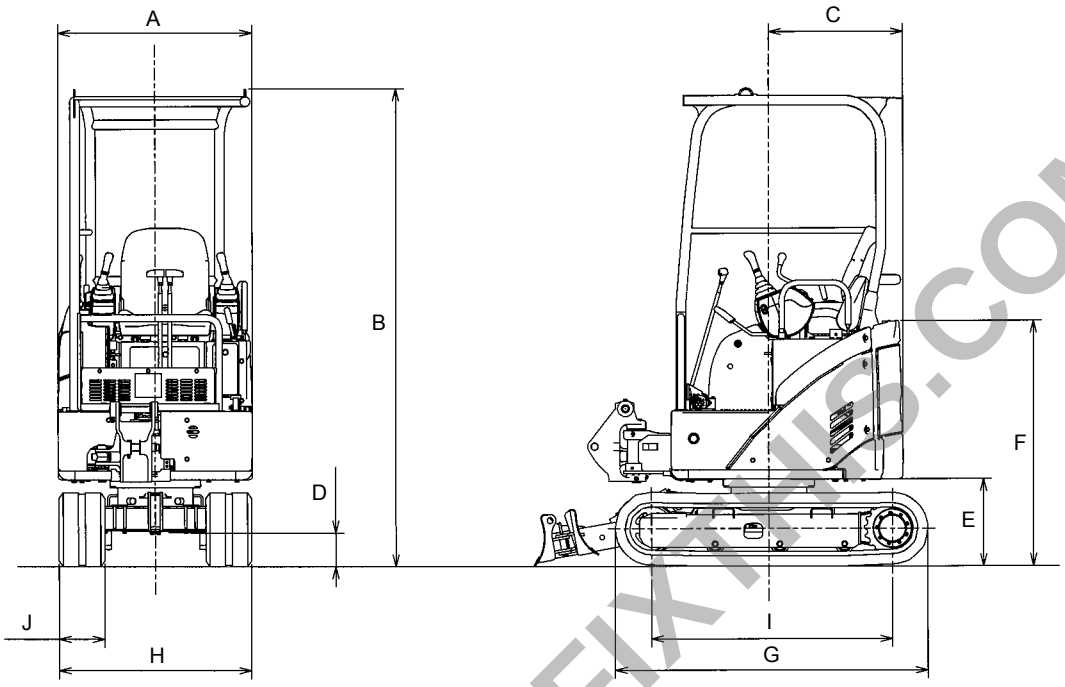
SPECIFICATIONS



M1MS-12-001

Type		ZAXIS17U-2	
		2-Pillars Canopy	ROPS 3-Pillars Canopy
Type of Front-End Attachment		Boom Swing Type	
Bucket Capacity (Heaped)	m^3 (yd^3)	0.044 (0.58)	
Operating Weight	kg (lb)	1750 (3860)	1770 (3900)
Basic Machine Weight	kg (lb)	1400 (3090)	1420 (3130)
Engine	kW/min^{-1} (PS/rpm)	Yanmar 3TNV70 11.0/2400 (15.0/2400)	
A: Overall Width	mm (ft·in)	980 (3′3″)	
B: Overall Height	mm (ft·in)	2380 (7′10″)	2400 (7′11″)
C: Rear-End Swing Radius	mm (ft·in)	675 (2′3″)	
D: Minimum Ground Clearance	mm (ft·in)	165 (6.5″)	
E: Counterweight Height	mm (ft·in)	435 (1′5″)	
F: Engine Cover Height	mm (ft·in)	1230 (4′0″)	
G: Undercarriage Length	mm (ft·in)	1570 (5′2″)	
H: Undercarriage Width	mm (ft·in)	970/1280 (3′2″/4′2″)	
I: Sprocket Center to Idler Center	mm (ft·in)	1210 (4′0″)	
J: Track Shoe Width	mm (ft·in)	230 (9.1″) (Rubber Crawler)	
Ground Pressure	KPa (kgf/cm^2, psi)	28 (0.28, 4.1)	
Swing Speed	min^{-1} (rpm)	8.9 (8.9)	
Travel Speed (fast/slow)	km/h	4.3/2.4	
Gradeability	Degree (%)	30 (58)	

NOTE: The dimensions do not include the height of the shoe lug.

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OUTLINE

The hydraulic system mainly consists of main circuit and pilot circuit.

Main Circuit:

Power Source		Controller	Actuator
Main Pumps	→	Control Valves	→Motors →Cylinders →Front Attachmens (Optional)

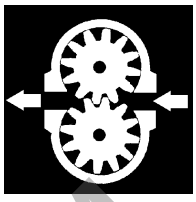
Pilot Circuit:

Power Source		Controller	Pilot Circuit
Pilot Pumps	→	2-Spool Solenoid Valve Unit	→Pilot Valve →Swing Motor →Travel Motor →Contorl Valve

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SECTION 3
COMPONENT OPERATION



CONTENTS

Group 1 Pump Device
Outline T3-1-1
Main Pump P1, P2 ..... T3-1-2
Main Pump P3, Pilot Pump P4 ..... T3-1-3
Horse Power Control Operation T3-1-4

Group 2 Swing Device
Outline T3-2-1
Swing Motor T3-2-2
Parking Brake T3-2-6
Valve Unit T3-2-7

Group 3 Control Valve
Outline T3-3-1
Hydraulic Circuit T3-3-10
Arm Regenerative Valve T3-3-16
Flow Combiner Valve T3-3-18
Main Relief Valve T3-3-20
Overload Relief Valve T3-3-21
Make-Up Valve T3-3-23

Group 4 Pilot Valve
Outline T3-4-1
Operation T3-4-4
Shockless Function
(Only for Travel Pilot Valve) T3-4-12

Group 5 Travel Device
Outline T3-5-1
Travel Motor T3-5-2
Parking Brake T3-5-4
Travel Brake Valve T3-5-6
Travel Reduction Gear T3-5-10

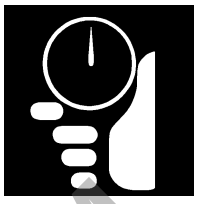
Group 6 Others (Upperstructure)
2-Spool Solenoid Valve T3-6-1
Pilot Relief Valve T3-6-3

Group 7 Others (Undercarriage)
Swing Bearing T3-7-1
Center Joint T3-7-2
Track Adjuster T3-7-4

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SECTION 4
OPERATIONAL PERFORMANCE TEST



CONTENTS

Group 1 Introduction
Operational Performance Test..... T4-1-1
Preparation for Performance Tests T4-1-2

Group 2 Standard
Operational Performance Standard.....T4-2-1
Main Pump P-Q Diagram T4-2-4

Group 3 Engine Test
Engine Speed T4-3-1
Engine Compression Pressure.....T4-3-2
Valve Clearance T4-3-4
Nozzle Check T4-3-6
Injection Timing T4-3-8

Group 4 Excavator Test
Travel Speed T4-4-1
Track Revolution Speed T4-4-2
Mistrack Check.....T4-4-3
Travel Motor Leakage.....T4-4-4
Swing Speed.....T4-4-5
Swing Function Drift Check T4-4-6
Swing Motor Leakage.....T4-4-8
Maximum Swingable Slant Angle T4-4-10
Swing Bearing Play.....T4-4-11
Hydraulic Cylinder Cycle Time.....T4-4-12
Dig Function Drift.....T4-4-15
Control Lever Operating Force.....T4-4-17
Control Lever Stroke.....T4-4-18
Combined Boom Raise/Swing
Function Check.....T4-4-19

Group 5 Component Test
Primary Pilot Pressure T4-5-1
Secondary Pilot Pressure T4-5-3
Main Relief Valve Set Pressure T4-5-4
Overload Relief Valve Set Pressure.....T4-5-7
Pump Driving Torque T4-5-9
Swing Motor Drainage T4-5-10
Travel Motor Drainage T4-5-12

