Westbury Fire Dept. - Board of Instructors

PROBATIONARY TRAINING DRILL

VENTILATION EQUIPMENT & OPERATIONS

Ventilation is one of the most critical functions performed on the fire ground. There are times when it is the single most important duty we accomplish, this is when there is known trapped occupant. Early and effective ventilation of a structure draws heat, smoke and toxic gases away from trapped occupants and the firefighter entering to make their rescue. This ventilation dramatically increases their chances of survival. Proper ventilation will decreases the chances of rollover, flashover or backdraft, and will reduce the punishment a firefighter will endure as they perform search and rescue and fire suppression, this ultimately decreases the livelihood of firefighter injuries, but if it is done improperly the consequences could be deadly.

As we teach with all of our drills, one of the most important elements in any fire suppression operation is the Size- up, with ventilation this is no different. The Firefighter performing ventilation needs to size up not only conditions of the fire, where it is, what stage is it in and where is it heading, they also need to have a good working understanding of fire, smoke and gases behavior and building constructions, all these factors will effect ventilation of that specific building. The ventilation you perform will ultimate dictate the flow path of air and eventually fire, if we performance our ventilation proficiently it can have a dramatic effect on all firefighting operation but indiscriminately breaking windows or cutting holes without considering the consequences could prove dangerous or deadly to both citizens your are there to help or other firefighters operating.

VENTILATION SIZE-UP

For ventilation to be performed safely and effectively, it is important that firefighters be able to size up & recognize many critical factors and then plug them into that existing event. Items like; fire behavior, stage of fire, fire spread, smokes behavior, building construction, exposures and weather will have an effect on your choices. Having a good working knowledge of all these factors and understand how the will affect your choices are keys to successful ventilations.

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FIRE BEHAVIOR

Fire is defined as the rapid persistent chemical change (combustion) that releases heat and light and is accompanied by flame. Effective ventilation is the management of the products of this combustion. The products of combustion can be divided into three categories;

Fire Gases - Heat - Smoke

FIRE GASES

Fire gases refer to the gases that are released from objects as they burn. These gases affect the physiology and behavior of humans in various ways. Proper ventilation will remove these gases and greatly increases survivability of occupants.

HEAT

Heat is the combustion product most responsible for fire spread in buildings. The three recognized ways that heat is transferred are conduction, convection, and radiation.

• **Convection**: currents of heat are the most common type of fire spread. Flames lapping out of windows, up stairwells, or out of holes in the roof are convection currents of heated gas.

• **Conduction**: is the transfer of heat through a solid. An example is the ignition of roofing material for a heated attic space once it hits its ignition temperature.

• **Radiation**: is defined as the transfer of heat through space. Surrounding contents are slowly heated until they reach their combustion temperature. Fires transferred to exposures are typically spread this way.

Properly placed and effective ventilation that interrupts or at least controls these methods of heat transfer is paramount to the confining, control and extinguishment of fires.

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VENTILATION EQUIPMENT & OPERATIONS

SMOKE

Smoke consists of finely divided particulate matter that is formed by the incomplete combustion of materials. One of the most reliable indicators of fire conditions within a burning building is the behavior of visible smoke. When performing a size-up of a structure fire attention should be given to smoke's volume, color, density, and pressure.

STAGES OF FIRE

Fire starts with the ignition or incipient stage (this is the beginning of our fire) and then it progresses through three additional stages:

Growth - **Fully Developed** - **Decay**

GROWTH STAGE

The growth stage follows the actual ignition; little heat exists at this early stage. The air is still oxygen rich and is drawn to the flame and convection carries the heat to the upper parts of the room or area. The heated gases spread laterally across the top of a room and then down, eventually igniting the combustible materials in the upper levels of the room. This is referred to as **Rollover**. Rollover differs from flashover in that only the gases in the upper levels of the room ignite not all of the contents. An indication of a fire moving from the growth stage to the fully developed stage is a **flashover**. Flashover occurs when there is a simultaneous ignition across the entire room and its contents. The fire in its growth stage radiates heat down from the ceiling onto the surfaces of the contents of the room (thermal radiation). The contents are gradually heated until they reach their ignition temperature. It is at this point that they ignite, and the room and its contents are fully involved in flame. Effective ventilation and a properly placed hose line directed at the ceiling can stop a fire at this point. A fire will move into the fully developed stage if not stopped.

FULLY DEVELOPED STAGE

This stage is commonly referred to as the free burning stage. Free burning fire in an area will continue to consume all the area's oxygen, once this occurs it moves into the decay stage.

DECAY STAGE

During this stage a fire confined to a compartment, large or small, will deplete the atmosphere of all oxygen. The room will be full of smoke and super heated gasses, and the only sign of fire are embers. This condition is extremely dangerous, in that is ripe for a **backdraft**. A backdraft is the rapid, almost instantaneous combustion of flammable gases, most items are at their ignition temperature, just lack oxygen to sustain burning. Firefighters confronted with a fire that is late in the fully developed (free-burning) stage, or in the decay stage, risk initiating a backdraft if they fail to recognize the conditions, and open the structure improperly. The opening of a door or window at this time supplies the missing link, oxygen and we have and explosion of fire, when everything ignites.

Firefighters must be aware of the characteristics, which may indicate a backdraft condition, such as;

- Pressurized smoke exiting small openings
- Confinement and excessive heat
- Little or no visible flame, but extreme heat
- Smoke leaving the building in puffs as if it is breathing
- Smoke stained windows
- Black smoke that is dense and turning grayish-yellow

If any of these conditions exist upon the arrival of the first company, the IC should be immediately notified and vertical ventilation should begin prior to entry by firefighters.

If we open the front door and instead of seeing the smoke exiting but instead we see the smoke head inwards with the fresh air from the outside, we can most likely expect either a backdraft or the area flashover in the very near future, we just gave the fire the air it needed.

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VENTILATION EQUIPMENT & OPERATIONS

FIRE SPREAD / SMOKE BEHAVIOR

As stated in Fire Behavior, one of the most reliable indicators of fire conditions within a burning building is the behavior and characteristics of visible smoke, variables that firefighters should consider during their size-up of a structure fire are;

Volume - Color - Density - Pressure

VOLUME

The term volume refers to the amount of smoke emitting from a structure. Generally speaking a high volume of smoke indicates a large fire. Note in some cases, petroleum based products fire can also produce large volumes of smoke but the fire can be relatively small or moderate; in an cases if firefighter see big smoke they should use caution and assume they have a large fire, especially since petroleum based fire burn extremely hot.

