

EX3600-6
HYDRAULIC EXCAVATOR OPERATOR'S MANUAL

PART NO. EM18M-1-1T

HITACHI

Operator's Manual

EX3600-6 **Hydraulic Excavator**

 **Hitachi Construction Machinery Co., Ltd.**
URL: <http://www.hitachi-c-m.com>



Recycle This book is printed on recycled paper.

PRINTED IN JAPAN (E) 2006, 08

EM18M-1-1T

Serial No 001001 and up

INTRODUCTION

Read this manual carefully to learn how to operate and service your machine correctly. Failure to do so could result in personal injury and/or machine damage.

This manual should be considered a permanent part of your machine and should remain with the machine when you sell it.

This machine is of metric design. Measurements in this manual are metric. Use only metric hardware and tools as specified.

Write product identification numbers in the Machine Numbers section. Accurately record all the numbers to help in tracing the machine should it be stolen. Your dealer also needs these numbers when you order parts. If this manual is kept on the machine, also file the identification numbers in a secure place off the machine.

Warranty is provided as a part of Hitachi's support program for customers who operate and maintain their equipment as described in this manual. The warranty is explained on the warranty certificate which you should have received from your dealer.

This warranty provides you the assurance that Hitachi will back its products when defects occur within the warranty period. In some circumstances, Hitachi also provides field improvements, often without charge to the customer, even if the product is out of warranty.

Should the equipment be abused or modified to change its performance beyond the original factory specifications, the warranty will become void and field improvements may be denied. Setting fuel delivery above specifications or otherwise overpowering machines will result in such action.

Moreover, when replacement parts are required, be sure to use genuine Hitachi parts. Failure to do so may result in voiding the warranty and/or denial of field improvements.

Only qualified, experienced operators officially licensed (according to local law) should be allowed to operate the machine.

Moreover, only officially licensed personnel should be allowed to inspect/service the machine.

The Yellow Pages in this operator's manual contain IMPORTANT SAFETY INFORMATION.

Read these pages thoroughly and familiarize yourself with the safety standards and recommendations set forth in these yellow pages of the manual.

Follow all safety instructions prior to and while operating the excavator.

Prior to operating this machine, in a country other than a country of its intended use, it may be necessary to make modifications to it so that it complies with the local regulatory standards (including safety standards) and legal requirements of that particular country.

Please do not export or operate this machine outside of the country of its intended use until such compliance has been confirmed. Please contact Hitachi Construction Machinery Co., Ltd. or any of our authorized distributor or dealer if you have any questions concerning compliance.

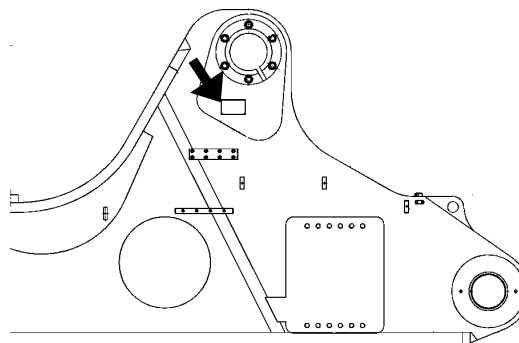
All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

MACHINE NUMBERS

MACHINE TYPE AND SERIAL NUMBER

MODEL/TYPE: _____

PRODUCT
IDENTIFICATION
NUMBER: _____



M18M-00-001

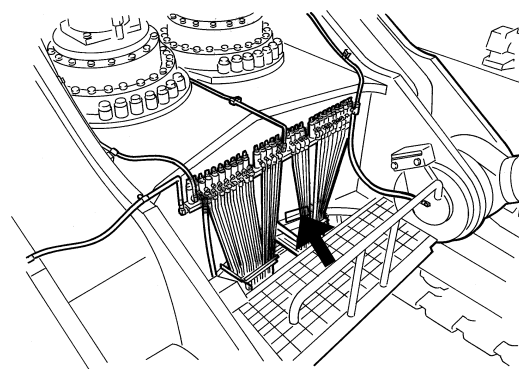
PRODUCT IDENTIFICATION NUMBER

PRODUCT
IDENTIFICATION
NUMBER: _____



NOTE:

_____ Marks to indicate the
start and end of the
PIN
_____ PRODUCT IDENTIFICATION
NUMBER (PIN)

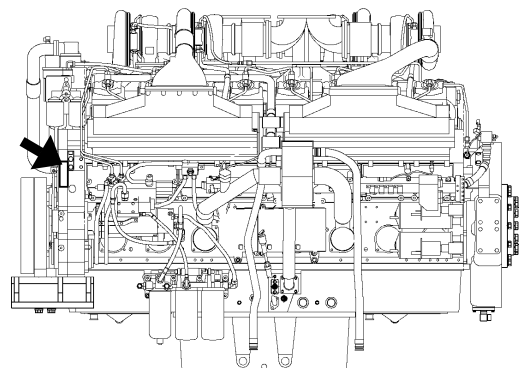


M146-07-018

ENGINE TYPE AND SERIAL NUMBER

TYPE: _____

MFG. NO. _____



M18M-00-002

TRAVEL MOTOR TYPE AND SERIAL NUMBER

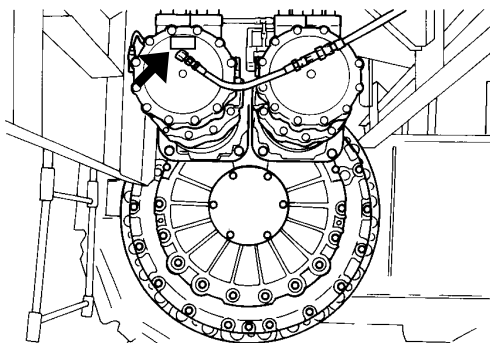
TYPE: _____

MFG. NO.(LEFT FRONT) : _____

MFG. NO.(LEFT REAR) : _____

MFG. NO.(RIGHT FRONT) : _____

MFG. NO.(RIGHT REAR) : _____



M145-07-079

MACHINE NUMBERS

SWING MOTOR TYPE AND SERIAL NUMBER

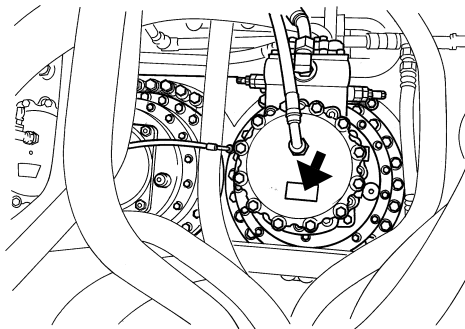
TYPE: _____

MFG. NO.(FRONT LEFT) : _____

MFG. NO.(FRONT RIGHT): _____

MFG. NO.(REAR LEFT): _____

MFG. NO.(REAR RIGHT): _____



M146-07-028

HYDRAULIC PUMP TYPE AND SERIAL NUMBER

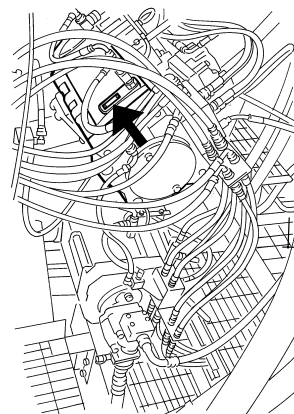
TYPE: _____

MFG. NO.(1, 2): _____

MFG. NO.(3, 4): _____

MFG. NO.(5, 6): _____

MFG. NO.(7, 8): _____

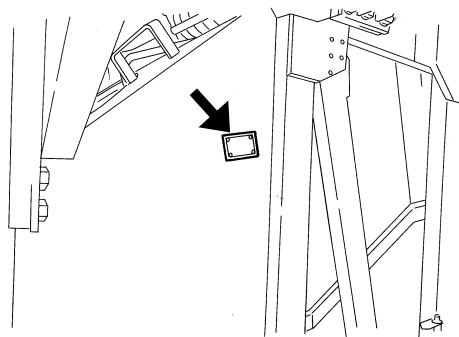


M146-07-059

FRONT TYPE AND SERIAL NUMBER (LOADING SHOVEL)

TYPE: _____

MFG. NO.: _____

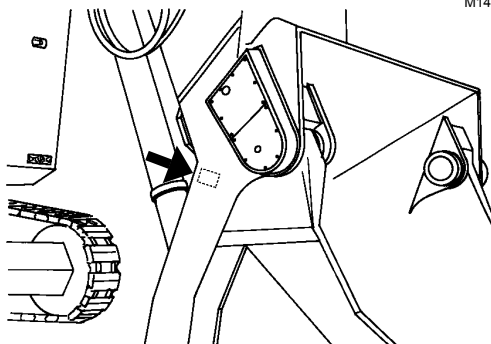


M146-07-060

BUCKET TYPE AND SERIAL NUMBER (LOADING SHOVEL)

TYPE: _____

MFG. NO.: _____



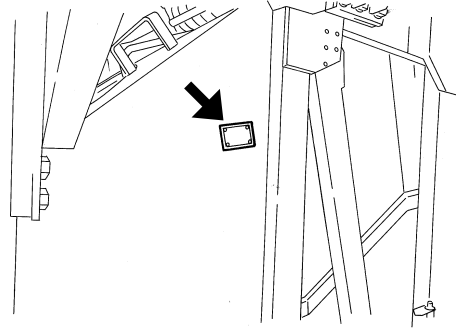
M117-12-003

MACHINE NUMBERS

FRONT TYPE AND SERIAL NUMBER (BACKHOE BOOM)

TYPE: _____

MFG. NO.: _____

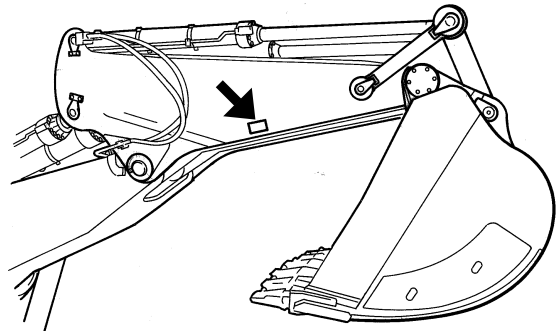


M146-07-060

FRONT TYPE AND SERIAL NUMBER (BACKHOE ARM)

TYPE: _____

MFG. NO.: _____

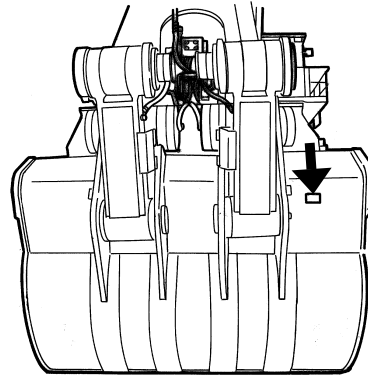


M146-07-061

BUCKET TYPE AND SERIAL NUMBER (BACKHOE)

TYPE: _____

MFG. NO.: _____



M146-01-020

CONTROL VALVE TYPE AND SERIAL NUMBER

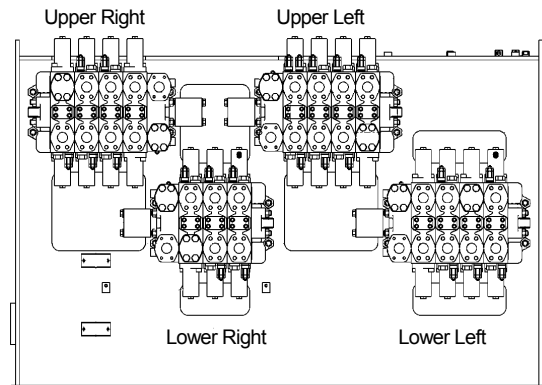
TYPE: _____

MFG. NO.(UPPER LEFT): _____

MFG. NO.(UPPER RIGHT): _____

MFG. NO.(LOWER LEFT): _____

MFG. NO.(LOWER RIGHT): _____



M18M-00-003

CONTENTS

MACHINE NUMBERS

SAFETY

Recognize Safety Information.....	S-1
Understand Signal Words.....	S-1
Follow Safety Instructions.....	S-2
Prepare for Emergencies.....	S-2
Wear Protective Clothing.....	S-3
Protect Against Noise.....	S-3
Inspect Machine.....	S-3
General Precautions for Cab.....	S-4
Use Handholds and Steps.....	S-5
Adjust the Operator's Seat.....	S-5
Fasten Your Seat Belt.....	S-6
Move and Operate Machine Safely.....	S-6
Handle Starting Aids Safely.....	S-6
Operate Only from Operator's Seat.....	S-7
Jump Starting.....	S-7
Keep Riders Off Machine.....	S-7
Investigate Job Site Beforehand.....	S-8
Protect Against Falling Stones and Debris.....	S-8
Provide Signals for Jobs Involving Multiple Numbers of Machines.....	S-9
Confirm Direction of Machine to be Driven.....	S-9
Drive Machine Safely.....	S-10
Avoid Injury from Rollover Accidents.....	S-11
Avoid Injury from Back-Over and Swing Accidents.....	S-12
Keep Person Clear from Working Area.....	S-13
Never Position Bucket Over Anyone.....	S-13
Avoid Undercutting.....	S-13
Avoid Tipping.....	S-14
Never Undercut a High Bank.....	S-14
Dig with Caution.....	S-15
Operate with Caution.....	S-15
Avoid Power Lines.....	S-15
Object Handling.....	S-16
Protect Against Flying Debris.....	S-16
Park Machine Safely.....	S-17
Handle Fluids Safely – Avoid Fires.....	S-17
Practice Safe Maintenance.....	S-18
Warn Others of Service Work.....	S-19
Support Machine Properly.....	S-19
Stay Clear of Moving Parts.....	S-19
Prevent Parts from Flying.....	S-20
Store Attachments Safely.....	S-20
Prevent Burns.....	S-21
Replace Rubber Hoses Periodically.....	S-21
Avoid High-Pressure Fluids.....	S-22
Prevent Fires.....	S-23
Evacuating in Case of Fire.....	S-24
Beware of Exhaust Fumes.....	S-24
Precautions for Welding and Grinding.....	S-25
Avoid Heating Near Pressurized Fluid Lines.....	S-25
Avoid Applying Heat to Lines Containing Flammable Fluids.....	S-25

Remove Paint Before Welding or Heating.....	S-26
Beware of Asbestos Dust.....	S-26
Prevent Battery Explosions.....	S-27
Service Air Conditioning System Safely.....	S-27
Handle Chemical Products Safely.....	S-28
Dispose of Waste Properly.....	S-28

SAFETY SIGNS	S-29
---------------------------	------

COMPONENTS NAME	1-1
------------------------------	-----

HANDLING STAIRWAY/EMERGENCY ROPE

Using Stairway.....	1-2
Operating Stairway.....	1-2
Emergency Escape.....	1-5
Emergency Exit.....	1-6
Evacuating in Case of Fire.....	1-6

OPERATOR'S STATION

Cab Features.....	1-8
Monitor Display.....	1-9
Starting Check Screen.....	1-9
Meter Check Screen.....	1-10
Tachometer.....	1-11
Coolant Temperature Gauge.....	1-11
Hydraulic Oil Temperature Gauge.....	1-11
Fuel Gauge.....	1-11
Engine Oil Pressure Gauge.....	1-12
Engine Oil Temperature Gauge.....	1-12
Hour Meter.....	1-12
Warning Indicators.....	1-12
Alternator Indicator.....	1-12
Pump Transmission Oil Level Indicator.....	1-13
Engine Stop Indicator.....	1-13
Engine Oil Pressure Indicator.....	1-13
Coolant Overheat Indicator.....	1-13
Coolant Level Indicator.....	1-14
Engine Over Run Indicator.....	1-14
Fuel Temperature Indicator.....	1-14
Hydraulic Oil Level Indicator.....	1-14
Stop Valve Indicator.....	1-15
Auto-Lubrication Indicator.....	1-15
Fast-Filling Indicator.....	1-16
Emergency Engine Stop Indicator.....	1-16
Tension Indicator.....	1-16
Electric Lever Indicator.....	1-16
Caution Indicators.....	1-17
Exhaust Temperature Indicator.....	1-17
Engine Warning Indicator.....	1-17
Hydraulic Oil Overheat Indicator.....	1-17
Pump Contamination Indicator.....	1-17
Stairway Position Indicator.....	1-18
Air Cleaner Restriction Indicator.....	1-18
Electrical Equipment Box Indicator.....	1-18
Status Indicators.....	1-18
Auto-Idle Indicator.....	1-18

CONTENTS

Travel Mode Indicator	1-19
Prelub Indicator	1-19
Left Console	1-20
Warning Lamp	1-20
Caution Lamp	1-20
Key Pad	1-20
Monitor Contrast Switch	1-20
Wiper Switch	1-21
Washer Switch	1-21
Wiper Delay Selector Switch	1-21
Air Conditioners	1-22
Designations And Functions Of Controls	1-23
Cooling	1-25
Heating	1-25
Dehumidifying And Heating	1-25
Defrosting	1-26
Blower Operation Without Cooling or Heating	1-26
Ventilation The Cab	1-26
AM/FM Radio Operation	1-27
Digital Clock Setting Procedure	1-28
Right Console	1-29
Key Switch	1-29
Emergency Engine Stop Switch	1-30
Engine Start Switch	1-30
Engine Stop Switch	1-30
Engine Speed Control Dial	1-31
Work Light Switch	1-32
Dome Light Switch	1-33
Maintenance Light Switch	1-34
Entrance Light Switch	1-35
Travel Mode Switch	1-36
Auto-Idle Switch	1-36
Buzzer Stop Switch	1-37
Fast-Filling System	1-38
Rear Console	1-39
Horn Switch	1-40
Adjusting The Seat	1-41
Seat Belt	1-44
Cab Door Release Button	1-45
Opening Cab Left Window	1-45

BREAK-IN

Observe Machine Closely	2-1
Every 10 Hours or Each Shift	2-1
After the First 50 Hours	2-2

OPERATING THE ENGINE

Inspect Machine Daily Before Starting	3-1
Before Turning Power ON	3-2
Turning Power ON	3-3
Starting the Engine	3-8
Starting in Cold Weather	3-9
Check Instruments after Starting	3-10
Using Booster Batteries	3-11
Stopping the Engine	3-13

Stopping the Engine in Emergency (In The Cab)	3-14
Stopping the Engine in Emergency (Except In The Cab)	3-15

DRIVING THE MACHINE

Drive the Machine Carefully	4-1
Steering the Machine Using Pedals	4-2
Steering the Machine Using Levers	4-3
Travel Mode Switch	4-4
Travel Alarm	4-5
Traveling	4-6
Operating on Soft Ground	4-7
Raise One Track Using Boom and Arm	4-7
Towing Machine a Short Distance	4-8
Operating Ground Condition	4-9
Precautions for Traveling on Slopes	4-10
Parking the Machine on Slopes	4-11
Parking the Machine	4-11

OPERATING THE MACHINE

Control Lever (ISO Pattern Backhoe)	5-1
Control Lever (HITACHI Pattern Backhoe)	5-2
Control Lever (ISO Pattern Loading Shovel)	5-3
Control Lever (HITACHI Pattern Loading Shovel)	5-4
Bucket Open-Close Pedals (Loading Shovel)	5-5
Pilot Control Shut-Off Lever	5-6
Engine Speed Control	5-7
Auto-Idle	5-8
Warming-Up Operation	5-9
Warming-Up the Cylinders and Motors	5-10
Precautions for Operations	5-11
Operate the Machine Safely	5-12
Operating Backhoe	5-13
Grading Operation	5-13
Avoid Abusive Operation	5-14
Operating Tips	5-15
Avoid Swinging Bucket to Move Objects	5-15
Loading Shovel Operation	5-16
Prohibited Operation	5-16
Object Handling	5-18
Overnight Storage Instructions	5-19

MAINTENANCE

Correct Maintenance and Inspection Procedures	7-1
Check the Hour Meter Regularly	7-2
Use Correct Fuels and Lubricants	7-2
Prepare Machine for Maintenance	7-3
Open Access Doors for Service	7-5
Inspection/Maintenance Lights	7-6
Use a Chain to Prevent Falling Accidents	7-7
Electric Pump (Optional)	7-8
Construction Outline	7-10
Hydraulic System	7-11
Periodic Replacement of Parts	7-14

MAINTENANCE UNDER SPECIAL ENVIRONMENTAL CONDITIONS

Maintenance Under Special

Environmental Conditions 9-1

STORAGE

Storing the Machine	10-1
Removing the Machine from Storage	10-2
Transporting the Machine	10-2

TROUBLESHOOTING

Cummins Fault Code Lamps and Diagnostic Switches	11-1
Engine	11-2
Electrical System	11-6
Mode Selection	11-9
Hydraulic System	11-9
Auto-Idle	11-12

CONTENTS

SPECIFICATIONS

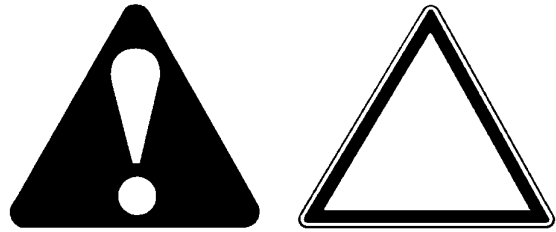
Specifications	12-1
Working Range (Loading Shovel).....	12-2
Working Range (Backhoe)	12-3

INDEX	14-1
--------------------	------

SAFETY

RECOGNIZE SAFETY INFORMATION

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



SA-688

001-E01A-0001

UNDERSTAND SIGNAL WORDS

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



SA-1223

- **CAUTION** also calls attention to safety messages in this manual.
- To avoid confusing machine protection with personal safety messages, a signal word **IMPORTANT** indicates a situation which, if not avoided, could result in damage to the machine.
-  **NOTE** indicates an additional explanation for an element of information.

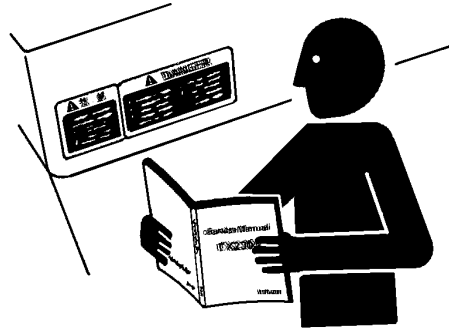
002-E01A-1223

SAFETY

FOLLOW SAFETY INSTRUCTIONS

- Carefully read and follow all safety signs on the machine and all safety messages in this manual.
- Safety signs should be installed, maintained and replaced when necessary.
 - If a safety sign or this manual is damaged or missing, order a replacement from your authorized dealer in the same way you order other replacement parts (be sure to state machine model and serial number when ordering).
- Learn how to operate the machine and its controls correctly and safely.
- Allow only trained, qualified, authorized personnel to operate the machine.
- Keep your machine in proper working condition.
 - Unauthorized modifications of the machine may impair its function and/or safety and affect machine life.
- The safety messages in this SAFETY chapter are intended to illustrate basic safety procedures of machines. However it is impossible for these safety messages to cover every hazardous situation you may encounter. If you have any questions, you should first consult your supervisor and/or your authorized dealer before operating or performing maintenance work on the machine.

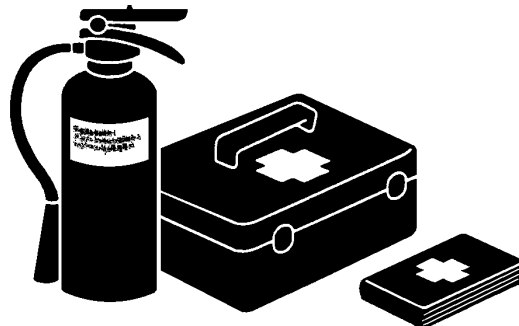
003-E01B-0003



SA-003

PREPARE FOR EMERGENCIES

- Be prepared if a fire starts or if an accident occurs.
 - Keep a first aid kit and fire extinguisher on hand.
 - Thoroughly read and understand the label attached on the fire extinguisher to use it properly.
 - To ensure that a fire-extinguisher can be always used when necessary, check and service the fire-extinguisher at the recommended intervals as specified in the fire-extinguisher manual.
- Establish emergency procedure guidelines to cope with fires and accidents.
- Keep emergency numbers for doctors, ambulance service, hospital, and fire department posted near your telephone.



SA-437

004-E01A-0437

SAFETY

WEAR PROTECTIVE CLOTHING

- Wear close fitting clothing and safety equipment appropriate to the job.

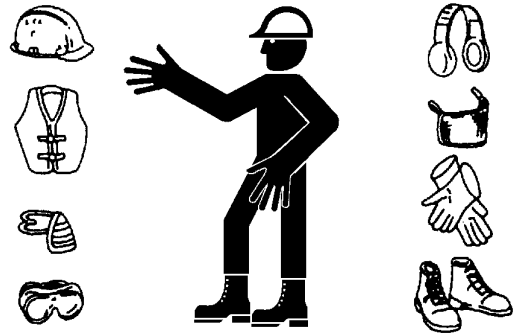
You may need:

- A hard hat
- Safety shoes
- Safety glasses, goggles, or face shield
- Heavy gloves
- Hearing protection
- Reflective clothing
- Wet weather gear
- Respirator or filter mask.

Be sure to wear the correct equipment and clothing for the job. Do not take any chances.

- Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.
- Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the machine.

005-E01A-0438



SA-438

PROTECT AGAINST NOISE

- Prolonged exposure to loud noise can cause impairment or loss of hearing.
- Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortably loud noises.



006-E01A-0434

SA-434

INSPECT MACHINE

- Inspect your machine carefully each day or shift by walking around it before you start it to avoid personal injury.
- In the walk-around inspection, be sure to cover all points described in the "PRE-START INSPECTION" chapter in the operator's manual.



007-E01A-0435

SA-435

SAFETY

GENERAL PRECAUTIONS FOR CAB

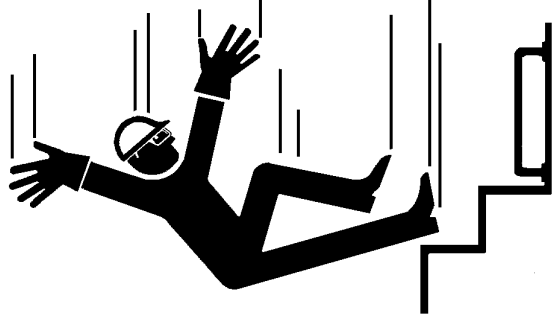
- Before entering the cab, thoroughly remove all dirt and/or oil from the soles of your work boots. If any controls such as a pedal is operated while with dirt and/or oil on the soles of the operator's work boots the operator's foot may slip off the pedal, possibly resulting in a personal accident.
- Do not leave parts and/or tools lying around the operator's seat. Store them in their specified locations.
- Avoid storing transparent bottles in the cab. Do not attach any transparent type window decorations on the windowpanes as they may focus sunlight, possibly starting a fire.
- Refrain from listening to the radio, or using music headphones or mobile telephones in the cab while operating the machine.
- Keep all flammable objects and/or explosives away from the machine.
- After using the ashtray, always cover it to extinguish the match and/or tobacco.
- Do not leave cigarette lighters in the cab. When the temperature in the cab increases, the lighter may explode.

524-E01A-0000

SAFETY

USE HANDHOLDS AND STEPS

- Falling is one of the major causes of personal injury.
 - When you get on and off the machine, always face the machine and maintain a three-point contact with the steps and handrails.
 - Do not use any controls as handholds.
 - Never jump on or off the machine. Never mount or dismount a moving machine.
 - Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.



SA-439

008-E01A-0439

ADJUST THE OPERATOR'S SEAT

- A poorly adjusted seat for either the operator or for the work at hand may quickly fatigue the operator leading to misoperations.
 - The seat should be adjusted whenever changing the operator for the machine.
 - The operator should be able to fully depress the pedals and to correctly operate the control levers with his back against the seat back.
 - If not, move the seat forward or backward, and check again.



SA-378

009-E01A-0378

SAFETY

FASTEN YOUR SEAT BELT

- If the machine should overturn, the operator may become injured and/or thrown from the cab. Additionally the operator may be crushed by the overturning machine, resulting in serious injury or death.
- Prior to operating the machine, thoroughly examine webbing, buckle and attaching hardware. If any item is damaged or worn, replace the seat belt or component before operating the machine.
- Be sure to remain seated with the seat belt securely fastened at all times when the machine is in operation to minimize the chance of injury from an accident.
- We recommend that the seat belt be replaced every three years regardless of its apparent condition.

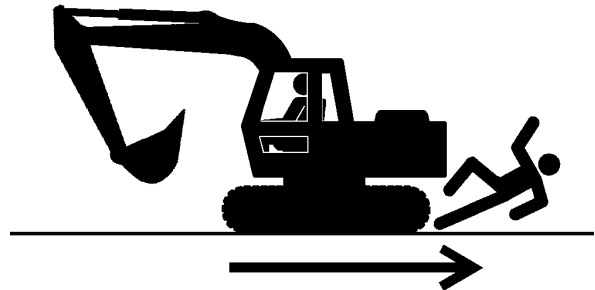


SA-237

010-E01A-0237

MOVE AND OPERATE MACHINE SAFELY

- Bystanders can be run over.
- Take extra care not to run over bystanders. Confirm the location of bystanders before moving, swinging, or operating the machine.
- Always keep the travel alarm and horn in working condition (if equipped). It warns people when the machine starts to move.
- Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the machine.



SA-426

011-E01A-0426

HANDLE STARTING AIDS SAFELY

Starting fluid:

- Starting fluid is highly flammable.
- Keep all sparks and flame away when using it.
- Keep starting fluid well away from batteries and cables.
- Remove container from machine if engine does not need starting fluid.
- To prevent accidental discharge when storing a pressurized container, keep the cap on the container, and store it in a cool, well-protected location.
- Do not incinerate or puncture a starting fluid container.



SA-293

036-E01A-0293-3

SAFETY

OPERATE ONLY FROM OPERATOR'S SEAT

- Inappropriate engine starting procedures may cause the machine to runaway, possibly resulting in serious injury or death.
- Start the engine only from the operator's seat.
- NEVER start the engine while standing on the track or on ground.
- Do not start engine by shorting across starter terminals.
- Before starting the engine, confirm that all control levers are in neutral.

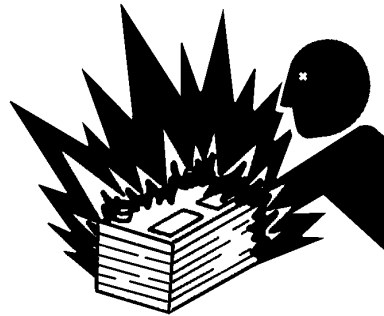


SA-444

012-E01B-0444

JUMP STARTING

- Battery gas can explode, resulting in serious injury.
- If the engine must be jump started, be sure to follow the instructions shown in the "OPERATING THE ENGINE" chapter.
- The operator must be in the operator's seat so that the machine will be under control when the engine starts. Jump starting is a two-person operation.
- Never use a frozen battery.
- Failure to follow correct jump starting procedures could result in a battery explosion or a runaway machine.

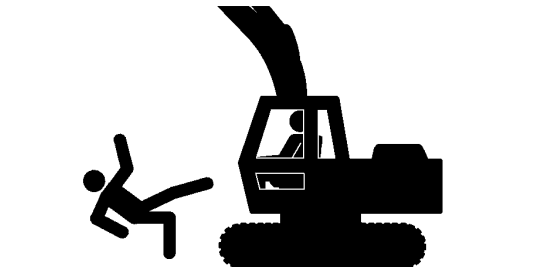


SA-032

S013-E01A-0032

KEEP RIDERS OFF MACHINE

- Riders on machine are subject to injury such as being struck by foreign objects and being thrown off the machine.
- Only allow the operator on the machine. Keep riders off.
- Riders also obstruct the operator's view, resulting in the machine being operated in an unsafe manner.



SA-379

014-E01B-0379

SAFETY

INVESTIGATE JOB SITE BEFOREHAND

- When working at the edge of an excavation or on a road shoulder, the machine could tip over, possibly resulting in serious injury or death.
- Investigate the configuration and ground conditions of the job site beforehand to prevent the machine from falling and to prevent the ground, stockpiles, or banks from collapsing.
- Make a work plan. Use machines appropriate to the work and job site.
- Reinforce ground, edges, and road shoulders as necessary. Keep the machine well back from the edges of excavations and road shoulders.
- When working on an incline or on a road shoulder, employ a signal person as required.
- Confirm that your machine is equipped a FOPS cab before working in areas where the possibility of falling stones or debris exist.
- When the footing is weak, reinforce the ground before starting work.
- When working on frozen ground, be extremely alert. As ambient temperatures rise, footing becomes loose and slippery.
- Beware the possibility of fire when operating the machine near flammable objects such as dry grass.

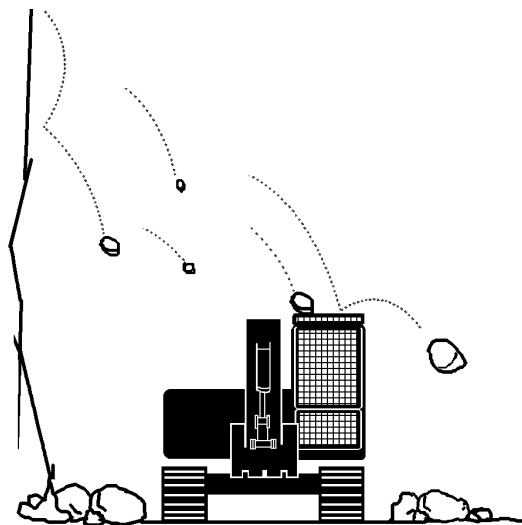


SA-380

015-E01A-0380

PROTECT AGAINST FALLING STONES AND DEBRIS

- Confirm that your machine is FOPS cab equipped before working in areas where the possibility of falling stones or debris exist.



SA-490

015-E01A-0380

SAFETY

PROVIDE SIGNALS FOR JOBS INVOLVING MULTIPLE NUMBERS OF MACHINES

- For jobs involving multiple numbers of machines, provide signals commonly known by all personnel involved. Also, appoint a signal person to coordinate the job site. Make sure that all personnel obey the signal person's directions.

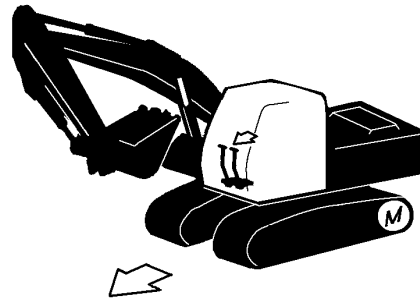


018-E01A-0481

SA-481

CONFIRM DIRECTION OF MACHINE TO BE DRIVEN

- Incorrect travel pedal/lever operation may result in serious injury death.
- Before driving the machine, confirm the position of the undercarriage in relation to the operator's position. If the travel motors are located in front of the cab, the machine will move in reverse when travel pedals/levers are operated to the front.



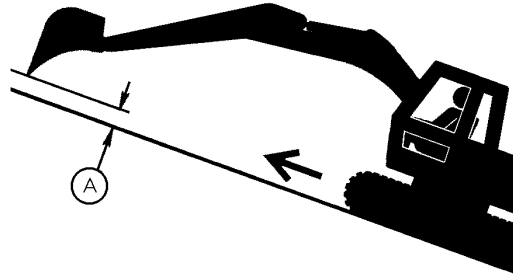
017-E01A-0491

SA-491

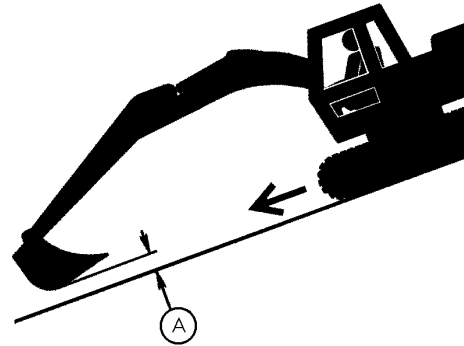
SAFETY

DRIVE MACHINE SAFELY

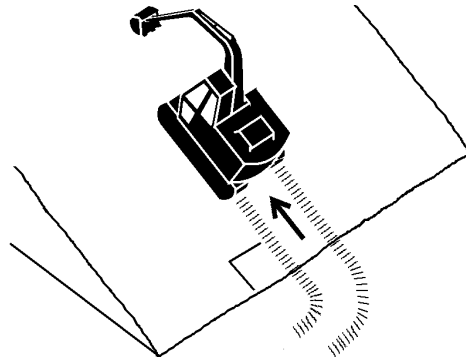
- Before driving the machine, always confirm that the travel levers/pedals direction corresponds to the direction you wish to drive.
- Be sure to detour around any obstructions.
- Avoid traveling over obstructions. Soil, fragments of rocks, and/or metal pieces may scatter around the machine. Don't allow personnel to stay around the machine while traveling.
- Driving on a slope may cause the machine to slip or overturn, possibly resulting in serious injury or death.
- When driving up or down a slope, keep the bucket facing the direction of travel, approximately 0.5 to 1.0 m (A) above the ground.
- If the machine starts to skid or becomes unstable, immediately lower the bucket to the ground and stop.
- Driving across the face of a slope or steering on a slope may cause the machine to skid or turnover. If the direction must be changed, move the machine to level ground, then, change the direction to ensure safe operation.



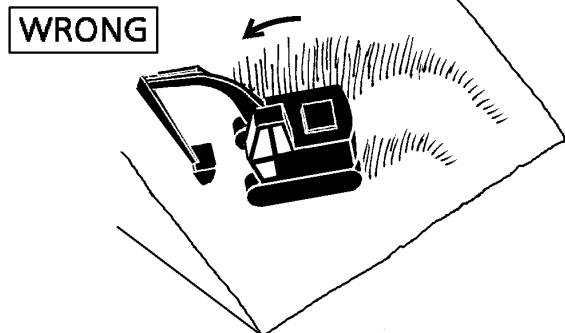
SA-387



SA-388



SA-441



SA-589

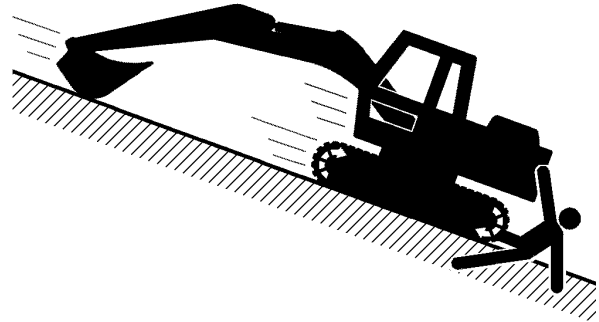
SAFETY

AVOID INJURY FROM ROLLAWAY ACCIDENTS

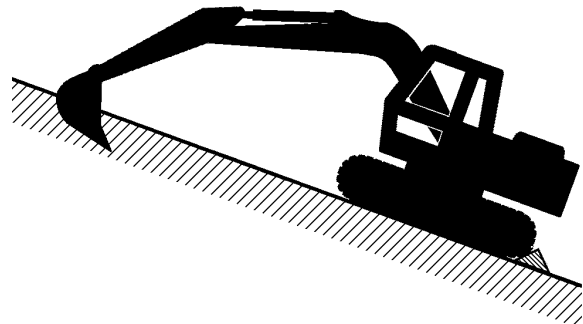
- Death or serious injury may result if you attempt to mount or stop a moving machine.

To avoid rollaways:

- Select level ground when possible to park machine.
- Do not park the machine on a grade.
- Lower the bucket and/or other work tools to the ground.
- Turn the auto-idle switch and the H/P mode switch off.
- Run the engine at slow idle speed without load for 5 minutes to cool down the engine.
- Stop the engine and remove the key from the key switch.
- Pull the pilot control shut-off lever to LOCK position.
- Block both tracks and lower the bucket to the ground. Thrust the bucket teeth into the ground if you must park on a grade.
- Position the machine to prevent rolling.
- Park a reasonable distance from other machines.



SA-391



SA-392

020-E02A-0493

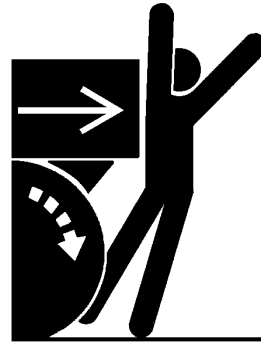
SAFETY

AVOID INJURY FROM BACK-OVER AND SWING ACCIDENTS

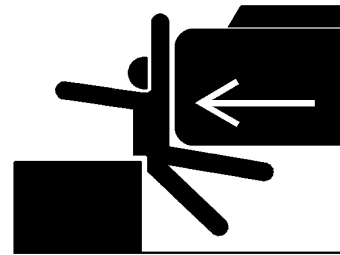
- If any person is present near the machine when backing or swinging the upperstructure, the machine may hit or run over that person, resulting in serious injury or death.

To avoid back-over and swing accidents:

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



SA-383



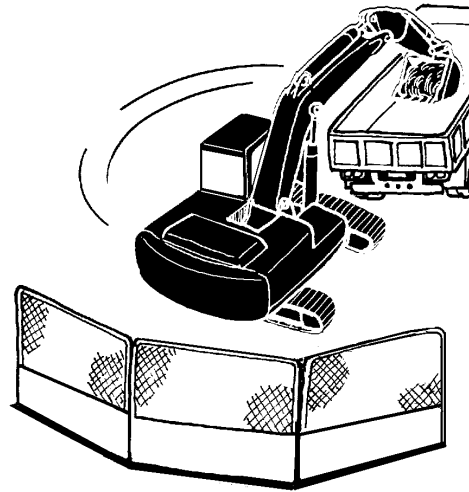
SA-384

021-E01A-0494

SAFETY

KEEP PERSON CLEAR FROM WORKING AREA

- A person may be hit severely by the swinging front attachment or counterweight and/or may be crushed against an other object, resulting in serious injury or death.
- Keep all persons clear from the area of operation and machine movement.
- Before operating the machine, set up barriers to the sides and rear area of the bucket swing radius to prevent anyone from entering the work area.



022-E01A-0386

SA-386

NEVER POSITION BUCKET OVER ANYONE

- Never lift, move, or swing bucket above anyone or a truck cab. Serious injury or machine damage may result due to bucket load spill or due to collision with the bucket.

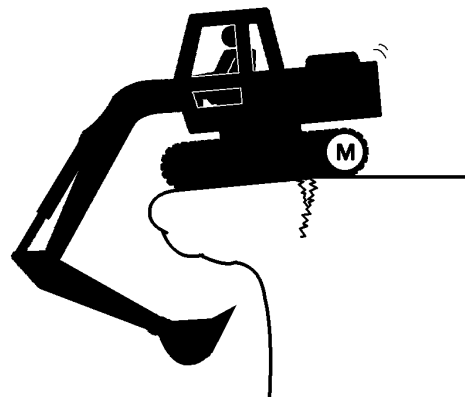


023-E01A-0487

SA-487

AVOID UNDERCUTTING

- In order to retreat from the edge of an excavation if the footing should collapse, always position the undercarriage perpendicular to the edge of the excavation with the travel motors at the rear.
- If the footing starts to collapse and if retreat is not possible, do not panic. Often, the machine can be secured by lowering the front attachment, in such cases.



024-E01A-0488

SA-488

SAFETY

AVOID TIPPING

DO NOT ATTEMPT TO JUMP CLEAR OF TIPPING MACHINE --- SERIOUS OR FATAL CRUSHING INJURIES WILL RESULT

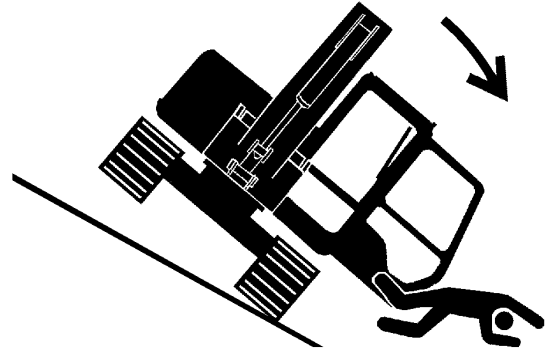
MACHINE WILL TIP OVER FASTER THAN YOU CAN JUMP FREE

FASTEN YOUR SEAT BELT

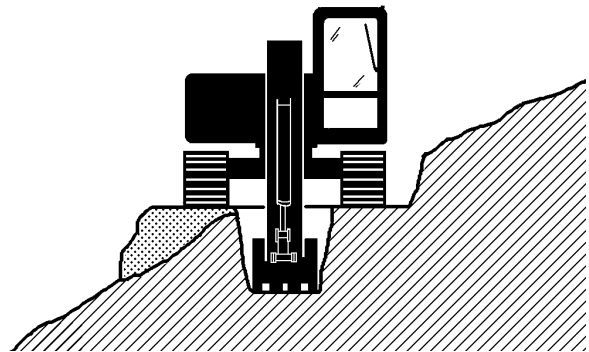
- The danger of tipping is always present when operating on a grade, possibly resulting in serious injury or death.

To avoid tipping:

- Be extra careful before operating on a grade.
 - Prepare machine operating area flat.
 - Keep the bucket low to the ground and close to the machine.
 - Reduce operating speeds to avoid tipping or slipping.
 - Avoid changing direction when traveling on grades.
 - NEVER attempt to travel across a grade steeper than 15 degrees if crossing the grade is unavoidable.
 - Reduce swing speed as necessary when swinging loads.
- Be careful when working on frozen ground.
 - Temperature increases will cause the ground to become soft and make ground travel unstable.



SA-012

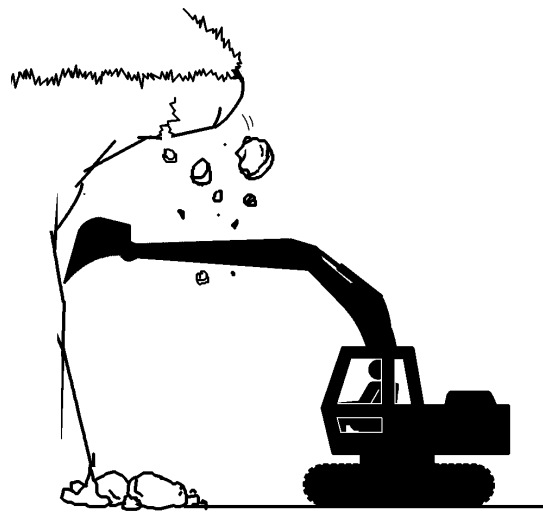


SA-440

025-E01B-0495

NEVER UNDERCUT A HIGH BANK

- The edges could collapse or a land slide could occur causing serious injury or death.



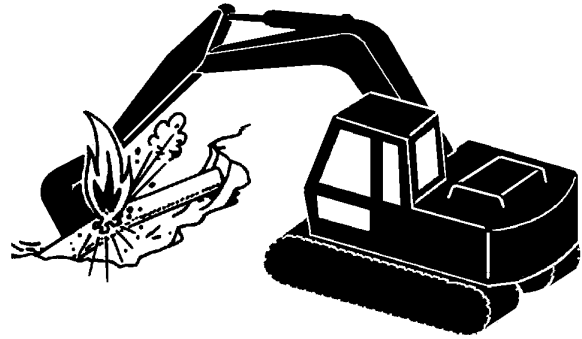
SA-489

026-E01A-0489

SAFETY

DIG WITH CAUTION

- Accidental severing of underground cables or gas lines may cause an explosion and/or fire, possibly resulting in serious injury or death.
- Before digging check the location of cables, gas lines, and water lines.
- Keep the minimum distance required, by law, from cables, gas lines, and water lines.
- If a fiber optic cable should be accidentally severed, do not look into the end. Doing so may result in serious eye injury.
- Contact your local "diggers hot line" if available in your area, and/or the utility companies directly. Have them mark all underground utilities.



SA-382

027-E01A-0382

OPERATE WITH CAUTION

- If the front attachment or any other part of the machine hits against an overhead obstacle, such as a bridge, both the machine and the overhead obstacle will be damaged, and personal injury may result as well.
- Take care to avoid hitting overhead obstacles with the boom or arm.



028-E01A-0389

SA-389

AVOID POWER LINES

- Serious injury or death can result if the machine or front attachments are not kept a safe distance from electric lines.
- When operating near an electric line, NEVER move any part of the machine or load closer than 3 m plus twice the line insulator length.
- Check and comply with any local regulations that may apply.
- Wet ground will expand the area that could cause any person on it to be affected by electric shock. Keep all bystanders or co-workers away from the site.



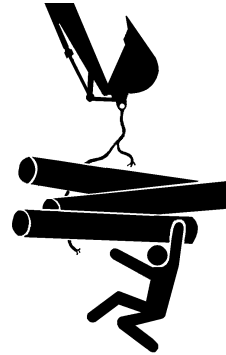
SA-381

029-E01A-0381

SAFETY

OBJECT HANDLING

- If a lifted load should fall, any person nearby may be struck by the falling load or may be crushed underneath it, resulting in serious injury or death.
- When using the machine for craning operations, be sure to comply with all local regulations.
- Do not use damaged chains or frayed cables, sables, slings, or ropes.
- Before craning, position the upperstructure with the travel motors at the rear.
- Move the load slowly and carefully. Never move it suddenly.
- Keep all persons will away from the load.
- Never move a load over a person's head.
- Do not allow anyone to approach the load until it is safely and securely situated on supporting blocks or on the ground.
- Never attach a sling or chain to the bucket teeth. They may come off, causing the load to fall.

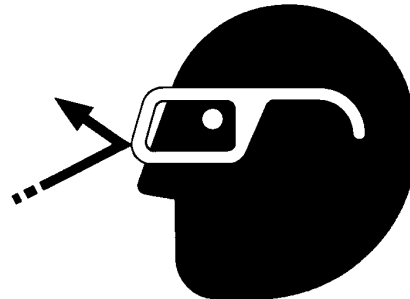


SA-014

030-E01A-0014

PROTECT AGAINST FLYING DEBRIS

- If flying debris hit eyes or any other part of the body, serious injury may result.
- Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.
- Keep bystanders away from the working area before striking any object.



031-E01A-0432

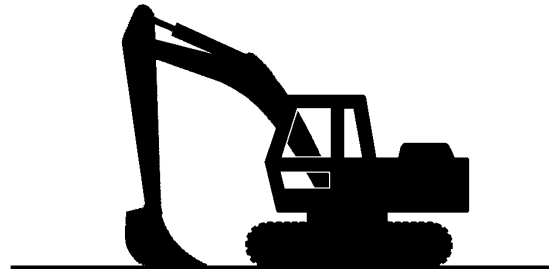
SA-432

SAFETY

PARK MACHINE SAFELY

To avoid accidents:

- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto-idle switch and H/P mode switch off.
- Run engine at slow idle speed without load for 5 minutes.
- Turn key switch to OFF to stop engine.
- Remove the key from the key switch.
- Pull the pilot control shut-off lever to the LOCK position.
- Close windows, roof vent, and cab door.
- Lock all access doors and compartments.



SA-390

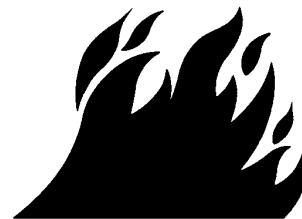
033-E08B-0390

HANDLE FLUIDS SAFELY—AVOID FIRES

- Handle fuel with care; it is highly flammable. If fuel ignites, an explosion and/or a fire may occur, possibly resulting in serious injury or death.
 - Do not refuel the machine while smoking or when near open flame or sparks.
 - Always stop the engine before refueling the machine.
 - Fill the fuel tank outdoors.
- All fuels, most lubricants, and some coolants are flammable.
 - Store flammable fluids well away from fire hazards.
 - Do not incinerate or puncture pressurized containers.
 - Do not store oily rags; they can ignite and burn spontaneously.
 - Securely tighten the fuel and oil filler cap.



SA-018



SA-019

034-E01A-0496

SAFETY

PRACTICE SAFE MAINTENANCE

To avoid accidents:

- Understand service procedures before doing work.
- Keep the work area clean and dry.
- Do not spray water or steam inside cab.
- Never lubricate or service the machine while it is moving.
- Keep hands, feet and clothing away from power-driven parts.

Before servicing the machine:

1. Park the machine on a level surface.
 2. Lower the bucket to the ground.
 3. Turn the auto-idle switch off.
 4. Run the engine at slow idle speed without load for 5 minutes.
 5. Turn the key switch to OFF to stop engine.
 6. Relieve the pressure in the hydraulic system by moving the control levers several times.
 7. Remove the key from the switch.
 8. Attach a "Do Not Operate" tag on the control lever.
 9. Pull the pilot control shut-off lever to the LOCK position.
 10. Allow the engine to cool.
- If a maintenance procedure must be performed with the engine running, do not leave machine unattended.
 - If the machine must be raised, maintain a 90 to 110° angle between the boom and arm. Securely support any machine elements that must be raised for service work.
 - Never work under a machine raised by the boom.
 - Inspect certain parts periodically and repair or replace as necessary. Refer to the section discussing that part in the "MAINTENANCE" chapter of this manual.
 - Keep all parts in good condition and properly installed.
 - Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.
 - When cleaning parts, always use nonflammable detergent oil. Never use highly flammable oil such as fuel oil and gasoline to clean parts or surfaces.
 - Disconnect battery ground cable (–) before making adjustments to electrical systems or before performing welding on the machine.



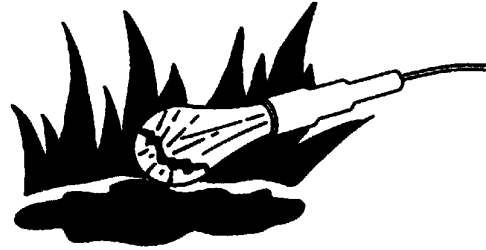
SA-028



SA-527

SAFETY

- Sufficiently illuminate the work site. Use a maintenance work light when working under or inside the machine.
- Always use a work light protected with a guard. In case the light bulb is broken, spilled fuel, oil, anti-freeze fluid, or window washer fluid may catch fire.



SA-037

WARN OTHERS OF SERVICE WORK

- Unexpected machine movement can cause serious injury.
- Before performing any work on the machine, attach a "Do Not Operate" tag on the control lever. This tag is available from your authorized dealer.



501-E01A-0287

SA-287

SUPPORT MACHINE PROPERLY

- Never attempt to work on the machine without securing the machine first.
- Always lower the attachment to the ground before you work on the machine.
- If you must work on a lifted machine or attachment, securely support the machine or attachment. Do not support the machine on cinder blocks, hollow tires, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack.

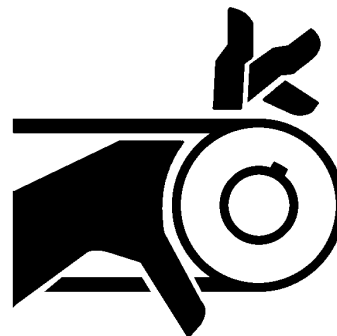


519-E01A-0527

SA-527

STAY CLEAR OF MOVING PARTS

- Entanglement in moving parts can cause serious injury.
- To prevent accidents, care should be taken to ensure that hands, feet, clothing, jewelry and hair do not become entangled when working around rotating parts.



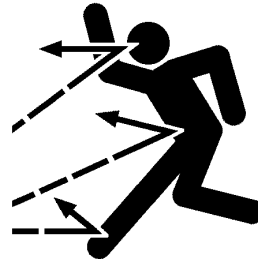
502-E01A-0026

SA-026

SAFETY

PREVENT PARTS FROM FLYING

- Grease in the track adjuster is under high pressure. Failure to follow the precautions below may result in serious injury, blindness, or death.
 - Do not attempt to remove GREASE FITTING or VALVE ASSEMBLY.
 - As pieces may fly off, be sure to keep body and face away from valve.
- Travel reduction gears are under pressure.
 - As pieces may fly off, be sure to keep body and face away from AIR RELEASE PLUG to avoid injury. GEAR OIL is hot.
 - Wait for GEAR OIL to cool, then gradually loosen AIR RELEASE PLUG to release pressure.

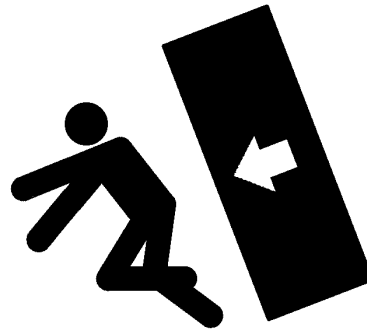


SA-344

503-E01B-0344

STORE ATTACHMENTS SAFELY

- Stored attachments such as buckets, hydraulic hammers, and blades can fall and cause serious injury or death.
- Securely store attachments and implements to prevent falling. Keep children and bystanders away from storage areas.



504-E01A-0034

SA-034

SAFETY

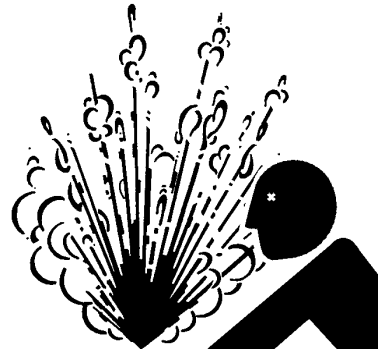
PREVENT BURNS

Hot spraying fluids:

- After operation, engine coolant is hot and under pressure. Hot water or steam is contained in the engine, radiator and heater lines. Skin contact with escaping hot water or steam can cause severe burns.
- To avoid possible injury from hot spraying water. DO NOT remove the radiator cap until the engine is cool. When opening, turn the cap slowly to the stop. Allow all pressure to be released before removing the cap.
- The hydraulic oil tank is pressurized. Again, be sure to release all pressure before removing the cap.

Hot fluids and surfaces:

- Engine oil, gear oil and hydraulic oil also become hot during operation. The engine, hoses, lines and other parts become hot as well.
- Wait for the oil and components to cool before starting any maintenance or inspection work.



SA-039



SA-225

505-E01B-0498

REPLACE RUBBER HOSES PERIODICALLY

- Rubber hoses that contain flammable fluids under pressure may break due to aging, fatigue, and abrasion. It is very difficult to gauge the extent of deterioration due to aging, fatigue, and abrasion of rubber hoses by inspection alone.
- Periodically replace the rubber hoses. (See the page of "Periodic replacement of parts" in the operator's manual).
- Failure to periodically replace rubber hoses may cause a fire, fluid injection into skin, or the front attachment to fall on a person nearby, which may result in severe burns, gangrene, or otherwise serious injury or death.



SA-019

S506-E01A-0019

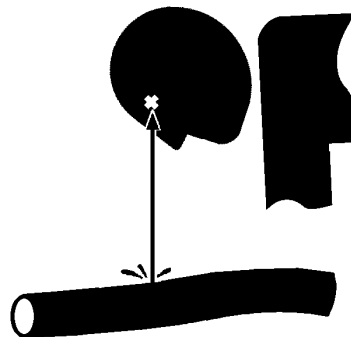
SAFETY

AVOID HIGH-PRESSURE FLUIDS

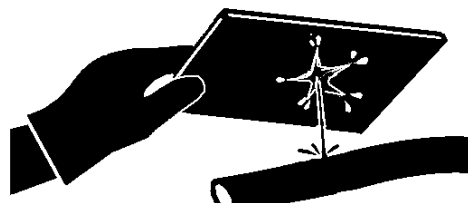
- Fluids such as diesel fuel or hydraulic oil under pressure can penetrate the skin or eyes causing serious injury, blindness or death.
- Avoid this hazard by relieving pressure before disconnecting hydraulic or other lines.
- Tighten all connections before applying pressure.
- Search for leaks with a piece of cardboard; take care to protect hands and body from high-pressure fluids. Wear a face shield or goggles for eye protection.
- If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.



SA-031



SA-292



SA-044

507-E03A-0499

SAFETY

PREVENT FIRES

Check for Oil Leaks:

- Fuel, hydraulic oil and lubricant leaks can lead to fires.
 - Check for oil leaks due to missing or loose clamps, kinked hoses, lines or hoses that rub against each other, damage to the oil-cooler, and loose oil-cooler flange bolts.
 - Tighten, repair or replace any missing, loose or damaged clamps, lines, hoses, oil-cooler and oil-cooler flange bolts.
 - Do not bend or strike high-pressure lines.
 - Never install bent or damaged lines, pipes or hoses.



SA-019

Check for Shorts:

- Short circuits can cause fires.
 - Clean and tighten all electrical connections.
 - Check before each shift or after eight (8) to ten (10) hours operation for loose, kinked, hardened or frayed electrical cables and wires.
 - Check before each shift or after eight (8) to ten (10) hours operation for missing or damaged terminal caps.
 - DO NOT OPERATE MACHINE if cable or wires are loose, kinked, etc..

Clean up Flammables:

- Spilled fuel, oil, antifreeze fluid and window washer fluid, and trash, grease, debris, accumulated coal dust, and other flammables may cause fires.
 - Prevent fires by inspecting and cleaning the machine daily, and by removing spilled or accumulated flammables immediately.

Check Key Switch:

- If fire breaks out, failure to stop the engine will escalate fire, hampering fire fighting.

Always check key switch function before operating the machine every day:

 1. Start the engine and run it at slow idle.
 2. Turn the key switch to the OFF position to confirm that the engine stops.
- If any abnormalities are found, be sure to repair them before operating the machine.

508-E02B-0019

SAFETY

Check Emergency Engine Stop Switch:

- If a fire breaks out, failure to release pressurized air inside the hydraulic tank will escalate fire, hampering fire fighting.
 - Check the emergency engine stop switch function every 250 hours:
 - 1) Start the engine and run it at slow Idle.
 - 2) Turn the emergency engine stop switch to the EMERG. STOP position.
 - 3) Confirm that both engines stop and that pressurized air inside the hydraulic oil tank is released (a hissing sound should be heard).
- If any abnormalities are found, be sure to repair them before operating the machine.

Check Heat Shields:

- Damaged or missing heat shield may lead to fires.
 - Damaged or missing heat shields must be repaired or replaced before operating the machine.

508-E02A-0393

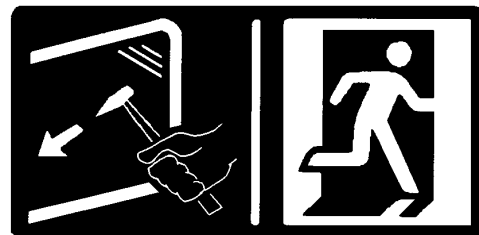
EVACUATING IN CASE OF FIRE

- If a fire breaks out, evacuate the machine in the following way:
 - Stop the engine by turning the key switch to the OFF position if there is time.
 - Use a fire extinguisher if there is time.
 - Exit the machine.
- In an emergency, if the cab door or front window can not be opened, break the front or rear window panes with the emergency evacuation hammer to escape from the cab. Refer the explanation pages on the Emergency Evacuation Method.

518-E02B-0393



SA-393

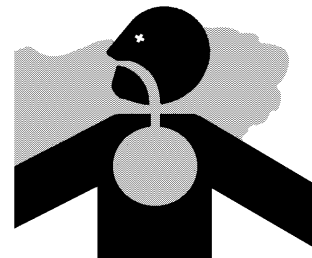


SS-1510

BEWARE OF EXHAUST FUMES

- Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.
 - If you must operate in a building, be sure there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

509-E01A-0016

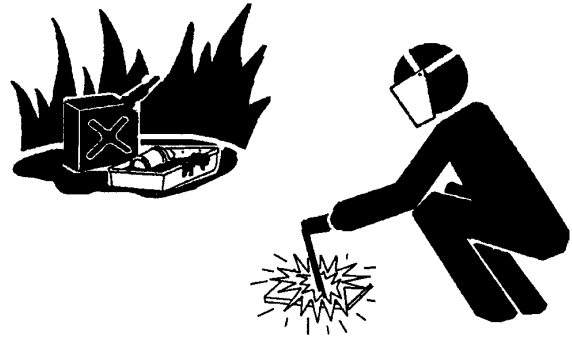


SA-016

SAFETY

PRECAUTIONS FOR WELDING AND GRINDING

- Welding may generate gas and/or small fires.
 - Be sure to perform welding in a well ventilated and prepared area. Store flammable objects in a safe place before starting welding.
- Only qualified personnel should perform welding. Never allow an unqualified person to perform welding.
- Grinding on the machine may create fire hazards. Store flammable objects in a safe place before starting grinding.
- After finishing welding and grinding, recheck that there are no abnormalities such as the area surrounding the welded area still smoldering.



SA-818

523-E01A-0818

AVOID HEATING NEAR PRESSURIZED FLUID LINES

- Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.
 - Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.
 - Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install temporary fire-resistant guards to protect hoses or other materials before engaging in welding, soldering, etc..



SA-030

AVOID APPLYING HEAT TO LINES CONTAINING FLAMMABLE FLUIDS

- Do not weld or flame cut pipes or tubes that contain flammable fluids.
- Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

510-E01B-0030

SAFETY

REMOVE PAINT BEFORE WELDING OR HEATING

- Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. If inhaled, these fumes may cause sickness.
 - Avoid potentially toxic fumes and dust.
 - Do all such work outside or in a well-ventilated area. Dispose of paint and solvent properly.
- Remove paint before welding or heating:
 1. If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
 2. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

511-E01A-0029



SA-029

BEWARE OF ASBESTOS DUST

- Take care not to inhale dust produced in the work site. Inhalation of asbestos fibers may be the cause of lung cancer.
 - Depending on the work site conditions, the risk of inhaling asbestos fiber may exist. Spray water to prevent asbestos from becoming airborne. Don't use compressed air.
 - When operating the machine in a work site where asbestos might be present, be sure to operate the machine from the upwind side and wear a mask rated to prevent the inhalation of asbestos.
 - Keep bystanders out of the work site during operation.
 - Asbestos might be present in imitation parts. Use only genuine Hitachi Parts.



SA-029

SAFETY

PREVENT BATTERY EXPLOSIONS

- Battery gas can explode.
 - Keep sparks, lighted matches, and flame away from the top of battery.
 - Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.
 - Do not charge a frozen battery; it may explode. Warm the battery to 16 °C (60 °F) first.
 - Do not continue to use or charge the battery when electrolyte level is lower than specified. Explosion of the battery may result.
 - Loose terminals may produce sparks. Securely tighten all terminals.
- Battery electrolyte is poisonous. If the battery should explode battery electrolyte may be splashed into eyes, possibly resulting in blindness.
 - Be sure to wear eye protection when checking electrolyte specific gravity.



SA-032

512-E01B-0032

SERVICE AIR CONDITIONING SYSTEM SAFELY

- If spilled onto skin, refrigerant may cause a cold contact burn.
 - Refer to the freon container for proper use when servicing the air conditioning system.
 - Use a recovery and recycling system to avoid venting freon into the atmosphere.
 - Never let the freon stream make contact with the skin.



SA-405

513-E01A-0405

SAFETY

HANDLE CHEMICAL PRODUCTS SAFELY

- Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with your machine include such items as lubricants, coolants, paints, and adhesives.
- A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.
- Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and use recommended equipment.
- See your authorized dealer for MSDS's (available only in English) on chemical products used with your machine.

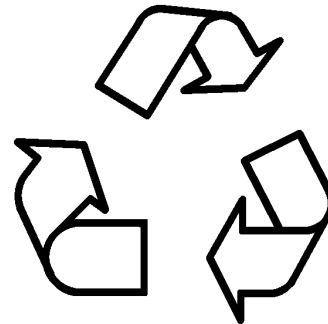


SA-309

515-E01A-0309

DISPOSE OF WASTE PROPERLY

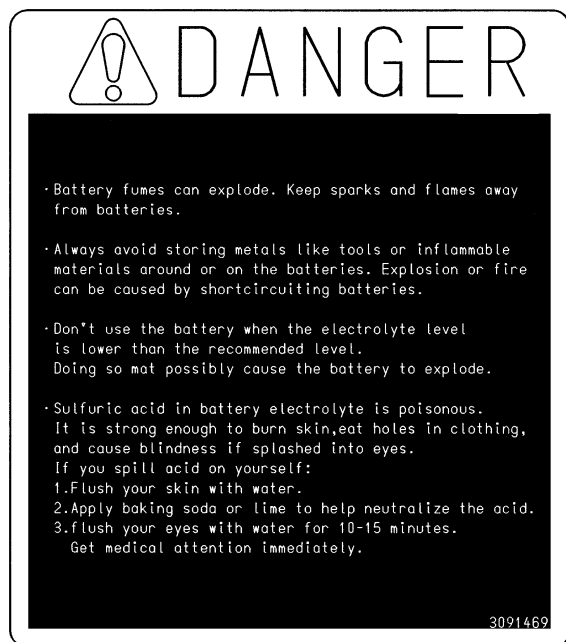
- Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with HITACHI equipment includes such items as oil, fuel, coolant, brake fluid, filters, and batteries.
- Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.
- Do not pour waste onto the ground, down a drain, or into any water source.
- Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.
- Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your authorized dealer.



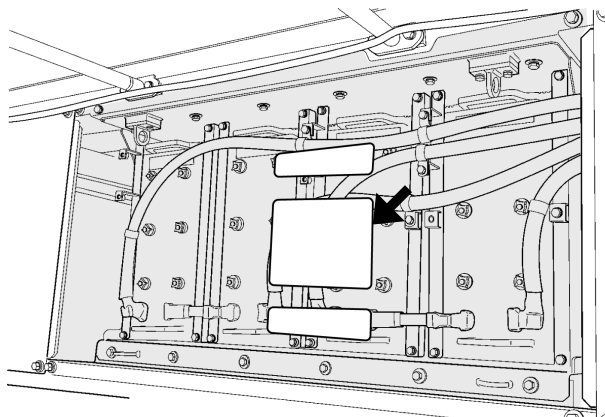
SA-226

516-E01A-0226

SAFETY SIGNS



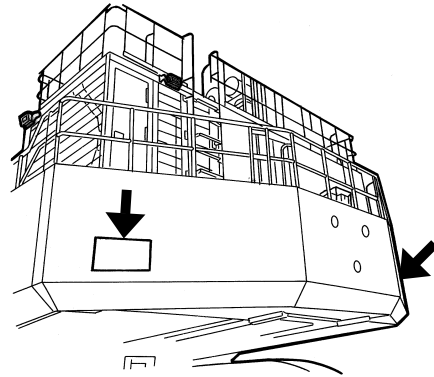
SS3091469



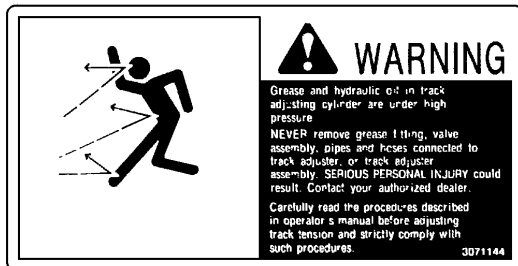
SAFETY SIGNS



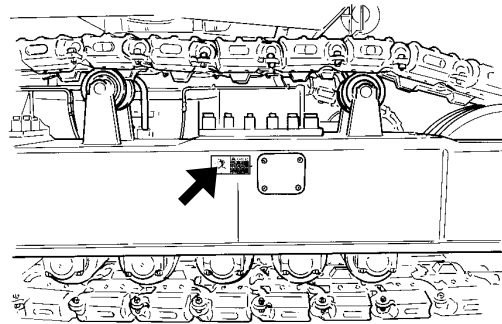
SS-442



M146-01-022

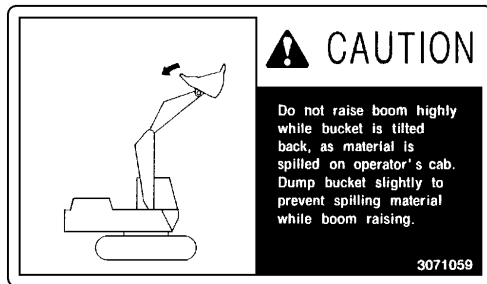


SS-445



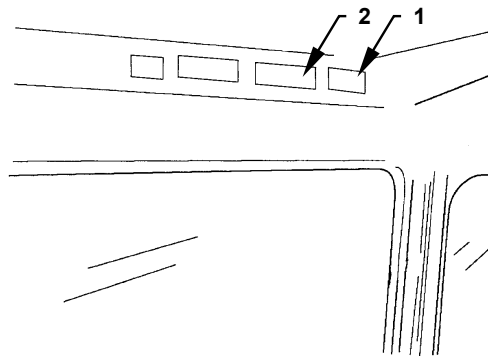
SS-688

1



(Loading Shovel)

SS-446



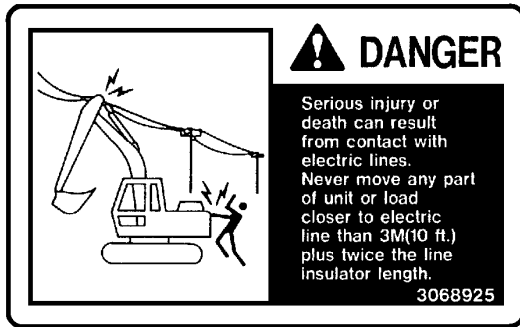
SS-2835

2

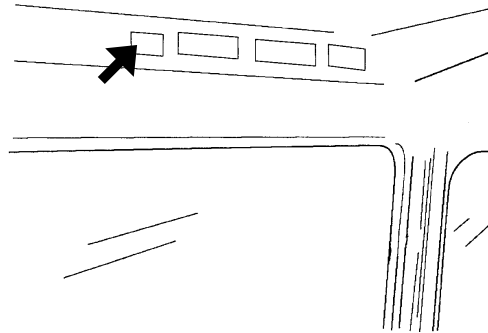


SS-742

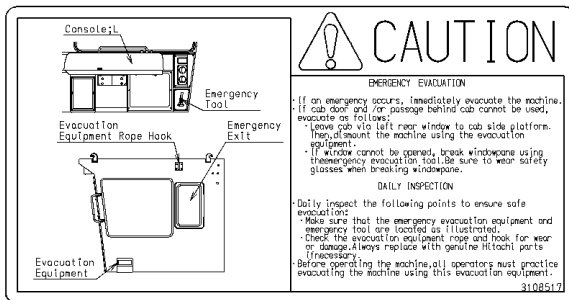
SAFETY SIGNS



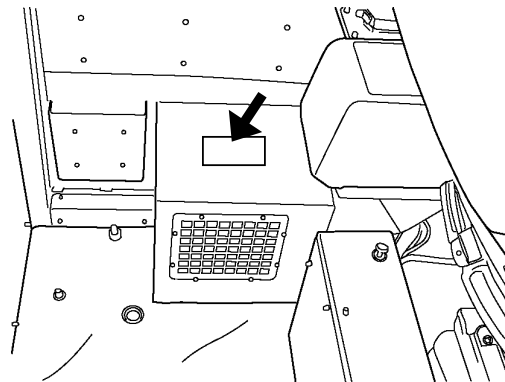
SS-410



SS-2835

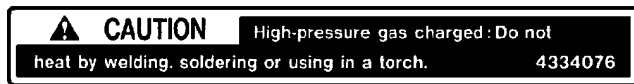


SS3108517

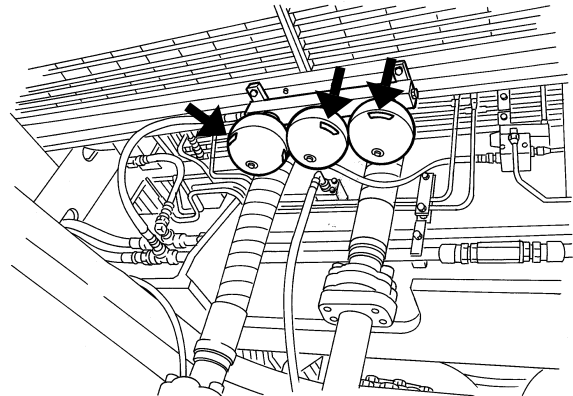


M18G-01-011

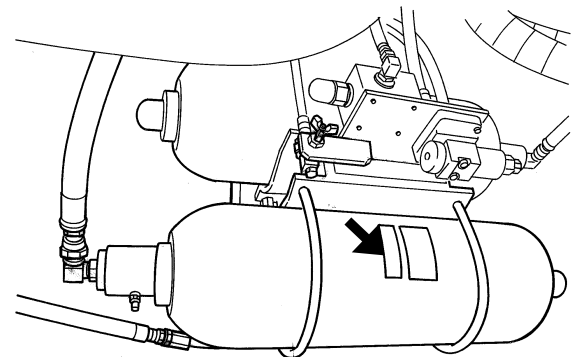
SAFETY SIGNS



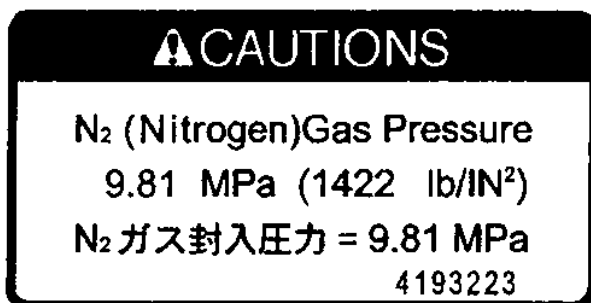
SS-413



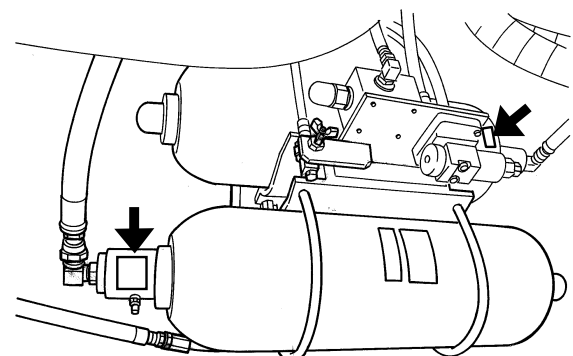
M146-01-024



M146-01-025

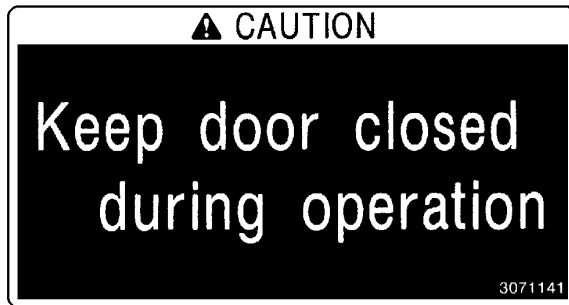


SS4193223

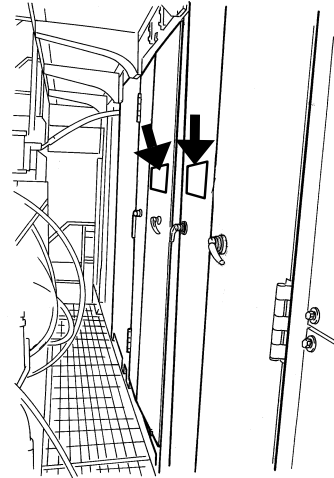


M146-01-025

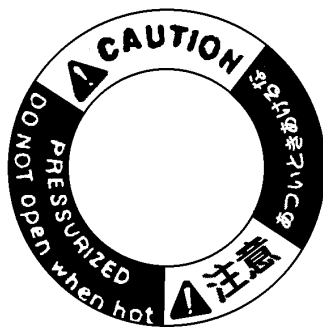
SAFETY SIGNS



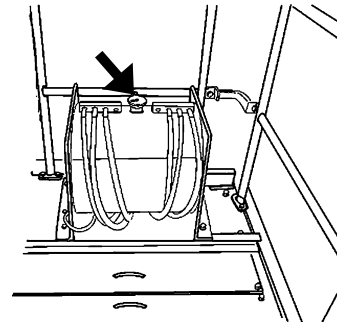
SS-449



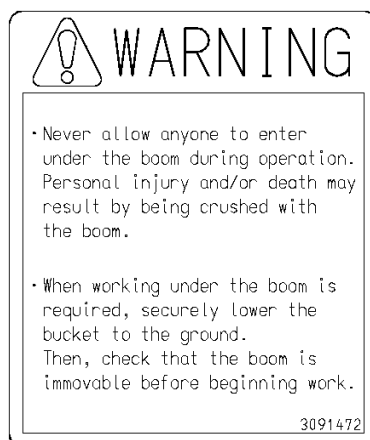
M146-01-027



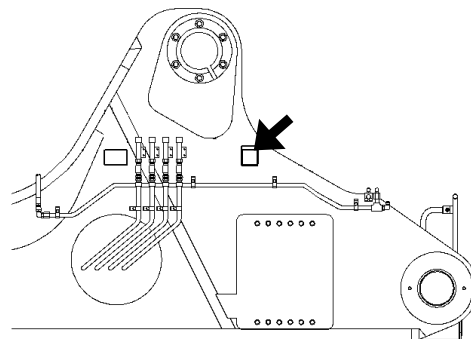
SS-710



SS-2836



SS-3091472



SS-2837

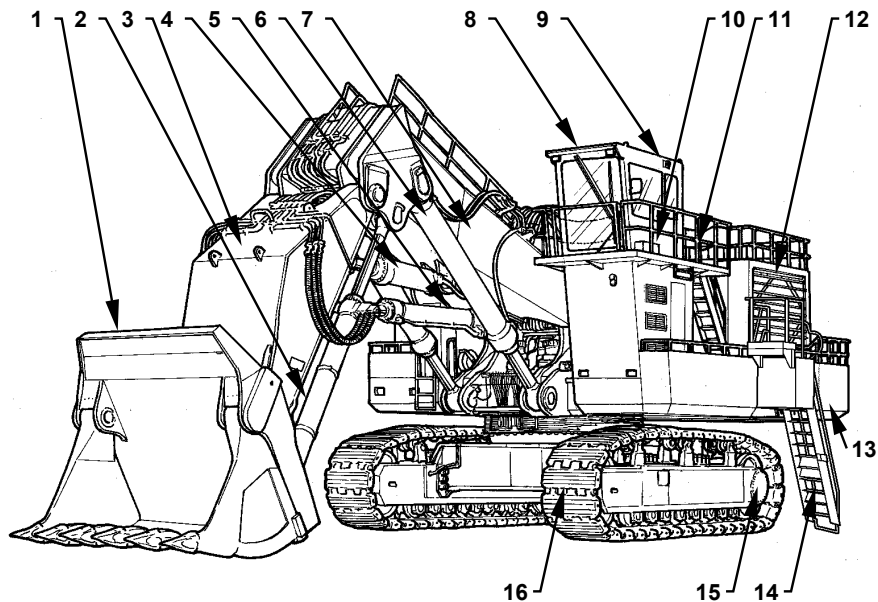
This image shows a full page of white paper with horizontal dotted lines, resembling notebook paper. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

COMPONENTS NAME

COMPONENTS NAME

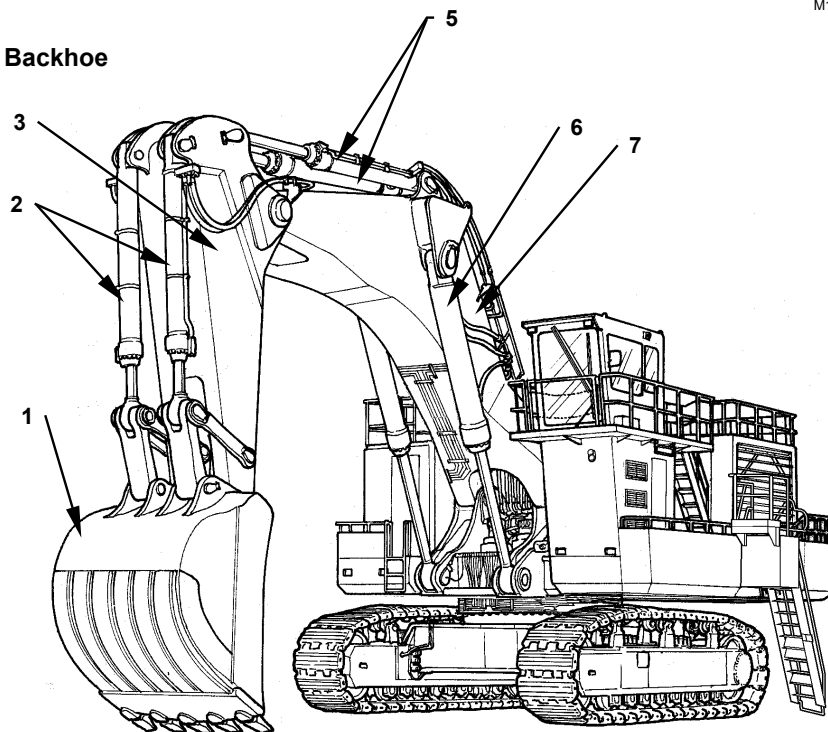
Loading Shovel

- 1- Bucket
- 2- Bucket Cylinder
- 3- Arm
- 4- Level Cylinder
- 5- Arm Cylinder
- 6- Boom Cylinder
- 7- Boom
- 8- Cab
- 9- Emergency Rope Hook
- 10- Emergency Rope Case
- 11- Fuel Tank
- 12- Radiator
- 13- Counterweight
- 14- Stairway
- 15- Travel Device
- 16- Track Shoe



M18M-01-001

Backhoe



M18M-01-002

HANDLING STAIRWAY/EMERGENCY ROPE

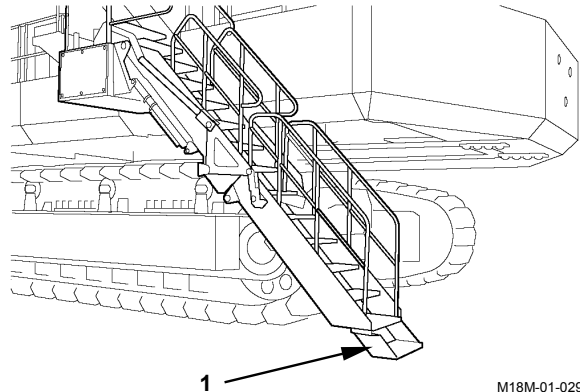
USING STAIRWAY

Always use stairway (1) when getting on and off the machine.
Do not attempt to climb onto or off the machine any other way.



WARNING:

- Always mount or dismount the machine only when the stairway is fully extended. When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Never jump on or off the machine. Never mount or dismount a moving machine.
- Thoroughly remove and clean slippery materials such as mud and/or grease from the steps and/or hand rails.



M18M-01-029

OPERATING STAIRWAY



WARNING:

- Check that no personnel are present around the machine before beginning operation. Never operate the machine when any personnel are present near machine.
- Lower the stairway only after checking that no obstructions are present in the spot where the stairway is lowered.



