front Pump Disassembly

14. Remove the front pump.

- (1) Socket head screws
- (2) Front pump

Caution:

- If hard to disconnect, tap the circumference with a soft hammer lightly. Do not pry apart with a screwdriver in the housing seam.
- The valve plate may remain stuck to the cylinder block. Be careful so that it will not undergo damage.



Removing the Front Pump

SAE21-33

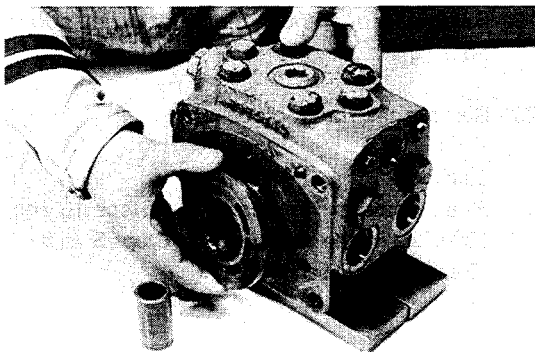
- (3) Remove the gasket.

15. Remove the coupling and valve plate from the port block.

- (1) Coupling
- (2) Valve plate

Caution:

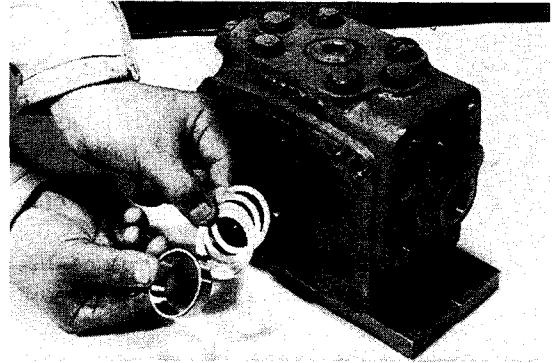
- The surface of the valve plate and port block has been precision machined. Be careful not to damage it.
- Note that the shape of the slot is different from that of the rear pump valve plate.



Coupling and Valve Plate

SAE21-36

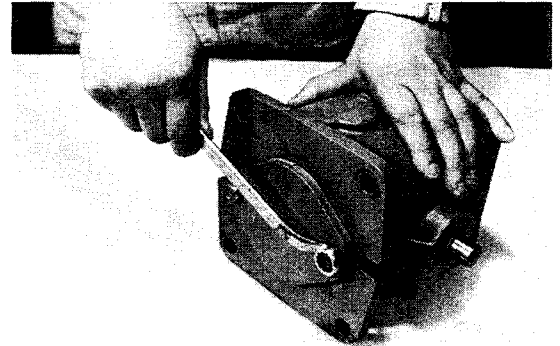
16. Remove the bearing outer race and shim from the port block.



Bearing Outer Race, Shim

SAE22-1

17. Remove the cover
 - (1) Bolts
 - (2) Cover

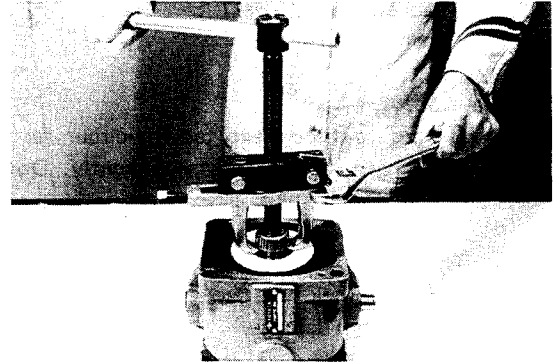


Cover

SAE22-3

18. Remove the bearing inner race.

SST 09950-20017



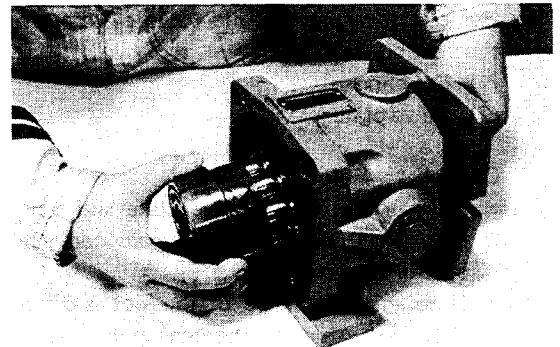
Bearing Inner Race

SAE22-4

19. Remove the cylinder block kit from pump housing.
20. Remove the thrust plate.

Caution:

When disassembling, carry out Steps 16 and 18 to 20 in the same way as Steps 3 to 6 of "Rear Pump Disassembly".



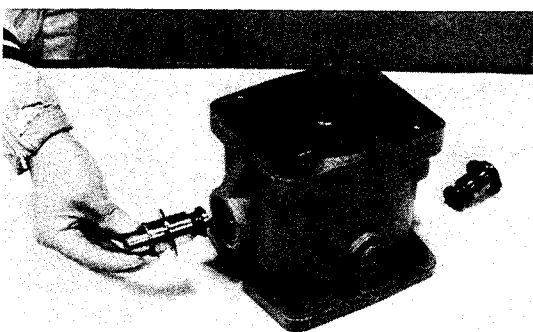
Cylinder Block Kit

SAE22-6

21. Remove the trunnion shafts.
22. Remove the swash plate.
23. Remove the pump shaft with bearing inner race.

Caution:

Carry out Steps 21 to 23 in the same way as Steps 7 to 9 of "Rear Pump Disassembly".



Trunnion Shaft

SAE22-12

24. Remove the bearing inner race from the pump shaft.
SST 09950-20017

Caution:

Disassemble when a defect of the bearing or pump shaft is found as a result of inspection.



Bearing Inner Race

SAE22-15

25. Remove the bearing outer race from pump housing.

Note:

Using a suitable bar of some kind, tap the circumference of the outer race equally on all sides and remove. SST 09700-30200-71 works the best.

Caution:

Remove the bearing only when it is damaged.



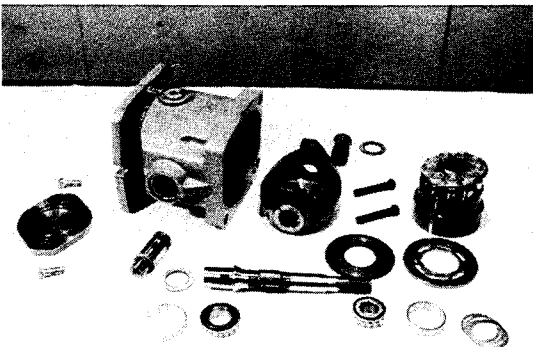
Bearing Outer Race

SAE22-17

26. Remove the oil seal and journal bearing.

Caution:

See item 13 of "Rear Pump Disassembly".

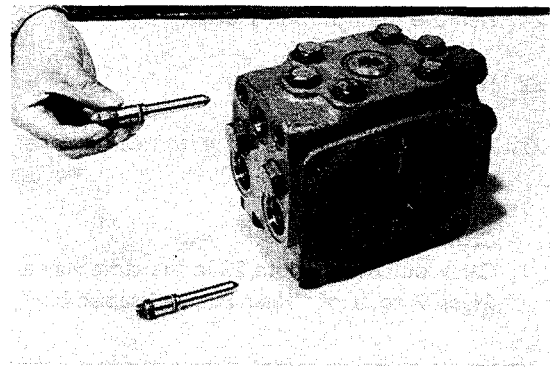


Disassembling the Front Pump

SAE22-22

Port Block Disassembly

27. Remove the straight pins.
28. Remove the bypass valve.



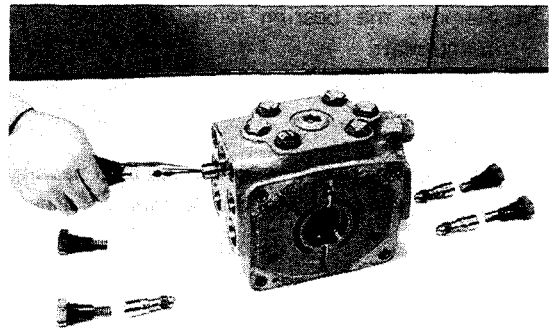
Bypass Valve

SAE22-26

29. Remove the check and high pressure relief valves.
 - (1) Spring seat cap
 - (2) Spring
 - (3) Relief valve assembly

Note:

When removal is difficult, use a snob-nosed pliers to pull it out. There are four relief valves.



Check & Hight Pressure Relief Valve

SAE22-29

30. Remove the charge relief valve.
 - (1) Plug
 - (2) Spring and relief valve

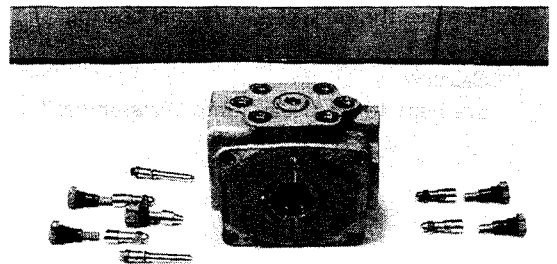
Caution:

Since there are pressure adjustment shims in the plug spring seating portion, jot down their number and thickness as a guide to reassembly.



Charge Relief Valve

SAE22-32



Disassembling the Port Block

SAE22-34

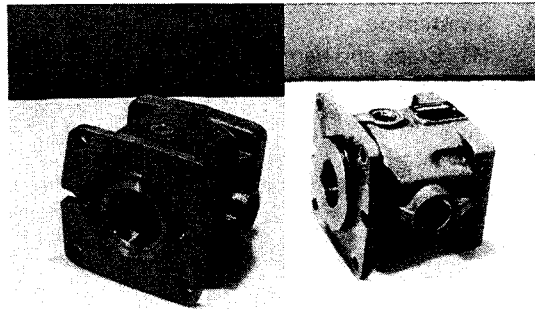
INSPECTION

Important:

- Inspect according to the following procedure as you perform the disassembly. The pump is a precision-machined unit, so be careful in handling the components. Check the defects and carefully determine whether replacement should be of a part, a sub-assembly or an entire assembly.
- Check the rotating parts especially for damage, the limit values and so on in connection with replacement.

Front Pump, Rear Pump Inspection

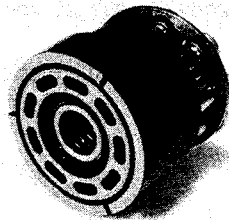
1. Pump housing
 - (1) Crack, damage
 - (2) Damage at the threaded portion



Pump Housing

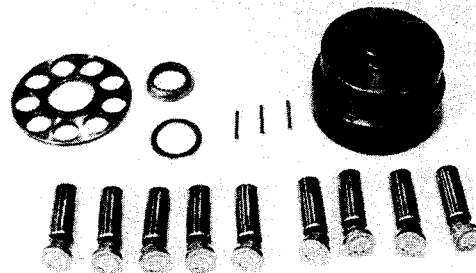
SAE21-6, 22-18

2. Cylinder block kit
 - (1) Cylinder block
 - (a) Wear and damage of each piston sliding part.
 - (b) Wear and damage of sliding surface
 - (c) Wear and damage at spline portion
 - (d) Crack and damage
 - (2) Piston
 - (a) Wear and damage of sliding surface
 - (b) Sliding conditions of piston
 - (c) Clogging of each oil path
 - (3) Retainer and retainer guide
 - (a) Wear and damage of sliding surface
 - (4) Collar and pin
 - (a) Wear and damage
 - (5) Spring
 - (a) Fatigue of spring



Cylinder Block Kit (1)

SAE21-9



Cylinder Block Kit (2)

SAE21-11

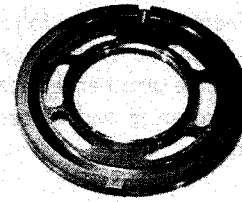
Caution:

Replace with the cylinder block kit if any defect is found on inspection.

3. Valve plate
 - (1) Wear and damage of sliding surface

Caution:

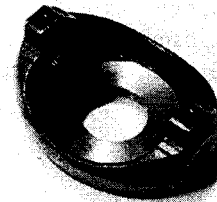
Note that the shape of the valve plate slot is different on the front and rear pumps.



Valve Plate

SAE22-24

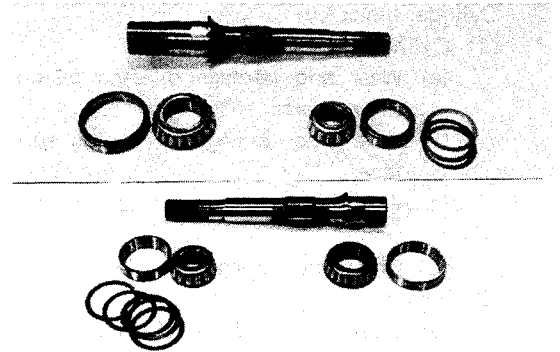
4. Swash plate
 - (1) Crack and damage



Swash Plate

SAE21-29

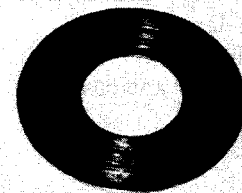
5. Pump shaft and bearing
 - (1) Damage and bending of pump shaft
 - (2) Wear and damage at the spline portion
 - (3) Wear, damage and rotation status of bearing



Pump Shaft, Bearing

SAE21-26, 22-20

6. Thrust plate
 - (1) Wear and damage of sliding face

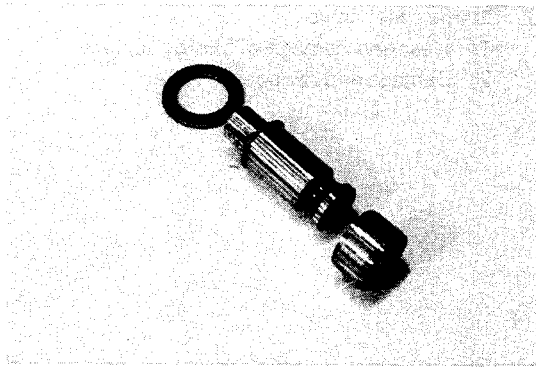


Thrust Plate

SAE21-21

7. Trunnion shaft
 - (1) Wear and damage of trunnion shaft
 - (2) Damage of retaining ring and washer

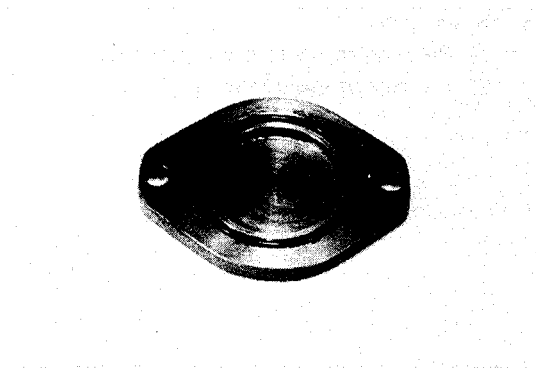
8. Journal bearing
 - (1) Wear and damage



Trunnion Shaft, Journal Bearing

SAE21-28

9. Front pump cover
 - (1) Damage of front pump cover

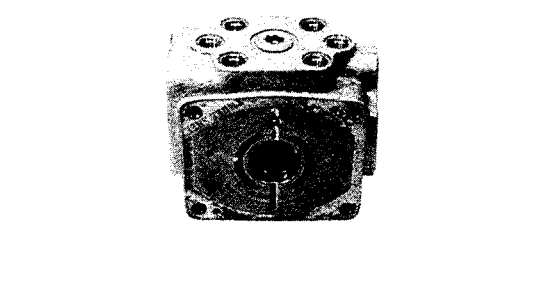


Front Pump Cover

SAE22-21

Port Block Inspection

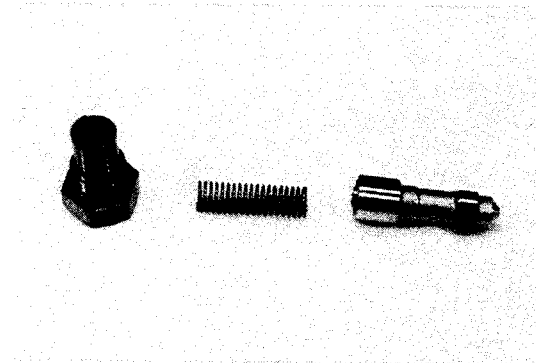
10. Port block
 - (1) Crack and damage
 - (2) Stepped wear of the check and high pressure relief valve seat and charge relief valve seat
 - (3) Damage at the threaded portion
 - (4) Wear and damage of each valve sliding part



Port Block

SAE22-34

11. Check and high pressure relief valve
 - (1) Wear and damage of sliding surface
 - (2) Damage and fatigue of check valve spring
 - (3) Clogging of orifice



Inspecting the Check and High Pressure Relief Valve

SAE22-35

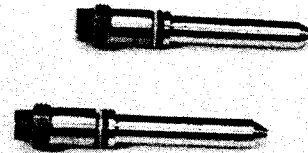
12. Charge relief valve
 - (1) Wear and damage of sliding surface
 - (2) Damage and fatigue of spring



Charge Relief Valve

SAE22-36

13. Bypass valve
 - (1) Bending and deformation of spool
 - (2) Damage of spool seat



Bypass Valve

SAE23-1

14. Coupling
 - (1) Wear and damage at the spline portion



Coupling

SAE23-2

DAMAGE OF HST PUMP ROTATING PARTS & WEAR LIMITS

1. Valve plate

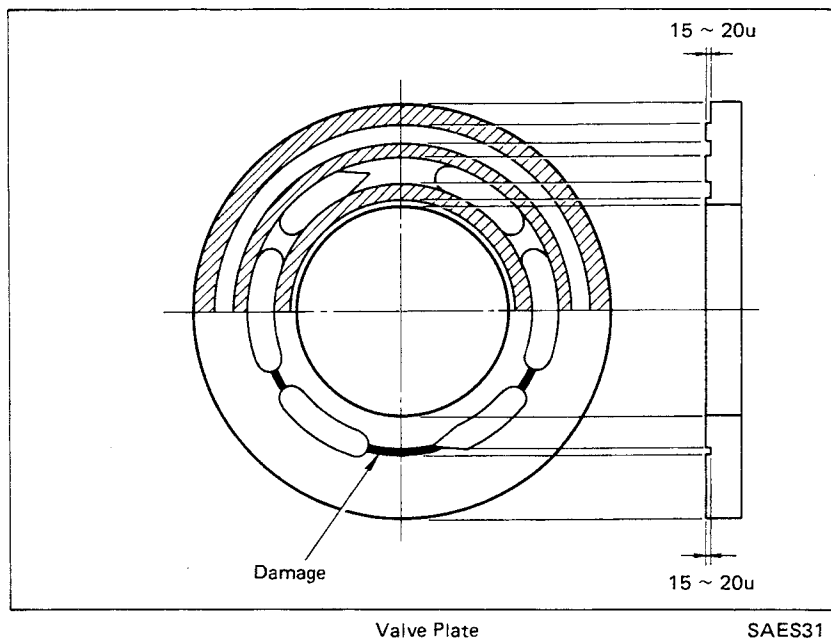
(1) Wear

(a) In the typical case of wear from the ingress of small foreign matter, the slanted line portion wear in the figure below reaches 15 to 20 microns. In this condition, use is impossible, so replacement must be undertaken.

(b) Surface roughness must be less than 0.8 S.

(2) Damage

When the number of damaged spots is small but the area affected is large, as shown in the figure below, the use of the valve plate is impossible whenever damage ranges from 15 to 20 microns (depth or width). Replacement is therefore necessary.

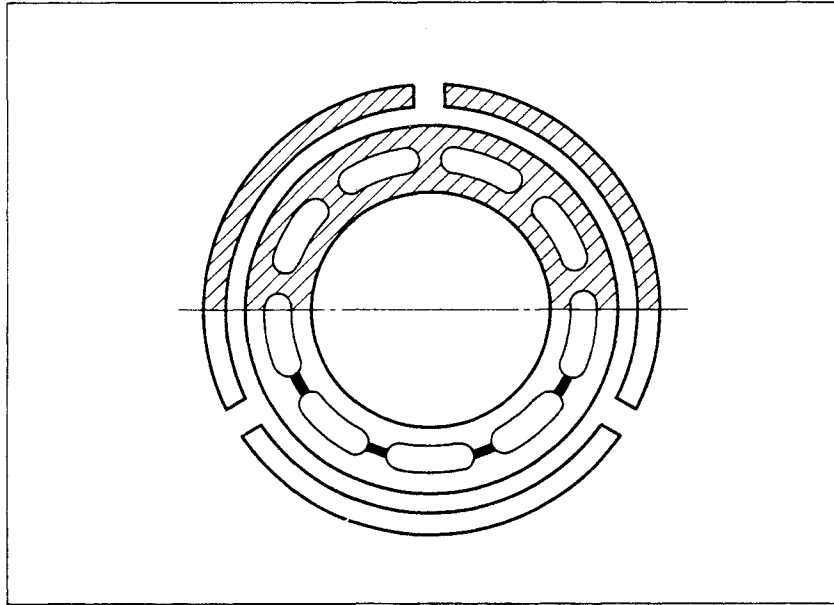


Note:

As a general guideline for the above cases, run your fingernail over the surface. If you notice it catches on anything, a replacement is necessary.

2. Cylinder Block

Heandle wear or damage as for the case of the valve plate.

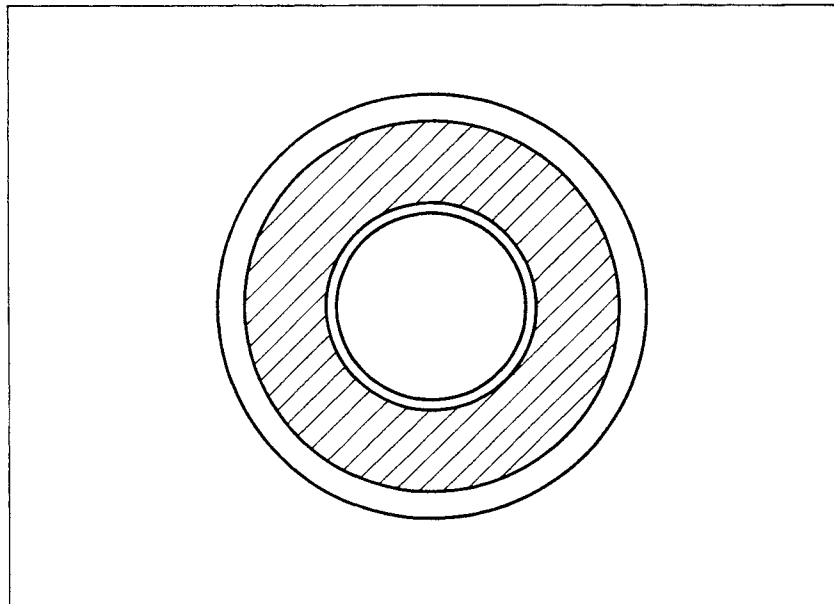


Cylinder Block

SAES32

3. Thrust plate

The thrust plate is unusable and must be replaced if the wear (slanted line portion) exceeds 15 to 20 microns in the figure below. Surface roughness must be within 0.8 S.



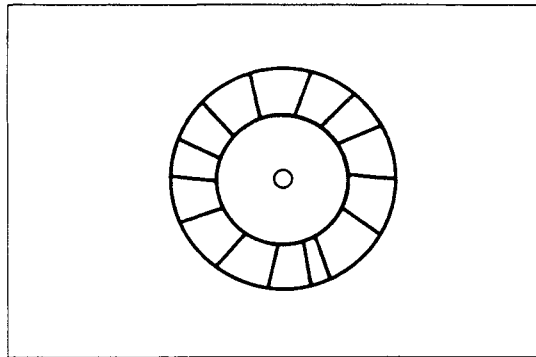
Thrust Plate

SAES33

4. Piston slipper

(1) Damage

The typical case of damage is shown in the figure on the right. Use is impossible once the damage depth or width exceeds the 15 to 20 micron range, so the piston must be replaced. The surface roughness must be within 1.5 S. If the piston slippers are damaged, the cylinder block subassembly must be replaced.

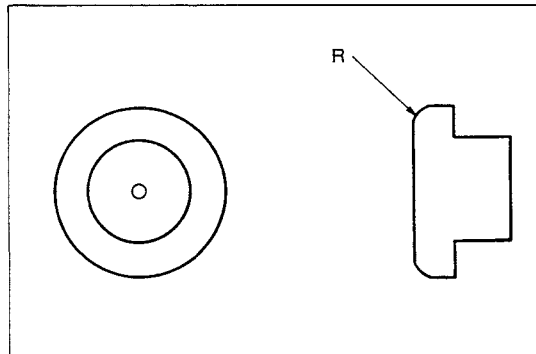


Piston Slipper

SAES34

(2) Wear from cavitation

With wear from cavitation the slipper circumference becomes rounded. If R is attached, use is impossible and the piston must be replaced. In this case, measure the charge pressure and adjust to the normal one as required.



Piston Slipper

SAES35

5. Clearance between piston and cylinder block piston hole

When the clearance between the piston and the cylinder block piston hole exceeds 45 to 50 μ , or if a visual check reveals obvious deformation or wear of the pistons or piston holes, the cylinder block sub-assembly must be changed.

ASSEMBLY

Caution:

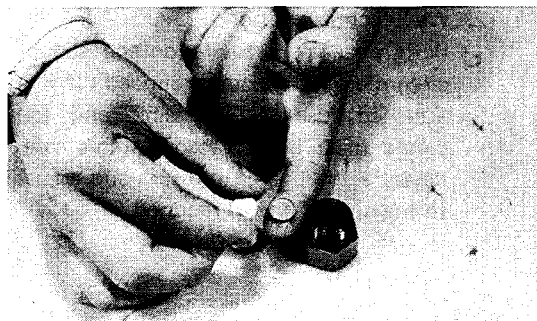
- After washing each part and removing the liquid with compressed air, lubricate with automatic transmission fluid and install.
- Handle parts carefully so as not to damage their sliding surfaces.
- Replace all seals, such as oil seals, "O" rings, and gaskets with new ones unless they are undamaged and have only been used a short time.
- When replacing a pump housing pump shaft, port block, or shaft bearing, the axial play in the pump shaft must be adjusted. However, since some of the assembly steps are different, see the section on the adjustment of axial play in the pump shaft.
- Carefully operate as entrance of dirt or foreign matters in the HST system will damage the system in a short period.

Port Block Assembly

1. Install the charge relief valve.
 - (1) Install the shims and O-ring to the plug
 - (2) Charge relief valve
 - (3) Spring
 - (4) Plug (with shim and O-ring)

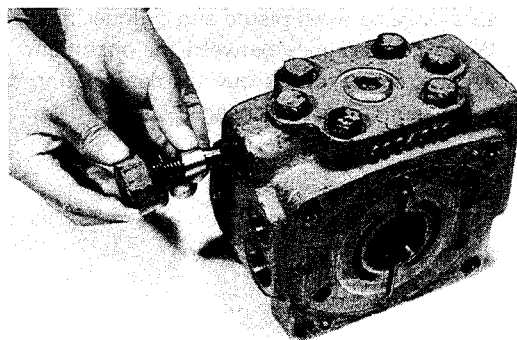
Caution:

If the disassembled parts are being reassembled, the same number of shims with the same thickness must be used. If the relief valve, spring or plug have been replaced, the shims will change and it will be necessary to adjust the relief valve pressure.



Charge Relief Valve (1)

SAE51-18



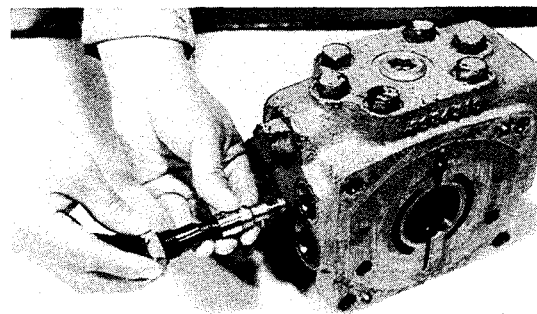
Charge Relief Valve (2)

SAE23-4

2. Install the check and high pressure relief valve.
 - (1) Check and high pressure relief valve
 - (2) Spring
 - (3) Spring seat cap with O-ring

Caution:

Always coat the relief valve with hydraulic fluid before insertion and, after insertion, check to see that it moves smoothly.

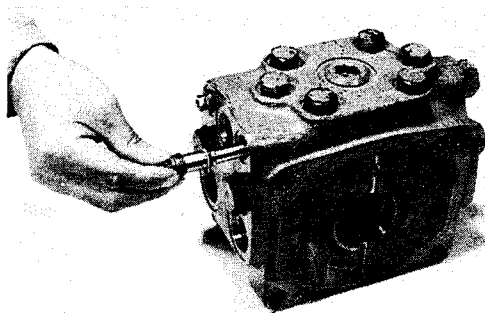


Check and High Pressure Relief Valve

SAE23-5

3. Install the bypass valve

4. Install the straight pins



Bypass Valve

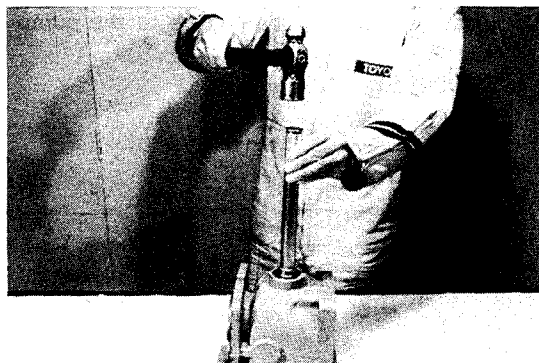
SAE23-6

Rear Pump Assembly

5. Install the journal bearings
SST 09620-30010

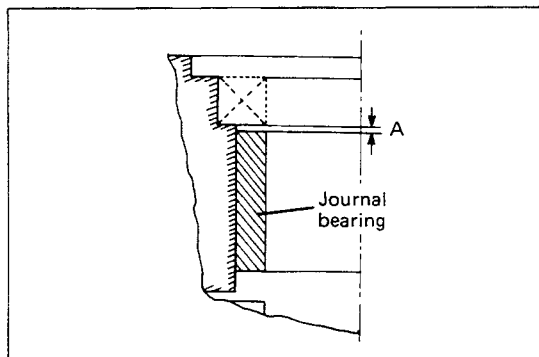
Important:

Install the Journal bearing so that dimension "A", shown in the diagram, equals 0.25 mm (0.098").



Journal Bearing (1)

SAE24-6



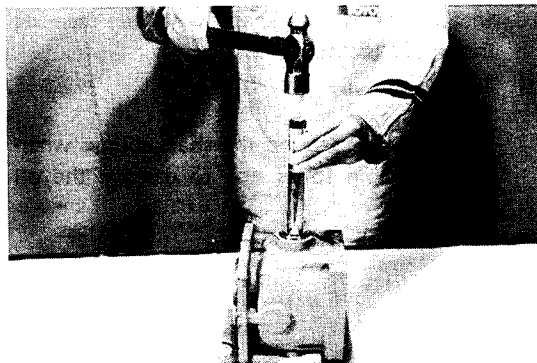
Journal Bearing (2)

SAES37

6. Install the oil seals
SST 09608-12010

Caution:

- Coat the inner surface of the lip seal with MP grease.
- Be careful not to confuse the lip seal direction.



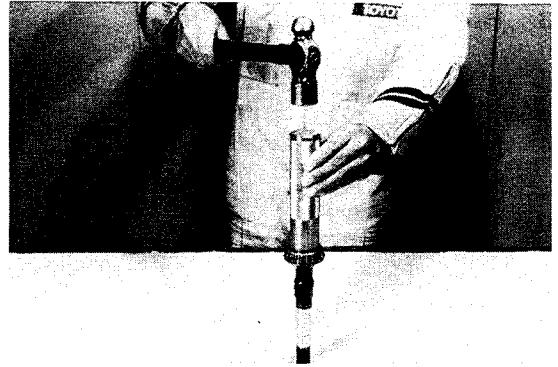
Oil Seal

SAE24-7

7. Install the bearing inner race on the pump shaft.
SST 09608-30012

Caution:

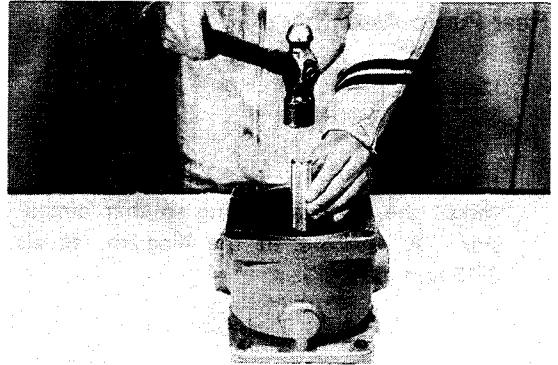
Be careful not to damage the portion of the pump shaft that might contact the seal lip.



Bearing Inner Race

SAE24-8

8. Install the bearing outer race to the pump housing.
SST 09550-10012



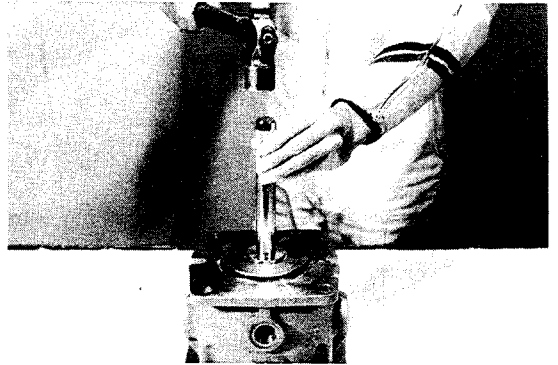
Bearing Outer Race

SAE24-10

9. Install the oil seal
 - (1) Oil seal
SST 09608-12010
 - (2) Retaining ring

Caution:

Apply a thin coat MP grease to the oil seal inner surface lip area.



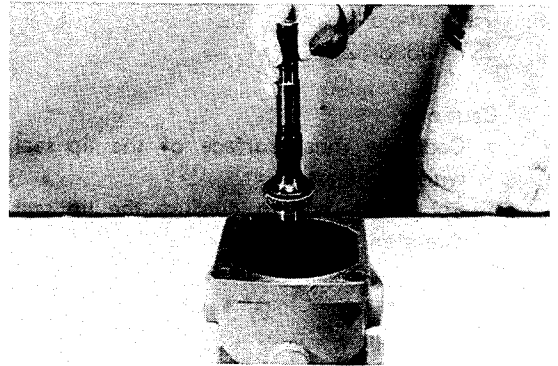
Oil Seal

SAE24-12

10. Install the pump shaft with the bearing inner race the pump housing.

Caution:

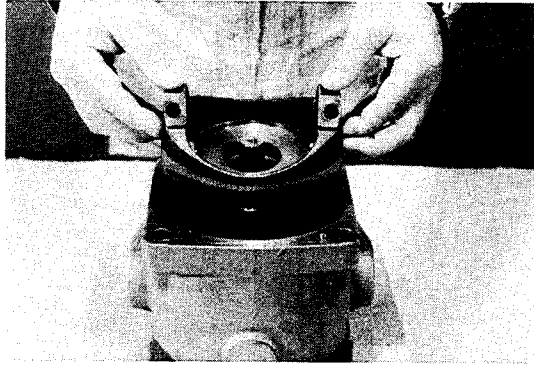
- o Wind tape around the shaft splines when assembling so as not to damage the oil seal lip.



Pump Shaft

SAE24-14

11. Install the swash plate inside the pump housing.



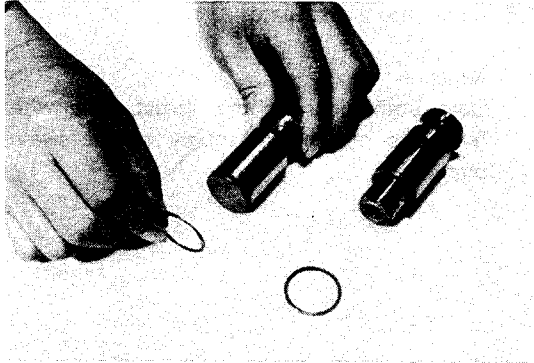
Swash Plate

SAE24-15

12. Install the trunnion shafts.
(1) Fit the retaining ring and washer on the trunnion shaft.

Important:

Square the edge of the key groove with a whetstone at this time and coat everything lightly with MP grease.



Trunnion Shafts (1)

SAE24-4

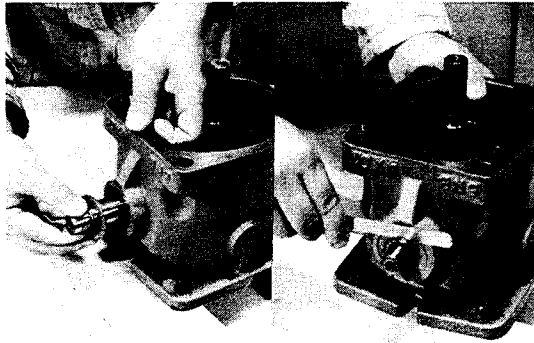
- (2) Insert the trunnion shafts from either side.

Note:

To make the swash plate entry easier, the swash plate may be lifted in the process. In doing so, align the key slots on the swash plate and trunnion shafts.

Caution:

Insert carefully so as not to damage the oil seal lip. Do not use a hammer to insert.



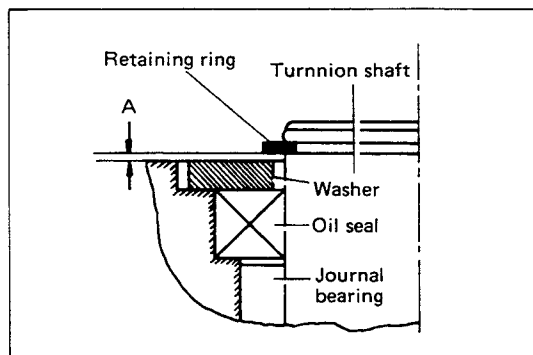
Trunnion Shafts (2)

SAE24-16,19

- (3) Insert the key from the inside of the swash plate.
(4) Adjust the position of the trunnion shafts so that the space ("A") between the retaining ring and the washer is 0.25 mm (0.0098").

Note:

Set the distance between the retaining ring and the washer by inserting a thickness gauge between them and pushing in the trunnion shafts.



Trunnion Shafts (3)

SAES38

- (5) Set bolts
 $T = 6.22 \sim 6.91 \text{ kg-m}$
 (44.9 ~ 49.9 ft-lbs)

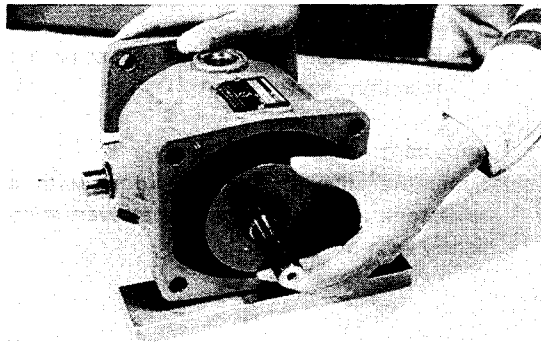


Securing the Set Bolts

SAE24-21

13. Install the thrust plate.

Note:
 Coat both sides of the thrust plate with hydraulic oil and fit snugly to the swash plate.

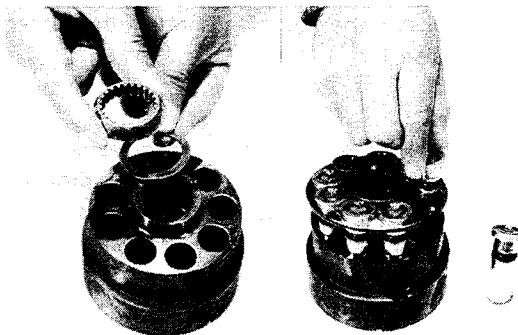


The Thrust Plate

SAE24-23

14. Assemble the cylinder block kit.

- (1) Pin
- (2) Collar
- (3) Retainer guide
- (4) Retainer
- (5) Piston



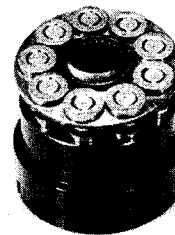
Assembling the Cylinder Block Kit

SAE23-17, 18

15. Install the cylinder block kit.

- (1) Coat the slipper upper surface with hydraulic fluid.

Caution:
 Before inserting the cylinder block kit, check to see that the slipper has not floated above the retainer by confirming that the retainer guide, collar and pins (3) are in proper place.



Installing the Cylinder Block Kit (1)

SAE21-8

- (2) Place the housing so that the axial direction is horizontal. Grasp the drive shaft end and slightly tilt the housing flange side upward.

Grasp the cylinder block kit with your other hand and insert it tilted downwards through the drive shaft. When inserting insure that the shaft spline and the cylinder block kit spline are aligned.

Caution:

Insert gently so that the retainer guide, collar, pin, etc. stay in place.

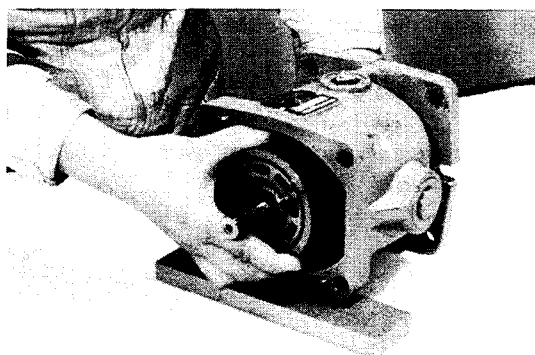
16. Install the bearing inner race.
SST 09620-30010

Note:

Position the pump housing so that the lower edge of the pump shaft comes into contact with the workbench.

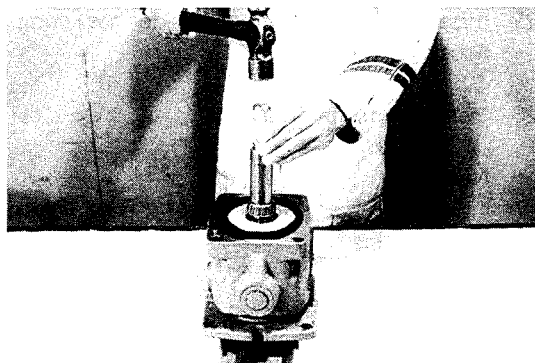
Caution:

- Insure adhesion completely up to the drive shaft step.
- Be very careful not to damage the cylinder block surface.
- The resin plate (thickness: approx. 1 mm (0.004")) may be placed on the finished surface of the cylinder block.



Installing the Cylinder Block Kit (2)

SAE24-24



Bearing Inner Race

SAE24-33

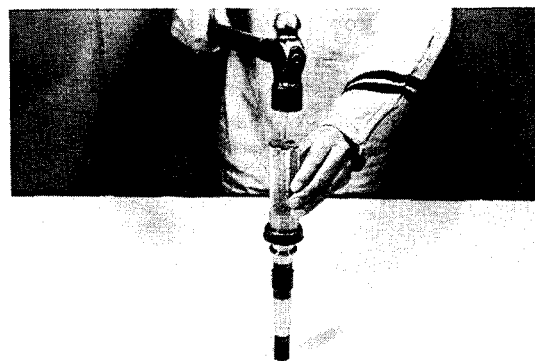
Front Pump Assembly

17. Install the journal bearings.
18. Install the oil seals.

Note:

Carry out Steps 17 and 18 in the same way as Steps 5 and 6 "Rear Pump Installation".

19. Install the bearing inner race on the pump shaft.
SST 09381-41950-71

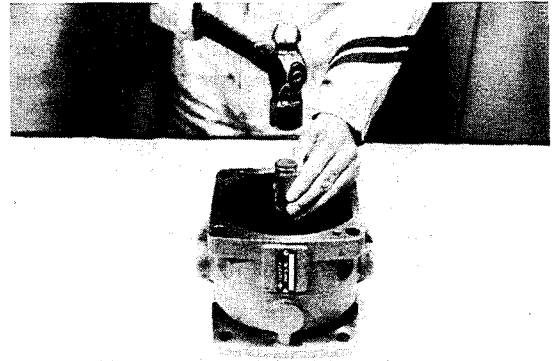


Bearing Inner Race

SAE23-7

20. Install the bearing outer race to the pump housing.
SST 09608-20012

21. Install the pump shaft with the bearing inner race.



Bearing Outer Race

SAE23-8

22. Install the swash plate inside the pump housing.

23. Install the trunnion shafts.

Note:

- Install as in Step 12 of "Rear Pump Installation".

24. Install the thrust plate.

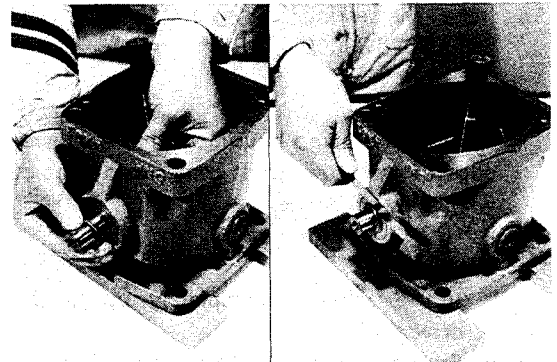
25. Assemble the cylinder block kit.

26. Install the cylinder block kit.

27. Install the bearing inner race.

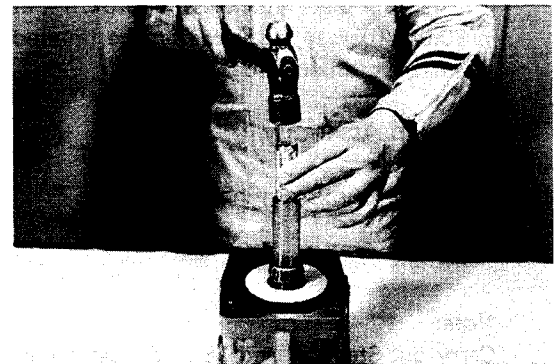
Caution:

Carry out Steps 24 to 27 in the same way as Steps 13 to 16 of "Rear Pump Installation".



Trunnion Shaft

SAE23-14, 15



Bearing Inner Race

SAE23-28

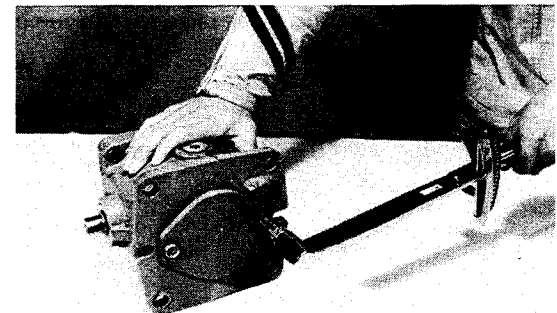
28. Install the front pump cover

(1) Cover

(2) Set bolts

T = 2.67 ~ 3.45 kg-m

(19.3 ~ 24.9 ft-lbs)



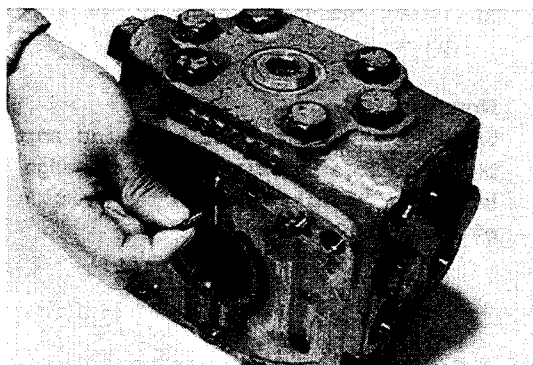
Front Pump Cover

SAE23-29

HST Pump Assembly

29. Install the front pump to the port block.

- (1) Install the straight pin



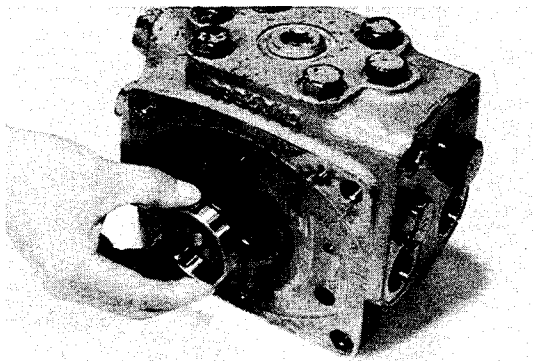
Straight Pin

SAE23-30

- (2) Install the shims and bearing outer race to the port block.

Caution:

- Assemble with an equal number of shims and with the same thickness as when disassembled.
- Normally, the bearing outer race can be inserted by hand. However, if it is difficult, lightly tap it with a soft hammer.



Bearing Outer Race

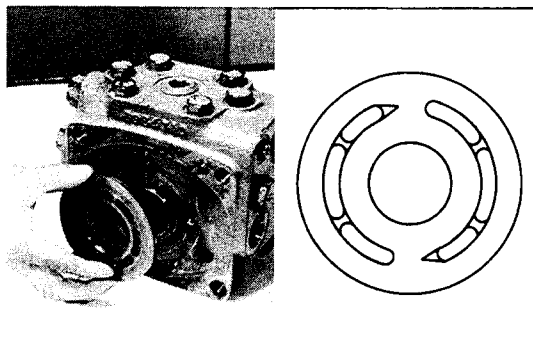
SAE23-31

- (3) Install the valve plate.

Note:

Install the valve plate after first checking the shape of the slot to make sure that it is not the rear pump valve plate.

- (4) Install the gasket



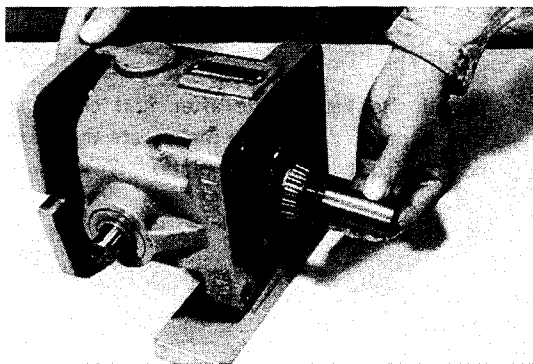
The Valve Plate

SAE23-33, SAES39

- (5) Install the coupling to the front pump shaft

Caution:

Insure that there is a retaining ring in the inner center coupling.



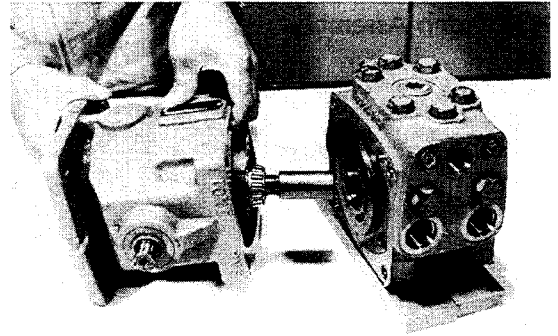
Coupling

SAE23-35

- (6) Install the front pump to the port block

Note:

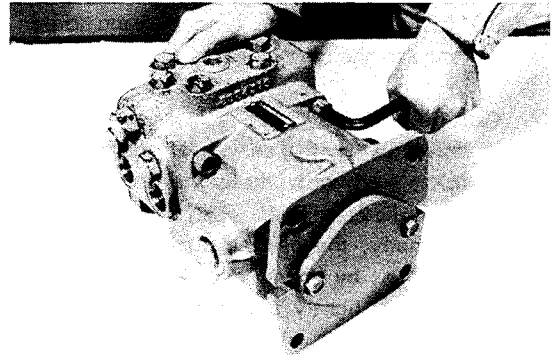
When installing the front pump and port block, do so after first checking the aligning marks to make sure that the direction of installation is correct.



Front Pump and Port Block

SAE23-36

- (7) Tighten the socket head screws
 $T = 9.0 \sim 10.5 \text{ kg-m}$
 $(65 \sim 75.8 \text{ ft-lbs})$



Tightening the Socket Head Screws

SAE24-2

30. Install the rear pump to the port block.
 - (1) Install the shims and bearing outer race to the port block

Caution:

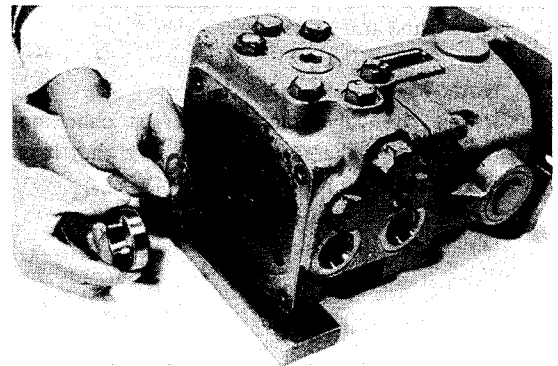
- Assemble with an equal number of shims and with the same thickness as when disassembled.
- Normally, the bearing outer race can be inserted by hand. However if it is difficult, lightly tap it with a soft hammer.

- (2) Install the straight pin
- (3) Install the valve plate

Note:

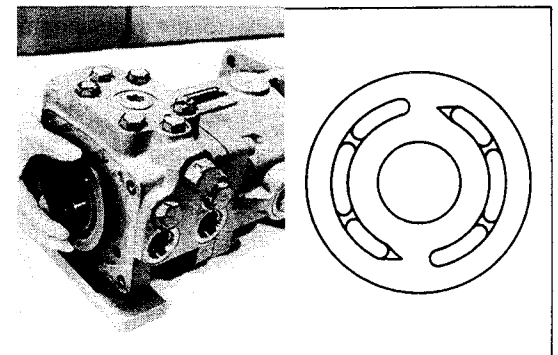
Install the valve plate after first checking the shape of the slot to make sure that it is not the front pump valve plate.

- (4) Install the gasket



Bearing Outer Race

SAE25-2



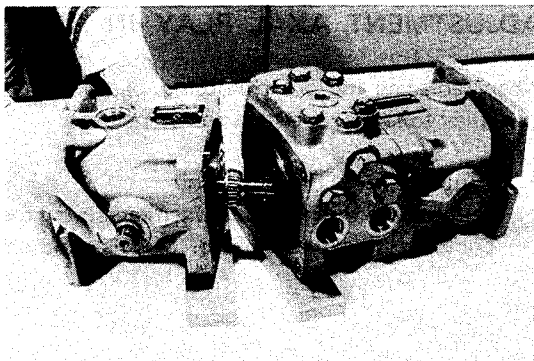
The Valve Plate

SAE25-3, SAES40

- (5) Install the rear pump to the port block

Note:

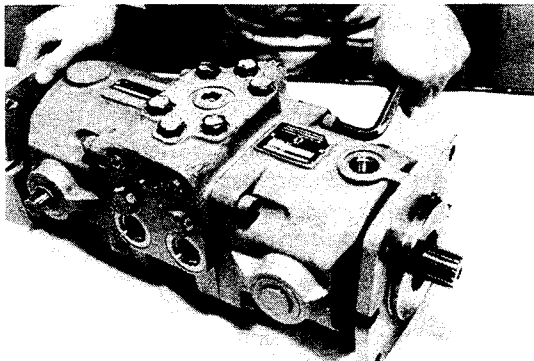
When installing the rear pump and port block, do so after first checking the aligning marks to make sure that the direction of installation is correct.



Rear Pump and Port Block

SAE25-7

- (6) Tighten the socket head screws
T = 9.0 ~ 10.5 kg-m
(65.0 ~ 75.8 ft-lbs)



Tightening the Socket Head Screws

SAE25-10

ADJUSTMENT AXIAL PLAY IN PUMP SHAFT

When replacing the pump housing, pump shaft, port block, or shaft bearings with new ones, adjust the axial play following the steps shown below.

Caution:

To obtain a correct value when measuring the axial play, measure it with the cylinder block kit in the pump housing disassembled. (Also leave the thrust plate and the valve plate disassembled.)

Adjusting Axial Play in Front Pump Shaft

1. Install front pump.
 - (1) Install as explained in Steps 17 to 23 of "Front Pump Installation".
 - (2) Installing bearing inner race. SST 09620-30010

Caution:

Refer to the Note and the Caution of Assembly Step 16

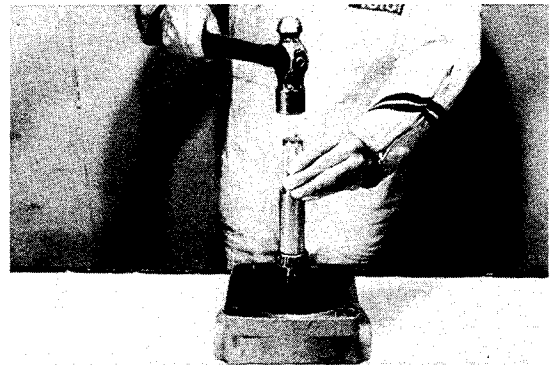
2. Install the front pump to the port block.
 - (1) Install the shims and bearing outer race to the port block.

Caution:

- Assemble with an equal number of shims and with the same thickness as when disassembled.
- Normally, the bearing outer race can be inserted by hand. However, if it is difficult, lightly tap it with a soft hammer.

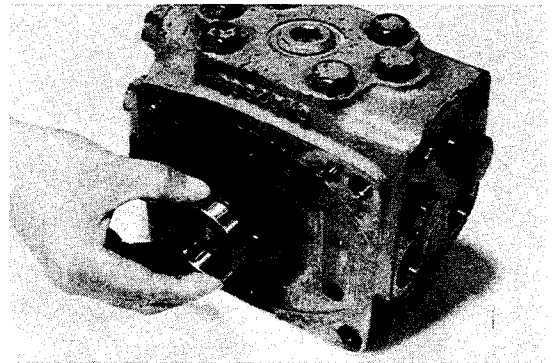
- (2) Install the gasket
- (3) Install the front pump to the port block
- (4) Tighten the socket head screws

$T = 9.0 \sim 10.5 \text{ kg-m}$
(65.0 ~ 75.8 ft-lbs)



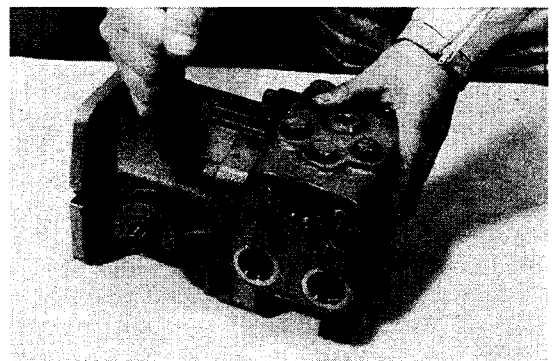
Bearing Inner Race

SAE24-11



Bearing Outer Race

SAE23-31



Tightening the Socket Head Screws

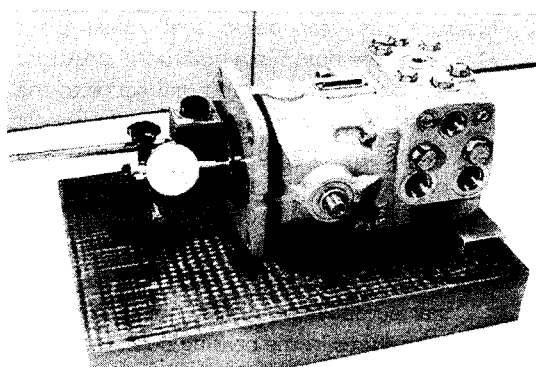
SAE21-32

3. Measure the front pump shaft axial play.
 - (1) Place the pump in a horizontal position.
 - (2) Set a magnet base and dial gauge to the pump housing flanges surface.
 - (3) Push the pump shaft forward and backward and measure the play.
Standard play: 0.06 – 0.25 mm
(0.0024 – 0.0098 in)
 - (4) If the play is not within the limits stated above, re-disassemble and adjust with shims in the bearing outer race side.
(Reference)

If play is insufficient:
decrease number of shims.

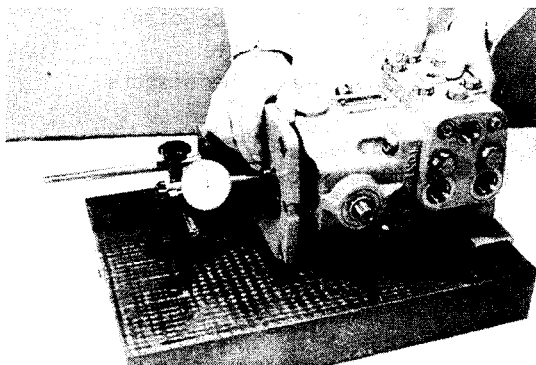
If play is excessive:
increase number of shims.

4. After adjusting, install correctly, following the installation steps.



Setting the Dial Gauge

SAE24-35



Measuring the Axial Play

SAE24-36

Adjusting Axial Play in Rear Pump Shaft

1. Install rear pump.
 - (1) Install as explained in Steps 5 to 12 of "Rear Pump Installation".
 - (2) Install bearing inner race.
SST 09620-30010

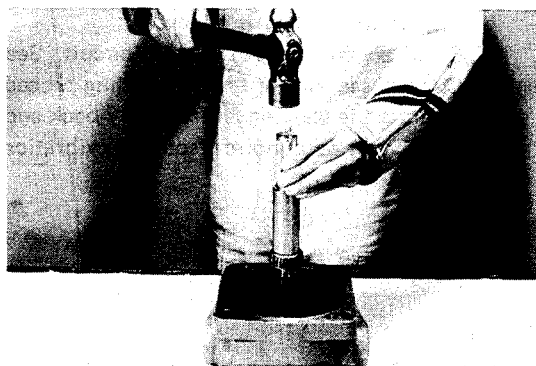
Caution:

Refer to the Note and Caution of Assembly Step 16.

2. Install the rear pump on the port block.

Note:

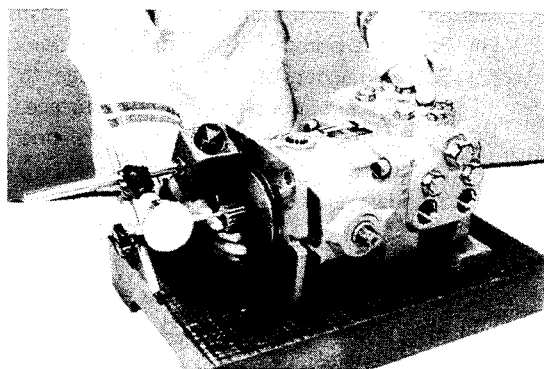
Assemble as explained in Step 2 of "Adjusting Axial Play in Front Pump Shaft".



Installing the Bearing Inner Race

SAE24-11

3. Measure the rear pump shaft axial play.
 - (1) Place the pump in a horizontal position.
 - (2) Set a magnet base and dial gauge to the pump housing flange surface.
 - (3) Push the pump shaft forward and backward and measure the play.
Standard play: 0.06 – 0.025 mm
(0.0024 – 0.0098 in)
 - (4) If the play is not within the limits started above, re-disassemble and adjust with shims in the bearing outer race side.
(Reference)
 - If play is insufficient:
decrease number of shims.
 - If play is excessive:
increase number of shims.
4. After adjusting, install correctly, following the installation steps.



Measuring the Axial Play

SAE25-11

INSTALLATION

Installation is the reverse of the removal procedure.

Caution:

- Coat and seal (about 10 cc) molybdenum disulfide grease at the spline portion and in grease seal cap of the HST pump and damper when installing the HST pump to the engine.
- Connect the piping after charging hydraulic oil through the drain port of the HST pump. (0.9 ~ 1.2 ℓ) (0.24 ~ 0.32 US gal)
- Start the engine with the steering lever at the neutral position, and warm up the HST pump at the idle speed.
- Make sure that the steering lever neutral position is correct. See "STEERING-Steering Neutral Adjustment" section for the adjusting method.
- Inspect the hydraulic oil level.
- Bleed air from the hydraulic circuit. See "HYDRAULIC SYSTEM-Bleeding Air from Hydraulic Circuit" section for the air bleeding procedure.
- Operate the steering lever slightly back and forth several times.
Check that no abnormal sound or vibration arises during this operation.

HST MOTOR ASSY (2SGK6,2SGK6,7)

REMOVAL

1. Remove the under covers.
 - (1) Front under cover
 - (2) Rear under cover



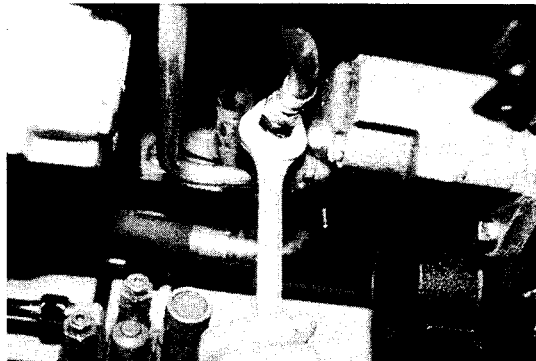
Under Cover

SAE6-31

2. Disconnect the piping.
 - (1) High pressure hose (width across flat: 27 mm)
 - (2) Low pressure hose (width across flat: 22 mm)

Caution:

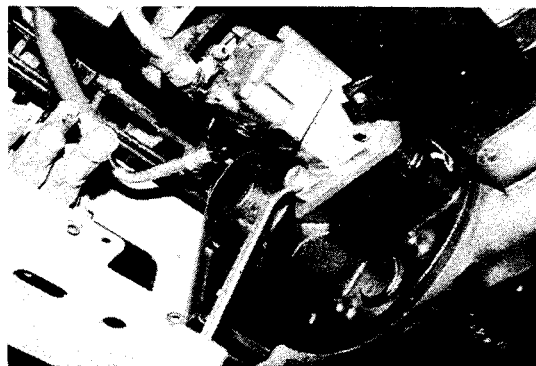
Fit nylon caps or other covers to the hoses and elbows to prevent entrance of foreign matters.



Disconnecting the Piping

SAE37-10

3. Remove the HST motor.
 - (1) Set bolts

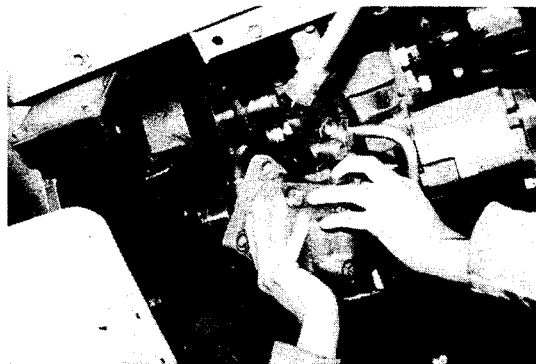


Set Bolt

SAE37-13

- (2) HST motor

4. Remove the fitting from the HST motor.



HST Motor

SAE37-20

DISASSEMBLY

Caution:

- Select a clean place and clean table for HST motor disassembly.
- Clean the motor assembly before starting disassembly.
- Carefully handle disassembled parts to prevent scratching or denting.
- Drain the hydraulic oil from the HST motor.

1. Remove the valve housing.
 - (1) Hold the motor at its mounting flange firmly with a vise.
 - (2) Set bolt
 - (3) Valve housing

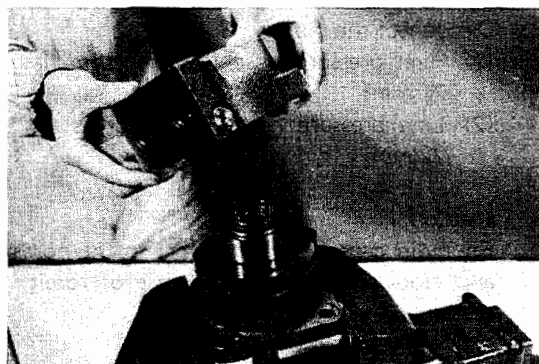
Caution:

Lift the valve housing straight upward. Careful lifting will cause the springs, pins and balance plate to come off and remain on the valve.

- (4) O-rings (one large ring and one small ring)

2. Remove the springs and pins.
 - (1) Springs (4 pcs.)
 - (2) Pins (4 pcs.)

3. Remove the balance plate with seal.



Valve Housing

SAE37-24



Springs and Pins

SAE37-25



Balance Plate

SAE37-26

4. Remove the inner and outer face seals from the balance plate.



Face Seals

SAE37-28

5. Remove the valve.



Valve

SAE37-30

6. Remove the valve plate.
(1) Valve plate
(2) O-rings (one large and one small ring)



Valve Plate

SAE37-32

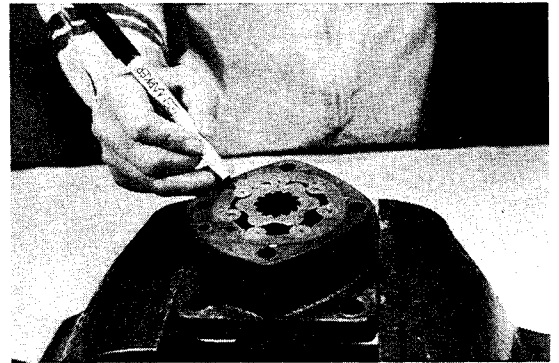
7. Remove the valve drive.



Valve Drive

SAE37-33

8. Remove the gyroller set.
 - (1) Use a marking pen and draw match marks to indicate relative positions of the housing, roller and star of the gyroller set.



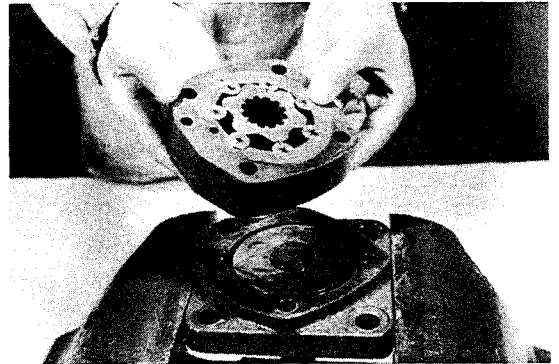
Match Marks

SAE37-34

- (2) Gyroller set

Caution:
Carefully prevent rollers from coming off from the gyroller set.

- (3) O-rings (one large ring and one small ring)



Gyroller Set

SAE37-36

9. Remove the drive.



Drive

SAE38-1

10. Remove the o-ring from the mounting flange.
 - (1) Remove the mounting flange from the vise.
 - (2) O-ring

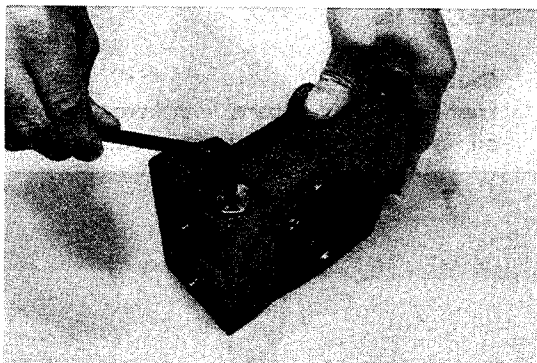


O-ring

SAE38-3

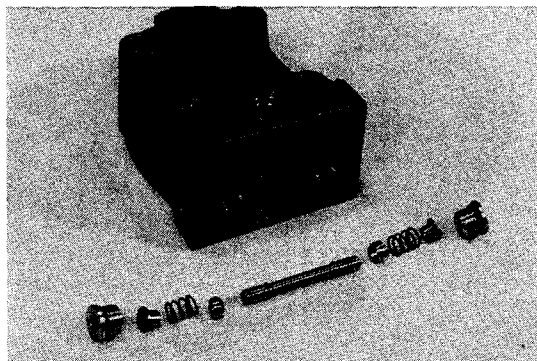
11. Remove the shuttle valve from the valve housing.

- (1) Plugs (2 pcs.)
- (2) Sleeves (2 pcs.)
- (3) Springs (2 pcs.)
- (4) Poppets (2 pcs.)
- (5) Piston



Shuttle Valve (1)

SAE38-26



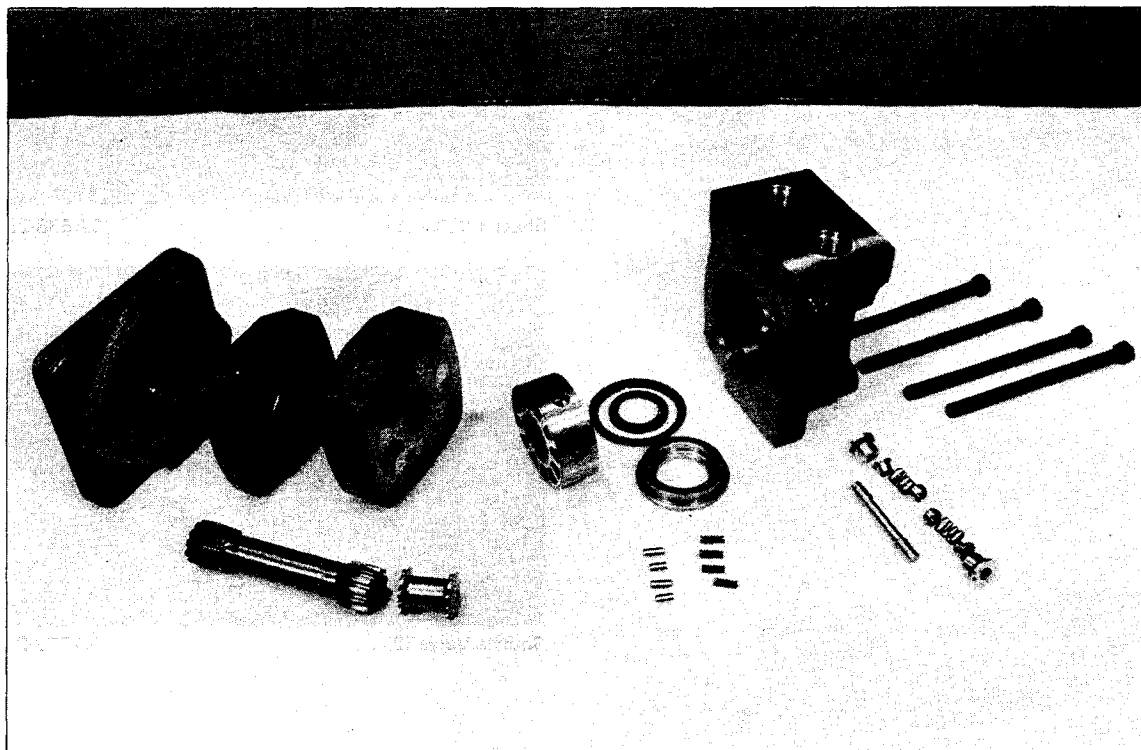
Shuttle Valve (2)

SAE38-27

INSPECTION

Caution:

Wash disassembled parts with kerosene or non-petrochemical solvent to remove metal particles and oil. Wash the gyroller set without disassembling it.