COLOR

The color of smoke can give even more information about a fire than volume. Though not hard and fast, whitish gray smoke indicates cellulose based materials (wood, paper, etc.) are burning in an oxygen abundant atmosphere. Dense black smoke is generally produced by hydrocarbons such as petroleum and petroleum-based products. Smoke color is an indicator of backdraft conditions (black turning to grayish-yellow). An unrecognizable color may indicate Hazardous materials are involved. Suffice to say that the color is a great indicator and should be noted during size-up.

DENSITY

Density, like volume and color, can indicate the conditions on the interior of the building. Thick smoke usually indicates a large fire, or a fire within a confined area. The density is often an indicator of the stage of a fire, and should be considered during the initial size-up.

PRESSURE

Large volumes of smoke moving out of a building under pressure, is a clear indicator of a large free burning fire. It is important to note that light smoke does not necessarily indicate a small fire. In the case of an attic fire, the smoke on the top floor may be light, while the fire above can be intense.

The important point here is that the characteristics of the smoke that a fire produces can provide valuable information about the fire itself and the building it is burning in.

BUILDING CONSTRUCTION

CONSTRUCTION AGE

During the ventilation size-up, firefighters need to consider age and type of the building. The age of a building affects the ability of fire to spread and the stability of the building under fire. Older buildings (Pre World War II) are constructed with mass, the wood is thick and solid, and areas in the structures are typically small with many rooms. Today it's the opposite, the construction is thin and cheap and the areas inside are large, open areas from front to back of the structure. What does this mean to use doing ventilation? If we vent an older structure, our vent is typically isolated to a specific area and the effects of that ventilation, especially accelerating the fire will not typically have a rapid effect on the structures stability. In newer construction it is just the opposite, the vent will affect large areas, maybe even an entire floor of the structure and the effects will more than likely compromise the structures stability.

CONSTRUCTION FEATURES THAT *HELP* OUR VENTILATION OPERATIONS

There are features of construction that help operations and ventilation. Lightweight steel framing materials protected by sheetrock or sprinklers, protected heavy gauge steel supports, and self-closing doors are examples of building features that **may** help control fire spread and assist our operations. There are also sprinklers, suppression systems and automatic smoke vents are features that can help our operations. The IC should know if they are present and use them effectively.

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VENTILATION EQUIPMENT & OPERATIONS

CONSTRUCTION FEATURES THAT *HINDER* VENTILATION OPERATIONS

Construction features that hinder firefighting operations are those that promote fire spread, increase the likelihood of partial or complete structural collapse (items like truss' Wood or Steel) or create obstacles to our entry and accessibility of the building (roll gates for example) . As stated earlier, per WWII is generally good for us, but not 100%. This is not true with all fire spread in older buildings, items like balloon construction, aged lumber and remodels can become a hindrance and can actually promote fire spread. In all construction new or old the contents specifically the newer synthetic materials, increases fire spread due to the high temperatures they burn at and the toxicity of their products of combustion.

There are construction features that greatly add to the likelihood of partial or complete collapse of a structure. Tanks and HVAC compressors places on the roof or in the attic during remodels, in buildings not designed to carry their dead load. Automatic sprinklers, that release hundreds of gallons of water onto a floor to hold a fire, but add a new live load to a structure. Heavy construction features such as cornices and parapet walls that can collapse and fall from the building under fire conditions.

Engineered construction (such as lightweight trusses, wooden I beams, heavy timber trusses) is the newest and most dangerous threat to firefighter's lives and safety. Developed to cut construction cost of buildings and meet requests for desired large open spaces. These buildings are to be approached from a ventilation standpoint with extreme caution. Each member is part of a "system" of construction an if one member of the system fails the entire system fails. Nominal lumber size, gang nail plates and horizontal open spaces create a system that promotes large fire spread and rapid failure. These systems are definitely not strong under fire conditions, due to their little mass and since they expand fire horizontally the fail is very quickly and typically encompasses a large area, unlike its legacy construction counterpart.

In commercial buildings there is now an emphasis on lavish landscaping with trees, bushes and fountains that inhibits our access to the exterior. Tighter security in the form of security doors, bars on windows, and roll-up gates, has added another layer of hindrance to firefighting operations. The quick and efficient venting of buildings from the exterior has become much more of a challenge.

OCCUPANCY CONSIDERATIONS

Knowing what and who occupies a building on fire is paramount to the safety of firefighters today. Hazardous materials must be identified and dealt with appropriately. There may be modifications to a building's interior such as large open holes in floors, which are known to occupants but not to us who are entering blind. This information is best obtained during the pre-fire inspection of properties. If the occupancy is not known before arrival, it is one of the first pieces of information that should be gathered as part of an initial size-up.

OTHER VENTILATION SIZE-UP CONSIDERATIONS

EXPOSURES

Ventilation moves smoke, fire, and heated gasses through doors, windows and man-made openings. Often these pathways are the same or in proximity to the pathways needed by occupants and firefighters to exit or enter the building or the floor that is on fire.

Fire and heated gasses threaten both internal and external exposures by auto-exposing (fire extension from floor to the floor above via the exterior of the building).

Venting an area where heat can radiate to an exposure also need to be considered. It can be done but assure provisions are put into place, (hose line a protection), before done otherwise we can be making a bad situation even worst.

WEATHER

The openings in a building either caused by fire or man-made cause the conditions on the outside of the building to effect the conditions on the inside of the building. The most influential of these conditions are wind, humidity, and temperature.

• Wind may blow fire and smoke both towards external and internal exposures. It can overpower convection, and drive heat and smoke into the inside the building.

• Humidity/Rain/Snow may keep products of combustion from rising, making our vertical ventilation less effective.

• Temperature can affect smoke movement. High temperatures may benefit the exit of smoke from a building. Low temperatures typically inhibit smoke movement from a building.

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VENTILATION EQUIPMENT & OPERATIONS

HORIZONTAL vs. VERTICAL VENTILATION

The **2 types of ventilation** we typically see on the fire ground are **Horizontal** and **Vertical** Ventilation:

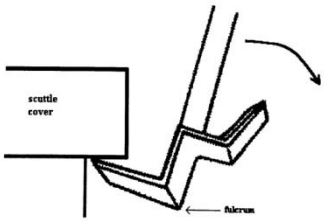
Vertical Ventilation - Done as soon as possible and at every structure fire.

When we say Vertical Ventilation we are talking above the fire, from a higher point then the fire. This is typically and most efficiently done by opening natural openings on the roof.