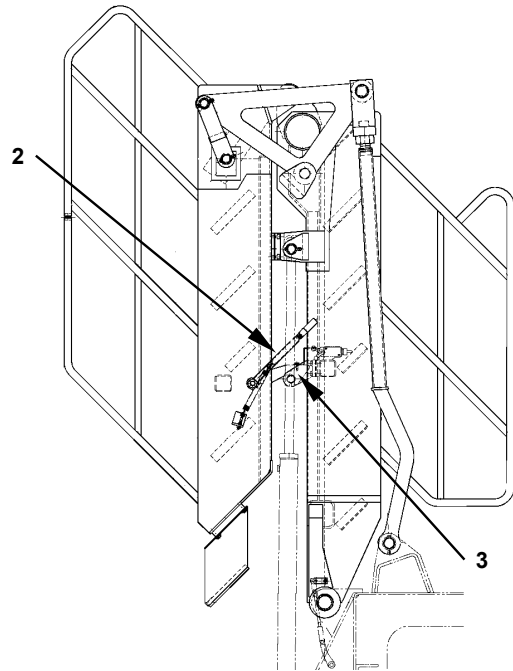
NOTE: When the key switch is turned ON, the stairway cannot be operated unless the pilot control shut-off lever is in the LOCK position.

HANDLING STAIRWAY/EMERGENCY ROPE

Extending

1. Be sure to pull the lever (2) to disengage the lock (3) before extending. In case the lock is difficult to disengage, press RETRACT button (4) two to three times to disengage the lock.
2. Press and hold the EXTEND (5) button until the stairway is fully extended. When the button is released, the stairway stops extending.

 **NOTE:** • The alarm starts to sound when the lock (3) is disengaged.
• The alarm continues to sound until stairway is fully extended.



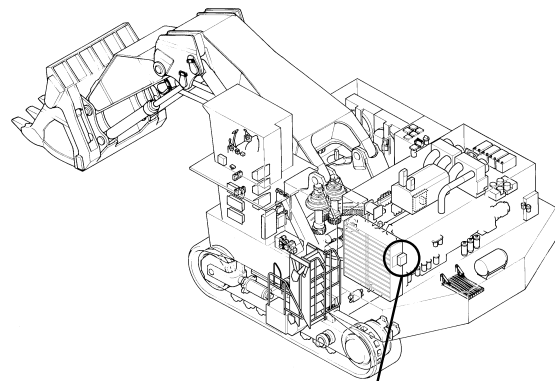
M18M-01-030

Retracting

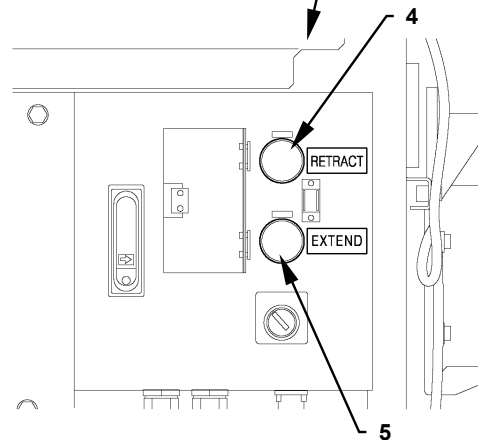
1. Press and hold the RETRACT button (4) until the stairway is fully retracted. When the button is released, the stairway stops retracting.
2. Be sure to pull the lever (2) down to engage the lock (3) after fully retracting.

 **NOTE:** • The alarm stops to sound when the stairway start to retract.
• The alarm stops to sound when the lock (3) is engaged after fully retracted.

 **NOTE:** Swing operation is inoperable unless the stairway operations are fully retracted and lock (3) is engaged.



M18M-03-007



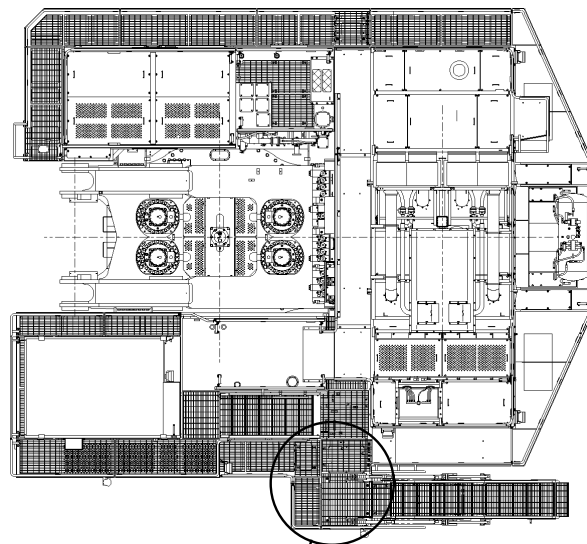
M18M-01-031

HANDLING STAIRWAY/EMERGENCY ROPE

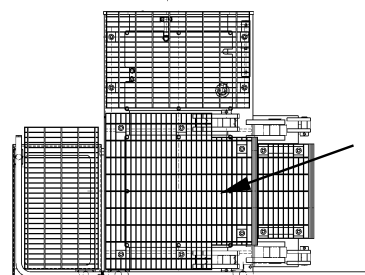
Emergency Operation

When the stairway cannot work by trouble, retract the stairway following the procedure shown below.

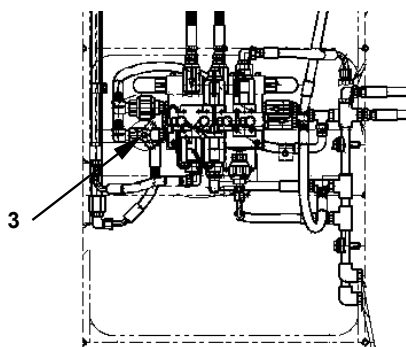
1. Remove the step (1) and cover (2) under the step (1).
2. Open the valve (3) fully.
3. Place the pilot control shut-off lever to the Lock position.
4. Start the engine. Run the engine at a slow speed.
5. Close the valve (4) fully. The stairway starts to retract.
6. Open the valve (4) gradually to slow down the retracting speed before the stairway is fully retracted.
7. After fully retracted, open the valve (4) fully and close the valve (3) fully.
8. Pull the lever down to engage the lock.
9. Stop the engine.
10. Install the cover (2) and the step (1).
11. Contact your authorized dealer.



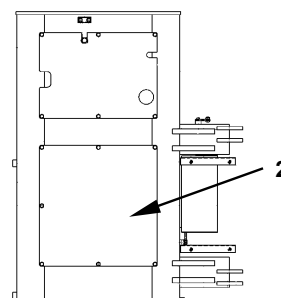
M18M-01-005



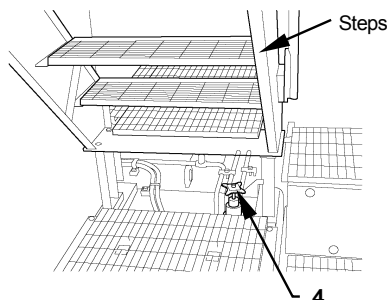
M18M-01-033



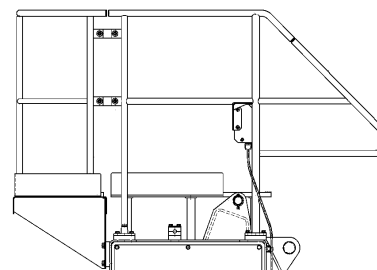
M18M-01-035



M18M-01-032



M18M-01-036



M18M-01-034

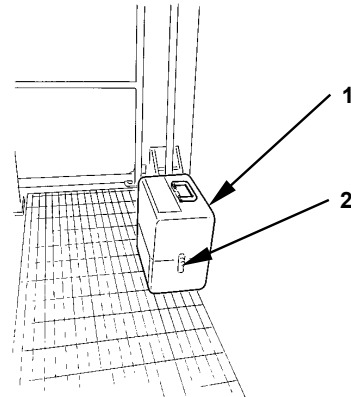
HANDLING STAIRWAY/EMERGENCY ROPE

EMERGENCY ESCAPE

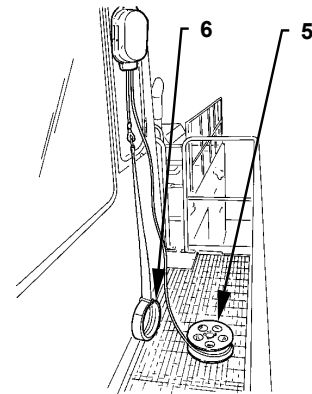
How to Use

Emergency escape device is provided in case (1) at the left outside the cab.

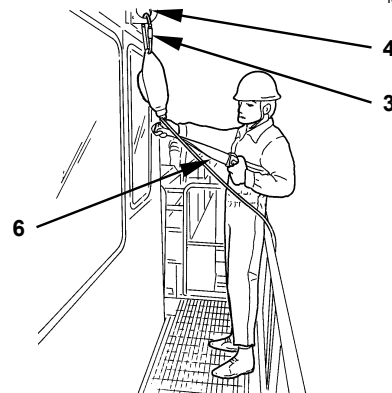
1. Unlock latch (2) on case (1) to open the cover.
2. Hang hook (3) onto the cab upper-left surface hanger (4).
3. Drop rope wound reel (5).
4. Fasten life belt (6) around your chest.
5. While holding two ropes, move to the outside fence and face toward the cab (as long as the two ropes are held, emergency escape device will not operate.)
6. As soon as the ropes are released, your body is slowly lowered. Descend while softly pushing the machine surface by hand to prevent the body from turning.
7. After landing, immediately take life belt (6) off and evacuate to a safe place.



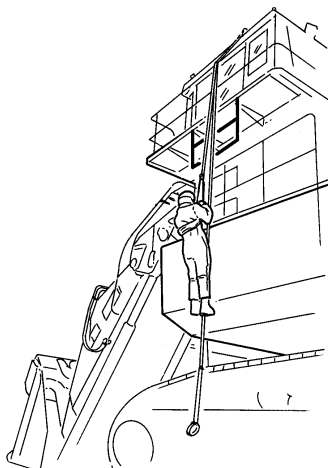
M118-07-102



M118-07-104



M118-07-108



M146-07-005



M118-07-109

HANDLING STAIRWAY/EMERGENCY ROPE

EMERGENCY EXIT

If the operator's cab door should not open in an emergency, escape in the following methods:

1. Open left window (1). Escape through the window.

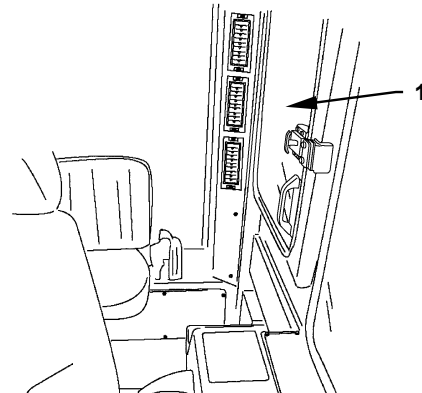


WARNING: Be sure to wear safety glasses before breaking the window glass.

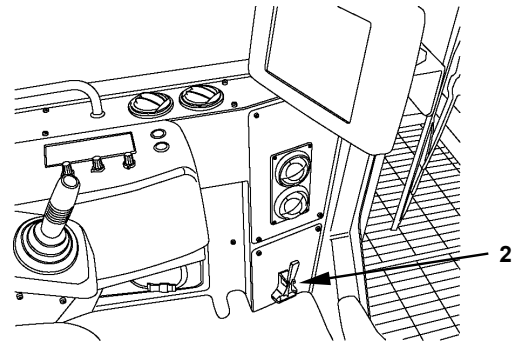
2. If left window (1) should be difficult to open, break the left window glass using emergency evacuation tool (2). Then, escape through the broken window.



NOTE: The emergency exit decal (3) is affixed to the upper side of the air conditioner circulation air inlet port (under the emergency exit).



M18M-01-003



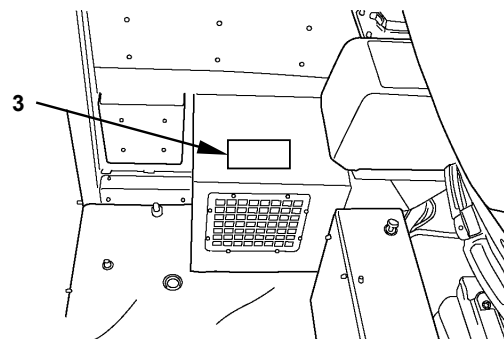
M18G-01-010

EVACUATING IN CASE OF FIRE

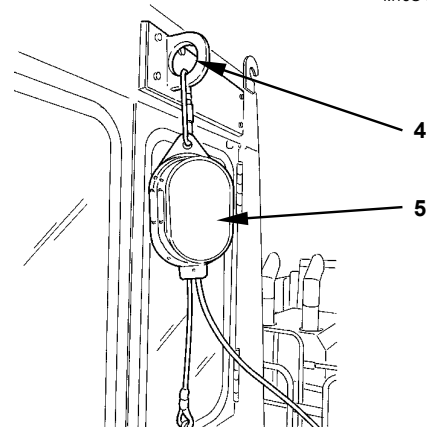
A fire on the machine can result in serious personal injury or death.

Avoid the risk of injury or death while evacuating from the machine during a fire by checking the following regularly:

- Always check if left window (1) can be opened and closed smoothly before starting the engine. If it fails to open or close smoothly, repair the window. Left window (1) can be used as an emergency exit.
- Malfunction of emergency escape device (5) worn rope or broken hanger may cause falling accident when evacuating. Before operating the machine, be sure to check if emergency escape device (5) or hanger (4) is not damaged. If any abnormalities are found, replace with new parts.
- Before operating the machine for the first time, all new operators must practice evacuating with this rope at least once.



M18G-01-011



M118-07-103

HANDLING STAIRWAY/EMERGENCY ROPE

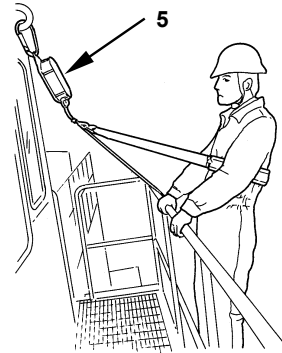
If a fire breaks out, evacuate the machine in the following way:

 **NOTE:** *Beside emergency engine stop switch (6) provided in the cab, two switches are located in engine compartment and one in pump compartment.*

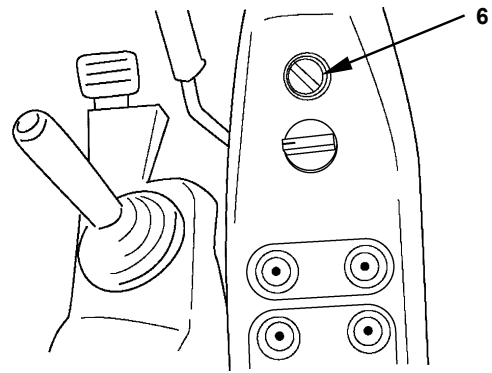
1. Stop the engines by turning emergency engine stop switch (6) to the EMERG STOP position if there is time.
 2. Pull the pilot control shut-off lever to the LOCK position.
 3. Use a fire extinguisher if there is time.
 4. Exit the machine in the following manner, depending on the location of the fire.
 - If engine compartment sidewalk (7) is not on fire, evacuate from the machine to the ground through cab door (12), step (9), sidewalk (7) and lower stairway (8).
 - If the engine compartment sidewalk (7) is on fire, first evacuate from cab (11) through cab door (12) to cab side platform (10). Then, get off the machine using emergency device (5).
- Emergency device (5) is provided in the case located on the left outside wall of the cab. (See the "EMERGENCY ESCAPE" section.)
- If the fire is around cab door (12), evacuate the cab by opening left window, and stepping to platform (10). Then, get off the machine using the emergency rope. If left window cannot be opened, break the windowpane using emergency evacuation tool (2) to gain access to platform (10).



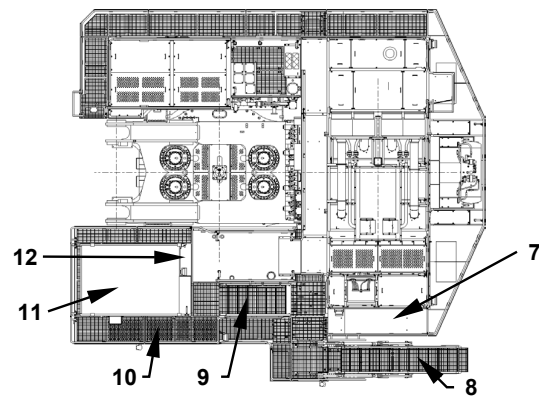
WARNING: Avoid possible injury to your eyes. Wear a pair of safety glasses or goggles when breaking windowpane with emergency evacuation tool (2).



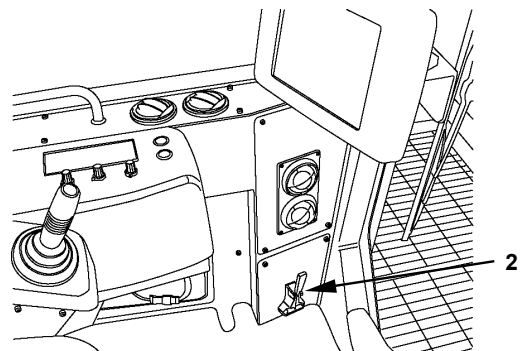
M118-07-109



M18M-01-004



M18M-01-005

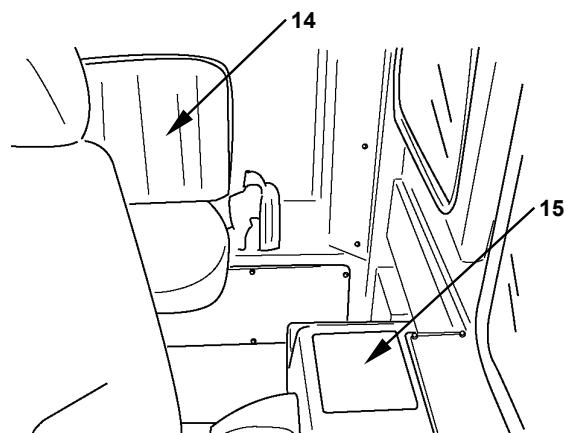
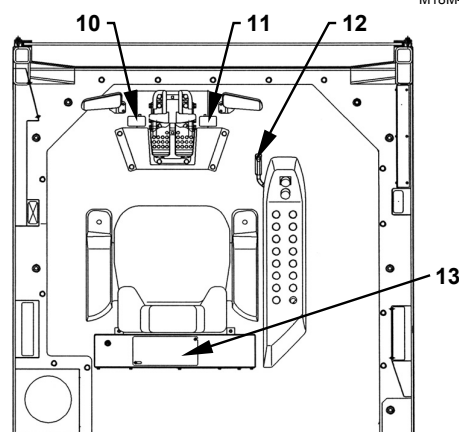
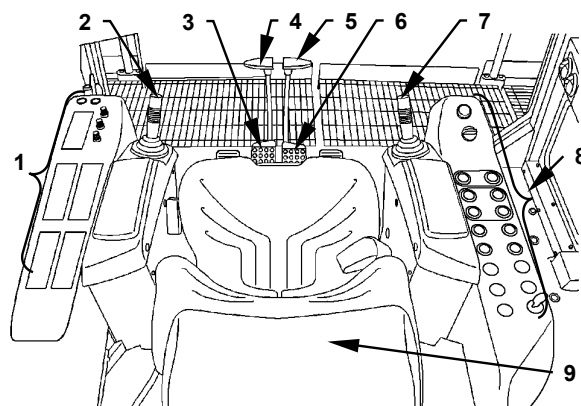


M18G-01-010

OPERATOR'S STATION

CAB FEATURES

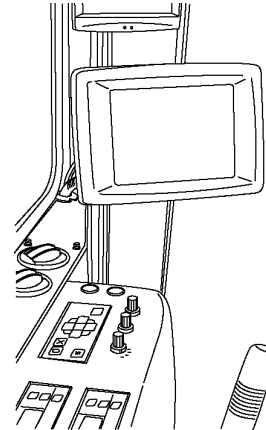
- 1- Left Console
- 2- Left Control Lever/Horn Switch
- 3- Left Travel Pedal
- 4- Left Travel Lever
- 5- Right Travel Lever
- 6- Right Travel Pedal
- 7- Right Control Lever/Horn Switch
- 8- Right Console
- 9- Operator's Seat
- 10- Bucket Close Pedal (For Loading Shovel)
- 11- Bucket Open Pedal (For Loading Shovel)
- 12- Pilot Control Shut-Off Lever
- 13- Rear Console
- 14- Trainer's Seat
- 15- Hot & Cool Box



OPERATOR'S STATION

MONITOR DISPLAY

Starting check screen and meter check screen will be displayed when key switch is turned to the ON position.



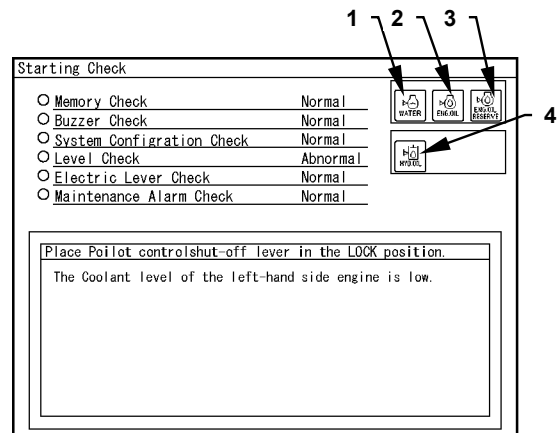
M18G-01-018

STARTING CHECK SCREEN

When key switch is turned to the ON position, starting check screen will be displayed at first.

- 1- Coolant Level Check Indicator
- 2- Engine Oil Level(Oil Pan) Check Indicator
- 3- Engine Oil Level(Reserve Tank) Check Indicator
- 4- Hydraulic Oil Level Check Indicator

Level check indicators will become green when fluid levels are appropriate.



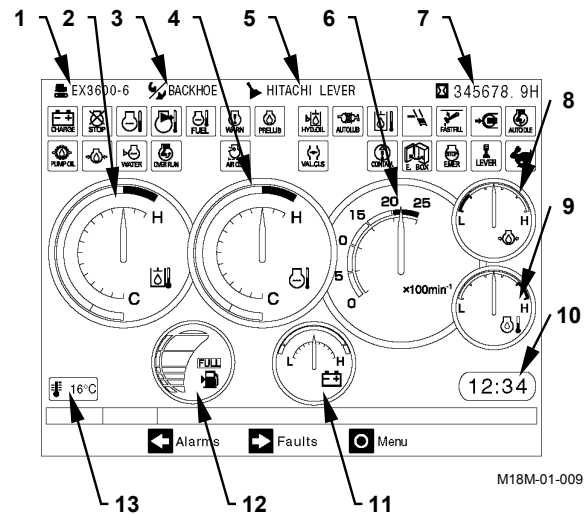
M18M-01-008

OPERATOR'S STATION

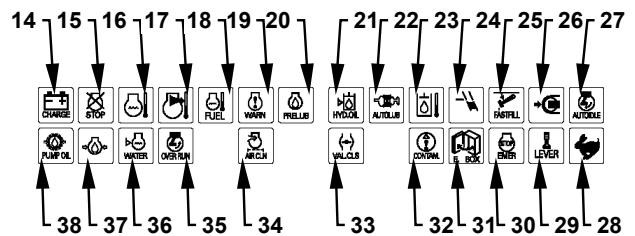
METER CHECK SCREEN

When key switch is turned to the ON position, meter check screen will be displayed next to starting check screen.

- 1- Model Name
- 2- Hydraulic Oil Temperature Gauge
- 3- Front Type
- 4- Coolant Temperature Gauge
- 5- Control Lever Pattern
- 6- Tachometer
- 7- Hour Meter
- 8- Engine Oil Pressure Gauge
- 9- Engine Oil Temperature Gauge
- 10- Clock
- 11- Battery Voltage Gauge
- 12- Fuel Gauge
- 13- Ambient Temperature



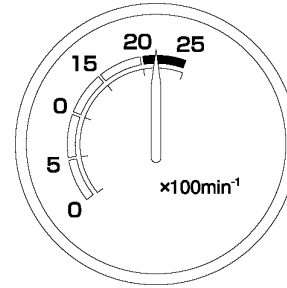
- 14- Alternator Indicator
- 15- Engine Stop Indicator
- 16- Coolant Overheat Indicator
- 17- Exhaust Temperature Indicator
- 18- Fuel Temperature Indicator
- 19- Engine Warning Indicator
- 20- Prelub Indicator
- 21- Hydraulic Oil Level Indicator
- 22- Auto-Lubrication Indicator
- 23- Hydraulic Oil Overheat Indicator
- 24- Stairway Position Indicator
- 25- Fast-Filling Indicator
- 26- Tension Indicator
- 27- Auto-Idle Indicator
- 28- Travel Mode Indicator
- 29- Electric Lever Indicator
- 30- Emergency Engine Stop Indicator
- 31- Electrical Equipment Box Indicator
- 32- Pump Contamination Indicator
- 33- Stop Valve Indicator
- 34- Air Cleaner Restriction Indicator
- 35- Engine Over Run Indicator
- 36- Coolant Level Indicator
- 37- Engine Oil Pressure Indicator
- 38- Pump Transmission Oil Level Indicator



OPERATOR'S STATION

TACHOMETER

Tachometer indicates engine speed in min^{-1} (R.P.M.).

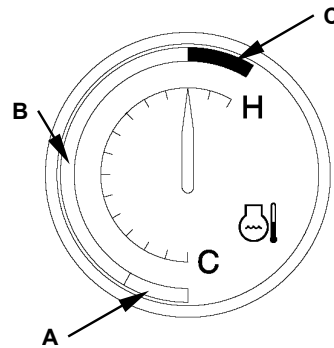


COOLANT TEMPERATURE GAUGE

- White zone (A) : Low temperature. Warming up operation is required.
- Blue zone (B) : Normal operating temperature.
- Red zone (C) : High temperature. Coolant is overheating.

If needle enters the red zone (C), reduce load immediately and run the engine at high idle or auto idle until needle returns to the blue zone (B). Stop the engine after cooling down and check radiator for restriction and clean fins or check the coolant leakage. If the problem continues, contact your authorized dealer.

IMPORTANT: Prevent possible engine damage.
Do not stop the engine when needle enters red zone, as temperature will rise further. Instead, reduce load and run the engine at high idle or auto idle.



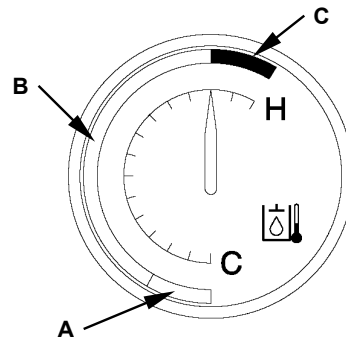
M18M-01-011

M18M-01-012

HYDRAULIC OIL TEMPERATURE GAUGE

- White zone (A) : Low temperature. Warming up operation is required.
- Blue zone (B) : Normal operating temperature.
- Red zone (C) : High temperature. Hydraulic oil is overheating.

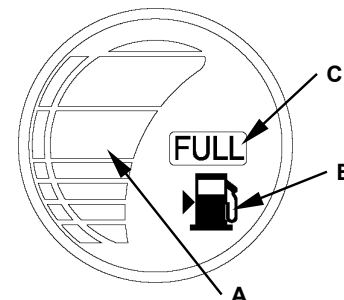
If needle enters the red zone (C), reduce load immediately and run the engine at high idle or auto idle to cool down until needle returns to the blue zone (B). Stop the engine after cooling down and check oil cooler for restriction and clean fins or check the hydraulic oil leakage. If the problem continues, contact your authorized dealer.



M18M-01-013

FUEL GAUGE

As fuel level goes down, blue lights of fuel level indicator (A) will go OFF. When the fuel remains come to approximately 755 liters (200 US gal), fuel level warning indicator (B) will become amber. When the fuel is full, full indicator (C) will light.

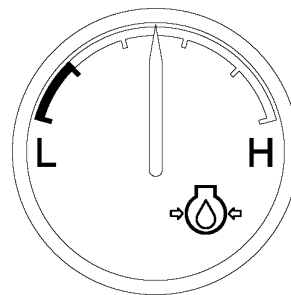


M18M-01-014

OPERATOR'S STATION

ENGINE OIL PRESSURE GAUGE

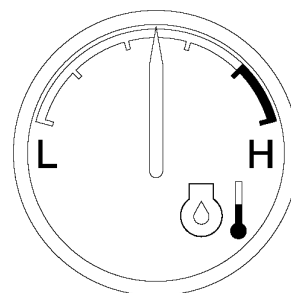
Engine oil pressure gauge indicates engine oil pressure.



M18M-01-039

ENGINE OIL TEMPERATURE GAUGE

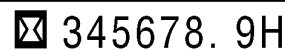
Engine oil temperature gauge indicates engine oil temperature.



M18M-01-040

HOURLY METER

The right hand number indicates tenth (six minutes) of an hour.



M18M-01-015

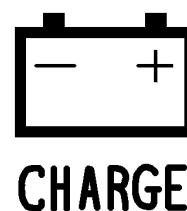
WARNING INDICATORS

Warning indicators described below.

ALTERNATOR INDICATOR

When alternator output is low, alternator indicator will come ON. Check the electrical system.

 **NOTE:** When key switch is turned to the ON position, this indicator normally stays ON until the engine starts.



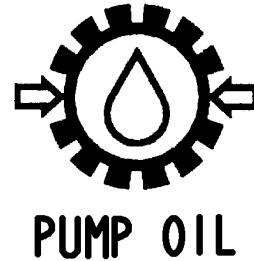
M144-01-023

OPERATOR'S STATION

PUMP TRANSMISSION OIL LEVEL INDICATOR

When pump transmission oil does not circulate, pump transmission oil level indicator will come ON and buzzer will sound. Stop the engine immediately. Check the oil leakage.

-  **NOTE:** Cold oil, low oil level, or operating on a steep slope may cause indicator to come ON.
-  **NOTE:** When key switch is turned to the ON position, this indicator normally stays ON until the engine starts.

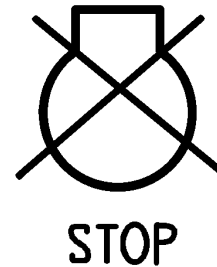


M144-01-024

ENGINE STOP INDICATOR

When electrical signals from sensors on the engine are judged abnormal, engine stop indicator will come ON. You must stop the engine immediately. Check the fault code on the monitor and contact your authorized dealer.

-  **NOTE:** When key switch is turned to the ON position, this indicator normally stays ON until the engine starts.

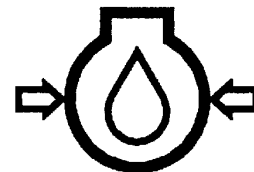


M144-01-026

ENGINE OIL PRESSURE INDICATOR

When engine oil pressure is low, engine oil pressure indicator in yellow or red will come on. Engine power will be reduced automatically. Stop the engine immediately. Check the fault code on the monitor and contact your authorized dealer.

-  **NOTE:** Cold oil, low oil level, or operating on a steep slope may cause indicator to come ON.



M481-01-007

COOLANT OVERHEAT INDICATOR

When coolant overheats, coolant overheat indicator in yellow or red will come on and engine power will be reduced automatically. Reduce load immediately and run the engine at High idle or auto idle to cool down the engine until needle returns to the green zone (B) of coolant temperature gauge. Stop the engine after cooling down and check radiator for restriction and clean fins or check the coolant leakage. If the problem continues, contact your authorized dealer.



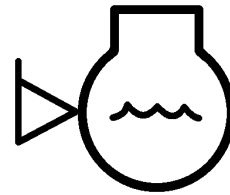
M424-01-012

OPERATOR'S STATION

COOLANT LEVEL INDICATOR

When coolant level is lower than the warning level, coolant level indicator in yellow or red will come on. Check coolant level and the coolant leakage.

 **NOTE:** *Operating on a steep slope may cause indicator to come ON.*



WATER

M117-01-035

ENGINE OVER RUN INDICATOR

When engine speed over to 2150 min^{-1} (2150 rpm), engine over run indicator will come ON and fuel injections of engine disables until speed falls below the over speed limit. Stop the engine and check on operating condition.

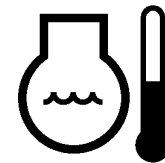


OVER RUN

M18G-01-029

FUEL TEMPERATURE INDICATOR

When fuel temperature is high, fuel temperature indicator in yellow or red will come ON and engine power will be reduced automatically. Stop the engine and check fuel cooler for restriction and clean fins.



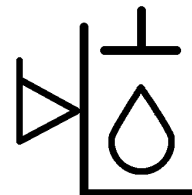
FUEL

M18M-01-016

HYDRAULIC OIL LEVEL INDICATOR

When hydraulic oil level in the hydraulic oil tank is lower than the warning level, hydraulic oil level indicator will come ON and buzzer will sound. Stop the engine immediately. Check the hydraulic oil level and hydraulic oil leakage.

 **NOTE:** *Operating on a steep slope may cause indicator to come ON.*



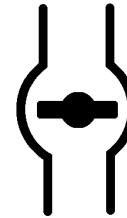
HYD.OIL

M117-01-049

OPERATOR'S STATION

STOP VALVE INDICATOR

When stop valve (4 used: 2 in the return circuits and 2 in the suction circuits) is closed, stop valve indicator will come ON. Buzzer will sound and engine will stop automatically. And the starter motor will not rotate even if engine start switch is pressed.

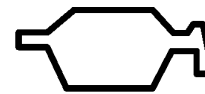


VAL. CLS

M117-01-041

AUTO-LUBRICATION INDICATOR

When auto-lubrication toggle switch on panel near grease can is in the AUTO-GREASING position, auto-lubrication indicator (A) in green will come ON. If the grease can is empty or auto-lubrication system is malfunctioning, auto-lubrication warning indicator (B) in red will come ON. When the switch is in the MANUAL GREASING or OFF position, manual greasing indicator (C) or greasing OFF indicator (D) in red will come ON, respectively.



AUTO LUB

A

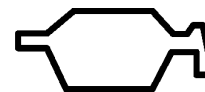
M18G-01-065



AUTO LUB

B

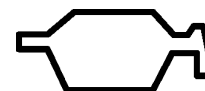
M117-01-036



MANUAL

C

M18G-01-066



OFF

D

M18G-01-067

OPERATOR'S STATION

FAST-FILLING INDICATOR

When the fast-filling panel is lowered, fast-filling indicator will come ON and buzzer will sound. The machine will not be able to swing.



M117-01-091

EMERGENCY ENGINE STOP INDICATOR

When the emergency engine stop switch is turned to the EMERG STOP position, emergency engine stop indicator will come ON and engine will stop. And the starter motor will not rotate even if engine start switch is pressed.

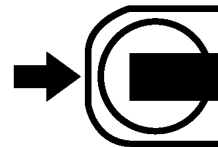


EMER.

M117-01-040

TENSION INDICATOR

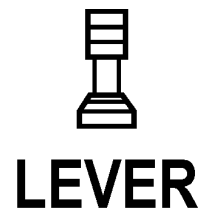
When the cushion cylinder is retracted to the stroke end due to material packing around the front idler, tension indicator will come ON and travel will stop automatically. Drive the machine to remove the packed material in the opposite direction against the direction the machine was being driven. Check the track sag and the adjuster cylinder accumulator for any abnormality.



M18G-01-032

ELECTRIC LEVER INDICATOR

When any abnormality occurs in the electric lever system, electric lever indicator will come ON. Buzzer will sound and operation will be stopped automatically. Stop the engine immediately.



M18G-01-028

OPERATOR'S STATION

CAUTION INDICATORS

Caution indicators described below.

EXHAUST TEMPERATURE INDICATOR

When engine exhaust temperature increases abnormally, exhaust temperature indicator will become red. And when exhaust temperature of some engine cylinders is abnormally lower or higher than the others, exhaust temperature indicator will become yellow. And then, the difference of exhaust temperature increases further, exhaust temperature indicator will also become red. Contact your authorized dealer.



M146-01-037

ENGINE WARNING INDICATOR

When electrical signals from some sensors on the engine except in relation to engine stop indicator, engine warning indicator will come ON. Stop the engine immediately and contact your authorized dealer.

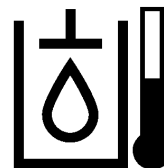
 **NOTE:** When key switch is turned to the ON position, this indicator normally stays ON for approximately 2 seconds.



M144-01-028

HYDRAULIC OIL OVERHEAT INDICATOR

When hydraulic oil overheats, hydraulic oil overheat indicator will come ON. Reduce load immediately and run the engine at high idle or auto idle to cool down until needle of hydraulic oil temperature gauge returns to the green zone. Stop the engine after cooling down and check oil cooler for restriction and clean fins or check the hydraulic oil leakage. If the problem continues, contact your authorized dealer.



M18G-01-031

PUMP CONTAMINATION INDICATOR

When contamination of any of the 8 main pumps and 5 swing or travel motors increases, pump contamination indicator will come ON. Follow the instruction displayed on the monitor.



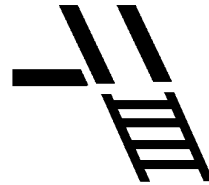
CONTAM.

M117-01-039

OPERATOR'S STATION

STAIRWAY POSITION INDICATOR

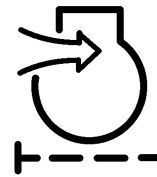
When the stairway is extended, stairway position indicator will come ON and buzzer will sound. The machine will not be able to swing. When the stairway retracts fully, stairway position indicator will go OFF and the machine will be able to swing.



M18M-01-037

AIR CLEANER RESTRICTION INDICATOR

When the air cleaner elements are clogged, air cleaner restriction indicator will come ON. Clean or replace the elements.

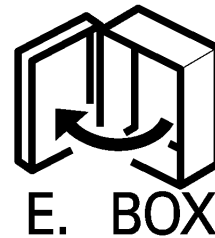


AIR CLN.

M117-01-038

ELECTRICAL EQUIPMENT BOX INDICATOR

When electric equipment box is opened, electrical equipment box indicator will come on. When electric equipment box is closed, electrical equipment box indicator will go off.



M18M-01-017

STATUS INDICATORS

Status indicators described below will become green.

AUTO-IDLE INDICATOR

When the auto-idle mode is turned ON with auto-idle switch, auto-idle indicator will come ON.



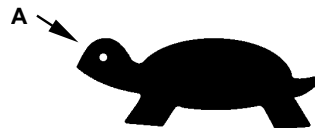
AUTO IDLE

M117-01-044

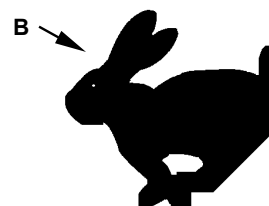
OPERATOR'S STATION

TRAVEL MODE INDICATOR

When the travel speed mode is shifted to slow with travel mode switch, slow travel mode indicator (A) will come ON. And when the travel speed mode is shifted to fast with travel mode switch, fast travel mode indicator (B) will come ON.



M117-01-043



M585-01-010

PRELUB INDICATOR

When the engine start switch is pressed, the prelub motor drives until the engine starts. This indicator stays on during the prelub motor operation.



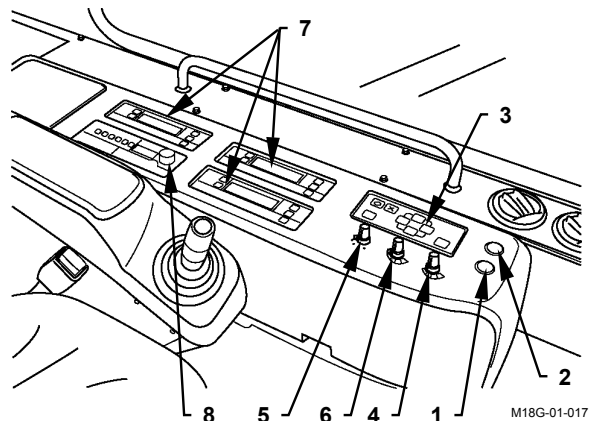
PRELUB

M117-01-047

OPERATOR'S STATION

LEFT CONSOLE

- 1- Warning Lamp (red)
- 2- Caution Lamp (yellow)
- 3- Key Pad
- 4- Monitor Contrast Switch
- 5- Wiper Switch/Washer Switch
- 6- Wiper Delay Selector Switch
- 7- Air Conditioner Panel
- 8- FM/AM Radio



WARNING LAMP

When the warning indicators on the monitor come ON, warning lamp will come ON in red.

CAUTION LAMP

When the caution indicators on the monitor come ON, caution lamp will come ON in yellow.

And when electrical signals from controllers or sensors are judged abnormal, faults code will be displayed on the monitor and caution lamp will also come ON in yellow.

KEY PAD

The monitor display can be operated with key pad.

MONITOR CONTRAST SWITCH

The monitor contrast can be adjusted with monitor contrast switch.

Clockwise Turn: Brighter Illumination

Counterclockwise Turn: Darker Illumination

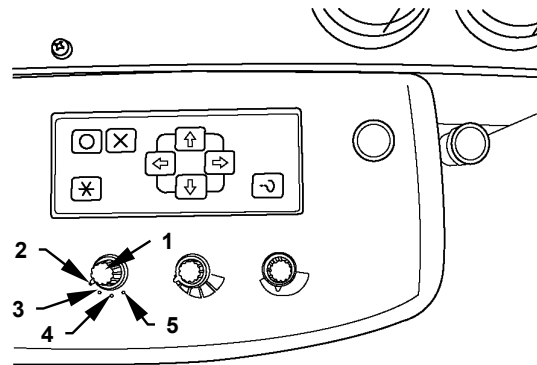
 **NOTE:** When nothing is displayed on the monitor even if key switch is turned to the ON position, adjust the monitor contrast at first.

OPERATOR'S STATION

WIPER SWITCH

The wiper can be operated with wiper switch (1) as follows:

- OFF position (2): Deactivated
- INT position (3): Wiper operates intermittently.
- LOW position (4): Wiper continuously operates in slow speed.
- HIGH position (5): Wiper continuously operates in fast speed.



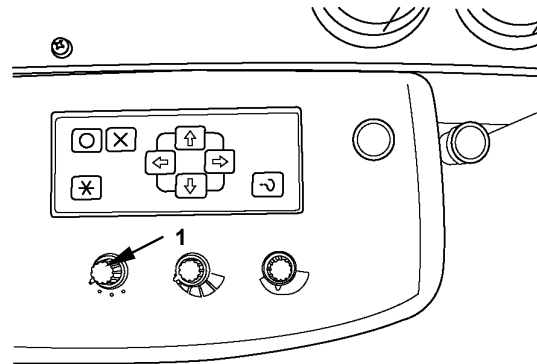
M18G-01-035

WASHER SWITCH

IMPORTANT: Washer motor may be damaged if washer switch (1) is held for more than 20 seconds, or continually operated with no fluid in the washer tank.

Windshield washer fluid can be squirted with washer switch (1).

Washer fluid will squirt and the wiper will operate as long as washer switch (1) is pressed. The wiper will operate four seconds more after washer switch (1) is released.

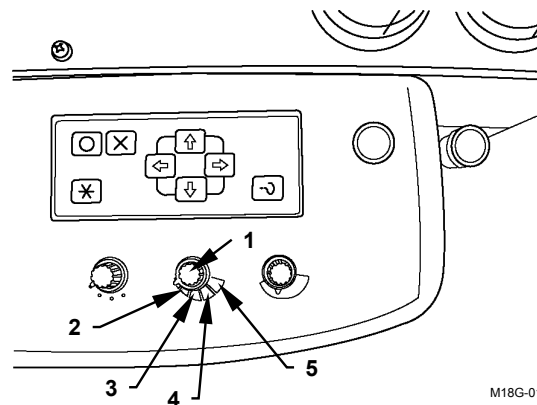


M18G-01-035

WIPER DELAY SELECTOR SWITCH

When the wiper switch is turned to the intermittent position, the interval between wiper operation can be adjusted in four stages with wiper delay selector switch (1) as follows:

- SHORT position (2): Wiper operates at approx. 4 seconds interval.
- position (3): Wiper operates at approx. 8 seconds interval.
- position (4): Wiper operates at approx. 15 seconds interval.
- LONG position (5): Wiper operates at approx. 25 seconds interval.



M18G-01-035

OPERATOR'S STATION

AIR CONDITIONERS

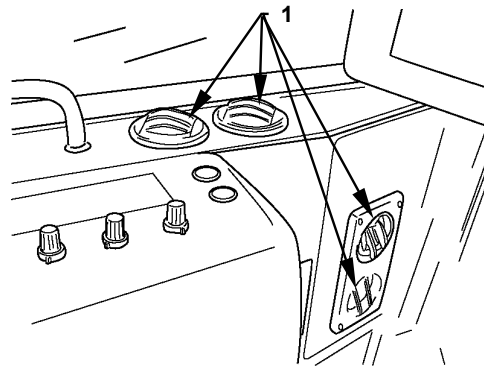
This machine is equipped with three air conditioners, all located in room under the cab. Airflow vents for these air conditioners are located inside the cab at the front, side, and rear, respectively. Moreover, three air conditioner control panels are provided in the cab, each designated for one of the three air conditioners.

Component Designation

- 1- Front Air Flow Vents
- 2- Side Air Flow Vents
- 3- Rear Air Flow Vents

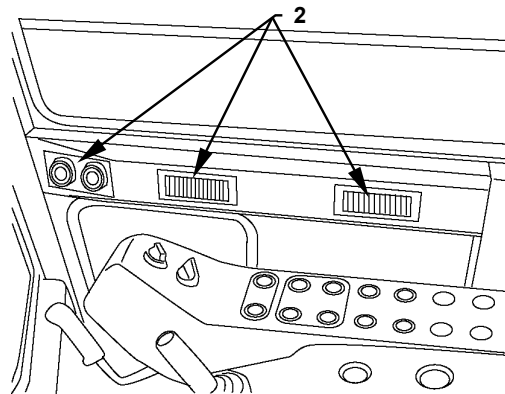
 **NOTE:** Direction of air flowing out of each vent can be changed by adjusting the louver.

- 4- Air Conditioner Front Panel
- 5- Air Conditioner Side Panel
- 6- Air Conditioner Rear Panel



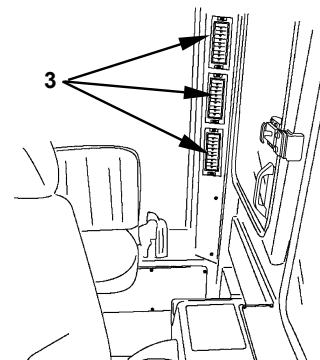
Front Air Flow Vents

M18G-01-036



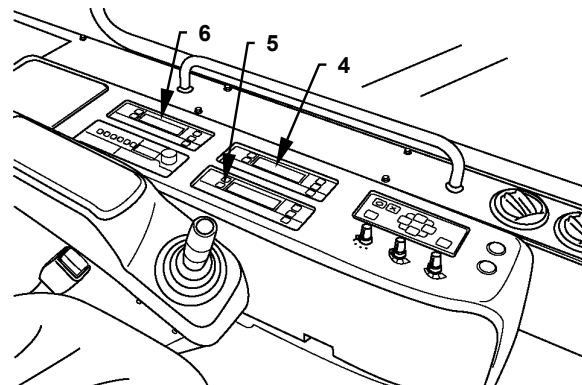
Side Air Flow Vents

M18M-01-018



Rear Air Flow Vents

M18M-01-003

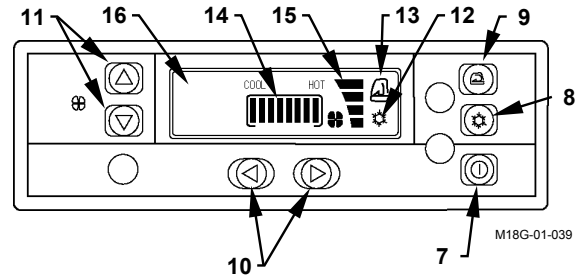


M18G-01-017

OPERATOR'S STATION

DESIGNATIONS AND FUNCTIONS OF CONTROLS

7. Power Switch
8. Air Conditioner Switch
9. Ventilation Shift Switch
10. Temperature Control Switches
11. Blower Control Switches
12. Air Conditioner Indicator
13. Ventilation Indicator
14. Temperature Indicator
15. Blower Speed Indicator
16. Liquid Crystal Display (LCD)



- Power switch (7)
Press power switch (7) to turn power ON. Press it again to turn power OFF.
- Air Conditioner Switch (8)
Press air conditioner switch (8) to turn ON the air conditioner. Press it again to turn it OFF.
- Air Conditioner Indicator (12)
Air conditioner indicator (12) will light when the air conditioner is turned ON.
- Ventilation Shift Switch (9)
Press ventilation shift switch (9) to shift ventilation to circulation mode. Press it again to shift it to fresh air mode.
- Ventilation indicator (13)
 -  Circulation
 -  Fresh Air

 **NOTE:** When the fresh air mode is selected, the cab is slightly pressurized, preventing dust from entering into the cab.

- Temperature Control Switches (10)
Press temperature control switch  (10) to increase the temperature.
Press temperature control switch  (10) to decrease the temperature.
- Temperature Indicator (14)
The number of the lit LCD indicates the relative temperature of the air blowing out. The higher the number of the lit LCD, the higher the temperature of the air blowing out is.

OPERATOR'S STATION

- Blower Control Switches (11)

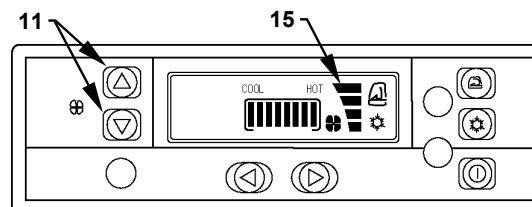
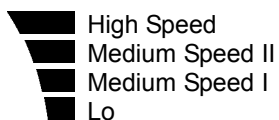
Press blower control switches (11) to control blower speed.

Each time blower control switch  (11) is pressed, the blower fan speed is increased from OFF to low, to medium, and to high.

Each time blower control switch  (11) is pressed, the blower fan speed is decreased from high to medium, to low, then it will be turned OFF.

- Blower Speed Indicator (15)

Each part of the indicator indicates blower fan speed as follows:



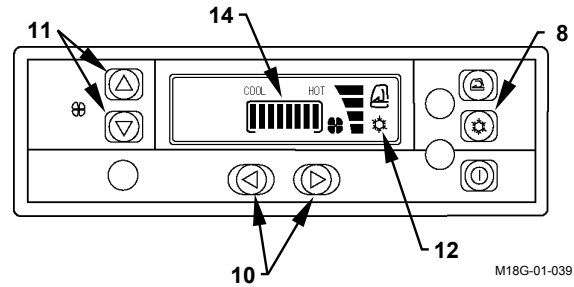
M18G-01-039

OPERATOR'S STATION

COOLING

Set the temperature to the lowest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until only the leftmost indicator (14) is on.)

Press blower control switch (11) to turn on the blower fan. Press air conditioner switch (8). (Air conditioner indicator (12) should turn on.) Cool air will flow from the vents. Use temperature control switch (10) and blower control switch (11) to adjust the temperature inside the cab.



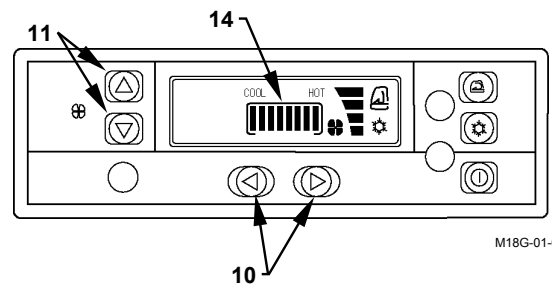
M18G-01-039

HEATING

Set the temperature to the highest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until all temperature indicators (14) turn on.)

Press blower control switch (11) to turn on the blower fan. Warm air will flow from the vents.

Use temperature control switch (10) and blower control switch (11) to adjust the temperature inside the cab.



M18G-01-039

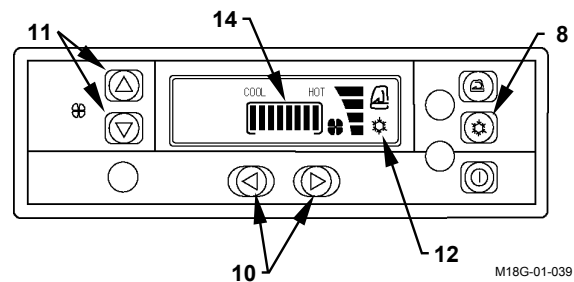
DEHUMIDIFYING AND HEATING (To prevent the windshield from clouding)

Set the temperature to the highest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until all temperature indicators (14) turn on.)

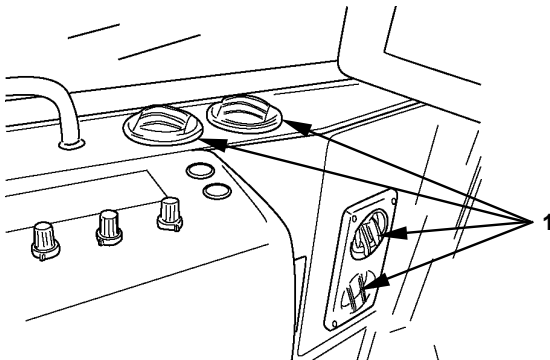
Press blower control switch (11) to turn on the blower fan. Press air conditioner switch (8). (Air conditioner indicator (12) should turn on.) Warm air will flow from the vents.

Adjust front air flow vents (1) and side air flow vents (2) so that the air flow is directed toward the windshield.

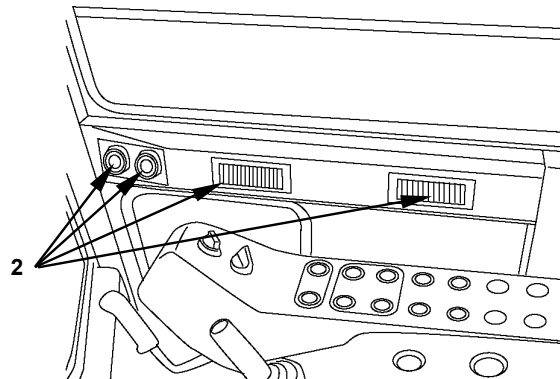
Use temperature control switch (10) and blower control switch (11) to adjust the temperature inside the cab.



M18G-01-039



M18G-01-036



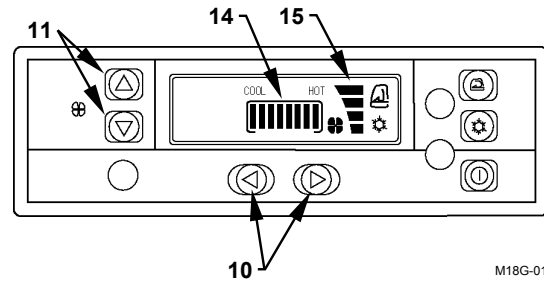
M18M-01-018

OPERATOR'S STATION

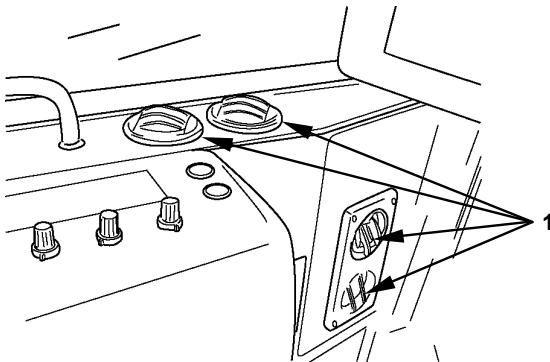
DEFROSTING

Set the temperature to the highest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until all temperature indicators (14) turn on.)

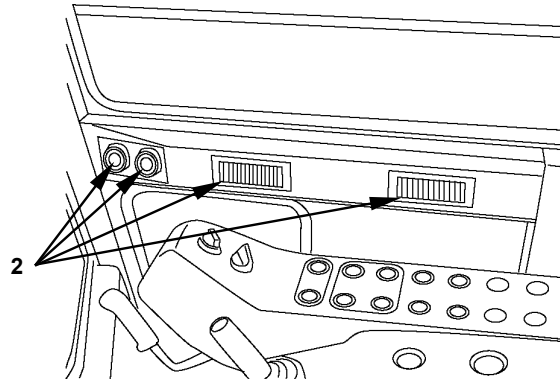
Repeatedly press blower switch (11) to the high speed position (until blower indicator (15) comes to high speed). Adjust front air flow vents (1) and side air flow vents (2) so that the air flow is directed toward the windshield.



M18G-01-039



M18G-01-036

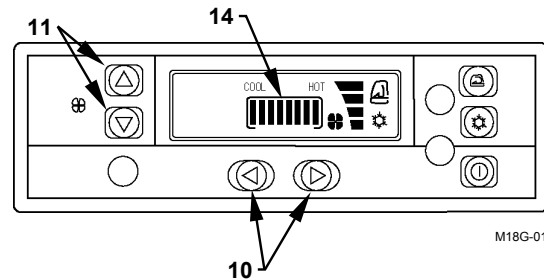


M18M-01-018

BLOWER OPERATION WITHOUT COOLING OR HEATING

Set the temperature to the lowest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until only the leftmost indicator (14) is on.)

Press blower control switch (11) to turn on the blower fan. Air will flow from the vents.



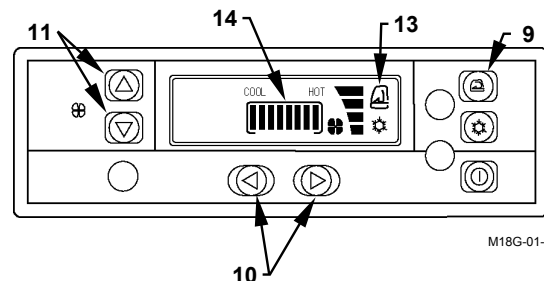
M18G-01-039

VENTILATION THE CAB

Turn on the fresh air indicator (13) using ventilation switch (9).

Set the temperature to the lowest setting using temperature control switch (10). (Repeatedly press temperature control switch (10) until only the leftmost temperature indicator (14) is on.)

Press blower control switch (11) to turn on the blower. Fresh air will flow from the vents.



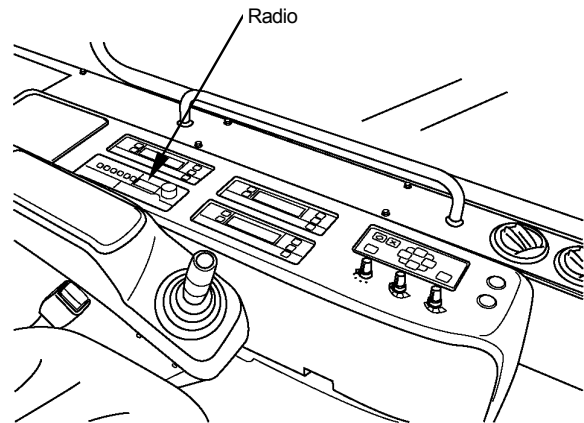
M18G-01-0391

OPERATOR'S STATION

AM/FM RADIO OPERATION

Controls on the radio

- 1- Power Switch/Volume Control Knob
- 2- Tone Adjustment Ring
- 3- AM/FM Switch
- 4- Station Presets
- 5- Tuning Switches
- 6- Display Mode Change Switch
- 7- Digital Display
- 8- Time Set Switches

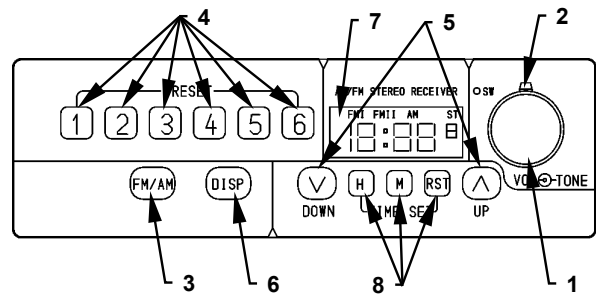


M18G-01-017

Tuning Procedure

- Manual Tuning Procedure
Repeatedly tap one of tuning switches (5) until the desired station is reached. Each time the tuning switch is pressed, the frequency changes at an interval.

Tap the tuning switch [UP] (^) to increase the frequency.
Tap the tuning switch [DOWN] (v) to decrease the frequency.



M1G6-01-026

- Automatic Search Function
Press and hold one tuning switch (5) for more than half a second, then release. The frequency display will move up to the next higher frequency station.

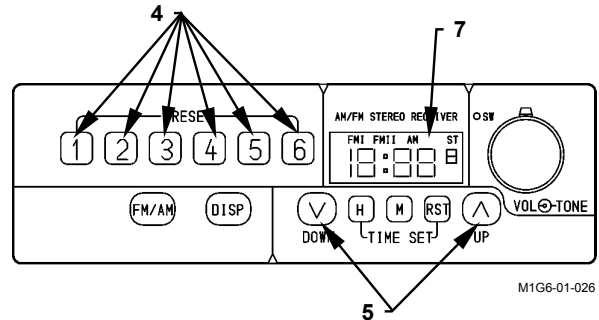
To go up to the next higher frequency station, press and hold the tuning switch [UP] (^).
To go down to the next lower frequency station, press and hold the tuning switch [DOWN] (v).

In order to deactivate the automatic search function while it is operating (while searching the next available frequency station), simply tap tuning switch (5) again. If the receiving radio waves are weak, i. e. such as when the machine is located between high rising buildings, etc., use the manual tuning procedure to select the desired station.

OPERATOR'S STATION

Station Presetting Procedure

1. Select the desired station using tuning switches (5). (Refer to the "Tuning Procedure" section.)
2. Press and hold one station preset (4) for more than 1 second until an electronic tone is heard. Now, the selected station is preset for the selected station preset. The frequency of the preset station will be indicated on digital display (7).



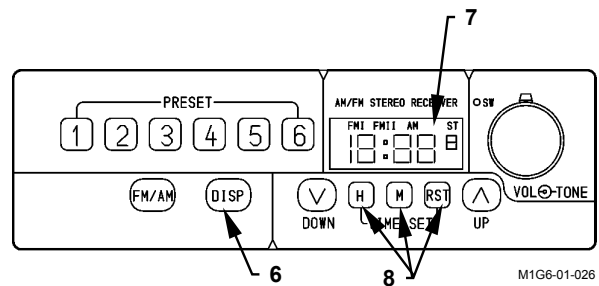
M1G6-01-026

Once the presetting is complete for a station preset (4), the radio will be tuned to the preset station when station preset (4) is pressed (for less than 1 second).

DIGITAL CLOCK SETTING PROCEDURE

NOTE: In order to set the clock, digital display (7) must be in the time display mode.

1. Press display mode button (6) to indicate the hour display on digital display (7).
2. Press and hold time set button (RST) (8) for longer than 1 second. The hour display will start flashing and the time set mode will be selected.
3. Press time set button (H or M) (8) to set the clock. Each time set button (H or M) (8) is pressed, the time display will increase by one. If time set button (H or M) (8) is pressed and held, the time display will change continuously.
 - When setting the hour, press time set button (H) (8).
 - When setting the minute, press time set button (M) (8).



M1G6-01-026

The time is displayed in 12 hour standard.

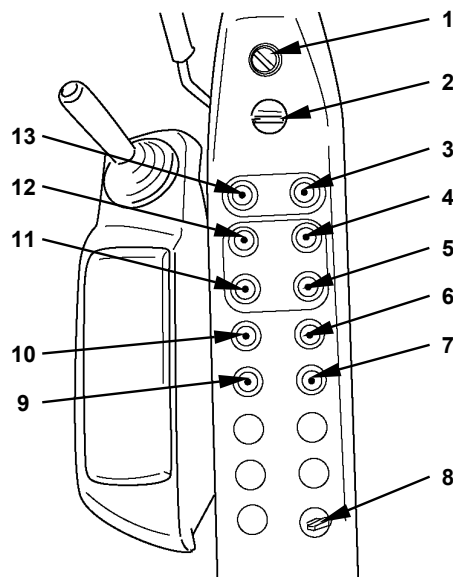
If either of the switches (H) or (M) is pressed and held, the hour or minute display will change continuously until the switch is released.

4. When the hour display is "12," if time set button (H) (8) is pressed, the hour display will be reset to "1." When the minute display is "59," if time set button (M)(8) is pressed, the minute display will be reset to "00." However, the hour display remains unchanged in this case.
5. After the clock setting is complete, press and hold time set button (RST)(8) again for longer than 1 second, or turn the radio switch OFF to end the clock time setting procedure. Digital display (7) stops flashing and changes to stay ON.

OPERATOR'S STATION

RIGHT CONSOLE

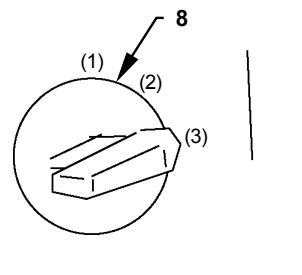
- 1- Emergency Engine Stop Switch
- 2- Engine Speed Control Dial
- 3- Engine Start Switch
- 4- Dome Light Switch
- 5- Entrance Light Switch
- 6- Auto Idle Switch
- 7- Fast-Filling Switch
- 8- Key Switch
- 9- Buzzer Stop Switch
- 10- Travel Mode Switch
- 11- Maintenance Light Switch
- 12- Work Light Switch
- 13- Engine Stop Switch



M18M-01-041

KEY SWITCH

- 1- OFF (Power OFF)
- 2- ACC (Horn, Radio, etc)
- 3- ON (Power ON)



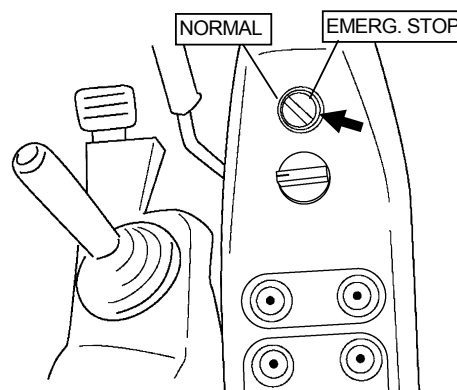
M18G-01-034

OPERATOR'S STATION

EMERGENCY ENGINE STOP SWITCH

1. Turn emergency engine stop switch from the NORMAL position to the EMERG STOP position when emergency engine stop is required.
2. Engine will stop.
3. Turn emergency engine stop switch to the NORMAL position before attempting to restart the engine.

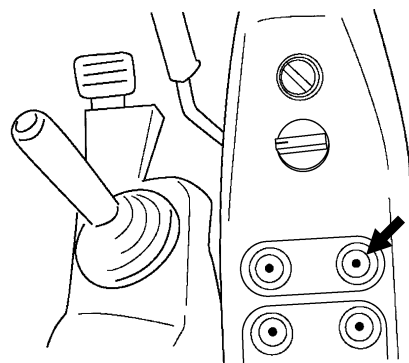
 **NOTE:** Do not use this switch when performing any inspection/service work.



M18M-01-004

ENGINE START SWITCH

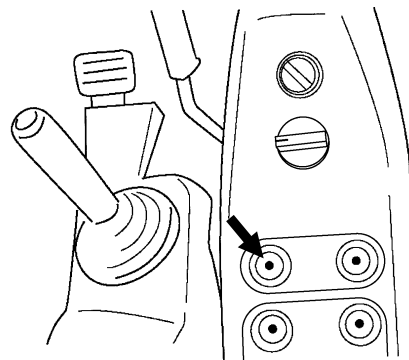
When engine start switch is kept pressed, the engine will continue to crank until the engine starts.



M18M-01-004

ENGINE STOP SWITCH

When engine stop switch is kept pressed until the engine stops rotating completely, the engine will stop.



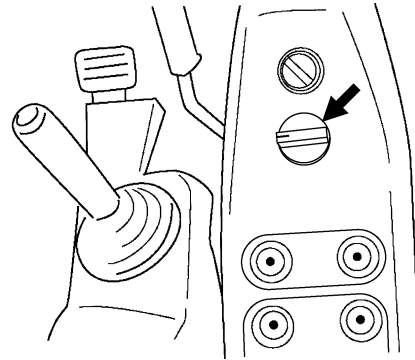
M18M-01-004

OPERATOR'S STATION

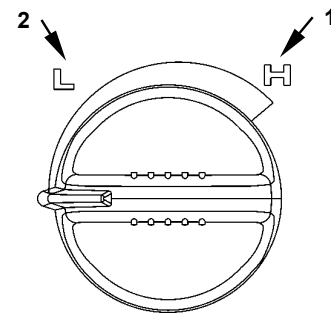
ENGINE SPEED CONTROL DIAL

Engine speed can be controlled with engine speed control dial.

- The fully clockwise position (1): Fast Idle
- The fully counterclockwise position (2): Slow Idle



M18M-01-004



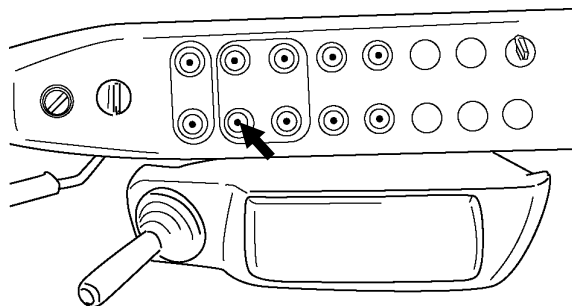
M18G-01-040

OPERATOR'S STATION

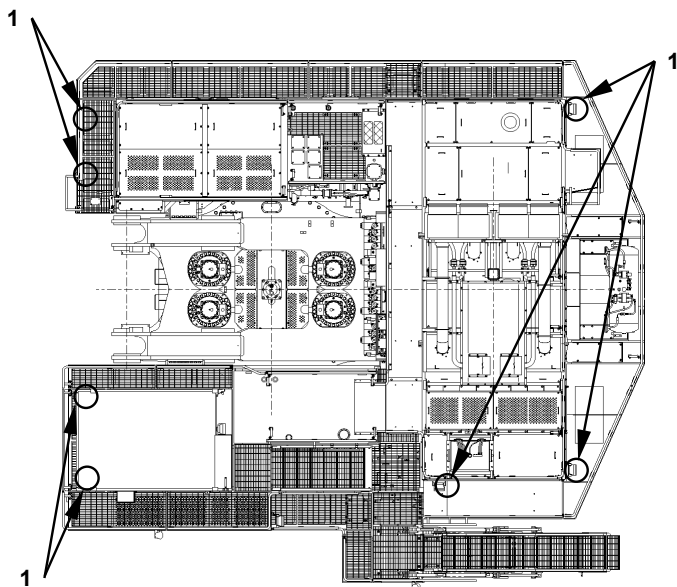
WORK LIGHT SWITCH

All 9 work lights (1) will be turned ON with work light switch. In addition, illumination for key pad (2), air conditioner panels (3) and radio (4) will be turned ON.

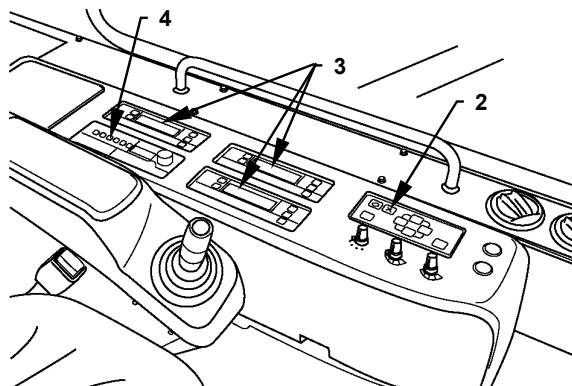
- On the cab roof toward front (2 pieces)
- On the room under the cab toward front (2 pieces)
- On the step in front of the right unit toward front (2 pieces)
- On the back of the engine unit toward left back (1 piece)
- On the back of the engine unit toward right back (1 piece)
- On the side of the engine unit toward left side (1 piece)



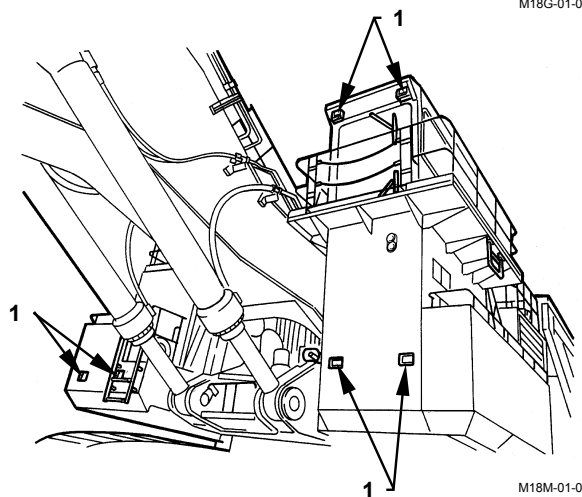
M18M-01-019



M18M-01-005



M18G-01-017

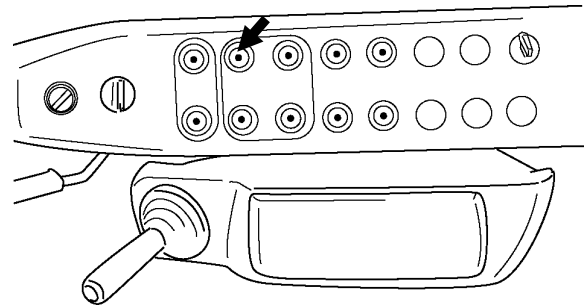


M18M-01-038

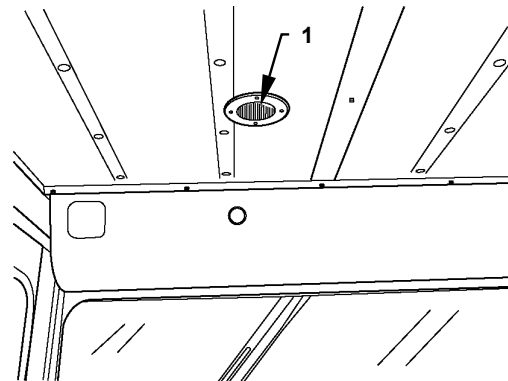
OPERATOR'S STATION

DOME LIGHT SWITCH

All 2 dome lights (1) located on the front and rear part of the cab ceiling will be turned ON with dome light switch.

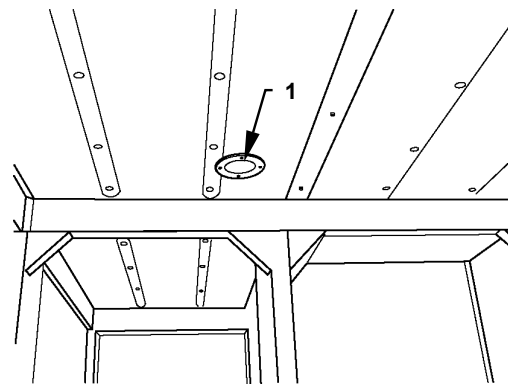


M18M-01-019



Front

M18G-01-043



Rear

M18G-01-044

OPERATOR'S STATION

MAINTENANCE LIGHT SWITCH

All 7 maintenance lights (1) will be turned ON with maintenance light switch.

In room under the cab (1 piece)

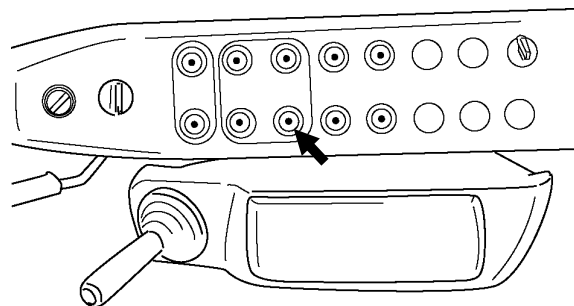
In pump room (1 piece)

In engine room (2 pieces)

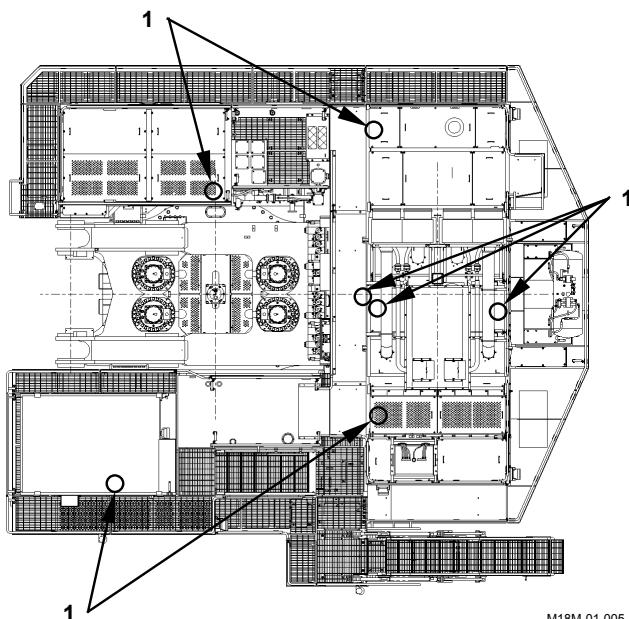
In radiator room (1 piece)

In oil cooler room (1 piece)

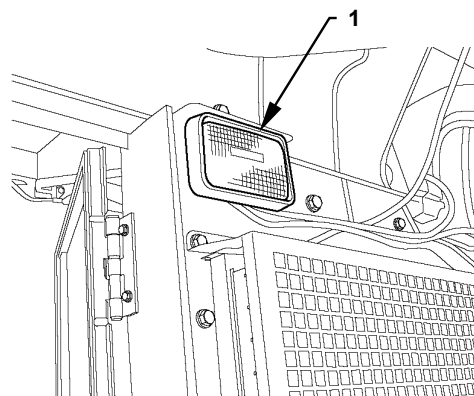
On engine unit for the control valve (1 piece)



M18G-01-033

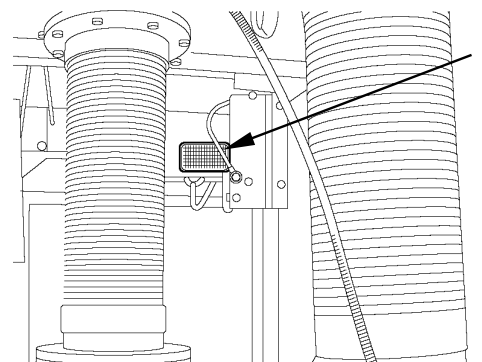


M18M-01-005



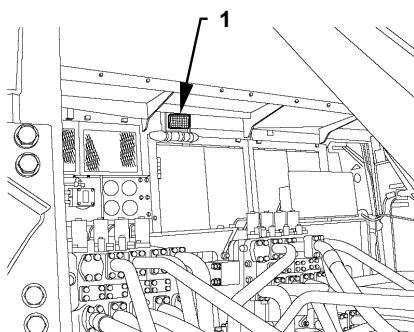
In Room Under the Cab

M18M-01-022



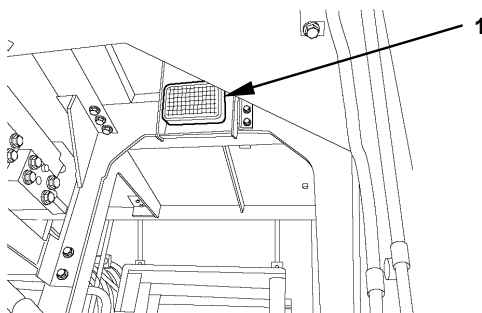
In Engine Room

M18M-01-023



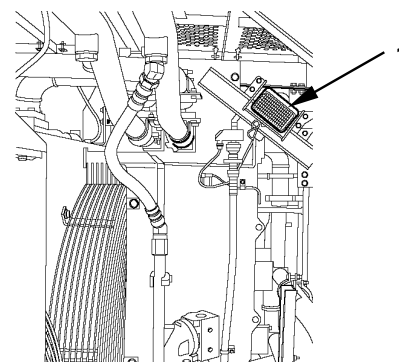
On Engine Unit For the Control Valve

M18M-01-025



In Pump Room

M18M-01-026



In Oil Cooler Room

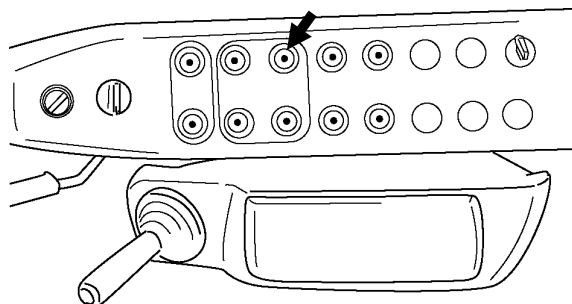
M18M-01-024

OPERATOR'S STATION

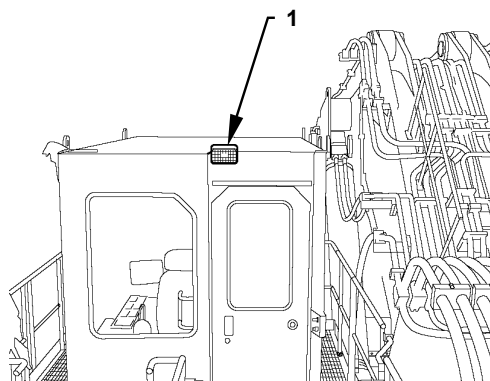
ENTRANCE LIGHT SWITCH

All 2 entrance lights (1) will be turned ON with entrance light switch.

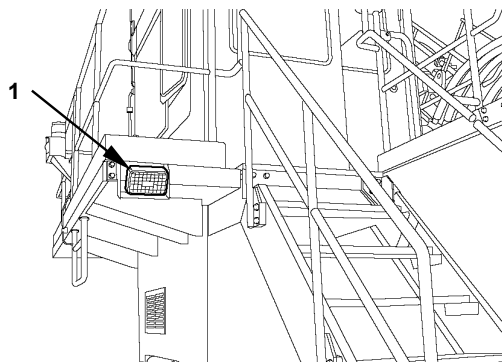
 **NOTE:** Entrance lights (1) will stay ON depending on the delayed power OFF time after the key switch is turned OFF with entrance light switch ON.



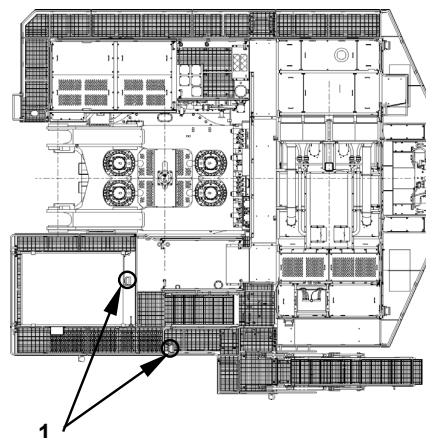
M18G-01-033



M18M-01-027



M18M-01-028



M18M-01-005

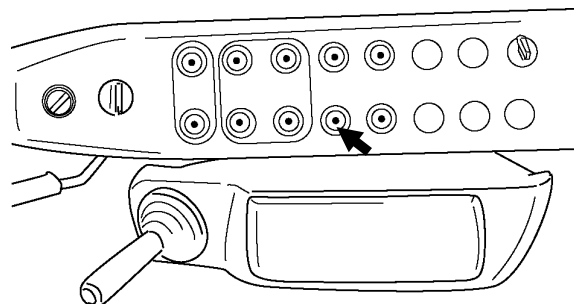
OPERATOR'S STATION

TRAVEL MODE SWITCH

Slow travel speed and fast travel speed can be selected with travel mode switch.

Slow mode : Slow travel mode indicator  is displayed in the part (1) of monitor.

Fast mode : Fast travel mode indicator  is displayed in the part (1) of monitor.



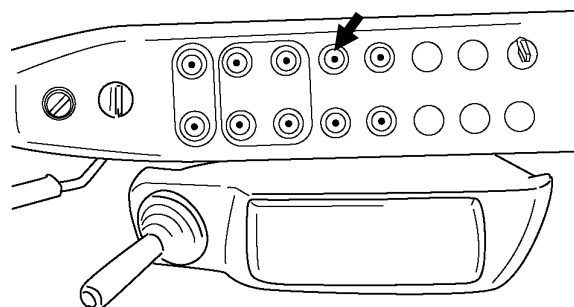
M18M-01-019



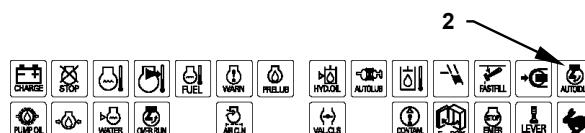
M18M-01-010

AUTO-IDLE SWITCH

Auto-idle mode will be turned ON with auto-idle switch.
Auto-idle Indicator (2) will come ON when auto-idle mode is turned on.



M18M-01-019



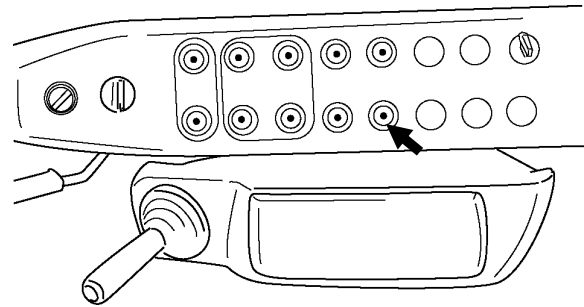
M18M-01-010

OPERATOR'S STATION

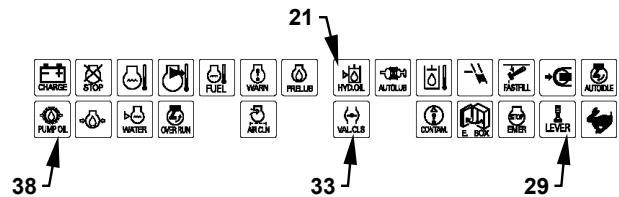
BUZZER STOP SWITCH

The buzzer will sound in the following cases.

1. Pump transmission oil does not circulate.
(Pump transmission oil level indicator (38) comes ON .)
2. Hydraulic oil tank oil level is low.
(Hydraulic oil level indicator (21) comes ON also.)
3. Stop valve for suction piping or return piping is closed.
(Stop valve indicator (33) comes ON also.)
4. Fast-filling panel is lowered.
5. Stairway is extended.
6. Electric lever system is abnormal. (Electric lever indicator (29) comes ON also)



M18M-01-019



M18M-01-010

When buzzer stop switch is pressed, the buzzer will stop sounding. However, indicators will stay ON. The buzzer is kept deactivated even after the switch is released until the key switch is turned OFF and is turned ON again or after all abnormalities are eliminated. During deactivation, if a new abnormal condition occurs, the indicator comes ON but the buzzer does not sound. When all abnormal conditions disappear, the buzzer is automatically reset and only sounds when a new abnormal condition occurs.