HST Motor

SAE39-5

1. Each fitting or sliding surface
 - (1) Correct any burr or dent with an oil stone.
2. Wear, damage and crack of each part

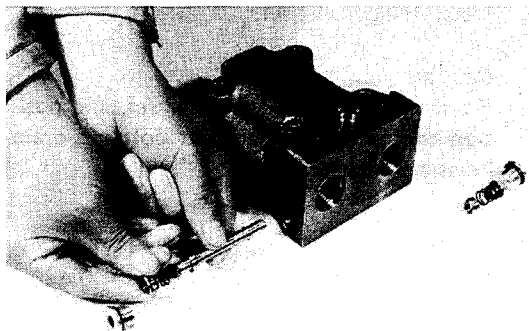
ASSEMBLY

Caution:

- After washing each part and blowing off the washing liquid with compressed air, coat hydraulic oil (automatic transmission fluid) and assemble.
- Handle parts carefully so as not to damage their sliding contact surfaces.
- Replace all seals such as oil seals, o-rings and gaskets with new ones unless they are free from damage and have only been used for a short time.

1. Install the shuttle valve to the valve housing.

- (1) Piston
 - (2) Poppets (2 pcs.)
 - (3) Springs (2 pcs.)
 - (4) Sleeves (2 pcs.)
 - (5) Plugs (2 pcs.)
- T = 2.1 ~ 2.5 kg-m
(15.2 ~ 18.1 ft-lbs)



Shuttle Valve

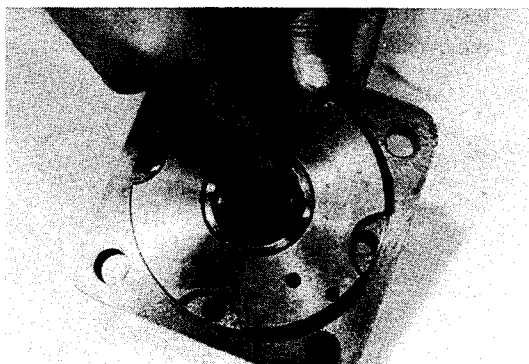
SAE39-6

2. Install the o-ring to the mounting flange.

Caution:

Coat grease on the o-ring.

3. Hold the mounting flange firmly in a vise.



O-ring

SAE39-11

4. Install the o-rings to the mounting flange.

- (1) O-ring large
- (2) O-ring small

Caution:

Coat grease on the o-ring.



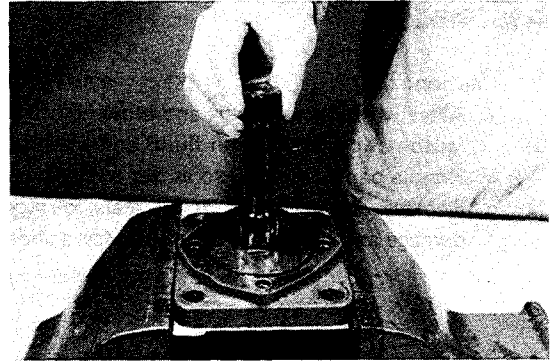
O-ring

SAE39-18

5. Install the drive.

Caution:

Face the longer spline of the drive downward, when installing the drive.



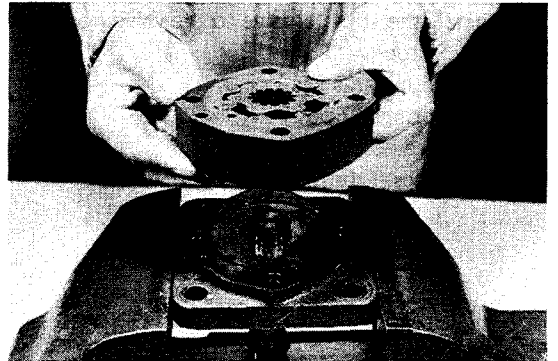
Drive

SAE39-21

6. Install the gyroller set.

Caution:

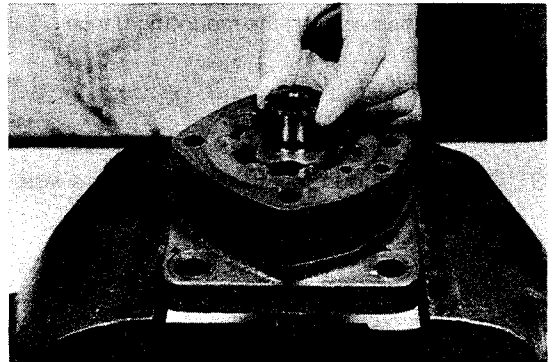
Fit the drive to the gryoller set, and position the gyroller set so that bolt and drain holes are aligned.



Gyroller Set

SAE39-23

7. Insert the vlave drive to the inside spline of the gyroller set.



Valve Drive

SAE39-27

8. When the valve drive spline tooth align with the external tooth of the gyroller star, mark the face of the valve drive tooth with a marking pen.

Caution

See the figure in 11 on the next page.



Marking on Valve Drive

SAE39-30

9. Install the o-ring to the valve plate.
 (1) O-ring large
 (2) O-ring small

Caution:
 Coat grease on o-rings.

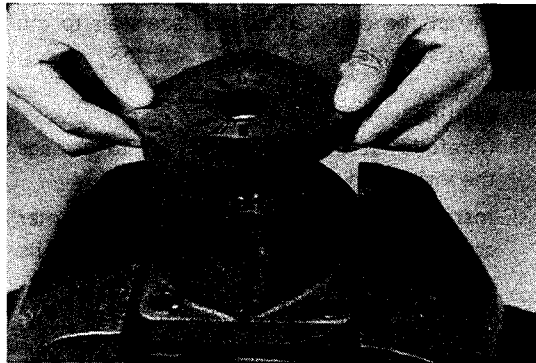


O-ring

SAE39-29

10. Install the valve plate.

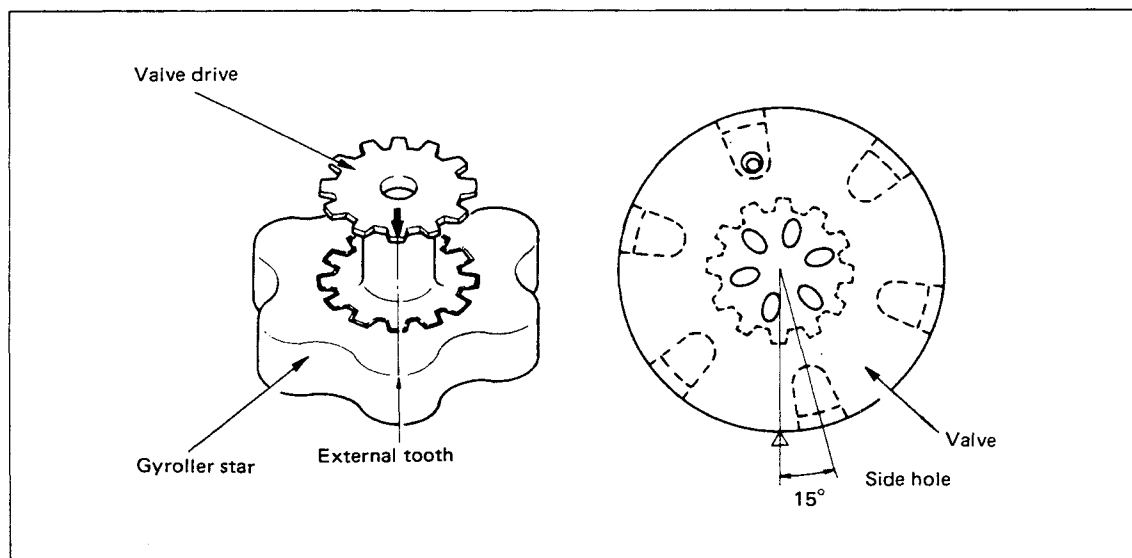
Caution:
 Align the bolt and drain holes.



Valve Plate

SAE39-31

11. Install the valve.



Gyroller Star and Valve Timing

SAES41

Caution:
 Fit the valve to the valve drive spline so that the valve side hole is deviated from the marked spline tooth of the valve drive by 15° to the right (by rotating the valve 15° counterclockwise) as illustrated above.

Caution:

- Set the installed valve to the center of the motor.
- Carefully install and set it because this step is important in determining the motor rotating direction.



Valve

SAE39-34

12. Install the outer and inner face seals to the balance plate.

Caution:

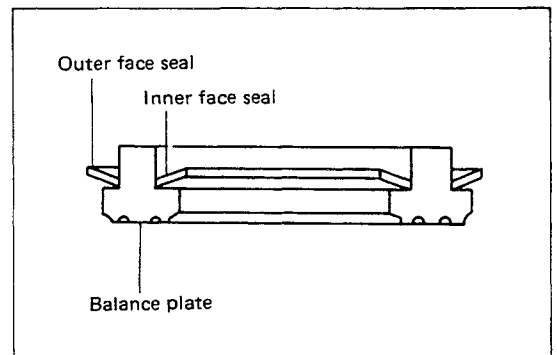
Carefully fit the seals so as not to damage the inside and outside surfaces.

Install the inner face seal to make its center convex and the outer face seal to make its center concave.



Outer Face Seal

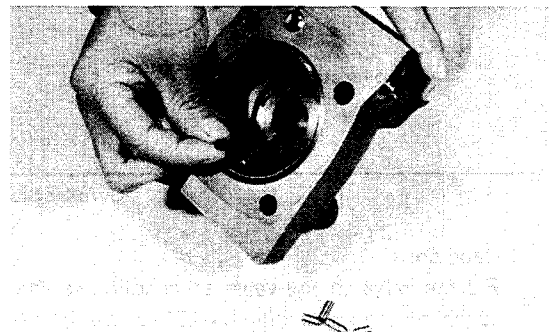
SAE38-36



Face Seal Installing Direction

SAE542

13. Install the springs and pins to the valve housing.
 - (1) Springs (4 pcs.)
 - (2) Pins (4 pcs.)



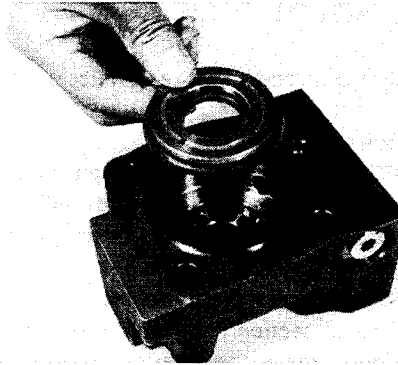
Installing the Spring and Pins

SAE38-32

14. Install the balance plate.

Caution:

Align the notched portion of the balance plate assembled in step 12 to the pin, and install it to the valve housing.



Balancing Plate

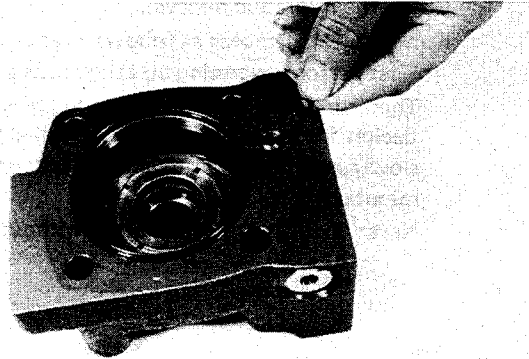
SAE39-7

15. Install the o-rings to the valve housing.

- (1) O-ring large
- (2) O-ring small

Caution:

Coat grease on the o-rings.



O-rings

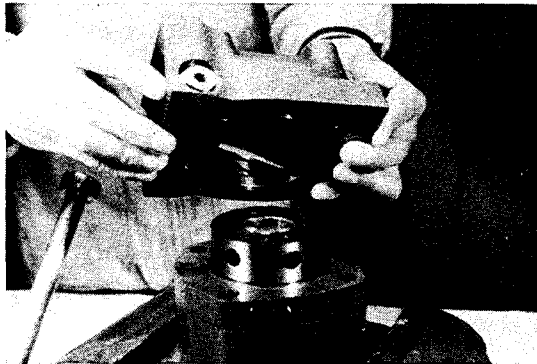
SAE39-10

16. Install the valve housing.

- (1) Valve housing

Caution:

While inserting a brass or bamboo spatula from the port hole to hold the balancing plate to prevent the plate from falling, place the valve housing on the valve and align bolt holes and drain holes.



Valve Housing

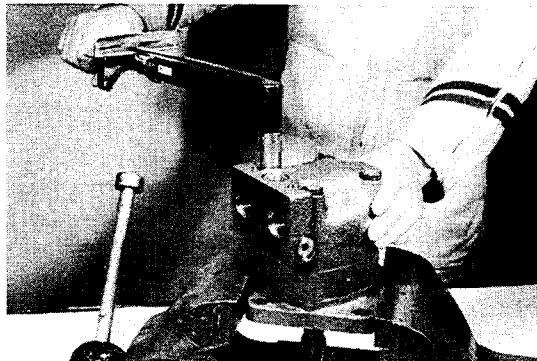
SAE40-2

- (2) Set bolts

$T = 5.0 \sim 5.5 \text{ kg-m}$
(36.1 ~ 39.7 ft-lbs)

Caution:

- Coat thread tightener on the threaded portion of the set bolts before installation.
- Carefully prevent o-rings from being trapped between parts.
- Stand the reassembled motor for 1 to 2 hours to wait for hardening of the thread tightener.



Tightening the Set Bolts

SAE40-6

INSTALLATION

The installation procedure is the reverse of the removal procedure.

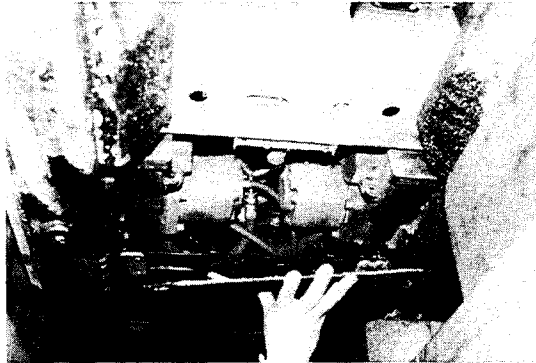
Caution:

- HST motor set bolt tightening torque $T = 6.5 \sim 9.0$ kg-m (46.9 ~ 65.0 ft-lbs)
- After filling hydraulic oil in the HST motor, connect the piping.
- Start the engine with the steering control lever at the neutral position. Warm up the HST pump at the idle speed.
- Bleed air from the hydraulic circuit. See "HYDRAULIC SYSTEM—Bleeding Air from Hydraulic Circuit" section for the air bleeding procedure.
- Slightly move the steering control lever back and forth several times and check that there is no abnormal sound or vibration.
- Check the hydraulic oil level.
- Run in the HST motor as follows after replacing it with a new one or after repairing it:
 - First perform warming up at the idling speed.
 - Then run the engine at a medium speed and perform loaded operation by repeating bringing the bucket into contact with a wall adhered with a cushion material or a banking, start the loader slowly and returning to the neutral shift immediately. Perform this loaded operation for a few minutes.
 - Never try high-speed operation without any load from the start.

HST MOTOR ASSY (2SDK8)

REMOVAL

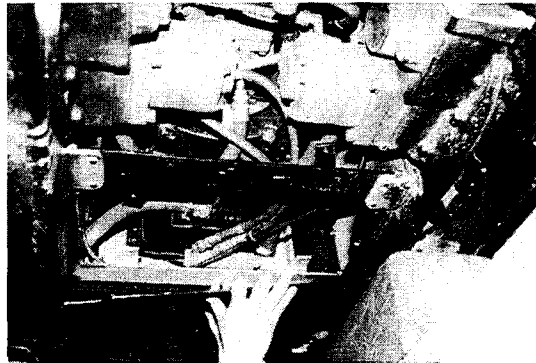
1. Remove the under covers.
 - (1) Front under cover.



Front Under Cover

SAE6-32

- (2) Rear under cover
 - (3) Member



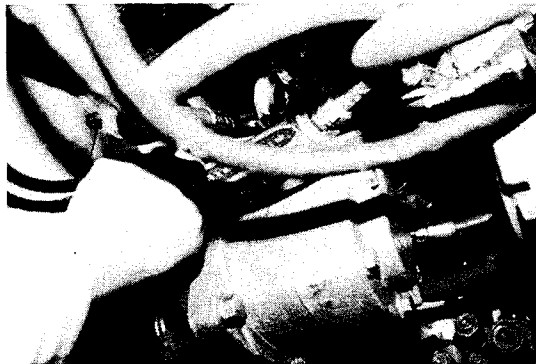
Rear Under Cover

SAE6-36

2. Disconnect the piping.
 - (1) High pressure hoses (width across flat: 27 mm) (Two)
 - (2) Low pressure hose (width across flat: 22 mm) (One)

Caution:

Fit nylon caps or other covers to the hoses and elbows to prevent entrance of foreign matters.



Disconnecting the Piping

SAE7-3

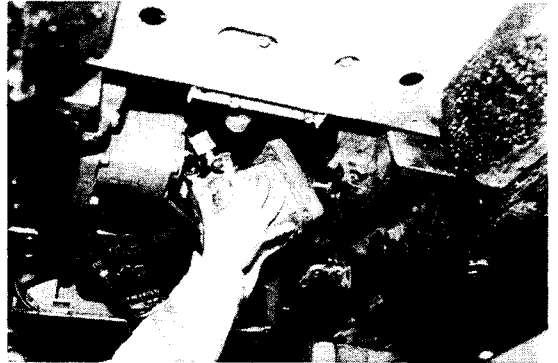
3. Remove the HST motor.
 - (1) Set Bolts



Set Bolts

SAE7-5

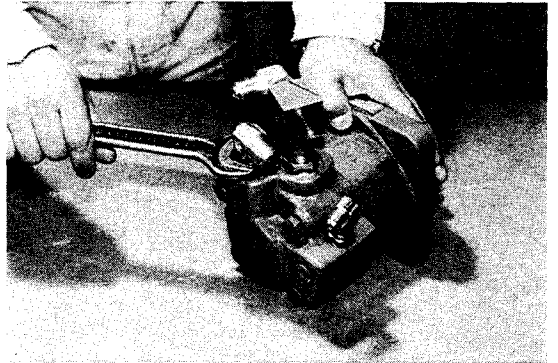
(2) HST motor



HST Motor

SAE7-13

4. Remove the fitting from the HST motor.



Fitting

SAE9-33

DISASSEMBLY

Caution:

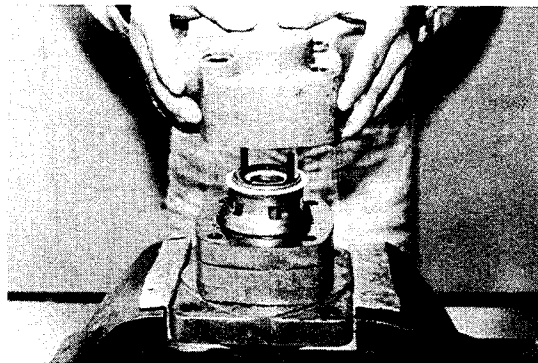
- Select a clean place and clean table for disassembly.
- Wash the motor assembly before disassembly.
- Carefully handle disassembled parts to prevent damages.
- Drain the hydraulic oil in the motor.

1. Remove the valve housing.
 - (1) Hold the motor at the mounting flange firmly in a vise.
 - (2) Set bolt (5/8" or 16 mm)
 - (3) Valve housing

Caution:

Lift the valve straight upward. Carefully lifting will cause the springs, pins and balance plate to come off and remain on the valve.

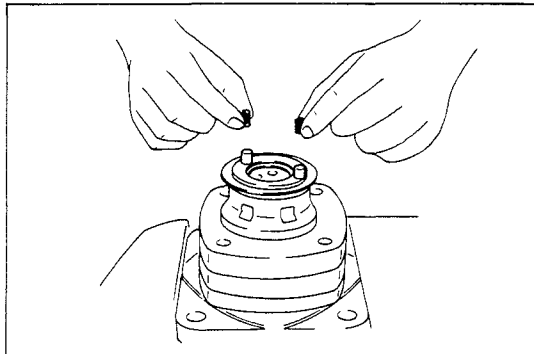
- (4) O-rings (one large ring and one small ring)



Valve Housing

SAE10-5

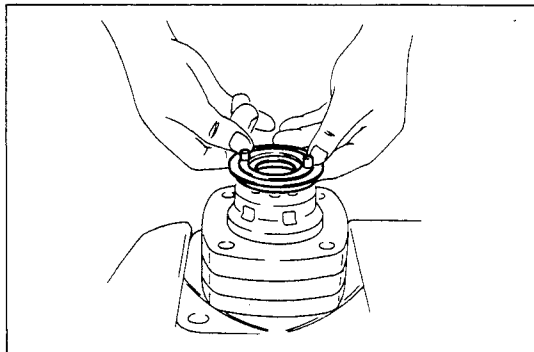
2. Remove the springs and pins.
 - (1) Springs (2 pcs.)
 - (2) Pins (2 pcs.)



Springs and Pins

SAES28

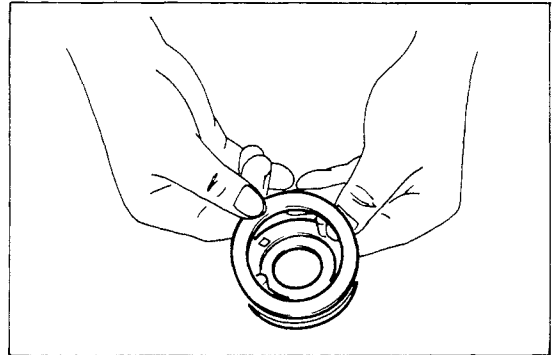
3. Remove the balance plate with seal.



Balance Plate

SAES36

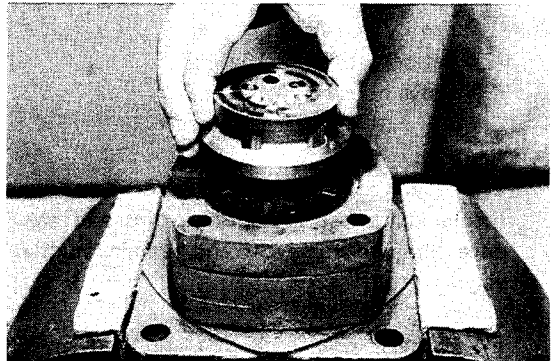
4. Remove the inner and outer face seals from the balance plate.



Face Seals

SAES68

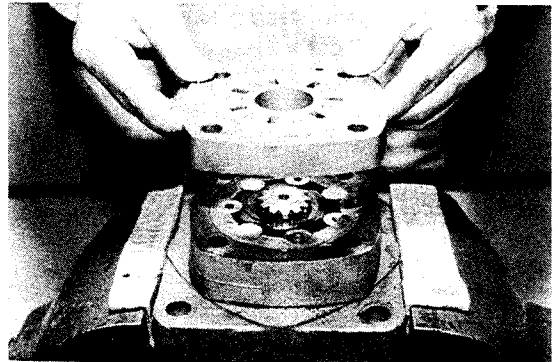
5. Remove the valve.



Valve

SAE10-18

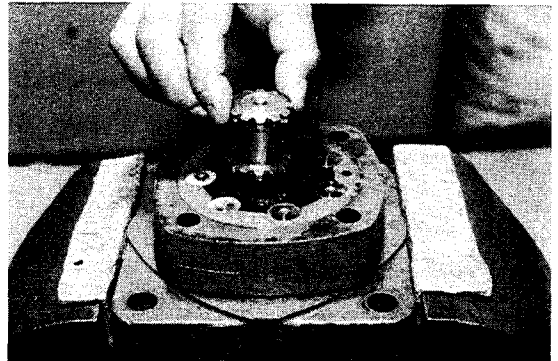
6. Remove the valve plate.
 - (1) Valve plate
 - (2) O-rings (one large ring and one small ring)



Valve Plate

SAE10-20

7. Remove the valve drive.



Valve Drive

SAE10-21

8. Remove the gyroller set.

Caution:

Use a marking pen and draw match marks indicating relative positions of the housing, roller and star of the gyroller set before removing it.

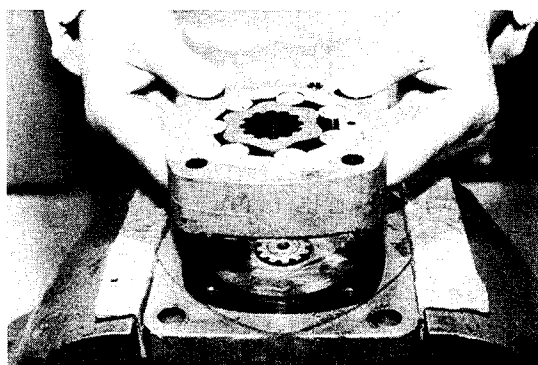
- (1) Gyroller set

Caution:

Carefully prevent rollers from coming off from the gyroller set.

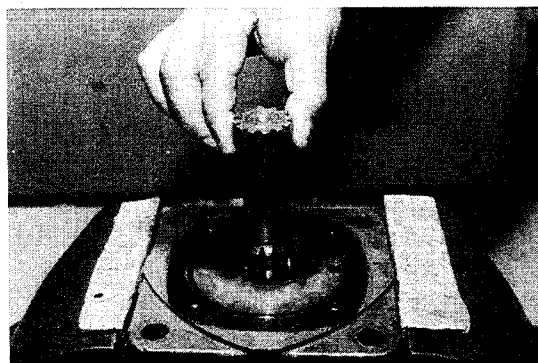
- (2) O-rings (one large ring and one small ring)

9. Remove the drive



Gyroller Set

SAE10-22

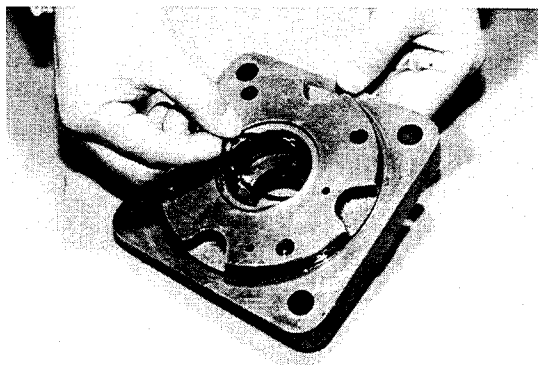


Drive

SAE10-24

10. Remove the o-ring from the mounting flange.

- (1) Remove the mounting flange from the vise.
(2) O-ring.

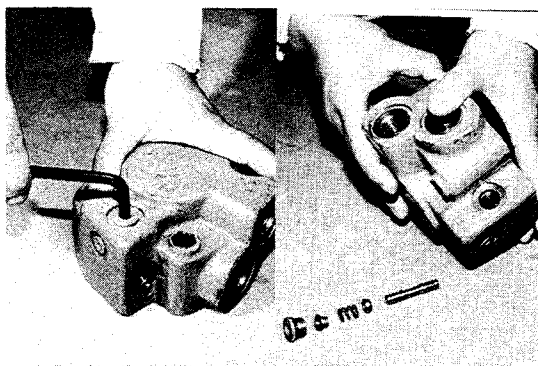


O-ring

SAE10-25

11. Remove the shuttle valve from the valve housing.

- (1) Plug
(2) Sleeve
(3) Spring
(4) Poppet
(5) Piston

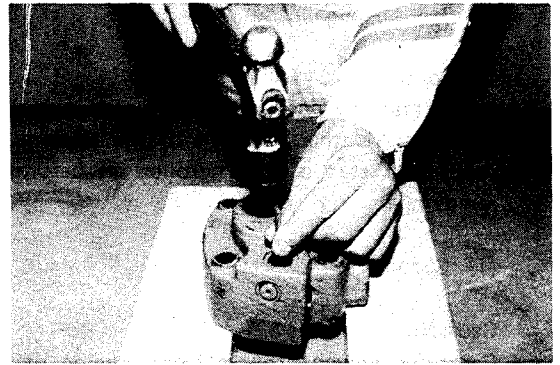


Shuttle Valve (1)

SAE10-7, 8

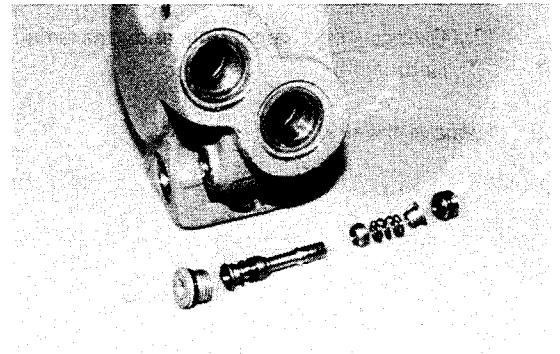
- (6) Plug
- (7) Sleeve
- (8) Spring
- (9) Popet

Use a $\phi 4 \sim 6$ mm, about 100 mm long round rod for removal of parts (6) to (9).



Shuttle Valve (2)

SAE10-9



Disassembling the Shuttle Valve

SAE10-10

INSPECTION

Caution:

Wash disassembled parts with kerosene or a non-petrochemical solvent to remove metal particles and oil. Wash the gyroller set without disassembling it.



HST Motor

SAE10-29

1. Each fitting or sliding surface
 - (1) Correct burrs and dents with an oil stone.
2. Wear, damage and crack of each part.

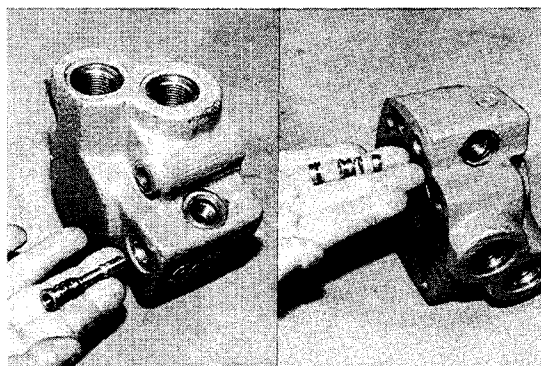
ASSEMBLY

Caution:

- After washing each part and blowing off the washing liquid with compressed air, coat hydraulic oil (automatic transmission fluid) sufficiently before assembly.
- Carefully handle the parts so as not to damage their sliding surfaces.
- Replace all seals such as oil seals, o-rings and gaskets with new ones unless they are free from damage and have only been used for a short time.

1. Install the shuttle valve to the valve housing.

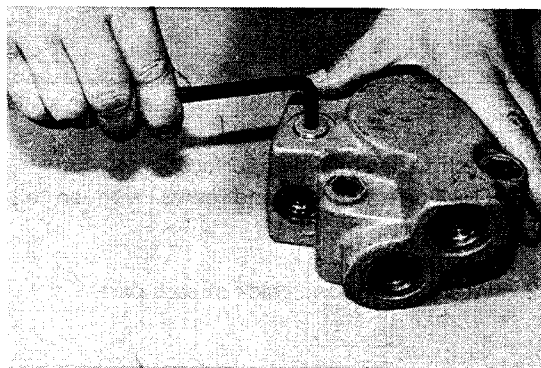
- (1) Poppet
- (2) Spring
- (3) Sleeve
- (4) Plug



Shuttle Valve (1)

SAE11-23, 24

- (5) Piston
 - (6) Poppet
 - (7) Sleeve
 - (8) Plug
- T = 2.1 ~ 2.5 kg-m
(15.2 ~ 18.1 ft-lbs)



Shuttle Valve (2)

SAE11-25

2. Install the o-ring to the mounting flange.

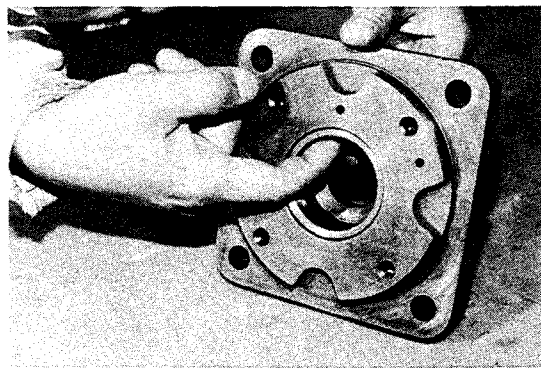
Caution:

Coat grease on the o-ring.

- 3. Hold the mounting flange firmly in a vise.
- 4. Install large and small o-rings to the mounting flange.

Caution:

Coat grease on the o-rings.



O-rings

SAE11-4

5. Install the drive.

Caution:

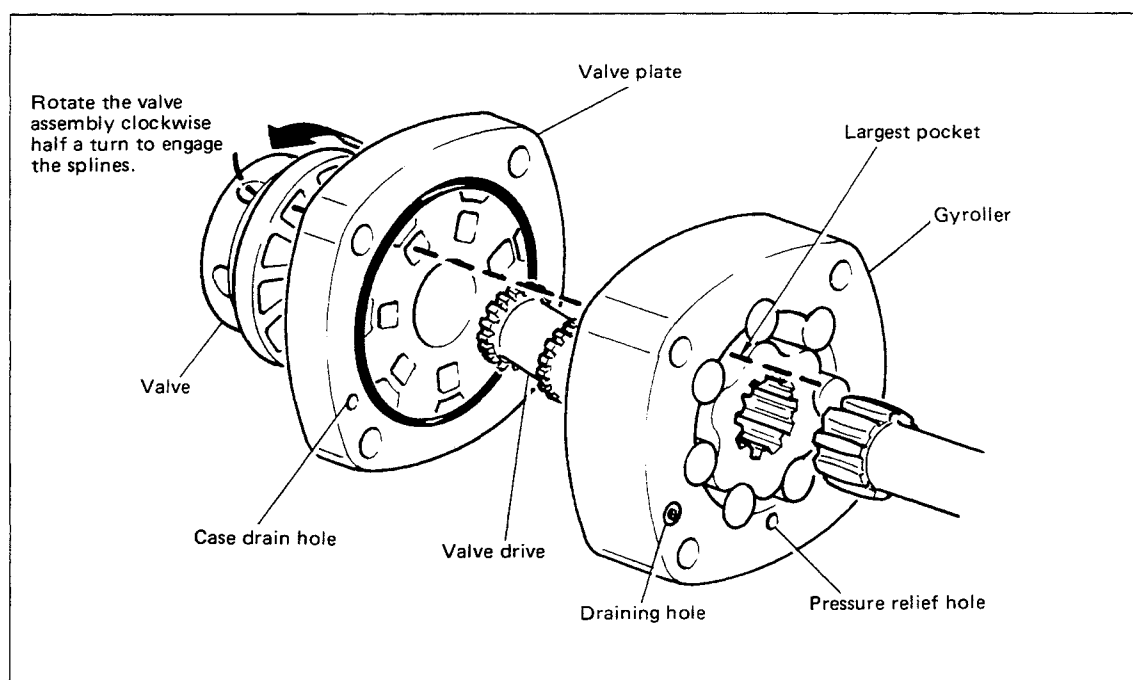
Face the longer drive spline downward, when installing the drive.



Drive

SAE11-8

6. Adjust the motor timing.



Motor Timing

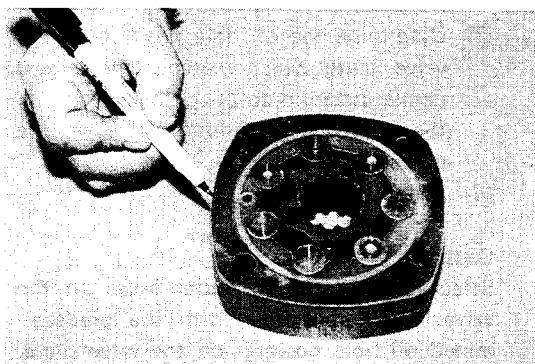
SAES43

- (1) Determine the position of the largest pocket of the gyroller and put a mark on the gyroller periphery.
(See the illustration above.)

- (2) Install the small O-ring to the gyroller.

Caution:

Coat grease on the O-ring.



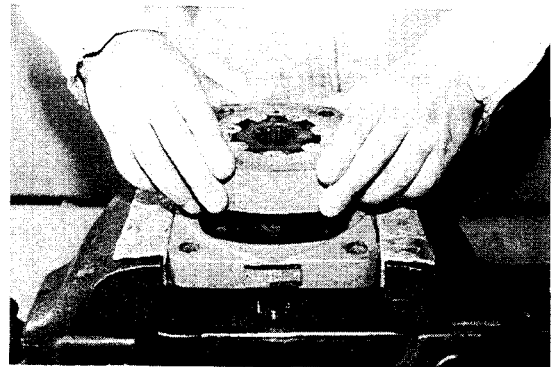
Mark

SAE11-10

- (3) Install the gyroller set.

Caution:

- Fit the drive to the gyroller set, with the drain and pressure relief hole positions on the gyroller set case aligned with the holes on the mounting flange.
- Carefully prevent rollers of the gyroller set from coming off.



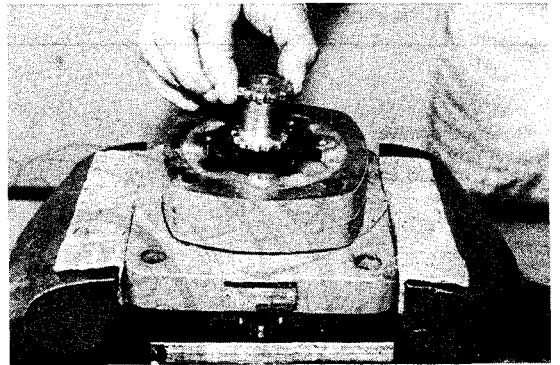
Gyroller Set

SAE11-11

- (4) Insert the valve drive to the inside spline of the gyroller set.
 (5) Install the large O-ring to the valve plate.

Caution:

Coat grease on the O-ring.



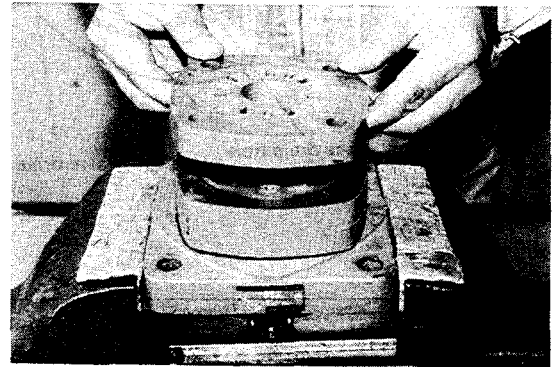
Valve Drive

SAE11-18

- (6) Install the valve plate.

Caution:

Align the drain hole on the valve plate case with the drain hole on the gyroller set case at the time of assembly. See the Motor Timing figure on the preceding page.



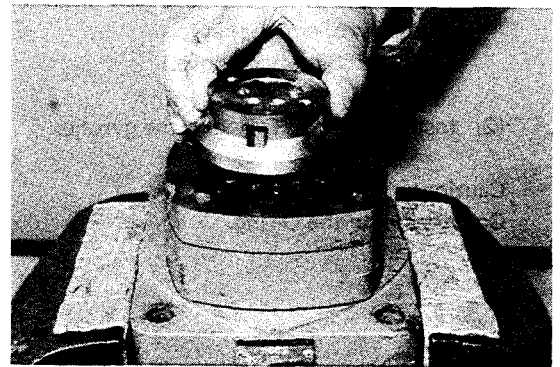
Valve Plate

SAE11-19

- (7) Determine the oil hole position on the valve plate which matches the largest pocket position on the gyroller.
 (See the Motor Timing figure on the preceding page.)
 (8) Install the valve.

Caution:

Select one of the six outer holes on the valve. Align this hole with the predetermined oil hole position on the valve plate. Rotate the valve by half tooth clockwise to mesh the valve inside spline with the valve drive spline.



Valve

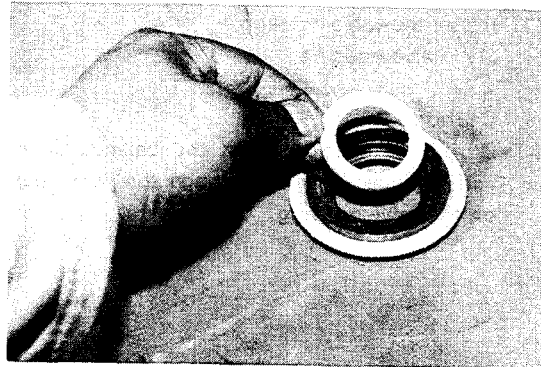
SAE11-22

7. Install the outer and inner face seals to the balance plate.

Caution:

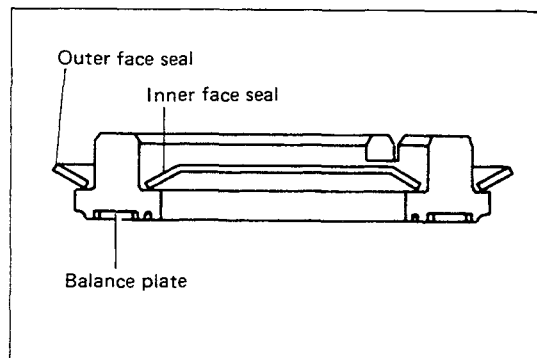
Carefully install them so as not to damage the outside and inside surfaces.

Install the inner face seal to make its center convex and the outer face seal to make its center concave.



Outer Face Seal

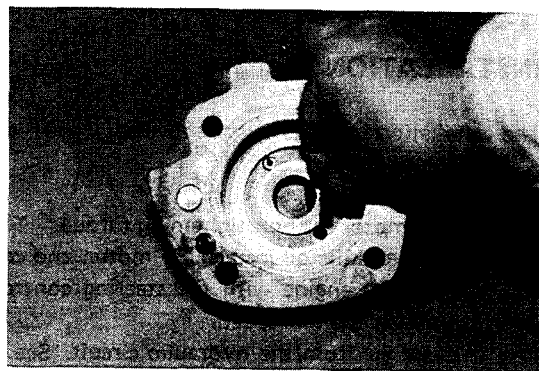
SAE11-27



Face Seal Installing Direction

SAES44

8. Install the springs and pins to the valve housing.
- (1) Springs (2 pcs.)
 - (2) Pins (2 pcs.)



Installing the Springs and Pins

SAE11-26

9. Install the balance plate.

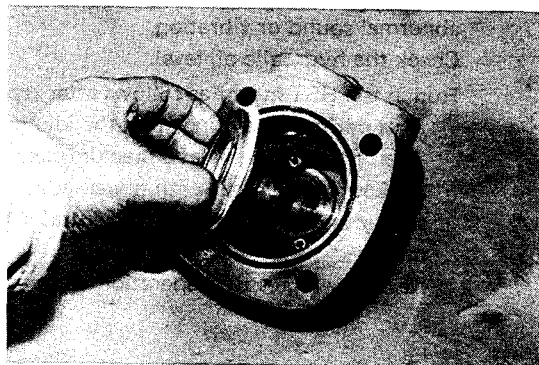
Caution:

Match the balance plate pin grooves with the position of the pins inserted to the valve housing.

10. Install the large and small O-rings to the valve housing.

Caution:

Coat grease on the O-rings.



Balance Plate

SAE11-29

11. Install the valve housing.

(1) Valve housing

Caution:

During installation, hold the balance plate with a finger inserted through the port hole on the valve housing.



Valve Housing

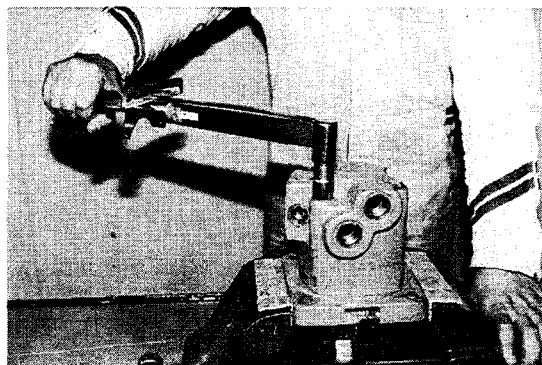
SAE11-32

(2) Set bolts

$T = 6.2 \sim 7.6 \text{ kg-m}$
(44.8 ~ 54.9 ft-lbs)

Caution:

- Coat thread tightener on the threaded portion of the set bolts before assembly.
- Carefully prevent the O-ring from being trapped between parts.
- Stand the reassembled motor for 1 to 2 hours to wait for hardening of the thread tightener.



Tightening the Set Bolts

SAE11-33

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

- HST motor set bolt tightening torque. $T = 6.5 \sim 9.0 \text{ kg-m}$ (46.9 ~ 65.0 ft-lbs)
- Fill hydraulic oil in the HST motor, and connect the piping.
- Start the engine with the steering control lever at the neutral position, and warm up the HST pump at the idle speed.
- Bleed air from the hydraulic circuit. See "HYDRAULIC SYSTEM—Bleeding Air from Hydraulic Circuit" section for the air bleeding procedure.
- Slightly operate the steering control lever back and forth several times to check that there is no abnormal sound or vibration.
- Check the hydraulic oil level.
- Run in the HST motor as follows after replacing it with a new one or after repairing it:
 - First perform warming up at the idling speed.
 - Then run the engine at a medium speed and perform loaded operation by repeating bringing the bucket into contact with a wall adhered with a cushion material or a banking, start the loader slowly and returning to the neutral shift immediately. Perform this loaded operation for a few minutes.
 - Never try high-speed operation without any load from the start.

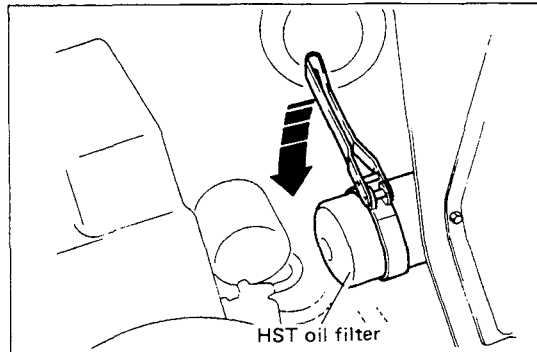
HST OIL FILTER

REMOVAL

1. Open the seat panel with driver's seat.
2. Remove the filter element.

Caution:

Carefully prevent entrance of dust and foreign matters into the hydraulic circuit.



Removing the Filter Element

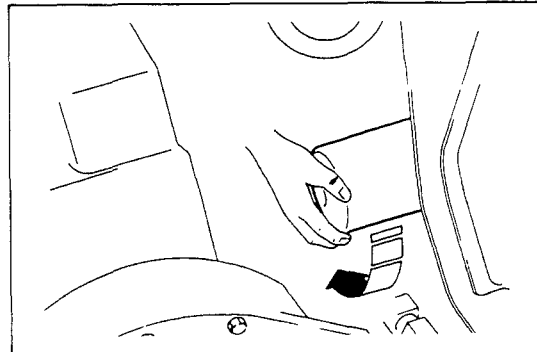
SAES46

INSTALLATION

1. Install the filter element.

Caution:

- Clean the installing surface.
- Coat new hydraulic oil on the gasket.
- Rotate the filter element about 2/3 turn by hand after the oil filter gasket comes into contact with the filter head.
- Write the date of mount and hours used so far on the element label before renewing the element.



Installing the Filter Element

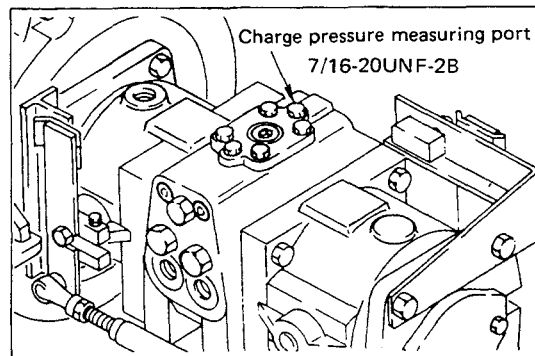
SAES47

CHARGE PRESSURE MEASUREMENT

1. Open the seat panel with driver's seat.
2. Remove the charge pressure check port plug from the HST pump, and install an oil pressure gauge.

Caution:

When installing the oil pressure gauge, carefully prevent dust or foreign matters from entering into the hydraulic circuit.



Charge Pressure Check Part.

SAES45

Standard charge oil pressure (1986. 3 ~ 1991. 5)

At idling engine speed:

2 kg/cm² (28.4 psi) or above

At maximum engine speed:

3.2 kg/cm² (45.5 psi) or above

If the above charge pressure is measured, the charge circuit may be judged as normal.

Standard charge pressure (1991.5 ~)

At idling engine speed:

3.5 kg/cm² (50 psi) or above

At maximum engine speed:

4.7 kg/cm² (67 psi) or above

RELIEF PRESSURE TEST

1. Remove the plug out of the relief pressure test exit (7/16 - 20UNF), and install the oil pressure meter.
2. Chock the front wheel, and measure the relief pressure.

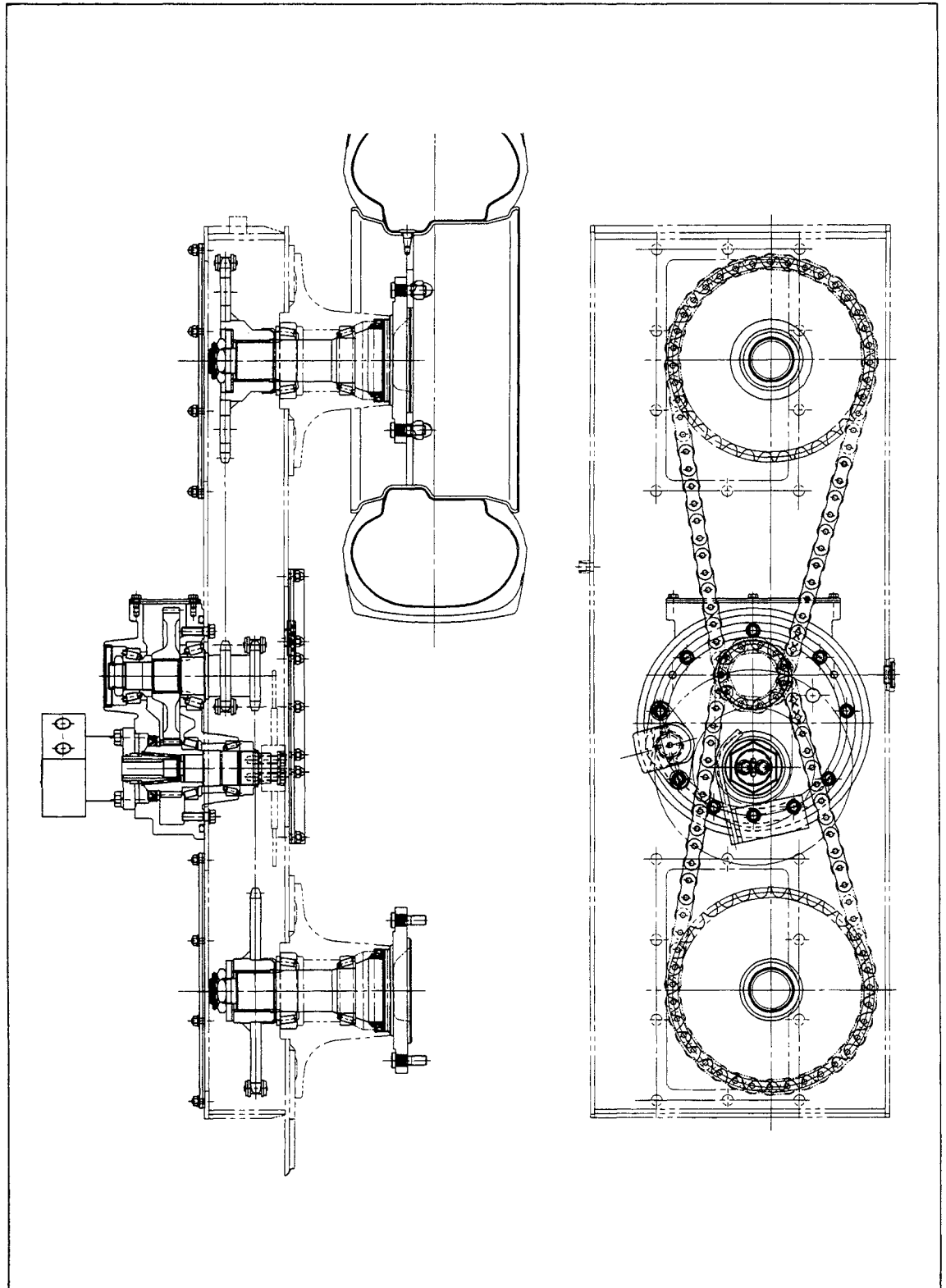
Relief set pressure:

2SDK6, 7 225 kg/cm² (3200 psi)

2SDK8 290 kg/cm² (4120 psi)

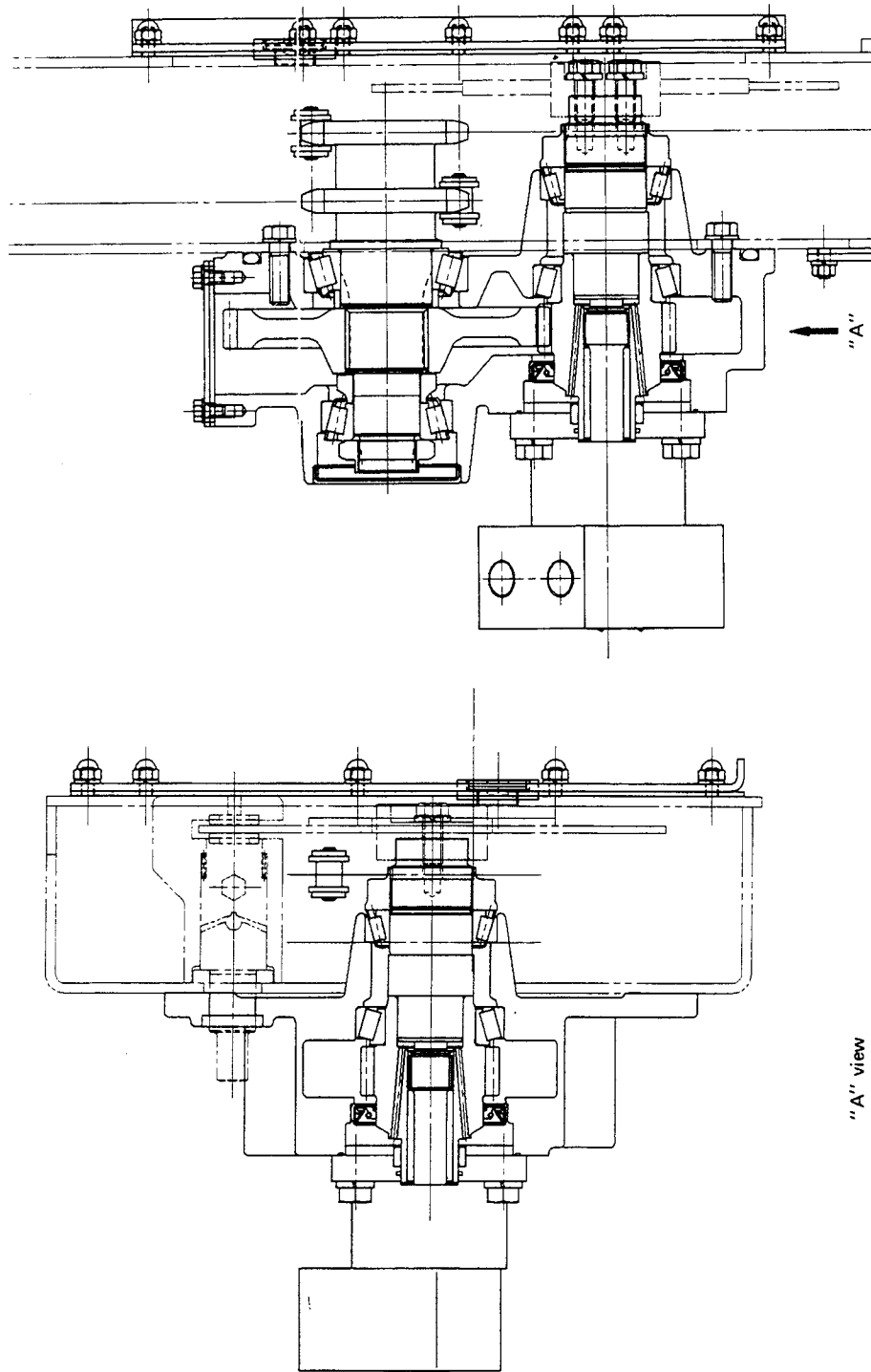
FINAL REDUCTION GEAR

	Page
DESCRIPTION	3-2
COMPONENTS	3-4
SPECIFICATIONS AND SERVICE STANDARDS	3-5
DRIVE CHAIN ASSY	3-6
DRIVE UNIT	3-11

DESCRIPTION

Final Reduction Gear Sectional View

SAEL6

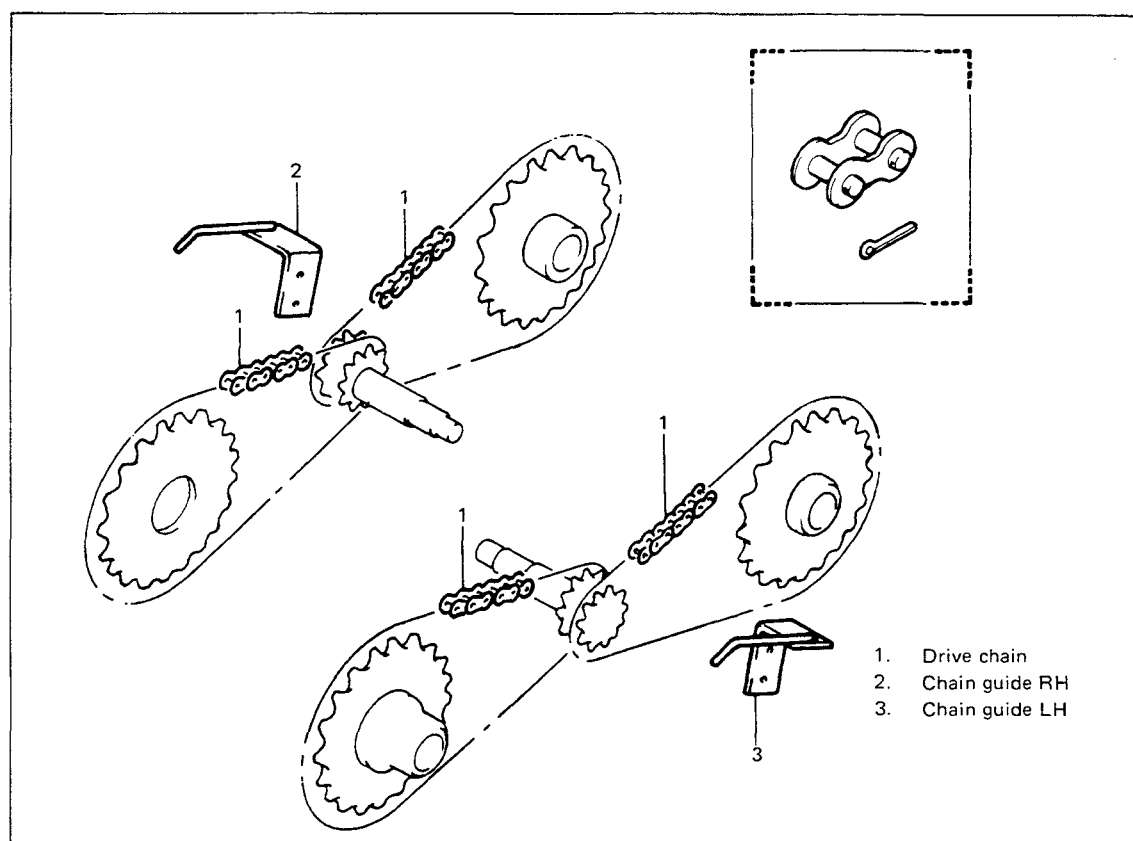


Drive Unit Sectional View

SAEM23

-
- Diagram illustrating the assembly of a mechanical component, showing various parts and their assembly sequence. The diagram includes torque specifications for different parts:
- $T=5.8 \sim 8.8$ (41.9 ~ 63.5)
 - $T=1.0 \sim 1.6$ (7.2 ~ 11.6)
 - $T=5.8 \sim 8.8$ (41.9 ~ 63.5)
- Parts are numbered 1 through 22T, 55T, and 11T. The diagram shows the assembly of a shaft with gears, bearings, and other components, including a detailed view of the final assembly on the right.

Drive Unit Components



Drive Chain Components

SAEM24

SPECIFICATIONS AND SERVICE STANDARDS

Type		2-step reduction type
No. 1 reduction gear	Gear type	Spur gear type
	Reduction ratio	2.500
No. 2 reduction gear	Gear type	Sprocket wheel type
	Reduction ratio	3.182
Overall reduction ratio		7.955
Chain type	2GK6, 2SDK6, 2SDK7	RS80
	2SDK8	RS80HT
Drive chain length limit (L) mm (in)		154.7 (6.09)
Drive unit set bolt tightening torque kg-m (ft-lbs)		5.8 ~ 8.8 (41.9 ~ 63.5)
Front cover set bolt tightening torque kg-m (ft-lbs)		1.0 ~ 1.6 (7.2 ~ 11.6)

DRIVE CHAIN ASSY

REMOVAL

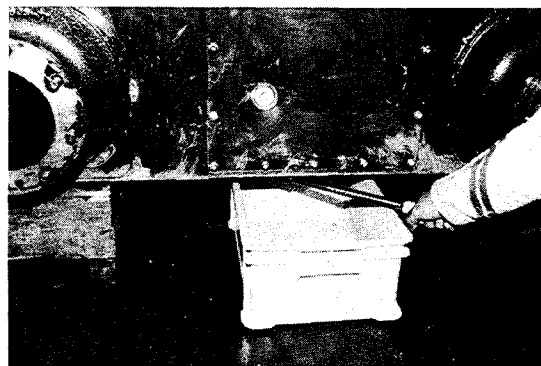
1. Remove the wheel.
 - (1) Loosen hub nuts.
 - (2) Jack up the vehicle and support it with stands under the frame.
 - (3) Hub nuts (8 pcs x 2)
 - (4) Front wheels
 - (5) Rear wheel



Wheel

SAE1-14

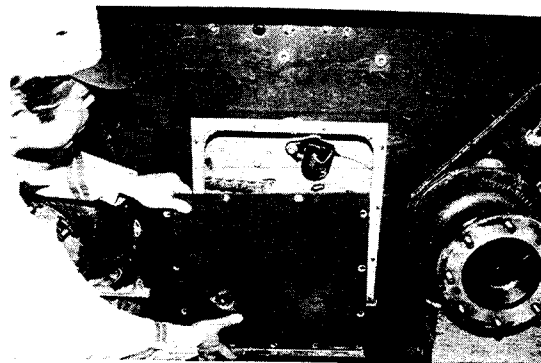
2. Drain the oil from the final reduction gear.
 - (1) Prepare an oil receiving container.
 - (2) Drain plug



Draining the Oil from Final Reduction Gear

SAE1-15

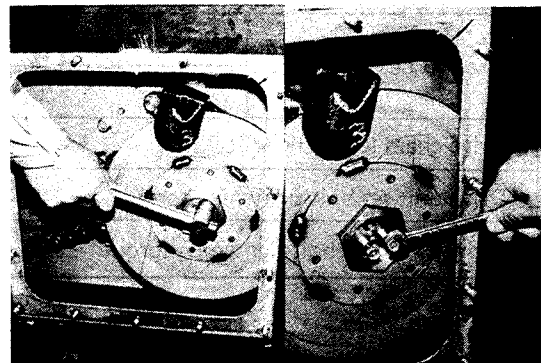
3. Remove the service hole cover.
 - (1) Cap nuts (13 pcs.)
 - (2) Service hole cover



Service Hole Cover

SAE1-17

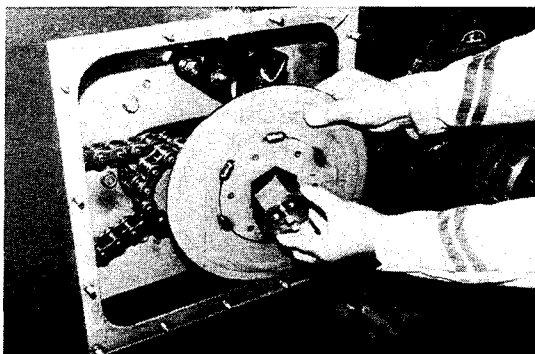
4. Remove the brake disc.
 - (1) Set bolts
 - (2) Use service bolts (2 Pcs.).
M8 x 1.25 pitch x 40 to 50 mm



Set Bolts and Using the Service Bolts

SAE1-20, 22

- (3) Adapter
- (4) Brake disc



Brake Disc

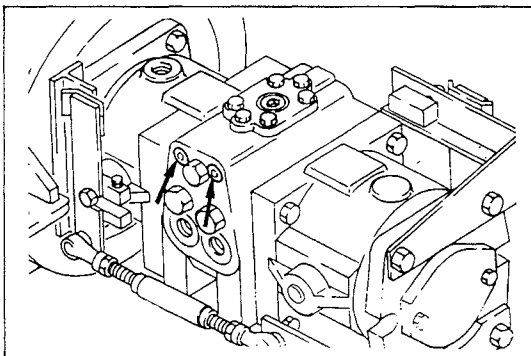
SAE1-24

5. Disconnect the rear drive chains.
- (1) Loosen the HST pump bypass valve.

Caution:

When disconnecting the drive chain on the left side, loosen the bypass valve on the front side.

- (2) Rotate the rear axle shaft to bring the chain joint to a position allowing easy disconnection.



Bypass Valve

SAES19

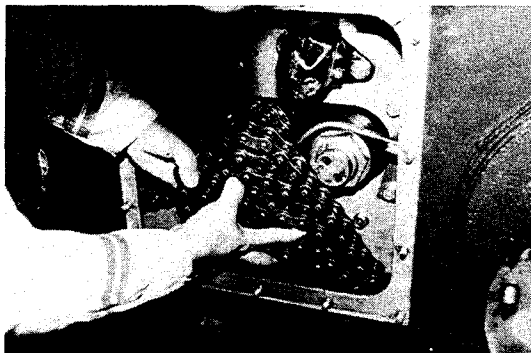
- (3) Disconnect the rear drive chain.
 - ① Cotter pin
 - ② Joint link



Disconnecting the Rear Drive Chain

SAE1-30

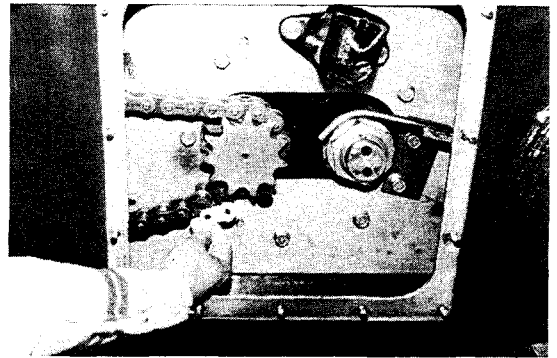
6. Remove the rear drive chain.



Rear Drive Chain

SAE1-32

7. Disconnect the front drive chain.
 - (1) Turn the front axle shaft until the joint link is accessible.
 - (2) Disconnect the chain.
 - ① Cotter pin
 - ② Joint link



Disconnecting the Front Drive Chain

SAE1-34

8. Remove the front drive chain.

INSPECTION

Caution:

Thoroughly wash each part with a washing liquid to eliminate dirt completely before inspection.

1. Drive chain
 - (1) Chain elongation by wear

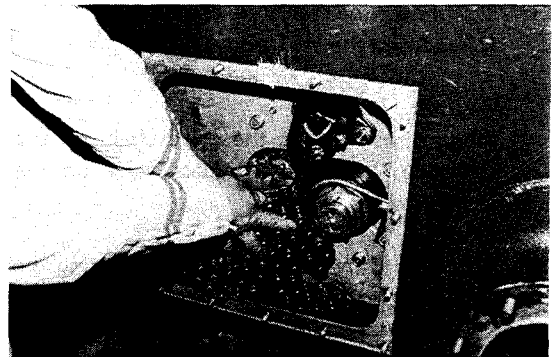
Measure the chain elongation by wear as described below and judge the wear elongation limit.

<Measurement Method>

- ① Measure the length with proper tension applied to the chain to eliminate overall chain looseness.
- ② Measure inside length (L1) and outside length (L2) between No. 6 link rollers as shown at right, and obtain the judgement dimension (L).

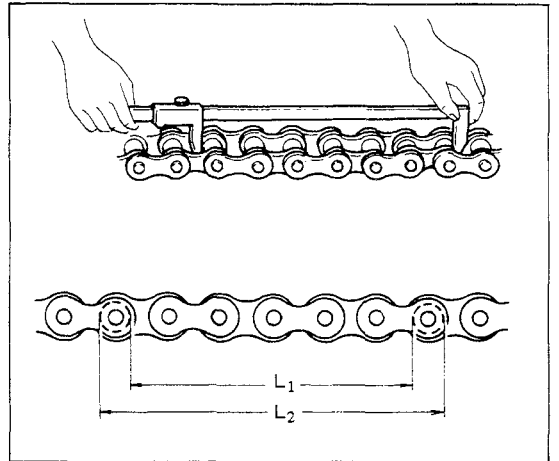
$$L = \frac{L_1 + L_2}{2}$$

Wear length limit (L): 154.7 mm
(6.09 in.)



Front Drive Chain

SAE3-1



Measuring the Chain Elongation

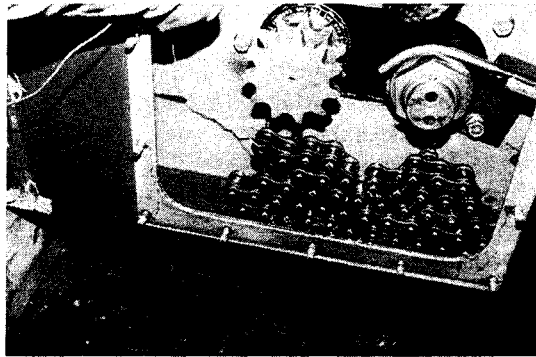
SAES23

INSTALLATION

1. Install the drive chains.

Caution:

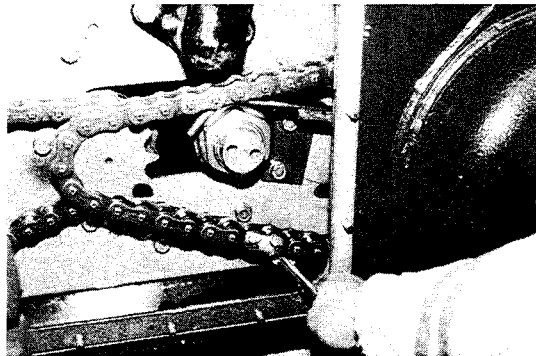
When setting the drive chain to the axle drive sprocket, tie a wire to one end of the chain.



Drive Chain

SAE3-4

- (1) Front drive chain assembly
 - ① Front drive chain
 - ② Joint link
 - ③ Cotter pin
- (2) Rear drive chain assembly
 - ① Rear drive chain
 - ② Joint link
 - ③ Cotter pin
- (3) Tighten the HST pump bypass valve.

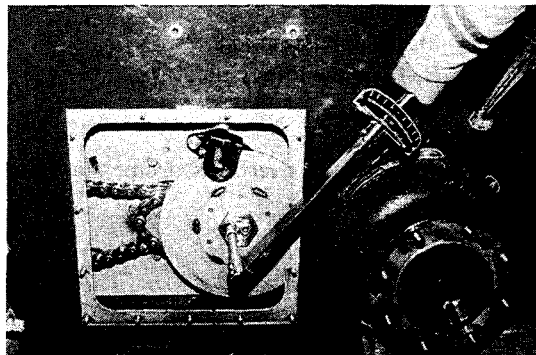


Rear Drive Chain

SAE12-27

2. Install the brake disc.
 - (1) Brake disc
 - (2) Adapter
 - (3) Set bolts

$T = 7.8 \sim 11.6 \text{ kg-m (56.3 \sim 83.8 ft-lbs)}$



Brake Disc

SAE2-26

3. Install the service hole cover.
 - (1) Service hole cover
 - (2) Cap nuts

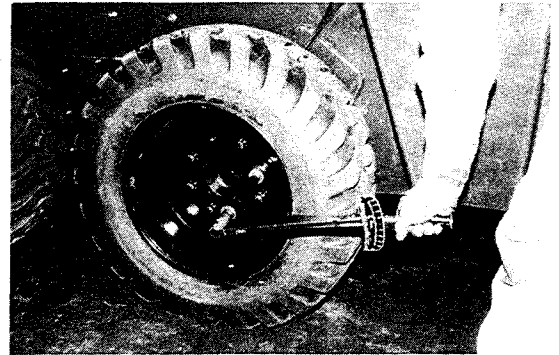
$T = 1.0 \sim 1.6 \text{ kg-m (7.2 \sim 11.6 ft-lbs)}$

4. Install the wheels.
 - (1) Front wheels
 - (2) Rear wheels
 - (3) Temporarily tighten hub nuts.
 - (4) Remove the stands.
 - (5) Hub nuts

$T = 12 \sim 15 \text{ kg-m (86.6} \sim 108.3 \text{ fr-lbs)}$

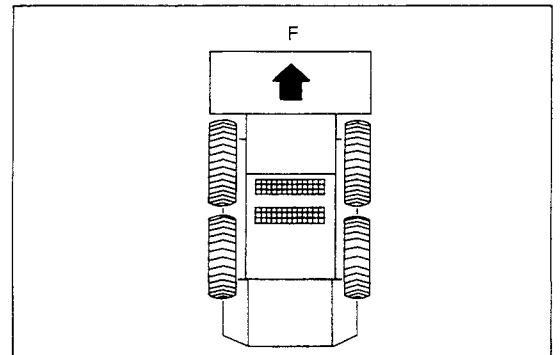
Caution:

Install the wheels so that the tire pattern is as illustrated at right. Wheel rotation must be limited to between the front and rear. Never replace between left and right tires.



