The gasoline-powered rotary saw is a powerful and effective rescue, forcible entry, and ventilation tool. A saw’s safety, performance, and reliability depend on how well the saw is maintained, the skill of the operator using it, and the operator’s knowledge of cutting techniques.

A rotary saw’s performance depends on how well it is maintained and the operator’s skill. Here, a probationary firefighter practices cutting an overhead rolling door. His objective is to cut a vertical slit for each and operate the door’s hoisting chain. (Photos 1 and 2 by Danny Hammontree.)

FUEL PROBLEMS

Small-engine mechanics will tell you that the vast majority of power saws sent to their shops for repair are there because of fuel problems. The main reason is that as gasoline ages, it tends to form a varnish that coats and clogs carburetor jets and other components. This phenomenon can occur in as little as a month: The saw becomes difficult to start and its performance decreases.

Adding a fuel preserver, or stabilizer, to a saw’s gasoline-oil mixture can prevent most fuel problems. This is especially important for saws that are not used frequently and may not need refueling for several months. Starting and test-running a saw periodically will not in itself prevent aging fuel from developing varnish and deposits, and running a saw “dry” and storing it without fuel is not practical because fueling the saw just before it is used will delay operations, and gasoline stored in a can also ages and deteriorates.
(2) A saw's depth of cut depends on the diameter of its blade. Here, a 14-inch diamond blade with a cutting depth of five inches barely cuts completely through the wind bracing inside this modern overhead door.

Several brands of fuel preservatives are available. Some manufacturers claim that their product keeps gasoline fresh for as long as 12 months. Some saw manufacturers market their own brand of two-cycle engine oil that contains a fuel preservative, which can be purchased in small, single-use containers. You mix the contents with one gallon of gasoline. This makes fueling easy and helps to ensure that the mix is the right concentration.

Fuel filler caps on power saws are designed to be "finger-tight." A close examination of a leaky fuel cap usually will reveal marks in the plastic from pliers used to loosen an over tightened cap. Over tightening a fuel cap causes its "O" ring gasket to deform and lose its seal. Often, firefighters attempt to correct this problem by further tightening the cap, making the leak worse. Eventually, over tightening a saw's fuel cap will strip its threads or, worse, ruin the fuel tank threads.

INSPECTIONS AND TESTS

It is much better to find a problem with a saw during a routine check at the firehouse than when it is urgently needed at a fire. A saw should be started and allowed to warm up and run at full throttle at least once a week. Many career fire companies, including mine, inspect and run their saws at the beginning of each shift. The inspection should begin with a careful examination of the blades. Look for damage or wear, such as missing carbide teeth or chips. Blades with broken or missing teeth will still cut, but they will be dull and less effective.

When inspecting composite-abrasive disks, check for cracks, frays, and fuel saturation. Any of these defects can cause an abrasive disk to break up from centrifugal force when operating at a high number of revolutions per minute (rpm). Check the diameter of abrasive disks. The depth of cut and cutting time depend on their diameter—for example, a 14-inch disk will cut to a depth of five inches when it is new. Abrasive disks decrease in diameter as they wear. A worn disk may not cut deep enough to penetrate thick components consisting of layers, such as sectional overhead doors reinforced with wind-bracing members.

After checking the condition of the blades, make sure that the blade is tightly fastened to the saw. Then, check for screws, nuts, and bolts that may be loose or missing as a result of the saw's vibration.

When checking the fuel level, check the condition of the "O" ring on the fuel cap. A deformed or missing "O" ring will cause a fuel leak. Tighten the fuel cap finger tight, and test for leaks by turning the saw on its other side. This positions the fuel cap at the bottom of the fuel tank, where it would be most likely to leak.
To start a "cold" saw, lock the throttle open and pull the choke lever. A well-maintained saw with fresh fuel and a clean spark plug should necessitate no more than three pulls of the starter cord while "on choke." Attempting to start a saw several times with the choke actuated will cause it to "flood."

Never pull a starting cord to the limit of its extension; doing so will eventually break the cord and damage the starting mechanism. Begin by pulling the starter cord a few inches until you feel resistance from the engine's compression. Then, start the saw with short, rapid pulls. Push in the choke lever after three pulls of the starter cord or anytime the engine "fires" or runs momentarily.

If the saw has a compression release, use it. I frequently hear young firefighters boast that they are strong enough to start a saw without its compression release. I tell them that the primary purpose of a compression release is to reduce wear on the starter cord and pulley; making the saw easier to start is secondary.

