F(S)-F105E

Hydraulic Breaker

F SERIES

(F1, F2, F3, F4, F5)

INSTRUCTION MANUAL

⚠ WARNING

Read and fully understand this manual before operating, inspecting or adjusting the hydraulic breaker.

FURUKAWA

Introduction

Thank you very much for purchasing our product. This product is a high-performance hydraulic breaker developed with our experience of many years and up-to-date engineering techniques. And has passed stringent tests before shipment. This manual explains the correct handling method, inspection, and repair for the daily work in order to use this breaker safely and efficiently. For the base machine (hydraulic excavator, etc.) on which this breaker is mounted, refer to the instruction manual of the base machine. Be sure to read this manual and fully understand the operation, inspection, and repair before using this breaker. Negligence of the contents of this manual will lead to a serious accident.

"Carelessness and negligence" cause an accident.
"Safety first"
You have the key to safety!

⚠ WARNING

- **Use this breaker according to the regulations of the country where it is used.**
- **This breaker should not be used for any work other than the specified works.**
- **If this breaker is used carelessly, an accident can occur, leading to serious injury or death.**
- **The operator and maintenance man should read and fully understand this manual before operating or repairing the breaker.**
- **Keep this manual near the machine so that people who operate/control the machine can read it before operation.**
- **If this manual is lost or damaged, order a new one from Furukawa Rock Drill or its distributor.**
- **It is obligatory to "conduct legal inspection" stipulated in the Industrial Health and Safety Law for this breaker.**
- **If this breaker is transferred, be sure to attach this manual to the breaker.**
- **The manufacturer can change the contents of this manual without any obligations because it should be constantly up-to-date. Please contact Furukawa Rock Drill or its distributor for any information not contained in this manual.**
- **For safety, common items are described in "SAFETY PRECAUTIONS," and others are mentioned on the succeeding pages.**

CONTENTS

■ Safety

■ Operation

■ Inspection/Maintenance

Warning for prevention of danger

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death. This signal word is to be limited to the extreme situations. (Risk of serious injury or death)

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death. (Possibility of serious injury or death)

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. (Minor or moderate injury)

NOTICE

Signs used to indicate a statement of company policy directly or indirectly related to the safety of personnel or protection of property.

Most accidents are caused by disregarding the basic rules of operation, inspection, or repair, or by neglecting the inspection before operation. Many accidents can often be avoided by recognizing potentially hazardous situations before they occur. Before operating, inspecting, or repairing this breaker, be sure to read and fully understand the preventive methods and WARNINGS described on the breaker or in this manual. Thoroughly understand the contents of this manual before operation, inspection, or repair of the breaker.

Safety labels and messages are classified as follows so that users can understand the warnings on the breaker or in this manual.

The safety messages include the preventive measures to avoid danger.

For safety, common items are described in "SAFETY PRECAUTIONS," and others are mentioned in the succeeding pages.

FURUKAWA Rock Drill cannot anticipate every possible circumstances that might involve a potential hazard on operation, inspection, or repair. Therefore, the WARNINGS in this manual are not all inclusive. If an operation, inspection, or repair not described in this manual is conducted, you must assume responsibility for safety.

Outline of machine

■ Specified works

⚠ WARNING

Do not use this breaker for any work other than the specified works.

This breaker can be used for breaking, dismantling, and scaling in mines, stone-breaking, or building engineering work (railroad, dam, dismantling and construction). The applicable works are as follows:

- Breaking with hammering
- Dismantling with hammering
- Scaling with hammering

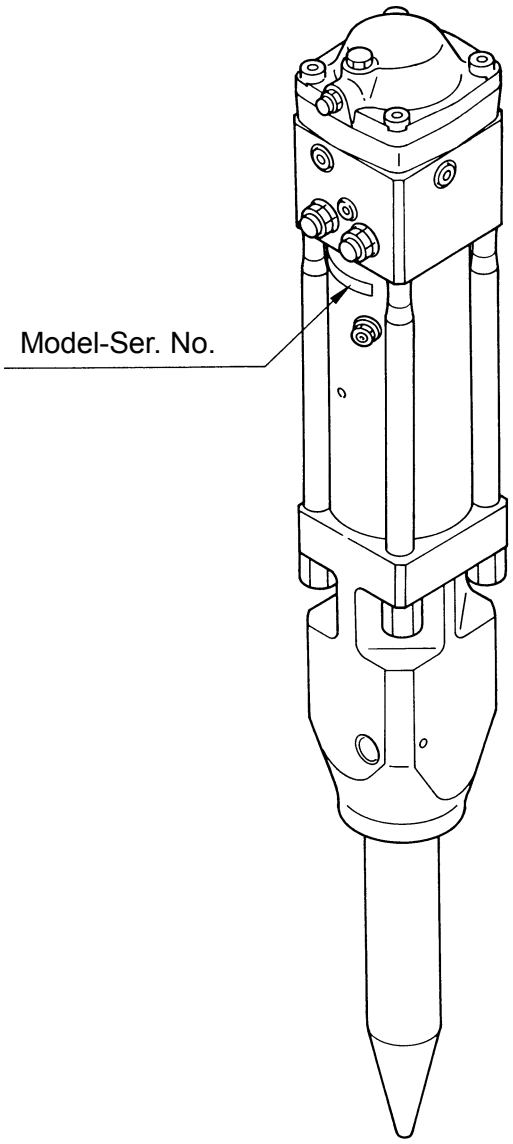
■ Running-in operation

This breaker has passed strict tests and inspections before delivery. However, if using the breaker forcibly at the beginning, the functions will be effected and its service life will be shortened. Carry out running-in operation by paying attention to the following items for the initial 100 hours (the time displayed by a service meter of the base machine).

- Warm up the base machine by idling for 5 minutes after starting the engine.
- Move the boom and arm for approx. 5 minutes after warm-up operation to raise the hydraulic oil temperature.
- Break and dismantle without overstraining the machine while the throttle lever is at the intermediate section.

Location of model name and serial No.

- The model name and serial No. are stamped on the cylinder top of the breaker main body. Advise the distributor of the model and machine No. when placing an order for parts or asking for repair.



- Entry of date of delivery, dealer, and serviceman

Date of delivery:	(year)	(month)	(day)
Model name		Serial No.	
Dealer Address		Phone	
Serviceman			

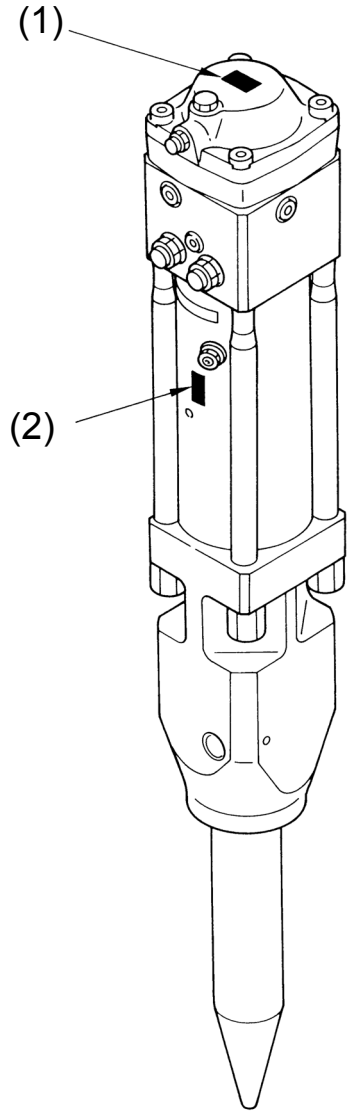
* Part Nos. shown in this manual are subject to change without notice.

Location of warning label

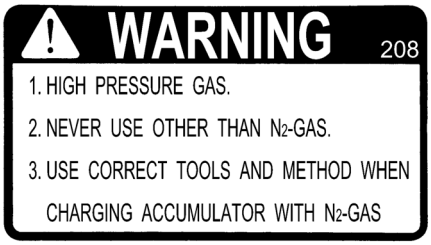
The warning labels show the instructions to prevent accidents caused by careless or wrong handling during inspection and repair. Follow the instructions shown by the labels as well as those shown in this manual.

NOTICE

If a warning label comes off or is damaged, stick it on again or replace it with a new one.



(1) 090200-04208



(2) 090200-04344

Safety

⚠ WARNING
Thoroughly understand the importance of "safety." Incorrect handling is very dangerous, leading to serious injury or death.

SAFETY PRECAUTIONS

⚠ WARNING

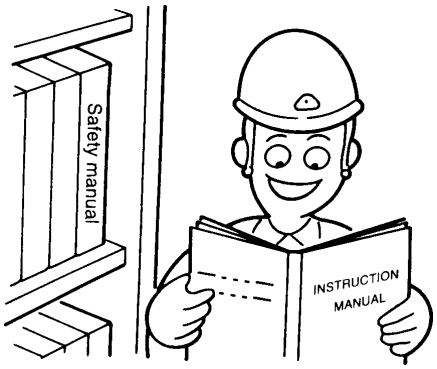
Strictly observe precautions for "safety," and take protective measures.

Safety control

■ Study instructions

Severe injury or death can result from failure to follow instructions.

- Study this safety manual and the instructions for both your particular hydraulic breaker and hydraulic excavator, and fully understand their controls, inspections and maintenance.
- Don't operate the machine until you fully understand all these items.
- Keep this manual and the instructions with your hydraulic excavator.



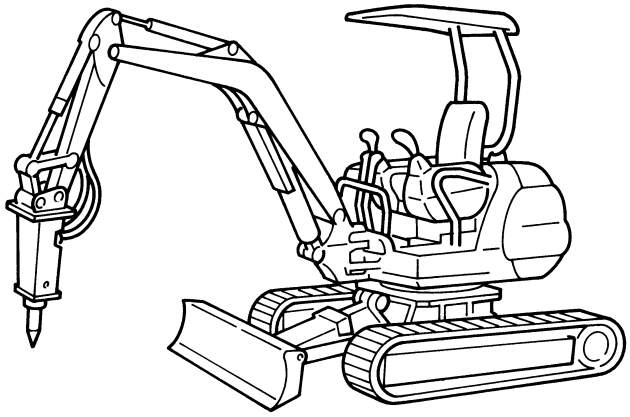
■ Follow instructions and warnings

- Severe injury or death can result from failure to follow instructions and warnings. Don't ignore what you don't understand.
- Make sure to read all safety instructions and warnings and fully understand them before operation.
- Because instructions, stickers and warning signs are very important for safety, keep them in good condition and replace them, if damaged.

■ Selecting the hydraulic excavator

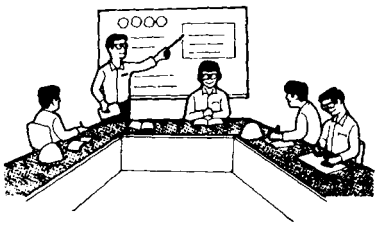
Install a hydraulic breaker to a proper-sized hydraulic excavator to fit with each other. If a hydraulic excavator is small for the hydraulic breaker, the excavator may lose balance and tip over.

- Make sure to install the hydraulic breaker to a manufacture's recommended hydraulic excavator. To install your particular hydraulic breaker to a proper hydraulic excavator, see the instructions for your hydraulic breaker.
- When operating the hydraulic breaker in a work site that is potentially dangerous because of falling rocks, use a hydraulic excavator fitted with a head guard or a FOPS.
  FOPS…Falling-Object Protective Structure provided by SAE regulation



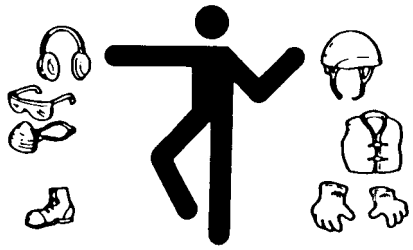
■ Observe the rules on the working spot!

- Make a working plan, prepare a daily or monthly report and record the working situation.
- When operating the breaker with a supervisor at the work site, follow the supervisor's instruction to work safely.
  A supervisor must work at inside work site or other dangerous work sites.
- When the operator alternates with another, he must inform the alternate of the machine condition by a memo or word of mouth.
- When placing a signal man, determine signals.
  The operator must obey the signals of the signal man.



■ Safety clothing/Protective instruments!

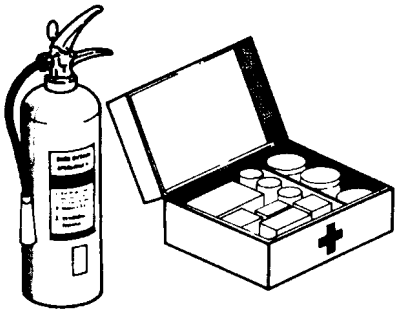
- Don't wear loose clothes, which can become entangled in the machinery and cause accidents. Take care of your safety clothing, especially cuffs and shoestrings.
- Don't wear coveralls soaked with oil to prevent fire hazard.
- Wear safety helmet and safety boots when operating or working on machine. Also wear safety glasses, breathing mask, ear protection, or safety rope if needed.
- Make sure your protective gear is always in good repair.



■ Fire and other accidents

Be sure a first aid kit and fire extinguisher are near at hand in case of emergencies.

- Learn how to use a fire extinguisher.
- Be familiar with where fire extinguishers are located.
- Know where a first aid kit is located.
- Know where to get assistance.



■ Modification is inhibited!

Be sure a first aid kit and fire extinguisher are near at hand in case of emergencies.

- Don't modify the machine arbitrarily, otherwise the machine may become unsafe, break down, or have a shortened service life.
- We cannot assume responsibility for the accident or trouble caused by the modification (including disassembly and repair) not permitted, and for the secondary damage.

■ Use the safety devices correctly!

Don't remove or modify the safety devices. If using a safety device erroneously, a serious accident will occur.

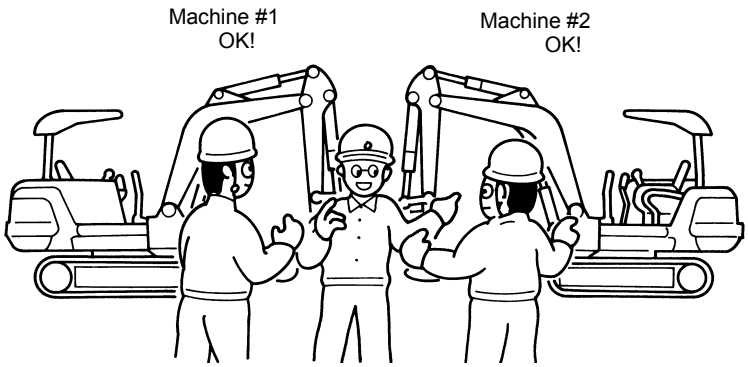
- Read the instruction manual of the hydraulic excavator for the safety device such as the safety lock lever. Understand the operation and many cautions and then use the device.

■ No fatigue or alcohol

Fatigue, lack of sleep, drugs or alcohol can lead to carelessness and cause accidents.
Don't operate a machine of you are in such a condition.
Get a periodical medical examination to maintain a healthy life style.

■ Safety guards

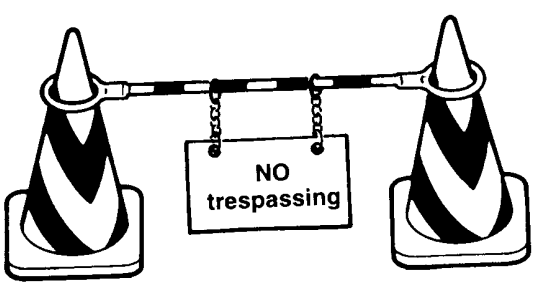
When operating two or more machines at a time, arrange signs and put a safety guard in place.

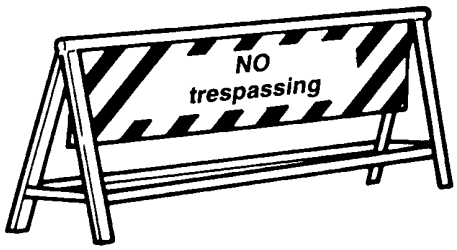


■ Trespassing prohibited

To prevent accidents, post no trespassing signs at dangerous working sites.

- Be sure all personnel and obstacles are clear of work area before operation.
- It is dangerous that unauthorized personnel trespass into the work site.
- If the work site is located in a town area, post no trespassing signs and palisade the work site.
- If the work site is located on a busy traffic street, put a signal person to prevent accidents.





■ Safe work site

Be sure all flammables (e.g. fuels and gas cylinder) and obstacles (e.g. tools, vehicles, wastes and other materials) are clear of work site to secure safe work site.

Check and record the conditions at site, such as geographical features and soil, for potential hazards.

Take precautions to minimize hazards. For example, make trespassing-prohibited area for a dangerous place. Put safety guards securely in place. Reinforce the ground.

■ Inspection before operation

Perform inspections before starting the engine or operating machine. If something is wrong, replace it.

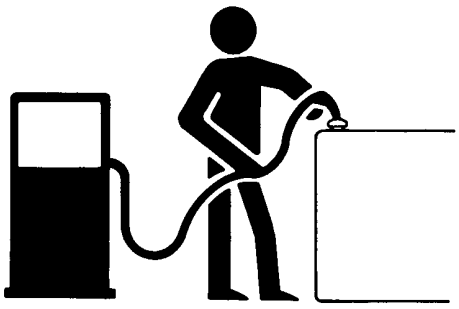
As for the detail of inspections before operation, follow instructions for your particular machine.

- Oil leakage
- Missing, damage or looseness of components
- Crack, damage or looseness of the rod
- Gas pressure in the gas tank which is located at upper part of the hydraulic breaker.

■ Be careful for fire!

Fuel, oil and other flammable fluids are dangerous and can be explosive. Always handle them with care.

- Don't put flammables close to the machine and don't smoke when filling the fuel tank.
- Stop the engine completely before filling the fuel tank.
- Add fuel and lubricants in the open air only.
- Don't overfill the fuel tank or other reservoirs.
- Always use a nonflammable solvent as a cleaner.
- Put out a fire immediately.
- Have fire-lighting tools near at hand.
- Don't smoke during inspections and maintenance.
- Use explosive-proof lights and lights fixtures when performing inspections of fuels, oils and battery fluid.