1. **Opening bulkhead doors** – This is the top of the interior stairs that leads to the roof. It is very important to open these bulkheads for: (**Priority # 1**)

- Clears smoke from the staircase, allowing victims to escape without being overcome by smoke. (*if doors are open to both fire area and staircase, this staircase will be charged with smoke, trapping occupants above this point*)
- Victims escaping to the roof may be trapped at top of stairs, overcome trying to get the bulkhead door open
- Allows firefighters a clear staircase to set up standpipe, stage before entering fire floor, conserving air supply not wasting their air before operating.

2. **Removing scuttle covers** – Like a Bulkhead, these are also an access point to the roof, but instead of a stairway they are typically accessed via a ladder.



When removing scuttle covers with a Roof Hook, place the tip under the cover and push down on the handle using its fulcrum and lever to pry the cover off.

Scuttles and Bulkheads should never be used as an entry point into a building once they are opened.

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3. **<u>Breaking or Removing Sky Lights</u>** - These look similar to a roof hatch but are made with glass on the top which allows light to enter the area.

If they can be force open they should, to lessen the chances of broken glass falling on operating firefighters below.

When they are open, it's important to open the returns (side walls) to see if there is fire in the cockloft area (area between the roof and ceiling)

4. **<u>Removing Vent Caps</u>** - These are ventilation ports on the roof.




These vent caps come in many shape form, some with fans, some that spin with the wind... After you pull one from the roof, you need to look into the opening and see if there is any duct work attached, if so it will need to be forced down and away from the newly formed opening on the roof.

Once we open all the natural opening, <u>in that listed order</u>; Bulkheads, Scuttles, Sky Lights and Vent caps and if we deem the roofs is still stability we may decide to:

5. **<u>Cutting a hole in the roof</u>** - *The process of cutting a roof and roof operations will be discussed at August Probationary Drill – that drill will go over all Roof Operations.*

<u>This Vertical Ventilation</u> *will allow the Fire Gases, Heat and Smoke to lift and will draw the fire to these opening, helping to prevent horizontal extension of fire and will make conditions more tolerable inside for any potential victims and advancing firefighters.*

The sooner was achieve Vertical Ventilation, the better !

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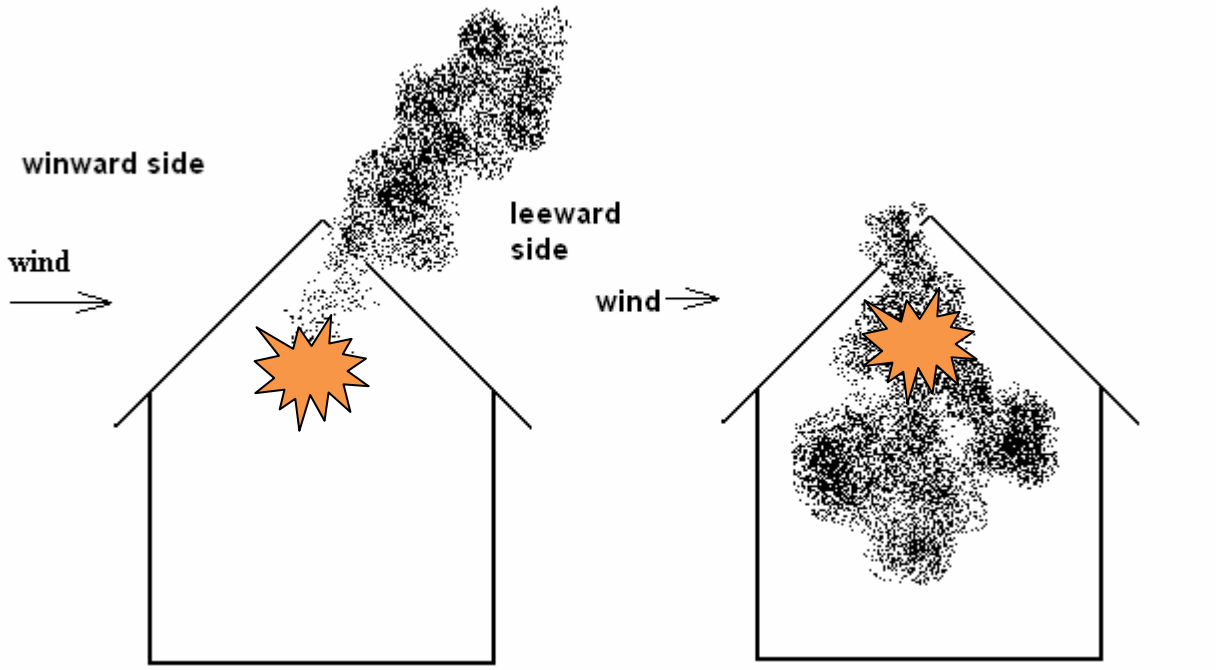
VENTILATION EQUIPMENT & OPERATIONS

Horizontal Ventilation

When we say Horizontal Ventilation we are talking the fire area and floor. This is typically done by windows and doors. Unlike Vertical Ventilation where smoke lifts and anything we do above the fire will help, with Horizontal Ventilation there are many more factors we need to take into consideration.



Here you we have an attic fire: if we cut on the right side of the roof the wind will aid our ventilation efforts but a cut on the left side it will actually hider our efforts, the wind will force smoke in and down into building, slowing our advancement to the seat of the fire.

This is why horizontal ventilation needs to have a thought process and not just randomly smashing windows, or cutting holes where and whenever you wish. We need to take into considerations wind direction, the direction the fire is burning, what stage the fire is in, and from what direction has the fire attack been made from, **all very important factors**.

- As stated above, venting a window's **windward side** will forces air into that widow, this will not only limit our ventilation, hinder advancement but it will also accelerate the fire.
- If we vent in the opposite direction a fire is burning and we may change the fires flow and draw the fire to advancing firefighter who may not expect it from their size up.