Wheel

SAE2-28



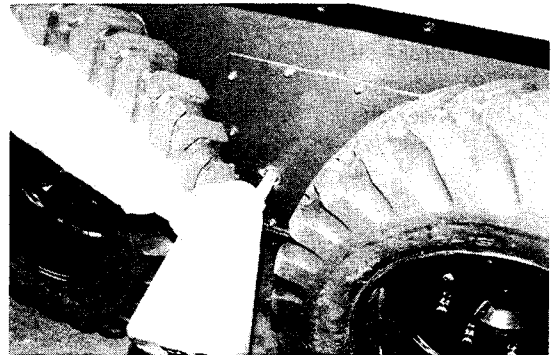
Wheel Mounting Direction

SAES20

5. Fill the final reduction gear oil.
 - (1) Install the drain plug.
 - (2) Remove the filler plug.

Caution:

Fill oil until it overflows from the filler plug hole.



Filling Oil into Final Reduction Gear

SAE12-35

DRIVE UNIT

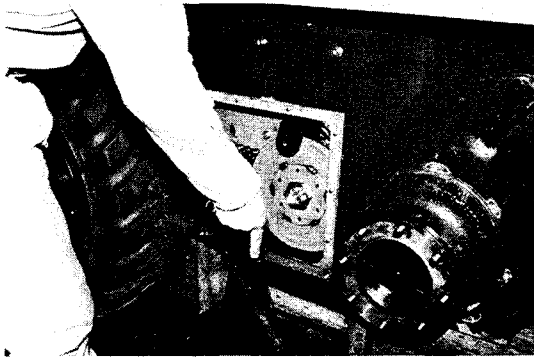
REMOVAL

1. Remove the rear wheels.
 - (1) Loosen hub nuts.
 - (2) Jack up the vehicle and place stands under the frame.
 - (3) Hub nuts (8 pcs.)
 - (4) Rear wheel
2. Drain oil from the final reduction gear.
 - (1) Prepare an oil receiving container.
 - (2) Drain plug
3. Remove the service hole cover.
 - (1) Cap nuts (13 pcs.)
 - (2) Service hole cover
4. Remove the brake disc.
 - (1) Set bolts
 - (2) Use service bolts (2 pcs.)
M8 x 1.25 pitch x 40 to 50 mm



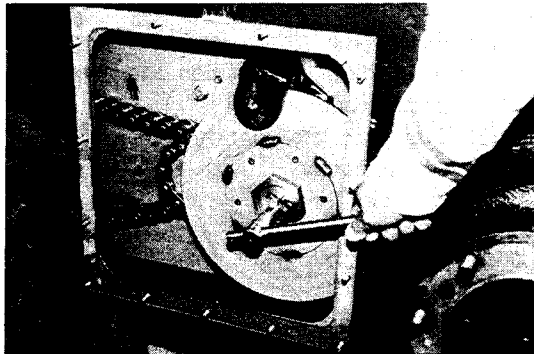
Rear Wheel

SAE5-25



Service Hole Cover

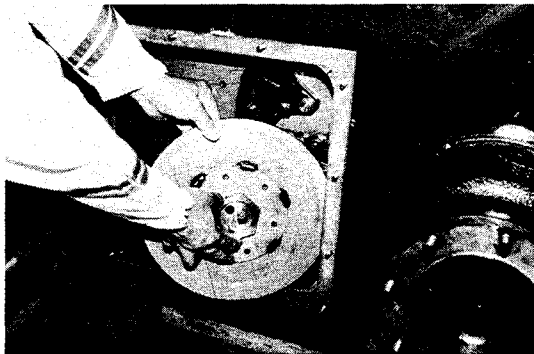
SAE5-27



Use Service Bolts

SAE5-31

- (3) Adapter
- (4) Brake disc



Brake Disk

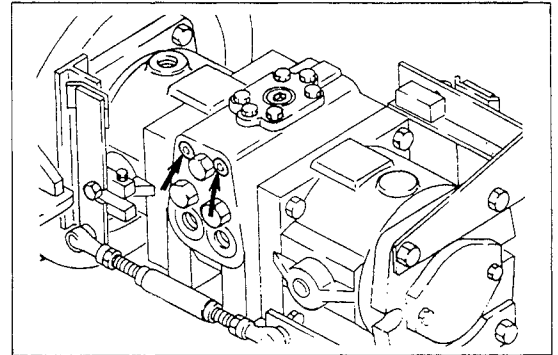
SAE5-33

5. Disconnect the rear drive chains.
 - (1) Loosen the HST pump bypass valve.

Caution:

When disconnecting the drive chain on the left side, loosen the front side bypass valve.

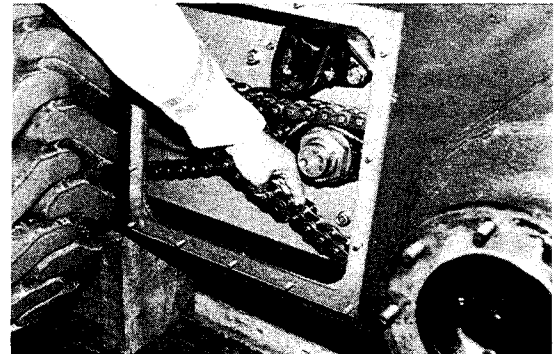
- (2) Rotate the rear axle shaft to bring the chain joint to a position allowing easy disconnection.



Bypass Valve

SAE519

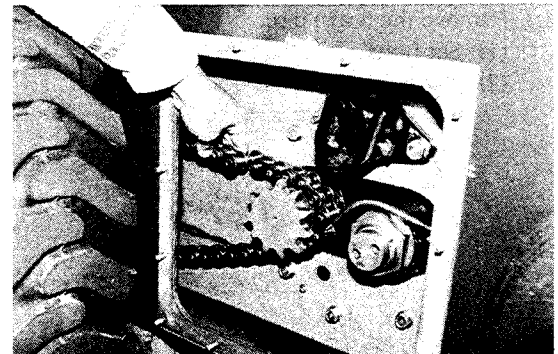
- (3) Disconnect the rear drive chain.
 - ① Cotter pin
 - ② Joint link



Disconnecting the Rear Drive Chain

SAE5-34

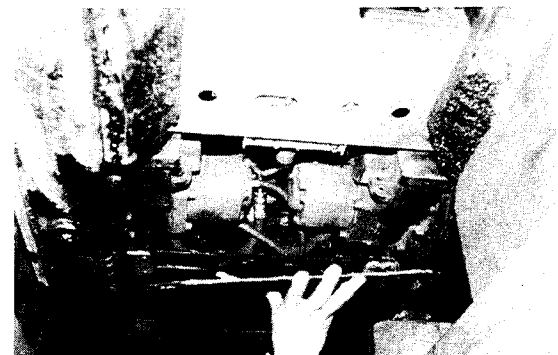
6. Disconnect the front drive chain.
 - (1) Rotate the front wheel to bring the chain joint to a position allowing easy disconnection.
 - (2) Disconnect the front drive chain.
 - ① Cotter pin
 - ② Joint link



Disconnecting the Front Drive Chain

SAE6-33

7. Remove the front under cover.
 - (1) Set bolts (4 pcs.)
 - (2) Front under cover



Front Under Cover

SAE6-32

8. Remove the rear under cover.

- (1) Set bolts (4 pcs.)
- (2) Rear under cover

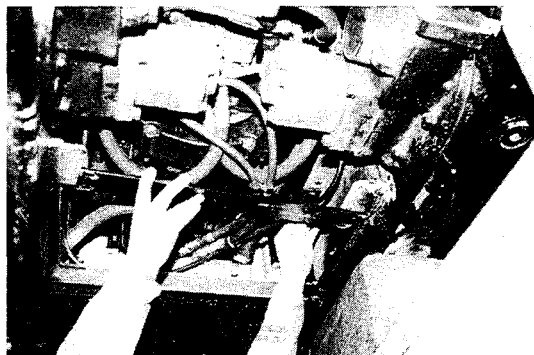


Rear Under Cover

SAE6-36

9. Remove the member.

- (1) Set bolts (4 pcs.)
- (2) Member



Member

SAE7-1

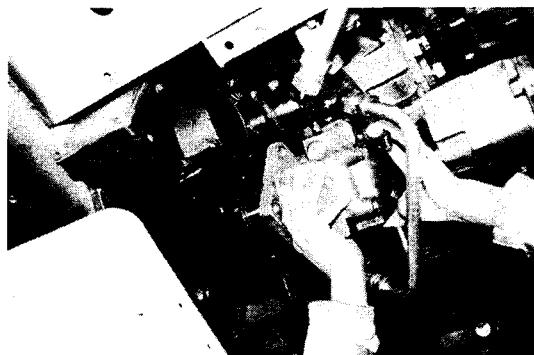
10. Remove the HST motor.

- (1) Disconnect the piping.
 - ① High pressure hoses (two)
 - ② Drain hose

Caution:

Fit nylon caps or other covers to the hoses and elbows to prevent entrance of foreign matters.

- (2) Set bolts (4 pcs.)
- (3) HST motor

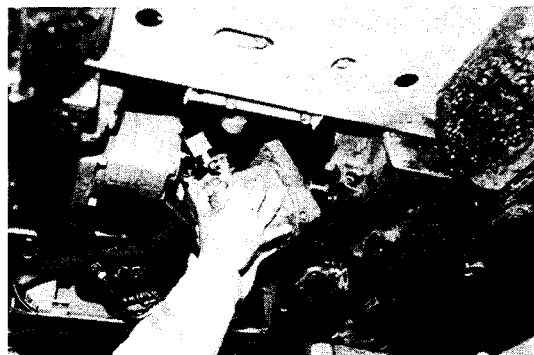


HST Motor (2SGK6, 2SDK6, 7)

SAE37-19

Caution:

See "HYDROSTATIC TRANSMISSION—HST Motor Assy" section for the HST motor removal procedure.



HST Motor (2SDK8)

SAE7-13

11. Remove the brake lever from the brake shaft.

- (1) Set bolt and nut
- (2) Brake lever



Brake Lever

SAE2-6

12. Remove the brake wire bracket from the drive unit.

- (1) Set bolt
- (2) Brake wire bracket



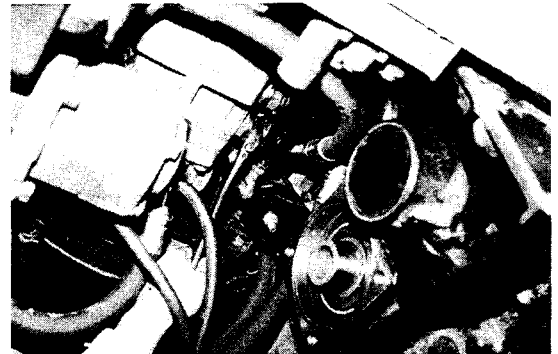
Brake Wire Bracket

SAE7-17

13. Disconnect the HST high pressure hose.
(HST pump side)

Caution:

- Disconnect only the hose which obstructs drive unit removal.
- Fit nylon caps or other covers to the hose and elbow to prevent entrance of foreign matters.



Disconnecting the HST High Pressure Hose

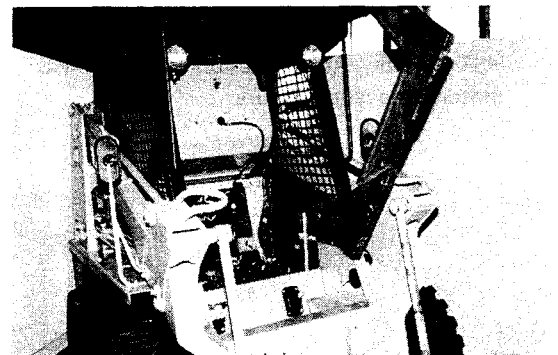
SAE7-30

14. Lightly suspend the drive unit with a wire rope.

SST 09010-20110-71

Caution:

Screw in service bolt (M8 x 1.25 pitch) to the brake wire bracket mounting hole, and use the service bolt and drive unit hook hole for suspension with the wire rope.



Setting the Wire Rope

SAE7-22

15. Remove the drive unit.

- (1) Remove the brake block and brake shaft.

- ① Set bolts (2 pcs.)
- ② Brake block
- ③ Brake shaft

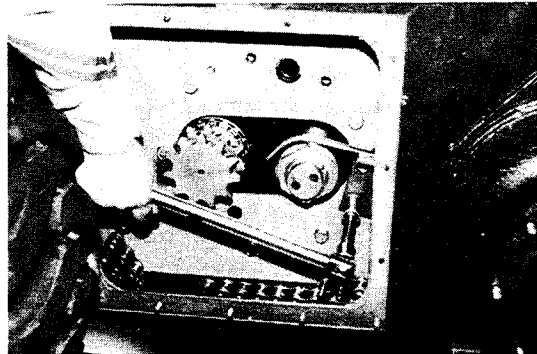


Brake Block and Shaft

SAE7-26

- (2) Remove the chain guide.

- ① Set bolts (2 pcs.)
- ② Chain guide



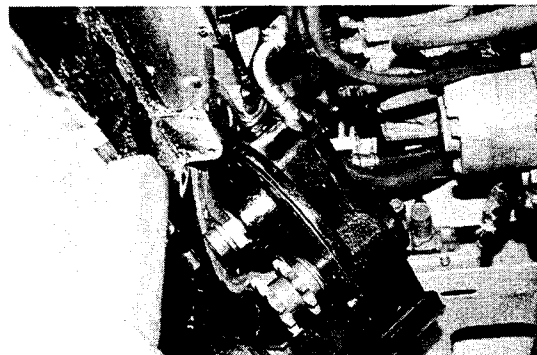
Chain Guide

SAE7-27

- (3) Set bolts (6 pcs.)
(4) Drive unit

Caution:

Remove the drive unit from below.

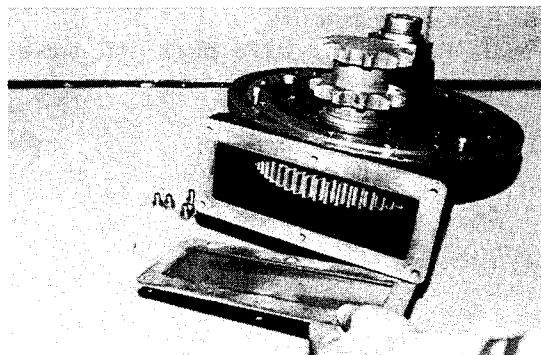


Drive Unit

SAE7-32

DISASSEMBLY

1. Remove the front cover.
 - (1) Set bolts (6 pcs.)
 - (2) Front cover
 - (3) Gasket



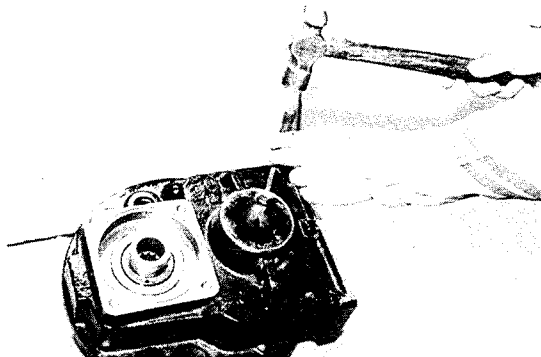
Front Cover

SAE7-34

2. Remove the seal cap.

Note:

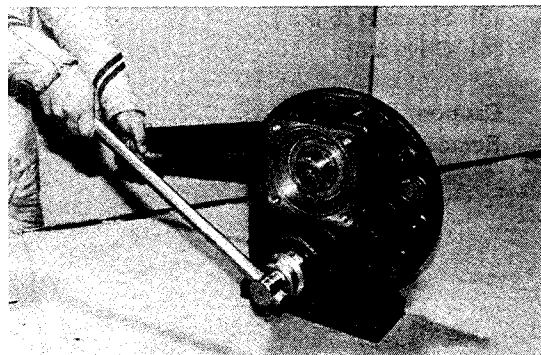
Brake the seal cap for removal.



Seal Cap

SAE7-36

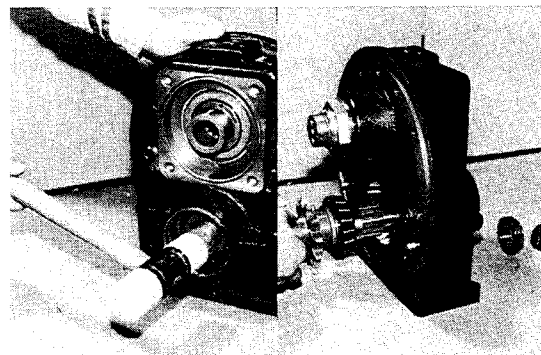
3. Remove the drive shaft.
 - (1) Unlock the lock nut.
 - (2) Lock nut (width across flat: 50 mm)



Lock Nut

SAE8-2

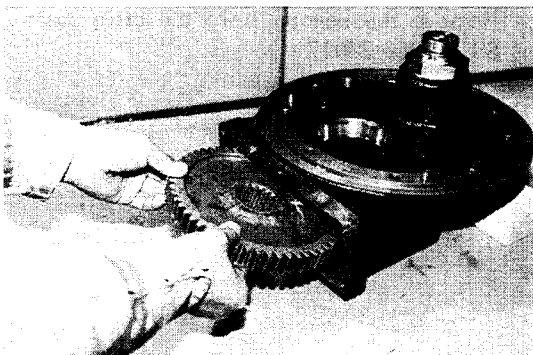
- (3) Bearing
- (4) Spacer
- (5) Drive shaft with bearing
- (6) Spacer



Drive Shaft with Bearing

SAE8-3, 4

4. Remove the drive gear.



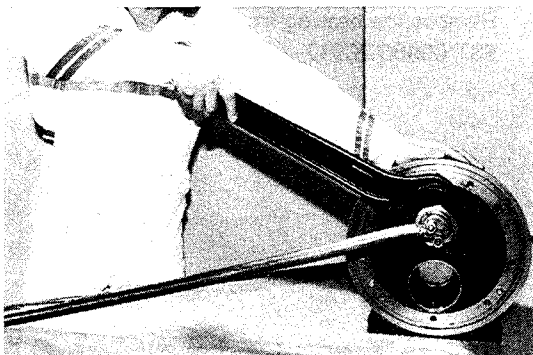
Driven Gear

SAE8-5

5. Remove the drive gear.
 (1) Unlock the lock nut.
 (2) Lock nut (width across flat: 67 mm)

Note:

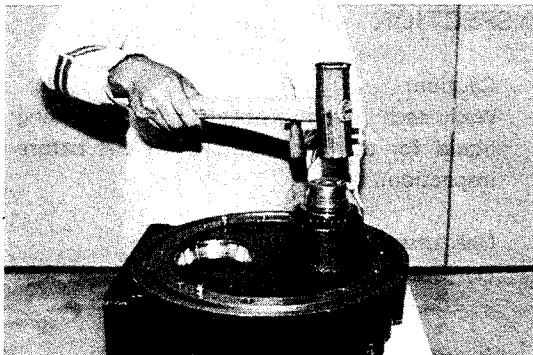
Use two service bolts (M12 x 1.25 pitch x about 50 mm (2 in.)) and remove with rotation stop as shown at right.



Lock Nut

SAE8-8

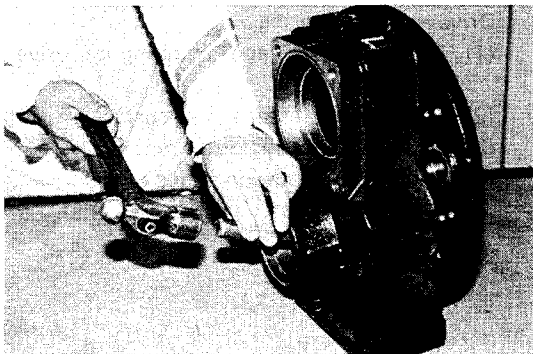
- (4) Drive gear with bearing
 (5) Oil seal
 (6) Bearing



Drive Gear with Bearing

SAE8-12

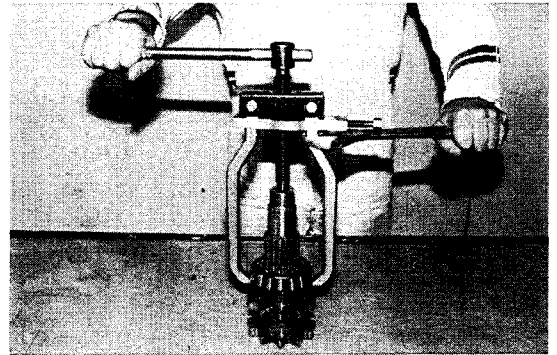
6. Remove the bearing outer race from the gear case.
 (1) Drive gear bearing outer race
 (2) Drive shaft bearing outer race



Bearing Outer Race

SAE8-16

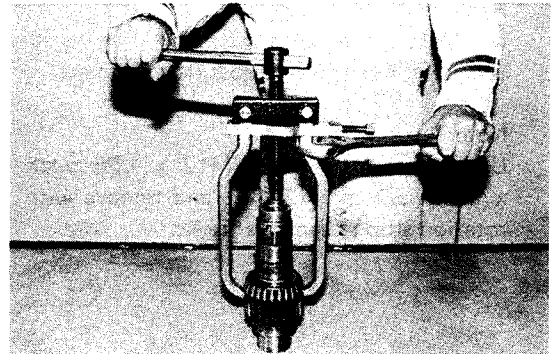
7. Remove the bearing from the drive shaft.
SST 09950-20017



Drive Shaft Bearing

SAE8-17

8. Remove the bearing from the drive gear.
SST 09950-20017



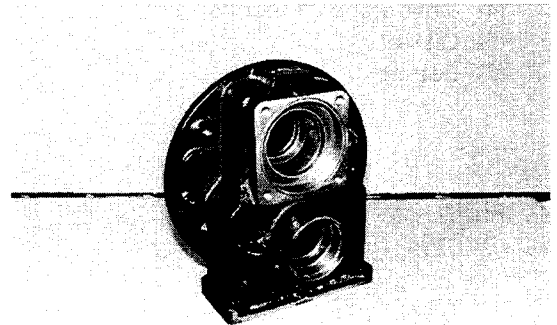
Drive Gear Bearing

SAE8-18

INSPECTION

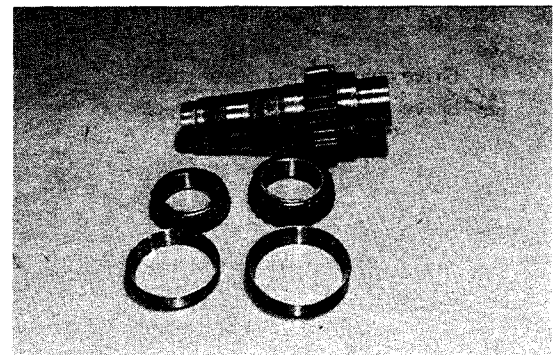
Caution:
Wash each part thoroughly with a washing liquid for complete removal of dirt before inspection.

1. Gear case
 - (1) Crack and damage
2. Drive gear and bearing
 - (1) Damage, crack and chipping of drive gear
 - (2) Damage on oil seal sliding surface
 - (3) Damage of bearing outer race
 - (4) Damage and rotation status of roller



Gear Case

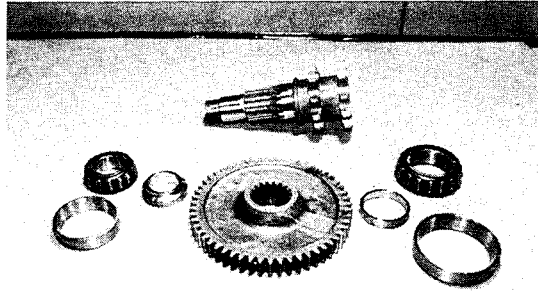
SAE8-32



Drive Gear and Bearing

SAE8-27

3. Drive shaft, driven gear and bearing
 - (1) Damage, crack and chipping of drive shaft
 - (2) Damage, crack and chipping of driven gear
 - (3) Damage of bearing outer race
 - (4) Damage and rotation status of roller
 - (5) Damage of spacer

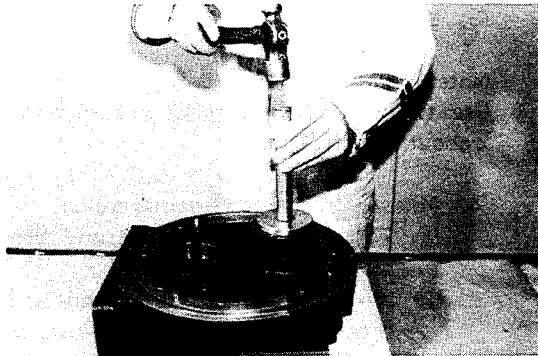


Drive Shaft, Driven Gear and Bearing

SAE8-30

ASSEMBLY

1. Install the drive gear bearing outer race to the gear case.
SST 09608-35014



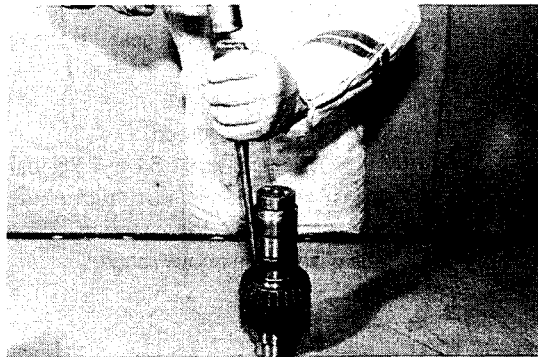
Drive Gear Bearing Outer Race

SAE8-34

2. Install the bearing to the drive gear.

Caution:

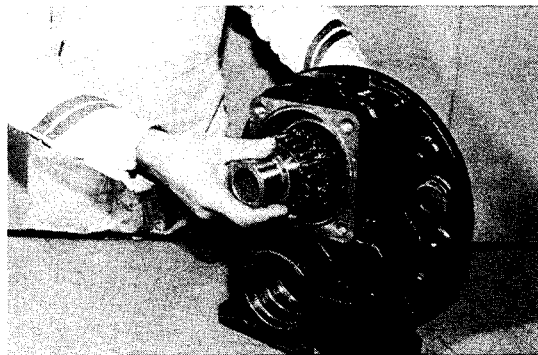
- Alternately and evenly tap the whole side circumference of the bearing inner race for assembly.
- Carefully protect the bearing from being damaged.



Drive Gear Bearing

SAE9-1

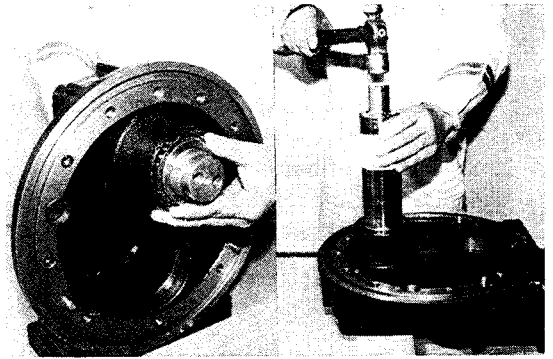
3. Install the drive gear with bearing to the gear case.
 - (1) Drive gear with bearing



Drive Gear with Bearing

SAE9-2

- (2) Bearing
SST 09316-60010



Bearing

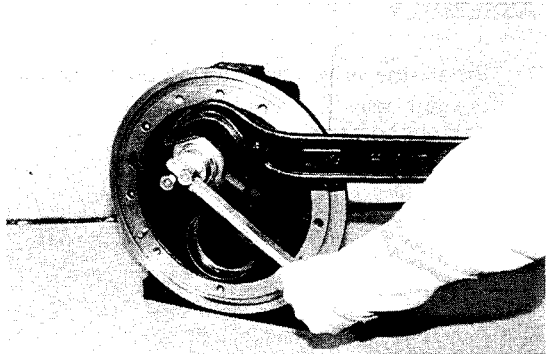
SAE9-3, 4

- (3) Lock nut

Note:

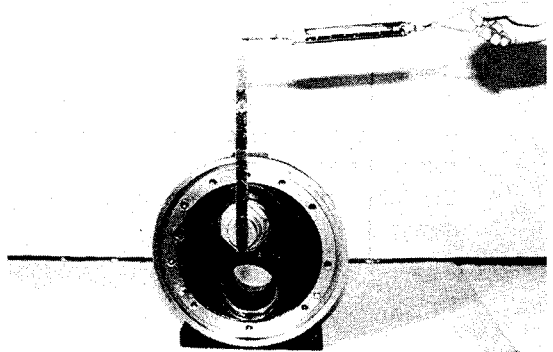
Use two service bolts (M12 x 1.25 pitch x about 50 mm (2 in.))

- (4) Adjust the drive gear bearing preload.
- ① Tighten the lock nut once, and then loosen it.
 - ② Manually tighten the lock nut and check that the drive gear rotates smoothly.
 - ③ Set the SST to the drive gear and set a spring scale to the SST. Measure the drive gear starting force.
SST 09381-42800-71
Starting force (preload):
0.7 ~ 0.8 kg (1.54 ~ 1.76 lbs)
 - ④ Adjust the lock nut tightening degree so that the starting force falls within the above range.



Lock Nut

SAE9-6



Measuring the Preload

SAE9-9

4. Install the drive shaft bearing outer races to the gear case.

Large: SST 09410-30200-71

Small: SST 09608-35014

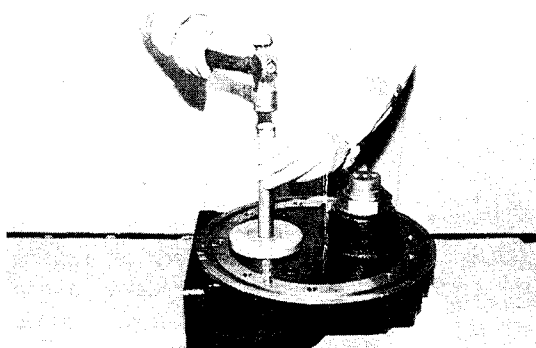
5. Install the bearing to the drive shaft.

Note:

Install in the same way as the drive gear bearing installation method.

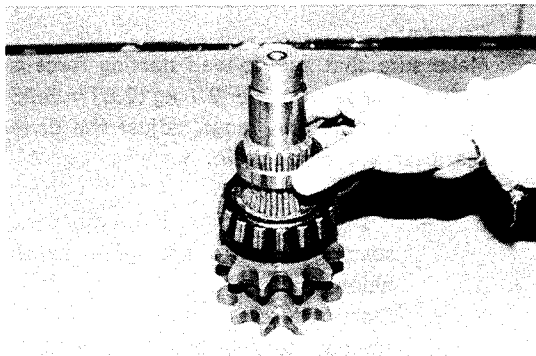
6. Install the drive shaft with bearing and driven gear to the gear case.

- (1) Install the spacer to the drive shaft with bearing.



Drive Shaft Bearing Outer Race

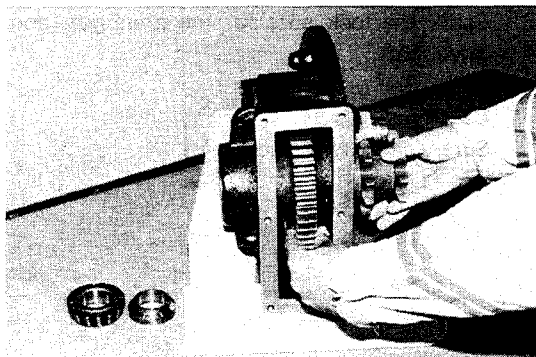
SAE9-10



Spacer

SAE9-13

- (2) Drive shaft with bearing and driven gear



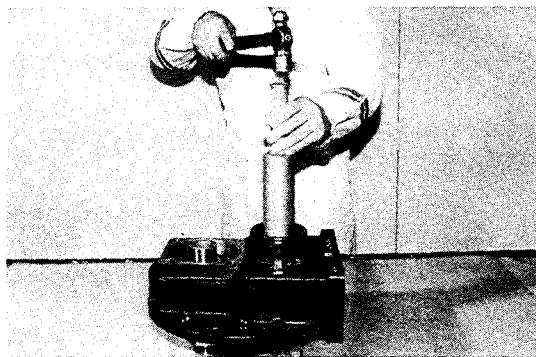
Drive Shaft and Driven Gear

SAE9-16

- (3) Spacer

- (4) Bearing

SST 09370-20270-71



Bearing

SAE9-18

- (5) Lock nut
- (6) Adjust the drive shaft bearing preload.
 - ① Tighten the lock nut once, and then loosen it.
 - ② Manually tighten the lock nut, and make sure that the drive shaft rotates smoothly.
 - ③ Set the SST to the sprocket portion of the drive shaft, and set a spring scale to the SST. Measure and record the drive shaft no-load starting force.
SST 09382-42800-71

Caution:

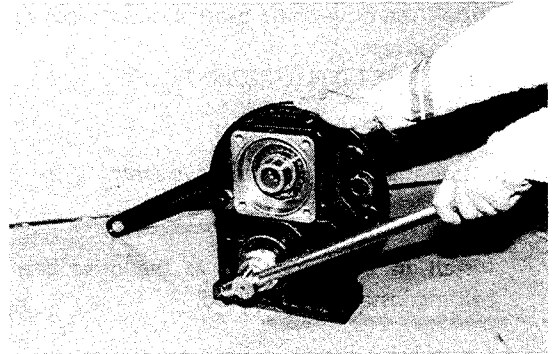
Make sure that the no-load starting force is within a range of 1.3 ~ 2.7 kg (2.87 ~ 5.95 lbs). If outside the range, adjust the drive gear bearing preload again.

- ④ Tighten the lock nut to adjust the starting force to the value shown below.
Starting force:
no-load starting force + 0.5 ~ 1.0kg
(1.10 ~ 2.20 lbs)

7. Caulk the lock nuts for the drive gear and drive shaft.

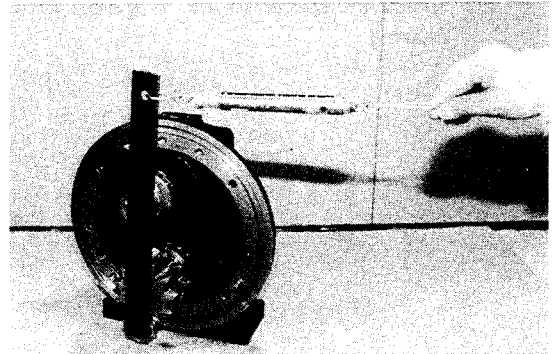
Caution:

Surely caulk two places.



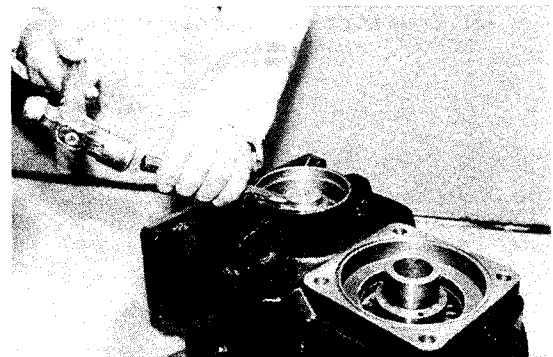
Lock Nut

SAE8-19



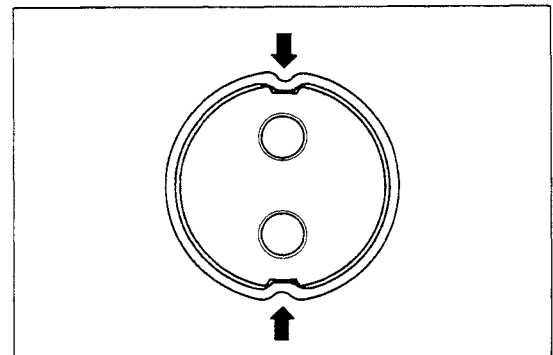
Measuring the Starting Force

SAE8-22



Caulking the Lock Nut (1)

SAE8-24



Caulking the Lock Nut (2)

SAE8-21

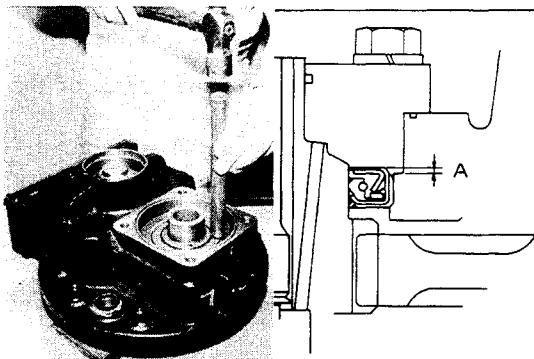
8. Install the oil seal.

Caution:

- Pay attention to the oil seal mounting direction.
 - Coat MP grease thinly on the oil seal lip and outer circumference.
 - Excessive driving may cause the oil seal to be damaged, so carefully operate.
- See the figure at right.

A = 1 mm (0.04 in) 1986. 3 ~ 1991. 2

A = 1.5 mm (0.059 in) 1991. 2 ~



Oil Seal

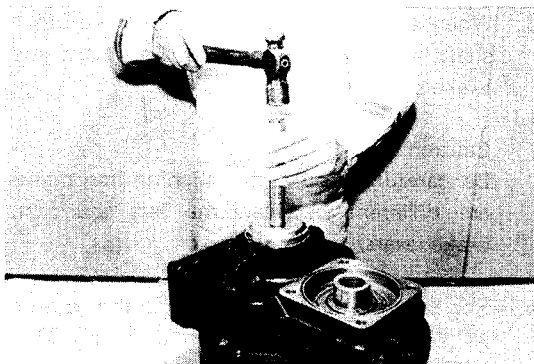
SAE9-25, SAES22

9. Install the seal cap.

Caution:

Apply Herme Seal or the equivalent on the outer circumference of the seal cap before installation.

SST 09608-35014

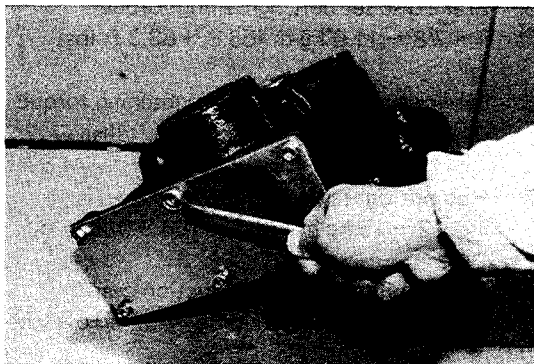


Seal Cap

SAE9-26

10. Install the front cover.

- (1) Gasket
 - (2) Front Cover
 - (3) Set bolts (6 pcs.)
- T = 1.0 ~ 1.6 kg-m (7.2 ~ 11.6 lbs)



Front Cover

SAE9-27

INSTALLATION

The installation procedure is the reverse of the removal procedure.

<Important points for drive unit installation>

1. Coat MP grease on the O-ring for the gear case before installation.

2. The tightening torque for the chain guide, brake block and drive unit set bolts are as follows:

$T = 5.8 \sim 8.8 \text{ kg-m (41.9} \sim 63.5 \text{ ft-lbs)}$

3. When installing the brake lever to the brake shaft, align the brake lever line mark and brake shaft line mark.

Caution:

Be careful because the aligning line marks are different between the left and right brake levers.

4. For HST motor installation, see the caution in "HYDROSTATIC TRANSMISSION—HST Motor Assy" section.

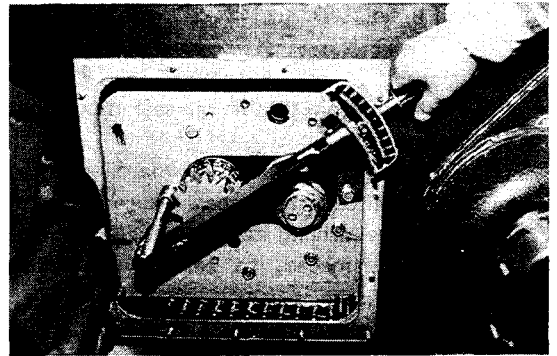
5. Brake disc set bolt tightening torque
 $T = 7.8 \sim 11.6 \text{ kg-m (56.3} \sim 83.3 \text{ ft-lbs)}$

6. Service hole cover cap nut tightening torque
 $T = 1.0 \sim 1.6 \text{ kg-m (7.2} \sim 11.6 \text{ ft-lbs)}$

7. Hub nut tightening torque
 $T = 12 \sim 15 \text{ kg-m (86.6} \sim 108.3 \text{ ft-lbs)}$

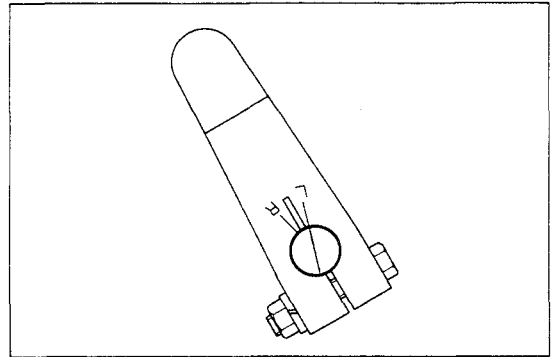
8. Supply oil to the final reduction gear.
 - (1) Install the drain plug and remove the filler plug.
 - (2) Supply oil until it overflows from the filler plug hole.

9. Bleed air from the hydraulic circuit.
See "HYDRAULIC SYSTEM—Bleeding Air from Hydraulic Circuit" section for the air bleeding procedure.



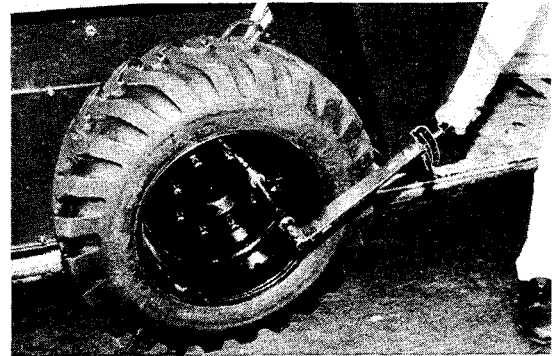
Tightening the Drive Unit Set Bolts

SAE11-35



Brake Lever

SAE24

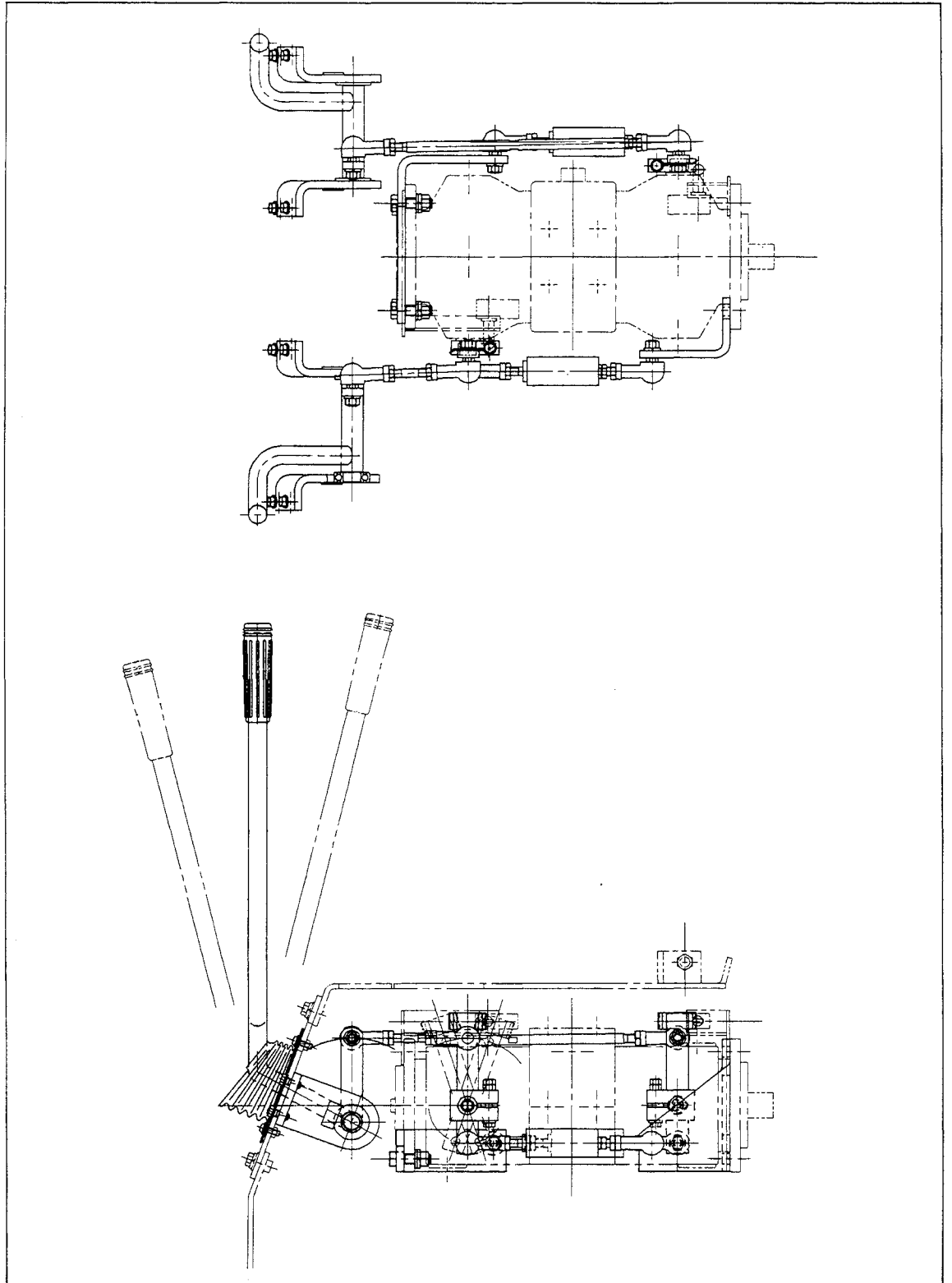


Tightening the Hub Nut

SAE12-33

STEERING

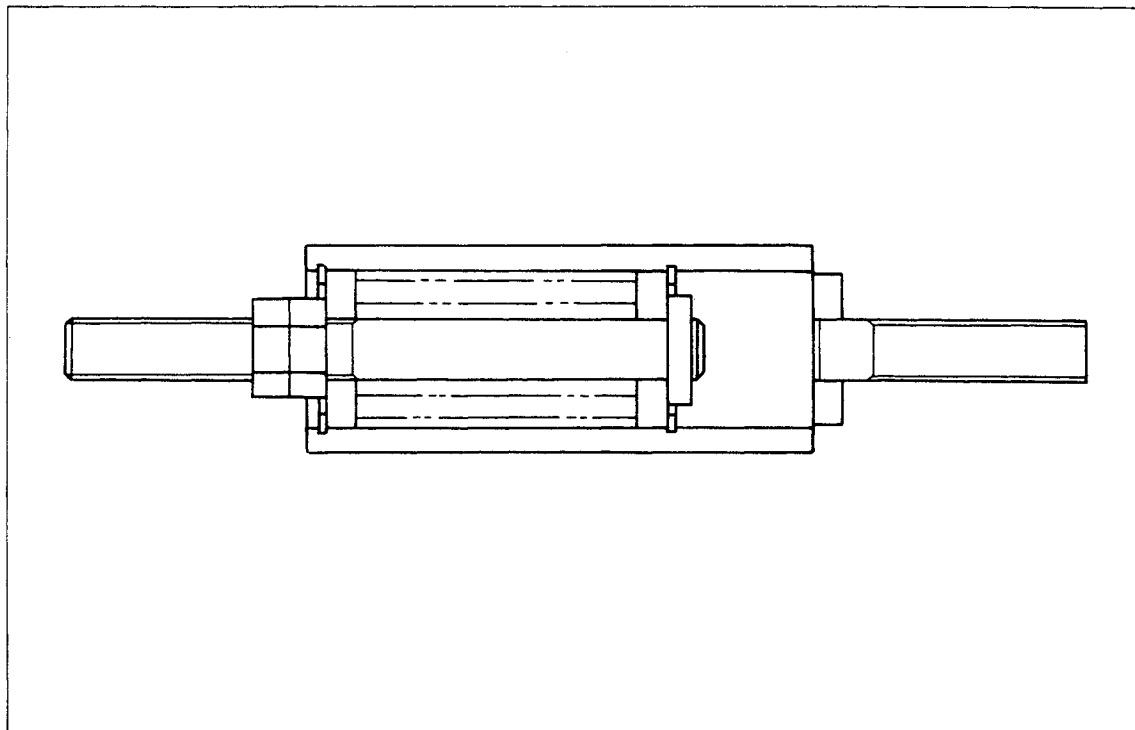
	Page
DESCRIPTION	4-2
SPECIFICATIONS	4-3
COMPONENTS	4-4
STEERING CONTROL LEVER	4-5
SPRING HOLDER ASSEMBLY	4-7
STEERING NEUTRAL ADJUSTMENT	4-9

DESCRIPTION

Steering Control Lever

SAEL10

Spring Holder



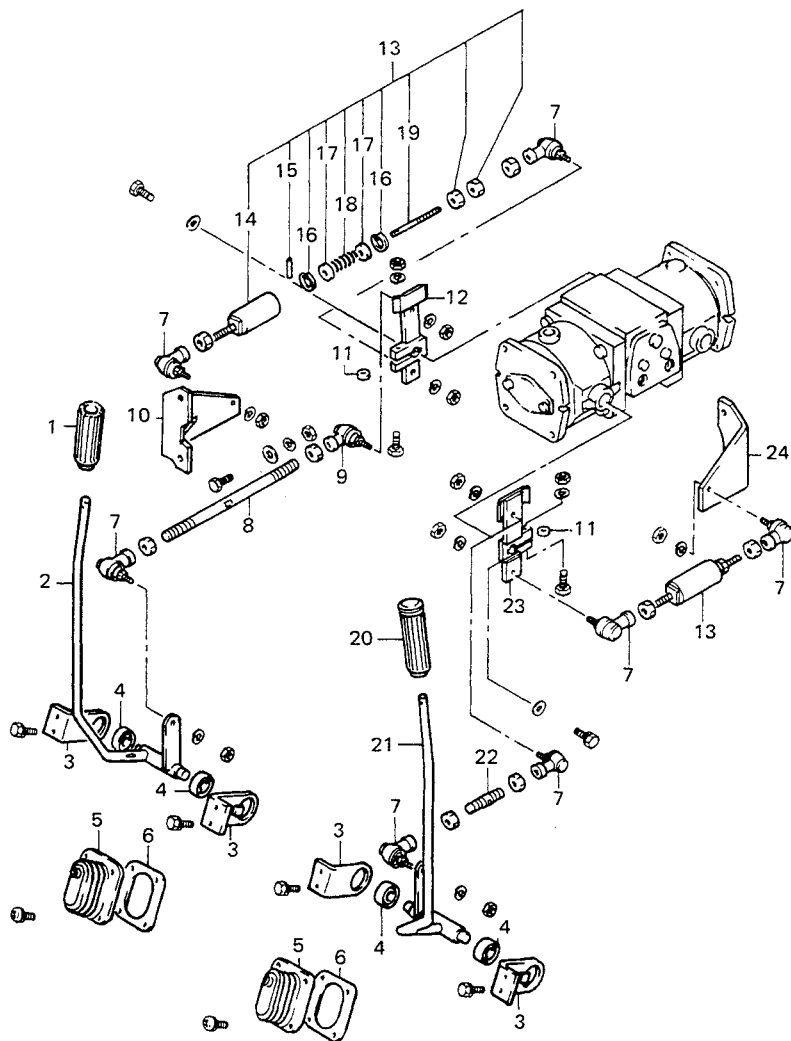
Spring Holder Sectional View

SAES56

SPECIFICATIONS

Steering type		Skid steering system
Spring holder	Free length of spring	64 mm (2.52 in)
	Installed length of spring	46.5 mm (1.83 in)
	Spring installation load	27 kg (59.5 lbs)
	Double nut tightening torque	1.5 ~ 2.5 kg-m (10.8 ~ 18.1 ft-lbs)

COMPONENTS



- | | |
|------------------------------|----------------------------|
| 1. Lever grip RH | 13. Spring holder assembly |
| 2. Steering lever RH | 14. Case |
| 3. Lever bracket | 15. Pin |
| 4. Bearing | 16. Snap ring |
| 5. Boot | 17. Spacer |
| 6. Boot plate | 18. Spring |
| 7. Connecting rod end No. 1 | 19. Rod |
| 8. Steering rod RH | 20. Lever grip LH |
| 9. Connecting rod end No. 2 | 21. Steering lever LH |
| 10. Spring holder bracket RH | 22. Steering rod LH |
| 11. Spacer | 23. Pump lever LH |
| 12. Pump lever RH | 24. Spring holder bracket |

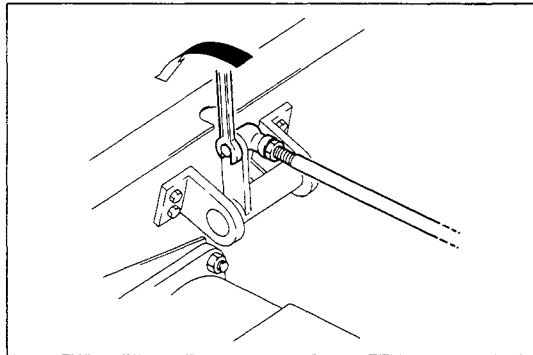
Steering Control Lever Components

SAEM44

STEERING CONTROL LEVER

REMOVAL

1. Disconnect the steering link
 - (1) Steering link RH
 - (2) Steering link LH
2. Disconnect the wiring. (RH only)



Disconnecting the Steering Link

SAES58

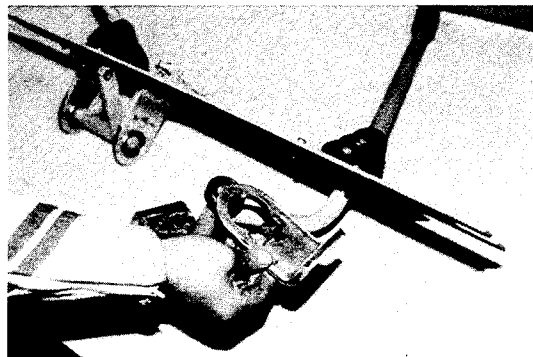
3. Remove the front cover with steering lever.
 - (1) Set bolts (6 pcs)
 - (2) Front cover with lever



Front Cover with Lever

SAE44-3

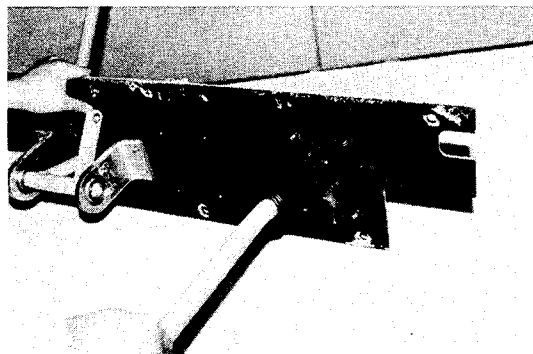
4. Remove the steering lever from the front cover.
 - (1) Set bolt
 - (2) Lever bracket



Lever Bracket

SAE44-5

- (3) Steering lever with bearing
- (4) Bearing



Steering Lever

SAE44-7

INSTALLATION

The installation procedure is the reverse of the removal procedure.

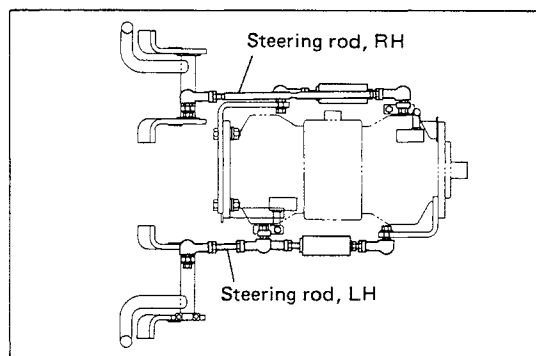
Caution:

- Adjust the length of the steering rods so that the lower parts of the steering levers become vertical to the frame as viewed from the side.

Also make adjustment so that the lever plays at the neutral position in the forward and backward directions become almost equal.

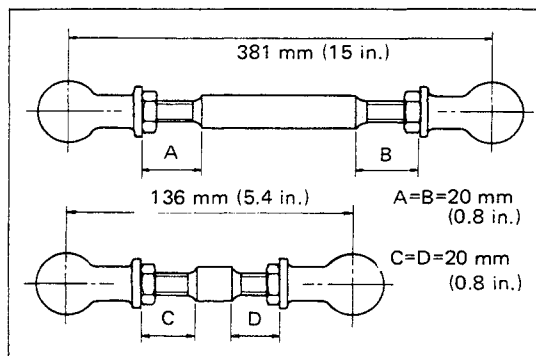
- Installed steering rod link dimensions
Install each steering rod so that the center-to-center distance between threaded parts of the connecting rod ends becomes as follows:
RH 381 mm (15 in) (reference)
LH 136 mm (5.4 in) (reference)

However, the screwed-in lengths of the steering rods on the left and right shall be equal.



Adjusting the Steering Lever Position

SAES57



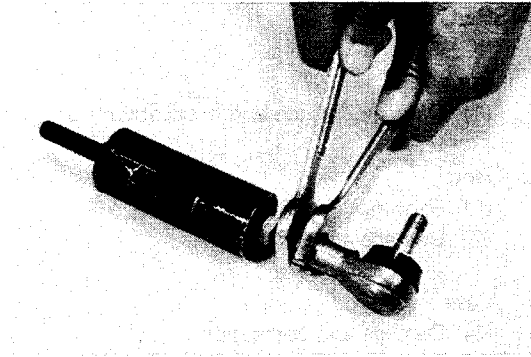
Connecting Rod Link Assembling Dimensions

SAES58

SPRING HOLDER ASSEMBLY

DISASSEMBLY

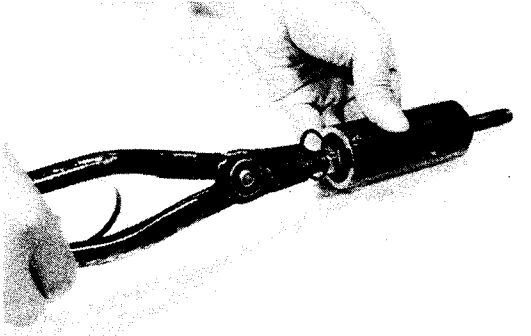
1. Remove the connecting rod end.
 - (1) Loosen the lock nut.
 - (2) Connecting rod end.



Connecting Rod End

SAD54-22

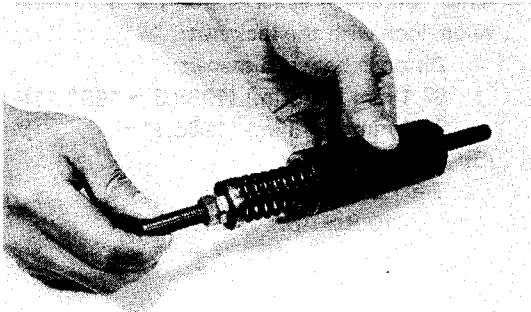
2. Remove the snap ring.



Snap Ring

SAD55-9

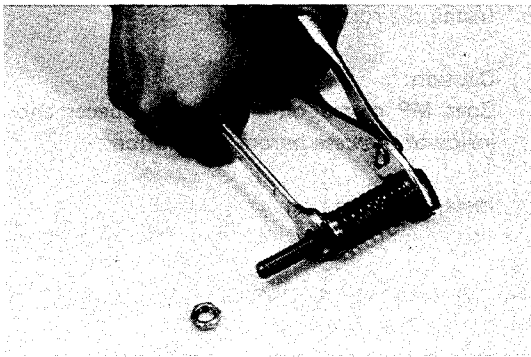
3. Extract the rod with the spring.



Extracting the Rod

SAD55-11

4. Remove the spring from the rod.
 - (1) Lock not
 - (2) Nut
 - (3) Spacer
 - (4) Spring
 - (5) Spacer

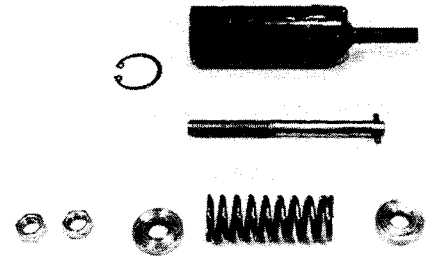


Spring

SAD55-20,15

INSPECTION

1. Spring
 - (1) Damage, fatigue and breakdown
2. Rod
 - (1) Bending
 - (2) Damage at threading
3. Case
 - (1) Damage and correction
4. Spacer
 - (1) Damage



Spring Holder

SAD55-18

ASSEMBLY

1. Install the spring to the rod.
 - (1) Spacer
 - (2) Spring
 - (3) Spacer
 - (4) Nut

Note:

After tightening the nut to make the distance between spacers to the following value, lock with the lock nut:

Distance between spacers:

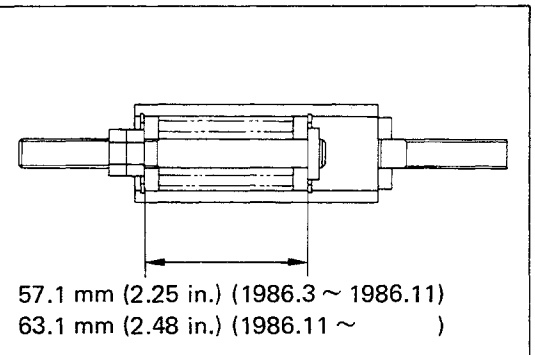
57.1 mm (2.25 in.) (1986.3 ~ 1986.11)

63.1 mm (2.48 in.) (1986.11 ~)

- (5) Lock nut

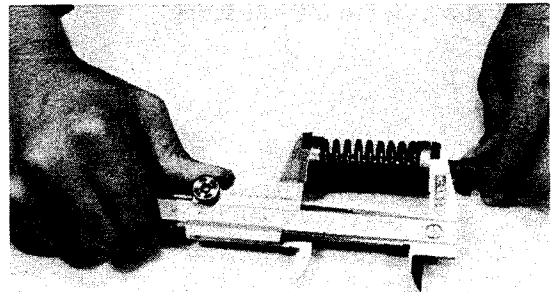
T = 1.5 ~ 2.5 kg-m

(10.8 ~ 18.1 ft-lbs)



Spring (1)

SAES56



Spring (2)

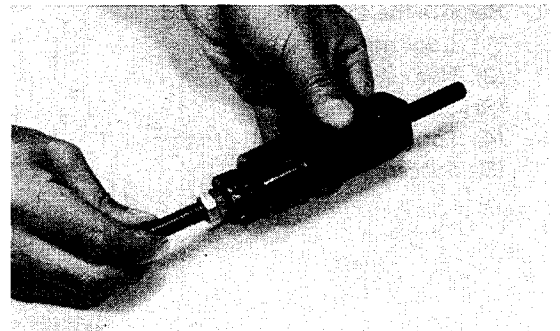
SAD55-21

2. Install the rod with spring.

Caution:

Coat MP grease on the spring, spacer and inside of the case before installation.

3. Install the snap ring.



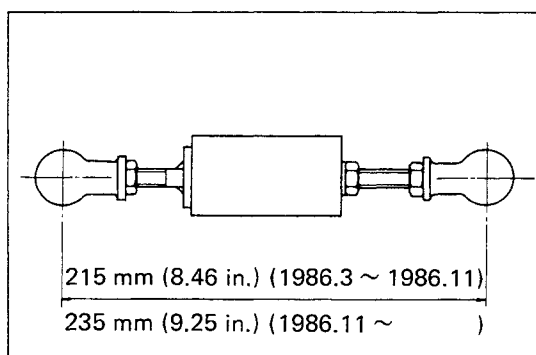
Rod with spring

SAD55-23

4. Install the connecting rod ends.

Reference:

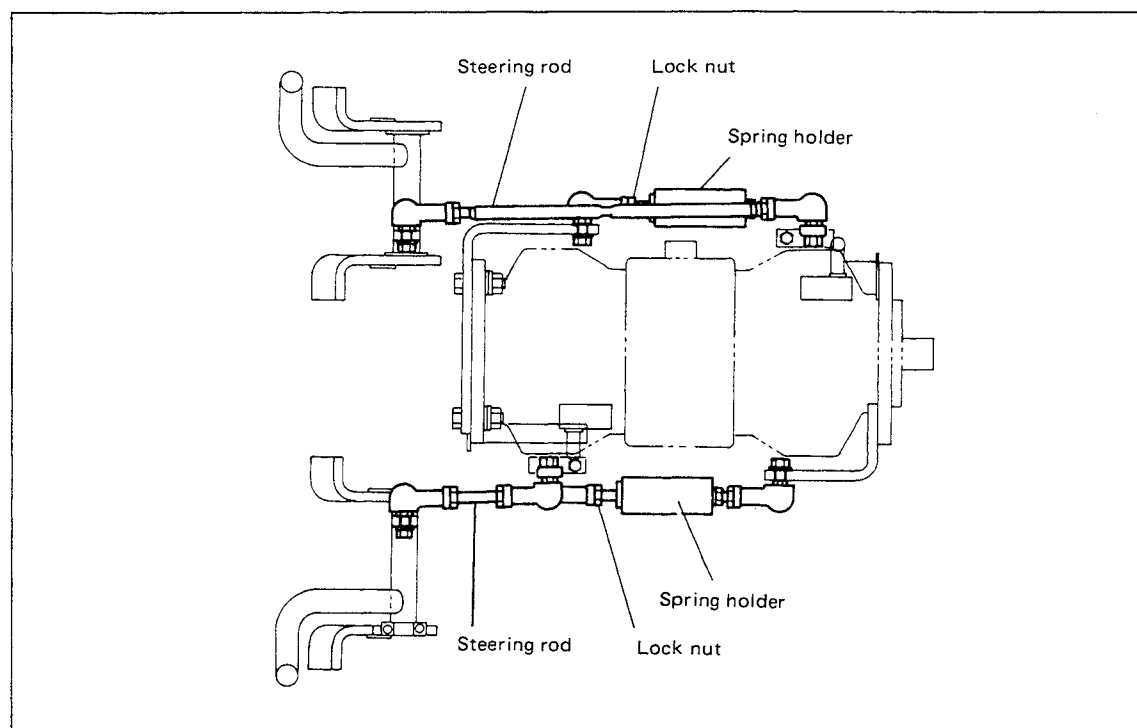
Install the rod ends so that the distance between the centers of rod end bolts becomes the value shown right. See the figure at right for the screwing-in amount. Temporarily tighten the lock nuts.



Connecting Rod End

SAES59

STEERING NEUTRAL ADJUSTMENT



Adjusting the Neutral Position of Steering

SAES57

Reference:

Make adjustment with the vehicle jacked up, frame supported by stands and wheels off the ground.

1. Warm up the engine at the lowest possible idling speed.
2. Gradually raise the engine speed and check if the wheels start to rotate. If they rotate, make necessary adjustment as follows:
 - (1) Disconnect the steering rod link.
 - (2) Loosen the lock nut for the connecting rod end on the spring holder case side.

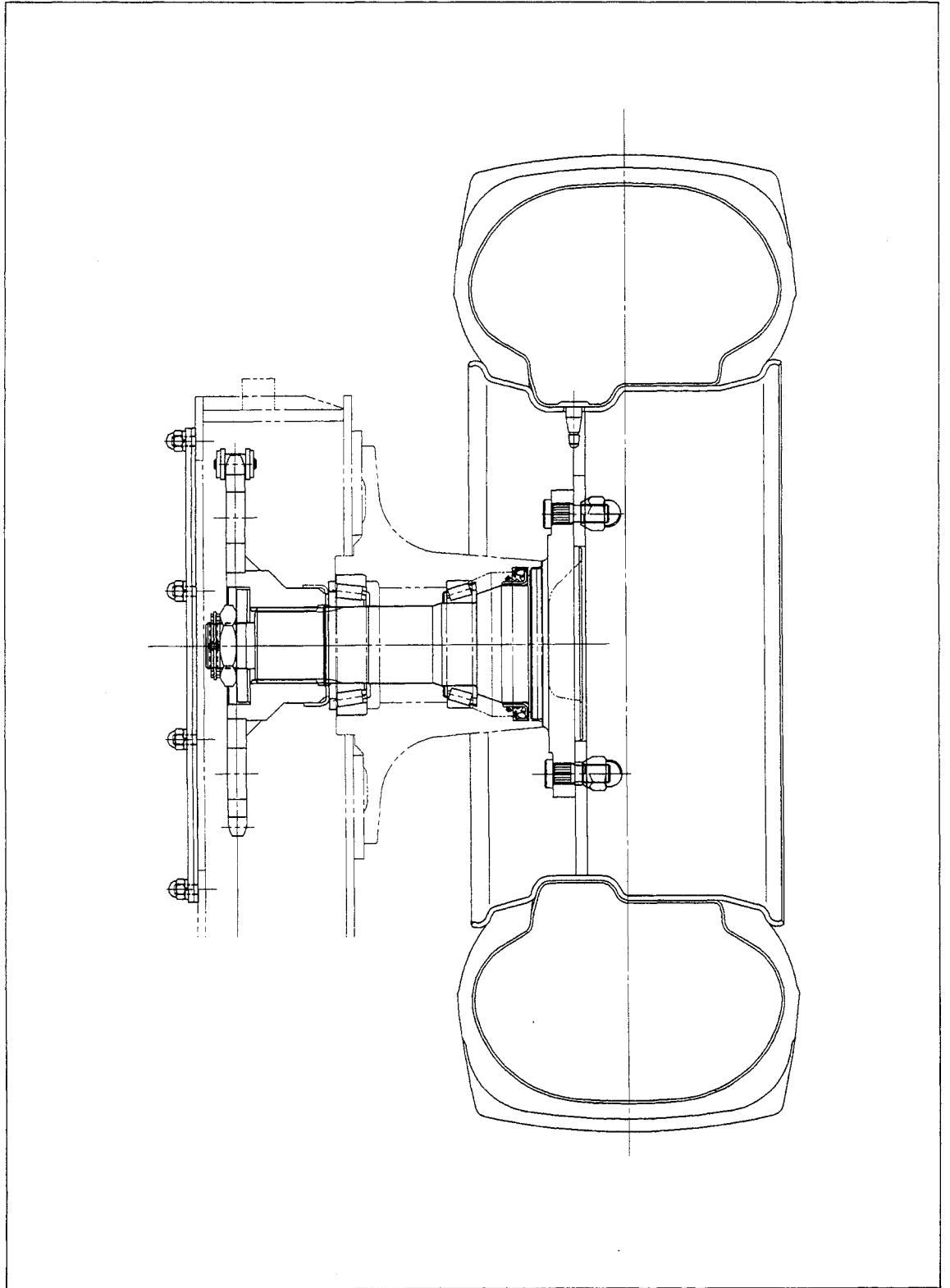
- (3) If right wheel rotates forward
Turn the spring holder case RH, and decrease the distance between the connecting rod ends (screwing in toward from the rod ends).
 - (4) If right wheel rotates backward
Turn the spring holder case RH, and increase the distance between the connecting rod ends (screwing out further the rod end).
 - (5) If left wheel rotates forward
Turn the spring holder case and increase the distance between the connecting rod ends.
 - (6) If left wheel rotates backward
Turn the spring holder case and decrease the distance between the connecting rod ends.
3. Raise the engine speed to the maximum level and check if wheels start to rotate. If they rotate, carry out fine adjustments as shown in 2 above.
 4. After adjustment, tighten lock nut for the connecting end rod.
 5. Connecting the steering rod link.
 6. Adjust the steering control lever positions.

Note:

See the "Steering Control Lever Installation" section.