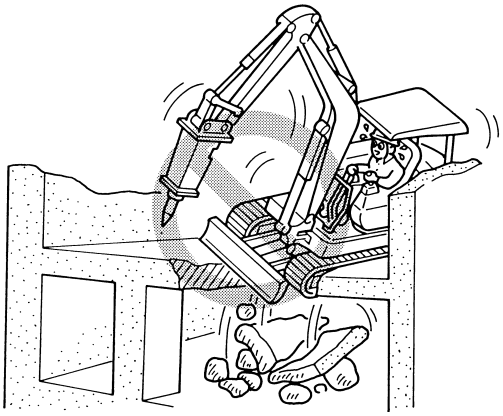


Precautions before and after starting the engine

■ Securing firm ground!

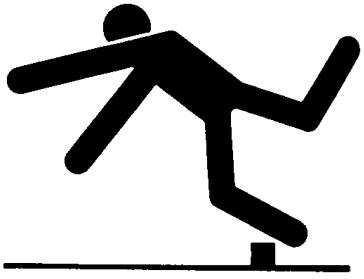
If working sites or tramming paths are rough, instability and vibration of the machine can cause accidents or property damage.

- Maintain graded working sited and roadways.
  Operate the hydraulic excavator on even, firm ground only. Do not operate the excavator on piles or other unstable ground.
- When operating the hydraulic excavator on a building, a floor may collapses and the excavator may tip over.
  Before operation, verify that the floor is strong enough to support the excavator. The floor also should be strong enough to bear the breaking impact. Reinforce the floor if necessary.



■ Cleaning around the operator seat!

- Don't put a tool or part around the operator seat, or the operation will be hindered.
- Wipe away mud or oil from the floor, pedal and lever. Otherwise, mis-operation will occur.
- Don't operate pedals and levers from outside of the operator station. The machine may move unexpectedly and accidents can result from operating the machine from outside of the operator station.
- To operate the hydraulic breaker safely, have a seat securely in the operator station.



■ Adjustment around the operator seat!

- Set the control lever at LOCK before starting the engine so that the operating devices may not move.

* For locking the machine control lever, refer to the instruction manual for the hydraulic excavator.

- Lower the vehicle front window and protective net of the hydraulic excavator to protect from flying stone chips and concrete debris.
- Always keep the windowpanes and back mirrors clean by wiping their surfaces.
- Adjust the operator seat. When the operator's back is closely in contact with the seat's back, he should operate the hydraulic breaker control pedal (or lever), machine control or traveling lever easily.

■ Precautions when starting the engine!

- Before starting the hydraulic excavator engine, give a sign by horn, etc. to the watch man, signal man and workers to warn them.
  * For starting the engine, refer to the instruction manual for the hydraulic excavator.

■ Carry out warm-up!

- After starting the engine, carry out the warm-up first.
- After warm-up, move the booms and arms slowly to warm up the hydraulic system for 5 minutes.
- Levers, pedals and switches for operation of hydraulic breakers are different depending on manufactures.
  Before operating a machine, fully understand its levers, pedals and switches function and operation, and perform inspection for them at a secure place.
- Operation of the pedal and levers from any place other than the operator's seat may cause malfunction, leading to an accident.
- Sit down correctly on the operator's seat when operating the machine.
- Operating the tramming lever incorrectly can cause serious injury or death.
  Before start tramming, check both directions of the track and the operator's seat.
  If a tramming motor has been fitted at front side of the operator station, operation of the tramming lever should be contrary.

■ Don't use machine before inspecting it

Machines that have not been inspected can cause unexpected accidents or machine breakdown.
If any troubles arise with machine, stop operating the machine immediately and repair them.

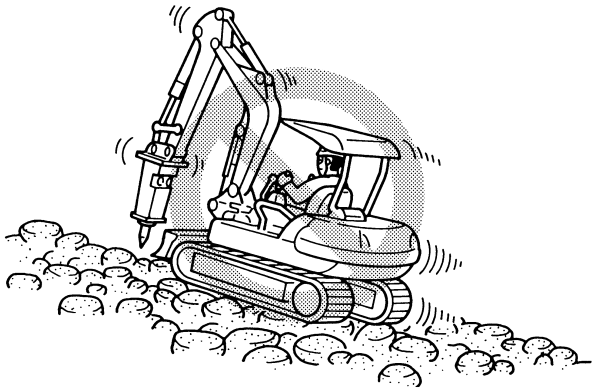
Precautions for safe operation

■ Don't suspend any objects

A load hanging from the hydraulic breaker may fall and cause serious injury, death or property damage.
Never suspend or place any objects on the breaker.

■ Tram safety

- Beep the horn before starting the machine to call the attention of a watchdog, guide, and workers.
- To prevent accidents, travel on flat ground as much as possible and make sure to hold the hydraulic breaker at 40 to 50cm (15 to 20 inches) above ground when tramming.
- Keep the machine away from utility poles, buildings or other obstacles as much as possible.
- When traveling underwater, observe the allowable depth of the hydraulic excavator in the water, and exercise special care so that the hydraulic breaker will not be completely underwater.
- Starting or stopping the machine abruptly on unstable ground and slopes can cause to tip over. Always operate the machine slowly on unstable ground and slopes.
- Be careful when tramming on frozen ground or snow.



■ Precautions when trouble has occurred!

- If trouble has occurred or if disassembly or repair is required, contact the distributor.
- If trouble has occurred in the hydraulic breaker, report to the superintendent.
  Don't operate the hydraulic breaker before the repair is ended.

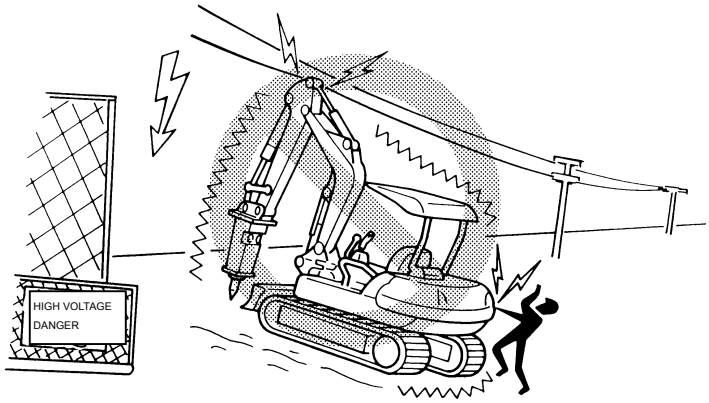
■ Beware of electrocution

- In case of high voltage lines, being close to them is enough to cause serious injury or death by an electric shock.
- Place the machine as far as possible from power lines.
- Make inquires to an electric company and use a signal person to guide the machine safety.

■ Touching a high voltage line with the machine

- In the event that a machine comes in contact with high voltage lines, warn all site personnel: "DO NOT TOUCH THE MACHINE" under any circumstances.
- When escaping from the hydraulic excavator, jump out of the excavator without touching any grab rails or steps.
  The figures in the table below may be used as a general guideline.

VOLTAGE (A,C)	SAFE DISTANCE
0 to 60,000V	3m or More
66,000V	4m or More
154,000V	5m or More
500,000V	11m or More

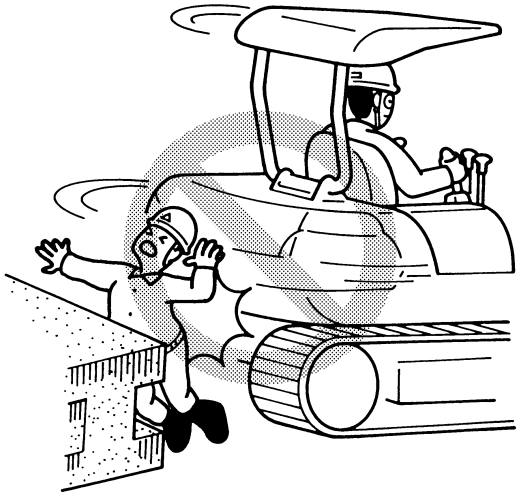


■ Beware of underground utilities

- Before operating, verify location with control offices of underground cables, gas pipes, water pipes and drain pipes and other underground utilities.
- If a gas pipe get damaged during operating, keep flammable materials away from the damaged gas pipe and report the damage to a fire station and neighbors immediately.
- When pipes of waterworks or drainage are broken, contact the controlling company.
- Cutting through a fiber optic cable can cause serious eye damage.

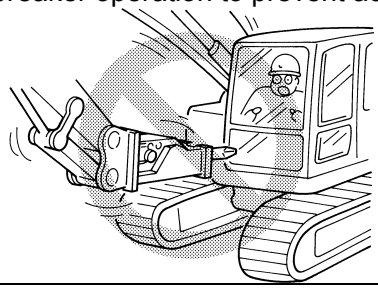
■ Turning precautions

- Operation near a building or wall may cause collision during turning, kicking workers around the machine or causing them to be crushed against the wall.
- Operate the machine in a place sufficiently away from a building or wall.
- Make sure all personnel are clear of the work area around the hydraulic excavator before turning.
- Before turning the hydraulic excavator, sound the horn to warn all personnel around the excavator.



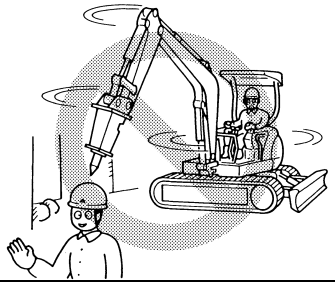
■ Beware of the hydraulic breaker operation

If the hydraulic breaker or the rod runs into the cab, serious injury or death can result from it.
Always be careful of the hydraulic breaker operation to prevent accidents.



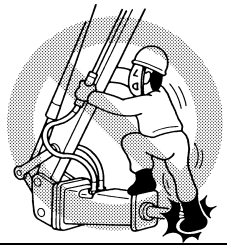
■ Beware of the rod end

The rod end is sharp and dangerous.
Always handle the rod with care and never turn its end toward any person.



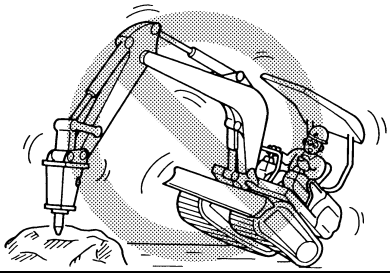
■ Beware of the rod when filling gas

When enclosing gas to the back-head (see page 2-1), the impact piston may be pushed out and the rod may be ejected.
Without the rod retainer, the rod can jump out unexpectedly. Before filling gas to the back-head inctall rod retainer and all personnel and materials are clear of the potentially dangerous direction of the rod ejection.



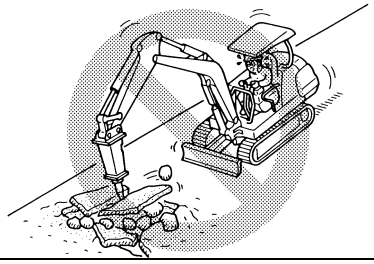
■ Don't jack up the hydraulic excavator

If pushing the rod so hard that the hydraulic excavator is jacked up, the excavator becomes unstable due to breaking rock unexpectedly or slipping the rod end. And serous injury or property damage can result from it.
Don't jack up the hydraulic excavator.



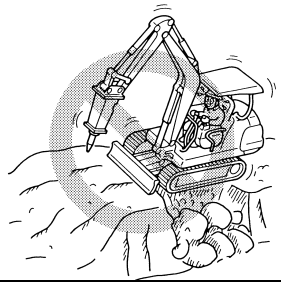
■ Operate the hydraulic excavator carefully on inclines

Operating the hydraulic excavator on inclines can cause tipping over because of the instability.
Maintain the supporting surface level for operation.
Operating or stopping the hydraulic breaker abruptly can cause tipping over because on the inertia.
Always operate the breaker slowly on inclines.



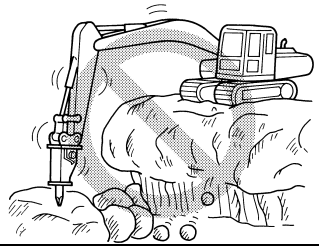
■ Beware of piles

When operating the hydraulic excavator on a pile, the pile may give way because of the excavator's weight or vibration, and the excavator might tip suddenly.
Operate the excavator on a pile with care.



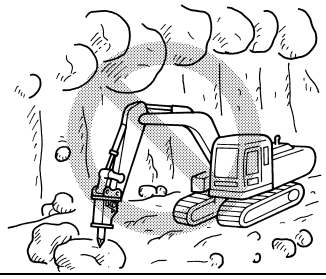
■ Don't operate the hydraulic excavator on cliffs

If breaking on cliffs or embankments, the hydraulic excavator may fall and serious injury or death can result from it.
In the event that the supporting surface gives way and it becomes too late to go backward, don't lift up the hydraulic breaker abruptly.
Putting the breaker down might be safer some times.



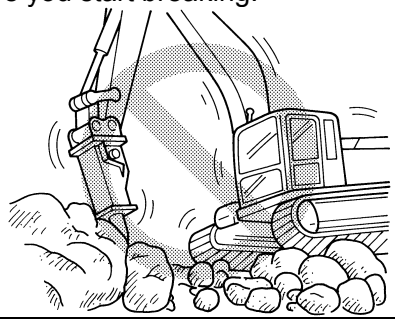
■ Beware of falling rocks

When breaking near a high wall, there are potential hazards of serious injury or property damage associated with falling rocks and giving way.
When breaking near a high wall, place the undercarriage at a right angle against the wall and make sure that the tramming motor is placed in back side of the track to escape quickly at any time.



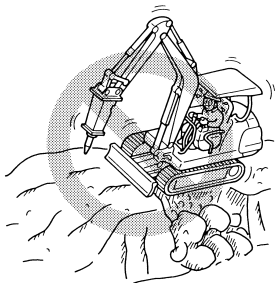
■ Don't operate the hydraulic breaker on unstable ground

If operating the hydraulic breaker on potentially unstable ground, vibrations and their impacts from the operation can cause to tip over unexpectedly.
Maintain graded working site before you start breaking.



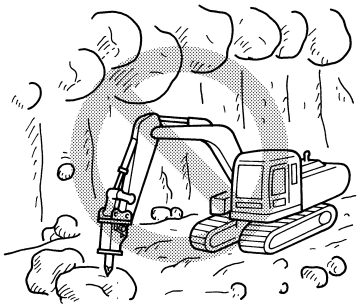
■ Keep away from cliffs and embankments

Keep as far away from cliffs and embankments as possible because ground may be soft.
Even if it seems firm, the ground may give way due to the machine's weight.



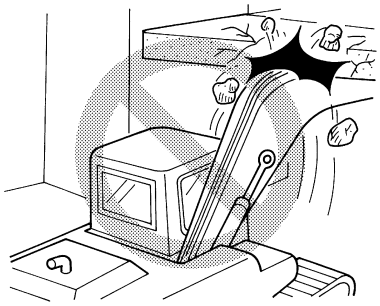
■ Be careful of softened ground after earthquakes

The ground becomes softened after an earthquake or an explosion.
Be careful of cliffs, embankments and falling rocks.
Make sure there are no undetonated explosives in the work area.



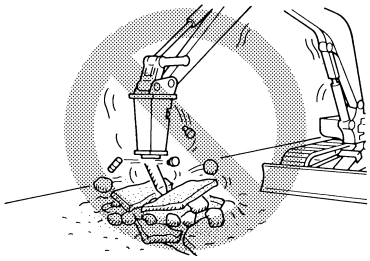
■ Be careful of softened ground after earthquakes

Be careful of surroundings and overhead when operating the machine at work site when indoors or in a narrow place.



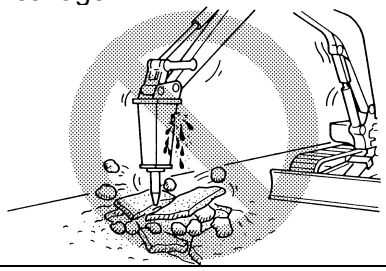
■ Stop operating when something is wrong with the machine

If a part breakage, strange noise or other trouble happens during operation, stop operating the machine immediately.
Operating the machine without repairing it can cause serious machine breakdown and accidents.
If something is wrong with the machine, check the cause of the trouble immediately and perform maintenance to prevent breakdown.



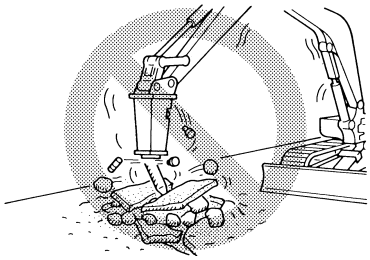
■ Stop the engine immediately when oil leaks

If the hydraulic oil leaks from the machine or the hose during operation, stop the operation and the engine immediately.
Check and repair the part of the oil leakage.



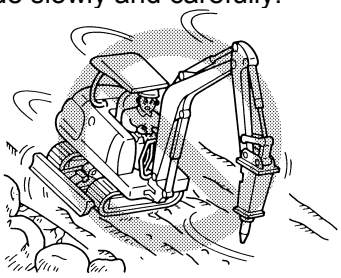
■ Pull down poles, beams and walls carefully

When pulling down buildings with the hydraulic breaker poles, beams and walls may fall down in an unexpected direction and can cause serious injury or death.
Be careful of the direction of pulling them down to prevent them from falling in a potentially dangerous direction.



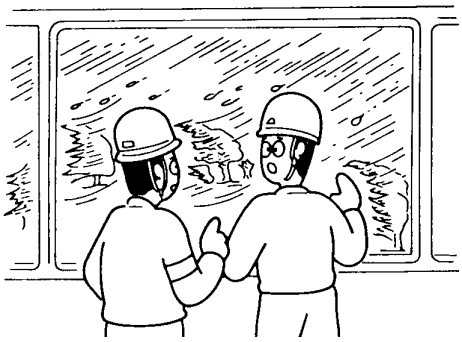
■ Be careful when turning aside

In general, horizontal stability of a hydraulic excavator is not as good as vertical stability of it. The hydraulic excavator might tip over when turning aside.
As the hydraulic excavator installed with hydraulic breaker has been loaded on the front, never turn aside abruptly.
Especially when on a slope, turn aside slowly and carefully.