Group 6 Adjustment
Fuel Lever Adjustment T4-6-1

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SECTION 5
TROUBLESHOOTING



CONTENTS

Group 1 Diagnosing Procedure

Introduction T5-1-1
Diagnosing Procedure T5-1-2

Group 2 Troubleshooting B

Troubleshooting B Procedure T5-2-1
Engine System Troubleshooting T5-2-2
Actuator System Troubleshooting T5-2-9
Front Attachment System Troubleshooting T5-2-13
Swing System Troubleshooting T5-2-18
Travel System Troubleshooting T5-2-20
Boom Swing System Troubleshooting T5-2-23
Blade System Troubleshooting T5-2-24
Side Frame Extend / Retract System Troubleshooting T5-2-25
How to Lower Boom In Case of Emergency and when Engine Stops T5-2-26

Group 3 Troubleshooting C

Troubleshooting C Procedure T5-3-1
Malfunction of Coolant Temperature Gauge T5-3-2
Malfunction of Fuel Gauge T5-3-4
Malfunction of Preheat Indicator T5-3-6
Malfunction of Alternator Indicator T5-3-7
Malfunction of Engine Oil Pressure Indicator T5-3-8
Malfunction of Overheat Indicator T5-3-9
Malfunction of Fuel Level Indicator T5-3-10
Malfunction of Monitor Buzzer T5-3-11
Malfunction of Hour Meter T5-3-12

Group 4 Electrical System Inspection

Precautions for Inspection and Maintenance T5-4-1
Fuse Continuity Test T5-4-3
Battery Voltage Check T5-4-4
Voltage Check T5-4-5
Continuity Check T5-4-6

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ADDITIONAL REFERENCES

- Please refer to the other materials (operator's manual, parts catalog, engine technical material and Hitachi training material etc.) in addition to this manual.

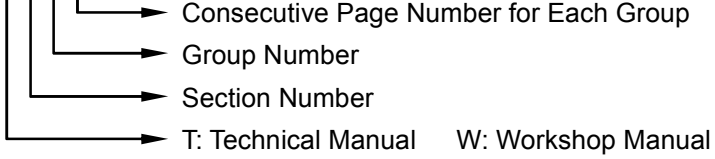
MANUAL COMPOSITION

- This manual consists the Technical Manual and the Workshop Manual.
  - Information included in the Technical Manual: technical information needed for redelivery and delivery, operation and activation of all devices and systems, operational performance tests, and troubleshooting procedures.
  - Information included in the Workshop Manual: technical information needed for maintenance and repair of the machine, tools and devices needed for maintenance and repair, maintenance standards, and removal/installation and assemble/disassemble procedures.

PAGE NUMBER

- Each page has a number, located on the center lower part of the page, and each number contains the following information:

Example : T 1-3-5



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SAFETY

RECOGNIZE SAFETY INFORMATION

- These are the **SAFETY ALERT SYMBOLS**.
  - When you see these symbols on your machine or in this manual, be alert to the potential for personal injury.
  - Follow recommended precautions and safe operating practices.



SA-688

UNDERSTAND SIGNAL WORDS

- On machine safety signs, signal words designating the degree or level of hazard - DANGER, WARNING, or CAUTION - are used with the safety alert symbol.
  - **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
  - **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
  - **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
  - **DANGER or WARNING safety signs** are located near specific hazards. General precautions are listed on **CAUTION safety signs**.
  - Some safety signs don't use any of the designated signal words above after the safety alert symbol are occasionally used on this machine.
- To avoid confusing machine protection with personal safety messages, a signal word **IMPORTANT** indicates a situation which, if not avoided, could result in damage to the machine.
- ***NOTE*** indicates an additional explanation for an element of information.



SA-1223

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INTRODUCTION

SAFETY ALERT SYMBOL AND HEADLINE NOTATIONS

In this manual, the following safety alert symbol and signal words are used to alert the reader to the potential for personal injury of machine damage.

⚠ This is the safety alert symbol. When you see this symbol, be alert to the potential for personal injury.
Never fail to follow the safety instructions prescribed along with the safety alert symbol.
The safety alert symbol is also used to draw attention to component/part weights.
To avoid injury and damage, be sure to use appropriate lifting techniques and equipment when lifting heavy parts.

- ⚠ **CAUTION:**
  Indicated potentially hazardous situation which could, if not avoided, result in personal injury or death.
- **IMPORTANT:**
  Indicates a situation which, if not conformed to the instructions, could result in damage to the machine.
- *NOTE:*
  Indicates supplementary technical information or know-how.

UNITS USED

- SI Units (International System of Units) are used in this manual.
  MKSA system units and English units are also indicated in parenthheses just behind SI units.
  Example : 24.5 MPa (250 kgf/cm^2, 3560 psi)

A table for conversion from SI units to other system units is shown below for reference purposees.

Quantity	To Convert From	Into	Multiply By	Quantity	To Convert From	Into	Multiply By
Length	mm	in	0.03937	Pressure	MPa	kgf/cm^2	10.197
	mm	ft	0.003281		MPa	psi	145.0
Volume	L	US gal	0.2642	Power	kW	PS	1.360
	L	US qt	1.057		kW	HP	1.341
	m^3	yd^3	1.308	Temperature	°C	°F	°C×1.8+32
Weight	kg	lb	2.205	Velocity	km/h	mph	0.6214
Force	N	kgf	0.10197		min^{-1}	rpm	1.0
	N	lbf	0.2248	Flow rate	L/min	US gpm	0.2642
Torque	N·m	kgf·m	1.0197		mL/rev	cc/rev	1.0
	N·m	lbf·ft	0.7375				

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MEMO

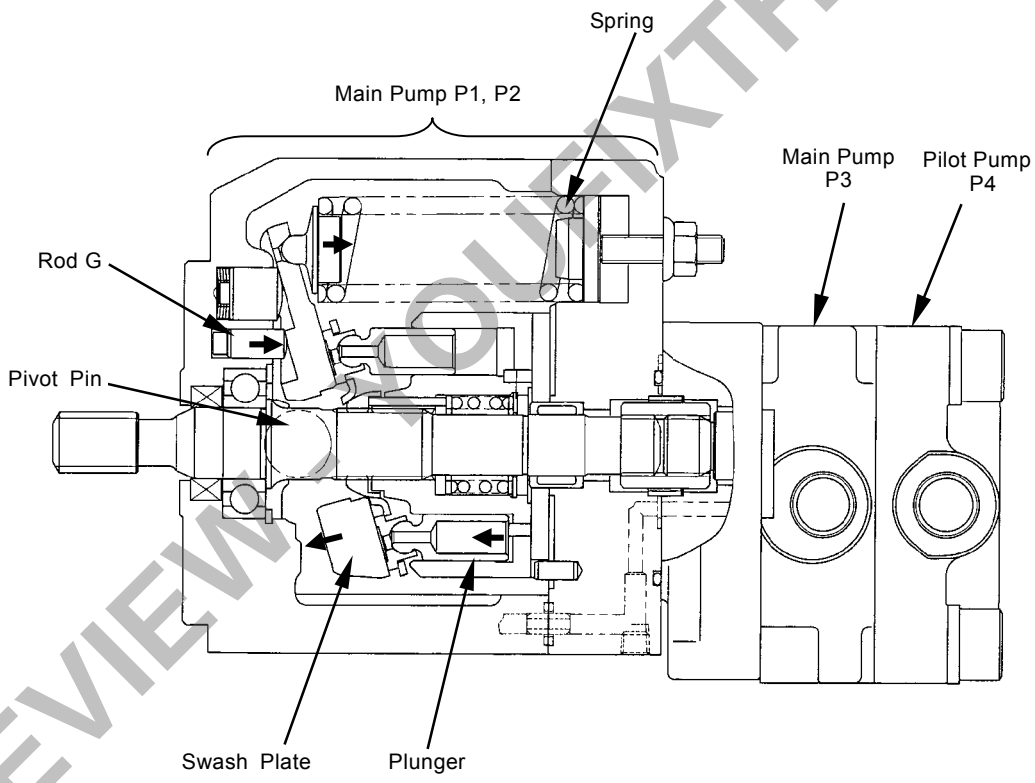
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HORSE POWER CONTROL OPERATION

In order to prevent the load of main pumps P1, P2, P3 from exceeding the engine torque, main pumps P1, P2 control its delivery flow rate.
When delivery pressure from main pumps P1, P2 increases, the plunger pushes the swash plate against the spring force. If the plunger force exceeds the spring force, the swash plate decreases the angle at the pivot pin and main pumps P1, P2 reduces flow rate.
Delivery pressure from main pump P3 acts on rod G through a inner passage in the pump. Rod G pushes the swash plate.

