CONTENTS

FOREWORD

This manual contains a number of instructions and safety recommendations regarding driving, handling, lubrication, maintenance, inspection and adjustment of the excavator.
The manual is to promote safety maintenance and enhance machine performance.

Keep this manual handy and have all personnel read it periodically.

If you sell the machine, be sure to give this manual to the new owners.

This machine complies with EC directive "2006/42/EC".

1. **Read** and **understand** this manual before operating the machine.

   This operator's manual may contain attachments and optional equipment that are not available in your area. Please consult your local Hyundai distributor for those items you require.

   Improper operation and maintenance of this machine can be hazardous and could result in serious injury or death.

   Some actions involved in operation and maintenance of the machine can cause a serious accident, if they are not done in a manner described in this manual.

   The procedures and precautions given in this manual apply only to intended uses of the machine.
   If you use your machine for any unintended uses that are not specifically prohibited, you must be sure that it is safe for you and others. In no event should you or others engage in prohibited uses of actions as described in this manual.

2. **Inspect** the jobsite and **follow** the safety recommendations in the **safety hints** section before operating the machine.

3. Use **genuine Hyundai spare parts** for the replacement of parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulting from non-genuine parts or non workmanlike repair.
   In such cases Hyundai cannot assume liability for any damage.

Continuing improvements in the design of this machine can lead to changes in detail which may not be reflected in this manual. Consult Hyundai or your Hyundai distributor for the latest available information for your machine or for questions regarding information in this manual.

BEFORE SERVICING THIS MACHINE

It is the responsibility of the owner and all service and maintenance personnel to avoid accidents and serious injury by keeping this machine properly maintained.

It also is the responsibility of the owner and all service and maintenance personnel to avoid accidents and serious injury while servicing the machine.

No one should service or attempt to repair this machine without proper training and supervision.

All service and maintenance personnel should be thoroughly familiar with the procedures and precautions contained in this manual.

All personnel also must be aware of any federal, state, provincial or local laws or regulations covering the use and service of construction equipment.

The procedures in this manual do not supersede any requirements imposed by federal, state, provincial or local laws.

Hyundai can not anticipate every possible circumstance or environment in which this machine may be used and serviced.

All personnel must remain alert to potential hazards.

Work within your level of training and skill.

Ask your supervisor if you are uncertain about a particular task. Do not try to do too much too fast.

Use your common sense.

※ How to adjust the language of cluster (cluster type 1)

User can select preferable language and all displays are changed the selected language.

※ Please refer to the page 3-20 for the cluster.

EC REGULATION APPROVED

· Noise level (EN474-1 : 2006 and 2000/14/EC) are as followings.

L_{WA} : 101dB (EU only)

L_{PA} : 70dB

· The value of vibrations transmitted by the operator's seat are lower than standard value of (EN474-1 : 2006 and 2002/44/EC)

CE

EC Declaration of Conformity

1. HYUNDAI CONSTRUCTION EQUIPMENT EUROPE N.V VOSSENDAAL 11, 2440 GEEL (Belgium), as authorized representative in the European Community of HYUNDAI CONSTRUCTION EQUIPMENT Co. Ltd.(Korea)
   certifies that the construction equipment machinery.

   Machine Type : *******
   Brand : HYUNDAI
   Model : *****
   Serial No : ***
   Year of Manufacturing : 20**

2. Manufacturer — Hyundai Construction Equipment Co. Ltd.
   12th, Fl., Hyundai Bldg. 75, Yulgok-ro, Jongno-Gu, Seoul, Republic of Korea

   Authorized representative : HYUNDAI CONSTRUCTION EQUIPMENT EUROPE N.V.
   Owner of the technical file for machine production : VOSSENDAAL 11, 2440 GEEL, BELGIUM

3. Harmonized European directives : 2006/42/EC (Machinery), 97/68/EC (Exhaust Gas Emission), 2004/108/EC (Electromagnetic Compatibility), 200/14/EC (Noise Emission)

4. Engine Manufacturer : ********
   - Engine Type : **********
   - Gross Power : *** kW / **** rpm (SAE J1995)
   - Net Power : *** kW / **** rpm (SAE J1349)

5. Noise level (Noise Emission Directive 2000/14/EC)
   - Certificate No : **********
   - Issue Date : DD/MM/YYYY
   - Conformity Assesment Procedure : **********
   - Notified Body Involved : **********
     ****
     ****
   - Measured Sound Power Level : ** dB(A)
   - Guaranteed Sound Power Level : ** dB(A)

6. EMC Certification (EMC Directive 2004/108/EC)
   - Certificate No : *********
   - Issued Date : DD/MM/YYYY
   - Notified Body Involved : **********
     ****
   - Standard(s) : *******

7. Remarks

   J. C. JUNG
   MANAGING DIRECTOR
   Place and date of issue :

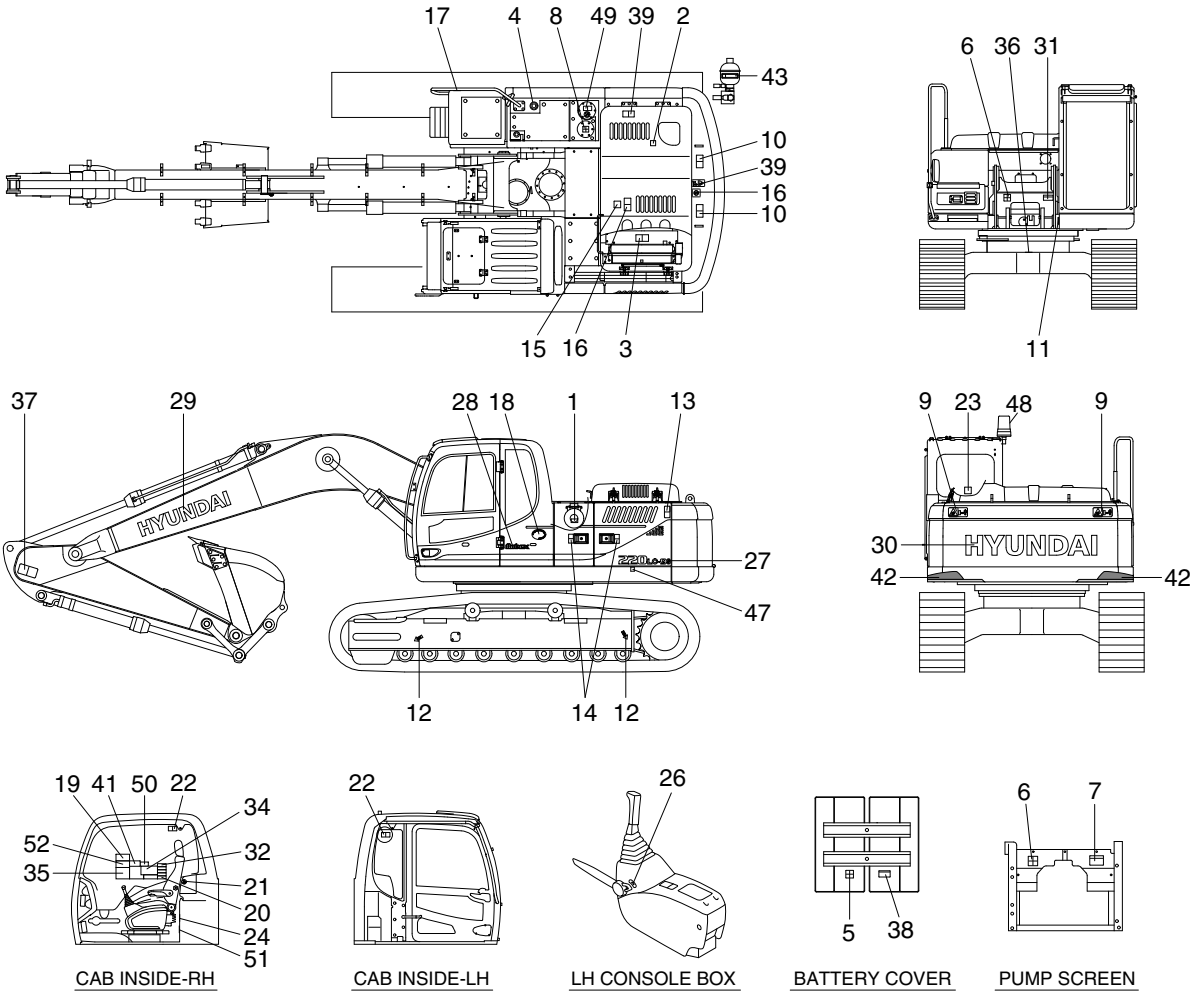
TABLE TO ENTER SERIAL NO. AND DISTRIBUTOR

Machine Serial No.	
Engine Serial No.	
Manufacturing year	
Manufacturer Address	Hyundai Construction Equipment co., Ltd. 12th, Fl., Hyundai Bldg. 75, Yulgok-ro, Jongno-Gu, Seoul, 03058, Korea
Distributor for U.S.A Address	Hyundai Construction Equipment U.S.A, Inc 6100 Atlantic Boulevard Norcross GA 30071 U.S.A
Distributor for Europe Address	Hyundai Construction Equipment Europe N. V. Vossendal 11 2240 Geel Belgium
Dealer Address	

SAFETY LABELS

1. LOCATION

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



2209S0SL01

1	Air cleaner filter	16	No step-engine hood	32	Locking-clamp
2	Turbocharger cover	17	Transporting	34	Service instruction
3	Radiator cap	18	Low emission engine	35	Lifting chart
4	Fueling	19	Control ideogram	36	Tie
5	Battery accident	20	Ref operator manual-cab RH pillar	37	Keep clear-boom/arm
6	High pressure hose	21	Hammer	38	Connector
7	Hydraulic oil level	22	Safety front window	39	Falling
8	Hydraulic oil lubrication	23	Alternate exit	41	Turbocharger
9	Keep clear-rear	24	Air conditioner filter	42	Reflecting
10	Lifting eye	26	Safety lever	43	Accumulator
11	Name plate	27	Model name	48	Beacon lamp
12	Slinging ideogram	28	Logo (ROBEX)	49	Fuel shut off
13	Keep clear-side	29	Trade mark (boom)	50	Water separator
14	Stay fix	30	Trade mark (CWT)	51	MCU connector
15	Shearing-engine hood	31	Reduction gear grease	52	Machine control pattern

2. DESCRIPTION

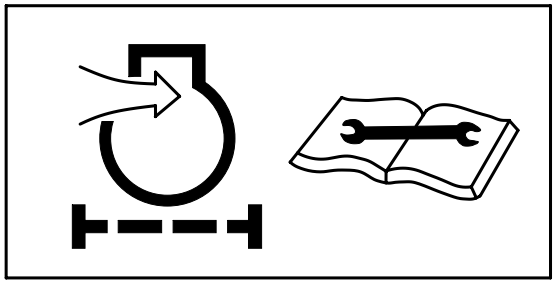
There are several specific warning labels on this machine please become familiarized with all warning labels.

Replace any safety label that is damaged, or missing.

1) **AIR CLEANER FILTER** (item 1)

This warning label is positioned on the air cleaner cover.

※ **Periodic and proper inspection, cleaning and change of elements prolong engine life time and maintain the good performance of engine.**

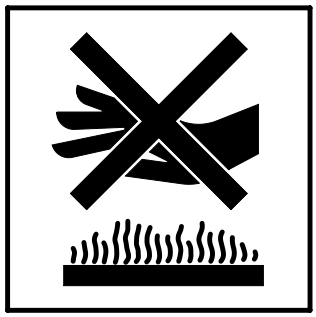


21070FW01

2) **TURBOCHARGER COVER** (item 2)

This warning label is positioned on the turbocharger cover.

⚠ **Do not touch turbocharger or it may cause severe burn.**



21070FW02

3) **RADIATOR CAP** (item 3)

This warning label is positioned on the radiator.

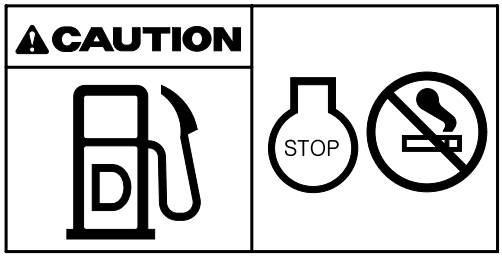
⚠ **Never open the filler cap while engine running or at high coolant temperature.**

14070FW03

4) **FUELING** (item 4)

This warning label is positioned on the right side of fuel filler neck.

⚠ **Stop the engine when refueling. All lights or flames shall be kept at a safe distance while refueling.**



21070FW04

5) BATTERY ACCIDENT (item 5)

This warning label is positioned on the battery cover.

⚠ Electrolyte containing sulfuric acid cause severe burns. Avoid being in contact with skin, eyes or clothes. In the event of accident flush with sufficient water, call a physician immediately.

※ Maintain the electrolyte at the recommended level.

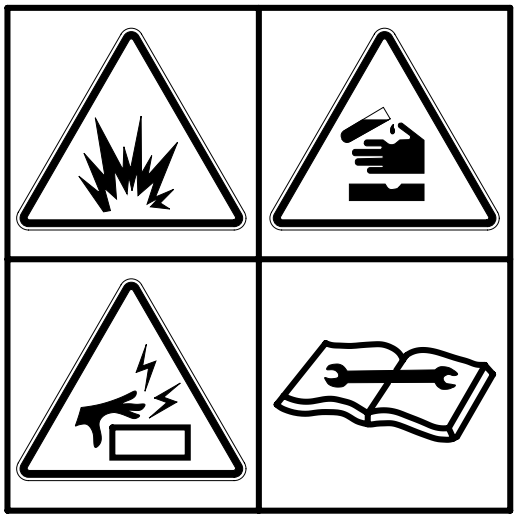
With electrolyte at proper level, less space may cause the gases to be accumulated in the battery.

⚠ Extinguish all smoking materials and open flames before checking the battery.

⚠ Do not use matches, lighters or torches as a light source near the battery for the probable presence of explosive gas.

⚠ Do not allow unauthorized personnel to change the battery or to use booster cables.

⚠ For safety from electric shock, do not battery terminal with a wet hand.



36070FW05

6) HIGH PRESSURE HOSE (item 6)

This warning label is positioned on the screen plate.

⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

※ Study the service manual before service job.

14070FW29

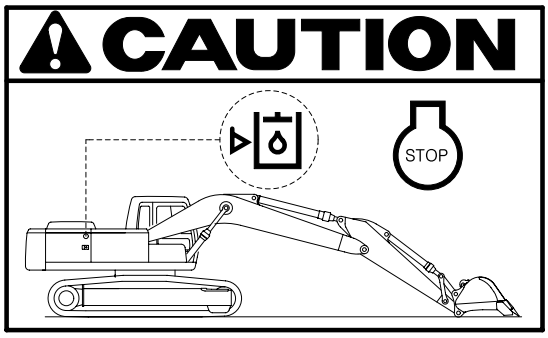
7) HYDRAULIC OIL LEVEL (item 7)

This warning label is positioned on the screen plate.

⚠ Place the bucket on the ground whenever servicing the hydraulic system.

※ Check oil level on the level gauge.

※ Refill the recommended hydraulic oil up to specified level if necessary.



21070FW07

8) HYDRAULIC OIL LUBRICATION (item 8)

This warning label is positioned on the top of the hydraulic tank.

※ Do not mix with different brand oils.

⚠ Never open the filler cap while high temperature.

⚠ Loosen the cap slowly and release internal pressure completely.

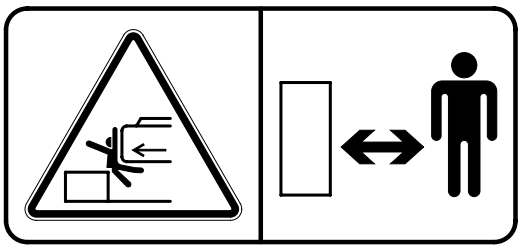
14070FW08

9) KEEP CLEAR (item 9)

This warning label is positioned on the rear of counterweight.

⚠ To prevent serious personal injury or death keep clear or machine swing radius.

⚠ Do not deface of remove this label from the machine.



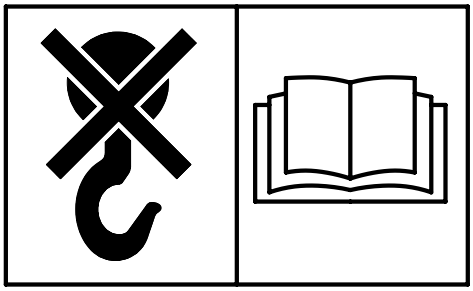
21090FW09

10) LIFTING EYE (item 10)

This warning label is positioned on the counterweight.

⚠ Do not lift the machine by using lifting eyes on the counterweight or the lifting eyes may be subject to overload causing its breaking and possible personal injury.

※ See page 5-9 for proper lifting method of the machine.



21070FW10

11) SIDE KEEP CLEAR (item 13)

This warning label is positioned on the side of LH rear side cover.

⚠ To prevent serious personal injury or death keep clear of machine swing radius.

⚠ Do not deface or remove this label from the machine.

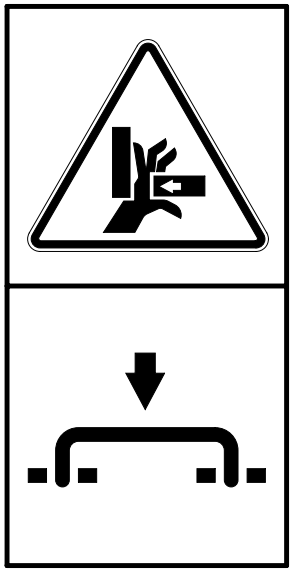
21070FW13

12) STAY FIX (item 14)

This warning label is positioned on the side cover.

⚠ Be sure to support the stay when the door needs to be opened.

⚠ Be careful that the opened door may be closed by the external or natural force like strong wind.



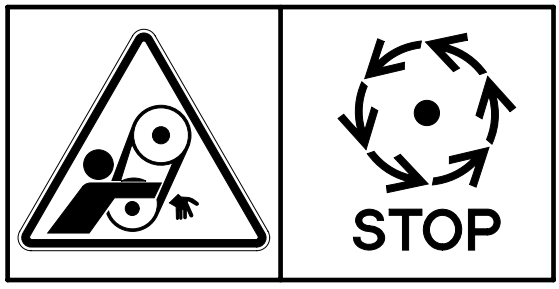
21070FW14

13) SHEARING-ENGINE HOOD (item 15)

This warning label is positioned on the engine hood.

⚠ Don't open the engine hood during the engine's running.

⚠ Don't touch exhaust pipe or it may cause severe burn.



21070FW15

14) NO STEP-ENGINE HOOD (item 16)

This warning label is positioned on the engine hood.

△ Don't step on the engine hood.

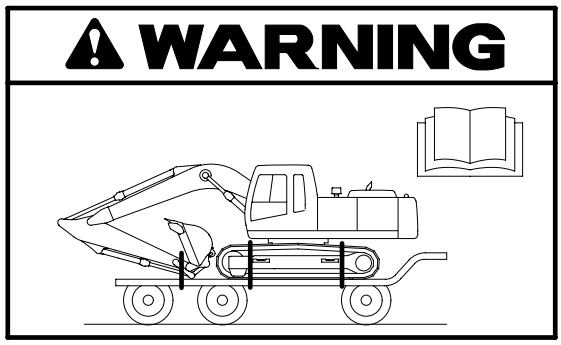
21070FW16

15) TRANSPORTING (item 17)

This warning label is positioned right side of upper frame.

⚠ Study the operator's manual before transporting the machine, if provided and tie down arm and track to the carrier with lashing wire.

See page 5-8 for details.



14070FW17

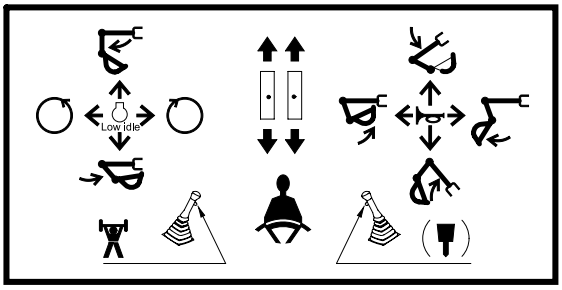
16) CONTROL IDEOGRAM (item 19)

This warning label is positioned in right window of the cab.

⚠ Check the machine control pattern for conformance to pattern on this label. If not, change label to match pattern before operating machine.

⚠ Failure to do so could result in injury or death.

See page 4-20 for details.

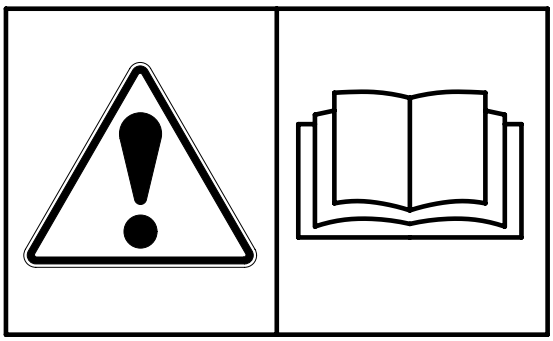


36070FW19

17) REF OPERATOR MANUAL (item 20)

This warning label is positioned on the right side window of the cab.

⚠ Study the operator's manual before starting and operating machine.



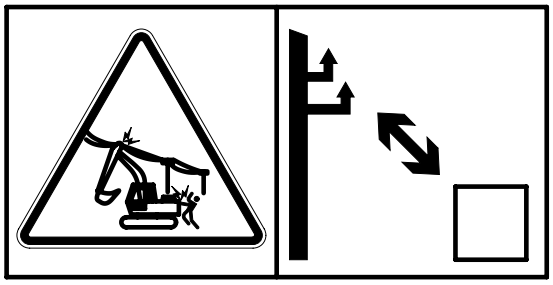
21070FW22

18) **MAX HEIGHT** (item 20)

This warning label is positioned on the right side window of the cab.

⚠ **Serious injury or death can result from contact with electric lines.**

An electric shock being received by merely coming into the vicinity of an electric lines, the minimum distance should be kept considering the supply voltage as page 1-7.



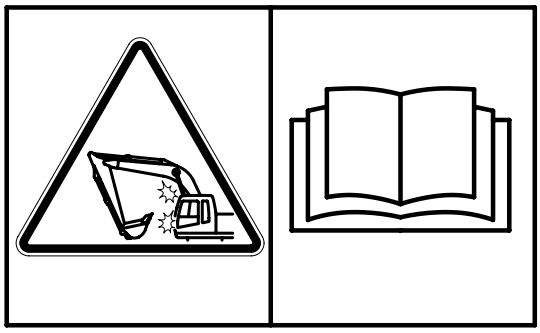
21070FW23

19) **INTERFERENCE** (item 20)

This warning label is positioned on the right side window of the cab.

⚠ **Be careful to operate machine equipped with quick clamp or extensions.**

⚠ **Bucket may hit cab or boom, boom cylinders when it reached vicinity of them.**

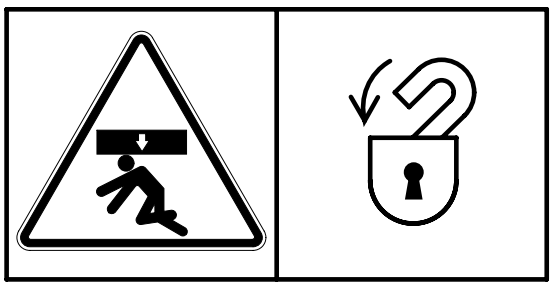


21090FW62

20) **SAFETY FRONT WINDOW** (item 22)

This warning label is positioned on the both side window of the cab.

⚠ **Be careful that the front window may be promptly closed.**



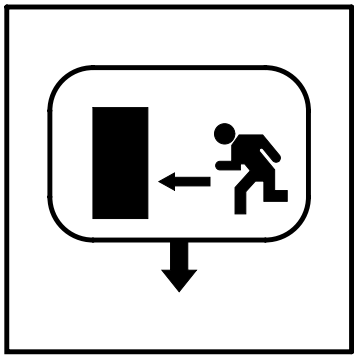
21070FW24

21) **ALTERNATE EXIT** (item 23)

This warning label is positioned on the inside of rear window.

※ **The rear window serves us an alternate exit.**

※ **To remove rear window, pull the ring and push out the glass.**

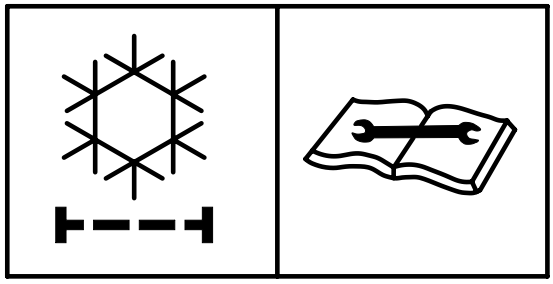


21070FW25

22) AIR CONDITIONER FILTER (item 24)

This warning label is positioned on the air conditioner cover.

※ **Periodic and proper inspection, cleaning and change of filter prolong air conditioner life time and maintain good performance.**

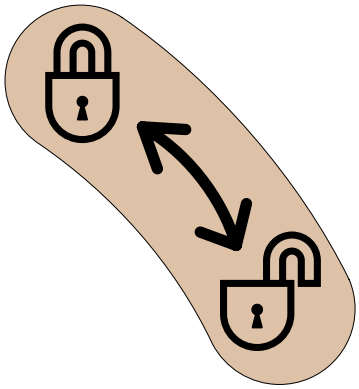


21070FW26

23) SAFETY LEVER (item 26)

This warning label is positioned on the cover of the safety lever.

⚠ **Before you get off the machine be sure to place the safety lever LOCKED position.**

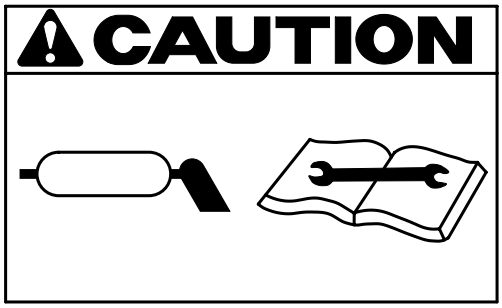


30007A1FW07A

24) REDUCTION GEAR GREASE (item 31)

This warning label is positioned in the front of upper frame.

⚠ **Grease is under high pressure.**
Grease coming out of the grease plug under pressure can penetrate the body causing injury or death.



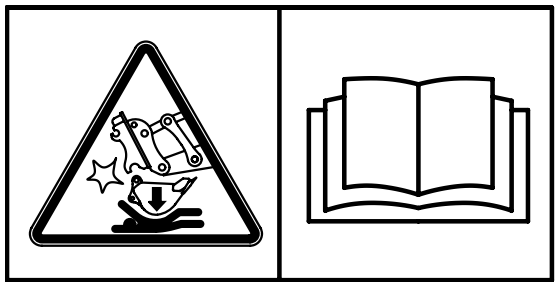
21070FW35

25) CLAMP-LOCKING (item 32)

This warning label is positioned on the right side window of cab.

⚠ **Serious injury or death can result from dropping bucket.**

⚠ **Operating the machine with quick clamp switch unlocked or without safety pin of moving hook can cause the bucket to drop off.**



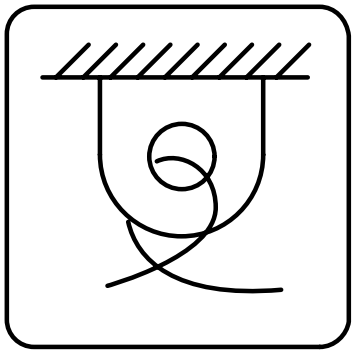
14070FW60

26) **TIE** (item 36)

This warning label is positioned on the lower frame.

⚠ **Make sure no personal are standing close to the tow rope.**

⚠ **See page 4-23 for detail.**



4507A0FW02

27) **KEEP CLEAR-BOOM/ARM** (item 37)

This warning label is positioned on both side of the arm.

⚠ **Serious injury or death can result from falling of the attachment.**

⚠ **To prevent serious injury or death, keep clear the underneath of attachment.**

14070FW31

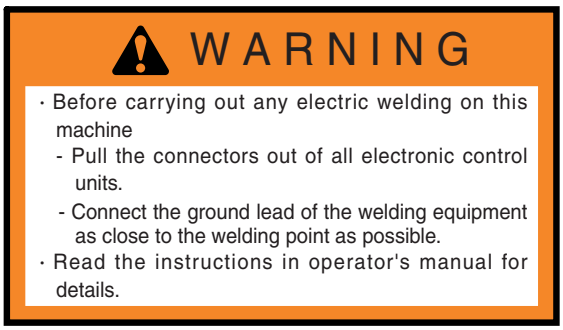
28) **CONNECTOR** (item 38)

This warning label is positioned on the battery cover.

⚠ **Before carrying out any electric welding on this machine, follow the below procedure.**

- Pull the connector out of all electric control units.
- Connector the ground lead of the welding equipment as close to the welding point as possible.

※ **See page 6-43 for detail.**



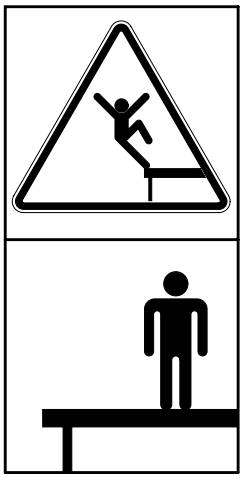
7807AFW20

29) **FALLING** (item 39)

This warning label is positioned on the top of the hydraulic tank.

⚠ **Falling is one of the major cause of personal injury.**

⚠ **Be careful of slippery conditions on the platforms, steps and handrails when standing on the machine.**

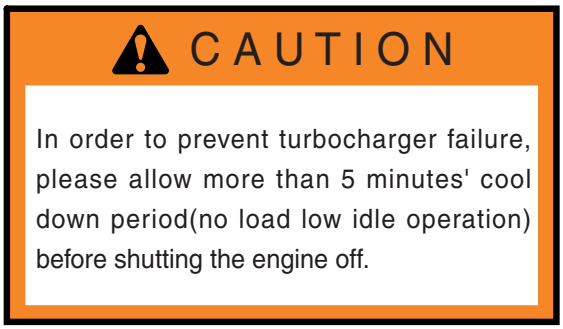


14070FW30

30) **TURBOCHARGER** (item 41)

This warning label is positioned on the right window of the cab.

⚠ **In order to prevent turbocharger failure, please allow more than 5 minutes cool down period (no load low idle operation) before shutting the engine off.**



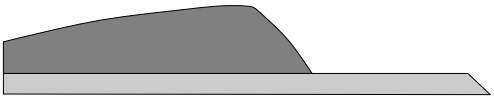
7807AFW20

31) **REFLECTING** (item 42)

This warning label is positioned on the rear of counterweight.

⚠ **To prevent serious personal injury or death keep clear of machine swing radius.**

⚠ **Do not deface or remove this label from the machine.**



21090FW70

32) **ACCUMULATOR** (item 43)

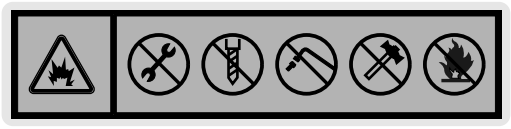
This warning label is positioned on the accumulator of the solenoid valve.

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

⚠ **Never make any hole in the accumulator expose it to flame or fire.**

⚠ **Do not weld anything to the accumulator.**

※ **When carrying out disassembly or maintenance of the accumulator, or when disposing of the accumulator, it is necessary to release the gas from the accumulator. A special air bleed valve is necessary for this operation, so please contact your Hyundai distributor.**



1107A0FW46

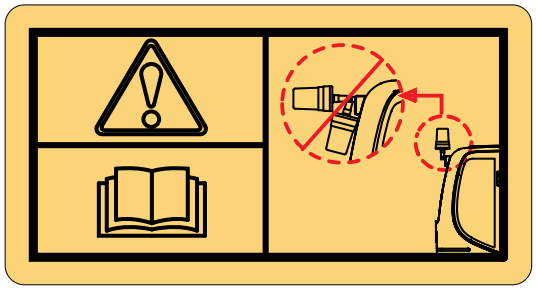
33) **BEACON LAMP** (item 48)

This warning label is positioned on the center outside of the cabin.

※ **Make sure the beacon lamp maintains a vertical position.**

A horizontal position can result in a decrease in life time of the lamp due to the infiltration of foreign substances such as dust or water.

※ **While the machine transfer, the beacon lamp is easy to break. In that case, change the position of the lamp to the horizontal.**



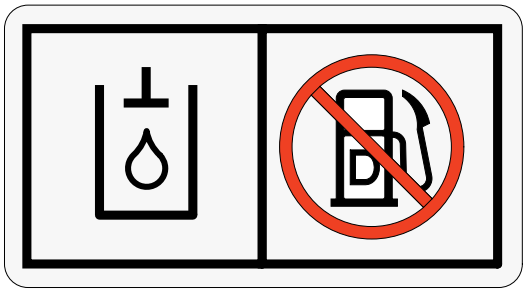
140Z90FW49

34) **FUEL SHUT OFF** (item 49)

This warning label is positioned on the left side of the hydraulic tank.

※ **Fill only the hydraulic oil.**

※ **Do not fill the diesel fuel.**



140WH90FW51

35) **WATER SEPARATOR** (item 50)

This warning label is positioned in right window of the cab.

⚠ **In order to protect high pressure fuel system, please drain water in water separator before starting the engine.**

210N90FW50

36) **MCU CONNECTOR** (item 51)

This warning label is positioned on the low cover of the air conditioner in the cab.

※ **MCU communicates the machine data with Laptop computer through RS232 service socket.**

※ **See page 3-60 for details.**

1409S0FW52

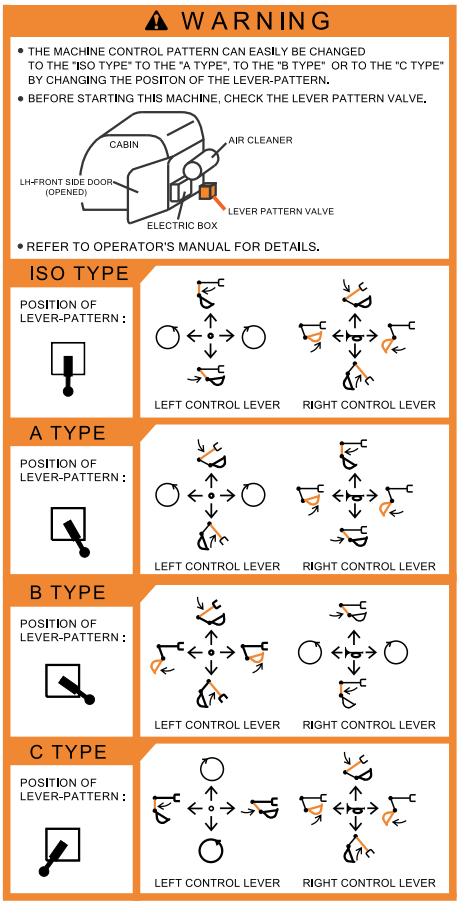
37) **MACHINE CONTROL PATTERN** (item 52)

This warning label is positioned inside of radiator screen plate.

⚠ **Check the machine control pattern for conformance to pattern on this label. If not, change label to match pattern before operating machine.**

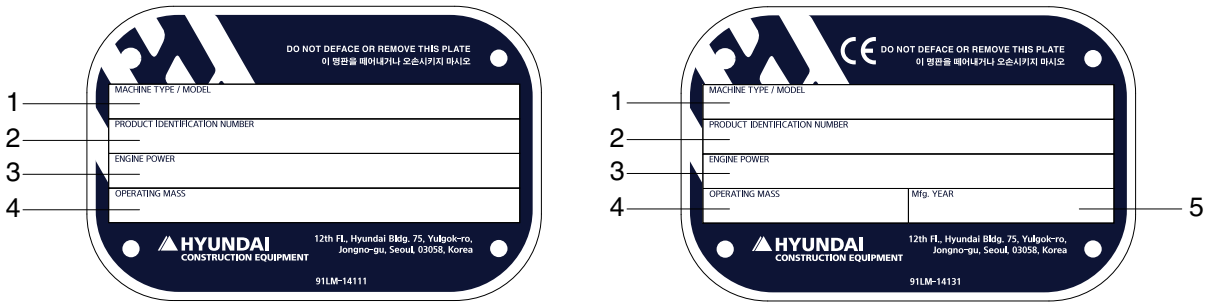
⚠ **Failure to do so could result in injury or death.**

※ **See page 4-34 for details.**



2209S0FW21

MACHINE DATA PLATE



FOR EU ONLY

21090FW10

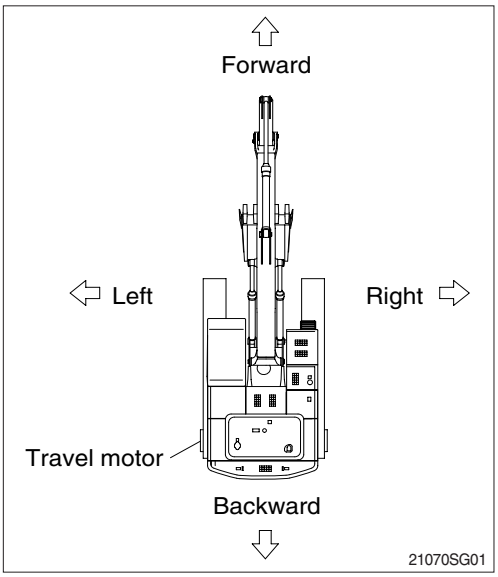
1 Machine type / model 2 Product identification number 3 Engine power
4 Operating mass 5 Manufacturing year

※ The machine serial number assigned to this particular machine and should be used when requesting information or ordering service parts for this machine from your authorized HYUNDAI dealer. The machine serial number is also stamped on the frame.

GUIDE

1. DIRECTION

The direction of this manual indicate forward, backward, right and left on the standard of operator when the travel motor is in the rear and machine is on the traveling direction.

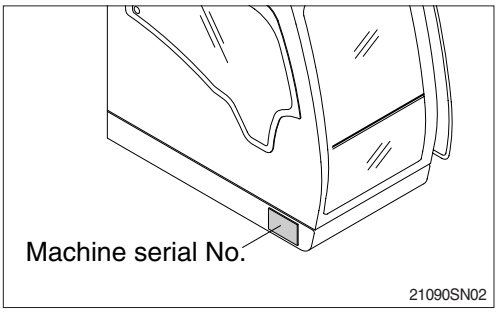


2. SERIAL NUMBER

Inform following when you order parts or the machine is out of order.

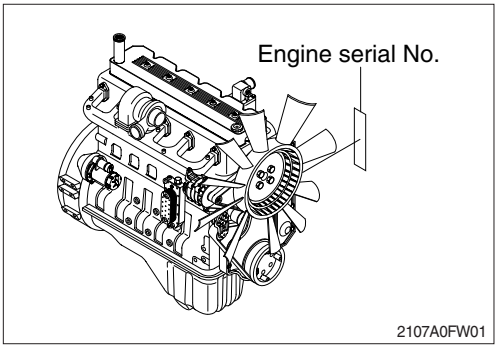
1) MACHINE SERIAL NUMBER

The numbers are located below the right window of the operator's cab.



2) ENGINE SERIAL NUMBER

The numbers are located on the engine name plate.



3. INTENDED USE

This machine is designed to be used mainly for the following work.

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

※ Please refer to the section 4 (efficient working method) further details.

4. SYMBOLS

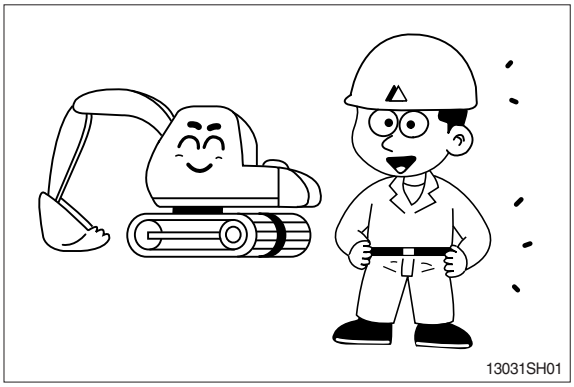
⚠ Important safety hint.

△ It indicates matters which can cause the great loss on the machine or the surroundings.

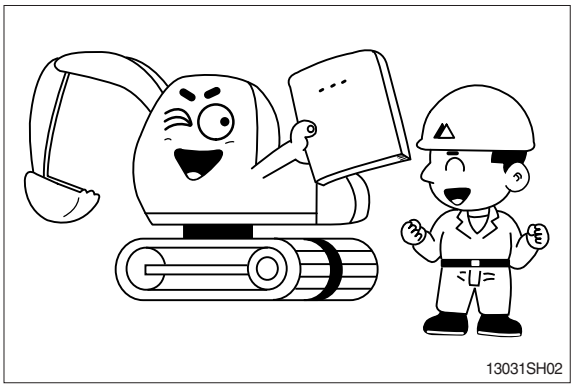
※ It indicates the useful information for operator.

1. BEFORE OPERATING THE MACHINE

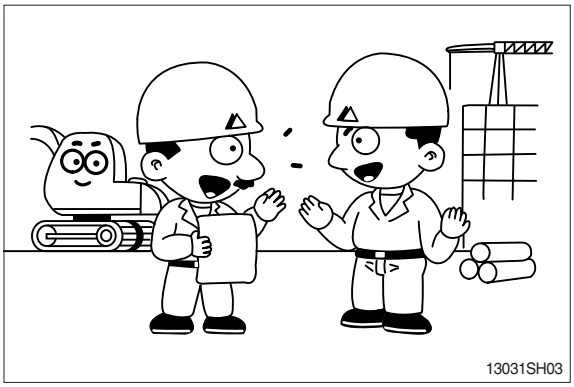
Think-safety first.
In special situation, wear protective clothing including a safety helmet, safety shoes, gloves, safety glasses and ear protection as required by the job condition.
Almost every accident is caused by disregarding the simple and fundamental safety hints.


13031SH01

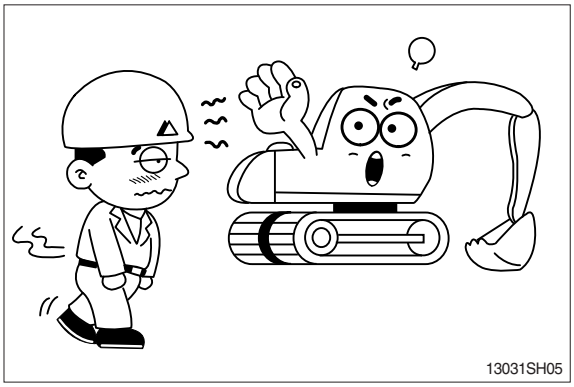
Be sure to understand thoroughly all about the operator's manual before operating the machine.
Proper care is your responsibility.


13031SH02

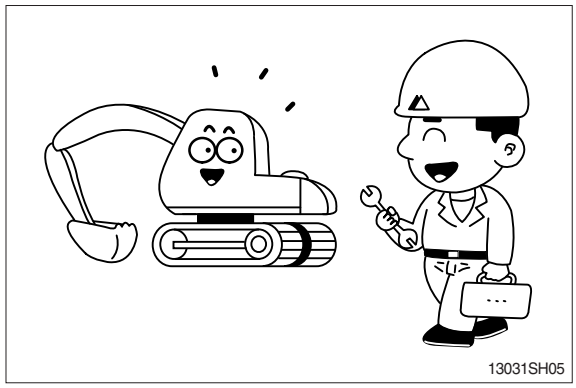
Fully understand the details and process of the construction before starting the work.
If you find anything dangerous on the job, consult with the job supervisor for the preventive measures before operating the machine.


13031SH03

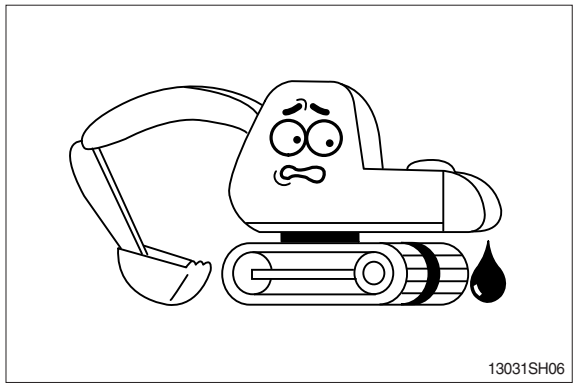
Do not operate when tired, or after drinking alcoholic beverages or any type of drugs.


13031SH05

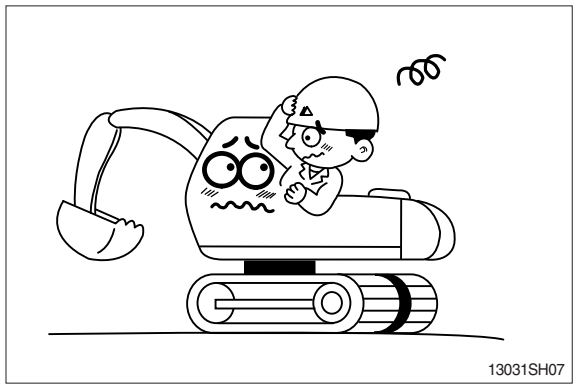
Check daily according to the operation manual.
Repair the damaged parts and tighten the loosened bolts.



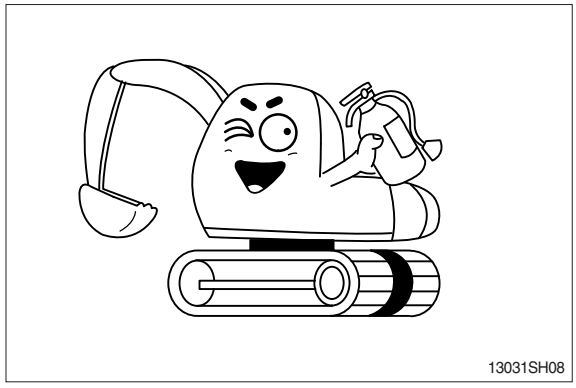
Check for leakage of engine oil, hydraulic oil, fuel and coolant.
Keep machine clean, clean machine regularly.



Do not operate the machine if it requires repairs.
Operate after complete repair.



Be prepared if a fire starts.
Keep a fire extinguisher handy and emergency numbers for a fire department near your telephone.

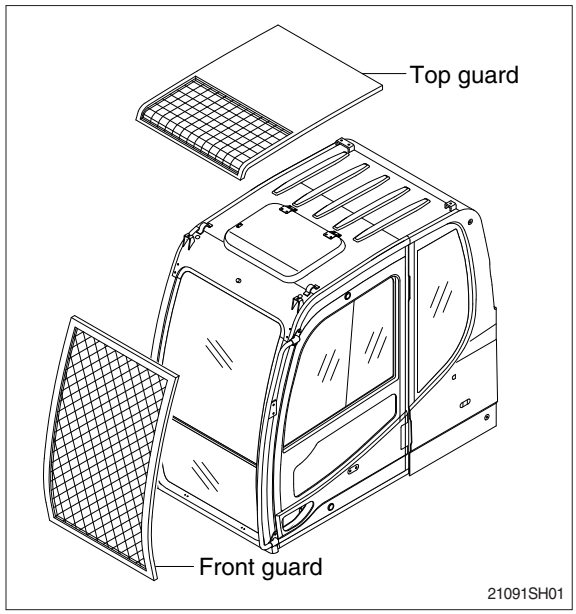


PROTECTION AGAINST FALLING OR FLYING OBJECTS

If there is any danger of falling or flying objects hitting the operator, install protective guards in place to protect the operator as required for each particular situation.

Be sure to close the front window before commencing work.

Make sure to keep all persons other than operator outside the range of falling or flying objects.
In case you need top guard, front guard and FOPS (falling object protective structure), please contact Hyundai distributor in Europe.



UNAUTHORIZED MODIFICATION

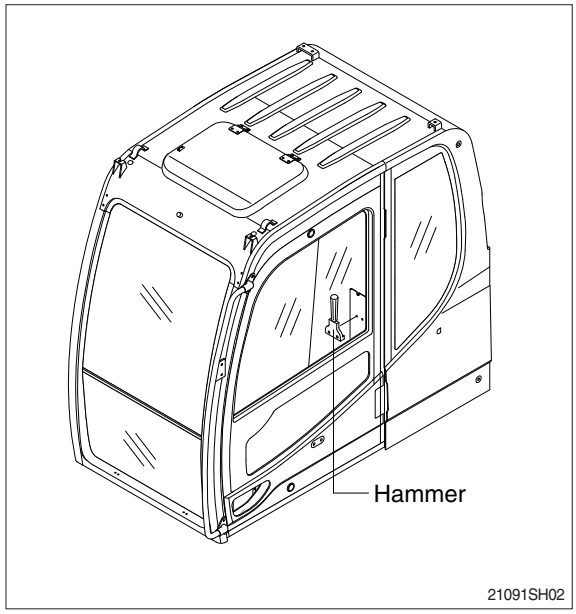
Any modification made without authorization from Hyundai can create hazards.

Before making a modification, consult your Hyundai distributor. Hyundai will not be responsible for any injury or damage caused by any unauthorized modification.

PREPARE FOR EMERGENCY

Only in case of emergency, use the installed hammer for breaking the windshield of the cab, and then exit carefully.

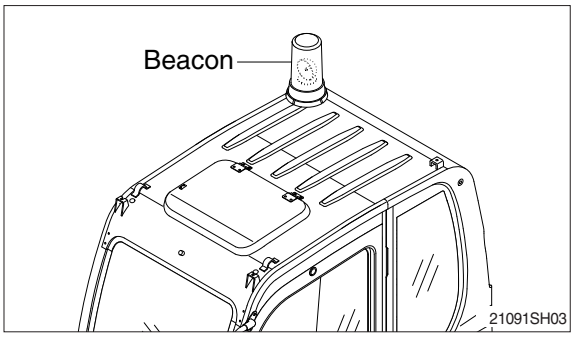
Be sure you know the phone numbers of persons you should contact in case of an emergency.



ROTATING BEACON

When you operate a machine on a road or beside a road, a rotating beacon is required to avoid any traffic accident.

Please contact your Hyundai distributor to install it.



PRECAUTIONS FOR ATTACHMENTS

When installing and using an optional attachment, read the instruction manual for the attachment and the information related to attachments in this manual.

Do not use attachments that are not authorized by Hyundai or your Hyundai distributor. Use of unauthorized attachments could create a safety problem and adversely affect the proper operation and useful life of the machine.

Any injuries, accidents, product failures resulting from the use of unauthorized attachments are not the responsibility of Hyundai.

The stability of this machine is enough to be used for general work. When you operate this machine, allow for the lifting capacity tables. If you want to use other special applications (not covered in this manual), you have to attach additional counterweight or be cautious while running the machine.

SAFETY RULES

Only trained and authorized personnel can operate and maintain the machine.
Follow all safety rules, precautions and instructions when operating or performing maintenance on the machine.
When working with another operator or a person on worksite traffic duty, be sure all personnel understand all hand signals that are to be used.

SAFETY FEATURES

Be sure all guards and covers are in their proper position. Have guards and covers repaired if damaged.
Use safety features such as safety lock and seat belts properly.
Never remove any safety features. **Always** keep them in good operating condition.
Improper use of safety features could result in serious bodily injury or death.

MACHINE CONTROL PATTERN

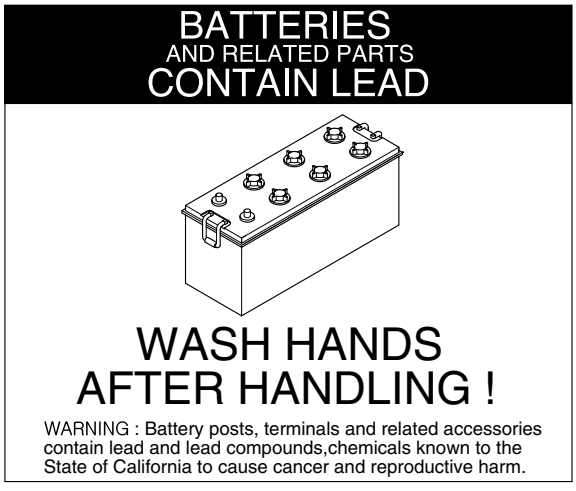
Check machine control pattern for conformance to pattern on label in cab.
If not, change label to match pattern before operating machine.
Failure to do so could result in injury.

CALIFORNIA PROPOSITION 65

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

This product contains or emits chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds.
WASH HANDS AFTER HANDLING



13031SH55

Do not load the machine with the lifting eyes on the counterweight.

⚠ The wrong loading method can result in serious bodily injury or death.

FIRE PREVENTION AND EXPLOSION PREVENTION

Regeneration

The exhaust gas temperatures during regeneration will be elevated. Follow proper fire prevention instructions and use the disable regeneration function when appropriate.

General

All fuels, most lubricants, and some coolant mixtures are flammable.

To minimize the risk of fire or explosion, the following actions are recommended.

Always perform a Walk-Around Inspection, which may help you identify a fire hazard.
Do not operate a machine when a fire hazard exists. Contact your dealer for service.

3001SH01

Understand the use of the primary exit and alternative exit on the machine.

Do not operate a machine with a fluid leak. Repair leaks and clean up fluids before resuming machine operation. Fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire. A fire may cause personal injury or death.

Do not weld on or drill holes in the engine cover. Flammable material such as leaves, twigs, papers, trash may accumulate in engine compartment.

Remove flammable material such as leaves, twigs, papers, trash and so on. These items may accumulate in the engine compartment or around other hot areas and hot parts on the machine.

Keep the access doors to major machine compartments closed and access doors in working condition in order to permit the use of fire suppression equipment, in case a fire should occur.

Clean all accumulations of flammable materials such as fuel, oil, and debris from the machine.

Do not operate the machine near any flame.

Keep shields in place. Exhaust shields (if equipped) protect hot exhaust components from oil spray or fuel spray in a break in a line, in a hose, or in a seal. Exhaust shields must be installed correctly.

Do not weld or flame cut on tanks or lines that contain flammable fluids or flammable material. Empty and purge the lines and tanks. Then clean the lines and tanks with a nonflammable solvent prior to welding or flame cutting. Ensure that the components are properly grounded in order to avoid unwanted arcs.

Dust that is generated from repairing nonmetallic hoods or fenders may be flammable and/or explosive. Repair such components in a ventilated area away from open flames or sparks. Use suitable Personal Protection Equipment (PPE).

Inspect all lines and hoses for wear or deterioration. Replace damaged lines and hoses. The lines and the hoses should have adequate support and secure clamps. Tighten all connections to the recommended torque. Damage to the protective cover or insulation may provide fuel for fires.

SAFETY FEATURES

Be sure all guards and covers are in their proper position. Have guards and covers repaired if damaged.
Use safety features such as safety lock and seat belts properly.
Never remove any safety features. **Always** keep them in good operating condition.
Improper use of safety features could result in serious bodily injury or death.

MACHINE CONTROL PATTERN

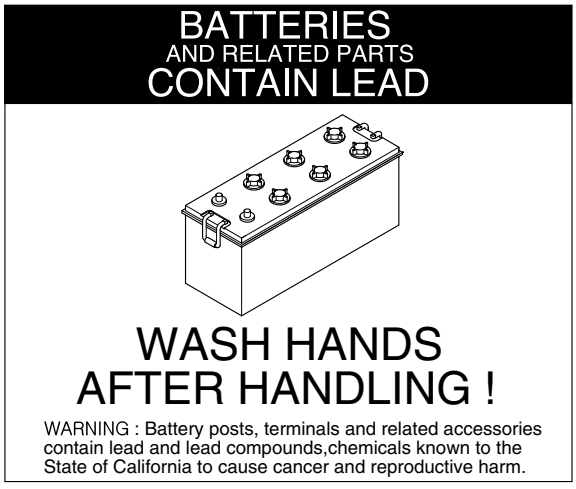
Check machine control pattern for conformance to pattern on label in cab.
If not, change label to match pattern before operating machine.
Failure to do so could result in injury.

CALIFORNIA PROPOSITION 65

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

This product contains or emits chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Battery posts, terminals and related accessories contain lead and lead compounds.
WASH HANDS AFTER HANDLING



13031SH55

Do not load the machine with the lifting eyes on the counterweight.

⚠ The wrong loading method can result in serious bodily injury or death.

Store fuels and lubricants in properly marked containers away from unauthorized personnel. Store oily rags and flammable materials in protective containers. Do not smoke in areas that are used for storing flammable materials.

3001SH02

Use caution when you are fueling a machine.
Do not smoke while you are fueling a machine. Do not fuel a machine near open flames or sparks. Always stop the engine before fueling. Fill the fuel tank outdoors. Properly clean areas of spillage.

Never store flammable fluids in the operator compartment of the machine.

3001SH03

Battery and battery cables

The following actions are recommended to minimize the risk of fire or an explosion related to the battery.

3001SH04

Do not operate a machine if battery cables or related parts show signs of wear or damage. Contact your dealer for service.

Follow safe procedures for engine starting with jump-start cables. Improper jumper cable connections can cause an explosion that may result in injury.

Do not charge a frozen battery. This action may cause an explosion.

Gases from a battery can explode. Keep any open flames or sparks away from the top of a battery. Do not smoke in battery charging areas.

Never check the battery charge by placing a metal object across the terminal posts. Use a voltmeter in order to check the battery charge.

Daily inspect battery cables that are in areas that are visible. Inspect cables, clips, straps, and other restraint for damage. Replace any damaged parts. Check for signs of the following, which can occur over time due to use and environmental factors :

- Fraying
- Abrasion
- Cracking
- Discoloration
- Cuts on the insulation of the cable
- Fouling
- Corroded terminals, damaged terminals, and loose terminals

Replace damaged battery cable (s) and replace any related parts. Eliminate any fouling, which may have caused insulation failure or related component damage or wear. Ensure that all components are reinstalled correctly.

An exposed wire on the battery cable may cause a short ground if the exposed area comes into contact with a grounded surface. A battery cable short produces heat from the battery current, which may be a fire hazard.

An exposed wire on the ground cable between the battery and the disconnect switch may cause the disconnect switch to be bypassed if the exposed area comes into contact with a grounded surface. This action may result in an unsafe condition for servicing the machine. Repair components or replace components before servicing the machine.

⚠ Fire on a machine can result in personal injury or death. Exposed battery cables that come into contact with a grounded connection can result in fires. Replace cables and related parts that show signs of wear or damage. Contact your Hyundai Heavy Industries dealer.

Wiring

Check electrical wires daily. If any of the following conditions exist, replace parts before you operate the machine.

- Fraying
- Signs of abrasion or wear
- Cracking
- Discoloration
- Cuts on insulation
- Other damage

Make sure that all clamps, guards, clips, and straps are reinstalled correctly. This action will help to prevent vibration, rubbing against other parts, and excessive heat during machine operation.

Attaching electrical wiring to hoses and tubes that contain flammable fluids or combustible fluids should be avoided.

Consult your Hyundai Heavy Industries dealer for repair or for replacement parts.

Keep wiring and electrical connections free of debris.

Lines, Tubes, and Hoses

Do not bend high-pressure lines. Do not strike high-pressure lines. Do not install any lines that are bent or damaged. Use the appropriate backup wrenches in order to tighten all connections to the recommended torque.

Check lines, tubes, and hoses carefully. Wear Personal Protection Equipment (PPE) in order to check for leaks. Always use a board or cardboard when you check for a leak. Leaking fluid that is under pressure can penetrate body tissue. Fluid penetration can cause serious injury and possible death. A pin hole leak can cause severe injury. If fluid is injected into your skin, you must get treatment immediately. Seek treatment from a doctor that is familiar with this type of injury.

Replace the affected parts if any of the following conditions are present :

- End fittings are damaged or leaking.
- Outer coverings are chafed or cut.
- Wires are exposed.
- Outer coverings are swelling or ballooning.
- Flexible parts of the hoses are kinked.
- Outer covers have exposed embedded armoring.
- End fittings are displaced.

Make sure that all clamps, guards, and heat shields are installed correctly. During machine operation, this action will help to prevent vibration, rubbing against other parts, excessive heat, and failure of lines, tubes, and hoses.

Do not operate a machine when a fire hazard exists. Repair any lines that are corroded, loose, or damaged. Leaks may provide fuel for fires. Consult your Hyundai dealer for repair or for replacement parts.

Ether

Ether (if equipped) is commonly used in cold weather applications. Ether is flammable and poisonous.

Do not spray ether manually into an engine if the machine is equipped with a thermal starting aid for cold weather starting.

Use ether in ventilated areas. Do not smoke while you are replacing an ether cylinder or while you are using an ether spray.

Do not store ether cylinders in living areas or in the operator compartment of a machine. Do not store ether cylinders in direct sunlight or in temperatures above 49˚C(120.2 ˚F). Keep ether cylinders away from unauthorized personnel.

Fire Extinguisher

As an additional safety measure, keep a fire extinguisher on the machine.

Be familiar with the operation of the fire extinguisher. Inspect the fire extinguisher and service the fire extinguisher regularly. Follow the recommendations on the instruction plate.

Consider installation of an aftermarket Fire Suppression System, if the application and working conditions warrant the installation.

Fire Safety

※ **Locate secondary exits and how to use the secondary exits before you operate the machine.**
※ **Locate fire extinguishers and how to use a fire extinguisher before you operate the machine.**

If you find that you are involved in a machine fire, your safety and that of others on site is the top priority. The following actions should only be performed if the actions do not present a danger or risk to you and any nearby people. At all times you should assess the risk of personal injury and move away to a safe distance as soon as you feel unsafe.
Move the machine away from nearby combustible material such as fuel/oil stations, structures, trash, mulch and timber.

Lower any implements and turn off the engine as soon as possible. If you leave the engine running, the engine will continue to feed a fire. The fire will be fed from away damaged hoses that are attached to the engine or pumps.

If possible, turn the battery disconnect switch to the OFF position. Disconnecting the battery will remove the ignition source in the event of an electrical short. Disconnecting the battery will eliminate a second ignition source if electrical wiring is damaged by the fire, resulting in a short circuit.

Notify emergency personnel of the fire and your location.

If your machine is equipped with a fire suppression system, follow the manufacturers procedure for activating the system.

※ **Fire suppression systems need to be regularly inspected by qualified personnel. You must be trained to operate the fire suppression system.**

Use the on-board fire extinguisher and use the following procedure :
1. Pull the pin.
2. Aim the extinguisher or nozzle at the base of the fire.
3. Squeeze the handle and release the extinguishing agent.
4. Sweep the extinguisher from side to side across the base of the fire until the fire is out.

Remember, if you are unable to do anything else, shut off the machine before exiting. By shutting off the machine, fuels will not continue to be pumped into the fire.
If the fire grows out of control, be aware of the following risks :
- Tires on wheeled machines pose a risk of explosion as tires burn. Hot shrapnel and debris can be thrown great distances in an explosion.
- Tanks, accumulators, hoses, and fittings can rupture in a fire, spraying fuels and shrapnel over a large area.

Remember that nearby all of the fluids on the machine are flammable, including coolant and oils. Additionally, plastics, rubbers, fabrics, and resins in fiberglass panels are also flammable.

Fire extinguisher Location

Make sure that a fire extinguisher is available. Be familiar with the operation of the fire extinguisher. Inspect the fire extinguisher and service the fire extinguisher. Obey the recommendations on the instruction plate.

Mount the fire extinguisher in the accepted location per local regulations.

If your machine is equipped with a ROPS structure, strap the mounting plate to the ROPS in order to mount the fire extinguisher. If the weight of the fire extinguisher exceeds 4.5 kg (10 lb), mount the fire extinguisher near the bottom of the ROPS. Do not mount the fire extinguisher at the upper one-third area on the ROPS.

Do not weld the ROPS structure in order to install the fire extinguisher. Also, do not drill holes in the ROPS structure in order to mount the fire extinguisher on the ROPS.

Consult your Hyundai dealer for the proper procedure for mounting the fire extinguisher.

THE EUROPEAN UNION PHYSICAL AGENTS (VIBRATION) DIRECTIVE 2002/44/EC

Vibration Data for Earth-moving Machines

Information Concerning Hand/Arm Vibration Level

When the machine is operated according to the intended use, the hand/arm vibration of this machine is below 2.5 m/s^2.

Information Concerning Whole Body Vibration Level

The highest root mean square value of weighted acceleration to which the whole body is subjected, is less than 0.5 m/s^2.

This section provides vibration data and a method for estimating the vibration level for earth moving machines.

Vibration levels are influenced by many different parameters. Many items are listed below.

- Operator training, behavior, mode and stress
- Job site organization, preparation, environment, weather and material
- Machine type, quality of the seat, quality of the suspension system, attachments and condition of the equipment

It is not possible to get precise vibration levels for this machine. The expected vibration levels can be estimated with the information in below Table in order to calculate the daily vibration exposure. A simple evaluation of the machine application can be used.

Estimate the vibration levels for the three vibration directions. For typical operating conditions, use the average vibration levels as the estimated level. With an experienced operator and smooth terrain, subtract the Scenario Factors from the average vibration level. For aggressive operations and severe terrain, add the Scenario Factors to the average vibration level in order to obtain the estimated vibration level.

※ **All vibration levels are in meter per second squared.**

ISO Reference Table A – Equivalent vibration levels of whole body vibration emission for earthmoving equipment.

Machine family	Machine kind	Typical operating condition	Vibration Levels			Scenario Factors		
			X axis	Y axis	Z axis	X axis	Y axis	Z axis
Excavator	Compact crawler excavator	Excavating	0.33	0.21	0.19	0.19	0.12	0.10
		Hydraulic breaker app.	0.49	0.28	0.36	0.20	0.13	0.17
		Transfer movement	0.45	0.39	0.62	0.17	0.18	0.28
	Crawler excavator	Excavating	0.44	0.27	0.30	0.24	0.16	0.17
		Hydraulic breaker app.	0.53	0.31	0.55	0.30	0.18	0.28
		Mining application	0.65	0.42	0.61	0.21	0.15	0.32
		Transfer movement	0.48	0.32	0.79	0.19	0.20	0.23
	Wheeled excavator	Excavating	0.52	0.35	0.29	0.26	0.22	0.13
		Transfer movement	0.41	0.53	0.61	0.12	0.20	0.19

ISO Reference Table A – Equivalent vibration levels of whole body vibration emission for earthmoving equipment.

Machine family	Machine kind	Typical operating condition	Vibration Levels			Scenario Factors		
			X axis	Y axis	Z axis	X axis	Y axis	Z axis
Loader	skid steer loader (tracks)	V-shaped motion	1.21	1.00	0.82	0.30	0.84	0.32
	Wheel backhoe loader	Excavating	0.28	0.26	0.20	0.09	0.16	0.06
	Wheel loader	Load and carry motion	0.84	0.81	0.52	0.23	0.20	0.14
		Mining application	1.27	0.97	0.81	0.47	0.31	0.47
		Transfer movement	0.76	0.91	0.49	0.33	0.35	0.17
		V-shape motion	0.99	0.84	0.54	0.29	0.32	0.14

※ **Refer to "ISO/TR 25398 Mechanical Vibration-Guideline for the assessment of exposure to whole body vibration of ride on operated earthmoving machines" for more information about vibration. This publication uses data that is measured by international institutes, organizations and manufacturers. This document provides information about the whole body exposure of operators of earthmoving equipment.**

Guidelines for Reducing Vibration Levels on Earthmoving Equipment

Properly adjust machines. Properly maintain machines. Operate machines smoothly. Maintain the conditions of the terrain. The following guidelines can help reduce the whole body vibration level :

1. Use the right type and size of machine, equipment, and attachments.
2. Maintain machines according to the manufacturer's recommendations.
   a. Tire pressures
   b. Brake and steering systems
   c. Controls, hydraulic system and linkages
3. Keep the terrain in good condition.
   a. Remove any large rocks or obstacles.
   b. Fill any ditches and holes.
   c. Provide machines and schedule time in order to maintain the conditions of the terrain.
4. Use a seat that meets "ISO 7096". Keep the seat maintained and adjusted.
   a. Adjust the seat and suspension for the weight and the size of the operator.
   b. Inspect and maintain the seat suspension and adjustment mechanisms.
5. Perform the following operations smoothly.
   a. Steer
   b. Brake
   c. Accelerate
   d. Shift the gears.
6. Move the attachments smoothly.
7. Adjust the machine speed and the route in order to minimize the vibration level.
   a. Drive around obstacles and rough terrain.
   b. Slow down when it is necessary to go over rough terrain.
8. Minimize vibrations for a long work cycle or a long travel distance.
   a. Use machines that are equipped with suspension systems.
   b. Use the ride control system on machines.
   c. If no ride control system is available, reduce speed in order to prevent bounce.
   d. Haul the machines between workplaces.
9. Less operator comfort may be caused by other risk factors. The following guidelines can be effective in order to provide better operator comfort:
   a. Adjust the seat and adjust the controls in order to achieve good posture.
   b. Adjust the mirrors in order to minimize twisted posture.
   c. Provide breaks in order to reduce long periods of sitting.
   d. Avoid jumping from the cab
   e. Minimize repeated handling of loads and lifting of loads.
   f. Minimize any shocks and impacts during sports and leisure activities.

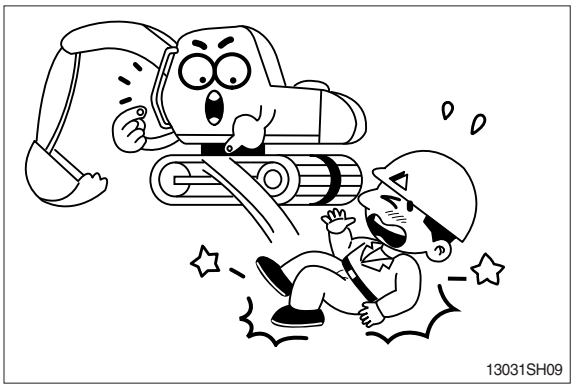
Sources

The vibration information and calculation procedure is based on "ISO/TR 25398 Mechanical Vibration-Guideline for whole body vibration exposure of operators of earthmoving equipment. The method is based on measured vibration emission under real working conditions for all machines.

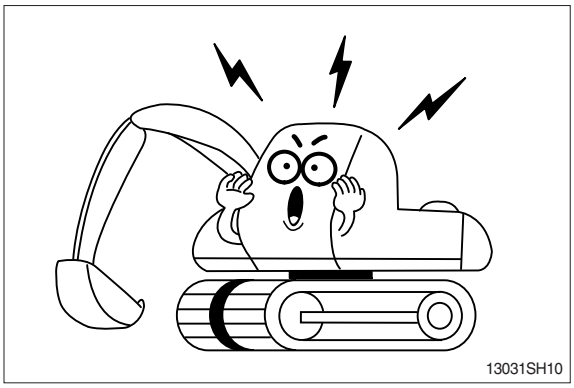
You should check the original directive. This document summarizes part of the content of the applicable law. This document is not meant to substitute the original sources. Other parts of these documents are based on information from the United Kingdom Health and Safety Executive.

2. DURING OPERATING THE MACHINE

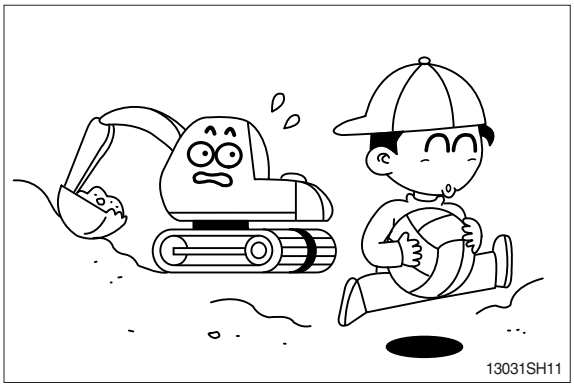
Use the handle and footstep when getting on or off the machine.
Do not jump on or off the machine.



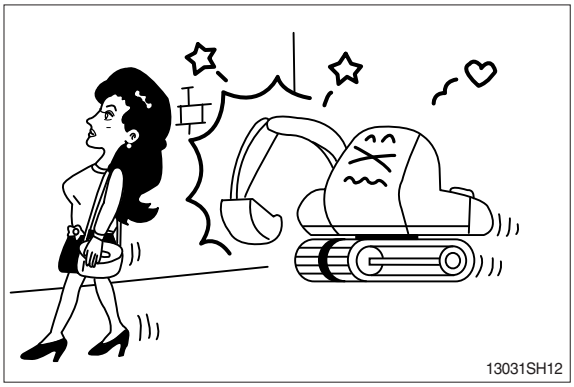
Sound the horn to warn nearby personnel before operating the machine.
Remove all the obstacles like frost on the window before operating the machine for the good visibility.



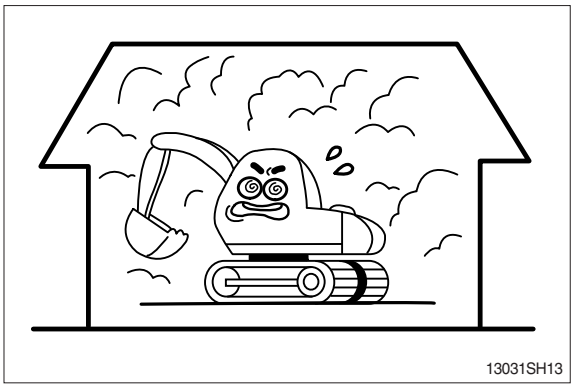
Operate carefully to make sure all personnel or obstacles are clear within the working range of the machine.
Place safety guards if necessary.



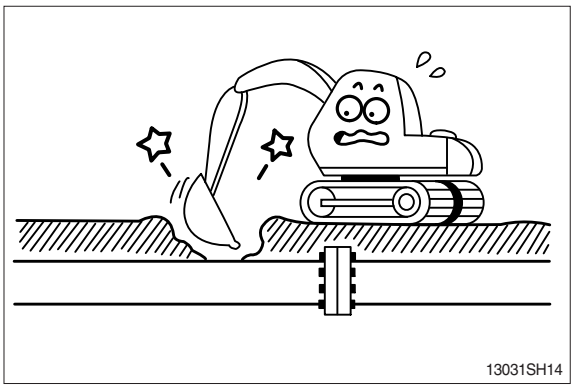
When using the work equipment, pay attention to job site.



Provide proper ventilation when operating engine in a closed area to avoid the danger of exhaust gases.

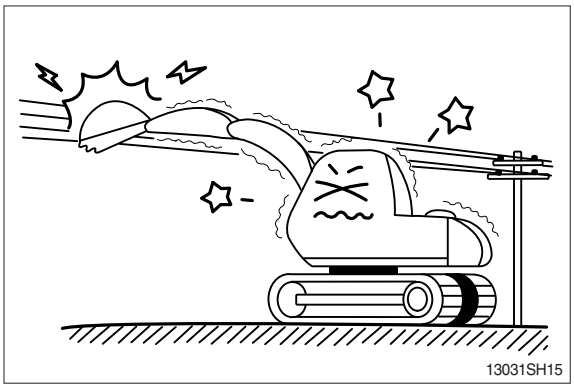


Check the locations of underground gas pipes or water line and secure the safety before operation.

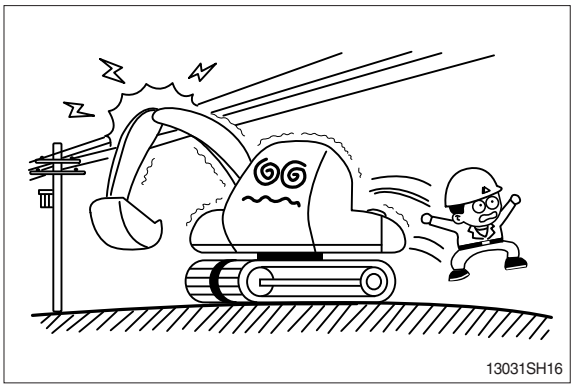


The operating near the electrical lines is very dangerous.
Operate within safe working range permitted as below.

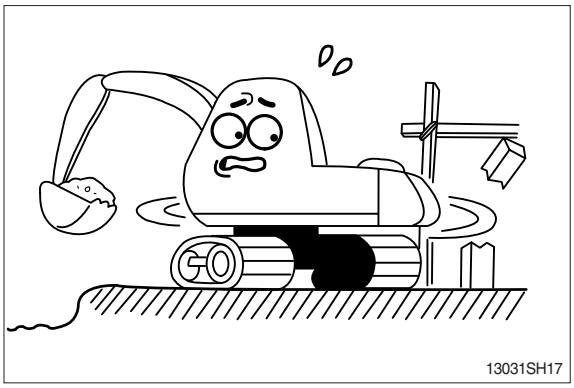
Supply voltage	Min safe separation
6.6 kV	3m (10 ft)
33.0 kV	4m (13 ft)
66.0 kV	5m (16 ft)
154.0 kV	8m (26 ft)
275.0 kV	10m (33 ft)



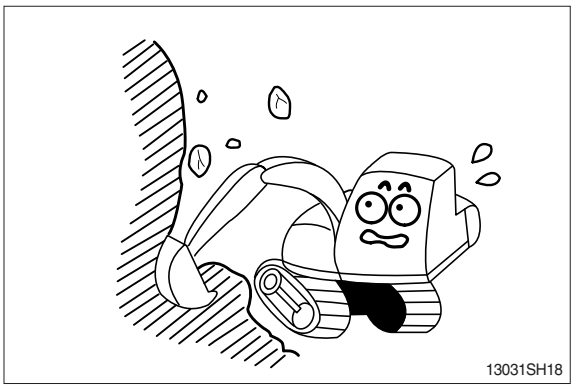
If the machine touches the electric power lines, keep sitting on the operator's seat and make sure the personnel on the ground not to touch the machine until turning off the electric current. Jump off the machine without contacting the machine when you need to get off.



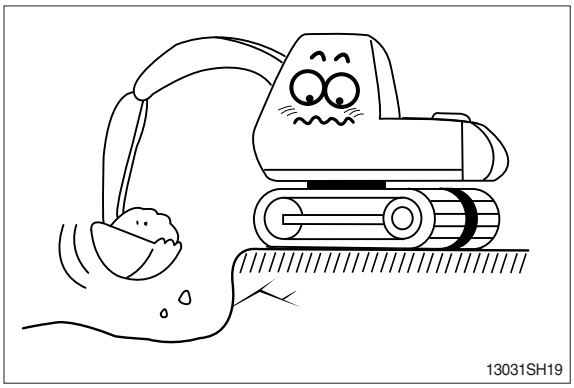
Watch out for obstacles.
Be particularly careful to check the machine clearance during the swing.



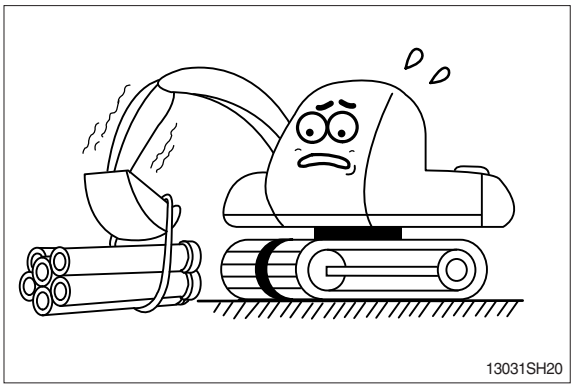
When using the machine as breaker or working in a place where stones may fall down, cab roof guard and head guard should be provided for proper protection.



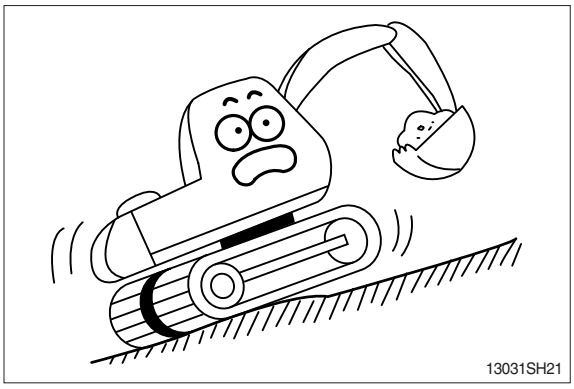
Avoid operating on a cliff or soft ground as there is danger of rolling over.
Make sure to get off easily as keeping the track at a right angle and putting the travel motor into the backward position when working on a cliff or soft ground inevitably.



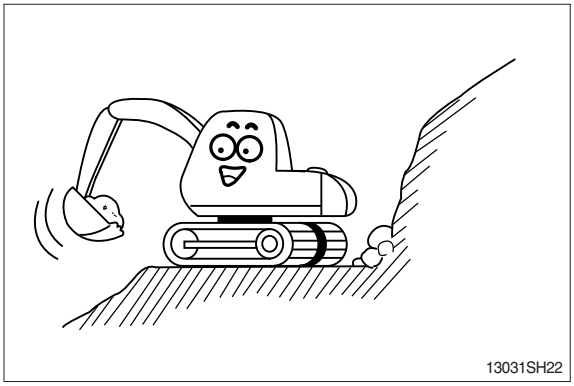
Operate for the lifting work considering the capacity of machine, weight and width of the load.
Be careful not to lift exceeding the machine capacity as it can be the cause of machine damage and safety accident.



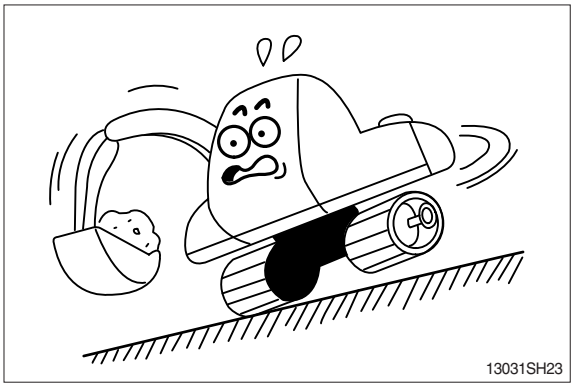
The operation on a slope is dangerous.
Avoid operating the machine on a slope of over 10 degree.



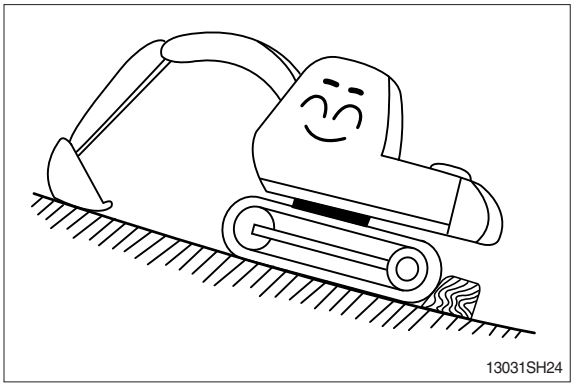
Operate the machine after making ground flat when operation is required on a slope.



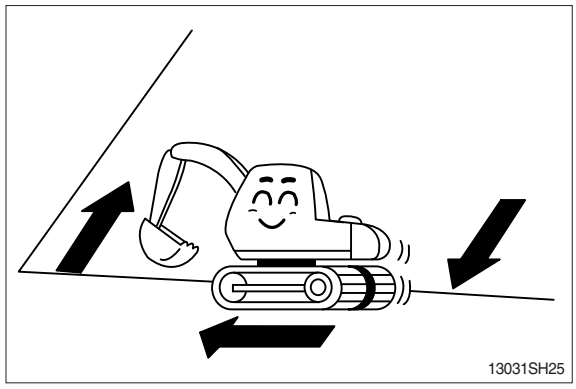
The swing on the slope can be danger of rolling over.
Do not operate to swing the machine with the bucket loaded on a slope since the machine may lose its balance under such an instance.



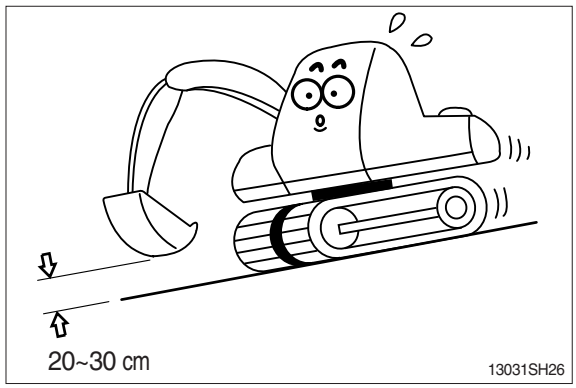
Avoid parking and stopping on a slope.
Lower the bucket to the ground and block the track when parking.



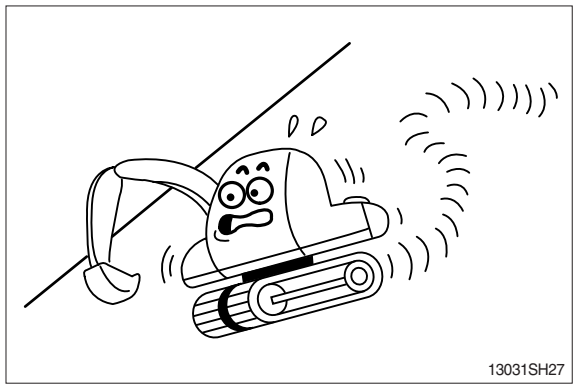
Avoid traveling in a cross direction on a slope as it can cause the danger of rolling over and sliding.



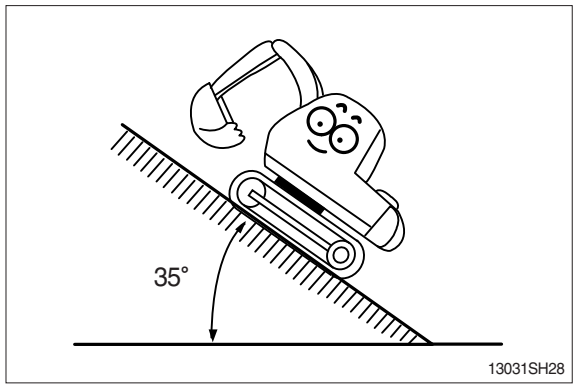
Traveling on a slope is dangerous.
Be sure to operate slowly when traveling down a slope and maintain the bucket at a height of 20~30 ㎝ (1 ft) above the ground so that it can be used as brake in an emergency.



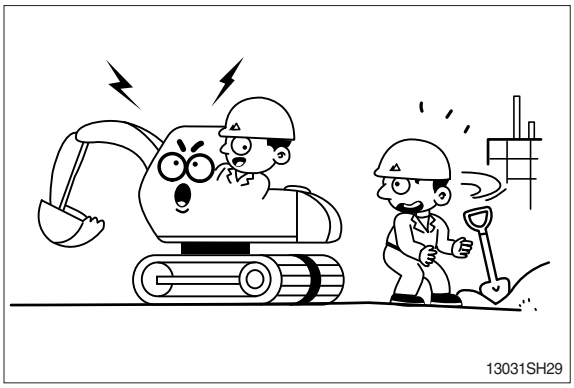
Steering of the machine while traveling on a slope is dangerous.
When an inevitable turning of direction is required, turn on the flat and solid ground.



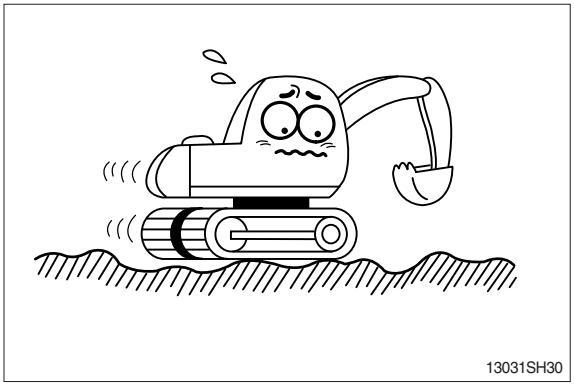
The engine angularity limits are 35 degree.
Do not operate by more than the engine limits in any case.



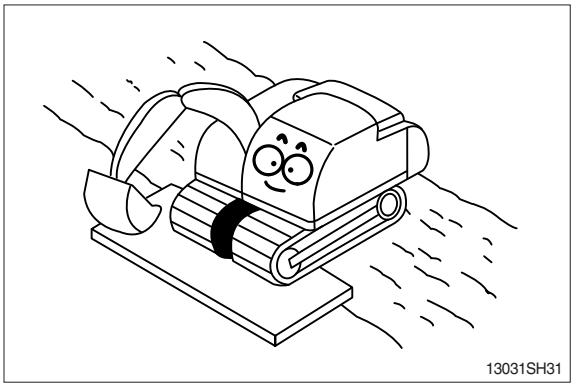
Before traveling the machine, sound the horn to warn nearby personnel.
Operate forward and backward correctly with confirming the location of the travel motor.