Firefighters are trained to start a rotary saw by placing the toe of their boot in or on the rear handle. This technique, however, can bump the throttle out of the locked position. (Lieutenant Michael Cianci, Fire Department of New York, teaches a more effective and comfortable method for starting a saw. For a detailed description of this method, see "Simple Saw Starting," *Fire Engineering*, July 1998.)

As soon as the saw starts, disengage the throttle lock to allow the saw to idle. This is important for two reasons. First, it's a good idea to warm up a saw's engine before running it at full throttle. Of course, it may not be possible to do this at a fire scene, but it should be done during test runs and training. Allowing the saw to idle for 10 seconds before running it at full throttle will definitely prolong the engine's life.

The second reason for testing a saw at idle is to make sure it will run without the blade's rotating. Never lift or carry a saw with its blade spinning. Two of my friends were seriously cut by carbide-tooth blades as they walked into saws being carried on a roof. If a saw must have its throttle repeatedly "gunned" to keep it running, take it out of service for repair. It is dangerous to use.

A saw's two-cycle engine is designed to run at full throttle. Starting a saw, allowing it to idle, and then shutting it off does more harm than good because it can foul the spark plug. Bring a saw that has been idling a minute or two to full throttle and watch it blow out a puff of oily smoke.

After a warm-up, run a saw at full throttle for at least a minute. Notice if there is any unusual vibration. This could be a warning sign that an abrasive disk is about to break and fly apart.

It is not abnormal for a saw to run unevenly at full throttle when it is not cutting because it is equipped with a governor that backs off the throttle to maintain safe, maximum rpm.

**READ THE OWNER'S MANUAL**

A saw's drive belt must be tightened periodically, in accordance with the manufacturer's recommendations. This is especially important after the first few hours of operation, when a new belt has a tendency to stretch. Belts with insufficient tension can slip when the saw is under a load.

Spark plugs on two-cycle engines tend to get sooty because they ignite gasoline mixed with oil. Spark plugs cost about two dollars a small investment that can make a big difference in your saw's performance. My company changes the spark plugs on our saws after a few hours of use, and we keep extra spark plugs on our apparatus.

Modern saws have very precise fuel mixtures to comply with emission standards and, thus, require a lot of air to run properly. Air filters, therefore, should be cleaned or replaced according to the
manufacturer's recommendations and definitely after cutting materials that produce a lot of dust, such as stucco or concrete.

Instructions and schedules for maintenance are detailed in the saw owner's manual. Honestly, do you ever read an owner’s manual or instructions when you get new tools and equipment? Most firefighters (including me) read the instructions only after we encounter a problem we can't fix. The owner’s manual can be quite large because of all the required safety (read “avoid liability”) information and they’re usually written in three or four languages. However, the manual does provide vital instructions for properly breaking in a saw, maintaining it, and operating it safely and effectively.

STORING AND CARRYING A SAW

Store the saw in an apparatus compartment, preferably in mounting brackets or its metal box. Fire companies that change into a spare apparatus must be careful not to cram a saw into a compartment jammed with other equipment. This can damage the saw, especially the abrasive disks, which can crack from rough handling. It’s a good idea for a company to keep its spare blades, a blade-changing wrench, and vise grips (to be explained later) in a bag or carrier. This protects the blades, keeps them together, and allows them to be taken along with the saw. When operating a saw at a distance, you should not have to run back to the apparatus to get another blade.

Carrying a saw in your hand while climbing a ladder to a roof can be dangerous because both your hands cannot maintain contact with the ladder. Also, the unequal weight on one side of the body tends to keep you off balance. Using a sling to carry the saw over your shoulder will allow you to climb a ladder with both hands in contact with the ladder.

(3) A sling allows both hands to maintain contact with the ladder when carrying a saw to the roof. (Photo by Lazaro Acosta)

It is faster and safer to raise a saw to the roof with a rope than to carry it up a ladder. You can easily raise the saw by taking a bag of strong, small-diameter rope to the roof, securing the free end, and tossing the bag to the ground. The bag should contain sufficient rope so that a firefighter on the ground can control the rope below the saw, to keep it from scraping against the side of the building and catching on projections.
If the rope remaining in the bag is insufficient, the firefighter on the ground should attach a second rope to the saw as a tag line. Perhaps the easiest way to get a saw and carrier of blades to a roof is to attach them to the tip of an aerial ladder and lift them in a crane-like manner.

