SEBM04250107

SHOP MANUAL

KOMATSU

WA500-1

MACHINE MODEL SERIAL No.

WA500-1 **10001 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- WA500-1 mount the S6D140-1 engine;
  For details of the engine, see the 6D140-1 Series Engine Shop Manual.

05-91(02)03261

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⚠ IMPORTANT SAFETY NOTICE

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

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

⚠ SAFETY

GENERAL PRECAUTIONS

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

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

PREPARATIONS FOR WORK

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

PRECAUTIONS DURING WORK

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

FOREWORD

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

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

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

STRUCTURE AND FUNCTION

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

TESTING AND ADJUSTING

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

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

DISASSEMBLY AND ASSEMBLY

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

MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

NOTICE

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

HOW TO READ THE SHOP MANUAL

VOLUMES

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

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

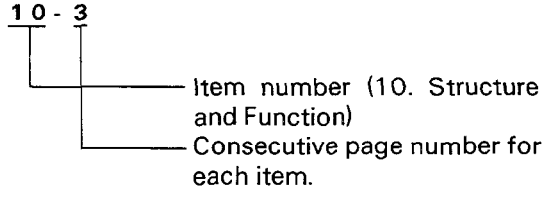
These various volumes are designed to avoid duplicating the same information. Therefore to deal with all repairs for any model, it is necessary that chassis, engine, electrical and attachment volumes are ready.

DISTRIBUTION AND UPDATING

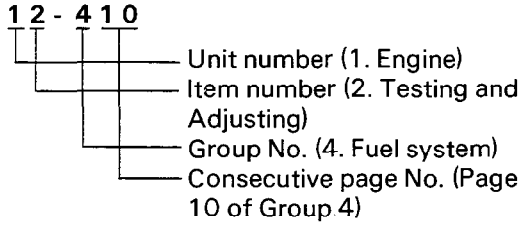
Any additions, amendments or other changes will be sent to KOMATSU distributers. Get the most up-to-date information before you start any work.

FILING METHOD

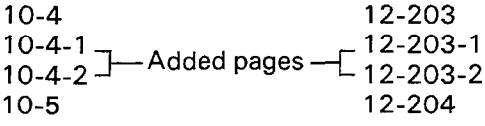
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1 (Chassis volume):



   Example 2 (Engine volume):



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



REVISED EDITION MARK (①②③ ····)

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

REVISIONS

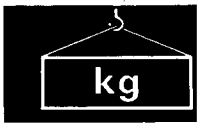
Revised pages are shown at the LIST OF REVISED PAGES on the between the title page and SAFETY page.

SYMBOLS

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

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

HOISTING INSTRUCTIONS



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

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

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

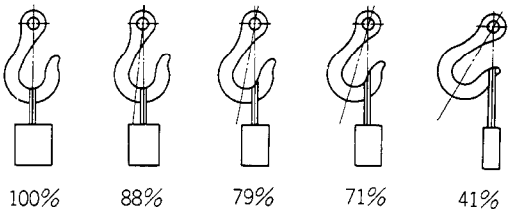
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

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

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

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

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



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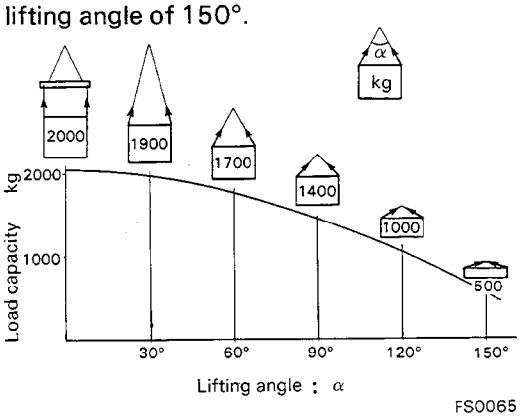
3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

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

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.

When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles.

When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



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kgm

STANDARD TIGHTENING TORQUE

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS

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

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

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

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

2. TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

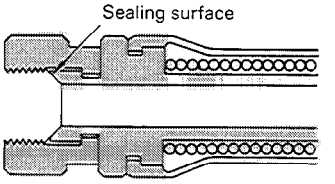
Use these torques for split flange bolts.

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

kgm

3. TIGHTENING TORQUE FOR NUTS OF FLARED

Use these torques for nut part of flared.