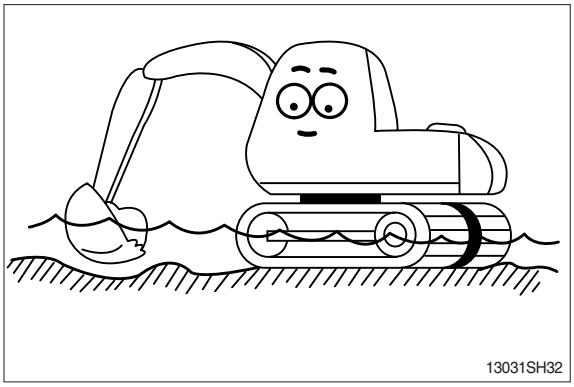
Slow down when traveling through obstacles or uneven ground.



When working on soft ground, place mats or wood boards on the ground to prevent the machine sinking.



When operating in water or when crossing shallow, check the bed soil condition and depth and flow speed of water, then proceed taking care that water is not above carrier roller.



MOUNTING AND DISMOUNTING

Never jump on or off the machine. **Never** get on or off a moving machine.

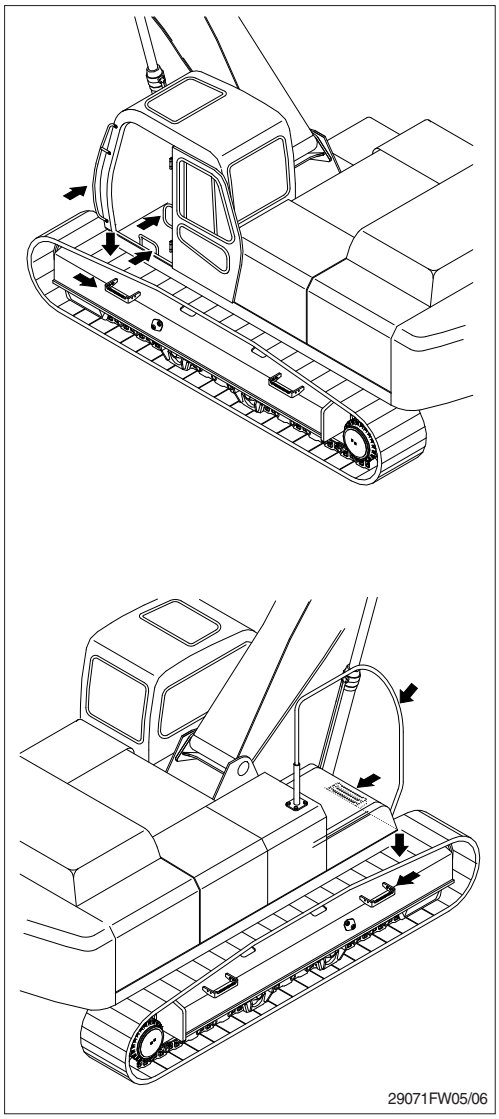
When mounting or dismounting, always face the machine and use the handrails, machine or track frame steps, and track shoes. Additional track frame step can be fitted for wider optional shoe. In this case please contact your Hyundai distributor.

Do not hold any control levers when getting on or off the machine.

Ensure safety by always maintaining at least three-point contact of hands and feet with the handrails, steps or track shoes.

Always remove any oil or mud from the handrails, steps and track shoes. If they are damaged, repair them and tighten any loose bolts.

If grasping the door handrail when mounting or dismounting or moving on the track, open and lock the door securely in the open position. Otherwise, the door may move suddenly, causing you to lose balance and fall.



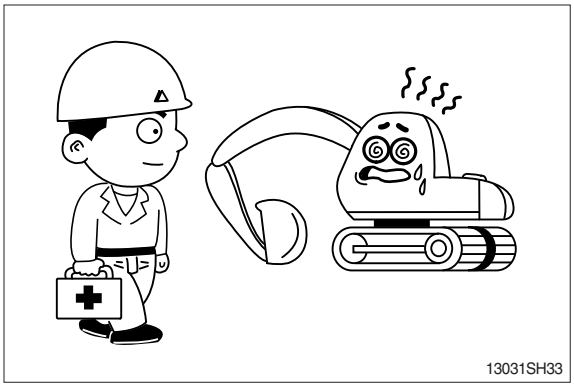
KEEP RIDERS OFF MACHINE

Riders on a machine are subject to injury such as being struck objects and being thrown off the machine.

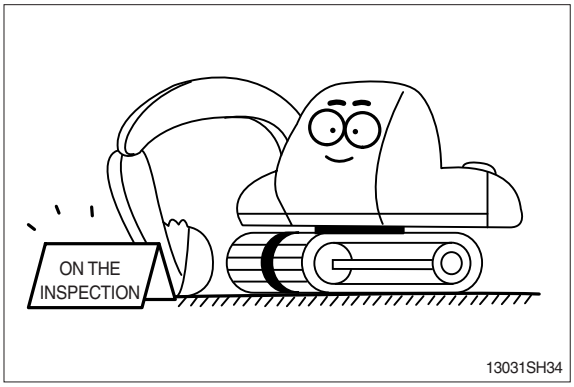
Only allow the operator on the machine. Keep riders off.

3. DURING MAINTENANCE

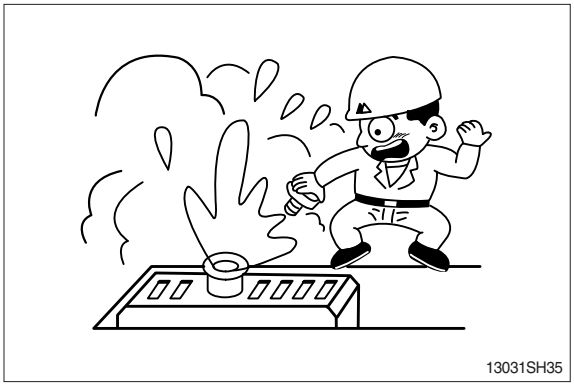
Stop the engine immediately when the trouble of the machine is found.
Inspect immediately the cause of trouble such as vibration, overheating and trouble in the cluster then repair.



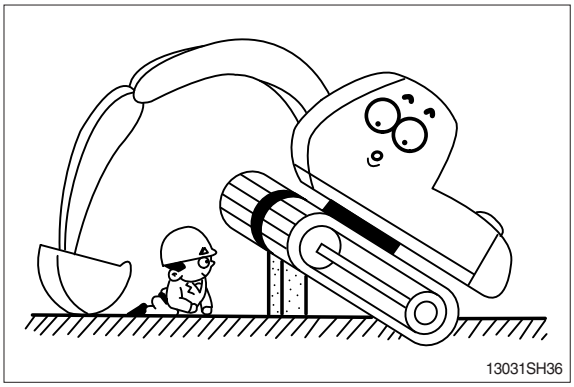
Park on a flat place and stop the engine for inspecting and repairing. Properly TAG machine is not operational. (remove start key)
Extreme care shall be taken during maintenance work. Parts may require additional safe guard.



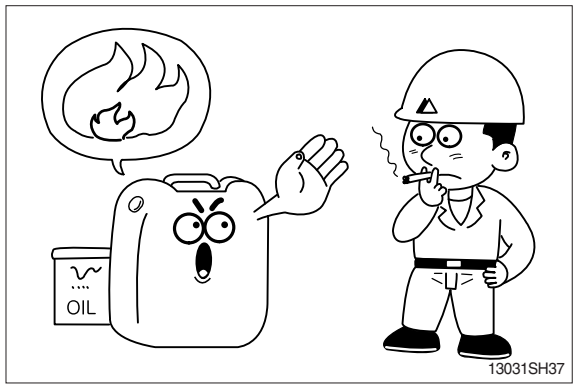
Do not remove the radiator cap from hot engine. Open the cap after the engine cools, below 50 °C (122 °F) to prevent personal injury from heated coolant spray or steam.



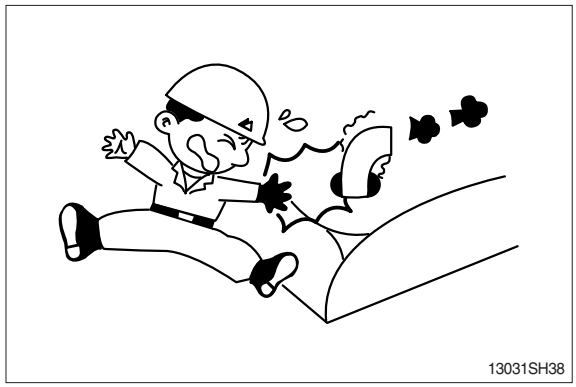
Do not work below the machine.
Be sure to work with proper safety supports.
Do not depend on the hydraulic cylinders to hold up the equipment and attachment.



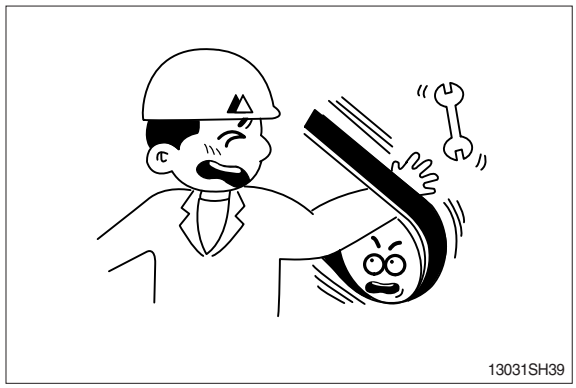
There is the danger of fire in fuel and oil.
Store in cool and dry area, away from any open flames.



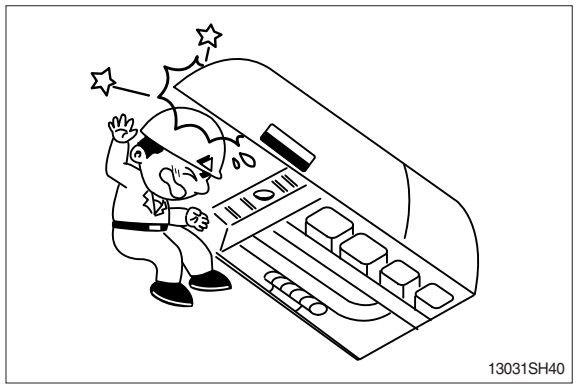
Do not touch exhaust pipe, or may cause severe burn.



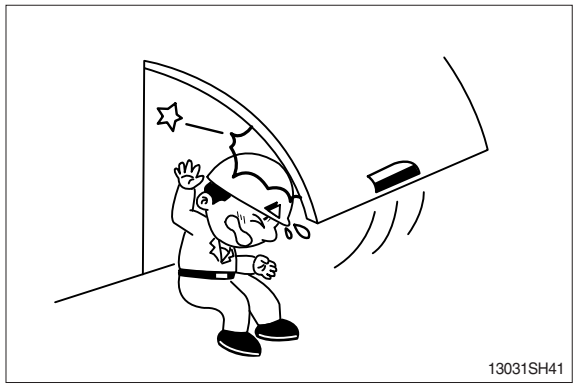
Do not open the engine hood and covers while the engine is running.



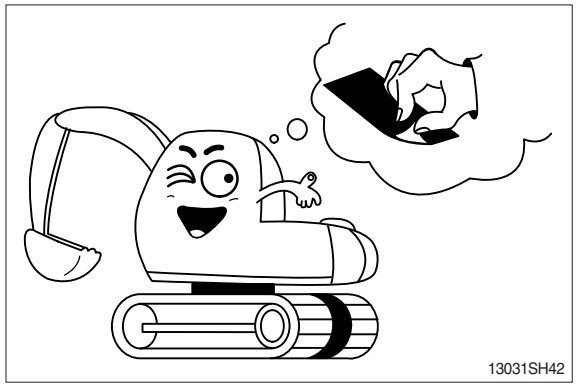
Be careful of not hitting the edges when you service engine.



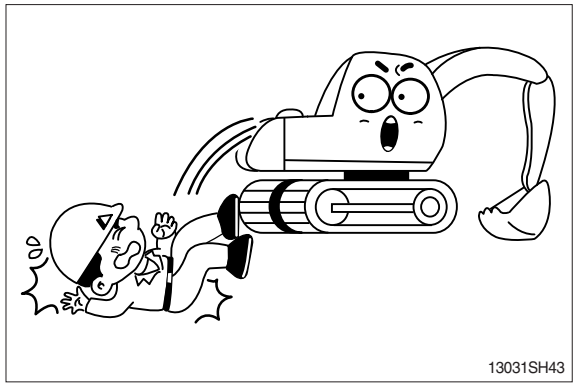
Be careful that the front window may be promptly closed.
Be sure to support stay, when the side door needs to be opened.
Be careful that the open side door may closed by the external or natural force like strong wind.


13031SH41

The antislip protection should be replaced if they have become worn or have been printed over.
Be sure to free of oil, water and grease etc.

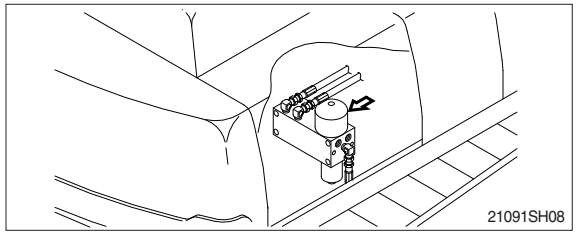

13031SH42

Be careful of not touching slip, fall down etc., when you work at the upper frame to service engine and/or other component.


13031SH43

HIGH PRESSURE GAS

Contain high pressure gas.
To avoid explosion and personal injury, do not expose to fire, do not weld, do not drill.
Relieve pressure before discharging.

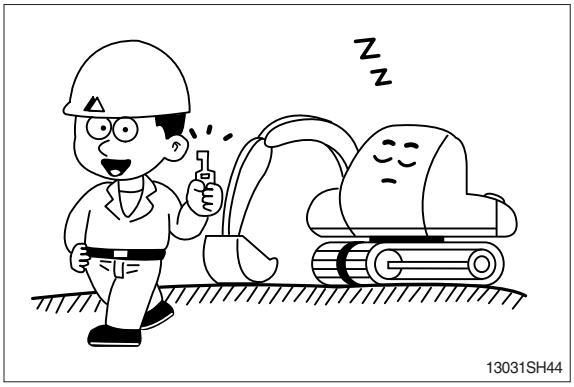

21091SH08

LIFT EYES CAN FAIL

Lift eyes or tank can fail when lifting tank containing fluids resulting in possible personal injury.
Drain tank of all fluids before lifting.

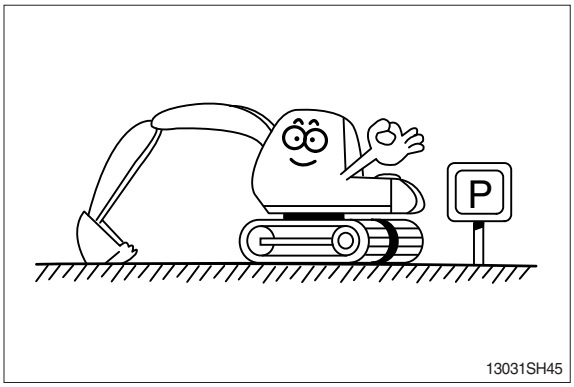
4. PARKING

When leaving the machine after parking, lower the bucket to the ground completely and put the safety lever at parking position then remove the key.
Lock the cab door.



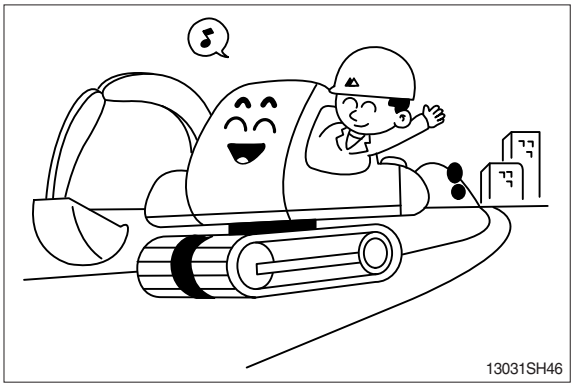
13031SH44

Park the machine in the flat and safe place.

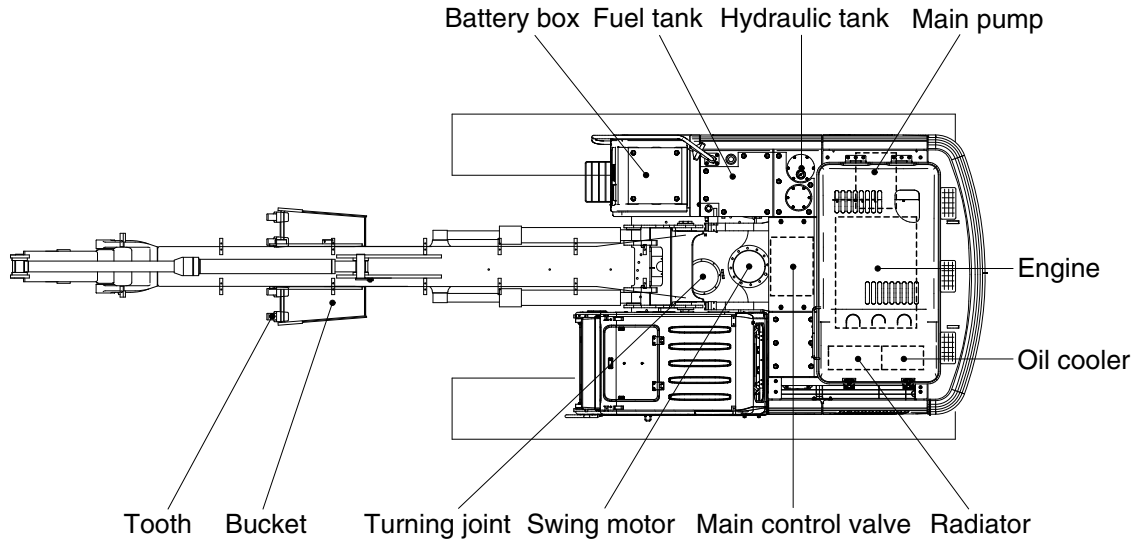


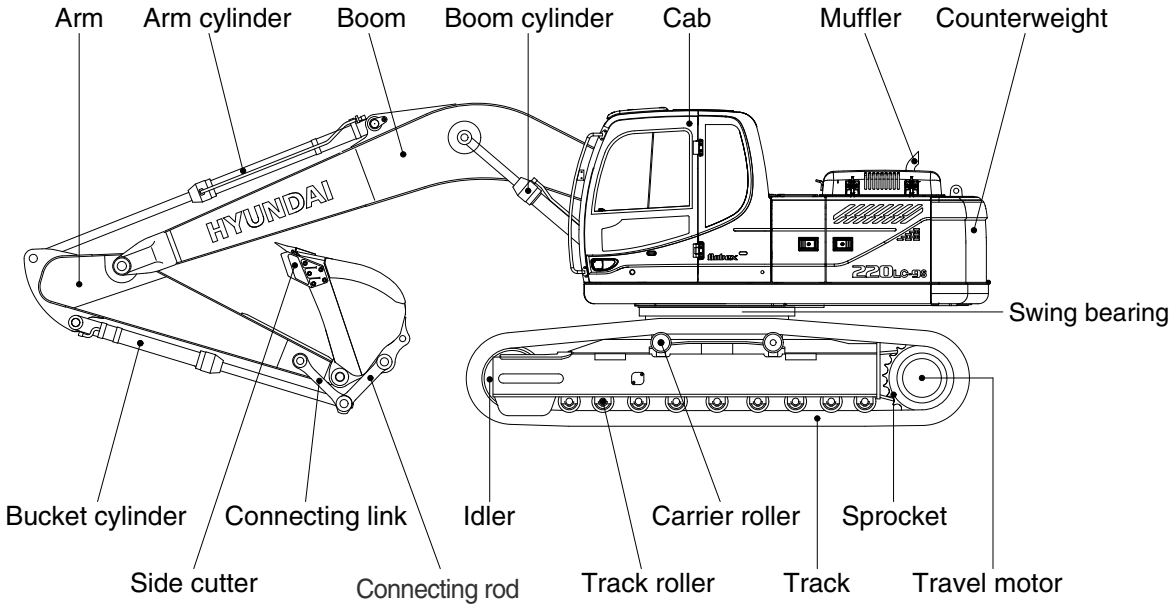
13031SH45

Hope you can work easily and safely observing safety rules.
For safe operation, observe all safety rules.


13031SH46

1. MAJOR COMPONENT



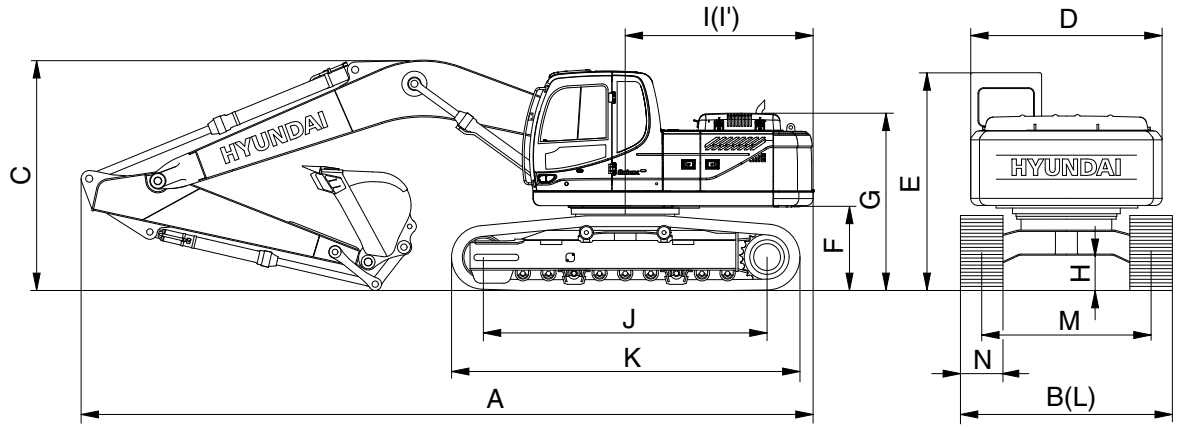


2209S2SP01

2. SPECIFICATIONS

1) R220LC-9S

· 5.68 m (18' 8") BOOM and 2.92 m (9' 7") ARM

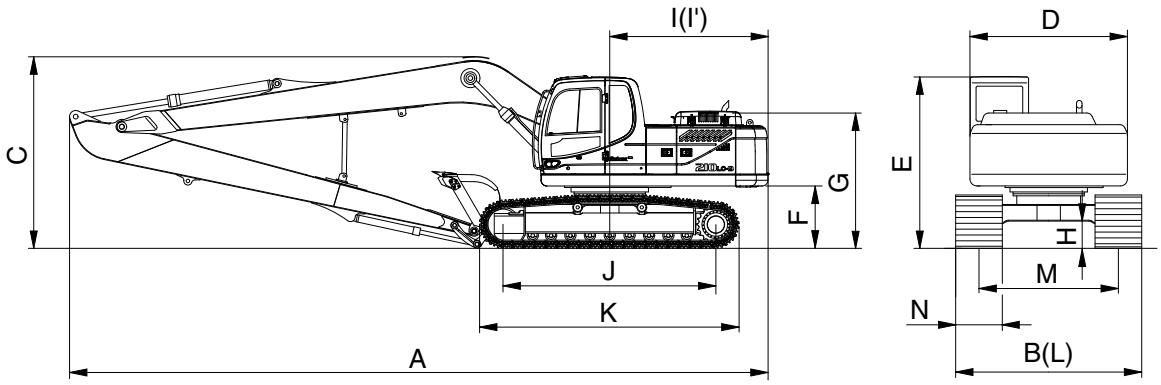


21092SP02

Description		Unit	Specification
Operating weight		kg (lb)	21900 (48280)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.92 (1.20)
Overall length	A	mm (ft-in)	9530 (31' 3")
Overall width, with 600mm shoe	B		2990 (9' 10")
Overall height	C		3030 (9' 11")
Superstructure width	D		2740 (9' 0")
Overall height of cab	E		3000 (9' 10")
Ground clearance of counterweight	F		1060 (3' 6")
Engine cover height	G		2320 (7' 7")
Minimum ground clearance	H		480 (1' 7")
Rear-end distance	I		2770 (9' 1")
Rear-end swing radius	I'		2840 (9' 4")
Distance between tumblers	J		3650 (12' 0")
Undercarriage length	K		4440 (14' 7")
Undercarriage width	L		2990 (9' 10")
Track gauge	M		2390 (7' 10")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.8/5.5 (2.4/3.4)
Swing speed		rpm	11.1
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.46 (6.54)
Max traction force		kg (lb)	21100 (46500)

2) R220LC-9S LONG REACH

· 8.2 m (26' 11") BOOM and 6.3 m (20' 8") ARM

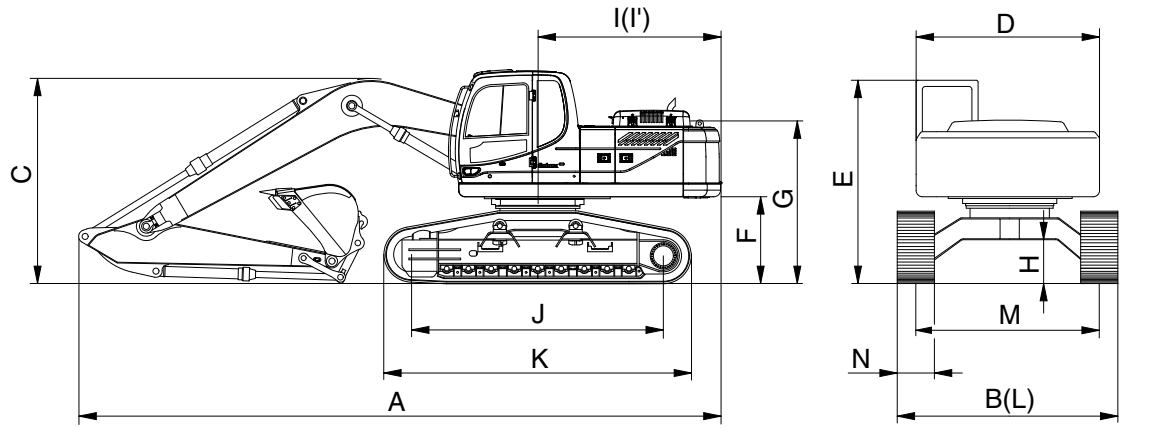


21092SP06

Description		Unit	Specification
Operating weight		kg (lb)	24360 (53700)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.52 (0.68)
Overall length	A	mm (ft-in)	12030 (39' 6")
Overall width, with 800 mm shoe	B		3190 (10' 6")
Overall height	C		3280 (10' 9")
Superstructure width	D		2740 (9' 0")
Overall height of cab	E		3000 (9' 10")
Ground clearance of counterweight	F		1060 (3' 6")
Engine cover height	G		2320 (7' 7")
Minimum ground clearance	H		480 (1' 7")
Rear-end distance	I		2770 (9' 1")
Rear-end swing radius	I'		2840 (9' 4")
Distance between tumblers	J		3650 (12' 0")
Undercarriage length	K		4440 (14' 7")
Undercarriage width	L		3190 (10' 6")
Track gauge	M		2390 (7' 10")
Track shoe width, standard	N		800 (32")
Travel speed (low/high)		km/hr (mph)	3.8/5.5 (2.4/3.4)
Swing speed		rpm	11.1
Gradeability		Degree (%)	35 (70)
Ground pressure (800 mm shoe)		kgf/cm^2 (psi)	0.42 (5.97)
Max traction force		kg (lb)	21100 (46500)

3) R220LC-9S HIGH WALKER

· 5.68 m (18' 8") BOOM and 2.92 m (9' 7") ARM

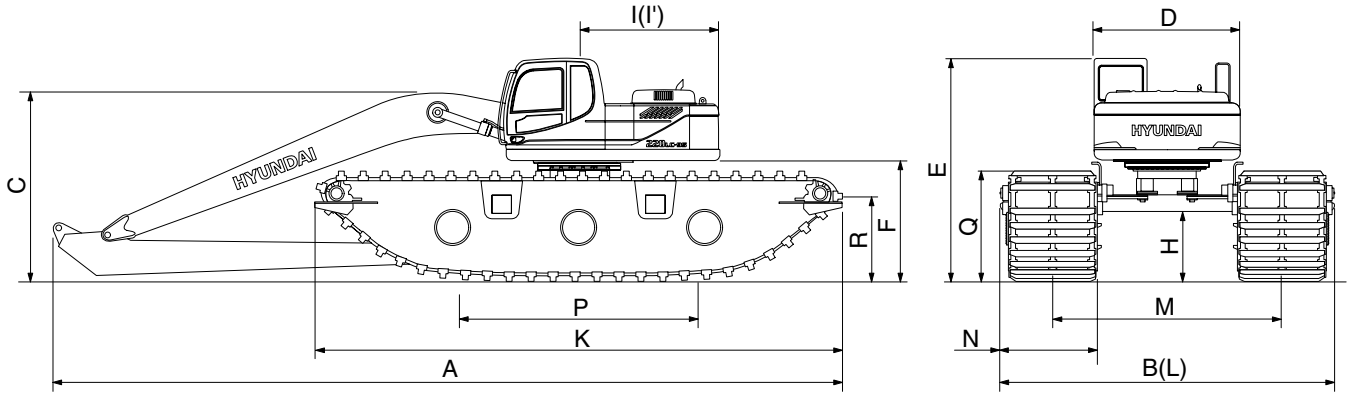


21092SP07

Description		Unit	Specification
Operating weight		kg (lb)	23160 (51060)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.92 (1.20)
Overall length	A	mm (ft-in)	9470 (31' 1")
Overall width, with 600 mm shoe	B		3395 (11' 2")
Overall height	C		3060 (10' 0")
Superstructure width	D		2740 (9' 0")
Overall height of cab	E		3100 (10' 2")
Ground clearance of counterweight	F		1240 (4' 1")
Engine cover height	G		2500 (8' 2")
Minimum ground clearance	H		660 (2' 2")
Rear-end distance	I		2770 (9' 1")
Rear-end swing radius	I'		2840 (9' 4")
Distance between tumblers	J		3650 (12' 0")
Undercarriage length	K		4440 (14' 7")
Undercarriage width	L		3395 (11' 2")
Track gauge	M		2795 (9' 2")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.8/5.5 (2.4/3.4)
Swing speed		rpm	11.1
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.49 (6.97)
Max traction force		kg (lb)	21100 (46500)

4) R220LC-9S AMPHIBIOUS

· 8.2 m (26' 11") BOOM and 6.3 m (20' 8") ARM



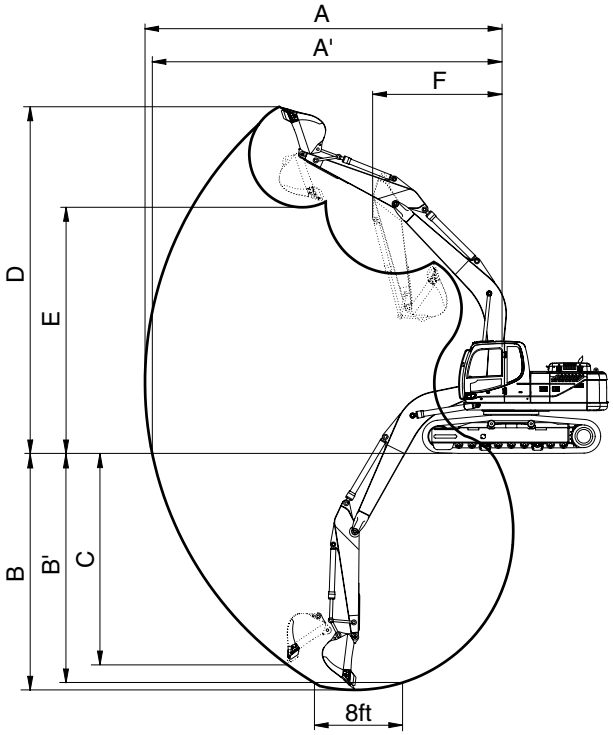
2209A2SP11

Description		Unit	Specification
Operating weight		kg (lb)	36370 (81040)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.52 (0.68)
Overall length	A	mm (ft-in)	13870 (45' 6")
Overall width (min/max)	B		4800/6280 (15' 9"/20' 7")
Overall height of boom	C		3730 (12' 3")
Superstructure width	D		2740 (9' 0")
Overall height of cab	E		4020 (13' 2")
Ground clearance of counterweight	F		2170 (7' 0")
Minimum ground clearance	H		1300 (4' 3")
Rear-end distance	I		2770 (9' 1")
Rear-end swing radius	I'		2840 (9' 4")
Maximum track length	K		9630 (31' 7")
Track width (min/max)	L		4470/5950 (14' 8"/19' 6")
Track gauge (min/max)	M		2850/4330 (9' 4"/14' 2")
Pontoon Width	N		1620 (5' 4")
Track length on ground	P		4150 (13' 7")
Track height	Q		2030 (6' 8")
Estimated Water Level	R		1550 (5' 1")
Travel speed (low/high)		km/hr (mph)	3.0/4.8 (1.9/3.0)
Swing speed		rpm	12.0

3. WORKING RANGE

1) R220LC-9S

· 5.68 m (18' 8") BOOM



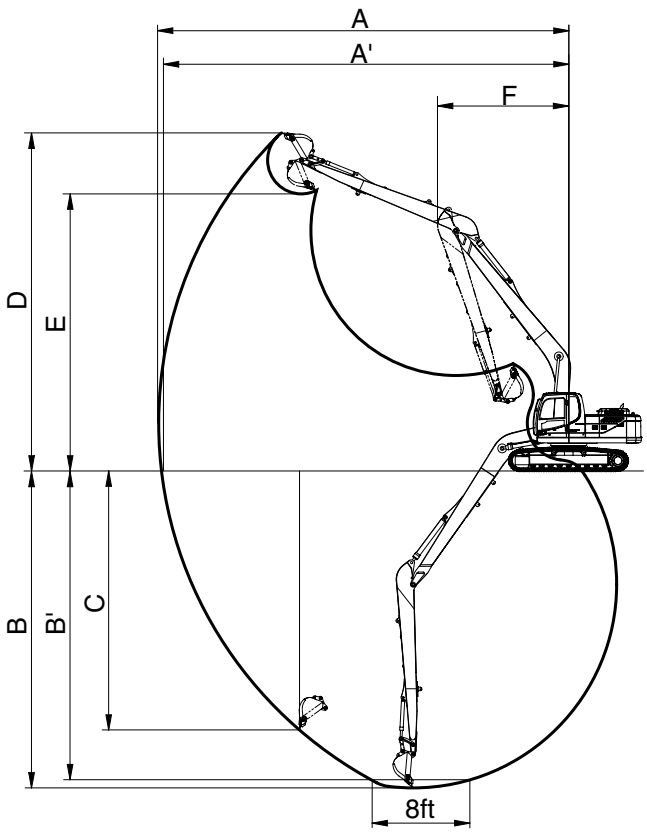
21092SP03

Description		2.0 m (6' 7") Arm	2.40 m (7' 10") Arm	2.92 m (9' 7") Arm	3.90 m (12' 10") Arm
Max digging reach	A	9140 mm (30' 0")	9500 mm (31' 2")	9980 mm (32' 9")	10910 mm (35' 10")
Max digging reach on ground	A'	8960 mm (29' 5")	9330 mm (30' 7")	9820 mm (32' 3")	10770 mm (35' 4")
Max digging depth	B	5820 mm (19' 1")	6220 mm (20' 5")	6730 mm (22' 1")	7720 mm (25' 4")
Max digging depth (8 ft level)	B'	5580 mm (18' 4")	6010 mm (19' 9")	6560 mm (21' 6")	7580 mm (24' 10")
Max vertical wall digging depth	C	5280 mm (17' 4")	5720 mm (18' 9")	6280 mm (20' 7")	7240 mm (23' 9")
Max digging height	D	9140 mm (30' 0")	9340 mm (30' 8")	9600 mm (31' 6")	10110 mm (33' 2")
Max dumping height	E	6330 mm (20' 9")	6520 mm (21' 5")	6780 mm (22' 3")	7290 mm (23' 11")
Min swing radius	F	3750 mm (12' 4")	3740 mm (12' 3")	3740 mm (12' 3")	3650 mm (12' 0")
Bucket digging force	SAE	133.4 [144.8] kN	133.4 [144.8] kN	133.4 [144.8] kN	133.4 [144.8] kN
		13600 [14770] kgf	13600 [14770] kgf	13600 [14770] kgf	13600 [14770] kgf
		29980 [32550] lbf	29980 [32550] lbf	29980 [32550] lbf	29980 [32550] lbf
	ISO	152.0 [165.0] kN	152.0 [165.0] kN	152.0 [165.0] kN	152.0 [165.0] kN
		15500 [16830] kgf	15500 [16830] kgf	15500 [16830] kgf	15500 [16830] kgf
		34170 [37100] lbf	34170 [37100] lbf	34170 [37100] lbf	34170 [37100] lbf
Arm digging force	SAE	144.2 [156.5] kN	119.6 [129.9] kN	102.0 [110.7] kN	84.3 [91.6] kN
		14700 [15960] kgf	12200 [13250] kgf	10400 [11290] kgf	8600 [9340] kgf
		32410 [35190] lbf	26900 [29210] lbf	22930 [24900] lbf	18960 [20590] lbf
	ISO	151.0 [164.0] kN	125.5 [136.3] kN	106.9 [116.1] kN	87.3 [94.8] kN
		15400 [16720] kgf	12800 [13900] kgf	10900 [11830] kgf	8900 [9660] kgf
		33950 [36860] lbf	28220 [30640] lbf	24030 [26090] lbf	19620 [21300] lbf

[ ] : Power boost

2) R220LC-9S LONG REACH

· 8.2 m (26' 11") BOOM

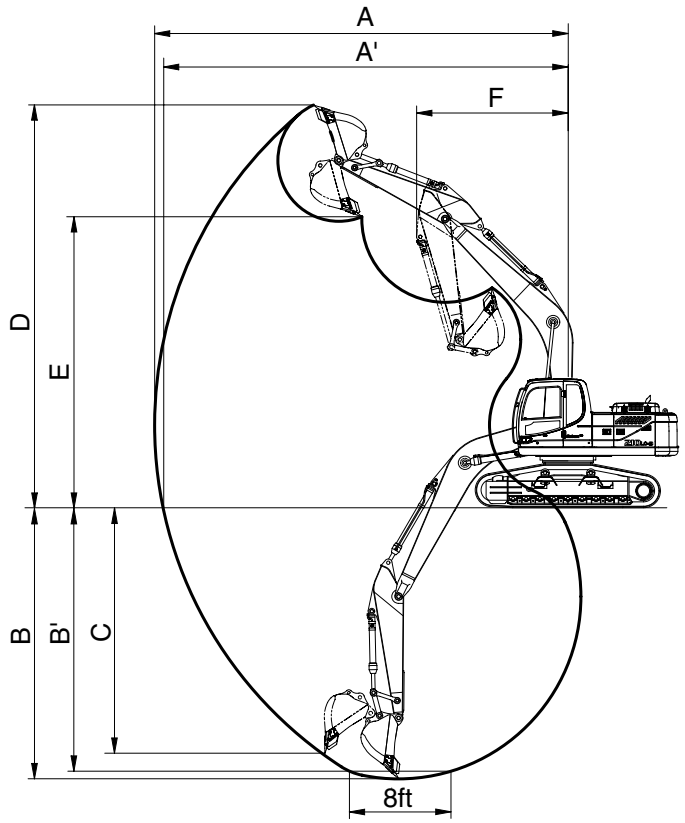


21092SP08

Description		6.3 m (20' 8") Arm
Max digging reach	A	15220 (50' 0")
Max digging reach on ground	A'	15120 (49' 7")
Max digging depth	B	11760 (38' 7")
Max digging depth (8 ft level)	B'	11650 (38' 3")
Max vertical wall digging depth	C	9610 (31' 6")
Max digging height	D	12550 (41' 2")
Max dumping height	E	10280 (33' 8")
Min swing radius	F	4870 (16' 0")
Bucket digging force	SAE	72.6 kN
		7400 kgf
		16310 lbf
	ISO	83.4 kN
		8500 kgf
		18740 lbf
Arm crowd force	SAE	49.0 kN
		5000 kgf
		11020 lbf
	ISO	50.0 kN
		5100 kgf
		11240 lbf

3) R220LC-9S HIGH WALKER

· 5.68 m (18' 8") BOOM



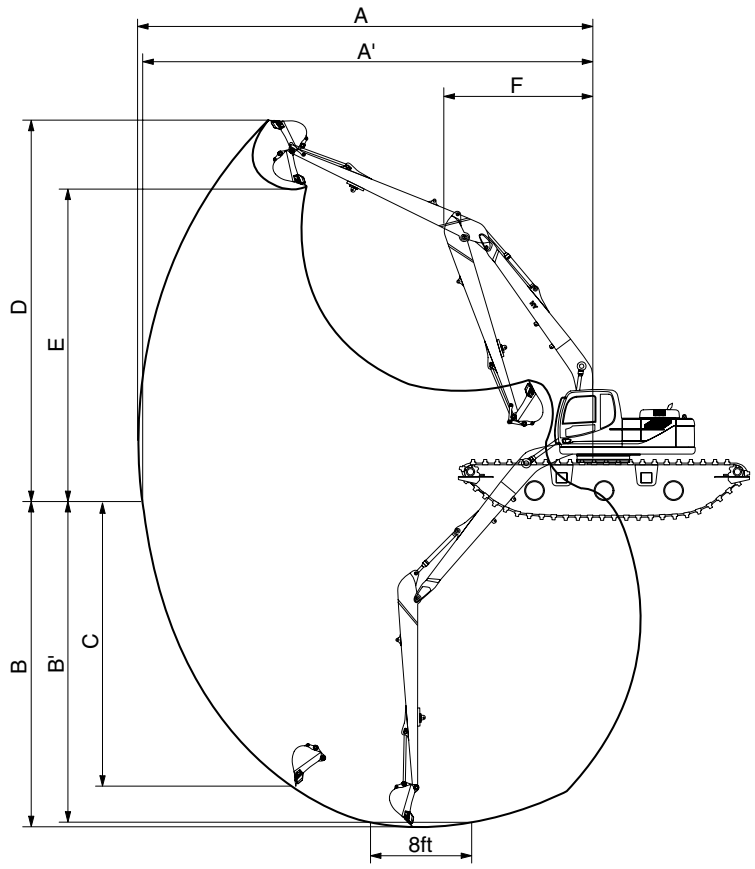
21092SP09

Description		2.0 m (6' 7") Arm	2.40 m (7' 10") Arm	2.92 m (9' 7") Arm	3.90 m (12'10") Arm
Max digging reach	A	9140 mm (30' 0")	9500 mm (31' 2")	9980 mm (32' 9")	10910 mm (35'10")
Max digging reach on ground	A'	8920 mm (29' 3")	9290 mm (30' 6")	9820 mm (32' 3")	10730 mm (35' 2")
Max digging depth	B	5630 mm (18' 6")	6010 mm (19' 9")	6550 mm (21' 6")	7530 mm (24' 8")
Max digging depth (8 ft level)	B'	5390 mm (17' 8")	5820 mm (19' 1")	6380 mm (20'11")	7390 mm (24' 3")
Max vertical wall digging depth	C	5090 mm (16' 8")	5630 mm (18' 6")	6100 mm (20' 0")	7050 mm (23' 1")
Max digging height	D	9330 mm (30' 7")	9530 mm (31' 3")	9780 mm (32' 1")	10300 mm (33' 9")
Max dumping height	E	6520 mm (21' 5")	6710 mm (22' 0")	6960 mm (22'10")	7480 mm (24' 6")
Min swing radius	F	3750 mm (12' 4")	3740 mm (12' 3")	3740 mm (12' 3")	3650 mm (12' 0")
Bucket digging force	SAE	133.4 [144.8] kN	133.4 [144.8] kN	133.4 [144.8] kN	133.4 [144.8] kN
		13600 [14770] kgf	13600 [14770] kgf	13600 [14770] kgf	13600 [14770] kgf
		29980 [32550] lbf	29980 [32550] lbf	29980 [32550] lbf	29980 [32550] lbf
	ISO	152.0 [165.0] kN	152.0 [165.0] kN	152.0 [165.0] kN	152.0 [165.0] kN
		15500 [16830] kgf	15500 [16830] kgf	15500 [16830] kgf	15500 [16830] kgf
		34170 [37100] lbf	34170 [37100] lbf	34170 [37100] lbf	34170 [37100] lbf
Arm crowd force	SAE	144.2 [156.5] kN	119.6 [129.9] kN	102.0 [110.7] kN	84.3 [91.6] kN
		14700 [15960] kgf	12200 [13250] kgf	10400 [11290] kgf	8600 [9340] kgf
		32410 [35190] lbf	26900 [29210] lbf	22930 [24900] lbf	18960 [20590] lbf
	ISO	151.0 [164.0] kN	125.5 [136.3] kN	106.9 [116.1] kN	87.3 [94.8] kN
		15400 [16720] kgf	12800 [13900] kgf	10900 [11830] kgf	8900 [9660] kgf
		33950 [36860] lbf	28220 [30640] lbf	24030 [26090] lbf	19620 [21300] lbf

[ ] : Power boost

4) R220LC-9S AMPHIBIOUS

· 8.2 m (26' 11") BOOM



2209A2SP12

Description		6.3 m (20' 8") Arm
Max digging reach	A	15220 mm (50' 0")
Max digging reach on ground	A'	14940 mm (49' 0")
Max digging depth	B	10630 mm (34' 11")
Max digging depth (8ft level)	B'	10520 mm (34' 6")
Max vertical wall digging depth	C	8480 mm (27' 10")
Max digging height	D	13670 mm (44' 10")
Max dumping height	E	11410 mm (37' 5")
Min swing radius	F	4870 mm (16' 0")
Bucket digging force	SAE	72.6 kN
		7400 kgf
		16310 lbf
	ISO	83.4 kN
		8500 kgf
		18740 lbf
Arm crowd force	SAE	49.0 kN
		5000 kgf
		11020 lbf
	ISO	50.0 kN
		5100 kgf
		11240 lbf

4. WEIGHT

1) R220LC-9S

Item	R220LC-9S	
	kg	lb
Upperstructure assembly	9400	20720
Main frame weld assembly	1920	4230
Engine assembly	530	1170
Main pump assembly	140	310
Main control valve assembly	220	485
Swing motor assembly	240	530
Hydraulic oil tank assembly	240	530
Fuel tank assembly	195	430
Counterweight	3800	8380
Cab assembly	440	970
Lower chassis assembly	8700	19180
Track frame weld assembly	2720	6000
Swing bearing	290	640
Travel motor assembly	300	660
Turning joint	55	120
Track recoil spring	140	310
Idler	170	370
Carrier roller	20	45
Track roller	40	90
Track-chain assembly (600 mm standard triple grouser shoe)	1350	2980
Front attachment assembly (5.68 m boom, 2.92 m arm, 0.92 m^3 SAE heaped bucket)	4030	8880
5.68 m boom assembly	1520	3350
2.92 m arm assembly	750	1650
0.92 m^3 SAE heaped bucket	765	1690
Boom cylinder assembly	180	400
Arm cylinder assembly	290	640
Bucket cylinder assembly	175	390
Bucket control link assembly	170	370

2) R220LC-9S LONG REACH

Item	R220LC-9S LONG REACH	
	kg	lb
Upperstructure assembly	9400	20720
Main frame weld assembly	1920	4230
Engine assembly	530	1170
Main pump assembly	140	310
Main control valve assembly	220	485
Swing motor assembly	240	530
Hydraulic oil tank assembly	240	530
Fuel tank assembly	195	430
Counterweight	5300	11680
Cab assembly	440	970
Lower chassis assembly	8700	19180
Track frame weld assembly	2720	6000
Swing bearing	290	640
Travel motor assembly	300	660
Turning joint	55	120
Track recoil spring	140	310
Idler	170	370
Carrier roller	20	45
Track roller	40	90
Track-chain assembly (800 mm standard triple grouser shoe)	1660	3660
Front attachment assembly (8.2 m boom, 6.3 m arm, 0.52 m^3 SAE heaped bucket)	4600	10140
8.2 m boom assembly	2105	4640
6.3 m arm assembly	1100	2430
0.52 m^3 SAE heaped bucket	465	1030
Boom cylinder assembly	180	400
Arm cylinder assembly	270	600
Bucket cylinder assembly	130	290
Bucket control rod assembly	170	370

3) R220LC-9S HIGH WALKER

Item	R220LC-9S HIGH WALKER	
	kg	lb
Upperstructure assembly	9430	20790
Main frame weld assembly	1950	4300
Engine assembly	530	1170
Main pump assembly	140	310
Main control valve assembly	220	485
Swing motor assembly	240	530
Hydraulic oil tank assembly	240	530
Fuel tank assembly	195	430
Counterweight	3800	8380
Cab assembly	440	970
Lower chassis assembly	9015	19870
Track frame weld assembly	3730	8220
Swing bearing	290	640
Travel motor assembly	300	660
Turning joint	55	120
Track recoil spring	140	310
Idler	170	370
Carrier roller	20	45
Track roller	40	90
Track-chain assembly (600 mm standard triple grouser shoe)	1350	2980
Front attachment assembly (5.68 m boom, 2.92 m arm, 0.92 m^3 SAE heaped bucket)	4030	8880
5.68 m boom assembly	1520	3350
2.92 m arm assembly	750	1650
0.92 m^3 SAE heaped bucket	765	1690
Boom cylinder assembly	180	400
Arm cylinder assembly	290	640
Bucket cylinder assembly	175	390
Bucket control rod assembly	170	370

4) R220LC-9S AMPHIBIOUS

Item	R220LC-9S AMPHIBIOUS	
	kg	lb
Upperstructure assembly	9400	20720
Main frame weld assembly	1920	4230
Engine assembly	520	1150
Main pump assembly	140	310
Main control valve assembly	220	485
Swing motor assembly	240	530
Hydraulic oil tank assembly	240	530
Fuel tank assembly	195	430
Counterweight	5300	11680
Cab assembly	310	680
Undercarriage assembly	21130	46580
Swing bearing	290	640
Travel motor assembly	300	660
Turning joint	55	120
Front attachment assembly (8.2 m boom, 6.3 m arm, 0.52 m^3 SAE heaped bucket)	4600	10140
8.2 m boom assembly	2105	4640
6.3 m arm assembly	1100	2430
0.52 m^3 SAE heaped bucket	465	1030
Boom cylinder assembly	180	400
Arm cylinder assembly	270	600
Bucket cylinder assembly	130	290
Bucket control linkage assembly	170	370

5. LIFTING CAPACITIES

1) ROBEX 220LC-9S

(1) 5.68 m (18' 8") boom, 2.92 m (9' 7") arm equipped with 0.92 m³ (SAE heaped) bucket, 600 mm (24") triple grouser shoe.

Load point height		Load radius										At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		7.5 m (25 ft)		Capacity		Reach
														m (ft)
7.5 m (25 ft)	kg lb											*3360 *7410	3150 6940	7.78 (25.5)
6.0 m (20 ft)	kg lb									*2340 *5160	*2340 *5160	*3450 *7610	2460 5420	8.74 (28.7)
4.5 m (15 ft)	kg lb							*4010 *8840	*4010 *8840	*3830 *8440	3180 7010	*3580 *7890	2100 4630	9.32 (30.6)
3.0 m (10 ft)	kg lb			*9780 *21560	*9780 *21560	*6150 *13560	*6150 *13560	*4840 *10670	4460 9830	*4230 *9330	3040 6700	3440 7580	1930 4250	9.59 (31.5)
1.5 m (5 ft)	kg lb			*8810 *19420	*8810 *19420	*7960 *17550	6490 14310	*5750 *12680	4160 9170	*4710 *10380	2880 6350	3390 7470	1880 4140	9.59 (31.5)
Ground Line	kg lb			*9550 *21050	*9550 *21050	*9160 *20190	6090 13430	*6490 *14310	3920 8640	4930 10870	2750 6060	3520 7760	1950 4300	9.31 (30.5)
-1.5 m (-5 ft)	kg lb	*8810 *19420	*8810 *19420	*12610 *27800	11870 26170	*9600 *21160	5940 13100	*6870 *15150	3800 8380	4860 10710	2690 5930	3920 8640	2190 4830	8.72 (28.6)
-3.0 m (-10 ft)	kg lb	*12190 *26870	*12190 *26870	*13980 *30820	12040 26540	*9320 *20550	5960 13140	*6740 *14860	3800 8380			*4460 *9830	2710 5970	7.75 (25.4)
-4.5 m (-15 ft)	kg lb			*11860 *26150	*11860 *26150	*8120 *17900	6140 13540					*4330 *9550	4080 8990	6.16 (20.2)

Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The load point is a hook located on the back of the bucket.
4. *indicates load limited by hydraulic capacity.

(2) 5.68 m (18' 8") boom, 2.40 m (7' 10") arm equipped with 0.92 m³ (SAE heaped) bucket, 600 mm (24") triple grouser shoe.

Load point height		Load radius										At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20ft)		7.5 m (25ft)		Capacity		Reach
														m (ft)
7.5 m (25 ft)	kg lb											*3700 *8160	3640 8020	7.15 (23.5)
6.0 m (20 ft)	kg lb							*4010 *8840	*4010 *8840			*3780 *8330	2760 6080	8.20 (26.9)
4.5 m (15 ft)	kg lb							*4490 *9900	*4490 *9900	*4230 *9330	3130 6900	*3900 *8600	2340 5160	8.82 (28.9)
3.0 m (10 ft)	kg lb					*6900 *15210	*6900 *15210	*5280 *11640	4400 9700	*4560 *10050	3010 6640	3760 8290	2130 4700	9.11 (29.9)
1.5 m (5 ft)	kg lb					*8560 *18870	6380 14070	*6120 *13490	4130 9110	*4970 *10960	2880 6350	3710 8180	2080 4590	9.10 (29.9)
Ground Line	kg lb			*8790 *19380	*8790 *19380	*9490 *20920	6080 13400	*6740 *14860	3930 8660	4950 10910	2780 6130	3890 8580	2180 4810	8.81 (28.9)
-1.5 m (-5 ft)	kg lb	*9760 *21520	*9760 *21520	*13510 *29780	12060 26590	*9650 *21270	6000 13230	*6960 *15340	3850 8490			4390 9680	2480 5470	8.18 (26.8)
-3.0 m (-10 ft)	kg lb	*14150 *31200	*14150 *31200	*13240 *29190	12280 27070	*9090 *20040	6080 13400	*6590 *14530	3900 8600			*4700 *10360	3190 7030	7.12 (23.4)
-4.5 m (-15 ft)	kg lb			*10630 *23440	*10630 *23440	*7400 *16310	6330 13960							

2) R220LC-9S LONG REACH

(1) 8.2 m (26' 11") boom, 6.3 m (20' 8") arm equipped with 0.52 m³ (0.68yd³)(SAE heaped) bucket, 800 mm (32") triple grouser shoe.

-  : Rating over-front
-  : Rating over-side or 360 degree

Load point height		Load radius														At max. reach		
		4.5 m (15.0 ft)		6.0 m (20.0ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)		10.5 m (35.0 ft)		12.0 m (40.0 ft)		13.5 m (45.0 ft)		Capacity		Reach
																		m (ft)
10.5 m 35.0 ft	kg lb															*1480 *3260	*1480 *3260	12.11 (39.7)
9.0 m 30.0 ft	kg lb											*930 *2050	*930 *2050			*1510 *3330	*1510 *3330	13.11 (43.0)
7.5 m 25.0 ft	kg lb											*1550 *3420	*1550 *3420			*1550 *3420	1320 2910	13.84 (45.4)
6.0 m 20.0 ft	kg lb									*1600 *3530	*1600 *3530	*1610 *3550	*1610 *3550			*1600 *3530	1160 2560	14.37 (47.1)
4.5 m 15.0 ft	kg lb									*1790 *3950	*1790 *3950	*1730 *3810	1720 3790	*1260 *2780	*1260 *2780	*1660 *3660	1050 2310	14.72 (48.3)
3.0 m 10.0 ft	kg lb					*2520 *5560	*2520 *5560	*2220 *4890	*2220 *4890	*2020 *4450	*2020 *4450	*1880 *4140	1630 3590	*1590 *3510	1220 2690	*1720 *3790	980 2160	14.89 (48.9)
1.5 m 5.0 ft	kg lb	*5620 *12390	*5620 *12390	*3940 *8690	*3940 *8690	*3090 *6810	*3090 *6810	*2590 *5710	*2590 *5710	*2270 *5000	2000 4410	*2050 *4520	1530 3370	*1790 *3950	1170 2580	*1800 *3970	940 2070	14.90 (48.9)
Ground /line	kg lb	*6990 *15410	6720 14820	*4770 *10520	4490 9900	*3620 *7980	3240 7140	*2950 *6500	2430 5360	*2510 *5530	1860 4100	*2220 *4890	1440 3170	*1820 *4010	1110 2450	1880 4140	930 2050	14.75 (48.4)
-1.5 m -5.0 ft	kg lb	*7830 *17260	6210 13690	*5390 *11880	4120 9080	*4060 *8950	2990 6590	*3260 *7190	2260 4980	*2740 *6040	1740 3840	*2380 *5250	1360 3000	*1570 *3460	1070 2360	1930 4250	960 2120	14.42 (47.3)
-3.0 m -10.0 ft	kg lb	*8230 *18140	5990 13210	*5780 *12740	3920 8640	*4370 *9630	2830 6240	*3490 *7690	2140 4720	*2900 *6390	1660 3660	*2490 *5490	1310 2890			2030 4480	1020 2250	13.92 (45.7)
-4.5 m -15.0 ft	kg lb	*8310 *18320	5940 13100	*5950 *13120	3830 8440	*4540 *10010	2740 6040	*3630 *8000	2070 4560	*3000 *6610	1620 3570	2510 5530	1290 2840			*2210 *4870	1140 2510	13.20 (43.3)
-6.0 m -20.0 ft	kg lb	*8100 *17860	6010 13250	*5900 *13010	3840 8470	*4550 *10030	2730 6020	*3640 *8020	2060 4540	*2970 *6550	1620 3570					*2340 *5160	1330 2930	12.25 (40.2)
-7.5 m -25.0 ft	kg lb	*7580 *16710	6180 13620	*5610 *12370	3930 8660	*4350 *9590	2790 6150	*3460 *7630	2120 4670	*2740 *6040	1690 3730					*2460 *5420	1670 3680	10.97 (36.0)
-9.0 m -30.0 ft	kg lb	*6650 *14660	6460 14240	*4980 *10980	4110 9060	*3840 *8470	2940 6480	*2930 *6460	2260 4980									
-10.5 m -35.0 ft	kg lb	*5040 *11110	*5040 *11110	*3730 *8220	*3730 *8220													

Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.

2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.

3. The load point is a hook located on the back of the bucket.

4. *indicates load limited by hydraulic capacity.

3) R220LC-9S HIGH WALKER

(1) 5.68 m (18' 8") boom, 2.92 m (9' 7") arm equipped with 0.92 m³ (SAE heaped) bucket, 600 mm (24") triple grouser shoe.

Load point height		Load radius										At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		7.5 m (25 ft)		Capacity		Reach
														m (ft)
7.5 m (25 ft)	kg											*3370	*3370	7.93
	lb											*7430	*7430	(26.0)
6.0 m (20 ft)	kg									*2700	*2700	*3460	3130	8.83
	lb									*5950	*5950	*7630	6900	(29.0)
4.5 m (15 ft)	kg							*4110	*4110	*3870	*3870	*3600	2740	9.37
	lb							*9060	*9060	*8530	*8530	*7940	6040	(30.7)
3.0 m (10 ft)	kg			*10440	*10440	*6400	*6400	*4960	*4960	*4290	3930	3680	2560	9.60
	lb			*23020	*23020	*14110	*14110	*10930	*10930	*9460	8660	8110	5640	(31.5)
1.5 m (5 ft)	kg			*8610	*8610	*8150	*8150	*5860	5380	*4760	3770	3650	2530	9.57
	lb			*18980	*18980	*17970	*17970	*12920	11860	*10490	8310	8050	5580	(31.4)
Ground Line	kg			*9870	*9870	*9260	8080	*6560	5150	*5150	3640	3820	2650	9.25
	lb			*21760	*21760	*20410	17810	*14460	11350	*11350	8020	8420	5840	(30.3)
-1.5 m (-5 ft)	kg	*9210	*9210	*13090	*13090	*9600	7940	*6880	5040	5200	3590	4280	2980	8.62
	lb	*20300	*20300	*28860	*28860	*21160	17500	*15170	11110	11460	7910	9440	6570	(28.3)
-3.0 m (-10 ft)	kg	*12660	*12660	*13780	*13780	*9230	7990	*6670	5060			*4470	3710	7.59
	lb	*27910	*27910	*30380	*30380	*20350	17610	*14700	11160			*9850	8180	(24.9)
-4.5 m (-15 ft)	kg			*11470	*11470	*7860	*7860					*4250	*4250	5.89
	lb			*25290	*25290	*17330	*17330					*9370	*9370	(19.3)

Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The load point is a hook located on the back of the bucket.
4. *indicates load limited by hydraulic capacity.

(2) 5.68 m (18' 8") boom, 2.4 m (7' 10") arm equipped with 0.92 m³ (SAE heaped) bucket, 600 mm (24") triple grouser shoe.

Load point height		Load radius										At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5 m (15 ft)		6.0 m (20 ft)		7.5 m (25 ft)		Capacity		Reach
														m (ft)
7.5 m (25 ft)	kg											*3700	*3700	7.31
	lb											*8160	*8160	(24.0)
6.0 m (20 ft)	kg							*4050	*4050			*3790	3480	8.30
	lb							*8930	*8930			*8360	7670	(27.2)
4.5 m (15 ft)	kg					*5360	*5360	*4580	*4580	*4260	4030	*3920	3020	8.87
	lb					*11820	*11820	*10100	*10100	*9390	8880	*8640	6660	(29.1)
3.0 m (10 ft)	kg					*7130	*7130	*5390	*5390	*4610	3900	4010	2810	9.12
	lb					*15720	*15720	*11880	*11880	*10160	8600	8840	6190	(29.9)
1.5 m (5 ft)	kg					*8720	8370	*6220	5360	*5020	3770	3990	2780	9.08
	lb					*19220	18450	*13710	11820	*11070	8310	8800	6130	(29.8)
Ground Line	kg			*9350	*9350	*9550	8080	*6790	5170	5290	3670	4210	2940	8.75
	lb			*20610	*20610	*21050	17810	*14970	11400	11660	8090	9280	6480	(28.7)
-1.5 m (-5 ft)	kg	*10290	*10290	*14180	*14180	*9620	8020	*6950	5100			*4650	3360	8.07
	lb	*22690	*22690	*31260	*31260	*21210	17680	*15320	11240			*10250	7410	(26.5)
-3.0 m (-10 ft)	kg	*14760	*14760	*12990	*12990	*8950	8120	*6470	5170			*4690	4350	6.94
	lb	*32540	*32540	*28640	*28640	*19730	17900	*14260	11400			*10340	9590	(22.8)
-4.5 m (-15 ft)	kg			*10150	*10150	*7020	*7020							
	lb			*22380	*22380	*15480	*15480							

4) R220LC-9S AMPHIBIOUS

(1) 8.2 m (26' 11") boom, 6.3 m (20' 8") arm equipped with 0.52 m³ (SAE heaped) bucket, 800 mm (32") triple grouser shoe.

-  : Rating over-front
-  : Rating over-side or 360 degree

Load point height		Load radius														At max. reach		
		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)		10.5 m (35.0 ft)		12.0 m (40.0 ft)		13.5 m (45.0 ft)		Capacity		Reach
																		m (ft)
12.0 m	kg															*1460	*1460	11.82
(40.0 ft)	lb															*3220	*3220	(38.8)
10.5 m	kg															*1480	*1480	12.88
(35.0 ft)	lb															*3260	*3260	(42.3)
9.0 m	kg											*1470	*1470			*1510	*1510	13.68
(30.0 ft)	lb											*3240	*3240			*3330	*3330	(44.9)
7.5 m	kg									*1550	*1550	*1570	*1570			*1560	*1560	14.26
(25.0 ft)	lb									*3420	*3420	*3460	*3460			*3440	*3440	(46.8)
6.0 m	kg									*1720	*1720	*1670	*1670	*1150	*1150	*1610	*1610	14.65
(20.0 ft)	lb									*3790	*3790	*3680	*3680	*2540	*2540	*3550	*3550	(48.1)
4.5 m	kg							*2100	*2100	*1930	*1930	*1820	*1820	*1520	*1520	*1680	*1680	14.86
(15.0 ft)	lb							*4630	*4630	*4250	*4250	*4010	*4010	*3350	*3350	*3700	*3700	(48.8)
3.0 m	kg	*5160	*5160	*3670	*3670	*2910	*2910	*2460	*2460	*2170	*2170	*1980	*1980	*1750	*1750	*1750	*1750	14.92
(10.0 ft)	lb	*11380	*11380	*8090	*8090	*6420	*6420	*5420	*5420	*4780	*4780	*4370	*4370	*3860	*3860	*3860	*3860	(49.0)
1.5 m	kg	*6630	*6630	*4530	*4530	*3450	*3450	*2820	*2820	*2420	*2420	*2150	*2150	*1830	*1830	*1840	*1840	14.80
(5.0 ft)	lb	*14620	*14620	*9990	*9990	*7610	*7610	*6220	*6220	*5340	*5340	*4740	*4740	*4030	*4030	*4060	*4060	(48.0)
Ground	kg	*7580	*7580	*5200	*5200	*3910	*3910	*3150	*3150	*2650	*2650	*2310	*2310	*1660	*1660	1930	1930	14.52
Line	lb	*16710	*16710	*11460	*11460	*8620	*8620	*6940	*6940	*5840	*5840	*5090	*5090	*3660	*3660	4250	4250	(47.6)
-1.5 m	kg	*8080	*8080	*5640	*5640	*4260	*4260	*3400	*3400	*2830	*2830	*2430	*2430			2030	2030	14.06
(-5.0 ft)	lb	*17810	*17810	*12430	*12430	*9390	*9390	*7500	*7500	*6240	*6240	*5360	*5360			4480	4480	(46.1)
-3.0 m	kg	*8230	*8230	*5860	*5860	*4460	*4460	*3560	*3560	*2940	*2940	*2490	*2490			2150	2150	13.41
(-10.0 ft)	lb	*18140	*18140	*12920	*12920	*9830	*9830	*7850	*7850	*6480	*6480	*5490	*5490			4740	4740	(44.0)
1-4.5 m	kg	*8090	*8090	*5870	*5870	*4510	*4510	*3610	*3610	*2950	*2950					*2270	*2270	12.52
(-15.0 ft)	lb	*17840	*17840	*12940	*12940	*9940	*9940	*7960	*7960	*6500	*6500					*5000	*5000	(41.1)
-6.0 m	kg	*7660	*7660	*5640	*5640	*4370	*4370	*3480	*3480	*2790	*2790					*2400	*2400	11.33
(-20.0 ft)	lb	*16890	*16890	*12430	*12430	*9630	*9630	*7670	*7670	*6150	*6150					*5290	*5290	(37.2)
-7.5 m	kg	*6850	*6850	*5120	*5120	*3960	*3960	*3070	*3070									
(-25.0 ft)	lb	*15100	*15100	*11290	*11290	*8730	*8730	*6770	*6770									
-9.0 m	kg	*5460	*5460	*4080	*4080													
(-30.0 ft)	lb	*12040	*12040	*8990	*8990													

Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.

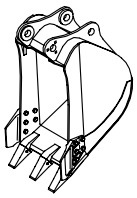
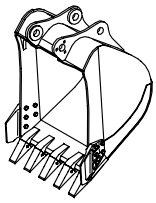
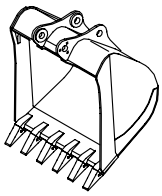
2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.

3. The load point is a hook located on the back of the bucket.

4. *indicates load limited by hydraulic capacity.

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

		
0.51 m³ SAE heaped bucket	※0.92, ★0.52, 0.80, 0.87, 1.10, 1.20 m³ SAE heaped bucket	1.34 m³ SAE heaped bucket

Capacity		Width		Weight	Recommendation				
					5.68 m (18' 8") boom				8.2 m (26' 11") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.0 m arm (6' 7")	2.4 m arm (7' 10")	2.92 m arm (9' 7")	3.90 m arm (12' 10")	6.3 m arm (20' 8")
0.51 m³ (0.67 yd³)	0.45 m³ (0.59 yd³)	700 mm (27.6")	820 mm (32.3")	570 kg (1260 lb)					
★0.52 m³ (0.68 yd³)	0.45 m³ (0.59 yd³)	935 mm (36.8")	1035 mm (40.7")	460 kg (1010 lb)					
0.80 m³ (1.05 yd³)	0.70 m³ (0.92 yd³)	1000 mm (39.4")	1120 mm (44.1")	770 kg (1700 lb)					
0.87 m³ (1.14 yd³)	0.75 m³ (0.98 yd³)	1090 mm (42.9")	1210 mm (47.6")	740 kg (1630 lb)					
※0.92 m³ (1.20 yd³)	0.80 m³ (1.05 yd³)	1150 mm (45.3")	1270 mm (50.0")	770 kg (1700 lb)					
1.10 m³ (1.44 yd³)	0.96 m³ (1.26 yd³)	1320 mm (52.0")	1440 mm (56.7")	830 kg (1830 lb					
1.20 m³ (1.57 yd³)	1.00 m³ (1.31 yd³)	1400 mm (55.1")	1520 mm (59.8")	850 kg (1870 lb)					
1.34 m³ (1.75 yd³)	1.15 m³ (1.50 yd³)	1550 mm (61.0")	1670 mm (65.7")	920 kg (2030 lb)					

※ : Standard bucket

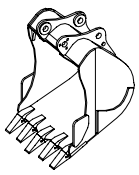
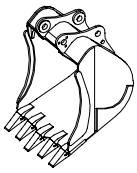
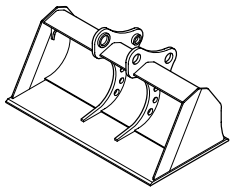
★ : Long reach bucket/Amphibious bucket

Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

Applicable for materials with density of 1600 kgf/m³ (2700 lbf/yd³) or less

Applicable for materials with density of 1100 kgf/m³ (1850 lbf/yd³) or less

2) HEAVY DUTY, ROCK-HEAVY DUTY AND SLOPE FINISHING BUCKET

Heavy duty bucket	Rock-heavy duty bucket	Slope finishing bucket
		
◈ 0.74, 0.90, 1.05 m³ SAE heaped bucket	⊙ 0.87, 1.20 m³ SAE heaped bucket	▣ 0.75 m³ SAE heaped bucket

Capacity		Width		Weight	Recommendation			
					5.68 m (18' 8") boom			
SAE heaped	CECE heaped	Without side cutter	With side cutter		2.0 m arm (6' 7")	2.4 m arm (7' 10")	2.92 m arm (9' 7")	3.90 m arm (12' 10")
◈0.74 m³ (0.97 yd³)	0.65 m³ (0.85 yd³)	985 mm (38.8")	-	770 kg (1700 lb)				
◈0.90 m³ (1.18 yd³)	0.80 m³ (1.05 yd³)	1070 mm (42.0")	-	810 kg (1790 lb)				
◈1.05 m³ (1.37 yd³)	0.92 m³ (1.20 yd³)	1290 mm (50.8")	-	890 kg (1960 lb)				
⊙0.87 m³ (1.14 yd³)	0.75 m³ (0.98 yd³)	1140 mm (44.9")	-	900 kg (1980 lb)				
⊙1.20 m³ (1.57 yd³)	1.00 m³ (1.31 yd³)	1410 mm (55.5")	-	1030 kg (2270 lb)				
▣0.75 m³ (0.98 yd³)	0.65 m³ (0.85 yd³)	1790 mm (70.5")	-	880 kg (1940 lb)				

◈ : Heavy duty bucket ⊙: Rock-heavy duty bucket ▣ : Slope finishing bucket

Applicable for materials with density of 2000 kgf/m³ (3370 lbf/yd³) or less

Applicable for materials with density of 1600 kgf/m³ (2700 lbf/yd³) or less

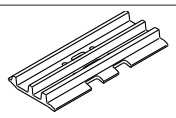
Applicable for materials with density of 1100 kgf/m³ (1850 lbf/yd³) or less

7. UNDERCARRIAGE

1) TRACKS

X-leg type center frame is integrally welded with reinforced box-section track frames. The design includes dry tracks, lubricated rollers, idlers, sprockets, hydraulic track adjusters with shock absorbing springs and assembled track-type tractor shoes with triple grousers.

2) TYPES OF SHOES

Model	Shapes		Triple grouser			
						
R220LC-9S	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	900 (36)
	Operating weight	kg (lb)	21900 (48280)	22250 (49050)	22515 (49640)	22760 (50180)
	Ground pressure	kgf/cm^2 (psi)	0.46 (6.54)	0.40 (5.69)	0.36 (5.12)	0.32 (4.55)
	Overall width	mm (ft-in)	2990 (9' 10")	3090 (10' 2")	3190 (10' 6")	3290 (10' 10")
R220LC-9S LONG REACH	Shoe width	mm (in)	-	-	800 (32)	-
	Operating weight	kg (lb)	-	-	24605 (54240)	-
	Ground pressure	kgf/cm^2 (psi)	-	-	0.39 (5.55)	-
	Overall width	mm (ft-in)	-	-	3190 (10' 6")	-
R220LC-9S HIGH WALKER	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	710 (28)*
	Operating weight	kg (lb)	23360 (51500)	23710 (52270)	23975 (52860)	24220 (53400)
	Ground pressure	kgf/cm^2 (psi)	0.50 (7.11)	0.43 (6.11)	0.38 (5.40)	0.43 (6.11)
	Overall width	mm (ft-in)	3395 (11' 2")	3495 (11' 6")	3595 (11' 10")	3505 (11' 6")

* : Double grouser

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	2 EA
Track rollers	9 EA
Track shoes	49 EA

4) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

Confirm the category from the list of applications in **table 2**, then use **table 1** to select the shoe. Wide shoes (categories B and C) have limitations on applications. Before using wide shoes, check the precautions, then investigate and study the operating conditions to confirm if these shoes are suitable.

Select the narrowest shoe possible to meet the required flotation and ground pressure. Application of wider shoes than recommendations will cause unexpected problem such as bending of shoes, crack of link, breakage of pin, loosening of shoe bolts and the other various problems.

※ Table 1

Track shoe	Specification	Category
600 mm triple grouser	Standard	A
700 mm triple grouser	Option	B
800 mm triple grouser	Option	C
800 mm triple grouser (long reach)	Standard	C
900 mm triple grouser	Option	C

※ Table 2

Category	Applications	Precautions
A	Rocky ground, river beds, normal soil	· Travel at low speed on rough ground with large obstacles such as boulders or fallen trees
B	Normal soil, soft ground	· These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles
C	Extremely soft ground (swampy ground)	· Use the shoes only in the conditions that the machine sinks and it is impossible to use the shoes of category A or B · These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Cummins 6BTAA / HYUNDAI HM 5.9
Type	4-cycle turbocharged diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	102 × 120 mm (4.02" × 4.72")
Piston displacement	5900 cc (360 cu in)
Compression ratio	17.3 : 1
Rated gross horse power (SAE J1995)	150 Hp at 1950 rpm (112 kW at 1950 rpm)
Maximum torque at 1500 rpm	62.6 kgf · m (453 lbf · ft)
Engine oil quantity	24 ℓ (6.3 U.S. gal)
Dry weight	496 kg (1094 lb)
High idling speed	2150 ± 50 rpm
Low idling speed	1050 ± 100 rpm
Rated fuel consumption	164.8 g/Hp · hr at 1950 rpm
Starting motor	Nippon denso (24 V-4.5 kW)
Alternator	Delco Remy (24 V-90 A)
Battery	2 × 12 V × 100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 117cc/rev
Maximum pressure	350kgf/cm^2 (4980psi) [380 kgf/cm^2 (5400 psi)]
Rated oil flow	2 × 222 ℓ /min (58.6U.S. gpm/ 48.8U.K. gpm)
Rated speed	1950 rpm

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	28.5 ℓ/min (7.5 U.S. gpm/6.3 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification	
		R220LC-9S	R220LC-9S Long reach & Amphibious
Type		9 spools two-block	
Operating method		Hydraulic pilot system	
Main relief valve pressure		350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]	350 kgf/cm^2 (4980 psi)
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi)	
	Arm	400 kgf/cm^2 (5690 psi)	300 kgf/cm^2 (4270 psi)
	Bucket	400 kgf/cm^2 (5690 psi)	280 kgf/cm^2 (3980 psi)

[ ]: Power boost

5) SWING MOTOR

Item	Specification	
	Type 1	Type 2, 3
Type	Fixed displacement axial piston motor	
Capacity	151 cc/rev	142.8 cc/rev
Relief pressure (working pressure)	265 kgf/cm^2 (3770 psi)	
Braking system	Automatic, spring applied hydraulic released	
Braking torque	59 kgf · m (427 lbf · ft)	58 kgf · m (420 lbf · ft)
Brake release pressure	33~50 kgf/cm^2 (470~711 psi)	21.3~35.6 kgf/cm^2 (154~257 psi)
Reduction gear type	2 - stage planetary	

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	350 kgf/cm^2 (4980 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	11 kgf/cm^2 (156 psi)
Braking torque	49.3 kgf · m (357 lbf · ft)

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	6.5 kgf/cm² (92 psi)
	Maximum	25 kgf/cm² (356 psi)
Single operation stroke	Lever	90 mm (3.5 in)
	Pedal	130 mm (4.4 in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 120 × ø 85 × 1290 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 140 × ø 100 × 1510 mm # ø 140 × ø 100 × 1460 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 120 × ø 85 × 1055 mm # ø 100 × ø 70 × 870 mm
	Cushion	Extend only

※ Discoloration of cylinder rod can occur when the friction reduction additive of lubrication oil spreads on the rod surface.

※ Discoloration does not cause any harmful effect on the cylinder performance.

: LONG REACH

9) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
R220LC-9S	Standard	600 mm (24")	0.46 kgf/cm² (6.54 psi)	49	2990 mm (9' 10")
	Option	700 mm (28")	0.40 kgf/cm² (5.69 psi)	49	3090 mm (10' 2")
		800 mm (32")	0.36 kgf/cm² (5.12 psi)	49	3190 mm (10' 6")
		900 mm (36")	0.32 kgf/cm² (4.55 psi)	49	3290 mm (10' 10")
R220LC-9S LONG REACH	Standard	800 mm (32")	0.39 kgf/cm² (5.55 psi)	49	3190 mm (10' 6")
R220LC-9S HIGH WALKER	Standard	600 mm (24")	0.50 kgf/cm² (7.11 psi)	49	3395 mm (11' 2")
	Option	700 mm (28")	0.43 kgf/cm² (6.11 psi)	49	3495 mm (11' 6")
		800 mm (32")	0.38 kgf/cm² (5.40 psi)	49	3595 mm (11' 10")
		※710 mm (28")	0.43 kgf/cm² (6.11 psi)	49	3505 mm (11' 6")

※ : Double grouser

10) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
R220LC-9S	0.51 m³ (0.67 yd³)	0.45 m³ (0.59 yd³)	3	700 mm (27.6")	820 mm (32.3")
	0.80 m³ (1.05 yd³)	0.70 m³ (0.92 yd³)	5	1000 mm (39.4")	1120 mm (44.1")
	0.87 m³ (1.14 yd³)	0.75 m³ (0.98 yd³)	5	1090 mm (42.9")	1210 mm (47.6")
	0.92 m³ (1.20 yd³)	0.80 m³ (1.05 yd³)	5	1150 mm (45.3")	1270 mm (50.0")
	1.10 m³ (1.44 yd³)	0.96 m³ (1.26 yd³)	5	1320 mm (52.0")	1440 mm (56.7")
	1.20 m³ (1.57 yd³)	1.00 m³ (1.31 yd³)	5	1400 mm (55.1")	1520 mm (59.8")
	1.34 m³ (1.75 yd³)	1.15 m³ (1.50 yd³)	6	1550 mm (61.0")	1670 mm (65.7")
	★0.52 m³ (0.68 yd³)	0.45 m³ (0.59 yd³)	5	935 mm (36.8")	1035 mm (40.7")
	◈0.74 m³ (0.97 yd³)	0.65 m³ (0.85 yd³)	5	985 mm (38.8")	-
	◈0.90 m³ (1.18 yd³)	0.80 m³ (1.05 yd³)	5	1070 mm (42.0")	-
	◈1.05 m³ (1.37 yd³)	0.92 m³ (1.20 yd³)	5	1290 mm (50.8")	-
	⊙0.87 m³ (1.14 yd³)	0.75 m³ (0.98 yd³)	5	1140 mm (44.9")	-
	⊙1.20 m³ (1.57 yd³)	1.00 m³ (1.31 yd³)	5	1410 mm (55.5")	-
	▣0.75 m³ (0.98 yd³)	0.65 m³ (0.85 yd³)	-	1790 mm (70.5")	-

★ : Long reach bucket/Amphibious bucket
◈ : Heavy duty bucket
⊙ : Rock-heavy duty bucket
▣ : Slope finishing bucket

9. RECOMMENDED OILS

Use only oils listed below. Do not mix different brand oil.
Please use HYUNDAI genuine oil and grease.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F)
			-50 (-58) / -30 (-22) / -20 (-4) / -10 (14) / 0 (32) / 10 (50) / 20 (68) / 30 (86) / 40 (104)
Engine oil pan	Engine oil	24 (6.3)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Gear oil	Type 1 : 5.0(1.3) Type 2,3 : 6.2(1.64)	★SAE 75W-90
Final drive	Gear oil	5.8 × 2 (1.5 × 2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank; 160 (42) System; 275 (73)	★ISO VG 15 ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	400 (106)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and soft water★1	35 (9.2)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

★1 : Soft water
City water or distilled water

★ : Cold region
Russia, CIS, Mongolia

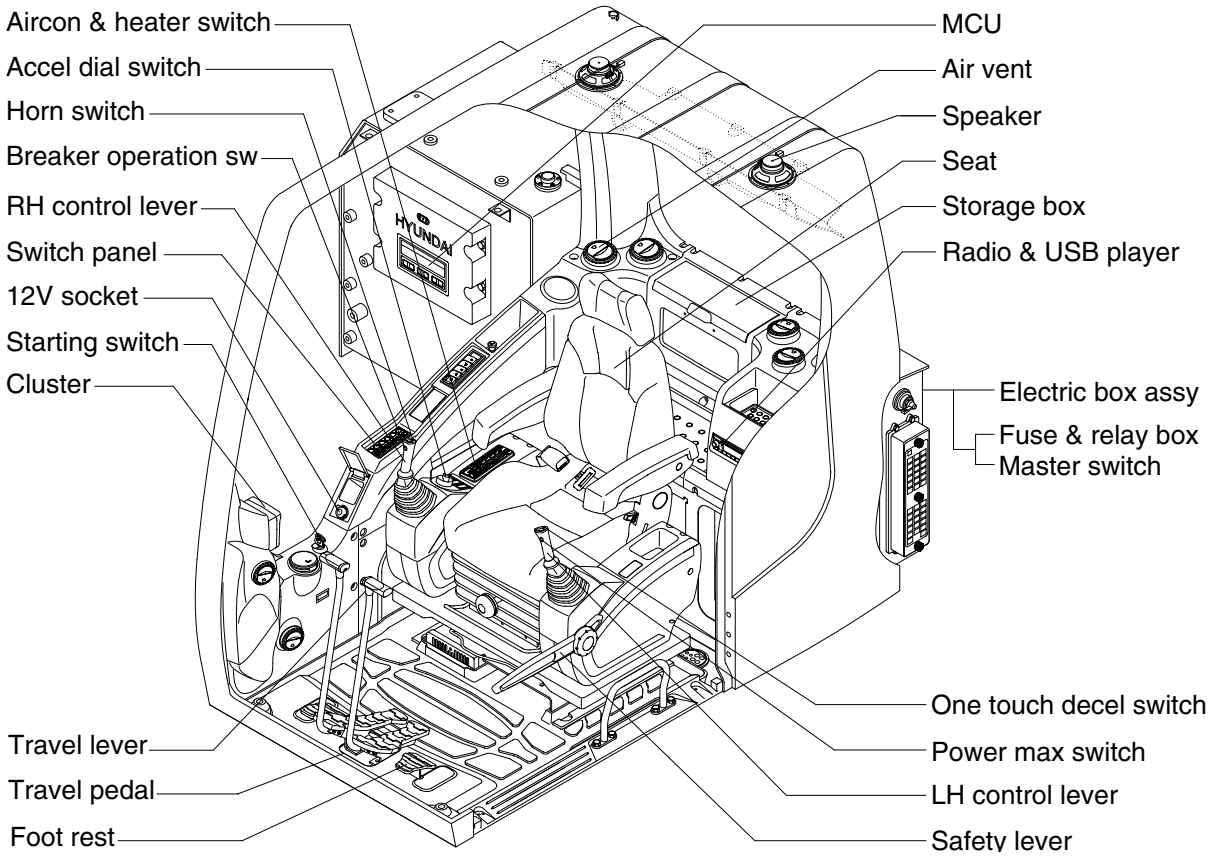
1. CAB DEVICES

1) The ergonomically designed console box and suspension type seat provide the operator with comfort.

2) ELECTRONIC MONITOR SYSTEM

(1) The centralized electronic monitor system allows the status and conditions of the machine to be monitored at a glance.

(2) It is equipped with a safety warning system for early detection of machine malfunction.



2209S3CD01

2. CLUSTER (TYPE 1)

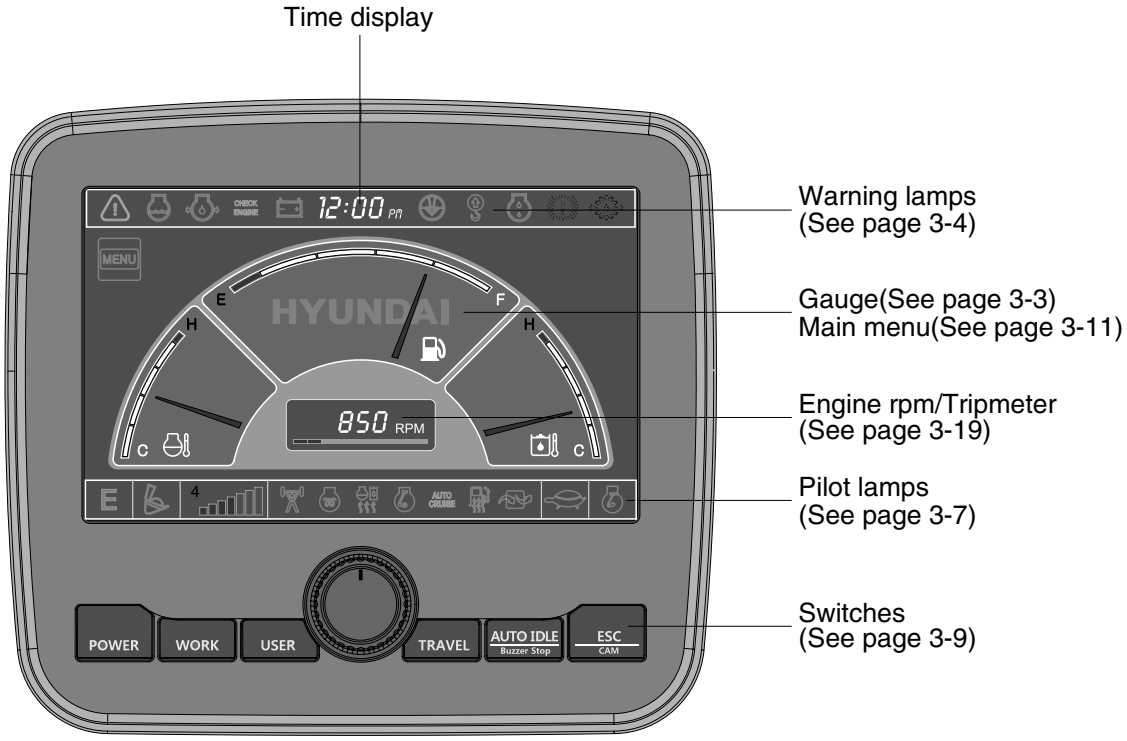
1) STRUCTURE

The cluster consists of LCD and switches as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection. Also, The LCD is to set and display for modes, monitoring and utilities with the switches.

