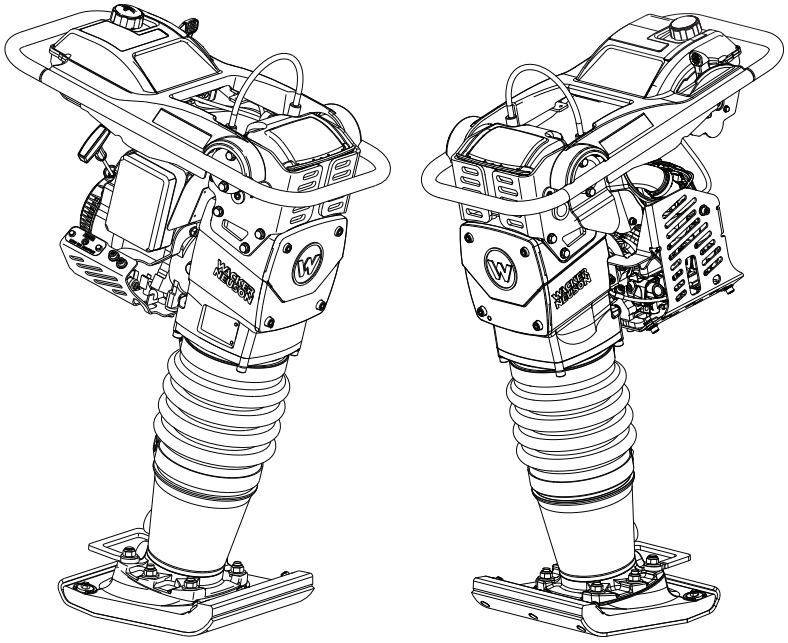
Repair Manual

Vibratory Rammer



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Manufacturer

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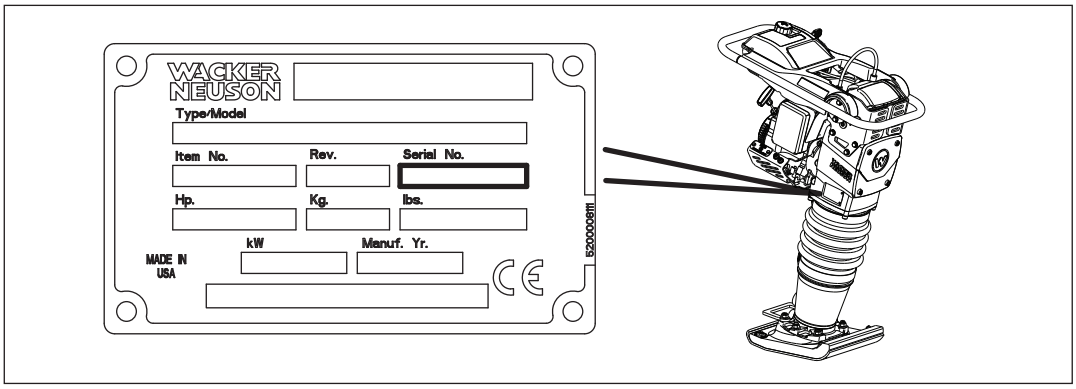
Foreword

SAVE THESE INSTRUCTIONS—This manual contains important instructions for the machine models below. These instructions have been written expressly by Wacker Neuson Production Americas LLC and must be followed during installation, operation, and maintenance of the machines.

Machine	Item Number
BS 50-4s, BS 50-4As	5200000644, 5200000662, 5200000679, 5200000680, 5200018226, 5200018219, 5100015099
BS 60-4s, BS 60-4As	5200000647, 5200000648, 5200000667, 5200000668, 5200000674, 5200000675, 5200014910, 5200018231, 5200018232, 5200018233, 5200022984, 5100015123
BS 70-4As	5100015124, 5100015126

Machine	Item Number
BS 50-2i	5200000642, 5200000643, 5200000657, 5200000658, 5200000659, 5200000660, 5200000661, 5200000678, 5200000687, 5200011099, 5100016650, 5200025428, 5200025429, 5100014907, 5100016648, 5100016649
BS 60-2i	5200000645, 5200000646, 5200000664, 5200000665, 5200000682, 5200000689, 5200000690, 5100014908
BS 70-2i	5200000649, 5200000650, 5200000672, 5200000673, 5100014909, 5100016653

Machine	Item Number
BS 50-2	5200000641, 5200000652, 5200000653, 5200000654, 5200000655, 5200000656, 5200000685, 5200000686
BS 60-2	5200000663, 5200000688, 5200019205
BS 70-2	5200000670, 5200000671



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Machine identification

A nameplate listing the model number, item number, revision number, and serial number is attached to this machine. The location of the nameplate is shown above.

Serial number (S/N)

For future reference, record the serial number in the space provided below. You will need the serial number when requesting parts or service for this machine.

Serial Number:

Machine documentation

- From this point forward in this documentation, Wacker Neuson Production Americas LLC will be referred to as Wacker Neuson.
- Keep a copy of the Operator's Manual with the machine at all times.
- For spare parts information, please see your Wacker Neuson Dealer, or visit the Wacker Neuson website at http://www.wackerneuson.com/.
- When ordering parts or requesting service information, be prepared to provide the machine model number, item number, revision number, and serial number.

Expectations for information in this manual

- This manual provides information and procedures to safely operate and maintain the above Wacker Neuson model(s). For your own safety and to reduce the risk of injury, carefully read, understand, and observe all instructions described in this manual.
- Wacker Neuson expressly reserves the right to make technical modifications, even without notice, which improve the performance or safety standards of its machines.
- The information contained in this manual is based on machines manufactured up until the time of publication. Wacker Neuson reserves the right to change any portion of this information without notice.
- The illustrations, parts, and procedures in this manual refer to Wacker Neuson factory-installed components. Your machine may vary depending on the requirements of your specific region.

CALIFORNIA Proposition 65 Warning

Combustion exhaust, some of its constituents, and certain vehicle components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Laws pertaining to spark arresters

NOTICE: State Health Safety Codes and Public Resources Codes specify that in certain locations spark arresters be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose. In order to comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

Manufacturer's approval

This manual contains references to *approved* parts, attachments, and modifications. The following definitions apply:

- **Approved parts or attachments** are those either manufactured or provided by Wacker Neuson.
- **Approved modifications** are those performed by an authorized Wacker Neuson service center according to written instructions published by Wacker Neuson.
- **Unapproved parts, attachments, and modifications** are those that do not meet the approved criteria.

Unapproved parts, attachments, or modifications may have the following consequences:

- Serious injury hazards to the operator and persons in the work area
- Permanent damage to the machine which will not be covered under warranty

Contact your Wacker Neuson dealer immediately if you have questions about approved or unapproved parts, attachments, or modifications.

1 Safety Information

1.1 Signal Words Used in this Manual

This manual contains DANGER, WARNING, CAUTION, *NOTICE,* and NOTE signal words which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service.

This is the safety alert symbol. It is used to alert you to potential personal hazards.
► Obey all safety messages that follow this symbol.

DANGER
DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

► To avoid death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

► To avoid possible death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

► To avoid possible minor or moderate injury from this type of hazard, obey all safety messages that follow this signal word.

NOTICE: Used without the safety alert symbol, NOTICE indicates a situation which, if not avoided, could result in property damage.

Note: *A Note contains additional information important to a procedure.*

1.2 Machine Description and Intended Use

This machine is a vibratory rammer. The Wacker Neuson Rammer consists of a gasoline or diesel engine, a clutch, a fuel tank, a spring-loaded ramming system, a ramming shoe, and a handle. The engine transmits power through the ramming system and ramming shoe, generating percussive impact force to compact soil. The operator guides and controls the machine from behind using the handle.

This machine is intended to be used for compacting cohesive, mixed, and granular soils in confined areas.

This machine has been designed and built strictly for the intended use described above. Using the machine for any other purpose could permanently damage the machine or seriously injure the operator or other persons in the area. Machine damage caused by misuse is not covered under warranty.

The following are some examples of misuse:

- Using the machine as a ladder, support, or work surface
- Using the machine to carry or transport passengers or equipment
- Using the machine as a hammer or for other demolition work
- Attaching the machine to any other machine
- Operating the machine outside of factory specifications
- Operating the machine in a manner inconsistent with all warnings found on the machine and in the Operator’s Manual

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This machine has been designed and built in accordance with the latest global safety standards. It has been carefully engineered to eliminate hazards as far as practicable and to increase operator safety through protective guards and labeling. However, some risks may remain even after protective measures have been taken. They are called residual risks. On this machine, they may include exposure to:

- Heat, noise, exhaust, and carbon monoxide from the engine
- Fire hazards from improper refueling techniques
- Fuel and its fumes
- Personal injury from improper lifting techniques or operating techniques

To protect yourself and others, make sure you thoroughly read and understand the safety information presented in this manual before operating the machine.

1.3 Safety Guidelines for Operating the Machine

Operator training

Before operating the machine:

- Read and understand the operating instructions contained in all manuals delivered with the machine.
- Familiarize yourself with the location and proper use of all controls and safety devices.
- Contact Wacker Neuson for additional training if necessary.

When operating this machine:

- Do not allow improperly trained people to operate the machine. People operating the machine must be familiar with the potential risks and hazards associated with it.

Operator qualifications

Only trained personnel are permitted to start, operate, and shut down the machine. They also must meet the following qualifications:

- have received instruction on how to properly use the machine
- are familiar with required safety devices

The machine must not be accessed or operated by:

- children
- people impaired by alcohol or drugs

Application area

Be aware of the application area.

- Keep unauthorized personnel, children, and pets away from the machine.
- Remain aware of changing positions and the movement of other equipment and personnel in the application area/job site.
- Identify whether special hazards exist in the application area, such as toxic gases or unstable ground conditions, and take appropriate action to eliminate the special hazards before using the machine.

Be aware of the application area.

- Do not operate the machine in areas that contain flammable objects, fuels, or products that produce flammable vapors.

Safety devices, controls, and attachments

Only operate the machine when:

- All safety devices and guards are in place and in working order.
- All controls operate correctly.
- The machine is set up correctly according to the instructions in the Operator's Manual.
- The machine is clean.
- The machine's labels are legible.

To ensure safe operation of the machine:

- Do not operate the machine if any safety devices or guards are missing or inoperative.
- Do not modify or defeat the safety devices.
- Only use accessories or attachments that are approved by Wacker Neuson.

Safe operating practices

When operating this rammer:

- Remain aware of the rammer's moving parts. Keep hands, feet, and loose clothing away from the rammer's moving parts.
- When working near the edges of pits, slopes, trenches, and platforms, always operate the rammer in such a way that there is no possibility of it tipping over or falling in.

When operating this rammer:

- Do not operate a rammer in need of repair.
- Do not tamper with or disable the function of the operating controls.
- Do not leave the rammer running unattended.
- Do not consume the operating fluids used in this machine. Depending on your machine model, these operating fluids may include water, wetting agents, fuel (gasoline, diesel, kerosene, propane, or natural gas), oil, coolant, hydraulic fluid, heat transfer fluid (propylene glycol with additives), battery acid, or grease.

Personal Protective Equipment (PPE)

Wear the following Personal Protective Equipment (PPE) while operating this machine:

- Close-fitting work clothes that do not hinder movement
- Safety glasses with side shields
- Hearing protection
- Safety-toed footwear

After Use

- Stop the engine when the machine is not being operated.
- Close the fuel valve on engines equipped with one when the machine is not being operated.
- Ensure that the machine will not tip over, roll, slide, or fall when not being operated.
- Store the machine properly when it is not being used. The machine should be stored in a clean, dry location out of the reach of children.

1.4 Safety Guidelines for Lifting the Machine

When lifting the machine:

- Make sure slings, chains, hooks, ramps, jacks, forklifts, cranes, hoists, and any other type of lifting device used is attached securely and has enough weight-bearing capacity to lift or hold the machine safely. See section *Technical Data* for machine weight.
- Remain aware of the location of other people when lifting the machine.
- Only use the lifting points and tie-downs described in the Operator's Manual.
- Make sure the transporting vehicle has sufficient load capacity and platform size to safely transport the machine.

To reduce the possibility of injury:

- Do not stand under the machine while it is being lifted or moved.
- Do not get onto the machine while it is being lifted or moved.

1.5 Service Safety

Service training

Before servicing or maintaining the machine:

- Read and understand the instructions contained in all manuals delivered with the machine.
- Familiarize yourself with the location and proper use of all controls and safety devices.
- Only trained personnel shall troubleshoot or repair problems occurring with the machine.
- Contact Wacker Neuson for additional training if necessary.

When servicing or maintaining this machine:

- Do not allow improperly trained people to service or maintain the machine. Personnel servicing or maintaining the machine must be familiar with the associated potential risks and hazards.

Precautions

When servicing or maintaining the machine:

- Read and understand the service procedures before performing any service to the machine.
- All adjustments and repairs must be completed before operating the machine. Do not operate the machine with a known problem or deficiency.
- All repairs and adjustments shall be completed by a qualified technician.
- Turn off the machine before performing maintenance or making repairs.
- Remain aware of the machine's moving parts. Keep hands, feet, and loose clothing away from the machine's moving parts.
- Re-install the safety devices and guards after repair and maintenance procedures are complete.

Machine modifications

When servicing or maintaining the machine:

- Use only accessories/attachments that are approved by Wacker Neuson.

When servicing or maintaining the machine:

- Do not defeat safety devices.
- Do not modify the machine without the express written approval of Wacker Neuson.

Replacing parts and labels

- Replace worn or damaged components.
- Replace all missing and hard-to-read labels.
- When replacing electrical components, use components that are identical in rating and performance to the original components.
- When replacement parts are required for this machine, use only Wacker Neuson replacement parts or those parts equivalent to the original in all types of specifications, such as physical dimensions, type, strength, and material.

Cleaning

When cleaning and servicing the machine:

- Keep the machine clean and free of debris such as leaves, paper, cartons, etc.
- Keep the labels legible.

When cleaning the machine:

- Do not clean the machine while it is running.
- Never use gasoline or other types of fuels or flammable solvents to clean the machine. Fumes from fuels and solvents can become explosive.

Personal Protective Equipment (PPE)

Wear the following Personal Protective Equipment (PPE) while servicing or maintaining this machine:

- Close-fitting work clothes that do not hinder movement
- Safety glasses with side shields
- Hearing protection
- Safety-toed footwear

In addition, before servicing or maintaining the machine:

- Tie back long hair.
- Remove all jewelry (including rings).

Safe service practices

- Do not alter engine speeds. Run the engine only at speeds specified in *Technical Data*.
- Do not operate the machine without an air cleaner.
- Disconnect the spark plug before servicing to avoid accidental start-up.
- Do not crank a flooded engine with the spark plug removed. Fuel trapped in the cylinder will squirt out the spark plug opening.
- Do not test for spark if the engine is flooded or the smell of gasoline is present. A stray spark could ignite the fumes.

1.6 Operator Safety while Using Internal Combustion Engines

WARNING
Internal combustion engines present special hazards during operation and fueling. Failure to follow the warnings and safety standards could result in severe injury or death.

► Read and follow the warning instructions in the engine owner's manual and the safety guidelines below.

DANGER
Exhaust gas from the engine contains carbon monoxide, a deadly poison. Exposure to carbon monoxide can kill you in minutes.

► NEVER operate the machine inside an enclosed area, such as a tunnel, unless adequate ventilation is provided through such items as exhaust fans or hoses.

Operating safety

When running the engine:

- Keep the area around the exhaust pipe free of flammable materials.
- Check the fuel lines and the fuel tank for leaks and cracks before starting the engine. Do not run the machine if fuel leaks are present or the fuel lines are loose.

When running the engine:

- Do not smoke while operating the machine.
- Do not run the engine near sparks or open flames.
- Do not touch the engine or muffler while the engine is running or immediately after it has been turned off.
- Do not operate a machine when its fuel cap is loose or missing.
- Do not start the engine if fuel has spilled or a fuel odor is present. Move the machine away from the spill and wipe the machine dry before starting.

Refueling safety

When refueling the engine:

- Clean up any spilled fuel immediately.
- Refill the fuel tank in a well-ventilated area.
- Re-install the fuel tank cap after refueling.
- Do not smoke.
- Do not refuel a hot or running engine.
- Do not refuel the engine near sparks or open flames.
- Use suitable tools for refueling (for example, a fuel hose or a funnel).
- Do not refuel if the machine is positioned in a truck fitted with a plastic bed liner. Static electricity can ignite the fuel or fuel vapors.

2 Operation

The information regarding the operation of the machine included in this manual is condensed. Refer to the Operator's Manual for complete operating instructions. Always read, understand, and follow the procedures in the Operator's Manual when operating the machine.

2.1 Recommended Fuel—4 stroke

This engine is certified to operate on automotive unleaded gasoline. Use only fresh, clean gasoline. Gasoline containing water or dirt will damage fuel system.

Use of oxygenated fuels

Some conventional gasolines are blended with alcohol. These gasolines are collectively referred to as oxygenated fuels. If you use an oxygenated fuel, be sure it is unleaded and meets the minimum octane rating requirement.

Before using an oxygenated fuel, confirm the fuel's contents. Some states and provinces require this information to be posted on the fuel pump.

The following is the Wacker Neuson approved percentage of oxygenates:

ETHANOL - (ethyl or grain alcohol) 10% by volume. You may use gasoline containing up to 10% ethanol by volume (commonly referred to as E10). Gasoline containing more than 10% ethanol (such as E15, E20, or E85) may not be used because it could damage the engine.

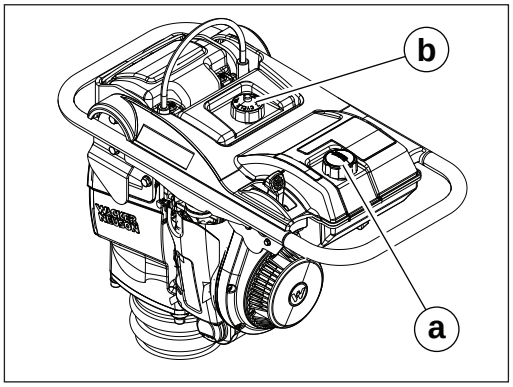
If you notice any undesirable operating symptoms, try another service station, or switch to another brand of gasoline.

Fuel system damage or performance problems resulting from the use of an oxygenated fuel containing more than the percentages of oxygenates mentioned above are not covered under warranty.

2.2 Recommended Fuel—2 stroke

For rammers with oil injection (BS 50-2i, BS 60-2i, BS 70-2i)

If the rammer has a fuel tank **(a)** and an oil tank **(b)**, it has oil injection—**No premixing of the gasoline and oil is required**. Mixing of the gasoline and oil is done automatically by the machine.



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Fill the fuel tank with regular unleaded gasoline. Fill the oil tank with Wacker Neuson two-cycle oil (or an equivalent). See chapter *Technical Data* for fuel and oil specifications.

Use of oxygenated fuels

Some conventional gasolines are blended with alcohol. These gasolines are collectively referred to as oxygenated fuels. If you use an oxygenated fuel, be sure it is unleaded and meets the minimum octane rating requirement.

Before using an oxygenated fuel, confirm the fuel's contents. Some states and provinces require this information to be posted on the fuel pump.

The following is the Wacker Neuson approved percentage of oxygenates:

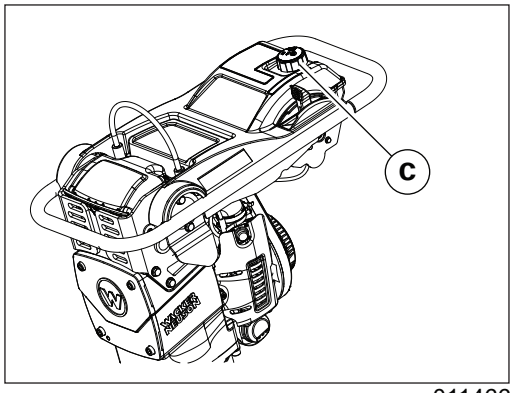
ETHANOL - (ethyl or grain alcohol) 10% by volume. You may use gasoline containing up to 10% ethanol by volume (commonly referred to as E10). Gasoline containing more than 10% ethanol (such as E15, E20, or E85) may not be used because it could damage the engine.

If you notice any undesirable operating symptoms, try another service station, or switch to another brand of gasoline.

Fuel system damage or performance problems resulting from the use of an oxygenated fuel containing more than the percentages of oxygenates mentioned above are not covered under warranty.

For rammers without oil injection
(BS 50-2, BS 60-2, BS 70-2, BS 65-V, BS 65-V)

If the rammer has a fuel tank **(c)** but no oil tank**,** the engine **requires a two-cycle gasoline/oil mixture**.



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NOTICE: Use only the recommended gasoline/oil mixture to fuel this machine. Using gasoline alone will severely damage the engine.

Requirements

- Use only Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification.
- A gasoline/oil ratio in a range from 50:1 to 100:1 can be used. For optimum engine performance and durability, a 100:1 ratio with a fully synthetic oil meeting the specification described above is preferred.
- Mix regular unleaded gasoline and two-cycle engine oil in a separate container before filling the tank.
- Refer to the chart below for the proper quantities to use when mixing gasoline and oil.

FUEL RATIO 50:1				**FUEL RATIO 100:1**			
Gasoline	**Oil**	**Gasoline**	**Oil**	**Gasoline**	**Oil**	**Gasoline**	**Oil**
5 liters	100 ml	1 gallon	2.5 oz.	5 liters	50 ml	1 gallon	1.25 oz.
10 liters	200 ml	3 gallons	8.0 oz.	10 liters	100 ml	3 gallons	4.0 oz.
15 liters	300 ml	5 gallons	13.0 oz.	15 liters	150 ml	5 gallons	6.5 oz.

2.3 Starting, Operating, and Stopping the Machine—WM 100

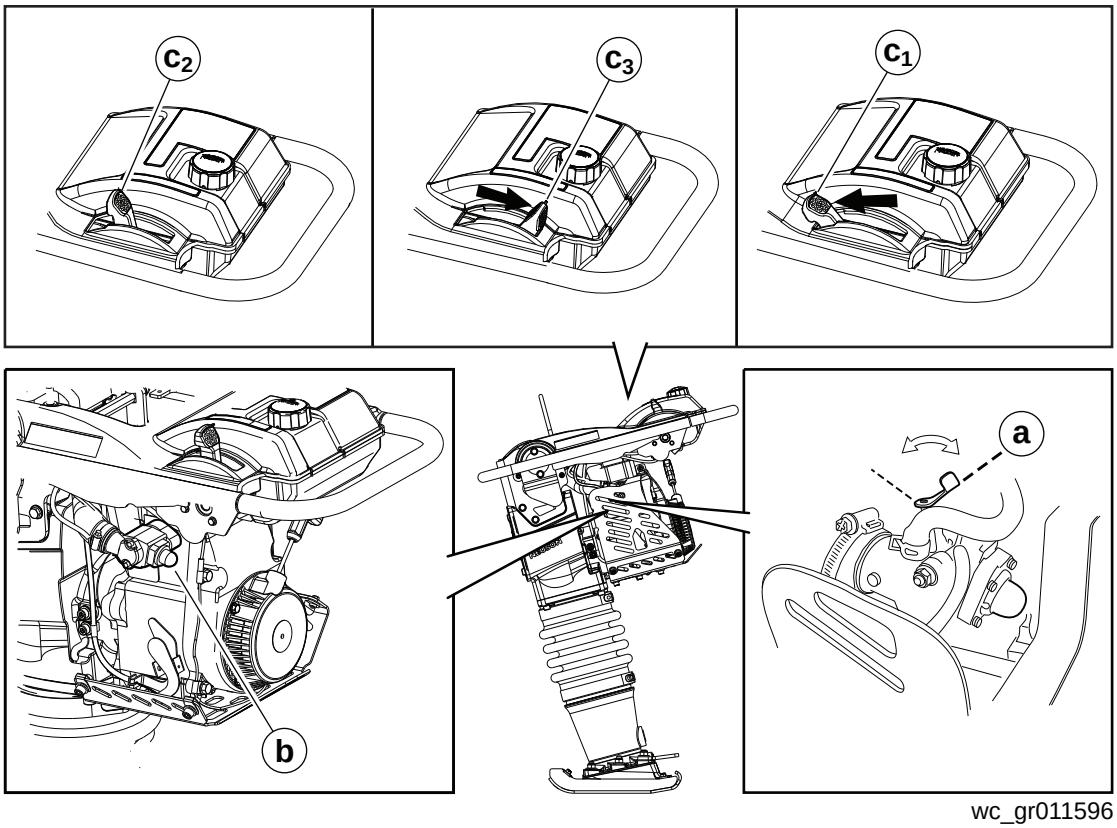
Requirements

- Rammer is in serviceable condition and has been properly maintained.
- There is fuel in the tank.

Starting the machine

Perform the procedure below to start the machine.

1. Set the throttle to the idle position **(c_2)**. This will automatically start the flow of fuel.



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2. Close the choke **(a)**.
3. Pump the purge bulb **(b)** 6–10 times or until you see fuel in the bulb.

Note: *The engine will not become flooded by pumping the purge bulb more than 10 times. Pumping the purge bulb removes air from the fuel system. It does not pump fuel into the carburetor.*

4. Pull the starter rope repeatedly until the engine starts.

Multiple pulls of the starter rope (usually fewer than five) may be required to start an engine:

- on a new machine being operated for the first time
- that has not been run for a long period of time (a week or more)
- that has been run completely out of fuel
- in cold weather conditions

This procedure continues on the next page.

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Operating the machine

Perform the procedure below to operate the rammer.

1. Open the choke **(a)**.
2. Set the throttle to the full position **(c_3)**.
3. Guide the rammer's direction of travel. Allow the rammer to pull itself forward. Do not try to overpower the rammer.

CAUTION

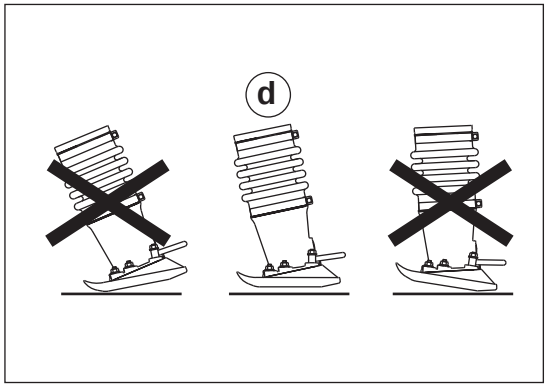
Do not lift or move the rammer to another location while it is operating. You may lose control of it.

► Stop the engine before lifting or moving the rammer to another location.

► Restart the engine only after the rammer is in place.

Safe operating practices

- For best compaction and shoe wear, the shoe must hit the ground flat **(d)**, not on its toe or heel.



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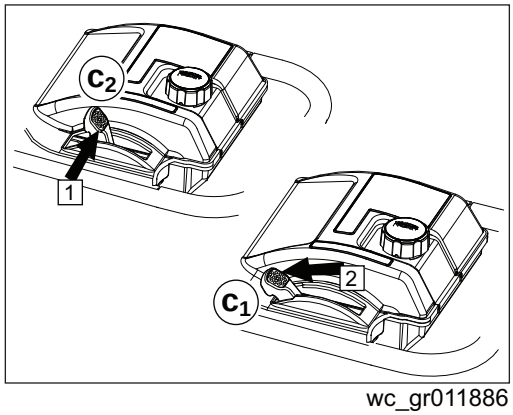
- Guide the rammer in such a way that you are not squeezed between the rammer and solid objects.
- Make sure you have solid footing when operating the rammer on uneven ground or when compacting coarse material.

Stopping the machine

1. Set the throttle in the idle position **(c_2)**.



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2. From the idle position, push the throttle to the right, then forward to the OFF position **(c_1)**. The engine will stop and the fuel valve will close.

2.4 Starting, Operating, and Stopping the Machine—Honda

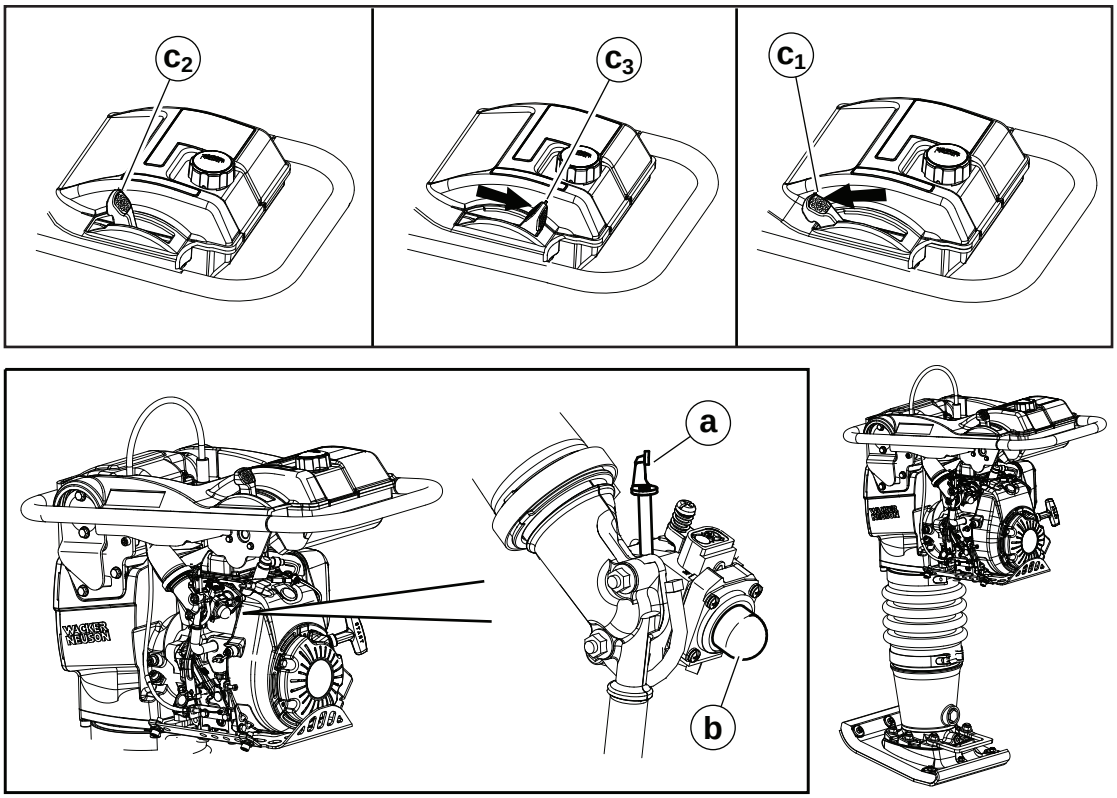
Requirements

- Rammer is in serviceable condition and has been properly maintained.
- There is fuel in the tank.

Starting the machine

Perform the procedure below to start the machine.

1. Set the throttle to the idle position **(c_2)**. This will automatically start the flow of fuel.



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2. Close the choke **(a)**.
3. Pump the purge bulb **(b)** 6–10 times or until you see fuel in the bulb.

Note: *The engine will not become flooded by pumping the purge bulb more than 10 times. Pumping the purge bulb removes air from the fuel system. It does not pump fuel into the carburetor.*

4. Pull the starter rope repeatedly until the engine starts.

Multiple pulls of the starter rope (usually fewer than five) may be required to start an engine:

- on a new machine being operated for the first time
- that has not been run for a long period of time (a week or more)
- that has been run completely out of fuel
- in cold weather conditions

This procedure continues on the next page.

Continued from the previous page.

Operating the machine

Perform the procedure below to operate the rammer.

1. Open the choke **(a)**.
2. Set the throttle to the full position **(c_3)**.
3. Guide the rammer's direction of travel. Allow the rammer to pull itself forward. Do not try to overpower the rammer.

CAUTION

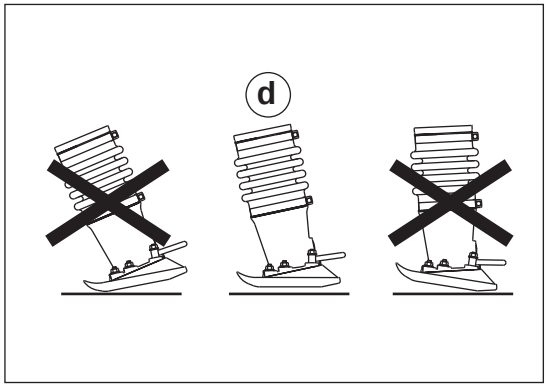
Do not lift or move the rammer to another location while it is operating. You may lose control of it.

► Stop the engine before lifting or moving the rammer to another location.

► Restart the engine only after the rammer is in place.

Safe operating practices

- For best compaction and shoe wear, the shoe must hit the ground flat **(d)**, not on its toe or heel.



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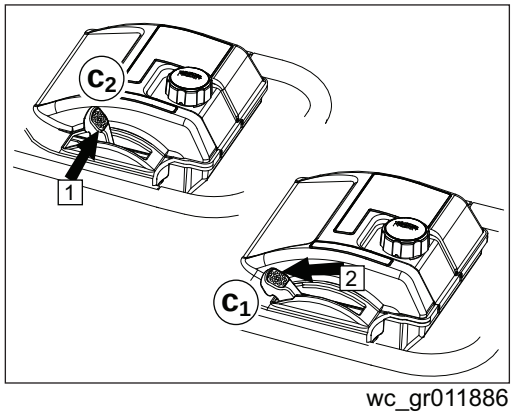
- Guide the rammer in such a way that you are not squeezed between the rammer and solid objects.
- Make sure you have solid footing when operating the rammer on uneven ground or when compacting coarse material.

Stopping the machine

1. Set the throttle in the idle position **(c_2)**.



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2. From the idle position, push the throttle to the right, then forward to the OFF position **(c_1)**. The engine will stop and the fuel valve will close.

2.5 Starting, Operating, and Stopping the Machine

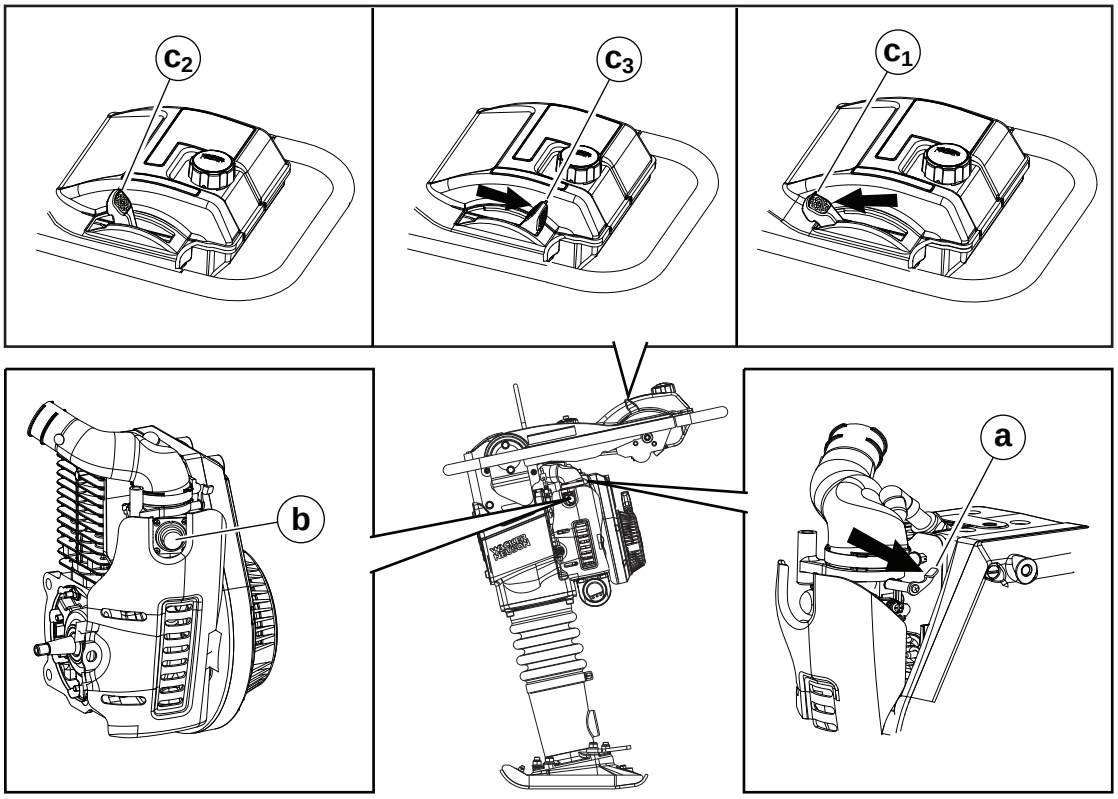
Requirements

- Rammer is in serviceable condition and has been properly maintained.
- There is fuel in the tank.

Starting the machine

Perform the procedure below to start the machine.

1. Set the throttle to the idle position **(c_2)**. This will automatically start the flow of fuel.



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2. Close the choke **(a)**.
3. Pump the purge bulb **(b)** 6–10 times or until you see fuel in the bulb.

Note: *The engine will not become flooded by pumping the purge bulb more than 10 times. Pumping the purge bulb removes air from the fuel system. It does not pump fuel into the carburetor.*

4. Pull the starter rope repeatedly until the engine starts.

Multiple pulls of the starter rope (usually fewer than five) may be required to start an engine:

- on a new machine being operated for the first time
- that has not been run for a long period of time (a week or more)
- that has been run completely out of fuel
- in cold weather conditions

This procedure continues on the next page.

Continued from the previous page.

Operating the machine

Perform the procedure below to operate the rammer.

1. Set the throttle to the full position **(c_3)**. The choke will open automatically.
2. Guide the rammer's direction of travel. Allow the rammer to pull itself forward. Do not try to overpower the rammer.

CAUTION

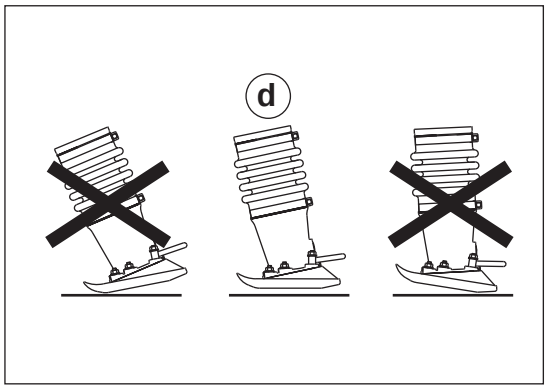
Do not lift or move the rammer to another location while it is operating. You may lose control of it.

► Stop the engine before lifting or moving the rammer to another location.

► Restart the engine only after the rammer is in place.

Safe operating practices

- For best compaction and shoe wear, the shoe must hit the ground flat **(d)**, not on its toe or heel.



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- Guide the rammer in such a way that you are not squeezed between the rammer and solid objects.
- Make sure you have solid footing when operating the rammer on uneven ground or when compacting coarse material.

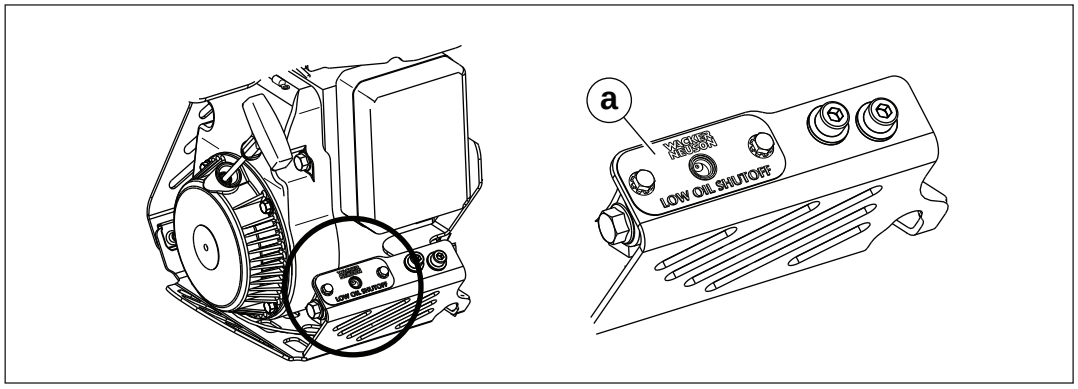
Stopping the machine

1. Set the throttle in the idle position **(c_2)**.
2. Shut off the engine by moving the throttle through the detent to the off position **(c_1)**. The engine will stop and the fuel valve will close.

2.6 Low Oil Shut-Off Switch—WM100

Overview

The low oil shutoff switch is designed to prevent engine damage caused by an insufficient amount of oil. When the engine is started, an illuminated indicator **(a)** notifies the operator of the status of the engine oil level.



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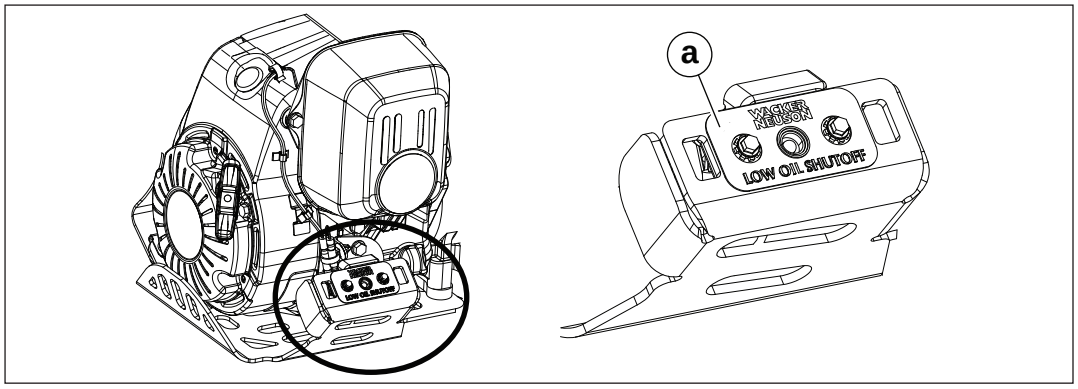
Condition	Engine oil level status	Required action
■ Indicator flashes quickly once upon engine startup	Engine oil level is acceptable.	None.
■ Indicator flashes slowly ■ Engine starts, but stops after 10–15 seconds	Engine oil level is low.	Add engine oil. See chapter *Technical Data* for quantity and type.
■ Indicator illuminates and remains lit ■ Engine starts and continues to run	Engine oil level is acceptable, but low oil shutoff switch is not functioning properly.	Check connections on low oil shutoff switch. Replace the switch if indicator remains lit.
■ Indicator does not flash upon engine startup ■ Engine starts and continues to run	Low oil shutoff switch is not functioning properly.	Check connections on low oil shutoff switch. Replace the switch if indicator still does not illuminate.

2.7 Low Oil Shut-Off Switch—Honda

Overview

The low oil shutoff switch is designed to prevent engine damage caused by an insufficient amount of oil. When starting the engine, an illuminated indicator **(a)** notifies the operator that the engine oil level is low.



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Condition	Engine oil level status	Required action
■ Indicator does not flash and engine starts	Engine oil level is acceptable.	None.
■ Indicator flashes slowly ■ Engine does not start	Engine oil level is low.	Add engine oil. See chapter *Technical Data* for quantity and type.

3 Troubleshooting

3.1 Diagnosing Starting Issues

Tools required All procedures can be accomplished with the following tools:

- Spark tester (part number 5000078836)
- Multimeter
- General hand tools (ratchet set, screwdrivers, etc.)

Where to start To determine where to start:

1. Determine the issue from the chart below. Complete all tasks in the order listed.

Engine doesn't start	**See topics**	**No.**
1. Check level of fuel in tank.	—	**—**
2. Check the fuel flow.	*Checking the Fuel Flow*	**3.3**
3. Check the ignition module/spark plug.	*Testing the Ignition Module and Checking the Spark Plug*	**3.4**
4. Check the stop switch.	*Checking the Stop Switch*	**3.5**
5. Check cylinder/piston for leakage.	*Conducting a Leak-Down Test*	**3.6**
6. Check the ignition wiring.	*Checking the Ignition Wiring*	**3.7**

Engine starts, but does not come up to full speed	**See topics**	**No.**
1. Check the fuel flow.	*Checking the Fuel Flow*	**3.3**
2. Check the fuel cap.	—	**—**
3. Check carburetor for dirt.	*See engine repair manual*	**—**
4. Check engine compression.	*Checking Engine Compression*	**3.8**

Engine starts, but shuts down after approximately 25 seconds	**See topics**	**No.**
1. Test oil float switch.	*Testing the Float Switch*	**4.47**
2. Check ignition module.	*Checking the Ignition Module*	**3.4**

Engine starts and runs to full speed, then slows down like it may stop, then picks up speed again.	**See topics**	**No.**
1. Check the spark plug	*Checking the Spark Plug*	**3.4**

Engine stops after running for approximately 45 minutes	**See topics**	**No.**
1. Check the fuel flow.	*Checking the Fuel Flow*	**3.3**
2. Check the spark plug.	*Checking the Spark Plug*	**3.4**
3. Check fuel cap for proper venting.	—	**—**
4. Check for vapor lock.	*Checking for Vapor Lock*	**3.9**
5. Purge the oil lines.	*Purging the Oil Lines*	**3.10**

Engine runs, but carburetor floods	See topics	No.
1. Check carburetor for dirt.	*See engine repair manual*	**—**
2. Check the fuel flow	*Checking the Fuel Flow*	**3.3**

3.2 Diagnosing Performance Issues

Background The two most common causes for performance problems are:

Probable cause	See Topic	No.
1. Lack of oil in the percussion system	*Draining Ramming System Oil*	**4.1**
2. Clutch malfunction	*Removing the Clutch Drum*	**4.37**

3.3 Checking the Fuel Flow

WARNING
Fire hazard. Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- ■ Fuel in tank
- ■ Fuel valve open (throttle out of stop position)

Procedure

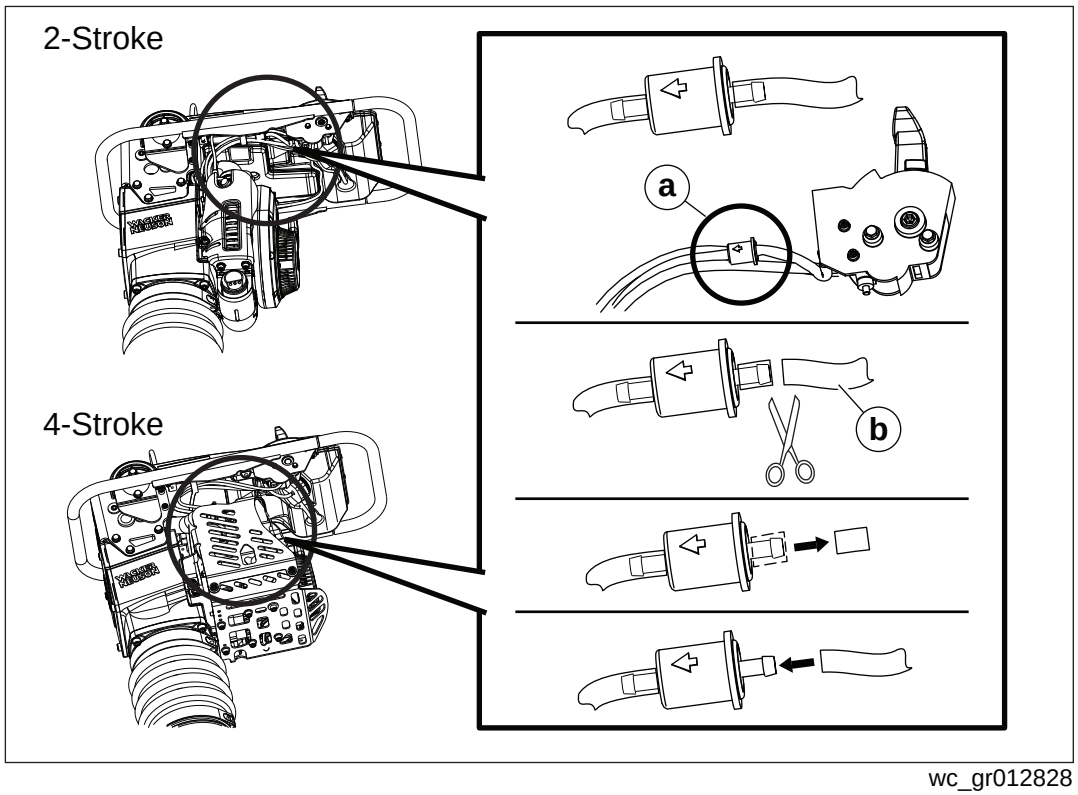
Perform the procedure below to check the fuel flow.

1. Open the fuel valve by setting the throttle to any position besides the STOP position.
2. Press the purge bulb several times and look for fuel flow through the fuel hoses.

Is there fuel flow in the fuel hoses?

Yes ____	No ____
Clean, adjust, or replace the spark plug and try starting again. If spark plug is OK, see topic *Testing the Ignition Module and Checking the Spark.*	Continue with step 3.

3. Locate the in-line fuel filter **(a)**.



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4. Cut the fuel hose **(b)** as close to the nipple as possible.

This procedure continues on the next page.

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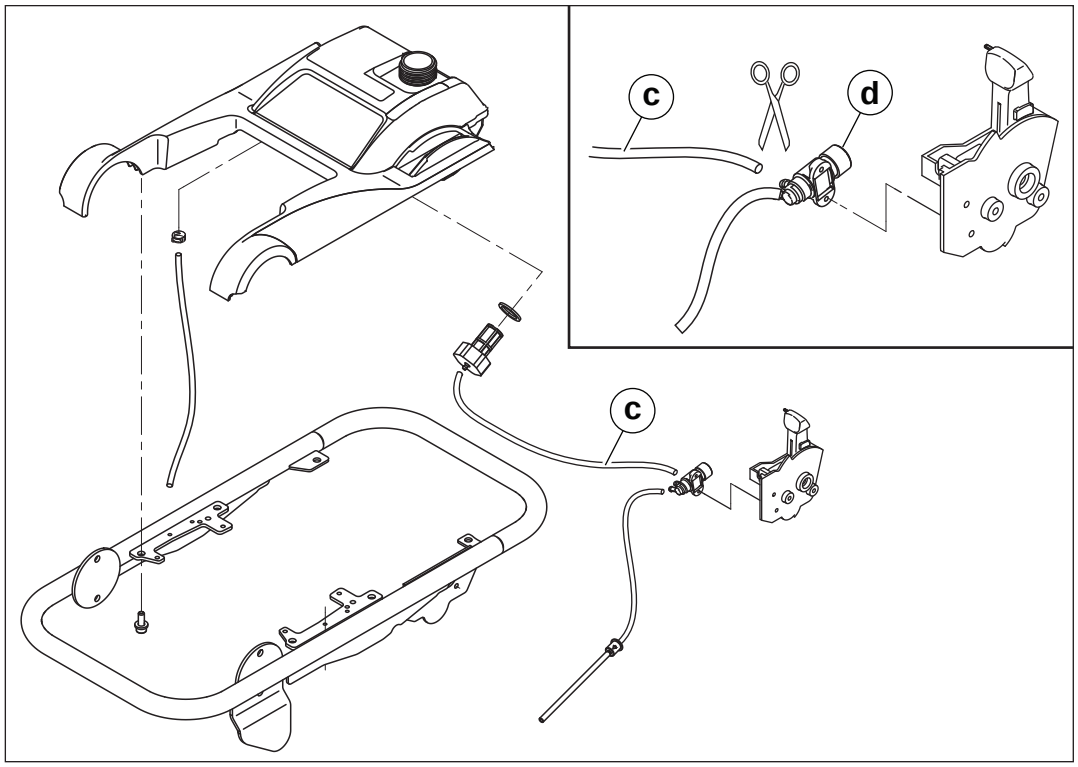
*Does fuel flow from the fuel hose **(b)**?*

Yes ____	No ____
Replace the in-line fuel filter.	Remove the stub of hose from the in-line fuel filter and reconnect the fuel hose **(b)**. Continue with step 5.

5. Locate the fuel hose **(c)**.



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6. Cut fuel hose **(c)** near the nipple of the fuel valve **(d)**. Reference step 4.

*Does fuel flow from fuel hose **(c)**?*

Yes ____	No ____
Replace the fuel valve.	Remove the stub of hose from the fuel valve and reconnect the fuel hose **(c)**. Continue with step 7.

7. Remove the in-tank fuel filter. See topic *Removing the Fuel Tank*.
8. Clean or replace the in-tank fuel filter.

Result The fuel flow has now been checked.

3.4 Testing the Ignition Module and Checking the Spark

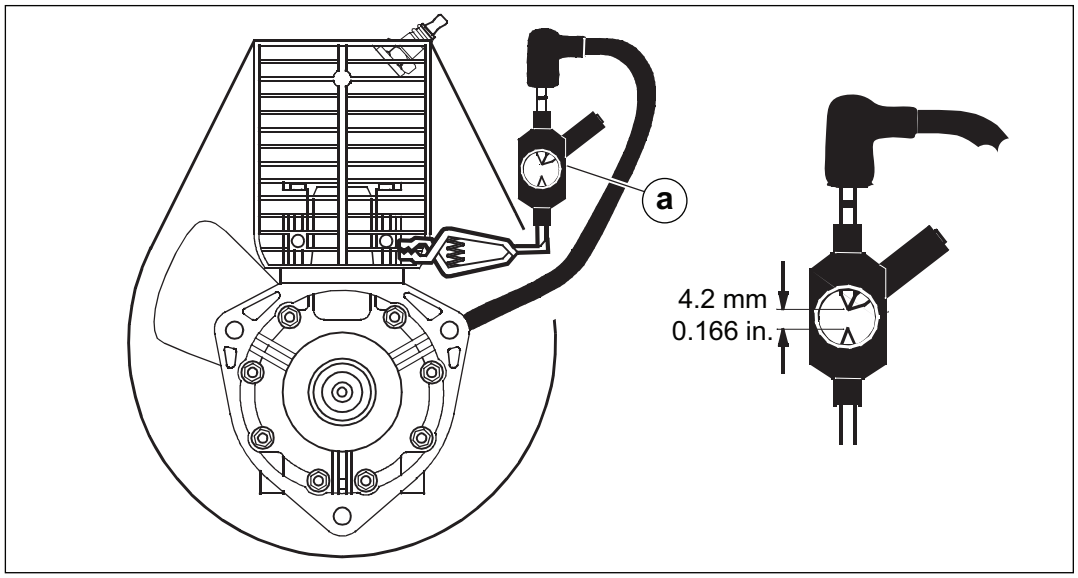
Requirements

- Ignition tester P/N 5000078836
- Engine removed

Procedure

Perform the procedure below to test the ignition module/check the spark.

1. Preset the gap of the ignition tester **(a)** to 4.2 mm (0.166 in.).



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2. Attach the end of the ignition cable to one end of the tester.
3. Ground the other end of the tester by clipping it onto the engine cylinder.
4. Crank the engine using the rewind starter.

Note: *A minimum of 500 rpm is required to produce spark.*

Does the spark jump the test gap?

Yes ____	No ____
The ignition system is OK.	The ignition system is malfunctioning. Replace the ignition module.

Result

The ignition module/spark has now been tested.

3.5 Checking the Stop Switch

Requirements

- Multimeter
- Typical hand tools

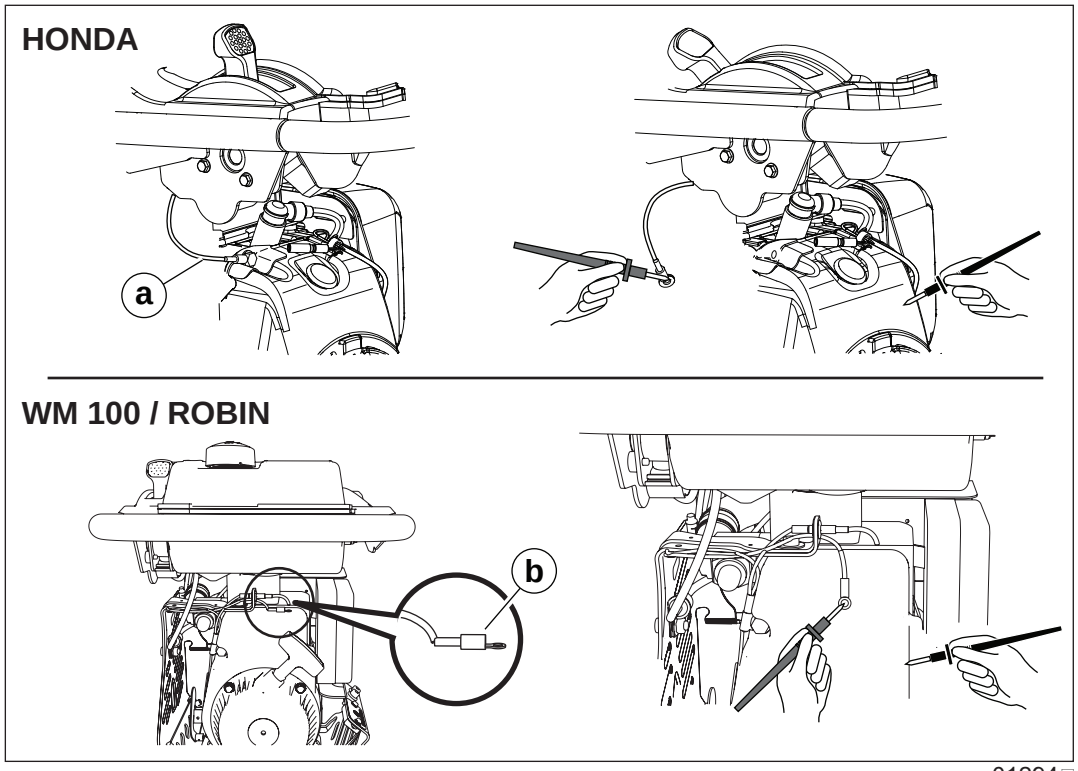
Background

For both 2-stroke and 4-stroke powered Rammers, the throttle lever acts as the stop switch when it is placed in the STOP position. The stop switch is a normally open (NO) switch; when activated (placed in the STOP position) it creates a short circuit to ground. The short circuit prevents the spark plug from firing and stops the engine.

Procedure

Perform the procedure below to check the stop switch.

1. For WM80, 2-stroke engines, start with step 3.
2. Locate the wire **(a** or **b)** running from the throttle/stop switch to the engine. Disconnect the wire from the engine.



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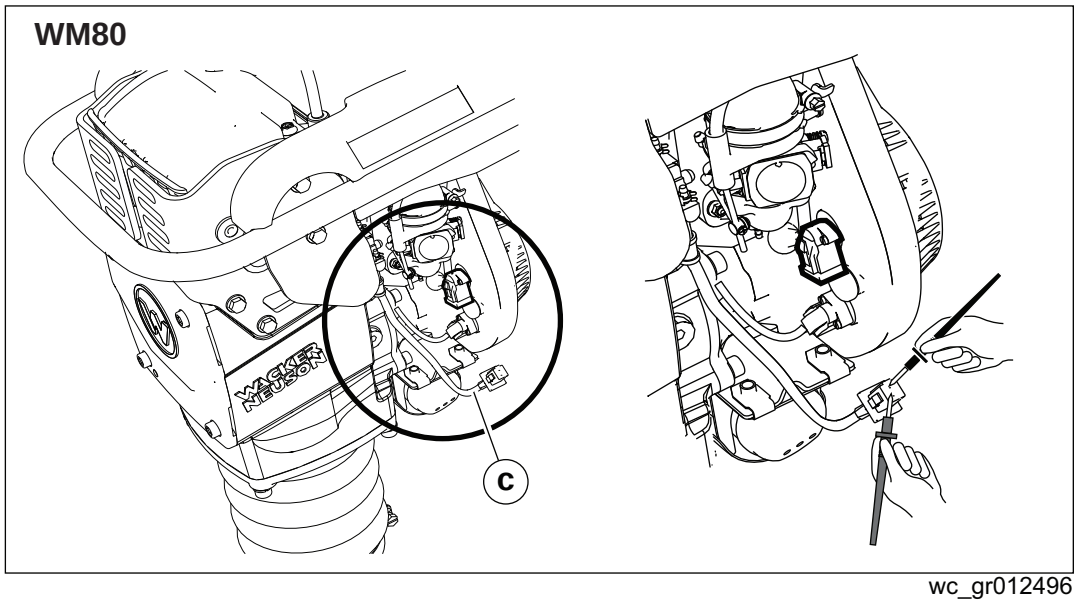
3. On WM80 engines, disconnect the connector **(c)**.



