



OPERATOR'S MANUAL

Catalog No.

1610-1

1630-1

1660-1

1660-6

1663-20



HEAVY-DUTY COMPACT HOLE-SHOOTERS

TO REDUCE THE RISK OF INJURY, USER MUST READ AND UNDERSTAND OPERATOR'S MANUAL.

GENERAL POWER TOOL SAFETY WARNINGS

WARNING READ ALL SAFETY WARNINGS AND ALL INSTRUCTIONS. Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury. Save all warnings and instructions for future reference. The term "power tool" in the warnings refers to your mains-operated (corded) power tool or battery-operated (cordless) power tool.

WORK AREA SAFETY

- Keep work area clean and well lit. Cluttered or dark areas invite accidents.
- Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases or dust. Power tools create sparks which may ignite the dust or fumes.
- Keep children and bystanders away while operating a power tool. Distractions can cause you to lose control.

ELECTRICAL SAFETY

- Power tool plugs must match the outlet. Never modify the plug in any way. Do not use any adapter plugs with earthed (grounded) power tools. Unmodified plugs and matching outlets will reduce risk of electric shock.
- Avoid body contact with earthed or grounded surfaces such as pipes, radiators, ranges and refrigerators. There is an increased risk of electric shock if your body is earthed or grounded.
- Do not expose power tools to rain or wet conditions. Water entering a power tool will increase the risk of electric shock.
- Do not abuse the cord. Never use the cord for carrying, pulling or unplugging the power tool. Keep cord away from heat, oil, sharp edges or moving parts. Damaged or entangled cords increase the risk of electric shock.
- When operating a power tool outdoors, use an extension cord suitable for outdoor use. Use of a cord suitable for outdoor use reduces the risk of electric shock.
- If operating a power tool in a damp location is unavoidable, use a ground fault circuit interrupter (GFCI) protected supply. Use of an GFCI reduces the risk of electric shock.

PERSONAL SAFETY

- Stay alert, watch what you are doing and use common sense when operating a power tool. Do not use a power tool while you are tired or under the influence of drugs, alcohol or medication. A moment of inattention while operating power tools may result in serious personal injury.
- Use personal protective equipment. Always wear eye protection. Protective equipment such as dust mask, non-skid safety shoes, hard hat, or hearing protection used for appropriate conditions will reduce personal injuries.
- Prevent unintentional starting. Ensure the switch is in the off-position before connecting to power source and/or battery pack, picking up or carrying the tool. Carrying power tools with your finger on the switch or energising power tools that have the switch on invites accidents.

- Remove any adjusting key or wrench before turning the power tool on. A wrench or a key left attached to a rotating part of the power tool may result in personal injury.
- Do not overreach. Keep proper footing and balance at all times. This enables better control of the power tool in unexpected situations.
- Dress properly. Do not wear loose clothing or jewellery. Keep your hair, clothing and gloves away from moving parts. Loose clothes, jewellery or long hair can be caught in moving parts.
- If devices are provided for the connection of dust extraction and collection facilities, ensure these are connected and properly used. Use of dust collection can reduce dust-related hazards.

POWER TOOL USE AND CARE

- Do not force the power tool. Use the correct power tool for your application. The correct power tool will do the job better and safer at the rate for which it was designed.
- Do not use the power tool if the switch does not turn it on and off. Any power tool that cannot be controlled with the switch is dangerous and must be repaired.
- Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools. Such preventive safety measures reduce the risk of starting the power tool accidentally.
- Store idle power tools out of the reach of children and do not allow persons unfamiliar with the power tool or these instructions to operate the power tool. Power tools are dangerous in the hands of untrained users.
- Maintain power tools. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tool's operation. If damaged, have the power tool repaired before use. Many accidents are caused by poorly maintained power tools.
- Keep cutting tools sharp and clean. Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control.
- Use the power tool, accessories and tool bits etc. in accordance with these instructions, taking into account the working conditions and the work to be performed. Use of the power tool for operations different from those intended could result in a hazardous situation.

SERVICE

- Have your power tool serviced by a qualified repair person using only identical replacement parts. This will ensure that the safety of the power tool is maintained.