The switches are to set the machine operation modes.

※ **The cluster installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.**

※ **When the cluster provides a warning immediately check the problem, and perform the required action.**



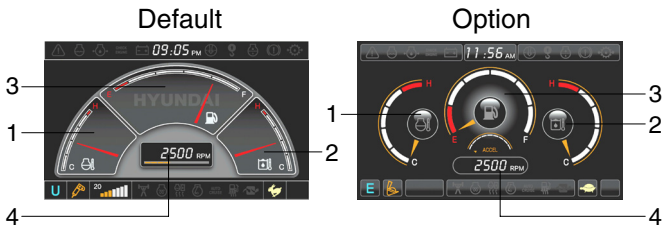
21093CD07

※ **The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.**

The warning lamp blinks until the problem is cleared. Refer to page 3-4 for details.

2) GAUGE

(1) Operation screen

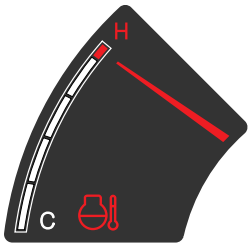


21093CD07A

1 Engine coolant temperature gauge
2 Hydraulic oil temperature gauge
3 Fuel level gauge
4 RPM / Tripmeter display

※ **Operation screen type can be set by the screen type menu of the display. Refer to page 3-21 for details.**

(2) Engine coolant temperature gauge



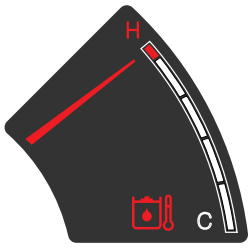
21093CD07G

① This gauge indicates the temperature of coolant.
- White range : 40-105˚C (104-221˚F)
- Red range : Above 105˚C (221˚F)

② If the indicator is in the red range or lamp blinks in red, turn OFF the engine and check the engine cooling system.

※ **If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(3) Hydraulic oil temperature gauge



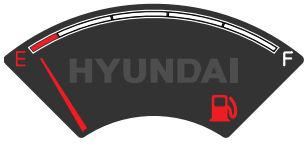
21093CD07E

① This gauge indicates the temperature of hydraulic oil.
- White range : 40-105˚C(104-221˚F)
- Red range : Above 105˚C(221˚F)

② If the indicator is in the red range or lamp blinks is red, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

※ **If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(4) Fuel level gauge



21093CD07F

① This gauge indicates the amount of fuel in the fuel tank.

② Fill the fuel when the red range, or lamp blinks in red.

※ **If the gauge indicates the red range or lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

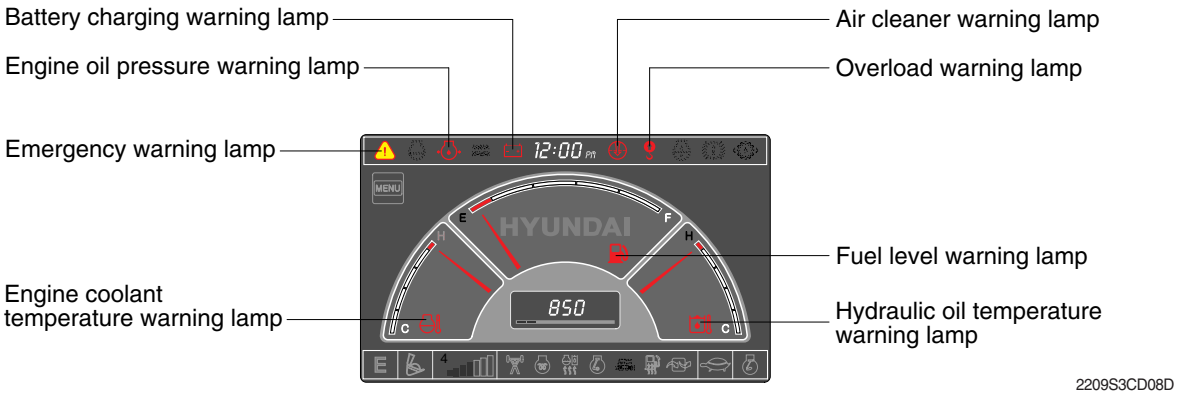
(5) RPM / Tripmeter display

21093CD02D

① This displays the engine speed or the tripmeter.

※ **Refer to page 3-19 for details.**

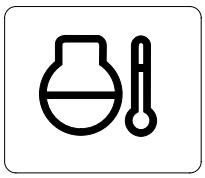
3) WARNING LAMPS



2209S3CD08D

※ **Each warning lamp on the top of the LCD pops up on the center of LCD and the buzzer sounds when the each warning is happened. The pop-up warning lamp moves to the original position and blinks when the select switch is pushed. And the buzzer stops.**
Refer to page 3-10 for the select switch.

(1) Engine coolant temperature



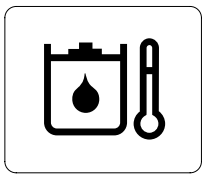
21093CD08A

① Engine coolant temperature warning is indicated two steps.
- 100˚C over : The lamp blinks and the buzzer sounds.
- 105˚C over : The lamp pops up on the center of LCD and the buzzer sounds.

② The pop-up lamp moves to the original position and blinks when the select switch is pushed. Also, the buzzer stops and lamp keeps blink.

③ Check the cooling system when the lamp keeps ON.

(2) Hydraulic oil temperature



21093CD08C

① Hydraulic oil temperature warning is indicated two steps.
- 100˚C over : The lamp blinks and the buzzer sounds.
- 105˚C over : The lamp pops up on the center of LCD and the buzzer sounds.

② The pop-up lamp moves to the original position and blinks when the select switch is pushed. Also, the buzzer stops and lamp keeps blink.

③ Check the hydraulic oil level and hydraulic oil cooling system.

(3) Fuel level

21093CD08B

① This warning lamp blinks and the buzzer sounds when the level of fuel is below 55 ℓ (14.53 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

(4) Emergency warning lamp

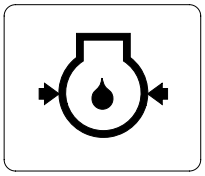
21093CD30

① This lamp pops up and the buzzer sounds when each of the below warnings is happened.
- Engine coolant overheating (over 105˚C)
- Hydraulic oil overheating (over 105˚C)
- Pump EPPR circuit abnormal or open
- Attachment flow EPPR circuit abnormal or open
- MCU input voltage abnormal
- Accel dial circuit abnormal or open
- Cluster communication data error

※ **The pop-up warning lamp moves to the original position and blinks when the select switch is pushed. Also the buzzer stops. This is same as following warning lamps.**

② When this warning lamp blinks, machine must be checked and serviced immediately.

(5) Engine oil pressure warning lamp

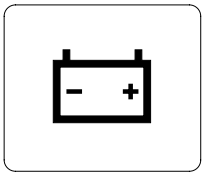


21093CD32

① This lamp blinks when the engine oil pressure is low.

② If the lamp blinks, shut OFF the engine immediately. Check oil level.

(6) Battery charging warning lamp

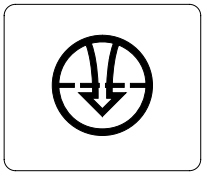


21093CD34

① This lamp blinks when the battery charging voltage is low.

② Check the battery charging circuit when this lamp blinks.

(7) Air cleaner warning lamp

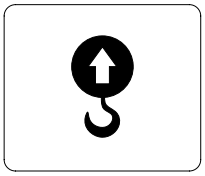


21093CD35

① This lamp blinks when the filter of air cleaner is clogged.

② Check the filter and clean or replace it.

(8) Overload warning lamp (opt)

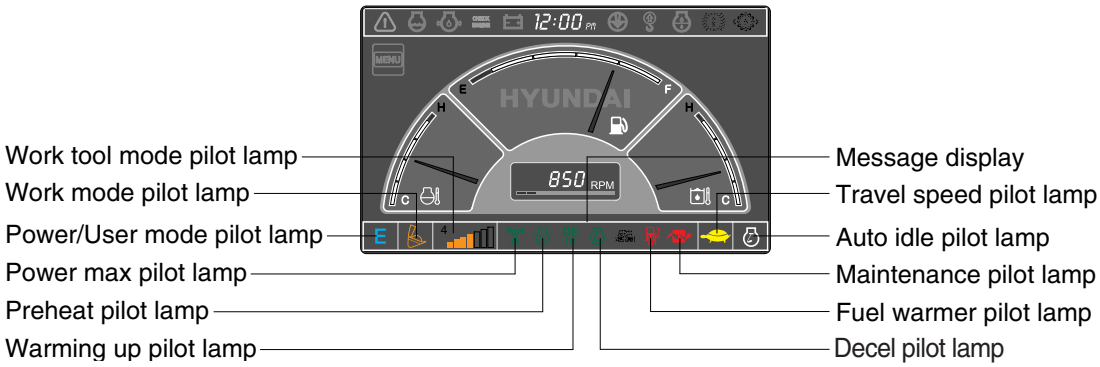


21093CD36

① When the machine is overload, the overload warning lamp blinks during the overload switch is ON. (if equipped)

② Reduce the machine load.

4) PILOT LAMPS



21093CD09

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work mode		General operation mode
			Breaker operation mode
			Crusher operation mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle
6	Work tool mode	4	Oil flow level of breaker or crusher mode
7	Message display	M	"Setting is completed" display after selection

(2) Power max pilot lamp

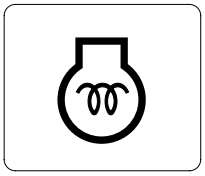
21093CD38

① The lamp will be ON when pushing power max switch on the LH RCV lever.

② The power max function is operated maximum 8 seconds.

※ **Refer to the page 3-37 for power max function.**

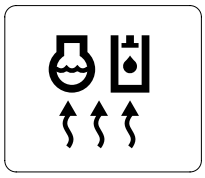
(3) Preheat pilot lamp



21093CD39

① Turning the start key switch ON position starts preheating in cold weather.
② Start the engine after this lamp is OFF.

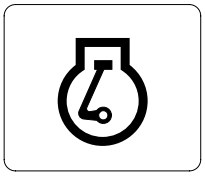
(4) Warming up pilot lamp



21093CD40

① This lamp is turned ON when the coolant temperature is below 30˚C(86˚F).
② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting the engine.

(5) Decel pilot lamp



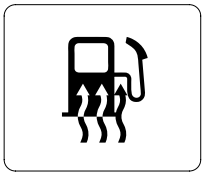
21093CD41

① Operating one touch decel switch on the RCV lever makes the lamp ON.
② Also, the lamp will be ON and engine speed will be lowered automatically to save fuel consumption when all levers and pedals are at neutral position, and the auto idle function is selected.

※ **One touch decel is not available when the auto idle pilot lamp is turned ON.**

※ **Refer to the page 3-37.**

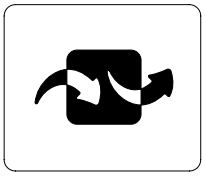
(6) Fuel warmer pilot lamp



21093CD43

① This lamp is turned ON when the coolant temperature is below 10˚C(50˚F) or the hydraulic oil temperature 20˚C(68˚F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60˚C, or the hydraulic oil temperature is above 45˚C since the start switch was ON position.

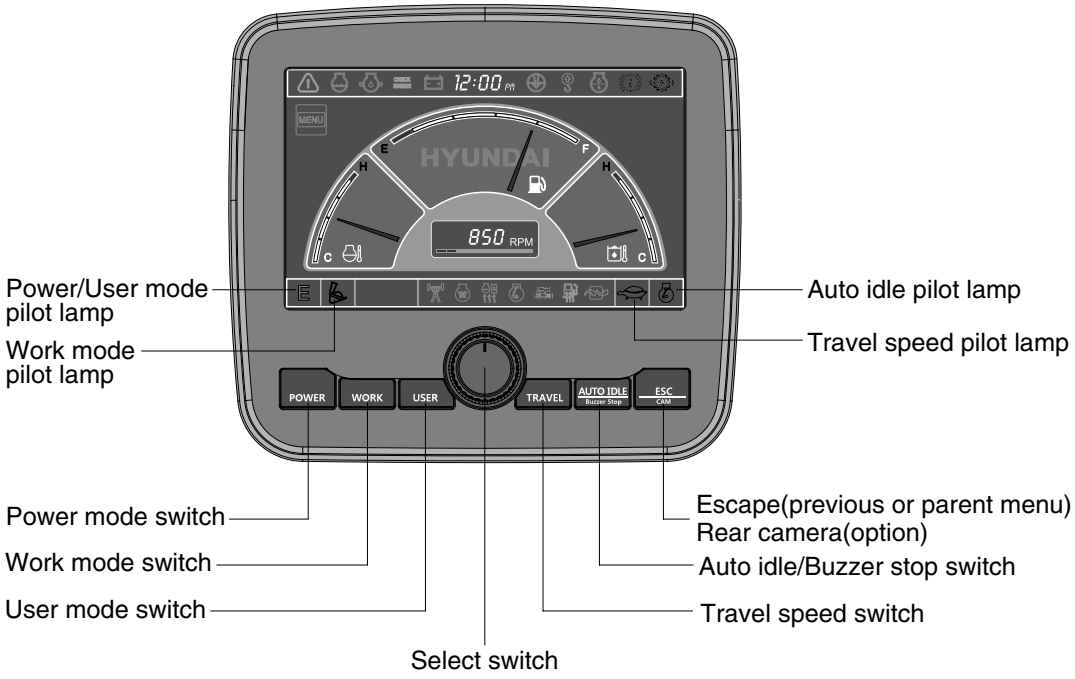
(7) Maintenance pilot lamp



21093CD44

① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.

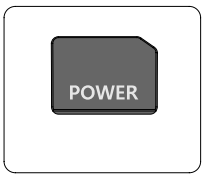
5) SWITCHES



21093CD45

※ **When the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 3-7 for details.**

(1) Power mode switch

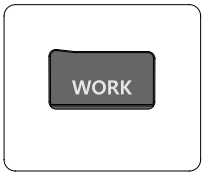


21093CD45A

① This switch is to select the machine power mode and selected power mode pilot lamp is displayed on the pilot lamp position.
- P : Heavy duty power work.
- S : Standard power work.
- E : Economy power work.

② The pilot lamp changes E → S → P → E in order.

(2) Work mode switch

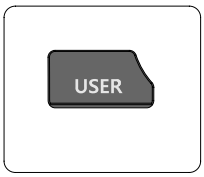


21093CD45C

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
- : General operation mode
- : Breaker operation mode (if equipped)
- : Crusher operation mode (if equipped)
- Not installed : Breaker or crusher is not installed.

※ **Refer to the page 4-10 for details.**

(3) User mode switch

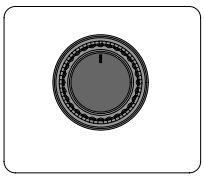


21093CD45D

① This switch is used to memorize the current machine operating status in the MCU and activate the memorized user mode.
- Memory : Push more than 2 seconds.
- Action : Push within 2 seconds.
- Cancel : Push this switch once more within 2 seconds.

② Refer to the page 3-12 for another set of user mode.

(4) Select switch



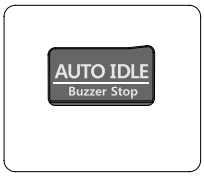
21093CD45E

① This switch is used to select or change the menu and input value.

② Knob push
- Long (over 2 sec) : Return to the operation screen
- Medium (0.5~2 sec) : Return to the previous screen
- Short (below 0.5 sec) : Select menu

③ Knob rotation
This knob changes menu and input value.
- Right turning : Down direction / Increase input value
- Left turning : Up direction / Decreased input value

(5) Auto idle/ buzzer stop switch

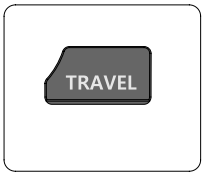


21093CD45F

① This switch is used to activate or cancel the auto idle function.
- Pilot lamp ON : Auto idle function is activated.
- Pilot lamp OFF : Auto idle function is cancelled.

② The buzzer sounds when the machine has a problem.
In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

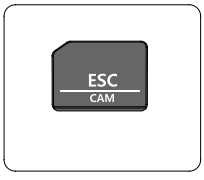
(6) Travel speed control switch



21093CD45G

① This switch is used to select the travel speed alternatively.
- : High speed
- : Low speed

(7) Escape/Camera switch



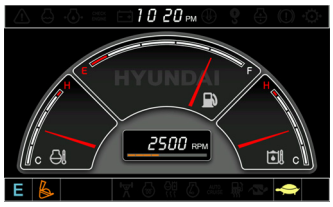
21093CD45H

① This switch is used to return to the previous menu or parent menu.

② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 3-22 for the camera.

③ If the camera is not installed, this switch is used only ESC function.

6) MAIN MENU



21093CD64

21093CD64A

Press

21093CD64B

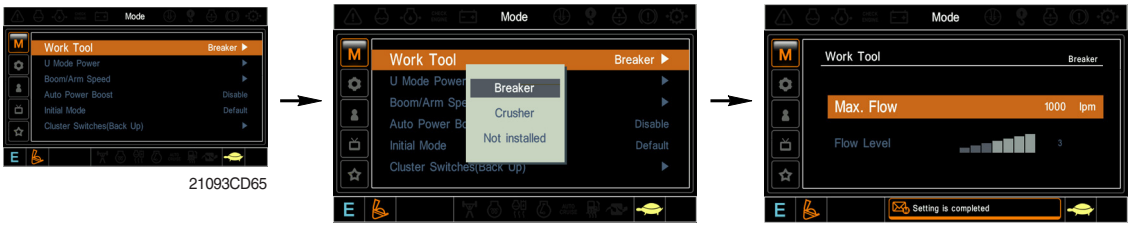
※ **Please refer to select switch, page 3-10 for selection and change of menu and input value.**

(1) Structure

No	Main menu	Sub menu	Description
1	M Mode 21093CD64D	Work tool U mode power Boom/Arm speed Auto power boost Initial mode Cluster switch (back up)	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Default, U mode Switch function
2	Monitoring 21093CD64E	Active fault Logged fault Delete logged fault Monitoring (analog) Monitoring (digital) Operating hours	MCU MCU All logged fault delete, Initialization canceled Machine information Switch status, Output status Operating hours for each mode
3	Management 21093CD64F	Maintenance information Machine security Machine Information A/S phone number Service menu	Replacement, Change interval oils and filters ESL mode setting, Password change Cluster, MCU, Engine, Machine A/S phone number, A/S phone number change Power shift, Hourmeter, Replacement history, Update
4	Display 21093CD64G	Display item Clock Brightness Unit Language Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Date format Korean, English, Chinese A type, B type
5	Utilities 21093CD64H	Tripmeter DMB (-#2828) Entertainment (-#2828) Camera setting Message box	3 kinds (A, B, C) DMB select, DAB select, Channel scan, Exit Play MP4, codec. Basic direction, Display switching, Full screen Record for fault, attachment etc.

(2) Mode setup

① Work tool



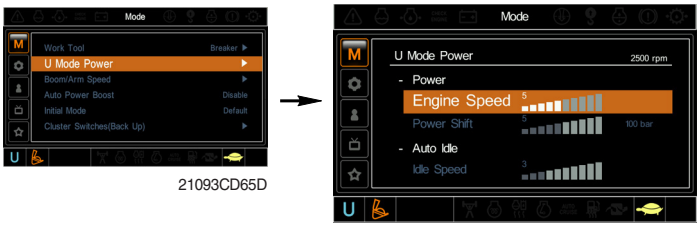
21093CD65 21093CD65A 21093CD65B

A B

- A : Select one installed optional attachment.
- B : Max flow - Set the maximum flow for the attachment.
  Flow level - Reduce the operating flow from maximum flow.
  Breaker - Max 7 steps, Reduced 10 lpm each step.
  Crusher - Max 4 steps, Reduced 20 lpm each step.

※ **The flow level is displayed with the work mode pilot lamp.**

② U mode power

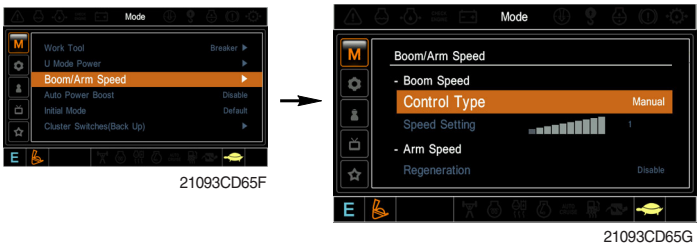


21093CD65D 21093CD65E

- Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
- U-mode can be activated by user mode switch.

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1500	1000 (low idle)	0
2	1600	1050	3
3	1700	1100	6
4	1800	1150 (decel rpm)	9
5	1900	1200	12
6	2000	1250	16
7	2050	1300	20
8	2100	1350	26
9	2150	1400	32
10	2200	1450	38

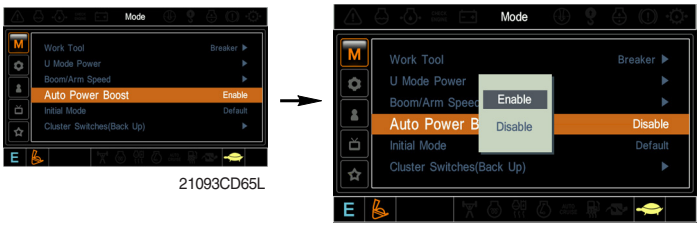
③ Boom/Arm speed



21093CD65F 21093CD65G

- **Boom speed**
  - Control type
    Manual - Boom up speed is fixed as set steps.
    Auto - Boom up speed is automatically adjusted as working conditions by the MCU.
  - Speed setting - Boom up speed is increased as much as activated steps.
- **Arm speed**
  - Regeneration - Arm regeneration function can be activated or cancelled.
    Enable - Arm in speed is up.
    Disable - Fine operation.

④ Auto power boost

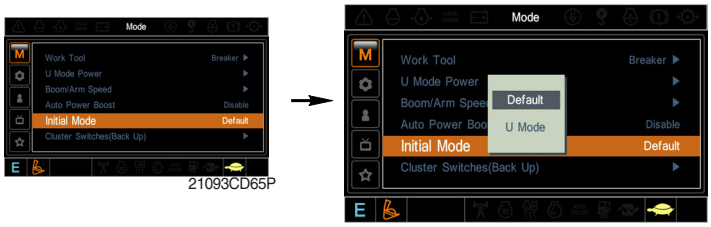


21093CD65L

21093CD65M

- The power boost function can be activated or cancelled.
- Enable - The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.
- Disable - Not operated.

⑤ Initial mode

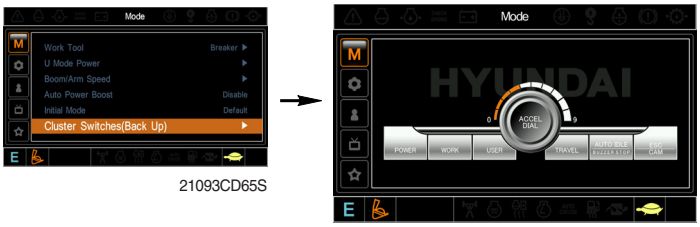


21093CD65P

21093CD65Q

- Default - The initial power mode is set E mode when the engine is started.
- U mode - The initial power mode is set U mode when the engine is started.

⑥ Cluster switch (back up)



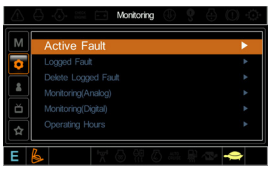
21093CD65S

21093CD65T

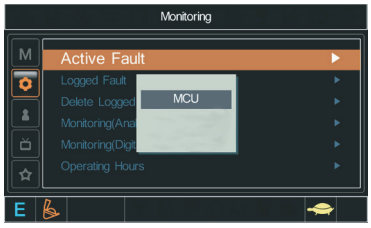
- The cluster switch can be selected and changed by this menu when the switches are abnormal on the cluster.
- In order to exit "Cluster switch" mode, please put the cursor on the ESC/CAM switch by turning the select switch and push the select switch.
- In "Cluster switch", other switches except "Select switch" do not work.

(3) Monitoring

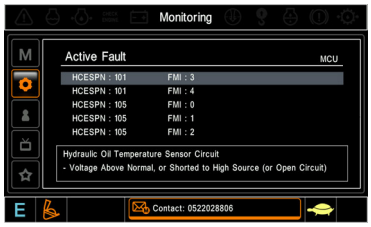
① Active fault



21093CD66



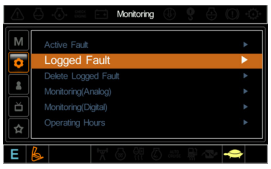
21093CD66A-1



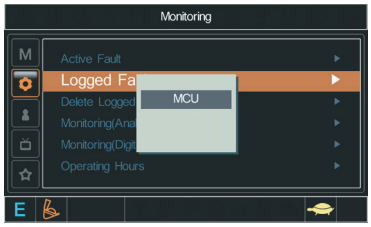
21093CD66B

- The active faults of the MCU can be checked by this menu.

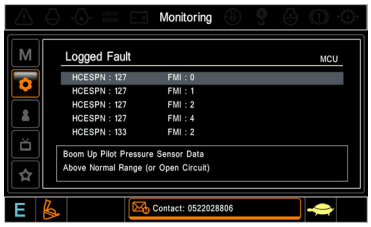
② Logged fault



21093CD66C



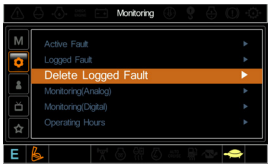
21093CD66D-1



21093CD66E

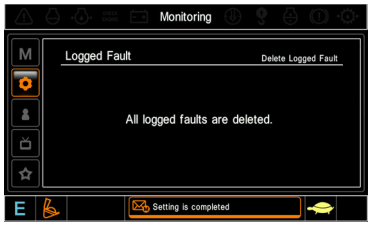
- The logged faults of the MCU can be checked by this menu.

③ Delete logged fault



21093CD66F

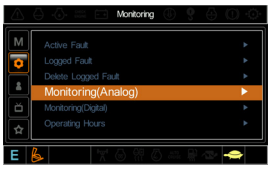
21093CD66G



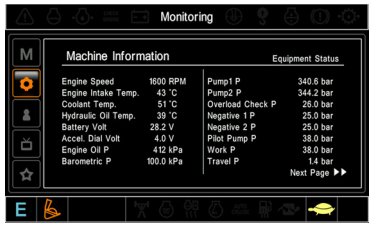
21093CD66H

- The logged faults of the MCU can be deleted by this menu.

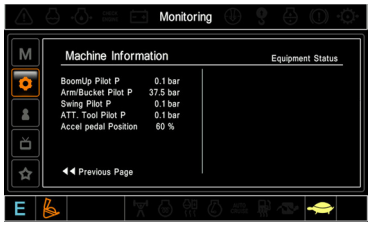
④ Monitoring(Analog)



21093CD66J



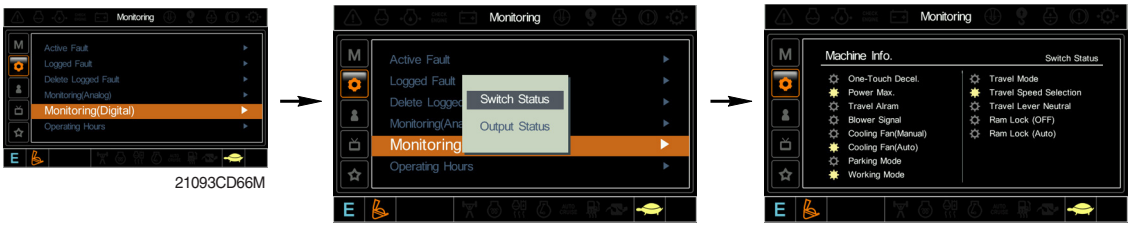
21093CD66K



21093CD66L

- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.

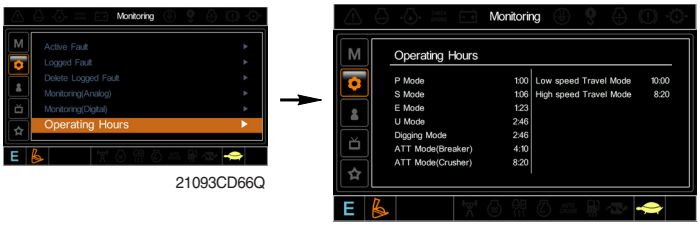
⑤ **Monitoring** (digital)



21093CD66M 21093CD66N 21093CD66P

- The switch status or output status can be confirmed by this menu.
- The activated switch or output pilot lamps ☼ are light ON.

⑥ **Operating hours**



21093CD66Q 21093CD66R

- The operating hour of each mode can be confirmed by this menu.

(4) Management

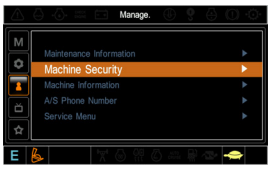
① Maintenance information

21093CD67 21093CD67A 21093CD67Q 21093CD67R 21093CD67S 21093CD67T

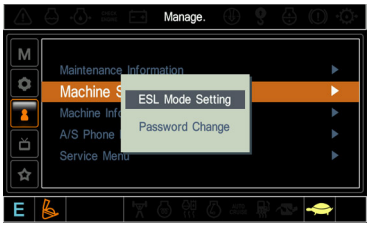
- Alarm(☼ ☼ ☼) : Gray ☼ - Normal
  Yellow ☼ - First warning
  Red ☼ - Second warning
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change or replace interval can be changed in the unit of 50 hours.
- OK : Return to the item list screen.
- **Change or relpace interval**

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Drain filter	1000
7	Hydraulic oil return filter	1000
8	Engine oil filter	500
9	Fuel filter	500
10	Pre-filter	500
11	Hydraulic tank breather	1000
12	Air cleaner (inner)	500
13	Radiator coolant	2000
14	Swing gear pinion grease	1000

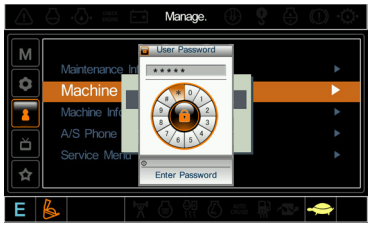
② Machine security



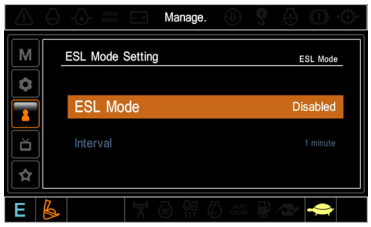
21093CD67C



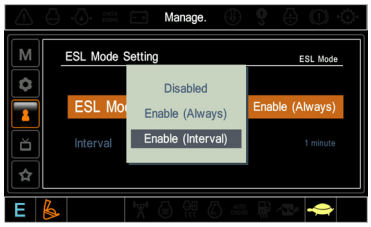
21093CD67D



21093CD67E



21093CD67EE



21093CD67H

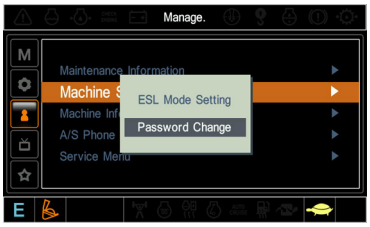
· **ESL mode**

- ESL : Engine Starting Limit
- ESL mode is designed to be a theft deterrent or will prevent the unauthorized operation of the machine.
- If the ESL mode was selected Enable, the password will be required when the start switch is turned ON.
- Disable : Not used ESL function

  Enable (always) : The password is required whenever the operator start engine.

  Enable (interval) : The password is required when the operator start engine first. But the operator can restart the engine within the interval time without inputting the password.

  The interval time can be set maximum 4 hours.

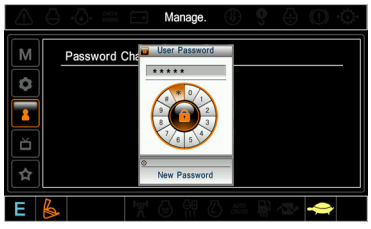


21093CD67U

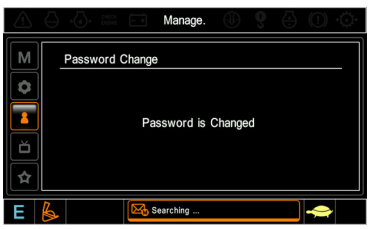
Enter the current password 21093CD67V

· **Password change**

- The password is 5~10 digits.



Enter the new password 21093CD67VV



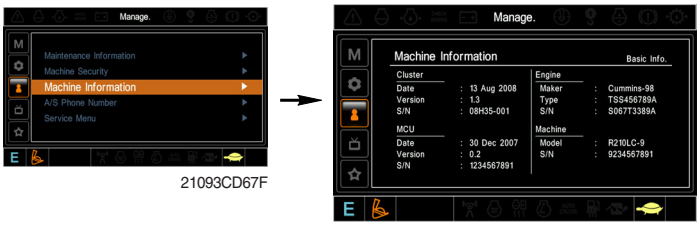
21093CD67X

The new password is stored in the MCU.

21093CD67XX

Enter the new password again

③ Machine Information



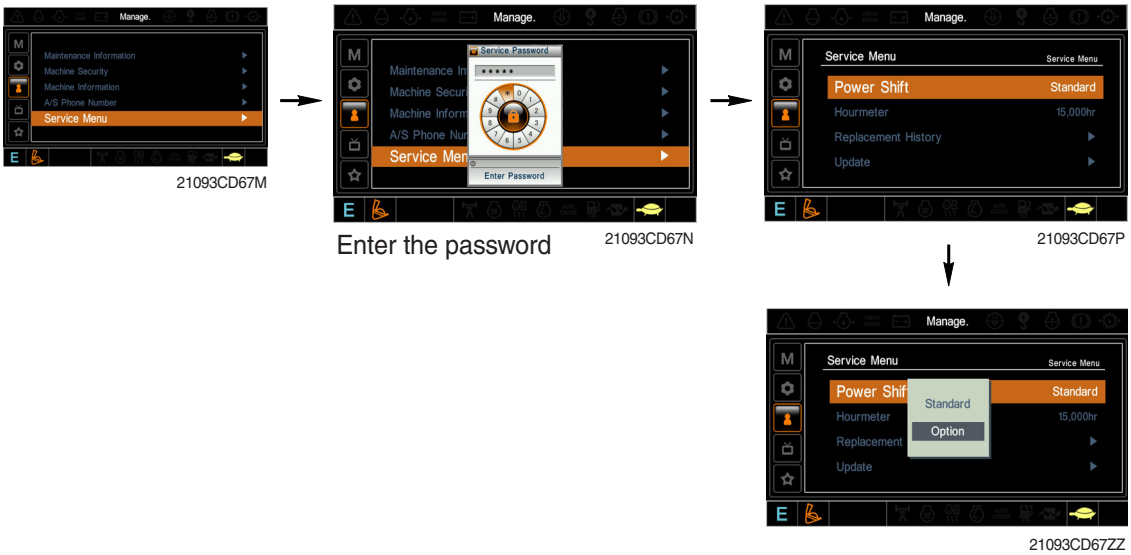
21093CD67F 21093CD67G

· This can confirm the identification of the cluster, MCU, engine and machine.

④ A/S phone number

21093CD67J 21093CD67K 21093CD67L 21093CD67Z 21093CD67Y

⑤ Service menu

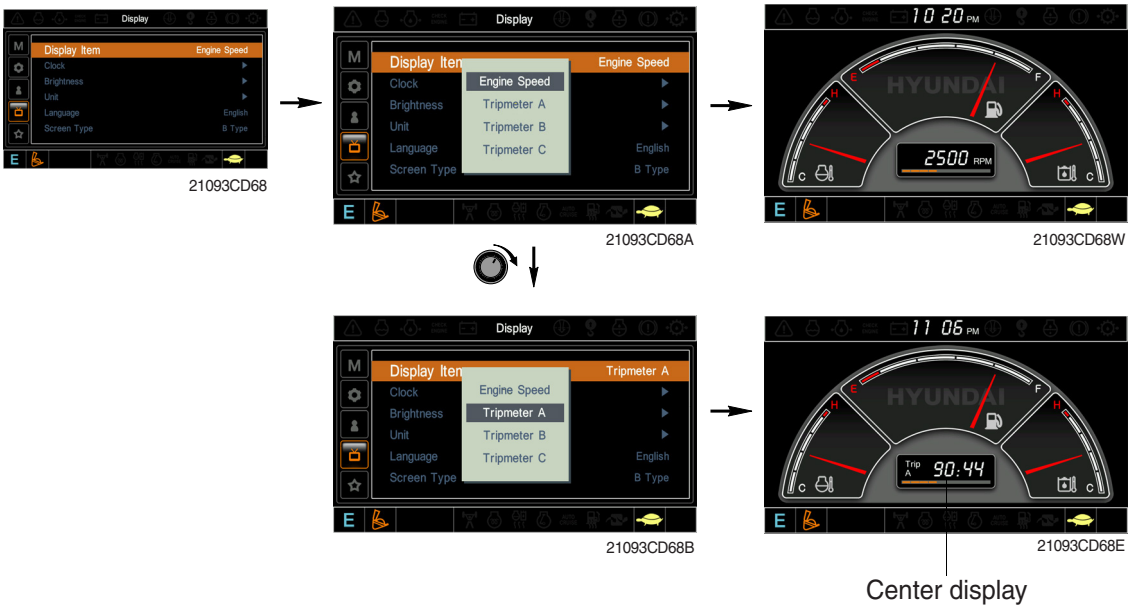


21093CD67M Enter the password 21093CD67N 21093CD67P 21093CD67ZZ

· Power shift (standard/option) : Power shift pressure can be set by option menu.
· Hourmeter : Operating hours since the machine line out can be checked by this menu.
· Replacement history : Replacement history of the MCU and cluster can be checked by this menu.
· Update : Firm ware can be upgraded by this menu. (the USB port is located under the cluster)

(5) Display

① Display item

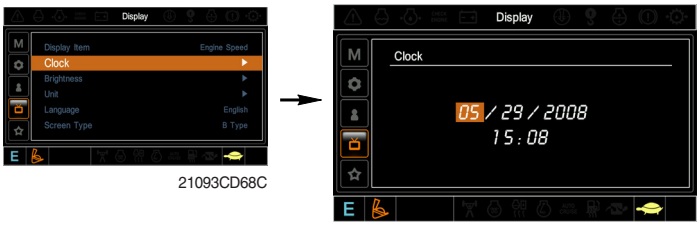


21093CD68 21093CD68A 21093CD68W

21093CD68B 21093CD68E

- The center display type of the LCD can be selected by this menu.
- The engine speed or each of the tripmeter (A,B,C) is displayed on the center display.

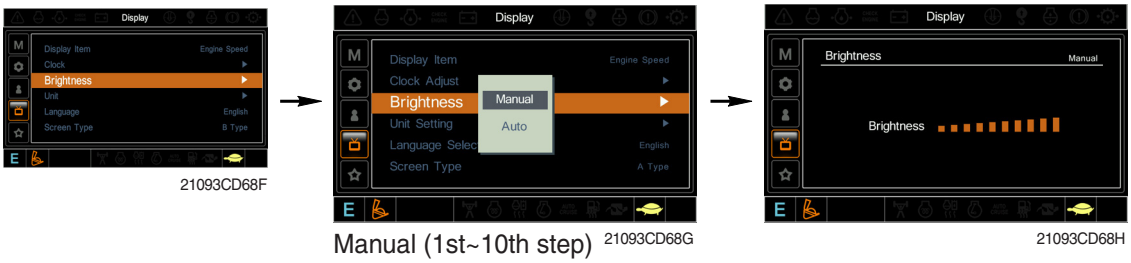
② Clock



21093CD68C 21093CD68D

- The first line's three spots "**/**/****" represent Month/Day/Year each.
- The second line shows the current time. (0:00~23:59)

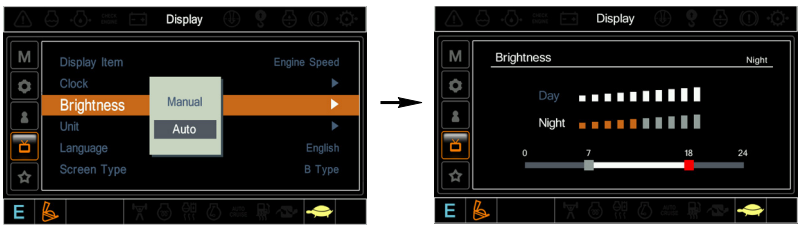
③ Brightness



21093CD68F

Manual (1st~10th step) 21093CD68G

21093CD68H



Auto (day/night) 21093CD68J

21093CD68K

※ If "Auto" is chosen, brightness for day and night can be differently set up. Also by using the bar in lower side, users can define which time interval belongs to day and night.
(in bar figure, gray area represents night time while white shows day time)

④ Unit

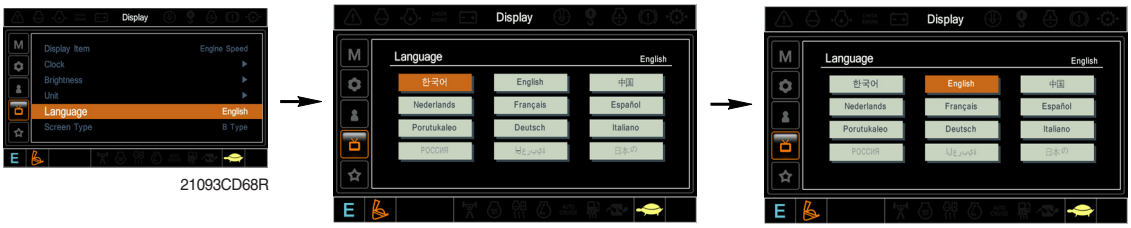
21093CD68L

21093CD68M

21093CD68N

- Temperature : ˚C ↔˚F
- Pressure : bar ↔ MPa ↔ kgf/cm²
- Flow : lpm ↔ gpm
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-Mar-yy

⑤ Language



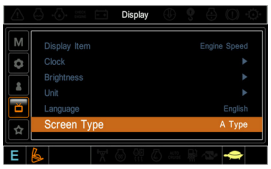
21093CD68R

21093CD68S

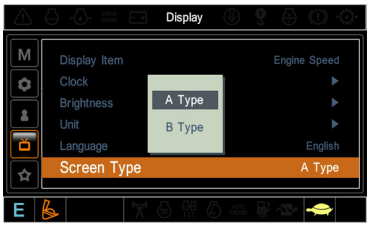
21093CD68T

- User can select preferable language and all displays are changed the selected language.

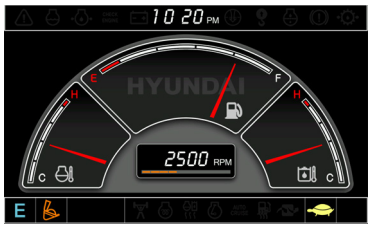
⑥ Screen type



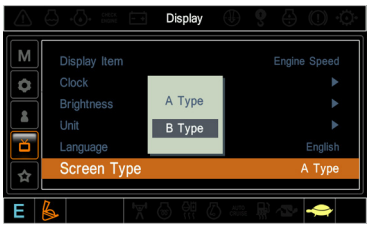
21093CD68U



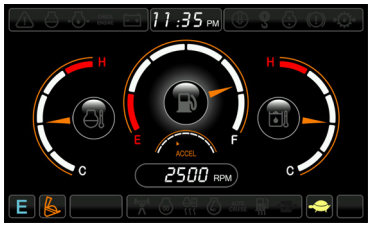
A Type 21093CD68V



Standard 21093CD68W



B Type 21093CD68X

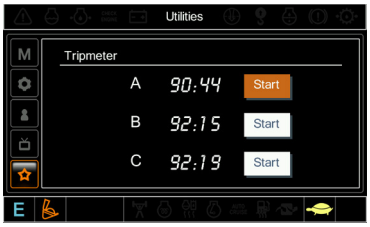


Option 21093CD68Y

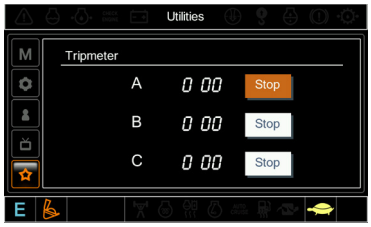
(6) Utilities

① Tripmeter

21093CD69



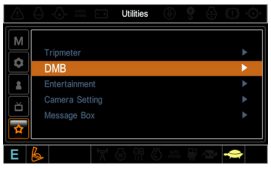
21093CD69A



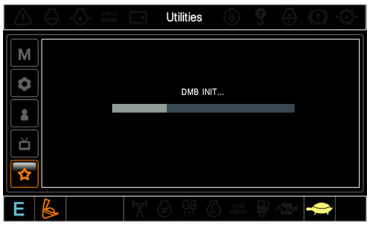
21093CD69B

- Maximum 3 kinds of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start" while it also can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

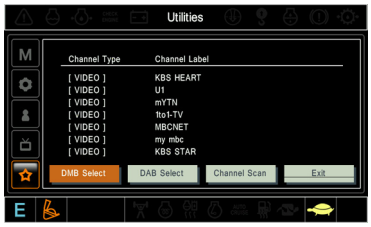
② DMB (-#2828)



21093CD69C



21093CD69D



21093CD69E

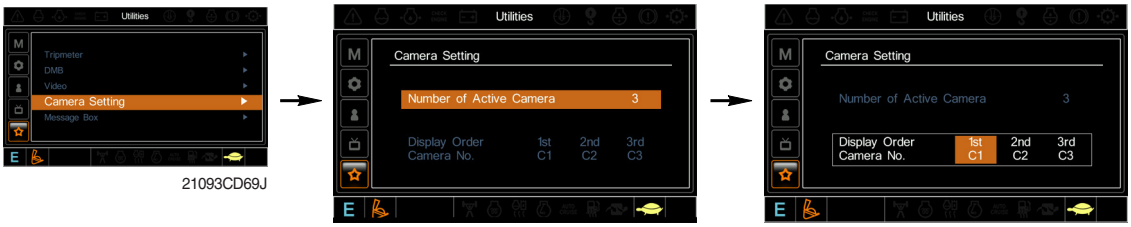
- DMB select : TV channel can be selected by this menu.
- DAB select : Audio channel can be selected by this menu.
- Channel scan : This menu can be used other region for TV/Audio.
- Exit : Exit DMB menu

③ Entertainment (-#2828)

- Play MP4 or codec file of external hard disk through USB port.
- The USB port is located under the cluster.

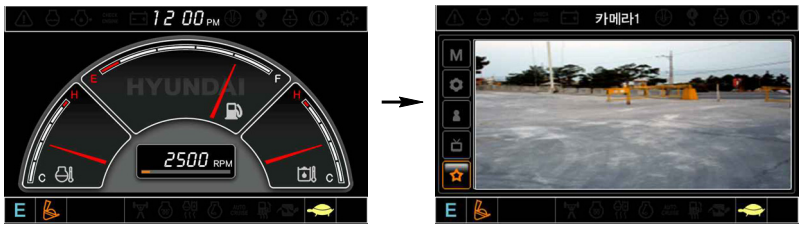
21093CD69F 21093CD69G

④ Camera setting



21093CD69J 21093CD69K 21093CD69L

- Three cameras can be installed on the machine.
- The display order can be set by this menu.

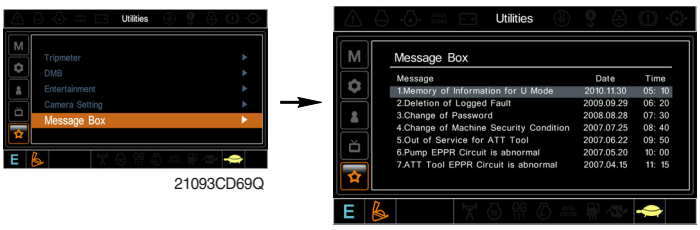


21093CD69M 21093CD69N

- If the camera was not equipped, this menu is not useful.
- In the operation screen, if the ESC/CAM switch is pushed, the first ordered display camera will be viewed.
- Turnning the select switch in clockwise direction, the next ordered will be shown and in counter-clockwise direction, the previously ordered will be shown.
- Push the select switch, the displayed screen will be enlargement.

⑤ Message box

- **The history of the machine operating status can be checked by this menu.**



21093CD69Q 21093CD69R

■ CLUSTER (TYPE 2)

1) MONITOR PANEL

The monitor panel consists of LCD and lamps as shown below, to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.

- LCD : Indicate operating status of the machine.
- Warning lamp : Indicate abnormality of the machine (red).
- Pilot lamp : Indicate operating status of the machine (amber).

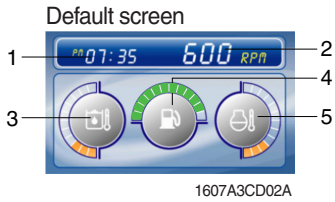
※ The monitor installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.

※ When the monitor provides a warning immediately check the problem, and perform the required action.

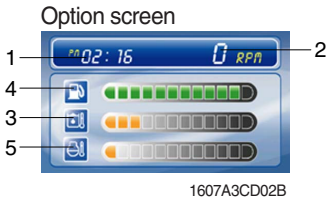
2209S3CD02

※ The warning lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press the buzzer stop switch and buzzer stop, but the warning lamp lights until the problem is cleared.

2) LCD main operation display



1607A3CD02A



1607A3CD02B

1 Time display
2 RPM display
3 Hydraulic oil temperature gauge
4 Fuel level gauge
5 Engine coolant temperature gauge

(1) Time display

1607A3CD02C

① This displays the current time.

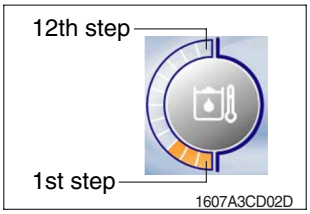
※ **Refer to the page 3-28 to set time for details.**

(2) RPM display

1607A3CD02C

① This displays the engine rpm.

(3) Hydraulic oil temperature gauge



1607A3CD02D

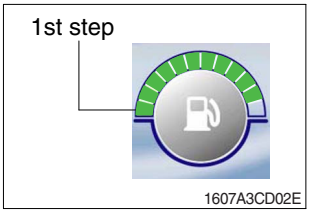
① This gauge indicates the temperature of hydraulic oil in 12 step gauge.
- ·1st step : Below 30˚C (86˚F)
- ·2nd~10th step : 30-105˚C (86-221˚F)
- ·11th~12th step : Above 105˚C (221˚F)

② The gauge between 2nd and 10th steps illuminates when operating.

③ Keep idling engine at low speed until the gauge between 2nd and 10th steps illuminates, before operation of machine.

④ When the gauge of 11th and 12th steps illuminates, reduce the load on the system. If the gauge stays in the 11th~12th steps, stop the machine and check the cause of the problem.

(4) Fuel level gauge



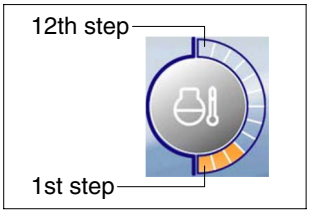
1607A3CD02E

① This gauge indicates the amount of fuel in the fuel tank.

② Fill the fuel when the 1st step or fuel icon blinks in red.

※ **If the gauge illuminates the 1st step or fuel icon blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(5) Engine coolant temperature gauge



1607A3CD02F

① This gauge indicates the temperature of coolant in 12 step gauge.
- · 1st step : Below 30˚C (86˚F)
- · 2nd~10th step : 30-105˚C (86-221˚F)
- · 11th~12th step : Above 105˚C (221˚F)

② The gauge between 2nd and 10th steps illuminates when operating.

③ Keep idling engine at low speed until the gauge between 2nd and 10th steps illuminates, before operation of machine.

④ When the gauge of 11th and 12th steps illuminates, turn OFF the engine, check the radiator and engine.

3) Warning of main operation screen

(1) Warning display

① Engine coolant temperature


- This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 105˚C (221˚F).
- Check the cooling system when the lamp blinks.

② Fuel level


- This lamp blinks and the buzzer sounds when the level of fuel is below 31 ℓ (8.2 U.S. gal).
- Fill the fuel immediately when the lamp blinks.

③ Hydraulic oil temperature


- This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105˚C (221˚F).
- Check the hydraulic oil level when the lamp blinks.
- Check for debris between oil cooler and radiator.

④ All gauge


- This lamp blinks and the buzzer sounds when the all gauge is abnormal.
- Check the each system when the lamp blinks.

⑤ Communication error

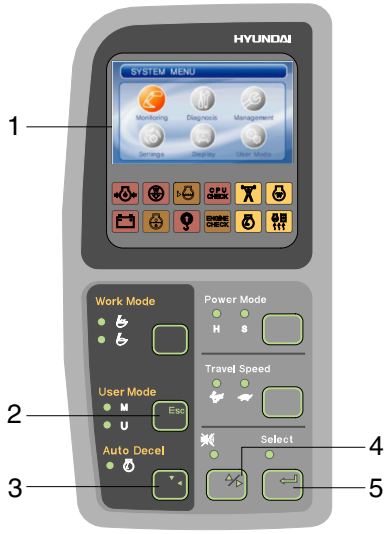
- Communication problem between MCU and cluster makes the lamp blinks and the buzzer sounds.
- Check if any fuse for MCU burnt off.
  If not check the communication line between them.

(2) Pop-up icon display

No	Switch	Selected mode	Interval
1	Work mode switch	General work mode	
		Heavy duty work mode	
2	Power mode switch	High power work mode	
		Standard power work mode	

No	Switch	Selected mode	Interval
3	Auto deceleration switch	Light ON	
		Light OFF	
4	Travel speed control switch	Low speed	
		High speed	

4) LCD



2209S3CD05

1 : LCD

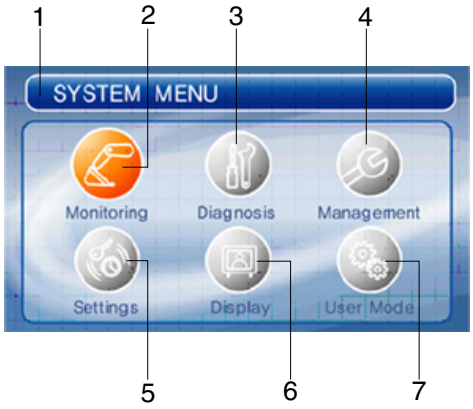
2 Esc : Escape,
Return to the previous menu

3 : Down / Left Direction

4 : Up/Right Direction

5 : Select (enter)
Activate the currently chosen item

(1) Main menu



2507A4OP94

1 SYSTEM MENU : Menu information

2 : Monitoring
- Equipment, Switch, Output

3 : Diagnosis
- Current error, Recorded error

4 : Maintenance

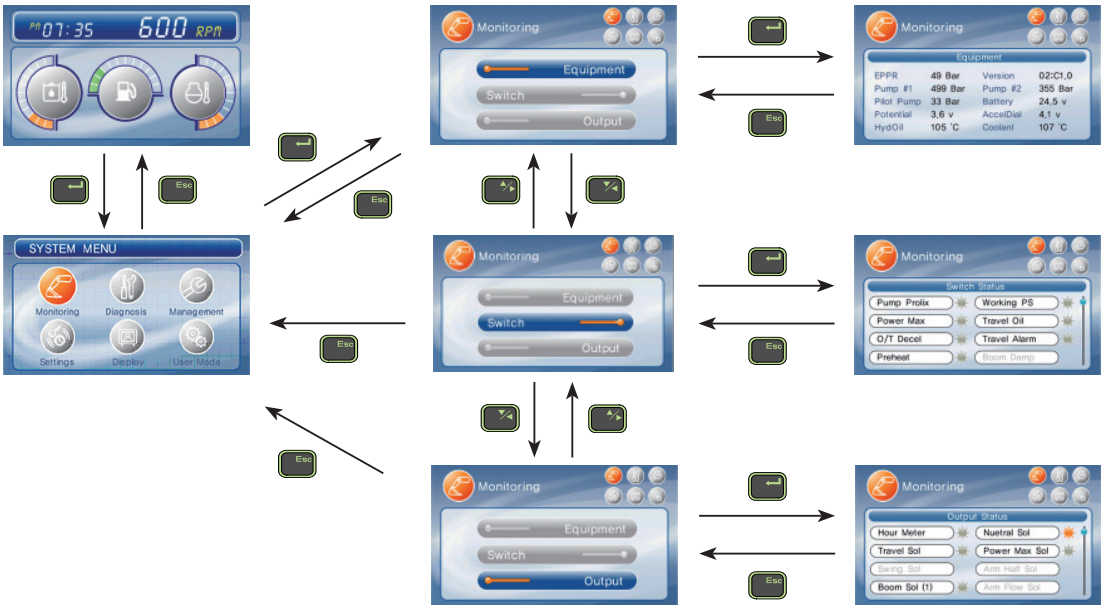
5 : Settings
- Time set, Dual mode
- System lock (reserved)

6 : Display
- Operation skin, Brightness, Language

7 : User mode

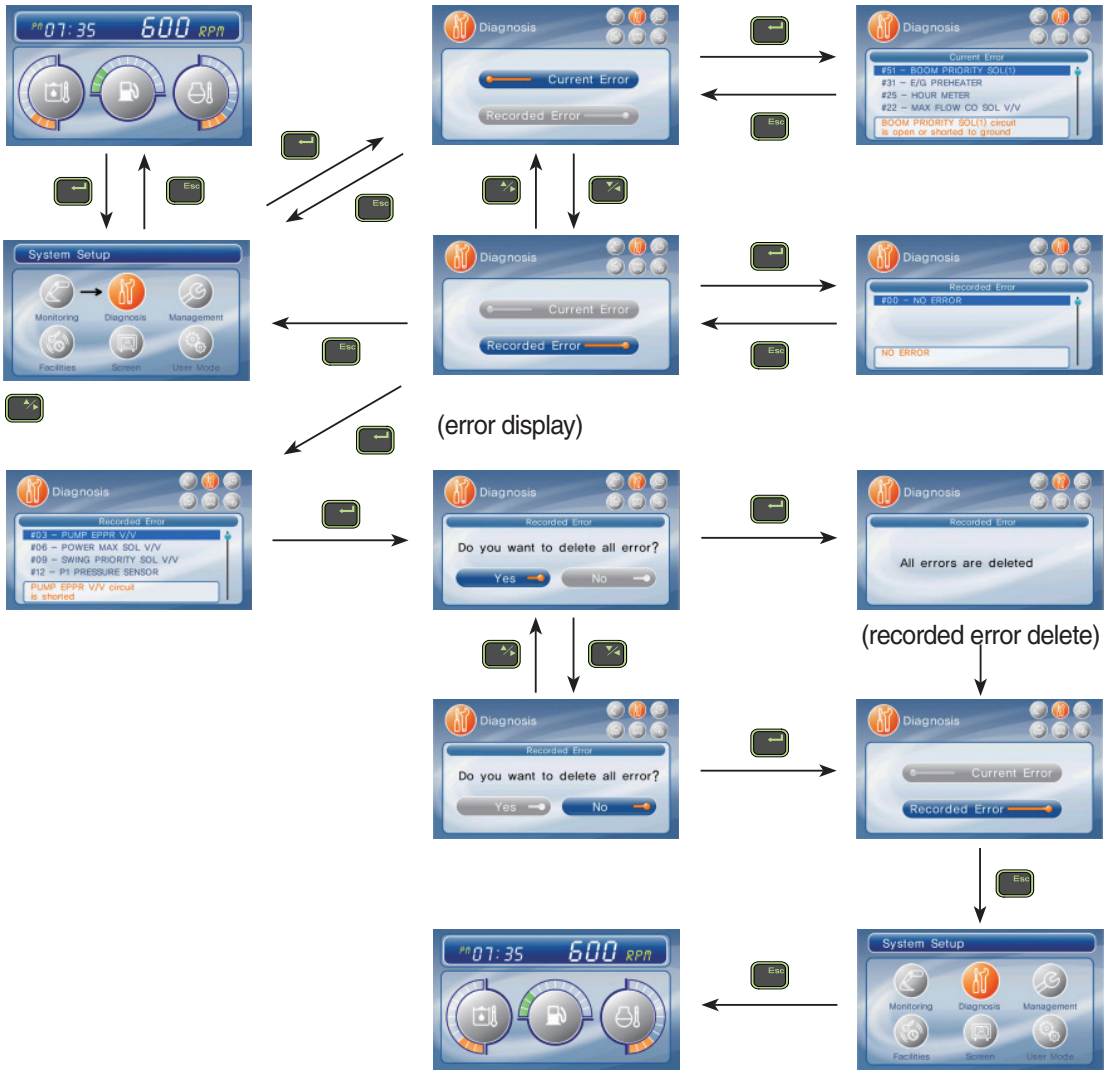
(2) Display map

① Monitoring



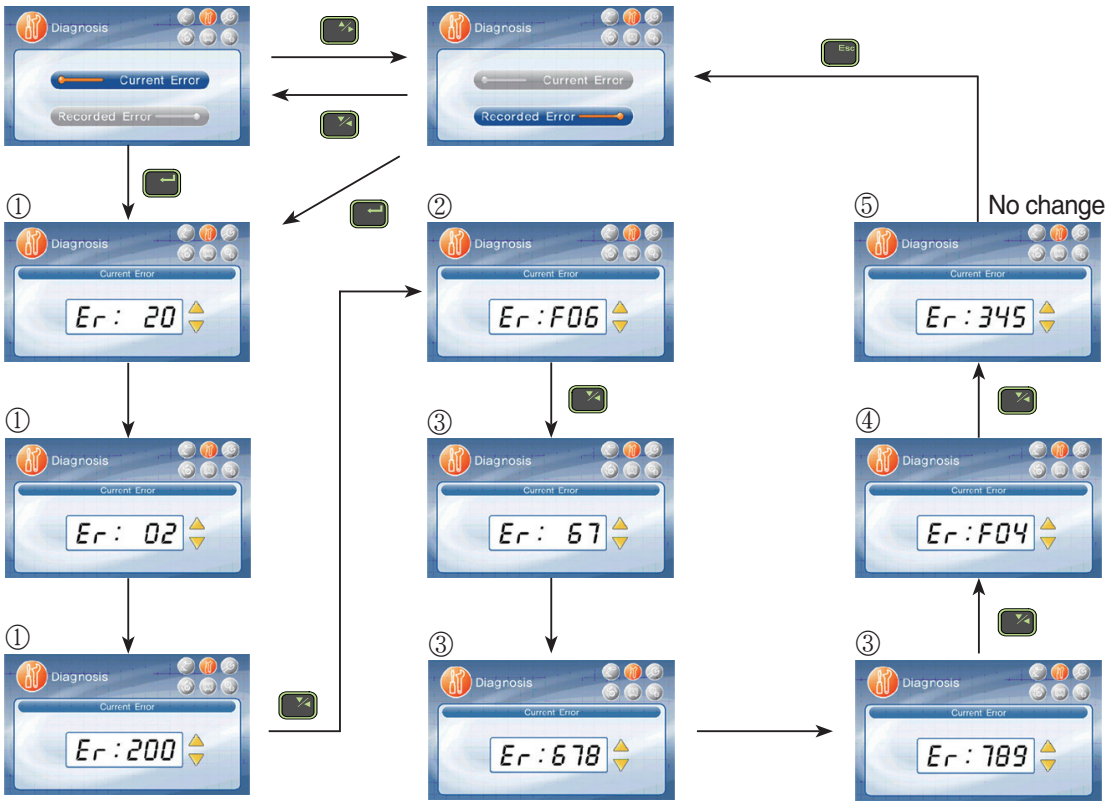
② Diagnosis

a. Protocol type 1

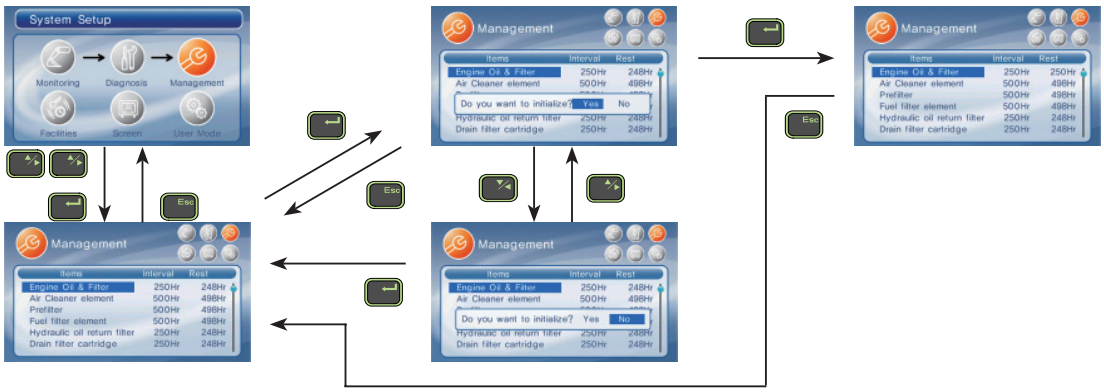


b. Protocol type 2

- If there are more than 2 error codes, each one can be displayed by pressing or switch respectively.
- 3 error codes (①SPN200200, ②FMI06, ③SPN6789, ④FMI04, ⑤345) display.

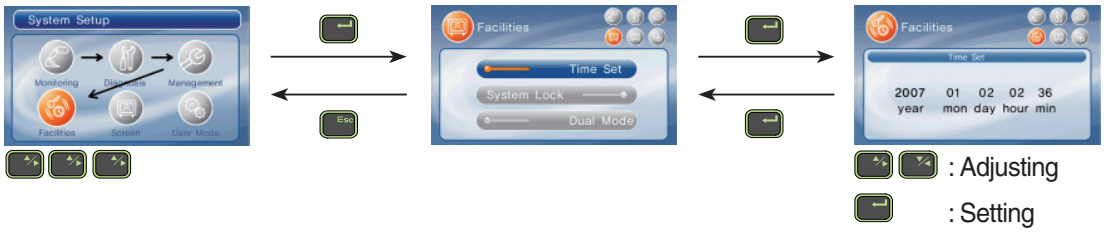


③ Maintenance



④ Setting

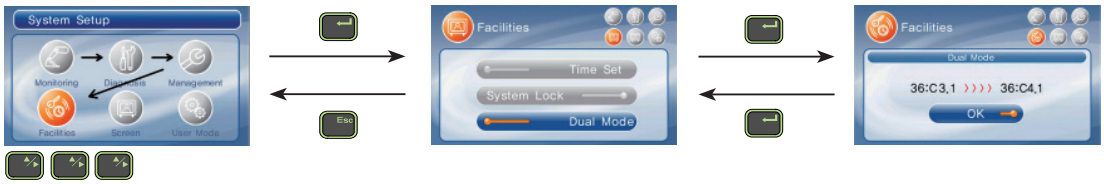
a. Time set



b. System lock - Reserved

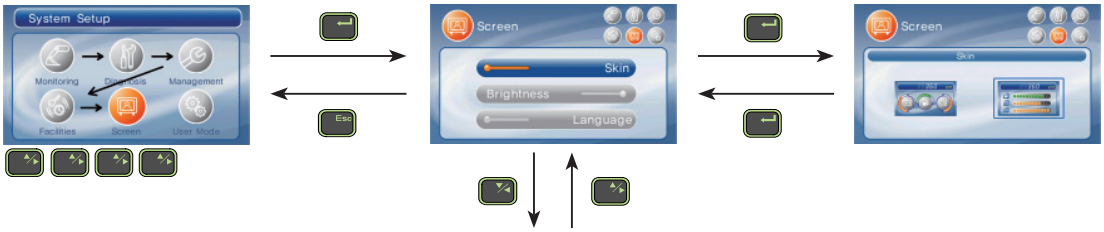
c. Dual mode

- Changing the MCU mode

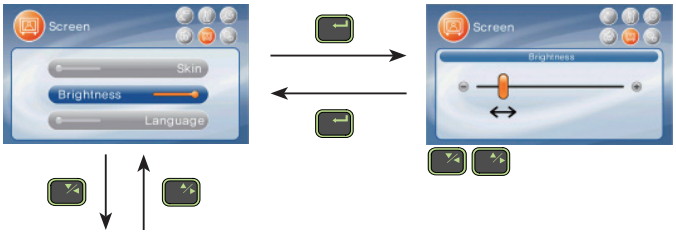


⑤ Display

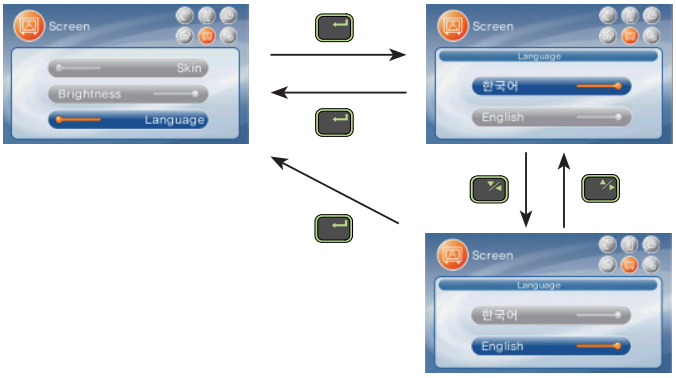
a. Operation skin



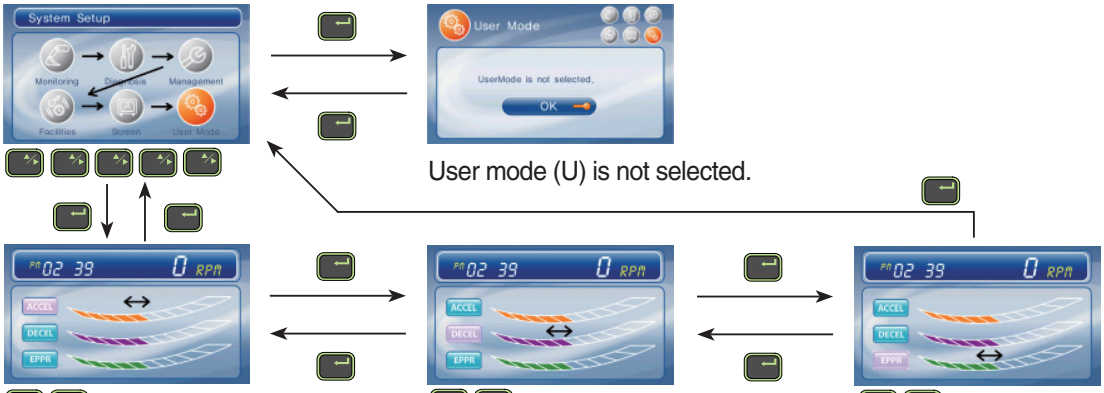
b. Brightness



c. Language

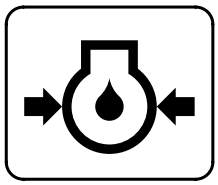


⑥ User mode



5) Warning and pilot lamp

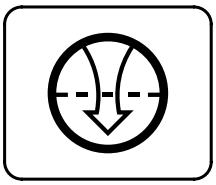
(1) Engine oil pressure warning lamp



21073CD07

① This lamp blinks and the buzzer sounds after starting the engine because of the low oil pressure.
② If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

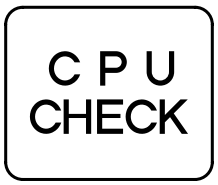
(2) Air cleaner warning lamp



21073CD08

① This lamp blinks and the buzzer sounds when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.

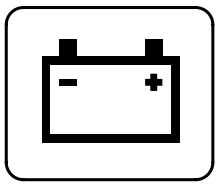
(3) MCU check warning lamp



21073CD10

① If any fault code is received from MCU, this lamp blinks and the buzzer sounds.
② Check the communication line between MCU and cluster.

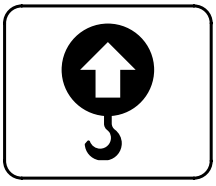
(4) Battery charging warning lamp



21073CD13

① This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
② Check the battery charging circuit when this lamp blinks during engine operation.

(5) Overload warning lamp (opt)



21073CD15

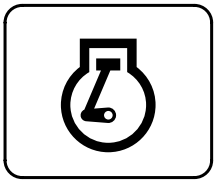
① When the machine is overload, the overload warning lamp blinks during the overload switch is ON.

(6) Power max pilot lamp

21073CD11

① The lamp will be ON when pushing power max switch on the LH RCV lever.

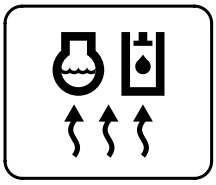
(7) Decel pilot lamp



21073CD17

① Operating auto decel or one touch decel makes the lamp ON.
② The lamp will be ON when pushing one touch decel switch on the LH RCV lever.

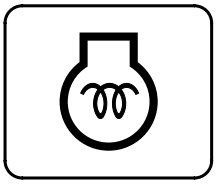
(8) Warming up pilot lamp



21073CD18

① This lamp is turned ON when the coolant temperature is below 30˚C (86˚F).
② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting.

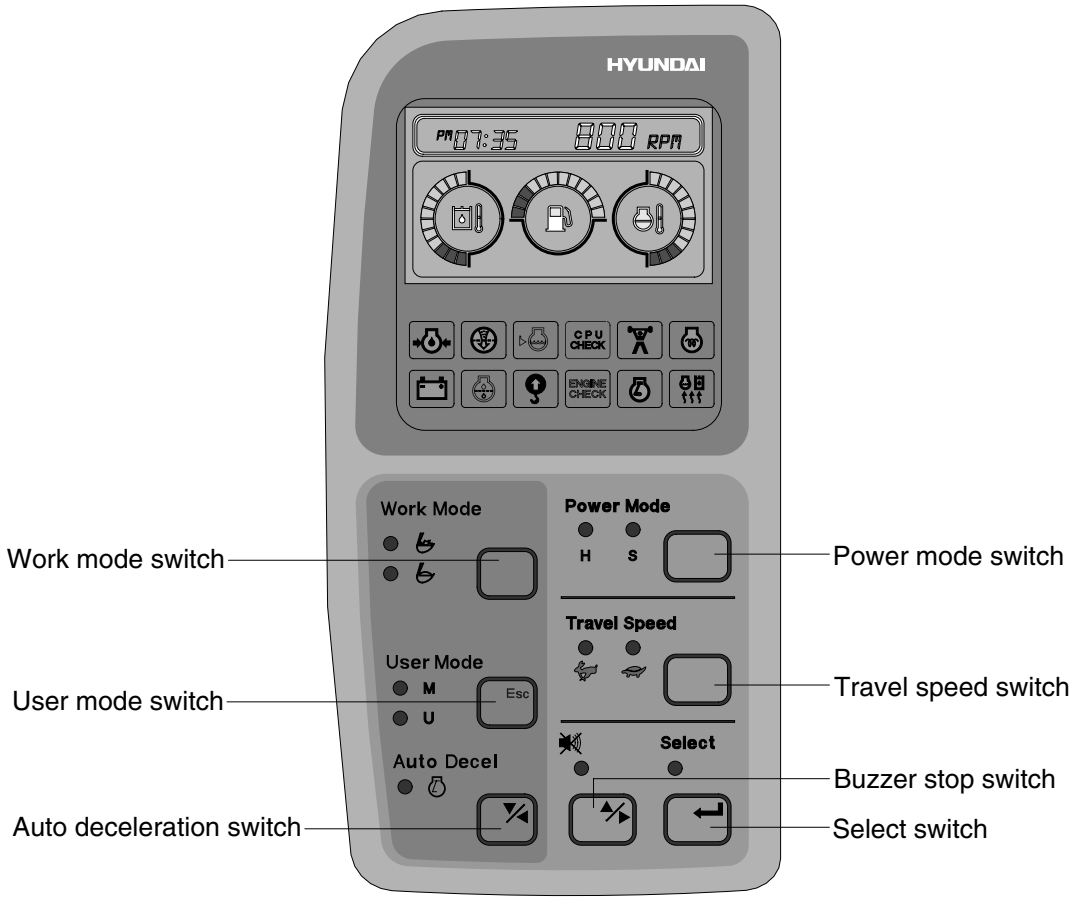
(9) Preheat pilot lamp



21073CD12

① Turning the start key switch ON position starts preheating in cold weather.
② Start the engine as this lamp is OFF.

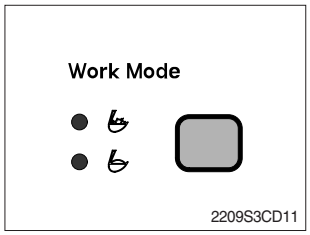
6) SWITCH PANEL



2209S3CD10

※ **When the switches (Work mode, Power mode, Auto decel, Travel speed control) are selected, the pop-up icon is displayed on the LCD.**
Refer to the page 3-25 for details.

(1) Work mode switch

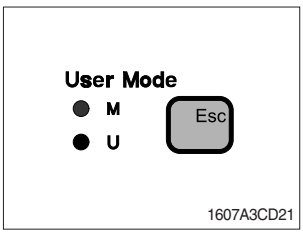


2209S3CD11

① This switch is to select the machine operation mode, which shifts from general operation mode to heavy duty operation mode by pressing the switch.
- : Heavy duty work mode
- : General work mode

※ **Refer to the page 4-15 for details.**

(2) User mode switch

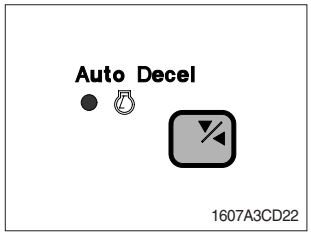


1607A3CD21

① This switch is to select the maximum power or user mode.
- M : Maximum power
- U : Memorizing operators preferable power setting.

※ **Refer to the page 4-15 for details.**

(3) Auto deceleration switch

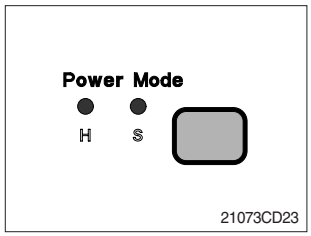


① This switch is used to actuate or cancel the auto deceleration function.

② When the switch actuated and all control levers and pedals are at neutral position, engine speed will be lowered automatically to save fuel consumption.

- Light ON : Auto deceleration function is selected.
- Light OFF : a. Auto deceleration function is cancelled so that the engine speed increased to previous setting value.
  b. One touch decel function is available.

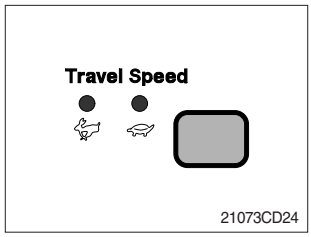
(4) Power mode switch



① The lamp of selected mode is turned ON by pressing the switch ( ).

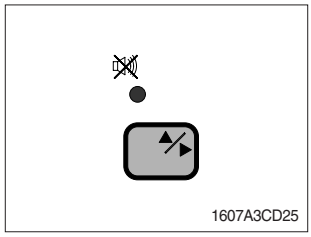
- H : High power work.
- S : Standard power work.

(5) Travel speed control switch



① This switch is to control the travel speed which is changed to high speed (rabbit mark) by pressing the switch and low speed (turtle mark) by pressing it again.

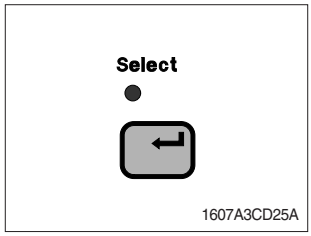
(6) Buzzer stop switch



① When the starting switch is turned ON first, normally the alarm buzzer sounds for 2 seconds during lamp check operation.

② The red lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the red lamp lights until the problem is cleared.

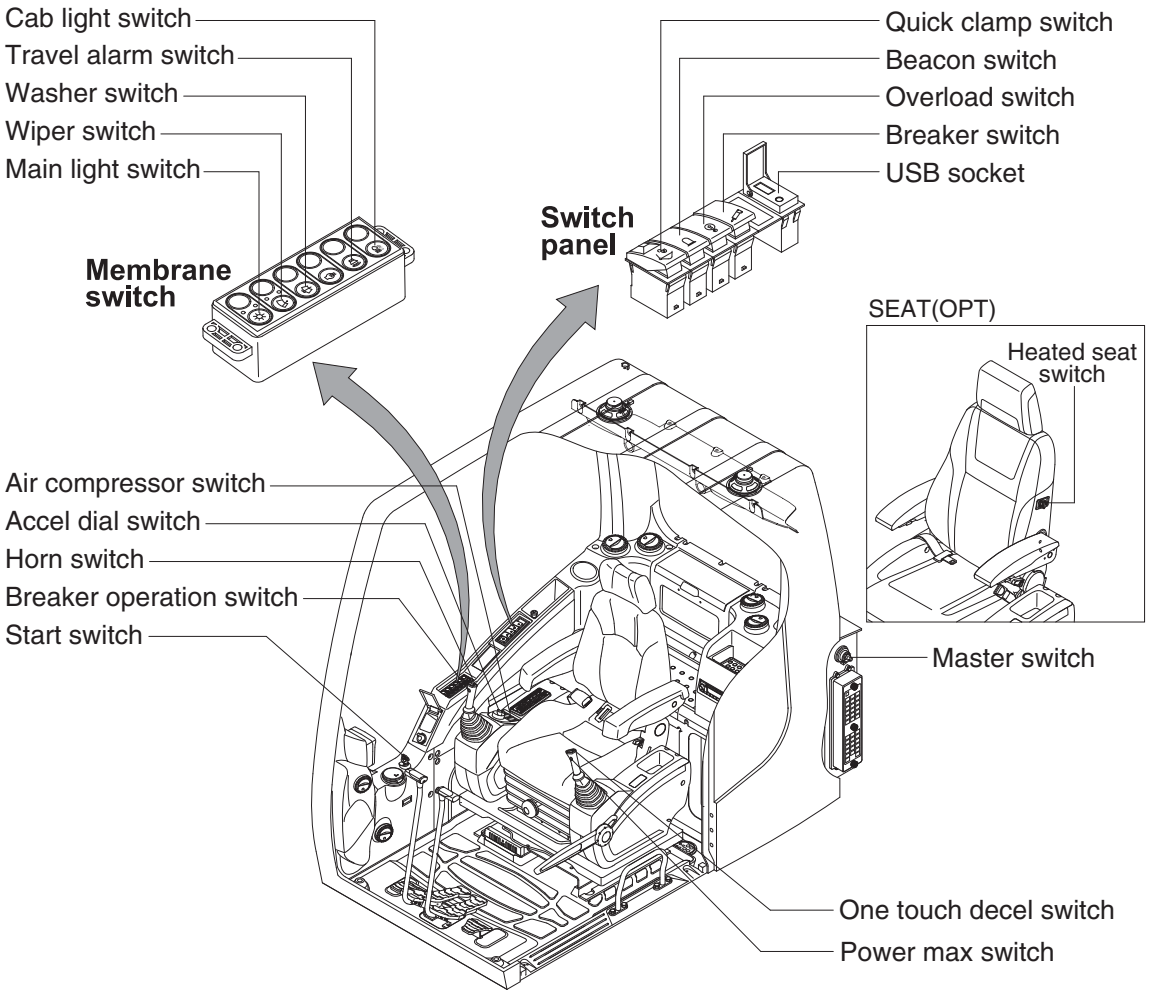
(7) Select switch



① This switch is used to enter main menu and sub menu of LCD.

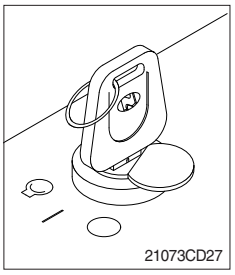
※ **Refer to the page 3-26 for details.**

3. SWITCHES



2209S3CD47

1) STARTING SWITCH

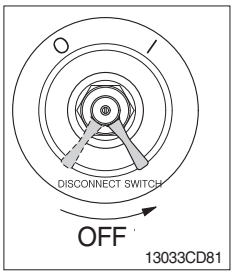


(1) There are three positions, OFF, ON and START.
- ○ (OFF) : None of electrical circuits activate.
- | (ON) : All the systems of machine operate.
- ⏻ (START) : Use when starting the engine.
  Release key immediately after starting.

※ **If you turn ON the starting switch in cold weather, the fuel warmer is automatically operated to heat the fuel by sensing the coolant temperature. Start the engine in 1~2 minutes after turning ON the starting switch. More time may take according to ambient temperature.**

※ **Key must be in the ON position with engine running to maintain electrical and hydraulic function and prevent serious machine damage.**

2) MASTER SWITCH

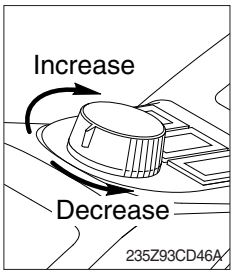


(1) This switch is used to shut off the entire electrical system.

(2) I : The battery remains connected to the electrical system.
O : The battery is disconnected to the electrical system.

※ **Never turn the master switch to O (OFF) with the engine running. Engine and electrical system damage could result.**

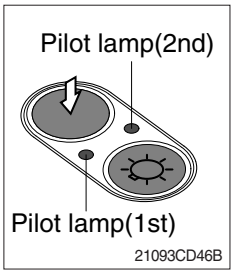
3) ACCEL DIAL SWITCH



(1) There are 10 dial setting.

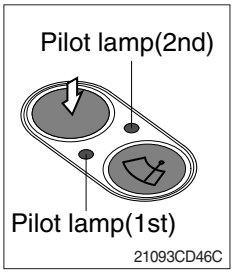
(2) Setting 1 is low idle and setting 10 is high idle.
- By rotating the accel dial to right : Engine speed increases
- By rotating the accel dial to left : Engine speed decreases

4) MAIN LIGHT SWITCH



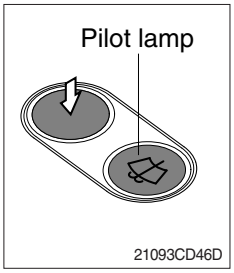
(1) This switch used to operate the head light and work light.
- Press the switch once, the head light comes ON and the 1st pilot lamp ON.
- Press the switch once more, the work light comes ON and the 2nd pilot lamp ON.
- Press the switch again, return to a first step position.
- Press the switch more than one second to turn off lights.

5) WIPER SWITCH



(1) This switch used to operate wiper.
- Press the switch once the wiper operates intermittently and the 1st pilot lamp comes ON.
- Press the switch once more, the wiper operates low speed and the 2nd pilot lamp comes ON.
- Press the switch again return to a first step position.
- Press the switch more than one second to turn off wiper.

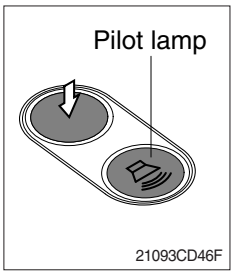
6) WASHER SWITCH



(1) The washer liquid is sprayed and the wiper is operated only while pressing this switch.

(2) The pilot lamp is turned ON when operating this switch.

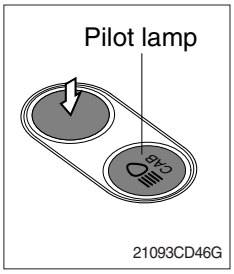
7) TRAVEL ALARM SWITCH



(1) This switch is to activate travel alarm function surrounding when the machine travels to forward and backward.

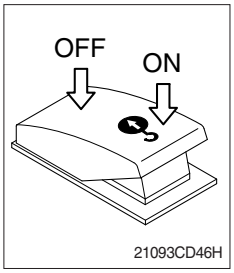
(2) On pressing this switch, the alarm operates only when the machine is traveling.

8) CAB LIGHT SWITCH (option)



(1) This switch turns ON the cab light on the cab.

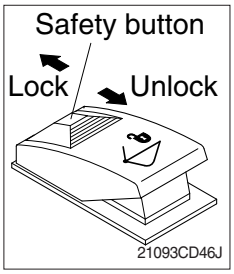
9) OVERLOAD SWITCH (option)



(1) When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.