OPERATOR'S STATION

FAST-FILLING SYSTEM

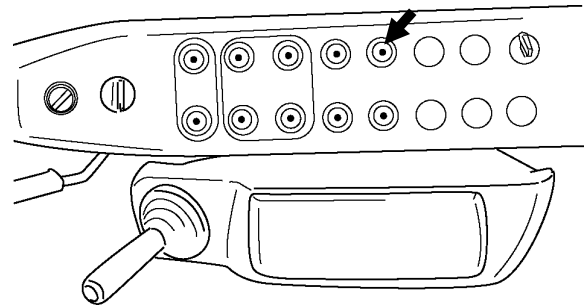
This machine is equipped with the fast-filling system for adding fuel, hydraulic oil, gear oil, engine oil, coolant and grease on the ground.

Fast-filling panel (1) at the rear of the machine will be raised or lowered with fast-filling switch as follows.

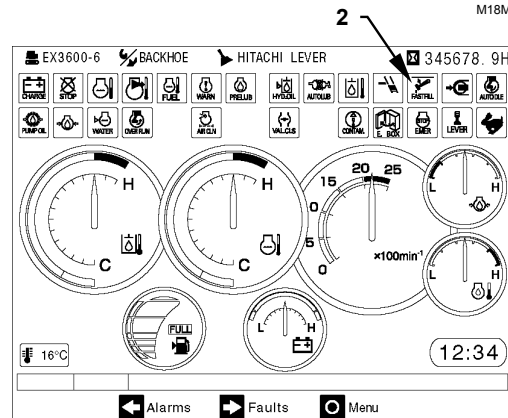
1. Pull the pilot control shut-off lever back to the LOCK position.
2. Run the engine at slow idle.
3. Press fast-filling system switch.
4. Fast-filling indicator (2) will come ON and fast-filling panel (1) will start to go down.
5. When fast-filling panel (1) is completely lowered, it will stop going down automatically.
6. Stop the engine.

WARNING: Never operate engine while adding oil.

NOTE: While fast-filling panel is lowered, the machine will not be able to swing.

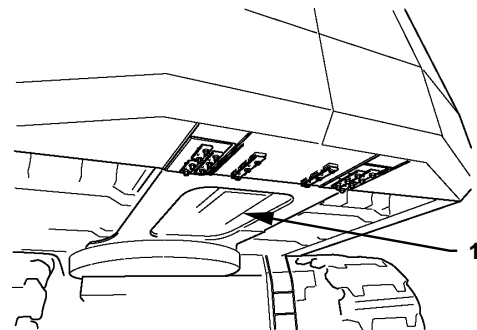


M18M-01-019

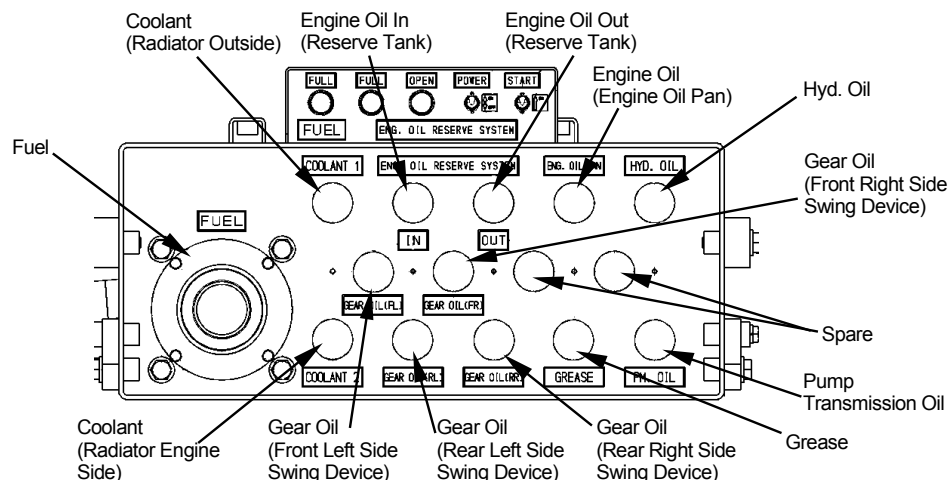


M18M-01-009

7. Add fuel, hydraulic oil, gear oil, engine oil, coolant and grease via the fast-filling panel.
8. Start the engine and run it at slow idle.
9. Press fast-filling system switch again.
10. Fast-filling panel (1) will start to go up.
11. When fast-filling panel (1) is completely raised, it will stop going up automatically and fast-filling indicator (2) will go OFF.



M18G-01-052

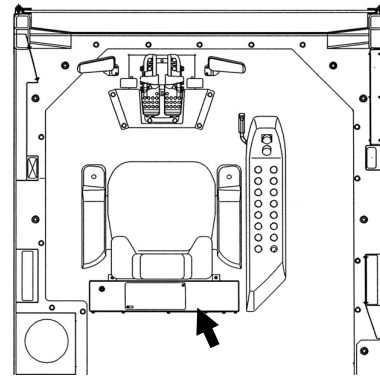


M18M-01-020

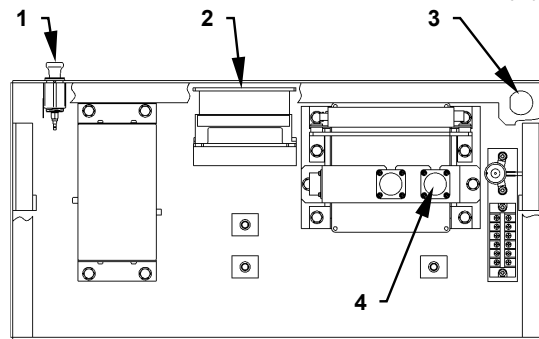
OPERATOR'S STATION

REAR CONSOLE

- 1- Cigar Lighter
- 2- Fuse Box
- 3- DLU Download Connector
- 4- ECM Data Link Connector



M18M-01-007



T18G-01-02-026

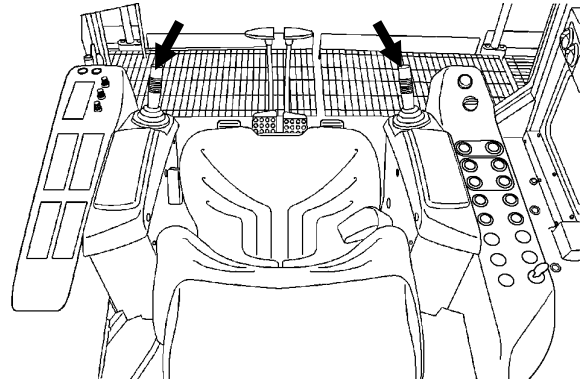
OPERATOR'S STATION

HORN SWITCH

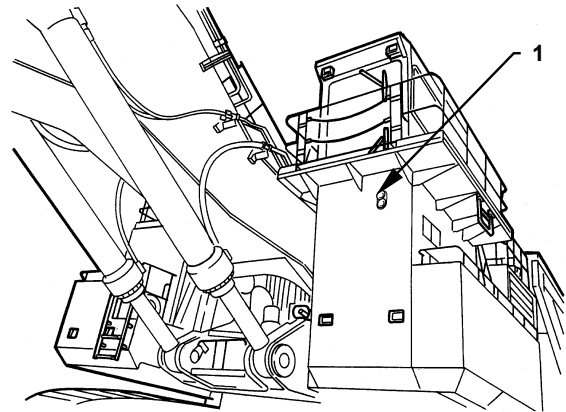
The horn (1) will continue to sound while horn switch is kept pressed.



WARNING: If horn (1) does not sound when pressed, immediately stop the engine and contact your authorized dealer. Operating the machine with a malfunctioning horn may result in personal injury or death.



M18M-01-006



M18M-01-038

OPERATOR'S STATION

ADJUSTING THE SEAT

- 1- Seat Inclination Adjustment Lever
- 2- Seat Fore-Aft Adjustment Lever
- 3- Seat Height Adjustment Lever
- 4- Seat/Armrest/Backrest Fore-Aft Adjustment Lever
- 5- Seat/Backrest Fore-Aft Adjustment Lever
- 6- Backrest Adjustment Lever
- 7- Armrest Height Adjustment Lever

Seat Inclination Adjustment

Pull lever (1) up to adjust the seat cushion angle (8 positions in 2.5 ° increments). When raising the rear side angle of the seat cushion, place your bodyweight on the front side of the cushion seat while pulling lever (1) up. When lowering the rear side angle of the seat cushion, place your bodyweight on the rear side of the cushion seat while pulling lever (1) up.

Seat Fore-Aft Adjustment

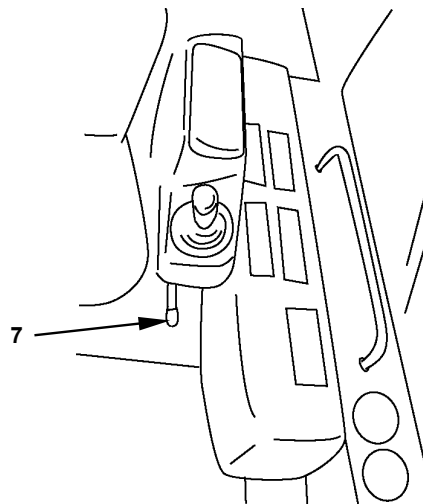
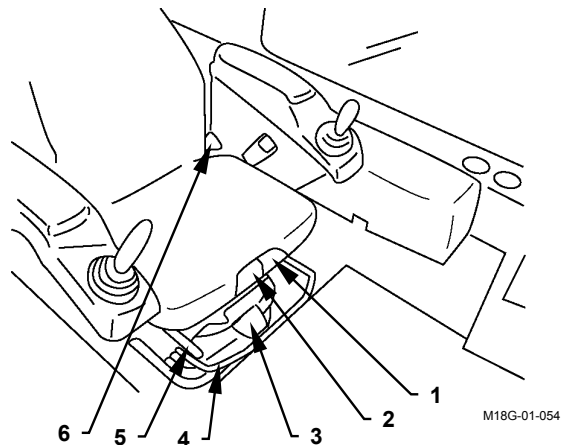
Pull lever (2) up to adjust the seat fore-aft position. The adjusting positions are provided in 4 places in 15 mm increments.

Armrest Height Adjustment



WARNING: When armrest lock lever (7) is raised, the armrest will suddenly be moved up to the maximum height by spring force. If armrest lock lever (7) is raised with the arm placed on the armrest arm, arm injury may result. Raise armrest lock lever (7) only after removing your arm from the armrest to avoid injury.

Pull armrest lock lever (7) up while pressing the armrest with your arm. Control your arm force to adjust the armrest height (4 positions). Release armrest lock lever (7) to lock the armrest in the desired position. Both right and left armrest heights can be independently adjusted.



OPERATOR'S STATION

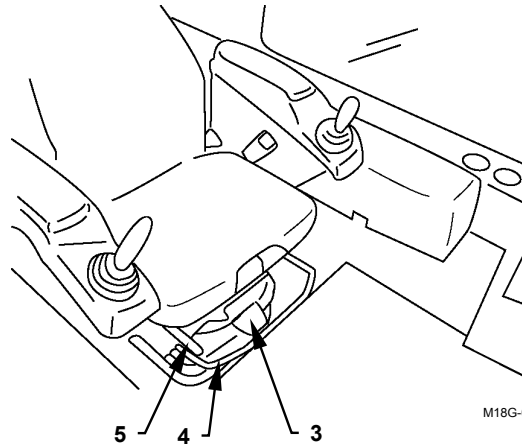
Seat/Backrest Fore-Aft Adjustment

Pull lever (5) up to adjust the seat/backrest fore-aft position. The adjusting positions are provided in 12 places in 10 mm increments.

Seat Height Adjustment

IMPORTANT: The seat is supported by the air suspension system. Turn the key switch ON to supply air from the compressor.

Pull lever (3) once and release it. The seat height should automatically adjust corresponding to your weight. When further adjustment is required, pull lever (3) continuously to raise the seat height further. When lever (3) is pushed downward, the seat height is lowered.



M18G-01-054

Seat/Armrest/Backrest Fore-Aft Adjustment

Pull lever (4) to adjust the fore-aft position of the seat, armrest, and backrest as a unit. The adjusting positions are provided in 15 places in 10 mm increments.

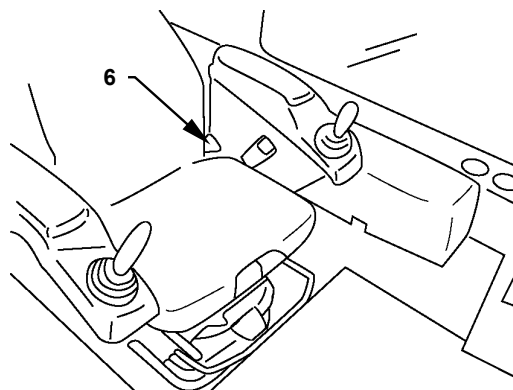
OPERATOR'S STATION

Backrest Adjustment

Pull lever (6) to adjust the tilt angle of the backrest. The backrest can be tilted forward up to the level position. The backward tilt adjusting positions are provided in 2 ° increments up to 80°.



WARNING: Adjust the backrest tilt angle while keeping your back in contact with the backrest. If the backrest is tilted forward without your back contacting the backrest, the backrest may be suddenly tilted, possibly resulting in injury to your back.



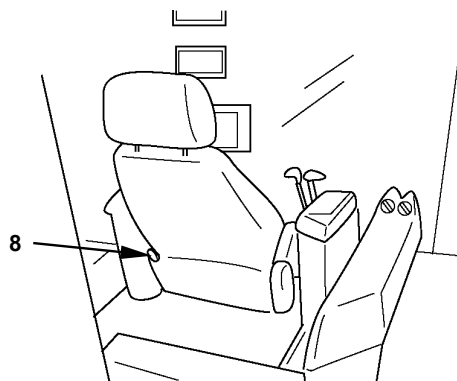
M18G-01-054

Lumbar Support Adjustment

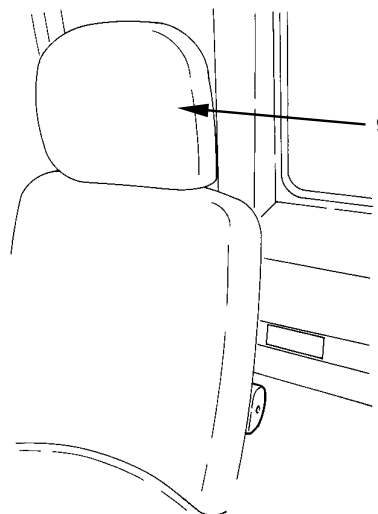
Turn dial (8) to adjust the lumbar support position.

Headrest Adjustment

Headrest (9) position can be adjusted in 7 positions in 100 mm increments in the up-down direction and up to 38° in the forward direction.



M18G-01-056



M18G-01-057

OPERATOR'S STATION

SEAT BELT



WARNING: Be sure to use the seat belt when operating the machine.
Before operating the machine, be sure to examine belt (1), buckle (2), or attaching hardware. Replace belt (1), buckle (2), or attaching hardware if they are damaged, or worn.
Replace seat belt every three years, regardless of appearance.

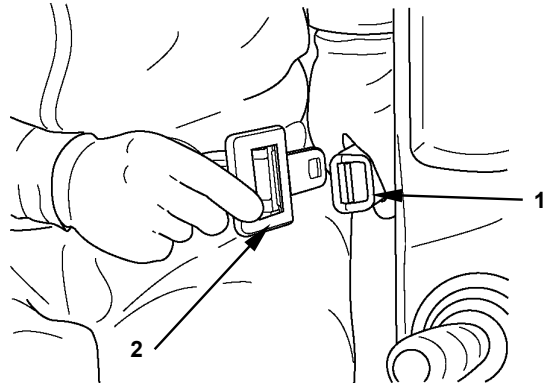
Seat Belt

1. Securely insert the end of seat belt (1) into buckle (2). Confirm that seat belt (1) is not twisted.
2. Pull out the end of belt (1) and securely insert it into buckle (2). Confirm that belt (1) is not twisted.

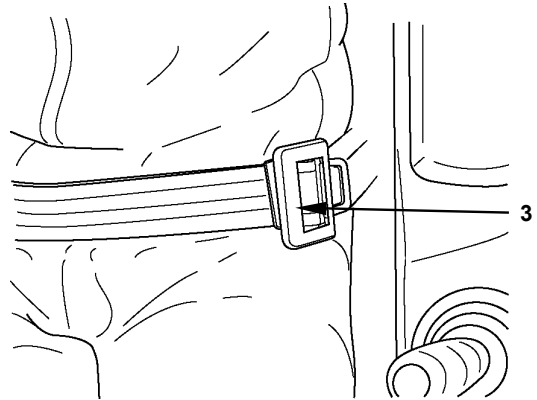


NOTE: If belt (1) is locked before the end is securely inserted into buckle (2), release the end of belt (1) to completely return it to the original position. Then, retry.

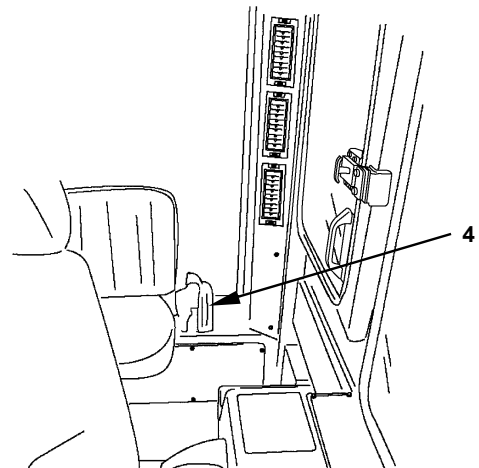
3. Push button (3) on buckle (2) to unfasten belt (1).
4. Seat belt (4) is also provided on the trainer seat.



M18G-01-058



M18G-01-059



M18M-01-003

OPERATOR'S STATION

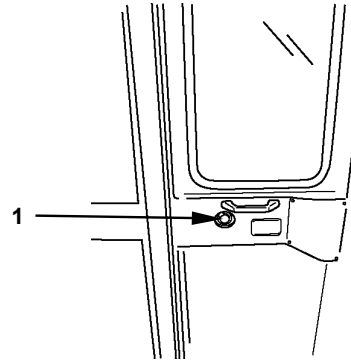
CAB DOOR RELEASE BUTTON

When opening the cab door, lock it in the fully opened position.



CAUTION: Open the cab door all the way until it securely locks in the latch on the side of the cab.

Push button (1) to unlock the door.



M18G-01-060

OPENING CAB LEFT WINDOW

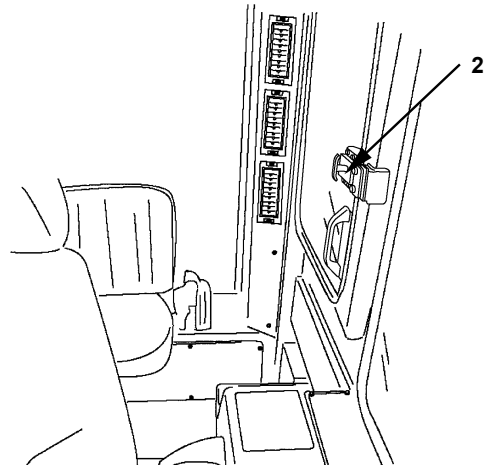
The cab left window can be opened.

Pull out lock pin (2) to unlock and open the cab left window. Rotate the knob to open the cab left window.



WARNING:

- Do not keep the cab left window open when the machine is parked on a slope, or while the wind is blowing hard. The cab left window may close accidentally, possibly resulting in personal injury.
- When opening or closing the cab left window, take extra care not to catch fingers between the base machine and the cab left window



M18M-01-003

[illegible]

BREAK-IN

OBSERVE MACHINE CLOSELY

- IMPORTANT:**
- Be extra cautious during the first 50 hours, until you become thoroughly familiar with the sound and feel of your new machine.
 - Do not attempt to travel the machine at full speed before the break-in period is over, as the lower rollers and front idlers may seize. For the first 200 hours of operation, operate the machine with the travel speed switch set to the slow speed mode.
 - When moving the machine to the jobsite after completion of local re-assembly, be sure to operate the machine with the travel speed switch set to the slow speed mode. Check lower rollers and front idlers every 10 minutes for excessively high temperature.
 - Perform correct break-in procedures for the front-attachment pins.
1. Operate the engine horsepower up to about 80 % of full load.
 2. Avoid excessive engine idling.
 3. Check indicator lights and gauges frequently during operation.

EVERY 10 HOURS OR EACH SHIFT

1. Perform 10-hour or each shift service. (See Maintenance interval guide -- 10 hours.)
2. Watch for fluid leaks.
3. Lubricate working tool pivots every 10 hours for the first 50 hours and when working in mud and water.

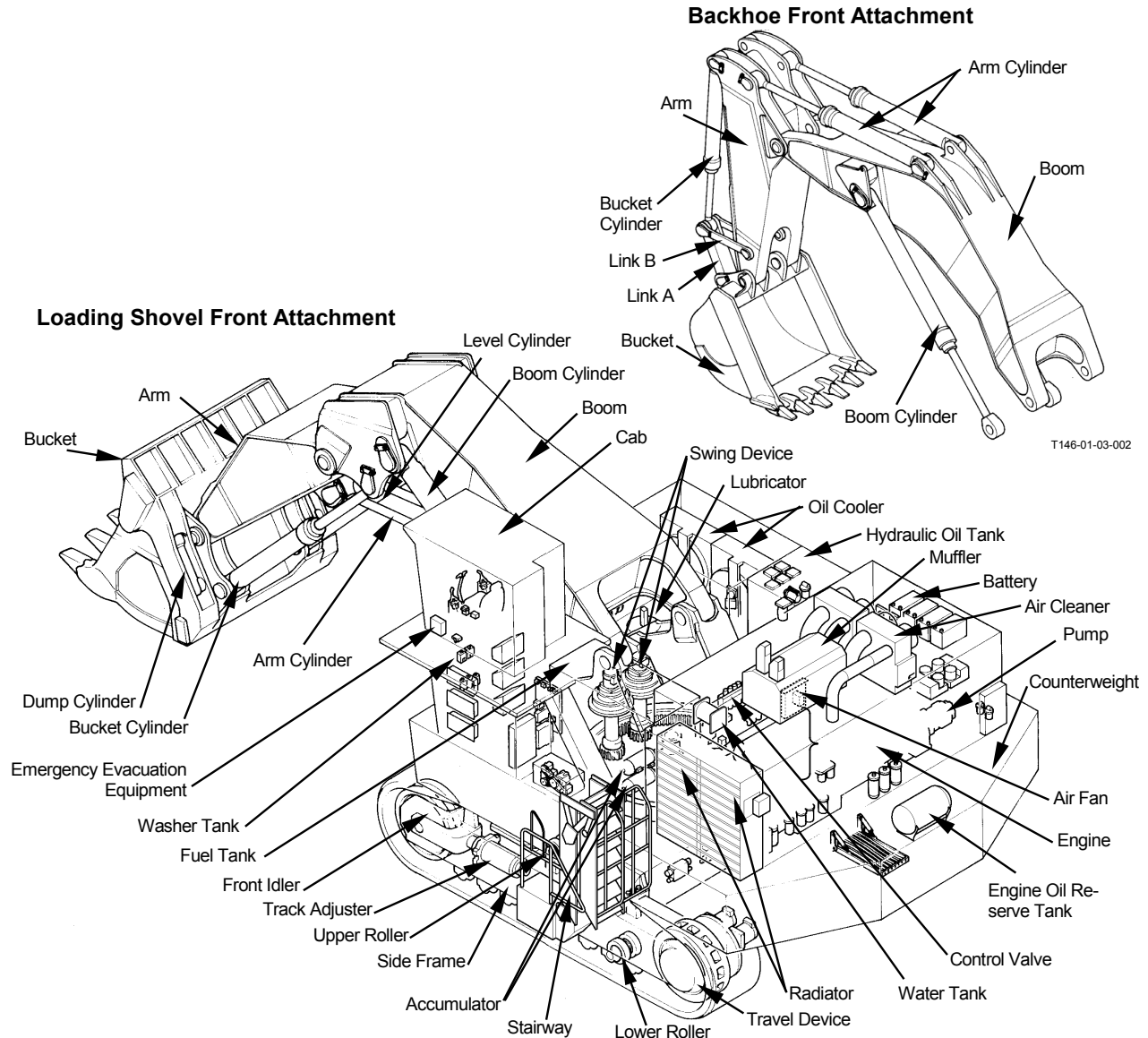
BREAK-IN

AFTER THE FIRST 50 HOURS

1. Check coolant, engine oil, and hydraulic oil level and for leaks every day. Refill with the recommended oils and coolant.
2. Check and grease the greasing points at the regular intervals. Grease the front attachment pins every day.
3. Retighten bolts at the regular intervals.
4. Re-drive in the tooth (point) holding wedges.
5. Check the monitor for any abnormality while operating the machine.
6. Operate the machine after thoroughly warming up the engine and hydraulic oil.
7. Check the machine for any abnormal operations while operating the machine.

OPERATING THE ENGINE

INSPECT MACHINE DAILY BEFORE STARTING



For other inspection and maintenance procedures, refer to the MAINTENANCE Section.

ELECTRICAL SYSTEM: Check for worn or frayed wires and loose or corroded connections.

BOOM, BUCKET, SHEET METAL, TRACKS, HARDWARE: Check for bent, broken, loose, or missing parts.

FUEL SYSTEM: Drain water and deposits from fuel tank.

HYDRAULIC SYSTEM: Check for leaks, missing or loose clamps, kinked hoses, and lines or hoses that rub against each other or other parts.

LUBRICATION: Check lubrication points.

PROTECTIVE DEVICES: Check guards, shields, and covers.

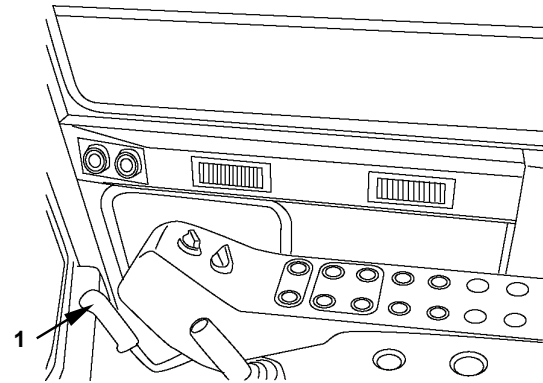
FIRE PREVENTION: Clean machine of debris.

SAFETY: Walk around machine to clear all persons from machine area.

OPERATING THE ENGINE

BEFORE TURNING POWER ON

1. Confirm that pilot control shut-off lever (1) is in the LOCK position.
2. Confirm that all control levers are placed in neutral.
3. Adjust the seat to allow full pedal and control levers stroke with operator's back against the backrest. Fasten the seat belt.



LOCK Position

M18M-01-018

OPERATING THE ENGINE

TURNING POWER ON

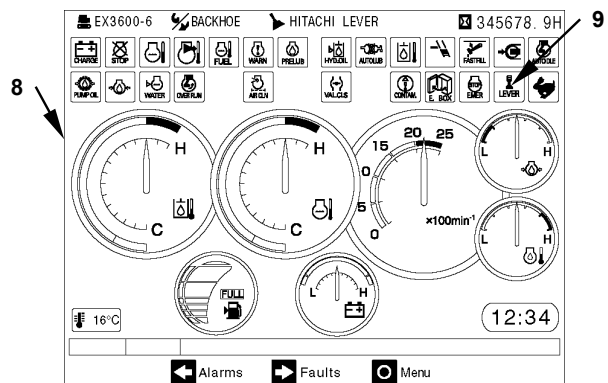
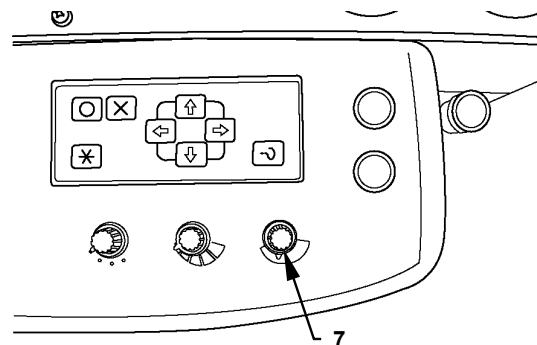
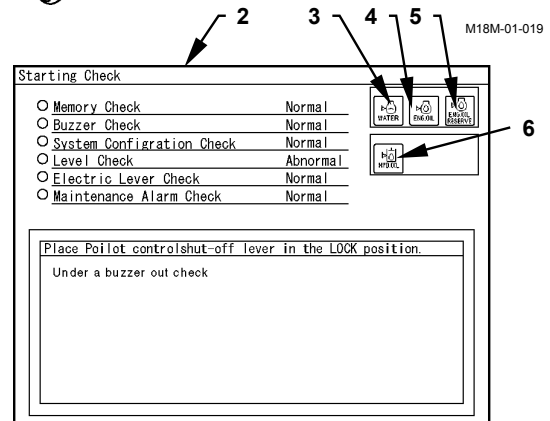
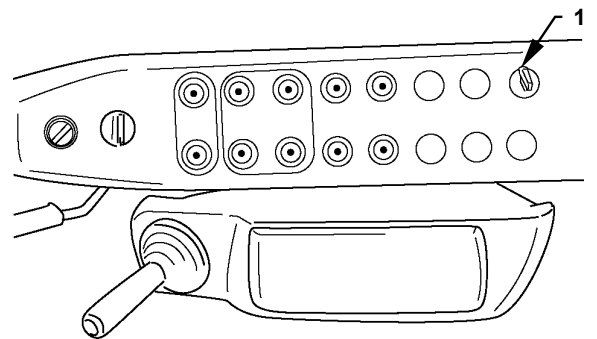
1. Turn key switch (1) to the ON position.
2. Starting check screen (2) will be displayed on the monitor.
3. Fluid level check is automatically performed. Level check indicators for coolant (3), engine oil in oil pan (4), engine oil in reserve tank (5) and hydraulic oil (6) will become green when fluid levels are appropriate.

NOTE: When nothing is displayed on the monitor even if key switch is turned to the ON position, adjust the monitor contrast switch (7) at first.

IMPORTANT: The monitor does not guarantee the machine conditions. Do not rely on the monitor alone. Check each fluid level visually at the regular intervals.

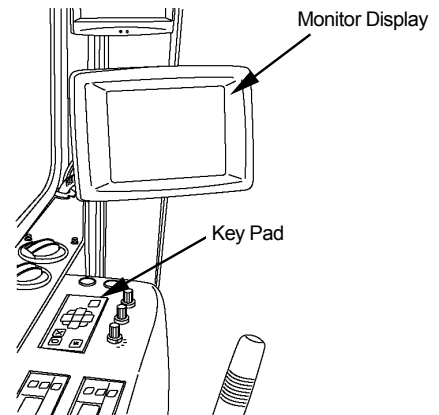
4. Make sure that all checking items indicate NORMAL. If one of the level checks indicates ABNORMAL, check the fluid level concerned and add as needed. In case other items indicate ABNORMAL, contact your authorized dealer.
5. The monitor will automatically shift from starting check screen (2) to meter check screen (8).

NOTE: When key switch (1) is turned to the ON position, electric lever indicator (9) will come ON if both electric levers are not in the neutral position. The electric lever not in the neutral position cannot be moved further. After turning the key switch to the OFF position, return both electric levers to the neutral position. Then, turn the key switch to the ON position again.

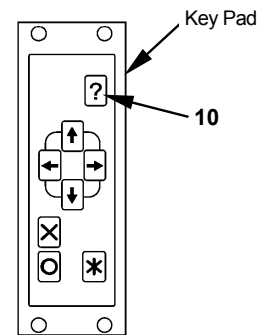


OPERATING THE ENGINE

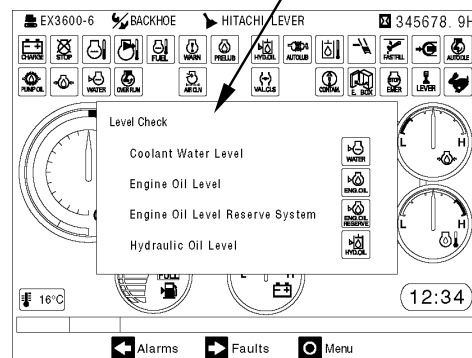
- NOTE:**
1. Level check screen (11) will be displayed when press **?** button (10) on key pad.
 2. Level check screen (11) shows up only when the engine is not running.
 3. Meter check screen (8) will be displayed again with **?** button (10) on key pad.



M18G-01-018

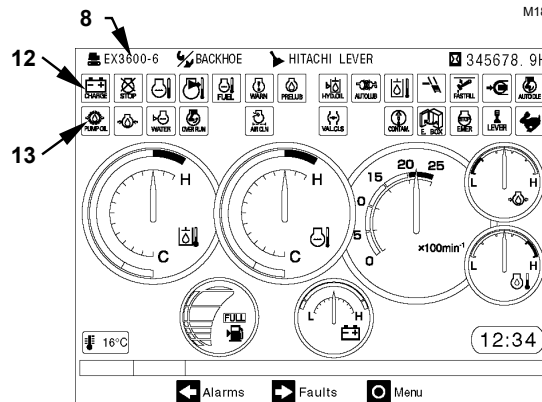


M18G-03-005



M18M-03-001

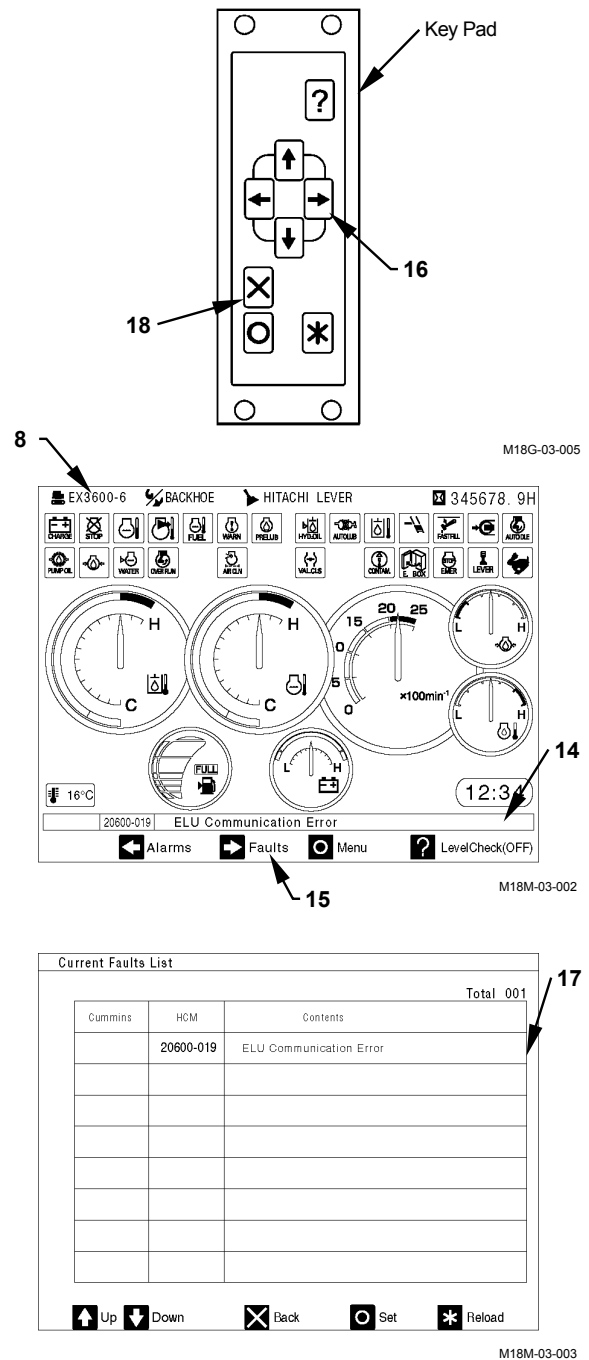
6. Warning indicators of alternator (12), pump transmission oil level (13) will stay ON.



M18M-01-009

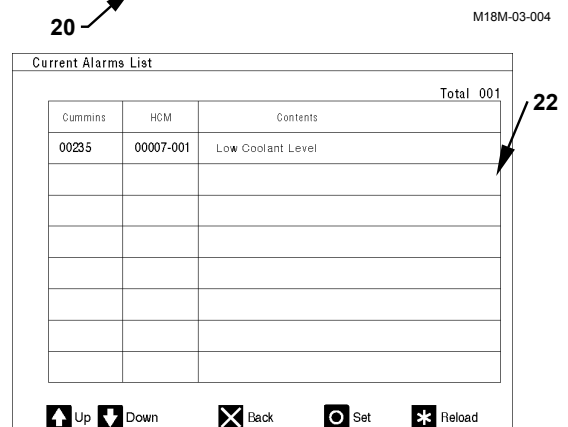
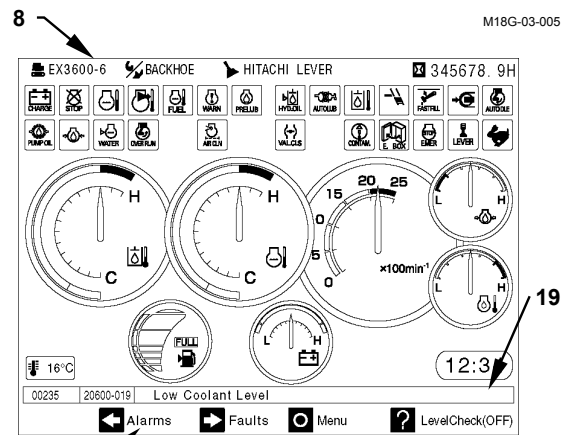
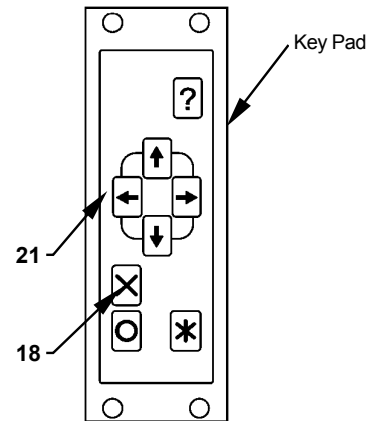
OPERATING THE ENGINE

7. Make sure not faults exist before starting engine. If any fault messages (14) exist, fault mark (15) will appear. Press  button (16) on key pad and current fault list (17) will be displayed. Meter check screen (8) will be displayed again with  button (18) on key pad. After confirming the faults messages on display, report the error codes (Cummins or HCM or both) to your authorized dealer.



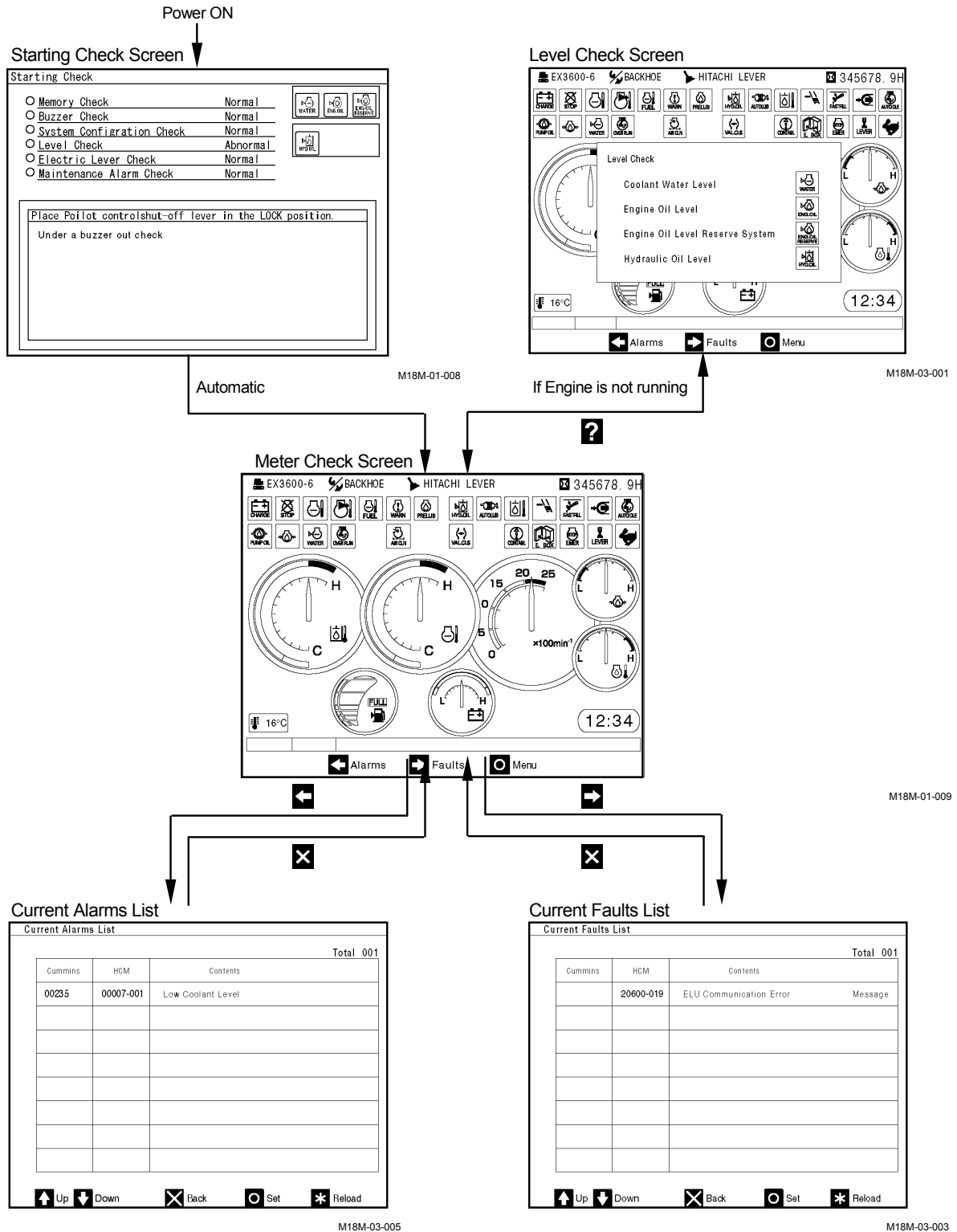
OPERATING THE ENGINE

8. Make sure not alarms exist before starting engine. If any alarm messages (19) exist, alarm mark (20) will appear. Press  button (21) on key pad, current alarm list (22) will be displayed. Meter check screen (8) will be displayed again with  button (18) on key pad. After confirming the alarm messages on display, report the error codes (Cummins or HCM or both) to your authorized dealer.



OPERATING THE ENGINE

MONITOR SCREEN FLOW -1



OPERATING THE ENGINE

STARTING THE ENGINE

1. Turn engine speed control dial (1) to the slow idle position.
2. Turn auto-idle switch (2) OFF.
3. Sound the horn with either one of both horn switches (3) to alert bystanders.
4. Press and hold engine start switch (4) until the engine starts. Prelub indicator (5) will light.

NOTE: • This machine is equipped with the Prelub system. This system functions to automatically lubricate engine components before the engine starts, immediately after the engine start switch (4) is pressed. The Prelub indicator remains lit while this function is operating.

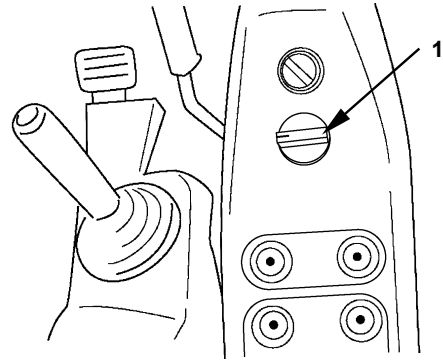
- Hold the engine start switch (4) until the engine starts after Prelub indicator (5) goes OFF.

IMPORTANT: Prevent damage to the starter. Never run the starter continuously for more than 15 seconds. If the engine fails to start, wait for 2 to 3 minutes and try again.

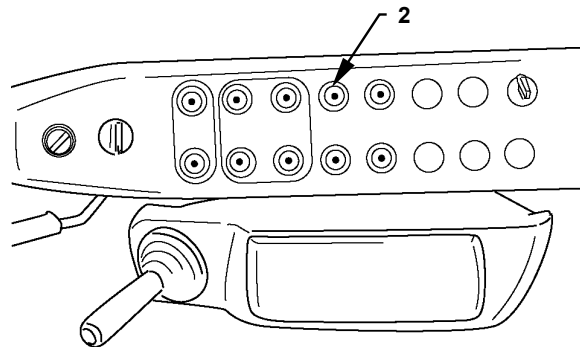
5. After the engine has started, immediately release the engine start switch (4).

IMPORTANT: • After a false start, do not press the start switches (4) until the engine completely stops rotating, or the starter may be damaged.

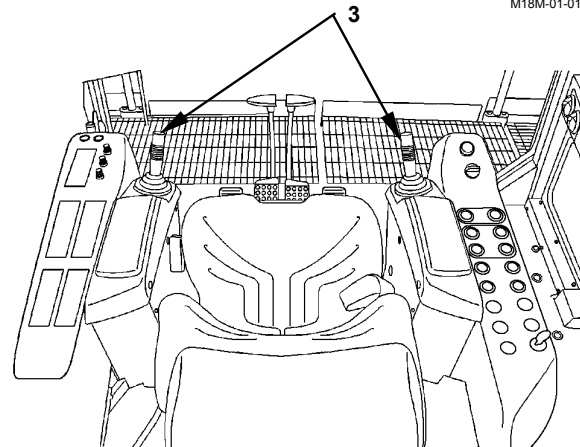
- The engine may vibrate due to resonance during idling operation. In this case, slightly increase engine speed to absorb resonance.



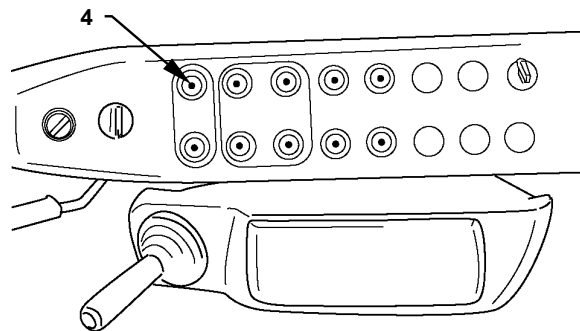
M18M-01-004



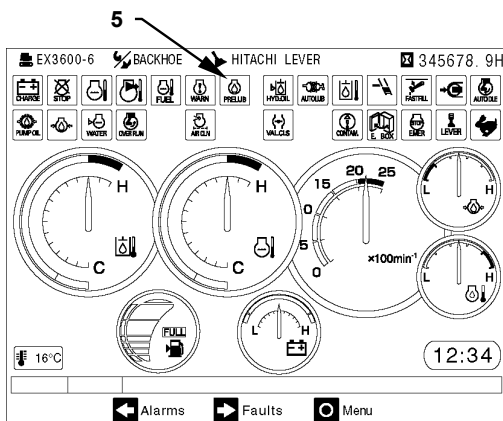
M18M-01-019



M18M-01-006



M18M-01-019



M18M-01-009

OPERATING THE ENGINE

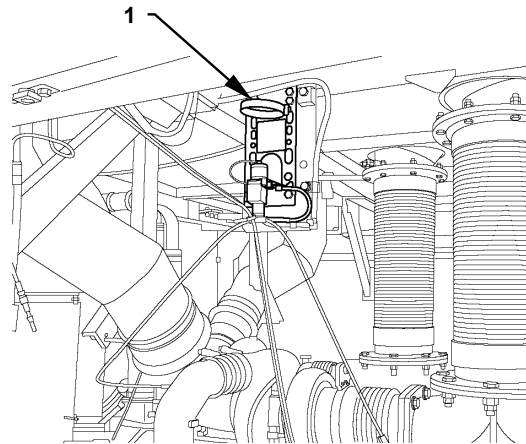
STARTING IN COLD WEATHER

WARNING: Prevent possible injury from exploding container. Starting fluid is highly flammable. Keep container away from heat, sparks, and open flame. Contents are pressurized. Do not puncture or incinerate container. Remove container from machine if engine does not need starting fluid.

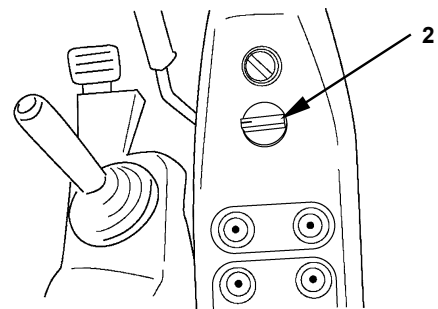
IMPORTANT: An ether is injected automatically.

1. Install an ether container on holder (1) located in the engine room.
2. Turn the engine speed control dial (2) to the slow idle position.
3. Press and hold engine start switch (3) until the engine starts. Prelub indicator (4) will light.
4. The starter will rotate to start the engine after Prelub indicator (4) goes OFF.
5. A shot of ether will be injected.
6. After the engine has started, release the engine start switch (3).
7. Be sure to remove the ether container once the engine is started.

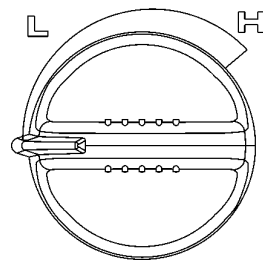
NOTE: When starting the engine at temperatures below -20°C (-4°F), contact your authorized dealer. A coolant heater, jacket water heater or extra battery capacity may be required.



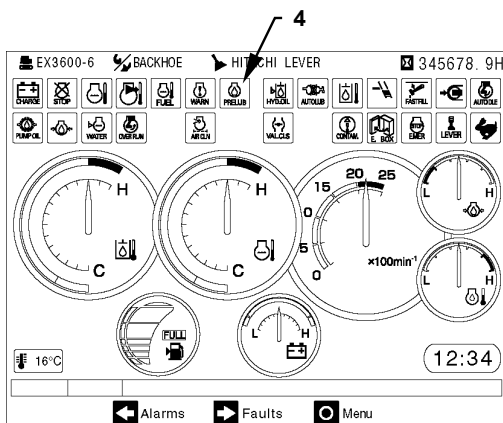
M18M-03-006



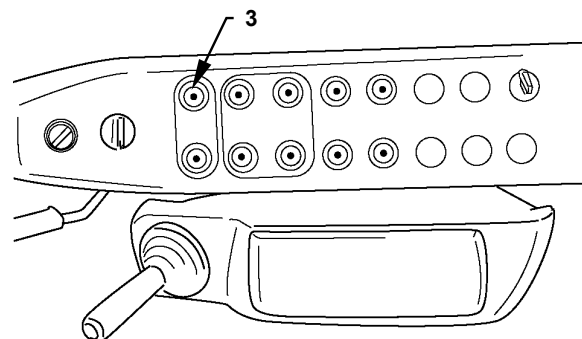
M18M-01-004



M18G-01-040



M18M-01-009



M18M-01-019

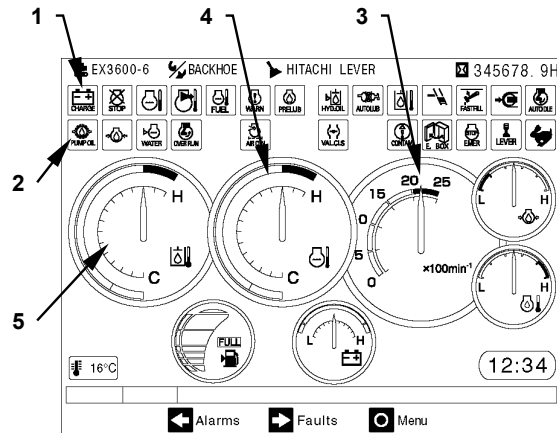
OPERATING THE ENGINE

CHECK INSTRUMENTS AFTER STARTING

IMPORTANT: Prevent possible damage to engine.
If warning indicators described below do not go OFF after starting engine, IMMEDIATELY STOP THE ENGINE and correct the cause.

Check that

1. Alternator indicator (1) goes OFF.
2. Pump transmission oil level indicator (2) goes OFF.
3. Other warning or caution indicators do not indicate abnormal.
4. Tachometer (3) indicates slow idle.
5. Coolant temperature gauge (4) indicates the blue or white zone.
6. Hydraulic oil temperature gauge (5) indicates the blue or white zone.
7. Engine noise and exhaust gas are normal.



M18M-01-009

NOTE: Handy engine troubleshooting can be done by checking the exhaust gas color (Check with the engine running, with no load, after sufficient warm-up operation.)

Colorless
or faint blue : normal (proper combustion)
Black : abnormal (improper combustion)
White : abnormal (oil ring worn, or
coolant leakage into cylinder)

IMPORTANT: Operate machine at less-than-normal loads and speeds until engine is at normal operating temperature.

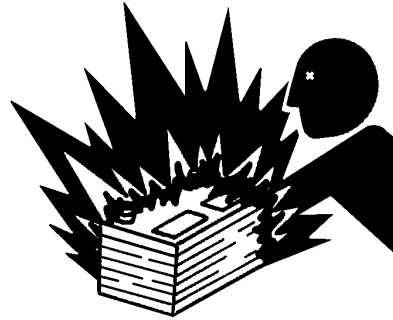
OPERATING THE ENGINE

USING BOOSTER BATTERIES



WARNING:

- An explosive gas is produced while batteries are in use or being charged. Keep flames or sparks away from the battery area. Charge the batteries in a well ventilated area. Do not continue to use or charge the battery when electrolyte level is lower than specified. Explosion of the battery may result. Park the machine on a dry, firm or concrete surface, not on steel plates, if the machine is parked on steel plates, dangerous sparks may be unexpectedly created on the machine. Never connect a positive terminal to a negative terminal, as a dangerous short circuit will occur.
- The operator must be in the operator's seat so that the machine will be under control when the engine starts. Jump starting is a two-person operation.



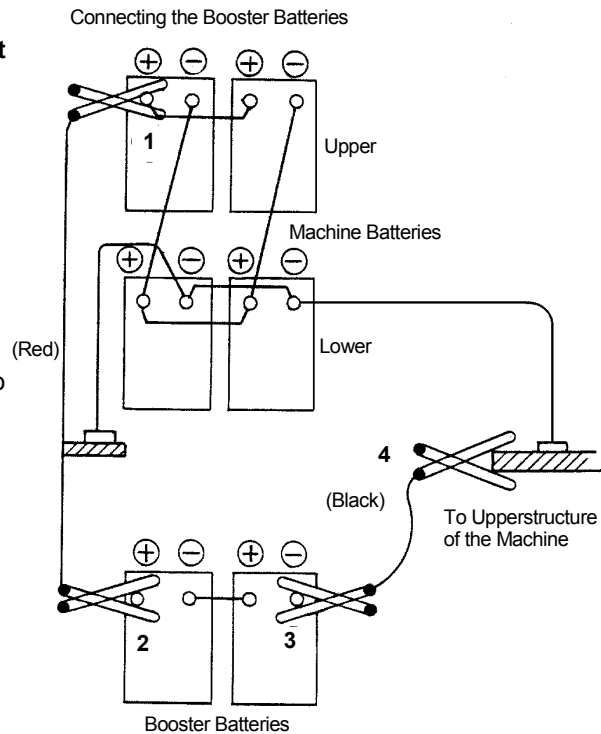
SA-032

IMPORTANT: The machine electrical system is a 24 volt negative (–) ground. Use only 24 volt booster batteries.

When the machine batteries are exhausted, start the engine using booster batteries as shown below.

Connecting the booster batteries

1. Stop the engine of the machine on which booster batteries are mounted.
2. Connect one end of red cable to the positive (+) terminal of machine batteries (1), and the other end to the positive (+) terminal of booster batteries (2).
3. Connect one end of black cable to the negative (–) terminal of booster batteries (3), and then make ground connection to the frame of the machine to be started with the other end of black (–) cable. In the last connection to machine frame (4), be sure to connect the cable end as far away from the machine batteries as possible.
4. Start the engine of the machine on which booster batteries are mounted.
5. Start the engine of the troubling machine.
6. After the engine starts, disconnect cables (1) and (2), following the procedure below.

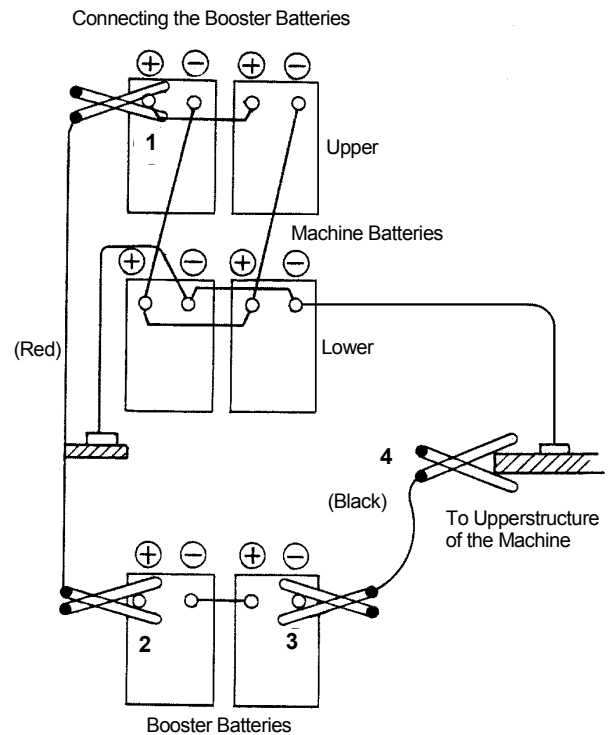


M117-03-002

OPERATING THE ENGINE

Disconnecting the booster batteries

1. Disconnect black negative (–) cable from machine frame (4) first.
2. Disconnect the other end of black negative (–) cable from booster batteries (3).
3. Disconnect red positive (+) cable from booster batteries (2).
4. Disconnect red positive (+) cable from machine batteries (1).



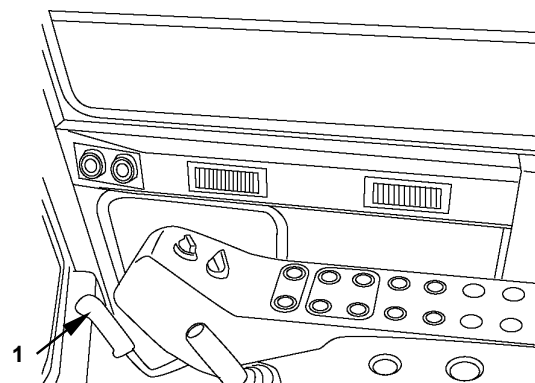
M117-03-002

OPERATING THE ENGINE

STOPPING THE ENGINE

Engine stop procedure

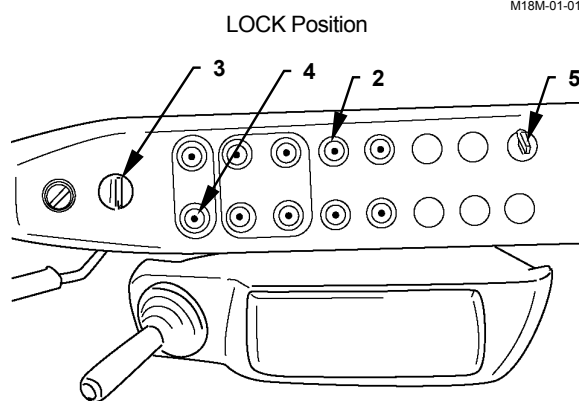
1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn auto-idle switch (2) OFF and engine speed control dial (3) to the slow idle position.
4. Run the engine at slow idle without load for 5 minutes.
5. Press and hold engine stop switch (4) until the engine completely stops rotating.



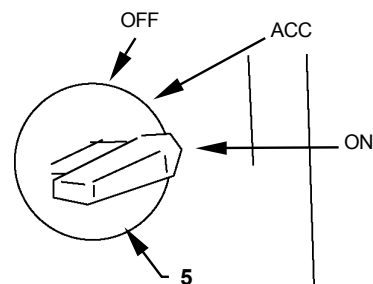
M18M-01-018

IMPORTANT: Turbocharger may be damaged if the engine is not properly shut down.

6. Turn key switch (5) to the OFF position. Remove the key from the key switch (5).
7. Pull pilot control shut-off lever (1) to the LOCK position.



M18M-01-019



M18G-01-034

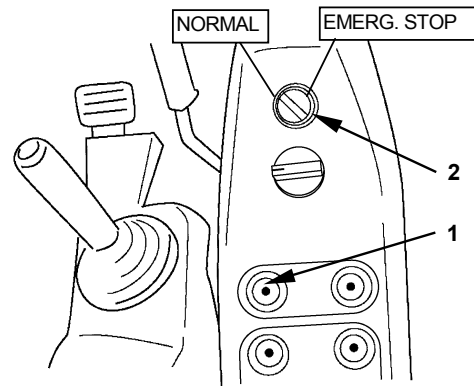
OPERATING THE ENGINE

STOPPING THE ENGINE IN EMERGENCY (IN THE CAB)

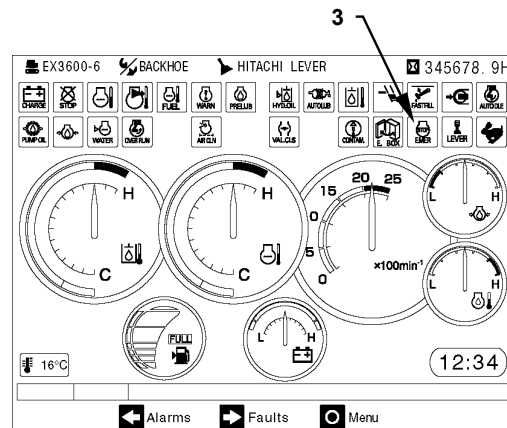
IMPORTANT: Normally, use the engine stop switch (1) to stop the engine. Use the emergency engine stop switch (2) only for emergency stops, or if the engine stop switch (1) malfunctions. If the engine is shut off without cooling down, the turbocharger free-wheels without receiving lubricant, resulting in serious damage to the turbocharger.

1. Turn emergency engine stop switch (2) from the NORMAL position to the EMERG STOP position when emergency engine stop is required in the cab.
2. Engine will stop simultaneously and emergency stop indicator (3) will come ON. In addition, the air pressure is bled from the hydraulic oil tank.
3. Turn emergency engine stop switch (2) to the NORMAL position and return the conditions to the normal engine stop before attempting to restart the engines.

 **NOTE:** Do not use emergency engine stop switch (2) in cab when performing any inspection/service work. Use emergency engine stop switches at the area where any inspection/service works are performed to avoid possible personal injury. Other engine stop switches are shown next module.



M18G-01-013



M18M-01-009

OPERATING THE ENGINE

STOPPING THE ENGINE IN EMERGENCY (EXCEPT IN THE CAB)

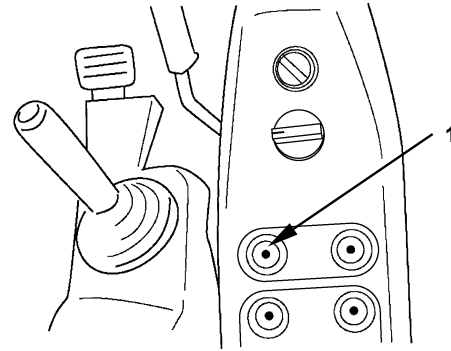
IMPORTANT: Normally, use the engine stop switch (1) to stop the engine. Use the emergency engine stop switch (2) only for emergency stops. If the engine is shut off without cooling down, the turbocharger free-wheels without receiving lubricant, resulting in serious damage to the turbocharger.

1. Turn emergency engine stop switch (2) from the NORMAL position to the EMERG STOP position when emergency engine stop is required except in the cab.
- 2 × In the engine room
 - 1 × In the pump room
 - 1 × In the oil cooler room
 - 1 × In the radiator room
2. Engine will stop and emergency stop indicator (3) will come ON.

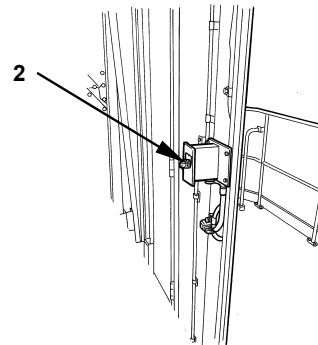
 **NOTE:** The air pressure will not be bled from the hydraulic oil tank.

3. Turn emergency engine stop switch (2) to the NORMAL position and return the conditions to the normal engine stop before attempting to restart the engines.

 **WARNING:** When performing any inspection/service work, use emergency engine stop switch (2) at the area where any inspection /service work are performed to avoid possible personal injury.

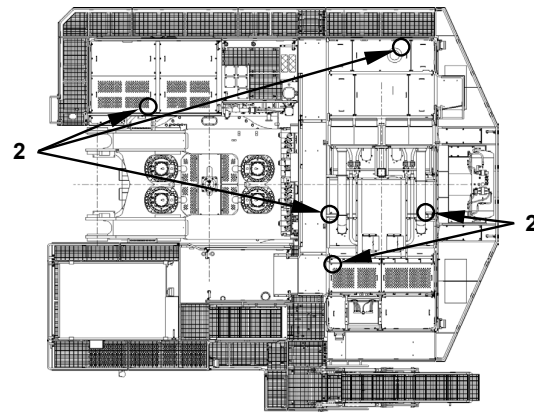


M18M-01-004

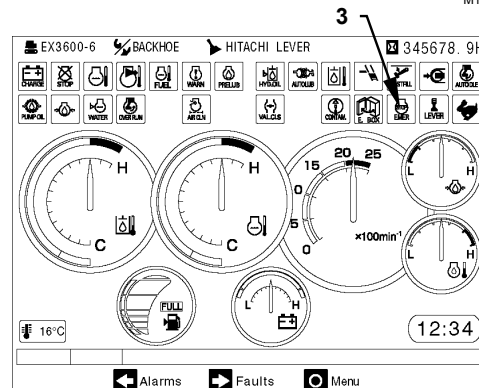


Rear Side In the Engine Room

M18M-07-002



M18M-01-005



M18M-01-009

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the entire width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

DRIVING THE MACHINE

DRIVE THE MACHINE CAREFULLY

IMPORTANT: During freezing weather, park machine on a hard surface to prevent tracks from freezing to the ground. Clean debris from tracks and track frame.

If tracks are frozen to the ground, raise tracks using boom, move machine carefully to prevent damage to drive train and tracks.

If engine stops under load, remove the load. Start engine immediately. Run the engine 30 seconds in slow idle speed before you add load.

Select a route that is as flat as possible. Steer machine as straight as possible making small, gradual changes in direction.

When driving over rough terrain, reduce engine speed to lessen the possibility of undercarriage damage.

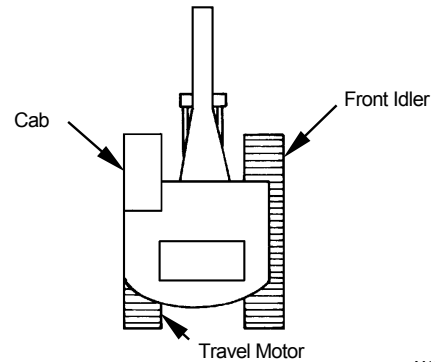
DRIVING THE MACHINE

STEERING THE MACHINE USING PEDALS

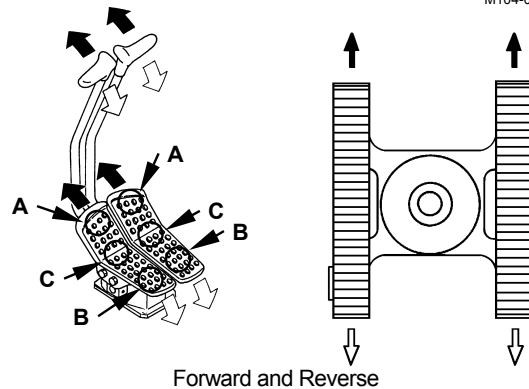


WARNING: In the standard travel position, the idlers are positioned at the front of the machine and the travel motors at the rear. If the travel motors are positioned at the front of the machine, the control actions of the travel pedals will be reversed. Be sure to confirm the position of the travel motors before traveling.

- **FORWARD TRAVEL**
Push down on front (A) of both pedals.
- **REVERSE TRAVEL**
Push down on rear (B) of both pedals.
- **NEUTRAL POSITION (C)**
When the travel pedals are placed in neutral, travel brakes automatically will be applied to hold the machine.
- **RIGHT TURN**
Push down on front of left pedal.
- **LEFT TURN**
Push down on front of right pedal.
- **SHORT TURN (Spin turn)**
Push down the front of one pedal and the rear of the other.

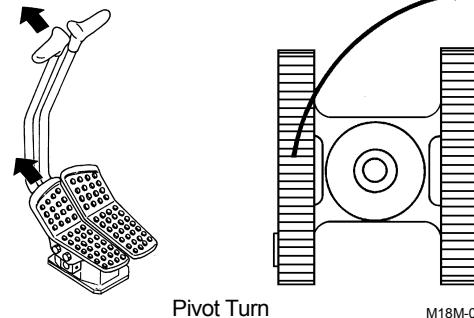


M104-04-001



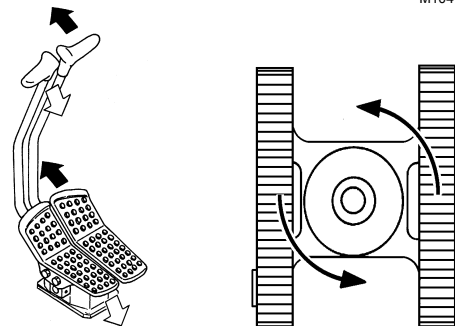
Forward and Reverse

M18M-04-001
M104-04-003



Pivot Turn

M18M-04-002
M104-04-005



Spin Turn

M18M-04-003
M104-04-007

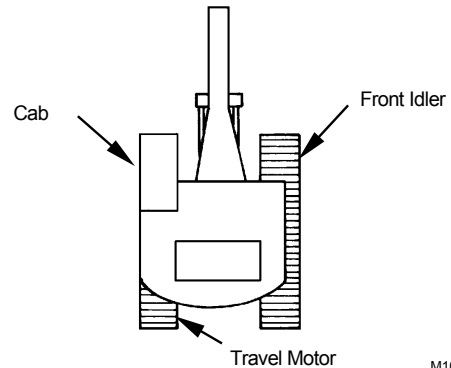
DRIVING THE MACHINE

STEERING THE MACHINE USING LEVERS

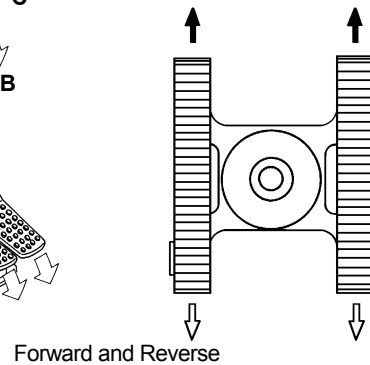
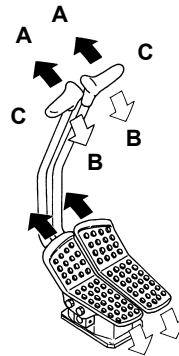


WARNING: In the standard travel position, the idlers are positioned at the front of the machine and the travel motors at the rear. If the travel motors are positioned at the front of the machine, the control actions of the travel levers will be reversed. Be sure to confirm the position of the travel motors before traveling.

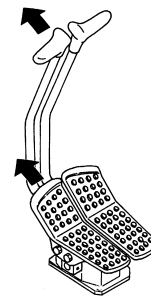
- **FORWARD TRAVEL**
Push both levers forward (A).
- **REVERSE TRAVEL**
Pull both levers rearward (B).
- **NEUTRAL POSITION (C)**
When the travel levers are placed in neutral, travel brakes automatically will be applied to hold the machine.
- **RIGHT TURN**
Push left lever forward.
- **LEFT TURN**
Push right lever forward.
- **SHORT TURN (Spin turn)**
Push one lever forward and pull the other rearward.



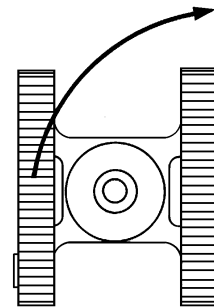
M104-04-001



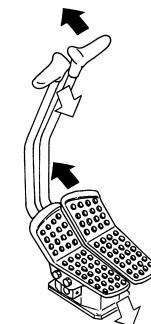
M18M-04-001
M104-04-003



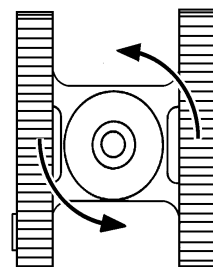
Pivot Turn



M18M-04-002
M104-04-005



Spin Turn



M18M-04-003
M104-04-007

DRIVING THE MACHINE

TRAVEL MODE SWITCH



WARNING: Tipping accidents can cause serious personal injury. Do not change travel mode while traveling; especially, changing speed to the fast mode when descending slopes will create a very dangerous situation. Always stop the machine before changing the travel mode speed. Confirm the travel mode using the indicators after changing modes.

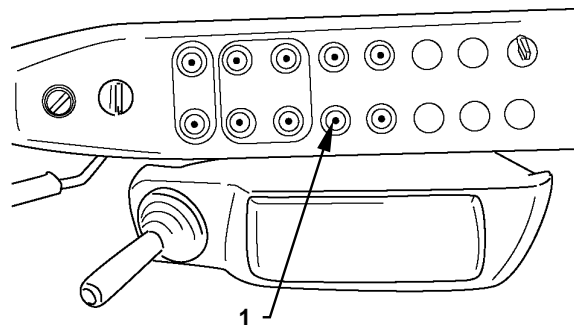
When descending steep slopes, avoid quick acceleration and deceleration in the fast travel mode. Damage to the travel motors may result.

Fast speed (rabbit) or slow speed (turtle) can be selected by pushing travel mode switch (1) at any engine speed.

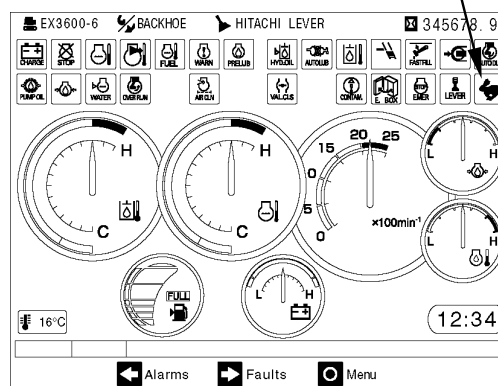
Indicator lights (2) show mode selection.

To decrease travel speed, for traveling on a slope or in a tight space, press switch to turtle position.

- 1- Travel mode Switch
- 2- Travel mode Indicator



M18M-01-019



M18M-01-009

DRIVING THE MACHINE

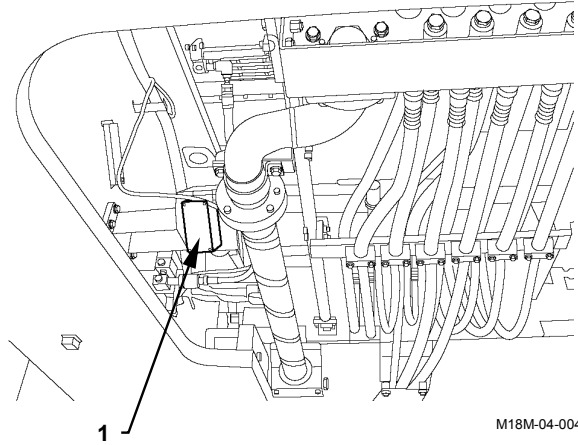
TRAVEL ALARM

The travel alarm functions to alert bystanders when the machine is traveling.



WARNING: If the travel alarm does not sound when the travel levers or pedals are operated, immediately stop the engine and contact your authorized dealer for repair. Operating with the travel alarm malfunctioning may result in a serious accident.

1- Travel Alarm



M18M-04-004

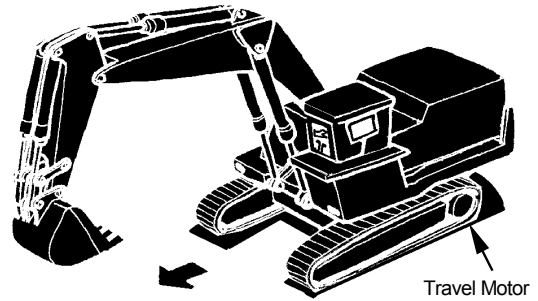
DRIVING THE MACHINE

TRAVELING

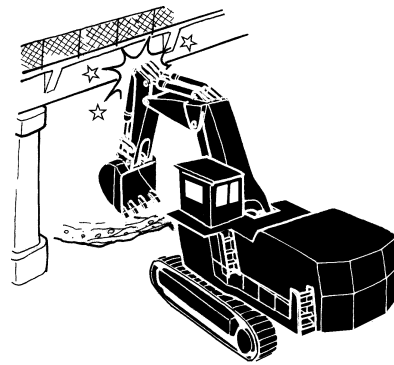


WARNING: Use a signal person when moving, swinging or operating the machine in congested areas. Coordinate hand signals before starting the machine.

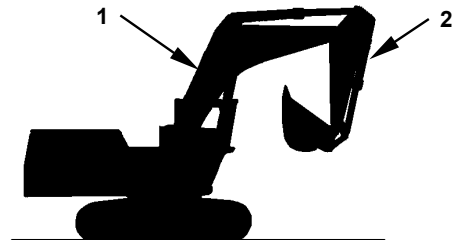
- Before moving machine, determine which way to move travel pedals/levers for the direction you want to go. When the travel motors are in the rear, pushing down on the front of the travel pedals or pushing the levers forward moves the machine forward, towards the idlers.
- Select a travel route that is as flat as possible. Steer the machine as straight as possible, making small gradual changes in direction.
- When traveling on a level surface, position the front with boom (1) fully raised, and arm (2) fully retracted, as illustrated, in order to apply the road as evenly as possible to all of the lower rollers.
- Before traveling on them, check the strengths of bridges and road shoulders, and reinforce if necessary.
- Use wood plates in order not to damage the road surface. Be careful of steering when operating on asphalt roads in summer.
- When crossing train tracks, use wood plates in order not to damage them.
- Do not make contact with electric wires or bridges.
- When crossing a river, measure the depth of the river using the bucket, and cross slowly. Do not cross the river when the depth of the river is deeper than the upper edge of the upper roller.
- When traveling on rough terrain, reduce engine speed. Select slow travel speed. Slower speed will reduce possible damage to the machine.
- Avoid operations that may damage the track and undercarriage components.
- During freezing weather, always clean snow and ice from track shoes before loading and unloading machine, to prevent the machine from slipping.



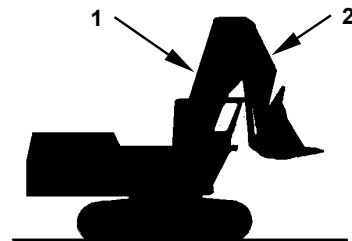
M145-05-003



M145-05-004



M145-05-027

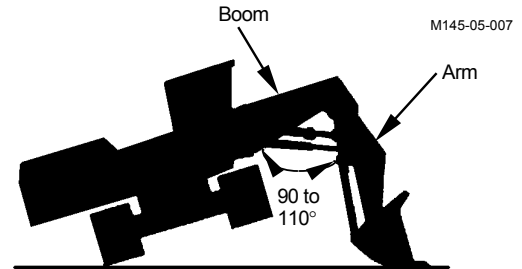
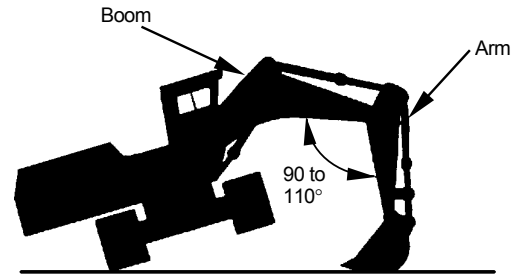


M145-05-022

DRIVING THE MACHINE

OPERATING ON SOFT GROUND

- Avoid traveling on very soft ground that does not have sufficient strength to firmly support the machine.
- If the machine is operated on very soft ground or becomes stuck, it may be necessary to clean the track frame area.
- Swing the upperstructure 90° and lower the bucket to raise one track off the ground. Make sure to keep the angle between the boom and arm 90 to 110° and position the bucket's round side on the ground.
- Rotate the raised track back and forth to remove mud and dirt.
- After lowering the track to the ground, move the engine speed control lever to the medium speed position and slow travel speed. Carefully move the machine to firm ground.
- Utilize the boom and arm functions to pull the machine toward firm ground.
- Tow the machine if it becomes stuck but can still operate its engine. Be sure to attach a towing wire correctly. (Refer to the "TOWING MACHINE A SHORT DISTANCE" section on the next page.)



M145-05-007

M145-05-025

RAISE ONE TRACK USING BOOM AND ARM

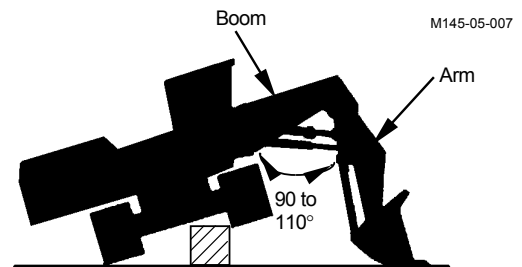
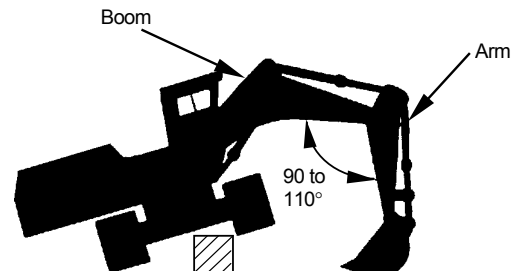


WARNING: Keep the angle between boom and arm 90 to 110° and position the bucket's round side on the ground.

Swing the upperstructure 90° and lower the bucket to raise track off ground. Do not dig bucket teeth into the ground when using the loader bucket.

Place blocks under machine frame to support the machine.

IMPORTANT: When the machine is equipped with the loading shovel front attachment, don't raise the machine off the ground by bucket tooth force with the bucket cylinder fully retracted. Failure to do so will cause excessive loads to be applied to the bucket pins and cylinders so that damage to the pins may result.



M145-05-007

M145-05-025

DRIVING THE MACHINE

TOWING MACHINE A SHORT DISTANCE



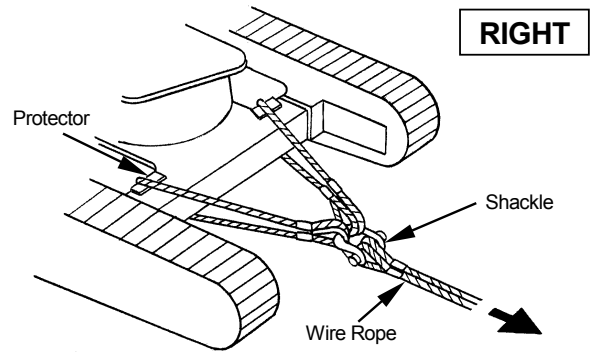
WARNING: Cables, straps, or ropes can break causing serious injury. Do not tow machine with damaged chains, frayed cables, slings, straps, or wire ropes.
Always wear gloves when handling cable, straps or wire ropes.

When your machine becomes stuck but the engine is still operational, attach wire rope tow lines as illustrated at right, and slowly tow your machine to firm ground using another machine.

Be sure to attach the wire ropes around the track frames of both machines as illustrated.

To prevent the wire ropes from being damaged, place some protective material between the track frame and the wire ropes.

- IMPORTANT:**
- Slowly tow, keeping the tow line horizontal and in a straight line with the tracks.
 - When the machine is towed, release parking brakes by operating the travel levers.



M114-05-100

DRIVING THE MACHINE

OPERATING GROUND CONDITION

Operate the machine on flat footing.

The machine should not be operated in water or mud.

There is a possibility that travel motors, travel reduction gears, and parts inside of the track frame damage with machine sinking.

In very soft footing, beware the possibility of the machine sinking gradually.

Always pay attention around the undercarriage.

If you must travel in water, check that towing will be possible.

The following conditions apply to travel across water;

- The bed of water is flat.
- The flow of water is slow.

While you cross in water, carefully confirm the depth and footing condition.

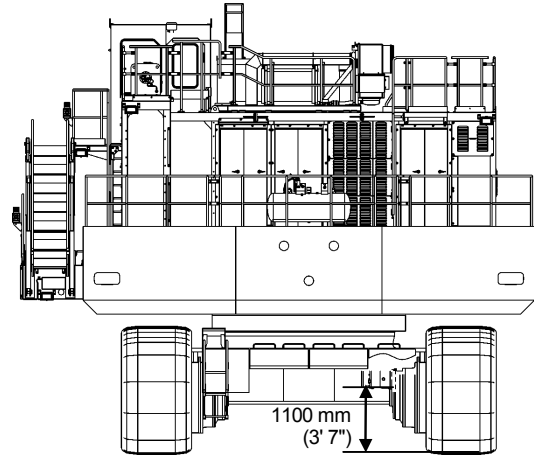
Do not move the machine into an area that has a water depth that is greater than 1,100 mm (3 ft 7 in) from the ground.

If the footing is weak and water flow is fast, take special care not submerge the swing bearing, swing pinion gears due to the machine sinking and the force of strong water current.

If submerge the swing bearing, swing pinion gears and center joint by mistake, do not operate the machine with such a condition continuously, it cause to wear swing bearing and swing pinion gears abnormally and may break swing bearing and gears.

Remove the drain plug to drain mud and water, and replace grease in the swing bearing bath or disassemble the swing bearing area immediately.

Please stop the machine operation and contact authorized distributor or dealer when submerge the swing bearing, swing pinion gears and center joint.