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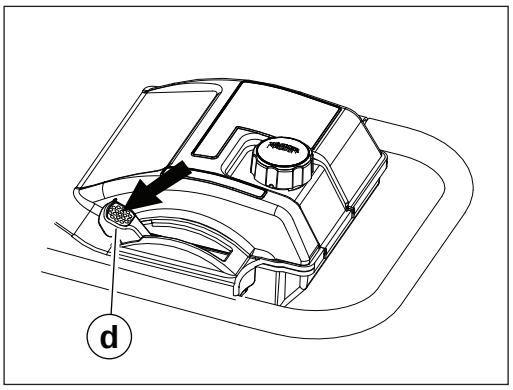
4. Set the throttle/stop switch **(d)** to the STOP position.
5. On 4-stroke engines, check for continuity between the wire the engine housing.

   On 2-stroke engines, check for continuity across the connector.



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Is there continuity?

Yes ____	**No** ____
The throttle/stop switch is OK. Reconnect the throttle/stop switch.	The throttle/stop switch is malfunctioning. Replace the throttle/stop switch.

Result The throttle/stop switch has now been checked.

3.6 Conducting a Leak-Down Test

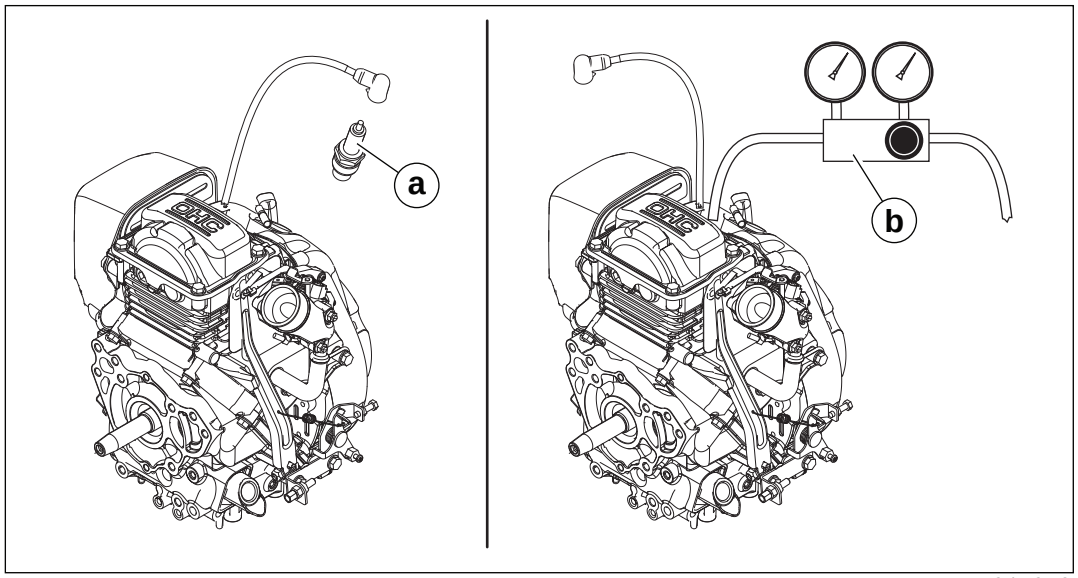
Requirements

- Leak down tester
- Torque wrench

Procedure

Perform the procedure below to conduct a leak-down test.

1. Remove the spark plug **(a)**.



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2. Set the piston at TDC using the starter rope.
3. Connect the leak-down tester **(b)** to the engine at the spark plug hole.
4. Set the regulator of the air supply to 100 psi. Test the engine leak down using the instruction of the leak-down tester.

Does the engine hold the pressure?

Yes ____	**No** ____
The air leakage is OK. Re-install the spark plug. Torque the spark plug to 35–41 Nm (25.8–30.2 ft.lbs.).	There is too much air leakage. Rebuild the engine.

Result

The engine air leakage has now been checked.

3.7 Checking the Ignition Wiring

Requirements

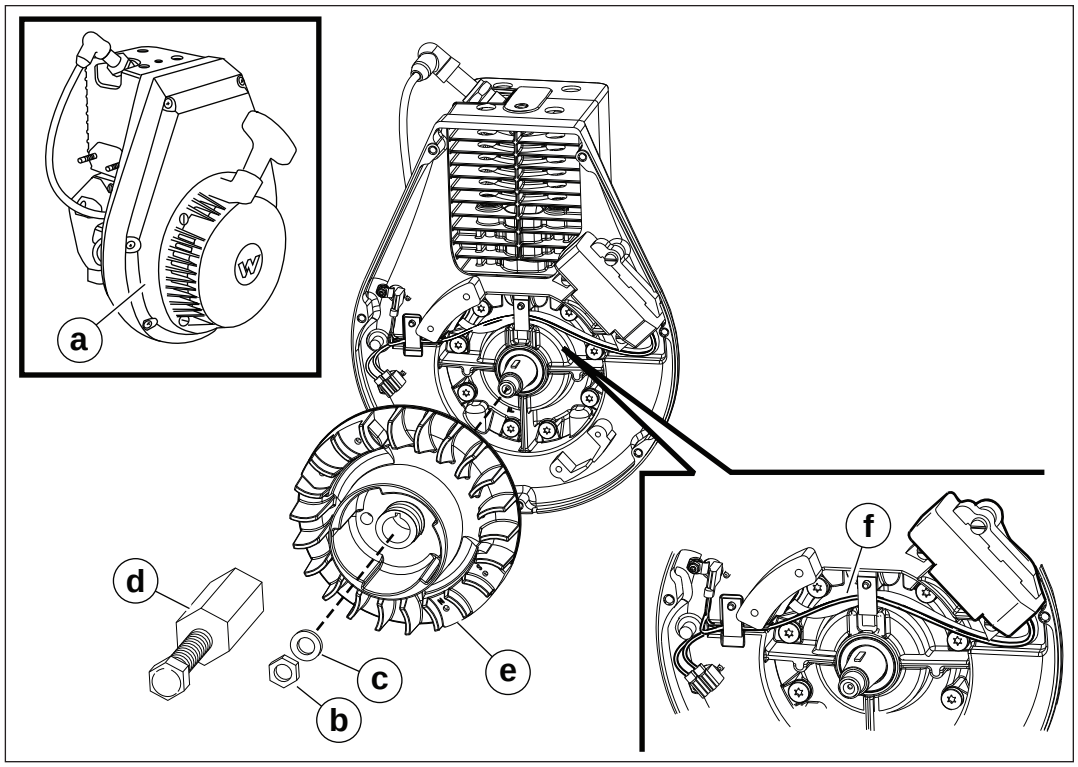
- Engine cool
- Puller PN 5000046503

Note: *The procedure below applies to the WM 80 engine. For other engines, see the engine manufacturer for more information.*

Procedure

Perform the procedure below to remove check the ignition wiring.

1. Remove the housing cover **(a)** from the WM 80 engine.
2. Remove the nut **(b)** and the washer **(c)**.



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3. Using puller 5000046503 **(d)**, pull the flywheel **(e)** off the crankshaft.
4. Check the wiring **(f)** for shorts to ground.
5. Repair or replace the wiring, or replace the ignition module.
6. Re-install the flywheel.
7. Re-install the housing cover.

Result

The ignition wiring has now been checked.

3.8 Checking Engine Compression

Requirements

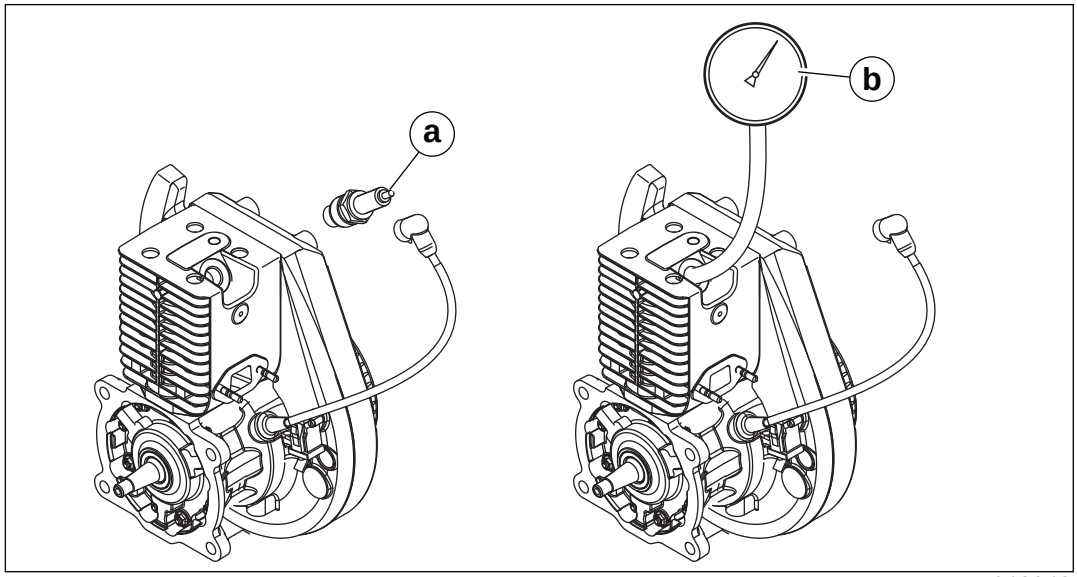
- Compression tester
- Torque wrench

Note: *The procedure below applies to the WM 80 engine. For other engines, see the engine manufacturer for more information.*

Procedure

Perform the procedure below to check engine combustion.

1. Remove the spark plug **(a)**.



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2. Install the compression gauge **(b)** into the cylinder.
3. Pull the starter rope several times and measure the pressure on the gauge.

Is 6 – 9.6 Nm (90 – 140 psi) measured?

Yes ____	**No** ____
The engine compression is OK. Re-install the spark plug. Torque the spark plug to 35–41 Nm (25.8–30.2 ft.lbs.).	There is too little compression. Rebuild the engine.

Result

The engine compression has now been checked.

3.9 Checking for Vapor Lock

Requirements

- Fresh, non-oxygenated fuel
- New fuel filter if applicable

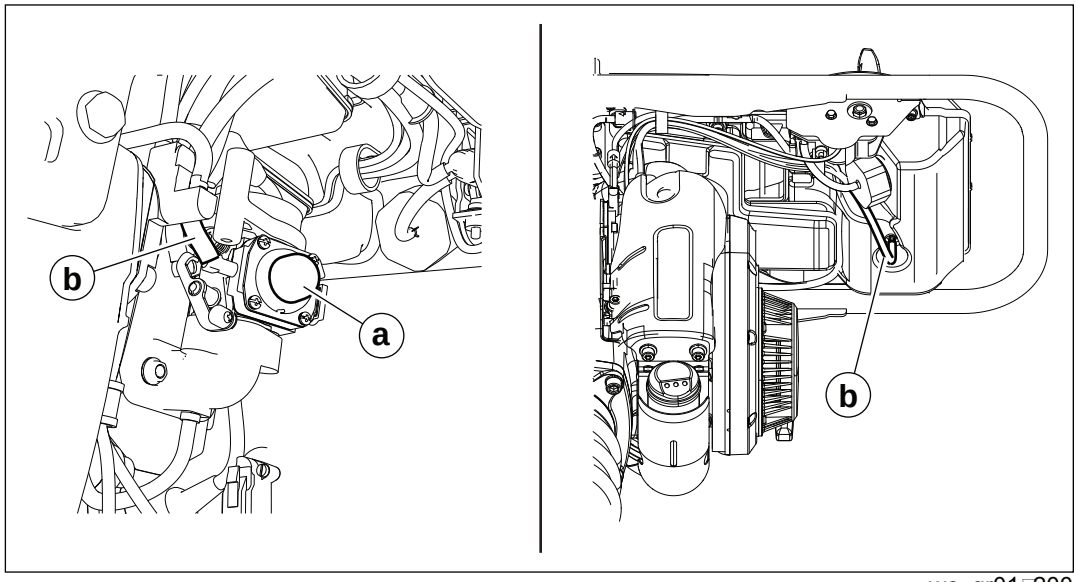
Background

Loading conditions, fuel blend, and ambient temperature all add to the chances of a vapor lock condition. If the engine runs for approximately 45 minutes and then stops, there may be a vapor lock condition.

Checking procedure

Perform the procedure below to check for vapor lock.

1. Check the fuel level in the fuel tank. Fill the fuel tank if necessary.
2. Check the purge bulb **(a)**. If there is no fuel in the purge bulb, a vapor lock condition may exist.



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3. Check for air bubbles in the return fuel hose **(b)**. If there are air bubbles present, a vapor lock condition may exist.

Solution

To rectify a vapor lock condition:

► Allow the machine to cool.

► Check the fuel tank cap. The cap needs to vent. If it is screwed on too tightly, venting will be inhibited.

► Replace the fuel with fresh, non-oxygenated fuel.

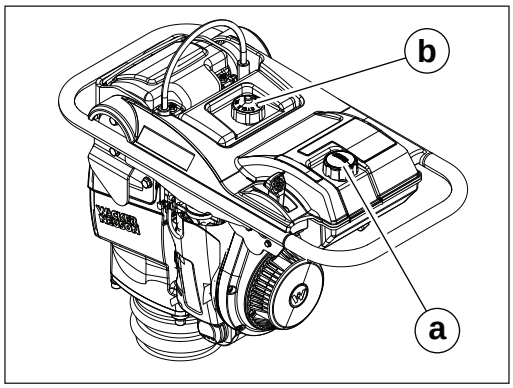
► Check the fuel filters. Replace the fuel filters if necessary.

► Check the fuel hoses for kinks and leaks. Replace the fuel hoses if necessary.

3.10 Purging the Oil Lines

For rammers with oil injection (BS 50-2i, BS 60-2i, BS 70-2i)

If the rammer has a fuel tank **(a)** and an oil tank **(b)**, it has oil injection. The oil lines may need purging.



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When

As needed: when air bubbles are visible in the oil supply line or discharge line

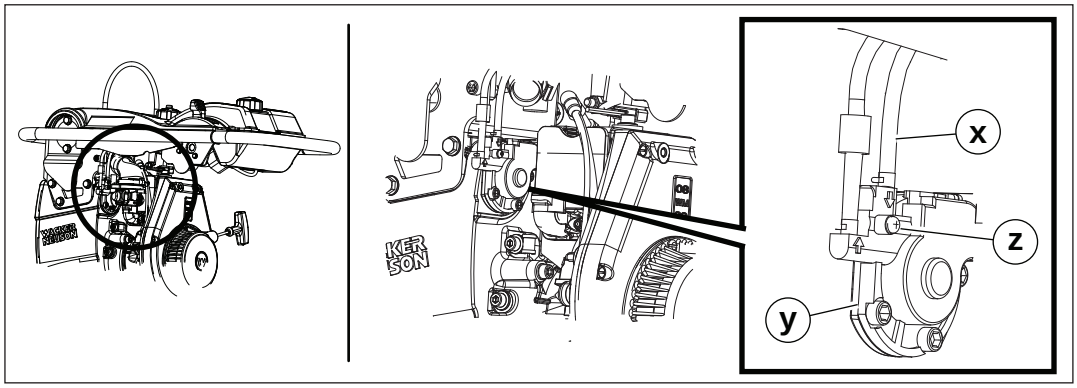
Requirements

- Machine is stopped
- Engine is cool to the touch
- Oil tank is filled
- Fresh oil (as specified in *Technical Data*)
- Phillips screwdriver
- Plastic syringe
- Clean, dry, absorbent cloth or paper towels

Purging the oil supply line

Perform the procedure below to purge the oil supply line.

1. Locate the oil supply line **(x)** connected to the oil pump **(y)**.



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2. Loosen (open), but do not remove, the bleed screw **(z)**. Gravity in the oil supply line will purge trapped air.
3. When air bubbles are no longer visible in the oil supply line, retighten the bleed screw.
4. Wipe residual oil from the supply line and oil pump.

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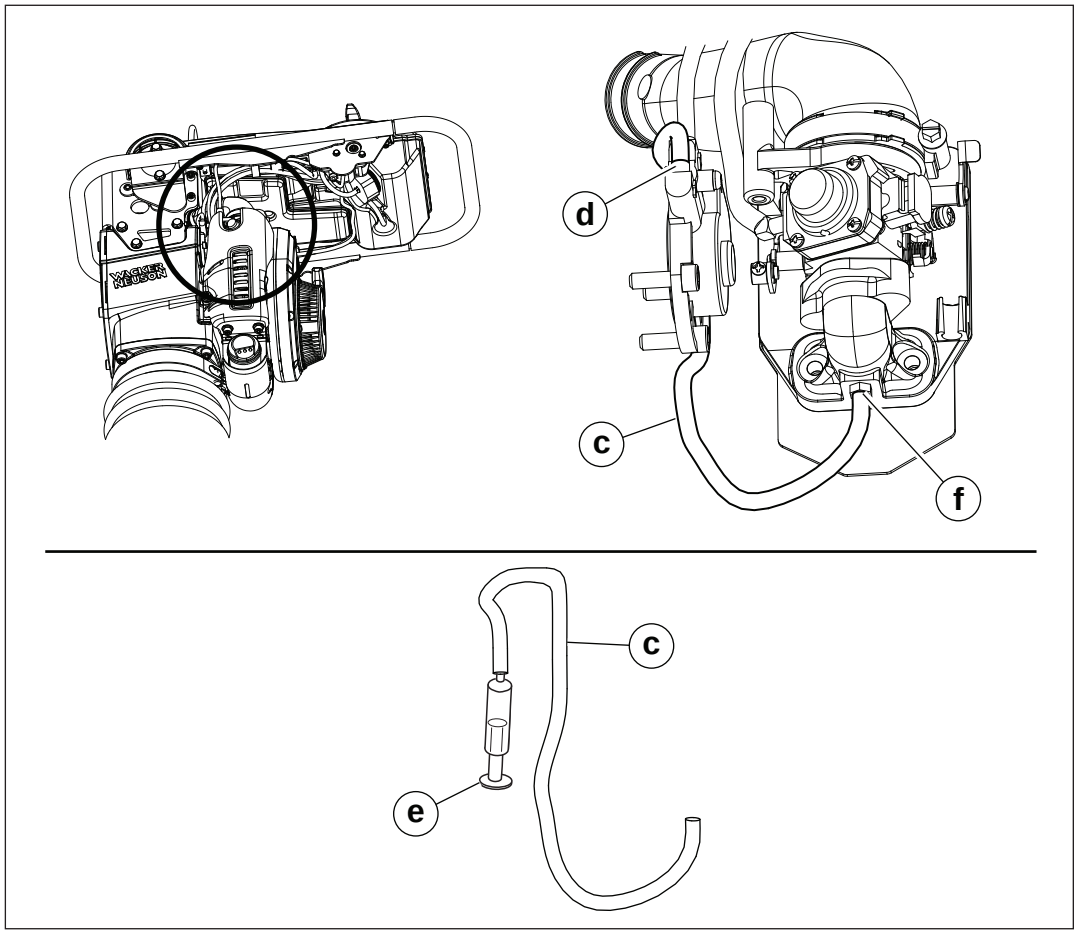
Purging the oil discharge line

Perform the procedure below to purge the oil discharge line.

1. Locate the oil discharge line **(c)**.



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2. If air bubbles are visible in the oil discharge line, they must be manually purged using the following method:

   Disconnect the oil discharge line at the oil pump **(d)**. Using a plastic syringe **(e)** filled with oil, inject oil into the oil discharge line until the air bubbles are gone, and oil is visible up to the carburetor adapter fitting **(f)**.

3. After the air bubbles have been purged, reconnect the oil discharge line. Make sure that the connections are tight with no oil leaks.
4. Wipe residual oil from the oil discharge line and fittings.

Result

The oil lines have been purged.

4 Disassembly and Reassembly

4.1 Draining the Ramming System Oil—BS50

Requirements

- Approved container for drained oil

Background

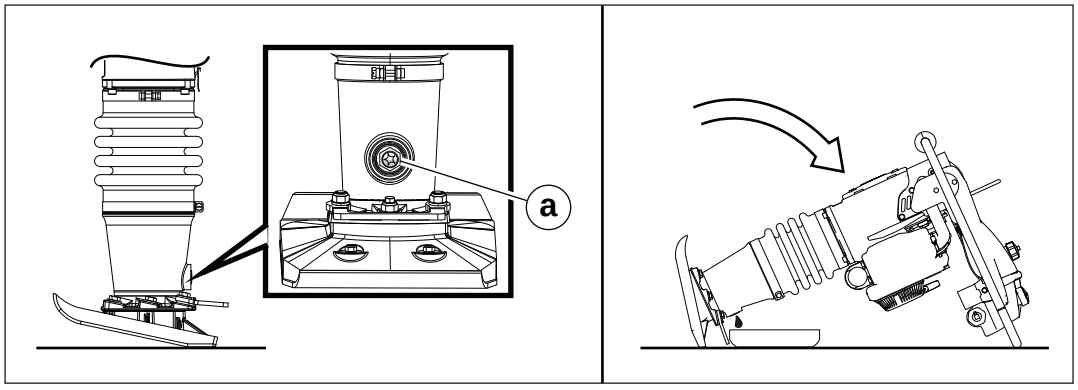
Lubricating oil is distributed throughout the ramming system by the action of the rammer. Holes drilled in the piston carry oil from the bottom of the rammer to the crankcase as the rammer operates. Oil in the ramming system must be maintained at the correct level to ensure the ramming system operates efficiently.

Procedure

Perform the procedure below to drain the ramming system oil.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the sight glass **(a)**.



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2. Tilt the rammer backward until it is resting on the handle and drain the oil into a suitable container.

Note: *It may take up to 10 minutes for the oil to drain.*

3. Dispose of oil in accordance with local environmental regulations.

Result

The ramming system oil has now been drained.

4.2 Refilling the Ramming System Oil — BS50

Requirements

- Teflon® tape

Background

Lubricating oil is distributed throughout the ramming system by the action of the rammer. Holes drilled in the piston carry oil from the bottom of the rammer to the crankcase as the rammer operates. Oil in the ramming system must be maintained at the correct level to ensure the ramming system operates efficiently.

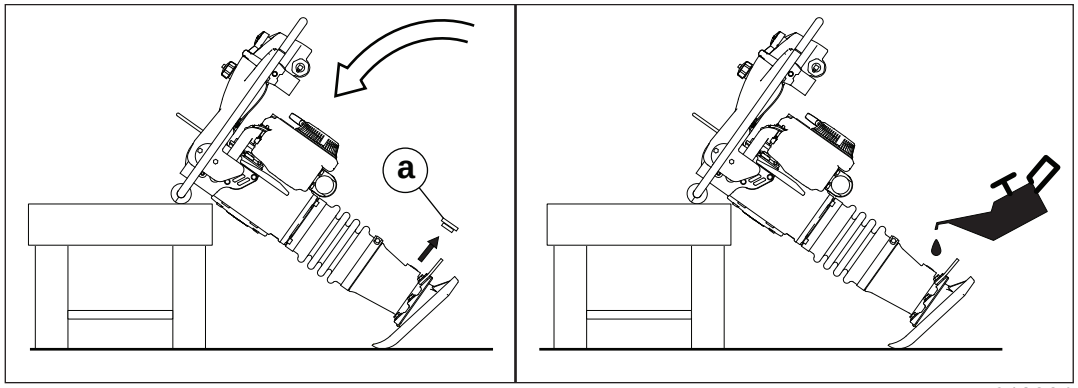
Procedure

Perform the procedure below to refill the ramming system oil.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

NOTICE: Do not overfill the ramming system with oil. High levels of oil can create a hydraulic lock in the ramming system. This can result in erratic operation and cause damage to the engine clutch, the ramming system, and the shoe.

1. Tip the rammer forward to allow access to the sight glass **(a)**. Secure the rammer in this position.



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2. Remove the sight glass.
3. Add oil to the machine through the sight glass opening in the housing.
4. Re-install the sight glass.

This procedure continues on the next page.

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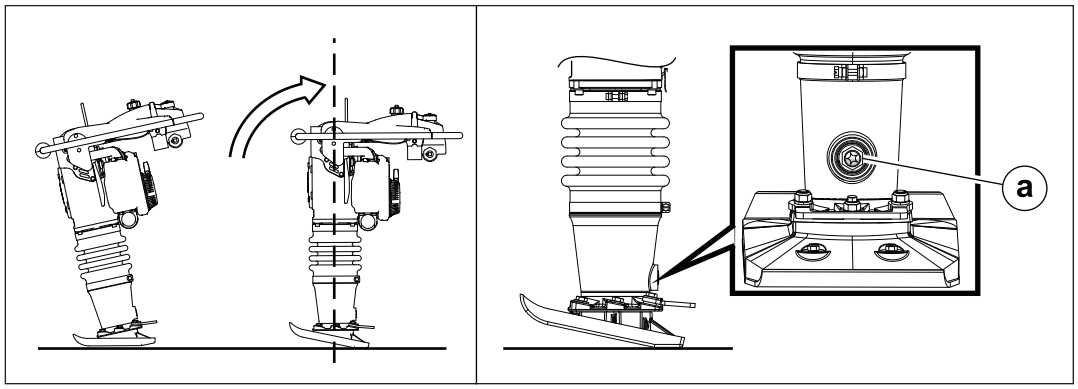
5. Tip the rammer so that it is perpendicular with the ground to check oil level.
6. Oil is at the correct level when the oil fills 1/2 to 3/4 of the sight glass **(a)**.



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7. Once the correct oil level is achieved, tip the rammer forward and secure the rammer.
8. Remove the sight glass, clean the threads, and wrap the threads with Teflon® tape.
9. Re-install the sight glass and torque to 9 Nm (6ft.lbs.).

Result The ramming system oil has now been refilled.

4.3 Draining the Ramming System Oil—BS60 and BS70

Requirements

- Approved container for drained oil

Background

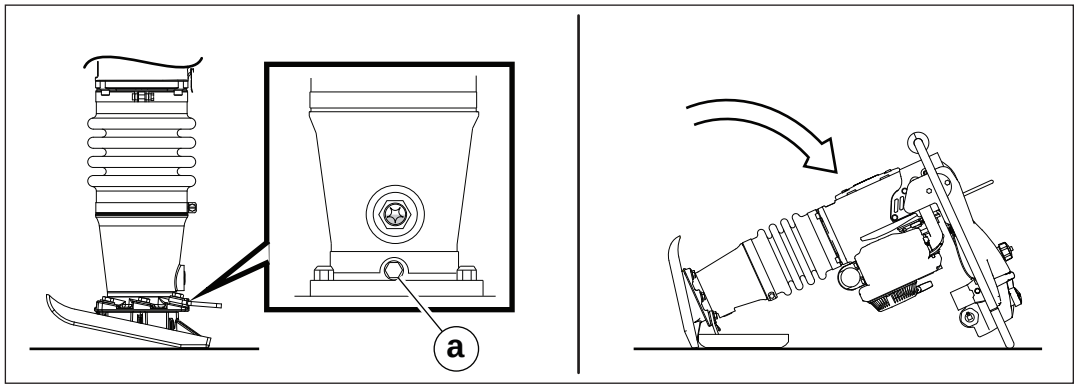
Lubricating oil is distributed throughout the ramming system by the action of the rammer. Holes drilled in the piston carry oil from the bottom of the rammer to the crankcase as the rammer operates. Oil in the ramming system must be maintained at the correct level to ensure the ramming system operates efficiently.

Procedure

Perform the procedure below to drain the ramming system oil.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Tilt the rammer backward until it is resting on the handle.
2. Place a suitable container under the drain plug and remove the drain plug **(a)**.



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Note: *It may take up to 10 minutes for the oil to drain.*

3. Re-install the drain plug and torque it to 54 Nm (40 ft.lbs.).

Note: *Dispose of oil in accordance with local environmental regulations.*

Result

The ramming system oil has now been drained.

4.4 Refilling the Ramming System Oil—BS60 and BS70

Requirements

- Teflon® tape

Background

Lubricating oil is distributed throughout the ramming system by the action of the rammer. Holes drilled in the piston carry oil from the bottom of the rammer to the crankcase as the rammer operates. Oil in the ramming system must be maintained at the correct level to ensure the ramming system operates efficiently.

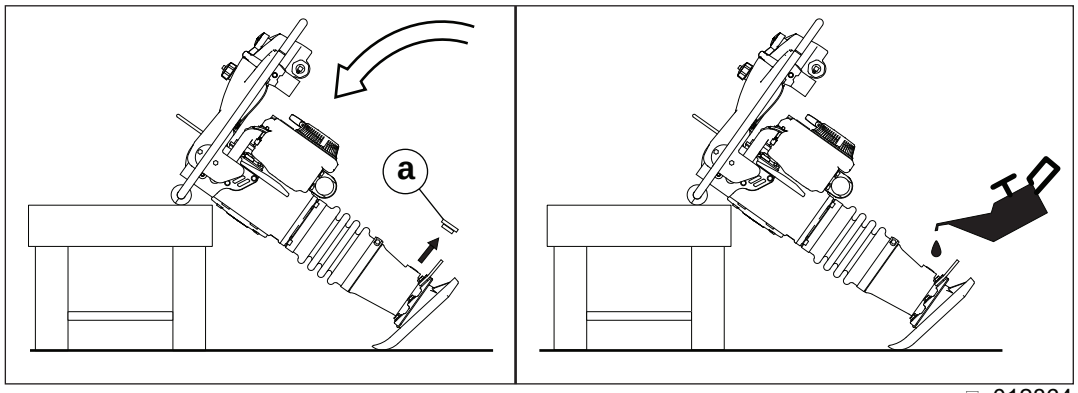
Procedure

Perform the procedure below to refill the ramming system oil.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

NOTICE: Do not overfill the ramming system with oil. High levels of oil can create a hydraulic lock in the ramming system. This can result in erratic operation and cause damage to the engine clutch, the ramming system, and the shoe.

1. Tip the rammer forward to allow access to the sight glass **(a)**. Secure the rammer in this position.



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2. Remove the sight glass.
3. Add oil to the machine through the sight glass opening in the housing.
4. Re-install the sight glass.

This procedure continues on the next page.

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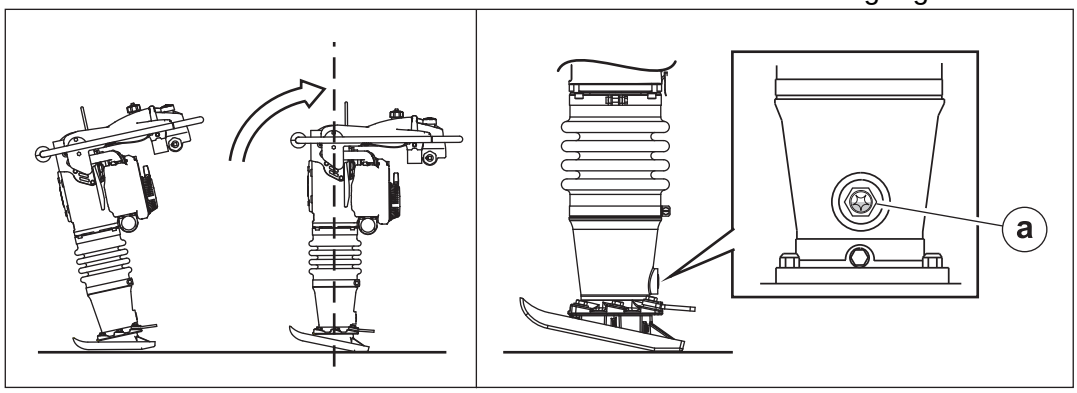
5. Tip the rammer so that it is perpendicular with the ground to check oil level. The oil is at the correct level when the oil fills 1/2 to 3/4 of the sight glass.



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6. Once the correct oil level is achieved, tip the rammer forward and secure the rammer.
7. Remove the sight glass, clean the threads, and wrap the threads with Teflon® tape.
8. Re-install the sight glass and torque to 9 Nm (6ft. lbs.).

Result The ramming system oil has now been refilled.

4.5 Removing the Ramming Shoe—BS50

Requirements

- Torque wrench
- Lifting device capable of lifting the machine
- See chapter *Technical Data* for weights

Procedure

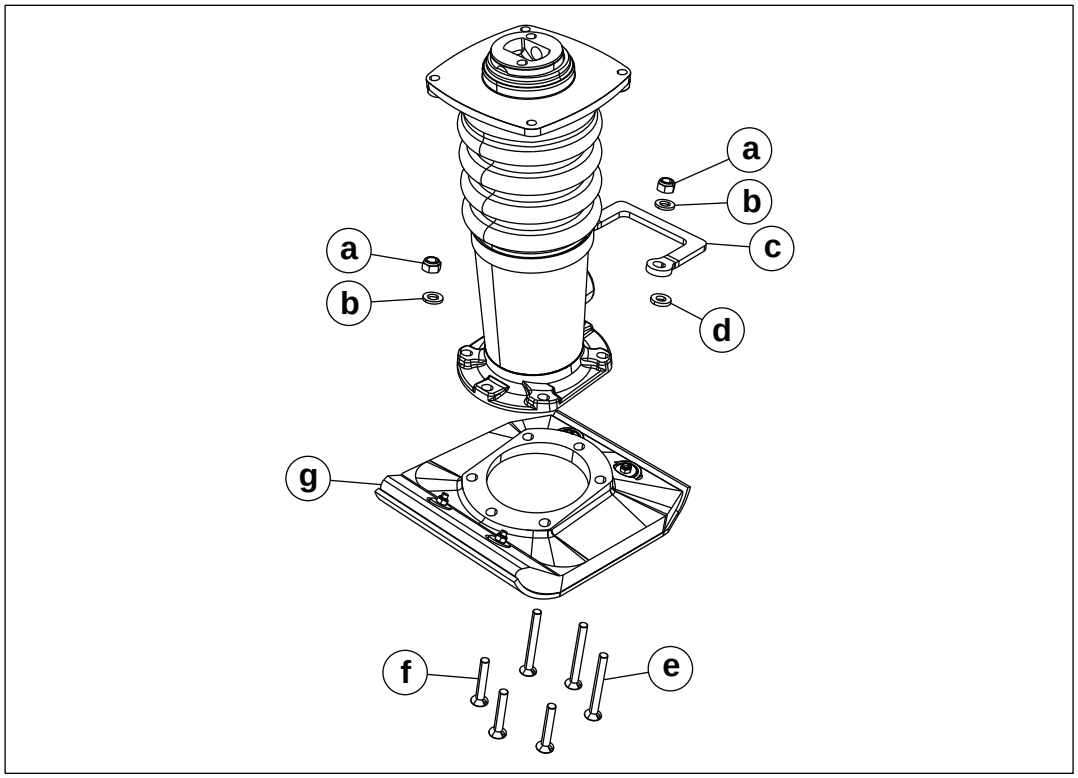
Perform the procedure below to remove the ramming shoe.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

WARNING
Crushing hazard. The machine may fall if not properly suspended during ramming shoe replacement.

► Only use appropriate lifting devices and techniques when lifting the machine.

1. Using the lifting device, support the machine in a vertical position.
2. Remove the six nuts **(a)** and the lock washers **(b)**.



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3. Remove the lifting handle **(c)** and the two spacers **(d)**.

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4. Raise the machine off the shoe **(g)** and secure it in position.

5. Remove the three rear plow bolts **(e)** and the three front plow bolts **(f)**.

Note: *To prevent the plow bolts from spinning, press the plow bolt heads firmly into the bottom plate while removing nuts.*

Result The ramming shoe has now been removed.

4.6 Installing the Ramming Shoe—BS50

Requirements

- Lifting device capable of lifting the machine
- See chapter *Technical Data* for weights

Procedure

Perform the procedure below to install the ramming shoe.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

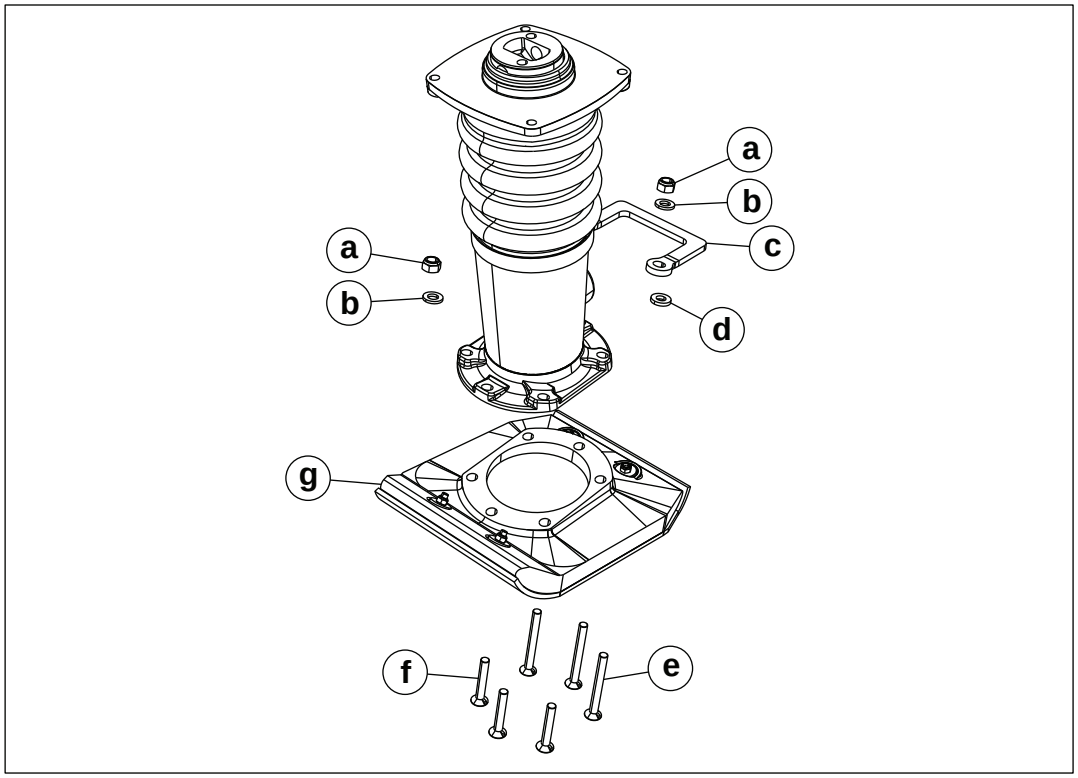
WARNING
Crushing hazard. The machine may fall if not properly suspended during ramming shoe replacement.

► Only use appropriate lifting devices and techniques when lifting the machine.

Note: *When reusing the plow bolts, clean the threads thoroughly before use.*

Note: *To prevent the plow bolts from spinning, press the plow bolt heads firmly into the bottom plate while installing the nuts.*

1. Raise the machine off the ground. Install the shoe **(g)** to the machine using three plow bolts **(e)**, three plow bolts **(f)**, two spacers **(d)**, the lifting handle **(c)**, six washers **(b)**, and six lock nuts **(a)**.



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2. Lower the machine to the ground and remove the lifting devices.

Results The ramming shoe has now been installed.

4.7 Removing the Ramming Shoe—BS60 and BS70

Requirements

- Torque wrench
- Lifting device capable of lifting the machine
- See chapter *Technical Data* for weights

WARNING
Crushing hazard. The machine may fall if not properly suspended during ramming shoe replacement.

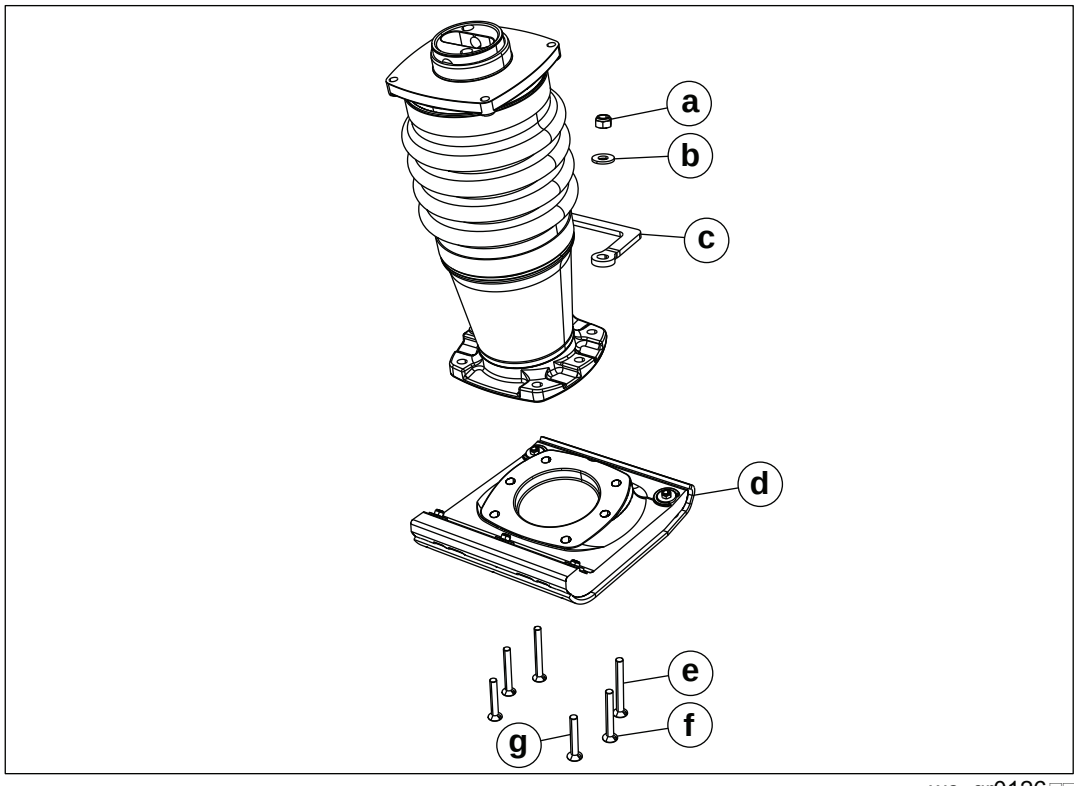
► Only use appropriate lifting devices and techniques when lifting the machine.

Procedure

Perform the procedure below to remove the ramming shoe.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Using the lifting device, support the machine in a vertical position.
2. Remove the six lock nuts **(a)**, the lock washers **(b)**, and the lifting handle **(c)**.



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3. Raise the machine off the shoe **(d)**. Position the machine in a secure place.

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Note: *Note the size and location of the plow bolts **(e**, **f**, and **g)** to aid during installation.*

4. Remove the six plow bolts **(e**, **f**, and **g)**.

Note: *To prevent the plow bolts from spinning, press the plow bolt heads firmly into the bottom plate while removing nuts.*

Result The ramming shoe has now been removed.

4.8 Installing the Ramming Shoe—BS60 and BS70

Requirements

- Lifting device capable of lifting the machine
- See chapter *Technical Data* for weights

WARNING
Crushing hazard. The machine may fall if not properly suspended during ramming shoe replacement.

► Only use appropriate lifting devices and techniques when lifting the machine.

Procedure

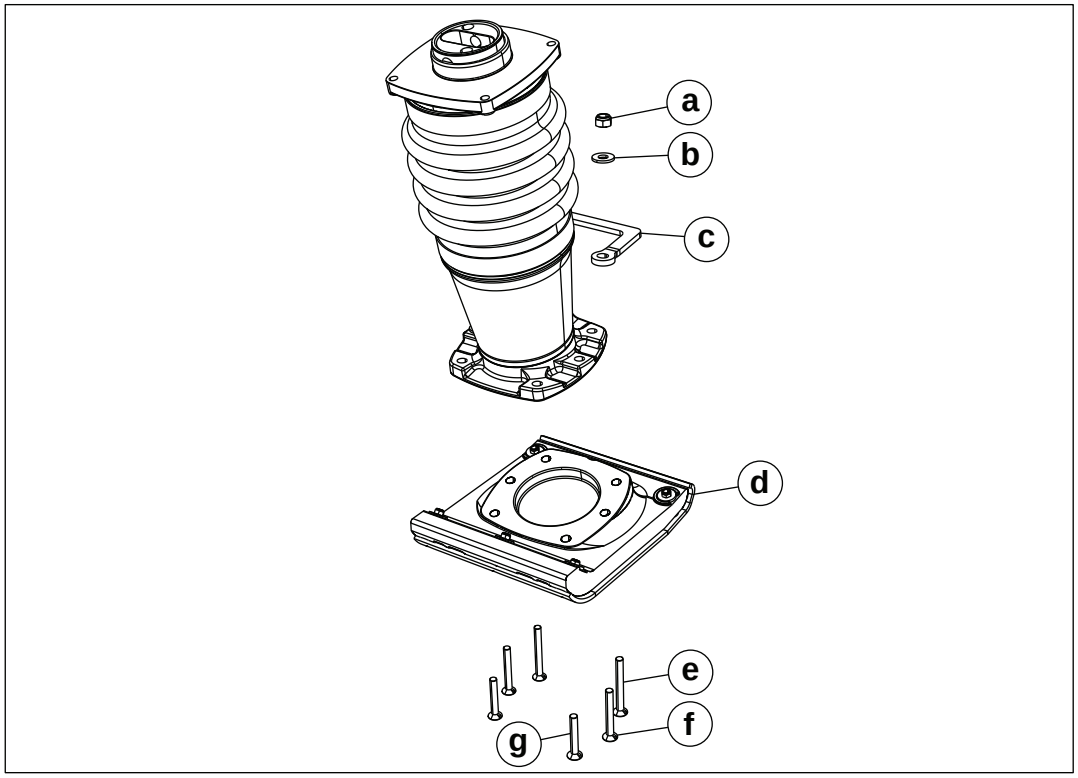
Perform the procedure below to install the ramming shoe.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

Note: *When re-using the plow bolts, clean the threads thoroughly before use.*

1. Raise the machine off the ground. Install the shoe **(d)** to the machine using the two plow bolts **(e)**, the two plow bolts **(f)**, the two plow bolts **(g)**, lifting handle **(c)**, six lock washers **(b)**, and the six lock nuts **(a)**.

Note: *To prevent the plow bolts from spinning, press the plow bolt heads firmly into the bottom plate while installing the nuts.*



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2. Lower the machine to the ground and remove the lifting devices.

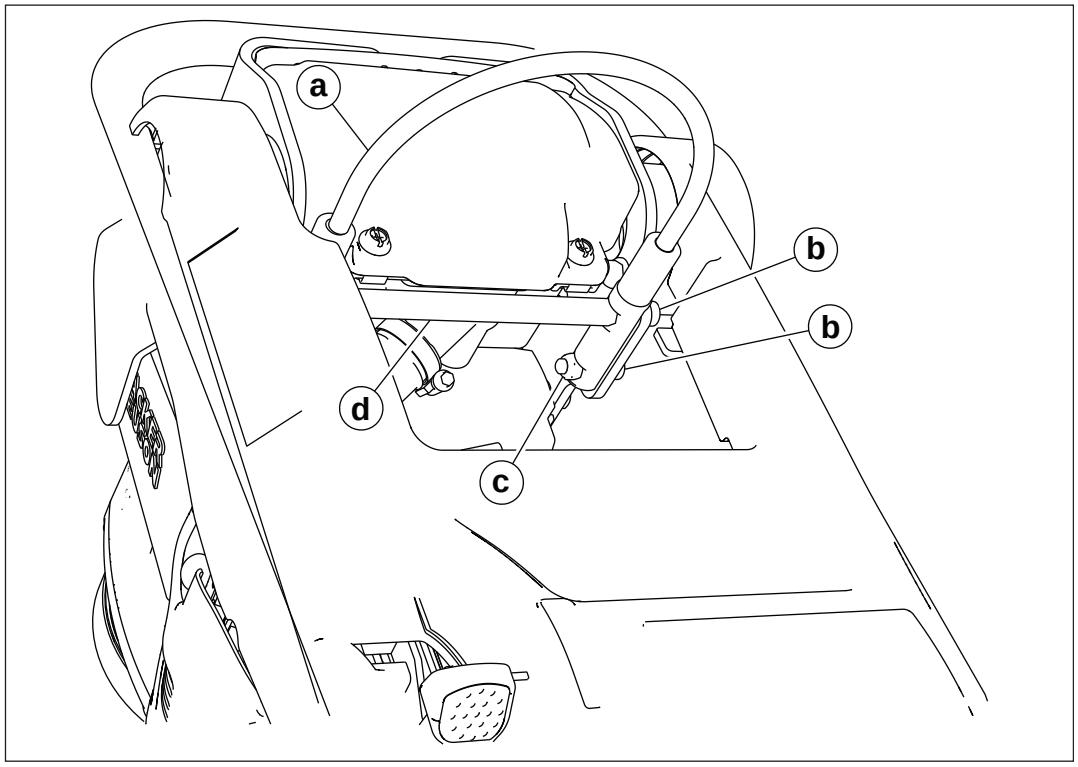
Result The ramming shoe has now been installed.

4.9 Removing the Lifting Cable

Procedure Perform the procedure below to remove the lifting cable.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the four socket head screws **(b)** and the two nuts **(c)**.



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2. Remove the brace **(d)** and the lifting cable **(a)**.

Result The lifting cable has now been removed.

4.10 Installing the Lifting Cable

Requirements

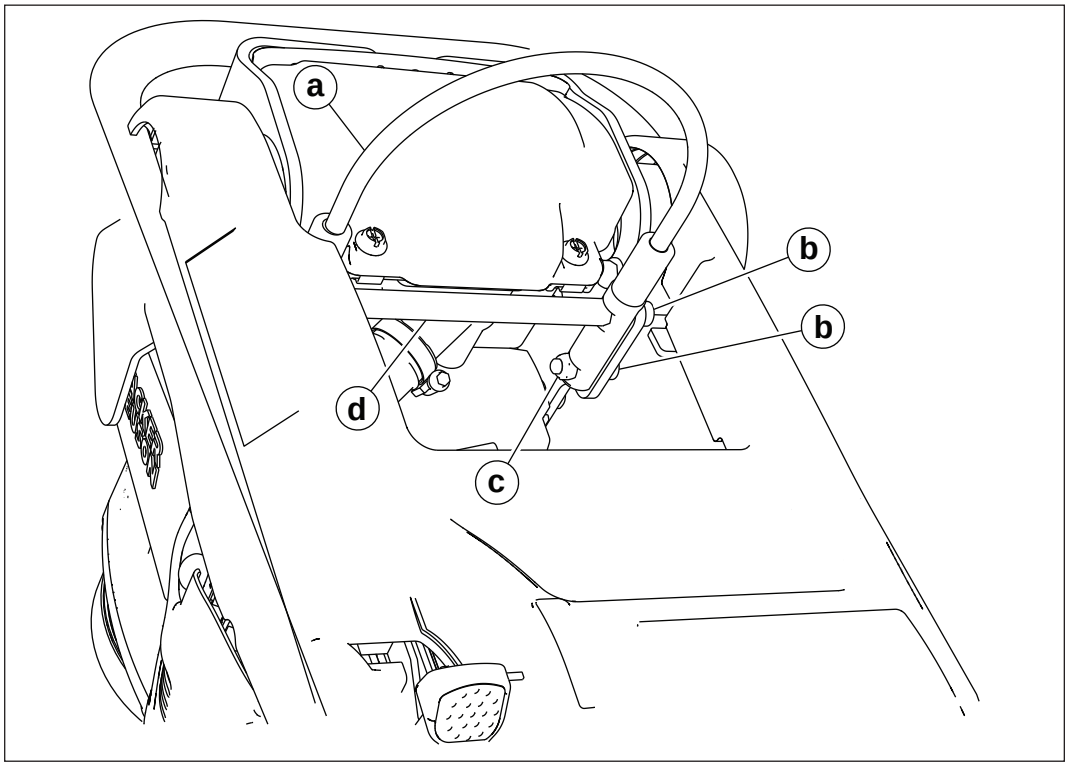
- Loctite® 243
- Torque wrench

Procedure

Perform the procedure below to install the lifting cable.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Apply Loctite® 243 to the four socket head screws **(b)**. Set the brace **(d)** and the lifting cable **(a)** into position and fasten the lifting cable using the four socket head screws **(b)** and the two nuts **(c)**. Torque the screws to 41 Nm (30 ft.lbs.).



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Result

The lifting cable has now been installed.

4.11 Removing the Oil Tank—BS 50-2i

Requirements

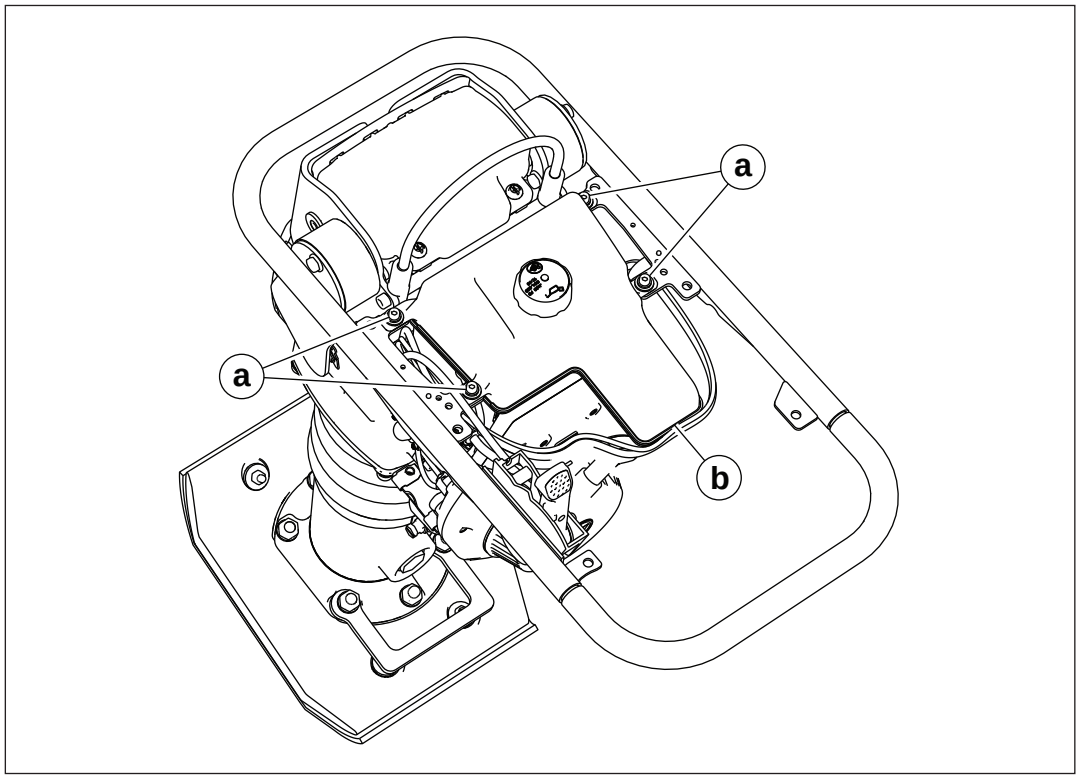
- Approved container for drained oil
- Fuel tank removed
- Plastic sheet to protect work surface

Procedure

Perform the procedure below to remove the oil tank.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the fuel tank. See topic *Removing the Fuel Tank*.
2. Remove the four screws and washers **(a)** that hold the oil tank **(b)** to the machine.



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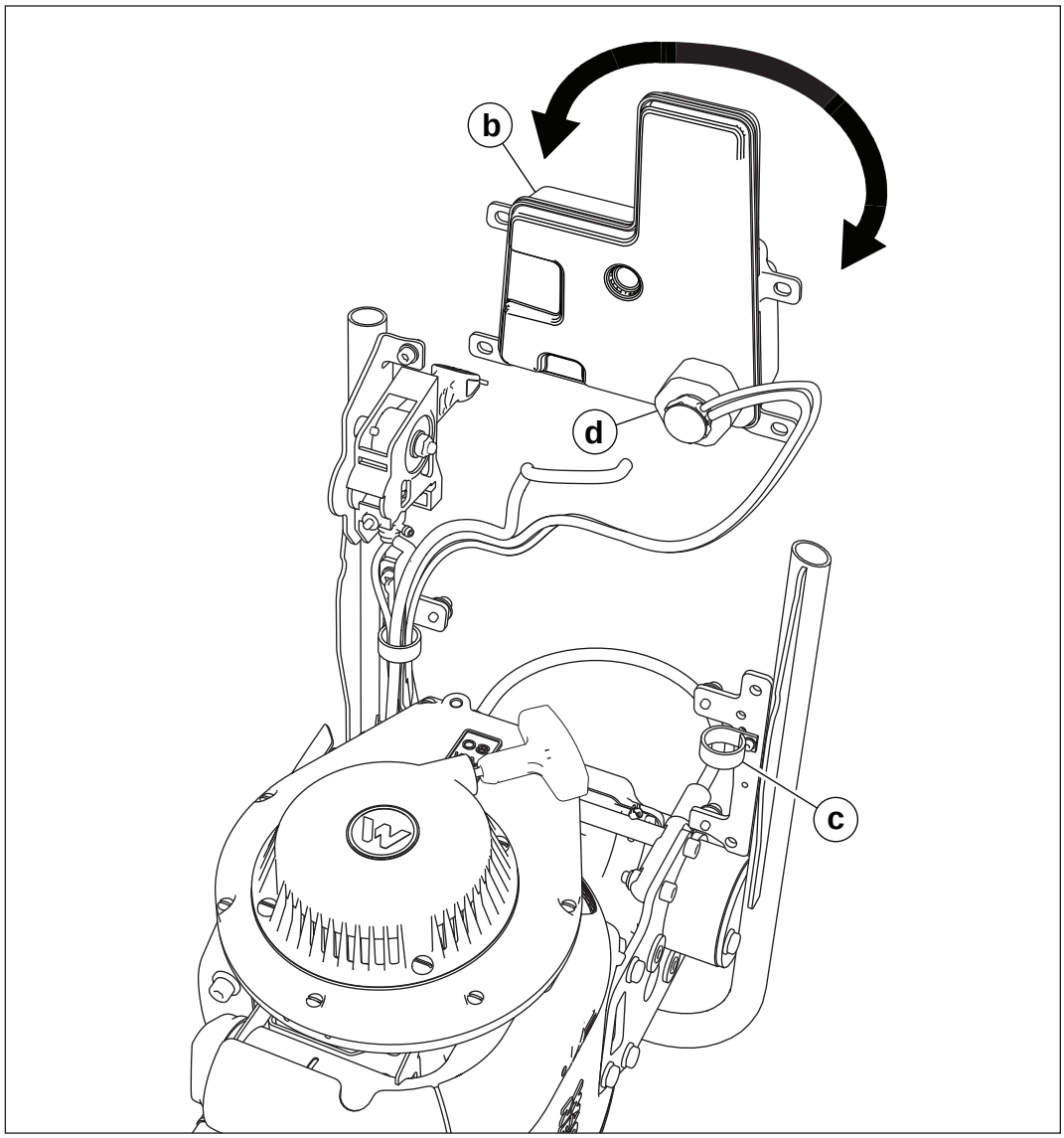
3. Remove the hose and wire from the clamp **(c)**.