AXLE

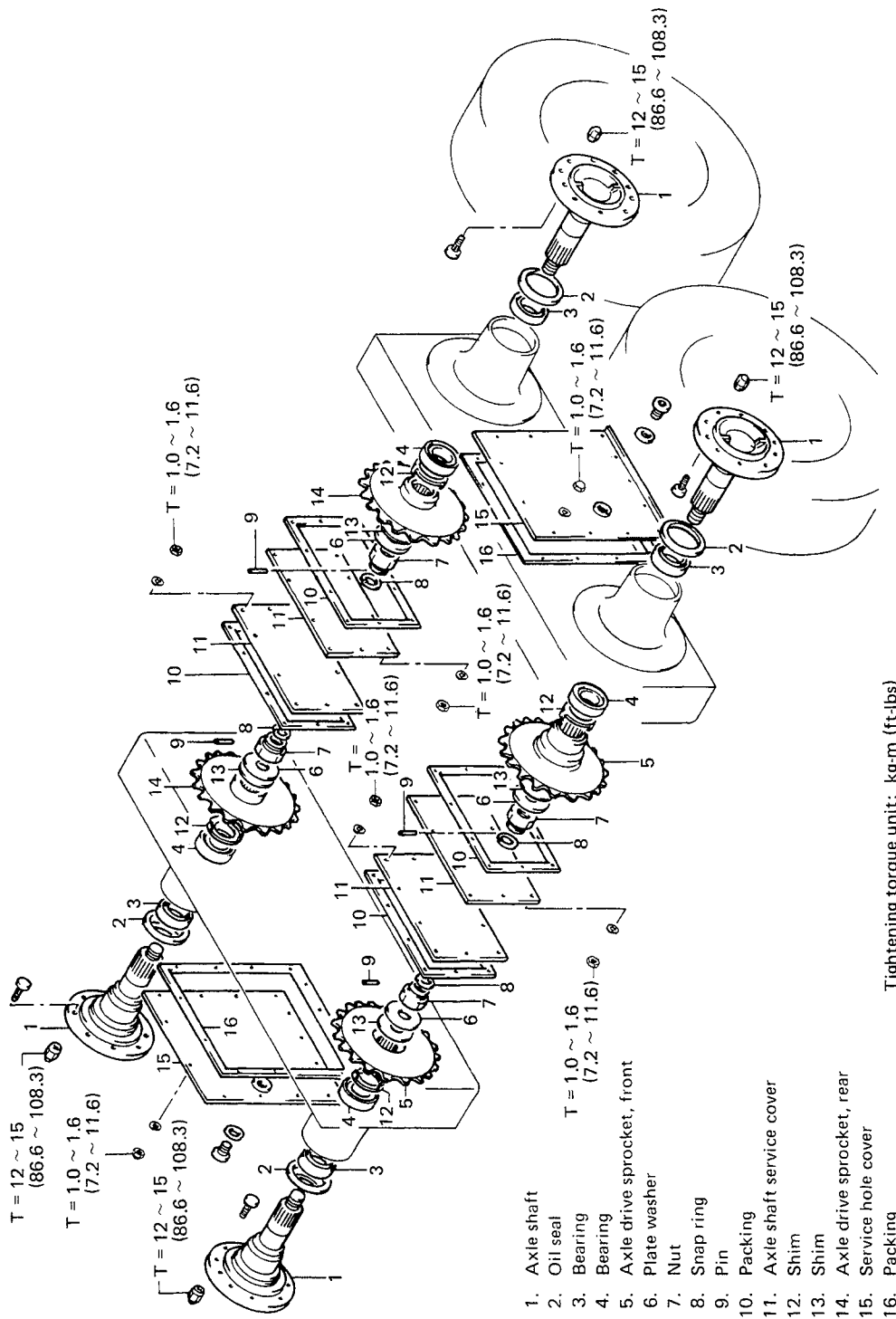
	Page
DESCRIPTION	5-2
COMPONENTS	5-3
SPECIFICATIONS AND SERVICE STANDARDS	5-4
FRONT AXLE	5-5
REAR AXLE	5-14

DESCRIPTION

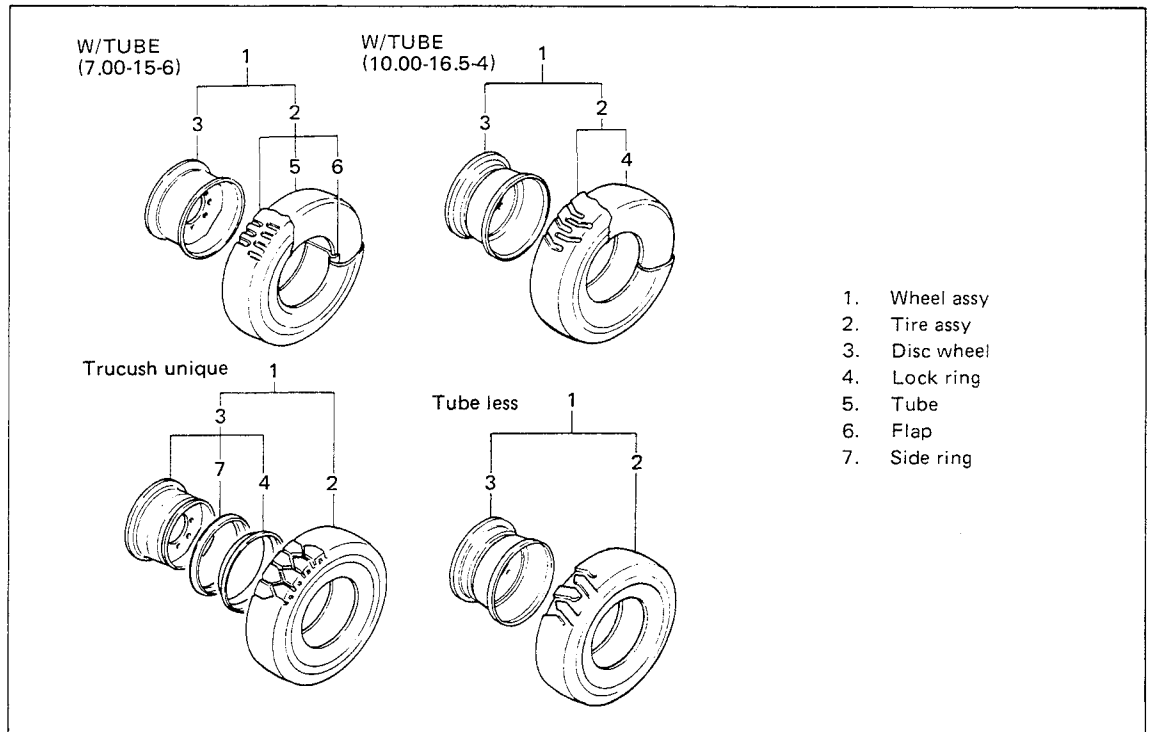
Axle Sectional View

SAEM35

COMPONENTS



Tightening torque unit: kg-m (ft-lbs)



Wheel Components

SAEM36

SPECIFICATIONS AND SERVICE STANDARDS

Axle shaft type		1/2 floating shaft tube type
Axle hub nut tightening torque		kg-m (ft-lbs)
* ¹ Axle shaft starting force		kg (lbs)
Wide tire (STD)	Tire size	10.00 – 16.5 – 4PR(OR) (with tube)
	Rim size	8.25 x 16.5 15°DC
	Inflation pressure	kg/cm ² (psi)
Wide tire (OPT)	Tire size	10.00 – 16.5 – 4PR(OR)
	Rim size	8.25 x 16.5 15°DC
	Inflation pressure	kg/cm ² (psi)
Narrow tire (OPT)	Tire size	7.00 – 15 – 6PR(OR)
	Rim size	5.5 F x 15 SDC
	Inflation pressure	kg/cm ² (psi)
Unique tire (OPT)	Tire size	7.00 – 15
	Rim size	5.5 F x 15 SDC
Trukush tire (OPT)	Tire size	7.00 – 15
	Rim size	5.5 F x 15 SDC

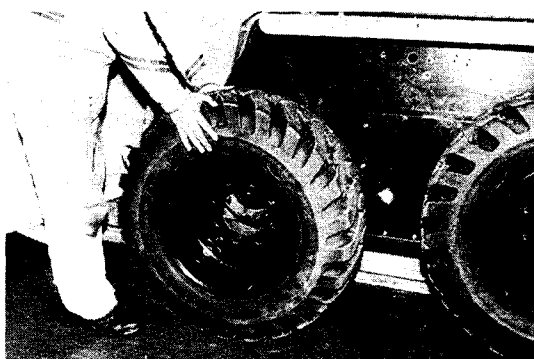
*1: The value measured at the hub bolt is shown here.

*2: A represents the no-load starting force with the nut tightened manually.

FRONT AXLE

DISASSEMBLY

1. Remove the front wheels.
 - (1) Loosen the hub nuts.
 - (2) Lower the bucket until the front wheels float above the floor and support the frame with stands placed underneath.
 - (3) Hub nuts (8 pcs. on one side)
 - (4) Front wheels



Front wheel

SAE2-31

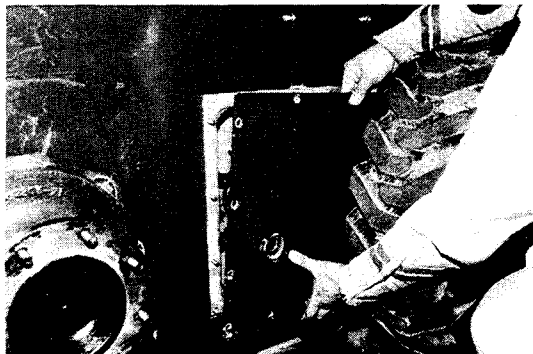
2. Drain oil from the final reduction gear.
 - (1) Prepare an oil receiving container.
 - (2) Drain plug



Draining Oil from Final Reduction Gear

SAE2-33

3. Remove the service hole cover.
 - (1) Cap nuts (13 pcs.)
 - (2) Service hole cover



Service Hole Cover

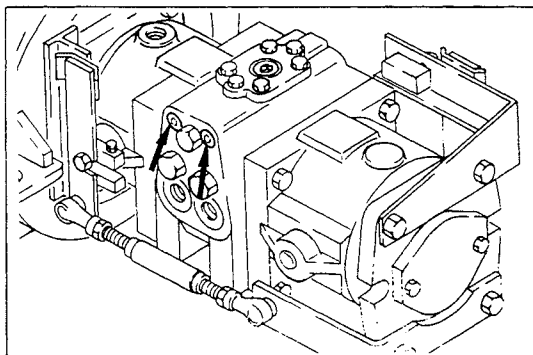
SAE2-36

4. Disconnect the front drive chain.
 - (1) Loosen the HST pump bypass valve.

Caution:

For chain LH: Loosen the front valve.

For chain RH: Loosen the rear valve.



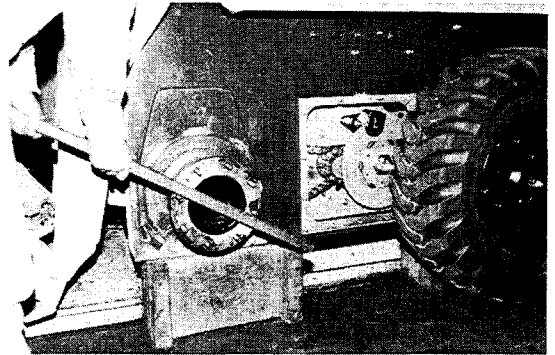
Bypass Valve

SAES19

- (2) Rotate the front axle shaft to bring the chain joint link to a place allowing easy disconnection.

Caution:

Apply a wooden bar to hub bolts to rotate the axle shaft.

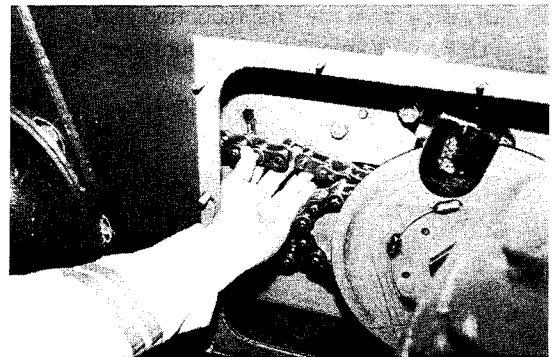


Rotating the Axle Shaft

SAE3-22

- (3) Disconnect the front drive chain.
 - ① Cotter pin
 - ② Joint link

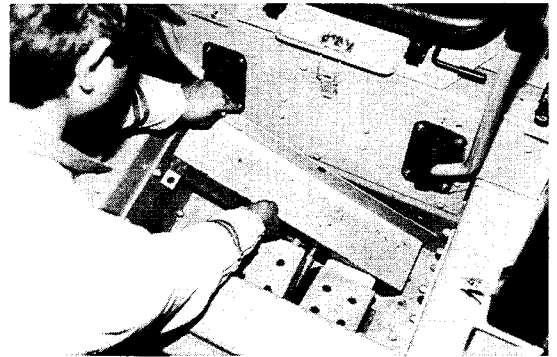
5. Remove the front drive chain.



Disconnecting the Drive Chain

SAE3-23

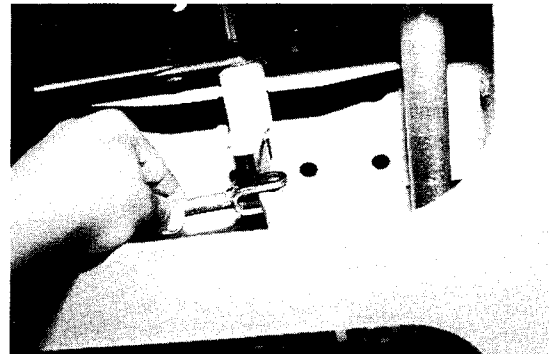
6. Remove the floor.
 - (1) Set bolts (5 pcs.)
 - (2) Floor



Floor

SAE3-19

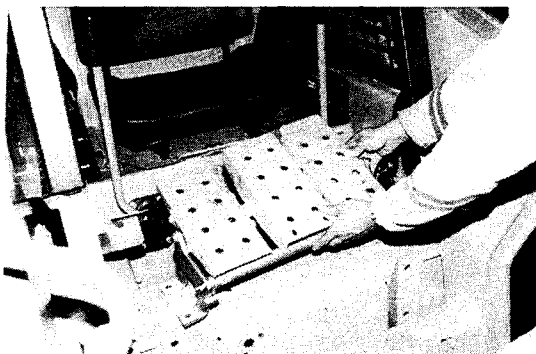
7. Remove the oil control valve pedal and link.
 - (1) Disconnect the control valve link (on pedal side).
 - ① Move the boot.
 - ② Cotter Pin
 - ③ Wahser
 - ④ Pin
 - (2) Disconnect the pedal lock link.



Disconnecting the Control Valve Link

SAE3-8

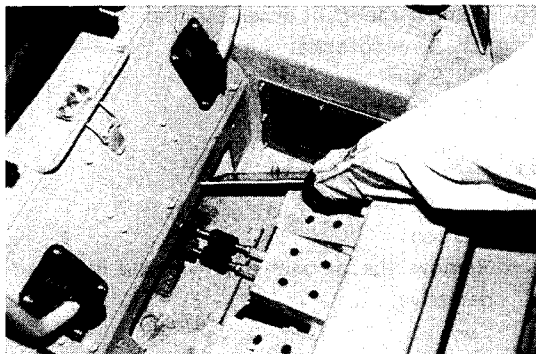
- (3) Set bolts (6 pcs.)
- (4) Pedal and link



Pedal and Link

SAE34-4

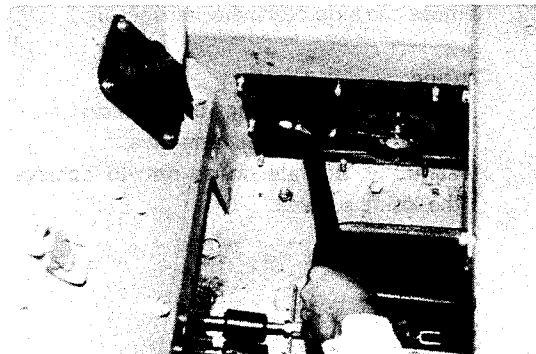
- 8. Remove the axle shaft service cover.
 - (1) Cap nuts (10 pcs.)
 - (2) Axle shaft service cover



Axle Shaft Service Cover

SAE3-21

- 9. Remove the front axle shaft.
 - (1) Snap ring
 - (2) Pin
 - SST 09700-30200-71



Pin

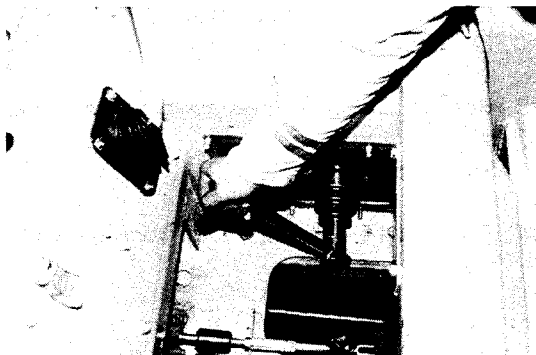
SAE3-29

- (3) Nut (width across flat: 55 mm)

Caution:

Apply a wooden bar to hub bolts to prevent the axle shaft from rotating.

- (4) Plate washer
- (5) Shim



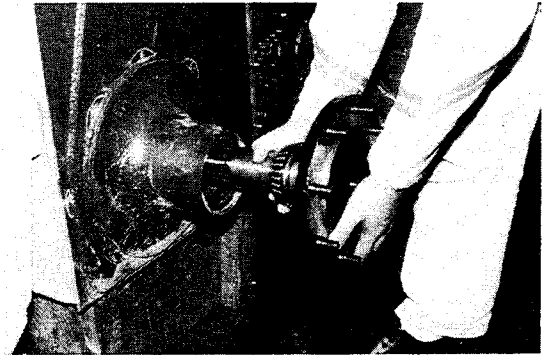
Nut

SAE3-30

(6) Front axle shaft with bearing

Caution:

Carefully extract the shaft so as not to damage the oil seal.



Front Axle Shaft

SAE3-32

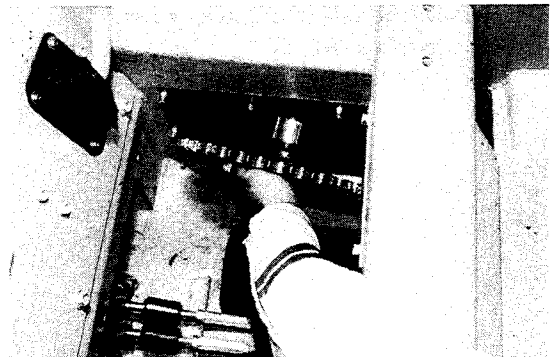
10. Remove the front drive sprocket.

- (1) Drive sprocket
- (2) Shim
- (3) Inner bearing

11. Remove the oil seal.

Caution:

Remove the oil seal only when it is judged defective.



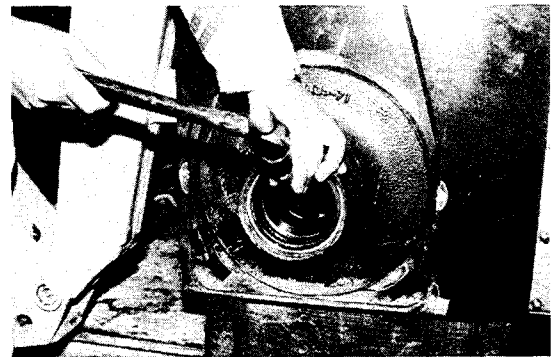
Front Drive Sprocket

SAE3-35

12. Remove the axle bearing outer races.

Caution:

- o Remove the bearing outer races only when they are judged defective.
- o Carefully operate so as not to damage the inside surface.



Bearing Outer Race

SAE4-2

- (1) Outer bearing outer race
- (2) Inner bearing outer race

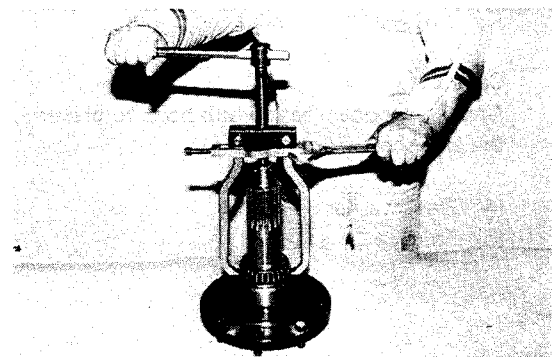
13. Remove the outer bearings from the axle shaft.

SST 09950-20017

14. Remove the oil seal shaft from the axle shaft.

Caution:

Remove the oil seal shaft only when it is judged defective.



Outer Bearing

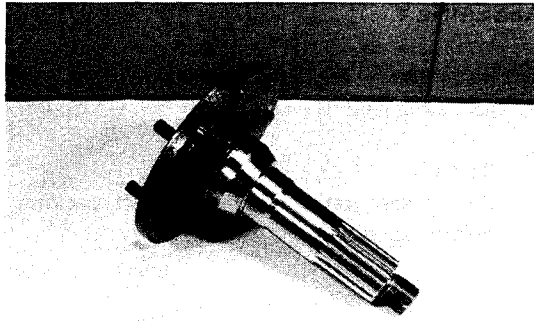
SAE4-4

INSPECTION

Caution:

Before inspection wash each part thoroughly with a washing liquid for perfect removal of dirt.

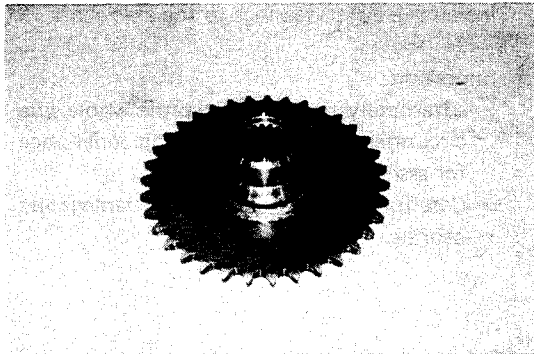
1. Axle shaft
 - (1) Crack and damage of shaft
 - (2) Crack, damage and wear of spline portion
 - (3) Damage and loosening hub bolts
 - (4) Damage of threaded portion



Axle Shaft

SAE34-5

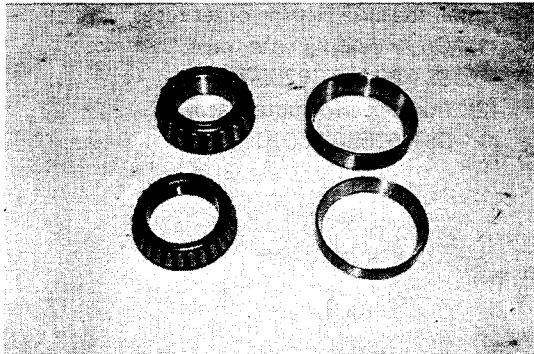
2. Axle drive sprocket
 - (1) Crack and damage of sprocket
 - (2) Crack, damage and wear of spline portion



Drive Sprocket

SAE5-2

3. Axle bearing
 - (1) Damage and wear of outer race
 - (2) Damage, wear and rotation status of rollers



Axle Bearing

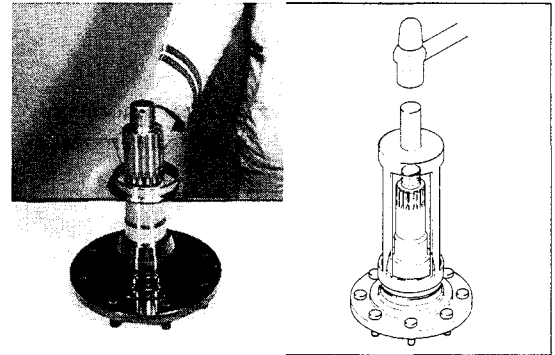
SAE5-4

ASSEMBLY

1. Install the oil seal shaft to the axle shaft.
SST 09421-42800-71

Caution:

Coat grease on the oil seal shaft packing before assembly.



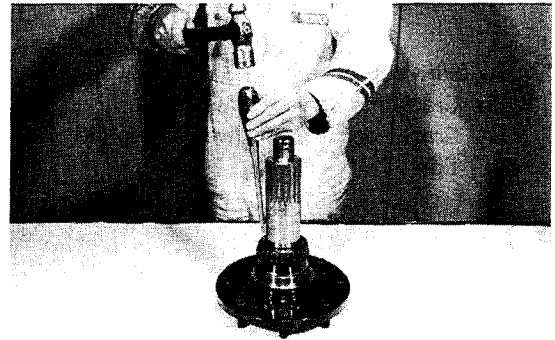
Oil Seal Shaft

SAE34-13,SAES48

2. Install the outer bearings to the axle shaft.

Important:

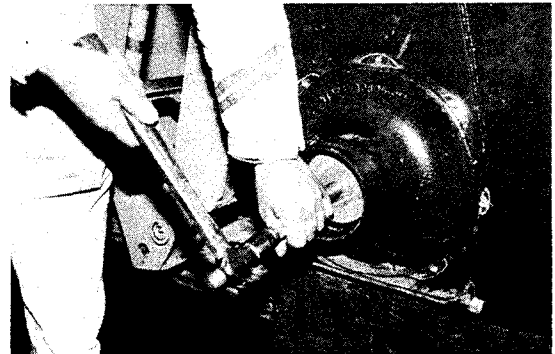
- Alternately and evenly tap the whole side circumference of the bearing inner race for assembly.
- Carefully operate so as not to damage the bearing.



Outer Bearing

SAE34-12

3. Install the axle bearing outer races.
 - (1) Outer bearing outer race
SST 09410-30200-71
 - (2) Inner bearing outer race
SST 09550-55010



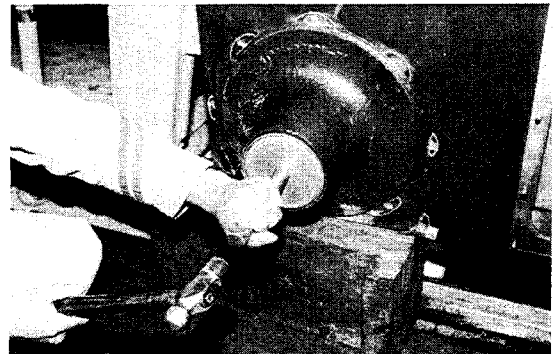
Outer Bearing Outer Race

SAE5-7

4. Install the oil seal.
SST 09320-10410-71

Caution:

Coat grease on the oil seal lip portion.



Oil Seal

SAE34-14

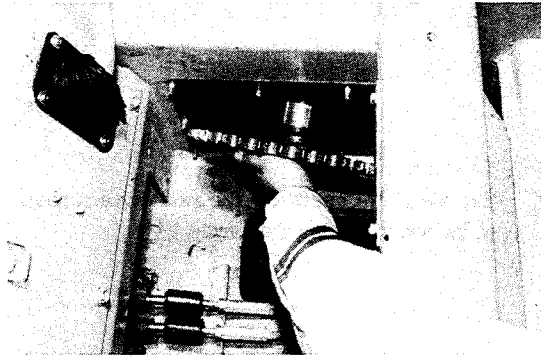
5. Install the axle drive sprocket and axle shaft.

- (1) Inner bearing
- (2) Shim
- (3) Axle drive sprocket
- (4) Axle shaft

Caution:

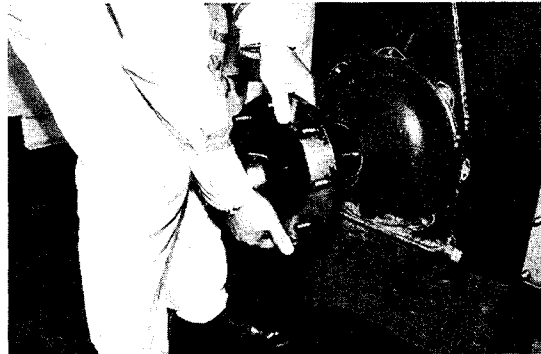
Carefully assemble so as not to damage the oil seal.

- (5) Shim
- (6) Plate washer
- (7) Nut



Axle Drive Sprocket

SAE3-35



Axle Shaft

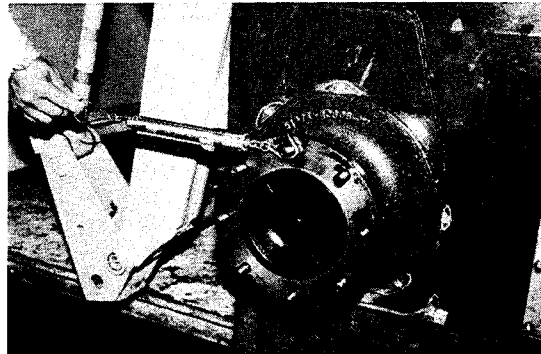
SAE5-13

(8) Adjust the axle bearing preload.

- ① Tighten the nut once and then loosen it.
- ② Manually tighten the nut and be sure that the axle shaft rotates smoothly.
- ③ Set a spring scale to a hub bolt, and measure and record the no-load starting force of the axle shaft.

Caution:

Check that the no-load starting force is in a range of 1.2 ~ 3.0 kg (2.6 ~ 6.6 lbs).



Starting Force Measurement

SAE5-16

- ④ Tighten the nut to adjust the starting force to the following value:

Starting force:

No-load starting force + 1.0~2.0 kg
(2.2~4.4 lbs)

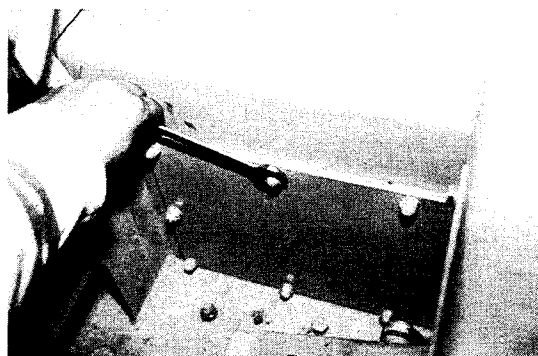
- (9) Pin
- (10) Snap ring

6. Install the axle shaft service cover.
 - (1) Service cover
 - (2) Cap nuts (10 pcs.)

$T = 1.0 \sim 1.6 \text{ kg-m (7.2 \sim 11.6 ft-lbs)}$

Caution:

Set the drive chain on the axle drive sprocket before installing the cover.



Axle Shaft Service Cover

SAE3-20

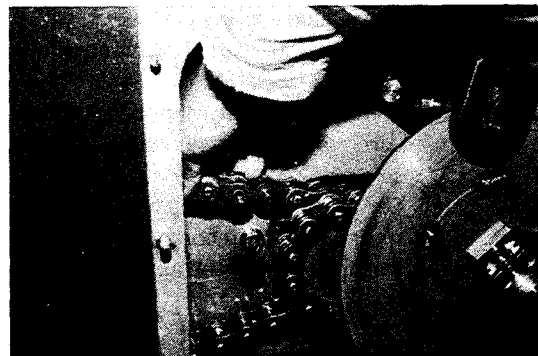
7. Install the oil control pedal and link.
 - (1) Pedal and link
 - (2) Set bolts (6 pcs.)
 - (3) Pedal lock link connection
 - (4) Control valve link connection
8. Install the floor.
 - (1) Floor
 - (2) Set bolts (5 pcs.)



Pedal and Link

SAE3-15

9. Connect the front drive chain.
 - (1) Drive chain
 - (2) Joint link
 - (3) Cotter pin
 - (4) Tighten the HST pump bypass valve.

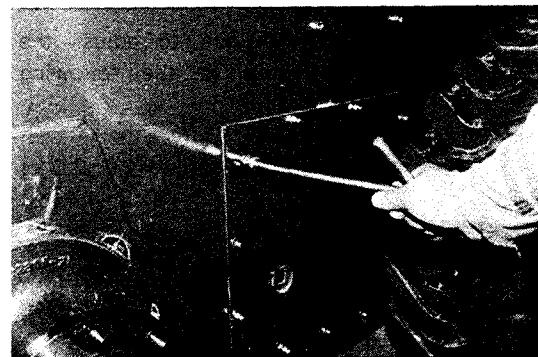


Front Drive Chain

SAE5-19

10. Install the service hole cover.
 - (1) Service hole cover
 - (2) Cap nuts (13 pcs.)

$T = 1.0 \sim 1.6 \text{ kg-m (7.2 \sim 11.6 ft-lbs)}$

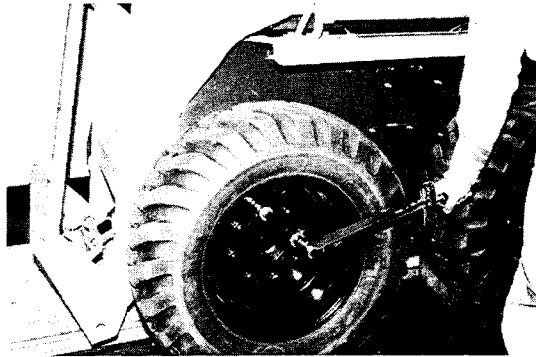


Service Hole Cover

SAE5-21

11. Install the front wheels.

- (1) Front wheels
- (2) Temporarily tighten the hub nuts.
- (3) Remove the stands.
- (4) Hub nuts
T = 12 ~ 15 kg-m (86.6 ~ 108.3 ft-lbs)



Front Wheel

SAE5-23

12. Supply oil to the final reduction gear.

- (1) Install the drain plug.
- (2) Remove the filter plug.
- (3) Supply oil until it overflows from the filter plug hole.



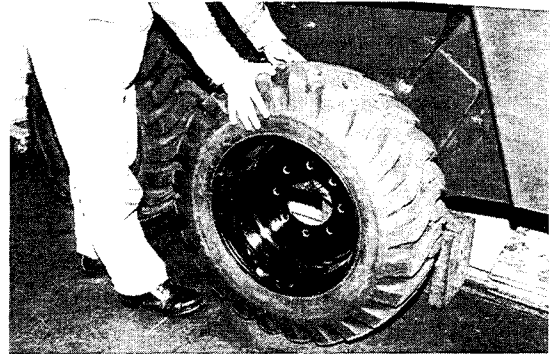
Supplying Oil to Final Reduction Gear

SAE12-35

REAR AXLE

DISASSEMBLY

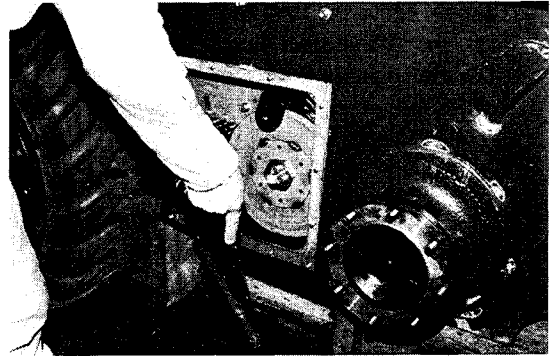
1. Remove the rear wheels.
 - (1) Loosen the hub nuts.
 - (2) Jack up the vehicle and support it with stands under the frame.
 - (3) Hub nuts
 - (4) Rear wheels



Rear Wheel

SAE5-25

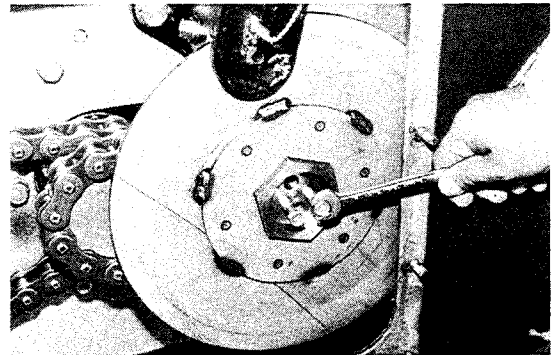
2. Drain oil from the final reduction gear.
3. Remove the service hole cover.
 - (1) Cap nuts (13 pcs.)
 - (2) Service hole cover



Service Hole Cover

SAE5-27

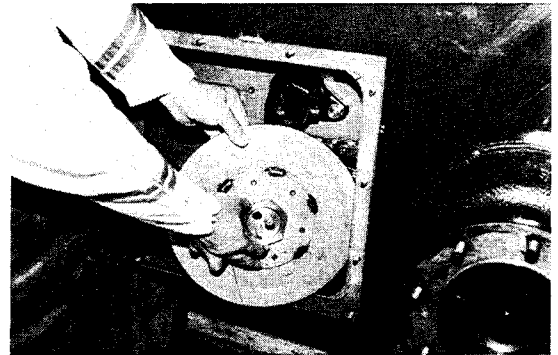
4. Remove the brake disc.
 - (1) Set bolts
 - (2) Use service bolts (2 pcs.)
M8 x 1.25 pitch x 40 ~ 50 mm



Service Bolt

SAE1-22

- (3) Adapter
- (4) Brake disc



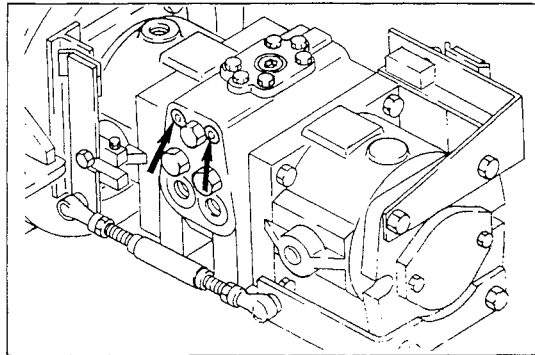
Brake Disc

SAE5-33

5. Disconnect the rear drive chain.
 - (1) Loosen the HST pump bypass valve.

Caution:

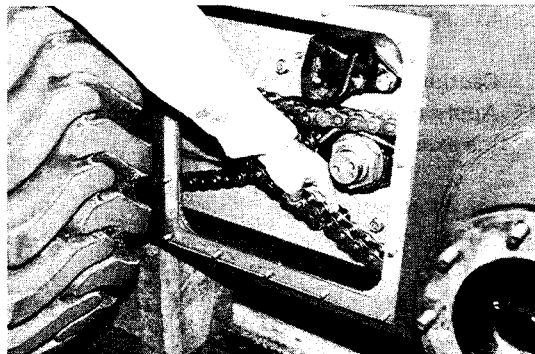
Loosen the front bypass valve when disconnecting the drive chain LH.



Bypass Valve

SAES19

- (2) Rotate the rear axle shaft to bring the chain joint link to a place allowing easy disconnection.
 - (3) Disconnect the rear drive chain.
 - ① Cotter pin
 - ② Joint link
6. Remove the rear drive chain.



Disconnecting the Drive Chain

SAE5-34

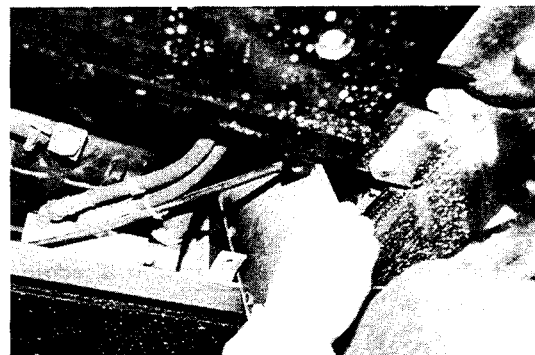
7. Remove the rear under cover.
 - (1) Set bolts
 - (2) Rear under cover



Rear Under Cover

SAE6-7

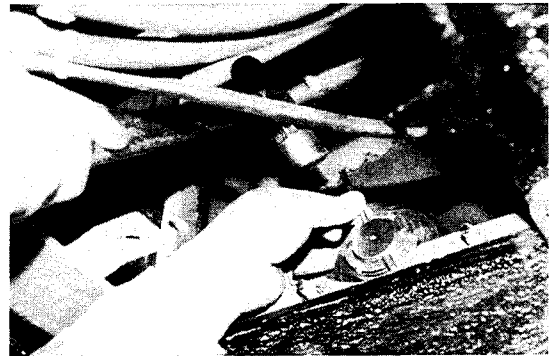
8. Remove the axle shaft service cover.
 - (1) Cap nuts (10 pcs.)
 - (2) Axle shaft service cover



Axle Shaft Service Cover

SAE6-10

9. Remove the rear axle shaft.
 - (1) Snap ring
 - (2) Pin
SST 09700-30200-71



Pin

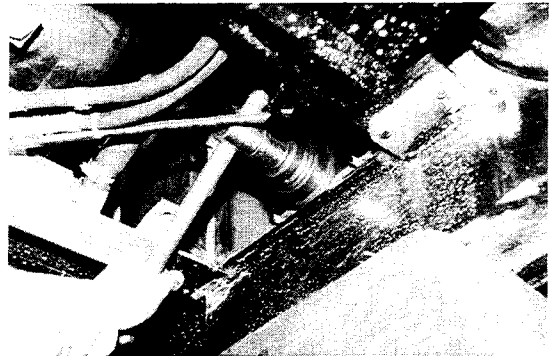
SAE6-14

- (3) Nut (width across flat = 55 mm)

Caution:

Apply a wooden bar to hub bolts to prevent the axle shaft from rotating.

- (4) Plate washer
- (5) Shim



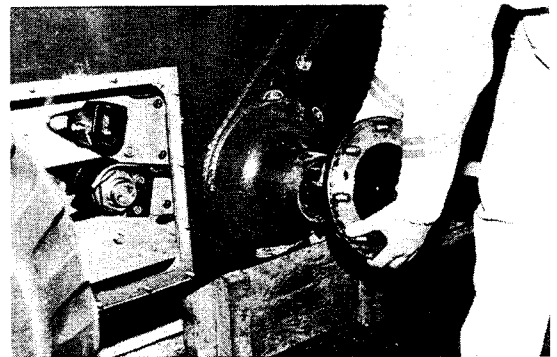
Nut

SAE6-15

- (6) Rear axle shaft with bearing

Caution:

Carefully extract the shaft so as not to damage the oil seal.



Rear Axle Shaft

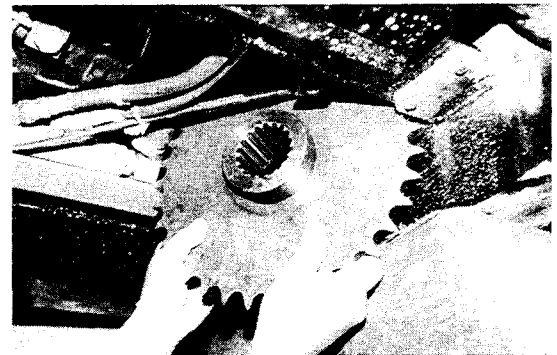
SAE6-17

10. Remove the rear drive sprocket.
 - (1) Drive sprocket
 - (2) Shim
 - (3) Inner bearing

11. Remove the oil seal.

Caution:

Remove the oil seal only when it is judged defective.



Front Drive Sprocket

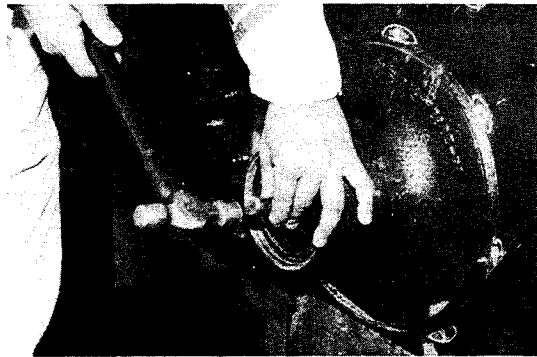
SAE6-20

12. Remove the axle bearing outer races.

Caution:

- Remove the bearing outer races only when they are judged defective.
- Carefully operate so as not to damage the inside surface of the axle housing.

- (1) Outer bearing outer race
- (2) Inner bearing outer race



Bearing Outer Race

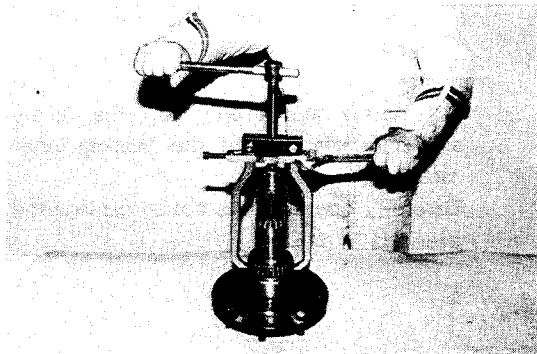
SAE6-21

13. Remove the outer bearing from the axle shaft.
SST 09950-20017

14. Remove the oil seal shaft from the axle shaft.

Caution:

Remove the oil seal shaft only when it is judged defective.



Outer Bearing

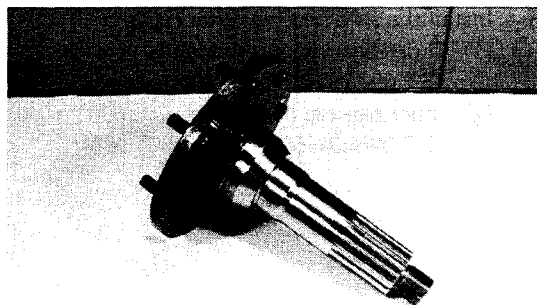
SAE4-4

INSPECTION

Caution:

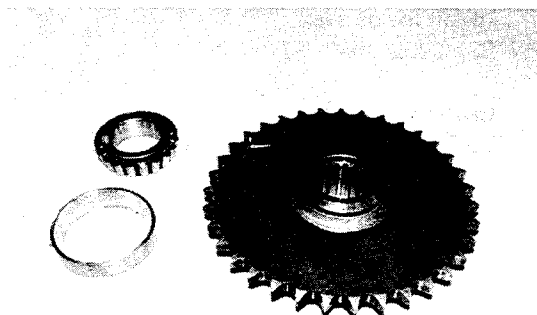
Wash each part thoroughly with washing liquid for perfect removal of dirt.

1. Axle shaft
 - (1) Crack and damage of shaft
 - (2) Crack, damage and wear of spline portion
 - (3) Damage and loosening of hub bolts
 - (4) Damage of threaded portion
2. Axle drive sprocket
 - (1) Crack and damage of sprocket
 - (2) Crack and damage of spline portion
3. Axle bearing
 - (1) Damage and wear of outer race
 - (2) Damage, wear and rotation status of rollers



Axle Shaft

SAE34-5



Drive Sprocket and Axle Bearing

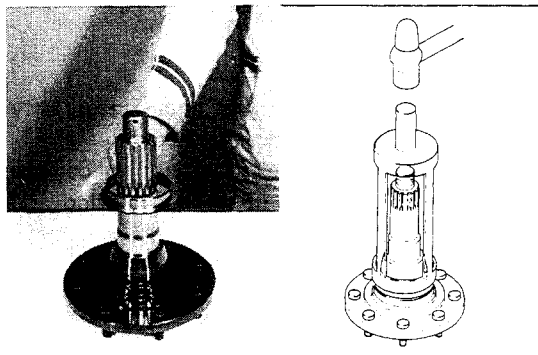
SAE6-25

ASSEMBLY

1. Install the oil seal shaft to the axle shaft.
SST 09421-42800-71

Caution:

Coat grease on oil seal shaft bearing before assembly.



Oil Seal Shaft

SAE34-13,SAES48

2. Install the outer bearing to the axle shaft.

Important:

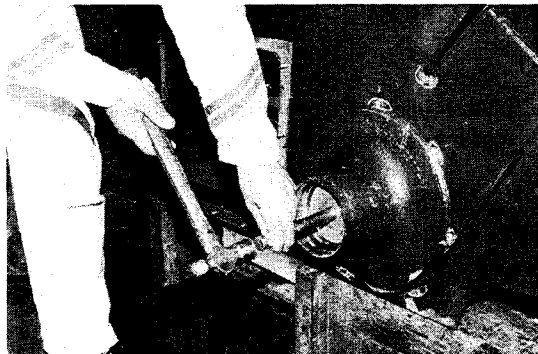
- Alternately and evenly tap the whole side circumference of the bearing inner race for assembly.
- Carefully operate so as not to damage the bearing.



Outer Bearing

SAE34-12

3. Install the axle bearing outer races.
 - (1) Outer bearing outer race
SST 09410-30200-71
 - (2) Inner bearing outer race
SST 09550-55010



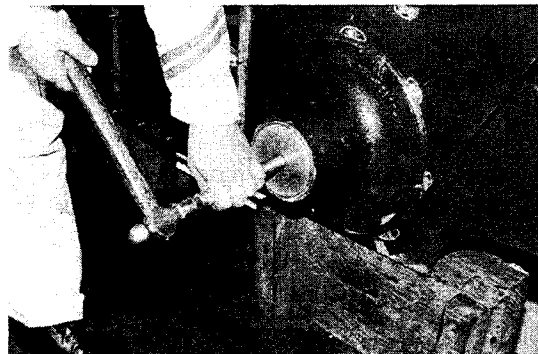
Outer Bearing Outer Race

SAE6-23

4. Install the oil seal.
SST 09320-10410-71

Caution:

Coat grease on the oil seal lip portion.



Oil Seal

SAE6-26

5. Install the axle drive sprocket and axle shaft.

- (1) Inner bearing
- (2) Shim
- (3) Axle drive sprocket
- (4) Axle shaft

Caution:

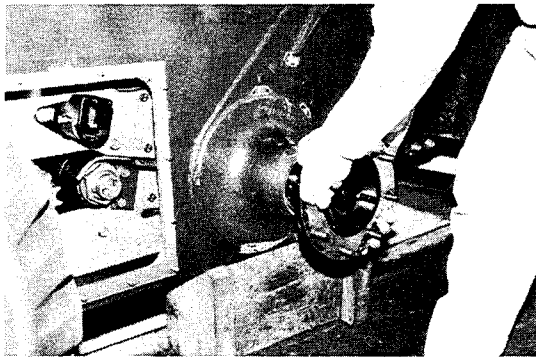
Carefully assemble so as not to damage the oil seal.

- (5) Shim
- (6) Plate washer
- (7) Nut



Axle Drive Sprocket

SAE6-19



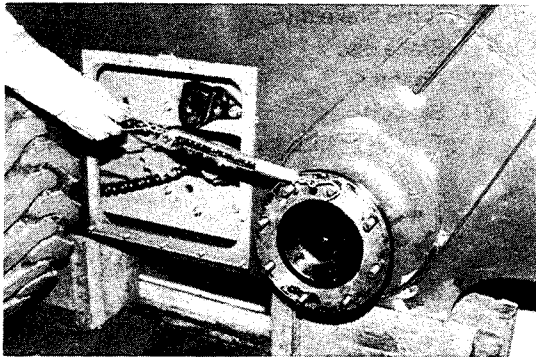
Axle Shaft

SAE6-18

- (8) Adjust the axle bearing preload.
- ① Tighten the nut once, and then loosen it.
 - ② Manually tighten the nut and check that the axle shaft rotates smoothly.
 - ③ Set a spring scale to a hub bolt, and measure and record the no-load starting force of the axle shaft.

Caution:

Check that the no-load starting force is in a range of 1.2 ~ 3.0 kg (2.6 ~ 6.6 lbs).



Starting Force Measurement

SAE6-27

- ④ Tighten the nut to adjust the starting force to the following value:
Starting force:
No-load starting force + 1.0~2.0 kg
(2.2~4.4 lbs)

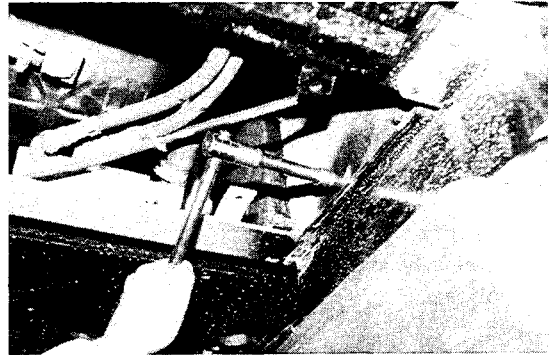
- (9) Pin
- (10) Snap ring

6. Install the axle shaft service cover.
 - (1) Service cover
 - (2) Cap nuts (10 pcs.)
 $T = 1.0 \sim 1.6 \text{ kg-m (7.2 \sim 11.6 ft-lbs)}$

Caution:

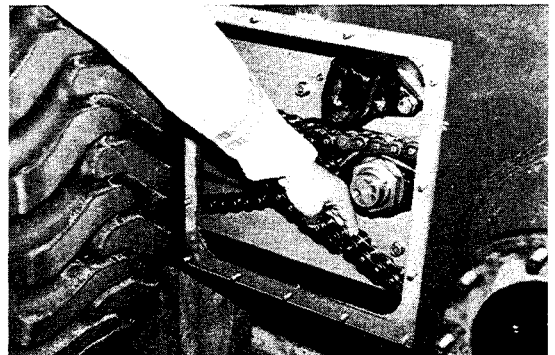
Set the drive chain on the axle drive sprocket before installing the cover.

7. Install the rear under cover.
 - (1) Rear under cover
 - (2) Set bolts (4 pcs.)
8. Connect the rear drive chain.
 - (1) Drive chain
 - (2) Joint link
 - (3) Cotter pin
 - (4) Tighten the HST pump bypass valve.



Axle Shaft Service Cover

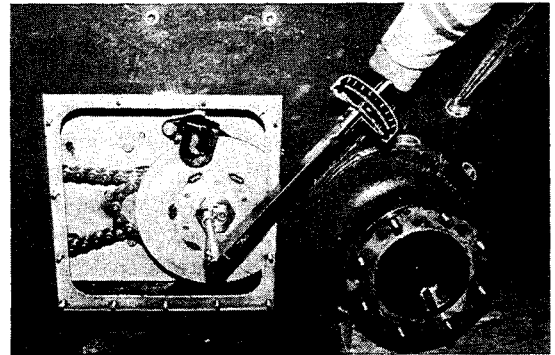
SAE6-9



Rear Drive Chain

SAE5-34

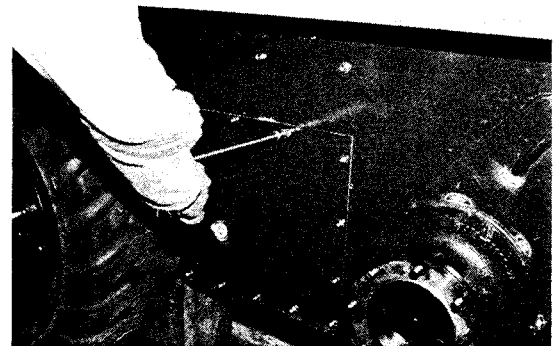
9. Install the brake disc.
 - (1) Brake disc
 - (2) Adapter
 - (3) Set bolts
 $T = 7.8 \sim 11.6 \text{ kg-m (56.3 \sim 83.8 ft-lbs)}$



Brake Disc

SAE2-26

10. Install the service hold cover.
 - (1) Service hole cover
 - (2) Cap nuts (13 pcs.)
 $T = 1.0 \sim 1.6 \text{ kg-m (7.2 \sim 11.6 ft-lbs)}$

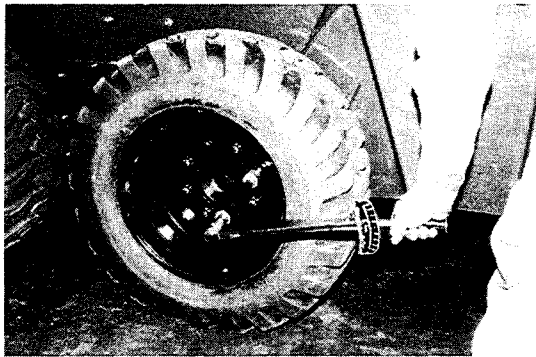


Service Hole Cover

SAE5-26

11. Install the rear wheels.

- (1) Wheels
- (2) Temporarily tighten hub nuts.
- (3) Remove the stands.
- (4) Hub nuts
T = 12 ~ 15 kg-m (86.6 ~ 108.3 ft-lbs)



Rear Wheel

SAE2-28

12. Supply oil to the final reduction gear.

- (1) Install the drain plug.
- (2) Remove the oil filler plug.
- (3) Supply oil until it overflows from the filler plug hole.

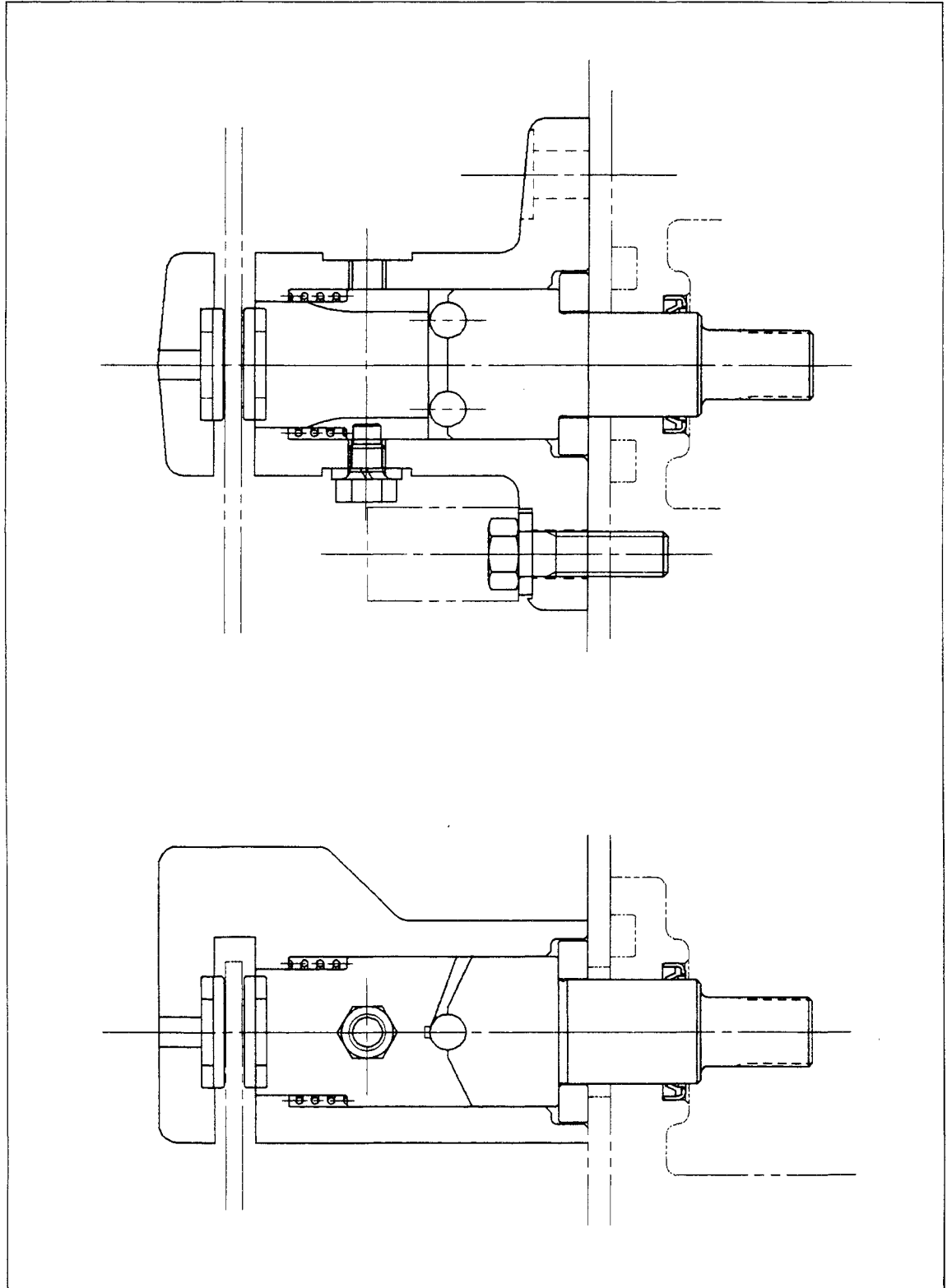


Supplying Oil to Final Reduction Gear

SAE12-35

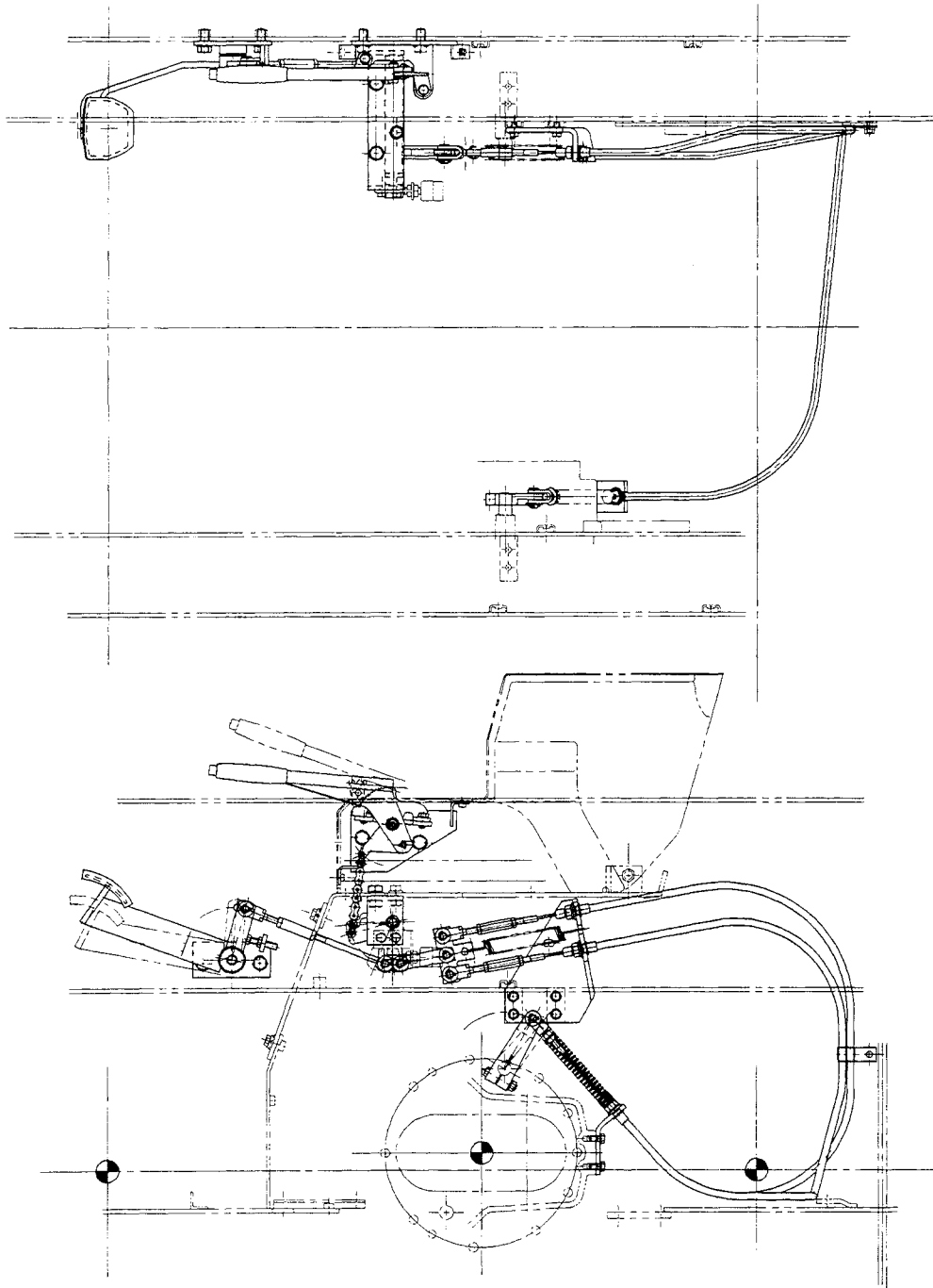
BRAKE

	Page
DESCRIPTION	6-2
COMPONENTS	6-4
SPECIFICATIONS AND SERVICE STANDARDS	6-6
DISC BRAKE	6-7
BRAKE LINK	6-13
PARKING BRAKE LEVER	6-14
BRAKE PEDAL	6-15

DESCRIPTION

Brake Sectional View

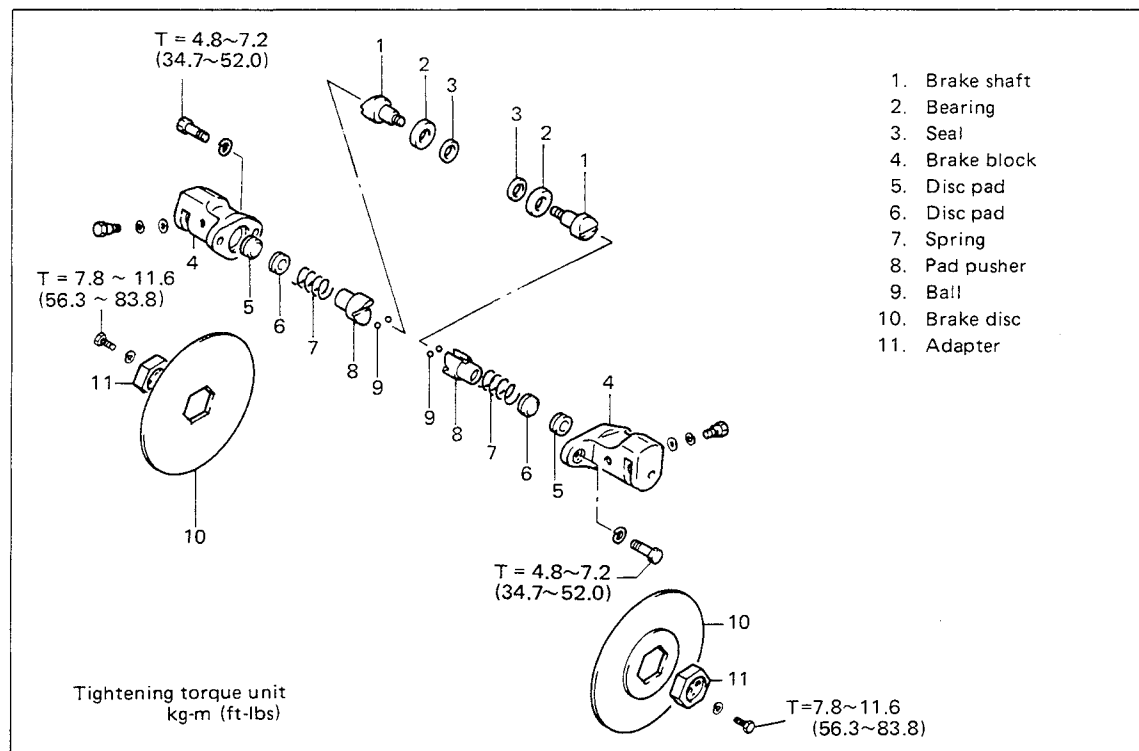
SAEM37



Brake System Schematic

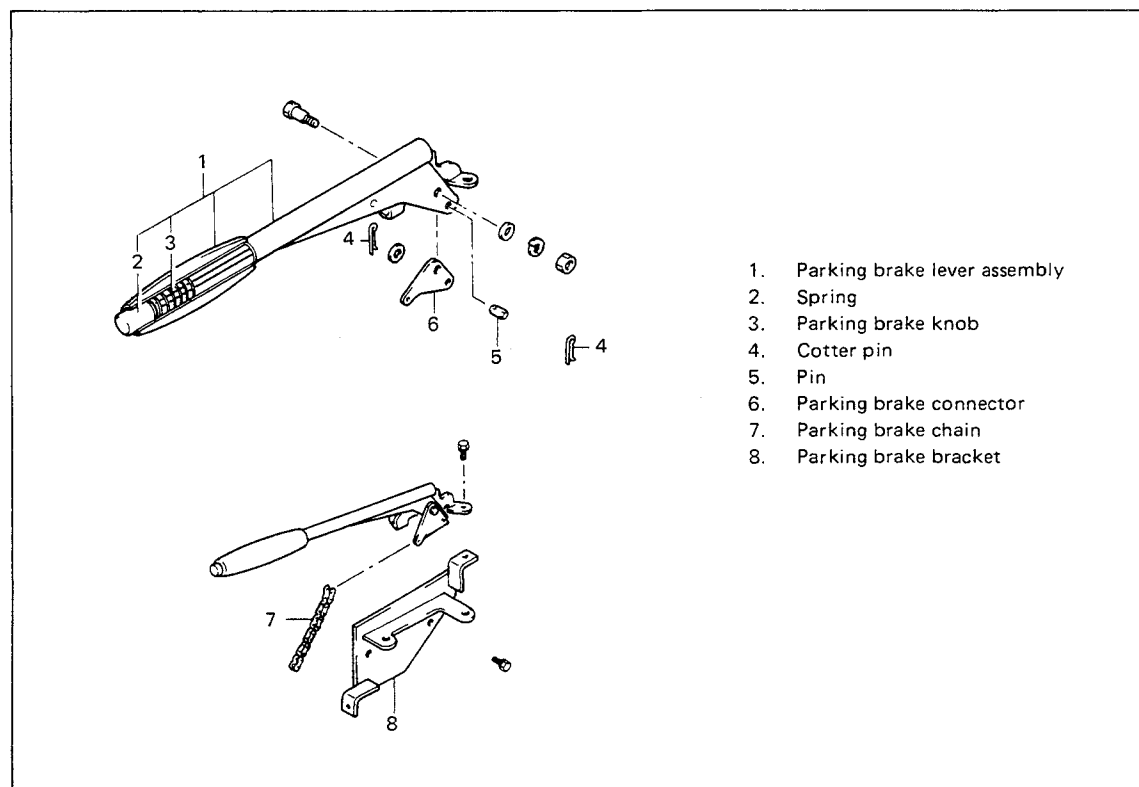
SAEL19

COMPONENTS



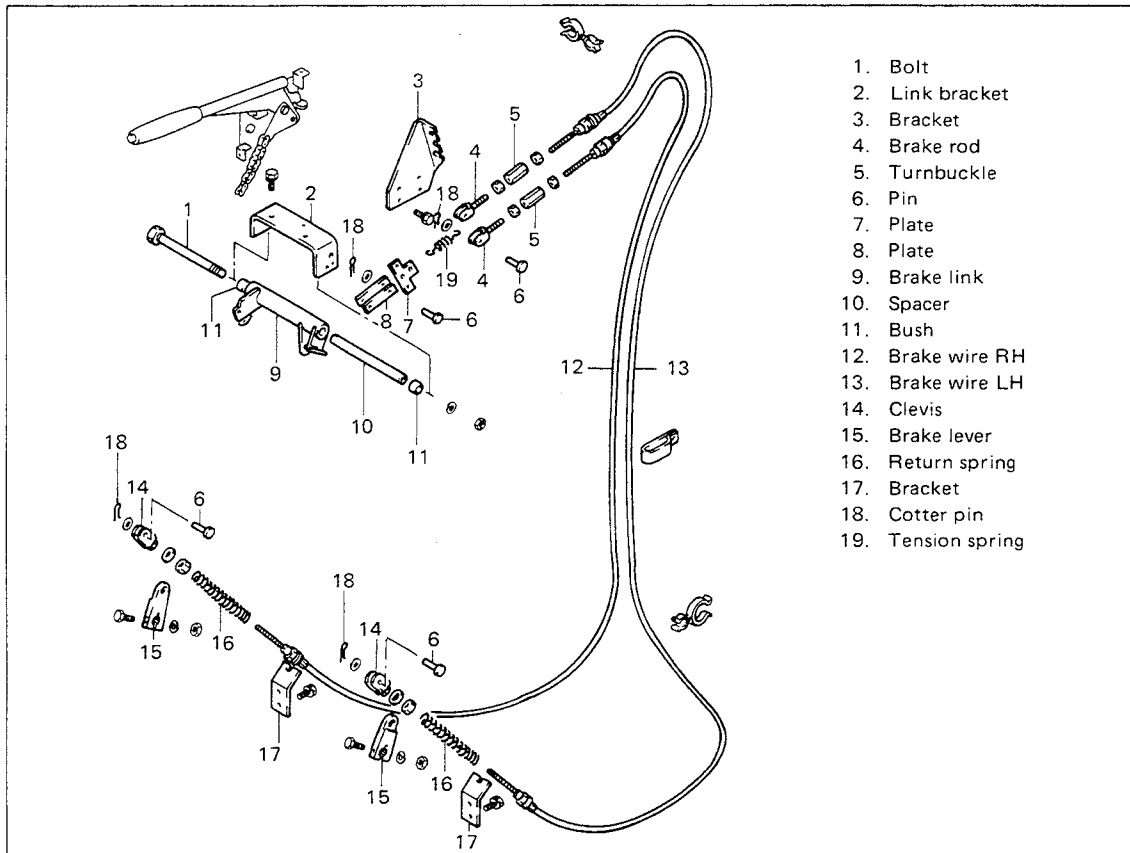
Disc Brake Components

SAEM39



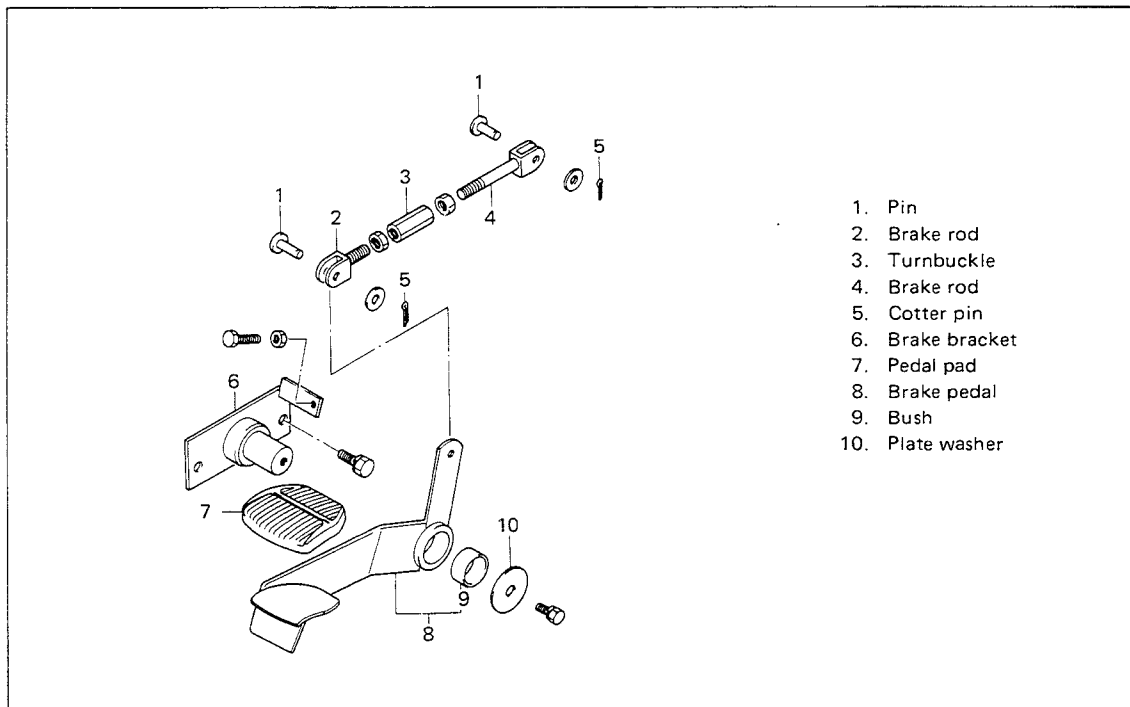
Parking Brake Lever Components

SAEM40



Brake Link Components

SAEM41



Brake Pedal (OPT) Components

SAEM42

SPECIFICATIONS AND SERVICE STANDARDS

Type		Mechanical wet disc brake
Disc pad dimensions (outside diameter x thickness) mm (in)		30 (1.181) x 6 (0.236)
Disc pad material		High tensile brass
Disc pad	Standard thickness mm (in)	6 (0.236)
	Wear limit mm (in)	5.5 (0.217)
Brake pedal height mm (in)		154 (6.06)
Brake pedal play mm (in)		35 (1.38)
Brake block set bolt tightening torque kg-m (ft-lbs)		4.8 ~ 7.2 (34.7 ~ 52.0)
Brake disc set bolt tightening torque kg-m (ft-lbs)		7.8 ~ 11.6 (56.3 ~ 83.8)

DISC BRAKE

REMOVAL

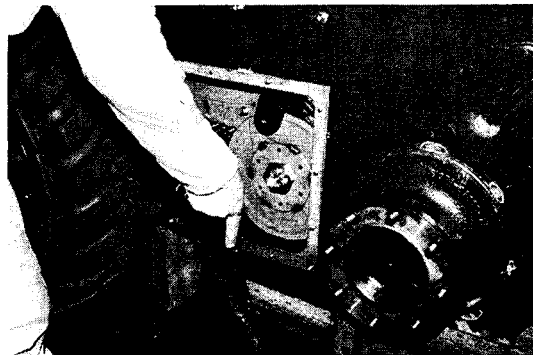
1. Remove the rear wheels.
 - (1) Loosen the hub nuts.
 - (2) Jack up the vehicle and support it with stands placed under the frame.
 - (3) Hub nuts
 - (4) Rear wheels



Rear Wheels

SAE5-25

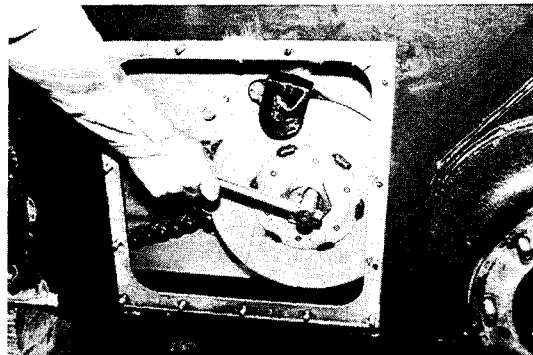
2. Drain oil from the final reduction gear.
 - (1) Cap nuts (13 pcs)
 - (2) Service hole cover



Service Hole Cover

SAE5-27

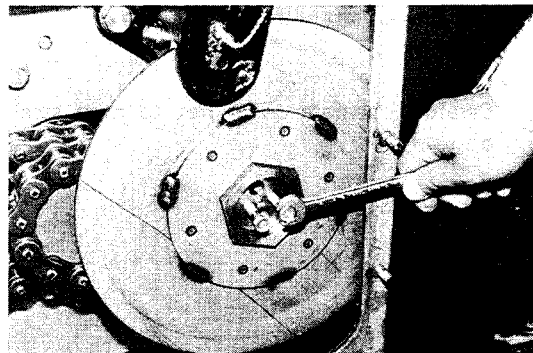
4. Remove the brake disc.
 - (1) Set bolts (2 pcs)



Set Bolts

SAE1-20

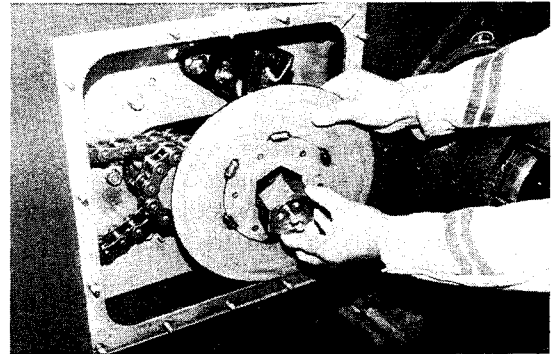
- (2) Use service bolts (2 pcs).
M8 x 1.25 pitch x 40 ~ 50 mm



Using Service Bolt

SAE1-22

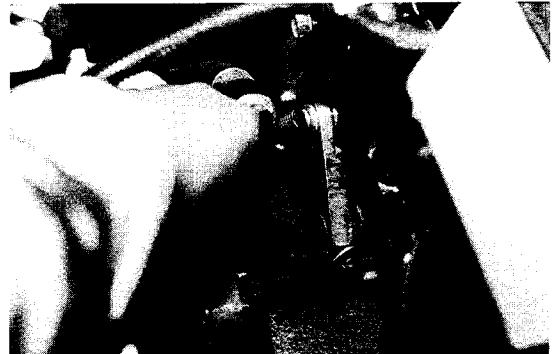
- (3) Adapter
- (4) Brake disc



Brake Disc

SAE1-24

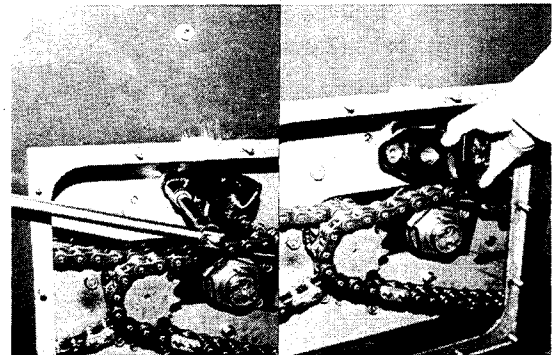
- 5. Remove the brake block and brake shaft.
 - (1) Remove the brake lever from the brake shaft.
 - ① Set bolt and nut
 - ② Brake lever



Brake Lever

SAE2-6

- (2) Set bolt
- (3) Brake block



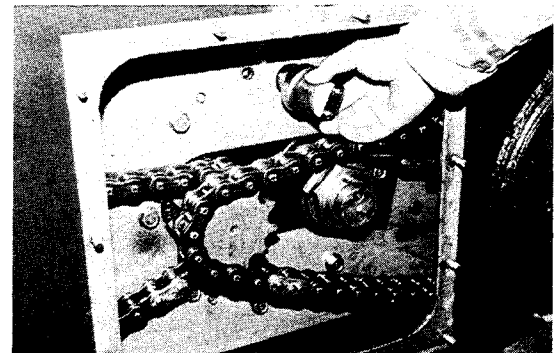
Brake Block

SAE2-3,7

- (4) Brake shaft with balls.