M18M-04-005

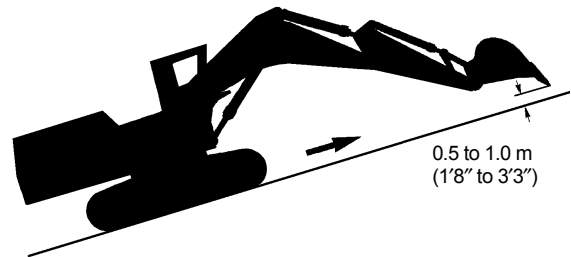
DRIVING THE MACHINE

PRECAUTIONS FOR TRAVELING ON SLOPES

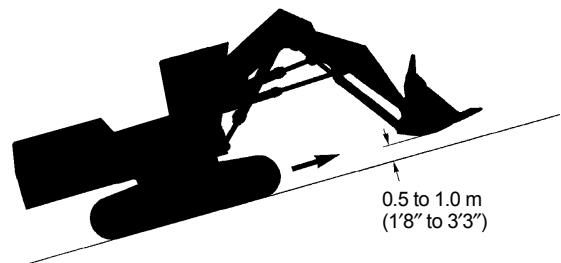


WARNING: Avoid possible injury from traveling on slopes. Tipping over or skidding down of the machine may result. Thoroughly read and understand precautions below and be sure to travel at slow speed on slopes. Never attempt to travel on slopes with the bucket loaded or any load suspended by the bucket.

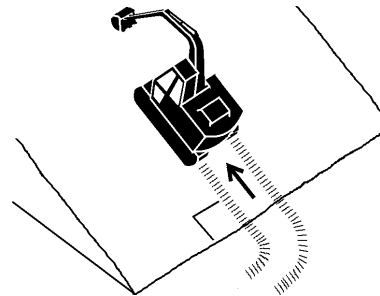
- Never attempt to ascend or descend 30 degrees or steeper slopes.
- Be sure to fasten the seat belt.
- Keep the bucket pointed in the direction of travel, approximately 0.5 to 1.0 m (1'8" to 3'3") above the ground. If the machine starts to skid or becomes unstable, lower the bucket immediately.
- Driving across the face of a slope or steering on a slope may cause the machine to skid or turnover. If the direction must be changed, move the machine to level ground, then, change the direction to ensure safe operation.
- Avoid swinging the upperstructure on slopes. Never attempt to swing the upperstructure downhill. The machine may tip over. If swinging uphill is unavoidable, carefully operate the upperstructure and boom at slow speed.
- If the engine stalls on a slope, immediately lower the bucket to the ground. Return the control levers to neutral. Then, restart the engine.
- Be sure to thoroughly warm up the machine before ascending steep slopes. If hydraulic oil has not warmed up sufficiently, sufficient performance may not be obtained.
- Turn the travel mode switch to the slow mode position on level ground before traveling down a slope. Never operate the travel mode switch while descending a slope. Failure to do so may possibly result in causing the machine to slip.
- When descending steep slopes, avoid quick acceleration and deceleration in the fast travel mode. Damage to the travel motors may result.



M145-05-016

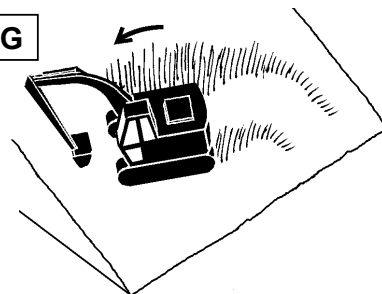


M145-05-024



SA-441

WRONG



SA-442

DRIVING THE MACHINE

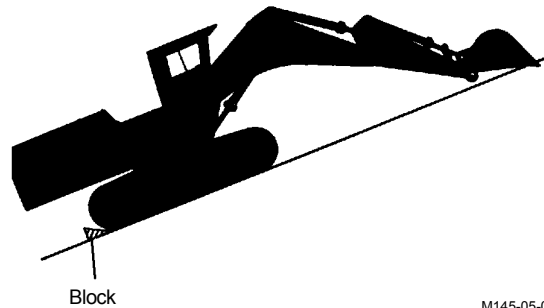
PARKING THE MACHINE ON SLOPES



WARNING: Avoid parking machine on slopes. The machine may tip over, possibly resulting in personal injury.

If parking the machine on a slope is unavoidable:

- Thrust the bucket teeth into the ground.
- Return the control levers to neutral and pull the pilot control shut-off lever to the LOCK position.
- Block both tracks.



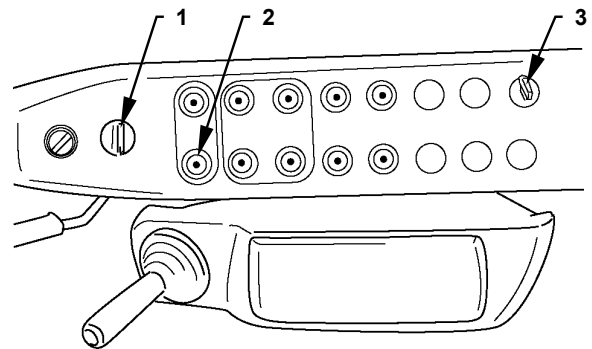
M145-05-006

PARKING THE MACHINE

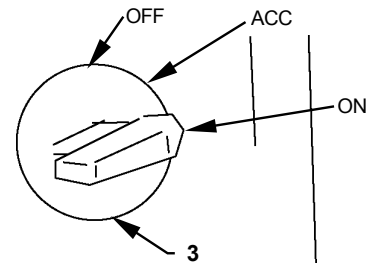
1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: Turbocharger may be damaged if the engine is not properly shut down.

4. Move engine speed control Dial (1) to the slow idle position. Run the engine approximately 5 minutes to cool the engine.
5. Press and hold engine stop switch (2) until the engine completely stops rotating.
6. Turn key switch (3) to OFF. Remove the key from the key switch.
7. Pull pilot control shut-off lever (4) to the LOCK position.



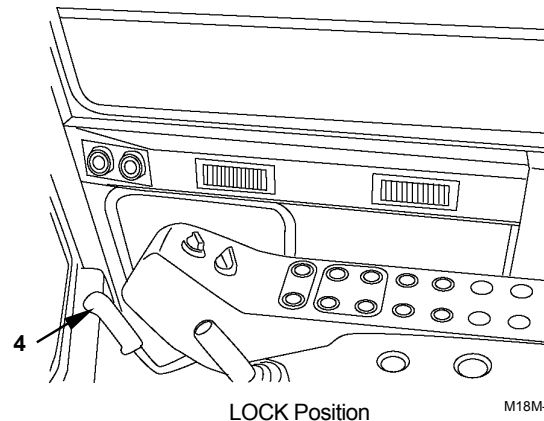
M18M-01-019



M18G-01-034

IMPORTANT: Protect cab electrical components from bad weather. Always close windows, roof vent and cab door when parking the machine.

8. Close windows, roof vent, and cab door.
9. Lock all access doors and compartments.



M18M-01-018

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.

OPERATING THE MACHINE

CONTROL LEVER (ISO PATTERN BACKHOE)



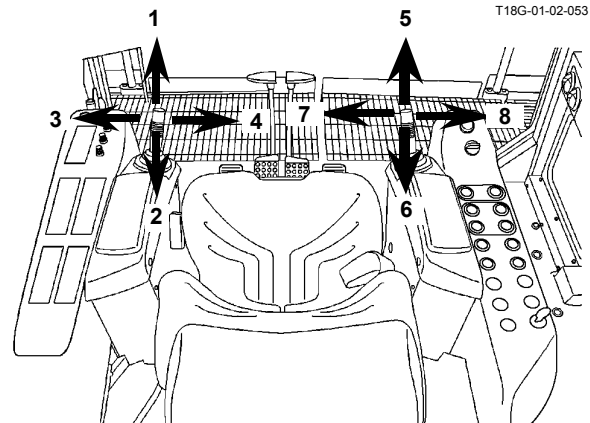
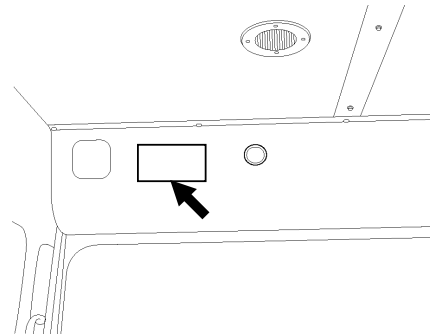
WARNING: Never place any part of body beyond window frame. It could be crushed by the boom if boom control lever is accidentally bumped or otherwise engaged. If window is missing or broken, replace immediately. Prevent possible injury from unexpected machine movement.
Make sure you know the location and function of each control before operating.

The machine is equipped with a label showing the control patterns of the levers and pedals.

IMPORTANT: When digging, avoid hitting tracks with boom cylinders. When digging over the end of the tracks, travel motors should be at the rear to maximize machine stability and lift capacity.

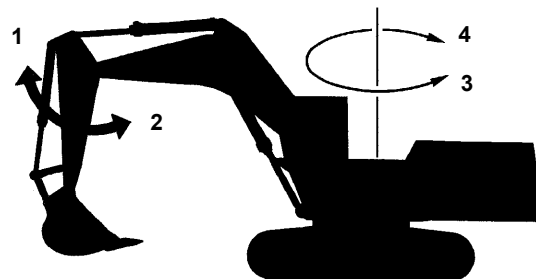
When a lever is released, it will automatically return to neutral, and that machine function will stop.

- 1- Arm Roll-Out
- 2- Arm Roll-In
- 3- Swing Left
- 4- Swing Right
- 5- Boom Lower
- 6- Boom Raise
- 7- Bucket Roll-In.
- 8- Bucket Roll-Out.

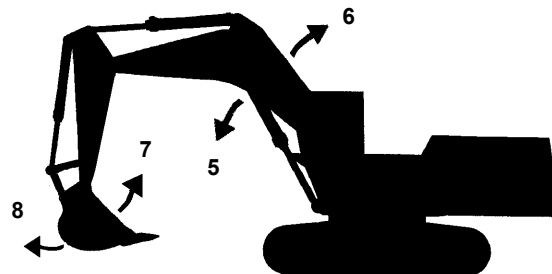


T18G-01-02-053

M18M-01-006



M142-05-002



M142-05-003

OPERATING THE MACHINE

CONTROL LEVER (HITACHI PATTERN BACKHOE)



WARNING: Never place any part of body beyond window frame. It could be crushed by the boom if boom control lever is accidentally bumped or otherwise engaged. If window is missing or broken, replace immediately.

Prevent possible injury from unexpected machine movement.

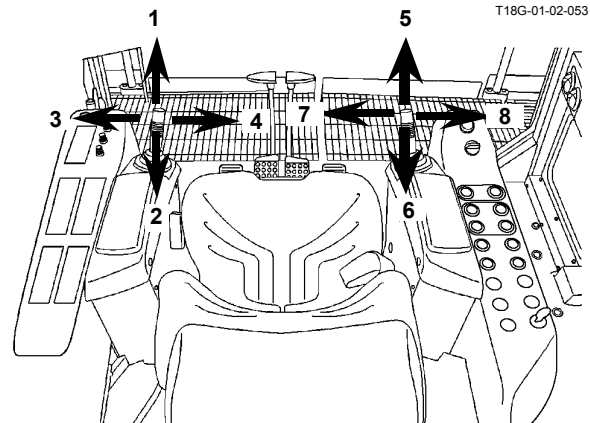
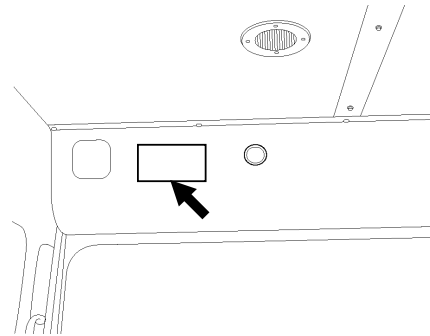
Make sure you know the location and function of each control before operating.

The machine is equipped with a label showing the control patterns of the levers and pedals.

IMPORTANT: When digging, avoid hitting tracks with boom cylinders.
When digging over the end of the tracks, travel motors should be at the rear to maximize machine stability and lift capacity.

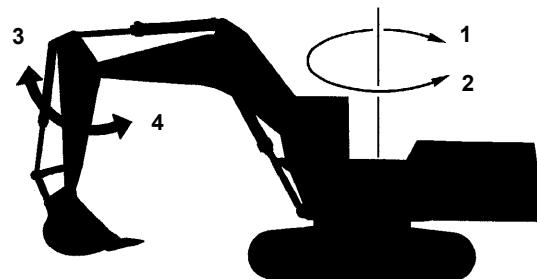
When a lever is released, it will automatically return to neutral, and that machine function will stop.

- 1- Swing Right
- 2- Swing Left
- 3- Arm Roll-Out
- 4- Arm Roll-In
- 5- Boom Lower
- 6- Boom Raise
- 7- Bucket Roll-In.
- 8- Bucket Roll-Out.

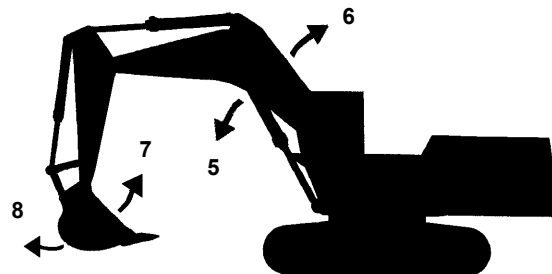


T18G-01-02-053

M18M-01-006



M142-05-002



M142-05-003

OPERATING THE MACHINE

CONTROL LEVER (ISO PATTERN LOADING SHOVEL)



WARNING: Never place any part of body beyond window frame. It could be crushed by the boom if boom control lever is accidentally bumped or otherwise engaged. If window is missing or broken, replace immediately.

Prevent possible injury from unexpected machine movement.

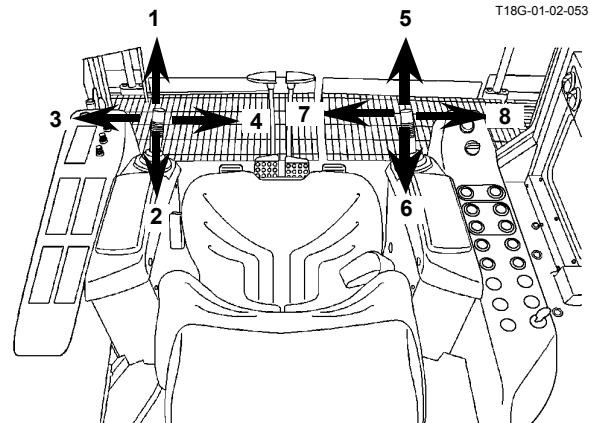
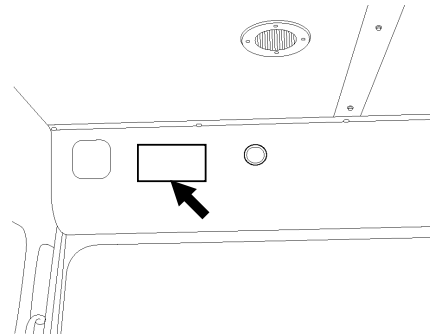
Make sure you know the location and function of each control before operating.

The machine is equipped with a label showing the control patterns of the levers and pedals.

IMPORTANT: When digging, avoid hitting tracks with boom cylinders.
When digging over the end of the tracks, travel motors should be at the rear to maximize machine stability and lift capacity.

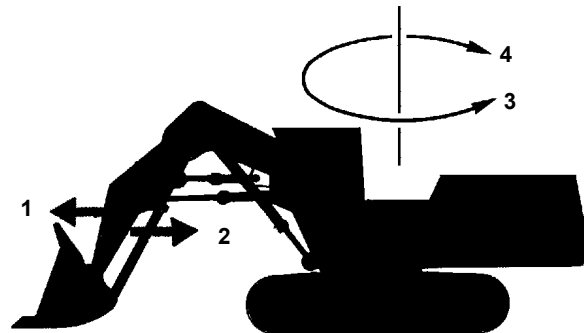
When a lever is released, it will automatically return to neutral, and that machine function will stop.

- 1- Arm Extend
- 2- Arm Retract
- 3- Swing Left
- 4- Swing Right
- 5- Boom Lower
- 6- Boom Raise
- 7- Bucket Tilt-In
- 8- Bucket Tilt-Out

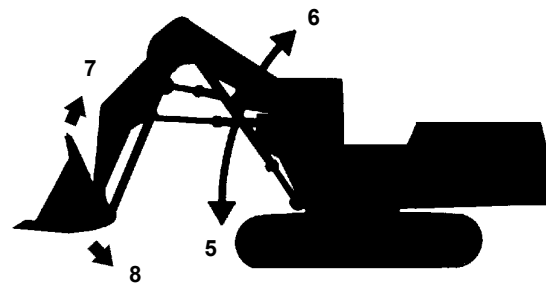


T18G-01-02-053

M18M-01-006



M117-05-027



M117-05-025

OPERATING THE MACHINE

CONTROL LEVER (HITACHI PATTERN LOADING SHOVEL)



WARNING: Never place any part of body beyond window frame. It could be crushed by the boom if boom control lever is accidentally bumped or otherwise engaged. If window is missing or broken, replace immediately.

Prevent possible injury from unexpected machine movement.

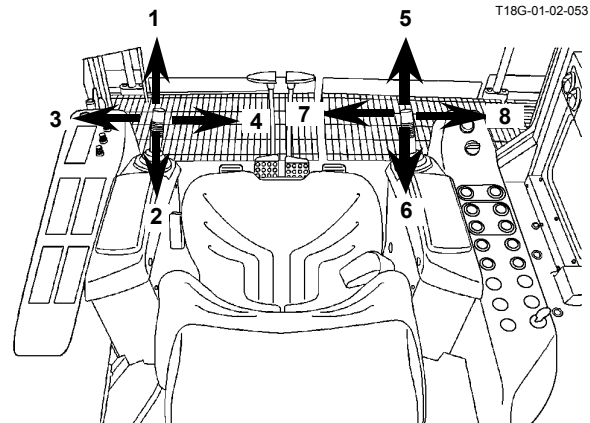
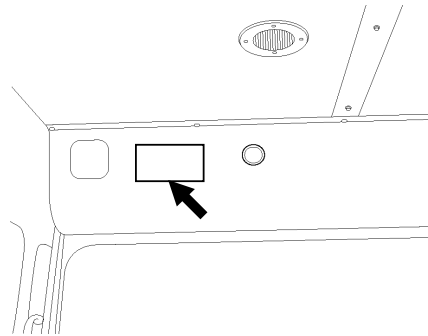
Make sure you know the location and function of each control before operating.

The machine is equipped with a label showing the control patterns of the levers and pedals.

IMPORTANT: When digging, avoid hitting tracks with boom cylinders.
When digging over the end of the tracks, travel motors should be at the rear to maximize machine stability and lift capacity.

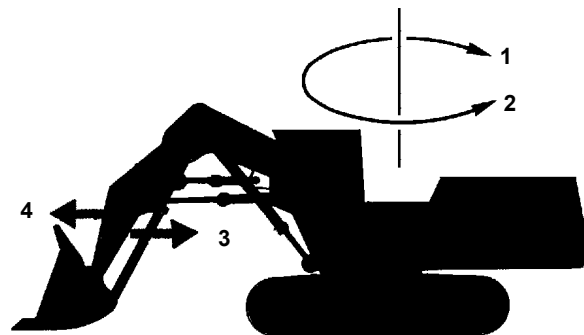
When a lever is released, it will automatically return to neutral, and that machine function will stop.

- 1- Swing Right
- 2- Swing Left
- 3- Arm Retract
- 4- Arm Extend
- 5- Boom Lower
- 6- Boom Raise
- 7- Bucket Roll-In.
- 8- Bucket Roll-Out.

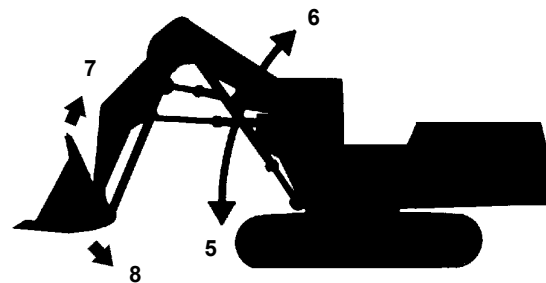


T18G-01-02-053

M18M-01-006



M117-05-027

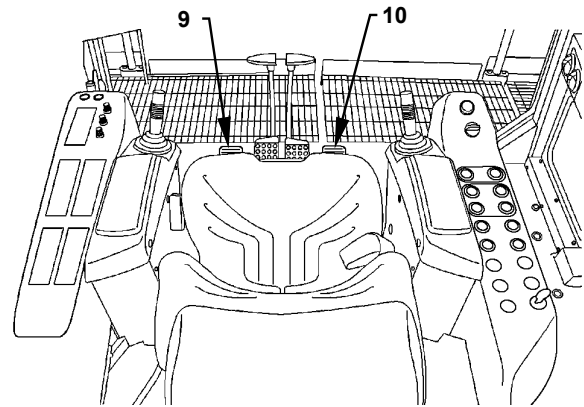


M117-05-025

OPERATING THE MACHINE

BUCKET OPEN-CLOSE PEDALS (LOADING SHOVEL)

- 9- Bucket Closing
- 10- Bucket Opening



M18M-01-006



M18G-05-004

OPERATING THE MACHINE

PILOT CONTROL SHUT-OFF LEVER

Pilot control shut-off lever (1) functions to prevent misoperation of the machine from occurring if the control levers are accidentally moved when leaving the operator's seat or when entering the cab.



WARNING:

- Always pull pilot control shut-off lever (1) into the full LOCK position. The pilot control shut-off function will not be activated otherwise.
- When leaving the machine:
 - Stop the engine.
 - Then, pull the pilot control shut-off lever up to the LOCK position.
- Always check to be sure that the pilot control lever is pulled up to the LOCK position before:
 - Transporting the machine.
 - Leaving the machine at the end of the shift.

Pilot Control Shut-Off Lever Operation

Before Leaving the Machine:

1. Park the machine on a firm, level surface. Lower the bucket to the ground. Return all control levers to neutral. Properly shut down the engine.
2. Pull pilot control shut-off lever (1) up into the full LOCK position.

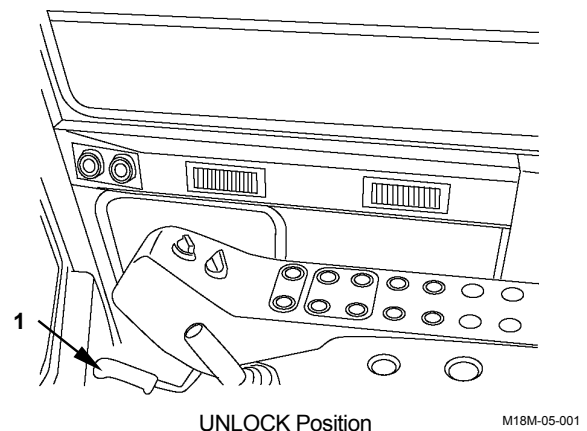
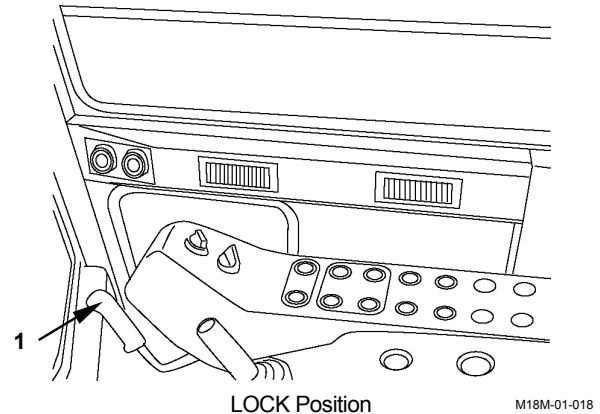
Before Starting Operation:

1. Confirm that pilot control shut-off lever (1) is pulled up to the LOCK position.

After starting the engine:

1. Confirm that all control levers and pedals are in neutral and that no part of the machine is in motion.
2. Lower pilot control shut-off lever (1) to the UNLOCK position.

If any part of the machine (any actuator) moves when the pilot control shut-off lever is lowered to the UNLOCK position despite the fact that all controls are placed in neutral, the machine is malfunctioning. Immediately pull the pilot control shut-off lever back to the LOCK position, and stop the engine. Then, see your authorized dealer.



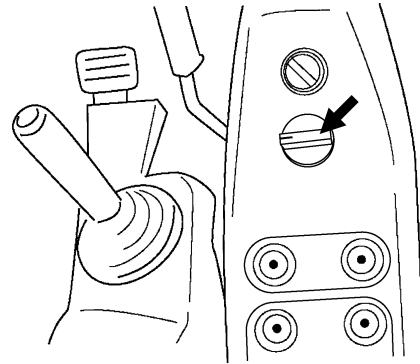
OPERATING THE MACHINE

ENGINE SPEED CONTROL

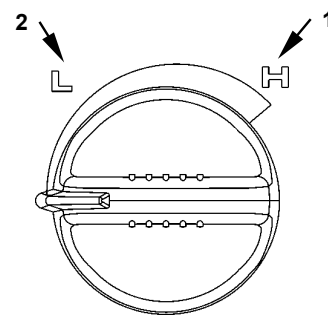
The engine speed is controlled with engine speed control dial.

- The fully clockwise position (1) : Fast Idle
- The fully counterclockwise position (2) : Slow idle

Before stopping the engine, always turn engine speed control dial to the slow idle position and run the engine five minutes at slow idle.



M18M-01-004



M18G-01-040

OPERATING THE MACHINE

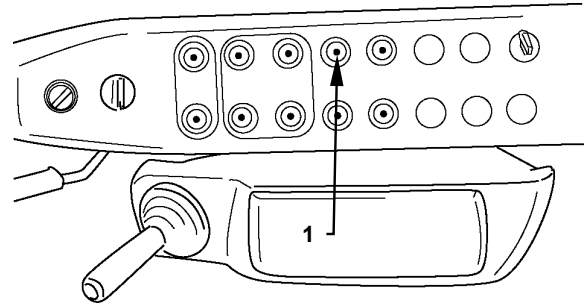
AUTO-IDLE

When auto-idle switch (1) is turned ON, approximately 4 seconds later after the control levers are returned to neutral, engine speed will be decreased to the auto-idle speed automatically to save the fuel consumption at no operation. If the control levers are operated, engine speed will return to the speed depending on the engine speed control dial (2) position immediately.

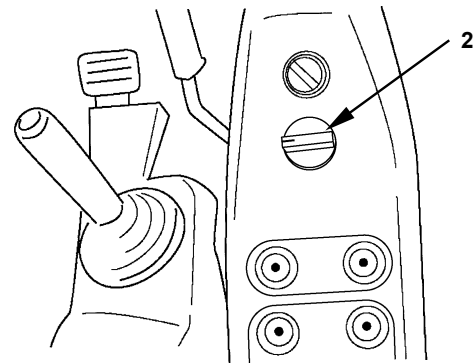


WARNING:

- Always check if auto-idle indicator (3) is turned on or off before starting operation. If the indicator is on, the auto-idle function will be activated.
- Always be aware of the engine speed control dial (2) position when auto-idle switch (1) is turned on. If the engine speed control dial (2) is in the fast idle position, and if the operator is not aware of that, the engine speed will unexpectedly increase when any control lever is operated, causing unexpected machine movement, thus possibly resulting in serious personal injury.
- Prevent the machine from unexpected movement. Be sure to turn auto-idle switch (1) off when unexpected machine movement is undesirable.



M18M-01-019

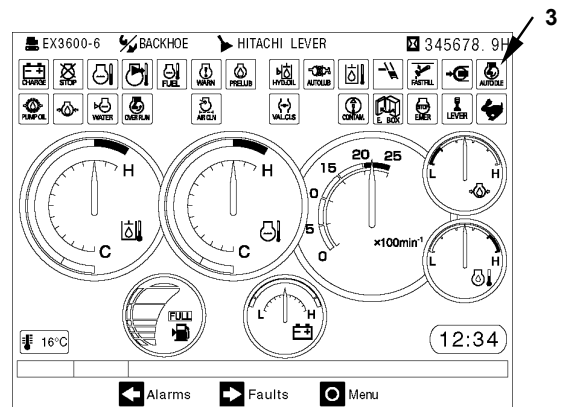


M18M-01-004

Note that auto-idle function can be turned on or off only when the key switch is in ON position. Always check if the auto-idle function is turned on or off with auto-idle indicator (3).

Auto-Idle Function ON : Auto-Idle Indicator (3) ON
Auto-Idle Function OFF : Auto-Idle Indicator (3) OFF

- In order to deactivate the auto-idle function, simply press auto-idle switch (1) when auto-idle indicator (3) is turned on. Auto-idle indicator (3) will go off.



M18M-01-009



NOTE: When the engine speed set by the engine speed control dial (2) is lower than that of the auto-idle level, auto-idle circuit will not work even if auto-idle indicator (3) is turned ON.

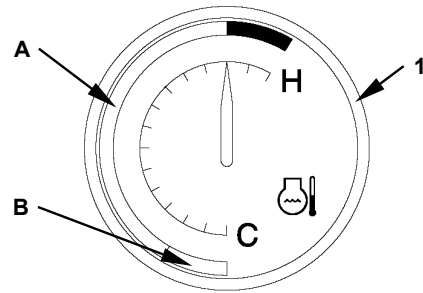
OPERATING THE MACHINE

WARMING-UP OPERATION

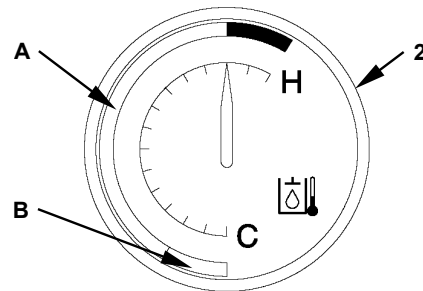
IMPORTANT: The proper engine operating coolant temperature and machine operating hydraulic oil temperature are corresponding to the blue zone (A) of the coolant temperature gauge (1) and hydraulic oil temperature gauge (2), respectively. If the machine is operated excessively when the coolant and hydraulic oil temperature are lower than the middle of the white zone (B), damage to the engine and hydraulic component may result.

Start the engine and warm up the machine until the needles of the each gauges enter the middle of the white zone (B) in the following procedures before starting to work.

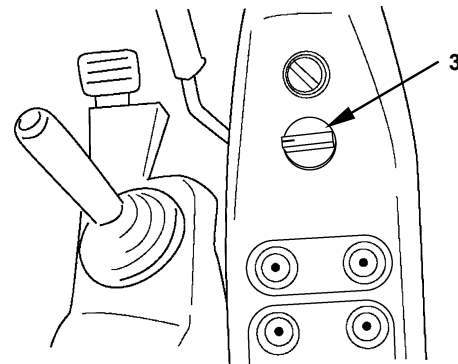
1. Run the engine at slow idle for 5 minutes.
2. Increase the engine speed to middle speed by operating the engine speed control dial (3). Run the engine for 5 minutes with the bucket held in the rolled-out (tilted-out) position. (Do not operate other functions than the bucket at this time.)
3. Increase the engine speed to the maximum speed. Run the engine for 5 to 10 minutes with the bucket rolled-in (tilted-in) or arm rolled-in (cylinder extend). (Do not operate other functions than the bucket or arm at this time.)
4. Operate the bucket and arm respectively until the needles of the each gauges enter the middle of the white zone (B).



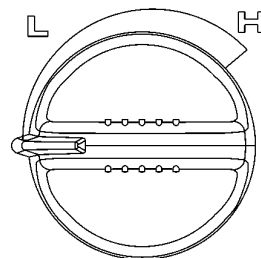
M18M-01-012



M18M-01-013



M18M-01-004



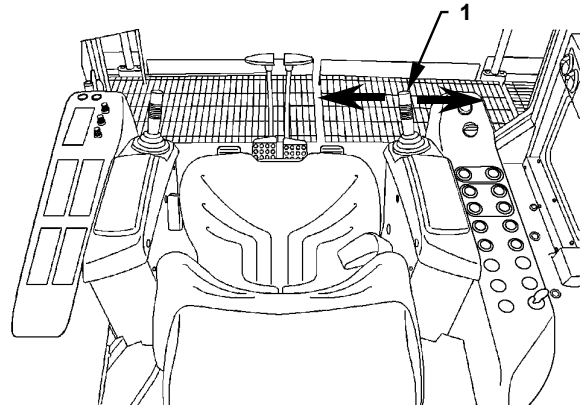
M18G-01-040

OPERATING THE MACHINE

WARMING-UP THE CYLINDERS AND MOTORS

IMPORTANT:

- In cold weather, be sure to thoroughly warm-up the cylinders and motors.
- If the hydraulic circuit is continuously relieved for a certain amount of time, the temperature in the control valve would rise excessively. Never operate to stroke end more than 15 seconds. After relieving any function, up to 15 seconds, be sure to have a 5–10 second intermission.



M18M-01-006

1. Run the engine for at least 5 minutes on slow idle.
2. Run the engine for at least 5 minutes at medium speed.
3. Extend the bucket cylinder to the far stroke end. Do not operate bucket control lever (1) for over 30 seconds at this time.
4. Retract the bucket cylinder to the near stroke end. Do not operate bucket control lever (1) for over 30 seconds at this time.
5. Repeat procedures 3 and 4 until the bucket working speed becomes normal. When atmospheric temperature is extremely low, extend the medium speed operating time.
6. Operate the other cylinders and the motors in the same way until the each of working speed becomes normal.

OPERATING THE MACHINE

PRECAUTIONS FOR OPERATIONS

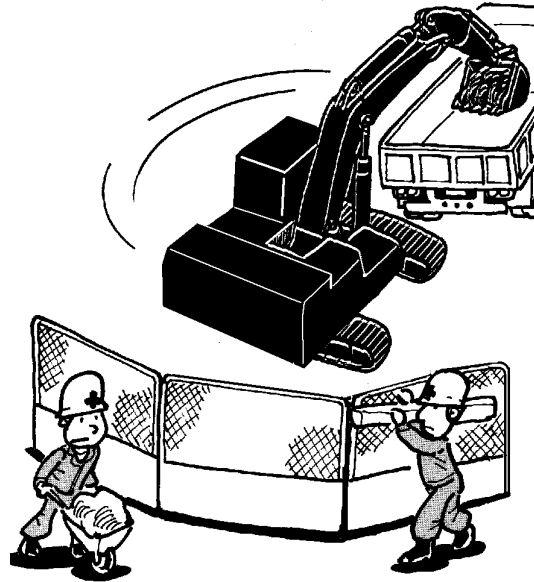


WARNING: Investigate the work site before starting operations.

- Be sure to install an overhead cab guard when operating in a work site which has a possibility of falling objects.
- If operation on soft ground is required, sufficiently reinforce the ground beforehand.
- Be sure to wear close fitting clothing and safety equipment appropriate for the job, such as a hard hat, etc. when operating the machine.
- Clear all persons and obstacles from area of operation and machine movement.
Always beware of the surroundings while operating. When working in a small area surrounded by obstacles, take care not to hit the upperstructure against obstacles.
- When loading onto trucks, bring the bucket over the truck beds from the rear side. Take care not to swing the bucket over the cab or over any person.



NOTE: The standard specification machine is equipped with the head guard integrated cab.



M117-05-006

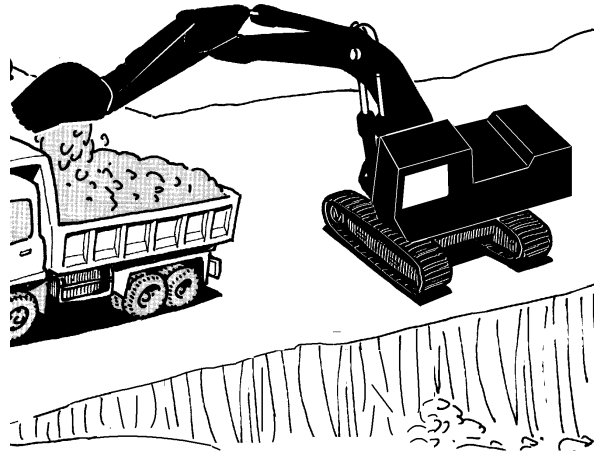
OPERATING THE MACHINE

OPERATE THE MACHINE SAFELY



WARNING: Prevent the machine from tipping over and from being involved in a ground collapse. Take the necessary precautions as follows:

- Make sure the worksite has sufficient strength to firmly support the machine.
When working close to an excavation or at road shoulders, operate the machine with the tracks positioned perpendicular to the cliff face with travel motors at the rear, so that the machine can more easily evacuate if the cliff face collapses.
- If working on the bottom of a cliff or a high bank is required, be sure to investigate the area first and confirm that no danger of the cliff or bank collapsing exists. If any possibility of cliff or bank collapsing exists, do not work on the area.
- Soft ground may collapse when operating the machine on it, possibly causing the machine to tip over. When working on a soft ground is required, be sure to reinforce the ground first using large pieces of steel plates strong and firm enough to easily support the machine.
- Note that there is always a possibility of machine tipping over when working on rough terrain or on slopes. Prevent machine tipping over from occurring. When operating on rough terrain or on slopes:
 - Reduce the engine speed.
 - Select slow travel speed mode.
 - Operate the machine slowly and be cautious with machine movements.



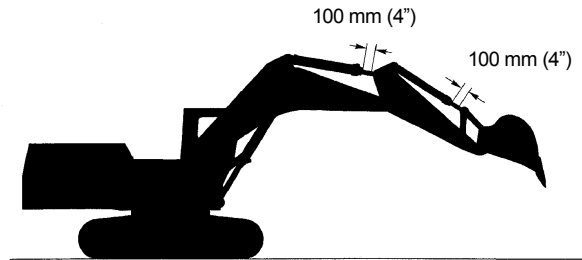
M117-05-007

OPERATING THE MACHINE

OPERATING BACKHOE

1. Place the bucket teeth on the ground with the bottom of the bucket at a 45 degree angle to the ground.
2. Pull the bucket toward the machine using the arm as the main digging force.
3. When soil sticks to the bucket, remove it by moving the arm and/or bucket rapidly back and forth.
4. When lowering the boom, avoid sudden stops that may cause shock load damage to the machine.
5. When operating the arm, avoid bottoming the cylinder to prevent cylinder damage.
6. When digging at an angle, avoid striking the tracks with the bucket teeth.
7. When digging a deep excavation, avoid striking the boom or bucket cylinder hoses against the ground.
8. When trenching a straight line, position the tracks parallel to the trench. After digging to the desired depth, move the machine as required to continue the trench.

 **NOTE:** When crowding the arm, it is normal for the arm to pause briefly at the lowest point of its curve, as shown. This is due to the fact that the force of gravity pulls the arm down quickly, and it takes a moment for the hydraulic force in the cylinder to catch up. This does not indicate machine trouble.



M145-05-008



M145-05-009

GRADING OPERATION

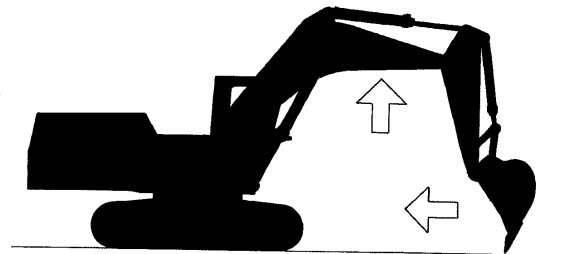


WARNING: Do not pull or push dirt with the bucket when traveling.

Position the arm slightly forward of the vertical position with bucket rolled back, as shown.

Operate arm roll-in function while slowly raising the boom. Once the arm moves past the vertical position slowly lower the boom to allow the bucket to maintain a smooth surface.

Grading operation can be more precisely done by operating the boom, arm and bucket simultaneously.



M145-05-010

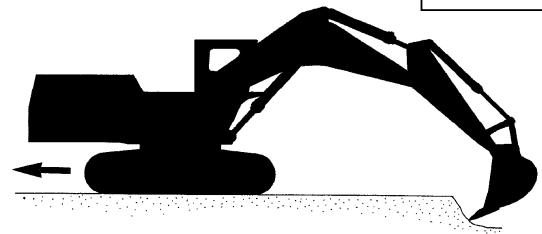
OPERATING THE MACHINE

AVOID ABUSIVE OPERATION



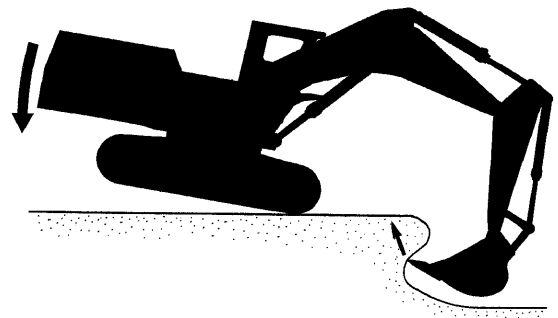
WARNING: Do not use travel as an additional digging force. Severe machine damage may result.

Do not raise rear of machine to use the machine's weight as additional digging force. Severe machine damage may result.



WRONG

M145-05-011



WRONG

M145-05-012

OPERATING THE MACHINE

OPERATING TIPS

Do not hit the track with the bucket when digging.
Whenever possible, position your machine on a level surface.
Do not use the bucket as a hammer or pile driver. Do not attempt to shift rocks and break walls using swing motion.



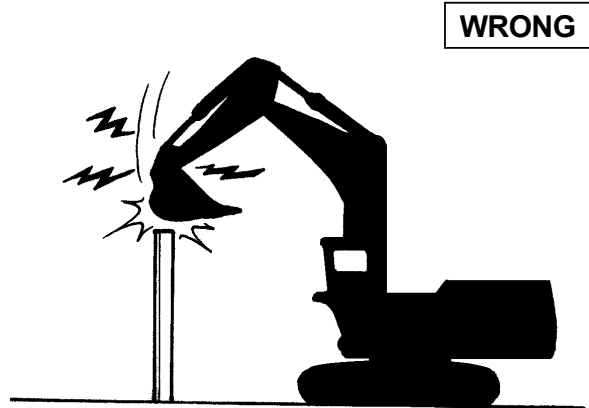
WARNING: To avoid damaging cylinders, do not strike the ground with the bucket nor use the bucket for tamping with the bucket cylinder fully extended (the bucket completely curled under).

Adjust the length and depth of each cut to produce a full bucket with every pass.
Full loads on every pass are more productive than a faster cycle with a partially filled bucket.
Full load should be the first objective, followed by speed, to increase productivity.



WARNING: Do not attempt to break ledge rock by extending the arm to maximum reach and dropping the front of the bucket on the bucket teeth for penetration. Serious damage to the machine can result.

Once the trench is open, ledge rock can be broken by pulling the bucket up under the layers. The top layers are pulled out first, with one or two layers being lifted at a time.



M145-05-013

AVOID SWINGING BUCKET TO MOVE OBJECTS



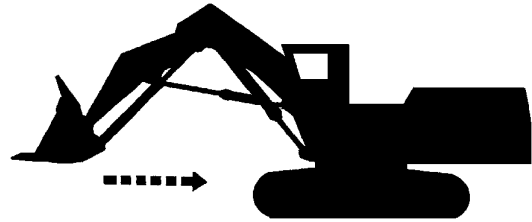
WARNING: Do not use the bucket for shifting rocks, breaking walls, and etc. using the swing motion.

These uses will damage the front attachment.

OPERATING THE MACHINE

LOADING SHOVEL OPERATION

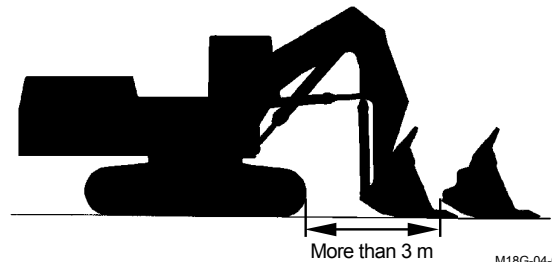
1. To dig, position the bucket bottom parallel to and touching the ground and extend the arm while crowding the bucket.
2. Digging force increases as the arm is retracted. Try to dig with the arm retracted where strong digging forces are required.



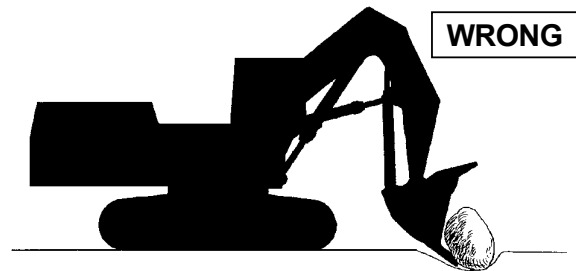
M18G-04-003

PROHIBITED OPERATION

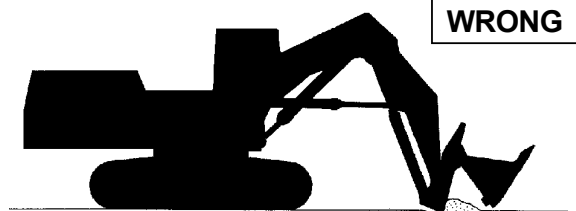
1. Never dig with the bucket retracted too closely to the undercarriage, as the machine components will be subjected to excessive force. If closely retracted digging is unavoidable, keep a distance of at least 3 m between the rear end of the bucket and the front end of the undercarriage.
2. Never dig with the bucket fully retracted and the bucket teeth stuck in the ground as the front attachment will be subjected to excessive force.
3. Do not use the rear of the bucket for grading operation, as this will damage it.
4. Do not push rocks or other heavy materials with the side of the bucket (using the swing movement of the upperstructure), as this may damage the front attachment. If such pushing is unavoidable, be sure to do it slowly and carefully.



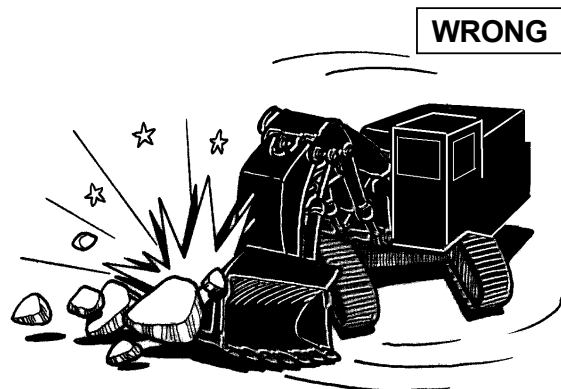
M18G-04-004



M18G-04-005



M18G-04-006



M117-05-020

OPERATING THE MACHINE



WARNING: When excavating with boom extended to high levels, do not tilt bucket back, as materials will spill on operator's cab. Dump bucket slightly to prevent spilling.

WRONG



M18G-04-007

IMPORTANT:

- When digging with the upperstructure at an angle to the undercarriage, avoid striking the tracks with the bucket.
- Avoid further extension of the bucket cylinder after the bucket comes into contact with the stopper, as the arm cylinder will be extended, moving the bucket forward.

WRONG



M18G-04-008

5. Do not use the weight of the base machine to pry earth as illustrated. Doing so will damage the base machine and may cause personal injury.

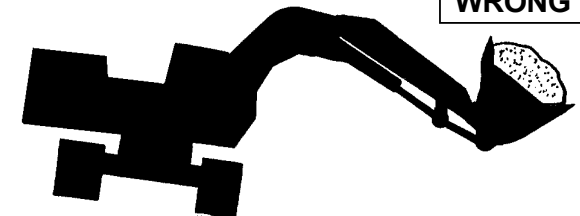
WRONG



M117-05-009

6. Machine stability is greater when the load is positioned parallel with the tracks. Machine stability is reduced when the load is swung to the side and when operating the front attachment perpendicular to the tracks. Sudden stop of boom lowering movement is especially likely to cause tipping over. When working on weak/soft surfaces or when loading high-density materials, operate the machine at reduced bucket loads.

WRONG



M117-05-011

OPERATING THE MACHINE

OBJECT HANDLING --- IF EQUIPPED



WARNING: When you use machine for object handling, be sure to comply with all local regulations.

Cables, straps, or ropes can break, causing serious injury. Do not use damaged chains, frayed cables, slings, straps, or ropes to crane.

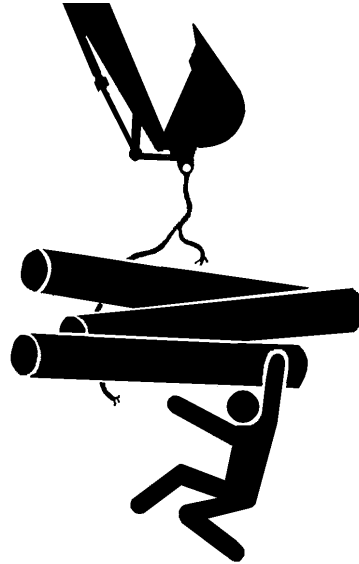
Never move the load quickly. Never move load over a person's head. Do not allow any persons near load.

Keep all persons away from wire-rope-attached load, lifted or sitting on the ground unless it is securely sitting on blocks or on the ground.

Position upperstructure so that the travel motors are at the rear.

Do not attach sling/chain to the bucket teeth.

- Secure sling/chain tightly to the load to be lifted. Wear gloves when securing sling/chain.
- Fasten sling/chain to bucket loop, with the bucket curled and arm retracted.
- Coordinate hand signals with your signal man before starting.
- Be aware of the location of all persons in the working area.
- Attach a hand line to load and make sure person holding it is well away from load.
- Before lifting, test your load.
 1. Park your machine close to load.
 2. Attach load to the machine.
 3. Raise load 50 mm above the ground.
 4. Swing the load all the way to one side.
 5. While keeping load close to the ground, move it away from machine.
 6. If there is any indication of reduced stability of your machine, lower load to the ground.
- Lift load only as high as necessary.

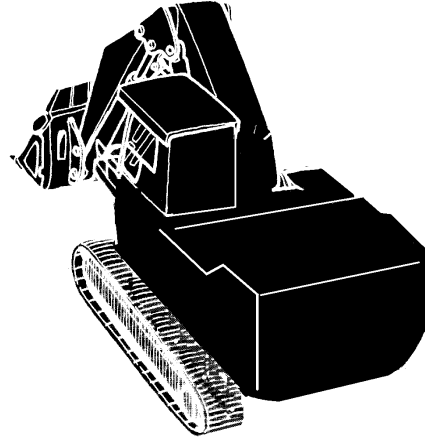


SA-014

OPERATING THE MACHINE

OVERNIGHT STORAGE INSTRUCTIONS

1. After finishing the day's operation, drive the machine to a firm, level ground where no possibility of falling stones, ground collapse, or floods. Park the machine referring to the "PARKING THE MACHINE" in the "DRIVING THE MACHINE" section.
2. Fill the fuel tank with fuel.
3. Clean the machine.
4. If anti-freeze or long life coolant is not used in cold weather, be sure to drain coolant from the radiator and the engine jacket. Also, be sure to put a "No Water in Radiator" tag in a visible place if the coolant has been drained.



M117-05-023

[illegible]

MAINTENANCE

CORRECT MAINTENANCE AND INSPECTION PROCEDURES

Learn how to service your machine correctly. Follow the correct maintenance and inspection procedures shown in this manual.

Inspect machine daily before starting.

- Check controls and instruments.
- Check coolant, fuel and oil levels.
- Check for leaks, kinked, frayed or damaged hoses and lines.
- Walk around machine checking general appearance, noise, heat, etc.
- Check for loose or missing parts.

If there is any problem with your machine, repair it before operating or contact your authorized dealer.

- IMPORTANT:**
- **Use only recommended fuel and lubricants.**
 - **Use only genuine HITACHI parts.**
 - **Failure to use recommended fuel, lubricants, and genuine Hitachi parts will result in loss of Hitachi product warranty.**
 - **Never adjust engine governor or hydraulic system relief valve.**
 - **Protect electrical parts from water and steam.**
 - **Never disassemble electrical components such as main controller, sensors, etc.**

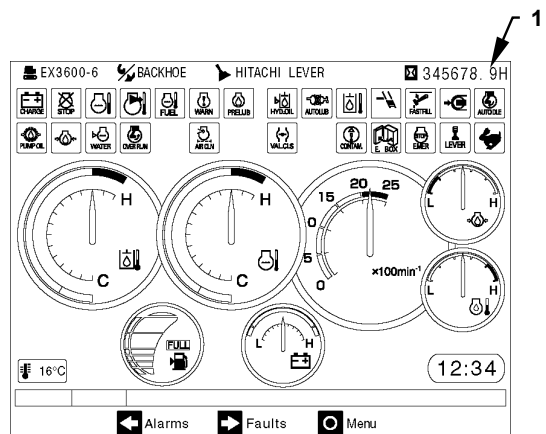


SA-005

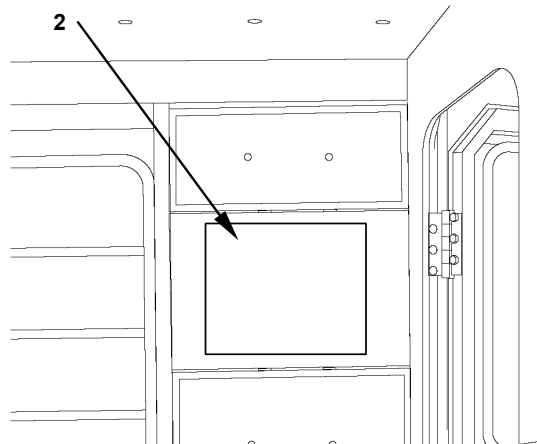
MAINTENANCE

CHECK THE HOUR METER REGULARLY

- Check hour meter (1) to determine when your machine needs periodic maintenance.
- Intervals on the periodic maintenance chart are for operating in normal conditions. If you operate your machine in more adverse conditions, you should service it at SHORTER INTERVALS.
- Lubricate, make service checks and adjustments at intervals shown on periodic maintenance chart (2) located on the inside of the cab rear right.



M18M-01-009



M18M-07-001

USE CORRECT FUELS AND LUBRICANTS

IMPORTANT: Always use recommended fuels and lubricants.
Failure to do so will result in machine damage and loss of Hitachi product warranty.

MAINTENANCE

PREPARE MACHINE FOR MAINTENANCE

Before performing the maintenance procedures given in the following chapters, park the machine as described below, unless otherwise specified.

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

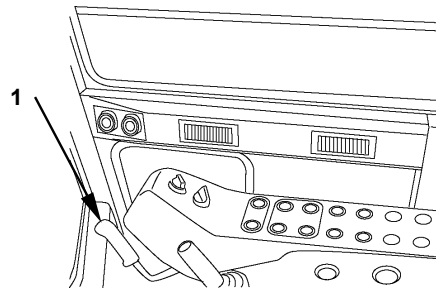
4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch. (If maintenance must be performed with engine running, do not leave machine unattended.)
6. Pull the pilot control shut-off lever (1) to the LOCK position.
7. Before performing any work on the machine, attach a "Do Not Operate" tag on the right control lever.

8. Ground Disconnecter

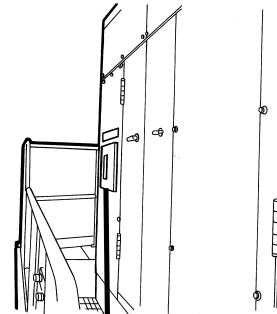
This machine is equipped with a battery ground disconnecter located outside of engine unit compartment on the right side. The battery ground circuit can be disconnected by pulling disconnecter lever (2) down before replacing the battery, checking the electrical system, or performing welding work on the machine.

IMPORTANT: Do not pull the ground disconnecter down while operating the machine.

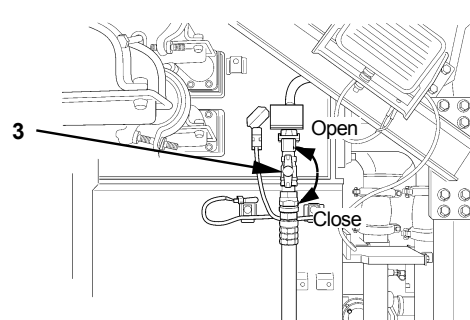
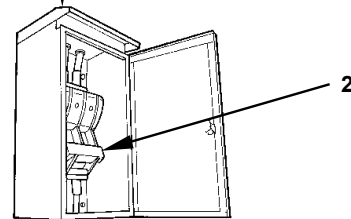
9. When using a vacuum pump to create negative pressure in the hydraulic oil tank while working on the hydraulic lines, close stop valve cock (3) on the hydraulic oil tank air bleed valve. Be sure to open cock (3) after completing the repair work.



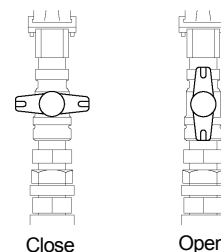
M18M-01-018



M146-01-021



M146-07-062

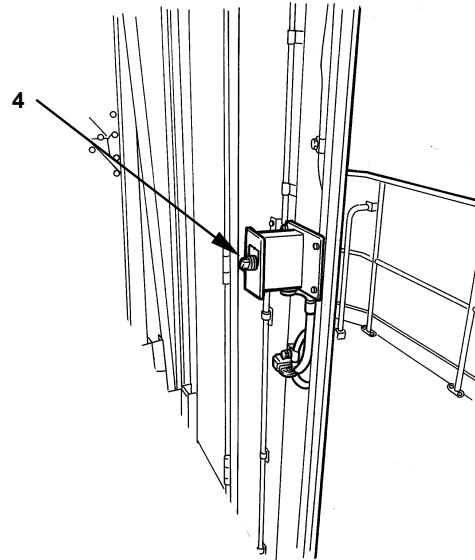


M146-01-033

M18M-07-068

MAINTENANCE

10. Before starting to check and/or service the inside of the engine compartment, turn engine stop switch (4) located at the engine compartment entrance to the EMERG. STOP position to assure safety.



M18M-07-002

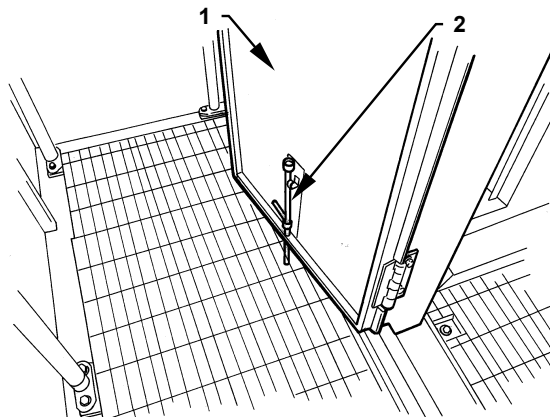
MAINTENANCE

OPEN ACCESS DOORS FOR SERVICE

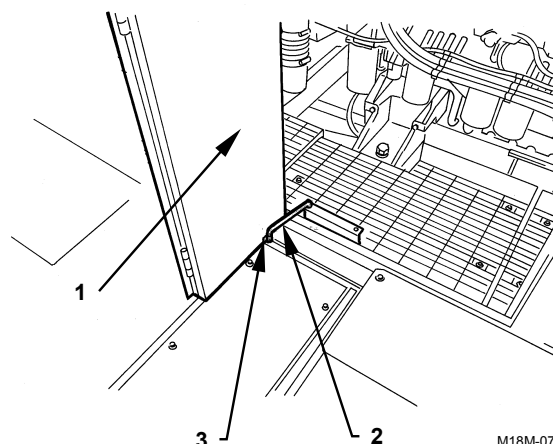


WARNING:

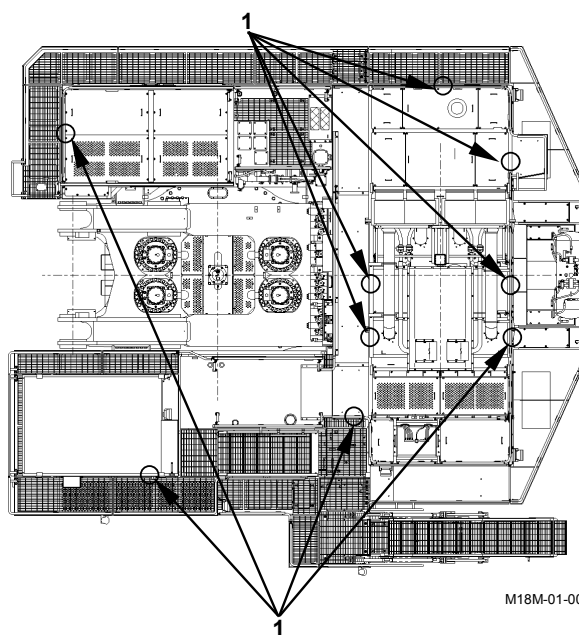
- Do not keep the access doors (1) open when the machine is parked on a slope, or while the wind is blowing hard. The access doors (1) may close accidentally, possibly resulting in personal injury.
- When opening or closing the access doors (1), take extra care not to catch fingers between the base machine and the access doors (1).
- To keep the access door open, lower rod (2) into a gap on the platform or into locking hole (3), as illustrated.



M146-07-015



M18M-07-003



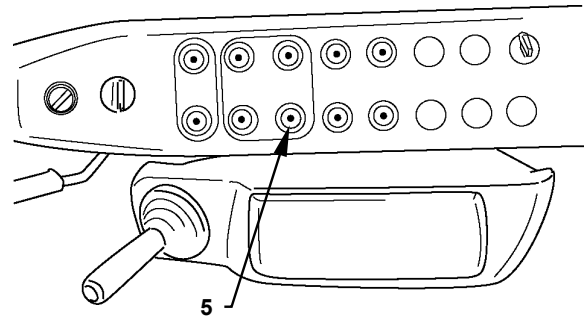
M18M-01-005

MAINTENANCE

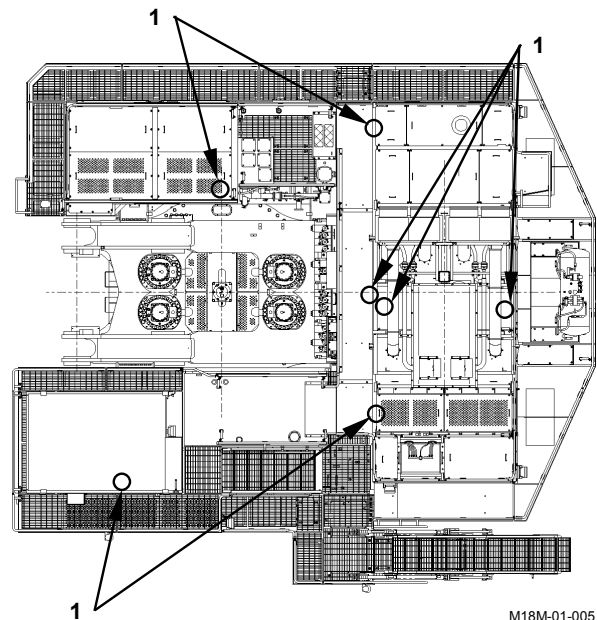
INSPECTION/MAINTENANCE LIGHTS

All 7 maintenance lights (1) will be turned ON with maintenance light switch.

Use switch (5), located on the switch panel in the cab, to turn on/off these lights.



M18M-01-019



M18M-01-005

MAINTENANCE

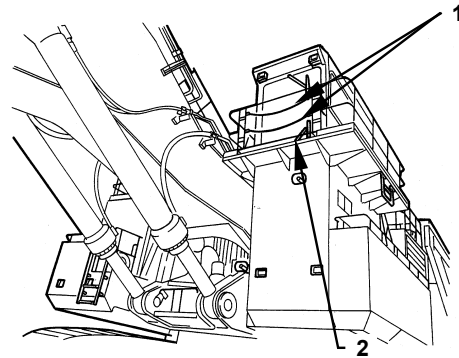
USE A CHAIN TO PREVENT FALLING ACCIDENTS

When inspection or maintenance is required on cab front step (2), tighten chain (1) as described below to prevent falling from cab front step (2).

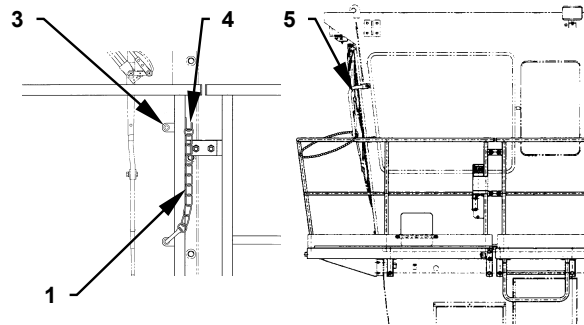


WARNING: Before starting inspection or maintenance on the cab front step, be sure to attach the chain to the step handrail. Before attaching the chain, check to be sure that the chain has no damage. If any damage such as wear or breaks are found, replace with new one.

1. Remove chain (1) from hook (3) located on the left-upper front cab and from handrail (5).
2. Install the free end of chain (1) to right hook (7) to attach the chain.
3. Check that chain (1) is securely installed to both hooks (6) and (7).
4. Before re-starting machine operation, remove chain (1) from right hook (7). After hanging the chain on hook (4), let it wrap around handrail (5). Then, re-install the end of chain (1) to left upper hook (3).

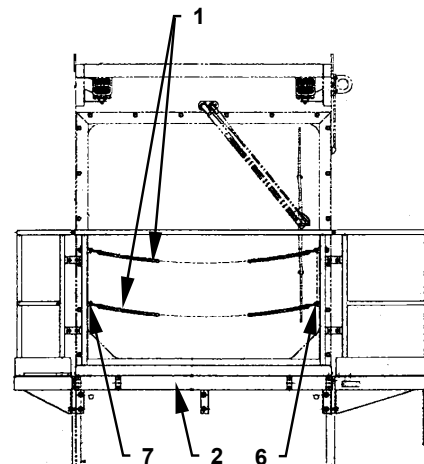


M146-01-029



M18M-07-015

M18M-07-011



M18M-07-012

MAINTENANCE

ELECTRIC PUMP (Optional)

This machine is equipped with an electric pump to draw hydraulic oil from the suction and return pipe lines to the hydraulic oil tank. The pump is driven by battery power. Continuously operate it while servicing the machine.

How to Operate Electric Pump



WARNING: Hydraulic oil may be hot just after operation. Be sure to wait for oil to cool before starting work.

1. Stop the engines.



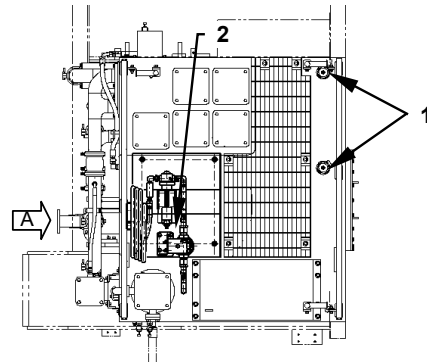
NOTE: Refer to page 7-3 for stopping the engines properly.

2. Release pressure of the hydraulic oil tank.

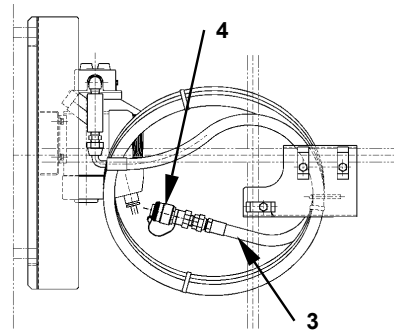


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

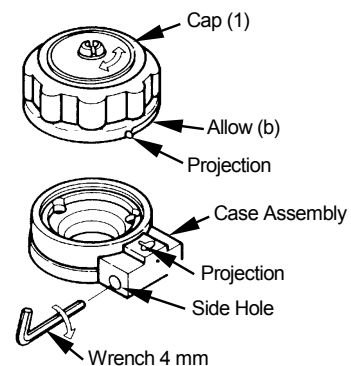
- (1) Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
 - (2) Turn cap (1) counter-clockwise about 30°, at which point stop cap (1) to release the air.
 - (3) Turn cap (1) further and remove cap (1).
 - (4) Align the projected part of cap (1) with the projected part of the case and install cap (1).
3. Connect suction hose (3) of electric pump (2) to quick coupler (4).
Quick Couplers are located in;
 - Suction Line: Suction Manifold under Pump Unit
 - Return Line: Return Line beside Control Valve
4. Before drawing oil, open stop valve (5).



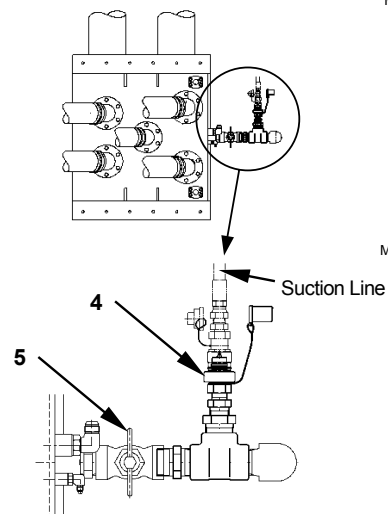
M18M-07-004



M18M-07-005



M110-07-022



M18M-07-006

M18M-07-007

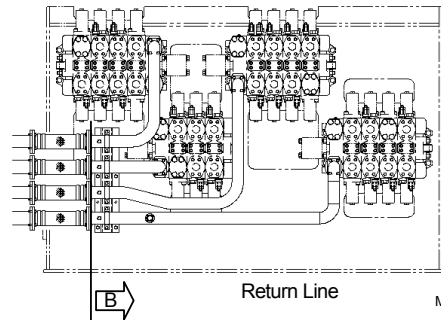
MAINTENANCE

5. Turn the key switch ON.
6. Remove plugs (6) and (7) on the pipe line to allow the electric pump to draw oil easily.

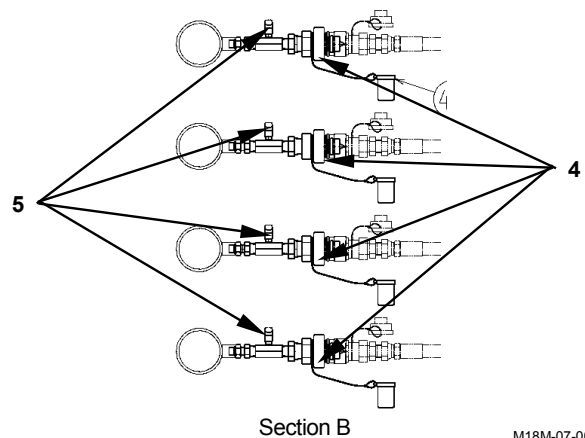
Plugs are located at

- Suction Line: Suction pipe of main pump
- Return Line: Top of oil cooler

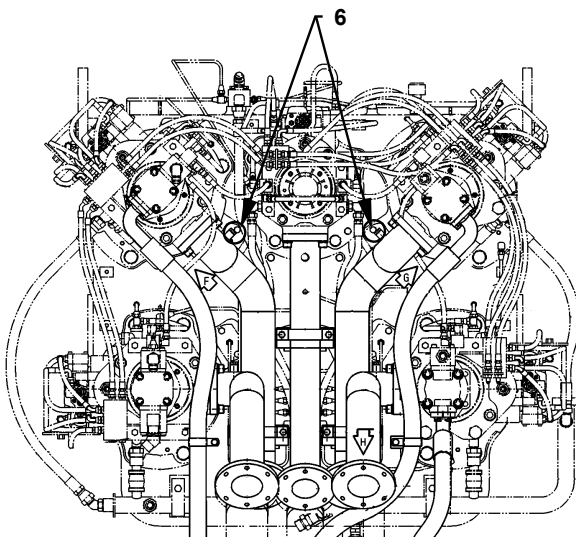
7. Close 2 stop valves (8) on the suction pipes under the hydraulic oil tank.
8. Turn electric pump (2) switch ON. The pump starts to draw oil.
9. After drawing oil, turn electric pump (2) switch OFF.
10. Install plugs (6) and (7). Close stop valve (5). Disconnect suction hose (3) of electric pump (2).



M18M-07-008

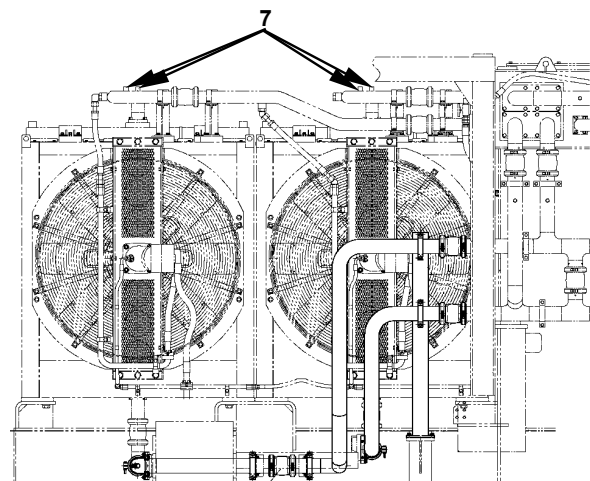


M18M-07-009

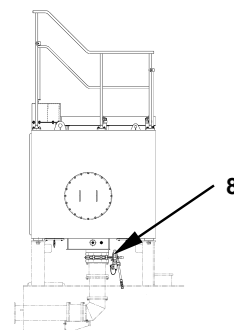


Main Pump Plugs

M18M-07-010



M18M-07-063

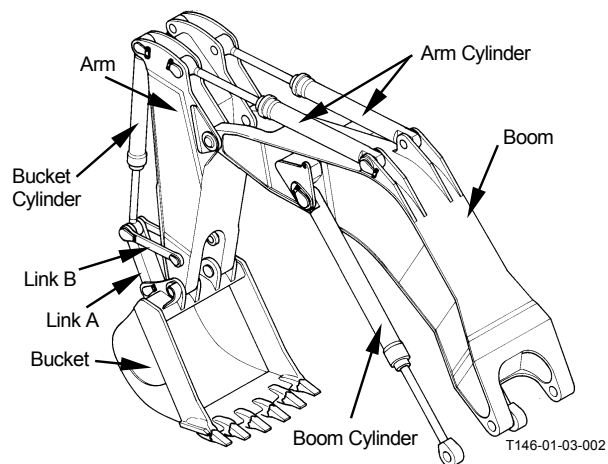


M18M-07-064

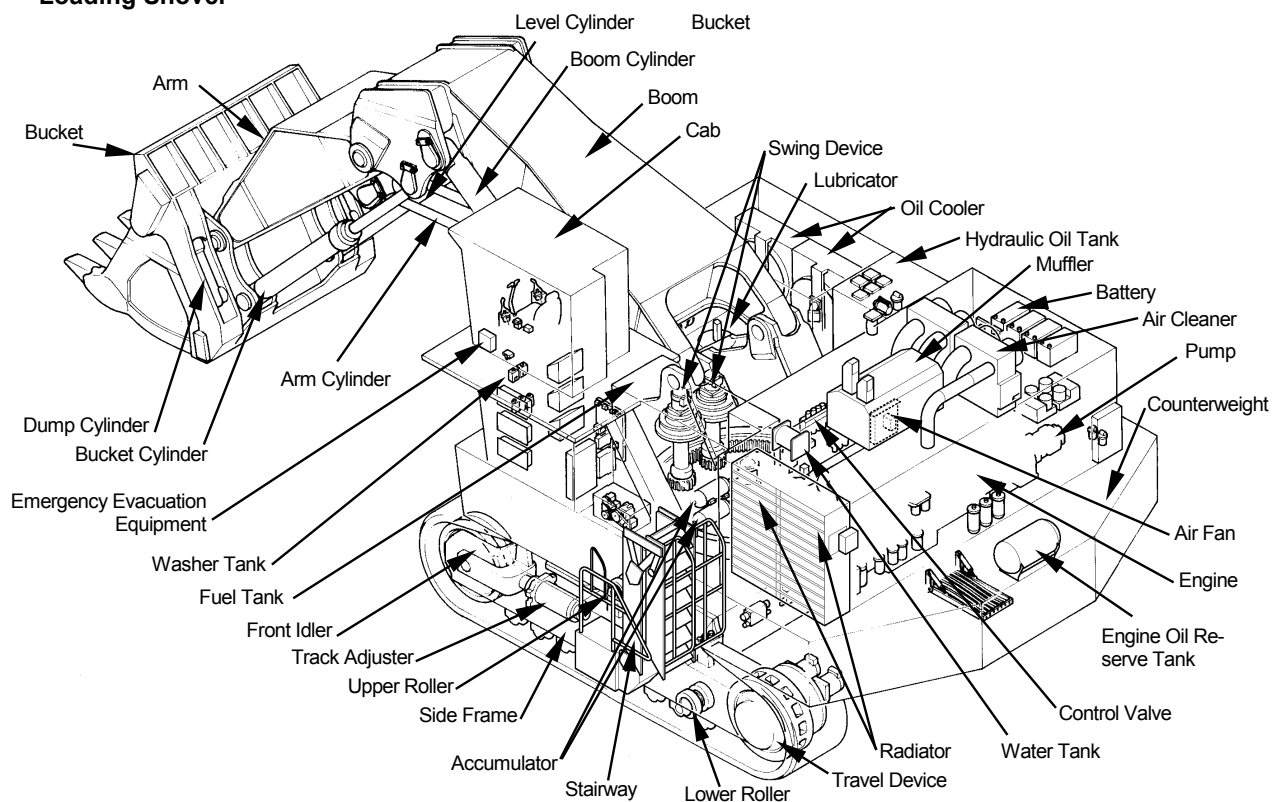
MAINTENANCE

CONSTRUCTION OUTLINE

Backhoe



Loading Shovel



MAINTENANCE

HYDRAULIC SYSTEM

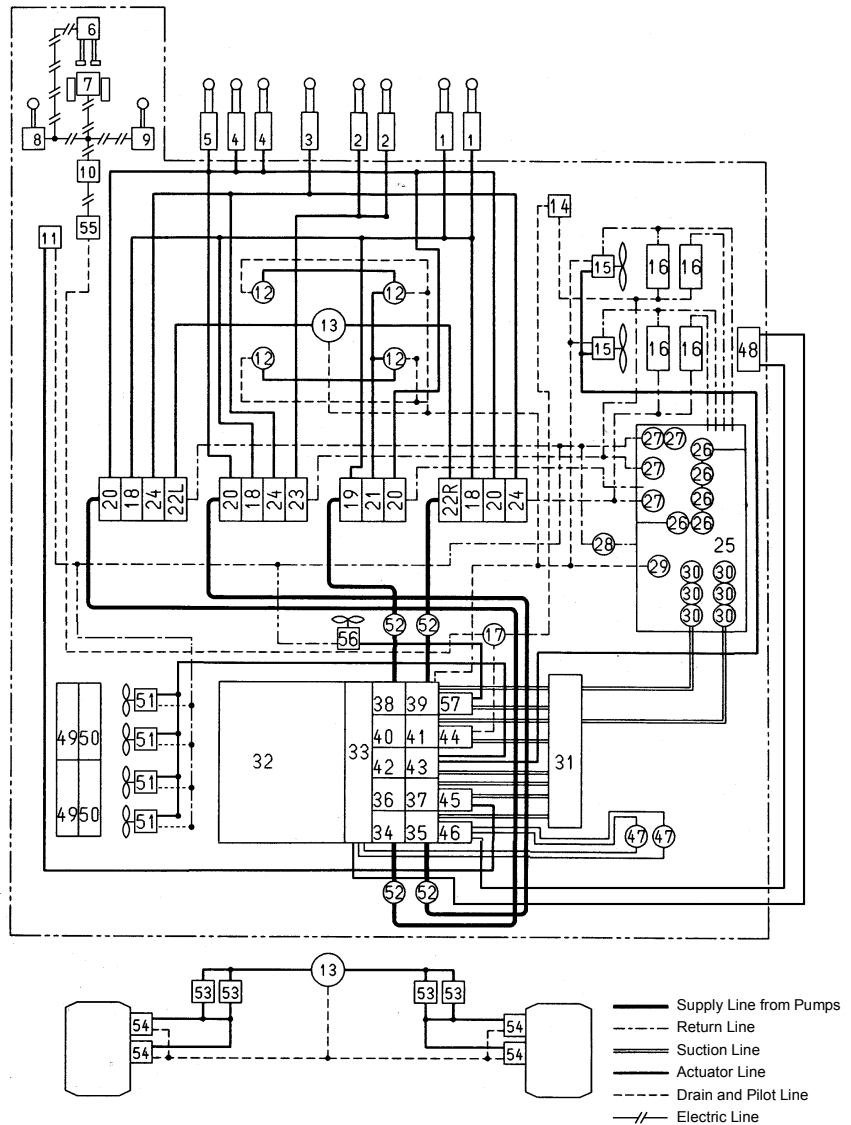
IMPORTANT: Hydraulic equipment such as hydraulic pumps, control valves, and relief valves have been adjusted at the factory. Do not attempt to disassemble or turn the adjusting screws, as they are very difficult to readjust. Consult your authorized dealer if any trouble should occur.

1. Oil from the main pumps flows through the control valves to the cylinders and motors. Most return oil from the control valves flows back to the hydraulic oil tank via the full-flow filters; a small amount returns via oil coolers directly. High pressure strainers are provided in the pump delivery lines between the pumps and control valves.
2. The solenoid valves actuated by the electric control levers/pedals send pilot oil from the pilot pumps to the control valves, moving their spools. This spool movement routes the pump delivery oil to the cylinders and motors.
3. Relief valves of sufficient capacity are provided in the control valves, full-flow filters and the pilot and oil cooler circuits in order to protect each circuit from abnormally high pressure.
4. The excavator is equipped with an accumulator in the pilot oil line which makes it possible to operate the front attachment for a few seconds after the engine has stopped. The accumulator is charged with high pressure gas; do not attempt to remove or disassemble it, and do not expose the accumulator to flame.
5. The excavator is equipped with an independent oil cooler and circulation pump for the pump transmission, which functions to cool pump transmission oil.

MAINTENANCE

Loading Shovel

1. BUCKET CYLINDER
2. DUMP CYLINDER
3. ARM CYLINDER
4. BOOM CYLINDER
5. LEVEL CYLINDER
6. ELECTRIC CONTROL LEVER (Travel)
7. ELECTRIC CONTROL LEVER (Bucket Open and Close)
8. ELECTRIC CONTROL LEVER (Front/Swing)
9. ELECTRIC CONTROL LEVER (Front)
10. ELECTRIC LEVER CONTROLLER
11. AIR CON. COMPRESSOR MOTOR
12. SWING MOTOR
13. CENTER JOINT
14. GREASE PUMP
15. OIL COOLER FAN MOTOR
16. OIL COOLER
17. PILOT FILTER
18. CONTROL VALVE (Bucket)
19. CONTROL VALVE (Bucket Rollin/Arm Rollin)
20. CONTROL VALVE (Boom)
21. CONTROL VALVE (Swing)
- 22L. CONTROL VALVE (Left Travel)
- 22R. CONTROL VALVE (Right Travel)
23. CONTROL VALVE (Bucket Open/Close)
24. CONTROL VALVE (Arm)
25. HYDRAULIC OIL TANK
26. FULL-FLOW FILTER
27. LOW PRESSURE RELIEF VALVE
28. BYPASS FILTER
29. DRAIN FILTER
30. SUCTION FILTER
31. SUCTION MANIHOLD
32. ENGINE
33. PUMP TRANSMISSION
34. MAIN PUMP (No. 1)
35. MAIN PUMP (No. 2)
36. MAIN PUMP (No. 3)
37. MAIN PUMP (No. 4)
38. MAIN PUMP (No. 5)
39. MAIN PUMP (No. 6)
40. MAIN PUMP (No. 7)
41. MAIN PUMP (No. 8)
42. RADIATOR FAN DRIVE PUMP
43. OIL COOLER FAN DRIVE PUMP
44. PILOT PUMP
45. AIR-CON. COMP. DRIVE PUMP
46. PUMP TRANSMISSION OIL COOLER PUMP
47. PUMP TRANSMISSION OIL FILTER
48. PUMP TRANSMISSION OIL COOLER
49. LTA COOLER
50. RADIATOR
51. RADIATOR FAN MOTOR
52. HIGH PRESSURE FILTER, CHECK VALVE
53. BRAKE VALVE
54. TRAVEL MOTOR
55. SOLENOID VALVE
56. AIR FAN MOTOR FOR ENGINE ROOM
57. AIR FAN DRIVE PUMP FOR ENGINE ROOM

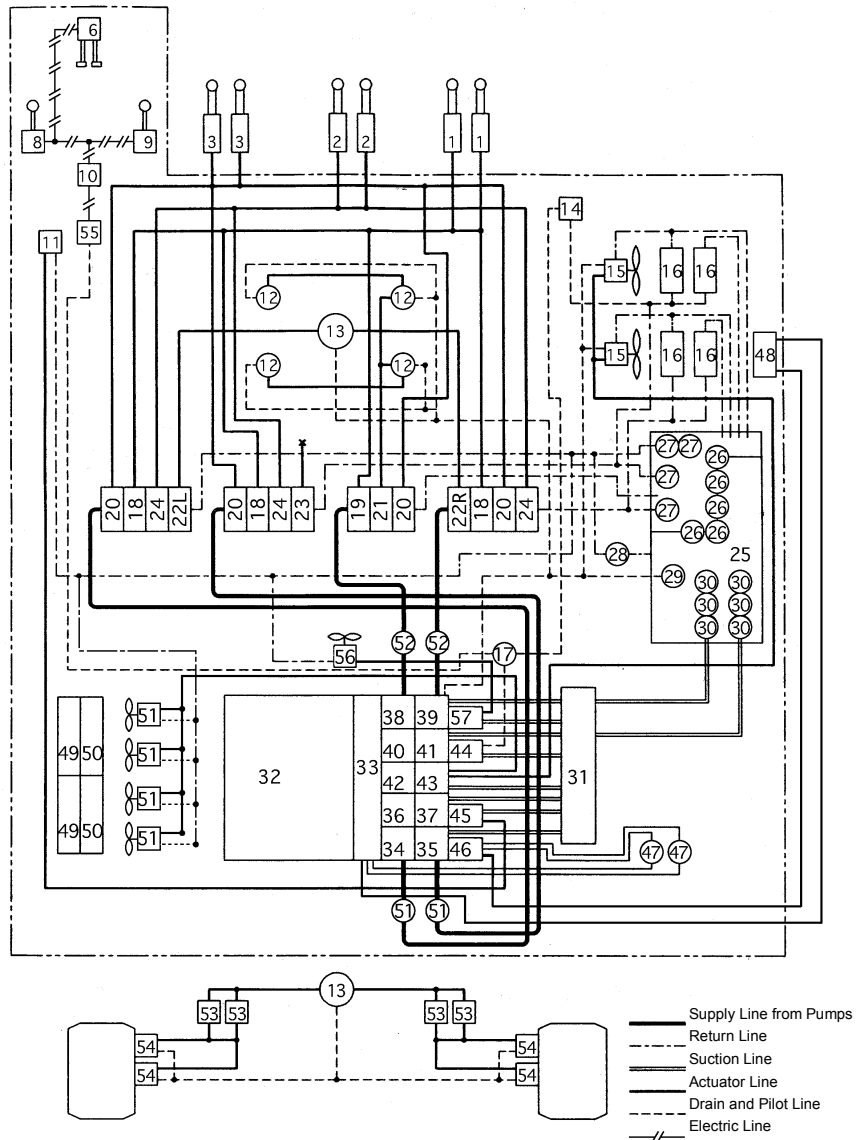


M18M-07-013

MAINTENANCE

Backhoe

1. BUCKET CYLINDER
2. ARM CYLINDER
3. BOOM CYLINDER
4. —
5. —
6. ELECTRIC CONTROL LEVER (Travel)
7. —
8. ELECTRIC CONTROL LEVER (Front/Swing)
9. ELECTRIC CONTROL LEVER (Front)
10. ELECTRIC LEVER CONTROLLER
11. AIR CON. COMPRESSOR MOTOR
12. SWING MOTOR
13. CENTER JOINT
14. GREASE PUMP
15. OIL COOLER FAN MOTOR
16. OIL COOLER
17. PILOT FILTER
18. CONTROL VALVE (Bucket)
19. CONTROL VALVE (Bucket Rollin/Arm Rollin)
20. CONTROL VALVE (Boom)
21. CONTROL VALVE (Swing)
- 22L. CONTROL VALVE (Left Travel)
- 22R. CONTROL VALVE (Right Travel)
23. CONTROL VALVE (Bucket Open/Close)
24. CONTROL VALVE (Arm)
25. HYDRAULIC OIL TANK
26. FULL-FLOW FILTER
27. LOW PRESSURE RELIEF VALVE
28. BYPASS FILTER
29. DRAIN FILTER
30. SUCTION FILTER
31. SUCTION MANIHOLD
32. ENGINE
33. PUMP TRANSMISSION
34. MAIN PUMP (No. 1)
35. MAIN PUMP (No. 2)
36. MAIN PUMP (No. 3)
37. MAIN PUMP (No. 4)
38. MAIN PUMP (No. 5)
39. MAIN PUMP (No. 6)
40. MAIN PUMP (No. 7)
41. MAIN PUMP (No. 8)
42. RADIATOR FAN DRIVE PUMP
43. OIL COOLER FAN DRIVE PUMP
44. PILOT PUMP
45. AIR-CON. COMP. DRIVE PUMP
46. PUMP TRANSMISSION OIL COOLER PUMP
47. PUMP TRANSMISSION OIL FILTER
48. PUMP TRANSMISSION OIL COOLER
49. LTA COOLER
50. RADIATOR
51. RADIATOR FAN MOTOR
52. HIGH PRESSURE FILTER, CHECK VALVE
53. BRAKE VALVE
54. TRAVEL MOTOR
55. SOLENOID VALVE
56. AIR FAN MOTOR FOR ENGINE ROOM
57. AIR FAN DRIVE PUMP FOR ENGINE ROOM



M18M-07-014

MAINTENANCE

PERIODIC REPLACEMENT OF PARTS

To ensure safe operation, be sure to conduct periodic inspection of the machine. In addition, the parts listed below, if defective, may pose serious safety/fire hazards. It is very difficult to gauge the extent of deterioration, fatigue, or weakening of the parts listed below simply by visual inspection alone. For this reason, replace these parts at the intervals shown in the table below. However, if any of these parts are found to be defective, replace before starting operation, regardless of the interval. Use genuine Hitachi parts.