BLADE SELECTION

There is no true “multipurpose” rotary saw blade that will cut every material effectively. Each rotary saw blade has its strengths and weaknesses, which may be in terms of price, durability, longevity, cutting speed, or cutting ability (different materials).

Since a fire company likely will carry more than one type of blade for cutting different materials, which blade should be kept on the saw? The blade should be selected in accordance with tactical priorities—rescue, of course, is the primary objective. Many fire companies, including mine, keep a metal-cutting blade on their saw. This enables them to rescue civilians and firefighters trapped by heavy steel doors,
substantial locks, or iron security bars. Ladder companies that protect life by ventilating roofs may choose to keep a wood-cutting blade on their saw, but they should keep metal-cutting blades in their carrier.

Firefighters must know the cutting capabilities of each type of blade, how to change blades rapidly, and how to ensure they are installed on a saw in the proper direction of rotation.

When purchasing blades, price does matter. Beware of "bargain" saw blades; they usually turn out to be no bargain. Cheap blades have a tendency to break and quickly wear out.

**TYPES OF BLADES FOR ROTARY SAWS**

Among the types of blades available for rotary saws are the following:

- **Composite abrasive disk.** This disk has served the fire and rescue service well for decades and continues to do an excellent job. There are three types of abrasive disks: one that cuts metal, one that cuts concrete and other masonry materials, and a "combination" blade that cuts metal and concrete/masonry.

A good, high-quality abrasive disk is hard to beat for cutting metal at great speed. My department compared the cutting speed of aluminum oxide disks against carbide and diamond blades. We found the disk cuts through thick metal such as iron security bars and case-hardened padlocks faster than other blades. Abrasive disks also cost considerably less than other blades, but they have some disadvantages:
• As mentioned earlier, they decrease in diameter as they wear. This reduces their depth of cut and may necessitate that a disk be changed during a cutting operation.

Abrasive disks are fragile. Dropping or improperly storing them can cause the disk to crack and eventually fail.

• If an abrasive disk is saturated with fuel from prolonged contact with spilled gasoline, this can dissolve the adhesive that binds the abrasive and fiber composite together. A fuel-saturated disk can come apart from centrifugal force at a high rpm.

• Binding an abrasive disk when cutting can cause the edges of the disk to fray.

• You must be extremely careful when reinserting a disk into the cut, or kerf, of objects constructed in layers such as automobile hoods and overhead or swinging doors. Contact with the metal reinforcement below or behind the surface of the exterior skin can cause one side of the blade to fray and possibly fail.

An abrasive disk that comes apart at high rpm can throw blade fragments a considerable distance. As mentioned in a previous article, firefighters in my department who were cutting an overhead door experienced a catastrophic failure of a metal/masonry combination disk. Later, a large portion of the disk was found inside the warehouse, deeply imbedded in a cardboard box. Remember, unusual vibration may be a warning that the disk is about to come apart.

![Image: Firefighter with a disk]

(B) This recruit just learned a valuable lesson! Abrasive disks are relatively fragile. Rough handling can cause a damaged disk to come apart at high rpm.

• **A carbide-tooth blade.** This blade is the best choice for cutting wood roofs covered with thick layers of fiberboard insulation, tar, and roofing paper. A blade with an aggressive pattern of carbide teeth will rapidly cut tongue and groove and plywood roof decking as well as wood sub and finish
floors. It can also cut roof decks constructed with lightweight gypsum concrete. A carbide-tooth blade may be effective in cutting a metal deck roof, depending on its thickness or gauge, but it will probably lose a few carbide teeth during the operation.

(9) A carbide-tip blade is the best choice for cutting this wood roof covered with a thick layer of insulation, tar, and paper. (Photo by Lazaro Acosta.)

Heavy-gauge metal deck roofs may have to be opened by first cutting through the thick layers of built-up roofing and fiberboard insulation with a carbide-tooth blade, scraping up the roof covering, and then cutting the deck with a metal-cutting blade. Although an explanation of ventilation techniques is beyond the scope of this article, I must point out that roofs constructed with metal decks or gypsum are prone to early collapse and that fires that warrant ventilation holes in these types of roofs are probably too dangerous to operate on or under.