Caution:
Carefully operate so as not to drop steel balls.

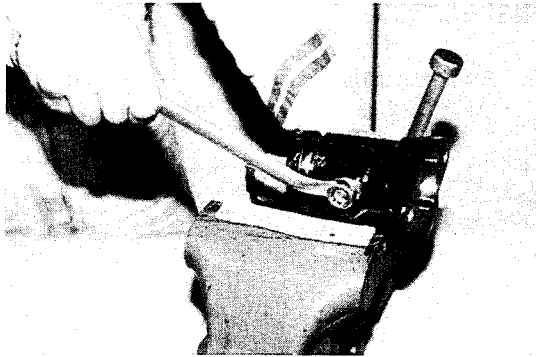
- (5) Bearing



Brake Shaft

SAE2-8

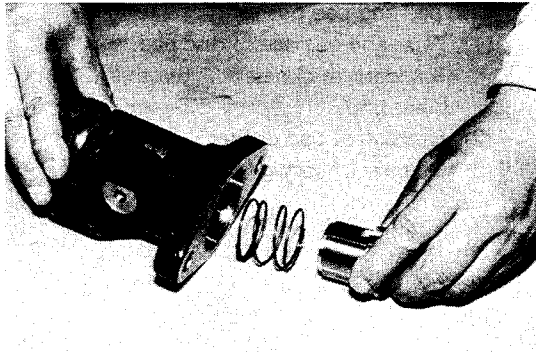
6. Remove the pad push from the brake block.
(1) Set bolt



Set Bolt

SAE2-10

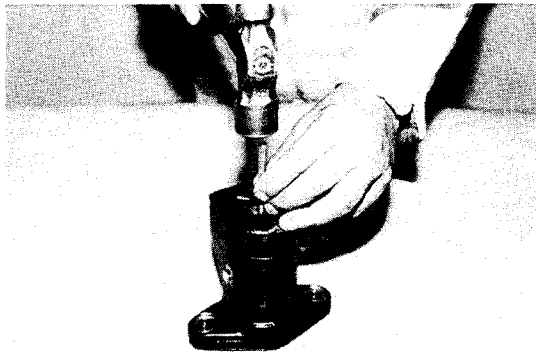
- (2) Pad pusher
(3) Spring



Pad Pusher

SAE2-21

7. Remove the disc pad from the brake block.
SST 09700-30200-71
(1) Disc pad

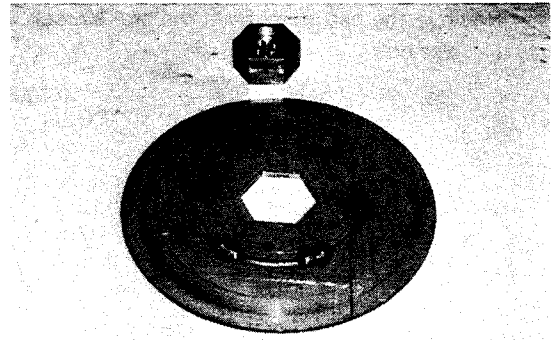


Disc pad

SAE2-12

INSPECTION

1. Brake disc and adapter
 - (1) Crack and damage

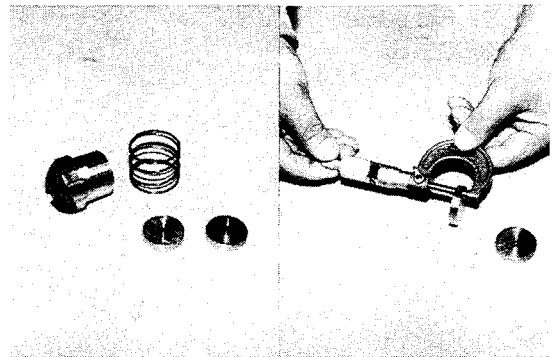


Brake Disc and Adapter

SAE3-2

2. Disc pad and pad pusher
 - (1) Wear and damage of disc pad

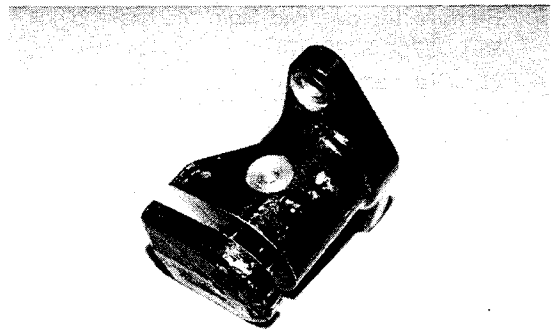
Standard thickness	6 mm (0.236 in)
Wear limit	5.5 mm (0.217 in)
 - (2) Damage of pad pusher
 - (3) Damage of spring



Disc Pad and Pad Pusher

SAE2-15,16

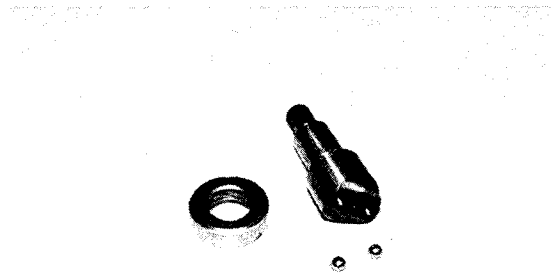
3. Brake block
 - (1) Crack and damage



Brake Block

SAE2-18

4. Brake shaft and bearing
 - (1) Damage of brake shaft
 - (2) Bearing rotation status
 - (3) Damage of steel balls



Brake Shaft Bearing

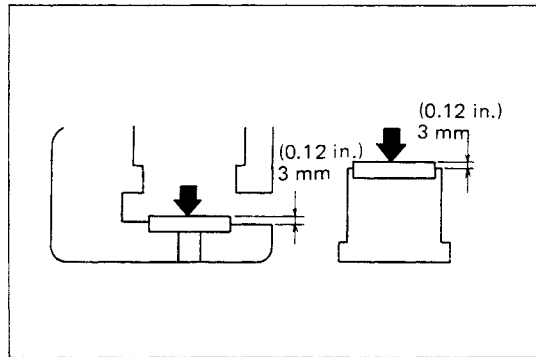
SAE2-9

INSTALLATION

The installation procedure is the reverse of the removal procedure.

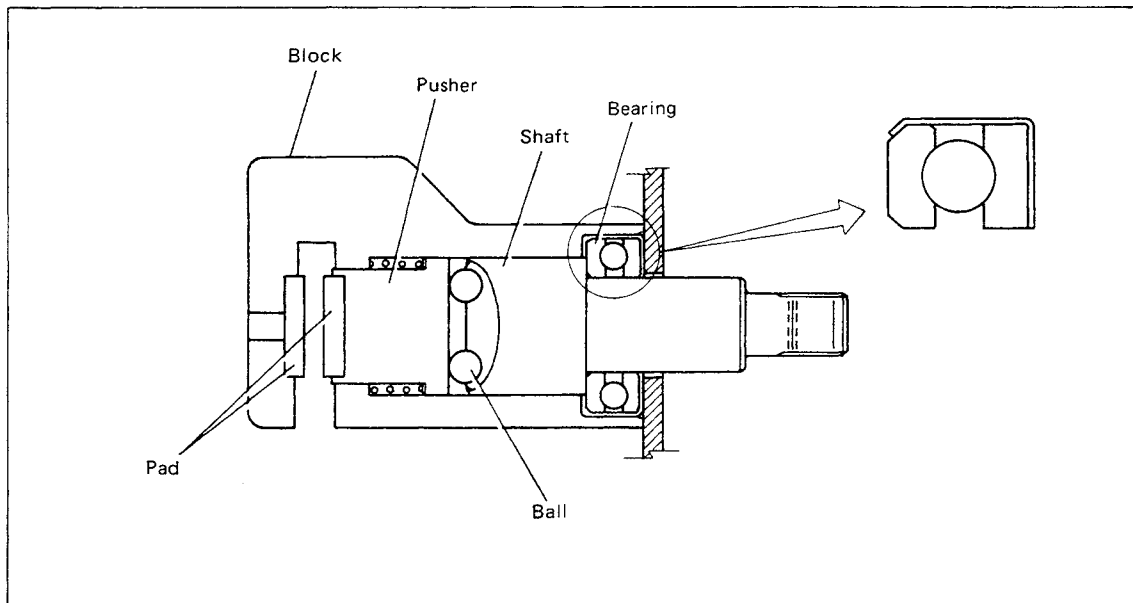
IMPORTANT POINTS FOR INSTALLATION

1. Disc pad assembly
 - (1) Drive the disc pads into the block and pusher. See the Figure for the installed dimensions of the assembly.



Disc pad

SAES49

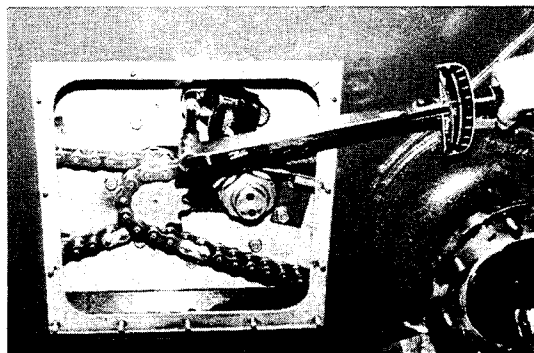


Important Points for Brake Assembly

SAES50

2. Pad pusher and brake shaft assembly.
 - (1) Coat MP grease at the time of assembly.
 - (2) Coat MP grease on steel balls to prevent them from dropping at the time of assembly.
 - (3) Pay attention to the bearing assembly direction.
3. Brake block set bolt tightening torque.

$$T = 4.8 \sim 7.2 \text{ kg-m (34.7} \sim 52.0 \text{ ft-lbs)}$$



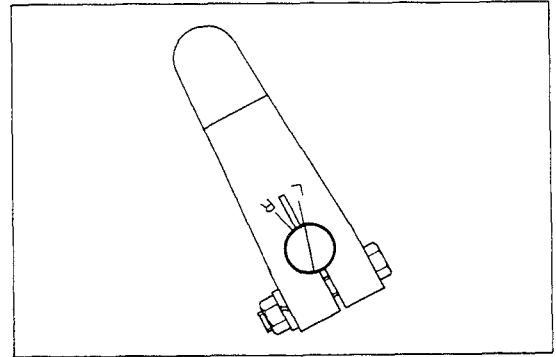
Tightening the Brake Block Set Bolt

SAE2-25

4. When installing the brake lever to the brake shaft, align the line marks on the brake lever and brake shaft.

Caution:

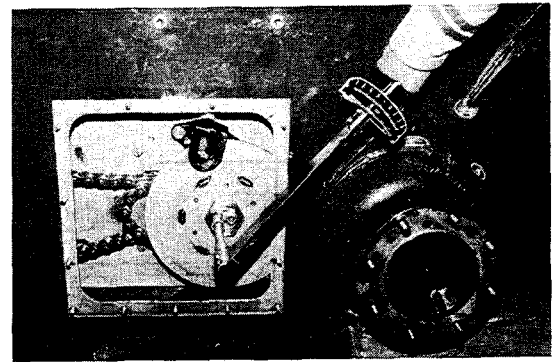
Note that the aligning line marks are different between the left and right brake levers.



Installing the Brake Lever

SAES24

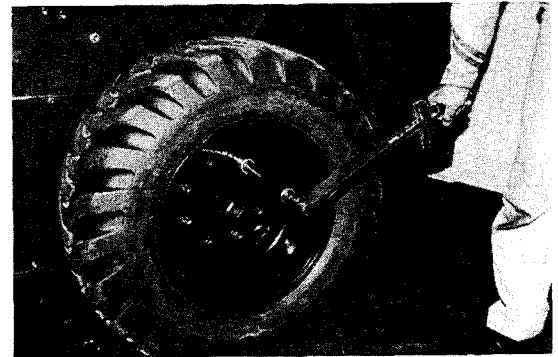
5. Brake disc set bolt tightening torque.
 $T = 7.8 \sim 11.6 \text{ kg-m (56.3} \sim 83.8 \text{ ft-lbs)}$
6. Service hole cover cap nut tightening torque.
 $T = 1.0 \sim 1.6 \text{ kg-m (7.2} \sim 11.6 \text{ ft-lbs)}$



Tightening the Brake Disc Set Bolt

SAE2-26

7. Hub nut tightening torque.
 $T = 12 \sim 15 \text{ kg-m (86.6} \sim 108.3 \text{ ft-lbs)}$
8. Fill oil in the final reduction gear.
 - (1) Install the drain plug and remove the filler plug.
 - (2) Supply oil until it overflows from the filler plug hole.

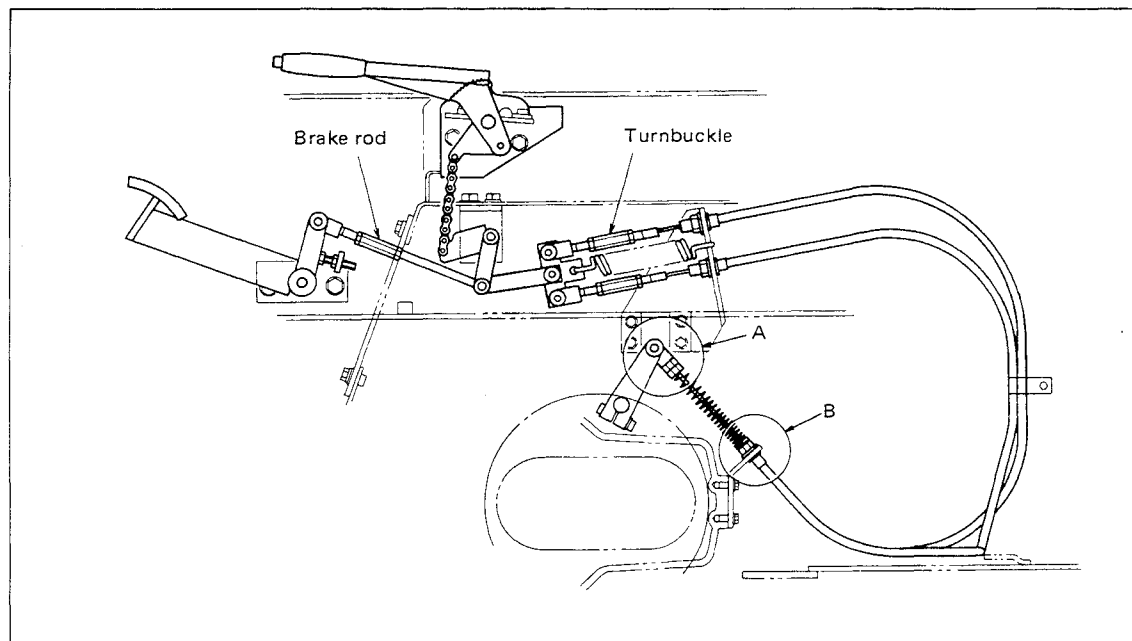


Tightening the Hub Nut

SAE2-29

BRAKE LINK

IMPORTANT POINTS FOR INSTALLATION

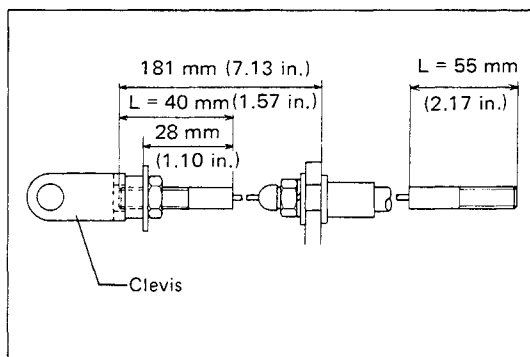


Important Points for Brake Link Assembly

SAEM43

1. Install the brake wire. (Part A in the above figure.)

- (1) Install the end of the brake wire, where bolt length (L) is shorter, to the clevis. The assembled dimensions shall be as shown in the figure at right.

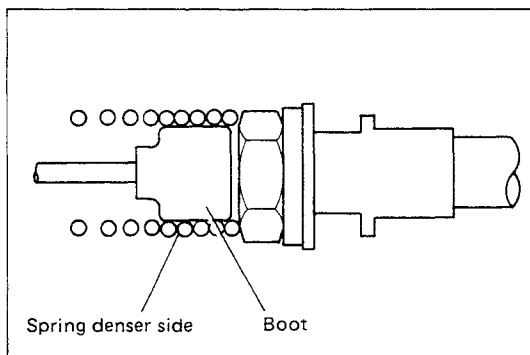


Brake Wire

SAES51

2. Install the return spring. (Part B in the above figure)

- (1) Install the spring with its denser side on the boot.



Return Spring

SAES52

PARKING BRAKE LEVER

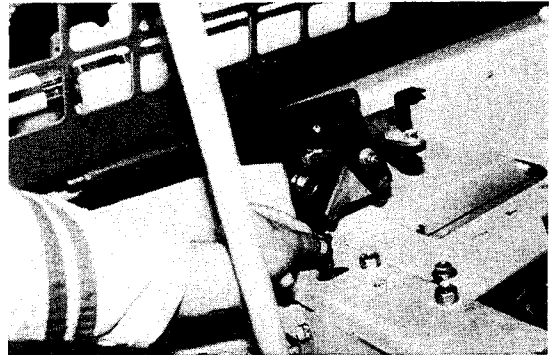
REMOVAL

1. Remove the duct RH.
(1) Set screws (12 pcs)
2. Disconnect the parking brake chain.
(1) U-ring
(2) Joint ring
3. Remove the parking brake lever.
(1) Set bolt
(2) Parking brake lever



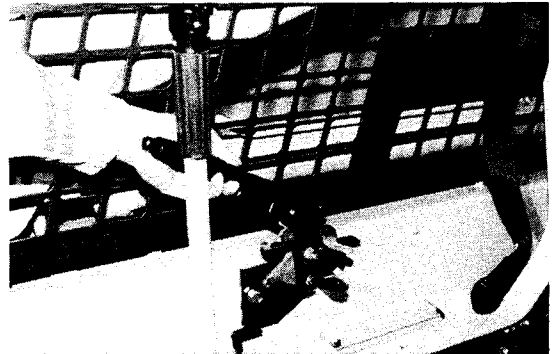
Duct RH

SAE32-24



Disconnecting the Chain

SAE32-25



Parking Brake Lever

SAE32-27

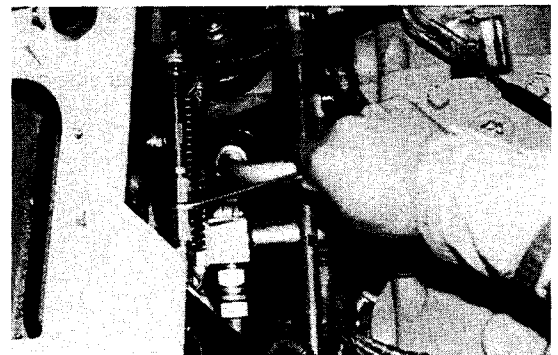
INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

Adjust the turnbuckle so that the parking brake lever pull stroke becomes 4 to 6 notches.

See the "brake pedal play" section.



Adjusting the Parking Brake Pull Stroke

SAE33-4

BRAKE PEDAL (OPT)

ADJUSTMENT

1. Brake pedal height

Adjust the stopper bolt so that distance S between the oil tank top surface and the pedal top become as shown below.

Pedal height (S) 154 mm (6.06 in)

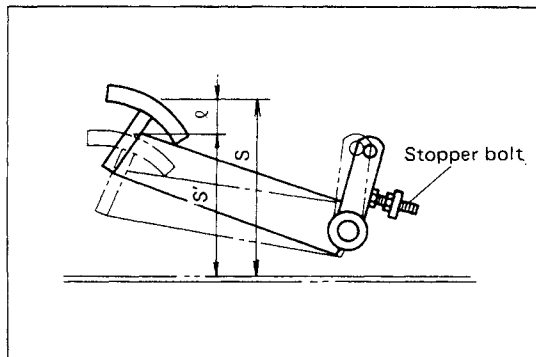
2. Brake pedal play

Adjust the turnbuckle so that brake pedal play ℓ becomes as shown below.

Pedal play (ℓ) 35 mm (1.38 in)

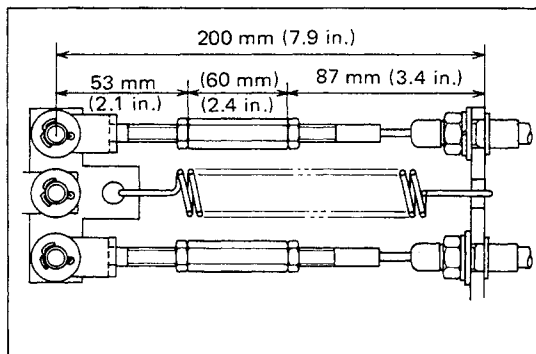
Pedal Height (S') 119 mm (4.69 in)

(The reference dimensions for turnbuckle assembled length is shown in the figure at right.)



Adjusting the Brake Pedal

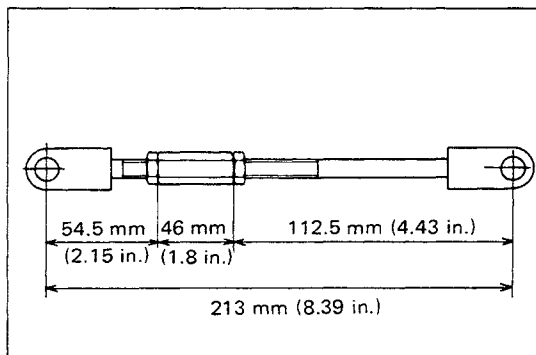
SAES53



Reference Dimensions for Turnbuckle Assembly SAES55

3. Brake rod assembly dimensions

When assembling the brake rod and turnbuckle, refer to the figure at right.



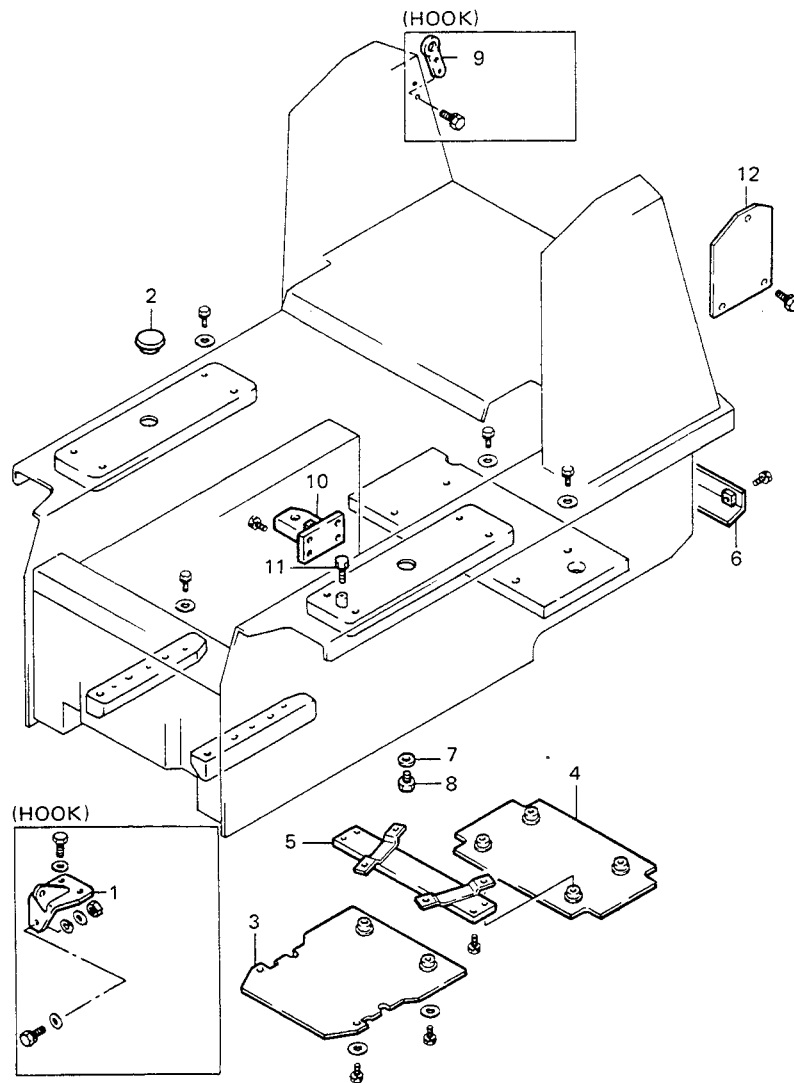
Brake Rod Assembly Dimensions

SAES54

BODY FRAME

	Page
COMPONENTS	7-2
WIRING DIAGRAM	7-8
SEAT BAR	7-14

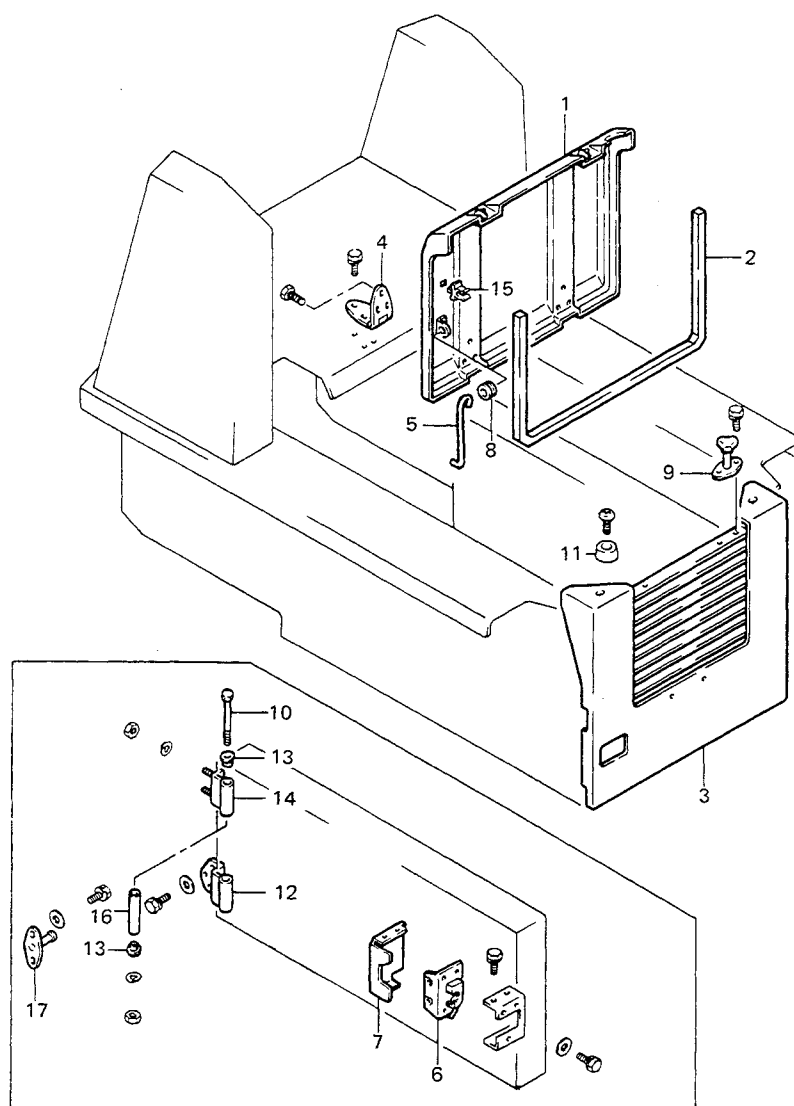
COMPONENTS



- | | |
|----------------------|--------------------|
| 1. Hook (OPT) | 7. Gasket |
| 2. Hole plug | 8. Plug |
| 3. Front under cover | 9. Hook (OPT) |
| 4. Rear under cover | 10. Bracket |
| 5. Member | 11. Breather plug |
| 6. Rear cover | 12. Separate plate |

Body Frame Components (1)

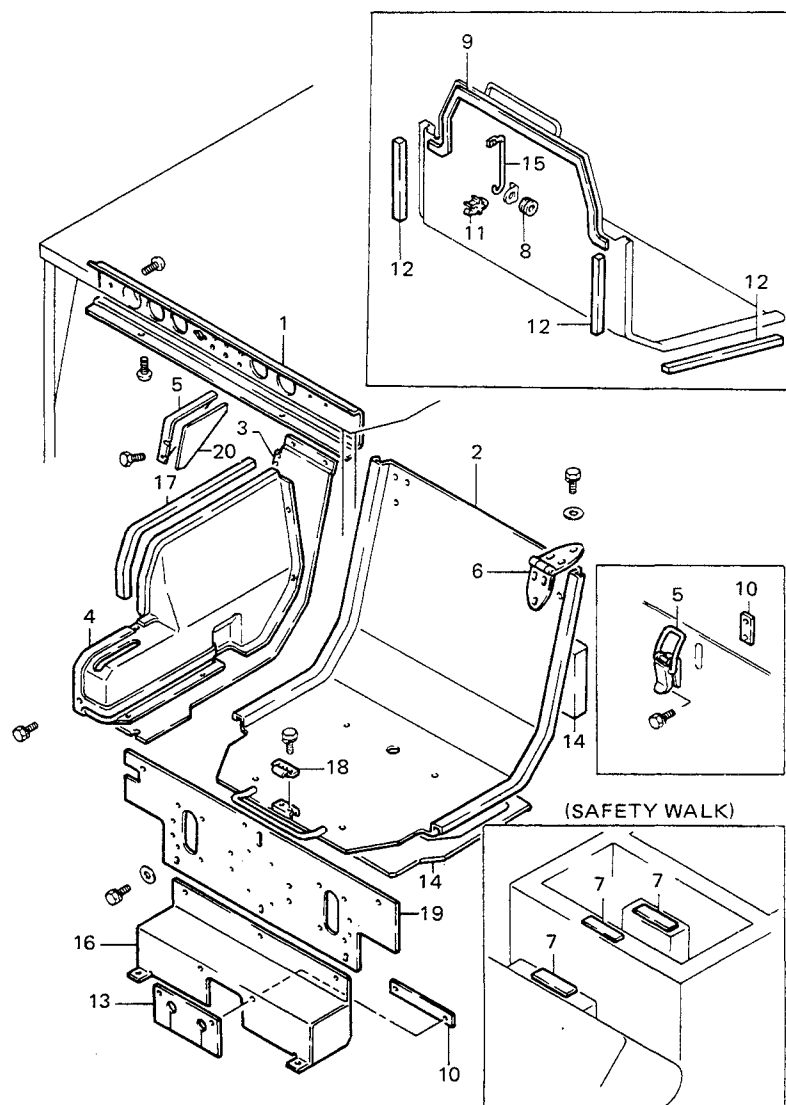
SAEM45



- | | |
|----------------------|-------------|
| 1. Engine hood | 10. Bolt |
| 2. Engine hood seal | 11. Cushion |
| 3. Grille | 12. Bracket |
| 4. Engine hood hinge | 13. Bushing |
| 5. Engine hood stay | 14. Bracket |
| 6. Grille lock | 15. Catch |
| 7. Cover | 16. Spacer |
| 8. Grommet | 17. Striker |
| 9. Hood fastener | |

Body Frame Components (2)

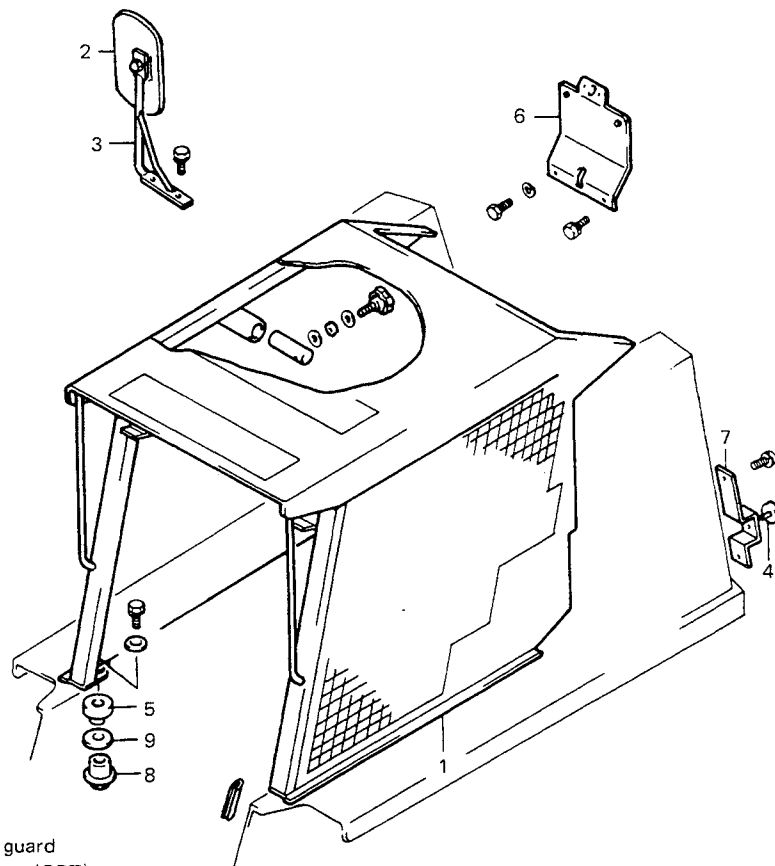
SAEM46



- | | |
|---------------------|------------------|
| 1. Instrument panel | 11. Catch |
| 2. Seat panel | 12. Rubber |
| 3. Upper panel | 13. Rubber plate |
| 4. Duct | 14. Mat |
| 5. Cover | 15. Stay |
| 6. Hinge | 16. Floor |
| 7. Safety walk | 17. Insulator |
| 8. Grommet | 18. Hook |
| 9. Insulator | 19. Front cover |
| 10. Plate | 20. Sponge |

Body Flame Components (3)

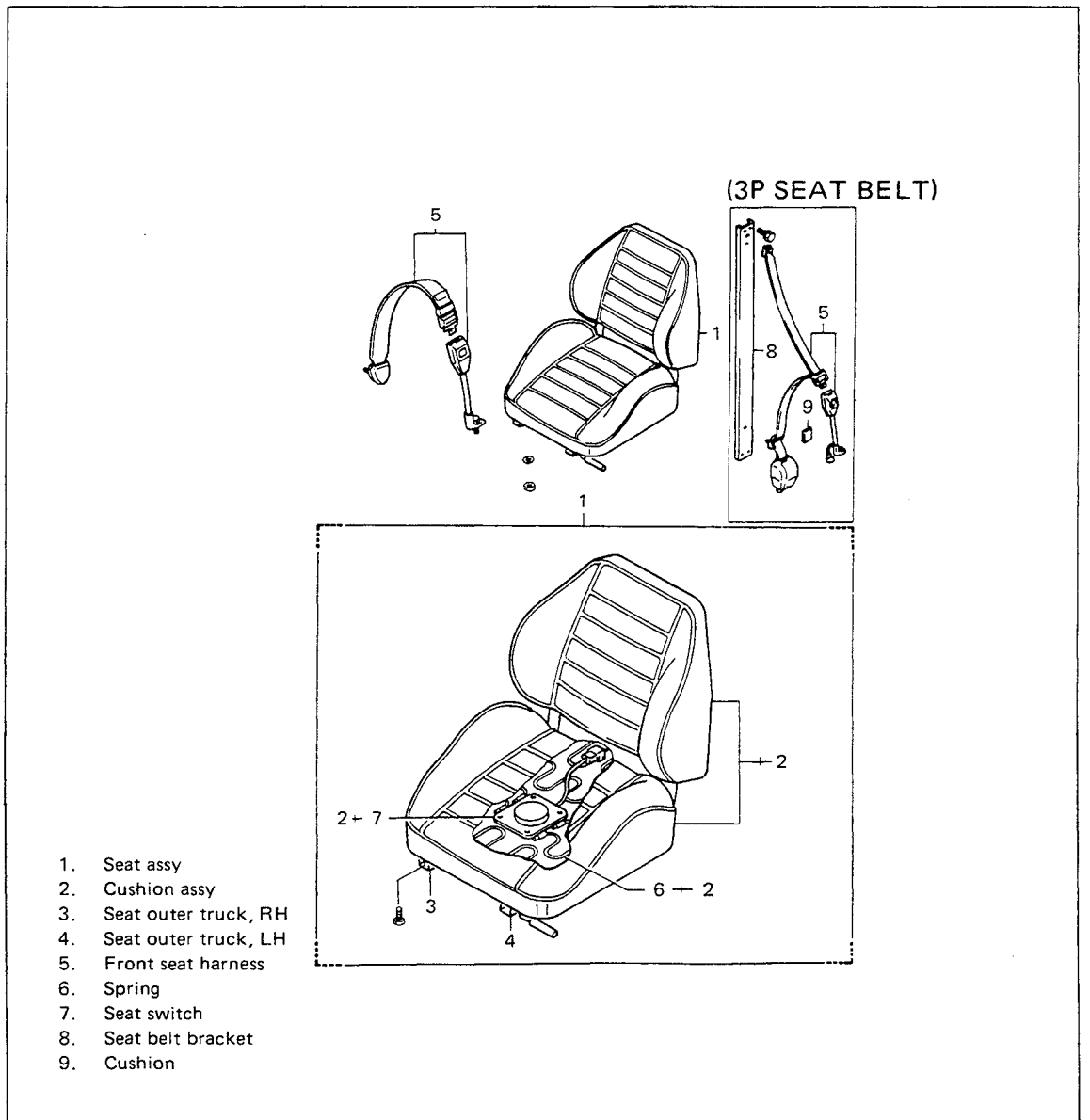
SAEM47



1. Operator guard
2. Back mirror (OPT)
3. Back mirror bracket (OPT)
4. Reflector (OPT)
5. Mount
6. Licence plate bracket (OPT)
7. Reflector bracket
8. Spacer
9. Plate

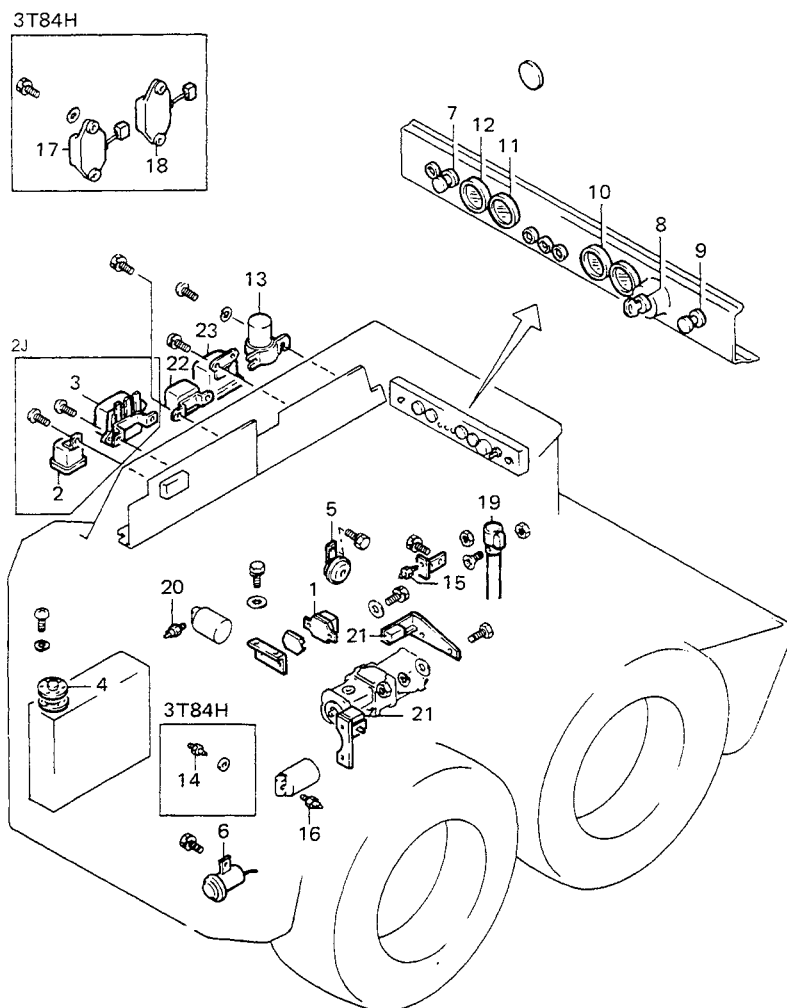
Operator Guard Components

SAEM48

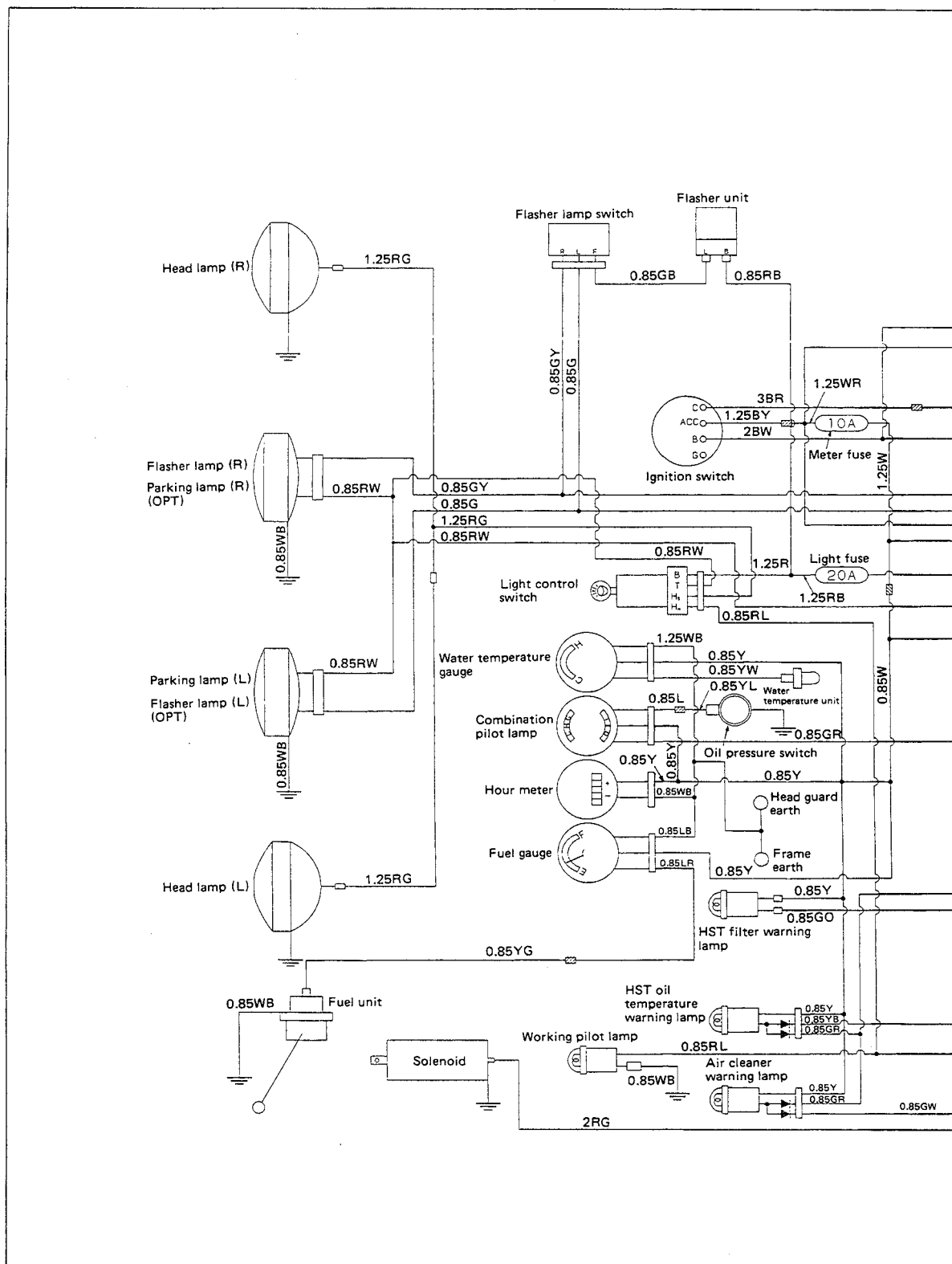


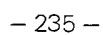
Driver Seat Components

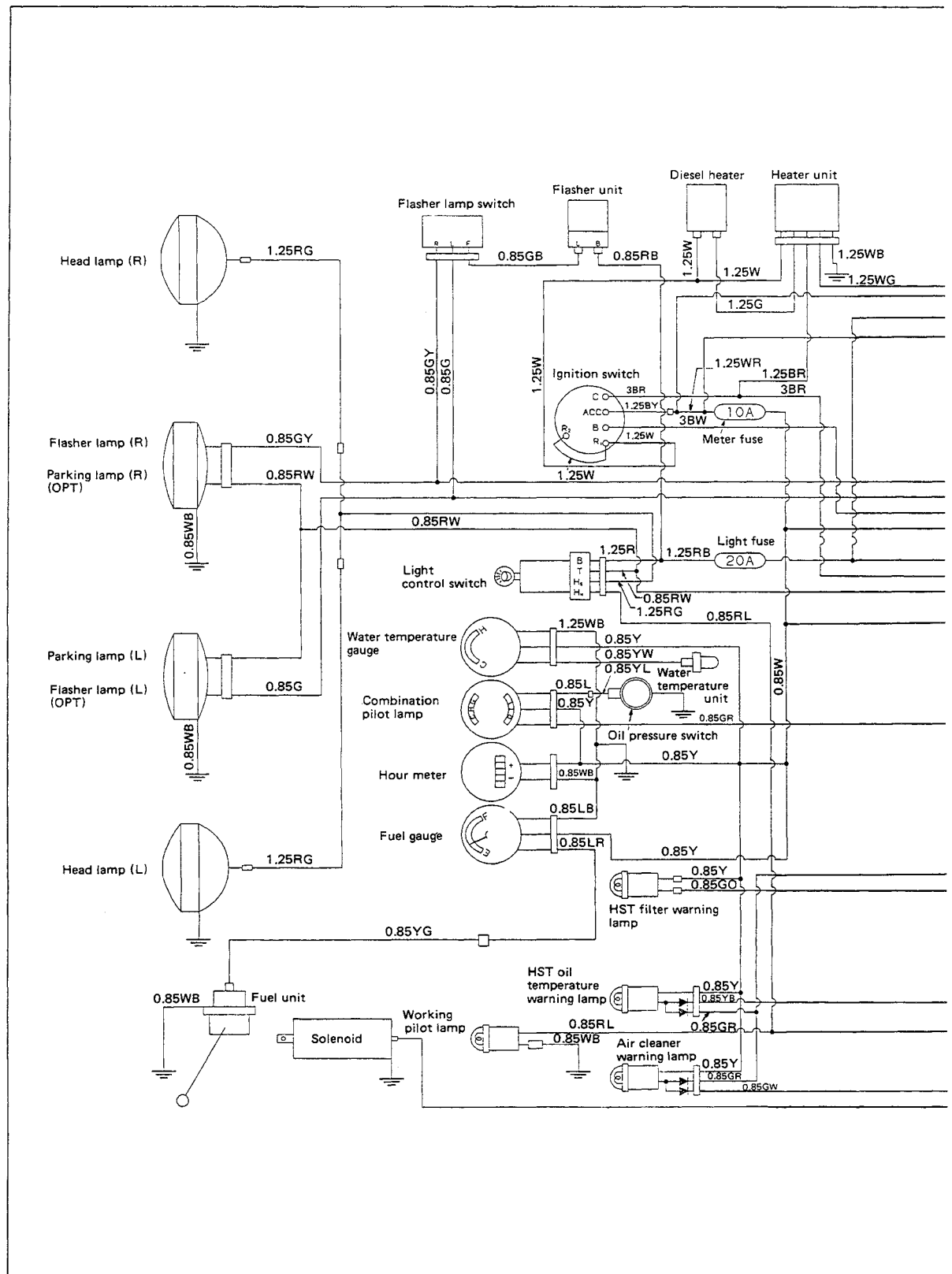
SAEM49



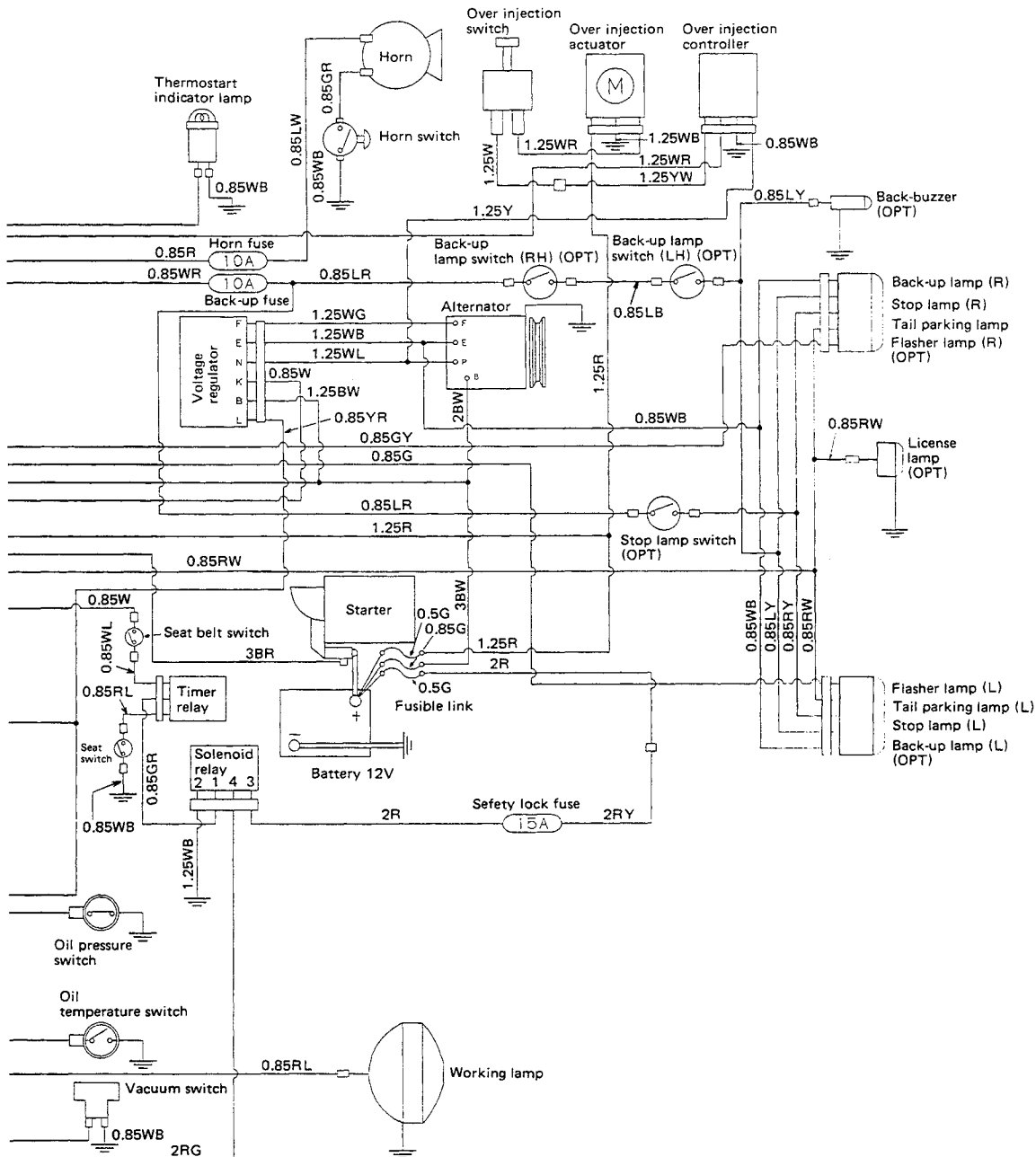
- | | |
|----------------------------------|---------------------------------------|
| 1. Voltage regulator | 13. Flasher unit |
| 2. Starter relay (2J) | 14. Water temperature sender |
| 3. Glow plug relay (2J) | 15. Stop lamp switch |
| 4. Fuel unit | 16. Oil temperature switch |
| 5. Horn | 17. Flame heater unit (3T84H) |
| 6. Back buzzer | 18. Over injection controller (3T84H) |
| 7. Light control switch | 19. Turn signal switch |
| 8. Ignition switch | 20. Oil pressure switch |
| 9. Over injection switch (3T84H) | 21. Back up lamp switch |
| 10. Fuel gauge | 22. Delay timer |
| 11. Water temperature gauge | 23. Pedal lock relay |
| 12. Hour meter | |

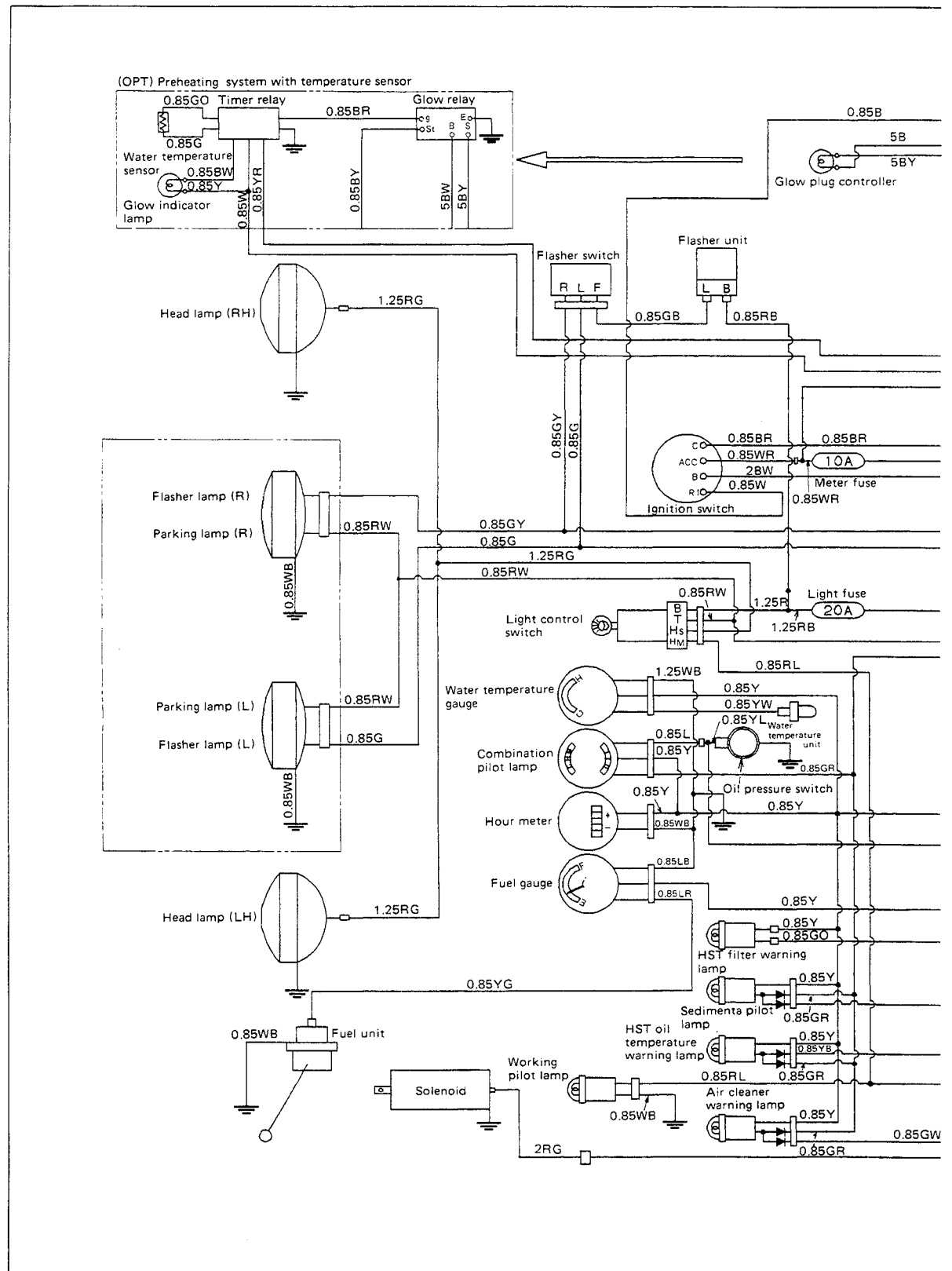




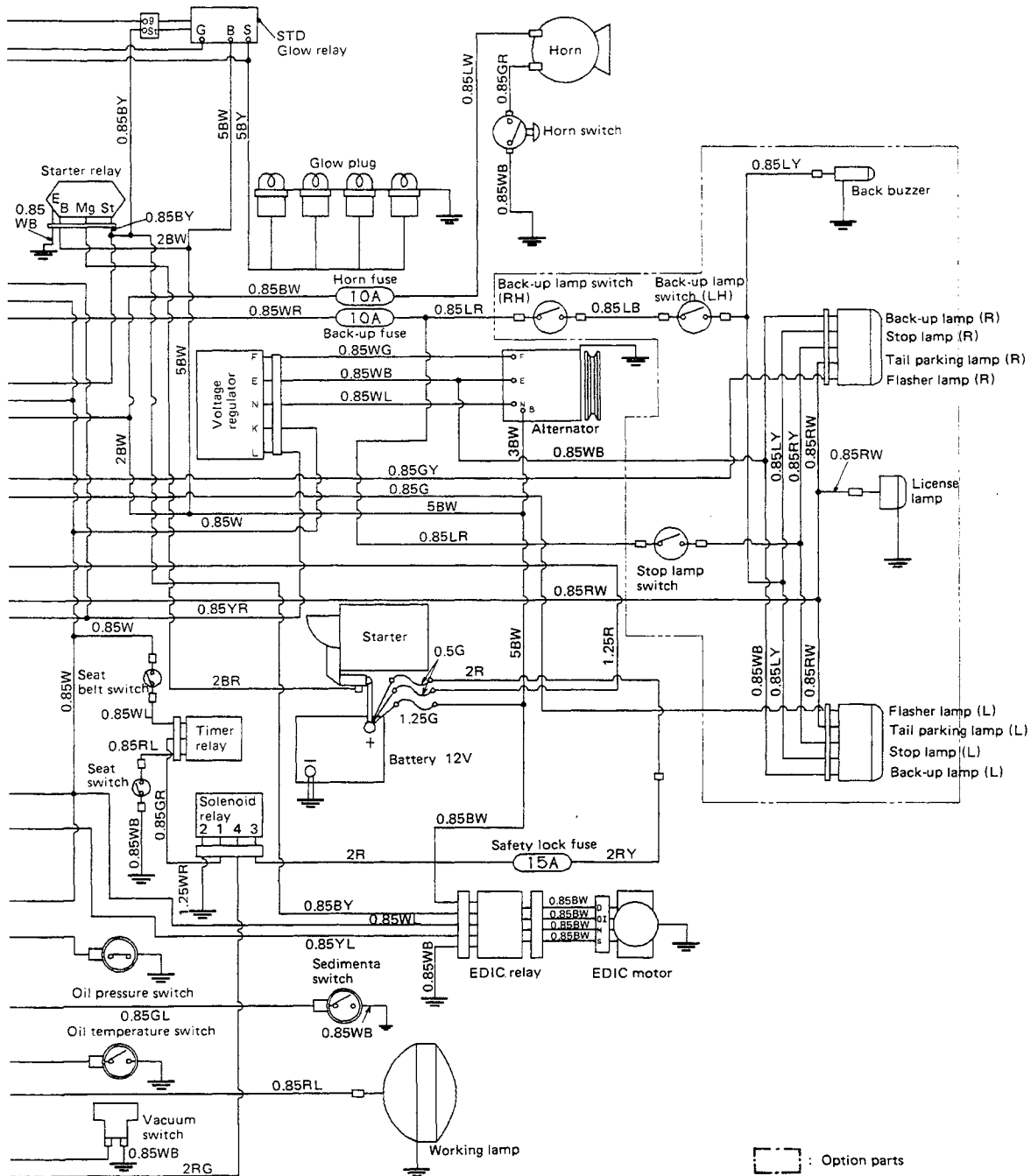


Wiring Diagram (2SDK6)





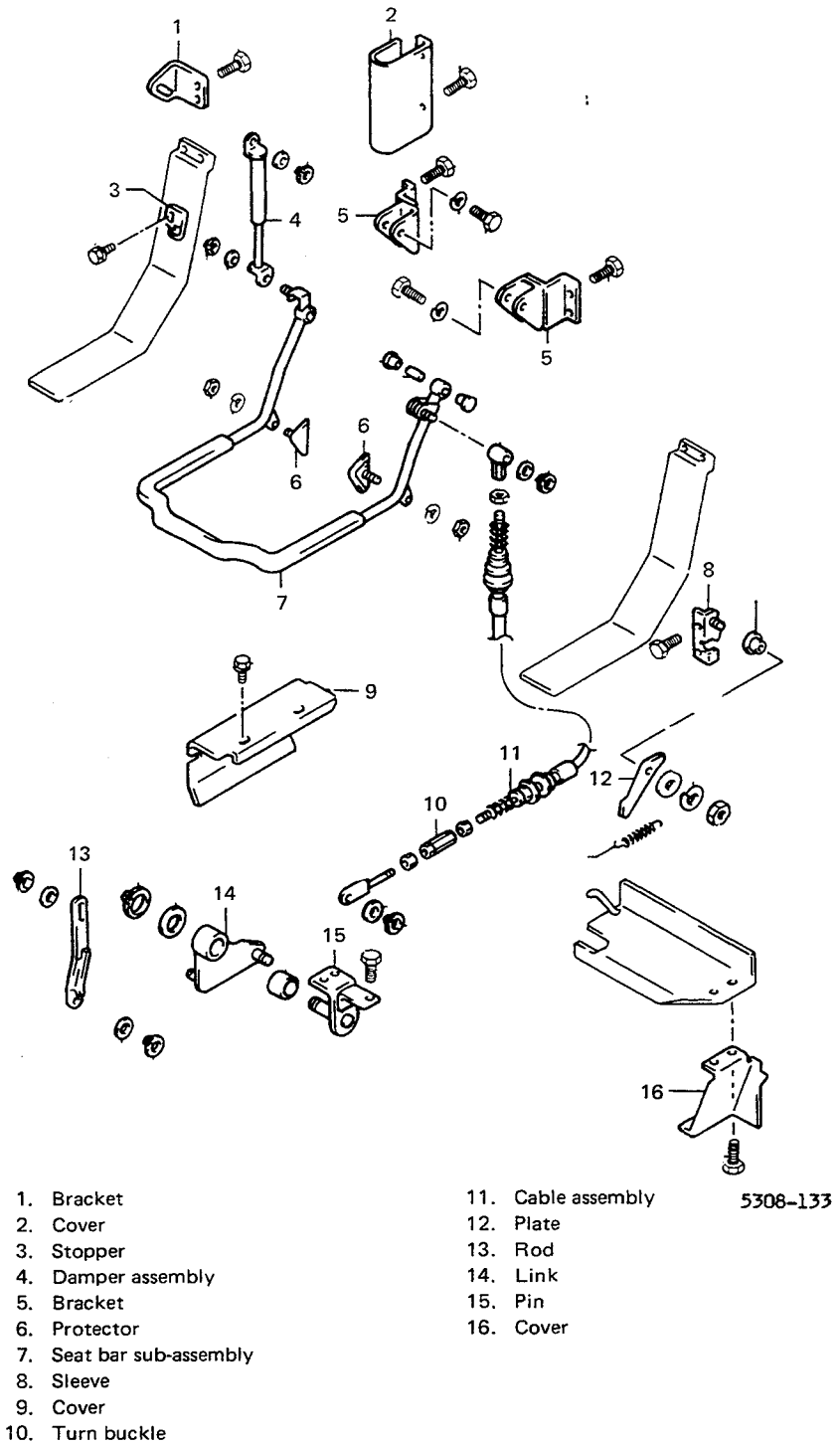
Wiring Diagram (2SDK7, 8)



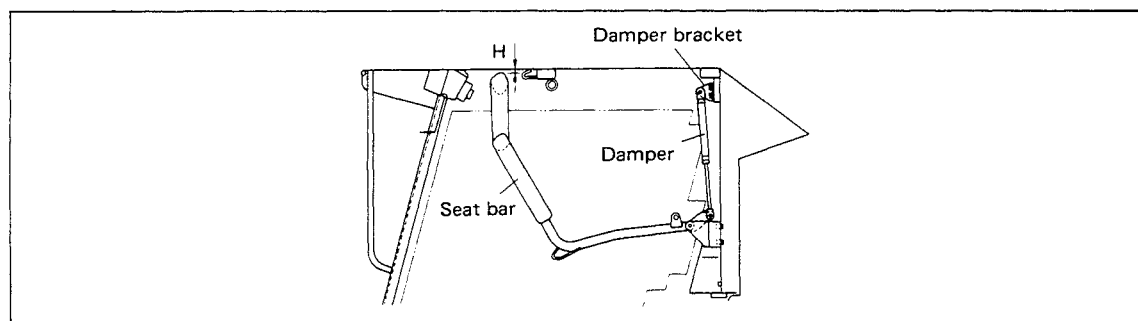
SAEL16

SEAT BAR

Components



ADJUSTMENT

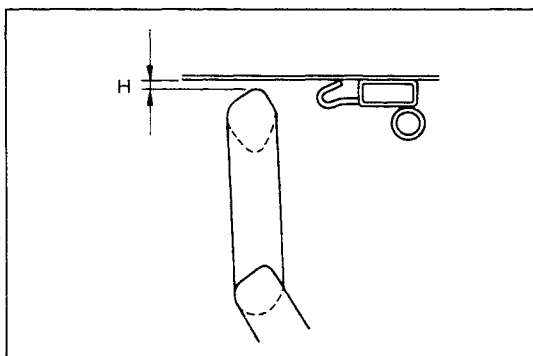


Adjusting the Seat Bar Height

1. Seat bar height adjustment

- (1) Stretching the damper in full stroke, adjust the distance between the seat bar and ceiling by sliding the oblong hole in the mount bracket.