Also, when replacing hoses, check the clamps for deformation, cracks, or other deterioration, and replace as necessary.

Be sure to perform periodic inspection of all hoses, as shown below, and replace or retighten any defective parts found, as necessary.

Consult your authorized dealer for correct replacement.

No.	Periodic Replacement Parts	Q'ty in Use	Replacement Intervals
Pump Delivery Hoses			Every 2 years or 8,000 hours of operation, whichever comes first
1	Main Pumps to High Pressure Filters	8	
2	High Pressure Filters to Blocks	4	
3	Blocks to High Pressure Pipes	4	
4	High Pressure Pipes to Control Valves	4	
5	Fan Pumps to Oil Cooler Fan Motor and Radiator Fan Motor	4	
6	Tail Hoses	6	
Front Hoses			
7	Control Valves to Front	2	
Loading Shovel Front Hoses			
8	Mainframe to Boom	16	
Backhoe Front Hoses			
9	Mainframe to Boom	16	
Travel Hoses and Swing Hoses			
10	Control Valves to Center Joint	4	
11	Control Valves to Swing Motors	8	
Fuel Hoses			
12	Fuel Tank to Engine	3	
13	Engine to Fuel Cooler	5	
14	Fuel Cooler to Fuel Tank	5	

 **NOTE:** Be sure to replace seals, such as O-rings and gaskets, when replacing hoses.

MAINTENANCE

PERIODIC REPLACEMENT OF RUBBER HOSES



WARNING: Rubber hoses, such as hydraulic hoses, lubrication hoses, fuel hoses, and heater hoses, may break due to aging, fatigue, and abrasion, possibly resulting in serious injury or death.

In order to avoid serious personal injury, be sure to replace the hoses listed in the following table every two years, or 8000 hours of operation, whichever comes first. Use genuine Hitachi parts.

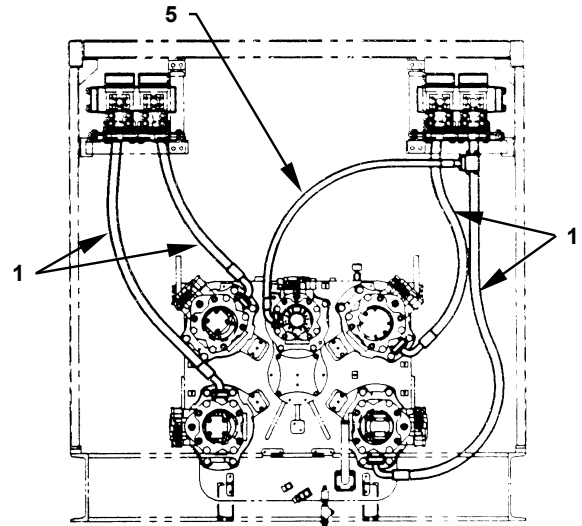
It is very difficult to gauge the extent of deterioration due to aging, fatigue, and abrasion of rubber hoses by inspection alone. Thus, if rubber hoses are not replaced periodically, serious personal injury may result due to falls of the front, penetration of high pressure oil into the skin, or fire.

Regardless of regular replacement intervals, if hoses are found to be defective by periodic inspection (refer to pages 7-70 and 7-80), be sure to repair or replace them before operating the machine. Be sure to replace seals, such as O-rings and hose clamps along with replacing hoses.

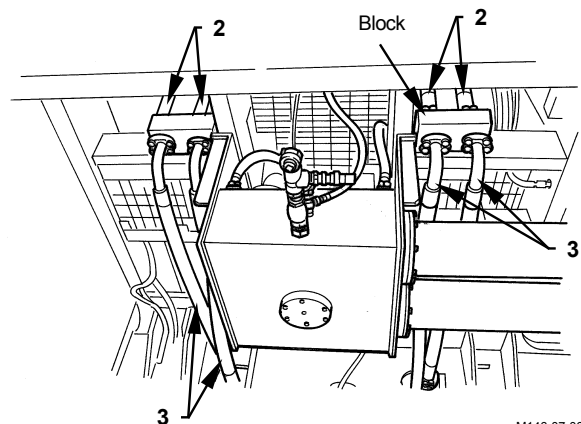
Consult your authorized dealer for correct hose replacement.

Hydraulic Hoses

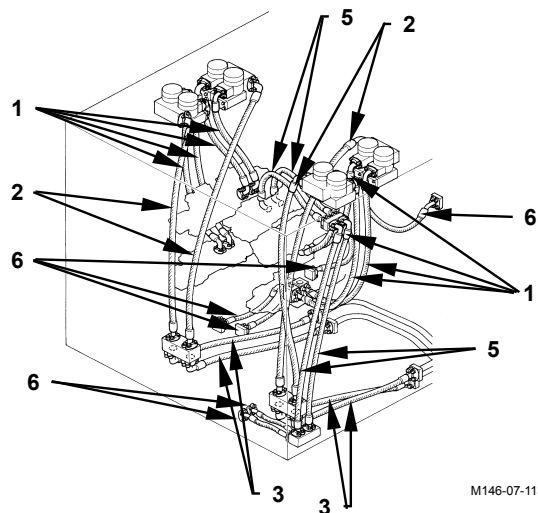
Hoses		Q'ty
Pump Delivery Hoses	Main pumps to High pressure filters (1)	8
	High pressure filters to Blocks (2)	4
	Blocks to High pressure pipes (3)	4
	High pressure pipes to Control valves (4)	4
	Fan pumps to oil cooler fan motor and radiator fan motor (5)	4
	Tail hoses (6)	6
Front Hoses	Control Valves to Front (7)	2



M146-07-095



M146-07-066

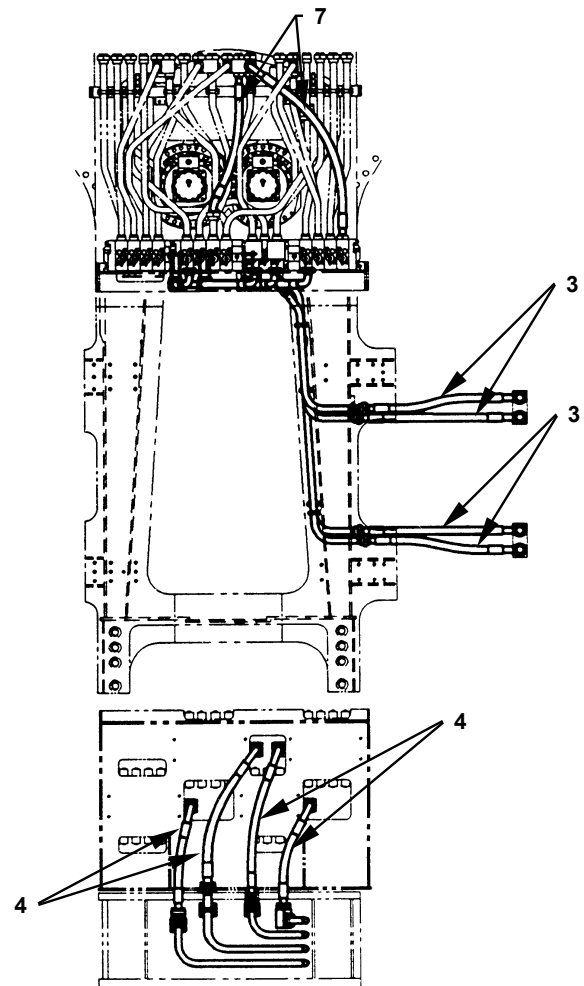


M146-07-113

MAINTENANCE

Hydraulic Hoses

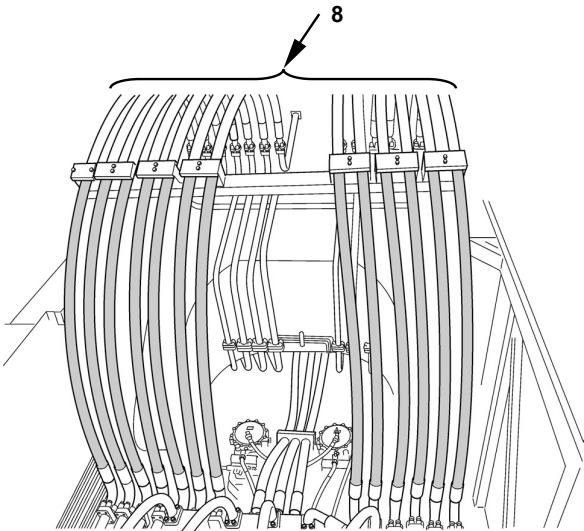
	Hoses	Q'ty
Pump Delivery Hoses	Main pumps to High pressure filters (1)	8
	High pressure filters to Blocks (2)	4
	Blocks to High pressure pipes (3)	4
	High pressure pipes to Control valves (4)	4
	Fan pumps to oil cooler fan motor and radiator fan motor (5)	4
	Tail hoses (6)	6
Front Hoses	Control Valves to Front (7)	2



M146-07-096

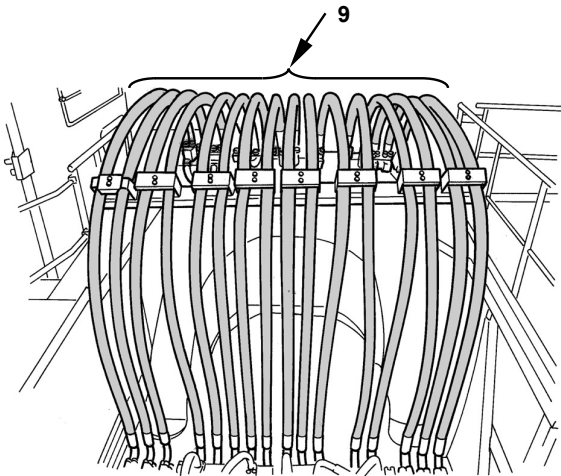
MAINTENANCE

Hoses		Q'ty in Use
Loading Shovel Front Hoses	Main Frame to Boom (8)	16



M146-07-097

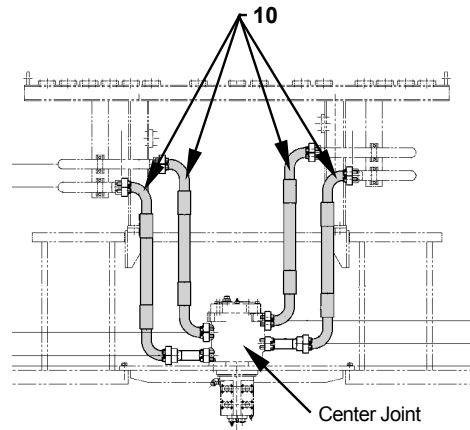
Hoses		Q'ty in Use
Backhoe Front Hoses	Main Frame to Boom (9)	16



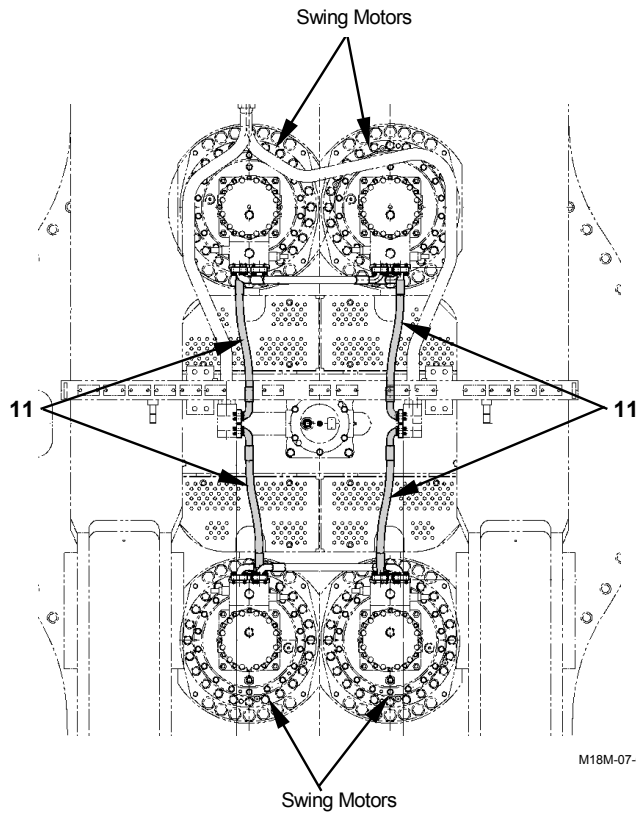
M146-07-017

MAINTENANCE

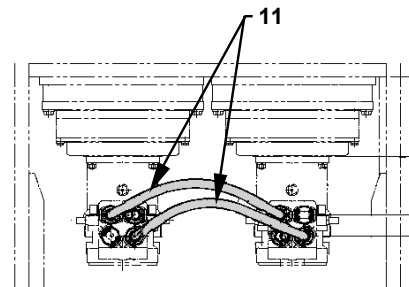
Hoses		Q'ty
Travel Hoses	Control Valves to Center Joint (10)	4
Swing Hoses	Control Valves to Swing Motors (11)	8



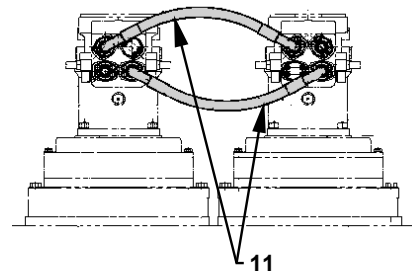
M18M-07-016



M18M-07-018



M18M-07-017

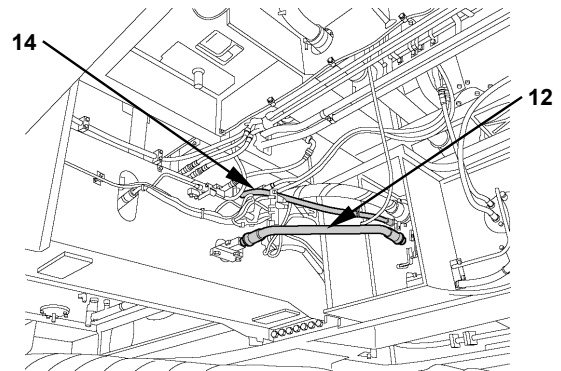


M18M-07-025

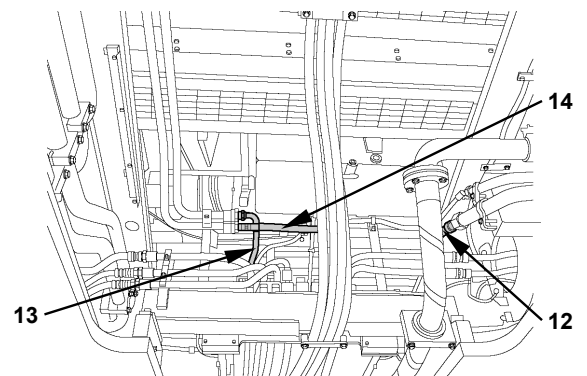
MAINTENANCE

Fuel Hoses

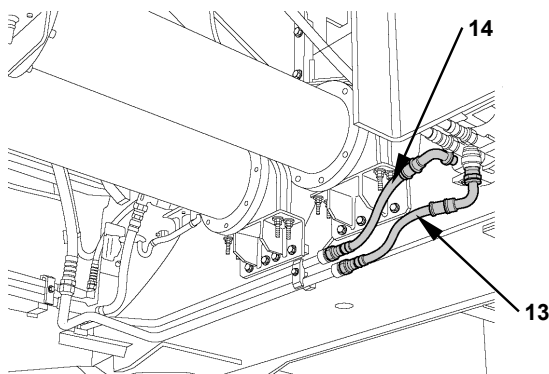
Hoses	Q'ty in Use
Fuel Tank to Engine (12)	3
Engine to Fuel Cooler (13)	5
Fuel Cooler to Fuel Tank (14)	5



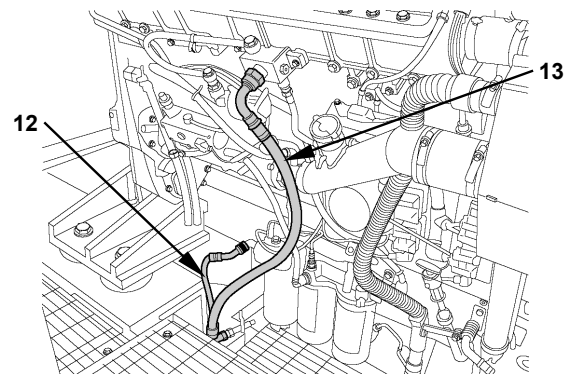
M18M-07-019



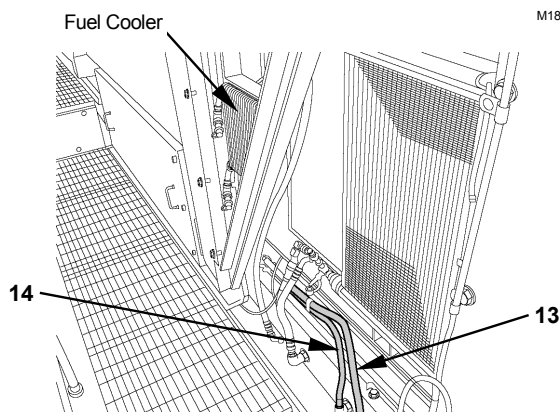
M18M-07-020



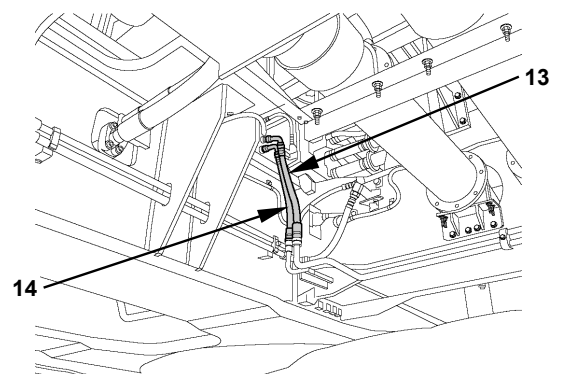
M18M-07-023



M18M-07-021



M18M-07-024



M18M-07-022

MAINTENANCE

MAINTENANCE INTERVAL GUIDE

A. GREASING (See Page 7-24)

Parts		Quantity	Interval (hours)						
			5	10	250	500	1000	1500	2000
1. Loader Front Joint Pins	Bucket Pins	10 *	★★						
	Other Front Pins	20 *	★★						
2. Backhoe Front Joint Pins	Bucket and Link Pins	14 *	★★						
	Other Front Pins	18 *	★★						
3. Swing Bearing		24 *							
4. Swing Internal Gear		350 L (92.5 US gal)							
5. Center Joint		1 *							

 **NOTE:** ★★ Maintenance required when operating in water or mud.

* Auto-lubrication is available.

B. ENGINE (See Page 7-36)

Parts			Classification of Oil	Quantity	Interval (hours)						
					10	50	250	500	1000	1500	2000
1. Engine Oil	Check Oil Level	Engine Oil Pan		1							
		Reserve Tank		1							
2. Check LED Monitor Signal (on Reserve Tank)				1							
3. Engine Oil	Change	Engine Oil Pan	Premium	260L (68.7 US gal)		*		*			
		Reserve Tank *		120L × (31.7 US gal)		*		*			
	Change	Engine Oil Pan	Standard	260L (68.7 US gal)		*		*			
		Reserve Tank *		258L × (68.2 US gal)		*		*			
4. Replace Engine Oil Filter				4		*					

 **NOTE:** * First time only

★ When change engine oil, change the oil in engine oil pan and reserve tank at the same time.

* Total quantity of oil (Engine Oil Pan and Reserve Tank) achieves 500 hours replacement interval. It differs according to the kind of engine oil used.

The capacity of reserve tank is 280L (74 US gal).

 **NOTE:** * The machine has a reserve system.

Reserve system is the system that oil is circulated between engine oil pan and reserve tank by the pump on reserve tank.

C. TRANSMISSION (See Page 7-43)

Parts			Quantity	Interval (hours)						
				10	50	250	500	1000	1500	2000
1. Pump Transmission Gear	Engine Oil	Check Oil Level	1	*						
		Change Oil	52 L (13.7 US gal)		*					
		Replace Filter	2							
		Clean Breather	1							
2. Swing Reduction Gear	Gear Oil	Check Oil Level	4	*						
		Change Oil	75 L (19.8 US gal)×4		*					
		Clean Breather	4							
3. Travel Reduction Gear	Gear Oil	Check Oil Level	2							
		Change Oil	220 L (58.1 US gal)×2				*			

 **NOTE:** * First time only.

MAINTENANCE

D. HYDRAULIC SYSTEM (See Page 7-51)

Parts		Quantity	Interval (hours)							
			10	50	250	500	2000	2500	4000	12000
1. Check Hydraulic Oil Level		1	*							
2. Drain Hydraulic Oil Tank Sump		1								
3. Change Hydraulic Oil		4000 L (1060 US gal)					★	★	★	
4. Replace Full-Flow Filter and Drain Filter		6		*						
5. Replace Bypass Filter		1		*						
6. Replace Pilot Oil Filter		1		*						
7. Suction Filter	Clean Filter	6	When changing hydraulic oil							
	Replace Filter	6								
8. Replace High-Pressure Strainer		8								
9. Clean Oil Cooler Core		4								
10.	Check Hoses and Lines (for leak, loose)	–								
	Check Hoses and Lines (for crack, bend, etc.)	–								

 **NOTE:** ★ Hydraulic oil changing interval differs according to the kind of hydraulic oil used. See recommended oil chart.

* First time only.

E. FUEL SYSTEM (See Page 7-74)

Tank capacity 7450 liter (1970 US gal)

Parts		Quantity	Interval (hours)							
			10	50	250	500	1000	1500	2000	
1. Drain Fuel Tank Sump		1								
2. Drain Fuel Filter Sediment		Stage 1 filter	3	Weekly or as required						
3. Replace Fuel Element		Stage 1 filter	3							
4. Replace Fuel Filter		Stage 2 filter	3							
5.	Check Fuel Hoses (for leak, loose)	–								
	Check Fuel Hoses (for crack, bend, etc.)	–								

 **NOTE:** The machine has 2 stage filtration system on suction fuel line.
 Stage 1 filter is equipped in front of fuel tank.
 Stage 2 filter is equipped on engine.

F. AIR CLEANER (See Page 7-81)

Parts		Quantity	Interval (hours)					
			10	50	250	500	1000	1500
1. Air Cleaner Outer Element	Cleaning	2 × 2	As required Replace per 6 cleaning when outer element is replaced					
	Replacement	2 × 2						
2. Air Cleaner Inner Element	Replacement	2 × 2						

MAINTENANCE

G. COOLING SYSTEM (See Page 7-83)

Parts	Quantity	Interval (hours)						
		10	50	250	500	1000	1500	2000
1. Check Coolant Level	1							
2. Check DCA4 Concentration in Coolant	-							
3. Replace Coolant Filter	2							
4. Change Coolant	614 L (162 US gal)	Twice a year, in spring and autumn *						
5. Clean Radiator, LTA Cooler Interior	1+1	When changing coolant						
6. Clean Radiator, LTA Cooler Core	1+1							

 **NOTE:** * Before leaving the Hitachi factory, the cooling system is filled with a mixture of water and Genuine Hitachi Long-Life Coolant. As long as Genuine Hitachi Long-Life Coolant is used, the service intervals between changing the coolant is once every two years, or every 4000 hours, whichever comes first.

H. AIR CONDITIONER (See Page 7-97)

Parts		Quantity	Interval (hours)						
			10	50	250	500	1000	1500	2000
1. Recirculation Air Filter	Cleaning	3	As required						
	Replacement	3	Replace per 4 cleaning						
2. Ventilation Air Filter	Cleaning	3	As required						
	Replacement	3	Replace per 4 cleaning						
3. Check Refrigerant Quantity		3							
4. Check Compressor Belt Tension		3							
5. Clean Condenser Core		3							
6. Check Tightening Torque		-							
7. Seasonal Maintenance		-	Preseason (once a year), Off-season (once a week)						

MAINTENANCE

I. ELECTRICAL SYSTEM (See Page 7-104)

J. MISCELLANEOUS (See Page 7-118)

Parts		Quantity	Interval (hours)						
			10	50	250	500	1000	1500	3000
1. Check Bucket Teeth for Wear and Looseness		6							
2. Inspect Emergency Rope and Rope Mounting Hardware		1							
3. Check Auto-Lubrication System		1							
4. Seat Belt	Check	2							
	Replacement	2	At least once every 3 years						
5. Check Washer Tank		2	As required						
6. Air Horn Compressor Filter	Cleaning	1	As required						
7. Check and Adjust Track Sag		2							
8. Check Accumulator and Track Adjuster Cylinder Circuit		2	Every year						
9. Clean Side Frame Area		2							
10. Check Tightening Torque of Bolts and Nuts		–		★					

 NOTE: ★ First time only.

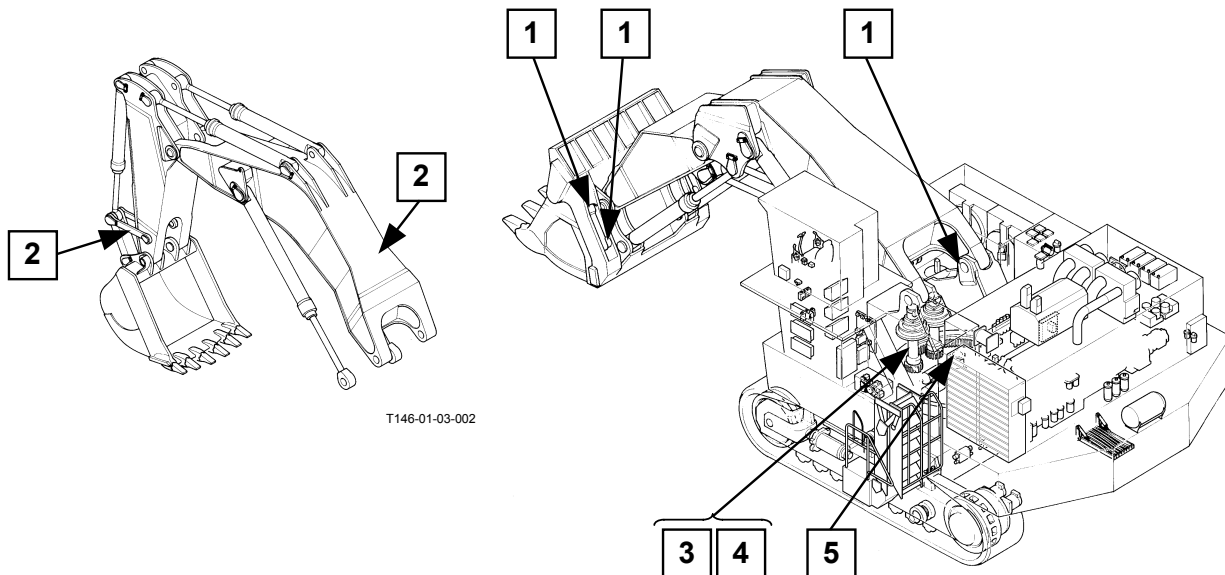
MAINTENANCE

A. GREASING

Parts		Quantity	Interval (hours)						
			5	10	250	500	1000	1500	2000
1. Loader Front Joint Pins	Bucket Pins	10 *	★★						
	Other Front Pins	20 *	★★						
2. Backhoe Front Joint Pins	Bucket and Link Pins	14 *	★★						
	Other Front Pins	18 *	★★						
3. Swing Bearing		24 *							
4. Swing Internal Gear		350 L (92.5 US gal)							
5. Center Joint		1 *							

NOTE: ★★ Maintenance required when operating in water or mud.

* Auto-lubrication is available.



M18M-03-007

Brand Names of Recommended Grease

Where to be applied	Swing Internal Gear		Front Joint Pins, Swing Bearing	
	-20 to 50 °C (-4 to 122 °F)			
Manufacturer				
British Petroleum	BP Energrease	LS-EP2	BP Energrease	LS-EP1
Caltex Oil	Multifax	EP2	Multifax	EP1
Esso	Beacon	EP2	Beacon	EP1
Idemitsu Kosan	Daphne Coronex Grease	EP2	Daphne Coronex Grease	EP1
Mobil Oil	Mobilux	EP2	Mobilux	EP1
Nippon Oil	Epinoc Grease	AP2	Epinoc Grease	AP1
Shell Oil	Shell Alvania EP Grease	2	Shell Alvania EP Grease	1

NOTE: The machine is shipped from the factory is filled with lubricants marked with .

MAINTENANCE

1 Loading Shovel Front Joint Pins --- daily

Add grease to all fittings shown below every 10 hours or each shift before starting. Most of the fittings are grouped, as shown, for quick and safe lubrication.

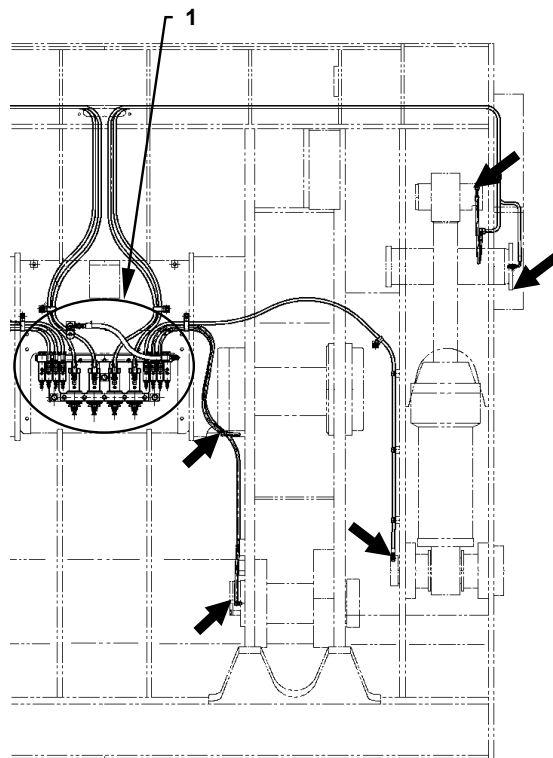
 **NOTE:** Auto-lubrication can be used for the fittings on the loading shovel front.

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Pull the pilot control shut-off lever to the LOCK position.
4. Apply grease to fittings until grease can be seen escaping from greasing places.
5. Take care not to supply excessive grease.

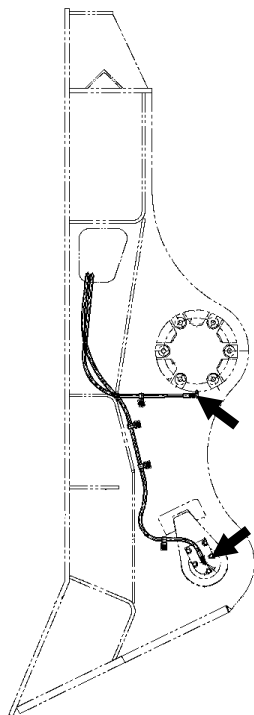
Manually greasing places are as illustrated below.

1. Grouped Grease Fittings (1) --- Bucket

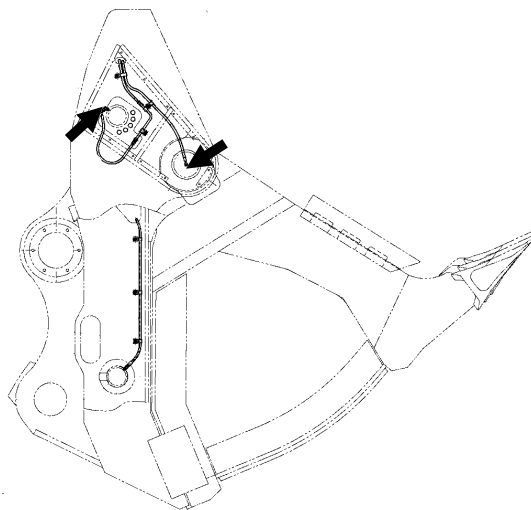
 : Lubrication points



M18M-07-027



M18M-07-026

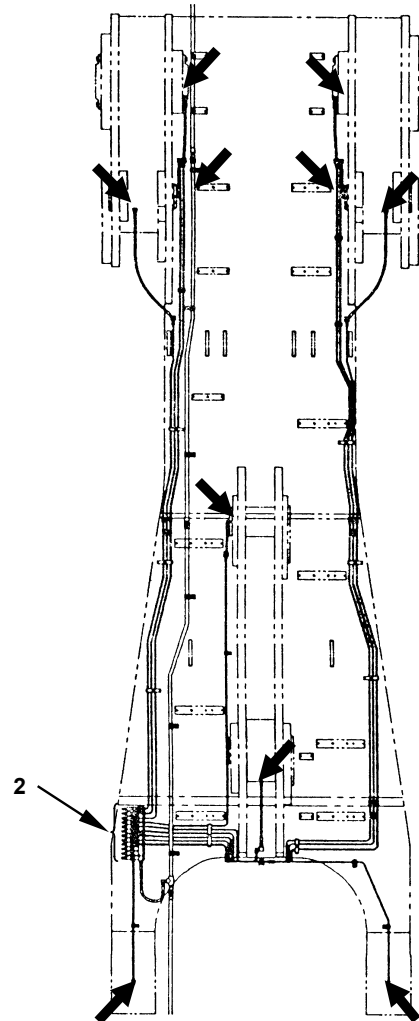


M18M-07-028

MAINTENANCE

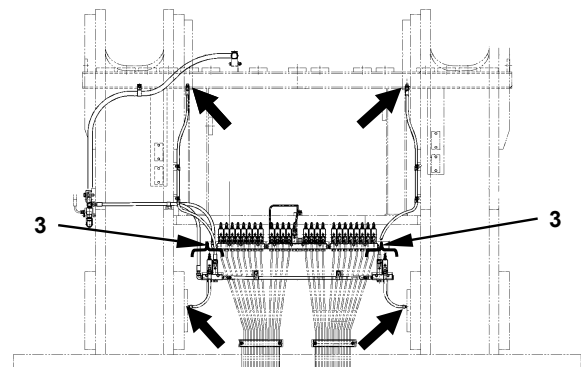
2. Grouped Grease Fittings (2) --- Boom

↖ : Lubrication Points



3. Grouped Grease Fittings (3) --- Boom Foot

M146-07-084

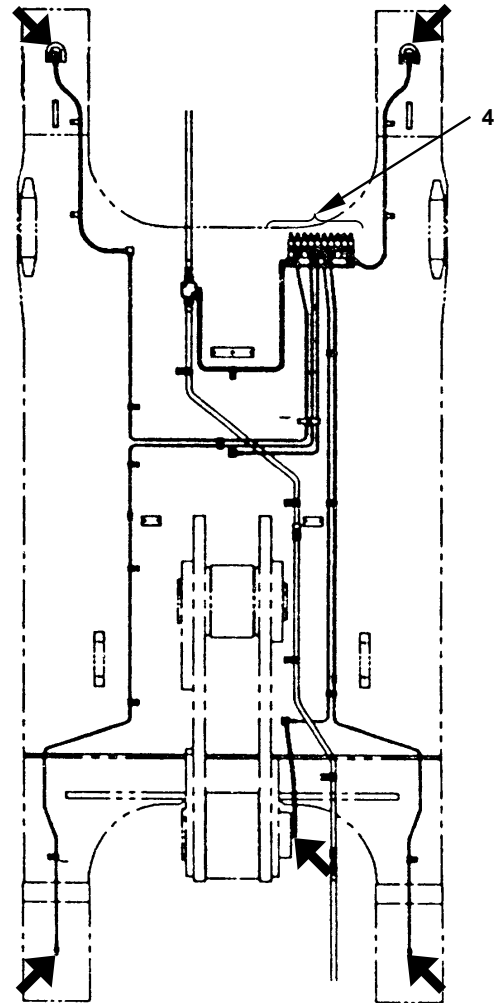


M18M-07-029

MAINTENANCE

4. Grouped Grease Fittings (4) --- Arm

↖ : Lubrication Points



M146-07-085

MAINTENANCE

2

Backhoe Front Joint Pins --- daily

Add grease to all fittings shown below every 10 hours or each shift before starting. Most of the fittings are grouped, as shown, for quick and safe lubrication.

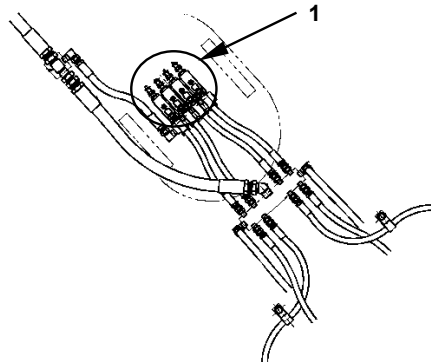
 **NOTE:** Auto-lubrication can be used for the fittings on the backhoe front except for the bucket and link.

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Pull the pilot control shut-off lever to the LOCK position.
4. Apply grease to fittings until grease can be seen escaping from greasing places.
5. Take care not to supply excessive grease.

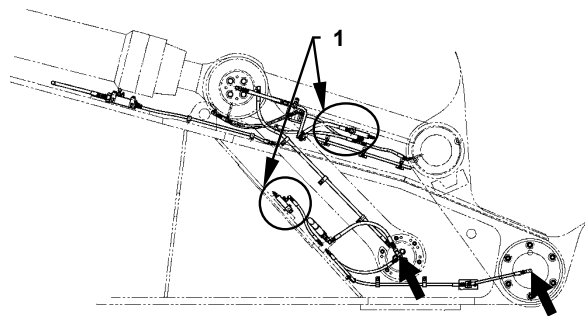
Manually greasing places are as illustrated below.

1. Grouped Grease Fittings (1) --- Bucket

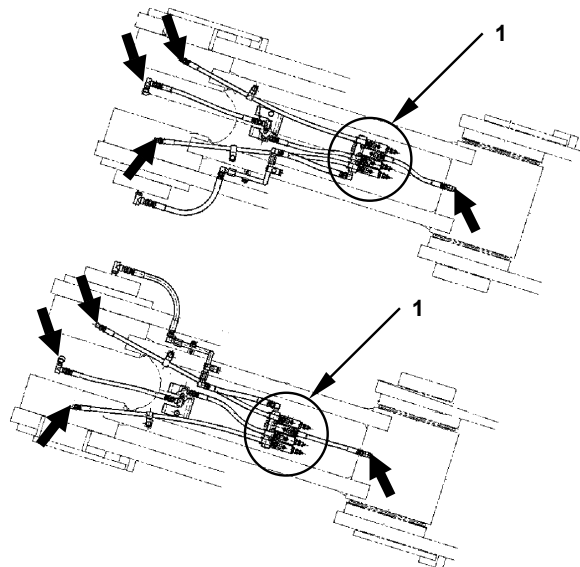
 : Lubrication points



M18M-07-030



M18M-07-032

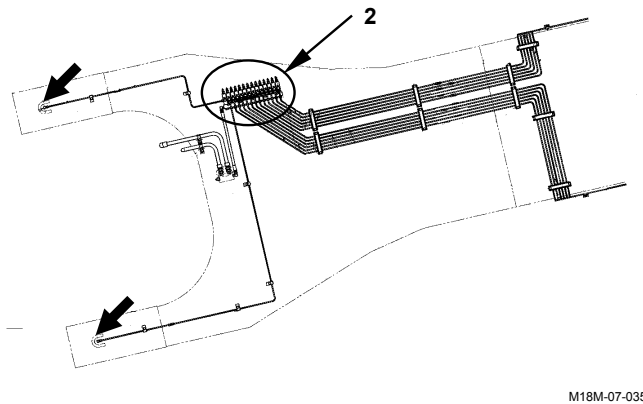
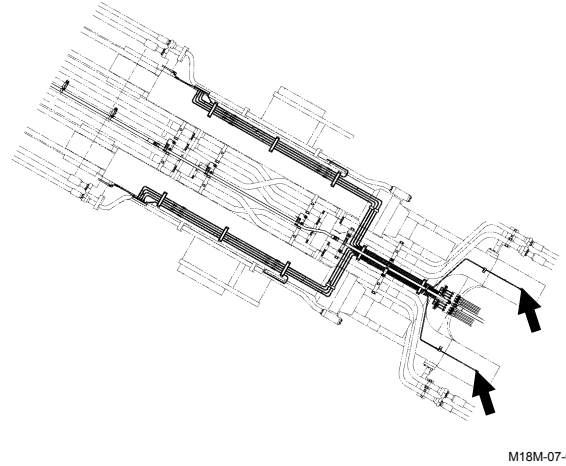
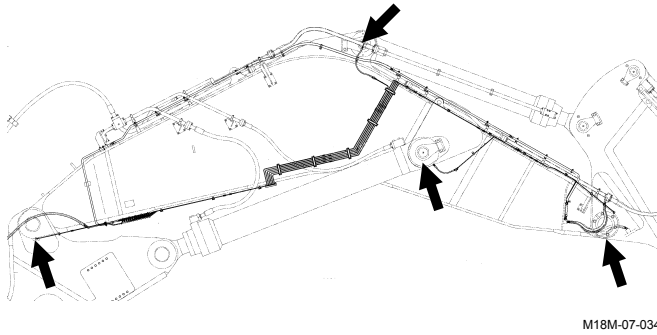


M18M-07-031

MAINTENANCE

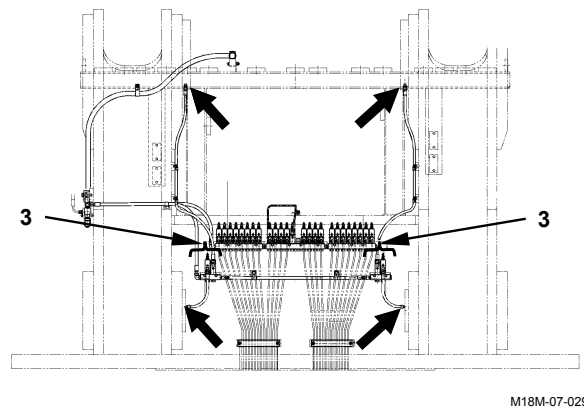
2. Grouped Grease Fittings (2) --- Boom

↖ : Lubrication points



3. Grouped Grease Fittings (3) --- Boom Foot

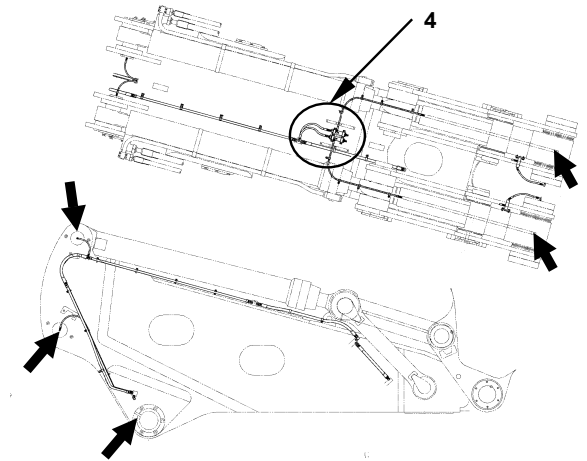
↖ : Lubrication points



MAINTENANCE

4. Grouped Grease Fittings (4) --- Arm

↖ : Lubrication points



M18M-07-036

MAINTENANCE

3

Swing Bearing --- every 250 hours (Grouped Grease Fittings --- Main Frame)

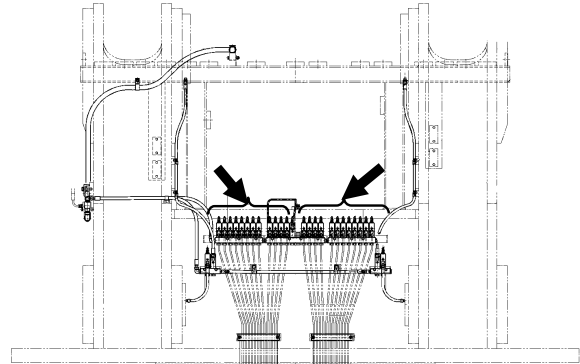
 **NOTE:** Auto-lubrication can be used for the fittings on the swing bearing.



WARNING: Lubricating both the swing bearing and gear and rotating the upperstructure must be done by one person. Before you lubricate the swing bearing, clear the area of all persons.

Each time you leave the cab

- Lower the bucket to the ground.
- Pull the pilot control shut-off lever to the LOCK position.
- Use handrails.



M18M-07-029

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Pull the pilot control shut-off lever to the LOCK position.
4. With the upperstructure stationary, apply grease to the twenty-four grease fittings.
5. Raise the bucket several inches off the ground and rotate the upperstructure 45° (1/8 turn).
6. Lower the bucket to the ground.
7. Repeat the procedure three times, beginning with step 3.
8. Apply grease to the swing bearing until grease can be seen escaping from the swing bearing seals.
9. Total amount of grease to be applied is approximately 10 to 12 strokes by grease lubricator.
10. Take care not to supply excessive grease.

MAINTENANCE

4

Swing Internal Gear --- every 2000 hours



WARNING: Adding or changing swing internal gear grease and rotating the upperstructure must be done by one person. Before you start, clear the area of all persons.

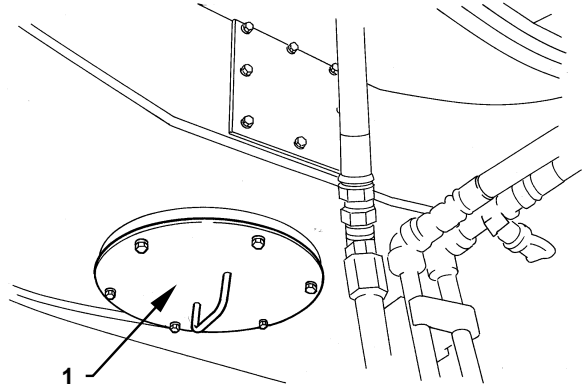
Each time you leave the cab

- Lower the bucket to the ground.
- Stop the engine.
- Pull the pilot control shut-off lever to the LOCK position.
- Use handrails.

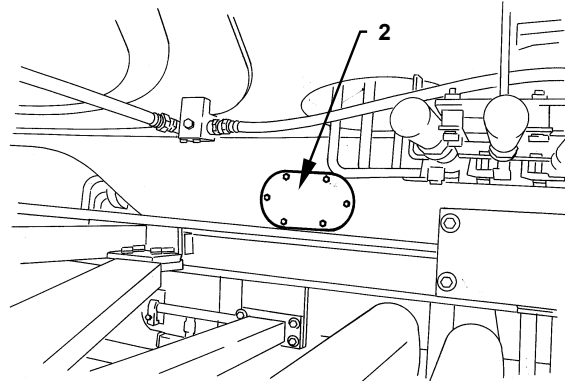
1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Press and hold the engine stop switch until stopping the engine completely. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.
7. Open cover (1) on the right side of the upper-structure.
8. Remove cover (1) on the underside of the swing gear housing and thoroughly remove old grease from the swing gear.
9. Remove cover (2) on the left side of the upperstructure. In order to add new grease evenly to the swing gear, swing the upperstructure twelve 30° intervals (one full turn) and add grease at each interval using a putty knife.
Total amount of grease applied should be approximately 350 liter (92.5 US gal).



M146-07-022



M146-07-023

MAINTENANCE

5

Center Joint --- every 500 hours (Grouped Grease Fittings --- Main Frame)

 **NOTE:** Auto-lubrication can be used for the fittings on the center joint.

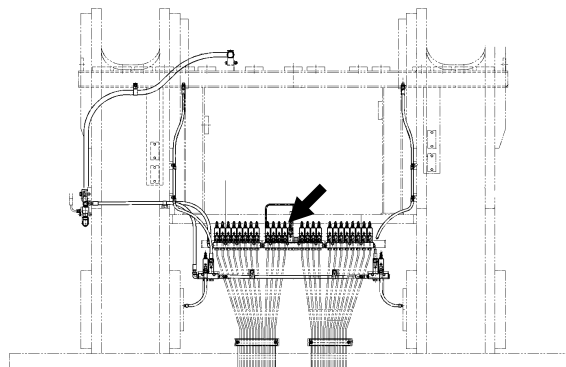


WARNING:

Each time you leave the cab

- **Lower the bucket to the ground.**
- **Pull the pilot control shut-off lever to the LOCK position.**
- **Use handrails.**

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Pull the pilot control shut-off lever to the LOCK position.
4. With the upperstructure stationary, apply grease to the one grease fitting.
5. Total amount of grease to be applied is approximately 5 to 6 strokes by grease lubricator.



M18M-07-029

MAINTENANCE

OPERATING THE LUBRICATOR

The machine is equipped with hose reel (4) and the lubricator, including the grease pump. This device is used for adding grease to the grouped fittings on the main frame and front attachment.

Greasing

IMPORTANT: Run the engine at medium or higher speed whenever the lubricator is used.

1. Connect hose (1) to coupler (2).
2. Move auto-lubrication toggle switch (3) located in oil cooler room to the MANUAL position.
3. Hold the high-pressure grease gun (4) attached to the hose end and pull out the hose from reel (5).
4. Stop pulling hose at any desired position; reel (5) clicks and automatically locks the hose.

IMPORTANT: Run the engine at slow speed whenever the lubricator is used.

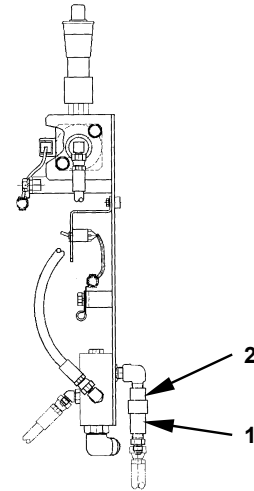
5. Insert the end of the grease gun in the desired fitting and pull gun lever; automatically adds grease to the fitting.

Storing Grease Hose After Finishing Greasing

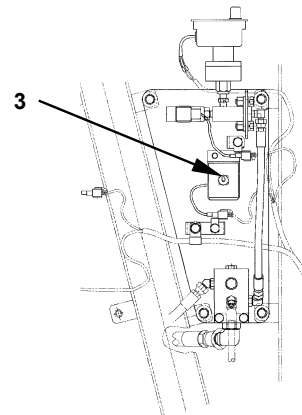
1. Slightly pull out the hose; reel (5) unlocks, automatically winds, and stores the hose.
2. Move auto-lubrication toggle switch (3) located in oil cooler room to the AUTO LUB position.

IMPORTANT: When the auto-lubrication system is provided, always be sure to turn auto-lubrication switch (3) to the AUTOMATIC GREASING position after completing manual greasing.

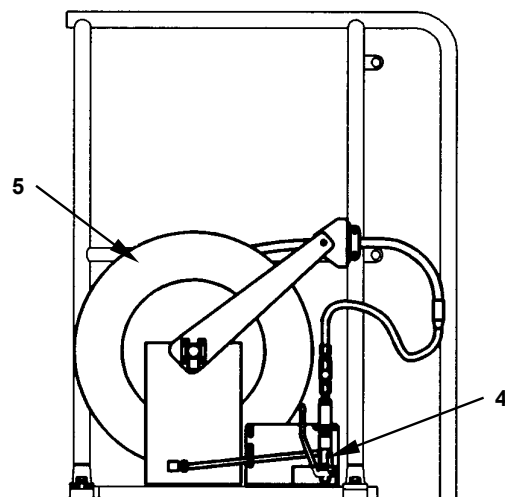
3. Disconnect hose (1) at coupler (2).
4. Pull gun lever to release residual pressure; a small amount of residual grease will escape from grease gun (4).



M18M-07-037



M18M-07-038



M146-07-105

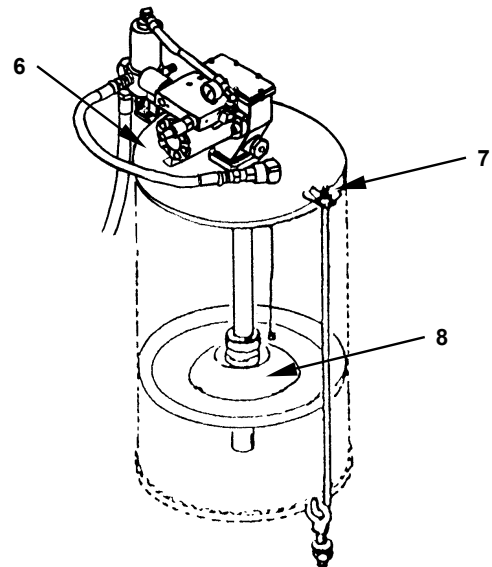
MAINTENANCE

Replacing Grease

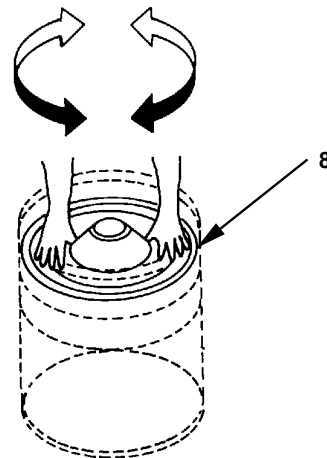
When the grease can is empty, replace it following the procedure shown below.

1. Remove wing nuts (7) to remove cover assembly (6) from the grease can. Remove cover assembly (6).
2. Remove follower plate (8) from the grease can. Replace the grease can with a new one.
3. Install follower plate (8) into the grease can.
4. Install cover assembly (6) on the lubricator housing while aligning grease tube with the hole on the follower plate, in order not to push down the plate into grease when installing the cover. Tighten wing nuts (7).

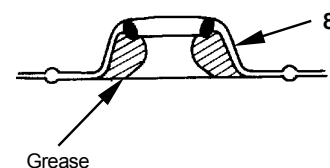
 **NOTE:** Greasing can be made from the ground through the fast-filling panel installed at the rear section of the machine. Refer to page 1-38 for fast-filling panel operation.



M146-07-107



M113-07-025



M113-07-026

MAINTENANCE

B. ENGINE

Parts			Classification of Oil	Quantity	Interval (hours)						
					10	50	250	500	1000	1500	2000
1. Engine Oil	Check Oil Level	Engine Oil Pan		1							
		Reserve Tank		1							
2. Check LED Monitor Signal (on Reserve Tank)				1							
3. Engine Oil	Change	Engine Oil Pan	Premium	260L (68.7 US gal)		*		★			
		Reserve Tank *		120L × (31.7 US gal)		★					
	Change	Engine Oil Pan	Standard	260L (68.7 US gal)		*		★			
		Reserve Tank *		258L × (68.2 US gal)		★					
4. Replace Engine Oil Filter				4		*					

 **NOTE:** * First time only

- ★ When change engine oil, change the oil in engine oil pan and reserve tank at the same time.
 - ※ Total quantity of oil (Engine Oil Pan and Reserve Tank) achieves 500 hours replacement interval. It differs according to the kind of engine oil used.
- The capacity of reserve tank is 280L (74 US gal).

 **NOTE:** * The machine has a reserve system.
Reserve system is the system that oil is circulated between engine oil pan and reserve tank by the pump on reserve tank.

Engine Oil Viscosity Requirements

Classification of Oil	API Service Class	Type	Viscosity Grade (SAE)	Temperature Ranges
Standard	CF-4	All Season Multigrade	15W-40	-18° to 50°C (0° to 122°F)
	CG-4	All Season Multigrade	15W-40	-18° to 50°C (0° to 122°F)
Premium	CH-4	All Season Multigrade	15W-40	-18° to 50°C (0° to 122°F)
	CI-4	All Season Multigrade	15W-40	-18° to 50°C (0° to 122°F)

-  **NOTE:**
- Oils with nominal ash content must be 1.0 to 1.5 percent mass. Oils with higher ash content, up to 1.85 percent ash, can be used in areas where the sulfur content of the fuel is normally 1 to 1.5 percent mass. Limiting ash content is critical to the prevention of valve and piston deposit formation.
 - The machine is shipped from the factory is filled with lubricants, Hitachi Super Wide DH-1 15W-40 (Class CF-4 (API Service Classification)).
 - Refer to the manual for Cummins Engine.
 - For further details, refer to Cummins B/No. 3810470-01 "Maintenance and Operation Practices for Maximum Engine Life".

MAINTENANCE

1 Engine Oil Level in Engine Oil Pan --- check daily

IMPORTANT: For most accurate readings, check the oil level every day before starting the machine. Be sure the machine is on a level surface.

1. Stop the engine.
2. Remove dipstick (1). Wipe oil off with a clean cloth. Reinsert dipstick (1).
3. Remove dipstick (1) again. Read oil level. Oil level must be the center of the marks static H and L on dipstick (1). The dipstick has "STATIC" and "RUNNING" reading on each side. Read the oil level on "STATIC" side.

IMPORTANT: Oil level in engine oil pan is constantly controlled to the center of static H and L by withdrawal pipe (2) for reserve system. If oil level is the center of static H and L, oil level does not need to be static H to add oil.

 **NOTE:** Checking the oil level immediately after shut down will result in inaccurate readings. Be sure to allow the oil to settle for at least 10 minutes before checking.

4. If the oil level is lower than static L, add oil to the center of the marks static H and L. Be sure to use only the oil to meet requirement and check the oil level in the reserve tank.

Engine Oil Level in Reserve Tank --- check daily

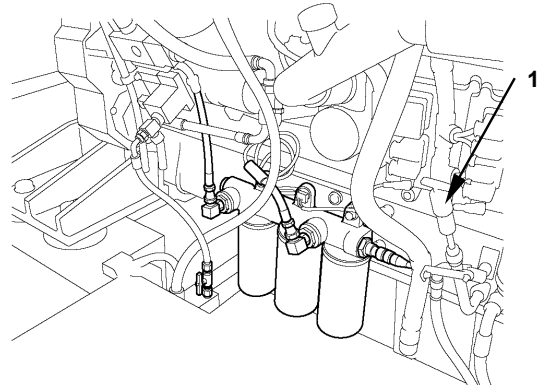
IMPORTANT: For most accurate readings, check the oil level every day before starting the machine. Be sure the machine is on a level surface.

1. Stop the engine.
2. Remove dipstick (3). Wipe oil off with a clean cloth. Reinsert dipstick (3).
3. Remove dipstick (3) again. Read oil level. Oil level must be above the line of premium or standard in accordance with the oil you use on dipstick (3).

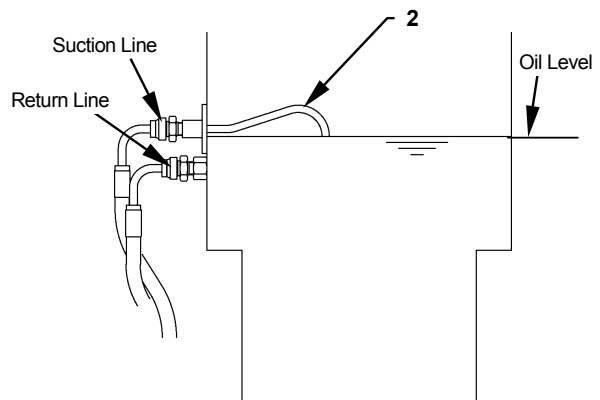
 **NOTE:** It is not necessary to add the oil until the oil level becomes lower than the line of premium or standard, once fill the oil up to the reserve tank. Judge by "premium" line when use premium oil, and judge by "STD" line when use standard oil.

4. If necessary, remove dipstick (3) and add oil. Be sure to use only the oil to meet the requirement.

 **NOTE:** Checking the oil level immediately after shut down will result in inaccurate readings. Be sure to allow the oil to settle for at least 10 minutes before checking.

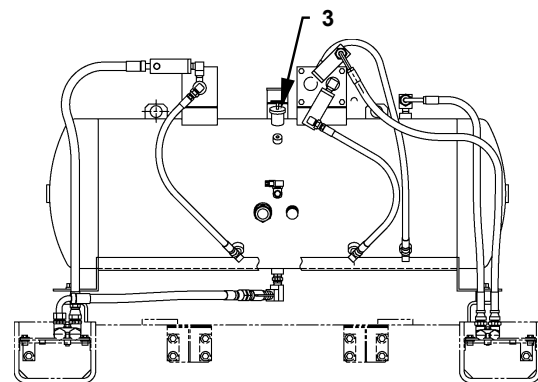


M18M-07-075



Engine Oil Pan

M18M-07-076



Reserve Tank

M18M-07-077

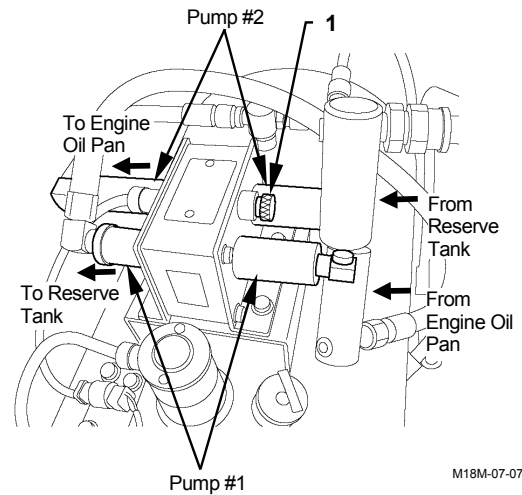


M18M-07-078

MAINTENANCE

2 Check LED Monitor Signal (on Reserve Tank) --- check daily

1. Start the engine.
2. Check LED monitor (1) to confirm if the pump normally works or not. LED monitor (1) signals the following states in response to operation of pump.
 - a. Steady: This signal indicates that the Pump #1 only is running and is transferred oil from the engine oil pan to the reserve tank.
 - b. Flashing: This signal indicates that the Pump #1 and #2 are running and oil is being transferred from the reserve tank to the engine oil pan.



M18M-07-079

IMPORTANT: The signal should alternate between periods of Steady and Flashing so that required engine oil level is being maintained on during operation.

 **NOTE:** If the LED monitor does not work, contact your authorized dealer.

MAINTENANCE

- 3** **Change Engine Oil in Engine Oil Pan**
--- every 500 hours
(first time after 50 hours)

- 4** **Replace Engine Oil Filters --- every 500 hours**
(first time after 50 hours)

1. Run the engine to warm oil. DO NOT run the engine until oil is hot.
2. Park the machine on a level surface.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

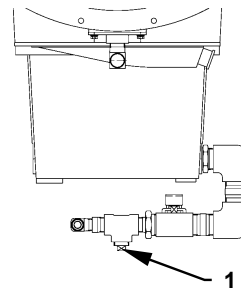
IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for 5 minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.

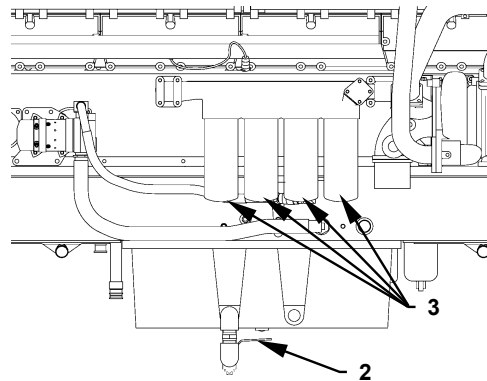


WARNING: Engine oil may be hot just after operation. Use care to be sure you are not burned from hot oil.

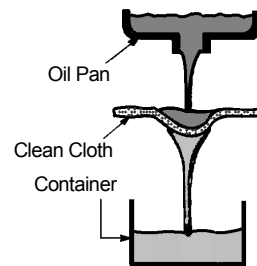
8. Prepare a container of 260 liter (68.7 US gal) or more capacity for the drain oil.
9. Remove drain plug (1) near the engine oil pan.
10. Open drain cock (2) to drain the engine oil.
11. Check if foreign material like metal particles are included in the drain oil by filtering it with a clean cloth.
12. Tighten drain plug (1) and close drain cock (2) securely.
13. Unscrew main filter cartridges (3), then discard them.
14. Fill the filters with lubricating oil to prevent crankshaft or bearing damage. Apply a light even coat of lubricating oil to the gasket sealing surface prior to installing the filters.
15. Position the filters to the filter head. Tighten by hand until the seal touches the filter head.
16. Tighten cartridges (3) one-half to three-fourths turn more using filter wrench.



M18M-07-080



M18M-07-081



M104-07-010

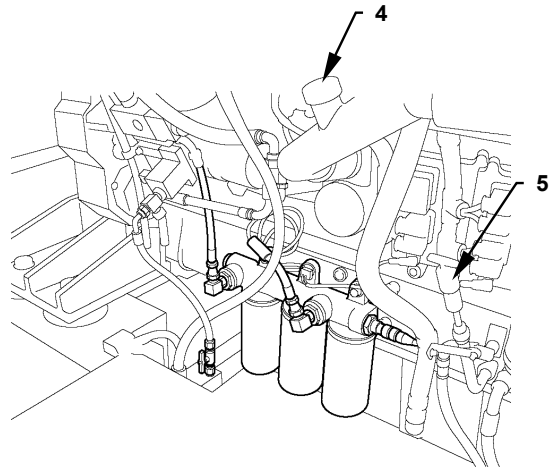
MAINTENANCE

17. Remove oil filler cap (4) and fill with 260 liter (68.7 US gal) oil.
18. Confirm oil level and adjust the oil level to be the center of the marks static H and L on dipstick (5). Start the engine and run at slow idle speed for 5 minutes. Stop the engine after confirming that engine oil pressure is rising. Ten to twenty minutes later, check oil level again and add oil if necessary.

IMPORTANT: After one shift, the oil level check must be done if oil level is the center of the marks static H and L.

 **NOTE:** Checking the oil level immediately after shut down will result in inaccurate readings. Be sure to allow the oil to settle for at least 10 minutes before checking.

 **NOTE:** Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M18M-07-075

Change Engine Oil in Reserve Tank --- every 500 hours (first time after 50 hours)

1. Run the engine to warm oil. DO NOT run the engine until oil is hot.
2. Park the machine on a level surface.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for 5 minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.



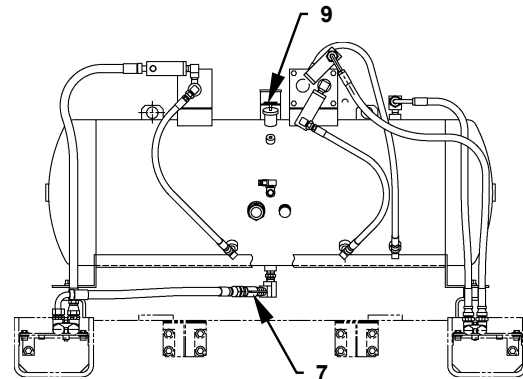
WARNING: Engine oil may be hot just after operation. Use care to be sure you are not burned from hot oil.

MAINTENANCE

8. Prepare a container of 280 liter (74 US gal) or more capacity for the drain oil.
9. Remove drain plug (6).
10. Open drain cock (7) and (8) to drain the engine oil.
11. Check if foreign material like metal particles are included in the drain oil by filtering it with a clean cloth.
12. Tighten drain plug (6) and close drain cock (7) and (8) securely.
13. Remove dipstick (9) and put the quantity of oil you need.
14. Confirm that oil level is above the line of premium or standard in accordance with the oil you use on dipstick (9).

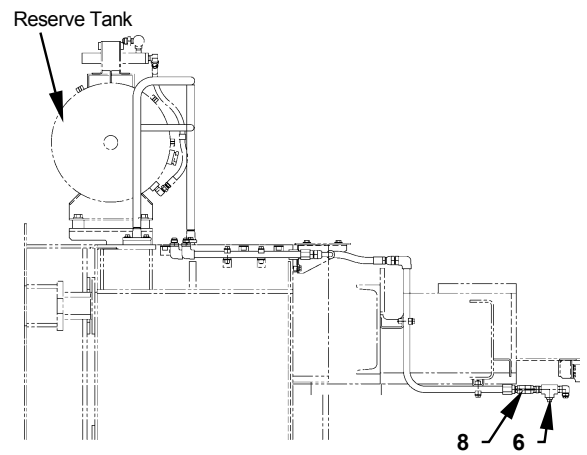
 **NOTE:** Checking the oil level immediately after shut down will result in inaccurate readings. Be sure to allow the oil to settle for at least 10 minutes before checking.

 **NOTE:** Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for Fast-Filling panel operation. If refilling the reserve tank up with oil, automatic fill system is available. See "How to operate automatic fill system" next page.

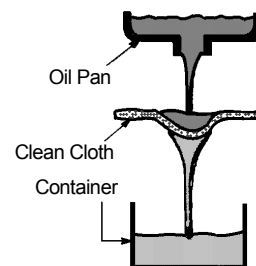


Reserve Tank

M18M-07-077



M18M-07-082

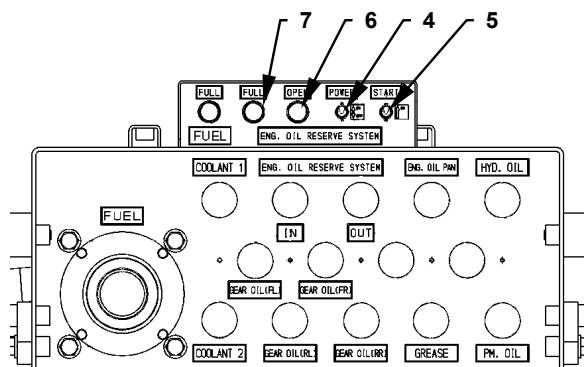


M104-07-010

MAINTENANCE

How to operate automatic fill system

1. Turn power switch (4) to ON position.
2. Turn start switch (5) to ON position.
3. The shut-off valve on the reserve tank opens. The shut-off valve open indicator (6) lights up.
4. Oil can begin filling the reserve tank through the shut-off valve.
5. When the oil in the reserve tank reaches the proper full level, the shut-off valve closes and full indicator (7) lights up.
6. Turn power switch (4) to the OFF position to turn the power off.



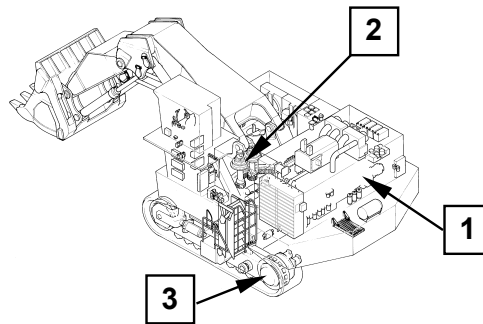
M18M-01-020

MAINTENANCE

C. TRANSMISSION

Parts			Quantity	Interval (hours)						
				10	50	250	500	1000	1500	2000
1. Pump Transmission Gear	Engine Oil	Check Oil Level	1	*						
		Change Oil	52 L (13.7 US gal)		*					
		Replace Filter	2							
		Clean Breather	1							
2. Swing Reduction Gear	Gear Oil	Check Oil Level	4	*						
		Change Oil	75 L (19.8 US gal)×4		*					
		Clean Breather	4							
3. Travel Reduction Gear	Gear Oil	Check Oil Level	2							
		Change Oil	220 L (58.1 US gal)×2				*			

 NOTE: * First time only.



M18M-03-007

Brand Names of Recommended Gear Oil

Kinds of Lubricants	Gear oil	
	Swing and Travel Reduction Gear	
Where to be applied	-20 to 50°C (-4 to 122°F)	
Manufacturer		
British Petroleum	BP Gear oil	SAE90EP
Caltex Oil	Universal Thuban	SAE90
Esso	Esso Gear Oil	GP80W-90 or GP85W-90
Idemitsu Kosan	Apolloil Gear	HE90
Mobil Oil	Mobilube	GX90
Nippon Oil	Gear Lube	SP90
Shell Oil	Shell Spirax	EP90
Remarks	API GL 4 Class	

 NOTE: The machine is filled with oil marked by  when shipped from the factory.

Recommended brands of Class CD oils (API Service Classification) are shown in the chart below.

If any oil other than these recommended oils is used, the oil must be Class CD or CF (API Service Classification) and meet the MILL2104C specifications (US military specifications).

Recommended Brands of Engine Oil (Reference)

Manufacturer	Brands
Nippon Oil Co., Ltd.	Diamond HDS-3 Engine Oil
	Hi-Diesel S-3
Idemitsu Kosan	Apolloil Diesel Motive S-330
Japan Energy	JOMO Delstar DX
Cosmo Oil	Cosmo Diesel CD
Showa Shell Sekiyu	White Pallot Super S-3 Oil
Mobil Sekiyu	Mobil Delvac 1300
Esso Sekiyu	Exxon D-3
General Sekiyu	General Gemico Super S-3

 NOTE: The machine shipped from the factory is filled with Apolloil Diesel Motive S-330.

MAINTENANCE

PUMP TRANSMISSION GEAR

Recommended Brands of Engine Oil



CAUTION: Avoid mixing oils of different brands. In most cases, different brands are not compatible with each other and, when mixed, can seize parts, or abnormally wear moving parts. It is best to stick with one and the same brand of oil at successive service intervals.

Recommended Oil Viscosities

Recommended Oil Viscosities																	
Air temperature °C	[-22]	[-13]	[-4]	[5]	[14]	[23]	[32]	[41]	[50]	[59]	[68]	[77]	[86]	[95]	[104]	[113]	[122]
[°F]	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50
Oil viscosities	(※) SAE15W-40 SAE15W-40 SAE30 SAE40																

NOTE: At air temperature of -10°C or less (※), SAE15W-40 with heating device is available. Contact your authorized dealer about heating device.

1

Pump Transmission Oil Level

--- Check every 50 hours
(first time after 10 hours)

IMPORTANT: For most accurate readings, be sure the machine is on a level surface.

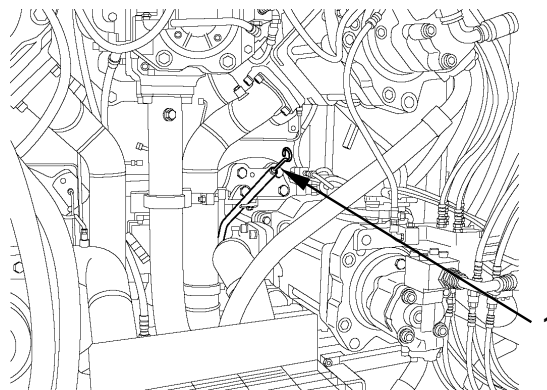
1. Stop the engines.

NOTE: Refer to page 3-13 for stopping the engines properly.

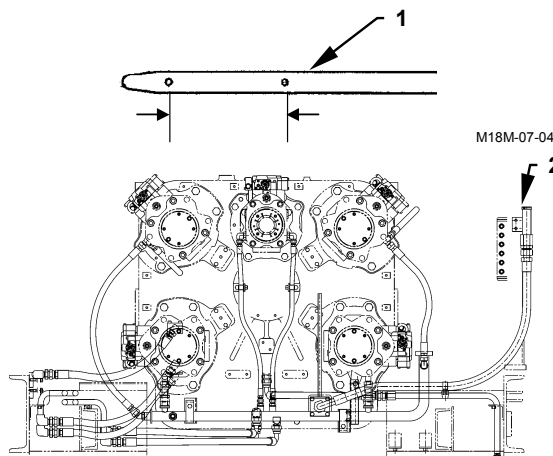
2. Remove dipstick (1). Wipe oil off with a clean cloth. Reinsert dipstick (1).
3. Remove dipstick (1) again. Read level. Oil level must be between the circle marks on dipstick (1).
4. If necessary, remove cap (2) and add oil. Be sure to use only recommended oil (see Recommended Engine Oil Chart).
5. Recheck oil level.

NOTE: Always allow oil to settle before checking the level. This may require 15 minutes.

NOTE: Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M18M-07-039



M18M-07-040

M18M-07-065

MAINTENANCE

2 Change Oil --- every 500 hours (first time after 50 hours)

1. Run the engines until oil is warm to drain completely.
DO NOT run the engines until oil is hot.
2. Park the machine on a level surface.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for five minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position

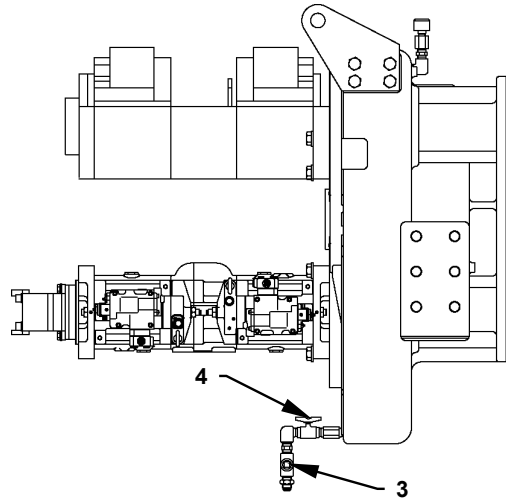


WARNING: Oil may be hot just after operation. Be sure to wait for oil to cool before starting work.

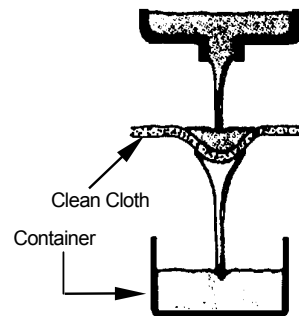
8. Prepare a container of 55 liter (14.5 US gal) or more capacity for the drain oil.
9. Remove drain plug (3) on the pump transmission housing, and loosen cock (4) to drain the oil.
10. Check if foreign material like metal particles are included in the drain oil by filtering it with a clean cloth.
11. Tighten drain plug (3) and cock (4) securely. Fill the pump transmission housing with 52 liter (13.7 US gal) oil.
12. Confirm that the oil level is between the circle marks on dipstick (1). Refer to the previous page.



NOTE: Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M18M-07-041



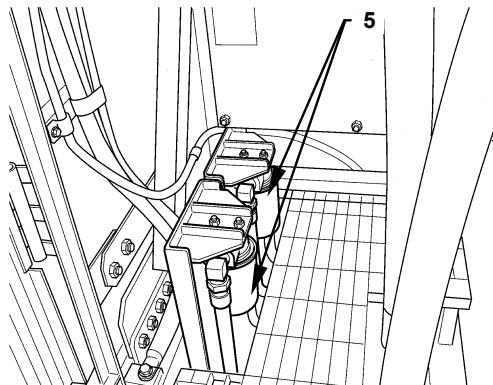
M107-07-095

MAINTENANCE

3 Replace Filter --- every 500 hours

1. Unscrew cartridge filter (5) from the filter head, discard the cartridge filter.
2. Fill the filter with oil. Apply a light even coat of lubricating oil to the gasket sealing surface prior to installing the cartridge filter.
3. Position cartridge filter (5) to the filter head. Tighten by hand until the seal touches the filter head, tighten an additional three-fourths turn.

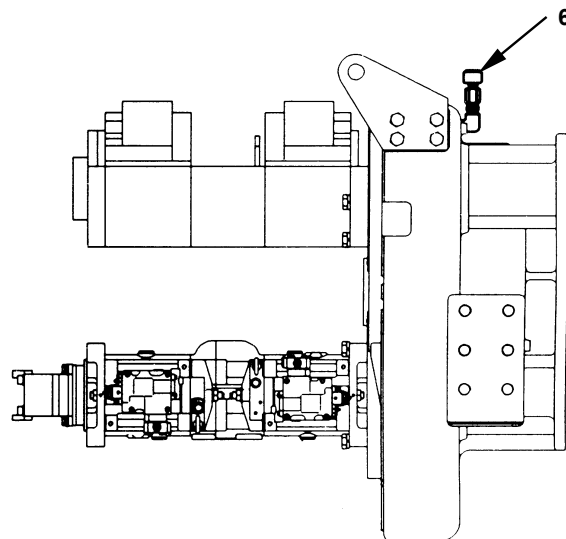
Be careful not to over tighten.



M146-07-068

4 Clean Breather --- every 500 hours

Remove breather cap (6) and clean the element.



M18M-07-042

MAINTENANCE

SWING REDUCTION GEAR

1 Check Oil Level --- every 50 hours (first time after 10 hours)

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.



WARNING: Gear oil may be hot just after operation. Be sure to wait for gear oil to cool before starting work.

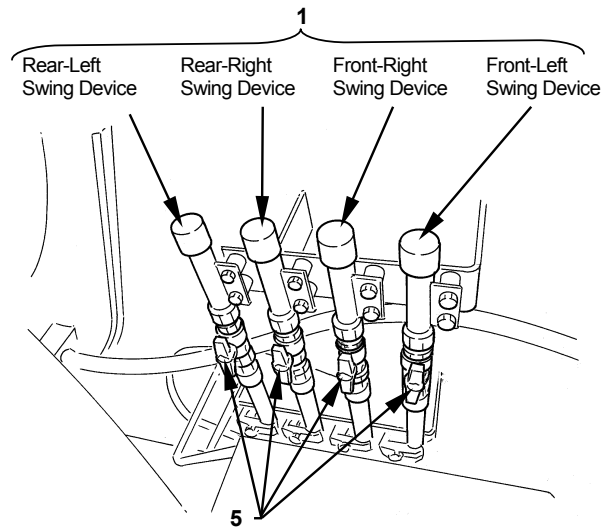
7. Open cocks (5).
8. Remove dipstick (1). Wipe oil off with a clean cloth. Reinsert dipstick (1).
9. Remove dipstick (1) again. Read level. Oil level must be between the top and notch on dipstick (1).
10. If necessary, remove oil supply plugs and add oil. Be sure to use only recommended oil. (See recommended Gear Oil Chart) Refer to next page to know how to add oil.
11. Recheck oil level.
12. Install dipsticks (1).
13. Close cocks (5) after checking.



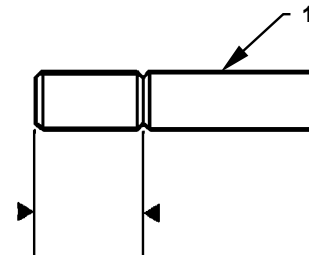
NOTE: Always allow oil to settle before checking the level. This may require 15 minutes.



NOTE: Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M146-07-027



M114-07-181

MAINTENANCE

2 Change Gear Oil --- every 1000 hours (first time after 50 hours)

1. Swing the machine until oil is warm to drain completely. DO NOT swing the machine until oil is hot.
2. Park the machine on a level surface.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

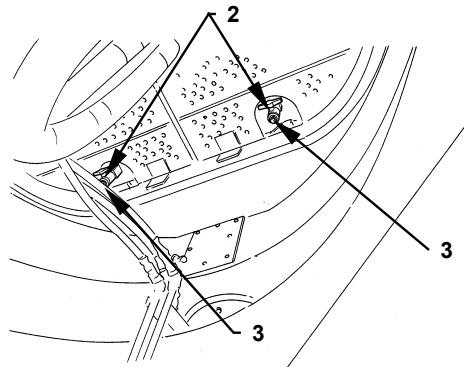
IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for five minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.

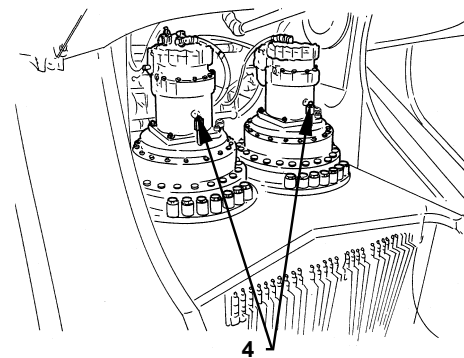


WARNING: Gear oil may be hot just after operation. Be sure to wait for gear oil to cool before starting work.

8. Prepare a container of 75 L (20 US gal) or more capacity for the drain oil.
9. Remove drain plug (3) and loosen drain cock (2) to drain oil.
10. Check if foreign material like metal particles are included in the drain oil by filtering it with a clean cloth
11. Tighten drain cock (2) and drain plug (3).
12. Remove oil supply plug (4) and fill with 75 L (20 US gal) oil. Be sure to use only recommended oil (see Recommended Gear Oil Chart).
13. Confirm that the oil level is between the top and notch on dipstick (1). Start the engine and swing the machine at slow speed for about 5 minutes. Stop the engine.
Ten to twenty minutes later, check oil level again and add oil if necessary.