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4. Lift the oil tank up from the machine, open the oil tank cap, and drain the oil into an approved container.
5. Hold the oil filter **(d)** and unscrew the oil tank **(b)** from the oil filter.

Result The oil tank has now been removed.

4.12 Installing the Oil Tank—BS 50-2i

Requirements

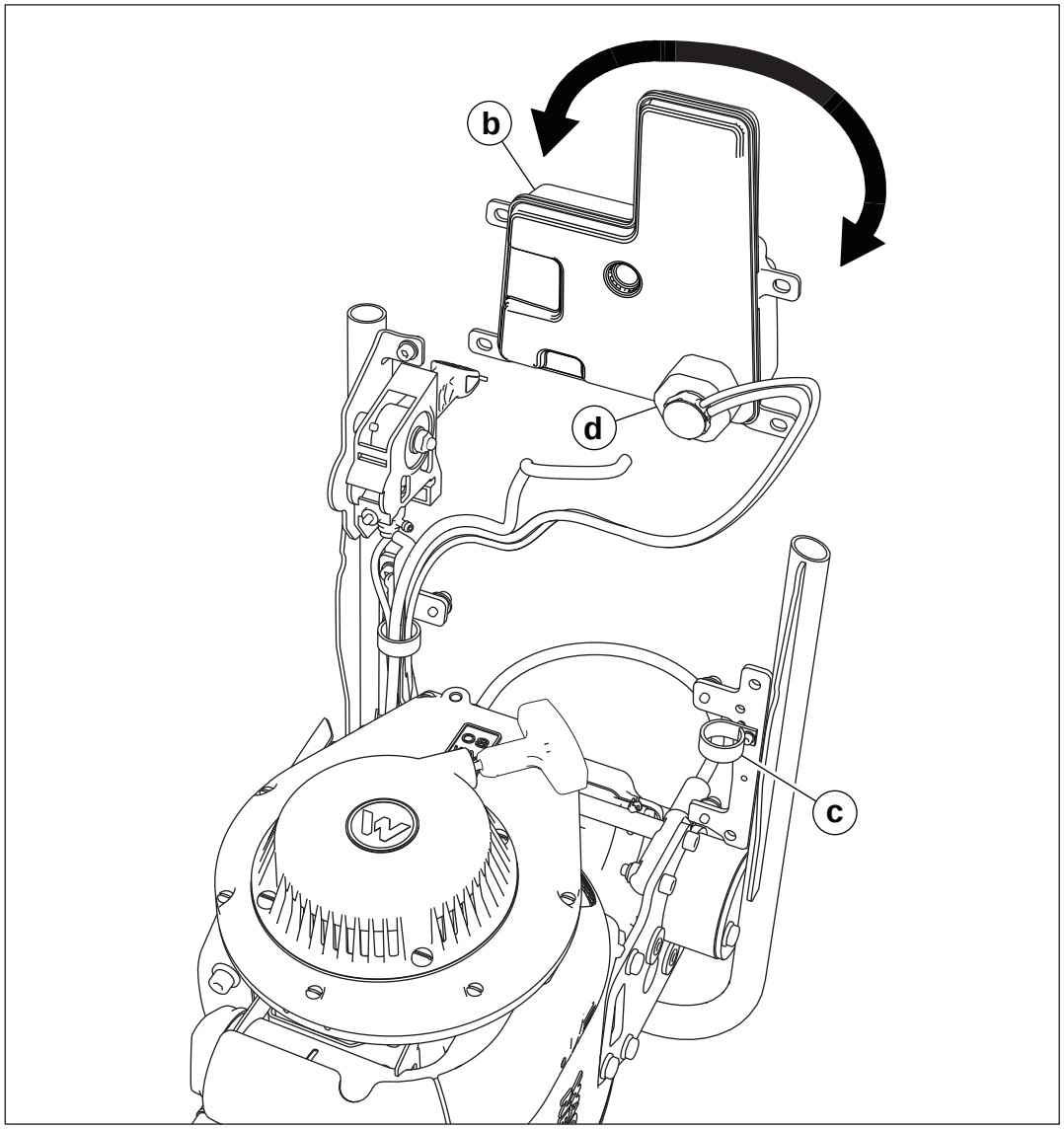
- Loctite® 243
- Torque wrench
- 2-cycle engine oil

Procedure

Perform the procedure below to install the oil tank.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Hold the oil filter **(d)** and screw the oil tank **(b)** onto the oil filter.



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2. Set the oil tank on the machine and install the hose and the wire in the clamp **(c)**.

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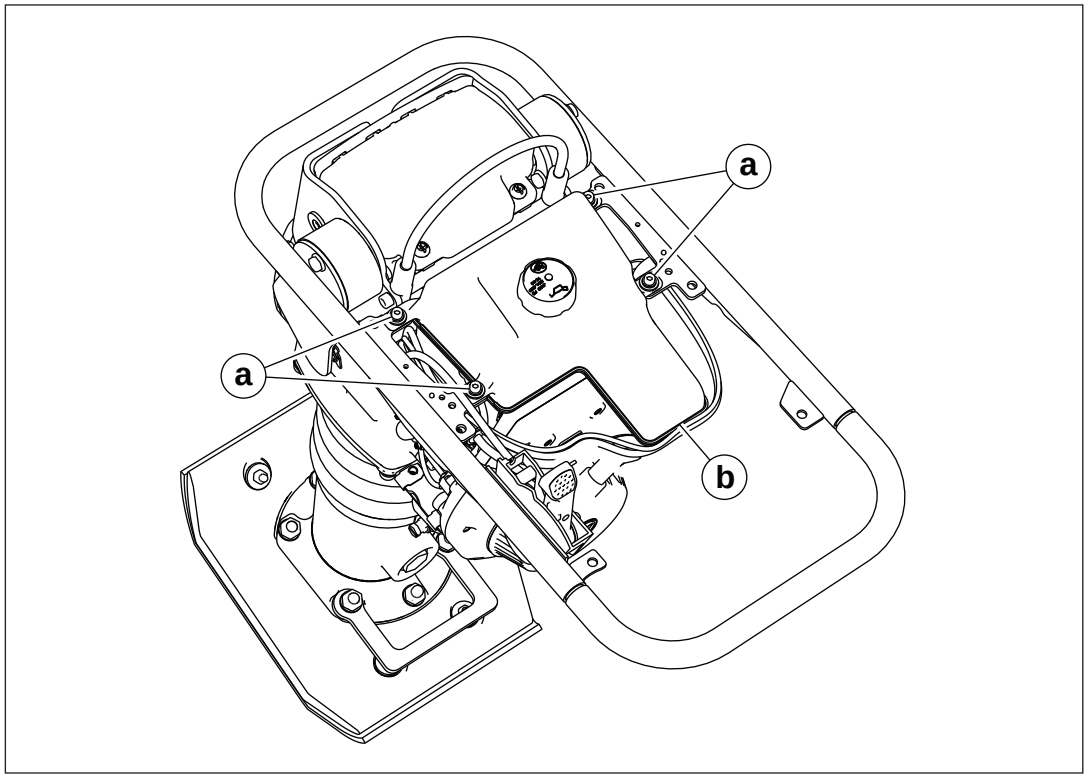
3. Clean and apply Loctite® 243 to the four screws **(a)** and fasten the oil tank **(b)** to the machine with the four screws and washers. Torque the four screws to 9.4 Nm (6.9 ft.lbs.).



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4. Fill the oil tank with oil.
5. Install the fuel tank. See topic *Installing the Fuel Tank*.

Result The oil tank has now been installed.

4.13 Removing the Fuel Tank

WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- ■ Approved container for drained fuel
- ■ Plastic sheet to protect work surface

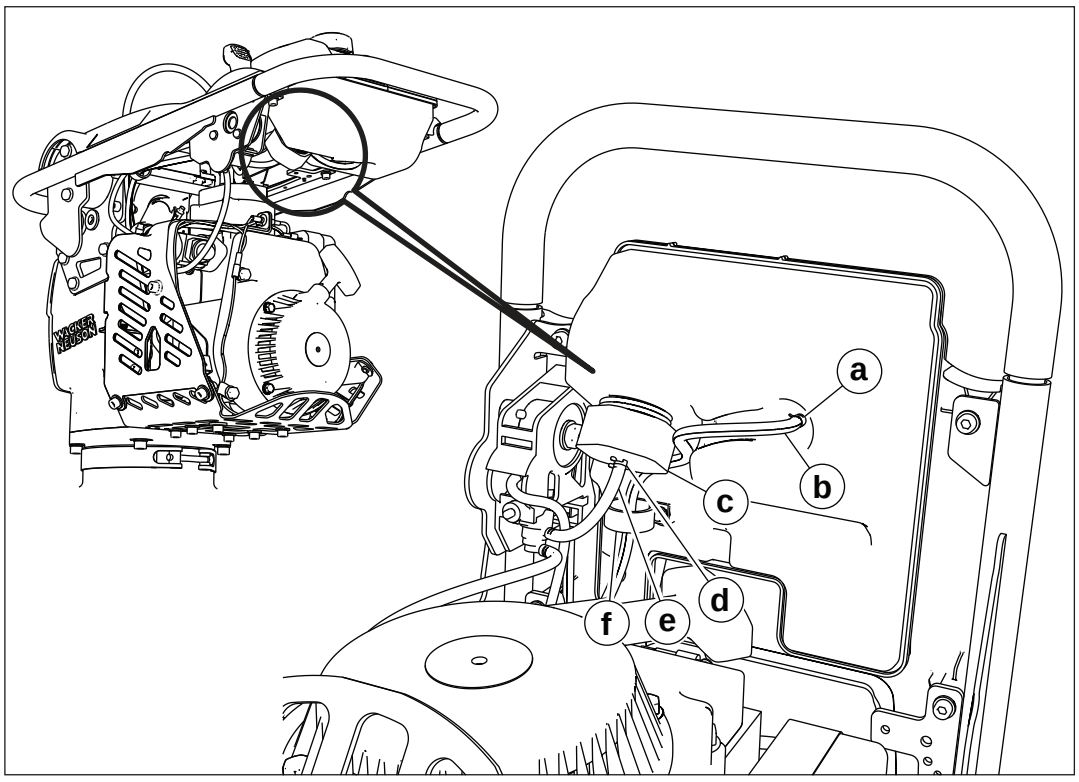
Procedure Perform the procedure below to remove the fuel tank.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Set the machine on a plastic sheet and drain the fuel tank contents into an approved container.

Note: *Dispose of fuel in accordance with local environmental regulations.*

2. Disconnect the clamp **(a)** and pull the fuel hose **(b)** from the fuel tank.



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3. Disconnect the clamp **(d)** at the fuel filter **(c)**.
4. Hold the fuel hose **(e)** near the fuel filter and unscrew the fuel filter from the fuel tank.

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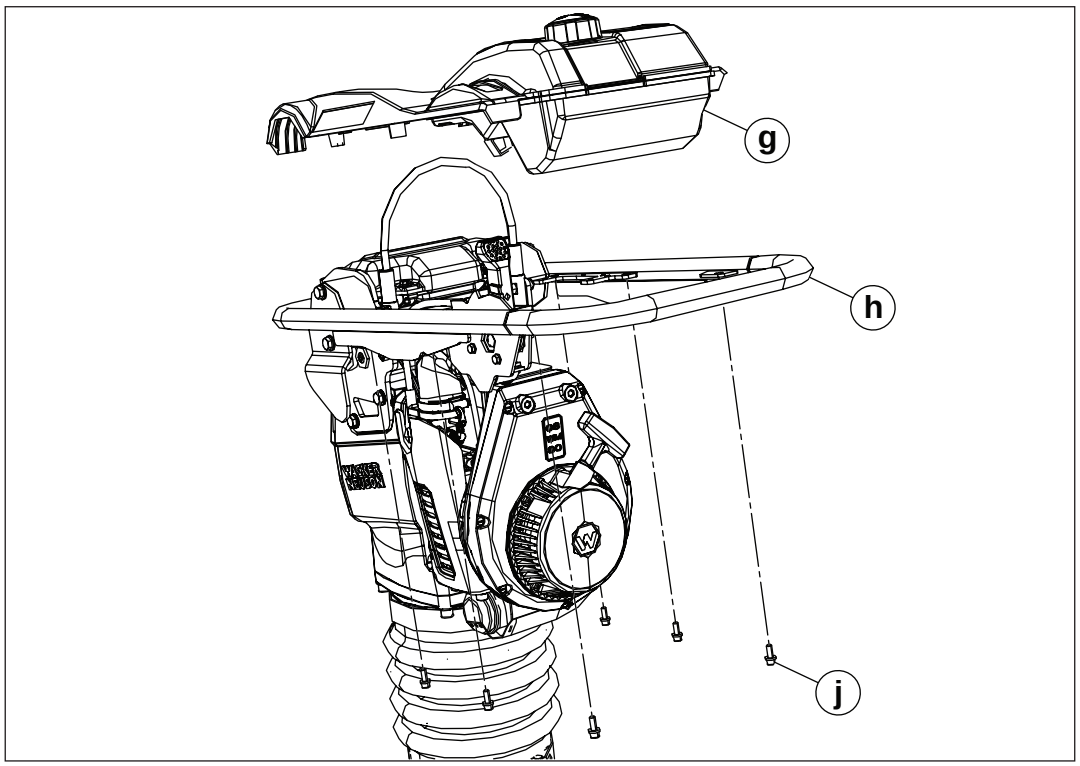
5. Remove and retain the clamp **(f)** for reuse during installation of the fuel tank.
Note: *Graphic is representative only; your machine may vary.*



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6. Remove the six screws **(j)** and lift the fuel tank **(g)** from the guide handle **(h)**.

Result The fuel tank has now been removed.

4.14 Installing the Fuel Tank

WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

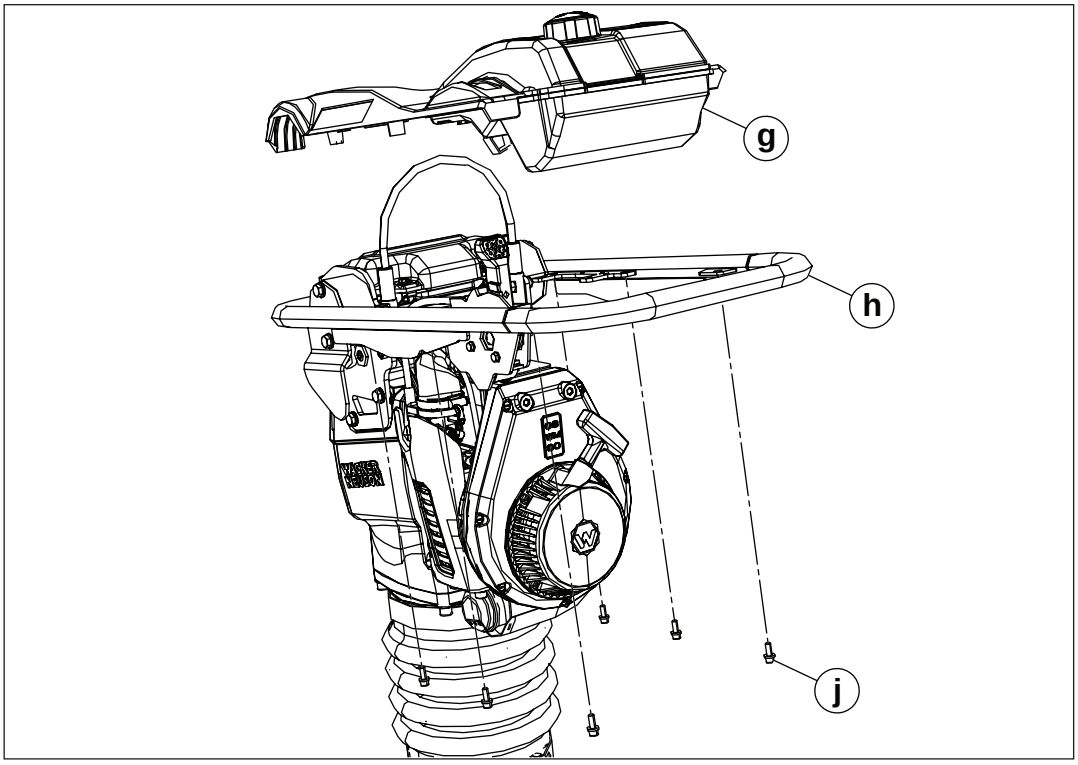
Requirements
- Loctite® 243
- Torque wrench

Procedure Perform the procedure below to install the fuel tank.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Set the fuel tank **(g)** on the guide handle **(h)**.
2. Apply Loctite® 243 to the six screws **(j)** and fasten the fuel tank to the guide handle. Torque the six screws to 9.4 Nm (6.9 ft.lbs.).

Note: *Graphic is representative only; your machine may vary.*



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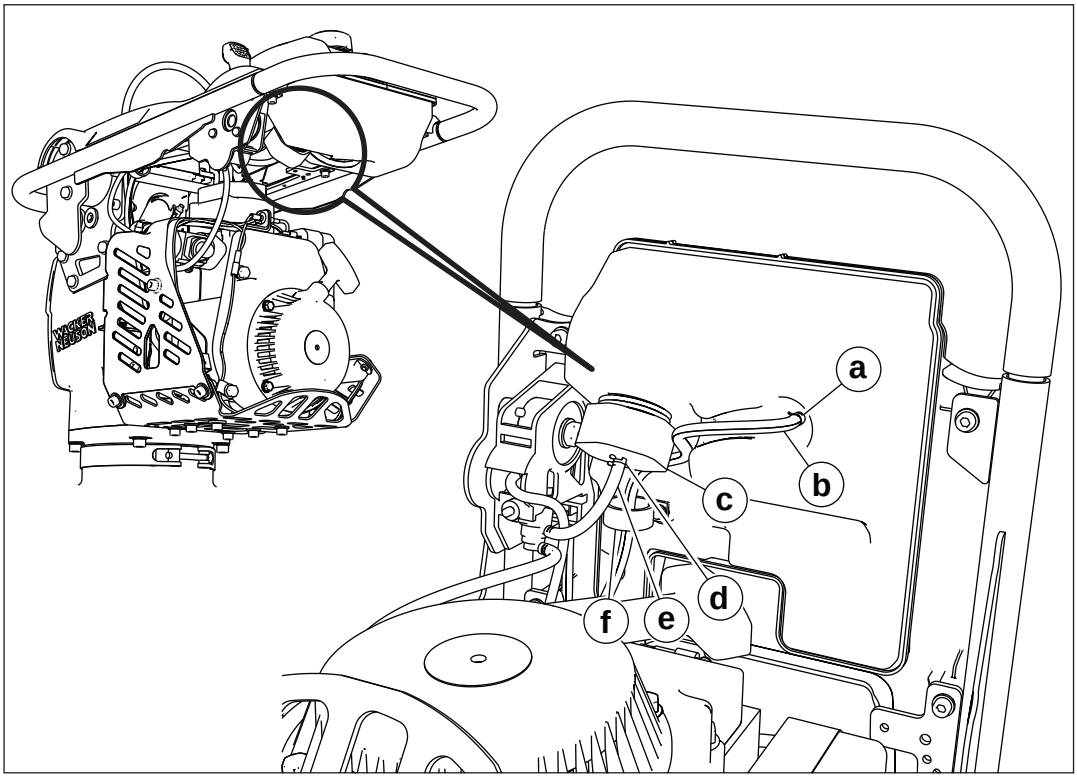
3. Install the clamp **(f)** and tighten the screw.
4. Hold the end of the fuel hose **(e)** near the fuel filter **(c)** and screw the fuel filter to the fuel tank.
5. Install the clamp **(d)** at the fuel filter **(c)**.



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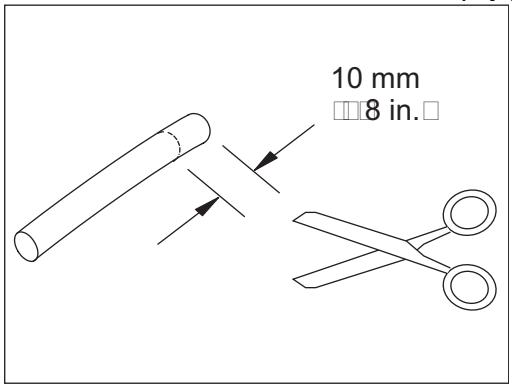
6. Remove 10 mm (3/8 in.) off the end of the hose **(b)**. Connect the fuel hose **(b)** to the fuel tank and install the clamp **(a)**.



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Result The fuel tank has now been installed.

4.15 Removing the Bellows

Requirements

- Punch
- Rubber mallet
- Two wood blocks 2” x 4” x 8” (5cm x 10cm x 20cm)

Background

The bellows should be warm. If possible, place machine in sunshine or near heat source to warm the bellows.

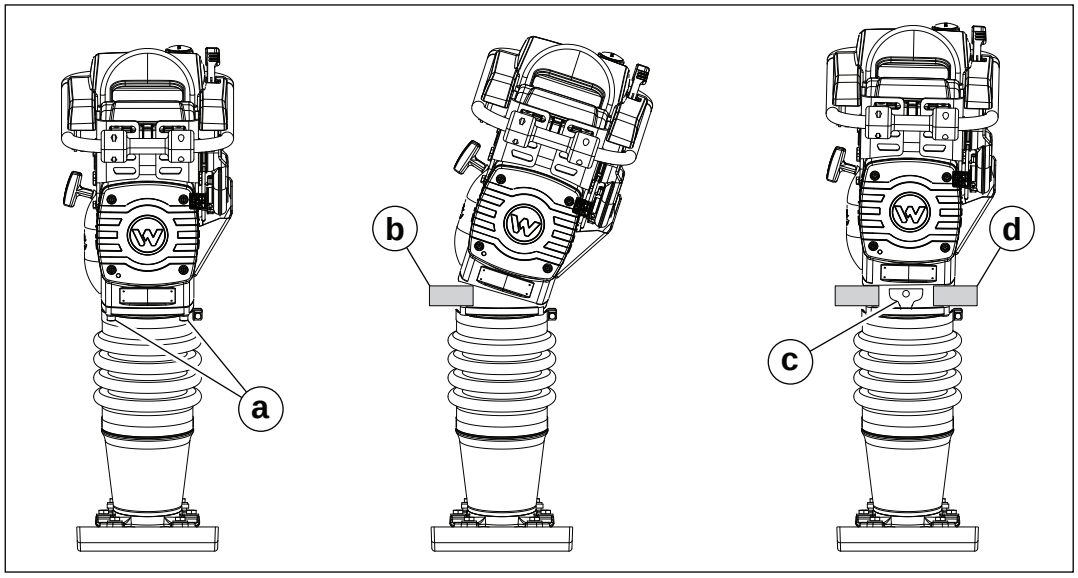
Procedure

Perform the procedure below to remove the bellows.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Drain the ramming system oil into an approved container.
Note: *Dispose of oil in accordance with local environmental regulations.*

2. Remove the four screws **(a)** and washers that fasten the ramming system to the crankcase.



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3. With the aid of an assistant, roll the crankcase and place a wood block **(b)** between the crankcase and the ramming system.

4. With the aid of an assistant, roll the crankcase the opposite direction and place a second wood block **(d)** between the crankcase and the ramming system. This provides access to the crankcase connecting rod and ram **(c)**.

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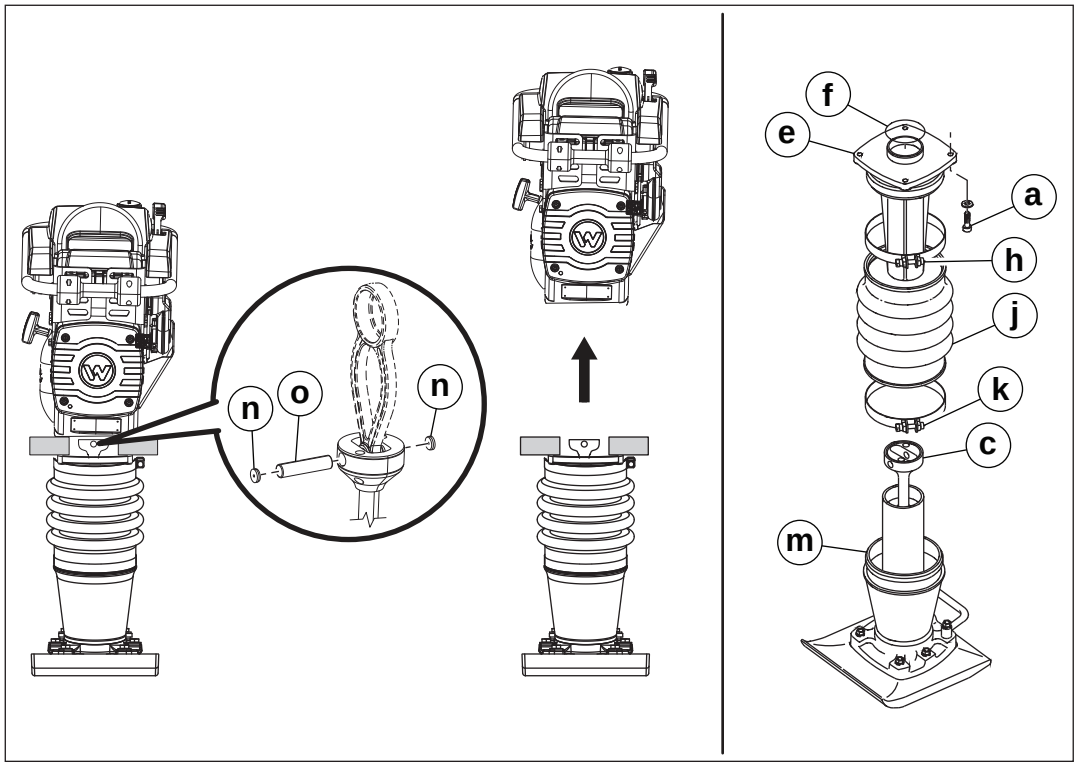
5. Drive out the two end plugs **(n)** and the piston pin **(o)** that holds the connecting rod to the ram **(c)**.

Note: *Do not reuse the end plugs.*



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6. With the aid of an assistant, lift and remove the crankcase from the ramming system.
7. Remove the O-ring **(f)** from the ramming system**.**

Note: *Do not reuse the O-ring.*

8. Loosen the upper clamp **(h)**.
9. Stand on the ramming shoe and pull the guide cylinder **(e)** from the bellows **(j)**.
10. Loosen the lower clamp **(k)**.
11. Stand on the ramming shoe and tap along the bottom of the bellows with a rubber mallet until the bellows **(j)** are removed from the protective pipe **(m)**.

Result The bellows have now been removed.

4.16 Installing the Bellows

CAUTION
Pinch point hazard. Hands and/or fingers may become pinched between the cylinder guide and the bellows during installation.

- ► Keep hands open with palms on the top of the cylinder guide when installing the cylinder guide into the bellows.
- ► Wear gloves during this procedure.

Requirements

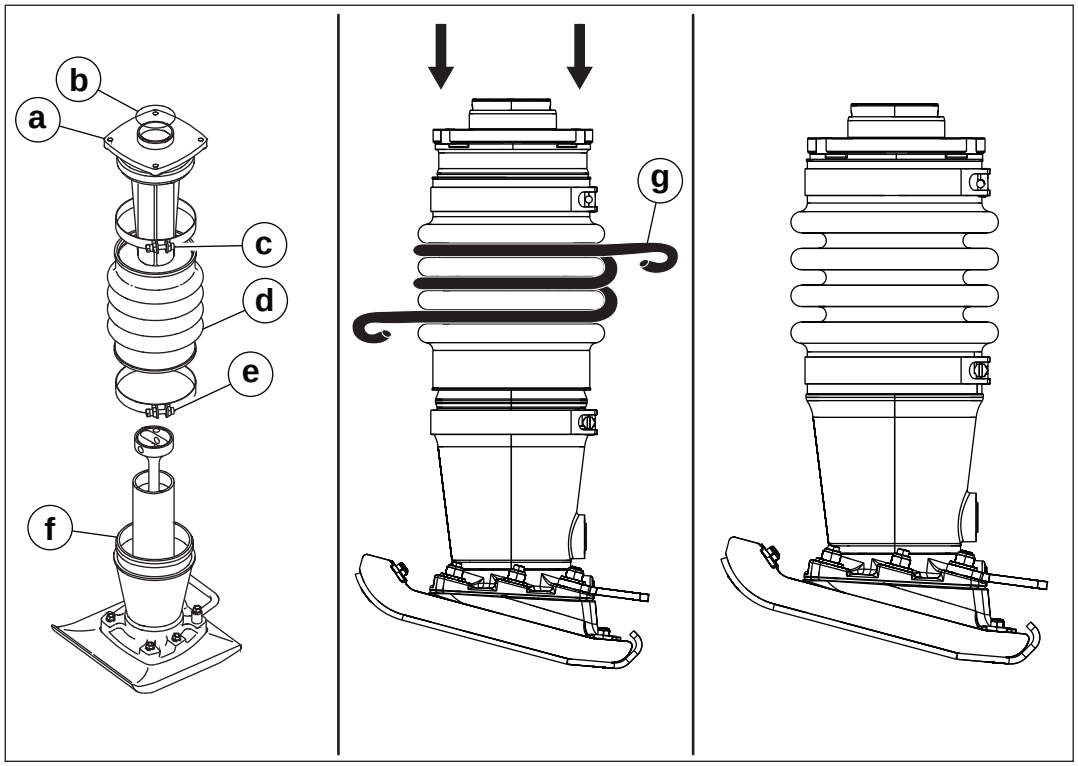
- Loctite® 243
- Air hose
- Two wood blocks 2” x 4” x 8” (5cm x 10cm x 20cm)
- New O-ring

Procedure

Perform the procedure below to install the bellows.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Apply a small amount of oil to the inside of the bellows **(d)** on both ends.



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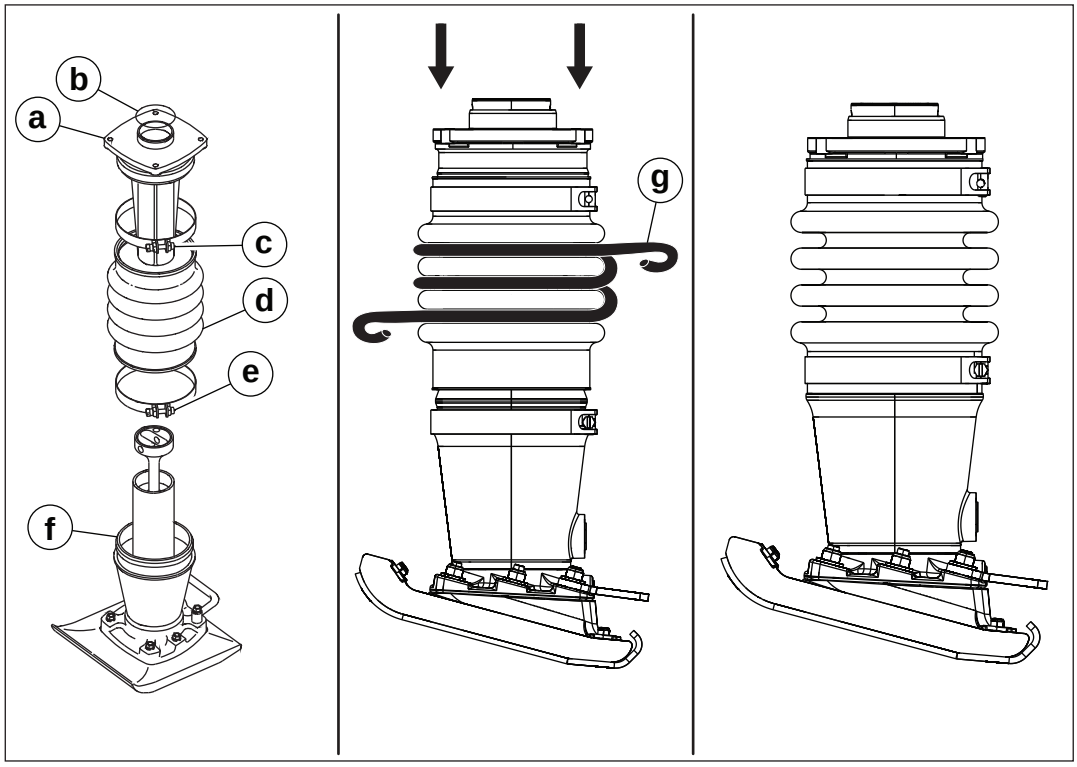
2. Use a piece of air hose **(g)** or similar, wrap it around inside the folds of the bellows.

Note: *This will keep the bellows from collapsing and aid in installation.*



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3. Set the lower clamp **(e)** in place.
4. Set the bellows **(d)** on the protective pipe **(f)** as square as possible.
5. Set the upper clamp **(c)** in place.
6. Set the cylinder guide **(a)** onto the bellows as square as possible.
7. With a strong push, slam the cylinder guide into the bellows and the bottom of the bellows onto the protective pipe.
8. Remove air hose from the folds of the bellows.
9. Partially tighten the upper and lower clamp onto the bellows.
10. Install a new O-ring **(b)**.

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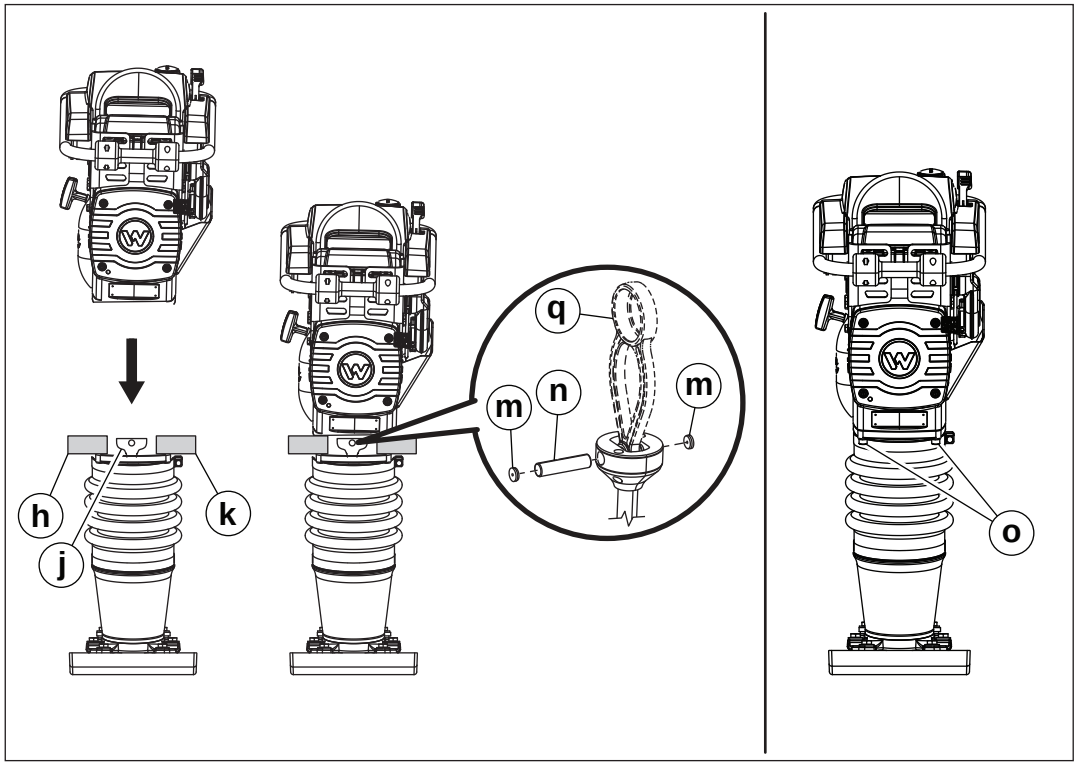
11.Place the two wood blocks **(h** and **k)** on the cylinder guide.



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12.With the aid of an assistant, position the crankcase on the two wood blocks and align the crankcase connecting rod **(q)** with the ram **(j)**.

13.Install the piston pin **(n)** and new end plugs **(m)**.

Note: *Use new end plugs **(m)** whenever the piston pin **(n)** has been removed.*

14.Remove the two wood blocks.

15.Apply Loctite® 243 to the four screws **(o)**.

Note: *When reusing bolts, clean the threads thoroughly before use.*

16.Fasten the ramming system to the crankcase with four screws **(o)** and washers. Torque the four screws **(o)** to 43 Nm (32 ft.lbs.).

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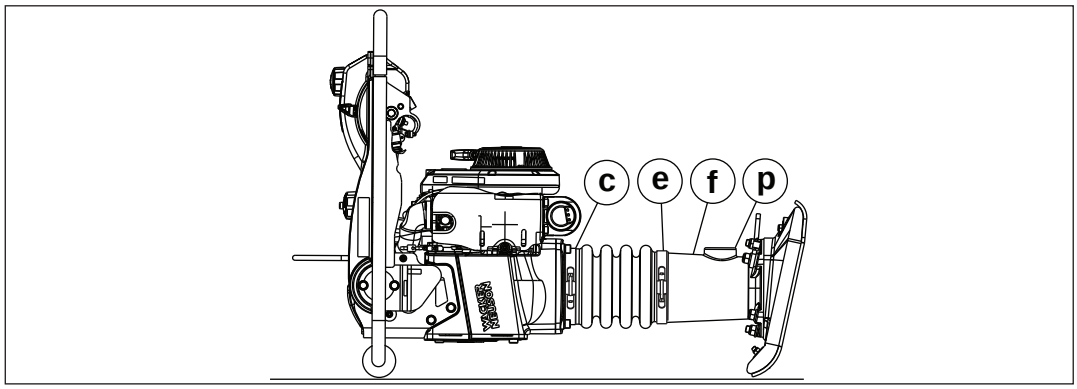
17. Lay the rammer flat on the ground and align the protective pipe **(f)** with the crankcase.



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18. Position the upper clamp **(c)** so the adjustment screw is 90° from the sight glass **(p)**.
19. Position the lower clamp **(e)** so the adjustment screw is 90° from the sight glass **(p)**.
20. Torque the upper and lower clamps to 13.5 Nm (10 ft.lbs.).
21. Fill the ramming system with clean oil.
22. Run the rammer for several minutes and check it for oil leaks around the guide cylinder and the bellows.

Result The bellows have now been installed.

4.17 Removing the Carburetor—WM80 oil injected

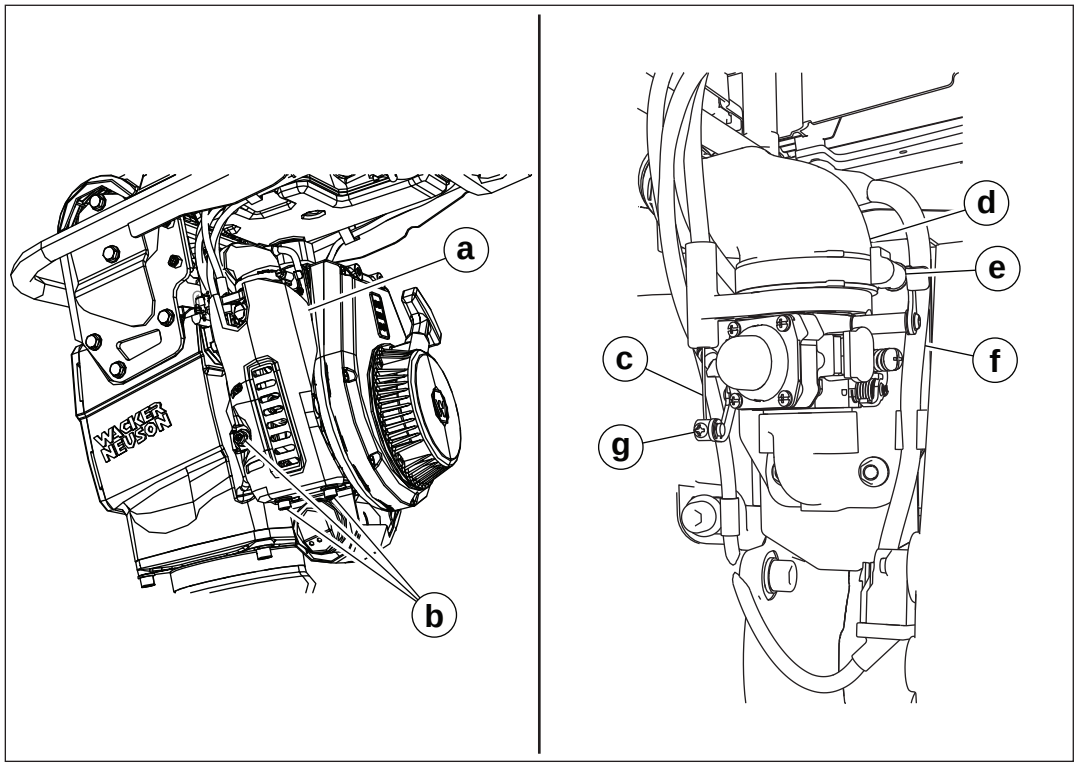
WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- ■ Approved container for drained fuel
- ■ Plastic sheet to protect work surface

Procedure Perform the procedure below to remove the carburetor.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Drain the fuel tank contents into an approved container.
Note: *Dispose of fuel in accordance with local environmental regulations.*
2. Remove the three screws **(b)** and the carburetor guard **(a)**.



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3. Loosen screw **(g)** and remove the throttle cable **(c)**.
4. Loosen clamp **(e)** and remove the air tube **(d)**.
5. Remove the spark plug wire **(f)** from the retainer clip.

This procedure continues on the next page.

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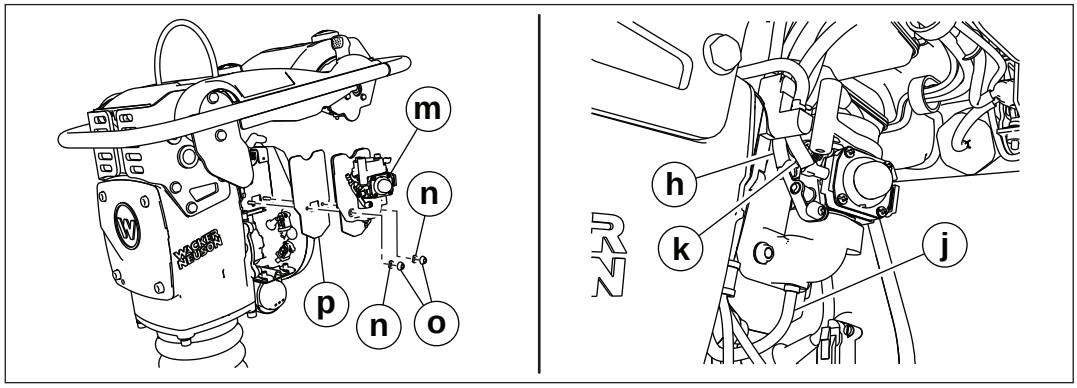
NOTICE: To avoid breaking the fittings, do not pull the hoses off the carburetor fittings. Use a utility knife to cut hose as close to the fitting as possible. Carefully cut the remaining hose from the fitting.

6. Clamp if necessary, then cut the fuel filter hose **(h)** close to the carburetor fittings and drain the fuel into an approved container.



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7. Clamp if necessary, then cut the fuel hose **(k)** close to the carburetor fittings and drain the fuel into an approved container.
8. On machines with revision 104 and higher, clamp if necessary, then cut the oil hose **(j)** close to the oil fitting. Drain the oil into an approved container.
9. Remove two nuts **(o)** and two washers **(n)** from the carburetor assembly **(m)**.
10. Remove the carburetor assembly **(m)** and the adapter gasket **(p)** from the machine.

This procedure continues on the next page.

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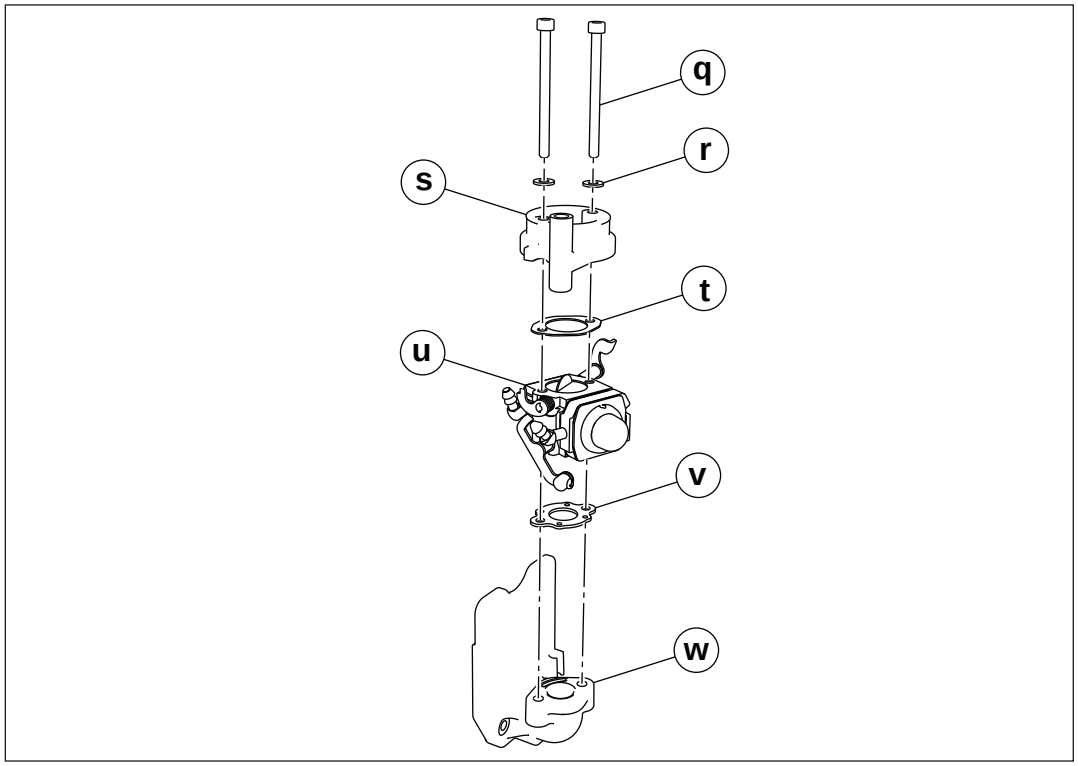
11. Remove two screws **(q)** and two washers **(r)** to disassemble the air tube adapter **(s)**, upper gasket **(t)**, carburetor **(u)**, lower gasket **(v)**, and the carburetor adapter **(w)**.



wc_gr012664

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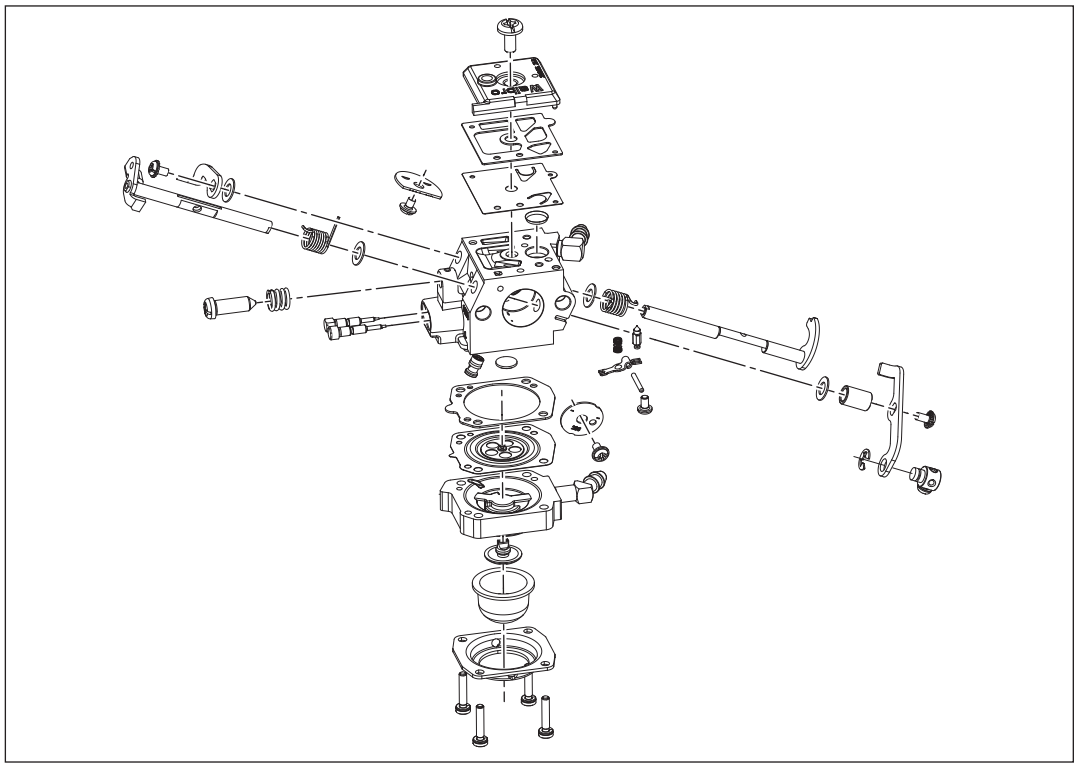
12.Disassemble the carburetor as needed.



wc_gr0126□8

Result The carburetor has now been removed.

4.18 Installing the Carburetor—WM80 oil injected

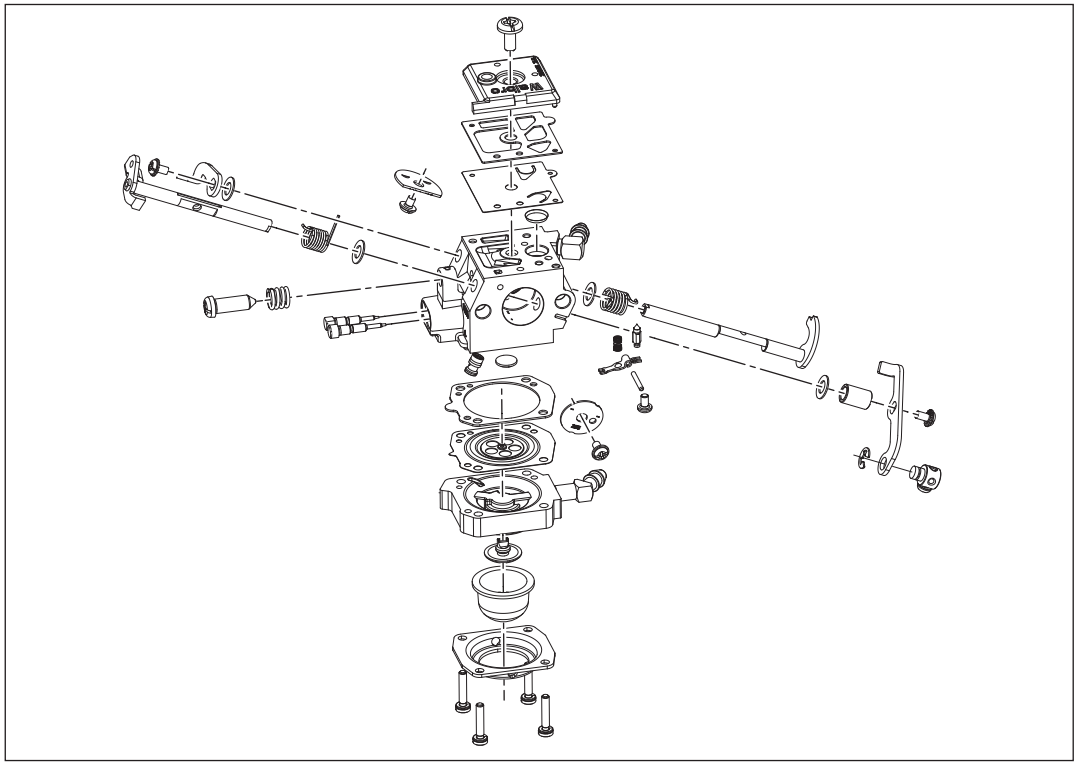
WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- Torque wrench
- Loctite® 243

Procedure Perform the procedure below to install the carburetor.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Assemble the carburetor as needed.



wc_gr0126□8

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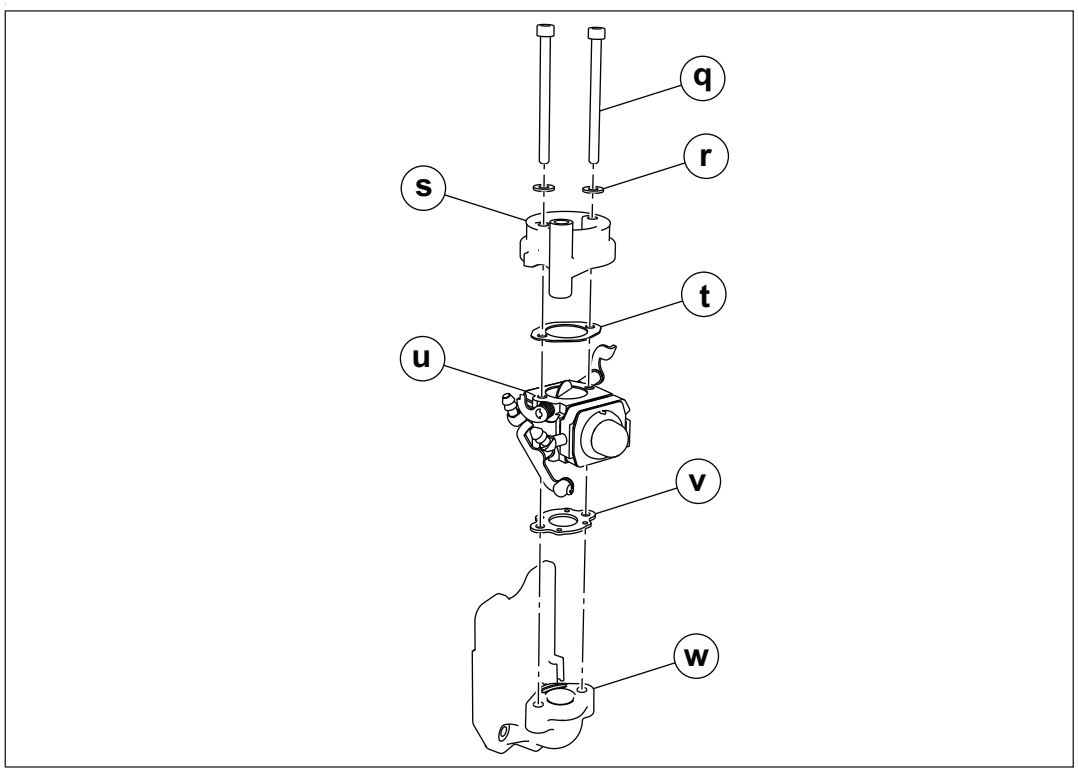
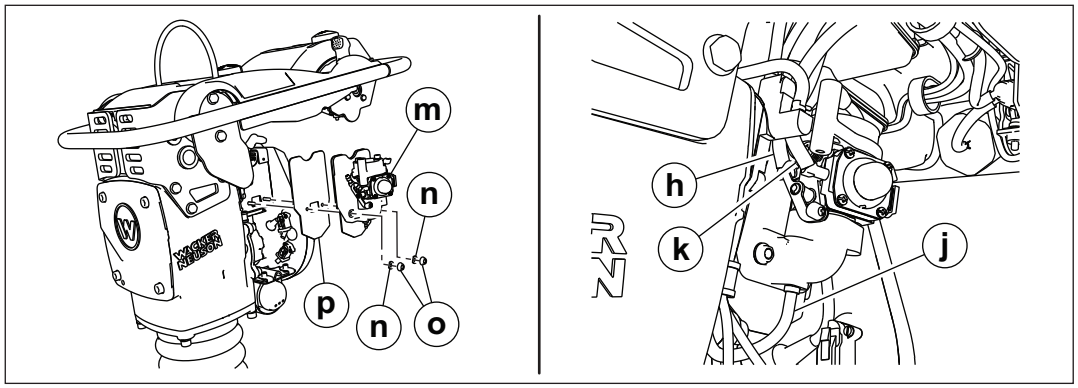
2. Assemble the air tube adapter **(s)**, upper gasket **(t)**, carburetor **(u)**, and lower gasket **(v)** to the carburetor adapter **(w)** with screws **(q)** and washers **(r)**. Torque screws to 5 Nm (4 ft.lbs.).



wc_gr012664

3. Install the two washers **(n)** and two nuts **(o)** fastening the adapter gasket **(p)** and the carburetor assembly **(m)** to the machine. Torque to 10.8 Nm (8 ft.lbs.).



wc_gr012882

4. Connect the fuel filter hose **(h)** and the fuel hose **(k)**.
5. On machines with revision 104 and higher, connect the oil hose **(j)**.

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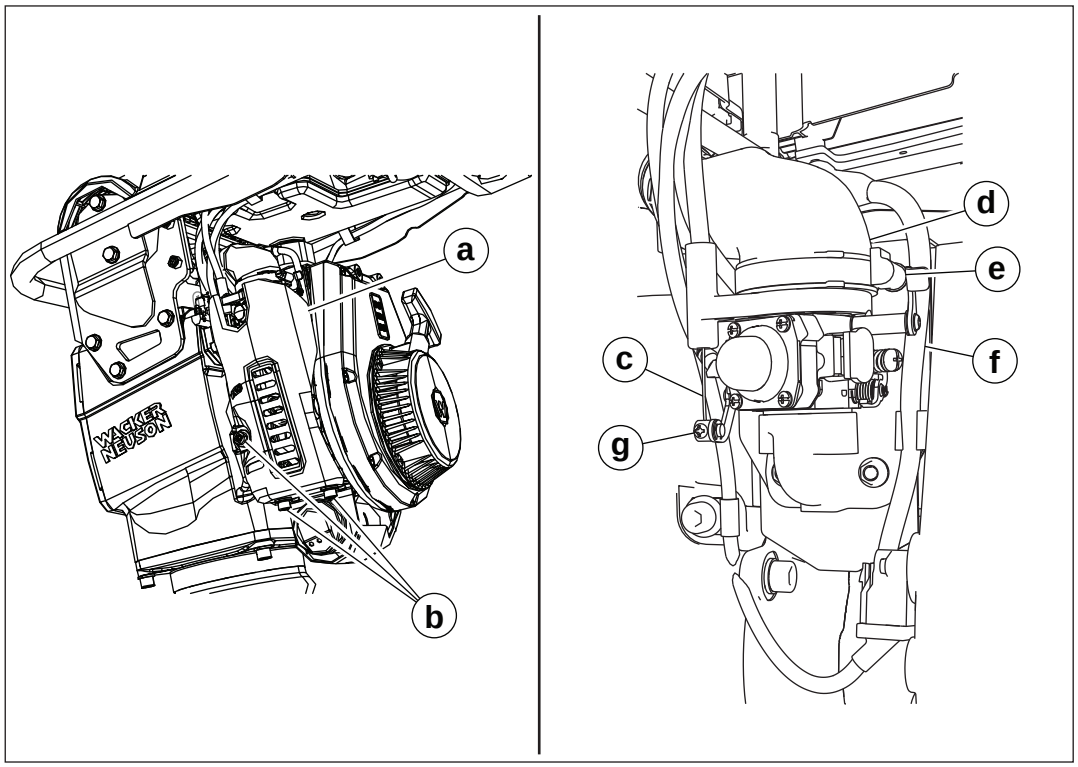
6. Connect the air tube **(d)** to the air tube adapter and tighten clamp **(e)**.



wc_gr012662

7. Install the throttle cable **(c)** and tighten the screw **(g)**.
8. Install the spark plug wire **(f)** into the retainer clip.
9. Apply Loctite® 243 to the three screws **(b)** and fasten the carburetor guard **(a)** to the machine. Torque the screws to 23 Nm (17 ft.lbs.).