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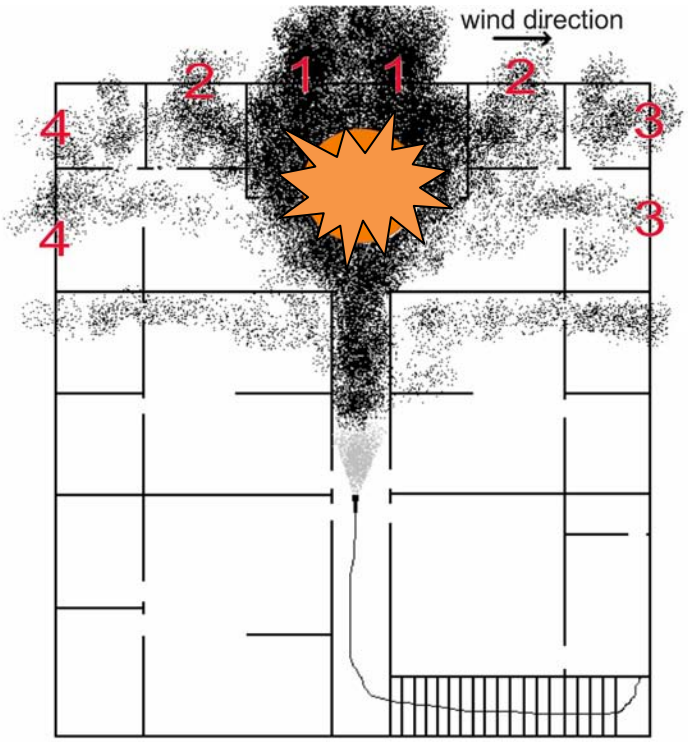
- Venting a fire in the growth or decay phase will accelerate the fire and if done with a search team in that area you could actually cause the fire to flashover on them.

We ultimately want to start or horizontal vents, in the area of fire, as water is put on the fire and ahead of the advancing hose line so this hose line can force the smoke, contaminates and smoke way from them instead of rolling back at them.

It is importance to have the horizontal ventilation coordinated with the inside operating teams, especially the search team and 1st hand lines.



1. These windows ideally are the windows we want to take first. They are ahead of the fire (orange) and the advancing hose line. The wind will also aid in the ventilation.

2. These windows would be next, they are also ahead of the hose line, to either side of the fire rooms and again wind will not hinder our efforts.

3. These windows would be next, we are expanding the area making surrounding areas more tolerable for operating personnel, yet wind direction will pull heat/smoke out.

4. When we take these windows, air will be forced into the area, the stronger the wind the bigger effect it will have. If **3** is taken first there will be a cross ventilation but if **4** is taken before **3** it may force air down the hall and at the hose line advancing down it. The flow path of air will always be the one of least resistance.

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VENTILATION EQUIPMENT & OPERATIONS

When the hose line is advances to a point it can throw water out these cleared window, it can be used for **hydraulic ventilation**: using the steam of the hose to force heat, smoke and contaminates out the opening.

When we clear windows or doors in horizontal ventilation, the windows/doors in that immediate area of fire should be taken as quick as possible. We are not going to spend time trying to save property and open then. The entire window will be cleared down to the frame. This will allow inside members the ability to use them to escape if need be. If we take any window, early, late, accidentally break trying to force open..., it will be made safe and cleared down to the frame, **No exceptions**.

As we get further away from the immediate fire area, the less the urgency to get the area vented quickly. In these cases if we can open the window and it will remain open this is what we will do. We need to understand this is someone property and we've all taken a sworn oath to protect property. These events are very traumatic events for the property owner and smashing windows that are not necessary makes this traumatic event worst for them and doesn't reflect positive for us, especially since people just don't understand why we do this.

When we open a window, we need to remember, smoke rises, so it will be most effective if we open the top part. If the room is isolated, then we want to split the opening where open ½ on top and ½ on the bottom, this will give a point for smoke to exit and fresh air to enter.

Tilt Wash Windows will allow you to tilt the window down, twist and removing the entire section from the frame. This can be done to both sections, allowing you to clear entire window to frame. Once our operation is complete, the homeowner can put these sections back in without any damage to the window.

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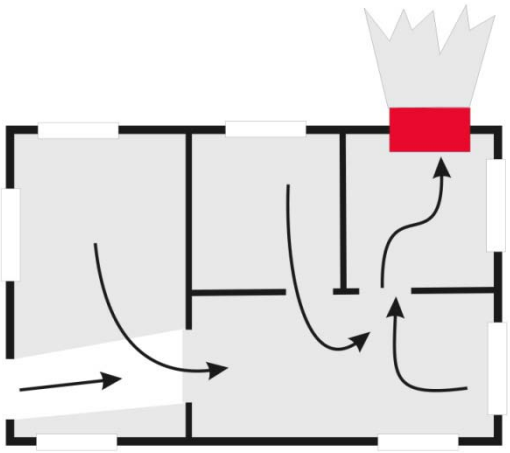
VENTILATION EQUIPMENT & OPERATIONS

PRESSURIZED VENTILATION

Another means of forcing Smoke, Heat and Fire Gases out a building is by pressurized ventilation. This Pressure can be Negative or Positive Pressure.

NEGETIVE PRESSURE

Negative pressure is nothing more than using an electric powered fans to *pull* smoke out of a building. The fan is usually placed in a window with the fan **exhausting** the contaminated atmosphere to the **outside**.



The fan blowing outwards creates a negative pressure within the building, this negative pressure draws fresh air from the outside inwards, equalize the pressure. This is typically done utilizing **electric fans**.

Multiple fans can be used from multiple locations or multiple fans stacked on top of each other from one location can be utilized to achieve this negative pressure.

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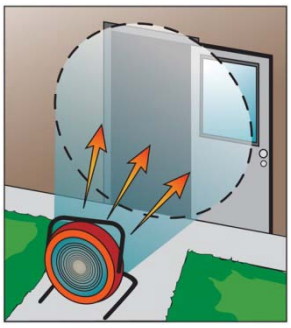
VENTILATION EQUIPMENT & OPERATIONS

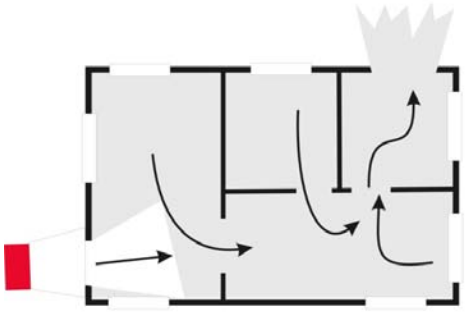
POSITIVE PRESSURE



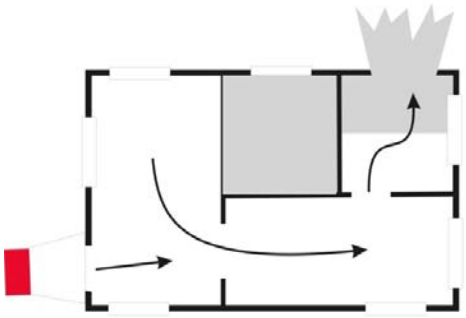
Positive pressure is nothing more than using fans to *push fresh air* into of a building. The fan is usually placed outside of a door with the fan blowing inwards which forces the contaminated atmosphere to the outside.

This method is typically done utilizing **gas power fans,** which create more pressure than electric fans.

