

Tempe Fire Department Policies and Procedures

Ladder Company Operations

202.02

Rev 03-03-06

PURPOSE

To familiarize personnel with the many important functions performed by ladder companies and some techniques that can be used to accomplish them.

PROCEDURE

LADDER COMPANY FUNCTIONS

The thought process for a ladder Captain requires a different path than that of an engine Captain. At fire incidents they need to work as a team in order for the operation to be successful. The ladder has to support the engine in getting water to the fire. These tasks may include: forcible entry, rescue, ventilation, access & egress with possible ground ladders, aerial standpipe, elevated streams or ladder pipe, pulling ceilings, walls, or floors, securing utilities, loss control operations, overhaul, or any combination of these tasks. All of our Ladder trucks carry extrication equipment, air bags, metal cutting, and other specialized equipment.

Where an engine Captain will be thinking in terms of the occupancy for life hazard, fire spread, fire flow needed to extinguish, water supply, and spotting for hose lays and line placement; the ladder Captain will be thinking of not only life hazard, fire location and spread, but access & egress, window type and positions, forcible entry, building height, building construction, roof type and load, ground ladder placement, best spot for aerial for: rescue, egress, defensive operations, collapse, positive pressure ventilation possibilities, vertical ventilation profile, and the type and location of utilities. Some helpful guidelines and specifics on these functions will be covered later in this policy.

The aerial ladder and its operation is just one of the many tools used in the functions of a ladder company. Ladder personnel need to be familiar with all of the tools, their use, limitations, and maintenance. For instance; the pick head axe is one of the most basic and useful tools on a ladder company. It should be kept sharp, clean, oiled, and free of paint on the head to be used as an efficient cutting tool. The handle can be marked with a painted stripe 16" and 24" from the head so after a rafter is sounded, the other end of the proposed vent hole can be marked by using the handle for measurement without sounding again. Although not the only sounding tool, the handle acts as a "spring" and is very effective for accurate sounding (wood is best).

SETTING UP THE AERIAL LADDER

The most stable position is in line with the chassis of the truck. The LTI has the most reach over the cab in this configuration, the E-1 to the rear, and the Bronto to the rear.

The least stable position is to the side of the truck. Always follow the manufacturer's recommendations. Use charts and graphs on the truck and owner's manual. Memorize the limits, angles, and loads for your truck.

Keep the truck as level as possible. Limits drop rapidly as the turn table is moved from level. The Bronto has an automatic leveling system in the outriggers.

Each aerial ladder has rated loads:

- Distributed load or the weight for each section of the aerial ladder will vary with the angle of the ladder.
- Tip load or the load that takes in account personnel and equipment at the end of the fly section.

- Total load limit varies with the extension and angle of the ladder.
- The Bronto has a platform load rating. The aerial attached to the boom is more for escape than for normal egress.

Know your aerial ladder's limitations. You can be under the total load and still exceed the distributed or tip loads and cause damage or failure of the ladder. There are load graphs and charts near the turntable and specifics in the operator's manual.

- Stop the truck on as level an area as possible. Take into account: building stability, height, construction, collapse possibilities, fire involvement, overhead wires, obstacles, and your mission; for fire calls think possible defensive position and rescue.
- Set brakes (also trailer brake on LTI)
- Engage PTO (LTI- turn on ladder power switch)
- Chock wheels
- Set outriggers and plates, down hill first, and level turntable. Allow the Bronto system to stabilize.

From the turntable: (E-1 optional pump panel)

- Pick the target for the ladder, plan the path, and consider obstacles.
- Switch on the fast idle for faster operation if it is not automatic.
- Elevate the ladder to just above the target angle.
- Rotate ladder to target.
- Extend ladder to desired length. (5' past a parapet, 1' past a window sill)
- Lower ladder to target.
- The Bronto has several different configurations, and 3 extra controls; jib up and down, and platform right and left. It can be operated from the platform or turn table and go over a parapet.

Notes:

Our overhead truss aerial ladders are designed to operate in a cantilever position (unsupported). When lowering into a parapet, window sill, etc., keep 6-8" distance so the ladder will not touch the building when loaded. As the ladder is loaded it may accidentally touch the building, keep the beams as perpendicular to the target as possible to prevent twisting of the ladder.