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

COATING MATERIALS

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

Nomenclature	Komatsu code	Applications
Adhesives	LT-1A	Used to apply rubber pads, rubber gaskets, and cork plugs.
	LT-1B	Used to apply resin, rubber, metallic and non-metallic parts when a fast, strong seal is needed.
	LT-2*	Preventing bolts, nuts and plugs from loosening and leaking oil.
	LT-3	Provides an airtight, electrically insulating seal. Used for aluminum surfaces.
	LT-4	Used to coat plugs (plate shaped, bowl shaped) and holes, and mating portion of shaft.
Sealant gasket	LG-1	Used with gaskets and packings to increase sealing effect.
	LG-3	Heat-resistant gasket for precombustion chambers and exhaust piping.
	LG-4	Used by itself on mounting surfaces on the final drive and transmission cases. (Thickness after tightening: 0.07 — 0.08 mm)
	LG-5	Used by itself to seal grease fittings, tapered screw fittings and tapered screw fittings in hydraulic circuits of less than 50 mm in diameter.
	LG-6	Silicon base type used in combination with LG-1 and LG-4.
	LG-7	Has a shorter curing time than LG-6, and is easier to peel off.
Antifriction compound (Lubricant including molybdenum disulfide)	LM-P	Applied to bearings and taper shafts to facilitate press-fitting and to prevent sticking, burning or rusting.
Grease (Lithium grease)	G2-LI	Applied to bearings, sliding parts and oil seals for lubrication, rust prevention and facilitation of assembling work.
Vaseline	—	Used for protecting battery electrode terminals from corrosion.

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

ELECTRIC

ELECTRIC WIRE CODE

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

CLASSIFICATION BY THICKNESS

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

CLASSIFICATION BY COLOR AND CODE

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

WEIGHT TABLE

⚠ This weight table is a guide for use when transporting or handling components.

Unit. kg

Machine Model	WA500-1
Serial Number	10001 –
Engine assembly	1453
Radiator assembly	285
Torque converter assembly	193
Transmission assembly	980
Damper	91
Upper drive shaft	18
Center drive shaft	33
Front drive shaft	44
Rear drive shaft	42
Front axle assembly	2028
Rear axle assembly	1776
Front differential assembly	288
Rear differential assembly	282
Planetary carrier assembly (1 piece)	80
Planetary hub assembly (1 piece)	102
Axle pivot (Rear axle)	93/119
Wheel (1 piece)	240
Tire (1 piece)	421
Steering valve	55
Steering cylinder (1 piece)	47
Brake (1 piece)	170
Hydraulic tank	156

Machine Model		WA500-1
Serial Number		10001 –
Hydraulic pump		13
Steering and POC pumps		20
Switch pump		13
POC valve		5
Machine control valve		90
Lift cylinder (1 piece)		279
Dump cylinder		283
Engine hood		43
Front frame		2486
Rear frame		2012
Bucket link (with bushing)		94
Tilt lever (with bushing)		489
Lift arm (with bushing)		1996
Bucket (with teeth)		2577
Counter-weight	Serial No. 10001 – 10452	880
	Serial No. 10453 and up	1500
Fuel tank		328
Battery (1 piece)		53
Cab assembly		305
Air conditioner unit		115
Operator's seat		40
Floor plate		131

TABLE OF OIL AND COOLANT QUANTITIES

RESERVOIR	KIND OF FLUID	AMBIENT TEMPERATURE	CAPACITY (ℓ)	
		−22 −4 14 32 50 68 86 104 122°F −30 −20 −10 0 10 20 30 40 50°C	Specified	Refill
Engine oil pan	Engine oil	SAE 30 / SAE 10W / SAE 10W-30 / SAE 15W-40	32	28.5
Brake		SAE 10W	5.1	2.4
Transmission case		SAE 30 / SAE 10W	70	62
Hydraulic system		SAE 10W	260	150
Axle (Front and rear)		See NOTE (4)	each 75	each 75
Fuel tank	Diesel fuel	ASTM D975 No. 2 / ASTM D975 No. 1	435	–
Cooling system	Water	Add antifreeze	80	–

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

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

NOTE:

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

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

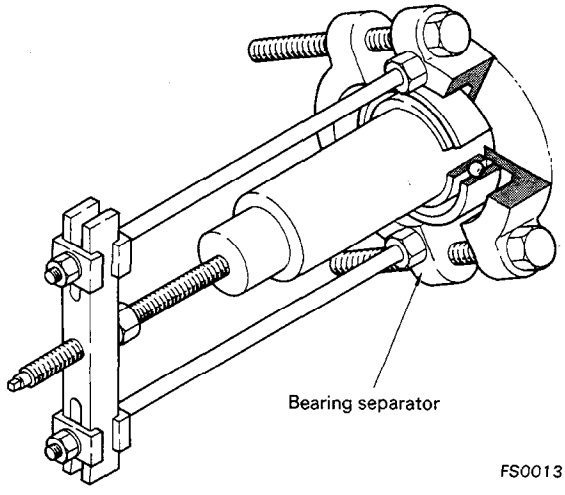
(2) When starting the engine in an atmospheric temperature of lower than 0°C, be sure to use engine oil of SAE10W, SAE10W-30 and SAE15W-40, even though an atmospheric temperature goes up to 10°C more or less in the day time.

