

# Operation & Maintenance Manual

## PC270LC-6

### HYDRAULIC EXCAVATOR

SERIAL NUMBERS PC270LC-6 - A83001 and up

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Chassis and Engine .....	CEAM003400
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Chassis .....	CEBM003000
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# **INTRODUCTION**

## INTRODUCTION

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### 1. FORWARD

This manual describes procedures for operation, handling, lubrication, maintenance, checking, and adjustment. It will help the operator and maintenance personnel realize peak performance through effective, economical and safe machine operation and maintenance.

Keep this manual handy and have all personnel read it periodically. If this manual is lost or becomes dirty and can not be read, request a replacement manual from your local distributor. If you sell the machine, be sure to give this manual to the new owner.

Continuing improvements in the design of this machine can lead to changes in detail, which may not be reflected in this manual. Consult your local distributor or Komatsu America International Co. for the latest available information on your machine or for questions regarding information in this manual.



#### WARNING

- **Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.**
- **Operators and maintenance personnel must read this manual thoroughly before operating or maintaining this machine.**
- **This manual should be kept near the machine for reference and periodically reviewed by all personnel who come across it.**
- **Some actions involved in operation and maintenance can cause a serious accident, if they are not performed in the manner described in this manual.**
- **The procedures and precautions given in this manual apply only to intended uses of the machine. If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for you and others. In no event should you or others engage in prohibited uses or actions as described in this manual.**
- **Komatsu America International Co. delivers machines that comply with all applicable regulations and standards of the country to which it has been shipped. If this machine has been purchased in another country or purchased from someone in another country, it may lack certain safety features and specifications that are necessary for use in your country. If there is any question about whether your product complies with the applicable standards and regulations of your country, consult your local distributor or Komatsu America International Co. before operating the machine.**
- **The description of safety is given in SAFETY, Section 1.**

## 2. SAFETY INFORMATION

Most accidents are caused by the failure to follow fundamental safety rules for the operation and maintenance of machines. To avoid accidents, read, understand and follow all precautions and warnings in this manual and on the machine before performing maintenance and machine operations.

To identify safety messages in this manual and on machine product graphics, the following signal words are used.

**DANGER!**

This word is used on safety messages and product graphics where there is a high probability of serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.

**WARNING!**

This word is used on safety messages and product graphics where there is a potentially dangerous situation, which could result in serious injury or death if the hazard is not avoided. These safety messages and product graphics usually describe precautions that must be taken to avoid the hazard. Failure to avoid this hazard may also result in serious damage to the machine.

**CAUTION!**

This word is used on safety messages and product graphics for hazards, which could result in minor or moderate injury if the hazard is not avoided. These safety messages and product graphics might also use this word for hazards where the only result could be damage to the machine.

**NOTICE**

This word is used for precautions that must be taken to avoid actions, which could shorten the life of the machine.

Safety precautions are described in full, see Section 1, SAFETY.

Komatsu America International Co. cannot predict every circumstance that might involve a potential hazard in operation and maintenance. Therefore the safety message in this manual and on the machine may not include all possible safety precautions. If any procedures or actions not specifically recommended or allowed in this manual are used, you must be sure that you and others can do such procedures and actions safely and without damaging the machine. If you are unsure about the safety of some procedures, contact your local distributor or Komatsu America International Co.

### 3. INTRODUCTION

#### 3.1 INTENDED USE

This Komatsu HYDRAULIC EXCAVATOR is designed to be used mainly for the following work:

- Digging work
- Ditching work
- Smoothing work
- Loading work

See See 12.15 WORK POSSIBLE USING HYDRAULIC EXCAVATOR on page 2-81.

#### 3.2 FEATURES

- This Komatsu HYDRAULIC EXCAVATOR is equipped with various controls based on an advanced electronics system.
  - The monitor panel greatly facilitates daily maintenance and self-diagnosis.
  - Working mode, travel speed and active mode are selectable.
  - Digging and lifting force can be increased by light-touch control.  
(For details See 12 OPERATION on page 2-43.)
- Adjustable wrist control levers make operations smooth and easy.
- Air-conditioned operator's cab assures comfortable operation.
- Low noise level and smart urban-style design and coloring.
- Superb operating performance provided by powerful engine and high-performance hydraulic pumps.
- Low fuel consumption controlled by an electronic control system provides an environment-friendly machine.

#### 3.3 BREAKING IN THE MACHINE

Your Komatsu machine has been thoroughly adjusted and tested before shipment. However, operating the machine under severe conditions at the beginning can adversely affect the performance and shorten the machine life. Be sure to break in the machine for the initial 100 hours (as indicated by the service meter).

During breaking in:

- After starting, let the engine idle for 5 minutes to allow proper engine warm-up prior to actual operation.
- Avoid operation with heavy loads or at high speeds.
- Avoid sudden starts or acceleration, unnecessarily abrupt stops and sharp steering except in cases of emergency.

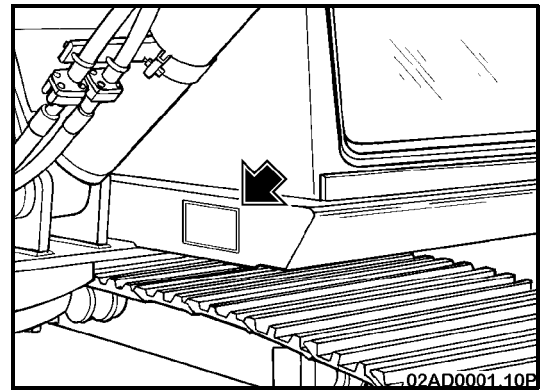
The precautions given in this manual for operating, maintenance, and safety procedures are only those that apply when this product is used for the specified purpose. If the machine is used for a purpose that is not listed in this manual, Komatsu America International Co. cannot bear any responsibility for safety. All consideration of safety in such operations is the responsibility of the user.

Operations that are prohibited in this manual must never be carried out under any circumstance.

## 4. LOCATION OF PLATES, TABLE TO ENTER P.I.N AND DISTRIBUTOR

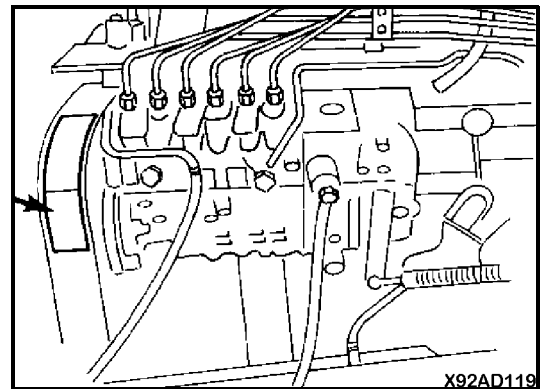
### 4.1 P.I.N. PLATE LOCATION

The product identification number is stamped on a plate attached to the bottom right of the operators cab.



### 4.2 ENGINE SERIAL NUMBER PLATE

The engine serial number is stamped on a plate on the left side of the engine head.



### 4.3 TABLE TO ENTER NUMBERS AND DISTRIBUTOR

Machine P.I.N.:	
Engine serial No.:	
Distributor name:	
Address:	Phone:
Service personnel for your machine:	

### REMARKS



## 5. TABLE OF CONTENTS

1. FORWARD .....	0-2
2. SAFETY INFORMATION .....	0-3
3. INTRODUCTION .....	0-4
3.1 INTENDED USE .....	0-4
3.2 FEATURES .....	0-4
3.3 BREAKING IN THE MACHINE .....	0-4
4. LOCATION OF PLATES, TABLE TO ENTER P.I.N AND DISTRIBUTOR .....	0-5
4.1 P.I.N. PLATE LOCATION .....	0-5
4.2 ENGINE SERIAL NUMBER PLATE .....	0-5
4.3 TABLE TO ENTER NUMBERS AND DISTRIBUTOR .....	0-5
5. TABLE OF CONTENTS .....	0-6
6. GENERAL PRECAUTIONS .....	1-3
7. PRECAUTIONS DURING OPERATION .....	1-11
7.1 BEFORE STARTING ENGINE .....	1-11
7.2 OPERATING MACHINE .....	1-13
7.3 TRANSPORTATION .....	1-19
7.4 BATTERY .....	1-21
7.5 TOWING .....	1-23
7.6 BUCKET WITH HOOK .....	1-24
8. PRECAUTIONS FOR MAINTENANCE .....	1-25
8.1 BEFORE CARRYING OUT MAINTENANCE .....	1-25
8.2 DURING MAINTENANCE .....	1-29
9. POSITION FOR ATTACHING SAFETY LABELS .....	1-35
10. GENERAL VIEW .....	2-2
10.1 GENERAL VIEW OF MACHINE .....	2-2
10.2 GENERAL VIEW OF OPERATORS COMPARTMENT .....	2-3
10.3 GENERAL VIEW OF MONITOR PANEL .....	2-4
11. EXPLANATION OF COMPONENTS .....	2-5
11.1 MACHINE MONITOR .....	2-5
11.1.1 MONITOR LIGHT GROUP .....	2-7
11.1.2 METER DISPLAY PORTION .....	2-9
11.1.3 SWITCHES .....	2-12
11.2 SWITCHES .....	2-15
11.2.1 STARTING SWITCH .....	2-15
11.2.2 FUEL CONTROL DIAL .....	2-16
11.2.3 CIGARETTE LIGHTER .....	2-16
11.2.4 SWING LOCK SWITCH .....	2-16
11.2.5 WIPER SWITCH .....	2-16
11.2.6 LIGHT SWITCH .....	2-17
11.2.7 ALARM BUZZER STOP SWITCH .....	2-17
11.2.8 CAB HEATER FAN SWITCH .....	2-17
11.2.9 HORN SWITCH .....	2-17
11.2.10 KNOB SWITCH .....	2-17
11.2.11 CAB LIGHT SWITCH .....	2-17
11.2.12 PUMP CONTROL OVERRIDE SWITCH .....	2-18
11.2.13 SWING LOCK OVERRIDE SWITCH .....	2-18

11.3	CONTROL LEVERS AND PEDALS .....	2-19
11.3.1	SAFETY LOCK LEVER .....	2-19
11.3.2	TRAVEL LEVERS .....	2-20
11.3.3	LEFT WORK EQUIPMENT CONTROL LEVER .....	2-20
11.3.4	RIGHT WORK EQUIPMENT CONTROL LEVER .....	2-21
11.3.5	ATTACHMENT CONTROL PEDAL .....	2-22
11.3.6	SELECTOR VALVES FOR BREAKER AND GENERAL ATTACHMENT (crusher etc.) .....	2-22
11.4	SEAT BELT .....	2-23
11.4.1	FASTEN THE BELT AND REMOVE IT .....	2-23
11.4.2	ADJUST THE BELT LENGTH .....	2-24
11.5	ROOF VENT .....	2-24
11.6	FRONT WINDOW .....	2-25
11.6.1	WHEN OPENING .....	2-25
11.6.2	WHEN CLOSING .....	2-26
11.6.3	FRONT BOTTOM WINDOW .....	2-27
11.7	DOOR LOCK .....	2-28
11.8	CAP, COVER WITH LOCK .....	2-28
11.8.1	METHOD OF OPENING AND CLOSING LOCK CAP .....	2-28
11.8.2	METHOD OF OPENING AND CLOSING COVER LOCK .....	2-29
11.9	HOT AND COOL BOX .....	2-29
11.10	STORAGE BOX .....	2-29
11.11	ASHTRAY .....	2-29
11.12	AIR CONDITIONER .....	2-30
11.12.1	GENERAL LOCATIONS ON CONTROL PANEL .....	2-30
11.12.2	PRECAUTIONS WHEN USING AIR CONDITIONER .....	2-32
11.12.3	CHECK, MAINTAIN AIR CONDITIONER .....	2-32
11.13	CAB HEATER .....	2-33
11.13.1	GENERAL LOCATIONS .....	2-33
11.14	PREPARATION FOR CAB HEATER .....	2-34
11.15	AM/FM RADIO .....	2-35
11.15.1	EXPLANATION OF COMPONENTS .....	2-35
11.15.2	METHOD OF OPERATION .....	2-37
11.15.3	PRECAUTIONS WHEN USING .....	2-38
11.15.4	SPECIFICATIONS .....	2-39
11.16	ELECTRIC POWER TAKE OUT ADAPTER .....	2-39
11.17	FUSE .....	2-40
11.18	FUSIBLE LINK .....	2-41
11.19	CONTROLLERS .....	2-41
11.20	TOOL BOX .....	2-41
11.21	GREASE GUN HOLDER .....	2-41
11.22	HANDLING ACCUMULATOR .....	2-42
12.	OPERATION .....	2-43
12.1	CHECK BEFORE STARTING ENGINE .....	2-43
12.1.1	WALK AROUND CHECK .....	2-43
12.1.2	CHECK BEFORE STARTING .....	2-45
12.1.3	ADJUST BEFORE OPERATION .....	2-48
12.1.4	OPERATIONS AND CHECKS BEFORE STARTING ENGINE .....	2-52
12.2	STARTING ENGINE .....	2-54
12.2.1	NORMAL STARTING .....	2-54
12.2.2	STARTING IN COLD WEATHER .....	2-55
12.3	OPERATIONS AND CHECKS AFTER ENGINE STARTS .....	2-57
12.3.1	WHEN NORMAL .....	2-57
12.3.2	IN COLD AREAS (AUTOMATIC WARM UP OPERATION) .....	2-59
12.4	MOVING MACHINE .....	2-63
12.4.1	MOVING MACHINE FORWARD .....	2-63
12.4.2	MOVING MACHINE REARWARD .....	2-65
12.5	STEERING MACHINE .....	2-67
12.5.1	STEERING (CHANGING DIRECTION) .....	2-67

# INTRODUCTION

---

12.6	STOPPING MACHINE .....	2-69
12.7	SWINGING .....	2-70
12.8	OPERATION OF WORK EQUIPMENT .....	2-71
12.9	HANDLING ACTIVE MODE .....	2-72
12.10	HANDLING WORKING MODE .....	2-74
12.10.1	WORKING MODE .....	2-74
12.10.2	POWER MAX., SWIFT SLOW DOWN .....	2-75
12.11	PROHIBITED OPERATIONS .....	2-76
12.11.1	USING SWING FORCE .....	2-76
12.11.2	USING TRAVEL FORCE .....	2-76
12.11.3	OPERATE CYLINDERS TO END OF STROKE .....	2-76
12.11.4	USING DROPPING FORCE OF BUCKET .....	2-77
12.11.5	USING DROPPING FORCE OF MACHINE .....	2-77
12.11.6	DIGGING ROCKY GROUND .....	2-77
12.11.7	SUDDEN LEVER SHIFT DURING HI-SPEED TRAVEL .....	2-77
12.12	PRECAUTIONS FOR OPERATION .....	2-78
12.12.1	PRECAUTIONS WHEN TRAVELING .....	2-78
12.12.2	PRECAUTIONS AT HI-SPEED TRAVEL .....	2-78
12.12.3	PERMISSIBLE WATER DEPTH .....	2-78
12.13	PRECAUTIONS WHEN TRAVELING ON HILLS .....	2-79
12.13.1	BRAKING WHEN TRAVELING DOWNHILL .....	2-80
12.13.2	IF SHOES SLIP .....	2-80
12.13.3	IF ENGINE STOPS .....	2-80
12.13.4	PRECAUTIONS ON SLOPES .....	2-80
12.14	HOW TO ESCAPE FROM MUD .....	2-81
12.14.1	WHEN ONE SIDE IS STUCK .....	2-81
12.14.2	WHEN BOTH SIDES ARE STUCK .....	2-81
12.15	WORK POSSIBLE WITH HYDRAULIC EXCAVATOR .....	2-81
12.15.1	BACKHOE WORK .....	2-81
12.15.2	SHOVEL WORK .....	2-82
12.15.3	DITCHING WORK .....	2-82
12.15.4	LOADING WORK .....	2-82
12.16	REPLACE OR INVERT BUCKET .....	2-83
12.16.1	REPLACEMENT .....	2-83
12.16.2	INVERSION .....	2-84
12.17	PARKING MACHINE .....	2-85
12.18	CHECK AFTER FINISHING WORK .....	2-86
12.19	STOPPING ENGINE .....	2-87
12.20	CHECK AFTER STOPPING ENGINE .....	2-87
12.21	LOCKING .....	2-88
13.	TRANSPORTATION .....	2-89
13.1	TRANSPORTATION PROCEDURE .....	2-89
13.2	LOADING, UNLOADING OF TRAILERS .....	2-89
13.2.1	LOADING .....	2-90
13.2.2	UNLOADING .....	2-91
13.2.3	SECURING MACHINE .....	2-92
13.2.4	REMOVAL, INSTALLATION OF MIRRORS .....	2-93
13.2.5	METHOD OF LIFTING MACHINE .....	2-94
13.3	PRECAUTIONS FOR TRANSPORTATION .....	2-95
14.	COLD WEATHER OPERATION .....	2-96
14.1	PRECAUTIONS FOR LOW TEMPERATURE .....	2-96
14.1.1	FUEL AND LUBRICANTS .....	2-96
14.1.2	COOLANT .....	2-96
14.1.3	BATTERY .....	2-96
14.2	PRECAUTIONS AFTER COMPLETION OF WORK .....	2-98
14.3	AFTER COLD WEATHER .....	2-98

15. LONG TERM STORAGE .....	2-99
15.1 BEFORE STORAGE .....	2-99
15.2 DURING STORAGE .....	2-99
15.3 AFTER STORAGE .....	2-100
15.4 STARTING MACHINE AFTER LONG TERM STORAGE .....	2-100
16. TROUBLESHOOTING .....	2-101
16.1 PHENOMENA THAT ARE NOT FAILURES .....	2-101
16.2 METHOD OF TOWING MACHINE .....	2-101
16.3 METHOD FOR LIGHT WEIGHT TOWING .....	2-101
16.4 PRECAUTION ON PARTICULAR JOB SITES .....	2-101
16.5 IF BATTERY IS DISCHARGED .....	2-102
16.5.1 REMOVING AND INSTALLING BATTERY .....	2-102
16.5.2 PRECAUTIONS FOR CHARGING BATTERY .....	2-103
16.5.3 STARTING ENGINE WITH BOOSTER CABLE .....	2-103
16.6 OTHER TROUBLE .....	2-105
16.6.1 ELECTRICAL SYSTEM .....	2-105
16.6.2 CHASSIS .....	2-106
16.6.3 ENGINE .....	2-107
16.6.4 ELECTRONIC CONTROL SYSTEM .....	2-108
17. GUIDES TO MAINTENANCE .....	3-2
18. OUTLINES OF SERVICE .....	3-4
18.1 OUTLINE OF OIL, FUEL, COOLANT .....	3-4
18.1.1 OIL .....	3-4
18.1.2 FUEL .....	3-4
18.1.3 COOLANT .....	3-5
18.1.4 GREASE .....	3-5
18.1.5 STORING OIL AND FUEL .....	3-5
18.1.6 FILTERS .....	3-5
18.2 OUTLINE OF ELECTRICAL SYSTEM .....	3-6
18.3 OUTLINE OF HYDRAULIC SYSTEM .....	3-6
18.4 OUTLINE OF FUEL SYSTEM .....	3-7
18.4.1 FUEL INJECTION PUMP .....	3-7
18.4.2 FUEL TANK .....	3-7
19. WEAR PARTS LIST .....	3-8
20. FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE .....	3-9
20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS .....	3-9
20.2 ENGINE OIL SPECIFICATIONS .....	3-10
20.2.1 NORMAL OPERATION .....	3-10
20.2.2 ARCTIC OPERATION .....	3-11
20.3 DAMPER CASE, SWING MACHINERY CASE, TRACK FRONT IDLERS, TRACK ROLLERS, TOP CARRIER ROLLERS AND HYDRAULIC SYSTEM OIL SPECIFICATIONS .....	3-11
20.4 FINAL DRIVE OIL SPECIFICATIONS .....	3-11
20.5 DIESEL FUEL SPECIFICATIONS .....	3-11
20.6 COOLANT SPECIFICATIONS .....	3-12
20.6.1 GENERAL .....	3-12
20.6.2 WATER .....	3-12
20.6.3 ANTIFREEZE .....	3-13
21. STANDARD TIGHTENING TORQUES FOR BOLTS AND NUTS .....	3-15
21.1 INTRODUCTION OF NECESSARY TOOLS .....	3-15
21.2 TORQUE LIST .....	3-16
22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS .....	3-17

## INTRODUCTION

---

23. MAINTENANCE SCHEDULE CHART .....	3-20
23.1 SCHEDULED MAINTENANCE CHART .....	3-20
23.2 MAINTENANCE INTERVAL WHEN USING HYDRAULIC BREAKER .....	3-22
24. SERVICE PROCEDURE .....	3-23
24.1 INITIAL 250 HOURS SERVICE .....	3-23
24.1.1 REPLACE FUEL FILTER CARTRIDGE .....	3-23
24.2 WHEN REQUIRED .....	3-24
24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT .....	3-24
24.2.2 CLEAN INSIDE OF COOLING SYSTEM .....	3-27
24.2.3 CHECK AND TIGHTEN TRACK SHOE BOLTS .....	3-31
24.2.4 CHECK AND ADJUST TRACK TENSION .....	3-32
24.2.5 CHECK ELECTRICAL INTAKE AIR HEATER .....	3-33
24.2.6 INSTALLATION OF BUCKET TEETH .....	3-34
24.2.7 REMOVAL OF BUCKET TEETH .....	3-36
24.2.8 ADJUST BUCKET CLEARANCE .....	3-38
24.2.9 CHECK WINDOW WASHER FLUID .....	3-39
24.2.10 CHECK, MAINTAIN AIR CONDITIONER .....	3-40
24.2.11 REPLACE ADD ON BREAKER FILTER ELEMENT .....	3-41
24.2.12 CLEAN IN LINE FILTER .....	3-42
24.3 CHECK BEFORE STARTING .....	3-43
24.3.1 CHECK COOLANT LEVEL, ADD COOLANT .....	3-43
24.3.2 CHECK OIL LEVEL IN ENGINE OIL PAN .....	3-43
24.3.3 CHECK FUEL LEVEL .....	3-44
24.3.4 CHECK OIL LEVEL IN HYDRAULIC TANK .....	3-44
24.3.5 CHECK AIR CLEANER FOR CLOGGING .....	3-45
24.3.6 CHECK ELECTRICAL WIRING .....	3-45
24.3.7 CHECK FUNCTION OF HORN .....	3-45
24.3.8 DRAIN WATER FROM FUEL WATER SEPARATOR .....	3-46
24.4 EVERY 100 HOURS SERVICE .....	3-47
24.4.1 LUBRICATION .....	3-47
24.4.2 CHECK OIL LEVEL IN SWING MACHINERY CASE .....	3-49
24.4.3 DRAIN WATER AND SEDIMENT FROM FUEL TANK .....	3-49
24.5 EVERY 250 HOURS SERVICE .....	3-50
24.5.1 CHECK OIL LEVEL IN FINAL DRIVE CASE, ADD OIL .....	3-50
24.5.2 CHECK LEVEL OF BATTERY ELECTROLYTE .....	3-50
24.5.3 REPLACE HYDRAULIC FILTER ELEMENT .....	3-51
24.5.4 LUBRICATE SWING CIRCLE (3 POINTS) .....	3-52
24.5.5 CHECK FAN BELT TENSION, ADJUST .....	3-53
24.5.6 AIR CONDITIONER COMPRESSOR BELT TENSION .....	3-54
24.6 EVERY 500 HOURS SERVICE .....	3-55
24.6.1 REPLACE FUEL FILTER CARTRIDGE AND FUEL-WATER SEPARATOR .....	3-55
24.6.2 CHECK SWING PINION GREASE LEVEL, ADD GREASE .....	3-57
24.6.3 CLEAN AND INSPECT RADIATOR FINS, OIL COOLER FINS, AFTERCOOLER FINS AND CONDENSER FINS (ONLY FOR MACHINES EQUIPPED WITH AIR CONDITIONING) .....	3-58
24.6.4 CLEAN FRESH/RECIRC AIR FILTERS OF AIR CONDITIONER .....	3-59
24.6.5 REPLACE HYDRAULIC TANK BREATHER ELEMENT .....	3-59
24.6.6 CHANGE ENGINE OIL, REPLACE FILTER .....	3-60
24.6.7 REPLACE IN LINE FUEL STRAINER .....	3-62
24.7 EVERY 1000 HOURS SERVICE .....	3-63
24.7.1 CHANGE OIL IN SWING MACHINERY CASE .....	3-63
24.7.2 CHECK OIL LEVEL IN DAMPER CASE, ADD OIL .....	3-64
24.7.3 CHECK TIGHTENING PARTS OF TURBOCHARGER .....	3-64
24.7.4 CHECK PLAY OF TURBOCHARGER ROTOR .....	3-64
24.7.5 CHECK DRIVE BELT, TENSIONER BEARING AND FAN HUB .....	3-65
24.8 EVERY 2000 HOURS SERVICE .....	3-66
24.8.1 CHANGE OIL IN FINAL DRIVE CASE .....	3-66
24.8.2 CLEAN HYDRAULIC TANK STRAINER .....	3-67
24.8.3 CLEAN, CHECK TURBOCHARGER .....	3-67

24.8.4	CHECK ALTERNATOR, STARTING MOTOR	3-67
24.8.5	CHECK VIBRATION DAMPER	3-67
24.8.6	CHANGE ANTIFREEZE	3-67
24.8.7	CHECK AND ADJUST VALVE CLEARANCE	3-68
24.9	EVERY 4000 HOURS SERVICE	3-70
24.9.1	CHECK WATER PUMP	3-70
24.10	EVERY 5000 HOURS SERVICE	3-71
24.10.1	CHANGE OIL IN HYDRAULIC TANK	3-71
25.	MACHINE SPECIFICATIONS	4-2
25.1	GENERAL	4-2
25.2	WORKING RANGE	4-4
26.	GENERAL PRECAUTIONS	5-2
26.1	PRECAUTIONS RELATED TO SAFETY	5-2
26.2	PRECAUTIONS WHEN INSTALLING ATTACHMENTS	5-3
27.	BUCKET WITH HOOK	5-4
27.1	CHECKING FOR DAMAGE	5-4
27.2	PROHIBITED OPERATIONS	5-4
27.3	PRECAUTIONS DURING OPERATIONS	5-4
28.	HANDLING HEATER	5-5
28.1	GENERAL LOCATIONS	5-5
28.2	PREPARATION FOR CAR HEATER	5-6
29.	HANDLING AIR CONDITIONER	5-7
29.1	DEFROSTER SELECTOR LEVER	5-7
29.2	PRECAUTIONS WHEN USING AIR CONDITIONER	5-8
30.	MACHINES READY FOR ATTACHMENT	5-9
30.1	GENERAL LOCATIONS	5-9
30.1.1	STOP VALVE	5-9
30.1.2	SELECTOR VALVE	5-10
30.1.3	CONTROL PEDAL	5-10
30.1.4	LOCK PIN	5-10
30.1.5	ADDITIONAL FILTER FOR BREAKER	5-10
30.1.6	ACCUMULATOR	5-11
30.2	HYDRAULIC CIRCUIT	5-11
30.2.1	SWITCHING TO FILTER CIRCUIT	5-11
30.2.2	CONNECTING HYDRAULIC CIRCUIT	5-12
30.2.3	PATH OF OIL FLOW	5-12
30.3	PROCEDURE FOR REMOVAL AND INSTALLATION OF ATTACHMENT	5-13
30.3.1	PROCEDURE FOR REMOVAL	5-13
30.3.2	PROCEDURE FOR INSTALLATION	5-13
30.4	OPERATION	5-14
30.4.1	WHEN USING BREAKER	5-14
30.4.2	WHEN USING GENERAL ATTACHMENT	5-15
30.5	LONG TERM STORAGE	5-15
30.6	SPECIFICATIONS	5-15
31.	INTRODUCTION OF ATTACHMENTS	5-16
31.1	BUCKET SELECTION	5-16
31.1.1	STANDARD DUTY PLATE BUCKET	5-16
31.1.2	HEAVY DUTY PLATE BUCKET	5-16
31.1.3	HEAVY DUTY CAST LIP BUCKET	5-16
31.2	ATTACHMENT INSTALLATION COMBINATION TABLE	5-17
31.2.1	PC270LC-6	5-17
31.3	SELECTION OF TRACK SHOES	5-18

## INTRODUCTION

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31.4	BACKHOE CONTROL PATTERN CONVERSION .....	5-19
32.	EXTENDING MACHINE SERVICE LIFE .....	5-20
32.1	HYDRAULIC BREAKER .....	5-20
32.1.1	MAIN FIELDS OF APPLICATION .....	5-20
32.1.2	MISTAKEN METHODS OF USE .....	5-21
32.1.3	GREASING POSITION FOR HYDRAULIC BREAKER .....	5-23
32.2	CRUSHER .....	5-23
32.2.1	MAIN FIELDS OF APPLICATION .....	5-23
32.2.2	MISTAKEN METHODS OF USE .....	5-24
32.3	GRAB FORK .....	5-25
32.3.1	MAIN FIELDS OF APPLICATION .....	5-25
32.3.2	MISTAKEN METHODS OF USE .....	5-25
32.4	GRAPPLE BUCKET .....	5-26
32.4.1	MAIN FIELDS OF APPLICATION .....	5-26
32.4.2	MISTAKEN METHODS OF USE .....	5-26
32.5	SCRAP GRAPPLE .....	5-27
32.5.1	MAIN FIELDS OF APPLICATION .....	5-27
32.5.2	MISTAKEN METHODS OF USE .....	5-27
32.6	CRUSHER AND CUTTER .....	5-28
32.6.1	MAIN FIELDS OF APPLICATION .....	5-28
32.6.2	MISTAKEN METHODS OF USE .....	5-28
32.7	HYDRAULIC PILE DRIVER .....	5-29
32.7.1	MAIN FIELDS OF APPLICATION .....	5-29
32.7.2	MISTAKEN METHODS OF USE .....	5-29

# SAFETY



## WARNING

**Read and follow all safety precautions. Failure to do so may result in serious injury or death.**

This safety section also contains precautions for optional equipment and attachments.



## 6. GENERAL PRECAUTIONS

### SAFETY RULES

- ONLY trained and authorized personnel should be allowed to operate and service this machine.
- Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.
- The owner and/or operator must replace any and all safety and warning product graphics if they are defaced or removed from the machine.
- Think before you act. Careful operators and service personnel are the best insurance against accidents.
- Do not rush. Hurrying can lead to accidents. Haste, carelessness and lack of training are the primary causes of equipment-related injuries.
- The operator must be alert, physically fit and free from the influences of alcohol, drugs and medications that might affect his eyesight, hearing or reactions.
- Safety must always be the operator's most important concern. He must refuse to operate when he knows it is unsafe and consult his supervisor when safety is in doubt.
- When working with another operator or a person on work site traffic duty, be sure all personnel understand all hand signals that are to be used.

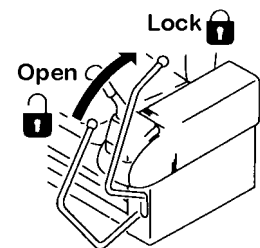
### SAFETY FEATURES

- Be sure all guards and covers are in their proper position. Be sure to replace them after servicing the machine. Have guards and covers repaired immediately if damaged.
- Use safety features such as safety lock lever and seat belt properly.
- A seat belt is required by OSHA in all applications. DO NOT operate this machine without a seat belt.
- NEVER remove any safety features. ALWAYS keep them in good operating condition.

**Safety lock lever → See 12.17 PARKING MACHINE on page 2-85**

**Seat belt → See 11.4 SEAT BELT on page 2-23**

- Improper use of safety features could result in serious bodily injury or death.
- Be sure the machine has the correct equipment required by local rules and regulations.



### UNAUTHORIZED MODIFICATION

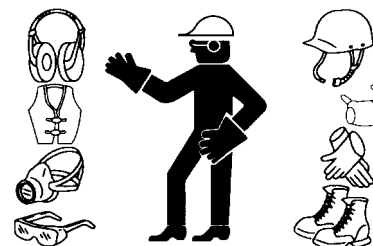
- Any modification made without authorization from Komatsu America International Co. can create hazards.
- Before making a modification, consult your local distributor. Komatsu America International Co. will not be responsible for any injury or damage caused by any unauthorized modification.

**INSIDE OPERATOR'S COMPARTMENT**

- When entering the operator's compartment, always remove all mud and oil from the soles of your shoes.
- If you operate the brake pedal with mud or oil stuck to your shoes, your foot may slip and this may cause a serious accident.
- After using the ashtray, make sure that any matches or cigarettes are properly extinguished, and be sure to close the lid. If the ashtray is left open, there is danger of fire.
- Do not stick suction pads to the window glass. Suction pads act as a lens and may cause fire.
- Do not leave lighters lying around the operator's compartment. If the temperature inside the operator's compartment become high, there is danger that the lighter may explode.
- Do not use cellular telephones inside the operator's compartment when driving or operating the machine. There is danger that this may lead to an unexpected accident.
- Never bring any dangerous objects such as flammable or explosive items into the operators cab.
- To ensure safety, do not use the radio or music headphones when operating the machine. There is danger that this may lead to a serious accident.
- When operating the machine, do not put your hands or head out of the window.

**CLOTHING AND PERSONAL PROTECTIVE ITEMS**

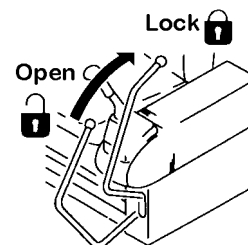
- Avoid loose clothing, jewelry, and loose long hair. They can catch on controls or in moving parts and cause serious injury or death. Also, do not wear oily clothes because they are flammable.
- Wear a hard hat, safety glasses, safety shoes, mask or gloves when operating or maintaining the machine. Always wear safety goggles, hard hat and heavy gloves if your job involves scattering metal chips or minute materials - this is particularly important when driving pins with a hammer and when cleaning the air cleaner element with compressed air. Also check that there are no other personnel near the machine.



**Cleaning of air cleaner element → See 24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT on page 3-24**

**ALWAYS APPLY LOCK WHEN LEAVING OPERATORS SEAT**

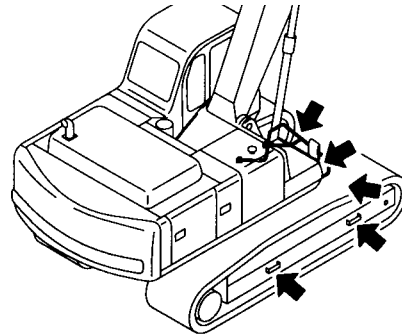
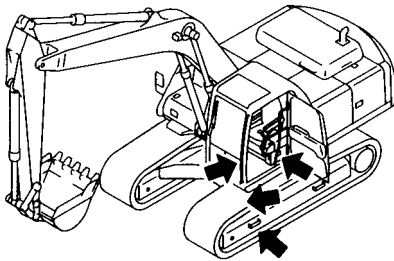
- When standing up from the operator's seat, always place the safety lock lever securely in the LOCK position. If you accidentally touch the travel or equipment levers when they are not locked, the machine or work equipment may move and cause serious injury or damage.
- When leaving the machine, lower the work equipment completely to the ground, set the safety lock lever to the LOCK position, then stop the engine and use the key to lock all the equipment locks. Always take the key with you.



**Work equipment posture → See 12.17 PARKING MACHINE on page 2-85**

**MOUNTING AND DISMOUNTING**

- Never jump on or off the machine. In particular, never get on or off a moving machine. These actions may lead to serious injury.
- When getting on or off the machine, always face the machine, and maintain three-point contact (both feet and one hand or one foot and both hands) with the handrails, steps, and track shoes to ensure that you support yourself securely.
- Never hold any control levers when getting on or off the machine. Do not use the machine's controls or hoses as handholds when climbing on or off the machine. Controls and hoses can move and do not provide solid support. Movement of the controls may cause unexpected machine movement and injury.
- Ensure safety by always maintaining at least three-point contact of hands and feet with the handrails, steps or track shoes.
- Before getting on or off the machine, if there is any oil, grease, or mud on the an rails, steps, or track shoes, wipe it off immediately. Always keep these parts clean. Repair any damage and tighten any loose bolts.
- Apply the door lock securely. If you grip the handrail inside the door when moving on top of the track shoes, and the door lock is not applied securely, the door may move and cause you to fall.
- Use the points marked by arrows in the diagram when getting on or off the machine.

**INJURY FROM WORK EQUIPMENT**

Do not enter or put your hand or arm or any other part of your body between movable parts, such as between the work equipment and cylinders, or between the machine and work equipment.

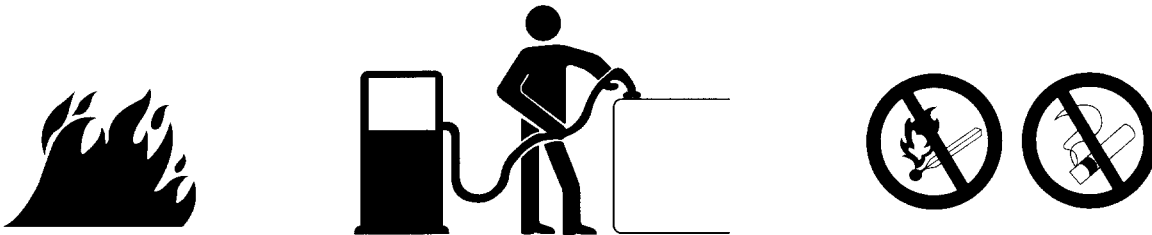
If the control levers are operated, the clearance between the machine and the work equipment will change and this may lead to serious damage or personal injury. If it is necessary to go between movable parts, always fix the work equipment so that it cannot move.



**FIRE PREVENTION FOR FUEL, OIL AND ANTIFREEZE**

Fuel, oil, and antifreeze can be ignited by a flame. Fuel is particularly **FLAMMABLE** and can be **HAZARDOUS**. Always strictly observe the following.

- Keep any flame away from flammable fluids.
- Stop the engine and do not smoke when refueling.
- Tighten all fuel and oil caps securely.
- Refueling and oiling should be made in well ventilated areas.
- Keep oil and fuel in the determined place and do not allow unauthorized persons to enter.
- Do not leave the area when supplying fuel.




**PRECAUTIONS WHEN HANDLING AT HIGH TEMPERATURES**

- Immediately after operations are stopped, the engine coolant, engine oil, and hydraulic oil are at high temperatures, and are still under pressure. Attempting to remove the cap, drain the oil or water, or replace the filters may lead to serious burns. Always wait for the temperature to go down, and follow the specified procedures when carrying out these operations.
- To prevent hot water from spurting out:
  - Turn engine off.
  - Allow water to cool.
  - Slowly loosen cap to relieve pressure before removing.
- To prevent hot oil from spurting out:
  - Turn engine off.
  - Allow oil to cool.
  - Slowly loosen cap to relieve pressure before removing.



## SAFETY

 **WARNING:** For reasons of safety, always follow these safety precautions.

### ASBESTOS DUST HAZARD PREVENTION

Asbestos dust can be hazardous to your health if it is inhaled. Komatsu America International Co. does not use asbestos in its products, but if you handle materials containing asbestos fibers during demolition operations, always do as follows.

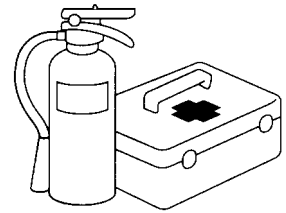
- Never use compressed air for cleaning.
- Use water to keep down the asbestos dust when cleaning.
- If there is danger that there may be asbestos dust in the air, operate the machine with the wind to your back whenever possible.
- Use an approved respirator if necessary.
- Do not allow any other person into the area during the operation.
- There is danger that non-genuine parts may contain asbestos, so use only Komatsu America International Co. genuine parts.
- Always observe any rules and regulations related to the job site and working environment.



### FIRE EXTINGUISHER AND FIRST AID KIT

As a precaution if any injury or fire should occur, always do as follows.

- Be sure that fire extinguishers have been provided and read the labels to ensure that you know how to use them.
- Provide a first aid kit at the storage point. Check the kit periodically and make any additions if necessary.
- Know what to do in the event of injury or fire.
- Make a list of the phone numbers of persons you should contact in case of an emergency (doctor, ambulance, fire station), and post the list at specified places to ensure that all workers can carry out the emergency contact.



### CAB GLASS

If the cab glass on the work equipment side should be broken, there is serious danger that you may come into direct contact with the work equipment. If the glass breaks, stop operation immediately and replace glass.

### WINDOW WASHER FLUID

Use an ethyl alcohol type washer fluid. **DO NOT** use a methyl alcohol type washer fluid because it may irritate your eyes.

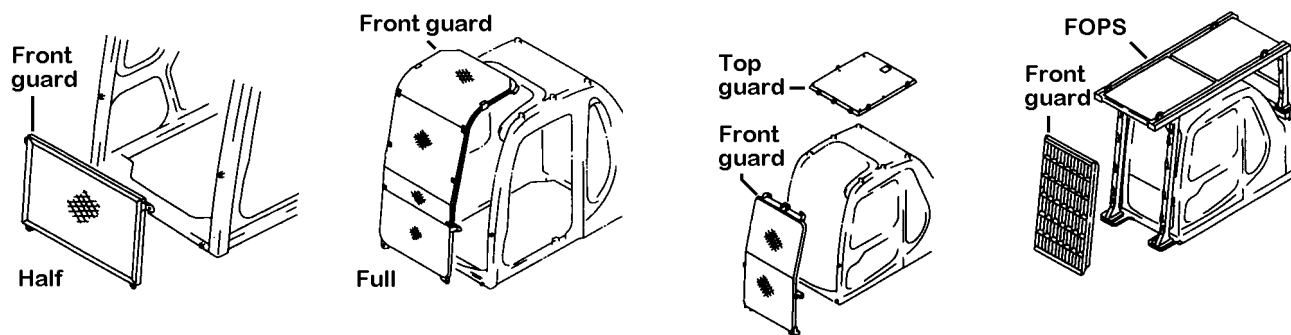
**PROTECTION AGAINST FALLING OR FLYING OBJECTS**

On job sites where there is danger that falling or flying objects may hit the operators cab, select a guard to match the operating conditions in order to protect the operator.

- For breaker operations, install a front guard and stick a laminated coating sheet to the front glass.
- When carrying out demolition or cutting operations, install a front guard and top guard, and stick a laminated coating sheet to the front glass.
- When working in mines or quarries where there is danger of falling rock, install FOPS (Falling Objects Protective Structure) and stick a laminated coating sheet to the front glass.
- When carrying out the above operations, always close the front window. In addition, always ensure that everyone apart from the operator is a safe distance away and is not in danger from failing or flying objects. Be particularly careful to keep people at a good distance during cutting operations.
- The above recommendations assume that the conditions are for standard operations, but it may be necessary to add additional guards according to the operating conditions on the job site. Always contact your distributor for advice before starting operations.
- If the glass on the work equipment side is broken, replace it with new glass immediately. If you put your hand out, it may get caught in the work equipment and this may lead to serious personal injury.
- The KAIC FOPS fulfills the standards and regulations of all countries, but if it is damaged or deformed by failing objects or by the machine rolling over, its strength will be reduced and it will be unable to ensure its basic function.



If such problems occur, please contact your distributor for advice about repairs.



**ESCAPE FROM FIRE**

If the machine catches fire, it may lead to serious personal injury or death. If a fire occurs during operation, escape from the machine as follows.

- Turn the starting switch OFF and stop the engine.
- If there is time, use the fire extinguisher to extinguish as much of the fire as possible.
- Use the handrails and steps to escape from the machine.

The above is the basic method for escaping from the machine, but it may be necessary to change the method according to the conditions, so carry out practice drills at the job site.

**MACHINES WITH ACCUMULATOR**

On machines equipped with an accumulator, for a short time after the engine is stopped, the work equipment will lower under its own weight when the work equipment control lever is shifted to LOWER. After the engine is stopped, set the safety lock lever to the lock position and also lock the attachment pedal with the lock pin.

When releasing the pressure inside the work equipment circuit on machines equipped with an accumulator, follow the procedure given in the inspection and maintenance section.

**Method of releasing pressure → See 11.22 HANDLING ACCUMULATOR on page 2-42**

The accumulator is filled with high-pressure nitrogen gas, and it is extremely dangerous if it is handled in the wrong way. Always observe the following precautions:

- Never make any hole in the accumulator or expose it to flame or fire.
- Do not weld any boss to the accumulator.
- When carrying out disassembly or maintenance of the accumulator, or when disposing of the accumulator, it is necessary to release the gas from the accumulator. A special air bleed valve is necessary for this operation, so please contact your distributor.

**Gas in accumulator → See 11.22 HANDLING ACCUMULATOR on page 2-42**

**PRECAUTIONS FOR ATTACHMENTS**

- When installing and using an optional attachment, read the instruction manual for the attachment and the information related to attachments in this manual.
- Do not use attachments that are not authorized by your distributor or Komatsu America International Co. Use of unauthorized attachments could create a safety problem and adversely affect the proper operation and useful life of the machine.
- Any injuries, accidents, product failures resulting from the use of unauthorized attachments will not be the responsibility of Komatsu America International Co.

**INDOOR VENTILATION**

- When starting the engine, or using fuel, flushing oil, or paint indoors or in areas with poor ventilation, always open the windows and doors to improve the ventilation and prevent the danger of gas poisoning.
- If the ventilation is still insufficient even when the windows and doors are opened, use a ventilation fan.

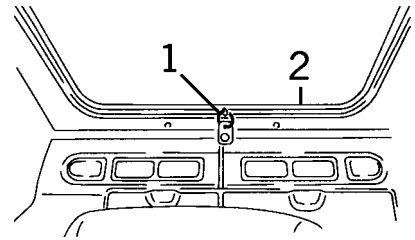


**⚠ WARNING:** Failure to follow these safety precautions may lead to a serious accident.

**EMERGENCY EXIT FROM OPERATORS CAB**

If it should become impossible to open the cab door for any reason, open the rear window and use it as an emergency escape.

- Remove the rear window as follows.
  - Pull ring (1) and completely remove seal (2) from the window frame rubber.
  - Push the corner of the rear window glass strongly to remove it to the outside.



Remove the rear window only when it is used as an emergency exit.



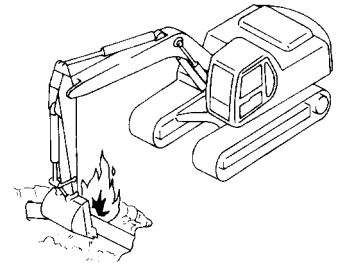
## 7. PRECAUTIONS DURING OPERATION

### 7.1 BEFORE STARTING ENGINE

#### SAFETY AT WORK SITE

- Before entering the operator's compartment, walk completely around the machine and clear the area of personnel and obstructions.
- Before starting the engine, thoroughly check the area for any unusual conditions that could be dangerous.
- Before starting the engine, examine the terrain and soil conditions of the work site. Determine the best and safest method of operation.
- Make a sloped machine position as horizontal as possible before continuing operations.
- If you need to operate on a street, protect pedestrians and cars by designating a person for work site traffic duty or by installing barriers around the work site,
- If water lines, gas lines, telephone lines, and high-voltage electrical lines may be buried under the work site, contact each utility and identify their locations. Be careful not to sever or cut any of these lines.
- Check the depth and flow of water before operating in water or crossing a river. NEVER be in water which is in excess of the permissible water depth.

**Permissible water depth → See 12.12 PRECAUTIONS FOR OPERATION on page 2-78**



#### FIRE PREVENTION

- Thoroughly remove wood chips, leaves, paper and other flammable debris that has accumulated in or around the engine compartment. They could cause a fire.
- Check fuel, lubrication, and hydraulic systems for leaks. Have any leaks repaired. Wipe up any excess oil, fuel, or other flammable fluids.

**Check point → See 12.1.1 WALK AROUND CHECK on page 2-43**

- Be sure a fire extinguisher is present and working.



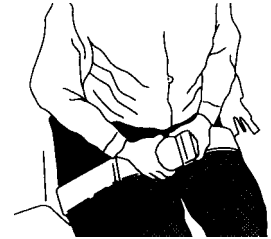
#### VENTILATION FOR ENCLOSED AREAS

If it is necessary to start the engine within an enclosed area, provide adequate ventilation. Exhaust fumes from the engine can KILL.



**IN OPERATORS CAB**

- Do not leave tools, spare parts or personal items lying around in the operator's compartment. They may damage, break or jam the control levers or switches. Always put them in their proper place.
- Keep the cab floor, controls, steps and handrails free of oil, grease, snow, and excess dirt.
- Check the seat belt, buckle and hardware for damage or wear. Replace any worn or damaged parts. NEVER use bleach, dye or solvents on the seat belt because this may weaken the webbing and result in personal injury. Clean the seat belt with warm water and a mild detergent. ALWAYS use seat belts when operating your machine.
- Do not service the air conditioning system unless you have the proper equipment that complies with all government regulations. It is unlawful to discharge Freon into the atmosphere.
- Know the alternate exit routes from the operator's compartment for use in an emergency.

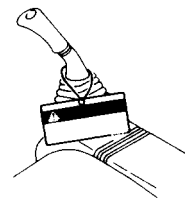


**PRECAUTIONS FOR MIRRORS, WINDOWS AND LIGHTS**

- Remove all dirt from the surface of the windows and lights to ensure that you can see well.
- Adjust the rear view mirror so that you can see clearly from the operator's seat, and always keep the surface of the mirror clean. If any glass is broken, replace it with a new part.
- Check that the head lamps and working lamps are installed to match the operating conditions. Check also that they light up properly.

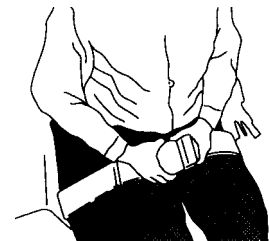
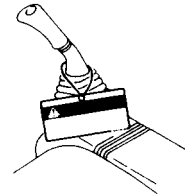
**WHEN STARTING ENGINE**

- Walk around your machine again just before mounting it, and check for people and objects that might be in the way.
- Never start the engine if a warning tag has been attached to the control levers.
- When starting the engine, sound the horn as an alert.
- Start and operate the machine only while seated.
- If another person is allowed on the machine, that person may sit only in the assistant's seat.
- Do not short circuit the starting motor to start the engine. This is not only dangerous, but may also damage the machine.



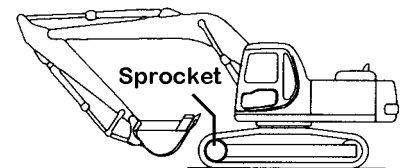
**7.2 OPERATING MACHINE****WHEN STARTING ENGINE**

- Perform a visual check of the machine before starting the engine. Look for such things as missing protective devices, leaks, improper fluid levels, trash buildup and loose, damaged or missing parts. **DO NOT** start the engine until any unsafe conditions are corrected.
- Walk around your machine again just before mounting it, checking for people and objects that might be in the way.
- **NEVER** start the engine if a warning tag has been attached to the control.
- Understand all control functions before starting the engine.
- When starting the engine, sound the horn as an alert. Start and operate the machine only while seated.
- Do not allow anyone other than the operator to ride in the cab or on the machine body.
- For machines equipped with a travel alarm buzzer, check that the warning device operates correctly.
- Keep hands and footwear free of grease, water and mud to insure positive control movement.
- Before driving the machine, adjust the seat and fasten the seat belt. Adjust the seat for maximum comfort and control of the machine. Adjust the seat belt to fit snugly and low around the hips to lessen the chance and severity of injury in the event of an accident. **Never** wear the seat belt across the abdomen.
- Before moving the machine, check the brakes, steering, attachment controls and safety devices such as the travel alarm for proper operation. **DO NOT** operate the machine until any unsafe conditions have been corrected.

**CHECK DIRECTION BEFORE STARTING MACHINE**

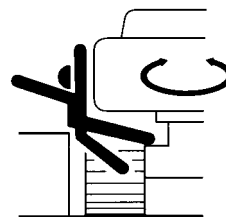
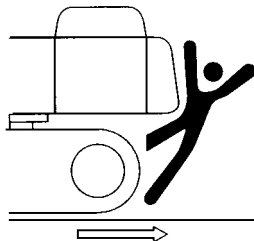
Before operating the travel lever, check the direction of the track frame. If the sprocket is at the front, the travel lever must be operated in the opposite direction.

**Travel operations → See 12.4 MOVING MACHINE on page 2-63**



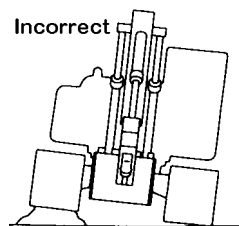
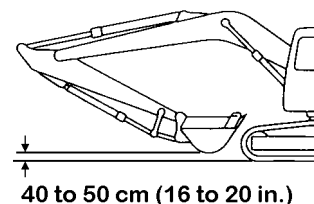
**CHECK THAT NO ONE IS IN AREA BEFORE SWINGING OR TRAVELING IN REVERSE**

- Always position a signal man for dangerous areas or places where the view is not clear.
- Make sure that no one comes inside the swing radius or travel path.
- Before starting to move, sound the horn or give a signal to warn people not to come close to the machine.
- There are blind spots behind the machine. Check for objects and personnel behind the machine before traveling in reverse.



**PRECAUTIONS WHEN TRAVELING**

- Never turn the starting switch to the OFF position when traveling. It is dangerous if the engine stops when the machine is traveling. It will be impossible to operate the steering.
- It is dangerous to look at other things when operating. Always concentrate on your work. It is dangerous to drive too fast, start suddenly, stop suddenly, turn suddenly, or snake when driving the machine.
- If any abnormality in the machine (noise, vibration, smell, abnormality in gauges, leakage of air or oil, etc.) is seen during operations, stop the machine immediately at a safe place and look for the cause.
- Keep the work equipment at a height of 40 to 50 cm (16 to 20 in) from the ground level.
- When traveling, do not operate the work equipment levers. If the work equipment levers have to be operated, stop the machine before operating them.
- Do not operate the steering suddenly. The work equipment may hit the ground and cause the machine to lose its balance, and this may damage the machine or structures in the area.
- When traveling on rough ground, travel at low speed, and avoid sudden changes in direction. Avoid traveling over obstacles as far as possible. If the machine has to travel over an obstacle, keep the work equipment as close to the ground as possible and travel at low speed. Never travel over obstacles which make the machine tilt strongly (10° or more). When traveling and during operations, always keep a good distance to prevent contact with other machines and structures.
- Drive slowly enough to insure complete control. Slow down when traveling in congested areas or on mud, ice or other slippery surfaces. Keep a safe distance away from other vehicles, according to the load and ground conditions.
- Always keep to the permissible water depth.



**Permissible water depth → See 12.12 PRECAUTIONS FOR OPERATION on page 2-78**

- When traveling over bridges or structures on private land, check that the bridge or structure can withstand the machine weight. When traveling on public roads, check with the local authorities and follow their instructions.

## SAFETY

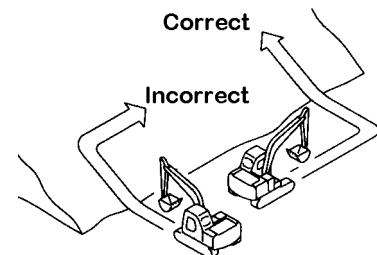
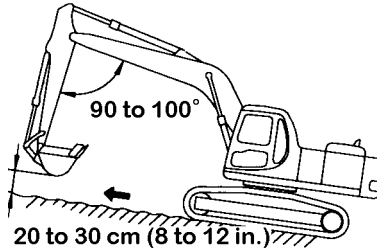
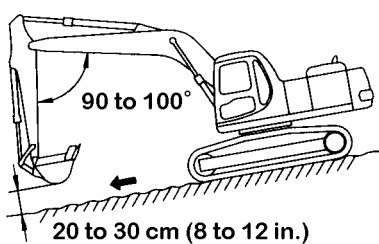
**⚠ WARNING:** For reasons of safety, always follow these safety precautions.

### TRAVELING ON SLOPES

- Never jump on to a machine that is running away in order to stop it. There is danger of serious injury.
- Traveling on slopes could result in the machine tipping over or slipping.
- On hills, banks or slopes, carry the bucket approximately 20 to 30 cm (8 to 12 in) above the ground. In case of emergency, quickly lower the bucket to the ground to help stop the machine.
- Do not turn on slopes or travel across slopes. Always go down to a flat place to perform these operations.

**Method of slope travel → See 12.13 PRECAUTIONS WHEN TRAVELING UP OR DOWN HILLS on page 2-79**

- Do not travel on grass, fallen leaves, or wet steel plates. Even slight slopes may cause the machine to slip to the side, so travel at low speed and make sure that the machine is always traveling directly up or down the slope.
- When traveling downhill, travel slowly at low speed. If necessary, use the brakes (shift the travel lever to neutral) and use the braking force of the engine.
- If the engine stops on a slope, shift the travel lever to the neutral position and start the engine again.

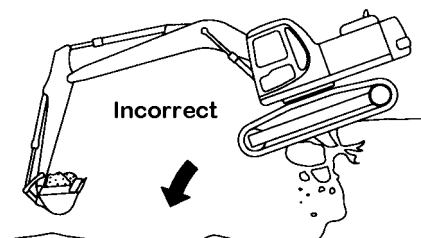
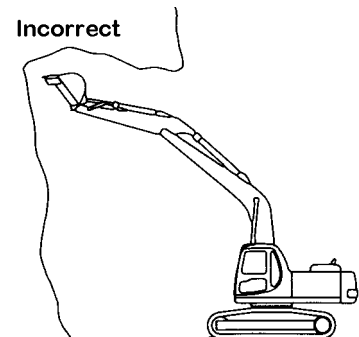


### PROHIBITED OPERATIONS

- Do not dig the work face under an overhang. This may cause the overhang to collapse and fall on top of the machine.
- Do not carry out deep digging under the front of the machine. The ground under the machine may collapse and cause the machine to fall. To make it easier to escape if there is any problem, set the crawlers at right angles to the road shoulder with the travel motor at the rear when carrying out digging operations. If the ground under the machine collapses and there is no time to drive out in reverse, do not panic and raise the arm and boom. It may actually be safer to lower the arm and boom.
- Do not swing the upper structure to the side when it is carrying a heavy load. Generally speaking, the machine is more liable to overturn when the work equipment is at the side than when it is at the front or rear.

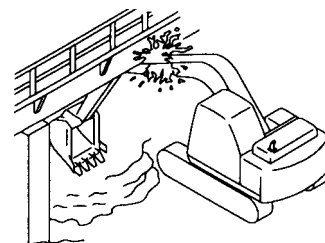
**For details → See 12.12 PRECAUTIONS FOR OPERATION on page 2-78**

- Limit of use; When using the machine, to prevent accidents caused by damage to the work equipment and overturning because of excessive load, do not use the machine in excess of its ability (in terms of the maximum load and stability determined by the structure of the machine).



**PRECAUTIONS FOR OPERATION**

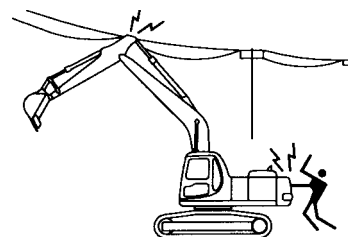
- Be careful not to go close to the edge of a cliff by mistake.
- Use the machine only for its main purpose. Using it for other purposes will cause failures.
- To ensure an ample view, do as follows.
  - When working in dark areas, fit working lamps and front lamps to the machine. If necessary, set up lighting at the job site.
  - Stop operations when the visibility is poor, such as in fog, mist, snow, and rain. Wait for the visibility to improve to a level which causes no problems for the operation.
- To avoid hitting the work equipment, always do as follows.
  - When working in tunnels, on bridges, under electric wires, or when parking the machine or carrying out other operations in places with limited height, be extremely careful not to hit the bucket or other parts.
  - To prevent collisions, operate the machine at a safe speed when working in confined spaces, indoors, or in crowded areas.
  - Do not pass the bucket over the heads of workers or over the operator's compartment of dump truck.



**DO NOT GO CLOSE TO HIGH-VOLTAGE CABLES**

- Do not let the machine touch overhead electric wires. In the case of high-voltage cables, even going close can cause electric shock.
- To prevent accidents, always do the following.
  - On job sites where there is danger of the machine contacting electric wires, consult with the electric power company and check that the actions required by law are being taken before starting operations.
  - Wear shoes with rubber soles and rubber gloves, spread a rubber sheet on the seat and be careful not to let any part of your body not protected by rubber touch the machine.
  - Use a signalman to give warning if the machine approaches too close to the electric cables.
  - Check with the electricity company about the voltage of the cables before starting operations.

Voltage	Minimum safety distance	
100 to 200 V	2 m	6.5 ft
6,600 V	2 m	6.5 ft
22,000 V	3 m	9.8 ft
66,000 V	4 m	13.1 ft
154,000 V	5 m	16.4 ft
187,000 V	6 m	19.7 ft
275,000 V	7 m	22.9 ft
500,000 V	11 m	36.0 ft



## SAFETY

**⚠ WARNING:** For reasons of safety, always follow these safety precautions.

### OPERATE CAREFULLY ON SNOW

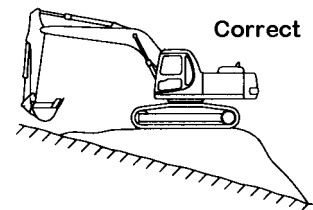
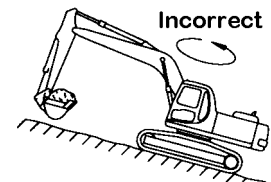
- When working on snow or icy roads, even a slight slope may cause the machine to slip to the side, so always travel at low speed and avoid sudden starting, stopping, or turning. There is particular danger of the machine slipping to the side when traveling up or down hills.
- When the temperature rises, frozen road surfaces become soft, so the machine travel becomes unstable.
- When there has been heavy snow, the road shoulder and objects placed beside the road are buried in the snow and cannot be seen, so always carry out snow-clearing operations carefully.

### WORKING ON LOOSE GROUND

- Avoid entering soft ground. It will be difficult for the machine to escape.
- Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. The ground may be weak in such areas. If the ground should collapse, the machine could fall or tip over and this could result in serious injury or death. Remember that the soil after heavy rain or blasting or after earthquakes is weakened in these areas.
- Earth laid on the ground and the soil near ditches is loose. It can collapse under the weight or vibration of your machine and cause your machine to tip over.
- Install the head guard (FOPS) if working in areas where there is danger of falling rocks.

### OPERATING ON SLOPES

- When working on slopes, there is danger that the machine may lose its balance and turn over when the swing or work equipment are operated. Always carry out these operations carefully.
- Do not swing the work equipment from the uphill side to the downhill side when the bucket is loaded. This operation is dangerous.
- If the machine has to be used on a slope, pile the soil to make a platform that will keep the machine as horizontal as possible. In addition, lower the bucket as far as possible, keep it pulled in to the front, and keep the swing speed as low as possible.



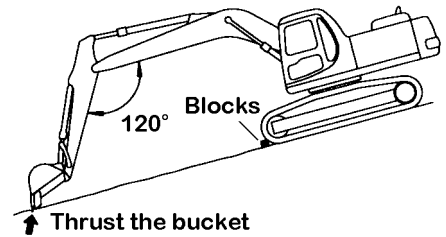
**Piled soil on slope → See 12.13 PRECAUTION WHEN TRAVELING UP OR DOWN HILLS on page 2-79**

### NEVER LET ANYONE RIDE ON ATTACHMENT

Never let anyone ride on any work attachment, such as the bucket, crusher, grapple, or clamshell (grab bucket). There is danger of the person falling and suffering serious injury.

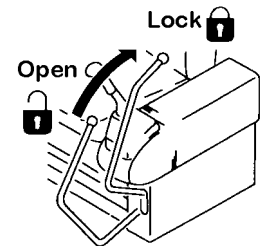
**PARKING THE MACHINE**

- Park on level ground where there is no danger of falling rocks or landslides. When parking on low ground, park in a place where there is no problem of flooding. When parking the machine, lower the work equipment to the ground.
- If the machine must be parked on a slope, block the tracks, lower the work equipment and thrust the bucket into the ground.
- After stopping the engine, operate the right work equipment control lever to the RAISE and LOWER positions 2 or 3 times to release the pressure remaining in the hydraulic circuit.
- When parking on public roads, provide fences, signs, flags, or lights, and put up any other necessary signs to ensure that passing traffic can see the machine clearly, and park the machine so that the machine, flags, and fences do not obstruct traffic.



**Parking procedure → See 12.17 PARKING MACHINE on page 2-85**

- When leaving the machine, lower the work equipment completely to the ground, set safety lock lever to the LOCK position, then stop the engine and use the key to lock all the equipment. Always remove the key and take it with you.



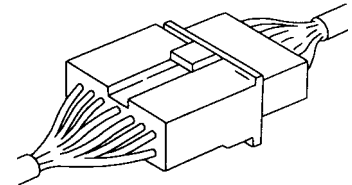
**Work equipment posture → See 12.17 PARKING MACHINE on page 2-85**

**Locks → See 12.21 LOCKING AND SECURING MACHINE on page 2-88.**

- Always close the door of the operator's compartment.

**PRECAUTIONS IN COLD WEATHER**

- After completing operations, remove any drops of water, snow, or mud stuck to the wiring harnesses, connector 10, switches, or sensors, and cover these parts. If drops of water get in and freeze, the machine may malfunction when it is next used, and this may lead to an unexpected accident.
- Carry out the warming-up operations thoroughly. If the control levers are operated before the machine is fully warmed up, the response of the machine will be slow, and this may lead to an unexpected accident.
- Operate the control levers to relieve the hydraulic pressure (raise the pressure to above the set pressure of the hydraulic circuit and relieve the pressure oil to the hydraulic tank) to warm up the oil in the hydraulic circuit. This improves the response of the machine and prevents mistaken operation.
- If the battery electrolyte is frozen, do not charge the battery or start the engine with power from another source. There is danger that the battery may catch fire. When charging the battery or starting with power from another source, let the battery electrolyte melt and check that there is no leakage of battery electrolyte before starting the operation.



**Battery charge ratio → See 14.1.3 BATTERY on page 2-96**

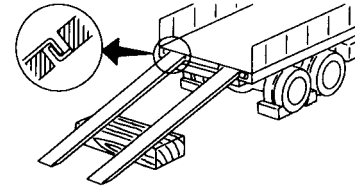
- In cold weather, do not touch metal surfaces with your bare hands. If you touch a metal surface in extremely cold weather, your skin may freeze to the metal surface.



## 7.3 TRANSPORTATION

### LOADING AND UNLOADING

- Loading and unloading the machine always involves potential hazards. Extreme CAUTION Should be used.
- When loading or unloading the machine, run the engine at low idling and travel at low speed.
- Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of the road.
- ALWAYS use ramps of adequate strength. Be sure that the ramps are wide, long, and thick enough to provide a safe loading slope. If there is excessive deflection of the ramps, strengthen the ramp with blocks.
- When loading or unloading the machine on piled soil or temporarily structure, be careful to ensure that the width, strength, and angle of the slope fulfill the limits.
- To prevent the machine from slipping, remove all oil, grease, or other material from the surface of the ramps. Remove all mud from the undercarriage of the machine. Be particularly careful on rainy days because the machine is more likely to slip.
- NEVER correct your steering on the ramps. If necessary, drive away from the ramps and climb again.
- The center of gravity of the machine will change suddenly at the joint between the ramps and the track or trailer, and there is danger of the machine losing its balance. Travel slowly over this point.
- After loading, block the machine tracks and secure the machine with tie downs.



**Loading and unloading → See 13 TRANSPORTATION on page 2-89**

**Tie-downs → See 13 TRANSPORTATION on page 2-89**

### SHIPPING

- When shipping the machine on a hauling vehicle, obey all state and local laws governing the weight, width, and length of a load. Also obey all applicable traffic regulations.
- Take into account the width, height and weight of the load when determining the shipping route.

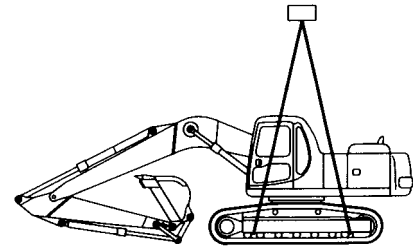
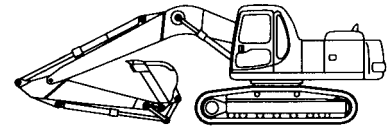
**Height, width, weight limits → See 13 TRANSPORTATION on page 2-89**

- When traveling over bridges or structures on private land, check first that the bridge or structure can withstand the weight of the machine. When traveling on public roads, check with the local authorities and follow their instructions.
- For machines equipped with a cab, always lock the door securely.

**PRECAUTIONS WHEN LIFTING**

When lifting the machine, always do as follows.

- Carry out the lifting operation on flat ground.
- Do not carry out the lifting operation with any person on the machine.
- Use wire rope that has ample strength to lift the weight of the machine.
- For details of the machine weight: → **See 25 SPECIFICATIONS on page 4-2.** The specifications are the standard specifications, so the method of lifting may differ according to the attachments and options actually installed. When lifting machines with different attachment, please contact your distributor for advice.
- Swing the upper structure so that it is at the sprocket end and set the upper structure parallel to the undercarriage when lifting.



**Work equipment position → See 13.2.5 METHOD OF LIFTING MACHINE on page 2-94**

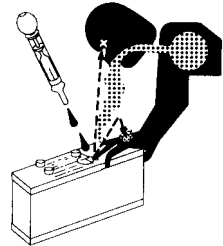
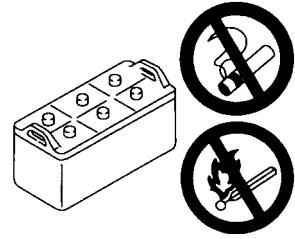
- When lifting the machine, pay careful attention to the center of gravity to maintain the balance.
- Do not go under the machine when it is raised.

## 7.4 BATTERY

### BATTERY HAZARD PREVENTION

Battery electrolyte contains dilute sulfuric acid and batteries generate hydrogen gas. Hydrogen gas is highly explosive, and mistakes in handling can cause serious injury or fire. To prevent problems, always do as follows.

- Do not smoke or bring any flame near the battery.
- When working with batteries, ALWAYS wear safety glasses and rubber gloves.
- If you spill battery electrolyte on yourself or your clothes, immediately flush the area with water.
- If battery electrolyte gets into your eyes, flush them immediately with large quantities of water and see a doctor at once.
- If you accidentally drink battery electrolyte, drink a large quantity of water or milk, raw egg or vegetable oil. Call a doctor or poison prevention center immediately.
- When cleaning the top surface of the battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten the battery caps securely.
- If the battery electrolyte is frozen, do not charge the battery or start the engine with power from another source. There is danger that the battery may catch fire. When charging the battery or starting with power from another source, let the battery electrolyte melt and check that there is no leakage of battery electrolyte before starting the operation.
- Always remove the battery from the machine before charging.



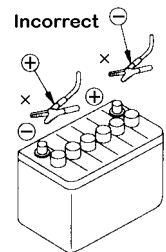
### STARTING WITH BOOSTER CABLES

If any mistake is made in the method of connecting the booster cables, it may cause fire. Always do as follows.

- Use two workers for the starting operation: one of these sits in the operator's seat.
- When using another machine to start a problem machine, be careful not to let the normal machine and problem machine touch each other.
- When connecting the booster cables, turn the starting switches OFF on both the normal machine and the problem machine.
- Be sure to connect the positive (+) cable first when installing the booster cables. Disconnect the ground or negative (-) cable first when removing them.
- Finally, when connecting the ground cable to the frame of the upper structure, sparks will be caused, so be sure to connect it as far as possible from the battery.

**Starting with booster cables → See 16.5 IF BATTERY IS DISCHARGED on page 2-102**

- When removing the booster cable, be careful not to let the booster cable clips contact each other or let the clip contact the machine.



**CHARGING BATTERY**

When charging the battery, if the battery is not handled correctly, there is danger that the battery may explode. Always follow the instructions for use of the battery and the instruction manual accompanying the charger, and do as follows.

- Take the charger to a well-ventilated place and remove the battery caps. This is to disperse the hydrogen gas and prevent explosion.
- Set the voltage of the charger to match the voltage of the battery to be charged. If the voltage is not selected correctly, the charger may overheat and cause an explosion.
- Connect the positive (+) charger clip of the charger to the positive (+) terminal of the battery, then connect the negative (-) charger clip of the charger to the negative (-) terminal of the battery. Be sure to fix the clips securely.
- Set the charging current to 1/10 of the value of the rated battery capacity; when carrying out rapid charging, set it to less than the rated battery capacity. If the charger current is too high, the electrolyte will leak or dry up, and this may cause the battery to catch fire and explode.



## 7.5 TOWING

### PRECAUTIONS WHEN TOWING

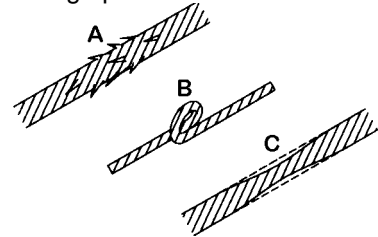
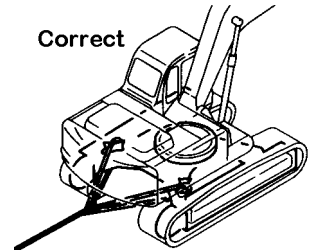
If any mistake is made in the method of selecting or inspecting the towing wire or in the method of towing, it may lead to serious personal injury. Always do as follows.

- Always use the method of towing given in this Operation & Maintenance Manual. Do not use any other method.

**Method of towing → See 16.2 METHOD OF TOWING MACHINE on page 2-101**

- Use leather gloves when handling the wire rope.
- When carrying out the preparation work for towing with two or more workers, determine the signals to use and follow these signals correctly.
- Always fit the towing rope to the left and right hooks and secure in position.
- If the engine on the problem machine will not start or there is a failure in the brake system, always contact your distributor.
- Never go between the towing machine and the towed machine during the towing operation.
- It is dangerous to carry out towing on slopes, so select a place where the slope is gradual. If there is no place where the slope is gradual, carry out operations to reduce the angle of the slope before starting the towing operation.
- When towing a problem machine, always use a wire rope with a sufficient towing capacity.
- Do not use a frayed (A), kinked (B) rope or a rope with any loss of diameter (C).
- Do not use the light-weight towing hook for towing another machine.

Correct



## 7.6 BUCKET WITH HOOK

### PROHIBITED OPERATIONS

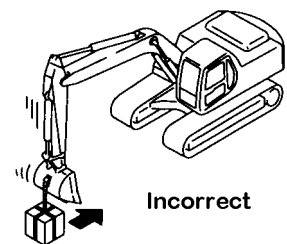
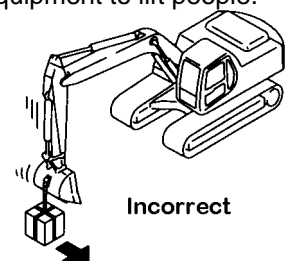
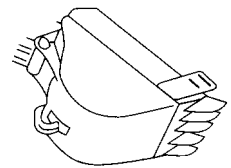
This machine is not designed to be used as a crane, so crane operations are prohibited. However, the following work is possible using the bucket with hook.

- Trench timbering work
- Cases where the nature of work requires it or when it is necessary for ensuring safe operation.

### PRECAUTIONS WHEN INSTALLING AND OPERATING BUCKET WITH HOOK

The swing speed of a hydraulic excavator is 3 to 4 times that of a mobile crane. When swinging with a raised load, adjust the swing speed so that the machine does not tip over. Lifting operations with a hydraulic excavator are permitted if they fulfill the following special conditions. Always follow these conditions.

- The specified special hook is installed to the bucket. For details, please contact your distributor.
- The following operations are prohibited.
  - Lifting loads with a wire rope fitted around the bucket teeth or wrapped directly around the boom or arm.
- When lifting a load, carry out the following checks to confirm that there is no abnormality before starting operations. Check that there are no cracks or deformations in the lifting equipment and that there is no abnormality in the stopper device.
- If the special hook is installed, there are extra items for the check before starting and periodic inspection, and the recording and storage of the periodic self-inspection is required.
- When carrying out work with a lifted load, set the machine on firm, flat ground and install the wire rope securely to the special lifting hook.
- Lifting operations are prohibited except for the main purpose. Never use the work equipment to lift people.
- People are not allowed within the operating radius.
- When carrying out lifting operations, decide a leader for the operation and the method of operation, procedure, and signs, and follow the directions from the leader.
- Wear leather gloves when handling the wire rope, and do not use any wire rope that does not fulfill the specified standards.
- When carrying out lifting operations, reduce the engine speed and operate slowly. Do not leave the operators seat when there is a raised load.
- It is dangerous to carry out operations that exceed the performance of the machine or to pull the load to the side or in towards the machine.
- Do not travel with a raised load.
- Depending on the operating posture of the machine, there is danger that the wire rope or lifting ring may come off, so be extremely careful to maintain the hook at an angle where the wire rope or ring do not come off.



## 8. PRECAUTIONS FOR MAINTENANCE

### 8.1 BEFORE CARRYING OUT MAINTENANCE

#### CONTACT WHEN THERE IS FAILURE

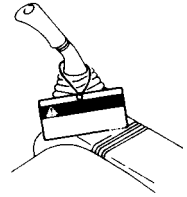
Carrying out maintenance that is not listed in this Operation & Maintenance Manual may cause unexpected failure. Please contact your distributor for repairs.

#### WARNING TAG

ALWAYS attach the DO NOT OPERATE warning tag to the gearshift lever in the operator's cab to alert others that you are working on the machine. Attach additional warning tags around the machine if necessary.

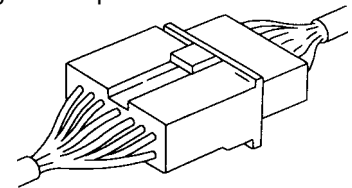
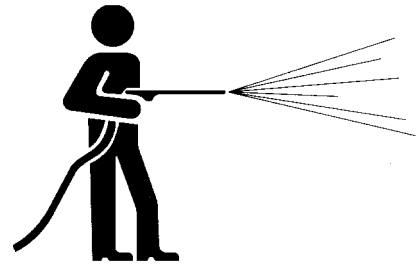
If others start the engine or operate the controls while you are performing inspection or maintenance, you could suffer serious injury.

Warning tag part No. 09963-03000



#### CLEAN BEFORE INSPECTION OR MAINTENANCE

- Clean the machine before carrying out inspection and maintenance. This prevents dirt from getting into the machine and also ensures safety during maintenance.
- If inspection and maintenance are carried out when the machine is dirty, it will become more difficult to locate the problems, and also there is danger that you may get dirt or mud in your eyes or that you may slip and injure yourself.
- When washing the machine, do as follows.
  - Wear shoes with non-slip pads to prevent yourself from slipping and falling on wet places.
  - Wear protective clothing when washing the machine with high pressure steam.
  - Take action to prevent touching high-pressure water and cutting your skin or having mud fly into your eyes.
  - Do not spray water directly on electrical components (sensors, connector). If water gets into the electrical system, there is danger that it will cause defective operation and malfunction.



**⚠ WARNING:** Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

### NEAT CLEAN WORK PLACE

Tidy any tools or hammers that are lying in the work place, wipe up any grease or oil or any other slippery substances, and clean the area to make it possible to carry out the operation in safety. If the work place is left untidy, you may trip or slip and suffer injury.

### FOLLOW LEADER IN OPERATIONS WITH OTHER WORKERS

When carrying out repairs of the machine or removal and installation of components, decide a leader and follow the instructions of the leader. There is danger that differences of opinion between workers when working together may lead to misunderstandings and cause an expected accident.

### RADIATOR COOLANT LEVEL

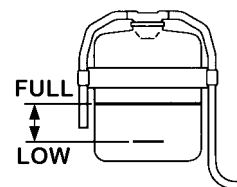
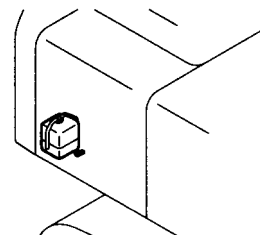
- When checking the radiator coolant level, stop the engine, let the engine and radiator cool down, then check the sub tank.

If the level in the sub tank is near the upper limit, there is enough coolant in the radiator.

**Coolant level → See 25 SPECIFICATIONS on page 4-2.**

If the level in the sub tank is below the lower limit, add coolant.

**Coolant level → See 24.3.1 CHECK COOLANT LEVEL, ADD COOLANT on page 3-43**



### DO NOT DISASSEMBLE RECOIL SPRING

The recoil spring assembly used to cushion the idler has a powerful spring built in, so if it is disassembled by mistake, the spring and other parts may fly out and cause serious injury or death. Never try to disassemble the recoil spring assembly.

### PROPER TOOLS

Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury. There is danger that pieces from chisels with crushed heads or hammers may get into your eyes and cause blindness.

**Tools → See 21.1 INTRODUCTION OF NECESSARY TOOLS on page 3-15**



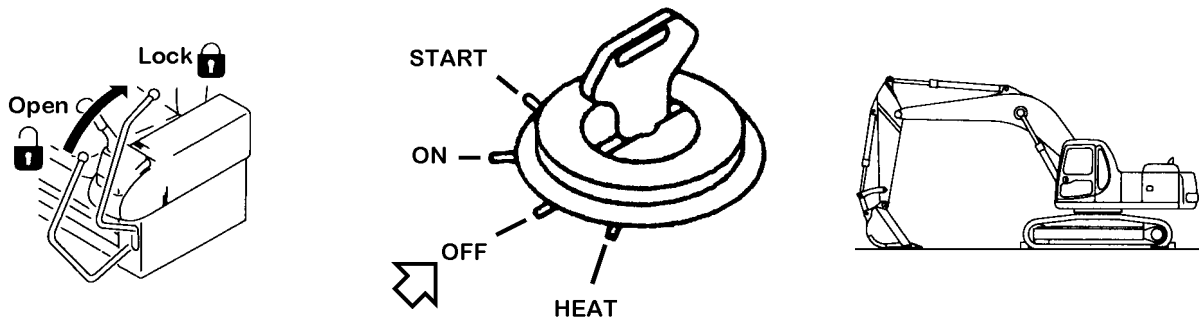


## SAFETY

**⚠ WARNING:** For reasons of safety, always follow these safety precautions.

### STOP THE ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE

- When carrying out inspection and maintenance, always stop the machine on firm, level ground where there is no danger of falling rocks and landslides, and where there is no danger of floods. Lower the work equipment to the ground and stop the engine.
- Operate the work equipment control lever to the RAISE and LOWER positions 2 or 3 times to release the remaining pressure in the hydraulic circuit, then set safety lock lever to the LOCK position.
- If it is necessary to run the engine when carrying out maintenance, such as when cleaning the inside of the radiator, place the safety lock lever in the LOCK position and carry out the operation with two workers.
- One worker should sit in the operator's seat so that he can stop the engine immediately if necessary. He should also be extremely careful not to touch any lever by mistake. Touch the levers only when they have to be operated.
- Put blocks under the shoes to prevent the track from moving.
- The worker doing the maintenance should be extremely careful not to touch or get caught in the moving parts.



### SUPPORT FOR WORK EQUIPMENT

- When carrying out inspection and maintenance with the work equipment raised, fit stand under the boom to prevent the work equipment from moving down.
- In addition, set the work equipment control levers to HOLD, then set safety lock lever 10 to the LOCK position.



### PERIODIC REPLACEMENT OF CRITICAL SAFETY PARTS

Hoses in the fuel system, hydraulic system, and brake system are important parts for safety, so they must be replaced at periodic intervals. The replacement of such safety critical parts requires skill and experience, so please contact your distributor for replacement. Replace these components periodically with new ones, regardless of whether or not they appear to be defective. These components deteriorate over time, and leakage of oil may cause fire or failure of the work equipment system. Replace or repair any such components if any defect is found, even though they have not reached the time specified.

**Replacement of safety critical parts → See 22 PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS on page 3-17**

**⚠ WARNING:** Failure to follow these safety precautions may lead to a serious accident.

## SAFETY

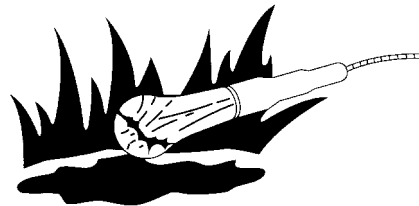
### USE OF LIGHTING

When checking fuel, oil, battery electrolyte, or window washing fluid, always use lighting with anti explosion specifications. If such lighting equipment is not used, there is danger of explosion.

If work is carried out in dark places without using lighting, it may lead to injury, so always use lighting.

Even if the place is dark, never use a lighter or flame instead of lighting. There is danger of fire. There is also danger that the battery gas may catch fire and cause an explosion.

When taking the power for the lighting from the machine itself, follow the instructions in this Operation & Maintenance Manual.