Although we can achieve effective ventilation, (as in the diagram to right - doing the entire area all at once); clearing an area can be done quicker and more efficient if we pressurize the entire building and control which room we vent, clearing one room/area at a time.

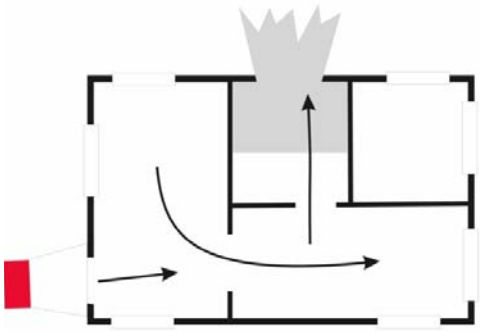


To the right, you can see we've isolated the middle room, in doing so it increased the pressure in the other areas, this means it will increase the smoke, heat, and fire gases that are being force out that one open window. This will clear that room much quicker. Once that room is completely cleared, we will isolate that room from being contaminated again by closing the door and move on to another room/area.



We will continue this process until all rooms are cleared.

This method typically works best when we start clearing areas closest to the fresh air entry point and working away from the fresh air supply, but not necessarily required.



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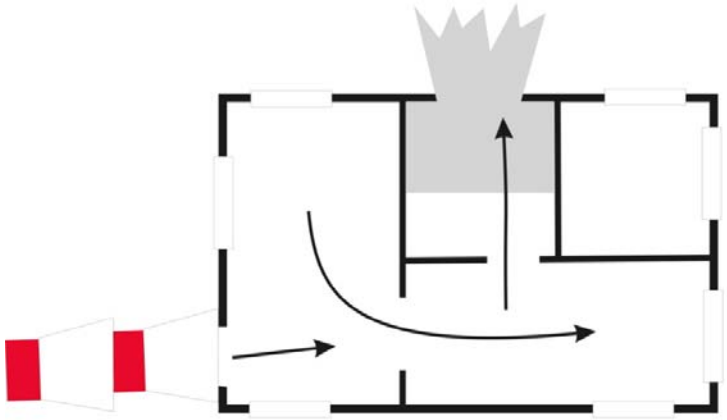
No matter how we do it, we need to control our point(s) of pressurization, where the fresh air is forced inwards (aka: inlet) and the point in which the pressure is released forcing contaminates out (aka: outlet). The outlet should always be smaller then in inlet, this creates resistance creating the pressure. If we are having problems pressurizing, it's typically due to the HVAC system, which is sometimes hard to control.



If we need to increase the pressure of the one fan pressurizing an opening, a second fan can be stacked behind the first fan. This will in essence turbo charger the first fans pressure.

This method of stacking fans may be needed in large footprint building or buildings with multiple floors.

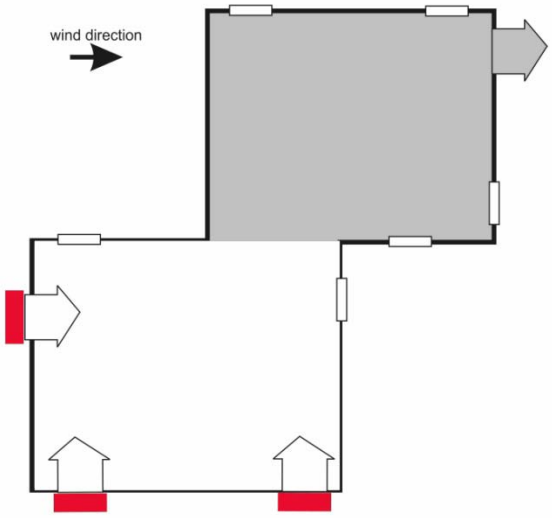
For Larger foot print buildings or multiple floors, we can pressurize a specific area/floor from multiple points and have the outlet be a different area or floor.

To the right you can see we have pressurized a large area which we can control from 3 different points.

These points not only pressurizing the area but the entire building, as long as we've controlled all the outlet points.

We can then choose our outlet point, open it, releasing the pressure and any contaminates from the area.

If there were more areas, we can do to each separately, isolate the cleared area and move to another.



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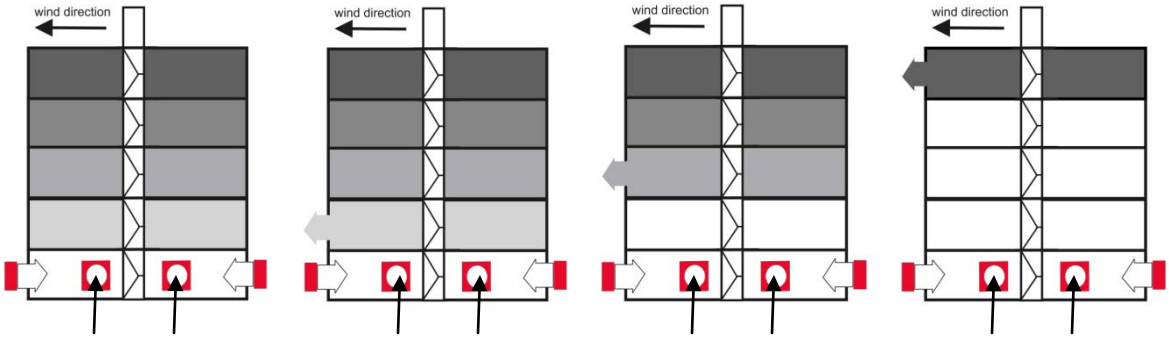

Here with a multiple story building, we can use multiple fans to pressurize the first floor.

We would then use the stairway to bring the pressure to the next floor, open a window clear that floor and work our way upwards.

Once we cleared a floor we would close the stairway door, open the next floors stairs, pressurize that floor, clear it and continue the process as we continued upward.

If this was a multi dwelling, once we pressurized a floor, we would do each individual apartment on that floor starting with the apartment closest to the pressurized stairs and working away.

The most important thing to remember before we use the stairs to pressurize the rest of the floors, is we need to remember to close the open Bulkhead door leading to the room. If we don't we will be unable to pressurize the floors, all the pressure will just escape through the bulkhead door. The pressure we created will always be released from the point of least resistance.