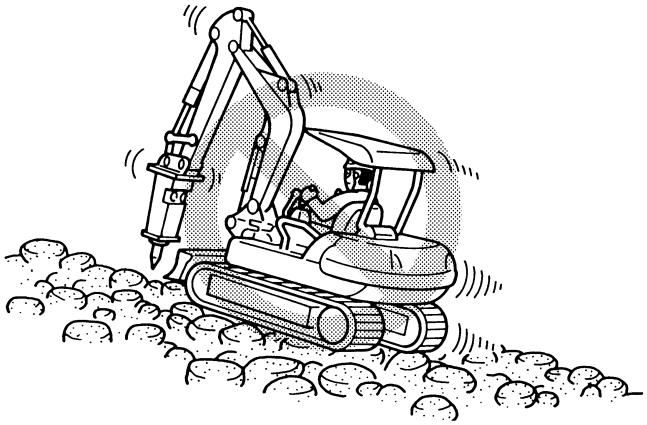
■ Postpone operation if visibility is poor

If visibility is not good enough to work, postpone the operation until visibility become better.
When expecting a strong wind, heavy rain or snow, and other rough weather which may prevent safe operation, contact your supervisor to ask for suspending the operation.



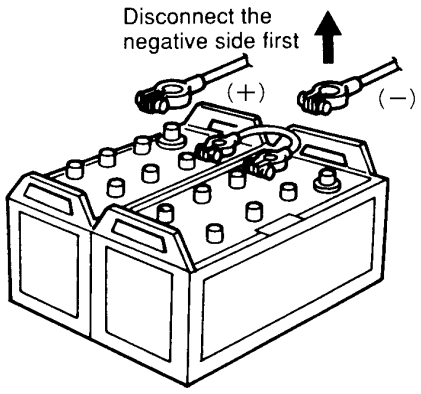
■ Flat working sites and paths

- If working sites or tramming paths are rough, instability and vibration of the machine can cause accidents or property damage.
  Maintain graded working sites and roadways.
  Operate the hydraulic excavator on even, firm ground only.
  Do not operate the excavator on piles or other unstable ground.
- Follow the instruction of the safe operation radius and limited weight for your particular machine, and operate the machine within the safe range of the operating radius securely.



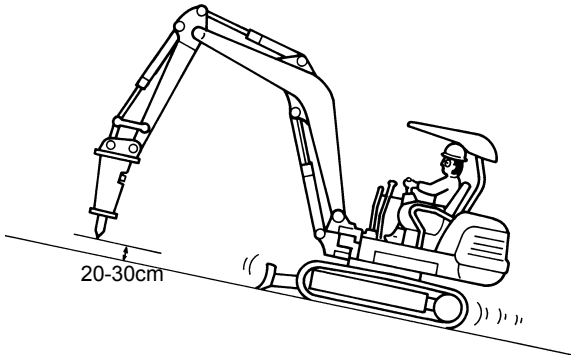
■ Connection/disconnection of battery

When disconnecting the power cables of the hydraulic excavator from the battery, be sure to disconnect the negative side first. When connecting power cables, connect the positive side first.



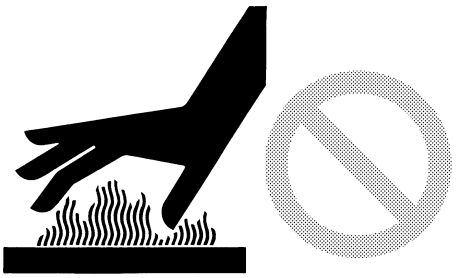
■ Tram carefully on slopes

- The machine might tip over when tramming on slopes.
- Make sure that the machine has the manufacturer's recommended gradeablity against the angle of a slope to tram.
- Always use caution and tram slowly when on a slope. And hold the hydraulic breaker in the air lower than the height on flat ground. (Breakers should be held at 20 to 30 cm above the ground.)



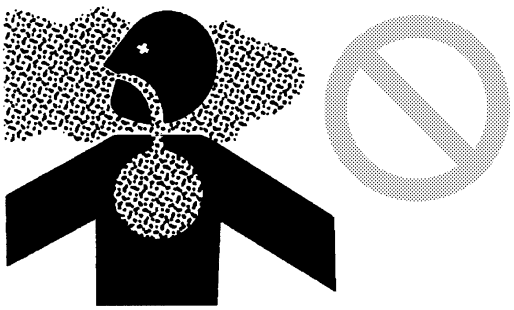
■ Beware of hot areas on the machine

Right after stopping the engine, the machine is still very hot and contacting the machine can cause serious injury.
The hydraulic breaker, rod, hydraulic excavator and hydraulic oil, in particular, become very hot.
Don't start inspections or maintenance until the temperature of such part cools down.



■ Beware of asbestos dusts

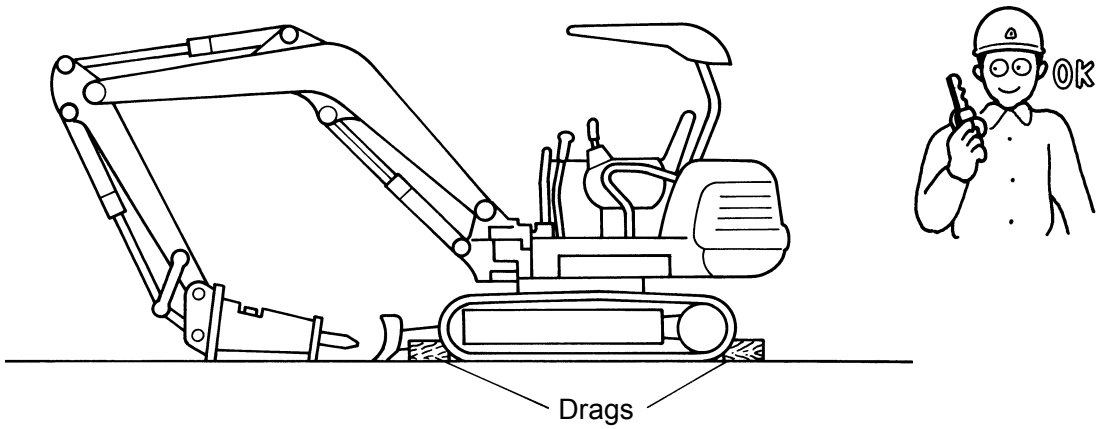
Don't breathe in dusts which may contain asbestos.
Breathing in dusts containing asbestos can cause lung cancer.
To avoid dusts blown up, sprinkle water over the work site.
Wear breathing mask when pull down a building containing asbestos with the hydraulic breaker.
Breaking without good ventilation can cause on anoxia or difficulty in breathing because of exhausted gases and dusts.
Provide proper ventilation when breaking at an indoor site.
Open doors and windows to get the open air.
Extend an exhaust pipe from inside to outside and install ventilation fans if necessary.



Precautions for parking and stopping the machine

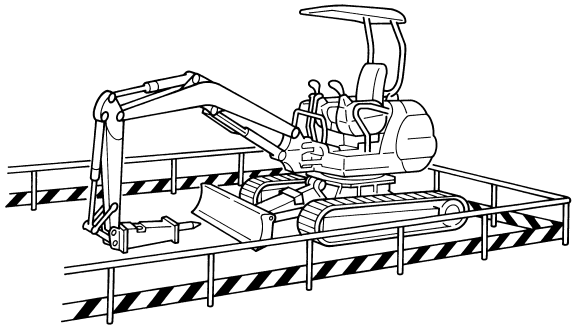
■ Precautions for parking and stopping the machine

- Stop the hydraulic excavator on flat and firm ground.
- When leaving the machine, set the hydraulic breaker on the ground, and take the key with you to prevent unauthorized people from operating the machine.
- Block up the tracks to prevent the excavator from moving unexpectedly.
- Stopping or parking the hydraulic excavator on inclines can cause unexpected moving. Don't stop or park on inclines.
- If stopping or parking on an incline is unavoidable, put the hydraulic breaker on the ground, place all levers in neutral position and block up the tracks on the downslope side. Also set the turning lock.



■ Perk on a street

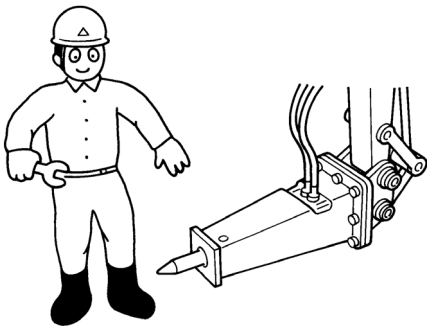
- When parking the hydraulic excavator on a street, post signs and palisade around the excavator to identity it even in the dark to prevent accidents.
- Set the hydraulic breaker on the ground and lock the doors to prevent unauthorized personnel from operating the machine or doing mischief.



Precautions for maintenance

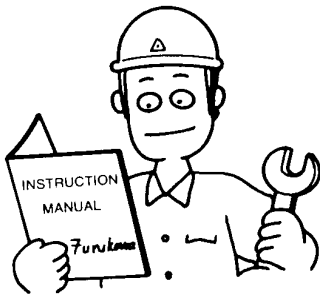
■ Inspect the machine after operation

- Perform inspections of bolts, oil leakage, cracks, damage, wear and hoses after operation every day.
- If something is wrong with the machine, perform maintenance and contact your work shop or manufacture to repair or replace the machine, if necessary.
- Operating the faulty machine without trouble shooting can cause unexpected machine damage or accidents.



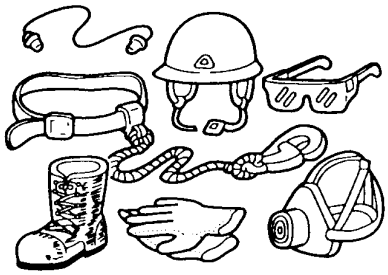
■ Study safety maintenance

- Failure to follow inspection and maintenance instructions can cause, not only property damage, but also serious injury or death.
- Before performing inspections for your particular machine carefully, and fully understand how to inspect the machine safely, including safety precautions, tools, qualifications, safety clothing, etc.
- Clean the hydraulic breaker before inspection and maintenance for safe work.



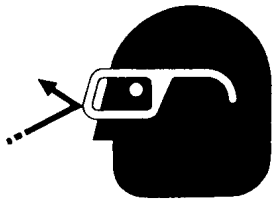
■ Protective clothing and device

- Performing inspection and maintenance without wearing protection can result in burns, cuts, falls, eye damage and other injuries.
- Always wear safety glasses, safety helmet, safety boots, gloves and when necessary, ear protections, when performing inspections. Make sure to wear a protective face shield, helmet, and other protective gear when using a grinder or a hammer, to protect from flying bits of steel.



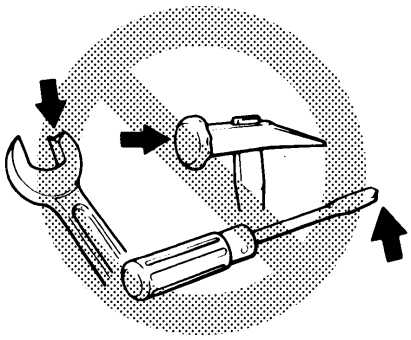
■ Beware of flying bits of steel

- When hammering pins, bushings, rods or other hard steel parts, flying pieces can cause eye damage.
- Always wear safety glasses and helmet when performing maintenance and use a brass punch between a part and hammer.
- To prevent accidents, due to flying bits be sure all personal are clear of the machine and work area before starting maintenance.



■ General precautions!

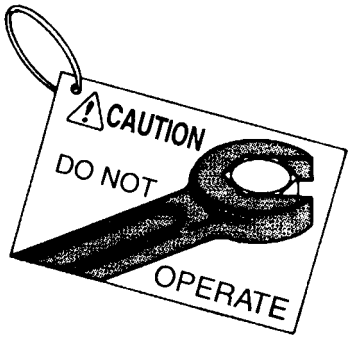
- Do not allow a third person to enter when inspecting or maintaining the machine.
- When mounting/dismounting the hydraulic breaker jointly with another person, follow the instructions from the superintendent. Determine signals with the coworker, and exchange communications sufficiently during work.
- Serious injury or death can result form failure to keep the work area clean and clear of debris, hand tools and other objects.
- Maintenance without proper tools can cause not only parts damage and poor performance, but also serious injury or death.



■ Use a caution tag!

If a person unconcerned starts the engine or moves the control lever erroneously, a serious accident will be caused.

- While inspecting or repairing, hang a caution tag and show clearly "Don't start the engine" and "Don't handle the control lever."
- Hang caution tags around the vehicle if necessary. Prevent mis-operation fully.

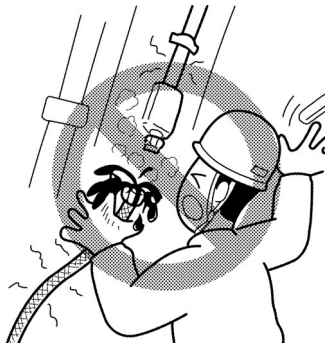


■ Beware of hydraulic oil

- High pressure diesel oils and hydraulic oils can cause serious injury or death if they get the skin or eyes. Use pasteboard or woodenboard to check oil leakage, not your bare hands. Hydraulic oil leakage from a pin hole is sometimes invisible.
- If hydraulic oil gets into skin, get emergency medical treatment immediately or death may result.
- Fatigued, deteriorated, or damaged hoses may break and high-pressure oil may gush out. Do not touch hoses.

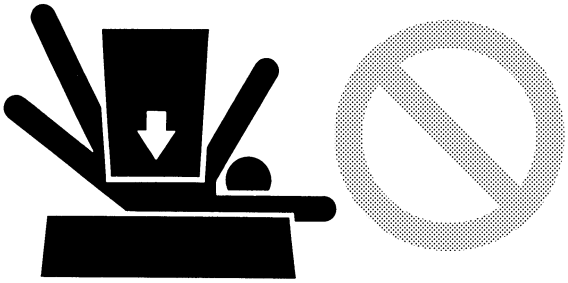
■ Relieve hydraulic pressure before maintenance

- Loosening hydraulic lines (i.e. cap, hose, piping and filter) without relieving pressure can cause hydraulic oil to blow out. Shut the stop valve of the breaker line.
- Before performing maintenance, make sure the temperature of each part cools down. Then relieve pressure on hydraulic system by following manufacture's instructions for your machine.



■ Prevent a fall without fail!

- If inspecting or repairing while the breaker is above the ground, be careful not to drop the breaker suddenly. Use a safety support or safety block as a receiving stand. If the breaker cannot be held firmly, do not do inspection or repair under the breaker.



■ Be careful when cutting bolts

When cutting bolts compressing rubbers and springs by a torch, parts may come out and can cause serous injury.
Make sure that all personnel and materials are clear of the work area to prevent accident.
When using a torch to cut a bolt near the hydraulic breaker, the hydraulic oil may catch a fire.
Never heat the breaker to prevent an explosion.

■ Handle nitrogen gas carefully.

- Relieve gas from the accumulator before removing

  The accumulator has been enclosed with high pressure gas, if removing the accumulator without relieving gas from it, the accumulator cover and other parts can blow up and cause serious injuries.

  Before removing the accumulator, make sure to relieve gas from the accumulator.
- Use nitrogen gas to charge the accumulator

  Using a different gas instead of nitrogen gas can cause an explosion.

  Be sure to use nitrogen gas only when charging the accumulator.
- Handle the accumulator with care

  If the accumulator explodes, serious accidents can result from it, because the accumulator has been enclosed with high pressure gas.

  Keep flammables away from the accumulator and always handle it with care.

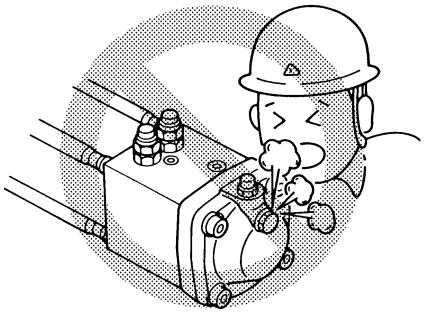
  Recharge the accumulator with correct pressure recommended by manufacturer of your particular machine.
- Handle nitrogen gas cylinders with care

  If a nitrogen gas cylinder explodes, serious accidents can result from it, because the nitrogen gas cylinder has been enclosed with high pressure gas.

  Keep flammable away from nitrogen gas cylinders and always handle them with care.
- Check bolts and other fittings before enclosing gas

  Enclosing gas to a nitrogen gas cylinder without installed bolts or other fittings securely can cause to blow out parts by gas pressure and serious injury or death can result from it.

  Check bolts and other fittings before enclosing gas.

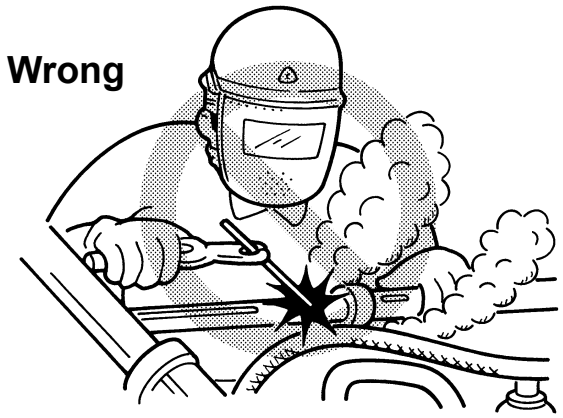


■ Weld safely

Serious accidents can result from unsafe welding practices. Weld only in the secure work area for maintenance.