### FIRE PREVENTION

During maintenance, fuel, batteries, and other materials which may catch fire are handled, so always do as follows.

- Store flammable materials such as fuel, oil, and grease away from frame.
- Do not leave the area when adding fuel or oil.
- Use non flammable oil as the oil for washing parts. Diesel oil and gasoline may catch fire, so do not use them.
- Do not smoke when carrying out inspection and maintenance. Always smoke in the specified smoking areas.
- When carrying out inspection of fuel, oil, or battery electrolyte, use lighting with anti-explosion specifications. Never use lighters or matches as lighting. Loose or damaged electrical connections may cause short circuits which may lead to fire. Always check during check before starting.
- Check that there is a fire extinguisher close to the location for carrying out inspection and maintenance.




### RULES TO FOLLOW WHEN ADDING FUEL OR OIL

- Spilled fuel and oil may cause you to slip, so always wipe it up immediately.
- Always tighten the cap of the fuel and oil fillers securely.
- Never use fuel for washing any parts.
- Always add fuel and oil in a well-ventilated place.



## SAFETY

 **WARNING:** For reasons of safety, always follow these safety precautions.

### 8.2 DURING MAINTENANCE

#### PERSONNEL

Only authorized personnel can enter the area during the maintenance operation. If necessary, have a guard supervise the area. Extra precaution should be used when grinding, welding, and using a sledge hammer.

#### REMOVAL, INSTALLATION AND STORAGE OF ATTACHMENTS

- Before starting removal and installation of attachments, decide the team leader.
- Do not allow anyone except the authorized workers close to the machine or attachment.
- Place attachments that have been removed from the machine in a safe place so that they do not fall. Put up a fence around the attachments and take other measures to prevent unauthorized persons from entering.



#### WORK UNDER THE MACHINE

- Stop the machine on firm, flat ground and lower the work equipment to the ground.
- Always block the track shoes of the machine securely.
- It is extremely dangerous to work with the track shoes jacked up from the ground using the work equipment. Never work with the machine raised in this way.



#### NOISE

If the surrounding noise is loud it may cause hearing problems or even loss of hearing.

- When carrying out maintenance of the engine or other operations with long exposure to noise, wear ear muffs or ear plugs.

#### WHEN WORKING ON MACHINE

- When carrying out maintenance operations on the machine, keep the area around your feet clean and tidy to prevent you from falling. Always do as follows.
  - Do not spill oil or grease. Do not leave tools lying about.
  - Watch your step when walking.
- Never jump down from the machine. When getting on or off the machine, use the steps and handrails, and maintain three-point contact (both feet and one hand or both hands and one foot) to support yourself securely.
- If the job requires it, wear protective clothing.
- To prevent injury from slipping or falling, when working on the hood or covers, never use any part except the inspection passage fitted with non-slip pads.



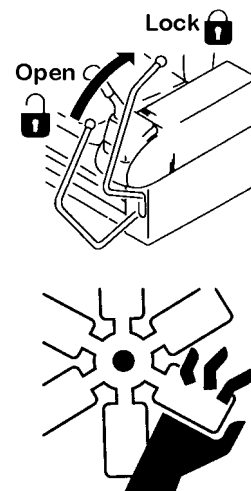
**LOCK INSPECTION COVERS**

When carrying out maintenance with the inspection cover open, lock the cover securely in position with the lock bar. If maintenance work is carried out with the inspection cover open but not locked, there is danger that it may suddenly close and cause injury if there is a gust of wind.

**TWO WORKERS FOR MAINTENANCE WHEN ENGINE IS RUNNING**

To prevent accidents, do not carry out maintenance with the engine running. If it is necessary to carry out maintenance with the engine running, always do as follows.

- One worker sits in the operator's seat so that it is possible to stop the engine immediately whenever necessary. The workers confirm their actions with each other.
- When working near rotating parts, be particularly careful. There is danger of getting caught.
- When cleaning the inside of the radiator, set safety lock lever to the LOCK position to make sure that the work equipment does not move.
- Be careful not to touch the control levers. If a control lever has to be operated, always signal your partner to move to a safe place.
- Never touch the fan blade or fan belt with your body or tools. There is danger of losing fingers or limbs.



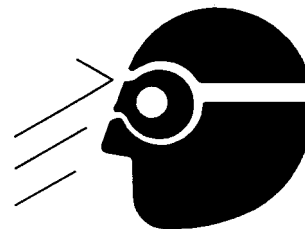
**DO NOT DROP TOOLS OR PARTS INSIDE MACHINE**

When carrying out inspection with the inspection window or tank oil filler open, be careful not to drop bolts, nuts, or tools inside the machine. If any part is dropped inside the machine, it will cause breakage or malfunctioning of the machine, which may lead to a serious accident. If you drop anything, always be sure to remove it.


- When carrying out inspection, put only the things necessary for inspection in your pockets.

**FLYING PIECES WITH HAMMER WORK**

- When working with hammers, wear protective glasses, helmet, and other protective clothing. Put a brass rod between the hammer and the object when hitting with the hammer.
- If hard metal parts such as pins, edges, teeth, and bearings are hit with a hammer, there is danger that small pieces will fly off and get into your eyes.

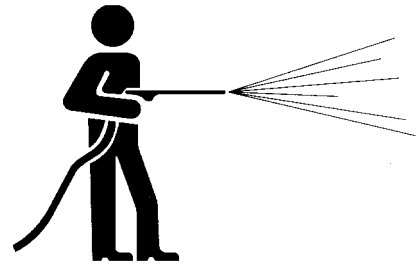


## SAFETY

 **WARNING:** For reasons of safety, always follow these safety precautions.

### KEEP THE MACHINE CLEAN

- Spilled oil or grease, or scattered tools or broken pieces are dangerous because they may cause you to slip or trip.
- Always keep your machine clean and tidy.
- If water gets into the electrical system, there is danger that the machine may not move or may move unexpectedly.
- Do not use water or steam to clean the sensors, connectors, or the inside of the operator's compartment.



### WELDING REPAIRS

When carrying out welding repairs, carry out the welding in a properly equipped place. The welding should be performed by a qualified worker. During welding operations, there is the danger of generation of gas, fire, or electric shock, so never let an unqualified worker do welding. The qualified welder must do as follows.

- To prevent explosion of the battery, remove the battery terminals.
- To prevent generation of gas, remove the paint from the location of the weld.
- If hydraulic equipment or piping or places close to them are heated, a flammable gas or mist will be generated and there is danger of it catching fire. To avoid this, never subject these places to heat.
- If heat is applied directly to rubber hoses or piping under pressure, they may suddenly break, so cover them with a fireproof covering.
- Wear protective clothing.
- Make sure there is good ventilation.
- Remove all flammable objects and provide a fire extinguisher.

### REMOVE BATTERY TERMINALS

- When repairing the electrical system or when carrying out electrical welding, remove the negative (-) terminal of the battery to stop the flow of current.



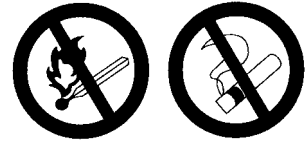
### ACTION WHEN ABNORMALITY IS FOUND DURING INSPECTION

- If any abnormality is found during inspection, always carry out repairs. In particular, if the machine is used when there are still problems with the brake or work equipment systems, it may lead to serious injury.
- If necessary depending on the type of failure, please contact your distributor for repairs.

**RULES TO FOLLOW WHEN ADDING FUEL**

If flame is brought close to fuel or oil, there is danger that it will catch fire. Always do as follows.

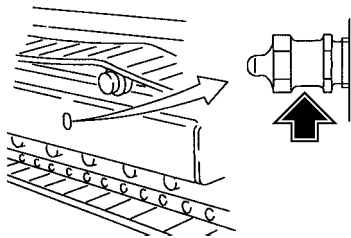
- Stop the engine when adding fuel or oil.
- Do not smoke.
- Wipe up spilled fuel and oil immediately.
- Always tighten the caps of the fuel and oil fillers securely.
- Always add fuel and oil in a well-ventilated place.
- Do not leave the work place when adding fuel or oil.



**PRECAUTIONS WITH HIGH PRESSURE GREASE WHEN ADJUSTING TRACK TENSION**

- Grease is pumped into the track tension adjustment system under high pressure. If the specified procedure for maintenance is not followed when making adjustments, the plug or grease fitting may fly out and cause damage or personal injury.
- When loosening the grease drain plug, never loosen it more than one turn.
- Never put your face, hands, feet, or any other part of your body directly in front of any grease drain plug or valve.

**Adjusting track tension → See 24.2.4 CHECK AND ADJUST TRACK TENSION on page 3-32**



**HANDLING HIGH PRESSURE HOSES**

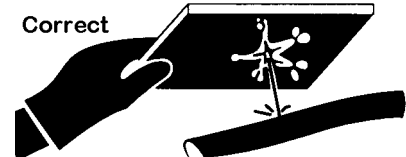
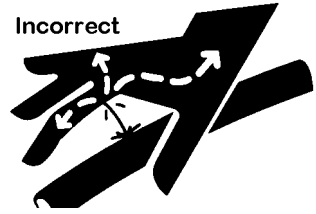
- If oil or fuel leaks from high-pressure hoses, it will cause serious injury through fire or defective actuation. If any damage to the hoses or loose bolts are found, stop operations immediately and contact your distributor.
- Experience and skill is required when replacing high pressure hoses. The tightening torque is determined according to the type and size of the hose, so please contact your distributor.
- If any of the following conditions are found, replace the part.
  - Damage, leakage and/or deformity from hose mouthpiece.
  - Wear, damage, cutting of covering, or exposure of strengthening wire layer.
  - Cover portion is swollen in places.
  - There is twisting or crushing at movable parts of hose.
  - Foreign material is embedded in the covering.

## SAFETY

**⚠ WARNING:** For reasons of safety, always follow these safety precautions.

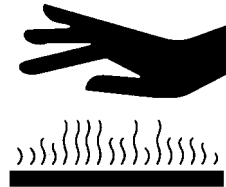
### PRECAUTIONS WITH HIGH PRESSURE OIL

- When inspecting or replacing high pressure piping or hoses, check that the pressure has been released from the circuit. Failure to release the pressure may lead to serious injury. Always do as follows.
- For details of the method of releasing the pressure: → **See 8.1 STOP THE ENGINE BEFORE CARRYING OUT INSPECTION AND MAINTENANCE on page 1-26** Do not carry out any inspection or replacement operation before the pressure has been completely removed.
- If there is any leakage from the piping or hoses, the piping and hoses and the area around them will be wet, so check for cracks in the piping or cracks or swelling in the hoses. If it is difficult to find the location, please contact your distributor.
- Wear protective glasses and leather gloves.
- If oil is leaking under high pressure from small holes, it is dangerous if it hits your skin or enters your eyes. It may make holes in your skin or cause blindness. If you are hit by a jet of high-pressure oil and suffer serious injury to your skin or eyes, wash off the oil with large amounts of water, then consult a doctor immediately for medical attention.



### PRECAUTIONS WHEN CARRYING OUT MAINTENANCE AT HIGH TEMPERATURE OR PRESSURE

- Immediately after stopping machine operations, the engine cooling water and oil at all parts are at high temperatures and under high pressure. In this condition, if the radiator cap is removed, or the oil or water are drained, or the filters are replaced, this may result in burns or other injury. Wait for the temperature to go down, then carry out the inspection and maintenance in accordance with the procedures given in this manual.



**Cleaning inside of cooling system → See 24.2.2 COOLING SYSTEM on page 3-27**

**Checking cooling water level, hydraulic oil level → See 24.3 CHECK BEFORE STARTING on page 3-43**

**Checking lubricating oil level, adding oil → See 24.3 CHECK BEFORE STARTING on page 3-43**

**Changing oil, replacing filters → See 24.3 CHECK BEFORE STARTING on page 3-43**

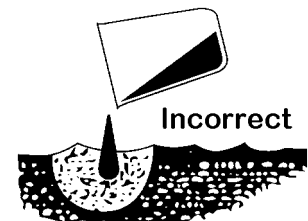
### WASTE MATERIALS

To prevent pollution of the environment, always do as follows.

Never dump waste oil in a sewer system, rivers, etc.

Always put oil drained from your machine in containers. Never drain oil directly onto the ground.

Obey appropriate laws and regulations when disposing of harmful materials such as oil, fuel, solvent, filters, and batteries.



### CHECKS AFTER INSPECTION AND MAINTENANCE

If inspection and maintenance items are forgotten or the function of the maintenance locations is not checked properly, unexpected problems may occur and this may lead to serious personal injury. Always do as follows.

- Checks after stopping engine
  - Has any inspection or maintenance location been forgotten?
  - Have any tools or parts been dropped? This is particularly dangerous if they get caught in the link mechanism for the levers.
  - Is there any leakage of water or oil? Have all the bolts been tightened properly?
- Checks when engine is running
  - **For details:** → **See 8.2 TWO WORKERS FOR MAINTENANCE on page 1-30** and pay full attention to safety.
  - Is the actuation of the inspection and maintenance locations correct?
  - Is there any oil leakage when the engine speed is raised and load is applied to the hydraulic system?

### MAINTENANCE FOR AIR CONDITIONER

If the air conditioner refrigerant gets into your eyes or touches your skin, it may cause blindness or frostbite.

- When handling the refrigerant, follow the precautions given on the container.
- To prevent the refrigerant from leaking into the atmosphere, use a recovery recycling system.
- Never touch the refrigerant.

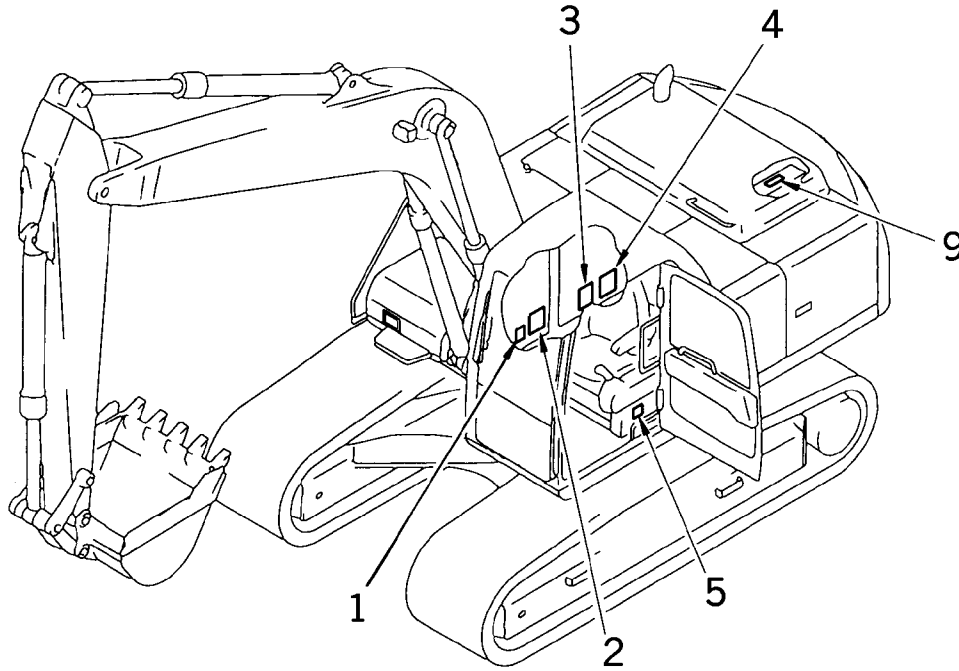


## 9. POSITION FOR ATTACHING SAFETY LABELS

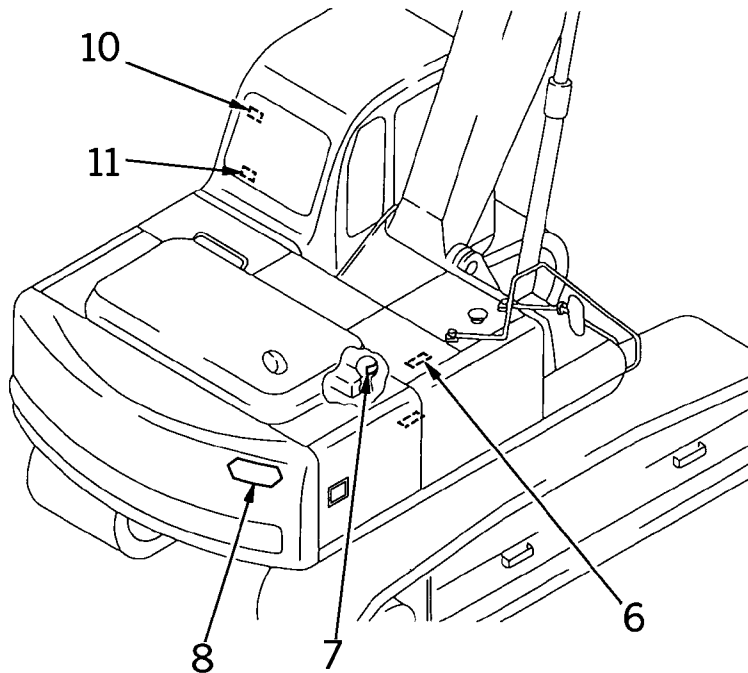
Always keep these labels clean. If they are lost or damaged, attach them again or replace them with a new label.

There are other labels in addition to the safety labels listed as follows, so handle them in the same way.

Safety labels may be available in languages other than English. To find out what labels are available, contact your distributor.



AN16731A



AW35412A

1. Warnings for leaving operator's seat  
(203-00-61270)

**⚠ WARNING**

To avoid hitting unlocked operation levers, lower equipment to ground and move **SAFETY LOCK LEVER** (located near seat) to **LOCK** position before standing up from operator's seat.

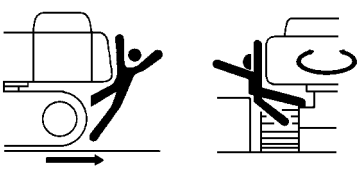
Sudden and unwanted machine movement can cause serious injury or death.

203-00-61270

X02AD104

2. Warnings before operating machine  
(203-00-61291)

**⚠ WARNING**



To prevent **SEVERE INJURY** or **DEATH**. Do the following before moving machine or its attachments:

- Honk horn to alert people nearby.
- Be sure no one is on or near machine or in swing area.
- Rotate cab for full view of travel path if it can be done safely.
- Use spotter if view is obstructed.

Follow above even if machine equipped with travel alarm and mirrors.

203-00-61291

X02AD105

3. Warnings for operation, inspection and maintenance.  
(14X-98-11580)

**⚠ WARNING**

Improper operation and maintenance can cause serious injury or death.

Read manual and labels before operation and maintenance. Follow instructions and warnings in manual and in labels on machine.


Keep manual in machine cab near operator. Contact your distributor for a replacement manual.

14X-98-11580

X02AD106

4. Warnings for high voltage  
(203-00-61310)

**⚠ DANGER**




Hazardous voltage hazard. Serious injury or death can occur if machine or attachments are not kept safe distance away from electric lines.

Line voltage	Safe Distance
6.6 kv	At least 10 ft (3 m)
66.0 kv	At least 16 ft (5 m)
275.0 kv	At least 33 ft (10 m)

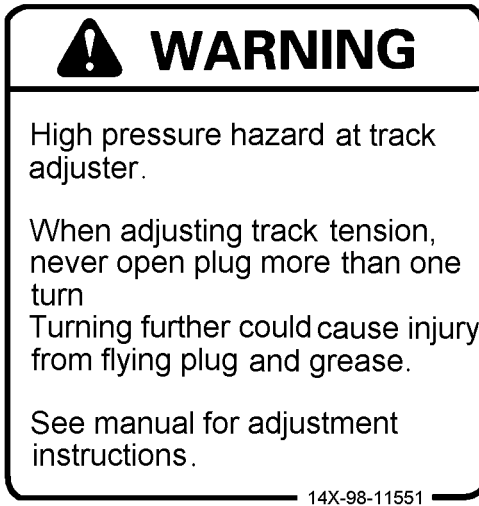
203-00-61310

X02AD107

## SAFETY

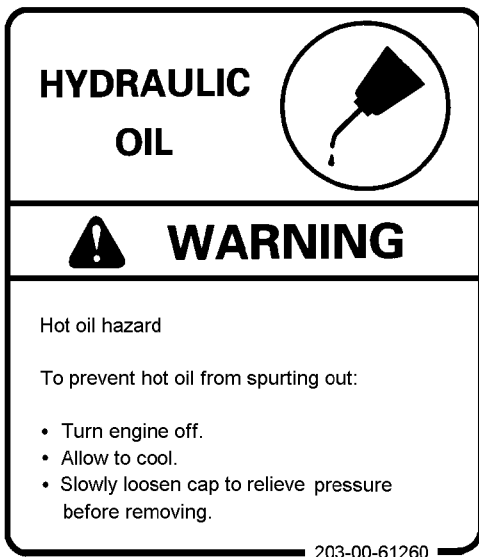
 **WARNING:** For reasons of safety, always follow these safety precautions.

5. Warnings when adjusting track tension  
(14X-98-11551)



X02AD108

6. Warnings for hot oil  
(203-00-61260)



X02AD109

7. Warnings for handling accumulator  
(14X-98-11390)



X02AD110

8. Keep off swing area  
(20Y-00-21270)



X02AD111

**⚠ WARNING:** Failure to follow these safety precautions may lead to a serious accident.

9. Warnings for hot water.

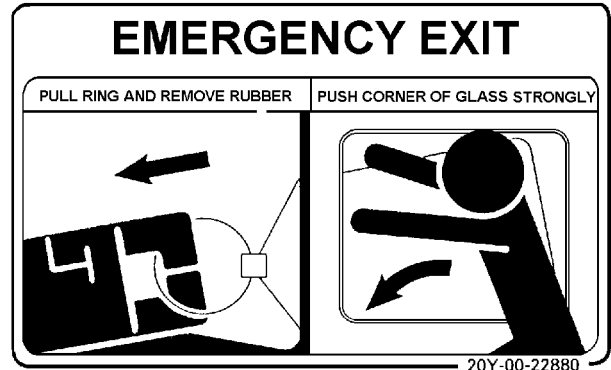
(14X-98-11531)



X02AD112

11. Explanation of emergency exit

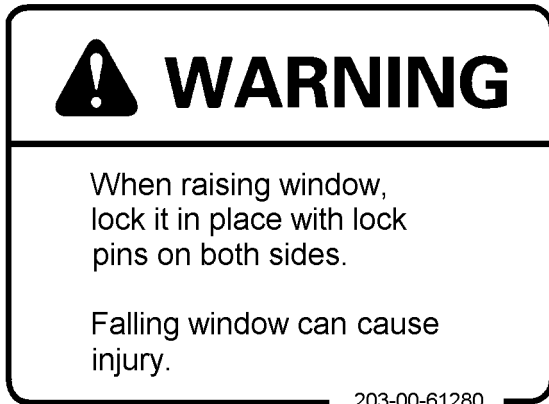
(20Y-00-22880)



X02AD114

10. Warnings when opening front windows.

(203-00-61280)



X02AD113

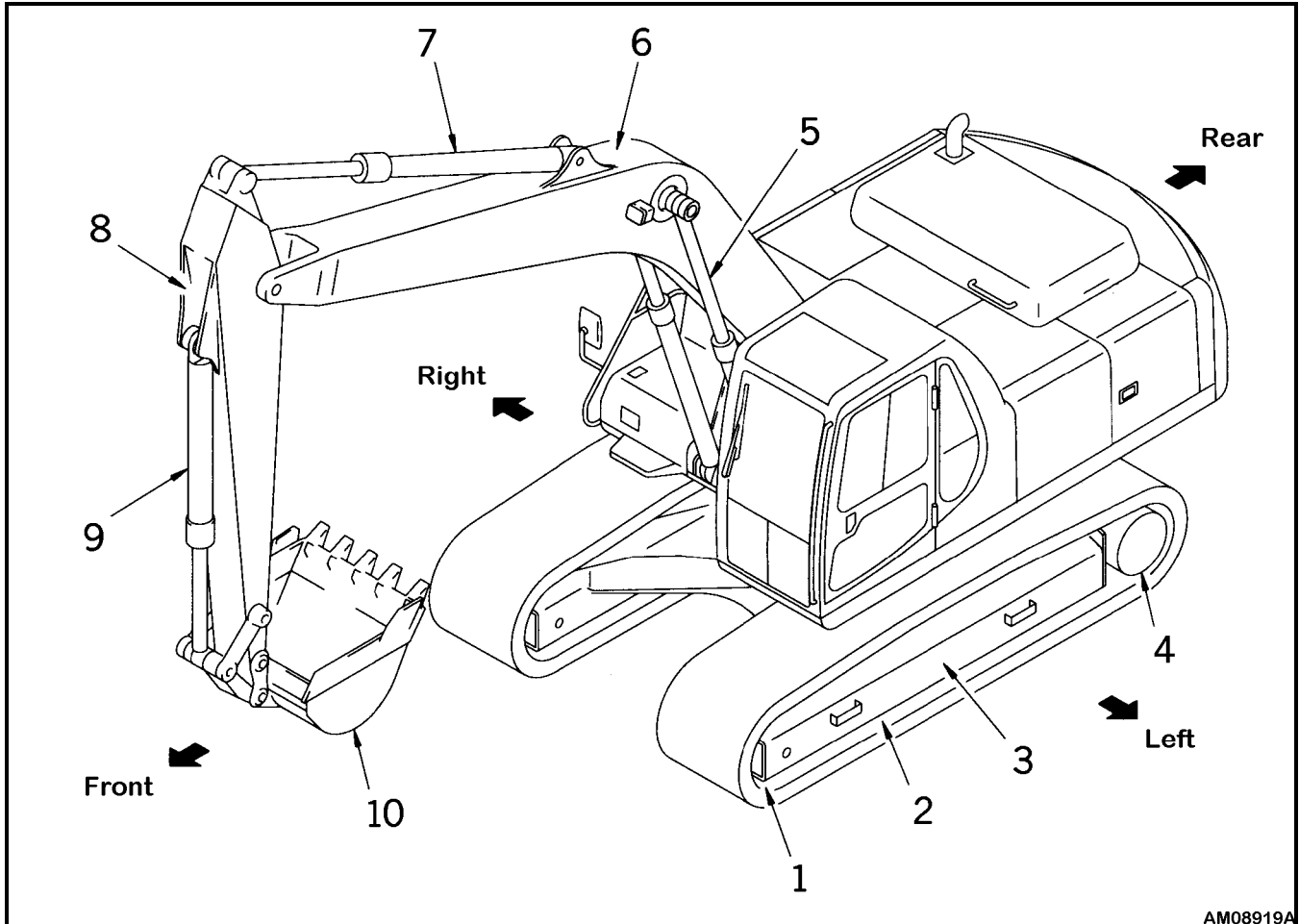
# **OPERATION**

# OPERATION

## 10. GENERAL VIEW

### 10.1 GENERAL VIEW OF MACHINE

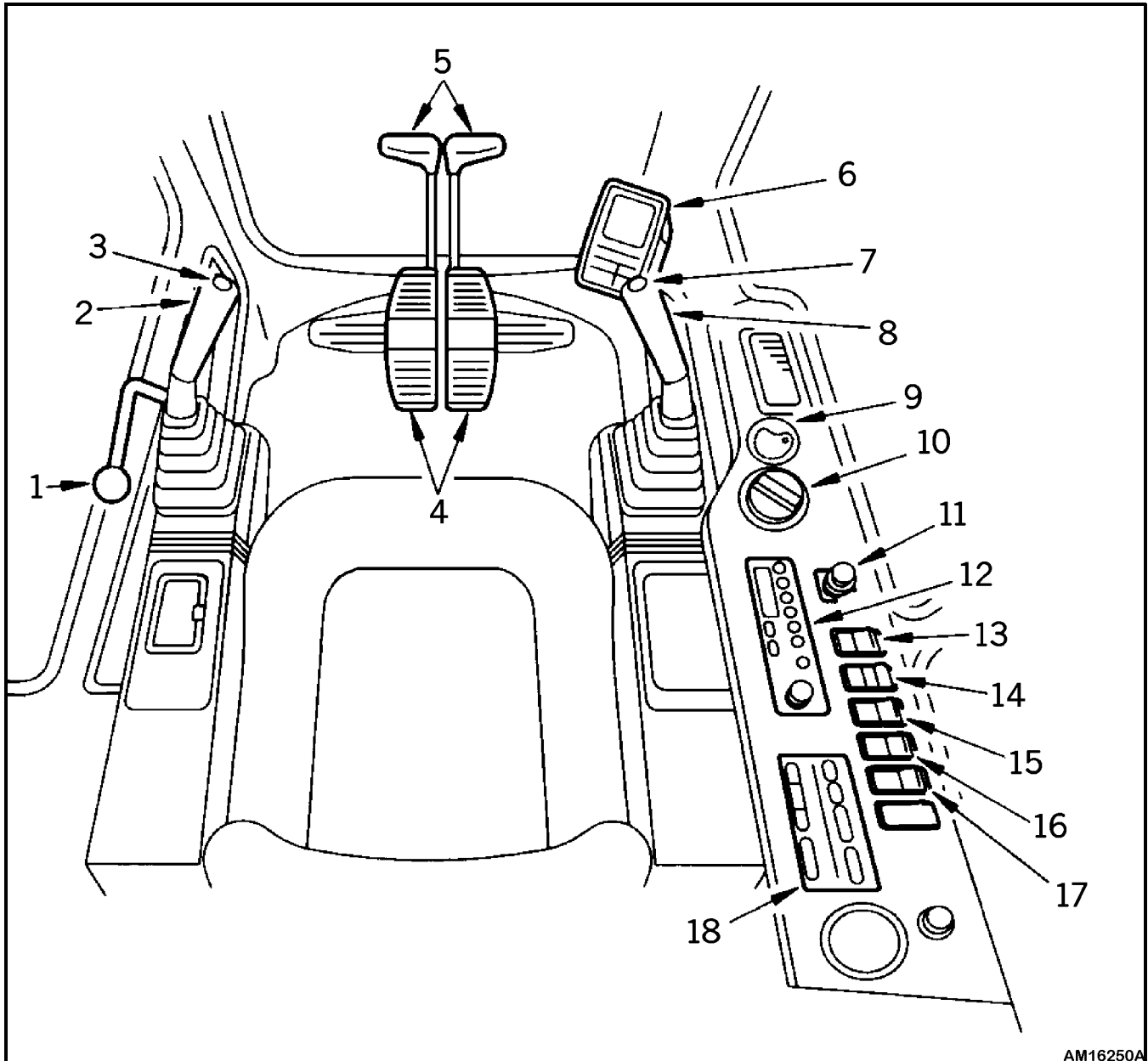
If directions are indicated in this manual, they refer to the directions shown by the arrows in the diagram below.



AM08919A

- |                |                  |                    |            |
|----------------|------------------|--------------------|------------|
| 1. Idler       | 4. Sprocket      | 7. Arm Cylinder    | 10. Bucket |
| 2. Track Shoe  | 5. Boom Cylinder | 8. Arm             |            |
| 3. Track Frame | 6. Boom          | 9. Bucket Cylinder |            |

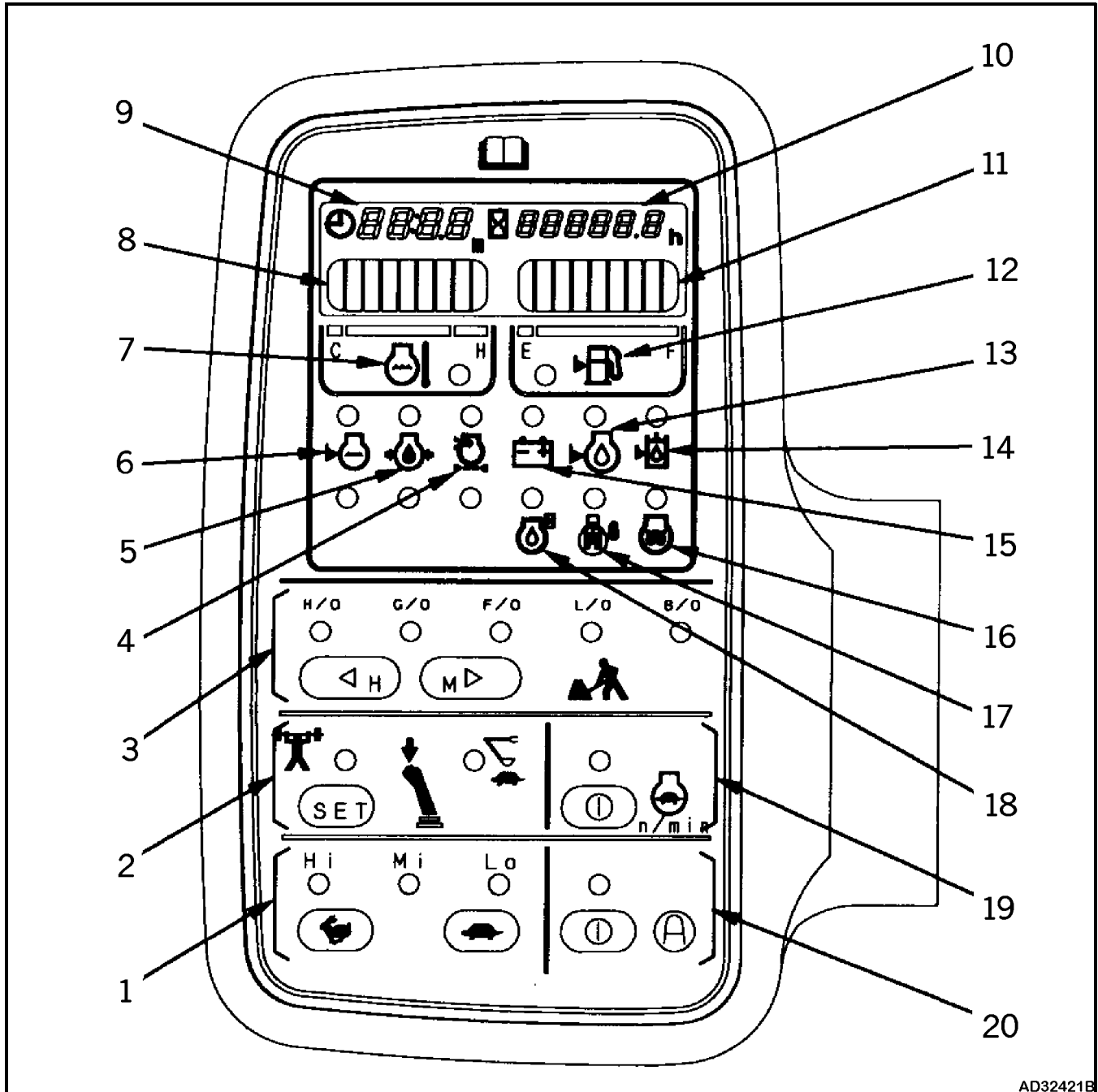
10.2 GENERAL VIEW OF OPERATORS COMPARTMENT



- |                      |                     |                        |                        |
|----------------------|---------------------|------------------------|------------------------|
| 1. Safety Lock Lever | 6. Machine Monitor  | 11. Lighter            | 16. Buzzer Stop Switch |
| 2. Left Work Lever   | 7. Horn Switch      | 12. Radio              | 17. Heater Fan Switch  |
| 3. Knob Switch       | 8. Right Work Lever | 13. Swing Lock Switch  | 18. A/C Controls       |
| 4. Travel Pedal      | 9. Starting Switch  | 14. Wiper Switch       |                        |
| 5. Travel Lever      | 10. Fuel Switch     | 15. Extra Light Switch |                        |

# OPERATION

## 10.3 GENERAL VIEW OF MONITOR PANEL



AD32421B

- |                                       |                                     |                                    |
|---------------------------------------|-------------------------------------|------------------------------------|
| 1. Travel Speed Switch                | 8. Engine Coolant Temperature Gauge | 14. Hydraulic Oil Level Monitor    |
| 2. Power Max Slow Down Switch         | 9. Display - Clock or Fault         | 15. Charge Level Monitor           |
| 3. Working Mode Switch                | 10. Service Meter                   | 16. Engine Preheat Monitor         |
| 4. Air Cleaner Monitor                | 11. Fuel Gauge                      | 17. Swing Lock Monitor             |
| 5. Engine Oil Pressure Monitor        | 12. Fuel Level Monitor              | 18. Engine Oil Replacement Monitor |
| 6. Radiator Coolant Monitor           | 13. Engine Oil Level Monitor        | 19. Auto Deceleration Switch       |
| 7. Engine Coolant Temperature Monitor |                                     | 20. Active Mode Switch             |



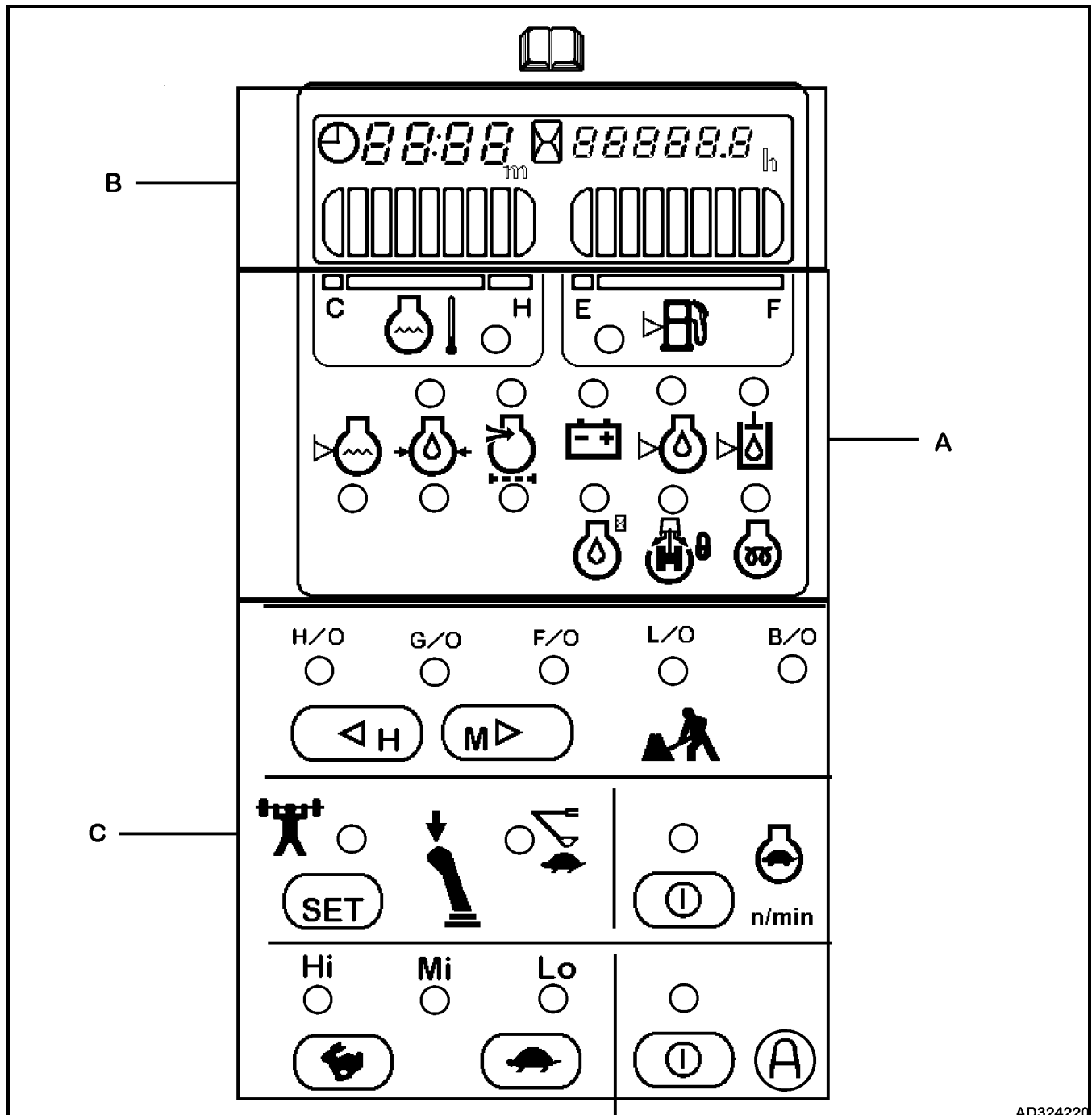
## 11. EXPLANATION OF COMPONENTS

The following is an explanation of the devices needed for operating the machine.

To carry out suitable operations correctly and safely, it is important to understand fully the methods of operating the equipment and the meanings of the displays.

### 11.1 MACHINE MONITOR

This monitor system consists of a monitor light group (A), a meter group (B) and switch group (C).



AD324220

## OPERATION

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### A. MONITOR LIGHT GROUP

The monitor light group is divided into three sets of items as listed following.

#### Basic Check Items

This displays the basic items that should be checked before starting the engine. If there is any abnormality, the appropriate monitor lamp will flash.

#### REMARK

When carrying out checks before starting, do not simply rely on the monitor. Always refer to the periodic maintenance items; see 12 OPERATION on page 2-43. to carry out checks.

#### Caution Items



#### WARNING

If these monitor items flash, check and repair the location as soon as possible.

These are items which need to be observed while the engine is running. If any abnormality occurs, items which need to be repaired as soon as possible are displayed. If there is any abnormality, the appropriate monitor lamp will flash to indicate the location of the abnormality.

#### Emergency Stop Items



#### WARNING

If any monitor lamp flashes, stop the engine or run it at low idle, and take the following action.

These are items which need to be observed while the engine is running. If any abnormality occurs, items which need to be repaired immediately are displayed.

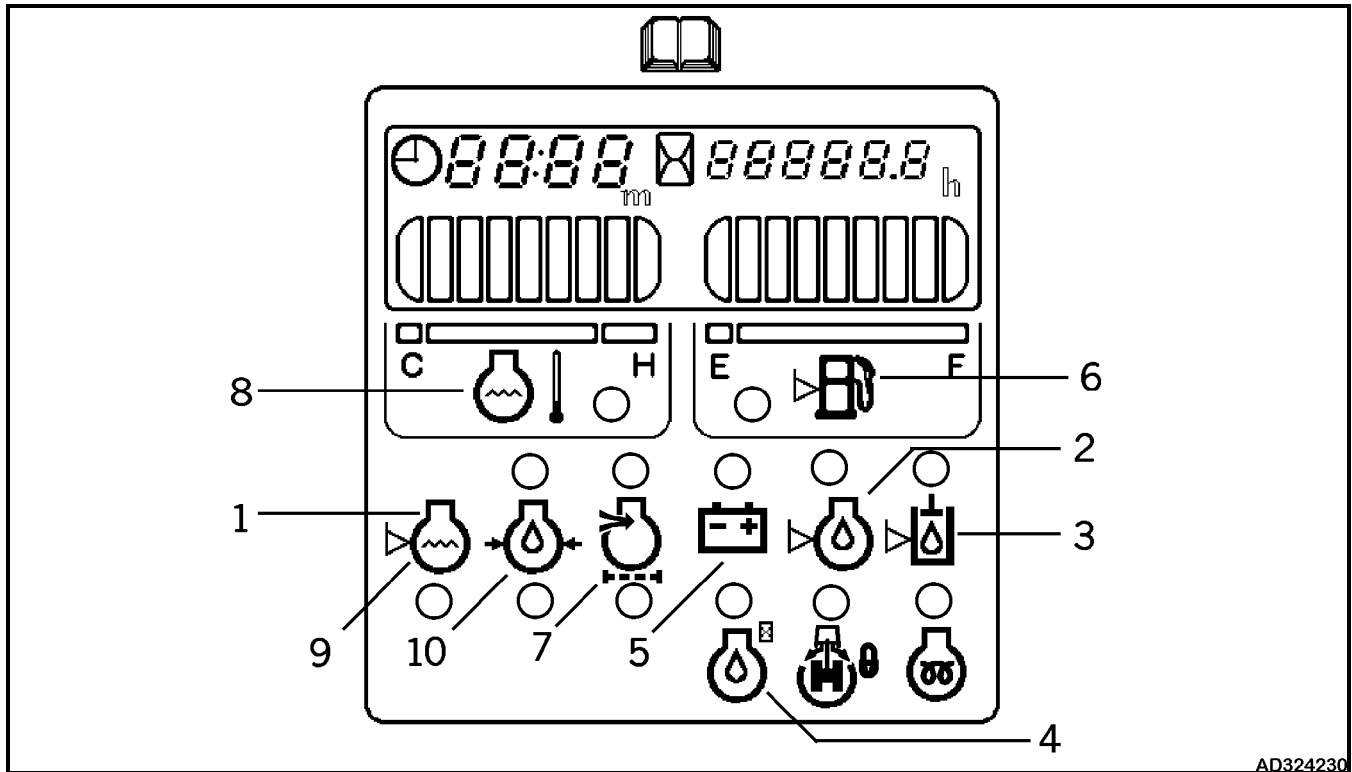
### B. METER GROUP

This portion consists of preheat monitor, swing lock monitor, engine water temperature gauge, fuel gauge, service meter and display.

### C. SWITCH GROUP

This selects working mode, travel speed and time setting of clock.

11.1.1 MONITOR LIGHT GROUP



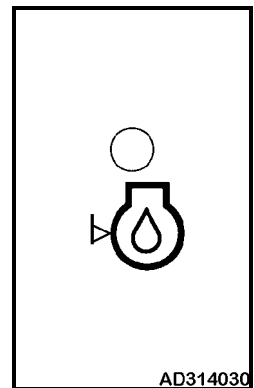
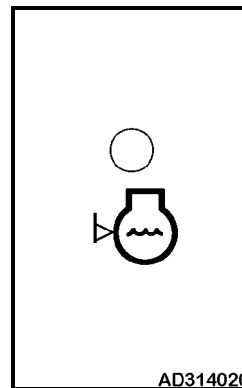
AD324230

**1. Radiator Coolant Level (Basic Check Items)**

This warns that the radiator coolant level is too low. If the monitor light flashes, check the coolant level in the radiator and reserve tank, and add.

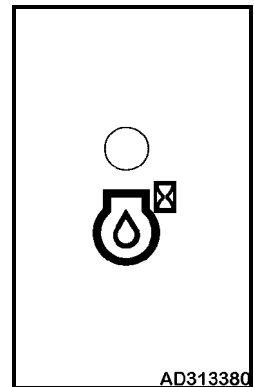
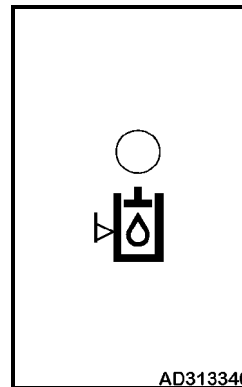
**2. Engine Oil Level**

This warns that the oil level in the engine oil pan is too low. If the monitor light flashes, check the oil level in the engine oil pan and add oil.



**3. Hydraulic Oil Level**

This warns that the hydraulic oil level is too low. If the monitor light flashes, check the hydraulic oil level and add oil.



**4. Replacement of Engine Oil**

If the set time (125, 250, 500H) passes after the engine oil is replaced, this light illuminates. At this time, replace the engine oil.

## OPERATION

### 5. Charge Level (Caution Items)

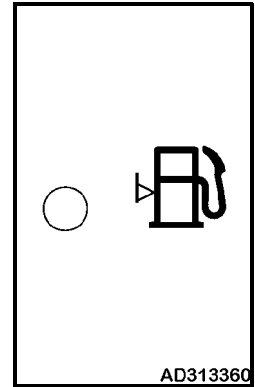
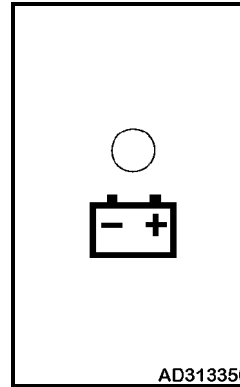
This monitor indicates an abnormality in the charging system while the engine is running. If the monitor light flashes, check the V-belt tension. If any abnormality is found; See 16.6 OTHER TROUBLE on page 2-105

#### REMARK

While the starting switch is ON, the light will remain illuminated and will go off once the engine is started.

### 6. Fuel Level

If the fuel drops below 45 ℓ (11.9 gal), the light will flash. Fill up with fuel at this time.

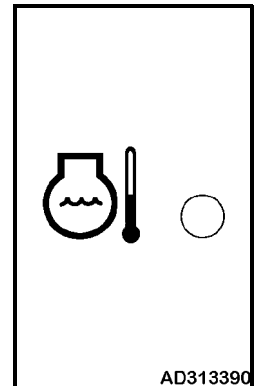
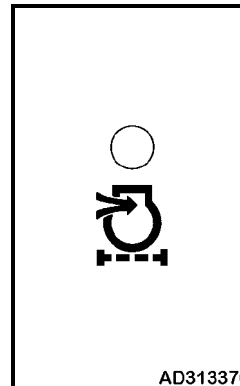


### 7. Air Cleaner Clogging

If the air cleaner element has clogged, the monitor light flashes. Stop the engine, check the air cleaner element and clean it.

### 8. Engine Coolant Temperature (Emergency Stop Items)

If the temperature of the engine coolant becomes abnormally high, the monitor light flashes, and the overheat prevention system is automatically actuated to reduce the engine speed. Stop operations and run the engine at low idle until the engine coolant temperature gauge enters the green range.



### 9. Radiator Coolant Level

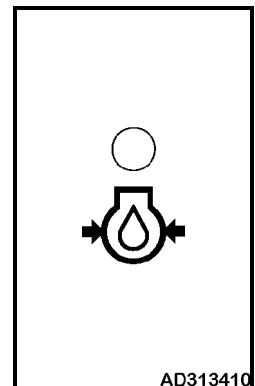
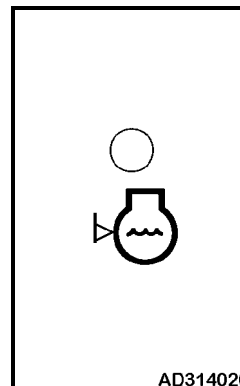
If the radiator coolant level drops, the monitor light flashes. Stop the engine, check the radiator coolant level, and add if necessary.

### 10. Engine Oil Pressure

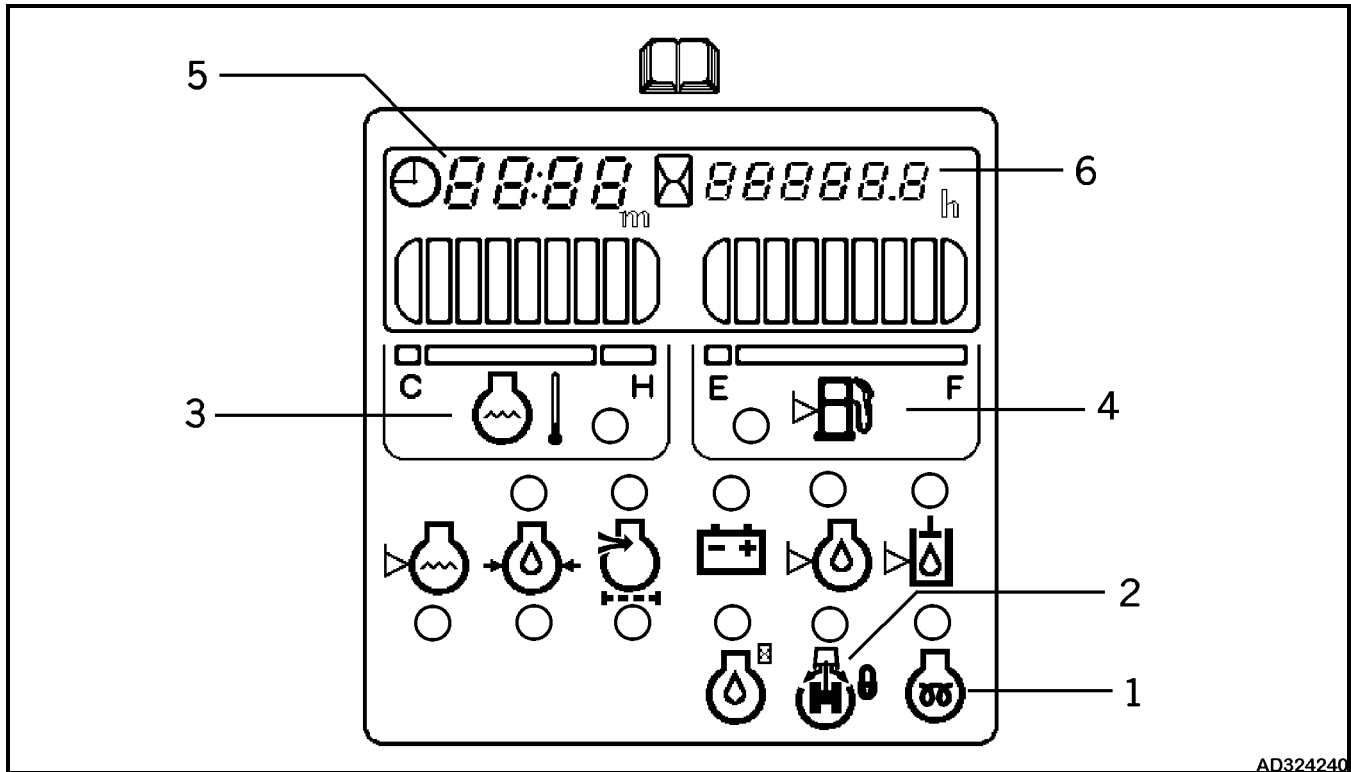
If the engine oil pressure drops below the normal pressure, the monitor light flashes. At this time, stop the engine and inspect it according; See 16.6 OTHER TROUBLE on page 2-105

#### REMARK

While the starting switch is ON, the light remains lit and goes off once the engine is started. When the engine starts, the buzzer may sound for a short time, however this does not indicate a fault.



11.1.2 METER DISPLAY PORTION



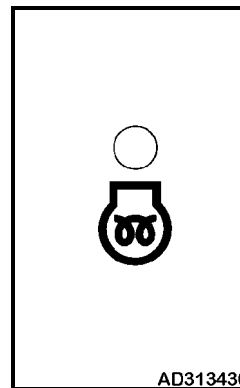
AD324240

**PILOT DISPLAY**

When the starting switch is ON, the pilot display lights up when the display items are functioning.

**1. Engine Preheat Monitor**

This monitor light indicates the preheat time required when starting the engine at an ambient temperature below 0°C (32°F). The monitor light illuminates when the starting switch is turned to HEAT position and flashes after 30 seconds to show that the preheat is done. The monitor lamp will go off after about 10 seconds.



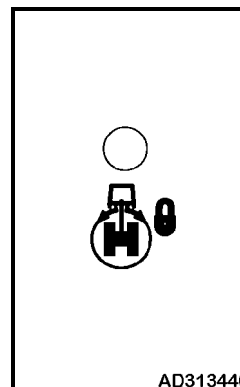
AD313430

**2. Swing Lock Light**

This informs the operator that the swing lock is being actuated.

When the swing lock switch is turned ON (actuated), the monitor light illuminates.

When the swing lock override switch is turned on, this monitor light flashes.



AD313440

**REMARK**

A disc brake is installed in the swing motor to mechanically stop motor rotation. The brake is always applied while the swing lock is actuated.

## OPERATION

### METERS

#### 3. Engine Coolant Temperature Gauge

This gauge indicates the engine coolant temperature. If the engine coolant temperature is normal during operation, the green range will illuminate. If the red range illuminates, the overheat prevention system will be actuated.

The overheat prevention system acts as follows.

When the red range (1) lights up:

Engine coolant temperature monitor (3) flashes.

When red range (2) lights up:

Engine speed is lowered further to low idle, engine coolant temperature monitor (3) flashes, and alarm buzzer sounds at the same time.

The overheat prevention system is actuated until the temperature enters the green range. When red range (2) lights, if the engine coolant temperature is reduced and the fuel control dial is turned to the low idle position, the display will be canceled.

#### 4. Fuel Gauge

This gauge indicates the amount of fuel in the fuel tank. If the fuel level is normal during operation, the green range will illuminate.

If only the red range illuminates during operation, there is less than 45 l (11.9 gal) of fuel remaining in the tank, so add fuel.


Red range (1) ON: Fuel gauge monitor lamp (LED) (2) flashes.

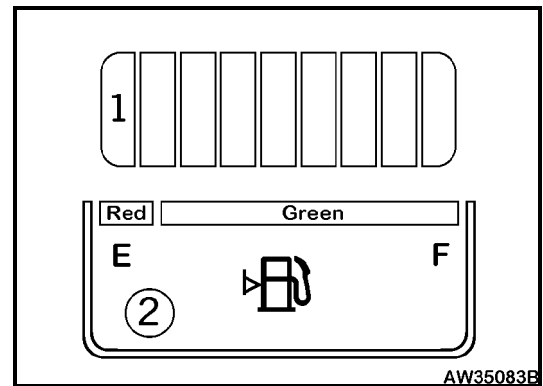
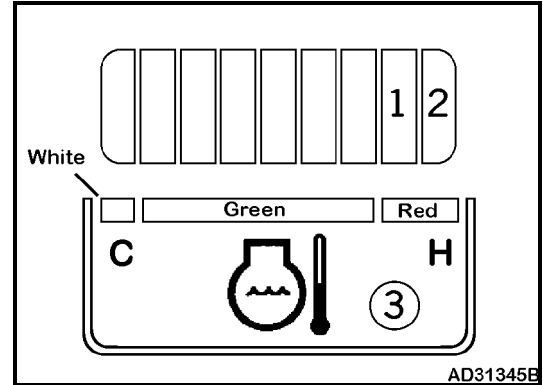
After the starting switch is turned ON, the correct level may not be displayed for a moment, but this does not indicate any abnormality.

When stopping the engine, turn the starting switch ON and check that all monitor lights and meters illuminate.

#### 5. Display

When the starting switch is ON, the time and service meter reading is displayed if the condition is normal. If the condition is abnormal, the content of the failure is displayed.

When setting the time, the symbol  flashes.



**Manual Setting**

1. When the time is displayed, depress clock switch (1) for 2.5 seconds or more.
2. ⊕ flashes.
3. Pressing H switch (2) increases hours and pressing M switch (3) increases minutes. If the switch (2) or (3) is pressed for 2.5 seconds or more, the hours or minutes increase continuously. When the correct time is reached, press clock switch (1). This completes clock setting.

**Correct Time Setting**

1. When the time is displayed, depress the clock switch for 2.5 seconds or more.
2. ⊕ flashes.
3. When SET switch (4) is pressed, the hour is rounded off for 0 to 14 minutes and rounded up for 45 to 59 minutes.

[Examples] 10:14 becomes 10:00 (rounded off)  
 10:45 becomes 11:00 (rounded up)

When SET switch (4) is pressed at the time signal or standard clock, the correct time is obtained.

4. When the correct time is reached, press clock switch (1). This completes clock setting.

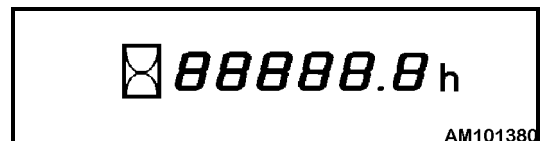
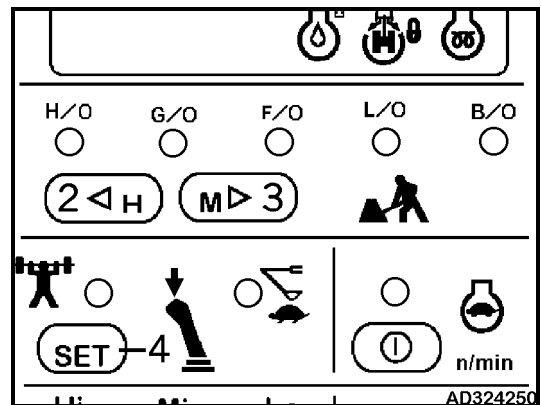
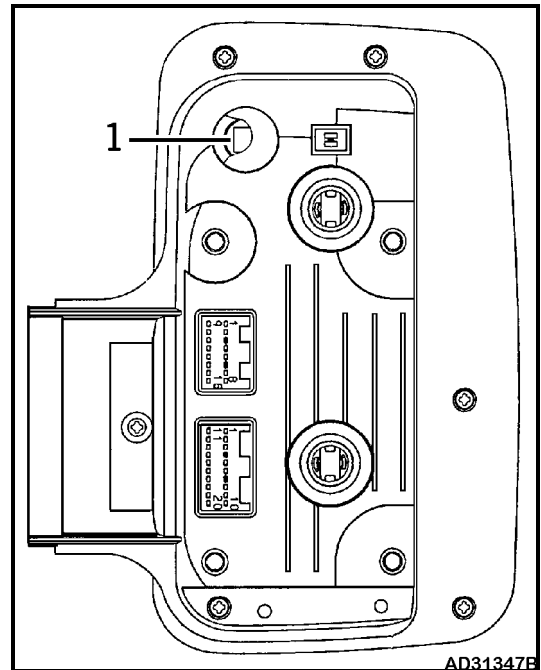
If the machine has a fault, error information appears while the starting switch is ON. The monitor flashes and displays all error information sequentially.

Monitor indications	Error mode
E02	PC-EPC valve system error
E03	Swing brake system error
E05	Governor system error
CALL	Non-operating error

If any of these monitors flashes; See 16.6.4 ELECTRONIC CONTROL SYSTEM on page 2-108

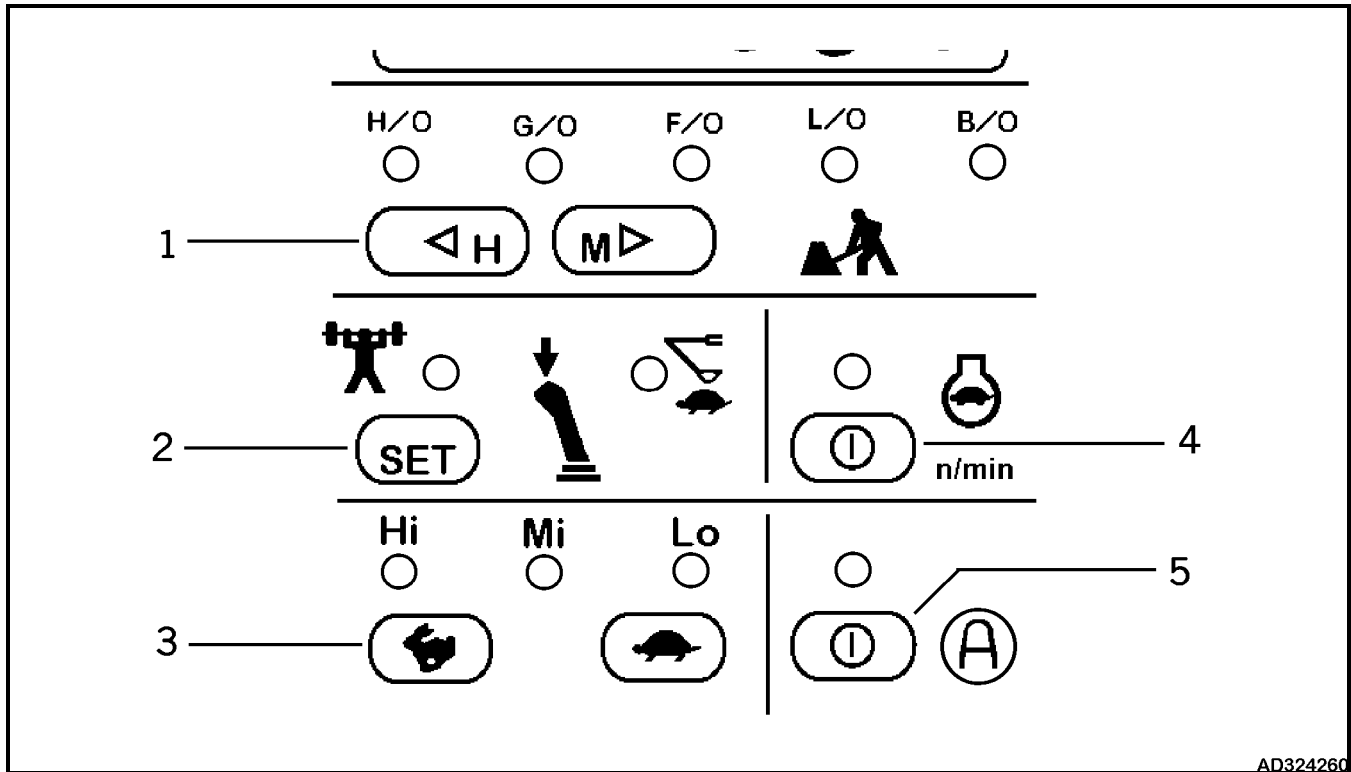
**6. Service Meter**

This meter shows the total operation hours of the machine. Set the periodic maintenance intervals using this display. The service meter advances while the engine is running, even if the machine is not traveling. The meter will advance by 1 for each hour of operation regardless of the engine speed.



## OPERATION

### 11.1.3 SWITCHES



#### 1. Working Mode Selector Switch

This switch is used to set the movement and power for the work equipment. By selecting the mode to match the working conditions, it is possible to carry out operations more easily.

- H/O** (Heavy-Duty Operation Mode) light illuminates - This is used for heavy-duty work.
- G/O** (General Operation Mode) light illuminates - This is used for ordinary work.
- F/O** (Finishing Operation Mode) light illuminates - This is used for leveling or grading work.
- L/O** (Lifting Operation Mode) light illuminates - This is used for fine control operations.
- B/O** (Breaker Operation Mode) light illuminates - This is used for breaker operations.

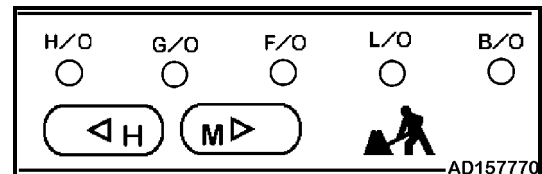
When starting the engine, G/O mode is automatically selected. Each time the switch is pressed, the mode selection changes.

#### NOTICE

When using the breaker, do not set to the H/O mode.

#### REMARK

The H switch is used for changing the hour and the M switch is used for changing the minute when setting the time. For details; See 11.1.2 DISPLAY on page 2-10.





## 2. Power Maximum, Swift Slow Down Switch

During operations, the knob switch can be operated at a touch to increase the power or reduce the speed (while the switch remains pressed).

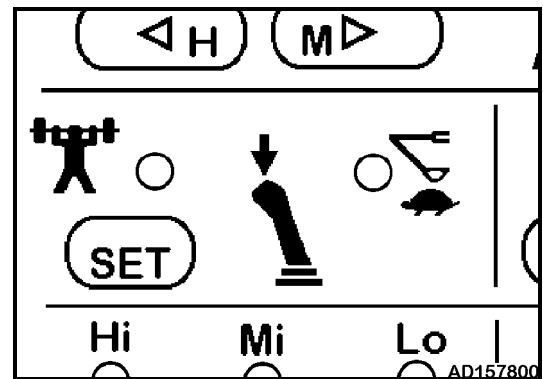
When power maximum light illuminates:

When the working mode is set to H/O or G/O mode, the power is increased while the knob switch is kept pressed. Even if the knob switch is kept pressed, the power maximum function is stopped after approximately 8.5 seconds.

When swift slow down light illuminates:

When the working mode is set to H/O or G/O mode, the speed is reduced while the knob switch is kept pressed.

When the engine is started, the power max light illuminates. Each time the SET switch is pressed, the mode is switched.



## 3. Travel Speed Switch

### **WARNING**

If the Hi-Lo switch is operated when the machine is traveling, the machine may deviate even when traveling in a straight line. To prevent this, always stop the machine before operating the travel speed switch.

This is used to select the three travel speeds.

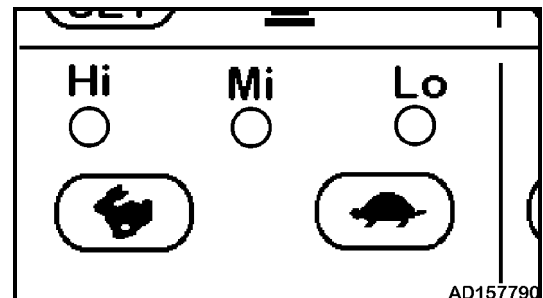
**Lo** light illuminates - Low speed travel.

**Mi** light illuminates - Middle speed travel

**Hi** light illuminates - High speed travel.

When the engine is started, the travel speed is automatically set to Lo.

When traveling in high speed travel (Hi) or middle speed travel (Mi), the travel speed is automatically switched to low speed travel (Lo) to match the travel surface on soft ground or when traveling uphill, so there is no need to operate this switch. Monitor light remains illuminated (Hi or Mi).

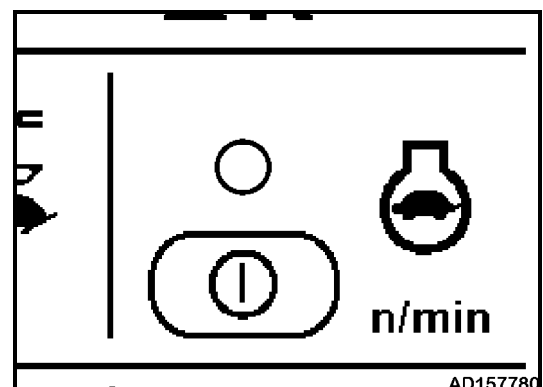


## 4. Auto-deceleration Switch

This switch acts to activate the function that automatically lowers the engine speed and reduces fuel consumption when the control lever is at neutral.

ON lights up : Auto-deceleration is actuated.

OFF : Auto-deceleration is canceled.



## OPERATION

### 5. Active Mode Switch

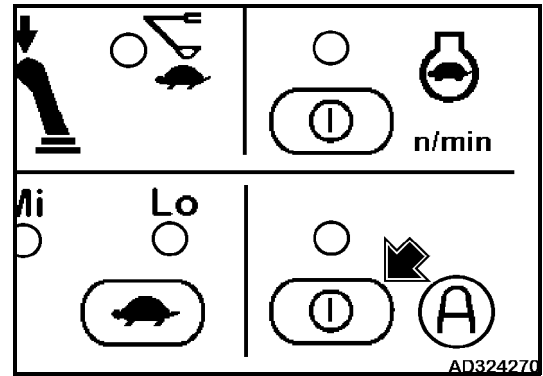
The active mode is effective for quick leveling operations or deep digging and loading operations.

Light illuminates: Active mode is actuated.

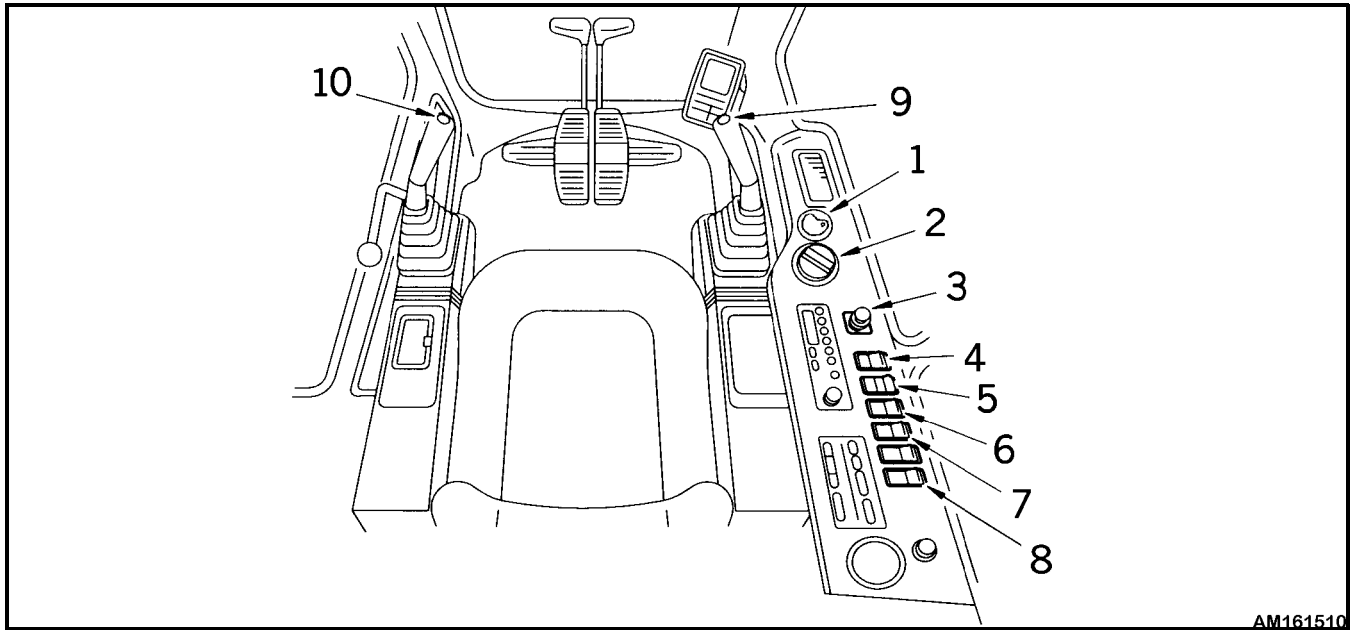
Light goes out: Active mode is canceled.

The light is off when the engine is started. It is possible to enter the active mode from any working mode.

If the active mode is actuated (lights illuminates), the working mode display does not change (display remains in H/O, etc.). When the active mode is canceled (light goes out), the system returns to the displayed working mode.



## 11.2 SWITCHES



AM161510

### 11.2.1 STARTING SWITCH

This switch is used to start or stop the engine.

#### OFF position

The key can be inserted or withdrawn. The switches for the electric system except the cab lamp and clock, are all turned off and the engine is stopped.

#### ON position

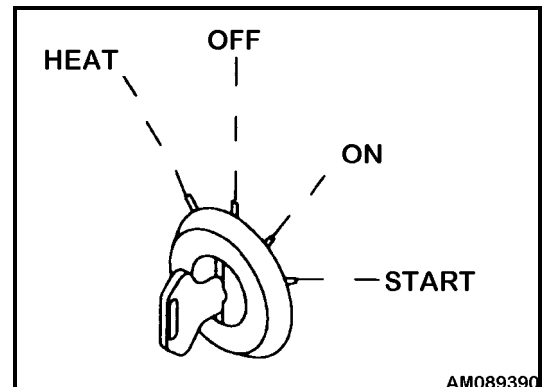
Electric current flows in the charging and lamp circuits. Keep the starting switch key at the ON position while the engine is running. Electricity flows to all electrical circuits except the START and HEAT circuit.

#### START position

This is the engine-start position. Keep the key at this position during cranking. Immediately after starting the engine, release the key which will automatically return to the ON position.

#### HEAT (preheat) position

When starting the engine in winter, set the key to this position. When the key is set to the HEAT position, the preheat monitor lights up. Keep the key at this position until the monitor lamp goes off. Immediately after the preheat monitor goes off, release the key. The key automatically returns to the OFF position. Then, start the engine by turning the key to the START position.



AM089390

## OPERATION

### 11.2.2 FUEL CONTROL DIAL

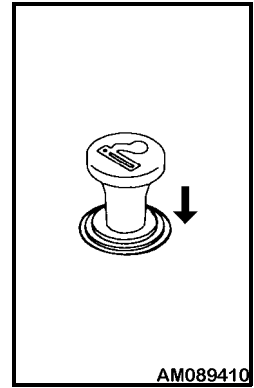
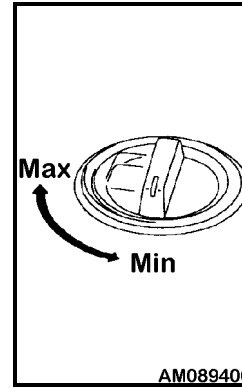
This adjusts the engine speed and output.

Low idle (MIN): Turned fully to the left

Full speed (MAX): Turned fully to the right

### 11.2.3 CIGARETTE LIGHTER

This is used to light cigarettes or cigars. To use, push the lighter in. After a few seconds it will spring back. Pull out the lighter and light your cigarette. By removing the cigarette lighter, the socket is available as a power source for the yellow flashing lamp. Max. current is 3.5 A (85 W).



### 11.2.4 SWING LOCK SWITCH



#### WARNING

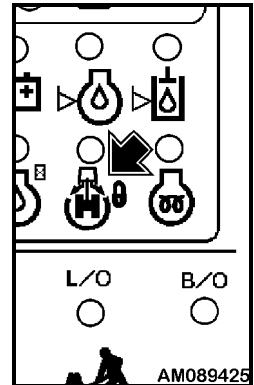
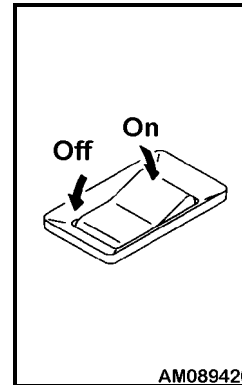
- When the machine is traveling under its own power, or when the swing is not being operated, always set the switch to the ON (ACTUATED) position.
- On a slope, the work equipment may swing to the down side even if the swing lock switch is located at the ON position. Be careful concerning this point.

This switch is used to lock the upper structure so that it cannot swing.

ON position (actuate): The swing lock is always applied, and the upper structure will not swing even if the swing is operated. In this condition, the swing lock light illuminates.

OFF position (cancel): The swing lock is applied only when all work equipment control levers are at neutral; when any work equipment control lever is operated, it is canceled.

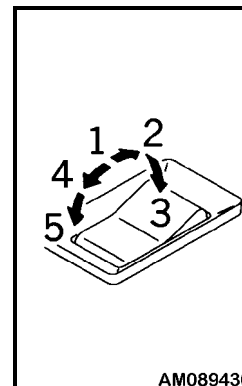
The swing lock is actuated approx. 4 seconds after all work equipment control levers are placed in neutral.



### 11.2.5 WIPER SWITCH

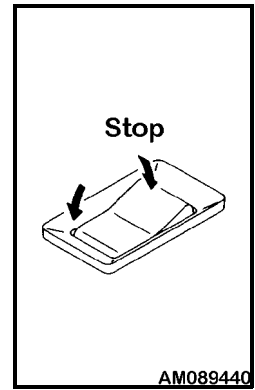
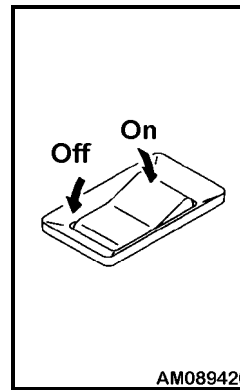
This actuates the wiper for the front glass.

1. OFF: Wiper stops
2. ON: Wiper moves continuously
3. Window washer fluid is sprayed out. When switch is released it returns to position (2).
4. ON: Wiper moves intermittently
5. Window washer fluid is sprayed out. When switch is released it returns to position (4).



**11.2.6 LIGHT SWITCH**

This switch is used to turn on the front lights, working lights, additional light at the top front of the cab, rear lights, and monitor lighting.



**11.2.7 ALARM BUZZER STOP SWITCH**

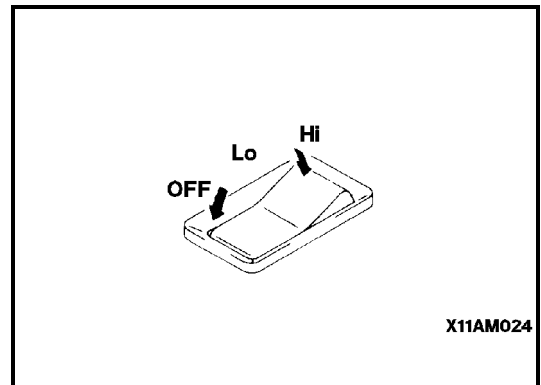
This is used to stop the alarm buzzer if it sounds to warn of an abnormality during operation.

**11.2.8 CAB HEATER FAN SWITCH**

This adjusts air-flow in 2 steps

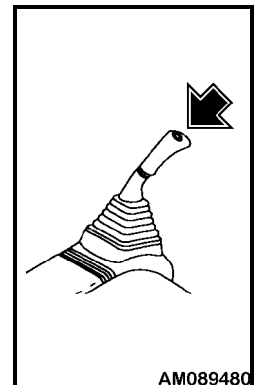
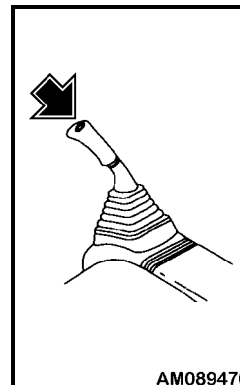
Hi: Strong air-flow.

Lo: Weak air-flow



**11.2.9 HORN SWITCH**

Press the switch on the right work equipment lever to sound the horn.



**11.2.10 KNOB SWITCH**

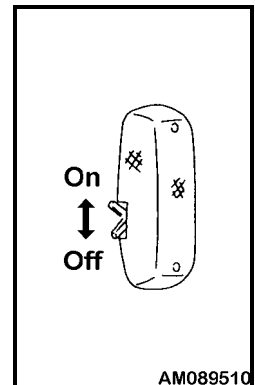
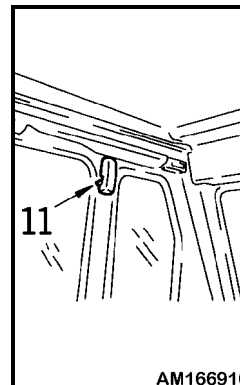
The knob switch on the left work equipment lever is used to actuate the power max or swift slow down functions. Keep the switch pressed. The power max. function can be used for a maximum of 8.5 seconds in H/O or G/O mode. The swift slow down function can be used for as long as the switch is kept pressed.

**11.2.11 CAB LIGHT SWITCH**

This is used to turn on the cab light.

ON: Lights up

It is possible to turn on the cab light even when the starting switch is at the OFF position, so be careful not to forget to turn it off.



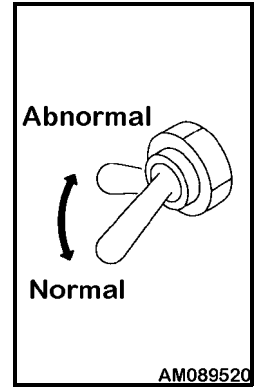
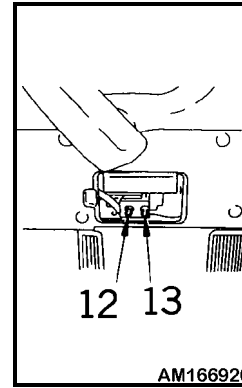
## OPERATION

### 11.2.12 PUMP CONTROL OVERRIDE SWITCH

When normal: Switch is pushed down

When abnormal: When the monitor display shows E02 (PC-EPC valve system error), move the switch up to make it possible to carry out work.

The pump control override switch is provided to make it possible to carry out work for a short time when there is a failure in the pump control system (PC-EPC valve system error). It is necessary to repair the abnormal location immediately.

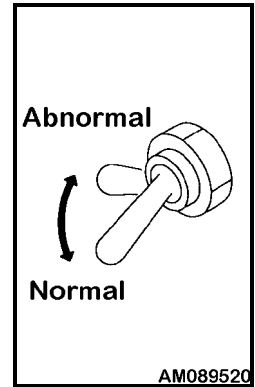
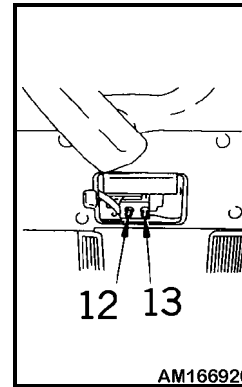


### 11.2.13 SWING LOCK OVERRIDE SWITCH

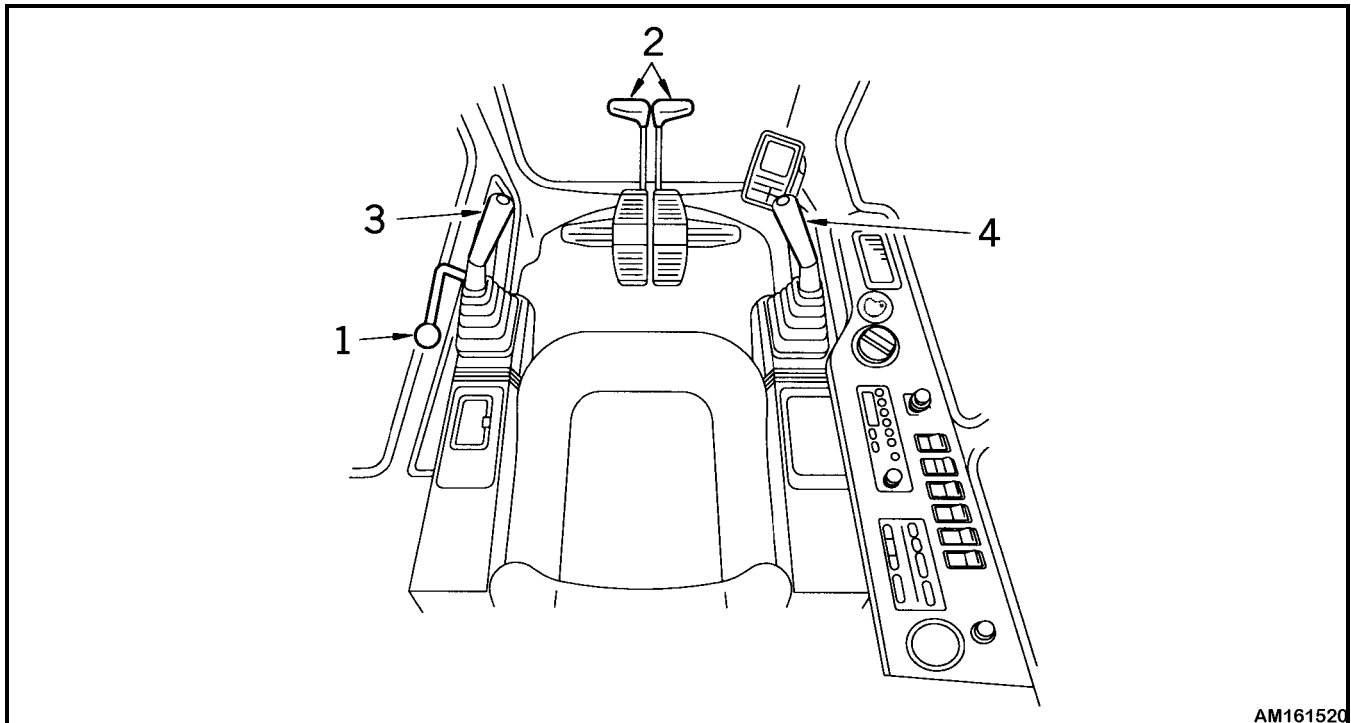
When normal: Switch is pushed down

When abnormal: When the monitor display shows E03 (Swing brake system error), the brake is canceled, and it becomes possible to actuate the swing and carry out normal operations. However, the swing brake remains released.