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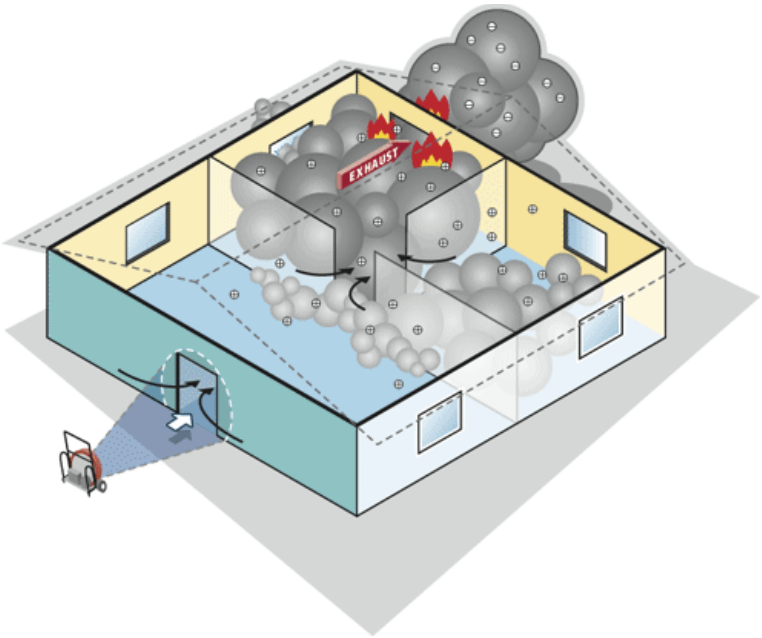
Positive Pressure ventilation (PPV) is a very effective means of ventilation as long as the points of outlet can be controlled. If the outlets pressure is greater than the inputs pressure, this method of ventilation doesn't work.



But when we can control the point(s) of pressurization and the outlet point is less than the pressurization point causing resistance, this method is very effective and works better then negative pressure in clearing areas.

Positive pressure also works better the negative pressure when attempting to clear a non visual gas such a CO, since we are controlling where we get the fresh air from and can do one area at a time, isolating them so they are not re-contaminated. With Negative pressure we are forcing bad air out, but where are we getting the fresh air from, from inside and possibly from another contaminated area.

Electric Fan Use

These fans are just super sized versions of the fans we are accustom to use in our home. They work the same way, we plug them in and they turn on.

There is an arrow on the top of the fan that tells us which direction the fan exhaust air will blow.

One difference between these fans and our house fans is the plug. The Engines fans have a standard plug but the ones on the ladder and heavy rescue truck have 3 Prong 20 W 120V Plugs

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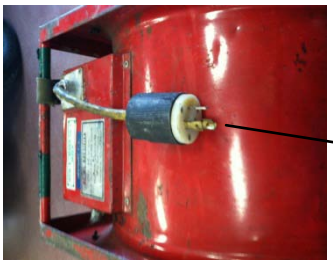
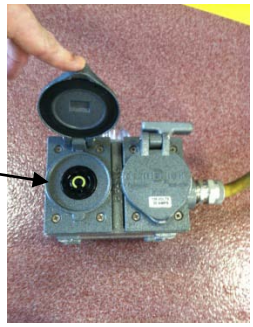
PROBATIONARY TRAINING DRILL

VENTILATION EQUIPMENT & OPERATIONS

This **3 Prong Plug** connects into the junction box, at the end of the electric reels of the Ladders or Heavy Rescue.

When they are plugged in we can twist to lock them in place.

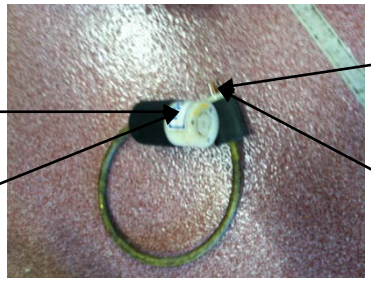


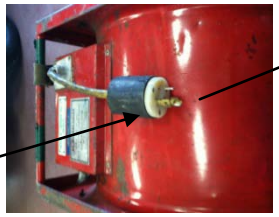


If we need to power an Engine's fan from a rigs generator or if we need to power a Ladder Truck's or Rescue truck's fan from a house outlet, we will need to use a Pigtail adaptor, which will convert 1 plug adaptor into the other: **Pigtail Adaptor**

House Plug

Female 20W 120V 3 Prong Plug





Male 3 Prong

(*photo 1*)

Above demonstrates converting a Male 3 Prong Plug, found on Trucks fans, to House Electric

If we needed to power an Engine's fan from a Ladder trucks power supply we would use the opposite pigtail one that had a Female House plug to a Male 3 Prong. This Pigtail would allow us to convert the Male House plug to the Male 3 Prong plug that could plug into one of the rigs electric reels junction boxes.

In the Pigtail boxes you will find longer pigtails that have a male and female <u>of the same plug</u>, these are not <u>pigtail adaptors</u>, but extension cords. These would be used when plugging multiple fans into 1 junction box. As you can see from the fan above (*photo 1*) the cord coming out of some fans are short and if we need to stack 2 fans on top of each other both fans plug wouldn't reach the junction box, this is when we would need to extended one of them, and use one of those extension cords. These extension cords only have 3 prong plug ends and if we needed to <u>extend and convert</u> we'd need a pigtail **and** an extension cord to get the job done.

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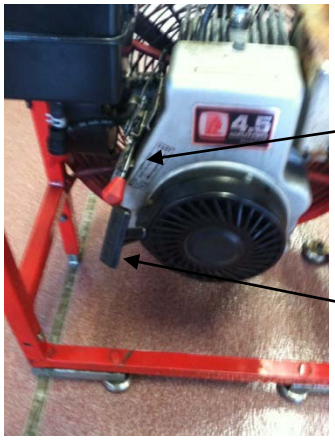
PROBATIONARY TRAINING DRILL

VENTILATION EQUIPMENT & OPERATIONS

Gas Fan Use

These fans much like the electric counter parts are used to move air but instead of being powered by electric they are powered by a gas motor. We need to understand since the fan is gas powered, when it is are running the exhaust is producing Carbon Monoxide, a toxic gas. Since it produces this deadly gas, they need to be run them in a well vented area preferable outside and should never run them inside a building. These fans are designed for outside use and for positive pressure; their output is much greater than an electric fan. A 16" electric fan produces 5,200 CFM (cubic feet minute) air movement where an 18" gas fans produces over 15,000 CFM.



Running these fans is no different than any other gas powered tool in our arsenal.

We want to move throttle from **stop to run** and just about full throttle.

We will then pull the pull cord spinning the motor making it run. Depending on the last time it ran, it may take a few pulls to get the motor to start.

Once the motor is running we will bring it to full throttle and direct the exhaust to the opening we choose.

Like the electric powered fan, there is an arrow on top of the fan which lets the user know which direction the exhaust will flow.