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

(4) For axle oil, use only recommended oil as follows.
SHELL: DONAX TT or TD
CALTEX: RPM TRACTOR HYDRAULIC FLUID
CHEVRON: TRACTOR HYDRAULIC FLUID
TEXACO: TDH OIL
MOBIL: MOBILAND SUPER UNIVERSAL

★ It is possible to substitute engine oil CLASS-CD SAE30 for axle oil.
If noise comes from the brake, it is no problem of durability.

4. Bearing separator



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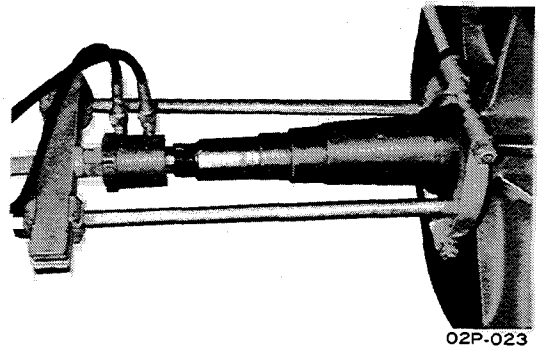

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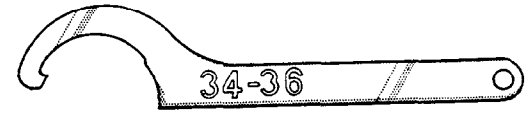
5. Hook wrench

A hook wrench has a claw which hooks into the turning sockets of round nuts. The wrench size is defined by the outer diameter of the round nut turned. The accompanying figure shows a hook wrench designed for use with round nuts of two different sizes.



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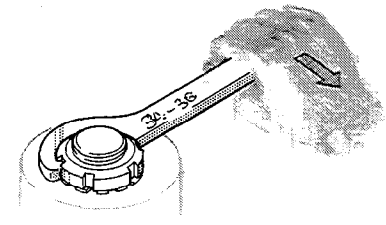

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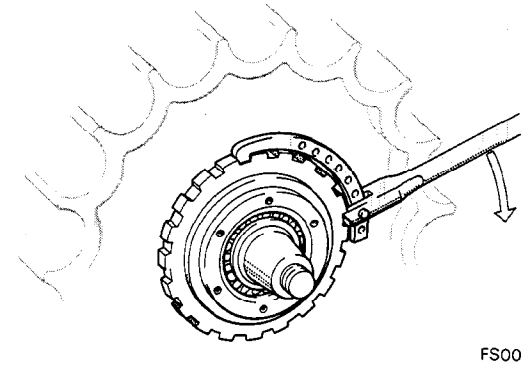
Removal and Installation of the Sprocket Wheel



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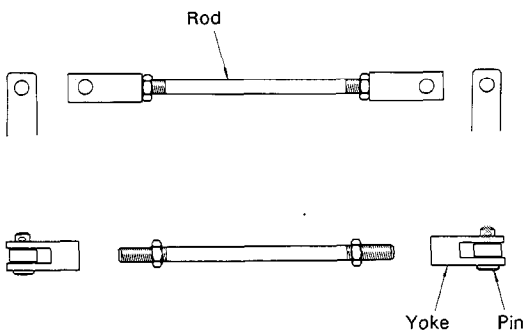
9. CLEARANCE ADJUSTMENTS

Store each set of shims or washers so that they can be installed in their original condition at the time of reassembly.

10. LINK RODS

1) If it is necessary to change the length of the link rod in order to remove it, first record the original length so that the rod can be easily reassembled in its original condition.
2) Remove the link rod at the pins.