The swing lock override switch is provided to make it possible to carry out swing operations for a short time even when there is an abnormality in the swing brake electric system (Swing brake system error). It is necessary to repair the abnormality immediately.



### 11.3 CONTROL LEVERS AND PEDALS

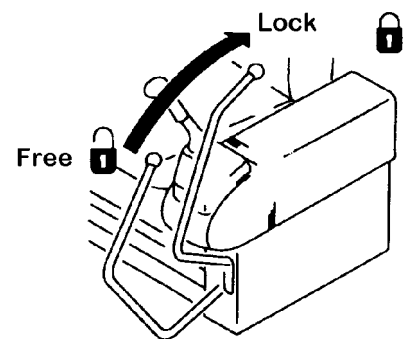


AM161520

#### 11.3.1 SAFETY LOCK LEVER

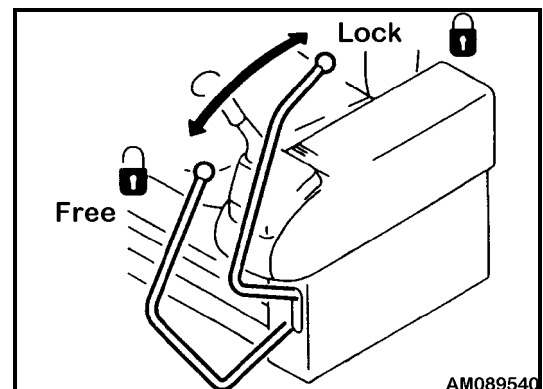
#### WARNING

- When leaving the operators compartment, set the safety lock lever securely to the LOCK position. If the control levers are not locked, and they are touched by mistake, this may lead to a serious accident. If the safety lock lever is not placed securely in the LOCK position, the control levers may not be properly locked. Check that the situation is as shown in the diagram.
- When the safety lock lever is raised, take care not to touch the work equipment control lever. If the safety lock lever is not properly locked at the up position, the work equipment and swing will move, creating a potentially dangerous situation.
- When the safety lock lever is lowered, take care not to touch the work equipment control lever.



AM088930

This lever locks the controls for the work equipment, swing, travel, and optional attachments. Pull the lever up to apply the lock. This lock lever is a hydraulic lock, so even if it is in the lock position, the work equipment control lever and travel lever will move, but the work equipment, travel motor, and swing motor will not work.



AM089540

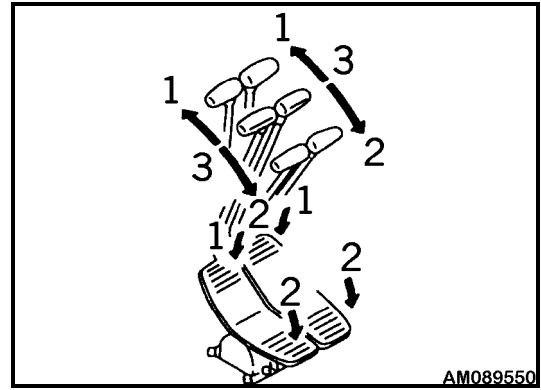
## OPERATION

### 11.3.2 TRAVEL LEVERS



#### WARNING

- Do not put your foot on the pedal unless the machine is traveling. If you leave your foot on the pedal and press it by mistake, the machine will move suddenly, and this may lead to a serious accident.
- With the track frame facing to the rear, the machine will move in the reverse direction by forward traveling and in the forward direction by reverse traveling. When the travel lever is used, check to see if the track frame is facing forward or backward. (If the sprocket is located to the rear, the track frame is facing forward.)



AM089550

1. FORWARD: The lever is pushed forward, the pedal is angled forward
2. REVERSE: The lever is pulled rearward, the pedal is angled back
3. NEUTRAL: The machine stops

#### REMARK

When the lever(s) or foot pedal(s) is/are shifted to the reverse position, the alarm sounds to warn that the machine is starting to move.

### 11.3.3 LEFT WORK EQUIPMENT CONTROL LEVER

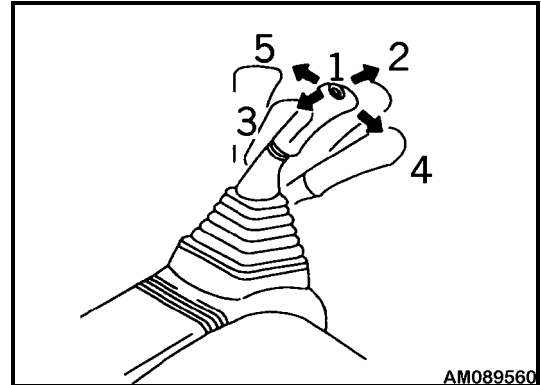


#### WARNING

If any lever is operated when in the deceleration range, the engine speed will suddenly increase, so be careful when operating the lever.

This lever is used to operate the arm and upper structure.

1	NEUTRAL		
	Arm Operation		Swing Operation
2	ARM OUT	4	SWING TO RIGHT
3	ARM IN	5	SWING TO LEFT



AM089560

When the lever is in the NEUTRAL (1) position, the upper structure and the arm will be retained in the position in which they stop. For lever position 2, 3, 4 and 5, the engine speed changes as follows because of the auto-deceleration mechanism.

- When the travel levers and work equipment control levers are at neutral, even if the fuel control dial is above the midrange position, the engine speed will drop to a midrange speed. If any of the levers are operated, the engine speed will rise to the speed set by the fuel control dial.
- If all control levers are set to neutral, the engine speed will drop by approx. 100 rpm, and after approx. 4 seconds, the engine speed will drop to the deceleration speed, approx. 1400 rpm.



11.3.4 RIGHT WORK EQUIPMENT CONTROL LEVER

**WARNING**

If any lever is operated when in the deceleration range, the engine speed will suddenly increase, so be careful when operating the lever.

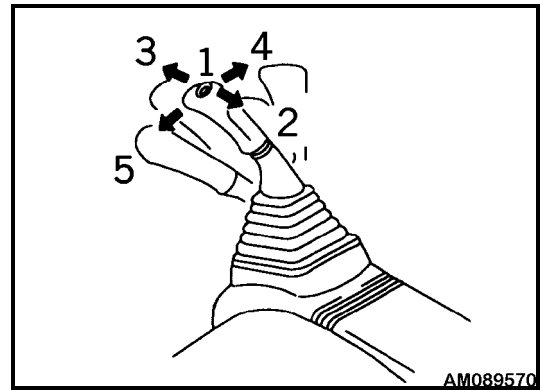
This lever is used to operate the arm and upper structure.

1	NEUTRAL		
	Boom Operation		Bucket Operation
2	BOOM RAISE	4	BUCKET DUMP
3	BOOM LOWER	5	BUCKET CURL

When the lever is in the NEUTRAL (1) position, the boom and the bucket will be retained in the position in which they stop.

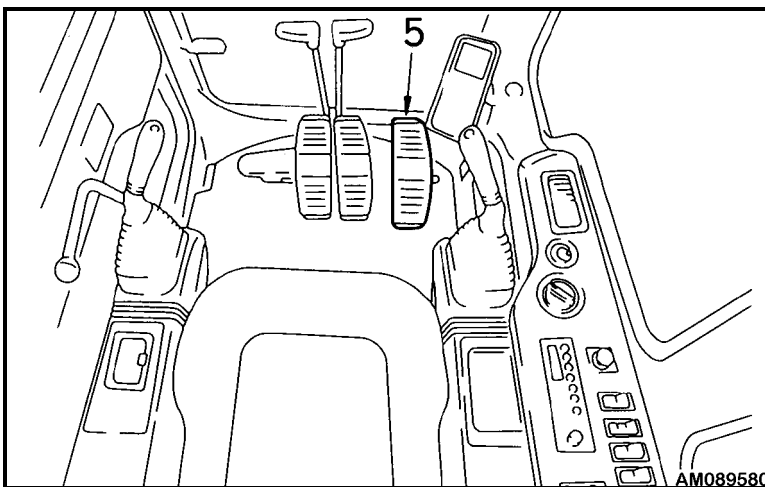
For lever position 2, 3, 4 and 5, the engine speed changes as follows because of the auto-deceleration mechanism.

- When the travel levers and work equipment control levers are at neutral, even if the fuel control dial is above the midrange position, the engine speed will drop to a midrange speed. If any of the levers are operated, the engine speed will rise to the speed set by the fuel control dial.
- If all control levers are set to neutral, the engine speed will drop by approx. 100 rpm, and after approx. 4 seconds, the engine speed will drop to the deceleration speed, approx. 1400 rpm.

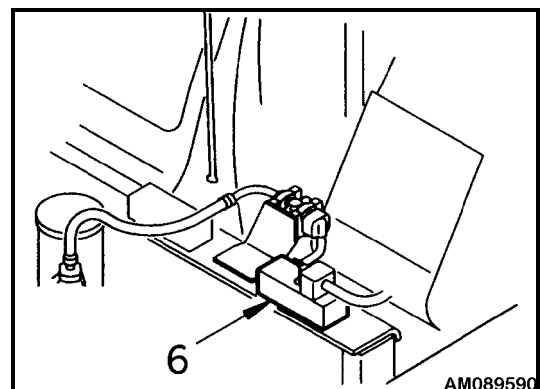


AM089570

ATTACHMENT CONTROLS



AM089580



AM089590

## OPERATION

### 11.3.5 ATTACHMENT CONTROL PEDAL



#### WARNING

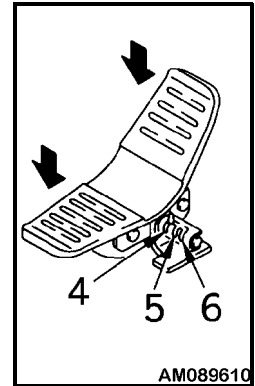
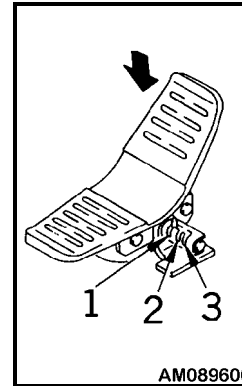
Do not put your foot on the pedal except when operating it. If you rest your foot on the pedal during operations, and you depress the pedal by mistake, the attachment may move suddenly and cause serious damage or injury.

#### When breaker is installed

- When the front of the pedal is depressed, the breaker is actuated.
- The positions of the lock pin are as follows: lock (1), pedal half stroke position (2), pedal full stroke position (3).
- Set the working mode to the breaker mode and set the lock pin to position 2.

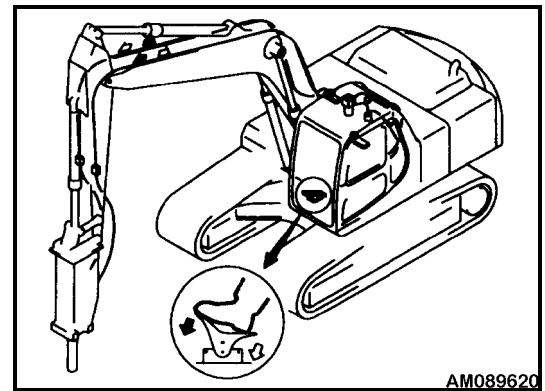
#### When general attachment is installed

- When the front of the pedal is depressed, the attachment is actuated. The positions of the lock pin are as follows: lock (4), pedal half stroke position (5), pedal full stroke position, (6).



#### Path of hydraulic oil

When the front of the pedal is depressed, the oil flows to the left piping for the work equipment; or when the rear of the pedal is depressed, the oil flows to the right piping for the work equipment. (When the breaker is installed, only the front of the pedal is used.)



### 11.3.6 SELECTOR VALVES FOR BREAKER AND GENERAL ATTACHMENT (crusher etc.)

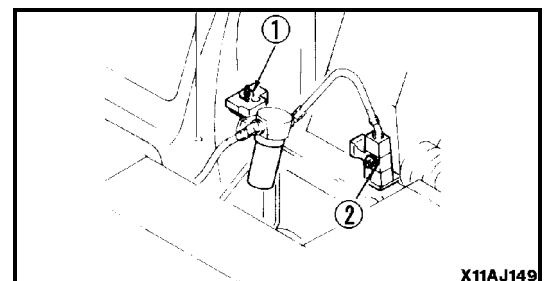
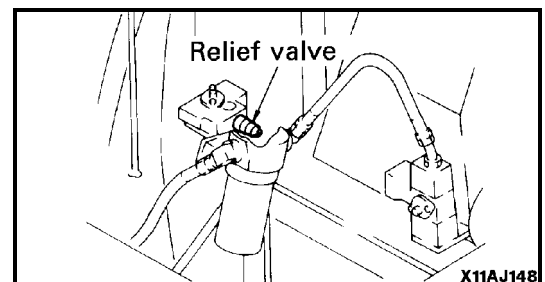








#### WARNING

Do not touch the relief valve.

When a breaker or general attachment (such as a crusher) are used, turn the rotors of the 3-way valves ① and ② to change them over according to the following illustration.

(The arrow marks indicating the port direction are stamped on the 3-way valve heads.)



Attachments	Left valve (1)	Right valve (2)
Breaker	Forward direction of machine 	Machine Left  Right
Crusher etc.	Forward direction of machine 	Machine Left  Right
When not in use	Forward direction of machine 	Machine Left  Right

**NOTICE**

Stop the engine and lower the work equipment and chassis to the ground to set in a stable position before carrying out the operation.

**REMARK**

For details, See 30 MACHINES READY FOR ATTACHMENTS on page 5-9.

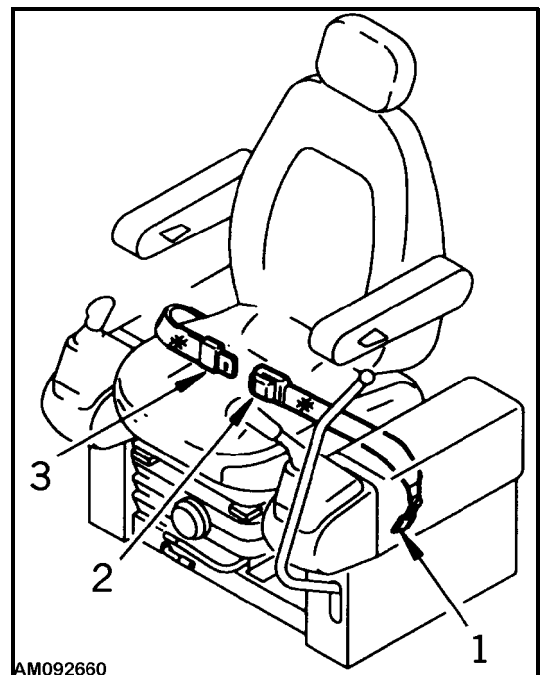
**11.4 SEAT BELT**

**⚠ WARNING**

- Before fastening the seat belt, inspect the securing brackets and belt for abnormal conditions. Replace any worn or damaged seat belt or the securing brackets.
- Adjust and fasten the seat belt before operating the machine.
- Always use seat belt when operating the machine.
- Do not use seat belt with either half of the belt kinked.

**11.4.1 FASTEN THE BELT AND REMOVE IT**

1. Adjust the seat so that there is sufficient knee room when fully depressing the pedals while seated, with the operators back against the backrest.
2. For suspension type seat, adjust tether belt (1), after adjusting the seat position.
3. After adjusting the seat position, sit in the seat. Grip buckle (2) and tongue (3) in each hand and insert tongue into buckle. Confirm by pulling the belt that the tongue is securely locked to the buckle.
4. When removing the belt, raise the tip of buckle (2) lever to release it.



## OPERATION

Fasten belt along your body without kinking it. Adjust the lengths of the belt on both the buckle and the tongue sides so that the buckle is located at the midpoint of your body front.

### 11.4.2 ADJUST THE BELT LENGTH

#### To shorten the belt

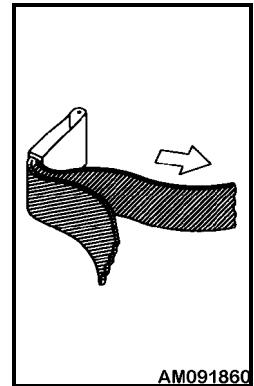
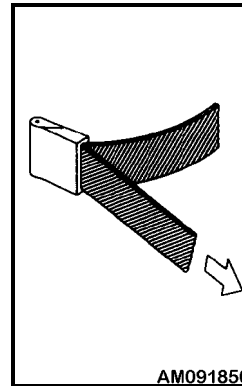
Pull the free end of the belt on either the buckle body or tongue side.

#### To lengthen the belt

Pull the belt while holding it at a right angle to buckle or tongue.

Inspect bolts and fittings on the chassis for tightness. Tighten any loose bolts to 20 to 29 N•m (15 to 20 lbf ft) torque.

If the seat belt is torn or frayed or if any of the fittings are broken or deformed from long service, replace the seat belt immediately.

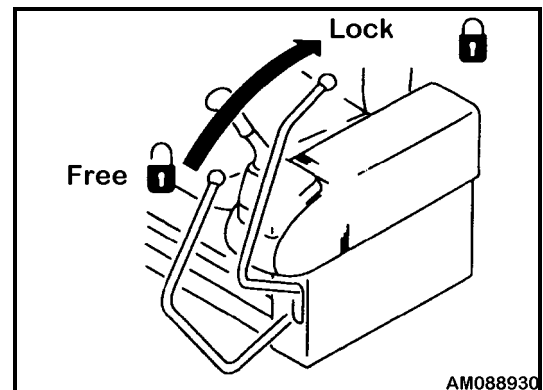


### 11.5 ROOF VENT



#### WARNING

- When leaving the operators compartment, set the safety lock lever securely to the LOCK position.
- If the control levers are not locked, and they are touched by mistake, this may lead to a serious accident.

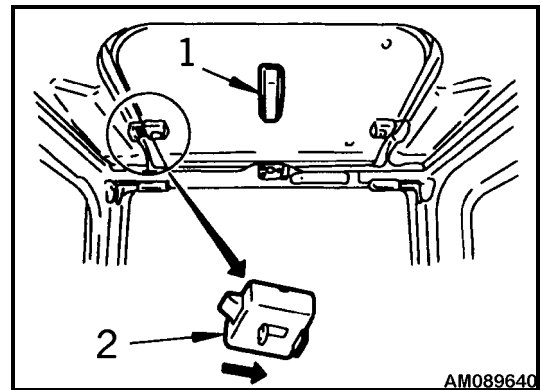


#### When opening

1. Lock the safety lock lever securely.
2. Open the two lock knobs (2) located on the left and right side, then push up and open the roof vent grasping grip (1) until gas springs (each side) are fully extended.

#### When closing

1. Close the roof vent by grasping grip (1) to overcome gas springs. Secure roof vent to cab with lock knobs (2). If the locks cannot be applied, reopen and close the roof vent again.



## 11.6 FRONT WINDOW

**WARNING**

When opening the front window, always hold the grip firmly with both hands and pull up. If you use only one hand, your hand may slip and get caught.

It is possible to store (pull up) the front window (top) in the roof of the operators compartment.

### 11.6.1 WHEN OPENING

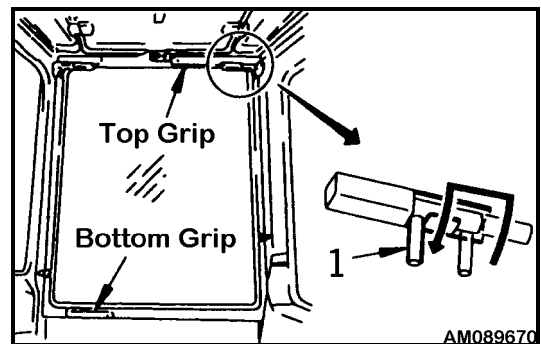
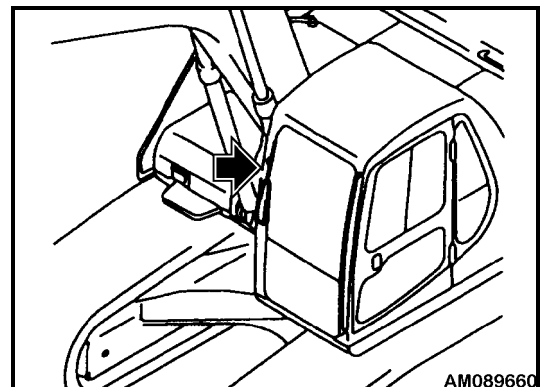
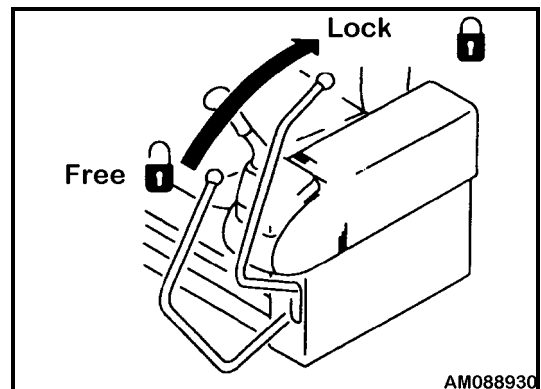
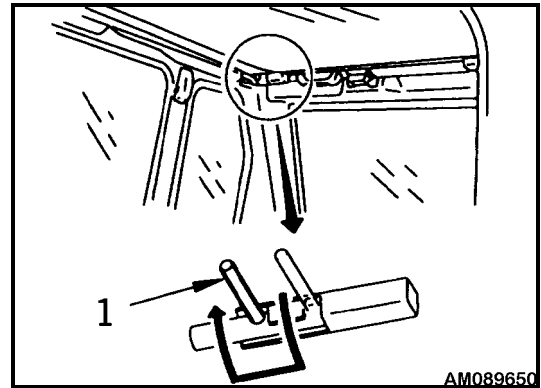
**WARNING**

When the front window is open, there is danger that it will fall, so always lock it with left and right lock pins (1).

1. Place the work equipment on flat ground and stop the engine.
2. Securely lock the safety lock lever.

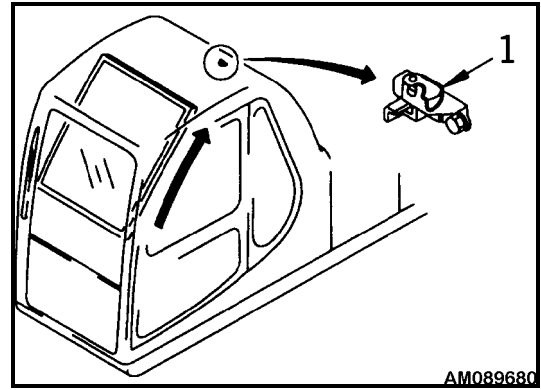
3. Check that the wiper is stowed in the right stay.

4. Pull lock pins (1) at the top left and right sides of the front window to the inside to release the lock.

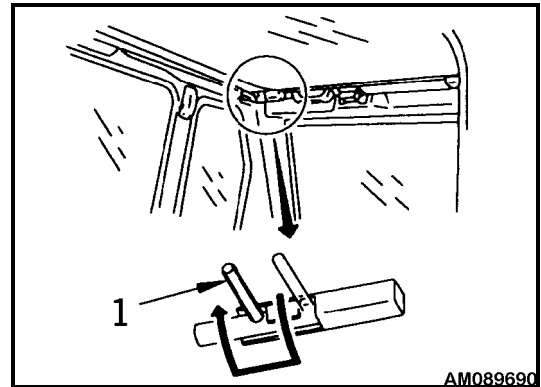


## OPERATION

- From the inside of the cab, hold the bottom grip with the left hand and the top grip with the right hand, pull up the window, and push it in fully until it is locked by catch (1).



- Lock with lock pins (1) on the left and right sides.



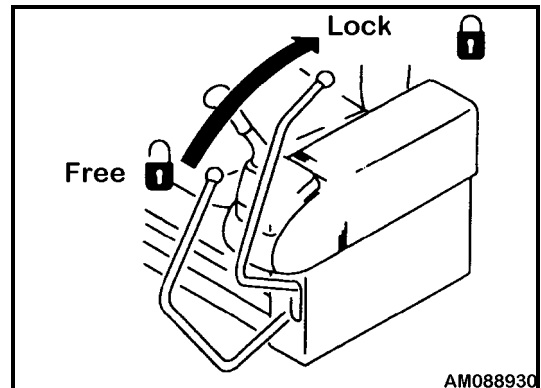
### 11.6.2 WHEN CLOSING



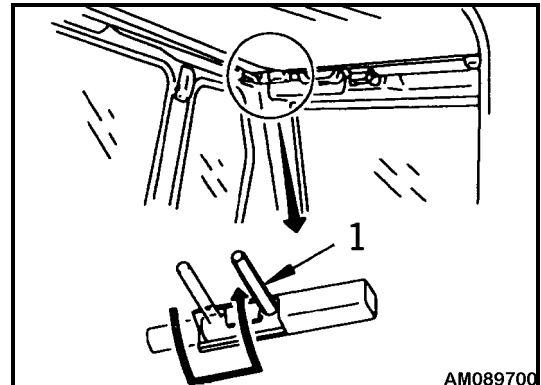
#### WARNING

When closing the window, lower it slowly and be careful not to get your hand caught.

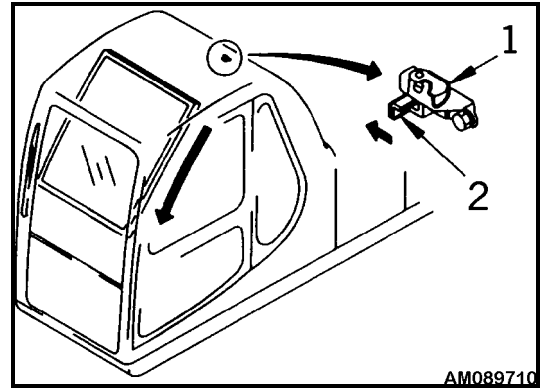
- Place the work equipment on flat ground and stop the engine.
- Securely lock the safety lock lever.



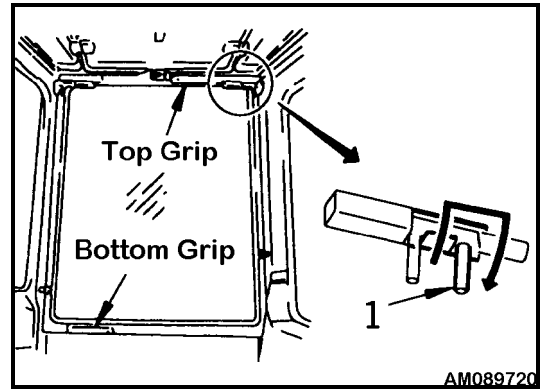
- Release the lock pin (1).



4. Hold the grip at the bottom of the front window with your left hand and the grip at the top with your right hand, release the lock of catch (1) with your right thumb, then pull the top grip slowly and lower the front window. When releasing the lock of catch (1) push release lever (2) in the direction of the arrow to release the lock.

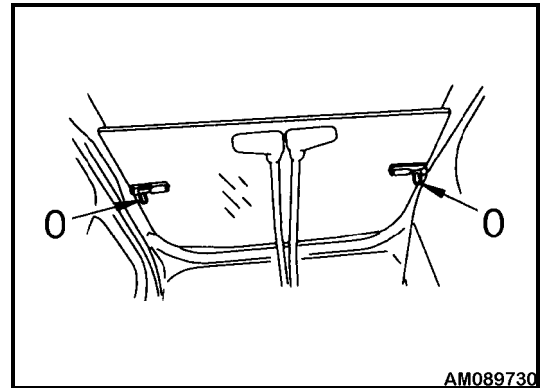


5. Lock securely with lock pins (1) at the left and right sides.

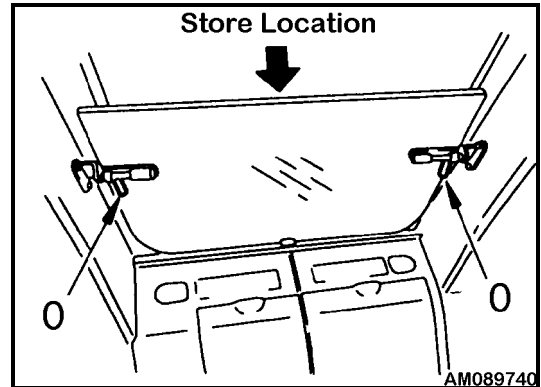


### 11.6.3 FRONT BOTTOM WINDOW

With the front window open, remove lock pins (0), and the bottom part of the front window can be removed.



Store the removed bottom part of the front window at the rear of the cab and lock with lock pins (0).

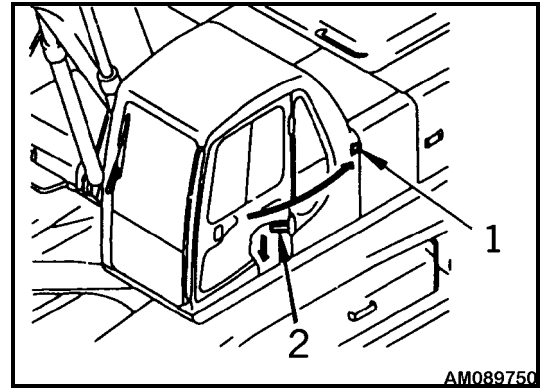


## OPERATION

### 11.7 DOOR LOCK

Use the door lock to fix the door in position after opening it.

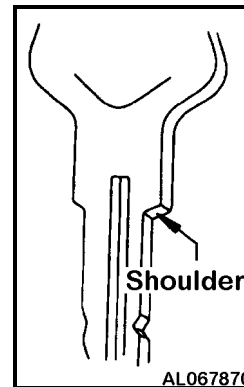
1. The door will become fixed in place when it is pressed against catch (1).
2. To release the lock, press knob (2) down at the left side of the seat to release the catch. When fixing the door, afix it firmly to the catch.



### 11.8 CAP, COVER WITH LOCK

The fuel filler, cab, engine hood, tool box cover, pump room door (right side of the machine body) and battery room door (left side of the machine body) are fitted with locks. Use the starting key to lock or unlock these places.

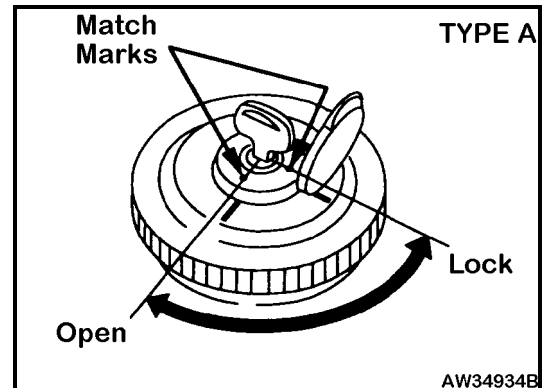
Insert the key as far as it will go. If the key is turned before it is inserted all the way, it may break.



#### 11.8.1 METHOD OF OPENING AND CLOSING LOCK CAP

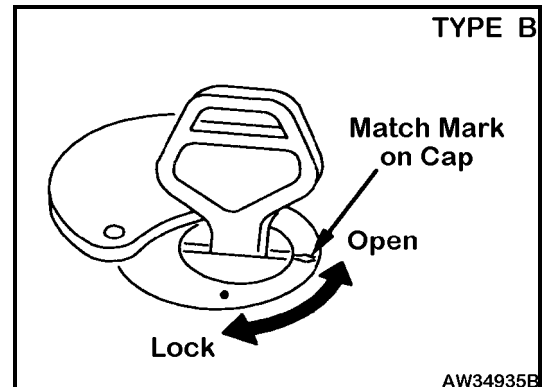
##### To Open the Cap

1. Insert the key into the key slot.
2. Turn the key clockwise for A type or counterclockwise for the B type. Align the key slot with the match mark on the cap, then open the cap.



##### To Lock the Cap

1. Turn the cap into place and insert the key into the key slot.
2. Turn the key counterclockwise for A type or clockwise for the B type and take the key out.





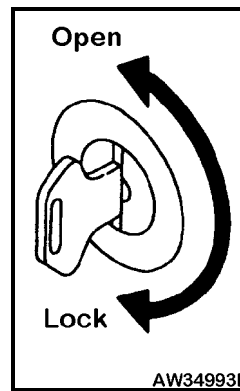
### 11.8.2 METHOD OF OPENING AND CLOSING COVER LOCK

#### To open the cover (locked cover)

1. Insert the key into the key slot.
2. Turn the key counterclockwise and open the cover by pulling the cover grip.

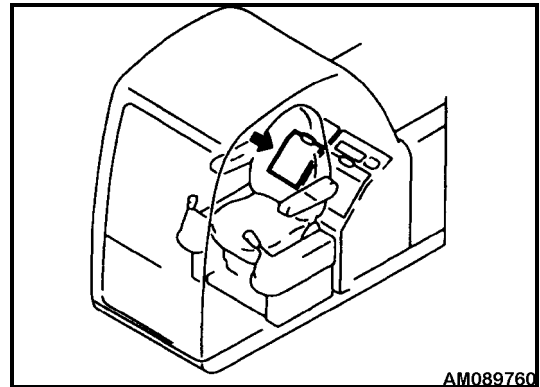
#### To lock the cover

1. Close the cover and insert the key into the key slot.
2. Turn the key clockwise and take the key out.



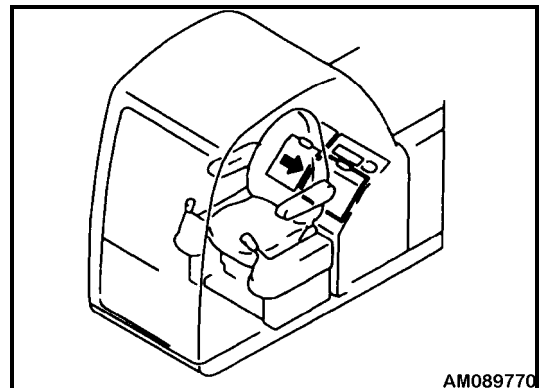
### 11.9 HOT AND COOL BOX

This is on the right side at the rear of the operators seat. It is interconnected with the air conditioner: it stays warm when the heater is used, and stays cool when the A/C is used.



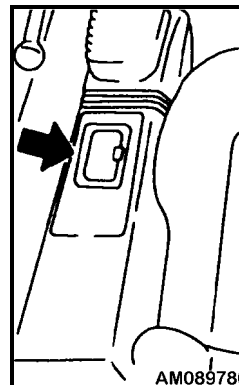
### 11.10 STORAGE BOX

This is on the left side at the rear of the operators seat. Keep the Operation & Maintenance Manual in this box so that it can be taken out and read whenever necessary.



### 11.11 ASHTRAY

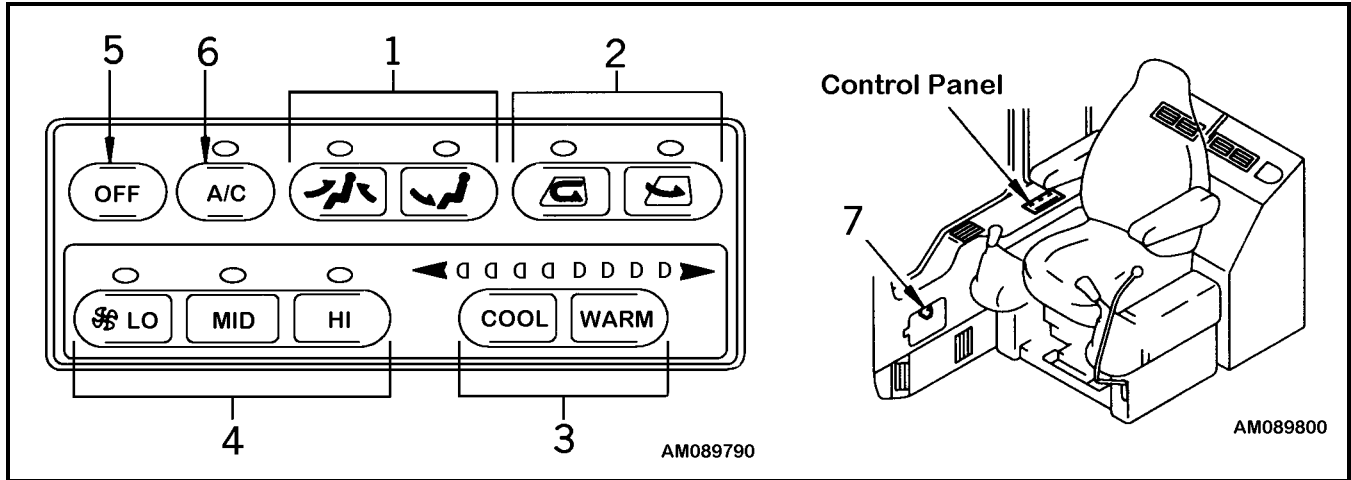
This is on the left side of the operators seat. Always make sure that you extinguish the cigarette or cigar before closing the lid.



# OPERATION

## 11.12 AIR CONDITIONER

### 11.12.1 GENERAL LOCATIONS ON CONTROL PANEL



The pilot lamp for the switches light up to indicate that the switch is functioning.

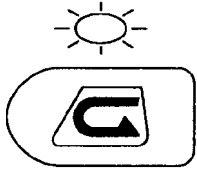
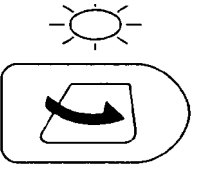
#### 1. Vent Selector Switch

This is used to select the vents which match the purpose of use.

Use	Sending breeze to upper part of body	Sending breeze to feet
Switch		
Vent		



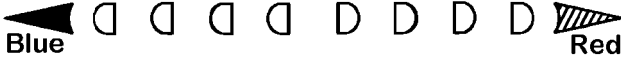
**2. Fresh/Recirc Selector Switch**

This switch is used to intake fresh air or recirculate the internal air.

Use	Recirculating internal air. Use this position to heat or cool the operators cab quickly or when the outside air is dirty.	Taking in fresh air. Use this position when taking in clean fresh air or when demisting.
Switch		

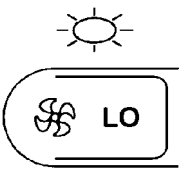
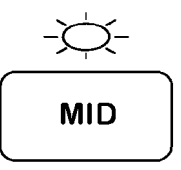
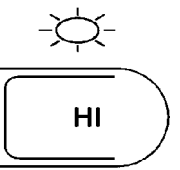
**3. Temperature Control Switch**

This switch is used to adjust the temperature steplessly between low and high.

Use	Cooling	Heating
Switch		
	 <p>The more lights in the blue range illuminate, the lower the temperature becomes; the more lights in the red range illuminate, the higher the temperature becomes. The range is divided into 7 levels, and each range is divided further steplessly.</p>	

**4. Wind Flow Selector Switch**

The wind flow can be adjusted to 3 levels.

Use	Low flow	Medium flow	High flow
Switch			

## OPERATION

### 5. Off Switch

This switch is used to stop the fan.

### 6. Air Conditioner Switch

This is used to switch the air conditioner ON/OFF.


### 7. Defroster Selector Lever

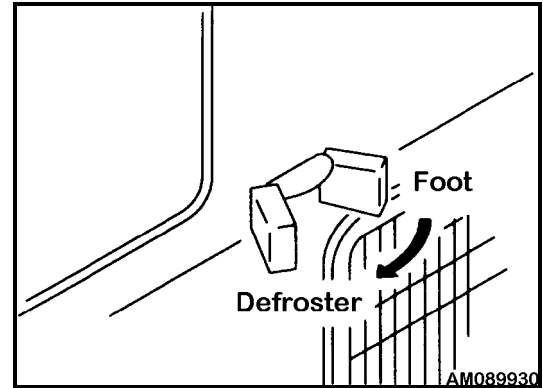
This is used to clear the mist from the front glass in cold or rainy conditions.

Selector lever forward ..... Defroster

Selector lever back ..... Foot

#### REMARK

The defroster can only be used when the vent selector panel is at the  position.



### 11.12.2 PRECAUTIONS WHEN USING AIR CONDITIONER

Carry out full ventilation from time to time when using the air conditioner.

If you smoke when the air conditioner is on, the smoke may start to hurt your eyes, so turn the lever to FRESH to remove the smoke while continuing the cooling.

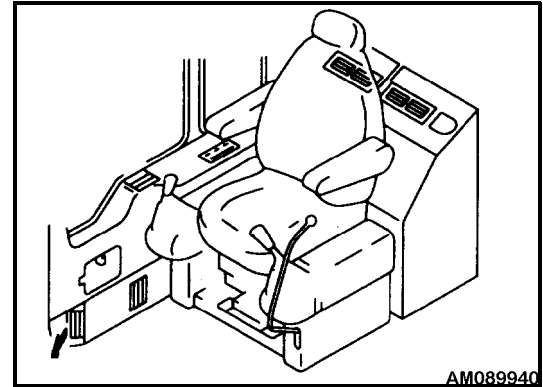
When running the air conditioner for a long period of time, turn the lever to the FRESH position once an hour to carry out ventilation and cooling.

Be careful not to make the temperature in the cab too low.

When the air conditioner is on, set the temperature so that it feels slightly cool when entering the cab (5 to 6°C lower than the outside temperature). This temperature difference is considered to be the most suitable for your health, so always be careful to adjust the temperature properly.

### 11.12.3 CHECK, MAINTAIN AIR CONDITIONER

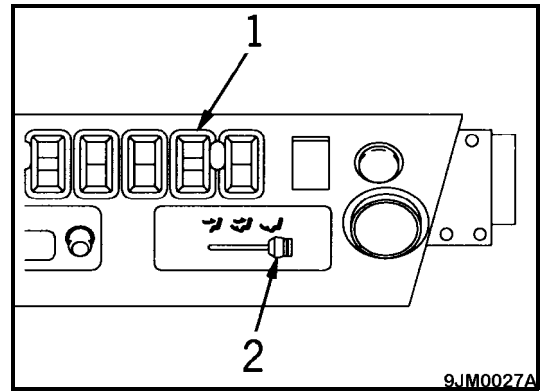
When carrying out inspection and maintenance of a machine equipped with air conditioner; see 23 MAINTENANCE SCHEDULE CHART on page 3-20.



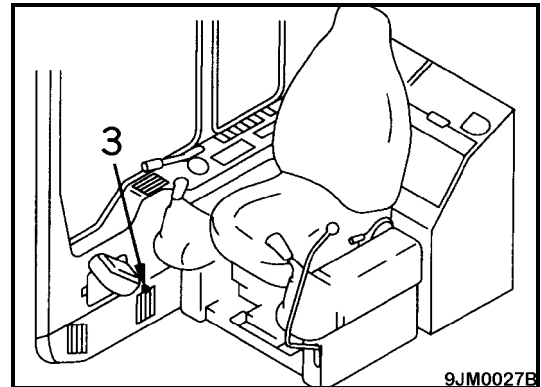
## 11.13 CAB HEATER

### 11.13.1 GENERAL LOCATIONS

This heater uses the hot coolant from the engine to carry out heating, so allow the engine to warm up before using the heater.



9JM0027A



9JM0027B

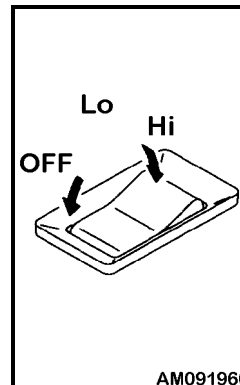
#### 1. Heater Fan Switch

This switch adjusts the windage in two stages.

Hi - High

Lo - Low

OFF - Heater is switched off




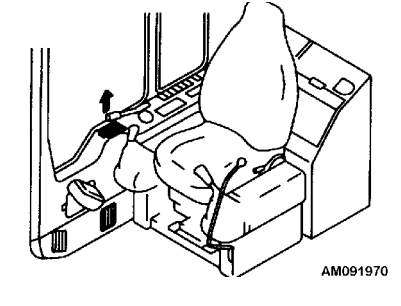
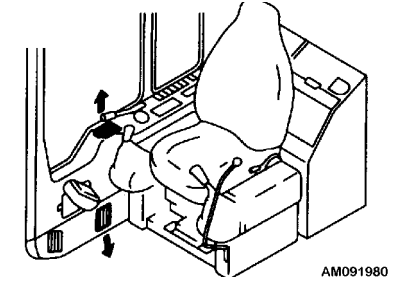
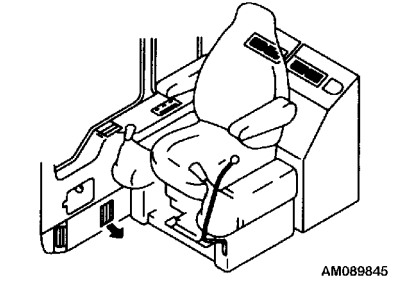


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# OPERATION

## 2. Vent Selector Switch

This is used to select the vents which match the purpose of use.



Purpose of use	Sending breeze to upper part of body	Sending breeze to upper part of body and feet	Sending breeze to feet
Lever			
Vent			

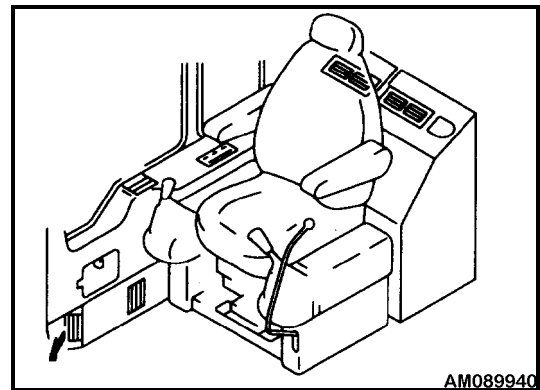
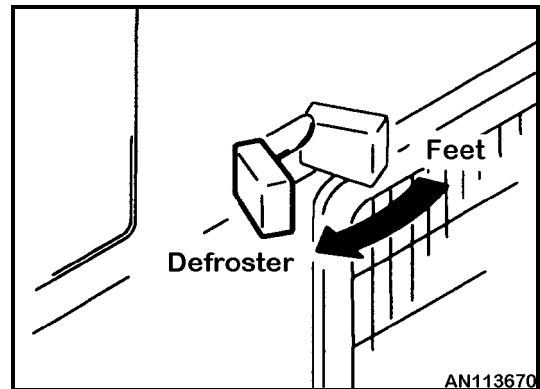
## 3. Defroster Selector Lever

This is used to clear the mist from the front glass in cold or rainy conditions.

Selector lever forward ..... Defroster

Selector lever back ..... Feet

The defroster can only be used when the vent selector panel is at the  or  position.



## 11.14 PREPARATION FOR CAB HEATER

Use the cab heater when the temperature drops. When using the heater, turn the shut-off valve, located on the front of the cylinder head, to the left to open it allowing coolant to flow to the heater. When the warm season returns and the heater is not to be used for a long period, turn valve to the right to close it.

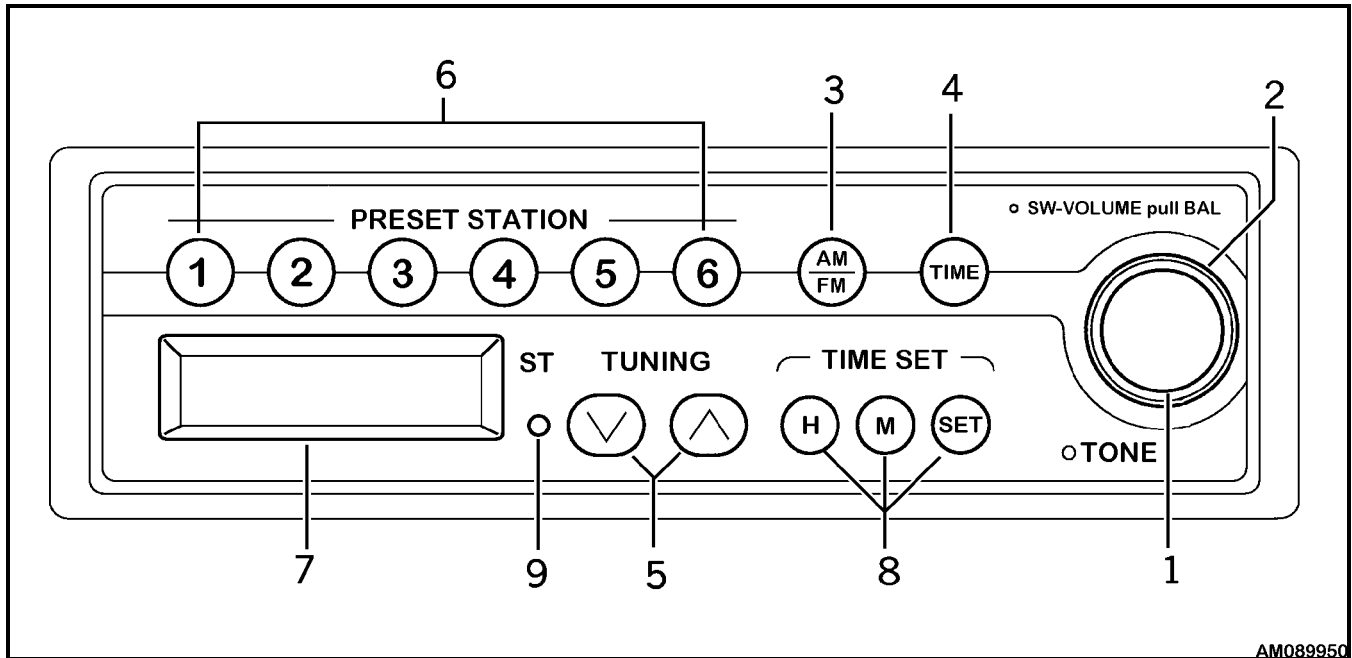
### REMARK

For machines equipped with an air conditioner, keep the valve open at all times.



## 11.15 AM/FM RADIO

### 11.15.1 EXPLANATION OF COMPONENTS



AM089950

#### 1. Power Switch/Volume/ Balance Control Knob

Press this knob to turn the power for the radio on. The frequency is displayed on display (7). Press again to turn the power off.

Turn the knob to adjust the volume as follows;

Turn CLOCKWISE ..... to increase volume.

Turn COUNTERCLOCKWISE ..... to reduce volume.

If the knob is pulled until it locks, it can be turned to the left or right to adjust the balance of the left and right speakers.

Turn CLOCKWISE ..... to < volume right speaker.

Turn COUNTERCLOCKWISE ..... to < volume left speaker

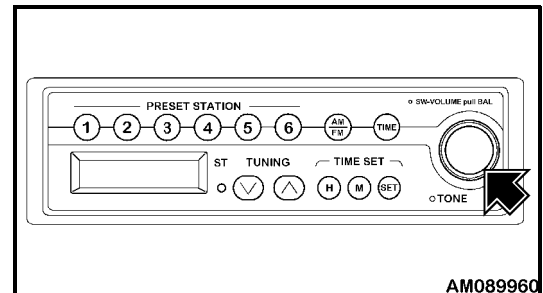
After adjusting the left and right balance, press lightly to return the knob to its original position. (If it is left pulled out, the overall volume cannot be adjusted.)

#### 2. Tone Control Knob

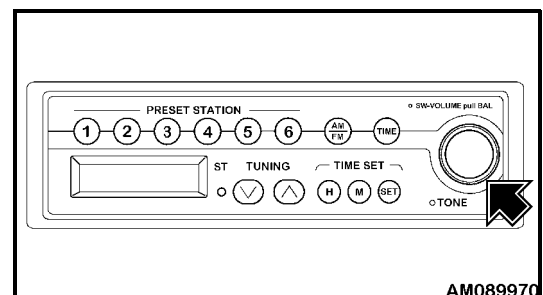
Turn the knob to adjust the tone as follows.

Turn CLOCKWISE ..... to emphasize high sounds

Turn COUNTERCLOCKWISE ..... to suppress high sounds



AM089960



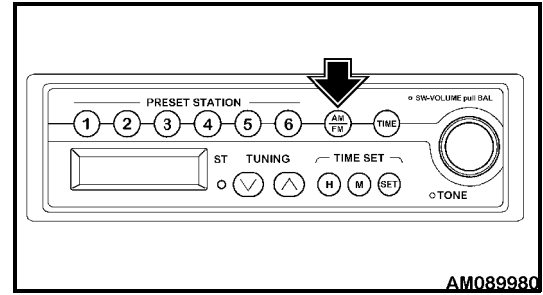
AM089970

## OPERATION

### 3. AM/FM Selector Button

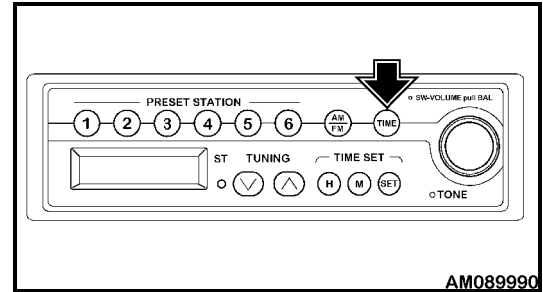
Press this button and select the desired band.

Each time the button is pressed, it switches AM FM AM ...



### 4. Display Selector Button (Time)

This equipment gives priority to the frequency display. If the button is pressed when the frequency is displayed, display will give the present time for 5 seconds. After 5 seconds pass, the display will automatically return to the frequency display. If any button other than TIME SET (H, M, SET) is pressed within the 5 seconds, the display will return to the frequency display.

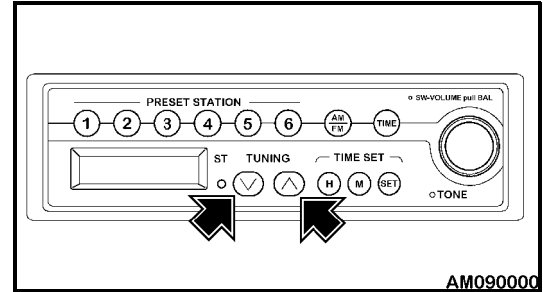


### 5. Manual Tuning Buttons

Use the buttons to change the frequency.

Up  $\wedge$ ; Each time the button is pressed, the frequency will go up in steps (FM: 10 kHz, AM: 0.2 MHz).

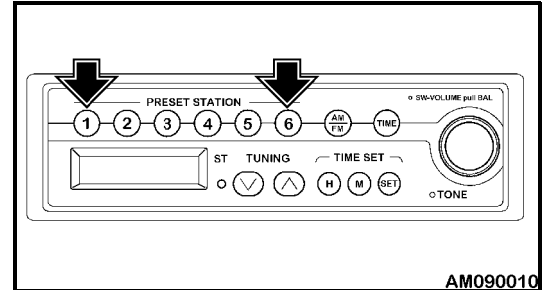
Down  $\vee$ ; Each time the button is pressed, the frequency will go down in steps (FM: 10 kHz, AM: 0.2 MHz).



### 6. Preset Buttons (1, 2, 3, 4, 5, 6)

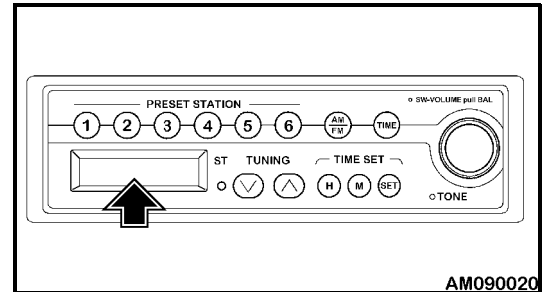
If these buttons are set to the frequency of the desired broadcasting station, the station can be selected at a touch.

For details of the method of presetting; see 11.15.2 METHOD OF OPERATION on page 2-37.



### 7. Display

The reception band, frequency, preset number, and time are displayed.





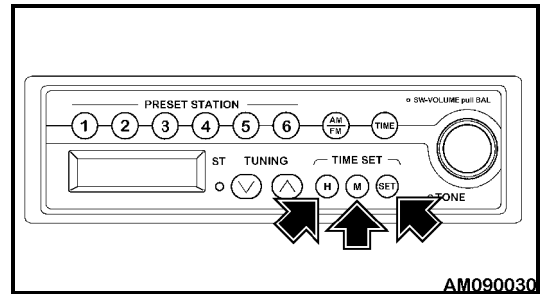
### 8. Time Correction Button

This is used to correct the time.

H: Hour

M: Minute

SET: Sets to start of hour (00 minutes)



### 9. Stereo Indicator

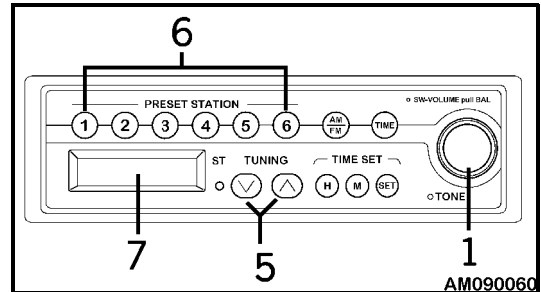
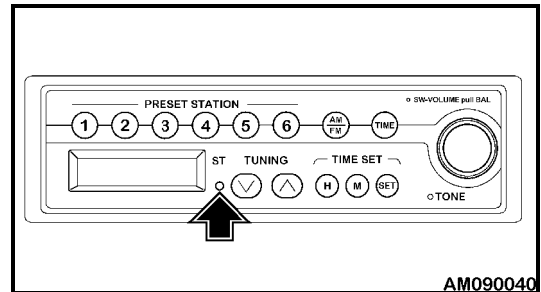
This lamp lights up when a stereo broadcasting is picked up when receiving an FM broadcasting station.

### 11.15.2 METHOD OF OPERATION

#### Method of Setting Preset Buttons

1. Press power switch (1) and display the frequency (7).
2. Turn the tuning button (manual, auto) to adjust to the desired frequency.
3. Select a preset button to use for recording the frequency setting, and keep that button pressed for at least 1.5 seconds. The sound will disappear, but when the setting is recorded, the sound will appear and the preset number will appear on display (7) to show that the station has been preset.

After completion, press preset button (6), and release it within ~ 1.5 seconds. The setting will change to the frequency of the station recorded for that button. One AM station and one FM station can be recorded for each preset button.



#### Manual Tuning

Press tuning button (5) and set to the desired frequency. Each time the button is pressed, the frequency will move up or down in steps of 10 MHz (AM) or 0.2 MHz (FM).

∇ button: Move to a higher frequency station

∧ button: Move to a lower frequency station

If the frequency reaches the top or bottom limit, it will automatically change as follows: top limit → bottom limit, or bottom limit → top limit.

#### Automatic Tuning

Keep tuning button (5) pressed for at least 0.5 seconds. When a station is picked up, it will automatically stop. To search for the next station, press tuning button again for at least 0.5 seconds.

∇ button: Move to a higher frequency station.

∧ button: Move to a lower frequency station.

If tuning button (5) is pressed during auto tuning, the auto tuning will be canceled and the frequency at the point where it is canceled will be picked up.

## OPERATION

### Setting Correct Time

1. Press display selector button (4) to display the time. After 5 seconds, the display will return to the frequency display and the time cannot be corrected. If this happens, press display selector button (4) again.
2. Press time adjustment button (8) and adjust the hour and minute.  
H button: Adjusts hour (advances one hour each time it is pressed)  
M button: Adjusts minute (advances one minute each time it is pressed)

If the H or M button are kept pressed, the time will advance until the button is released.

SET button: Sets to start of hour (when it is pressed, the minute returns to 00)

If the minute display is between 0 and 29, and the SET button is pressed, the minute reading will return to 00. If it is pressed when the minute display is between 30 and 59, the minute display will return to 00 and the hour will advance by 1.

Example 10:29 → 10:00  
10:30 → 11:00

Press the H, M, and SET buttons to set to the correct time.

### Antenna

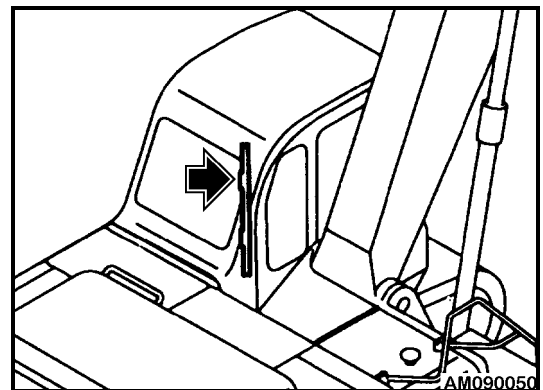
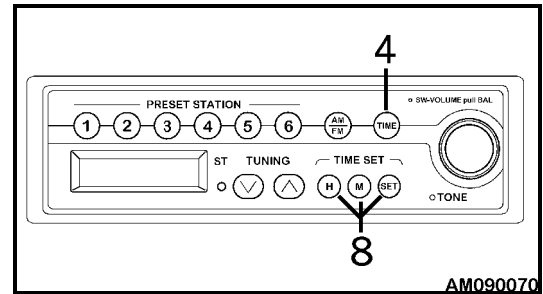
In areas where the reception is weak or there is interference, extend the antenna. If the radio is set to a station with strong radio waves, retract the antenna to set to a weaker input.

### NOTICE

Always retract the antenna before transporting the machine or driving the machine into a work shop or garage.

### 11.15.3 PRECAUTIONS WHEN USING

- To ensure safety, always keep the sound to a level where it is possible to hear outside sounds during operation.
- If water gets into the speaker case or radio (auto tuning), it may lead to an unexpected failure, so be careful not to get water on the equipment.
- Do not wipe the scales or buttons with benzene, thinner, or any other solvent. Wipe with a soft dry cloth. Use a cloth soaked in alcohol if the equipment is extremely dirty.
- When the battery is disconnected, the settings for the preset buttons are all cleared, so set again.



**11.15.4 SPECIFICATIONS**

Tuning method	PLL synthesizer method
Reception frequency	AM 530 kHz to 1730 kHz (in 10 kHz steps) FM 87.5 MHz - 107.9 MHz (in 0.2 MHz steps)
Actual max. sensitivity	AM 30 dB FM 15 dB
Actual max. output	10 W x 2
Current consumption	Max. 2 A
External dimensions:	184 x 56 x 116 mm
Weight:	0.65 kg

**11.16 ELECTRIC POWER TAKE OUT ADAPTER**

Pull out the connector plug for take out electric power from the rear side of the panel.

Maximum usable electric power is 85 W (24 V x 3.5 A).

**NOTICE**

Do not use as a 12 V power supply. It will cause machine failure.

## OPERATION

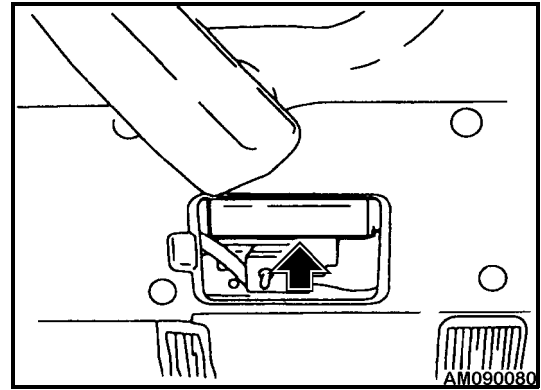
### 11.17 FUSE

#### NOTICE

Before replacing a fuse, be sure to turn off the starting switch.

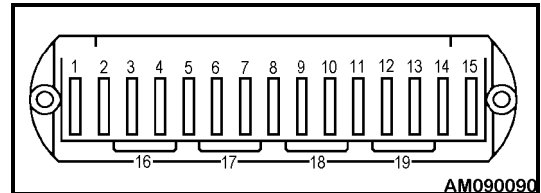
The fuses protect the electrical equipment and wiring from burning out.

If the fuse becomes corroded, or white powder can be seen, or the fuse is loose in the fuse holder, replace the fuse. Replace a fuse with another of the same capacity.



Fuse capacity and name of circuit

No.	Fuse	Circuit
1	10 Amp	Pump governor controller
2	10 Amp	Solenoid
3	20 Amp	Air conditioner (motor)
4	10 Amp	Right head lamp, working lamp
5	10 Amp	Radio, cigarette lighter, Air conditioner panel, heater, window washer, left knob switch,
6	10 Amp	Horn
7	15 Amp	Wiper
8	15 Amp	Head light, rear working light
9	10 Amp	Travel alarm, spare
10	10 Amp	Key switch signal
11	10 Amp	Spare
12	10 Amp	Spare
13	10 Amp	Buzzer, monitor
14	10 Amp	Battery relay, electric heater relay, start signal
15	10 Amp	Cab light, radio (back-up)
16	10 Amp	Spare
17	10 Amp	Spare
18	15 Amp	Spare
19	20 Amp	Spare

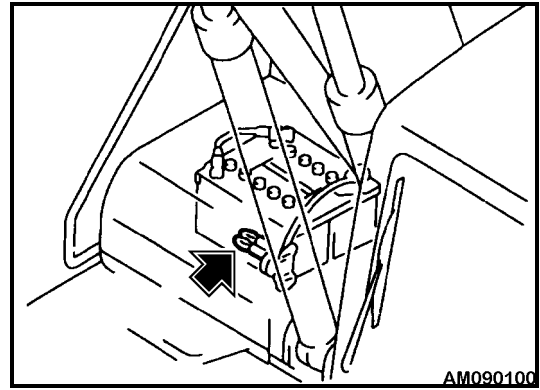


### 11.18 FUSIBLE LINK

If the starting motor will not rotate when the starting switch is turned ON, a possible cause is disconnection of wire type fusible link. Inspect the fusible link in battery box cover at right side of machine and, if necessary, replace it.

#### REMARK

A fusible link refers to the large size fuse wiring installed in the high current flow portion of the circuit to protect the electrical components and wiring from burning, similarly to an ordinary fuse.

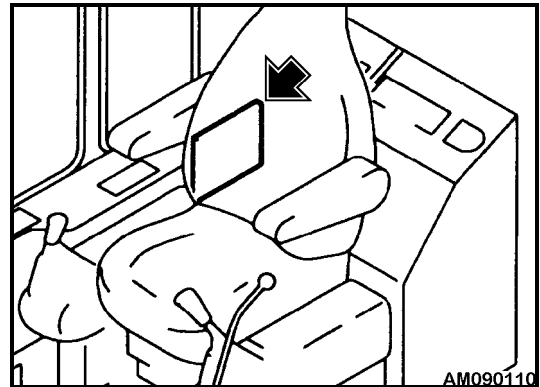


### 11.19 CONTROLLERS

A pump controller and electronic governor controller are provided.

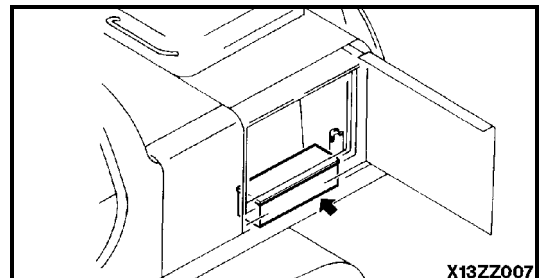
#### NOTICE

Never splash or spill water, mud or drink over the controllers as this may cause a fault. If a fault occurs in the controller, do not attempt repair, but consult your distributor.



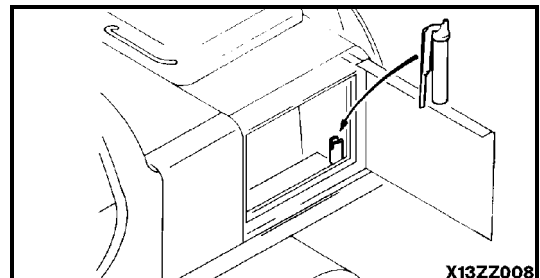
### 11.20 TOOL BOX

This is used for storing the tools.



### 11.21 GREASE GUN HOLDER

This is inside the left rear door of the machine. Fit the grease gun to the holder when it is not being used.



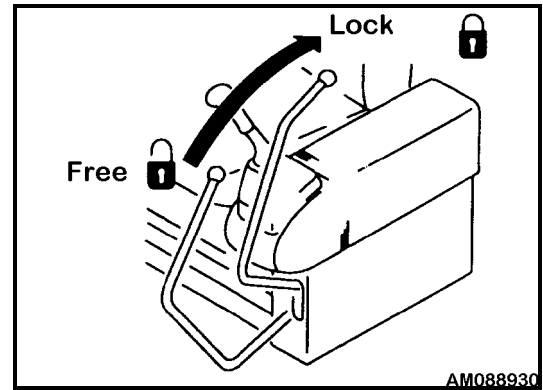
## OPERATION

### 11.22 HANDLING ACCUMULATOR

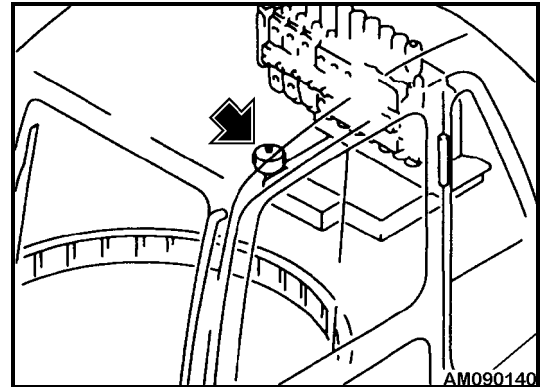
#### WARNING

On machines equipped with an accumulator, for a short time after the engine is stopped, if the work equipment control lever is moved to the LOWER position, the work equipment will move down under its own weight. After stopping the engine, always place the safety lock lever in the LOCK position and lock the attachment control pedal with the lock pin. The accumulator is filled with high-pressure nitrogen gas, and it is extremely dangerous if it is handled in the wrong way. Always observe the following precautions.

- Never make any hole in the accumulator or expose it to flame or fire.
- Do not weld any boss to the accumulator.
- When disposing of the accumulator, it is necessary to release the gas from the accumulator, so please contact your distributor.



This machine is equipped with the accumulator in the control circuit. The accumulator is a device to store the pressure in the control circuit, and when it is installed, the control circuit can be operated for a short time even after the engine is stopped. Therefore, if the control lever is moved in the direction to lower the work equipment, it is possible for the work equipment to move under its own weight. The accumulator is installed to the position shown in the diagram on the right.



## 12. OPERATION

### 12.1 CHECK BEFORE STARTING ENGINE

Perform following check for operator safety and maintenance of machine performance.

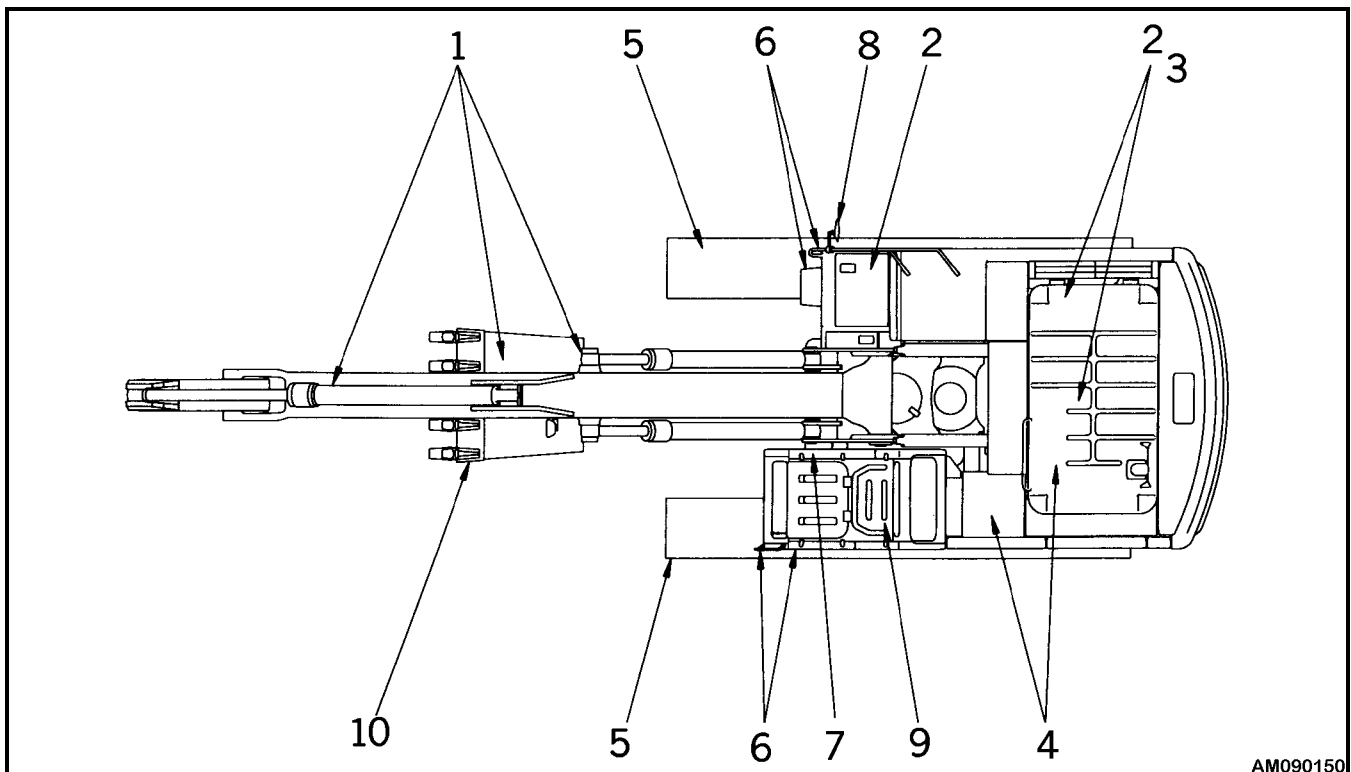
#### 12.1.1 WALK AROUND CHECK



#### WARNING

Leakage of oil or fuel, or accumulation of flammable material around high temperature parts, such as the engine muffler or turbocharger, may cause fire. Check carefully, and if any abnormality is found, repair it or contact your distributor.

Before starting the engine, look around the machine and under the machine to check for loose nuts or bolts, or leakage of oil, fuel, or coolant, and check the condition of the work equipment and hydraulic system. Check also for loose wiring, play, and collection of dust at places which reach high temperatures. Always carry out the items in this section before starting the engine each day.



AM090150

#### 1. Check for Damage, Wear, Play in Work Equipment, Cylinders, Linkage, Hoses

Check that there are no cracks, excessive wear, or play in the work equipment, cylinders, linkage, or hoses. If any abnormality is found, repair it.

## **OPERATION**

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### **2. Remove Dirt and Dust from Around Engine, Battery, Radiator**

Check if there is any dirt or dust accumulated around the engine or radiator. Check also if there is any flammable material (dead leaves, twigs, grass, etc.) accumulated around the battery or high temperature engine parts, such as the engine muffler or turbo-charger. Remove all such dirt or flammable material.

### **3. Check for Leakage of Coolant or Oil Around Engine**

Check that there is no leakage of oil from the engine or leakage of coolant from the cooling system. If any abnormality is found, repair it.

### **4. Check for Oil Leakage from Hydraulic Equipment, Hydraulic Tank, Hoses, Joints**

Check that there is no oil leakage in the system. If any abnormality is found, repair the place where the oil is leaking.

### **5. Check the Undercarriage (Track, Sprocket, Idler, Guard) for Damage, Wear, Loose Bolts, or Leakage of Oil from Rollers**

### **6 Check for Damage to Handrail, Loose Bolts**

Repair any damage and tighten any loose.

### **7. Check for Damage to Gauges, Monitor, Loose Bolts**

Check that there is no damage to the gauges and monitor in the operators cab. If any abnormality is found, replace the parts. Clean off any dirt on the surface.

### **8. Clean Rear View Mirror, Check for Damage**

Check that there is no damage to the rear view mirrors. If they are damaged, replace with a new mirror. Clean the surface of the mirror and adjust the angle so that the view to the rear can be seen from the operators seat.

### **9. Seat Belt Option and Mounting Clamps**

Check that there is no abnormality in the seat belt or the mounting clamps. If there is any damage, replace with new parts.

### **10. Check Bucket with Hook for Damage.**

Check the hook, catcher and hook foot for damage. If damage is found, contact your distributor for repair.



### 12.1.2 CHECK BEFORE STARTING

Always carry out the items in this section before starting the engine each day.

#### Check Coolant Level, Add Coolant

**WARNING**

Do not open the radiator cap unless necessary. When checking the coolant, always check the radiator reserve tank when the engine is cold.

1. Open the left rear cover on the machine and check that the coolant level is between the FULL and LOW marks on radiator reserve tank (1). If the coolant level is low, add coolant through the filler of reserve tank to the FULL level.
2. After adding coolant, tighten the cap securely.
3. If the reserve tank becomes empty, first inspect for coolant leaks and then fill the radiator and reserve tank with coolant.

For details of coolant to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

#### Check Oil Level in Engine Oil Pan, Add Oil

**WARNING**

The turbocharger (with safety cover) exhaust manifold is near the dipstick (1), so be careful not to touch it.

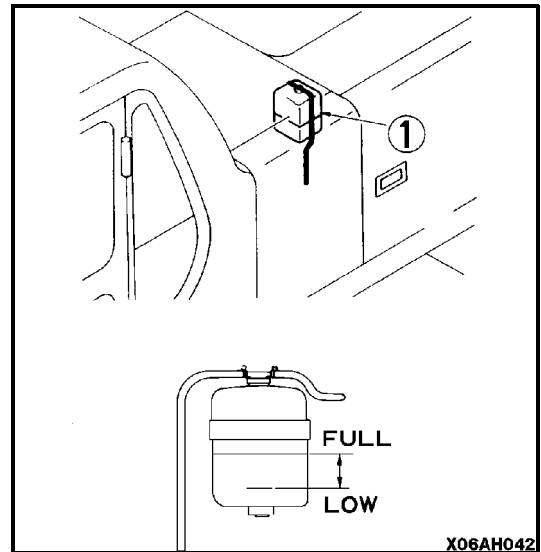
1. Open the engine hood on the machine.
2. Remove dipstick (G) and wipe the oil off with a cloth.
3. Insert dipstick fully in the guide tube, then take it out again.
4. The oil level should be between the H and L marks on dipstick. If the oil level is below the L mark, add engine oil through oil filler (F).

For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

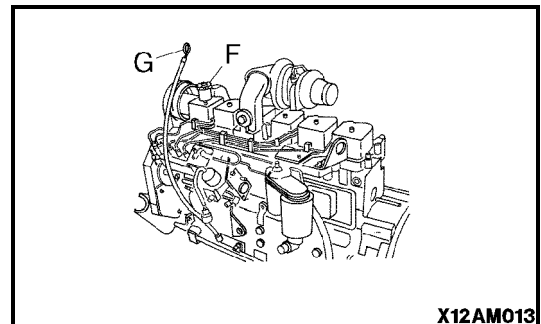
5. If the oil is above the H mark, drain the excess engine oil from drain plug, and check the oil level again.
6. If the oil level is correct, tighten the oil filler cap securely and close the engine hood.

#### REMARK

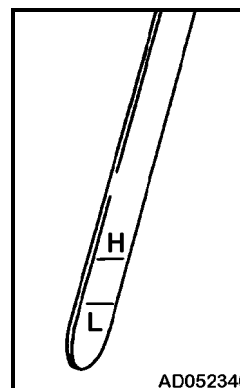
When checking the oil level after the engine has been operated, wait for at least 15 minutes after stopping the engine before checking. If the machine is at an angle, make it horizontal before checking.



X06AH042



X12AM013



AD052340

## OPERATION

### Check Fuel Level, Add Fuel

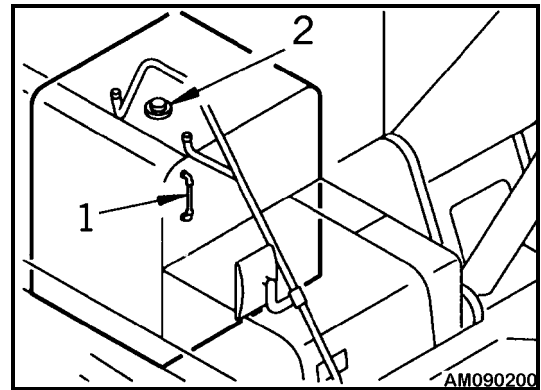


#### WARNING

When adding fuel, never let the fuel overflow. This may cause a fire. If you spill fuel, thoroughly clean up any spillage.

1. Use sight gauge (1) on the front face of the fuel tank to check that the tank is full.
2. If the fuel level is not within the sight gauge, add fuel through filler port (2) while watching sight gauge (1).

Fuel capacity ..... 340 l (89.8 gal)



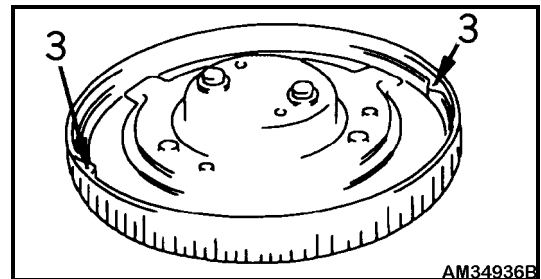
### NOTICE

For details of the fuel to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

3. After adding fuel, tighten the cap securely.

### REMARK

If breather hole (3) on cap is clogged, the pressure in the tank will drop and fuel will not flow. Clean hole from time to time.



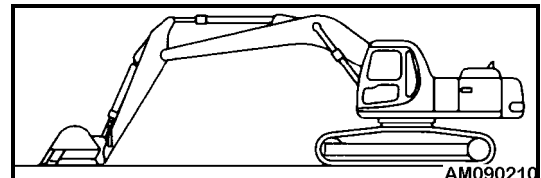
### Check Oil Level in Hydraulic Tank, Add Oil



#### WARNING

- When removing the oil filler cap, oil may spurt out, so turn cap slowly to release the internal pressure before removing the cap.
- If oil has been added to above the H mark, stop the engine and wait for the hydraulic oil to cool down, then drain the excess oil from the drain plug.

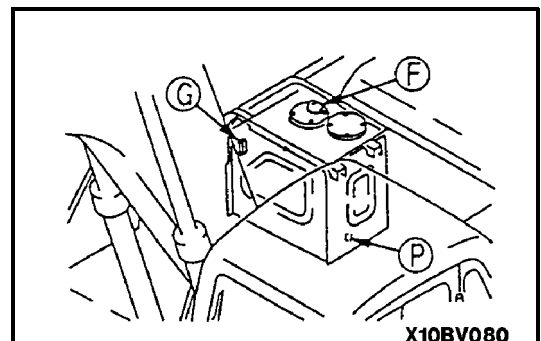
1. If the work equipment is not in the position shown, start the engine, run the engine at low speed, retract the arm and bucket cylinders, then lower the boom, set the bucket teeth in contact with the ground, and stop the engine.
2. 15 seconds after stopping the engine, move each control lever (for work equipment and travel) to the full stroke in all directions to release the internal pressure.
3. Open the door on the right side of the machine. Check sight gauge (G). The oil level is normal if between H and L marks.



### NOTICE

Do not add oil if the level is above the H line. This will damage the hydraulic equipment and cause the oil to spurt out.