Before welding:

- Remove battery terminals to prevent breakage of electric devices.
- When welding near batteries, remove batteries form the machine to prevent from explosions.
- Remove paints form welding parts to prevent generation of toxic gas.
- Remove electrics from the hydraulic excavator to prevent breakage.
- Place the ground within 3 ft of the part being welded. Make sure there are no seals, bearings or other insulating parts between the ground and the part being welded.
- Always wear protective clothing and mask when welding.
- Always insure good ventilation during welding.
- Keep away form flammable materials and have fire-fighting tools near at hand.
- If a pressurize pipe or hose is heated directly, it can burst and catch fire. Wear fire protective clothing.
- Put inflammables away and prepare "fire extinguishing equipment" in advance.



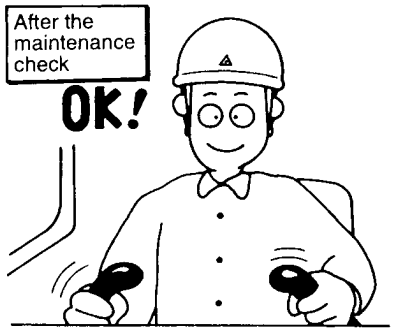
■ Be careful of the heavy rod

The rod is heavy even if it doesn't look so.

Be careful not to pinch fingers or hurt your back when removing or replacing the rod.

■ Check the machine after the maintenance

- After maintenance, run the engine at low idle and check for oil and water leakage areas where the maintenance was performed.
- Move the operating levers slowly to check their functions.
- Increase the engine speed and check again for oil and water leakage.
- Move each operating lever normally to check their functions.
- Run the engine of the hydraulic breaker with a regular setting speed and check for oil leakage, hydraulic oil, gas pressure and number of impact.

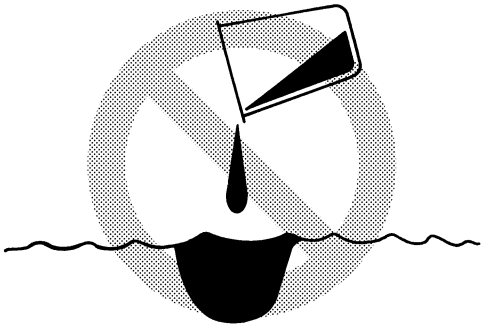


■ Store the hydraulic breaker safely

- The hydraulic breaker can fall and cause serious injury if not properly shelved.
- Store them securely.
- Don't let unauthorized personal or children enter the storage room.

■ Dispose of waste

- Disposal of waste can cause environmental pollution.
- Never dump waste on the ground, rivers or ponds.
  When waste is drained from the machine, use a container to collect the waste.
- Follow local, States or Federal regulations to dispose of refuse oils, fuels, cooling water, coolants, brake oils, solvents, filters, batteries and other potentially harmful waste.

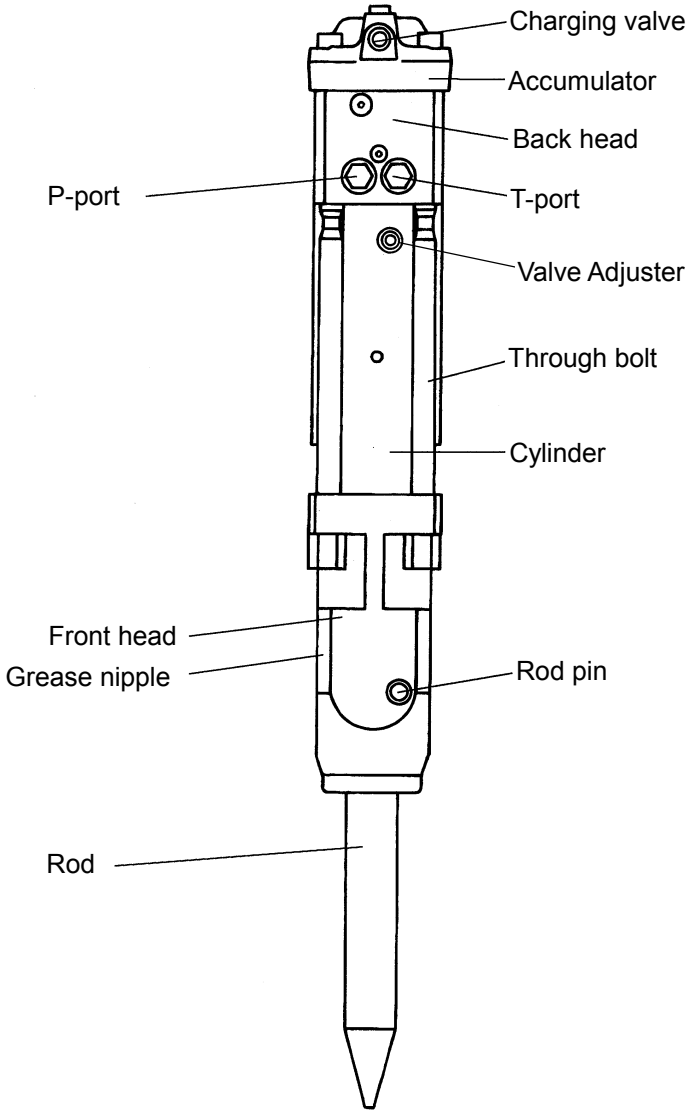


Operation

NAME OF COMPONENTS AND SPECIFICATIONS

Name of components and specifications

■ F1~F5



■ Standard specifications

Item \ Model			F1	F2	F3	F4	F5
Mass of body (incl. rod)		kg	43	58	81	106	152
Total mass	Side bracket	kg	70	92	136	180	246
	Bracket	kg	66	86	129	172	225
	B-BOX	kg		109	149	200	283
	T-BOX	kg		100	134	192	255
Hydraulic oil pressure		MPa	9.8 to 13.7	9.8 to 13.7	9.8 to 13.7	9.8 to 13.7	9.8 to 13.7
Required oil qty		ℓ/min	12 to 20	16 to 30	25 to 40	32 to 48	42 to 62
Number of blows		min^{-1}	900 to 1250	900 to 1200	850 to 1200	750 to 1000	700 to 900
Hose diameter (IN/OUT)		mm	9/9	12/12	12/12	12/12	12/12

FUNCTION OF EACH PART

■ Through bolt

Front head, cylinder and back head of breaker body are secured with four through bolts.

Cylinder

Hydraulic circuit for reciprocating the piston and valve are built in. The cylinder is the heart of the breaker body .

Accumulator

The inside is charged with high-pressure N2 gas. The accumulator compensates for pressure in the hydraulic circuit and prevents pulsation. (See "Charging accumulator with N2 gas and inspection of charge pressure," p.3-14.)

Piston

Kinetic energy of the piston is converted into hammering energy when the piston hits the rod, and consequently rock is broken.

Front head

The front head supports the entire breaker with the front bush built in because of the shock transmitted from the rod .

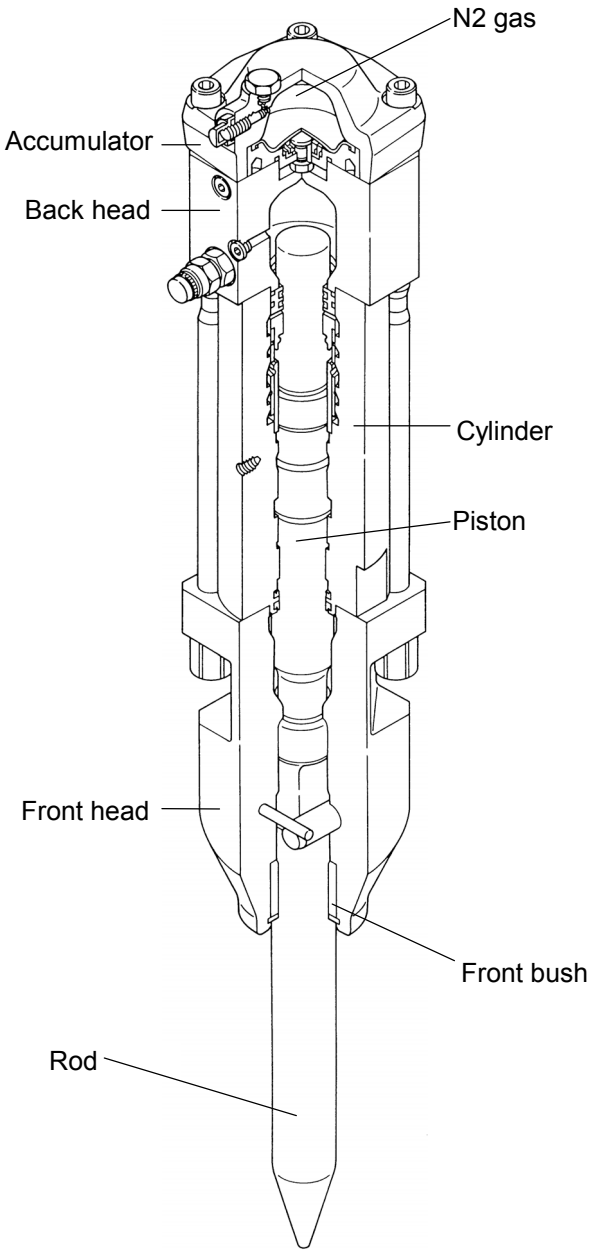
Rod

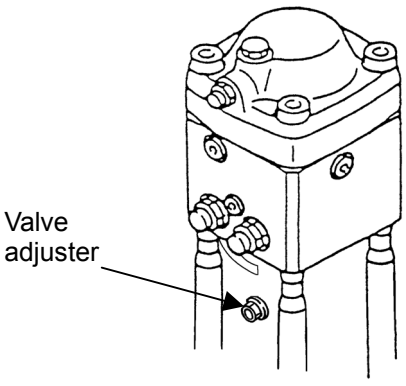
A flat rod, wedge point, and moil point can be used in accordance with application.

(See "Types of rods and major applications," p.2-6.)

Valve adjuster

This valve adjusts the oil consumption of the breaker. The number of blows and oil consumption are increased by opening this valve counterclockwise, and decreased by closing it. (See “ADJUSTMENT OF ADJUSTER”, p.3-13.)