If the rod G force exceeds the spring force, the swash plate decreases the angle at the pivot pin and main pumps P1, P2 reduce flow rate.
Consequently, delivery flow rate of main pumps P1, P2 varies depending on changes in load from main pump P3 so that the total load from the three main pumps does not exceed the engine torque.



T1MS-03-01-001

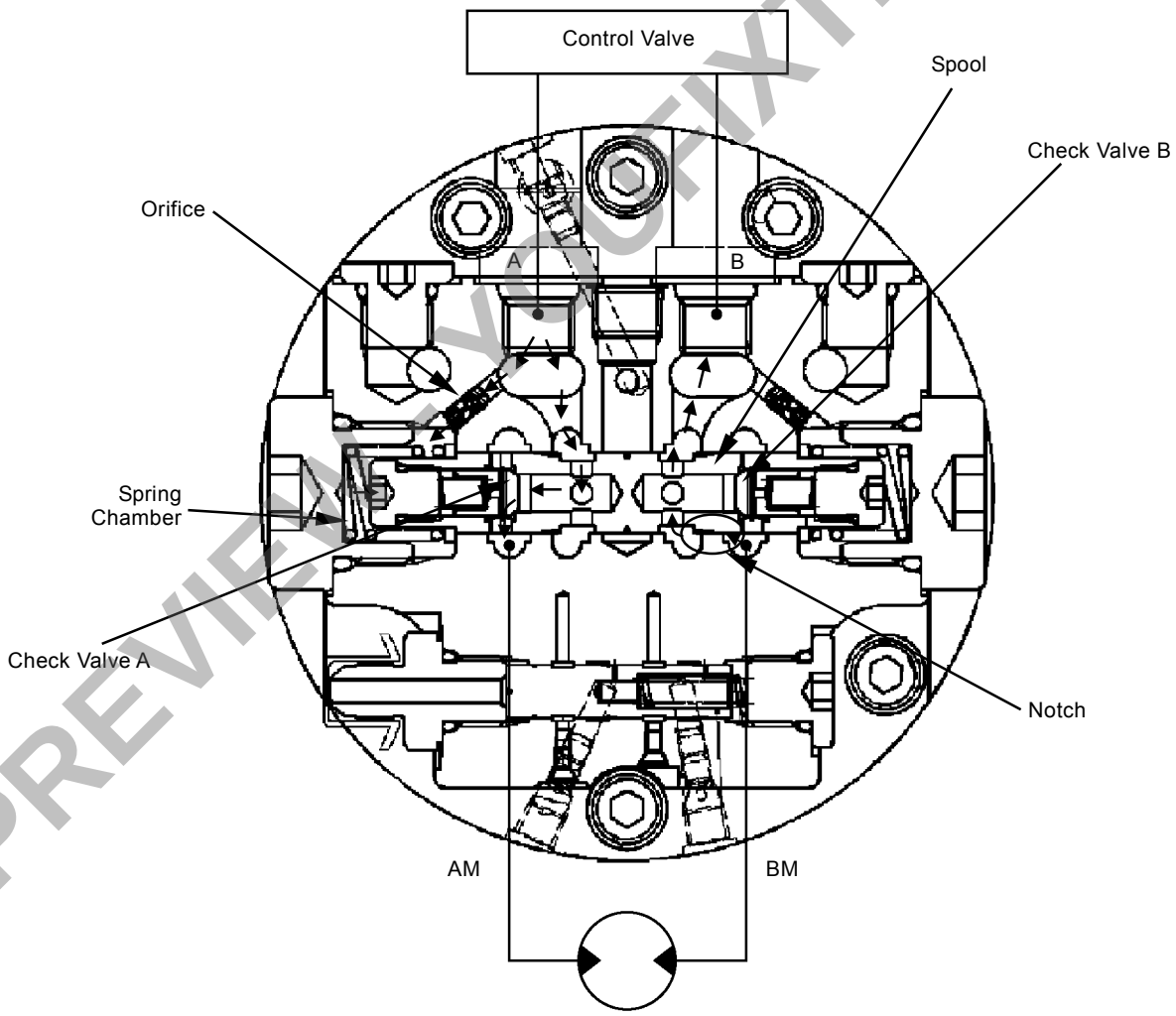
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Counterbalance Valve

- Travel Operation
  When pressure oil from the control valve is supplied to port A, pressure oil opens the check valve and flows to motor port AM through inside of the spool. On the other hand, return oil from motor port BM is blocked by check valve B and the spool.
  Thereby, pressure at port A side increases gradually, pressure at port A enters to the spring chamber from the orifice, and moves the spool to the right while acting on the end surface of spool.
  As a result, as the spool notch opens and port BM is connected to port B, the travel motor rotates.

- Descending Operation
  When the machine travels down a slope, the travel motors are forcibly driven by the machine own weight so that the motor draws oil like a pump.
  Pressure oil in port A is drawn into the travel motor and pressure at port A decreases.
  Thereby, the spool returns to the left and return oil from port BM to port B is restricted so that the oil pressure brake is activated for the travel motor.
  When return oil from port BM is restricted, pressure at port A increases again and moves the spool to the right so that the motor rotates.



T1MS-03-05-008

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Measurement:

1. Stop the engine.
2. After five minutes, measure the boom and bucket retraction the arm and blade cylinder extension, and amount of the bucket drift. When measuring the swing cylinder, measure the boom swing cylinder retraction and extension in left and right direction to the slope.
3. Repeat each measurement three times and calculate the mean values.

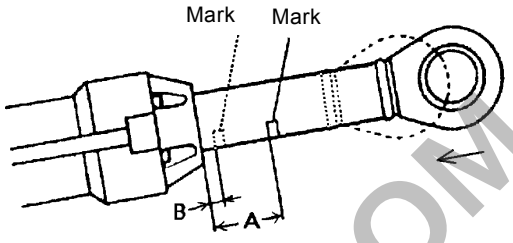
Evaluation:

Refer to T4-2 Operational Performance Standard.

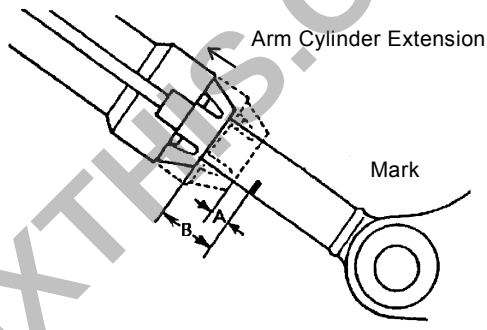
Remedy:

Refer to T5-2 Troubleshooting B.