4. If the level is below the L mark, remove the upper cover of the hydraulic tank and add oil through oil filler (F).



**NOTICE**

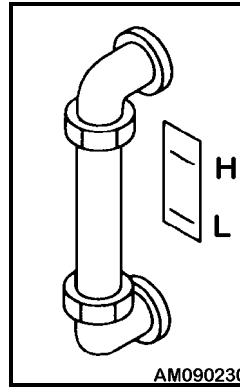
For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

**REMARK**

The oil level will vary depending upon the oil temperature. Accordingly, use the following as a guide:

Before operation: around L level (Oil temperature 10 to 30°C (50 to 86°F))

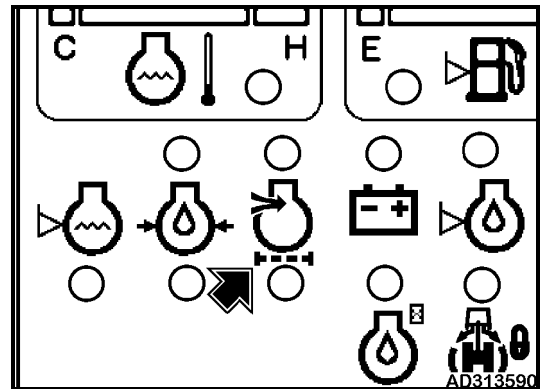
Normal operation: around H level (Oil temperature 50 to 80°C (122 to 176°F))



**Check Air Cleaner for Clogging**

1. Confirm that the air cleaner clogging monitor does not flash.
2. If it flashes, immediately clean or replace the element.

For details of method of cleaning the element, See 24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT on page 3-24



**Check Electric Wiring**

**⚠ WARNING**

- If fuses are frequently blown or if there are traces of short circuit on the electrical wiring, locate the cause and carry out repair.
- Accumulation of flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always check and remove such material.
- Keep the top surface of the battery clean and check the breather hole in the battery cap. If it is clogged with dirt or dust, wash the battery cap to clean the breather hole.

Check for damage and wrong capacity of the fuse and any sign of disconnection or short circuit in the electric wiring. Check also for loose terminals and tighten any loose parts. Check the wiring of the battery, starting motor and alternator carefully in particular.

When carrying out walk around checks or checks before starting, always inspect if there is any accumulation of flammable material around the battery, and remove such flammable material. Please contact your distributor for investigation and correction of the cause.

**Check Function of Horn**

Turn the starting switch to the ON position. Confirm that the horn sounds without delay when the horn button is pressed. If the horn does not sound, ask your distributor for repair.

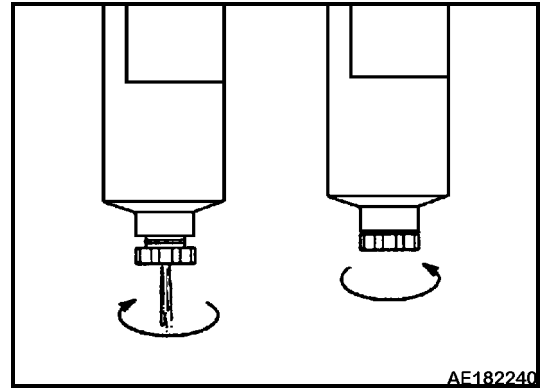
## OPERATION

### Drain Water from the Fuel Water Separator

1. With the engine off open the engine cover and locate the water drain at the bottom of the primary fuel filter. Position a suitable container under filter to catch run off.
2. Open the drain valve, located on the bottom of primary filter, and drain into a suitable container. Close the valve when clear diesel fuel appears.

#### NOTICE:

Do not over tighten the valve. Over tightening can damage the threads.



### 12.1.3 ADJUST BEFORE OPERATION



#### WARNING

- Adjust seat position before starting operations or after changing the operator.
- Adjust seat so that the travel pedals can be depressed fully with the operators back against the backrest.

#### Fore and Aft Adjustment

Move lever (1) to right. After the seat is set to the desired position, release the lever.

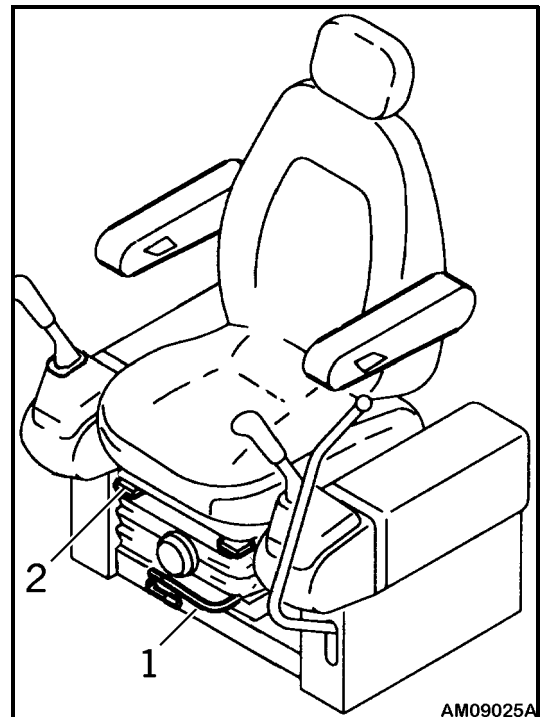
Adjustable distance . . . . . 100 mm (3.3 in) in 10 steps

#### Adjusting Reclining



#### NOTICE

The seat can be reclined to a large angle when the seat is pushed fully forward, but the reclining angle is reduced when the seat is moved back, so when moving the seat to the rear, return the seat back to its original position.

Pull lever (2) and set the seat back to a position which is comfortable for operation, then release the lever. Sit with your back against the seat back when adjusting. If your back is not touching the seat back, the seat back may suddenly move forward.



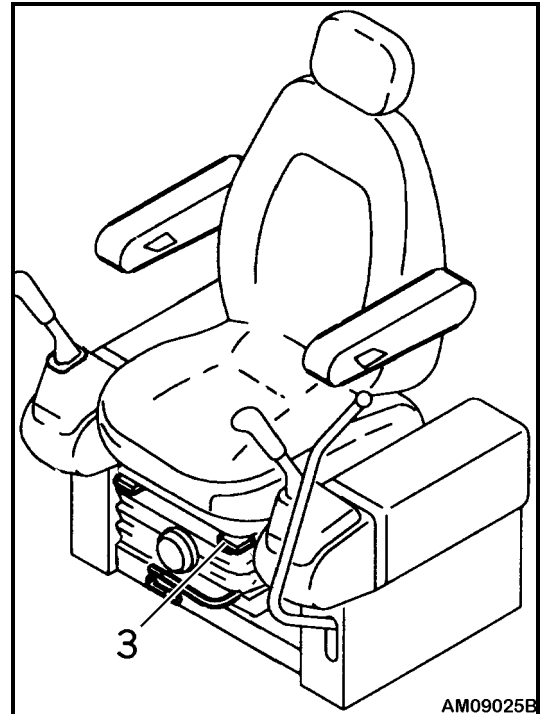
**Adjusting Seat Tilt**

1. Front tilt (); Push lever (3) down to adjust the angle of the front of the seat. (4 stages). To raise the angle at the front of the seat, keep the lever pushed down and apply your weight to the rear of the seat. To lower the angle at the front of the seat, keep the lever pushed down and apply your weight to the front of the seat.
2. Rear tilt (); Pull lever (3) up to adjust the angle of the rear of the seat. (4 stages). To raise the angle at the rear of the seat, keep the lever pulled up and stand up slightly to remove your weight from the seat. To lower the angle at the rear of the seat, keep the lever pulled up and apply your weight to the rear of the seat.

Amount of tilt . . . . . Up 13°, down 13°

3. Seat height; It is possible to move the seat up or down by combining adjustments 1 and 2. After setting the forward tilt or rear tilt to the desired height, operate the opposite part to set the seat horizontal then secure in position.

Height adjustment . . . . . 60 mm (2.4 in)



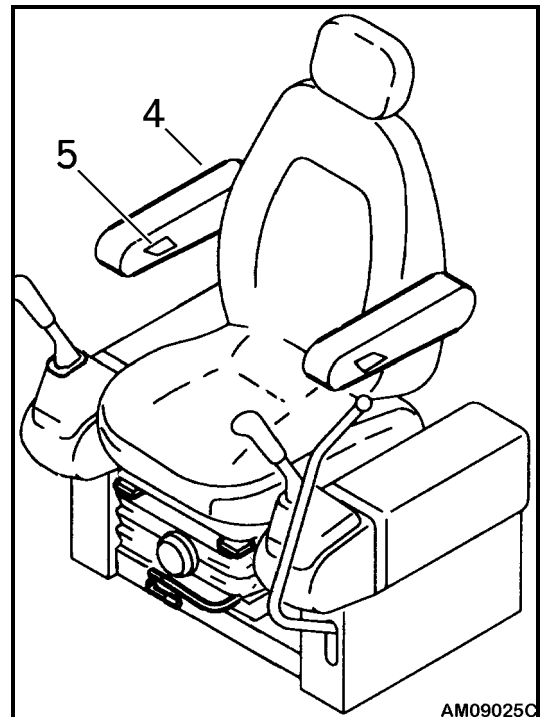
**Adjusting Armrest Angle**

Armrest (4) can be made to spring up by hand ~ 90°. In addition, by turning the bottom (5) of the armrest by hand it is possible to make fine vertical adjustments of the armrest angle.

Armrest adjustment angle . . . . . 25°

**REMARK**

If the seat back is tipped to the front without raising the armrest, the armrest will rise automatically.

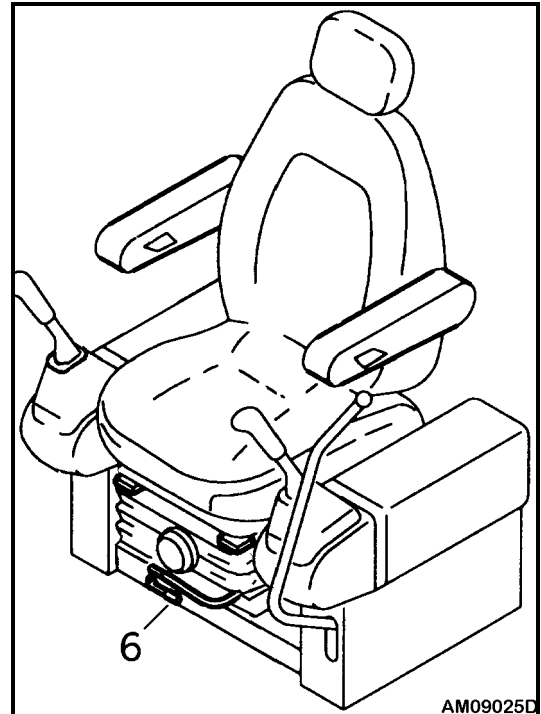


## OPERATION

### Overall Fore and Aft Adjustment of Seat

Pull up lever (6), set to the desired position, then release the lever. In this case, the operators seat, left and right control levers, and safety lock lever all slide together.

Fore and aft adjustment . . . . . 120 mm (4.8 in)

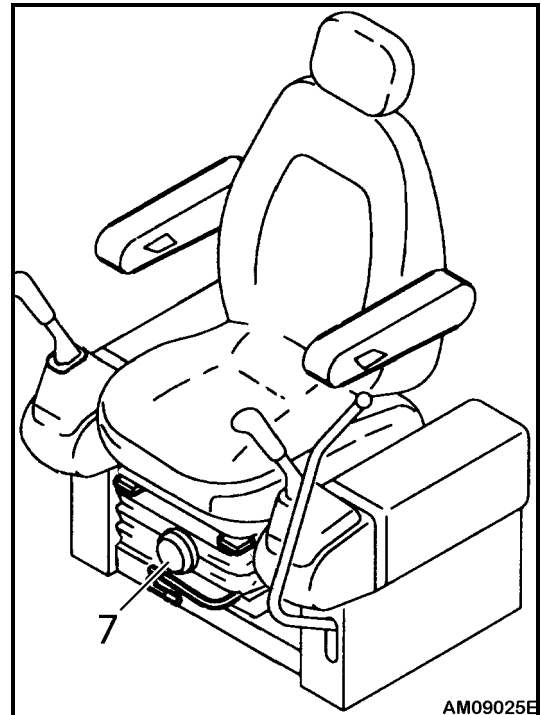


### Adjusting Suspension

Turn knob (7) to the right to make the suspension harder, or to the left to make the suspension softer. Adjust the reading of the dial to match the operators weight and select the optimum suspension.

#### REMARK

To obtain the optimum adjustment, turn the knob so that the indicator of the weight display (kg) in the transparent portion of knob is the same as the operators weight.



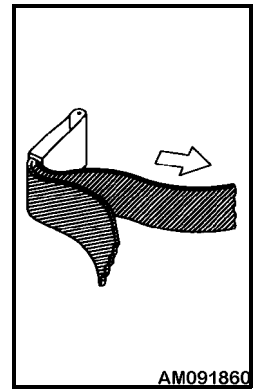
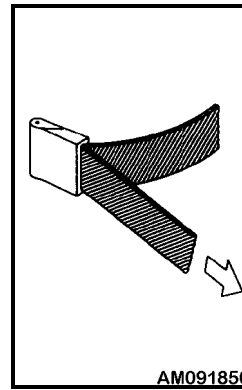
**Adjust the Belt Length**

To shorten the belt:

Pull the free end of the belt on either the buckle body or tongue side.

To lengthen the belt:

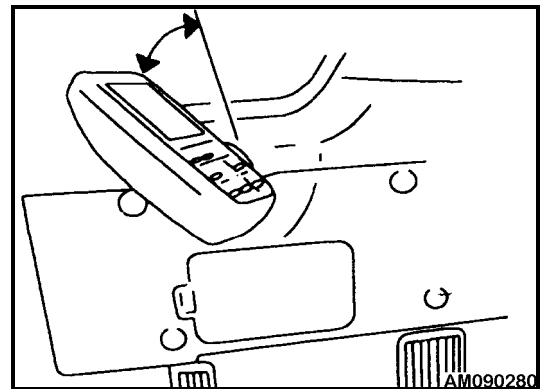
Pull the belt while holding it at a right angle to buckle or tongue.



**Adjustment of Monitor Panel Angle**

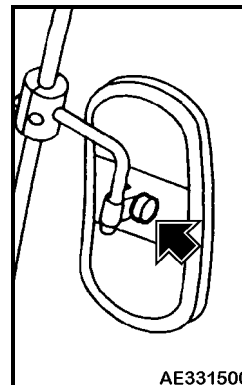
Turn the monitor panel so that the operator can view the monitor with ease. When adjusting the angle, the panel should be set to the desired position using both hands. The panel is automatically locked at that position.

Amount of adjustment: ..... 30° (step less)



**Adjustment of Mirrors**

Loosen nut of each mirror and adjust the mirror angle at which you can see the reflected view most easily from the operators seat. In particular, adjust the mirrors so that you can see persons on both left and right sides of the rear end of the machine.

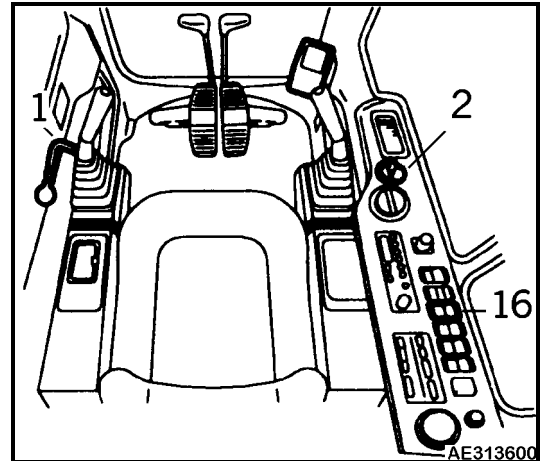


## OPERATION

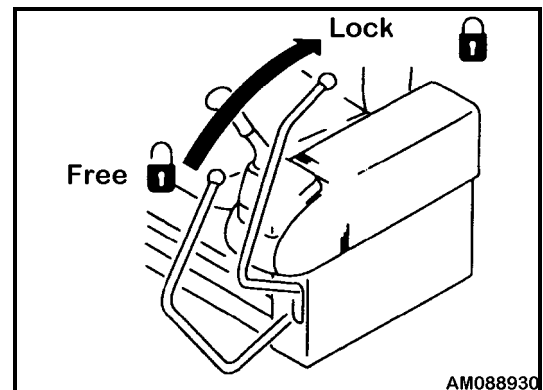
### 12.1.4 OPERATIONS AND CHECKS BEFORE STARTING ENGINE

#### WARNING

If the control lever is touched by accident, the work equipment or the machine may move suddenly. When leaving the operators compartment, always set the safety lock lever securely to the LOCK position.

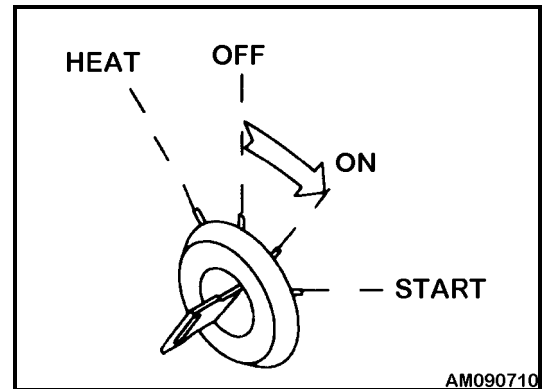


1. Check that safety lock lever (1) is at the LOCK position.
2. Check the position of each lever. Set the control lever to the neutral position. When starting the engine, never touch the knob button.



3. Insert the key in starting switch (2), turn the key to the ON position, then carry out the following checks.

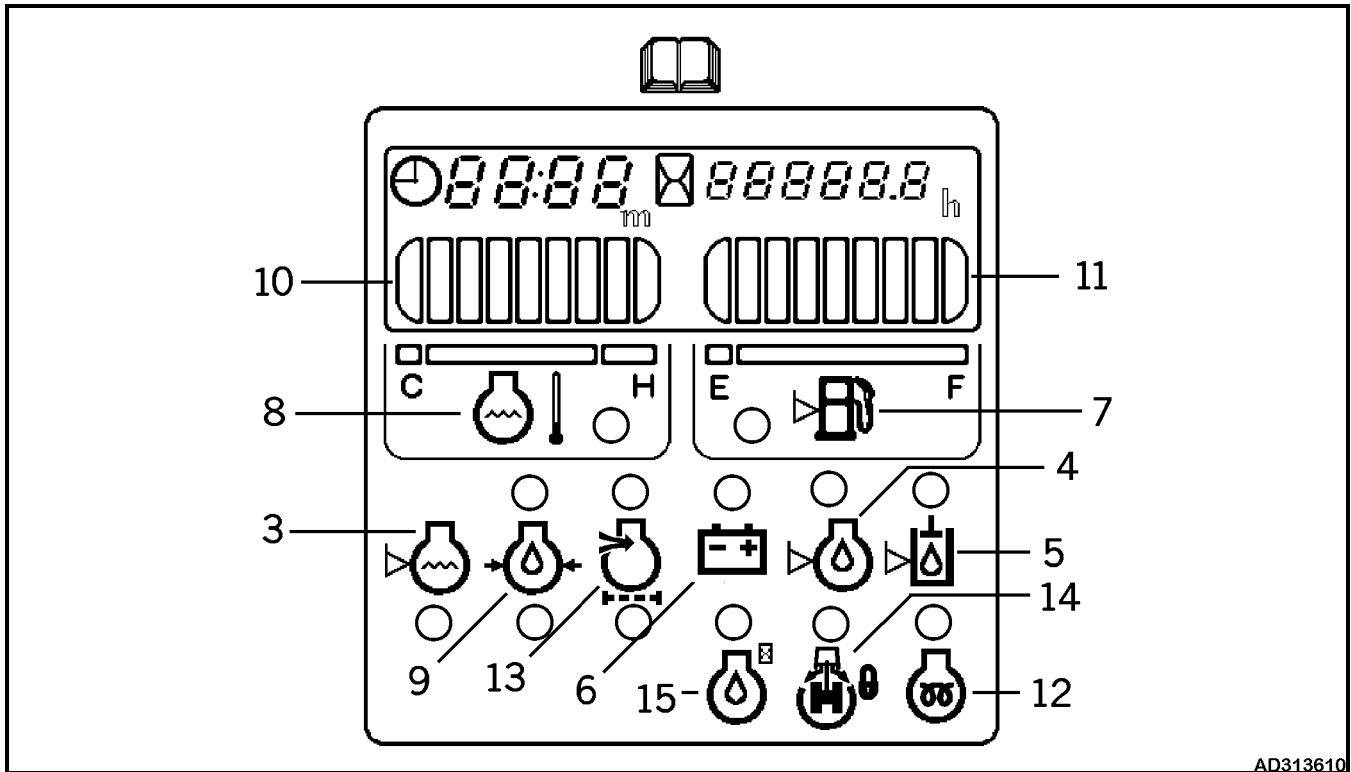
The buzzer will sound for ~ 1 sec, and the following monitors and gauges will light up for ~ 3 sec.



3	Radiator coolant level	8	Engine coolant temperature	13	Air cleaner clogging
4	Engine oil level	9	Engine oil pressure	14	Swing lock lamp
5	Hydraulic oil level	10	Engine coolant temperature	15	Replacement of engine oil
6	Charge level	11	Fuel gauge		
7	Fuel level	12	Engine preheat light		

If the monitors or gauges do not light up or the buzzer does not sound, there is probably a broken bulb or disconnection in the monitor wiring, so contact your distributor for repairs.





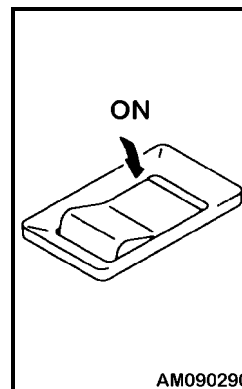
AD313610

After ~ 3 sec, the following gauges will remain on and the other monitors will go out.

Engine coolant temperature gauge (10)

Fuel gauge (11)

Press lamp switch (16) to turn on the head lights. If the lights do not illuminate, there is probably a broken bulb or disconnection in the wiring, so contact your distributor for repairs.



AM090290

# OPERATION

## 12.2 STARTING ENGINE

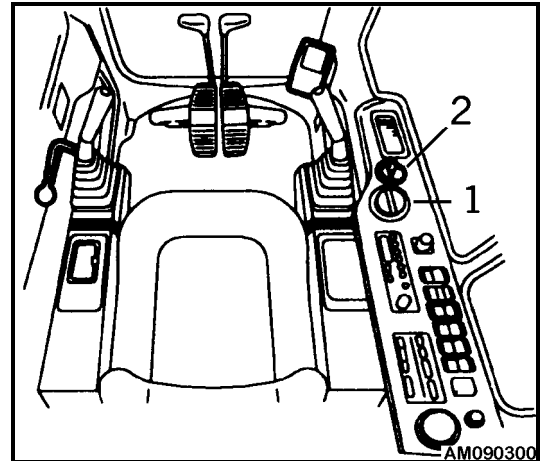
### 12.2.1 NORMAL STARTING

#### WARNING

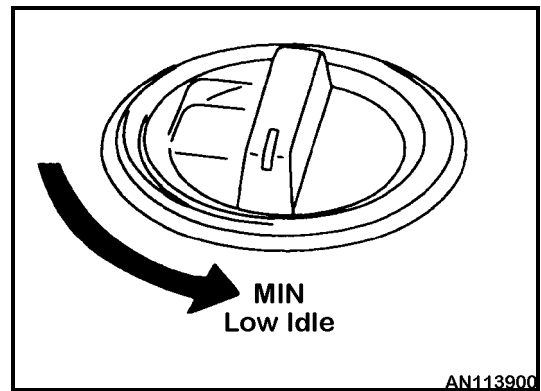
Check that there are no persons or any obstacles in the surrounding area, then sound the horn as an alert and start the engine.

#### NOTICE

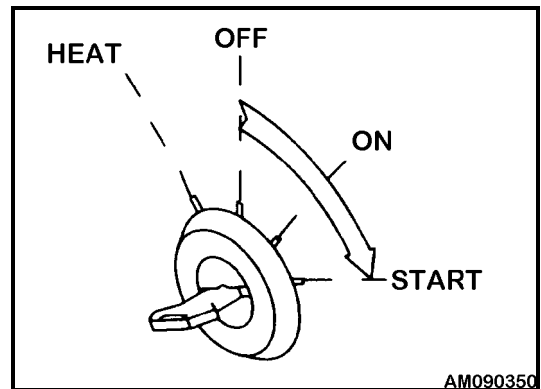
Do not keep the starting motor rotating continuously for more than 20 seconds. If the engine will not start, wait for at least 2 minutes before trying to start the engine again.



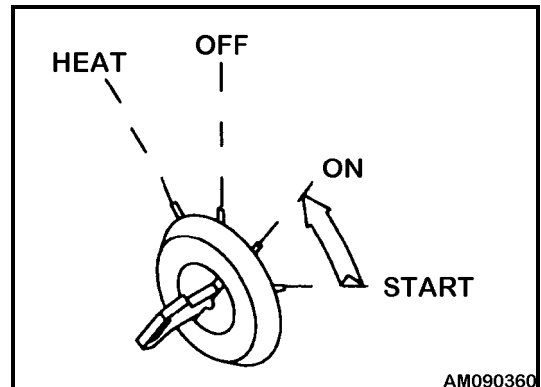
1. Set fuel control dial (1) at the low idle (MIN) position.



2. Turn the key in starting switch to the START position. The engine will start.



3. When the engine starts, release the key in starting switch (2). The key will return automatically to the ON position.



12.2.2 STARTING IN COLD WEATHER

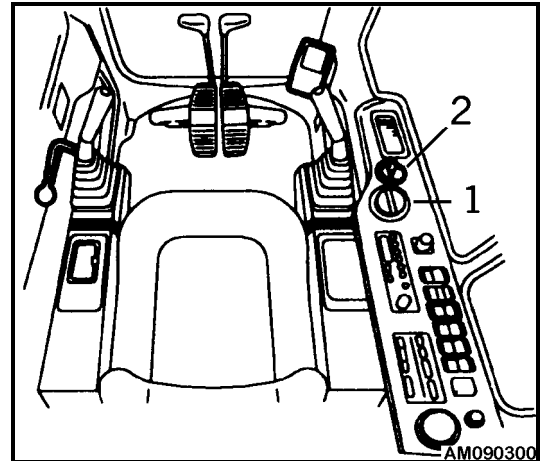
**WARNING**

- Check that there are no persons or any obstacles in the surrounding area, then sound the horn as an alert and start the engine.
- Never use starting aid fluids as they may cause explosions.

**NOTICE**

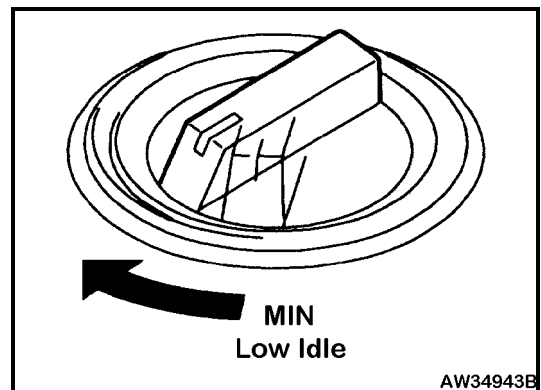
Do not keep the starting motor rotating continuously for more than 20 seconds. If the engine will not start, wait for at least 2 minutes before trying to start the engine again.

1. Set fuel control dial at 3 notches from the low idle (MIN) position.

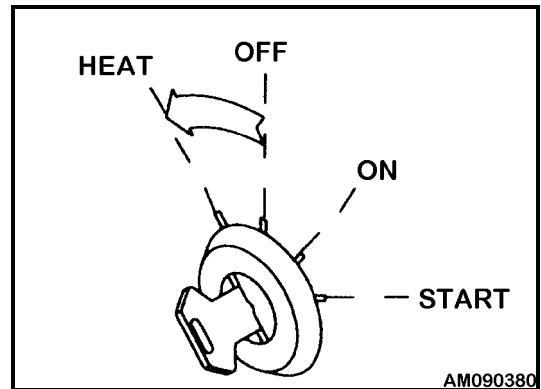


**REMARK**

There are 10 notches for the dial rotation, and the click can be felt by hand.

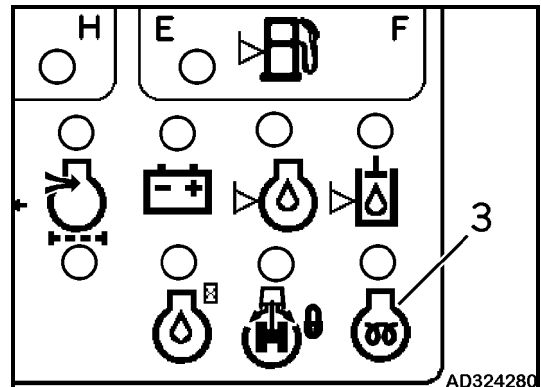


2. Hold the key in starting switch (2) at the HEAT position, and check that preheat monitor (3) lights up. After about 30 seconds, preheat monitor will flash for about 10 seconds to indicate that preheat is finished.



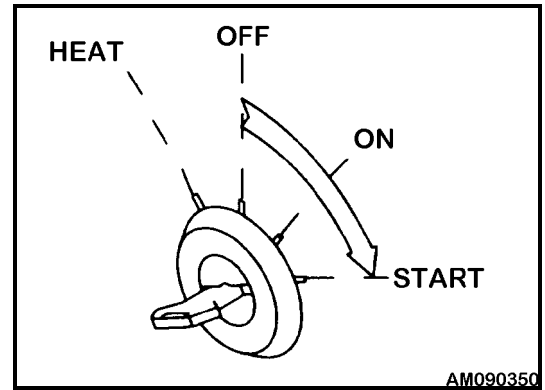
**REMARK**

The monitor and gauge also light up when the key is at the HEAT position, but this does not indicate any abnormality.

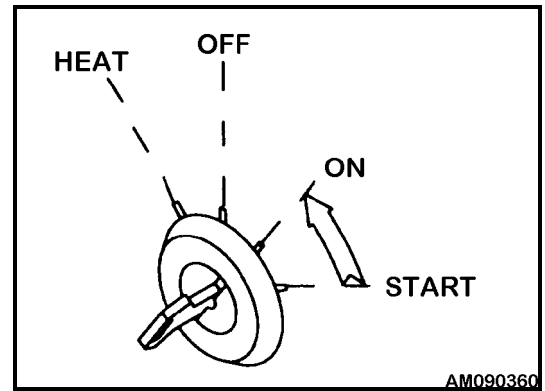


## OPERATION

- When the preheat monitor (3) flashes, turn the key in starting switch (2) to the START position to start the engine.



- When the engine starts, release the key in starting switch (2). The key will return automatically to the ON position.



## 12.3 OPERATIONS AND CHECKS AFTER ENGINE STARTS

### WARNING

- **Emergency stop:** If there has been any abnormal actuation or trouble, turn the starting switch key to the OFF position.
- **If the work equipment is operated without warming the machine up sufficiently, the response of the work equipment to the movement of the control lever will be slow. The work equipment may not move as the operator desires, so always carry out the warm up operation. Particularly in cold areas, be sure to carry out the warming up operation fully.**

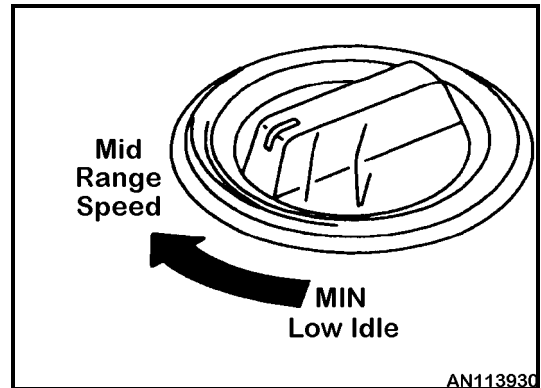
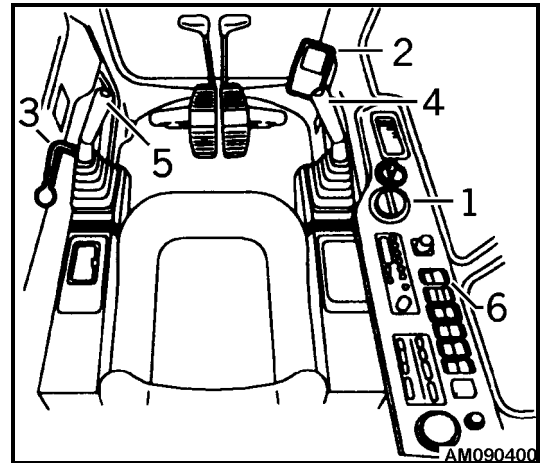
### 12.3.1 WHEN NORMAL

#### NOTICE

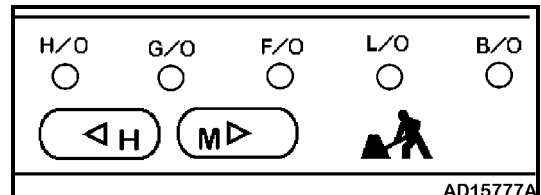
When the hydraulic oil is at a low temperature, do not carry out operations or move the levers suddenly. Always carry out the warm up operation. This will help to extend the machine life. Do not suddenly accelerate the engine before the warm up operation is completed. Do not run the engine at low idle or high idle continuously for more than 20 minutes. This will cause leakage of oil from the turbocharger oil supply piping. If it is necessary to run the engine at idle, apply a load from time to time or run the engine at a midrange speed.

After starting the engine, do not immediately start operations. First, carry out the following operations and checks.

1. Turn fuel control dial to the center position between low idle (MIN) and high idle (MAX) and run the engine at medium speed for about 5 minutes with no load.

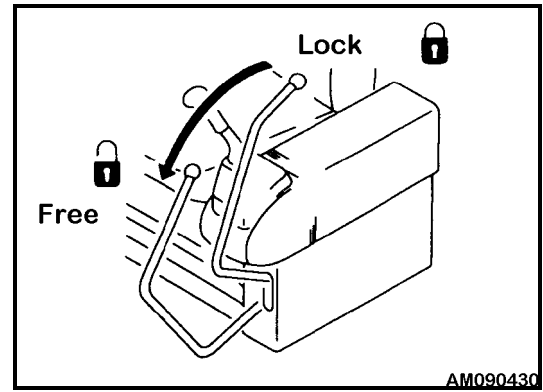


2. While running the engine at medium speed, press working mode switch until the heavy-duty operation mode lamp is turned on.

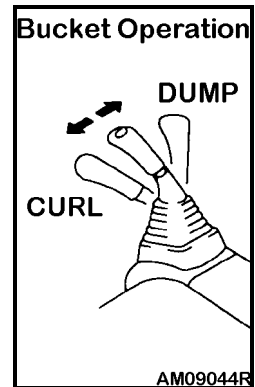
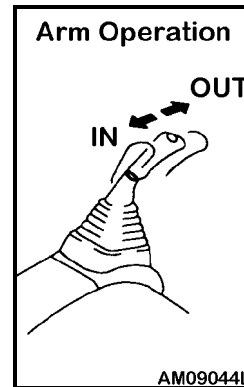


## OPERATION

3. Set the safety lock lever to the FREE position, and raise the bucket from the ground.



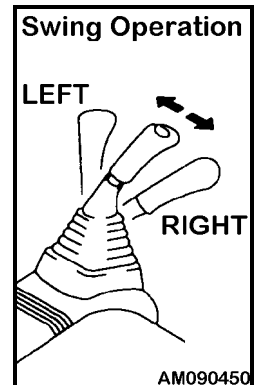
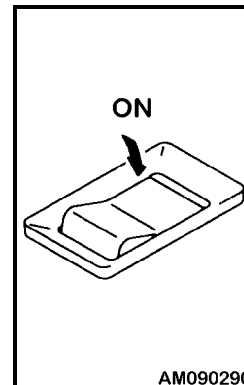
4. Operate bucket control lever (4) and arm control lever (5) slowly to move the bucket cylinder and arm cylinder to the end of the stroke.



5. Carry out bucket and arm operation for 5 minutes at full stroke, alternating between bucket operation and arm operation at 30 second intervals. If the swing lock switch (6) is set to the ON (actuated) position and swing control lever (5) is operated at full stroke, oil temperature rise can be increased earlier.

### NOTICE

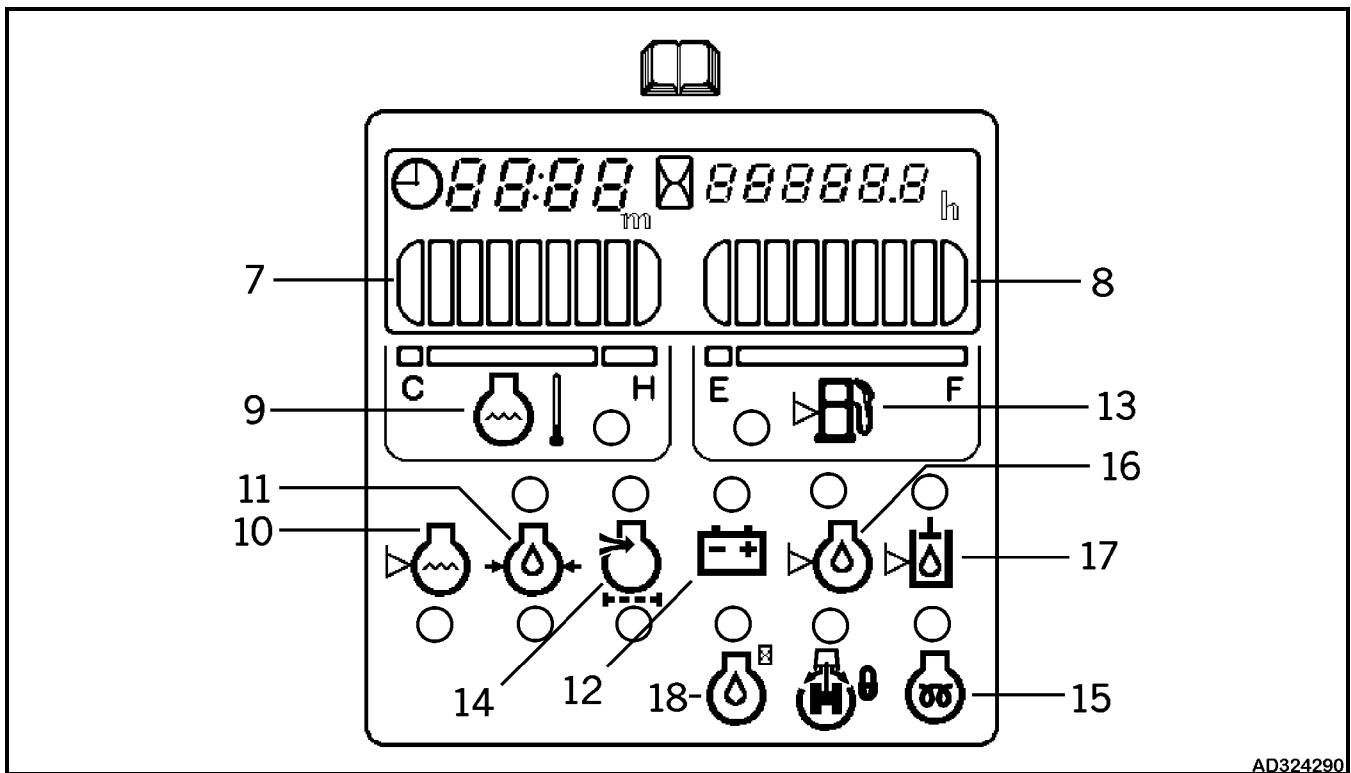
When the work equipment is retracted, take care that it does not interfere with the machine body or ground.



6. After carrying out the warm up operation, check that each gauge and monitor light is in the following condition as shown on the chart.

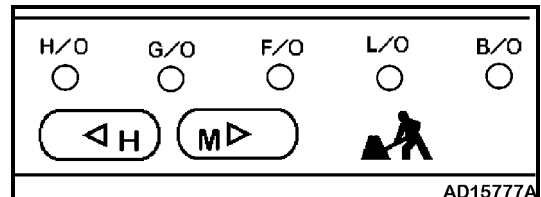
7	Engine Temperature Gauge	Green Range
8	Fuel gauge	Green Range
9	Engine coolant monitor	OUT
10	Radiator coolant level monitor	OUT
11	Engine oil pressure monitor	OUT
12	Charge level monitor	OUT

13	Fuel level monitor	OUT
14	Air cleaner clogging monitor	OUT
15	Engine preheat light	OUT
16	Engine oil level monitor	OUT
17	Hydraulic oil level monitor	OUT
18	Replacement monitor of engine oil	OUT



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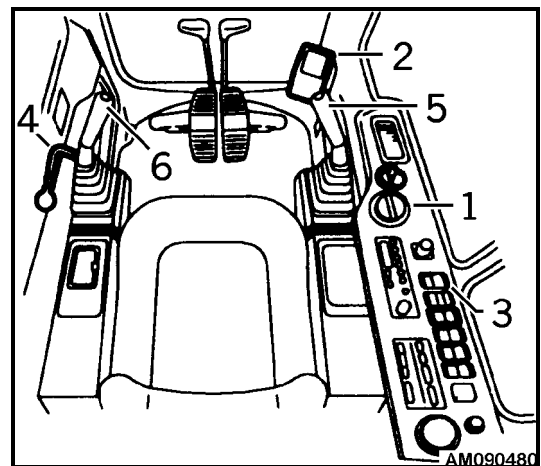
- 7. Check that there is no abnormal exhaust gas color, noise, or vibration. If any abnormality is found, repair it.
- 8. Press mode switch (2) until required operation mode light is turned on.



AD15777A

**12.3.2 IN COLD AREAS (AUTOMATIC WARM UP OPERATION)**

When starting the engine in cold areas, carry out the automatic warm up operation after starting the engine. When the engine is started, if the engine coolant temperature is low (below 30°C, 86°F), the warm up operation is carried out automatically. The engine speed is automatically raised to 1400 RPM. The automatic warm up operation is canceled automatically if the engine coolant temperature reaches the specified temperature (30°C, 86°F) or if the warm up operation is continued for 10 minutes. The automatic warm up operation is also canceled automatically if the fuel control dial is manually held at more than 70% of full speed for more than 3 seconds. When the automatic warm up operation is cancelled, the engine speed will return to the desired speed by setting the fuel control dial. If the engine coolant temperature or hydraulic oil temperature are low after the automatic warm up operation, warm the engine up further as follows.



AM090480

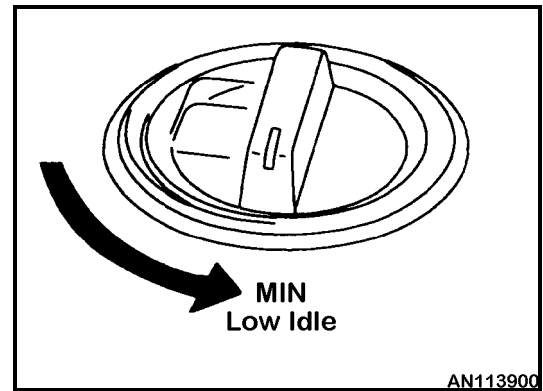
**NOTICE**

When the hydraulic oil is at a low temperature, do not carry out operations or move the levers suddenly. Always carry out the warm up operation. This will help to extend the machine life. Do not suddenly accelerate the engine before the warm up operation is completed. Do not run the engine at low idle or high

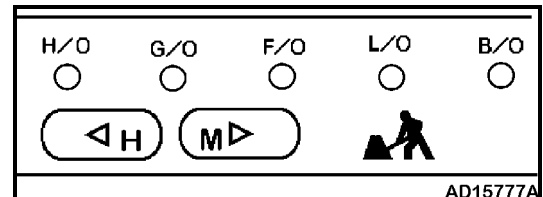
## OPERATION

idle continuously for more than 20 minutes. This will cause leakage of oil from the turbocharger oil supply piping. If it is necessary to run the engine at idling, apply a load from time to time or run the engine at a midrange speed.

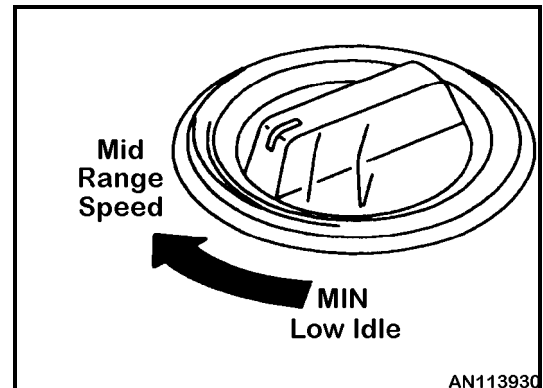
1. Set fuel control dial (1) to the low idle (MIN) position and run the engine for about 5 minutes without load.



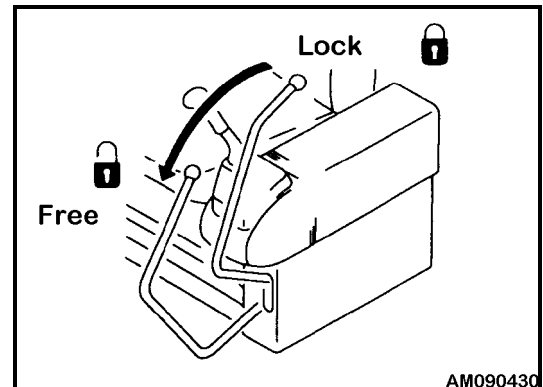
2. Press working mode switch (2) on the monitor panel until the H/O (heavy-duty operation) mode light illuminates.



3. Turn fuel control dial (1) to the medium speed position.

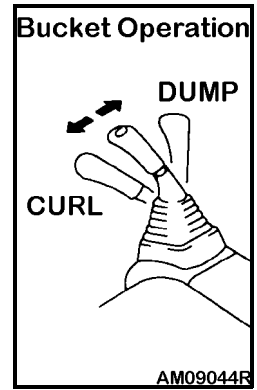
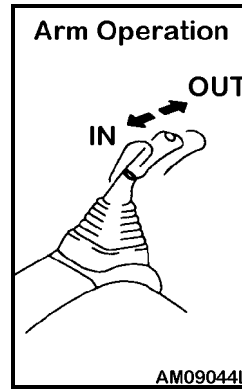


4. Set safety lock lever to the FREE position and raise the bucket from the ground.





5. Operate bucket control lever and arm control lever slowly to move the bucket cylinder and arm cylinder to the end of their stroke.
6. Operate the bucket for 30 seconds and the arm for 30 seconds in turn fully for 5 minutes.

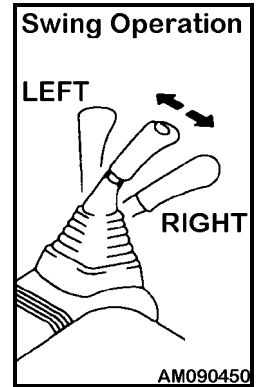
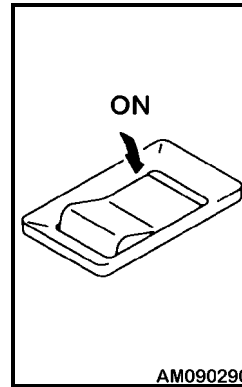


**REMARK**

Turn swing lock switch (3) ON (actuated) and operate the lever to make the oil temperature rise more quickly.

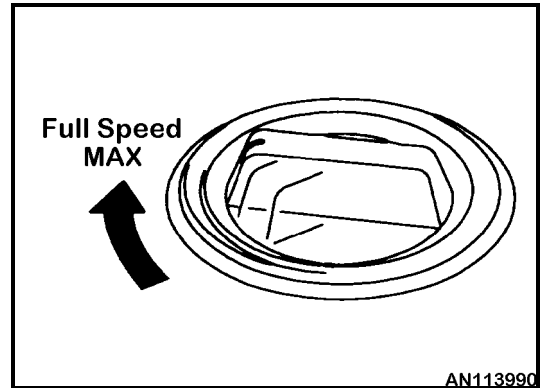
**NOTICE**

When the work equipment is retracted, take care that it does not interfere with the machine body or ground.



7. Turn fuel control dial (1) to the full speed (MAX) position and repeat the operation in Step 6 for 3 to 5 minutes.
8. Repeat the following operation 3 to 5 times and operate slowly.

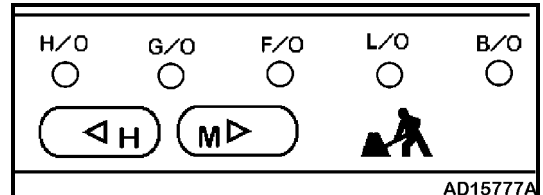
Boom operation	RAISE	LOWER
Arm operation	IN	OUT
Bucket operation	CURL	DUMP
Swing operation	LEFT	RIGHT
Travel (Lo) operation	FORWARD	REVERSE



**REMARK**

If the above operation is not carried out, there may be a delay in response when starting or stopping each action, so continue the operation until it becomes normal.

9. Use working mode switch (2) on the monitor panel to select the working mode to be used.

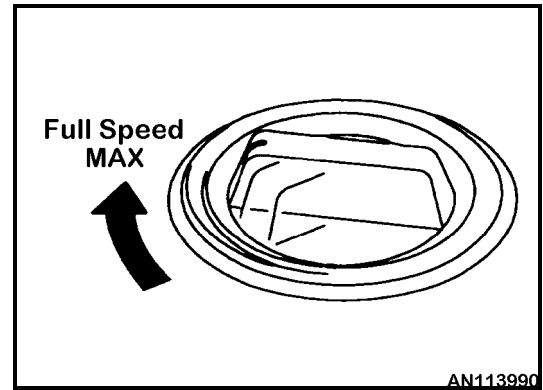


## OPERATION

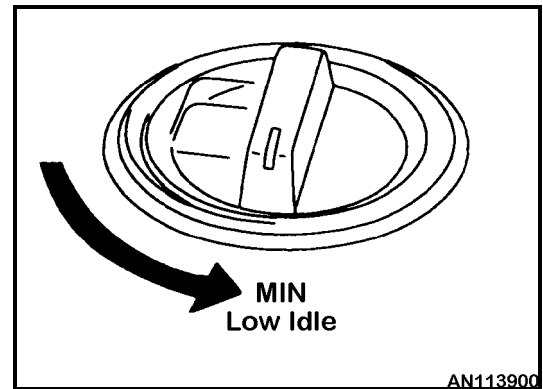
### NOTICE

Canceling automatic warm up operation: If it becomes necessary in an emergency to lower the engine speed to low idle, cancel the automatic warm up operation as follows.

1. Turn the fuel control dial (1) to the full speed (MAX) position and hold it for 3 seconds.



2. When the fuel control dial (1) is returned to the low idle (MIN) position, the engine speed will drop.

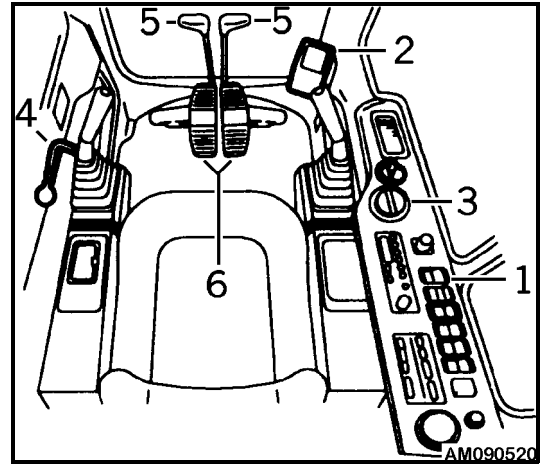


## 12.4 MOVING MACHINE

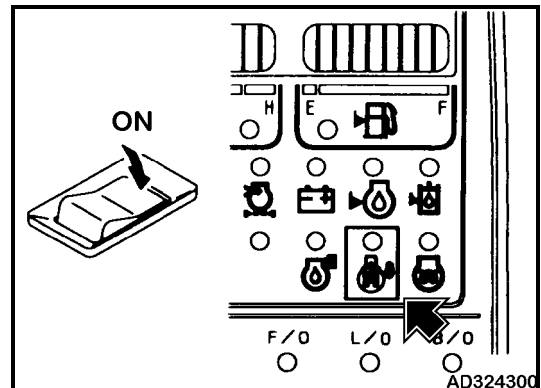
### 12.4.1 MOVING MACHINE FORWARD

**⚠ WARNING**

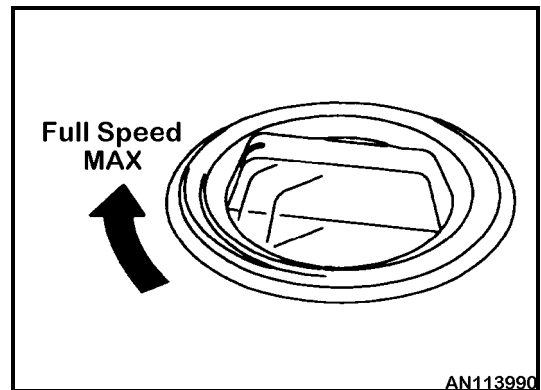
- Before operating the travel levers, check the direction of the track frame. If the sprocket is at the front, the operation of the travel levers is reversed.
- When moving off, check that the area around the machine is safe, and sound the horn before moving.
- Clear all personnel from the machine and the area.
- Clear all obstacles from the path of the machine.
- If the lever is moved inside the deceleration range, engine speed will rise suddenly. Operate the levers carefully.
- For machines equipped with the travel alarm, check that the alarm works properly.



1. Set swing lock switch (1) to the ON (actuated) position and confirm that swing lock monitor light (2) illuminates.

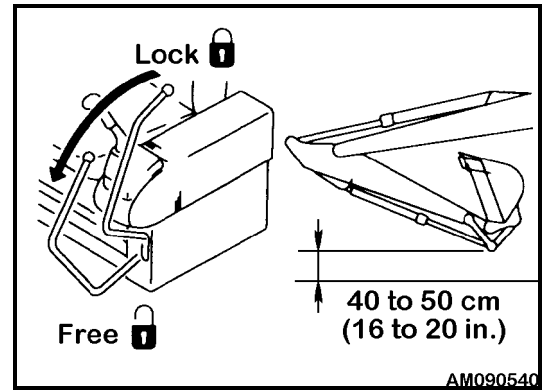


2. Turn fuel control dial (3) towards the full speed position to increase the engine speed.



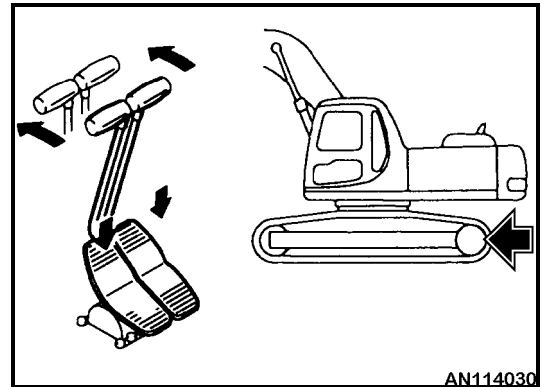
## OPERATION

- Set safety lock lever (4) in the FREE position, fold the work equipment, and raise it 40 to 50 cm (16 to 20 in) from the ground.



- Operate right and left travel levers (5) or right and left travel pedals (6) as follows.

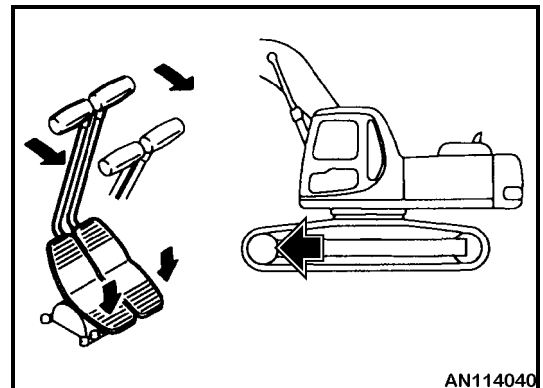
- When the sprocket is at the rear of the machine; Push levers (5) forward slowly or depress the front part of pedals (6) slowly to move the machine off.



- When the sprocket is at the front of the machine; Pull levers (5) backward slowly or depress the rear part of pedals (6) slowly to move the machine off.

### REMARK

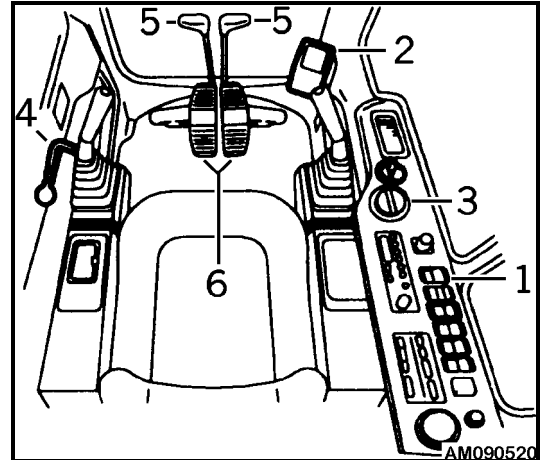
Each time the travel levers are operated on machines equipped with the travel alarm, the alarm sounds to warn people in the machine vicinity.



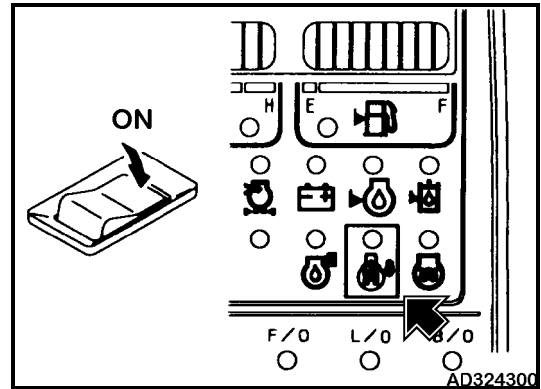
12.4.2 MOVING MACHINE REARWARD

**WARNING**

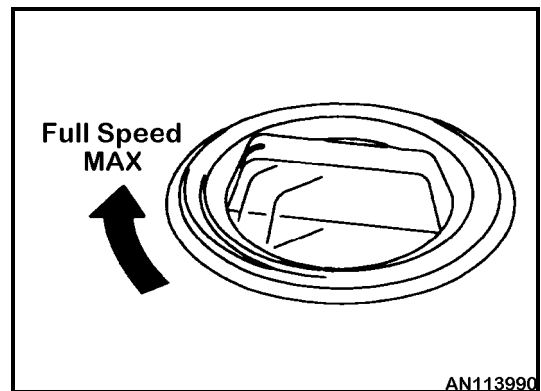
- Before operating the travel levers, check the direction of the track frame. If the sprocket is at the front, the operation of the travel levers is reversed.
- When moving off, check that the area around the machine is safe, and sound the horn before moving.
- Clear all personnel from the machine and the area.
- Clear all obstacles from the path of the machine.
- Use extreme care when reversing the machine. Note there is a blind spot behind the machine.
- If the lever is moved inside the deceleration range, engine speed will rise suddenly. Operate the levers carefully.
- For machines equipped with the travel alarm, check that the alarm works properly.



1. Set the swing lock switch (1) to the ON (actuated) position and confirm that the swing lock monitor light (2) illuminates.

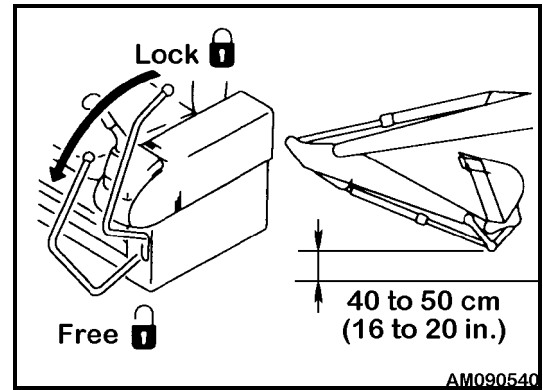


2. Turn the fuel control dial (3) towards the full speed position to increase the engine speed.



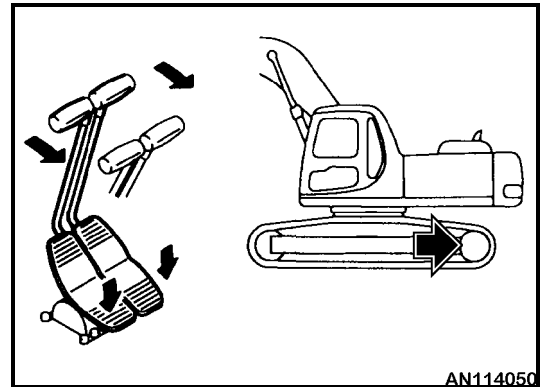
## OPERATION

3. Set safety lock lever (4) in the FREE position, fold the work equipment, and raise it 40 to 50 cm (16 to 20 in) from the ground.

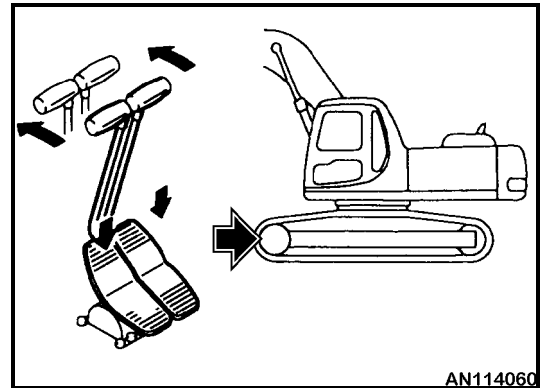


4. Operate right and left travel levers (5) or right and left travel pedals (6) as follows.

- When the sprocket is at the rear of the machine; Pull levers (5) backward slowly or depress the rear part of pedals (6) slowly to move the machine off.



- When the sprocket is at the front of the machine; Push levers (5) forward slowly or depress the front part of pedals (6) slowly to move the machine off.



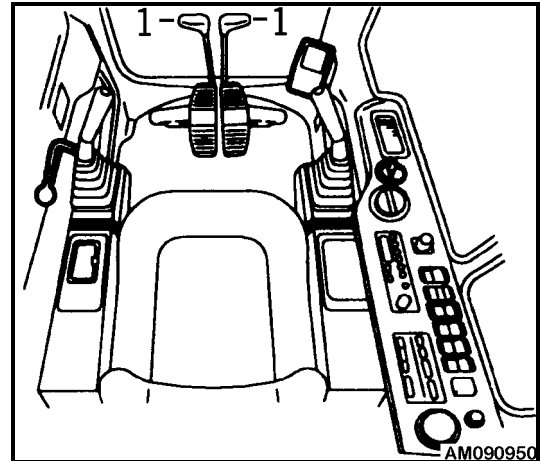
## 12.5 STEERING MACHINE

### 12.5.1 STEERING (CHANGING DIRECTION)

#### WARNING

Before operating the travel levers, check the position of the sprocket. If the sprocket is at the front, the operation of the travel levers is reversed.

Use the travel levers to change direction. Avoid sudden changes of direction as far as possible. In particular, when carrying out counter rotation (spin turn), stop the machine first before turning. Operate two travel levers (1) as follows.

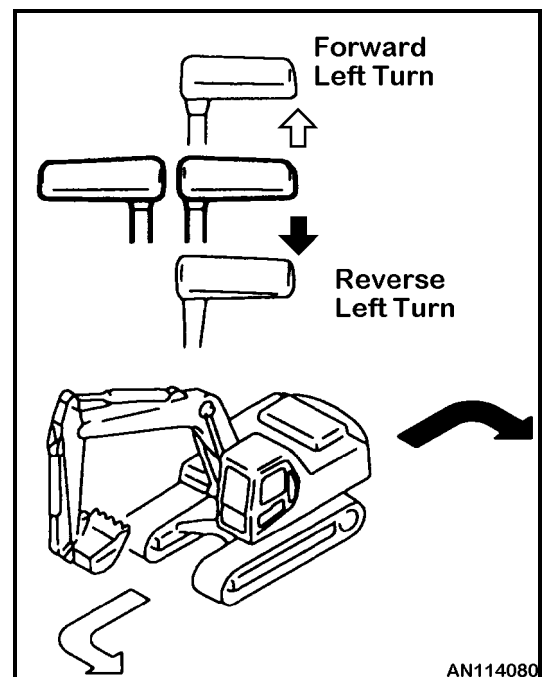


#### Changing Direction of Machine When Stopped

When turning to the left; Push the right travel lever forward to travel left when traveling forward; and pull it back to turn left when traveling in reverse.

#### REMARK

When turning to the right, operate the left travel lever in the same way.



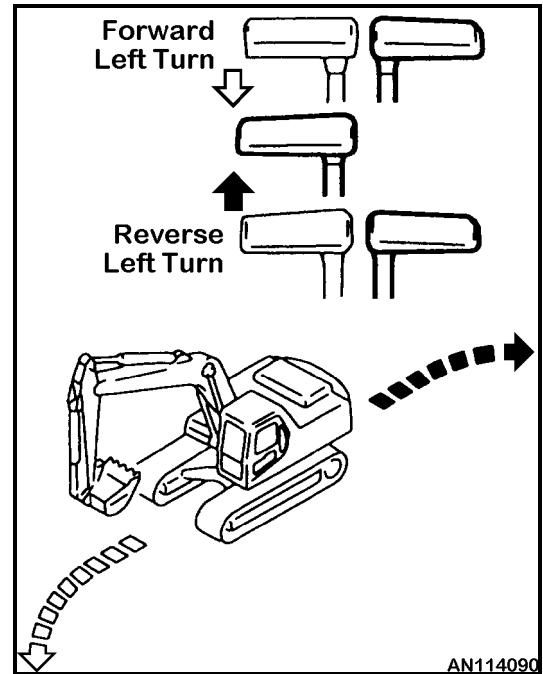
## OPERATION

### Steering When Traveling (Left and Right Travel Levers Both Operated in Same Direction)

When turning to the left; if the left travel lever is returned to the neutral position, the machine will turn to the left.

#### REMARK

When turning to the right, operate the right travel lever in the same way.

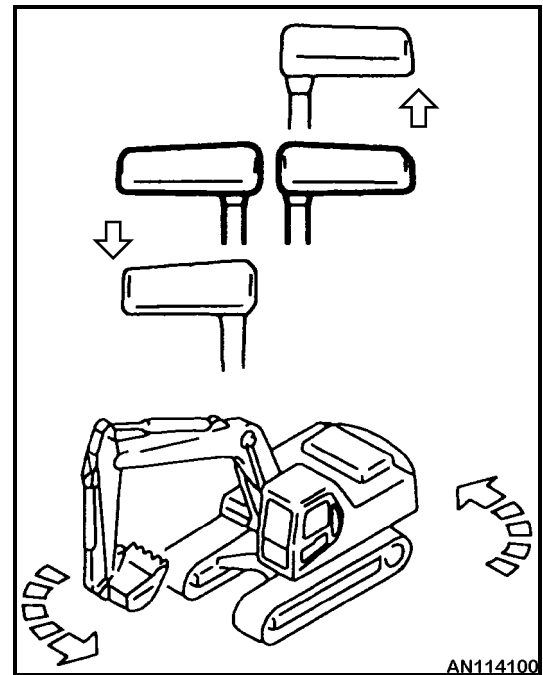


### When Making Counter Rotation Turn (Spin Turn)

When turning left using counter rotation, pull the left travel lever back and push the right travel lever forward.

#### REMARK

When turning right using counter rotation, pull the right travel lever back and push the left travel lever forward.

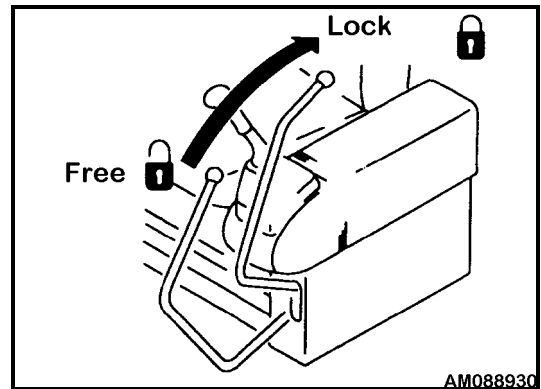
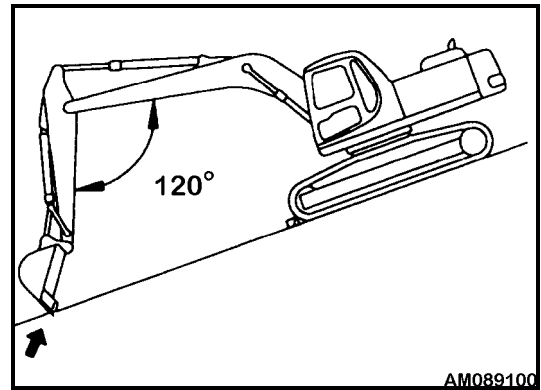




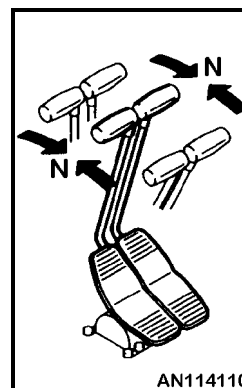
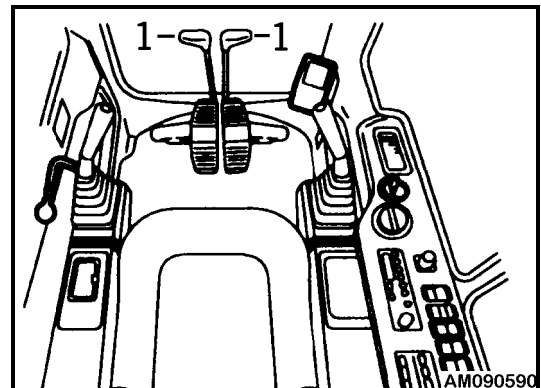
## 12.6 STOPPING MACHINE

### WARNING

- Avoid stopping suddenly. Give yourself ample room when stopping.
- When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks beneath the track shoes. As an additional safety measure, thrust the bucket into the ground.
- If the control lever is touched by accident, the work equipment or the machine may move suddenly, and this may lead to a serious accident. Before leaving the operators compartment, always set the safety lock lever securely to the LOCK position.



1. Put the left and right travel levers (1) in the neutral position to stop the machine.



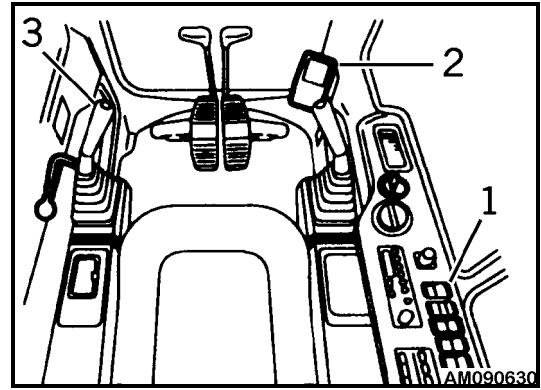
# OPERATION

## 12.7 SWINGING



### WARNING

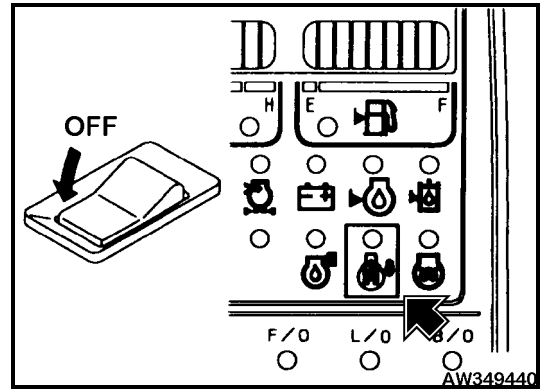
When operating the swing, check that the area around the machine is safe.



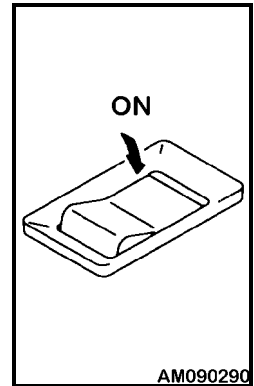
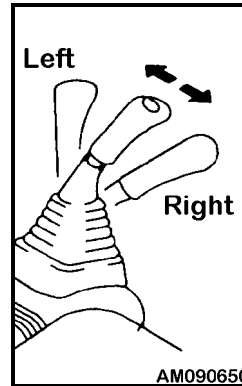
1. Before operating the swing, turn the swing lock switch (1) OFF (canceled).

### NOTICE

Check that swing lock monitor (2) goes out at the same time.



2. Operate left work equipment control lever (3) to swing the upper structure.
3. When not operating the swing, turn swing lock switch (1) ON (actuated).



## 12.8 OPERATION OF WORK EQUIPMENT

### WARNING

If any lever is operated when in the deceleration range, the engine speed will suddenly increase, so be careful when operating the levers.

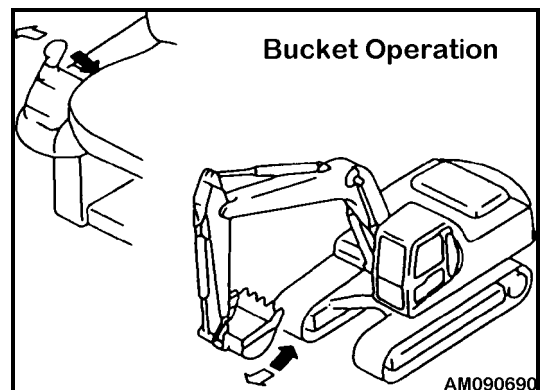
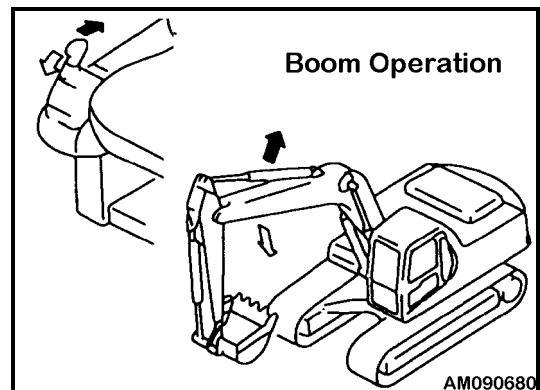
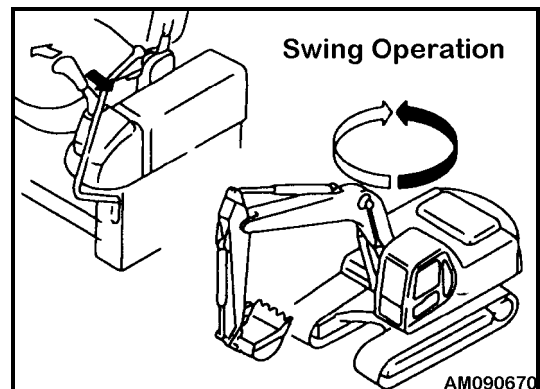
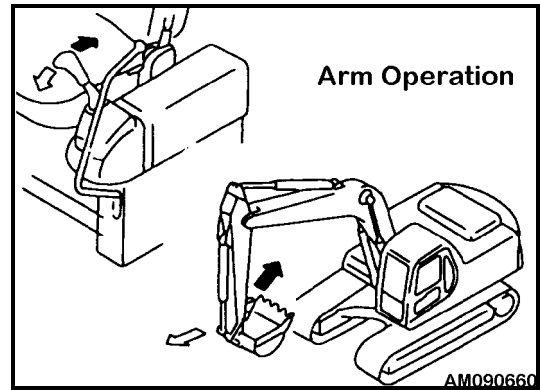
The work equipment is operated by the left and right work operation control levers. The left work equipment control lever operates the arm and swing, and the right work equipment control lever operates the boom and bucket.

The movements of the lever and work equipment are as shown in the diagrams on the right. When the levers are released, they automatically return to the neutral position and the work equipment is held in place.

- If the work equipment control lever is returned to the neutral position when the machine is stopped, even if the fuel control dial is set to FULL, the auto-deceleration mechanism will act to reduce the engine speed to a mid-range speed.

### REMARK

If the levers are operated within 15 seconds after stopping the engine, it is possible to lower the work equipment to the ground. In addition, the levers can also be operated to release any remaining pressure inside the hydraulic cylinder circuit and to lower the boom after loading the machine on a trailer.



## OPERATION

### 12.9 HANDLING ACTIVE MODE

Make full use of the active mode to match the purpose and conditions of the operation in order to carry out operations effectively and efficiently.

The active mode selector switch can be turned ON (lights up) in order to provide quick leveling operations and effective deep digging and loading operations.

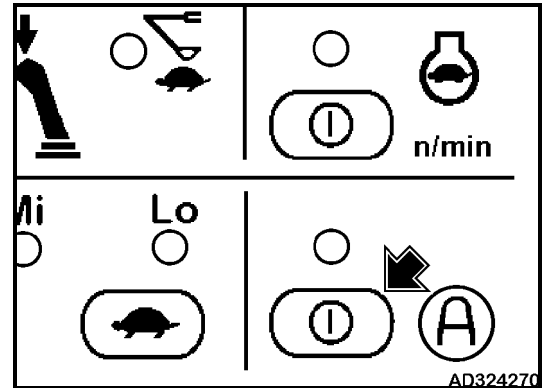
ON lights up: Active mode ON

ON goes out: Active mode canceled

The ON lamp is off when the engine is started.

If it is turned ON (lights up), it is possible to enter the active mode from any working mode.

Even when it is turned ON (lights up), the working mode display does not change. When the lamp goes out, the system returns to the original working mode.



Mode	Effective operation	Advantages for operation
Active	Digging and loading	The boom lowering speed is increased, so the cycle time for deep digging operations is reduced.
	Leveling	By increasing the arm IN speed and the pump response, the speed of rough leveling (light loads) is increased.

#### REMARK

Use the active mode with the fuel control dial turned to the MAX position. If it is not at the MAX position, it will be impossible to achieve a suitable increase in the work equipment speed.

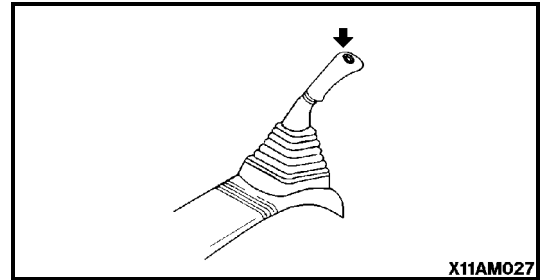
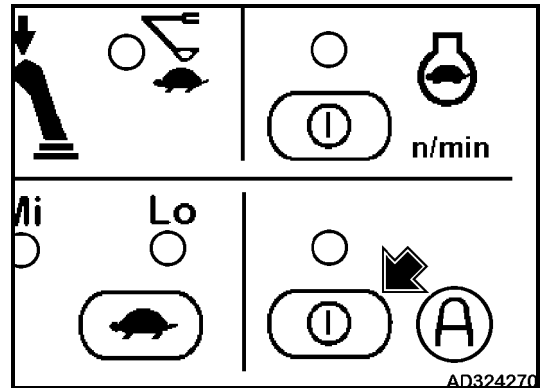
The active mode includes a load detection function. If a heavy load is applied, the engine speed will drop 200-300 rpm to inform the operator that there is a heavy load, but the work equipment power will not drop. (In the active mode or when traveling, the load detection function is actuated.)

Active power-max function. When digging deep and loading or under heavy load, use the active power-max function according to the following procedures.

1. Turn on the active mode selector switch.
2. While in this condition, press and hold the knob switch of the left-hand work equipment lever.
3. Since the machine returns to the normal active mode in 8.5 seconds after the switch is pressed, use the active power-max function effectively for heavy and quick work.

Function	Suitable work	Advantage on work
Active power-max	Digging and loading (Heavy load) Rock lifting (Heavy load)	Since the digging force of arm and bucket is increased, working speed is increased.

The load sensing function is installed to the active mode. If the machine is set to the active power-max, however, the load sensing function is turned off and the engine speed remains at full speed to increase the speed of the work equipment.



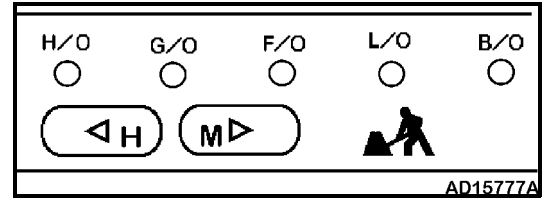
# OPERATION

## 12.10 HANDLING WORKING MODE

### 12.10.1 WORKING MODE

The mode selector switch can be used to switch the mode to match the operating conditions and purpose, thereby enabling work to be carried out efficiently. Make effective use of each mode as follows.

When the starting switch is turned ON, the working mode is automatically set to general operation mode (G.O), so normal operations can be carried out without setting the mode. Use the working mode switch to set the mode to the most efficient mode to match the type of work.



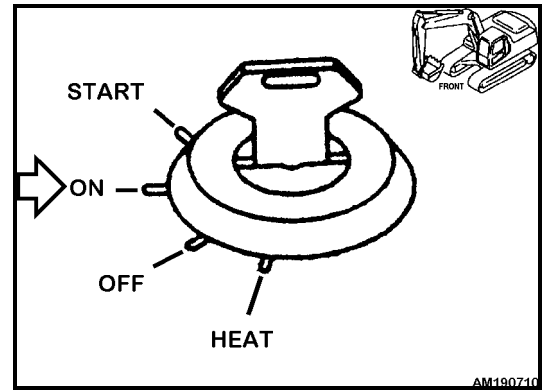
ID	Working mode	Applicable operation	Power max.		Swift slow down	
			Power	Set pressure	Speed	Set pressure
H/O	Heavy duty operation	Large volume digging and loading in a short time	5% up	9% up	40% down	9% up
G/O	General operation	Normal digging and loading operations	23% up	9% up	30% down	9% up
F/O	Finishing operation	Leveling or hauling operations	-	-	-	-
L/O	Lifting operation	Aligning position	-	-	-	-
B/O	Breaker operation	Breaker operations	-	-	-	-

### NOTICE

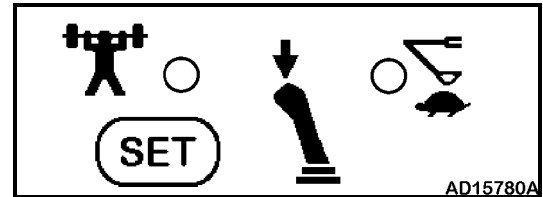
Do not use the heavy-duty operation mode for breaker operations. If breaker operations are carried out in the heavy duty operation mode, there is danger that the hydraulic equipment may be damaged or broken.

**12.10.2 POWER MAX., SWIFT SLOW DOWN**

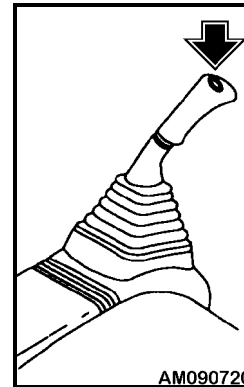
The power max. and swift slow down for the work equipment can be carried out at a touch during operations. This can be used effectively in combination with the working mode when necessary.



1. When the starting switch is turned ON, the power max. lamp lights up. When set switch is pressed once, the speed down lamp turns on and the power up lamp goes out, and when pressed again, the opposite occurs.



2. When the left knob button is given a single click (keep depressed after initially pressing) power keeps increasing while depressed. However, power up automatically completes after 8.5 seconds.



## OPERATION

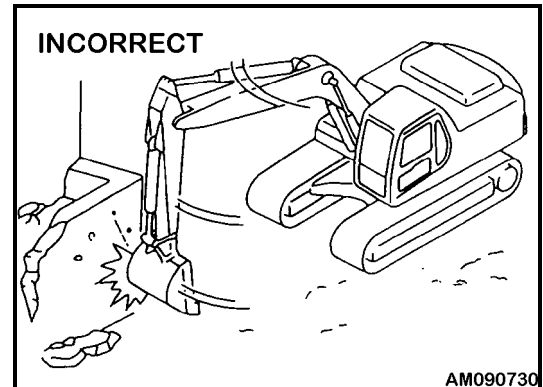
### 12.11 PROHIBITED OPERATIONS

#### WARNING

- If it is necessary to operate the work equipment control lever when the machine is traveling, first stop the machine before operating the work equipment control lever.
- If the lever is moved inside the deceleration range, the engine speed will suddenly rise. Operate the levers carefully.
- Never operate the machine on a rock bed (hard or soft rock).

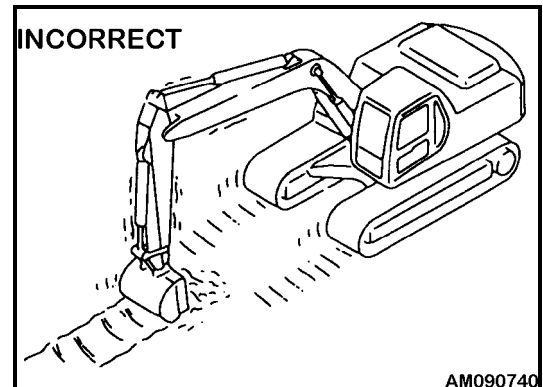
#### 12.11.1 USING SWING FORCE

Do not use the swing force to compact soil or break earth mounds or walls. When swinging, do not dig the bucket teeth into the soil. These operations will damage the work equipment.