H = 10 ~ 20 mm (0.39 ~ 0.79 in)

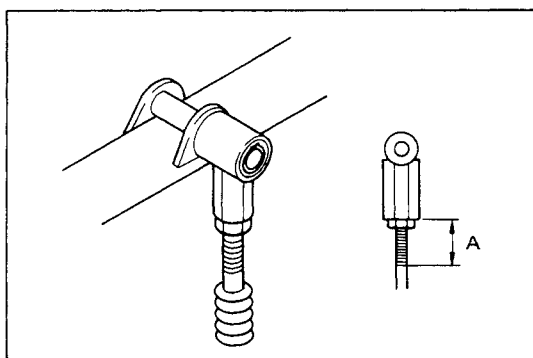


Adjusting Seat Bar Height

2. Seat bar cable length adjustment.

- (1) Connect the seat bar and cable.

A = Approx. 15 mm (0.59 in)



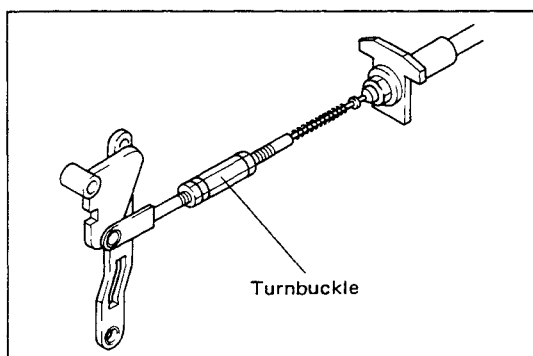
Connecting Seat Bar and Cable

- (2) Use the turnbuckle on the left side of the operator seat, and adjust the cable length.

With the pedal in the locked state (ordinary electrical locking state), screw in the turnbuckle.

When the seat bar starts to be lowered slightly from the uppermost position, lock the nut.

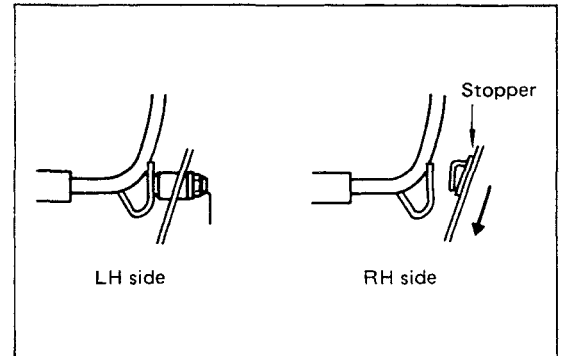
(The seat bar height shall be within the range of H in step 1 above.)



Adjusting Seat Bar Cable Length

3. Lowermost position stopper adjustment

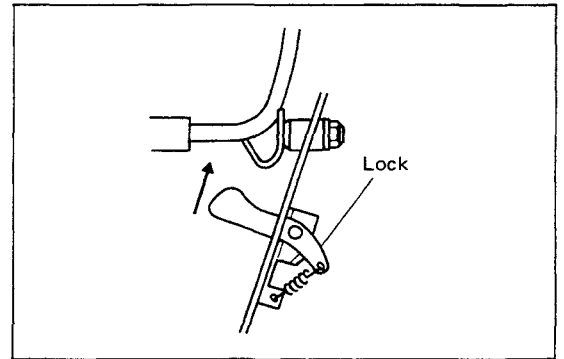
- (1) Lower the seat bar fully until the stopper comes into contact with the boss of the seat bar switch LH.
Slide the stopper RH until it comes into contact with the stopper on the seat bar side, and fix it by the bolt.



Adjusting the Lowermost Position Stopper

4. Lowermost position lock adjustment

- (1) Adjust the locks on the left and right sides.
- (2) Temporarily fit the temporarily assembled lock on the side panel. After adjusting the seat bar lowermost position stopper, bring the lock into contact with the seat bar and fix it by the bolt.
Establish close contact between the lock and seat bar to leave no clearance.

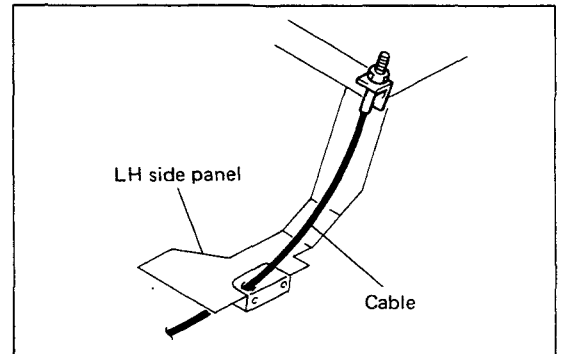


Adjusting the Lowermost Position Lock

Assembly

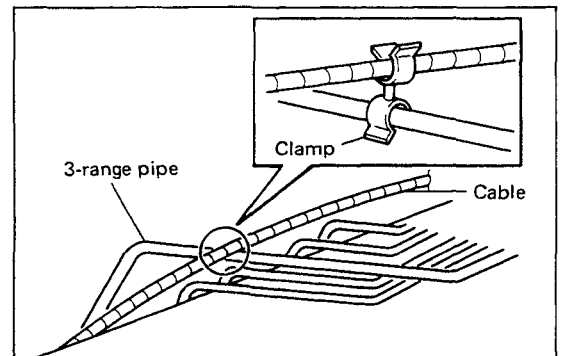
1. Cable route

- (1) Pass the cable through the opening in the fore part of the side panel.



Cable Route to Side Panel

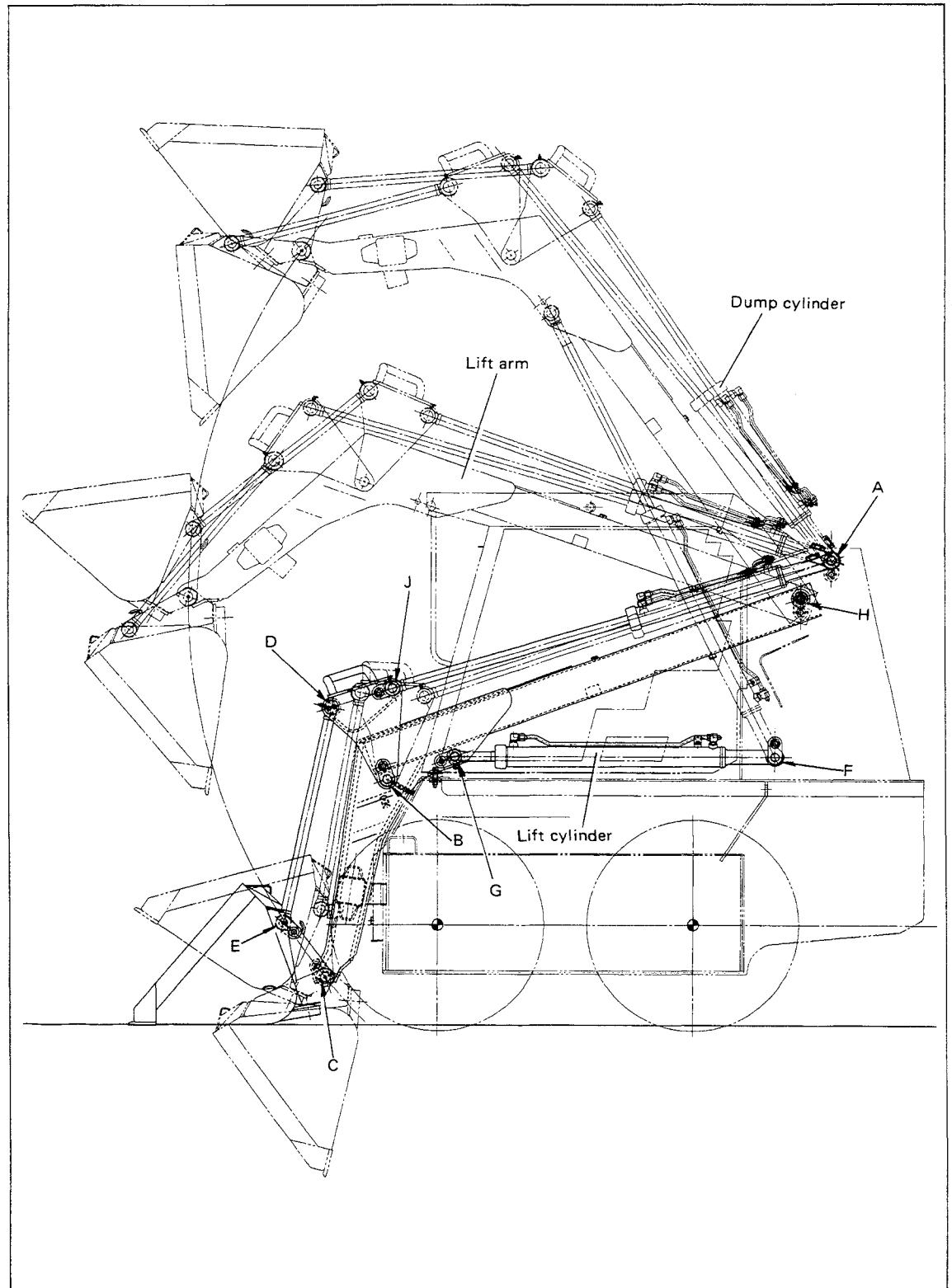
- (2) Pass the cable above the material handling pipes and outside of the 3-range pipe.



Cable Route to Pipes

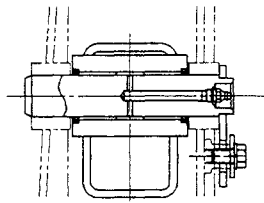
LIFT ARM & BUCKET BRACKET

	Page
DESCRIPTION	8-2
COMPONENTS	8-5
PRE-REMOVAL INSPECTION	8-7
LIFT ARMS	8-8
BUCKET BRACKET	8-13

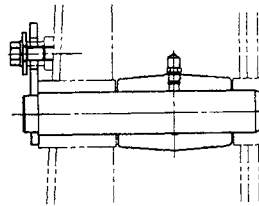
DESCRIPTION

Lift Arms & Link (1)

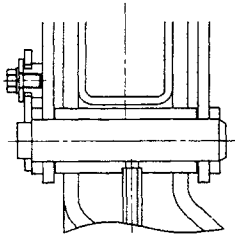
SAEL4



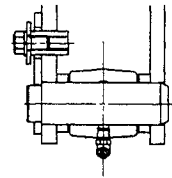
"A" section



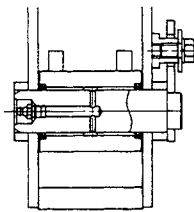
"F" section



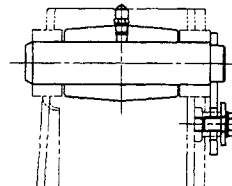
"B" section



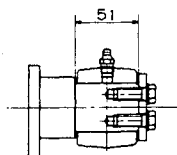
"G" section



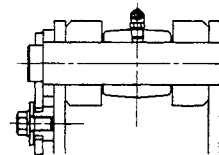
"C" section



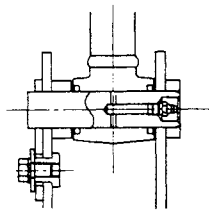
"H" section



"D" section



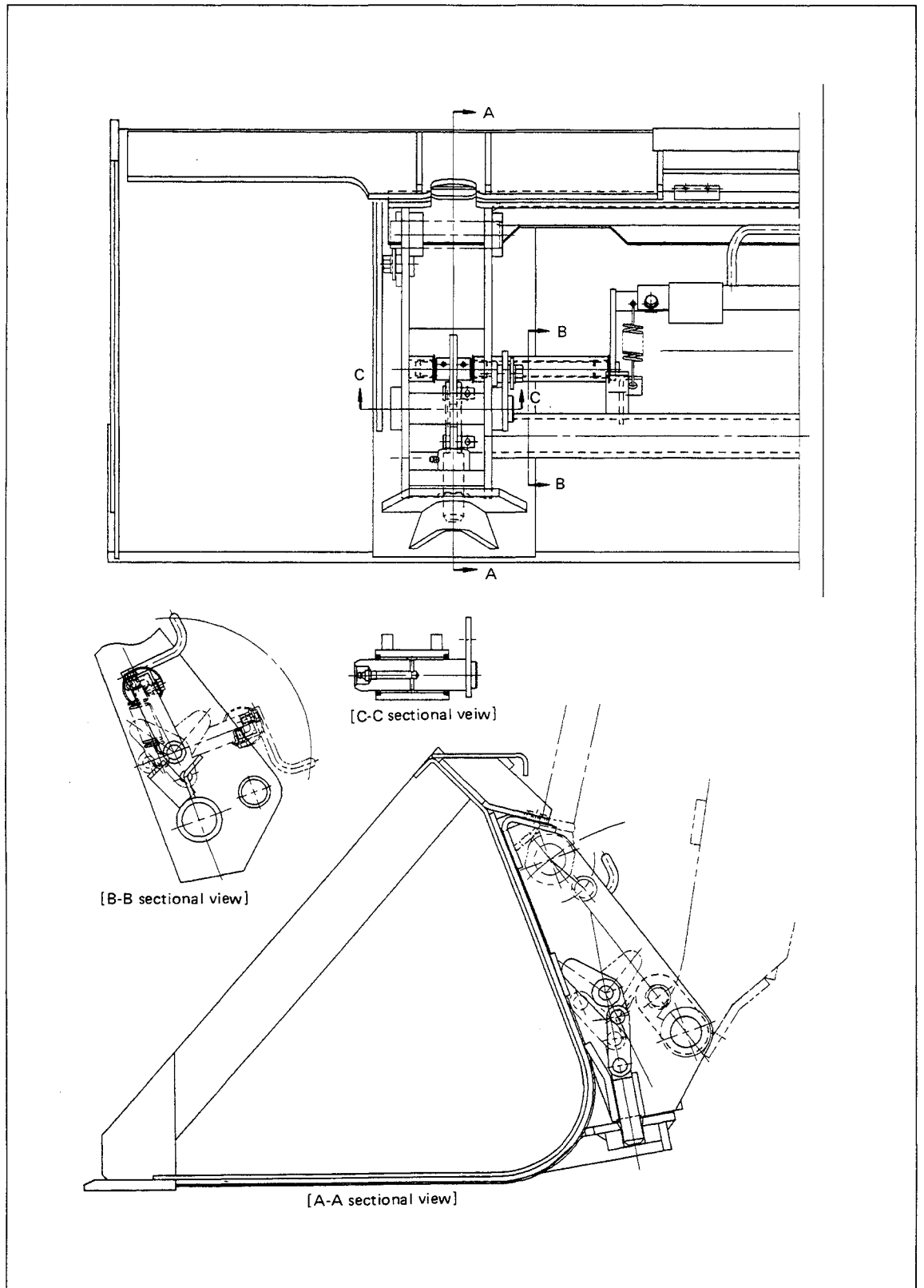
"J" section



"E" section

Link Pin Sectional View

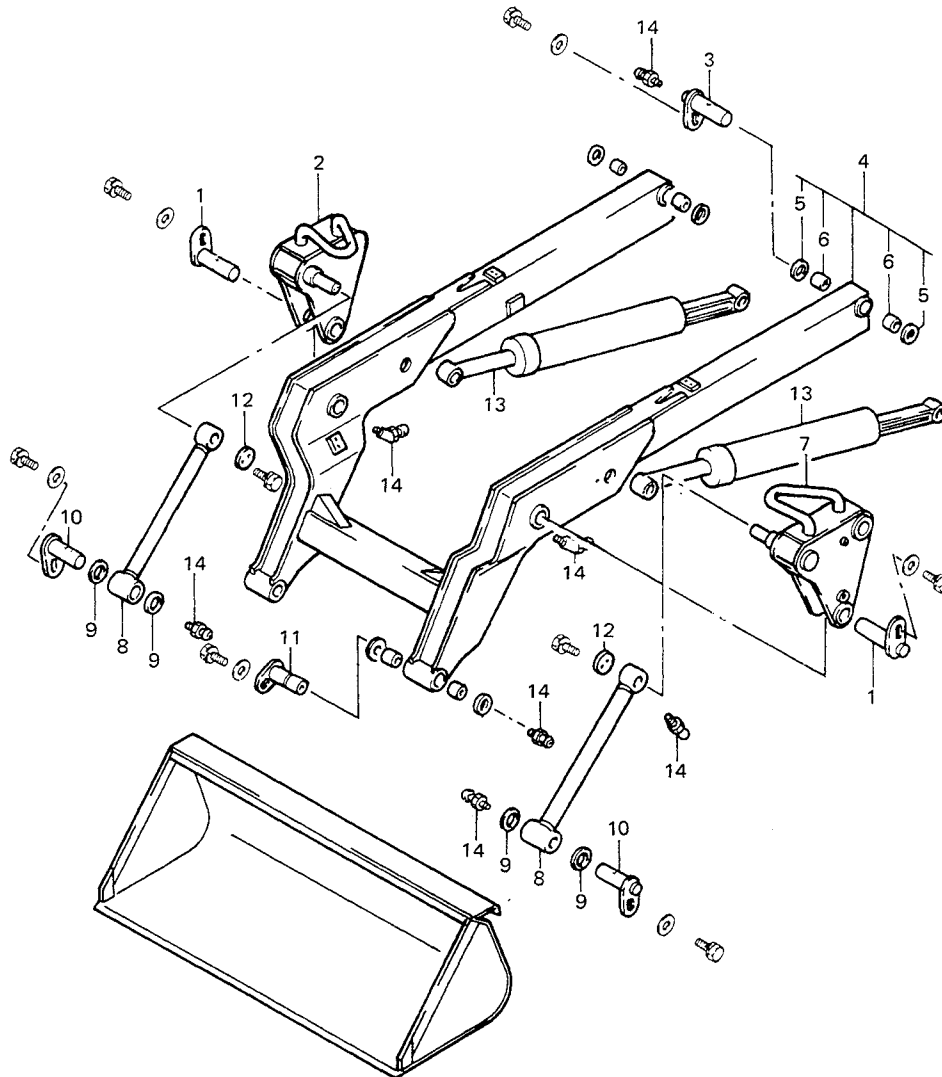
SAEM11



Bucket Bracket Sectional View

SAEL5

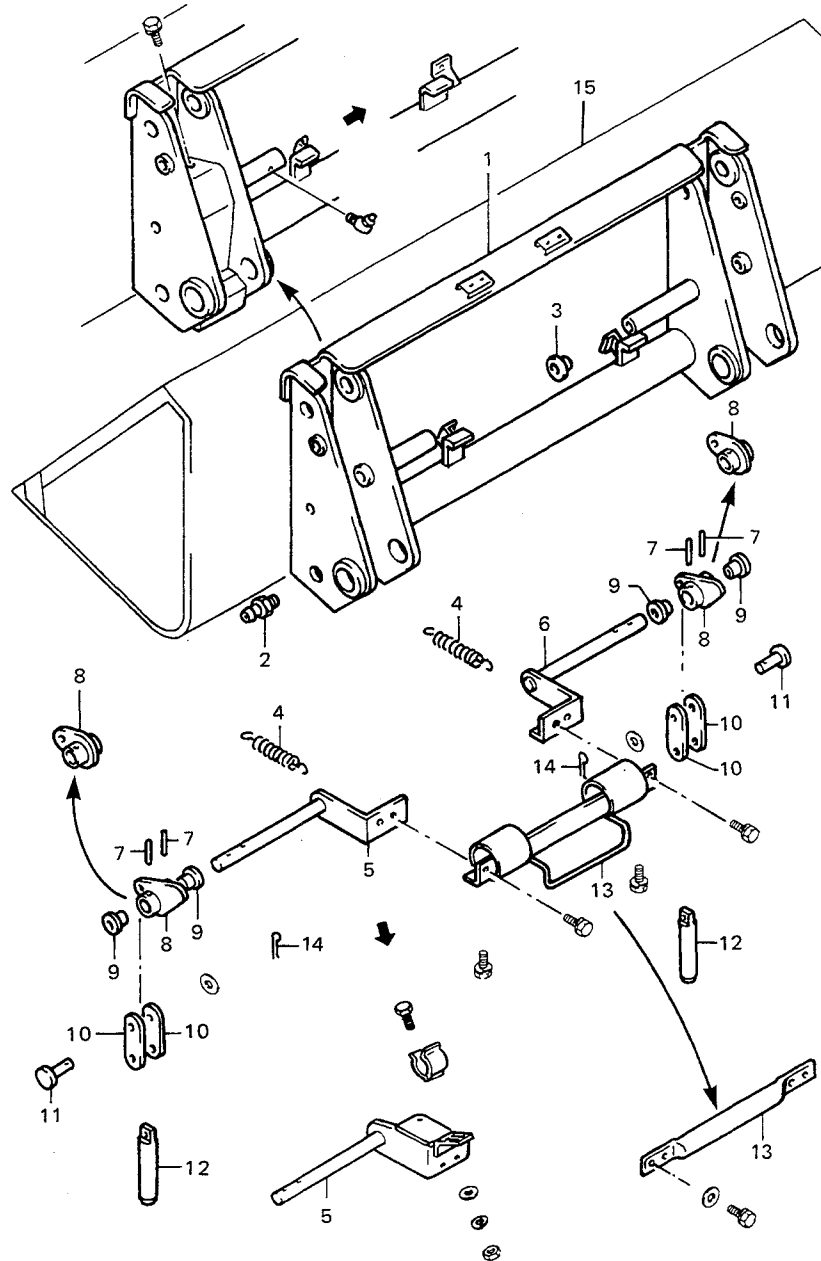
COMPONENTS



- | | |
|----------------------------|------------------------|
| 1. Counter arm support pin | 8. Connecting rod |
| 2. Counter arm RH | 9. Dust seal |
| 3. Lift arm support pin | 10. Connecting rod pin |
| 4. Lift arm | 11. Lift arm front pin |
| 5. Oil seal | 12. Washer |
| 6. Lift arm bushing | 13. Dump cylinder |
| 7. Counter arm LH | 14. Grease fitting |

Lift arm & Link Components

SAEM12



1. Bucket bracket
2. Grease fitting
3. Bushing
4. Spring
5. Stop lever LH
6. Stop lever RH
7. Spring pin
8. Middle link

9. Bushing
10. Link plate
11. Pin
12. Stopper pin
13. Stopper arm
14. Cotter pin
15. Bucket

Link Bracket Components

SAEM14

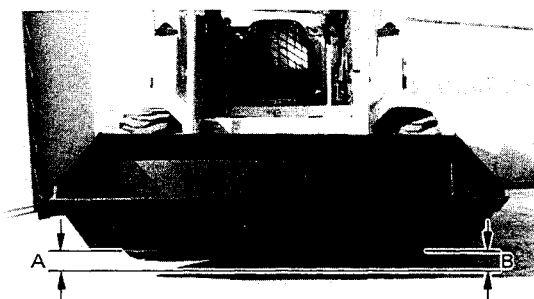
PRE-REMOVAL INSPECTION

Note:

Inspect the arm system (lift arm, bucket bracket, etc.) in the installed state.

1. Lift arm horizontal angle inspection
Face the bucket upward and fully lower the arm. Is the bottom of the bucket level (parallel with the ground)?

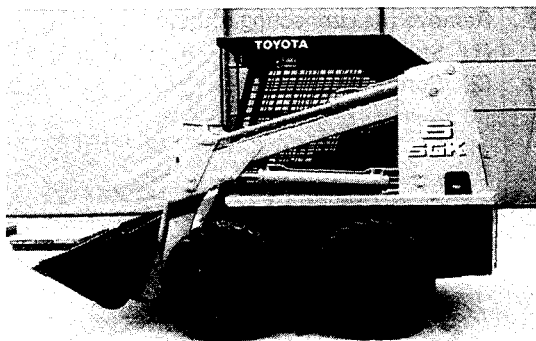
Limit of level difference between left and right (A-B) = 15 mm (0.6 in.)



Lift Arm Horizontal Angle Inspection

SAE48-22

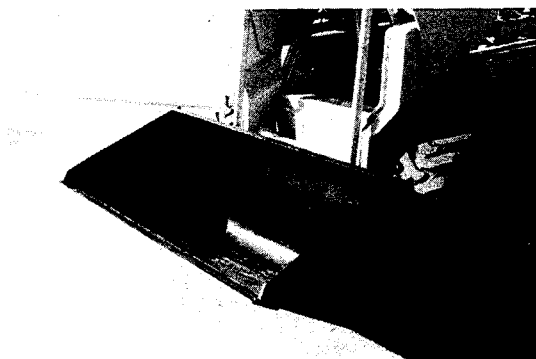
2. Lift arm and bucket bracket inspection
Dents, impact damage, cracks, bends, etc. and welded area cracks, separation, etc.



Damage, Crank, and Bend Inspection

SAE45-13

3. Bucket inspection
 - (1) Bucket bend, damage or cracks
 - (2) Bucket edge and stopper edge wear or damage



Bucket Inspection

SAE48-20

4. Oil leakage inspection
 - (1) Leakage from cylinder, high pressure hose or pipe
 - (2) Greasing of arm components

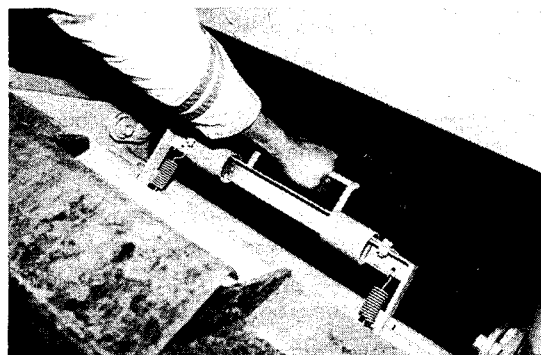
5. Lift arm Stopper
 - (1) A gap of lift arm stopper (Standard value)
0 ~ 3 mm (0 ~ 0.12 in.)

6. Natural lowering (hydraulic drift) and natural forward tilt inspection
Apply the normal load and set the lift arm and bucket to horizontal state. After 15 minutes, measure extension or retraction of each cylinder rod.
Natural lowering 48 mm (1.9 in.) [to be measured at lift cylinder rod]
Natural forward tilt 24 mm (1.0 in.) [to be measured at dump cylinder rod]

LIFT ARM

REMOVAL

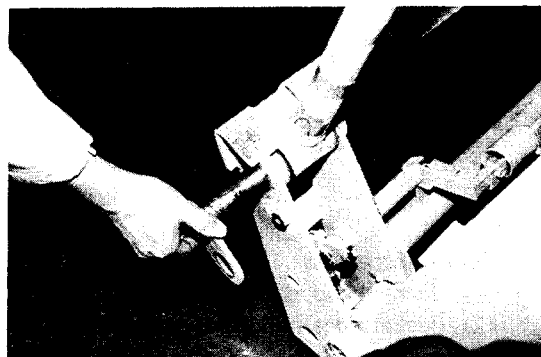
1. Remove the bucket.
 - (1) Bring the bucket into contact with the ground.
 - (2) Push down the bucket lock lever.
 - (3) Move the vehicle backward.



Bucket

SAE18-15

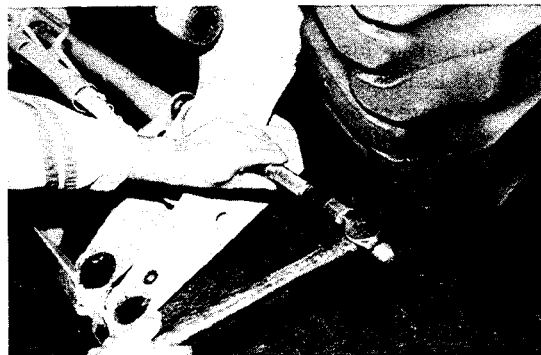
2. Remove the connecting rod pin.
 - (1) Stopper bolt
 - (2) Connecting rod pin



Connecting Rod Pin

SAE18-18

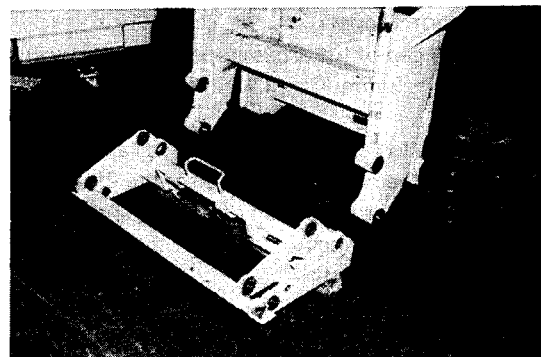
3. Remove the bucket bracket.
 - (1) Stopper bolt
 - (2) Lift arm front pin



Lift Arm Front Pin

SAE18-21

- (3) Bucket bracket



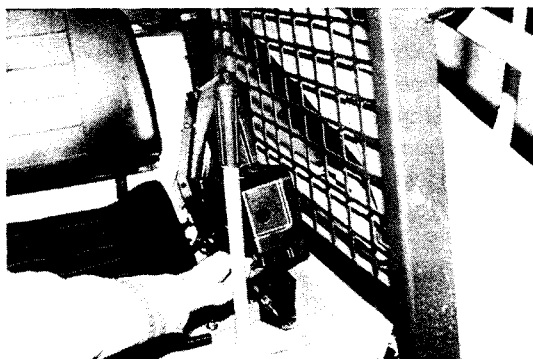
Bucket Bracket

SAE18-25

4. Remove the overhead guard.

(1) Duct LH

- ① Set screws (6 pcs.)
- ② Accelerator lever knob
- ③ Stop button (2J engine model)
- ④ Duct LH



Duct LH

SAE18-35

(2) Disconnect the wiring.

- ① Main harness connector
- ② Grounding cable
- ③ Wiring to pedal lock solenoid
- ④ Wiring to horn

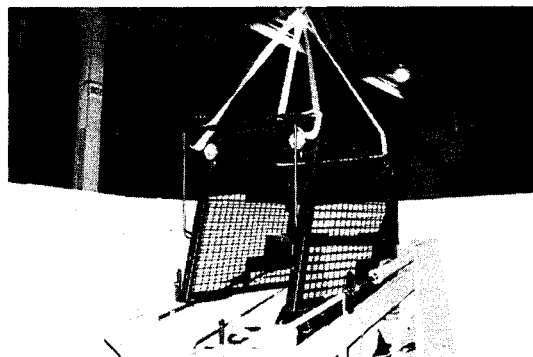


Disconnecting the Wiring

SAE18-36, SAE19-1

(3) Set bolts (4 pcs.)

(4) Overhead guard

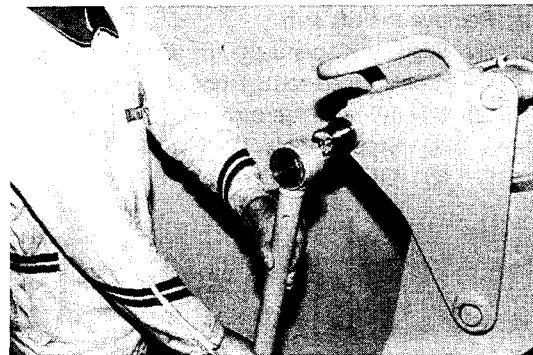


Overhead Guard

SAE19-14

5. Remove the connecting rod.

- (1) Set bolt
- (2) Washer
- (3) Connecting rod



Connecting Rod

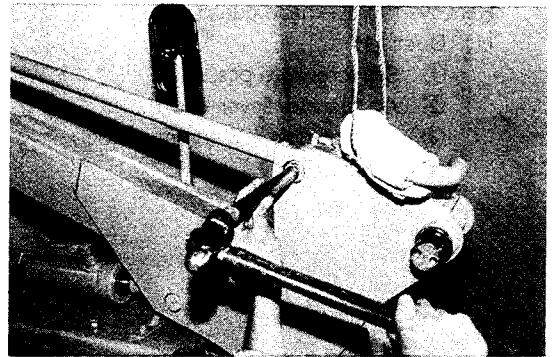
SAE19-17

6. Remove the dump cylinder.
 - (1) Suspend the counter arm with a wire rope.
 - (2) Stopper bolt
 - (3) Dump cylinder front pin
 - (4) Hose cover
 - ① Set bolts (2 pcs.)
 - ② Hose cover
 - (5) Disconnect the high pressure hose.

Caution:

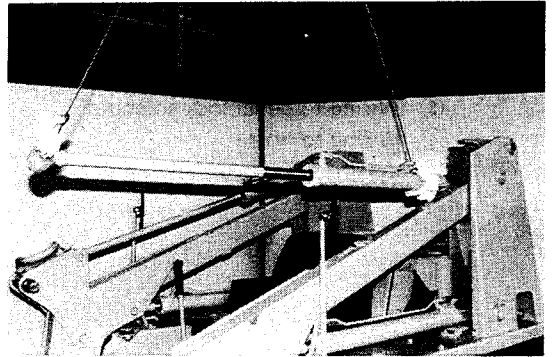
Suspend the dump cylinder slightly with a wire rope before removing the dump cylinder rear pin.

- (6) Stopper bolt
- (7) Dump cylinder rear pin
- (8) Dump cylinder



Dump Cylinder Front Pin

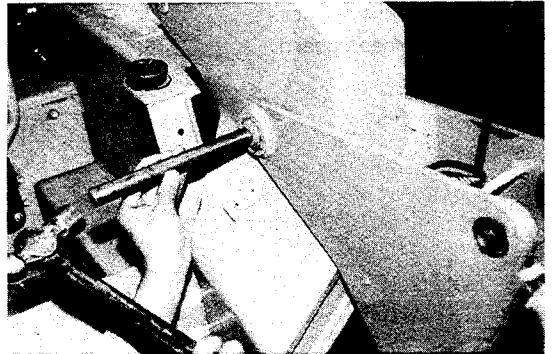
SAE19-20



Dump Cylinder

SAE19-28

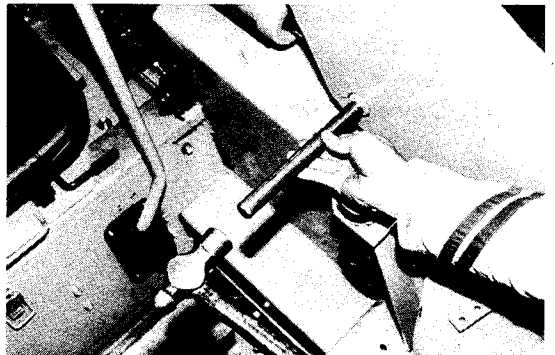
7. Remove the counter arm.
 - (1) Suspend the counter arm with a wire rope.
 - (2) Stopper bolt
 - (3) Counter arm support pin
 - (4) Counter arm



Counter Arm

SAE19-30

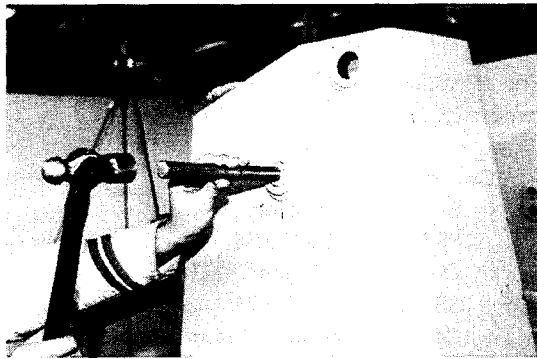
8. Remove the lift arm
 - (1) Slightly suspend the lift arm with a wire rope applied to its front and rear.
 - (2) Lift cylinder rod pin
 - ① Stopper bolt
 - ② Lift cylinder rod pin



Lift Cylinder Rod Pin

SAE19-35

- (3) Lift arm support pin
① Stopper bolt
② Lift arm support pin



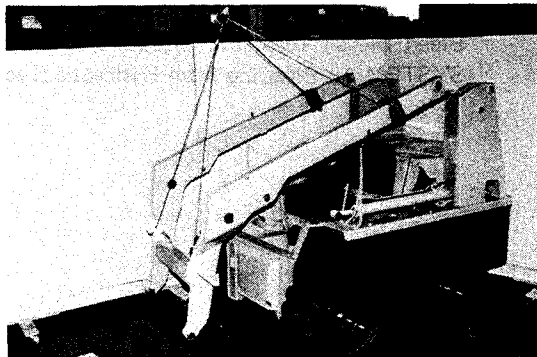
Lift Arm Support Pin

SAE20-4

- (4) Lift arm

Caution

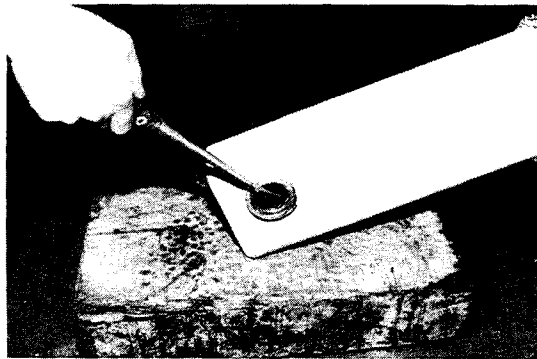
When suspending the lift arm, hoist it little by little and as horizontal as possible.



Lift Arm

SAE20-6

9. Remove the oil seal from the lift arm.



Oil Seal

SAE20-11

10. Remove the bushing from the lift arm.
SST 09620-30010



Bushing

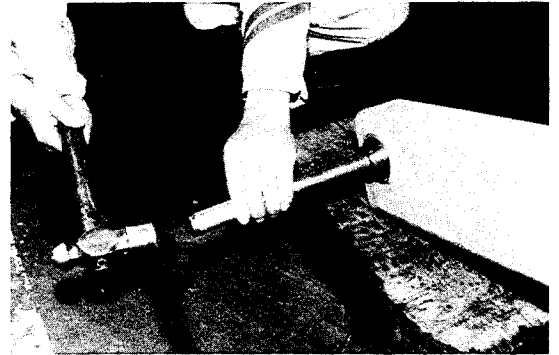
SAE20-12

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

- Bushing installation
SST 09120-10170-71
- Oil seal installation
SST 09120-10170-71
- Coat MP grease on each support pin before reassembly.
- Apply sufficient grease to each lubricating part.
- Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit section.



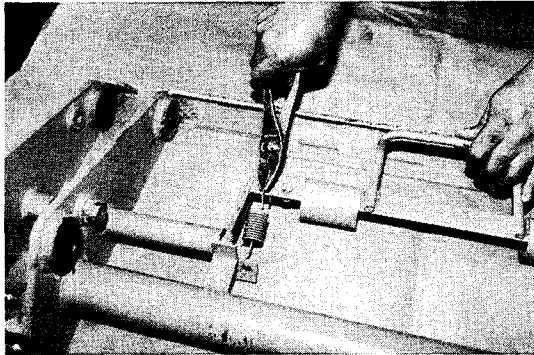
Oil Seal

SAE20-13

BUCKET BRACKET

DISASSEMBLY

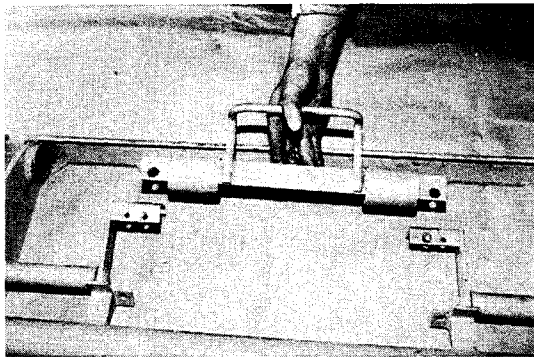
1. Remove the spring.



Spring

SAE18-26

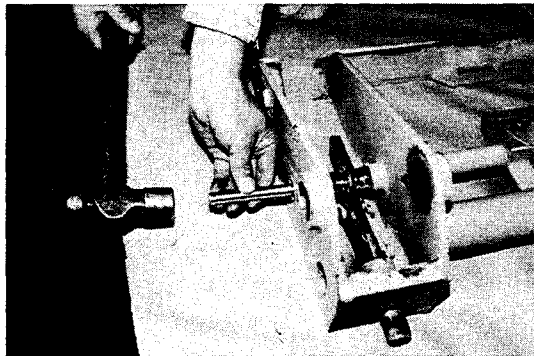
2. Remove the stopper arm.
(1) Set bolts (2 pcs.)
(2) Stopper arm



Stopper Arm

SAE18-28

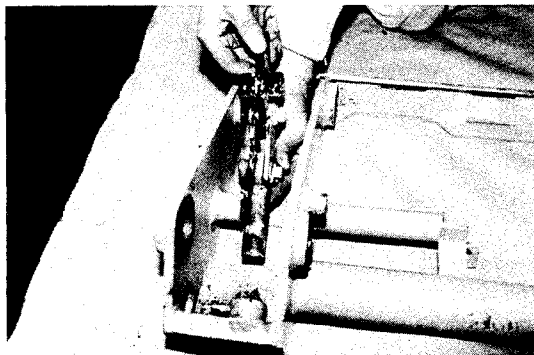
3. Remove the stopper lever.
(1) Spring pin
(2) Stopper lever



Stopper Lever

SAE18-30

4. Remove the stopper pin with middle link and link plate.



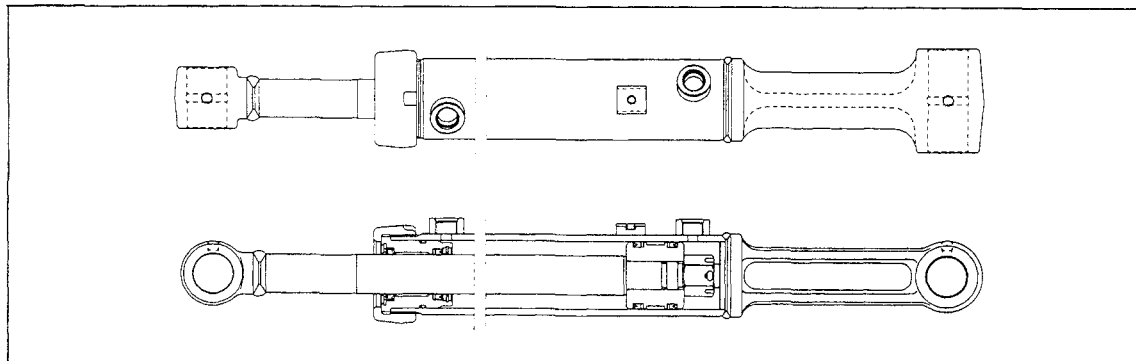
Stopper Pin with Link

SAE18-31

CYLINDER'S

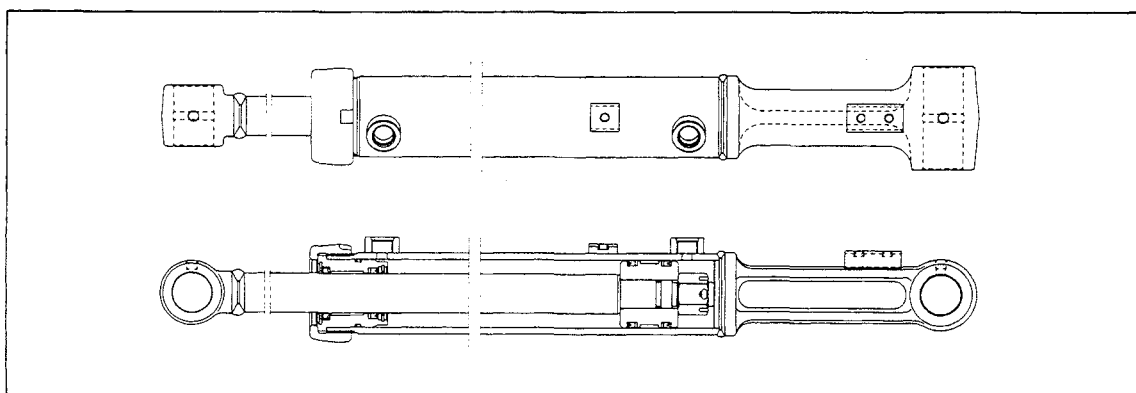
	Page
DESCRIPTION	9-2
SPECIFICATIONS & SERVICE STANDARDS	9-2
COMPONENTS	9-3
LIFT CYLINDER ASSY	9-5
DUMP CYLINDER ASSY	9-11

DESCRIPTION



Lift Cylinder Sectional View

SAEM15



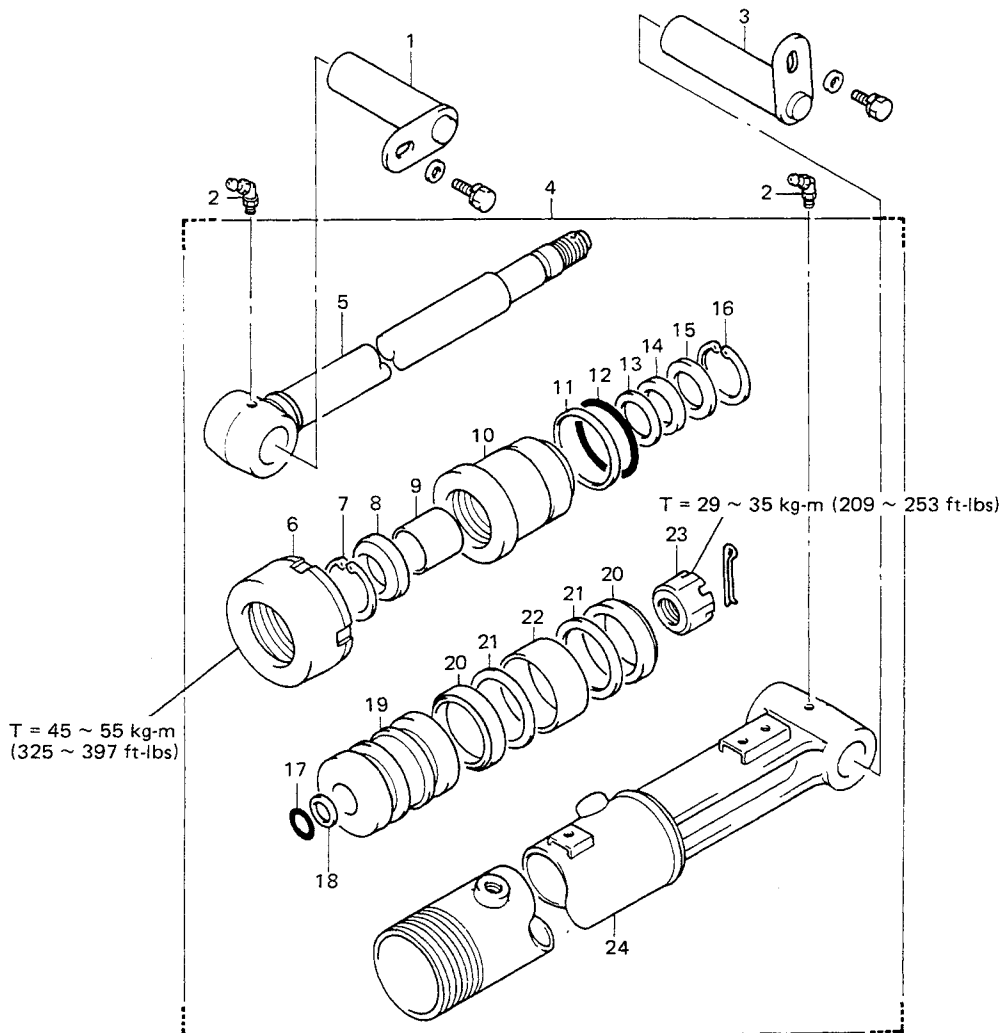
Dump Cylinder Sectional View

SAEM16

SPECIFICATIONS & SERVICE STANDARDS

Item		Lift cylinder	Dump cylinder
Type		Double action type	←
Piston stroke	mm (in)	653 (25.7)	447 (17.6)
Piston seal type		U packing	←
Rod seal type		U packing	←
Cylinder inside diameter	Standard value	60 (2.362)	←
	Limit	60.35 (2.376)	←
Piston rod outside diameter	Standard value	35 (1.378)	←
	Limit	34.92 (1.375)	←
Piston rod bending	Standard value	0	←
	Limit	1.0 (0.039)	←
Cylinder cover tightening torque	kg-m (ft-lbs)	45 ~55 (325 ~397)	←
Castled nut tightening torque	kg-m (ft-lbs)	29 ~35 (209 ~253)	←

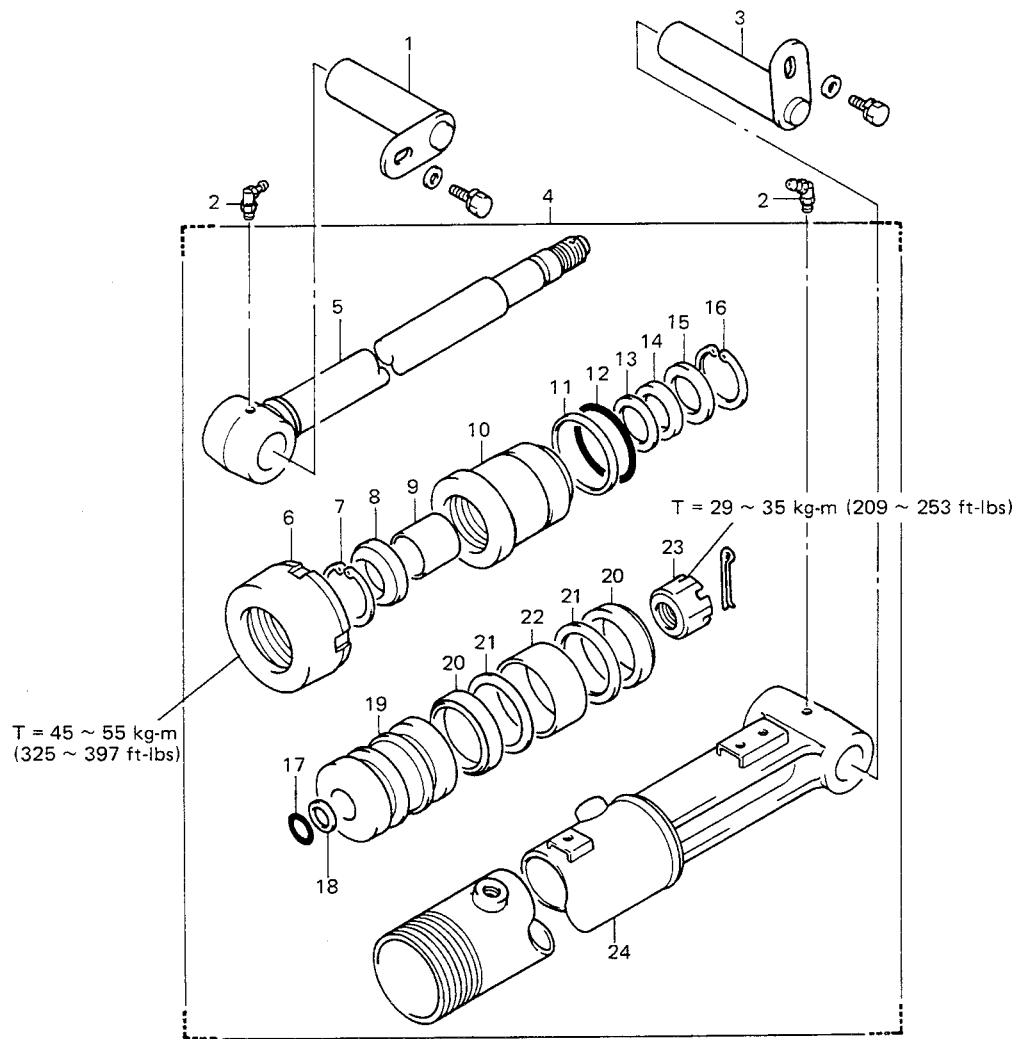
COMPONENTS



- | | |
|--------------------------|----------------------------|
| 1. Lift cylinder rod pin | 13. Back up ring |
| 2. Grease fitting | 14. U packing |
| 3. Lift cylinder end pin | 15. Spacer |
| 4. Lift cylinder assy | 16. Snap ring |
| 5. Piston rod | 17. O-ring |
| 6. Cylinder cover | 18. Back up ring |
| 7. Snap ring | 19. Piston |
| 8. Dust seal | 20. U packing |
| 9. Bushing | 21. Back up ring |
| 10. Rod guide | 22. Wear ring |
| 11. Back up ring | 23. Castled nut |
| 12. O-ring | 24. Lift cylinder sub-assy |

Lift Cylinder Components

SAEM14



LIFT CYLINDER ASSY

REMOVAL

1. Remove the bucket.
2. Remove the cylinder rod pin.

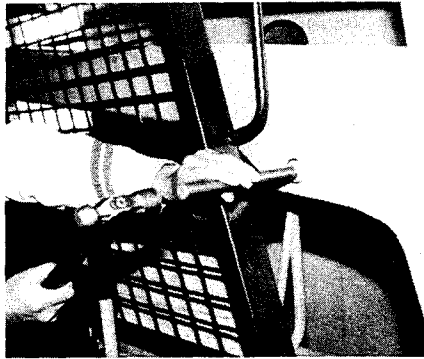
Caution

- Raise the lift arm to the position where the cylinder rod pin can be driven out from inside, and suspend it there with a wire rope.
- Pump the lift pedal several times to release the remaining pressure.

- (1) Stopper bolt
- (2) Cylinder rod pin

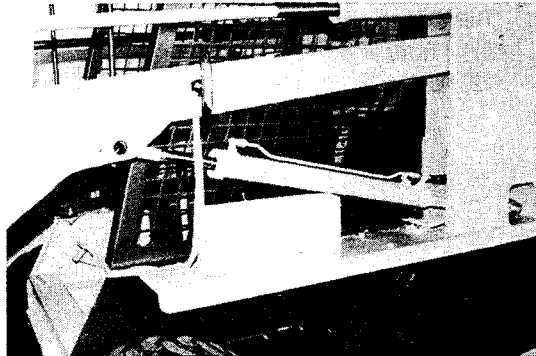
Caution:

Support the bottom side of the lift cylinder with a wooden block.



Lift Cylinder Rod Pin

SAE29-16



Supporting the Lift Cylinder

SAE29-17

3. Remove the air cleaner.

Caution:

Carry out this operation only when removing the lift cylinder left.

- (1) Disconnect the inlet hose.
- (2) Disconnect the wiring to the vacuum sensor.
- (3) Cleaner band clamp bolt
- (4) Air cleaner with hose



Air Cleaner

SAE29-22

4. Remove the muffler and exhaust pipe.

Caution:

Carry out this operation only when removing the lift cylinder right.

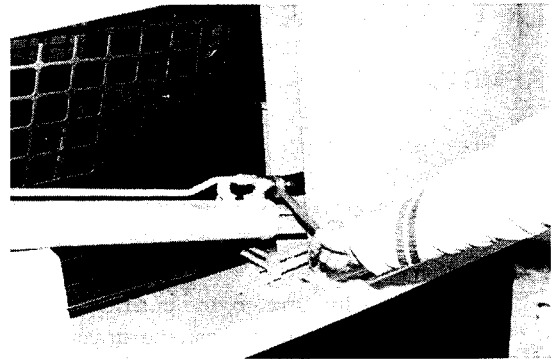
- (1) Exhaust pipe set nuts (4 pcs.)
- (2) Muffler band clamp bolt
- (3) Muffler assy & exhaust pipe



Muffler Assy & Exhaust Pipe

SAE31-4

5. Disconnect the piping.



Disconnecting the Piping

SAE29-23

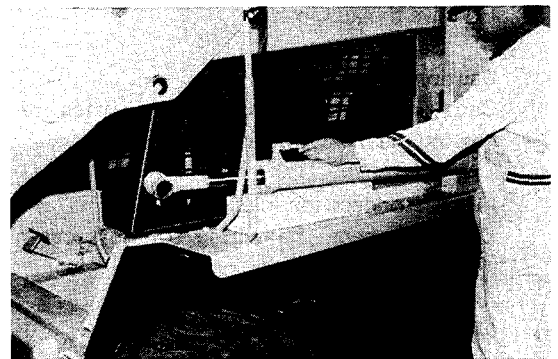
6. Remove the lift cylinder.
 - (1) Stopper bolt
 - (2) Cylinder end pin



Cylinder End Pin

SAE29-25

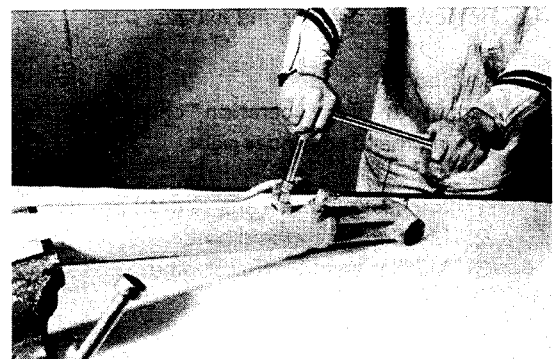
- (3) Lift cylinder



Lift Cylinder

SAE29-27

7. Remove the lift cylinder pipe.
 - (1) Disconnect the cylinder pipe.
 - (2) Set bolt
 - (3) Cylinder pipe



Lift Cylinder Pipe

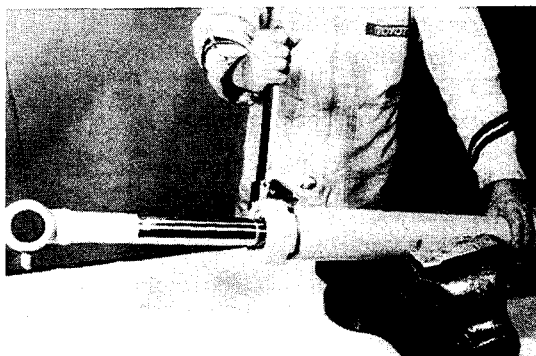
SAE29-29

DISASSEMBLY

1. Remove the cylinder cover.
SST 09620-10100-71

Caution:

When using a vise to hold it in place, do not tighten it too much.



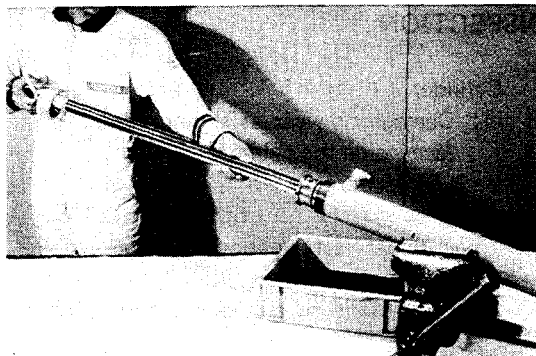
Cylinder Cover

SAE29-31

2. Remove the piston rod with the cylinder cover, rod guide and piston.

Caution:

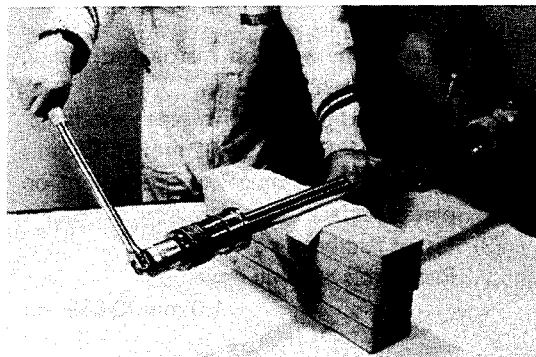
- Pull the piston rod parallel with the cylinder.
- Be careful not to damage the piston rod by contact with the cylinder cover.



Piston Rod

SAE29-34

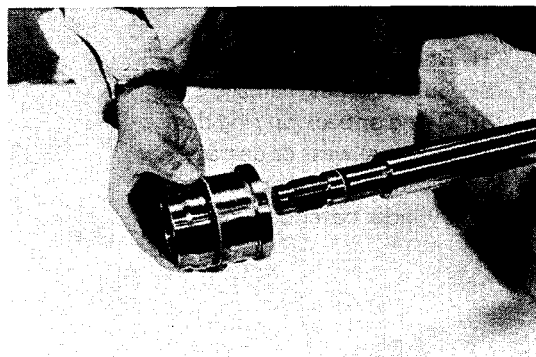
3. Remove the piston
 - (1) Cotter pin
 - (2) Castled nut
 - (3) Piston
 - (4) Wear ring
 - (5) U packing
 - (6) Back up ring
 - (7) Spacer (1990. 2 ~)



Piston

SAE29-35

4. Remove the rod guide.
5. Remove the cylinder cover.
6. Remove the O-ring and back up ring from the piston rod.



Rod Guide

SAE30-2

7. Disassemble the rod guide.
 - (1) Snap ring
 - (2) Spacer
 - (3) U packing, back up ring
 - (4) Snap ring
 - (5) Dust seal
 - (6) Bushing

Caution:

Force out the bushing only when it is found defective.

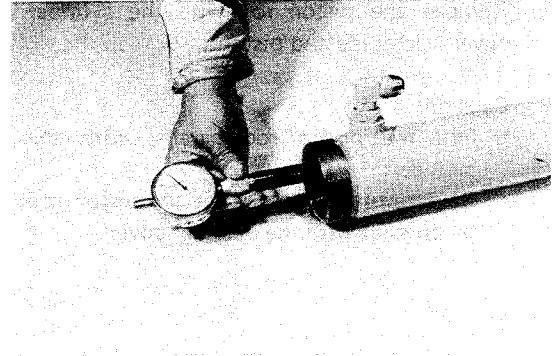


Disassembling the Rod Guide

SAE30-7

INSPECTION

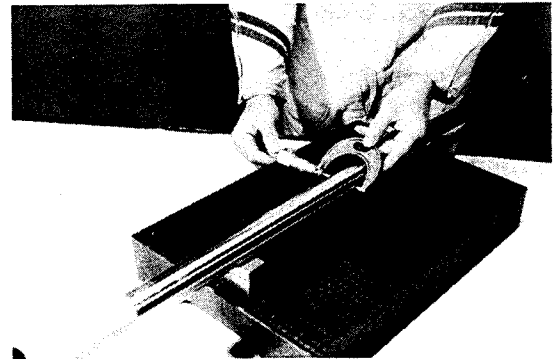
1. Cylinder
 - (1) Damage or wear at sliding contact surface inside the cylinder.
Cylinder bore wear limit:
60.35 mm (2.376 in.)
 - (2) Cylinder deformation, damage or corrosion
 - (3) Local dent on cylinder outside surface



Cylinder

SAE30-19

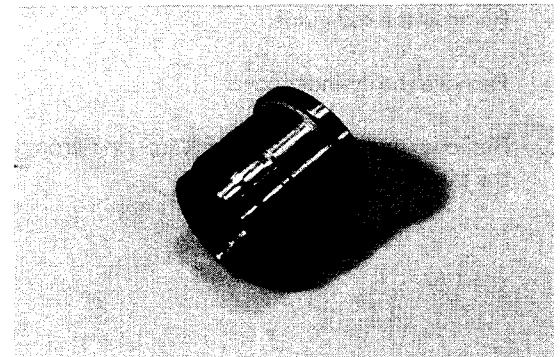
2. Piston rod
 - (1) Damage or wear on piston rod sliding contact surface.
Piston rod outside diameter wear limit:
34.92 mm (1.375 in.)
 - (2) Exfoliation, damage or corrosion on plated surface
 - (3) Piston rod bending
Piston rod bending limit:
1.0 mm (0.039 in.)



Piston Rod

SAE30-17

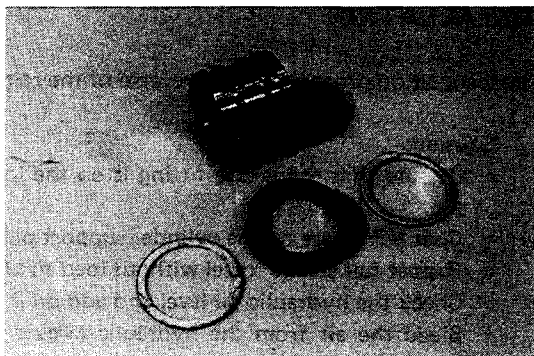
3. Rod guide
 - (1) Rod guide damage
 - (2) Guide bushing damage
 - (3) O-ring or back up ring damage
 - (4) Dust seal wear or damage
 - (5) U packing wear or damage
 - (6) Cylinder cover damage



Rod Guide

SAE30-10

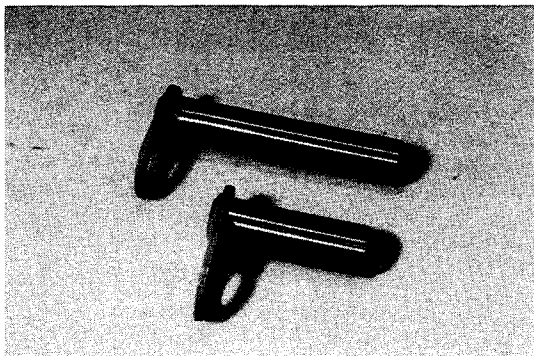
4. Piston
 - (1) Piston damage
 - (2) U packing wear or damage
 - (3) O-ring damage
 - (4) Wear ring damage
 - (5) Back up ring damage



Piston

SAE30-12

5. Cylinder support pin
 - (1) Crack or wear



Cylinder Support Pin

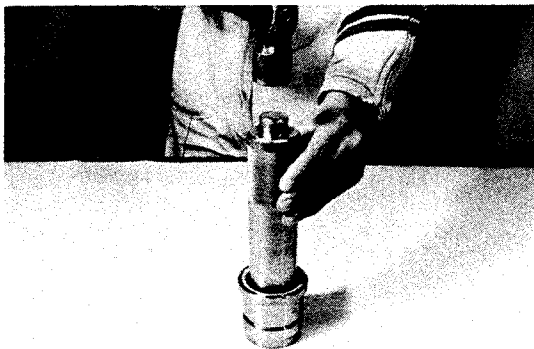
SAE30-21

ASSEMBLY

The assembly procedure is the reverse of the disassembly procedure.

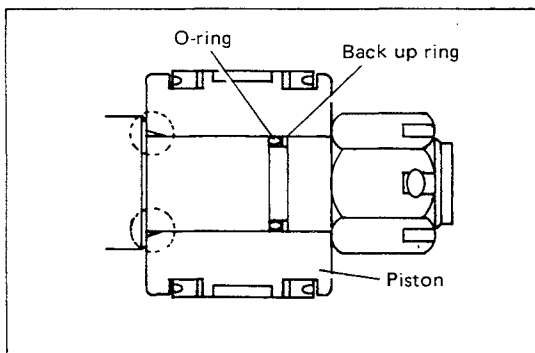
Caution:

- Do not assemble parts in dry state. Always coat hydraulic oil before assembly.
- Replace U packings, O-rings and dust seals with new ones after disassembly.
- Dust seal assembly:
SST 09608-35014
- Pay attention to the positions and directions when assembling the back up ring and piston at the piston rod.
- Castled nut tightening torque
 $T = 29 \sim 35 \text{ kg-m (209} \sim 253 \text{ ft-lbs)}$
- Cylinder cover assembly
Coat three Bond No. 1344 or equivalent on the whole threaded portion before assembly.
 $T = 45 \sim 55 \text{ kg-m (325} \sim 397 \text{ ft-lbs)}$



Dust Seal

SAE30-9



Piston and Back up Ring

SAES12

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

- Be sure that the grease fitting is on the lower side before installing the rod side cylinder support pin.
- Coat MP grease on the cylinder support pin and insertion hole.
- Repeat full stroke travel without load to bleed the air and to check normal functioning.
- Check the hydraulic oil level and add oil if insufficient.
- Bleed the air from the hydraulic circuit according to the procedure in the Hydraulic Piping-Air Bleeding from Hydraulic Circuit section.

DUMP CYLINDER ASSY

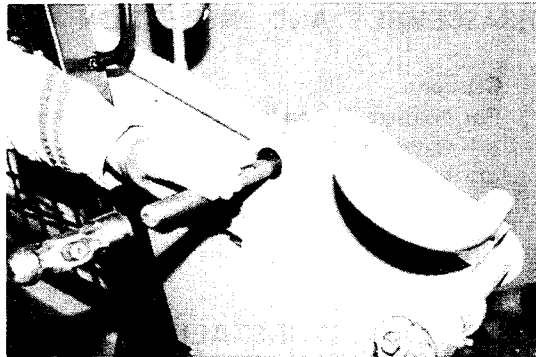
REMOVAL

1. Lower the bucket until contact with the ground.
2. Remove the cylinder rod pin.

Note:

Pump the dump pedal several times to release the remaining air pressure.

- (1) Stopper bolt
 - (2) Cylinder rod pin
3. Disconnect the piping.



Cylinder Rod Pin

SAE30-24



Disconnecting the piping

SAE30-26

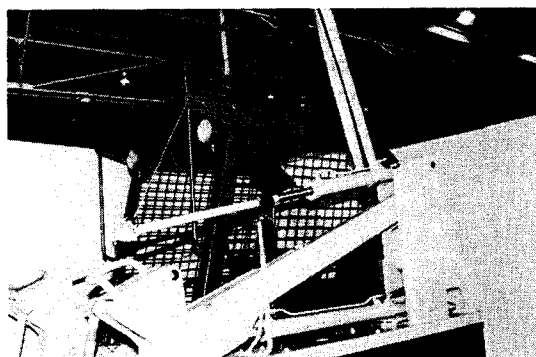
4. Remove the dump cylinder.
 - (1) Lightly suspend the dump cylinder with a wire rope.
 - (2) Stopper bolt
 - (3) Cylinder end pin



Cylinder End Pin

SAE30-28

- (4) Dump cylinder
5. Remove the hose guide and dump cylinder pipe.



Dump Cylinder

SAE30-36

DISASSEMBLY AND INSPECTION

Caution:

For disassembly and inspection, see the procedures for the lift cylinder.

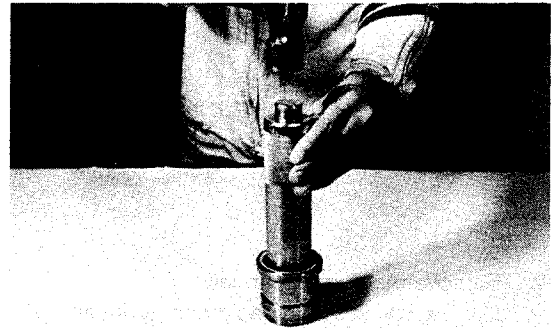
- | | |
|---|----------------------|
| (1) Cylinder bore wear limit: | 60.35 mm (2.376 in.) |
| (2) Piston rod outside diameter wear limit: | 34.92 mm (1.375 in.) |
| (3) Piston rod bending limit: | 1.0 mm (0.039 in.) |

ASSEMBLY AND INSTALLATION

The assembly and installation procedures are the reverse of the disassembly and removal procedures.

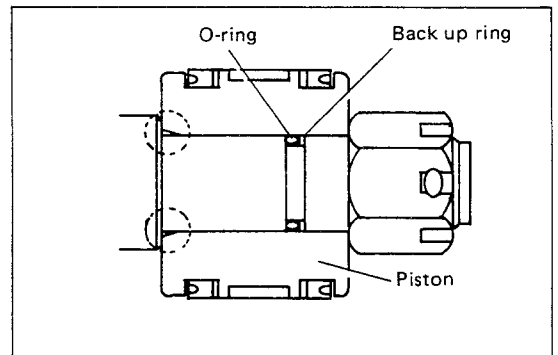
Caution:

- Do not assemble parts in dry state. Always coat hydraulic oil before assembly.
- Replace U packings, O-rings and dust seals with new ones after disassembly.
- Dust seal assembly
SST 09608-35014
- Pay attention to the positions and directions when assembling the back up ring and piston at the piston rod.
- Castled nut tightening torque
T = 29 ~ 35 kg-m (209 ~ 253 ft-lbs)
- Cylinder cover assembly
Coat Three Bond No. 1344 or equivalent on the whole threaded portion before assembly.
T = 45 ~ 55 kg-m (325 ~ 397 ft-lbs)
- Be sure that the grease fitting is on the lower side before installing the rod side cylinder support pin.
- Coat MP grease on the cylinder support pin and insertion hole.
- Repeat full stroke travel without load to bleed the air and to check normal functioning.
- Check the hydraulic oil level and add oil if insufficient.
- Bleed the air from the hydraulic circuit according to the procedure in the Hydraulic Piping-Air Bleeding from Hydraulic Circuit section.