SPECIFIC SAFETY RULES

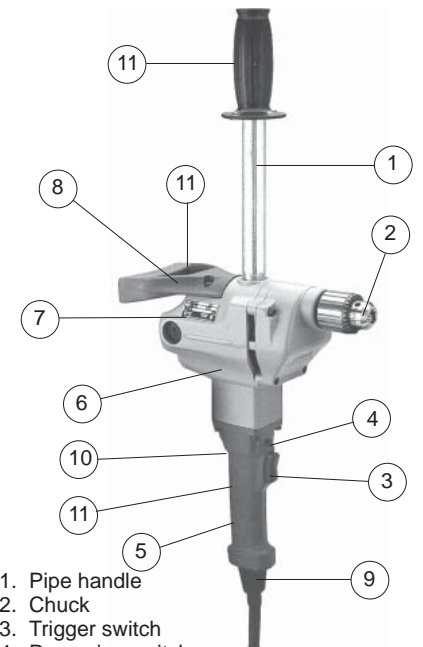
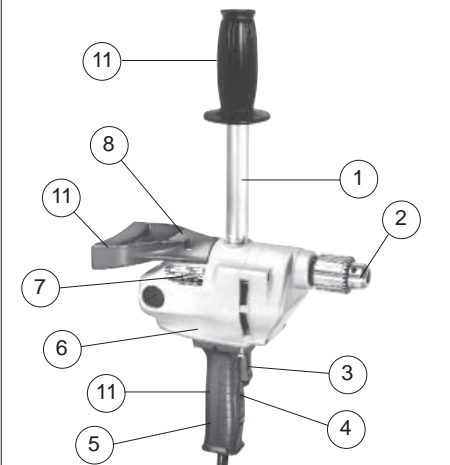
- Use auxiliary handle(s), if supplied with the tool. Loss of control can cause personal injury.
- Hold power tool by insulated gripping surfaces, when performing an operation where the cutting accessory may contact hidden wiring or its own cord. Cutting accessory contacting a "live" wire may make exposed metal parts of the power tool "live" and could give the operator an electric shock.
- Maintain labels and nameplates. These carry important information. If unreadable or missing, contact a MILWAUKEE service facility for a free replacement.
- WARNING Some dust created by power sanding, sawing, grinding, drilling, and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:
 - lead from lead-based paint
 - crystalline silica from bricks and cement and other masonry products, and
 - arsenic and chromium from chemically-treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

SYMBOLOLOGY

	Double Insulated
	Amps
	Volts
	Alternating Current Only
	Direct or Alternating Current
$n_0 \text{ XXXXmin.}^{-1}$	No Load Revolutions per Minute (RPM)
	Underwriters Laboratories, Inc. United States and Canada
	Mexican Approvals Marking

FUNCTIONAL DESCRIPTION



1. Pipe handle
2. Chuck
3. Trigger switch
4. Reversing switch
5. Switch handle
6. Motor housing
7. Nameplate
8. Spade handle
9. Quik-Lok® cord (1663-20 only)
10. Speed control dial (1663-20 only)
11. Insulated gripping surfaces

SPECIFICATIONS

Tool	Wood								Mild Steel		
	Cat. No.	Volts AC/DC	No Load RPM	Twist Drills	Selfeed Bits	Hole Saws	Auger Bits	Ship Auger Bits	Flat Boring Bits	Twist Bits	Hole Saws
1610-1	120 AC	650	1/2"	2-9/16"	3-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1/2"	2-1/4"
1630-1	120 AC	1000	1/2"	2-1/4"	3"	1-1/2"	1-1/2"	1-1/4"	1-1/4"	1/2"	1-3/4"
1660-1	120 AC/DC	450	1/2"	3"	4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1/2"	2-5/8"
1660-6	120 AC/DC	450	1/2"	3"	4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1/2"	2-5/8"
1663-20	120 AC	115-450	1/2"	3"	4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1/2"	2-5/8"

GROUNDING

⚠ WARNING Improperly connecting the grounding wire can result in the risk of electric shock. Check with a qualified electrician if you are in doubt as to whether the outlet is properly grounded. Do not modify the plug provided with the tool. Never remove the grounding prong from the plug. Do not use the tool if the cord or plug is damaged. If damaged, have it repaired by a MILWAUKEE service facility before use. If the plug will not fit the outlet, have a proper outlet installed by a qualified electrician.

Grounded Tools: Tools with Three Prong Plugs

Tools marked "Grounding Required" have a three wire cord and three prong grounding plug. The plug must be connected to a properly grounded outlet (See Figure A). If the tool should electrically malfunction or break down, grounding provides a low resistance path to carry electricity away from the user, reducing the risk of electric shock.

The grounding prong in the plug is connected through the green wire inside the cord to the grounding system in the tool. The green wire in the cord must be the only wire connected to the tool's grounding system and must never be attached to an electrically "live" terminal.

Your tool must be plugged into an appropriate outlet, properly installed and grounded in accordance with all codes and ordinances. The plug and outlet should look like those in Figure A.