(2) When it turned OFF, buzzer stops and warning lamp goes out.

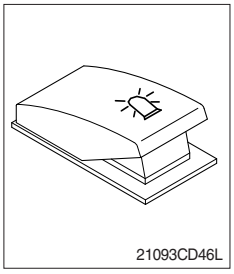
10) QUICK CLAMP SWITCH (option)



(1) This switch is used to engage or disengage the moving hook on quick clamp.

※ **Refer to the page 8-6 for details.**

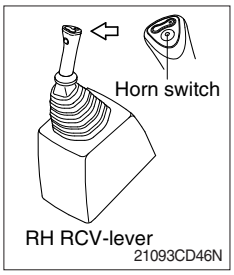
11) BEACON SWITCH (option)



(1) This switch turns ON the rotary light on the cab.

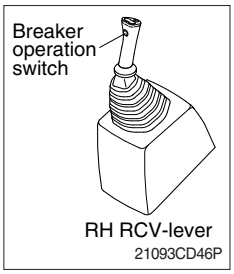
(2) The indicator lamp is turned ON when operating this switch.

12) HORN SWITCH



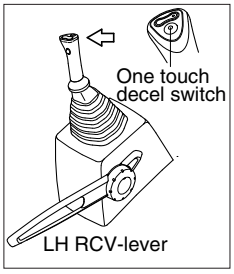
(1) This switch is at the top of right side control lever.
On pressing, the horn sounds.

13) BREAKER OPERATION SWITCH



(1) On pressing this switch, the breaker operates only when the breaker operation mode is selected.

14) ONE TOUCH DECEL SWITCH

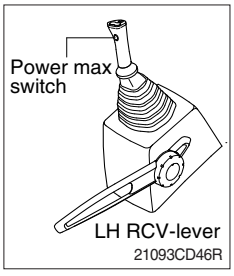


(1) This switch is used to actuate the deceleration function quickly.

(2) The engine speed is increased to previous setting value by pressing the switch again.

(3) One touch decel function is available only when the auto idle pilot lamp is turned OFF.

15) POWER MAX SWITCH

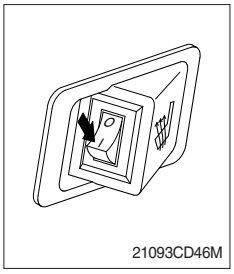


(1) This switch activate power max function.
When this switch is kept pressed, hydraulic power of work equipment will be increased to approx 110 percent during 8 seconds.

(2) After 8 seconds, function is cancelled automatically even the switch keeps pressed.

※ **Do not use for craning purposes.**

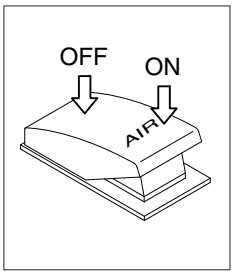
16) HEATED SEAT SWITCH (option)



(1) This switch is used to heat the seat.
- Heater ON : 10±3.5˚C
- Heater OFF : 20±3˚C

(2) On pressing the switch, the indicator lamp is turned ON.

17) AIR COMPRESSOR SWITCH (option)



17W93CD46N

(1) This switch is used to activate the air compressor.

(2) The indicator lamp is turned on when operating this switch

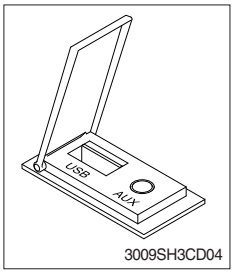
18) BREAKER SELECTION SWITCH (option)


3009SH3CD03

(1) This switch is used to select breaker.

※ **The breaker operates only when this switch is selected.**

19) USB SOCKET

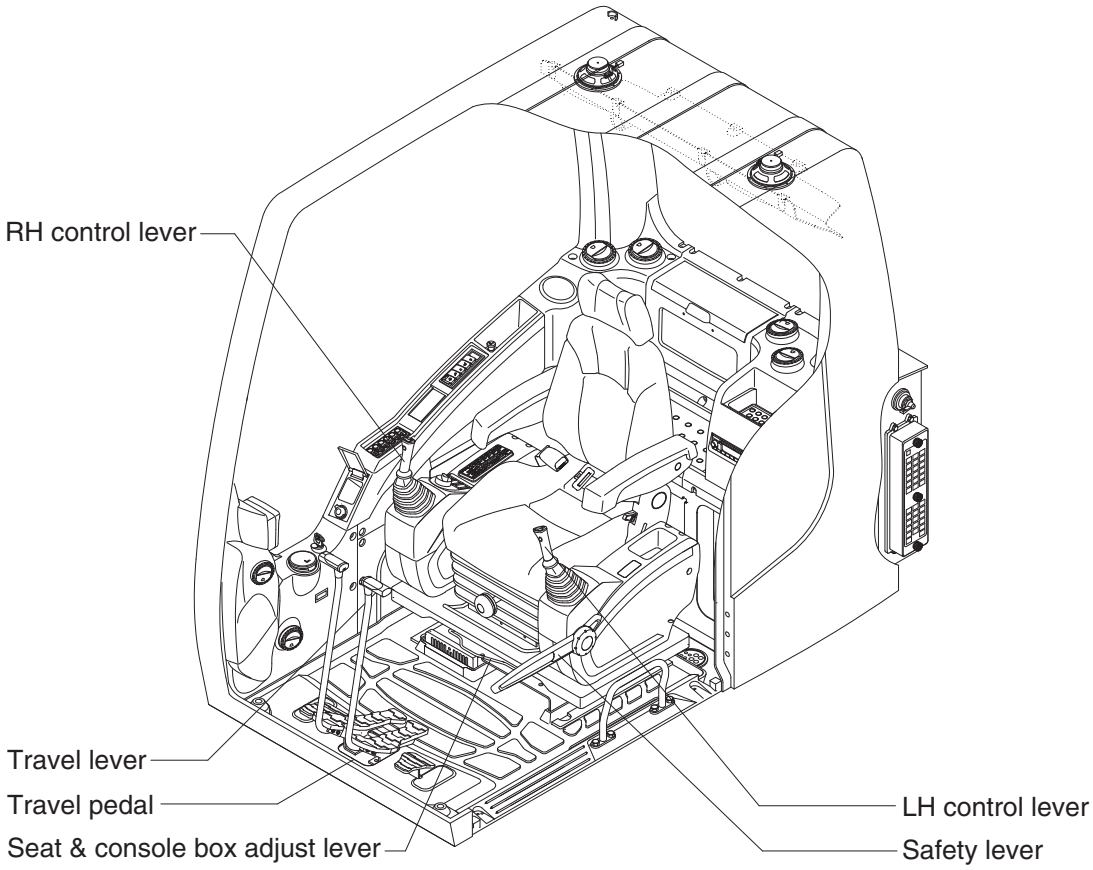


3009SH3CD04

(1) MP3 files are played when a USB device is connected to the USB port.

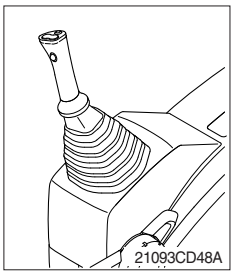
(2) In addition, the AUX port enables headphone and other devices.

4. LEVERS AND PEDALS



2209S3CD48

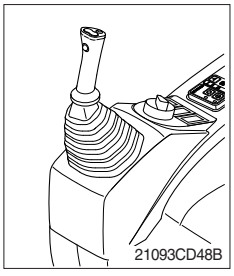
1) LH CONTROL LEVER



(1) This joystick is used to control the swing and the arm.

(2) Refer to operation of working device in chapter 4 for details.

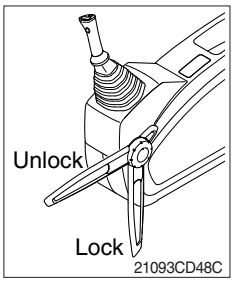
2) RH CONTROL LEVER



(1) This joystick is used to control the boom and the bucket.

(2) Refer to operation of working device in chapter 4 for details.

3) SAFETY LEVER



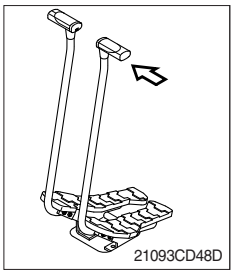
(1) All control levers and pedals are disabled from operation by locating the lever to lock position as shown.

※ **Be sure to lower the lever to LOCK position when leaving from operator's seat.**

(2) By pull lever to UNLOCK position, the machine is operational.

※ **Do not use the safety lever for handle when getting on or off the machine.**

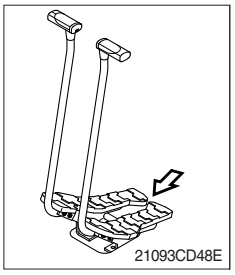
4) TRAVEL LEVER



(1) This lever is mounted on travel pedal and used for traveling by hand. The operation principle is same as the travel pedal.

(2) Refer to traveling of the machine in chapter 4 for details.

5) TRAVEL PEDAL

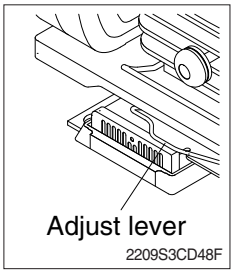


(1) This pedal is used to move the machine forward or backward.

(2) If left side pedal is pressed, left track will move.
If right side pedal is pressed, right track will move.

(3) Refer to traveling of machine in chapter 4 for details.

6) SEAT AND CONSOLE BOX ADJUST LEVER



(1) This lever is used to move the seat and console box to fit the contours of the operator's body.

(2) Pull the lever to adjust forward or backward over 170 mm (6.7").

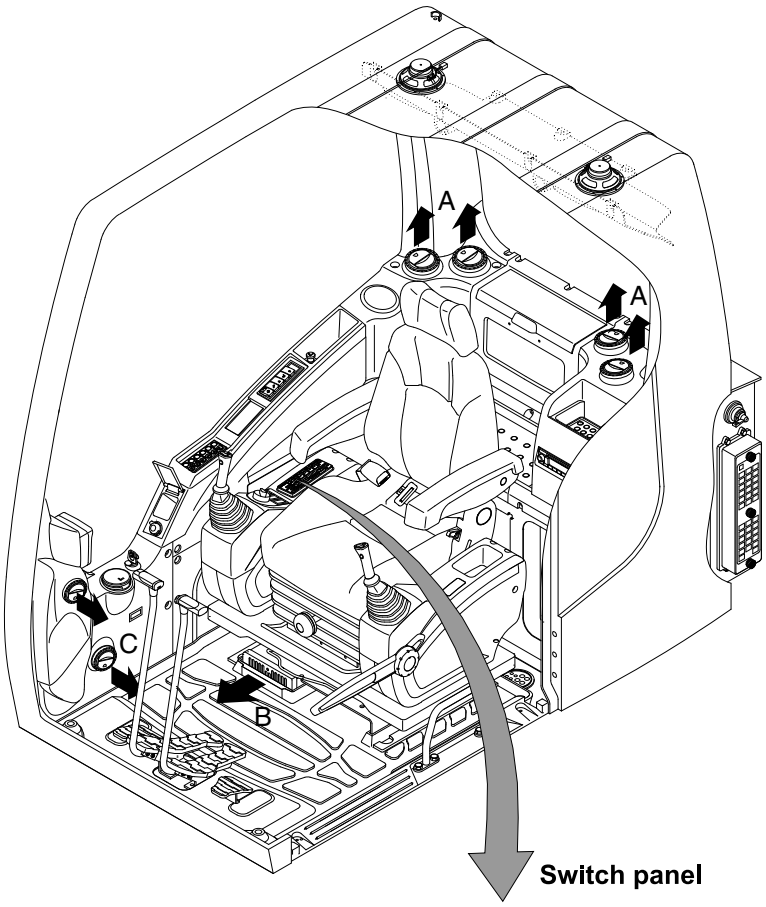
5. AIR CONDITIONER AND HEATER

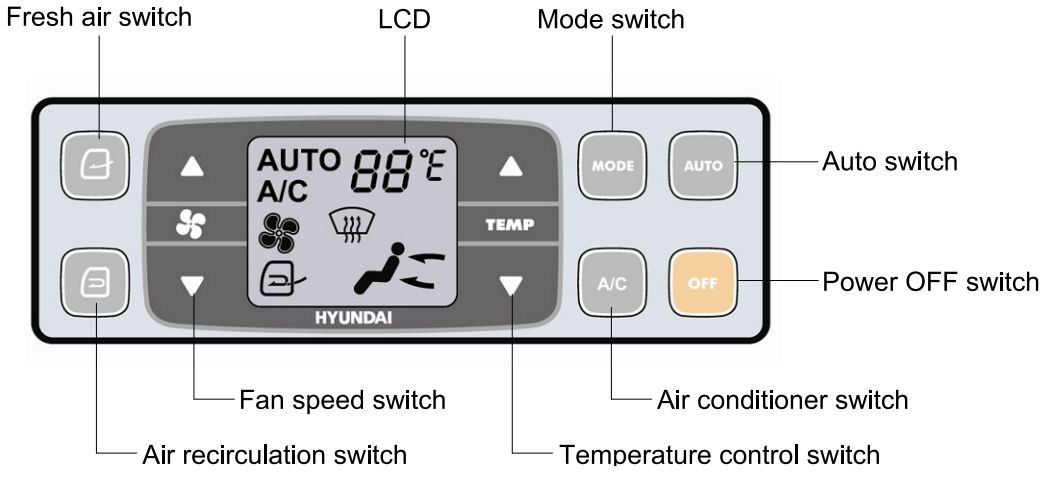
■ **FULL AUTO AIR CONDITIONER AND HEATER** (standard)

Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

※ **Refer to the page 3-45 for semi auto air conditioner and heater.**

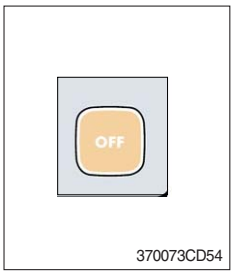
· **Location of air flow ducts**





2209S3CD49

1) POWER OFF SWITCH



(1) This switch makes the system and the LED OFF.
Just before the power OFF, set values are stored.

(2) Default setting values

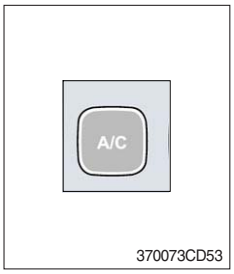
Function	Air conditioner	In/outlet	LCD	Temperature	Mode
Value	OFF	Inlet	OFF	Previous sw OFF	Previous sw OFF

2) AUTO SWITCH

(1) Turn the starting switch to ON position, LCD lights ON.
Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(2) This switch can restart system after system OFF.

3) AIR CONDITIONER SWITCH (compressor switch)

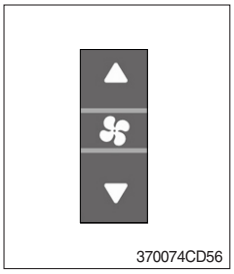


(1) This switch turns the compressor and the LCD ON.

(2) In accordance with the temperature sensed by duct (evaporator) sensor, compressor turns ON or OFF automatically.

※ **Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.**
In this case, exchange the drain cock.

4) FAN SPEED SWITCH

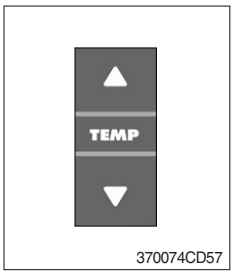


(1) Fan speed is controlled automatically by setted temperature.

(2) This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(3) This switch makes the system ON.

5) TEMPERATURE CONTROL SWITCH



(1) Setting temperature indication (Lo, 18~31˚C, Hi, scale : 1˚C)

(2) Max cool and max warm beeps 5 times.

(3) The max cool or the max warm position operates as following table.

Temperature	Compressor	Fan speed	In/Outlet	Mode
Max cool	ON	Max (Hi)	Recirculation	Vent
Max warm	OFF	Max (Hi)	Fresh	Foot

(4) Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)

① Default status (˚C)

② Push Up/Down temperature control switch simultaneously more than 5 second displayed temperature unit change (˚C → ˚F)

6) MODE SWITCH

(1) Operating this switch, it beeps and displays symbol of each mode in order.

· A type : Vent → Vent/Foot → Foot → Foot/Def → Vent

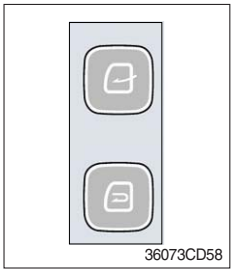
Mode switch		Vent	Vent/Foot	Foot	Foot/Def
Outlet	A	●	●		
	B		●	●	●
	C				●

· B type : Vent → Vent/Foot → Def/Foot → Def/Vent → Def/Vent/Foot

Mode switch		Vent	Vent/Foot	Def/Foot	Def/Vent	Def/Vent/Foot
Outlet	A	●	●		●	●
	B		●	●		●
	C			●	●	●

(2) When defroster mode operating, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

7) FRESH AIR/AIR RECIRCULATION SWITCH



(1) It is possible to change the air-inlet method.

① Fresh air ( )

Inhaling air from the outside.

※ **Check out the fresh air filter periodically to keep a good efficiency.**

② Air recirculation ( )

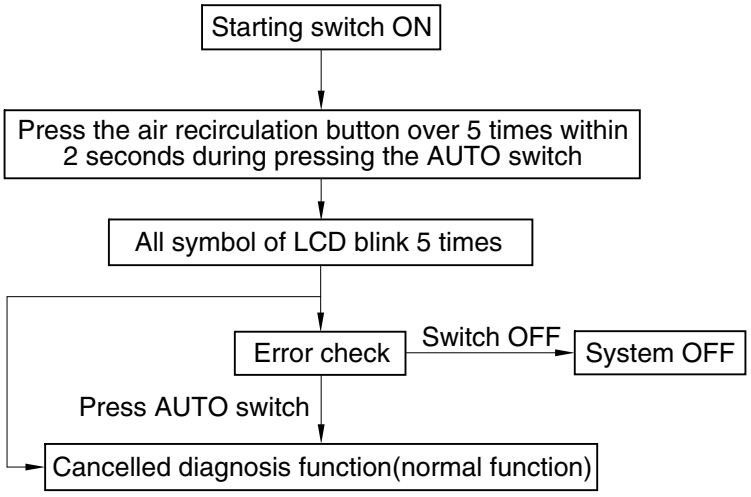
It recycles the heated or cooled air to increase the energy efficiency.

※ **Change air occasionally when using recirculation for a long time.**

※ **Check out the recirculation filter periodically to keep a good efficiency.**

8) SELF DIAGNOSIS FUNCTION

(1) Procedure



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(2) Error check

- The corresponding error code flickers on the setup temperature display panel, the other symbol bol will turn OFF.
- Error code flickers every 0.5 second.
- If error code is more than two, each code flickers 2 times in sequence.
- Error code

Error code	Description	Error code	Description
11	Cabin inside sensor	16	Mode actuator 1
12	Ambient sensor	17	Mode actuator 2
14	Duct (evaporator) sensor	18	Intake actuator
15	Temp actuator	-	-

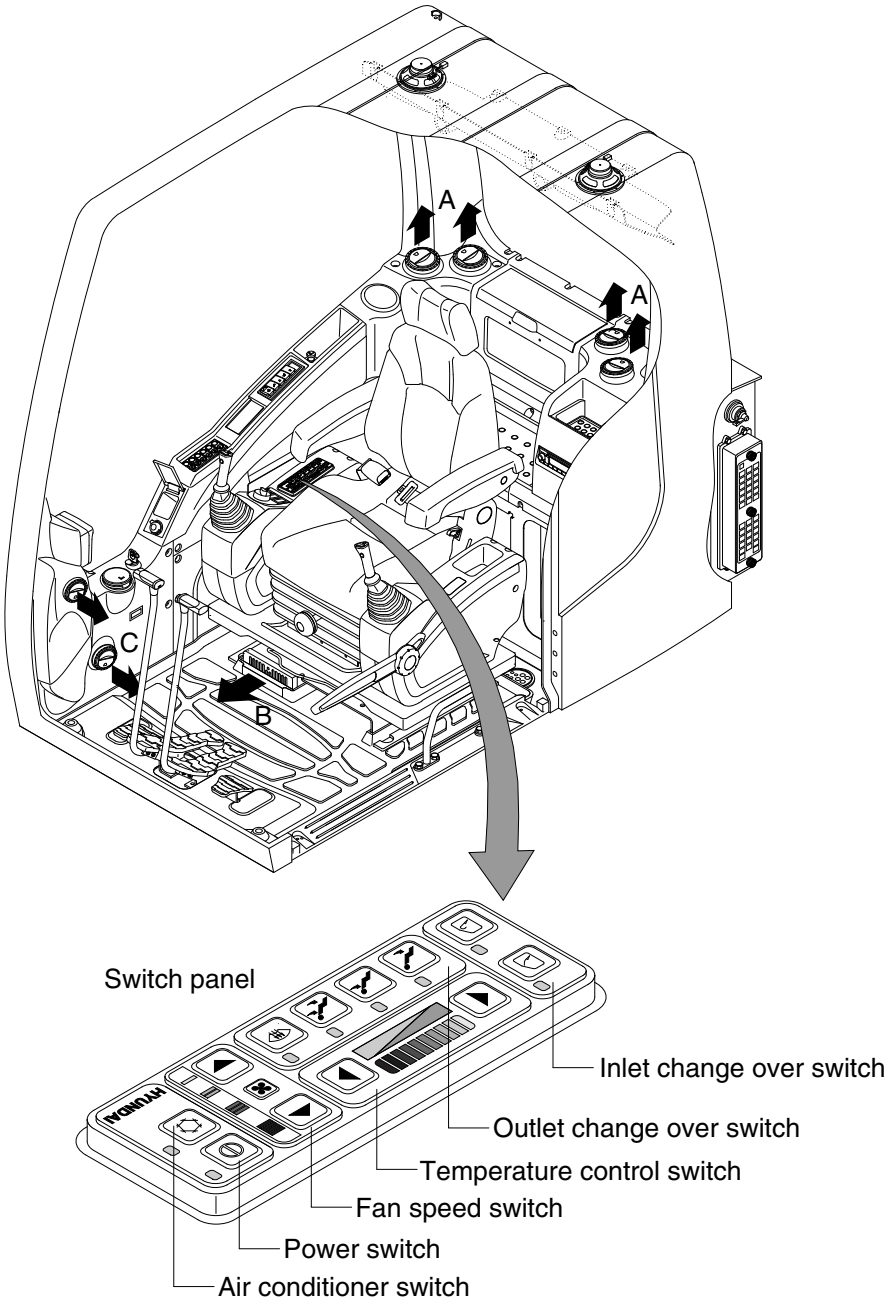
(3) Fail safe function

Error description	Fail safe function
Cabin inside sensor (11)	25˚C alternate value control
Ambient sensor (12)	20˚C alternate value control
Duct (evaporator) sensor (14)	1˚C alternate value control
Temp actuator (15)	If opening amount is 0 %, the alternate value is 0 %
	If not, the alternate value is 100 %
Mode actuator 1, 2 (16, 17)	The alternate value is Vent

■ SEMI AUTO AIR CONDITIONER AND HEATER (option)

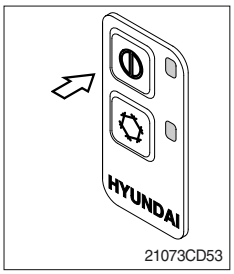
Semi auto air conditioner and heater are equipped for pleasant operation against outside temperature and defrost on window glass.

- **Refer to the page 3-41 for full auto air conditioner and heater.**
- **Location of air flow ducts**



2209S3CD53

1) POWER SWITCH

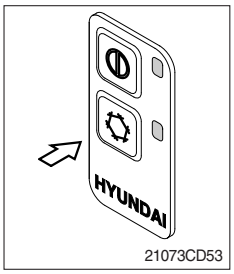


(1) This switch makes the system and the LED simultaneously ON or OFF.

(2) Default setting values

Function	Air conditioner	Fan speed	Temperature	Outlet	Inlet
Value	OFF	1	Max cool	Face	Recirculation

2) AIR CONDITIONER SWITCH (compressor switch)

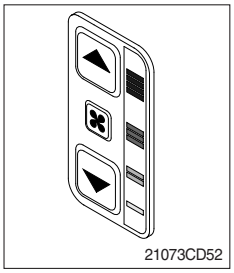


(1) Operating this switch turns the compressor and the LED simultaneously ON or OFF.

(2) In accordance with the evaporator temperature, compressor turns on or off automatically without changing LED state.

※ **Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the vacuum valve of drain hose has a problem.**
In this case, exchange the vacuum valve.

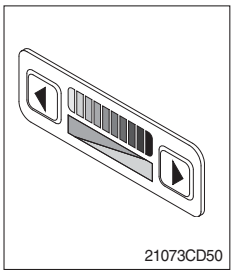
3) FAN SPEED SWITCH



(1) It is possible to control the fan to four steps.

(2) The first step or the fourth step gives 5 times beeps.

4) TEMPERATURE CONTROL SWITCH



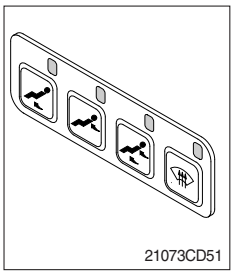
(1) There are 9 steps to control temperature from max cool to max warm controlled up and down by 1 step.

(2) Max cool and max warm arouse 5 times beeps.

(3) For the max warm or the max cool it's better to be configured as following table.

Temperature	Air conditioner	Fan speed	Outlet	Inlet
Max cool	ON	4	Face	Recirculation
Max warm	OFF	3	Foot	Fresh

5) OUTLET CHANGE OVER SWITCH



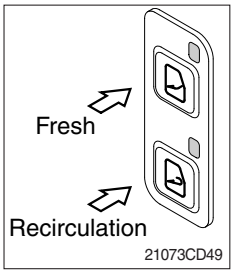
(1) There are four steps of air flow.

Switch position		Mode			
Outlet	A		●	●	
	B	●		●	●
	C				●

(2) When defroster switch operating, INLET switch turns to FRESH mode and air conditioner switch turns ON.

(3) In case of heating range (5~Max warm), air conditioner won't turns ON.

6) INLET CHANGE OVER SWITCH



(1) It is possible to change the air-inlet method.

① **Fresh**

Inhaling air from the outside to pressurize cab inside.

※ **Check out the fresh air filter periodically to keep a good efficiency.**

② **Recirculation**

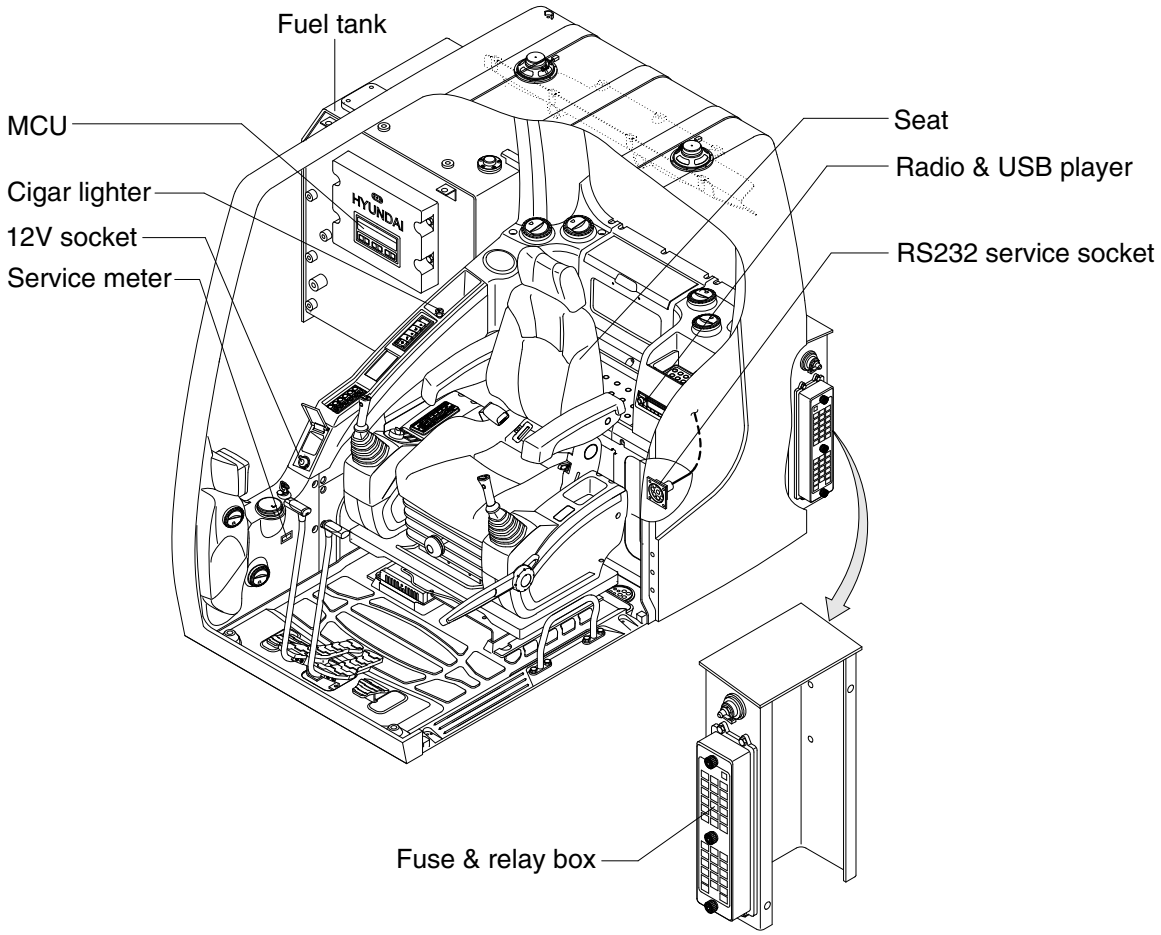
It recycles the heated or cooled air to increase the energy efficiency.

※ **Change air occasionally when using recirculation for a long time.**

※ **Check out the recirculation filter periodically to keep a good efficiency.**

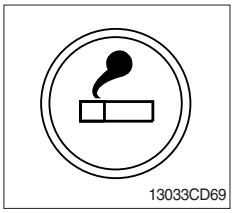
(2) Recirculation function operates when the system is OFF but it can be changed whenever needed.

6. OTHERS



2209S3CD50

1) CIGAR LIGHTER



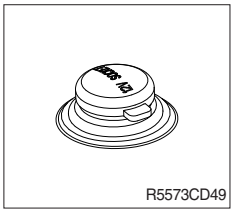
13033CD69

(1) This can be used when the engine starting switch is ON.

(2) The lighter can be used when it springs out in a short while after being pressed down.

※ **Service socket**
Use cigar lighter socket when you need emergency power.
Do not use the lighter exceeding 24V, 100W.

2) 12V SOCKET



R5573CD49

(1) Utilize the power of 12V as your need and do not exceed power of 12 V, 30 W.

3) RADIO AND USB PLAYER : MACHINE SERIAL NO.: -#6965

75793CD62

■ FRONT PANEL PRESENTATION

1 SEL ····· Sound function selection button (audio selection)

2 ····· Power and volume button

3 MODE ····· Mode button (select RADIO / USB / AUX)

4 ····· UP / DOWN tuning button

5 1 ····· Preset memory button 1
DISP ····· ID3 v2 display

6 2 ····· Preset memory button 2
SCN ····· File scan

7 3 ····· Preset memory button 3
RPT ····· Repeat play selector

8 4 ····· Preset memory button 4
RDM ····· Random play selector

9 5 ····· Preset memory button 5
D- ····· Directory down

10 6 ····· Preset memory button 6
D+ ····· Directory up

11 ····· Aux function

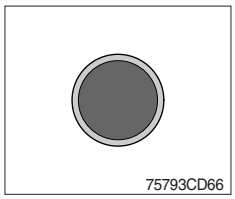
12 BSM ····· Preset scan (PS)
Best station memory (BSM)

13 MUTE ····· Audio mute button

14 AM/FM ····· AM / FM button (radio)

■ GENERAL

(1) Power and volume button



① Power ON/OFF button

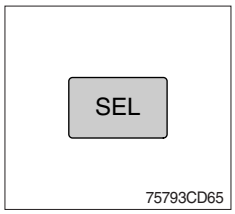
Press power button to turn the unit ON or OFF shortly.

When the power is ON, the previous mode (last memory) will appear.

② Volume up / down control

Turn volume up / down button right to increase the volume level. The level will be shown in VOLUME xx on the LCD display. Turn it left to decrease the volume level. After 5 seconds of volume indication, display will return to the previous mode.

(2) Sound function selection button (audio selection)



① This button is to adjust the sound. Each time you press power button shortly, LCD displays each mode as follows :

BASS → TREBLE → BAL → BEEP → LOUD → VOLUME

※ When this button is pressed, LCD display shows selected function for 5 seconds and then returns back to the previous mode. On selected function, level can be controlled by turning this button. The display will automatically return to normal indication in 5 seconds after the last adjustment is made or when another function is activated.

② Bass control

To adjust the bass level, first select the bass mode by pressing the select button SEL until BASS indication appears on the LCD display. Within 5 seconds of choosing the bass mode, turn power button right / left to adjust the bass level as desired.

The bass level will be shown on the LCD display from a minimum of BASS –10 to a maximum of BASS +10.

The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

③ Treble control

To adjust the treble level, first select the treble mode by pressing the select button SEL until TREBLE indication appears on the LCD display. Within 5 seconds of choosing the treble mode, turn power button right / left to adjust the treble level as desired.

The treble level will be shown on the LCD display from a minimum of TREBLE -10 to a maximum of TREBLE +10.

The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

④ Balance control

To adjust the left-right speaker balance, first select the balance mode by pressing the select button SEL until the BAL indication appears on the LCD display.

Within 5 seconds of choosing the balance mode, turn power button right / left to adjust the balance as desired.

The balance position will be shown on the LCD display from BAL 10L (full left) to BAL 10R (full right).

When the volume level between the left and right speakers is equal, BAL L=R will be shown on the LCD display panel.

The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

⑤ Beep control

To adjust the beep mode, first select the beep mode by pressing the select button SEL until BEEP indication appears on the LCD display.

The beep mode will be shown on the LCD display from BEEP 2ND, BEEP OFF and BEEP ON by turning power button right / left.

The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

Select BEEP ON when you wish to hear the BEEP sound whenever any function button is pressed.

Select BEEP 2ND when you wish to hear the BEEP sound whenever any tuner pre-set button and/or tune seek buttons are pressed for more than 3 seconds.

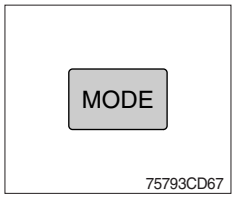
⑥ Loud control

When listening to music at low volume levels, this feature will boost the bass and treble response.

This action will compensate for the reduction in bass and treble performance experienced at low volume.

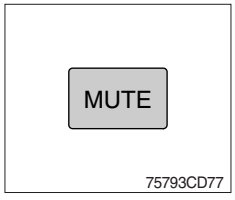
To select the loudness feature, press select button SEL until LOUD ON or LOUD OFF is displayed, then turn power button left or right to activate or deactivate loudness.

(3) Mode button



① Press mode button to select RADIO / USB / AUX.

(4) Audio mute button

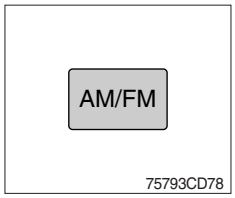


① Press mute button momentarily to mute volume and MUTE mark will blink on the LCD display.

Press the button again to return to the mode in use before the mute mode was activated.

■ RADIO

(1) AM / FM / LW band selector

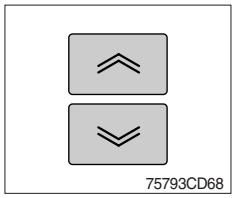


① Each time this button is pressed, the radio button is changed.
Each time this button is pressed, LCD displays each band as follows :

FM1 → FM2 → FM3 → AM → LW

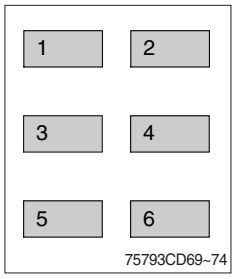
※ LW band is only available for Europe.

(2) Up / down tuning



① To automatically select a radio station, momentarily press the up tune seek button ⩓ or down tune seek button ⩔ for less than 3 seconds to search for the closest radio station.
To manually select a radio station, press the up tuning & down tuning button for longer than 3 seconds.
The radio frequency will move up or down step by step each time you press button.

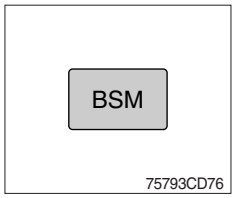
(3) Station pre-set button



① Pressing these buttons shortly will recall your favorite pre-set radio stations.
To store your favorite stations into any of the 6 pre-set memories in each band (AM/FM/LW), use the following procedure :

a. Turn the radio ON and select the desired band.
b. Select the first station to be pre-set using the manual up/ down or automatic seek tuning control button.
c. Press the chosen pre-set button to store your selected station into and continue to hold it in. The beep sound will be momentarily heard and the pre-set number will apear on the LCD display indicating that the station is now set into that pre-set memory position and can be recalled at any time, by pressing that pre-set button.

(4) Pre-set scan (PS) / Best station memory (BSM) button



① **Pre-set scan (PS)**

Press BSM button shortly to scan the 6 pre-set station stored the memories on each band (AM/FM/LW).

The unit will stop at each pre-set station (the pre-set number on the LCD display will flash during pre-set scan operation) and remain on the selected frequency. Press the button momentarily again to remain on the station currently being heard.

② **Best station memory (BSM)**

Pressing BSM button for longer than 2 seconds will activate the BSM tuning feature which will automatically scan and enter each station into memory.

If you have already set the pre-set memories to your favorite stations, activating the BSM tuning feature will erase those stations and enter the new ones.

This BSM feature is most useful when traveling in a new area where you are not familiar with the local stations.

■ USB PLAYER

(1) USB function

There are two ways to play mp3 files in a USB device : using USB socket in the cab and the USB/AUX cable connected to the front side of the player.

· **Use of USB socket**

① Connect a USB device, which saves mp3 files, to USB socket in the cabin.

② If a USB device has not been connected, MP3 files are automatically played when you insert it into the USB port.

③ If a USB device has connected, MP3 files are played when you press mode for USB.

· **Use of USB/AUX cable** (option)

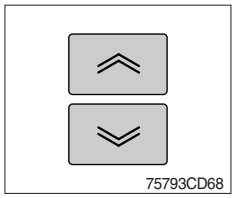
75793CD81

① Connect the USB/AUX cable to the player in order to play MP3 files in a USB device.

② If a USB device has not been connected, MP3 files are automatically played when you insert it into the cable.

③ If a USB device has connected, MP3 files are played when you press mode for USB.

(2) File selection & cue / review button



① File selection function

This button is used to select file up / down. Each time the forward file select ⩓ is pressed, file number is increased.

Each time the backward file select ⩔ is pressed, file number is decreased.

② Cue / review functions

High-speed audible search of file on a USB can be made by this button (the cue and review functions).

Press and hold the cue button ⩓ to advance rapidly in the forward direction or the review button ⩔ to advance rapidly in the backward direction.

(3) MP3 directory / file searching

① The power button is used to select a particular directory and file.

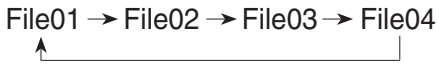
Press and hold for more than 3 seconds while playing MP3 file.

Turn right / left the power button to search the directory. Press the button when you find the wanted directory.

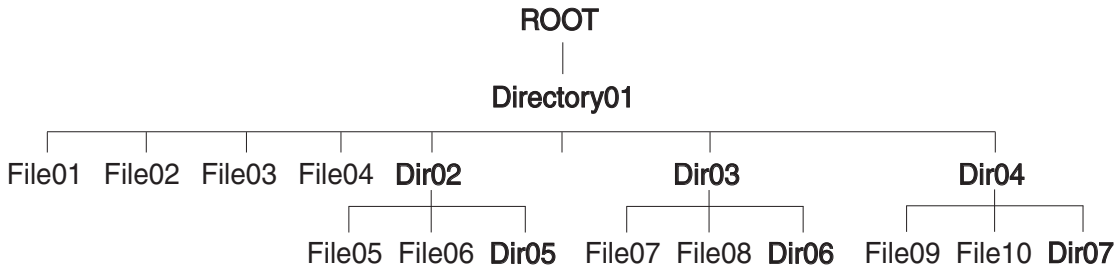
For example, the directory search generally changes in two methods depending on the order of writing as follows.

- Method 1 : ROOT→Dir01→Dir02→Dir03→Dir04→Dir05→Dir06→Dir07
- Method 2 : ROOT→Dir01→Dir02→Dir05→Dir03→Dir06→Dir04→Dir07

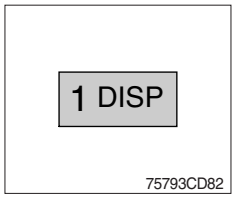
If you want to search the file in the located directory, turn right / left the power button consecutively. Press the button when you find the wanted file. The unit will then play the selected file. For instance, the file search changes in Dir01 as follows.



※ MP3 direction / file configuration

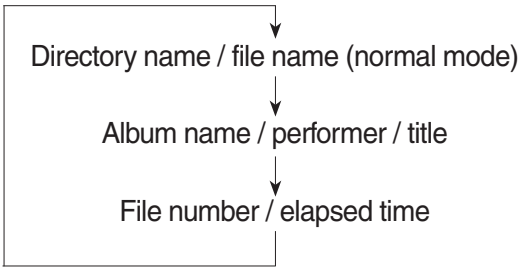


(4) ID3 v2 display

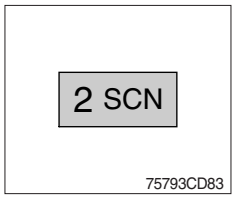


① Disp button is used to change the display information.
While playing an MP3 file, you can change the file information shown on the LCD display.
Each time you press DISP (display), the display changes to show the following.

※ If the MP3 disc does not have any ID3 information, the display will show NO ID3 on LCD display.



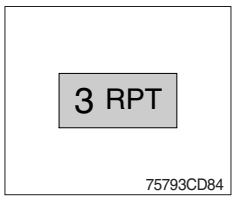
(5) File scan (SCN)



① During USB play, press SCN button to play the first 10 seconds of each file on the whole file on the USB (SCN mark will appear on the LCD display).
When a desired file is reached, press the SCN button again to cancel the function.
The unit will then play the selected file.

※ In case of playing MP3 file, when the SCN (scan) button is pressed and held for longer than 2 seconds, the SCN mark will blink on the LCD display and all files in the selected directory will be introduced until the file scan mode is cancelled by pressing the SCN button again or by activating the random or repeat functions.

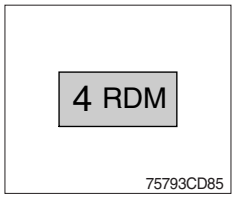
(6) Repeat play selector (RPT)



① During USB play, press RPT button to play the selected file repeatedly (RPT will appear on the LCD display).
Play of the file will continue to repeat until this button is pressed again and the RPT disappears from the LCD display.

※ In case of playing MP3 file, when the RPT button is pressed and held longer than 2 seconds, the RPT mark will blink on the LCD display and play all files in the selected directory and will be repeated until the directory repeat mode is cancelled by pressing the repeat button again or by activating the scan or random functions (RPT mark will disappear from LCD display).

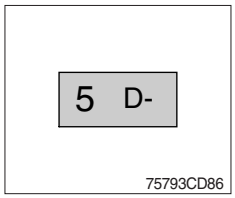
(7) Random play selector (RDM)



① During USB play, press RDM button to play the files on the USB in a random shuffled order (RDM will appear on the LCD display). The file select function will also select file in the random order instead of the normal process.
The random play mode can be cancelled by this button again.

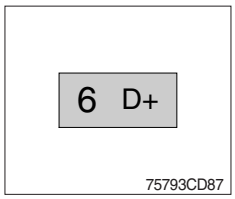
※ In case of MP3 file, when the random button is pressed and held longer than 2 seconds, the RDM mark will blink on the LCD display and play all files in directory randomly until the directory random mode is cancelled by pressing the random button again or by activating the scan or repeat functions (RDM mark will disappear from LCD display).

(8) Directory down



① Press D- button briefly while playing MP3. The previous directory is located each time you press this button.

(9) Directory up



① Press D+ button briefly while playing MP3 . The next directory is located each time you press this button.

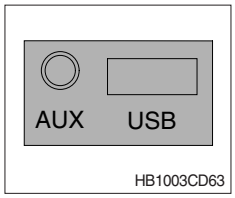
※ If the MP3 file does not have a directory, the unit play MP3 at 10-file intervals.

※ If any MP3 file does not exist in USB, this button can not operate.

■ AUX PLAYER

(1) Aux function

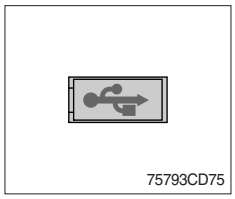
· **Use of USB socket**



① If you want to listen to music of a external audio device, connect a external audio device into the USB port.

② Press mode button to change a current mode for AUX. If audio file of audio device is playing, you can listen to music through speaker.

· **Use of USB/AUX cable** (option)



① If you want to listen to music of a external audio device, connect a external audio device through USB/AUX cable.

② Press mode button to change a current mode for AUX. If audio file of audio device is playing, you can listen to music through speaker.

RADIO AND USB PLAYER : MACHINE SERIAL NO.: #6966-B949

75793CD62-2

■ FRONT PANEL PRESENTATION

1 SEL ····· Audio selection button

····· Audio selection knob

2 ····· Power and volume button

3 MODE ····· Mode button
(select RADIO / USB / AUX)

4 ····· UP / DOWN tuning button

5 1 ····· Preset memory button 1
DISP ····· ID3 v2 display

6 2 ····· Preset memory button 2
SCN ····· File scan

7 3 ····· Preset memory button 3
RPT ····· Repeat play selector

8 4 ····· Preset memory button 4
RDM ····· Random play selector

9 5 ····· Preset memory button 5
D- ····· Directory down

10 6 ····· Preset memory button 6
D+ ····· Directory up

11 ····· Aux function

12 BSM ····· Preset scan (PS)
Best station memory (BSM)

13 MUTE ····· Audio mute button

14 AM/FM ····· AM / FM button (radio)

15 ····· Send

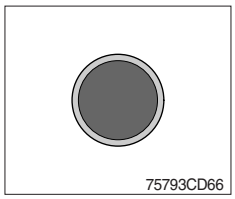
16 ····· End

17 MIC ····· MIC (microphone)

18 AUX ····· Aux connector

■ GENERAL

(1) Power and volume button



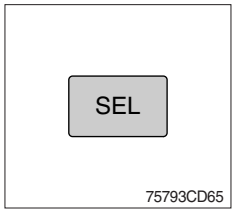
① **Power ON/OFF button**

Press power button to turn the unit ON or OFF shortly.
When the power is ON, the previous mode (last memory) will appear.

② **Volume up / down control**

Turn volume up / down button right to increase the volume level. The level will be shown in VOLUME xx on the LCD display. Turn it left to decrease the volume level. After 5 seconds of volume indication, display will return to the previous mode.

(2) Sound function selection button (audio selection)



① This button is to adjust the sound. Each time you press SEL button shortly, LCD displays each mode as follows :

BASS → TREBLE → BAL → LOUD → EQ

※ When this button is pressed, LCD display shows selected function for 5 seconds and then returns back to the previous mode. On selected function, level can be controlled by turning this button. The display will automatically return to normal indication in 5 seconds after the last adjustment is made or when another function is activated.

② **Bass control**

To adjust the bass level, first select the bass mode by pressing the SEL button until BASS indication appears on the LCD display. Within 5 seconds of choosing the bass mode, turn button selection knob right / left to adjust the bass level as desired.
The bass level will be shown on the LCD display from a minimum of BASS –10 to a maximum of BASS +10.
The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

③ **Treble control**

To adjust the treble level, first select the treble mode by pressing the SEL button until TREBLE indication appears on the LCD display. Within 5 seconds of choosing the treble mode, turn button selection knob right / left to adjust the treble level as desired.
The treble level will be shown on the LCD display from a minimum of TREBLE -10 to a maximum of TREBLE +10.
The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

④ Balance control

To adjust the left-right speaker balance, first select the balance mode by pressing the SEL button until the BAL indication appears on the LCD display.

Within 5 seconds of choosing the balance mode, turn button selection knob right / left to adjust the balance as desired.

The balance position will be shown on the LCD display from BAL 10L (full left) to BAL 10R (full right).

When the volume level between the left and right speakers is equal, BAL L=R will be shown on the LCD display panel.

The display will automatically return to the normal indication in 5 seconds after the last adjustment or when another function is activated.

⑤ Loud control

When listening to music at low volume levels, this feature will boost the bass and treble response.

This action will compensate for the reduction in bass and treble performance experienced at low volume.

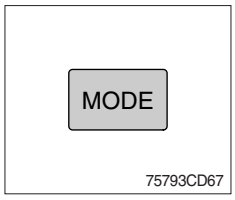
To select the loudness feature, press SEL button until LOUD ON or LOUD OFF is displayed, then turn power button (type A) or selection knob (type B) left or right to activate or deactivate loudness.

⑥ Equalizer (EQ)

You can select an equalizer curve designed for 4 music types (POP, ROCK, CLASSIC, JAZZ).

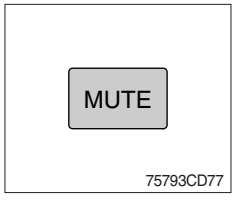
To select the desired curve, first select the EQ mode by pressing SEL button until the "EQ OFF" indication appears on the display panel. Within 5 seconds of choosing the EQ mode, turn power and volume button (type A) or selection knob (type B) to select an equalizer curve as desired.

(3) Mode button



① Press mode button to select RADIO / USB / AUX / BT audio.

(4) Audio mute button

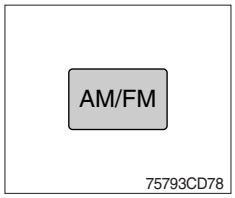


① Press mute button momentarily to mute volume and MUTE mark will blink on the LCD display.

Press the button again to return to the mode in use before the mute mode was activated.

■ RADIO

(1) AM / FM / LW band selector

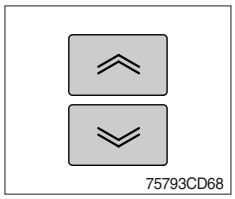


① Each time this button is pressed, the radio button is changed.
Each time this button is pressed, LCD displays each band as follows :

FM1 → FM2 → FM3 → AM → LW

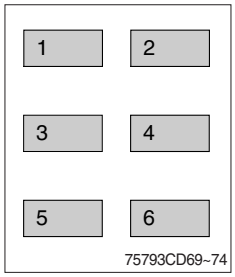
※ LW band is only available for Europe.

(2) Up / down tuning



① To automatically select a radio station, momentarily press the up tune seek button ⩓ or down tune seek button ⩔ for less than 3 seconds to search for the closest radio station.
To manually select a radio station, press the up tuning & down tuning button for longer than 3 seconds.
The radio frequency will move up or down step by step each time you press button.

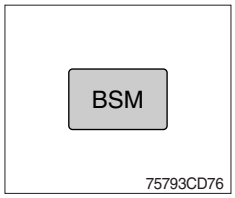
(3) Station pre-set button



① Pressing these buttons shortly will recall your favorite pre-set radio stations.
To store your favorite stations into any of the 6 pre-set memories in each band (AM/FM/LW), use the following procedure :

a. Turn the radio ON and select the desired band.
b. Select the first station to be pre-set using the manual up/down or automatic seek tuning control button.
c. Press the chosen pre-set button to store your selected station into and continue to hold it in. The beep sound will be momentarily heard and the pre-set number will apear on the LCD display indicating that the station is now set into that pre-set memory position and can be recalled at any time, by pressing that pre-set button.

(4) Pre-set scan (PS) / Best station memory (BSM) button



① **Pre-set scan (PS)**

Press BSM button shortly to scan the 6 pre-set station stored the memories on each band (AM/FM/LW).

The unit will stop at each pre-set station (the pre-set number on the LCD display will flash during pre-set scan operation) and remain on the selected frequency. Press the button momentarily again to remain on the station currently being heard.

② **Best station memory (BSM)**

Pressing BSM button for longer than 2 seconds will activate the BSM tuning feature which will automatically scan and enter each station into memory.

If you have already set the pre-set memories to your favorite stations, activating the BSM tuning feature will erase those stations and enter the new ones.

This BSM feature is most useful when traveling in a new area where you are not familiar with the local stations.

■ USB PLAYER

75793CD81-1

(1) USB function

① Connect a USB device if you want to listen to MP3 file in a USB device.

② It will automatically play MP3 file in the USB device and the LCD display will show “READING USB”.

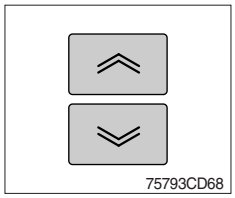
※ If there are no files on USB device, playback will revert back to the previous mode after displaying “NO FILE”.

(2) AUX function

① If you want to listen to music of a external audio device, connect a external audio device through AUX cable.

② Change AUX mode by pressing MODE button.
If audio file of Audio device is playing, you can listen to music through speaker.

(3) File selection & cue / review button



① **File selection function**

This button is used to select file up / down.

Each time the forward file select ⩓ is pressed, file number is increased.

Each time the backward file select ⩔ is pressed, file number is decreased.

② **Cue / review functions**

High-speed audible search of file on a USB can be made by this button (the cue and review functions).

Press and hold the cue button ⩓ to advance rapidly in the forward direction or the review button ⩔ to advance rapidly in the backward direction.

(4) MP3 directory / file searching

① The D-, D+ button is used to select a particular directory and file.

Press and hold for more than 3 seconds while playing MP3 file.

Turn right / left the power button (type A) or selection knob (type B) to search the directory. Press the button when you find the wanted directory.

For example, the directory search generally changes in two methods depending on the order of writing as follows.

· Method 1 : ROOT → Dir01 → Dir02 → Dir03 → Dir04 → Dir05 → Dir06 → Dir07

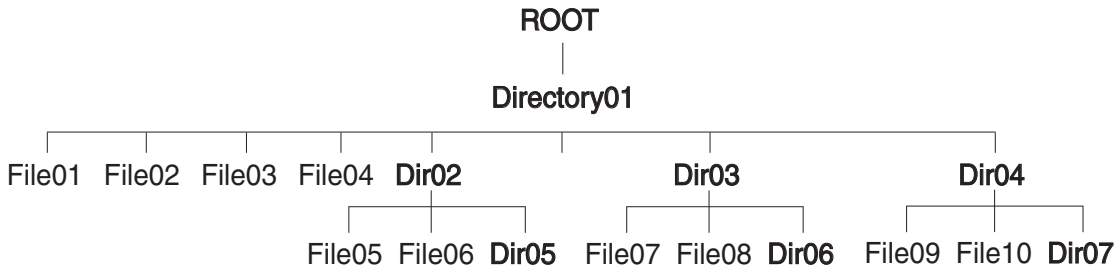
· Method 2 : ROOT → Dir01 → Dir02 → Dir05 → Dir03 → Dir06 → Dir04 → Dir07

If you want to search the file in the located directory, turn right / left the power button (type A) or selection knob (type B) consecutively. Press the button when you find the wanted file. The unit will then play the selected file.

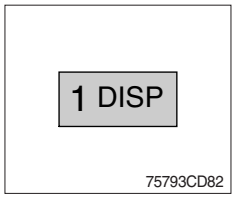
For instance, the file search changes in Dir01 as follows.

File01 → File02 → File03 → File04

※ MP3 directory / file configuration

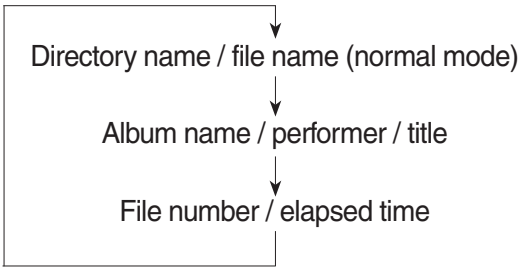


(5) ID3 v2 display

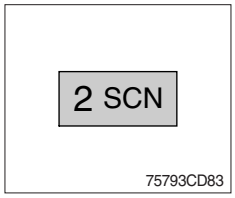


① Disp button is used to change the display information.
While playing an MP3 file, you can change the file information shown on the LCD display.
Each time you press DISP (display), the display changes to show the following.

※ If the MP3 disc does not have any ID3 information, the display will show NO ID3 on LCD display.



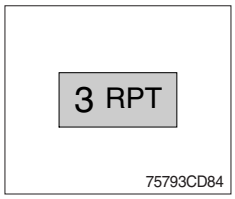
(6) File scan (SCN)



① During USB play, press SCN button to play the first 10 seconds of each file on the whole file on the USB (SCN mark will appear on the LCD display).
When a desired file is reached, press the SCN button again to cancel the function.
The unit will then play the selected file.

※ In case of playing MP3 file, when the SCN (scan) button is pressed and held for longer than 2 seconds, the SCN mark will blink on the LCD display and all files in the selected directory will be introduced until the file scan mode is cancelled by pressing the SCN button again or by activating the random or repeat functions.

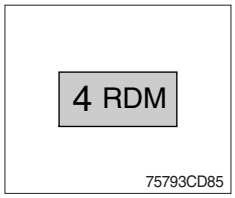
(7) Repeat play selector (RPT)



① During USB play, press RPT button to play the selected file repeatedly (RPT will appear on the LCD display).
Play of the file will continue to repeat until this button is pressed again and the RPT disappears from the LCD display.

※ In case of playing MP3 file, when the RPT button is pressed and held longer than 2 seconds, the RPT mark will blink on the LCD display and play all files in the selected directory and will be repeated until the directory repeat mode is cancelled by pressing the repeat button again or by activating the scan or random functions (RPT mark will disappear from LCD display).

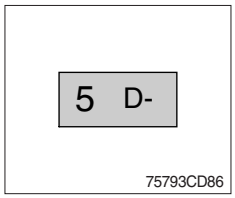
(8) Random play selector (RDM)



① During USB play, press RDM button to play the files on the USB in a random shuffled order (RDM will appear on the LCD display). The file select function will also select file in the random order instead of the normal process.
The random play mode can be cancelled by this button again.

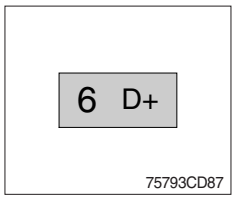
※ In case of MP3 file, when the random button is pressed and held longer than 2 seconds, the RDM mark will blink on the LCD display and play all files in directory randomly until the directory random mode is cancelled by pressing the random button again or by activating the scan or repeat functions (RDM mark will disappear from LCD display).

(9) Directory down



① Press D- button briefly while playing MP3. The previous directory is located each time you press this button.

(10) Directory up



① Press D+ button briefly while playing MP3 . The next directory is located each time you press this button.

※ If the MP3 file does not have a directory, the unit play MP3 at 10-file intervals.

※ If any MP3 file does not exist in USB, this button can not operate.

RADIO AND USB PLAYER (WITH BLUETOOTH) : MACHINE SERIAL NO.: #B950-

9403CD100

■ FRONT PANEL PRESENTATION

1 ····· Power ON/OFF, Volume UP/DOWN button

2 ····· Manual UP/DOWN Tuning, File search, SEL button

3 ····· Mode button, Audio mute button

4 ····· Call & Pair button

5 ····· Call end button

6 ····· Station preset 1
DIS ····· Display button

7 ····· Station preset 2

8 ····· Station preset 3
RPT ····· Repeat play button

9 ····· Station preset 4
RDM ····· Random play button

10 ····· Station preset 5
DIR- ····· Directory down button

11 ····· Station preset 6
DIR+ ····· Directory up button

12 ····· Scan play button (SCAN)
Best station memory (BSM) button

13 ····· Auto tune up, Seek up button

14 ····· Auto tune down, Track down button

15 ····· USB connector

16 ····· AUX IN Jack

17 ····· MIC hole

RADIO AND USB PLAYER (WITHOUT BLUETOOTH) : MACHINE SERIAL NO.: #B950-

9403CD101

■ FRONT PANEL PRESENTATION

1 ····· Power ON/OFF, Volume UP/DOWN button

2 ····· Manual UP/DOWN Tuning, File search, SEL button

3 ····· Mode button, Audio mute button

4 ····· Radio seek up button

5 ····· Radio seek down button

6 ····· Station preset 1
DIS ····· Display button

7 ····· Station preset 2

8 ····· Station preset 3
RPT ····· Repeat play button

9 ····· Station preset 4
RDM ····· Random play button

10 ····· Station preset 5
DIR- ····· Directory down button

11 ····· Station preset 6
DIR+ ····· Directory up button

12 ····· Scan play button (SCAN)
Best station memory (BSM) button

13 ····· Track up button

14 ····· Track down button

15 ····· USB connector

16 ····· AUX IN Jack

■ GENERAL

(1) Power and volume button

① Power ON / OFF button

Press power button (1) to turn the unit on or off.

② Volume UP/DOWN control knob

Turn VOL knob (1) right to increase the volume level.
Turn VOL knob (1) left to decrease the volume.
After 5 seconds the display will return to the previous display mode.

③ Initial volume level set up

I-VOL is the volume level the unit will play at when next turned on. To adjust the I-VOL level, press and hold VOL button (1) for longer than 2 seconds. The current volume level displays on the display panel.
Then turn button (1) right or left to set the volume level as the I-VOL level.

④ Clock ON/OFF control

The CLOCK was default at off status. To turn CLOCK ON, press and hold VOL button (1) for longer than 2 seconds to display I-VOL, then short press VOL again, turn VOL knob while CLOCK OFF display, then the CLOCK ON will be displayed.

※ **Due to time tolerance, the clock display on the Audio unit might have little difference.**

⑤ Clock adjustment

With CLOCK ON selected, press VOL knob again after CLOCK ON display, the hour will blink, turn VOL knob right or left to adjust hour.
Simply press VOL again, the minute will blink, turn VOL knob to adjust minute. Then press VOL again to confirm the clock once finished.

(2) Menu Selection

① This button can adjust the sound effect and other things.
Each time you press this button (2), LCD displays as follows :

BAS → TREB → BAL L=R → FAD F=R → EQ → LOUD ON → BEEP 2ND

On each setting, the level can be controlled by turning TUNE knob (2). When the last adjustment is made, after 5 seconds, the display will automatically return to the previous display mode.

② Bass control

To adjust the bass tone level, first select the bass mode by pressing SEL button (2) repeatedly until BASS appears on the display panel. Then turn knob (2) right or left within 5 seconds to adjust the bass level as desired. The bass level will be shown on the display panel from a minimum of BASS-7 to a maximum of BASS+7.

③ Treble control

To adjust the treble tone level, first select the treble mode by pressing SEL button (2) repeatedly until TREB appears on the display panel. Then turn knob (2) right or left within 5 seconds to adjust the treble level as desired. The treble level will be shown on the display panel from a minimum of TREB -7 to a maximum of TREB +7.

④ Balance control

To adjust the left-right speaker balance, first select the balance mode by pressing SEL button (2) repeatedly until BAL indication appears on the display panel. Then turn knob (2) right or left within 5 seconds to adjust the balance as desired. The balance position will be shown by the bars on the display panel from BAL 10R (full right) to BAL 10L (full left).

⑤ Fader control

To adjust the front-rear speaker balance, first select the fader mode by pressing SEL button (2) repeatedly until FADER indication appears on the display panel. Then turn knob (2) right or left within 5 seconds to adjust the front-rear speaker level as desired. The fader position will be shown by the bars on the display panel from FAD 10F (full front) to FAD 10R (full rear).

⑥ EQ control

You can select an equalizer curve for 4 music types (CLASSIC, POP, ROCK, JAZZ). Press button (2) until EQ is displayed, then turn knob (2) right or left to select the desired equalizer curve. Each time you turn the knob, LCD displays as follows :

EQ OFF → CLASSIC → POP → ROCK → JAZZ

※ **When the EQ mode is activated, the BASS and TREBLE modes are not displayed.**

⑦ Loud control

When listening to music at low volume levels, this feature will boost the bass and treble response. This action will compensate for the reduction in bass and treble performance experienced at low volume.

To select the loudness feature, press button (2) until LOUD is displayed, then turn knob (2) right or left to activate or deactivate loudness.

⑧ Beep control

To adjust the BEEP mode, first select the BEEP mode by pressing button (2) repeatedly until BEEP indication appears on the display panel. Then turn knob (2) left or right within 5 seconds to select BEEP 2ND, BEEP OFF or BEEP ON.

- BEEP 2ND : You will only hear the beep sound when the buttons are held down for more than 2 seconds.
- BEEP OFF : You can not hear the sound beep when you press the buttons.
- BEEP ON : You can hear the beep sound each time you press the buttons.

(3) Mute control

① Press and hold MUTE button (3) for over 2 seconds to mute sound output and MUTE ON will blink on the LCD. Press the button again to cancel MUTE function and resume to normal playing mode.

(4) Mode selection

① Repeat press MODE button (3) to switch between FM1, FM2, AM, USB, AUX, BT MUSIC.

※ If there is no USB, AUX, Bluetooth Phone connected, it would not display USB, AUX, BT when you press button (3).

■ RADIO

(1) Mode button

① Repeat press MODE button to select FM1, FM2 or AM.

(2) Manual tuning button

① To manually tune to a radio station, simply turn encoder TUNE (2) left or right to increase or decrease the radio frequency.

(3) Auto tuning button

① To automatically select a radio station, simply press Seek up or Track down button.

(4) Station preset button

① In radio mode, pressing buttons (6) to (11) will recall the radio stations that are memorized. To store desired stations into any of the 6 preset memories, in either the AM or FM bands, use the following procedure :

a. Select the desired station.
b. Press and hold one of the preset buttons for more than 2 seconds to store the current station into preset memory. Six stations can be memorized on each of FM1, FM2, and AM.

(5) Preset scan (PS) / Best station memory (BSM) button

① Press BSM button (12) momentarily to scan the 6 preset stations stored in the selected band. When you hear your desired station, press it again to listen to it.
Press BSM button (12) for longer than 2 seconds to activate the Best Station Memory feature which will automatically scan and enter each station into memory.

※ **If you have already set the preset memories to your favorite stations, activating the BSM tuning feature will erase those stations and enter into the new ones. This BSM feature is most useful when travelling in a new area where you are not familiar with the local stations.**

■ USB PLAYER

(1) USB playback


9403CD110

① The unit was equipped with a front USB jack and also a rear USB Jack.
With a USB device plugged in the front USB jack, it will be detected as front USB mode. And with a USB device plugged in the rear USB jack, it will be detected as rear USB. To get to a USB mode, press MODE (3) button momentarily or insert the USB device in front or rear USB jack.

※ **If no mp3 or wma files in USB device, it will convert to the previous mode after display NO FILE.**

(2) Track Up / Down button

9403CD106

① Press SEEK up (13) or TRACK down (14) to select the next or previous track. Press and hold the buttons to advance the track rapidly in the forward or backward direction.

9403CD107

(3) MP3 directory / File searching

9403CD111

① Button (2) is used to select a particular directory and file in the device. Turn button (2) right or left to display the available directories. Press button (2) momentarily when the desired directory is displayed, then turn button (2) right or left again to display the tracks in that directory. Press button (2) to begin playback when the desired file is displayed.

(4) Directory Up / Down button

9403CD112

① During MP3/WMA playback, simply press DIR- button (10) to select the previous directory (if available in the device); simply press DIR+ button (11) to select the next directory (if available in the device).

※ **If the USB device does not contain directories, it would play MP3/WMA tracks at 10- file when you press DIR- button (10), and play MP3/WMA tracks at 10+ file when you press DIR+ (11) button.**

(5) Track Scan Play (SCAN) button

- SCAN playback : Simply press SCAN (12) button to play the first 10 seconds of each track.
- SCAN folder : Press and hold SCAN button for longer than 2 seconds to scan play the tracks in current folder.
- SCAN off : Simply press it again to cancel SCAN feature.

(6) Track Repeat Play (RPT) button

- REPEAT playback : Simply press RPT (8) button to play current track repeatedly.
- REPEAT folder : Press and hold RPT for longer than 2 seconds to repeat play the tracks in current folder.
- REPEAT off : Simply press it again to cancel REPEAT feature.

(7) Track Random Play (RDM) button

- RANDOM playback : Simply press RDM (9) button to play the tracks in the device in a random sequence.
- RANDOM folder : Press and hold RDM button for longer than 2 seconds to random play the tracks in current folder.
- RANDOM off : Simply press it again to cancel RANDOM feature.

(8) ID3 v2 (DISP)

① While a MP3 file is playing, press DISP button (6) to display ID3 information. Repeat push DISP button (6) to show directory name / file name and album name / performer / title.

※ **If the MP3 disc does not have any ID3 information, it will show NO ID3.**

* USB Information and Notice

a. Playback FILE SYSTEM and condition allowance.
   - FAT, FAT12, FAT16 and FAT32 in the file system.
   - V1.1, V2.2 and V2.3 in the TAG (ID3) version.

b. Display up to 32 characters in the LCD display.

c. No support any of MULTI-CAED Reader.

d. No high speed playback but only playing with normal full speed.

※ **DRM files in the USB may cause malfunction to playback in the radio unit.**

※ **The temperature below -10 Celsius, the audio unit with USB hook up would be affected to play well.**

■ AUX OPERATION

It is possible to connect your portable media player to the audio system for playback of the audio tracks via the cab speakers.

To get the best results when connecting the portable media to the audio system, follow these steps :

- Use a 3.5 mm stereo plug cable to connect the media player headphone socket at each end as follows.
- Adjust the portable media player to approximately 3/4 volume and start playback.
- Press the MODE button (3) on the audio unit to change into AUX mode.
- The volume and tone can now be adjusted on the audio unit to the desired level.

※ **The audio quality of your media player and the audio tracks on it may not be of the same sound quality as the audio system is CD Player.**

※ **If the sound of the media player is too low compared with the radio or CD, increase the volume of the player.**

※ **If the sound of the media player is too loud and/or distorted, decrease the volume of the player.**

※ **When in AUX mode, only the Volume, Bass, Treble, EQ and Mode functions of the audio unit can be used.**

■ **BLUETOOTH** (if equipped)

1) Using a bluetooth wireless connection

(1) Your audio unit supports bluetooth wireless technology. You can set up a wireless link with bluetooth cellular phone.

(2) Keep PAIRING the cellular phone with audio unit in a few minutes as the phone are being switched on well enough.

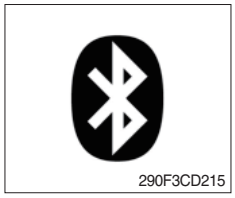
※ **Since this audio unit is on standby to connect with your cellular phone via bluetooth wireless technology, using this audio unit without running the engine can result battery drainage.**

※ **This audio unit phone call reception is on standby when ignition switch is set to ACC OFF or ON.**

※ **The line-of-sight distance between this audio unit and your cellular phone must be 10 meters or less for sending and receiving voice and data via bluetooth wireless technology. However the transmission distance may become shorter than the estimated distance depending on the environment in use.**

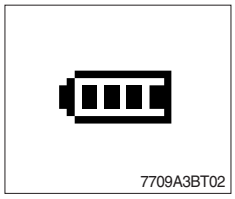
※ **Digital Noise & Echo suppression system provides the best sound clarity with little or no distortion (Echo & side tone will happen depending on cellular phone or service network).**

※ **To ensure the quality of calling, you should select a proper bluetooth VR level. This audio unit has already set with the best bluetooth VR level.**



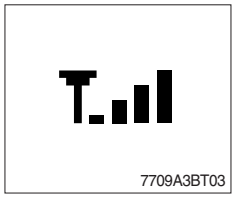
① Bluetooth icon

It will blink while establishing the bluetooth pairing.
It will light after a bluetooth device connected.



② Battery icon

It indicates the battery status of the connected bluetooth device.



③ Single strength icon

It indicates the signal strength of the connected bluetooth device.

2) Pairing in hands free modes

(1) Press and hold CALL button (4) for 2 seconds until you hear beep sound, then appears PAIR STR on the display.

(2) For the next procedure, go to cellular phone pairing mode.

(3) If it is in pairing status with audio unit and cellular phone, PAIRING will show on the display.

(4) If you want to exit pairing mode, press CALL END button (5) briefly while pairing, then it will show PAIR CLR on the display.

(5) Bluetooth Icon and PAIR OK appear on the display when pairing is successful.

3) Cellular phone pairing mode

(1) Browse your cellular phone menu and find the connectivity or bluetooth connection section.

(2) Select search for a new handsfree device function and allow the phone to find the mobile.

(3) HYUNDAI should appear on your cellular phone screen.

(4) Press connect menu among the handsfree option on your cellular phone.

(5) The cellular phone should prompt for a pin code. Insert the pin code 0000.

(6) The cellular phone should confirm that it has established a new paired connection.

(7) Close the menu. The pairing is now completed. It appears PAIR FAIL on the display for 3 seconds.

※ Each cellular phone type has distinct phone menu so you may need to refer to your manufactures instruction for the correct procedure on how to connect a new bluetooth device.

※ Please retry to the pairing instruction if HYUNDAI does not appear on the cellular phone screen.

※ Please select authorized, if there is authorized menu in the menu of bluetooth connection in your cellular phone.

※ Once the bluetooth pairing is completed between your cellular pone and this audio unit, the both units will be automatically recognized on its paring and when you turn on the key in your car even though this audio unit is turned off.

※ This audio unit can store up to 6 phones pairings. If the memory is full, the first stored paired phone will be deleted.

※ The connecting priority will be given to the last connected cellular phone.

※ If you want to change the connecting priority, try to connect this audio unit from the cellular phone.

4) Bluetooth connection and disconnection

(1) When established bluetooth connection between this audio unit and the cellular phone, bluetooth icon on the display appears and then the display shows HF/AV CONN when handsfree & AV profile connected.


9403CD118

(2) To disconnect bluetooth link
Press and hold CALL END button (4) for 2 seconds, it shows DIS CON and disappears bluetooth Icon on the display.


9403CD117

(3) To disconnect bluetooth link
Press CALL button (3) briefly, it blinks bluetooth Icon on the display while bluetooth is being connected. If the connection is completed, it appears bluetooth Icon on the display.

※ When your cellular phone battery is at low charge, the bluetooth connection may occasionally be lost. To maintain good connectivity ensure that your phone battery is adequately charged.

※ In case of failure of bluetooth pairing :
- Delete item in paired list on your phone.
- Reset both phone by power off/on and the audio unit by ACC off/on.

※ Connecting priority of handsfree profile is higher than headset profile.

※ The headset mode does not support caller ID, reject call and call Transfer.

5) Using the audio unit as a handsfree device

(1) When the audio unit is ringing, it shows CALL and follows with the phone number ********** on the display.


9403CD117/8

(2) To accept call
Press CALL button (4), it appears ANSWER CALL and follows TALKING on the display.

(3) To end call
To end call, press CALL END button (5), it appears REJECT on the display.

※ If reject call is activated in your phone, then your cellular phone does not support reject call function.

6) Audio transfer between the audio unit and phone

The audio transfer function is for switching the call from the audio unit to the cellular phone for private conversation.

(1) Press CALL button (4) briefly during conversation, it appears CALL TRANS on the display. To switch back to the audio unit, press button (4) briefly during private conversation, then it appears CALL TRANS on the display again.

※ **This function will be a cause of disconnection of bluetooth link in some nokia phones, but you do not worry just press button (4) during private conversation, then switch back to the audio unit automatically.**

※ **The quality of calling between cellular phone and audio unit is better than calling between one audio unit and another one.**

7) Last call number dialing

(1) Press CALL button (4) briefly, it appears CALL TO, then simply press CALL button once again, it would make the last call with phone number display on LCD.
If Reject call is activated in your phone, then your cellular phone does not support Reject Call function.

※ **If you are using SAMSUNG phone, then you may need to press once more send button. First press button shows phone contact list in your phone, then second press make the last call.**

8) To make a call by cellular phone

The audio transfer function is for switching the call from the audio unit to the cellular phone for private conversation.

(1) The audio unit activated automatically when you make a call by cellular phone.
(2) When you make a call processing by cellular phone, it shows CALLING on the display.
(3) When you receive a call, the phone number ******** appears on the display.

9) Using the audio unit as bluetooth music

The audio unit supports A2DP (Audio Advanced Distribution Profile) and AVRCP (Audio Video Remote Control Profile), and both profiles are available to listen music at the audio unit via cellular phone which is supporting the two profiles above.

(1) To play music, search the menu on your cellular phone as below :
i.e : Menu → File manager → Music → Option → Play via bluetooth.
It appears BT MP3 on the display.

(2) During BT MP3 playing, you could select the previous or next track by pressing SEEK up or TRACK down button on audio unit or operate via your cellular phone.

(3) To stop music, press button (5) briefly and it will automatically switch into the previous mode.

(4) To resume music playing, press the play button on your cellular phone.

※ This function maybe different depends on cellular phone. Please follow the cellular phone menu. Some kinds of phone need to pair once more for bluetooth MP3 connection.

※ This function will be caused to disconnect A2DP, AVRCP depends on cellular phone.

※ Information about songs (e.g.: the elapsed playing time, song title, song index, etc.) cannot be displayed on this audio unit.

■ RESET AND PRECAUTIONS

1) Reset function

Interfere noise or abnormal compressed files in the MP3 disc or USB instrument may cause extraordinary operation (or unit frozen/locking up). It's strongly recommended to use appropriate USB storage not cause any malfunction to the audio unit. In the unlikely event that the player fails to operate correctly, try out to reset unit by any of following two methods.

(1) press and hold 

simultaneously for about 5 seconds. (without Bluetooth)

Press and hold 


simultaneously for about 5 seconds. (with Bluetooth)

(2) Take out the fuse for the audio system in the vehicle once and then plug again.

※ It will be necessary to re-enter the radio preset memories as these will have been erased when the microprocessor was reset.
After resetting the player, ensure all functions are operation correctly.

2) Precautions

When the inside of the car is very cold and the player is used soon after switching on the heater, moisture may form on the disc or the optical parts of the player and proper playback may not be possible.

If moisture forms on the optical parts of the player, do not use the player for about one hour. The condensation will disappear naturally allowing normal operation.

(1) Operation voltage : 9~32 volts DC, negative

(2) Output power : 40 watts maximum (20 watts x 2 channels)

(3) Tuning range

Area	Band	Frequency range	Step
USA	FM	87.5~107.9 MHZ	200K
	AM	530~1710 KHZ	10K
EUROPE	FM	87.5~108.0 MHZ	50K
	AM	522~1620 KHZ	9K
ASIA	FM	87.5~108.0 MHZ	100K
	AM	531~1602 KHZ	9K
LATIN	FM	87.5~107.9 MHZ	100K
	AM	530~1710 KHZ	10K

- AREA Selection :
  - To select an area, press and hold related buttons at FM1 band for about 3 seconds.
  - USA Area: Press and hold mode + 1DIS buttons for 3 seconds
  - EUROPE Area: Press and hold mode + 2 buttons for 3 seconds
  - ASIA Area: Press and hold mode + 3RPT buttons for 3 seconds
  - LATIN Area: Press and hold mode + 4RDM buttons for 3 seconds.

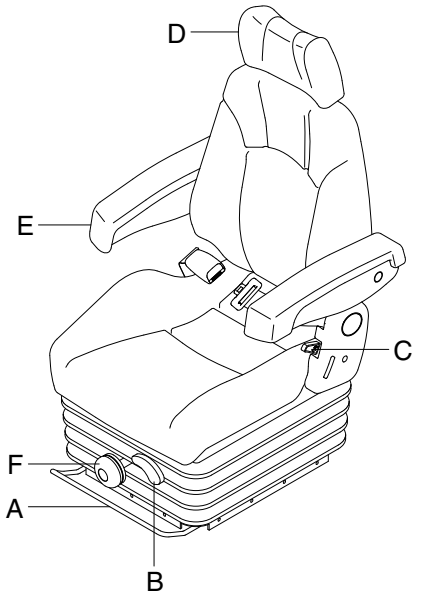
(4) USB version : USB 1.1

(5) Bluetooth version : V2.1

(6) Bluetooth supported profile :
- A2DP : Advanced Audio Distribution Profile
- AVRCP : Audio/Video Remote Control Profile
- HFP : Hands-Free Profile

4) **SEAT** (standard)

The seat is adjustable to fit the contours of the operator's body. It will reduce operator fatigue due to long work hours and enhance work efficiency.



2209S3CD54

(1) Horizontal adjustment (A)

① Pull lever A to adjust seat forward or backward.

② The seat can be moved forward and backward over 169 mm (6.7") in 13 steps.

(2) Tilt adjustment (B)

Pull or push lever B to adjust seat cushion upward or downward.

(3) Adjustable Backrest

Pull lever C to adjust seat backrest.

(4) Arm rest adjustment (E)

This can be adjusted by turning the knob E.

(5) Head rest adjustment (D)

This is adjustable vertically to fit operator's requirements, over a 75 mm (3.0") height range and 79.5˚ angle.

(6) Weight adjustment (F)

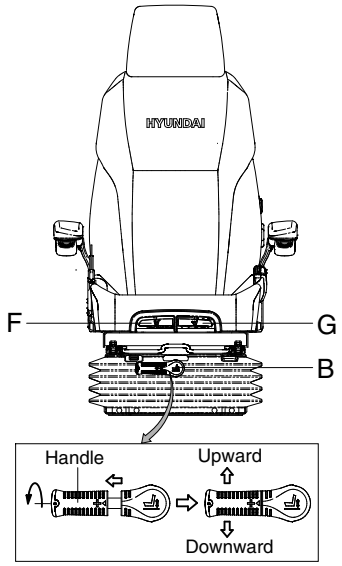
Adjust the handle to the operator's weight (50~130 kg).

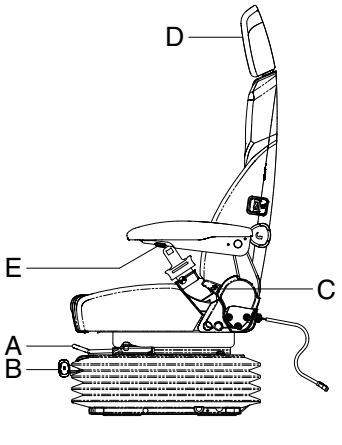
⚠ Always check the condition of the seat belt and mounting hardware before operating the machine.

⚠ Replace the seat belt at least once every three years, regardless of appearance.

5) SEAT (heated, option)

The seat is adjustable to fit the contours of the operator's body. It will reduce operator fatigue due to long work hours and enhance work efficiency.





21093CD55

(1) Forward/Backward adjustment (A)

① Pull lever A to adjust seat forward or backward.

② The seat can be moved forward and backward over 140 mm (5.5") in 13 steps.

(2) Height/weight adjustment (B)

① Turn the handle to adjust seat upward or downward

· Turn to clockwise, the seat is moved to upward and the weight is increased.
If it is turned to counterclockwise, the seat is moved to downward and the weight is decreased.

② **Method of changing direction** (up/down)

· First, pull the handle to outside.

· Second, rotate 180˚ and release the handle.

(3) Reclining adjustment (C)

Pull lever C to adjust seat back rest.

(4) Arm rest adjustment (E)

This can be adjusted by pushing the button E to right and left.

(5) Head rest adjustment (D)

This is adjustable vertically to fit operator's requirements over 60 mm (2.4").

(6) Seat cushion tilt adjustment (F)

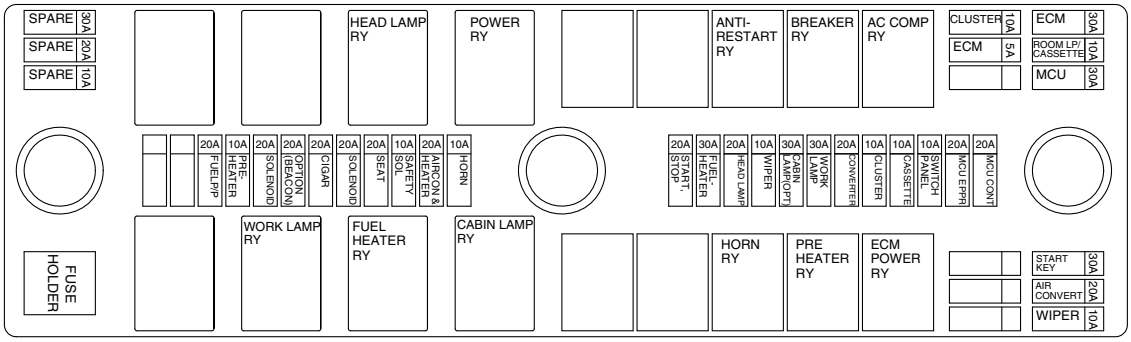
Pull lever F to adjust seat cushion tilting angle.

(7) Seat cushion length adjustment (G)

⚠ Pull lever G to adjust seat cushion forward or backward.

⚠ Always check the condition of the seat belt and mounting hardware before operating the machine. Replace the seat belt at least once every three years, regardless of appearance.

6) FUSE & RELAY BOX



21093CD56

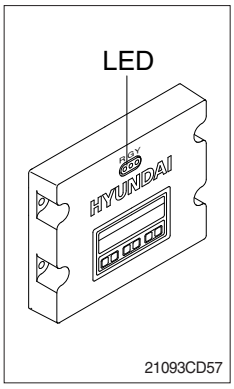
(1) The fuses protect the electrical parts and wiring from burning out.

(2) The fuse box cover indicates the capacity of each fuse and circuit it protects.

※ **Replace a fuse with another of the same capacity.**

⚠ **Before replacing a fuse, be sure to turn OFF the starting switch.**

7) MCU



21093CD57

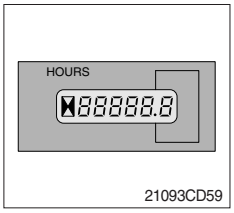
(1) To match the pump absorption torque with the engine torque, MCU varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.

(2) Three LED lamps on the MCU display as below.

LED lamp	Trouble	Service
G is turned ON	Normal	-
G and R are turned ON	Trouble on MCU	· Change the MCU
G and Y are turned ON	Trouble on serial communication line	· Check if serial communication lines between controller and cluster are disconnected
Three LED are turned OFF	Trouble on MCU power	· Check if the input power wire (24 V, GND) of controller is disconnected · Check the fuse

G : green, R : red, Y : yellow

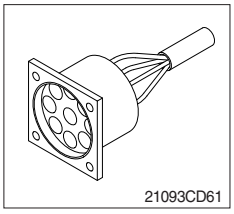
8) SERVICE METER



(1) This meter shows the total operation hours of the machine.

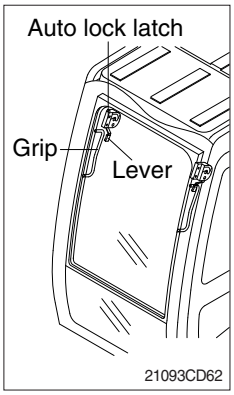
(2) Always ensure the operating condition of the meter during the machine operation. Inspect and service the machine based on hours as indicated in chapter 6, maintenance.

9) RS232 SERVICE SOCKET



(1) MCU communicates the machine data with Laptop computer through RS232 service socket.

10) UPPER WINDSHIELD

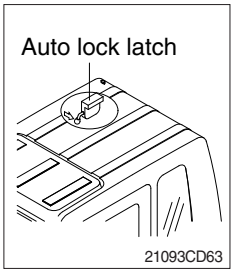


(1) Perform the following procedure in order to open the upper windshield.

① Pull both levers with hold both grips that are located at the top of the windshield frame and push the windshield upward.

② Hold both grips and back into the lock position until auto lock latch is engaged, then release the lever locked position.

⚠ When working, without having locked the windshield by the auto lock (by pushing the windshield to the rear untill it's completely fixed), please be careful as it can cause personal injury if the windshield is not fixed or falls off.



(2) Perform the following procedure in order to close the upper windshield.

① Pull the lever of the auto lock latch in order to release the auto lock latch.