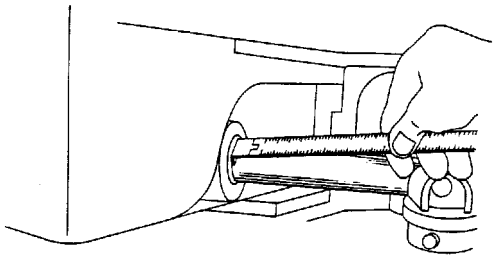
Boom, Bucket and Blade Cylinder Retraction



T110-06-03-002



T110-06-03-001



T1MP-04-04-016

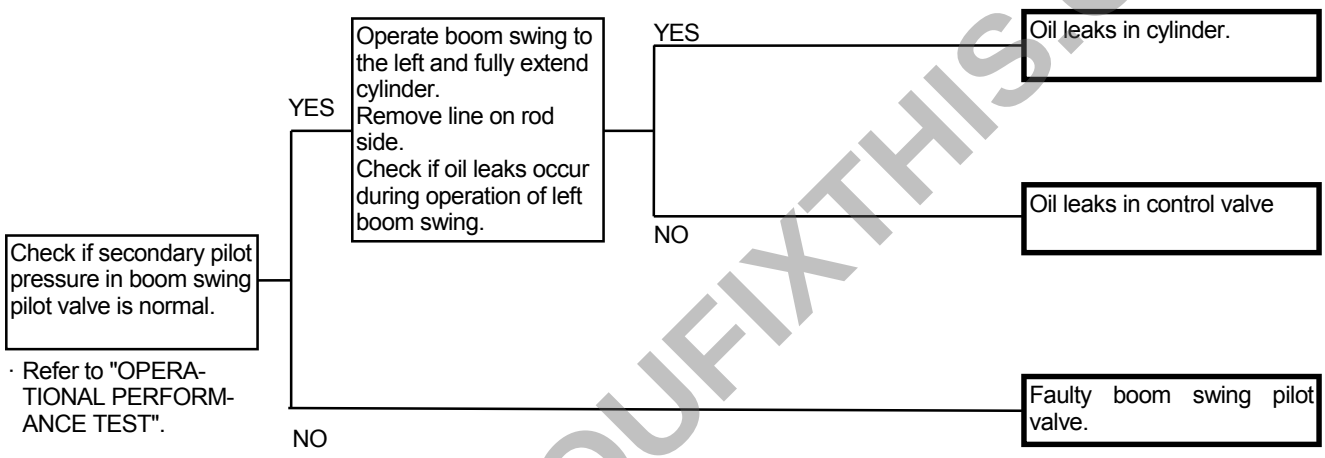
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BOOM SWING SYSTEM TROUBLE-SHOOTING

Boom swing does not move or moves slowly.

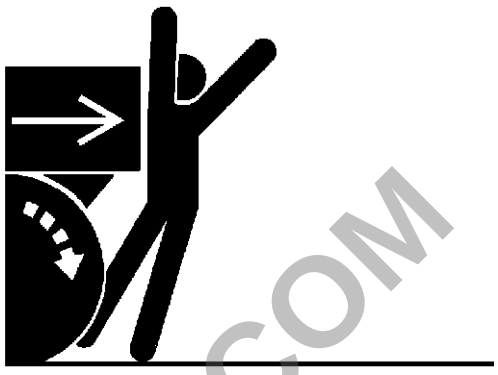
- In case each actuator of the side frame extend/retract, blade, swing and boom swing does not move or moves slowly, the main relief valve on pump P3 may be faulty.



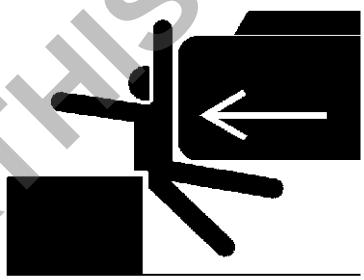
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AVOID INJURY FROM BACK-OVER AND SWING ACCIDENTS



SA-383



SA-384

- If any person is present near the machine when backing or swinging the upperstructure, the machine may hit or run over that person, resulting in serious injury or death.

  To avoid back-over and swing accidents:
  - Always look around BEFORE YOU BACK UP AND SWING THE MACHINE. BE SURE THAT ALL BYSTANDERS ARE CLEAR.
  - Keep the travel alarm in working condition (if equipped).
    ALWAYS BE ALERT FOR BYSTANDERS MOVING INTO THE WORK AREA. USE THE HORN OR OTHER SIGNAL TO WARN BYSTANDERS BEFORE MOVING MACHINE.
  - USE A SIGNAL PERSON WHEN BACKING UP IF YOUR VIEW IS OBSTRUCTED. ALWAYS KEEP THE SIGNAL PERSON IN VIEW.
    Use hand signals, which conform to your local regulations, when work conditions require a signal person.
  - No machine motions shall be made unless signals are clearly understood by both signalman and operator.
  - Learn the meanings of all flags, signs, and markings used on the job and confirm who has the responsibility for signaling.
  - Keep windows, mirrors, and lights clean and in good condition.
  - Dust, heavy rain, fog, etc., can reduce visibility. As visibility decreases, reduce speed and use proper lighting.
  - Read and understand all operating instructions in the operator’s manual.

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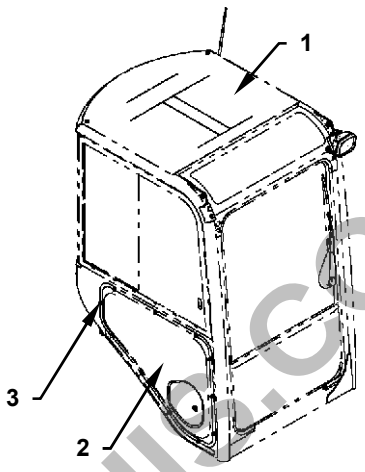
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REMOVAL AND INSTALLATION OF CAB