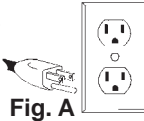


Fig. A

Double Insulated Tools: Tools with Two Prong Plugs

Tools marked "Double Insulated" do not require grounding. They have a special double insulation system which satisfies OSHA requirements and complies with the applicable standards of Underwriters Laboratories, Inc., the Canadian Standard Association and the National Electrical Code. Double Insulated tools may be used in either of the 120 volt outlets shown in Figures B and C.

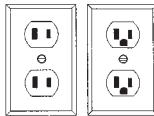


Fig. B Fig. C

EXTENSION CORDS

Grounded tools require a three wire extension cord. Double insulated tools can use either a two or three wire extension cord. As the distance from the supply outlet increases, you must use a heavier gauge extension cord. Using extension cords with inadequately sized wire causes a serious drop in voltage, resulting in loss of power and possible tool damage. Refer to the table shown to determine the required minimum wire size.

The smaller the gauge number of the wire, the greater the capacity of the cord. For example, a 14 gauge cord can carry a higher current than a 16 gauge cord. When using more than one extension cord to make up the total length, be sure each cord contains at least the minimum wire size required. If you are using one extension cord for more than one tool, add the nameplate amperes and use the sum to determine the required minimum wire size.

Guidelines for Using Extension Cords

- If you are using an extension cord outdoors, be sure it is marked with the suffix "W-A" ("W" in Canada) to indicate that it is acceptable for outdoor use.
- Be sure your extension cord is properly wired and in good electrical condition. Always replace a damaged extension cord or have it repaired by a qualified person before using it.
- Protect your extension cords from sharp objects, excessive heat and damp or wet areas.

Recommended Minimum Wire Gauge For Extension Cords*

Nameplate Amperes	Extension Cord Length				
	25'	50'	75'	100'	150'
0 - 2.0	18	18	18	18	16
2.1 - 3.4	18	18	18	18	14
3.5 - 5.0	18	18	16	14	12
5.1 - 7.0	18	16	14	12	12
7.1 - 12.0	16	14	12	10	
12.1 - 16.0	14	12	10		
16.1 - 20.0	12	10			

* Based on limiting the line voltage drop to five volts at 150% of the rated amperes.

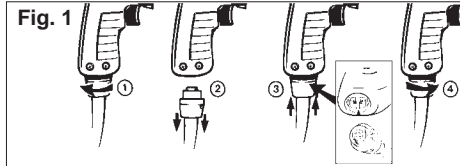
READ AND SAVE ALL INSTRUCTIONS FOR FUTURE USE.

ASSEMBLY

⚠ WARNING To reduce the risk of injury, always unplug tool before changing or removing accessories. Only use accessories specifically recommended for this tool. Others may be hazardous.

Removing and Replacing Quik-Lok® Cords

MILWAUKEE's exclusive Quik-Lok® Cords provide instant field replacement or substitution.

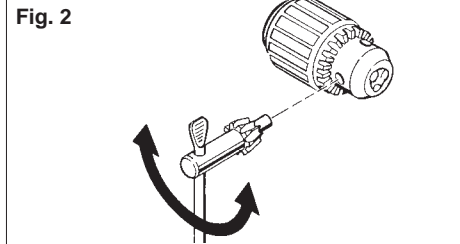


1. To remove the Quik-Lok® Cord, turn the cord nut 1/4 turn to the left and pull it out.
2. To replace the Quik-Lok® Cord, align the connector keyways and push the connector in as far as it will go. Turn the cord nut 1/4 turn to the right to lock.

Pipe Handle

Thread pipe handle into the threaded hole in the motor housing.

Installing Bits into Keyed Chucks



1. Unplug tool.
2. Open the chuck jaws wide enough to insert the bit. Be sure the bit shank and chuck jaws are clean. Dirt particles may prevent the bit from lining up properly.
3. Insert the bit into the chuck. Center the bit in the chuck jaws and lift it about 1/16" off of the bottom. Then, tighten the chuck jaws by hand to align the bit.
4. Place the chuck key in each of the three holes in the chuck, turning it clockwise as shown. Tighten securely.
5. To remove the bit, insert the chuck key into one of the holes in the chuck and turn it counterclockwise.

⚠ WARNING To reduce the risk of injury, always wear eye protection.