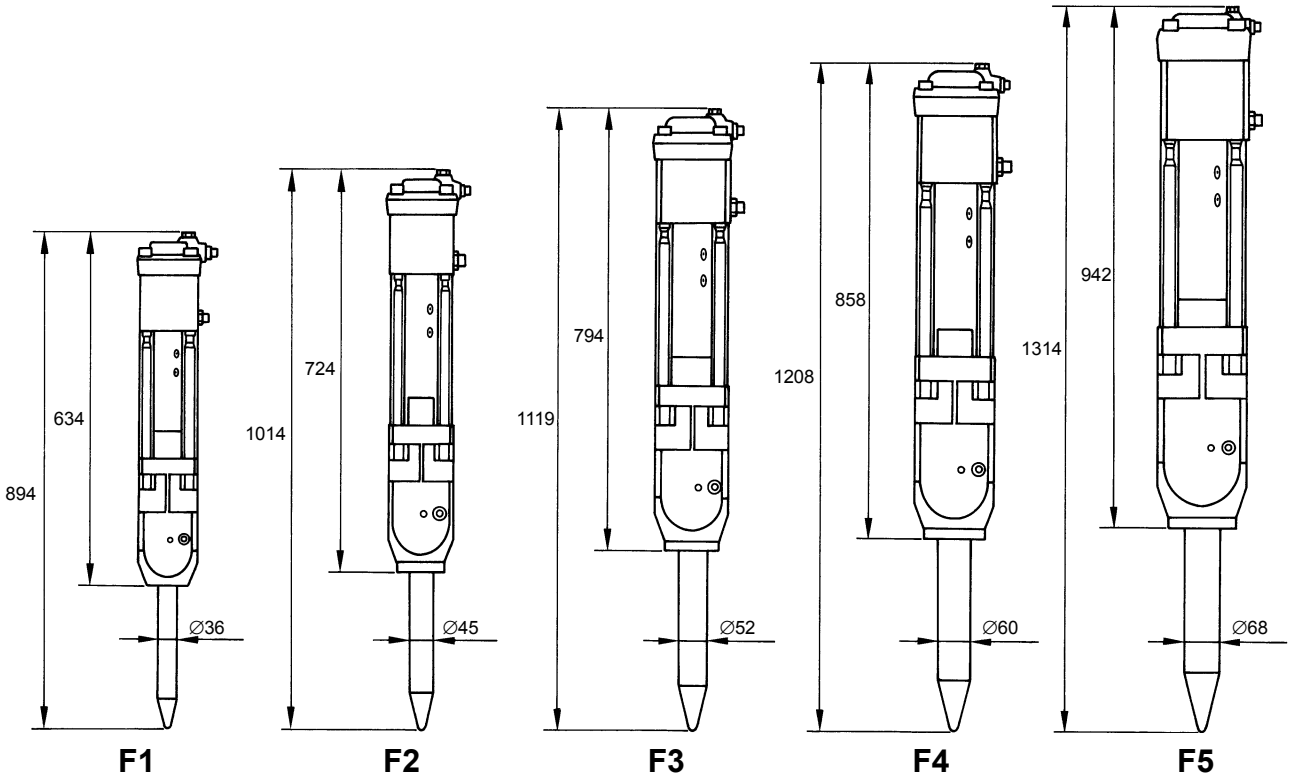




OUTSIDE DIMENSIONS

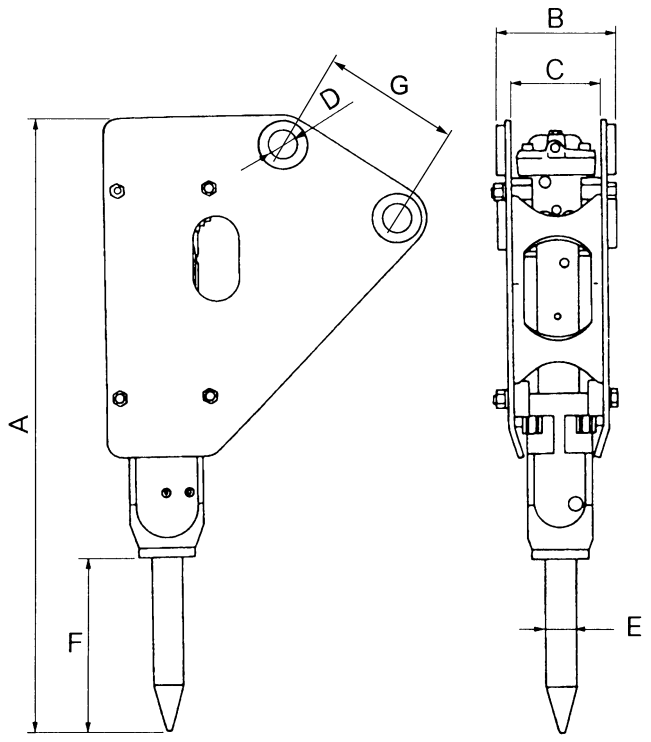
Outside dimensions of hydraulic breaker

■ **F1~F5**

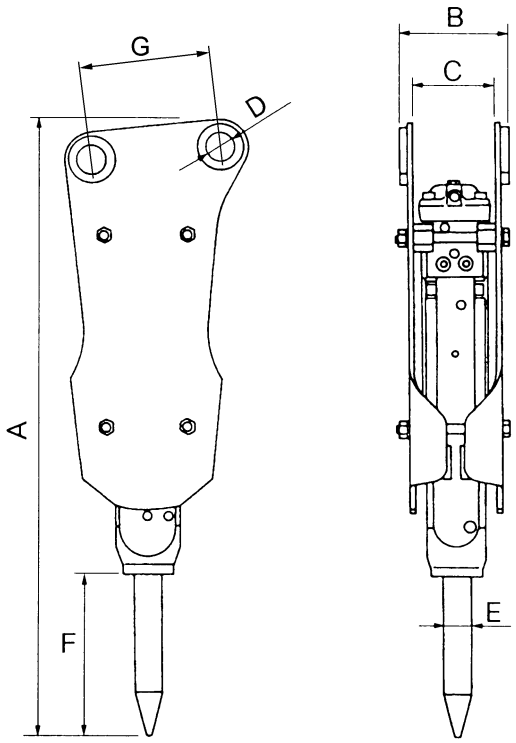


Outside dimensions of bracket

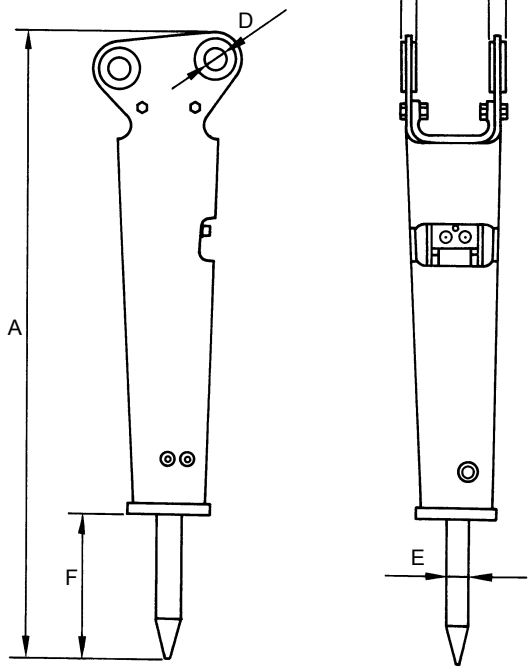
■ **Side Bracket**



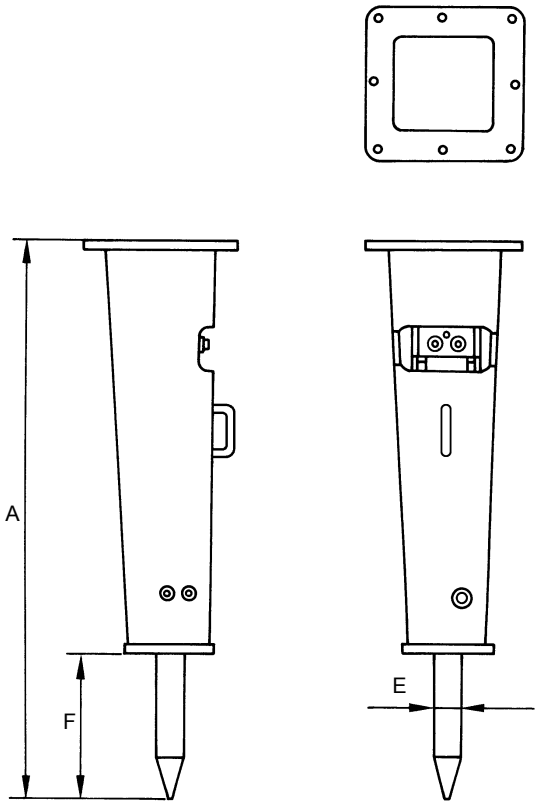
■ **Bracket**



■ B-box



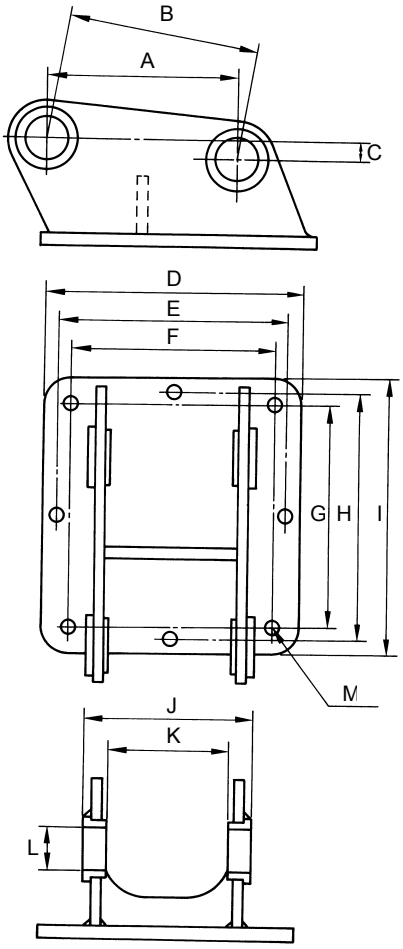
■ T-box



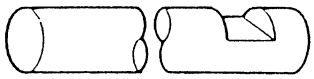
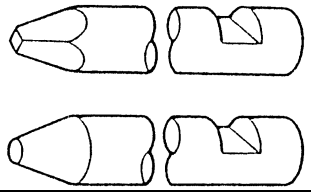
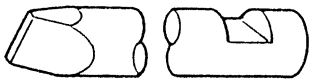
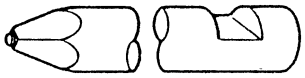
Item					Model F1	F2	F3	F4	F5
Dimen-sion	A	Total length	Side bracket	mm	899	1015	1115	1230	1352
			Bracket	mm	1009	1095	1255	1335	1458
			B-BOX	mm		1241	1395	1507	1689
			T-BOX	mm		1050	1159	1255	1369
	B	Outside of bracket		mm	180	180	214	235	235
	C	Inside of bracket		mm	130	130	154	175	175
	D	Inner diameter of boss		mm	∅45	∅45	∅60	∅60	∅60
	E	Rod diameter		mm	∅36	∅45	∅52	∅60	∅68
	F	Effective length		mm	260	290	325	350	372
	G	Distance Between Pins	Side bracket	mm	124	187	187	233	233
					161	215	246	277	277
			Bracket	mm	140	195	215	280	280
			B-BOX	mm		150	240	251	282

■ Top bracket (T-box)

Item \ Model		F2	F3	F4	F5
Dimension (mm)	A	200	220	240	280
	B	201	221	241	281
	C	20	20	20	20
	D	272	298	336	379
	E	242	264	294	
	F	216	236	260	328
	G	236	256	280	328
	H	262	284	314	
	I	292	318	356	379
	J	180	214	235	235
	K	140	154	175	175
	L	45	60	60	60
	M	14	18	22	22

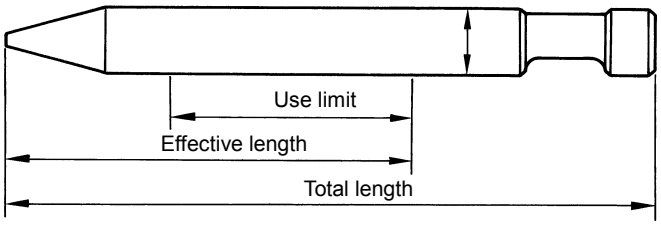


Type of rod and major applications

Type of rods	Shape	Major applications
Flat rod		Concrete breaking
Moil point		Multipurpose applications, including breaking of reinforced concrete, as well as excavation of bedrock
Wedge point		Concrete breaking, excavation of bedrock, operations on the face of slope, excavation of ditches, etc.
Core rod (Ball-point rod)		Breaking metal ores, as well as quartzite and other highly abrasive objects

- Furukawa rods come in a moil point, wedge point, flat rod, and rod with cemented carbide core. In general, the moil point is used frequently, but select an appropriate rod according to the nature of work and the characteristics of the object to break.

■ Dimension/weight of rod



Item \ Model		F1	F2	F3	F4	F5
Rod dia.	(mm)	36	45	52	60	68
Total length	(mm)	400	460	510	560	600
Effective length	(mm)	260	290	325	350	372
Use limit	(mm)	185	215	225	240	252
Mass	(kg)	2.8	5.0	8.0	11.0	15.0

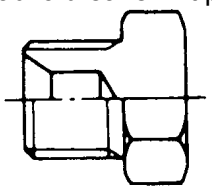
Oil hose plug and cap

NOTICE

When attaching/detaching the oil hose plug and union cap, clean them well to prevent entry of dust.

Oil hose plug

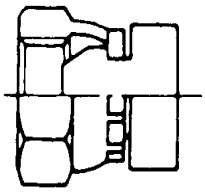
The oil hose plug is used to plug the hose attached to the hydraulic breaker. It prevents mud or dust from entering the hose when the hydraulic breaker is removed from the base machine for bucket operation, etc.



Model	Part No.	Parts Name	Q'ty
F1	084899-03000	9 Oil hose plug	2
F2 F3 F4 F5	084899-04000	12 Oil hose plug	2

Union cap

The union cap is used to cap the piping bracket attached to the base machine for prevention of the piping bracket from being smeared with mud during bucket operation, etc.



Model	Part No.	Parts Name	Q'ty
F1	084899-03000	9 Union cap	2
F2 F3 F4 F5	084899-04000	12 Union cap	2

NOTICE

Keep the removed union cap and hose plug in the tool box.

MOUNTING ON BASE MACHINE

⚠ WARNING

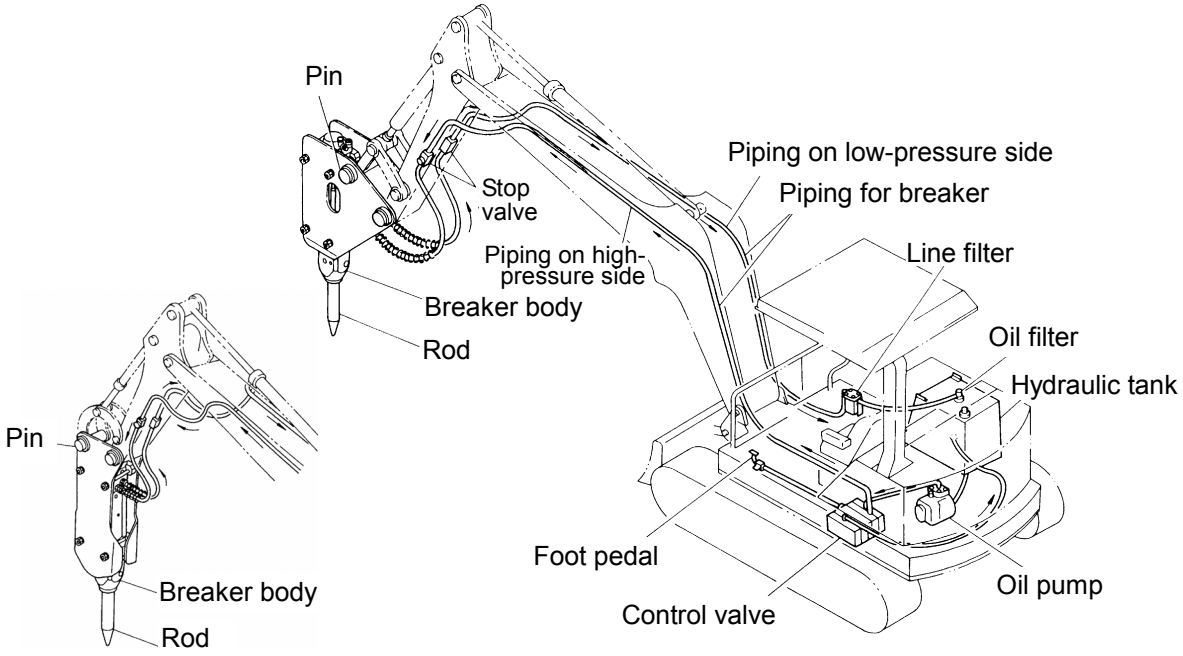
Two persons are necessary for mounting/dismounting the hydraulic breaker, so determine signals for operation in advance.

Be sure to use a crane to handle brackets, pins, and other heavy objects.

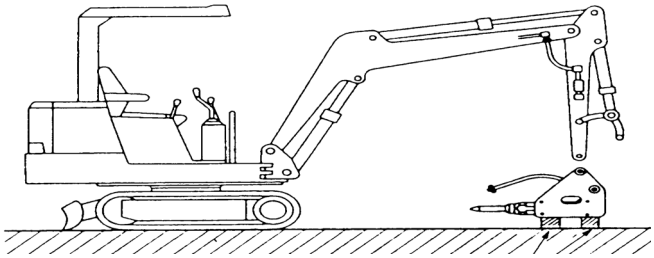
When the pin retaining bolt is removed during operation, the mounting pin will come off, and the hydraulic breaker will come off the hydraulic excavator, leading to injury or death.

⚠ CAUTION

When positioning pin holes, do not put your hand or finger in them, otherwise your hand or finger may be cut off when the arm or hydraulic breaker moves.

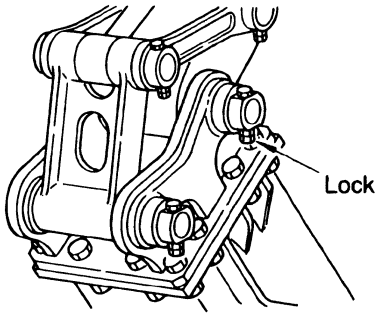


1. Place the hydraulic breaker on timber. (Attach hoses and bushings.)
2. Move the base machine to align the hydraulic breaker with the arm. Lower the boom and align the pin hole at the end of the arm with the pin hole in the bracket.
3. Insert a pin, install a stop ring, and attach a bolt.



4. When the arm pin is inserted, raise the boom, and place the breaker on the timber. Extend the bucket cylinder, and insert the pin into the hole in the bucket link.

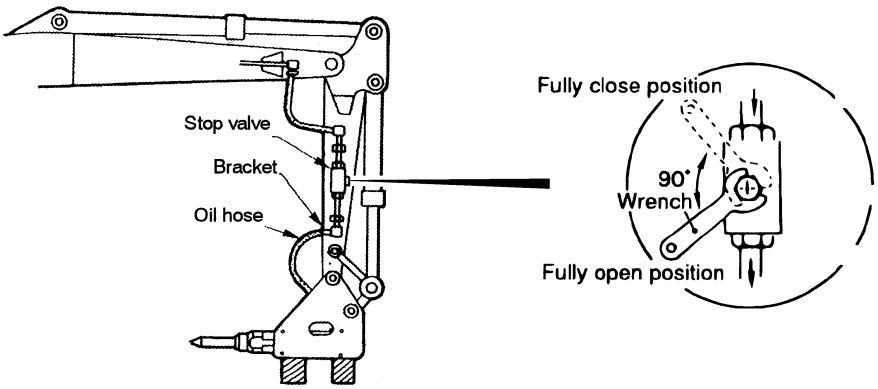
5. Install the stop ring, and install the retaining bolt. Bolt locking is of a double-nut type. Tighten the nuts firmly.



6. Stop the engine of the base machine, turn off the main switch, and let out the air from the hydraulic oil tank. (Let out the air according to the base machine operation manual.)

7. Check that the stop valves on both sides of the end of the arm are in the "Close" position.

8. Remove the union cap and oil hose plug from the hydraulic breaker pipe attached to the end of the arm, and connect the oil hose.



NOTICE

Provide a pan to collect waste oil before attaching/detaching the oil hose. Wipe the spilt oil completely.

Exercise sufficient care so that dust will not enter through the metal fittings at the end of the oil hose.

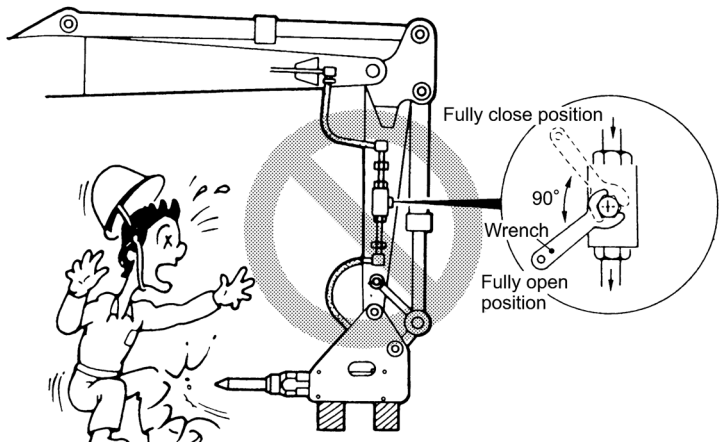
- Entry of dust in the oil hose will cause contamination of hydraulic oil, causing failure of the hydraulic breaker and base machine.

9. Start the engine of the base machine, and raise the boom. Then operate the bucket cylinder to straighten the twisted connection hose of the hydraulic breaker.

10. Turn the high-/low-pressure stop valve on the hydraulic breaker pipe at the end of the arm by 90 degrees (the line on the head shows the direction of flow), and connect the hydraulic circuit. (Set the stop valve in the fully open position.)

NOTICE

The rod may shoot out by the hydraulic pressure in the piping, so do not stand near the rod.



■ Removal of hydraulic breaker

Remove the hydraulic breaker in the reverse order of mounting.

- Place the hydraulic breaker on a flat place.
- Stop the engine of the base machine, and let the air pressure out of the hydraulic oil tank.
- Fully close the stop valve at the end of the arm.
- Mount the union cap and oil hose plug on the oil hose and the end of the arm.
- Place the removed pins and retaining bolts/nuts on the hydraulic breaker side.

OPERATION PROCEDURES (BREAKING)

⚠ CAUTION

Only those who have completed the technical course for operation of vehicle type construction machines (for dismantleing) and mastered the method of operation can operate the hydraulic breaker. Operate the base machine in accordance with the operation textbook used during the training course and the operation manual for the base machine.

Precautions for safe operation

⚠ CAUTION

Before starting the engine, confirm the safety of the area around the base machine.

Precautions before work

■ Start-up inspection before work

For safe operation of the machine and prevention of failure, be sure to conduct start-up inspection before starting the engine.

■ Warm-up of machine

- Do not operate the machine right after starting the engine. Idle the machine for warm-up. Warm the hydraulic oil sufficiently especially in winter or for operation in a cold place.
- When operating the hydraulic breaker, idle the engine and operate the hydraulic breaker with a light load.

■ Cleaning the area around driver's seat

- Keep the area around the driver's seat clean at all times to avoid improper operation or malfunction.
- Put spare parts and tools in a tool box.

■ Adjustment around the driver's seat

- Be sure to lower the windshield and protection net of the vehicle to protect yourself from scattered stones and concrete pieces.
- Adjust the seat position so that you can easily operate various operation levers or step on the pedal when you are seated deeply with your back in close contact with the back of the seat.

■ Security

- Before starting operation, check the topographical and geological conditions of the work site, and pay sufficient attention to cracks in the ground and collapse of buildings.
- Station guards, arrange fences, and take other safety measures to protect pedestrians and general vehicles.

Precautions for traveling/stopping

■ Precautions for traveling

- To secure the forward field of vision and ensure traveling safety, raise the hydraulic breaker 30-40 cm or more from the ground and select a flat ground for traveling.
- When traveling in water, keep the allowable traveling depth of the hydraulic excavator, and exercise sufficient care so that the hydraulic breaker will not be immersed in water.

■ Precautions when traveling up-/down-slopes

- Do not travel exceeding the hill climbing ability and safety of the vehicle.
- When traveling an up- or down-slope, lower the engine speed in advance, and keep the angle between the boom and arm at 90-110°. Keep the hydraulic breaker 30-40 cm above the ground, and travel the machine facing the slop at all times.

■ Precautions for stopping

- Select a firm ground to part the vehicle. Set the breaker perpendicularly and put the rod end on the ground.
- When leaving the driver's seat, set the "Safety lock" to prevent the boom and arm from moving, and then stop the engine.

Breaking operation

⚠ CAUTION

Park the base machine on a stable, firm ground as much as possible.

Excessive thrust will cause loss of balance of the base machine when the concrete is broken.

NOTICE

Select a good place so that the rod will not slip during hammering.

The breaker operation procedure for general concrete breaking operation is shown below.

1. Move the base machine to the front of the concrete to be broken.
2. Operate the boom, arm, and bucket cylinder of the base machine, set the breaker perpendicularly to the concrete surface to break, and then push and thrust the breaker against the concrete.

3. Step on the breaker pedal to operate the breaker.

NOTICE

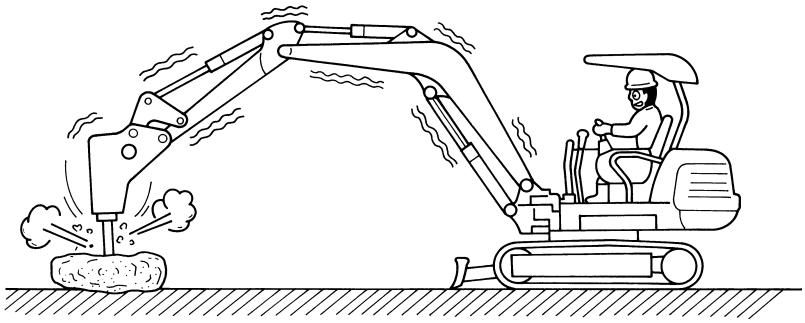
When the thrust drops during hammering, operate the boom to increase the thrust.