The Bronto is a boom with a ladder bolted to it. The platform is to remain suspended and not rest on anything.

Dual controls can be used with experience and skill, however, this should not be the normal procedure but used in special circumstances such as an under wire raise. The smoothness of the motion of the Bronto can allow multi-control use, however, be aware of all areas of the aerial and obstacles.

When approaching the target switch the fast idle off for a smooth, controlled approach. A spotter or lookout man should be employed to watch the clearance of the waterway, nozzle, cables, etc. from a different perspective than the turntable operator. Use proper hand signals.

Stowing the Aerial Ladder:

- Raise the ladder clear from the building. (Fast idle off)
- Retract the ladder. (Fast idle on)
- Rotate the ladder over bed position.
- Lower the ladder to the bed. (Fast idle off on approach)
- After bedding, apply pressure to the top of the cylinders with the "down" control to lock the ladder down so it doesn't bounce while driving, 1000 psi is adequate.
- The Bronto jib is completely closed after the boom is retracted and stowed in that position.

Note:

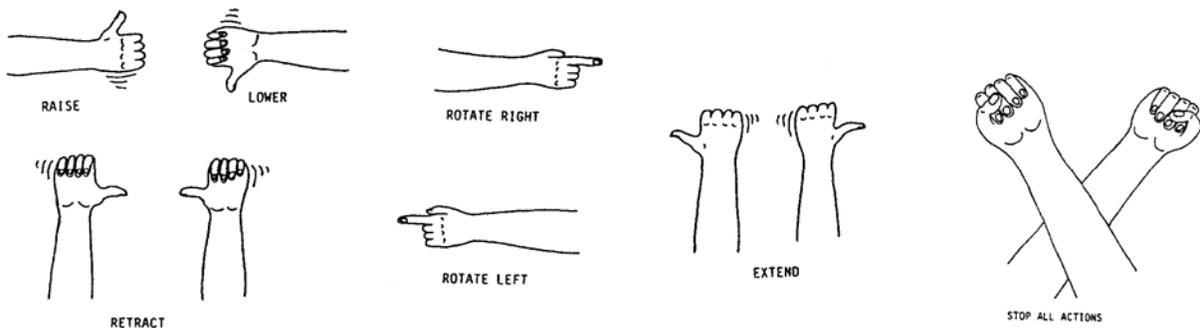
The fast idle switch will make the aerial ladder move faster and controls more sensitive. Depending on the operator's skill, it is advisable to have the fast idle off when raising the aerial away from the building and in bedding it. When the fast idle is off, the ladder moves slower and the controls are less sensitive making fine adjustments easier.

Critical points to Avoid:

- Low angles when loaded, especially rotation. Stay within the safety margins posted at each turntable.
- Lateral force.
- Twisting force (loading one side).
- Compression of overhead truss (supported).

Safety Factors:

- Avoid moving the ladder with personnel on it in normal operations. The Bronto is made to move with personnel in the platform, but not on the ladder portion.
- Secure personnel to the ladder with a ladder belt.



Aerial Ladder Hand Signals

- Secure hose (usually handlines) to the ladder with straps down the center.
- Except for stokes basket operation, never use the aerial ladder as a crane.
- Load the ladder according to the charts.
- Do not use the tip as a ram of any kind.
- Keep at least 10' distance from any wires.
- Wind lowers limits. 30 mph is the maximum wind speed for operation.
- Always keep an operator near the turntable controls. On the Bronto, the turntable operator can over-ride the platform operator.

Reach:

Practice with positioning will quickly teach you your aerial ladder's reach. The height of the aerial is measured from the top rung to the ground at full extension with a 75 degree angle. The Bronto at 75 degrees with the jib fully open.

It is possible to compute the reach of the aerial ladder for different buildings. You need to know the height of the building and how far away the turntable is positioned from the building. The Pythagorean Theorem states that for a right triangle the sum of the square of the sides is equal to the square of the hypotenuse, or: A squared + B squared = C squared. By substituting B as the building height and A as the distance from the building to the turntable, then C will have to be the length of the aerial ladder to make the reach.