Result The carburetor has now been installed.

4.19 Removing the Carburetor—WM80 non-oil injected

WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

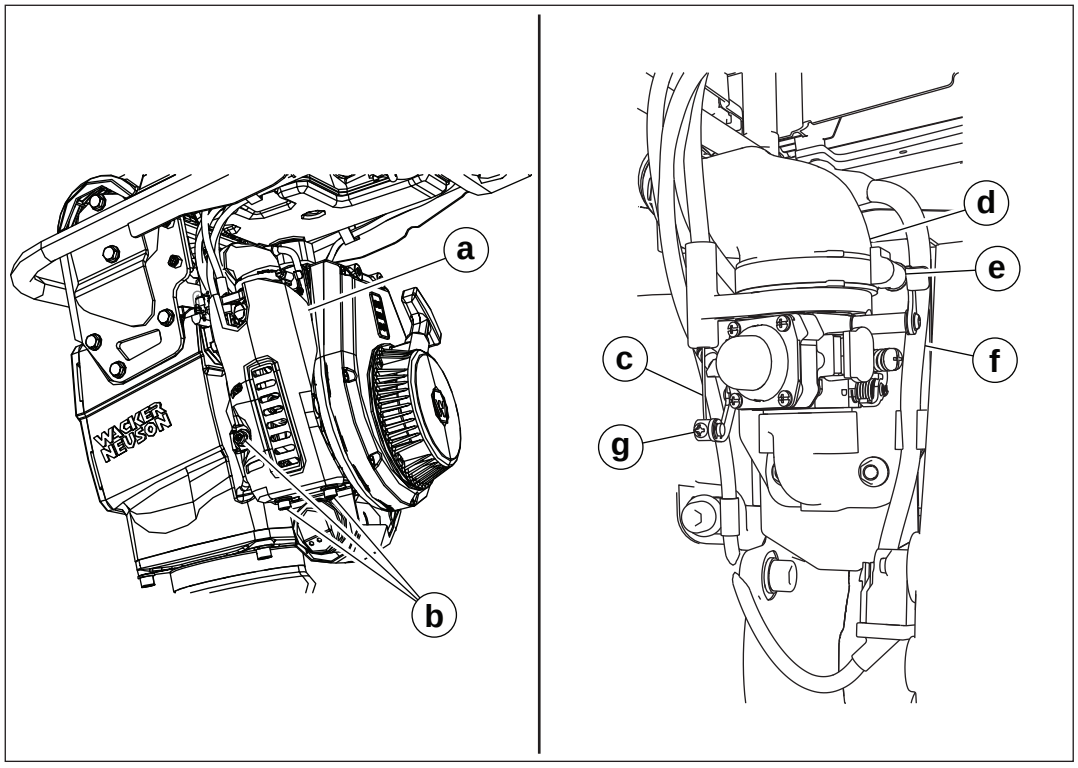
Requirements
- ■ Plastic sheet to protect work surface
- ■ Approved container for drained fuel

Procedure

Perform the procedure below to remove the carburetor.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Drain the fuel tank contents into an approved container.
Note: *Dispose of fuel in accordance with local environmental regulations.*
2. Remove the three screws **(b)** and the carburetor guard **(a)**.



wc_gr012662

3. Loosen screw **(g)** and remove the throttle cable **(c)**.
4. Loosen clamp **(e)** and remove the air tube **(d)**.
5. Remove the spark plug wire **(f)** from the retainer clip.

This procedure continues on the next page.

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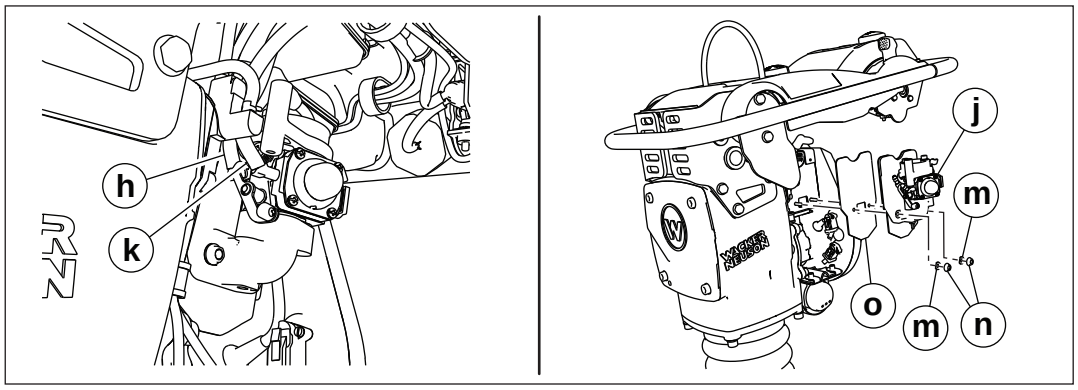
NOTICE: To avoid breaking the fittings, do not pull the hoses off the carburetor fittings. Use a utility knife to cut hose as close to the fitting as possible. Carefully cut the remaining hose from the fitting.

6. Clamp if necessary, then cut the fuel filter hose **(h)** close to carburetor fitting and drain the fuel into an approved container.



wc_gr012890

7. Clamp if necessary, then cut the fuel hose **(k)** close to carburetor fitting and drain the fuel into an approved container.
8. Remove two nuts **(n)** and two washers **(m)** from the carburetor assembly **(j)**.
9. Remove the carburetor assembly **(j)** and the adapter gasket **(o)** from the machine.

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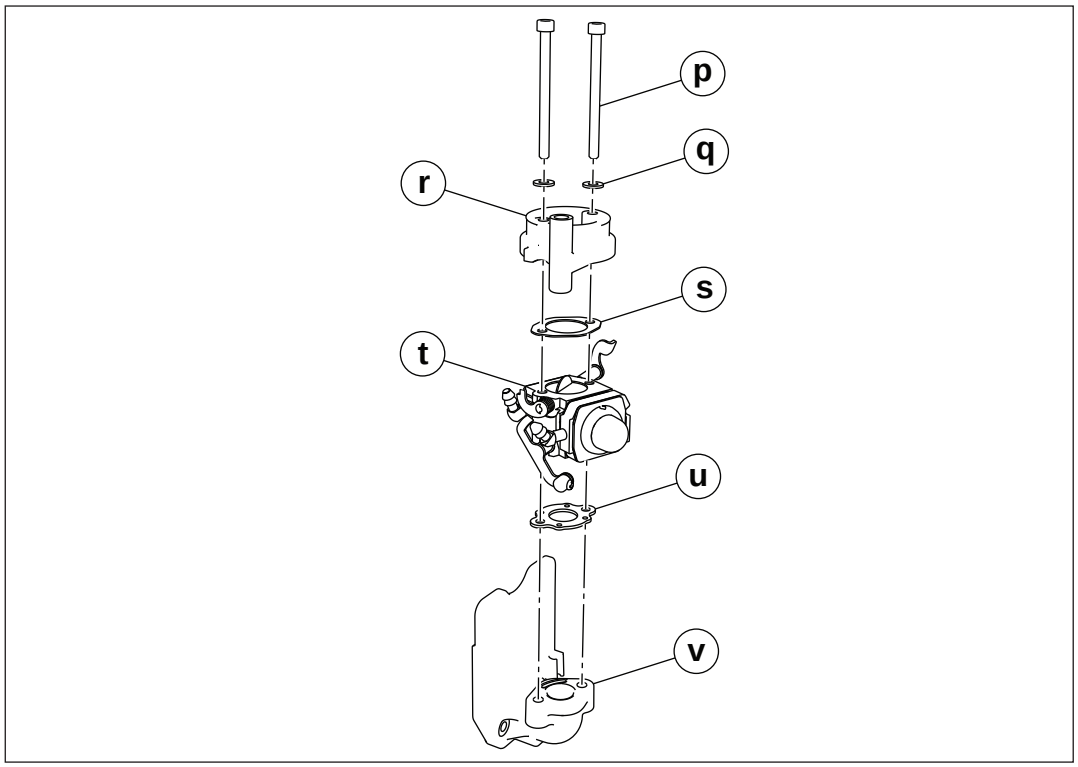
10. Remove two screws **(p)** and two washers **(q)** to disassemble the air tube adapter **(r)**, upper gasket **(s)**, carburetor **(t)**, lower gasket **(u)**, and the carburetor adapter **(v)**.



wc_gr012668

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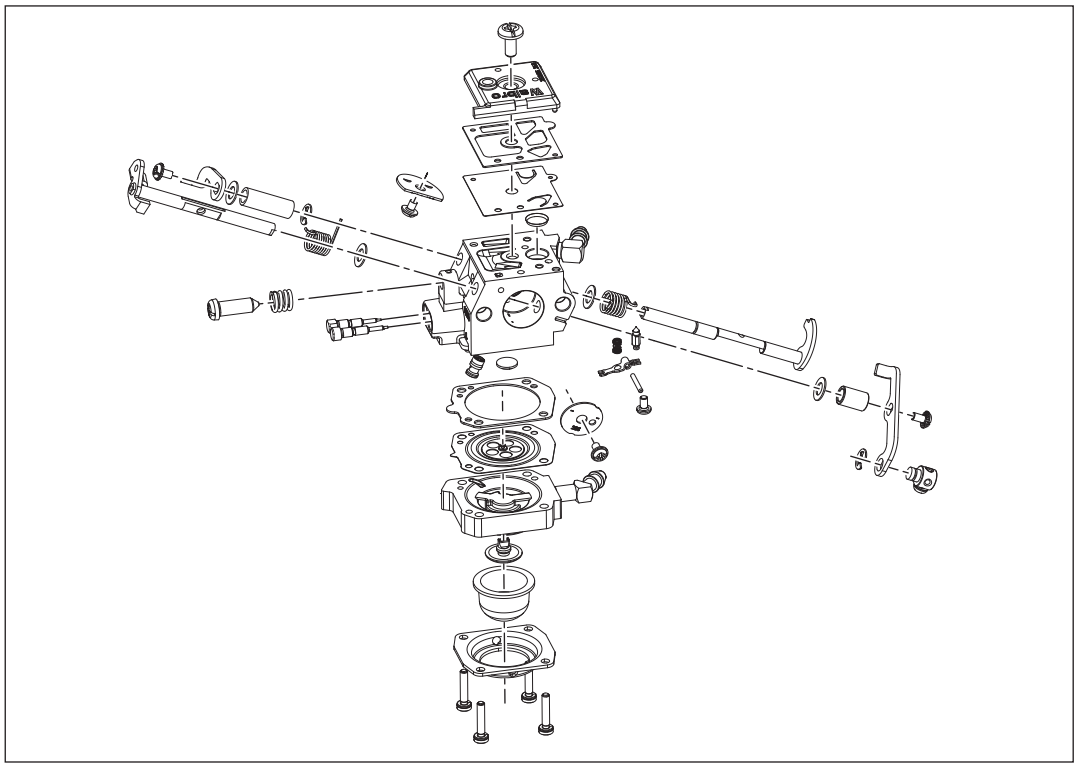
11.Disassemble the carburetor as needed.



wc_gr0126□9

Result The carburetor has now been removed.

4.20 Installing the Carburetor—WM80 non-oil injected

WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

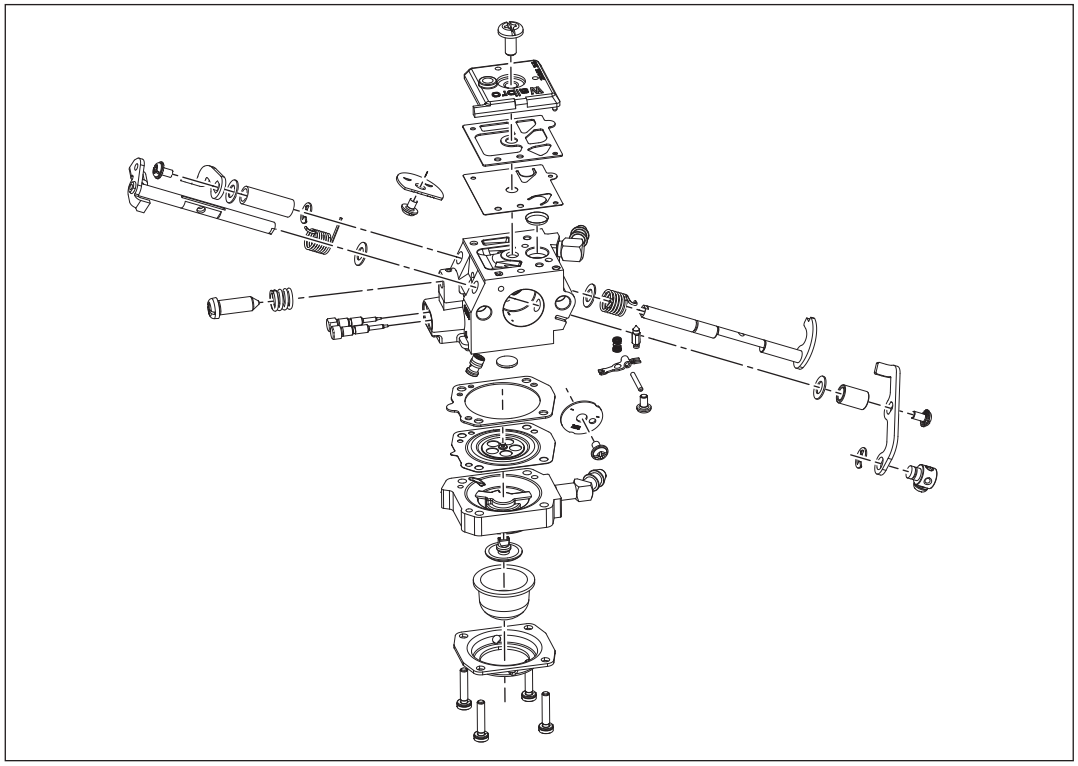
Requirements
- Torque wrench
- Loctite® 243

Procedure

Perform the procedure below to install the carburetor.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Assemble the carburetor as needed.



wc_gr012609

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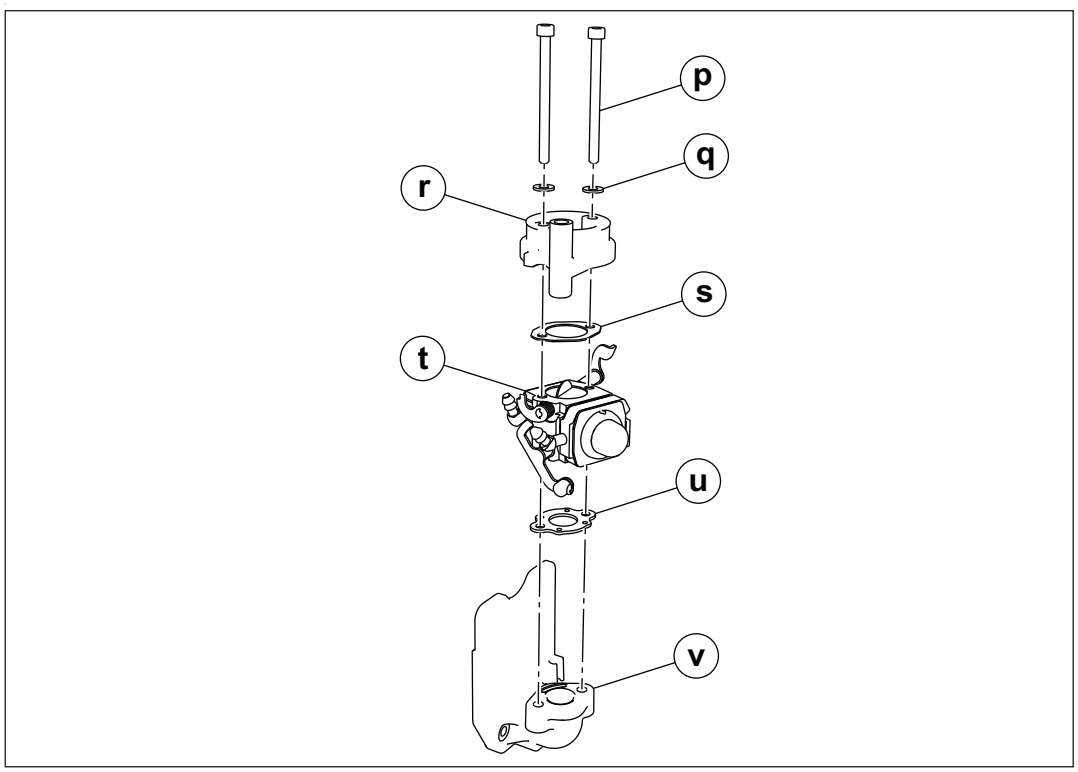
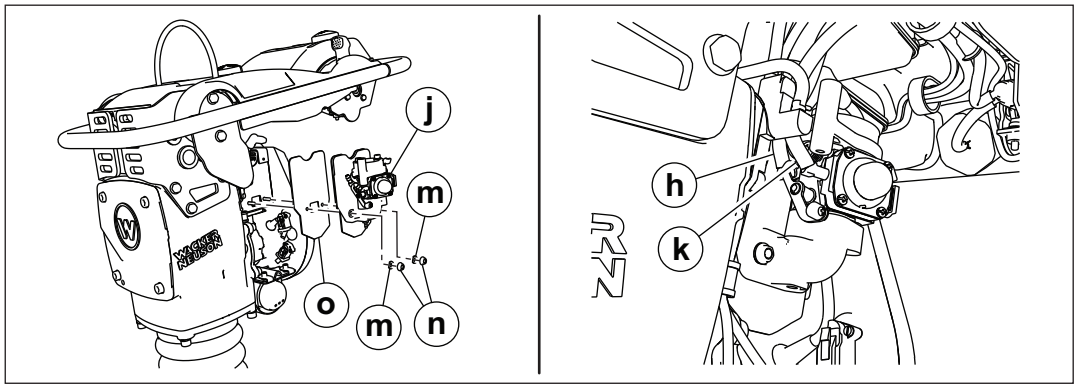
2. Assemble the air tube adapter **(r)**, upper gasket **(s)**, carburetor **(t)**, and lower gasket **(u)** to the carburetor adapter **(v)** with screws **(p)** and washers **(q)**. Torque screws to 5 Nm (4 ft.lbs.).



wc_gr012668

3. Install two washers **(m)** and two nuts **(n)** fastening the adapter gasket **(o)** and the carburetor assembly **(j)** to the machine. Torque nuts to 10.8 Nm (8 ft.lbs.).



wc_gr012889

4. Connect the fuel filter hose **(h)** and the fuel hose **(k)**.

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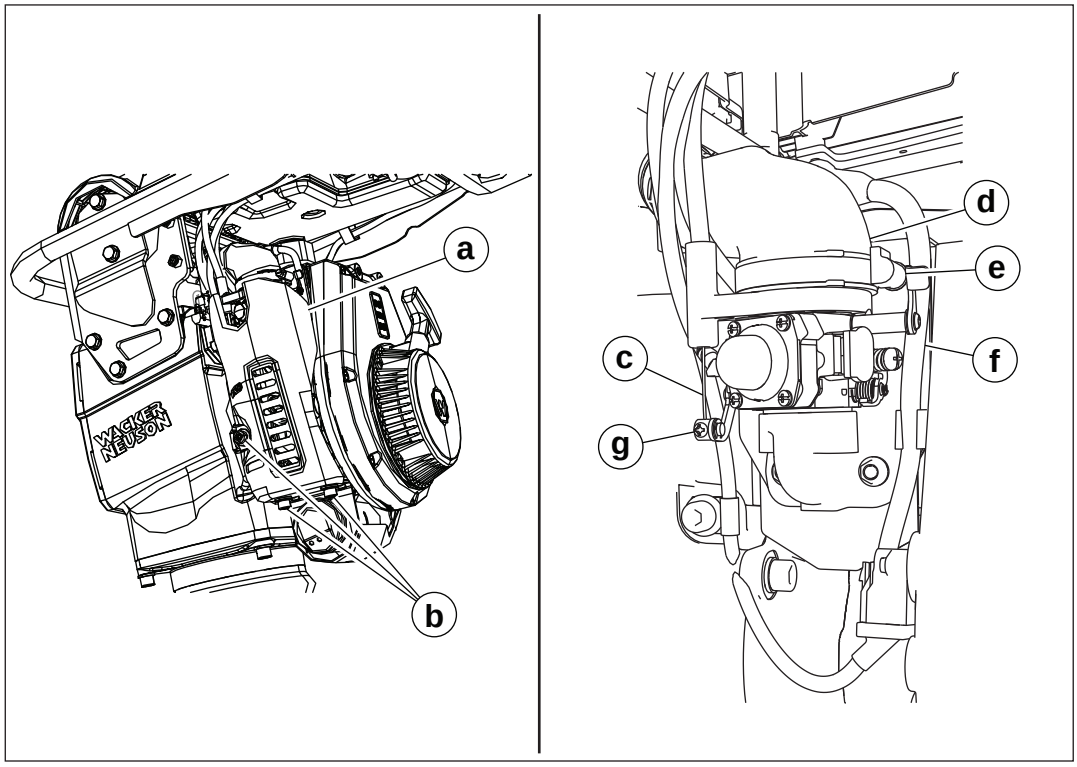
5. Install the spark plug wire **(f)** in the retainer clip.



wc_gr012662

6. Connect the air tube **(d)** and tighten the clamp **(e)**.
7. Install the throttle cable **(c)** and tighten the screw **(g)**.
8. Apply Loctite® 243 to the three screws **(b)** and install the carburetor guard **(a)**. Torque screws to 23 Nm (16 ft.lbs.).

Result The carburetor has now been installed.

4.21 Removing the Carburetor—Robin

WARNING
Fire hazard. Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

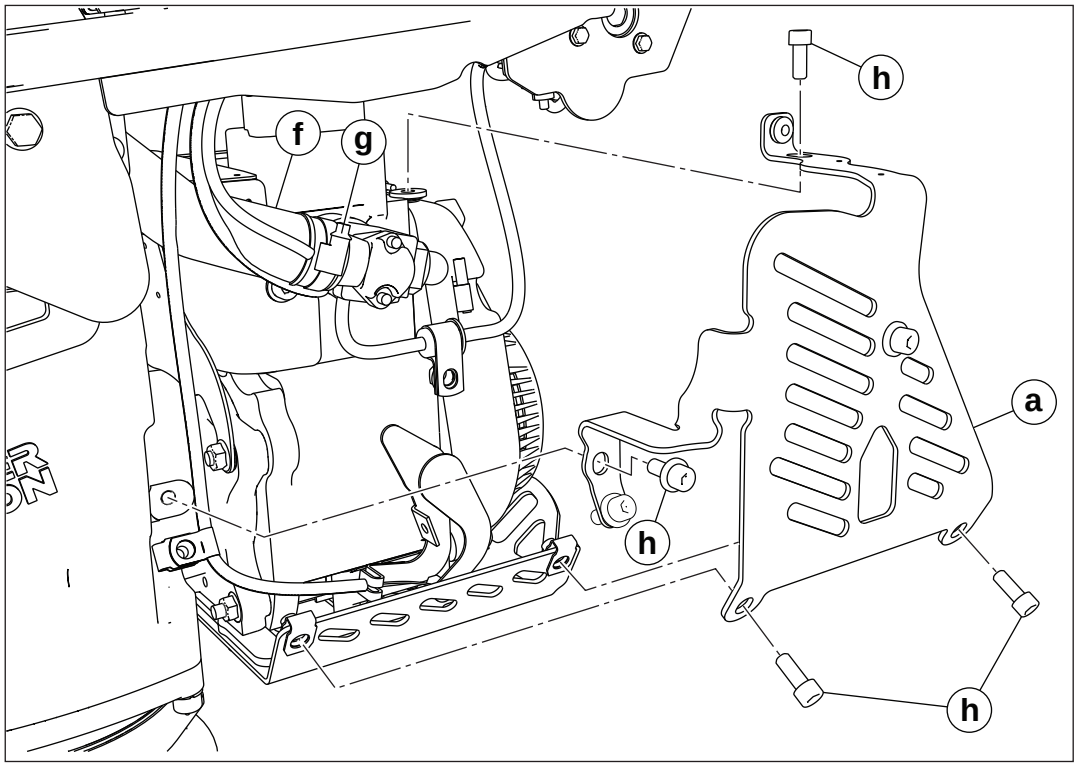
Requirements
- Approved container for drained fuel
- Plastic sheet to protect work surface

Procedure

Perform the procedure below to remove the carburetor.

1. Drain the fuel tank contents into an approved container.
Note: *Dispose of fuel in accordance with local environmental regulations.*

2. Remove the four screws **(h)** and swing the carburetor guard **(a)** to the side.



wc_gr012692

3. Loosen the clamp **(g)** and disconnect the air tube **(f)** from the air intake.

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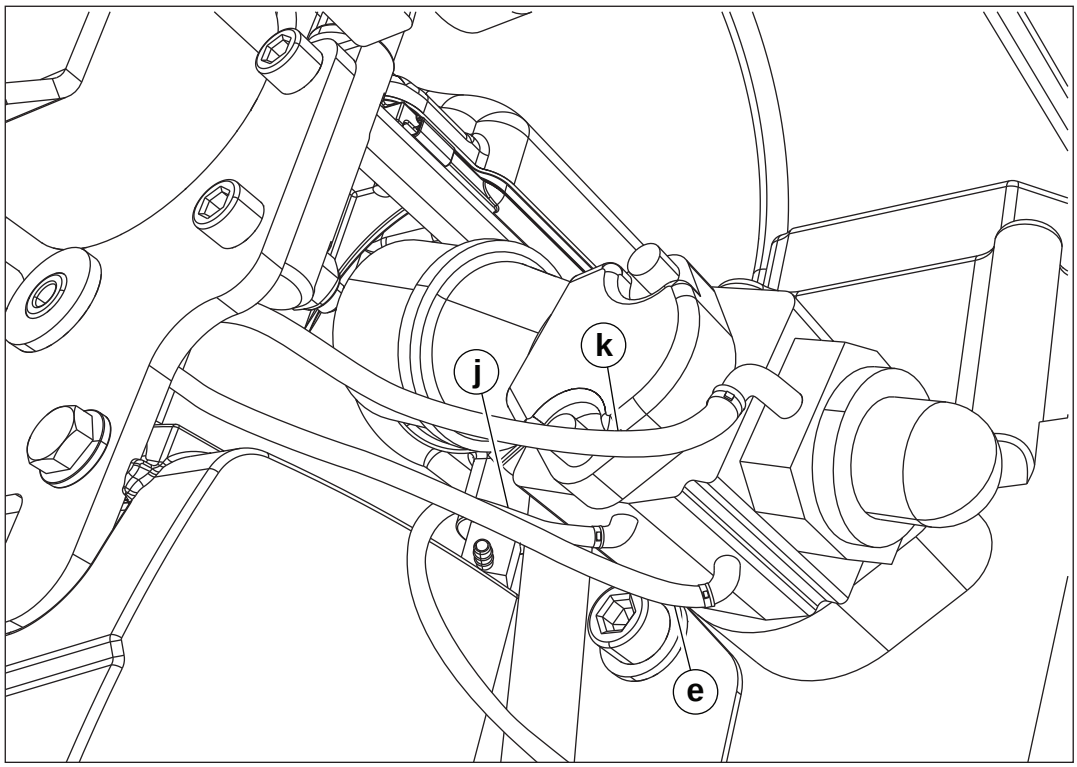
NOTICE: To avoid breaking the fittings, do not pull the hoses off the carburetor fittings. Use a utility knife to cut hose as close to the fitting as possible. Carefully cut the remaining hose from the fitting.

4. Clamp if necessary, then cut the fuel filter hose **(j)** close to the carburetor fitting and drain the fuel into an approved container.



wc_gr0128□4

5. Clamp if necessary, then cut the fuel line hose **(e)** close to the carburetor fitting and drain the fuel into an approved container.
6. Cut the vent hose **(k)** close to the carburetor fitting.

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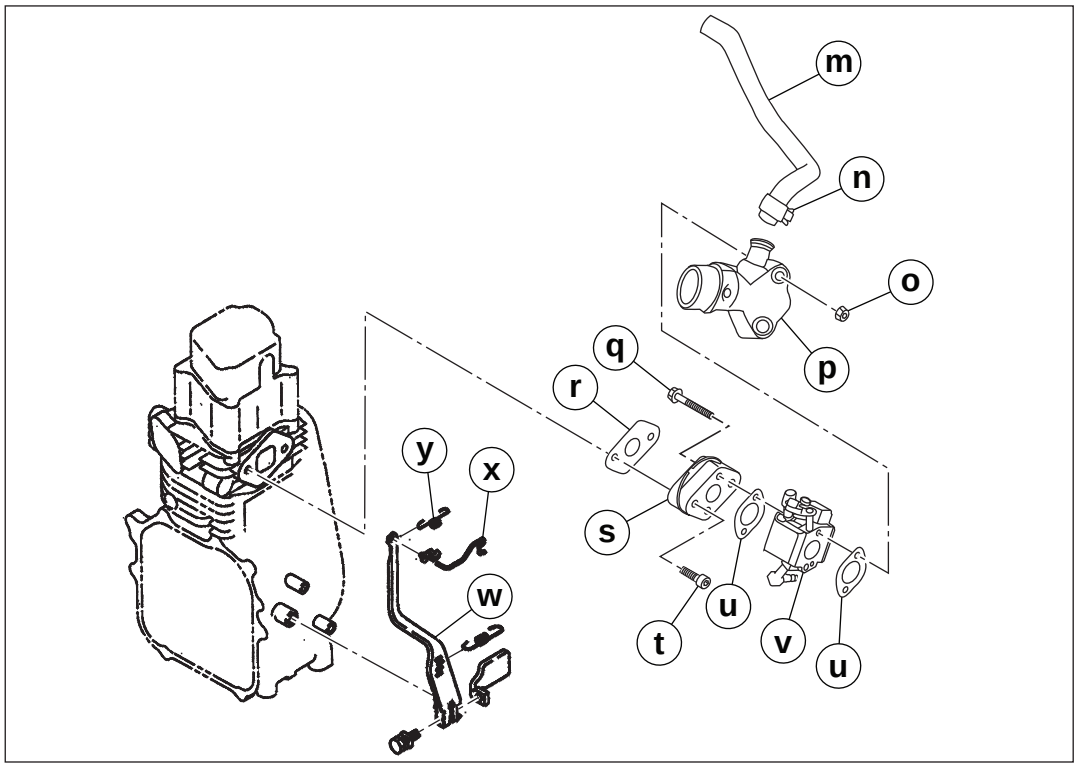
7. Loosen the clamp **(n)** and disconnect the hose **(m)**.



wc_gr0126□4

8. Remove the governor linkage **(x)** and the spring **(y)** connecting the governor **(w)** to the carburetor assembly.
9. Remove two nuts **(o)** and remove the air intake **(p)**, the two gaskets **(u)**, and the carburetor **(v)**.
10. Remove the two screws **(t)** and remove the carburetor adapter **(s)**, the two screws **(q)**, and the gasket **(r)**.

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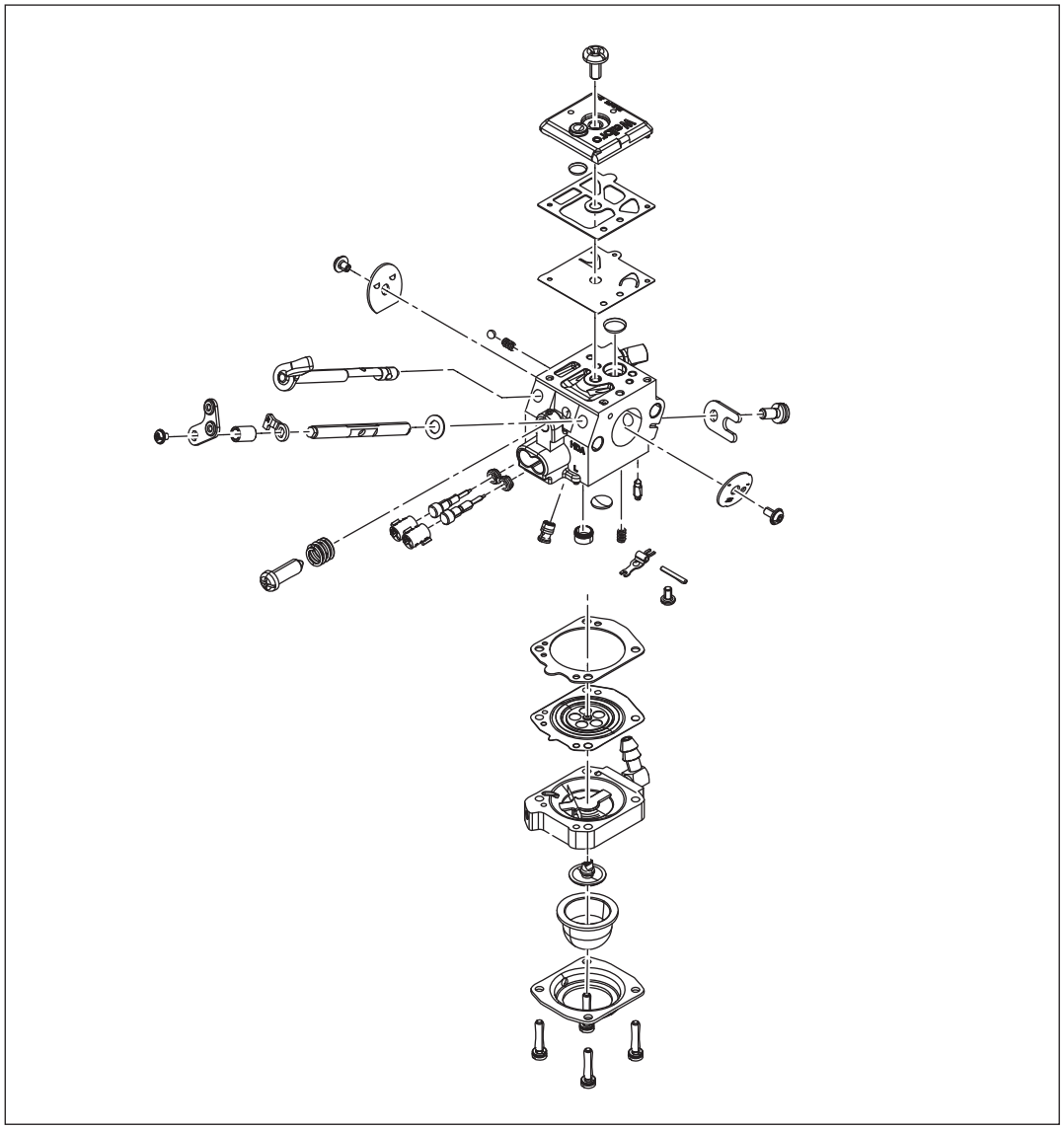
11.Disassemble the carburetor as needed.



wc_gr0126□□

Result The carburetor has now been removed.

4.22 Installing the Carburetor—Robin

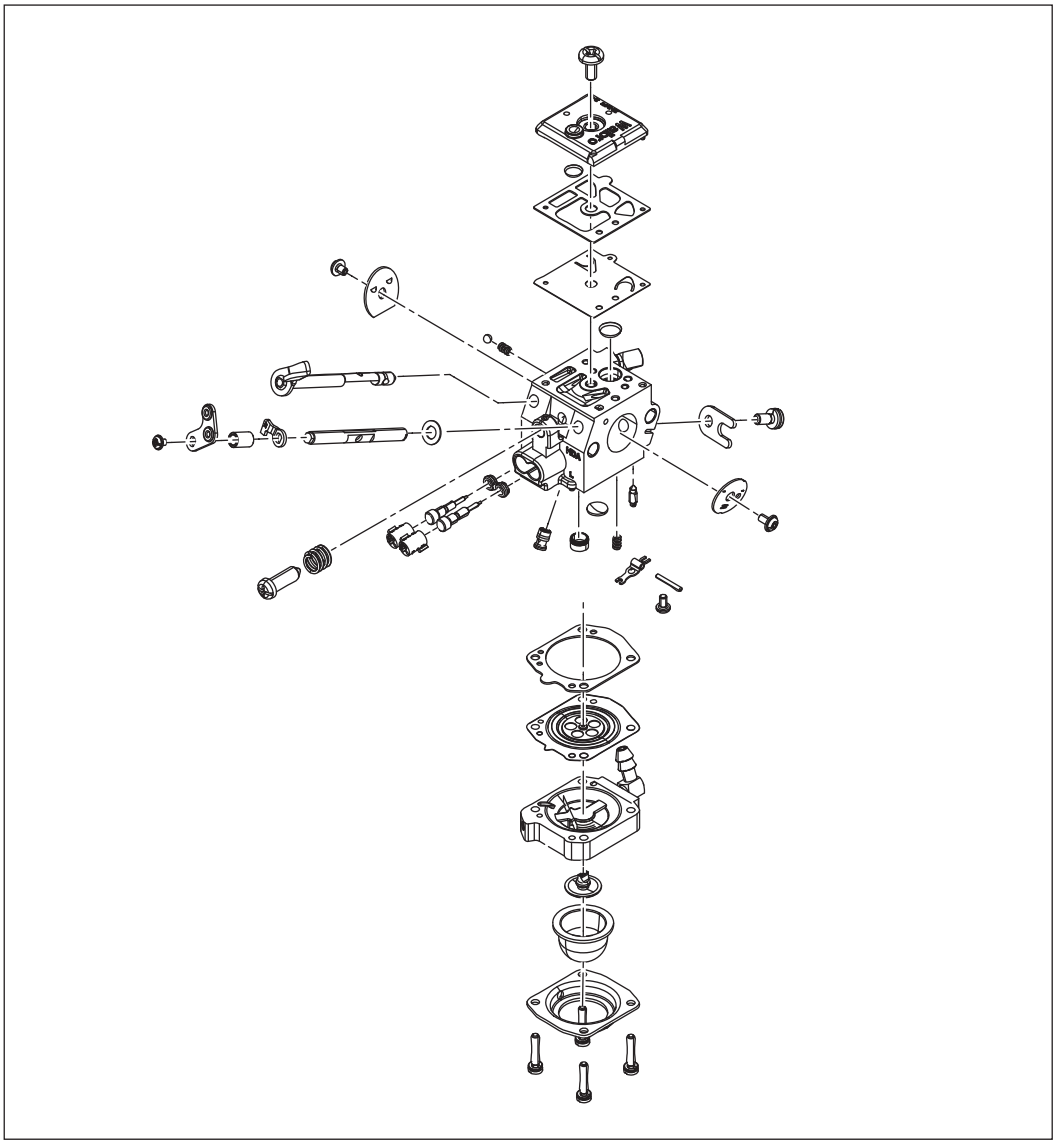
WARNING
Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- Torque wrench
- Loctite® 243

Procedure

Perform the procedure below to install the carburetor.

1. Assemble the carburetor as needed.



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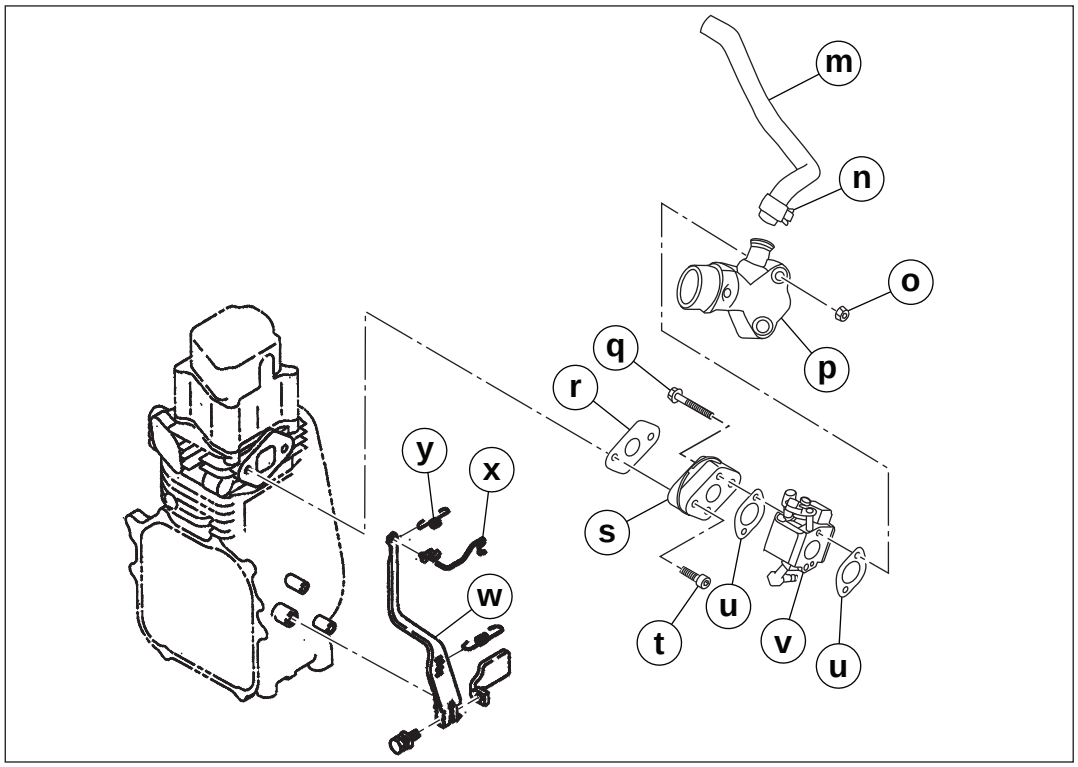
2. Install the two screws **(q)** into the carburetor adapter **(s)**.



wc_gr0126□4

3. Install the two screws **(t)** fastening the gasket **(r)** and the carburetor adapter **(s)** to the engine.
4. Install the two gaskets **(u)**, the carburetor **(v)**, and the air intake **(p)** to the carburetor adapter **(s)**. Fasten using two nuts **(o)**.
5. Install the governor linkage **(x)** and spring **(y)** connecting the governor **(w)** to the carburetor assembly.
6. Connect the hose **(m)** to the air intake and tighten the clamp **(n)**.

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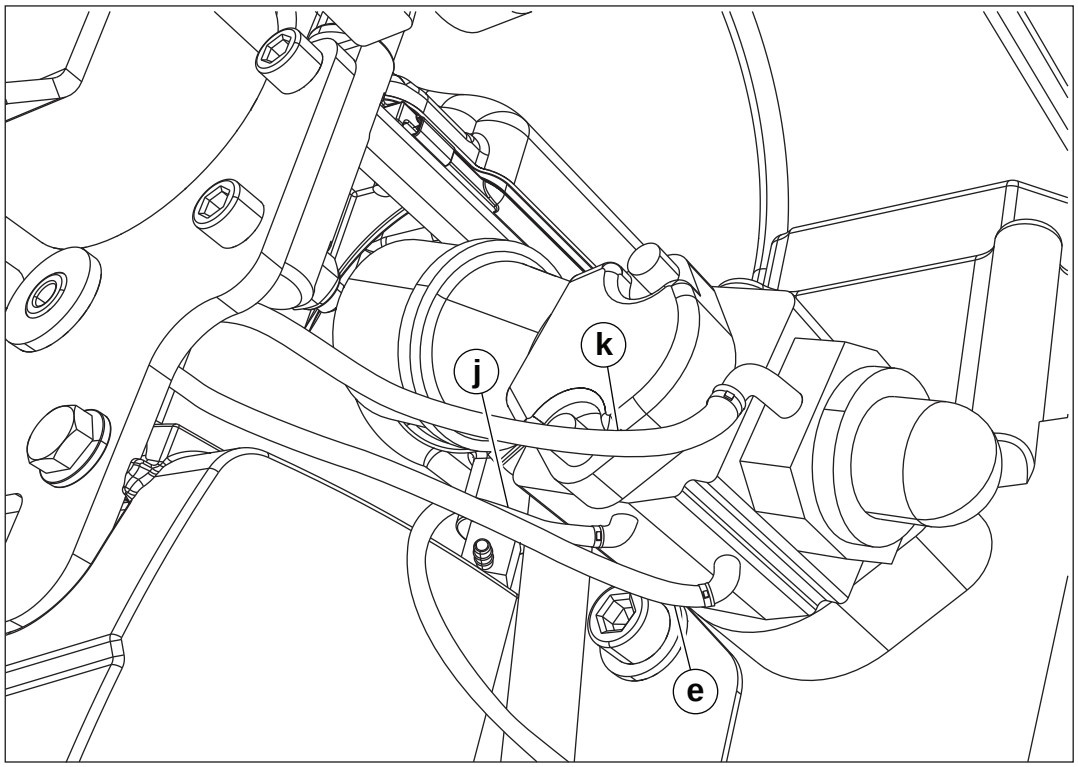
7. Connect the vent hose **(k)**, fuel filter hose **(j)**, and fuel hose **(e)** to the carburetor fittings.



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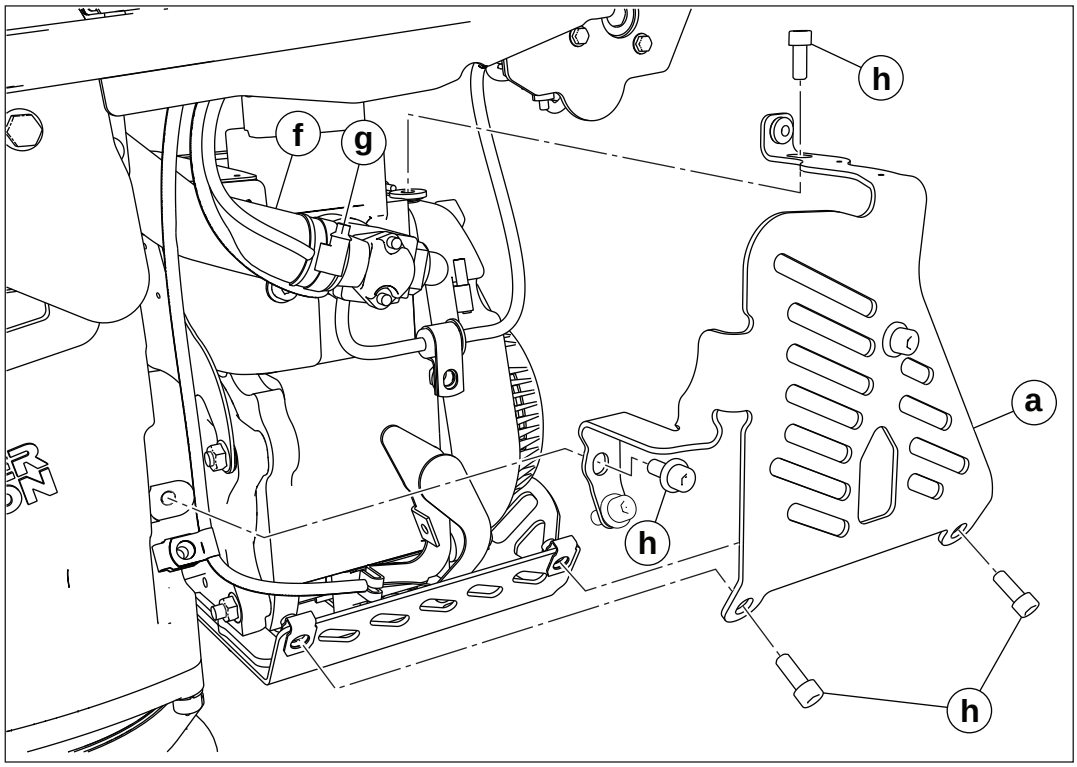
8. Connect the air tube **(f)** to the air intake and tighten the clamp **(g)**.



wc_gr012692

9. Apply Loctite® 243 to the four screws **(h)** and fasten the carburetor guard **(a)** to the machine. Torque the screws to 25 Nm (18 ft.lbs.).

Result The carburetor has now been installed.

4.23 Removing the Carburetor—Honda

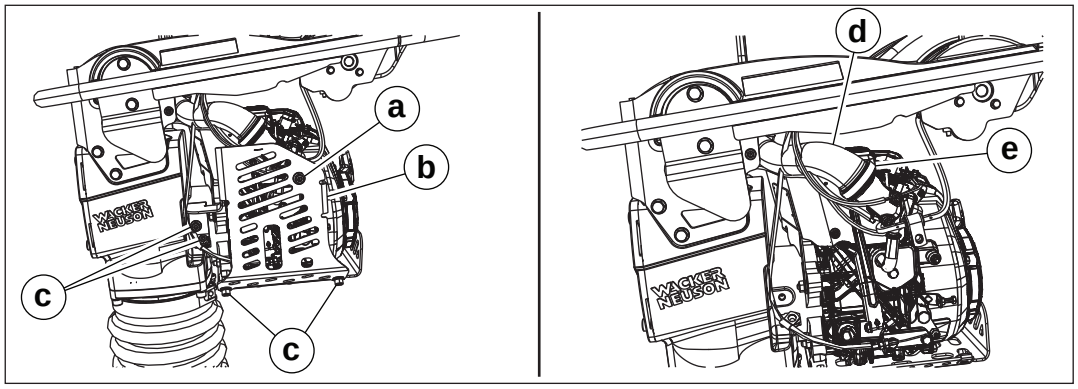
WARNING
Fire hazard. Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- ■ Approved container for drained fuel
- ■ Plastic sheet to protect work surface

Procedure

Perform the procedure below to remove the carburetor.

1. Drain the fuel tank contents into an approved container.
Note: *Dispose of fuel in accordance with local environmental regulations.*
2. Remove any wire ties attached to the carburetor guard **(b)**.



wc_gr012682

3. Remove the screw **(a)** and the nut fastening the fuel filter and the clip to the carburetor guard **(b)**.
4. Remove the four screws **(c)** and the carburetor guard **(b)**.
5. Loosen the hose clamp **(e)** and disconnect the air tube **(d)**.

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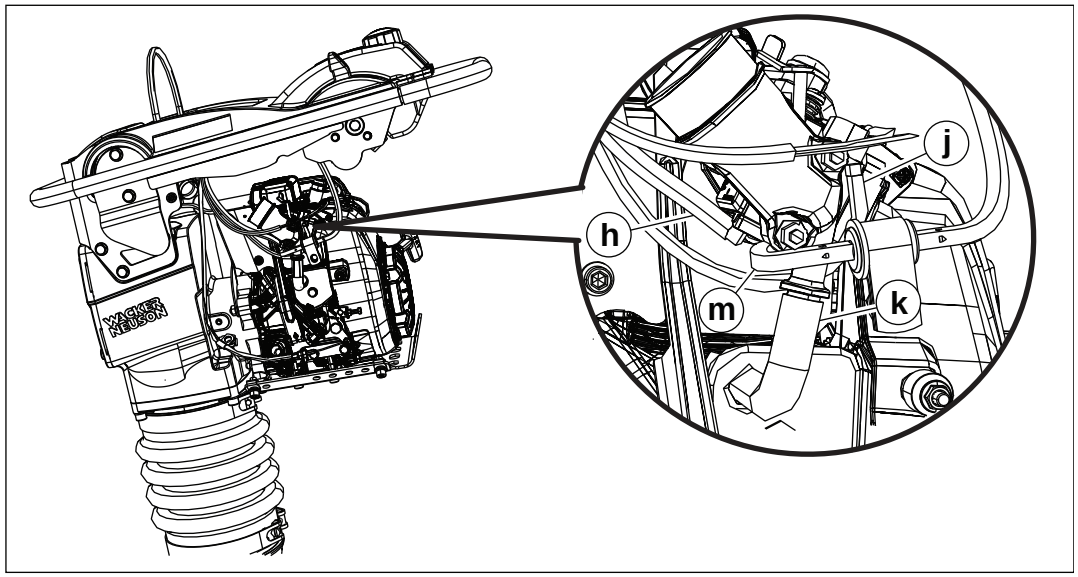
NOTICE: To avoid breaking the fittings, do not pull the hoses off the carburetor fittings. Use a utility knife to cut hose as close to the fitting as possible. Carefully cut the remaining hose from the fitting.

6. Clamp if necessary, then cut the fuel filter hose **(m)** close to carburetor fitting and drain the fuel into an approved container.



wc_gr01268

7. Clamp if necessary, then cut the fuel hose **(h)** close to carburetor fitting and drain the fuel into an approved container.
8. Cut the vent hose **(j)** close to carburetor fitting.
9. Disconnect the breather tube **(k)** from the carburetor.

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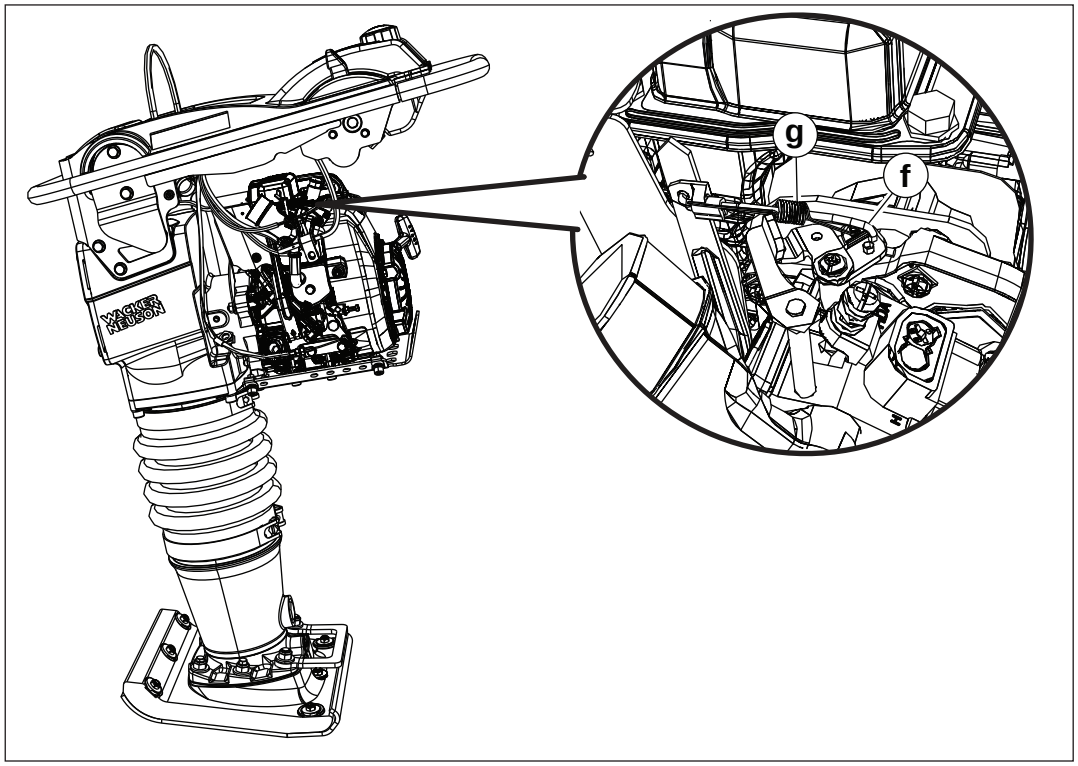
10. Remove the governor rod **(f)** and the spring **(g)** connecting the governor arm to the carburetor.



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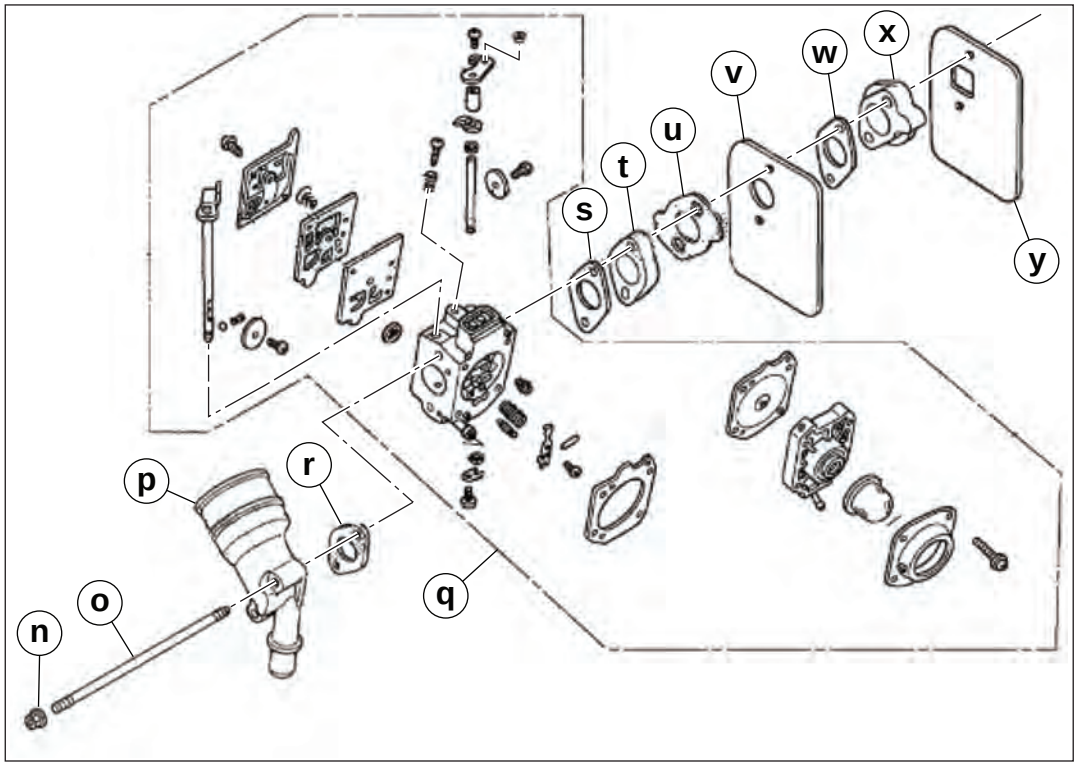
11.Remove the two nuts **(n)** from the two stud bolts **(o)**.



wc_gr01268

12.Remove the elbow **(p)**, the gasket **(r)**, and the carburetor **(q)** from the two stud bolts **(o)**.

13.Remove five gaskets **(s)**, **(t)**, **(u)**, **(w)**, and **(y)**, one plate **(v)**, and one insulator **(x)** from the two stud bolts **(o)**.

14.Disassemble the carburetor as needed.

Result The carburetor has now been removed.