② Reverse above step ① and ② in order to close the upper windshield.

1. SUGGESTION FOR NEW MACHINE

1) It takes about 100 operation hours to enhance its designed performance.

2) Operate according to below three steps and avoid excessive operation for the initial 100 hours.

Service meter	Load
Until 10 hours	About 60 %
Until 100 hours	About 80 %
After 100 hours	100 %

※ **Excessive operation may deteriorate the potential performance of machine and shorten lifetime of the machine.**

3) Be careful during the initial 100 hours operation

(1) Check daily for the level and leakage of coolant, engine oil, hydraulic oil and fuel.

(2) Check regularly the lubrication and fill grease daily all lubrication points.

(3) Tighten bolts.

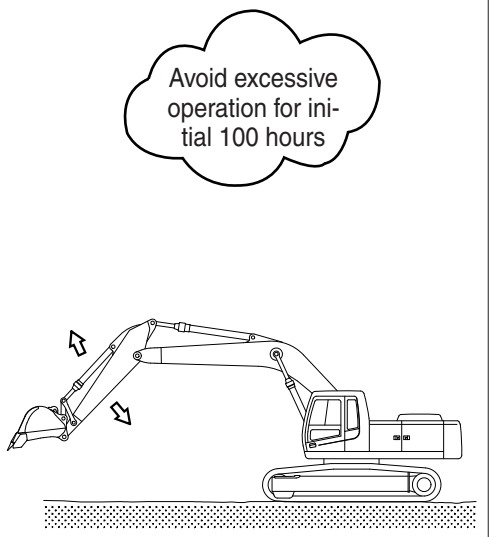
(4) Warm up the machine fully before operation.

(5) Check the gauges occasionally during the operation.

(6) Check if the machine is operating normally during operation.

4) Replace followings after initial operation hours.

Checking items	Hours
Engine oil	250
Engine oil filter element	
Fuel filter	
Prefilter	
Hydraulic oil return filter element	
Hydraulic oil tank drain filter cartridge	
Pilot line filter element	
Swing reduction gear oil	
Travel reduction gear oil	



21074OP01

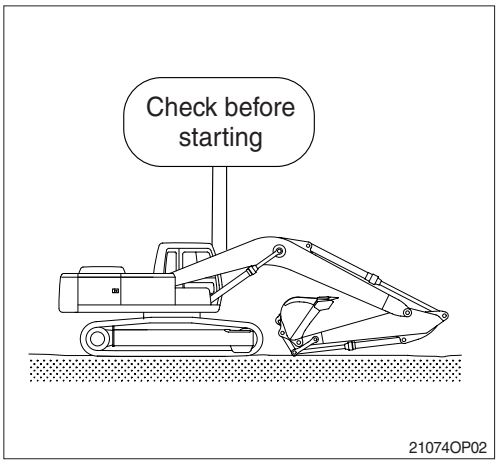
2. CHECK BEFORE STARTING THE ENGINE

1) Look around the machine and under the machine to check for loosen nut or bolts, collection of dirt, or leakage of oil, fuel or coolant and check the condition of the work equipment and hydraulic system. Check also loosen wiring, and collection of dust at places which reach high temperature.

※ **Refer to the daily check on the chapter 6, maintenance.**

2) Adjust seat to fit the contours of the operator's body for the pleasant operation.

3) Adjust the rear view mirror.



21074OP02

3. STARTING AND STOP THE ENGINE (CLUSTER TYPE 1)

1) CHECK INDICATOR LIGHTS

(1) Check if all the operating levers are in the neutral position.

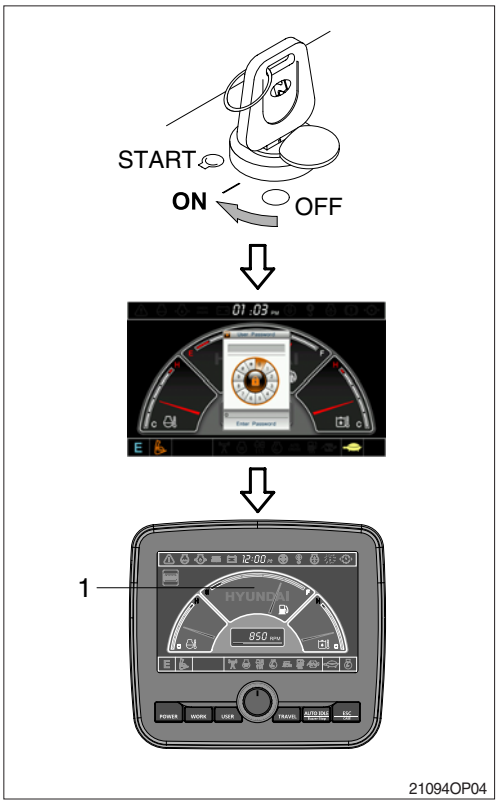
(2) Turn the starting switch to the ON position. Buzzer sounding for 4 seconds with HYUNDAI logo on cluster.

※ **If the ESL mode is set to the enable, enter the password to start engine.**

※ **If the password has failed 5 times, please wait 30 minutes before re-attempting to enter the password.**

※ **Refer to page 3-17 for ESL mode.**

(3) After initialization of cluster, the operating screen is displayed on LCD (1).
Also, self-diagnostic function is carried out.



2) STARTING ENGINE IN NORMAL TEMPERATURE

※ **Sound the horn to warn the surroundings after checking if personnel or obstacles are in the area.**

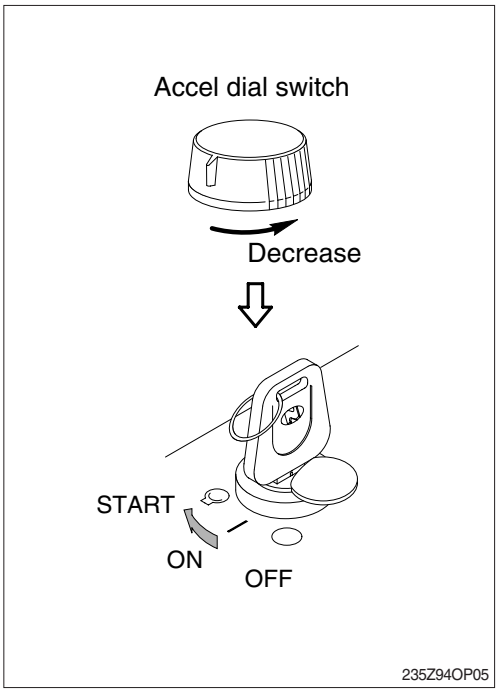
(1) Turn the accel dial switch to low idle position.

(2) Turn the starting switch to START position to start the engine.

※ **Do not hold the starting switch in the START position for longer than 20 seconds.**
The start system may be seriously damaged.

※ **If the engine does not start, allow the starter to cool for about 2 minutes before re-attempting to start the engine again.**

(3) Release the starting switch instantly after the engine starts to avoid possible damage to the starting motor.



3) STARTING ENGINE IN COLD WEATHER

※ **Sound horn to warn surroundings after checking if there are obstacles in the area.**

※ **Replace the engine oil and fuel referring to recommended oils at page 2-22.**

※ **Fill the anti-freeze solution to the coolant as required.**

※ **If you turn ON the starting switch, the fuel warmer is automatically operated to heat the fuel by sensing the coolant temperature.**

(1) Check if all the levers are in the neutral position.

(2) Turn the accel dial switch to low idle position.

(3) Turn the starting switch to the ON position, and wait 1~2 minutes. More time may take according to ambient temperature.

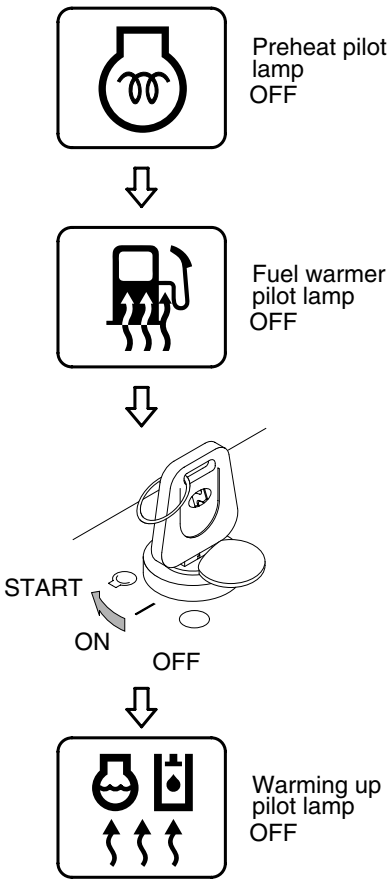
(4) Wait for five minutes to warm up the engine after the preheating pilot lamp off, and than turn the starting switch to the START position to start the engine.

※ **If the engine does not start, allow the starter to cool for about 2 minutes before attempting to start the engine again.**

(5) Release the starting switch immediately after starting engine.

(6) If the temperature of the coolant is lower than 30˚C the warming up automatically starts.

※ **Do not operate the working devices, or convert the operation mode into other mode during the warming up.**



4) INSPECTION AFTER ENGINE START

Inspect and confirm the following after engine starts.

(1) Is the level gauge of hydraulic oil tank in the normal level?

(2) Are there leakages of oil or water?

(3) Are all the warning lamps turned OFF (1-9)?

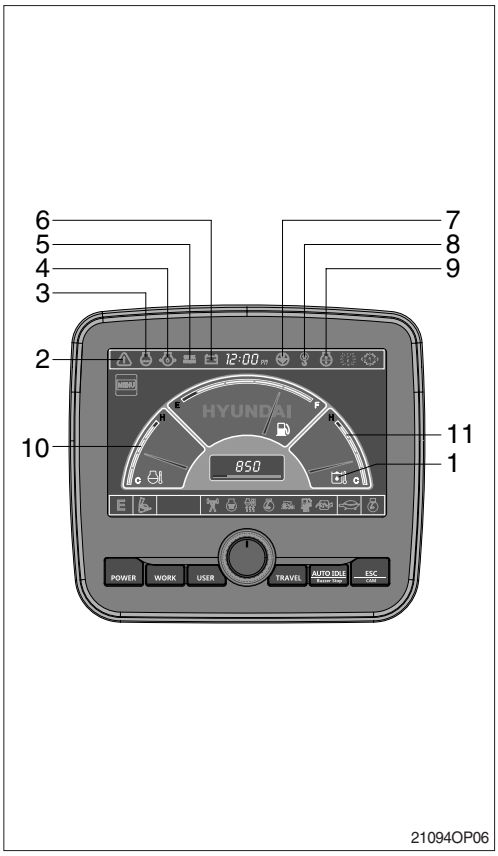
(4) Are the indicator of water temperature gauge (10) and hydraulic temperature gauge (11) in the operating range?

(5) Are the engine sound and the color of exhaust gas normal?

(6) Are the sound and vibration normal?

※ **Do not increase engine speed quickly after starting, it can damage engine or turbocharger.**

※ **If there are problems in the cluster, stop the engine immediately and correct problems as required.**



5) WARMING-UP OPERATION

※ **The most suitable temperature for the hydraulic oil is about 50˚C (122˚F).**
It can cause serious trouble in the hydraulic system by sudden operation when the hydraulic oil temperature is below 25˚C (77˚F).
Then temperature must be raised to at least 25˚C (77˚F) before starting work.

(1) Run the engine at low idle speed for 5 minutes.

(2) Speed up the engine by accel dial and run the engine at mid-range speed.

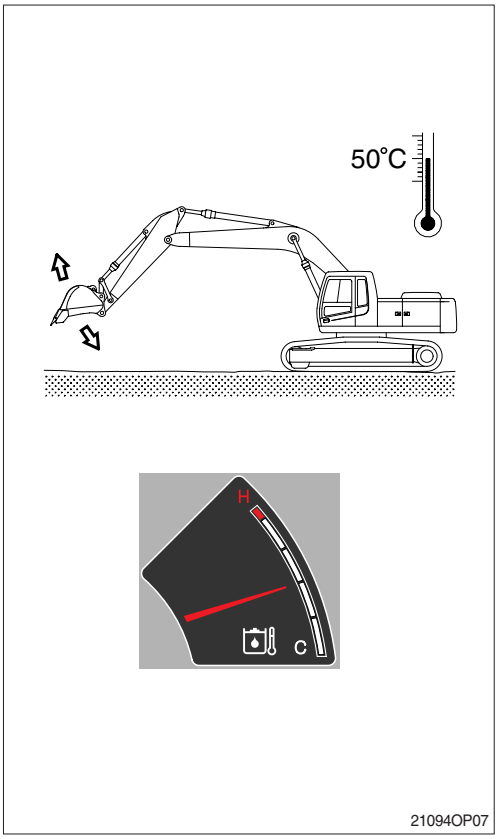
(3) Operate bucket lever for 5 minutes.

※ **Do not operate anything except bucket lever.**

(4) Run the engine at the high speed and operate the bucket lever and arm lever for 5-10 minutes.

※ **Operate only the bucket lever and arm lever.**

(5) This warming-up operation will be completed by operation of all cylinders several times, and operation of swing and traveling.



6) TO STOP THE ENGINE

※ **If the engine is abruptly stopped before it has cooled down, engine life may be greatly shortened. Consequently, do not abruptly stop the engine apart from an emergency.**

※ **In particular, if the engine has overheated, do not abruptly stop it but run it at medium speed to allow it to cool gradually, then stop it.**

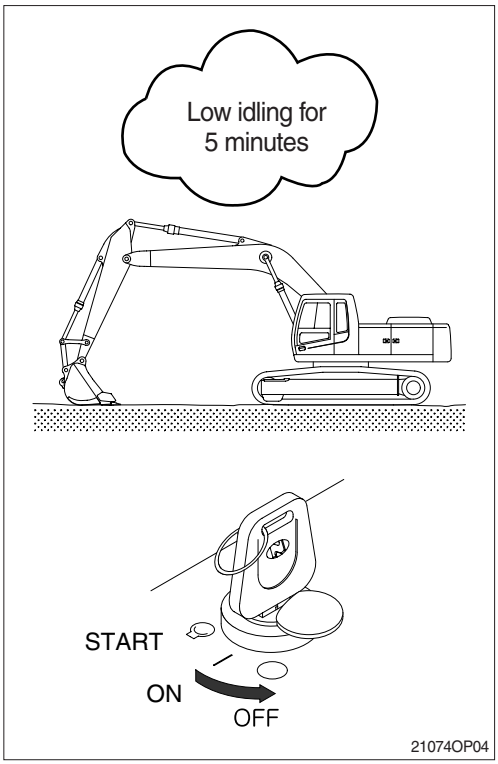
(1) Down the bucket on the ground then put all the levers in the neutral position.

(2) Run the engine at low idle speed for about 5 minutes.

(3) Return the key of starting switch to the OFF position.

(4) Remove the key to prevent other people using the machine and LOCK safety lever.

(5) Lock the cab door.



■ STARTING AND STOP THE ENGINE (CLUSTER TYPE 2)

1) CHECK INDICATOR LIGHTS

(1) Check if all the operating lever is on the neutral position.

(2) Turn the starting switch to the ON position, and check following.

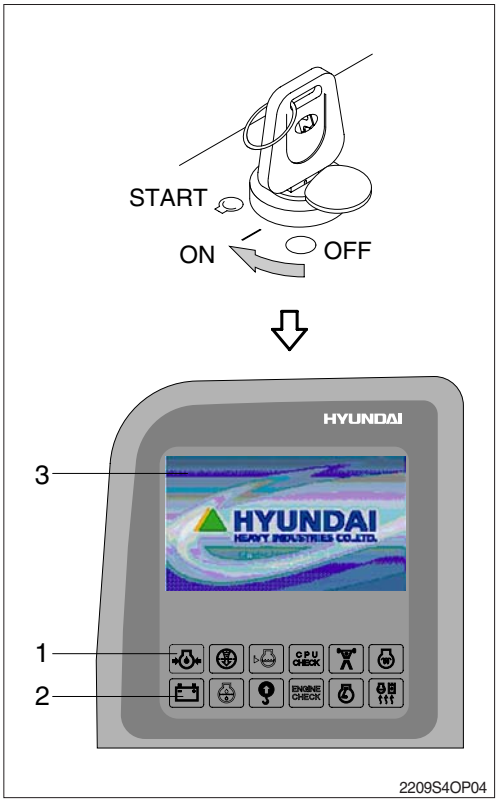
① If all the lamps light ON and buzzer sounding for 2 seconds.

② After lamp check 「1.00」, the version of cluster program, is displayed on 「LCD (3)」 for 5 seconds and the cluster returns to default.

③ Only below lamps will light ON and all the other lights will turn OFF after 2 seconds.

·Engine oil pressure warning lamp (1)

·Battery charging warning lamp (2)



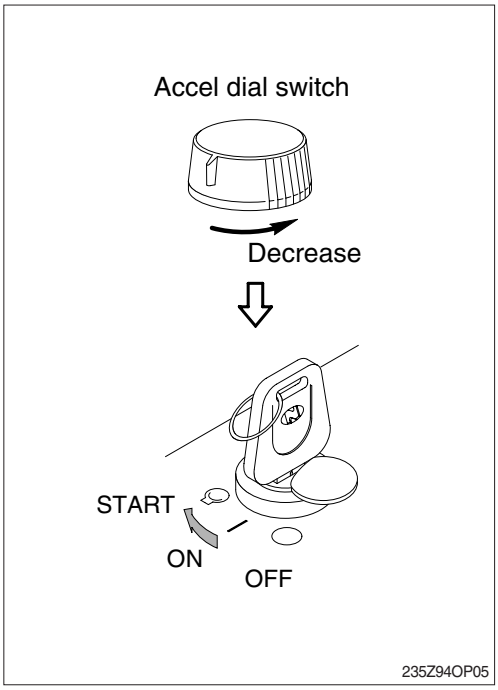
2) STARTING ENGINE IN NORMAL TEMPERATURE

※ **Sound the horn to warn the surroundings after checking if personnel or obstacles are in the area.**

(1) Turn the starting switch to START position to start the engine.

※ **If the engine does not start, allow the starter to cool for about 2 minutes before attempting to start the engine again.**

(2) Release the starting switch instantly after the engine starts to avoid possible damage to the starting motor.



3) STARTING ENGINE IN COLD WEATHER

※ **Sound horn to warn surroundings after checking if there are obstacles in the area.**

※ **Replace the engine oil and fuel referring to recommended oils at page 2-22.**

※ **Fill the anti-freeze solution to the coolant as required.**

※ **If you turn ON the starting switch, the fuel warmer is automatically operated to heat the fuel by sensing the coolant temperature.**

(1) Check if all the levers are in the neutral position.

(2) Turn the accel dial switch to low idle position.

(3) Turn the starting switch to the ON position, and wait 1~2 minutes. More time may take according to ambient temperature.

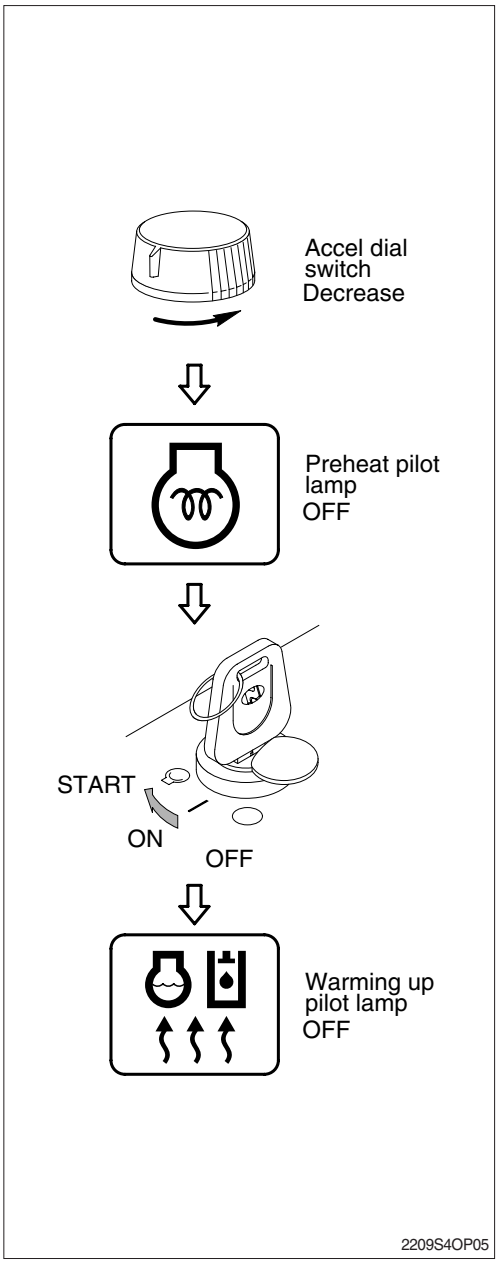
(4) Wait for five minutes to warm up the engine after the preheat pilot lamp OFF, and than turn the starting switch to the START position to start the engine.

※ **If the engine does not start, allow the starter to cool for about 2 minutes before attempting to start the engine again.**

(5) Release the starting switch immediately after starting engine.

(6) If the temperature of the coolant is lower than 30˚C the warming up automatically starts.

※ **Do not operate the working devices, or convert the operation mode into other mode during the warming up.**



4) INSPECTION AFTER ENGINE START

Inspect and confirm the following after engine starts.

(1) Is the level gauge of hydraulic oil tank in the normal level?

(2) Are there leakages of oil or water?

(3) Are all the warning lamps turned OFF (1-6)?

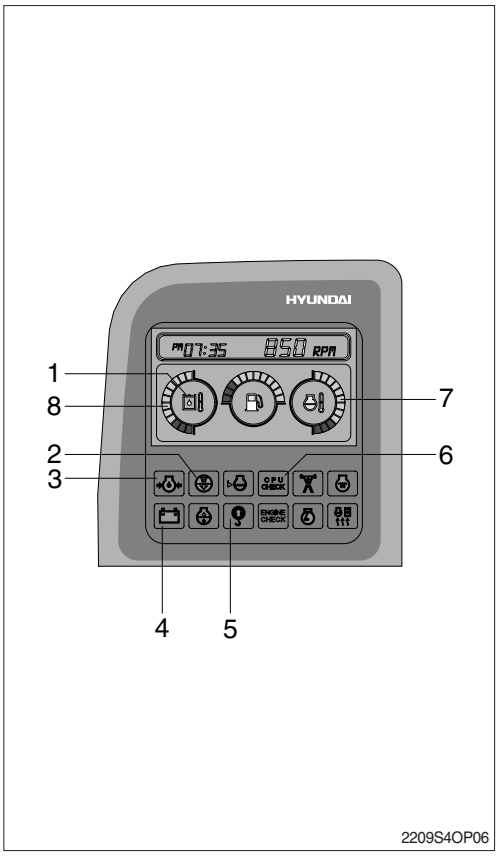
(4) Are the indicator of water temperature gauge (7) and hydraulic temperature gauge (8) in the green zone?

(5) Are the engine sound and the color of exhaust gas normal?

(6) Are the sound and vibration normal?

※ **Do not increase engine speed quickly after starting, it can damage engine or turbocharger.**

※ **If there are problems in the control panel, stop the engine immediately and correct problem as required.**



2209S4OP06

5) WARMING-UP OPERATION

※ **The most suitable temperature for the hydraulic oil is about 50˚C (122˚F).**
It can cause serious trouble in the hydraulic system by sudden operation when the hydraulic oil temperature is below 25˚C (77˚F).
Then temperature must be raised to at least 25˚C (77˚F) before starting work.

(1) Run the engine at low idling for 5 minutes.

(2) Speed up the idling and run the engine at mid-range speed.

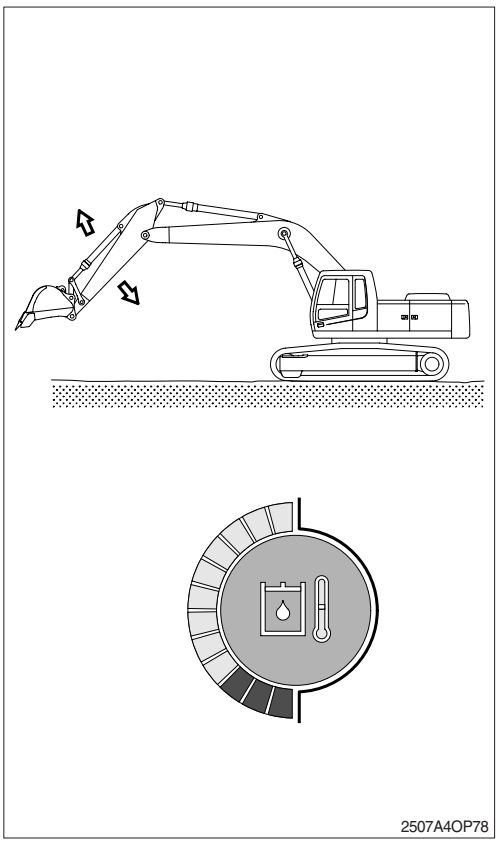
(3) Operate bucket lever for 5 minutes.

※ **Do not operate anything except bucket lever.**

(4) Run the engine at the high speed and operate the bucket lever and arm lever for 5-10 minutes.

※ **Operate only the bucket lever and arm lever.**

(5) This warming-up operation will be completed by operation of all cylinders several times, and operation of swing and traveling.


2507A4OP78

4. MODE SELECTION SYSTEM (CLUSTER TYPE 1)

1) STRUCTURE OF MECHATRONICS SYSTEM

CAPO, Computer Aided Power Optimization system, is the name of mode selection system developed by Hyundai.

※ **Please refer to chapter 3, cluster for below modes setting.**

(1) Power mode

Power mode designed for various work loads supports high performance and reduces fuel consumption.

- P mode : Heavy duty power
- S mode : Standard power
- E mode : Economy power

(2) Work mode

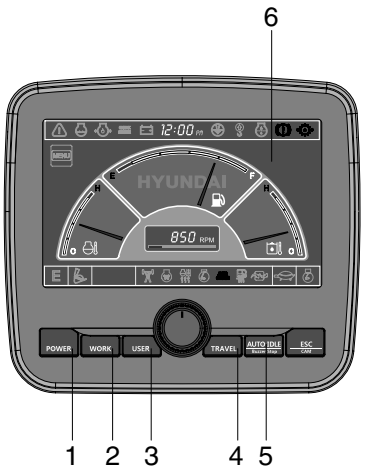
One of the two work modes can be selected for the optimal work condition of the machine operation.

① **General work mode (bucket)**

When key switch is turned ON, this mode is selected automatically.

② **Work tool mode (breaker, crusher)**

It controls the pump flow and system pressure for the optimal operation of breaker or crusher.



21094OP10

1 Power mode switch
2 Work mode switch
3 User mode switch
4 Travel mode switch
5 Auto idle mode switch
6 LCD

(3) User mode

① User mode is useful for setting the user preperable power quickly.
(engine speed, power shift and idle speed)

② There are two methods for use of user mode.

a. In operation screen

User mode switch is used to memorize the current machine operating status and activate the memorized user mode.
Refer to page 3-10.

b. In menu

Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in menu status.

- Each memory mode has a initial set which are mid-range of max engine speed, power shift and auto idle speed.

21094OP11

- High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

※ **Refer to the page 3-12 for setting the user mode (available on U mode only).**

· LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1500	1000 (low idle)	0
2	1600	1050	3
3	1700	1100	6
4	1800	1150 (decel rpm)	9
5	1900	1200	12
6	2000	1250	16
7	2050	1300	20
8	2100	1350	26
9	2150	1400	32
10	2200	1450	38

21094OP12

(4) Travel mode

: Low speed traveling.

: High speed traveling.

(5) Auto idle mode

Pilot lamp ON : Auto idle function is activated.

Pilot lamp OFF : Auto idle function is canceled.

(6) Monitoring system

Information of machine performance as monitored by the MCU can be displayed on the LCD. Refer to the page 3-11.

(7) Self diagnostic system

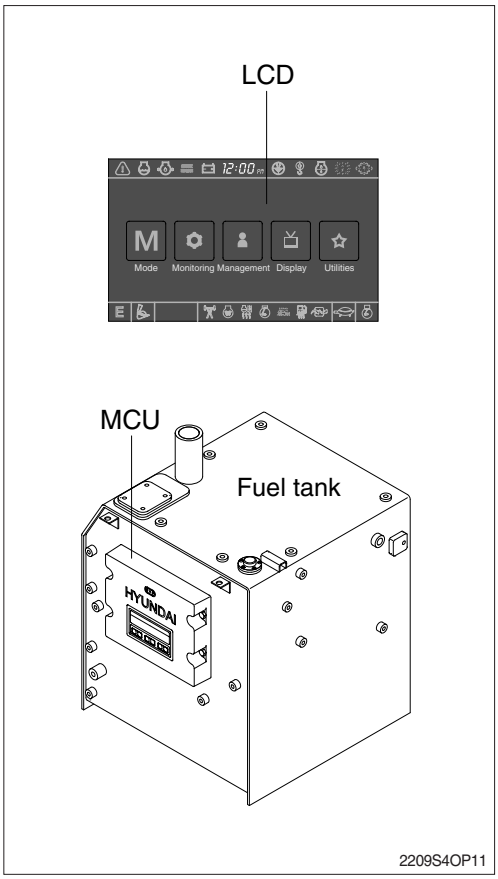
MCU (Machine Control Unit)

The MCU diagnoses machine status and problems and displays fault code in the cluster (fault code detected by MCU is composed of HCESPN and FMI).

※ **Refer to the page 3-11 for LCD display.**

(8) Anti-restart system

The system protects the starter from inadvertent restarting after the engine is already operational.



2209S4OP11

2) HOW TO OPERATE MODE SELECTION SYSTEM

(1) When start key switch is turned ON

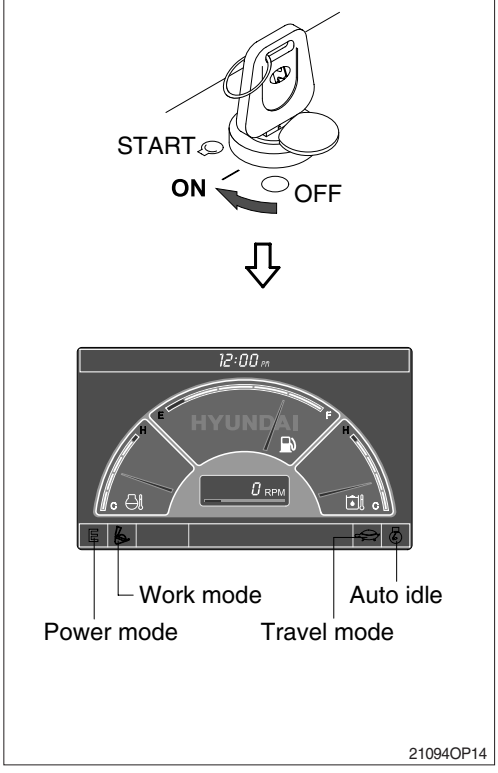
① When start key switch is turned on, the cluster turns on and buzzer sounds for 4 seconds. And then main information as gauges and engine speed are displayed on LCD.

② Initial default mode settings are displayed in the cluster.

Mode		Status
Power mode	E	ON
Work mode		ON
Travel mode	Low ( )	ON
Auto idle		ON

※ **These setting can be changed at U mode.**

③ Self-diagnostic function can be carried out from this point.



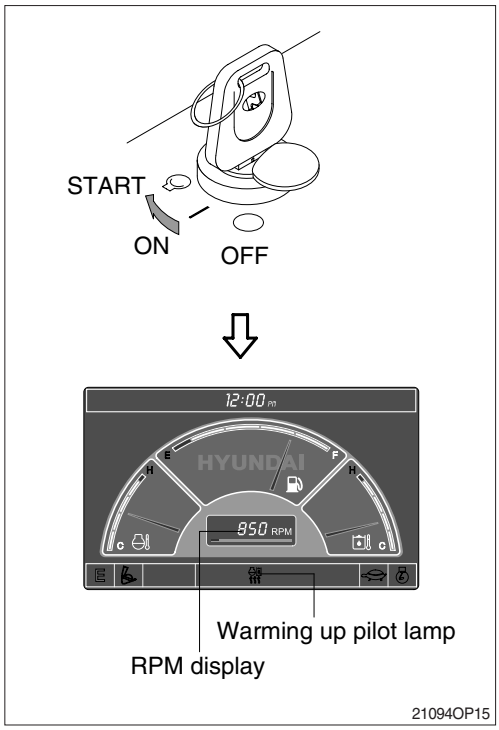
21094OP14

(2) After engine start

① When the engine is started, rpm display indicates low idle, 1000±100 rpm.

② If coolant temperature is below 30˚C, the warming up pilot lamp lights ON and after 4 seconds the engine speed increases to 1150±100 rpm automatically to warm up the machine.

· After 2-3 minutes, you can select any mode depending on job requirement.



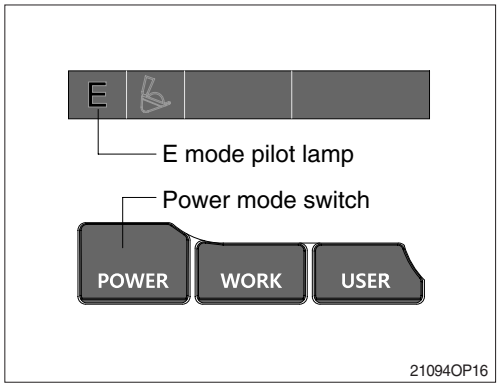
3) SELECTION OF POWER MODE

(1) E mode

The accel dial is set 10 and the auto idle mode is canceled.

Engine rpm	Effect
1900 ± 50	Variable power control in proportion to lever stroke (improvement in fuel efficiency) ※ Same power as S mode in full lever operation.

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**

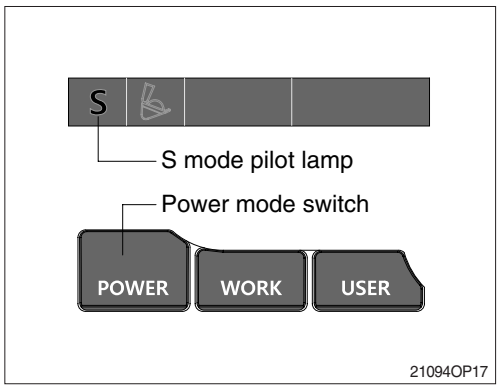


(2) S mode

The accel dial is set 10 and the auto idle mode is canceled.

Engine rpm	Effect
2000 ± 50	Standard power

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**

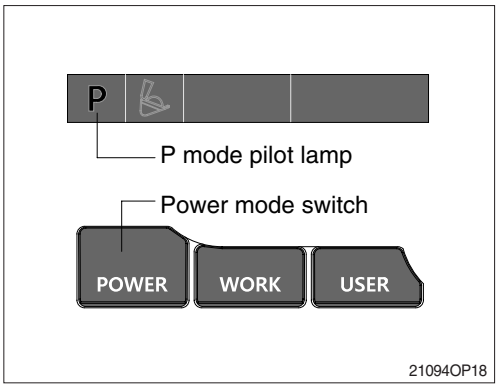


(3) P mode

The accel dial is set 10 and the auto idle mode is canceled.

Engine rpm	Effect
2100 ± 50	Approximately 120 % of power and speed available than S mode.

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**



■ MODE SELECTION SYSTEM (CLUSTER TYPE 2)

1) STRUCTURE OF CAPO SYSTEM

CAPO, Computer Aided Power Optimization system, is the name of mode selection system developed by Hyundai.

(1) Work mode

2 work modes can be selected for the optimal work speed of the machine operation.

① **Heavy duty work mode**

The boom priority solenoid is activated to make the boom operation speed faster.

② **General work mode**

When key switch is turned ON, this mode is selected automatically and swing operation speed is faster than heavy duty work mode.

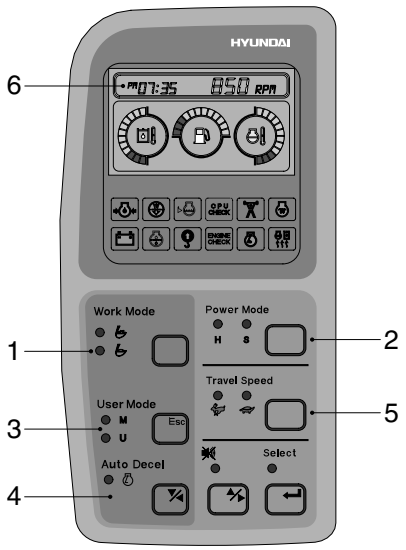
(2) Power mode

Power mode designed for various work loads maintains high performance and reduces fuel consumption.

- H mode : High power
- S mode : Standard power

(3) User mode

- M : Maximum power
- U : You can change the engine and pump power and memorize it for your pre-ference

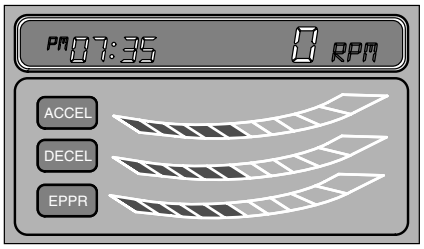


2209S4OP07

1 Work mode
2 Power mode
3 User mode
4 Auto decel mode
5 Travel mode
6 LCD

How to modulate the memory set

① Each memory mode has a initial set which are mid-range of max engine speed, auto decel rpm, and EPPR valve input current.



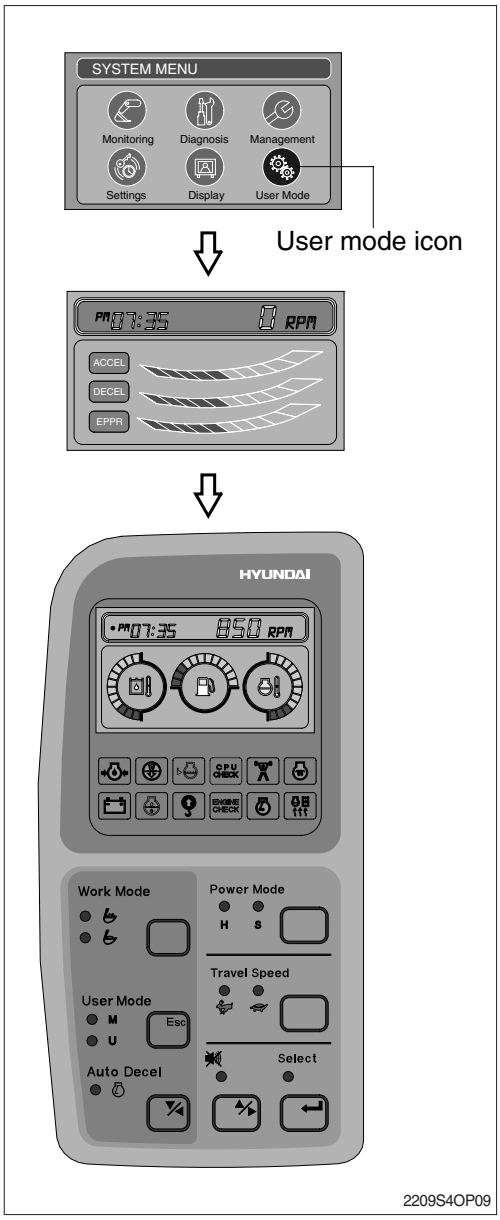
2507A4OP08

② High idle rpm, auto decel rpm, EPPR pressure can be modulated and memorized separately in the U-mode.

※ **Refer to the page 3-29 for set of user mode.**

· **LCD segment vs parameter setting**

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (mA)
1	1500	1000 (low idle)	150
2	1600	1050	200
3	1700	1100	250
4	1800	1150 (decel rpm)	300
5	1900	1200	350
6	2000	1250	400
7	2050	1300	450
8	2100	1350	500
9	2150	1400	550
10	2200	1450	600



(4) Auto decel mode

Engine quick deceleration.

(5) Travel mode

: Low speed traveling.

: High speed traveling.

(6) Monitoring system

Information of machine performance as monitored by the MCU can be displayed on the **LCD**. Refer to the page 3-26.

(7) Self diagnostic system

① **MCU (Machine Control Unit)**

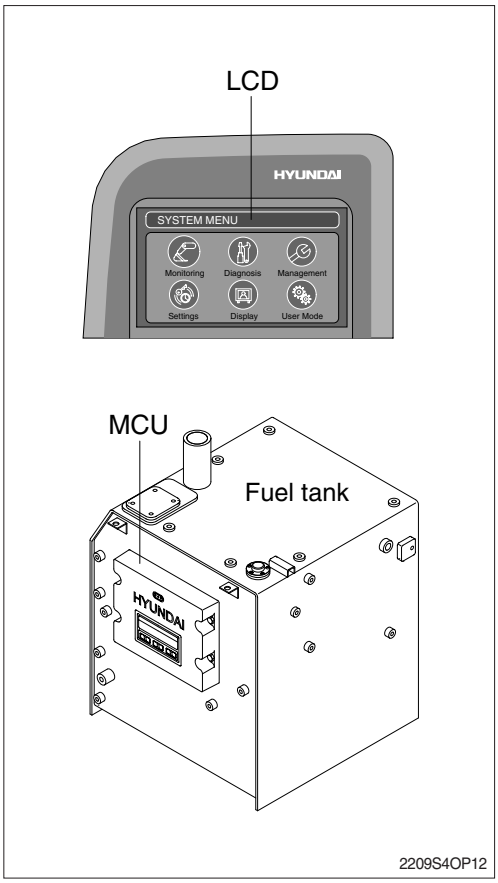
The MCU diagnoses problems in the CAPO system caused by electric parts' malfunction and by open or short circuit, which are displayed on the **LCD** as error codes (2 digit).

※ **Consult hyundai or huyndai dealer for details.**

※ **Refer to the page 3-26 for LCD display.**

(8) Anti-restart system

The system protects the starter from inadvertent restarting after the engine is already operational.



2209S4OP12

2) HOW TO OPERATE MODE SELECTION SYSTEM

(1) When start key switch is turned ON

① When start key is turned ON, all illumination lamps are ON and all lamps are OFF automatically after 5 seconds. But a battery charging warning lamp and an engine oil pressure warning lamp keep turned ON until engine starting.

② After lamp check 「**1.00**」, the version of cluster program, is displayed on **LCD** for 2 seconds.

③ After the version of program is displayed, the cluster returns to default. Exactly engine rpm, battery charging warning lamp and engine oil pressure warning lamp are turned ON and S mode, auto decel, low travel speed (turtle mark) are displayed.

④ In default condition self-diagnostic function including trouble detecting of electric system can be carried out.

2209S4OP13

(2) After engine start

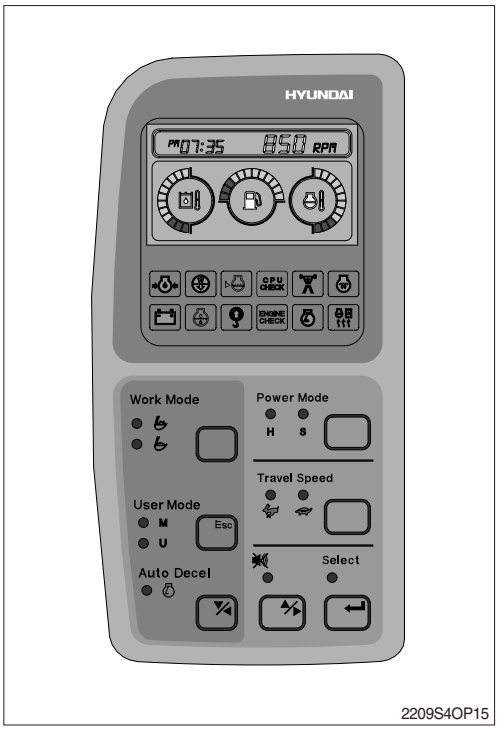
① When the engine is started, three lamps are ON as below.

Mode		Status
Work mode		ON
Power mode	S	ON
Travel mode	Low ( )	ON
Auto decel mode		ON

- In this condition, tachometer indicates low idle, 1000±100 rpm.
- If coolant temperature is below 30˚C, after 10 seconds the engine speed increases to 1150±100rpm automatically to warm up the machine.
- After 2-3 minutes, you can select any mode depending on job requirement.

② Self-diagnostic function can be carried out the same as start key is ON.

※ **Refer to the page 3-27 for details.**



2209S4OP15

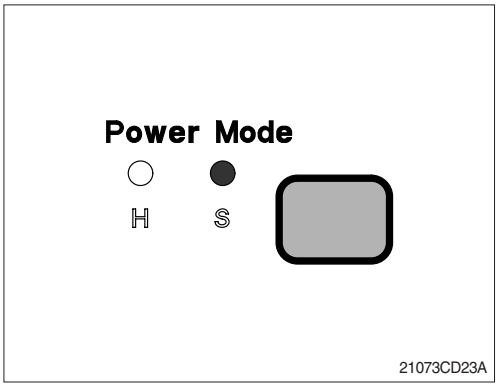
3) SELECTION OF POWER MODE

(1) S mode

When the accel dial is at setting 10 and auto decel mode is cancelled and S mode is selected.

Engine rpm	Effect
1900 ± 50	Same power as **non** mode type machine.

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**



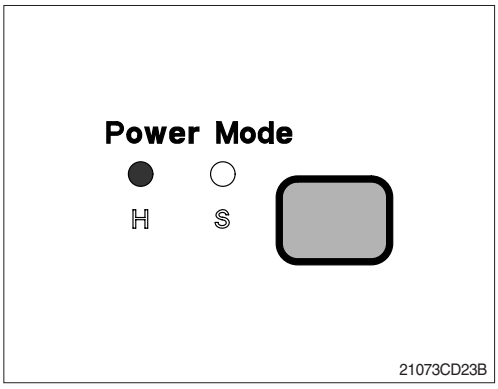
21073CD23A

(2) H mode

When the accel dial is at setting 10 and auto decel mode is cancelled and H mode is selected.

Engine rpm	Effect
2000 ± 50	Approximately 110% of power and speed available than **non** mode type machine or **S** mode.

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**



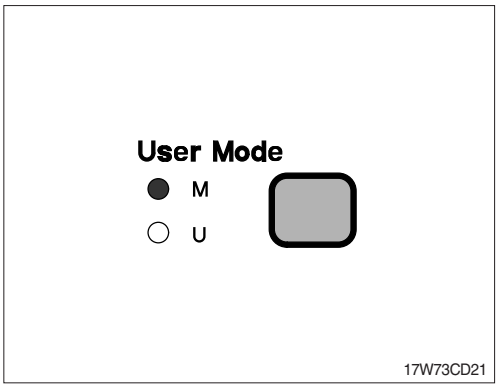
21073CD23B

(3) M mode

When the accel dial is at setting 10 and auto decel mode is cancelled and M mode is selected.

Engine rpm	Effect
2100 ± 50	Approximately 130% of power and speed available than **non** mode type machine or **S** mode.

※ **When the accel dial is located below 9 the engine speed decreases about 50~100 rpm per dial set.**



5. OPERATION OF THE WORKING DEVICE

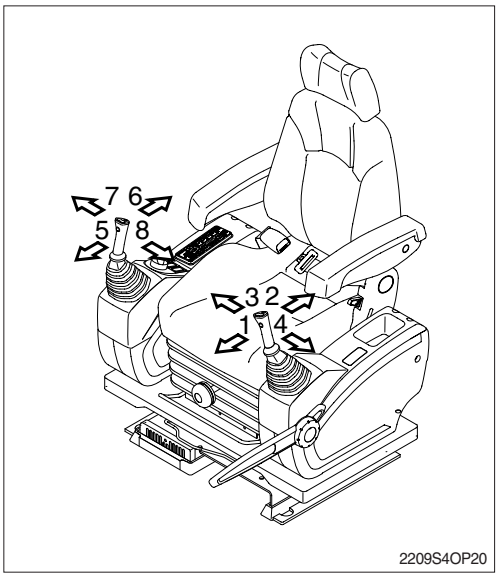
※ **Confirm the operation of control lever and working device.**

1) Left control lever controls arm and swing.

2) Right control lever controls boom and bucket.

3) When you release the control lever, control lever returns to neutral position automatically.

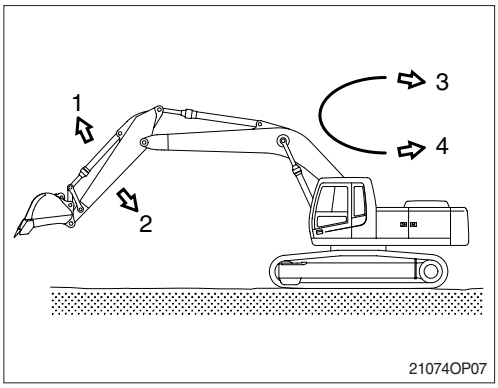
※ **When operating swing, consider the swing distance by inertia.**



2209S4OP20

※ **Left control lever**

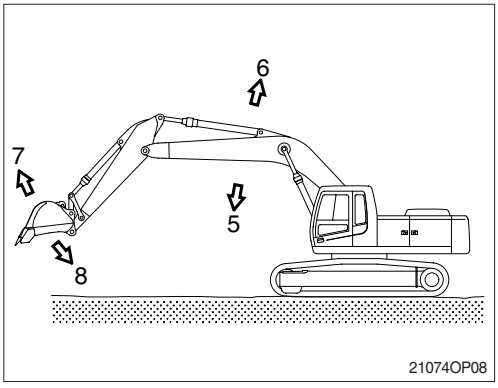
1 Arm roll-out
2 Arm roll-in
3 Swing right
4 Swing left



21074OP07

※ **Right control lever**

5 Boom lower
6 Boom raise
7 Bucket roll-out
8 Bucket roll-in



21074OP08

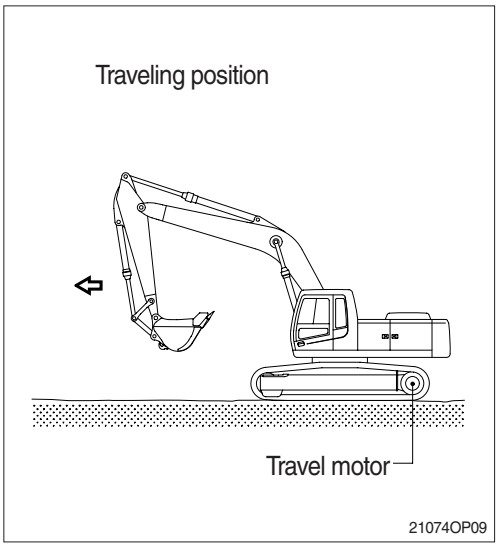
6. TRAVELING OF THE MACHINE

1) BASIC OPERATION

(1) Traveling position

It is the position which the traveling motor is in the rear and the working device is forward.

⚠ **Be careful as the traveling direction will be reversed when the whole machine is swinged 180 degree.**



(2) Traveling operation

It is possible to travel by either travel lever or pedal.

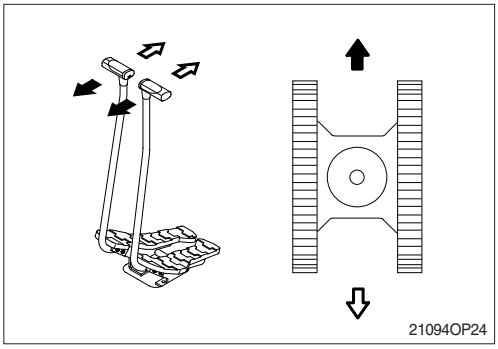
※ **Do not travel continuously for a long time.**

※ **Reduce the engine speed and travel at a low speed when traveling on uneven ground.**

(3) Forward and backward traveling

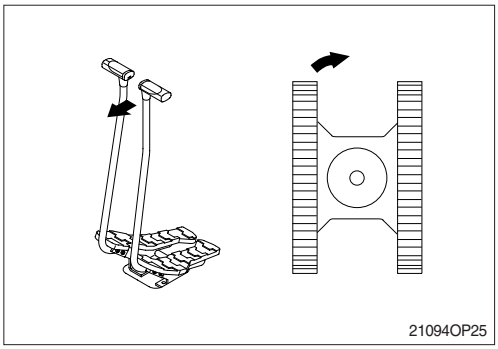
When the left and right travel lever or pedal are pushed at the same time, the machine will travel forward or backward.

※ **The speed can be controlled by the operation stroke of lever or pedal and change of direction will be controlled by difference of the left and right stroke.**



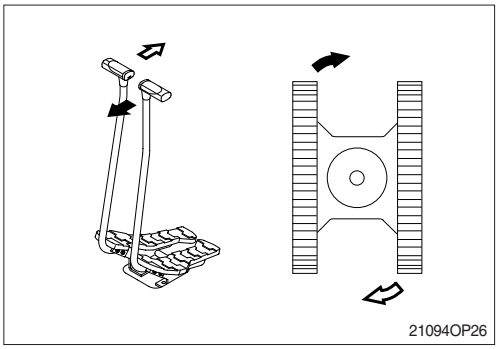
(4) Pivot turning

Operating only one side of lever or pedal make the change of direction possible by moving only one track.



(5) Counter rotation

It is to change the direction at the original place by moving the right and left track. Both side of lever or pedal are operated to the other way at the same time.



2) TRAVELING ON A SLOPE

(1) Make sure that the travel lever is properly maneuvered by confirming the travel motor is in the right location.

(2) Lower the bucket 20 to 30 ㎝ (1 ft) to the ground so that it can be used as a brake in an emergency.

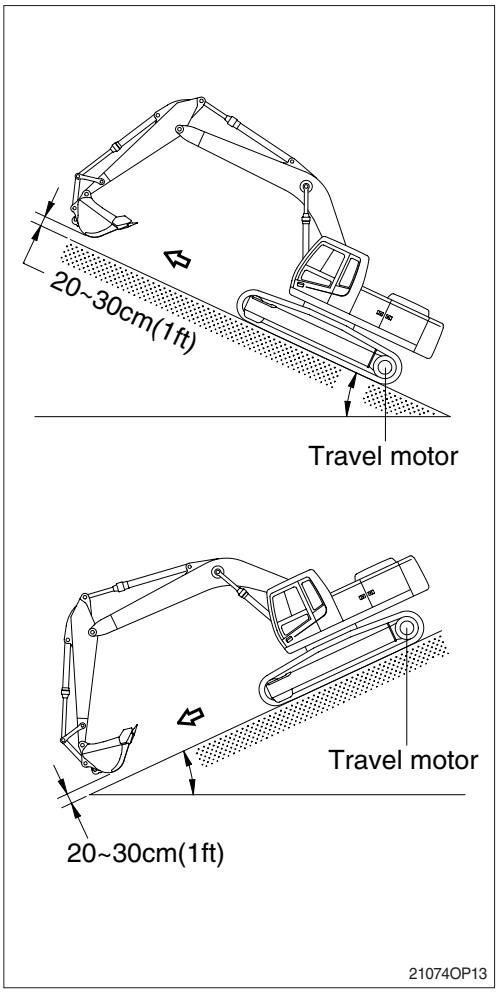
(3) If the machine starts to slide or loses stability, lower the bucket immediately and brake the machine.

(4) When parking on a slope, use the bucket as a brake and place blocks behind the tracks to prevent sliding.

※ **Machine cannot travel effectively on a slope when the oil temperature is low. Do the warming-up operation when it is going to travel on a slope.**

⚠ **Be careful when working on slopes. It may cause the machine to lose its balance and turn over.**

⚠ **Be sure to keep the travel speed switch on the LOW (turtle mark) while traveling on a slope.**



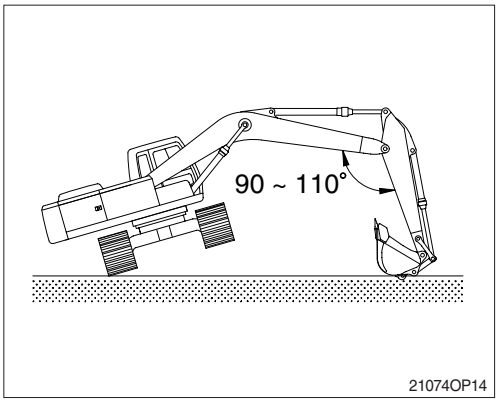
3) TRAVELING ON SOFT GROUND

※ **If possible, avoid to operate on soft ground.**

(1) Move forward as far as machine can move.

(2) Take care not to go beyond the depth where towing is impossible on soft ground.

(3) When driving becomes impossible, lower bucket and use boom and arm to pull the machine. Operate boom, arm, and travel lever at the same time to avoid the machine sinking.



4) TOWING THE MACHINE

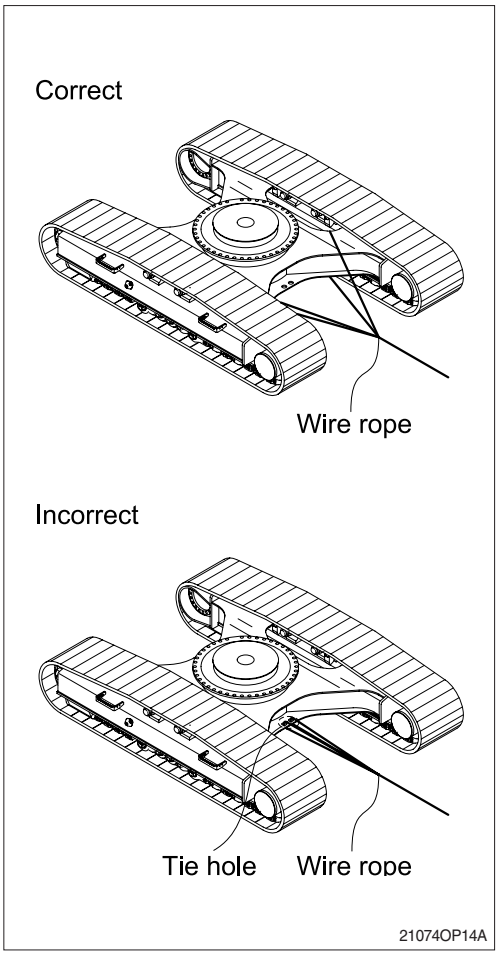
Tow the machine as follows when it can not move on it's own.

(1) Tow the machine by other machine after hook the wire rope to the frame as shown in picture at right.

(2) Hook the wire rope to the frame and put a support under each part of wire rope to prevent damage.

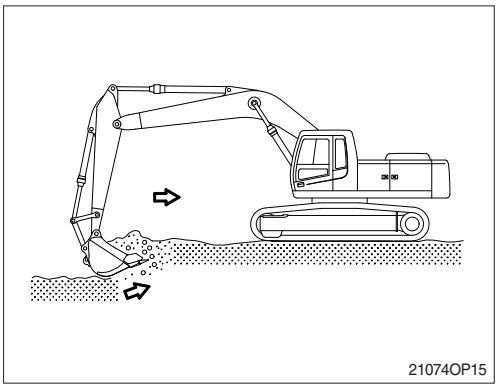
※ **Never tow the machine using only the tie hole, because this may break.**

⚠ **Make sure no personnel are standing close to the tow rope.**

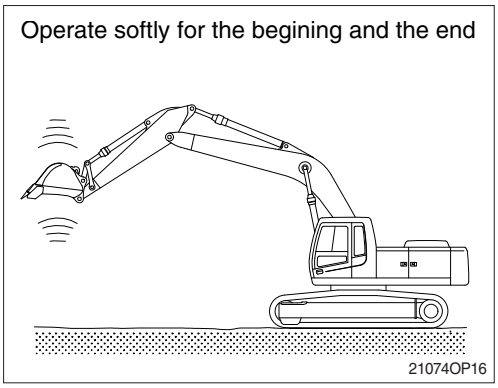


7. EFFICIENT WORKING METHOD

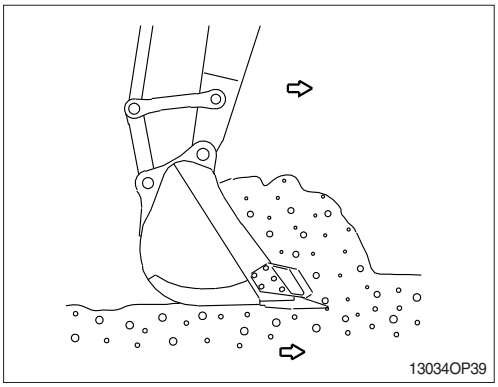
1) Do the digging work by arm.
   Use the pulling force of arm for digging and use together with the digging force of the bucket if necessary.



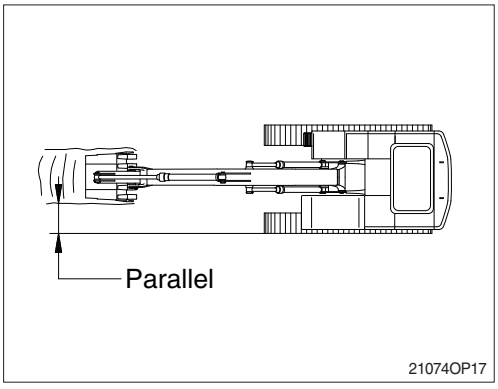
2) When lowering and raising the boom operate softly for the beginning and the end.
   In particularly, sudden stops while lowering the boom may cause damage to the machine.



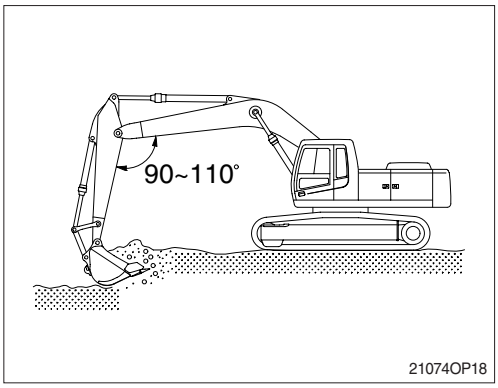
3) The digging resistance and wearing of tooth can be reduced by putting the end of bucket tooth to the digging direction.



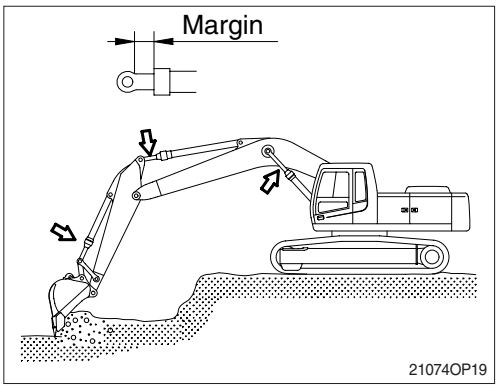
4) Set the tracks parallel to the line of the ditch to be excavated when digging ditch. Do not swing while digging.



5) Dig slowly with keeping the angle of boom and arm, 90-110 degree when maximum digging force is required.

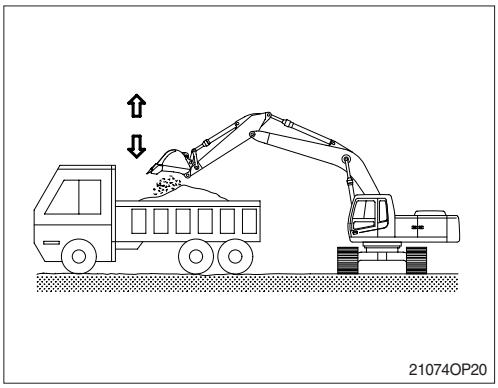


6) Operate leaving a small safety margin of cylinder stroke to prevent damage of cylinder when working with the machine.

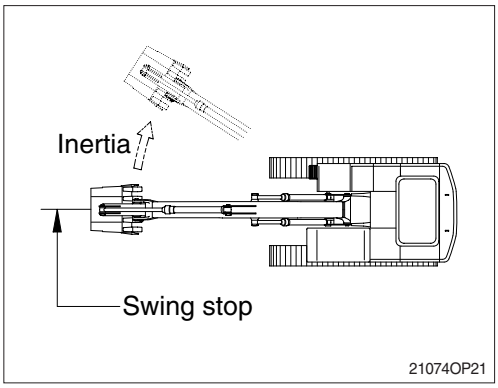


7) Keep the bucket to the dumping position and the arm horizontal when dumping the soil from the bucket.
   Operate bucket lever 2 or 3 times when hard to dump.

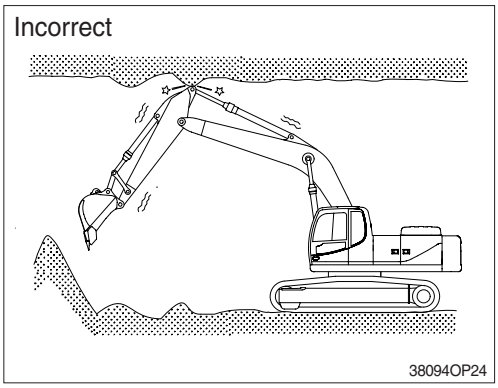
※ **Do not use the impact of bucket tooth when dumping.**



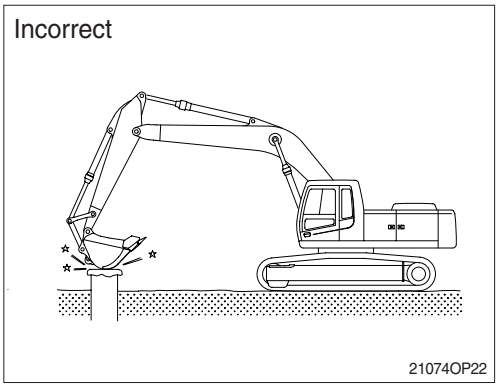
8) Operate stop of swing considering the swing slip distance is created by inertia after neutralizing the swing lever.



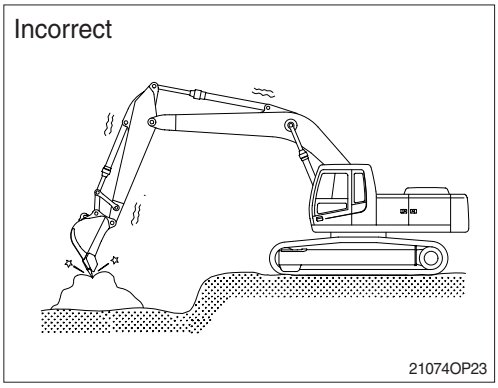
9) If the excavation is in an underground location or in a building, make sure that there is adequate overhead clearance and that there is adequate ventilation.



10) Do not use the dropping force of the work equipment for digging.
The machine can be damaged by the impact.



11) Do not use the bucket to crack hard objects like concrete or rocks.
This may break a tooth or pin, or bend boom.



12) NEVER CARRY OUT EXCESSIVE OPERATIONS

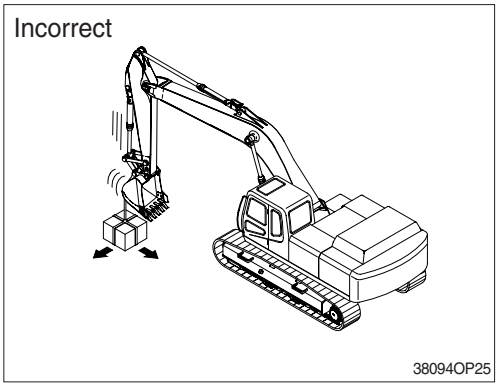
Operation exceeding machine performance may result in accident or failure.

Carry out lifting operation within specified load limit.

Never carry out operations which may damage the machine such as overload or over-impact-load.

Never travel while carrying a load.

In case you need installing over load warning device for object handling procedure, please contact Hyundai distributor.



12) BUCKET WITH HOOK

When carrying out lifting work, the special lifting hook is necessary.

The following operations are prohibited.

- Lifting loads with a wire rope fitted around the bucket teeth.
- Lifting loads with the wire rope wrapped directly around the boom or arm.

When performing lifting operation, securely hook the wire rope onto the special lifting hook.

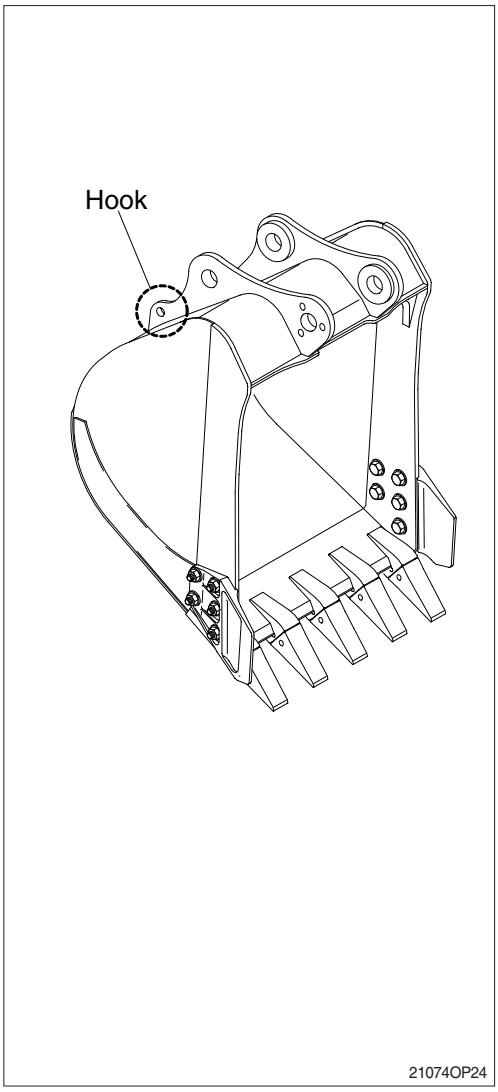
When performing lifting operation, never raise or lower a person.

Due to the possible danger of the load falling or of collision with the load, no persons shall be allowed in the working area.

Before performing lifting operation, designate an operation supervisor.
Always execute operation according to his instructions.

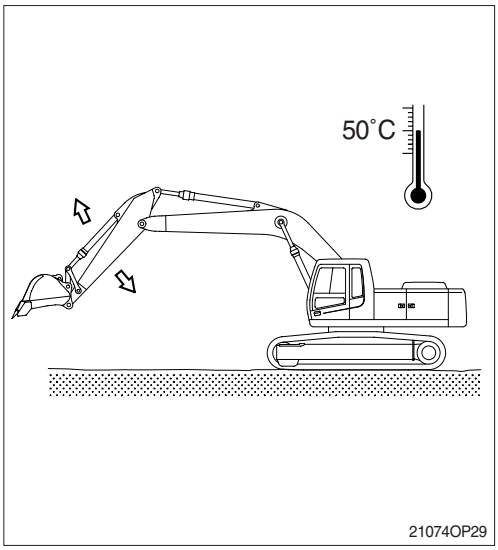
- Execute operating methods and procedures under his direction.
- Select a person responsible for signaling. Operate only on signals given by such person.

Never leave the operator's seat while lifting a load.



8. OPERATION IN THE SPECIAL WORK SITES

1) OPERATION THE MACHINE IN A COLD WEATHER



(1) Use proper engine oil and fuel for the weather.

(2) Fill the required amount of antifreeze in the coolant.

(3) Refer to the starting engine in cold weather. Start the engine and extend the warming up operation.

(4) Be sure to open the heater cock when using the heater.

(5) Always keep the battery completely charged.

※ **Discharged batteries will freeze more easily than fully charged.**

(6) Clean the machine and park on the wood plates.

2) OPERATION IN SANDY OR DUSTY WORK SITES

(1) Inspect air cleaner element frequently. Clean or replace element more frequently, if warning lamp comes ON and buzzer sounds simultaneously, regardless of inspection period.

※ **Replace the inner and outer element after 4 times of cleaning.**

(2) Inspect radiator, oil cooler and condenser frequently, and keep cooling fins clean.

(3) Prevent sand or dust from getting into fuel tank and hydraulic tank during refilling.

(4) Prevent sand or dust from penetrating into hydraulic circuit by tightly closing breather cap of hydraulic oil tank. Replace hydraulic oil filter and air breather element frequently. Also, replace the fuel filter frequently.

(5) Keep all lubricated part, such as pins and bushings, clean at all times.

(6) If the air conditioner and heater filters clogged, the heating or cooling capacity will drop. Clean or replace the filter element more frequently.

(7) Clean electrical components, especially the starting motor and alternator to avoid accumulation of dust.

3) SEA SHORE OPERATION

(1) Prevent ingress of salt by securely tightening plugs, cocks and bolts of each part.

(2) Wash machine after operation to remove salt residue.
Pay special attention to electrical parts, and hydraulic cylinders and track tension cylinder to prevent corrosion.

(3) Inspection and lubrication must be carried out more frequently.
Supply sufficient grease to replace all old grease in bearings which have been submerged in water for a long time.

4) OPERATION IN MUD, WATER OR RAIN WORK SITES

(1) Perform a walk around inspection to check for any loose fittings, obvious damage to the machine or any fluid leakage.

(2) After completing operations, clean mud, rocks or debris from the machine. Inspect for damage, cracked welds or loosened parts.

(3) Perform all daily lubrication and service.

(4) If the operations were in salt water or other corrosive materials, make sure to flush the affected equipment with fresh water.

5) OPERATION IN ROCKY WORK SITES

(1) Check for damage to the undercarriage and for looseness, flaws, wear and damage in bolts and nut.

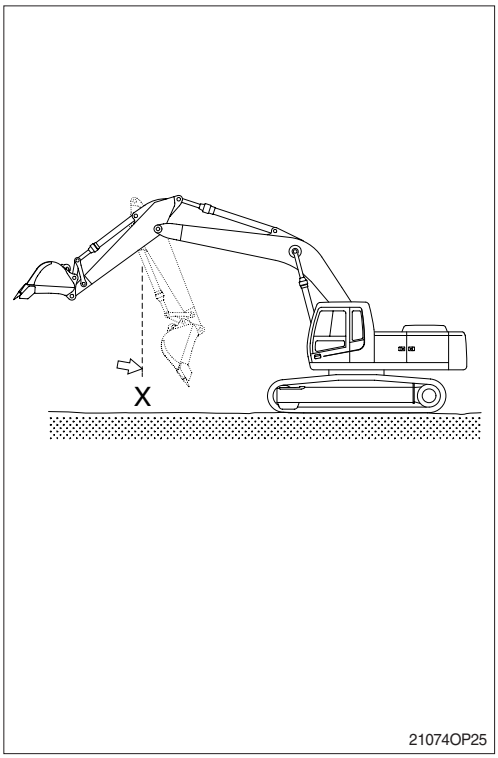
(2) Loosen the track tension a little when working in such areas.

(3) Do not turn the undercarriage directly over the sharp edge rock.

9. NORMAL OPERATION OF EXCAVATOR

Followings may occur during operation due to the nature of a hydraulic excavator.

1) When rolling in the arm, the roll-in movement stop momentary at point X in the picture shown, then recovers speed again after passing point X.
   The reason for this phenomenon is that movement by the arm weight is faster than the speed of oil flow into the cylinder.
2) When lowering the boom, one may hear continuous sound.
   This is caused by oil flow in the valve.
3) Overloaded movement will produce sound caused by the relief valves, which are for the protection of the hydraulic systems.
4) When the machine is started swing or stopped, a noise near the swing motor may be heard. The noise is generated when the brake valve relieves.



10. ATTACHMENT LOWERING (when engine is stopped)

1) On machines equipped with an accumulator, for a short time (within 1 minute) after the engine is stopped, the attachment will lower under its own weight when the attachment control lever is shifted to LOWER. That is happen only starting switch ON position and safety lever UNLOCK position. After the engine is stopped, set the safety lever to the LOCK position.

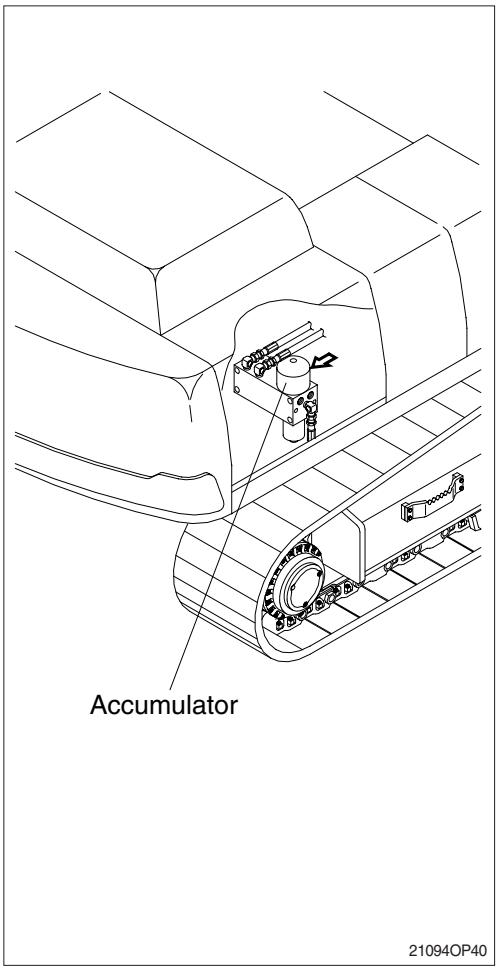
⚠ **Be sure no one is under or near the attachment before lowering the boom.**

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

⚠ **Never make any hole in the accumulator expose it to flame or fire.**

⚠ **Do not weld anything to the accumulator.**

※ **When carrying out disassembly or maintenance of the accumulator, or when disposing of the accumulator, it is necessary to release the gas from the accumulator.**
A special air bleed valve is necessary for this operation, so please contact your Hyundai distributor.



11. STORAGE

Maintain the machine taking care of following to prevent the deterioration of machine when storing the machine for a long time, over 1 month.

1) BEFORE STORAGE

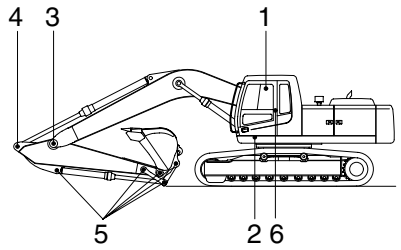
(1) Cleaning the machine

Clean the machine. Check and adjust tracks. Grease each lubrication part.

(2) Lubrication position of each part

Change all oil.

※ Be particularly careful when you reuse the machine.
As oil can be diluted during storage.
Apply an anticorrosive lubricant on the exposed part of piston rod of cylinder and in places where the machine rusts easily.



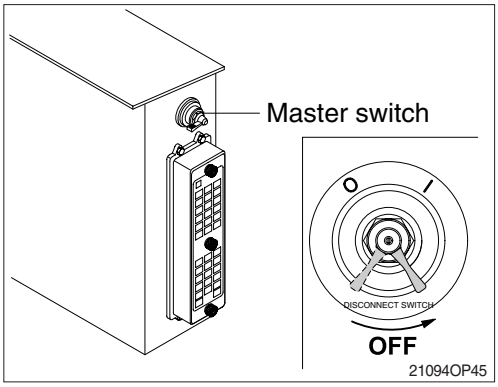
1 Lubricating manifold (5EA)
2 Boom cylinder pin (2EA)
3 Boom and arm connection pin (1EA)
4 Arm cylinder pin (rod side, 1EA)
5 Arm and bucket (6EA)
6 Boom rear bearing center (1EA)

21074OP26

(3) Master switch

Turn OFF the master switch mounted electric box and store the machine.

(4) Be sure to mix anticorrosive antifreezing solution in the radiator.

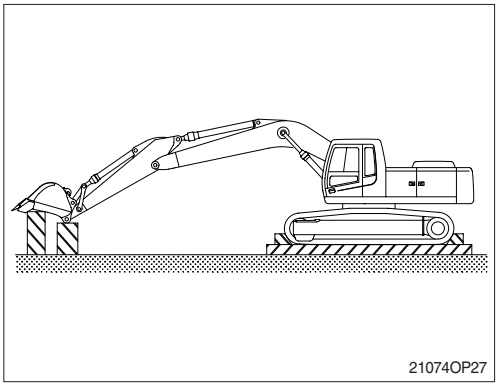


21094OP45

(5) Prevention of dust and moisture

Keep machine dry. Store the machine setting wood on the ground.

※ Cover exposed part of piston rod of cylinder.
※ Lower the bucket to the ground and set a support under track.



21074OP27

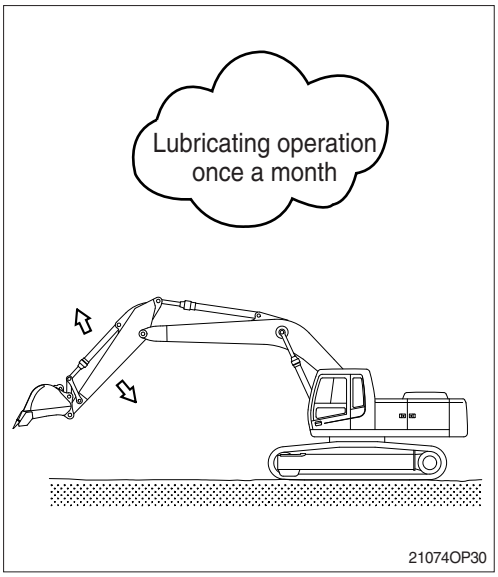
2) DURING STORAGE

Start engine and move the machine and work equipment once a month and apply lubrication to each part.

※ **Check the level of engine oil and coolant and fill if required when starting engine.**

※ **Clean the anticorrosive on the piston rod of cylinder.**

※ **Operate the machine such as traveling, swing and work equipment operation to make sure enough lubrication of all functional components.**



※ BATTERY

① **Once a month, start the engine for 15 minutes (or use a charger) to charge the battery.**

② **Every 2 months, check the battery voltage and keep battery voltage over 25.08V.**

③ **If the machine stock period is over 6 months, disconnect the battery negative (-) terminal.**

3) AFTER STORAGE

Carry out the following procedure when taking out of a long time storage.

(1) Wipe off the anticorrosive lubricant on the hydraulic piston rod.

(2) Completely fill fuel tank, lubricate and add oil.

(3) **When storage period is 6 months over**

If the machine stock period is over 6 months, carry out the following procedure.

This procedure is to drain condensation water for the **swing reduction gear** durability.

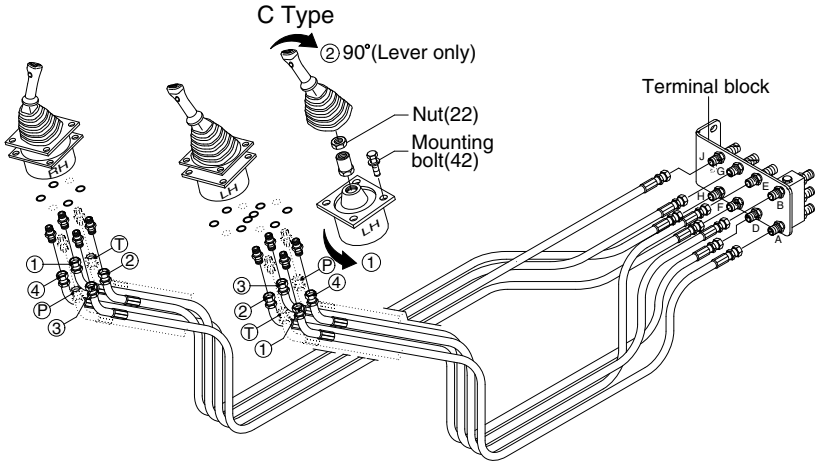
※ **Remove the drain port plug and drain the water until the gear oil comes out and then tighten the drain plug.**

※ **Refer to the service instruction, section 6 for the drain plug location.**

※ **If the machine is stored without carrying out the monthly lubricating operation, consult your Hyundai dealer for service.**

12. RCV LEVER OPERATING PATTERN

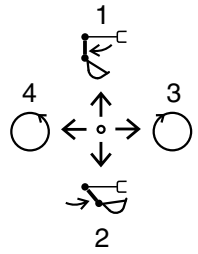
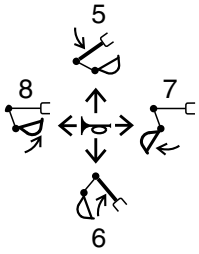
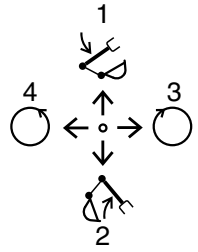
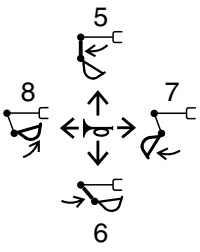
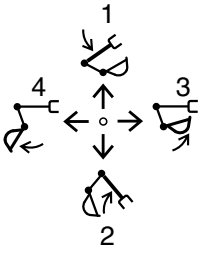
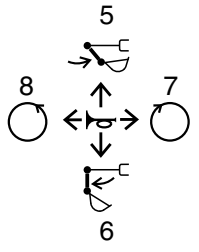
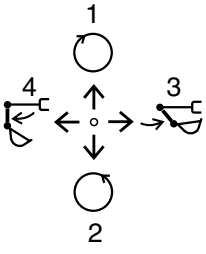
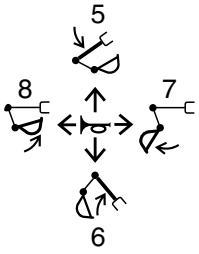
1) PATTERN CHANGE VALVE NOT INSTALL (standard)



※ Whenever a change is made to the machine control pattern also exchange the pattern label in the cab to match the new pattern.

※ The hose modification works must be carried out between RCV lever and terminal block (Not between terminal block and MCV).

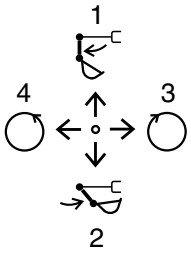
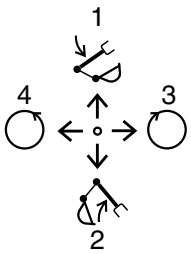
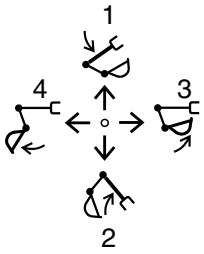
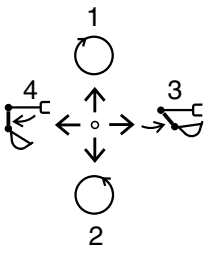
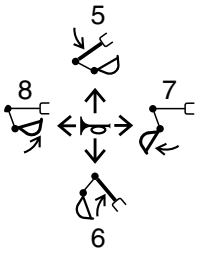
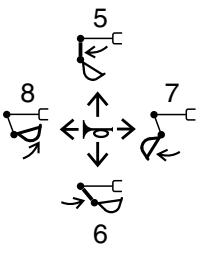
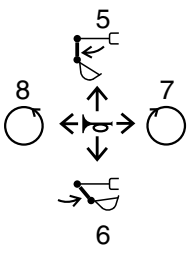
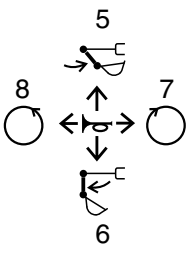
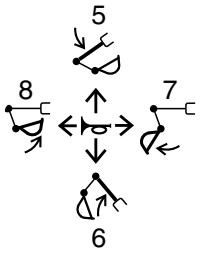
2209S4OP50

Pattern	Operation		Control function		Hose connection (port)		
	Left RCV lever	Right RCV lever			RCV lever	Change of Terminal block From	To
ISO Type Hyundai			Left	1 Arm out	②	D	-
				2 Arm in	④	E	-
				3 Swing right	③	B	-
				4 Swing left	①	A	-
			Right	5 Boom lower	④	J	-
				6 Boom raise	②	H	-
				7 Bucket out	①	G	-
				8 Bucket in	③	F	-
A Type			Left	1 Boom lower	②	D	J
				2 Boom raise	④	E	H
				3 Swing right	③	B	-
				4 Swing left	①	A	-
			Right	5 Arm out	④	J	D
				6 Arm in	②	H	E
				7 Bucket out	①	G	-
				8 Bucket in	③	F	-
B Type			Left	1 Boom lower	②	D	J
				2 Boom raise	④	E	H
				3 Bucket in	③	B	F
				4 Bucket out	①	A	G
			Right	5 Arm out (-#7800)	④	J	D
				5 Arm in (#7801-)	④	J	D
				6 Arm in (-#7800)	②	H	E
				6 Arm out (#7801-)	②	H	E
				7 Swing right	①	G	B
				8 Swing left	③	F	A
C Type			Left	① Loosen the RCV lever mounting bolt (42) and rotates lever assy 90˚ counterclockwise; then install. ② To put lever in correct position, disassemble nut (22) and rotates only lever 90˚ clockwise.			
			Right	Same as ISO type			

2) PATTERN CHANGE VALVE INSTALL (option)

※ **If the machine is equipped with the pattern change valve, the machine operation pattern can be easily changed.**

※ **Whenever a change is made to the machine control pattern also exchange the pattern label in the cab to match the new pattern.**

Operation	ISO type	A type	B type		C type
			-#7800	#7801-	
Left RCV lever					
Right RCV lever					

(1) The machine control pattern can be easily changed from the "ISO type" to "A type", "B type" or "C type" by changing the position of the lever position.