Chuck Removal

This tool is equipped with a threaded spindle to hold the chuck. Before removing the chuck, unplug the tool and open the chuck jaws. A left-handed thread

screw is located inside the chuck to prevent the chuck from loosening when the tool is operated in reverse direction. Remove the screw by turning it clockwise. To remove the chuck, hold the tool so that only the side of the chuck rests firmly and squarely on a solid workbench. Insert the chuck key or a chuck remover bar in one of the keyholes. Turn the chuck so the key is at about a 30° angle to the bench top and strike the key sharply with a hammer so the chuck turns in a counterclockwise direction (looking from the front of the tool). This should loosen the chuck from the spindle which has a right hand thread making it easy to remove the chuck by hand.

NOTE: When replacing the chuck, always replace the left hand thread screw in the chuck.

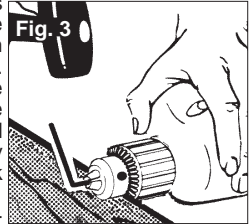


Fig. 3

OPERATION

⚠ WARNING To reduce the risk of personal injury when drilling, always hold tool by the insulated gripping surfaces when performing an operation where the cutting tool may contact hidden wiring or its own cord. Contact with a "live" wire will make exposed metal parts of the tool "live" and shock the operator.

⚠ WARNING When drilling, always hold the drill securely using the pipe handle, or brace the drill against a solid fixed object in preparation for a sudden reaction. When drilling, never use your body to brace drill. Never put your hands (or other body parts) between the part of the drill being braced and the object it is being braced against. Hands (or other body parts) that are in the path of the reaction can be pinched, crushed, and broken.

Bit Binding

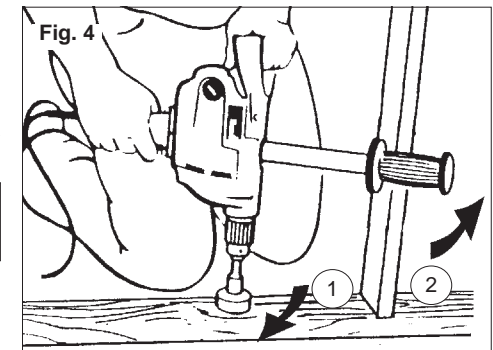


Fig. 4

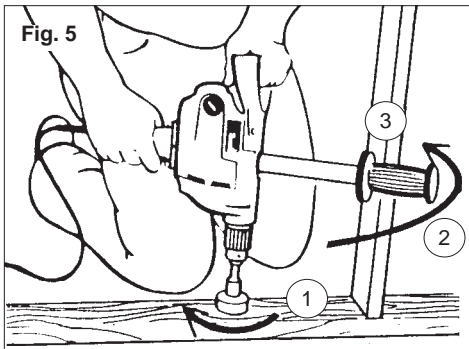
If the bit binds, the drill will suddenly react in the opposite direction of the rotation of the bit. Figure 4 shows the path of reaction, (1) if the drill bit binds while being driven in forward (2). The operator should reduce the chances of a sudden reaction by following the instructions listed below. The operator should also prepare for a sudden reaction by holding securely using the pipe handle or bracing against a solid fixed object.

To reduce the chance of bit binding:

- Use sharp bits. Sharp bits are less likely to bind when drilling.
- Use the proper bit for the job. There are many types of bits designed for specific purposes.
- Avoid drilling warped, wet, knotty, and or pitchy material if possible.
- Avoid drilling in material that you suspect contains hidden nails or other things that may cause the bit to bind.

The direction of reaction is always opposite of the direction of bit binding. Reaction is even more likely to occur when enlarging already existing holes and at the point when the bit breaks through the other side of the material.

Bracing for forward rotation



When drilling in forward, the bit will **rotate** in a clockwise direction. If the bit binds in the hole, the bit will come to a sudden stop and drill will suddenly **react** in a counterclockwise direction.

Figure 5 shows an example of a Compact Hole-Shooter properly braced for forward rotation.

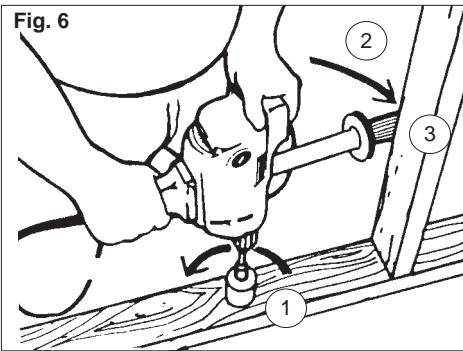
1. Forward (clockwise) rotation
2. Reaction
3. Brace drill with pipe handle here

If the bit binds, the pipe handle or the motor housing braced against the stud will hold the drill in position.