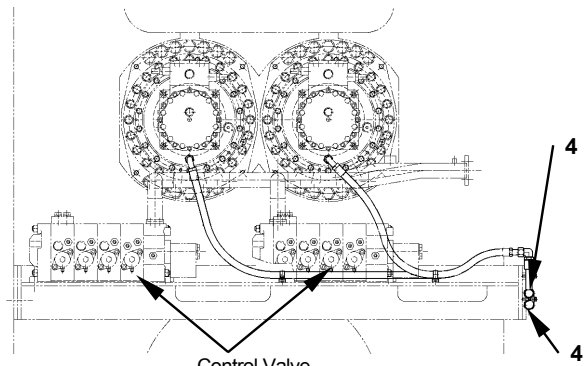


M146-07-029



Front Side

M146-07-030



Control Valve
Rear Side

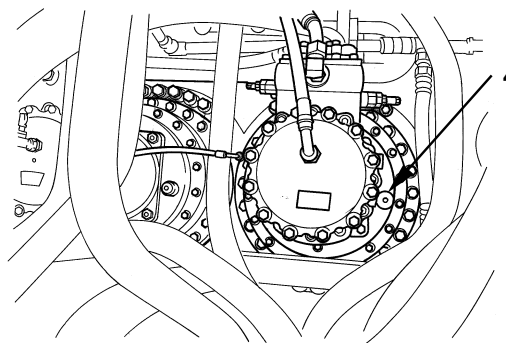
M18M-07-043

3 Clean Breather --- every 1000 hours

1. Remove plug (4) cap and clean the element.



NOTE: Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M146-07-028

MAINTENANCE

TRAVEL REDUCTION GEAR

1 Check Oil Level --- every 250 hours

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

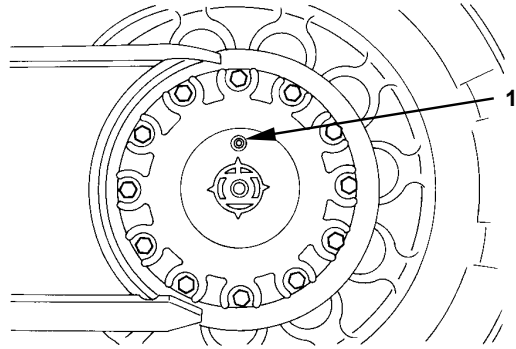
IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.

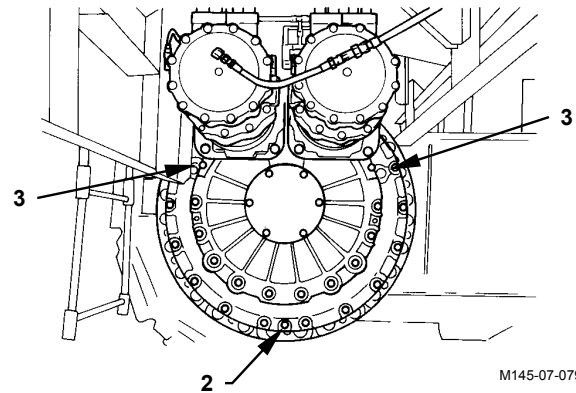


WARNING: Keep body and face away from oil level check plug (air release plug) (1). Gear oil may be hot just after operation. Be sure to wait for gear oil to cool and then gradually loosen oil level check plug (air release plug) (1) to release pressure.

7. After gear oil has cooled, slowly loosen oil level check plug (air release plug) (1) to release pressure.
8. Remove oil level check plug (1). Oil must be up to the bottom of hole.
9. If necessary, after oil supply plugs (3) have been removed, add oil until oil flows out of the oil level check plug hole. Be sure to use only recommended oil. (See Recommended Gear Oil Chart)
10. Wrap oil level check plug (1) threads with sealing-type tape. Install oil level check plug (1). Tighten the plug to 69 N·m (7 kgf·m, 51 lbf·ft).
11. Wrap oil supply plug (3) threads with sealing-type tape. Install oil supply plug (3). Tighten oil supply plug (3) to 196 N·m (20 kgf·m, 145 lbf·ft).
12. Check the gear oil level in the other travel reduction gear.



M145-07-048



M145-07-079

MAINTENANCE

2 Change Gear Oil --- every 2000 hours (first time after 500 hours)

1. Drive the machine until oil is warm to drain completely.
DO NOT drive the machine until oil is hot.
2. Park the machine on a level surface.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for five minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.

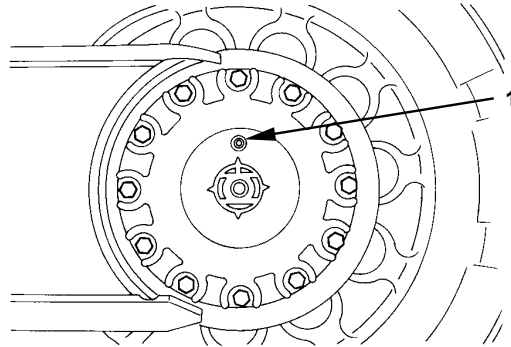


WARNING: Keep body and face away from oil level check plug (air release plug) (1). Gear oil may be hot just after operation. Be sure to wait for gear oil to cool and then gradually loosen oil level check plug (air release plug) (1) to release pressure.

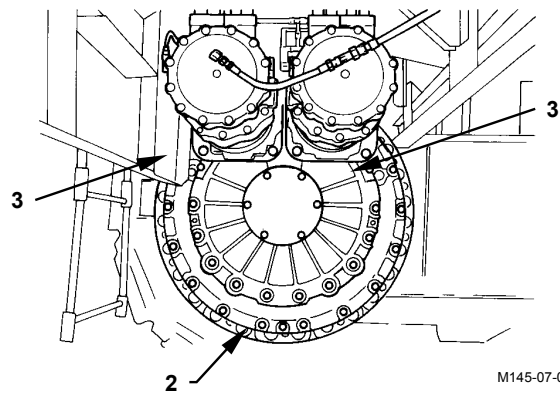
8. After gear oil has cooled, slowly loosen oil level check plug (air release plug) (1) to release pressure.
9. Prepare a container of 220 L (58 US gal) or more capacity for the drain oil.
10. Remove drain plugs (2) to drain oil.
11. Check if foreign materials like metal particles are included in the drain oil by filtering it with a clean cloth.
12. Wrap the threads of drain plug (2) with sealing-type tape. Install drain plug (2).
Tighten the plug to 69 N·m (7 kgf·m, 51 lbf·ft).
13. Remove oil level check plug (1).
14. After oil supply plug (3) has removed, add oil until oil flows out of the oil level check plug hole. Be sure to use only recommended oil. (See Recommended Gear Oil Chart.)
15. Wrap the threads of oil level check plug (1) with sealing-type tape. Reinstall oil level check plug (1) and tighten it to 69 N·m (7 kgf·m, 51 lbf·ft).
16. Wrap the threads of oil supply plug (3) with sealing-type tape. Reinstall oil supply plug (3) and tighten it to 196 N·m (20 kgf·m, 145 lbf·ft).
17. Repeat steps 7 to 13 for the other travel reduction gear.
18. Start the engine and drive the machine at slow speed for about 5 minutes. Stop the engine.
Ten to twenty minutes later, check oil level again and add oil if necessary.



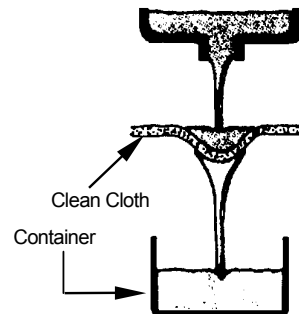
NOTE: Always allow oil to settle before checking the level. This may require 15 minutes.



M145-07-048



M145-07-079



M107-07-095

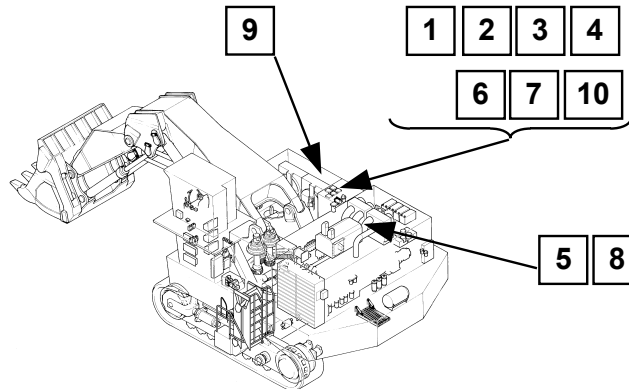
MAINTENANCE

D. HYDRAULIC SYSTEM

Parts	Quantity	Interval (hours)							
		10	50	250	500	2000	2500	4000	12000
1. Check Hydraulic Oil Level	1	*							
2. Drain Hydraulic Oil Tank Sump	1								
3. Change Hydraulic Oil	4000 L (1060 US gal)					★	★	★	
4. Replace Full-Flow Filter and Drain Filter	6		*						
5. Replace Bypass Filter	1		*						
6. Replace Pilot Oil Filter	1		*						
7. Suction Filter	Clean Filter	When changing hydraulic oil							
	Replace Filter								
8. Replace High-Pressure Strainer	8								
9. Clean Oil Cooler Core	4								
10. Check Hoses and Lines (for leak, loose)									
	Check Hoses and Lines (for crack, bend, etc.)								

 **NOTE:** ★ Hydraulic oil changing interval differs according to the kind of hydraulic oil used. See recommended oil chart.

* First time only.



M18M-03-007

Brand Names of Recommended Hydraulic Oil

Kind of Lubricant	Hydraulic Oil					
Where to be applied	Hydraulic System					
Change Interval	4000 hours		2500 hours		2000 hours	
Environmental Temp.	−20 to 50°C (−4 to 122°F)	−10 to 50°C (14 to 122°F)	−20 to 50°C (−4 to 122°F)	−10 to 50°C (14 to 122°F)	−20 to 50°C (−4 to 122°F)	−10 to 50°C (14 to 122°F)
Manufacturer	Super EX 46HN					
Hitachi			Super Hydro 46 WRHU			
Idemitsu Kosan						
British Petroleum					Bartran HV46	
Caltex Oil						Rando Oil HD46
Texaco INC.						Rando Oil HD46
Chevron U.S.A INC.						Chevron AW46
Esso						NUTO H46
Mobil Oil						DTE 25
Remarks	Anti-wear type hydraulic oil					

 **NOTE:** Use proper hydraulic oil in accordance with the atmospheric temperature.
The machine shipped from the factory is filled with oil marked .

MAINTENANCE

INSPECTION AND MAINTENANCE OF HYDRAULIC EQUIPMENT



CAUTION: During operation the parts of the hydraulic system become very hot. Allow the machine to cool down before beginning inspection or maintenance.

1. Be sure that the machine is parked on a level, firm surface before servicing hydraulic equipment.
2. Lower the bucket to the ground and stop the engine.
3. Begin servicing hydraulic components only after components, hydraulic oil and lubricants are completely cooled, and after releasing residual pressure.
 - 3.1 Bleed air from the hydraulic oil tank to release internal pressure.
 - 3.2 Allow the machine to cool down.

Note that servicing heated and pressurized hydraulic components may cause hot parts and/or oil to fly off or escape suddenly, possibly resulting in personal injury.
 - 3.3 Keep body parts and face away from plugs or screws when removing them.

Hydraulic components may be pressurized even when cooled.
 - 3.4 Never attempt to service or inspect the travel and swing motor circuits on slopes. They are highly pressurized due to self-weight.

MAINTENANCE

4. When connecting hydraulic hoses and pipes, take special care to keep seal surfaces free from dirt and to avoid damaging them. Keep these precautions in mind:

- 4.1 Wash hoses, pipes, and the tank interior with a washing liquid and thoroughly wipe it out before re-connecting them.
- 4.2 Only use O-rings that are free of damage or defects. Be careful not to damage them during reassembly.
- 4.3 Do not allow high pressure hoses to twist when connecting them. The life of twisted hoses will be shortened considerably.
- 4.4 Carefully tighten low pressure hose clamps to following torque specifications. Do not overtighten.
 T Bolt Clamp: 4.4 N·m (0.45 kgf·m, 3.3 lbf·ft)
 Jubilee Clamp: 5.9 to 6.9 N·m
 (0.6 to 0.7 kgf·m, 4.3 to 5.1 lbf·ft)

- 4.5 When connecting screw type joints, apply seal tape to the threads of male screw. Be sure to leave a couple of threads at the male screw top unwrapped, as shown. Do not overwrap. Apply seal tape around threads as shown, so that the tape does not loosen when the female screw is tightened.

- 4.6 Carefully tighten nut for bandy pipe to following torque specifications on the right side. Do not overtighten.

5. When adding hydraulic oil, always use the same brand of oil; do not mix brands of oil. As the machine is filled with Super EX 46HN when it is shipped from the factory, use it as a general rule. When selecting to use another brand of oil listed in the table "Brand names of recommended hydraulic oil", be sure to completely replace the oil in the system.

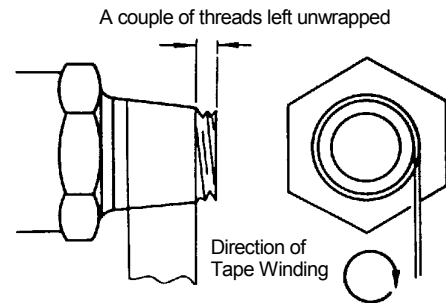
6. Do not use hydraulic oils other than those listed in the table "Brand names of recommended hydraulic oil".

7. Only 50 to 60% of the total hydraulic circuit oil on a large size excavator can be replaced at a time. Accordingly, conduct minimum flushing twice.

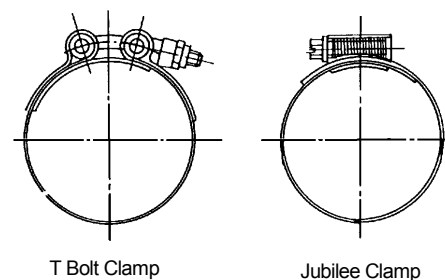
8. In case the machine is used for dredging operations, replace the hydraulic oil at a 2000 hour interval regardless of the oil brand used.

9. If any other hydraulic oil (having a different replacement interval) is unavoidably used, replace the oil in accordance with the individual replacement interval standard.

10. Never run the engine without oil in the hydraulic oil tank.



M114-07-041

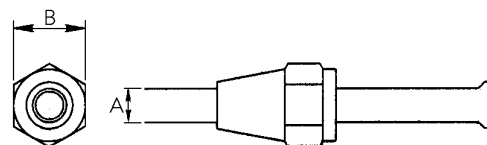


M114-07-042

M114-07-043

Bandy Pipe

Pipe Dia. (A)		Φ8	Φ10
Width Across Flat (B) (mm)		17	19
Fastening Torque	N·m	34	49
	(kgf·m)	(3.5)	(5)
	(lbf·ft)	(25.5)	(36)



M117-07-149

MAINTENANCE

1 Check Hydraulic Oil Level --- daily

IMPORTANT: Never run the engine without oil in hydraulic oil tank.

1. Park the machine on a level surface.
2. Position the machine with the front attachment positioned as illustrated on the right.
3. Lower the bucket to the ground.
4. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for five minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.
8. Check oil level gauge (1) on hydraulic oil tank. Oil must be between marks on the gauge (1). If necessary, add oil.



WARNING: Keep body and face away from cap (3). Turn cap (3) slowly and remove the cap only after releasing the internal pressure completely.

To add oil:

9. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
10. Turn cap (2) counterclockwise about 30°, at which point stop cap (2) to release the air.
11. Turn cap (2) further and remove cap (2).
12. Align the projected part of cap (2) with the projected part of the case and install cap (2).
13. Add oil. Recheck oil level gauge (1).
14. Install cap (2).



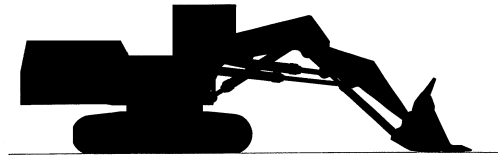
NOTE: Always allow oil to settle before checking the level. This may require 15 minutes.



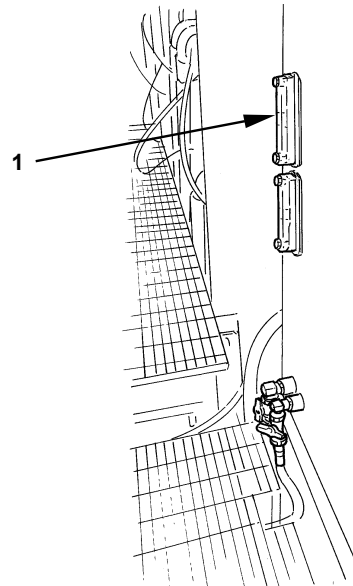
NOTE: Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



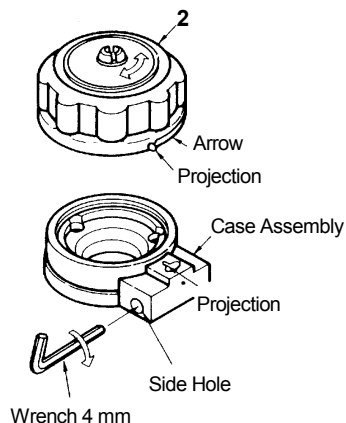
M142-07-093



M117-07-127



M146-07-034



M110-07-022

MAINTENANCE

2 Drain Hydraulic Oil Tank Sump --- every 250 hours

IMPORTANT: Never run the engine without oil in hydraulic oil tank.

1. Park the machine on a level surface with the upper-structure rotated 90° for easier access.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.



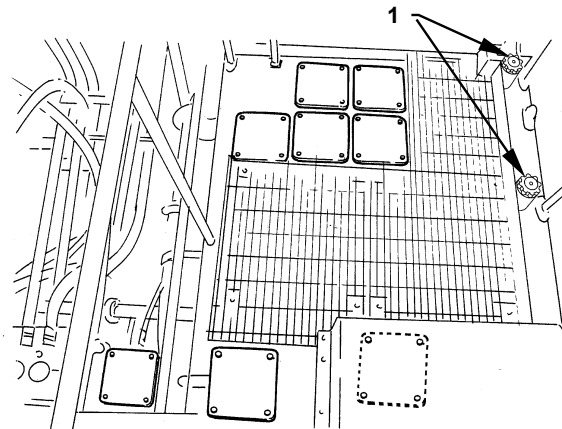
WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

7. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
8. Turn cap (1) counterclockwise about 30°, at which point stop cap (1) to release the air.
9. Turn cap (1) further and remove cap (1).
10. Align the projected part of cap (1) with the projected part of the case and install cap (1).

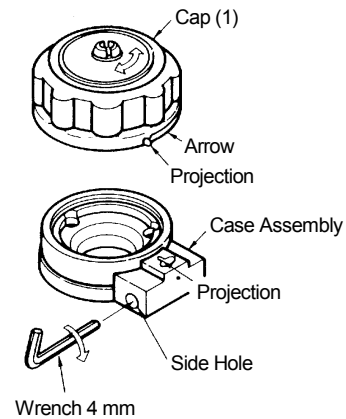


WARNING: Do not loosen the drain cock until oil is cool. Hydraulic oil may be hot just after operation, potentially causing serious injury.

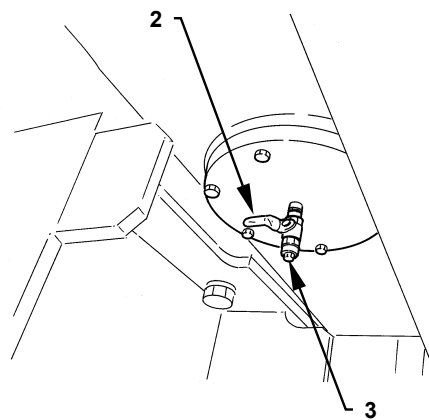
11. After oil is cool, remove drain plug (3) and open drain cock (2) to drain water and sediment.
12. After draining water and sediment, tighten drain cock (2) securely and install drain plug (3).



M146-07-031



M110-07-022



M146-07-032

MAINTENANCE

3

Change Hydraulic Oil

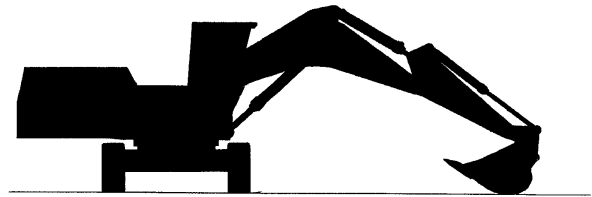
--- every 4000 hours, 2500 hours or 2000 hours

IMPORTANT: Hydraulic oil changing intervals differ according to kind of hydraulic oils used. (See Recommended Oil Chart in this group)

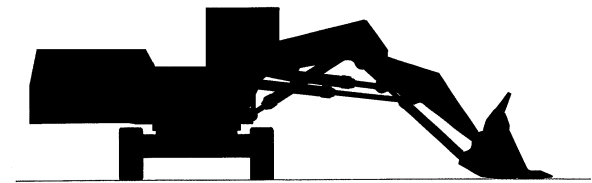


WARNING: Hydraulic oil may be hot just after operation. Be sure to wait for oil to cool before starting work.

1. Park the machine on a level surface with the upper-structure rotated 90° for easier access.
2. Position the machine with the arm cylinder fully retracted and the bucket cylinder fully extended.
3. Lower the bucket to the ground as illustrated.
4. Turn the auto-idle switch off.



M142-07-092



M117-07-126

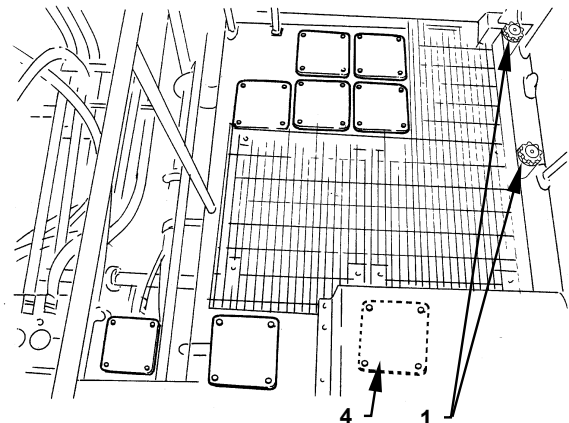
IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle speed without load for five minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.
8. Clean the top of the hydraulic oil tank to keep dirt out of the hydraulic system.

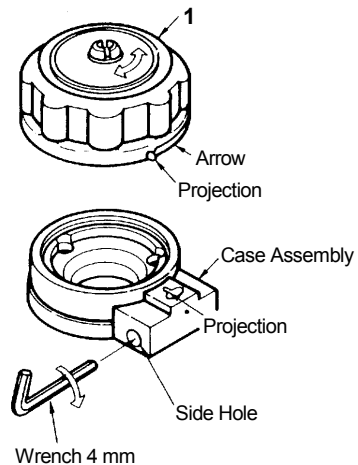


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

9. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
10. Turn cap (1) counterclockwise about 30°, at which point stop cap (1) to release the air.
11. Turn cap (1) further and remove cap (1).
12. Align the projected part of cap (1) with the projected part of the case and install cap (1).
13. Remove cover (4).
14. Drain oil using a suction pump.
The hydraulic oil tank capacity, up to specified oil level, is approximately 2950 liter (780 US gal).



M146-07-031



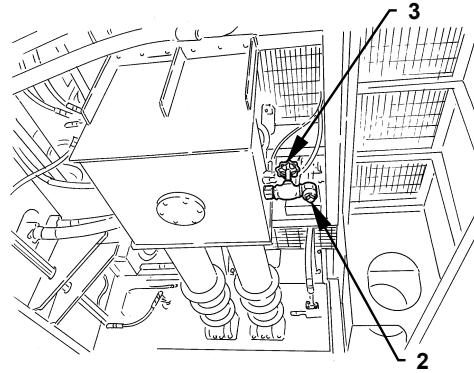
M110-07-022

MAINTENANCE

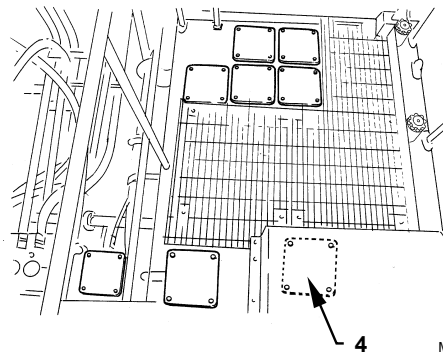
15. Remove drain plug (2) on the suction manifold and loosen drain valve (3). Allow oil to drain.
 16. Remove drain plug (9) under oil tank and loosen drain cock (8) to drain water and sediment completely.
 17. Install drain cock (8).
 18. Tighten drain valve (3).
 19. Clean, install and tighten drain plug (2).
 20. Add oil via cover (4) hole until it is between the marks on sight gauge (5) of hydraulic oil tank. Be sure to use only recommended oil (see Recommended Hydraulic Oil Chart).
 21. Reinstall cover (4) with bolts (4 used). At this time, be sure to replace the O-ring with new one and check that it is correctly installed.
 22. Bleed any air remaining in the hydraulic system
-  **NOTE:** Refer to page 7-58 for bleeding air properly.
23. Confirm that the oil level is at the mark on gauge (5). Start the engine and operate all cylinders and motors at slow speed for about 15 minutes. Stop the engine after bleeding air from the hydraulic circuit sufficiently. Ten to twenty minutes later, check oil level again and add oil if necessary.

 **NOTE:** Always allow oil to settle before checking the level. This may require 15 minutes.

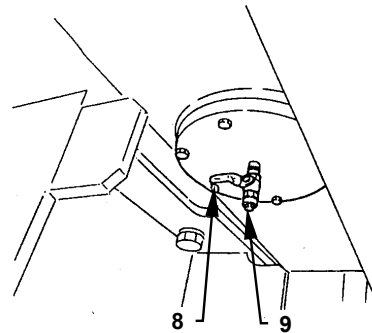
 **NOTE:** Oil can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



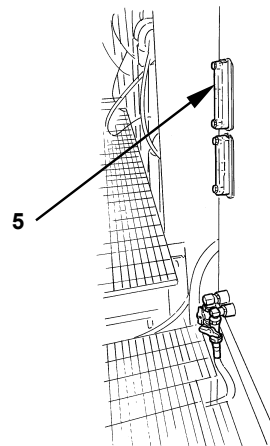
M146-03-033



M146-07-031



M146-03-034



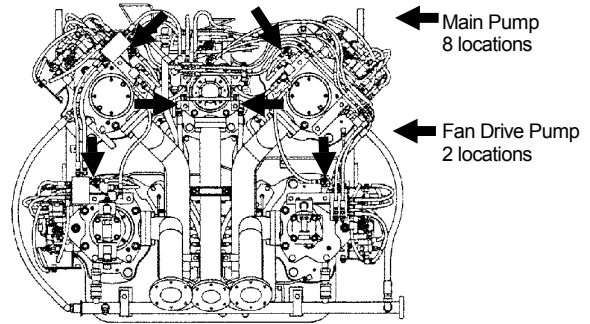
M146-07-034

MAINTENANCE

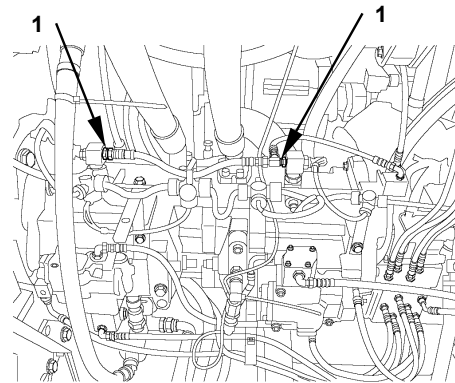
Bleeding Air from Hydraulic Pump

IMPORTANT: If the hydraulic pump is not filled with oil, it will be damaged when the engine is started.

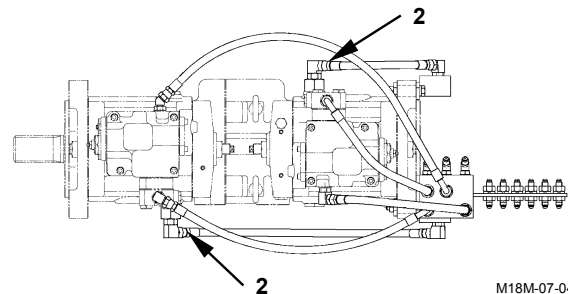
1. Loosen hose connectors (1) of the 8 main pumps to release trapped air. Retighten pipe connectors (1) when air stops and oil flows from connector (1).
2. Loosen hose connectors (2) on the drain line of the 2 fan drive pumps to release trapped air. Retighten pipe connectors (2) when air stops and oil flows from pipe connectors (2).
3. Start the engine and run at slow idle.
4. Purge air from the hydraulic system by running the engine at slow idle and operating the control levers slowly and smoothly for 15 minutes.
5. Position the machine as illustrated in the oil level checking procedure.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.
8. Check the hydraulic oil tank gauge. Add oil if necessary.



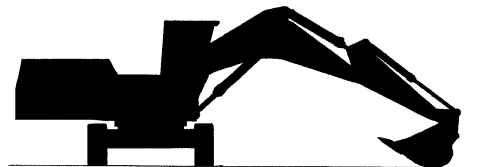
M18G-07-115



M18M-07-044



M18M-07-045



M142-07-092



M117-07-126

MAINTENANCE

4

Replace Full-Flow Filter and Drain Filter --- every 500 hours (first time after 50 hours)

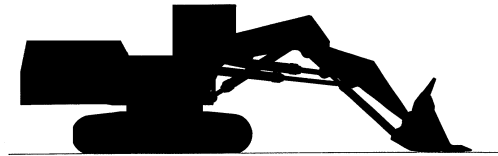
1. Park the machine on a level surface.
2. Lower the bucket to the ground as illustrated.
3. Turn the auto-idle switch off.



M142-07-093

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.



M117-07-127

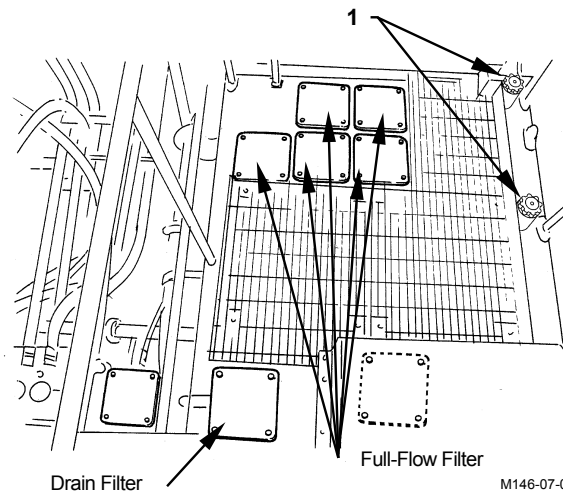


WARNING: Hydraulic oil and components may be hot just after operation. Be sure to allow oil and components to cool before starting work.

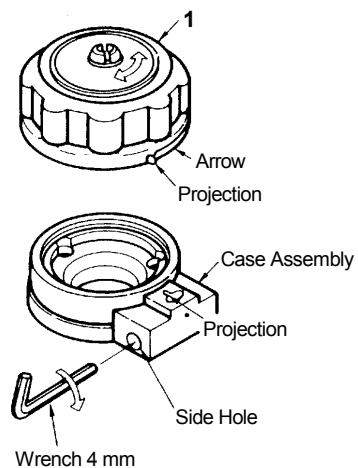


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

7. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
8. Turn cap (1) counterclockwise about 30°, at which point stop cap (1) to release the air.
9. Turn cap (1) further and remove cap (1).
10. Align the projected part of cap (1) with the projected part of the case and install cap (1).



M146-07-031



M110-07-022

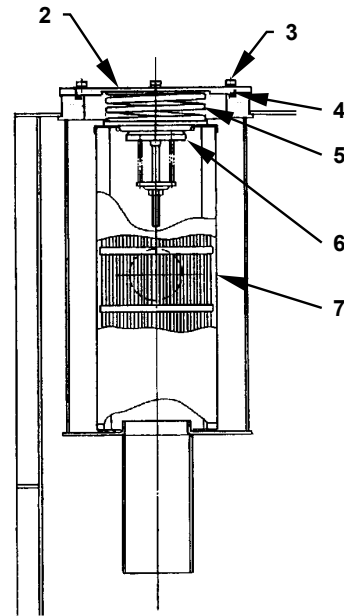
MAINTENANCE

 **NOTE:** *There is spring tension under the cover. Hold down the cover when removing last two bolts.*

11. Hold down filter cover (2) against light spring load when removing the last two bolts. Remove filter cover (2).
12. Remove spring (5), valve (6), and element (7).

 **NOTE:** *Remove the element and inspect for metal particles and debris in the bottom of the filter case. Excessive amounts of brass and steel particles can indicate a failed hydraulic pump, motor, valve or an impending failure. A rubber type of material can indicate cylinder packing failure.*

13. Discard element (7) and O-ring (4).
14. Install a new element (7), valve (6) and spring (5).
15. Install filter cover (2) with a new O-ring (4).
16. Install and tighten bolts (3) to 49 N·m (5 kgf·m, 36 lbf·ft).
17. Repeat steps 11 to 16 for the other filter.



M111-07-040

MAINTENANCE

5

Replace Bypass Filter

--- every 500 hours (first time after 50 hours)

1. Park the machine on a level surface.
2. Lower the bucket to the ground as illustrated.
3. Turn the auto-idle switch off.



M142-07-093

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.



M117-07-127

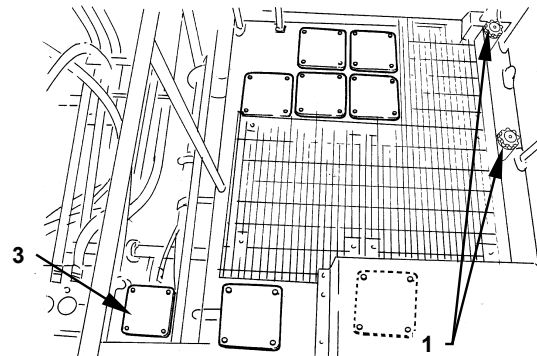


WARNING: Hydraulic oil and components may be hot just after operation. Be sure to allow oil and components to cool before starting work.

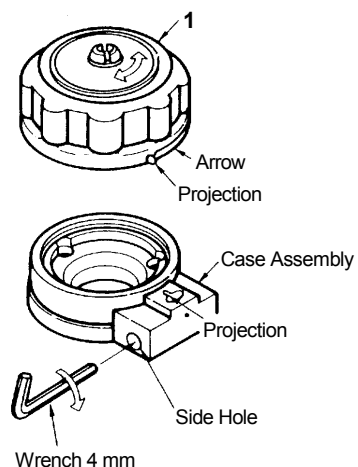


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

7. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
8. Turn cap (1) counterclockwise about 30°, at which point stop cap (1) to release the air.
9. Turn cap (1) further and remove cap (1).
10. Align the projected part of cap (1) with the projected part of the case and install cap (1).



M146-07-031



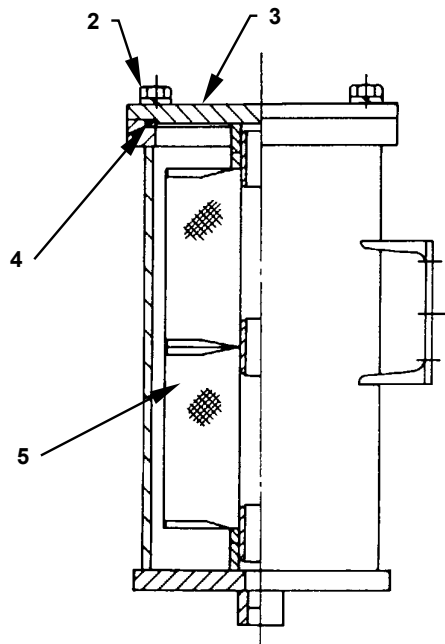
M110-07-022

MAINTENANCE

11. Loosen bolts (2) and remove cover (3).
12. Remove filter element (5) and O-ring (4) from the filter housing.

 **NOTE:** Remove the element and inspect for metal particles and debris in the bottom of the filter case. Excessive amounts of brass and steel particles can indicate a failed hydraulic pump, motor, valve or an impending failure. A rubber type of material can indicate cylinder packing failure.

13. Inspect filter element (5) and the filter housing for metal particles and debris.
14. Discard O-ring (4) and element (5).
15. Install new element (5) into the filter housing.
16. Install filter cover (3) with new O-ring (4).
17. Install and tighten bolts (2) to 88 N·m (9 kgf·m, 65 lbf·ft).



M114-07-051

MAINTENANCE

6

Replace Pilot Oil Filter

--- every 500 hours (first time after 50 hours)

1. Park the machine on a level surface.
2. Lower the bucket to the ground as illustrated.
3. Turn the auto-idle switch off.



M142-07-093

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine.
6. Operate the right and left control levers to release pressure from the pilot accumulator.
7. Remove the key from the key switch.
8. Pull the pilot control shut-off lever to the LOCK position.



M117-07-127

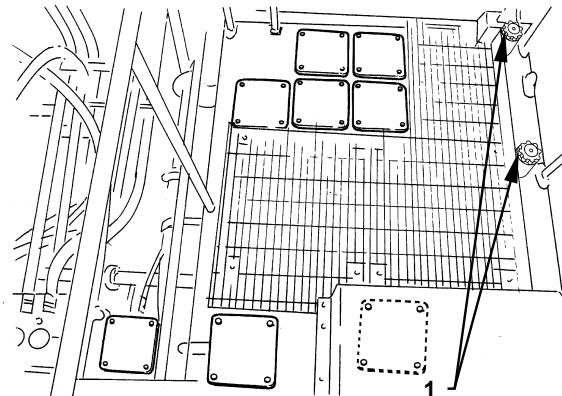


WARNING: Hydraulic oil and components may be hot just after operation. Be sure to allow oil and components to cool before starting work.

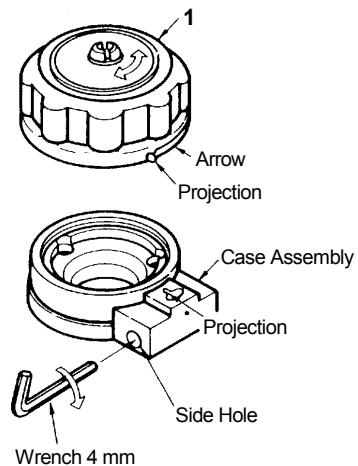


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap only after releasing the internal pressure completely.

9. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
10. Turn cap (1) counterclockwise about 30°, at which point stop cap (1) to release the air.
11. Turn cap (1) further and remove cap (1).
12. Align the projected part of cap (1) with the projected part of the case and install cap (1).



M146-07-031



M110-07-022

MAINTENANCE

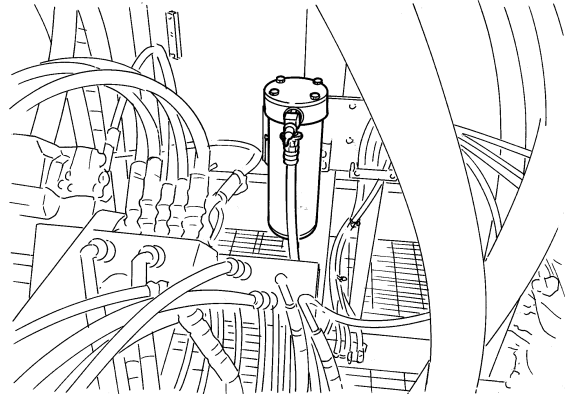
13. Remove bolts (2). Hold down filter cover (4) when removing last two bolts.

 **NOTE:** *There is spring tension under filter cover (4). Hold down filter cover (4) when removing last two bolts (2).*

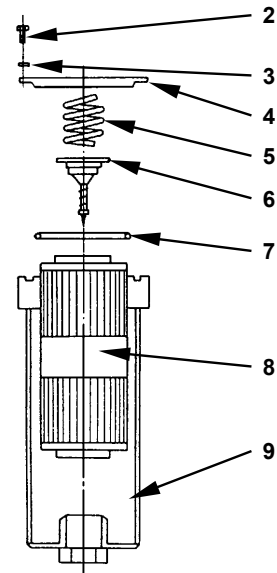
14. Remove spring (5), valve (6), O-ring (7) and filter element (8) from filter housing (9).

 **NOTE:** *Remove element and inspect for materials on element and in bottom of filter housing. Excessive amounts of foreign materials can indicate abnormalities in the system.*

15. Inspect filter element (8) and filter housing (9) for foreign materials.
16. Install new filter element (8), valve (6), and spring (5) into filter housing (9).
17. Install washer (3), cover (4) and new O-ring (7).
18. Tighten bolts (2) to 88 N·m (9 kgf·m, 65 lbf·ft).



M146-07-035



M114-07-053

MAINTENANCE

7

Suction Filter

Cleaning Suction Filter

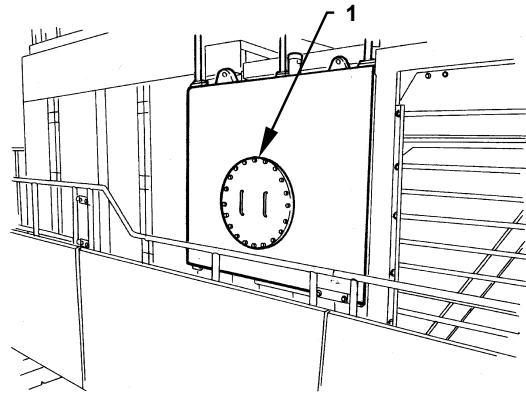
--- when replacing hydraulic oil

6 unit suction filters are provided in the hydraulic oil tank. Clean them when replacing hydraulic oil.

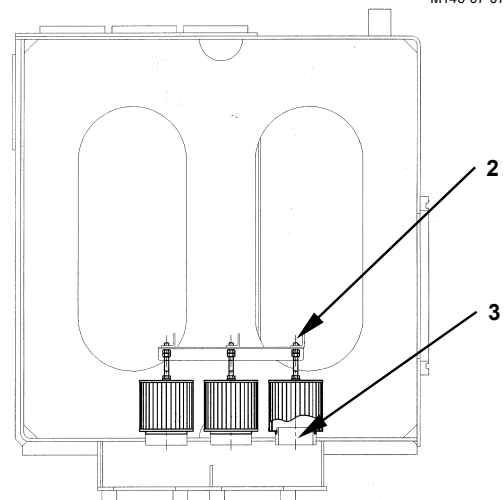


WARNING: Sufficiently ventilate before entering the hydraulic oil tank after draining hydraulic oil.

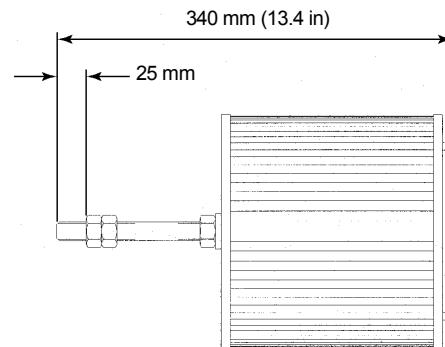
1. After draining oil, remove cover (1) to remove rod assembly (2).
2. Clean the inside of the hydraulic oil tank and the suction filters.
3. Before installing, check dimensions of rod assembly (2) by referring the figure below. Securely re-install the rod assembly into pipe (3).
4. Replace the O-ring with new one and check that it is correctly installed before re-installing cover (1). Secure cover (1) with bolts.
5. Bleed any air remaining in the hydraulic system (refer to [Air Bleeding Procedures] on page 7-58).



M146-07-070



M146-07-012



Rod Assembly

M146-07-013

MAINTENANCE

Replace Suction Filter

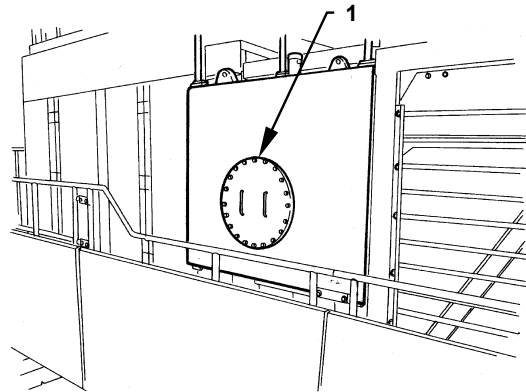
--- every 12000 hours

6 unit suction filters are provided in the hydraulic oil tank. Clean them when replacing hydraulic oil. Replace all suction filters.

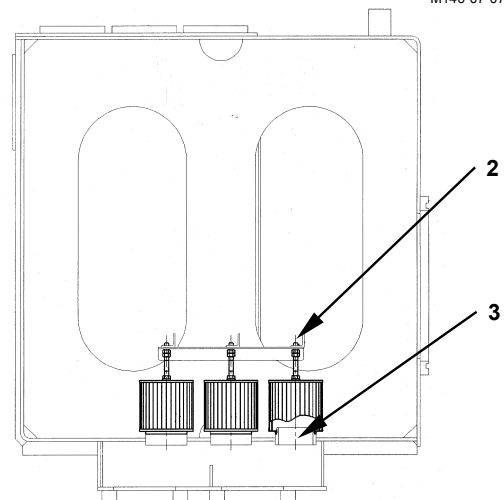


WARNING: Sufficiently ventilate before entering the hydraulic oil tank after draining hydraulic oil.

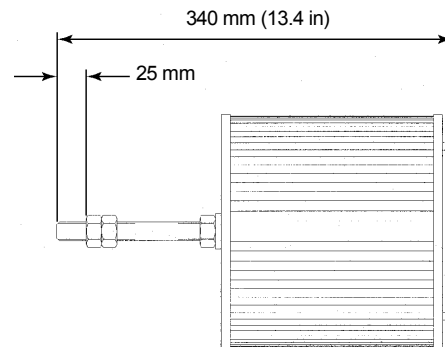
1. After draining oil, remove cover (1) to remove rod assembly (2).
2. Clean the inside of the hydraulic oil tank.
3. Replace the element of rod assembly (2).
4. Before installing, check dimensions of rod assembly (2) by referring the figure below. Securely re-install the rod assembly into pipe (3).
5. Replace the O-ring with new one and check that it is correctly installed before re-installing cover (1). Secure cover (1) with bolts.
6. Bleed any air remaining in the hydraulic system (refer to [Air Bleeding Procedures] on page 7-58).



M146-07-070



M146-07-012



Rod Assembly

M146-07-013

MAINTENANCE

8 Replace High-Pressure Strainer --- every 12000 hours

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.

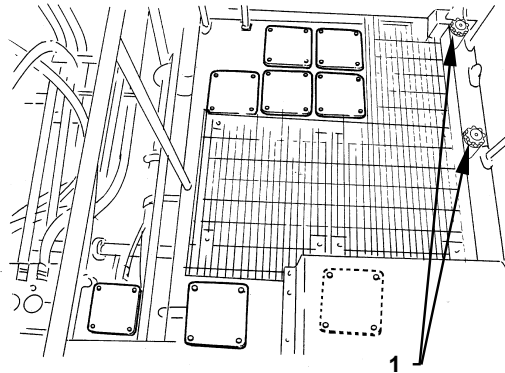


WARNING: Hydraulic oil and components may be hot just after operation. Be sure to allow oil and components to cool before starting work.

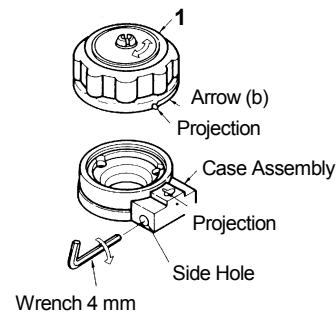


WARNING: Keep body and face away from cap (1). Turn cap (1) slowly and remove the cap (1) only after releasing the internal pressure completely.

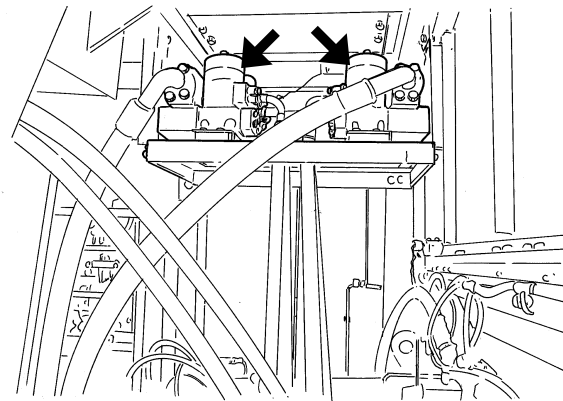
7. Insert the wrench as shown and turn the wrench clockwise and hold the wrench.
8. Turn cap (1) counter-clockwise about 30°, at which point stop cap to release the air.
9. Turn cap (1) further and remove cap (1).
10. Align the projected part of cap with the projected part of the case and install cap (1).
11. Remove bolts (2), cover (3) and strainer assembly (6) from housing (7).
12. Discard O-rings ((4) and (5)) and strainer assembly (6).
13. Install new strainer assembly (6) into housing (7) with the rubber seal down and the welding bead line on strainer assembly (6) away from the housing inlet.
14. Install cover (3) with new O-rings ((4) and (5)).
15. Install and tighten bolts (2) to 265 N·m (27 kgf·m, 195 lbf·ft).
16. Repeat steps 11 to 15 for the other strainer.



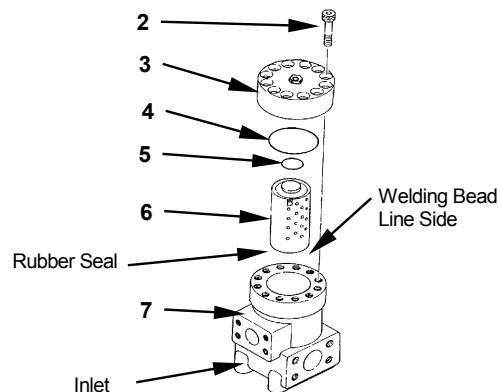
M146-07-031



M110-07-022



M146-07-036



M114-07-062

MAINTENANCE

9

Clean Oil Cooler Core --- every 500 hours

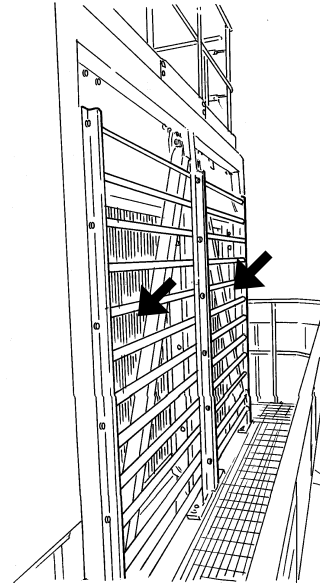


WARNING: Wear safety glasses or goggles when using compressed air to clean oil cooler core.

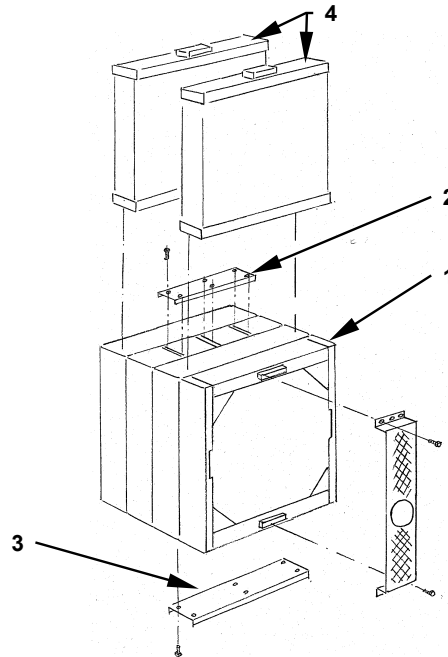
IMPORTANT: High pressure air or water can damage the cooler core fins. Use air pressure [0.2 MPa (2 kgf/cm²) or less] and keep the nozzle more than 500 mm away from the core surface.

Clean the oil cooler core using compressed air [0.2 MPa (2 kgf/cm²) or less] or tap water. Upper and lower covers (2 and 3) can be removed from oil cooler frame (1). Remove the covers to clean the cooler core thoroughly. Four oil coolers (4) units are arranged in both series and parallel. Clean all the cooler units.

IMPORTANT: If upper cover (2) and lower cover (3) are incorrectly installed, the cooler performance will be deteriorated. Be sure to reinstall them in their original positions.



M146-07-037



M146-07-089

MAINTENANCE

10

Check Hoses and Lines

--- daily

--- every 250 hours

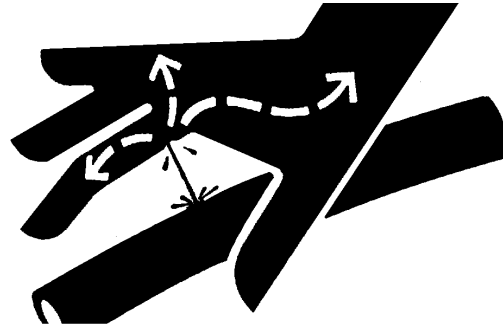


WARNING: Escaping fluid under pressure can penetrate the skin causing serious injury. To avoid this hazard, search for leaks with a piece of cardboard. Take care to protect hands and body from high-pressure fluids. If an accident occurs, see a doctor familiar with this type of injury immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.

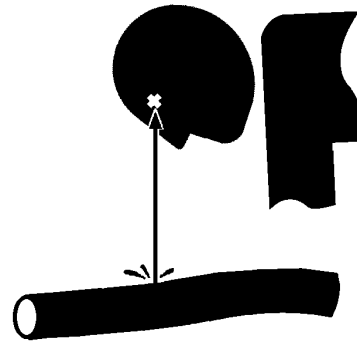


WARNING: Hydraulic oil and lubricant leaks can lead to fire that may result in serious injury. To avoid this hazard :

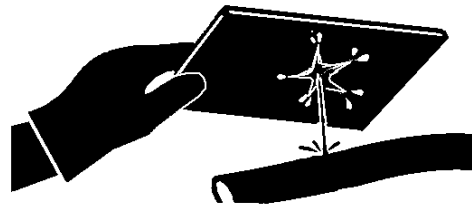
- Park the machine on a firm, level surface. Lower the bucket to the ground. Stop the engine. Remove key from the key switch. Pull the pilot control shut-off lever to the LOCK position.
- Check for missing or loose clamps, kinked hoses, lines or hoses that rub against each other, damaged oil cooler, and loose oil cooler flange bolts, for leaks. Check hoses, lines and oil cooler at the check points indicated below for leaks and other damage that may result in future leaks. If any abnormalities are found, replace or re-tighten them, as shown in Tables 1-3.
- Tighten, repair or replace any missing, loose or damaged clamps, hoses, lines, oil cooler, and loose oil cooler flange bolts. Do not bend or strike high-pressure lines. Never install bent or damaged hoses or lines.



SA-031



SA-292



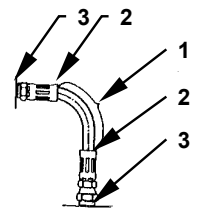
SA-044

MAINTENANCE

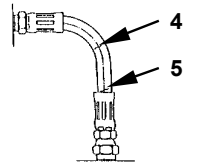
Table 1. Hoses

Interval(hours)	Check Points	Abnormalities	Remedies
Daily	Hose covers	Leak (1)	Replace
	Hose ends	Leak (2)	Replace
	Fittings	Leak (3)	Retighten or replace
Every 250 hours	Hose covers	Crack (4)	Replace
	Hose ends	Crack (5)	Replace
	Hose covers	Exposed reinforcement (6)	Replace
	Hose covers	Blister (7)	Replace
	Hose	Bend (8)	Replace
	Hose	Collapse (9)	Replace (Use proper bend radius)
	Hose ends and fittings	Deformation or Corrosion (10)	Replace

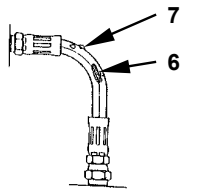
 **NOTE:** Refer to the illustrations in Fig.1 for each check point location or for a description of the abnormality. Use genuine Hitachi parts.



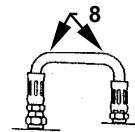
M115-07-145



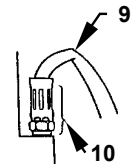
M115-07-146



M115-07-147



M115-07-148



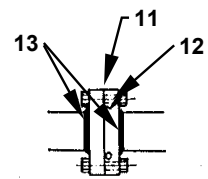
M115-07-149

Fig.1

MAINTENANCE

Table 2. Lines

Interval(hours)	Check Points	Abnormalities	Remedies
Daily	Contact surfaces of flange joints	Leak (11)	Replace O-ring and/or retighten bolts
	Welded surfaces on joints	Leak (12)	Replace
	Clamps	Loose	Retighten
Every 250 hours	Welded surfaces on joints	Crack (13)	Replace
	Clamps	Missing	Replace
		Deformation	Replace



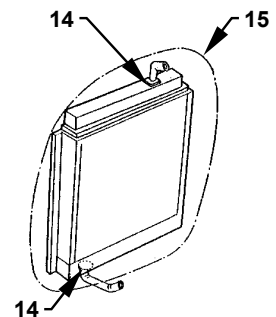
M115-07-150

Fig. 2

NOTE: Refer to the illustrations in Fig.2 for each check point location or for a description of the abnormality. Use genuine Hitachi parts.

Table 3. Oil cooler

Interval(hours)	Check Points	Abnormalities	Remedies
Every 250 hours	Contact surfaces of flange joints	Leak (14)	Replace O-ring and/or retighten bolts
	Oil cooler	Leak (15)	Replace



M115-07-151

Fig. 3

NOTE: Refer to the illustrations in Fig.3 for each check point location .

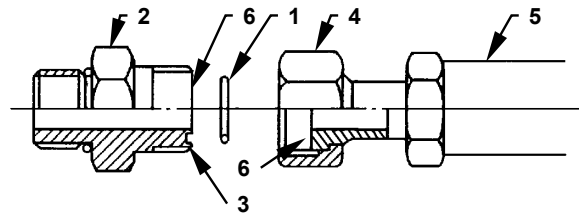
MAINTENANCE

SERVICE RECOMMENDATIONS FOR HYDRAULIC FITTINGS

Two hydraulic fitting designs are used on this machine.

Flat Face O-ring Seal Fitting (ORS Fitting)

An O-ring is used on the sealing surfaces to prevent oil leakage.



M104-07-033

1. Inspect fitting sealing surfaces (6). They must be free of dirt or defects.
2. Replace O-ring (1) with a new one when assembling fittings.
3. Lubricate O-ring (1) and install it into groove (3) using petroleum jelly to hold it in place.
4. Tighten fitting (2) by hand, pressing the fitting joint together to ensure O-ring (1) remains in place and is not damaged.
5. Tighten fitting (2) or nut (4) to the torque values shown. Do not allow hose (5) to twist when tightening fittings.
6. Check for leaks. If oil leaks from a loose connection, do not tighten fitting (2). Open the connection, replace O-ring (1) and check for correct O-ring position before tightening the connection.

Torque specifications		±10%			
Width across flats (mm)		27	32	36	41,46
Fastening torque	N·m	93	137	175	205
	(kgf·m)	(9.5)	(14)	(18)	(21)
	(lbf·ft)	(69)	(101)	(130)	(152)

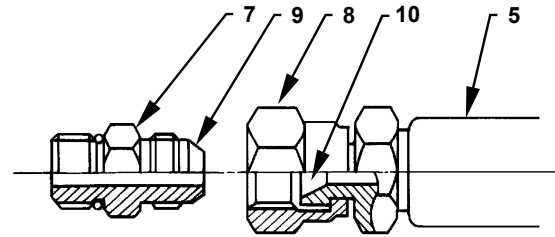
MAINTENANCE

Metal Face Seal Fittings

Fittings are used on smaller hoses and consist of a metal flare and a metal flare seat.

1. Inspect flare (10) and flare seat (9). They must be free of dirt or obvious defects.

IMPORTANT: Defects in the tube flare cannot be repaired. Overtightening a defective flare fitting will not stop a leak.



M202-07-051

2. Tighten fitting (7) by hand.
3. Tighten fitting (7) or nut (8) to the torque values shown. Do not allow hose (5) to twist when tightening fittings.

Width across flats (mm)		19	22	27
Fastening torque	N·m	29.5	39	93
	(kgf·m)	(3)	(4)	(9.5)
	(lbf·ft)	(21.5)	(29)	(69)

MAINTENANCE

E. FUEL SYSTEM

Tank capacity 7450 liter (1970 US gal)

Parts	Quantity	Interval (hours)						
		10	50	250	500	1000	1500	2000
1. Drain Fuel Tank Sump	1							
2. Drain Fuel Filter Sediment	Stage 1 filter	Weekly or as required						
3. Replace Fuel Element	Stage 1 filter							
4. Replace Fuel Filter	Stage 2 filter							
5.	Check Fuel Hoses (for leak, loose)							
	Check Fuel Hoses (for crack, bend, etc.)							

 **NOTE:** The machine has 2 stage filtration system on suction fuel line.
 Stage 1 filter is equipped in front of fuel tank.
 Stage 2 filter is equipped on engine.

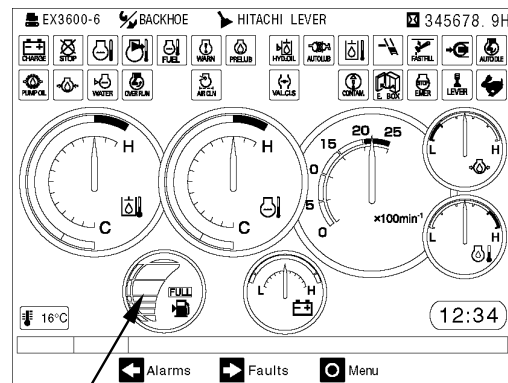
 **WARNING:** Use only recommended **DIESEL FUEL OIL (JIS K-2204 or ASTM2-D)**. Never use gasoline. If gasoline is used accidentally, fire will break out, resulting in serious personal injury or death.

Recommended Fuel

Use only high-quality DIESEL FUEL OIL in accordance with JIS K-2204, ASTM2-D, or equivalent. For further details, refer to the manual for Commins Engine.

Refueling

1. Park the machine on a firm, level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.
4. Check fuel gauge (1) on the monitor. Add fuel if necessary, as follows.
 Fuel Tank Capacity: 7450 liter (1970 US gal)



M18M-01-009

 **NOTE:** Avoid condensation. Fill the tank at the end of each day's operation.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

5. Run the engine at slow idle for 5 minutes.
6. Stop the engine. Remove the key from the key switch.
7. Pull the pilot control shut-off lever to the LOCK position.

MAINTENANCE



WARNING:

- Shut down the engine when fueling. Do not smoke while fueling – or when handling fuel containers.
- Fuel leaked or spilled onto hot surface or electrical components can cause a fire.
- After fueling, secure filler cap.

IMPORTANT: Keep all dirt, dust, water and other foreign materials out of the fuel system.



NOTE: Take care not to spill fuel on the machine or ground. Do not fill the tank more than specified.

8. Remove filler cap (2). Add fuel via the filler tube. Do not fill the tank more than specified.
Be sure to select a charging pump of appropriate capacity when fueling to avoid overflowing.

9. A filter is provided in the filler port. Clean the filter in light oil at the regular interval.

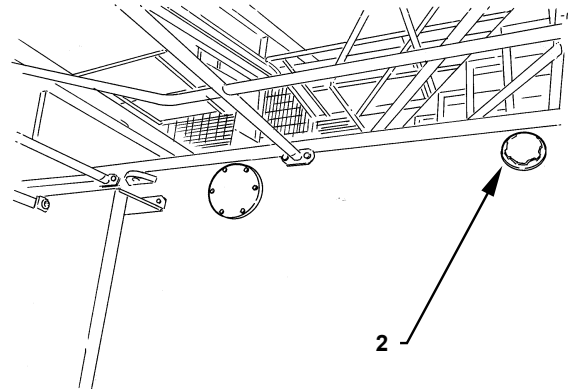
10. Reinstall filler cap (2).



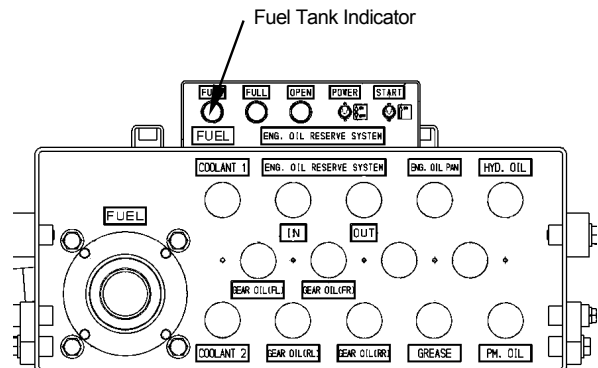
NOTE: Fuel can be supplied from the ground using the fast-filling panel located in the rear of the base machine. Refer to page 1-38 for the fast-filling panel operation.



NOTE: Full of the tank can be confirmed by the fuel tank indicator on the fast-filling panel.
As filling the tank, flash interval of the indicator changes short. When the tank is full, the indicator flashes continuously.
Stop refueling within 30 seconds after the indicator flashes continuously.



M146-07-038



M18M-01-020

MAINTENANCE

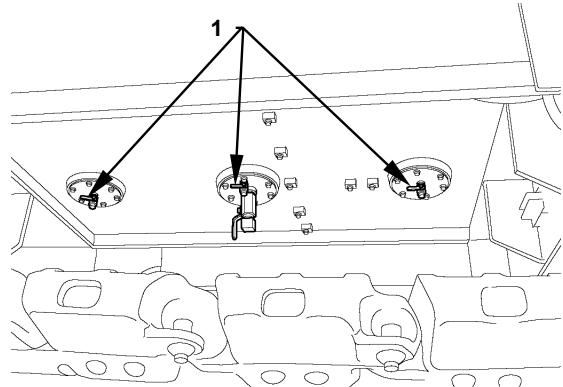
1

Drain Fuel Tank Sump --- daily

1. Park the machine on a level surface with the upper-structure rotated 90° for easier access.
2. Lower the bucket to the ground.
3. Turn the auto-idle off.

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.
7. Open drain cock (1) for several seconds to drain water and sediment. Close drain cock (1).



M18M-07-069

2

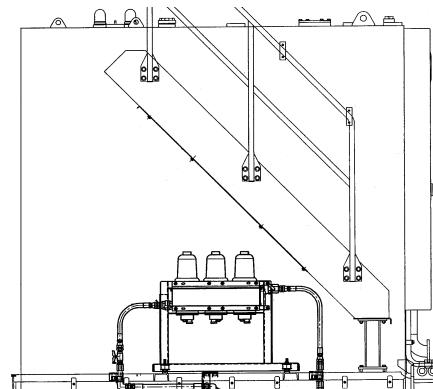
Drain Fuel Filter Sediment --- Weekly or as required (Water visible in clear bowl)

1. Stop the engine.

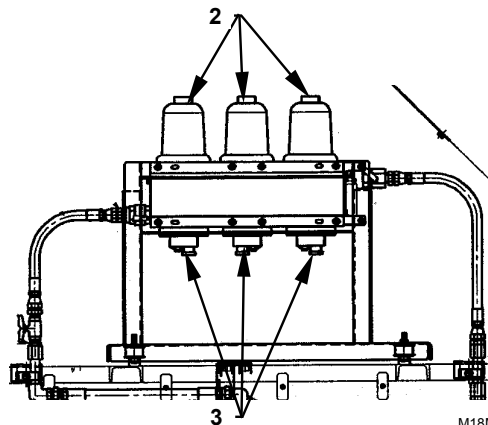


WARNING: Fuel may be hot just after operation. Be sure to wait for fuel to cool before starting work.

2. Loosen fuel vent cap (2) to open.
3. Loosen drain valve (3) to drain water.
4. Collect water into a cup.
5. When fuel flows out of the drain, close drain valve (3).
6. Close fuel vent cap (2).
7. Start the engine. Increase engine speed for one minute to purge the air from the fuel system.



M18M-07-070



M18M-07-071

MAINTENANCE

3

Replace Fuel Element --- every 250 hours

IMPORTANT: When fuel level reaches top of filter element in clear cover before 250 hours, replace fuel element before change interval.

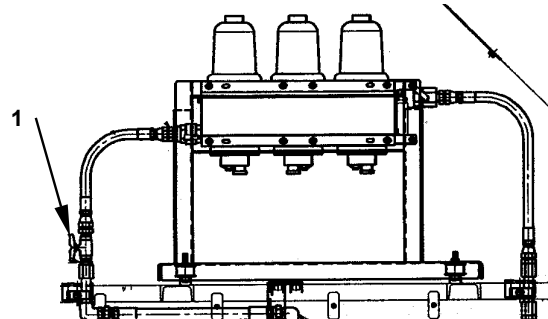
Be sure to prepare a container large enough to collect fuel when replacing fuel filter to avoid ground contamination and for safety.

1. Stop the engine.

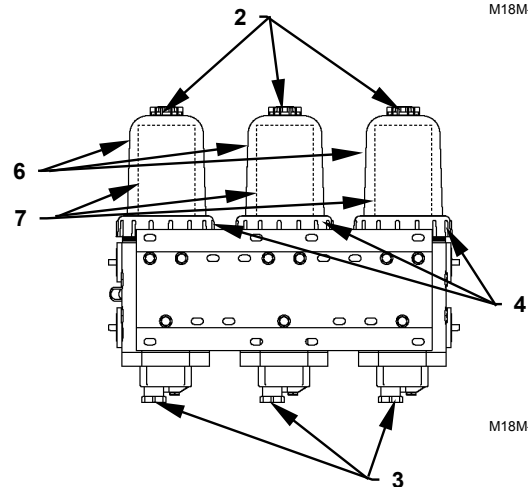


WARNING: Fuel may be hot just after operation. Be sure to wait for fuel to cool before starting work.

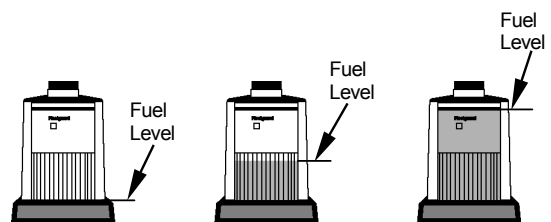
2. Close cock (1) on the inlet line.
3. Loosen fuel vent cap (2) to break the air lock in the filter.
4. Open drain valve (3) and drain the fuel level below collar (4) level, then close drain valve (3).
5. Using Collar/Vent Cap Wrench (5), remove clear cover (6) by removing collar (4). Discard the o-ring from clear cover (6). (A new o-ring is supplied with the new filter.)
6. Remove filter element (7). Be sure the sealing grommet is removed from the center stud.
7. Install new filter element (7) (supplied with a sealing grommet inserted into the element.) on the center stud by pushing down.
8. After checking the new o-ring (supplied with the new filter) at clear cover (6) is in place, install clear cover (6) and collar (4). Hand tighten collar (4) until seated. Do not use Collar/Vent Cap Wrench (5) to tighten.
9. Remove fuel vent cap (2) from the top of clear cover (6). Fill clear cover (6) with enough clean fuel to cover the bottom half of the filter element.
10. Reinstall fuel vent cap (2) and tighten by hand only.
11. Start the engine. When the lubrication system reaches its normal operating pressure, increase engine speed for one minute.



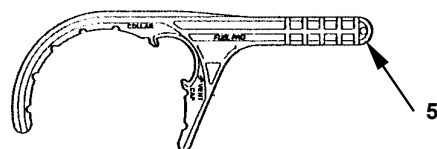
M18M-07-071



M18M-07-072



M18M-07-073



M18M-07-074

Refer to the manual for Cummins Engine.

MAINTENANCE

4

Replace Fuel Filter --- every 250 hours

IMPORTANT: Be sure to prepare a container large enough to collect fuel when replacing fuel filter to avoid ground contamination and for safety.

1. Stop the engine.



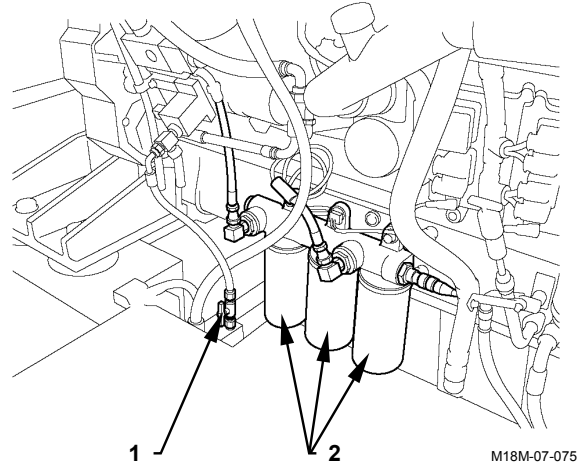
WARNING: Fuel may be hot just after operation. Be sure to wait for fuel to cool before starting work.

2. Close cock (1) on the inlet line.
3. Unscrew spin-on filters (2) from the filter head, discard filters.
4. Fill the filter with clean fuel. Apply a light even coat of lubricating oil to the gasket sealing surface prior to installing the filter.
5. Position filter (2) to the filter head. Tighten by hand until the seal touches the filter head, tighten an additional one-half to three-fourths turn.
6. Open cock (1) on the inlet line.



NOTE: Be sure to tighten the filter by hand. If any tools are used for tightening, breakage or deformation of the filter head may arise.

Refer to the manual for Cummins Engine.



MAINTENANCE

5

Check Fuel Hoses

--- daily

--- every 250 hours



WARNING: Fuel leaks can lead to fires that may result in serious injury.

To avoid this hazard :

1. Park the machine on a firm, level surface. Lower the bucket to the ground. Stop the engine. Remove key from the key switch. Pull the pilot control shut-off lever to the LOCK position.
2. Check for kinked hoses, and hoses that rub against each other parts for leaks.
Check hoses at the check points indicated below for leaks and other damage that may result in future leaks. If any abnormalities are found, replace or re-tighten them, as shown in Table 4.
3. Repair or replace any loose or damaged hoses.
Never install bent or damaged hoses.

MAINTENANCE

Table 4. Hoses

Interval (hours)	Check Points	Abnormalities	Remedies
Daily	Hose covers	Leak (1)	Replace
	Hose ends	Leak (2)	Replace
	Fittings	Leak (3)	Retighten or replace
Every 250 hours	Hose covers	Crack (4)	Replace
	Hose ends	Crack (5)	Replace
	Hose covers	Exposed reinforcement (6)	Replace
	Hose covers	Blister (7)	Replace
	Hose	Bend (8)	Replace
	Hose	Collapse (9)	Replace (Use proper bend radius)
	Hose ends and fittings	Deformation or corrosion (10)	Replace

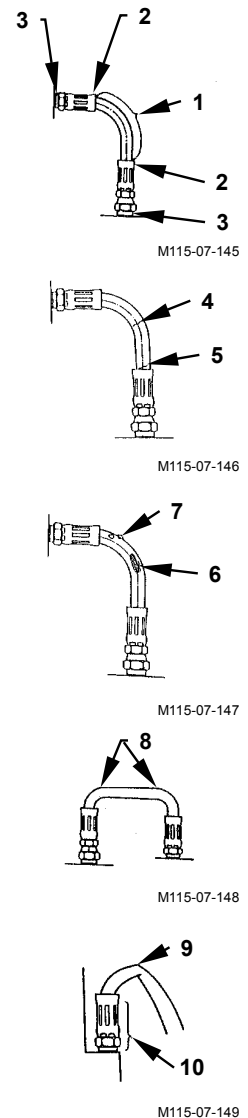


Fig. 4

NOTE: Refer to the illustrations in Fig. 4 for each check point location or for a description of the abnormality. Use genuine Hitachi parts.

MAINTENANCE

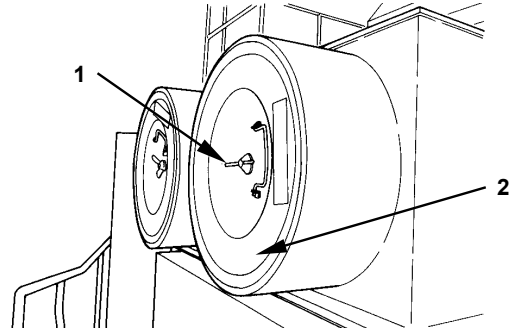
F. AIR CLEANER

Parts		Quantity	Interval (hours)						
			10	50	250	500	1000	1500	2000
1. Air Cleaner Outer Element	Cleaning	2 × 2	As required						
	Replacement	2 × 2	Replace per 6 cleaning						
2. Air Cleaner Inner Element	Replacement	2 × 2	When outer element is replaced						

1 Clean Air Cleaner Outer Element
--- as required

2 Replace Air Cleaner Outer and Inner Elements
--- per 6 cleaning or when outer element is replaced

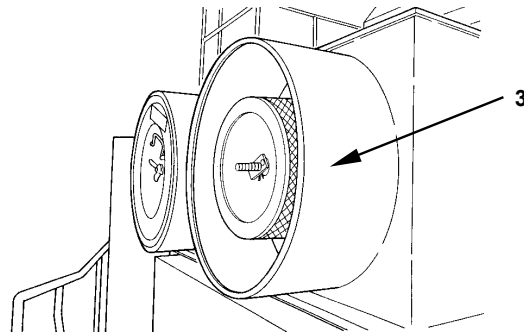
1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Turn the auto-idle switch off.



M117-07-015

IMPORTANT: The turbocharger may be damaged if the engine is not properly shut down.

4. Run the engine at slow idle speed without load for five minutes.
5. Stop the engine. Remove the key from the key switch.
6. Pull the pilot control shut-off lever to the LOCK position.
7. Remove wing nut (1).
Remove outer element (2).



M117-07-016



WARNING: Use reduced compressed air pressure (Less than 0.2 MPa, 2 kgf/cm², 28 psi). Clear area of bystanders, guard against flying chips, and wear personal protection equipment including goggles or safety glasses.

8. Clean outer element (2) using compressed air (Less than 0.2 MPa, 2 kgf/cm², 28 psi). Direct the air to the inside of the filter element, blowing out. Inspect outer element (2) for any damage. If outer element is damaged, replace with a new one.
9. Clean body (3) interior before installing outer element (2). Install outer element (2).

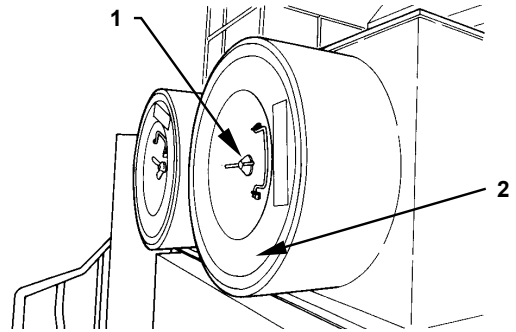


NOTE: Check air cleaner restriction indicator on the monitor panel. If air cleaner restriction indicator comes ON. Stop the engine and replace outer element.

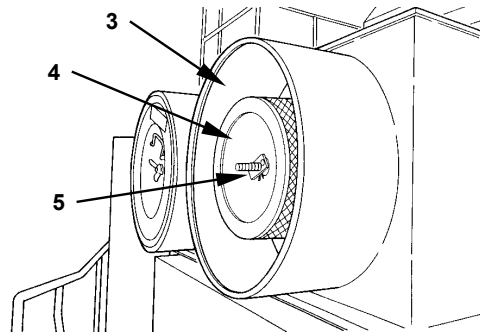
MAINTENANCE

Replacement

1. When replacing air cleaner filter element, replace both, outer (2) and inner (4) elements together.
2. Remove wing nut (1) and outer element (2).
3. Clean the filter housing (3) interior before removing inner element (4).
4. Remove nut (5) and inner element (4).
5. First install inner element (4) and nut (5) and then install outer element (2) and wing nut (1).



M117-07-015



M117-07-016

MAINTENANCE

G. COOLING SYSTEM

Parts	Quantity	Interval (hours)						
		10	50	250	500	1000	1500	2000
1. Check Coolant Level	1							
2. Check DCA4 Concentration in Coolant	—							
3. Replace Coolant Filter	2							
4. Change Coolant	614 L (162 US gal)	Twice a year, in spring and autumn *						
5. Clean Radiator, After Cooler Interior	1+1	When changing coolant						
6. Clean Radiator, After Cooler Core	1+1							

 **NOTE:** * Before leaving the Hitachi factory, the cooling system is filled with a mixture of water and Genuine Hitachi Long-Life Coolant. As long as Genuine Hitachi Long-Life Coolant is used, the service intervals between changing the coolant is once every two years, or every 4000 hours, whichever comes first.

Coolant

Use a proper coolant mix of water, antifreeze and anti-corrosive agent DCA4.

 **NOTE:** DCA4 is a brand name of Dry Chemical Additive manufactured by the America Fleetguard Co.

1. Water

Use soft water with fewer impurities or tap water as a coolant.

If hard water with many impurities is used, the anti-corrosive agent DCA4 will be neutralized and lose its effect as an anticorrosive agent.

2. Long-Life Coolant

Long-Life coolant protects the cooling system from rusting and freezing.

Long-life coolant can be used throughout the year without changing.

As long as Genuine Hitachi Long-Life Coolant is used, the service interval between changing the coolant is once every two years, or every 4000 hours, whichever comes first.

IMPORTANT: Long-Life Coolant concentration is usually 50%. However Long-Life Coolant concentration should be changed for the cold weather range. Refer to the manual for Cummins Engine.

MAINTENANCE

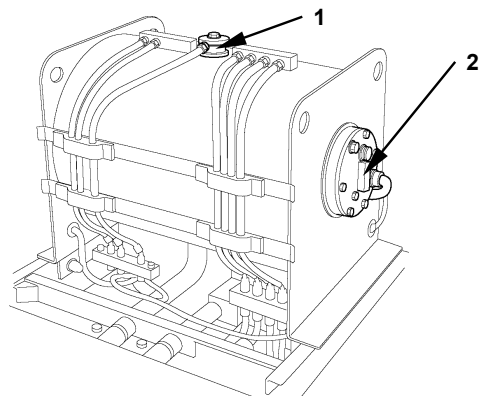
1

Check Coolant Level --- daily

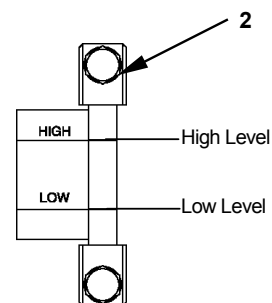


WARNINGN: Do not remove water tank cap (1) until the coolant is cool; otherwise high-temperature steam may escape, potentially causing scalding. Slowly loosen cap (1) to release pressure after the system has cooled and then remove.

Check that the coolant level is between the HIGH and LOW marks on water tank level gauge (2).
If the coolant level is below the LOW mark, remove cap (1) on the water tank and add coolant via the opening.



M18M-07-046



M18M-07-047

MAINTENANCE

2

Check DCA4 Concentration in Coolant --- every 500 hours

Anticorrosive Agent DCA4

Be sure to use the anticorrosive agent DCA4 in your Cummins Cooling System. DCA4 protects the cooling system from rusting, makes an anticorrosive film on the cylinder liner to prevent the liner from corroding, and reduces sediments in the engine coolant passages. Maintain the acceptable concentration range of 1.2 to 3 units per 3.78 L (1 US gal) of coolant.

DCA4 concentration is adjusted by replacing the DCA4-containing filter and/or adding DCA4 liquid.

- Coolant Filter

The following solid DCA4 containing coolant filter is available.

Application	Fleetguard Part No.	Cummins Part No.	Hitachi Part No.	Number of DCA Units
Check and Maintenance	WF-2076	3100309	4460208	23

- DCA4 Liquid

The following DCA4 liquid units are available for refill.

Application	Fleetguard Part No.	Cummins Part No.	Hitachi Part No.	Number of DCA Units
Refill	DCA60L	3305373	4275270	5
	DCA65L		4280278	20

MAINTENANCE

- Precautions for using DCA4



WARNING: DCA4 includes alkali. Avoid splashing DCA4 in your eyes or swallowing it. If DCA4 is splashed into your eyes or swallowed, follow the instructions shown below. Keep out of reach of children.

1. Exposure tolerances

Slight skin exposure to DCA4 will cause no serious problems. However, longer or repeated exposure times, inhaling, swallowing or splashing DCA4 in your eyes will cause serious problems. Take the emergency measures shown below.

Cause	Symptoms	Emergency Measure
Inhaling	The nose smarts.	Breathe fresh air.
Long or repeated exposure	The skin smarts.	Wash with fresh water. Take off clothes contaminated with DCA4 and clean them thoroughly.
Splashing in eyes	The eyes smart.	Wash immediately with fresh water for 15 minutes and see a physician.
Swallowing		Drink a lot of carbonated beverages and see a physician.

2. Disposal

Be careful not to spill DCA4 on machine or ground. If DCA4 is spilt, wipe it up and clean contaminated surface thoroughly. Use a container to collect spilt DCA4 and consign it to professional disposers. Disposal of surplus DCA4 when changing coolant should also be assigned to professional disposers.

MAINTENANCE

Checking and Adjusting DCA4 Concentration

- Initial Charge (when replacing coolant totally)
Replace the coolant filter and add the DCA4 liquid for re-fill. Use coolant filter (WF-2076). One DCA65L unit is equivalent to four DCA60L units. The sample combinations of DCA65L and DCA60L are shown in the following table. Appropriately combine both DCA65L and DCA60L so that the required concentration can be obtained.

Antifreeze or LLC Concentration (%)	DCA Units per 1 gal of Water Plus Anti-freeze or LLC	Coolant Volume (L)	Required Concentration (Unit)	Filter (P/No.)	Nos. of Units (Unit)	Quantity	DCA4 Liquid for Refill (P/No.)	Nos. of Units (Unit)	Quantity	Total Units (Unit)
Over 50%	2	614	325 (614/3.78×2 = 325 DCA Unit)	WF-2076	23	2	DCA65L	20	14	326 DCA Unit (23×2+20×14)

- Replacing Coolant Filter --- every 500 hours
DCA4 deteriorates its function after being used for a long time. Normally replace it every 500 hours. However, when the DCA4 concentration is measured:
 - When the antifreeze or LLC concentration is 50%: If over 3 units concentration is measured, no replacement is required, allowing the replacement hour to extend up to max. 1000 hours.
- Checking Coolant Concentration
 1. If a large quantity of coolant was added when repairing the engine or radiator, check the coolant concentration in accordance with Item 5 Inspection Procedure in this manual and maintain the proper coolant concentration. (If the total coolant was replaced, conduct the initial charge in accordance with Item above on this page.)
 2. The coolant concentration may be outside the specification according to operation conditions or due to an unexpected failure. Then, it is recommendable to check the concentration every 500 hours.