When we place the fan at an opening we want to make sure the fan exhaust covered the entire opening. We will check by using out hand, backing up the fan until the opening is covered.

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PROBATIONARY TRAINING DRILL

VENTILATION EQUIPMENT & OPERATIONS

Here we can see the fans exhaust has coverage over the entire doorway. If the entire opening is not covered, pressure will escape through the uncovered area.

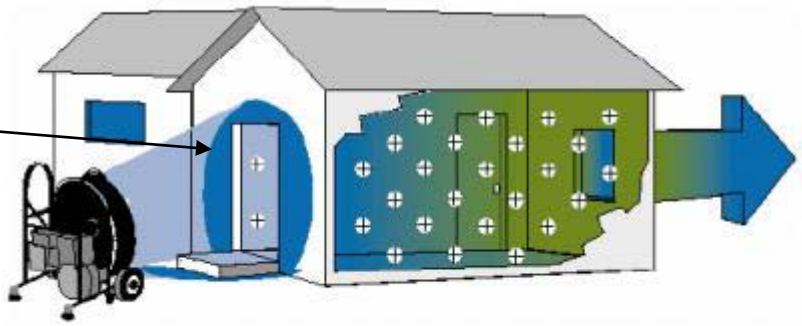


Figure 2 - PPV Cone of Air [5]

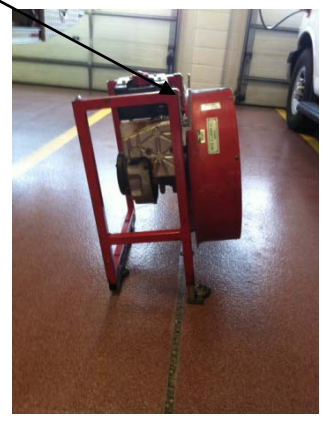
To help us achieve an angle the allows for this coverage

There are legs on the front of the fan that drop.

By squeezing the leg releases and tilting the fan backward, the legs will drop. When you've achieved the desired angle release the lock and the legs will lock in that position.

Leg Locks (squeeze)

Legs not dropped



Legs dropped down

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PROBATIONARY TRAINING DRILL

VENTILATION EQUIPMENT & OPERATIONS

HANDS ON PORTION @ Training Building

With Training building charged with smoke floors 1 and 2:

- Use 1 electric fan off Engine (House electric) Negative pressure 1st floor for power inside training building – Hang from a window
- Using same Fan, take to a door, stack with a fan of a truck (3 Prong) and connect both using a junction box from the truck. (review pigtails and extension cords) – ventilate using negative pressure out that door

  Close all doors and re charge building with smoke

- Use Gas powered fan – positive pressure a door and clear smoke from building 1st the 1st floor then the 2nd , controlling the doors and windows

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PROBATIONARY TRAINING DRILL

Power Saws/Equipment

PORTABLE POWER SAWS

- Improves efficiency by facilitating cutting operations
- Can be extremely dangerous if misused or if safety precautions are disregarded.

DESCRIPTION:

- High speed, two cycle engine
- Gasoline/oil mixture: 4.8 fluid ounces of oil to one gallon of gasoline
- 20 to 30 minutes operating time
- Special suction wick; allow saw to operate regardless of position, such as upside down, sideways, etc.

Four different types of blades:

1. **CARBIDE TIP**:

- Will cut through gravel & tar covered roofs, **wood** flooring, light sheet metal and similar material
- Dislodged carbide tips can become airborne & cause injuries
- Blades are placed out of service when eight (8) or more tips are missing, broken, or worn down.

2. **ALUMINUM OXIDE** (Abrasive Disc):

- Will cut various types **Metals**, including auto bodies, metal security doors, metal window bars, etc.

3. **SILCON CARBIDE** (Abrasive Disc):

- Will cut through concrete & other **masonry** materials
- They are very similar looking to the Aluminum Oxide blade

  You need to read the label differentiate one from another

3. **DIAMOND BLADE** (Abrasive Disc):

- Will cut through both **Metal** like the Aluminum Oxide **and Masonry** like the Silicon Carbide.

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PROBATIONARY TRAINING DRILL

Power Saws/Equipment

Testing & Starting the Saw:

- Move to a safe area – Do not start in explosive atmosphere.
- Check all nuts, bolts, and screws for tightness.
- Check fuel level.
- Shake saw vigorously to insure gasoline and oil is mixed.
- Place the saw on a flat surface holding it firmly in a level position.
- Place the RED (Stop) lever in the **run** position
  This Lever is also the Stop switch, used to shut saw down quickly in an emergency, via a flick of the thumb.

- Engage the choke (BLUE lever), by either pushing to down position or pulling it out.
  Each saw we have the choke may be different but the function is the same.

- Engage the trigger (throttle) lock.

- Press the decompression button

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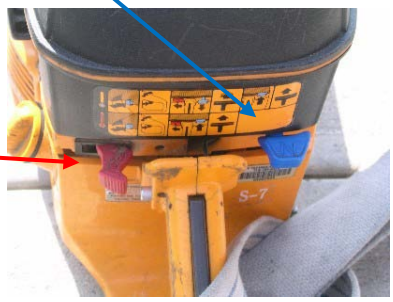
PROBATIONARY TRAINING DRILL

Power Saws/Equipment

- Place the left foot in the control guard & the right foot back for balance.
- Lift the starter cord a couple of inches. (This is to prevent damage to the recoil mechanism).
- Pull the starter cord, until you here the motor kick.

- Disengage the choke and pull the starter cord again.
- Once the saw starts disengage the trigger lock, by squeezing & releasing the throttle trigger.
- To shut down the saw just switch the red lever back to the stop position



NOTE: With large boots not fitting into the handle, members have the option of placing their right foot onto the lip of the right side of the handle. If this method is employed the carrying handle should be held down with the right hand. An additional option is to insert a tool or a substantial object such as a thick piece of wood or steel through the handle and step on the same prior to starting the saw. Regardless of which method is used, the saw handle must be held by hand prior to starting the saw.

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PROBATIONARY TRAINING DRILL

Power Saws/Equipment

SAFETY PRECAUTIONS & PROCEDURES:

- All members operating and/or in the immediate area of cutting operations shall wear full protective clothing. Goggles, safety glasses should be worn or eye shields must be in the down position when operating any saw.
- Only members who have demonstrated an aptitude and who have been thoroughly trained in its operation should operate the saw during fire operations.
- Have a plan of action BEFORE STARTING SAW; plan should include:
  Location & sequence of cuts and openings
  A safe means of egress
  Wind direction – consider its effect on exposures & other members

SAW OPERATING TEAM

- The firefighter who operates the saw (Operator) will be assisted and/or guided by another member.
- A physical communication system between the Guide Man and the Operator will be as follows:

A. One slap on the back of Operator .....Stop Cut.
B. Two slaps on the back of Operator .....Cut.
C. Three slaps on the back of Operator .....Shut Down Saw.