Bracing for reverse rotation

When drilling in reverse, the bit will **rotate** in a counterclockwise direction. If the bit binds in the hole, the bit will come to a sudden stop and the drill will suddenly **react** in a clockwise direction.

Figure 6 shows an example of a Compact Hole-Shooter properly braced for reverse rotation.

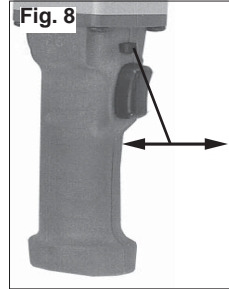


1. Reverse (counterclockwise) rotation
2. Reaction
3. Brace drill with pipe handle here

If the bit binds, the pipe handle or the motor housing braced against the stud will hold the drill in position.

Reversing

A reversing switch is located below or above the trigger switch for removal of bits from holes. Permit the motor to come to a complete stop before reversing. Reversing the tool with the gears in motion may cause severe damage. When removing selffeed bits from partially drilled holes, a flick of the trigger switch will free the threaded pilot screw. When the threads are loose, lift the bit from the workpiece with the motor stopped.



Bit Selection

- Use sharp bits. Sharp bits are less likely to bind when drilling.
- Use the proper bit for the job. There are many types of bits designed for specific purposes. Check the information on the bit's packaging for proper usage.
- Do not use bits larger than the rated capacity of the drill. Gear damage or motor overload may result. See Specifications.

Drilling

Before drilling, clamp the material down securely. A poorly secured piece of material may result in personal injury or inaccurate drilling. When drilling in light gauge metal or wood, use a wooden block to back up the material to prevent damage to the workpiece.

Mark the center of the hole to be drilled with a center punch to give the bit a start and to prevent it from "walking." Lubricate the drill bit with cutting oil when drilling iron or steel. Use a coolant when drilling nonferrous metals such as copper, brass or aluminum.

To start a selffeed bit, run the threaded feed screw into the work by flicking the trigger switch, permitting the bit to coast until the teeth contact the work surface. Align the bit properly before proceeding. This will reduce cocking and jamming when starting. To reduce jamming on breakthrough, decrease the drilling pressure when the feed screw point breaks through the workpiece. Proceed with steady, even pressure.

Speed Control Dial

Catalog number 1663-20 has a Speed Control Dial to provide electronic speed control. (The trigger does not control the speed - it only turns the tool on and off). The dial is located on rear of the handle. The dial has positions numbered 1-8. Position 8 provides full speed at no load. Position 1 provides approximately 25% of the full no load speed. Reduced speed can be useful for starting bits and obtaining the optimum speed for a given bit size. Do not adjust the speed while drilling. This tool is furnished with Electronic Feedback to provide a more constant speed under load.

MAINTENANCE

WARNING To reduce the risk of injury, always unplug your tool before performing any maintenance. Never disassemble the tool or try to do any rewiring on the tool's electrical system. Contact a MILWAUKEE service facility for ALL repairs.

Maintaining Tools

Keep your tool in good repair by adopting a regular maintenance program. Before use, examine the general condition of your tool. Inspect guards, switches, tool cord set and extension cord for damage. Check for loose screws, misalignment, binding of moving parts, improper mounting, broken parts and any other condition that may affect its safe operation. If abnormal noise or vibration occurs, turn the tool off immediately and have the problem corrected before further use. Do not use a damaged tool. Tag damaged tools "DO NOT USE" until repaired (see "Repairs").

Under normal conditions, relubrication is not necessary until the motor brushes need to be replaced. After six months to one year, depending on use, return your tool to the nearest MILWAUKEE service facility for the following:

- Lubrication
- Brush inspection and replacement
- Mechanical inspection and cleaning (gears, spindles, bearings, housing, etc.)
- Electrical inspection (switch, cord, armature, etc.)
- Testing to assure proper mechanical and electrical operation

ACCESSORIES

WARNING To reduce the risk of injury, always unplug the tool before attaching or removing accessories. Use only specifically recommended accessories. Others may be hazardous.

WARNING To reduce the risk of injury, electric shock and damage to the tool, never immerse your tool in liquid or allow a liquid to flow inside the tool.

Cleaning

Clean dust and debris from vents. Keep the tool handles clean, dry and free of oil or grease. Use only mild soap and a damp cloth to clean your tool since certain cleaning agents and solvents are harmful to plastics and other insulated parts. Some of these include: gasoline, turpentine, lacquer thinner, paint thinner, chlorinated cleaning solvents, ammonia and household detergents containing ammonia. Never use flammable or combustible solvents around tools.

Repairs

If your tool is damaged, return the entire tool to the nearest service center.