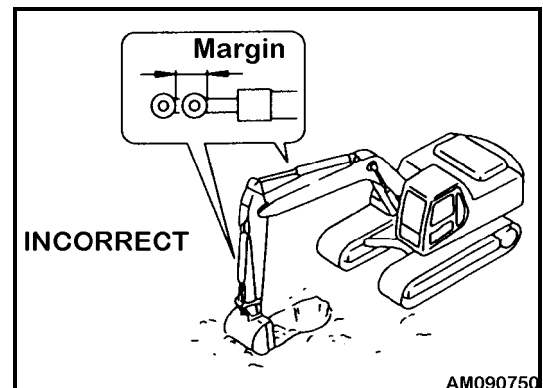
#### 12.11.2 USING TRAVEL FORCE

Do not leave the bucket dug into the ground and use the travel force to excavate. This will bring excessive force to bear on the machine and the work equipment.



#### 12.11.3 OPERATE CYLINDERS TO END OF STROKE

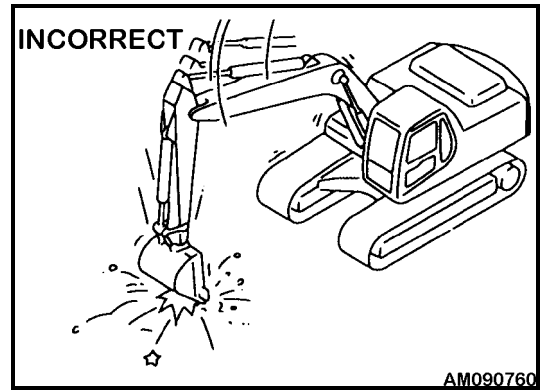
If the cylinder is operated to the end of its stroke during operations, the ensuing force will be brought to bear on the stopper inside the cylinder, and this will reduce the life of the machine. To prevent this, always leave a small safety margin when operating the cylinders.





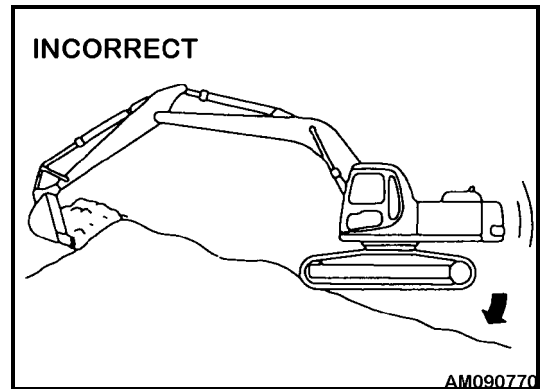
**12.11.4 USING DROPPING FORCE OF BUCKET**

Do not use the dropping force of the bucket as a pickaxe, breaker, or pile driver. This will bring excessive force to bear on the rear of the machine, and will not only damage the machine, but is also dangerous.



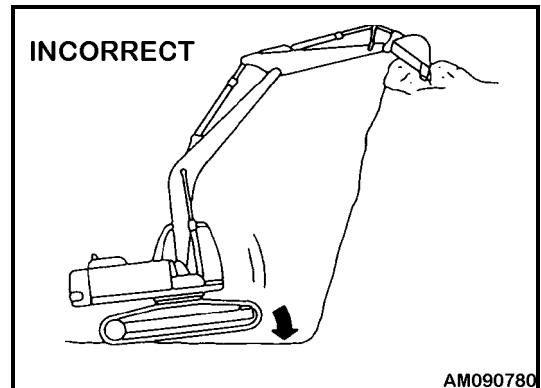
**12.11.5 USING DROPPING FORCE OF MACHINE**

Do not use the dropping force of the machine for digging.



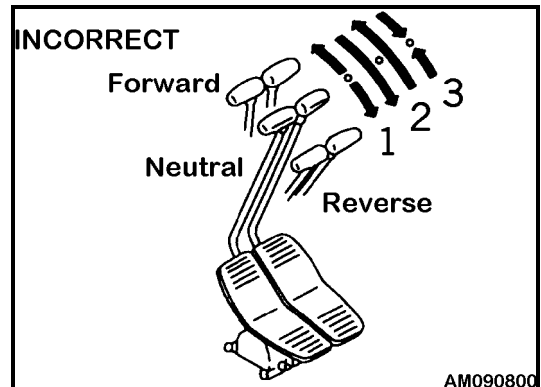
**12.11.6 DIGGING ROCKY GROUND**

It is better to excavate hard rocky ground after breaking it up by some other means. This will not only reduce damage to the machine but make for better economy.



**12.11.7 SUDDEN LEVER SHIFT DURING HI-SPEED TRAVEL**

1. Never carry out sudden lever shifting as this may cause sudden starting.
2. Avoid sudden lever shifting from forward to reverse (or vice versa).
3. Avoid sudden lever shifting change such as sudden stopping from near top speed (lever release operation).

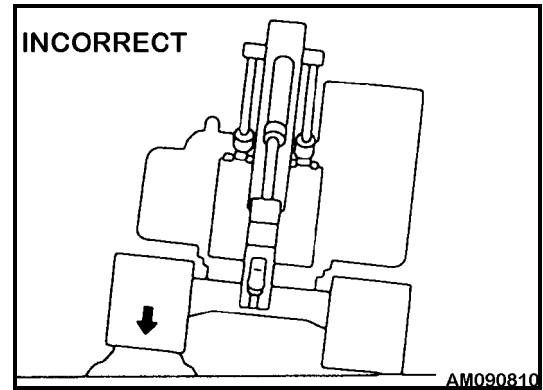


## OPERATION

### 12.12 PRECAUTIONS FOR OPERATION

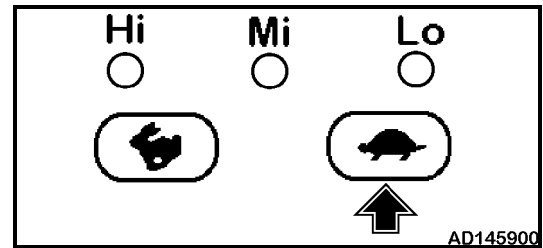
#### 12.12.1 PRECAUTIONS WHEN TRAVELING

When traveling over obstacles such as boulders or tree stumps, the machine (in particular, the undercarriage) is subjected to a large shock, so reduce the travel speed and travel over the obstacle at the center of the tracks. As far as possible, remove such obstacles or avoid traveling over them.



#### 12.12.2 PRECAUTIONS AT HI-SPEED TRAVEL

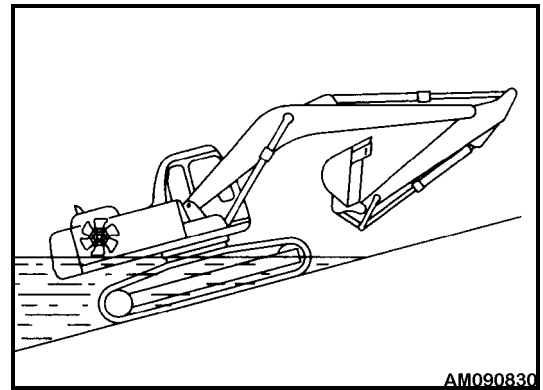
On uneven roadbeds such as rock beds or uneven roads with large rocks, travel at Mi or Lo speed. When Hi speed traveling, set the track idlers in the forward direction.



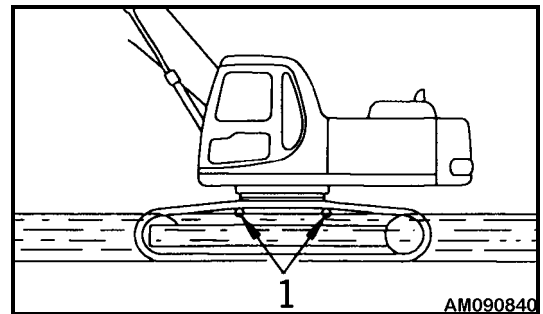
#### 12.12.3 PERMISSIBLE WATER DEPTH

##### NOTICE

When driving the machine out of the water, if the angle of the machine exceeds 15°, the rear of the upper structure will go under water, and water will be thrown up by the radiator fan. This may cause the fan to break. Be extremely careful when driving the machine out of water.



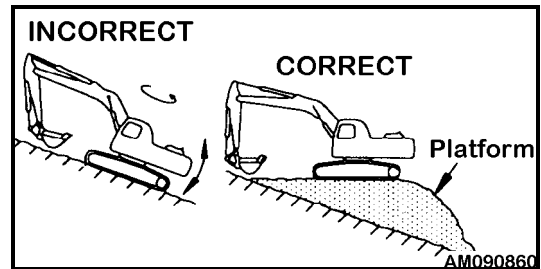
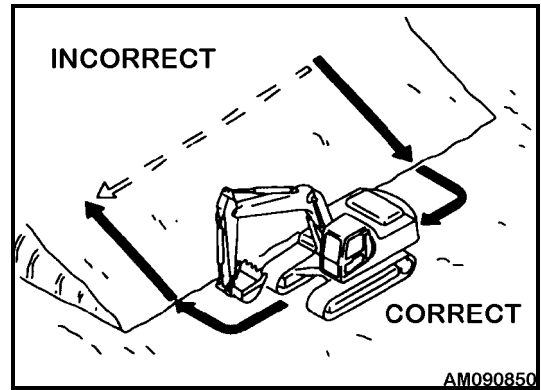
Do not immerse the machine in water by more than the permissible depth (under center of carrier roller (1)). In addition, for parts that have been immersed in water for a long time, pump in grease until the old grease comes out from the bushings. (Around the bucket pins)



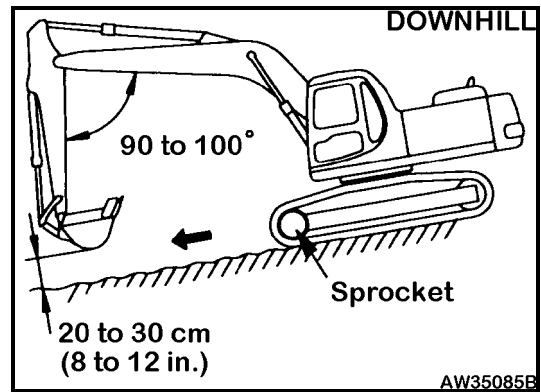
12.13 PRECAUTIONS WHEN TRAVELING ON HILLS

**WARNING**

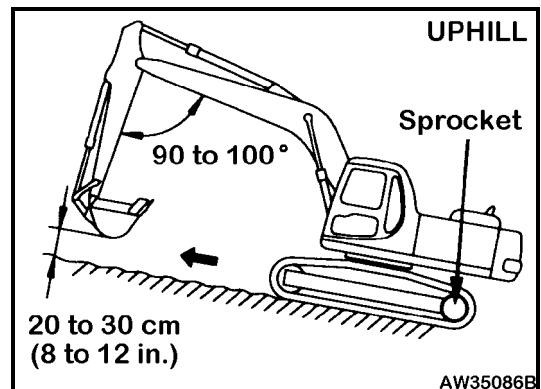
- When traveling, raise the bucket ~ 20 to 30 cm (8 to 12 in) from the ground. Do not travel downhill in reverse.
- When traveling over ridges or other obstacles, keep the work equipment close to the ground and travel slowly.
- It is dangerous to turn on slopes or to travel across slopes. Always go down to a flat place to perform these operations. It may be longer, but it will ensure safety.
- If the machine starts to slide or loses stability, lower the bucket immediately and brake the machine.
- Turning or operating the work equipment when working on slopes may cause the machine to lose its balance and turn over, so avoid such operations. It is particularly dangerous to swing downhill when the bucket is loaded. If such operations have to be carried out, pile soil to make platform on the slope so that the machine can be kept horizontal when operating.
- Do not travel on slopes of over 30° as there is danger that the machine may overturn.



1. When traveling down steep hills, use the travel lever and fuel control lever to keep the travel speed low. When traveling down slopes of more than 15°, set the work equipment in the posture shown in the figure on the right, and lower the engine speed.



2. When traveling up a steep hill of more than 15° set the work equipment in the posture shown in the diagram on the right.



## **OPERATION**

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### **12.13.1 BRAKING WHEN TRAVELING DOWNHILL**

To brake the machine during downhill runs, put the travel lever in the neutral position. This will cause the brake to be automatically applied.

### **12.13.2 IF SHOES SLIP**

When traveling uphill, if the shoes slip or it is impossible to travel uphill using the force of the track only, it is possible to use the pulling force of the arm to help the machine travel uphill.

### **12.13.3 IF ENGINE STOPS**

If the engine stops when traveling uphill, move the travel levers to the neutral position, lower the bucket to the ground, stop the machine, then start the engine again.

### **12.13.4 PRECAUTIONS ON SLOPES**

- If the engine stops when the machine is on a slope, never use the left work equipment control lever to carry out swing operations. The upper structure will swing under its own weight.
- Do not open or close the door on the cab if the machine is on a slope. This may cause a sudden change in the operating force. Always keep the door locked.

## 12.14 HOW TO ESCAPE FROM MUD

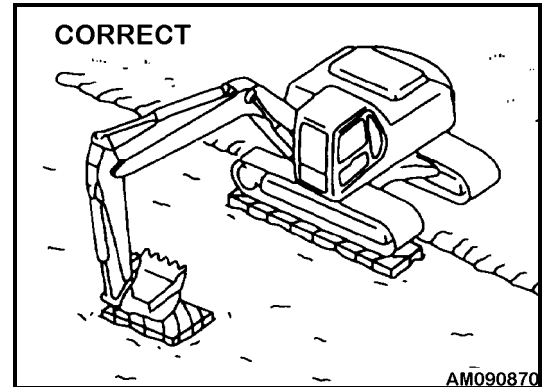
Always operate the machine carefully to avoid getting stuck in mud. If the machine does get stuck in mud, use the following procedures to get the machine out.

### 12.14.1 WHEN ONE SIDE IS STUCK

When only one side is stuck in mud, use the bucket to raise the track, then lay boards or logs and drive the machine out. If necessary, put a board under the bucket also.

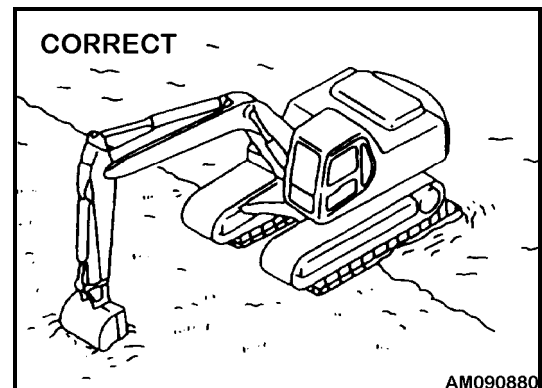
#### NOTICE

When using the boom or arm to raise the machine, always have the bottom of the bucket in contact with the ground. (Never push with the teeth). The angle between the boom and arm should be 90 to 110°. The same applies when using the inverted bucket.



### 12.14.2 WHEN BOTH SIDES ARE STUCK

When the tracks on both sides are stuck in mud and the machine will not move, lay boards as explained above, and dig the bucket into the ground in front. Then pull in the arm as in normal digging operations and put the travel levers in the FORWARD position to pull the machine out.

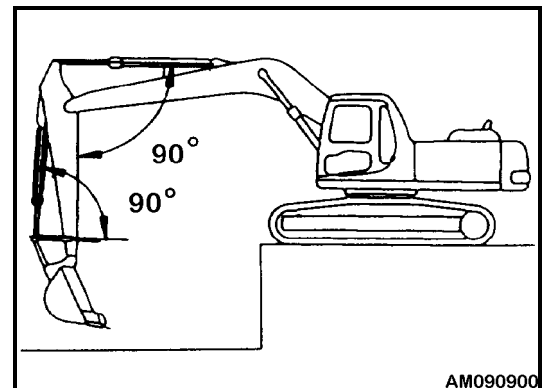


## 12.15 WORK POSSIBLE WITH HYDRAULIC EXCAVATOR

In addition to the following, it is possible to further increase the range of applications by using various attachments.

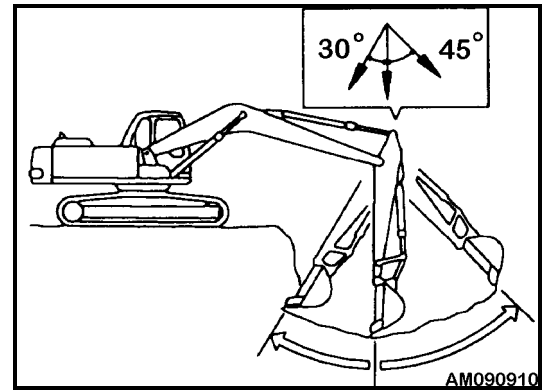
### 12.15.1 BACKHOE WORK

When condition of the machine is as shown in the diagram at right, each cylinders maximum pushing excavation force is obtained when the bucket cylinder and link, arm cylinder and arm are at 90°. When excavating, use this angle effectively to optimize your work efficiency.



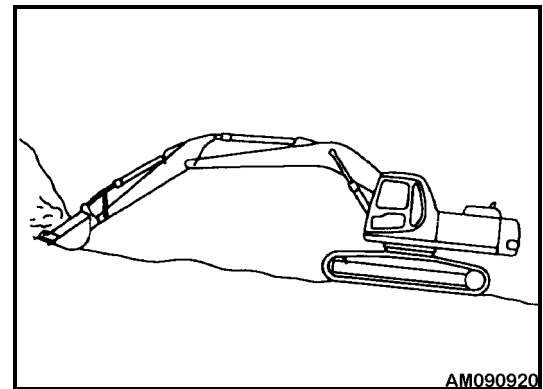
## OPERATION

The range for excavating with the arm is from a 45° angle away from the machine to a 30° toward the machine. There may be some differences depending on the excavation depth, but try to stay within the above range rather than going all the way to the extreme end of the cylinder stroke.



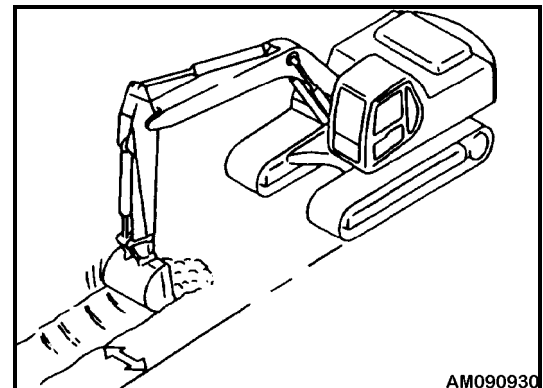
### 12.15.2 SHOVEL WORK

A shovel is suitable for excavating at a position higher than the machine. Shovel work is performed by attaching the bucket in the reverse direction.



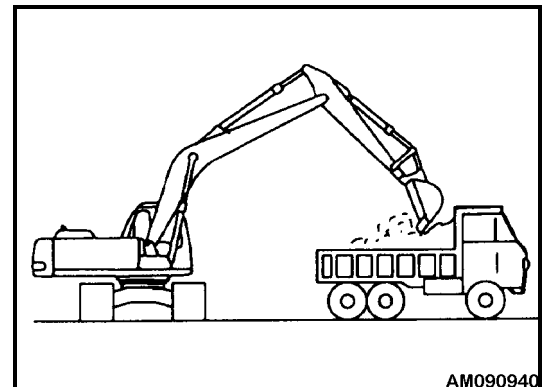
### 12.15.3 DITCHING WORK

Ditching work can be performed efficiently by attaching a bucket to match the width of the ditch and then setting the tracks parallel to the line of the ditch to be excavated. To excavate a wide ditch, first dig out both sides and then finally remove the center portion.



### 12.15.4 LOADING WORK

In places where the swing angle is small, work efficiency can be enhanced by locating the dump truck in a place easily visible to the operator. Loading is easier and capacity greater if you begin from the front of the dump truck body than if loading is done from the side.



## 12.16 REPLACE OR INVERT BUCKET

### WARNING

- When knocking the pin in with a hammer, metal particles may fly and cause serious injury, particularly if they get into your eyes. When carrying out this operation, always wear goggles, helmet, gloves, and other protective equipment.
- When the bucket is removed, place it in a stable condition.

Stop the machine on a firm, flat surface. When performing joint work, make clear the signals to each other and work carefully for safety sake.

### 12.16.1 REPLACEMENT

1. Place the bucket in contact with a flat surface.

#### REMARK

When removing the pins, place the bucket so that it is in light contact with the ground. If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.

2. Remove the retainer bolts and nuts, then remove pins (A) and (B) and remove the bucket.

#### NOTICE

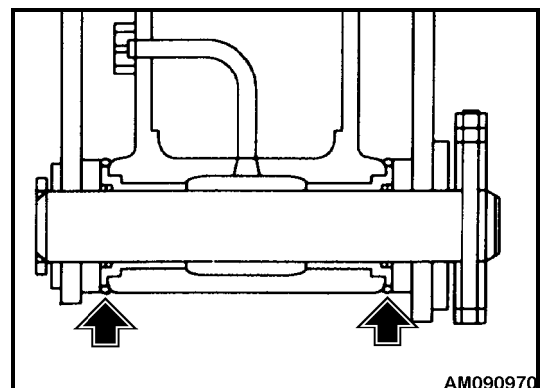
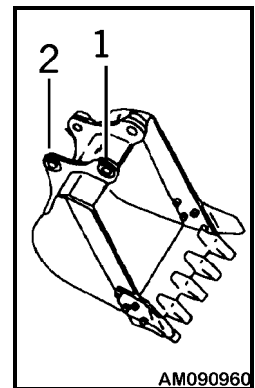
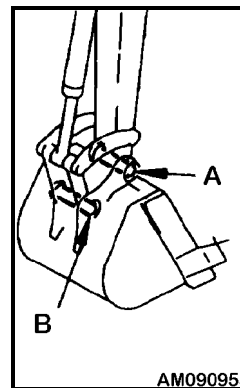
After removing the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing on both sides do not become damaged.

3. Align the arm with holes (1) and the link with holes (2), then coat with grease and install pins (A) and (B).

#### REMARK

When installing the bucket, the o-rings are easily damaged, so fit the o-rings on the boss of the arm end. After driving in the pin, move the o-ring down to the regular groove.

4. Install the retainer bolts and nuts for each pin, then grease the pin.



## OPERATION

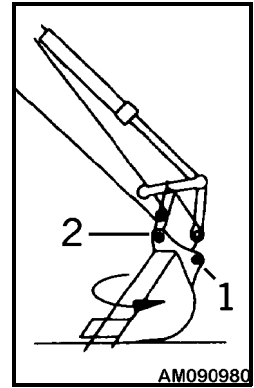
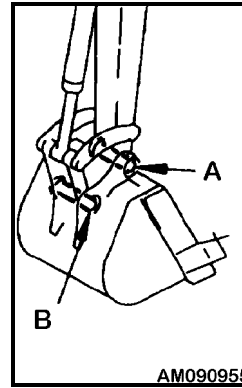
### 12.16.2 INVERSION

1. Place the bucket in contact with a flat surface.

#### REMARK

When removing the pins, place the bucket so that it is in light contact with the ground. If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.

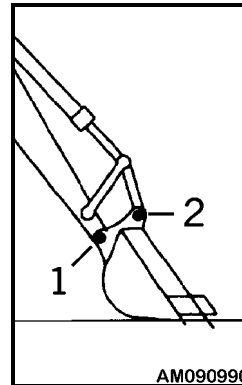
2. Remove the retainer bolts and nuts, then remove pins (A) and (B), and remove the bucket.



#### NOTICE

After removing the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing on both sides do not become damaged.

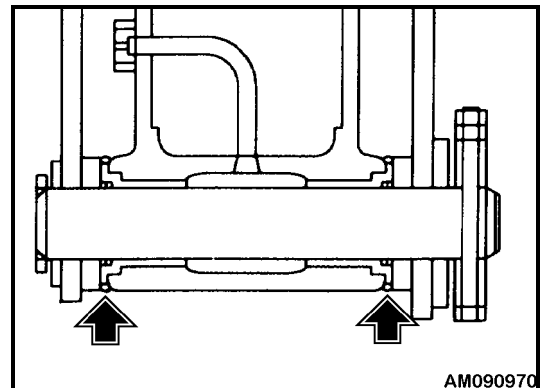
3. Install the bucket inversely. After the bucket is inverted, correct the inclination and direction of the retaining pin holes (1) and (2) and stabilize the bucket securely.
4. Align the arm with holes (1) and the link with holes (2), then coat with grease and install pins (A) and (B).



#### REMARK

When installing the bucket, the o-rings are easily damaged, so fit the o-rings on the boss of the arm end. When knocking in the pins, move the o-ring down to the regular groove.

5. Install the retainer bolts and nuts for each pin, then grease the pin.

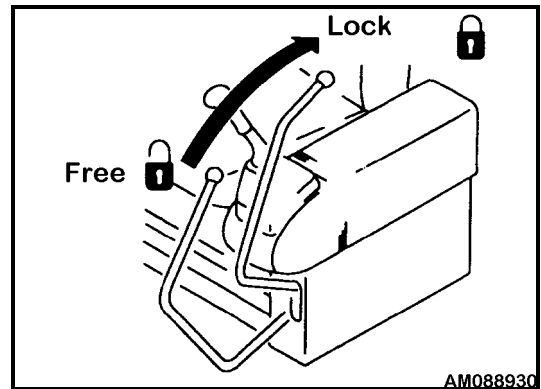
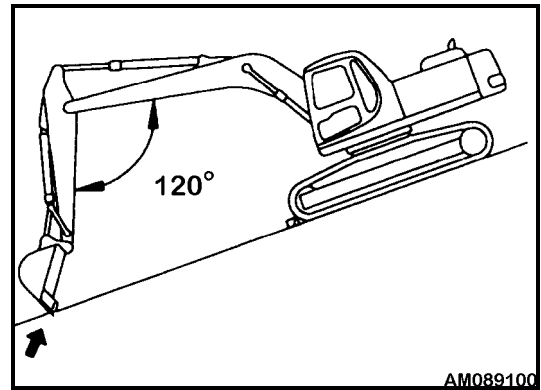




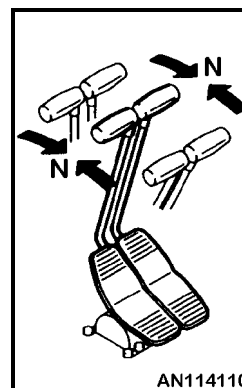
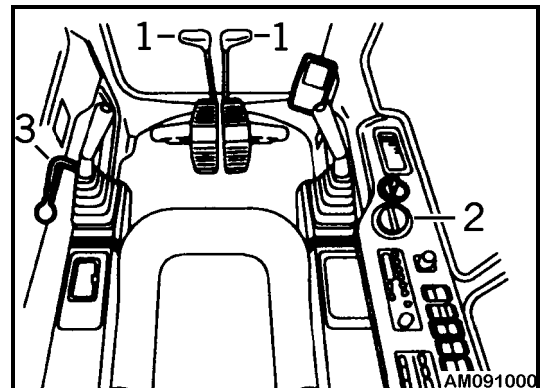
12.17 PARKING MACHINE

**⚠ WARNING**

- Avoid stopping suddenly. Give yourself ample room when stopping.
- When stopping the machine, select flat hard ground and avoid dangerous places. If it is unavoidably necessary to park the machine on a slope, insert blocks underneath the track shoes. As an additional safety measure, thrust the bucket into the ground.
- If the control lever is touched by accident, the work equipment or the machine may move suddenly, and this may lead to a serious accident. Before leaving the operators compartment, always set the safety lock lever securely to the LOCK position.

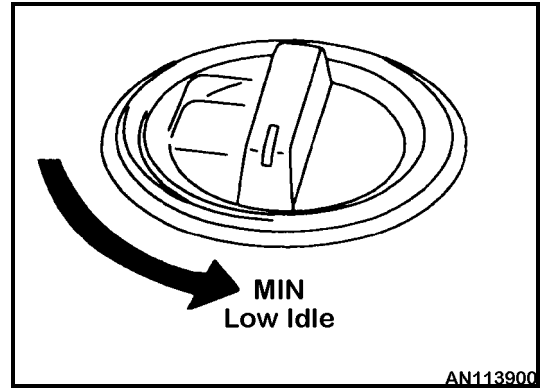


1. Put the left and right travel levers (1) in the neutral position to stop the machine.

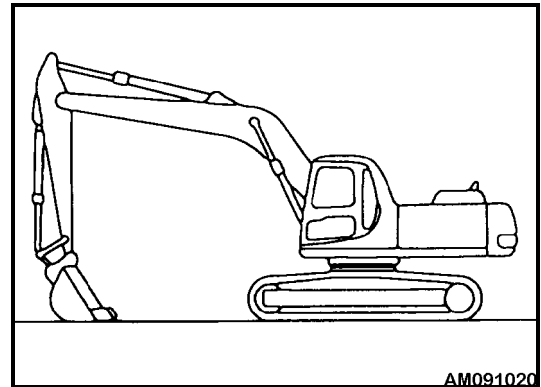


## OPERATION

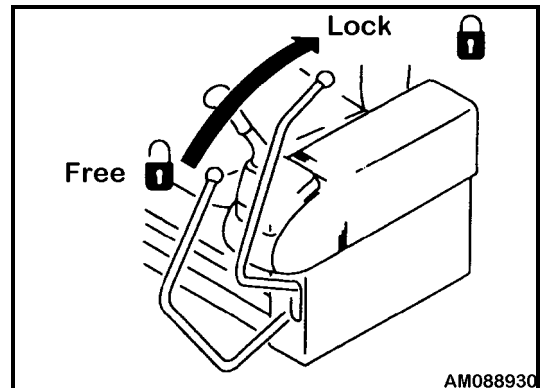
- Turn fuel control dial (2) to lower the engine speed to low idle.



- Lower the bucket horizontally until the bottom touches the ground.

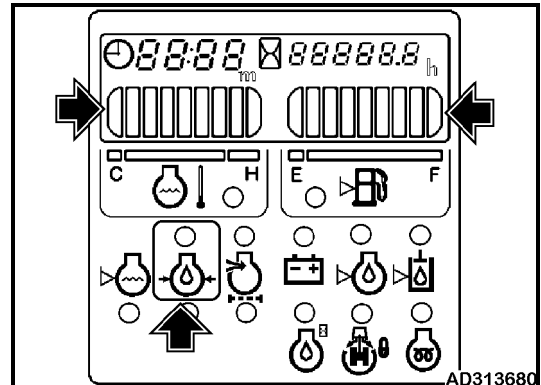


- Set safety lock lever in the LOCK position.



### 12.18 CHECK AFTER FINISHING WORK

Check the engine coolant temperature, engine oil pressure and fuel level on the monitor.

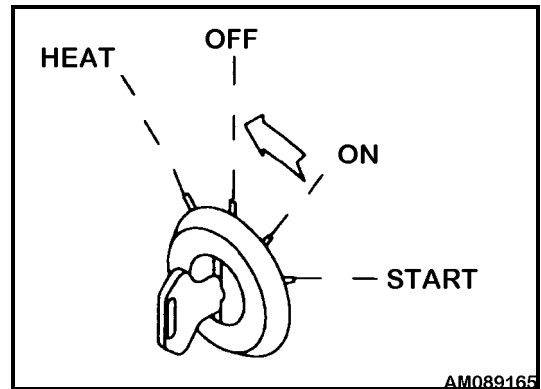
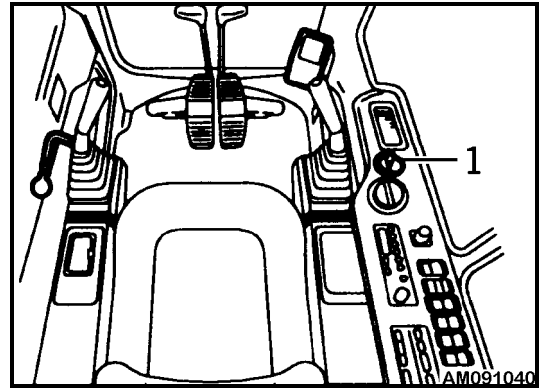


## 12.19 STOPPING ENGINE

### NOTICE

If the engine is abruptly stopped before it has cooled down, engine life may be greatly shortened. Consequently, do not abruptly stop the engine except for an emergency. In particular, if the engine has overheated, do not abruptly stop it but run it at medium speed to allow it to cool gradually, then stop it.

1. Run the engine at low idle speed for about 5 minutes to allow it to gradually cool down.
2. Turn the key in starting switch (1) to the OFF position to stop the engine.
3. Remove the key from starting switch.



## 12.20 CHECK AFTER STOPPING ENGINE

1. Walk around the machine and check the work equipment, paint-work, and undercarriage, and check also for leakage of oil or coolant. If any abnormalities are found, repair them.
2. Fill the fuel tank.
3. Check the engine compartment for paper and debris. Clean out any paper and debris to avoid a fire hazard.
4. Remove any mud stuck to the undercarriage.

## OPERATION

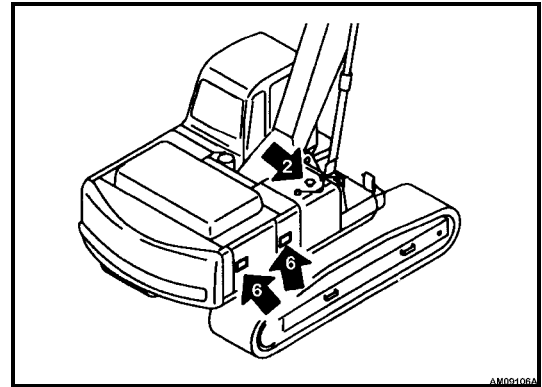
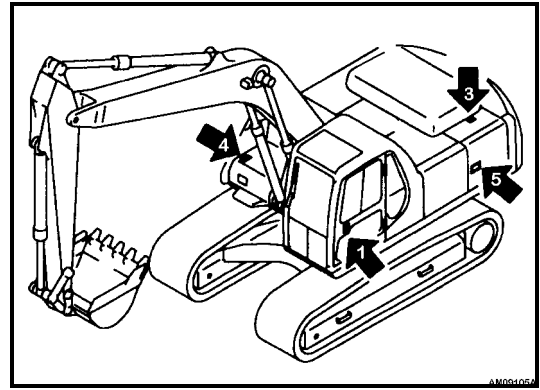
### 12.21 LOCKING

Always lock the following places.

1. Door of cab. Always remember to close the window.
2. Fuel tank filler port
3. Engine hood
4. Battery box cover
5. Left side door of the machine
6. Right side door of the machine

#### REMARK

Use the starting switch key to open and close all these places.



## 13. TRANSPORTATION

When transporting the machine, observe all related laws and regulations, and be careful to assure safety.

### 13.1 TRANSPORTATION PROCEDURE

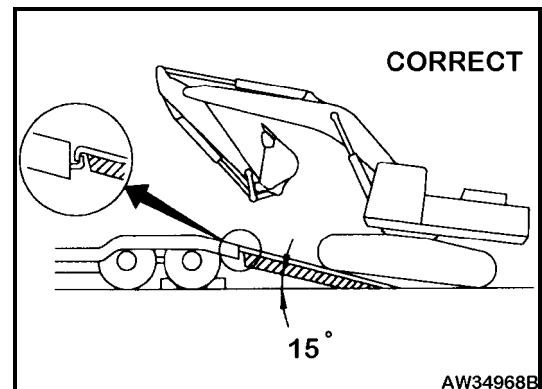
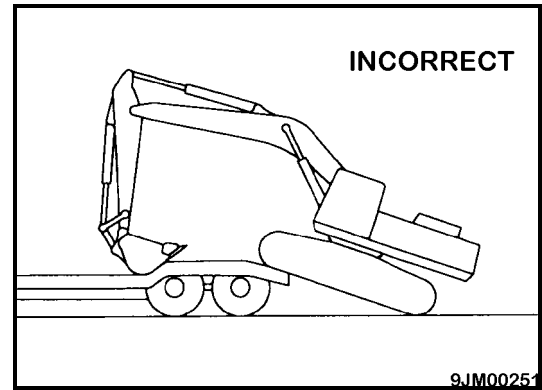
As a basic rule, transport the machine by trailer. Select the trailer to match the weight and dimensions given; See 25 SPECIFICATIONS on page 4-2 Note that the value for the weight and transportation dimensions given in SPECIFICATIONS may differ according to the type of shoe or type of arm or other attachments.

### 13.2 LOADING, UNLOADING OF TRAILERS



#### WARNING

- Always turn the auto-deceleration switch OFF (cancel) during loading and unloading operations. If the auto-deceleration switch is left ON, the machine may suddenly start moving.
- Run the engine at low idle, set to low speed, and operate the machine slowly when loading or unloading.
- Do not carry out loading or unloading operations during the auto warm up operation. If the auto warm up operation is canceled before completion, the travel speed may suddenly change.
- Select firm, level ground when loading or unloading the machine. Maintain a safe distance from the edge of the road.
- Use ramps with ample width, length, thickness and strength and install them at a maximum slope of 15°. When using piled soil, compact the piled soil fully and prevent the slope face from collapsing.
- Remove all mud and dirt from the machine tracks before starting in order to prevent the machine from slipping on the ramps. Be sure that the ramp surface is clean and free of water, snow, grease, oil, or ice.
- Never correct your steering on the ramps. There is danger that the machine may turn over. If necessary, drive off the ramps, correct the direction, then enter the ramps again.
- It is dangerous to use the work equipment for loading and unloading operations.
- When on the ramps, do not operate any lever except the travel lever.
- The center of gravity of the machine will change suddenly at the joint between the ramps and the track or trailer, and there is danger of the machine losing its balance. Travel slowly over this point.
- When swinging the upper structure on the trailer, the trailer is unstable, so pull in the work equipment and swing slowly.

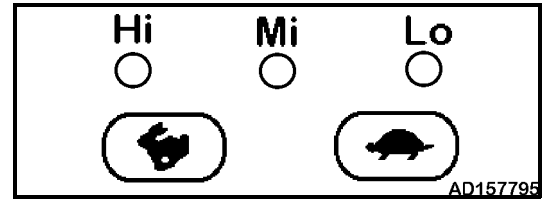
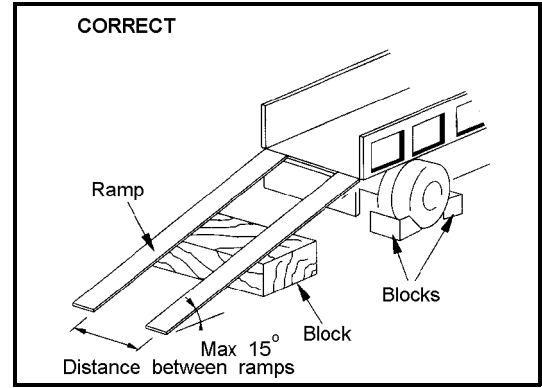


When loading or unloading, always use ramps or a platform and carry out the operation as follows.

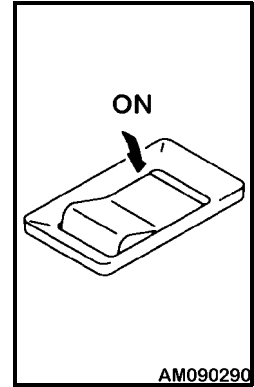
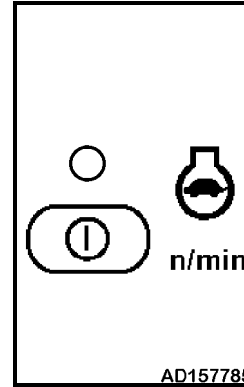
# OPERATION

## 13.2.1 LOADING

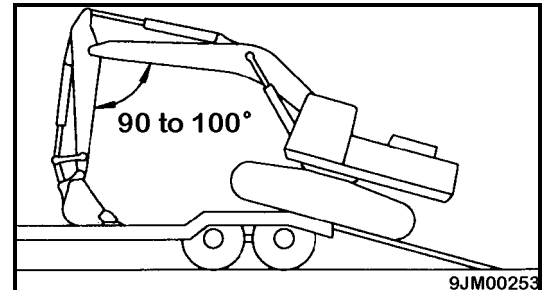
1. Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of a road.
2. Properly apply the brakes on the trailer and put blocks under the ramp tires to ensure that the trailer does not move. Then fix the ramps in line with the centers of the trailer and the machine. Be sure that the two sides are at the same level as one another. Make the slope of the ramps a maximum of 15°. Set the distance between the ramps to match the center of the tracks.
3. Set the travel speed switch to Lo.



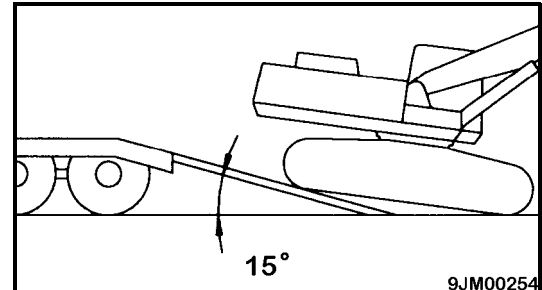
4. Turn the auto-deceleration switch OFF and turn the fuel control dial to lower the engine speed.
5. Turn the swing lock switch ON to apply the swing lock.



6. If the machine is equipped with work equipment, set the work equipment at the front, and travel forward to load it; if it has no work equipment, travel in reverse to load it.

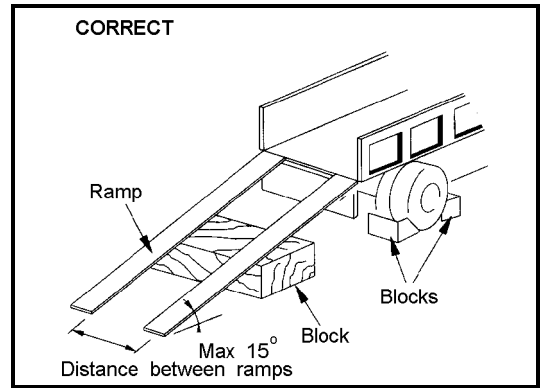


7. Align the direction of travel with the ramps and travel slowly. Lower the work equipment as far as possible without causing interference. When on the ramps, operate only the travel lever. Do not operate any other lever or pedal.

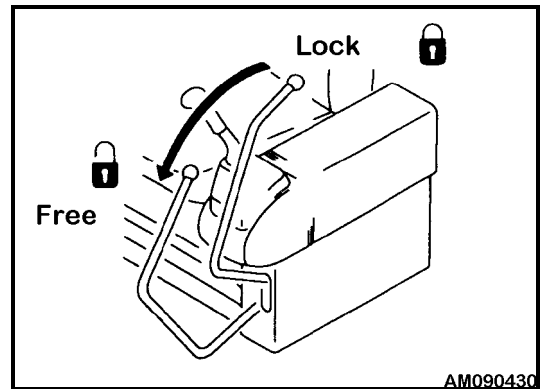


**13.2.2 UNLOADING**

1. Perform loading and unloading on firm, level ground only. Maintain a safe distance from the edge of a road.
2. Properly apply the brakes on the trailer and put blocks under the ramp tires to ensure that the trailer does not move. Then fix the ramps in line with the centers of the trailer and the machine. Be sure that the two ramps are at the same level as each another. Make the slope of the ramps a maximum of 15°. Set the distance between the ramps to match the center of the tracks.

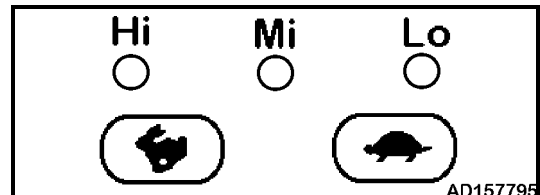


3. Remove the chains or wire rope holding the machine to the trailer bed.
4. Start the engine. Warm the engine up fully.
5. Set the safety lock lever to the FREE position.



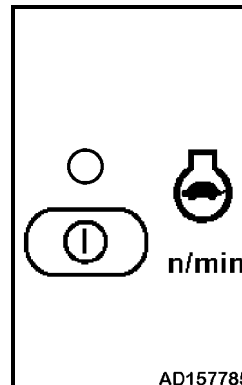
AM090430

6. Set the travel speed switch to Lo.

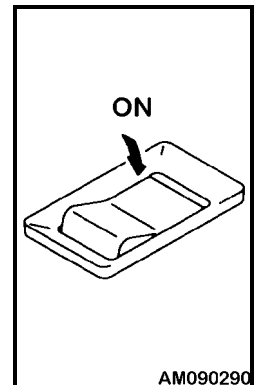


AD157795

7. Turn the auto-deceleration switch OFF and turn the fuel control dial to lower the engine speed.
8. Turn the swing lock switch ON to apply the swing lock.



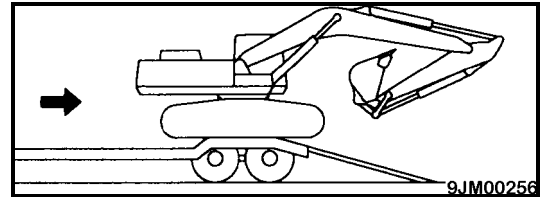
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## OPERATION

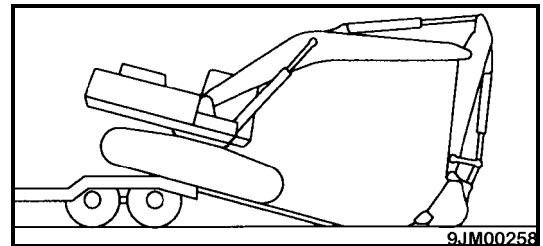
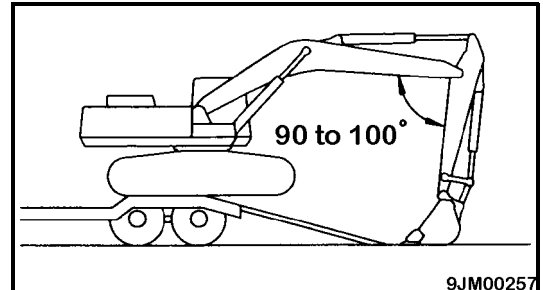
9. Raise the work equipment, pull in the arm under the boom, then move the machine slowly.
10. When the machine is horizontal on top of the rear wheels of the trailer, stop the machine.



### NOTICE

If the machine is unloaded with the arm pulled in, the work equipment will be damaged. When moving on to the ramps, to prevent damage to the hydraulic cylinders, do not let the bucket hit the ground.

11. When moving from the rear of the trailer on to the ramps, set the angle of the arm and boom to 90 to 100°, lower the bucket to the ground, then move the machine slowly.
12. When moving down the ramps, operate the boom and arm slowly to lower the machine carefully until it is completely off the ramps.



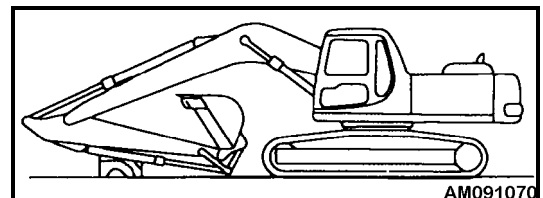
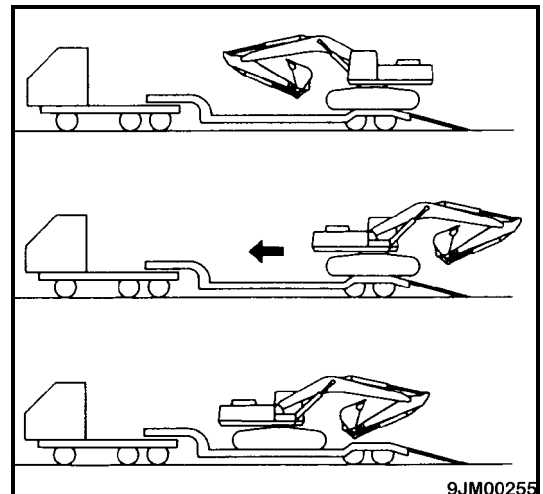
### 13.2.3 SECURING MACHINE

#### NOTICE

Retract the radio antenna and remove the mirrors. Tie the removed parts securely to the trailer. To prevent damage to the bucket cylinder during transportation, fit a wooden block at one end the bucket cylinder to prevent it from touching the floor.

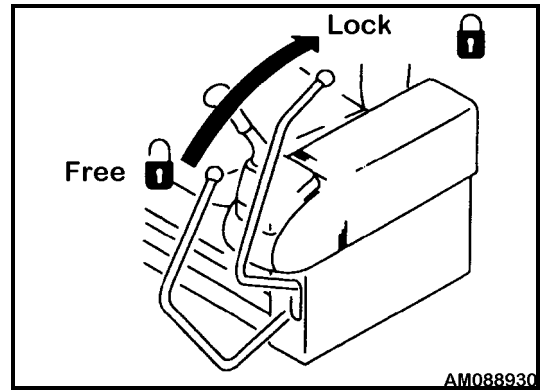
After loading the machine on to a trailer, tie the machine down as follows.

1. When the machine becomes horizontal over the rear wheels of the trailer, stop the machine.
2. Swing the upper structure slowly 180°, then move the machine slowly to the front of the trailer. (If the machine is not equipped with work equipment, load it as it is.)
3. Stop the machine at the specified position on the trailer.
4. Extend the bucket and arm cylinders fully, then lower the boom slowly.
5. Stop the engine, then remove the key from the starting switch.

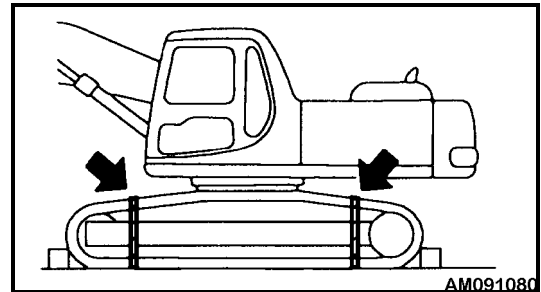




6. Lock the control levers securely with the safety lock lever.
7. Lock the cab, side cover, and engine hood.

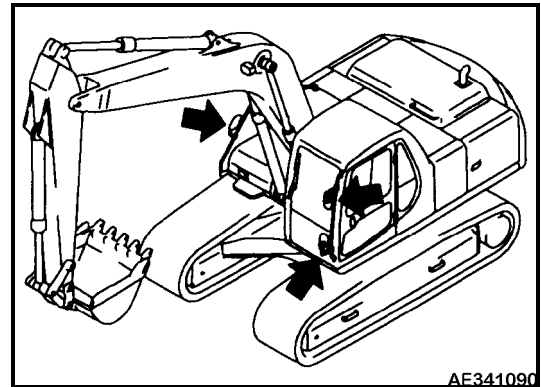


8. Put blocks under both ends of the tracks to prevent the machine from moving during transportation, and tie the machine down securely with chains or wire rope of suitable strength. Be particularly careful to fix the machine in position securely so that it does not slip to the side.



### 13.2.4 REMOVAL, INSTALLATION OF MIRRORS

There are mirrors in the positions shown in the diagram on the right. If they are damaged, or when removing and installing them for transportation, do as follows.

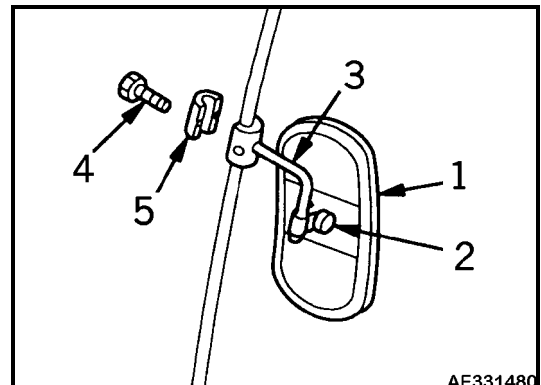


#### Removal

1. Loosen lock nut (2) of mirror (1), then remove mirror from support (3).
2. Loosen bolt (4) and remove support (3) and clamp (5) from the handrail.

#### Installation

1. Install support (3) and clamp (5) on the handrail, then tighten with bolt
2. Install mirror (1) to support, then tighten lock nut (2).



## OPERATION

### 13.2.5 METHOD OF LIFTING MACHINE



#### WARNING

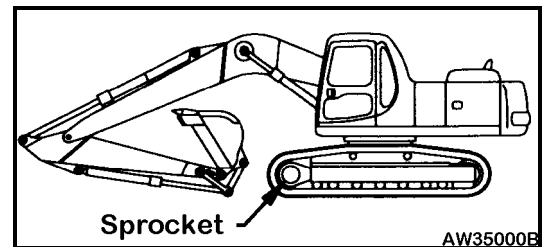
- Never raise the machine with any worker on it.
- Always make sure that the wire rope used for lifting the machine is of ample strength for the weight of the machine.
- Never try to lift the machine in any posture other than the posture given in the procedure below. There is danger that the machine may lose its balance.
- Never lift the machine with the upper structure swung to the side. Swing the work equipment so that it is at the sprocket end and set the undercarriage and upper structure parallel before lifting.
- When lifting, be careful of the center of gravity and be sure to maintain the balance.

#### NOTICE

The lifting procedure given below applies to machines with standard specifications. The method of lifting differs according to the attachments and options actually installed. In such cases, please contact your distributor.

For details of the weight; See 25 SPECIFICATIONS on page 4-2  
When lifting the machine, carry out the operation on flat ground as follows.

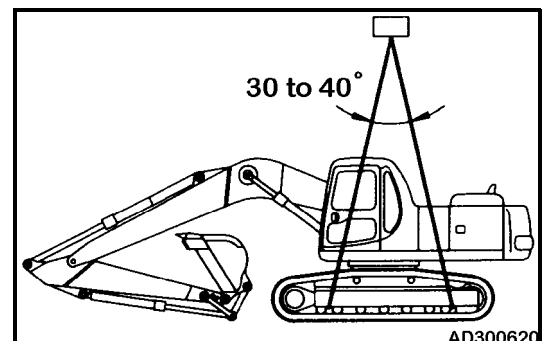
1. Start the engine, then swing the upper structure so that the work equipment is at the rear of the machine.
2. Extend the bucket cylinder and arm cylinder fully, then lower the work equipment to the ground as shown in the diagram on the right using the boom cylinder.
3. Stop the engine, check that there is nothing around the operators compartment, then get off the machine. Close the cab door and front glass securely.
4. Pass the wire rope between the 1st and 2nd track rollers from the front of the machine and the 1st and 2nd track rollers from the rear of the machine.



#### REMARK

For machines equipped with a full roller guard for the track roller, pass the wire rope from under the track shoe.

5. Set the lifting angle of the wire rope to 30 to 40°, then lift the machine slowly.
6. After the machine comes off the ground, check carefully that the machine is balanced, then lift slowly.



### **13.3 PRECAUTIONS FOR TRANSPORTATION**

- Determine the route for transporting the machine by taking into account the width, height and weight of the machine.
- Always check that the door on the cab is closed and locked before transporting the machine.

#### **NOTICE**

Always retract the radio antenna. Obey all state and local laws governing the weight, width and length of a load. Observe all regulations governing wide loads.

## **14. COLD WEATHER OPERATION**

### **14.1 PRECAUTIONS FOR LOW TEMPERATURE**

If the temperature becomes low, it becomes difficult to start the engine, and the coolant may freeze, so do as follows.

#### **14.1.1 FUEL AND LUBRICANTS**

Change to fuel and oil with low viscosity for all components. For details of the specified viscosity; see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

#### **14.1.2 COOLANT**



#### **WARNING**

**Keep antifreeze fluid away from an open flame. Never smoke when using antifreeze.**

#### **NOTICE**

Never use methanol, ethanol or propanol based antifreeze. Absolutely avoid using any water leak preventing agent irrespective of whether it is used independently or mixed with an antifreeze. Do not mix one antifreeze with a different brand.

For details of the antifreeze mixture when changing the coolant; see 24.2 WHEN REQUIRED on page 3-24.

Use a Permanent Antifreeze (ethylene glycol mixed with corrosion inhibitor, antifoam agent, etc.) meeting the standard requirements as shown below. With permanent antifreeze, no change of coolant is required for a year. If it is doubtful that an available antifreeze meets the standard requirements, ask the supplier of that antifreeze for information.

Standard requirements for permanent antifreeze

SAE ..... J 1034  
FEDERAL STANDARD ..... O-A-548D

#### **REMARK**

Where no permanent antifreeze is available, an ethylene glycol antifreeze without corrosion inhibitor may be used only for the cold season. In this case, clean the cooling system twice a year (in spring and autumn). When refilling the cooling system, add antifreeze in autumn, but do not add any in spring.

#### **14.1.3 BATTERY**




#### **WARNING**

- **To avoid gas explosions, do not bring fire or sparks near the battery.**
- **Battery electrolyte is dangerous. If it gets in your eyes or on your skin, wash it off with large amounts of water, and consult a doctor.**

When the ambient temperature drops, the capacity of the battery will also drop. If the battery charge ratio is low, the battery electrolyte may freeze. Maintain the battery charge as close as possible to 100%, and insulate it against cold temperature so that the machine can be started easily the next morning.

**REMARK**

Measure the specific gravity and calculate the rate of charge from the following conversion table.

Fluid temp 	20°C	0°C	10°C	20°C
Rate of charge	68°F	32°F	14°F	4°F
100%	1.28	1.29	1.30	1.31
90%	1.26	1.27	1.28	1.29
80%	1.24	1.25	1.26	1.27
75%	1.23	1.24	1.25	1.26

## OPERATION

### 14.2 PRECAUTIONS AFTER COMPLETION OF WORK

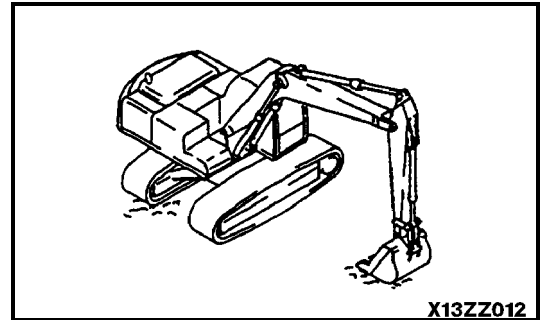
To prevent mud, water, or the undercarriage from freezing and making it impossible for the machine to move on the following morning, always observe the following precautions.

- Mud and water on the machine body should be completely removed. This is to prevent damage to the seal caused by mud or dirt getting inside the seal with frozen drops of water.
  - Park the machine on hard, dry ground. If this is impossible, park the machine on wooden boards. The boards help protect the tracks from being frozen to the ground and the machine can move the next morning.
  - Open the drain valve and drain any water collected in the fuel system to prevent it from freezing.
  - After operation in water or mud, remove water from undercarriage as described below, to extend undercarriage service life.
1. Swing 90° with the engine at low idle and bring work equipment beside track.
  2. Slightly float track by slowly pushing the ground and cause track to idle run. Perform this for the opposite track also.



#### WARNING

Performing idle running of the tracks is potentially dangerous so stay well away from the tracks at this time.



- As the battery capacity drops markedly in low temperatures, cover the battery or remove it from the machine, keep it in a warm place, and install it again the next morning.
- If electrolyte level is found low, add distilled water in the morning before beginning work. Do not add the water after the day's work so as to prevent fluid in the battery from freezing overnight.

### 14.3 AFTER COLD WEATHER

When season changes and the weather becomes warmer, do as follows.

- Replace the fuel and oil for all parts with oil of the viscosity specified.

For details; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

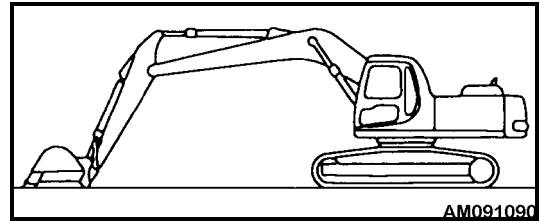
- If for any reason permanent antifreeze cannot be used, and an ethyl glycol base antifreeze (winter, one season type) is used instead, or if no antifreeze is used, drain the cooling system completely, then clean out the inside of the cooling system thoroughly, and fill with fresh coolant.

## 15. LONG TERM STORAGE

### 15.1 BEFORE STORAGE

#### NOTICE

To protect the cylinder rods when the machine is not being used, set the work equipment in the posture shown in the diagram. This prevents rusting of the cylinder rod.



When putting the machine in storage for a long time, do as follows.

- After every part is washed and dried, the machine shall be housed in a dry building. Never leave it outdoors. In case it is required to leave it outdoors, park the machine on flat ground free from flooding or other danger and cover it with canvas etc.
- Completely fill the fuel tank, lubricate and change the oil before storage.
- Apply a thin coat of grease to metal surface of the hydraulic piston rods.
- Disconnect the negative terminals of the battery and cover it, or remove it from the machine and store it separately.
- If the ambient temperature is expected to drop below 0°C, always add antifreeze to the coolant.
- Lock each control lever and pedal with the lock lever and pedal lock.
- Set the stop valve to the lock position on machines ready for attachments. Install the blind plugs to the elbows.
- Set the selector valve to the “When not use” position on machines ready for attachments.

### 15.2 DURING STORAGE



#### WARNING

If it is unavoidably necessary to carry out the rust preventive operation While the machine is indoors, open the doors and windows to improve ventilation and prevent gas poisoning.

Operate the engine and move the machine for a short distance once a month so that a new film of oil will be coated over movable parts and component surfaces. At the same time, also charge the battery. Also, operate the air conditioner in the case of machines equipped with an air conditioner.

## **OPERATION**

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### **15.3 AFTER STORAGE**

#### **NOTICE**

If the machine is stored without carrying out the monthly rust prevention operation, request your distributor for service.

Carry out the following procedure when taking the machine out of long term storage.

- Wipe off the grease from the hydraulic cylinder rods.
- Add oil and grease to all places.

### **15.4 STARTING MACHINE AFTER LONG TERM STORAGE**

When starting the machine after a long term storage, first cancel the automatic warm up function as follows.

1. Turn the starting switch key to the ON position.
2. Turn the fuel control dial from the low idle (MIN) position to the full (MAX) position, hold it there for 3 seconds, then return it to the low idle (MIN) position and start the engine.

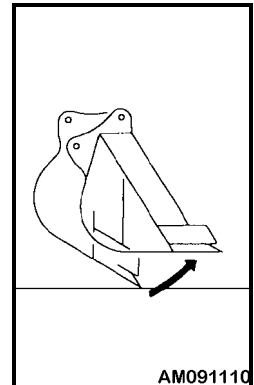
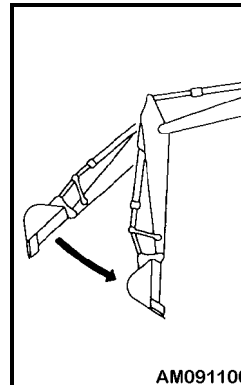


## 16. TROUBLESHOOTING

### 16.1 PHENOMENA THAT ARE NOT FAILURES

Note that the following phenomena are not failures:

1. When the arm is pulled in, the speed of movement will drop momentarily when the arm is more or less vertical.
2. The arm speed will drop momentarily when the bucket teeth are more or less horizontal.
3. When starting or stopping the swing, noise will be emitted from the brake valve.
4. When going down a steep slope at low speed, a noise will be emitted from the travel motor.

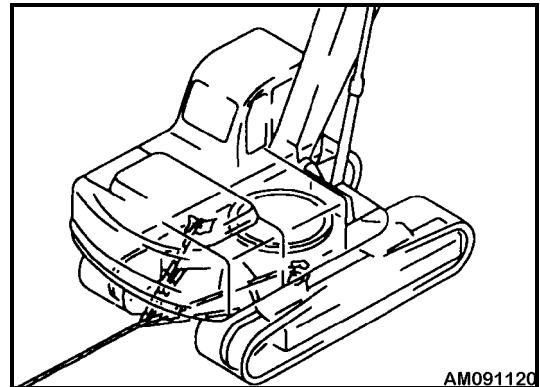


### 16.2 METHOD OF TOWING MACHINE

#### ⚠ WARNING

When towing the machine, use a wire rope that has ample strength for the weight of the machine that is being towed.

If the machine sinks in mud and cannot get out under its own power, or if the drawbar pull of the excavator is being used to tow a heavy object, use a wire rope as shown in the diagram on the right. Place pieces of wood between wire ropes and body to prevent damage to ropes and body. Never use the light-weight hole for towing.

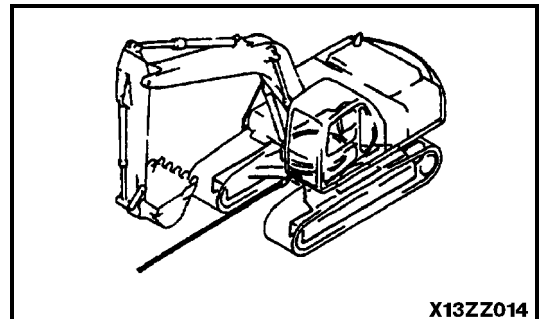


### 16.3 METHOD FOR LIGHT WEIGHT TOWING

#### ⚠ WARNING

- The shackle must always be used.
- Hold the rope level and direct it straight to the track frame.
- Move the machine slowly in the Lo mode.

There is a hole in the track frame to fit the shackle when towing light objects.



### 16.4 PRECAUTION ON PARTICULAR JOB SITES

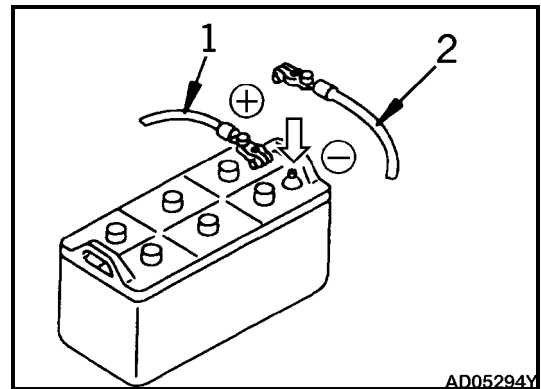
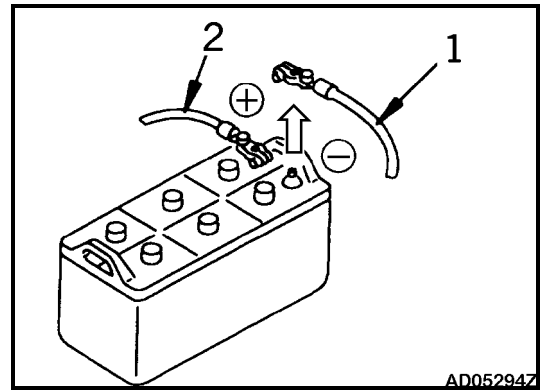
1. When carrying out digging operations in water, if the work equipment mounting pins go into the water, carry out greasing every time the operation is carried out.
2. For heavy-duty operations and deep digging, carry out greasing of the work equipment mounting pins every time before operation. After greasing, operate the boom, arm and bucket several times, then grease again.

## OPERATION

### 16.5 IF BATTERY IS DISCHARGED


#### WARNING

- When checking or handling the battery, stop the engine and turn the starting switch key to the OFF position before starting.
- The battery generates hydrogen gas, so there is danger of an explosion. Do not bring lighted cigarettes near the battery, or do anything that will cause sparks.
- Battery electrolyte is dilute sulphuric acid, and it will attack your clothes and skin. If it gets on your clothes or on your skin, wash it off immediately with large amounts of water. If it gets in your eyes, wash it out with fresh water, and consult a doctor.
- When handling the battery, always wear protective goggles.
- When removing the battery, first disconnect the cable from the negative (-) terminal. When installing, install the positive (+) terminal first. If a tool touches the cable connecting the positive terminal and the chassis, there is danger that it will cause sparks.
- If the terminals are loose, there is danger that the defective contact may generate sparks that will cause an explosion. When installing the terminals, install them tightly.
- When removing or installing, check which is the positive (+) terminal and negative (-) terminal.



#### 16.5.1 REMOVING AND INSTALLING BATTERY

- Before removing the battery, remove the negative (-) terminal cable. Loosen the nut of the terminal and remove the cables from the battery. If any tool touches between the positive terminal and the chassis, there is danger of sparks being generated.
- When installing the battery, connected the ground cable last. Insert the hole of the terminal on the battery and tighten the nut. Tightening torque:

 ..... 9.8 to 14.7 N•m  
7.2 to 10.9 lbf ft

## 16.5.2 PRECAUTIONS FOR CHARGING BATTERY

### Charging Battery When Mounted on Machine

- Before charging, disconnect the cable from the negative terminal of the battery. Otherwise, an unusually high voltage will damage the alternator.
- While charging the battery, remove all plugs for satisfactory ventilation. To avoid gas explosions, do not bring fire or sparks near the battery.
- If the electrolyte temperature exceeds 45°C(113°F), stop charging for a while.
- Turn off the charger as soon as the battery is fully charged. Overcharging the battery may cause the following:
  - 1) Decrease the quantity of electrolyte.
  - 2) Damage the electrode plate.
- Do not mix the cables, positive (+) to negative (-) or negative (-) to positive (+), as it will damage the alternator.
- When performing any service to the battery besides checking the electrolyte level or measuring the specific gravity, disconnect cables from the battery.

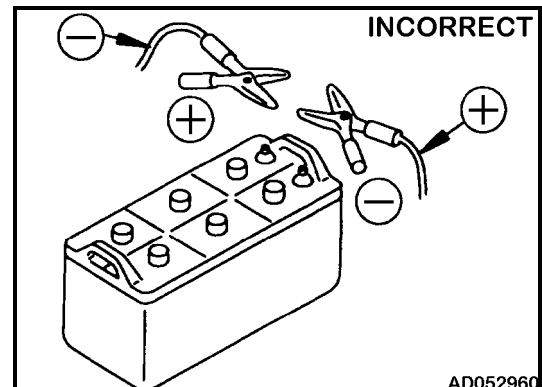
## 16.5.3 STARTING ENGINE WITH BOOSTER CABLE

When starting the engine with a booster cable, do as follows:



### WARNING

- Precautions when connecting and disconnecting booster cable
- When connecting the cables, never contact the positive (+) and negative (-) terminals.
- When starting the engine with a booster cable, always wear safety glasses.
- Be careful not to let the normal machine and problem machine contact each other. This prevents sparks from generating near the battery which could ignite the hydrogen gas given off by the battery. If hydrogen gas explodes, it could cause serious injury.
- Make sure that there is no mistake in the booster cable connections. The final connection is to the revolving frame, but sparks will be generated when this is done, so connect to a place as far as possible from the battery. (However, avoid connecting the cable to the work equipment, as connection is poor.)
- Use care when removing the cables from the machine that has been started. Do not allow the cable ends to contact each other or the machine, to avoid hydrogen explosion.



## OPERATION

### NOTICE

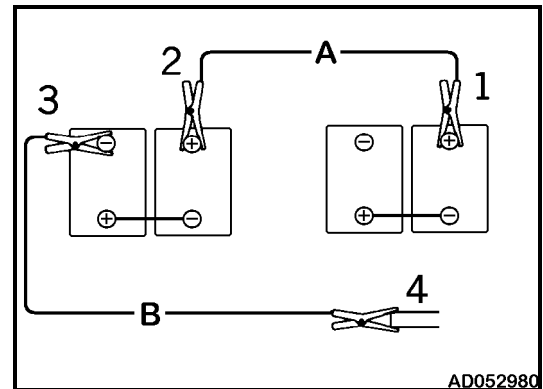
The size of the booster cable and clip should be suitable for the battery size. The battery of the normal machine must be the same capacity as that of the engine to be started. Check the cables and clips for damage or corrosion. Make sure that the cables and clips are firmly connected.

### Connecting the Booster Cables

Keep the starting switch at the OFF position.

Connect the booster cable as follows, in the order of the numbers marked in the diagram.

1. Make sure that the starting switches of the normal machine and problem machine are both at the OFF position.
2. Connect one clip of booster cable (A) to the positive (+) terminal of the problem machine battery (1).
3. Connect the other clip of booster cable (A) to the positive terminal of the normal machine battery (2).
4. Connect one clip of booster cable (B) to the negative (-) terminal (3) of the normal machine battery.
5. Connect the other clip of booster cable (B) to the revolving frame (4) of the problem machine.



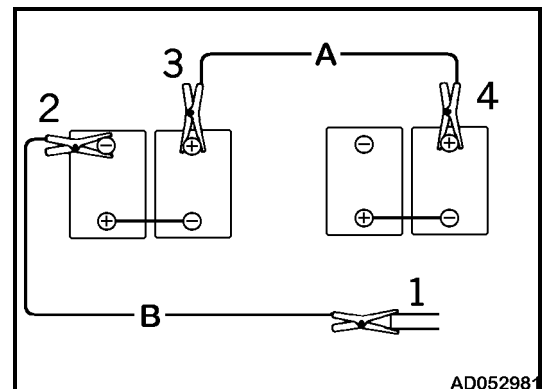
### Starting the Engine

1. Make sure the clips are firmly connected to the battery terminals.
2. Start the engine of the normal machine and keep running at high idle speed.
3. Turn the starting switch of the problem machine to the START position and start the engine. If the engine doesn't start at first, try again after 2 minutes or so.

### Disconnecting the Booster Cables

After the engine has started, disconnect the booster cables in the reverse of the order in which they were connected.

1. Remove one clip of booster cable (B) from the revolving frame (1) of the problem machine.
2. Remove the other clip of booster cable (B) from the negative terminal (2) of the normal machine.
3. Remove one clip of booster cable (A) from the positive terminal (3) of the normal machine.
4. Remove the other clip of booster cable (A) from the positive terminal (4) of the problem machine.



## 16.6 OTHER TROUBLE

( ) Always contact your distributor when dealing with these items.

- In cases of abnormalities or causes which are not listed below, please contact your distributor for repairs.

### 16.6.1 ELECTRICAL SYSTEM

Problem	Main Causes	Remedy
Light does not glow brightly even when the engine runs at high speed	<ul style="list-style-type: none"> <li>• Defective wiring</li> <li>• Defective adjustment of fan belt tension</li> </ul>	<ul style="list-style-type: none"> <li>• (Check, repair loose terminals, disconnections)</li> <li>• Adjust fan belt tension For details; See 24.5.5 CHECK FAN BELT TENSION, ADJUST on page 3-53.</li> </ul>
Light flickers while engine is running		
Charge level monitor does not go out even when engine is running	<ul style="list-style-type: none"> <li>• Defective alternator</li> <li>• Defective wiring</li> </ul>	<ul style="list-style-type: none"> <li>• (Replace)</li> <li>• (Check, repair)</li> </ul>
Abnormal noise is generated from alternator	<ul style="list-style-type: none"> <li>• Defective alternator</li> </ul>	<ul style="list-style-type: none"> <li>• (Replace)</li> </ul>
Starting motor does not turn when starting switch is turned to ON	<ul style="list-style-type: none"> <li>• Defective wiring</li> <li>• Insufficient battery charge</li> <li>• Defective starting motor</li> </ul>	<ul style="list-style-type: none"> <li>• (Check, repair)</li> <li>• Charge</li> <li>• (Replace)</li> </ul>
Pinion of starting motor keeps going in and out	<ul style="list-style-type: none"> <li>• Insufficient battery charge</li> <li>• Defective safety relay</li> </ul>	<ul style="list-style-type: none"> <li>• Charge</li> <li>• (Replace)</li> </ul>
Starting motor turns engine sluggishly	<ul style="list-style-type: none"> <li>• Insufficient battery charge</li> <li>• Defective starting motor</li> </ul>	<ul style="list-style-type: none"> <li>• Charge</li> <li>• (Replace)</li> </ul>
Starting motor disengages before engine starts	<ul style="list-style-type: none"> <li>• Defective wiring</li> <li>• Insufficient battery charge</li> </ul>	<ul style="list-style-type: none"> <li>• (Check, repair)</li> <li>• Charge</li> </ul>
Preheat monitor does not light	<ul style="list-style-type: none"> <li>• Defective wiring</li> <li>• Defective heater relay</li> <li>• Defective monitor</li> </ul>	<ul style="list-style-type: none"> <li>• (Check, repair)</li> <li>• (Replace)</li> <li>• (Replace)</li> </ul>
Oil pressure monitor does not light up when engine is stopped (starting switch at ON position)	<ul style="list-style-type: none"> <li>• Defective monitor</li> <li>• Defective caution light switch</li> </ul>	<ul style="list-style-type: none"> <li>• (Replace)</li> <li>• (Replace)</li> </ul>
Outside of electrical heater is not warm when touched by hand	<ul style="list-style-type: none"> <li>• Defective wiring</li> <li>• Disconnection in electric heater</li> <li>• Defective operation of heater relay switch</li> </ul>	<ul style="list-style-type: none"> <li>• (Check, repair)</li> <li>• (Replace)</li> <li>• (Replace)</li> </ul>

## OPERATION

### 16.6.2 CHASSIS

Problem	Main Causes	Remedy
Speed of travel, swing, boom, arm, bucket is slow	<ul style="list-style-type: none"> <li>Lack of hydraulic oil</li> </ul>	<ul style="list-style-type: none"> <li>Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> </ul>
Pump generates abnormal noise	<ul style="list-style-type: none"> <li>Clogged element in hydraulic tank strainer</li> <li>Lack of hydraulic oil</li> </ul>	<ul style="list-style-type: none"> <li>Clean; See 24.8 EVERY 2000 HOURS SERVICE on page 3-66.</li> <li>Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> </ul>
Excessive rise in hydraulic oil temperature	<ul style="list-style-type: none"> <li>Loose fan belt</li> <li>Dirty oil cooler</li> <li>Lack of hydraulic oil</li> </ul>	<ul style="list-style-type: none"> <li>Adjust fan belt tension; See 24.5 EVERY 250 HOURS SERVICE on page 3-50.</li> <li>Clean; See 24.6 EVERY 500 HOURS SERVICE on page 3-55.</li> <li>Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> </ul>
Track comes off	<ul style="list-style-type: none"> <li>Track too loose</li> </ul>	<ul style="list-style-type: none"> <li>Adjust track tension; See 24.2 WHEN REQUIRED on page 3-24.</li> </ul>
Abnormal wear of sprocket		
Bucket rises slowly, does not rise	<ul style="list-style-type: none"> <li>Lack of hydraulic oil</li> </ul>	<ul style="list-style-type: none"> <li>Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> </ul>
Does not swing	<ul style="list-style-type: none"> <li>Swing lock switch still applied</li> </ul>	<ul style="list-style-type: none"> <li>Turn swing lock switch OFF</li> </ul>

**16.6.3 ENGINE**

Problem	Main Causes	Remedy
Engine oil pressure monitor illuminates	<ul style="list-style-type: none"> <li>• Engine oil pan level is low, sucking in air</li> <li>• Clogged oil filter cartridge</li> <li>• Defective tightening of oil pipe joint, oil leakage from damaged parts</li> <li>• Defective engine oil pressure sensor</li> <li>• Defective monitor</li> </ul>	<ul style="list-style-type: none"> <li>• Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> <li>• Replace cartridge; See 24.5 EVERY 250 HOURS SERVICE on page 3-50.</li> <li>• (Check, repair)</li> <li>• (Replace sensor)</li> <li>• (Replace monitor)</li> </ul>
Steam is emitted from top part of radiator (pressure valve)	<ul style="list-style-type: none"> <li>• Coolant level low, leakage</li> <li>• Loosen fan belt</li> <li>• Dirt or scale accumulated in cooling system</li> </ul>	<ul style="list-style-type: none"> <li>• Add coolant, repair; See 24.3 CHECK BEFORE STARTING on page 3-43</li> <li>• Adjust fan belt tension; See 24.5 EVERY 250 HOURS SERVICE on page 3-50.</li> <li>• Change coolant, clean inside of cooling system; See 24.2 WHEN REQUIRED on page 3-24</li> </ul>
Radiator coolant level monitor illuminates	<ul style="list-style-type: none"> <li>• Clogged radiator fin and/or damaged fins</li> <li>• Defective thermostat</li> <li>• Loose radiator filler cap (high altitude operation)</li> <li>• Defective coolant level sensor</li> <li>• Defective monitor</li> </ul>	<ul style="list-style-type: none"> <li>• Clean or repair; See 24.6 EVERY 500 HOURS SERVICE on page 3-55.</li> <li>• (Replace thermostat)</li> <li>• Tighten cap or replace packing</li> <li>• (Replace sensor)</li> <li>• (Replace monitor)</li> </ul>
Engine does not start when starter motor is turned	<ul style="list-style-type: none"> <li>• Lack of fuel</li> <li>• Air in fuel system</li> <li>• Defective fuel injection pump or nozzle</li> <li>• Starter motor cranks engine sluggishly</li> <li>• Preheat monitor does not illuminate</li> <li>• Defective compression (Valve clearance)</li> </ul>	<ul style="list-style-type: none"> <li>• Add fuel; See 24.3 CHECK BEFORE STARTING on page 3-43</li> <li>• Repair place where air is sucked in; See 24.6 EVERY 500 HOURS SERVICE on page 3-55.</li> <li>• (Replace pump or nozzle)</li> <li>• See 16.6.1 ELECTRICAL SYSTEM on page 2-105</li> <li>• See 16.6.1 ELECTRICAL SYSTEM on page 2-105</li> <li>• (Adjust valve clearance)</li> </ul>
Exhaust gas is white or blue	<ul style="list-style-type: none"> <li>• Too much oil in oil pan</li> <li>• Improper fuel</li> </ul>	<ul style="list-style-type: none"> <li>• Add oil to specified level; See 24.3 CHECK BEFORE STARTING on page 3-43</li> <li>• Change to specified fuel</li> </ul>

## OPERATION

Problem	Main Causes	Remedy
Exhaust gas occasionally turns black	<ul style="list-style-type: none"> <li>• Clogged air cleaner element</li> <li>• Defective nozzle</li> <li>• Defective compression</li> <li>• Defective turbocharger</li> </ul>	<ul style="list-style-type: none"> <li>• Clean or replace; See 24.2 WHEN REQUIRED on page 3-24</li> <li>• (Replace nozzle)</li> <li>• See above</li> <li>• Clean or replace turbocharger</li> </ul>
Combustion noise occasionally makes breathing sounds	<ul style="list-style-type: none"> <li>• Defective nozzle</li> </ul>	<ul style="list-style-type: none"> <li>• (Replace nozzle)</li> </ul>
Abnormal noise generated (combustion and mechanical)	<ul style="list-style-type: none"> <li>• Low grade fuel being used</li> <li>• Overheating</li> <li>• Damage inside muffler</li> <li>• Excessive valve clearance</li> </ul>	<ul style="list-style-type: none"> <li>• Change to specified fuel</li> <li>• See above</li> <li>• (Replace muffler)</li> <li>• (Adjust valve clearance)</li> </ul>

### 16.6.4 ELECTRONIC CONTROL SYSTEM

If an error code is displayed on the machine monitor display (normally this displays the time), follow the self-diagnostic remedy table below.

Monitor display	Failure Mode	Remedy
E02	TVC valve system error	When the pump control override switch is turned ON, normal operations become normal, but carry out inspection immediately. (@)
E03	Swing brake system error	Turn swing lock override switch ON and release brake. When applying swing brake, operate swing lock switch manually. In this case, carry out inspection immediately. (@)
E05	Governor system error	The governor cannot carry out control. Operate the governor lever manually. To secure at the full position, there is a mounting hole for the lock bolts in the bracket. In this case, carry out inspection immediately.
CALL	Operation cannot be continued	Move machine to a safe posture, and carry out inspection immediately.
If no error code is displayed but work equipment or swing cannot be operated		Carry out inspection immediately.

(@) For details of handling the pump control or swing lock override switches; See 11.2.12 PUMP CONTROL OVERRIDE SWITCH on page 2-18 or See 11.2.13 SWING LOCK OVERRIDE SWITCH on page 2-18.



# **MAINTENANCE**

### 17. GUIDES TO MAINTENANCE

Do not carry out any inspection or maintenance operation that is not given in this manual. Perform maintenance work on hard, flat ground.

#### **Check service meter:**

Check the service meter every day to see if the time has come for any necessary maintenance to be carried out.

#### **Komatsu genuine replacement parts:**

Use genuine Komatsu parts specified in the Parts Book as replacement parts.

#### **Komatsu genuine oils and grease:**

Use genuine Komatsu oils and grease. Choose oils and grease with the proper viscosities specified for ambient temperature. Also, keep containers of the oil and grease clean. Keep foreign materials away from oil and grease.

#### **Always use clean washer fluid:**

Use automobile window washer fluid and be careful not to let any dirt get into it.

#### **Keeping the machine clean:**

Always keep the machine clean. This makes it easier to find parts causing problems. Keep in particular grease fittings, breathers and oil level gauges clean and avoid foreign matters from getting in them.

#### **Be careful of hot water and oil:**

Draining hot oils and coolants and removing their filters immediately after the engine stops are hazardous. Allow the engine to cool. If the oil has to be drained when it is cold, warm up the oil to a suitable temperature (approx. 20 to 40°C(68 - 104°F)) before draining it.

#### **Checking foreign materials in drained oil and on filter:**

After oil is changed or filters are replaced, check the oil and filters for metallic particles and foreign materials. If large quantities of metallic particles or foreign materials are found, consult your distributor.