4. After braking concrete, return the pedal to the original position immediately.

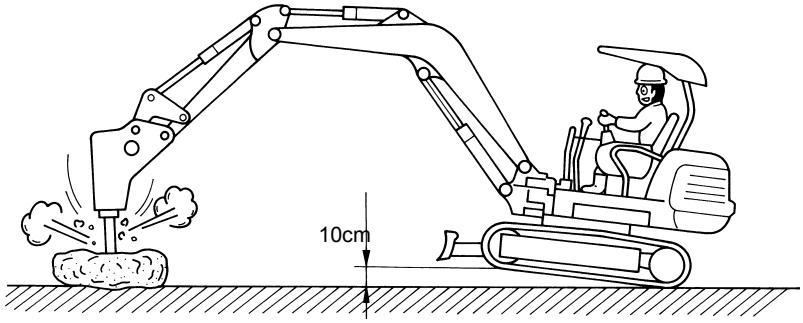
Repeat the above operation for breaking.

Optimal thrust

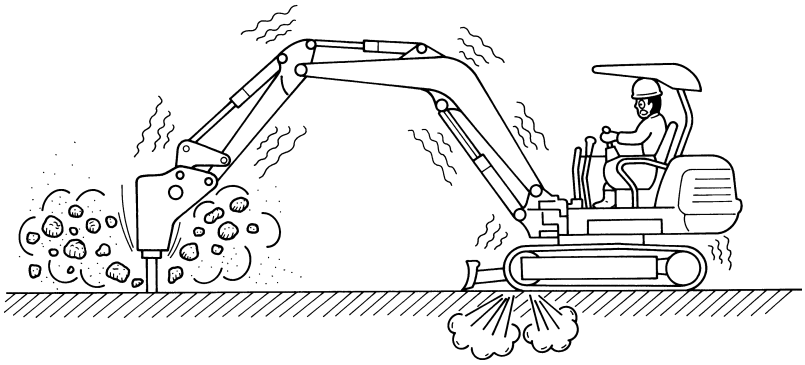
In order to effectively use the breaking force, appropriate thrust must be given to the breaker. When the thrust is insufficient, impact will be applied to the breaker, bracket, and carriage arm, leading to their failure.



When excessive thrust is applied and striking operation is conducted with the front of the base machine lifted by more than 10 cm, the machine will suddenly fall forward right after rock is broken, and the breaker or the end of the bracket will crash against rock, leading to breakage of the breaker or the bracket, as well as damage to the base machine itself.

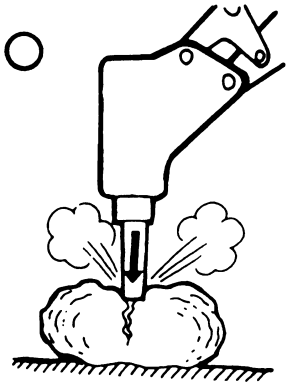


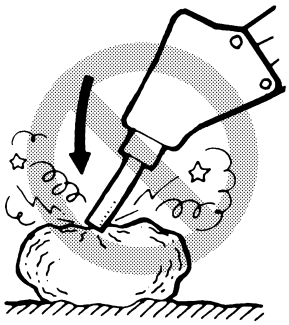
When the machine hammers a rock while the front of the base machine is lifted, the vibration during hammering will be transmitted also to the crawler, so avoid such operation for protection of the crawler. Exercise care so that thrust will be applied at all times during hammering operation. Avoid idle hammering.



Direction of thrust

The direction of thrust should coincide with the direction of the rod shaft. Hammer the rod against rock as perpendicularly as possible. When it hammers a rock slantwise, the rod and front bush will be galled or the rod will be broken. Select the parking ground carefully for stable hammering, and hammer the rod in a firm and stable manner.





Precautions for operation

⚠ WARNING

Wrong traveling lever operation may cause a serious accident, resulting in injury or death.
Operate the traveling lever correctly.

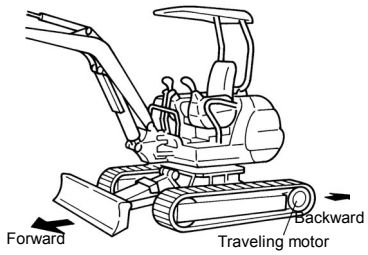
Do not run the machine with the breaker pushing rock.

■ Confirmation of operation lever, pedal, and switch

Operation of the operation levers, pedals, and switches of hydraulic excavators may be different according to the maker and model. Operate them correctly.

■ Confirmation of crawler traveling direction

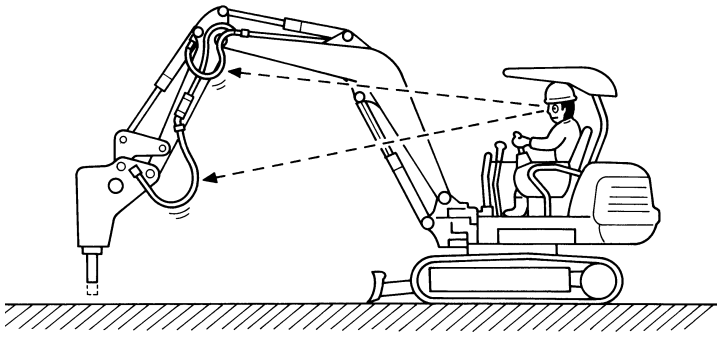
Confirm the direction of crawler traveling and the operator's seat before traveling the machine.



■ Pay attention to the following during operation

1. Stop operation when hoses are vibrating abnormally.

Check the hoses on the high-pressure and low-pressure sides of the breaker for abnormal vibration. If they are vibrating abnormally, ask your Furukawa dealer for inspection.



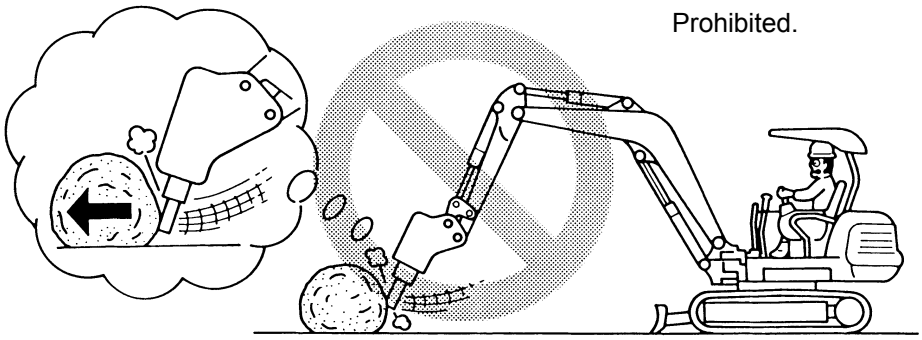
2. Stop operation right after breaking. (Avoid idle blows as much as possible.)

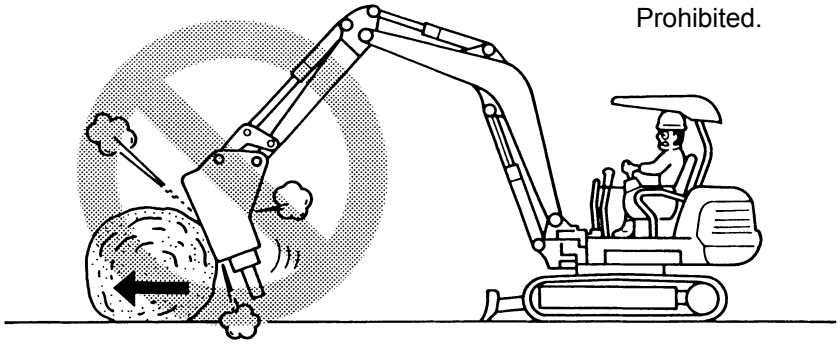
After breaking rock, stop striking immediately. Continuous idle blows will exercise adverse effecrts on the machine as well. When appropriate thrust is not applied to the breaker or the rod is twisted during striking, idle blows will result. (Idle blows will produce metallic sound unlike ordinary blows.)

3. Do not move rock.

Rolling or falling a rock with the rod end or bracket side by using the boom or arm of the base machine as shown in the figure will result in breakage of the breaker mounting bolt or bracket, breakage and galling of the rod, and damage to the arm and boom. Do not move rock.

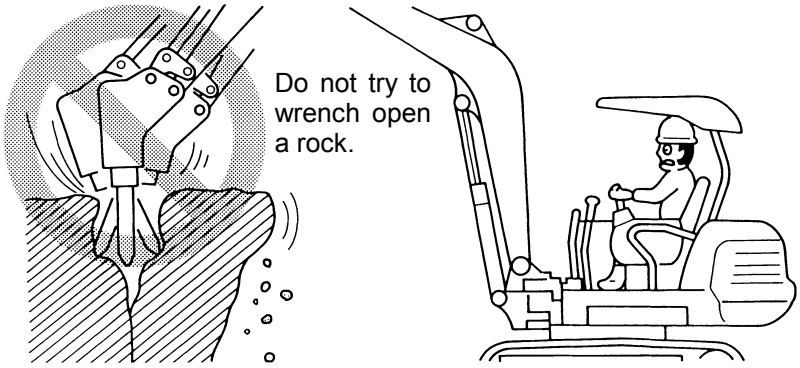
It is strictly prohibited to travel when the breaker is in contact with rock.





4. Do not wrench open rock.

Do not put the rod into a crack in rock and move the rod to and for to break the rock, otherwise the rod will be broken or the frame and mounting bracket will be damaged.



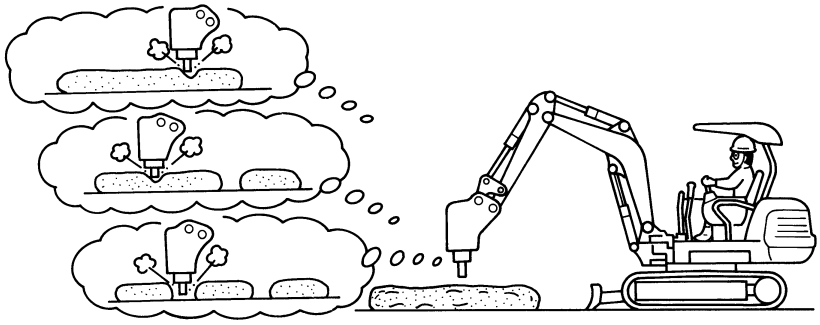
5. Do not hammer continuously for more than one minute.
If a rock cannot broken after hammering the same position for one minute, change the hammering position. Continued hammering of the same place for a long time will cause abnormal wear of the rod.

6. Break a large rock from edges.
Hammer rifts or edges, which are easy to break, for efficient breaking of a large, hard rock.

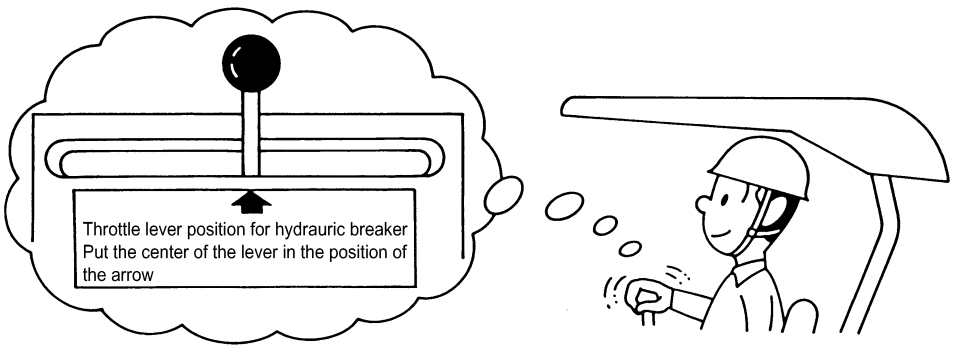
NOTICE

Change hammering positions when the rock cannot be broken within one minute.

Hammer a rock from the edge sequentially.

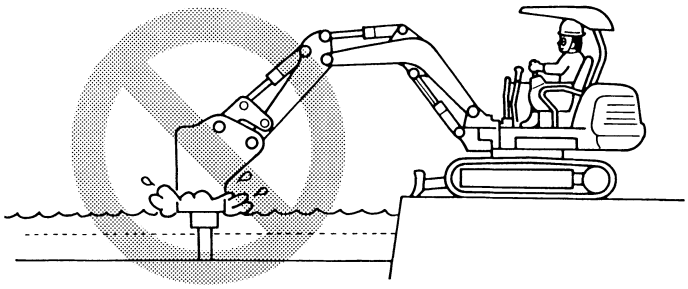


7. Select an appropriate engine speed (rpm) for breaking with the breaker.
Run the engine at the specified speed for breaking. The hammering force will not change even if the engine speed is increased. Increased engine speed will cause oil temperature rise, leading to overheating.



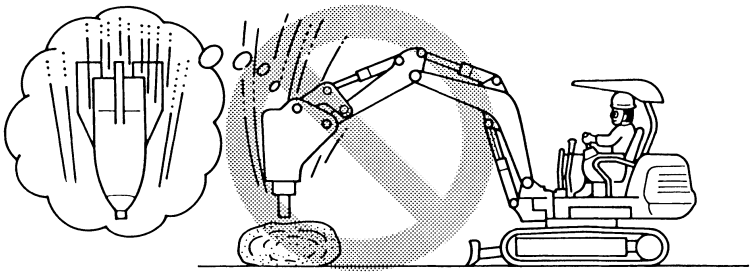
8. Do not break rock in water or mud.

Do not put any portion other than the rod in water or mud, Otherwise, water or mud will enter the hydraulic oil, leading to early failure of the breaker or base machine.



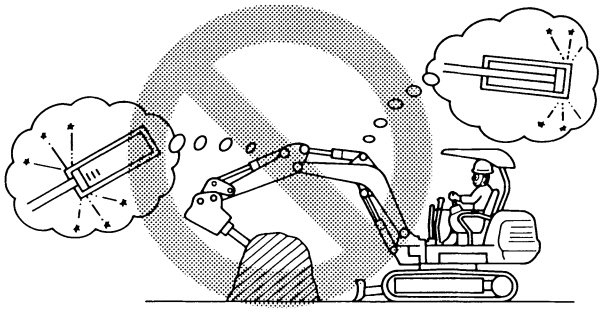
9. Do not allow the breaker to fall to break rock.

Do allow the breaker to fall to break a rock, otherwise excessive force will be applied to the breaker or base machine, causing damage to the breaker and various parts of the base machine.



10. Do not do breaking operation at the stroke end of the base machine cylinder.

Breaking operation conducted at the stroke end (when the cylinder is extended or retracted to a maximum extent) of respective hydraulic cylinders of a base machine will lead to damage to the cylinders and other parts of the base machine.



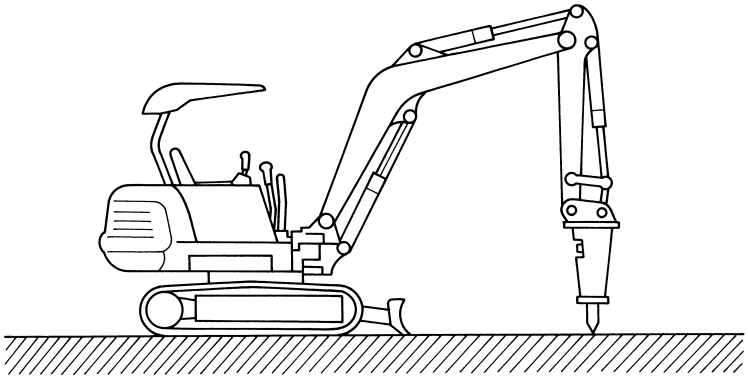
Storage after operation

⚠ CAUTION

The rod is hot right after hammering, so do not touch it.

When operation is suspended or completed

When operation is suspended or completed, move the base machine to a flat ground, remove mud from the breaker body, and vertically lower the hydraulic breaker.



- Check for oil leakage from the piping and damage to the rod.
- When the breaker is used in a river, water might have entered not only the base machine but also the inside of the breaker body. Dry them sufficiently, and grease the front head section.

LONG-TERM STORAGE

⚠ CAUTION

Negligence of the following operation will cause rust inside the machine, leading to failure.

When the machine will not be used for a long time (more than three weeks), clean the outside of the hydraulic breaker and carry out the following operations:

- Check the appearance of each part for defects.
- Remove the rod and apply rust preventive oil to the inside of the front head.
- Grease the outside.
- Place the breaker on square timber in a well-ventilated room. When it is unavoidable to store the breaker outdoors, place it on flat ground with sufficient ventilation and drainage, and cover it with a sheet.

When using the machine after long-term storage

When using the hydraulic breaker after long-term storage, ask your Furukawa dealer for inspection.

NOTICE

Sudden operation of the hydraulic breaker under high pressure will cause seizure of the piston and cylinder.

- Before starting the breaker, carry out running-in (5-10 minutes).
- During running-in of the breaker, check that the number of blows is regular.
- Check that there is no oil leakage from any part of the breaker during running-in.
- Check respective pipes for damage or oil leakage.
- After running-in and confirmation of no defects, and start breaking operation.

TROUBLESHOOTING

The table below is prepared for the person in charge of maintenance to be able to take corrective measures immediately when hydraulic breaker trouble occurs. Understand the details of the situation shown below when trouble occurs, and then contact the distributor.