CIRCLE OF DANGER

- During cutting operations, everyone in the vicinity of a saw in operation shall observe, "as near as possible and practical, a 20 foot radius Circle of Danger."
- This circle shall be measured in all directions FROM THE POINT WHERE THE BLADE OF THE SAW IS IN OPERATION.
- Only the Officer, the Operator and the member designated as the guide may enter this circle. All persons directly to the rear of the operating saw blade must be warned away, as the saw may throw debris 20' feet or more.
- The Operator shall not bring a "live saw" (i.e. a saw with engine running) into a position that puts other members within the Circle of Danger.

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PROBATIONARY TRAINING DRILL

Power Saws/Equipment

MOVING WITH THE SAW

- Before moving from one position to another, DISENGAGE THE CLUTCH, RELEASE TRIGGER, AND PLACE BLADE ON FLAT SURFACE TO STOP THE BLADE FROM SPINNING. Keep the blade on the surface and roll the saw to the next assignment.
- The member assigned as a guide holds onto the Operator. They then proceed in unison. This is an awkward position and debris, hose lines or obstructions may be in the way. The Operator, after maneuvering over these obstacles, must always return the saw blade to surface as soon as possible.
- This method has been chosen to prevent the operator from carrying a "live saw" (and possibly accidentally running into someone). If saw rolls into a hole while traveling in this position, the blade will go over the edge and the operator will immediately know he must stop. This situation can then be investigated before advancing.
- The saw shall be shut down when moved to distant areas of operation, (e.g., level to level).

OTHER SAFETY CONCERNS

- If conditions permit, scrape gravel and debris from the path to be cut, in order to reduce the danger of injury from flying chips and loose materials.
- To prevent accidents caused by moving belts, gears, blades, etc., it is imperative that Operator and Guide have their clothing completely buttoned up and close fitting.
- "GUNNING" the saw while the Operator is either "standing by" or moving to a new point of operation SHALL NOT BE PERMITTED. Gunning engages the centrifugal clutch and causes the blade to spin, thus increasing the possibility of injury.
- The saw cut should be only as deep as necessary. Deep cuts may weaken supporting beams and lead to collapse. The experienced Operator will know when a beam is being cut by the sound and feel of the saw.
- Side pressure or twisting of the blade when operating should be avoided. The saw should never be forced. If too much pressure is applied to the blade, the hazard of blade breakage (carbide tipped) or blade shattering (aluminum oxide or silicon carbide discs) is increased.
- Always place saw down when changing operators
- Avoid using saws from portable ladders
- Hold with two hands
- The saw shall always be shut down when unattended

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PROBATIONARY TRAINING DRILL

Power Saws/Equipment

CUTTING OPERATIONS

CARBIDE TIP BLADES

- Lean forward, squeeze the throttle and bring the blade up to full RPMs before contacting the surface with the blade. Let the blade lower itself into the material. Then move backwards, guided by your guide man. Maintain the saw at full RPMs while cutting.
- Do not over-extend yourself.
- Do not reach forward past the point of good balance.
- A slight back and forth motion of the saw will widen the cut & help prevent the blade from binding.

ABRASIVE DISCS or DIAMOND BLADE

- When the disc is brought into contact with the material, run the engine at low speed and gradually increase it as the disc cuts into the material; this provides guidance. Once a groove is formed, work at full throttle and regulate engine speed by varying pressure on the material.
- When a cut has been completed, stop the blade by lifting the spinning blade from the cut, releasing the trigger and placing the blade on the surface being cut.

MAINTENANCE PROCEDURES

- Saw should be checked at minimum weeks and after every cutting operations. Checking means running the saw and testing all of its functions. Does the choke work, does the saw shut down quickly when turned to off position. Making sure the saw is clean is also important and may affect saws performance.
- If a saw is difficult to start, doesn't stay running or any condition that makes the saw unsafe or could waste time or hinder operations at a fire call, it should be written up for service and the officer of the rig it came off of notified. Any maintenance like adjusting belts, changing air filters... will be done by the district.
- After the check, the saw will be refueled and place or rig ready for use.

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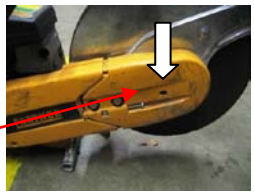
PROBATIONARY TRAINING DRILL

Power Saws/Equipment

Changing the Blade

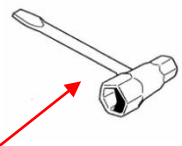
- After use, during our regular inspection or at a scene to meet a specific saw function we may needs to change the saws blade:
  - Carbide blades missing more than 8 teeth, cracked, damaged, gunked with tar...
  - Abrasive disc blades are placed out of service whenever they are cracked or badly nicked, center of hole wears out of round, or blade is worn down to 8 inches or less – **These blades MUST BE CHANGED**

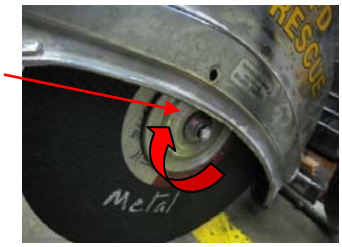
Changing the Cutting Blade



- The blade is between the flange hub (on opposite side) and the flange washer

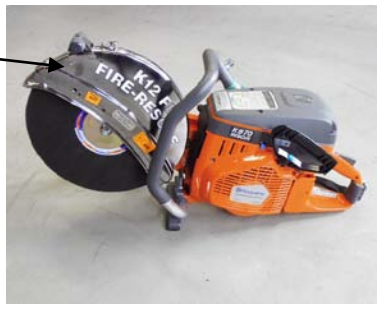
- Lock the shaft using a screwdriver or steel pin. Slide in hole as far as possible and turn the blade slowly. The pin drops in and locks the shaft.





- While holding the shaft locking pin, turn washer bolt counter-clockwise to loosen, utilizing the Saws wrench. (the Saw Wrench is kept next to Spare blades and gas)

- Remove the flange washer and bolt. Replace the blade.
  Note the blades rotation (arrow marking on blade) assure it matches rotation of saw marked on the blade cover.



- Assembly of blade takes place in the reverse order.

All Probationary members will start saw, cut wood (pallets) , change blade, cut metal, change blade back to original, and refuel as part of this evolution.