Dust Seal

SAE30-8



Backup Ring, Piston

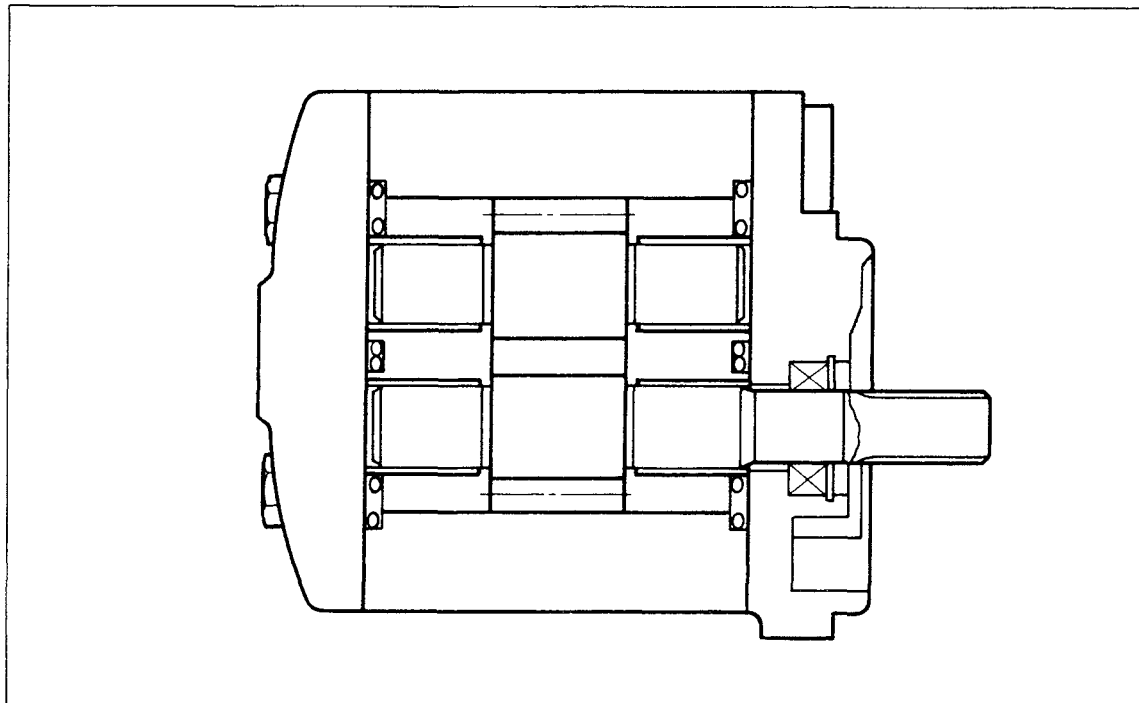
SAES12

OIL PUMP

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DESCRIPTION	10-2
SPECIFICATIONS & SERVICE STANDARDS	10-2
COMPONENTS	10-3
OIL PUMP ASSY	10-4
TESTING METHOD	10-13

DESCRIPTION

One single type gear pump is used as the oil pump. It is commonly used for HST charging and materials handling, and is connected to the PTO shaft of the engine.



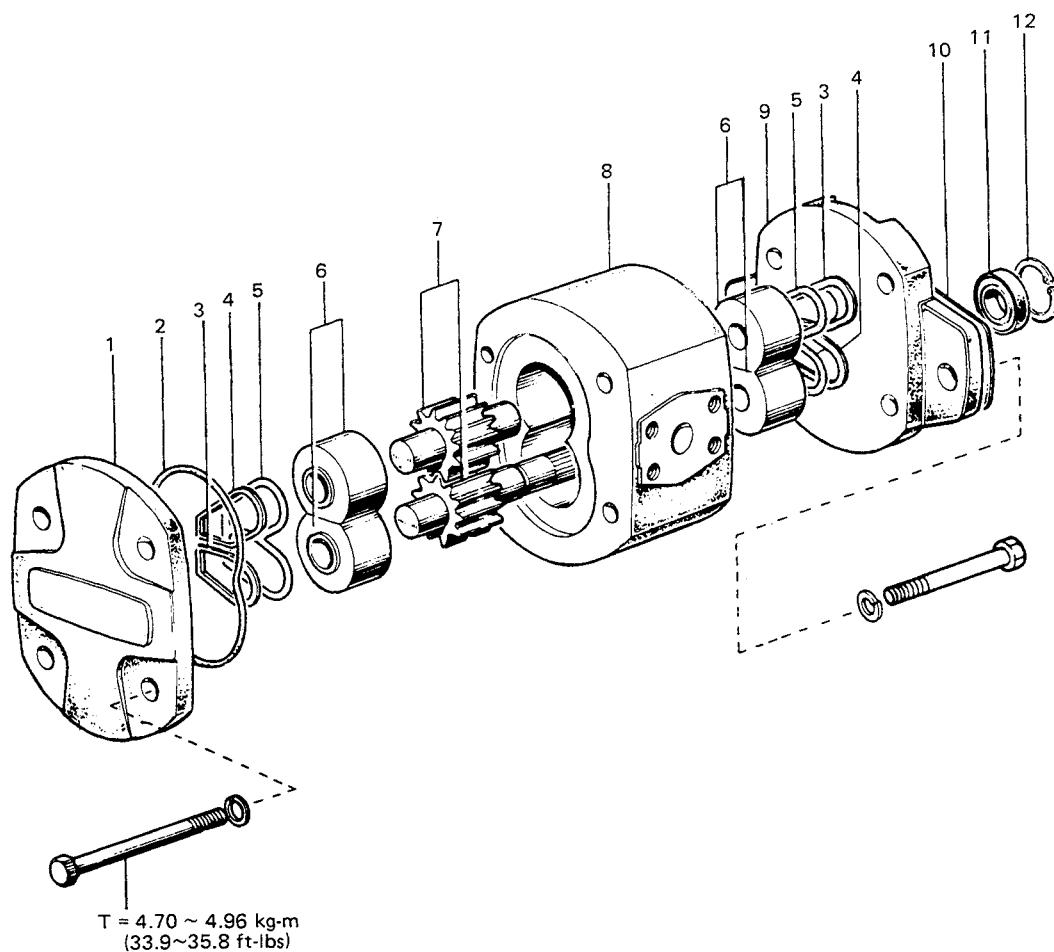
Oil Pump Sectional View

SAES2

SPECIFICATIONS & SERVICE STANDARDS

Item	Model	2SGK6	2SDK6	2SDK7	2SDK8
Pump name		Gear pump	←	←	←
Pump type		KRP4-21C	KRP4-19C	←	←
Theoretical discharge volume cc/rev (cu-in/rev)		21.0 (1.28)	19.2 (1.17)	←	←
Discharge volume (at 1500 rpm)	ℓ/min. (US gal/min.)	30.6 (8.08)	27.9 (7.37)	←	←
Drive method		PTO gear drive	←	←	←
Revolving speed ratio to engine speed		1 : 1.190	1 : 1.107	1 : 1.25	←
Body inner surface scratch limit	mm (in)	0.1 (0.0039)	←	←	←
Body shaft diameter limit	mm (in)	18.935 (0.745)	←	←	←
Gear shaft diameter limit	mm (in)	19.123 (0.753)	←	←	←
Bushing inside diameter limit	mm (in)	26.411 (1.040)	←	←	←
Pump cover set bolt tightening torque	kg-m (ft-lbs)	4.70 ~ 4.96 (33.9 ~ 35.8)	←	←	←

COMPONENTS



- | | |
|--------------------|----------------------|
| 1. Pump cover | 7. Gear set |
| 2. Body seal | 8. Pump body |
| 3. Backing ring RH | 9. Mounting flange |
| 4. Backing ring LH | 10. Oil pump packing |
| 5. Bushing seal | 11. Oil seal |
| 6. Bushing set | 12. Snap ring |

Oil Pump Components

SAEM7

OIL PUMP ASSY

REMOVAL

1. Open the engine hood.
2. Open the rear grille.
3. Remove the radiator.

Caution:

- For details of the removal, see the explanation in the Engine Assy Removal section.
- The photograph shows the 2J engine.

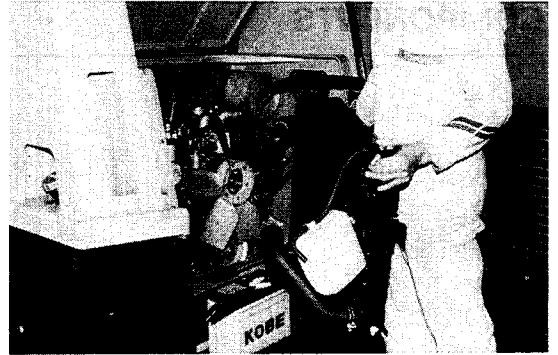
4. Remove the muffler exhaust pipe.
(Only for the 4P and 2J engine models)

Caution:

For details of the removal, see the explanation in the Engine Removal section.

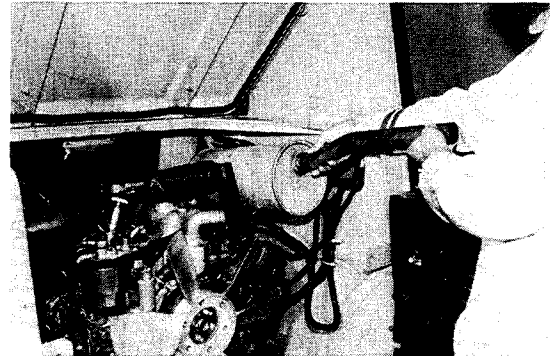
5. Remove the muffler bracket (only for the 2J engine model).
 - (1) Set bolts (2 pcs.)
 - (2) Muffler bracket

6. Remove the air cleaner (only for the 3T84H engine model).
 - (1) Disconnect the inlet hose.
 - (2) Disconnect the wiring to the vacuum sensor.
 - (3) Air cleaner band clamp bolt
 - (4) Air cleaner with hose



Radiator

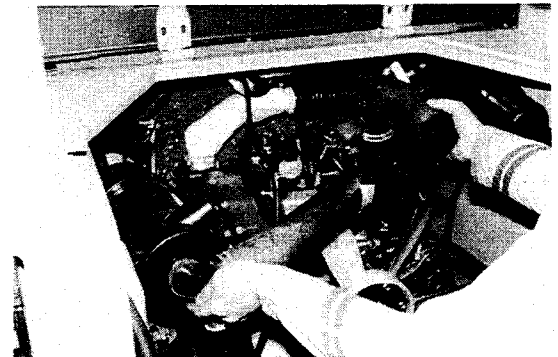
SAE32-11

Muffler & Exhaust Pipe
(2J Engine Model)

SAE32-9

Muffler & Exhaust Pipe
(4P Engine Model)

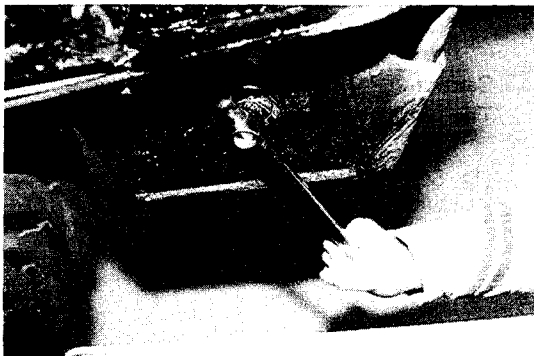
SAE35-18



Air cleaner

SAE42-13

7. Drain the hydraulic oil.
 (1) Drain plug



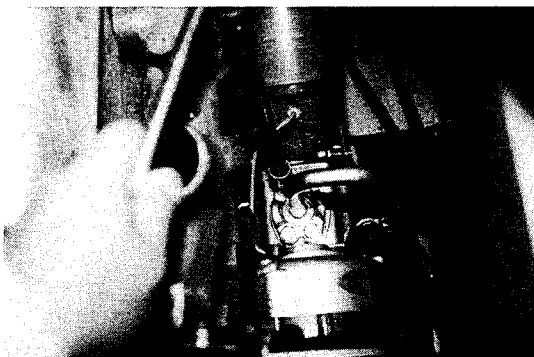
Draining the Hydraulic Oil

SAE14-8

8. Disconnect the oil pump piping.
 (1) Outlet hose (on oil pump side)
 ① Set bolts (4 pcs.)
 ② Flange

Caution:

- Fit a nylon cap to the hose to prevent dirt or dust entrance.
- The photograph shows the 2J engine model.



Disconnecting the Outlet Hose

SAE31-7

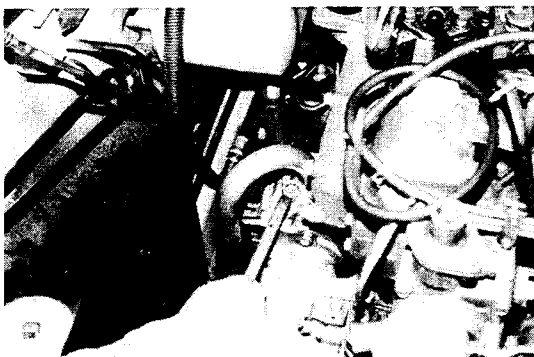
- (2) Suction pipe (oil pump side)
 ① Set bolts (4 pcs.)

Caution:

Fit a nylon cap to the pipe to prevent dirt or dust entrance.

Disconnecting the Suction Pipe
(2J Engine Model)

SAE32-6

Disconnecting the Suction Pipe
(3T84H Engine Model)

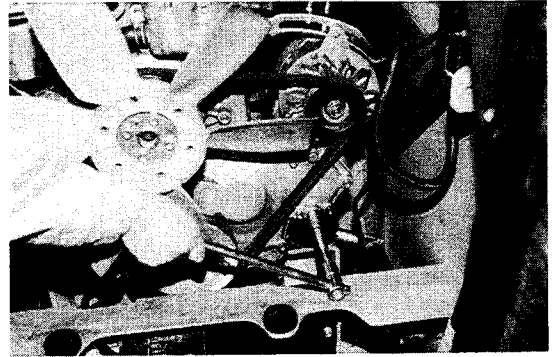
SAE42-24

9. Remove, the oil pump.

Caution:

The photograph shows the 2J engine model.

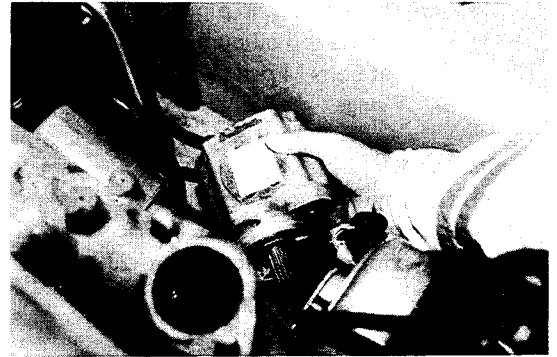
- (1) Set bolts (2 pcs.)



Set Bolts

SAE31-12

- (2) Oil pump



Oil Pump

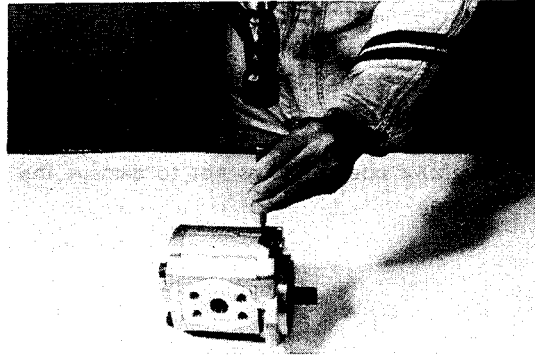
SAE31-13

DISASSEMBLY

Caution

- Always operate in a clean place.
- Use fresh hydraulic oil for parts washing.

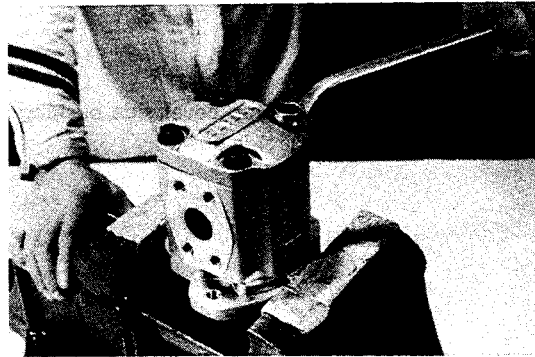
1. Punch matchmarks on the cover, pump, body and mounting flange.



Punching the Matchmarks

SAE31-19

2. Remove the pump cover.
 - (1) Set the pump to a vise.
 - (2) Loosen set bolts.
 - (3) Remove from the vise.
 - (4) Set bolts
 - (5) Pump cover



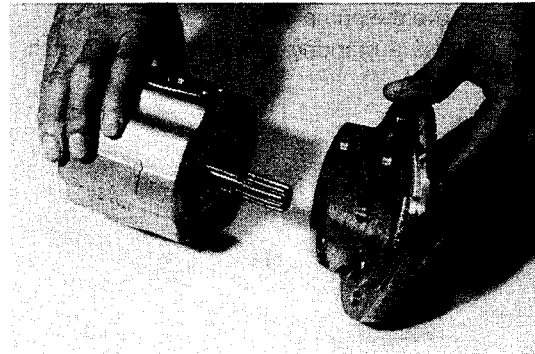
Pump Cover

SAE31-18

3. Remove the mounting flange.

Caution:

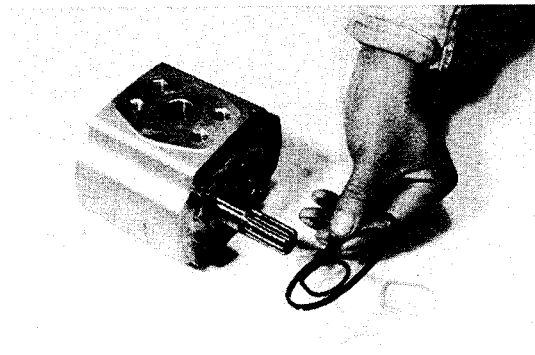
Carefully protect the oil seal from any damage.



Mounting Flange

SAE31-21

4. Remove seals on the pump cover side and mounting flange side.
 - (1) Body seal
 - (2) Packing ring
 - (3) Bushing seal

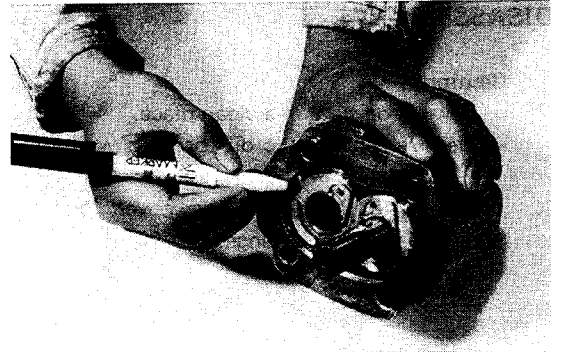


Seals

SAE31-22

5. Remove the bushing.
 - (1) Use a marking pen and draw a matchmark between the bushing and body.

Caution:
Carefully operate so as not to damage the bushing.

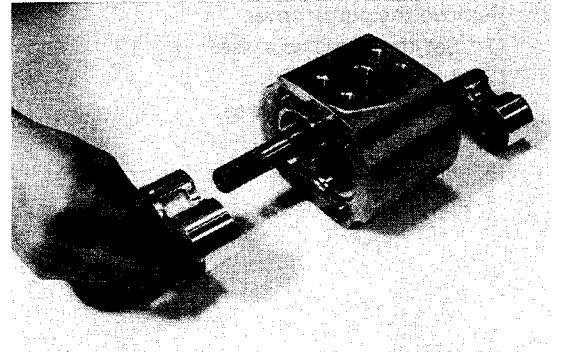


Matchmark

SAE31-23

- (2) Bushing

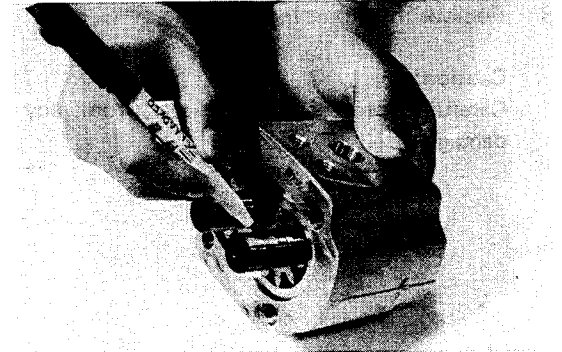
Caution:
Never confuse the pump cover side bushing and mounting flange side bushing.



Bushing

SAE31-25

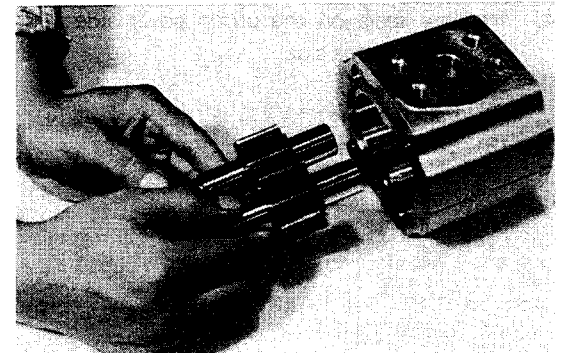
6. Remove the pump gear.
 - (1) Use a marking pen and draw a matchmark.



Matchmark

SAE31-26

- (2) Drive gear
- (3) Driven gear



Pump Gear

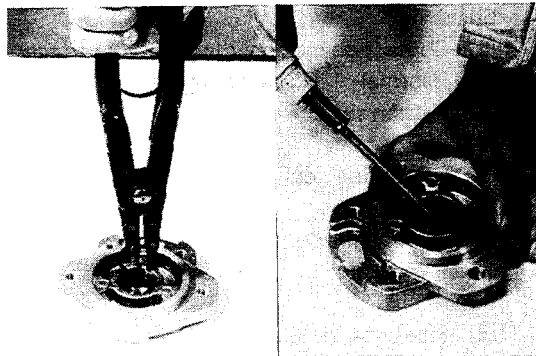
SAE31-28

7. Remove the oil seal from the mounting flange.

- (1) Snap ring
- (2) Oil seal

Caution:

Remove the oil seal only when it is found defective.



Oil Seal

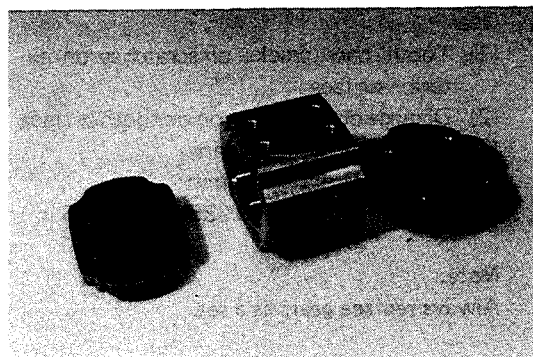
SAE31-29, 30

INSPECTION

Caution:

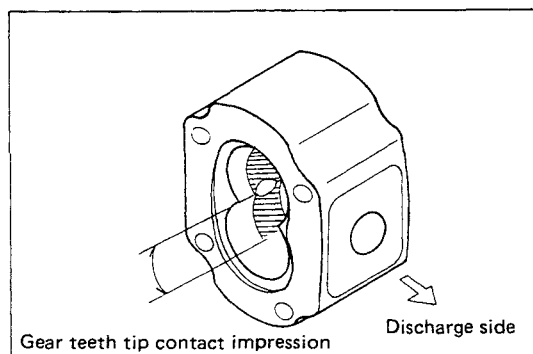
Wash and inspect the disassembled parts after checking the contamination and discoloration states.

1. Body, cover and flange
 - (1) Gear contact impressions on the inside surface of the body on the suction side.
(Normal = Trace of contact on 1/3 of body inside circumference)
 - (2) Damage on mating surfaces of the body, cover and flange.
 - (3) Damage at mounting portion and each threaded portion.
 - (4) Scratches on body inside surface
Body inside surface scratch depth
Limit = 0.1 mm (0.0039 in.)



Pump Body

SAE31-31

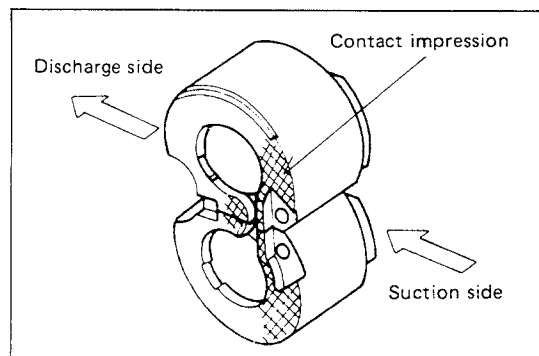


Gear Tooth Tip Contact Impression

SAES-3

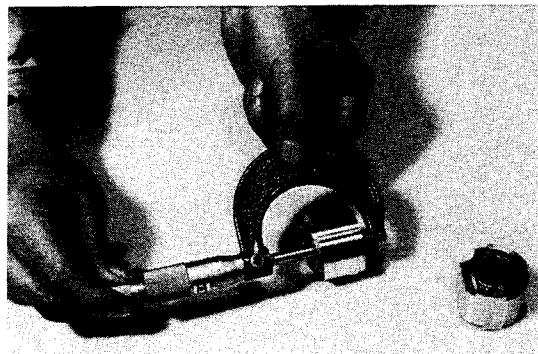
2. Bushing

- (1) Contact on inside sliding contact surfaces
(Normal = Gloss on about half of the suction side)
- (2) Scratching on inside sliding contact surfaces
Bushings inside diameter limit:
19.123 mm (0.753 in.)
- (3) Side exterior surface contact
(Normal: Fairly strong on the suction side and slight on the discharge side)
- (4) Scratching on side exterior surface
Limit length in bushing axial direction:
26.411 mm (1.040 in.)



Bushings Contact Impression

SAES4



Bushings

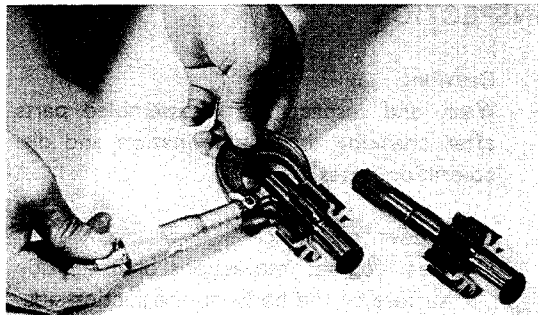
SAE31-32

3. Gear

- (1) Tooth base cracks or scratches on exterior surface
- (2) Damage or discoloration on tooth surface
- (3) Scratching on gear shaft
Gear shaft diameter limit:
18.935 mm (0.745 in.)

Note:**Always replace gears as a set.**

- (4) Wear and damage at spline portion

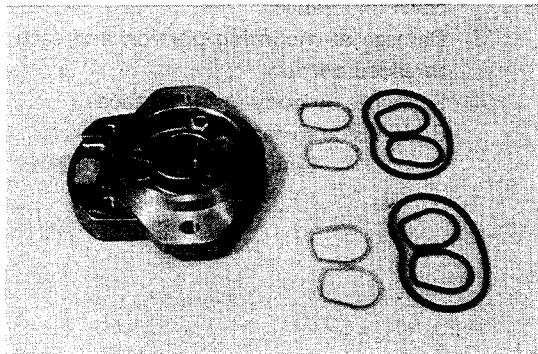


Gear

SAE31-34

4. Seals

- (1) Damage, deformation or wear at mounting flange oil seal lip.
- (2) Deformation or damage of backing ring.

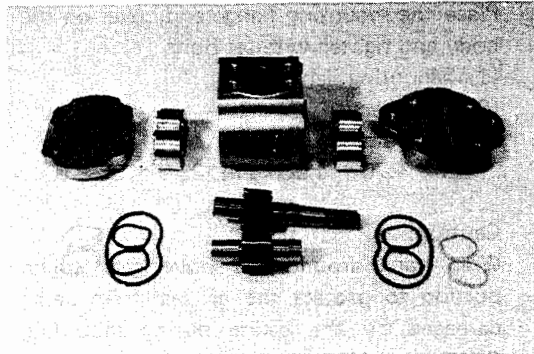
Caution:**Always replace the body seal and bushing seal after disassembly.**

Oil Seal and Seals

SAE31-35

ASSEMBLY

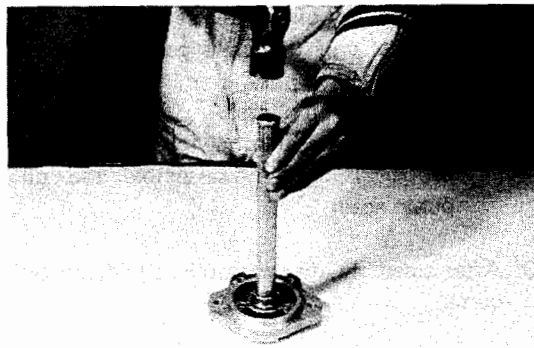
1. Wash each part and blow with compressed air.
2. Coat grease slightly on each part.
 - (1) Oil seal lip
 - (2) Body seal
 - (3) Bushing seal
 - (4) Backing ring



Oil Pump

SAE32-1

3. Install the oil seal to the mounting flange.
 - (1) Oil seal
SST 09620-30010
 - (2) Snap ring



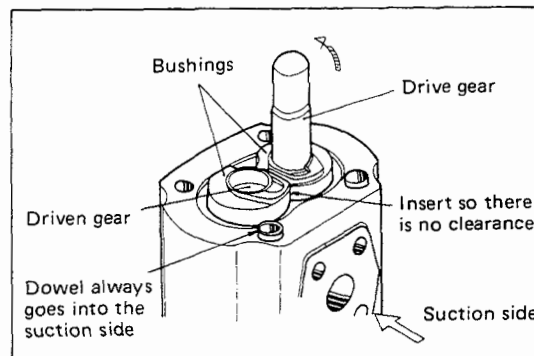
Oil Seal

SAE32-2

4. Insert two cover bushings into the body at the same time.

Caution:

- Make sure that the dowel is on the suction side.
- Coat hydraulic oil on the body inside surface.
- Do not pound in the bushing.
- Be careful not to mistake the bushing combination.
- Make sure bushings are correctly set without dislocation.



Bushing

SAE5

5. Assemble the drive gear and driven gear.

Caution:
Assemble according in the matchmark so that the teeth surfaces engage the same surfaces as before disassembly.
6. Simultaneously insert to mounting flange side bushings into the body.

7. Assemble the seals
 - (1) Bushing seal
 - (2) Backing ring
 - (3) Body seal

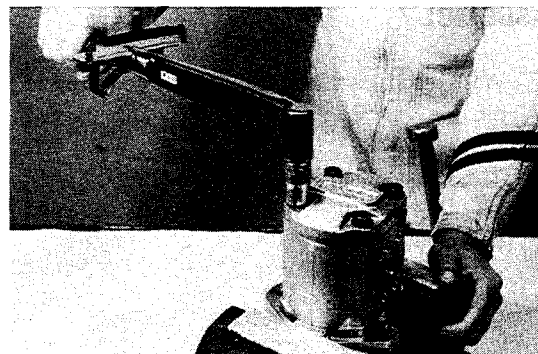
Caution

Be sure that the backing ring center portion does not overlap.

8. Place the mounting flange and cover on the body and tighten with set bolts.
 - (1) Mounting flange
 - (2) Pump cover
 - (3) Set bolts $T = 4.70 \sim 4.96 \text{ kg-m (33.9} \sim 35.8 \text{ ft-lbs)}$

Caution:

Wrap tape around the drive gear spline portion to protect the oil seal from being damaged by the spline during mounting flange assembly.



Cover

SAE32-4

9. Confirmation of oil pump assembly
 - (1) Lightly grip the drive gear shaft in a vise.
 - (2) Rotate the oil pump.
 - (3) If it rotates lightly, the assembly is proper. If hard, disassemble the oil pump again.
10. After assembly, fill hydraulic oil in the oil pump.

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

Apply grease (Molybdenum disulfide grease) to oil pump spline shaft.

Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit section.

TESTING METHOD

Caution:

For precise testing, a bench test must be performed. However, this is impossible for actual service. A test shall be performed as described below after installing the pump to the vehicle.

1. Install an oil pressure gauge {0 ~ 200 kg/cm² (0 ~ 2844 psi)} to the oil control valve.
2. Install an engine tachometer.
3. Start the engine.
4. With the oil control valve lever at the neutral position, run the engine at 800 ~ 1000 rpm for about 10 minutes.
5. If no defect is found in the oil pump, raise the engine speed to 1500 ~ 2000 rpm and keep the engine running for 10 minutes.

Caution:

If any abnormality is found in step 4 or 5 above, immediately stop the engine and disassemble the oil pump again.

6. Check if the oil control valve relief pressure setting is as specified.
For details, see the Oil Control Valve Relief Pressure Adjustment Section.
7. Check if the engine speed is as specified.
For details, see the Engine — Engine Adjustment section.
8. Judge properness of the engine side oil pump discharge rate on the basis of the lift cylinder rising time.
 - Measure the lift cylinder full stroke rising time at a hydraulic oil temperature of 50 ~ 55°C and an engine speed of 2600 rpm (2SGK6, 2SDK7 or 2SDK8) or 2650 rpm (2SDK6).

Model	2SGK6	2SDK6	2SDK7	2SDK8
Item				
Rising time (sec.) (no load)	3.8 ~ 4.1	←	←	←

OIL CONTROL VALVE

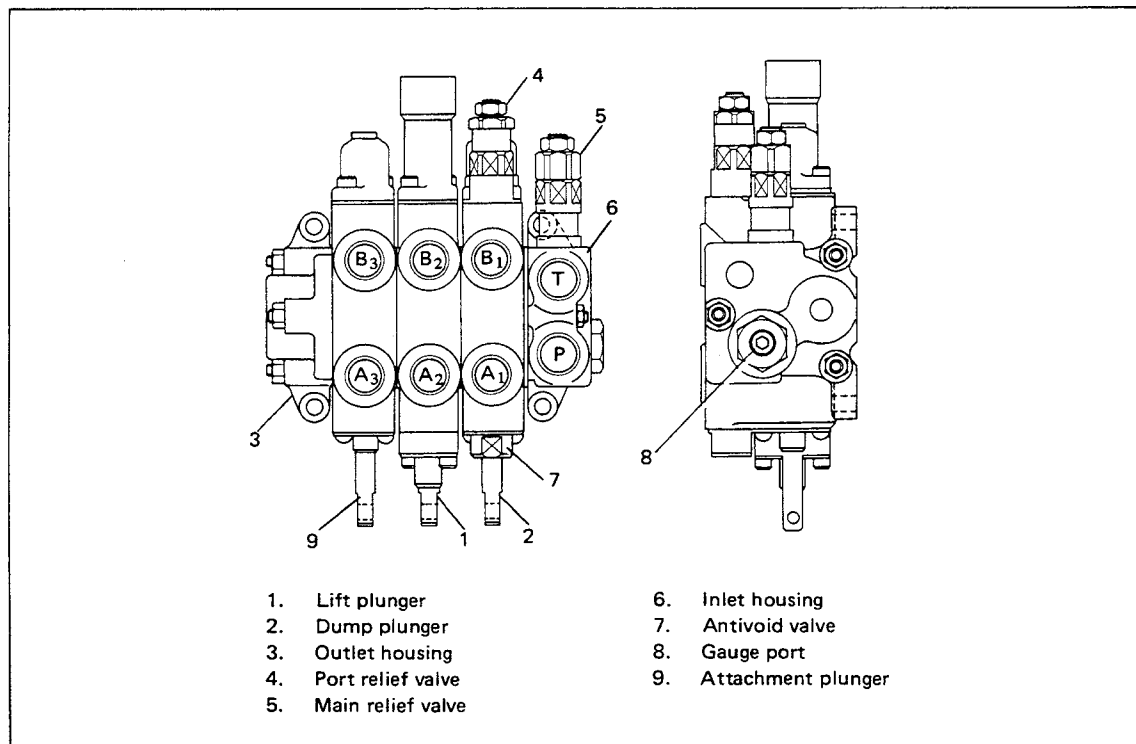
	Page
OIL CONTROL VALVE	11-2
DESCRIPTION	11-2
SPECIFICATIONS & SERVICE STANDARDS	11-2
SECTIONAL VIEWS	11-3
HYDRAULIC CIRCUIT	11-6
COMPONENTS	11-8
OIL CONTROL VALVE ASSY	11-9
OIL CONTROL VALVE LINK	11-23
DESCRIPTION	11-23
COMPONENTS	11-25
PEDAL LOCK SYSTEM	11-26
SOLENOID	11-27

OIL CONTROL VALVE

DESCRIPTION

An add-on type 2-spool valve is adopted as the oil control valve and installed on the rear left side of the vehicle. This valve consists of the inlet housing (with built-in main relief valve), dump plunger section (with built-in antvoid valve and port relief valve), lift plunger section (with float position) and outlet housing.

A series circuit is adopted in the dump plunger section to enable the dump cylinder and lift cylinder to be operated simultaneously.



Oil Control Valve

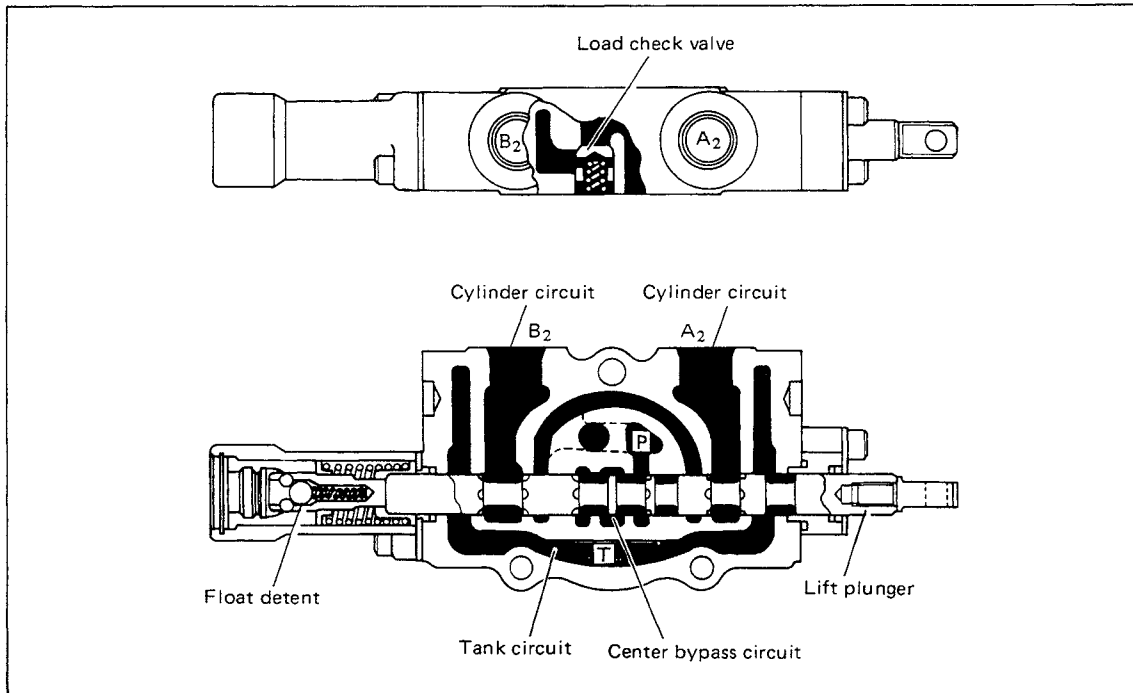
SAEM8

SPECIFICATIONS & SERVICE STANDARDS

Type		Add-on type	
Oil control valve set pressure	Main relief pressure	1986. 3 ~ 1991. 4	150 kg/cm ² (2,130 psi)
		1991. 5 ~	153 kg/cm ² (2,180 psi)
	Port relief pressure	1986. 3 ~ 1991. 4	110 kg/cm ² (1,560 psi)
		1991. 5 ~	113 kg/cm ² (1,610 psi)
Weight		7 kg (15.4 lbs)	
Detent pin tightening torque		2.2 kg-m (15.9 ft-lbs)	
Relief valve tightening torque		5 kg-m (36.1 ft-lbs)	
Tie rod set nut tightening torque (upper)		4.7 kg-m (33.9 ft-lbs)	
Tie rod set nut tightening torque (lower)		1.94 kg-m (14.0 ft-lbs)	

SECTIONAL VIEWS

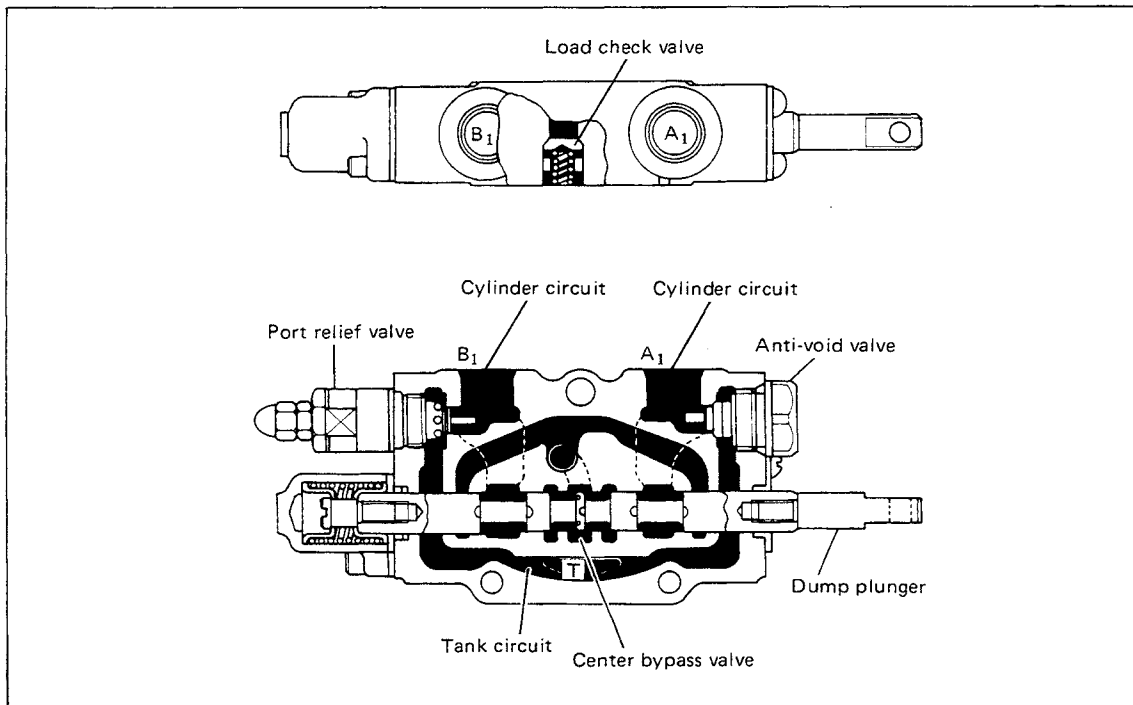
LIFT PLUNGER HOUSING



Lift Plunger Housing Sectional View

SAEM58

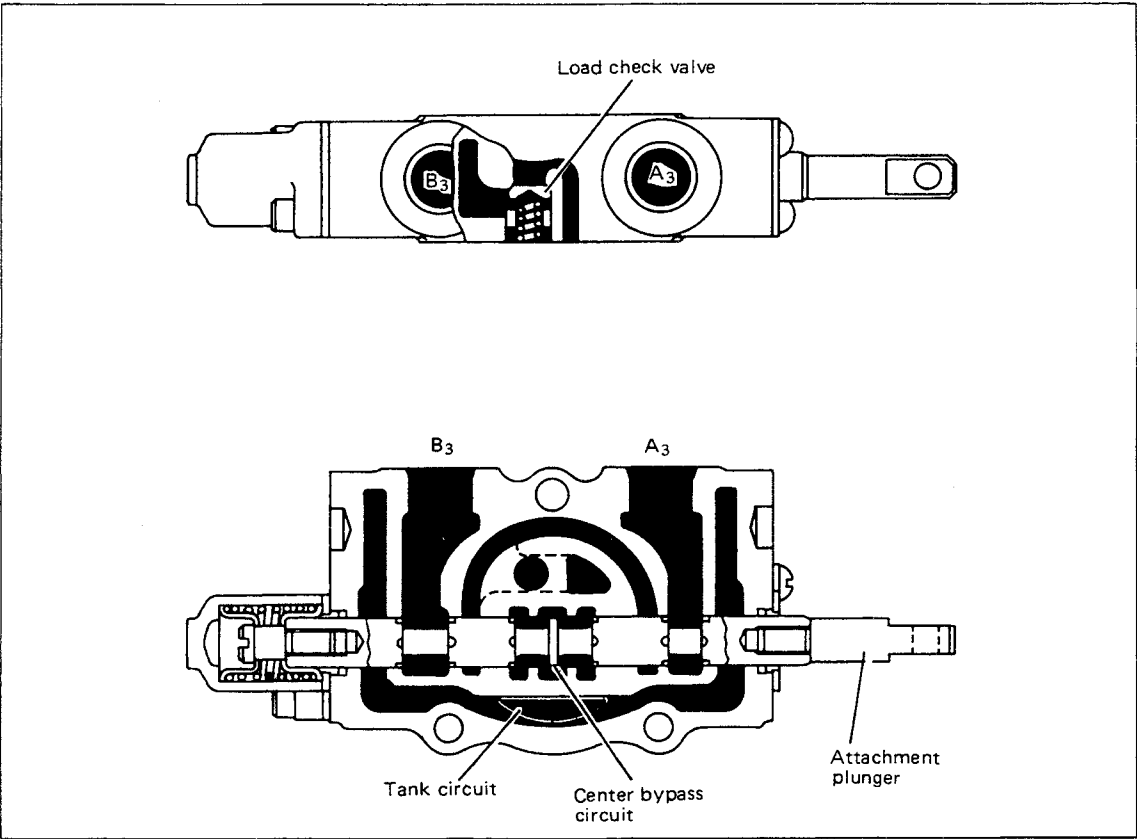
DUMP PLUNGER HOUSING



Dump Plunger Housing Sectional View

SAEM59

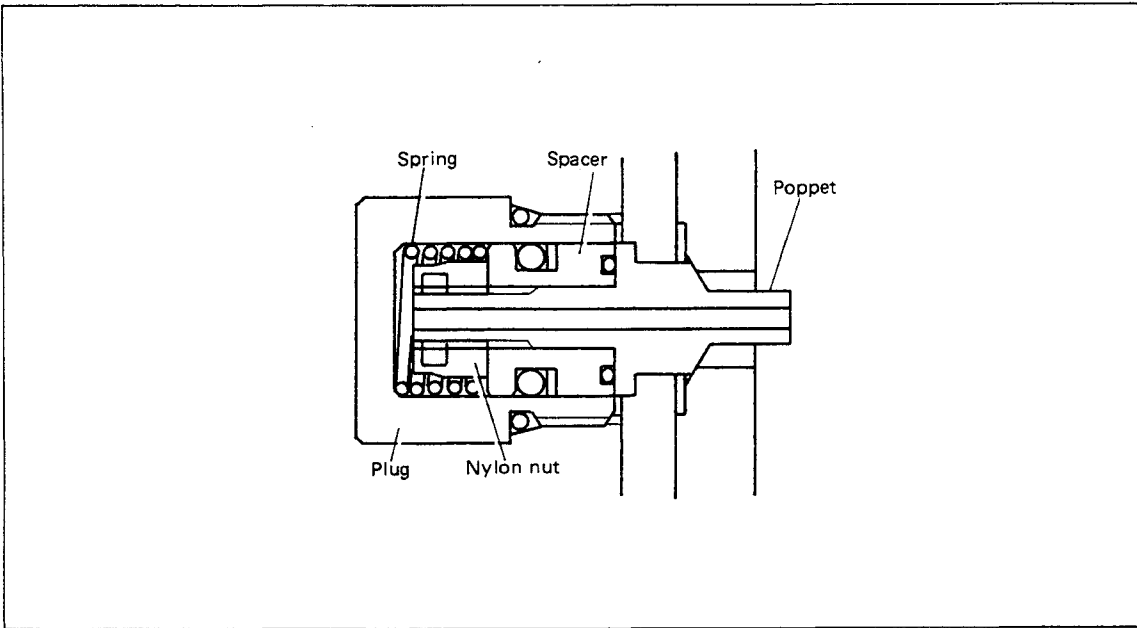
ATTACHMENT PLUNGER HOUSING



Attachment Plunger Housing Sectional View

SAEM60

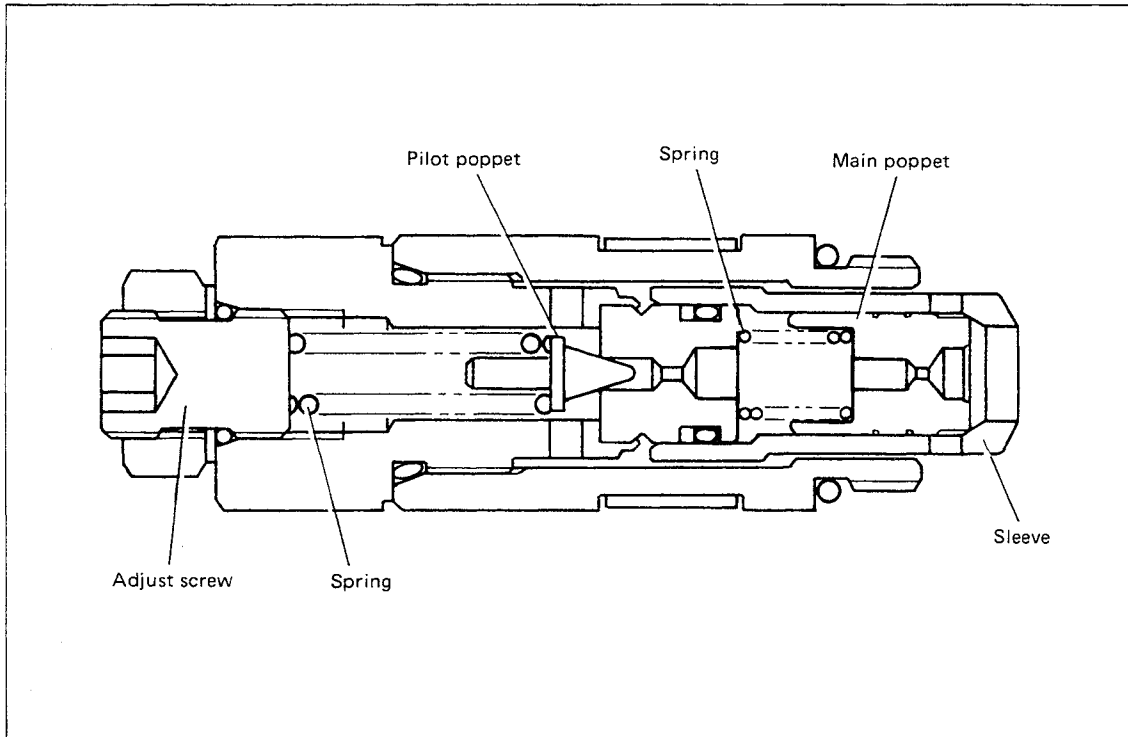
ANTI-VOID VALVE



Anti-void Valve Sectional View

SAES69

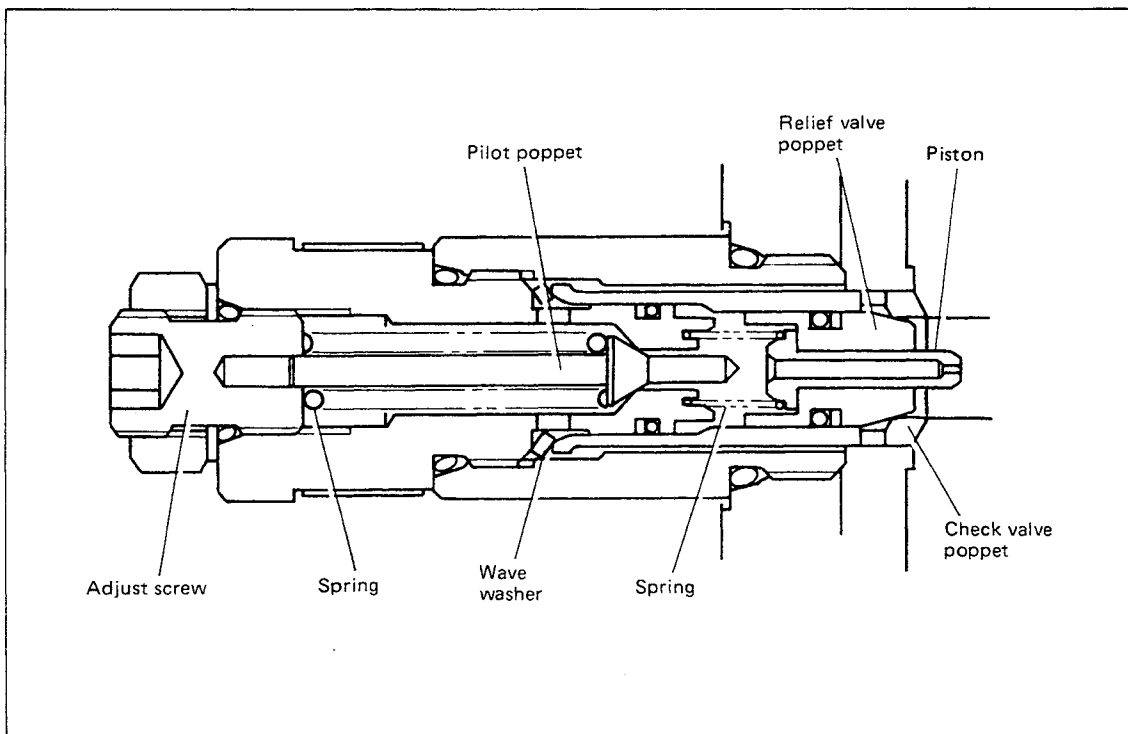
MAIN RELIEF VALVE



Main Relief Valve Sectional View

SAES70

PORT RELIEF VALVE



Port Relief Valve Sectional View

SAES71

HYDRAULIC CIRCUIT

A series circuit is adopted in the dump plunger section to enable the dump and lift cylinders to be operated simultaneously.

When the dump and lift pedals are operated at the same time, the oil flow becomes as follows:

Pressurized oil: Oil pump → Inlet P port → Center bypass circuit → Dump plunger section

Poppet → B1 port → Dump cylinder bottom side

└─→ A1 port → Dump cylinder rod side

Return oil: Dump cylinder rod side → A1 port → Center bypass circuit → Lift plunger

(Pressurized oil) Dump cylinder bottom side → B1 port ──→

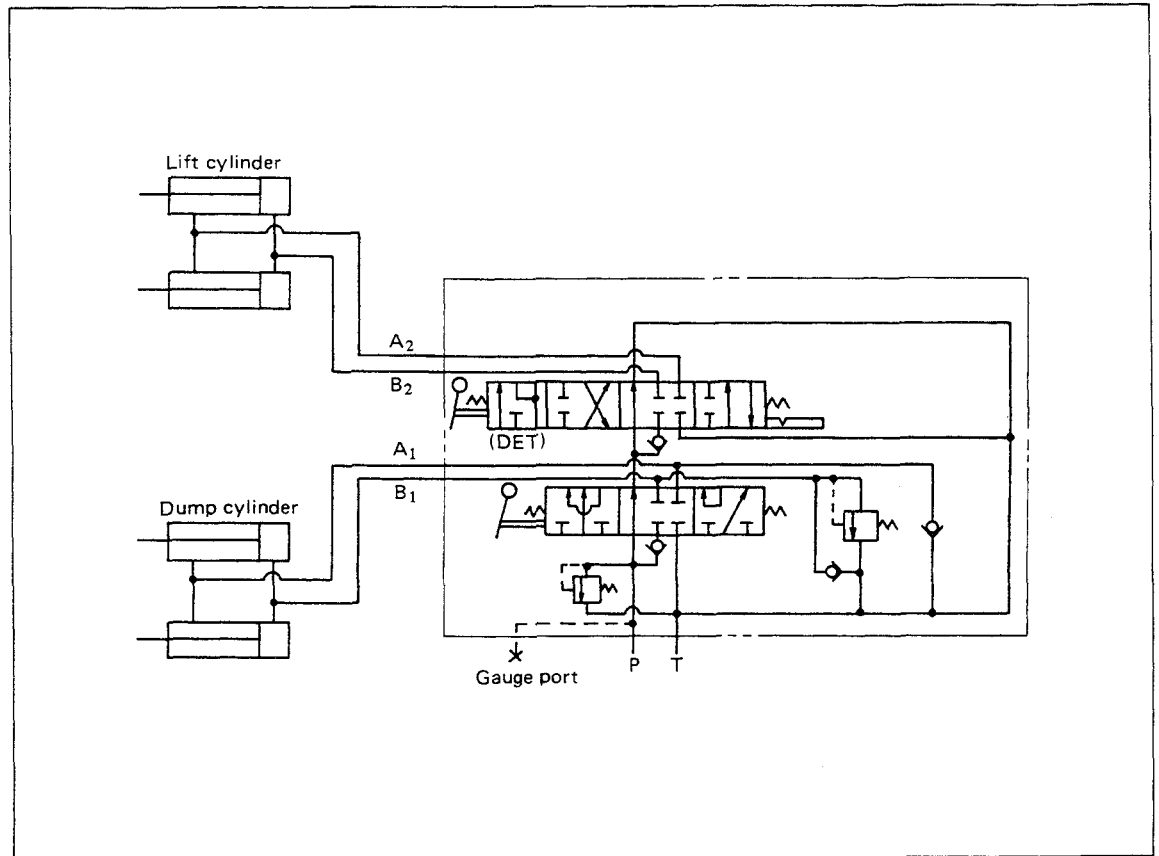
section poppet → B2 port → Lift cylinder bottom side

└─→ A2 port → Lift cylinder rod side

Return oil: Lift cylinder rod side → A2 port → Low pressure circuit → Inlet T port

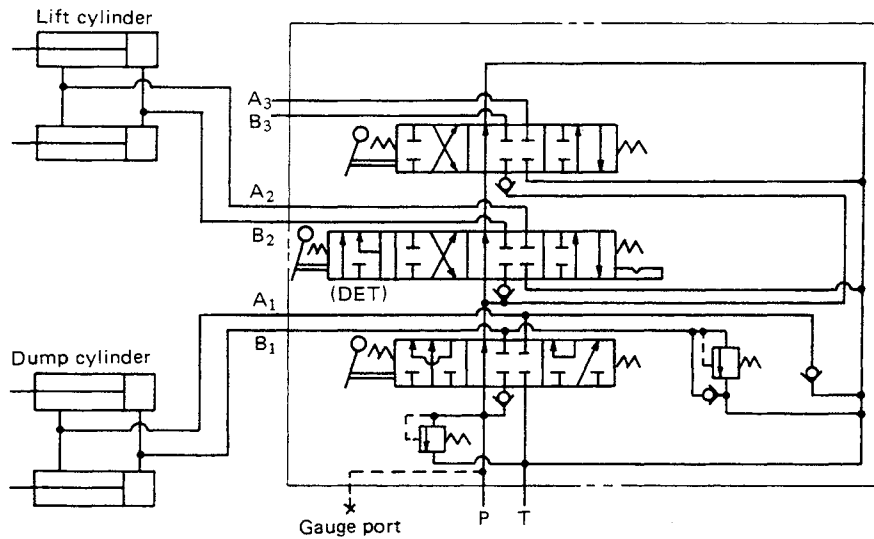
Lift cylinder bottom side → B2 port ──→

→ Tank



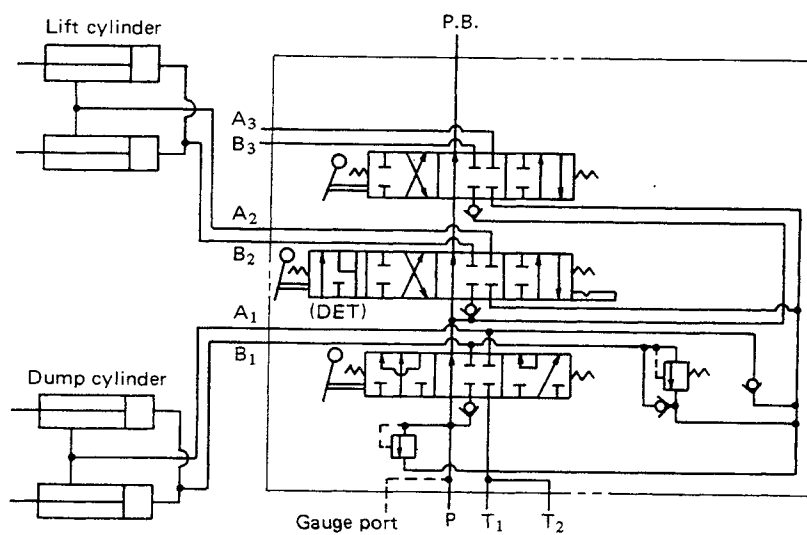
Hydraulic Circuit Diagram (2-Spool valve)

SAES6



Hydraulic Circuit Diagram (3-spool valve)

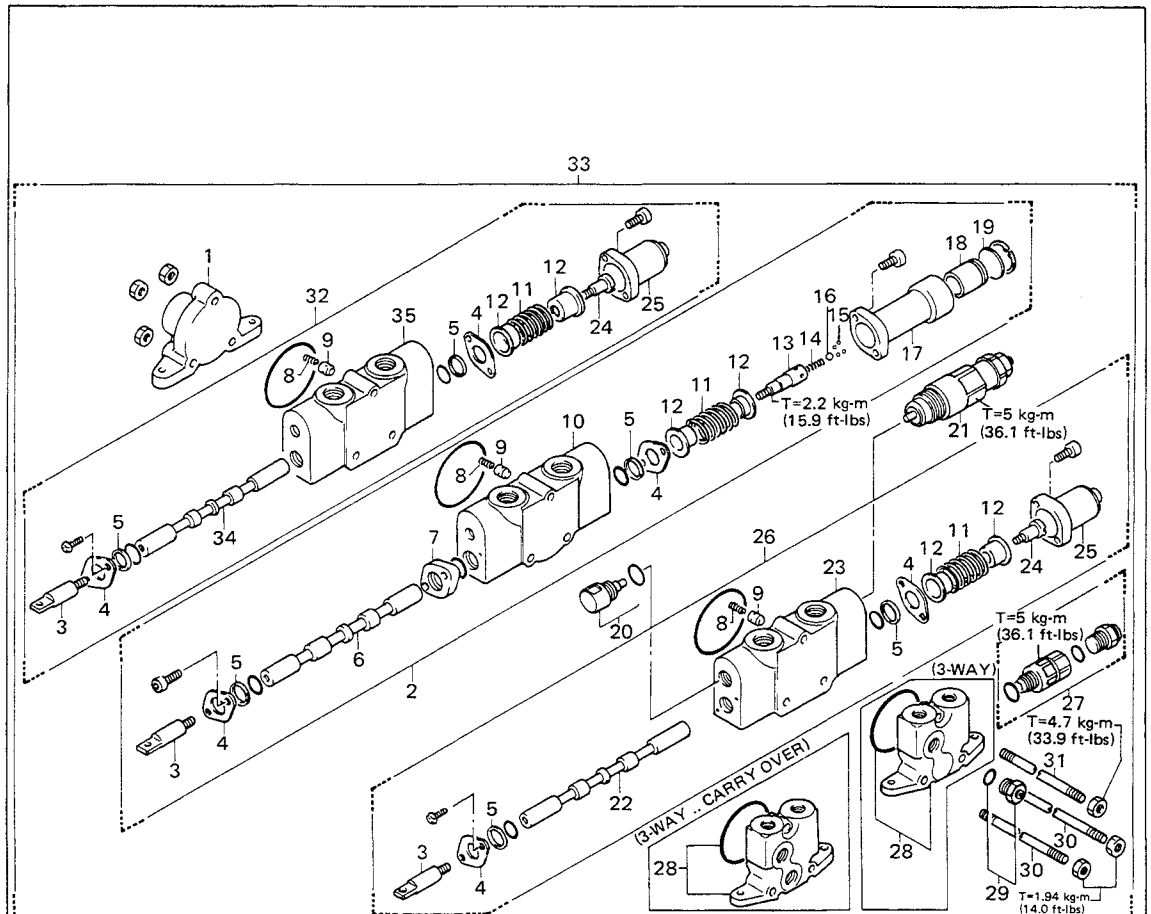
SAES7



Hydraulic Circuit Diagram (3-Spool Valve with Carry-over)

SAES8

COMPONENTS



- | | |
|--------------------------|--------------------------------|
| 1. Outlet housing | 19. Spacer |
| 2. Lift plunger section | 20. Antivoid valve |
| 3. Plunger head | 21. Port relief valve |
| 4. Seal plate | 22. Dump plunger |
| 5. Wiper | 23. Dump plunger housing |
| 6. Lift plunger | 24. Cap screw |
| 7. Spacer | 25. Cap |
| 8. Spring | 26. Dump plunger section |
| 9. Poppet | 27. Main relief |
| 10. Lift plunger housing | 28. Inlet housing |
| 11. Spring | 29. Plug |
| 12. Spring seat | 30. Tie rod |
| 13. Detent pin | 31. Tie rod |
| 14. Detent spring | 32. Attachment plunger section |
| 15. Lock ball | 33. Oil control valve assy |
| 16. Detent ball | 34. Attachment plunger |
| 17. Float detent case | 35. Attachment plunger housing |
| 18. Sleeve | |

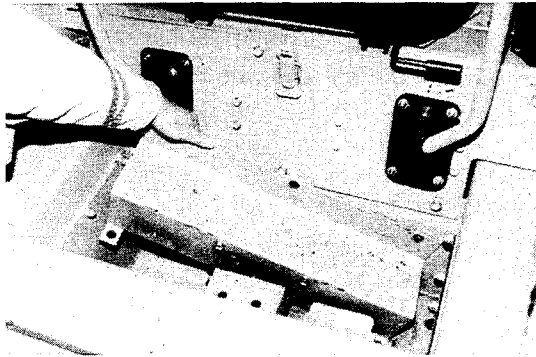
Oil Control Valve Components

SAEL17

OIL CONTROL VALVE ASSY

REMOVAL

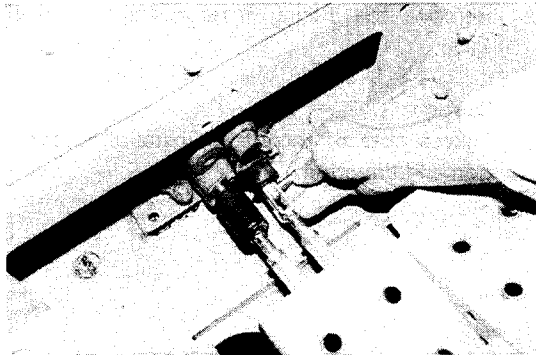
1. Remove the floor.
 - (1) Set bolts (5 pcs.)
 - (2) Floor



Floor

SAE26-16

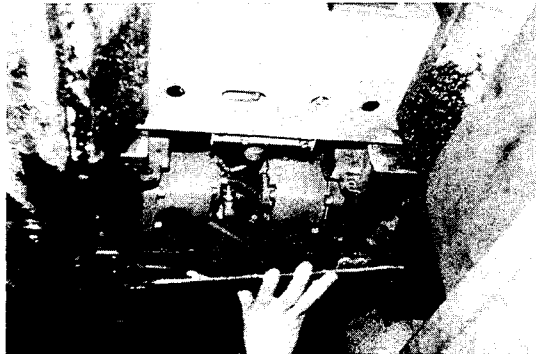
2. Disconnect the control valve link.
 - (1) Boots movement
 - (2) Cotter pin.
 - (3) Washer
 - (4) Pin



Disconnecting the Control Valve Link

SAE26-17

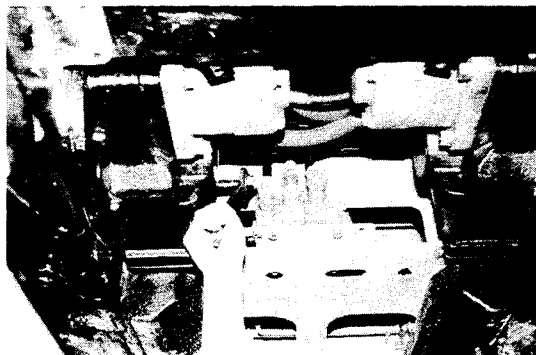
3. Remove the front under cover.
 - (1) Set bolts (4 pcs.)
 - (2) Front under cover



Front Under Cover

SAE6-32

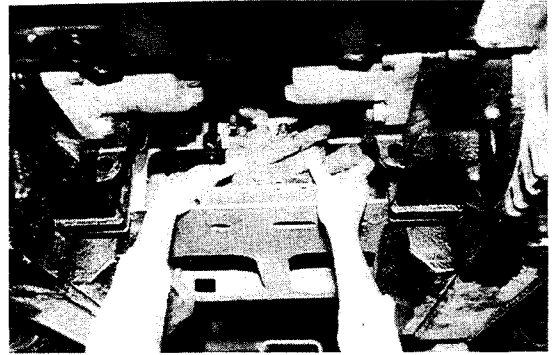
4. Disconnect the hydraulic piping.
 - (1) Lift cylinder pipe
 - (2) Dump cylinder pipe
 - (3) Valve to filter pipe
 - (4) High pressure hose



Disconnecting the Piping

SAE26-20

5. Remove the oil control valve.
 - (1) Set bolts
 - (2) Oil control valve with fitting



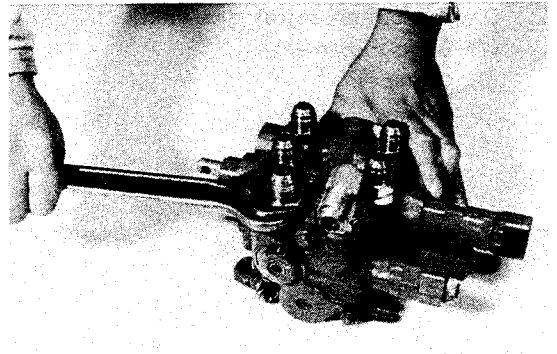
Oil Control Valve

SAE26-21

6. Remove the fitting from the oil control valve.

Caution:

Take a note of the fitting installation position and direction.



Fitting

SAE26-22

DISASSEMBLY

Caution:

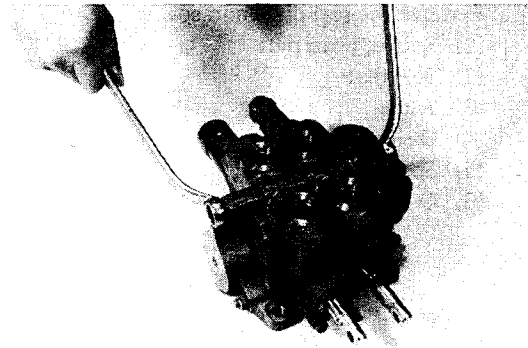
- The photo to the right shows the twin valve. Perform the plunger section attachment operation using the same procedures as those for the plunger dump section.
- Always operate in a clean location.
- Since each part is finished with high precision. Carefully prevent any damage.

1. Remove the valve tie rods and separate each plunger section.
 - (1) Set nuts
 - (2) Valve tie rods
 - (3) Inlet housing
 - (4) Dump plunger section
 - (5) Lift plunger section
 - (6) Outlet housing

Caution:

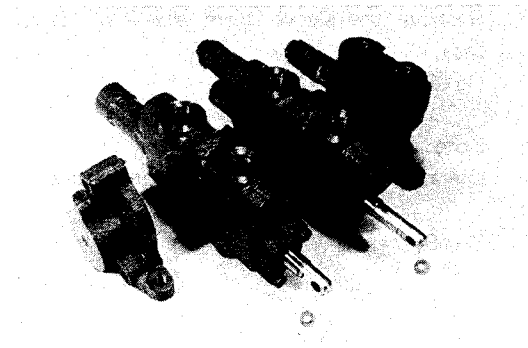
- Carefully operate so as not to lose the check valve poppet and spring.
- Pay attention so as not to damage the mating surface of the housing.
- Attach a tag to each plunger section for identification.

2. Remove the main relief valve from the inlet housing.



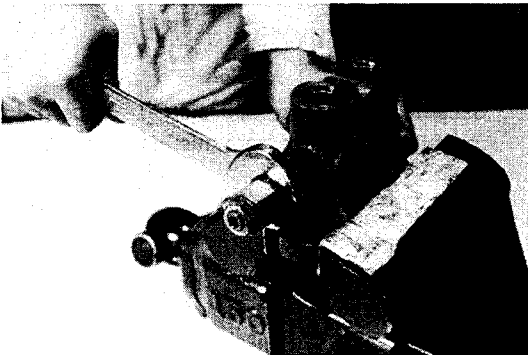
Valve tie Rod

SAE26-36



Separating the Plunger Sections

SAE27-2

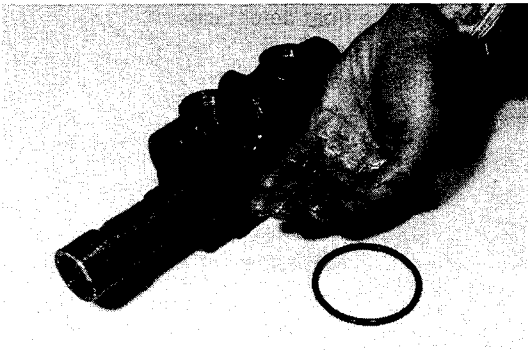


Main Relief Valve

SAE27-4

Lift Plunger Section Disassembly

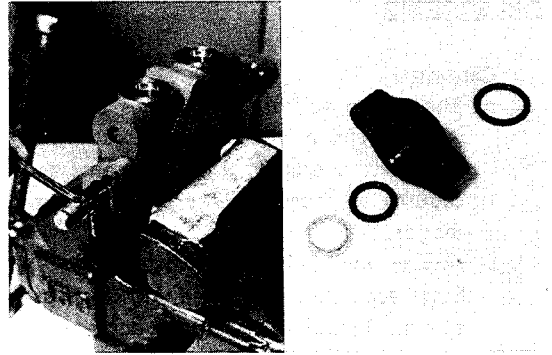
3. Remove the O-ring, check valve poppet and spring from the lift plunger housing.
 - (1) O-ring
 - (2) Spring
 - (3) Poppet



Poppet and Spring

SAE27-6

4. Remove the seal plate and spacer.
 - (1) Socket head bolt
 - (2) Seal plate
 - (3) Wiper
 - (4) O-ring
 - (5) Spacer
 - (6) O-ring



Seal Plate and Spacer

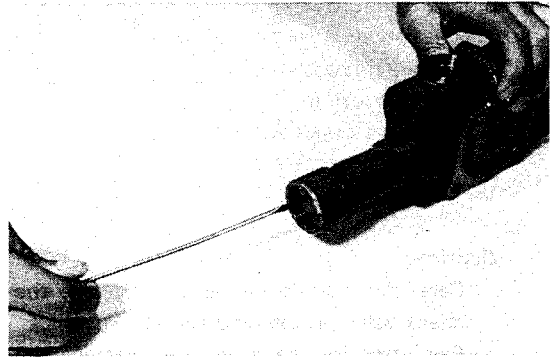
SAE27-7, 9

5. Remove the sleeve from the float detent case.
 - (1) Snap ring

Note:

Use a thin-tipped Screwdriver for removal.