Example: If the building target is 70 feet high and the turntable is 40 feet away from the building, then:

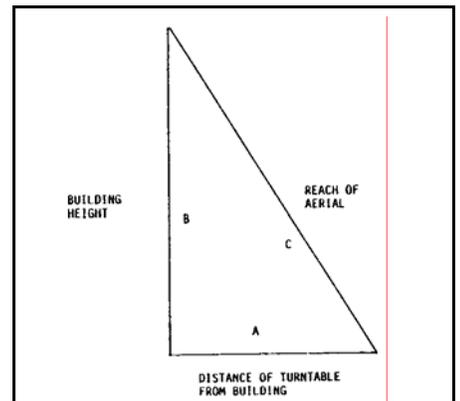
$$A \text{ squared} + B \text{ squared} = C \text{ squared}$$

$$40 \text{ squared} + 70 \text{ squared} = C \text{ squared}$$

or

$$1600 + 4900 = 6500 \quad (\text{so, find the square root of } 6500 \text{ which is approx. } 81 \text{ feet})$$

So the LTI's aerial ladder (90') would reach. The E-One's aerial ladder (75') would not. The Bronto's 114' would reach easily.



Computing Reach

Ladder Pipe:

Each of our ladder truck's pre-plumbed waterways has a mounted automatic fog nozzle that can be operated at the tip or remotely. The fog tip can be switched with straight stream tips.

For normal operations the nozzle is pinned to the end of the outer-mid section of the LTI and the middle section of the E-One. For ladder pipe operations the pin must be moved so that the nozzle is attached to the end of the fly section.

Set up in the best defensive position for the area that Command has assigned. Allow for 5 minutes of fire spread and be sure an engine is assigned and coming to pump your ladder pipe (the E-One can pump itself). Do not drive the exposure to the fire. Our aerials are the most expensive fire apparatus we have. Consider the area a building collapse will cover.

Extend to the height needed for the ladder pipe. Stay within the manufacture's recommendations. A good rule of thumb is 80 percent of the ladder length for maximum extension. Once water is flowing do not extend or retract the ladder. This may damage the waterway and could lead to failure of the waterway.

The angle of the aerial ladder should not exceed 75 degrees. The angle can be less within manufacture's limits.

Nozzle pressures should be 100 psi for the fog nozzle and 80 psi for the straight stream nozzles.

Remember:

- The weight of the water is a distributed load and part of the total load.
- The firefighter at the nozzle is part of the tip load and part of the total load.
- Rotation is done **s l o w l y** to avoid lateral force.
- Nozzle sweep is also done **s l o w l y** to avoid twisting force.
- Force of the nozzle reaction is approx. 1/2 of the GPM. The exact formula is $1.57 \times D^2 \times NP$.
- Weight from water discharged can cause failure of upper floors if not drained. Keep track of the total amount of water (check the digital gauge that gives GPM and total gallons) or keep track of the time. Advise command if large amounts of water accumulate on upper floors or flat roofs.
- Handlines can also be used off of the aerial while flowing a ladder pipe. Be aware of the added weight and secure hoses to the aerial ladder.

Stream Reach:

1 1/4" SS	84'	400 GPM
1 1/2" SS	88'	600 GPM
2" SS	94'	1000 GPM
Fog on SS	90'	1000 GPM

Optimum penetration is getting 90 percent of the GPM inside a 15" circle at the seat of the fire. This may not always be possible. Attempting to extend the reach will cause the stream to break up rapidly.

Due to the large water flow demands, each ladder pipe should have its own pumper attached with 4" lines, preferably 2 if possible; the Bronto has 1 inlet. It is best to park close and have another pumper steamed to the hydrant for supply (E-One has a pump). The inlet pressure at the ladder intake should not exceed 200 psi.