Carbide-tooth blades can also cut lightweight sheet metal covering a wood roof or the thin metal skin of an overhead door, permitting the operator to reach inside to release locks and latches to raise the door. However, there must be no contact between the door’s heavy steel framework and the spinning blade.
A carbide-tooth blade is not intended to cut locks, hinges, security bars, or heavy-gauge metal. Doing so will break off carbide teeth, propel them like bullets, and destroy the blade. A rotary saw with a carbide-tooth blade will cut rapidly through Lexan® polycarbonate windows and impact-resistant windows made with laminated glass. Use caution when cutting impact-resistant glass with a rotary saw; it can shower the saw operator and anyone in the vicinity with glass and plastic fragments. All personnel working near the operation area must have eye protection and full protective clothing. Additionally, the saw operator should avoid inhaling glass and plastic particles by pulling his protective hood up to cover the nose and mouth or using a filter mask or an SCBA.

Make sure that a carbide-tooth blade can be used on your brand of saw. One major saw manufacturer clearly states that carbide-tip blades must not be used on its saws.

- **Carbide “chip” blade.** This blade can cut metal, wood, stucco, lightweight gypsum concrete, polycarbonate plastic, and laminated impact-resistant glass. It is a very strong and durable blade. At an FDIC H.O.T. session in which vehicle fires were extinguished, we cut the hoods and trunks of 100 automobiles with one carbide-chip blade. At the end of the sessions, the blade showed no appreciable signs of wear.
My company used a carbide-chip blade to cut through the thick steel side of a railroad box car filled with burning scrap paper. The blade was effective, but the job was extremely time-consuming and punishing. Next time, we'll call for a cutting torch.

Because a carbide-chip blade can cut metal and wood, it is an excellent choice for cutting metal overhead garage doors that are reinforced on the inside with wood 2-inch x 4-inch wind bracing.

Use extreme caution when cutting with a carbide-chip blade. It will throw pieces of metal with considerable force. Similarly, it is difficult to cut thick metal such as security bars or padlocks without "spitting" a few carbide chips. At one training session, firefighters were cutting the shackle of a large...
case-hardened padlock when a carbide chip thrown from the blade hit and shattered a tempered glass door a few feet away. Everyone near a carbide-chip blade in operation must wear full protective clothing as well as eye protection.

Carbide-chip blades have a relatively wide kerf, or thickness, of cut. This can make it difficult to cut deadbolts because the blade is wider than the space between a door and jamb. “Gapping,” or increasing, this space (to be explained later) may be insufficient to allow the blade to be inserted and spin freely. Consequently, you may have to cut into the door and jamb before the blade reaches the deadbolt.

The carbide-chip blade can be used to ventilate wood roofs, but it is not as effective as a carbide-tooth blade. This is most apparent when cutting a roof covered with thick layers of built-up roofing because the carbide-chip blade tends to gum up from the roof tar and bog down the saw.

**METAL-CUTTING DIAMOND BLADES**

Diamond blades have cutting surfaces that are coated or imbedded with small pieces of industrial diamonds. For years, the construction industry and rescue teams have used diamond blades on rotary saws to cut concrete, asphalt, and other masonry materials.

![A metal-cutting diamond blade is used to cut the hinges on this security gate. (Photo by Lazaro Acosta.)](image)

A few years ago, diamond blades were developed for cutting metal as well as concrete. When I first saw an advertisement for a metal-cutting diamond blade, I thought the manufacturer’s claims were too good to be true. Although I was skeptical, I purchased a diamond blade more than a year ago for under $200 and put it to the test. Since then, the blade has been subjected to several hours of extremely hard use, cutting thick steel pipe, strong locks, heavy steel doors, and iron security bars. The blade cuts the most substantial laminated glass with ease. I have intentionally misused the blade by trying to cut too fast, binding the blade and forcibly plunging it into the kerf in steel-reinforced doors.
A diamond blade certainly isn't the best choice for cutting wood and should not be used to ventilate wooden roofs. However, we were surprised at its capability. Last Thanksgiving, my company was ordered to open the exterior walls of an old balloon-frame house. The diamond blade effectively cut through the one-inch-thick wood siding that was covered with a thick layer of stucco applied over wire lath.

Prolonged cutting of heavy-gauge steel or thick iron bars can overheat a diamond blade, causing it to lose its temper and warp. You can cool a diamond blade by withdrawing it from the cut and allowing it to spin freely for a few seconds.