Situation	Cause	Correction
1. Hammering operation not available		
(I) Hydraulic oil is not supplied to the oil inlet of the breaker.	(a) Failure of hose and pipe • Clogging or breakage of the pipe system	(a) Inspection, repair, or replacement of piping system
	(b) Failure of operation valve system • Fallen or damaged tie-rod or control cable	(b) Inspection, repair, or replacement of valves
	(c) Insufficient hydraulic oil	(c) Refill the hydraulic oil tank
(II) The hydraulic oil is supplied sufficiently to the oil inlet of the breaker.	(d) Failure inside the breaker	(d) Ask the distributor for an overhaul
2. Hammering operation is available but the hammering force is weak.		
(I) High-pressure oil is not supplied sufficiently to the oil inlet of the breaker.	(a) Failure of hoses and pipes • Clogged piping system • Oil leakage	(a) Inspection, repair, or replacement of piping system
	(b) Failure of operation valve system • Deformed pedal • Deformed control cable • Galling of control valve	(b) Inspection, repair, or replacement of operation valve system
	(c) Insufficient hydraulic oil	(c) Refill the hydraulic oil tank
	(d) Contamination and deterioration of hydraulic oil	(d) After cleaning the tank, change the oil completely
	(e) Pump out of order	(e) Ask the base machine distributor for an overhaul
	(f) Drop in preset pressure of the relief valve	(f) Ask the base machine dealer for maintenance

Situation	Cause	Correction
(II) High-pressure oil is supplied sufficiently to the oil inlet of the breaker (III) The number of blows increased	(f) Failure of the inside of cylinder • Entry of foreign substances	(f) Ask the distributor for an overhaul
3. The hammering force weakens and hose vibration becomes greater	(a) The accumulator of the breaker body is defective • Gas leakage • Breakage of diaphragm • The adjuster for adjusting the hammering force is opened	(a) Ask the distributor for an overhaul. • Fill the gas or replace the diaphragm • Adjust the number of blows according to the procedure, p.3-13
4. Oil leakage from the front head or rod becomes worse	(a) Abrasion of the cylinder seal	(a) Ask the distributor for an overhaul
5. The piston is operating but hammering operation is unavailable.	(a) Galling of rod	(a) Remove the front section, remove the rod, and make correction with a buff or oil stone
6. The play between the breaker body and T-box becomes large and the noise increases	(a) Breakage of respective dampers	(a) Replace dampers

HYDRAULIC OIL

Selection of hydraulic oil

- In order to exhibit the hydraulic breaker performance to a maximum extent and maintain high efficiency, selection of hydraulic oil is very important. In general, hydraulic oil specified by the base machine maker is recommended.

  Our company recommends the following hydraulic oil. Contact your Furukawa Rock Drill dealer in the following cases:

  a. When the machine is operated in a place where our recommended hydraulic oil is unavailable.
  b. When the properties of the hydraulic oil specified by the base machine maker are substantially different from the properties of the hydraulic oil recommended by our company.

Classification of hydraulic oil and grease

Brand / Application	Hydraulic oil			Grease	
	ISO VG32	ISO VG46	ISO VG68	NLGI No.1	NLGI No.2
Area	Cold district	Warm district	Hot and humid district	Cold district	Warm, or hot and humid district

Oil temperature control

- The hydraulic breaker is operated by the hydraulic power source of construction machinery (hydraulic excavator, etc.). After warming up the base machine, start the operation when the temperature is approx. 40°C. Usually, the hydraulic oil temperature of the hydraulic breaker and base machine circuit must be controlled between 40 and 60°C.
- If the hydraulic oil temperature exceeds 80°C, the viscosity is lowered to cause not only malfunction of the breaker but also short service life of seals, deterioration of hydraulic oil and the like. When using the machine in extremely hot weather, pay special attention to the oil temperature control.

NOTICE

If you have operated the breaker when the oil temperature exceeded 80°C, you must check the seals.

Oil contamination

- The contamination of hydraulic oil may not only damage the hydraulic breaker but also damage the base machine's hydraulic devices and parts. It is important to check the contamination daily.
- Pay special attention to the oil contamination and replace it earlier than usual if necessary. When replacing the oil, clean the hydraulic oil tank, cylinder, and pipes completely. Check the hydraulic oil when cleaning and replacing the oil filter.

Filter:	Replace it after first 50 hours and subsequently every 100 hours.
Hydraulic oil:	Replace it according to the recommendations of the base machine manufacturer

Inspection/Maintenance

MAINTENANCE, INSPECTION AND REPAIR

A hydraulic breaker is an attachment of a hydraulic excavator or the like. Therefore not only the inspection and repair mentioned in this manual but also those for the base machine (hydraulic excavator, etc.) are very important. Read the instruction manual fully and carry out inspection and repair accurately to use a hydraulic breaker safety and efficiently.

Periodical inspection and repair

■ Monthly inspection

Ask the distributor for an inspection once a month to prevent troubles and to use a hydraulic breaker safety.

■ Yearly inspection

Bring your hydraulic breaker to the distributor and ask for an inspection and repair once a year to prevent troubles and to use a breaker safety. Shorten the intervals according to the contents or conditions of work, and you will prevent troubles.

Parts	Check points		Standard of judgment	
			Description	Method
Breaker main body	Cylinder		(1) No oil leakage.	Visual
	Accumulator		(1) The charge gas pressure must be within the specified value. (2) No oil leakage. (3) The torque of mounting bolt must be proper.	Measure the pressure. Visual Check the torque.
	Front head group	Front bush Rod pin	(1) The wear amount must be within the specified value. 1) (2) Every part must be grassed fully.	Measure the wear amount. Visual
	Rod		(1) The effective length must be proper. 2) (2) No damage. (3) The wear of shank must be minimized.	Measure the length. Visual Visual
	Through bolt		(1) No bolt must be loosened, and the tightening torque must be proper.	Check the looseness and torque.
Bracket	Top bracket		(1) No crack and damage.	Visual
	T-box B-box bracket Side bracket			
	Bolt		(1) No bolt must be loosened, and the tightening torque must be proper.	Check the looseness and torque.

Parts	Check points	Standard of judgment	
		Description	Method
Pipes	Pin and bush	(1) No pin and bush must be worn. (2) All pins and bushes must be greased fully.	Visual
	Oil hose	(1) No oil leakage. (2) Metal fixtures have no looseness.	Visual Check the oil hoses.
	Pipe	(1) No mounting bolt must not fall off, nor be loosened.	Check the pipes.
	Control valve	(1) No oil leakage. (2) Valve must be opened and closed normally.	Visual Check the valves.
	Relief valve 3)	(1) No oil leakage. (2) Valve must work normally under the specified relief pressure, and the pointer of pressure gauge must not move.	Visual Measure the pressure.
	Line filter 3)	(1) No oil leakage/No damage. (2) No element must be clogged.	Visual Check the elements.
	Operation pedal	(1) Operative power and play amount must be proper.	Check the power and amount.
	Stop valve	(1) No oil leakage. (2) Valve must be opened and closed normally.	Visual Check the valves.
Total Function		(1) The operative pressure and number of blows must be within the specified valued and parts must work normally.	Measure the values.

Notes: 1) Refer to P3-8 for the wear limit of each part.
2) Refer to P3-8, 3-9 for the rod use limit (effective length).
3) In some types of hydraulic excavators, a relief valve and line filter (exclusively for breaker) are not set in the piping circuit of a hydraulic breaker. In such a case, omit these checks.

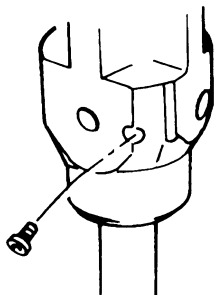
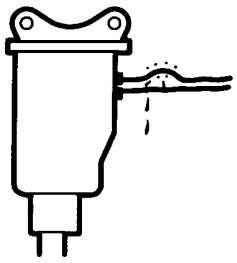
■ Disassembly and reassembly of breaker body

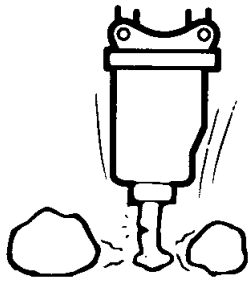
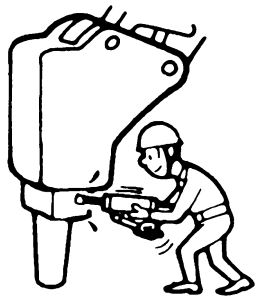
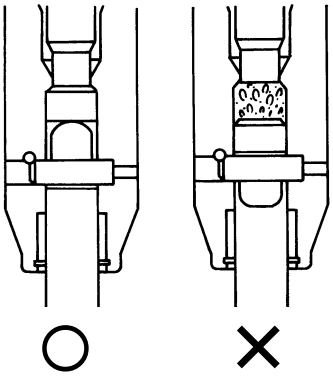
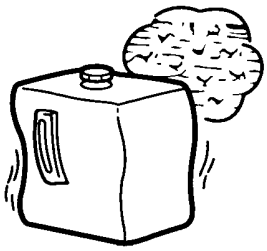
The breaker body, which is manufactured with high processing technique, is composed of high-quality hydraulic parts. Never diassemble the breaker on a work spot. Please ask the distributor to disassemble. A technical service engineer will disassemble, reassemble and then adjust the machine. If you diassemble it, we cannot guarantee its functions.

Daily inspection / inspection and maintenance before operation

NOTICE

Before operation, be sure to check the following items and lubricate respective parts.

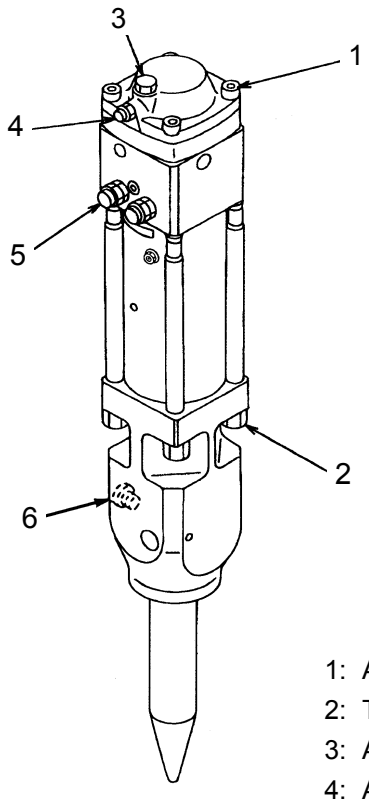
Inspection item	Location	Correction
• Looseness, falling-off, or damage to bolts and nuts 	• Accumulator mounting bolt • Through bolt • Bracket securing bolt	• Check missing bolts • Check for damage • Check for looseness • Retighten to correct tightening torque
• Falling-off of screw plug 	• Screw plug • Stop pin • Rod pin	• Replace when damaged or lost
• Looseness of hose bracket, damage to hose, and oil leakage 	• Hydraulic piping for breaker • Oil hose	• Retighten sufficiently • Replace when damaged
• Abnormal oil leakage 	• Seals of cylinder, and accumulator • Gap between front head and rod	• Check the leakage with the normal flow of rod lubrication oil or hydraulic oil • Contact the distributor for investigation of the cause

Inspection item	Location	Correction
• Abnormal abrasion and cracks in rod 	• Rod	• If the rod is burred, deformed, or its end is broken, correct with a grinder • If the rod is extremely worn, replace it • If the rod is cracked, replace it with a new one
• Greasing  	• When using a grease gun, grease 5-10 times before start and every 2-3 hours thereafter • Supply grease through the grease filler port in the front head	• Apply grease to the bracket mounting pin • **Grease them while the rod is on the ground and it is pushed against the piston** * **To prevent entry of grease into piston striking chamber side, push the rod against the piston while greasing.**
• Level of hydraulic oil • Contamination 	• Hydraulic oil tank	• Check the oil level of the hydraulic oil tank mounted on the base machine every time work is performed. After starting the machine (after operating the boom and arm), check again • Judge it by the color of the hydraulic oil. Follow the criteria for judging contamination set by service engineer according to the site. If contamination is excessive, drain and flush the hydraulic oil tank and then fill with new oil

Tightening torque

Breaker main body

■ F1-F5



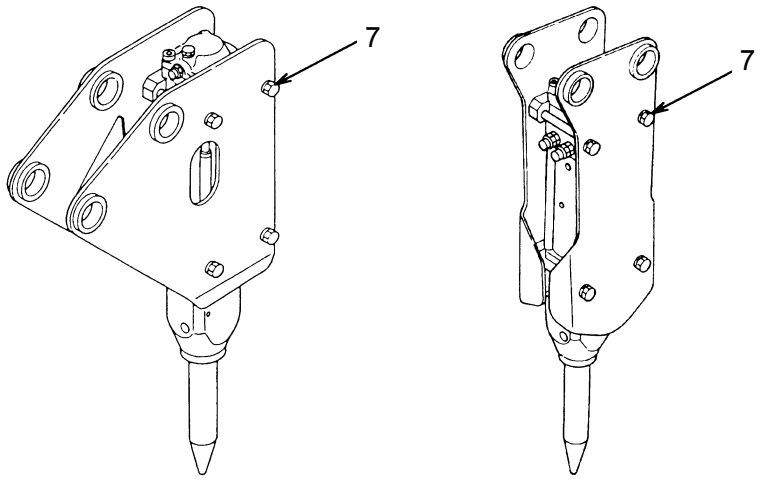
1: Accumulator/Bolt
2: Through bolt Nut
3: Accumulator/plug
4: Accumulator/cap
5: Connector
6: Screw plug

Unit: N·m

Location		Model		F1	F2	F3	F4	F5
1	Accumulator/Bolt	Bolt size		M16×2.0	M16×2.0	M16×2.0	M16×2.0	M20×2.5
		HEX socket size	mm	14	14	14	14	17
		Tightening torque	N-m	245	245	245	245	343
2	Through bolt Nut	Thread size		M18	M20	M22	M24	M27
		Nut HEX size	mm	27	30	32	36	41
		Tightening torque	N-m	245	343	441	539	735
3	Accumulator/plug	HEX head size	mm	22	22	22	22	22
		Tightening torque	N-m	147	147	147	147	147
4	Accumulator/cap	HEX head size	mm	M12×1.25	M12×1.25	M12×1.25	M12×1.25	M12×1.25
		Tightening torque	N-m	147	147	147	147	147
5	Connector	HEX head size	mm	22	27	27	27	27
		Tightening torque	N-m	196	245	245	245	245
6	Screw plug	HEX head size	mm	5	6	6	6	6
		Tightening torque	N-m	25	35	35	50	50

Side Bracket / bracket

■ F1-F5

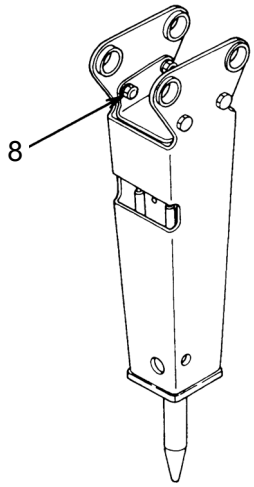


Unit: N·m

Location		Model		F1	F2	F3	F4	F5
7	Bracket	Bolt size		M16×2.0	M18×2.5	M20×2.5	M22×2.5	M24×3.0
		HEX head size	mm	24	27	30	32	36
		Nut HEX size	mm	24	27	30	32	36
		Tightening torque	N-m	294	392	490	588	785

B-box

■ F2-F5

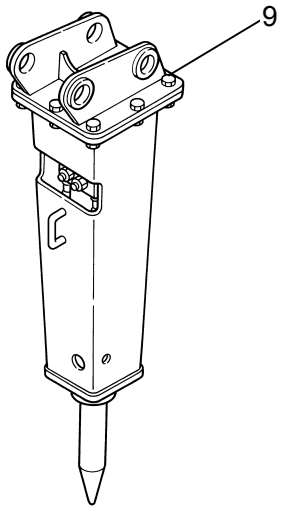


Unit: N·m

Location		Model		F2	F3	F4	F5
8	Top cover	Bolt size		M18×2.5	M20×2.5	M22×2.5	M24×3.0
		HEX head size	mm	27	30	32	36
		Nut HEX size	mm	27	30	32	36
		Tightening torque	N-m	294	343	392	490

T-box

■ F2-F5



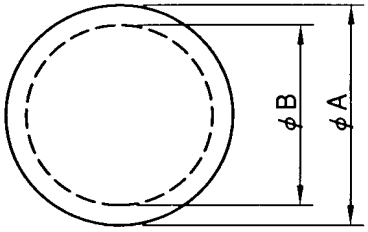
Unit: N·m

Location		Model		F2	F3	F4	F5
9	Top cover	Bolt size		M12×1.75	M16×2.0	M20×2.5	M20×2.5
		HEX head size	mm	19	24	30	30
		Nut HEX size	mm	19	24	30	30
		Tightening torque	N-m	196	294	441	441

WEAR LIMIT DIMENSIONS FOR CONSUMABLE PARTS

F1-F5

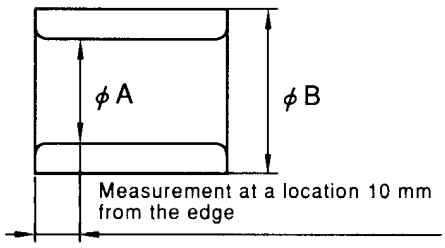
■ Rod pin



Unit (mm)

Model	Dimension (A) of new part	Wear limit dimension(B)
F1	20	18
F2	25	23
F3	25	23
F4	30	28
F5	35	32

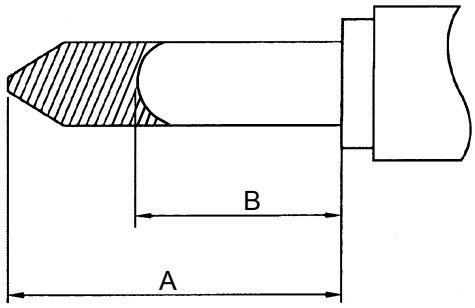
■ Front bush



Unit (mm)

Model	Bore (A) of new part	Wear limit of bore
F1	—	—
F2	45	47
F3	52	54
F4	60	62
F5	68	72

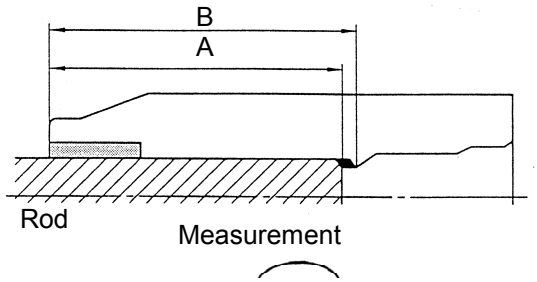
■ Rod



Unit (mm)

Model	Effective length (A) of new part	Wear limit effective length (B)
F1	260	185
F2	290	215
F3	325	225
F4	350	240
F5	372	252

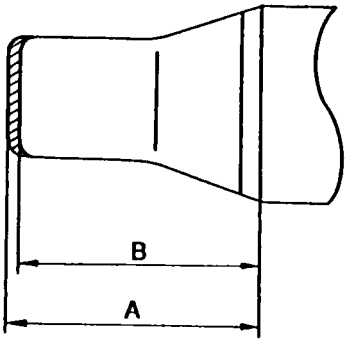
■ Front head



Unit (mm)

Model	Inner length (A) of new rod	Wear limit inner length(B) of rod
F1	135	137
F2	165	167
F3	185	187
F4	205	208
F5	227	230

■ Piston



Unit (mm)

Model	Dimension (A) of new part	Wear limit dimension(B)
F1	35	34
F2	35	34
F3	45	44
F4	50	49
F5	53	52

NOTICE

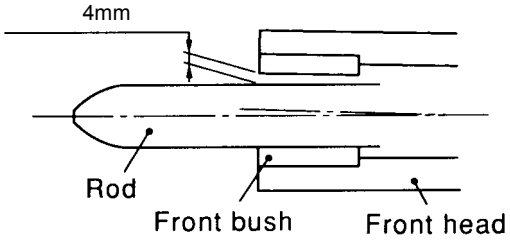
Be sure to use "genuine Furukawa parts" for replacement.