⚠ **Before starting the machine, check the lever position of pattern change valve and actual operating of attachment.**

(2) Change of operating pattern

- A type

① Loosen the wing bolt.

② Move lever from the "ISO" type to "A", "B" or "C" type position.

③ After the lever is set, tighten the bolt in order to secure the lever.

- B type

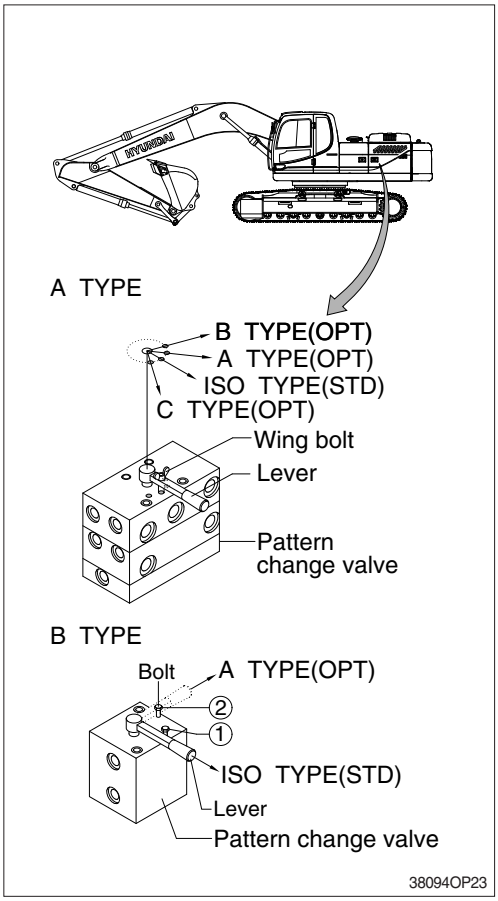
① Loosen bolt (1) or bolt (2).

② Move lever to the "ISO" or "A" position.

③ After setting to secure lever.

· Bolt (1) for "ISO" pattern

· Bolt (2) for "A" pattern

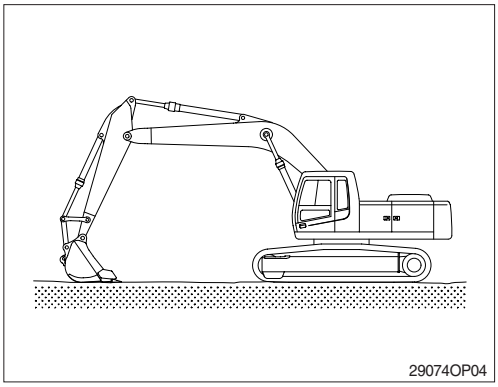


13. SWITCHING HYDRAULIC ATTACHMENT CIRCUIT

1) The combined hydraulic attachment circuit is capable of providing single action or double action.

2) The position of 3 way valve selects the single action hydraulic attachment circuit or the double action hydraulic attachment circuit.

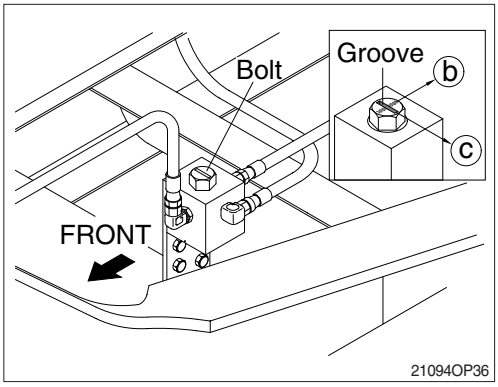
3) Before you change the flow mode of hydraulic attachment circuit, place the machine in the servicing position as shown. Stop the engine.



4) Use the spanner to turn the bolt of 3 way valve. Make sure that you turn the bolt between ⓑ and ⓒ.

(1) One way flow (hydraulic breaker)
Position the groove parallel to the piping (ⓑ).

(2) Two way flow (clamshell or shear)
Position the groove perpendicular to the piping (ⓒ).



1. PREPARATION FOR TRANSPORTATION

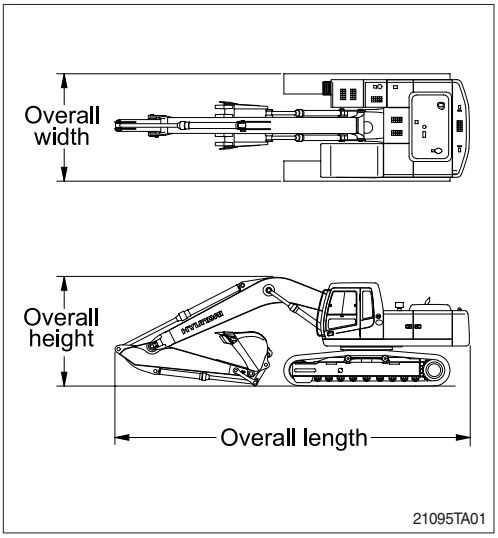
1) When transporting the machine, observe the various road rules, road transportation vehicle laws and vehicle limit ordinances, etc.

2) Select proper trailer after confirming the weight and dimension from the chapter 2, specification.

3) Check the whole route such as the road width, the height of bridge and limit of weight and etc., which will be passed.

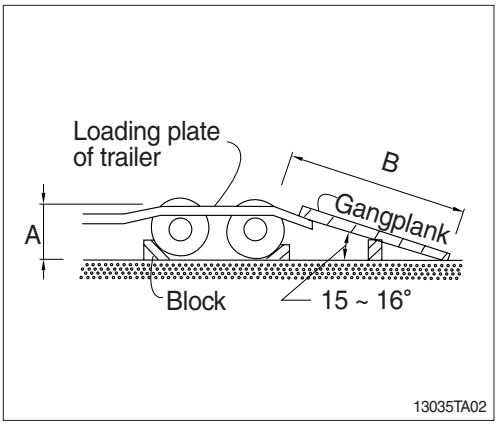
4) Get the permission from the related authority if necessary.

5) Prepare suitable capacity of trailer to support the machine.



6) Prepare gangplank for safe loading referring to the below table and illustration.

A	B
1.0	3.65 ~ 3.85
1.1	4.00 ~ 4.25
1.2	4.35 ~ 4.60
1.3	4.75 ~ 5.00
1.4	5.10 ~ 5.40
1.5	5.50 ~ 5.75



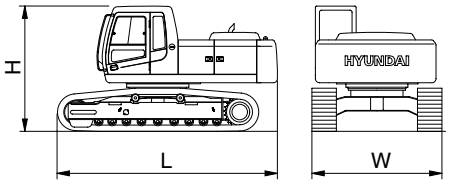
2. DIMENSION AND WEIGHT

1) R220LC-9S

(1) Base machine

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	4990 (16' 4")
H	Height	mm (ft-in)	2920 (9' 7")
W	Width	mm (ft-in)	2990 (9' 10")
Wt	Weight	kg (lb)	17610 (38820)

※ With 600 mm (24") triple grouser shoes and 3800 kg (8380 lb) counterweight.

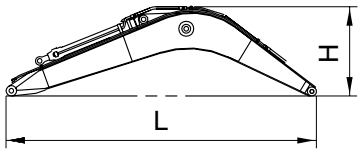


21095TA02

(2) Boom assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	5900 (19' 4")
H	Height	mm (ft-in)	1550 (5' 1")
W	Width	mm (ft-in)	700 (2' 4")
Wt	Weight	kg (lb)	1950 (4300)

※ 5.68 m (18' 8") boom with arm cylinder (included piping and pins).

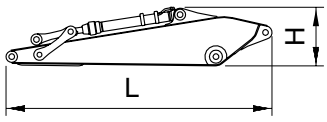


13035TA03

(3) Arm assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	3910 (12'10")
H	Height	mm (ft-in)	870 (2' 10")
W	Width	mm (ft-in)	350 (1' 2")
Wt	Weight	kg (lb)	1095 (2410)

※ 2.92 m (9' 7") arm with bucket cylinder (included linkage and pins).

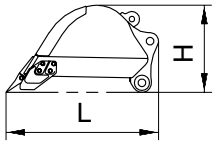


13035TA04

(4) Bucket assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	1600 (5' 3")
H	Height	mm (ft-in)	980 (3' 3")
W	Width	mm (ft-in)	1270 (4' 2")
Wt	Weight	kg (lb)	765 (1690)

※ 0.92 m^3 (1.20 yd^3) SAE heaped bucket (included tooth and side cutters).

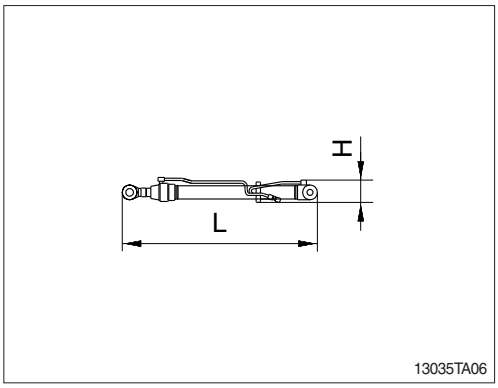


13035TA05

(5) Boom cylinder

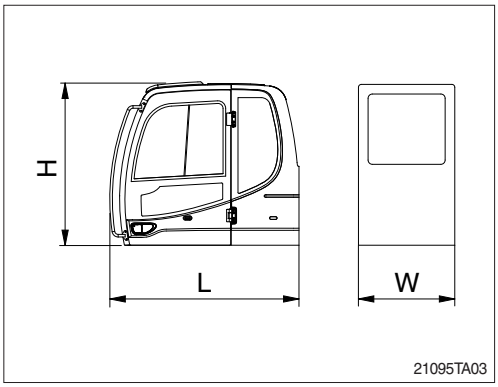
Mark	Description	Unit	Specification
L	Length	mm (ft-in)	1960 (6' 5")
H	Height	mm (ft-in)	230 (0' 9")
W	Width	mm (ft-in)	330 (1' 1")
Wt	Weight	kg (lb)	180 (400)

※ **Included piping.**



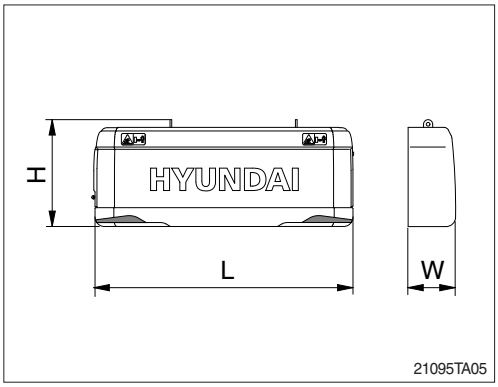
(6) Cab assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	2000 (6' 7")
H	Height	mm (ft-in)	1740 (5' 9")
W	Width	mm (ft-in)	1288 (4' 2")
Wt	Weight	kg (lb)	440 (970)



(7) Counterweight

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	2740 (9' 0")
H	Height	mm (ft-in)	1160 (3' 10")
W	Width	mm (ft-in)	560 (1' 10")
Wt	Weight	kg (lb)	3800 (8380)

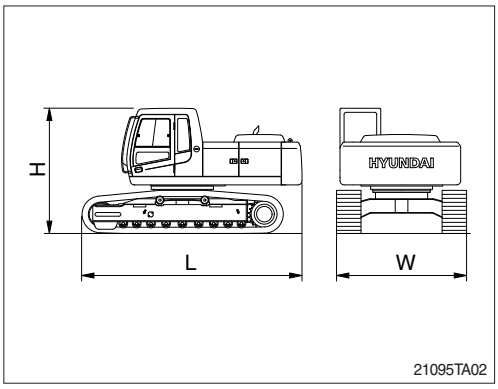


2) R220LC-9S LONG REACH

(1) Base machine

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	4990 (16' 4")
H	Height	mm (ft-in)	2920 (9' 7")
W	Width	mm (ft-in)	3190 (10' 6")
Wt	Weight	kg (lb)	19850 (43760)

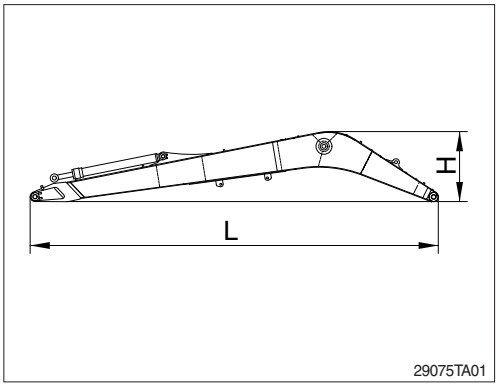
※ With 800 mm (32") triple grouser shoes and 5300 kg (11680 lb) counterweight.



(2) Boom assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	8395 (27' 7")
H	Height	mm (ft-in)	1515 (5' 0")
W	Width	mm (ft-in)	800 (2' 7")
Wt	Weight	kg (lb)	2470 (5450)

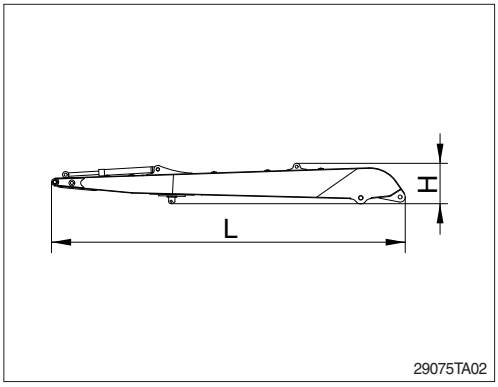
※ 8.2 m (26' 11") boom with arm cylinder (included piping and pins).



(3) Arm assembly

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	7280 (23' 11")
H	Height	mm (ft-in)	835 (12' 9")
W	Width	mm (ft-in)	480 (1' 7")
Wt	Weight	kg (lb)	1340 (2960)

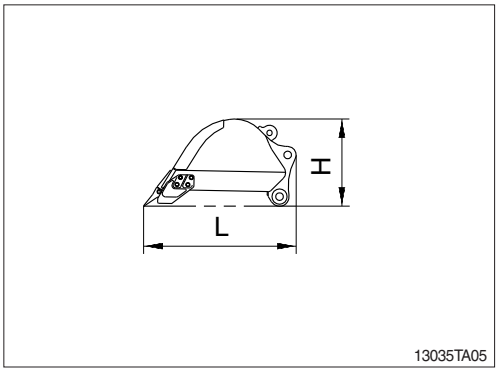
※ 6.3 m (20' 8") arm with bucket cylinder (included linkage and pins).



(4) Bucket assembly

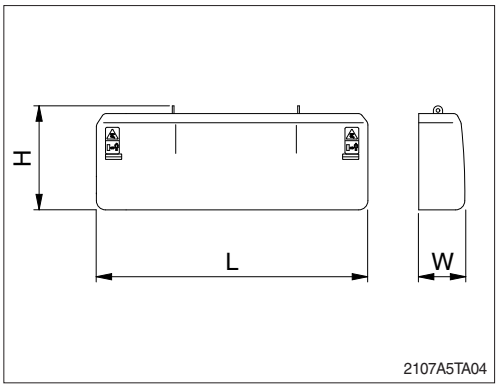
Mark	Description	Unit	Specification
L	Length	mm (ft-in)	1400 (4' 7")
H	Height	mm (ft-in)	820 (2' 8")
W	Width	mm (ft-in)	1035 (3' 5")
Wt	Weight	kg (lb)	460 (1010)

※ 0.52 m³ (0.68 yd³) SAE heaped bucket (included tooth and side cutters).



(5) Counterweight

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	2740 (9' 0")
H	Height	mm (ft-in)	1162 (3' 10")
W	Width	mm (ft-in)	560 (1' 10")
Wt	Weight	kg (lb)	5300 (11680)

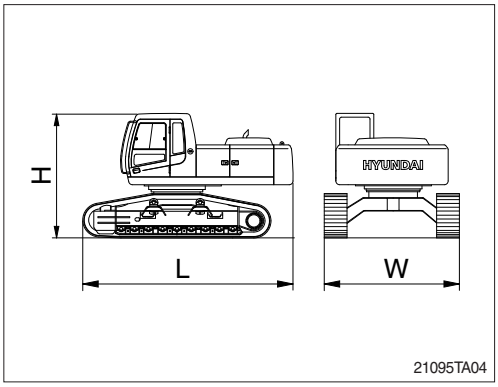


3) R220LC-9S HIGH WALKER

(1) Base machine

Mark	Description	Unit	Specification
L	Length	mm (ft-in)	4990 (16' 4")
H	Height	mm (ft-in)	3100 (10' 2")
W	Width	mm (ft-in)	3395 (11' 2")
Wt	Weight	kg (lb)	19070 (42040)

※ With 600 mm (24") triple grouser shoes and 3800 kg (8380 lb) counterweight.

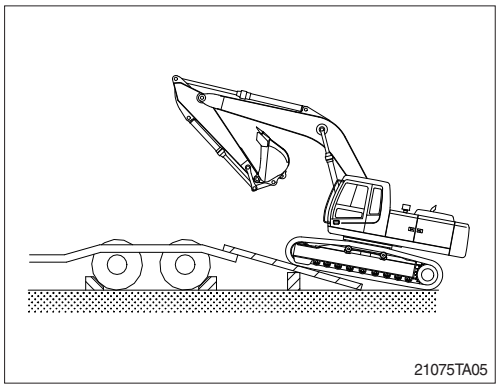


3. LOADING THE MACHINE

1) Load and unload the machine on a flat ground.

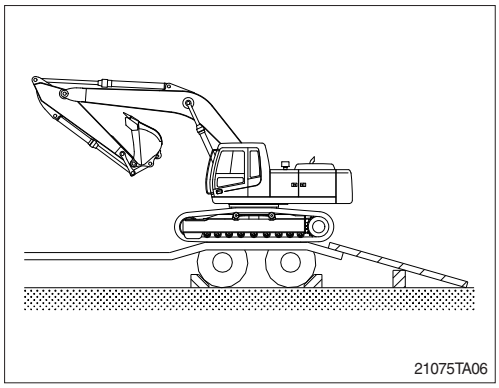
2) Use the gangplank with sufficient length, width, thickness and gradient.

3) Place the safety lever to the LOCK position (if equipped) before fixing the machine at the bed of trailer and confirm if the machine parallels the bed of trailer.
   Keep the travel motor in the rear when loading and in the front when unloading.

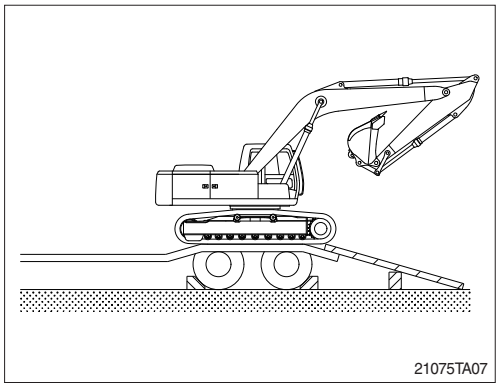

21075TA05

4) Do the following after loading the machine to the trailer.

(1) Stop loading when the machine is located horizontally with the rear wheel of trailer.


21075TA06

(2) Place the safety lever to the LOCK position (if equipped) after the swing the machine 180 degree.


21075TA07

(3) Lower the working equipment gently after the location is determined.

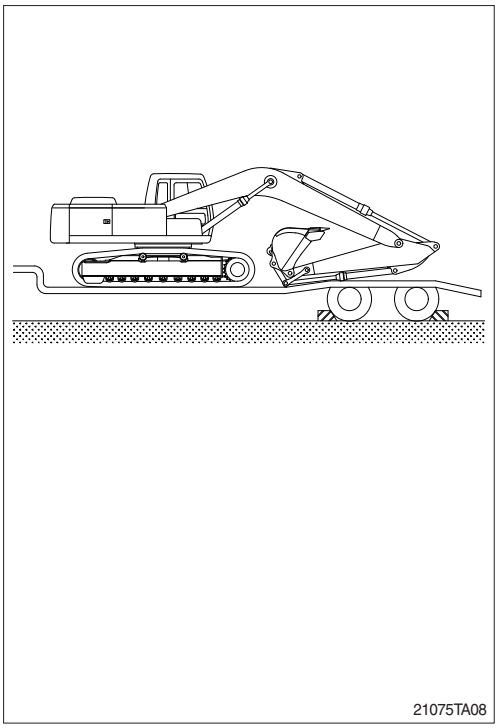
※ **Place rectangular timber under the bucket cylinder to prevent the damage of it during transportation.**

⚠ **Be sure to keep the travel speed switch on the LOW (turtle mark) while loading and unloading the machine.**

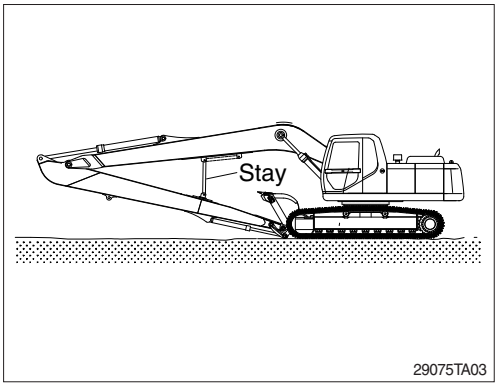
⚠ **Avoid using the working equipment for loading and unloading since it will be very dangerous.**

⚠ **Do not operate any other device when loading.**

⚠ **Be careful on the boundary place of loading plate or trailer as the balance of machine will abruptly be changed on the point.**


21075TA08

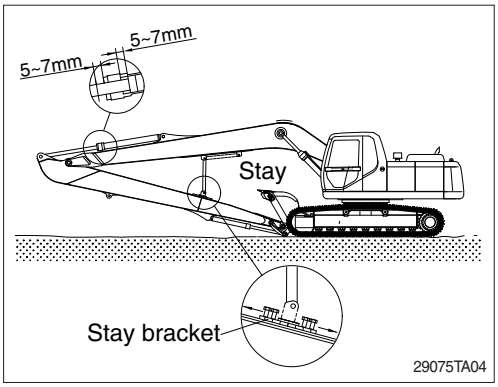
⚠ **The machine with long reach attachments should be moved or transmitted with boom and arm fixed using stay.**



29075TA03

5) Fix method of stay bracket

(1) Extend arm cylinder to maximum.
(2) Mark on the rod of 5~7 mm distance from tube end.
(3) Retract the arm cylinder to the mark.
(4) Adjust the stay bracket and than fix the stay to the proper location.



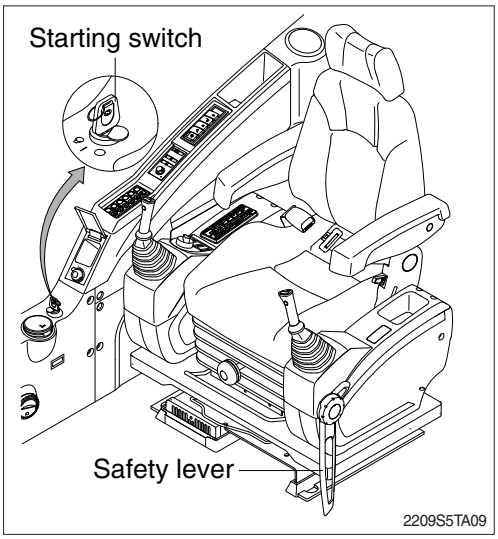
29075TA04

4. FIXING THE MACHINE

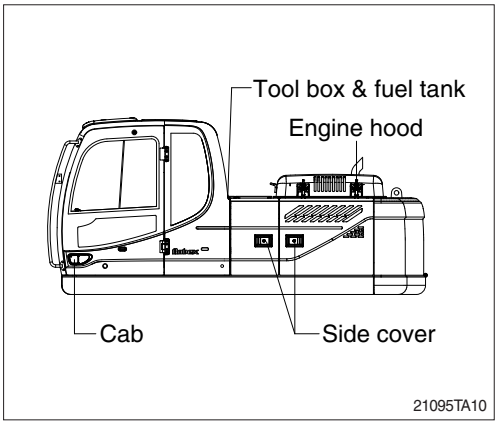
1) Lower down the working device on the loading plate of trailer.

2) Keep the safety lever on the LOCK position.

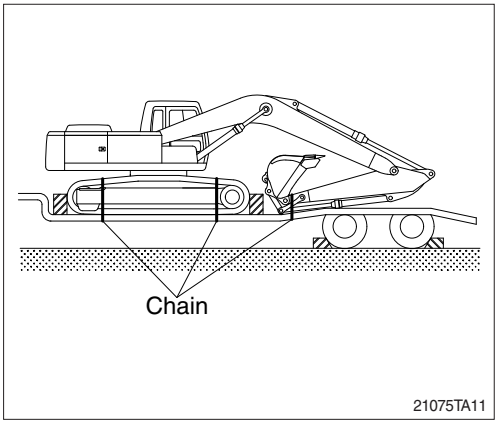
3) Turn OFF all the switches and remove the key.



4) Secure all locks.



5) Place timber underneath of the track and fix firmly with wire rope to prevent the machine from moving forward, backward, right or left.



5. LOADING AND UNLOADING BY CRANE

1) Check the weight, length, width and height of the machine referring to the chapter 2, specification when you are going to hoist the machine.

2) Use long wire rope and stay to keep the distance with the machine as it should avoid touching with the machine.

3) Put a rubber plate contact with wire rope and machine to prevent damage.

4) Place crane on the proper place.

5) Install the wire rope and stay like the illustration.

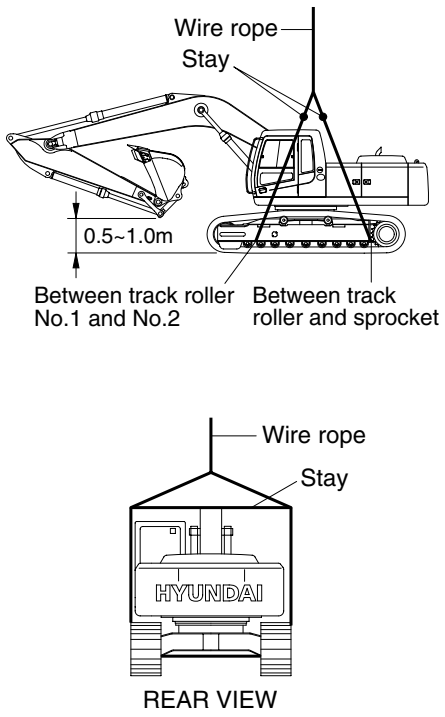
⚠ **Make sure wire rope is proper size.**

⚠ **Place the safety lever to LOCK position to prevent the machine moving when hoisting the machine.**

⚠ **The wrong hoisting method or installation of wire rope can cause damage to the machine.**

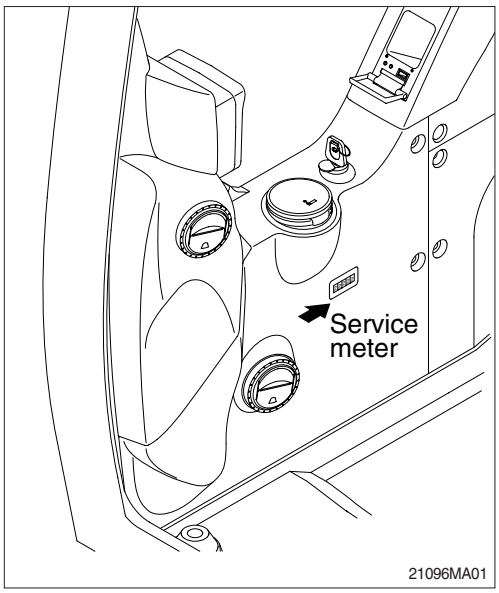
⚠ **Do not load abruptly.**

⚠ **Keep area clear of personnel.**



1. INSTRUCTION

1) INTERVAL OF MAINTENANCE



(1) You may inspect and service the machine by the period as described at page 6-11 based on hour meter at control panel.

(2) Shorten the interval of inspect and service depending on site condition. (such as dusty area, quarry, sea shore and etc.)

(3) Practice the entire related details at the same time when the service interval is doubled.
For example, in case of 100hours, carry out all the maintenance 「Each 100hours, each 50 hours and daily service」 at the same time.

2) PRECAUTION

(1) Start to maintenance after you have the full knowledge of machine.

(2) The monitor installed on this machine does not entirely guarantee the condition of the machine.
Daily inspection should be performed according to clause 4, maintenance check list.

(3) Engine and hydraulic components have been preset in the factory.
Do not allow unauthorized personnel to reset them.

(4) Ask to your local dealer or Hyundai for the maintenance advice if unknown.

(5) Drain the used oil and coolant in a container and handle according to the method of handling for industrial waste to meet with regulations of each province or country.

3) PROPER MAINTENANCE

(1) Replace and repair of parts

It is required to replace the wearable and consumable parts such as bucket tooth, side cutter, filter and etc., regularly.

Replace damaged or worn parts at proper time to keep the performance of machine.

(2) Use genuine parts.

(3) Use the recommended oil.

(4) Remove the dust or water around the inlet of oil tank before supplying oil.

(5) Drain oil when the temperature of oil is warm.

(6) Do not repair anything while operating the engine.

Stop the engine when you fill the oil.

(7) Relieve hydraulic system of the pressure before repairing the hydraulic system.

(8) Confirm if the cluster is in the normal condition after completion of service.

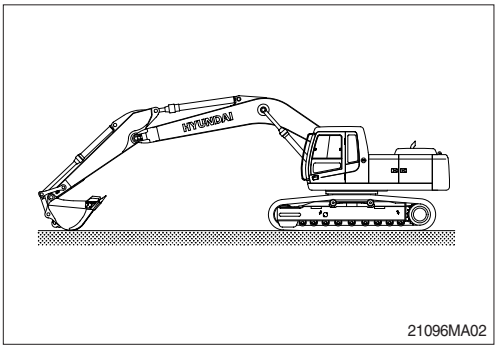
(9) For more detail information of maintenance, please contact local Hyundai dealer.

※ **Be sure to start the maintenance after fully understand the chapter 1, safety hints.**

4) RELIEVING THE PRESSURE IN THE HYDRAULIC SYSTEM

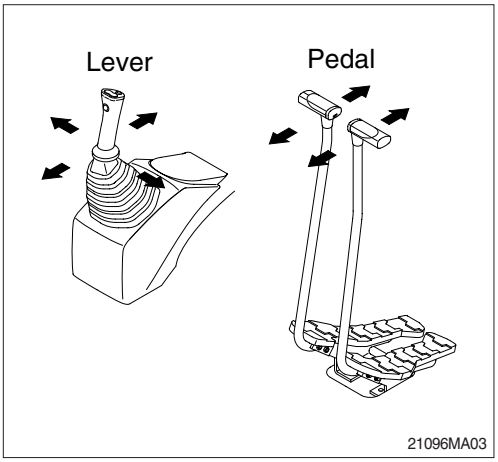
※ **Spouting of oil can cause the accident when loosening the cap or hose right after the operating of machine as the machine or oil is on the high pressure on the condition.**
Be sure to relieve the pressure in the system before repairing hydraulic system.

(1) Place machine in parking position, and stop the engine.

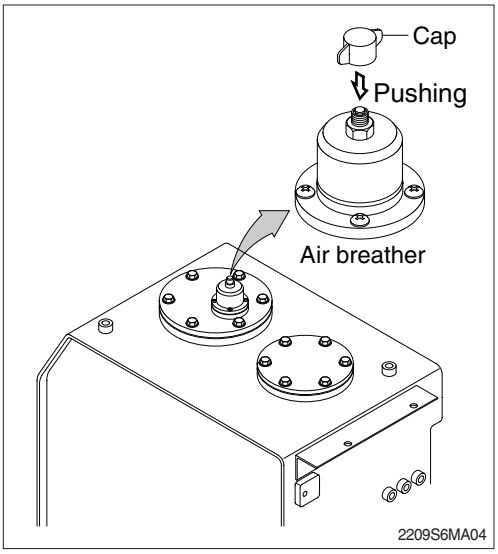


(2) Set the safety lever completely in the release position, operate the control levers and pedals fully to the front, rear, left and right, to release the pressure in the hydraulic circuit.

※ **This does not completely release the pressure, so when serving hydraulic component, loosen the connections slowly and do not stand in the direction where the oil spurt out.**



(3) Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.



5) PRECAUTION WHEN INSTALLING HYDRAULIC HOSES OR PIPES

(1) Be particularly careful that the joint of hose, pipe and functioning item are not damaged. Avoid contamination.

(2) Assemble after cleaning the hose, pipe and joint of functioning item.

(3) Use genuine parts.

(4) Do not assemble the hose in the condition of twisted or sharp radius.

(5) Keep the specified tighten torque.

6) PERIODICAL REPLACEMENT OF SAFETY PARTS

(1) It is desirable to do periodic maintenance the machine for using the machine safely for a long time.
However, recommend to replace regularly the parts related safety not only safety but maintain satisfied performance.

(2) These parts can cause the disaster of life and material as the quality changes by passing time and it is worn, diluted, and gets fatigued by using repeatedly.
These are the parts which the operator can not judge the remained lifetime of them by visual inspection.

(3) Repair or replace if an abnormality of these parts is found even before the recommended replacement interval.

<table>
<tr><th colspan="3">Periodical replacement of safety parts</th><th>Interval</th></tr>
<tr><td colspan="2" rowspan="2">Engine</td><td>Fuel hose (tank-engine)</td><td rowspan="2">Every
2 years</td></tr>
<tr><td>Heater hose
(heater-engine)</td></tr>
<tr><td rowspan="6">Hydraulic system</td><td rowspan="3">Main circuit</td><td>Pump suction hose</td><td rowspan="3">Every
2 years</td></tr>
<tr><td>Pump delivery hose</td></tr>
<tr><td>Swing hose</td></tr>
<tr><td rowspan="3">Working device</td><td>Boom cylinder line hose</td><td rowspan="3">Every
2 years</td></tr>
<tr><td>Arm cylinder line hose</td></tr>
<tr><td>Bucket cylinder line hose</td></tr>
</table>

※ 1. Replace O-ring and gasket at the same time when replacing the hose.

2. Replace clamp at the same time if the hose clamp is cracked when checking and replacing the hose.

2. TIGHTENING TORQUE

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6 × 1.0	0.9 ~ 1.3	6.5 ~ 9.4	1.1 ~ 1.7	8.0 ~ 12.3
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60.0
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.5	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.25	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

2) PIPE AND HOSE (FLARE type)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

4) TIGHTENING TORQUE OF MAJOR COMPONENT

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket)	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
2		Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	55 ± 3.5	398 ± 25
3		Engine mounting bolt (bracket-frame, RR)	M24 × 3.0	97 ± 7.0	702 ± 51
4		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
5		Coupling mounting socket bolt	M18 × 2.5	32 ±1.0	231 ±7.2
6		Fuel tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
7	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	4.8 ± 0.3	34.7 ± 2.2
8		Main pump mounting socket bolt	M20 × 2.5	42 ± 4.5	304 ± 32.5
9		Main control valve mounting nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
11		Turning joint mounting bolt, nut	M12 × 1.75	12.3 ± 1.3	89.0 ± 9.4
12	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 5.8	422 ± 42
13		Swing bearing upper part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
14		Swing bearing lower part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
15		Travel motor mounting bolt	M16 × 2.0	23 ± 2.5	166 ± 18.1
16		Sprocket mounting bolt	M16 × 2.0	26 ± 3.0	188 ± 21.7
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7± 3.0	215 ± 21.7
18		Track roller mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Track tension cylinder mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
20		Track shoe mounting bolt, nut	M20 × 1.5	78 ± 8.0	564 ± 57.9
21		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
22	Others	Counterweight mounting bolt	M36 × 3.0	337 ± 33	2440 ± 72.3
23		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
24		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

3. FUEL, COOLANT AND LUBRICANTS

1) NEW MACHINE

New machine used and filled with following lubricants.

Description	Specification
Engine oil	SAE 10W-30 (API CH-4), ★1SAE 5W-40 (API CH-4)
Hydraulic oil	Hyundai genuine long life hydraulic oil (ISO VG 32, VG 46, VG 68 only) Coventional hydraulic oil (ISO VG 15★1, ★VG16)
Swing and travel reduction gear	SAE 80W-90 (API GL-5)
Grease	Lithium base grease NLGI No. 2 , ★NLGI No. 1
Fuel	ASTM D975-No. 2
Coolant	Mixture of 50% ethylene glycol base antifreeze and 50% water. Mixture of 60% ethylene glycol base antifreeze and 40% water.★1

★ : Arctic machinery

★1 : Cold region
Russia, CIS, Mongolia

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

2) RECOMMENDED OILS

Use only oils listed below. Do not mix different brand oil.
Please use HYUNDAI genuine oil and grease.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	24 (6.3)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Gear oil	Type 1 : 5.0(1.3) Type 2,3 : 6.2(1.64)	★SAE 75W-90
Final drive		5.8 × 2 (1.5 × 2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank; 160 (42) System; 275 (73)	★ISO VG 15 ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	400 (106)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and soft water★1	35 (9.2)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

★1 : Soft water
City water or distilled water

★ : Cold region
Russia, CIS, Mongolia

4. MAINTENANCE CHECK LIST

1) DAILY SERVICE BEFORE STARTING

Check items	Service	Page
Visual check		
Engine oil level	Check, Add	6-18
Coolant level	Check, Add	6-20
Fan belt tension	Check, Adjust	6-24
Air cleaner (oil bath, option)	Check, Clean, Add	6-25-1~25-3
Fuel tank	Check, Refill	6-26
Prefilter	Check, Clean	6-26
Hydraulic oil level	Check, Add	6-31
★ Attachment pin and bushing	Lubricate	6-40
· Boom cylinder tube end		
· Boom foot		
· Boom cylinder rod end		
· Arm cylinder tube end		
· Arm cylinder rod end		
· Boom + Arm connecting		
· Bucket cylinder tube end		
Control panel & pilot lamp	Check, Clean	6-41

★ Lubricate every 10 hours or daily for initial 100 hours.

2) EVERY 50 HOURS SERVICE

Check items	Service	Page
Fuel tank (water, sediment)	Drain	6-26
Swing reduction gear oil	Check, Add	6-34
Track tension	Check, Adjust	6-36
Attachment pin and bushing	Lubricate	6-40
· Bucket cylinder rod end		
· Bucket + Arm connecting		
· Bucket control link + Arm		
· Bucket control rod		

3) INITIAL 50 HOURS SERVICE

Check items	Service	Page
Bolts & Nuts · Sprocket mounting bolts · Travel motor mounting bolts · Swing motor mounting bolts · Swing bearing mounting bolts · Engine mounting bolts · Counterweight mounting bolts · Turning joint locating bolts · Track shoe mounting bolts and nuts · Hydraulic pump mounting bolts	Check, Tight	6-8

4) EVERY 200 HOURS SERVICE

Check items	Service	Page
★ Return filter	Replace	6-32
★ Pilot line filter	Replace	6-33
★ Drain filter cartridge	Replace	6-33

★ Replace 3 filters for continuous hydraulic breaker operation only.

5) INITIAL 250 HOURS SERVICE

Check items	Service	Page
Engine oil	Change	6-18, 19
Engine oil filter	Replace	6-18, 19
Prefilter (water, element)	Replace	6-26
Fuel filter	Replace	6-27
Pilot line filter	Replace	6-33
Hydraulic return filter	Replace	6-32
Drain filter cartridge	Replace	6-33
Swing reduction gear oil	Change	6-34
Travel reduction gear oil	Change	6-35

6) EVERY 250 HOURS SERVICE

Check items	Service	Page
Battery (voltage)	Check, Clean	6-41
Swing bearing grease	Lubricate	6-34
Aircon & heater fresh air filter	Check	6-45
Engine oil *1	Change	6-18, 19
Engine oil filter *1	Replace	6-18, 19
Bolts & Nuts	Check, Tight	6-8
· Sprocket mounting bolts		
· Travel motor mounting bolts		
· Swing motor mounting bolts		
· Swing bearing mounting bolts		
· Engine mounting bolts		
· Counterweight mounting bolts		
· Turning joint locating bolts		
· Track shoe mounting bolts and nuts		
· Hydraulic pump mounting bolts		
Attachment pin and bushing	Lubricate	6-40
· Boom cylinder tube end		
· Boom foot		
· Boom cylinder rod end		
· Arm cylinder tube end		
· Arm cylinder rod end		
· Boom + Arm connecting		
· Bucket cylinder tube end		

*1 Cold region

7) EVERY 500 HOURS SERVICE

Check items	Service	Page
★Engine oil	Change	6-18, 19
★Engine oil filter	Replace	6-18, 19
Radiator, cooler fin and charge air cooler	Check, Clean	6-23
☆Air cleaner element (primary)	Check, Clean	6-25
Fuel filter element	Replace	6-27
Prefilter	Change	6-26

★ If you use high sulfur containing fuel above than 0.5% or use low grade of engine oil reduce change interval.

☆ Clean the primary element only after 500 hours operation or when the air cleaner warning lamp blinks. Replace primary element and safety element after 4 times cleanings of primary element.

8) EVERY 1000 HOURS SERVICE

Check items	Service	Page
Hydraulic oil return filter	Replace	6-32
Drain filter cartridge	Replace	6-33
Pilot line filter	Replace	6-33
Air breather element	Replace	6-33
Swing reduction gear oil	Change	6-34
Swing reduction gear grease	Change	6-34
Travel motor reduction gear oil	Change	6-35
Grease in swing gear and pinion	Change	6-35

9) EVERY 2000 HOURS SERVICE

Check items	Service	Page
Coolant	Change	6-20, 21, 22, 23
Air cleaner (oil bath, option)	Disassemble, Clean, Change	6-25-1~25-3
Hydraulic tank		
★ Oil *1	Change	6-31
· Suction strainer	Check, Clean	6-32
Hoses, fittings, clamps (fuel, coolant, hydraulic)	Check, Retighten, Replace	-

*1 Conventional hydraulic oil

★ **Change oil every 600 hours of continuous hydraulic breaker operation.**

10) EVERY 5000 HOURS SERVICE

Check items	Service	Page
Hydraulic tank		
★ Oil *2	Change	6-31

*2 Hyundai genuine long life hydraulic oil

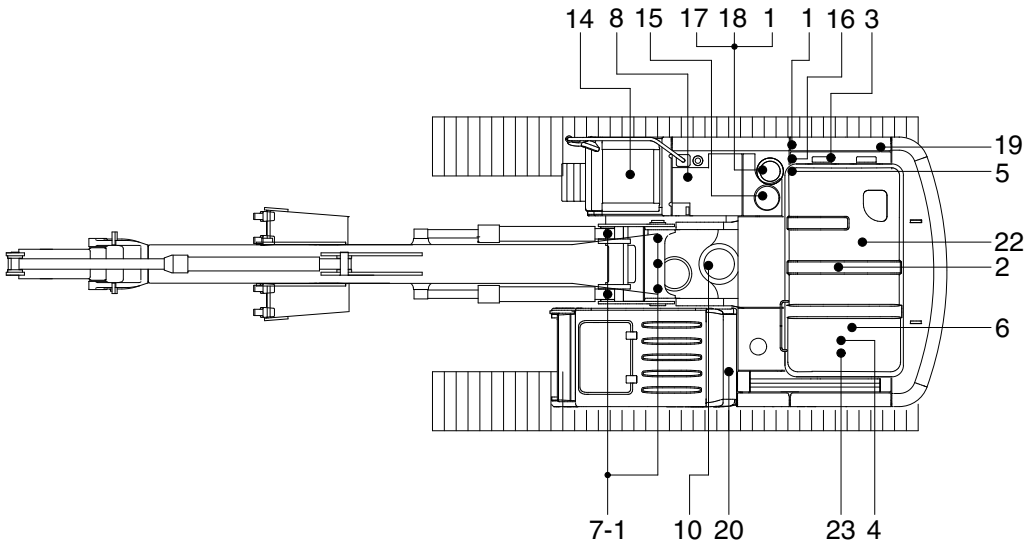
★ **Change oil every 1000 hours of continuous hydraulic breaker operation.**

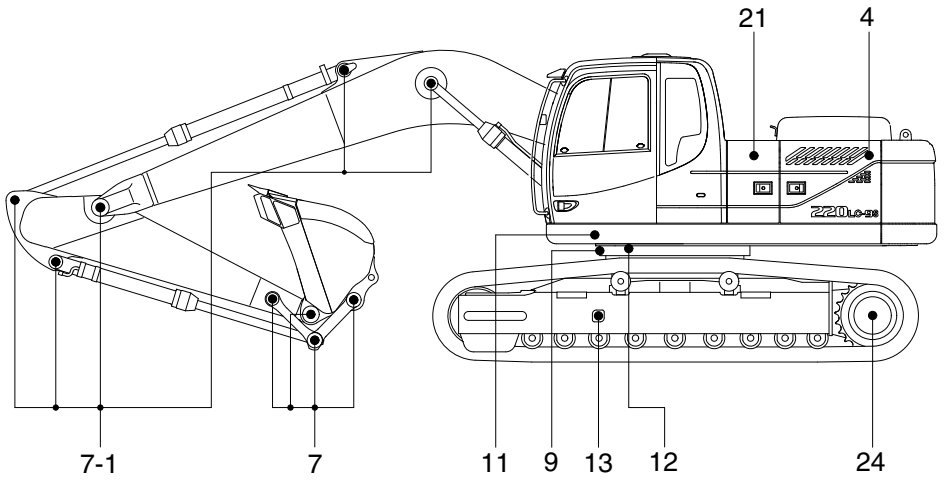
11) WHEN REQUIRED

Whenever you have trouble in the machine, you must perform the service of related items, system by system.

Check items	Service	Page
Fuel system		
· Fuel tank	Drain or Clean	6-26
· Prefilter	Clean or Replace	6-26
· Fuel filter element	Replace	6-27
Engine lubrication system		
· Engine oil	Change	6-18, 19
· Engine oil filter	Replace	6-18, 19
Engine cooling system		
· Coolant	Add or Change	6-20, 21, 22, 23
· Radiator	Clean or Flush	6-20, 21, 22, 23
· Charge air cooler	Check	6-23
Engine air system		
· Air cleaner element	Replace	6-25
· Air cleaner (oil bath, option)	Check, Clean, Replace	6-25-1~25-3
Hydraulic system		
· Hydraulic oil	Add or Change	6-31
· Return filter	Replace	6-32
· Drain line filter	Replace	6-33
· Pilot line filter	Replace	6-33
· Element of breather	Replace	6-33
· Suction strainer	Clean	6-32
Under carriage		
· Track tension	Check, Adjust	6-36
Bucket		
· Tooth	Replace	6-38
· Side cutter	Replace	6-38
· Linkage	Adjust	6-37
· Bucket assy	Replace	6-37
Air conditioner and heater		
· Fresh air filter	Clean, Replace	6-44
· Recirculation filter	Clean	6-45

5. MAINTENANCE CHART





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Caution

1. Service intervals are based on the hour meter reading.
2. The number of each item shows the lubrication point on the machine.
3. Stop engine while filling oil, and use no open flames.

Service interval	No.	Description	Service action	Oil symbol	Capacity ℓ (U.S.gal)	Service points No.
10 Hours or daily	1	Hydraulic oil level	Check, Add	HO	160 (42)	1
	2	Engine oil level	Check, Add	EO	24 (6.3)	1
	4	Radiator coolant	Check, Add	C	35 (9.2)	1
	5	Prefilter (water, element)	Check, Clean	-	-	1
	6	Fan belt tension and damage	Check, Adjust	-	-	1
	8	Fuel tank	Check, Refill	DF	400 (106)	1
	21	Air cleaner (oil bath, option)	Check, Clean, Add	EO	5.0 (1.3)	1

Service interval	No.	Description	Service action	Oil symbol	Capacity ℓ (U.S.gal)	Service points No.
50 Hours or weekly	7	Attachment pins & bushing	Check, Add	PGL	-	5
	8	Fuel tank (water, sediment)	Check, Clean	-	-	1
	10	Swing reduction gear case	Check, Add	GO	Type 1 : 5.0(1.3) Type 2,3 : 6.2(1.64)	1
	11	Swing reduction gear grease	Check, Add	PGL	1.1 kg (2.4 lb)	1
	13	Track tension	Check, Adjust	PGL	-	2
250 Hours	2	Engine oil ★3	Change	EO	24 (6.3)	1
	3	Engine oil filter ★3	Replace	-	-	1
	7-1	Attachment pins & bushing	Check, Add	PGL	-	12
	9	Swing bearing grease	Check, Add	PGL	-	2
	14	Battery (voltage)	Check, Clean	-	-	1
	20	Aircon and heater fresh air filter	Check, Clean	-	-	1
500 Hours	2	Engine oil	Change	EO	24 (6.3)	1
	3	Engine oil filter	Replace	-	-	1
	5	Prefilter	Replace	-	-	1
	21	Air cleaner element (primary)	Check, Clean	-	-	1
	22	Fuel filter element	Replace	-	-	1
	23	Radiator, oil cooler, charge air cooler	Check, Clean	-	-	3
1000 Hours	10	Swing reduction gear case	Change	GO	Type 1 : 5.0(1.3) Type 2,3 : 6.2(1.64)	1
	11	Swing reduction gear grease	Change	PGL	1.1 kg (2.4 lb)	1
	12	Swing gear and pinion grease	Change	PGL	13 kg (28.7 lb)	1
	15	Hydraulic oil return filter	Replace	-	-	1
	16	Drain filter cartridge	Replace	-	-	1
	17	Air breather element	Replace	-	-	1
	19	Pilot line filter element	Replace	-	-	1
	24	Travel reduction gear case	Change	GO	5.8 (1.5)	2
2000 Hours	1	Hydraulic oil ★1	Change	HO	160 (42)	1
	4	Radiator coolant	Change	C	35 (9.2)	1
	18	Hydraulic oil suction strainer	Check, Clean	-	-	1
	21	Air cleaner (oil bath, option)	Disassemble, Clean, Change	EO	5.0 (1.3)	1
	-	Hoses, fittings, clamps (fuel, coolant, hydraulic)	Check, Retighten, Replace	-	-	-
5000 Hours	1	Hydraulic oil ★2	Change	HO	160 (42)	1
As required	20	Aircon & heater fresh filter	Replace	-	-	1
	20	Aircon & heater recirculation filter	Clean, Replace	-	-	1
	21	Air cleaner element (primary, safety)	Replace	-	-	2
	21	Air cleaner (oil bath, option)	Check, Clean, Replace	EO	5.0 (1.3)	1

★1 Conventional hydraulic oil ★2 Hyundai genuine long life hydraulic oil ★3 Cold region

※ Oil symbol

Please refer to the recommended lubricants for specification.

DF : Diesel fuel GO : Gear oil HO : Hydraulic oil

C : Coolant PGL : Grease EO : Engine oil

1) CHECK ENGINE OIL LEVEL

Check the oil level with the machine on a flat ground before starting engine.

(1) Pull out the dipstick and wipe with a clean cloth.

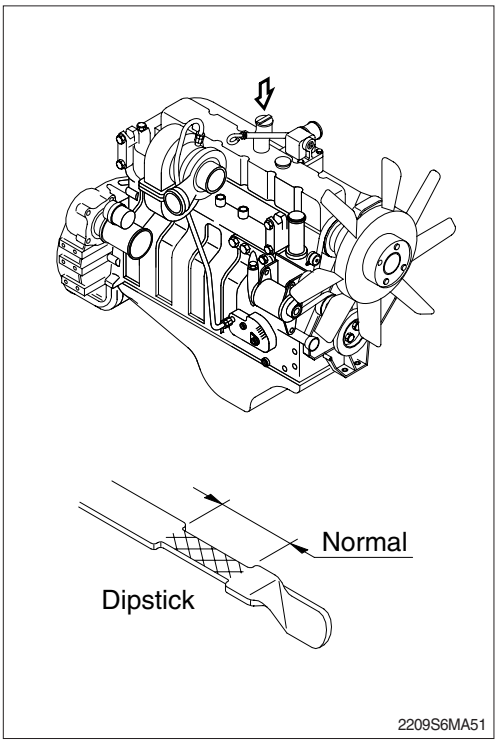
(2) Check the oil level by inserting the dipstick completely into the hole and pulling out again.

(3) **If oil level is LOW, add oil and then check again.**

※ **If the oil is contaminated or diluted, change the oil regardless of the regular change interval.**

※ **Check oil level after engine has been stopped for 15 minutes.**

⚠ **Do not operate unless the oil level is in the normal range.**

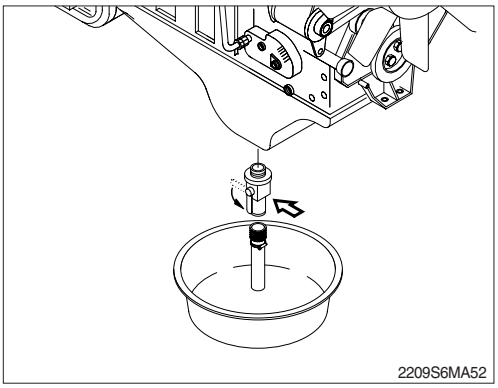


2) REPLACEMENT OF ENGINE OIL AND OIL FILTER

(1) Warm up the engine.

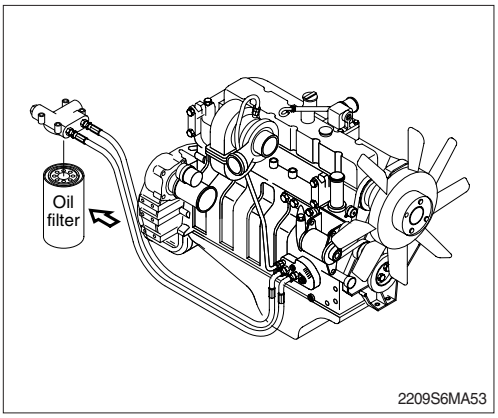
(2) Turn the lever to open position.

※ **A drain pan with a capacity of 24 liters (6.3 U.S. gallons) will be adequate.**



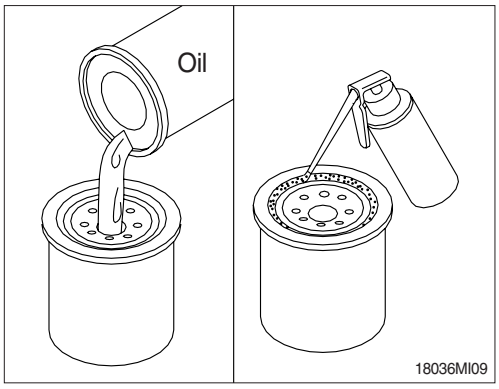
(3) Clean around the filter head, remove the filter and clean the gasket surface.

· Wrench size : 90 ~ 95 mm (3.5~3.8 in)



(4) Apply a light film of lubricating oil to the gasket sealing surface before installing the filters.

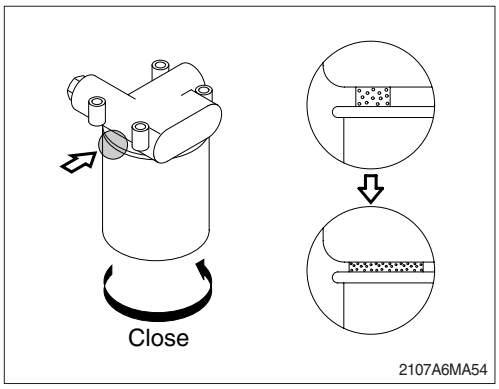
※ **Fill the filters with clean lubricating oil.**



(5) Install the filter to the filter head.

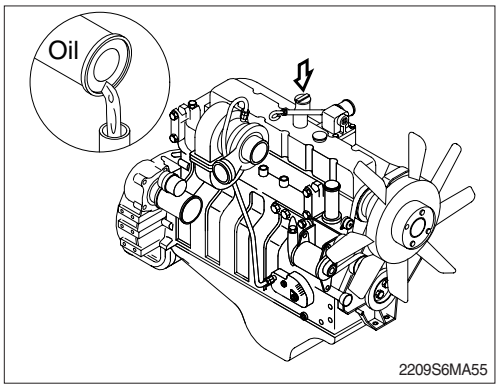
※ **Mechanical over-tightening may distort the threads or damage the filter element seal.**

· Install the filter as specified by the filter manufacturer.

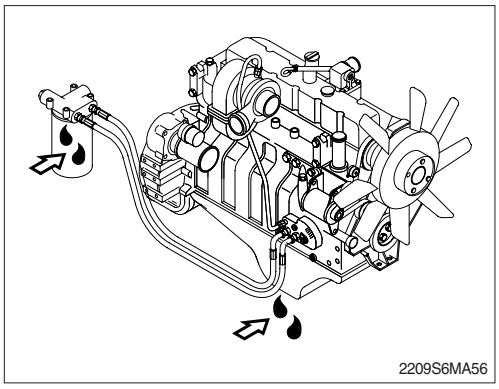


(6) Fill the engine with clean oil to the proper level.

· Quantity : 24 ℓ (6.3 U.S. gallons)



(7) Operate the engine at low idle and inspect for leaks at the filters and the drain plug.
Shut the engine off and check the oil level with the dipstick. Allow 15minutes for oil to drain down before checking.



3) CHECK COOLANT

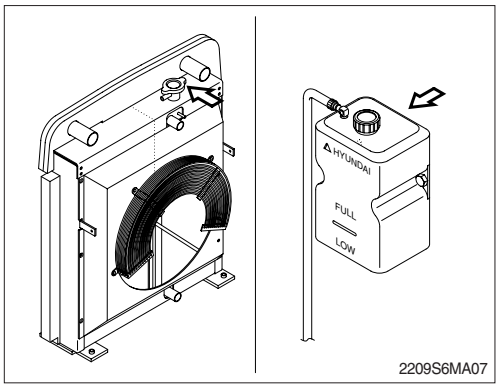
(1) Check if the level of coolant in reservoir tank is between FULL and LOW.

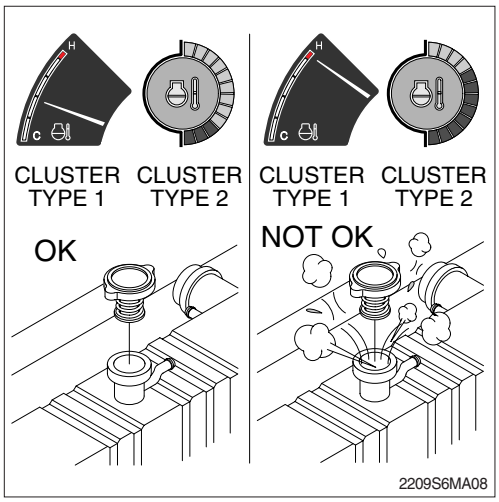
(2) Add the mixture of antifreeze and water after removing the cap of the reservoir tank if coolant is not sufficient.

(3) Be sure to add the coolant by opening the cap of radiator when coolant level is below LOW.

(4) Replace gasket of radiator cap when it is damaged.

⚠ **Hot coolant can spray out if radiator cap is removed while engine is hot. Remove the cap after the engine has cooled down.**





4) FLUSHING AND REFILLING OF RADIATOR

(1) Change coolant

⚠ **Avoid prolonged and repeated skin contact with used antifreeze. Such prolonged repeated contact can cause skin disorders or other bodily injury.**

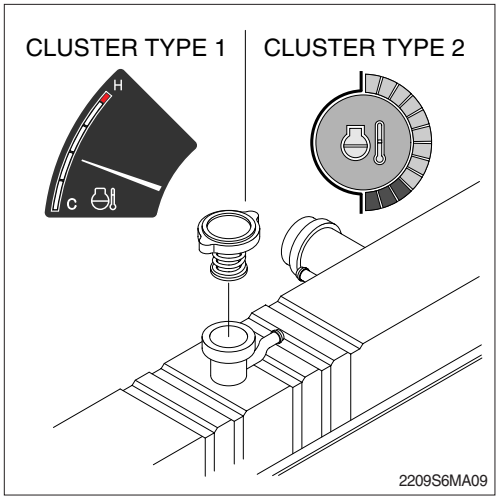
Avoid excessive contact-wash thoroughly after contact.

Keep out of reach of children.

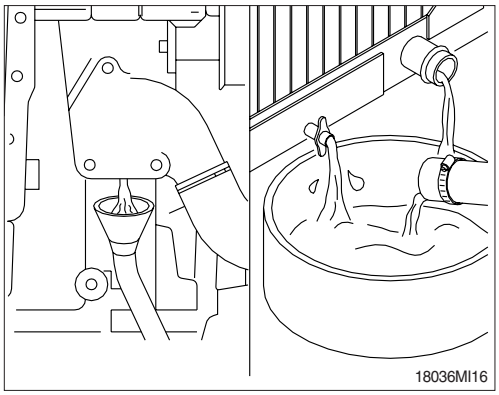
※ **Protect the environment : Handling and disposal of used antifreeze can be subject to federal, state, and local law regulation.**

Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for the receipt of used antifreeze.

If in doubt, contact your local authorities for guidance as to proper handling of used antifreeze.



⚠ Wait until the temperature is below 50 °C (122 °F) before removing the coolant system pressure cap.
Failure to do so can cause personal injury from heated coolant spray.
Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet. A drain pan with a capacity of 40 liters (10 U.S. gallons) will be adequate in most applications.

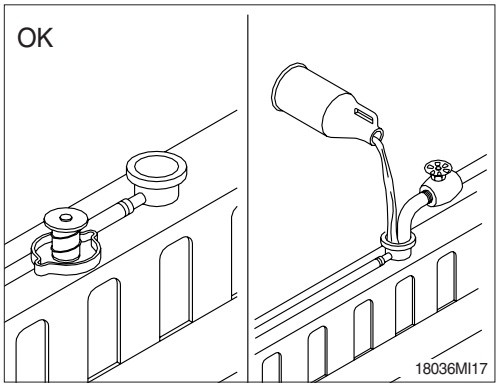


(2) Flushing of cooling system

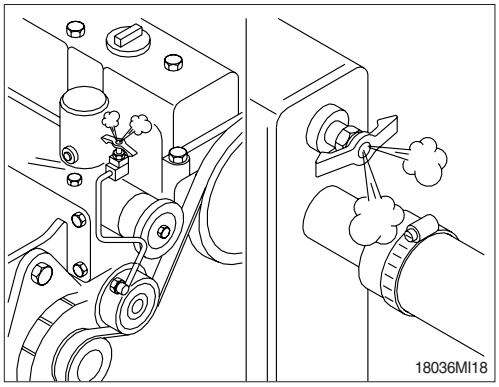
① Fill the system with a mixture of sodium carbonate and water (or a commercially available equivalent).

※ Use 0.5kg (1.0 pound) of sodium carbonate for every 23 liters (6.0 U.S. gallons) of water.

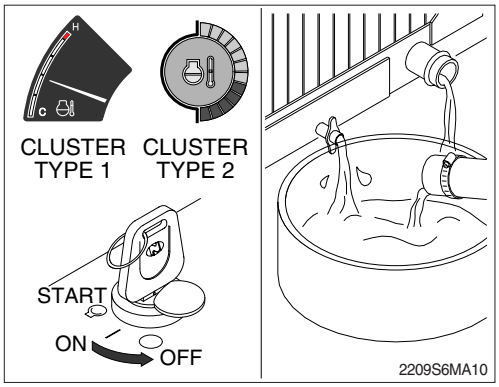
※ Do not install the radiator cap. The engine is to be operated without the cap for this process.



※ During filling, air must be vented from the engine coolant passages. Open the engine venting petcock.
The system must be filled slowly to prevent air locks. Wait 2 to 3 minutes to allow air to be vented, then add mixture to bring the level to the top.



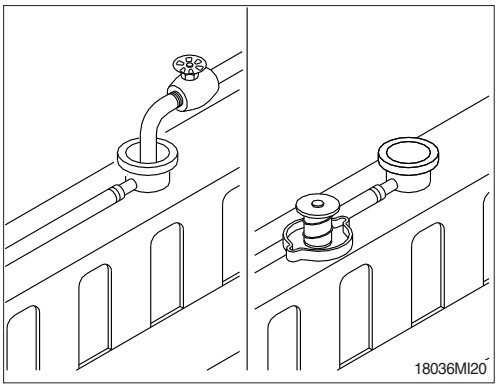
② Operate the engine for 5 minutes with the coolant temperature above 80 °C (176 °F).
Shut the engine off, and drain the cooling system.



③ Fill the cooling system with clean water.

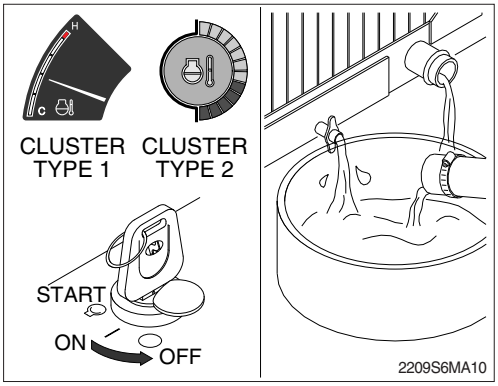
※ **Be sure to vent the engine and aftercooler for complete filling.**

※ **Do not install the radiator cap or the new coolant filter.**



④ Operate the engine for 5 minutes with the coolant temperature above 80 °C (176 °F). Shut the engine off, and drain the cooling system.

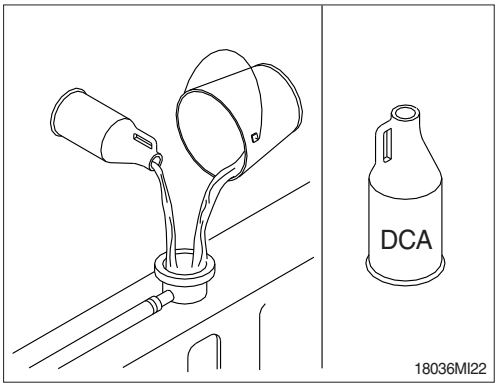
※ **If the water being drained is still dirty, the system must be flushed again until the water is clean.**



(3) Cooling system filling

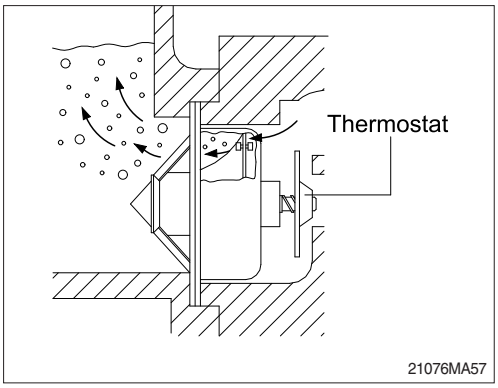
① Use a mixture of 50 percent soft water and 50 percent ethylene glycol antifreeze to fill the cooling system. Refer to the page 6-10.
Coolant capacity (engine only) : 9.5 *l* (2.5 U.S. gallons)

※ **Do not use hard water such as river water or well water.**

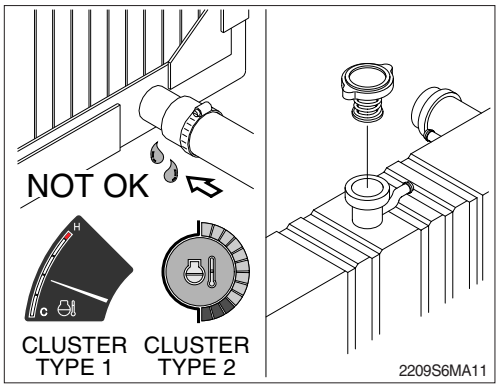


② The system has a maximum fill rate of 14 liters (3.5 U.S. gallons) per minute.
Do not exceed this fill rate.

※ **The system must be filled slowly to prevent air locks.**
During filling, air must be vented from the engine coolant passage.



③ Install the pressure cap. Operate the engine until it reaches a temperature 80 °C (176 °F), and check for coolant leaks.
Check the coolant level again to make sure the system is full of coolant.

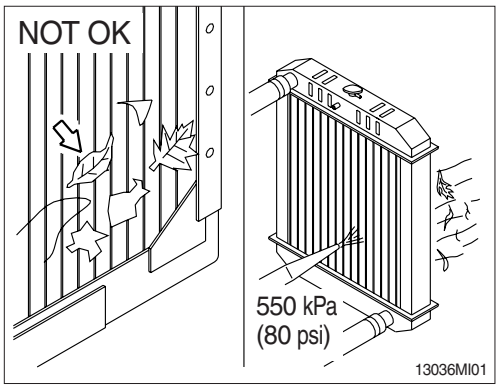


5) CLEAN RADIATOR AND OIL COOLER

Check, and if necessary, clean and dry outside of radiator and oil cooler. After working in a dusty place, clean radiator more frequently.

(1) Visually inspect the radiator for clogged radiator fins.

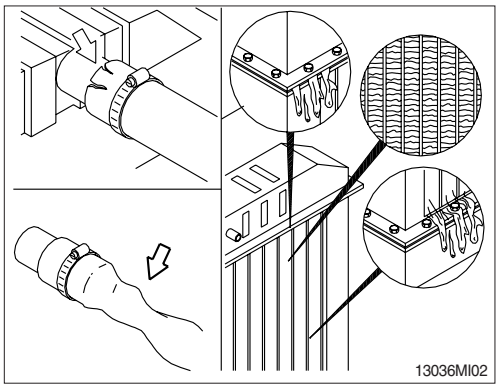
(2) Use 550 kPa (80 psi) air pressure to blow the dirt and debris from the fins.
Blow the air in the opposite direction of the fan air flow.



(3) Visually inspect the radiator for bent or broken fins.

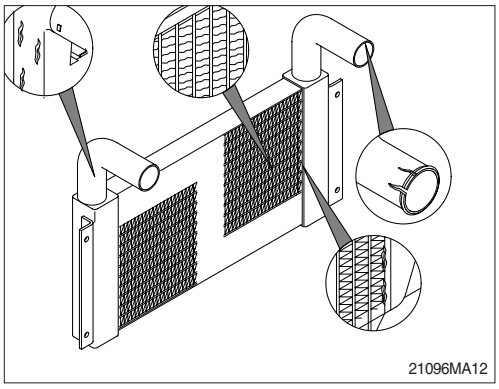
※ **If the radiator must be replaced due to bent or broken fins which can cause the engine to overheat, refer to the manufacturer's replacement procedures.**

(4) Visually inspect the radiator for core leaks.



6) CHECK CHARGE AIR COOLER

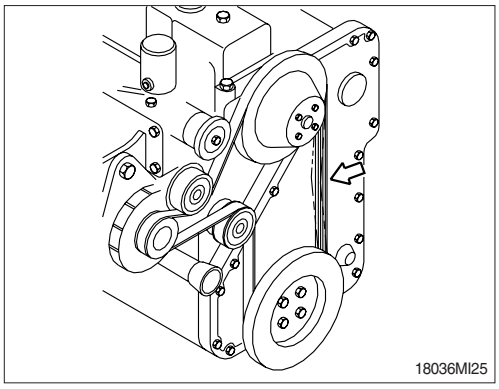
Inspect the charge air cooler for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, please contact Hyundai distributor.



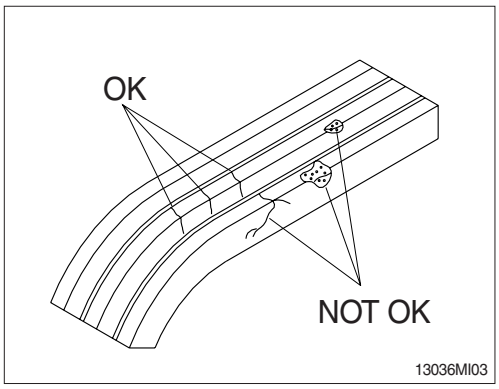
7) FAN BELT TENSION

(1) Measure the belt deflection at the longest span of the belt.

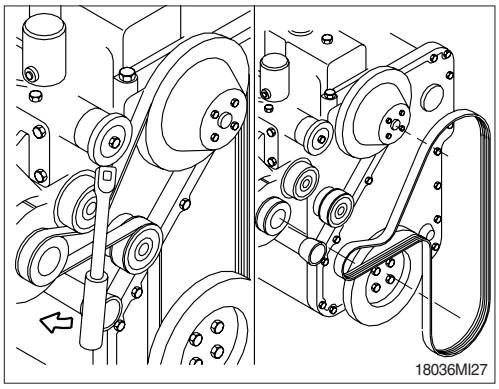
· Maximum deflection : 9.5 - 12.7 mm
(3/8 to 1/2 inch)



(2) Inspect the drive for damage.



(3) Inspect the drive belt, tension bearing and fan hub.

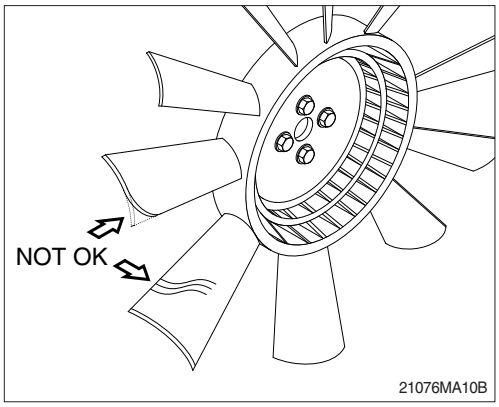


8) INSPECTION OF COOLING FAN

⚠ Personal injury can result from a fan blade failure. Never pull or pry on the fan. This can damage the fan blade and cause fan failure.

※ Rotate the crankshaft by using the engine barring gear.

※ A visual inspection of the cooling fan is required daily.
Check for cracks, loose rivets, and bent or loose blades.
Check the fan to make sure it is securely mounted. Tighten the capscrews if necessary.
Replace any fan that is damaged.



9) CLEANING OF AIR CLEANER

(1) Primary element

① Loosen the clamps and remove the element.

② Clean the inside of the body.

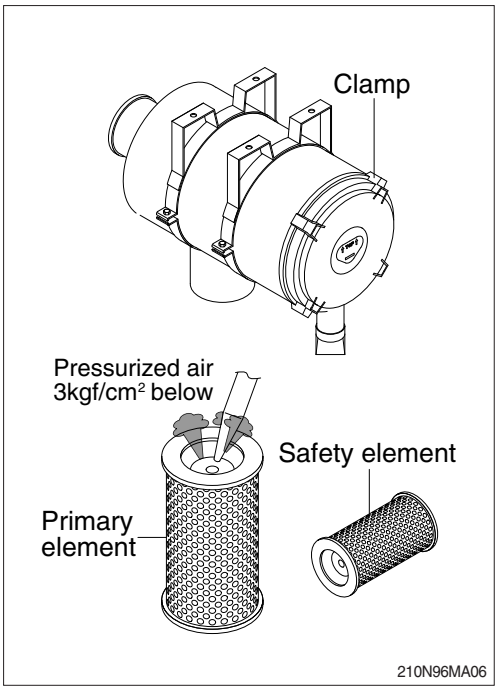
③ Clean the element with pressurized air.

- Remove the dust inside of the element by the pressurized air (below 3 kgf/cm², 40 psi) forward and backward equally.

④ Inspect for cracks or damage of element by putting a light bulb inside of the element.

⑤ Insert element and tighten wing nut.

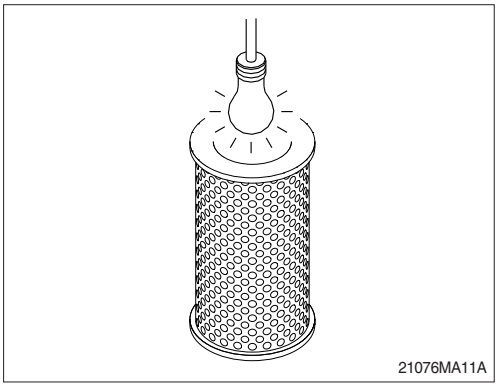
※ **Replace the primary element after 4 times cleanings.**



(2) Safety element

※ **Replace the safety element only when the primary element is cleaned for the 4 times.**

※ **Always replace the safety element. Never attempt to reuse the safety element by cleaning the element.**



9-1) AIR CLEANER (OIL BATH, OPTION)
(MACHINE SERIAL NO. : -#F258)

△ **Always cover the engine intake hole while the air cleaner is being serviced.**

(1) General service

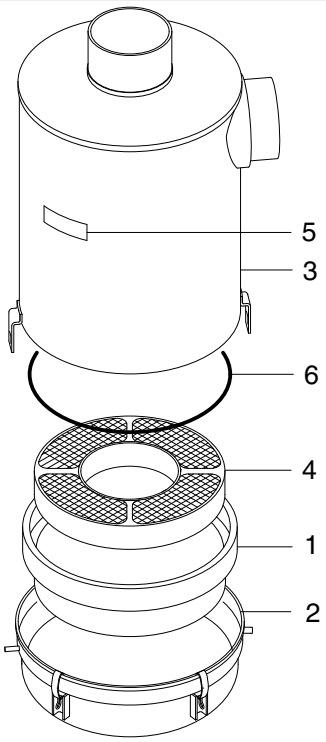
① The oil bath air cleaner should be inspected constantly for leaks and damage.

② The removable element assembly (4) should be removed the from the oil cups (1, 2) and inspected daily or at each oil cup service.
Watch all connections for mechanical tightness.

③ Be sure cleaner outlet pipe is not fractured.
If air cleaner has been dented or damaged,

④ check all connections immediately.
In case of leakage and if adjustment does not

⑤ correct the trouble, replace necessary parts or O-ring.



1 Inner cup assy
2 Outer cup assy
3 Body assy
4 Removable element
5 Marking
6 O-ring

480S6MA35

(2) Oil cup

① Service the inner oil cup (1) and outer oil cup (2) daily or when 1/2" of dirt has collected in bottom of either cup.

※ **Severe operating conditions may require several inspections daily.**

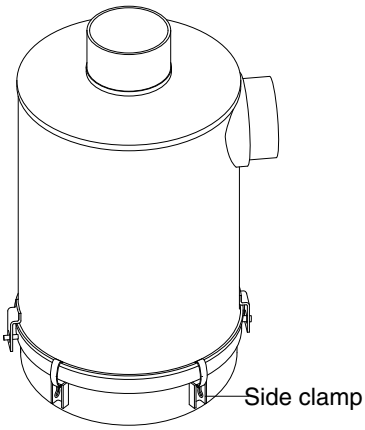
② Loosen the side clamps and removing bottom of unit and lift the removable element assembly (4) from the oil cup.

③ Pour out the oil and remove inner cup (1) from out cup (2) and remove sludge and wipe clean.

④ Reassembled inner cup (1) in outer cup (2) and refill both cups to indicated oil level.

⑤ The same oil specified for the engine crankcase is generally acceptable.

※ **Do not over fill or under fill the cup.**
Overfilling means loss of capacity and under filling means lack of efficiency.



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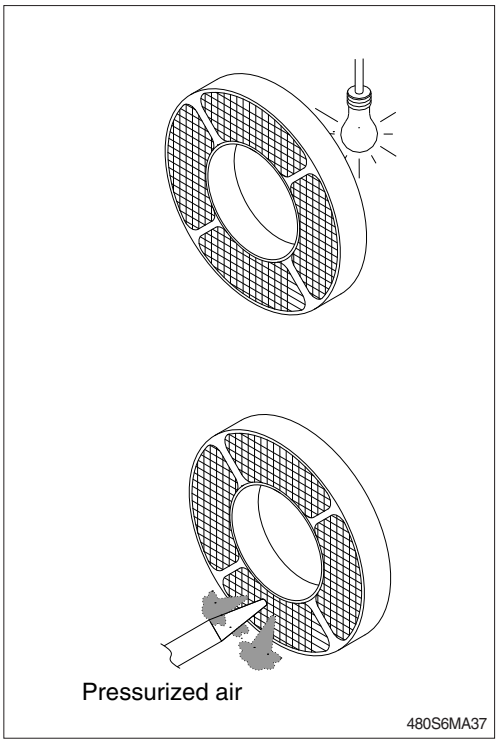
(3) Removable element

① First step in servicing removable element assembly is hold up to a strong light. An even, bright pattern of light through the wire element means if is clean.

② If removable element is even partially plugged with dirt, lint or chaff, wash thoroughly with solvent.
Then blowout with compressed air.

③ Inspect lower portion of body assembly and center tube each time oil cup is serviced. See back side for service details.

④ Reassemble removable element assembly to serviced oil cups and to air cleaner body.
Be sure the oil cup is tight to body assembly.

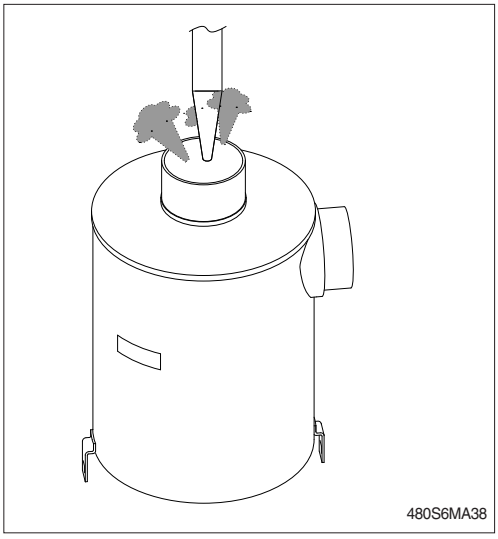


(4) Body assembly

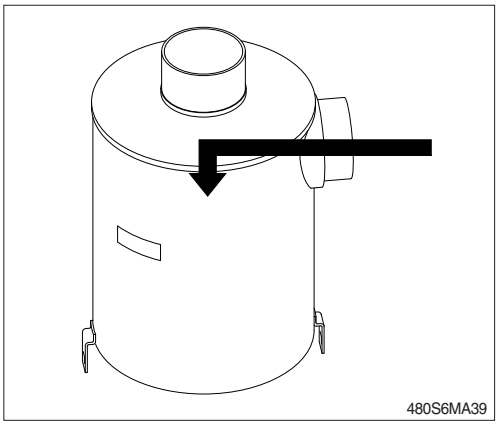
The lower portion of the body assembly should be inspected each time the air cleaner is serviced. If there is any sign of build-up or plugging, the body assembly should be removed and cleaned. At least once a year, remove the body assembly and perform the following service steps.

① Remove oil cup and removable element assembly.

② Check and clean center tube.



③ Pump solvent through the air outlet with sufficient force and volume to produce a hard, even stream out the bottom of the body assembly. Reverse flush until all foreign material is removed.



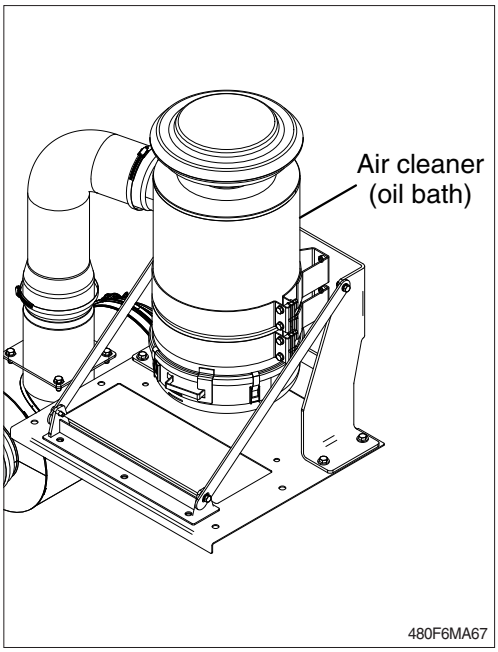
9-2) AIR CLEANER (OIL BATH, OPTION)
(MACHINE SERIAL NO. : #F259-)

※ In harsh working condition, the filter element must be inspected and cleaned daily or change the oil.

※ Failure to manage filters can cause degradation. If the filter is clogged, engine damage and power loss will occur.

※ In order to ensure the filtration efficiency of oil bath, it is recommended to replace a set of metal elements every year.

※ The maximum ash capacity of the filter element is approximately to 14 kg (31 lb).

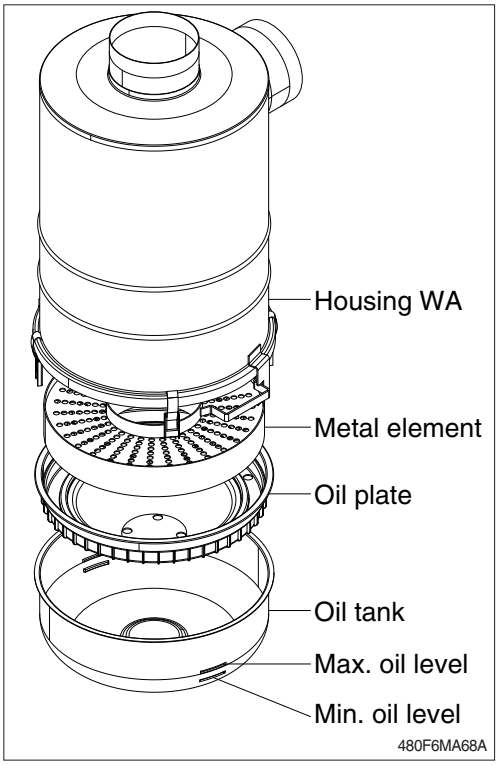


(1) Check air cleaner

Check the inside and outside of the air cleaner.

(2) Cleaning and replacement of filter element

① Disassemble as shown the illustration.
② Check the filter element with the light.
③ Clean or change the filter elment if necessary. Immerse the filter element in diesel for 20 to 30 minutes, take out the filter element and then wash is with diesel to remove the remaining dust on the filter element.
④ Use commpressed air to dry completely.
⑤ Check the housing WA.
⑥ Check the lower body of the air cleaner and center tube everytime when the oil tank is serviced. Replace any broken, cracked or missing part.
⑦ After serviced, assemble oil tank with oil plate and fill the oil (3 ~ 5 ℓ / 0.8 ~ 1.3 U.S. gal) in the guide line. Frequently check whether the oil tank buckle for looseness.



10) FUEL TANK

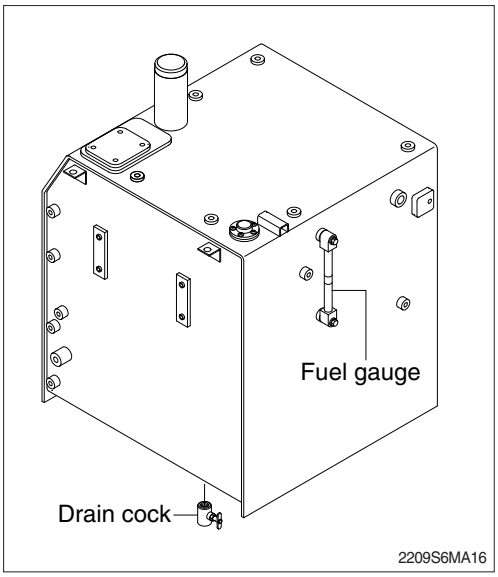
(1) Fill fuel fully when system the operation to minimize water condensation, and check it with fuel gauge before starting the machine.

(2) Drain the water and sediment in the fuel tank by opening the drain cock.

※ **Be sure to LOCK the cap of fuel tank.**

※ **Remove the strainer of the fuel tank and clean it if contaminated.**

⚠ **Stop the engine when refueling.**
All lights and flames shall be kept at a safe distance while refueling.



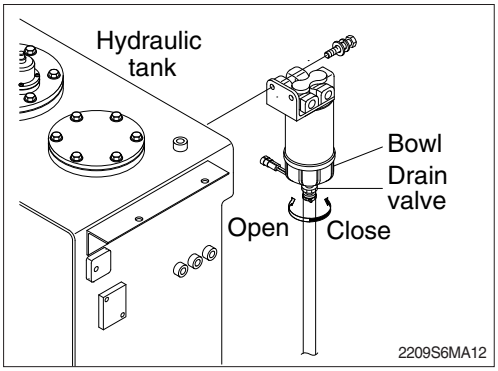
11) PREFILTER

※ **Inspect or drain the collection bowl of water daily and replace the element every 500 hours.**

(1) Drain water

① Open bowl drain valve to evacuate water.