4.24 Installing the Carburetor—Honda

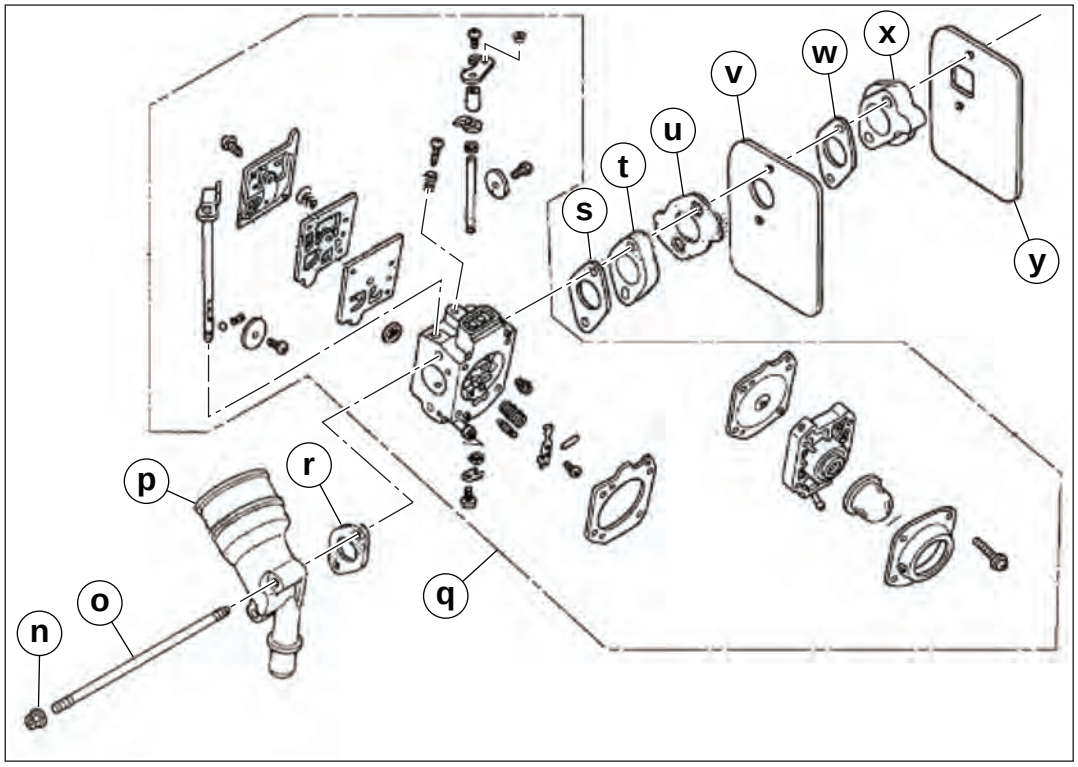
WARNING
Fire hazard. Fuel is flammable and may ignite.
- ► Keep all sources of ignition far away while performing this procedure.
- ► Clean up spilled fuel immediately.

Requirements
- Torque wrench
- Plastic sheet to protect work surface

Procedure

Perform the procedure below to install the carburetor.

1. Assemble the carburetor **(q)** as needed.



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2. Install the five gaskets **(s)**, **(t)**, **(u)**, **(w)**, and **(y)**, one plate **(v)**, and one insulator **(x)** to the two stud bolts **(o)**.
3. Install the carburetor **(q)**, the gasket **(r)**, and the elbow **(p)**, to the two stud bolts **(o)**.
4. Fasten using two nuts **(n)**.

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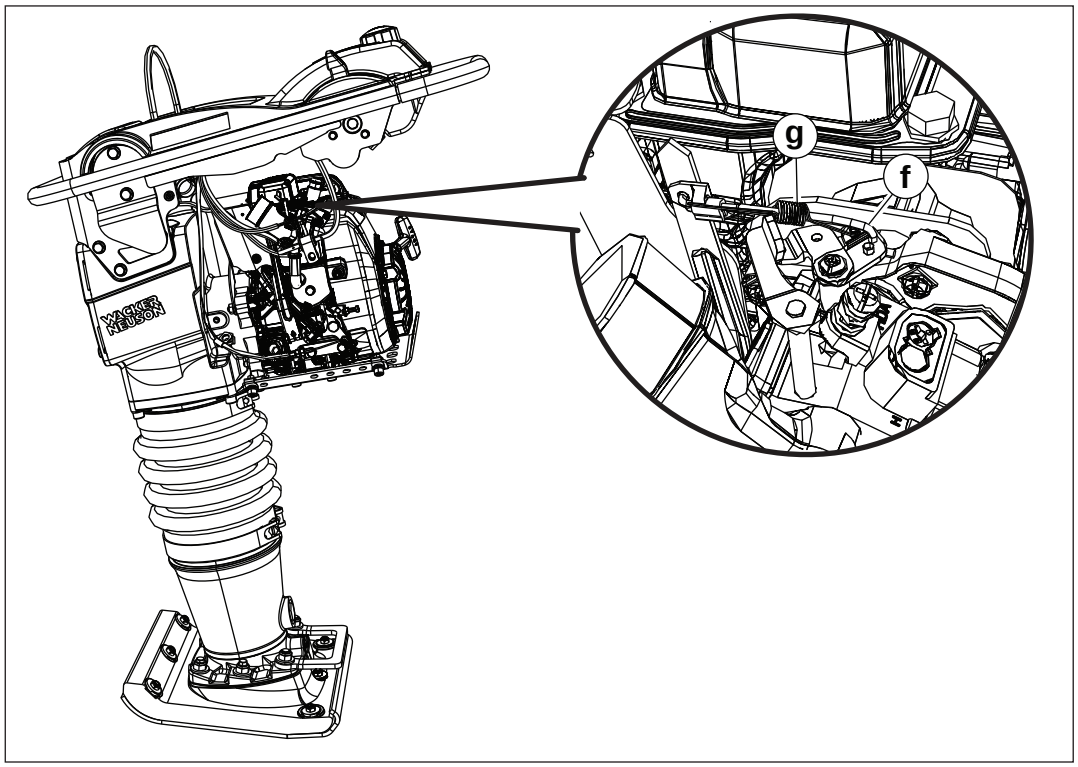
5. Install the governor rod **(f)** and the spring **(g)** connecting the governor arm to the carburetor.



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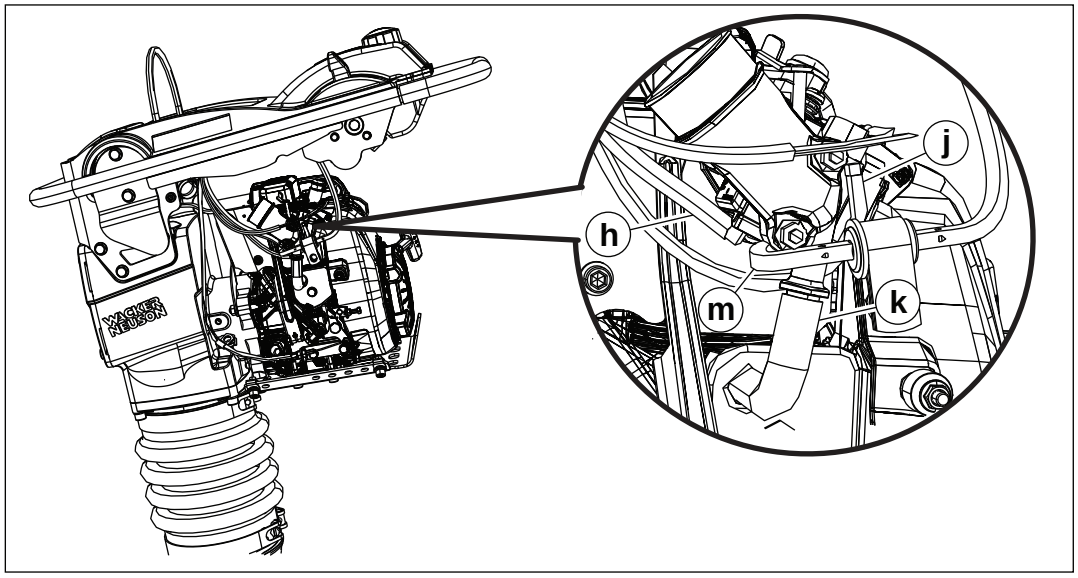
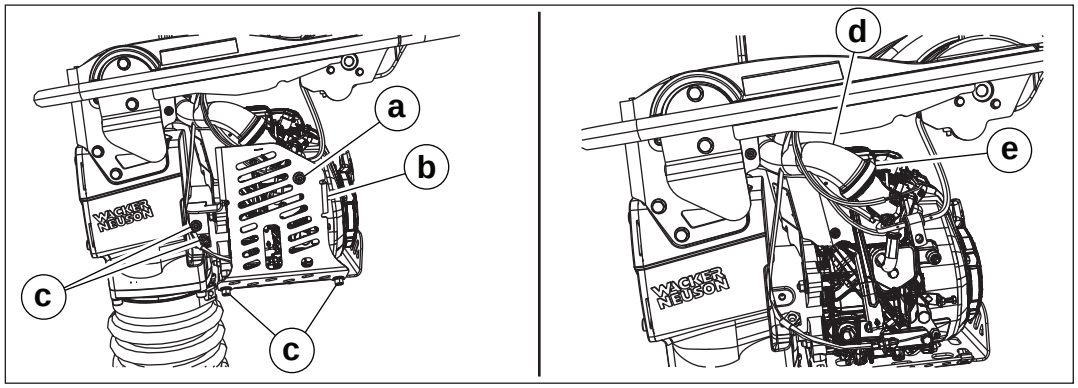
6. Connect the fuel filter hose **(m)**, the vent hose **(j)**, and the fuel hose **(h)** to the carburetor fittings.



wc_gr01268

7. Connect the breather tube **(k)** to the carburetor.
8. Connect the air tube **(d)** and tighten the hose clamp **(e)**.



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9. Apply Loctite® 243 to the four screws **(c)** and fasten the carburetor guard **(b)** to the machine. Torque the screws to 25 Nm (18 ft.lbs.).
10. Apply Loctite® 243 to the screw **(a)** and the nut fastening the fuel filter and clip to the carburetor guard **(b)**. Torque the screw to 25 Nm (18 ft.lbs.).
11. Install any wire ties attached to the carburetor guard **(b)**.

Result The carburetor has now been installed.

4.25 Removing the Engine—WM 80

Requirements

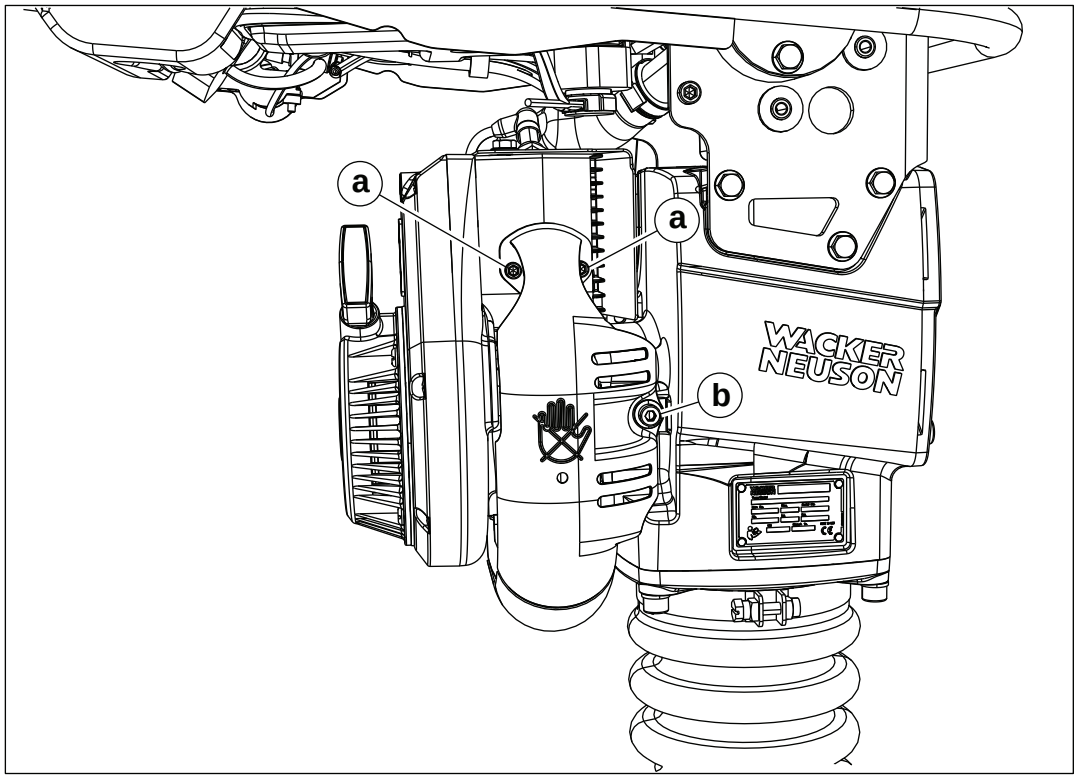
- Machine shut down and cool
- Carburetor removed

Procedure

Perform the procedure below to remove the WM 80 engine.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the carburetor. See topic *Removing the Carburetor—WM80 oil injected or Removing the Carburetor—WM80 non-oil injected.*
2. Remove the screws **(a)** and **(b)**.



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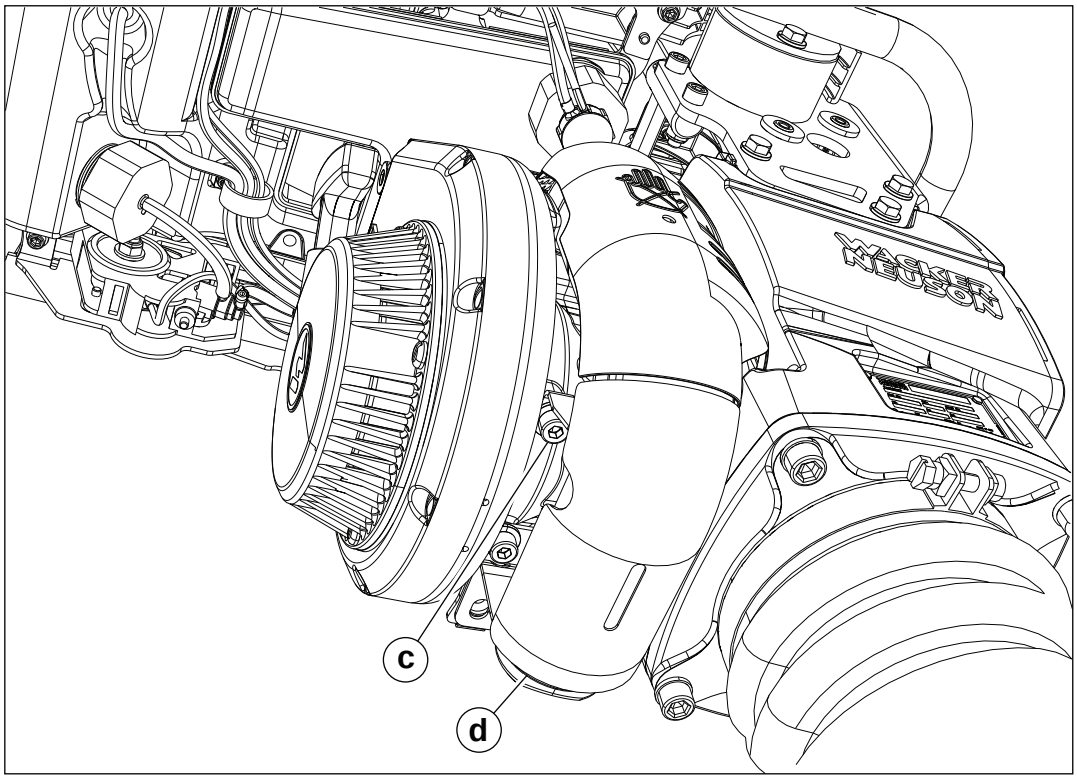
3. Remove the screw **(c)** and the muffler assembly **(d)**.



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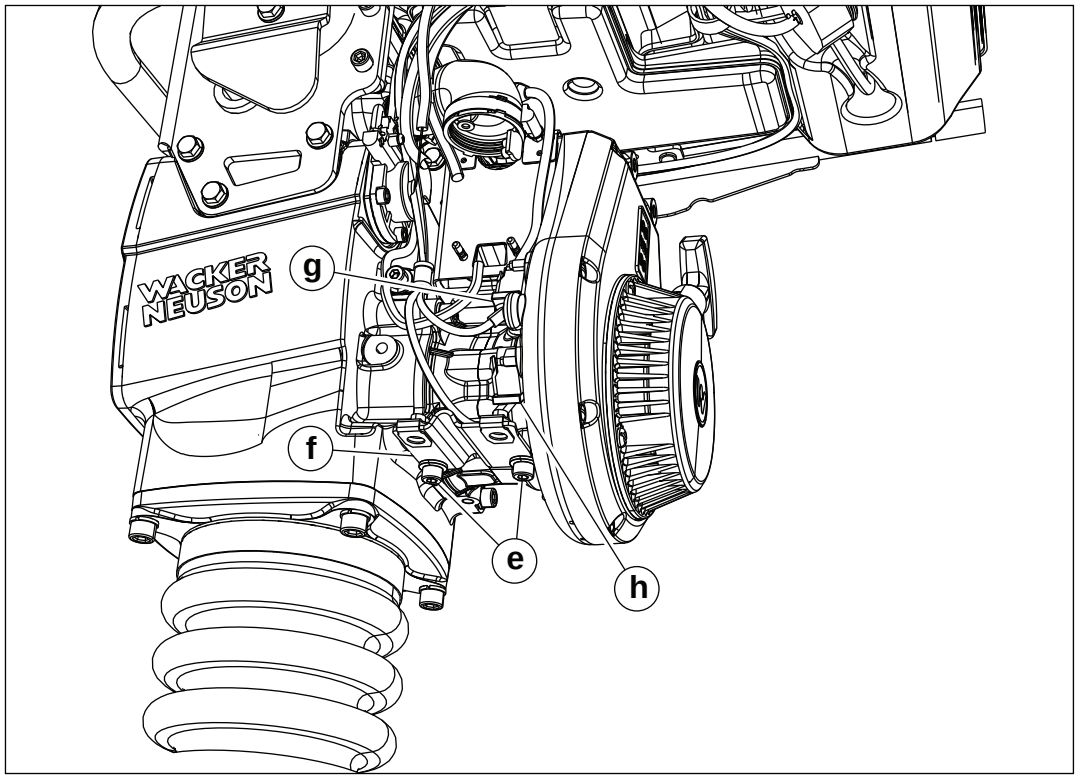
4. Remove the two screws **(e)** and the bracket **(f)**.



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5. Disconnect the stop switch connector **(g)** and the float switch connector **(h)** (if equipped).

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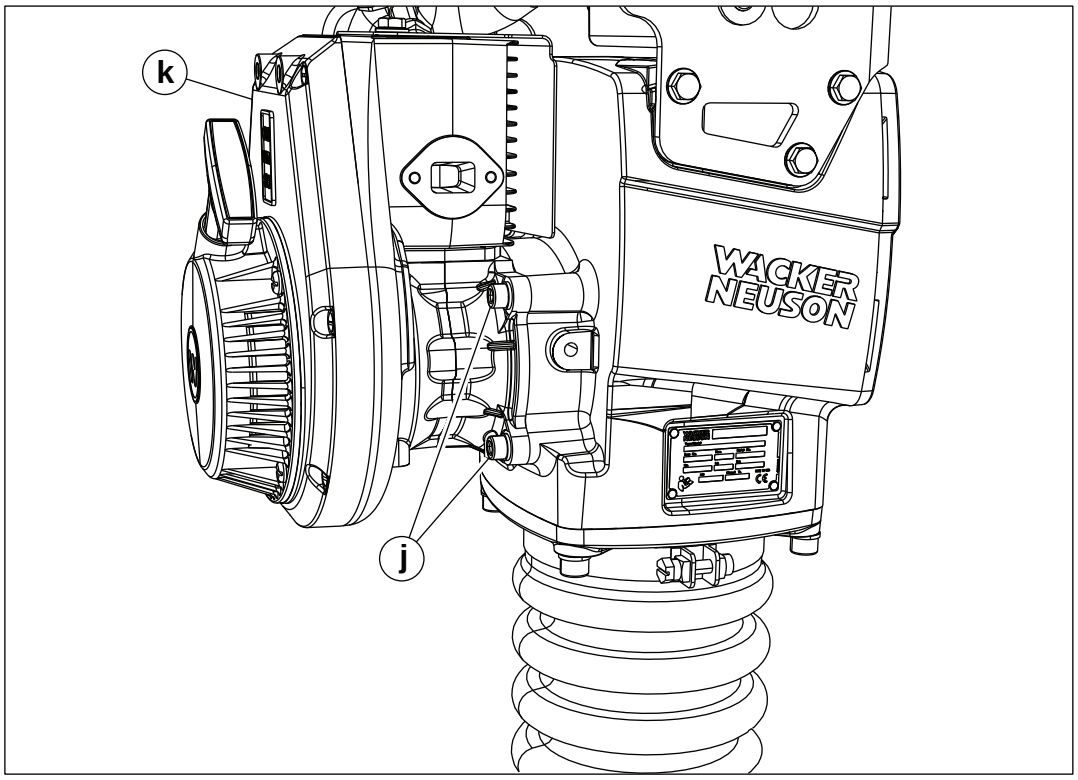
6. Remove the screws **(j)** on each side and remove the engine **(k)**.



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Result The engine has now been removed.

4.26 Installing the Engine—WM 80

Requirements

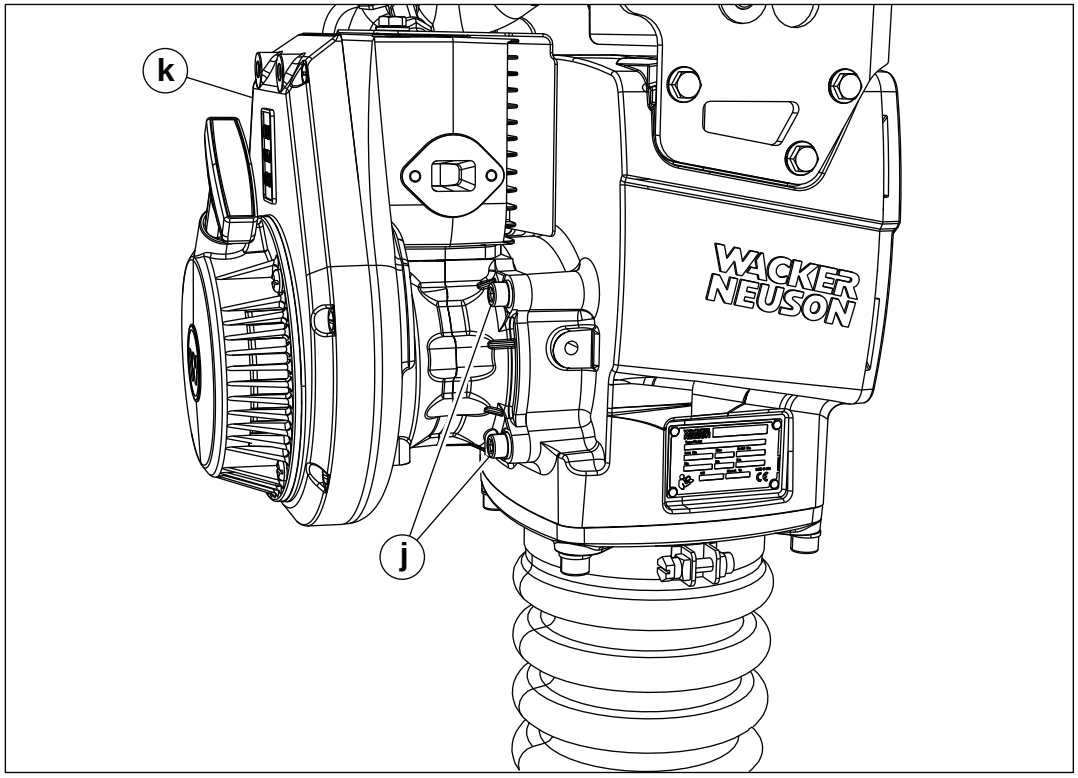
- Torque wrench
- Loctite® 243

Procedure

Perform the procedure below to install the engine.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Apply Loctite® 243 to the four screws **(j)** and fasten the engine **(k)** to the machine. Torque the screws to 27 Nm (20 ft.lbs.).



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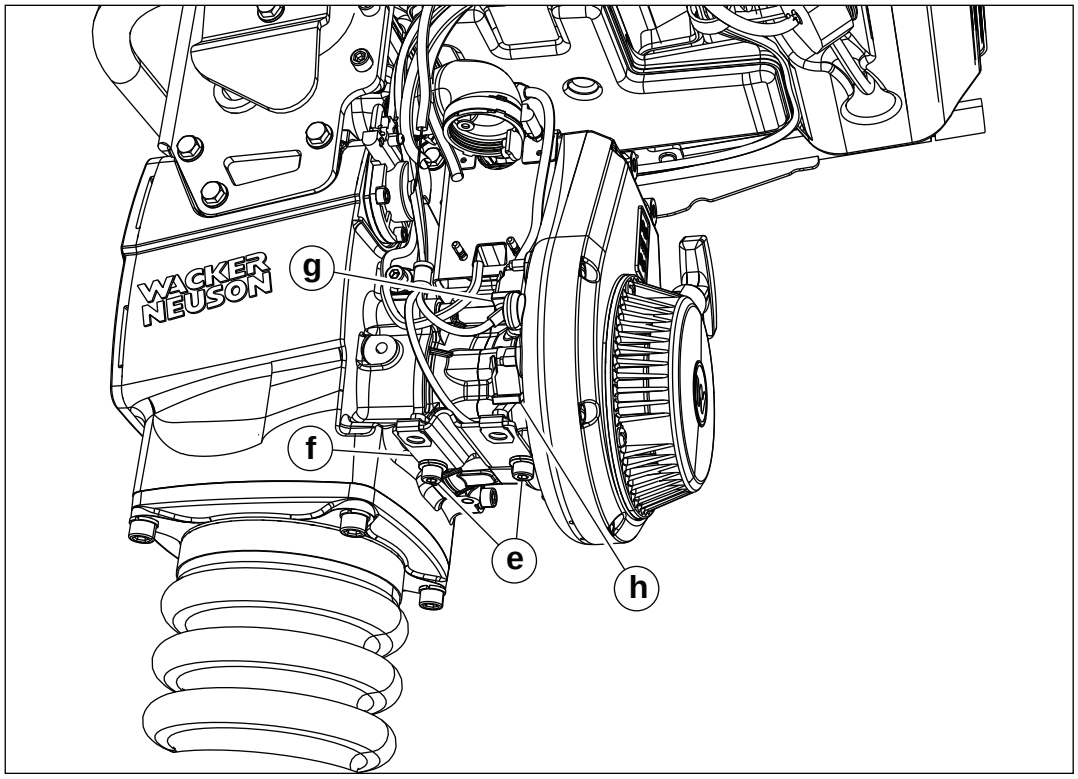
2. Apply Loctite® 243 to the screws **(e)** and fasten the bracket **(f)** to the machine. Torque the screws to 24 Nm (18 ft.lbs.).



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3. Connect the stop switch connector **(g)** and the float switch connector **(h)** (if equipped).

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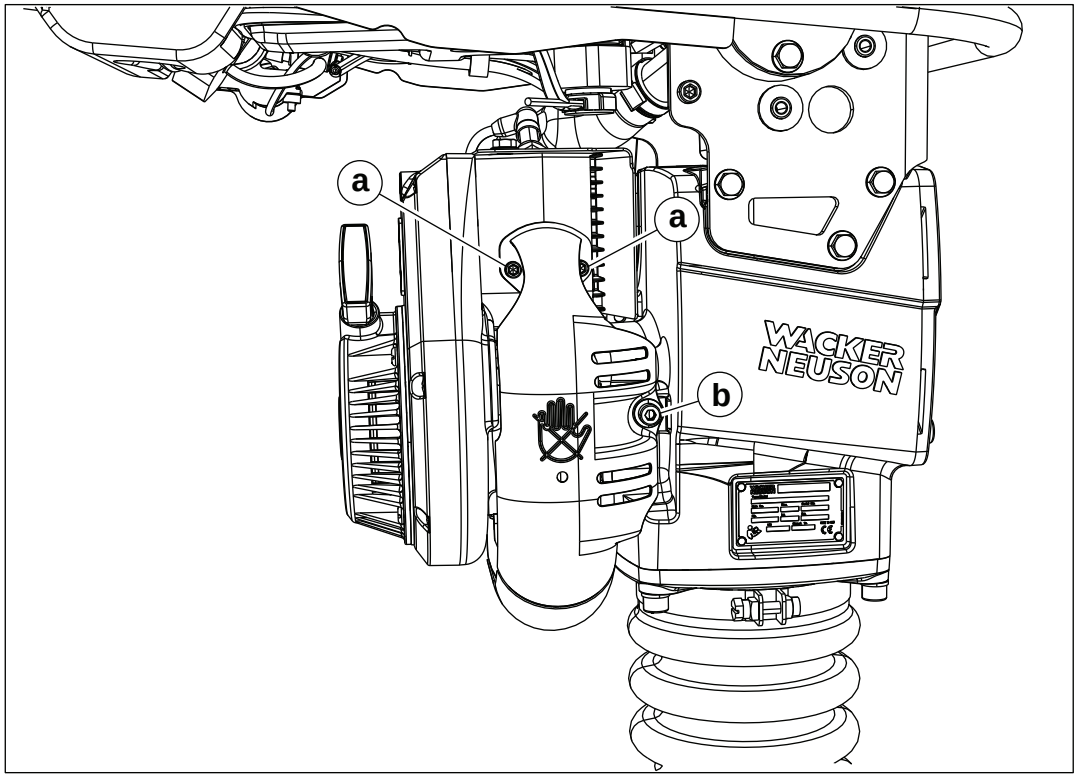
4. Hold the muffler flush to the bottom of the engine. Apply Loctite® 243 to the screw **(a)**. Install and torque the screw to 18 Nm (13 ft.lbs.).
5. Apply Loctite® 243 to the screw **(b)**. Install and torque the screw to 24 Nm (18 ft.lbs.).



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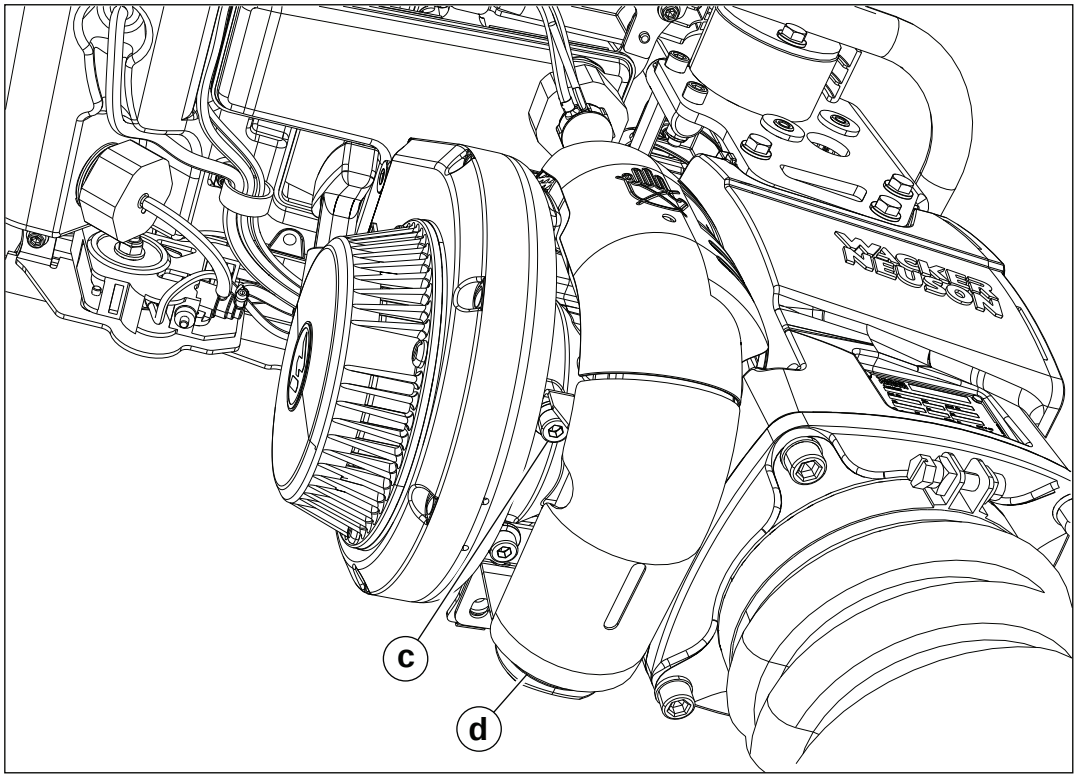
6. Apply Loctite® 243 to the screw **(c)**. Install and torque the screw to 24 Nm (18 ft.lbs.).



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7. Install the carburetor. See topic *Installing the Carburetor—WM80 oil injected or Installing the Carburetor—WM80 non-oil injected*.

Result The engine has now been installed.

4.27 Removing the Engine—Honda

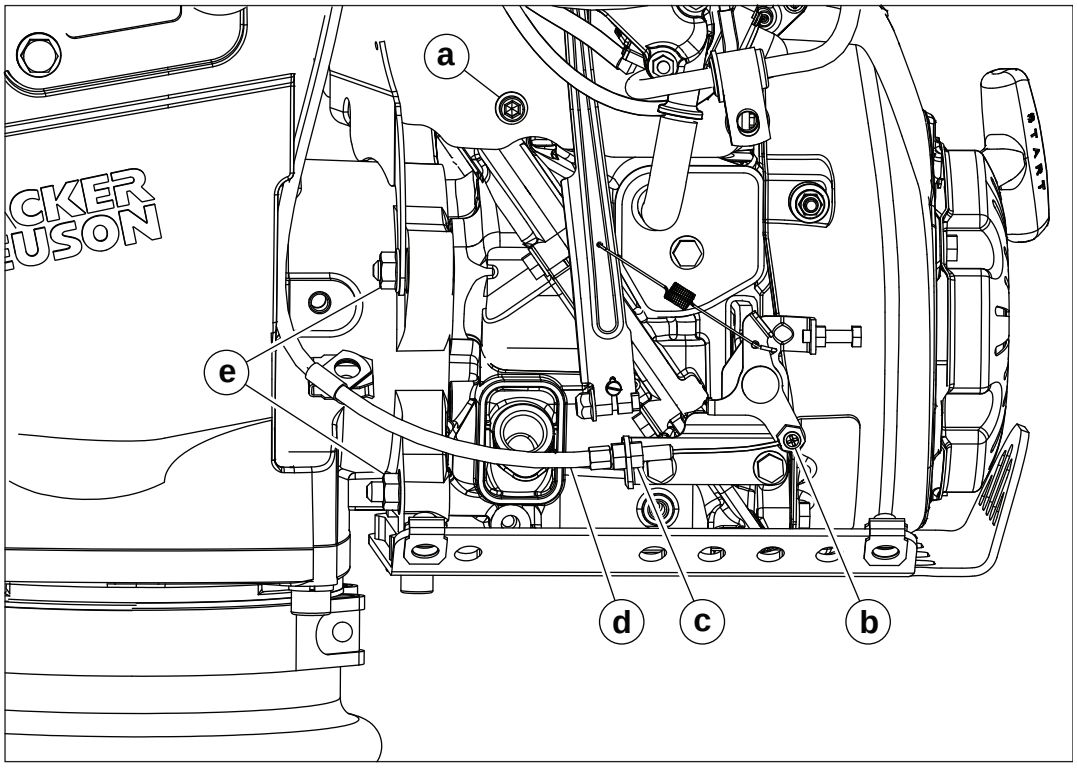
Requirements

- Machine shut down and cool
- Carburetor removed

Procedure

Perform the procedure below to remove the GX100 (Honda) engine.

1. Remove the carburetor. See topic *Removing the Carburetor—Honda.*
2. Loosen the screw **(b)** and the nut **(c)** and remove the throttle cable **(d)** from the engine.



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3. Remove the two engine mounting nuts **(e)** and the one heat shield screw **(a)**.

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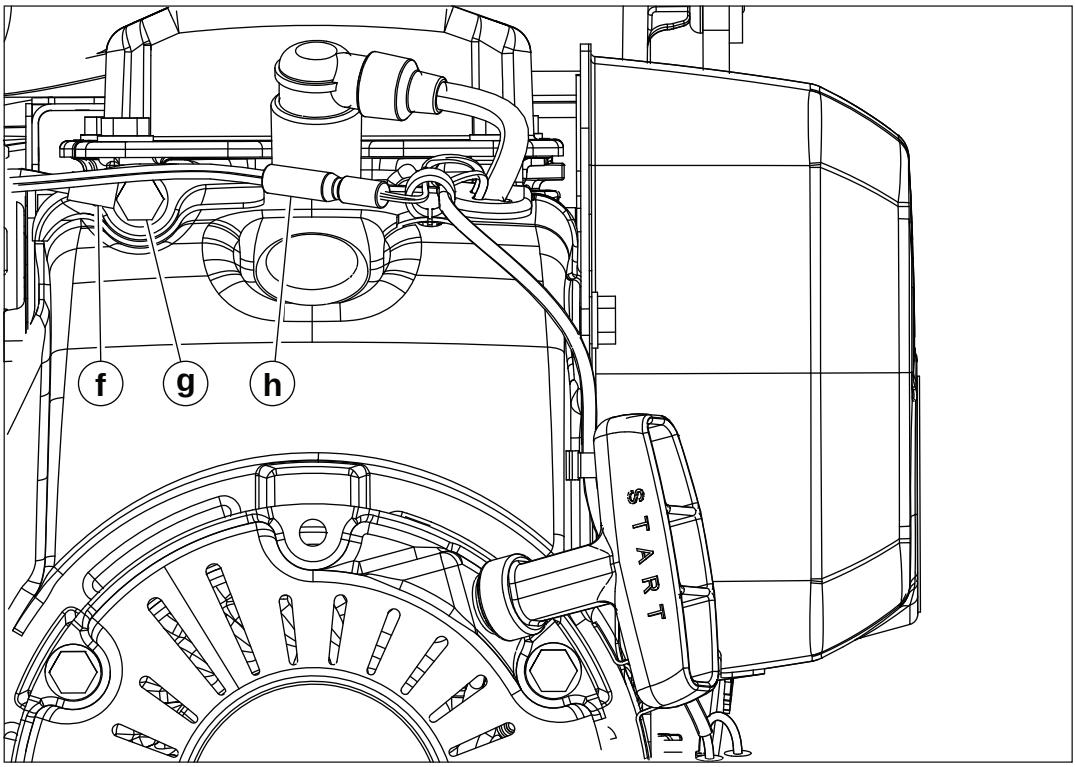
4. Remove the screw **(g)** and the wire **(f)** from the engine.



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5. Disconnect the wire **(h)**.

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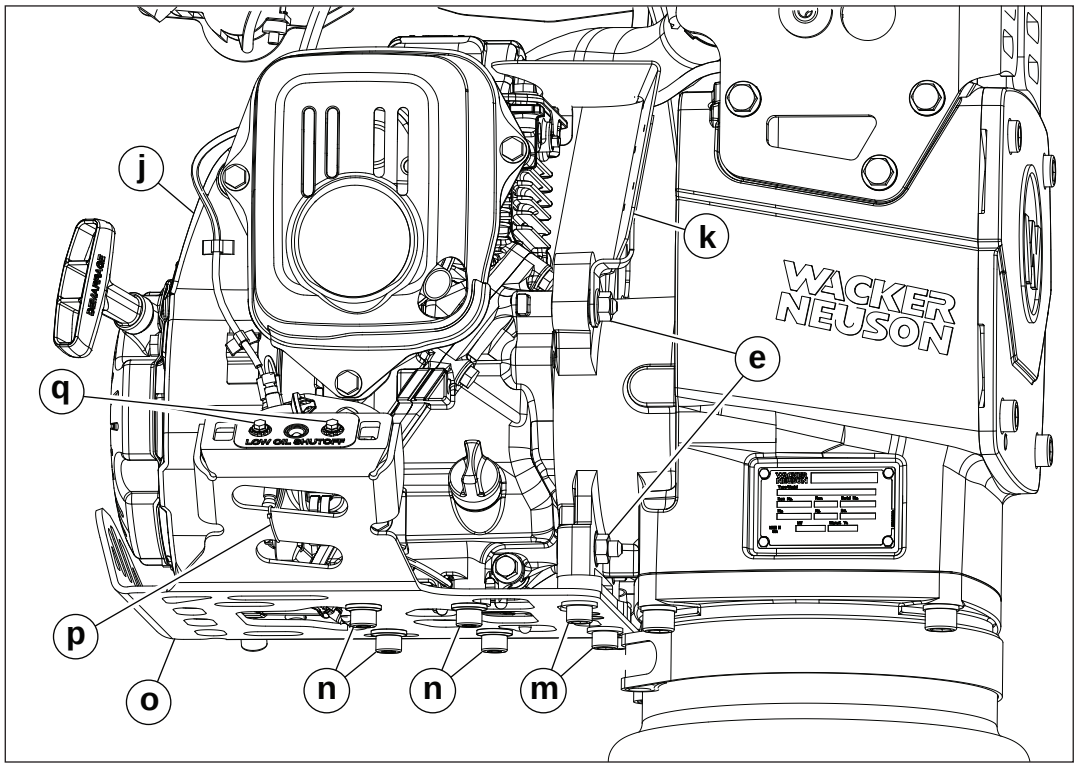
6. Remove the wire tie **(p)** fastening the low-oil shutdown switch wire to the lower engine guard.



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7. Remove the two screws **(q)** and remove the low-oil shutdown switch from the lower engine guard **(o)**.
8. Remove the four 20 mm screws **(n)** and the two 30 mm **(m)** screws and remove the lower engine guard **(o)** from the machine.
9. With the aid of an assistant, support the engine and remove the two engine mounting nuts **(e)**.
10. Remove the engine **(j)** and the heat shield **(k)** from the machine.

Result The engine has now been removed.

4.28 Installing the Engine—Honda

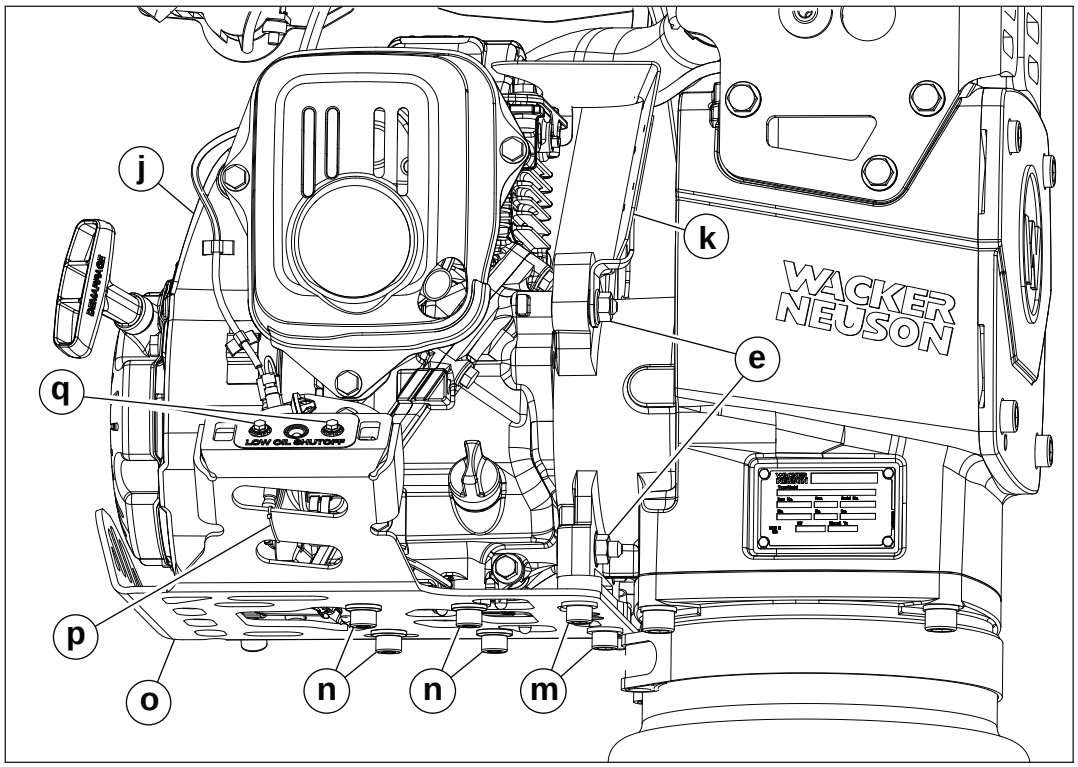
Requirements

- Torque wrench
- Loctite® 243

Procedure

Perform the procedure below to install the GX100 (Honda) engine.

1. With the aid of an assistant, install the engine **(j)**, the heat shield **(k)**, and the two engine mounting nuts **(e)**. Tighten the nuts **(e)** but do not torque the nuts at this time.



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2. Apply Loctite® 243 to the two 30 mm screws **(m)** and the four 20 mm screws **(n)**.
3. Fasten the lower engine guard **(o)** to the machine with the screws **(m)** and **(n)**. Torque all six screws to 25 Nm (18 ft.lbs.).
4. Install the low-oil shutdown switch to the lower engine guard **(o)** with two screws **(q)**.
5. Install a new wire tie **(p)** fastening the low-oil shutdown switch wire to the lower engine guard.

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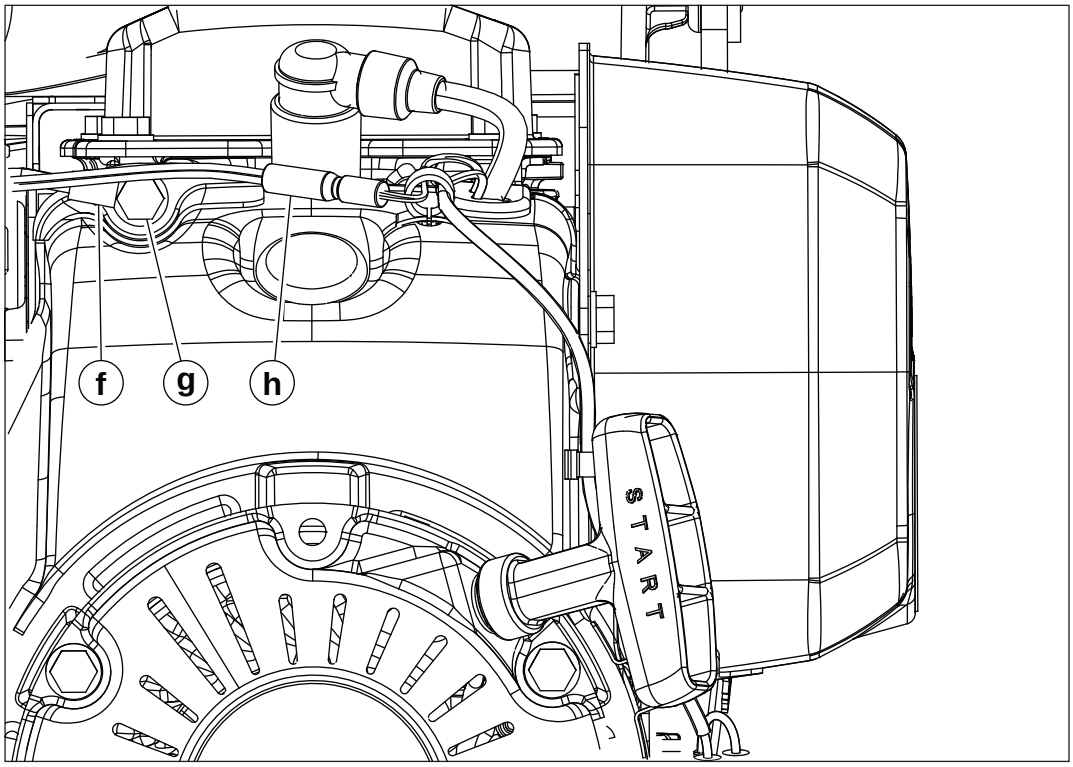
6. Fasten the wire **(f)** to the engine with the screw **(g)**.



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7. Connect the wire **(h)**.

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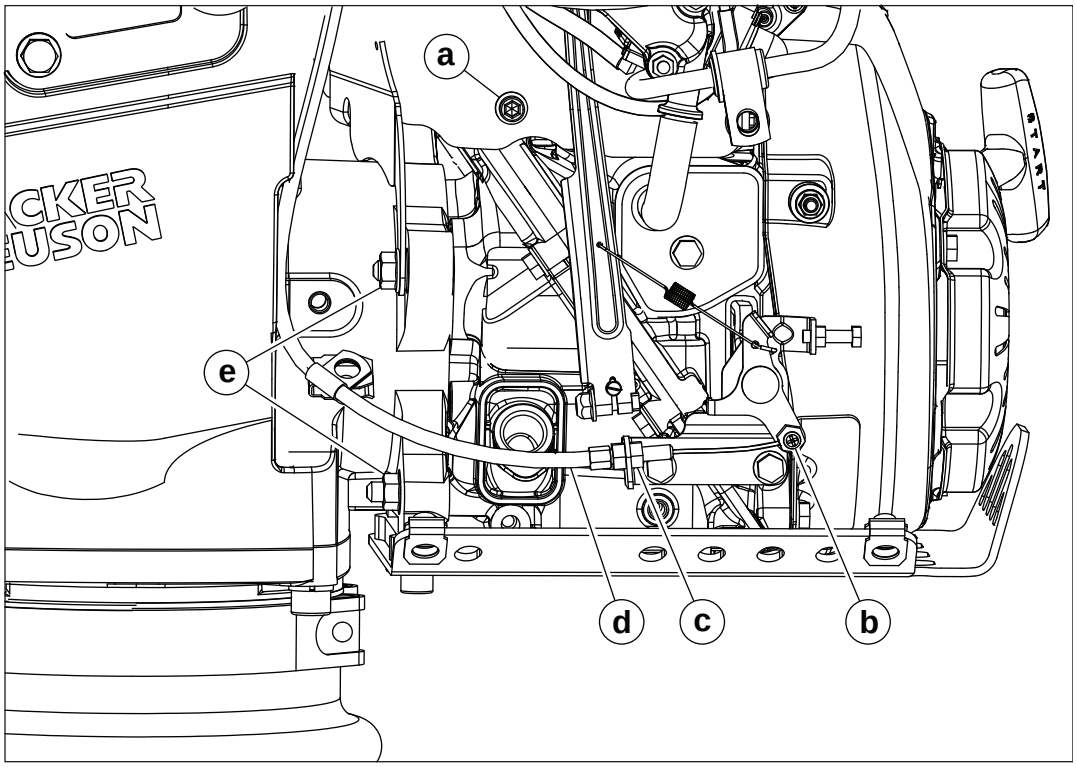
8. Install the throttle cable **(d)** to the engine and tighten the nut **(c)** and screw **(b)**.



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9. Apply Loctite® 243 to the two engine mounting nuts **(e)** and the two engine mounting nuts on the opposite side of the machine. Torque all four engine mounting nuts to 25 Nm (18 ft.lbs.).
10. Install the heat shield screw **(a)**.
11. Install the carburetor. See topic *Installing the Carburetor—Honda.*

Result The engine has now been installed.

4.29 Removing the Engine—Robin

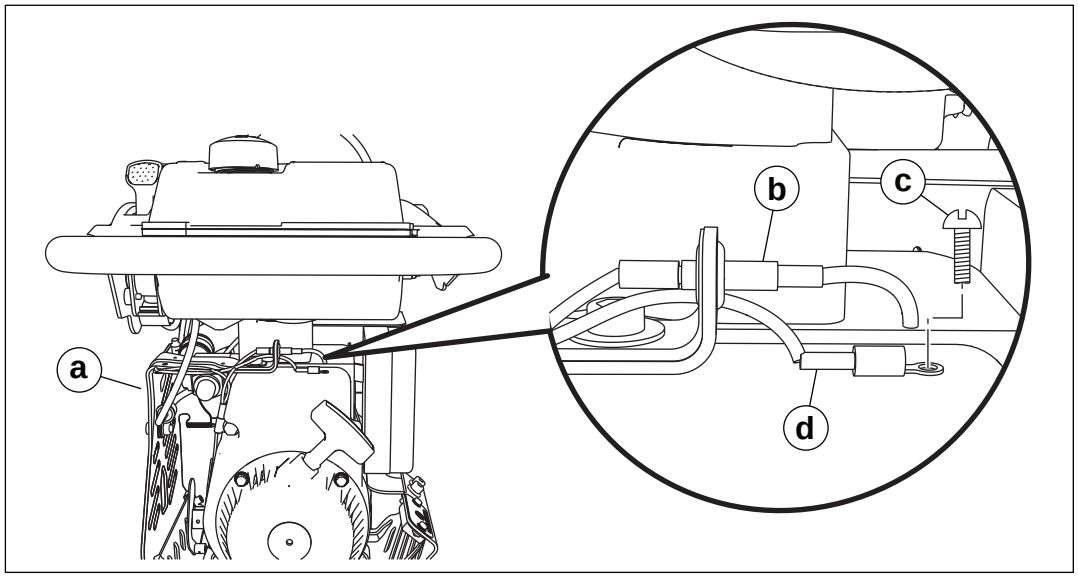
Requirements

- Machine shut down and cool

Procedure

Perform the procedure below to remove the Robin engine.

1. Disconnect the wire **(b)** and remove the screw **(c)**.
2. Remove the wires **(b** and **d)** from the grommet on top of the carburetor guard **(a)**.



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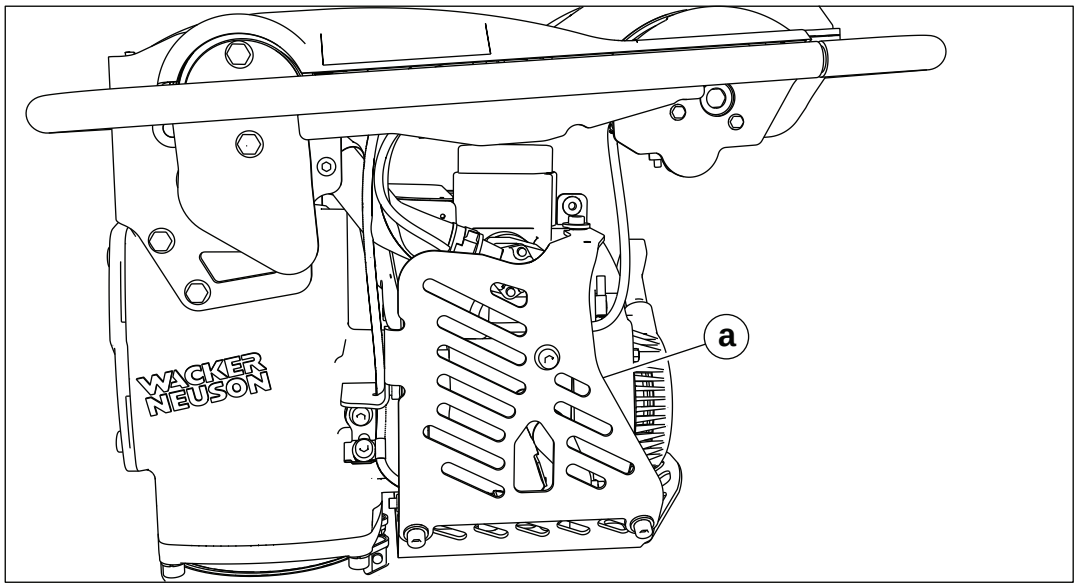
3. Remove the carburetor guard **(a)**.



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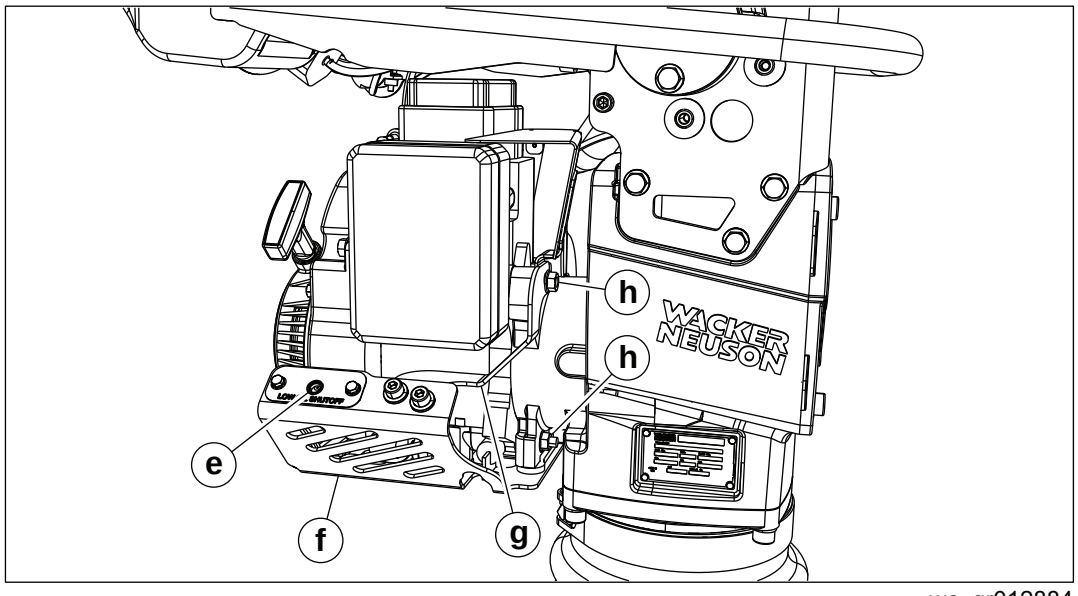
4. Remove the low-oil shutdown switch **(e)** from the lower guard **(f)**.
5. Remove the lower guard **(f)**.
6. Remove the two nuts **(h)** and the support bracket **(g)**.



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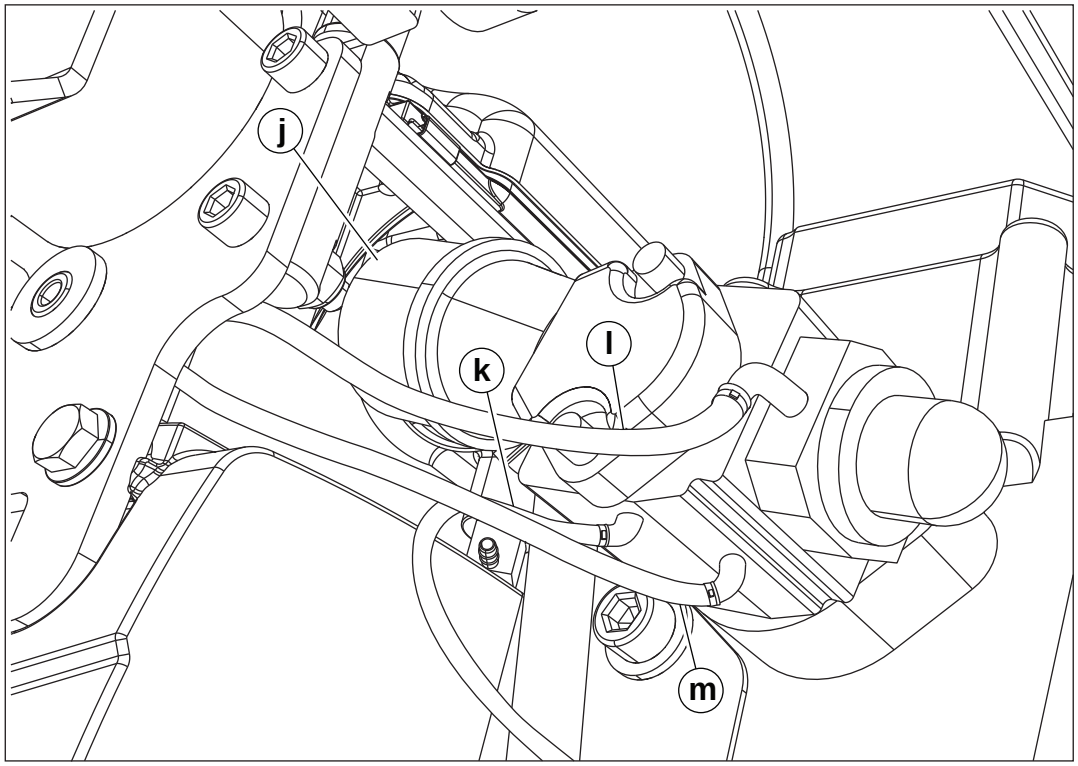
7. Remove the air intake tube **(j)**.