REPLACEMENT OF ROD & FRONT BUSH

- When a rod is used for many hours, it is deformed or burrs are produced. In such a case, deburr with a grinder.
- If the rod end is worn, the rod is liable to slip. Regrind the rod end to make it smooth.
- If the rod is repaired many times, the hardened surface layer will be lost and the rod will be worn earlier than usual. In such a case, replace it with a new one.
- If the clearance between the rod and front bush is large, the piston comes in contact with the rod abnormally to cause damage to the piston or the rod is prone to break. When the clearance exceeds the standard value, replace the rod and front bush together.

■ Standard replacement

(1) F2-F5

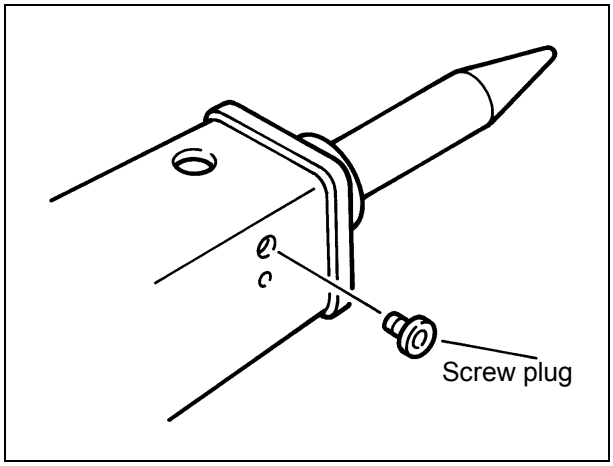


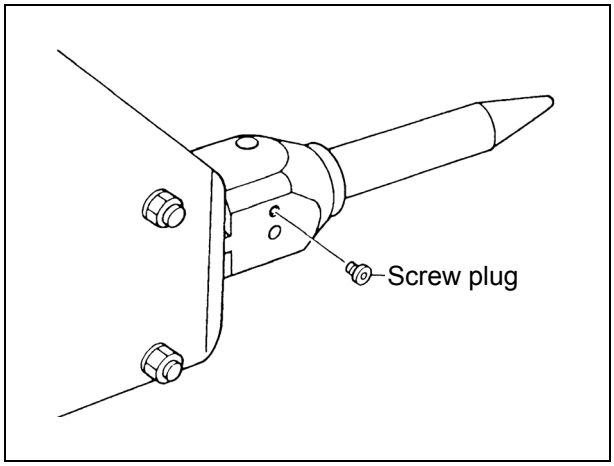
NOTICE

Use of a non genuine rod will void the warranty of the breaker.

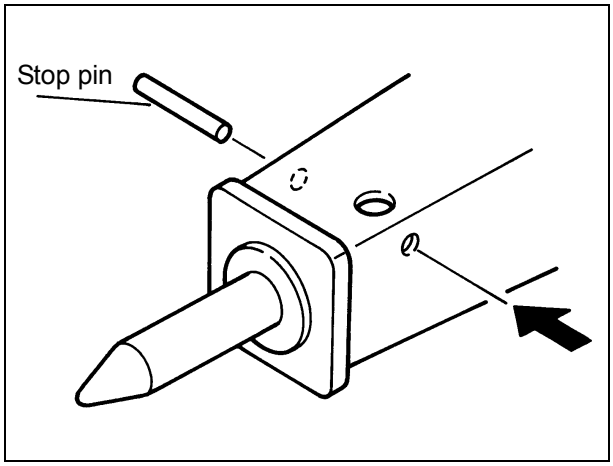
Removing from T-box and side bracket

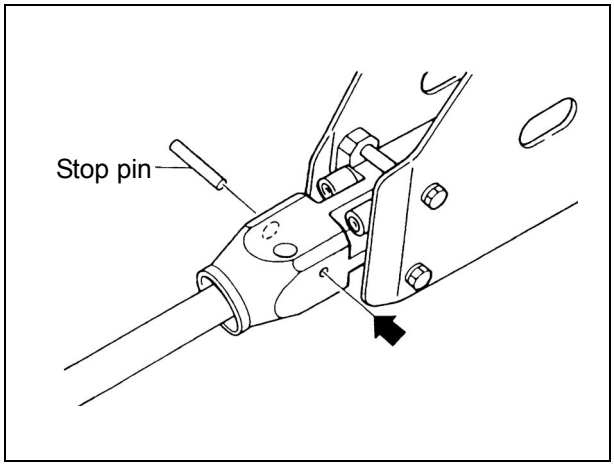
1. Remove the screw plug on the side of the front head with an Allen wrench.



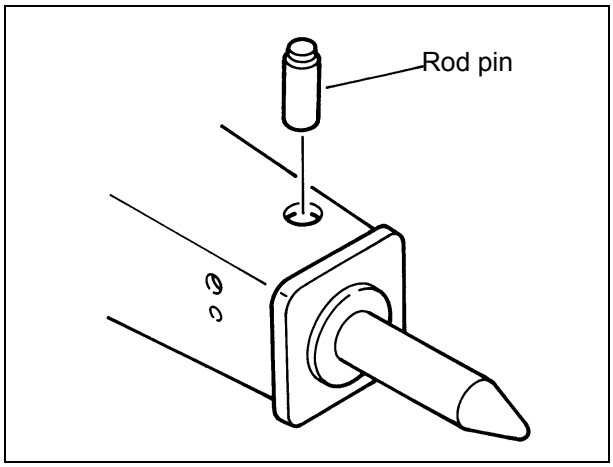


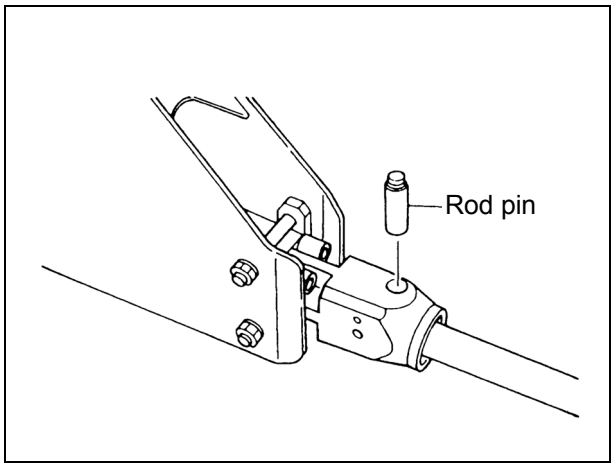
2. After removing the screw plug, apply an Allen wrench or a screwdriver to the smaller pin to remove the stop pin.



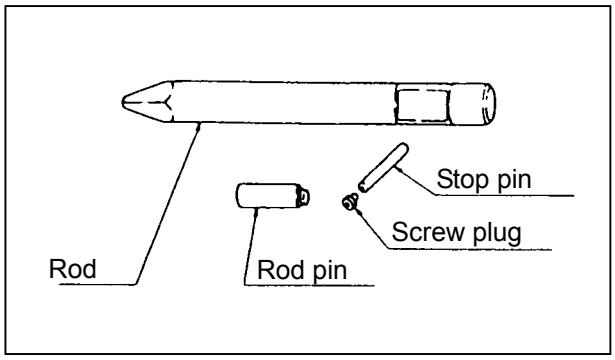


3. When the stop pin is removed, push out the rod pin by pushing it up from the bottom with the stop pin.

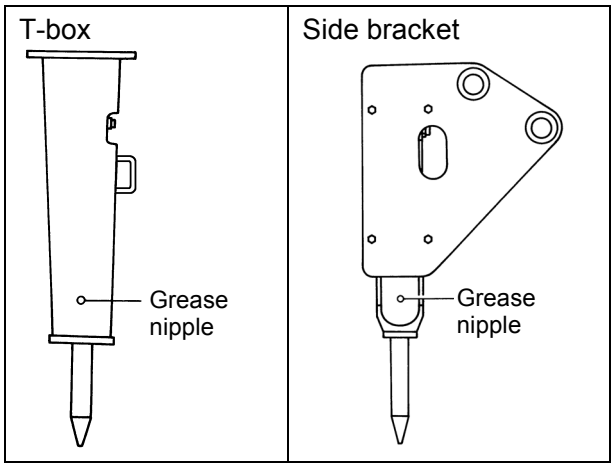




4. Pull out the rod. Check the removed parts for abrasion, damage, and scratches. Remove burrs and swelling especially from the rod pin.



5. When assembling the rod pin, align the rod pin hole in the front head with the groove in the rod, and insert the rod pin. Grease the moving section of the rod pin and rod.



NOTICE

Substantially deformed rod pin will make it difficult to replace the rod. Check the condition periodically, and replace earlier than usual.

6. Reassemble a new rod in the opposite procedure of disassembly.

ADJUSTMENT OF ADJUSTER

NOTICE

In fact, adjustment is necessary only when the breaker is mounted on a base machine which is out of the applicable base machine range. Avoid unnecessary adjustment.
Adjust the adjuster while the breaker is in the stop condition.
When exceeding the adjustment range of the adjuster, the hydraulic oil may leak. It is dangerous. (Refer to the maximum rotation adjustment range as shown below.)

- The valve adjuster adjusts the oil consumption of the breaker. The number of blows and oil consumption are increased by opening the valve adjuster counterclockwise, and decreased by closing it.

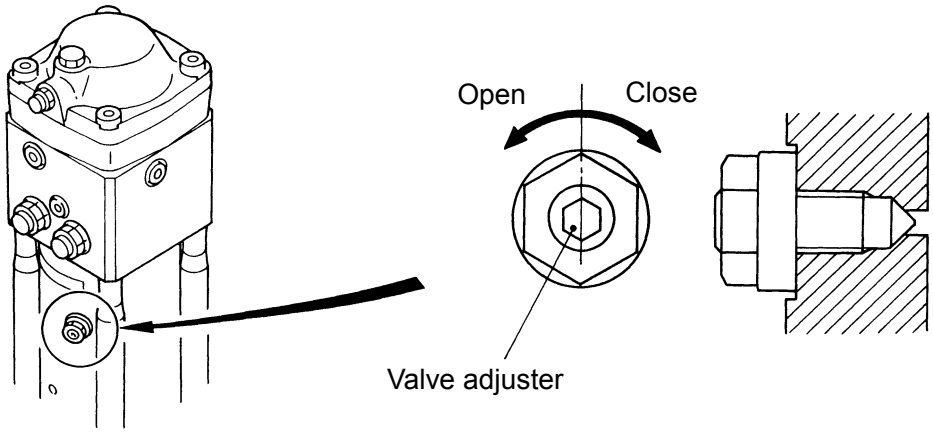


Table 1. Adjuster adjustment range

Model	Hydraulic oil pressure (MPa)	Oil consumption (lit./min)	Valve adjuster position rev (standard)	Maximum rotation adjustment range of valve adjuster
F1	13.7	12~20	1/2	3 turns
F2		16~30	1~2	
F3		25~40	1/2~3/4	
F4		32~48	1~2	
F5		42~62	1~2	

Note: The adjuster position in Table 1 is standard. The adjuster is set most properly in factory and then delivered. Therefore the adjuster position may be different from those in Table 1.

- If the adjuster function is not necessary, exchange the valve adjuster for the GPF plug stored in the tool box.
- When the GPF plug is installed, the operation is within the maximum rotation adjustment (3 turns) range and the oil quantity and number of blows are at the highest values.

Model	Part No.	Part Name
F1~F5	084891-01000	GPF plug

CHARGING THE ACCUMULATOR WITH N2 GAS AND INSPECTION OF CHARGE PRESSURE

⚠ WARNING

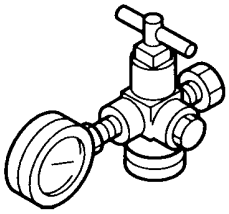
Never use any gas other than nitrogen gas.

⚠ CAUTION

When charging only the accumulator with N2 gas, make sure that the body and cover of the accumulator are tightened securely.

NOTICE

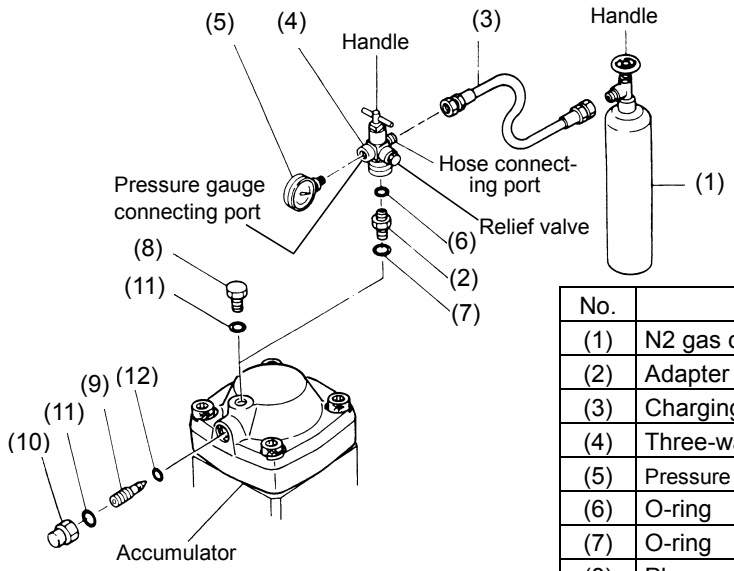
Be sure to use a three-way valve for charging gas. (If gas is charged directly from a gas cylinder, the diaphragm may be broken.)



NOTICE

When you charge the back head with N2 gas, ask the distributor for assistance.

N2 gas charging tool assembly



No.	Part name
(1)	N2 gas cylinder
(2)	Adapter
(3)	Charging hose
(4)	Three-way valve
(5)	Pressure gauge (15Mpa)
(6)	O-ring
(7)	O-ring
(8)	Plug
(9)	Vlave
(10)	Cap
(11)	O-ring
(12)	O-ring

Inspection of charge pressure

1. Install the adapter (2) and pressure gauge (5) to the three-way valve (4). (Make sure that the O-rings (6) and (7) are installed in the adapter (2).)
2. Tighten the cap and relief valve installed in the three-way valve (4).
3. Remove the cap (10) from the accumulator and tighten the valve (9) completely.
4. Remove the plug (8) and screw the adapter (2) installed in the three-way valve (4).
5. Loosen the valve (9) slowly, and the charge pressure is indicated on the pressure gauge. (As soon as the pointer of the gauge moves, stop loosening.) When the charge pressure is high, loosen the relief valve and tighten it immediately. By repeating this action, pressure is slowly lowered.

NOTICE

If the hydraulic breaker is already warmed, check the pressure with the hydraulic oil temperature gauge regardless of the ambient temperature.

6. After checking the charge pressure, tighten the valve (9) completely.
7. Loosen the relief valve and discharge the N2 gas from the three-way valve (4).
8. Remove the three-way valve (4) and tighten the plug (8) and cap (10). (Make sure that the O-rings (11) are installed on the plug (8) and cap (10).)

NOTICE

Check to see if gas is leaking from the valve. (Soapy water is optimal for inspection.)

Charging accumulator with N2 gas

1. After performing the inspection steps 1 to 4 of charge pressure, remove the cap from the three-way valve (4).
2. Connect the charging hose (3) to the three-way valve (4) and N2 gas cylinder (1).
3. Loosen the valve (9) about one turn.
4. Slowly turn the handle of N2 gas cylinder (1) counterclockwise to charge the accumulator with N2 gas. For gas charging pressure, refer to the table given at under "N2 gas charging pressure for accumulator".
5. When the gas exceeds the specified value, turn the handle of N2 gas cylinder clockwise, close the cock and check the pressure.
6. Tighten the valve (9) completely.
7. Loosen the relief valve of the three-way valve (4) and discharge N2 gas in the charging hose.
8. Remove the charging hose (3).
9. Close the cap and relief valve of the three-way valve (4).
10. Repeat operations from 5 onward to check the charge pressure. Make sure that the pressure is correct. (In the above procedure, the handle of the three-way valve is not used.)

N2 gas charging pressure for accumulator

Ambient temperature [°C]	N2 gas charging pressure
	MPa
–25 to –15	5.1 to 5.5
–15 to –5	5.3 to 5.7
–5 to +5	5.5 to 5.9
+5 to +15	5.7 to 6.1
+15 to +25	5.9 to 6.3
+25 to +35	6.1 to 6.5
+35 to +45	6.3 to 6.7

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