② Close drain valve.



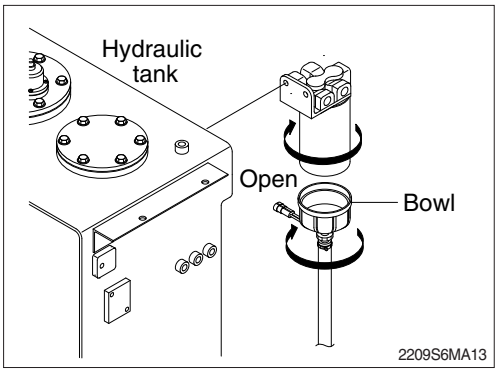
(2) Replace element

① Drain the unit of fuel. Follow "Drain water" instructions above.

② Remove element and bowl from filter head.

※ **The bowl is reusable, do not damage or discard.**

③ Separate element from bowl. Clean bowl and seal gland.

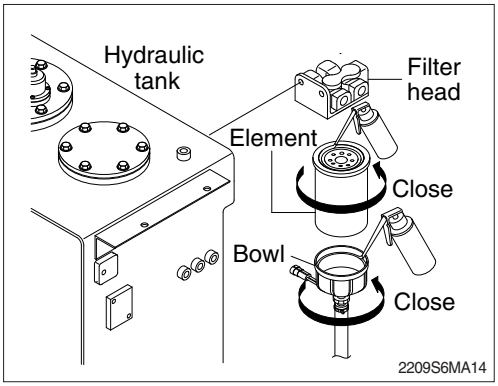


④ Lubricate new bowl seal with clean fuel or motor oil and place in bowl gland.

⑤ Attach bowl to new element firmly by hand.

⑥ Lubricate new element seal and place in element top gland.

⑦ Attach the element and bowl to the head.



12) REPLACEMENT OF FUEL FILTER

(1) Clean around the filter head, remove the filter and clean the gasket surface.
 · Wrench size : 90~95 mm (3.5~3.8 in)

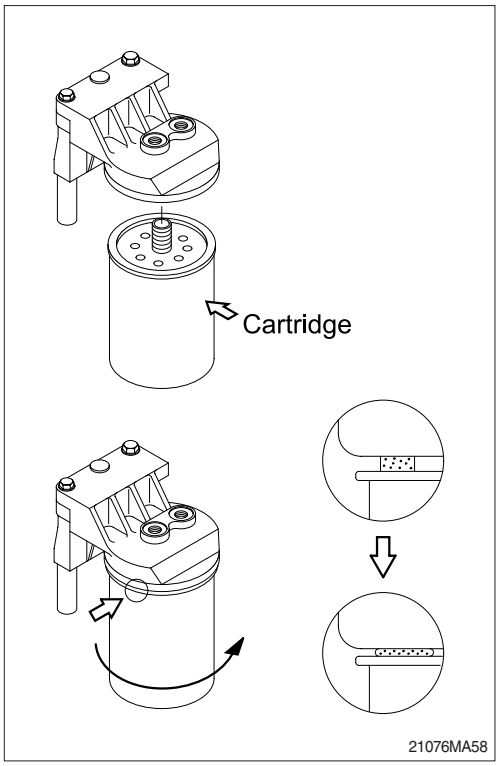
(2) Replace the O-ring.

(3) Fully fill fuel in the new filter.

(4) Apply engine oil on the gasket of new filter when mounting, and tighten 3/4 to 1 turn more after the gasket touches the filter head.

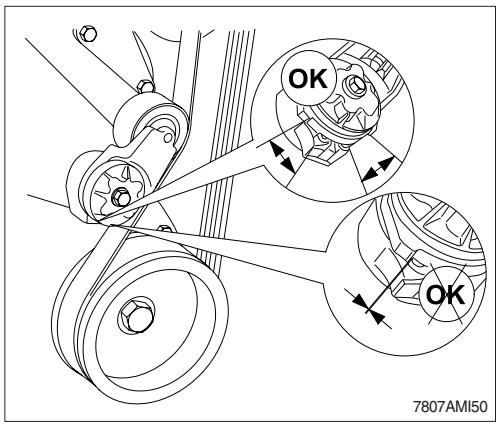
(5) Relieve the air after mounting.

※ **Check for fuel leakage after the engine starts. If air is in the fuel system, the engine will not start, Start engine after bleeding the air according to the method of bleeding air.**

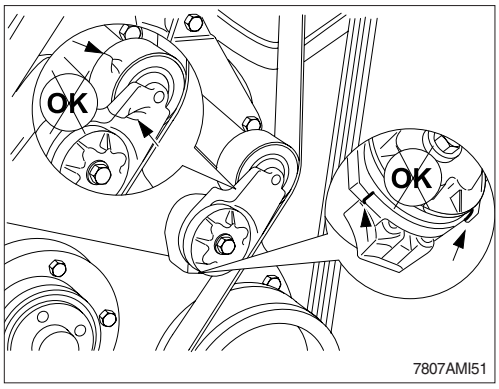


13) BELT TENSIONER, AUTOMATIC ADJUSTMENT

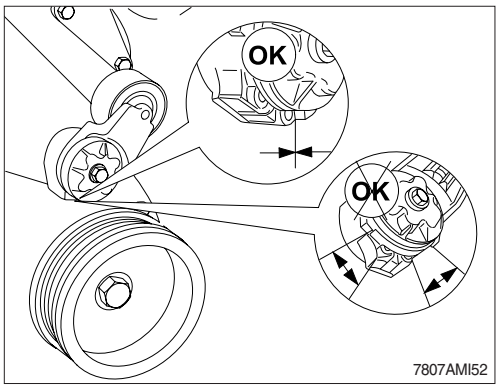
(1) Every 1000hours, or 1 year, whichever occurs first, inspect the automatic belt tensioner.
With the engine turned off, check that neither the top nor bottom tensioner arm stop is touching the cast boss on the tensioner body. If either of the stops is touching a boss, the alternator belt must be replaced. Check to make sure the correct belt part number is being used it either condition exists.



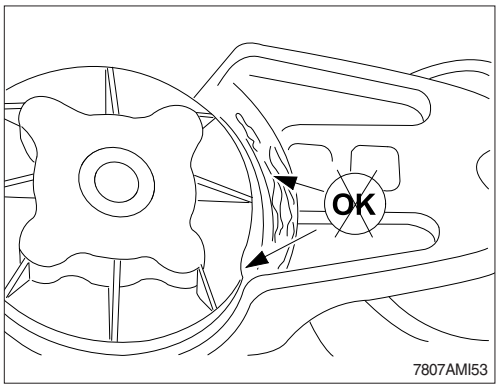
(2) Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner must be replaced. Refer to a Cummins Authorized Repair facility. Check the tensioner for dirt build-up. If this condition exists, the tensioner must be removed and steam-cleaned.



(3) Check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are not touching, the tensioner must be replaced.



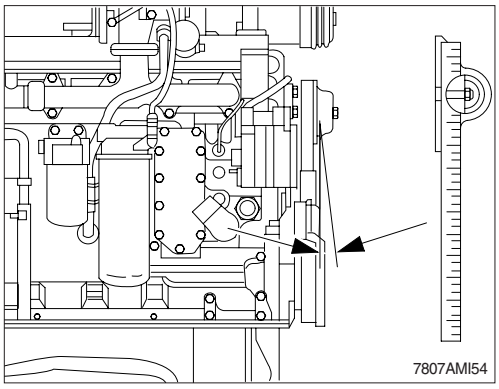
(4) Inspect the tensioner for evidence of the pivoting tensioner arm contacting the stationary circular base. If there is evidence of these two areas touching, the pivot tube bushing has failed and the tensioner must be replaced.



(5) A worn tensioner that has play in it or a belt that "walks" off its pulley possibly indicates pulley misalignment.

※ **Maximum pulley misalignment is three degrees. This measurement can be taken with a straightedge and an inclinometer.**

(6) Install the belt.

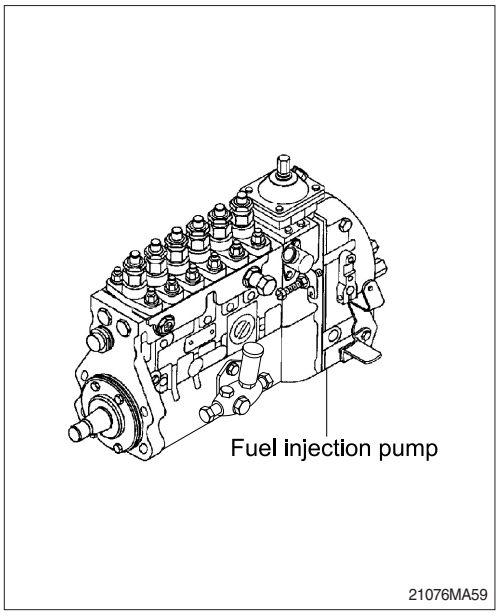


14) BLEEDING THE FUEL SYSTEM

(1) Controlled venting is provided at the injection pump through the fuel drain manifold. Small amounts of air introduced by changing the fuel filters or fuel injection pump supply line will be vented automatically, if the fuel filter is changed in accordance with the instructions.

※ **Manual bleeding is required if :**

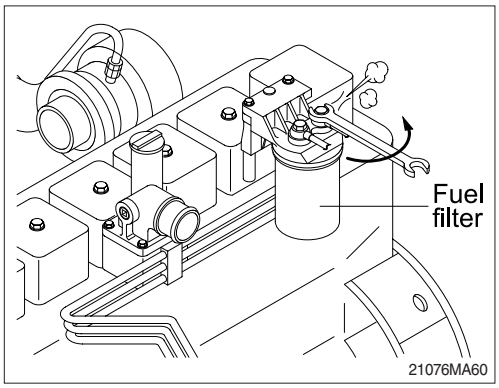
- **The fuel filter is not filled prior to installation.**
- **Fuel injection pump is replaced.**
- **High pressure fuel line connections are loosened or fuel lines replaced.**
- **Initial engine start up or start up after an extended period of no engine operation.**
- **Machine fuel tank has been run until empty.**



(2) Venting the low pressure lines and fuel filter

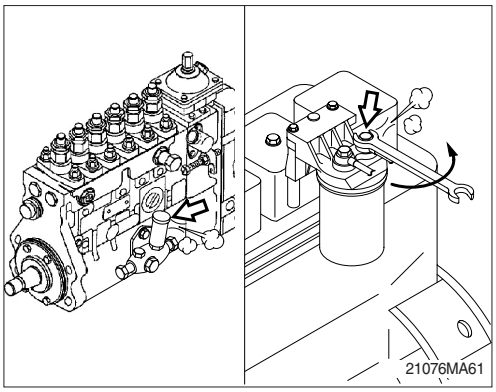
① Open the bleed screw.

- Wrench size : 17 mm



② Operate the hand lever until the fuel flowing from the fitting is free of air.
Tighten the bleed screw.

- Torque : 2.45 kgf·m (18 lbf·ft)



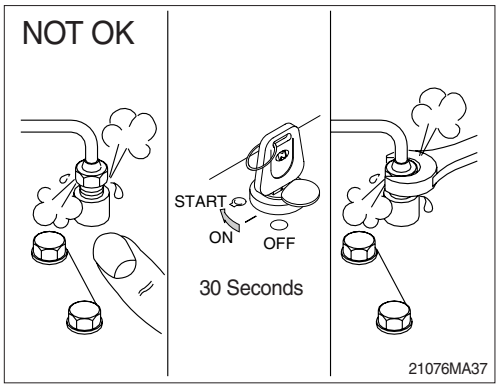
(3) Venting the high pressure lines

⚠ The pressure of the fuel in the line is sufficient to penetrate the skin and cause serious bodily harm.

① Loosen the fittings at the injectors, and crank the engine to allow entrapped air to bleed from the lines. Tighten the fittings.

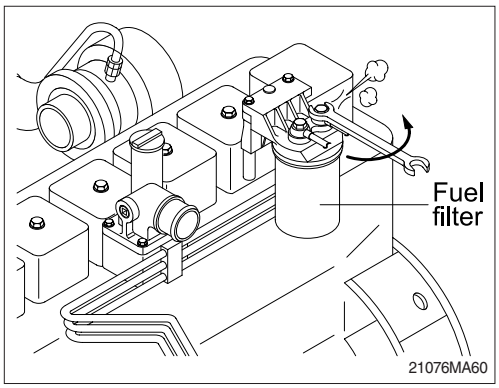
· Wrench size :19 mm

② Start the engine and vent one line at a time until the engine runs smoothly.



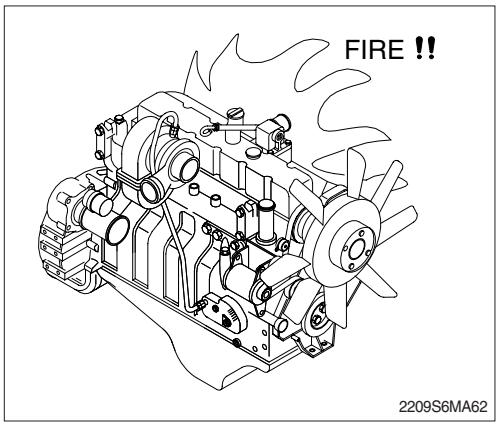
※ Do not engage the starter for more than 30 seconds each time when it is used to vent the system : wait 2 minutes between engagements.

⚠ Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.



15) LEAKAGE OF FUEL

⚠ Be careful and clean the fuel hose, injection pump, fuel filter and other connections as the leakage from these part can cause fire.

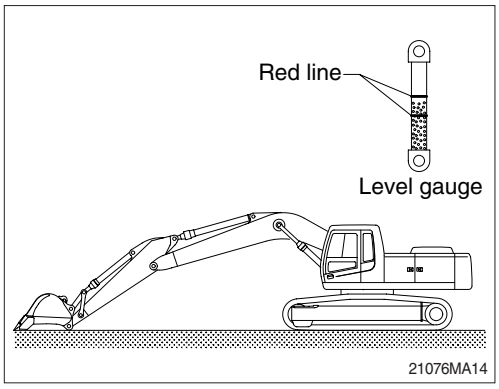


16) HYDRAULIC OIL CHECK

(1) Stop the engine after retract the arm and bucket cylinders, then lower the boom and set the bucket on the ground at a flat location as in the illustration.

(2) Check the oil level at the level gauge of hydraulic oil tank.

(3) The oil level is normal if between the red lines.



17) FILLING HYDRAULIC OIL

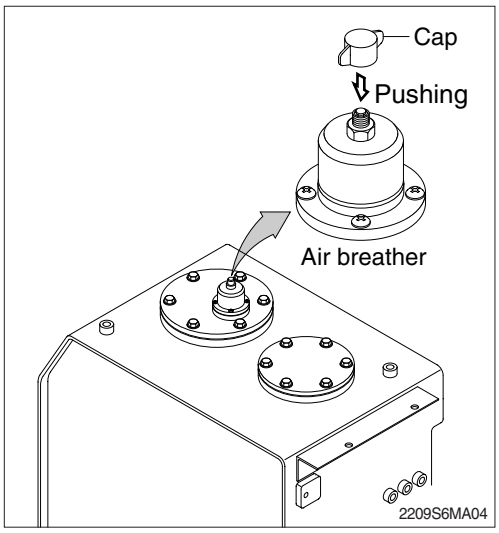
(1) Stop the engine to the position of level check.

(2) Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

(3) Remove the breather on the top of oil tank and fill the oil to the specified level.
- Tightening torque : 1.44±0.3 kgf · m
  (10.4±2.1 lbf · ft)

(4) Start engine after filling and operate the work equipment several times.

(5) Check the oil level at the level check position after engine stops.



18) CHANGE HYDRAULIC OIL

(1) Lower the bucket on the ground pulling the arm and bucket cylinder to the maximum.

(2) Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

(3) Remove the cover.
- Tightening torque : 6.9±1.4 kgf · m
  (50±10 lbf · ft)

(4) Prepare a suitable container.

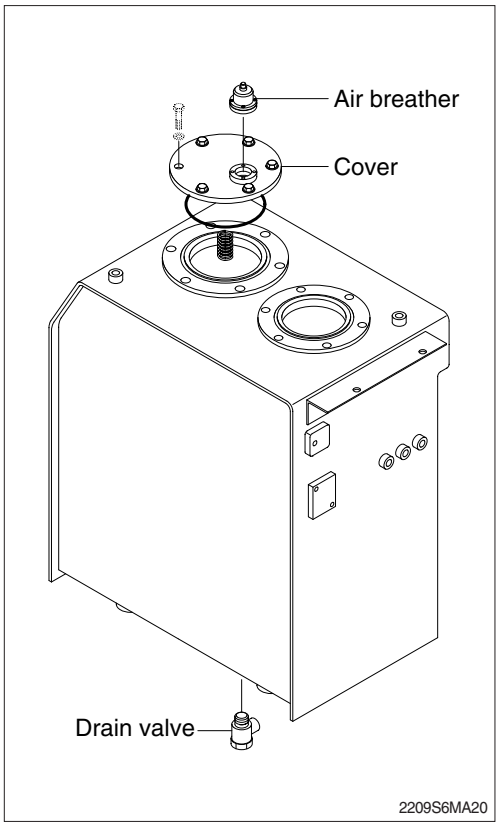
(5) To drain the oil loosen the drain plug at the bottom of the oil tank.

(6) Fill proper amount of recommended oil.

(7) Put the breather in the right position.

(8) Bleed air hydraulic pump loosen the air breather at top of hydraulic pump assembly.

(9) Start engine and run continually. Release the air by full stroke of each control lever.



19) CLEAN SUCTION STRAINER

Clean suction strainer as follows paying attention to the cause to be kept during oil filling.

(1) Remove the cover on the top of the oil tank.
- Tightening torque : 6.9±1.4 kgf · m
  (50±10 lbf · ft)

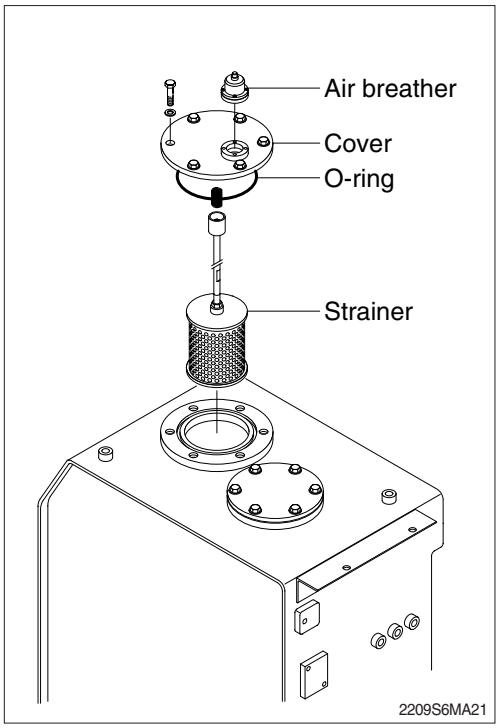
(2) Pull out the strainer in the tank.

(3) Wash the foreign material on the suction strainer with gasoline or cleaning oil.

(4) Replace the suction strainer if it is damaged.

(5) Assemble with reverse order of disassembly. Be sure to install a new O-ring and reinsert in the oil tank.

※ **Loosen the bolt slowly at the cover can be spring out by the spring when removing it.**



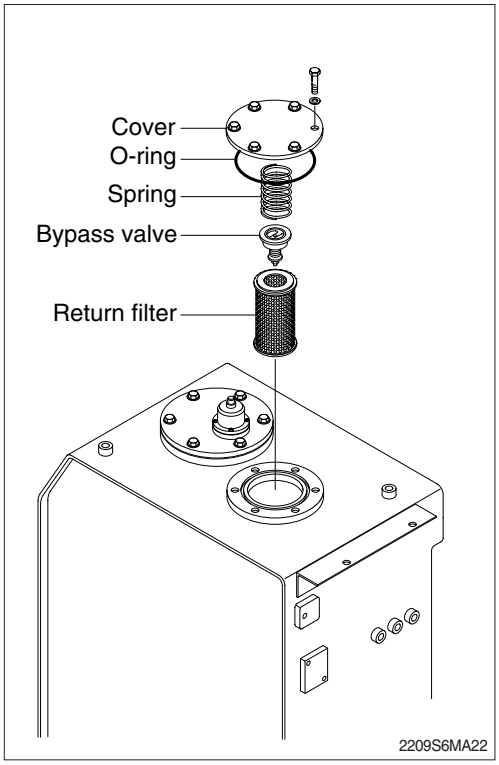
20) REPLACEMENT OF RETURN FILTER

Replace as follows paying attention to the cause to be kept during the replacement.

(1) Remove the cover.
- Tightening torque : 6.9±1.4 kgf · m
  (50±10 lbf · ft)

(2) Remove the spring, by-pass valve, and return filter in the tank.

(3) Replace the element with new one.



21) REPLACEMENT OF ELEMENT IN HYDRAULIC TANK BREATHER

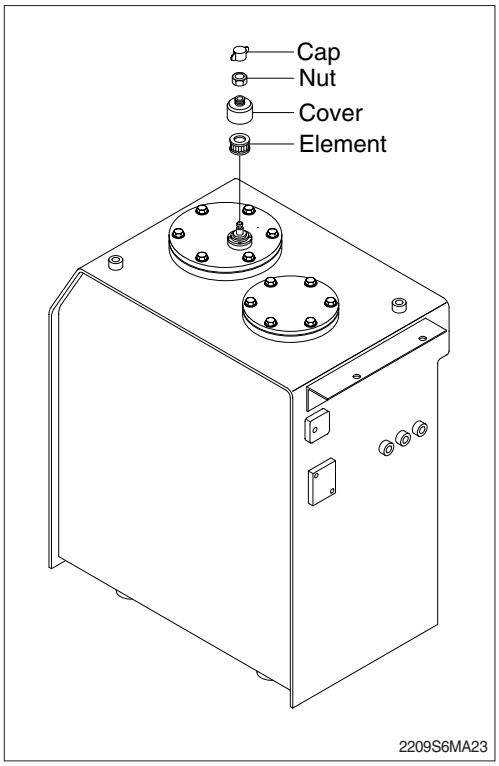
(1) Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

(2) Loosen the lock nut and remove the cover.

(3) Pull out the filter element.

(4) Replace the filter element new one.

(5) Reassemble by reverse order of disassembly.
- Tightening torque : 0.2~0.3 kgf · m
  (1.4~2.1 lbf · ft)

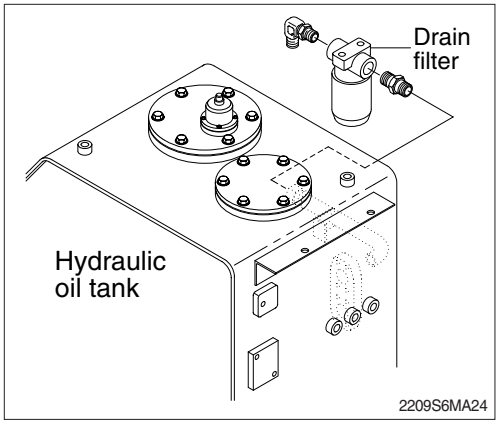


22) REPLACE OF DRAIN FILTER CARTRIDGE

Clean the dust around filter and replace with new one after removing the cartridge.

※ **Tighten about 2/3 turn more after the gasket of cartridge contacts seal side of filter body for mounting.**

※ **Change cartridge after initial 250 hours of operation. Thereafter, change cartridge every 1000 hours.**



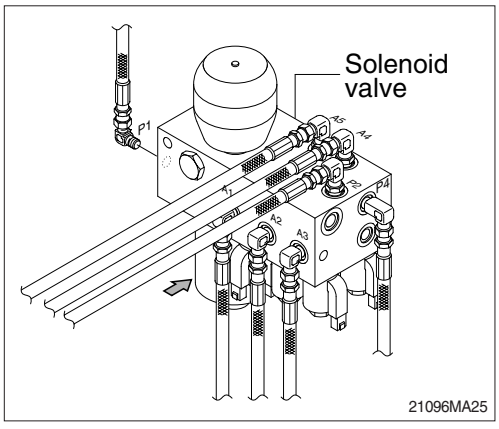
23) REPLACE OF PILOT LINE FILTER

(1) Loosen the nut positioned on the filter body.

(2) Pull out the filter element and clean filter housing.

(3) Install the new element and tighten using specified torque.

※ **Change cartridge after initial 250 hours of operation. Thereafter, change cartridge every 1000 hours.**

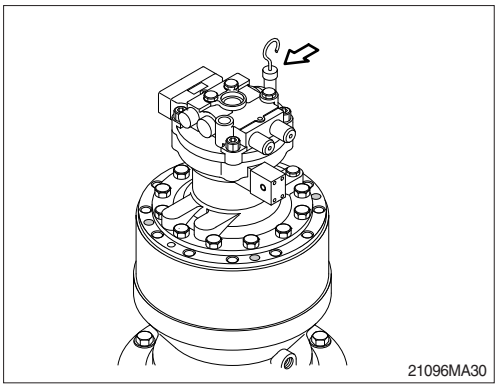


24) CHECK THE SWING REDUCTION GEAR OIL

(1) Pull out the dipstick and clean it.

(2) Insert it again.

(3) Pull out one more time to check the oil level and fill the oil if the level is not sufficient.



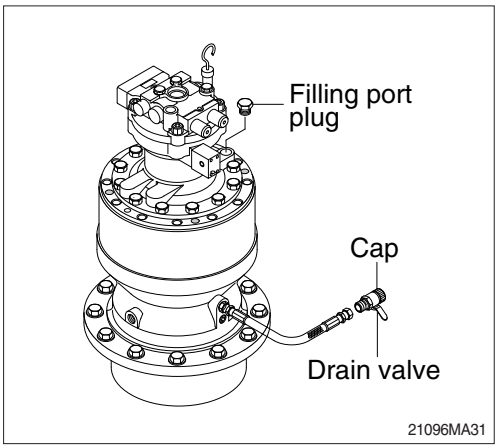
25) CHANGE SWING REDUCTION GEAR OIL

(1) Raise the temperature of oil by swinging the machine before replace the oil and park the machine on the flat ground.

(2) Prepare into a proper container.

(3) Open the cap and loosen the drain valve.

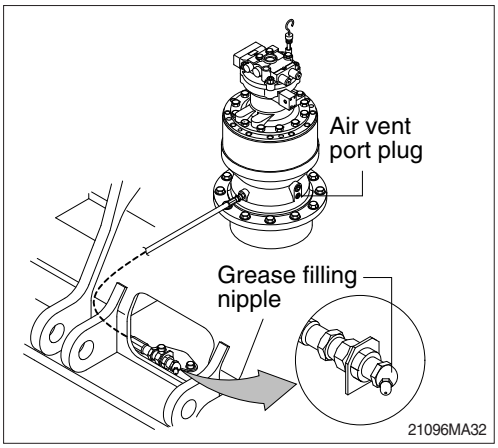
(4) Clean around the valve and close the drain valve and cap.
Fill proper amount of recommended oil.
- Amount of oil
  - Type 1 : 5.0 ℓ (1.3 U.S.gal)
  - Type 2, 3 : 6.2 ℓ (1.64 U.S.gal)



26) LUBRICATE BEARING OF OUTPUT SHAFT IN REDUCTION GEAR

(1) Remove air vent plug.

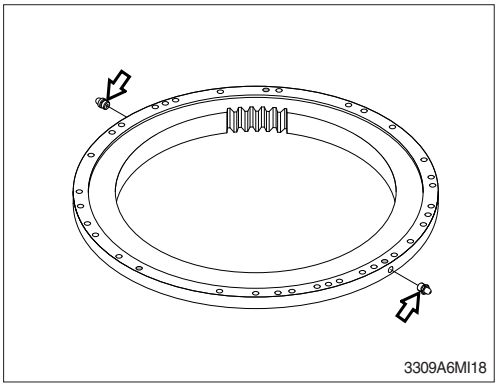
(2) Lubricate NLGI No.2 with grease gun until comes out new grease from air vent port.
- Amount of oil : 1.1 kg (2.4 lb)



27) LUBRICATE SWING BEARING

(1) Grease at 2 fitting.

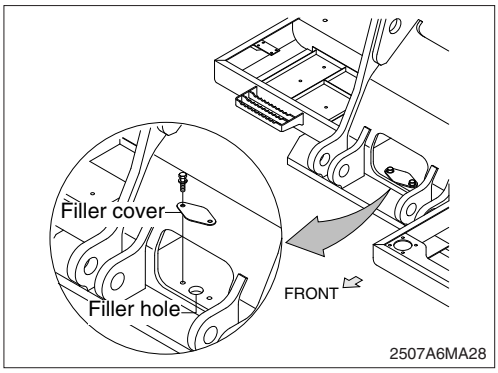
※ **Lubricate every 250 hours.**



28) SWING GEAR AND PINION

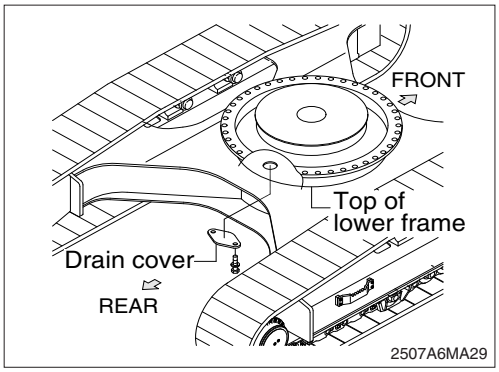
(1) Drain old grease

① Remove under cover of lower frame.
② Remove drain cover of lower frame.
③ Remove filler cover of upper frame.
④ Operate full turn (360) of swing several times.



(2) Refill new grease

① Install drain cover.
② Fill with new grease.
③ Install filler cover.
· Capacity : 13 kg (28.7 lb)

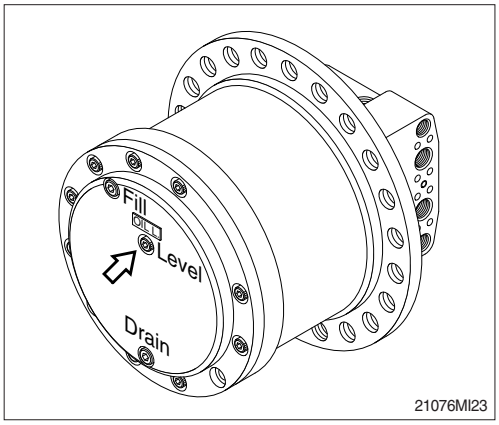


29) CHECK THE TRAVEL REDUCTION GEAR OIL

(1) Operate the machine to the position of drain plug down to the flat ground.

(2) Loosen the level plug and check the oil level.
If the level is at the hole of the plug, it is normal.
Fill the oil if it is not sufficient.

· Amount of oil : 5.8 ℓ (1.5 U.S.gal)



30) CHANGE OF THE TRAVEL REDUCTION GEAR OIL

(1) Raise the temperature of the oil by traveling machine first.

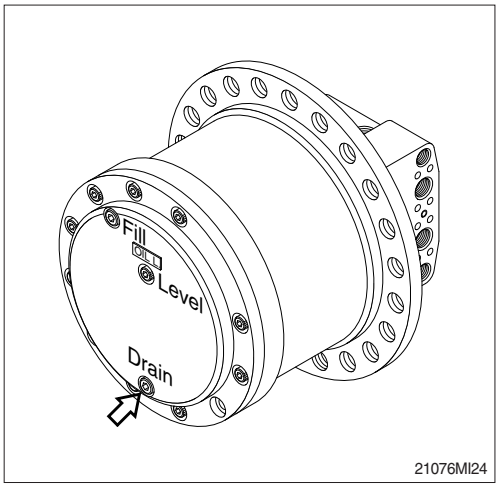
(2) Stop when the position of the drain plug is down.

(3) Loosen the level plug and then the drain plug.

(4) Drain the oil to adequate container.

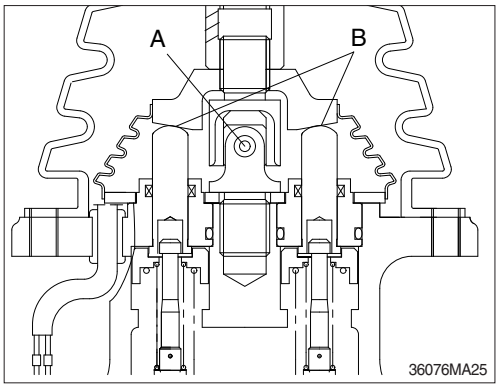
(5) Tighten the drain plug and fill specified amount of oil at filling port.

(6) Tighten the level plug and travel slowly to check if there is any leakage of oil.



31) LUBRICATE RCV LEVER

Remove the bellows and with a grease gun grease the joint part (A) and sliding parts (B).



32) ADJUSTMENT OF TRACK TENSION

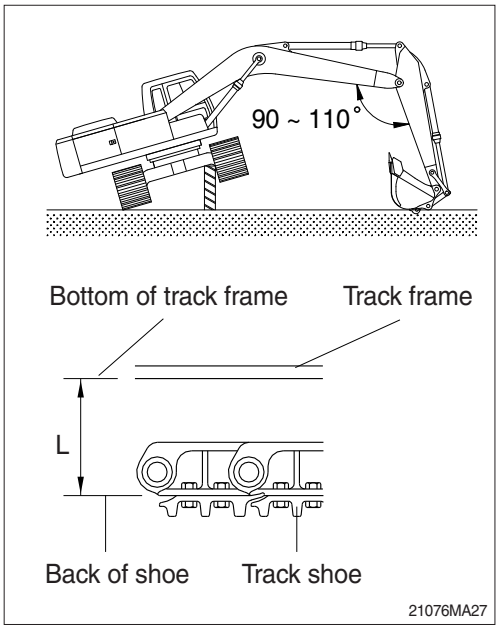
※ **It is important to adjust the tension of track properly to extend the lifetime of track and traveling device.**

※ **The wear of pins and bushings on the under-carriage will vary with the working conditions and soil properties.**
It is thus necessary to continually inspect the track tension so as to maintain the standard tension on it.

(1) Raise the chassis with the boom and arm.

(2) Measure the distance between bottom of track frame on track center and track of shoe.

※ **Remove mud with rotating the track before measuring.**



Length (L)	
300~320 ㎜	11.8~12.6"

(3) If the tension is tight, drain the grease in the grease nipple and if the tension is loose, charge the grease.

⚠ **Personal injury or death can result from grease under pressure.**

⚠ **Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.**
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

※ **When the grease is drained, move the track to the forward and backward slightly.**
If the track tension is loose even after the grease is charged to the maximum, change the pins and bushings as there are worn seriously.

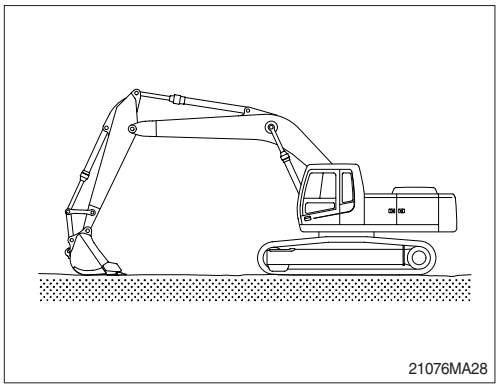
33) REPLACEMENT OF BUCKET

⚠ **When knocking the pin in with a hammer, metal particles may fly and cause serious injury, particularly if they get into your eyes. When carrying out this operation, always wear goggles, helmet, gloves, and other protective equipment.**

※ **When the bucket is removed, place it in a stable condition.**

※ **When performing joint work, make sure signals to each other and work carefully for safety's sake.**

(1) Lower the bucket on the ground as the picture shown in the right.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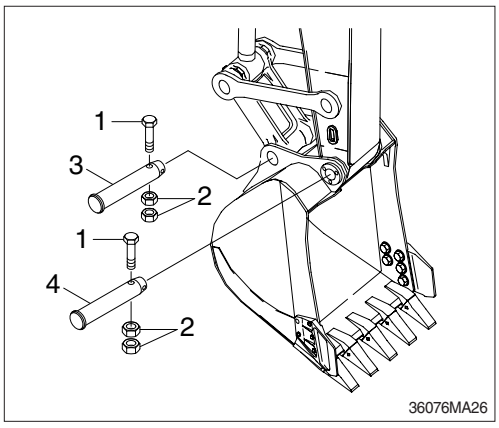
(2) Lock the safety lever to the LOCK position and stop the engine.

(3) Remove the stopper bolts (1) and nuts (2), then remove pins (3, 4) and remove the bucket.

※ **When removing the pins, place the bucket so that it is in light contact with the ground.**

※ **If the bucket is lowered strongly to the ground, the resistance will be increased and it will be difficult to remove the pins.**



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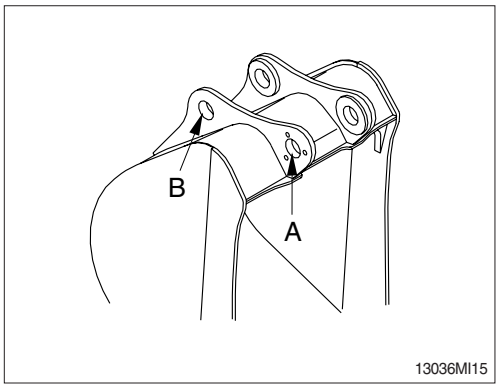
※ **After remove the pins, make sure that they do not become contaminated with sand or mud and that the seals of bushing on both sides do not become damaged.**

(4) Align the arm with holes (A) and the link with holes (B), then coat with grease and install pins(3, 4)



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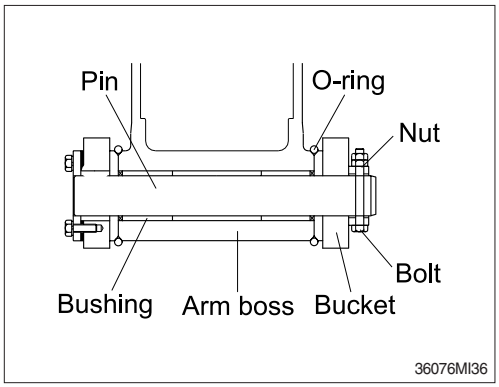
※ **When installing the bucket, the O-rings are easily damaged, so fit the O-rings on the boss of the bucket as shown in the picture. After knocking the pin, move the O-ring down to the regular groove.**

(5) Install the stopper bolt (1) and nuts (2) for each pin, then grease the pin.



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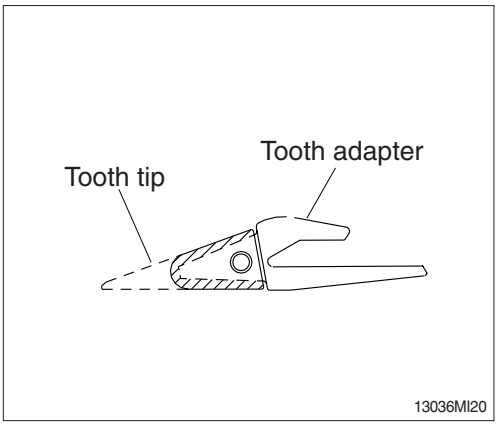
34) REPLACEMENT OF BUCKET TOOTH

(1) Timing of replacement

① Check wearing condition as shown in the illustration and replace tooth tip before adapter starts to wear.

② If excessive use, tooth adapter has worn out, replacement may become impossible.



(2) Instructions for replacement

① Pull out pin by striking pin with punch or hammer, avoiding damage to locking washer.

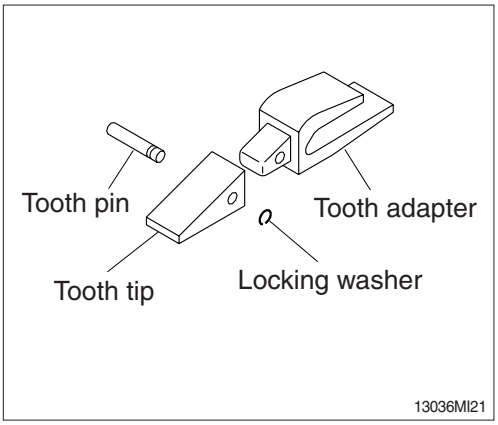
② Remove dust and mud from surface of tooth adapter by using knife.

③ Place locking washer in its proper place, and fit tooth tip to adapter.

④ Insert pin until locking washer is positioned at tooth pin groove.

⚠ Personal injury can result from bucket falling.

⚠ Block the bucket before changing tooth tips or side cutters.



35) ADJUSTMENT OF BUCKET CLEARANCE

(1) Lower the bucket on the ground as the picture shown in the right.

(2) Swing to the left and keep the arm boss to be contact to the bucket left.

(3) Lock the safety lever to the LOCK position and stop the engine.

(4) Measure the clearance (A) between bucket and arm boss. This is the total clearance.

(5) Adjusting

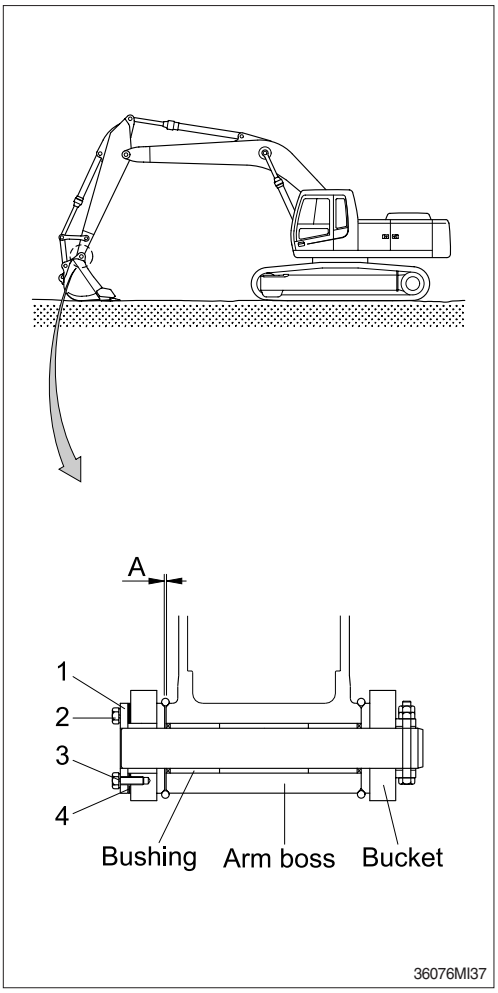
① Loosen bolt (2), and remove washer (3), plate (1) and shim (4).

② Remove the shim equivalent value with measuring value.

③ Assemble the parts in the reverse order of removal.

- Tightening torque : 29.6±3.2 kgf · m (214.0±23.1 lbf · ft)
- Normal clearance : 0.5 ~ 1.0 mm (0.02 ~ 0.04 in)

※ **If the bucket is not adjusted correctly, noise and vibration created during operation, and damaged O-ring, pin and bushing quickly.**



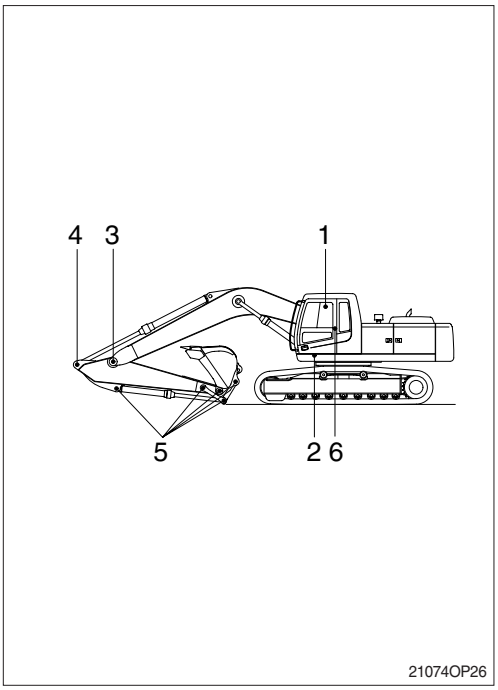
36) LUBRICATE PIN AND BUSHING

(1) Lubricate to each pin of working device

Lubricate the grease to the grease nipple according to the lubricating interval.

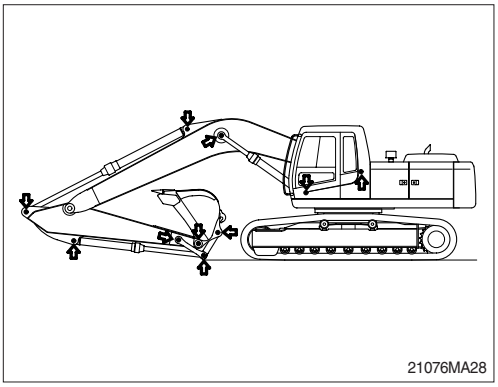
No.	Description	Qty
1	Lubrication manifold at boom	5
2	Boom cylinder pin	2
3	Boom and arm connection pin	1
4	Arm cylinder pin (Rod side)	1
5	Bucket cylinder pin (Head, rod)	2
	Bucket link (Control rod)	3
	Arm and control link connection pin	1
	Arm and bucket connection pin	1
6	Boom rear bearing center	1

※ **Shorten lubricating interval when working in the water or dusty place.**



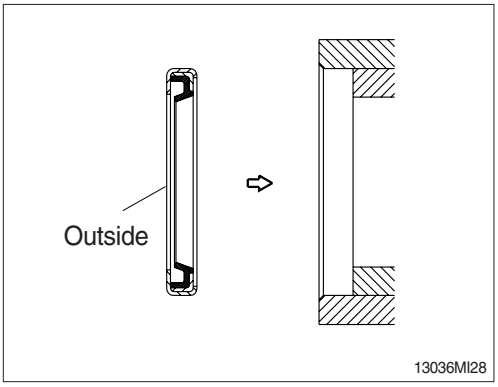
(2) Dust seals are mounted on the rotating part of working device to extend the lubricating interval.

※ **Mount the lip to be faced outside when replace the dust seal.**



※ **If it is assembled in wrong direction, it will cause fast wear of pin and bushing, and create noise and vibration during operation.**

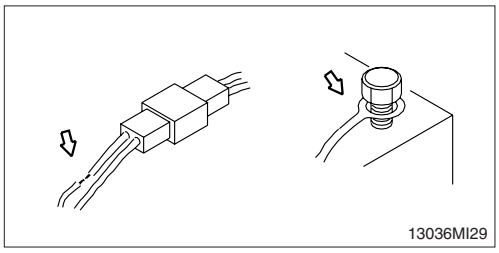
※ **Assemble the seal same direction with picture and use with plastic hammer when replace.**



7. ELECTRICAL SYSTEM

1) WIRING, GAUGES

Check regularly and repair loose or malfunctioning gauges when found.



2) BATTERY

(1) Clean

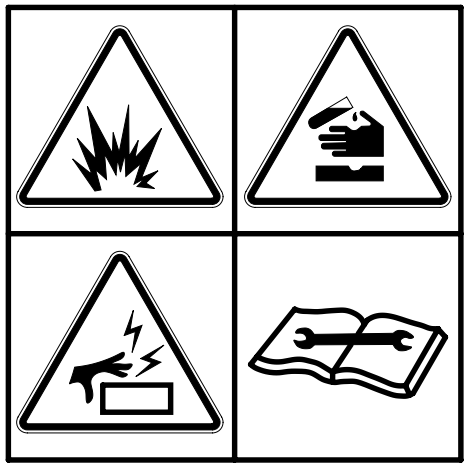
① Wash the terminal with hot water if it is contaminated, and apply grease to the terminals after washing.

⚠ Battery gas can explode. Keep sparks and flames away from batteries.

⚠ Always wear protective glasses when working with batteries.

⚠ Do not stain clothes or skin with electrolyte as it is acid.

Be careful not to get the electrolyte in eyes. Wash with clean water and go to the doctor if it enters the eyes.



(2) Recycle

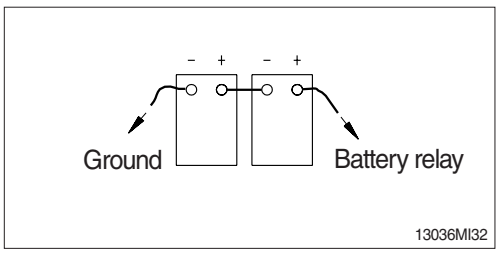
Never discard a battery.

Always return used batteries to one of the following locations.

- A battery supplier
- An authorized battery collection facility
- Recycling facility

(3) Method of removing the battery cable

Remove the cable from the ground connection first (⊖ terminal side) and reconnect it last when reassembling.



3) STARTING THE ENGINE WITH A BOOSTER CABLE

Keep following order when you are going to start engine using booster cable.

(1) Connection of booster cable

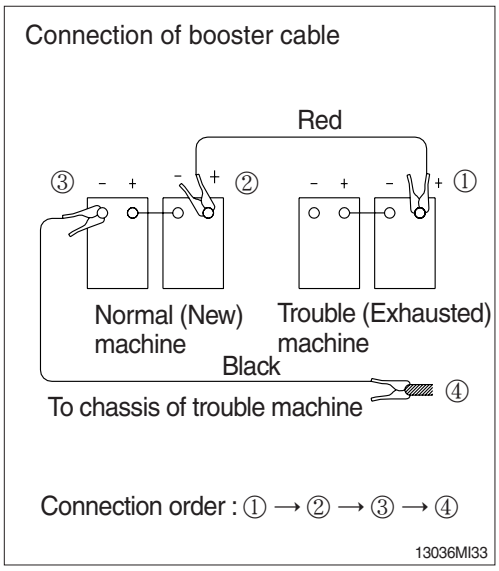
※ **Use the same capacity of battery for starting.**

① Make sure that the starting switches of the normal machine and trouble machine are both at the OFF position.

② Connect the red terminal of booster cable to the battery (+) terminal between exhausted and new battery.

③ Connect the black terminal of the booster cable between new battery (-) terminal and chassis of trouble machine.

※ **Keep firmly all connection, the spark will be caused when connecting finally.**

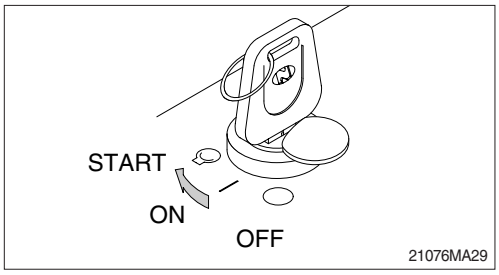


(2) Starting the engine

① Starting the engine of the normal machine and keep it to run at high idle.

② Start engine of the trouble machine with starting switch.

③ If you can not start it by one time, restart the engine after 2 minutes.



(3) Taking off the booster cable

① Take off the booster cable (black).

② Take off the booster cable (red) connected to the (+) terminal.

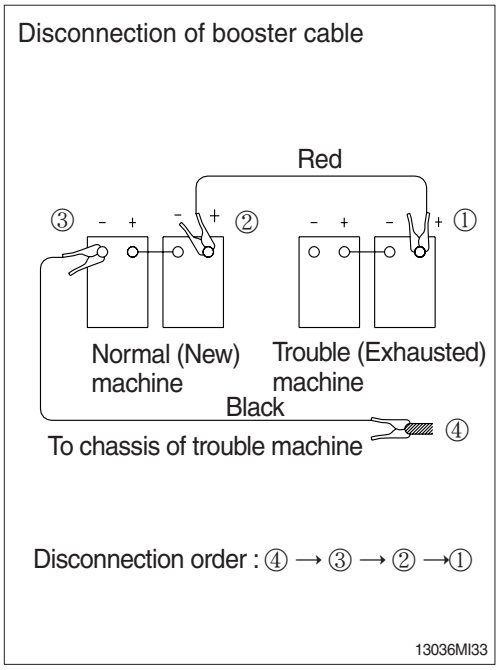
③ Run engine with high idle until charging the exhausted battery by alternator, fully.

⚠ **Explosive gas is generated while using the battery or charging it. Keep away flame and be careful not to cause the spark.**

※ **Charge the battery in the well ventilated place.**

※ **Place the machine on the earth or concrete. Avoid charging the machine on the steel plate.**

※ **Do not connect (+) terminal and (-) terminal when connecting booster cable because it will be shorted.**



(4) Welding repair

Before start to welding, follow the below procedure.

① Shut off the engine and remove the starting switch.

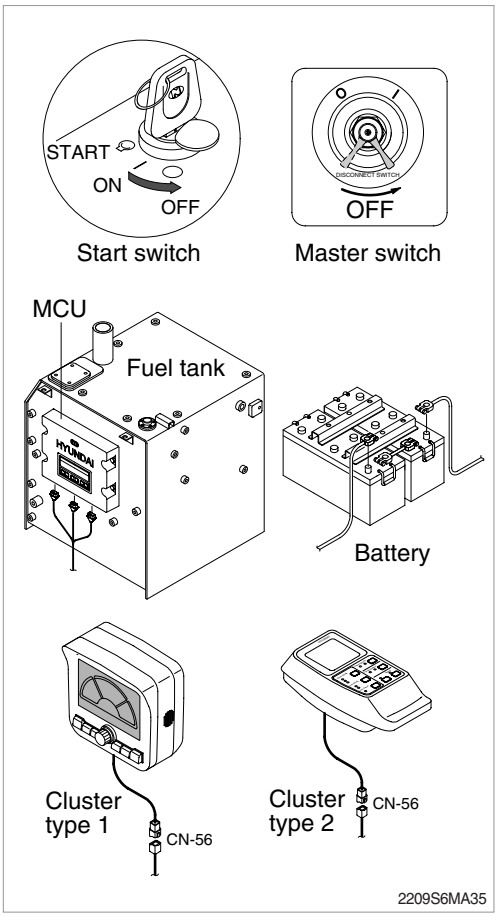
② Disconnect ground cable from battery by master switch.

③ Before carrying out any electric welding on the machine, the battery cables should be disconnected and the connectors pulled out of the electronic control units (MCU, cluster etc).

④ Connect the earth (ground) lead of the welding equipment as close to the welding point as possible.

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

⚠ **Do not attempt to welding work before carry out the above.**
If not, it will caused serious damage at electric system.

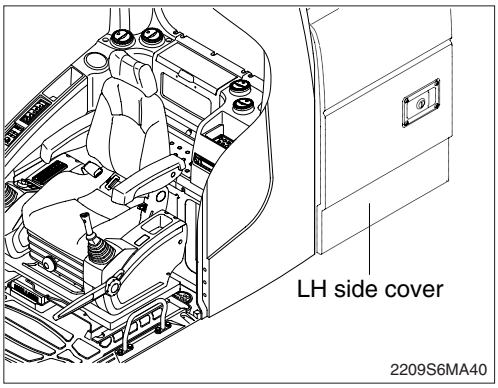


8. AIR CONDITIONER AND HEATER

1) CLEAN AND REPLACE OF FRESH AIR FILTER

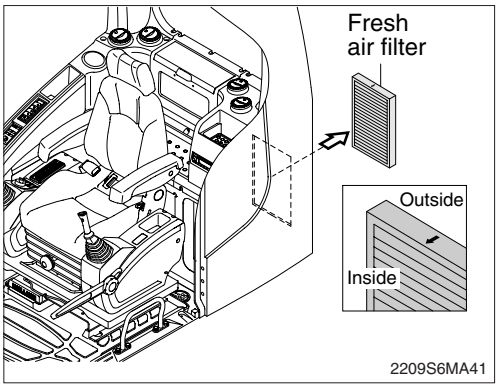
※ **Always stop the engine before servicing.**

(1) Open the LH side cover.



(2) Remove the fresh air filter.

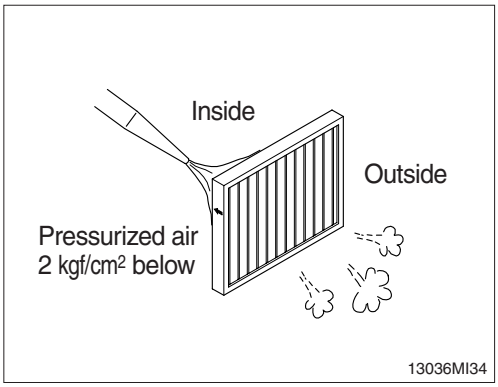
※ **When installing a filter, be careful not to change the filter direction.**



(3) Clean the filter using a pressurized air (below 2 kgf/cm^2, 28 psi).

△ **When using pressurized air, be sure to wear safety glasses.**

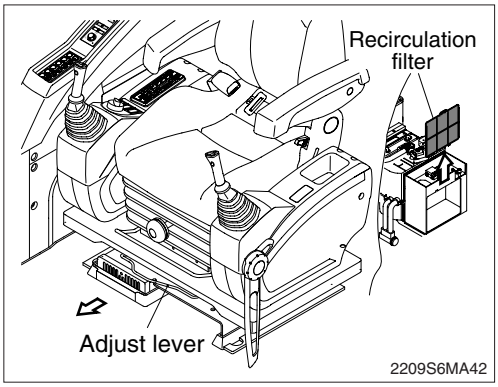
(4) **Inspect the filter after cleaning. If it is damaged or badly contaminated, use a new filter.**



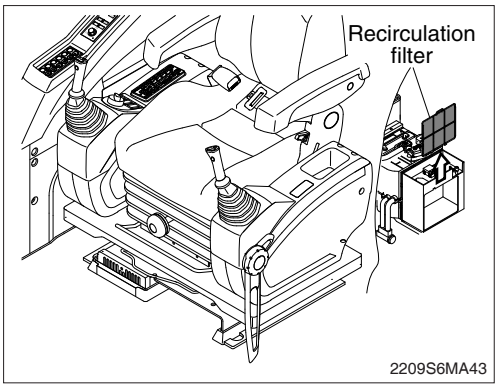
2) CLEAN AND REPLACE OF RECIRCULATION FILTER

※ **Always stop the engine before servicing.**

(1) Move seat and console box to arrow direction using the adjust lever.



(2) Remove recirculation filter.

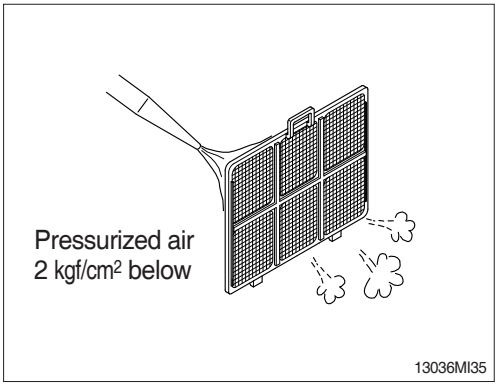


(3) Clean the recirculation filter using a pressurized air (below 2 kgf/cm², 28 psi) or washing with water.

△ **When using pressurized air, be sure to wear safety glasses.**

※ **Dry off after washing with water.**

(4) Inspect the filter after cleaning. If it is damaged or badly contaminated, use a new filter.



3) PRECAUTIONS FOR USING AIR CONDITIONER

(1) When using the air conditioner for a long time, open the window once every one hour.

(2) Be careful not to overcool the cab.

(3) The cab is properly cooled if the operator feels cool when entering there from outside (about 5˚C lower than the outside temperature).

(4) When cooling, change air occasionally.

4) CHECK DURING SEASON

Ask the service center for replenishment of refrigerant or other maintenance service so that the cooling performance is not damaged.

5) CHECK DURING OFF-SEASON

Operate the air conditioner 2 or 3 times a month (each for a few minutes) to avoid loss of oil film in the compressor.

6) REFRIGERANT (R134-a) AMOUNT : 750 ± 20 g

7) COMPRESSOR LUBRICANT OIL (SYNTHETIC OIL) : 265mL

1. ENGINE

※ **This guide is not intended to cover every conditions, however many of the more common possibilities are listed.**

Trouble	Service	Remark
The engine oil pressure lamp lights ON when engine speed is raised after completion of warm up.	· Add the oil to the specified level. · Replace the oil filter cartridge. · Check oil leakage from the pipe or the joint. · Replace the monitor.	
Steam is emitted from the top part of the radiator (the pressure valve). Coolant level warning lamp lights ON.	· Supply the coolant and check leakage. · Adjust fan belt tension. · Wash out inside of cooling system. · Clean or repair the radiator fin. · Check the thermostat. · Tighten the radiator cap firmly or replace the packing of it. · Replace the monitor.	
The engine does not start when the starting motor is turned over.	· Add fuel. · Repair where air is leaking into fuel system. · Check the injection pump or the nozzle. · Check the valve clearance. · Check engine compression pressure. · In cold weather, check if fuel warmer system is working normal.	Refer to the pages 3-8, 3-31 and 4-4, 4-8
Exhaust gas is white or blue.	· Adjust to specified oil quantity. · Replace with specified fuel.	
Exhaust gas occasionally turns black.	· Clean or replace the air cleaner element. · Check the nozzle. · Check engine compression pressure. · Clean or replace the turbocharger.	
Combustion noise occasionally changes to breathing sound.	· Check the nozzle.	
Unusual combustion noise or mechanical noise.	· Check with specified fuel. · Check over-heating · Replace the muffler. · Adjust valve clearance.	

2. ELECTRICAL SYSTEM

Trouble	Service	Remark
Lamp does not glow brightly even when engine runs at high speed. Lamp flickers while engine runs.	· Check for loose terminals and open-circuit wiring. · Adjust belt tension.	
Battery charging lamp does not go out even when engine runs at high speed.	· Check the alternator. · Check and repair wiring.	
Unusual noise is emitted from the alternator.	· Check the alternator.	
Starting motor does not turn when starting switch is turned ON.	· Check and repair the wiring. · Charge the battery. · Check the starting motor. · Check the safety relay.	
The pinion of the starting motor keeps going in and out.	· Charge the battery. · Check the safety relay.	
Starting motor turns the engine sluggishly.	· Charge the battery. · Check the starting motor.	
The starting motor disengages before the engine starts up.	· Check and repair the wiring. · Charge the battery.	
The engine warming up lamp does not go ON.	· Check and repair wiring. · Check the monitor.	
The engine oil pressure lamp does not light up when engine is stationary (when the starting switch is in ON position.)	· Check the monitor. · Check the caution lamp switch.	
Battery charging lamp does not light up when the engine is stationary. (when the starting switch is in ON position.)	· Check the monitor. · Check and repair the wiring.	

3. OTHERS

Trouble	Service	Remark
Track slip out of place. Excessive wear of the sprocket.	· Adjust tension of track.	
Bucket either rises slowly or not at all.	· Add oil to specified level.	
Slow speed of travel, swing, boom, arm and bucket.	· Add oil to specified level.	
Unusual noise emitted from pump.	· Clean the hydraulic tank strainer.	
Excessive oil temperature rise of hydraulic oil.	· Clean the oil cooler. · Adjust fan belt tension. · Add oil to specified level.	

HYDRAULIC BREAKER AND QUICK CLAMP

1. SELECTING HYDRAULIC BREAKER

1) Become familiar with the manual and select breakers suitable to machine specifications.
2) Make careful selection in consideration of oil quantity, pressure and striking force, to enable satisfied performance.
3) When apply a breaker to the machine, consult your local dealer of Hyundai for further explanation.

2. CIRCUIT CONFIGURATION

1) As for breaker oil pressure line, use extra spool of main control valve.

2) Set proper breaker pressure on load relief valve.
※ The initial setting pressure of load relief valve for breaker is 200 bar.

3) The pressure of the ROBEX220LC-9S system is 350 kgf/cm² (4980 psi).

4) Adjusting oil quantity

■ **CLUSTER TYPE 1**

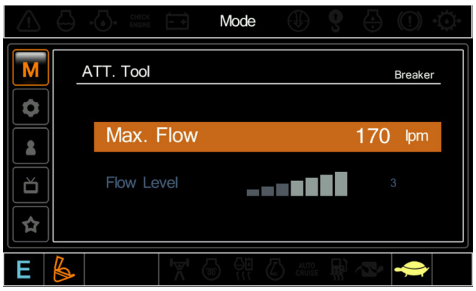
(1) Use the breaker mode from work tool of cluster. Use select switch to control the oil flow quantity.
· Setting oil quantity (180 lpm)

Flow set

· Max flow : Set the maximum flow for the attachment.
· Flow level : Reduce the operating flow from maximum flow.
- Breaker : Max 7 steps, reduced 10 lpm each step.

(2) If the quantity of hydraulic oil is not controlled properly, it causes short lifecycle of the breaker and the machine by increased breaking force and count.

Oil quantity setting (cluster type 1)



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■ **CLUSTER TYPE 2**

(1) Use accel dial switch to control the oil flow quantity.

5) The accumulator should be used to the breaker charging and return line.
If the accumulator is not used, it will be damage as the input wave is delivered.
※ **Keep the pressure pulsation of pump below 60 kgf/cm² (853 psi) by installing the accumulator.**

6) Do not connect the breaker return line to the main control, but connect to the return line front of the cooler.

7) Do not connect the breaker return line to drain lines, such as of swing motor, travel motor or pump, otherwise they should be damaged.

8) One of spool of the main control valve should be connected to the tank.

9) Select the size of pipe laying considering the back pressure.

10) Shimless tube should be used for the piping. The hose and seal should be used Hyundai genuine parts.

11) Weld the bracket for pipe clamp to prevent damage caused by vibration.

3. MAINTENANCE

1) MAINTENANCE OF HYDRAULIC OIL AND FILTER

(1) As machine with an hydraulic breaker provides the hydraulic oil becomes severely contaminated.

(2) So, unless frequently maintained, the machine may easily go out of order.

(3) Inspect and maintain hydraulic oil and 3 kinds of filter elements in particular, in order to prolong machine life.

2) RELEASE THE PRESSURE IN BREAKER CIRCUIT

When breaker operating is finished, stop engine and push pedal or switch for breaker to release pressure in breaker circuit.

If pressure still remains, the lifetime of the diaphragm in the accumulator will be shortened.

3) Be careful to prevent contamination by dust, sand and etc.

If such pollution become mixed into the oil, the pump moving parts will wear abnormally, shorten lifetime and become damaged.

4) When operating breaker, bolts and nuts of main equipment may be loosened by vibration. So, it must be inspected periodically.

Service interval

unit : hours

Attachment	Operating rate	Hydraulic oil	Filter element
Breaker	100 %	600★1	200
		1000★2	

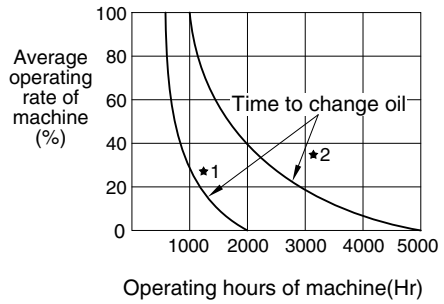
★1 : Conventional hydraulic oil

★2 : Hyundai genuine long life hydraulic oil

● **Replace following filter same time**

- Hydraulic return filter : 1 EA
- Pilot line filter : 1 EA
- Drain filter cartridge : 1 EA

Hyd oil change guide for hydraulic breaker



★1 : Conventional hydraulic oil

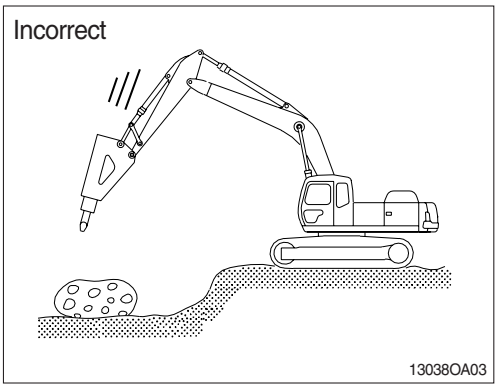
★2 : Hyundai genuine long life hydraulic oil

4. PRECAUTIONS WHILE OPERATING THE BREAKER

1) DO NOT BREAK ROCK WHILE LOWERING

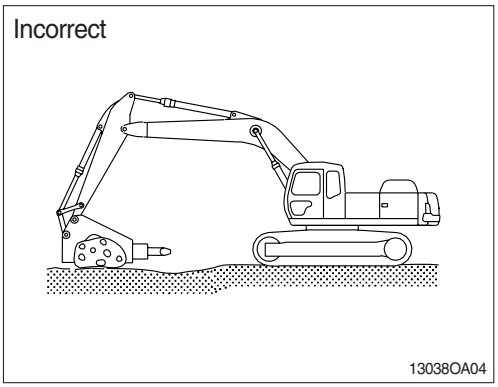
As the breaker is heavy in comparison with bucket, it must be operated slowly.

If breaker is rapidly pushed down, working device may be damaged.



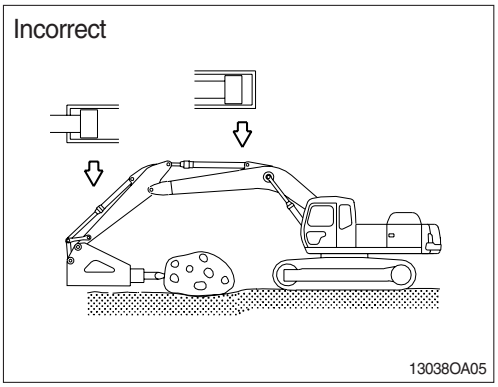
2) DO NOT USE BREAKER TO CARRY BROKEN STONE OR ROCK BY SWING OPERATING

This may damage the operation device and swing system.



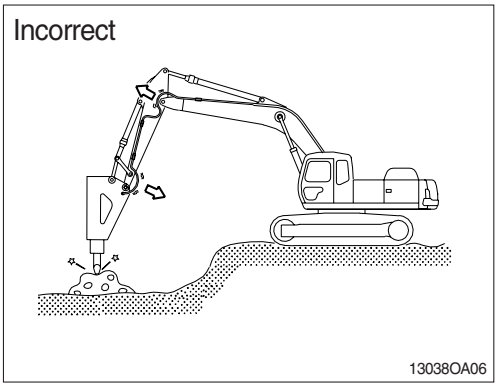
3) OPERATE BREAKER WITH A GAP IN EXCESS OF 100 mm (4 inches) FROM THE END OF THE STROKE TIP

If breaker is operated with the end tip, the cylinder may be damaged.



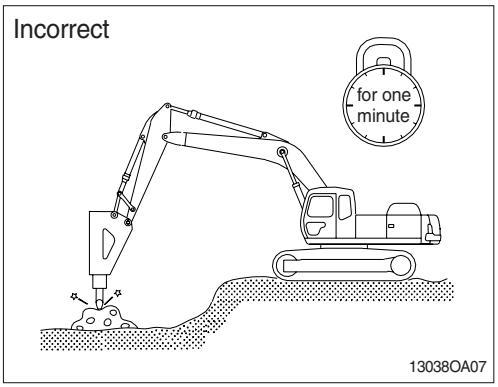
4) IF THE HYDRAULIC HOSES VIBRATE EXCESSIVELY

If the machine used in this condition continuously this will effect badly on the machine such as loosening bolt, oil leakage, damage of pump pipe and etc.



5) DO NOT CONTINUE TO WORKING OVER ONE MINUTE AT SAME POSITION OF BOOM AND ARM

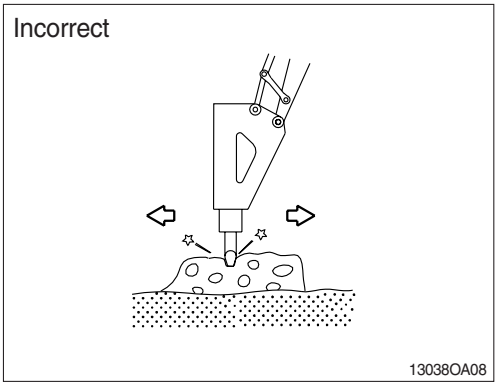
This will increase the temperature of the oil, and cause problem in the accumulator and seals.



6) DO NOT MOVE MACHINE OR BREAKER WHILE STRIKING

Do not move hammer while striking.

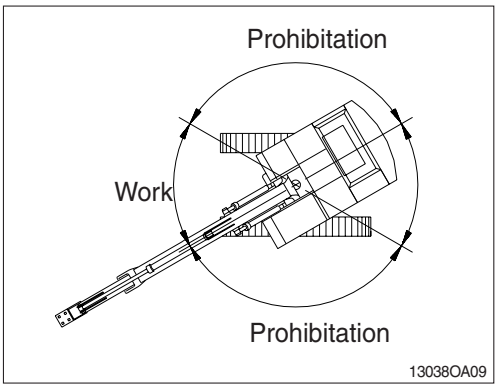
This will cause damage to the working device and the swing system.



7) DO NOT WORK WHILE SWING STATE

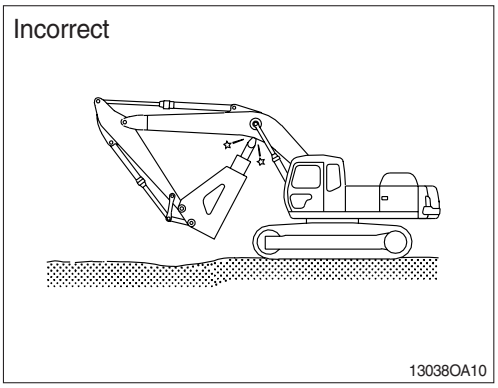
Do not work while swing position of superstructure.

It cause the band of track shoe, oil leakage of roller.



8) TAKE CARE OF CHISEL AND BOOM INTERFACE

Make sure of the arm and bucket control lever operation.

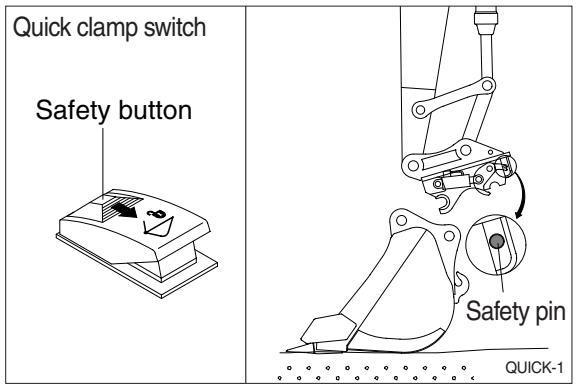


5. QUICK CLAMP

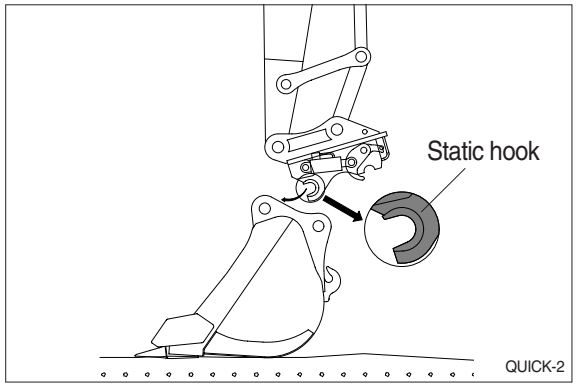
1) FIXING BUCKET WITH QUICK CLAMP

(1) Before fixing bucket, remove safety pin of the moving hook.

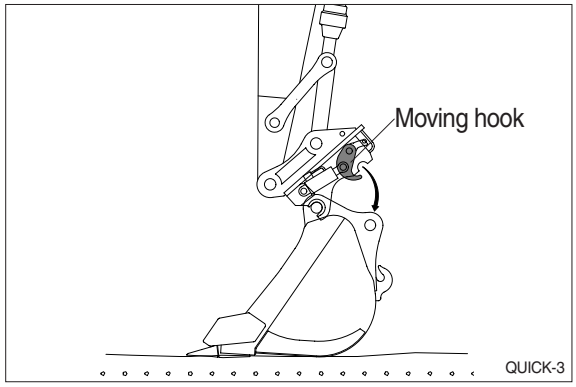
(2) Pulling safety button, press the quick clamp switch to unlock position. Then, the moving hook is placed on release position.



(3) Aligning the arm and bucket, insert static hook of quick clamp to the bucket pin.

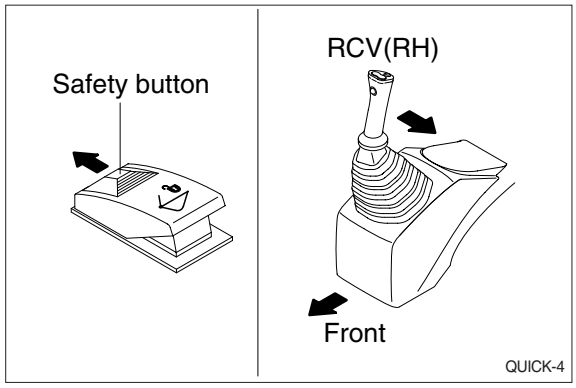


(4) Operate RCV lever to bucket-in position. Then, the moving hook is coupled with the bucket link pin.
Make sure that the moving hook is completely contacted with bucket link pin.

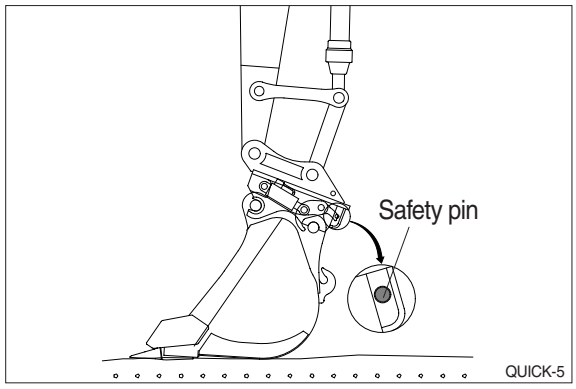


(5) Push safety button to lock position.
Operate RCV lever to bucket-in position.

※ **Be sure to check connection status between bucket pins and hooks of quick clamp.**



(6) After checking the connection status between bucket pins and hooks of quick clamp, **insert safety pin of moving hook to lock position.**



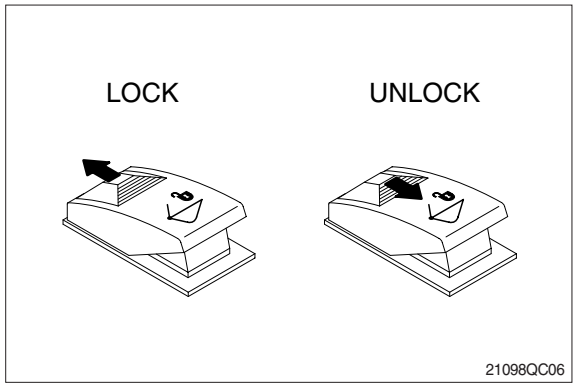
2) REMOVE BUCKET FROM QUICK CLAMP

Removing procedure is reverse of fixing.

3) PRECAUTION OF USING QUICK CLAMP

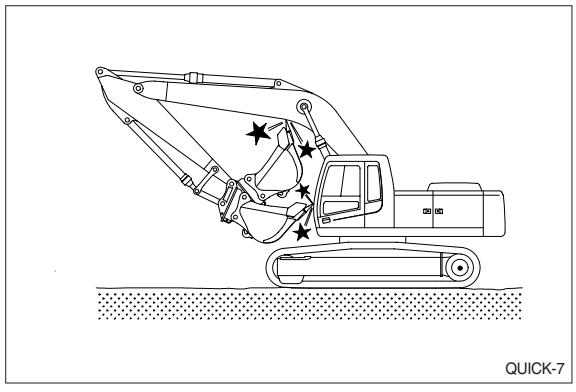
⚠ **When operating the machine with quick clamp, confirm that the quick clamp switch is lock position and safety pin of moving hook is inserted.**
Operating the machine with quick clamp switch unlocked and without safety pin of moving hook can cause the bucket to drop off and bring about the accident.

⚠ **Serious injury or death can result from this accident.**



⚠ **Be careful to operate the machine equipped with quick clamp. The bucket may hit cab, boom and boom cylinders when it reaches vicinity of them.**

HYUNDAI will not be responsible for any injury or damage in case that safety pin is not installed properly.



1. SAFETY OPERATION

1) UNDERSTAND MACHINE OPERATION

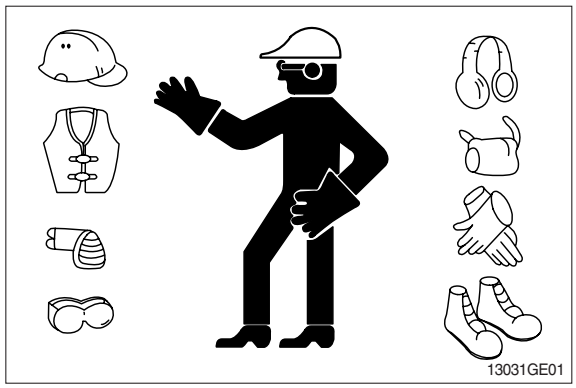
(1) Only qualified operator with understanding and experience should operate the amphibious machine. This operation manual must be read carefully and operators must understand all the contents before operate the amphibious machine.

(2) Operator must hold normal excavator license certified by local government. Training must be conducted to inexperience operator before operate the machine.

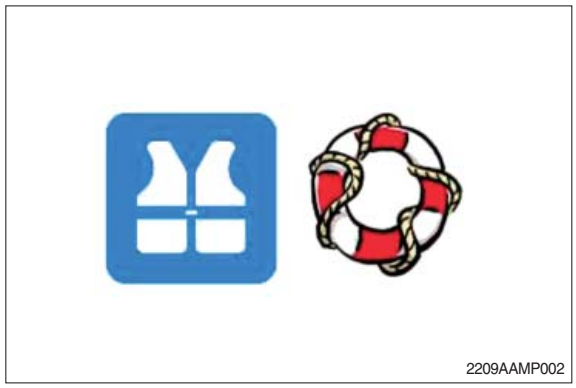
(3) Learn and remember the location and purpose of all controls, instruments, buttons, indicator lamps and caution signs.

2) WEAR PROTECTIVE CLOTHING

(1) Wear protective clothing and other safety equipment during machine installation, operation and maintenance.



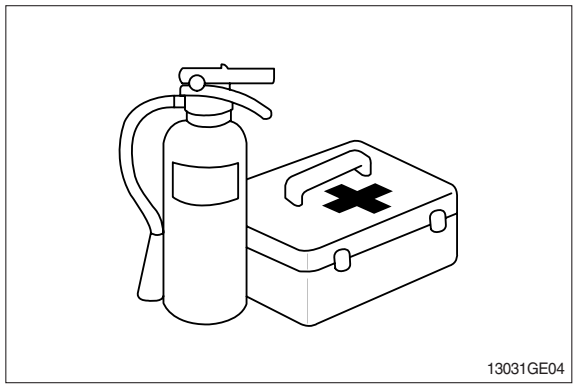
(2) Prepare lifebelt inside the operator cabin before operate the machine in open water. Safety life jacket must be worn for safety reason.



3) PREPARE SAFETY EQUIPMENT

(1) Stick any provided safety sign stickers at the glass inside the operator cabin. The stickers must be in position where the operator can clearly read the sign.

(2) Fasten a complete first-aid kit and fully charged fire extinguisher at the amphibious machine and learn how to use them correctly.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4) INSPECT THE MACHINE

(1) Inspect your machine carefully every time before you use it. Check the base of the pontoons for damage or cracks. Do some repairing if the damage or the cracks are very serious prior to operation in open water or swampy area.

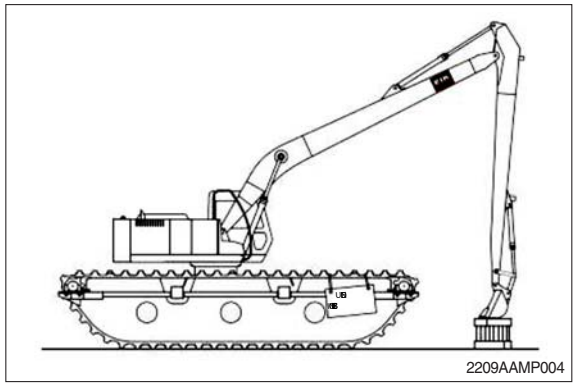
(2) Do not start or operate the amphibious machine before you are in the operator's seat.

(3) When you are to operate the machine, be sure that all personnel are away from the machine

5) INSPECTION AND MAINTENANCE

(1) Stop the engine before inspection or maintenance.

(2) Use safety sign "under inspection and maintenance" in order to warn the others not to operate and keep away from the amphibious machine.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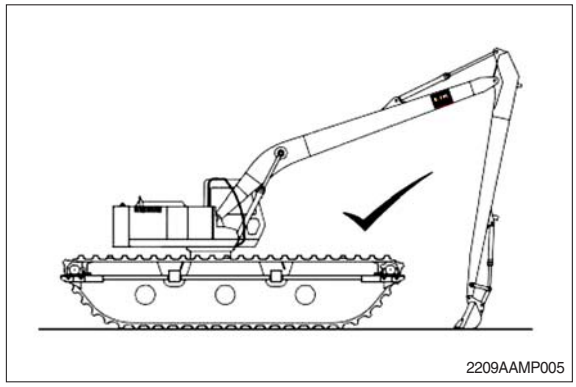
6) PARK MACHINE SAFELY

(1) Be sure that you lower the bucket and stop the engine when you are going to park the machine. Put the control lever in neutral position before you leave the cab.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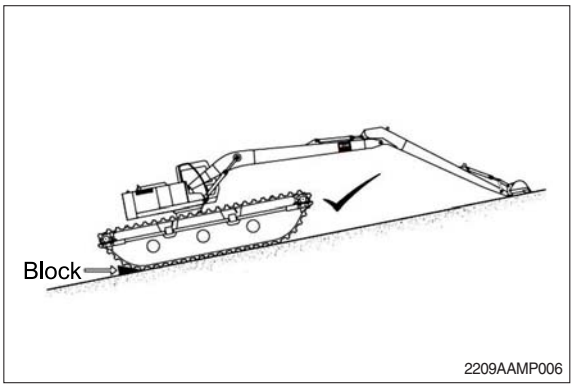
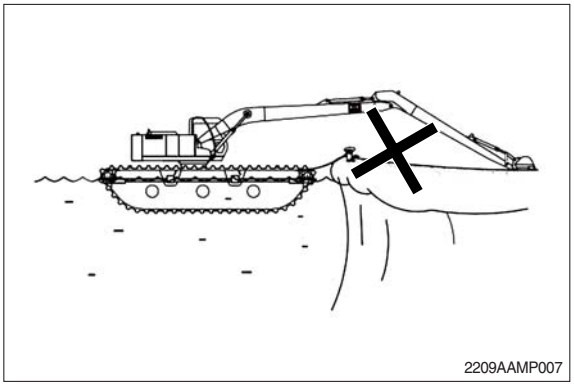
(2) Put the blocks againt the track if you park the machine on a slope and do not park the machine with the track pointed the downhill.



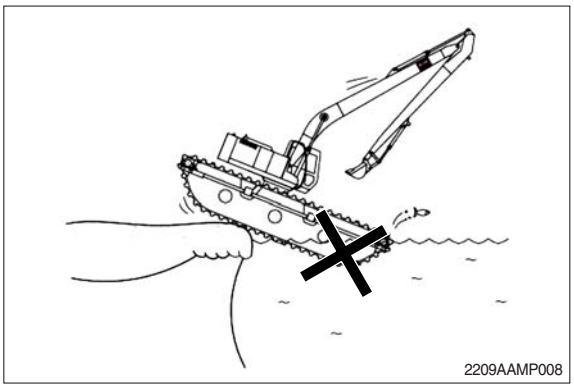
(3) Take the engine and cab key with you before leave the machine.

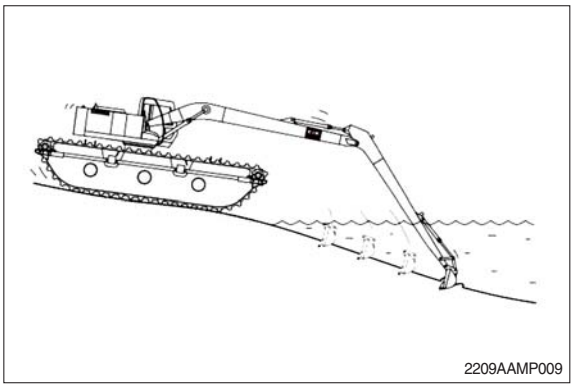
(4) Do not park your machine inside water.



7) EXAMINE THE WATER DEPTH & WATER BED CONTOUR.