#### **Fuel strainer:**

Do not remove the fuel strainer while fueling.

#### **Oil change:**

Check or change oils in the places where dust is scarce to keep foreign materials away from oils.

#### **Warning tag:**

Attach the warning tag (09963-03000) to the starting switch or other appropriate control lever to avoid someone who is not aware of the circumstances from starting the engine. During the operation, always obey the precautions on the safety label attached to the machine.

#### **Welding instructions:**

Turn off the engine starting switch. Do not apply more than 200 V continuously. Connect ground cable within 1 m from the area to be welded. Avoid seals or bearings from being between the area to be welded and the position of grounding point. Do not use the area around the work equipment pins or the hydraulic cylinders as the grounding point.

#### **Fire prevention:**

Use nonflammable cleaner or light oil for cleaning parts. Keep flame or cigarette light away from light oil.

#### **Clamp faces:**

When o-rings or gaskets are removed, clean the clamp faces and replace the o-rings and gaskets with new ones. Be sure to fit o-rings and gaskets when assembling.

**Objects in your pockets:**

Keep your pockets free of loose objects which can fall out and drop into the machinery; especially when you work on the machinery while bending over it.

**Checking undercarriage:**

When working in rocky areas, check for damage to the undercarriage and for looseness, flaws, wear and damage in bolts and nuts. Loosen the track tension a little when working in such areas.

**Precautions when washing machine:**

Never spray steam or water directly on the connectors and mechatronics parts. Do not allow water to get on the monitors and controllers inside the operator's cab. Never spray steam or water directly at the radiator or oil cooler portions.

**Pre and post work checks:**

Before starting work in mud, rain, snow or at seashore, check plugs and valves for tightness. Wash the machine immediately after the work to protect components from rusting. Lubricate components more frequently than usual. Be sure to lubricate work equipment pins daily if they are submerged in water.

**Dusty work sites:**

When working at dusty work sites, do as follows:

Inspect the air cleaner clogging monitor to see whether the air cleaner is blocked up. Clean the radiator core frequently to avoid clogging. Clean and replace the fuel filter frequently. Clean electrical components, especially the starting motor and alternator, to avoid accumulation of dust.

**Avoid mixing oils:**

Never mix oils of different brands. If you have only oil which is a different brand from the one that is used in the machine, do not add it but replace all the oil.

### 18. OUTLINES OF SERVICE

- Use genuine Komatsu parts for replacement.
- When changing or adding oil, do not use a different type of oil.
- Unless otherwise specified, the oil and coolant used at the time of shipment from the factory are as shown in the table below.

Item	Kind of fluid
Engine oil pan	SAE 15W-40 API classification CF-4
Swing machinery case, final drive case, Damper case	SAE 30 API classification CE
Hydraulic tank	SAE 10W API classification CD
Fuel tank	ASTM D975 No. 2 (However, ASTM D975 No. 1 is used for the winter season (October to March))
Radiator	Ethylene glycol antifreeze 50/50 mix with water

#### 18.1 OUTLINE OF OIL, FUEL, COOLANT

##### 18.1.1 OIL

- Oil is used in the engine and work equipment under extremely severe conditions (high temperature, high pressure), and it deteriorates with use. Always use oil that matches the grade and temperature for use given in the Operation & Maintenance Manual. Even if the oil is not dirty, always replace the oil after the specified interval.
- Oil corresponds to blood in the human body, so always be careful when handling it to prevent any impurities (water, metal particles, dirt, etc.) from getting in. The majority of problems with machines are caused by the entry of such impurities. Take particular care not to let any impurities get in when storing or adding oil.
- Never mix oils of different grades or brands.
- Always add the specified amount of oil. Having too much oil or too little oil are both causes of problems.
- If the oil in the work equipment is not clear, there is probably water or air getting into the circuit. In such cases, please contact your distributor.
- When changing the oil, always replace the related filters at the same time.
- We recommend you have an analysis made of the oil periodically to check the condition of the machine. For those who wish to use this service, please contact your distributor.

##### 18.1.2 FUEL

- The fuel injection pump is a precision instrument, and if fuel containing water or dirt is used, it cannot work properly.
- Be extremely careful not to let impurities get in when storing or adding fuel.
- Always use the fuel specified in the Operation & Maintenance Manual. Fuel may congeal depending on the temperature when it is used (particularly in low temperature below -15°C(5°F), so it is necessary to change to a fuel that matches the temperature.
- To prevent the moisture in the air from condensing and forming water inside the fuel tank, always fill the fuel tank after completing the day's work. Before starting the engine, or when 10 minutes have passed after adding fuel, drain the sediment and water from the fuel tank.
- If the engine runs out of fuel, or if the filters have been replaced, it is necessary to bleed the air from the circuit.

### 18.1.3 COOLANT

- Use water that has a low mineral content. Water used with antifreeze should meet the following guidelines.

**Total Hardness** - Not to exceed 300 parts per million to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.

**Chlorides** - Not to exceed 100 parts per million to prevent corrosion.

**Sulfites** - Not to exceed 100 parts per million to prevent corrosion.

- When using antifreeze, always observe the precautions given in the Operation & Maintenance Manual.
- These machines are supplied with Komatsu original antifreeze in the coolant when the machine is shipped. This antifreeze is effective in preventing corrosion of the cooling system. The antifreeze can be used continuously for two years or 4000 hours. Therefore, it can be used as it is even in hot areas.
- Antifreeze is inflammable, so be extremely careful not to expose it to flame or fire.
- The proportion of antifreeze to water differs according to the ambient temperature. For details of the mixing proportions; See ? COOLING SYSTEM on page ?-?.
- If the engine overheats, wait for the engine to cool before adding coolant.
- If the coolant level is low, it will cause overheating and will also cause problems with corrosion from the air in the coolant.

### 18.1.4 GREASE

- Grease is used to reduce friction and help prevent twisting and noise at joints.
- The nipples not included in the maintenance section are nipples for overhaul, so they do not need grease. If any joint becomes stiff after being used for a long time, add grease.
- Always wipe off all of the old grease pushed out when greasing. Be particularly careful to wipe off the old grease in places where sand or dirt sticking to the grease would cause wear of the rotating parts.

### 18.1.5 STORING OIL AND FUEL

- Keep indoors to prevent any water, dirt, or other impurities from getting in.
- When keeping drum cans for a long period, put the drum on its side so that the filler port of the drum can is at the side (to prevent moisture from being sucked in). If drum cans have to be stored outside, cover them with a waterproof sheet or take other measures to protect them.
- To prevent any change in quality during long term storage, be sure to use in the order of first in first out (use the oldest oil or fuel first).

### 18.1.6 FILTERS

- Filters are extremely important safety parts. They prevent impurities in the fuel and air circuits from entering important equipment and causing problems. Replace all filters periodically. For details, see the Operation & Maintenance Manual. However, when working in severe conditions, it is necessary to consider replacing the filters at shorter intervals according to the oil and fuel (sulfur content) being used.
- Never try to clean the filters (cartridge type) and use them again. Always replace with new filters.
- When replacing oil filters, check if any metal particles are stuck to the old filter. If any metal particles are found, please contact your distributor.
- Do not open packs of spare filters until just before they are to be used.
- Always use genuine Komatsu filters.

### 18.2 OUTLINE OF ELECTRICAL SYSTEM

- If the wiring gets wet or the insulation is damaged, the electrical system leaks and this could result in a hazardous malfunction of the machine.
- Services relating to the electrical system are (1) check of fan belt tension, (2) check of damage or wear in the fan belt and (3) check of battery fluid level.
- Never remove or disassemble any electrical components installed in the machine. Never install any electrical components other than these specified by Komatsu.
- Be careful to keep the electrical system free of water when washing the machine or when it rains.
- Since the controller for the control system may cause a malfunction due to external wave interference; before installing a radio receiver and a walkie-talkie or citizen band, consult your distributor.
- When working near the seashore, carefully clean the electrical system to prevent corrosion.
- When installing a cooler or any other electrical equipment, connect it to an independent power source connector. The optional power source must never be connected to the fuse, starting switch, or battery relay.

### 18.3 OUTLINE OF HYDRAULIC SYSTEM

- During operation and immediately after operation is ended, the temperature of the hydraulic system still remains high. In addition, high hydraulic pressure is applied to the system. Take care when inspecting and maintaining the hydraulic system.
  - Stop the machine on level ground, lower the bucket to the ground, then set so that there is no pressure applied to the cylinder circuit.
  - Always stop the engine.
  - Immediately after operations, the hydraulic oil and lubricating oil are at high temperature and high pressure, so wait for the oil temperature to go down before starting maintenance. Even when the temperature goes down, the circuit may still be under internal pressure, so when loosening the plug or screw, or the hose joint, do not stand in front of the part. Loosen it slowly to release the internal pressure before removing it.
  - When carrying out inspection or maintenance of the hydraulic circuit, always bleed the air from the hydraulic tank to remove the internal pressure.
- Periodic maintenance includes the inspection of the hydraulic oil level, replacement of the filter and refilling of hydraulic oil.
- When a high pressure hose, etc. is removed, check the o-ring for damage. If necessary, replace it.
- After the hydraulic filter element and strainer are cleaned or replaced, or after the hydraulic system is repaired or replaced or the hydraulic piping is removed, bleed air from the hydraulic circuit.
- The accumulator is charged with high-pressure nitrogen gas. Incorrect handling may be dangerous. For the handling procedure, See 11.22 HANDLING ACCUMULATOR on page 2-42.

## 18.4 OUTLINE OF FUEL SYSTEM

- Cleanliness of diesel fuel determines the service life of the fuel injection components. Water and contaminants, allowed to reach precision injection components, cause rapid wear and poor performance. Clean fuel and regular servicing of the fuel tank and fuel filtering components are necessary for long service life. Always clean the area around the fuel tank filler cap before refueling.

**⚠ WARNING**

- Do not smoke while filling the fuel tank or servicing the fuel system because a fire or explosion could result.
- When filling the fuel tank, place the fuel nozzle against the side of the filler neck to reduce the chance of static electricity sparks.
- Never remove the fuel filler cap or fill the fuel tank while the engine is running or when the machine is indoors. The fumes are hazardous and a spark or flame could cause a fire or explosion.
- Before working on the electrical system, disconnect the negative (ground) battery cable. Tag the cable and controls to warn against starting.
- Never mix gasoline, gasohol, or alcohol with diesel fuel. This creates a fire or explosion hazard that could result in personal injury or death.

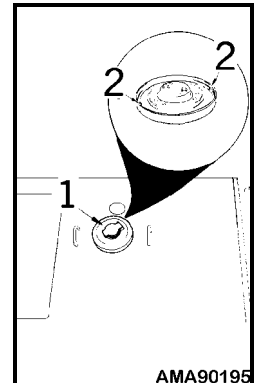
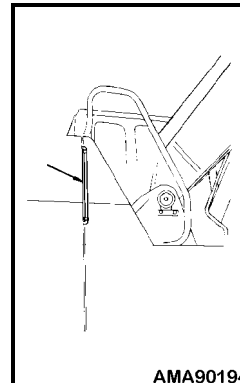
### 18.4.1 FUEL INJECTION PUMP

#### Do Not Attempt to Adjust the Fuel Injection Pump

Unsatisfactory operation of the engine may not be due to the fuel injection pump. If unsatisfactory operation persists after servicing the filters, consult your distributor to service the fuel injection pump. Special equipment and knowledge are required for proper injection pump service. These are available at your distributor.

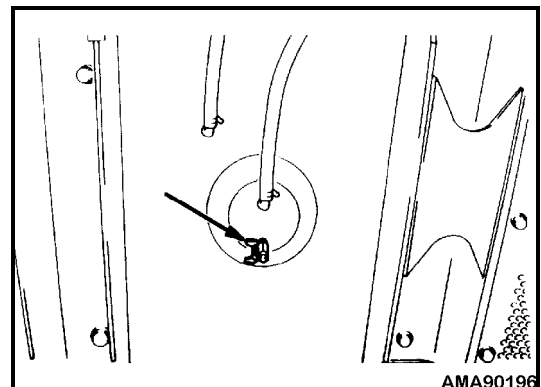
### 18.4.2 FUEL TANK

- Check the fuel level at the gauge on the control panel. The fuel level can also be checked using the sight gauge on the side of the fuel tank. To prevent moisture due to condensation, the fuel tank must be filled at the end of each day's operation. Fuel is added by removing fuel cap (1) and adding fuel. If fuel cap breather holes (2) are clogged, fuel flow to the engine may stop. Periodically check and clean the fuel cap breather holes.



#### Draining Fuel Tank

- Loosen the valve on the bottom of the fuel tank. Drain the water and sediment from the tank until clean fuel appears. Close the valve.



## MAINTENANCE

### 19. WEAR PARTS LIST

Wear parts such as the filter elements, bucket teeth, etc. are to be replaced at the time of periodic maintenance or before their abrasion limits. The wear parts should be changed correctly to use the machine economically. For part change, genuine Komatsu parts of excellent quality should be used. When ordering parts, please check the part number in the parts book. Use the current parts book to write in the numbers.

( ): The items in parentheses are to be replaced at the same time.

Item	Part No.	Part Name	Qty	Replacement frequency
Engine oil filter		Cartridge	1	Every 250 hours of service
Hydraulic oil filter		Element (O-ring)	1 (1)	Every 250 hours of service
Fuel filter		Cartridge	1	Every 500 hours of service
Fuel-water separator		Cartridge	1	Every 500 hours of service
Hydraulic tank breather		Element	1	Every 500 hours of service
Air cleaner		Double Element	1	When required
Additional breaker filter		Element (O-ring)	1 (1)	See 23.2 MAINTENANCE INTERVAL WHEN USING HYDRAULIC BREAKER on page 3-22.
Electrical engine air intake heater		Gasket	2	When required
In-line fuel strainer		Strainer	1	Every 500 hours of service
Bucket		SuperV Tooth Tooth adapter (pin for SuperV)	- - (1/tooth)	When required
		Left side shroud (bolt) Right side shroud (bolt)	1 (3) 1 (3)	When required



## 20. FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE

### 20.1 PROPER SELECTION OF FUEL, COOLANT AND LUBRICANTS

It is not our policy to approve fuel, coolant and lubricants or to guarantee performance in service. The responsibility for the quality of the fuel, coolant and lubricant must remain with the supplier. When in doubt, consult your distributor. The specified fuel, coolant and lubricants recommended for this machine are as shown in the following table.

RESERVOIR	FLUID TYPE	AMBIENT TEMPERATURE								CAPACITY	
		-22	-4	14	32	50	68	86	104°F	Specified	Refill
		-30	-20	-10	0	10	20	30	40°C		
Engine oil pan	Engine oil	SAE 30								26.3 ℓ 6.95 gal	24ℓ 6.34 gal
		SAE 10W									
		SAE 10W-30									
		SAE 15W-40									
Damper case										0.75 ℓ 0.20 gal	--
Swing machinery case		SAE 30								5.5ℓ 1.45 gal	5.5ℓ 1.45 gal
Final drive (each)										10ℓ 2.6 gal	9.5ℓ 2.5 gal
Track front idler (each)										0.07 - 0.08ℓ 2.4 - 2.7 oz	0.07 - 0.08ℓ 2.4 - 2.7 oz
Track roller (each)		SAE 30								0.19 - 0.21 ℓ 6.4 to 7.1 oz	0.19 - 0.21 ℓ 6.4 to 7.1 oz
Top carrier roller (each)										0.23 to 0.25 ℓ 7.8 to 8.5 oz	0.23 to 0.25 ℓ 7.8 to 8.5 oz
Hydraulic system		SAE10W								246 ℓ 65 gal	166 ℓ 43.9 gal
		SAE 10W-30									
		SAE 15W-40									
Fuel tank	Diesel fuel See 20.5page 3-11	ASTM D975 No. 2								340 ℓ 89.8 gal	--
		ASTM D975 No. 1									
All lube fittings	Grease	No.2 Multi-purpose lithium grease with 3% molybdenum disulfide								Fill as instructed	
Cooling system	Coolant	See 24.2.2 CLEAN INSIDE OF COOLING SYSTEM on page 3-27.								23.3 ℓ 6.2 gal	--

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.

ASTM: American Society of Testing and Materials

SAE: Society of Automotive Engineers

## MAINTENANCE

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### 20.2 ENGINE OIL SPECIFICATIONS

#### 20.2.1 NORMAL OPERATION

Oil performance recommendations are as follows:

- The use of a quality engine lubricating oil combined with appropriate oil and filter change intervals are critical factors in maintaining engine performance and durability.
- Komatsu Engine Oil or multi-viscosity engine oil meeting American Petroleum Institute (API) performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

#### NOTICE:

Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available. If API classification CC or CC/CD is used, reduce the engine oil change interval by half.

- A sulfated ash limit of 1.0 mass percent is suggested for optimum valve and piston deposit and oil consumption control. The sulfated ash **must not** exceed 1.85 mass percent. The sulfated ash limit of 1.85 mass percent has been placed on all engine lubricating oils recommended for use in the engine. Higher ash oils can cause valve and/or piston damage and lead to excessive oil consumption.
- The API service symbol displays the following information. The upper half of the symbol displays the appropriate oil categories; the lower half may contain words to describe oil energy conserving features. The center section identifies the SAE oil viscosity grade.

Oil viscosity recommendations are as follows:

- The use of a multi-grade lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures.
- While SAE 15W-40 multi-viscosity oil is recommended for most operating climates, refer to the previous table for oil viscosity recommendations for extreme climates.

#### NOTICE:

Limited use of low viscosity oils, such as SAE 10W-30 may be used for easier starting and providing sufficient oil flow at ambient temperatures below -5°C (+23°F). However, continuous use of low viscosity oils can decrease engine life due to wear.

Single-graded oils may be used if multi-graded oil is not available, but be sure to use oil that matches the temperature in the table.

- Special "break-in" lubricating oils are not recommended for a new or rebuilt engine. Use the same type of oil during the "break-in" as specified for normal operation.
- Additional information regarding lubricating oil availability throughout the world is available in the "E.M.A. Lubricating Oils Data Book for Automotive and Industrial Engines." The data book may be ordered from the Engine Manufacturers Association, 401 North Michigan Ave., Chicago, IL U.S.A. 60611. The telephone number is (312) 644-6610.

### 20.2.2 ARCTIC OPERATION

If an engine is operated in ambient temperatures consistently below -23°C (-10°F) and there are no provisions to keep the engine warm when it is **not** in operation, use a synthetic engine oil API performance classification CF-4, CG-4, CF-4/SG or CG-4/SH with adequate low temperature properties such as SAE 5W-20 or 5W-30.

The oil supplier **must** be responsible for meeting the performance service specifications.

**NOTICE:**

The use of a synthetic base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as; corrosion, deposits and wear.

### 20.3 DAMPER CASE, SWING MACHINERY CASE, TRACK FRONT IDLERS, TRACK ROLLERS, TOP CARRIER ROLLERS AND HYDRAULIC SYSTEM OIL SPECIFICATIONS

Komatsu Engine Oil or engine oil meeting American Petroleum Institute (API) performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

**NOTICE:**

Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available.

**NOTICE:**

The track front idlers, track rollers and top carrier rollers are lubricated for the life of the component. Lubrication should only be necessary during rebuilding.

### 20.4 FINAL DRIVE OIL SPECIFICATIONS

Komatsu Engine Oil or engine oil meeting American Petroleum Institute (API) performance classification CF-4, CG-4, CF-4/SG or CG-4/SH or MIL-L-2104D or E is recommended.

**NOTICE:**

Classification CD, CE, CD/SF or CE/SF oils may be used in areas where CF-4, CG-4, CF-4/SG or CG-4/SH oil is not yet available.

### 20.5 DIESEL FUEL SPECIFICATIONS



**WARNING**

Possible fire hazard - never mix gasoline, gasohol and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions an explosion which could result in personal injury or death.



**WARNING**

Never remove the fuel tank filler cap or refill the fuel tank while the engine is running or when hot or when the machine is indoors. Fumes are dangerous, a spark or flame could result in a fire or explosion.

**NOTICE:**

Due to the precise tolerances of diesel fuel injection systems, it is extremely important that the fuel be kept clean and free of contaminants or water. Contaminants or water in the system can cause severe damage to both the injection pump and nozzles.

**REMARK**

Below -12°C (+10°F) the paraffin in ASTM Grade No. 2-D diesel fuel will change to wax particles and clog the fuel filters. For best results use Grade No. 1-D diesel fuel in cold weather.

## MAINTENANCE

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For normal service above -12°C (+10°F), the use of ASTM Grade No. 2-D diesel fuel with a minimum Cetane number of 40 is recommended. The use of No. 2-D diesel fuel will result in optimum engine performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to prevent misfires and excessive smoke.

At operating temperatures below -12°C (+104°F) or extended engine idle, use ASTM Grade No. 1-D diesel fuel. The use of lighter fuels can reduce fuel economy.

Where a winterized blend of Grade No. 2-D and No. 1-D fuels is available, it may be substituted for Grade No. 1-D fuel. However, it is the supplier's responsibility to provide the fuel for the anticipated ambient temperature.

Use a low sulfur content fuel having a cloud point that is at least 10 degrees below the lowest expected fuel temperature. Cloud point is the temperature at which crystals begin to form in the fuel.

The viscosity of the fuel **must** be kept above 1.3 cSt to provide adequate fuel system lubrication.

Optionally, the equivalent grades of recognized Federal Government specifications may be used; the latest revisions of VV-F-800a.

## 20.6 COOLANT SPECIFICATIONS

### 20.6.1 GENERAL

Selection and maintenance of the engine coolant is important to long engine life. The following information provides recommendations for selecting the engine coolant and maintaining the supplemental coolant additives (SCA).

Heavy duty diesel engines require a balanced coolant mixture of water and antifreeze. The coolant mixture **must** be drained and replaced at the specified service interval shown; See 23 MAINTENANCE SCHEDULE CHART on page 3-20, or every two years of operation, whichever comes first.

### 20.6.2 WATER

Use water which has a low mineral content. Water used in conjunction with antifreeze, coolant filters and inhibited water must meet the following standards:

- Total Hardness** - Not to exceed 170 parts per million (10 grains/gallon maximum) to prevent scale deposits. Water containing dissolved magnesium and calcium (the usual reason for water hardness) above the specified amount will cause scale deposits to develop in the engine.
- Chlorides** - Not to exceed 40 parts per million (2.5 grains/gallon maximum) to prevent corrosion.
- Sulfites** - Not to exceed 100 parts per million (5.8 grains/gallon maximum) to prevent corrosion.
- Dissolved Solids** - Not to exceed 340 parts per million (20 grains/gallon maximum) to minimize sludge deposits, scale deposits, corrosion or a combination of these.

If any of the above requirements cannot be met, use distilled, de-ionized, or de-mineralized water. To determine if local water supplies meet these standards, water samples can be tested by water treatment laboratories. Softened water that is prepared using common salt (sodium chloride) contains excessive amounts of chlorides and should not be used.

#### NOTICE:

Never use water alone in the cooling system because rust, scale deposits and corrosion will occur.

**20.6.3 ANTIFREEZE**

In climates where the temperature is above -34°C (-30°F), use a coolant mixture that contains 50 percent antifreeze. **Antifreeze is essential in any climate.** It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do **not** use more than 50 percent antifreeze in the mixture unless additional freeze protection is required. **Never** use more than 68 percent antifreeze under any condition.

An antifreeze concentration greater than 68% will adversely affect freeze protection and heat transfer rates. Antifreeze concentrations between 68 and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates.

Ethylene glycol, low silicate antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silica-gel (hydro-gel). This gel formation can occur when the cooling system contains an over concentration of high silicate antifreeze and/or supplemental coolant additive. **DO NOT** use methanol or alcohol as an antifreeze because of its low boiling point.

Antifreeze may retain its freeze protection for more than one season but coolant conditioners must be added to maintain corrosion protection. Antifreeze formulated with methoxy propanol, or propylene glycol, is not recommended for this system.

**NOTICE:**

Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or anti-leak additives should **NOT** be used in this system. Sealer or anti-leak additives will cause plugging problems in the cooling system.

**⚠ WARNING**

**Use extreme caution when adding coolant to a hot radiator to avoid being burned. Wear gloves and goggles and keep face away from the filler neck.**

Check the solution periodically and at normal operating temperature, to be sure the cooling system has sufficient protection against freezing. An antifreeze concentration greater than 68% will adversely affect antifreeze protection and heat transfer rates. Antifreeze concentrations between 68% and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates. The following table shows the approximate percentage of antifreeze solution required for various temperatures.

Approximate Freezing Point	Percentage of Antifreeze Concentration by Volume	Specific Gravity at 16°C (60°F)
0°C (+32°F)	0	1.000
-7°C (+20°F)	15	1.025
-12°C (+10°F)	25	1.040
-18°C (0°F)	33	1.053
-23°C (-10°F)	40	1.062
-29°C (-20°F)	45	1.070
-34°C (-30°F)	48	1.074
-40°C (-40°F)	53	1.080
-46°C (-50°F)	56	1.083
-51°C (-60°F)	59	1.088
-57°C (-70°F)	62	1.092
-62°C (-80°F)	65	1.095
-68°C (-90°F)	67	1.097
-69°C (-92°F)	68	1.098

**REMARK**

Do not use a 100% antifreeze solution for freezing protection, This will cause severe corrosion in the cooling system and if not detected will cause radiator and oil cooler core damage. Use a water/antifreeze solution as described in the preceding table.

## **MAINTENANCE**

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In tropical climates where antifreeze availability may be limited, use a corrosion inhibitor or supplemental coolant additive (SCA), to protect the engine cooling system.

## **21. STANDARD TIGHTENING TORQUES FOR BOLTS AND NUTS**

### **21.1 INTRODUCTION OF NECESSARY TOOLS**

The following tools are needed when carrying out maintenance.

No.	Name of tool	Part No.	Remarks
1	Wrench	09002-01417 09002-03032	Applicable width across flats 14mm - 17mm 30mm - 32mm
2	Screwdriver	09033-00190	Interchangeable flat head and cross head type
3	Socket wrench set	20Y-98-22130	Applicable width across flats - 10 mm, 13 mm, 14 mm, 17 mm, 19 mm, 22 mm, 24 mm, Extension socket
4	Wrench	09002-03641	Applicable width across flats - 36 mm - 41 mm
5	Socket	09021-03044	
6	Hexagon wrench	09007-00836	Applicable width across flats 8 mm
7	Filter wrench	09019-08035	
8	Grease pump	07950-10450	For greasing work
9	Nozzle	07951-11400	
10	Grease cartridge	07950-90403	(Lithium base grease, 400 g)
11	Hammer	09039-00150	
12	Pinch bar	09055-10390	
13	Handle	09024-00300	

If any of the above tools are broken, please order them from your distributor.

## MAINTENANCE

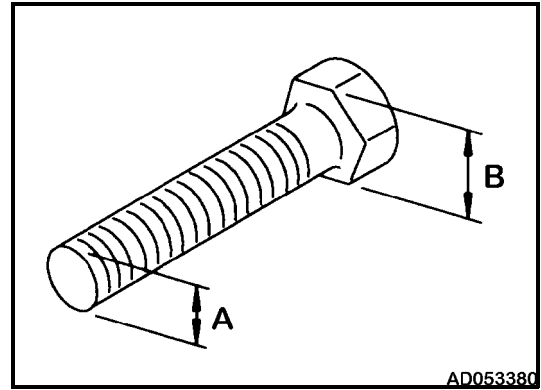
### 21.2 TORQUE LIST

Unless otherwise specified, tighten the metric bolts and nuts to the torque shown in the table.

The tightening torque is determined by the width across the flats (B) of the nut and bolt.

If it is necessary to replace any nut or bolt, always use a genuine Komatsu part of the same size as the part that was replaced.

$$1 \text{ N}\cdot\text{m} = 0.1 \text{ kgm} = 0.74 \text{ lbf ft}$$



AD053380

Thread pitch (A)	Flats width (B)	T		H	
		N•m	kgm	lbf ft	
6	10	13.2 ± 1.4	1.35 ± 0.15	9.73 ± 1.03	
8	13	31.4 ± 2.9	3.2 ± 0.3	23.2 ± 2.1	
10	17	65.7 ± 6.8	6.7 ± 0.7	48.5 ± 5.0	
12	19	112 ± 9.8	11.5 ± 1.0	82.6 ± 7.2	
14	22	177 ± 19	18.0 ± 2.0	131 ± 14	
16	24	279 ± 29	28.5 ± 3	206 ± 21	
18	27	383 ± 39	39 ± 3	282 ± 29	
20	30	549 ± 58	56 ± 6	405 ± 43	
22	32	745 ± 78	76 ± 8	549 ± 58	
24	36	927 ± 98	94.5 ± 10	684 ± 72	
27	41	1320 ± 140	135 ± 15	973 ± 100	
30	46	1720 ± 190	175 ± 20	1270 ± 140	
33	50	2210 ± 240	225 ± 25	1630 ± 180	
36	55	2750 ± 290	280 ± 30	2030 ± 210	
39	60	3280 ± 340	335 ± 35	2420 ± 250	

#### NOTICE

When tightening panels or other parts having fixtures made of plastic, be careful not to use excessive tightening torque: doing so will damage the plastic parts.



## 22. PERIODIC REPLACEMENT OF SAFETY CRITICAL PARTS

To ensure safety at all times when operating or driving the machine, the user of the machine must always carry out periodic maintenance. In addition, to further improve safety, the user should also carry out periodic replacement of the parts given in the table. These parts are particularly closely connected to safety and fire prevention.

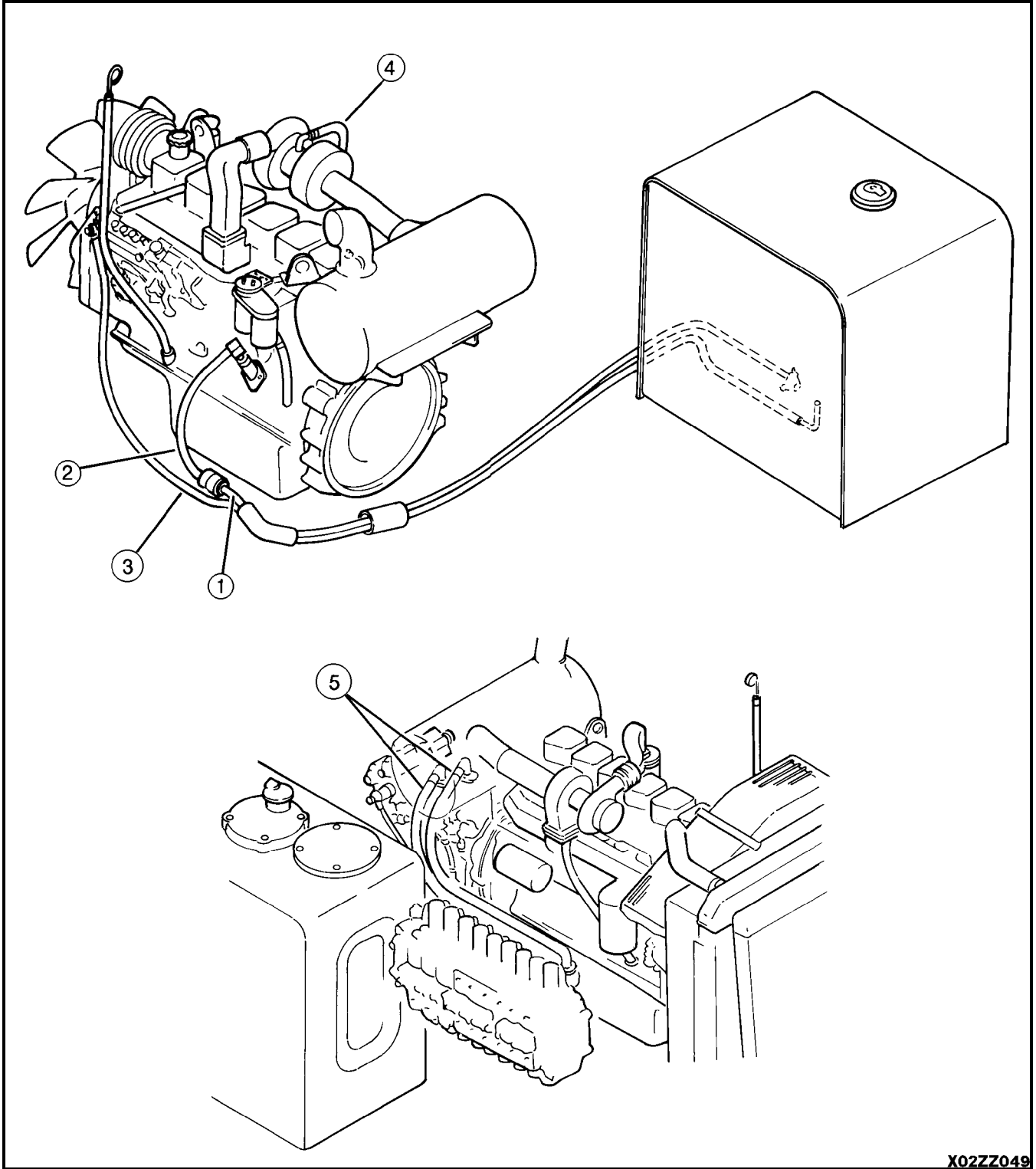
With these parts, the material changes as time passed, or they easily wear or deteriorate. However, it is difficult to judge the condition of the parts simply by periodic maintenance, so they should always be replaced after a fixed time has passed, regardless of their condition. This is necessary to ensure that they always maintain their function completely. However, if these parts show any abnormality before the replacement interval has passed, they should be repaired or replaced immediately.

If the hose clamps show any deterioration, such as deformation or cracking, replace the clamps at the same as the hoses. When replacing the hoses, always replace the o-rings, gaskets, and other such parts at the same time.

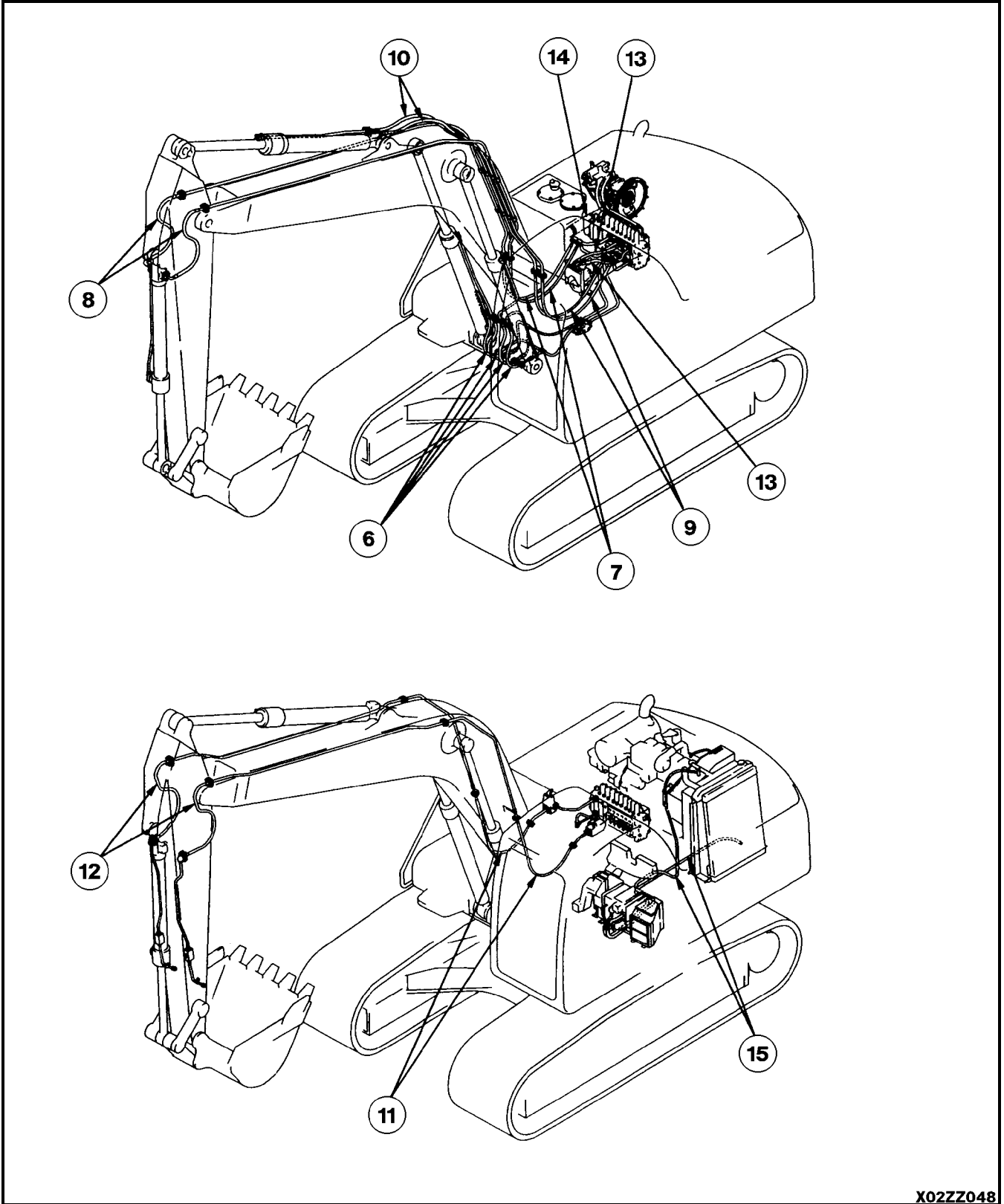
Ask your distributor to replace the safety critical parts.

### SAFETY CRITICAL PARTS

No.	Safety critical parts for periodic replacement	Qty	Replacement interval
1	Fuel hose (fuel tank to strainer)	1	Every 2 years or 4000 hours, whichever comes sooner
2	Fuel hose (inline strainer to left pump)	1	
3	Fuel return hose (Fuel injection pump to fuel tank)	1	
4	Turbocharger lubrication oil hose	1	
5	Pump outlet hose (Pump to control valve)	2	
6	Work equipment hoses (Boom cylinder inlet)	4	
7	Work equipment hose swing (Bucket cylinder line - Boom foot section)	2	
8	Work equipment hose (Bucket cylinder inlet)	2	
9	Work equipment hose (Arm cylinder line - Boom foot section)	2	
10	Work equipment hose (Arm cylinder inlet)	2	
11	Additional attachment line hose (Boom foot section)	2	
12	Additional attachment line hose (Boom top section)	2	
13	Swing line hose (Swing motor inlet)	2	
14	Main suction hose	1	
15	Heater hose	2	
16	Seat belt	1	Replace every 3 years



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# MAINTENANCE

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## 23. MAINTENANCE SCHEDULE CHART

### 23.1 SCHEDULED MAINTENANCE CHART

SERVICE ITEM	PAGE
<b>INITIAL 250 HOURS SERVICE - 24.1</b>	
1. Replace fuel filter cartridge and fuel-water separator cartridge .....	3-23
<b>WHEN REQUIRED - 24.2</b>	
1. Check, clean and replace air cleaner element .....	3-24
2. Clean inside of cooling system (every 2 years or 2000 hours) .....	3-27
3. Check and tighten track shoe bolts .....	3-31
4. Check and adjust track tension .....	3-32
5. Check electrical intake air heater .....	3-33
6. Installation of bucket teeth - SuperV type .....	3-34
7. Removal of bucket teeth - SuperV type .....	3-36
8. Adjust bucket clearance .....	3-38
9. Check window washer fluid, add fluid .....	3-39
10. Check and adjust air conditioner .....	3-40
11. Replace additional breaker filter element .....	3-41
12. Clean in line filter element - Rectangular .....	3-42
<b>CHECK BEFORE STARTING - 24.3</b>	
1. Check coolant level, add coolant .....	3-43
2. Check engine oil level, add oil .....	3-43
3. Check fuel level, add fuel .....	3-44
4. Check oil level in hydraulic tank, add oil .....	3-44
5. Check air cleaner for clogging .....	3-45
6. Check electrical wiring .....	3-45
7. Check function of horn .....	3-45
8. Drain water from fuel water separator .....	3-46

<b>SERVICE ITEM</b>	<b>PAGE</b>
<b>EVERY 100 HOURS SERVICE - 24.4</b>	
1. Grease lubrication . . . . .	3-47
2. Check oil level in swing machinery case, add oil . . . . .	3-49
3. Drain water from fuel water separator . . . . .	3-49
<b>EVERY 250 HOURS SERVICE - 24.5</b>	
1. Check oil level in final drive cases, add oil . . . . .	3-50
2. Check level of battery electrolyte . . . . .	3-50
3. Replace hydraulic filter element . . . . .	3-51
4. Lubricate swing circle, 3 points . . . . .	3-52
5. Check fan belt tension, adjust . . . . .	3-53
6. Check, adjust belt tension of A/C compressor belt . . . . .	3-54
<b>EVERY 500 HOURS SERVICE - 24.6</b>	
1. Replace fuel filter cartridge and fuel-water separator . . . . .	3-55
2. Check swing pinion grease level, add grease . . . . .	3-57
3. Clean and inspect radiator fins, oil cooler fins, aftercooler fins and condenser fins . . . . .	3-58
4. Clean internal and external air filters of air conditioner - if equipped . . . . .	3-59
5. Replace hydraulic tank breather . . . . .	3-59
6. Change engine oil, replace engine oil filter cartridge . . . . .	3-60
7. Replace in-line fuel strainer . . . . .	3-62
<b>EVERY 1000 HOURS SERVICE - 24.7</b>	
1. Change oil in swing machinery case . . . . .	3-63
2. Check oil level in damper case, add oil . . . . .	3-64
3. Check all tightening parts of turbocharger . . . . .	3-64
4. Check play of turbocharger rotor . . . . .	3-64
5. Check drive belt, tensioner bearing and fan hub . . . . .	3-65
<b>EVERY 2000 HOURS SERVICE - 24.8</b>	
1. Change oil in final drive case . . . . .	3-66
2. Clean hydraulic tank strainer . . . . .	3-67
3. Clean, check turbocharger . . . . .	3-67
4. Check alternator, starter motor . . . . .	3-67

# MAINTENANCE

SERVICE ITEM	PAGE
<b>(EVERY 2000 HOURS SERVICE - 24.8)</b>	
5. Check vibration damper .....	3-67
6. Change antifreeze .....	3-67
7. Check engine valve clearance, adjust .....	3-68
<b>EVERY 4000 HOURS SERVICE - 24.9</b>	
1. Check water pump .....	3-70
<b>EVERY 5000 HOURS SERVICE - 24.10</b>	
1. Change oil in hydraulic tank .....	3-71

## 23.2 MAINTENANCE INTERVAL WHEN USING HYDRAULIC BREAKER

For machines equipped with a hydraulic breaker, the hydraulic oil deteriorates faster than for normal bucket digging operations, so set the maintenance intervals as follows.

### Replacing hydraulic element

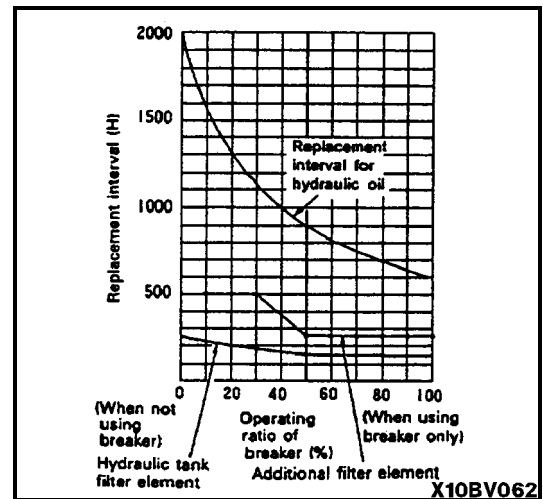
On new machines, replace the element after the first 100 to 150 hours, then carry out further replacement of the element according to the table on the right.

### Changing oil in hydraulic tank

Change the oil according to the table on the right.

### Replacing additional filter element for breaker

Use a guideline of 250 hours for use of the breaker (operating ratio for the breaker: 50 % or more), and replace the element according to the table on the right.



## **24. SERVICE PROCEDURE**

### **24.1 INITIAL 250 HOURS SERVICE**

Carry out the following maintenance only after the first 250 hours.

#### **24.1.1 REPLACE FUEL FILTER CARTRIDGE**

For details of the method of replacing, see the section on EVERY 500 HOURS.

# MAINTENANCE

## 24.2 WHEN REQUIRED

### 24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT



#### WARNING

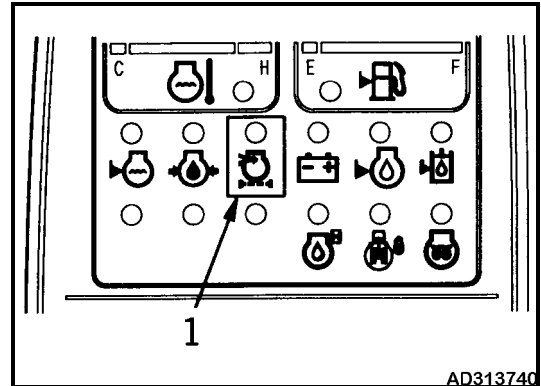
- Never clean or replace the air cleaner element with the engine running.
- When using pressure air to clean the element wear safety glasses or goggles to protect the eyes.

#### Checking

If air cleaner clogging monitor (1) flashes, clean the air cleaner element.

#### NOTICE

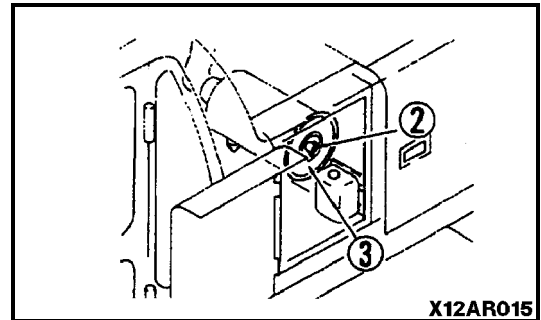
Do not clean the air cleaner element until the air cleaner clogging monitor on the monitor panel flashes. If the element is cleaned frequently before the clogging monitor flashes, the air cleaner will not be able to display its performance fully, and the cleaning efficiency will also go down. In addition, during the cleaning operation, more dirt stuck to the element will fall inside the inner element.



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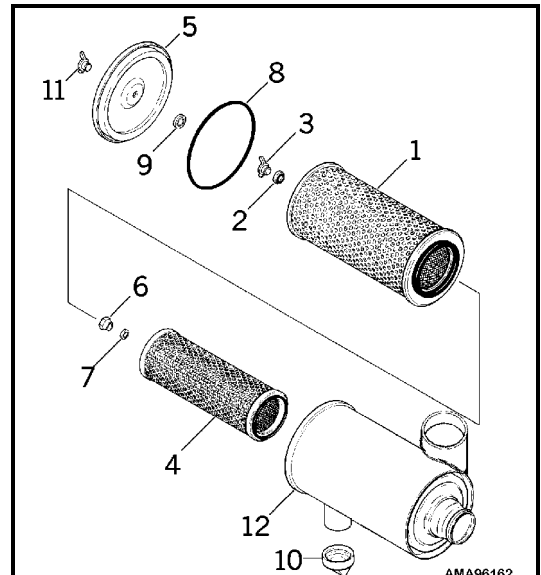
#### Cleaning the Outer Element

1. Open the engine hood, loosen wing nut (2), and remove cover (3).



X12AR015

2. Remove wing nut (11), then take out outer element (1). To prevent dirt or dust from entering, use tape or a clean cloth to cover the air connector end of the air cleaner body. Clean the air cleaner housing (12) interior and the cover (5).



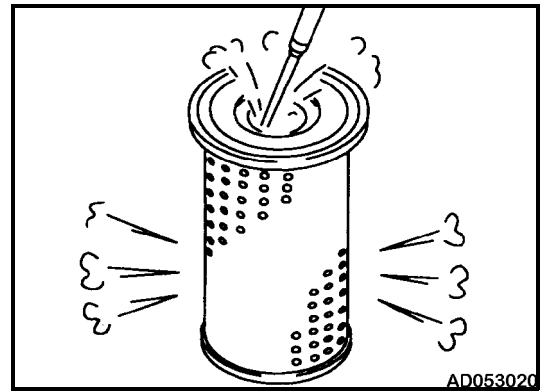
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**WARNING**

Wear eye protection when using air under pressure to clean parts. Limit air to less than 7 kg/cm<sup>2</sup> (100 psi).

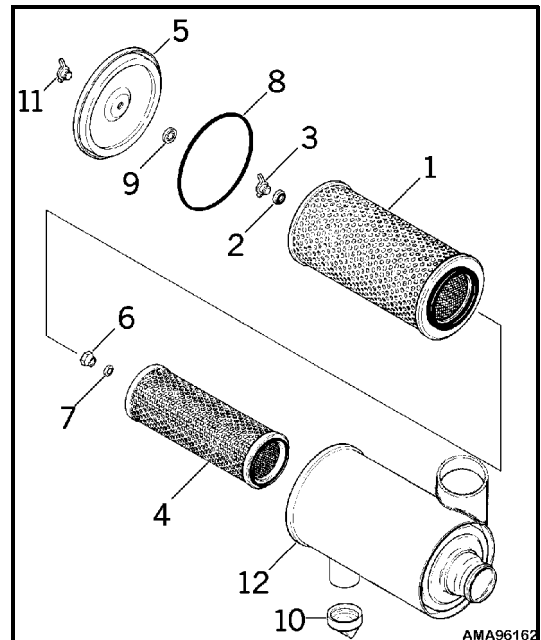
3. Direct dry compressed air to element (6) from inside along its folds, then direct it from outside along its folds and again from inside.



- a) Remove one seal from the outer element (1) whenever the outer element has been cleaned.
- b) Replace the outer element which has been cleaned 6 times repeatedly or used throughout a year. Replace the inner element (4) at the same time.
- c) Replace both inner and outer elements when the monitor lamp flashed soon after installing the cleaned outer element even though it has not been cleaned 6 times.
- d) Check inner element mounting nut for looseness and, if necessary, retighten.

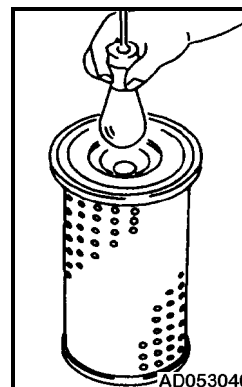
 Hex nut (6) ..... 4.9 to 5.9 N•m

- e) If seal washer (2 or 7) is/are damaged or the thread of nut (3 or 6) is/are broken, replace with a new part/s.
- f) Remove vacuator valve (10) and clean with compressed air.



- |                  |                 |
|------------------|-----------------|
| 1. Outer element | 7. Nut seal     |
| 2. Nut seal      | 8. Cover gasket |
| 3. Wing nut      | 9. Snap ring    |
| 4. Inner element | 10. Vacuator    |
| 5. End cover     | 11. Wing nut    |
| 6. Hex nut       | 12. Housing     |

4. If small holes or thinner parts are found on the element when it is checked by shining a light through it after cleaning, replace the element.



## MAINTENANCE

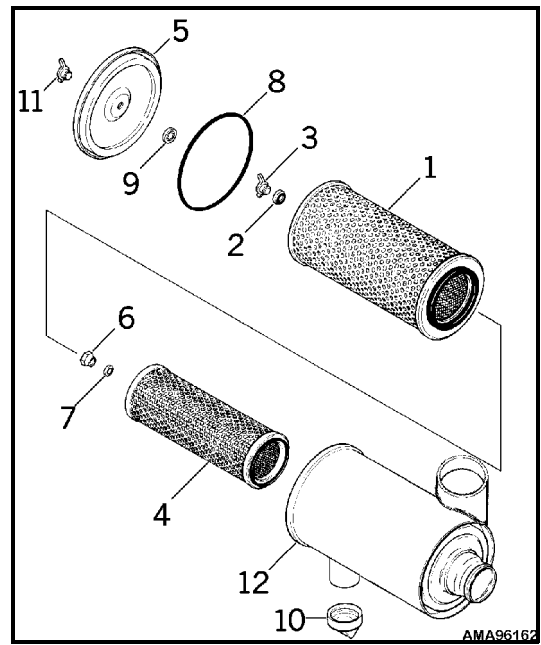
### NOTICE

Do not use an element whose folds or gasket or seal are damaged. When cleaning the element, do not hit or beat it against anything. Wrap up unused elements and store them in a dry area.

5. Remove the cloth and tape used for cover in Step 2.
6. Install the cleaned element (1) and fix it with the wing nut (3).

### Replacing inner element

1. First remove the outer element (1), and then remove the inner element (4).
2. Place the cover over the air intake part to prevent dust entering.
3. Clean the air cleaner body interior, then remove the cover from the air intake port in Step 2.
4. Fit a new inner element and tighten it with nuts. The inner element must not be cleaned and used again.
5. Set the new outer element in position and secure it with the wing nut.
6. Remove vacuator valve (10), then clean with compressed air. After cleaning, install again.



24.2.2 CLEAN INSIDE OF COOLING SYSTEM



**WARNING**

- Soon after the engine has been stopped, the coolant is hot and can cause personal injury. Allow the engine to cool before draining water.
- Since cleaning is performed while the engine is running, it is very dangerous to enter the rear side of the machine as the machine may suddenly start moving. If the under cover is left removed, it may interfere with the fan. While the engine is running, never enter the rear side of the machine.
- Never remove the radiator cap when the engine is at operating temperature. At operating temperature, the coolant is under pressure. Steam blowing up from the radiator could cause personal injury. Allow the engine to cool until the radiator filler cap is cool enough to touch with your hand. Remove the filler cap slowly to allow pressure to be relieved.

**NOTICE:**

**Never use water alone in the cooling system because corrosion will occur.**

In climates where the temperature is above -37°C (-34°F), use a coolant mixture that contains 50 percent antifreeze. **Antifreeze is essential in any climate.** It broadens the operating temperature range by lowering the coolant freezing point and by raising its boiling point. Do **not** use more than 50 percent antifreeze in the mixture unless additional freeze protection is required.

An antifreeze concentration greater than 68% will adversely affect freeze protection and heat transfer rates. Antifreeze concentrations between 68% and 100% actually have a higher freezing point than a 68% antifreeze concentration and should not be used due to reduced heat transfer rates.

Low silicate ethylene or propylene glycol antifreeze is recommended. The antifreeze should contain no more than 0.1% anhydrous alkali metasilicate. Low silicate antifreeze is recommended to avoid the formation of silicate-gel (hydrogel). This gel formation can occur when the cooling system contains an over concentration of high silicate antifreeze and/or excessive supplemental coolant additive. **DO NOT** use methanol or alcohol as an antifreeze because of its low boiling point.

Super Coolant (AF-ACL) has an anti-corrosion effect as well as an antifreeze effect. The ratio of antifreeze to water depends on the ambient temperature, but to obtain the corrosion resistance effect, a minimum ratio of 30% by volume is necessary.

**NOTICE:**

**Do not mix types of antifreeze solutions. Mixed solutions make it impossible to determine the protection against freezing. Antifreeze containing sealer or anti-leak additives should NOT be used in this system. Sealer or anti-leak additives will cause plugging problems in the cooling system.**

Check the solution periodically and at normal operating temperature to be sure the cooling system has sufficient protection against freezing.

- When deciding the ratio of antifreeze to water, check the lowest temperature in the past, and decide from the mixing rate table given below. It is actually better to estimate a temperature about 10°C lower when deciding the mixing rate.

# MAINTENANCE

## Mixing Rate of Water and Antifreeze

Approximate Freezing Point	Percentage of Antifreeze Concentration by Volume	Specific Gravity at 16°C (60°F)
0°C (+32°F)	0	1.000
-7°C (+20°F)	15	1.025
-12°C (+10°F)	25	1.040
-18°C (0°F)	33	1.053
-23°C (-10°F)	40	1.062
-29°C (-20°F)	45	1.070
-34°C (-30°F)	48	1.074
-40°C (-40°F)	53	1.080
-46°C (-50°F)	56	1.083
-51°C (-60°F)	59	1.088
-57°C (-70°F)	62	1.092
-62°C (-80°F)	65	1.095
-68°C (-90°F)	67	1.097
-96°C (-92°F)	68	1.098



### WARNING

Antifreeze is flammable, so keep it away from any flame.

- Use city water for the cooling water.  
For water requirements, See 20.6 COOLANT on page 3-12



### WARNING

When removing drain plug, avoid pouring coolant on yourself.

- Stop the machine on level ground when cleaning or changing the coolant.
- Prepare a container to catch drained coolant:



Coolant catch container ..... Min 24 l capacity

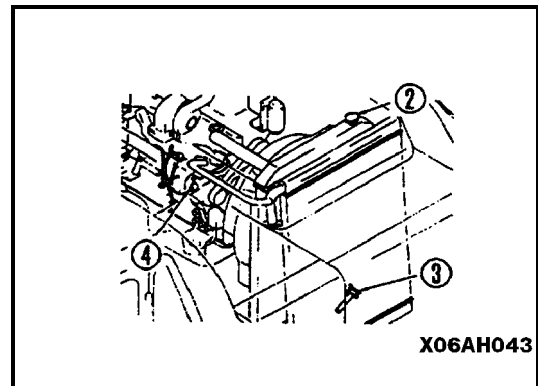
### Draining System

1. Turn radiator cap (2) slowly to remove it.

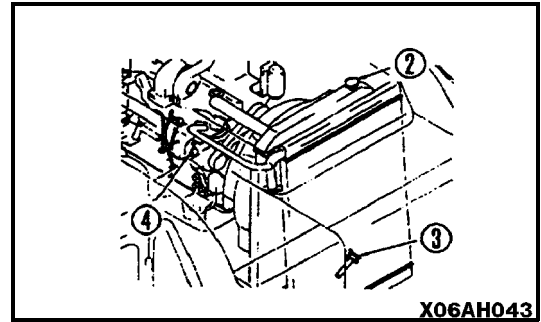
### REMARK

Open the cab heater valves at the engine.

2. Remove the undercover, then set a container to catch the coolant from drain valve (3) and drain plug (4). Open drain valve (3) at the bottom of the radiator to drain the coolant. Remove drain plug (4) in the cylinder block to drain the coolant.
3. After draining the coolant, close drain valve (3) and drain plug (4) and fill with water.



4. Open drain valve (3) and drain plug (4), run the engine at low idle, and flush water through the system for 10 minutes.  
When doing this, adjust the speed of filling and draining the water so that the radiator is always full. While flushing water through the system, watch carefully that the filler hose does not come out of the radiator filler.
5. After flushing, stop the engine, close drain valves after all the water has drained out.

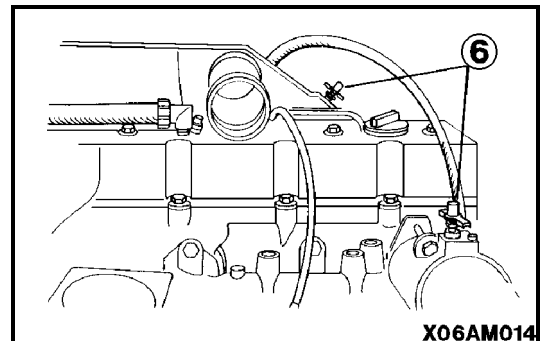


6. After draining the water, clean with a flushing agent.  
We recommend use of a genuine Komatsu cleaning agent. For details of the cleaning method, see the instructions given with the cleaning agent.

### REMARK

Close the cab heater valves before any flushing compounds are circulated through the cooling system.

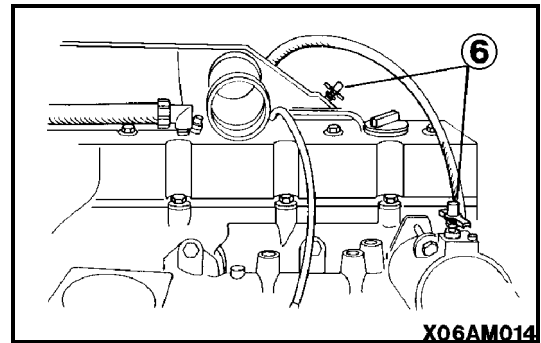
7. After cleaning, open drain valve (3) and drain plug (4) to drain all the cooling water, then close them and fill slowly with clean water.
8. When the water comes up to near the water filler port, open drain valve (3) and drain plug (4), run the engine at low idle, and continue to run water through the system until clean colorless water comes out.  
When doing this, adjust the speed of filling and draining the water so that the radiator is always full. While flushing water through the system, watch carefully that the filler hose does not come out of the radiator filler.
9. When the water is completely clean, stop the engine, close drain valve (3), then wrap with sealing tape and close drain valve (4).
10. Open the after-cooler air drain valves (6).
11. Install the undercover.



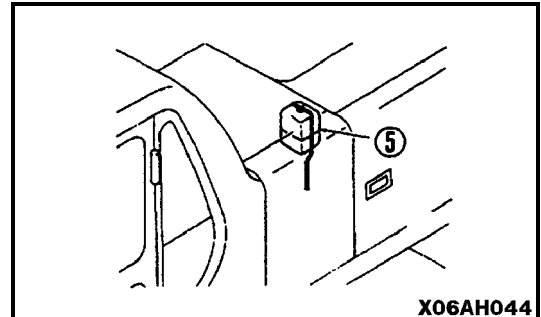
## MAINTENANCE

### Filling System

12. Add coolant (antifreeze mixture) until it overflows from the coolant filler. When the coolant comes up to near the water filler port, close the after-cooler air drain valves (6).



13. To remove the air in the coolant, run for five minutes at low idle, then for another five minutes at high idle. When doing this, leave radiator cap off.
14. After draining the coolant from the reserve tank (5), clean the inside of the reserve tank and refill between FULL and LOW level.



15. Stop the engine, wait for about three minutes, add coolant up to near the radiator filler port, then tighten cap.

### Cleaning Radiator

Minor internal sludge accumulations will be removed when flushing the cooling system.

When internal accumulations are found that cannot be removed by normal flushing methods, consult your distributor.

Remove all bugs and dirt from the radiator core, using air or water under pressure. Direct the flow through the core, opposite to the normal direction of air flow.

**24.2.3 CHECK AND TIGHTEN TRACK SHOE BOLTS**

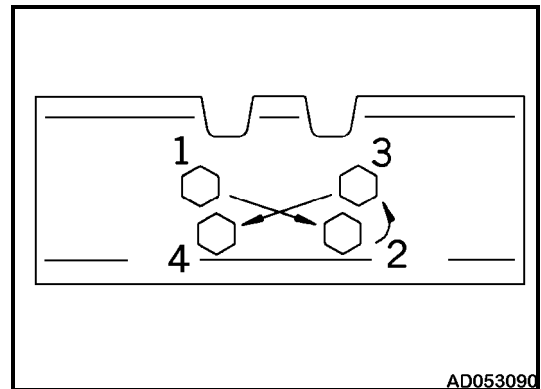
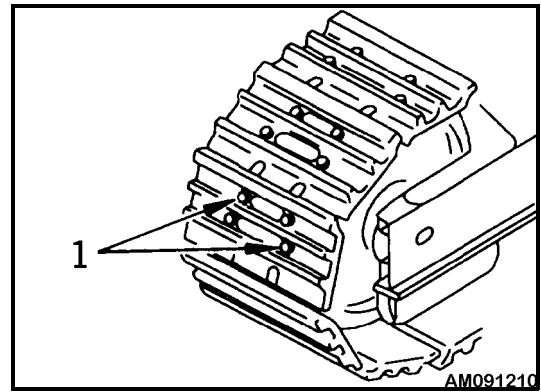
If the machine is used with track shoe bolts (1) loose, they will break, so tighten any loose bolts immediately.

**Method for Tightening**

1. First tighten to  $200 \pm 20 \text{ N}\cdot\text{m}$  ( $147.5 \pm 15 \text{ lbf ft}$ ) then check that the nut and shoe are in close contact with the link contact surface.
  
2. After checking, tighten a further  $120^\circ \pm 10^\circ$  (two flats).

**Order for Tightening**

Tighten the bolts in the order shown in the diagram on the right. After tightening, check that the nut and shoe are in close contact with the link mating surface.



# MAINTENANCE

## 24.2.4 CHECK AND ADJUST TRACK TENSION

### WARNING

Carry out this operation with two workers. The operator must move the machine in accordance with the signals from the other worker. The track tension is checked with the chassis raised, so it is extremely dangerous if the machine is lowered by mistake during the inspection. Never move the machine while anyone is carrying out measurements.

The wear of pins and bushings on the undercarriage will vary with the working conditions and soil properties. It is thus necessary to continually inspect the track tension so as to maintain the standard tension.

Carry out the check and adjustment under the same conditions as when operating (on job sites where the track becomes clogged with mud, measure with the track clogged with mud).

### Inspection

1. Raise the chassis with the boom and arm. When doing this, operate the levers slowly.
2. Measure the clearance between the bottom of the track frame and the top of the track shoe at a position that is safe even if the chassis should come down.

Standard clearance: . . . . . 331 ± 20 mm (13.4 ± 0.8 in)

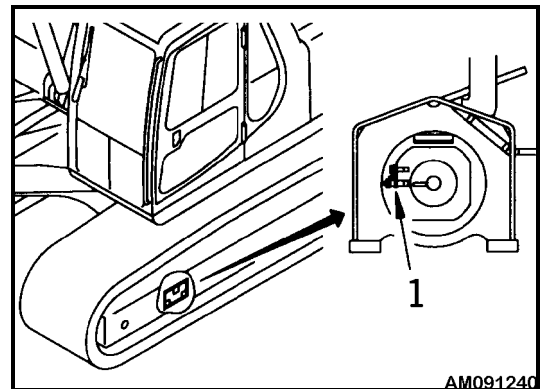
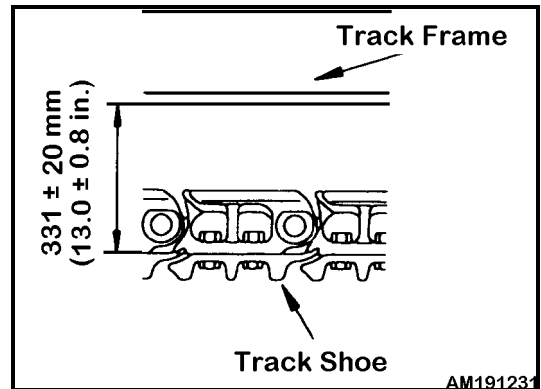
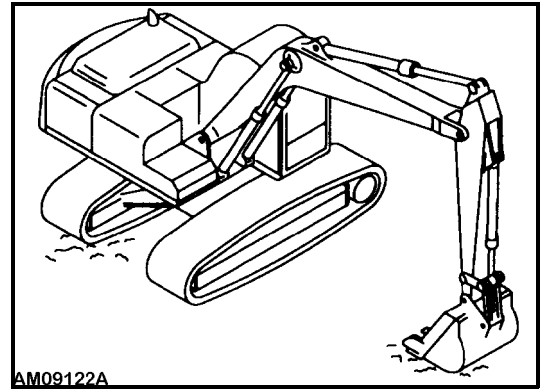
Measurement position; Midway between the 4th and 5th track roller from sprocket

If the track tension is not at the standard value, adjust it in the following manner.

### Adjustment

### WARNING

Grease inside the adjusting mechanism is under high pressure. Grease coming from plug (1) under pressure can penetrate the body causing injury or death. For this reason, do not loosen plug (1) more than one turn. Do not loosen any part other than plug (1). Furthermore, do not bring your face in front of the plug. If the track tension is not relieved by this procedure, please contact your distributor.

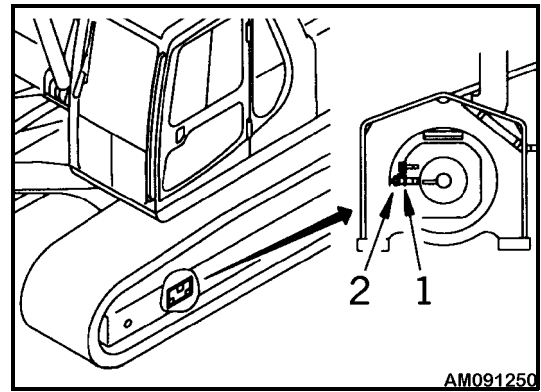




**When Increasing Tension**

Prepare a grease gun.

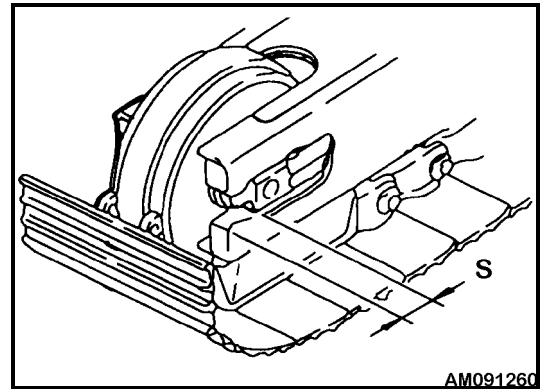
1. Pump in grease through grease fitting (2) with a grease gun.
2. To check that the tension is correct, move the machine slowly forward and backward.



3. Check the track tension again, and if the tension is not correct, adjust it again.

**NOTE**

If the track adjustment cannot be attained, it is permissible to pump in grease until S becomes 0 mm. If the tension is still loose, the pin and bushing are excessively worn, so they must be either turned or replaced. Please contact your distributor.

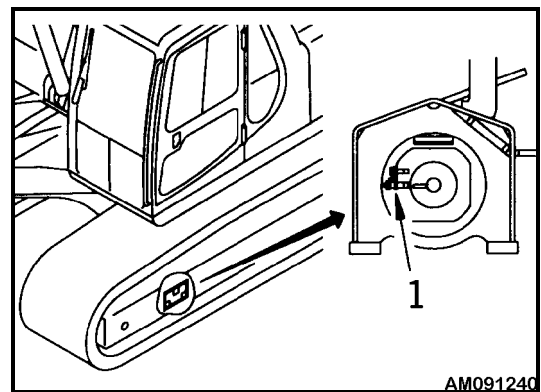


**When Loosening Tension**

**WARNING**

It is extremely dangerous to release the grease by any method except the procedure given below. If the track tension is not relieved by this procedure, please contact your distributor.

1. Loosen plug (1) gradually to release the grease.
2. Turn plug (1) a maximum of one turn.
3. If the grease does not come out smoothly, move the machine backwards and forwards a short distance.
4. Tighten plug (1).
5. To check that the correct tension has been achieved, move the machine backwards and forwards.
6. Check the track tension again, and if the tension is not correct, adjust it again.



**24.2.5 CHECK ELECTRICAL INTAKE AIR HEATER**

Before the start of the cold season (once a year), contact your distributor to have the electrical intake air heater repaired or checked for dirt or disconnections.

## MAINTENANCE

### 24.2.6 INSTALLATION OF BUCKET TEETH

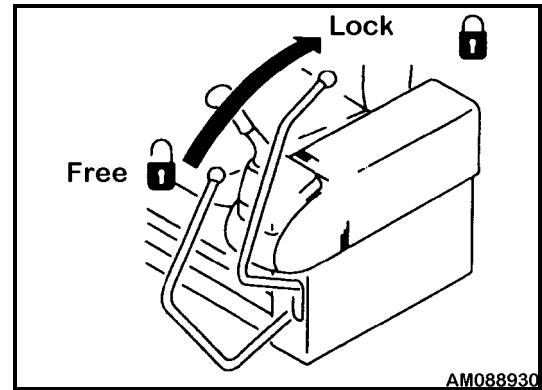
#### Installation

Replace the point before the adapter starts to wear.

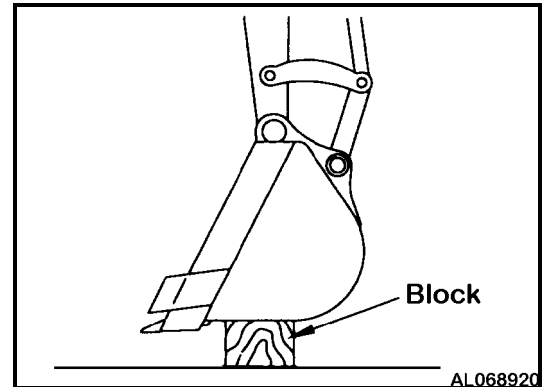


#### WARNING

It is dangerous if the work equipment moves by mistake when the teeth are being replaced. Set the work equipment in a stable condition, then stop the engine and apply the locks securely to Free the levers.



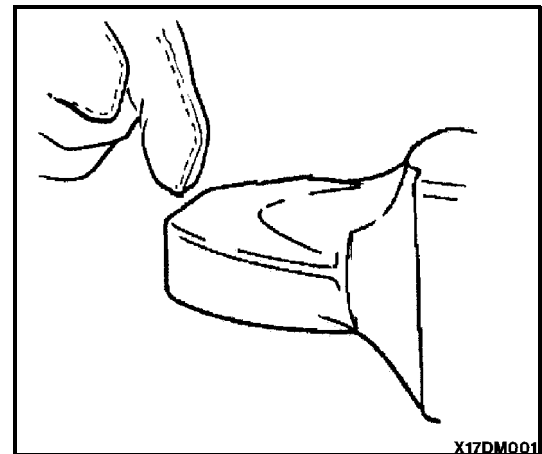
1. Place a block under the bucket bottom to allow the pin of tooth (1) to be knocked out with a hammer. Carry out full stroke operation of the control levers within 15 seconds after stopping the engine. After confirming that the work equipment is in a stable condition, lock the safety lock lever. Set so that the bottom face of the bucket is horizontal.



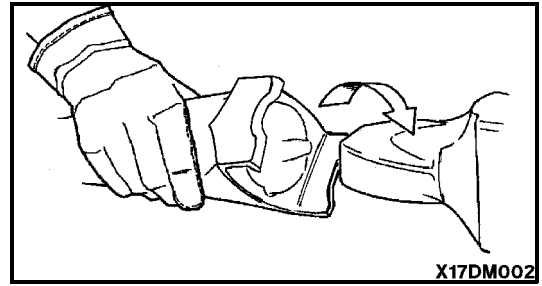
#### WARNING

- When installing SuperV® teeth, always work safely and use proper equipment to avoid injury. Wear OSHA approved hard hat, safety glasses, gloves, and steel toed shoes. Be sure other people are out of the way; only one person is needed to install SuperV® points.
- All struck tools or punches should have a bevel or radius around the striking face that is equal to 1/10th the width of the striking face.

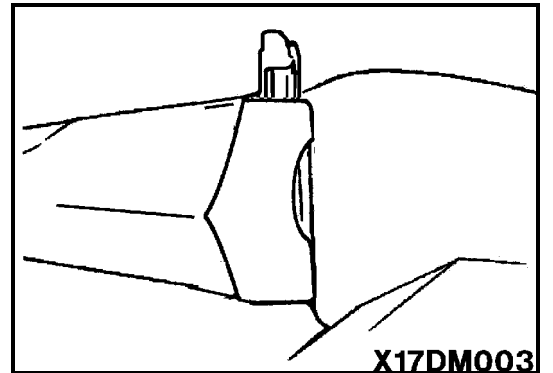
2. Prepare a Removal Tool or a heavy duty punch and a 1 kg hammer. Clean the adapter nose of any dirt or debris to insure the point will seat fully. Inspect the pin's rubber components for damage. If the rubber is cracked or deformed, replace the pins with new pins.



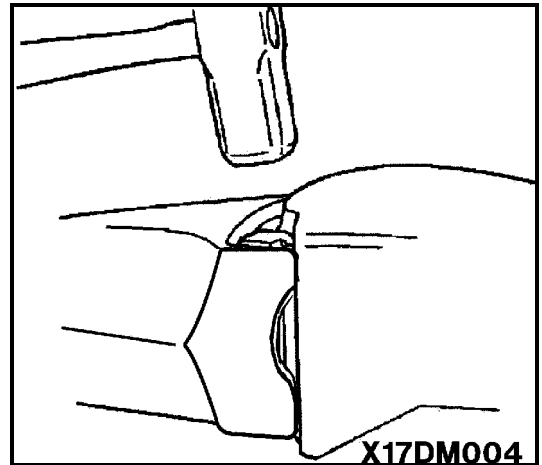
3. Twist the point on with a quarter turn to contact the rectangular end of the adapter nose.



4. Insert the pin with the guide rail facing the back of the adapter. Drive the pin in to seat it fully. The pin should click as the locking mechanism seats on the point ear when fully installed.



5. Check that the top and the bottom of the pin is flush with the top and bottom of the point ear.



## MAINTENANCE

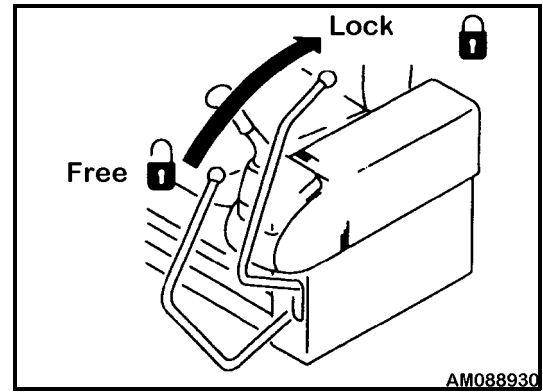
### 24.2.7 REMOVAL OF BUCKET TEETH

Replace the point before the adapter starts to wear.



#### WARNING

It is dangerous if the work equipment moves by mistake when the teeth are being replaced. Set the work equipment in a stable condition, then stop the engine and apply the safety lock lever securely.

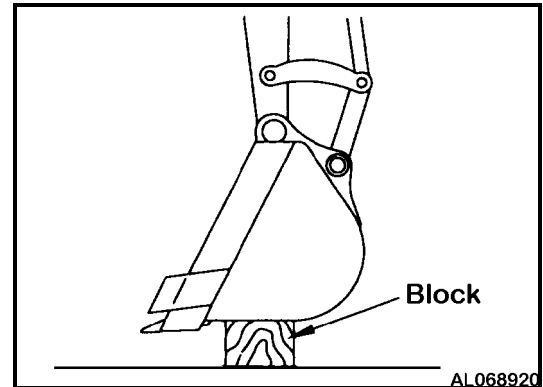


1. Place a block under the bottom of the bucket to allow the pin to be knocked out with a hammer. Carry out full stroke operation of the control levers within 15 seconds after stopping the engine. After confirming that the work equipment is in a stable condition, lock the safety lock lever. Set so that the bottom face of the bucket is horizontal.



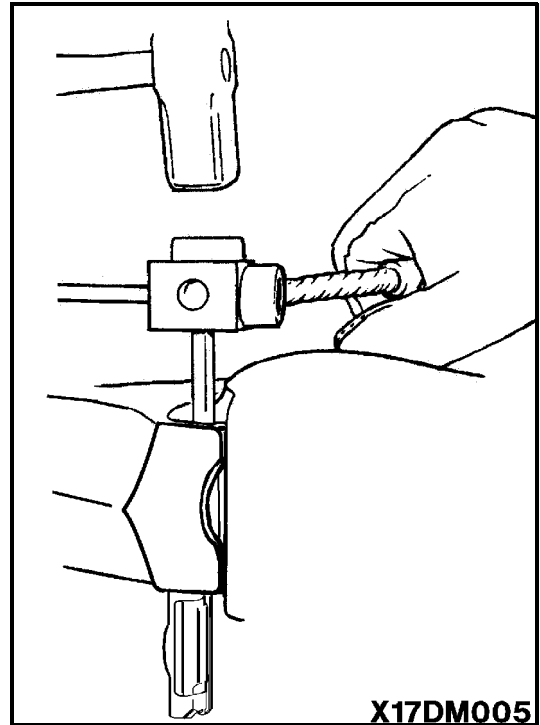
#### WARNING

When installing SuperV® teeth, always work safely and use proper equipment to avoid injury. Wear OSHA approved hard hat, safety glasses, gloves, and steel toed shoes. Be sure other people are out of the way; only one person is needed to install SuperV® points. All struck tools or punches should have a bevel or radius around the striking face that is equal to 1/10th the width of the striking face.

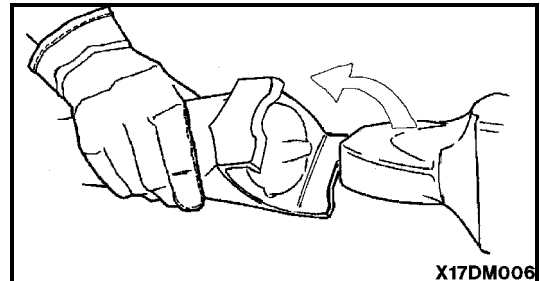


2. Prepare a Removal Tool or a heavy duty punch and a 1 kg hammer. Hammer the sides of both point ears to loosen fine material which may have been packed around the pin.

3. Place the small end of the Removal Tool on top of the pin and start the removal tool with the hammer to initiate removal.
4. Once the pin has begun to disengage, place the long end of the removal tool against the top of the pin and complete the removal by driving the pin out the bottom of the point ear completely clear of the point and adapter.



4. Pull the point off the adapter with a quarter twist.



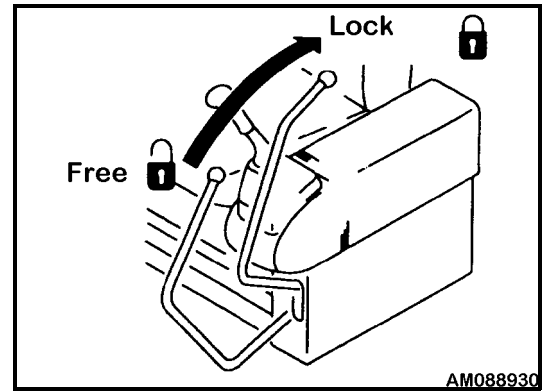
## MAINTENANCE

### 24.2.8 ADJUST BUCKET CLEARANCE

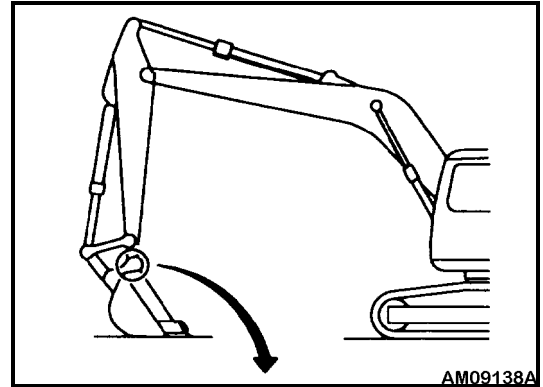


#### WARNING

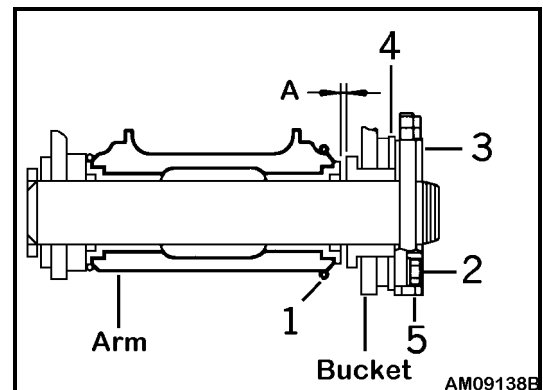
It is dangerous if the work equipment moves by mistake when the clearance is being adjusted. Set the work equipment in a stable condition, then stop the engine and lock the lever securely.



1. Set the work equipment to the position shown in the diagram at right, stop the engine and set the lock lever to the locked position.



2. Measure the amount of play A. Measurement is easier if you move the bucket to one side or the other so all the play can be measured in one place. Use a gap (clearance) gauge for easy and accurate measurement.
3. Loosen plate mounting bolts (2), and plate (3). The shim is a split type, so the operation can be carried out without removing the bolts.
4. Remove shim (4) corresponding to the amount of play A measured above.



#### [Example]

In the case of play of 3 mm, remove two 1 mm shims and one 0.5 mm shim. Play becomes 0.5 mm. For shim (4), two types of 1 mm and 0.5 mm are used. When play a is smaller than one shim, do not carry out any maintenance.

5. Tighten the four bolts (2). If the bolts are too stiff to tighten, pull out pin stopper bolt (5) for easier tightening.

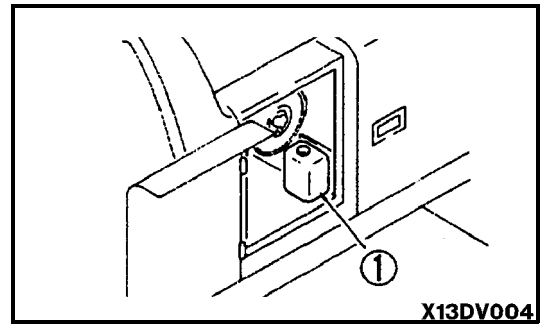
**24.2.9 CHECK WINDOW WASHER FLUID**

If there is air in the window washer fluid, check the level of the fluid in window washer tank (1). Add automobile window washer fluid if necessary.

When adding fluid, be careful not to let any dust get in.