- (2) Spacer



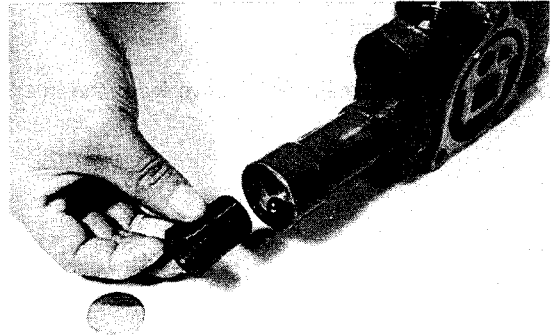
Snap Ring

SAE27-10

- (3) Sleeve

Caution:

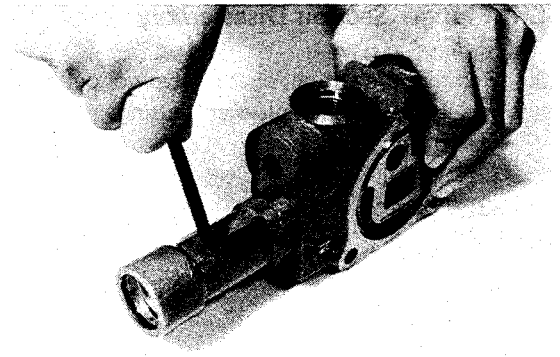
Because the detent ball (large) jumps out, carefully prevent it from missing.



Sleeve

SAE27-11

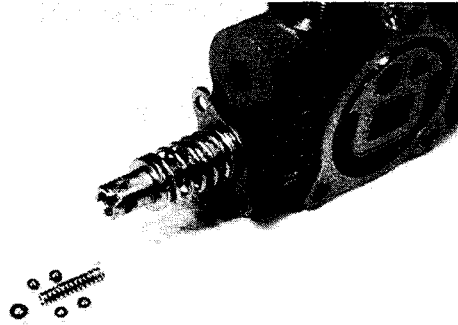
6. Remove the float detent case.
 - (1) Socket head bolt
 - (2) Float detent case



Float Detent Case

SAE27-12

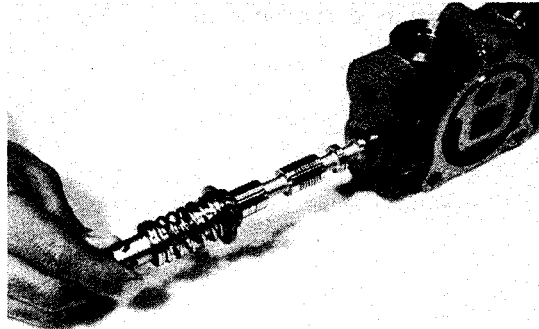
7. Remove the detent ball, lock balls and detent spring from the lift plunger.
- (1) Detent ball (one large piece)
 - (2) Lock balls (four small pieces)
 - (3) Detent spring



Balls and Detent Spring

SAE27-15

8. Extract the lift plunger from the housing.



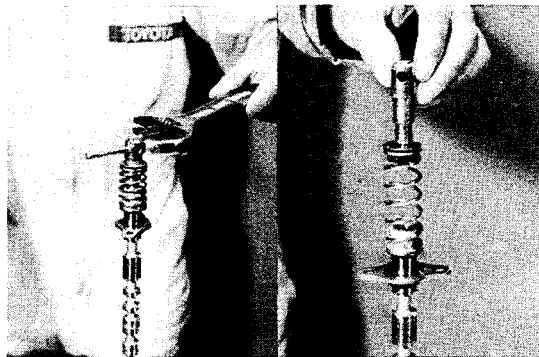
Lift Plunger

SAE27-16

9. Remove the plunger spring.
- (1) Fix the plunger operating portion with a vise.
 - (2) Insert the SST to the side hole in the detent pin and loosen the screw.
SST 09700-30200-71

Note:

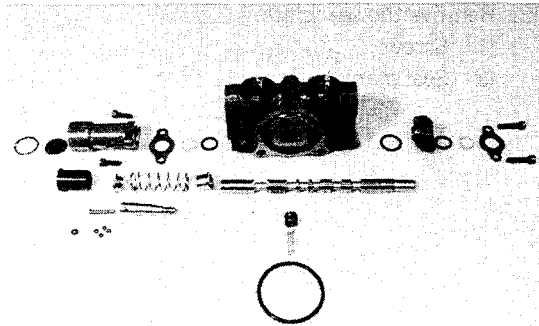
Carry out this operation while applying a force to the detent pin and gradually extending the compression spring.



Plunger Spring

SAE27-19, 20

- (3) Detent pin
- (4) Spring seat
- (5) Plunger spring
- (6) Spring seat
- (7) Seal plate
- (8) Wiper
- (9) O-ring

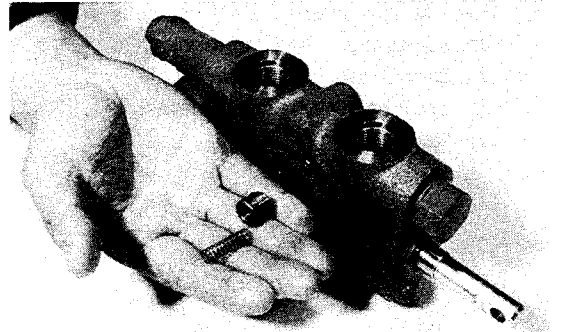


Disassembling Lift Plunger

SAE27-21

Dump plunger Section Disassembly

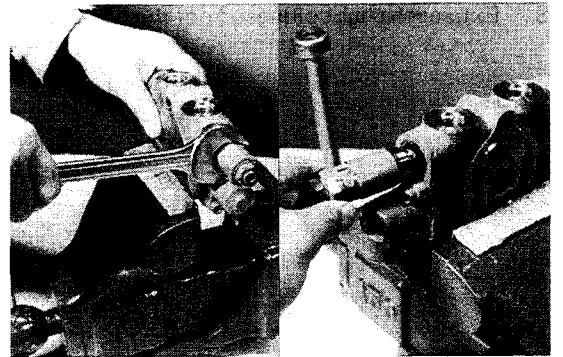
10. Remove the O-ring, poppet and spring from the dump plunger housing.



Poppet and Spring

SAE27-36

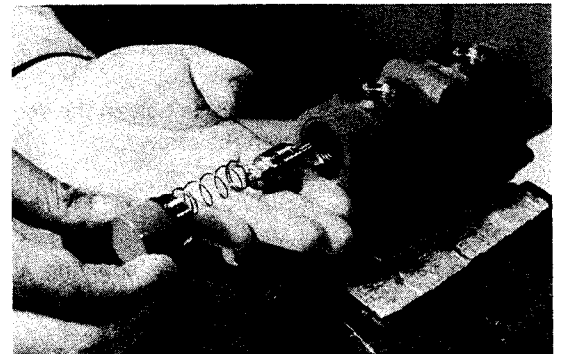
11. Remove the port relief valve.



Port Relief Valve

SAE28-6, 7

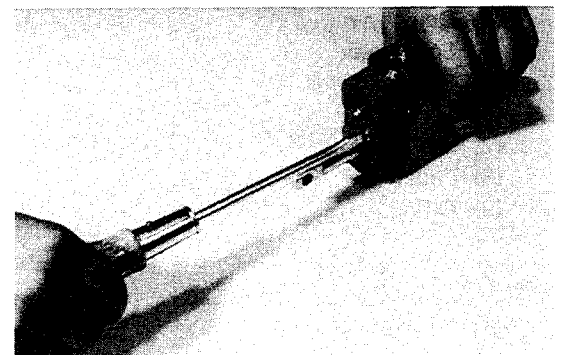
12. Remove the antvoid valve.



Antvoid Valve

SAE28-10

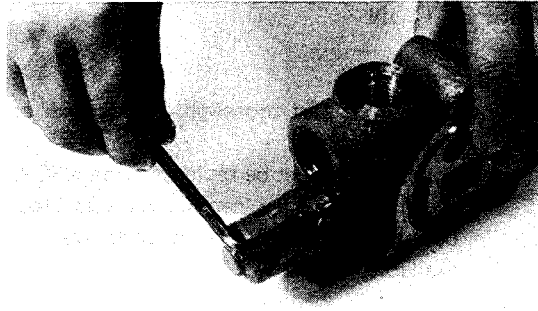
13. Remove the seal plate.
 - (1) Screw
 - (2) Seal plate



Seal Plate

SAE28-12

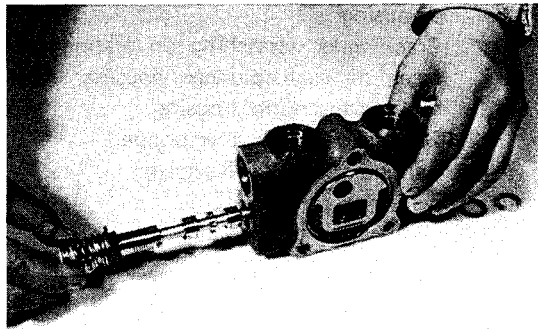
14. Remove the cap.
- (1) Socket head bolt
 - (2) Cap



Cap

SAE28-13

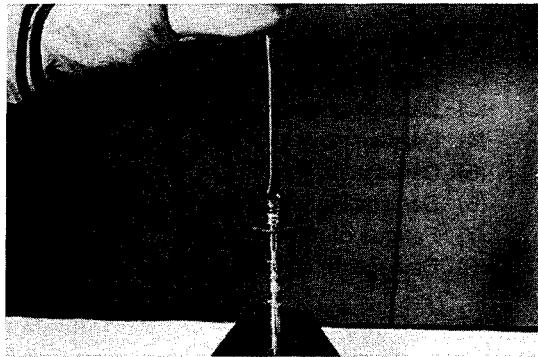
15. Remove the dump plunger.
- (1) Dump plunger
 - (2) Wiper
 - (3) O-ring



Dump Plunger

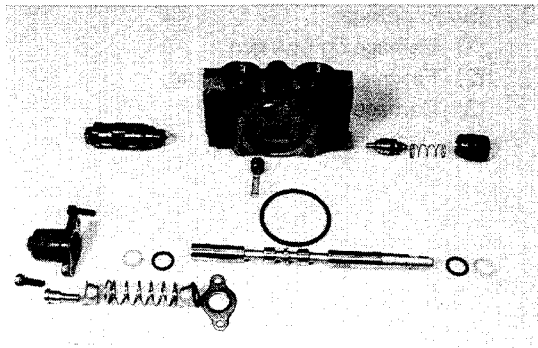
SAE28-15

16. Remove the plunger spring.
- (1) Fix the plunger operation portion with a vise.
 - (2) Cap screw
 - (3) Spring seat
 - (4) Plunger spring
 - (5) Spring seat
 - (6) Seal plate
 - (7) Wiper
 - (8) O-ring



Plunger Spring

SAE28-16



Disassembling the Dump Plunger

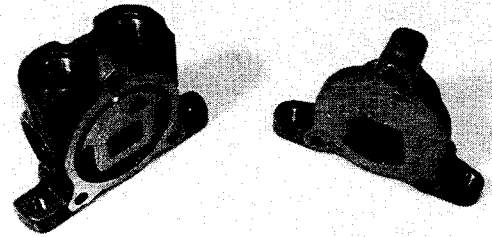
SAE28-18

INSPECTION

Caution:

- Clean each part thoroughly, and repair or replace if defective.
- Some parts must be replaced as an ASSY, even though they can be disassembled, because individual service parts are not available.

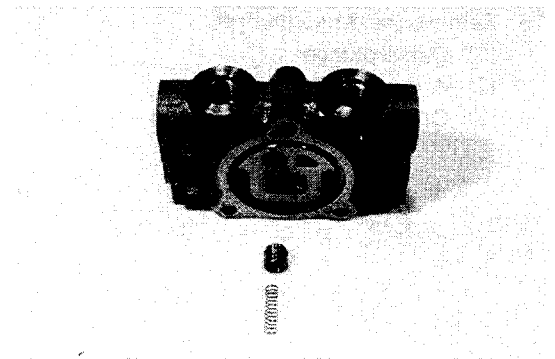
1. Valve housing
 - (1) Cracking or scratching on mating surfaces of each plunger housing, inlet housing and outlet housing
 - (2) Damage on check valve poppet
 - (3) Fatigue of check valve spring



Inlet and Outlet Housings

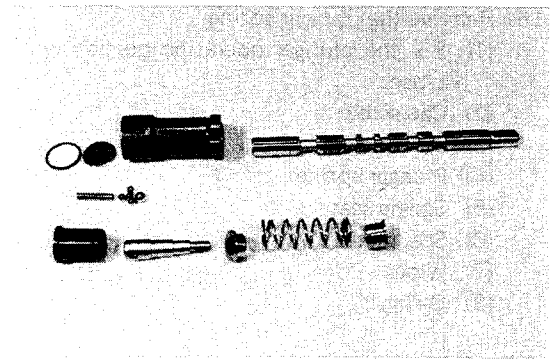
SAE28-27

2. Lift plunger, detent, etc.
 - (1) Damage on plunger
 - (2) Fatigue of plunger spring
 - (3) Damage or deformation of spring seat
 - (4) Damage on detent pin threaded portion
 - (5) Damage on sleeve
 - (6) Damage on detent ball
 - (7) Fatigue of detent spring
 - (8) Damage on float detent case



Plunger Housing

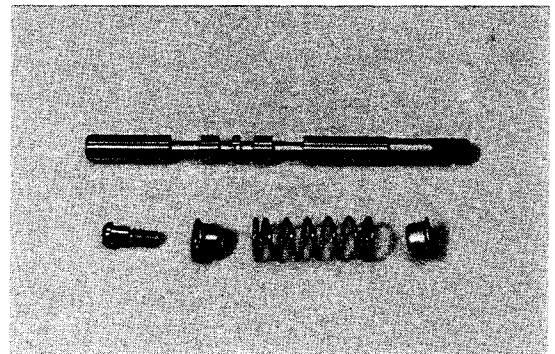
SAE27-23



Lift Plunger and Detent

SAE27-25

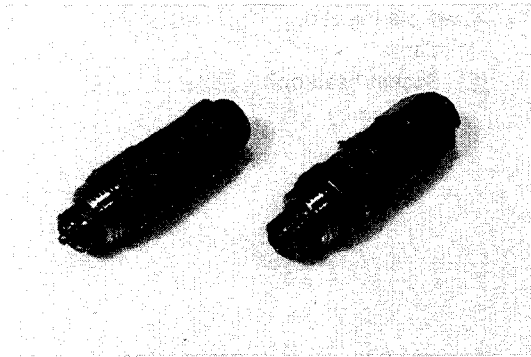
3. Dump plunger
 - (1) Damage on plunger
 - (2) Fatigue of plunger spring
 - (3) Damage or spring seat
 - (4) Damage of cap screw



Dump Plunger

SAE28-19

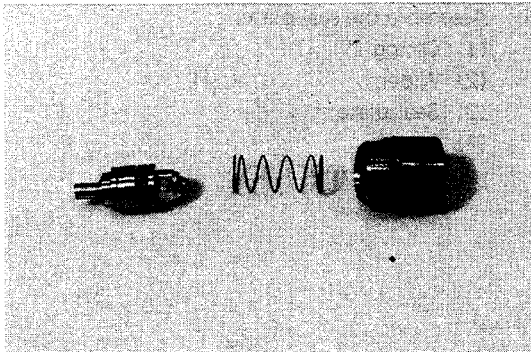
4. Main relief valve and port relief valve
 - (1) Poppet sliding state
 - (2) Port clogging



Relief Valve

SAE28-25

5. Antivoid valve
 - (1) Poppet sliding state
 - (2) Spring fatigue



Antivoid Valve

SAE28-21

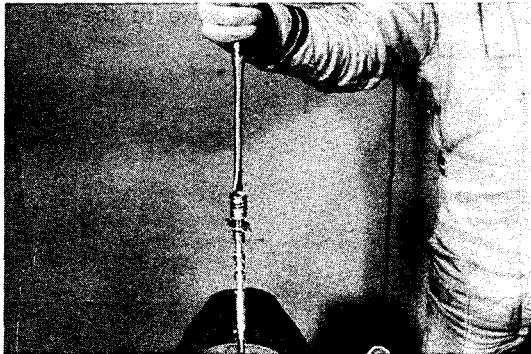
ASSEMBLY

Caution:

After cleaning each part and blowing with compressed air, carry out assembly in a clean location.

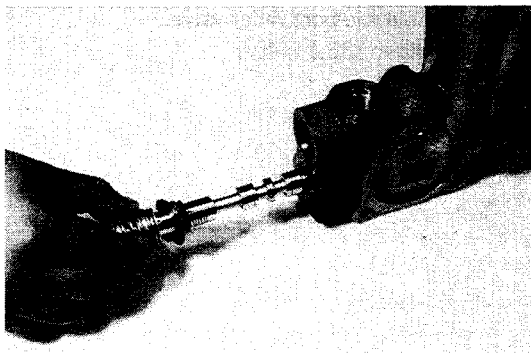
Dump Plunger Section Assembly

1. Assemble the plunger spring.
 - (1) O-ring
 - (2) Wiper
 - (3) Seal plate
 - (4) Spring seat
 - (5) Plunger spring
 - (6) Spring seat
 - (7) Cap screw
2. Assemble the dump plunger to the plunger housing.



Plunger Spring

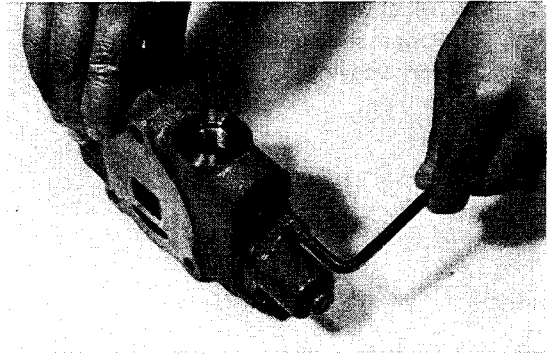
SAE28-29



Plunger

SAE28-30

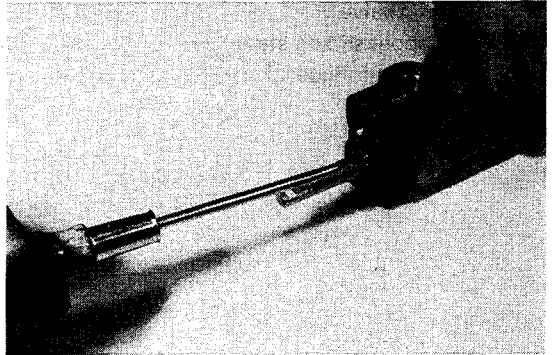
3. Assemble the cap.
 - (1) Cap
 - (2) Socket head bolt



Cap

SAE28-31

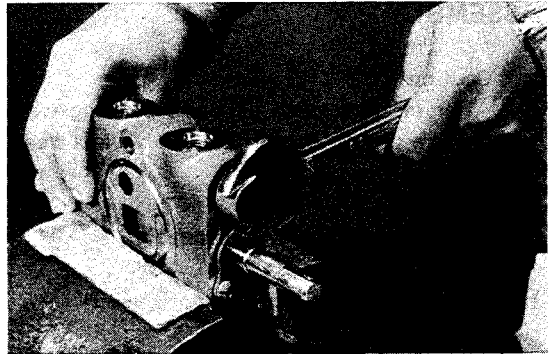
4. Assemble the seal plate.
 - (1) O-ring
 - (2) Wiper
 - (3) Seal plate
 - (4) Screw



Seal Plate

SAE28-32

5. Assemble the antvoid valve to the dump plunger housing.

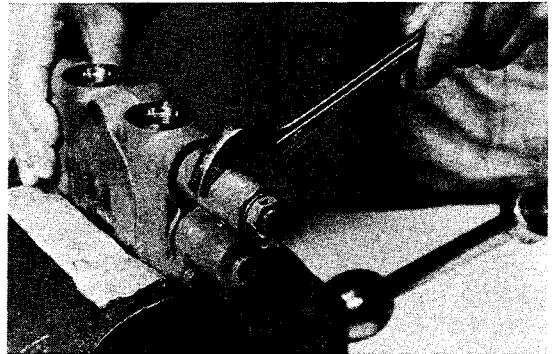


Antvoid Valve

SAE28-33

6. Assemble the port relief valve.

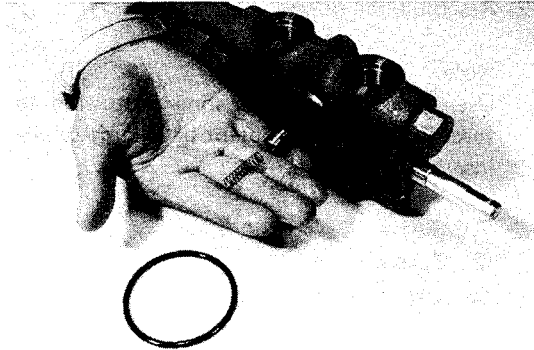
T = 5 kg-m (36.1 ft-lbs)



Port Relief Valve

SAE28-34

7. Assemble the check valve poppet, spring and O-ring.



Poppet Spring

SAE28-36

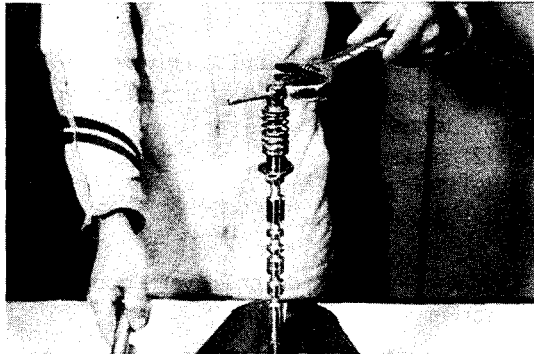
Lift plunger Section Assembly

8. Assemble the plunger spring.

- (1) O-ring
- (2) Wiper
- (3) Seal plate
- (4) Spring seat
- (5) Plunger spring
- (6) Spring seat
- (7) Detent pin

SST 09700-30200-71

T = 2.2 kg-m (15.9 ft-lbs)



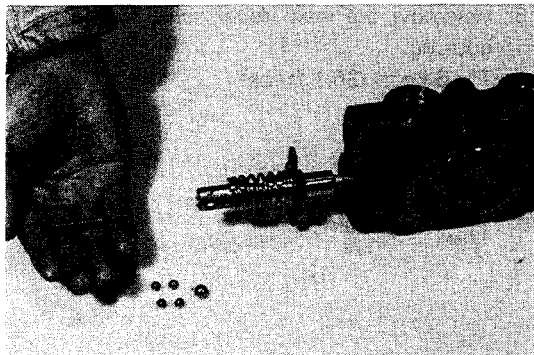
Detent Pin

SAE27-30

9. Assemble the lift plunger to the lift plunger spring.
10. Assemble the detent spring, detent ball and lock balls to the detent pin. (Temporary assembly)

Note:

Coat sufficient grease on the spring and balls before assembly.



Detent Spring and Balls

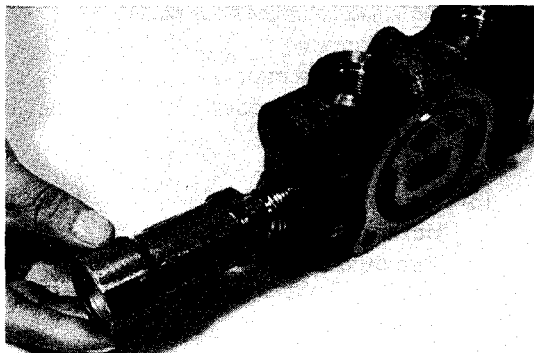
SAE27-31

11. Assemble the float detent case.

- (1) Float detent case
- (2) Socket head bolt

Caution:

Carefully assemble so that the lock balls will not come out from the side holes in the detent pin.



Float Detent Case

SAE27-32

12. Assemble the sleeve.

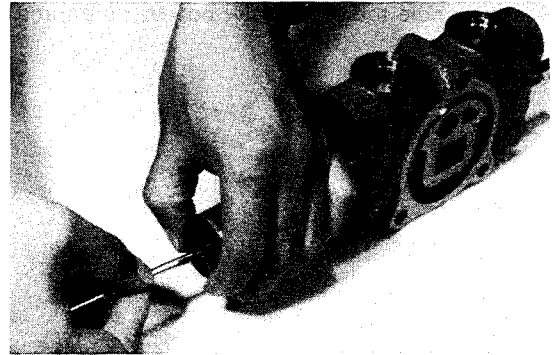
Note:

Use a punch having a long protrusion to force in the center detent ball (large) while inserting the sleeve.

- (1) Sleeve
- (2) Spacer
- (3) Snap ring

Caution:

Coat sufficient grease around the ball and sleeve.

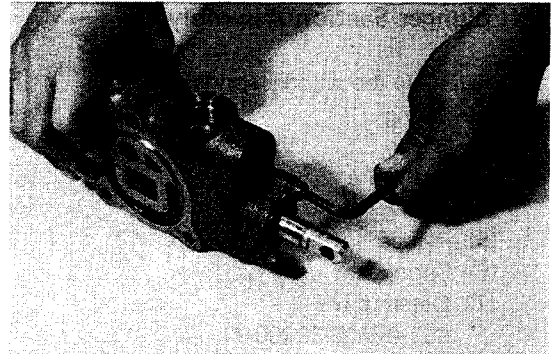


Sleeve

SAE27-33

13. Assemble the spacer and seal plate.

- (1) Assemble the O-ring and wiper to the spacer.
- (2) Spacer
- (3) Seal plate
- (4) Socket head bolt

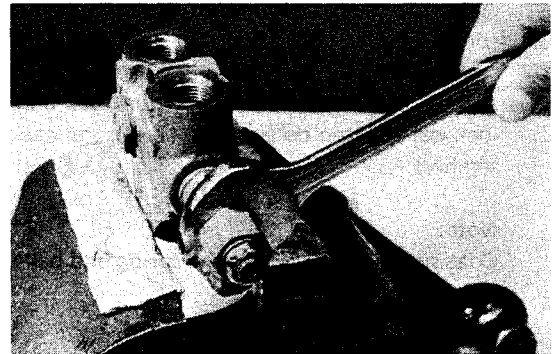


Spacer and Seal Plate

SAE27-34

14. Assemble the main relief valve to the inlet housing.

T = 5 kg-m (36.1 ft-lbs)

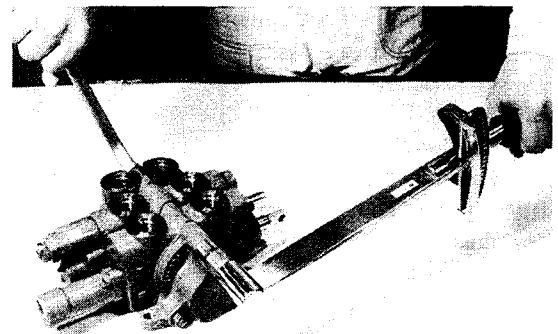


Main Relief Valve

SAE29-2

16. Assemble each plunger housing

- (1) Outlet housing
- (2) Lift plunger section
- (3) Dump plunger section
- (4) Inlet housing
- (5) Valve tie rods
- (6) Set nuts
 - Upper nut T = 4.7 kg-m (33.9 ft-lbs)
 - Two other nuts T = 1.94 kg-m (14.0 ft-lbs)



Plunger Housing

SAE29-3

INSTALLATION

The installation procedure is the reverse of the removal procedure.

Caution:

Bleed the air from the hydraulic circuit. For the air bleeding procedure, see the HYDRAULIC SYSTEM-Air Bleeding from Hydraulic Circuit section.

RELIEF PRESSURE ADJUSTMENT

Caution:

- After the relief valve is disassembled, always make adjustment according to the procedure described below. Negligence of the procedure may result in improper hydraulic pressure adjustment, causing damage to hydraulic components such as the oil pump.
 - Adjustment is unnecessary unless the relief valve is disassembled or if the relief valve is replaced with a new one.
1. Remove the pressure check plug (PT1/4) from the side of the oil control valve, and install an oil pressure gauge (0 ~ 200 kg/cm² (0 ~ 2844 psi)).
 2. Start the engine for warm up until the oil temperature rises (to 50 ~ 55°C) while checking no oil leakage or abnormal sound.
 3. Main relief valve adjustment
 - (1) Loosen the main relief valve locknut.

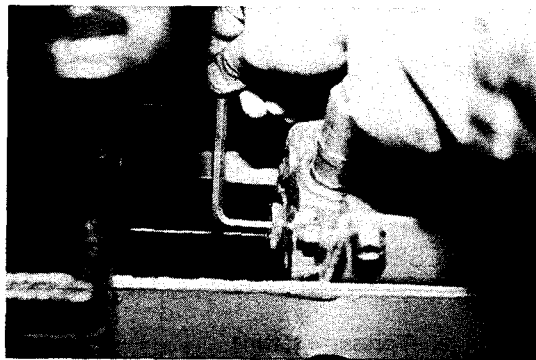
Caution:

Make sure that several adjust screw threads remain in the pilot section.

- (2) Operate the lift pedal (for either up or down) and increase the engine speed while reading the oil pressure gauge.
- (3) With the pedal kept depressed and the lift arm at its top position, increase the engine speed to the maximum rpm. Turn the adjust screw to adjust the oil pressure (relief set pressure) to the specified level. (See the next page.)

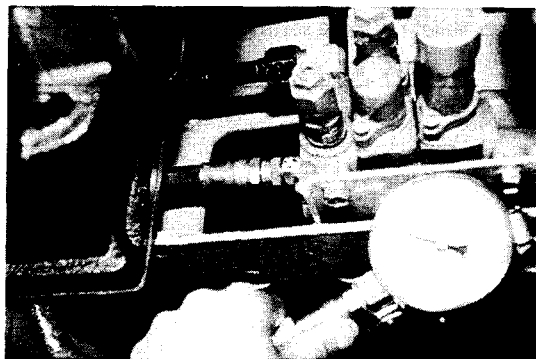
Clockwise turn increases the pressure.

Counterclockwise turn decreases the pressure.



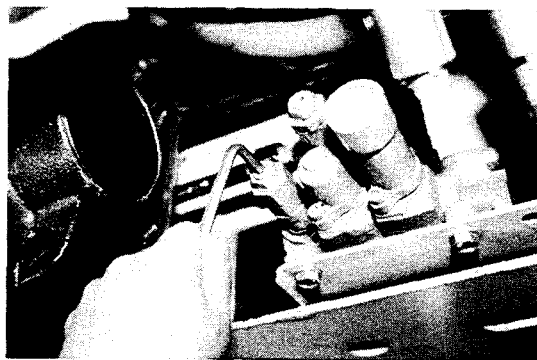
Removing the Pressure Check Plug

SAE41-20



Measuring the Oil Pressure

SAE41-23



Adjusting the Oil Pressure

SAE41-22

4. Port relief valve adjustment

- (1) Loosen the port relief valve locknut.
- (2) Depress the dump pedal forward (for bucket forward tilting), and increase the engine speed while reading the oil pressure gauge.
- (3) With the pedal kept depressed and the bucket tilted fully forward, increase the engine speed to the maximum rpm. Turn the adjust screw to adjust the oil pressure (relief set pressure) to the specified level.
 Clockwise turn increases the pressure
 Counterclockwise turn decreases the pressure

Note:

- Check if the maximum no-load speed is as specified. For details, see the ENGINE-Engine Adjustment section.
 - If the specified oil pressure is exceeded, immediately return the pedal to its neutral position.
5. After the oil pressure adjustment, fix the adjust screw and lock with the locknut.
 6. Remove the oil pressure gauge and install the pressure check plug. Wrap seal tape around the plug before installation.

OIL PRESSURE SPECIFICATIONS

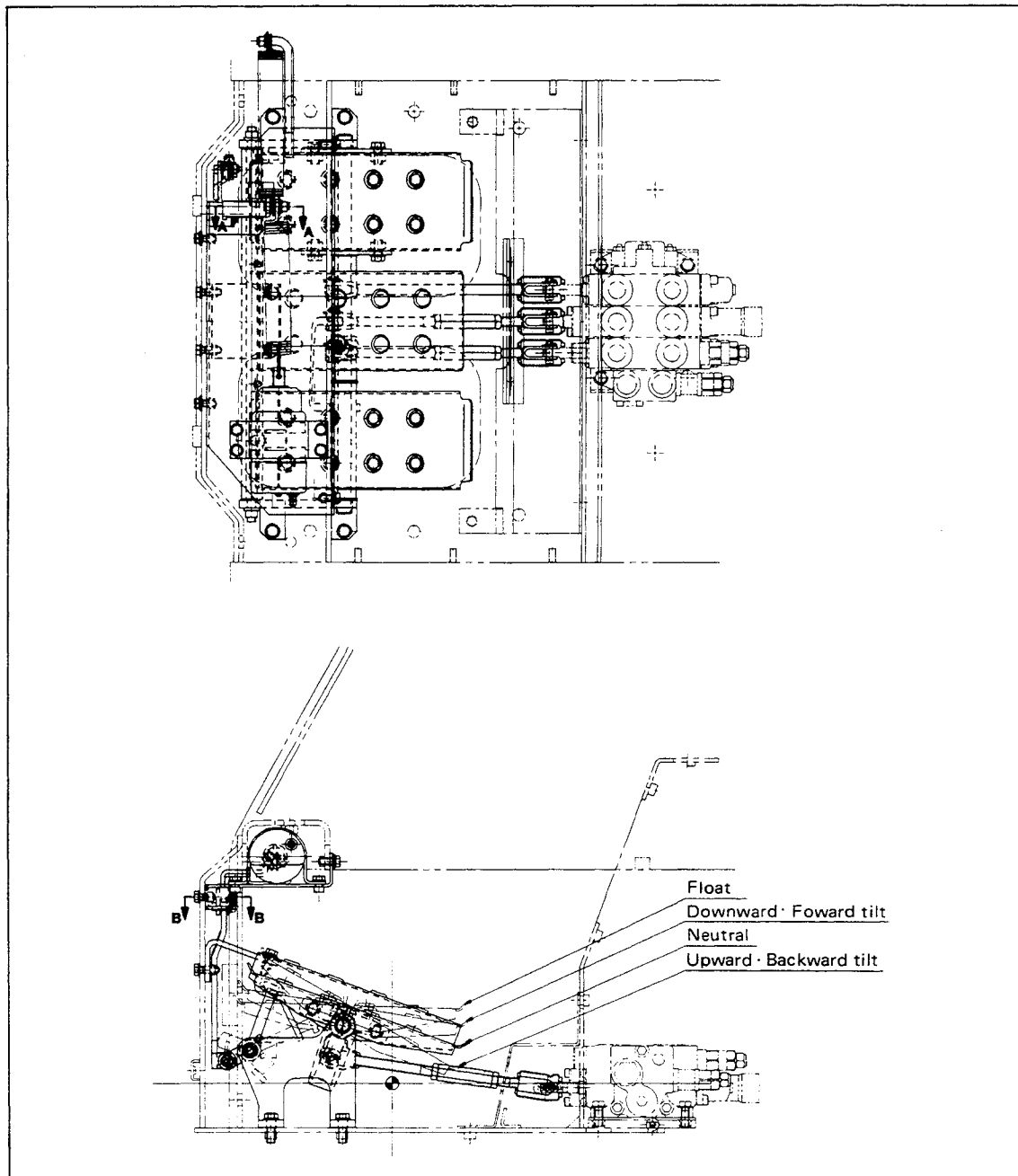
Main relief pressure setting	1986. 3 ~ 1991. 4	150 $\begin{smallmatrix} +7 \\ -2 \end{smallmatrix}$ kgf/cm ² (2,130 $\begin{smallmatrix} +100 \\ -30 \end{smallmatrix}$ psi)
	1991. 5 ~	153 $\begin{smallmatrix} +7 \\ -2 \end{smallmatrix}$ kgf/cm ² (2,180 $\begin{smallmatrix} +100 \\ -30 \end{smallmatrix}$ psi)
Port relief pressure setting	1986. 3 ~ 1991. 4	110 $\begin{smallmatrix} +7 \\ -2 \end{smallmatrix}$ kgf/cm ² (1,560 $\begin{smallmatrix} +100 \\ -30 \end{smallmatrix}$ psi)
	1991. 5 ~	113 $\begin{smallmatrix} +7 \\ -2 \end{smallmatrix}$ kgf/cm ² (1,610 $\begin{smallmatrix} +100 \\ -30 \end{smallmatrix}$ psi)

OIL CONTROL VALVE LINK

DESCRIPTION

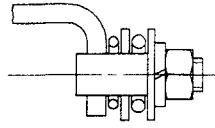
The foot pedal system is adopted. Electrical pedal lock safety devices are provided for both the lift and dump pedals. The pedal lock is not unlocked unless the starter switch, seat switch and seat belt switch (*seat bar switch) are operated at the same time.

- * For the loaders equipped with seat bar, here read seat bar switch, and disregard seat belt switch. Bring seat bar to lowest position.

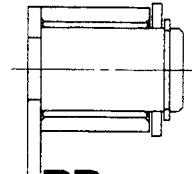


Oil Control Valve Link (1)

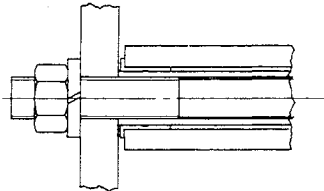
SAEL2



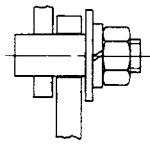
AA Section



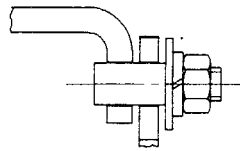
BB Section



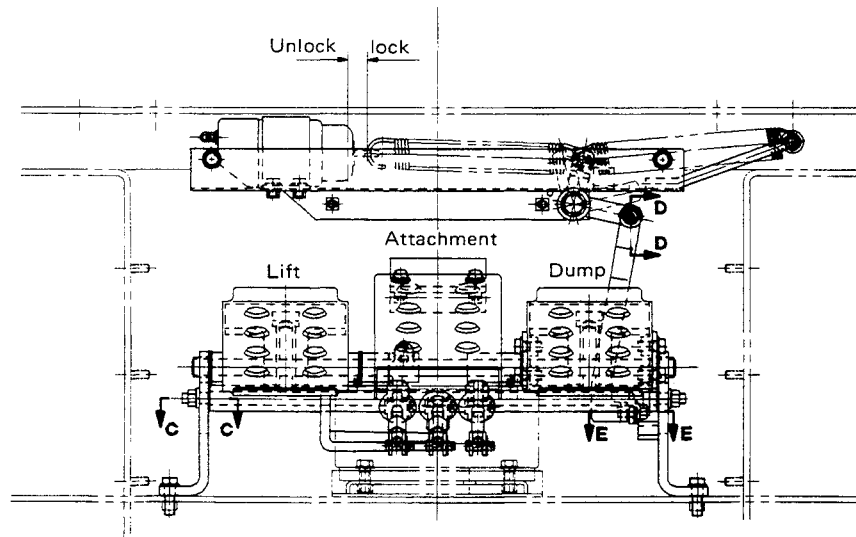
CC Section



DD Section



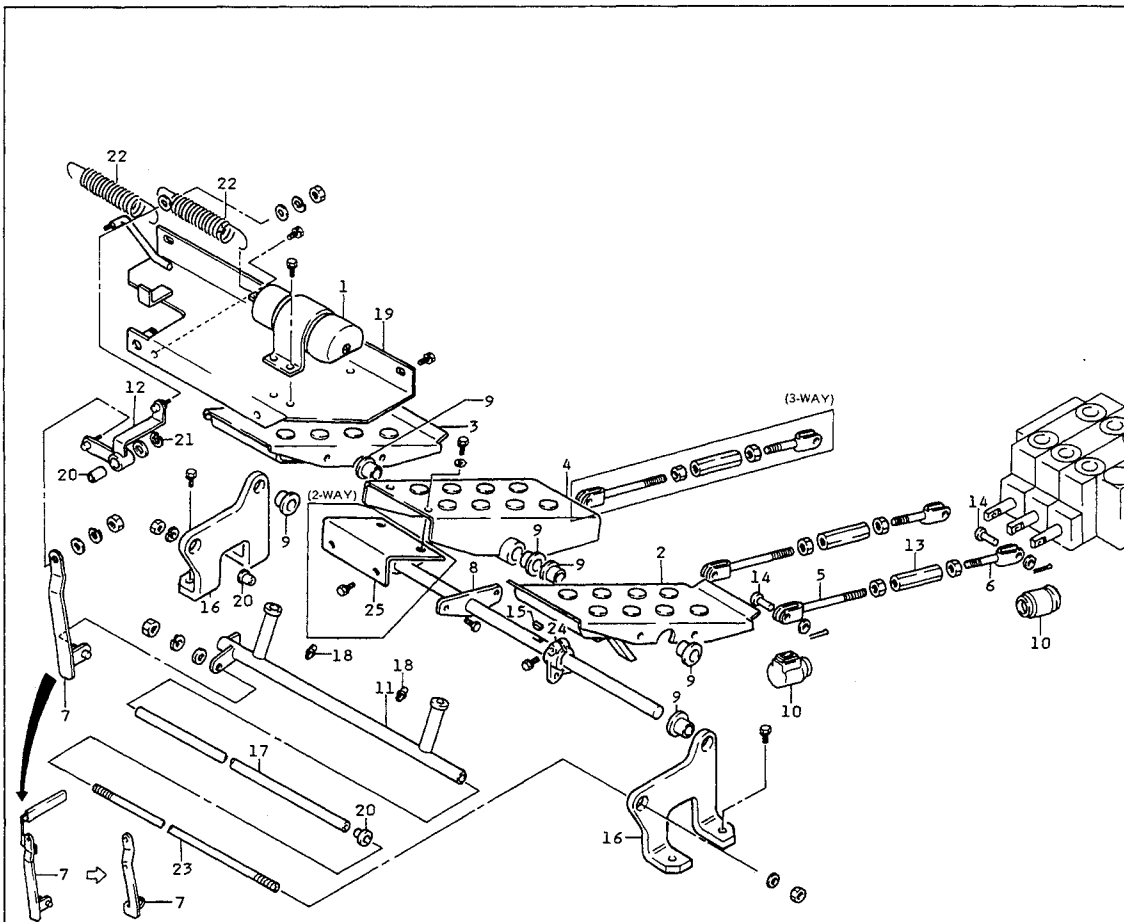
EE Section



Oil Control Valve Link (2)

SAEL3

COMPONENTS

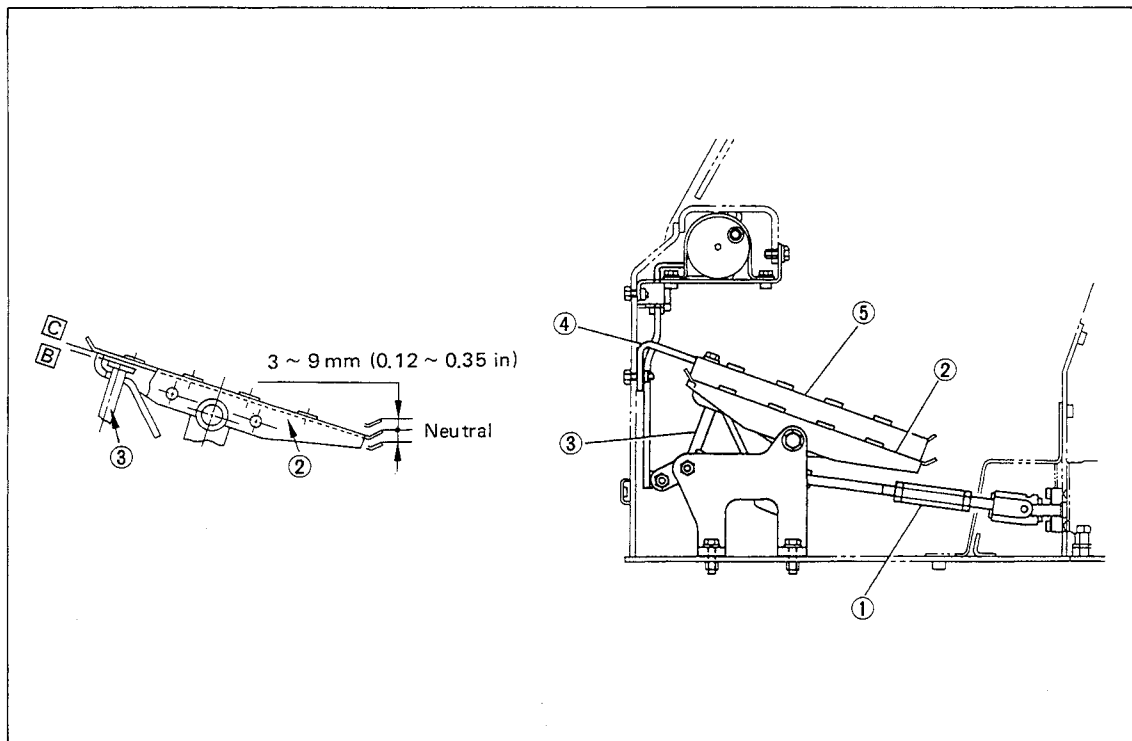


- | | |
|----------------------------------|--------------------|
| 1. Solenoid assy | 14. Pin |
| 2. Left pedal | 15. Key |
| 3. Dump pedal | 16. Support |
| 4. Attachment pedal | 17. Spacer |
| 5. Control valve lever rod No. 1 | 18. Grease fitting |
| 6. Control valve lever rod No. 2 | 19. Bracket |
| 7. Rod | 20. Bushing |
| 8. Pedal support pin | 21. Snap ring |
| 9. Bushing | 22. Spring |
| 10. Control valve link boot | 23. Bolt |
| 11. Lock link | 24. Lever |
| 12. Link | 25. Pedal stopper |
| 13. Turn buckle | |

Oil Control Valve Link Components

SAEL18

PEDAL LOCK SYSTEM



SAEM54

PEDAL ADJUSTMENT (for Dump and Lift pedals)

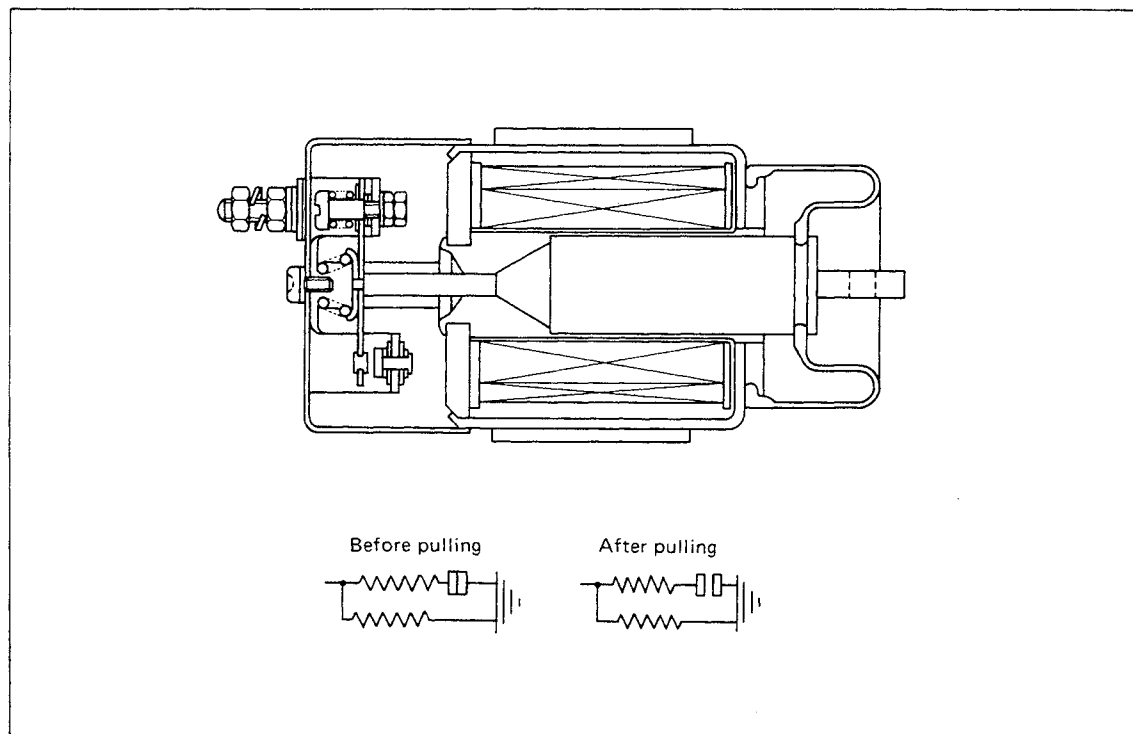
1. Adjust turnbuckle① so that operating pedal② angle becomes about 20° at its neutral position.
2. Manually move operating pedal② lightly (as far as its play), and adjust turnbuckle① so that the play at the rear end of the pedal becomes 3 to 9 mm (0.12 to 0.35 in) without causing contact between surfaces B and C.
3. Firmly fix the turnbuckle by the lock nut.

ATTACHMENT PEDAL FIXING PROCEDURE (when no attachment is fitted)

The attachment pedal fixing procedure is as follows:

1. Use a bolt to fix pedal stopper④ to the frame.
2. Use a bolt to fix attachment pedal⑤ to pedal stopper④.

SOLENOID

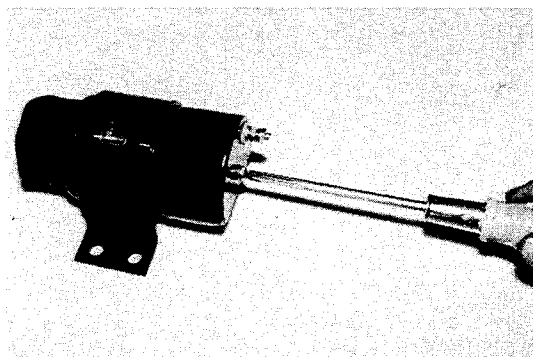


Solenoid Sectional View

SAEM61

SPECIFICATIONS

Rated Voltage		12V
Voltage	Pull coil (P.C.)	25 A max.
	Holding coil (H.C.)	5 A max.
Operating voltage	Stroke: 27 mm (1.1 in.) at a load of 1 kg (2.2 lbs)	12 V max.
Weight		Approx. 1.5kg(3.3lbs.)

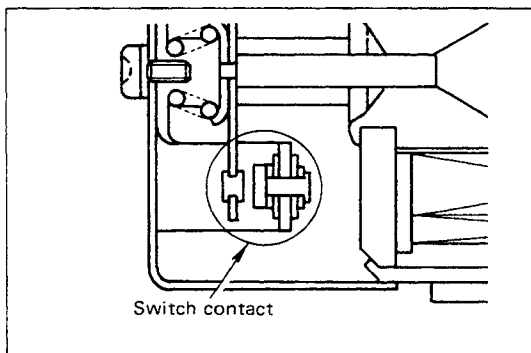


Switch Cover

SAE44-14

INSPECTION

1. Remove the switch cover.
(1) Set screw (1 pc.)
2. Check that the switch contact is open when the solenoid valve is supplied with a current. If closed, the solenoid valve may be burnt.



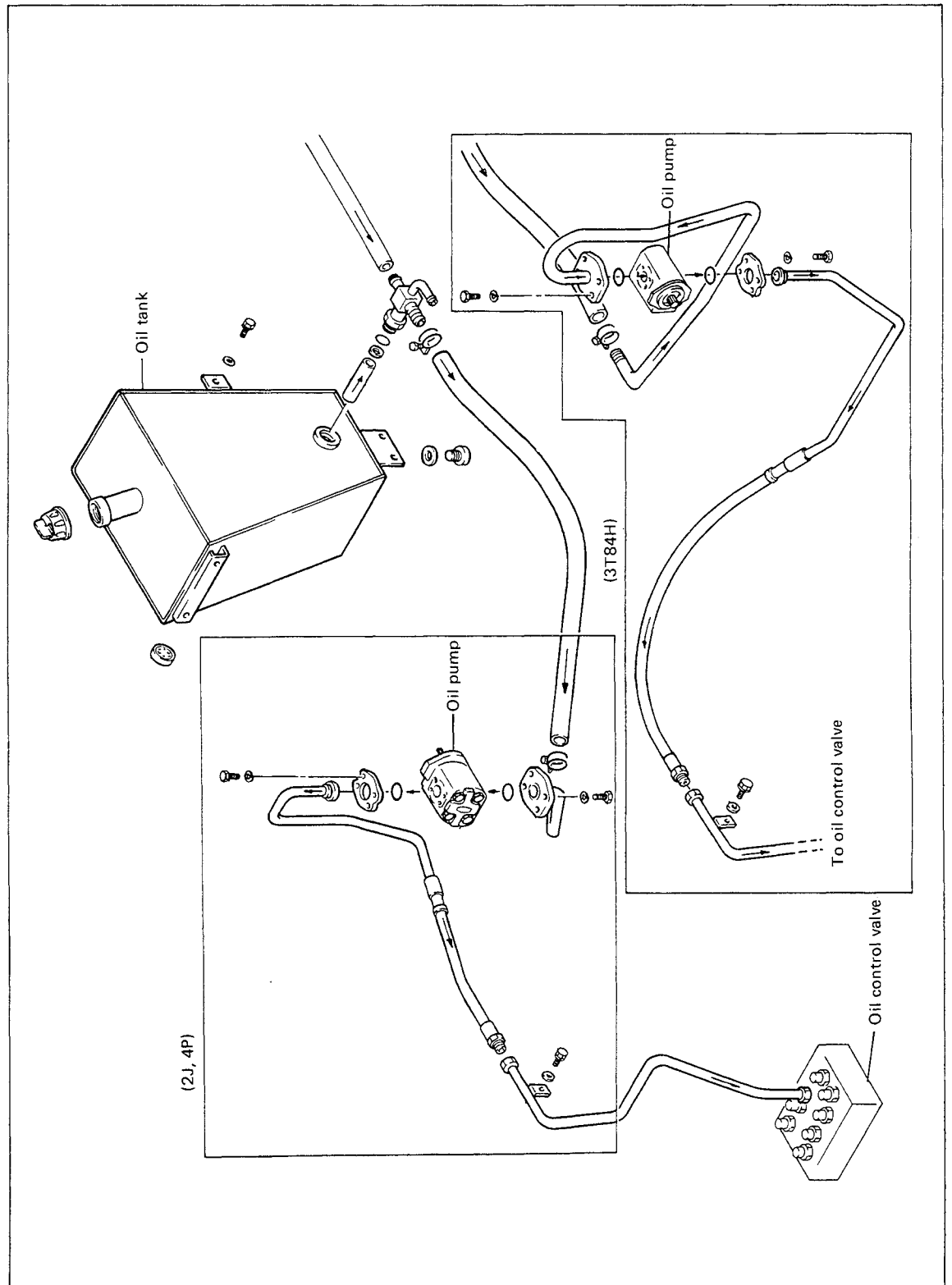
Inspecting the Contact

SAEM61

HYDRAULIC SYSTEM

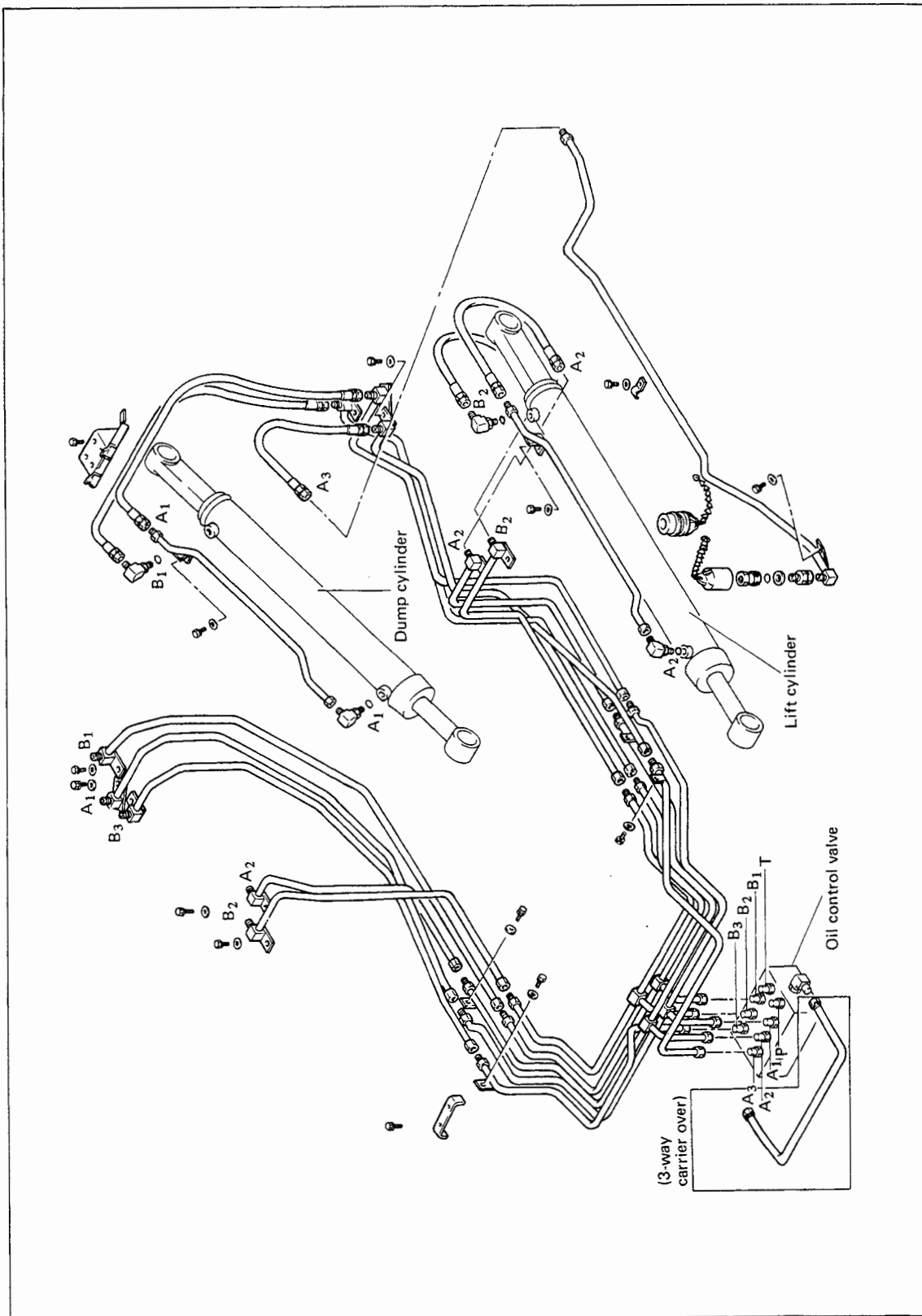
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HYDRAULIC PIPING	12-2
BLEEDING AIR FROM HYDRAULIC CIRCUIT	12-4
HYDRAULIC CIRCUIT DIAGRAM	12-5

HYDRAULIC PIPING



Hydraulic Piping (Tank to Valve)

SAEL11



Hydraulic Piping (Valve to Cylinder)

SAEL12

BLEEDING AIR FROM HYDRAULIC CIRCUIT

When reconnecting the hydraulic piping after disconnection, bleed air as described below.

1. Remove the oil cooler air vent plug.
2. Connect a hose (inside diameter of 6 mm and length of 2 m) to the union (PT1/8, 90404-51096), and install them to the oil cooler air vent hole.

Caution:

A transparent hose should be used to make air bleeding status visible.

3. Remove the filler cap from the hydraulic oil tank.

Caution:

The hose must be put into the oil.

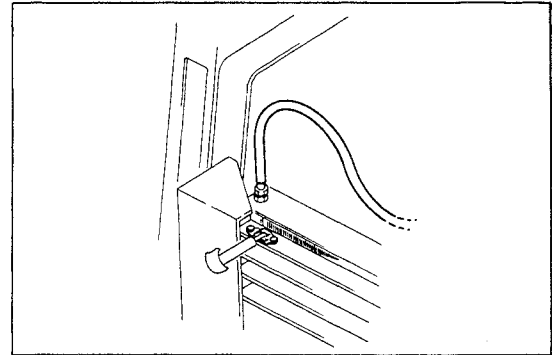
4. Start the engine and warm it up at the idle speed.

5. Raise the engine speed to about 2000 rpm and bleed air according to the following steps:
 - (1) Depress and release the operating pedal several times.
 - (2) Slightly move the steering lever back and forth several times.
 - (3) Repeat full stroke operation by depressing and releasing the operating pedal.
 - (4) Repeat forward and backward travel by operating the steering control levers.

Caution:

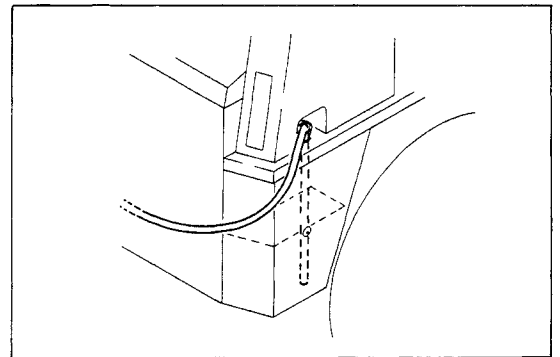
Since travel feeling is not good if air is mixed in the hydraulic circuit, careful operation is necessary during traveling.

6. After confirming no air bubble in the oil flowing through the hose, remove the union with hose and install the air vent plug to the oil cooler. Wind seal tape around the plug before installation.



Installing the Union with Hose

SAES59

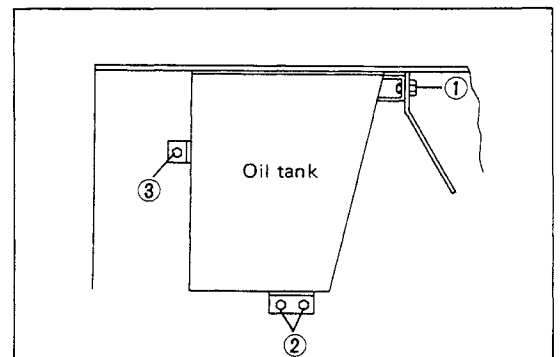


Putting in the Hose

SAES60

CAUTION FOR OIL TANK INSTALLATION

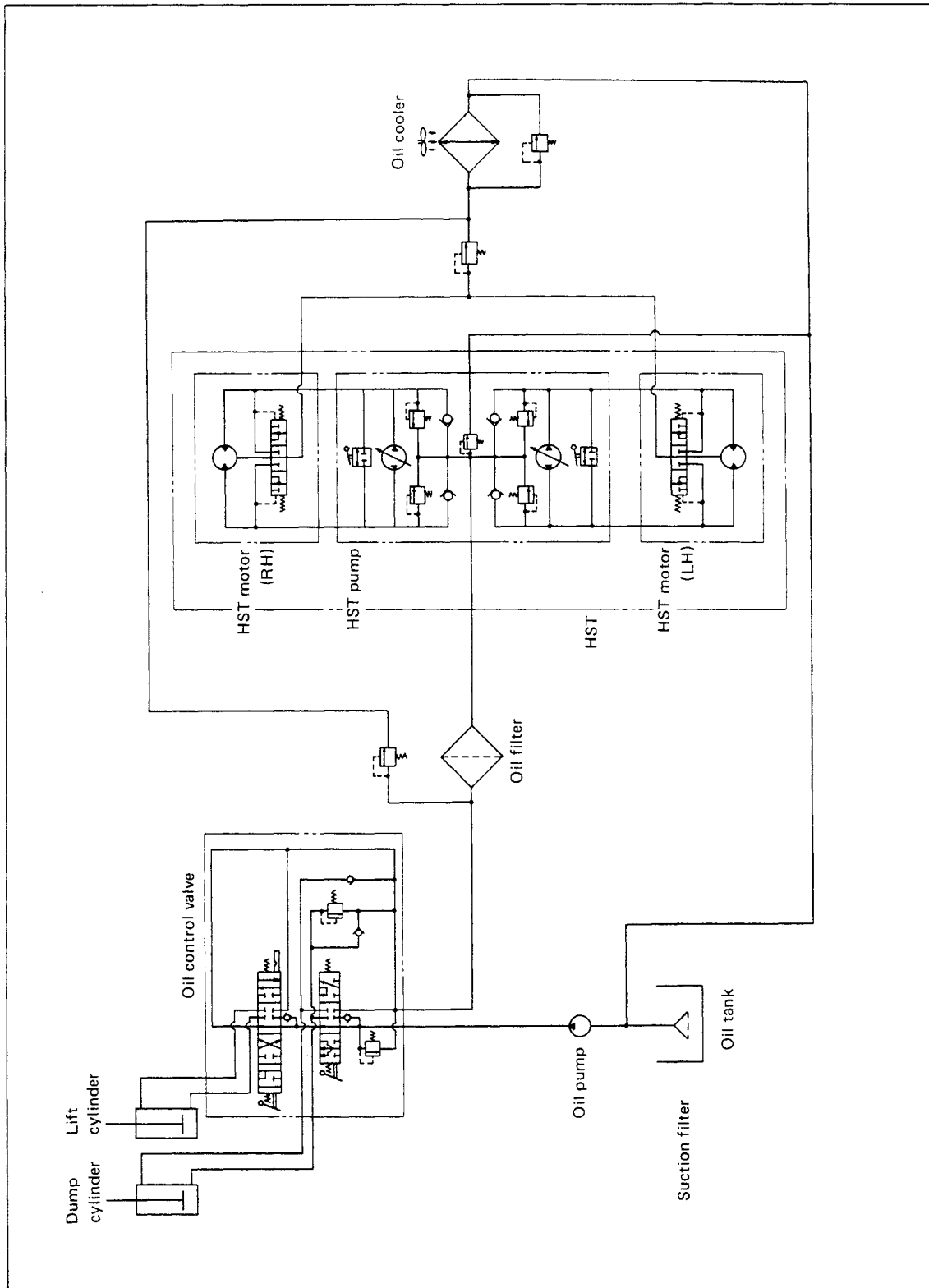
1. When installing the oil tank, tighten the set bolts in the order shown in the figure at right.



Installing the Oil Tank

SAES62

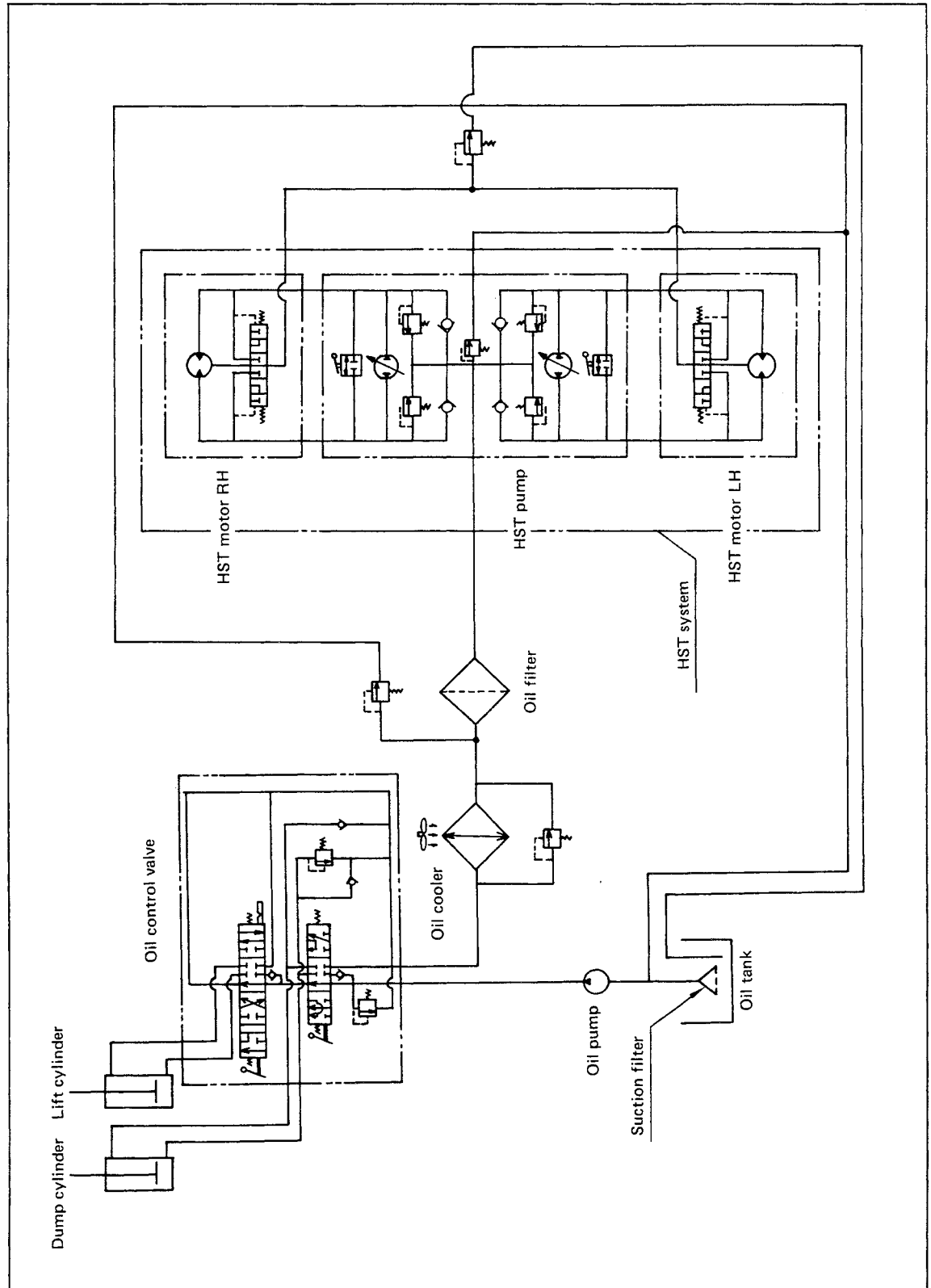
HYDRAULIC CIRCUIT DIAGRAM (1986. 3 ~ 1991. 5)



Hydraulic Circuit Diagram

SAEL13

HYDRAULIC CIRCUIT DIAGRAM (1991.5 ~)



Hydraulic Circuit Diagram

APPENDIX

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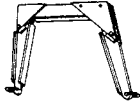
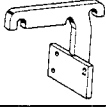

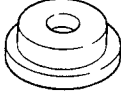
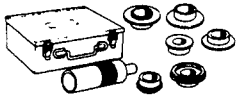


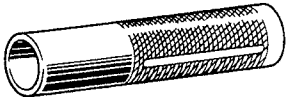



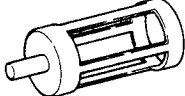
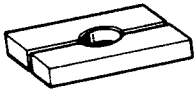

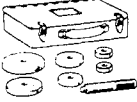
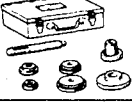

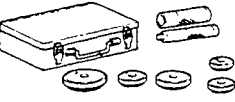
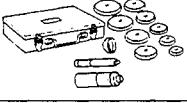
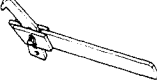
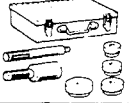
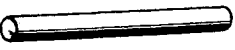
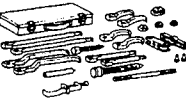
Fig No.	S. S. T.	Part Number	Part Name
1		09010-20110-71	Hanger, engine unit
2		09010-20120-71	Hook, engine
3		09090-04000	Device, engine sling
4		09120-10170-71	Remover & replacer, transmission bearing
5		09316-60010	Replacer, transmission & transfer bearing
6		09320-10410-71	Replacer, front axle hub inner bearing
7		09370-20270-71	Replacer, drive pinion bearing
8		09381-41950-71	Replacer, H. S. T. pump bearing
9		09381-42800-71	Preload tool, drive gear
10		09382-42800-71	Preload tool, drive shaft
11		09410-30200-71	Replacer, rear axle hub inner bearing
12		09421-42800-71	Replacer, axle shaft oil seal
13		09527-21011	Remover, rear axle shaft bearing
14		09550-10012	Replacer set, differential

Fig No.	S. S. T.	Part Number	Part Name
15		09550-55010	Replacer set, differential
16		09608-12010	Replacer set, front hub & drive pinion bearing
17		09608-20012	Tool set, front hub & drive pinion bearing
18		09608-30012	Tool set, front hub & drive pinion bearing
19		09608-35014	Tool set, axle hub & drive pinion bearing
20		09620-10100-71	Remover & replacer, cylinder cap
21		09620-30010	Replacer set, steering gear box
22		09700-30200-71	Remover, spring pin tool
23		09950-20017	Puller, universal

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