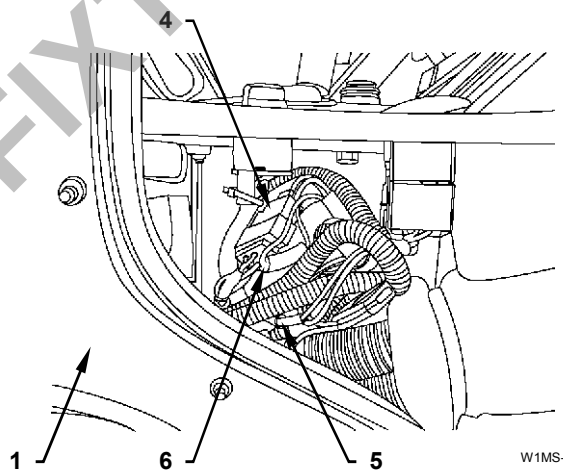
Removal

1. Remove nuts (3) (11 used) from cover (2). Remove cover (2) from cab (1).
   : 13 mm



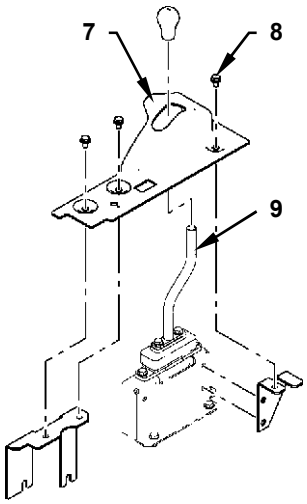
W1MS-02-01-002

2. Disconnect connectors (4) and plugs (5, 6) at the lower right of cab (1).



W1MS-02-01-003

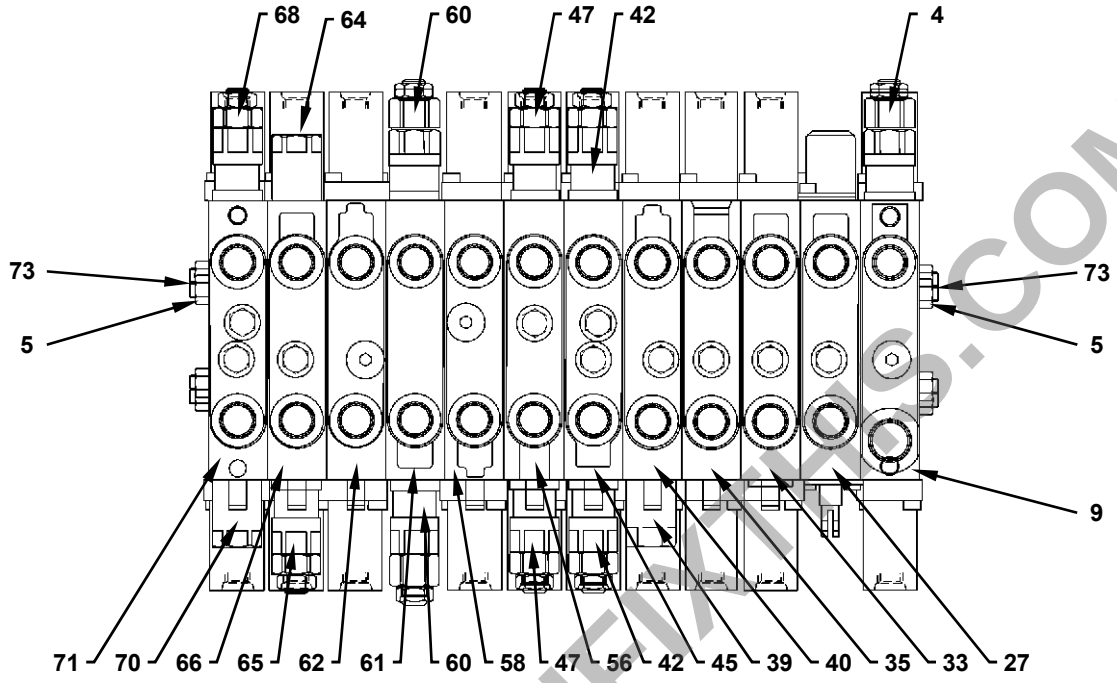
3. Remove bolts (8) (3 used) from cover (7). Remove cover (7) from blade lever (9).
   : 13 mm



W1MS-02-01-004

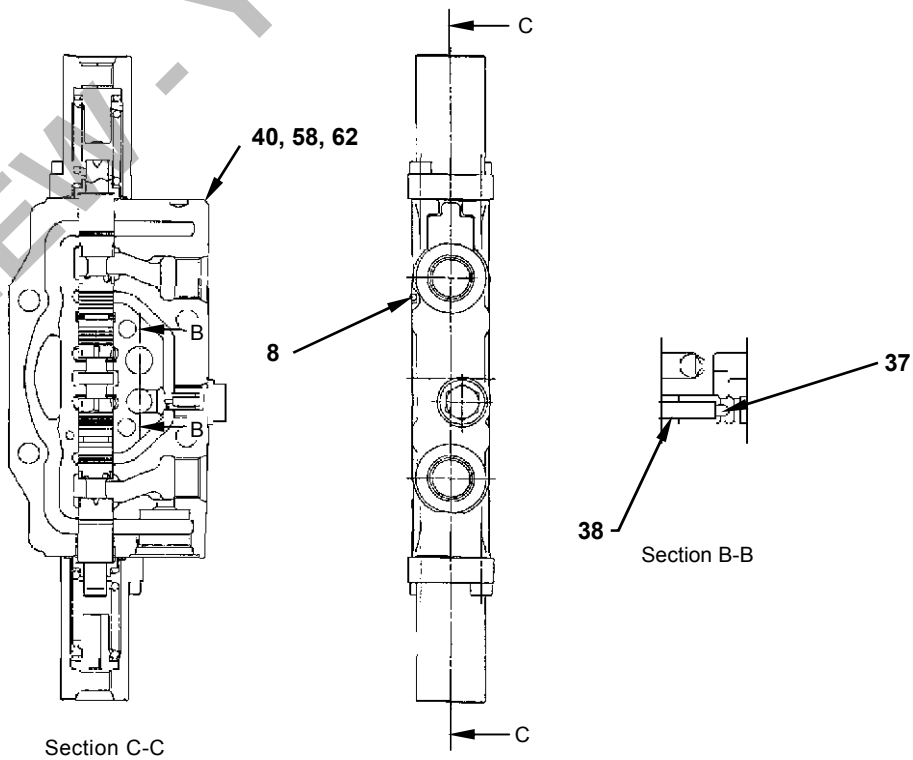
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ASSEMBLY OF BODY



W1MS-02-05-004

Installation Positions of Spring (38) and Check Valve (37)



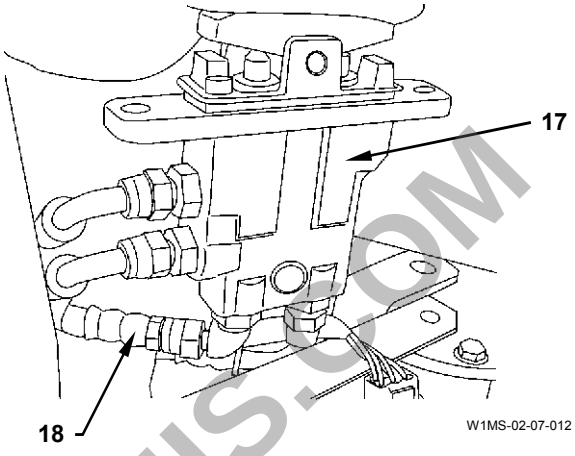
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Installation

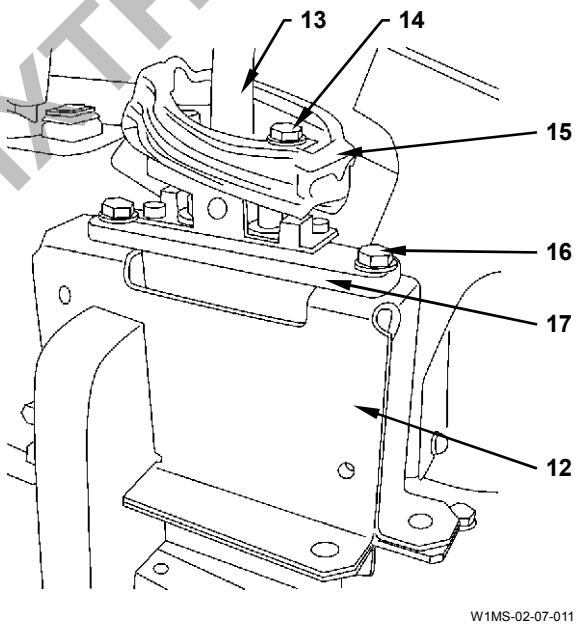
1. Connect hoses (18) (4 used) to pilot valve (17).
   : 19 mm
   : 29.5 N·m (3 kgf·m, 21.5 lbf·ft)



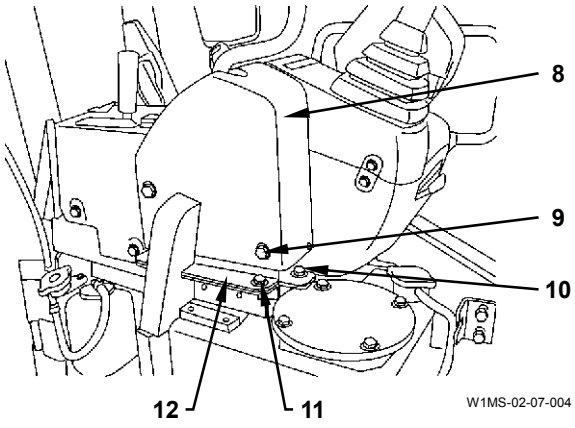
2. Install pilot valve (17) to bracket (12) with bolts (16) (2 used).
   : 13 mm
   : 20 N·m (2 kgf·m, 14.5 lbf·ft)

3. Install cover (15) and lever (13) to pilot valve (17) with bolts (14) (2 used).
   : 13 mm
   : 20 N·m (2 kgf·m, 14.5 lbf·ft)