- Proportion for mixing washer fluid with water

The proportion differs according to the ambient temperature, so dilute the washer fluid with water to the following proportions before adding.



Area, season	Proportions	Freezing temperature
Normal	Washer fluid : water	-10°C (14°F)
Winter in cold area	Washer fluid ½: water ½	-20°C (-4°F)
Winter in extremely cold area	Pure washer fluid	-30°C (-22°F)

There are two types depending on the freezing temperature:

- 10°C (14°F) (general use)
- 30°C (-22°F) (cold area use)

Select according to the area and season.

# MAINTENANCE

## 24.2.10 CHECK, MAINTAIN AIR CONDITIONER

### Check Level of Refrigerant (Gas)

**⚠ WARNING**

If the refrigerant used in the cooler gets into your eyes or on your hands, it may cause loss of sight or frostbite, so never loosen any part of the refrigerant circuit.

If the level of the refrigerant (gas) is low, the cooling effect will be reduced. Run the engine at high idle, and check the flow of the refrigerant gas R134a in the refrigerant circuit through the sight glass of the receiver when the cooler is running at high speed.

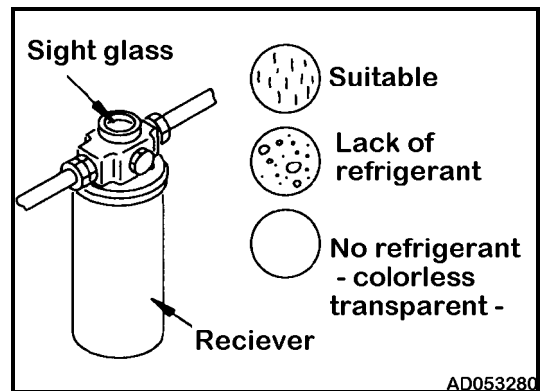
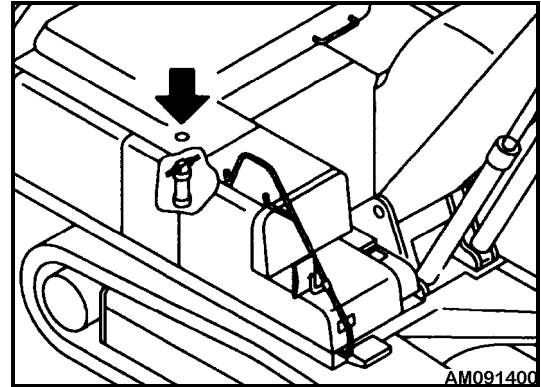
- No bubbles in refrigerant flow: Suitable
- Some bubbles in flow (bubbles pass continuously): Lack of refrigerant
- Colorless, transparent: No refrigerant

**REMARK**

When there are bubbles, the refrigerant gas level is low, so contact your distributor to have refrigerant added. If the air conditioner is run with the gas level low, it will cause damage to the compressor.

### Inspection During Off-season

Even during the off-season, run the compressor at low speed for 3 to 5 minutes once a month to prevent the loss of the oil film at the lubricated parts of the compressor.



### Cooler Check and Maintenance Items

Check, maintenance items	Content of check, maintenance	Guideline for maintenance interval
Refrigerant (gas)	Charge amount	Twice a year (spring, autumn)
Condenser	Clogged fins	Every 500 hours
Compressor	Operating condition	Every 4000 hours
V-belt	Damage, tension	Every 250 hours
Blower motor, fan	Operating condition (abnormal noise?)	When required
Control mechanism	Operating condition (functioning normally?)	When required
Piping mounts	Mounting condition, looseness at tightening or connecting points, gas leakage, damage,	When required

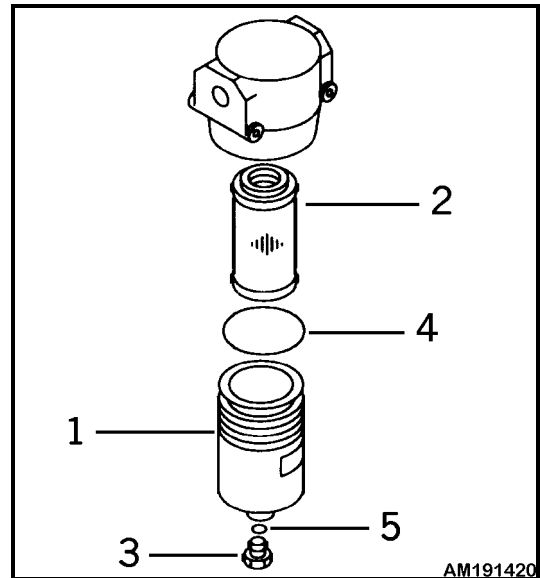
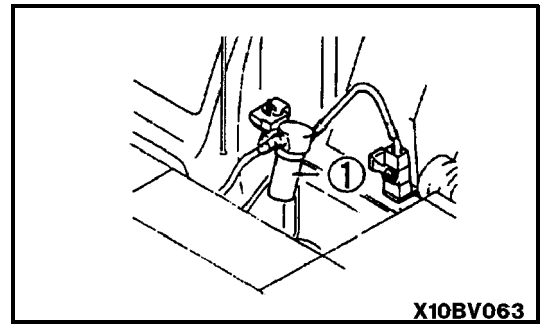


24.2.11 REPLACE ADD ON BREAKER FILTER ELEMENT

**WARNING**

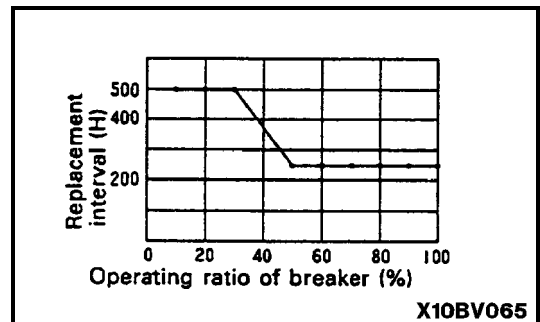
The oil is at high temperature after the engine has been operated, so never replace the filter immediately after finishing operations. Wait for the parts to cool down before changing the filter.

- Prepare a container to catch the oil.
1. Place a container under the filter element to catch the oil.
  2. Turn filter case (1) to the left to remove, then take out element (2) and discard. Remove o-ring (4) from case and replace both with new.
  3. Remove plug (3) from filter case (1). Discard o-ring (5) and replace with new.
  4. Clean the removed parts. Replace plug (3) with new o-ring (5) to filter case. Install new element (2) and o-ring (4) to case.
  5. When installing, bring the case into contact with the filter holder, then tighten an additional ½ turn.



**NOTICE**

When the breaker is used, replace the element every 250 hours (when the breaker operating ratio is more than 50%) as shown in the table on the right.



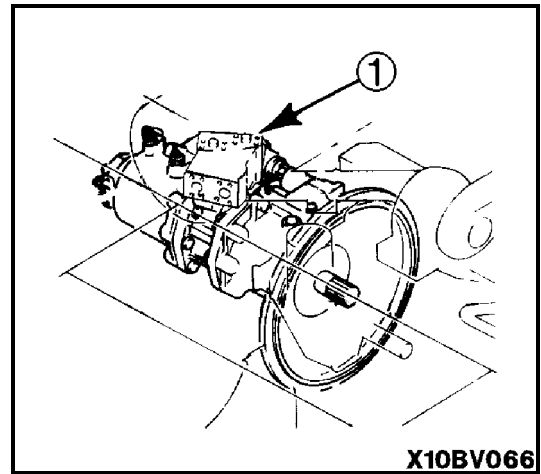
## MAINTENANCE

### 24.2.12 CLEAN IN LINE FILTER

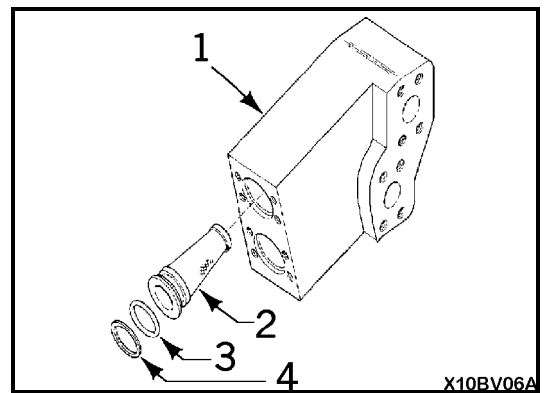
#### REMARK

If the hydraulic system between the pump and in line filter (1) has been opened, or if there is any abnormality in the hydraulic equipment, remove the dirt inside the circuit as follows:

1. With a suitable container to catch oil, remove [one at a time] hose from filter to valve.
2. Remove filter (2) and discard o-ring (3) and back up ring (4). Clean filter as follows;
  - a) When cleaning the filter, remove all dirt stuck to the side of the filter.
  - b) When reassembling the filter replace o-ring (3) and back up ring (4) at the same time.
  - c) Install filter and secure hoses.
  - d) Start the engine and run at low idle for 5 minutes to bleed the air. It is not necessary to operate the control levers to bleed the air.



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## 24.3 CHECK BEFORE STARTING

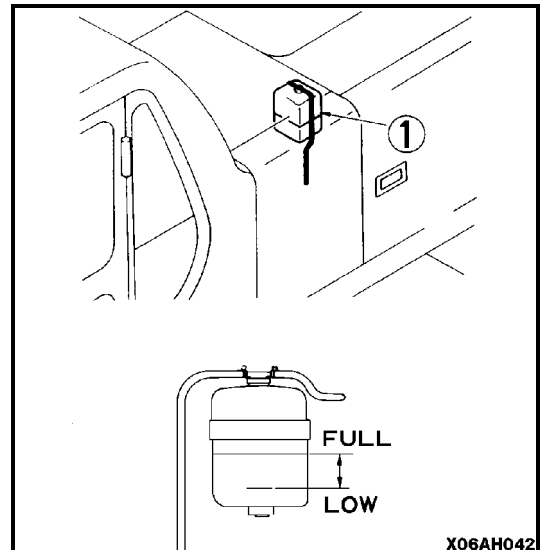
### 24.3.1 CHECK COOLANT LEVEL, ADD COOLANT

**⚠ WARNING**

Do not open the radiator cap unless necessary. When checking the coolant, always check the radiator reserve tank when the engine is cold.

1. Open the rear cover on the left side of the machine and check that the coolant level is between the FULL and LOW marks on radiator reserve tank (1) (shown in the diagram on the right). If the coolant level is low, add through the filler of reserve tank (1) to the FULL level.
2. After adding coolant, tighten the caps securely.
3. If the reserve tank becomes empty, first inspect for coolant leaks and then fill the radiator and the reserve tank.

For details of coolant; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.



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### 24.3.2 CHECK OIL LEVEL IN ENGINE OIL PAN

**⚠ WARNING**

The turbocharger (with safety cover) exhaust manifold is near dipstick (1), so be careful not to touch it.

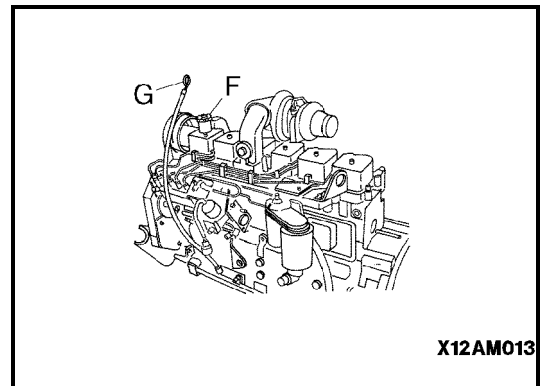
1. Open the engine hood on the machine.
2. Remove dipstick and wipe the oil off with a cloth.
3. Insert dipstick fully in the oil filler pipe, then take it out again.
4. The oil level should be between the H and L marks on dipstick. If the oil level is below the L mark, add engine oil through oil filler.

For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

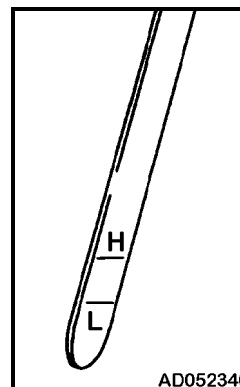
5. If the oil is above the H mark, drain the excess engine oil from drain valve, and check the oil level again.
6. If the oil level is correct, tighten the oil filler cap securely and close the engine hood.

**REMARK**

When checking the oil level after engine has been operated, wait for at least 15 minutes after stopping the engine before checking. If the machine is at an angle, make it horizontal before checking.



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## MAINTENANCE

### 24.3.3 CHECK FUEL LEVEL

#### WARNING

When adding fuel, never let the fuel overflow. This may cause a fire. If you spill fuel, thoroughly clean up spillage.

1. Use sight gauge (G) on the front face of the fuel tank to check that the tank is full.
2. If the fuel level is not within the sight gauge, add fuel through filler port (F), while watching sight gauge (G).

Fuel capacity: ..... 340 l (89.8 gal)

For details of the fuel to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

3. After adding fuel, tighten the cap securely.

#### REMARK

If the breather holes (3) on the cap are clogged, the pressure in the tank will drop and the fuel will not flow. Clean the holes from time to time.

### 24.3.4 CHECK OIL LEVEL IN HYDRAULIC TANK

#### WARNING

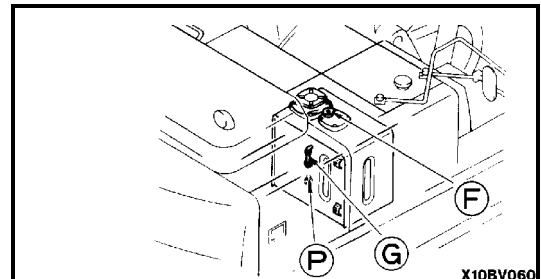
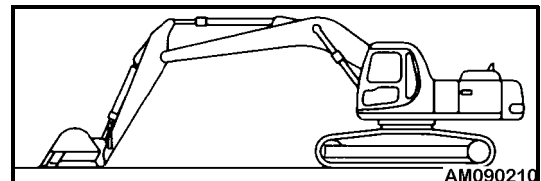
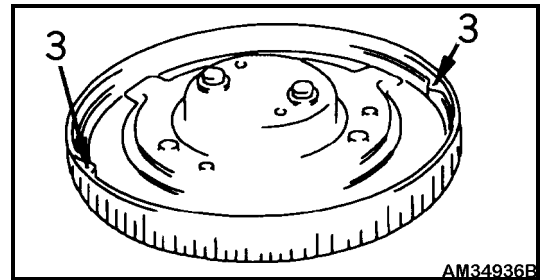
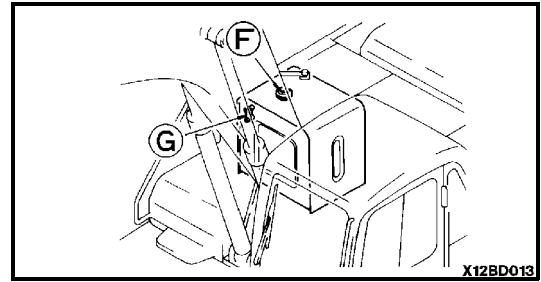
- When removing the oil filler cap, oil may spurt out, so turn the cap slowly to release the internal pressure before removing the cap.
- If oil has been added to above the H mark, stop the engine and wait for the hydraulic oil to cool down, then drain the excess oil from the drain plug.

1. If the work equipment is not in the condition shown in the diagram on the right, start the engine, run the engine at low speed, retract the arm and bucket cylinders, then lower the boom, set the bucket teeth in contact with the ground, and stop the engine.
2. Within 15 seconds after stopping the engine, move each control lever (for work equipment and travel) to the full stroke in all directions to release the internal pressure.
3. Open the door on the right side of the machine. Check sight gauge (G). The oil level is normal if between H and L marks.

#### NOTICE

Do not add oil if the level is above the H line. This will damage the hydraulic equipment and cause the oil to spurt out.

4. If the level is below the L mark, remove the upper cover of the hydraulic tank and add oil through oil filler (F).

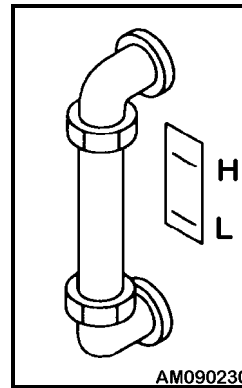


For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

**REMARK**

The oil level will vary depending upon the oil temperature. Accordingly, use the following as a guide:

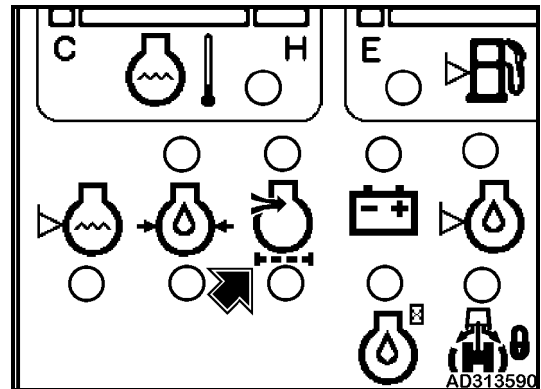
- Before operation: around L level (Oil temperature 10 to 30°C (50 to 86°F))
- Normal operation: around H level (Oil temperature 50 to 80°C (122 to 176°F))



**24.3.5 CHECK AIR CLEANER FOR CLOGGING**

1. Confirm that the air cleaner clogging monitor does not flash.
2. If it flashes, immediately clean or replace the element.

For details of method of cleaning the element; See 24.2.1 CHECK, CLEAN AND REPLACE AIR CLEANER ELEMENT on page 3-24



**24.3.6 CHECK ELECTRICAL WIRING**

**⚠ WARNING**

- If fuses are frequently blown or if there are traces of short circuit on the electrical wiring, locate the cause and carry out repair.
- Accumulation of flammable material (dead leaves, twigs, grass, etc.) around the battery may cause fire, so always check and remove such material.
- Keep the top surface of the battery clean and check the breather hole in the battery cap. If it is clogged with dirt or dust, wash the battery cap to clean the breather hole.

Check for damage and wrong capacity of the fuse and any sign of disconnection or short circuit in the electrical wiring. Check also for loose terminals and tighten any loose parts. Check the wiring of the battery, starting motor and alternator carefully in particular.

When carrying out walk-around checks or checks before starting, always check if there is any accumulation of flammable material around the battery, and remove such flammable material. Please contact your distributor for investigation and correction of the cause.

**24.3.7 CHECK FUNCTION OF HORN**

Turn the starting switch to the ON position. Confirm that the horn sounds without delay when the horn button is pressed. If the horn does not sound, ask your distributor for repair.

## MAINTENANCE

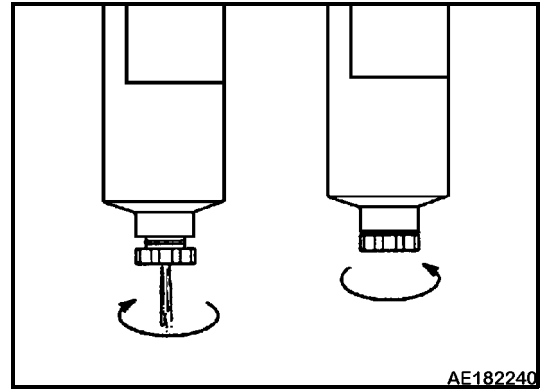
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### 24.3.8 DRAIN WATER FROM FUEL WATER SEPARATOR

1. With the engine off open the engine cover and locate the water drain at the bottom of the primary fuel filter.
2. To open drain valve, turn the valve approx. 1½ to 2 turns until draining occurs. Drain the filter sump of water until clear fuel is visible.
3. Turn the valve clockwise to close.

#### NOTICE

Do not over tighten the valve. Over tightening can damage the threads.

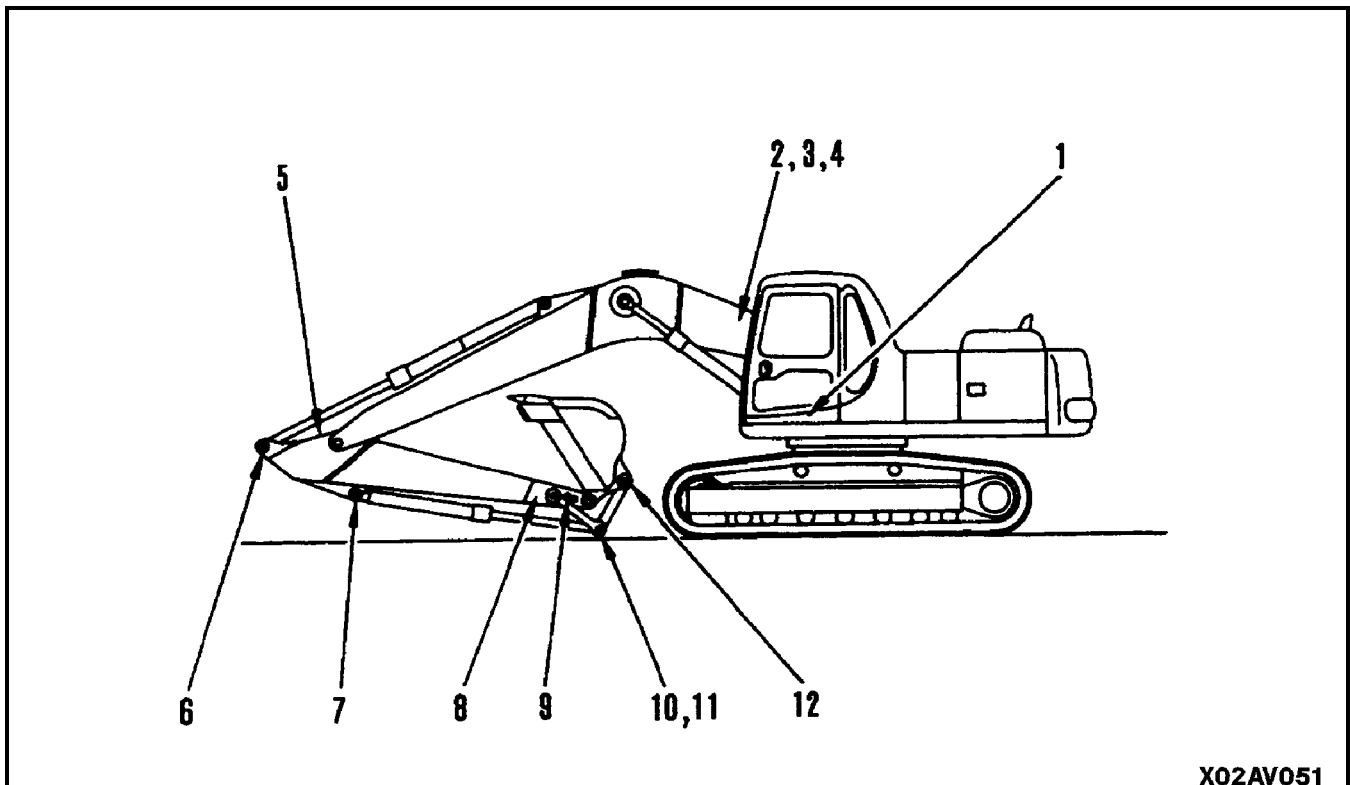


**24.4 EVERY 100 HOURS SERVICE**

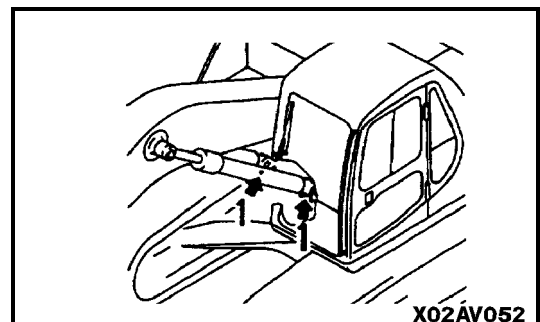
**24.4.1 LUBRICATION**

**NOTICE**

- For the first 100 hours on new machines where the parts are setting in, carry out greasing every 10 hours.
  - After digging under water, be sure to supply grease to the pins which were submerged.
1. Set the work equipment in the greasing posture below, then lower the work equipment to the ground and stop the engine.
  2. Using a grease pump, pump in grease through the grease fittings shown by arrows.
  3. After greasing, wipe off any old grease that was pushed out.

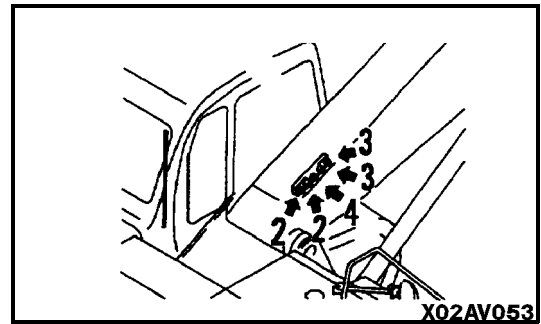


1. Boom cylinder foot pin (2 points)

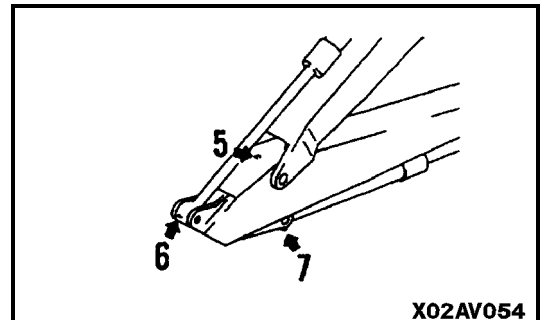


## MAINTENANCE

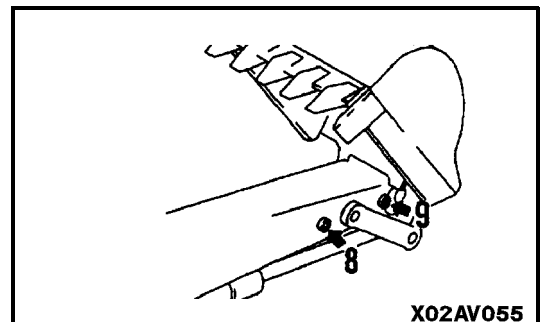
2. Boom foot pin (2 points)
3. Boom cylinder rod end (2 points)
4. Arm cylinder foot pin (1 point)



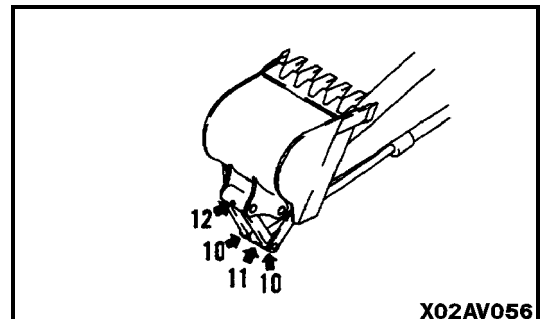
5. Boom-Arm coupling pin (1 point)
6. Arm cylinder rod end (1 point)
7. Bucket cylinder foot pin (1 point)



8. Arm-Link coupling pin (1 point)
9. Arm-Bucket coupling pin (1 point)



10. Link coupling pin (2 points)
11. Bucket cylinder rod end (1 point)
12. Bucket-Link coupling pin (1 point)





24.4.2 CHECK OIL LEVEL IN SWING MACHINERY CASE



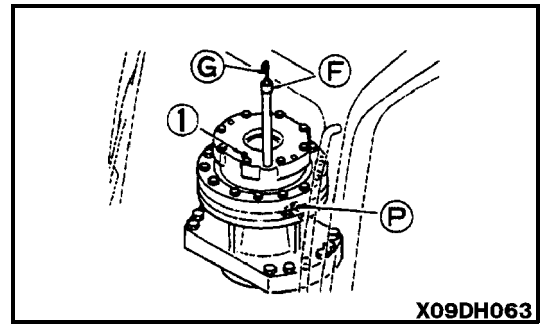
**WARNING**

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before carrying out this check.

1. Remove dipstick (G) and wipe the oil from the dipstick with a cloth.
2. Insert dipstick (G) fully in the guide.
3. When dipstick (G) is pulled out, if the oil level is between the H and L marks of the gauge, oil level is proper.
4. If the oil does not reach the L mark on the dipstick (G), add oil through the dipstick tube (F). When refilling, remove the bleeder plug (1).

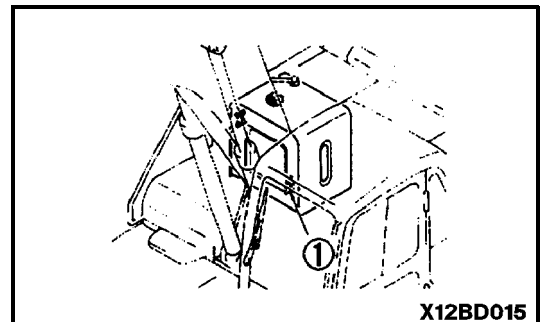
For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

5. If the oil level exceeds the H mark on the dipstick, loosen drain valve (P) to drain the excess oil.
6. After checking oil level or adding oil, insert the dipstick into the hole and install air bleeder plug (1).



24.4.3 DRAIN WATER AND SEDIMENT FROM FUEL TANK

1. Carry out this procedure before operating the machine.
2. Prepare a container to catch the fuel that is drained.
3. Open valve (1) at the bottom of the tank and drain the sediment and water that has accumulated at the bottom together with fuel. When doing this, be careful not to get fuel on yourself.
4. When only clean fuel comes out, close drain valve



**NOTICE**

Never use trichlene for washing the inside of the tank.

## MAINTENANCE

### 24.5 EVERY 250 HOURS SERVICE

#### 24.5.1 CHECK OIL LEVEL IN FINAL DRIVE CASE, ADD OIL

##### WARNING

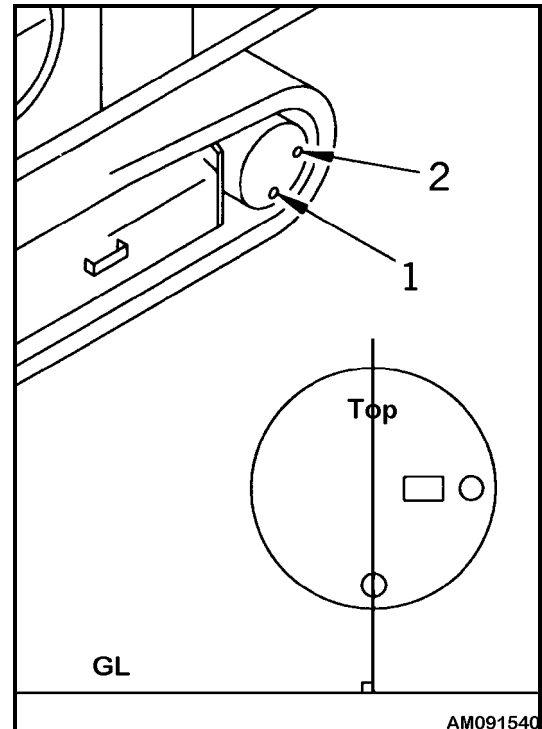
- The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before starting the operation.
- If there is still pressure remaining inside the case, the oil or plug may fly out. Loosen the plug slowly to release the pressure.

Prepare a handle.

1. Set the TOP mark at the top, with the UP mark and plug (1) perpendicular to the ground surface.
2. Remove plug (2) using the handle. When the oil level reaches a point 10 mm below the bottom of the plug hole, the correct amount of oil has been added.
3. If the oil level is too low, install plug (2), operate the travel levers, and drive forward or in reverse to rotate the sprocket one turn. Then repeat Step 2 to check again.
4. If the oil level is still too low, add oil through the hole in plug (2) until the oil overflows.

For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

5. After checking, install plug (1).



#### 24.5.2 CHECK LEVEL OF BATTERY ELECTROLYTE

##### WARNING

- To avoid gas explosions, do not bring fire or sparks near the battery.
- Battery electrolyte is dangerous. If it gets in your eyes or on your skin, wash it off with large amounts of water, and consult a doctor.

Carry out this check before operating the machine.

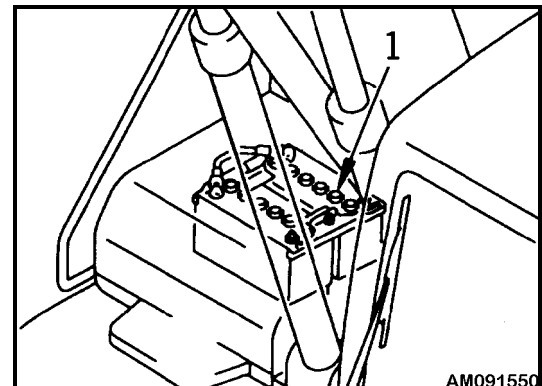
1. Open the battery box cover on the right side of the machine.
2. Remove cap (1), and check that the electrolyte is at the specified level (10 to 12 mm (0.40 to 0.47 in) above the plate). If the level is low, add distilled water to the specified level.

If the battery electrolyte is spilled, have dilute sulphuric acid added.

3. Clean the air hole in the battery cap, then tighten the cap securely.

##### REMARK

When adding distilled water in cold weather, add it before starting operations in the morning to prevent the electrolyte from freezing.



24.5.3 REPLACE HYDRAULIC FILTER ELEMENT

**WARNING**

When removing the oil filler cap, turn it slowly to release the internal pressure before removing it.

1. Remove the cover over the hydraulic tank.
2. Remove the oil filler cap (A), to release the internal pressure.
3. Loosen (4) bolts, then remove cover (1). When doing this, the cover may fly out under the force of spring (2), so hold the cover down when removing the bolts.
4. After removing spring (2) and valve (3), take out element (4).
5. Clean all the removed parts in diesel oil.
6. Install a new element in the place where old element (4) was installed.
7. Set valve (3) and spring (2) on top of the element.
8. Set cover (1) in position, push it down by hand, and install the cover with the mounting bolts.
9. Mount the oil filler cap and install the cover.
10. To bleed the air, start the engine according to See 12.2 STARTING ENGINE on page 2-54.and run the engine at low idle for 10 minutes.
11. Stop the engine.

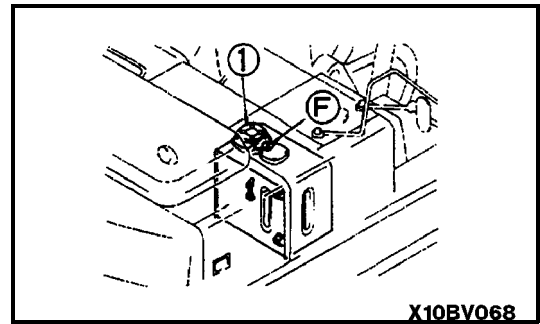
**REMARK**

After halting work, operate the machine for more than 5 minutes to eliminate air bubbles in the oil inside the tank.

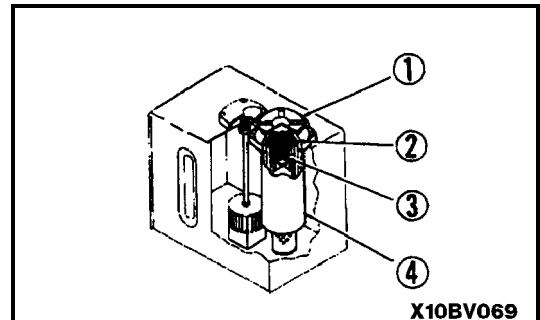
12. Check for oil leakage and wipe off any spilled oil.

When the hydraulic breaker is installed, the hydraulic oil deteriorates earlier than in normal bucket digging work. The first element replacement should be at 100 to 150 hours for new machines. Thereafter, replace the element according to the table on the right.

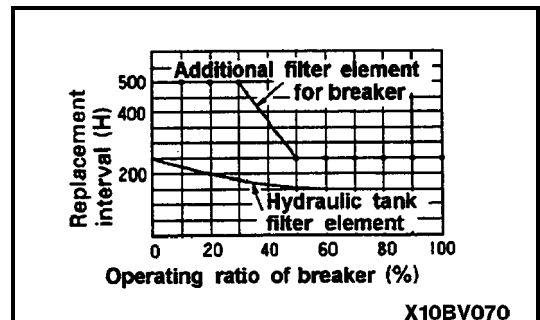
Replace the additional filter element for the breaker every approx. 250 hours (when breaker operating ratio is more than 50%) according to the table on the right.



X10BV068



X10BV069



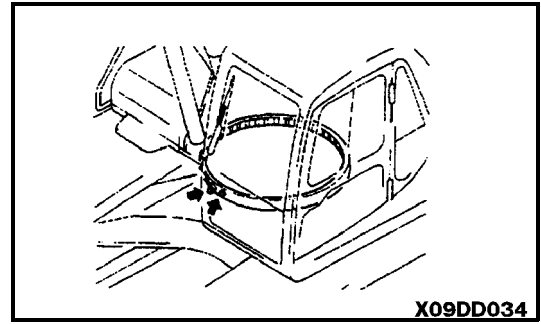
X10BV070

## MAINTENANCE

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### 24.5.4 LUBRICATE SWING CIRCLE (3 POINTS)

1. Lower the work equipment to the ground.
2. Using a grease gun, pump in grease through the grease fittings shown by arrows.
3. After greasing, wipe off all the old grease that was pushed out.



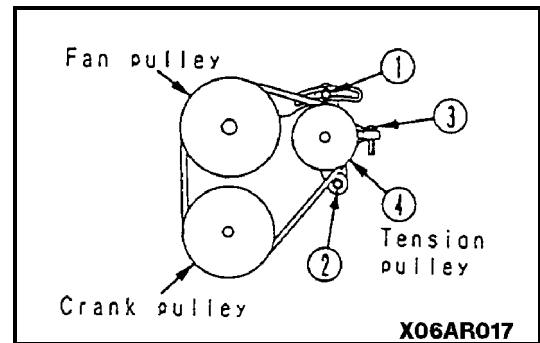
**24.5.5 CHECK FAN BELT TENSION, ADJUST**

**Checking**

The belt would normally deflect by about 5-6 mm (.20-.24 in) when pressed with the finger (with a force of approximately 6 kg. (13 lb.)) at a point midway between the fan pulley and tension pulley.

**Adjusting**

1. Loosen bolts and nuts (1) and (2).
2. Loosen the lock nut and move tension pulley (4) with adjustment bolt (3) so the belt deflects about 5-6 mm (.20-.24 in) (with a force of approximately 6 kg. (13 lb.)).
3. Tighten the bolts and nuts (1) and (2) to fix tension pulley (4) in position.
4. Check each pulley for damage, wear of the V-groove, and wear of the V-belt. In particular, be sure to check that the V-belt is not touching the bottom of the V-groove.
5. Replace the belt if it has stretched, leaving no allowance for adjustment, or if there is a cut or crack on the belt.
6. When the new belt is set, readjust it after operating for an hour.



## MAINTENANCE

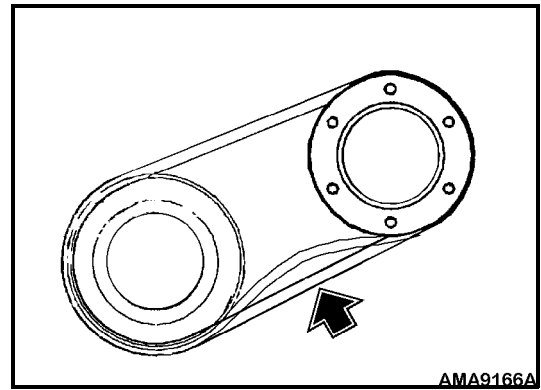
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### 24.5.6 AIR CONDITIONER COMPRESSOR BELT TENSION

#### Checking

If the belt is loose, it will slip and the air conditioner will not be able to cool properly.

Tension of the compressor drive belt should be  $637 \pm 108$  N (143.2  $\pm$  24.3 lbf)



## 24.6 EVERY 500 HOURS SERVICE

Maintenance for every 100 and 250 hours service should be carried out at the same time.

### 24.6.1 REPLACE FUEL FILTER CARTRIDGE AND FUEL-WATER SEPARATOR

**WARNING**

- Engine is at high temperature immediately after the machine has been operated. Wait for engine to cool down before replacing the filter.
- Do not bring fire or sparks near the fuel.

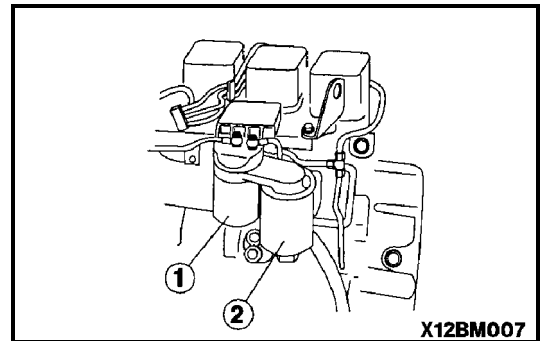
Prepare a filter wrench and a container to catch the fuel.



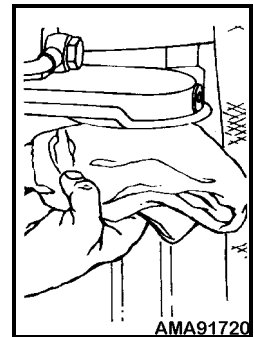
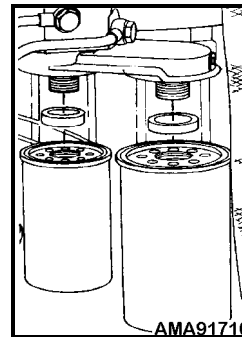
Fuel catch container . . . . . Min 3.8 ℓ (1 gal) capacity



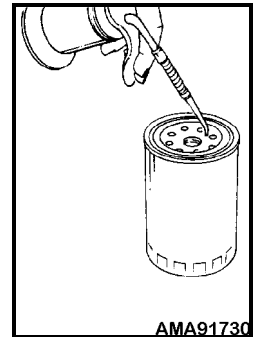
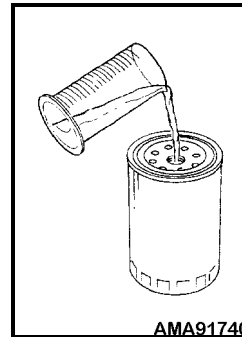
Filter wrench . . . . . 09019-08035



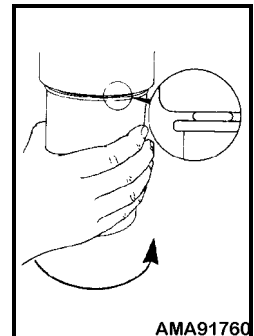
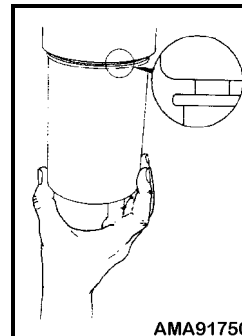
1. Set the container to catch the fuel under the cartridges.
2. Using a filter wrench, remove cartridges (1) and (2).
3. Clean the cartridge holder.



4. Fill a new cartridge with clean fuel, coat the packing surface with engine oil, then install it to the cartridge holder.



5. When installing, tighten until the packing surface contacts the seal surface of the cartridge holder, then tighten it up ½ to ¾ of a turn. If the cartridge is tightened too far, the packing will be damaged and this will lead to leakage of fuel. If the cartridge is too loose, fuel will also leak from the packing, so always tighten to the correct amount. After replacing the fuel cartridges, bleed the air from the system as follows:

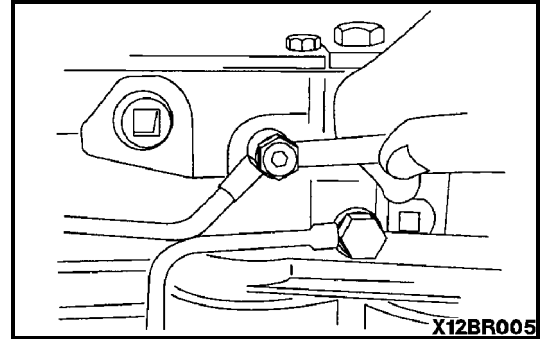


## MAINTENANCE

### BLEEDING THE FUEL SYSTEM

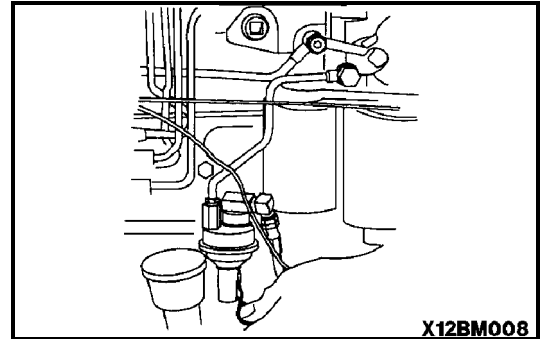
Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the filters or injection pump supply line will be vented automatically if the fuel filter is changed in accordance with the instructions. However, manual bleeding will be required if:

- The fuel filter is not filled prior to installation.
- The injection pump is replaced.
- The high pressure fuel lines are replaced.



### VENTING THE LOW PRESSURE LINES AND FUEL FILTER

1. Loosen the bleed screw. (wrench size: 10mm)
2. Operate the hand lever on the lift pump until the fuel flowing from the fitting is free of air.
3. Air/fuel can be pumped from this location with the hand lever on the lift pump if the fuel solenoid valve is energized.
4. Air can be vented from both pumps through the fuel drain manifold by operation the starting motor. When using the starting motor to vent the system, do not engage it for more than 30 seconds at a time; wait (2) minutes between engagements.



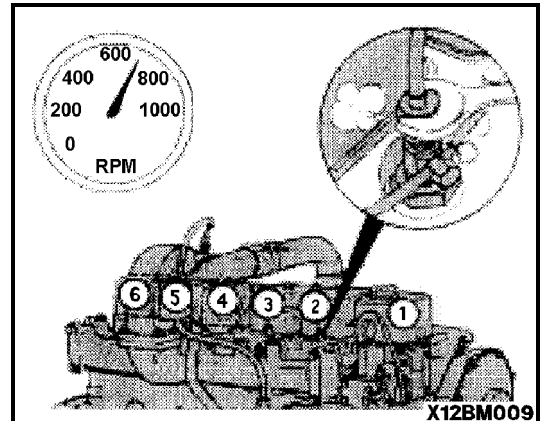
### WARNING

It is necessary to put the engine in the "RUN" position. Because the engine may start, be sure to follow all the safety precautions. Use the normal starting procedure.

### VENTING THE HIGH PRESSURE LINES

Loosen the fittings at the injectors and crank the engine to allow entrapped air to bleed from the lines. Tighten the fittings to 30 N•m (22 lbf ft)(wrench size: 17 mm).

**CAUTION:** High pressure can cause penetration of skin.




### WARNING


Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire. Start the engine and vent one line at a time until the engine runs smoothly.

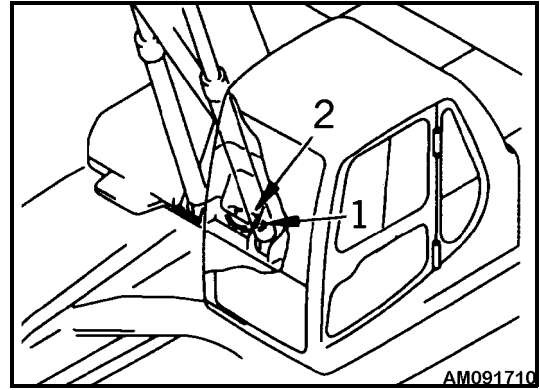


**24.6.2 CHECK SWING PINION GREASE LEVEL, ADD GREASE**

1. Remove bolts (1) on the top of the revolving frame and remove cover. Insert a scale into the grease and check that the height of the grease in the portion where the pinion passes is at least 28 mm (1.1 in). Add more grease if necessary.
2. Check if the grease is milky white. If milky white, it is necessary to change the grease. Please contact your distributor. Install cover (2) with bolts (1).

 Total grease capacity ..... 33 ℓ (8.7 gal)

 Grease weight ..... 29.7 kg (65.5 lb).



## MAINTENANCE

### 24.6.3 CLEAN AND INSPECT RADIATOR FINS, OIL COOLER FINS, AFTERCOOLER FINS AND CONDENSER FINS (ONLY FOR MACHINES EQUIPPED WITH AIR CONDITIONING)



#### WARNING

If compressed air, steam, or water hit your body directly, there is danger of injury. Always wear protective glasses, mask, and safety shoes.

1. Open the engine hood and rear door on the left side of the machine. Loosen bolts (1) and remove the radiator front cover.
2. When cleaning radiator fins, remove four bolts (2) fixing the oil cooler to the radiator. Tilt the oil cooler outward, then clean the radiator fins.
3. Blow off mud, dust or leaves clogging the radiator fins, oil cooler fins and after cooler fins using compressed air. At the same time, clean the net in front of the oil cooler. Clean the condenser fins on machines equipped with air conditioner. Steam or water may be used instead of compressed air. After cleaning, secure the oil cooler with bolts (2) and install the cover with bolts (1).

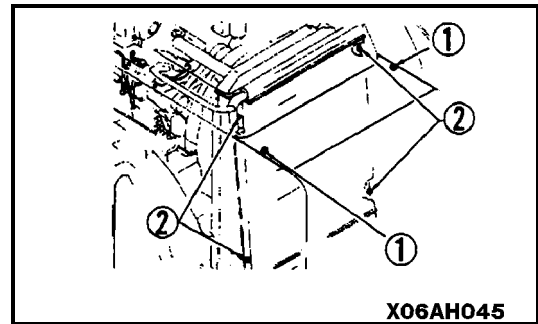
#### REMARK

An aftercooler is installed on the PC270LC-6.

4. Check the rubber hose. Replace with a new one if the hose is found to have cracks or to be hardened by ageing. Further, check hose clamps for looseness.

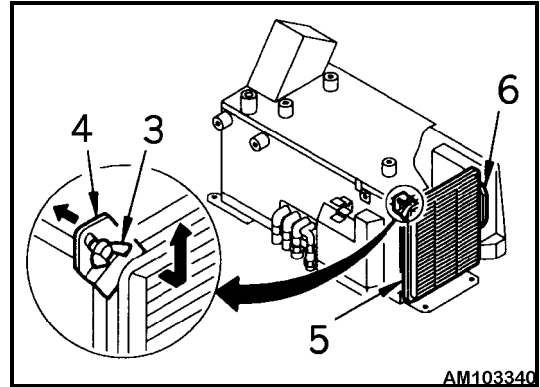
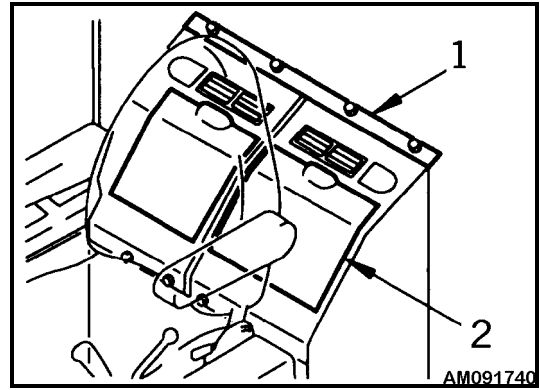
#### NOTICE

To prevent damage to the fins, apply compressed air from an appropriate distance. Damaged fins may cause water leakage or overheating. In a dusty site, check the fins daily, irrespective of the maintenance interval.



**24.6.4 CLEAN FRESH/RECIRC AIR FILTERS OF AIR CONDITIONER**

1. Remove bolts at the top of the luggage box, then remove bracket (1).
2. Remove the bolts at the bottom of the luggage box, then pull up box (2) to remove. Loosen wing bolt (3), move stopper (4) aside, then pull recirculation air filter (5) up to remove it. Pull fresh air filter (6) to the side (left side of the machine) to remove it.
3. Clean filters (5) and (6) with compressed air. If there is oil on the filter or it is extremely dirty, wash it in a neutral washing agent. After washing it, dry it completely before using it again.



**REMARK**

If the dirt clogging the filter cannot be removed by blowing it with air or washing it in water, replace the filter with a new part. If the filter becomes clogged, the air flow will be reduced, and there will be an abnormal noise from the air conditioner unit.

**NOTICE**

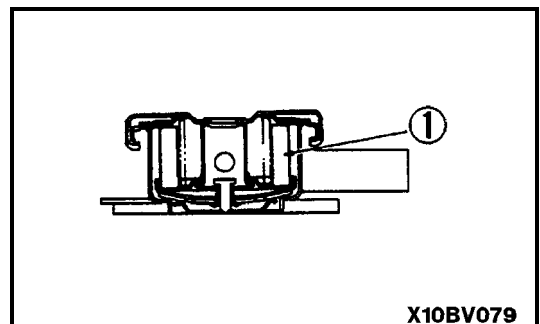
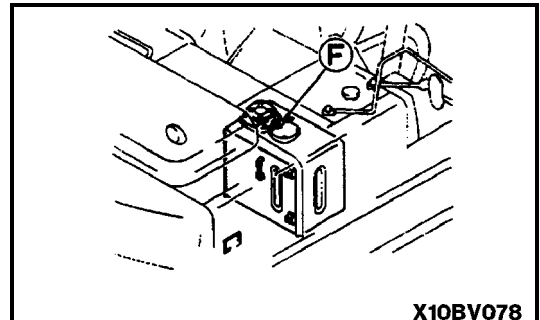
As a guideline, the filters should be cleaned every 500 hours, but on dusty job sites, clean the filters more frequently.

**24.6.5 REPLACE HYDRAULIC TANK BREATHER ELEMENT**

**⚠ WARNING**

Wait for the oil to cool down before replacing the breather element. When removing the oil filler cap, turn it slowly to release the internal pressure, then remove it carefully.

1. Remove the cover over the hydraulic tank and remove the oil filler cap (1) at the top of the hydraulic tank.
2. Replace element (1) inside the cap.




# MAINTENANCE


## 24.6.6 CHANGE ENGINE OIL, REPLACE FILTER


### **WARNING**

The oil is at high temperature after the machine has been operated. Always wait for the temperature to go down before starting this operation.

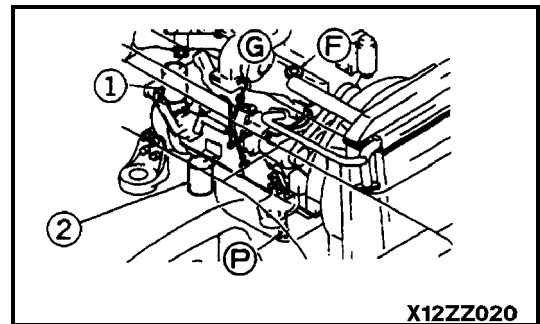
Prepare the following.

 Oil catch container . . . . . Min 26.3 l (7 gal)capacity

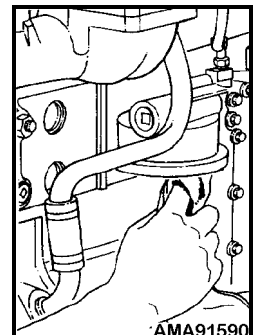
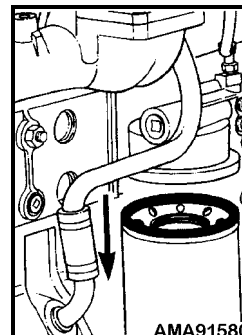
 Filter wrench . . . . . 09019-08035

 Refill capacity . . . . . 24 l (6.3 gal)

1. Place a container under drain valve (P) located on the bottom of the machine.
2. Loosen drain valve (P) slowly to prevent getting oil on yourself, and drain the oil.
3. Check the drained oil, and if there are excessive metal particles or foreign material, please contact your distributor.
4. Close drain valve (P).



5. Open the engine hood. Using the filter wrench from the upper side of the engine, turn filter cartridge counterclockwise to remove it. In particular, if this operation is carried out immediately after stopping the engine, a large amount of oil will come out, so wait for 10 minutes before starting the operation.
6. Clean the filter holder, coat the packing surface of a new filter cartridge with engine oil (or coat it thinly with grease).



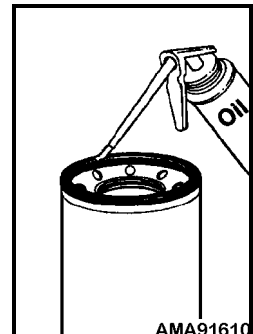
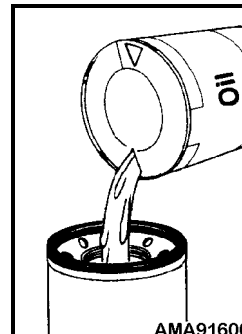
### REMARK

Confirm that no remnants of old packing still adhere to the filter holder as this may result in oil leakage.

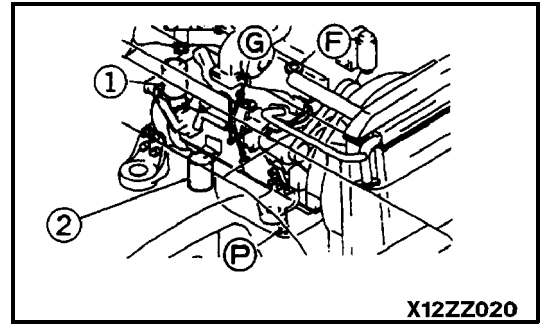
### REMARK

Do not over tighten filter or use any tools for installation because this can damage the gasket and filter.

7. Fill the new filter with clean oil.
8. Install the new filter.



9. Thread the filter on by hand (do not spin) by turning it clockwise until the seal just makes contact the filter header. Give the element an additional  $\frac{1}{4}$  to  $\frac{1}{2}$  turn.

**X12ZZ020**

10. After replacing the filter cartridge, add engine oil through oil filler (F) until the oil level is between the H and L marks on dipstick (G).

For details of the oil to use, See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

11. Run the engine at low idle for a short time, then stop the engine, and check that the oil level is between the H and L marks on the dipstick. For details, See 24.3 CHECK BEFORE STARTING on page 3-43

**NOTICE**

Even if the machine has not been operated for 500 hours, the oil and filter cartridge must be replaced when the machine has been operated for 6 months. In the same way, even if the machine has not been operated for 6 months, the oil and filter cartridge must be replaced when the machine has been operated for 500 hours.

## MAINTENANCE

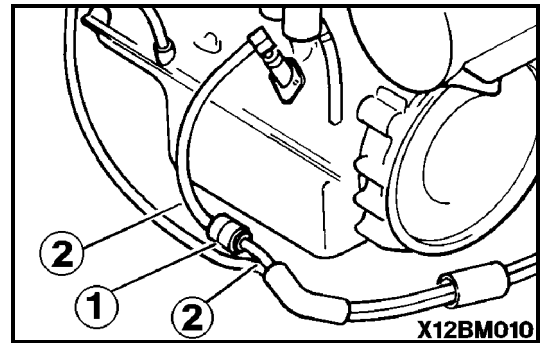
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### 24.6.7 REPLACE IN LINE FUEL STRAINER

1. Disconnect and plug fuel hoses (2).
2. Remove and discard the in-line fuel strainer (1).
3. Install the new fuel strainer and reverse the above process.

#### REMARK

Refer to arrow mark on the fuel strainer for correct fuel flow direction.



Bleed the air in the fuel system using the procedure in: See 24.6.1  
REPLACE FUEL FILTER CARTRIDGE AND FUEL-WATER  
SEPARATOR on page 3-55.


## 24.7 EVERY 1000 HOURS SERVICE


Maintenance for every 100, 250 and 500 hours service should be carried out at the same time.

### 24.7.1 CHANGE OIL IN SWING MACHINERY CASE

**WARNING**

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before carrying out maintenance.

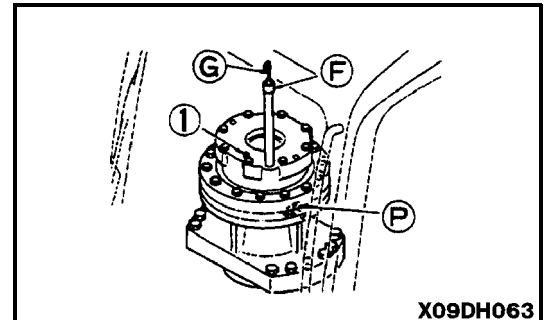
 Oil catch container . . . . . 5.5 l (1.5 gal) minimum

 Refill capacity . . . . . 5.5 l (1.5 gal)

1. Set a container under drain valve (P) under the machine body to catch the oil.
2. Loosen drain valve (P) under the machine body, drain the oil, then tighten the drain plug again.
3. Remove dipstick (G) and air bleed plug (1), then add the specified amount of oil through gauge hole (F).

For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

4. After adding oil, install air bleed plug (1).
5. Wipe off the oil on the dipstick with a cloth. Insert dipstick (G) fully into the guide, and then pull it out again.
6. The oil level should be between top H and bottom L marks on the dipstick (G). If the oil does not reach the bottom mark, add engine oil through gauge hole(F). If the oil is above the top mark, drain the excess engine oil from drain valve (P), and check the oil level again.



## MAINTENANCE

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### 24.7.2 CHECK OIL LEVEL IN DAMPER CASE, ADD OIL



#### WARNING

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before carrying out maintenance.

#### NOTICE

Park the machine on flat ground and stop the engine. After waiting for more than 30 minutes after stopping the engine, check the oil level.

1. Open the door on the right side of the machine.
2. Remove plug (G) and check the oil level. If the oil is up to near the bottom of the plug hole, it is normal. If insufficient, remove plug (F) and add oil through the hole of plug (F) up to the bottom of the plug hole (G).

For details of the oil to use, see 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9.

#### NOTICE

If excess oil is supplied, drain it to the specified amount to avoid overheating.

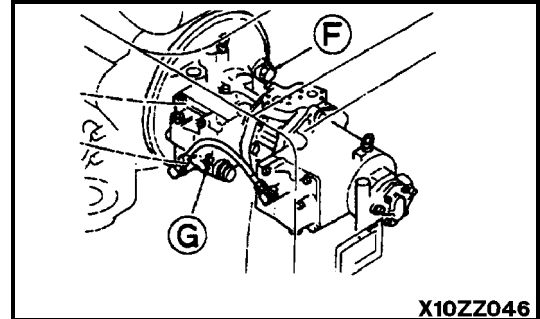
3. Install plugs (G and F).
4. Close the door.

### 24.7.3 CHECK TIGHTENING PARTS OF TURBOCHARGER

Contact your distributor to have the tightening portions checked.

### 24.7.4 CHECK PLAY OF TURBOCHARGER ROTOR

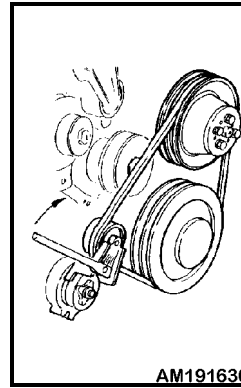
Ask distributor to check the play of the turbocharger rotor.





## 24.7.5 CHECK DRIVE BELT, TENSIONER BEARING AND FAN HUB

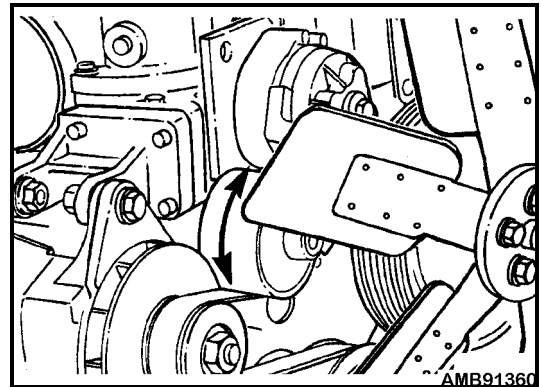
1. Remove drive belt by lifting tensioner using a 1/2 inch square drive wrench to release the tension.
2. Inspect the belt for damage.



3. Check the tensioner bearing.

### REMARK

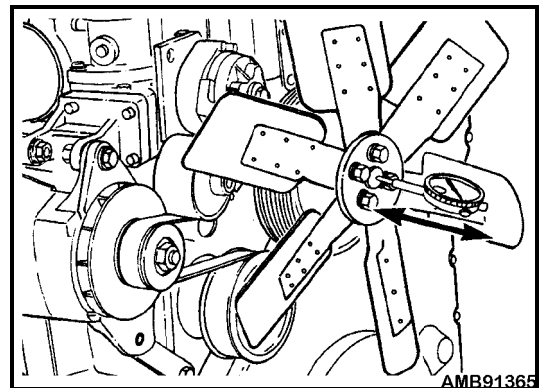
The tensioner pulley should spin freely with no rough spots detected under hand pressure.



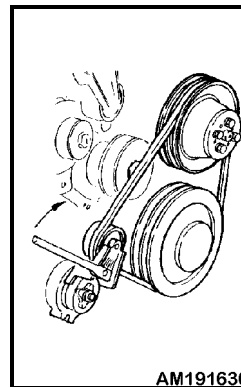
4. Check the fan hub bearing.

### REMARK

The fan hub should spin freely without excessive end play.



5. Install the drive belt.



# MAINTENANCE

## 24.8 EVERY 2000 HOURS SERVICE

Maintenance for every 100, 250, 500 and 1000 hours service should be carried out at the same time.

### 24.8.1 CHANGE OIL IN FINAL DRIVE CASE



#### WARNING

- The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before carrying out maintenance.
- If there is still pressure remaining inside the case, the oil or plug may fly out. Loosen the plug slowly to release the pressure.

Prepare the following.



Oil catch container . . . . . 10 ℓ (2.6 gal) minimum



Refill capacity . . . . . 9.5 ℓ (2.5 gal)

1. Set the TOP mark at the top, with the TOP mark and plug (1) perpendicular to the ground surface.
2. Set a container under plug (1) to catch the oil.
3. Remove plugs (1 and 2) and drain the oil.

#### REMARK

Check the o-rings on plugs for damage. If necessary, replace with new ones.

4. Screw in plug (1).
5. Add oil through the hole of plug (2).

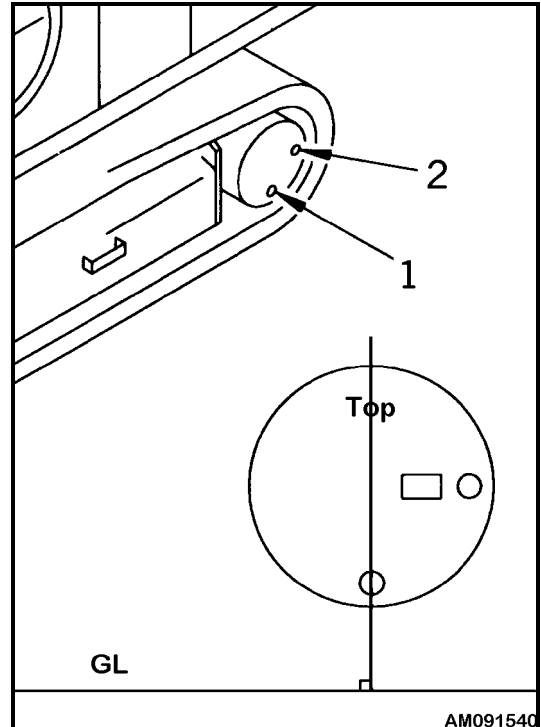
For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO TEMPERATURE on page 3-9.

6. When the oil overflows from the hole of plug (2), install plug (2).

Tightening torque of plugs



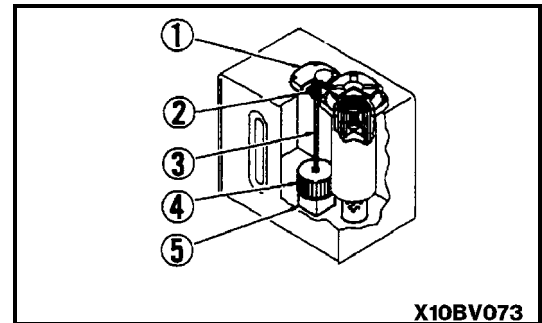
Both plugs . . . . . 70 ±10 N•m (50.7 ±1 lbf ft)



**24.8.2 CLEAN HYDRAULIC TANK STRAINER**

The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before changing the oil. When removing the oil filler cap, turn it slowly to release the internal pressure, then remove it carefully.

1. Remove 4 bolts, then remove cover (1). When doing this, cover may fly off because of the force of spring (2). So keep the cover pushed down when removing the bolts.
2. Hold the top of rod (3) and pull up to remove spring (2) and strainer (4).
3. Remove any dirt stuck to strainer (4), then wash. If strainer is broken, replace it with a new part.
4. When installing, insert strainer (4) into protruding part (5) of the tank, and assemble.
5. Tighten the bolts to install cover (1).



**24.8.3 CLEAN, CHECK TURBOCHARGER**

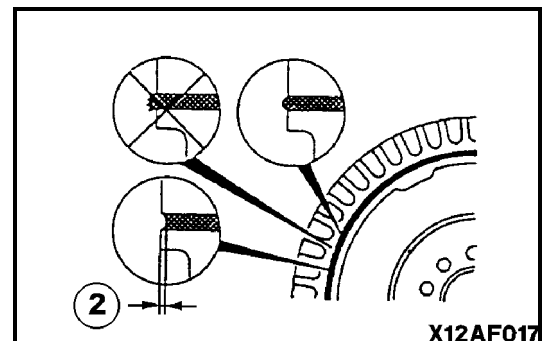
Contact your distributor for cleaning or inspection.

**24.8.4 CHECK ALTERNATOR, STARTING MOTOR**

The brush may be worn, or the bearing may have run out of grease, so contact your distributor for inspection or repair. If the engine is started frequently, carry out inspection every 1000 hours.

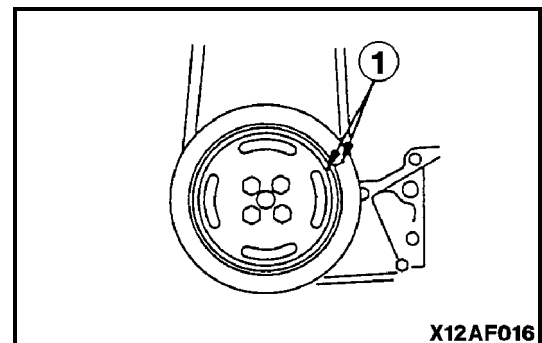
**24.8.5 CHECK VIBRATION DAMPER**

Check that there are no cracks or peeling in the outside surface of the rubber. If any cracks or peeling are found, contact your distributor.



**24.8.6 CHANGE ANTIFREEZE**

Follow the procedure of 24.2.2 CLEAN INSIDE OF COOLING SYSTEM on page 3-27 for draining and refilling the cooling system.

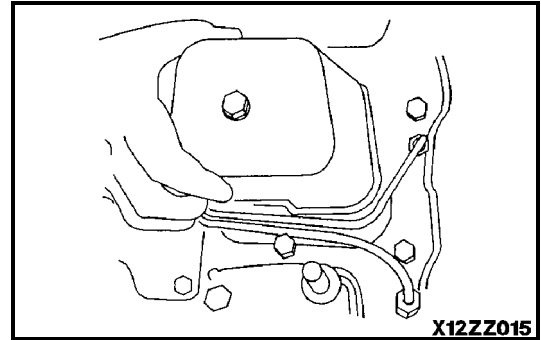


# MAINTENANCE

## 24.8.7 CHECK AND ADJUST VALVE CLEARANCE

### Adjusting the valves

1. Remove the valve covers.
2. Locate top dead center (TDC) for cylinder Number 1 by turning engine slowly while pressing on the engine timing pin (A).
3. When the pin engages the hole in the crankshaft gear, Cylinder Number 1 is at TDC on the compression stroke.



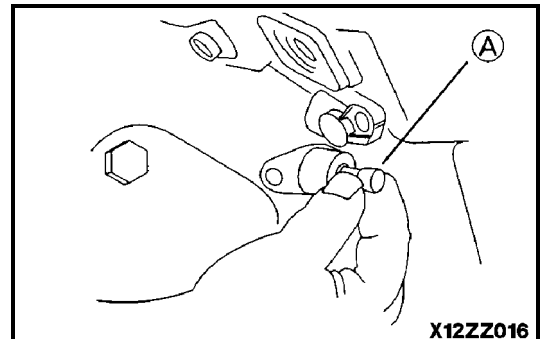
### CAUTION: Be sure to disengage the pin after locating TDC.

Valve clearance: Intake: 0.254 mm (0.010 in)  
Exhaust: 0.508 mm (0.020 in)

Check/set valves with engine cold - below 60°C (140°F).

### NOTE:

The clearance is correct when some resistance is "felt" when the feeler gauge is slipped between the valve stem and the rocker lever.

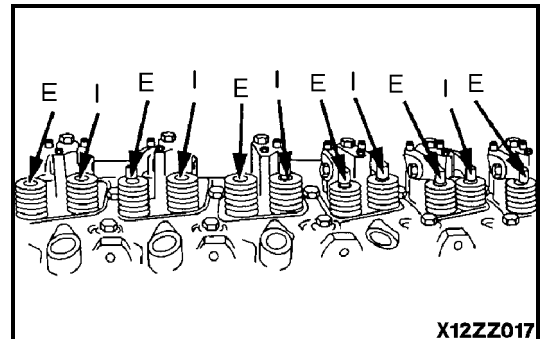


With the engine in TDC position, check and adjust the following valve clearances:

Intake (I) cylinders: 1,2,4

Exhaust (E) cylinders: 1,3,5

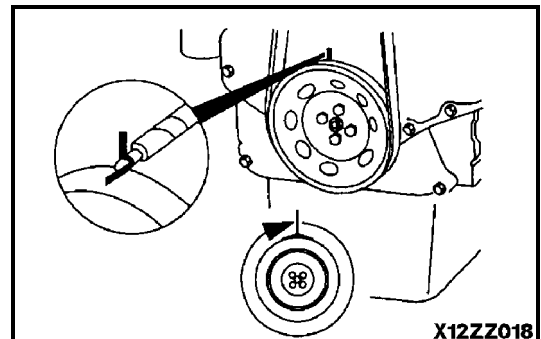
Tighten the locknut to 24 N•m (18 lbf ft) and recheck the valve lash.



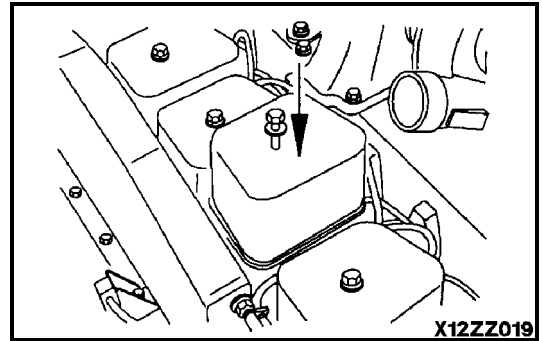
Mark the pulley and rotate the crankshaft 360 Degrees. Be sure the timing pin is disengaged before rotating. The timing pin will not engage in this position. With the engine in this position, check and adjust the following valve clearances.

Intake (I) cylinders: 3, 5, 6

Exhaust (E) cylinders: 2, 4, 6



Tighten the locknut to 24 N•m (18 lbf ft) and recheck the valve lash. Reinstall the valve covers and tighten capscrews to 24 N•m (18 lbf ft).



## **MAINTENANCE**

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### **24.9 EVERY 4000 HOURS SERVICE**

Maintenance for every 100, 250, 500 and 1000 hours service should be carried out at the same time.

#### **24.9.1 CHECK WATER PUMP**

Check that there isn't any oil leakage, coolant leakage, or clogging of the drain hole. If any abnormality is found, contact your distributor for disassembly and repair or replacement.

**24.10 EVERY 5000 HOURS SERVICE**




Maintenance for every 100, 250, 500 and 1000 hours service should be carried out at the same time.

**24.10.1 CHANGE OIL IN HYDRAULIC TANK**

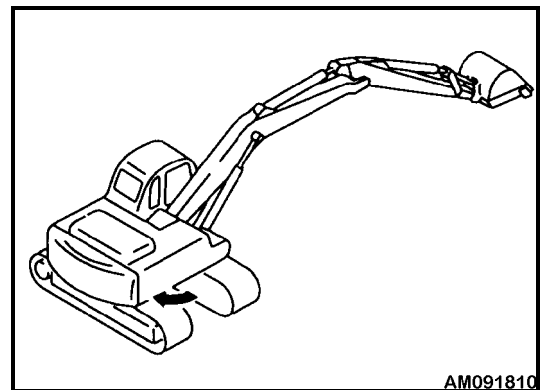
**▲ WARNING**

**The oil is at high temperature immediately after the machine has been operated. Wait for the oil to cool down before changing the oil. When removing the oil filler cap, turn it slowly to release the internal pressure, then remove it carefully.**

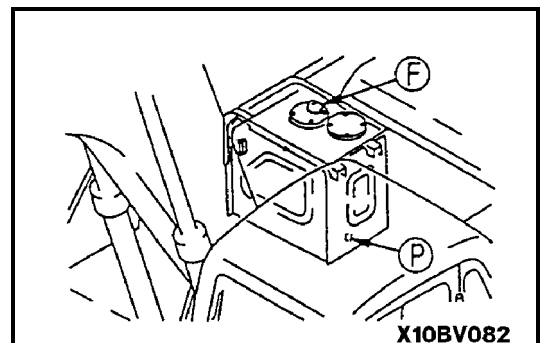
Prepare the following.

-  Oil catch container . . . . . Min 166 ℓ (44 gal) capacity
-  Ratchet wrench . . . . . 24 mm socket and/or ½ in. Drive
-  Refill capacity . . . . . 166 ℓ (44 gal)

1. Swing the upper structure so the drain plug at the bottom of the hydraulic tank is in the middle between the left and right tracks.
2. Retract the arm and bucket cylinders to the end of the stroke, lower the boom, and put the teeth in contact with the ground.
3. Set the safety lock lever to the LOCK position and stop the engine.



4. Remove the cap of oil filler port (F) at the top of the hydraulic tank.
5. Set a container immediately under the drain plug under the machine body to catch the oil that is drained. Using the handle, remove drain plug (P) and drain the oil. Take care not to get oil on yourself when you remove drain plug. Check the o-ring installed to plug (F), and if it is scratched or damaged, replace the o-ring. After draining the oil, tighten the drain plug.



Tightening torque:

-  Drain plug . . . . . 69 ±10 N•m (50 ±7 lbf ft)

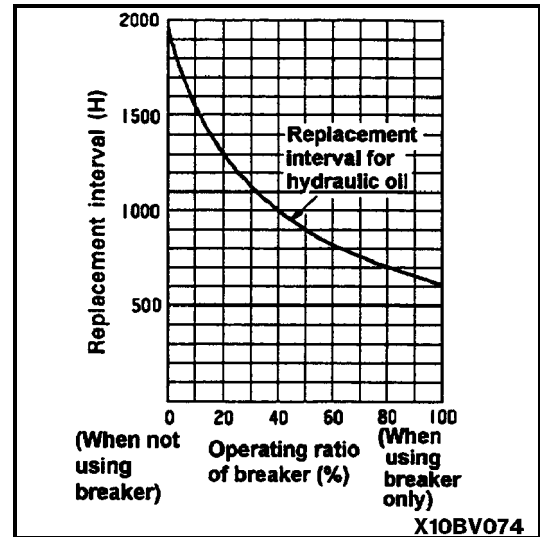
6. Add the specified amount of engine oil through oil filler port (F). Check that the oil level is between H and L on the sight gauge.

For details of the oil to use; See 20 FUEL, COOLANT AND LUBRICANTS ACCORDING TO AMBIENT TEMPERATURE on page 3-9

## MAINTENANCE

### NOTICE

When the hydraulic breaker is installed, the hydraulic oil deteriorates earlier than in normal bucket digging work. Therefore, replace the hydraulic oil according to the chart at the right.

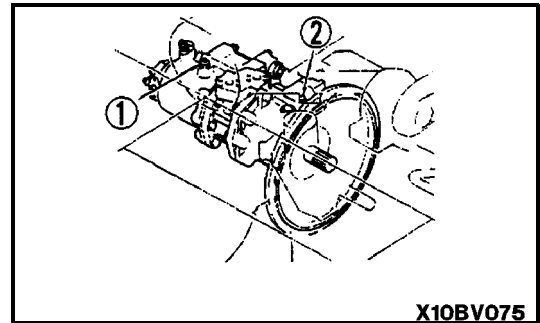


7. After replacing hydraulic oil and cleaning or replacing filter element and strainer, bleed air from the circuit according to the following procedure.

### Procedure for Bleeding Air

Bleed the air from the various components in the order below (Following steps through 7).

1. Bleeding air from pump
  - a.) Loosen air bleed plug (1) and check that oil oozes out from the air bleeder.
  - b.) If no oil oozes out, remove the drain hose from the pump case, and add hydraulic oil through drain port (2) to fill the pump case. Oil will come out when the drain hose is removed, so secure the hose at a position higher than the level of the oil in the hydraulic tank.
  - c.) After completing the air bleed operation, tighten air bleed plug (1) and install the drain hose.



### NOTICE

If the drain hose is installed first, oil will spurt out from plug hole. If the pump is operated without filling the pump case with hydraulic oil, abnormal heat will be generated and this may cause premature damage to the pump.



2. Start the engine. For details: See 12.2 STARTING ENGINE on page 2-54. Run the engine for 10 minutes at low idle, then go on to the next operation.
3. Bleeding air from cylinders
  - a.) Run the engine at low idle, and extend and retract each cylinder 4 to 5 times. Do not operate the cylinder to the end of its stroke. Stop at a point ~ 100 mm (4 in.) before the end of the, stroke.
  - b.) Next, operate each cylinder 3 to 4 times to the end of its stroke.
  - c.) Finally, operate each cylinder 4 to 5 times to the end of its stroke to completely remove the air.

**NOTICE**

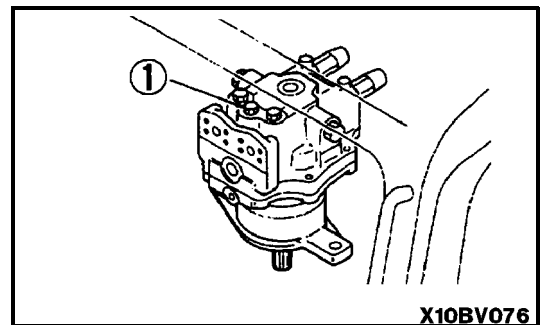
If the engine is run immediately at high speed or the cylinder is operated to the end of its stroke, the air inside the cylinder may cause damage to the piston packing.

4. Bleeding air from swing motor - Carry out this operation only when the oil in the swing motor case has been drained.
  - a.) Run the engine at low idle, loosen air bleed plug (1) and check that oil oozes out from air bleed plug.

**NOTICE**

When doing this, do not operate the swing.

- b.) If no oil oozes out, stop the engine, remove air bleed plug then fill the motor case with hydraulic oil.
- c.) After completing the air bleed operation, tighten air bleed plug (1).
- d.) Run the engine at low idle, and swing the upper structure at least 2 times uniformly to the left and right.

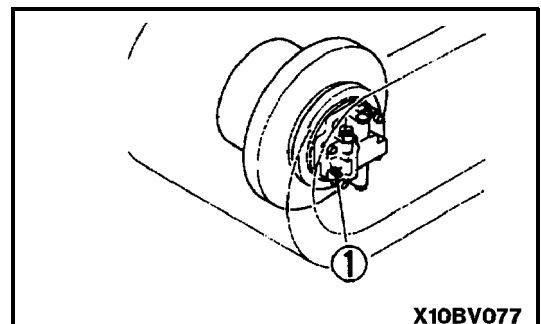


X10BV076

**NOTICE**

If the air is not bled from the swing motor, the motor bearings may be damaged.

5. Bleeding air from travel motor - Carry out this operation only when the oil in the travel motor case has been drained.
  - a.) Run the engine at low idle, loosen air bleed plug (1) and check that oil flows out. If oil flows out, tighten the air bleed plug. Stop the engine and refill the motor case with oil.
  - b.) With the engine running at low idle, and swing the upper structure 90° to bring the work equipment to the side of the track.



X10BV077

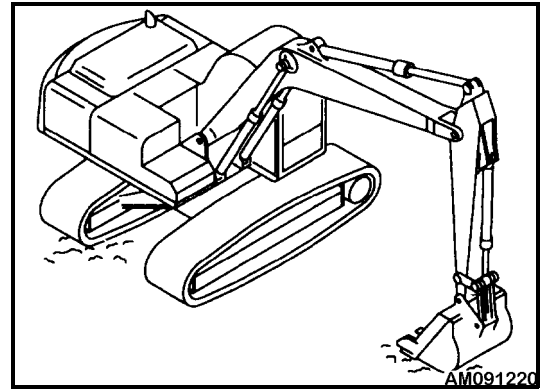
## MAINTENANCE

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- c.) Use the work equipment to jack up the chassis so that the track comes slightly off the ground, then run the track under no load for 2 minutes. Carry out this operation on the left and right sides.

When rotating the track under no load, rotate the track uniformly in forward and reverse.

6. Bleeding air from attachment (hydraulic breaker, etc.) - If a hydraulic breaker or any other attachment has been newly installed, run the engine at low idle and operate the equipment repeatedly (~ 10 times) until the air has been bled from the attachment and circuit.