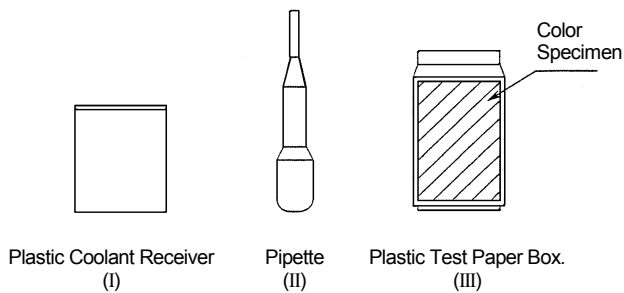
MAINTENANCE

Inspection Procedures of Coolant Concentration

- Check the concentration of DCA4 in coolant using the inspection kit shown below.

Name of Kit		Cummins Parts No.	Hitachi Parts No.
Inspection Kit	CC2602	—	4404083

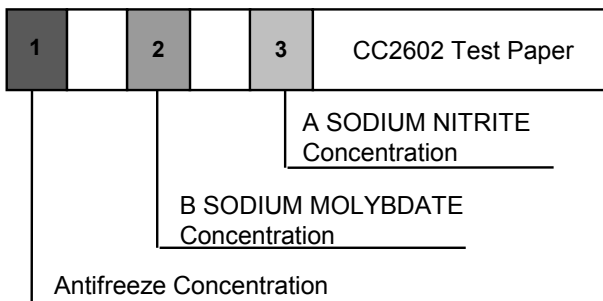
Contents of the Kit:



M162-07-077

• Outline

1. Both A and B reagents are coated on CC2602 test paper, allowing to measure the color changes on both A and B reagents.
2. At the same time, one more reagent is coated to easily determine the antifreeze concentration through color change. (The antifreeze concentration checked by this method should be just a guide line. When the exact antifreeze concentration is required, measure it using a specified equipment.)



M162-07-076

3. Do not use diluted coolant for measurement. Collect coolant into the attachment beaker. Directly dip the test paper into the collected coolant. Compare the reagent color change on the test paper with the color specimen coated on the test paper box 45 seconds after desiccating.

MAINTENANCE

• Precautions for Using CC2602 Test Kit

Maintain coolant temperature to 10 to 54°C while checking. Otherwise, incorrect color change may result.

Compare the reagent color with the color specimen to measure the concentration in daylight.

In case it is difficult to specify the color concentration through the comparison of the reagent color with the color specimen, adopt the lighter side concentration as a safer value.

The reagents provided in the test kit are sensitive to light, heat, and excessive moisture so that they should be stored in a plastic container. Unless the test papers are used, be sure to close the container cover correctly.

Avoid to expose the test kit to the direct ray of the sun while storing and maintain the ambient temperature of the storing place to 32°C or lower.

The effective life time of the reagent is printed on the upper section of the CC2602 container.

Do not use any reagents after the effective life time expires.

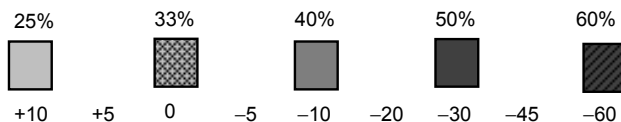
If the reagent color has changed to light brown or pink, avoid using such reagent.

If the color specimen was spoiled, wipe stain with a cloth. Do not use any soap or solvent.

The reagent color continues to change from soon after being dipped into coolant and stops after it is dried up. Therefore, measure the coolant concentration within the specified time range.

Concentration Check Table

% GLYCOL/FREEZEPOINT (°F)



DCA Unit/3.78L (1 US gal)

(SCA UNITS PER GALLON)

(SODIUM
MOLYBDATE
LEVEL)

		0.0	1.7	2.8	3.1	3.7	4.1	4.9	5.7
ROW 6		0.0	1.7	2.8	3.1	3.7	4.1	4.9	5.7
ROW 5		0.0	1.7	2.3	2.7	3.1	3.5	4.3	5.1
ROW 4		0.0	1.4	1.8	2.0	2.4	2.8	3.6	4.4
ROW 3		0.0	1.2	1.5	1.7	2.1	2.5	3.3	4.1
ROW 2		0.0	1.0	1.2	1.4	1.8	2.2	3.0	3.8
ROW 1		0.0	0.6	0.9	1.1	1.5	1.9	2.7	3.5
ROW 0		0.0	0.3	0.6	0.8	1.2	1.6	2.4	3.2
									
		A	B	C	D	E	F	G	H

(SODIUM NITRITE LEVEL)

MAINTENANCE

- How to Use Test Kit

IMPORTANT: Measure time precisely to obtain the correct test results. Use a stop watch or watch with a second hand. If the reagent color change is checked too early or too late, correct measurement results won't be obtained. If coolant is maintained based on incorrect check data, damage to the engine may result.

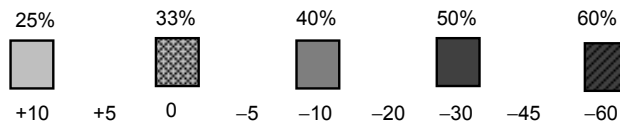
1. Use coolant collected from the radiator or the engine drain cock for checking. Don't collect coolant from the reservoir. Wait to cool the collected coolant temperature to 10 to 54°C before checking.
2. As soon as one test paper is taken out of the plastic container, close the cover correctly. Do not touch the area coated with the reagent. If the area has already changed to light brown use another test paper.
3. Dip the test paper into the collected coolant for one second. After taking up the test paper, desiccate the extra coolant.
4. Wait 45 seconds. Then, compare the changed reagent color on the test paper with the color specimen and determine the coolant concentration by following procedures.
 - (1) Take a record of the anti freeze concentration by comparing the color on reagent section (1) with the anti freeze color specimen printed on the test paper plastic box (III).
 - (2) Take a record of concentration by comparing the color on reagent section (2) with the SODIUM MOLYBDATE color specimen printed on the test paper plastic box (III).
 - (3) Take a record of concentration by comparing the color on reagent section (3) with the SODIUM NITRITE color specimen printed on the test paper plastic box (III).
5. Complete all color comparison check within 75 seconds after dipping the test paper into the coolant.

MAINTENANCE

6. In case the reagent color corresponds to that between the color specimens, take the intermediate value. If it is difficult to determine which value should be taken, adopt the lighter color side concentration as a safer value.
7. Using the concentration check table, find the intersection between the recorded SODIUM MOLYBDATE concentration and the SODIUM NITRITE concentration. This intersection shows the coolant additive agent concentration per 1 US gal of the coolant.
8. The colored concentration values in the concentration check table printed on the test paper box represents the values to be applied when the LLC concentration is 50%. When the LLC concentration is 40% or less, do not determine by color. Determine by figure values.
9. Record the measured coolant additive agent concentration value on the maintenance record sheet as reference data when performing next maintenance services.

Concentration Check Table

% GLYCOL/FREEZEPOINT (°F)



DCA Unit/3.78L (1 US gal)

(SCA UNITS PER GALLON)

(SODIUM
MOLYBDATE
LEVEL)

	ROW 6	0.0	1.7	2.8	3.1	3.7	4.1	4.9	5.7
	ROW 5	0.0	1.7	2.3	2.7	3.1	3.5	4.3	5.1
	ROW 4	0.0	1.4	1.8	2.0	2.4	2.8	3.6	4.4
	ROW 3	0.0	1.2	1.5	1.7	2.1	2.5	3.3	4.1
	ROW 2	0.0	1.0	1.2	1.4	1.8	2.2	3.0	3.8
	ROW 1	0.0	0.6	0.9	1.1	1.5	1.9	2.7	3.5
	ROW 0	0.0	0.3	0.6	0.8	1.2	1.6	2.4	3.2
		A	B	C	D	E	F	G	H

(SODIUM NITRITE LEVEL)

MAINTENANCE

• Checking and Controlling Coolant

Obtain the concentration value from the concentration check table. Concentration and its control are as follows.

Coolant Additive Agent DCA4 Control Standard

Concentration of Antifreeze or LLC	Concentration per 1 US gal of Coolant Additive Agent DCA4	Control Method
50%	1.2 or less	Replace the coolant filter. Add one bottle of DCA60L (containing 5 DCA units) per 15 L of coolant.
	1.2 to 3.0	Perform the normal maintenance service. Replace the coolant filter every 500 hours.
	3.0 or more	Keep using the coolant until concentration is reduced to 3 units without replacing the filter. Use the filter up to the next 500 hour replacement time (maximum useable time limit: 1000 hours). In case concentration is over 4.0 units, replace the total coolant and conduct the initial charge in accordance with Item in this manual.
	Necessary DCA4 Volume to be Added When Replacing Total Coolant.	Add 1.75 DCA units per 1 US gal (3.785 L) of coolant.

IMPORTANT: Water with a lot of impurity or insufficient quantity of DCA4 will lead to corrosion of cylinder liners, which will result in engine damage.

MAINTENANCE

3

Replace Coolant Filter --- every 500 hours

Check the DCA4 concentration every 500 hours. (Refer to page 7-85 for the checking procedure.) If the concentration is lower than the acceptable range, and if the coolant filter has to be replaced as a result (Refer to "Concentration Check Table" section on page 7-88.), replace the WF-2076 coolant filter, following the procedure below:

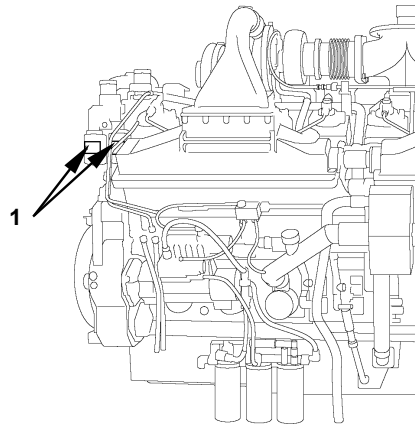


WARNING: Do not attempt to loosen coolant filter (1) until the engine is cool.

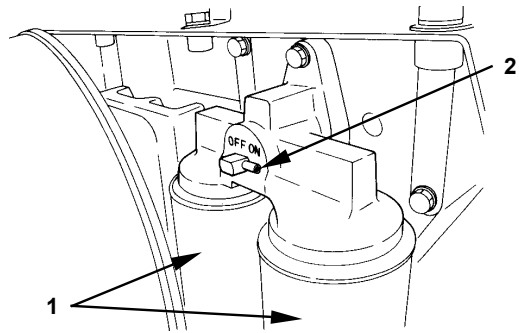
IMPORTANT:

- Be sure to prepare a container large enough to collect coolant when replacing water filter to avoid ground contamination and for safety.
- Be sure to tighten the filter by hand. If any tools are used for tightening, breakage or deformation of the filter head may arise. For details other than filter replacement intervals, refer to the manual for Cummins Engine.

1. Move shut-off valves knob (2) to the OFF position.
2. Remove filters (1) and discard it.
3. Apply a thin film of lubricating oil to the gasket sealing surface prior to installing new filters (1).
4. Position new filters (1) to the filter head.
Tighten until the seal touches the filter head; tighten an additional one-half to three-fourths turn.
5. Move shut-off valves knob (2) back to the ON position.



M18M-07-048



M117-07-018

MAINTENANCE

4

Change Coolant

--- twice a year (in spring and autumn)

5

Clean Radiator Interior

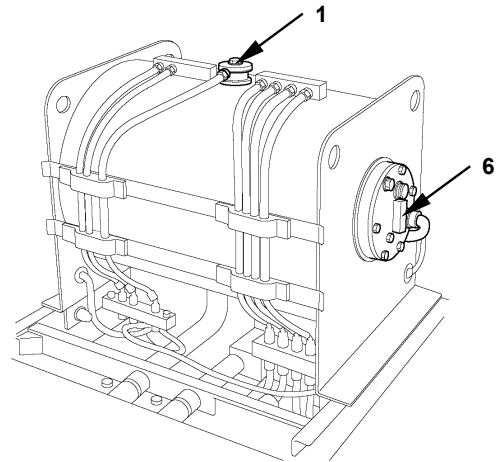
--- when changing coolant

 **NOTE:** Before leaving the Hitachi Factory, the cooling system is filled with a mixture of water and Genuine Hitachi Long-Life Coolant. As long as Genuine Hitachi Long-Life Coolant is used, the service intervals between changing the coolant is once every two years, or every 4000 hours, whichever comes first.

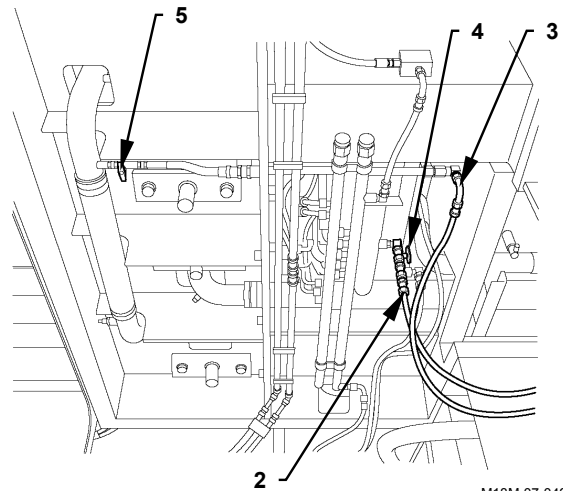


WARNING: Do not loosen the radiator cap until the engine is cool. Loosen the radiator cap slowly to the stop. Release all pressure before removing the radiator cap.

1. Park the machine on a solid and level surface. Lower the bucket to the ground. Stop the engine.
2. Remove water tank cap (1). Remove the hoses (2), (3) and open drain cocks (4) and (5) on the drain pipes to allow the coolant to drain completely. Remove impurity such as water scale at the same time.
3. Close drain cocks (4) and (5) and reinstall the hoses (2) and (3). Fill the radiator with soft water containing less impurity or tap water and a radiator cleaner agent via the water tank cap (1). And fill the water tank in same way between the HIGH and LOW marks on water tank level gauge (6). Reinstall water tank cap (1).
4. Start the engine and run it at a speed slightly higher than slow idle; when the needle of the coolant temperature gauge reaches the blue zone, run the engine for about ten more minutes.
5. Stop the engine and drain water in same way. Flush out the cooling system with soft water or tap water, until draining water is clear. This helps remove rust and sediment.
6. Close drain cocks (4), (5) and reinstall the hoses (2) and (3). Fill the radiator and water tank with soft water or tap water in same way. At that time, mix the LLC. The concentration of LLC is 50%. Slowly add coolant to avoid mixing air bubbles in the system.



M18M-07-046



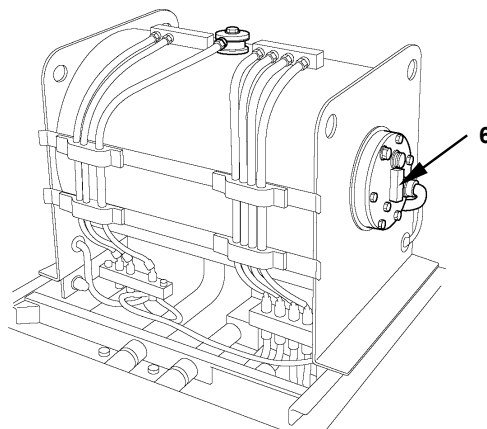
M18M-07-049

MAINTENANCE

IMPORTANT: Long-Life Coolant concentration is usually 50%. However Long-Life Coolant concentration should be changed for the cold weather range. Refer to the manual for Cummins Engine.

7. Add 1.2 to 3.0 DCA units per 1 US gal (3.78 L) of coolant.
8. Confirm that the coolant level is between the marks H and L on gauge (6). Start the engine and run at slow idle speed for about 5 minutes. Stop the engine after bleeding air from the cooling system sufficiently. Check coolant level again and add coolant if necessary.

 **NOTE:** Coolant can be refilled from the ground using the Fast-Filling panel located in the rear of the base machine. Refer to page 1-38 for the Fast-Filling panel operation.



M18M-07-046

MAINTENANCE

6

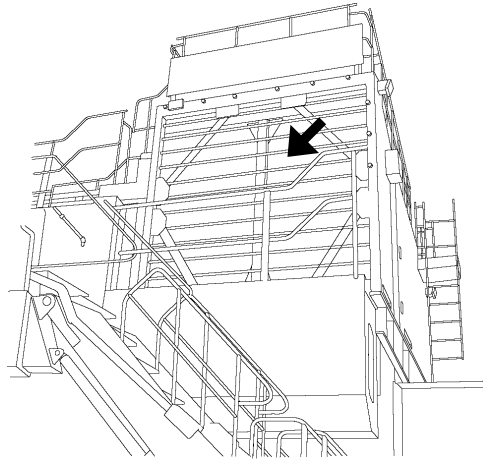
Clean Radiator Core --- every 500 hours



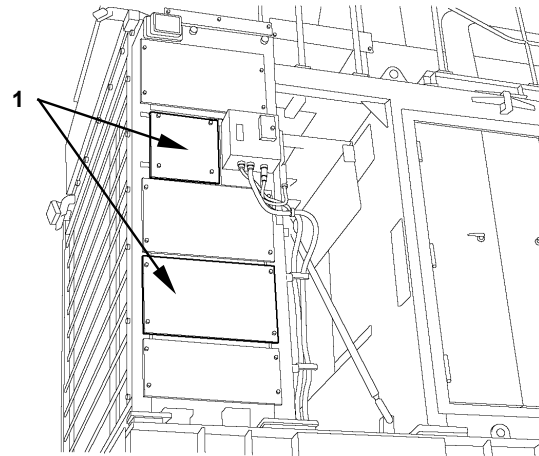
WARNING: Always wear safety glasses or goggles when using compressed air (Less than 0.2 MPa, 2 kgf/cm², 28 psi) to clean radiator core.

IMPORTANT: High-pressure air or water can damage fins. When cleaning the radiator core with high-pressure air or water, keep the nozzle 200 mm (8 in) or more away from the core face in order not to cause any damage.

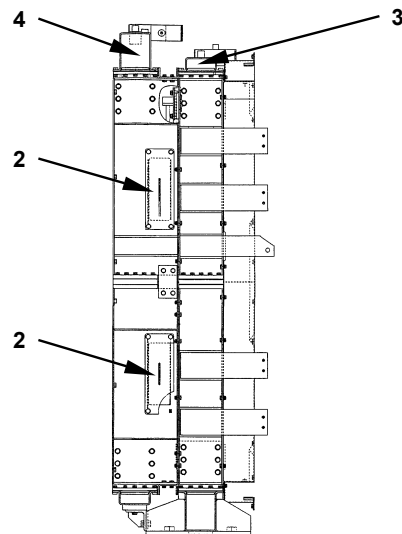
1. Remove cover in front of the radiator. Clean radiator core with compressed air (Less than 0.2 MPa, 2 kgf/cm², 28 psi) or water.
2. Remove the covers (1) beside radiators and remove the covers (2) between radiator core (3) and after-cooler core (4).
3. Clean radiator core (3) and aftercooler core (4) from space between cores in same way.
4. Same as opposite side.
5. After cleaning, install the covers (2) and (1).



M18M-07-050



M18M-07-051



M18M-07-052

MAINTENANCE

H. AIR CONDITIONER

Parts		Quantity	Interval (hours)						
			10	50	250	500	1000	1500	2000
1. Recirculation Air Filter	Cleaning	3	As required						
	Replacement	3	Replace per 4 cleaning						
2. Ventilation Air Filter	Cleaning	3	As required						
	Replacement	3	Replace per 4 cleaning						
3. Check Refrigerant Quantity		3							
4. Check Compressor Belt Tension		3							
5. Clean Condenser Core		3							
6. Check Tightening Torque		—							
7. Seasonal Maintenance		—	Preseason (once a year), Off-season (once a week)						

1 Recirculation Air Filter



WARNING: Always wear safety glasses or goggles when using compressed air (Less than 0.2 MPa, 2 kgf/cm²) to clean filters.

IMPORTANT: Plugged inner or outer air filter will reduce cooling capacity of the air conditioner. Be sure to clean them periodically.

Cleaning --- As required

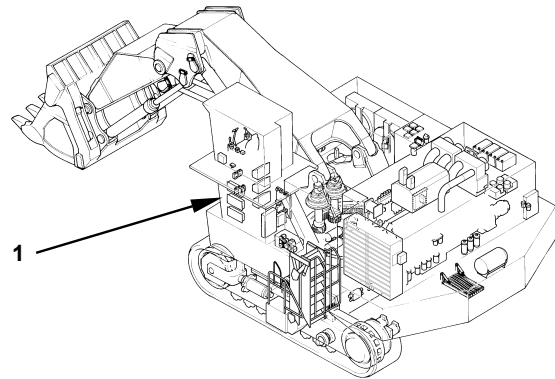
1. Recirculation air filters (2) (three pieces) are located in room (1) under the cab. Open cover (3). Remove recirculation air filters (2).
2. Clean recirculation air filters with compressed air (Less than 0.2 MPa, 2 kgf/cm²) or a soft brush.

Replacing --- Replace per 4 cleaning

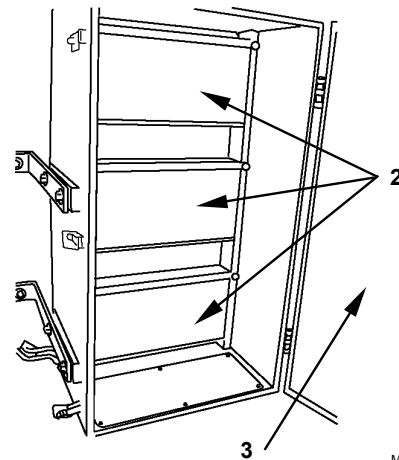
If the cooling capacity decreases even after cleaning recirculation air filters due to filter clogging, replace them.



NOTE: Same filter elements are used for the air conditioner recirculation and ventilation air filters.



M18M-03-007



M18G-07-083

MAINTENANCE

2 Ventilation Air Filter

Clean Air Filter --- As required

WARNING: Always wear safety glasses or goggles when using compressed air (Less than 0.2 MPa, 2 kgf/cm²) to clean filters.

IMPORTANT: Plugged inner or outer air filter will reduce cooling capacity of the air conditioner. Be sure to clean them periodically.

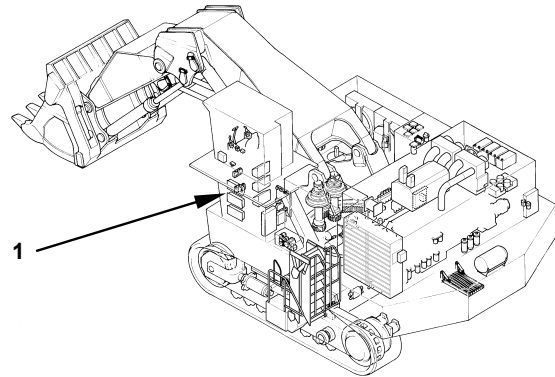
1. Ventilation air filters (2) (three pieces) are located in room (1) under the cab.
Remove ventilation air filters (2).
2. Clean ventilation air filters (2) with compressed air (Less than 0.2 MPa, 2 kgf/cm²) or a soft brush.

Replace Air Filter --- Replace per 4 cleaning

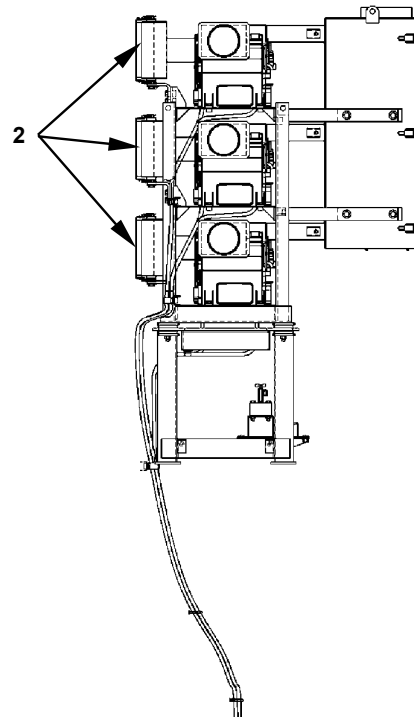
Changing interval of ventilation air filters (2) differs depending on environmental conditions.

If the cooling capacity decreases after cleaning ventilation air filters (2), caused by filter plugging, replace it earlier than the standard interval.

NOTE: Same filter elements are used for the air conditioner recirculation and ventilation air filters.



M18M-03-007



M18G-07-132

MAINTENANCE

3 Check Refrigerant Quantity --- every 250 hours

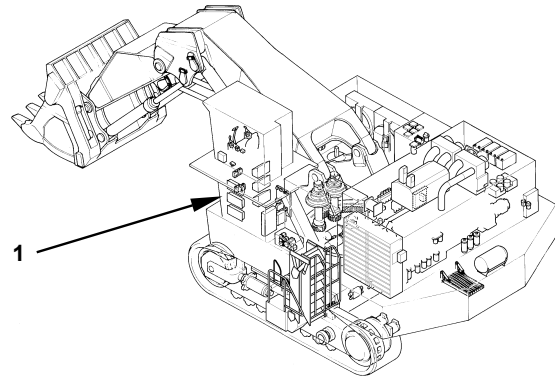
WARNING: DO NOT allow liquid refrigerant to contact eye or skin. Liquid refrigerant will freeze eye or skin on contact. Be careful not to loosen connections in the air conditioner circuit.

IMPORTANT:

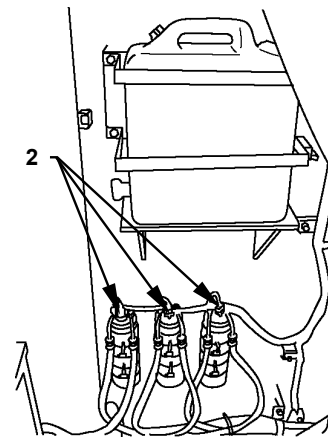
- Do not operate the compressor without refrigerant in the air conditioning circuit, as doing so may damage them.
- Do not overcharge the system with refrigerant to avoid dangerous high pressure and low cooling effect.

Air conditioner liquid tanks (2) (three pieces) are located in room (1) under the cab. Insufficient refrigerant quantity lowers cooling effect of the air conditioner. Check the refrigerant quantity through sight glass on liquid tanks (2) (three pieces).

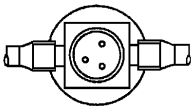
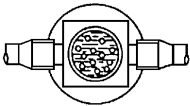
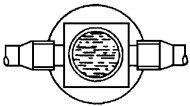
1. Start the engine and run at fast idle speed.
2. Turn the air conditioner and blower fan speed to the high speed.
3. Press temperature control switch repeatedly until the air temperature is maximum cool.
4. Check the refrigerant quantity through sight glass.



M18M-03-007



M18G-07-084

Refrigerant Quantity	Sight Glass	
Appropriate	 M114-07-090	Almost clear. Gas bubbles may be seen but will disappear by changing engine speed.
Insufficient	 M114-07-091	A steady stream of gas bubbles is seen in the liquid flowing from the receiver-dryer.
Scarce	 M114-07-092	No bubbles but misty.

5. If the refrigerant level is low, consult your authorized dealer.

MAINTENANCE

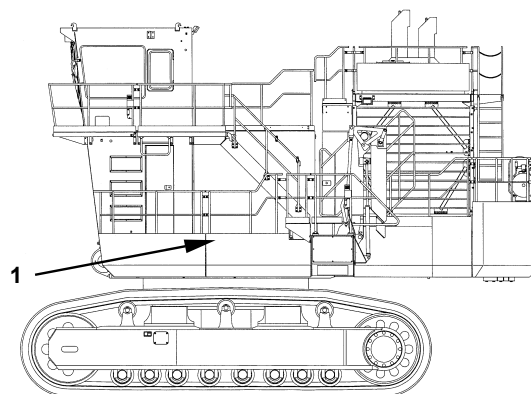
4

Check Compressor Belt Tension --- every 250 hours

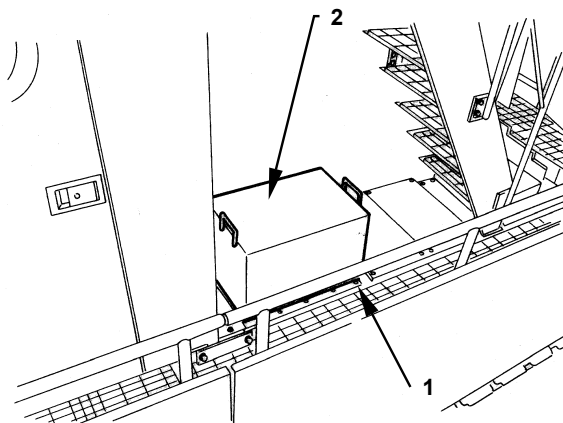
Remove box-type cover (2), located on bed (1) under the step, to gain access to the compressor belt.

Visually check belt for wear. Replace if necessary. Start the engine and run for 10 minutes. Check belt tension by depressing the midpoint between the hydraulic motor and compressor pulleys with the thumb. Deflection must be 13 to 14 mm (0.5 to 0.6 in) at a depressing force of approximately 98 N (10 kgf, 22 lbf).

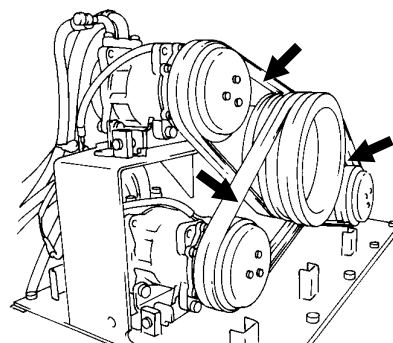
If tension is not within specifications, loosen the compressor mounting bolts to adjust belt tension.



M18M-07-053



M146-07-071



M146-07-001

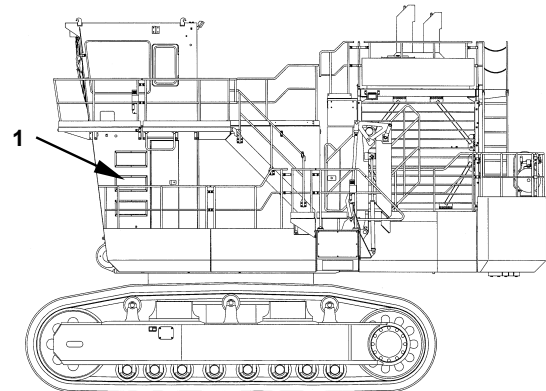
MAINTENANCE

5 Clean Condenser Core --- every 500 hours

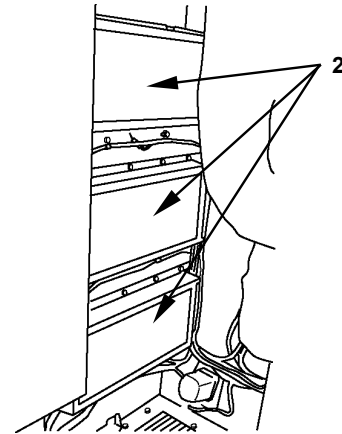
! WARNING: Always wear safety glasses or goggles when using compressed air (Less than 0.2 MPa, 2 kgf/cm², 28 psi) to clean condenser core.

Remove condenser cover (2) (three pieces), located in room (1) under the cab.

Use compressed air (Less than 0.2 MPa, 2 kgf/cm², 28 psi) to clean the condenser core (three pieces).



M18M-07-053



M18G-07-086

MAINTENANCE

6

Check Tightening Torque --- every 250 hours

Check the tightness of mounting bolts, hose connections and fittings every 250 hours. Tighten to torque specifications if any are loose.

Torque Specifications for Hose Connections:

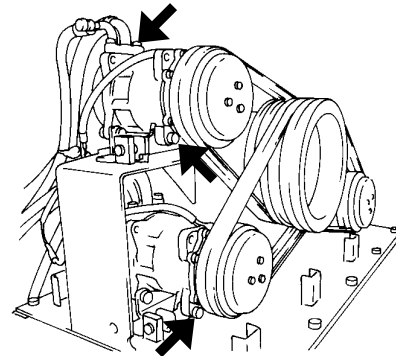
Wrench Size (mm)	Fastening Torque		
	N·m	(kgf·m)	(lbf·ft)
19	11.5 to 14.5	(1.2 to 1.5)	(8.7 to 10.5)
24	19.5 to 24.5	(2 to 2.5)	(14.5 to 18)
27	29.5 to 34	(3 to 3.5)	(21.5 to 25.5)

Torque Specifications for Compressor Mounting Bolts:

Wrench Size (mm)	Fastening Torque		
	N·m	(kgf·m)	(lbf·ft)
10	19.5 to 29.5	(2 to 3)	(14.5 to 21.5)

Torque Specifications for Liquid Tank:

Wrench Size (mm)	Fastening Torque		
	N·m	(kgf·m)	(lbf·ft)
10	7.8 to 11.5	(0.8 to 1.2)	(5.8 to 8.7)



M146-07-001

MAINTENANCE

7

Seasonal Maintenance

--- preseason

--- off-season



WARNING: Do not attempt to loosen connections in air conditioning circuit when the air conditioner malfunctions. Doing so may cause high pressure gas to spout, resulting in serious injury. Consult your authorized dealer immediately.

1. Preseason maintenance

Prior to the season, consult your authorized dealer for maintenance of the air conditioner in order to operate it in good condition during the season.

This maintenance includes replenishment of refrigerant, inspection and replacing (if necessary) of inner and outer air filters, line connections, pressure switches and inspection and cleaning of evaporator.

2. Off-season maintenance

- (1) Operate the compressor once a week at low speed for several minutes in order to maintain its parts in well lubricated condition. Be sure to run the engine at slow idle and air temperature to MEDIUM COOL. This operation also prevents refrigerant leakage caused by a dried up shaft seal.
- (2) Check for refrigerant leakage. If the refrigerant level is low during off-season, rust will form inside the circuit.



NOTE: Do not remove compressor belt from the compressor during off-season.

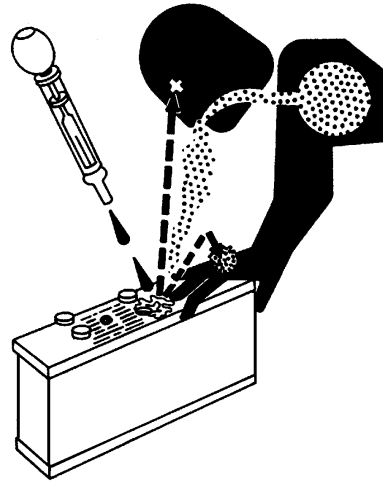
MAINTENANCE

I. ELECTRICAL SYSTEM

! WARNING: Improper radio communication equipment and associated parts, and/or improper installation of radio communication equipment effects the machine's electronic parts, causing involuntary movement of the machine. Also, improper installation of electrical equipment's may cause machine failure and/or a fire on the machine.

Be sure to consult your authorized dealer when installing radio communication equipment or additional electrical parts, or when replacing electrical parts.

Never attempt to disassemble or modify the electrical/electronic components. If replacement or modification of such components is required, contact your authorized dealer.



SA-036

! WARNING: Never allow to wash the electric parts in the machine by water. Example: harness, control box, and relay box etc.

1 Batteries

! WARNING: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check the battery electrolyte level.

Do not continue to use or charge the battery when electrolyte level is lower than specified. Explosion of the battery may result.

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into the eyes.

Avoid hazard by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Using proper booster battery starting procedures.

If you spill acid on yourself:

1. Flush your skin with water.

MAINTENANCE

2. Apply baking soda or lime to help neutralize the acid.
3. If splashed in eyes, flush with water for 10 to 15 minutes. Get medical attention immediately.

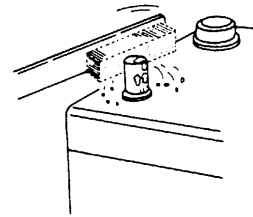
If acid is swallowed:

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

IMPORTANT: Add water to batteries in freezing weather before you begin operating your machine for the day, or else charge the batteries.

IMPORTANT: If the battery is used with the electrolyte level lower than the specified lower level, the battery may deteriorate quickly.

IMPORTANT: Don't refill electrolyte more than the specified upper level. Electrolyte may spill, damaging the painted surfaces and/or corroding other machine parts.



M409-07-072

 **NOTE:** In case electrolyte is refilled more than the specified upper level line or beyond the bottom end of the sleeve, remove the excess electrolyte until the electrolyte level is down to the bottom end of the sleeve using a pipette. After neutralizing the removed electrolyte with sodium bicarbonate, flush it with plenty of water, otherwise, consult the battery manufacturer.

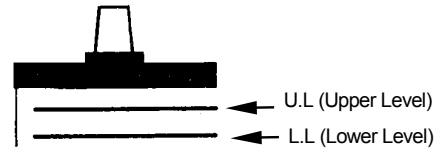
MAINTENANCE

Electrolyte Level Check

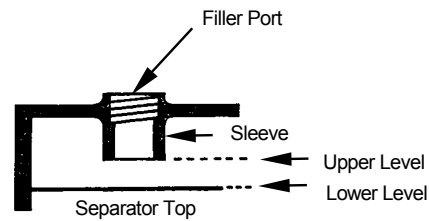
1. Check the electrolyte level at least once a month.
2. Park the machine on level ground and stop the engine.
3. Check the electrolyte level.
 - 3.1 When checking the level from the battery side:

Clean around the level check lines with a wet towel. Don't use a dry towel. Static electricity may be developed, causing the battery gas to explode. Check if the electrolyte level is between U.L (Upper Level) and L.L (Lower Level). In case the electrolyte level is lower than the middle level between the U.L and L.L, immediately refill distilled water or commercial battery fluid. Be sure to refill with distilled water before recharging (operating the machine). After refilling, securely tighten the filler plug.
 - 3.2 When impossible to check the level from the battery side or no level check mark is indicated on the side:

After removing the filler plug from the top of the battery. Check the electrolyte level by viewing through the filler port. It is difficult to judge the accurate electrolyte level in this case. Therefore, when the electrolyte level is flush with the U.L, the level is judged to be proper. Then, referring to the right illustrations, check the level. When the electrolyte level is lower than the bottom end of the sleeve, refill with distilled water or commercial battery fluid up to the bottom end of the sleeve. Be sure to refill with distilled water before recharging (operating the machine). After refilling, securely tighten the filler plug.
 - 3.3 When an indicator is available to check the level, follow its check result.
4. Always keep around the battery terminals clean to prevent battery discharge. Check terminals for loose and/or rust. Coat terminals with grease or petroleum jelly to prevent corrosion build up.



M146-07-109



Proper

M146-07-110



Since the electrolyte surface touches the bottom end of the sleeve, the electrolyte surface is raised due to surface tension so that the electrode ends are seen curved.

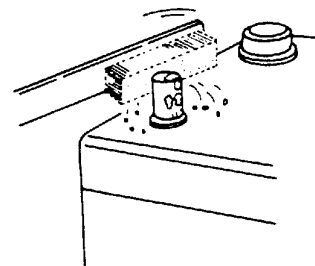
Lower

M146-07-111



When the electrolyte surface is lower than the bottom end of the sleeve, the electrode ends are seen straight.

M146-07-112



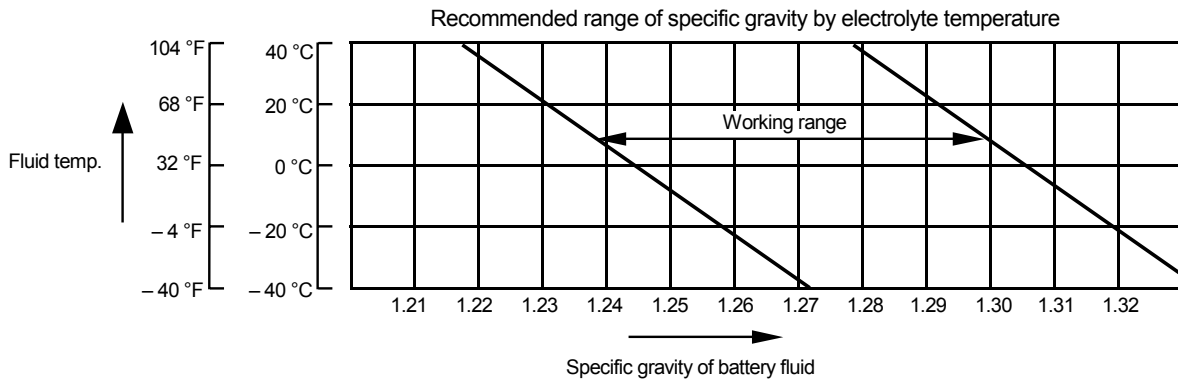
M409-07-072

MAINTENANCE

Check electrolyte specific gravity

IMPORTANT: Check the specific gravity of the electrolyte after it is cooled, not immediately after operation.

Check the electrolyte specific gravity in each battery cell. The lowest limit of the specific gravity for the electrolyte varies depending on electrolyte temperature. The specific gravity should be kept within the range shown below. Charge the battery if the specific gravity is below the limit.



MAINTENANCE

REPLACE BATTERIES

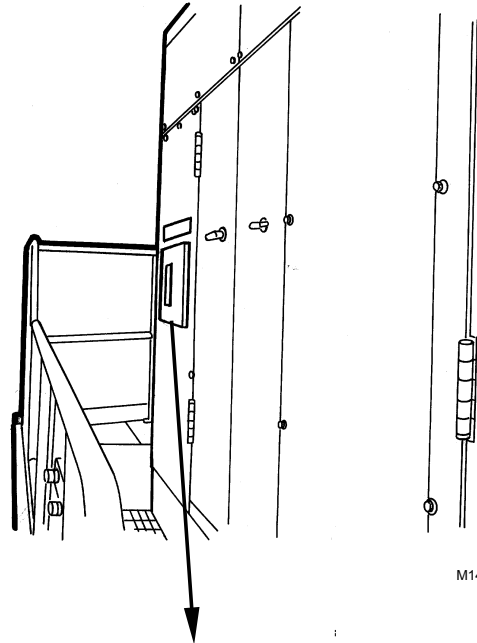
Your machine has four 12-volts batteries with negative (–) ground.

If one of four batteries in a 24-volt system has failed but the others are still good, replace all the batteries together with new ones of the same type. For example, replace a failed maintenance-free battery with a new maintenance-free battery. Different types of batteries may have different rates of charge. This difference could overload one of the batteries and cause it to fail.

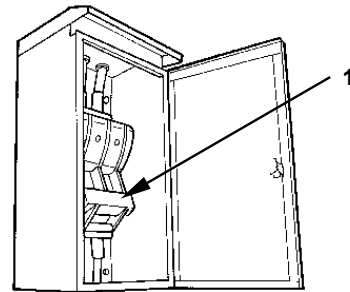
IMPORTANT: Do not pull the disconnecter lever (1) down during operation.

 **NOTE:** *Ground Disconnecter*
This machine is equipped with a battery ground disconnecter located outside of engine unit compartment on the right side. The battery ground circuit can be disconnected by pulling disconnecter lever (1) down before replacing the battery, checking the electrical system, or performing welding work on the machine.

 **CAUTION:** Do not replace the battery in human strength. Use the crane to replace safely.



M146-01-021



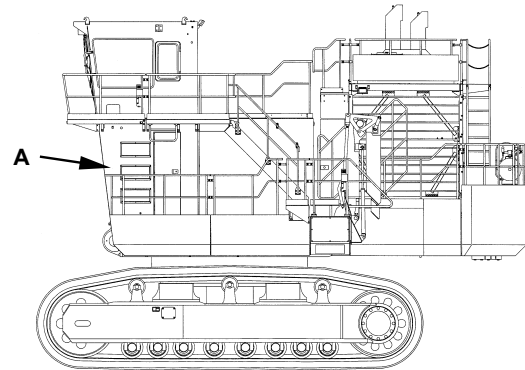
M146-07-062

MAINTENANCE

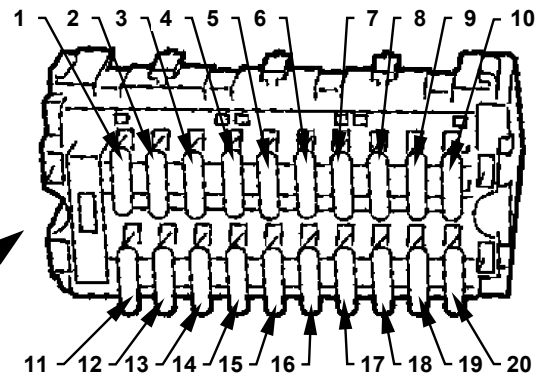
2 Replacing Fuses --- as required

If any electrical component fails, first check the fuses in the fuse box, located in room (A) under the cab. Remove fuse box cover and confirm that the fuses shown below are provided.

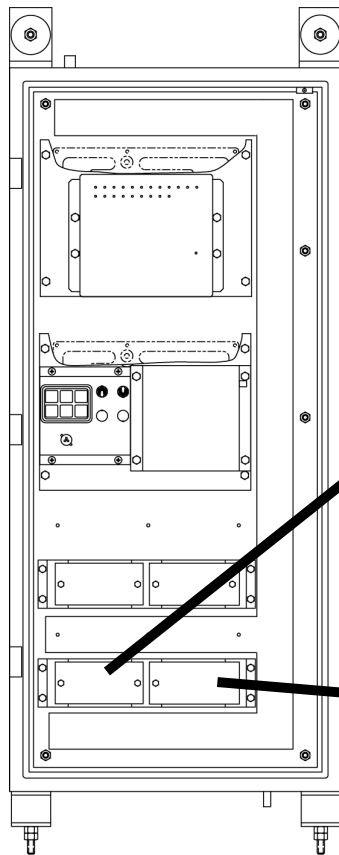
IMPORTANT: Install fuse with correct amperage rating to prevent electrical system damage from overload.



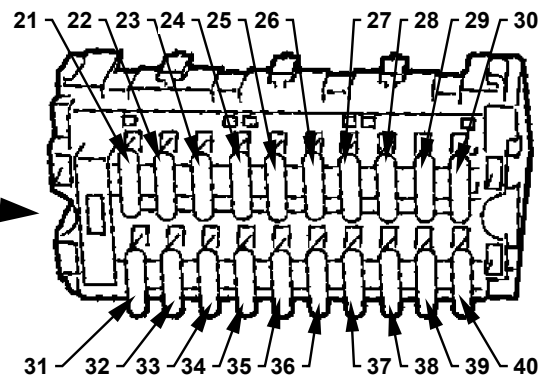
M18M-07-053



T18G-05-07-001



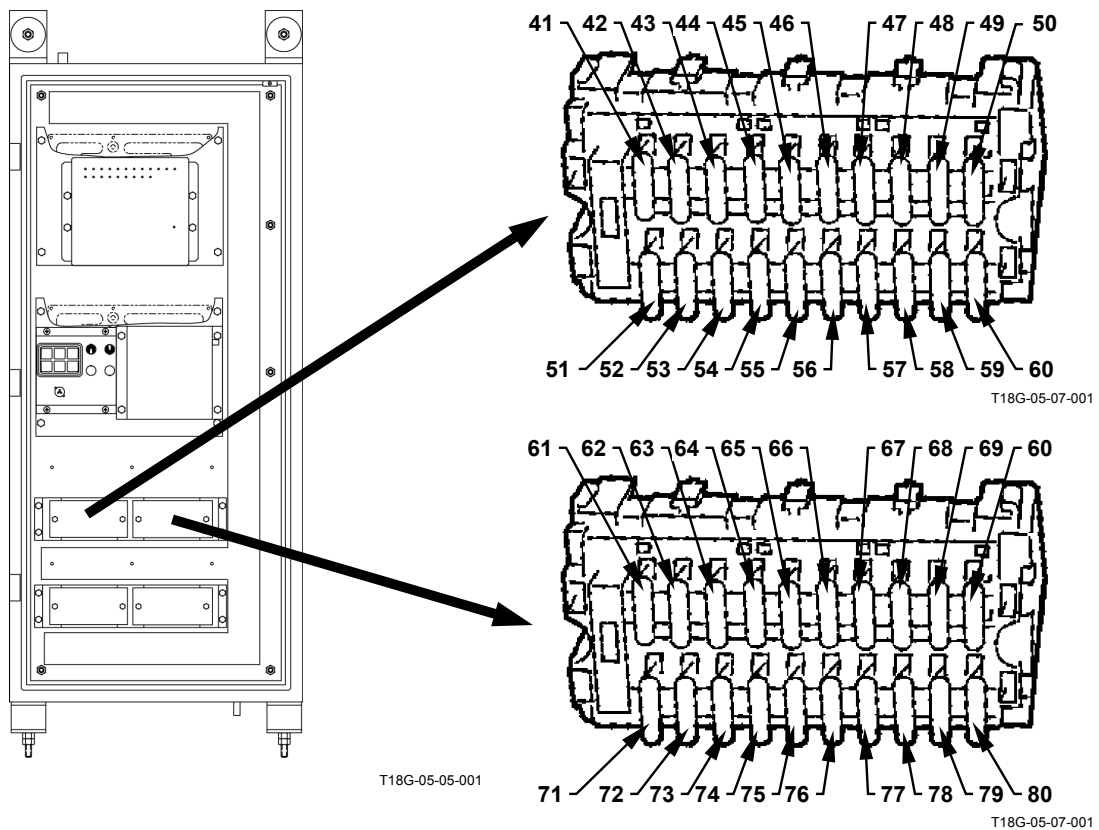
M18M-07-054



T18G-05-07-001

- | | | | |
|--------------------------------|--------------------------------|----------------------------------|--------------------------------|
| 1- MC MAIN POWER 5A | 11- OPT. C/U MAIN POWER 10A | 21- WASHER MOTOR RELAY 5A | 31- A/C MAIN POWER (FRONT) 15A |
| 2- DELAYED POWER OFF RELAY 5A | 12- OPT. C/U MAIN POWER 10A | 22- TRAVEL SPEED SELECT RELAY 5A | 32- A/C MAIN POWER (SIDE) 15A |
| 3- ---- | 13- OPT. C/U KEY ON SIG. 5A | 23- A/C MAIN RELAY (FRONT) 5A | 33- A/C MAIN POWER (REAR) 15A |
| 4- MMS BACKUP 5A | 14- OPT. C/U KEY ON SIG. 5A | 24- A/C MAIN RELAY (SIDE) 5A | 34- A/C C. FAN (FRONT) 20A |
| 5- HMU MAIN POWER 5A | 15- MC KEY ON SIG. 5A | 25- A/C MAIN RELAY (REAR) 5A | 35- A/C C. FAN (SIDE) 20A |
| 6- AIR HORN COMPRESSOR (L) 30A | 16- ELU PWM POWER RELAY 5A | 26- BATTERY RELAY 5A | 36- A/C C. FAN (REAR) 20A |
| 7- AIR HORN COMPRESSOR (R) 30A | 17- DLU OPT. KEY SW ON SIG. 5A | 27- A/C CONTROL AMP (FRONT) 5A | 37- DLU SERVICE TOOL 5A |
| 8- FOLDING STAIRWAY SOL(A) 10A | 18- ---- | 28- A/C CONTROL AMP (SIDE) 5A | 38- ORBCOMM MAIN PAWER 5A |
| 9- BOX LIGHT 5A | 19- ECM LAMP POWER 5A | 29- A/C CONTROL AMP (REAR) 5A | 39- MMS MAIN PAWER 5A |
| 10- CAB. BATTERY POWER 30A | 20- HMU KEY ON SIG. 5A | 30- MOTION ALARM 5A | 40- CHARGE SIG. 5A |

MAINTENANCE

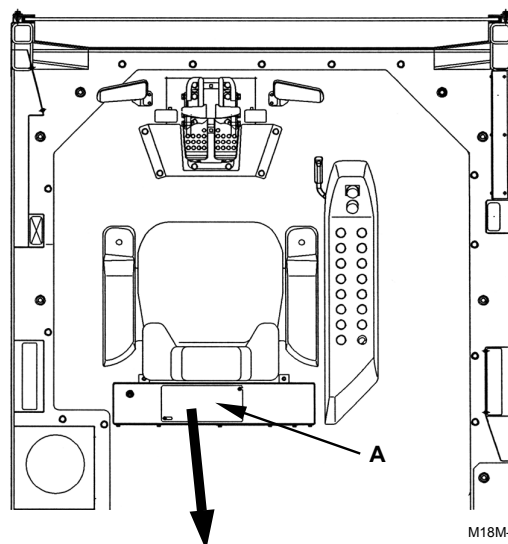


41- SEAT SUSPENSION	51- MC SOL. POWER 10A	61- WORK LIGHT (1) 10A	71- -----
AIR COMPRESSOR 15A	52- MC PWM POWER 10A	62- WORK LIGHT (2) 10A	72- -----
42- -----	53- ELU SOL. POWER 15A	63- WORK LIGHT (3) 10A	73- ENTRANCE LIGHT (1) 10A
43- -----	54- -----	64- WORK LIGHT (4) 10A	74- -----
44- TRAVEL SPEED SELECTOR	55- ECM DATA LINK 15A	65- WORK LIGHT (5) 10A	75- WIPER MOTOR (LOW) 30A
SOL. 5A	56- -----	66- WORK LIGHT (6) 10A	76- WIPER MOTOR (HIGH) 30A
45- FOLDING STAIRWAY SOL (B)	57- -----	67- MAINTENANCE LIGHT (1) 10A	77- WASHER MOTOR 10A
5A	58- -----	68- MAINTENANCE LIGHT (2) 10A	78- FAST FILLING SYSTEM SOL.
46- DOME LED LIGHT 5A	59- ENG.OIL RESERVE TANK	69- MAINTENANCE LIGHT (3) 10A	5A
47- AIR BREATHER SOL. 5A	PUMPING UNIT 15A	70- MAINTENANCE LIGHT (4) 10A	79- CSU MAIN POWER 5A
48- TERMINAL (24V) 15A	60- OIL PUMP 20A		80- -----
49- DC/DC CONVERTER (1) 15A			
50- DC/DC CONVERTER (2) 15A			

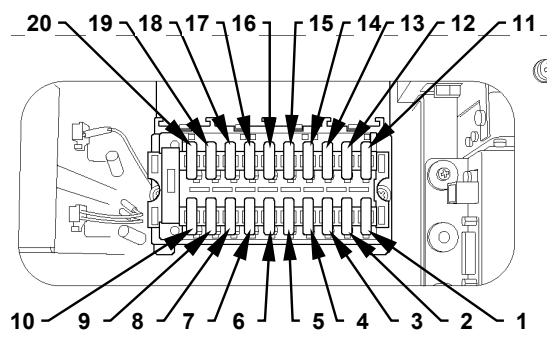
MAINTENANCE

Remove cover (A) on the rear console in the cab. Also, check the fuses.

- 1- MAIN POWER KEY SW 20A
- 2- ELU MAIN POWER 5A
- 3- IDU MAIN POWER 5A
- 4- DLU MAIN POWER 5A
- 5- ORBCOMM BATTERY POWER 5A
- 6- RADIO BACKUP 5A
- 7- ELU KEY ON SIG. 5A
- 8- IDU KEY ON SIG. 5A
- 9- DLU KEY ON SIG. 5A
- 10- BUZZER 5A
- 11- KEY ON SIG. (CONTROL BOX) 5A
- 12- ECM KEY ON SIG. 5A
- 13- RADIO (ACC) 5A
- 14- AIR HORN COMP. ACC SIG. 5A
- 15- LIGHTER 10A
- 16- TERMINAL (ACC) 10A
- 17- TERMINAL (12V) 15A
- 18- -----
- 19- MONITOR CONTROL UNIT 5A
- 20- PILOT CONTROL SHUT-OFF LEVER SW 5A



M18M-01-007

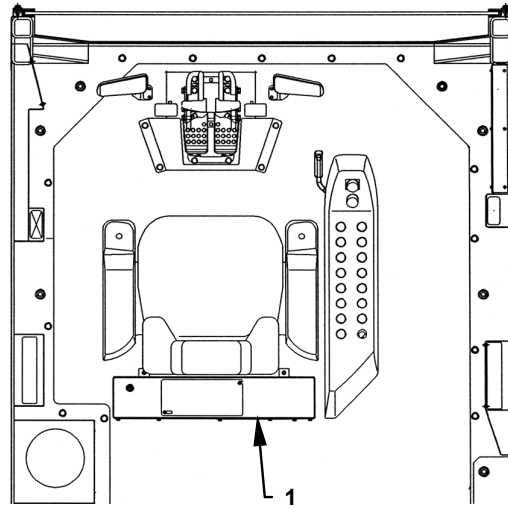


T18G-01-02-030

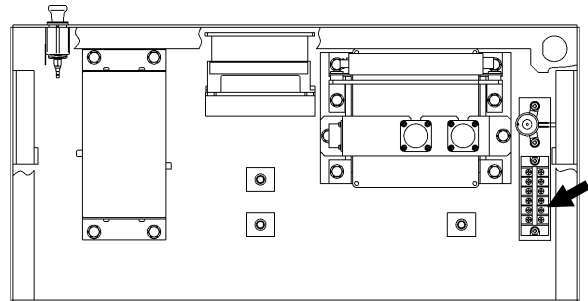
MAINTENANCE

3 Power Source Terminal

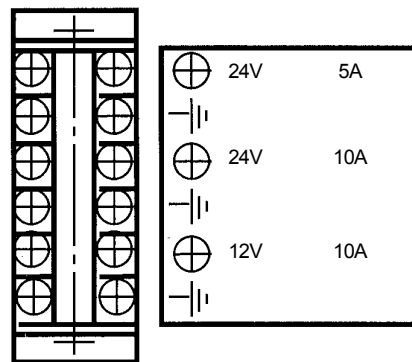
- 12 Volts and 24 Volts Terminal
Remove cover (1) on the rear console in the cab. 12 volts and 24 volts terminal are located in the rear console. Use this terminal to power electrical devices of 12 volts and 24 volts rating. Fuses for this terminal are provided with 5 ampere and 10 ampere fuses.



M18M-01-007



T18G-01-02-026



M18M-07-062

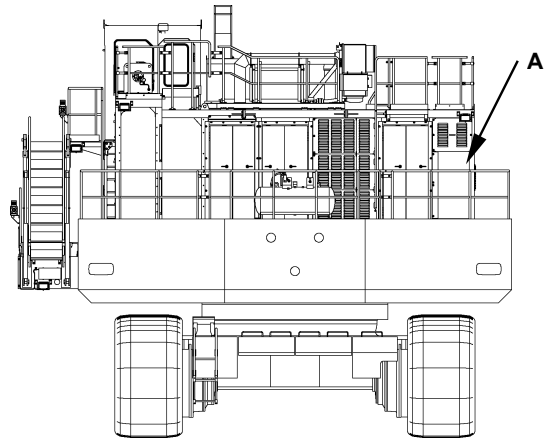
MAINTENANCE

4 High Current Fuse

High current fuses are located in engine unit (A).

High current fuses protect electric main circuit against excessive current.

If high current fuses is melted and disconnected by short circuit, see your authorized dealer.



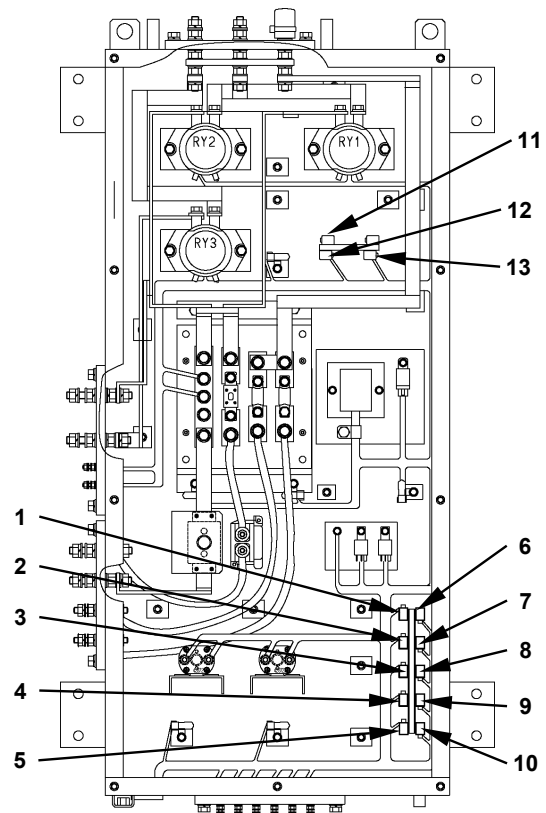
M18M-07-055

High Current Fuse Connection Table (1)

No.		
1	75A	FUSE BOX; FUSE No.1, 2, 4 to 12, 55
2	75A	FUSE BOX; FUSE No.31 to 33, 69, 70
3	75A	FUSE BOX; FUSE No.30, 34 to 36, 48 to 50, 73
4	75A	FUSE BOX; FUSE No.37 to 39, 44 to 47, 53, 59, 60, 67, 68, 77 to 79
5	75A	FUSE BOX; FUSE No.61 to 66
6	75A	FUSE BOX ; FUSE No.41, 51, 52, 75, 76
7	45A	OPTION TERMINAL
8	75A	ENGINE STARTER RELAY
9	45A	ECM POWER
10	75A	FOLDING STAIRWAY RELAY

Fuse

No.		
11	10A	ENG. OIL FILL. SYS. VALVE
12	5A	IDU (PRELUB SIG.)
13	30A	ZENER DIODE

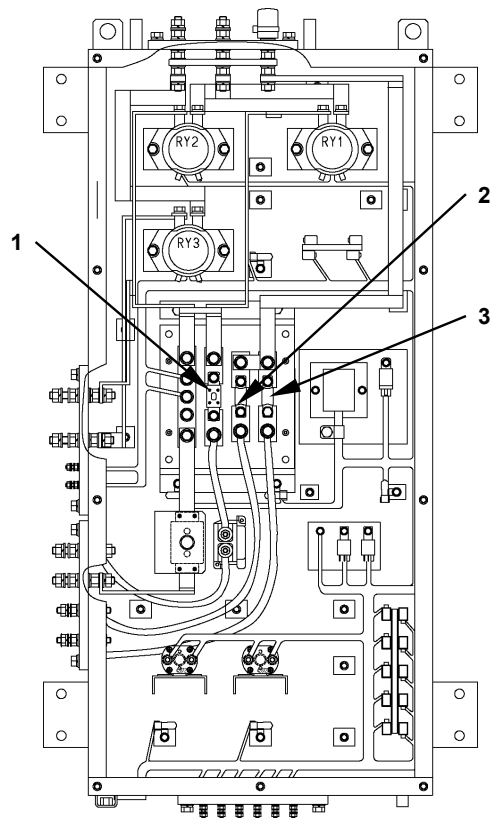


M18M-07-056

MAINTENANCE

High Current Fuse Connection Table (2)

No.	Amp	
1	400A	PRELUB RELAY
2	250A	FOLDING STAIRWAY MOTOR 1
3	250A	FOLDING STAIRWAY MOTOR 2



M18M-07-056

MAINTENANCE

5

Check Electrical Cables and Wire Harnesses for Short Circuits



WARNING: Short circuits can cause fires that may result in serious injury.

To avoid this hazard:

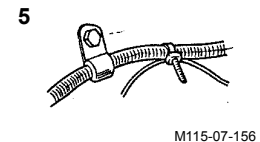
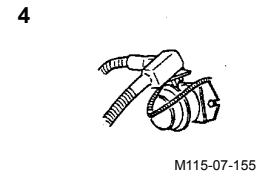
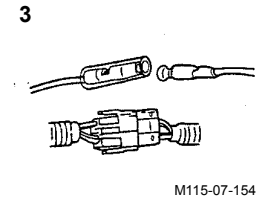
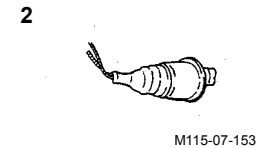
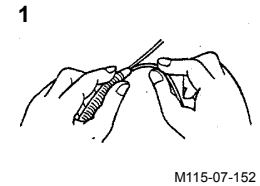
1. Park the machine on a solid, level surface. Lower the bucket to the ground. Stop the engine. Remove key from the key switch. Pull the pilot control shut-off lever to the LOCK position.
2. Clean and tighten all electrical connections.
3. Check before each shift or after ten (10) hours of operation for loose, kinked, hardened or frayed electrical cables and wires.
Check before each shift or after ten (10) hours of missing or damaged terminal caps.
DO NOT OPERATE MACHINE if cable or wire are loose, kinked, etc.

Check cables and harnesses at the check points indicated below for damage that may result in future short circuits. If any abnormalities are found, replace, retighten or reconnect them, as shown in Table 1.
4. Tighten, repair or replace any loose or damaged electrical cables, wires, and terminal caps before operating the machine.

MAINTENANCE

Table 1. Electrical Cables and Wire Harnesses

Interval (hours)	Check Points	Abnormalities	Remedies
Daily	Wire harnesses and cables (1)	Degree of hardening	Replace
		Cracks	Replace
		Worn tape	Replace
		Contact with part edge	Replace
		Missing cap (harness terminal)	Replace
		Loose screw terminal	Retighten
		Damaged at the contacting part with clamps	Replace
	Lead wires of sensor and solenoid valve (2)	Degree of hardening	Replace
		Cracks	Replace
		Worn tape	Replace
		Contact with part edge	Replace
	Connector (3)	Degree of Hardening	Replace
		Loose locking	Lock
		Contact with part edge	Replace
		Damaged and crushed parts	Replace
		Loose or worn part	Replace
	Terminal and terminal cover (4)	Degree of hardening of cover	Replace
		Cracks	Replace
		Worn cover	Replace
		Missing cover	Replace
		Loose locking	Reconnect
	Clamps of the harnesses or connectors (5)	Missing	Replace
		Clamping positions	Correcting
		Damage	Replace



 **NOTE:** Refer to the illustrations in Fig. 1 for each check point location.
Replace the damaged parts with genuine Hitachi parts.

Fig. 1

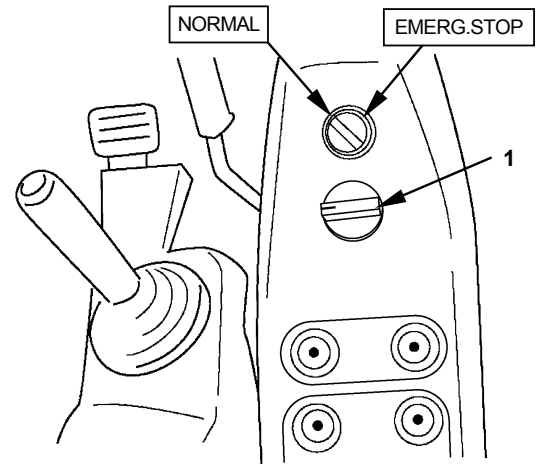
MAINTENANCE

6 Check Emergency Engine Stop Switch --- Every 250 Hours

Check the emergency engine stop switch function every 250 hours, following the procedures below.

1. Start the engine and run at slow idle.
2. Turn emergency engine stop switch (1) to the EMERG STOP position.
3. Confirm that the engine stops.

If any abnormalities are found, be sure to repair them before operating the machine.



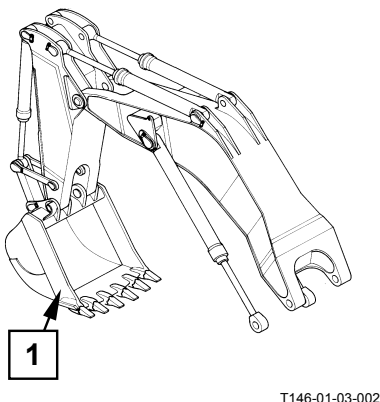
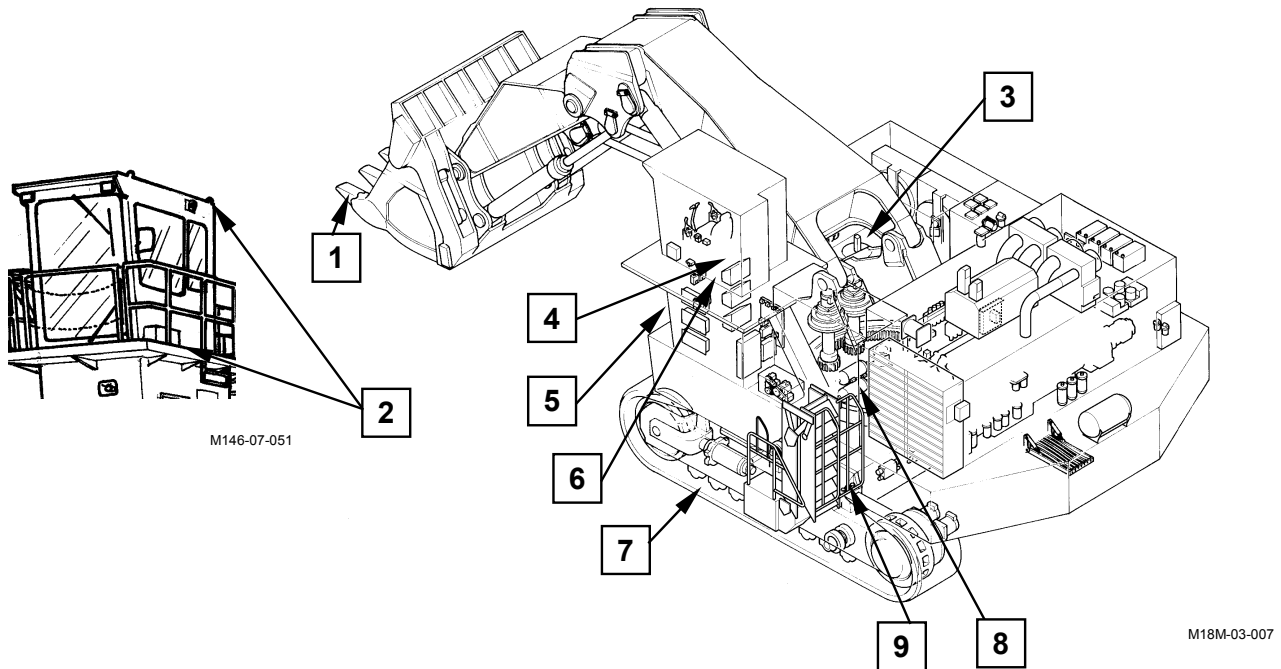
M18M-01-004

MAINTENANCE

J. MISCELLANEOUS

Parts		Quantity	Interval (hours)						
			10	50	250	500	1000	1500	3000
1. Check Bucket Teeth for Wear and Looseness		6							
2. Inspect Emergency Rope and Rope Mounting Hardware		1							
3. Check Auto-Lubrication System		1							
4. Seat Belt	Check	2							
	Replacement	2	At least once every 3 years						
5. Check Washer Tank		2	As required						
6. Air Horn Compressor Filter	Cleaning	1	As required						
7. Check and Adjust Track Sag		2							
8. Check Accumulator and Track Adjuster Cylinder Circuit		2	Every year						
9. Clean Side Frame Area		2							
10. Check Tightening Torque of Bolts and Nuts		–		★					

 NOTE: ★ First time only.



MAINTENANCE

1 Check Bucket Teeth --- every 10 hours

1. Check bucket teeth for wear and looseness

Replace teeth if tooth wear exceeds the designated service limit shown below.

Dimension A in mm (ft, in.)		
	New	Limit of Use
Loading Shovel Bucket	520 (1' 8")	290 (11")
Backhoe Bucket	470 (1' 7")	260 (10")

If point (1) is worn excessively, making a hole, new point (1) cannot be installed on worn nose (2).

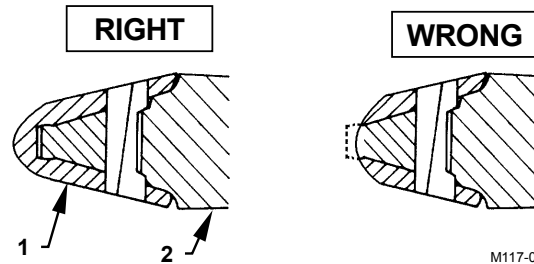
NOTE: Check the bucket teeth periodically so that wear does not exceed the designed service limit.

Alternate buckets may use different tooth assemblies.

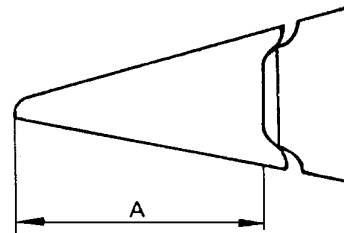
2. Replacing procedure

WARNING: Guard against injury from flying pieces of metal. Wear goggles or safety glasses.

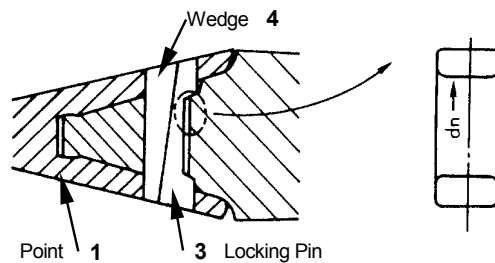
1. Install point (1) and locking pin (3).
The side of the locking pin marked "up →" must be installed upward as shown in the figure.
2. Use a 7 to 10 kg (15 to 22 lb) hammer and drive out wedge (4).
3. Drive the wedge so that the difference between the top of wedge and the surface of the point is less than 50 mm (2 in).
4. Cut the lower end the wedge longer than the surface of the point by gas.



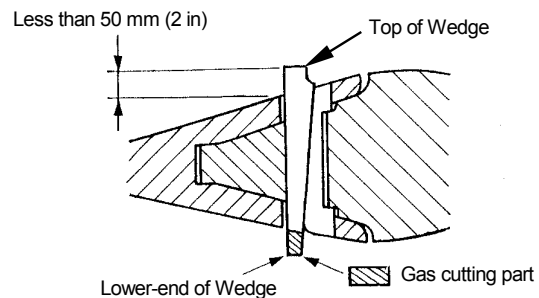
M117-07-153



M115-07-094



M115-07-136

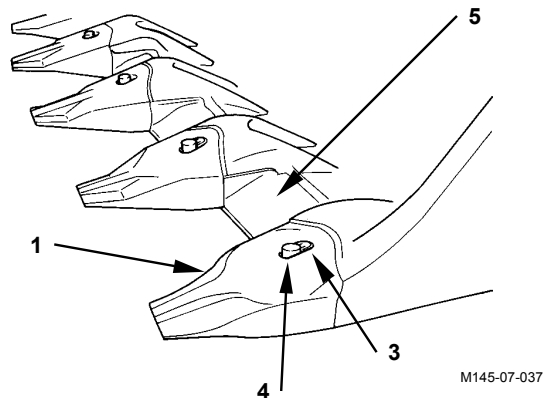


M115-07-097

MAINTENANCE

3. Maintenance

1. Drive wedge (4) using a hammer again after operating 2 to 4 hours.
2. Drive wedge (4) every morning for the first week of operation.
3. Drive wedge (4) once a month from the second week.
4. Cut the projected part using gas when the lower end of wedge (4) projects from the bottom surface of point (1).
5. Replace the wedge (4) with oversize wedge 110W₂ (4202527) when its top is flush with the upper surface of point (1).
6. When wedge (4) tends to come out of point (1), apply spot welding to wedge (4) and spool (3) after driving the wedge in point (1).

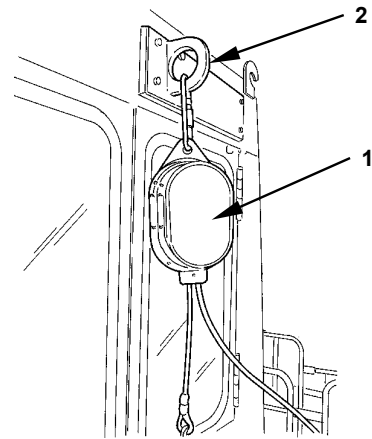


 **NOTE:** When installing new point and shroud (5), remove the hooks attached to them using gas.

MAINTENANCE

2 Inspect Emergency Evacuation Equipment and Hanger --- daily

Inspect emergency evacuation equipment (1) and hanger (2) before operating the machine. If any item is worn and/or damaged, replace the equipment and/or hanger with genuine Hitachi parts.



M146-07-002

MAINTENANCE

3 Auto-Lubrication System --- daily

The machine is equipped with auto-lubrication system for the front attachment joint pins, swing bearing and center joint.

Checking Indicator Pins

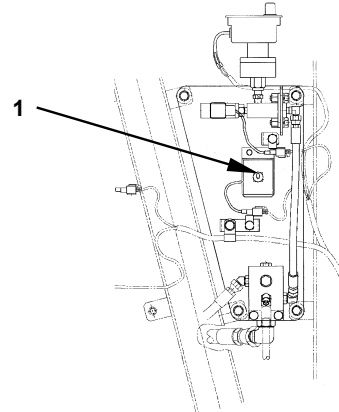
IMPORTANT: The auto-lubrication system is equipped with injectors (3) for greasing. Check indicator pins (2) of injectors (3) every day to confirm that greasing is done correctly. Also, check grease piping for leakage.

1. Move auto-lubrication toggle switch (1) located in front of oil cooler to the MANUAL position. Check that the grease pump begins operating and indicator pins (2) retract.
2. Move auto-lubrication toggle switch (1) to the AUTO LUB. position. Indicator pin positions are as follows:

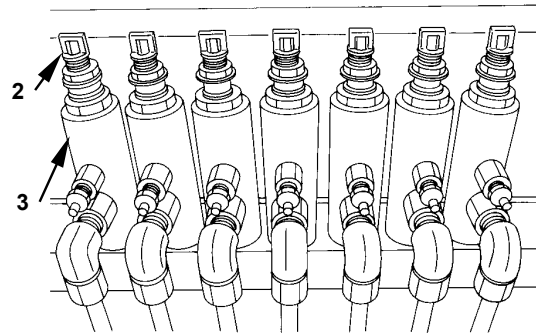
Indicator pins (2) are retracted while the grease pump is operating.

Indicator pins (2) are extended while the grease pump is stopped.

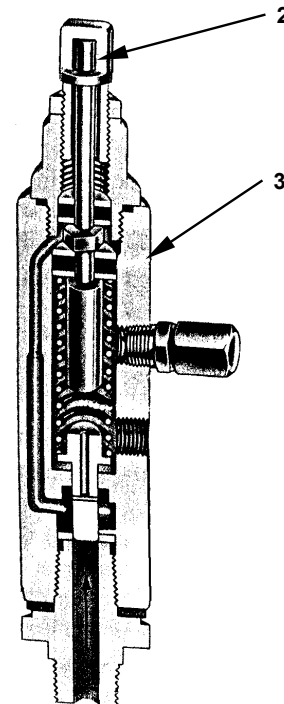
 **NOTE:** The stroke of pin movement differs depending on the greasing volume of injectors (3).



M18M-07-038



M145-07-029



M117-07-173

MAINTENANCE

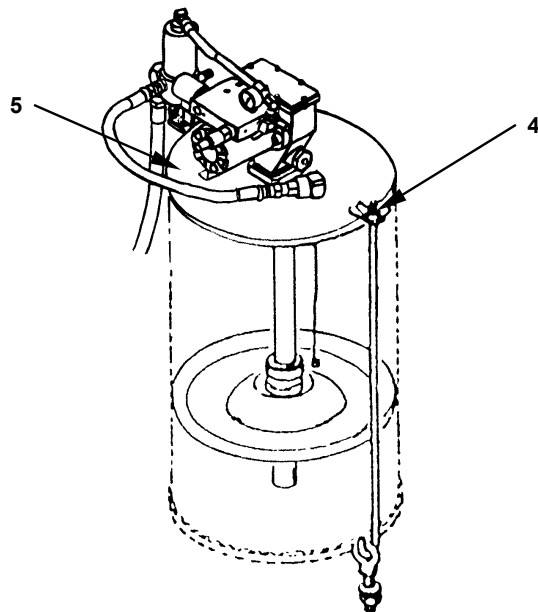
Check Grease Level --- daily

Remove two wing nuts (4). Open grease-can top cover assembly (5) to check quantity of grease inside. Add grease if necessary.

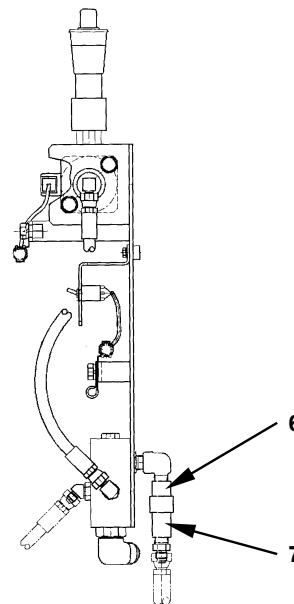
Automatic Greasing

Move auto-lubrication toggle switch (3) to the AUTO LUB. position. Disconnect hose (6) at coupler (7). The grease pump intermittently delivers grease for approximately one minute with an interval of 10 minutes according to the greasing schedule preset at the factory. The greasing schedule, interval and volume, can be adjusted as shown next page.

IMPORTANT: Do not adjust greasing interval to be too long or the greasing volume to be too small.



M146-07-107



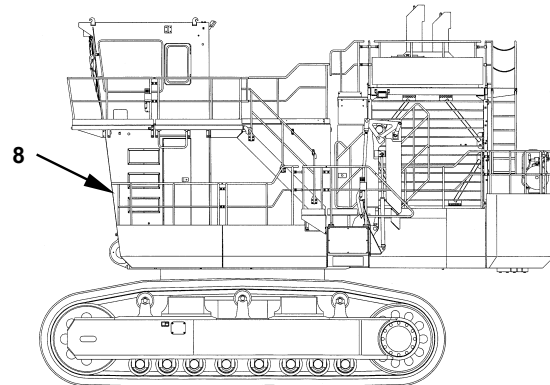
M18M-07-037

MAINTENANCE

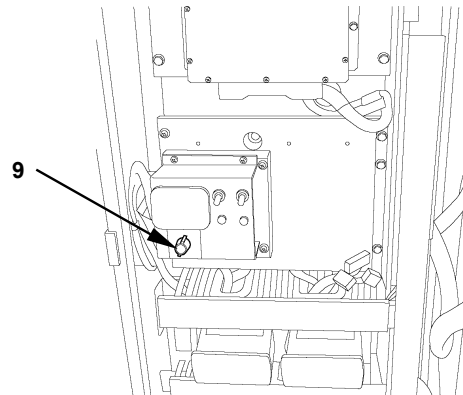
1. Adjusting Greasing Interval

Turn adjusting switch (9) located in room (8) under the cab to the desired position out of four possible positions: 3, 5, 10, and 15 minutes.

Greasing Interval (minutes)
3
5
10
15



M18M-07-053



M18M-07-057

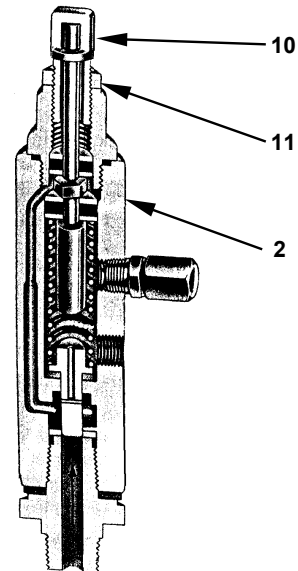
2. Adjusting Greasing Volume

Loosen locknut (11) on injector (2). Turn adjusting nut (10) clockwise until it stops. This is the minimum delivery position of 0.168 cm^3 (0.010 in^3). Turn adjusting nut (10) counterclockwise approximately 10 turns. This is the maximum delivery position of 1.165 cm^3 (0.071 in^3). Select appropriate greasing volume between the maximum and minimum volumes. Tighten locknut (11).

 **NOTE:** Injectors (2) have been adjusted as shown below at the time of shipment:

Front attachment joint pins: Maximum
Swing bearing: Minimum
Center joint: Minimum

Model	SL-I	SL-II
Min. Volume	$0.168 \pm 40\%$	$1.165 \pm 15\%$
Max. Volume	$1.165 \pm 40\%$	$8.163 \pm 5\%$



M117-07-173

MAINTENANCE

Manual Greasing

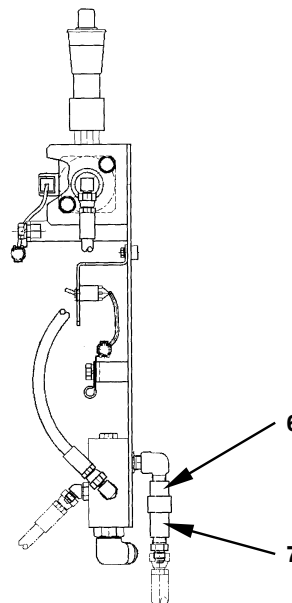
Connect hose (7) to coupler (6).

Move auto-lubrication toggle switch (1) to the MANUAL position.

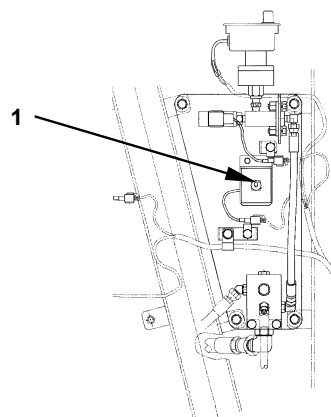
Apply grease using a grease gun. Refer to pages 7-24 to 7-35 of this manual.

After finishing greasing, disconnect hose (7) from coupler (6), release grease pressure in hose reel (12) via the grease gun.

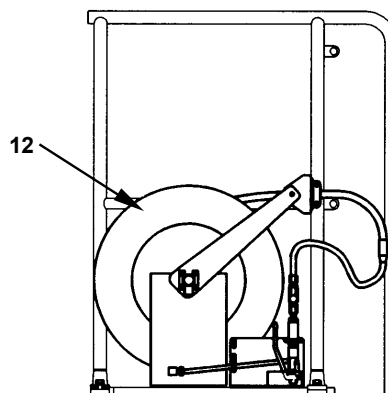
 **NOTE:** When manual greasing is selected, the auto-lubrication indicator on the monitor display will come on. This is not abnormal.



M18M-07-037



M18M-07-038



M146-07-105

MAINTENANCE

4

Check and Replace Seat Belt

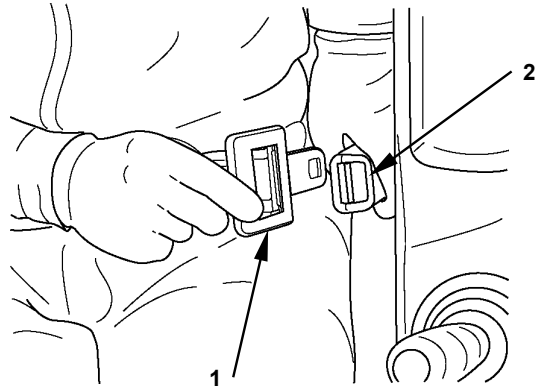
Check --- daily

Replace --- every 3 years

Always maintain the seat belt in a functional condition and replace when necessary to ensure proper performance.