4. Install bracket (12) with bolt (10) and bolts (11) (2 used).
   : 13 mm
   : 20 N·m (2 kgf·m, 14.5 lbf·ft)



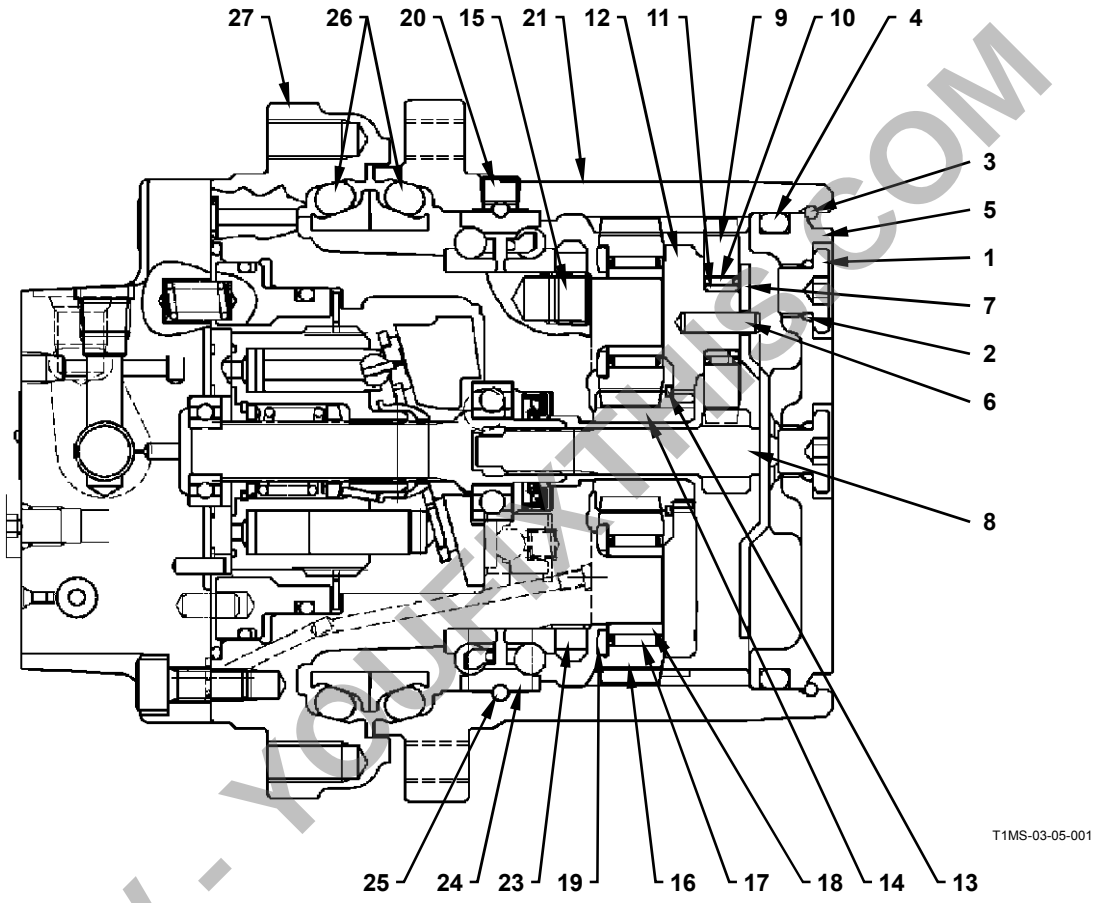
5. Install cover (8) to bracket (12) with bolts (9) (2 used).
   : 13 mm
   : 20 N·m (2 kgf·m, 14.5 lbf·ft)



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ASSEMBLY OF TRAVEL DEVICE



1 - Plug (2 Used)
2 - O-Ring (2 Used)
3 - Stopper Ring
4 - O-Ring
5 - Cover
6 - Pin (3 Used)
7 - Thrust Plate
8 - Drive Gear
9 - First Stage Planetary Gear (3 Used)
10 - Needle Bearing (3 Used)
11 - Inner Race (3 Used)
12 - Carrier
13 - Retaining Ring
14 - Sun Gear
15 - Plug
16 - Second Stage Planetary Gear (4 Used)
17 - Needle Bearing (4 Used)
18 - Inner Race (4 Used)
19 - Thrust Washer (4 Used)
20 - Plug
21 - Ring Gear
22 - * Plug (2 Used)
23 - Bearing Nut
24 - Angular Bearing
25 - Ball (94 Used)
26 - Floating Seal (2 Used)
27 - Body

*NOTE: As for the parts with mark *, refer to W3-2-4.*

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SECTION 4
FRONT ATTACHMENT



— CONTENTS —

Group 1 Front Attachment

Hydraulic Circuit Pressure Release Procedure W4-1-1
Removal and Installation of Front Attachment W4-1-2
Maintenance Standard..... W4-1-8
Standard Dimensions for Arm and Bucket Connection W4-1-11

Group 2 Cylinder

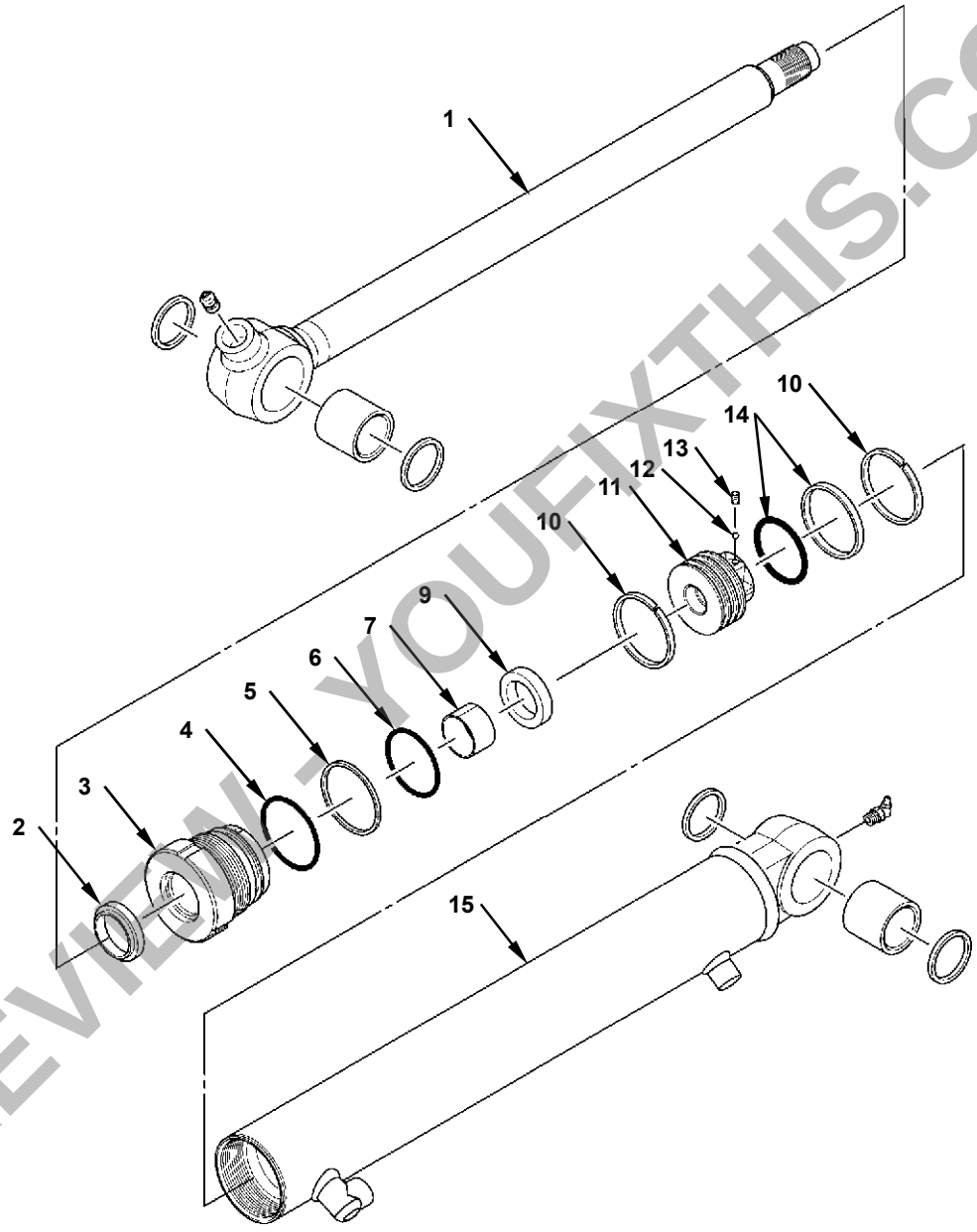
Hydraulic Circuit Pressure Release Procedure W4-2-1
Removal and Installation of Cylinder W4-2-2
Disassembly of Boom Cylinder W4-2-34
Disassembly of Arm, Bucket, Blade, Boom Swing, and Side Frame Extend/Retract Cylinders W4-2-39
Assembly of Boom Cylinder..... W4-2-48
Assembly of Arm, Bucket, Blade, Boom Swing, and Side Frame Extend/Retract Cylinders W4-2-54
Maintenance Standard..... W4-2-60