### NOTICE

If the method of bleeding the air from the attachment itself is specified by the manufacturer, bleed the air according to those specifications.

### 7. Operation

- a) After completing the air bleed operation, stop the engine and wait for at least 5 minutes before starting operations. This will allow the bubbles in the oil inside the tank to escape.
- b) Check that there is no leakage of oil, and wipe up any oil that has been spilled.

# **SPECIFICATIONS**

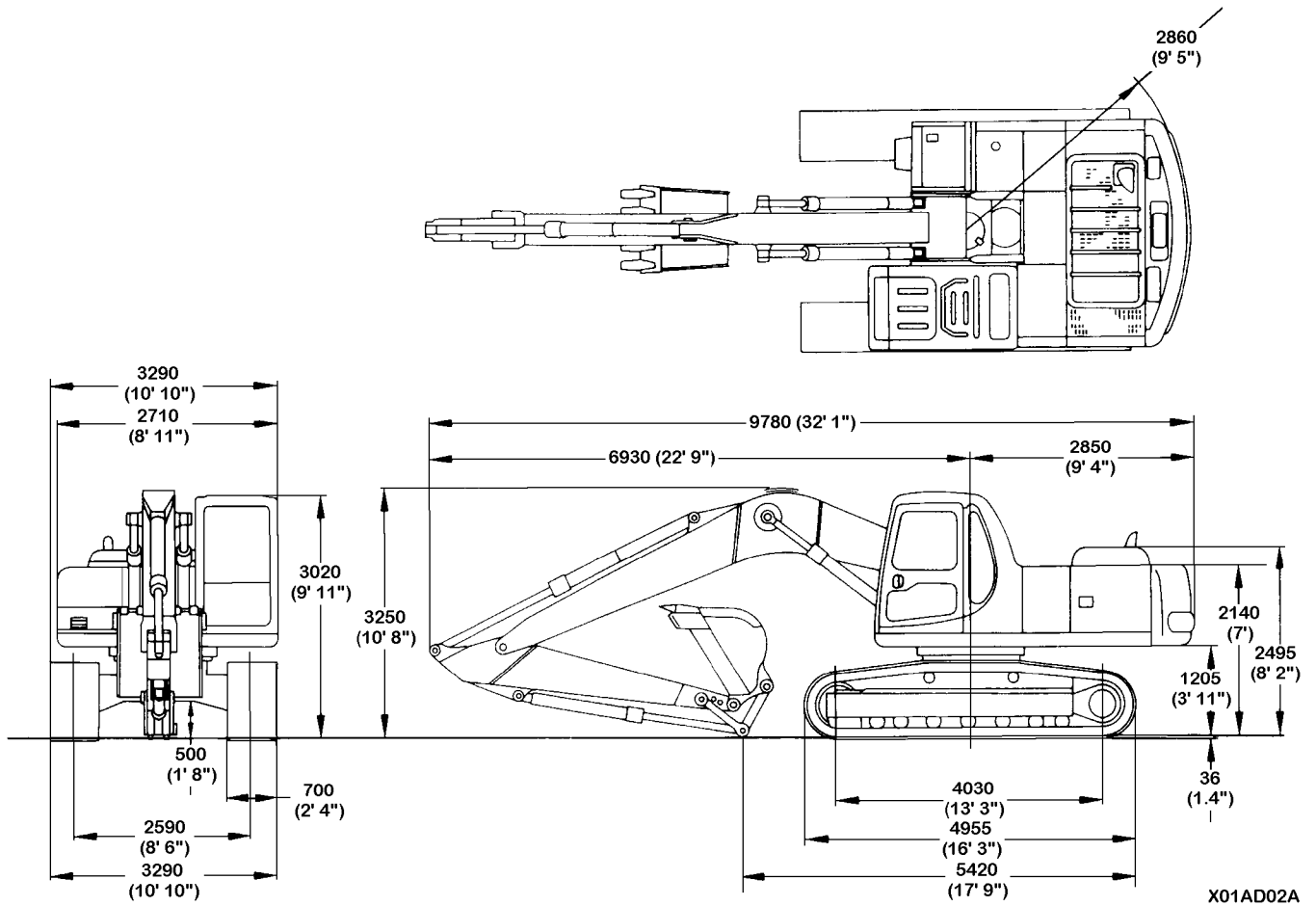
## SPECIFICATIONS

### 25. MACHINE SPECIFICATIONS

#### 25.1 GENERAL

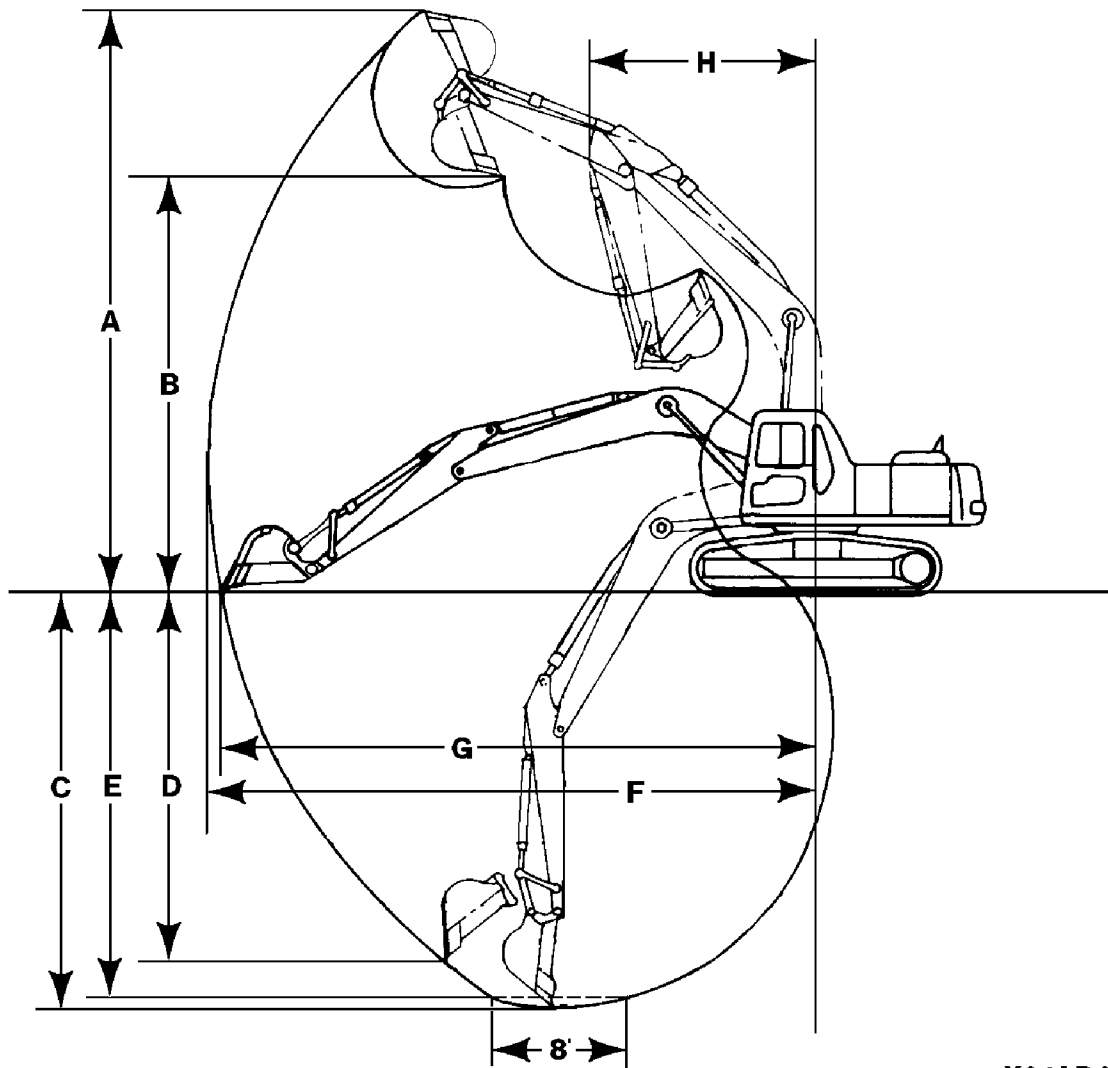
		PC270LC-6
<b>WEIGHT</b>		
● Operating weight (without operator)		27500 kg (60627 lb)
<b>Performance</b>		
● Bucket capacity		See 31.2 ATTACHMENT INSTALLATION COMBINATION TABLE on page 5-17
● Travel speed	Low speed	2.6 km/h (1.6 MPH)
	Middle speed	4.2 km/h (2.6 MPH)
	High speed	5.3 km/h (3.3 MPH)
● Swing speed		11 rpm
<b>TRACK SHOE</b>		
● Triple grouser shoe (standard)		700mm (28 in) width
<b>ENGINE</b>		
● Model		SA6D102EA-1 diesel engine
● Flywheel horsepower		130 kW (174 HP)/2200 rpm net 138 kW (185 HP)/2200 rpm gross
● Starting motor		24 V 5.5kW
● Alternator		24 V 50 A
● Battery		12 V 150 Ah x 2 pieces

# SPECIFICATIONS



# SPECIFICATIONS

## 25.2 WORKING RANGE



**X01AD025**

PC270LC-6		Arm 	2500 mm	3050 mm	3500 mm			
A	Max dig height		9376 mm	9715 mm	9850 mm			
B	Max dump height		6526 mm	6818 mm	6976 mm			
C	Max dig depth		5903 mm	6448 mm	6902 mm			
D	Max vertical wall dig depth		5352 mm	5794 mm	6280 mm			
E	Max dig depth for 8' level		5697 mm	6270 mm	6740 mm			
F	Max. dig reach		9565 mm	10087 mm	10490 mm			
G	Max dig reach ground level		9376 mm	9907 mm	10317 mm			
H	Min swing radius		3580 mm	3492 mm	3542 mm			
Bucket dig force at power max			18800 kg	18800 kg	18800 kg			

## SPECIFICATIONS

Arm crowd force at power max	16200 kg	14100 kg	12200 kg			
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# **OPTIONS, ATTACHMENTS**



### 26. GENERAL PRECAUTIONS

#### 26.1 PRECAUTIONS RELATED TO SAFETY

If attachments or options other than those authorized are installed, this will not only affect the life of the machine, but will also cause problems with safety. When installing attachments not listed in this Operation & Maintenance Manual, please contact your distributor first. If you do not contact your distributor, we cannot accept any responsibility for any accident or failure.



#### WARNING

Precautions for removal and installation operations. When removing or installing attachments, obey the following precautions and take care to ensure safety during the operation.

- Carry out the removal and installation operations on a flat, firm ground surface.
- When the operation is carried out by two or more workers, determine signals and follow these during the operation.
- When carrying heavy objects of more than 25 kg (55 lb), use a crane.
- When removing heavy parts, always support the part before removing it. When lifting such heavy parts with a crane, always pay careful attention to the position of the center of gravity.
- It is dangerous to carry out operations with the load kept suspended. Always set the load on a stand, and check that it is safe.
- When removing or installing attachments, make sure that they are in a stable condition and will not fall over.
- Never go under a load suspended from a crane. Always stand in a position that is safe even if the load should fall.

#### NOTICE

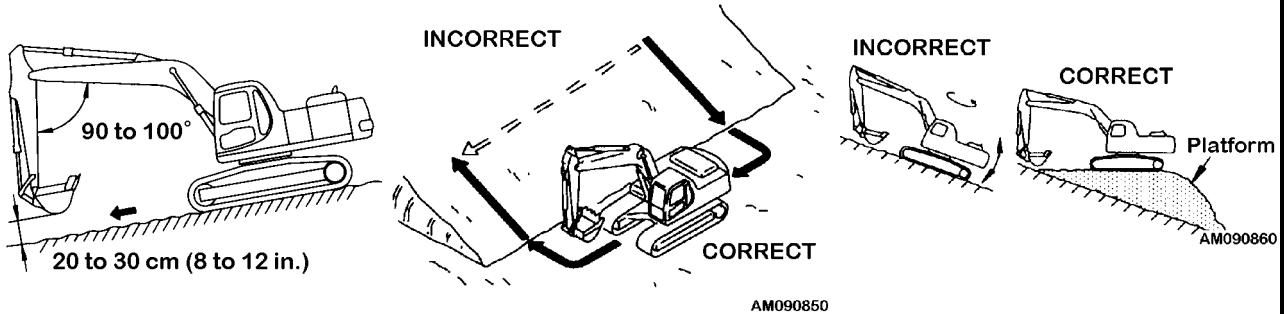
Qualifications are required to operate a crane. Never allow the crane to be operated by an unqualified person. For details of the removal and installation operations, please contact your distributor.

26.2 PRECAUTIONS WHEN INSTALLING ATTACHMENTS

**⚠ WARNING**

Long work equipment reduces the stability of the chassis, so if the swing is operated on a slope, or when going down a steep hill, the machine may lose its balance and overturn. The following operations are particularly dangerous, so never operate the machine in these ways.

- Going downhill with the work equipment raised
- Traveling across slopes
- Swinging the upper structure on slopes



- If heavy work equipment is installed, the overrun of the swing becomes greater (the distance from the point where the operator operates the control levers to stop the swing to the point where the upper structure stops completely), so there is danger of mistaking the distance and hitting something. Always operate so that there is an ample margin to the stopping point. Furthermore, the hydraulic drift also becomes larger (when the work equipment is stopped in mid-air, it will gradually move down under its own weight).
- Always follow the correct procedure when installing the boom and arm. If the correct procedure is not followed, this may lead to serious damage or injury, so please consult your distributor before carrying out installation.

If long work equipment is installed, the working range will suddenly become larger, so there is danger of mistaking the distance and hitting something. Always operate the work equipment so that there is ample space from any obstacles in the area.

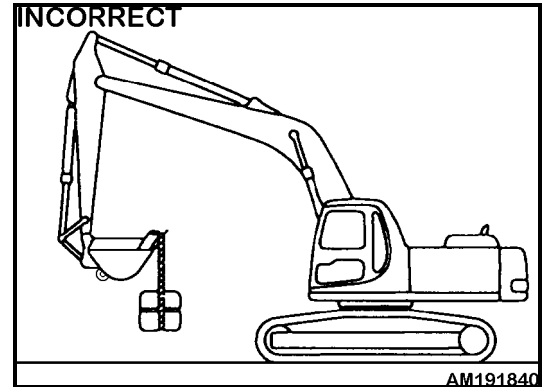
### 27. BUCKET WITH HOOK

#### 27.1 CHECKING FOR DAMAGE

Check that there is no damage to the hook or hook mount. If any abnormality is found, please contact your distributor.

#### 27.2 PROHIBITED OPERATIONS

Do not lift with the bucket teeth, always use the hook.



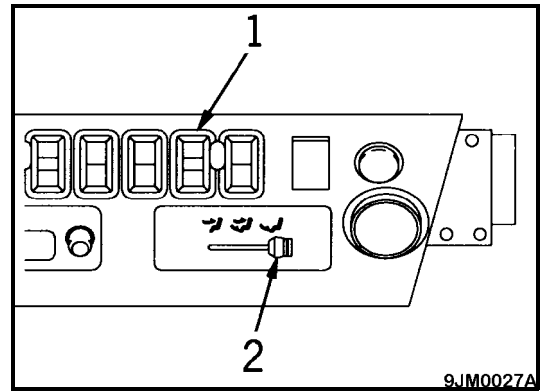
#### 27.3 PRECAUTIONS DURING OPERATIONS

- When carrying out lifting operations, reduce the engine speed and use the lifting operation mode.
- Depending on the posture of the work equipment, there is danger that the load may slip off the hook. Always be careful to maintain the correct hook angle to prevent this from happening.
- Never steer the machine while lifting a load.
- Loads suspended must not exceed the limit indicated in the Lifting Capacity Table mounted on the left rear window of cab.

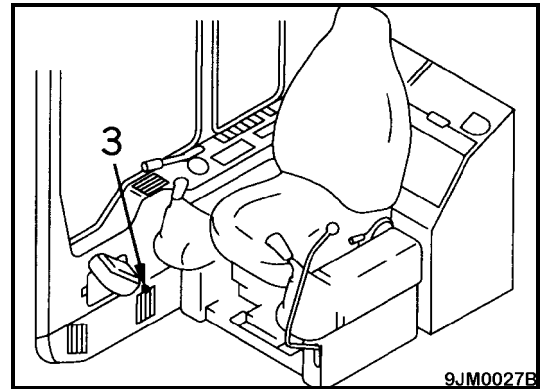
## 28. HANDLING HEATER

### 28.1 GENERAL LOCATIONS

This heater uses the hot coolant from the engine to carry out heating, so allow the engine to warm up before using the heater.



9JM0027A



9JM0027B

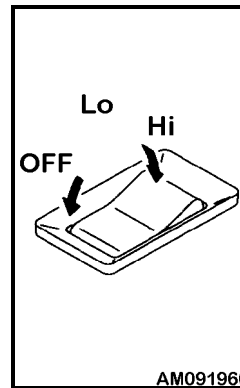
#### 1. Heater Fan Switch

This switch adjusts the wind flow in two stages.

Hi - High

Lo - Low

OFF - Heater is switched off




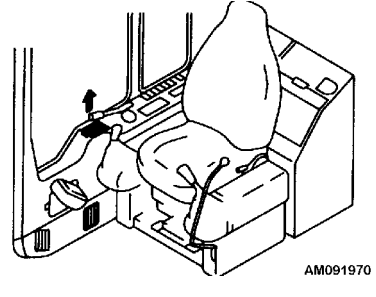
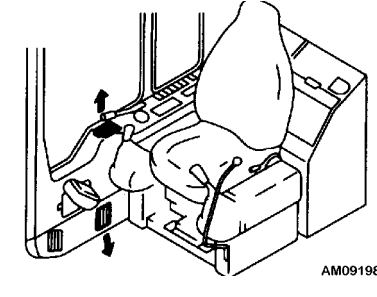
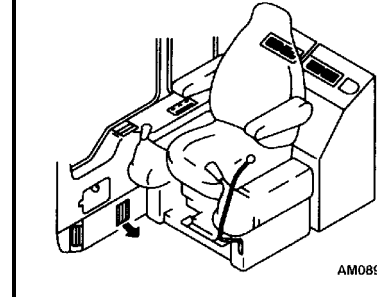


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## OPTIONS, ATTACHMENTS

### 2. Vent Selector Switch

This is used to select the vents which match the purpose of use.



Purpose of use	Sending breeze to upper part of body	Sending breeze to upper part of body and feet	Sending breeze to feet
Lever			
Vent			

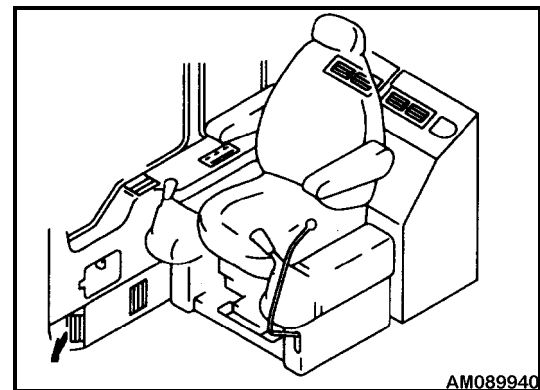
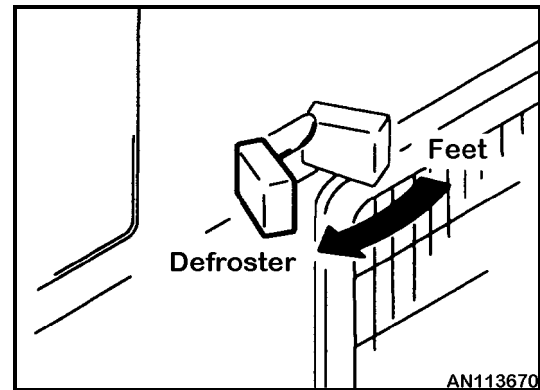
### 3. Defroster Selector Lever

This is used to clear the mist from the front glass in cold or rainy conditions.

Selector lever forward - Defroster

Selector lever back - Feet

The defroster can be used when the vent selector panel is at the  or  position.



## 28.2 PREPARATION FOR CAR HEATER

Use the car heater when the temperature drops. When using the car heater, turn valve (1) on the water pump to the left to open it. When the warm season returns and the car heater is not to be used for a long period, turn valve (1) to the right to close it.

### REMARK

For machines equipped with an air conditioner, keep valve (1) open at all times.



## 29. HANDLING AIR CONDITIONER

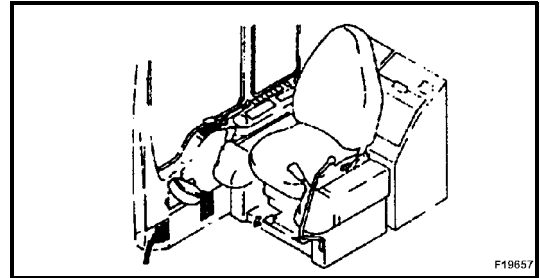
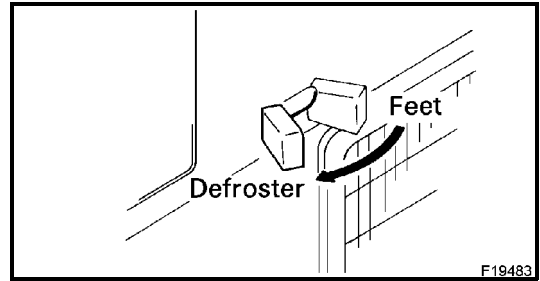
### 29.1 DEFROSTER SELECTOR LEVER

This lever is used to eliminate condensation produced in winter or the rainy season etc.

Change-over lever forward: Defroster

Change-over lever backward: to operator's feet

Defroster is available when using the air outlet change-over lever in  



### 29.2 PRECAUTIONS WHEN USING AIR CONDITIONER

**Carry out ventilation from time to time when using the cooler.**

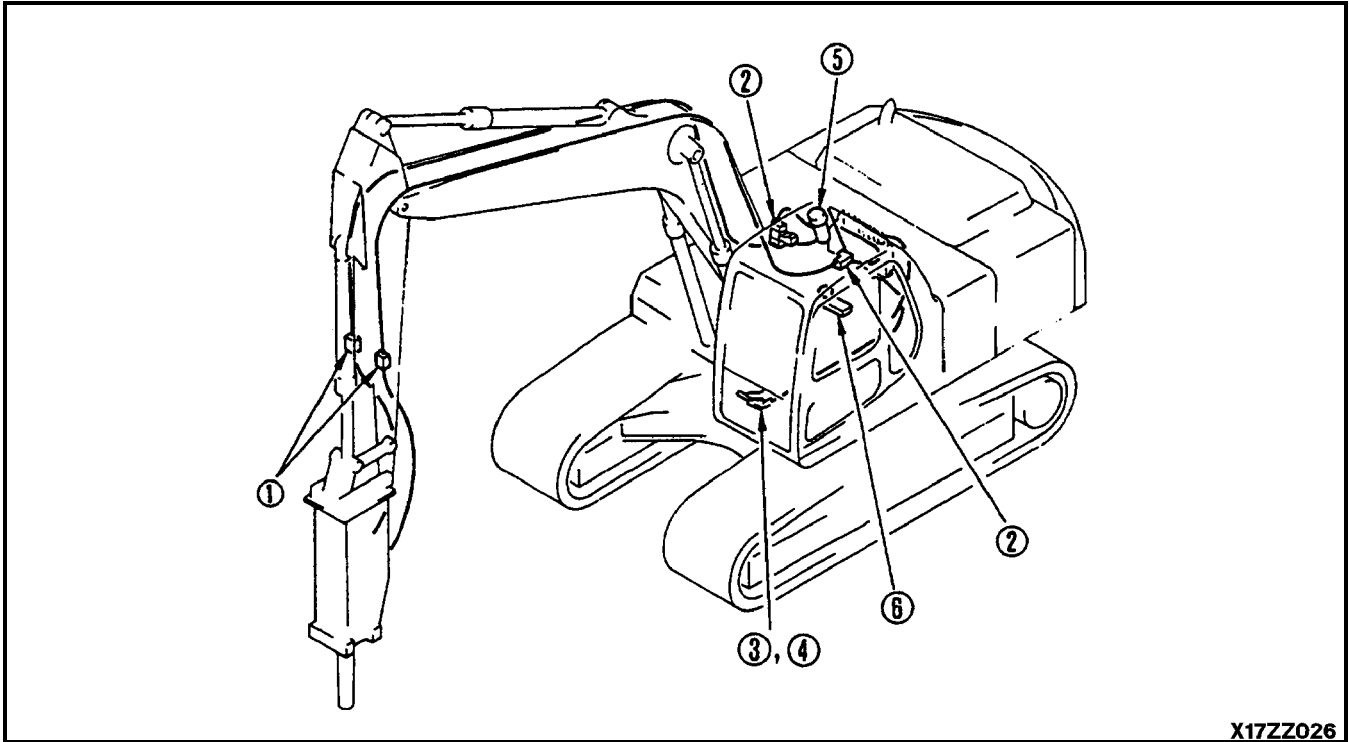
- If you smoke when the cooler is on, the smoke may start to irritate your eyes, so turn the lever to FRESH to remove the smoke while continuing the cooling.
- When running the air conditioner for a long time, turn the lever to the FRESH position once an hour to carry out ventilation and cooling.

**Be careful not to make the temperature in the cab too low.**

- When the cooler is on, set the temperature so that it feels slightly cool when entering the cab (5-6°C (9-11°F) lower than the outside temperature). This temperature difference is considered to be the most suitable for your health, so always be careful to adjust the temperature properly.

## 30. MACHINES READY FOR ATTACHMENT

### 30.1 GENERAL LOCATIONS

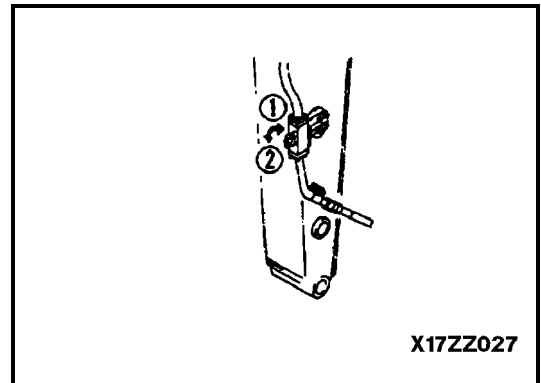


#### 30.1.1 STOP VALVE

This valve stops the flow of the hydraulic oil.

- 1. OFF ..... Hydraulic oil stops.
- 2. ON ..... Hydraulic oil flows.

When removing or installing attachments, set this valve to the OFF position.



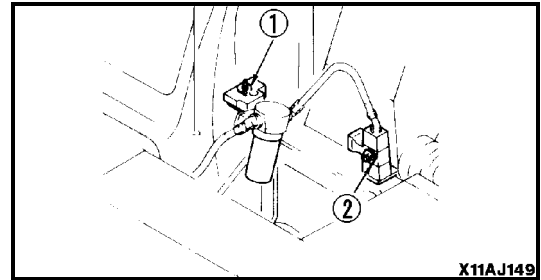


## OPTIONS, ATTACHMENTS

### 30.1.2 SELECTOR VALVE

This switches the flow of the hydraulic oil.

For details of the attachment to install and the direction of the left and right 3-way valves (1) and (2), See 30.2 HYDRAULIC CIRCUIT on page 5-11.



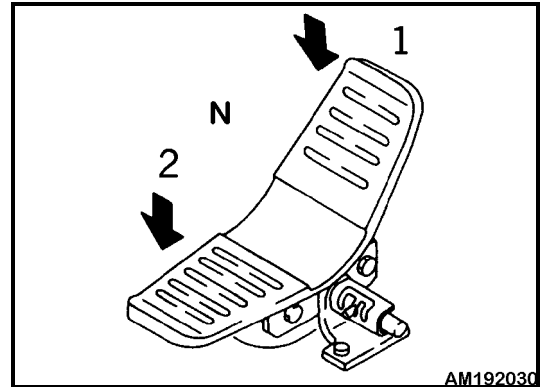
### 30.1.3 CONTROL PEDAL

This pedal is used to operate the attachment. The pedal can be depressed to the front, neutral, and rear to operate the attachment as follows.

#### Hydraulic breaker

Front of pedal (1)	.....	Actuate
Pedal neutral (N)	.....	Stop
Rear of pedal (2)	.....	Locked out

For use of the pedals with other attachments, consult with the attachment manufacturer at the time of installation to determine the operation of the attachment and pedals.



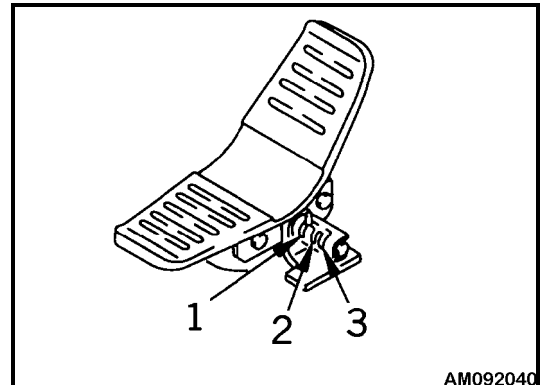
### 30.1.4 LOCK PIN

This locks the control pedal.

Position (1)	.....	Lock
Position (2)	.....	Pedal forward stroke
Position (3)	.....	Pedal full stroke

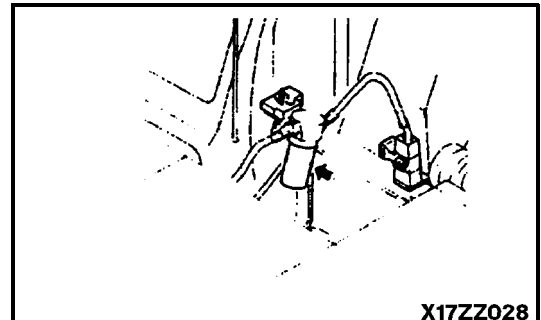
- When using the breaker, select the breaker mode on the monitor, and use position (3).
- If another attachment is used at lower flow, select position (2).

Keep the lock pin in the LOCK position (1) except when using the attachment.



### 30.1.5 ADDITIONAL FILTER FOR BREAKER

This is used to prevent deterioration of the hydraulic oil when using the breaker. The oil flows through this only when the selector valve is at the breaker position. See 30.2 HYDRAULIC CIRCUIT on page 5-11.

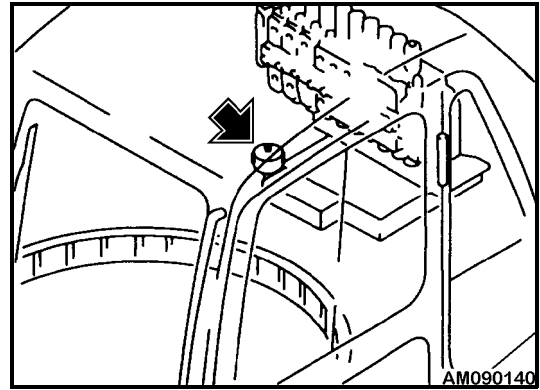


30.1.6 ACCUMULATOR

**WARNING**

The accumulator is charged with high pressure nitrogen gas, and it is extremely dangerous if it is handled mistakenly. For details; See 11.22 HANDLING ACCUMULATOR on page 2-42.

This is installed to release any remaining pressure in the attachment circuit after the engine is stopped. Normally, do not touch it.

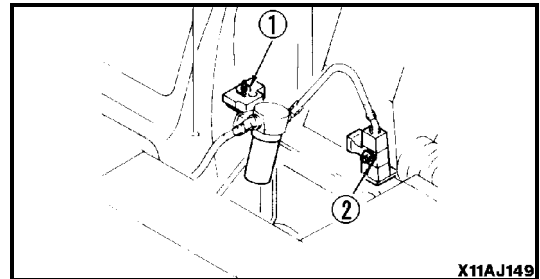


30.2 HYDRAULIC CIRCUIT

30.2.1 SWITCHING TO FILTER CIRCUIT

When a breaker or general attachment (such as a crusher) are used, set Left and right 3-way valves (1) and (2) as follows.

Referring to the following chart, turn the rotors to left and right 3-way valves (1) and (2) using a wrench to select the attachment to be mounted and the direction of both 3-way valves. (The arrows indicating the port direction are stamped on the 3-way valve heads.)



Attachments	Left valve (1)	Right valve (2)
Breaker	Forward direction of machine 	Machine Left  Right
Crusher etc.	Forward direction of machine 	Machine Left  Right
When not in use	Forward direction of machine 	Machine Left  Right

- When the machine is equipped with the breaker, connect the return circuit directly to the return filter.
- The standard set pressure for the low pressure safety valve is 210 kg/cm<sup>2</sup> (2990 psi) when shipped from the plant.
- When installing breakers made by other manufacturers, it is necessary to adjust the pressure, so please contact your distributor.

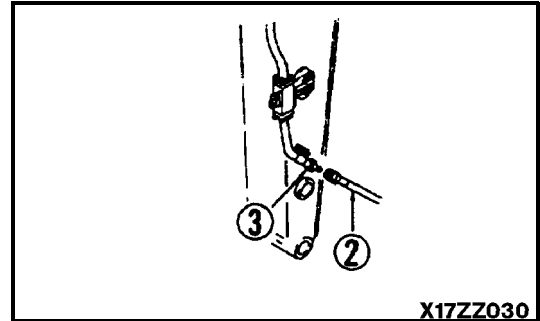
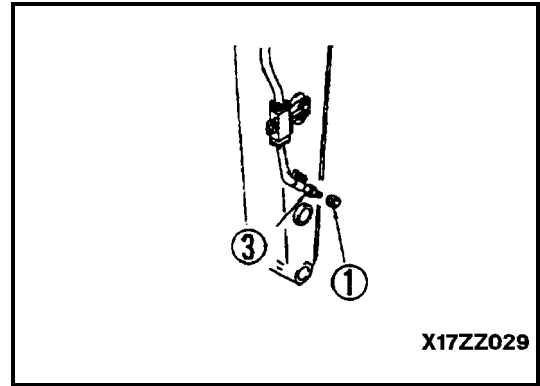
## OPTIONS, ATTACHMENTS

### 30.2.2 CONNECTING HYDRAULIC CIRCUIT

When connecting the attachment, connect the hydraulic circuit as follows.

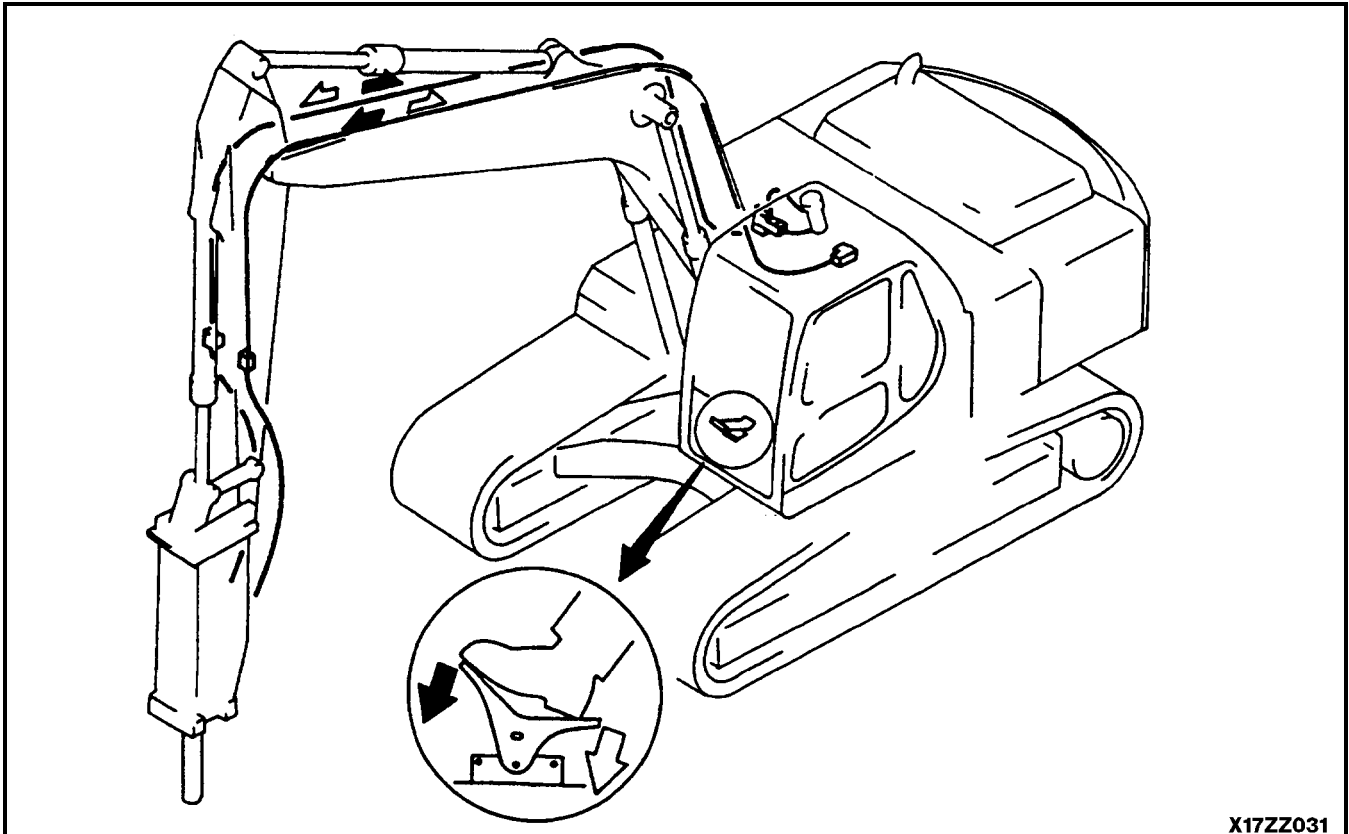
1. Remove blind plug (1) at the tip of the stop valve piping, (two places). Be careful not to lose or damage the removed parts.
2. Connect attachment piping (2) provided by the attachment maker to the part from which the plug was removed.

When it is shipped from the plant, tube a 1 inch taper seal hose is installed to tube (3). When adding an accumulator, the action to take differs according to the attachment maker, so please contact your distributor.



### 30.2.3 PATH OF OIL FLOW

The direction of operation of the pedal and the path of the oil flow is as shown in the diagram below.



## 30.3 PROCEDURE FOR REMOVAL AND

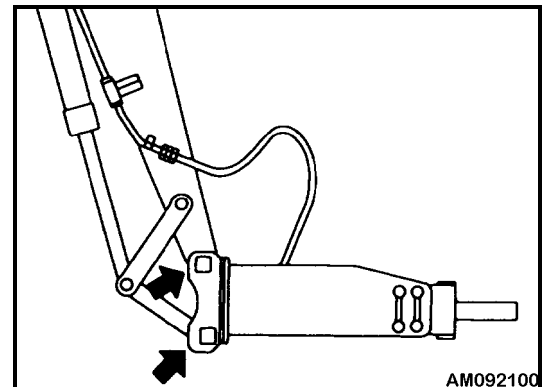
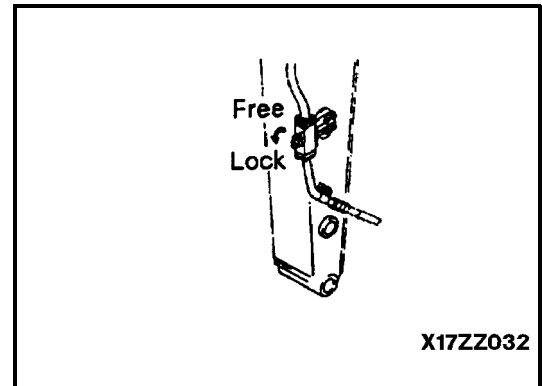
## INSTALLATION OF ATTACHMENT

### 30.3.1 PROCEDURE FOR REMOVAL

1. Lower the attachment to the ground and stop the engine.
2. After stopping the engine, operate each control lever and attachment control pedal to the front and rear, and left and right 2 or 3 times to the end of its stroke to release the remaining pressure inside the hydraulic circuit.
3. After checking that the oil temperature is low, turn the rotor of the stop valve connected to the inlet and outlet piping on the arm side face toward the lock side.
4. Remove the hoses from the attachment line, then install blind covers to the inlet port and outlet port (2 places).

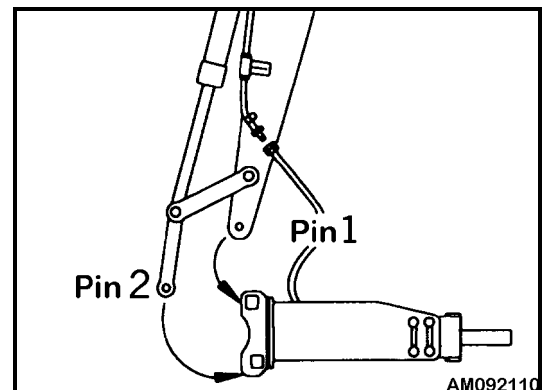
The blind covers are to prevent defective actuation of the attachment caused by the entry of dirt or dust, so fit them securely before storing the parts away.

5. Pull out the mounting pins (2 places), remove the attachment, then install the bucket. For details of the procedure for installing the bucket; See 12.16 REPLACEMENT OR INVERSION OF BUCKET on page 2-83.
6. After installing the bucket, check the oil level in the hydraulic tank.



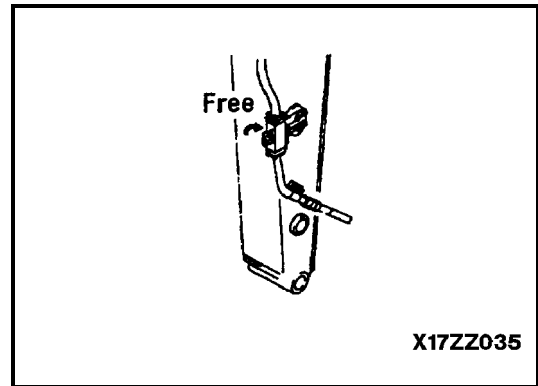
### 30.3.2 PROCEDURE FOR INSTALLATION

1. Remove the bucket. For details of the procedure for removing the bucket; See 12.16 REPLACEMENT OR INVERSION OF BUCKET on page 2-83.
2. Place the attachment in a horizontal position, then install to the arm with pin (1) and then pin (2).
3. After installing the attachment, stop the engine. Then operate each control lever and attachment control pedal to the front and rear, and left and right 2 or 3 times to the end of its stroke to release the remaining pressure inside the hydraulic circuit.
4. After checking that the oil temperature is low, remove the tube caps from the outlet port (2 places) tubes. Be careful that no dirt or mud is stuck to the attachment hose mouthpiece.



## OPTIONS, ATTACHMENTS

5. Connect the attachment hoses to each tube. Turn the rotor of the stop valve connected to the inlet and outlet piping on the arm side face toward the free side.
6. After installing the attachment, check the oil level in the hydraulic tank.



### 30.4 OPERATION



#### WARNING

- Be careful when operating the pedal in the deceleration range. The engine speed will rise suddenly.
- Do not put your foot on the pedal except when operating the pedal. If you rest your foot on the pedal during operations, and it is depressed by accident, the attachment may move suddenly and cause serious damage or injury.

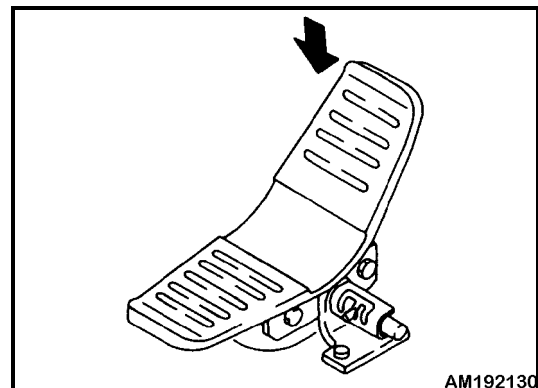
Operate the attachment as follows.

#### 30.4.1 WHEN USING BREAKER

Set the attachment pedal lock pin at the pedal forward stroke position (middle slot). Set the working mode to the B/O (breaker) position.

##### Precautions when using

- Check that the stopper valve is in the ON position.
- Check that the selector valve is the position for using the breaker. For details of the path followed by the oil; See 30.2.3 PATH OF OIL FLOW on page 5-12.
- Consult with the individual attachment maker to decide whether it is necessary to install an accumulator for the attachment.
- For details of other precautions when handling the breaker, read and use correctly the instruction manual provided by the breaker manufacturer.
- When using the breaker, the hydraulic oil deteriorates more rapidly than for normal operations, so change the hydraulic oil and replace the additional filter element at a shorter interval.

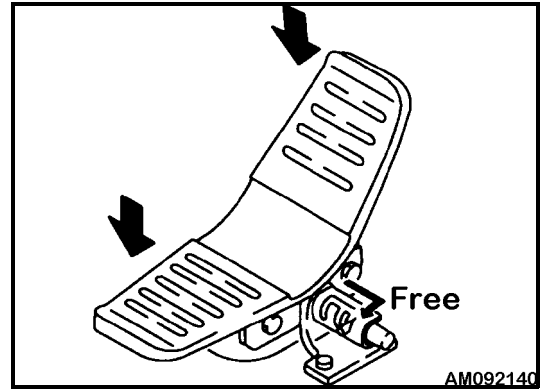


**30.4.2 WHEN USING GENERAL ATTACHMENT**

When the lock pin is set at the FREE position and the front or rear of the pedal is depressed, the attachment is actuated.

**Precautions when using**

- Check that the stopper valve is in the ON position.
- Check that the selector valve is in the T position (to additional filter) for using the crusher. For details of the path followed by the oil; See 30.2.3 PATH OF OIL FLOW on page 5-12.
- For details of other precautions when handling the attachment, read and use correctly the instruction manual provided by the individual manufacturer.



**30.5 LONG TERM STORAGE**

If the machine is not to be used for a long time, do as follows.

- Set the stop valve in the LOCK position.
- Install tube caps and o-rings to the valves.
- Set the selector valve to the T position (to tank).
- Set the lock pin on the attachment pedal at the LOCK position.

If there is no breaker or general attachment installed, operating the pedal may cause overheating.

**30.6 SPECIFICATIONS**

Max. oil flow when merged .....	191 x2 l/min
Relief set pressure of service valve safety valve .....	280 kg/cm <sup>2</sup> (3980 psi)
Cracking pressure of service valve safety valve .....	250 kg/cm <sup>2</sup> (3560 psi)
Low pressure safety valve relief set pressure .....	210 kg/cm <sup>2</sup> (2987 psi)
Low pressure safety valve cracking pressure .....	155 kg/cm <sup>2</sup> (2205 psi)

Other than these specifications, low pressure safety valve relief set pressure of 250 kg/cm<sup>2</sup> (3560 psi) and low pressure safety valve cracking pressure of 205 kg/cm<sup>2</sup> (2915 psi) are provided. Consult your distributor.

### **31. INTRODUCTION OF ATTACHMENTS**

#### **31.1 BUCKET SELECTION**

Guidelines for matching bucket with application.

##### **31.1.1 STANDARD DUTY PLATE BUCKET**

- General purpose
- Truck loading
- Mass excavation
- General excavation in loam, sandy soils, or soils containing very little rock

##### **31.1.2 HEAVY DUTY PLATE BUCKET**

- General excavation in compacted soils or dense clay
- Excavation in gravel or loosely embedded to moderate rock conditions

##### **31.1.3 HEAVY DUTY CAST LIP BUCKET**

- Shot rock conditions
- Tough and abrasive excavating

**31.2 ATTACHMENT INSTALLATION COMBINATION TABLE**

**31.2.1 PC270LC-6**

This table lists the combination of attachments which can be installed on the different arms.

- : Used with material weight up to 1803 kg/m<sup>3</sup> (3040 lb/yd<sup>3</sup>)
- ◇: Used with material weight up to 1495 kg/m<sup>3</sup> (2520 lb/yd<sup>3</sup>)
- ☆: Used with material weight up to 1198 kg/m<sup>3</sup> (2020 lb/yd<sup>3</sup>)
- X: Cannot be used
- +: Light duty applications only

**NOTICE**

- When the boom is fully lowered during oblique digging, the boom interferes with the undercarriage. Operate the boom carefully.

Bucket	Capacity	Width	Weight	Number of teeth	Arm			
					2.0m	2.5m	3.05m	3.5m
Standard plate	0.76m <sup>3</sup> 1.00yd <sup>3</sup>	762 mm 30 in	766 kg 1688 lb	4	○	○	○	○
	1.06m <sup>3</sup> 1.38yd <sup>3</sup>	914 mm 36 in	841 kg 1854 lb	5	○	○	○	◇
	1.25m <sup>3</sup> 1.63 yd <sup>3</sup>	1067 mm 42 in	920 kg 2029 lb	5	○ <sup>+</sup>	○ <sup>+</sup>	◇	X
	1.53m <sup>3</sup> 2.00 yd <sup>3</sup>	1219 mm 48 in	981 kg 2162 lb	5	○ <sup>+</sup>	○ <sup>+</sup>	◇	X
Heavy duty plate	0.76m <sup>3</sup> 1.00yd <sup>3</sup>	762 mm 30 in	986 kg 2173 lb	4	○	○	○	○
	1.06m <sup>3</sup> 1.38yd <sup>3</sup>	914 mm 36 in	1079 kg 2378 lb	4	○	○	○	◇
	1.25m <sup>3</sup> 1.63 yd <sup>3</sup>	1067 mm 42 in	1197 kg 2640 lb	5	○ <sup>+</sup>	○ <sup>+</sup>	◇	X
	1.53m <sup>3</sup> 2.00 yd <sup>3</sup>	1219 mm 48 in	1290 kg 2845 lb	5	○ <sup>+</sup>	○ <sup>+</sup>	◇	X
Heavy duty cast	0.76m <sup>3</sup> 1.00yd <sup>3</sup>	762 mm 30 in	1022 kg 2254 lb	4	○	○	○	○
	1.06m <sup>3</sup> 1.38yd <sup>3</sup>	991 mm 39 in	1178 kg 2598 lb	5	○	○	○	◇
	1.24m <sup>3</sup> 1.62 yd <sup>3</sup>	1143 mm 45 in	1269 kg 2797 lb	5	○ <sup>+</sup>	○ <sup>+</sup>	◇	X



## OPTIONS, ATTACHMENTS

### 31.3 SELECTION OF TRACK SHOES

Select suitable track shoes to match the operating conditions.

- Confirm the category from the list of uses in Table 1, then use Table 2 to select the shoe.
- Categories B and C are wide shoes, so there are limitations on their use. When using these shoes, check the precautions, then investigate and study fully the conditions of use to confirm that these shoes are suitable.
- When selecting the shoe width, select the narrowest shoe possible that will give the required flotation and ground pressure. If a wider shoe than necessary is used, the load on the track will increase, and this will cause the shoes to bend, links to crack, pins to break, shoe bolts to come loose, and various other problems.

**Table 1**

Category	Use	Precautions when using
A	Rocky ground, riverbeds, normal soil	<ul style="list-style-type: none"> <li>• On rough ground with large obstacles such as boulders or fallen trees, travel at low speed.</li> </ul>
B	Normal soil, soft ground	<ul style="list-style-type: none"> <li>• These shoes cannot be used on rough ground where there are large obstacles such as boulders or fallen trees.</li> <li>• Travel at Hi or Mi speed only on flat ground, and if it is impossible to avoid going over obstacles, shift down and travel at half speed in Lo.</li> </ul>
C	Extremely soft or swampy ground	<ul style="list-style-type: none"> <li>• Use the shoes only in places where the machine sinks and it is impossible to use A or B shoes.</li> <li>• These shoes cannot be used on rough ground where there are large obstacles such as boulders or fallen trees.</li> <li>• Travel at Hi or Mi speed only on flat ground, and if it is impossible to avoid going over obstacles, shift down and travel at half speed in Lo.</li> </ul>

**Table 2**

Track shoe	PC270LC-6	
	Specifications	Category
600 mm triple grouser	Optional	A
700 mm triple grouser	Standard	B
800 mm triple grouser	Optional	C

### 31.4 BACKHOE CONTROL PATTERN CONVERSION

The work equipment control levers may be changed to a popular backhoe control pattern to fit individual operator's preferences.

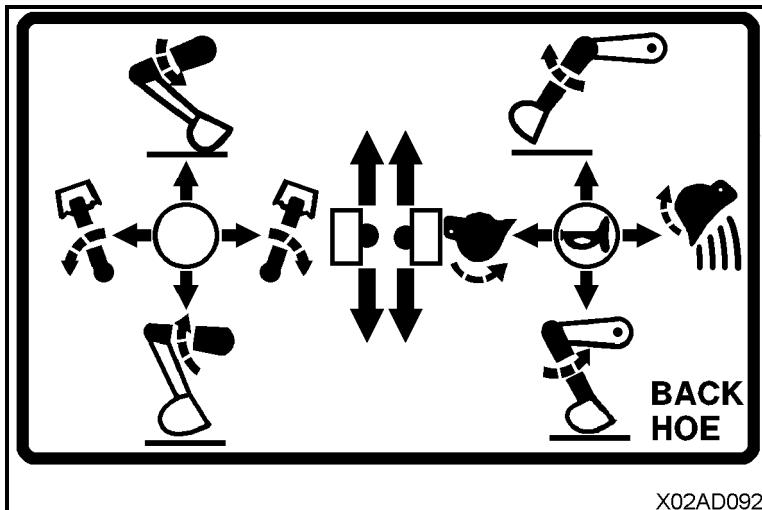
Control pattern differences

Arm Dump	↔	Boom down
Arm Excavation	↔	Boom up

This conversion **MUST** be performed by your distributor.

**⚠ WARNING**

- After converting the excavator control pattern to the backhoe pattern, all operator's and maintenance personnel should make note of the change.
- The excavator control pattern label **MUST** be replaced by the backhoe pattern label 203-916-A730 shown below.



### 32. EXTENDING MACHINE SERVICE LIFE

This section describes the necessary precautions to be observed when operating a hydraulic excavator equipped with an attachment.

#### NOTICE

Select the attachment most suited to the machine. The models to which attachments can be mounted vary. For selection of attachment and machine model, consult your distributor.

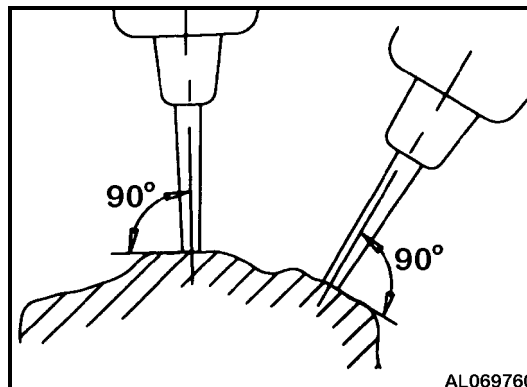
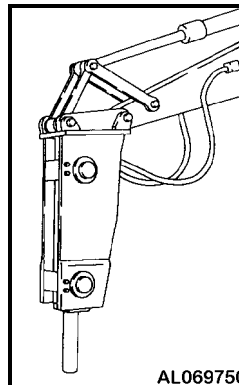
#### 32.1 HYDRAULIC BREAKER

##### 32.1.1 MAIN FIELDS OF APPLICATION

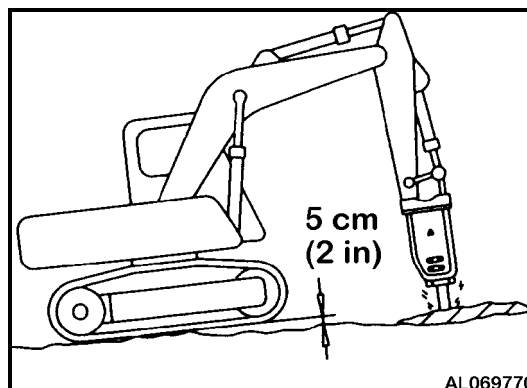
- Crushed rock
- Demolition work
- Road construction

This attachment can be used for a wide range of work including demolition of buildings, breaking up of road surfaces, tunnel work, breaking up slag, rock crushing, and breaking operations in quarries.

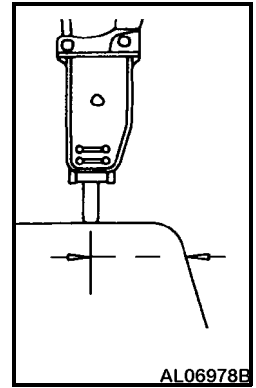
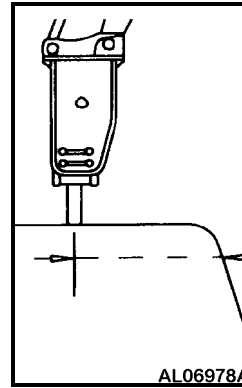
Keep the chisel pushed perpendicularly against the impact surface when carrying out breaking operations.



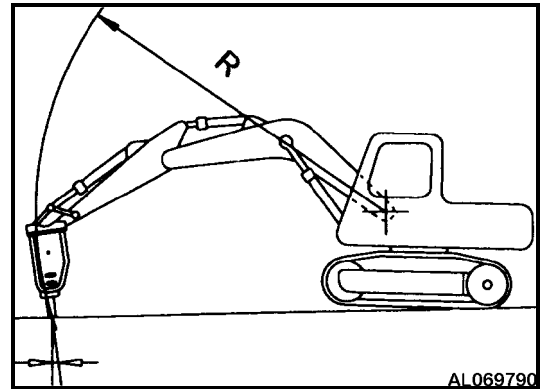
When applying impact, push the chisel against the impact surface and operate so that the chassis rises 5 cm (2 in) off the ground. Do not let the machine come further off the ground than is necessary.



When applying continuous impact to the same impact surface, if the chisel does not penetrate or break the surface within 1 minute, change the point of impact and carry out breaking operations closer to the edge.



The direction of penetration of the chisel and the direction of the breaker body will gradually move out of line with each other, so always adjust the bucket cylinder to keep them aligned.



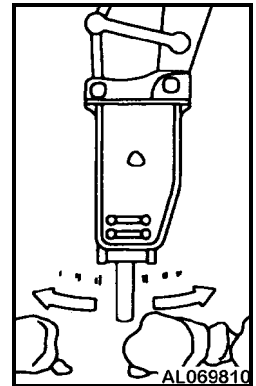
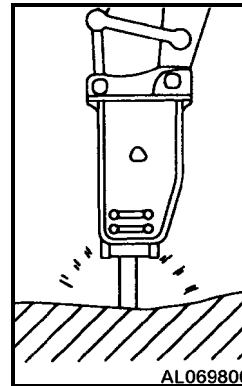
Always keep the chisel pressed against the impact surface properly to prevent using the impact force when there is no resistance.

**32.1.2 MISTAKEN METHODS OF USE**

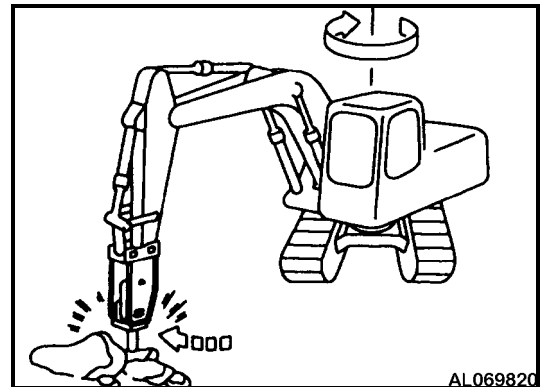
To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

Using the mount to gather in pieces of rock



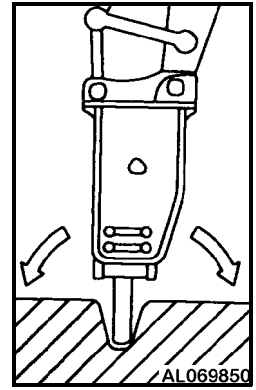
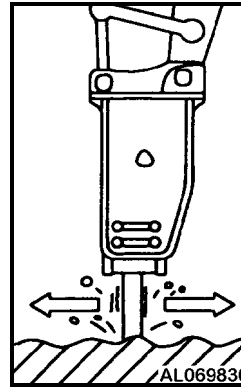
Operations using the swing force



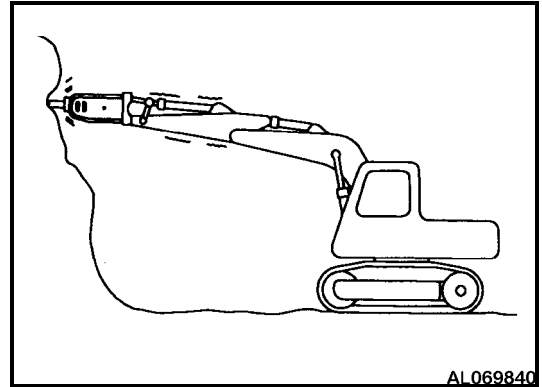
## OPTIONS, ATTACHMENTS

Moving the chisel while carrying out impacting operations

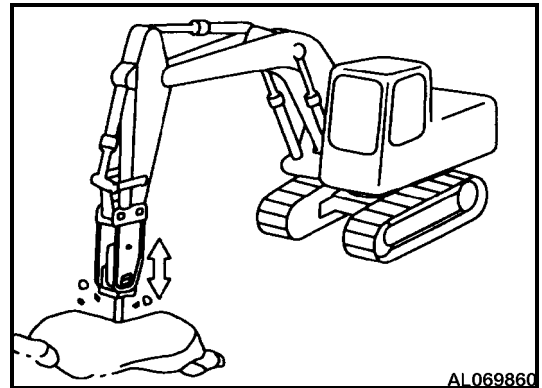
Twisting the chisel when it has penetrated the rock



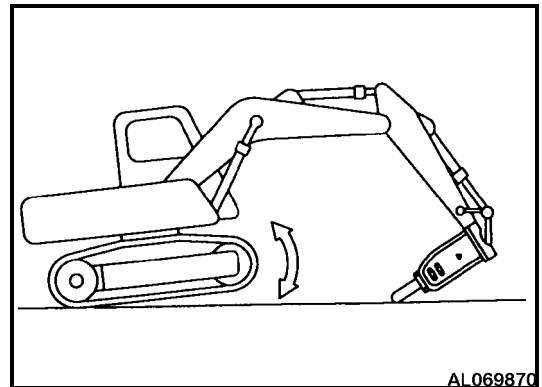
Holding the chisel horizontal or pointed up when carrying out impacting operations



Pecking operations



Extending the bucket cylinder fully and thrusting to raise the machine off the ground

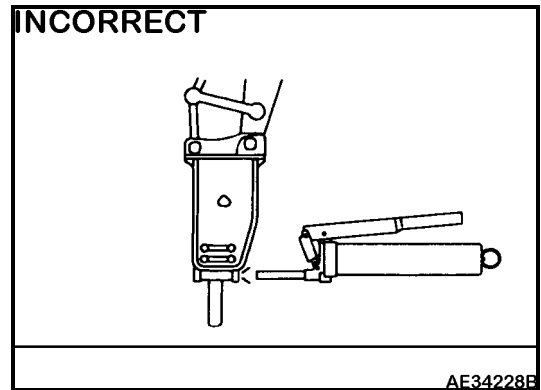
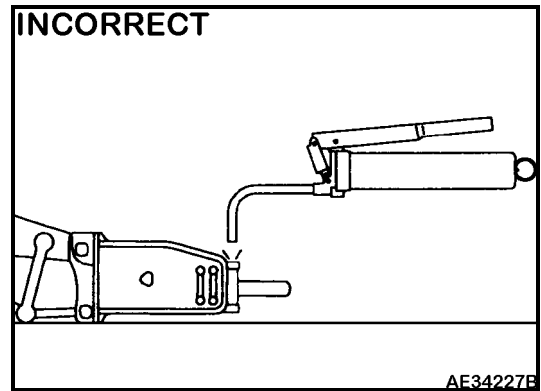
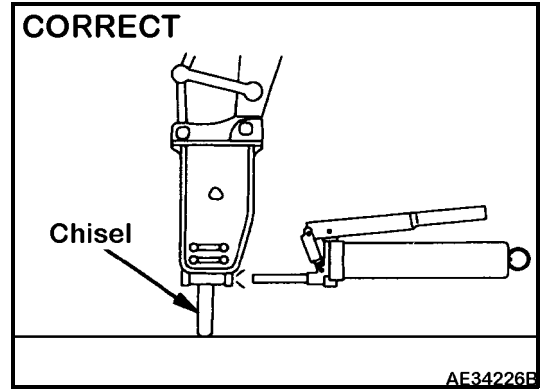


**32.1.3 GREASING POSITION FOR HYDRAULIC BREAKER**

Supply grease in the correct position.

**NOTICE**

If grease is supplied in an incorrect position, the breaker is filled with more grease than necessary. As a result, soil and sand will enter the hydraulic circuit and can damage the hydraulic devices while the breaker is used. Accordingly, be sure to supply grease in the correct position.

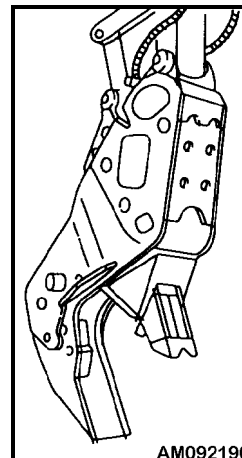


**32.2 CRUSHER**

**32.2.1 MAIN FIELDS OF APPLICATION**

- Road repair work
- Demolition work

This attachment can be used for a wide range of work including peeling off and crushing pavement roads, demolishing wooden houses and buildings, and crushing foundation and roadbeds.



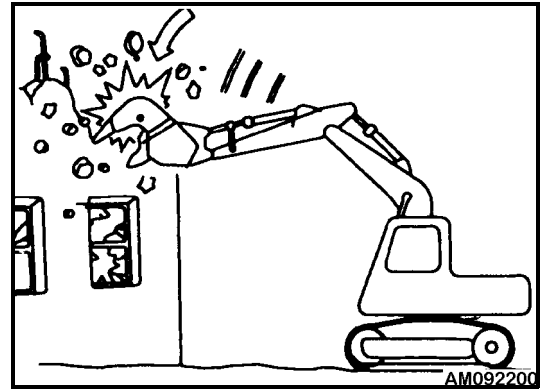
## OPTIONS, ATTACHMENTS

### 32.2.2 MISTAKEN METHODS OF USE

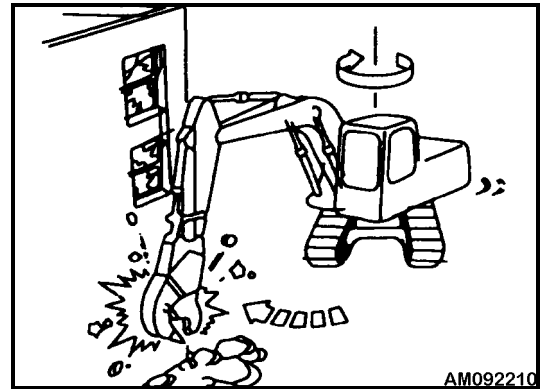
To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

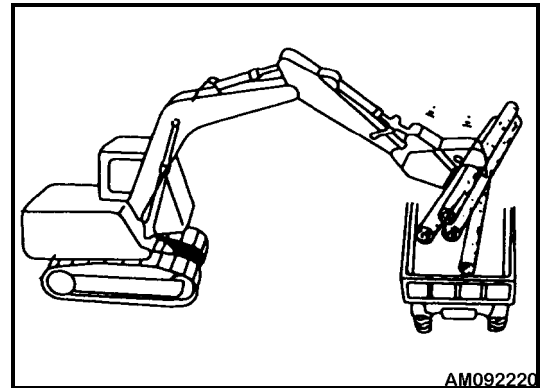
Impact operations using attachment



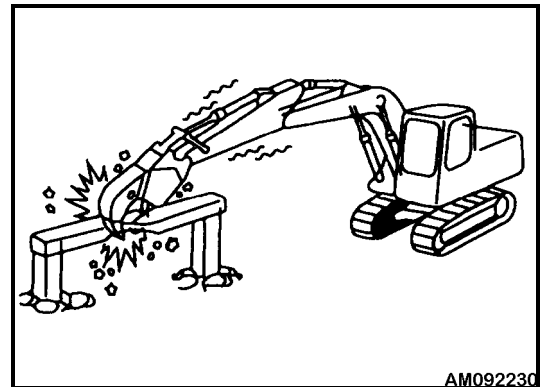
Impact operations using swing force



Overloading work equipment during lifting and loading operations



Operations using attachment to grip at an angle

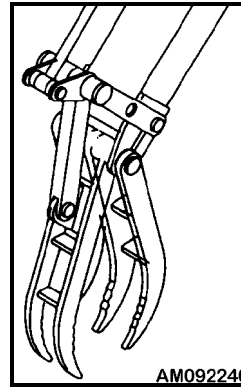


### 32.3 GRAB FORK

#### 32.3.1 MAIN FIELDS OF APPLICATION

- Disposing of industrial waste
- Disposing of demolition waste

This can be used for a wide range of work including collecting or loading demolition waste materials and debris, timber, grass etc.

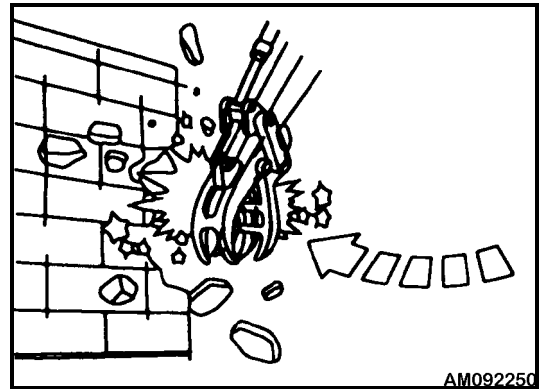


#### 32.3.2 MISTAKEN METHODS OF USE

To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

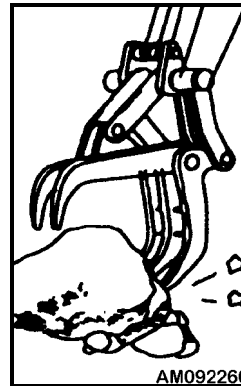
- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

Operations using the swing force

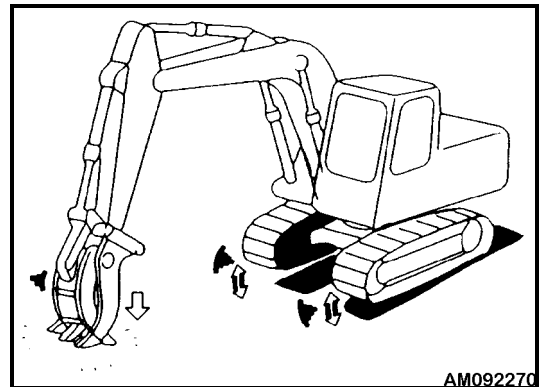


Operations using one side of work equipment

Impact operation with no load



Pushing fork into ground surface to jack up and change direction of machine





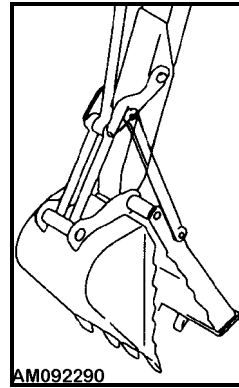
## OPTIONS, ATTACHMENTS

### 32.4 GRAPPLE BUCKET

#### 32.4.1 MAIN FIELDS OF APPLICATION

- Demolition
- Disposing of industrial waste
- Forestry

This bucket is widely used for demolition including breaking-up work, grading and digging, clean-up work after natural disasters, dumping industrial waste, and forestry work, etc.

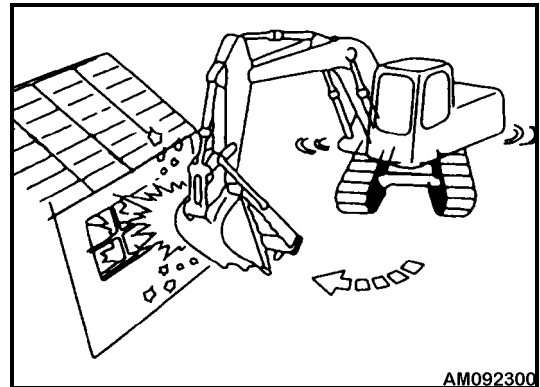


#### 32.4.2 MISTAKEN METHODS OF USE

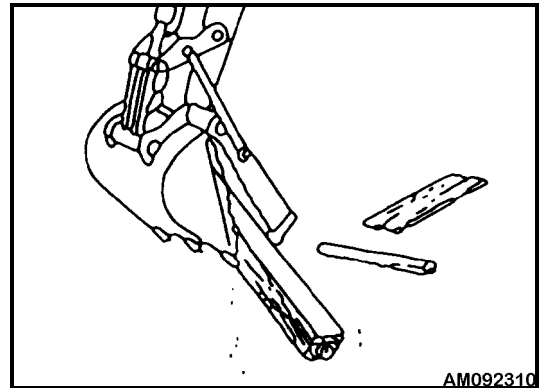
To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

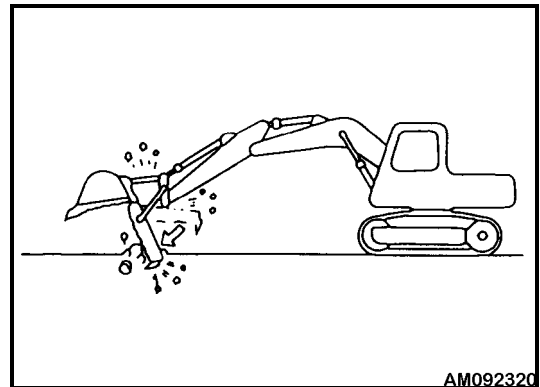
Operations using the swing force



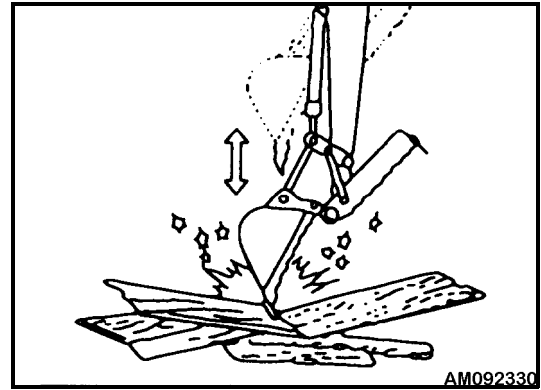
Grabbing an object using buckets on only one side



Closing the sub-bucket with the boom and arm fully extended.



Impact operation with no load

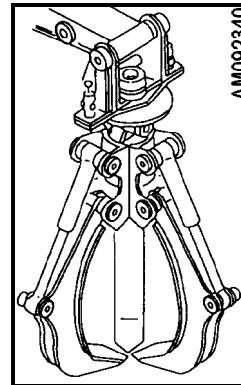


## **32.5 SCRAP GRAPPLE**

### **32.5.1 MAIN FIELDS OF APPLICATION**

- Disposal of rock or debris

This attachment is mounted to the arm end and used to grasp rock, debris etc. by opening and closing the claws (3 to 5) corresponding to the extension and retraction of the hydraulic cylinder.

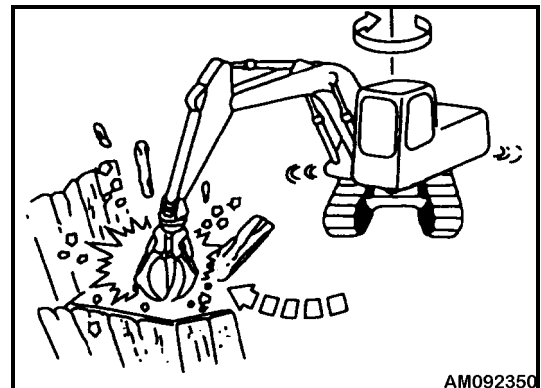


### **32.5.2 MISTAKEN METHODS OF USE**

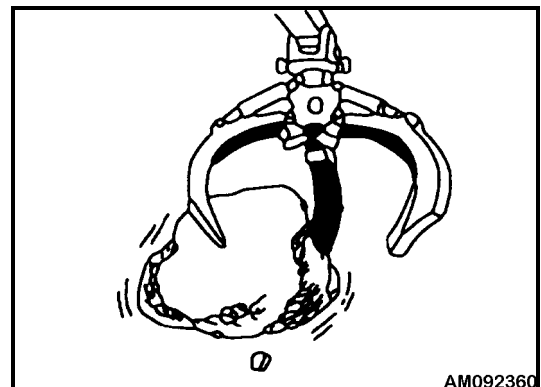
To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

Operations using the swing force

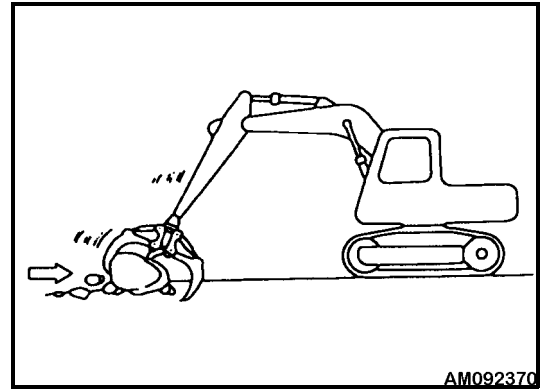


Operations using one side of work equipment

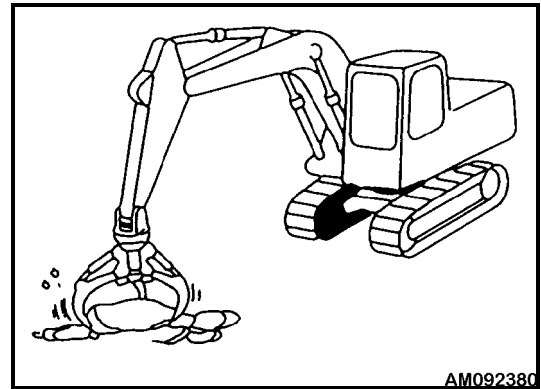


## OPTIONS, ATTACHMENTS

Catching and dragging with claw end



Gouging

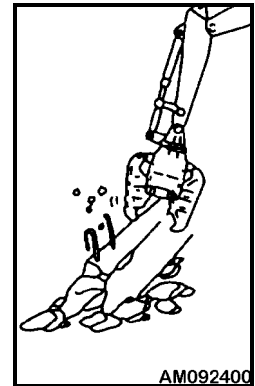
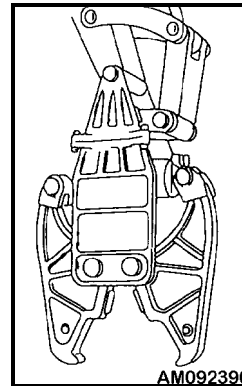


### 32.6 CRUSHER AND CUTTER

#### 32.6.1 MAIN FIELDS OF APPLICATION

- Demolition
- Road repair work

This is the optimum attachment for demolition of steel frame reinforced structures, and for crushing of concrete blocks and rock, etc. The unique blade shape provides heavy crushing power.



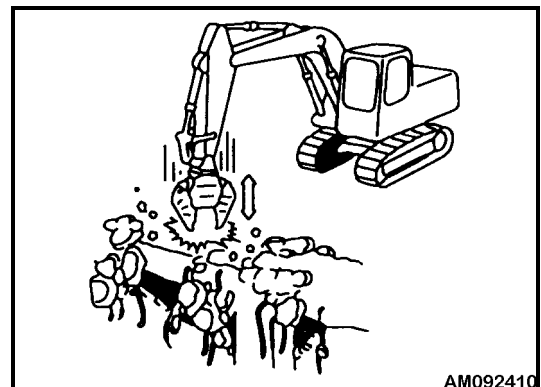
#### 32.6.2 MISTAKEN METHODS OF USE

To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

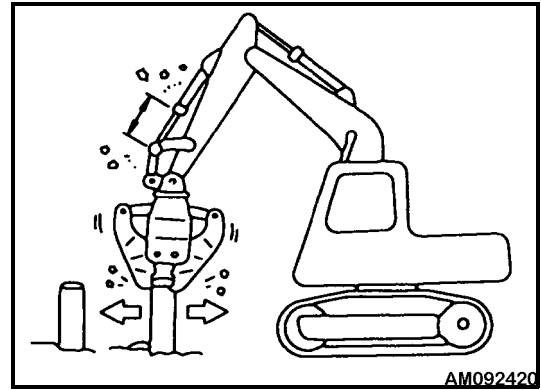
- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

Operations using cutting tip on one side only

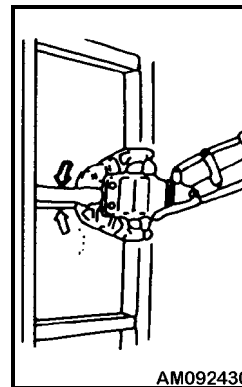
Impact operation with no load



Twisting operations at end of cylinder stroke



Sudden gripping and breaking operations

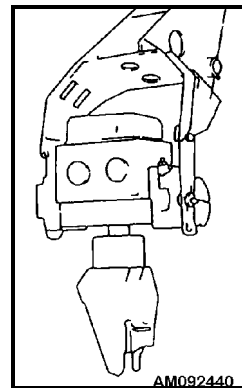


## **32.7 HYDRAULIC PILE DRIVER**

### **32.7.1 MAIN FIELDS OF APPLICATION**

- Foundation work
- River work
- Water supply and sewerage

This is a piling machine employing the hydraulic power source of the excavator. The machine features a long arm and a chuck unit movable by 360°. This facilitates operations such as driving and removing long piles, driving in piles at corners, vertical driving etc.

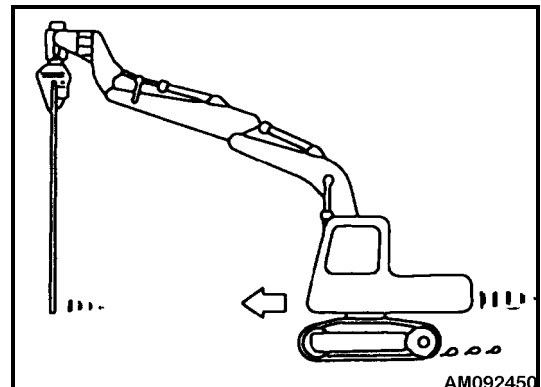


### **32.7.2 MISTAKEN METHODS OF USE**

To ensure that the machine has a long life, and to ensure that operations are carried out in safety, do not operate the machine in any of the following ways.

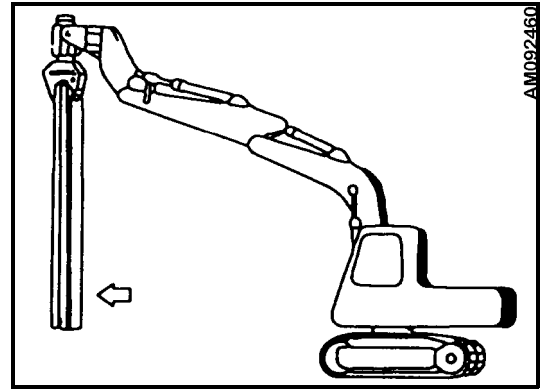
- Do not operate the cylinder to the end of its stroke. Always leave 5 cm (2 in) to spare.

Forward or swing motion while grasping a pile

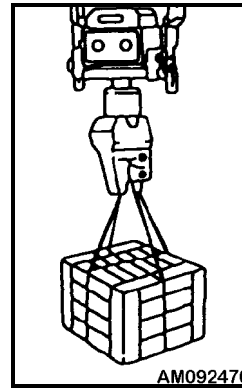


## OPTIONS, ATTACHMENTS

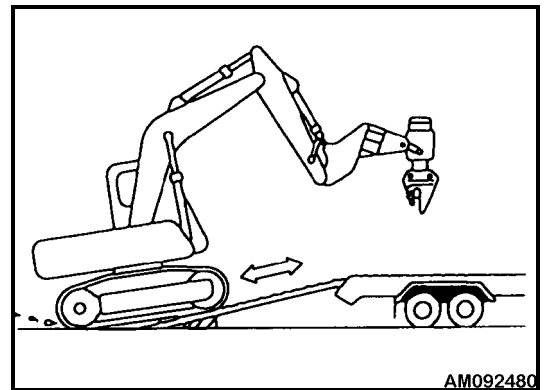
Lifting more than two piles at the same time



Work other than standard works



Loading or unloading a machine equipped with hydraulic pile driver



**PROPOSAL FOR MANUAL REVISION**

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<b>P R O P O S E R</b>	NAME OF COMPANY:		LOCATION:			
	DEPARTMENT:		PHONE NO:			
	NAME:		DATE:			
	MANUAL NAME:					
	MANUAL NO:					
MACHINE MODEL: S/N IF APPLICABLE:						
PAGE NO:						
PROBLEM:						
<p>Attach photo or sketch.          If more space is needed, use another sheet.</p>						
<b>FOR INTERNAL USE ONLY</b>						
CORRECTIVE ACTION:						