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8. Label the fuel hoses to aid in re-installation.
9. Clamp if necessary, then cut the fuel filter hose **(k)**, fuel hose **(m)**, and the vent hose **(l)** close to the carburetor fittings and drain the fuel into an approved container.

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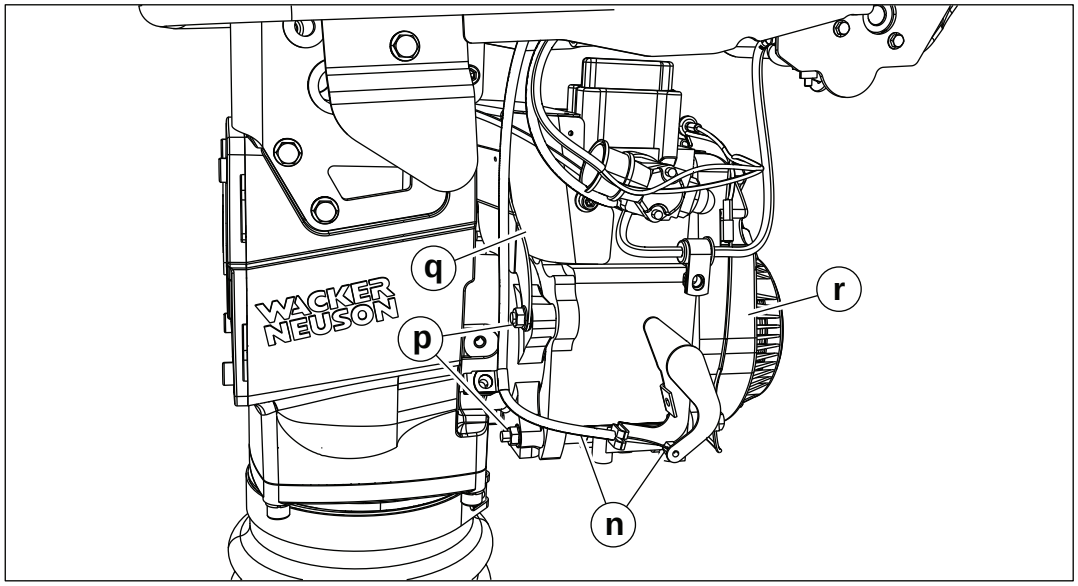
10.Disconnect the throttle cable **(n)**.



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11.Remove the two nuts **(p)**, the heat shield **(q)**, and the engine **(r)**.

Result The engine has now been removed.

4.30 Installing the Engine—Robin

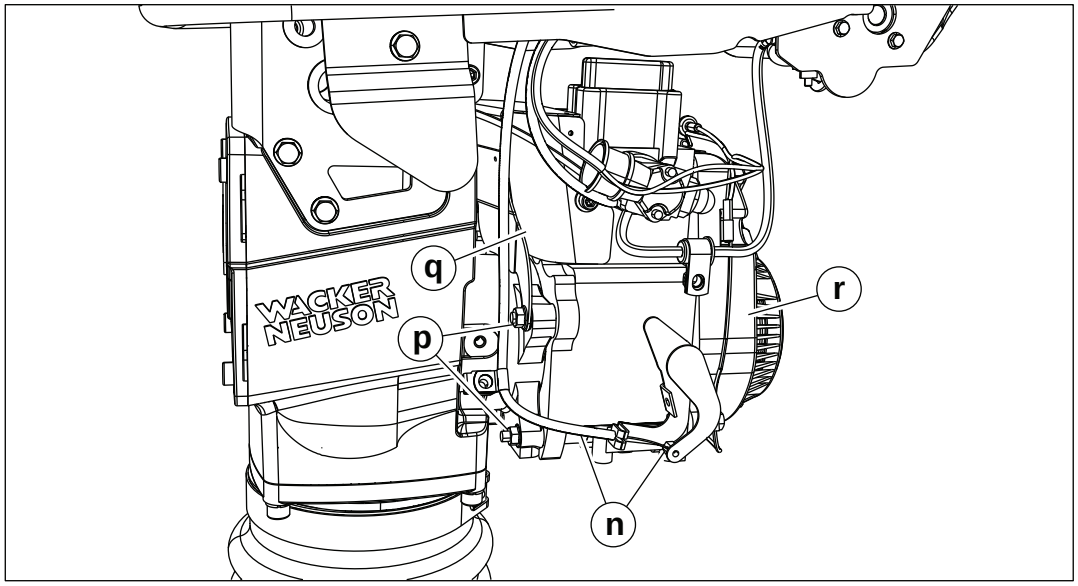
Requirements

- Torque wrench
- Loctite® 243

Procedure

Perform the procedure below to install the WM 100 engine.

1. Install the engine **(r)**, the heat shield **(q)**, and two engine mounting nuts **(p)**. Do not tighten nuts **(p)** at this time.



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2. Fasten the throttle cable **(n)** to the engine.

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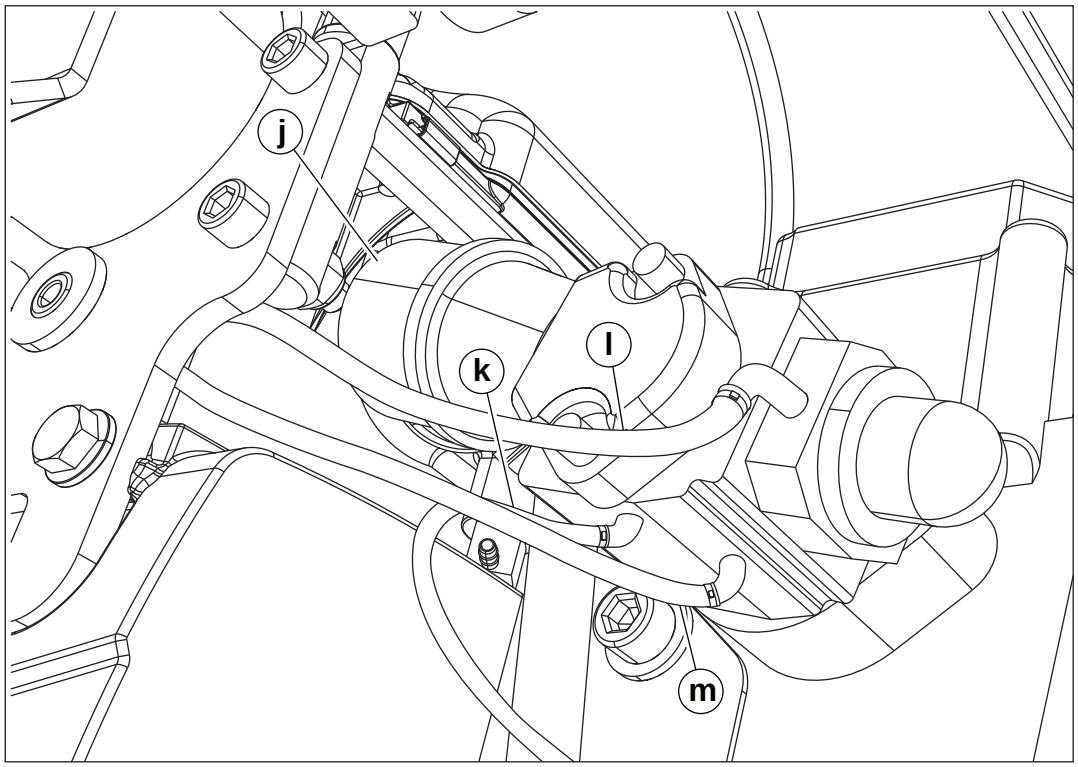
3. Connect the air intake tube **(j)** and the hoses **(k**, **l**, and **m)**.



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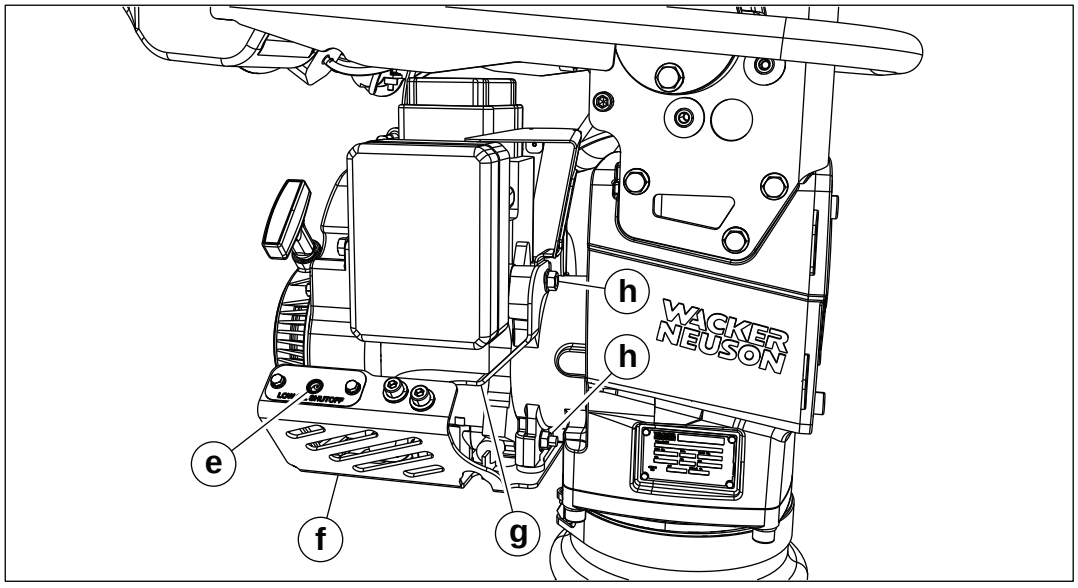
4. Install the lower guard **(f)**, the low-oil shutdown switch **(e)**, and the support bracket **(g)**.



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5. Apply Loctite® 243 to the two engine mounting nuts **(h)** and the two engine mounting nuts on the opposite side of the machine.
6. Install and torque all four engine mounting nuts to 25 Nm (18 ft.lbs.).

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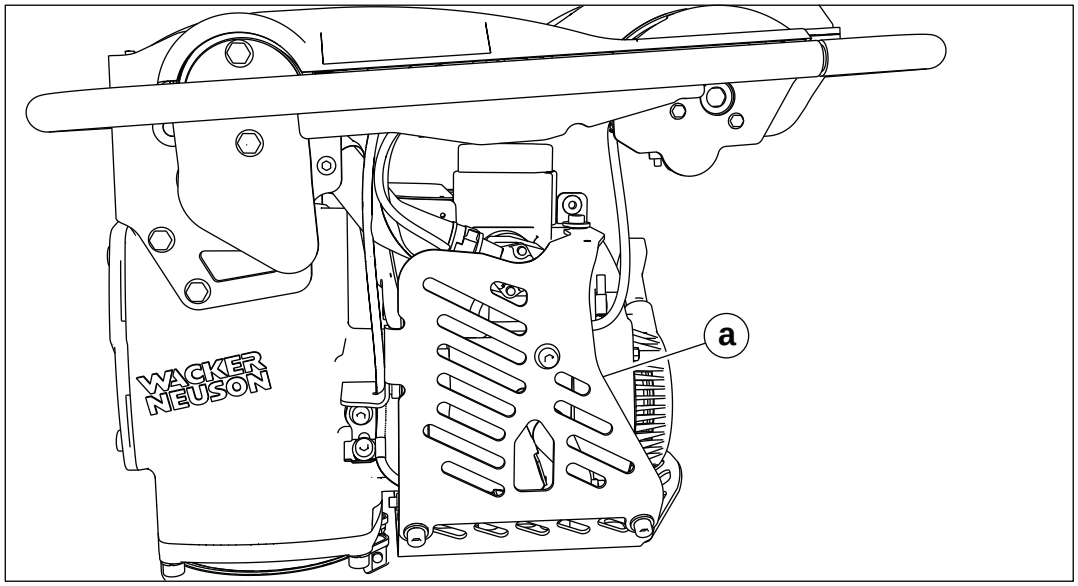
7. Apply Loctite® 243 to the four screws and fasten the carburetor guard **(a)** to the machine. Torque the screws to 25 Nm (18 ft.lbs.).



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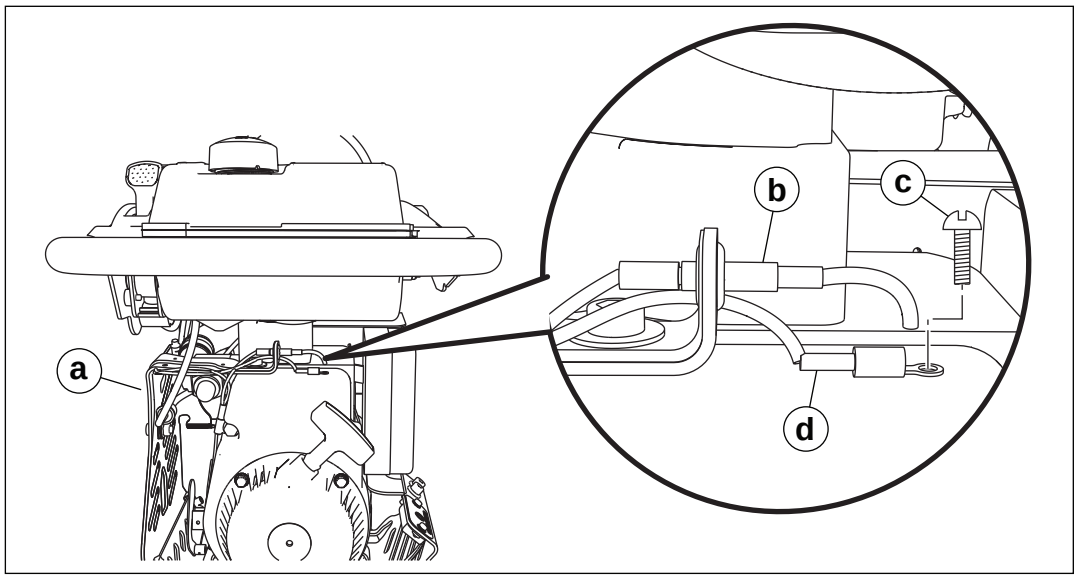
8. Install the wire **(d)** through the rubber grommet on the carburetor guard and fasten to the engine shroud with the screw **(c)**.
9. Install the wire **(b)** through the rubber grommet and connect to the mating connector.



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Result The engine has now been installed.

4.31 Removing the Upper Machinery

Requirements

- Punch
- Two wood blocks 2” x 4” x 8” (5cm x 10cm x 20cm)

Procedure

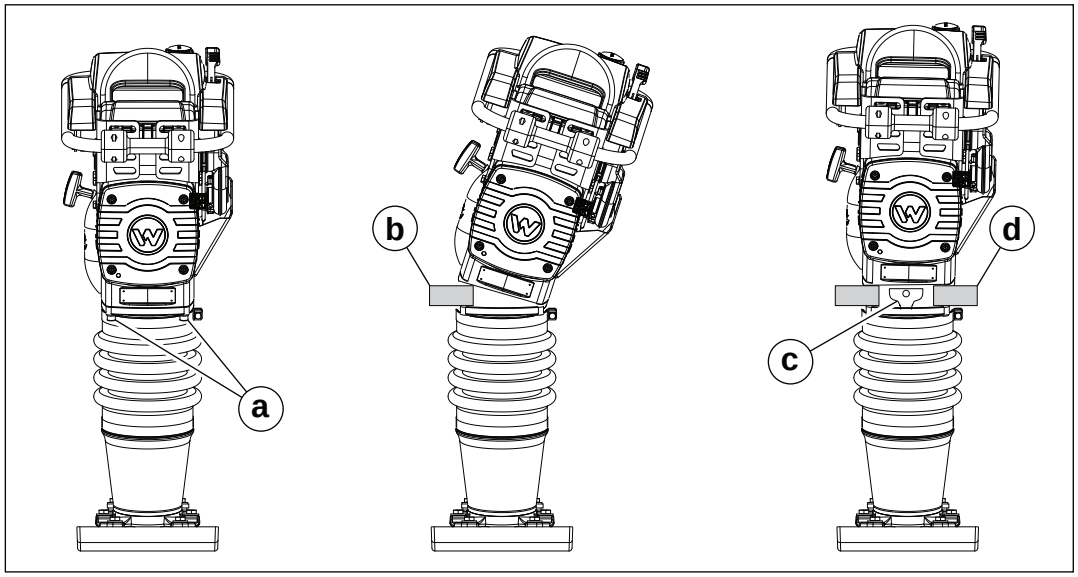
Perform the procedure below to remove the upper machinery.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Drain the ramming system oil into an approved container.

Note: *Dispose of oil in accordance with local environmental regulations.*

2. Remove the four screws **(a)** and washers that fasten the ramming system to the crankcase.



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3. With the aid of an assistant, roll the crankcase and place a wood block **(b)** between the crankcase and the ramming system.
4. With the aid of an assistant, roll the crankcase the opposite direction and place a second wood block **(d)** between the crankcase and the ramming system. This provides access to the crankcase connecting rod and ram **(c)**.

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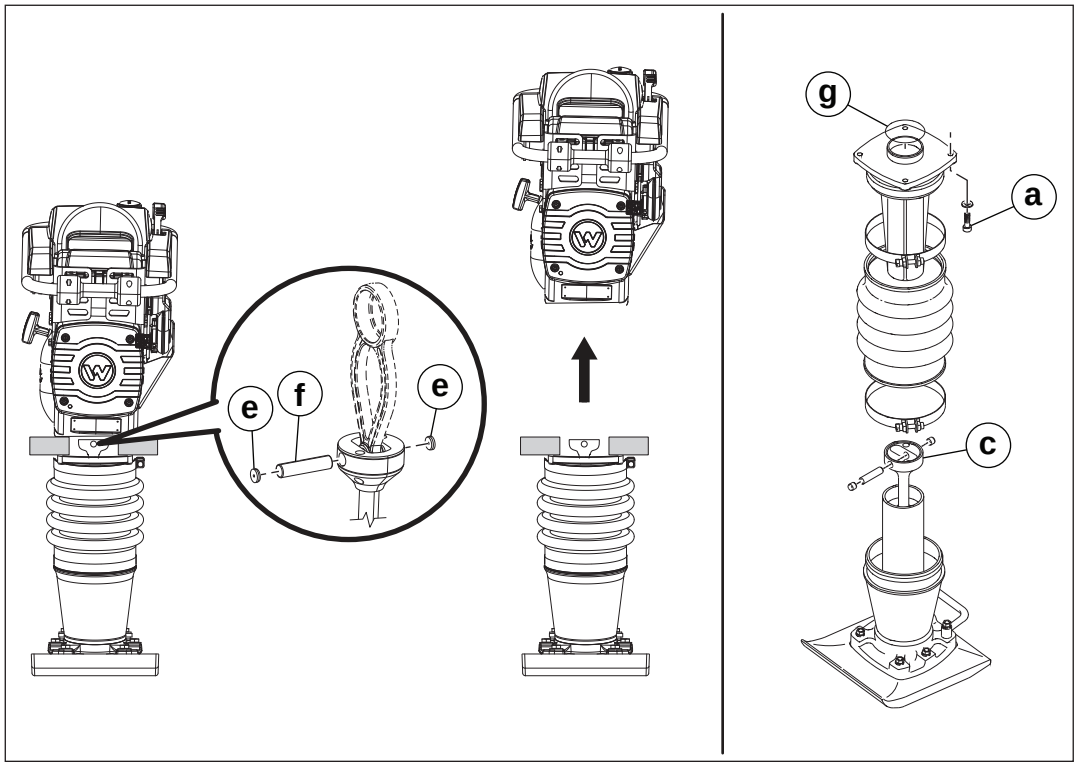
5. Drive out the two end plugs **(e)** and the piston pin **(f)** that holds the connecting rod to the ram **(c)**.

Note: *Do not reuse the end plugs.*



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6. With the aid of an assistant, lift and remove the crankcase from the ramming system.

7. Remove O-ring **(g)** from the ramming system**.**

Note: *Do not reuse the O-ring.*

Result The upper machinery has now been removed.

4.32 Installing the Upper Machinery

Requirements

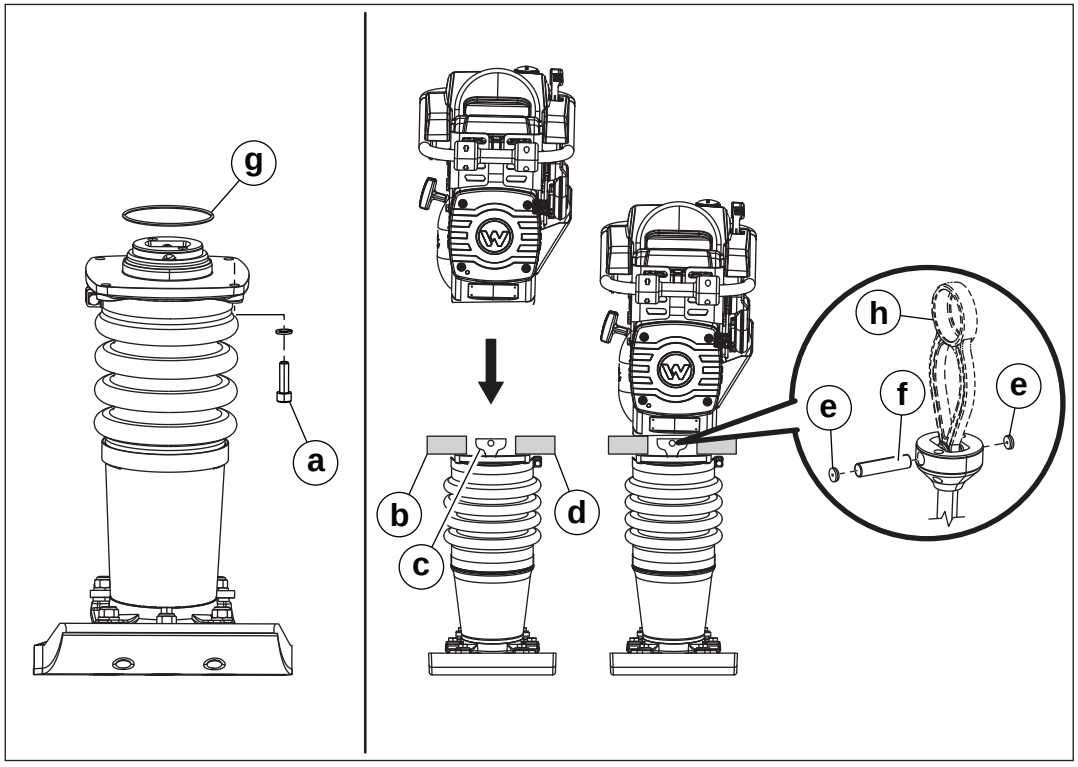
- Punch
- New end plugs
- New O-ring
- Loctite® 243
- Two wood blocks 2” x 4” x 8” (5cm x 10cm x 20cm)

Procedure

Perform the procedure below to install the upper machinery.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Install a new O-ring **(g)**.



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2. Place the two wood blocks **(b** and **d)** on the guide cylinder.
3. With the aid of an assistant, position the upper machinery on the two wood blocks and align the crankcase connecting rod **(h)** with the ram **(c)**.

Note: *Use new end plugs **(e)** whenever the piston pin **(f)** has been removed.*

4. Using a hammer and punch, drive in the piston pin **(f)** and new end plugs **(e)**.
5. Remove the two wood blocks **(b** and **d)**.

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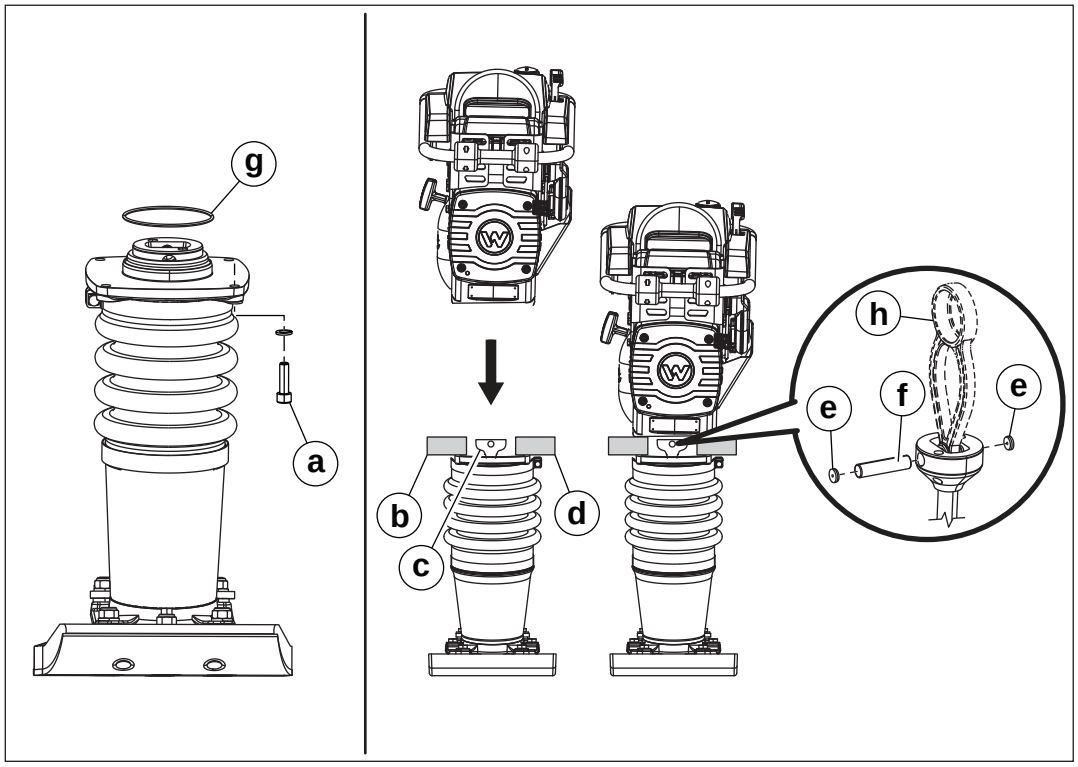
6. Apply Loctite® 243 to the four screws **(a)**.

Note: *When reusing bolts, clean the threads thoroughly before use.*



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7. Fasten the upper machinery to the ramming system with four screws **(a)** and washers. Torque the four screws **(a)** to 43 Nm (32 ft.lbs.).

Result The upper machinery has now been installed.

4.33 Removing the Crankcase

Requirements

- 2-Jaw bearing puller
- Large diameter retaining ring pliers
- Hydraulic press
- Split puller
- Slide hammer
- Upper machinery removed
- Engine removed
- Oil pump removed (oil-injected machines only (BSxx-2i))

Procedure

Perform the procedure below to remove the crankcase.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the upper machinery. See topic *Removing the Upper Machinery.*
2. Remove the engine. See topic *Removing the Engine.*
3. Remove the clutch drum. See topic *Removing the Clutch Drum.*
4. Remove the oil pump (oil-injected machines only (BSxx-2i)). See topic *Removing the Oil Pump.*

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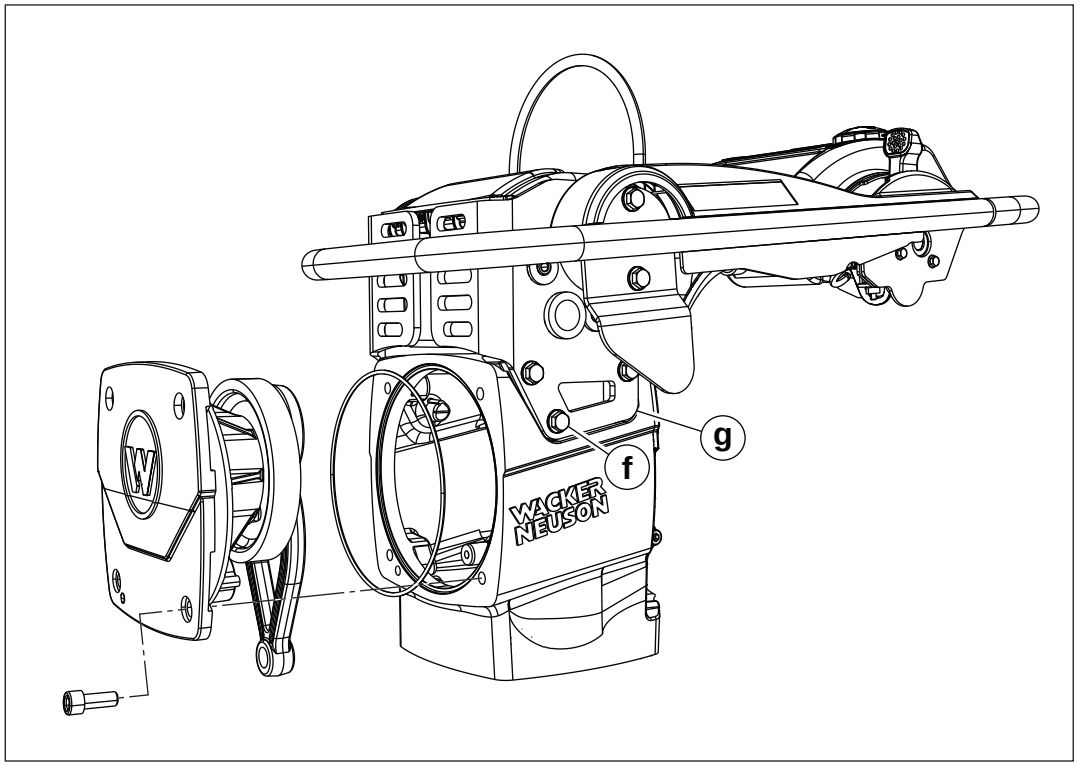
5. Remove the six screws **(f)** and remove the guide handle assembly **(g)** from the crankcase.



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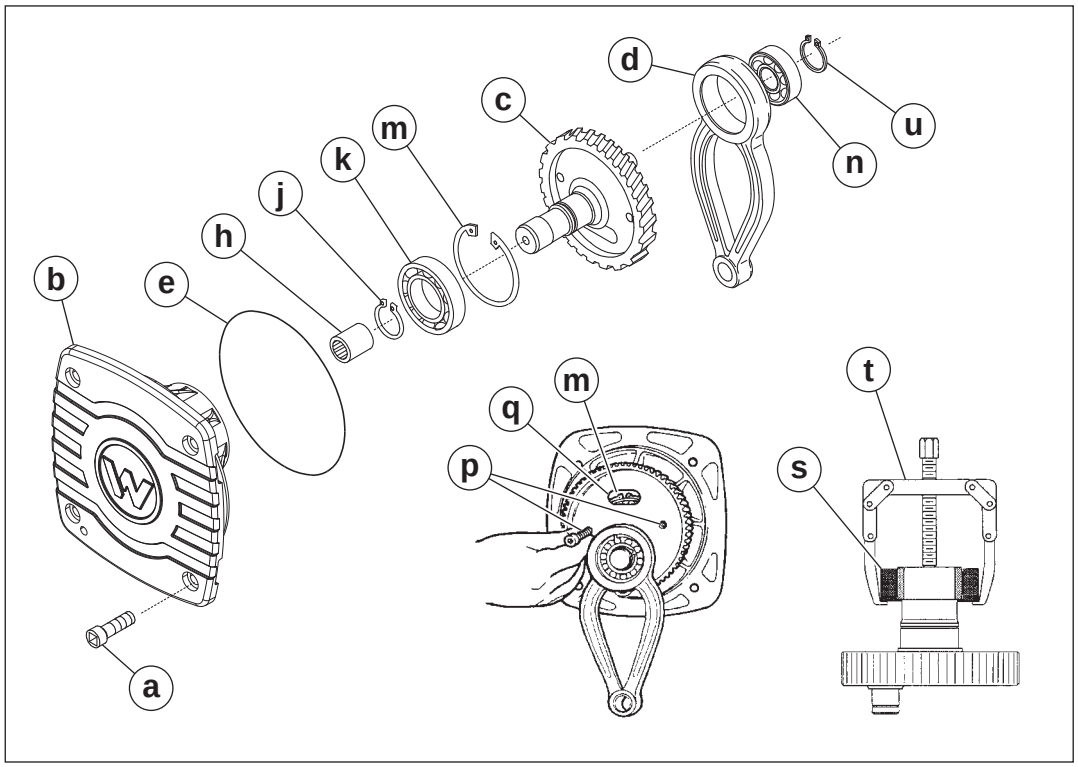
6. Reach through the slotted hole **(q)** in the crank gear and release the large retaining ring **(m)**.



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7. Thread two M8 socket head cap screws, or threaded rods, through the pusher holes **(p)** in the crank gear. Turn the screws into the crank gear to free the crank gear and the bearing from the cover.
8. Remove the small retaining ring **(j)** holding the bearing **(k)** to the crank gear.
9. Pull the bearing free of the shaft using the split puller **(s)** and a 2-jaw bearing puller **(t)**.
10. Remove the small retaining ring **(u)** that holds the connecting rod and the bearing **(n)** to the crank gear.
11. Pull the connecting rod **(d)** off the crank gear with a 2-jaw bearing puller.
12. Press the bearing **(n)** out of the connecting rod.
13. The needle bearing **(h)** remains intact in the crankcase cover. Inspect the needle bearing for wear and, if damaged, remove it by using a slide hammer or similar pulling device.

Result The crankcase has now been removed.

4.34 Installing the Crankcase

Requirements

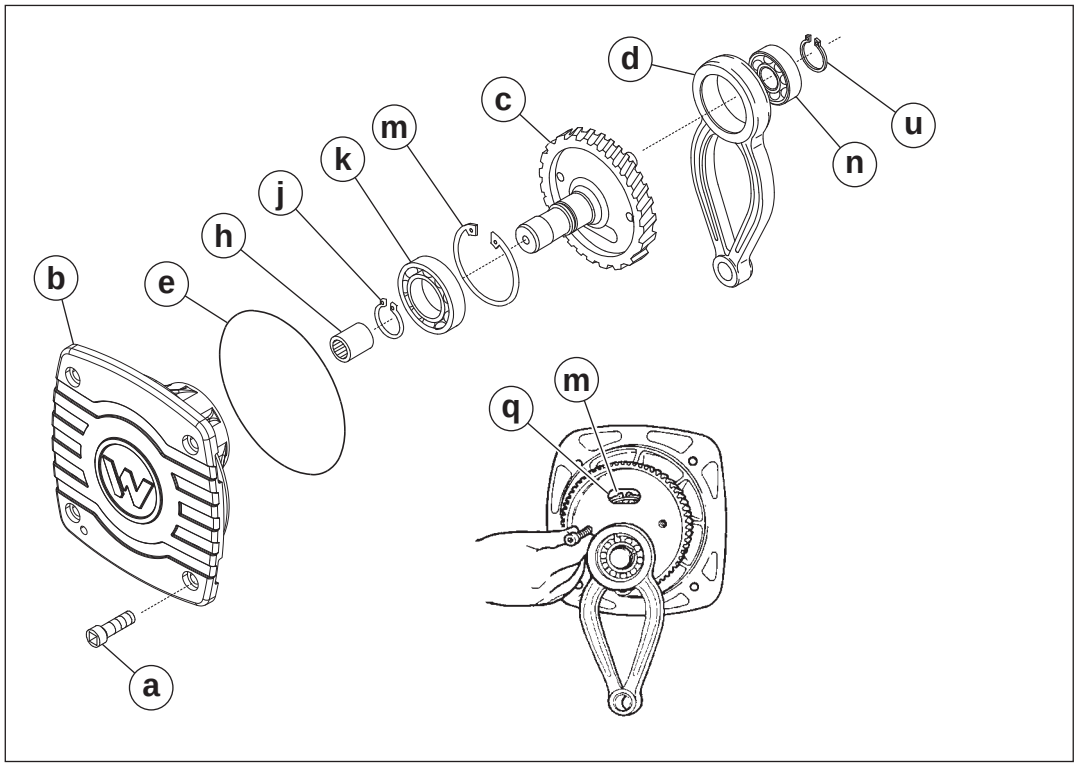
- New O-ring
- Loctite® 243
- Large diameter retaining ring pliers
- Hydraulic press

Procedure

Perform the procedure below to install the crankcase.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. If the needle bearing **(h)** was removed, press a new needle bearing into the front crankcase cover **(b)** until the outer race is flush with the flange surface.



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2. Place the large retaining ring **(m)** over the shaft of the crank gear **(c)**.
3. Press the ball bearing **(k)** onto the shaft of the crank gear and re-install the small retaining ring **(j)**.
4. Press the ball bearing **(n)** into the connecting rod **(d)**.
5. Press the connecting rod assembly onto the crank gear **(c)** and secure it in place with the small retaining ring **(u)**.

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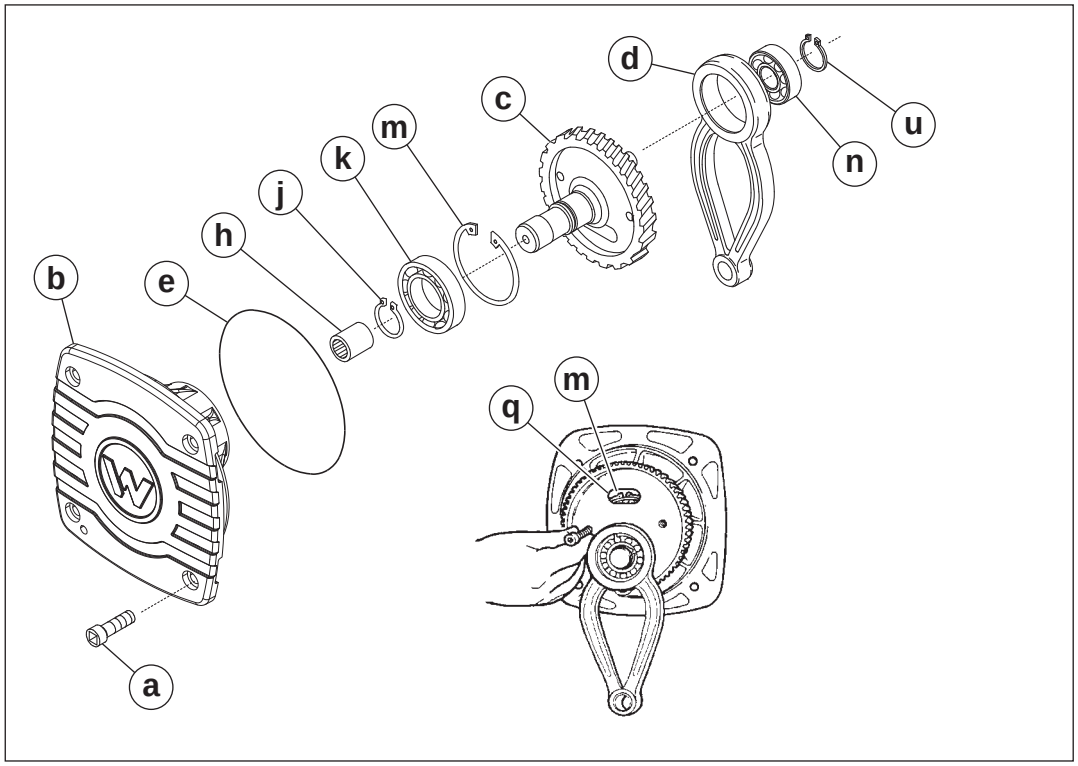
6. Push the complete crank gear assembly into the bearing housing of the front crankcase cover **(b)**.



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7. Reach through the slotted hole **(q)** in the crank gear and seat the large retaining ring **(m)** in the groove.
8. Install a new O-ring **(e)**.
9. Re-install the clutch drum. See topic *Installing the Clutch Drum.*

Note: *The following step applies to machines equipped with an oil pump.*

10. Re-install the oil pump (BS 50-2i only). See topic *Installing the Oil Pump.*

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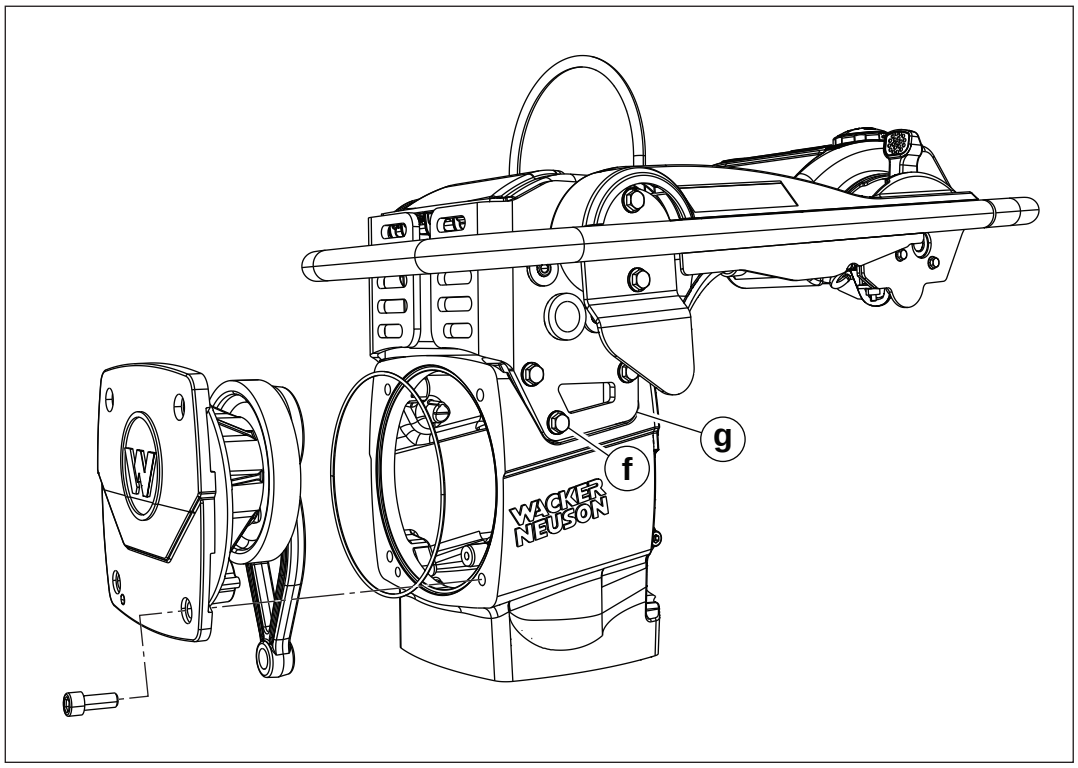
11. Install the guide handle assembly **(g)** to the crankcase using six screws **(f)**. Apply Loctite® 243 and torque the screws to 31 Nm (23 ft.lbs.).



wc_gr0128□□

12. Re-install the engine. See topic *Installing the Engine.*

13. Re-install the upper machinery. See topic *Installing the Upper Machinery.*

Result The crankcase has now been installed.

4.35 Removing the Clutch

Requirements

- Machine shut down and cool
- Engine removed
- Clutch puller P/N 5000117972

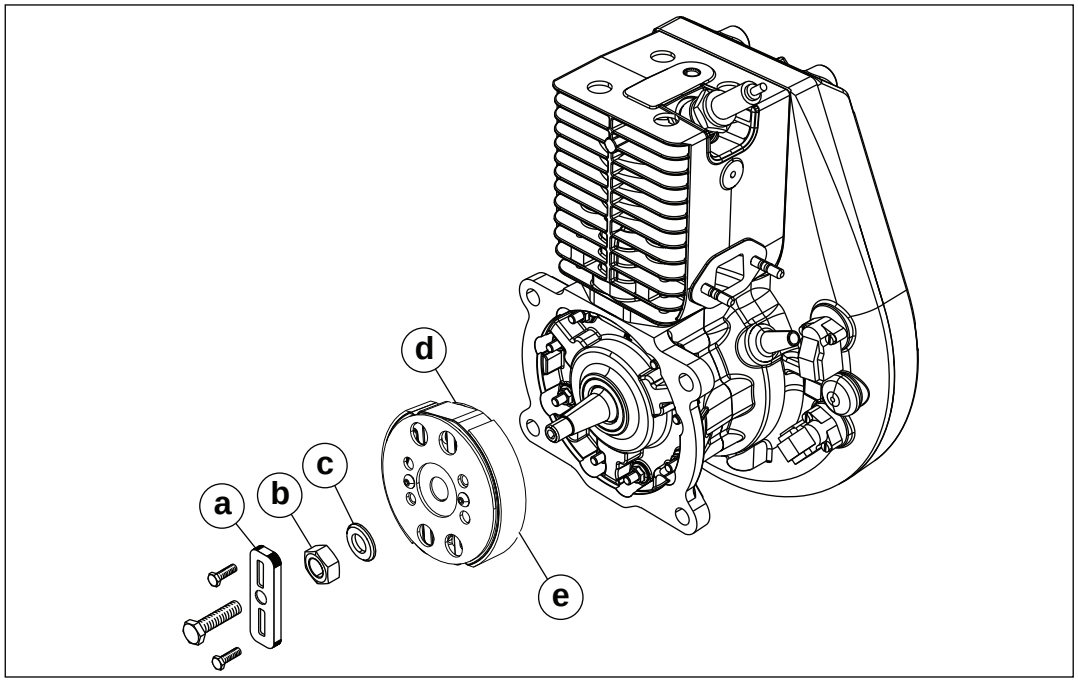
Procedure

Perform the procedure below to remove the clutch.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the engine. See topic *Removing the Engine.*
2. Inspect the condition of the clutch shoes **(e)** and replace them if necessary. The clutch shoes should be absolutely dry. If oil is present, inspect the engine shaft seal.

Note: *Graphic is representative only; your machine may vary.*



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3. Prevent the clutch **(d)** from turning and loosen the clutch nut **(b)**.

Note: *Loosen the nut but do not completely remove it from the engine crankshaft. This will protect the crankshaft threads from the clutch puller screw.*

4. Screw the clutch puller **(a)** (or other suitable puller) into the small holes in the clutch. Turn the center screw against the end of the crankshaft until the clutch hub breaks free of the tapered shaft.
5. Remove the clutch puller **(a)**, the nut **(b)**, the washer **(c)**, and the clutch **(d)**.

Result

The clutch has now been removed.

4.36 Installing the Clutch

Requirements

- Torque wrench

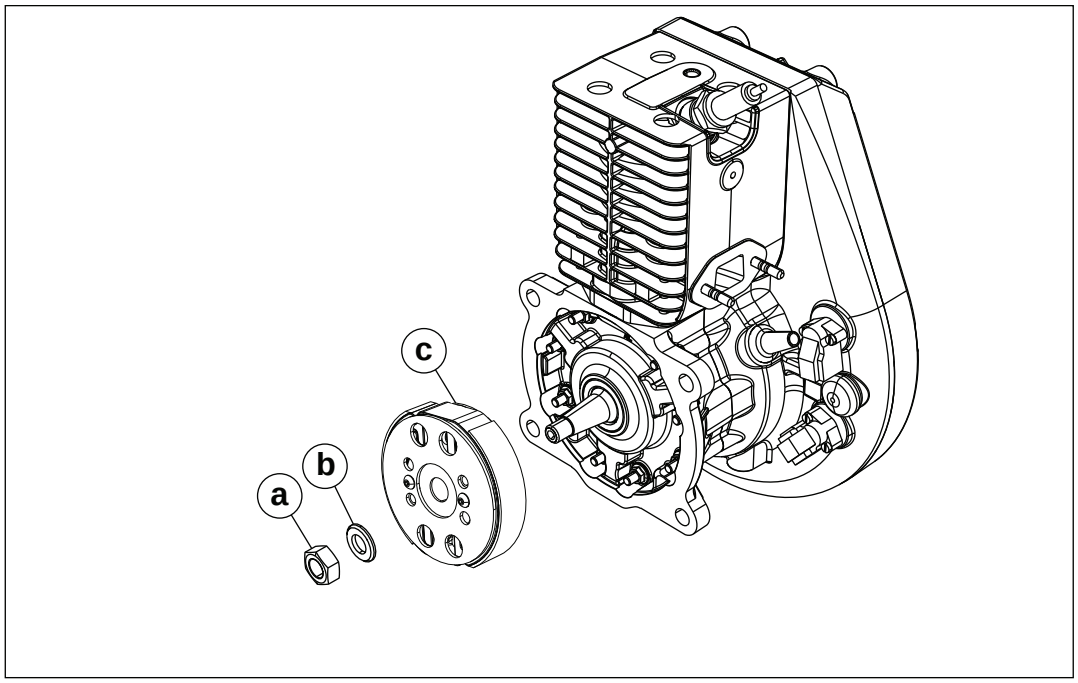
Procedure

Perform the procedure below to install the clutch.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Set the clutch **(c)** on the engine crankshaft.
Note: *When installing the clutch, make sure the taper in the clutch hub and the engine crankshaft are absolutely free of oil or grease.*

2. Install washer **(b)** and nut **(a)**. Torque the nut to 34 Nm (23 ft.lbs.).
Note: *Graphic is representative only; your machine may vary.*



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3. Install the engine. See topic *Installing the Engine.*

Result

The clutch has now been installed.

4.37 Removing the Clutch Drum

Requirements

- Upper machinery removed
- Engine removed
- Hydraulic press
- Slide hammer
- Engine removed

Procedure

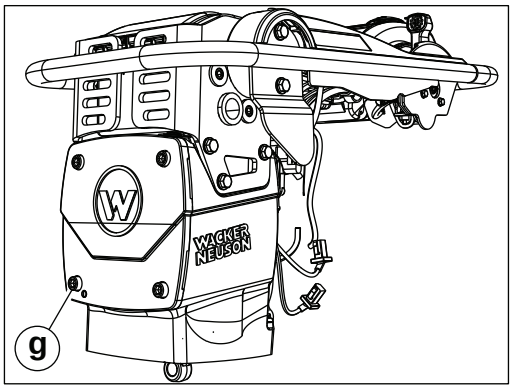
Perform the procedure below to remove the clutch drum.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the upper machinery. See topic *Removing the Upper Machinery*.
2. Remove the engine. See topic *Removing the Engine*.

Note: *The front cover cannot be removed until the connecting rod is disconnected from the ram.*

3. Remove the four screws **(g)** from the front cover.



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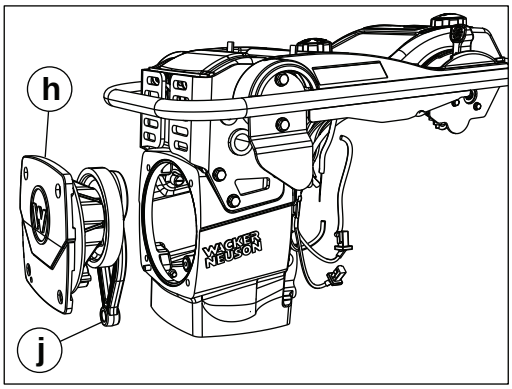

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4. Insert a screwdriver into the slots on each side of the front cover **(h)** and pry off the front cover. The front cover will come off with the crank gear and connecting rod **(j)** attached.

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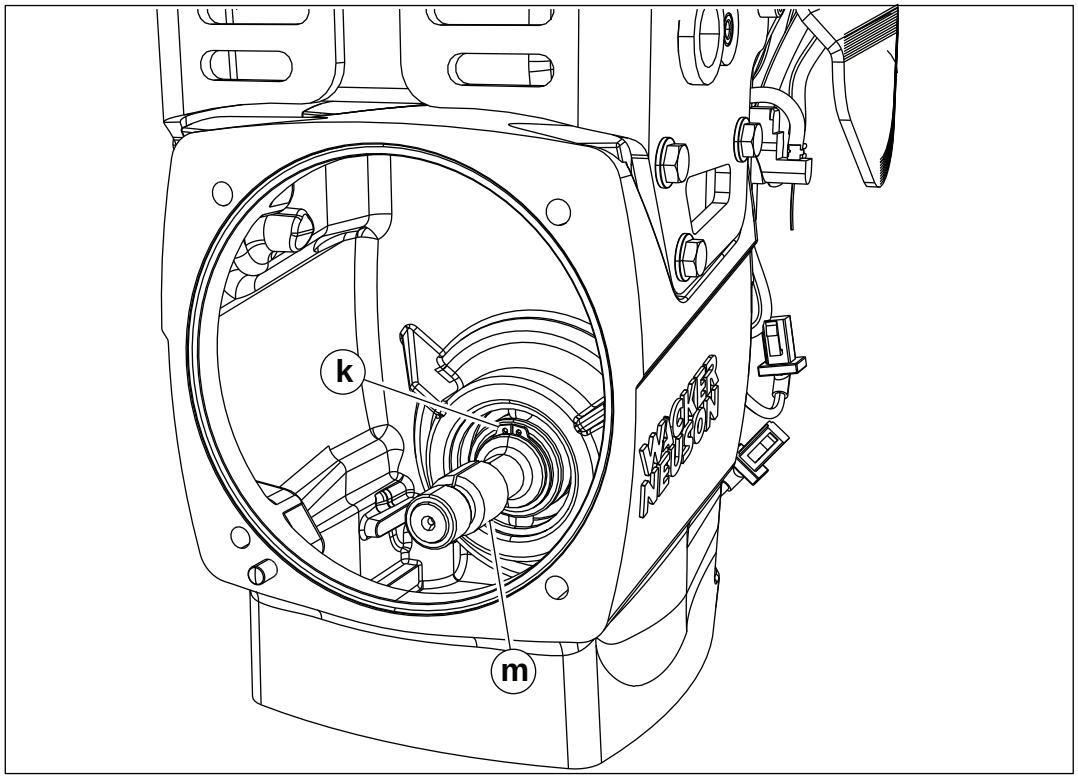
5. Remove the small retaining ring **(k)** from the clutch drum shaft **(m)**.



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6. Press the clutch drum shaft **(m)** from the crankcase. Inspect the clutch drum shaft for wear or damage and replace it if necessary.

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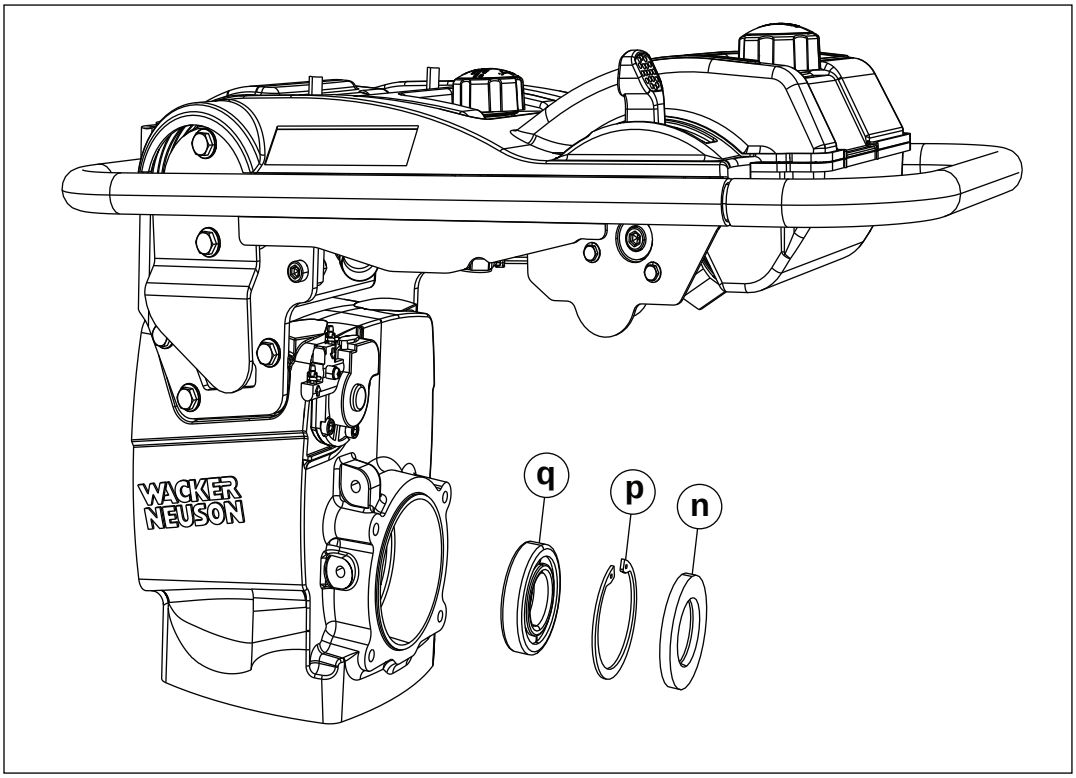
7. Remove the shaft seal **(n)** and the retaining ring **(p)**.



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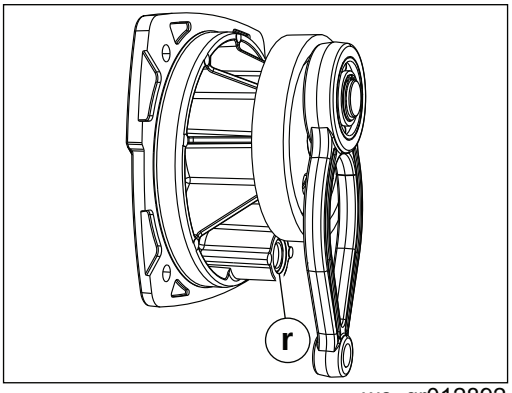
8. Press the clutch drum bearing **(q)** from the crankcase. Inspect the clutch drum bearing for wear or damage and replace it if necessary.
9. The needle bearing **(r)** remains intact in the crankcase cover. Inspect the needle bearing for wear or damage. Replace it if necessary using a slide hammer or a similar pulling device.



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Result The clutch drum has now been removed.

4.38 Installing the Clutch Drum

Requirements

- Hydraulic press
- Assistant
- Slide hammer
- Punch
- Torque wrench
- Loctite® 243
- Shell gadus S2 V100 2 grease or equivalent

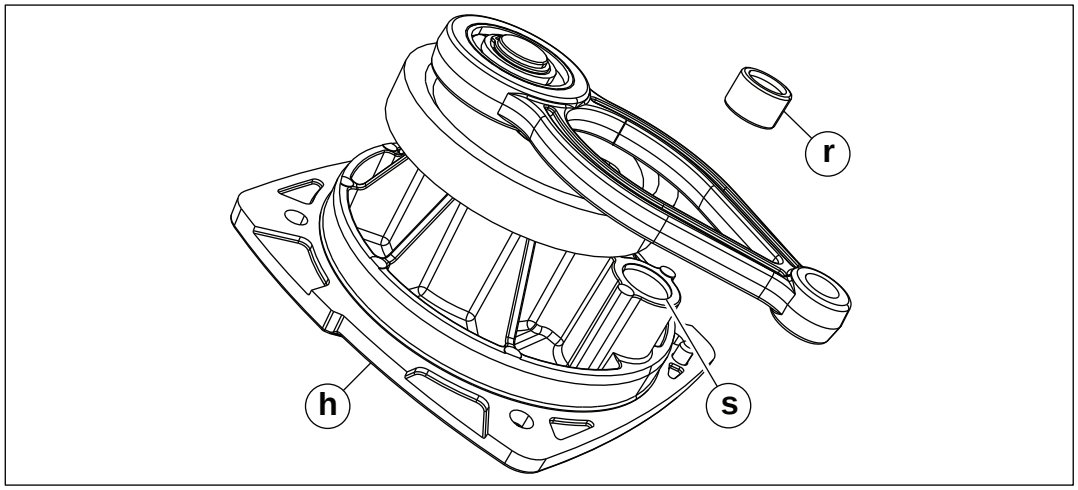
Procedure

Perform the procedure below to install the clutch drum.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. If the needle bearing **(r)** was removed, press a new needle bearing into the front cover **(h)** until seated in the bore **(s)**.