Some diamond blades that have become dull from cutting heavy metal can be sharpened by running them for a few seconds in concrete block or dry asphalt. These abrasive materials wear down the matrix bonding the diamonds to the blade to expose fresh diamonds to the cutting surface. Read and follow the manufacturer's instructions on how to "dress" or sharpen a diamond blade and to determine if it has a specified direction of rotation.

**SAW SAFETY**

Most injuries from rotary saws result from accidental contact with a rotating blade or projectiles thrown from the saw. As mentioned before, never lift or carry a rotary saw with its blade spinning. To stop a rotating blade, release the throttle and gently press the blade on the pavement or back into the material you were cutting.
All personnel working near a rotary saw in operation must protect themselves from sparks, fragments of the material being cut, and flying pieces of blade. Wear full protective clothing and eye protection (this cannot be said too many times). Sparks from a saw can ignite combustibles or spilled flammable liquids or accelerants spread about by an arsonist. As I mentioned in a previous article, firefighters in my battalion were about to cut an overhead door at the rear of a supermarket when a lieutenant smelled gasoline. The operation was stopped. Later, we found that an arsonist had used a lawn sprayer to spread gasoline throughout the store.

A rotary saw can rapidly fatigue its operator because of its weight and gyroscopic action. Usually, a saw operator will lose his effectiveness and accuracy before he feels tired, especially if he is cutting horizontally or over his head. Company officers must carefully watch for signs of fatigue and relieve a saw operator before he becomes a danger to himself and other firefighters. One of the first indications of operator fatigue is binding the blade. Rotate personnel frequently. Don’t expect a young firefighter with a desire to prove himself to voluntarily stop cutting and hand off the saw to another firefighter.

Fasten one to two feet of lightweight chain to a large pair of vise grips. This will allow a firefighter assisting the saw operator to clamp and steadily hold the padlock or chain being cut from a safe distance.

**CUTTING TECHNIQUES**

A rotary saw is not an “equal-opportunity” machine—in other words, not every firefighter will have equal ability to handle a saw. During training, company officers should identify the strengths and weaknesses of personnel. Plan your cuts—for example, when cutting a large opening in an overhead door, have your strongest and tallest members make the cuts at the top of the door, and then rotate in the shorter members.

The most common error inexperienced or unskilled saw operators make is to bind the blade and stop its rotation. Often, new personnel will continue to depress the throttle when the blade can’t turn. This will quickly damage the saw’s centrifugal clutch. Listen to a saw. Rotary saws are designed to cut at or near their full rpm. Let the saw determine its cutting speed. Attempting to cut faster than a saw can cut will “bog down” the saw and bind its blade. A decrease in rpm is a signal to “back off” on the saw and allow the blade to regain speed.

There is an exception to the rule of always cutting at a high rpm: When cutting steel, allow the blade to first cut a groove at low speed before bringing the saw to full throttle. This will reduce the gyroscopic action of the saw and the tendency for the blade to slide across the smooth metal surface.

Cutting a deadbolt is one of the fastest and least damaging methods for forcing an outward-swinging door. The key is to first “gap” the door-increase the space between the door and the jamb. You can do
this easily by driving the blade of a flathead ax between the door and the jamb until the space is wide enough to allow a rotary saw blade to spin freely. Gapping a door substantially reduces the time to cut a deadbolt because the blade does not have to grind away at the edge of the door and jamb before it can cut the deadbolt.

(20-22) A carbide-chip blade will not fit in the space between the security gate and the frame. The space is expanded by “gapping” the gate with a flat ax, which allows the blade to spin freely and cut the dead bolt. (Photos by Lazaro Acosta.)

TRAINING ISSUES

Firefighter recruits require more training on rotary saws than in the past, because many young people entering the fire service today have no experience with power tools. Before learning to run a saw, a new firefighter should be taught how to cut with an ax. This seems to be a dying skill. Then recruits
can practice operating a rotary saw by cutting pallets, scrap automobile hoods, and old doors. Then, recruits must learn to cut objects overhead such as door hinges, roll-down gates, and security bars.

Cutting overhead can be simulated, if necessary, by having recruits operate a saw while on their knees. They can practice horizontal and vertical overhead cuts in doors or hoods held securely in the upright position.

New firefighters should not be afraid of a rotary saw; instead, they should have a healthy respect for it and know the consequences of losing control of this powerful tool.

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