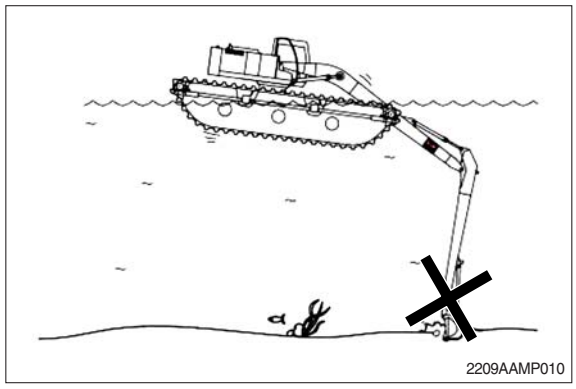
Always examine the water depth and the contour of the water bed with the excavator front attachment before launching the machine onto the water. Steep or sudden step or uneven contour may result in machine instability which could be hazardous during the launch. Do refer to see 9-5 page on the safe operating water depth for the machine.





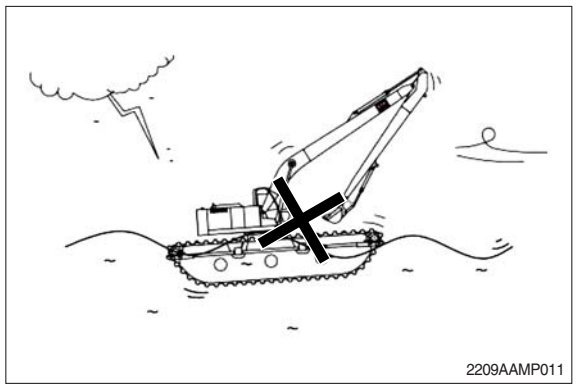
8) AVOID DIGGING JOB DURING FLOATED POSITION

In a floated position, the digging job application at the water depth more than 1.5 m is prohibited unless the machine is equipped with extra equipment such as additional pontoons and spud piles that could increase the stability of the whole machine.



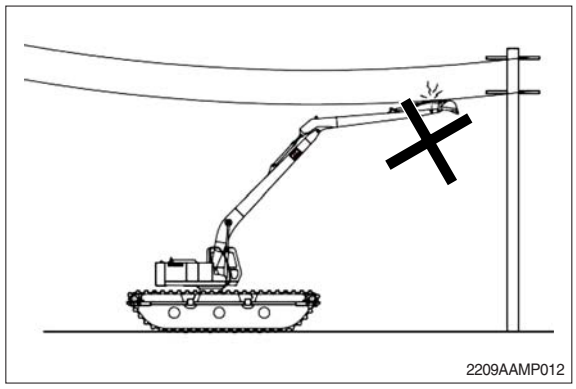
9) AVOID WATER TRAVELLING DURING BAD WEATHER CONDITION

Travelling in open water is limited to still water only. Do not try to operate the machine during the water is running stream or the wind is blowing over than 4 m/s.



10) BEWARE OF POWER LINE

Beware of power lines when travelling on land. Lower the long reach attachment if you need to pass over. Serious injury or death can result from contact with electric lines.



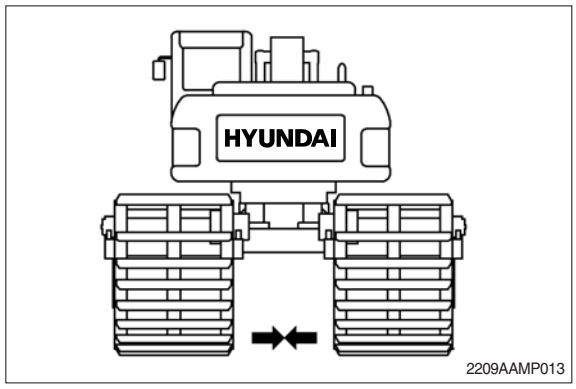
2. BASIC MACHINE OPERATION

1) OPERATING THE MACHINE

(1) Operate the machine with wider undercarriage

Since the undercarriage of the amphibious machine can be set to narrow mode as per figure 013 and wide mode as per figure 014, it is compulsory to operate the machine with wider undercarriage.

※ The undercarriage must be adjusted to the maximum width either manually or hydraulically. Narrow undercarriage is only applicable for non-operation application.



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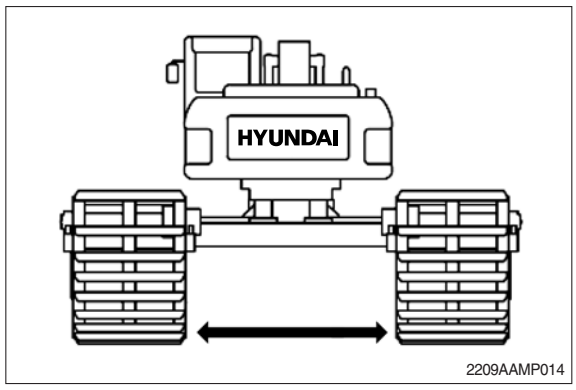

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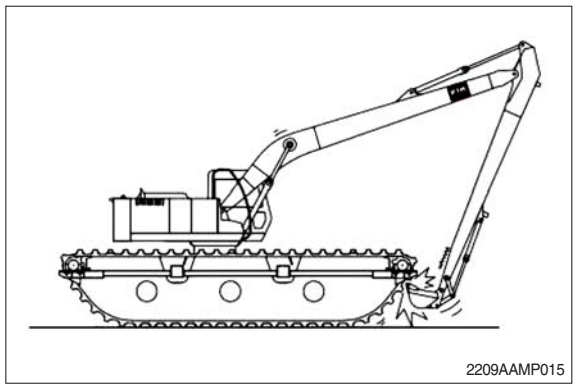
(2) Operate the boom, stick and bucket carefully

Since the machine is attached with a long reach, be careful when moving these attachments up, down and turn. Begin and end the operation with slowly and smoothly. The attachment may collide with the pontoons and cause severe damage to the structure and very troublesome for repairing.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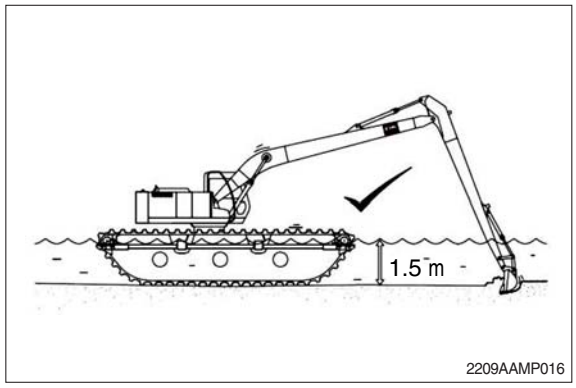
(3) Operate the machine safely

Without additional pontoons and spud piles, digging inside the water only valid for the depth up to 1.5 m only.



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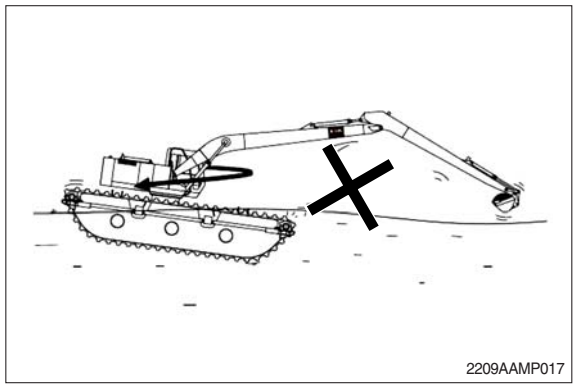
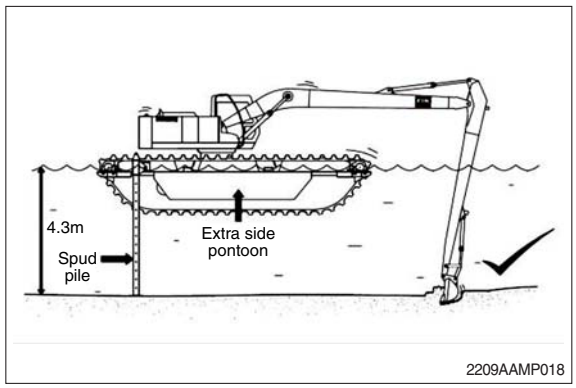
Do not put the front attachment (either with load or without load) in long reach position as per figure 017 and do not swing the machine when working in such condition at water depth more than 1.5 m.

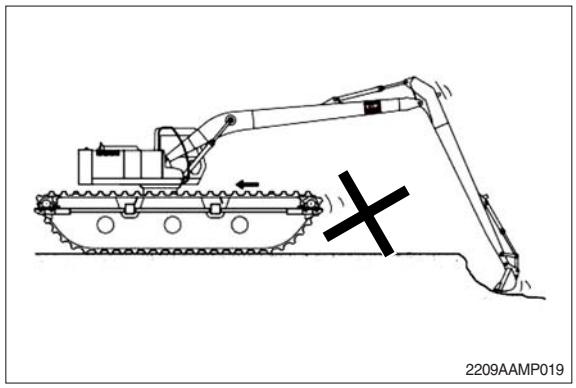


Spud piles and additional pontoons can stabilize the machine during floats up to 4.3 m water depth (depend on the spud piles and machine size).



(4) Avoid abusive operation

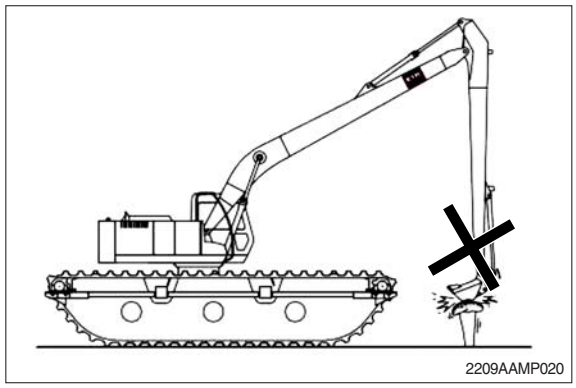
Do not use travel force as additional digging technique. This operation will exert unreasonable force upon the machine structure especially to the front attachments and severe damage may result.



(5) Avoid hammering operation

Do not perform hammering and pilling operations using the bucket which could cause damage to the bucket and the front attachments of the machine.

Such operations are dangerous and should be avoided in all circumstances.



2) TRAVELLING THE MACHINE

(1) General

① Before launch the machine into water or sludge, check to see that the pontoons have serious damage or cracks.

② Check the track chain tension before start the work. Slack track chain may come off during steering. Adjust the track chain tension but do not excessively tight that would give high travel resistance to the machine.

③ Before operating the travel levers, confirm which direction the tracks and travel motor are facing. Refer to the arrows at the pontoon which are directed to the front side.

(2) Land

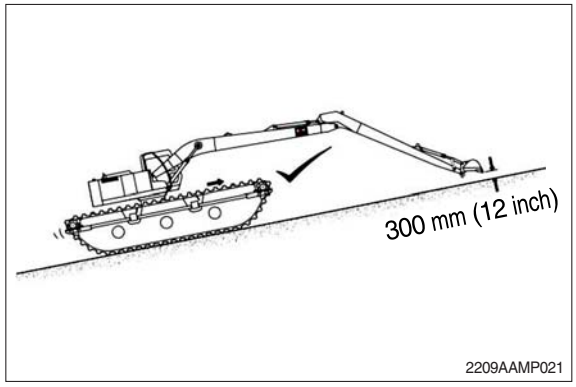
① Use a flagman when travelling on the shoulder of a road or in confined area.

② Travel on flat ground an in straight lines (turn with large angles) as much as possible. When turning the machine, use alternating forward and reverse movement as much as possible instead of making one sharp turn.

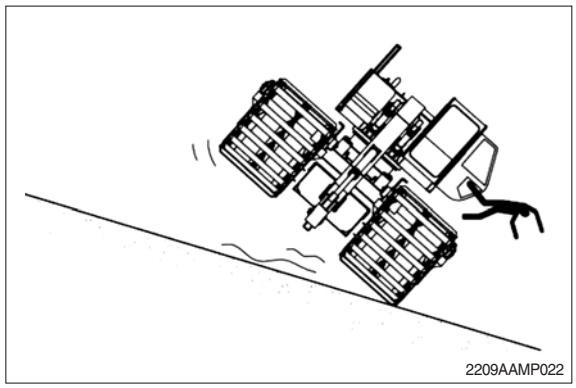
③ Avoid a hard travel on land with many stones, rocks and stub as much as possible that may shorten the track shoes life.

④ When travelling on rough ground, use low (1st) gear with low engine speed to reduce the shock to the pontoons and machine.

⑤ When ascending or descending slopes, keep the bucket 300 mm (12 in) above the ground which give you enough time to lower the bucket to the ground immediately if the machine start to slip.



⑥ Avoid changing directions on a slope. Otherwise the machine may turn over or slide sideways



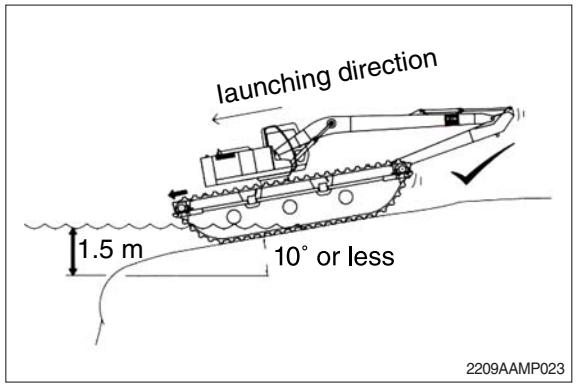
(3) Water

① Launching the machine in water

Do not directly launch the machine into open water without examine the water depth. Before launch the machine, choose a land with slope approximately 10° or less continues down to the the water until the machine can floats.

Lower the front attachment to create a low center of gravity for the machine which could stabilze the machine during launching.

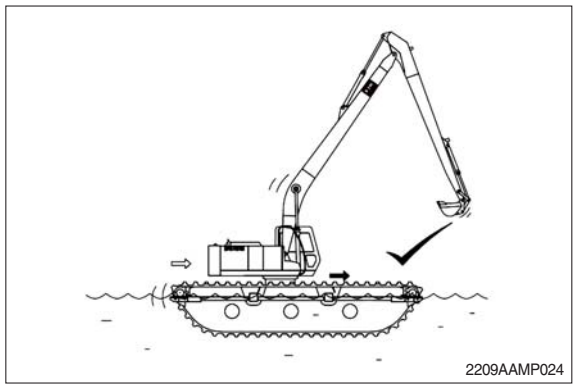
Launch the machine tailforemost at a slow speed. Refer to the arrow direction at the machine before launching.



② Before and during travelling the machine in water

Check to see first that there are no bubles coming out from the pontoons after launching and before travelling. Make sure that the machine is not abnormally tipped to one side before proceed with operation.

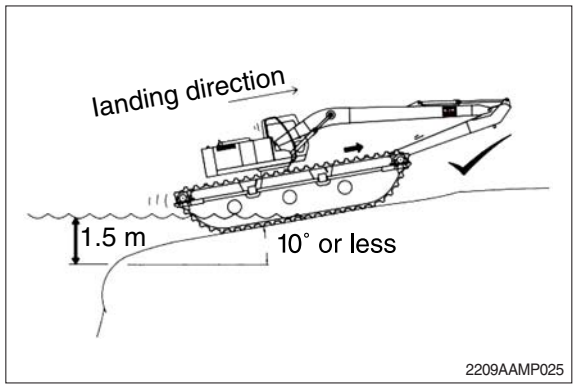
Travel the machine according to the arrow direction at the pontoon and smoothly adjust the front attachments position, up or down when you want to keep your machine horizontal and stable.



③ Landing the machine

Lower the front attachment once the front track catches the land during landing. If the track slips during landing, use the bucket to help your machine escape from water.

Make sure that your front machine is facing to the land during landing.



3. UNDERCARRIAGE MAINTENANCE

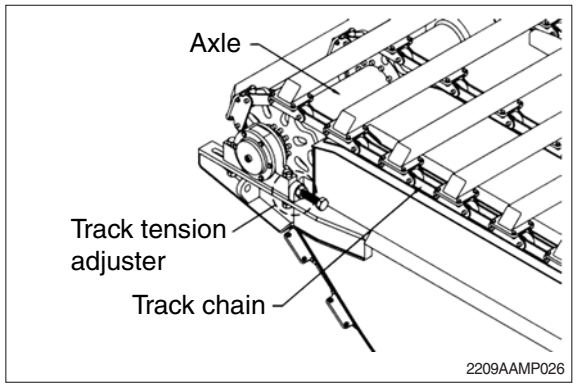
Regular, intervals of proper lubrication and maintenance are essential for long life of the parts and provide safe operation without drastically loss performance.
This chapter provides correct procedures for lubrication and maintenance for the undercarriage.

1) TRACK TENSION

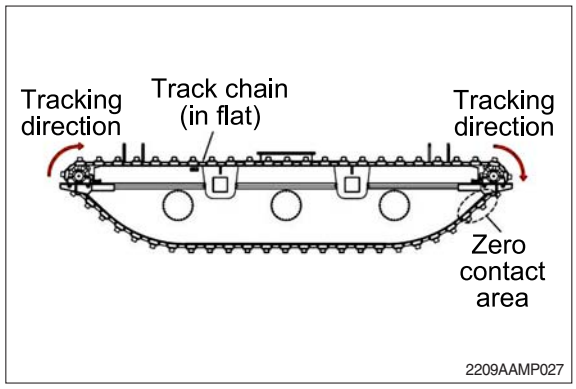
(1) Check the track chain condition before and after travelling the machine.
The chain may come off from the track if it is too slack or loose during steering. Use bolts at track tension adjuster to adjust the track chain tension but do not over tight the track chain that would give high travel resistance to the machine.

(2) Before the track chain can be adjusted, the mechanic must examine how slack the track is and what is the suitable tension must be set.

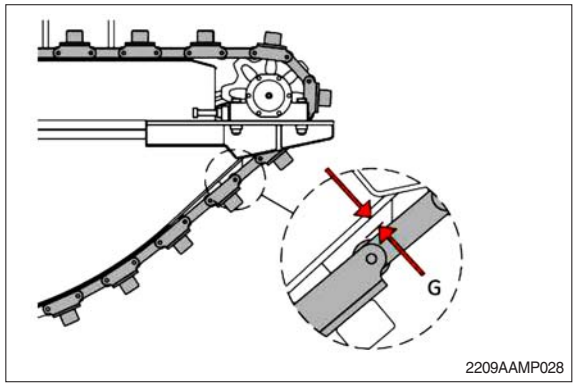
(3) Firstly, be sure that the bottom and the top track chains of the pontoon are in tension or flat. Use the axle tracking force to get the flat chain on top of the pontoon.



(4) Check the track chain at the front side of the axle tracking direction. An area where the track rollers do not contact with the pontoon body (called as Zero Contact Area (ZCA)) should occur due to track chain movement as per figure 027.



(5) Measure the gap between the track rollers and pontoon body at the ZCA as per figure 028. If the biggest gap, G is between 38.1~63.5 mm (1.5~2.5"), that means the track chain is in the good tension. If that gap is more than 63.5 mm (2.5"), the track chain is in the slack condition and must be tensed correctly.



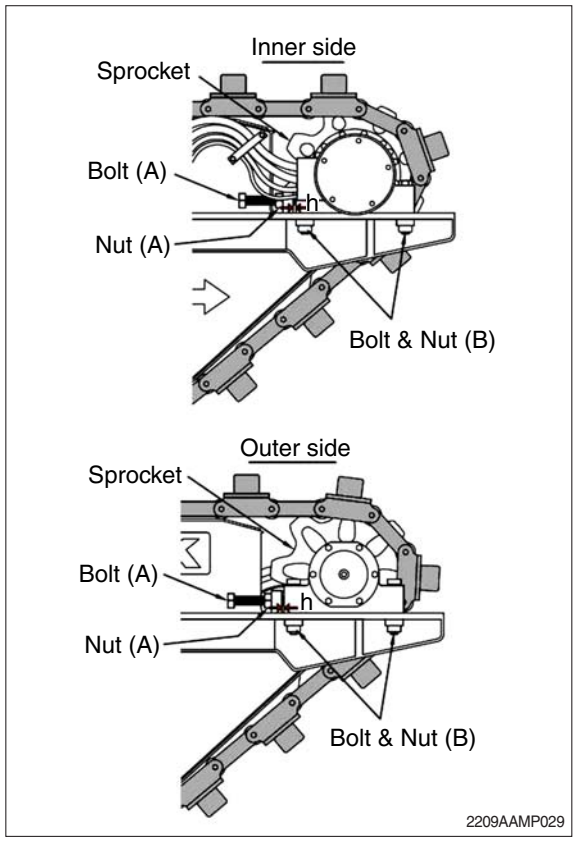
(6) Loosen the lock nut (A) at the track tension adjuster and push out the axle by retighten the bolt (A) until the biggest gap between track roller and pontoon body at the ZCA is between 38.1~63.5 mm (1.5~2.5").

※ **Bolts and nuts (B) must be loosed before axle can be pushed out and both of axles (front and rear) must be pushed out with the same distance.**

⚠ **Do not excessively tight the bolt until gap G is less than 38.1 mm (1.5").**

(7) Measure the gap, **h** and adjust the track tension until all **h** are same at each end of pontoon to ensure that each axle is aligns with the track chain as per figure 029.

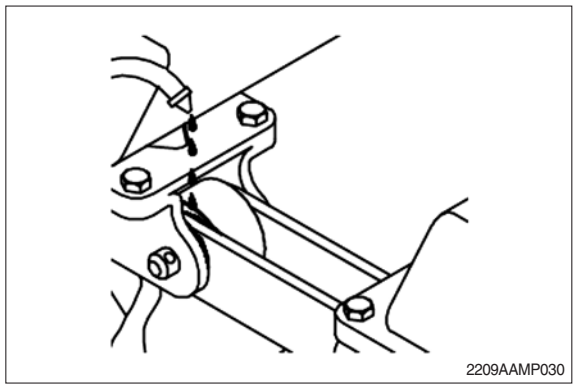
※ **Misalignment between axle and track chain can cause excessive wear and tear to the sprockets and track chain.**



2) TRACK ROLLERS LUBRICATION

Lubricate the track rollers with waste oil especially after the machine has been exposed to water or sludge and after the machine is not use for a long period. The machine may travel smoothly and can longer the track rollers and pontoon life if the lubrication is done frequently.

※ **Before lubrication, please refer to your local environment laws & regulations.**
Waste oil may pollutes the environment especially water and plants.



3) GREASING

Greasing is very important for the frictional components such as bearing, pin and bushing or gear mechanism. The purpose of greasing is not only limited to reduce the friction between two or more contact parts but also as an additional protection from corrosion. The next figures show the most important components/parts on the amphibious undercarriage that must be regularly greased in order to slow down the wear rate, corrosion and hence longer the components life.

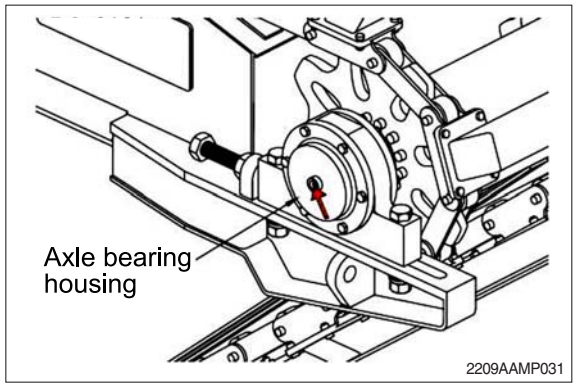
※ Before apply greasing; please refer to your local environment laws & regulations. Grease may pollutes the environment especially water, plants and animals.

(1) Axle Bearing

Spherical roller bearing is sealed inside the bearing housing at each axle on each pontoon. These bearings must be greased for every 50 hours (refer to figure 031).

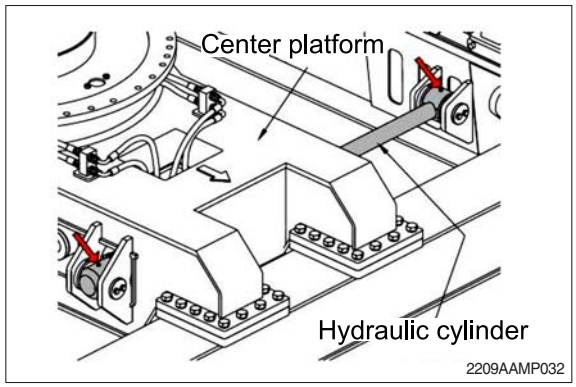
※ Some models of Amphibious Undercarriage do not have axle bearing.

※ Grease must be pumped into each axle bearing housing until it is full.



(2) Pin & Bushing

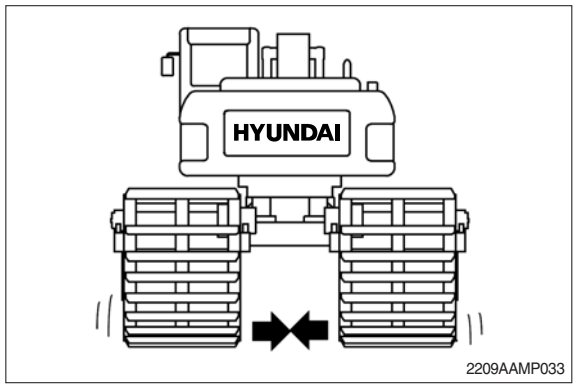
The application of pin and bushing on Amphibious Undercarriage is limited at extendable model only. These pin and bushing must be greased for every 50 hours.



4) HYDRAULIC CYLINDER

The application of hydraulic cylinders is limited at extendable model only. When extend, the hydraulic cylinder shaft is exposed to air, water and other solid objects that can cause corrosion or serious scratch. When the shaft surface is no longer smooth, the seals will damage and leaks will happen.

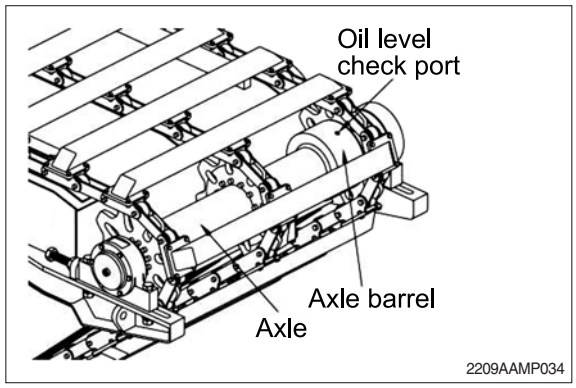
Since the shaft is not protected during extends, the only way to reduce the corrosion rate is by retracting the shaft during land travelling and parking. When the shaft is sealed inside the barrel, the hydraulic oil will protects it from outside contaminants hence longer the shaft life and maintain the hydraulic cylinder ability.



5) TRAVEL REDUCTION GEAR OIL

Check the gear oil condition of the travel reduction gear for every 250 hours.

Since the hydraulic travel motors were sealed inside the axle barrel, the gear oil condition can be checked, removed or replaced through the oil level check port as per figure 034.



(1) Rotate the axle until the oil level check port is approximately horizontal to imaginary line as per figure 035.

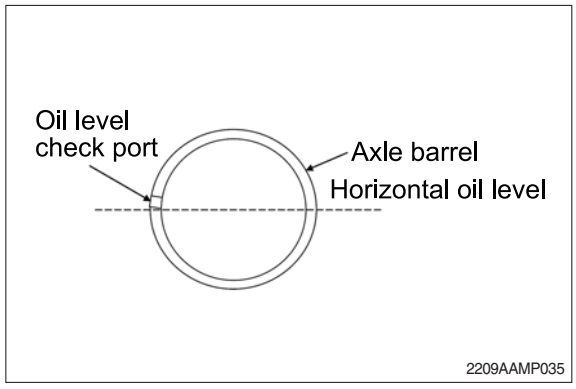
※ **Oil level check port must be a bit high than the oil level before remove the plug.**

(2) Lower the bucket/attachments to the ground.

(3) Run the engine at slow idle speed without load for five minutes.

※ **The turbocharger may be damaged if the engine is not properly shut down.**

(4) Stop the engine. Remove the key from the key switch.



(6) Pull the safety lever to the LOCK position.

⚠ **Keep your body and face away from oil level check plug. Gear oil may be hot after operation. Wait until the gear oil cool and then gradually loosen the plug to release the pressure.**

(7) After gear oil has cooled, slowly loosen the oil level check plug to release the pressure inside the axle barrel.

(8) Oil must be approximately horizontal to the hole.

(9) If necessary, add oil until the oil flows out from the oil level check plug hole.

(10) Wrap the plug threads with sealing-type tape. Install the plug and tighten the plug.

(11) Check the oil level in the other three reduction gear at each axle.

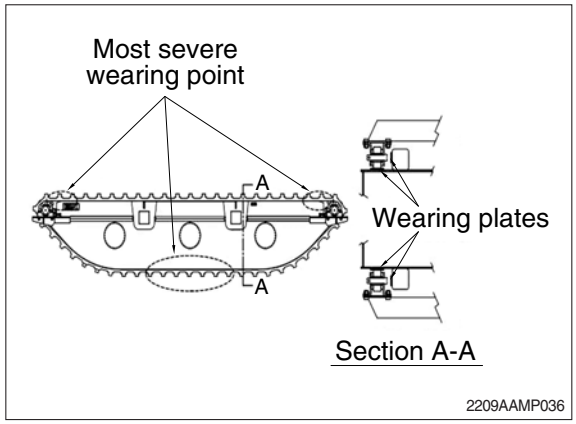
6) WEARING PLATES

Wearing plates are welded to the pontoon at the portions where the pontoon contacts and frictional with the track rollers or track pins during travelling and steering. Without these wearing plates, the said portions at the pontoon are very fast and very easy to get wear. Therefore, be sure to make the following checks in order to keep your pontoons are applicable for long term use:

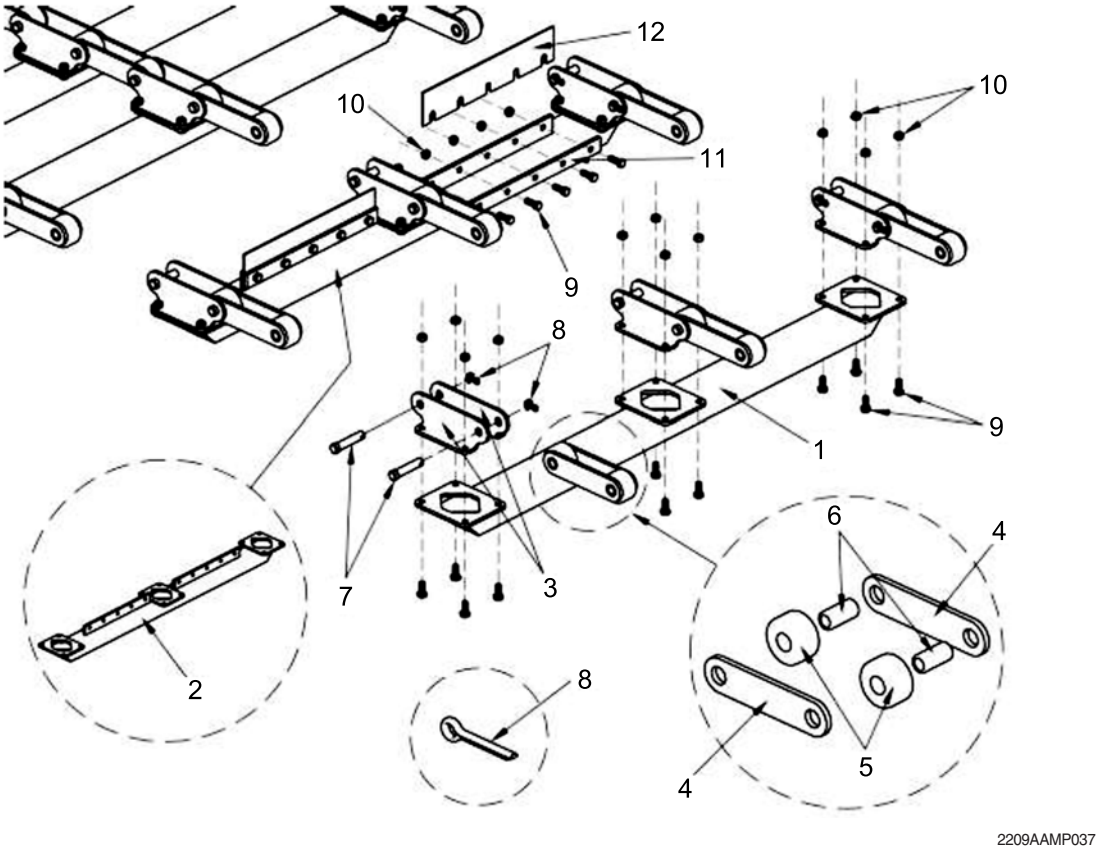
(1) The amount of wear and tear for the wearing plates should be checked at the bottom and the upper corner of the pontoons which are subjected to most severe wearing rate.

(2) Measure the thickness of the wearing plates for every 100 hours and make replacement if the remaining thickness of the plate is below 4 mm.

⚠ **Failure to replace the wear wearing plates could cause serious damage to pontoon body. Moving track chain is just like a blunt saw waiting to cut off the pontoon body after the wearing plate have been finished 'cut-off'.**



7) TRACK PARTS



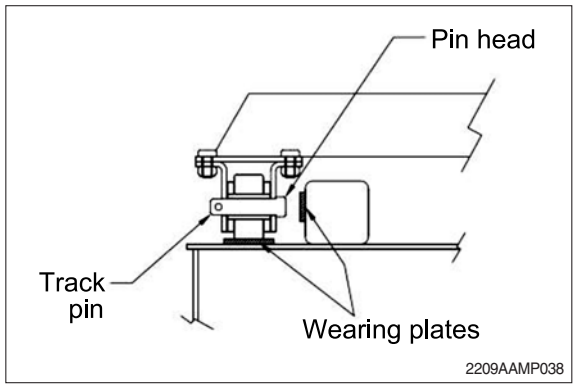
1	Normal track shoe	7	Track pin
2	Cleaning track shoe (option)	8	Cotter pin
3	Shoe link plate	9	Bolt
4	Roller link plate	10	Nut
5	Roller	11	Clamp plate (option)
6	Bushing	12	Dozer blade (option)

(1) Inspect the track shoes for every 100 hours and make replacement if the part is seriously damage and cannot be used anymore. Inspection rate must be more frequently than normal especially when the machine has been operated on the land for a long period.

※ **Track shoes are not limited for travelling on land only. Track shoes also are useful for paddling on open water. With the large surface area and big in quantity, it creates huge amount of resistance with water and help machine to move faster even without additional propelling devices.**
Track shoes also can protect the bottom of the pontoon from unseen dangerous items when working in swampy or muddy areas such as sharp scrap metals, stumps or rocks.

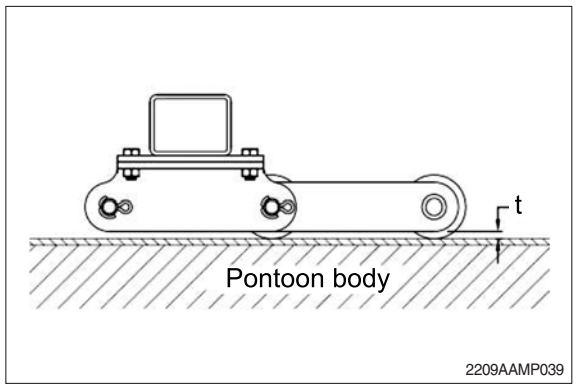
※ **Failure to make replacement of the damage track shoes can affect the pontoon body and increase the cost for maintenance.**
A track shoe life is varies substantially with different travel frequencies, quality of soil and water and application method of the machine.

(2) Change the track pins if the head are seriously wear. Replace the pin if the head thickness wears until less than 4 mm. For every 100 hours, the track pin head must be inspected since the head is always contact and frictional with the wearing plate.



(3) A roller must be replaced if the value of **t** is less than 3mm as per figure 039. Normally, a track roller and a bushing wear at the same rate and the replacement must be made simultaneously. Do not let until the rollers are completely wear and the track link contact with the pontoon body.

※ **Track rollers and bushings life are vary substantially with different travel frequencies and medium of operation. Track rollers and bushings are very fast to get wear when the machine is operated at sandy or muddy area.**
Wear rate of tracks rollers and bushings does not directly proportional with machine working hours.

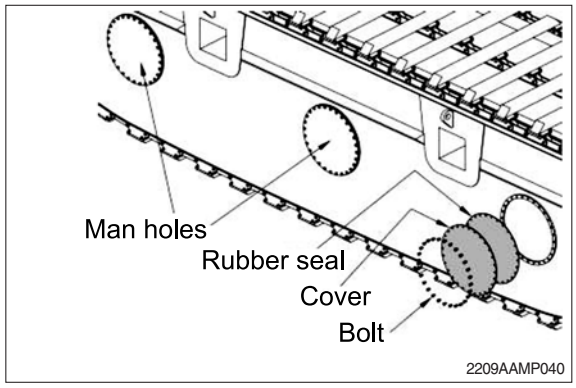


8) PONTOON

Pontoons provide sufficient buoyancy force to float the whole machine on open water. Sometimes, the leaks may happen at welding joints especially after the pontoons have been exposed to extreme environment for long period. Water leaks inspection must be made for every 500 hours in order to keep pontoons safe for operation. In other case, inspection must be made immediately if the machine is tipped abnormally to one side during operating on open water.

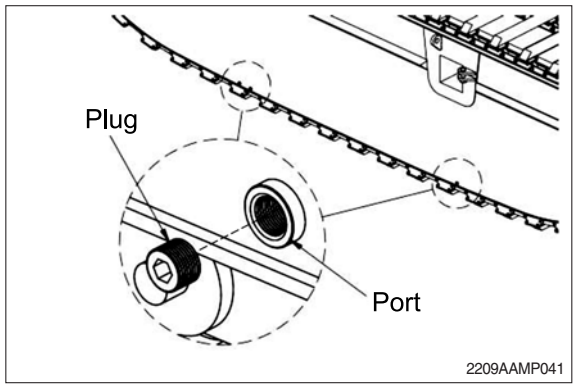
(1) Each pontoon provides man holes at the side wall for maintenance purpose (as per figure 040).

※ **Serious damage or leaks maybe need to be repaired from inside. Small leaks can be inspected and repaired from outside.**



(2) Remove all the drain port plugs for each compartment at the bottom of the inner side wall for suspected leakage pontoon.

※ **Compartment with plenty amount of water flows out from the drain port is subjected to leakage.**



(3) All compartments of a pontoon that are required for buoyancy purpose are to be air tested to a pressure between 5 to 6 psi.

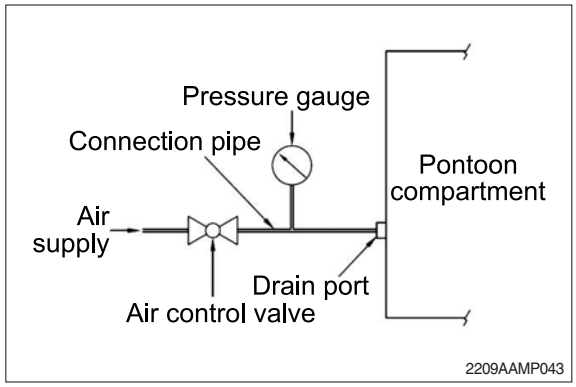
※ **The air pressure for the test may be measured by pressure gauges. When a pressure gauge is used, care must be taken to prevent the over pressuring of the compartment. This pressure testing must be carried out prior to the application of a protective coating on the pontoons or in way of the weld.**

※ **It is essential when using a pressure gauge to ensure that the gauge is correctly calibrated at all times.**

(4) Install the pressure gauge and air supply valve to drain port of the subjected leakage compartment (refer to figure 043).

(5) Air is supplied into the compartment until the required test pressure is achieved.

(6) The air is then shut off by closing the supply valve and all welded seams, joints and connections of the effected compartment are tested with soapy water to determine if there are any leaks and the positions of the leaks.



(7) Where leaks do occur, the leaks area is to be re-welded, and on completion, the air tested repeated on the compartment effected.

※ **This operation is to be repeated if necessary until no further leaks from that compartment are observed.**

※ **The man hole must be tested with soapy water. The rubber pads that keep the compartment isolated are subjected to lose its elastic properties becoming very brittle and breaking into shards when struck. This case happens because rubber has moderate resistance to environmental damage by heat, light and ozone.**

9) HYDRAULIC LINE

Hydraulic line for amphibious undercarriage is built up from the combination of pipes and hydraulic hoses. Hydraulic hoses are used when pipes or tube cannot be used, usually to provide flexibility for machine operation or maintenance. It is more than half of amphibious undercarriage hydraulic line is covered by hydraulic hoses.

(1) Since the hydraulic hoses are built up by rubber and steel layers, regular inspection must be made in order to keep the operation safe and steady.
Unseen hard and sharp objects could damage and burst the expose hydraulic hoses especially when operating the machine in swampy or muddy area.

(2) Hydraulic hoses and pipes inside the pontoon are protected and do not required regular inspection as per external hydraulic hoses. Inspection is only needs if machine is keep losing the hydraulic oil but the leaks could not be detected from external hydraulic line. In this case, drain ports must be removed and compartment with plenty of hydraulic oil abnormally coming out from the drain port is subjected to leakage.

(3) Access the compartment through the man hole and then fix the problems. The joints and the fittings maybe loosen or the O-rings have lost it elastic properties.

All the provided information are base to design specification and are gained from long term experience in design and manufacturing amphibious undercarriage. Hopefully all the information is not only help the users to operate the amphibious undercarriage safely and confidently but also could optimized the machine performance and then satisfaction is achieved with the return on investment.

4. ASSEMBLY MANUAL

1) INSTALLATION PRECAUTIONS

These precautionary steps are necessary to ensure the safety during the installation progress.

(1) For safety, check the surroundings before start the installation.

(2) Install the caution signs or caution tape surroundings the installation base.

(3) Wear helmet and other safety clothing during the installation progress.

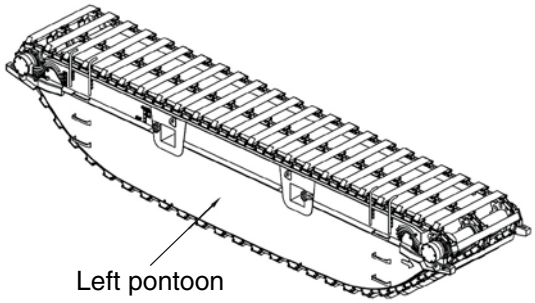
(4) Keep all personnel and objects clear from the installation base except for the installation tools and workers.

2209AAMP101

2) UNDERCARRIAGE AND BASE MACHINE INSTALLATION

(1) Positions one of the pontoons (either left or right) on a firm, flat and wide ground to ensure the stability of machine during the entire process.

⚠ **Secure the chains/cables onto the lifting hooks located at the top side of the pontoon. Use proper chains or cables that are capable to withstanding the weight of the pontoon.**



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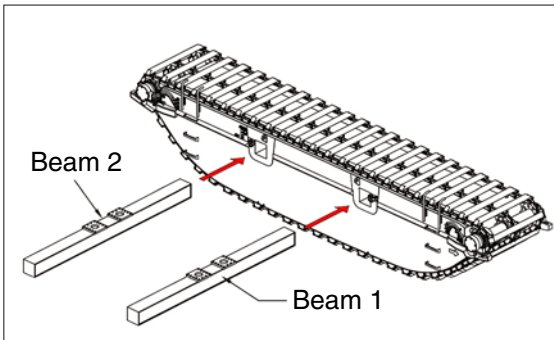
(2) Lift the pontoon linkage beam one by one and slowly insert the beam into the square holes at the pontoon as per figure 103.



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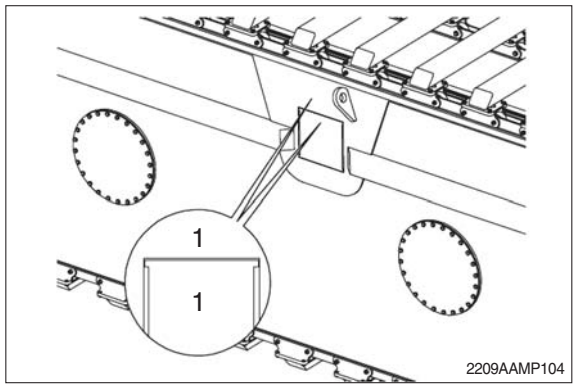
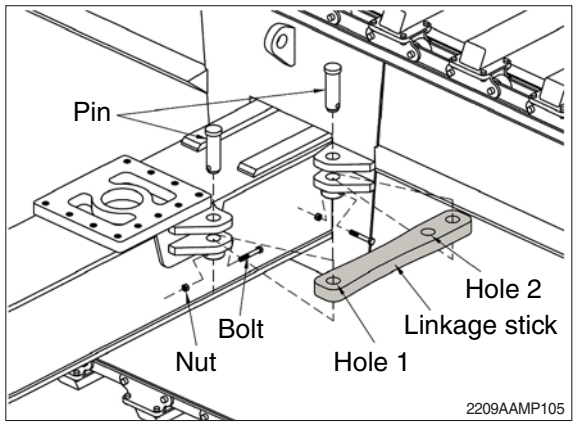
※ Identify which side of the pontoon is inner and which side is outer. Inner side is on the hydraulic motors with hydraulic hoses. Make sure that you install the beams from the inner side.

⚠ Carefully handle the beams movement from crashing the thin pontoon body or external hydraulic hoses that may cause serious damage.

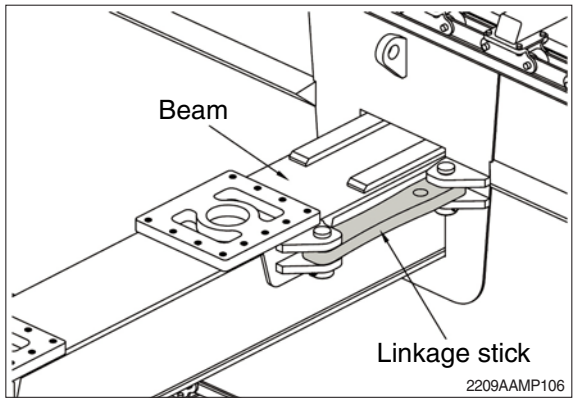
※ Each of the beams has its own marking number at one side of face end.
During installation, confirm that these marking numbers are match with the square holes number located on the outer side of pontoon as shown in figure 104.



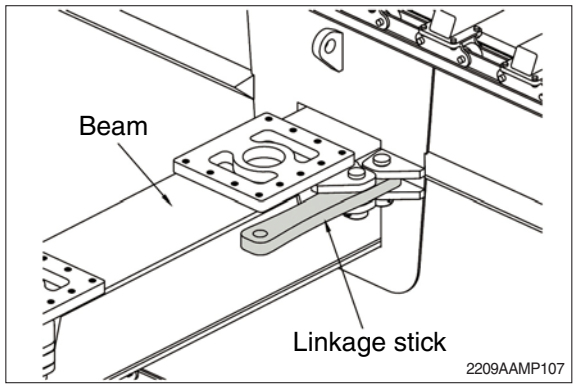
(3) Lock and secure the beams to the pontoon with linkage sticks as per figure 105.



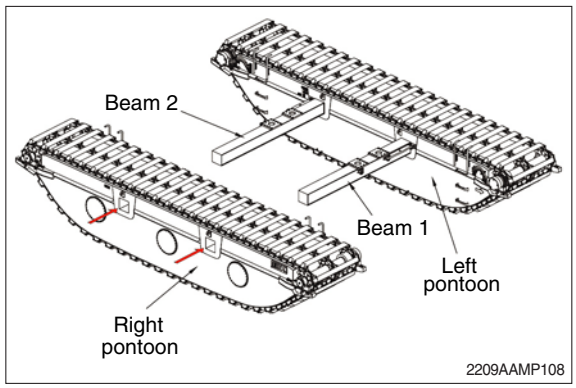
※ Please note that each linkage stick has three holes. Before install the linkage stick, refer to the labels at holes and match it with the pontoon. Lock the beam to hole 1 or hole 2 which could serve differ width for the machine, depends on the needs and working condition. Lock the pin with supplied bolt and nut.



※ **Figure 106 on previous page shows that the beam has been locked to hole 1 at linkage stick which serve the maximum width to the undercarriage. This position is recommended for operation mode.**

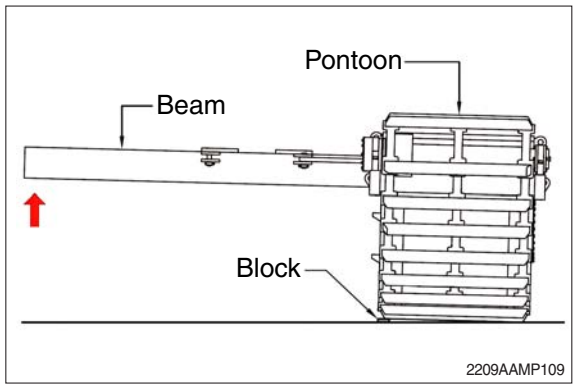


※ **Figure 107 above shows that the beam has be installed to hole 2 at linkage stick which serve the minimum width to the undercarriage. This position is ONLY recommended for transportation and NOT for operation mode.**

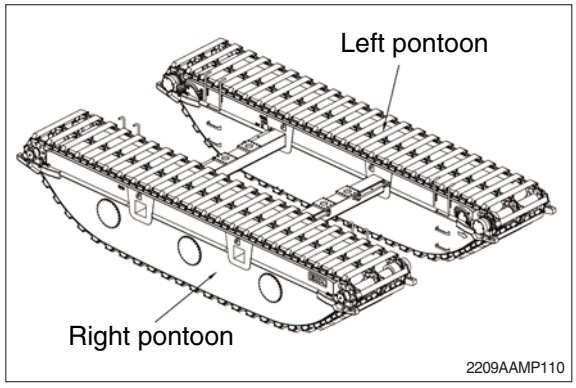


(4) Lift the second pontoon and assemble it with the previous one as per figure 108 This step needs to be done carefully and slowly since pontoon is a heavy structure. Beware with the inertia and momentum of the pontoon during movement which could cause serious damage to surroundings and itself.

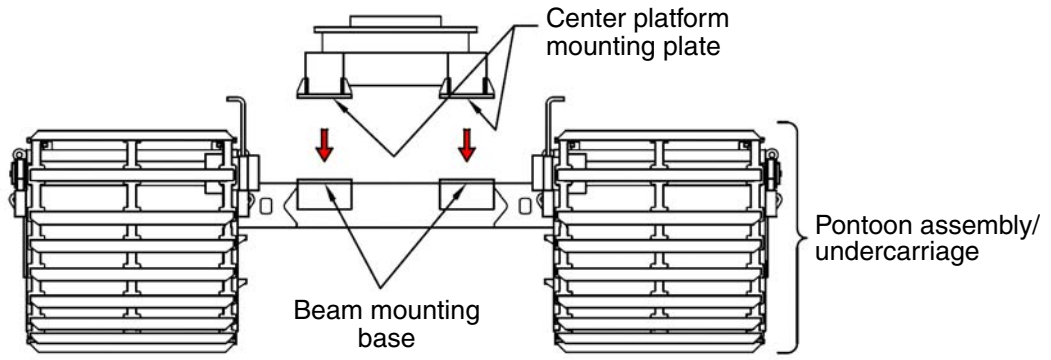
※ **For easier and faster works, the beams must be leaned higher than its level by placing a thin blocks under the left pontoon as per figure 109.**



(5) Repeat step (3) and the pontoon assembly should looks like figure 110.



(6) Lift and place the center platform onto the pontoon assembly carefully. Align the center platform mounting plate with beam mounting base on the beams as shown in figure 111.



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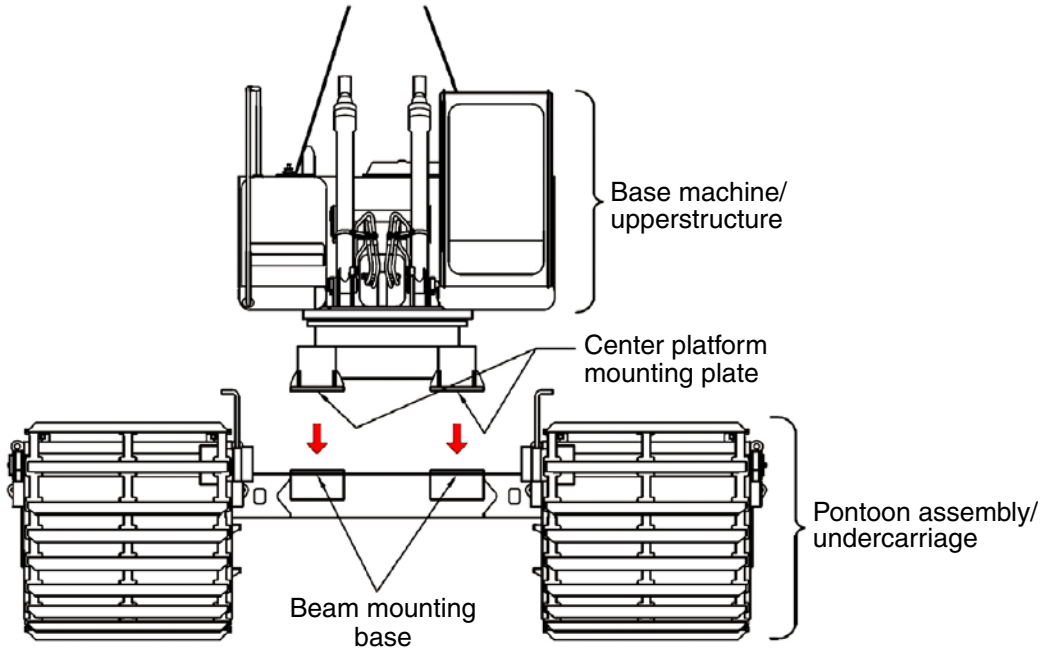
※ **In other case, the center platform has been mounted together with the base machine due to shipping requirement. So, both of center platform and base machine need to be lifted together without dismantle them as per figure 112.**



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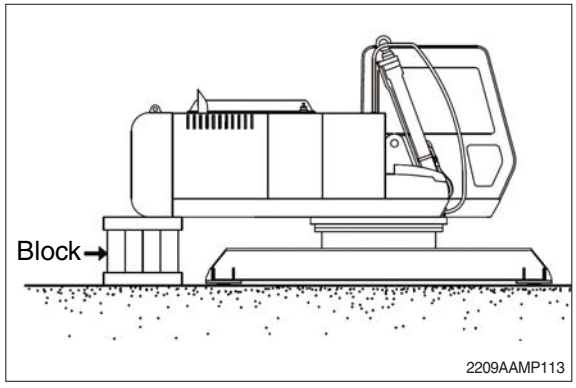
⚠ **If the center platform has been mounted together with the base machine, a block must be placed under the rear tip of the base machine to ovoid tipping during the evacuation process.**



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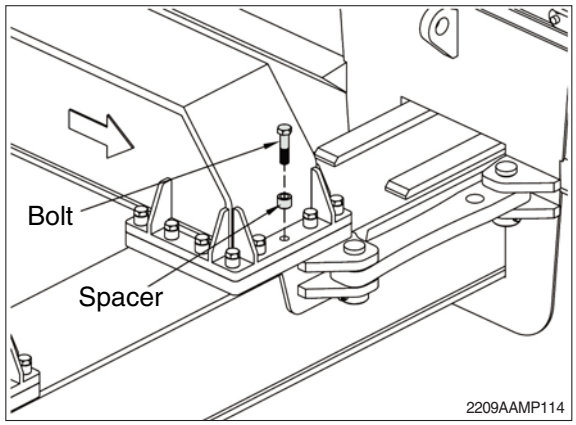
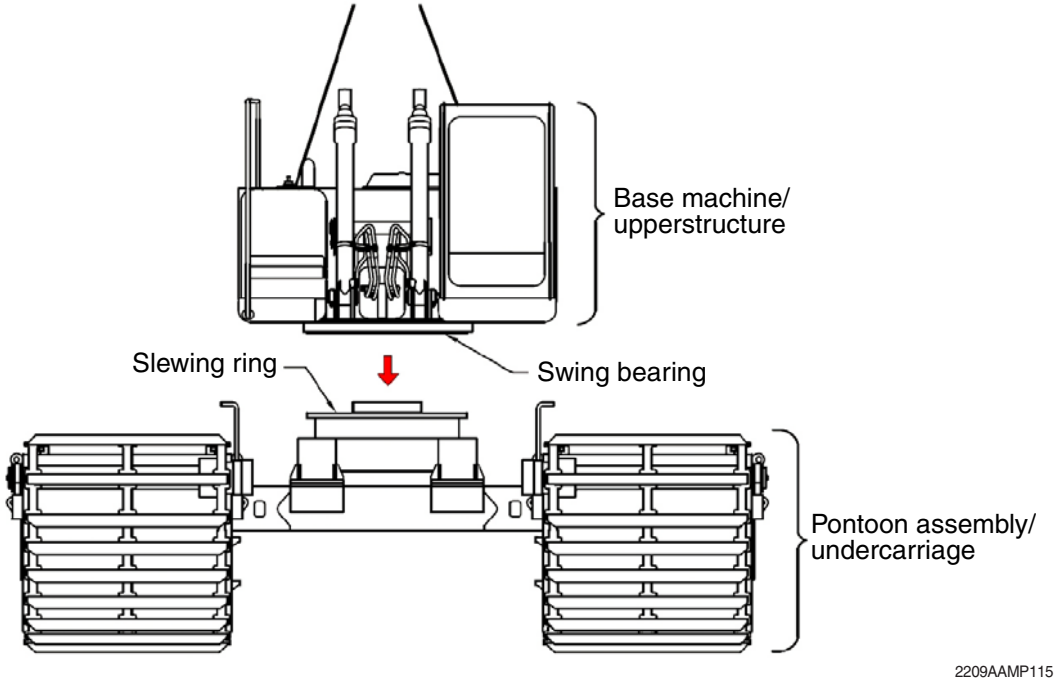
(7) Use the supplied bolt and spring washers to lock the center platform at the beams as per figure 114.

※ **Match the yellow arrows symbol direction at the pontoon and at the center platform. The arrows are directed to the front side.**

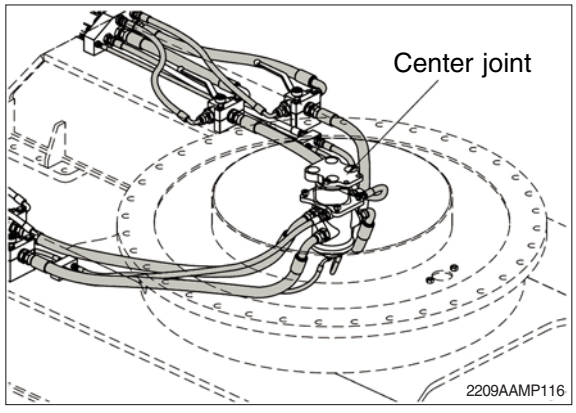


(8) Lift and place the base machine onto the slewing ring at the center platform carefully as per figure 115 (if the center platform and base machine are separately delivered). Align and match the holes of base machine swing bearing with the slewing ring holes. Securely tighten all bolts before removing the lifting chains or cables.



※ **Ensure that the center joint can be fitted to the center platform before installing the base machine. Make some modification if the center joint mounting on the center platform differs from the original. This case only happens if the center joint has been replaced with different type or model.**

※ **Dismantle the front attachment (boom, arm and bucket) from the base machine before do lifting.**



(9) Install the center joint and connect all hydraulic hoses from center platform to center joint as per figure 116. Center joint also can be installed to the center platform after step (7).

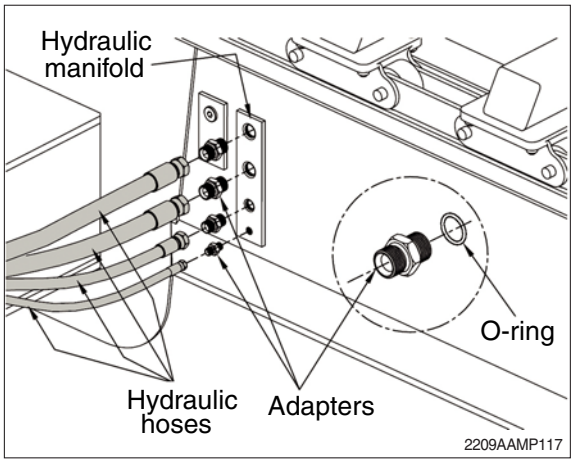
※ **If the hydraulic hoses weren't supplied upon delivery, use the existing hydraulic hoses from the original machine or contact your supplier to get the necessary hydraulic hoses. Change the supplied fittings at center platform if they are not compatible with your center joint type.**

※ **For safety, do not yet connect the hydraulic hoses from the main pumps inside the base machine to the center joint. These hydraulic hoses only could be connected after all hydraulic connections for undercarriage are complete.**

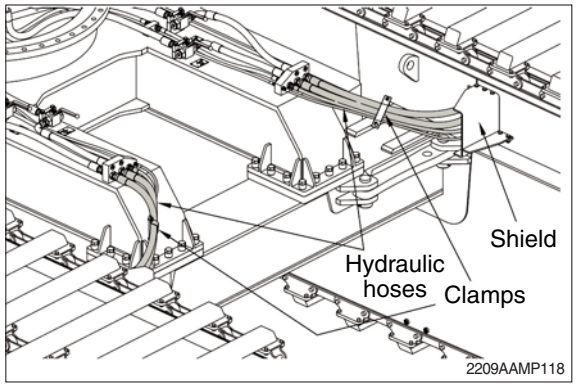
(10) The next process is to transfer the hydraulic pressure from the base machine to the travel motors at pontoons and hydraulic cylinders at the center platform by connecting all hydraulic hoses at the pontoons to the center platform.

(11) If the hydraulic hoses were delivered as loose parts, carefully reinstall the supplied hydraulic hoses and adapters to the hydraulic manifold located at both of pontoons as per figure 117.

※ **Tight the adapter carefully so that the O-ring does not clipped between pontoon hydraulic manifold and adapter which could damage the O-ring and then cause leaking at the joint.**

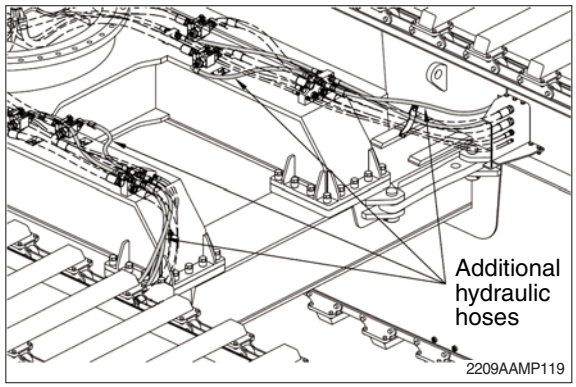


(12) After that, connect the previously installed hydraulic hoses from both of pontoons to hydraulic manifolds at the center platform. Use the supplied clamps to properly queue all hydraulic hoses. Install the shied to protect hydraulic hoses from any sharp and hard objects during working.

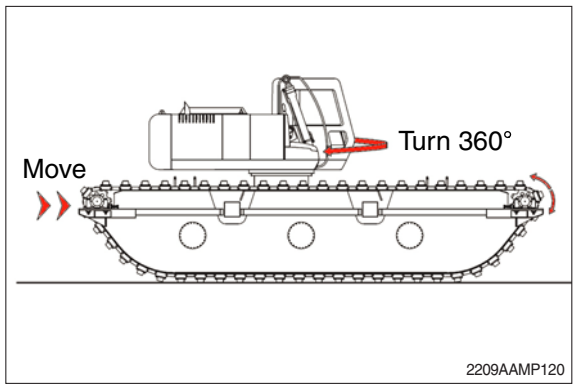


(13) Securely tight all adapters and hydraulic hoses to avoid leaking.

※ **If the undercarriage was supplied with spud piles, the additional hydraulic hoses must be installed to link the hydraulic flow from the center platform to the spud pile through pontoons as per figure 117.**



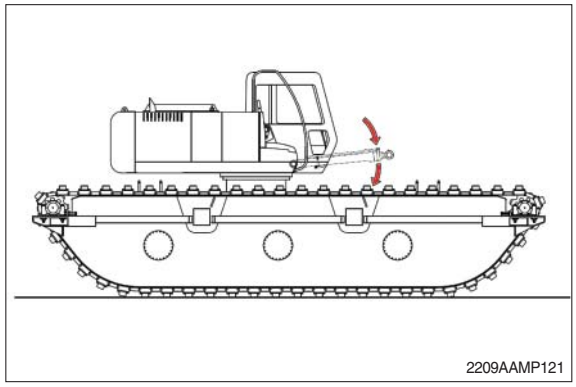
(14) Drive the machine freely to test either the hydraulic system is functioning properly or not. Observe again any oil leaks at the join before you satisfy with the installation.



3) FRONT ATTCHMENTS MOUNTING PREPARATION

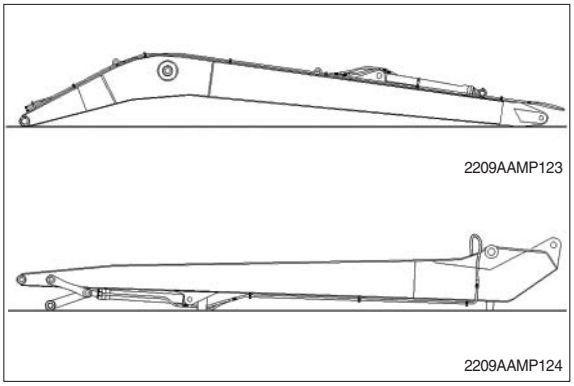
These preparation steps preferred to be done before front attachments installation.
A planning before start a work not only can result faster and easy work but also could save the life.

(1) After finish the assembly works for pontoon with the main machine, leave the 2 set of lifting boom cylinder/ram intact onto the machine body as shown in figure 121. Then, run the engine to ensure the boom cylinders are functioning properly.



(2) Retrieve the boom mounting pin from the machine. Note that some machine models require removing the storage compartment on the right of the machine before the boom mounting pin could be removed directly.

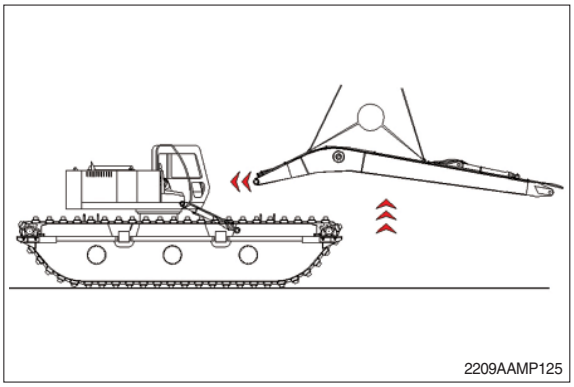
(3) Position the long boom as in figure 123 and lay the long stick/dipper arm as shown in figure 124. Check and ensure the ground is firm and solid. Sufficient safety measures should be taken ensuring the long boom and stick will not tip over or falling side way during the course of subsequent installation works.



4) FRONT ATTACHMENTS MOUNTING PROCEDURES

(1) Lift the long boom carefully toward the machine. Align the boom boss hole to boom mounting bracket on the machine.

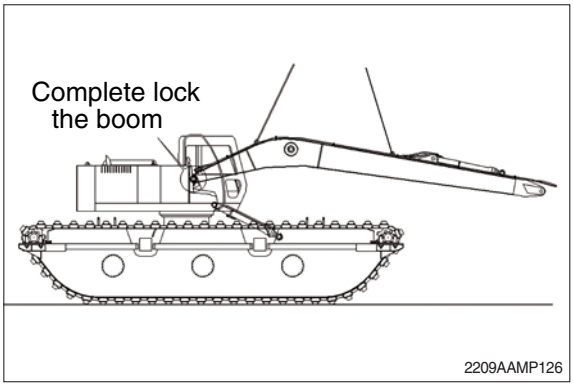
⚠ **Use only metal chain or cable that is capable of withstanding the weight of the boom.**



(2) Secure the chain/cable onto the lifting hooks located at the top of the boom.

(3) Upon proper alignment of the boom boss onto the mounting bracket, lock and secure the boom onto the machine with the boom mounting pin that has been removed before.

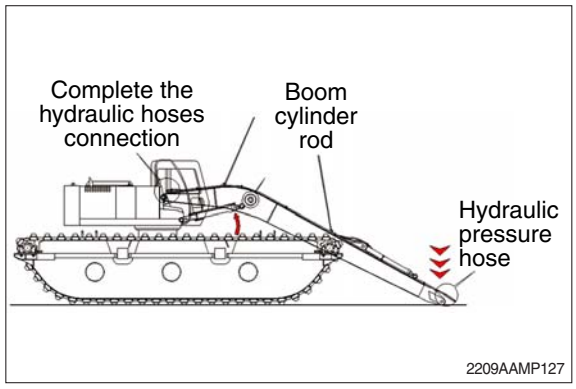
※ **Reinstall the machine storage compartment after finish the boom installation**



(4) Lower the boom until the tip of the boom is firmly rested on the ground.

(5) Lift both of the boom cylinders and align the head with the boom cylinder rod.
Lock and secure the cylinders head with the pin that is readily at the boom as per figure 126.

(6) Connect and securely fasten all hydraulic hoses linking between the machine and the boom, and at the end of boom.



(7) After connecting all the hydraulic hoses, you are now ready to verify if the hydraulic system is properly connected. Run the engine and test that the booms hydraulic system is functioning properly.

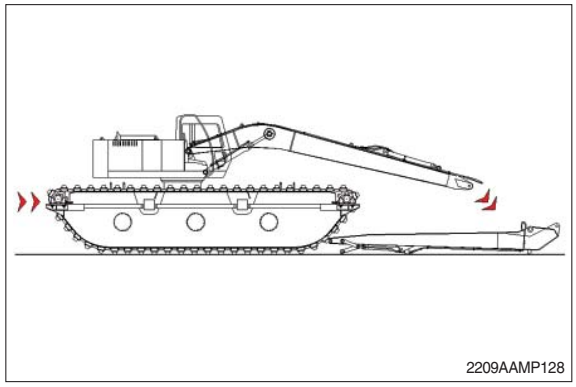
⚠ **Do not remove the chain/cable until you are completely satisfied with the hydraulic installation.**
Do not remove hydraulic hose at the end of the boom which was supplied together with the package. Removing the hose at this instance will cause malfunction to the boom hydraulic system.

※ **Observe for any oil leaks in the hydraulic system.**

(8) When you are completely satisfied with the proper functioning of the boom hydraulic system, lower the rest the boom onto the ground. Now, you may proceed to remove the chain/cable from the lifting hook.

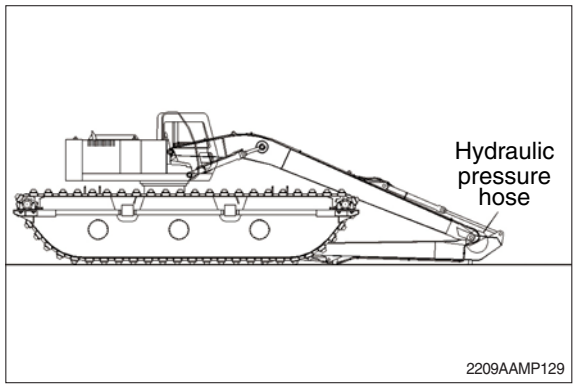
(9) The boom cylinders are properly function by now and are able to lift the boom with ease. Position the boom yoke onto the stick/dipper arm as per figure 128.
Once properly aligned, secure and lock it with the yoke pin that was supply with the package.

※ **Remember that all the hydraulic hoses from the machine are readily connected with the pontoons. If the stick is positioned far from the assembly base, just drive the machine toward the stick without need to lift it nearly.**

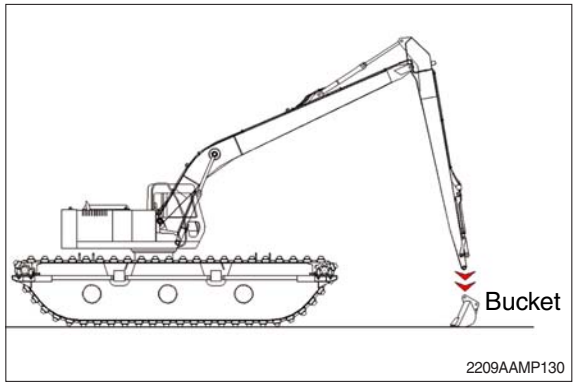


(10) Mount the stick/dipper arm's cylinder/ram onto the stick/dipper arm with the pin supplied with the long reach package.

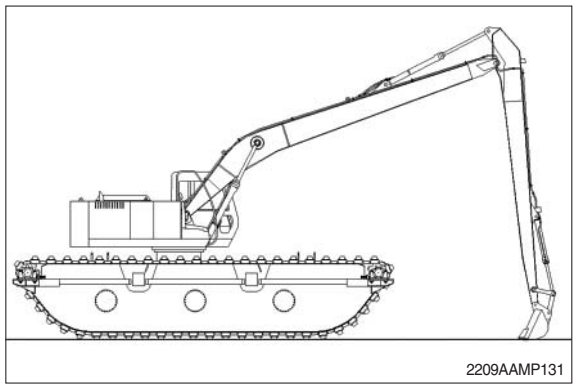
(11) Connect and securely fasten all hydraulic hoses between the boom and stick/dipper arm.



(12) Mount the bucket that was supplied with the package.



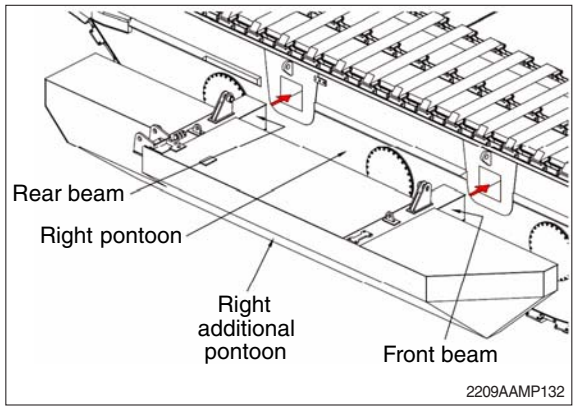
(13) Perform a final round of checking to ensure all bolts, nuts, pins, hydraulic hoses are properly installed and tightened. When you are completely satisfied with the installation, you may proceed to test the entire long reach set up on your machine.



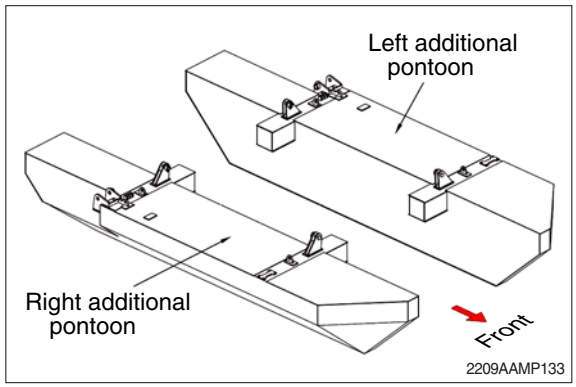
5) ADDITIONAL PONTOONS INSTALLATION (OPTIONAL)

Additional pontoons are the optional parts for amphibious excavator. By adding these pontoons, the amphibious excavator becomes more stable during travelling on open water but still not recommended for digging jobs at water level more than 1.5m depth.

(1) Lift the additional pontoon slowly close to the main pontoon as per figure 132 and insert both of beams into the square holes at the main pontoon from outside.



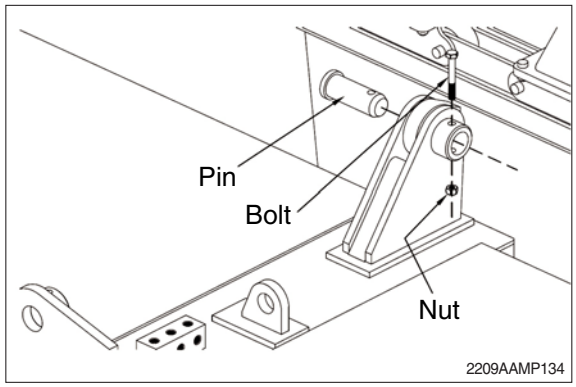
※ **Identify which additional pontoon need to be assembled first since one of them is left and another one is right. Figure 133 shows the top view and directions of the additional pontoons.**



(2) Align the holes of additional pontoon mounting brackets and main pontoon lifting hooks. Use the supplied pins to lock both of pontoon together as per figure 134.

(3) Repeat step (1) and step (2) for the second additional pontoon.

※ **Lifting hooks at main pontoons may be having minor damage due to repeatedly lifting jobs. Examine all lifting hook holes at main pontoon by using the supplied pin and do some repairing if the pin could not get through the holes. It is very important to do this step for faster and efficient installation process.**

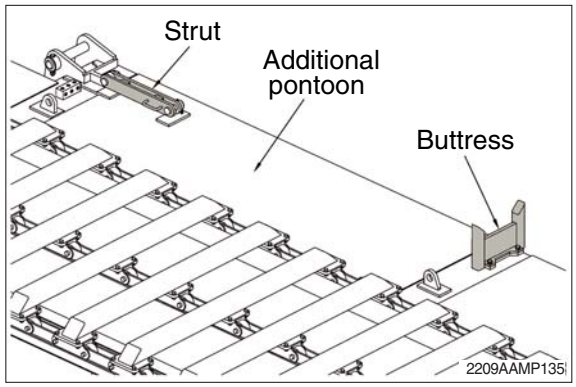


6) SPUD PILES INSTALLATION (OPTIONAL)

Spud piles are the optional parts for amphibious excavator. This type of spud piles must be installed to additional pontoons. By adding these spud piles, the digging jobs could be done at water level up to 4.5 m depth (depend on front attachment size and weight).

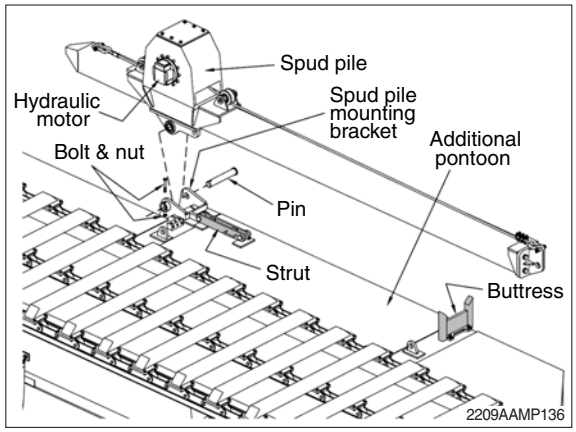
(1) Before install the spud piles to the additional pontoons, ensure that the pile struts and pile buttress have been mounted to theirs position as per figure 135.

※ **The strut and the buttress also could be installed to the additional pontoon at the last process.**



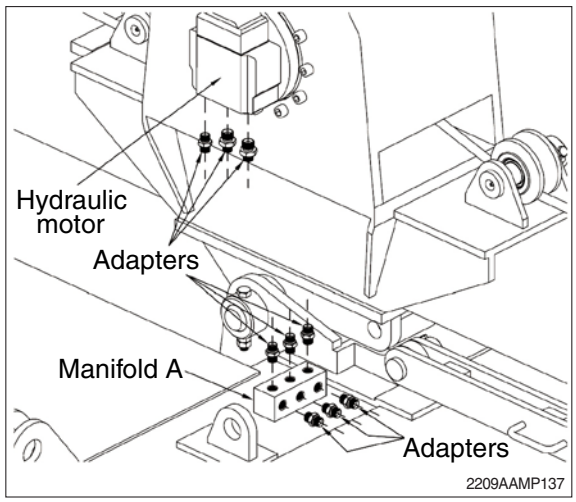
(2) Lift and install one of the spud piles to the spud pile mounting bracket located at additional pontoon. Use the supplied pin, bolt and nut to securely lock the spud pile at the bracket as per figure 136.

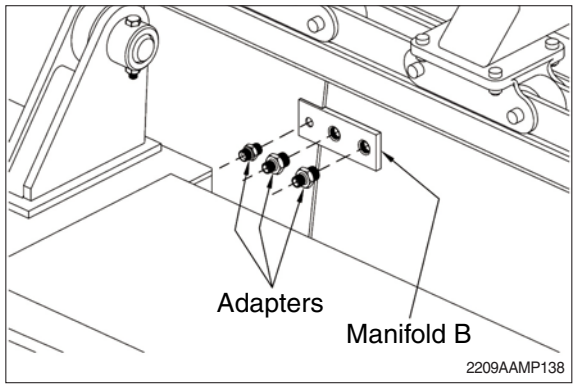
※ **During installation, hydraulic motor at the spud pile must facing to the inner side of the undercarriage.**



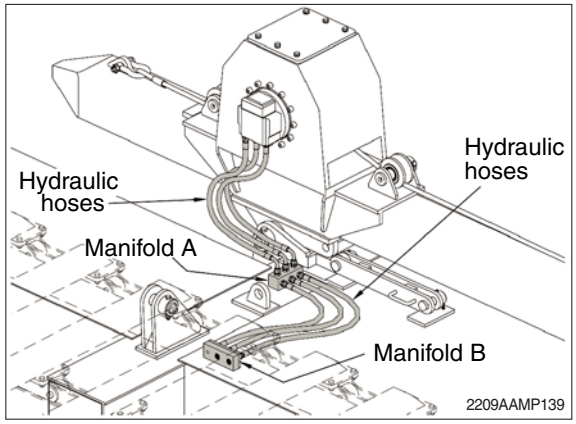
(3) Install all supplied adapters (fittings) to hydraulic motor ports, manifold A at additional pontoon and manifold B at main pontoon as per figure 137 and figure 138.

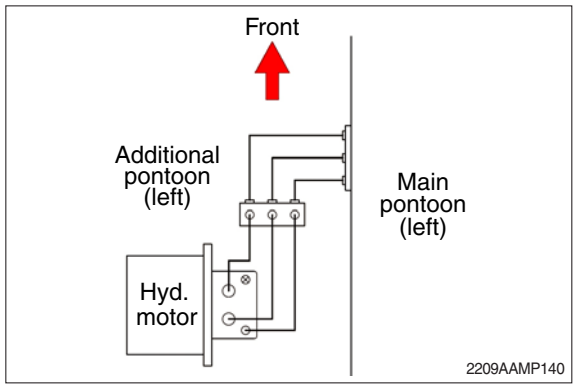
※ **In some cases, all adapters have been readily installed to all said parts.**





(4) Complete the spud pile installation by connecting all the supplied hydraulic hoses from hydraulic motors at spud pile to main pontoons as per figure 139 and figure 140. Ensure that all hydraulic hoses and fittings are securely tight to avoid leaking.



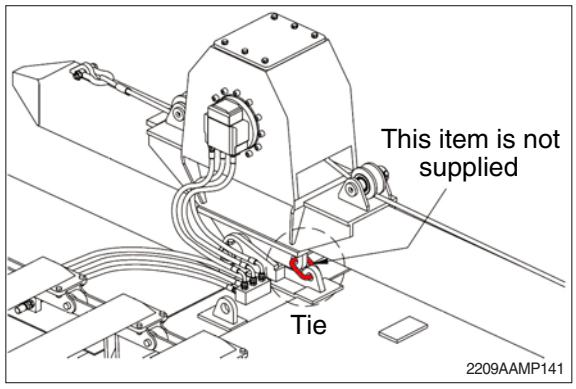


(5) Repeat all step (1) to step (4) for second spud pile.

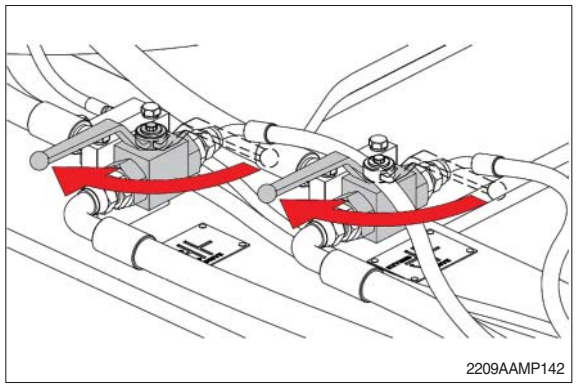
TEST THE SPUD PILES

(6) If the strut and the buttress are not yet installed to the additional pontoon, you may do a quick test to the spud pile to test the hydraulic function.

(7) Securely tie both of strut mounting holes at addition pontoon and spud pile together with chain or wire as per figure 141 to avoid the piles tipping to rear side.



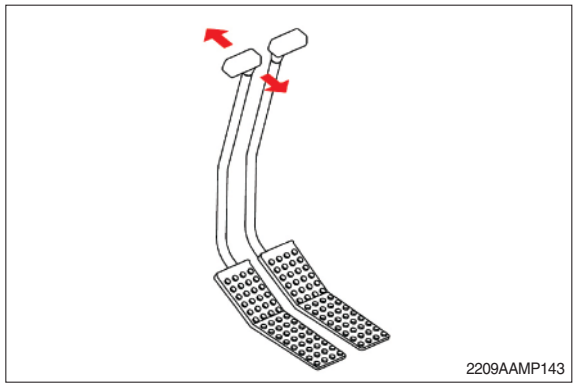
(8) At the center platform, switch the direction of ball valve handle to other direction in order to divert the hydraulic flow to the spud pile hydraulic motors as per figure 142. (Follow the direction of sign plates if has any).



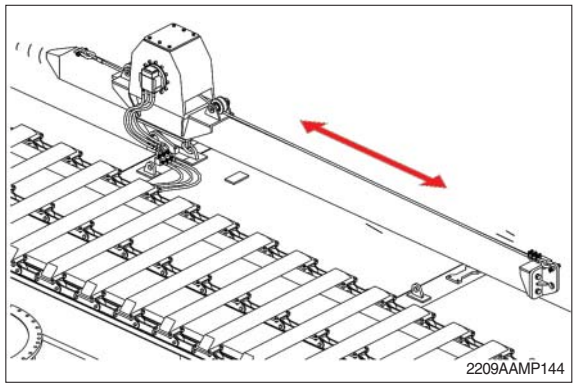
(9) Use the pedal control inside the operator cabin to control the piles movement as per figure 143.

※ **Although the hydraulic line has been designed so that the piles could be controlled by using pedal control on left hand side, test the right hand pedal control if the piles still not moving.**

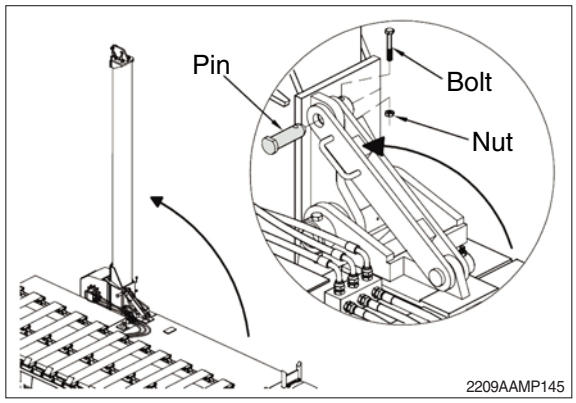
※ **Since the hydraulic line from the base machine to the spud pile hydraulic motors is quite long, it took time for the hydraulic flows to reach there.**



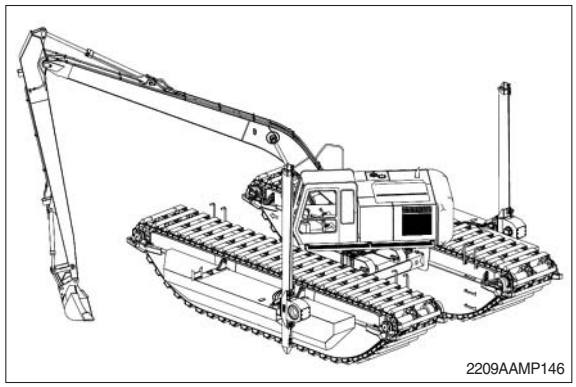
(10) Test the both of piles movement until satisfy.



(11) Untie the strut mounting holes and use the machine front attachment to lift the piles vertically. Install and let the strut to hold the piles vertically. Use the supplied bolt and nut to lock the pin as per figure 145.



(12) Finally, the spud piles are completely installed and the whole machine is ready for action.



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