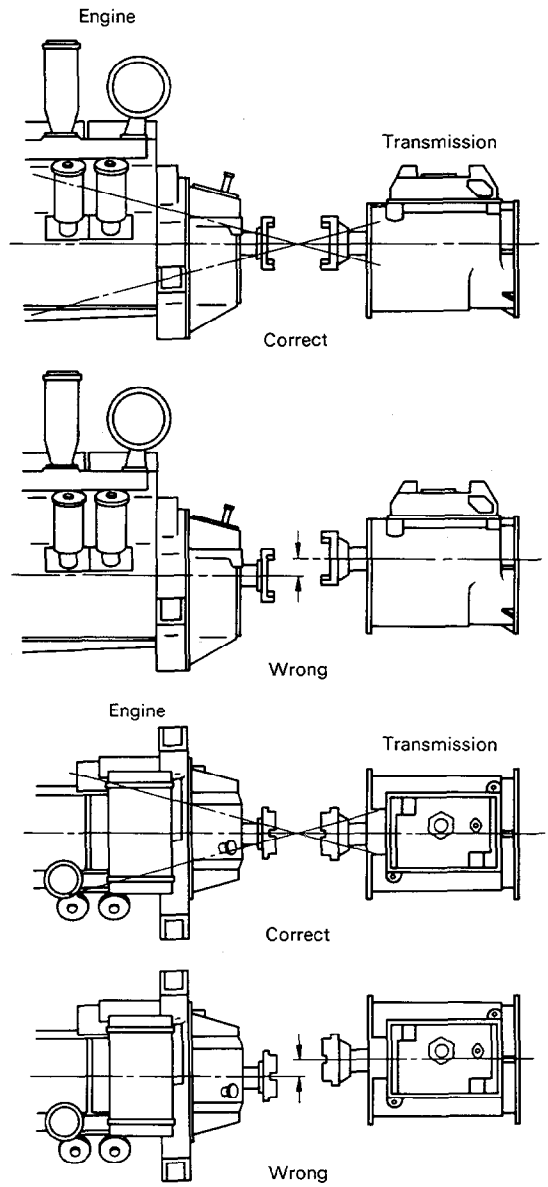
FS0017

11. SHIMS AND WASHERS

1) Shims are used to center the engine and adjust the action of the bevel gears. Handle very carefully as they get deformed easily.
2) Record the numbers and positions to speed adjustment after reinstallation.
3) Do not reuse any shims or washers that are deteriorated, damaged, bent or deformed.
4) Insert thin shims between thicker ones.

12. CENTERING

Centering is very important for interfaces in the power train — for example, between the engine and the transmission and between the bevel gear shaft and the final drives. Incorrect centering only increases the stresses acting on the turning parts, so always make sure that the deviation is within the specified limits.



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MEASURING INSTRUCTIONS

PREPARATIONS BEFORE CHECKING

1. **Cleaning of parts**
   Wash parts to be checked. Special care should be paid to thoroughly remove dust and dirt from the surfaces on which measurements are to be made so that possible errors can be eliminated.

2. **Minor repair of part surfaces**
   Remove scratches, dents and rust from parts to be checked. If the surface are rough, the measurements will be inaccurate. When smoothing any surface, be careful not to use an oilstone or sand paper coarser than the finished surface.

3. **Preparation of measuring tools**
   Clean the tools and thoroughly remove dust and dirt from the surfaces which contact parts. Check the tools for proper function and zero-point adjustment. Remedy any abnormality.

4. **Maintenance of measuring tools**
   Handle all tools with sufficient care and do not subject them to unreasonable force or shocks which can affect their delicate construction. Periodically check the tools for accuracy and, if necessary, calibrate them. Put the tools back into their cases and return them to their fixed storage locations whenever not in use. It is recommended to assign a person to be responsible for the proper storage of measuring tools.

MEASURING TOOLS

- Repeat each measurement two or three times to eliminate possible errors. Further repetition will be necessary, if there is a large variation in the readings.
- When measuring the inside or outside diameter of a cylindrical object, take two readings with the measuring device put in two directions at right angles to each other. Repeat this at several points along the overall length of the object.
- Along eye-measurement below the unit of a scale may be used for making a comparison between two approximately equal measurements, the accuracy of such eye-measurements should not be considered as reliable.
- At the start of each measurement, select a measuring device having an accuracy appropriate for judging whether the measurement reaches its allowable limit.

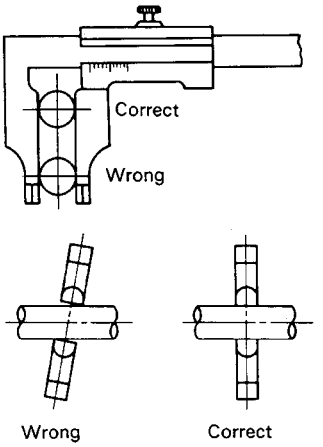
BLOCK GAUGES

- To bring two blocks into contact, wash each block with benzene to remove rust-preventing oil and wipe with a clean cotton cloth. Put one block on the other, causing a sliding or twisting movement between the two.
- If the contact between two blocks feels rough, apply a fine-grade oilstone to the blocks along their edges. (Do not try to rub the contact surface of the blocks.)
- Do not leave the blocks in contact for a long time. Long-time contact will make the blocks difficult to separate or cause black rust to appear on the contact surfaces.
- When separating two blocks, slide or twist them. Do not try to pull them apart, by force or strike them with a mallet.
- When storing a block gauge, wipe off moisture, dirt and fingerprints, coat with a rust-preventing lubricant such as vaseline, and put the gauge back in its case.

VERNIER CALIPERS

- At the start of measurement, close the jaws and check that there is no clearance (due to wear) between the jaws and that the "zero" point of the graduation is in exact alignment with the "zero" point of the vernier scale.

- **Measuring an outer diameter**



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