Note: *Keep the inside of the clutch drum absolutely free of any oil or grease.*



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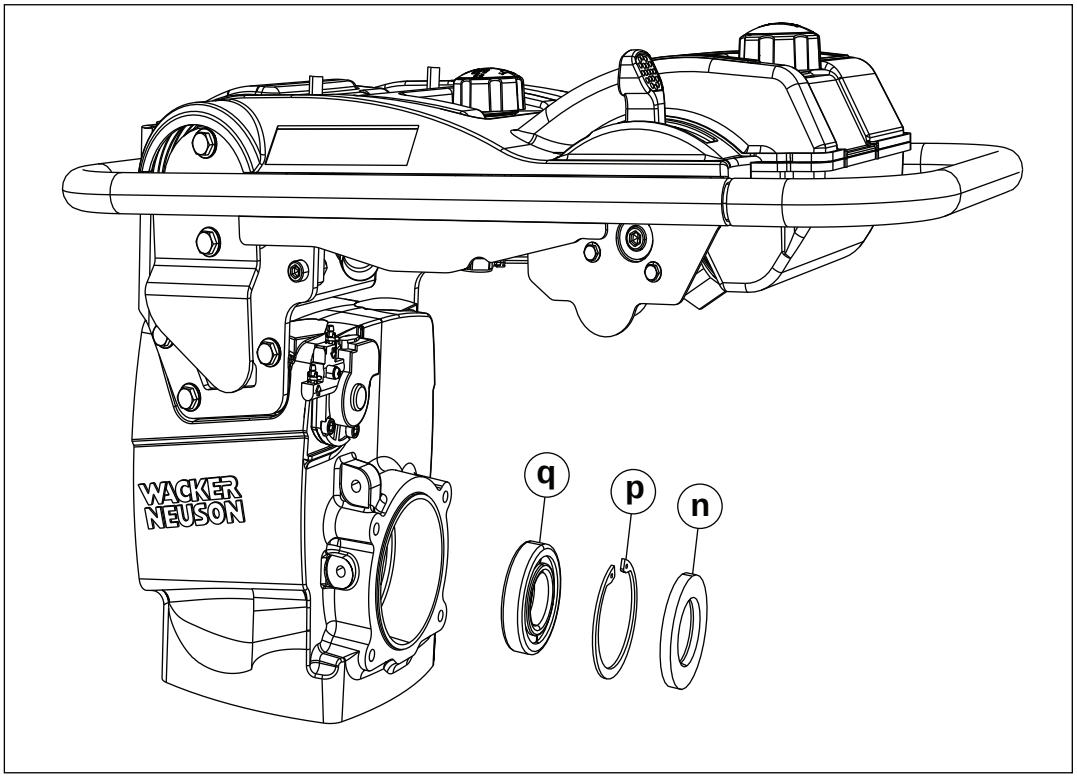
2. Press the clutch drum bearing **(q)** into the crankcase and secure the clutch drum bearing with the retaining ring **(p)**.



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3. Pack the shaft seal **(n)** with grease. Install the shaft seal with the open side facing the bearing **(q)**.
4. Press the clutch drum **(m)** into the crankcase.

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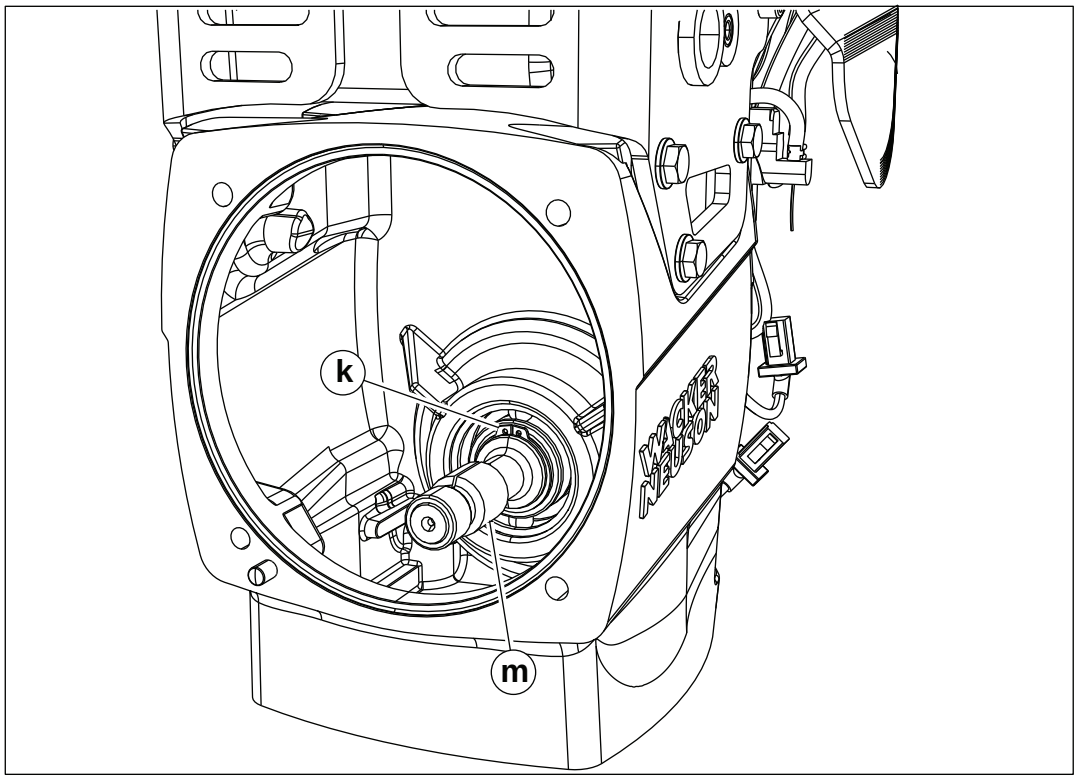
5. Secure the clutch drum **(m)** with the small retaining ring **(k)**.



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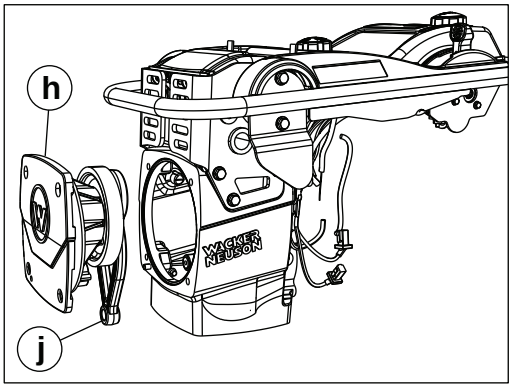
6. Install the front cover **(h)** to the crankcase. Apply Loctite® 243 and torque screws **(g)** to 49 Nm (36 ft. lbs.).



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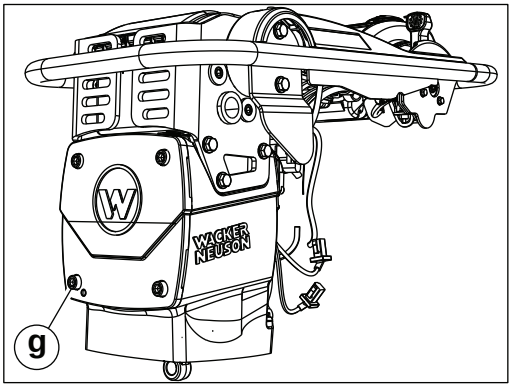

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7. Install upper machinery. See topic *Installing the Upper Machinery*.
8. Install the engine. See topic *Installing the Engine.*

Result The clutch drum has now been installed.

4.39 Removing the Oil Pump

Background Oil-injection machines can run up to 65 hours on one tank of oil. If the machine has been used for a long period of time and it does not appear to have used any oil and the oil line check valve is operating correctly, remove and check the oil pump.

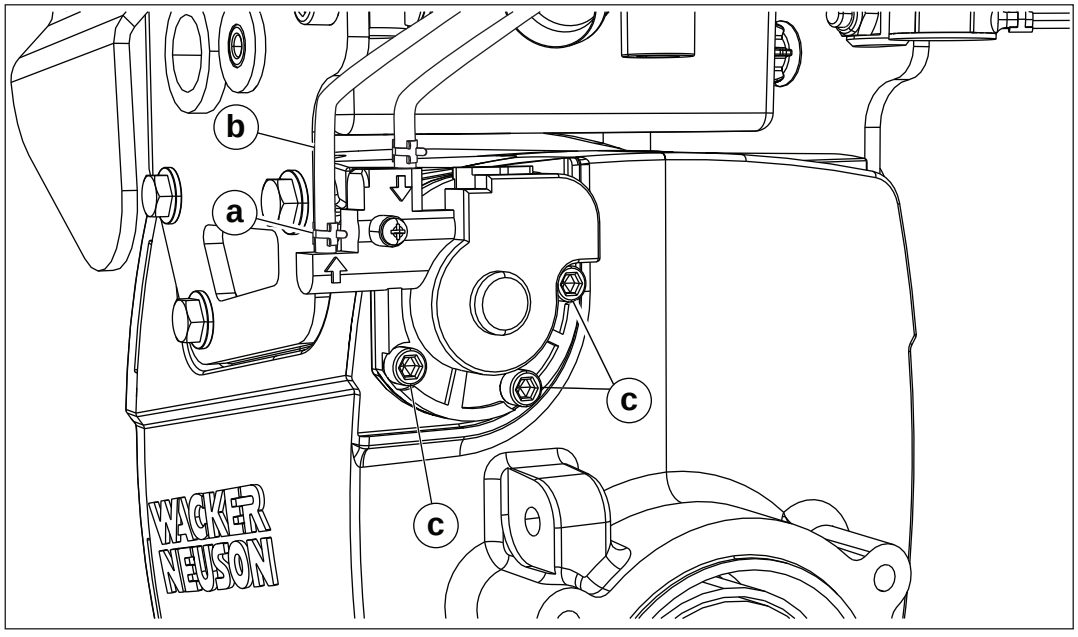
Requirements

- Machine shut down and cool
- Engine removed
- Oil tank at least 1/4 full

Procedure Perform the procedure below to remove and test the oil pump.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the engine. See topic *Removing the Engine—WM80.*
2. Remove the clamp **(a)** and the output hose **(b)** from the oil pump. **Do not remove the input hose**.



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3. Remove the three screws **(c)**.

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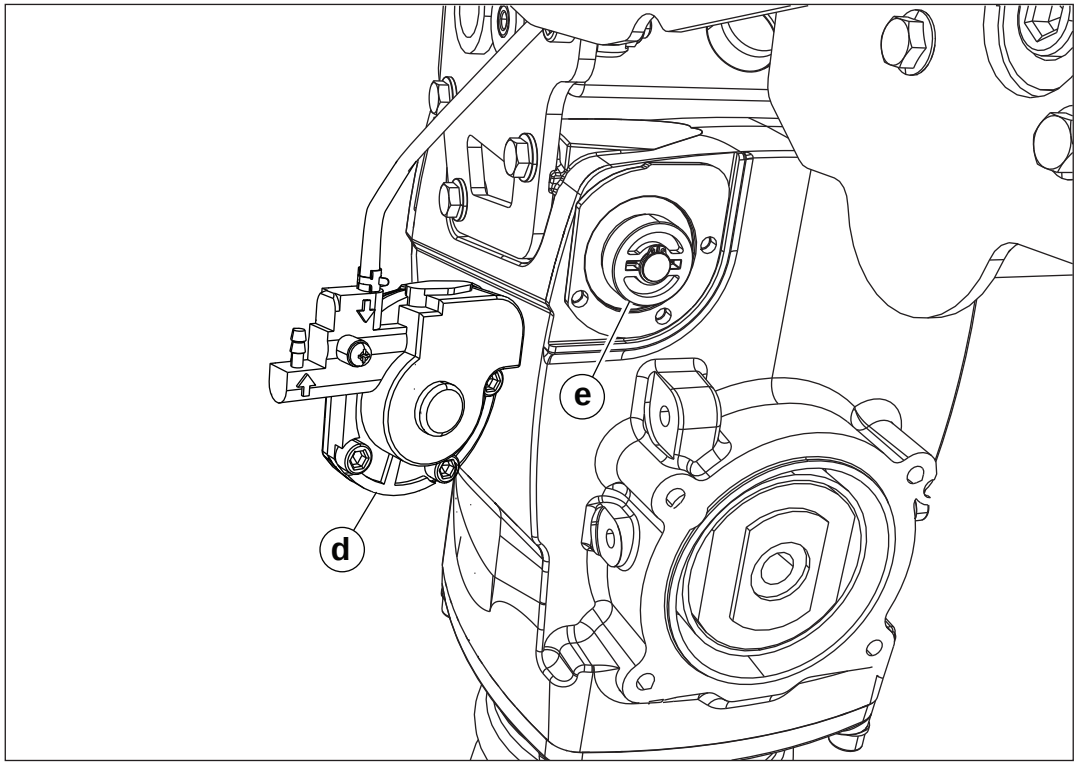
4. Separate the pump **(d)** from the cartridge portion.
5. Inspect the gear **(e)** for damage. If the gear is damaged, replace it.



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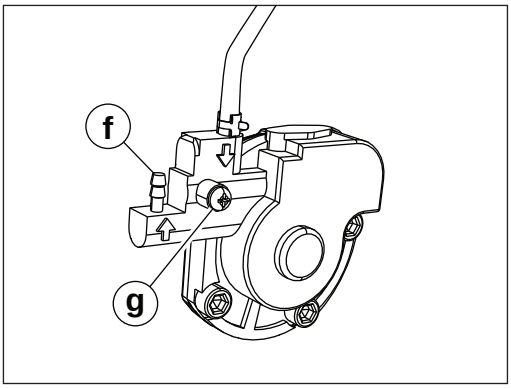
6. Open the bleed screw **(g)** until oil flows from the output nipple **(f)**, then close the bleed screw.
7. Rotate the small gear **(h)** within the pump. Oil should flow out of the output nipple **(f)** within 20 revolutions of the small gear. If no oil flows out of the nipple, replace the pump.

Note: *The oil delivers a 0.8 mm (0.030 in.) droplet of oil every 7–9 seconds of operation at 4350 rpm.*



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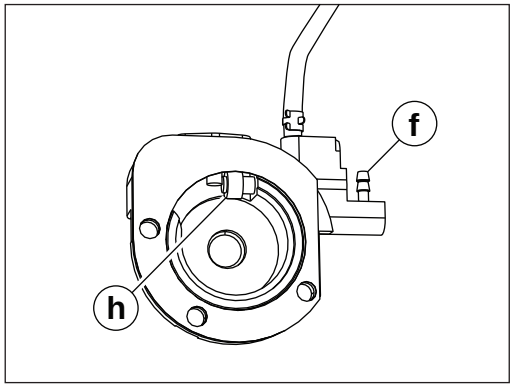

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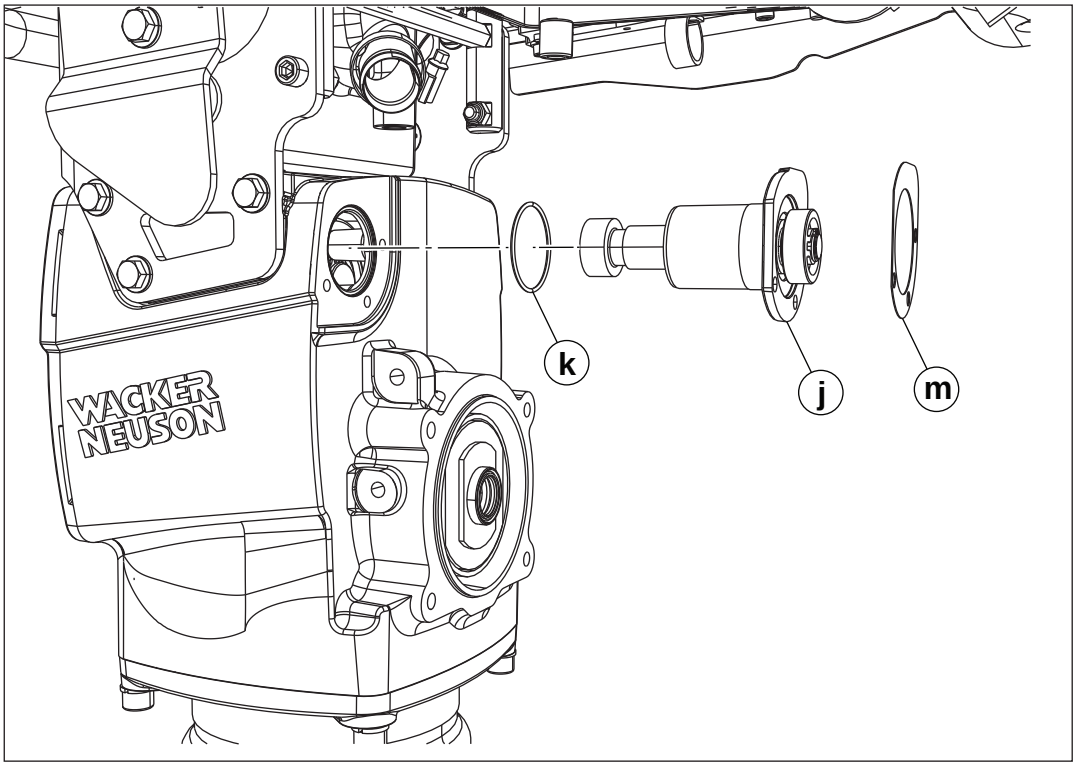
8. Remove the cartridge assembly **(j)**, O-ring **(k)**, and gasket **(m)**. Inspect parts for damage. Replace if necessary.



wc gr01286

Result The oil pump has now been removed.

4.40 Installing the Oil Pump

Requirements

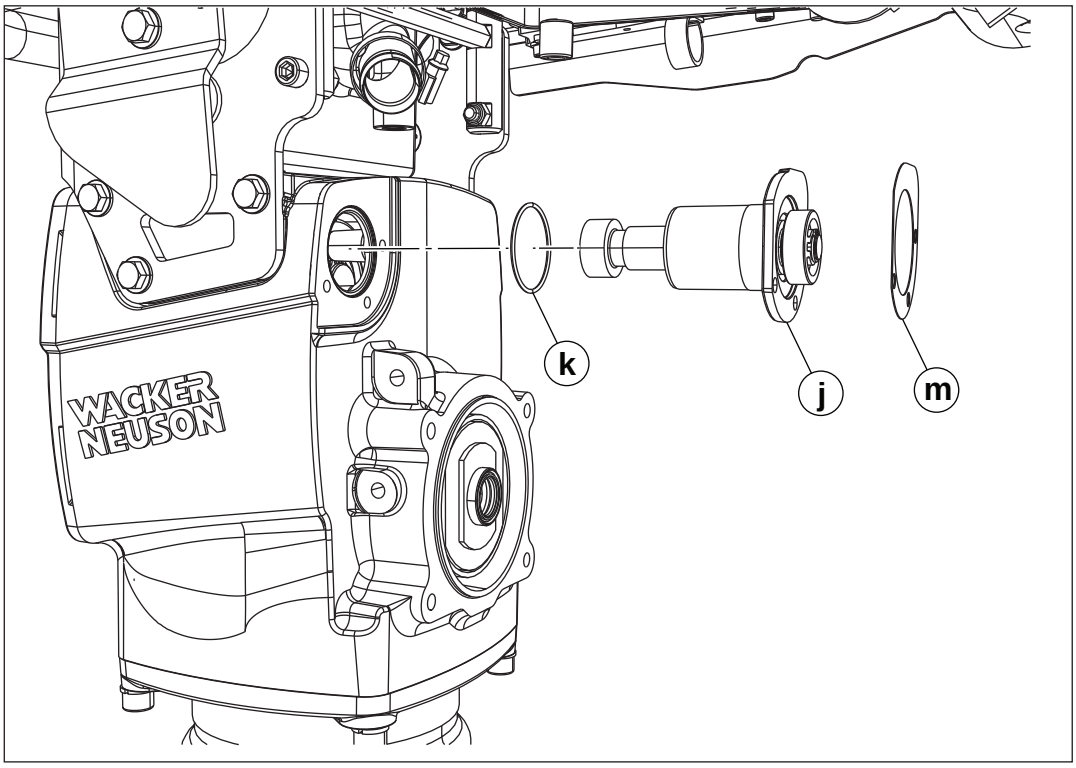
- Torque wrench
- 2-cycle engine oil
- Syringe

Procedure

Perform the procedure below to install the oil pump.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon, or scan the QR code with a smart phone.

1. Install the O-ring **(k)**, cartridge assembly **(j)**, and gasket **(m)**.



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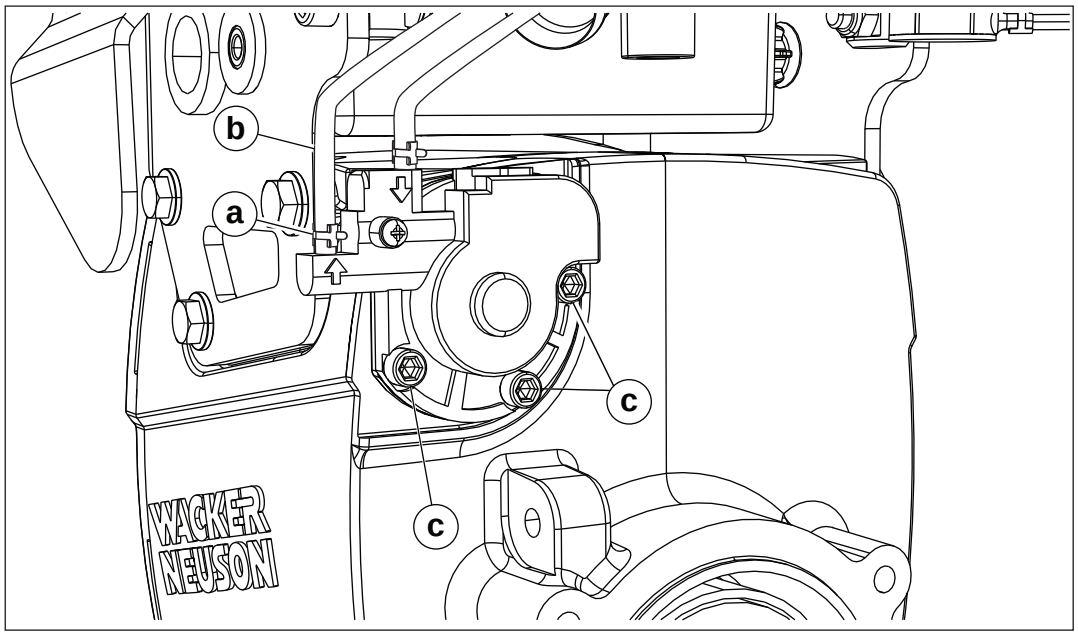
2. Install the oil pump to the machine using three screws **(c)**. Torque the screws to 9.5 Nm (7 ft.lbs.).



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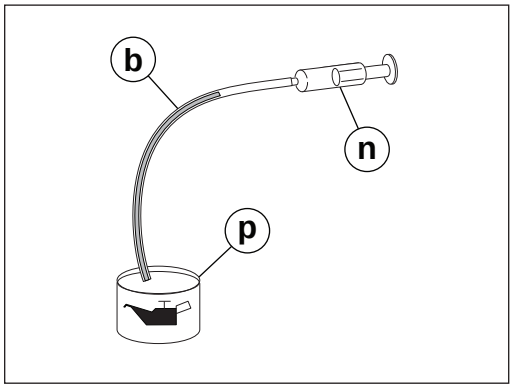
3. With a syringe **(n)** connected to one end of the output oil hose **(b)**, set the other end into a source of 2-cycle engine oil **(p)**. Then, draw the oil from the source into the output oil hose. Fill the output oil hose with oil.



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4. Connect the output hose **(b)** using the clamp **(a)**. Connect the other end of the output hose to the carburetor adapter when installing the engine.
5. Install the engine. See topic *Installing the Engine—WM80.*
6. Fill the oil tank with 2-cycle engine oil.

Result The oil pump has now been installed.

4.41 Removing the Spring System Cover—Hydraulic Press Method

Requirements

- Hydraulic press
- Upper machinery removed
- Bellows removed
- Ramming shoe removed
- Three M8 x 206 mm Torx head guide screws (PN 5000046252)

Background

There are two methods for removing the spring system cover: The preferred method is using the special spring box tool P/N 5000081423. For those who don't have the special tool, the hydraulic press method may be used.

Procedure

Perform the procedure below to remove the spring system cover.

WARNING

Personal injury hazard. The spring system cover is under high pressure. If the spring system cover is removed incorrectly, the springs can eject with enough force to cause serious injury or death!

► Only remove or install the spring system cover using the hydraulic press or spring box tool method.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the bellows. See topic *Removing the Bellows*.
2. Remove the ramming shoe. See topic *Removing the Ramming Shoe—BS50,* or *Removing the Ramming Shoe—BS60 and BS70.*

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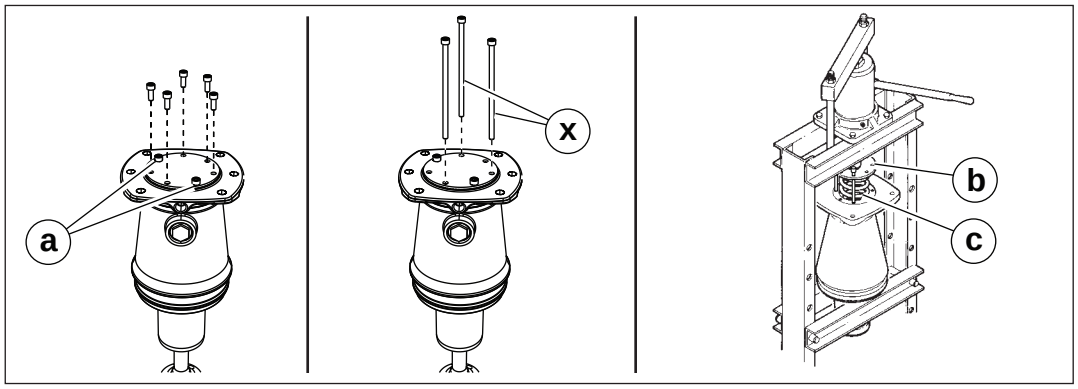
3. Remove all but two of the screws **(a)** that hold the spring system cover to the spring cylinder.



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4. Install three M8 x 206 mm guide screws **(x)** through the spring system cover and into the spring cylinder.
5. Place the spring cylinder in a hydraulic press, and position the head of the press ram in firm contact with the center of the spring system cover **(b)**.
6. Lock the hydraulic press so that it holds the spring system cover in place.
7. Remove the remaining two screws **(a)**.
8. Slowly release the hydraulic press and allow the lower spring set **(c)** to expand.

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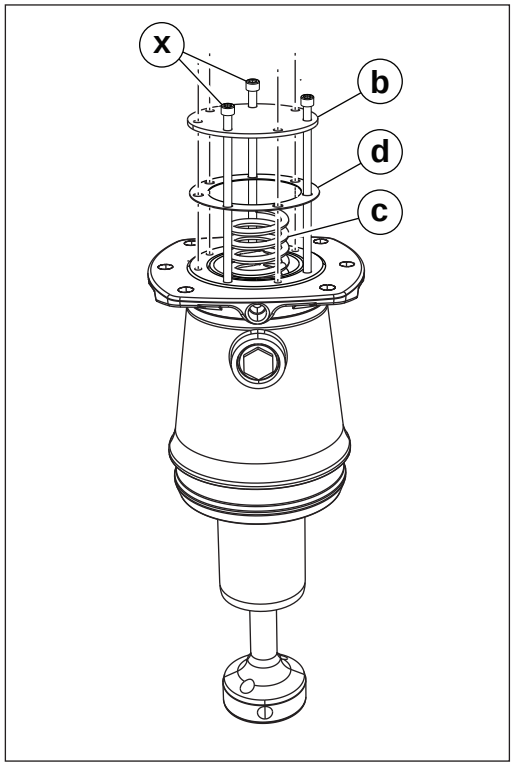
9. After all the spring pressure is released, remove the three M8 x 206 mm guide screws **(x)**, spring system cover **(b)**, gasket **(d)**, and lower spring set **(c)**.



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Result The spring system cover has now been removed.

4.42 Installing the Spring System Cover—Hydraulic Press Method

Requirements

- Hydraulic press
- Loctite® 243
- Three M8 x 206 mm Torx head guide screws (PN 5000046252)

Background

There are two methods for removing the spring system cover: The preferred method is using the special spring box tool P/N 5000081423. For those who don't have the special tool, the hydraulic press method may be used.

Procedure

Perform the procedure below to install the spring system cover.

WARNING

Personal injury hazard. The spring system cover is under high pressure. If the spring system cover is removed incorrectly, the springs can eject with enough force to cause serious injury or death!

► Only remove or install the spring system cover using the hydraulic press or spring box tool method.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

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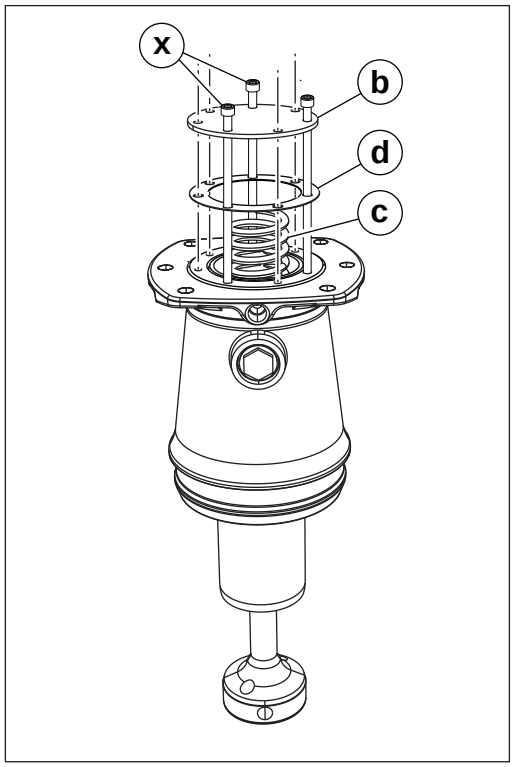
1. Install the lower spring set **(c)**, new gasket **(d)**, and spring system cover **(b)** into the spring cylinder.



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2. Install three M8 x 206 mm guide screws **(x)** through the spring system cover and into the spring cylinder.

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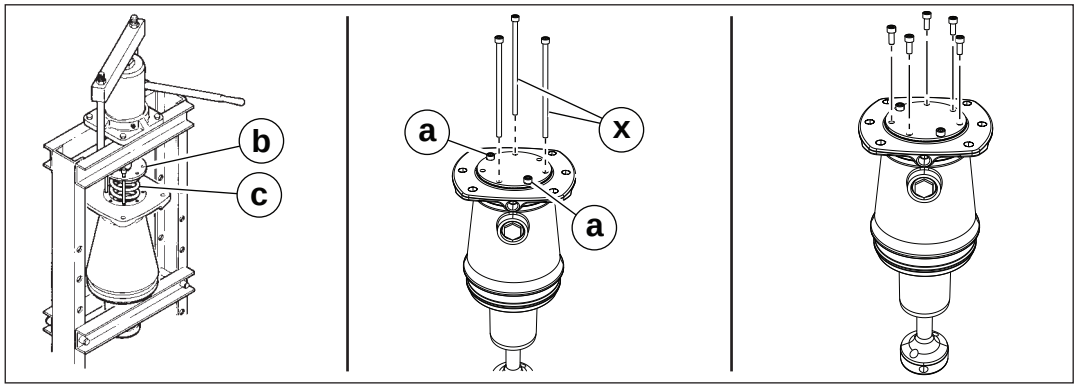
3. Center the lower spring set **(c)** and the spring system cover **(b)** under the hydraulic press ram.



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4. Align the holes in the spring system cover **(b)** as close as possible with the holes in the spring cylinder.
5. Compress the lower spring set **(c)** until the spring system cover **(b)** rests on the spring cylinder.
6. Apply Loctite® 243 and install the two screws **(a)** that hold the spring system cover **(b)** to the spring cylinder. Torque the two screws to 24 Nm (18 ft.lbs.).
7. Remove the three M8 x 206 mm guide screws **(x)**.
8. Apply Loctite 243 and install the remaining screws that hold the spring system cover **(b)** to the spring cylinder. Torque the screws to 24 Nm (18 ft.lbs.).
9. Re-install the ramming shoe. See topic *Installing the Ramming Shoe—BS50,* or *Installing the Ramming Shoe—BS60 and BS70*.
10. Re-install the bellows. See topic *Installing the Bellows*.

Results

The spring system cover has now been installed.

4.43 Removing the Spring System Cover—Spring Box Tool

Requirements

- Spring box tool P/N 5000081423
- Loctite® 243
- Upper assembly removed
- Bellows removed
- Ramming shoe removed

Background

There are two methods for removing the spring system cover: The preferred method is using the special spring box tool P/N 5000081423. For those who don't have the special tool, the hydraulic press method may be used.

Procedure

Perform the procedure below to remove the spring system cover.

WARNING

Personal injury hazard. The spring system cover is under high pressure. If the spring system cover is removed incorrectly, the springs can eject with enough force to cause serious injury or death!

► Only remove the spring system cover using the hydraulic press or spring box tool method.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

Spring Box Tool Method

1. Remove the bellows. See topic *Removing the Bellows.*
2. Remove the ramming shoe. See topic *Removing the Ramming Shoe—BS50,* or *Removing the Ramming Shoe—BS60 and BS70.*

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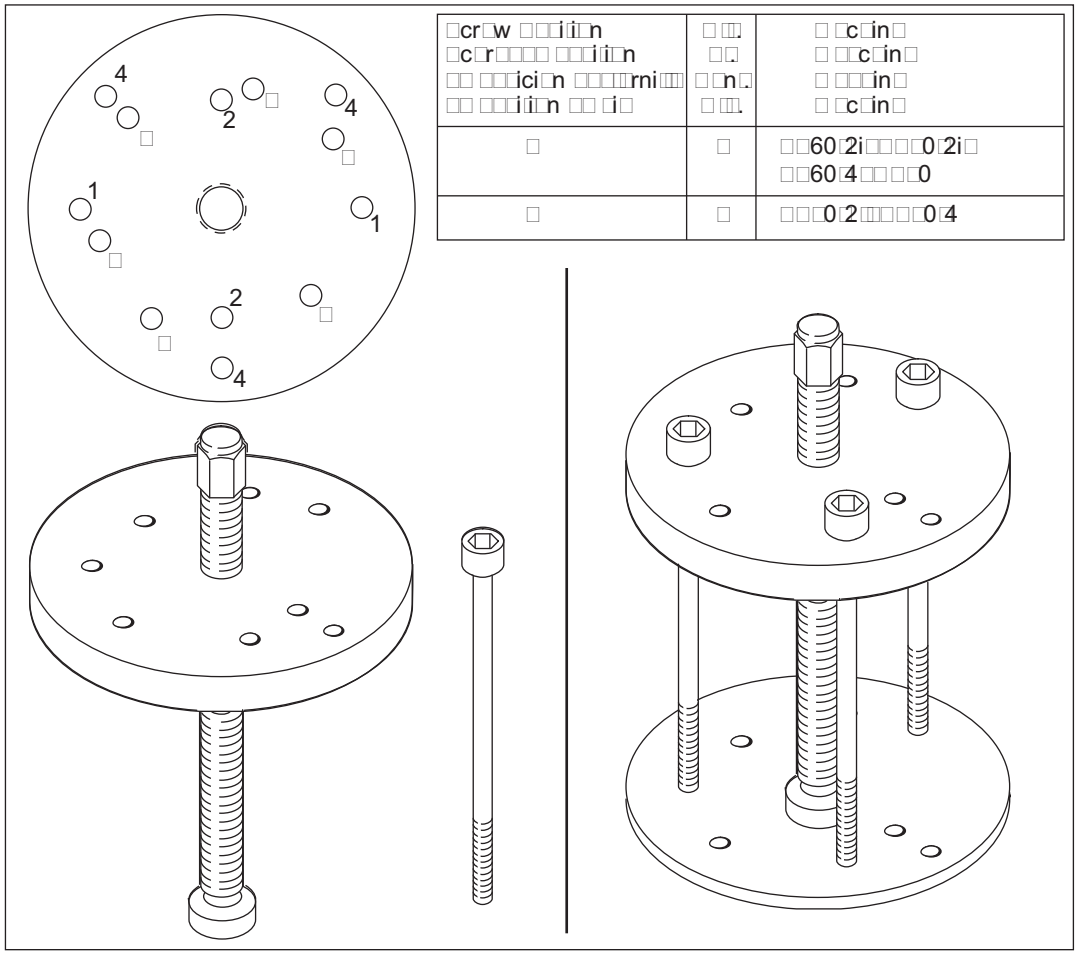

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Note: *Spring box tool P/N 5000081423*

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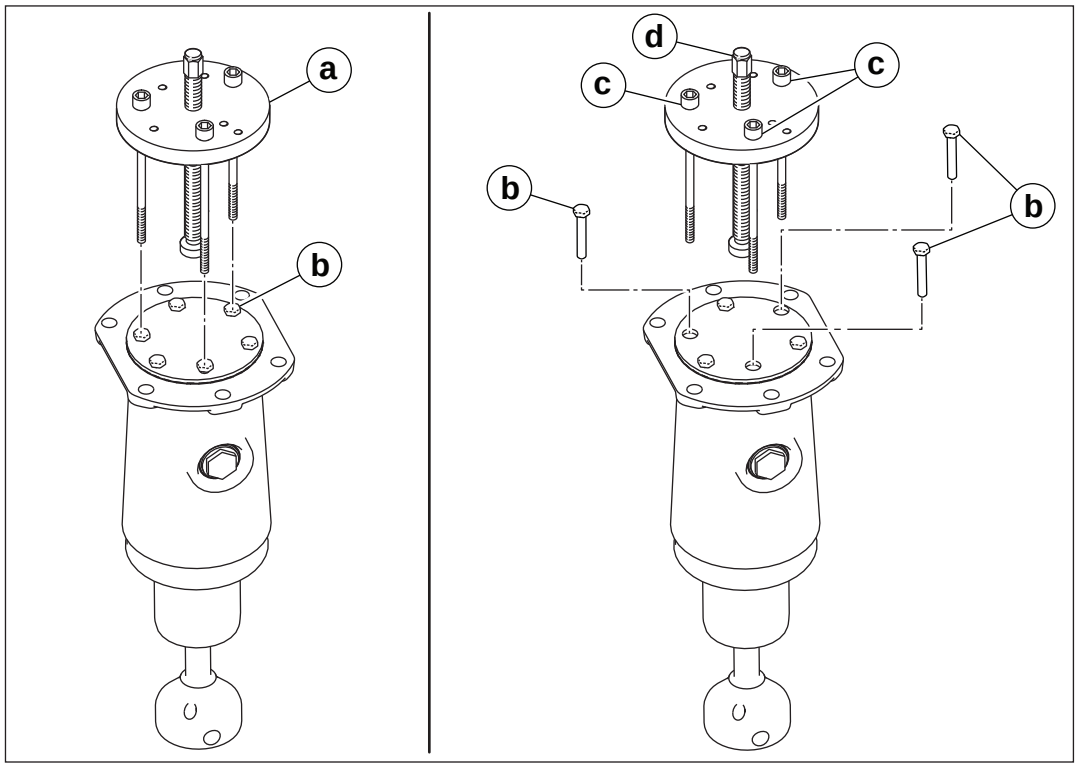
3. Align three holes in the spring box tool **(a)** with the three screws **(b)** in the spring system cover.



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4. Remove the three screws **(b)**.
5. Insert the three spring box screws **(c)** through the three selected holes in the spring box tool and turn the screws into the spring cylinder until they bottom out.
6. Turn the threaded rod **(d)** through the center of the spring box tool until it reaches the spring system cover.

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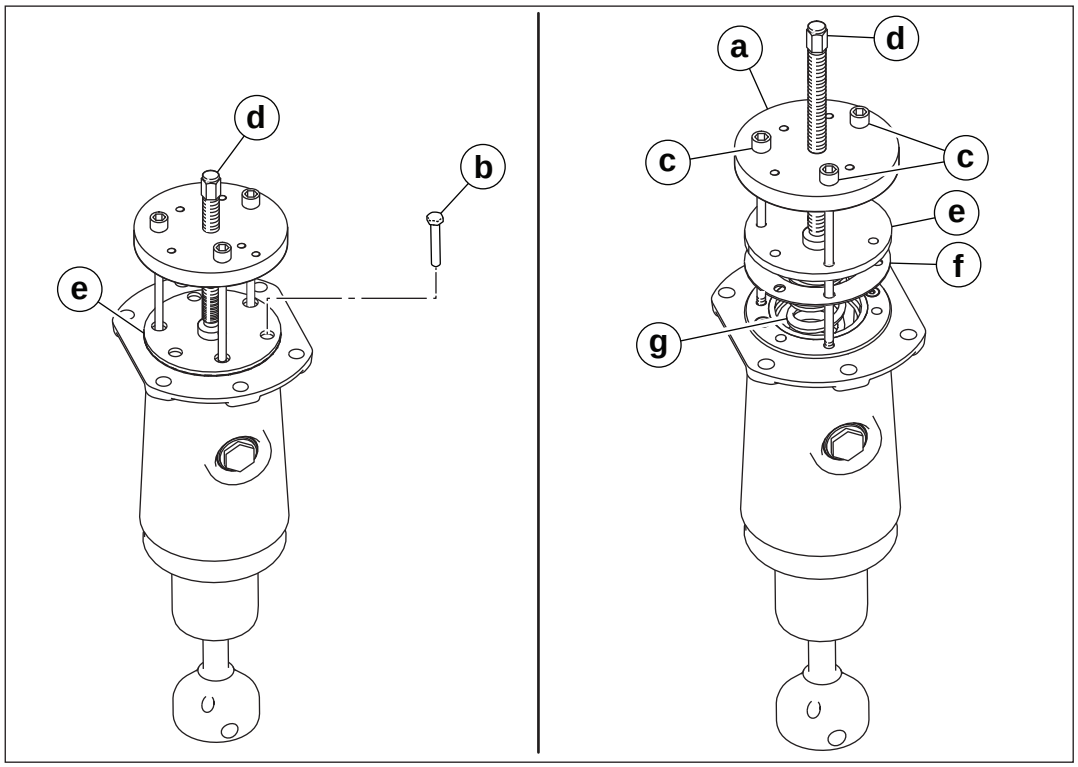
7. With the threaded rod **(d)** holding the spring system cover **(e)** in place, remove the remaining screws **(b)** from the spring system cover.



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8. Slowly loosen the threaded rod **(d)** until the springs have fully expanded and the pressure is released.
9. After all the spring pressure is released, remove the spring box screws **(c)** and remove the spring box tool **(a)**.
10. Remove the spring system cover **(e)**, the gasket **(f)**, and the lower spring set **(g)**.

Result The spring system cover has now been removed.

4.44 Installing the Spring System Cover—Spring Box Tool

Requirements

- Spring box tool P/N 5000081423
- Loctite® 243
- New gasket

Background

There are two methods for installing the spring system cover: The preferred method is using the special spring box tool P/N 5000081423. For those who don't have the special tool, the hydraulic press method used.

Procedure

Perform the procedure below to install the spring system cover.

WARNING

Personal injury hazard. The spring system cover is under high pressure. If the spring system cover is removed incorrectly, the springs can eject with enough force to cause serious injury or death!

► Only remove the spring system cover using the hydraulic press or spring box tool method.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

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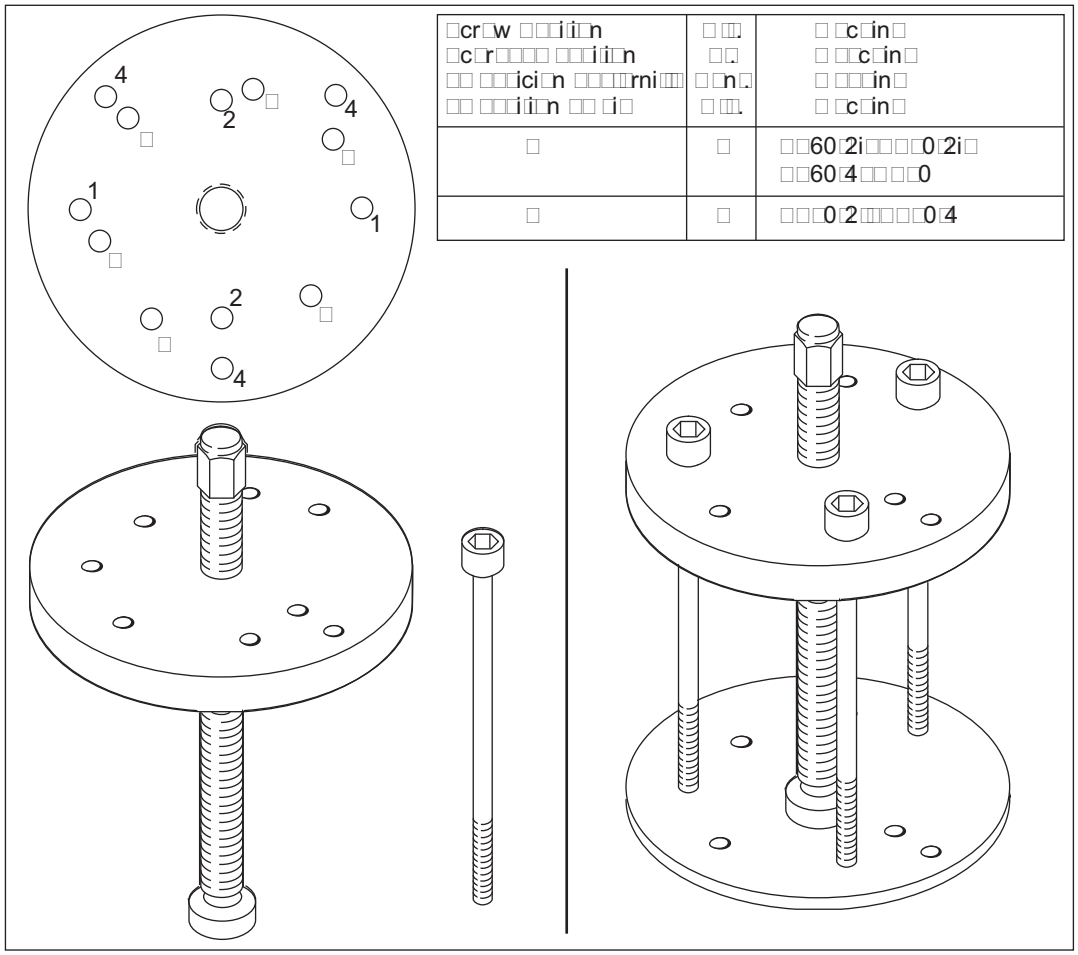
Spring Box Tool Method



wc_gr0128 1

Note: *Spring box tool P/N 5000081423*

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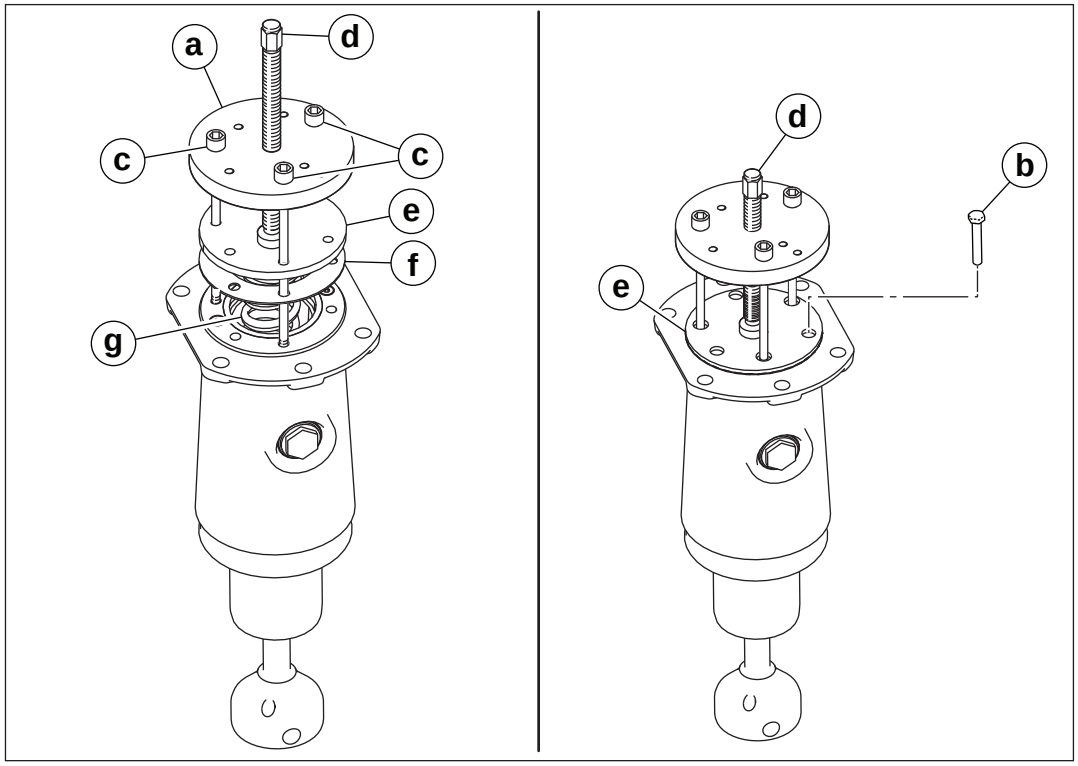
1. Install the bottom spring set **(g)** into the spring cylinder.



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2. Place a new gasket **(f)** onto the spring cylinder.
3. Align the three holes in the spring box tool **(a)** with the three holes in the spring system cover **(e)**.
4. Insert the three spring box screws **(c)** through the selected holes in the spring box tool and through the holes in the spring system cover.
5. Turn the spring box screws **(c)** into the spring cylinder until they bottom out.
6. Turn the threaded rod **(d)** until the spring system cover makes contact with the spring cylinder.
7. Apply Loctite® 243 to all the screws used to fasten the spring system cover to the spring cylinder.
8. Install the screws **(b)** that hold the spring system cover to the spring cylinder. Torque the screws to 24 Nm (18 ft.lbs.).

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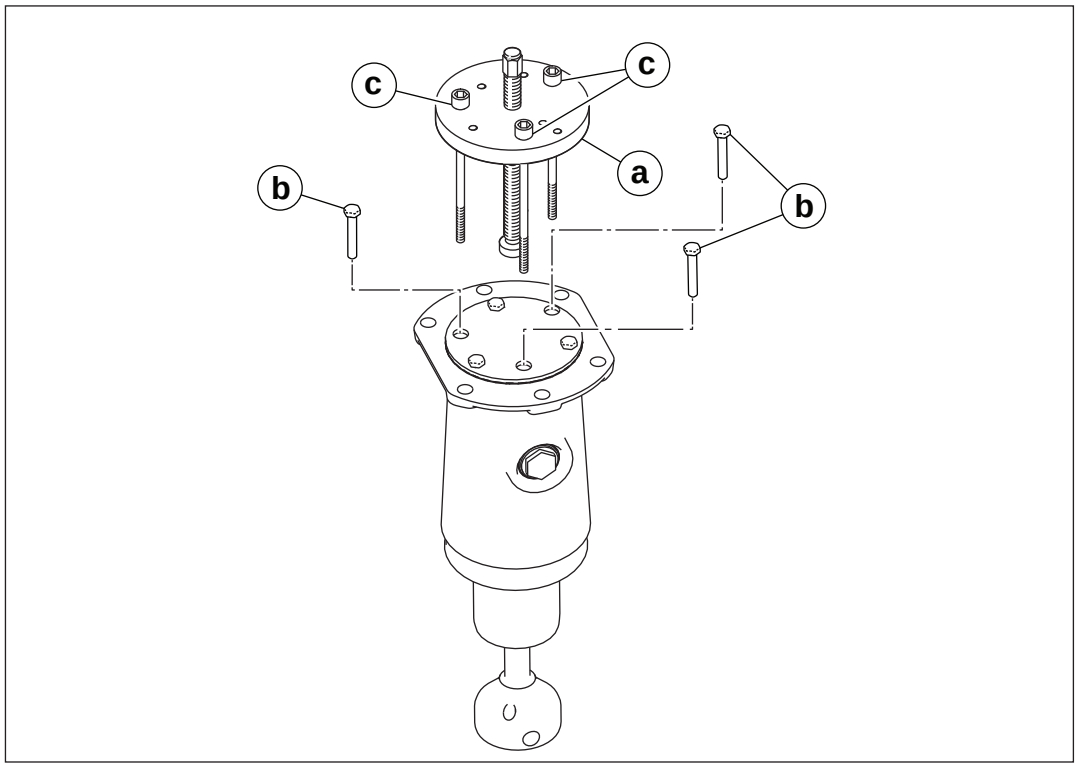
9. Remove the spring box screws **(c)** and remove the spring box tool **(a)**.



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10. Install the remaining three screws **(b)** that hold the spring system cover to the spring cylinder. Torque the screws to 24 Nm (18 ft.lbs.).
11. Install the ramming shoe. See topic *Installing the Ramming Shoe—BS50,* or *Installing the Ramming Shoe—BS60 and BS70.*
12. Install the bellows. See topic *Installing the Bellows.*

Result The spring system cover has now been installed.

4.45 Removing the Upper Spring Set

Requirements

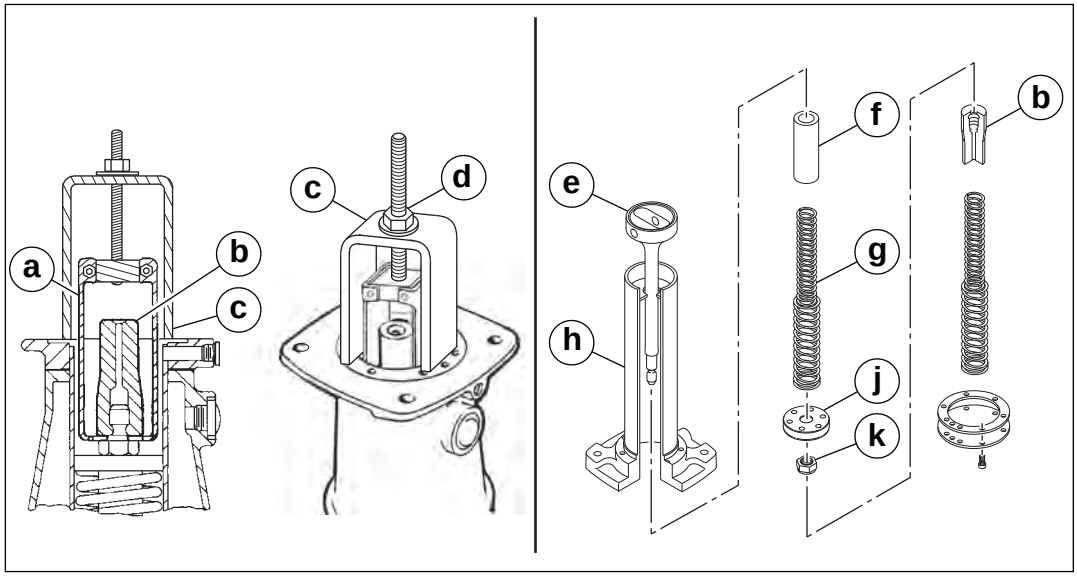
- Drift pin
- Rubber mallet
- Impact bushing puller P/N 5000116816
- Ramming shoe removed
- Spring system cover removed
- Lower springs removed

Procedure

Perform the procedure below to remove the upper spring set.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Loosen the nut **(d)** on the impact bushing puller to allow the yoke **(c)** to set on the flange surface of the rammer, and the jaws to reach the bottom of the impact bushing.



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2. Push the jaws **(a)** of the impact bushing puller over the impact bushing **(b)** until it seats at the bottom of the impact bushing.
3. Once the jaws are seated on the impact bushing, tighten the two wing nuts on the jaws holding them in place.

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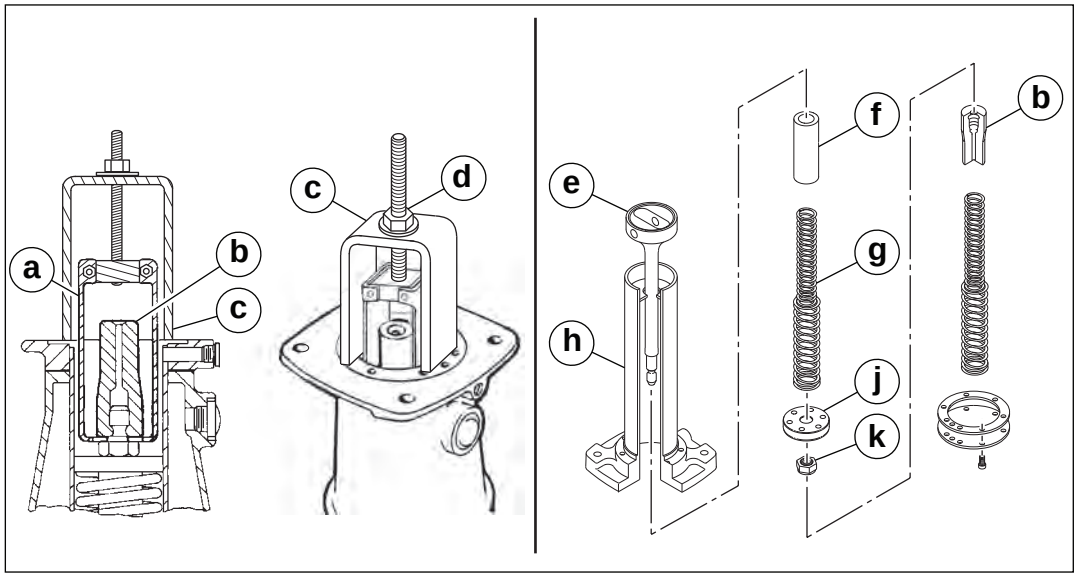
4. Tighten the nut **(d)** on the impact bushing puller to remove the impact bushing **(b)** and discard the impact bushing.



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5. Place a drift pin through the holes on the end of the ram **(e)** to prevent the ram from turning.
6. Use an impact wrench to remove the locknut **(k)**.
7. Remove the piston guide **(j)**.
8. Remove the upper spring set **(g)** and the bushing **(f)** from the spring cylinder **(h)**.

Result The upper spring set has now been removed.