Prior to operating the machine, thoroughly examine belt (1), buckle (2) and attaching hardware. If any item is damaged or materially worn, replace the seat belt or component before operating the machine.

We recommend that the seat belt be replaced every three years regardless of its apparent condition.



M18G-01-058

5

Check Windshield Washer Fluid Lever

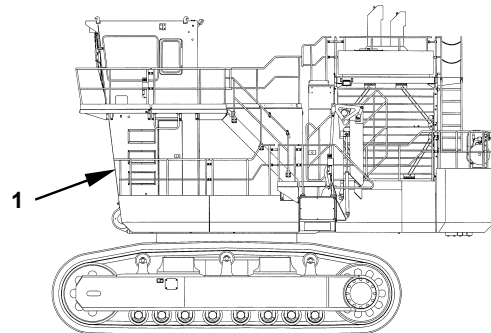
--- as required

Windshield washer tank (2) is located in room (1) under the cab.

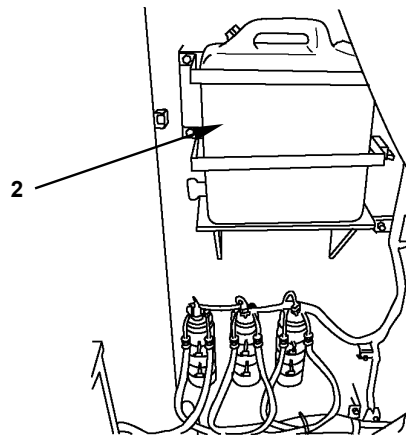
Check fluid in windshield washer tank (2).

If the fluid level is low, remove cap of windshield washer tank (2) and add fluid via the opening.

During winter season, use all season windshield washer which will not freeze.



M18M-07-053



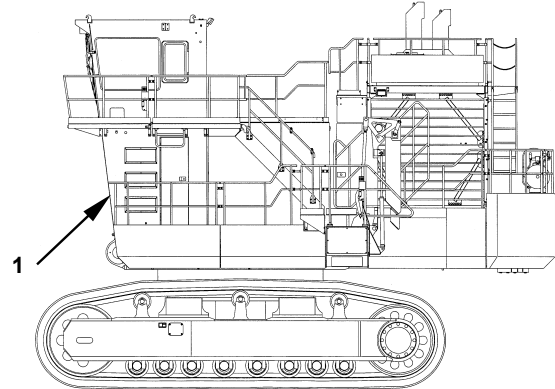
M18G-07-084

MAINTENANCE

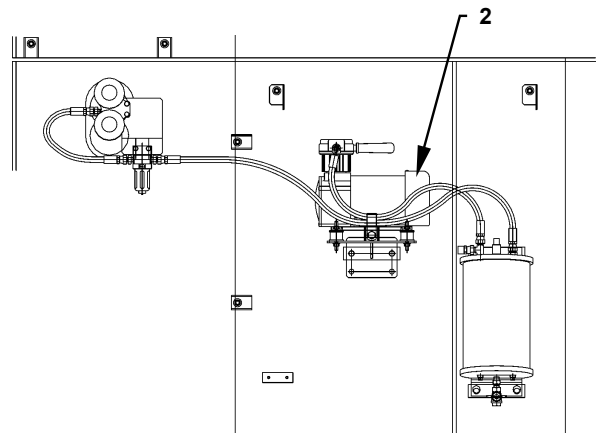
6

Clean Air Horn Compressor Filter --- as required

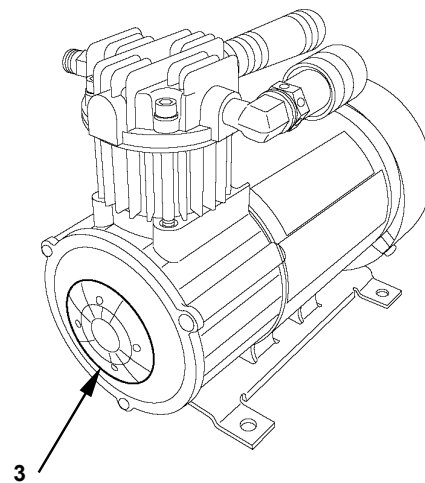
Air horn compressor (2) is located in room (1) under the cab. Remove the cap (3) and clean the filter.



M18M-07-053



M18M-07-066



M18M-07-067

MAINTENANCE

7

Check and Adjust Track Sag --- every 50 hours



WARNING: Be sure to place blocks under the machine frame to support the machine when one track is raised off ground.

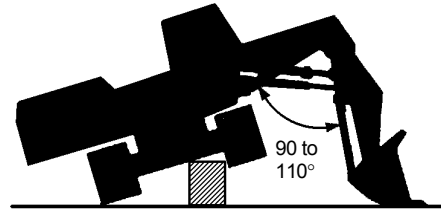
Swing the upperstructure 90° and lower the bucket to raise the track off the ground as shown.

Keep the angle between the boom and arm 90 to 110° and position the bucket's round side on the ground. Place blocks under the machine frame to support the machine. Rotate track one full rotation. Thoroughly clean track area to remove soil.

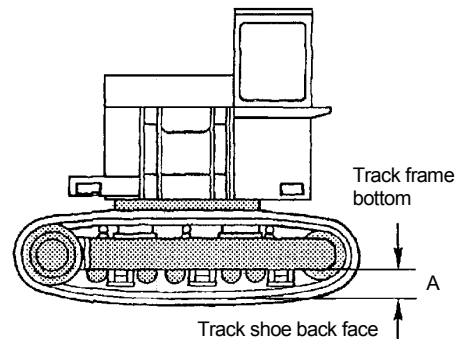
Measure distance (A) at the middle of the track frame from the bottom of the track frame to the back face of the track shoe.

Track sag specifications --- 580 to 620 mm
(22.8 in to 24.4 in)

 **NOTE:** When operating the machine on sand, gravel, snow or mud, providing longer track sag is recommended in the above-mentioned value range.



M117-05-030



M115-07-170

Precautions for Adjusting Track Sag

1. When measuring track sag after adjusting, be sure to rotate the raised track one full rotation.
2. When adjusting track sag, lower the bucket to the ground to raise one track off the ground. Repeat this procedure to raise the other track. Each time, be sure to place blocks under the machine frame to support the machine.
3. When operating the machine after it has been stored for a long time or its track adjuster cylinder hose or piping has been replaced, first push the right travel lever forward to extend adjuster cylinder, and then add grease to the fitting to tighten the tracks.

MAINTENANCE

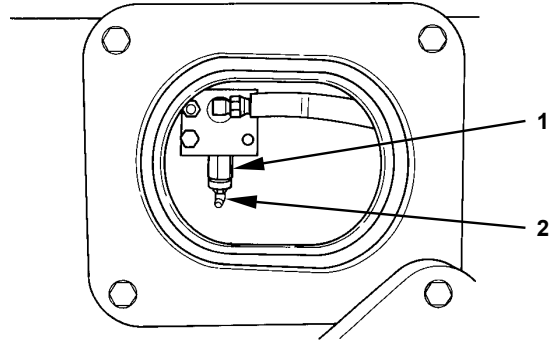
Loosen the Track



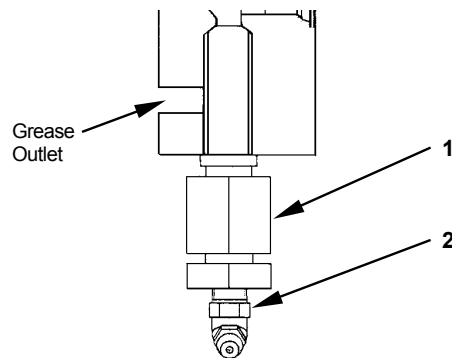
WARNING: Do not loosen valve (1) quickly or loosen it too much as high-pressure grease in the adjusting cylinder may spout out. Loosen carefully, keeping body parts and face away from valve (1).
Never loosen grease fitting (2).

IMPORTANT: When gravel or mud is packed between sprockets and track links, remove it before loosening.

1. To loosen the track, slowly turn valve (1) counter-clockwise using long socket 24; grease will escape from the grease outlet.
2. Between 1 to 1.5 turns of valve (1) is sufficient to loosen the track.
3. If grease does not drain smoothly, slowly rotate the raised track.
4. When proper track sag is obtained, turn valve (1) clockwise and tighten to 147 N·m (15 kgf·m, 108 lbf·ft).



M117-07-074



M117-07-105

Tighten the Track



WARNING: It is abnormal if the track remains tight after turning valve (1) counterclockwise or if the track is still loose after charging grease to fitting (2). In such cases, **NEVER ATTEMPT TO DIS-ASSEMBLE** the track shoes or track adjuster, because of dangerous high-pressure grease inside the track adjuster. See your authorized dealer immediately.

To tighten the track, connect grease lubricator or a grease gun to grease fitting (2) and add grease until the sag is within specifications.

MAINTENANCE

8

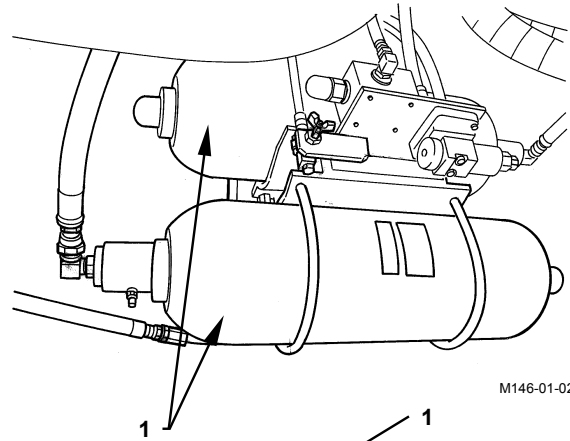
Check Accumulator and Track Adjuster Cylinder Circuit --- every year



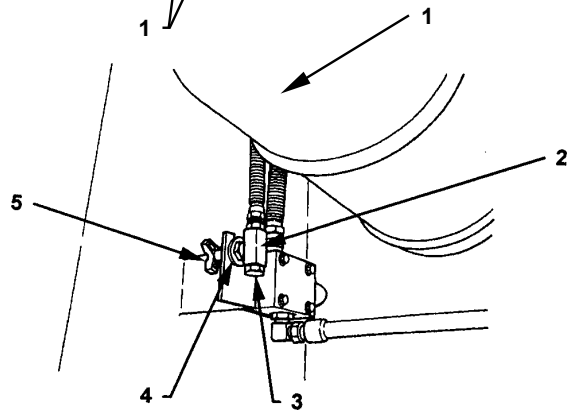
WARNING: Accumulator (1) in the track adjuster cylinder circuit is charged with high-pressure nitrogen. Be sure to release pressure before servicing the hose between accumulator and track adjuster cylinder circuit, following the procedure shown below.

1. Loosen lock nut (4) of valve (2) located under accumulator (1).
2. Confirm that handle (5) is sufficiently tightened by turning it clockwise. Remove plug (3).
3. Slowly turn handle (5) counterclockwise to open valve; pressurized oil escapes gradually.

IMPORTANT: Low pressure in the track adjuster cylinder circuit will cause damage to the track adjuster and travel device. Be sure to check the accumulator and adjuster cylinder circuit regularly to maintain correct circuit pressure. Consult your authorized dealer when checking accumulator.



M146-01-025



M146-07-081

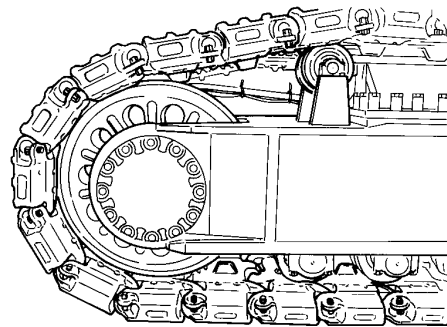
9

Check Side Frame Area --- daily

Soil or rocks stuck in the side frame area will disturb smooth rotation of the undercarriage components such as the lower rollers, upper rollers, sprockets or front idlers.

Remove soil and rocks from the area every day. In addition, clean the area at least once a week.

Be sure to thoroughly clean the area in cold seasons to prevent excessive wear of upper rollers due to freezing.



M117-07-075

MAINTENANCE

10

Check Tightening Torque of Bolts and Nuts --- every 250 hours (first time after 50 hours)

Check tightness after the first 50 hours then every 250 hours. Tighten to torque shown if any are loose. Bolts and nuts should be replaced with those of the same or higher grade.

IMPORTANT: Check and tighten bolts and nuts using a torque wrench.

Torque Specifications

No.	Descriptions	Bolt Dia (mm)	Q'ty	Wrench Size (mm)	Torque		
					N·m	(kgf·m)	(lbf·ft)
1	Engine cushion rubber mounting bolt	36	10	55	3140	(320)	(2310)
2	Engine bracket mounting bolt	a	16	50	1950	(200)	(1440)
		b	32	30	540	(55)	(400)
		c	6	32	740	(75)	(540)
3	Hydraulic oil tank mounting bolt	33	12	50	1910	(195)	(1410)
4	Fuel tank mounting bolt	33	18	50	1910	(195)	(1410)
5	Pump transmission mounting bolt	12	16	19	110	(11)	(81)
6	Pump mounting bolt (Main pump)	24	16	36	950	(97)	(700)
	Pump mounting bolt (Fan pump)	20	4	30	550	(56)	(410)
7	Gear pump mounting bolt	14	6	22	140	(14)	(103)
8	Air con. Compressor drive pump mounting bolt	14	2	22	140	(14)	(103)
9	Control valve mounting bolt	20	16	30	390	(40)	(290)
10	Swing device mounting bolt	33	56	55	2550	(260)	(1880)
		24	96	36	950	(97)	(700)
11	Swing motor mounting bolt	20	16	30	390	(40)	(290)
12	Battery mounting bolt	6	16	10	20	(2)	(15)
13	Cab mounting bolt	18	10	27	300	(31)	(220)
14	Cab bed mounting bolt	12	49	19	110	(11)	(81)
15	Cab cushion rubber mounting bolt	12	40	19	110	(11)	(81)
16	Swing bearing mounting bolt (Upperstructure)	56	60	85	9810	(1000)	(7230)
	Swing bearing mounting bolt (Track)	56	60	85	9810	(1000)	(7230)
17	Counterweight mounting bolt	56	11	85	6860	(700)	(5060)
18	Travel motor mounting bolt	20	16	30	390	(40)	(290)
19	Upper roller mounting bolt	22	24	32	740	(75)	(540)
20	Lower roller mounting bolt	45	64	70	4710	(480)	(3470)
21	Radiator mounting bolt	27	8	41	1370	(140)	(1010)
22	Travel device mounting bolt (A)	30	24	46	1910	(195)	(1410)
	Travel device mounting bolt (B)	39	56	60	4410	(450)	(3250)
	Travel device mounting bolt (C)	20	36	30	390	(40)	(290)
23	Side frame mounting bolt	56	68	85	9810	(1000)	(7230)
24	Track pin-retaining bolt	30	152	46	1910	(195)	(1410)
25	Front pin-retaining bolt (Loader) (A)	12	40	19	88	(9)	(65)
	Front pin-retaining bolt (Loader) (B)	16	12	24	205	(21)	(152)
	Front pin-retaining bolt (Loader) (C)	24	12	36	932	(95)	(690)
	Front pin-retaining bolt (Loader) (D)	20	24	30	540	(55)	(400)
	Front pin-retaining bolt (Loader) (E)	27	10	(19)	1029	(105)	(760)
26	Front pin-retaining bolt (Backhoe) (A)	20	24	30	390	(40)	(290)
	Front pin-retaining bolt (Backhoe) (B)	16	12	24	205	(21)	(152)
	Front pin-retaining bolt (Backhoe) (C)	24	12	36	932	(95)	(687)

MAINTENANCE

Tightening Torque Chart

Bolt Dia.	Wrench Size	Hexagon Wrench Size	  M552-07-091			  M552-07-090			  M157-07-225		
			Socket Bolt								
			N·m	(kgf·m)	(lbf·ft)	N·m	(kgf·m)	(lbf·ft)	N·m	(kgf·m)	(lbf·ft)
M8	13	6	30	(3.1)	(22)	20	(2.0)	(15.0)	10	(1.0)	(7.4)
M10	17	8	65	(6.6)	(48)	50	(5.1)	(37)	20	(2.0)	(15.0)
M12	19	10	110	(11.0)	(81)	90	(9.2)	(66)	35	(3.6)	(26.0)
M14	22	12	180	(18.5)	(135)	140	(14.0)	(103)	55	(5.6)	(41)
M16	24	14	270	(27.5)	(200)	210	(21.5)	(155)	80	(8.2)	(59)
M18	27	14	400	(41.0)	(295)	300	(30.5)	(220)	120	(12.0)	(89)
M20	30	17	550	(56.0)	(410)	400	(41.0)	(295)	170	(17.0)	(125)
M22	32	17	750	(76.5)	(550)	550	(56.0)	(410)	220	(22.5)	(162)
M24	36	19	950	(97.0)	(700)	700	(71.5)	(520)	280	(28.5)	(205)
M27	41	19	1400	(143)	(1030)	1050	(107)	(770)	400	(41.0)	(295)
M30	46	22	1950	(200)	(1440)	1450	(148)	(1070)	550	(56.0)	(410)
M33	50	24	2600	(265)	(1920)	1950	(200)	(1440)	750	(76.5)	(550)
M36	55	27	3200	(325)	(2360)	2450	(250)	(1810)	950	(97.0)	(700)

IMPORTANT: Make sure bolt and nut threads are clean before installing.
Apply lubricant (e. g. white zinc B solved into spindle oil) to bolts and nuts to stabilize their friction coefficient.

 **NOTE:** Tightening torque required is shown in N·m.
For example, when tightening a bolt or nut with a wrench of 1 m length, turning the end of it with a force of 120 N, the torque produced will be:

$$1 \text{ m} \times 120 \text{ N} = 120 \text{ N} \cdot \text{m}$$

To produce the same torque with a wrench of 0.25 m:

$$0.25 \text{ m} \times \boxed{} \text{ N} = 120 \text{ N} \cdot \text{m}$$

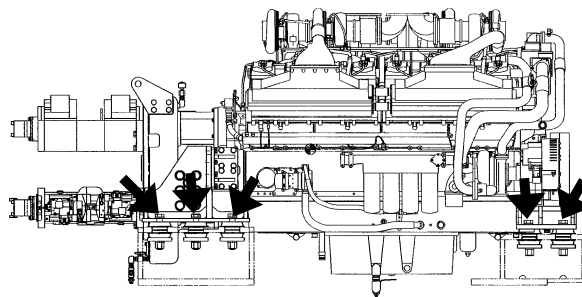
Necessary force will be:

$$120 \text{ N} \cdot \text{m} \div 0.25 \text{ m} = 480 \text{ N}$$

MAINTENANCE

1. Engine cushion rubber mounting bolts.

Tool: 55 mm
Torque: 3140 N·m (320 kgf·m, 2310 lbf·ft)



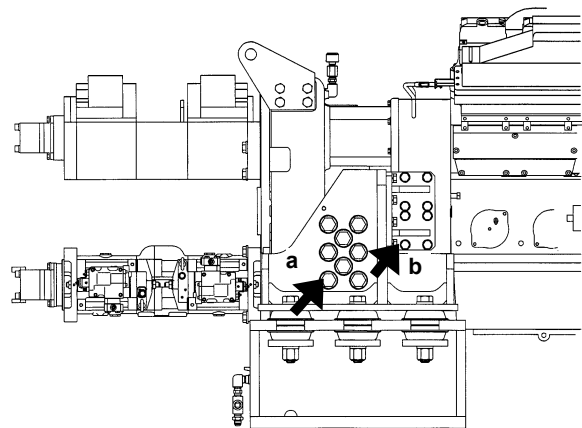
M18M-07-058

2. Engine bracket mounting bolts.

Engine flywheel side

a

Tool: 50 mm
Torque: 1950 N·m (200 kgf·m, 1440 lbf·ft)



M18M-07-059

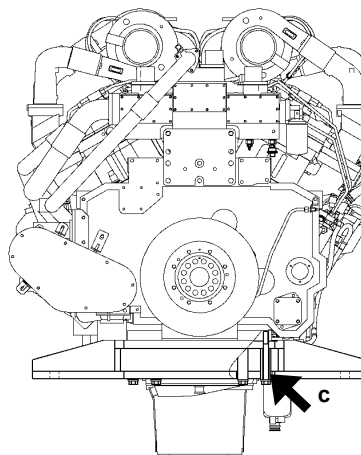
b

Tool: 30 mm
Torque: 540 N·m (55 kgf·m, 400 lbf·ft)

Engine fan side

c

Tool: 32 mm
Torque: 740 N·m (75 kgf·m, 540 lbf·ft)



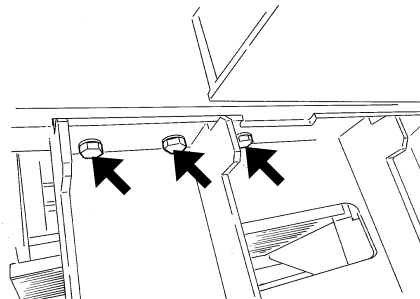
M18M-07-060

MAINTENANCE

3. Hydraulic tank mounting bolts.

Tool: 50 mm

Torque: 1910 N·m (195 kgf·m, 1410 lbf·ft)

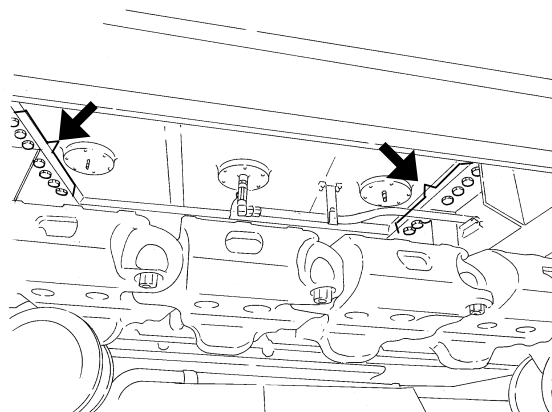


M146-07-052

4. Fuel tank mounting bolts.

Tool: 50 mm

Torque: 1910 N·m (195 kgf·m, 1410 lbf·ft)

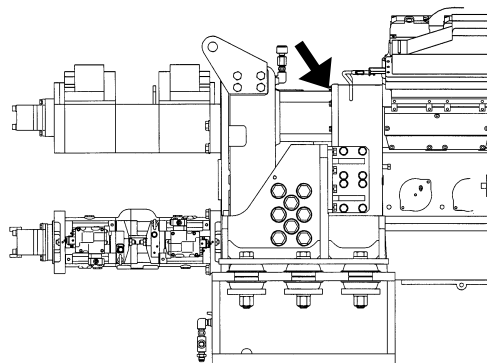


M146-07-053

5. Pump transmission mounting bolt.

Tool: 19 mm

Torque: 110 N·m (11 kgf·m, 81 lbf·ft)



M18M-07-059

6. Pump mounting bolts.

Main pump

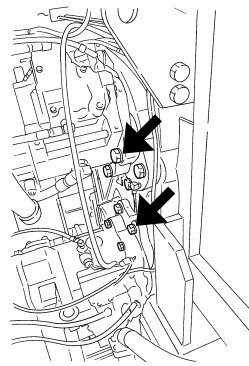
Tool: Hex. Wrench 36 mm

Torque: 950 N·m (97 kgf·m, 700 lbf·ft)

Fan pump

Tool: Hex. Wrench 30 mm

Torque: 550 N·m (56 kgf·m, 410 lbf·ft)



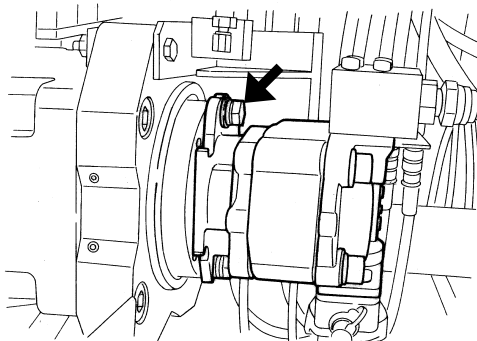
M146-07-054

MAINTENANCE

7. Gear pump mounting bolt.

Tool: 22 mm

Torque: 140 N·m (14 kgf·m, 103 lbf·ft)

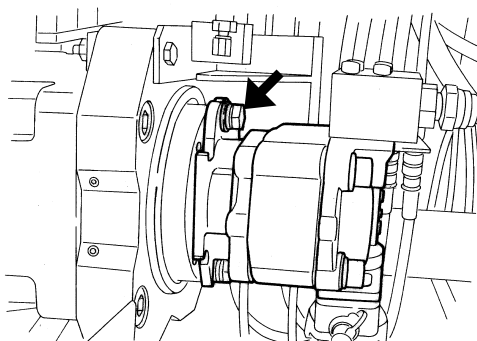


146-07-076

8. Air con. compressor drive pump mounting bolt.

Tool: 22 mm

Torque: 140 N·m (14 kgf·m, 103 lbf·ft)

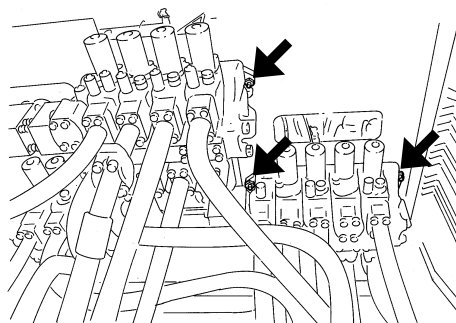


M146-07-076

9. Control valve mounting bolts.

Tool: 30 mm

Torque: 390 N·m (40 kgf·m, 290 lbf·ft)



M146-07-055

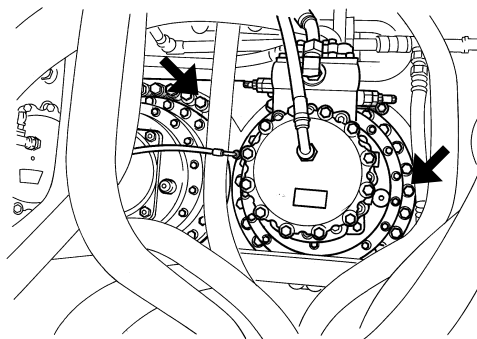
10. Swing device mounting bolts.

Tool: 55 mm

Torque: 2550 N·m (260 kgf·m, 1880 lbf·ft)

Tool: 36 mm

Torque: 950 N·m (97 kgf·m, 700 lbf·ft)



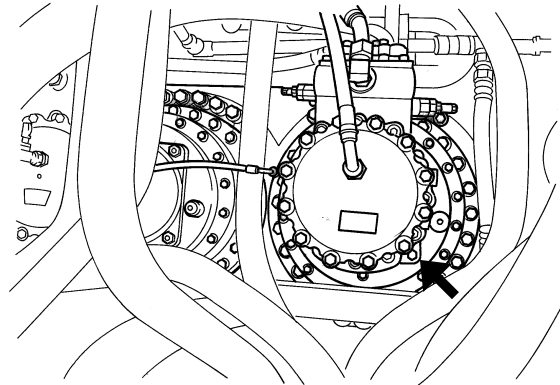
M146-07-028

MAINTENANCE

11. Swing motor mounting bolt.

Tool: 30 mm

Torque: 390 N·m (40 kgf·m, 290 lbf·ft)

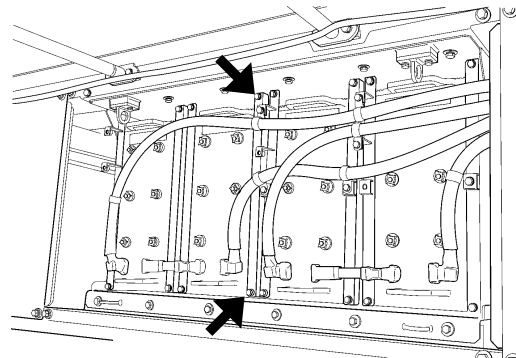


M146-07-028

12. Battery mounting bolts.

Tool: 10 mm

Torque: 20 N·m (2 kgf·m, 15 lbf·ft)

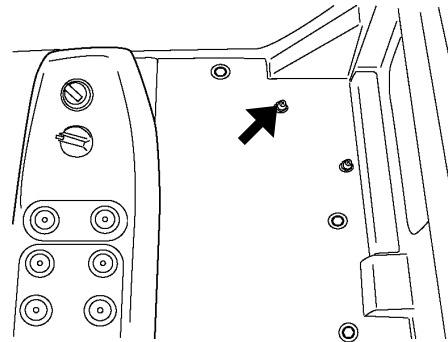


M146-07-080

13. Cab mounting bolt.

Tool: 27 mm

Torque: 300 N·m (31 kgf·m, 220 lbf·ft)

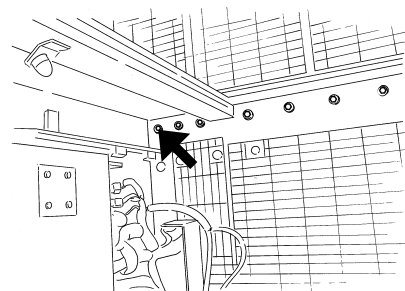


M18M-07-061

14. Cab bed mounting bolt.

Tool: 19 mm

Torque: 110 N·m (11 kgf·m, 81 lbf·ft)



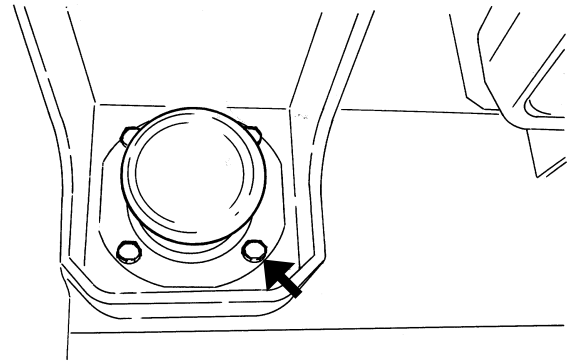
M146-07-057

MAINTENANCE

15. Cab cushion rubber mounting bolts.

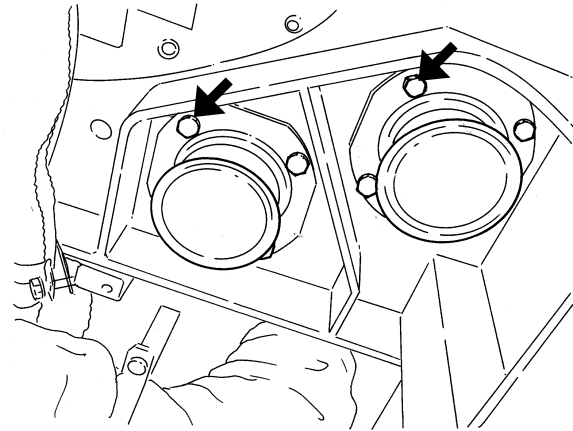
Tool: 19 mm

Torque: 110 N·m (11 kgf·m, 81 lbf·ft)



(Front Side)

M146-07-063



(Rear Side)

M146-07-064

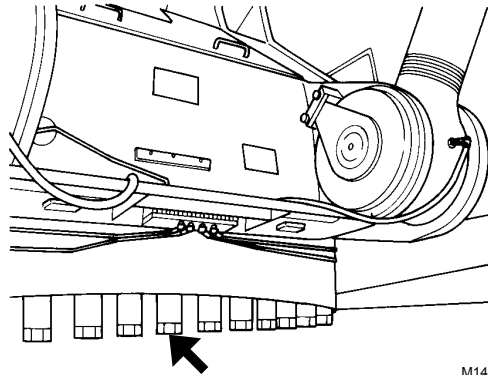
MAINTENANCE

16. Swing bearing mounting bolt.

Upperstructure

Tool: 85 mm

Torque: 9810 N·m (1000 kgf·m, 7230 lbf·ft)



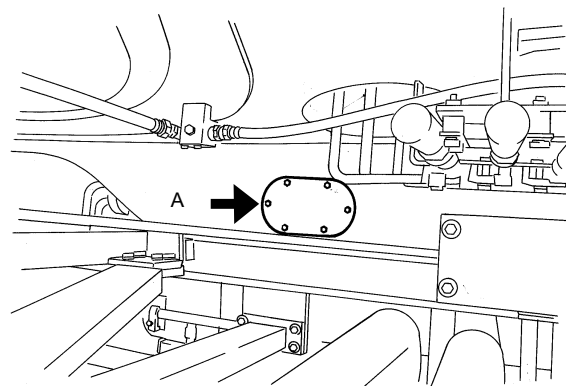
M144-07-100

Track

Remove cover (A) and check the tightening torque.

Tool: 85 mm

Torque: 9810 N·m (1000 kgf·m, 7230 lbf·ft)

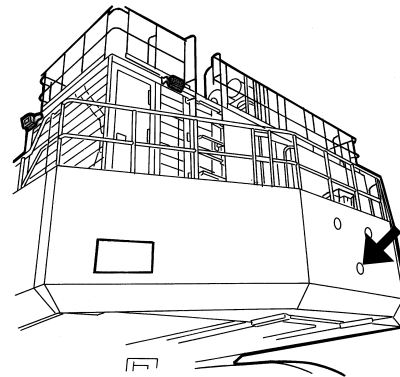


M146-07-023

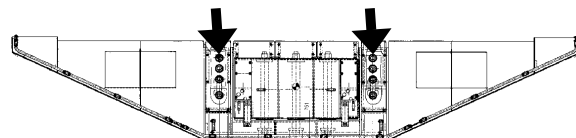
17. Counterweight mounting bolt.

Tool: 85 mm

Torque: 6860 N·m (700 kgf·m, 5060 lbf·ft)



M146-01-022



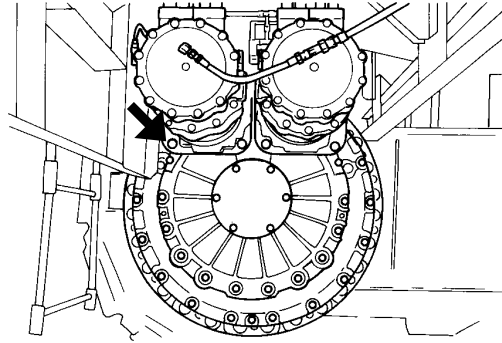
M18M-07-069

MAINTENANCE

18. Travel motor mounting bolt.

Tool: 30 mm

Torque: 390 N·m (40 kgf·m, 290 lbf·ft)

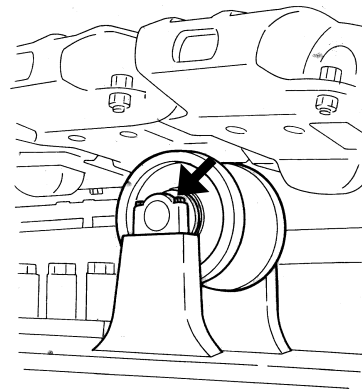


M145-07-079

19. Upper roller mounting bolt.

Tool: 32 mm

Torque: 740 N·m (75 kgf·m, 540 lbf·ft)

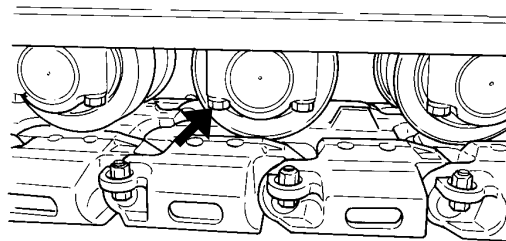


M146-07-077

20. Lower roller mounting bolt.

Tool: 70 mm

Torque: 4710 N·m (480 kgf·m, 3470 lbf·ft)



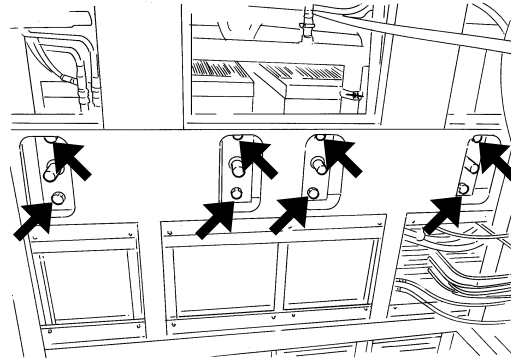
M117-07-089

MAINTENANCE

21. Radiator mounting bolts.

Tool: 41 mm

Torque: 1370 N·m (140 kgf·m, 1010 lbf·ft)

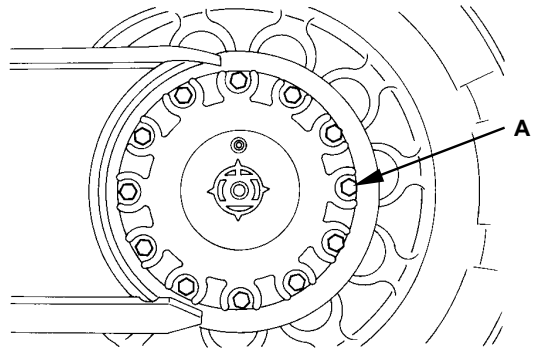


22. Travel device mounting bolts.

M146-07-058

A. Tool: 46 mm

Torque: 1910 N·m (195 kgf·m, 1410 lbf·ft)



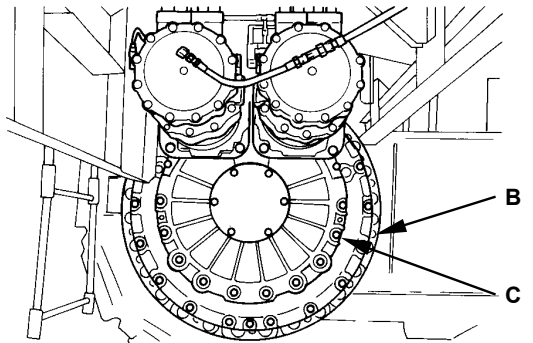
B. Tool: 60 mm

Torque: 4410 N·m (450 kgf·m, 3250 lbf·ft)

M145-07-048

C. Tool: 30 mm

Torque: 390 N·m (40 kgf·m, 290 lbf·ft)



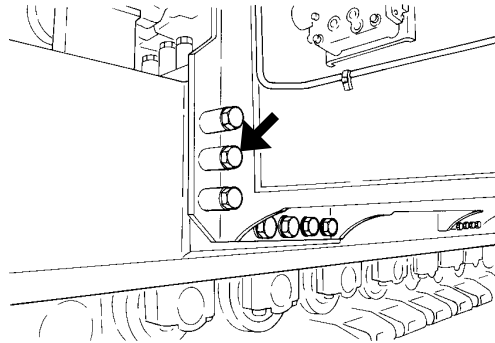
M145-07-079

MAINTENANCE

23. Side frame mounting bolt.

Tool: 85 mm

Torque: 9810 N·m (1000 kgf·m, 7230 lbf·ft)

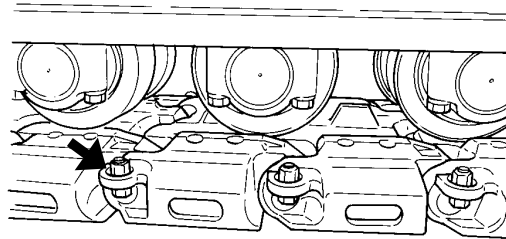


M145-07-095

24. Track pin-retaining bolt.

Tool: 46 mm

Torque: 1910 N·m (195 kgf·m, 1410 lbf·ft)



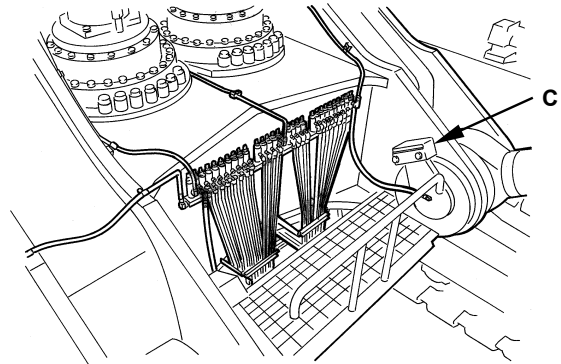
M117-07-089

MAINTENANCE

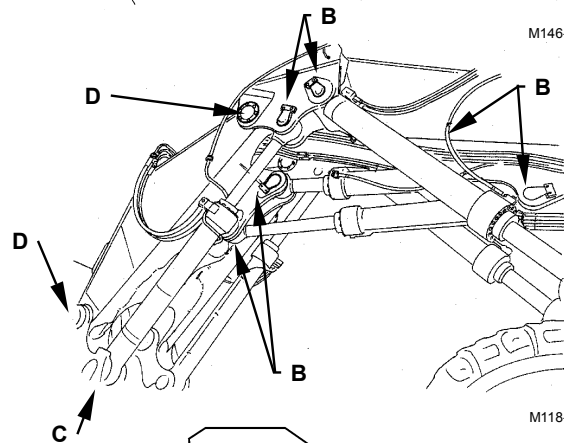
25. Front pin-retaining bolts.

(Loader)

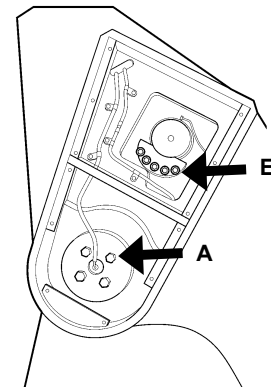
	Tool		Torque	
	mm	N·m	(kgf·m)	(lbf·ft)
A	19	88	(9)	(65)
B	24	205	(21)	(152)
C	36	932	(95)	(690)
D	30	540	(55)	(400)
E	19	1029	(105)	(760)
	(Hex. Wrench)			



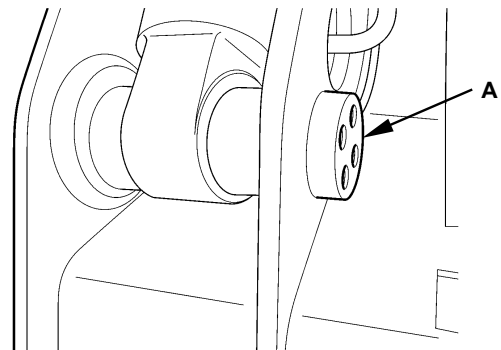
M146-07-018



M118-07-053



M118-07-114

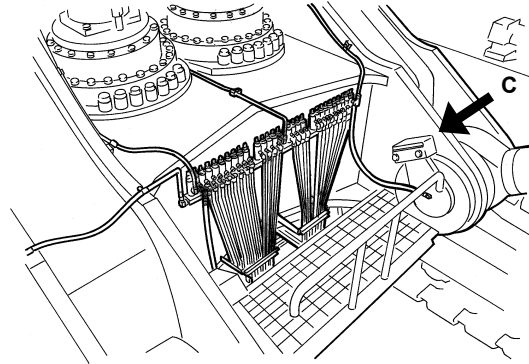


M118-07-115

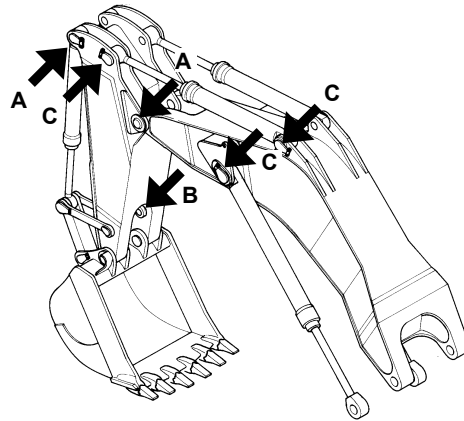
MAINTENANCE

26. Front pin-retaining bolt. (Backhoe)

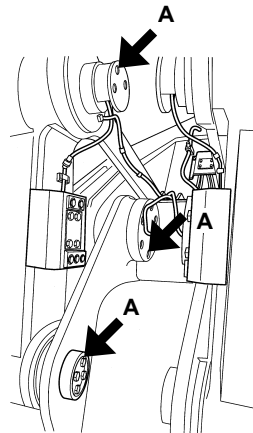
- (A) Tool: 30 mm
Torque: 390 N·m (40 kgf·m, 290 lbf·ft)
- (B) Tool: 24 mm
Torque: 205 N·m (21 kgf·m, 152 lbf·ft)
- (C) Tool: 36 mm
Torque: 932 N·m (95 kgf·m, 687 lbf·ft)



M146-07-018



T146-01-03-002



M146-07-078

[illegible]

MAINTENANCE UNDER SPECIAL ENVIRONMENTAL CONDITIONS

MAINTENANCE UNDER SPECIAL ENVIRONMENTAL CONDITIONS

Operating Conditions	Precautions for Maintenance	
Muddy Soil, Rainy or Snowy Weather	Before Operation: After Operation:	Check the tightness of plugs and all drain cocks. Clean the machine and check for cracks, damaged, loose or missing bolts and nuts. Lubricate all necessary parts without delay.
Near the Ocean	Before Operation: After Operation:	Check the tightness of plugs and all drain cocks. Thoroughly clean the machine with fresh water to wash off salt. Service electrical equipment often to prevent corrosion.
Dusty Atmosphere	Air Cleaner: Radiator: Fuel System: Electrical Equipment:	Clean the element regularly at shorter service intervals. Clean the oil cooler screen to prevent clogging of the radiator core. Clean the filter element and strainer regularly at shorter service intervals. Clean them regularly, in particular, the terminals of the alternator and starter.
Rocky Ground	Tracks: Front Attachment:	Carefully operate while checking for cracks, damage and loose bolts and nuts. Loosen the tracks a little more than usual. Standard attachment may be damaged when digging rocky ground. Reinforce the bucket before using it, or use a heavy duty bucket.
Freezing Weather	Fuel: Lubricant: Engine Coolant: Battery: Tracks:	Use high quality fuel suitable for low temperature. Use high quality low viscosity hydraulic oil and engine oil. Be sure to use antifreeze. Fully charge the batteries regularly at shorter service intervals. If not fully charged, electrolyte may freeze. Keep the tracks clean. Park the machine on a hard surface to prevent the tracks from freezing to the ground.
Falling Stones	Cab:	When operating in the area of possible falling rocks or other debris, be sure to work carefully, paying close attention to falling rocks, though the machine is equipped with the reinforced cab meeting SAE FOPS.

[illegible]

STORAGE

STORING THE MACHINE

1. Inspect the machine. Repair worn or damaged parts. Install new parts if necessary.
2. Clean the outer air cleaner element.
3. Retract all hydraulic cylinders, if possible. If not, coat exposed cylinder rods with grease.
4. Lubricate all grease points.
5. Park the tracks on long stable blocks.
6. Wash the machine.
7. Disconnect the battery ground circuit with the ground disconnecter.
8. Add an antirust agent to the coolant. In cold weather, add an antifreeze, or drain the coolant completely. Be sure to attach a "No Water in Radiator" tag on a clearly visible location if the system is drained.
9. Loosen the alternator belt.
10. Paint necessary areas to prevent rust.
11. Store the machine in a dry, protected place. If stored outside, cover with a waterproof cover.
12. If the machine is stored for a long time, operate hydraulic functions for travel, swing and digging two to three times for lubrication, at least once a month.
Be sure to check the level of coolant and all lubricants and lubrication conditions before operating.

STORAGE

REMOVING THE MACHINE FROM STORAGE



WARNING: Start the engine **ONLY** in a well-ventilated place.

1. Remove grease from the cylinder rods if coated.
2. Adjust alternator belt tension.
3. Fill the fuel tank. Bleed air from the fuel system. Check all fluid levels.
4. Start the engine.
Run the engine at half speed for several minutes before full load operation.
5. Cycle all hydraulic functions several times.
6. Carefully check all systems before operating the machine at full load.



NOTE: When the machine has been stored for a long time, be sure to perform the following steps as well:

- (a) Check condition of all hoses and connections.
- (b) Warm up the engine.
- (c) Stop the engine.
- (d) Install new fuel filters. Replace the engine oil filter and fill the engine with oil.

IMPORTANT: If the machine has not been used for a long time, oil films on sliding surfaces may have broken down. Cycling hydraulic functions for travel, swing and digging two to three times is necessary to lubricate the sliding surfaces.

TRANSPORTING THE MACHINE

IMPORTANT: In case of transporting the machine with disassembling, contact your authorized dealer.

IMPORTANT: In case of transporting the machine through public road, obey the traffic law in that region.

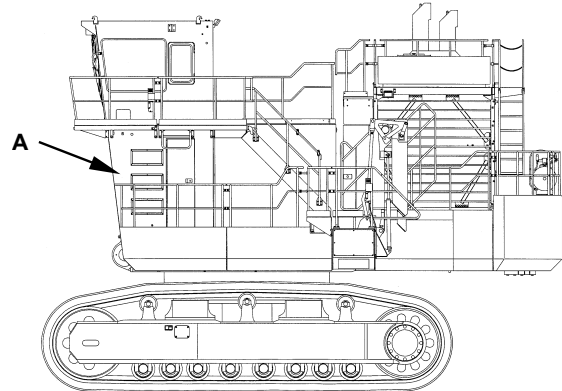
IMPORTANT: In case of transporting the machine by carrier, fix the machine tightly with wire rope not to fall from the carrier.

TROUBLESHOOTING

CUMMINS FAULT CODE LAMPS AND DIAGNOSTIC SWITCHES

Cummins fault code lamp (1) and diagnostic switch are located inside electric equipment box (2) in the room (A) under the cab.

- 3- Maintenance lamp
- 4- Warning lamp
- 5- Stop lamp
- 6- Diagnostic switch
- 7- Increment and decrement switch



M18M-07-053

Active Cummins fault code can be read using the warning lamp (4) and stop lamp (5).

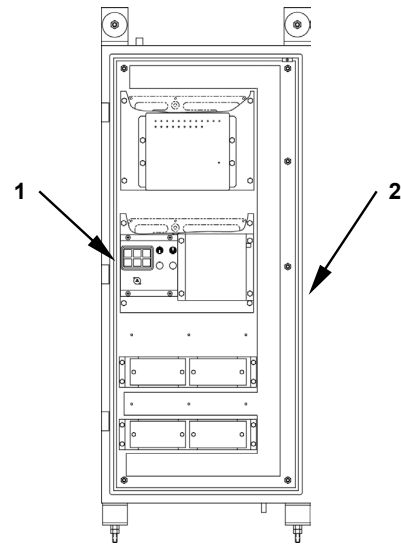
 **NOTE:** Active Cummins fault code can be also viewed on monitor display.

How to read a fault code

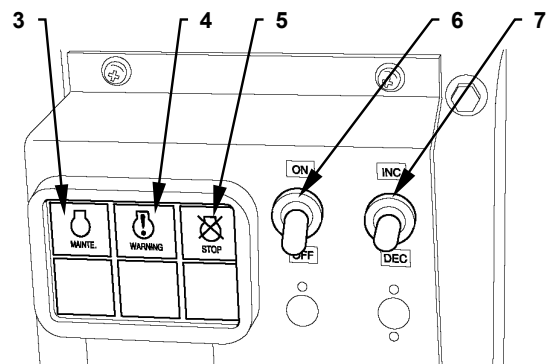
Turn the key switch to the ON position.
Hold the diagnostic switch to the ON position

In case one Cummins fault code is recorded, the Cummins fault code will flash in the following sequence. First, the warning lamp (4) will flash. Then there will be a short, one-second pause when the warning lamp (4) and the stop lamp (5) is off. The numbers of the recorded Cummins fault code will then flash on stop lamp (5). There will be a one-second pause between each number. When the number is done flashing, warning lamp (4) will flash again. The number will repeat in the same sequence.

In case more than one Cummins fault codes are recorded, the first Cummins fault code will flash in above sequence. The Cummins fault code will flash twice per one fault code. Then, the next Cummins fault code will flash sequentially in the same manner. To go to the second Cummins fault code before the first Cummins fault code flashes twice, move the increment and decrement switch (7) to the INC position, then release. To go back to the previous Cummins fault code, move the increment and decrement switch (7) to the DEC position and then release.



M18M-07-054



M18M-11-001

TROUBLESHOOTING

ENGINE		
Problem	Cause	Solution
Engine Cranks But Will Not Start or Hard to Start	Emergency engine stop switch	Turn switch off (to NORMAL)
	No fuel	Add fuel. Bleed air.
	Wrong fuel	Drain tank. Use correct fuel.
	Contaminated fuel	Drain tank and add clean fuel.
	Low battery power	Charge or install new battery.
	Poor electrical connection	Clean and tighten battery and starter motor connections.
	Starter motor failure	Replace starter.
	Wrong engine oil	Drain oil. Use correct oil.
	Air filter plugged	Replace elements.
	Fuel filter plugged	Remove air from fuel system. Clean fuel tank strainer.
	Engine compression low	See your authorized dealer.
	Leaks in fuel system	Check fuel system connections.
	Air in fuel system	Bleed air.
Engine Knocks, Runs Irregularly or Stops	Engine oil level low	Add oil.
	Plugged air intake system	Clean filter and system.
	Low coolant temperature	Thermostat not working correctly or too "cool".
	Water, dirt or air in fuel system	Bleed air from fuel system. Clean fuel tank outlet screen.
	Fuel shut-off solenoid valve failure	See your authorized dealer.

TROUBLESHOOTING

ENGINE		
Problem	Cause	Solution
Engine Not Developing Full Power	Air filters plugged	Replace filter elements.
	Fuel line restricted	Repair or replace fuel line.
	Contaminated fuel	Drain fuel tank and clean outlet screen. Refill.
	Fuel filters plugged	Change filters.
	Plugged fuel tank breather	Clean or install new breather.
	Wrong fuel	Use correct fuel.
	Wrong oil	Use correct oil.
	Turbocharger failure	See your authorized dealer.
	Exhaust restriction	Remove muffler and run engine.
	Engine is too hot or cold	See below.
	Engine failure	See your authorized dealer.
	Valve clearance	Check and adjust valves.
	Intake or exhaust system leakage	See your authorized dealer.
Engine Overheats	Low coolant level	Add coolant.
	Thermostat	See your authorized dealer.
	Engine overloaded	Check hydraulic relief valves.
	Radiator cap faulty	Install new cap.
	Radiator core or or fuel cooler core plugged	Clean radiator and fuel cooler
	Fan damaged	Replace fan.
	Air cleaner plugged	Clean air cleaner.
	Alternator belt loose	Tighten or install new belt.
	Cooling system passages dirty	Flush cooling system.
	Temperature gauge or sending unit	See your authorized dealer.

TROUBLESHOOTING

ENGINE		
Problem	Cause	Solution
Coolant Temperature Too Low	Thermostat Temperature gauge or sending unit	See your authorized dealer. See your authorized dealer.
Low Engine Oil Pressure	Engine oil pump or pump drive Low oil level Engine oil pressure regulation valve Plugged oil pump intake screen Plugged oil filter Oil leaks Oil diluted with fuel or coolant Engine temperature too high Wrong oil	See your authorized dealer. Add oil. See your authorized dealer. See your authorized dealer. Install a new oil filter. Check for leaks. See your authorized dealer. Check cooling system. Drain oil. Use correct oil.
Engine Uses Too Much Oil	Wrong oil Oil leaks Engine temperature too high Plugged air cleaner Internal engine component wear	Drain oil. Use correct oil. Check engine oil drain plug. Check cooling system. Clean element or install new element. See your authorized dealer.
Engine Uses Too Much Fuel	Plugged or dirty air intake system Wrong fuel Basic engine failures	Clean air intake system. Use correct fuel. See your authorized dealer.
Excessive Black or Gray Exhaust Smoke	Wrong fuel Plugged or dirty air intake or exhaust system Basic engine failures	Drain tank. Use correct fuel. Clean air intake and exhaust system. See your authorized dealer.

TROUBLESHOOTING

ENGINE		
Problem	Cause	Solution
Exhaust Gas is White	Wrong fuel	Drain tank. Use correct fuel.
	Cold engine	Run engine until warm.
	Thermostat faulty or too "cool"	See your authorized dealer.
	Coolant leakage into engine cylinder	See your authorized dealer.
Turbocharger Excessively Noisy or Vibrates	Bearings not lubricated	Insufficient oil pressure. Check for restricted turbocharger oil line.
	Worn bearings	See your authorized dealer.
	Air leak in engine, intake or exhaust manifold	Inspect, repair.
	Improper clearance between turbine wheel and turbine housing	See your authorized dealer.
	Broken blades on turbine	Remove exhaust elbow and air inlet hose and inspect.
Oil Dripping from Turbocharger Adapter	Damaged or worn bearings and/or worn seals	See your authorized dealer. Inspect and clean air cleaner. Check for proper engine service intervals or dirt enter into engine.
	Excessive crankcase pressure	Check vent tube to ensure tube is not plugged. Clean.
	Turbocharger oil return line carbon build up where line passes exhaust manifold	Remove line. Inspect, clean.
Excessive Drag in Turbo-charger Rotating Members	Carbon build-up behind turbine wheel caused by combustion deposits	Inspect, clean.
	Dirt build-up behind compressor wheel caused by air intake leaks	Inspect, clean.
	Bearing seizure or dirty or worn bearings, caused by excessive temperature, unbalanced wheel, dirty oil, oil starvation, or insufficient lubrication	See your authorized dealer.

TROUBLESHOOTING

ELECTRICAL SYSTEM

Problem	Cause	Solution
Nothing Works	Battery	Recharge or replace.
Nothing Works (Except clock)	Battery relay	Replace relay.
Batteries Undercharged	Loose or corroded connections Alternator belt loose Alternator not charging Fuse Key switch failure	Clean and tighten or replace batteries. Tighten or install new belt. See your authorized dealer. Replace fuse. Replace key switch.
Starting Motor Will Not Turn	Battery undercharged or dead Battery cables making poor connections High current fuse Key switch Start relay Starter solenoid Starter Starter pinion jammed in flywheel gear Major engine failure	Recharge or replace battery. Clean connections. Replace high current fuse. See your authorized dealer. See your authorized dealer. See your authorized dealer. Repair or replace start motor. Repair or replace starter. See your authorized dealer.
Starter Solenoid Chatters	Poor connections at batteries or starter Low battery charge Starter solenoid "hold-in" windings open	Clean connections. Recharge or replace batteries. See your authorized dealer.
Starter Motor Turns but Will Not Crank Engine	Starter pinion gear not engaging flywheel ring gear Pinion shift mechanism jammed or malfunctioning Pinion gear teeth broken Flywheel gear teeth broken	See your authorized dealer. See your authorized dealer. See your authorized dealer. See your authorized dealer.
Engine Cranks Slowly	Battery cables damaged or broken internally Battery or starter cable connections loose or corroded	Inspect and replace cables. Clean and tighten connections.

TROUBLESHOOTING

ELECTRICAL SYSTEM

Problem	Cause	Solution
Engine Cranks Slowly	Battery discharged or will not hold a charge	Replace battery.
	Starter "dragging"	See your authorized dealer.
	Low battery voltage	Recharge or replace battery.
Starter Motor Continues to Run After Engine Starts	Start relay stuck	See your authorized dealer.
	Starter solenoid stuck	See your authorized dealer.
	Starter not disengaging	See your authorized dealer.
	Key switch	See your authorized dealer.
Charging Indicator Light On-Engine Running	Loose or glazed alternator belt	Check belt. Replace if glazed, tighten if loose.
	Engine speed low	Adjust rpm to specification.
	Excessive electrical load from added accessories	Remove accessories or install higher output alternator.
	Loose or corroded electrical connections on battery, ground strap, starter, or alternator	Inspect, clean, or tighten electrical connections.
	Battery voltage low	Change or replace battery.
	Alternator or regulator	See your authorized dealer.
	Indicator circuit	See your authorized dealer.
Noisy Alternator	Worn drive belt	Replace belt.
	Worn pulleys	Replace pulleys and belt.
	Pulley misaligned	Adjust alternator mount.
	Alternator bearing	Loosen alternator belts. Turn pulley by hand. If any roughness is felt, repair alternator.
No Monitor Panel Indicators Work	Fuse	Replace fuse.
	Wiring harness	See your authorized dealer.
Individual Light in Monitor Panel is Not Working	Bulb	Replace bulb.
	Fuse	Replace fuse.
	Wiring harness	See your authorized dealer.

TROUBLESHOOTING

ELECTRICAL SYSTEM

Problem	Cause	Solution
No Indicators in Gauge Panel Operate	Circuit board Wiring harness Fuse	See your authorized dealer. See your authorized dealer. Replace fuse.
Indicator Light in Gauge Panel is Inoperative	Bulb Fuse Sender Wiring harness failure	Replace bulb. Replace fuse. Do sender check. See your authorized dealer.
Coolant Temperature Gauge Does Not Work	Fuse Gauge Gauge sender Wiring harness	Replace fuse. See your authorized dealer. Do coolant temperature gauge sender check. See your authorized dealer.
Fuel Gauge Does Not Work	Fuse Gauge Wiring harness	Replace fuse. See your authorized dealer. See your authorized dealer.

TROUBLESHOOTING

MODE SELECTION

Problem	Cause	Solution
Fast/Slow Travel Speed Does Not Function	Travel mode switches	See your authorized dealer.
	Pilot pressure switch (Travel)	See your authorized dealer.
	Pump delivery pressure sensor wire harness	See your authorized dealer.
	Main controller	See your authorized dealer.
	Solenoid valve unit	See your authorized dealer.
	Damaged travel motor	See your authorized dealer.
Auto-Idle Does Not Work	Fuse	Replace fuse.
	Switch panel	See your authorized dealer.
	Electrical connector	See your authorized dealer.
	Wire harness	See your authorized dealer.
	EC motor	See your authorized dealer.
	Pressure switches (Travel, Front)	See your authorized dealer.
	Main controller	See your authorized dealer.

HYDRAULIC SYSTEM

Problem	Cause	Solution
Hydraulic Functions are Slow	Low oil level	Fill reservoir to full mark.
	Cold oil	Warm up hydraulic oil to normal cycle times.
	Wrong oil	Drain tank. Use correct oil.
	Engine speed too low	Increase speed or see your authorized dealer.
	Pilot circuit	See your authorized dealer.
	Worn pump	See your authorized dealer.
	Restricted pump suction line	See your authorized dealer.
Hydraulic Oil Overheats	Wrong oil	Use correct oil.
	Air leak in pump suction line	See your authorized dealer.
	Oil lines restricted	See your authorized dealer.
	Low oil level	Fill reservoir to full mark.
	Plugged filters	Install new filters.
	Worn pump	See your authorized dealer.
	Oil cooler bypass	See your authorized dealer.
	Relief valve	See your authorized dealer.
	Contaminated oil	Drain oil and refill.
	Improperly adjusted hydraulic components	See your authorized dealer.

TROUBLESHOOTING

HYDRAULIC SYSTEM

Problem	Cause	Solution
Hydraulic Oil Overheats	Oilcooler core plugged Fan damaged Worn fan motor or pump	Clean and straighten fins. Replace fan. See your authorized dealer.
Oil Foams	Air leak in line from reservoir to pump Kinks or dents in oil lines Wrong oil Water in oil High or low oil level	Repair leak or see your authorized dealer. Check lines. Use correct oil. Change oil. Correct level.
Low or No Oil Pressure	Wrong oil Improperly adjusted hydraulic components No oil in system Worn cylinder packings Relief valve	Use correct oil. See your authorized dealer. Fill with correct oil. See your authorized dealer. See your authorized dealer.
No Hydraulic Functions (Noise from pumps)	Hydraulic pump Lack of hydraulic oil Damaged suction line or hose Clogged suction filter	See your authorized dealer. Add oil. See your authorized dealer. Clean.
Hydraulic Cylinders Operate but Cannot Lift Load	Hydraulic pump worn Main relief valve pressure low Hydraulic oil level low Suction screen plugged Pump suction line leaking	See your authorized dealer. See your authorized dealer. Add oil. Clean strainer and system. Inspect suction line.

TROUBLESHOOTING

HYDRAULIC SYSTEM

Problem	Cause	Solution
One Control Lever Does Not Work	Relief valve pressure low Tube or hose damaged Hydraulic fittings loose Damaged O-rings in fittings Hydraulic Pump Electric lever Pilot lines	See your authorized dealer. Repair or replace. Tighten. Install new O-ring. See your authorized dealer. See your authorized dealer. Repair or replace.
One Cylinder Does Not Work	Control valve spool damaged or contaminated with dirt Hydraulic lines damaged Fittings loose O-ring in fitting damaged Electric lever Pilot lines	See your authorized dealer. Repair or replace. Tighten. Install new O-ring. See your authorized dealer. Repair or replace.
One Cylinder Does Not Work or Has Little Power	Piston seals leaking Cylinder rod damaged Pilot lines Electric lever	See your authorized dealer. See your authorized dealer. Repair or replace. See your authorized dealer.
Both Side Travel Motors Do Not Work	Center joint failure Electric lever Pilot lines	See your authorized dealer. See your authorized dealer. See your authorized dealer.
One Travel Motor Does Not Work	Travel motor Parking brake not releasing Electric lever Pilot lines	See your authorized dealer. See your authorized dealer. See your authorized dealer. Repair or replace.
Travel is Not Smooth	Track adjustment Front idler or rollers damaged Track frame bent Rocks or mud "jammed" in track frame Travel brake not releasing	Adjust tension. See your authorized dealer. See your authorized dealer. Remove and repair. See your authorized dealer.

TROUBLESHOOTING

HYDRAULIC SYSTEM

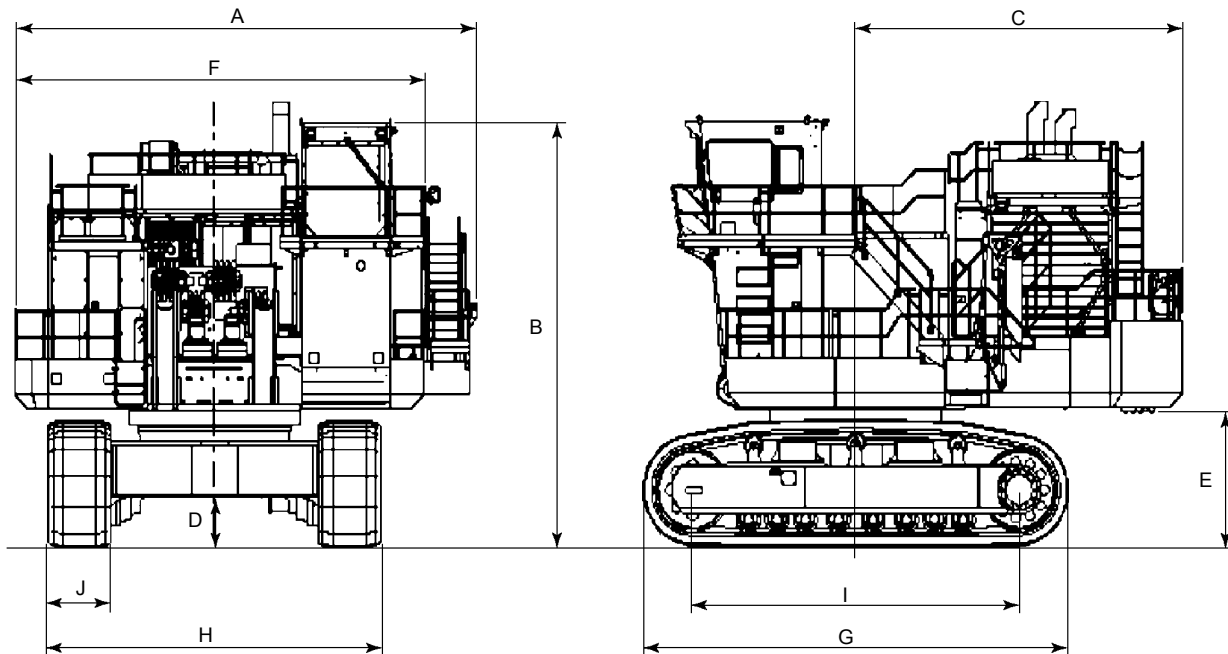
Problem	Cause	Solution
Swing Does Not Work	Swing motor	See your authorized dealer.
	Electric lever	See your authorized dealer.
	Pilot lines	See your authorized dealer.
Swing is Not Smooth	Swing gear	See your authorized dealer.
	Swing bearing	See your authorized dealer.
	Lack of grease	Apply grease.

AUTO-IDLE

Problem	Cause	Solution
Auto-Idle Does Not Work	Fuse	Replace
	Auto-Idle switch	Replace
	Pilot pressure switch	Replace
	Failure of connector contact	Repair or replace
	Wiring harness	Repair or replace
	Engine speed control lever sensor	Replace
	Controller	See your authorized dealer
	Controller on the engine	See your authorized dealer
Engine Speed Control Lever Does Not Function	Failure of connector contact	Repair or replace
	Wiring harness	Repair or replace
	Engine speed control lever sensor	Replace
	Controller on the engine	See your authorized dealer

SPECIFICATIONS

SPECIFICATIONS



M18M-12-001

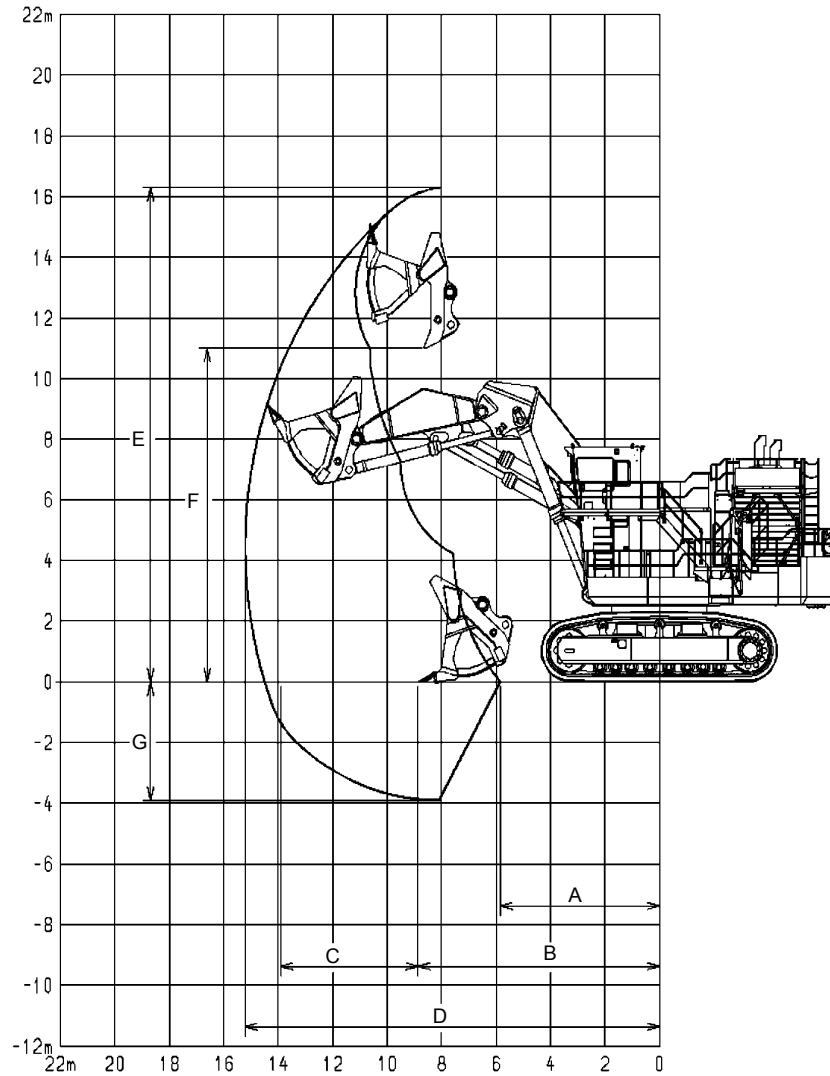
Model	EX3600-6 Hydraulic Excavator	
Type of Front-End Attachment	Loader Front	Backhoe Front
Bucket Capacity (Heaped)	PCSA 21.0 m ³ (27.5 yd ³)	PCSA 22.0 m ³ (28.8 yd ³)
Operating Weight	361000 kg (795900 lb)	359000 kg (791500 lb)
Engine	Cummins QSK60-C 1450 kW/1800 min ⁻¹ (1971PS/1800 rpm)	
A: Overall Width	9420 mm (30 ft 11 in)	
B: Cab Height	*7830 mm (25 ft 8 in)	
C: Rear End Swing Radius	6780 mm (22 ft 3 in)	
D: Minimum Ground Clearance	*905 mm (2 ft 12 in)	
E: Counterweight Clearance	*2440 mm (8 ft 0 in)	
F: Overall Width of Upperstructure	8360 mm (27 ft 5 in)	
G: Undercarriage Length	8700 mm (28 ft 7 in)	
H: Undercarriage Width	6770 mm (22 ft 3 in)	
I: Sprocket Center to Idler Center	6660 mm (21 ft 10 in)	
J: Track Shoe Width	1270 mm (4 ft 2 in) (Grouser shoe)	
Ground Pressure	189 kPa (1.93 kgf/cm ² , 27.4 psi)	188 kPa (1.92 kgf/cm ² , 27.3 psi)
Swing Speed	3.2 min ⁻¹ (rpm)	
Travel Speed (Fast/Slow)	2.2/1.7 km/h (4.9/3.8 mph)	
Gradeability	31° (tanθ = 0.60)	

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

SPECIFICATIONS

WORKING RANGE

Loading Shovel



M18M-12-002

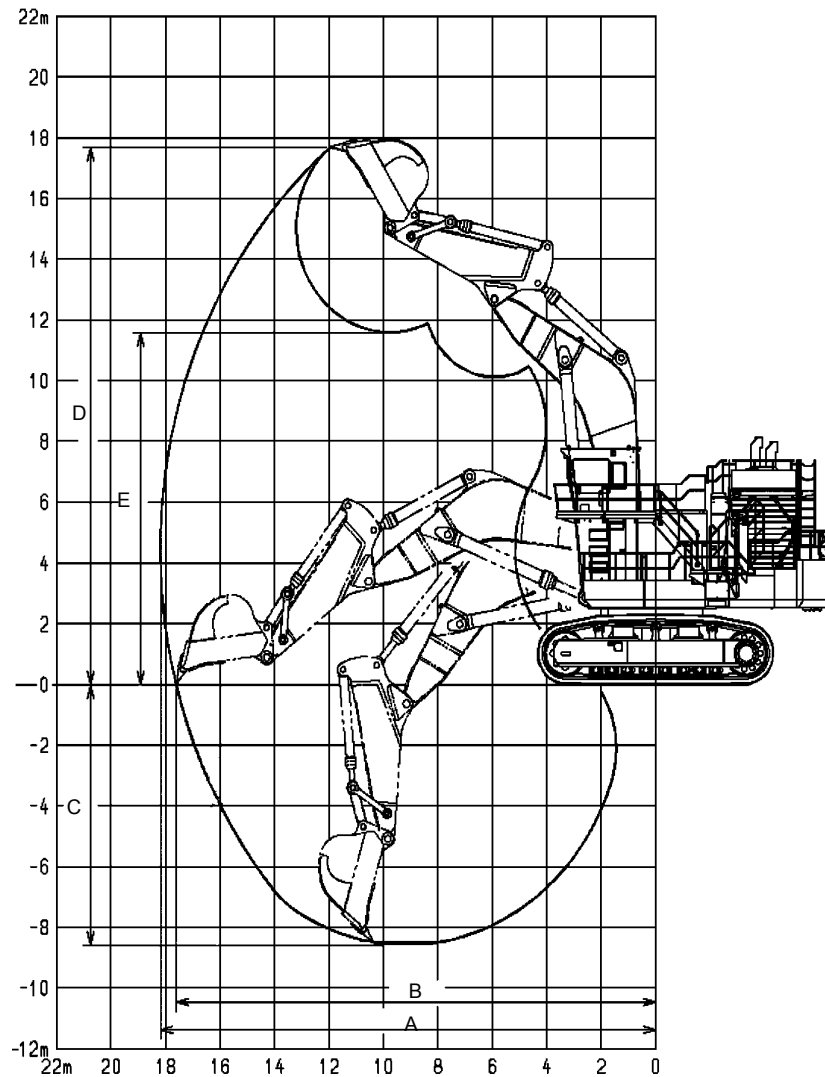
Item	Category	Loading Shovel
A: Minimum Digging Distance		5850 mm (19 ft 2 in)
B: Minimum Level Crowding Distance		8870 mm (29 ft 1 in)
C: Level Crowding Distance		5050 mm (16 ft 7 in)
D: Maximum Digging Reach		15220 mm (49 ft 11 in)
E: Maximum Cutting Height		16300 mm (53 ft 6 in)
F: Maximum Dumping Height		10990 mm (36 ft 1 in)
G: Maximum Digging Depth		3910 mm (12 ft 10 in)

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

SPECIFICATIONS

WORKING RANGE

Backhoe



M18M-12-003

Item	Category	Backhoe
A: Maximum Digging Reach		18190 mm (59 ft 8 in)
B: Maximum Digging Reach (on ground)		17610 mm (57 ft 9 in)
C: Maximum Digging Depth		8580 mm (28 ft 2 in)
D: Maximum Cutting Height		17690 mm (58 ft 1 in)
E: Maximum Dumping Height		11590 mm (38 ft 0 in)

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

SPECIFICATIONS

MEMO

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings present.

INDEX

A

AM/FM Radio Operation	1-27
Adjust the Operator's Seat	S-5
Adjusting The Seat	1-41
After the First 50 Hours	2-2
Air Cleaner	7-81
Air Cleaner Restriction Indicator	1-18
Air Conditioner	7-97
Air Conditioners	1-22
Alternator Indicator	1-12
Auto-Idle	5-8, 11-12
Auto-Idle Indicator	1-18
Auto-Idle Switch	1-36
Auto-Lubrication Indicator	1-15
Avoid Abusive Operation	5-14
Avoid Applying Heat to Lines Containing Flammable Fluids	S-25
Avoid Heating Near Pressurized Fluid Lines	S-25
Avoid High-Pressure Fluids	S-22
Avoid Injury from Back-Over and Swing Accidents	S-12
Avoid Injury from Rollaway Accidents	S-11
Avoid Power Lines	S-15
Avoid Swinging Bucket to Move Objects	5-15
Avoid Tipping	S-14
Avoid Undercutting	S-13

B

BREAK-IN	2-1
Before Turning Power ON	3-2
Beware of Asbestos Dust	S-26
Beware of Exhaust Fumes	S-24
Blower Operation Without Cooling or Heating ...	1-26
Bucket Open-Close Pedals (Loading Shovel)	5-5
Buzzer Stop Switch	1-37

C

COMPONENTS NAME	1-1
Cab Door Release Button	1-45
Cab Features	1-8
Caution Indicators	1-17
Caution Lamp	1-20
Check Instruments after Starting	3-10
Check the Hour Meter Regularly	7-2
Confirm Direction of Machine to be Driven	S-9
Construction Outline	7-10
Control Lever (HITACHI Pattern Loading Shovel)	5-4
Control Lever (HITACHI Pattern Backhoe)	5-2
Control Lever (ISO Pattern Backhoe)	5-1
Control Lever (ISO Pattern Loading Shovel)	5-3
Coolant Level Indicator	1-14
Coolant Overheat Indicator	1-13
Coolant Temperature Gauge	1-11
Cooling	1-25
Cooling System	7-83

Correct Maintenance and Inspection Procedures	7-1
Cummins Fault Code Lamps and Diagnostic Switches	11-1

D

DRIVING THE MACHINE	4-1
Defrosting	1-26
Dehumidifying And Heating	1-25
Designations And Functions Of Controls	1-23
Dig with Caution	S-15
Digital Clock Setting Procedure	1-28
Dispose of Waste Properly	S-28
Dome Light Switch	1-33
Drive Machine Safely	S-10
Drive the Machine Carefully	4-1

E

Electric Lever Indicator	1-16
Electric Pump (Optional)	7-8
Electrical Equipment Box Indicator	1-18
Electrical System	7-104, 11-6
Emergency Engine Stop Indicator	1-16
Emergency Engine Stop Switch	1-30
Emergency Escape	1-5
Emergency Exit	1-6
Engine	7-36, 11-2
Engine Oil Pressure Gauge	1-12
Engine Oil Pressure Indicator	1-13
Engine Oil Temperature Gauge	1-12
Engine Over Run Indicator	1-14
Engine Speed Control	5-7
Engine Speed Control Dial	1-31
Engine Start Switch	1-30
Engine Stop Indicator	1-13
Engine Stop Switch	1-30
Engine Warning Indicator	1-17
Entrance Light Switch	1-35
Evacuating in Case of Fire	S-24, 1-6
Every 10 Hours or Each Shift	2-1
Exhaust Temperature Indicator	1-17

F

Fast-Filling Indicator	1-16
Fast-Filling System	1-38
Fasten Your Seat Belt	S-6
Follow Safety Instructions	S-2
Fuel Gauge	1-11
Fuel System	7-74
Fuel Temperature Indicator	1-14

G

General Precautions for Cab	S-4
Grading Operation	5-13
Greasing	7-24

INDEX

H

HANDLING STAIRWAY/EMERGENCY ROPE	1-2
Handle Chemical Products Safely	S-28
Handle Fluids Safely – Avoid Fires	S-17
Handle Starting Aids Safely	S-6
Heating	1-25
Horn Switch	1-40
Hour Meter	1-12
Hydraulic Oil Level Indicator	1-14
Hydraulic Oil Overheat Indicator	1-17
Hydraulic Oil Temperature Gauge	1-11
Hydraulic System	7-11, 51, 11-9

I

INDEX	14-1
Inspect Machine	S-3
Inspect Machine Daily Before Starting	3-1
Inspection/Maintenance Lights	7-6
Investigate Job Site Beforehand	S-8

J

Jump Starting	S-7
---------------	-----

K

Keep Person Clear from Working Area	S-13
Keep Riders Off Machine	S-7
Key Pad	1-20
Key Switch	1-29

L

Left Console	1-20
Loading Shovel Operation	5-16

M

MAINTENANCE	7-1
MAINTENANCE UNDER SPECIAL ENVIRONMENTAL CONDITIONS	9-1
Maintenance Interval Guide	7-20
Maintenance Light Switch	1-34
Maintenance Under Special Environmental Conditions	9-1
Meter Check Screen	1-10
Miscellaneous	7-118
Mode Selection	11-9
Monitor Contrast Switch	1-20
Monitor Display	1-9
Move and Operate Machine Safely	S-6

N

Never Position Bucket Over Anyone	S-13
Never Undercut a High Bank	S-14
Numbers of Machines	S-9

O

OPERATING THE ENGINE	3-1
OPERATING THE MACHINE	5-1

OPERATOR'S STATION	1-8
Object Handling	S-16, 5-18
Observe Machine Closely	2-1
Open Access Doors for Service	7-5
Opening Cab Left Window	1-45
Operate Only from Operator's Seat	S-7
Operate the Machine Safely	5-12
Operate with Caution	S-15
Operating Backhoe	5-13
Operating Ground Condition	4-9
Operating Stairway	1-2
Operating Tips	5-15
Operating on Soft Ground	4-7
Overnight Storage Instructions	5-19

P

Park Machine Safely	S-17
Parking the Machine	4-11
Parking the Machine on Slopes	4-11
Periodic Replacement of Parts	7-14
Periodic Replacement of Rubber Hoses	7-15
Pilot Control Shut-Off Lever	5-6
Practice Safe Maintenance	S-18
Precautions for Operations	5-11
Precautions for Traveling on Slopes	4-10
Precautions for Welding and Grinding	S-25
Prelub Indicator	1-19
Prepare Machine for Maintenance	7-3
Prepare for Emergencies	S-2
Prevent Battery Explosions	S-27
Prevent Burns	S-21
Prevent Fires	S-23
Prevent Parts from Flying	S-20
Prohibited Operation	5-16
Protect Against Falling Stones and Debris	S-8
Protect Against Flying Debris	S-16
Protect Against Noise	S-3
Provide Signals for Jobs Involving Multiple	
Pump Contamination Indicator	1-17
Pump Transmission Oil Level Indicator	1-13

R

Raise One Track Using Boom and Arm	4-7
Rear Console	1-39
Recognize Safety Information	S-1
Remove Paint Before Welding or Heating	S-26
Removing the Machine from Storage	10-2
Replace Rubber Hoses Periodically	S-21
Right Console	1-29

S

SAFETY	S-1
SAFETY SIGNS	S-29
SPECIFICATIONS	12-1
STORAGE	10-1
Seat Belt	1-44

INDEX

Service Air Conditioning System Safely.....	S-27	Working Range (Loading Shovel)	12-2
Specifications	12-1		
Stairway Position Indicator.....	1-18		
Starting Check Screen.....	1-9		
Starting in Cold Weather	3-9		
Starting the Engine	3-8		
Status Indicators	1-18		
Stay Clear of Moving Parts	S-19		
Steering the Machine Using Levers.....	4-3		
Steering the Machine Using Pedals.....	4-2		
Stop Valve Indicator.....	1-15		
Stopping the Engine	3-13		
Stopping the Engine in Emergency (Except In The Cab)	3-15		
Stopping the Engine in Emergency (In The Cab)	3-14		
Store Attachments Safely	S-20		
Storing the Machine.....	10-1		
Support Machine Properly	S-19		
T			
TROUBLESHOOTING	11-1		
Tachometer	1-11		
Tension Indicator	1-16		
Towing Machine a Short Distance	4-8		
Transmission	7-43		
Transporting the Machine.....	10-2		
Travel Alarm	4-5		
Travel Mode Indicator.....	1-19		
Travel Mode Switch	1-36, 4-4		
Traveling	4-6		
Turning Power ON.....	3-3		
U			
Understand Signal Words.....	S-1		
Use Correct Fuels and Lubricants	7-2		
Use Handholds and Steps	S-5		
Use a Chain to Prevent Falling Accidents	7-7		
Using Booster Batteries	3-11		
Using Stairway	1-2		
V			
Ventilation The Cab	1-26		
W			
Warming-Up Operation	5-9		
Warming-Up the Cylinders and Motors	5-10		
Warn Others of Service Work	S-19		
Warning Indicators.....	1-12		
Warning Lamp	1-20		
Washer Switch.....	1-21		
Wear Protective Clothing	S-3		
Wiper Delay Selector Switch	1-21		
Wiper Switch.....	1-21		
Work Light Switch.....	1-32		
Working Range (Backhoe)	12-3		