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DISASSEMBLY OF ARM, BUCKET, BLADE, BOOM SWING, AND SIDE FRAME EXTEND/RETRACT CYLINDERS

Arm Cylinder



W1MS-04-02-002

1 - Piston Rod
2 - Wiper Ring
3 - Cylinder Head
4 - O-Ring
5 - Backup Ring
6 - O-Ring
7 - Bushing
9 - U-Ring
10 - Slide Ring (2 Used)
11 - Piston
12 - Steel Ball
13 - Set Screw
14 - Seal Ring Assembly
15 - Cylinder Tube

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CAUTION

The tightening torque in the *Standard Torque Chart* in *General Service Information* should be applied only to the bolts with a “7” head. (JIS strength classification: 7T)



- Apply 60% torque to bolts that are not listed.
- Apply 80% torque when tightened to aluminum alloy.

0000023enTNVIDISM

CAUTION

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine’s safety and performance characteristics, shorten the engine’s life and may affect the warranty coverage on your engine. *See Yanmar Warranties section.*

Consult your authorized Yanmar dealer or distributor for assistance when checking items marked with a ●.

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CAUTION

If the fuel filter / water separator is positioned higher than the fuel level in the fuel tank, water may not drip out when the fuel filter / water separator drain cock is opened. If this happens, turn the air vent screw on the top of the fuel filter / water separator 2-3 turns counterclockwise.

Be sure to tighten the air vent screw after the water has drained out.

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CAUTION

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- NEVER operate the engine with the air cleaner element(s) removed. This may allow foreign material to enter the engine and damage it.

0000026en

CAUTION

The maximum air intake restriction, in terms of differential pressure measurement, must not exceed 0.90 psi (6.23 kPa; 635 mmAq). Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

0000046en

CAUTION

Do not short-circuit the charging system between alternator terminals IG and L. Damage to the alternator will result.

0000035en

CAUTION

Do not connect a load between alternator terminals L and E. Damage to the alternator will result.

0000036en

CAUTION

Do not remove the positive (+) battery cable from alternator terminal B while the engine is operating. Damage to the alternator will result.

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The engine oil on a new engine becomes contaminated from the initial break-in of internal parts. It is very important that the initial oil and filter change is performed as scheduled.

Note: The oil drain plug may be in another location if an optional oil pan is used.

Drain the engine oil as follows:

1. Make sure the engine is level.
2. Start the engine and bring it up to operating temperature.
3. Stop the engine.
4. Remove the oil filler cap **(Figure 5-1, (1))** to vent the engine crankcase and allow the engine oil to drain more easily.
5. Position a container under the engine to collect waste oil.

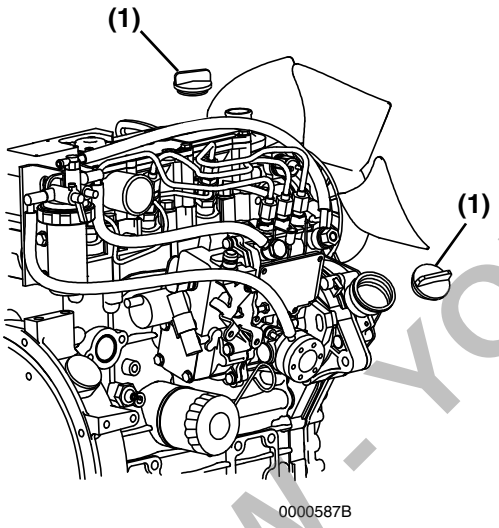


Figure 5-1

6. Remove the oil drain plug **(Figure 5-2, (1))**. Allow oil to drain.
7. After all oil has been drained from the engine, reinstall the oil drain plug **(Figure 5-2, (1))** and tighten to 39.8 - 47.0 ft·lb (53.9 - 63.7 N·m, 5.5 - 6.5 kgf·m).
8. Dispose of used oil properly.

Remove the engine oil filter as follows:

1. Turn the engine oil filter **(Figure 5-2, (2))** counterclockwise **(Figure 5-2, (4))** using a filter wrench.

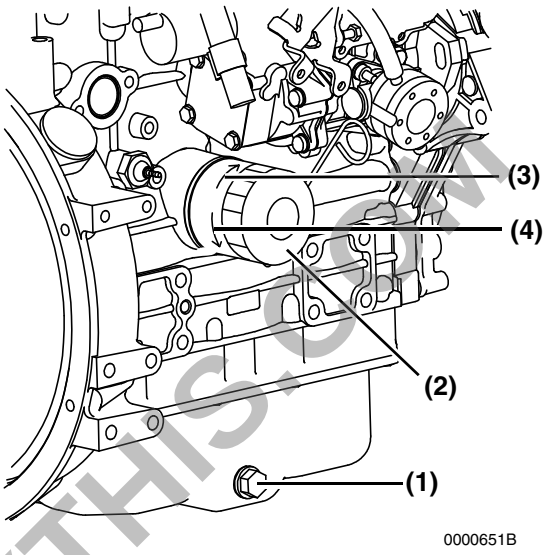


Figure 5-2

2. Clean the engine oil filter mounting face.
3. Lightly coat the gasket on the new oil filter with clean engine oil. Install the new engine oil filter manually by turning it clockwise **(Figure 5-2, (3))** until it contacts the mounting surface. Tighten to 14 - 17 ft·lb (19.6 - 23.5 N·m, 2.0 - 2.4 kgf·m or one additional turn using the filter wrench.

Applicable Engine Oil Filter Part No.	
2TNV70 3TNV70 3TNV76	119305-35150

4. Add new engine oil to the engine as specified in *Adding Engine Oil on page 4-14*.

Check and Adjust Cooling Fan V-Belt

The V-belt will slip if it does not have the proper tension. This will prevent the alternator from generating sufficient power. Also, the engine will overheat due to the engine coolant pump pulley slipping.

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4. Insert the push rods in their respective positions.

Reassembly of Rocker Arm Assembly

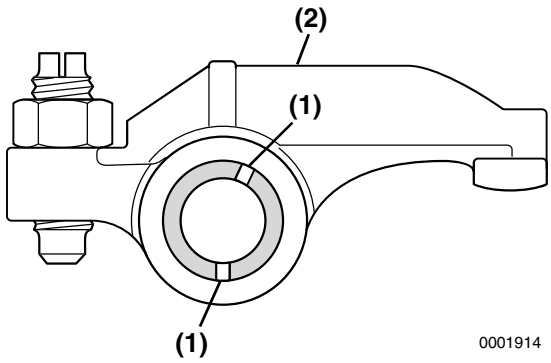


Figure 6-31

IMPORTANT

*Ensure the lubrication holes in the rocker arm shaft **(Figure 6-31, (1))** are oriented correctly with respect to the rocker arms **(Figure 6-31, (2))**.*

1. Lubricate the rocker arm shaft. Slide the rocker arm supports **(Figure 6-32, (5))**, springs **(Figure 6-32, (4))** and rocker arms **(Figure 6-32, (1))** onto the shaft.