4.46 Installing the Upper Spring Set

Requirements

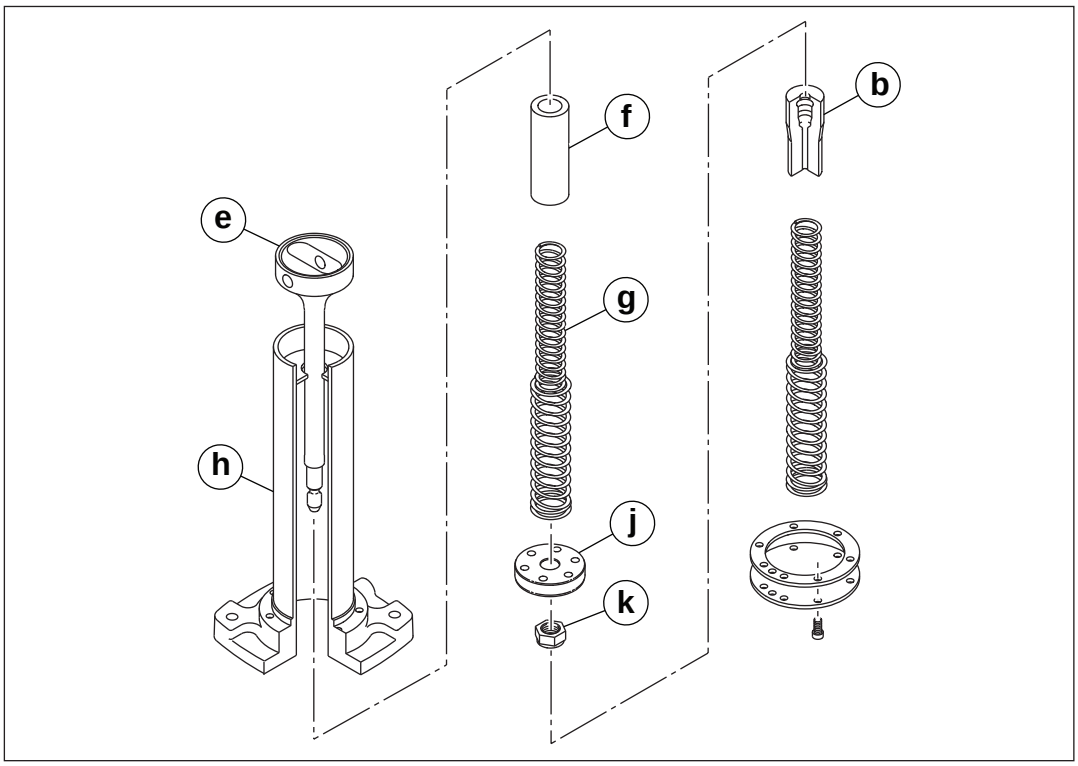
- Drift pin
- Rubber mallet
- Loctite® 243

Procedure

Perform the procedure below to install the upper spring set.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Slide the ram **(e)** into the spring cylinder **(h)**.



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2. Re-install the bushing **(f)** and the upper spring set **(g)**.
3. Re-install the piston guide **(j)**.
4. Place a drift pin through the holes on the end of the ram **(e)** to prevent the ram from turning.
5. Apply Loctite 243 to the locknut **(k)**, then re-install it. Torque the locknut to:
   - **BS50-2i:** 176 Nm (130 ft.lbs.)
   - **BS60-2 / BS60-4 / BS60-4As:** 250 Nm (184 ft.lbs.)
6. Press a new impact bushing **(b)** onto the end of the ram and seat it by hitting the end of the impact bushing with a rubber mallet.

This procedure continues on the next page.

Continued from the previous page.

7. Using one of the two recommended methods, re-install the lower springs and the spring system cover.
8. Re-install the ramming shoe.

Result The upper spring set has now been installed.

4.47 Testing the Float Switch

Background The function of the float switch is to prevent the engine from running without oil in the oil tank. If the oil tank is low on oil, the float switch opens and prevents ignition. A severed float switch wire will also prevent ignition. In the event that the engine runs but shuts off by itself within approximately 25 seconds, even with oil in the oil tank, the float switch could be faulty.

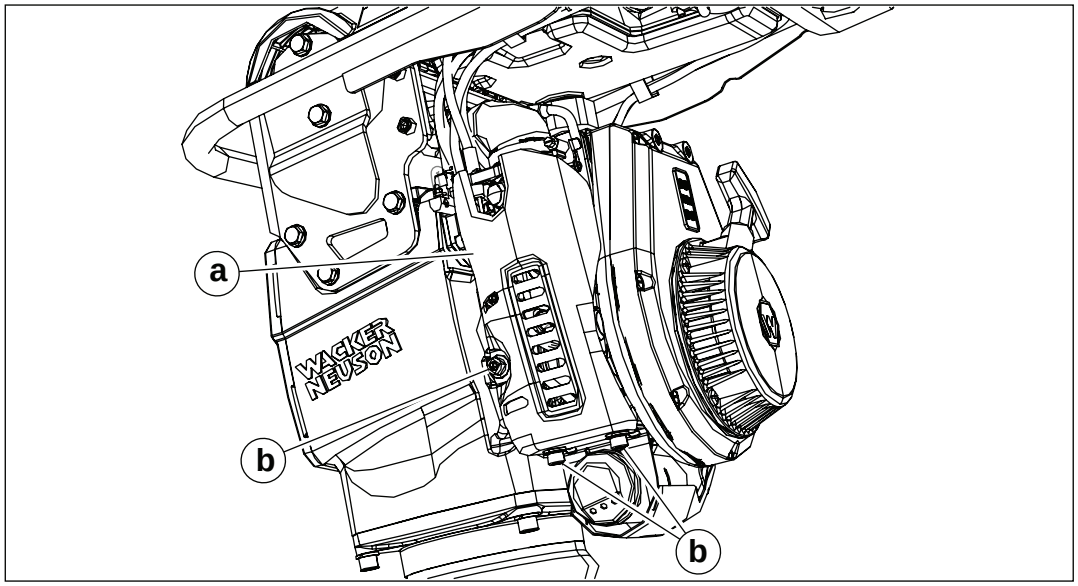
Requirements

- Machine shut down and cool
- Multimeter
- Oil tank at least 1/4 full
- Torque wrench
- Loctite® 243

Procedure Perform the procedure below to test the float switch.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

1. Remove the three screws and washers **(b)**, and remove the carburetor guard **(a)**.



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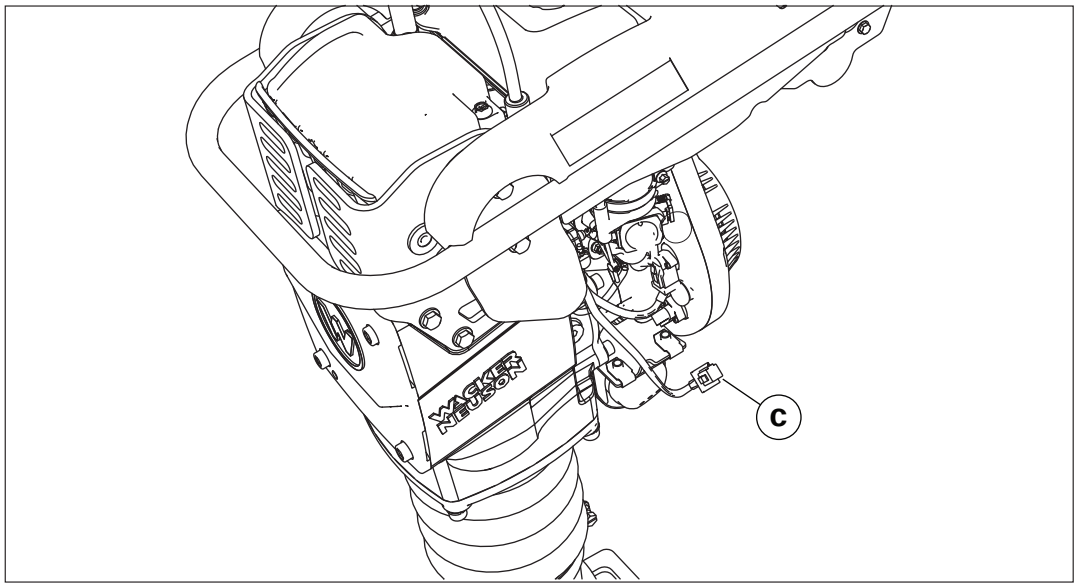
2. Disconnect the float switch connector **(c)**.



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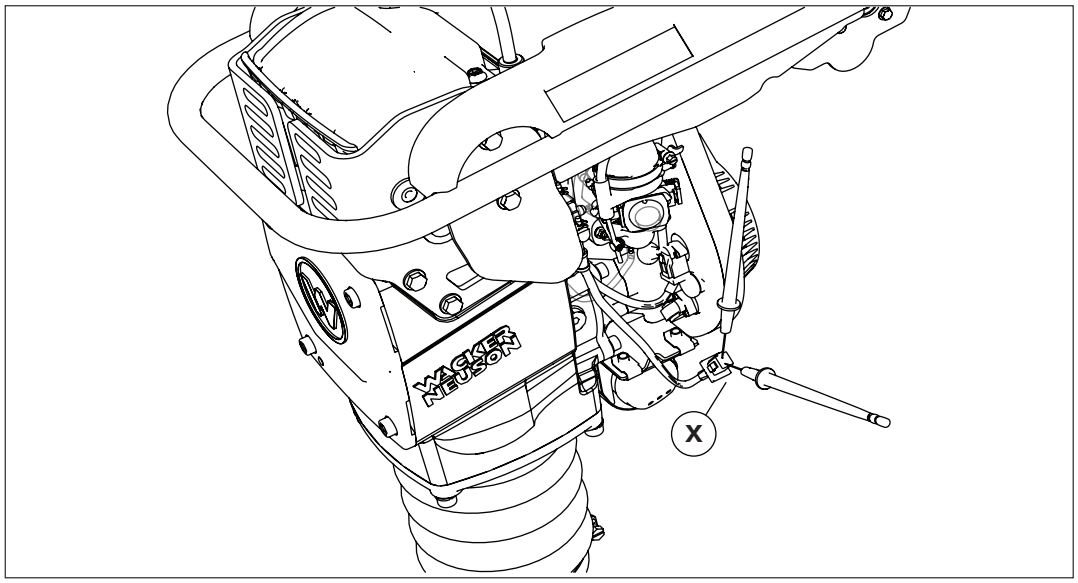
3. Check the continuity of the float switch by measuring across the connector terminals **(x)**.



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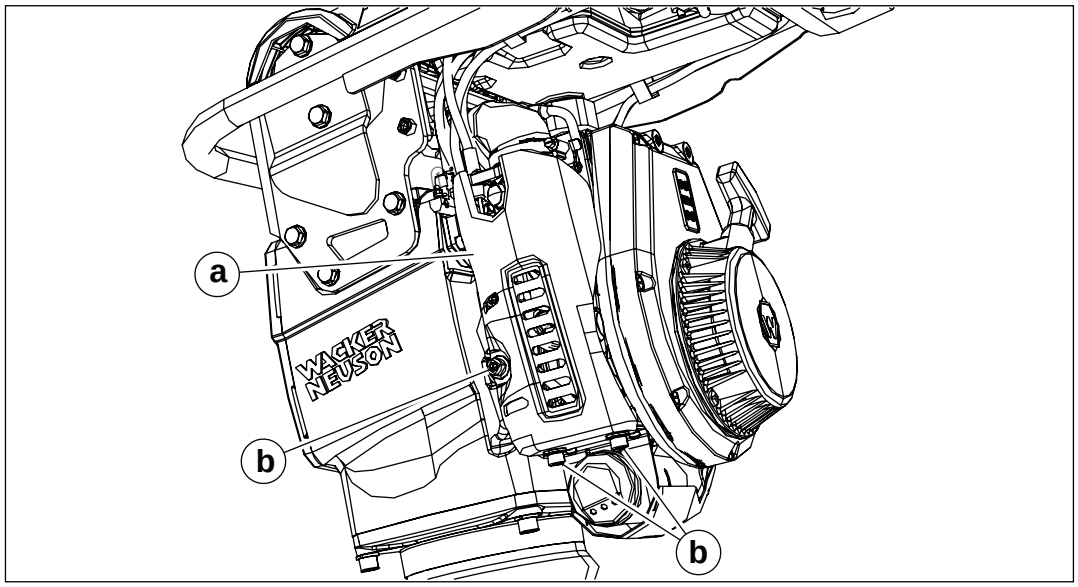
Does the float switch have continuity?

Yes ____	**No** ____
The float switch is OK.	The float switch has failed; replace it. See topic *Replacing the Float Switch*.

This procedure continues on the next page.

Continued from the previous page.

4. Reconnect the float switch.
5. Apply Loctite® 243 to the three screws **(b)** and fasten the carburetor guard **(a)** to the machine. Torque the screws to 23 Nm (17 ft.lbs.).



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Result The float switch has now been tested.

4.48 Replacing the Float Switch

Requirements

- Machine shut down and cool
- Approved container for drained oil
- Plastic sheet to protect work surface
- Torque wrench
- Loctite® 243

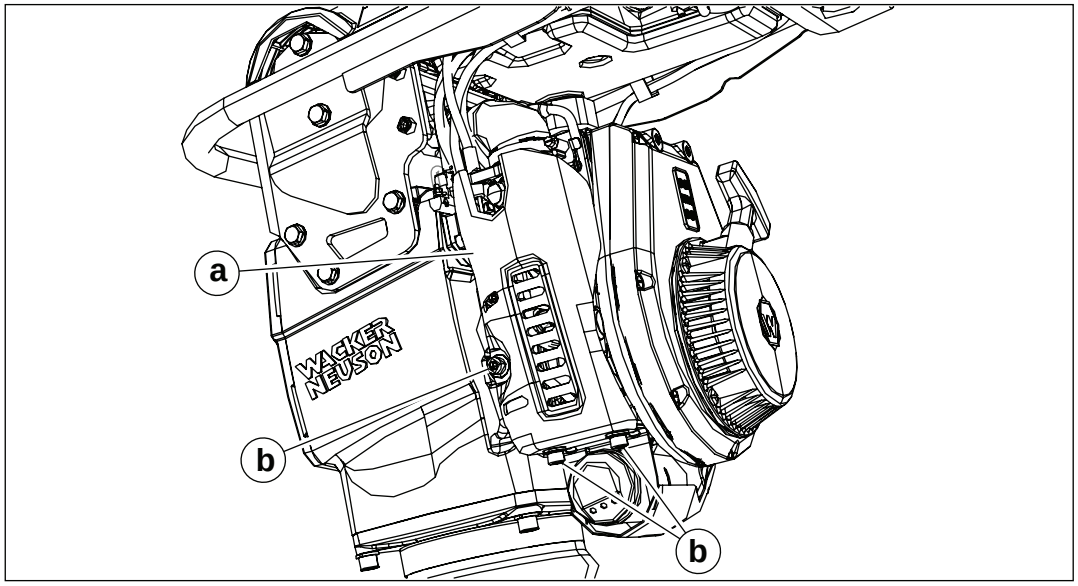
Procedure

Perform the procedure below to replace the float switch.

To view an animation of this procedure, internet access is needed.
To view the animation, click on the video icon or scan the QR code with a smart phone.

Note: *Dispose of oil in accordance with local environmental regulations.*

1. Set the machine on a plastic sheet and drain the oil tank contents into an approved container.
2. Remove the three screws and washers **(b)**, and remove the carburetor guard **(a)**.



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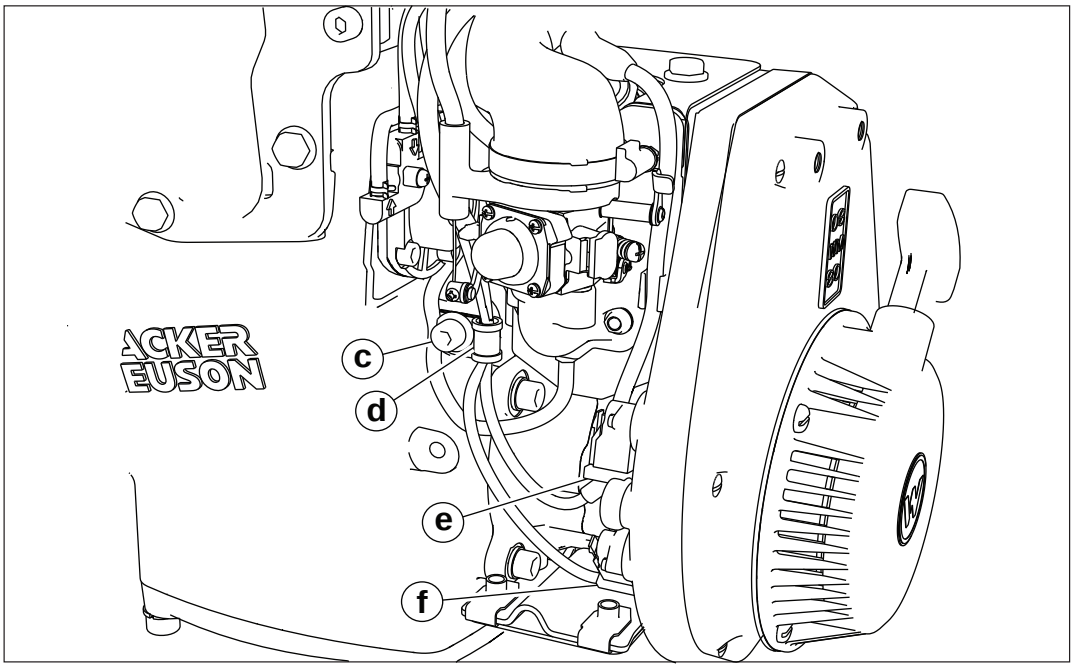
3. Disconnect the stop switch **(e)** and the float switch **(f)**.



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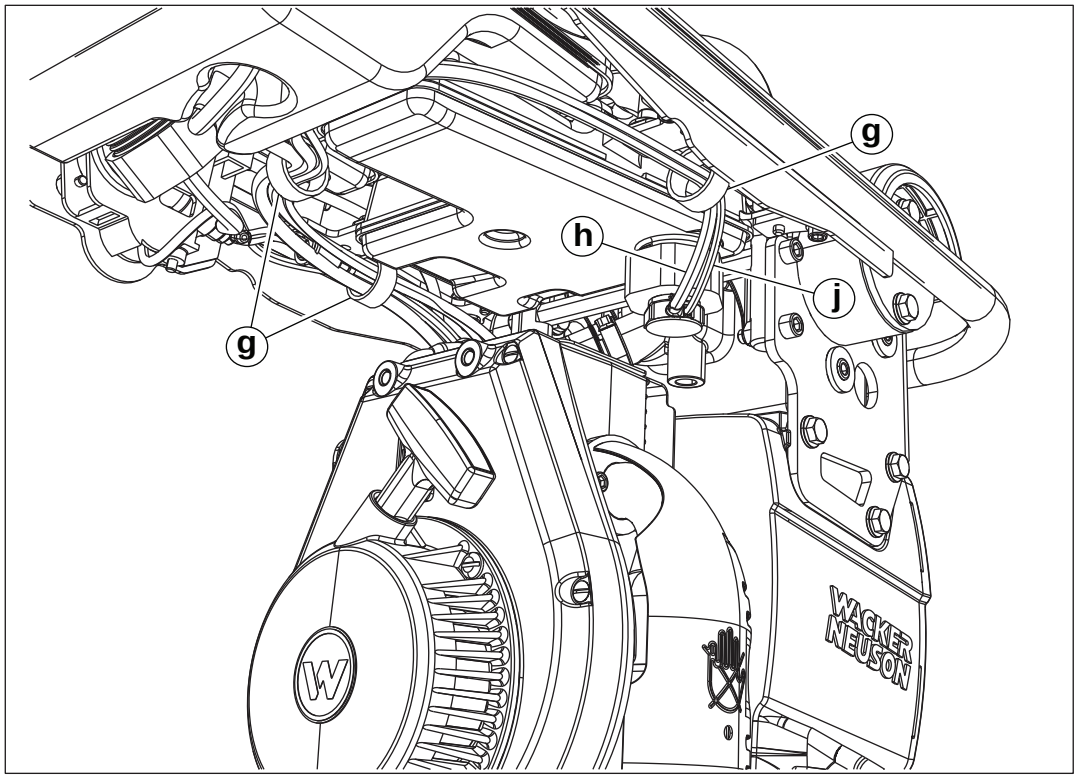
Note: *For ease of installation, record the routing of the float switch wire.*

4. Remove the screw **(c)** and the clamp **(d)**.
5. Remove the oil hose **(h)** and the float switch wire **(j)** from the clamps **(g)**.



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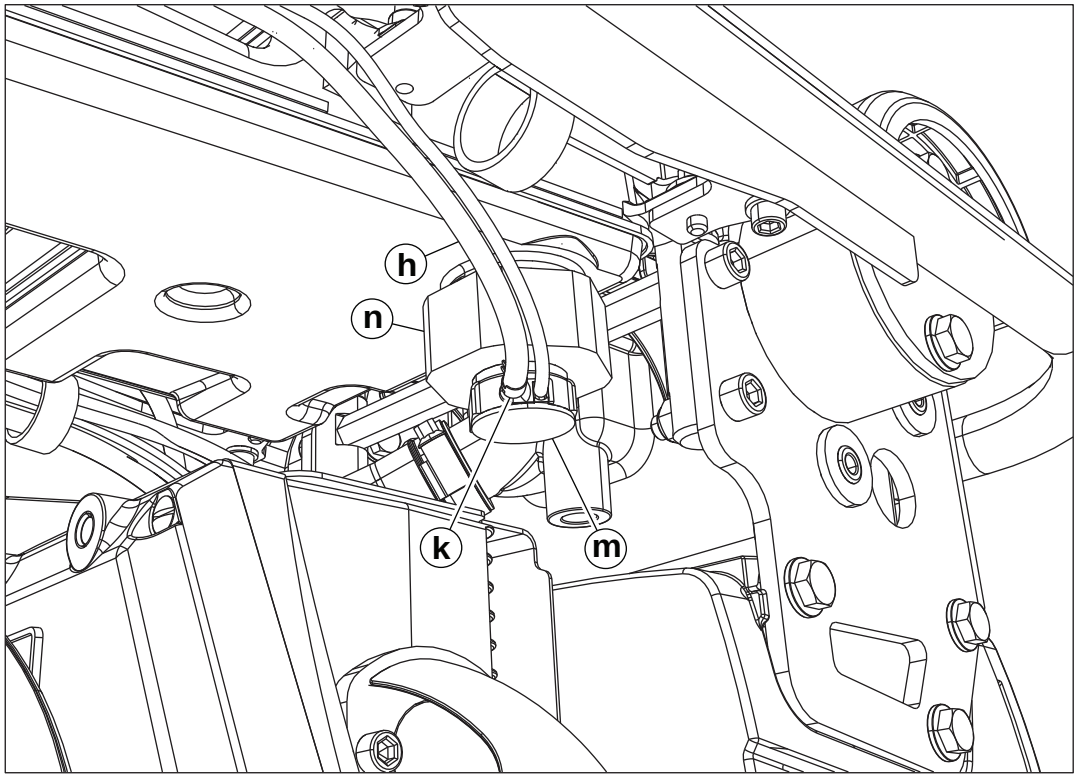
6. Cut the oil hose **(h)** from the float switch **(m)**. Remove and retain the clamp **(k)** for re-use during installation.



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7. Using two flathead screwdrivers, one on either side of the float switch **(m)**, pry the float switch out of the oil filter assembly **(n)**.

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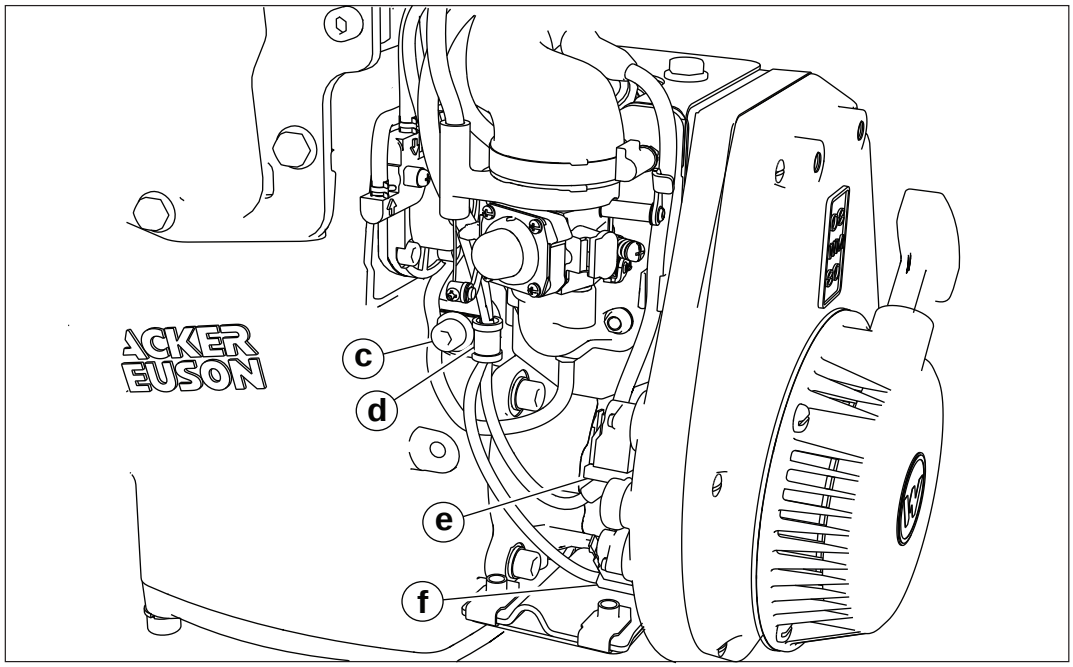
Installation

1. Route and connect the float switch connector **(f)** and re-connect the stop switch connector **(e)**.



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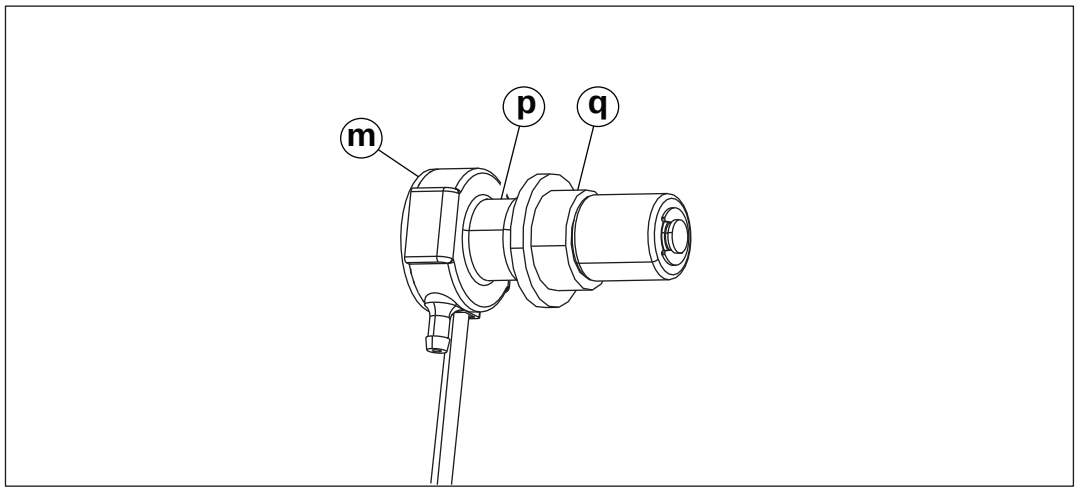
2. Install the clamp **(d)** and the screw **(c)**.
3. Before installing the new float switch **(m)**, apply oil to the shaft **(p)**.



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4. Move the grommet **(q)** over the shaft.

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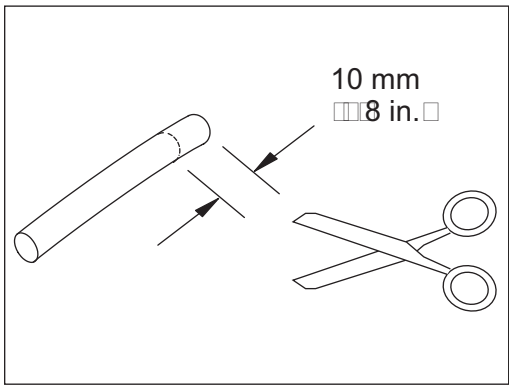
5. Remove 3/8 in. (10 mm) off the end of the oil hose **(h)**.



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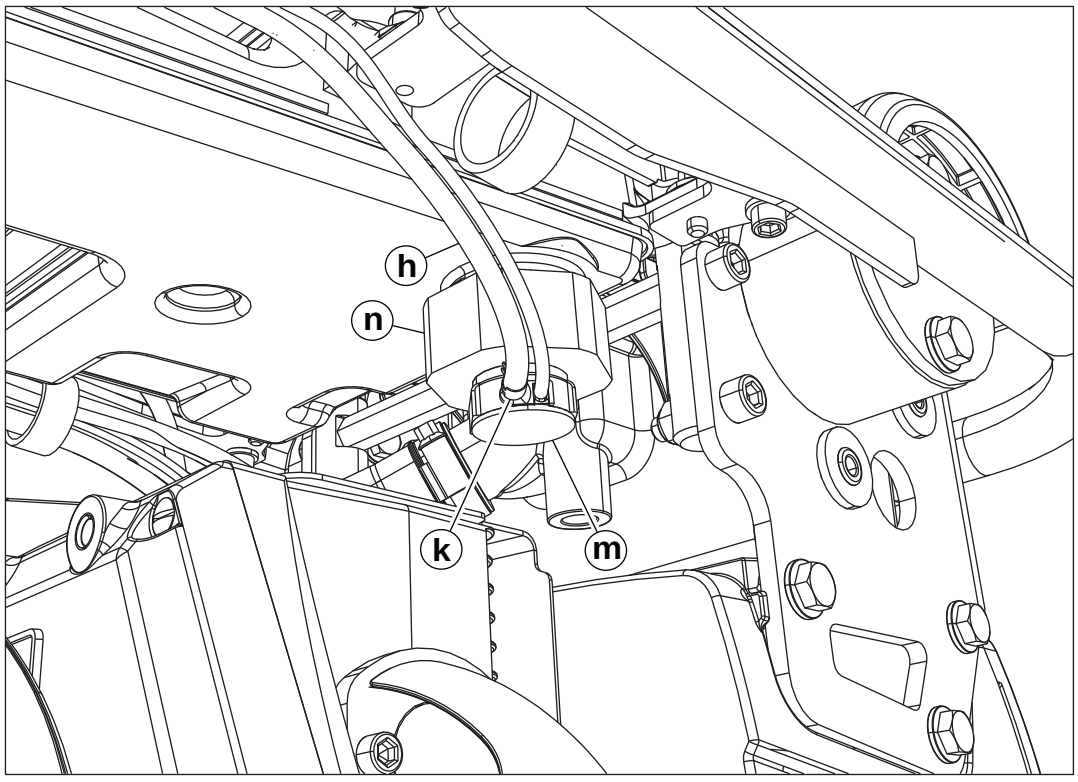
6. Insert the float switch **(m)** into the oil filter **(n)**.
7. Install the clamp **(k)** and connect the oil hose **(h)** to the float switch **(m)**.
8. Install the oil hose and the wire in the clamps.



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This procedure continues on the next page.

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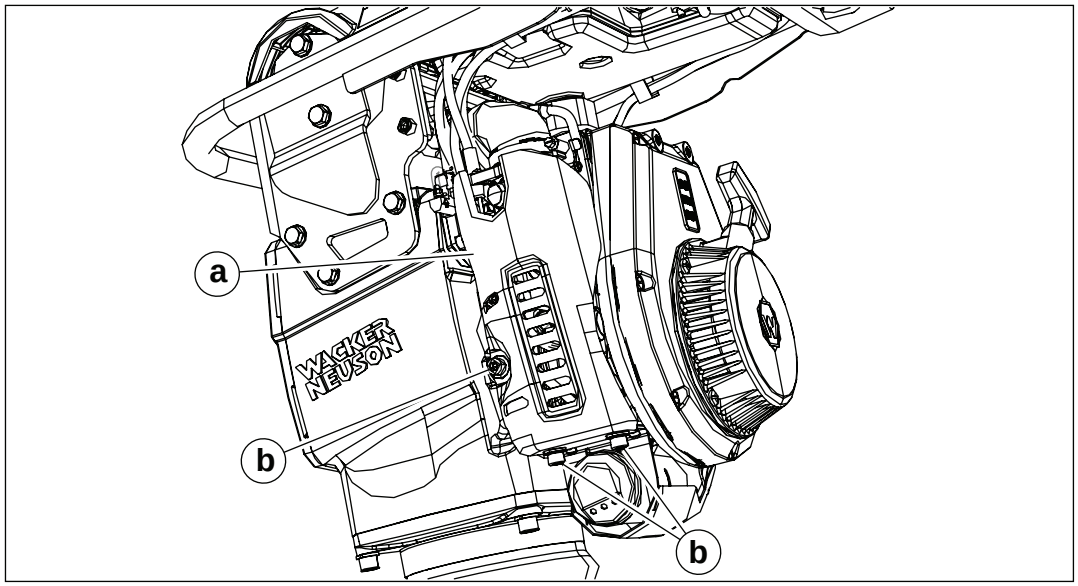
9. Apply Loctite® 243 to the three screws **(b)** and fasten the carburetor guard **(a)** to the machine. Torque the screws to 23 Nm (17 ft.lbs.).



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Result The float switch has now been replaced.

5 Technical Data

5.1 BS 50-4s

Machine		BS 50-4s	
Item number		5200000644 5200000662	5200000679 5200000680
Engine model		WM 100	
Operating weight	kg (lb)	63 (139)	
Engine speed–operating	rpm	3,950 ± 100	4,200 ± 100
Engine speed–idle	rpm	2,000 ± 100	
Clutch Engagement	rpm	2,650 ± 100	
Max. rated power @ rated speed[1]	kW (hp)	2.4 (3.2)	
Spark plug	type	NGK: BMR4A or CHAMPION: RCJ14	
Electrode gap	mm (in.)	0.6–0.7 (0.023–0.027)	
Air cleaner	type	Four-stage with cyclonic precleaner	
Engine lubrication	oil grade	SAE 10W30 SJ or higher	
Engine oil capacity	L (qt)	0.30 (0.3)	
Fuel tank capacity	L (qt)	3.0 (3.2)	
Fuel	type	Regular unleaded gasoline	
Fuel consumption	L (qt)/hr	1.2 (1.3)	
Running time	hr	2.5	
Ramming system lubrication	oil grade	SAE 10W30 SJ or higher	
Ramming system capacity	ml (oz.)	890 (30)	

[1]Gross engine power rating per SAE J1995. Actual power output may vary due to conditions of specific use.

5.2 BS 50-4As

Machine		BS 50-4As		
Item number		5200018219 5200018226		5100015099
Engine model		Honda GX100		Honda GXR120
Operating weight	kg (lb)	64 (141)		
Engine speed–operating	rpm	3,950 ± 100	4,200 ± 100	3,950 ± 100
Engine speed–idle	rpm	1,850 ± 150		
Clutch Engagement	rpm	2,650 ± 100		
Max. rated power @ rated speed[1]	kW (hp)	2.35 (3.15)		2.80 (3.75)
Spark plug	type	NGK: CR5HSB or DENSO U16FSR-UB		
Electrode gap	mm (in.)	0.6–0.7 (0.024–0.028)		
Air cleaner	type	Four-stage with cyclonic precleaner		
Engine lubrication	oil grade	SAE 10W30 SJ or higher		
Engine oil capacity	L (qt)	0.40 (0.42)		
Fuel tank capacity	L (qt)	3.0 (3.2)		
Fuel	type	Regular unleaded gasoline		
Fuel consumption	L (qt)/hr	0.88 (0.93)		1.00 (1.10)
Running time	hr	3.4		3.0
Ramming system lubrication	oil grade	SAE 10W30 SJ or higher		
Ramming system capacity	ml (oz.)	890 (30)		

[1]Gross engine power rating per SAE J1995. Actual power output may vary due to conditions of specific use.

5.3 BS 60-4s

Machine		BS 60-4s	
Item number		5200000647 5200000667 5200000674 5200000675	5200000648 5200000668 5200022984
Engine model		WM 100	
Operating weight	kg (lb)	71 (156)	
Engine speed–operating	rpm	3,950 ± 100	4,200 ± 100
Engine speed–idle	rpm	2,000 ± 100	
Clutch Engagement	rpm	2,650 ± 100	
Max. rated power @ rated speed[1]	kW (hp)	2.4 (3.2)	
Spark plug	type	NGK: BMR4A or CHAMPION: RCJ14	
Electrode gap	mm (in.)	0.6–0.7 (0.023–0.027)	
Air cleaner	type	Four-stage with cyclonic precleaner	
Engine lubrication	oil grade	SAE 10W30 SJ or higher	
Engine oil capacity	L (qt)	0.30 (0.3)	
Fuel tank capacity	L (qt)	3.0 (3.2)	
Fuel	type	Regular unleaded gasoline	
Fuel consumption	L (qt)/hr	1.2 (1.3)	
Running time	hr	2.5	
Ramming system lubrication	oil grade	SAE 10W30 SJ or higher	
Ramming system capacity	ml (oz.)	890 (30)	

[1]Gross engine power rating per SAE J1995. Actual power output may vary due to conditions of specific use.

5.4 BS 60-4As

Machine		BS 60-4As		
Item number		5200014910 5200018231 5200018232 5200018233		5100015123
Engine model		Honda GX100		Honda GXR120
Operating weight	kg (lb)	72 (158)		
Engine speed–operating	rpm	3,950 ± 100	4,200 ± 100	3,950 ± 100
Engine speed–idle	rpm	1,850 ± 150		
Clutch Engagement	rpm	2,650 ± 100		
Max. rated power @ rated speed[1]	kW (hp)	2.35 (3.15)		2.80 (3.75)
Spark plug	type	NGK: CR5HSB or DENSO: U16FSR-UB		
Electrode gap	mm (in.)	0.6–0.7 (0.024–0.028)		
Air cleaner	type	Four-stage with cyclonic precleaner		
Engine lubrication	oil grade	SAE 10W30 SJ or higher		
Engine oil capacity	L (qt)	0.40 (0.42)		
Fuel tank capacity	L (qt)	3.0 (3.2)		
Fuel	type	Regular unleaded gasoline		
Fuel consumption	L (qt)/hr	0.88 (0.93)		1.00 (1.10)
Running time	hr	3.0		3.4
Ramming system lubrication	oil grade	SAE 10W30 SJ or higher		
Ramming system capacity	ml (oz.)	890 (30)		

[1]Gross engine power rating per SAE J1995. Actual power output may vary due to conditions of specific use.

5.5 BS 70-4As

Machine		BS 70-4As
Item number		5100015124, 5100015126
Engine model		Honda GXR120
Operating weight	kg (lb)	80 (177)
Engine speed–operating	rpm	3,950 ± 100
Engine speed–idle	rpm	1,850 ± 150
Clutch Engagement	rpm	2,650 ± 100
Max. rated power @ rated speed[1]	kW (hp)	2.80 (3.75)
Spark plug	type	NGK: CR5HSB or DENSO: U16FSR-UB
Electrode gap	mm (in.)	0.6–0.7 (0.024–0.028)
Air cleaner	type	Four-stage with cyclonic precleaner
Engine lubrication	oil grade	SAE 10W30 SJ or higher
Engine oil capacity	L (qt)	0.40 (0.42)
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel	type	Regular unleaded gasoline
Fuel consumption	L (qt)/hr	1.00 (1.10)
Running time	hr	3.4
Ramming system lubrication	oil grade	SAE 10W30 SJ or higher
Ramming system capacity	ml (oz.)	890 (30)

[1] *Gross engine power rating per SAE J1995. Actual power output may vary due to conditions of specific use.*

5.6 Sound Measurements

Products are tested for sound pressure level in accordance with EN 500-4:2011.

Sound power level is tested in accordance with European Directive 2000/14/EC - Noise Emission in the Environment by Equipment for use outdoors.

Machine		Sound Pressure at Operator's Location dB(A)	Guaranteed Sound Power dB(A)
BS 50-4As	5200018219 5200018226	90	108
BS 50-4s **BS 50-4As**	5200000644 5200000662 5100015099	91	108
BS 60-4s	5200000648 5200000668	91	108
BS 60-4As	5200014910 5200018231 5200018232 5200018233 5100015123	92	108
BS 60-4s **BS 60-4As**	5200000647 5200000667 5200000674 5200000675 5200011110 5200011111	98	108
BS 70-4As	5100015124 5100015126	92	108

5.7 Vibration Measurements

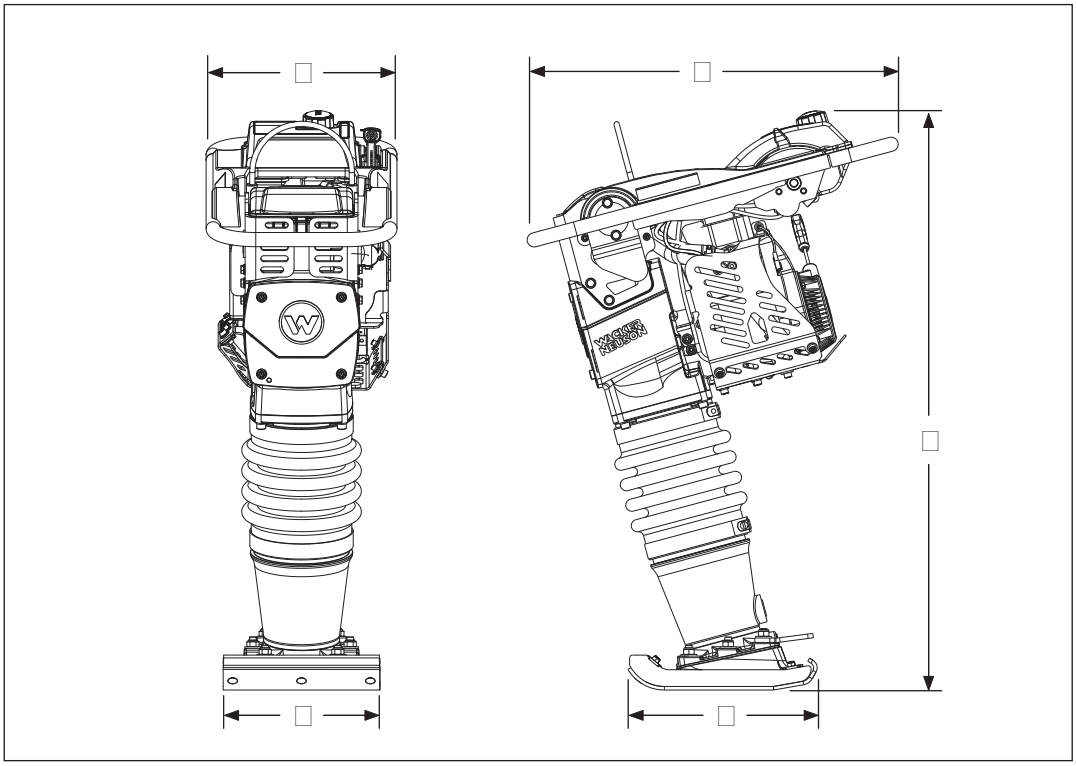
Products are tested for hand/arm vibration (HAV) level in accordance with ISO 5349, EN1033, and EN500-4 where applicable.

Machine		HAV m/sec^2	HAV ft/sec^2
BS 50-4s	5200000644 5200000662	9.2	30.2
BS 50-4s	5200000679	4.9	16.1
BS 50-4s	5200000680	8.6	28.2
BS 50-4As	5200018219 5200018226	9.0	29.5
BS 50-4As	5100015099	9.4	30.8
BS 60-4s **BS 60-4As**	5200000647 5200000648 5200000667 5200000668 5200000674 5200000675 5200011110 5200011111	6.5	21.3
BS 60-4As	5200014910 5200018231 5200018232 5200018233	9.1	29.8
BS 60-4As	5100015123	9.2	30.2
BS 70-4As	5100015124 5100015126	7.4	24.3

HAV Uncertainties

Hand-transmitted vibration was measured per ISO 5349-1. This measurement includes an uncertainty of 1.5 m/s^2.

5.8 Dimensions



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	A mm (in.)	B mm (in.)	C mm (in.)	D mm (in.)	E mm (in.)
BS 50-4s **BS 50-4As**	673 (26.5)	343 (13.5)	940 (37.0)	280 (11.0)	337 (13.27)
BS 60-4s **BS 60-4As**	673 (26.5)	343 (13.5)	965 (38.0)	280 (11.02)	336 (13.25)
BS 70-4As	673 (26.5)	343 (13.5)	965 (38.0)	280 (11.02)	336 (13.25)

Notes

6 Technical Data

6.1 BS 50-2i

Machine		BS 50-2i
Engine model	—	WM80
Engine speed - operating	rpm	4,400 ± 100
Engine speed - idle	rpm	2,000 ± 100
Maximum rated power @ rated speed[1]	kW (hp)	1.7 (2.2) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four-stage with cyclonic precleaner
Fuel specification	type	Regular unleaded gasoline (minimum 85 octane)
Oil specification, 2-cycle	type	Wacker Neuson 2-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification.
Oil tank capacity	L (qt)	1.3 (1.4)
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.0 (1.1)
Running time	hr	2.9
Ramming system lubrication	type	SAE 10W30
Ramming system oil capacity	ml (oz.)	710 (24)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.2 BS 50-2i Operating Weight

Machine **Item Number**		**BS 50-2i** 5200000642 5200000660 5200000687 5200000678 5200025428	**BS 50-2i** 5200000643 5200000658 5200000659 5200000687 5200025429	**BS 50-2i** 5200000661	**BS 50-2i** 5200000657 5200011099
Operating weight	kg (lb)	59 (131)	58 (129)	57 (126)	56 (124)

6.3 BS 60-2i

Machine		BS 60-2i
Engine model	—	WM80
Engine speed - operating	rpm	4,400 ± 100
Engine speed - idle	rpm	2,000 ± 100
Max. rated power @ rated speed[1]	kW (hp)	1.8 (2.4) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four stage with cyclonic precleaner
Fuel specification	type	Regular unleaded gasoline
Oil specification, 2-cycle	type	Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification
Oil tank capacity	L (qt)	1.3 (1.4)
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.2 (1.3)
Running time	hr	2.5
Ramming system lubrication	type	SAE 10W30
Ramming system capacity	ml (oz.)	890 (30)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.4 BS 60-2i Operating Weight

Machine **Item Number**		**BS 60-2i** 5200000645 5200000664 5200000682 5200000689 5200000690	**BS 60-2i** 5200000646 5200000665
Operating weight	kg (lb)	66 (145)	64 (141)

6.5 BS 70-2i

Machine		BS 70-2i
Engine model	—	WM80
Engine speed - operating	rpm	4,400 ± 100
Engine speed - idle	rpm	2,000 ± 100
Max. rated power @ rated speed[1]	kW (hp)	2.0 (2.7) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four stage with cyclonic precleaner
Fuel specification	type	Regular unleaded gasoline
Oil specification, 2-cycle	type	Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification
Oil tank capacity	L (qt)	1.3 (1.4)
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.3 (1.4)
Running time	hr	2.3
Ramming system lubrication	type	SAE 10W30
Ramming system capacity	ml (oz.)	890 (30)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.6 BS 70-2i Operating Weight

Machine Item Number		BS 70-2i 5200000649, 5200000650, 5200000672, 5200000673
Operating weight	kg (lb)	74 (164)

6.7 BS 50-2

Machine		BS 50-2
Engine model	—	WM80
Engine speed - operating	rpm	4,400
Engine speed - idle	rpm	2,000 ± 100
Max. rated power @ rated speed[1]	kW (hp)	1.7 (2.2) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four-stage with cyclonic precleaner
Fuel specification	—	Gasoline-oil mixture
Gasoline/2-cycle oil mixing ratio	—	50:1 – 100:1
Oil specification, 2-cycle	—	Use only Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification. A gasoline/oil ratio in a range from 50:1 to 100:1 can be used. For optimum engine performance and durability, a 100:1 ratio with a fully synthetic oil meeting the specification described above is preferred.
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.2 (1.3)
Running time	hr	2.9
Ramming system lubrication	type	SAE 10W30
Ramming system oil capacity	ml (oz.)	710 (24)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.8 BS 50-2 Operating Weight

Machine **Item Number**		**BS 50-2** 5200000641	**BS 50-2** 5200000655	**BS 50-2** 5200000653 5200000652	**BS 50-2** 5200000654 5200000685 5200000686	**BS 50-2** 5200000656
Operating weight	kg (lb)	59 (129)	59 (131)	56 (124)	58 (129)	57 (126)

6.9 BS 60-2

Machine		BS 60-2
Engine model	—	WM80
Engine speed - operating	rpm	4,400
Engine speed - idle	rpm	2,000 ± 100
Max. rated power @ rated speed[1]	kW (hp)	1.8 (2.4) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL95YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four-stage with cyclonic precleaner
Fuel specification	—	Gasoline-oil mixture
Gasoline/2-cycle oil mixing ratio	—	50:1 – 100:1
Gasoline specification	—	Regular unleaded gasoline (minimum 85 octane)
Oil specification, 2-cycle	—	Use only Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification. A gasoline/oil ratio in a range from 50:1 to 100:1 can be used. For optimum engine performance and durability, a 100:1 ratio with a fully synthetic oil meeting the specification described above is preferred.
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.2 (1.3)
Running time	hr	2.5
Ramming system lubrication	type	SAE 10W30
Ramming system oil capacity	ml (oz.)	890 (30)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.10 BS 60-2 Operating Weight

Machine Item Number		BS 60-2 5200000663, 5200000688, 5200019205
Operating weight	kg (lb)	66 (143)

6.11 BS 70-2

Machine		BS 70-2
Engine model	—	WM80
Engine speed - operating	rpm	4,400
Engine speed - idle	rpm	2,000 ± 100
Max. rated power @ rated speed[1]	kW (hp)	2.0 (2.7) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0,76
Cylinder head compression (cold)	bar/cm^2 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four-stage with cyclonic precleaner
Fuel specification	—	Gasoline-oil mixture
Gasoline/2-cycle oil mixing ratio	—	50:1 – 100:1
Oil specification, 2-cycle	—	Use only Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification. A gasoline/oil ratio in a range from 50:1 to 100:1 can be used. For optimum engine performance and durability, a 100:1 ratio with a fully synthetic oil meeting the specification described above is preferred.
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.3 (1.4)
Running time	hr	2.3
Ramming system lubrication	type	SAE 10W30
Ramming system oil capacity	ml (oz.)	890 (30)

[1]Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.

6.12 BS 70-2 Operating Weight

Machine Item Number		BS 70-2 5200000670, 5200000671
Operating weight	kg (lb)	74 (164)

6.13 BS 65-V

Machine		BS 65-V
Engine model	—	WM80
Engine speed - operating	rpm	4,400 ± 100
Engine speed - idle	rpm	1,800 ± 100
Max. rated power @ rated speed[1]	kW/hp	2.0 (2.7) @ 4,400 rpm
Clutch engagement	rpm	2,500 ± 100
Spark plug	type	Champion QL87YC
Electrode gap	mm (in.)	0.76 (0.030)
Cylinder head compression (cold)	bar/cm^3 (psi)	8.0–9.7 (120–140)
Air cleaner	type	Four-stage with cyclonic precleaner
Fuel specification	—	Gasoline-oil mixture
Gasoline/2-cycle oil mixing ratio	—	50:1 – 100:1
Oil specification, 2-cycle	—	Use only Wacker Neuson two-cycle or other fully synthetic oil meeting the NMMA TC-W3, JASO FD, or ISO-L-EGD specification. A gasoline/oil ratio in a range from 50:1 to 100:1 can be used. For optimum engine performance and durability, a 100:1 ratio with a fully synthetic oil meeting the specification described above is preferred.
Fuel tank capacity	L (qt)	3.0 (3.2)
Fuel consumption	L (qt)/hr	1.2 (1.3)
Running time	hr	2.5
Ramming system lubrication	oil grade	SAE 10W30, service class SJ or higher
Ramming system oil capacity	ml (oz.)	890 (30)

[1] *Net engine power rating per 80/1269/EEC and ISO 3046-1. Actual power output may vary due to conditions of specific use.*

6.14 BS 65-V Operating Weight

Machine Item Number		BS 65-V 5200000669
Operating weight	kg (lb)	68 (150)

6.15 Sound Measurements

Products are tested for sound pressure level in accordance with EN 500-4:2011.

Sound power level is tested in accordance with European Directive 2000/14/EC - Noise Emission in the Environment by Equipment for use outdoors.

Machine	Sound Pressure at Operator's Location dB(A)	Guaranteed Sound Power dB(A)
BS 50-2i	92	108
BS 60-2i	92	
BS 70-2i	93	
BS 50-2	92	108
BS 60-2	92	
BS 70-2	93	
BS 65-V	92	108

6.16 Vibration Measurements

Products are tested for hand/arm vibration (HAV) level in accordance with ISO 5349, EN1033, and EN500-4 where applicable.

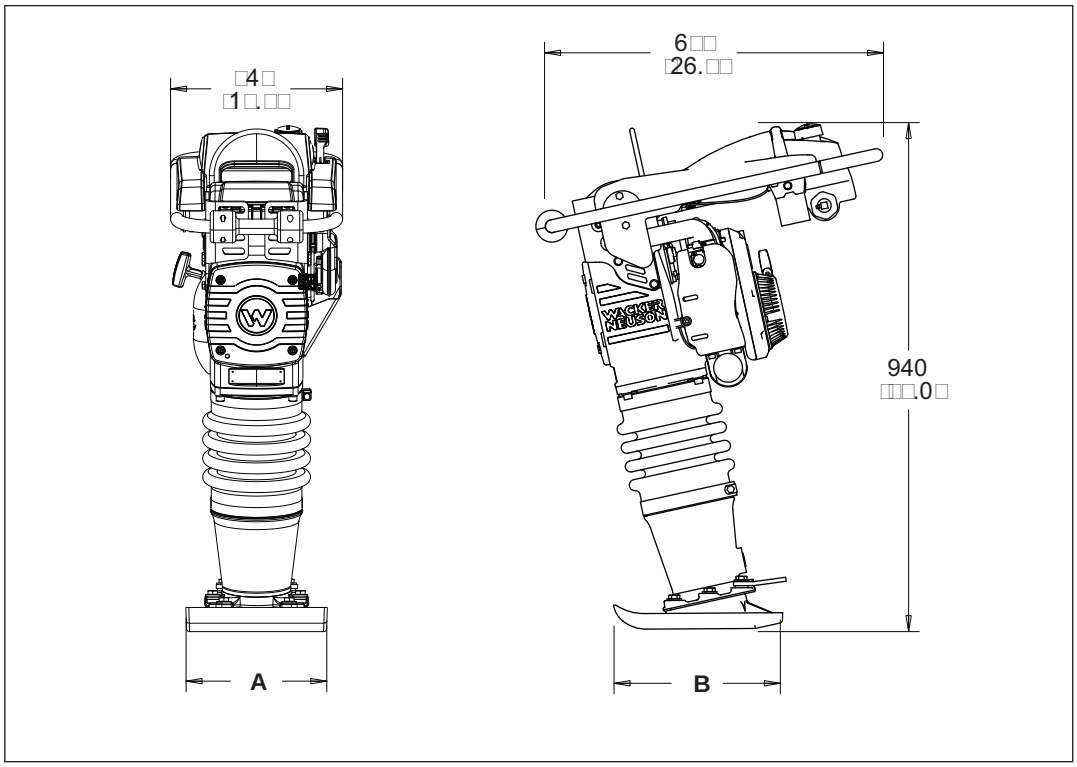
Machine	Item number	HAV m/sec^2	HAV ft/sec^2
BS 50-2i	5200000642, 5200000643, 5200000659, 5200000660, 5200000658, 5200000678, 5200025428, 5200025429	9.8	32.1
	5200000661, 5200000657, 5200011099, 5200000687	5.4	17.7
BS 60-2i	5200000645, 5200000646, 5200000664, 5200000665, 5200000689, 5200000690, 5200000682	7.6	24.9
BS 70-2i	5200000649, 5200000650, 5200000673, 5200000672	6.8	22.3
BS 50-2	5200000655, 5200000654, 5200000685	9.8	32.1
	5200000641, 5200000652, 5200000656, 5200000653, 5200000686	5.4	17.7
BS 60-2	5200000663, 5200000688, 5200019205	7.6	24.9
BS 70-2	5200000670, 5200000671	6.8	22.3
BS 65-V	5200000663	8.6	28.2

HAV Uncertainties

Hand-transmitted vibration was measured per ISO 5349-1. This measurement includes an uncertainty of 1.5 m/s^2.

6.17 Dimensions—BS 50-2i, BS 50-2

mm (in.)



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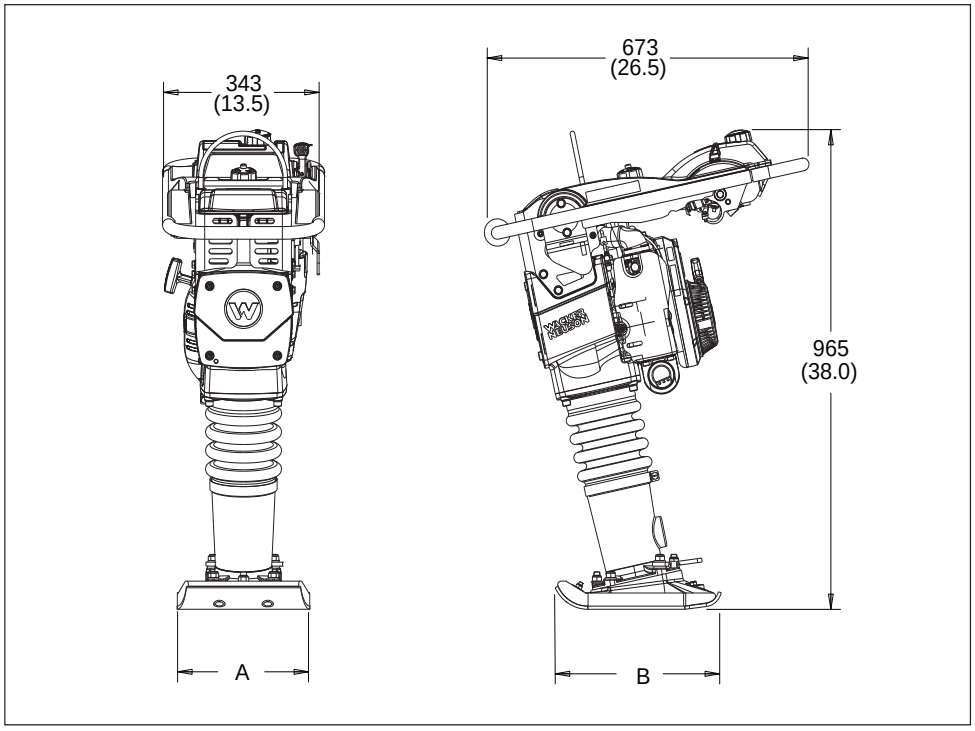
BS 50-2i	BS 50-2	A mm (in.)	B mm (in.)
5200000642 5200000660 5200000687 5200000678 5200025428	5200000656 5200000686	280 (11.03)	337 (13.27)
5200000643 5200000658 5200000659 5200025429	5200000641 5200000654 5200000685	250 (9.84)	337 (13.25)
5200000661 5200000687	5200000655	280 (11.03)	344 (13.55)
5200000657	5200000652	165 (6.50)	337 (13.25)
5200011099	5200000653	190 (7.50)	344 (13.55)

6.18 Dimensions—BS 60-2i, BS 60-2, BS 70-2i, BS 70-2, BS 65-V

mm (in.)



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BS 60-2i	BS 60-2	A mm (in.)	B mm (in.)
5200000645 5200000664 5200000689 5200000682	5200000663 5200000688 5200019205	280 (11.02)	336 (13.25)
5200000646 5200000665 5200000690	—	280 (11.02)	342 (13.45)

BS 70-2i	BS 70-2	A mm (in.)	B mm (in.)
5200000649 5200000673	5200000671	330 (12.99)	342 (13.45)
5200000650 5200000672	5200000670	280 (11.02)	336 (13.25)

BS 65-V	A mm (in.)	B mm (in.)
5200000669	280 (11.02)	336 (13.25)

Important: For spare parts information, please see your Wacker Neuson Dealer, or visit the Wacker Neuson website at http://www.wackerneuson.com/.

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