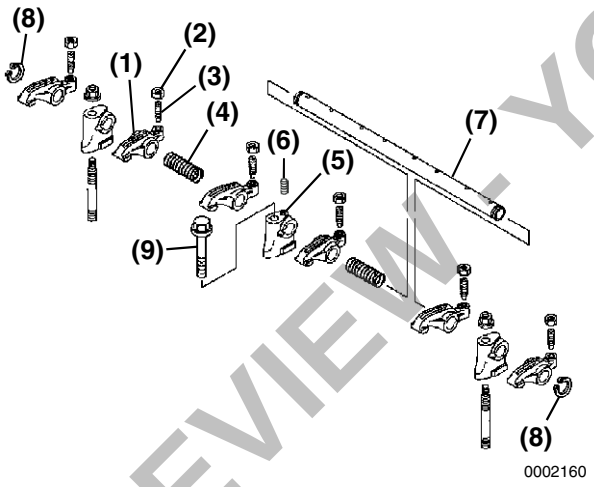


Figure 6-32

Note: The rocker arm shaft fits tightly in the rocker arm supports. Clamp the support in a padded vise. Twist and push on the rocker arm shaft to reinstall.

Note: On 3-cylinder models, the set screw is located in the center support. On 2-cylinder models, the set screw is located in the front (cooling fan) end support.

2. Align the hole in the rocker arm shaft **(Figure 6-32, (7))** and the hole in the rocker arm support **(Figure 6-32, (5))**. Reinstall the alignment set screw **(Figure 6-32, (6))**.
3. Place the rocker arm shaft assembly onto the cylinder head.
4. If removed, reinstall the valve adjusting screws **(Figure 6-32, (3))** and lock nuts **(Figure 6-32, (2))**.
5. Align the push rods with their respective rocker arms.
6. Reinstall and tighten the rocker arm shaft retaining bolts to the specified torque.
7. Tighten the rocker arm shaft alignment screw.
8. Adjust the valve clearance. *See Measuring and Adjusting Valve Clearance on page 6-34.*

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- EXAMPLE: If the distance between the two “longer” marks is approximately 2.0 cm and the distance from the TDC mark is approximately 4.0 cm, the answer is approximately 2. This indicates there is 10° (2 x 5°) between the TDC mark and the first “longer” mark on the timing grid. That means the first “longer” mark on the timing grid indicates 10° BTDC, the second “longer” mark indicates 15° BTDC and the third timing mark indicates 20°. If the answer is 3, that indicates there is 15° (3 x 15°) between the TDC mark and the first “longer” mark and that the first “longer” mark indicates 15° BTDC with the second and third “longer” marks indicating 20° BTDC and 25° BTDC respectively.

9. Highlight the timing reference mark on the flywheel housing **(Figure 7-25, (2))** or engine back plate **(Figure 7-26, (2))**. Highlight the TDC (Top Dead Center) mark **(Figure 7-25, (1))**, **(Figure 7-26, (1))** on the flywheel.

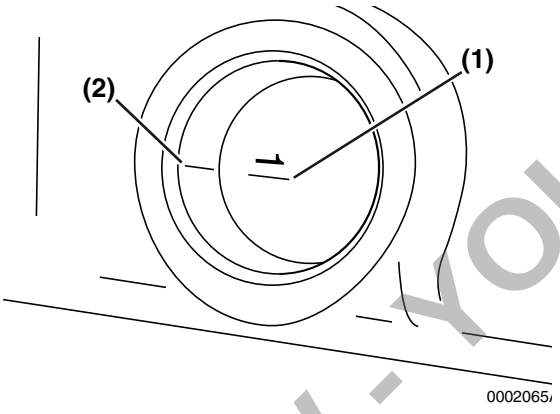


Figure 7-25

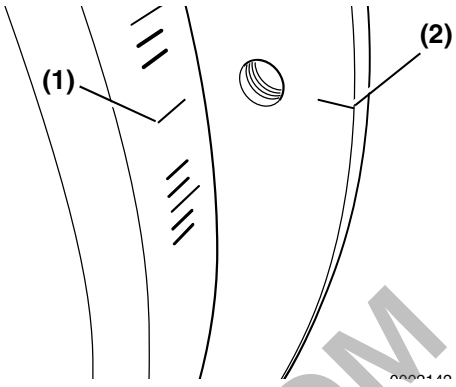


Figure 7-26

10. Highlight the target timing mark **(Figure 7-26, (1)), (Figure 7-27, (1))** on the flywheel timing grid as determined in the *Fuel Injection Timing Chart* below.

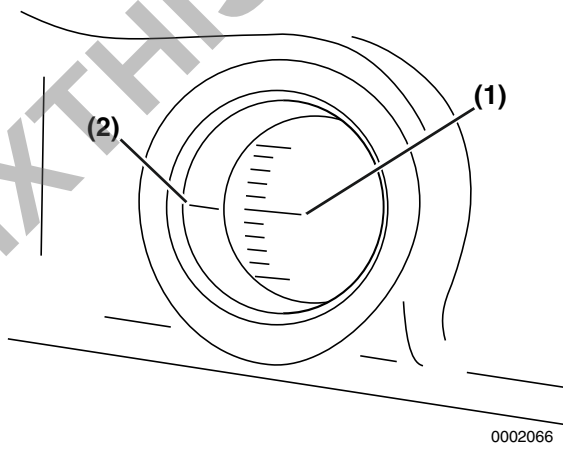


Figure 7-27

Fuel Injection Timing Chart

Model		VM				CH	VH	
Engine Speed (rpm)		2000-2100	2200	2300-2600	2700-3000	3000-3600	3100-3400	3500-3600
2TNV70	Injection Timing BTDC ±1°	15°		16°	18°	-	-	-
3TNV70		15°		16°	18°	21°	20°	21°
3TNV76		15°	16°		18°	21°	20°	21°

11. Remove all high-pressure fuel injection lines. *See Removal of High-Pressure Fuel Injection Lines on page 7-11.*
12. Turn on all fuel supply valves.

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5. Install a switch **(Figure 10-37, (6))** in a circuit between the battery positive (+) terminal **(Figure 10-37, (2))** and the starter solenoid switch terminal **(Figure 10-37, (8))** on the starter motor.
6. Use a suitable tachometer to monitor the rpm of the starter.
7. Turn the switch to the ON position to energize the solenoid and operate the starter. Monitor the rpm, amperage draw and voltage. For test specifications, see *Starter Motor Information on page 10-5* for the appropriate starter motor.

Installation of Starter Motor

1. Reinstall the starter motor to the flywheel housing.
2. Reinstall the starter mounting bolts **(Figure 10-38, (1))**. Tighten the bolts to specification. *See Tightening Torques for Standard Bolts and Nuts on page 4-25.*

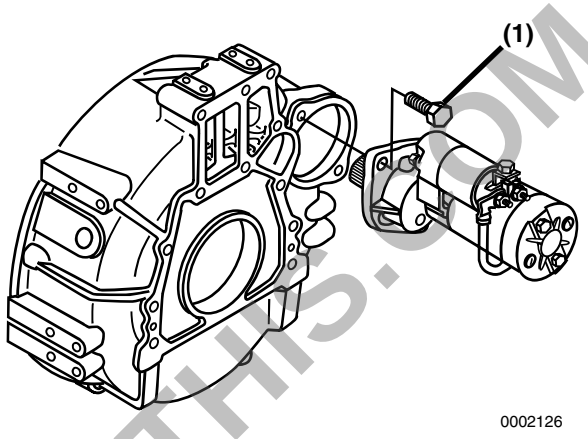


Figure 10-38

3. Reconnect the electrical wires to the solenoid switch assembly. Be sure to place the cover over the battery positive (+) cable connection.
4. Reconnect the battery, negative (-) cable last.

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