Aerial Waterway as a Standpipe:

The pre-plumbed waterway is a ready made standpipe that can be utilized by removing the fog nozzle at the tip. This procedure can be used to:

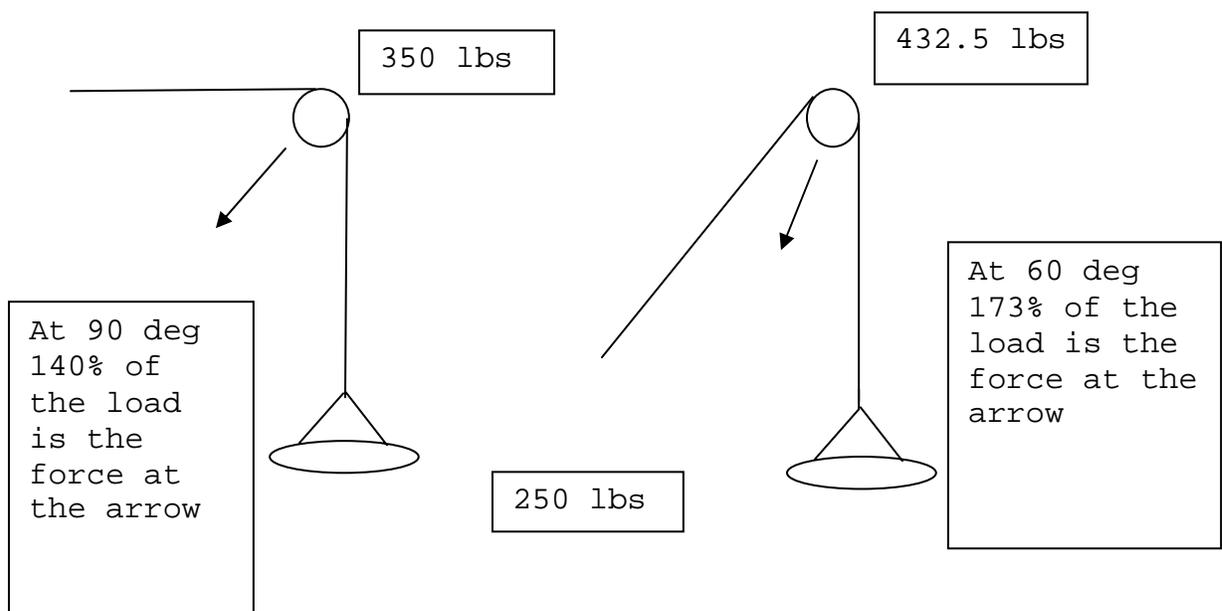
- Take handlines aloft through windows or the roof.
- Stretch a horizontal standpipe on an upper floor with a wye and bundles.
- Supply monitors on adjacent roofs for use on the fire building.

STOKES BASKET OPERATION

This is a fast operation to get a person from an elevated position to the ground by using the aerial ladder to move them in a stokes basket suspended beneath the aerial.

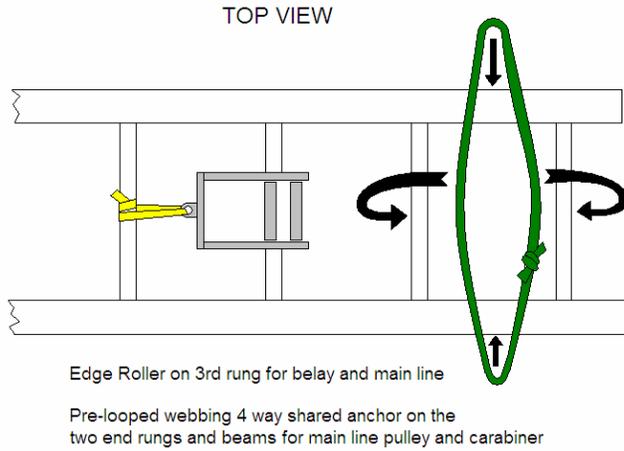
The procedure for using the aerial as a rescue tool with the stokes basket is pictured in the High Angle Rescue policy (208.04); however, the drawings here show the rigging configuration to use.

Points to remember in this operation is the load of the stokes basket and patient become tip load. Use the extension and angle according to the manufacturer's limits. The forces on each side of the rope from the aerial tip are exerted on the aerial. To stay within a safe range, figure twice the weight of the load for the tip load.

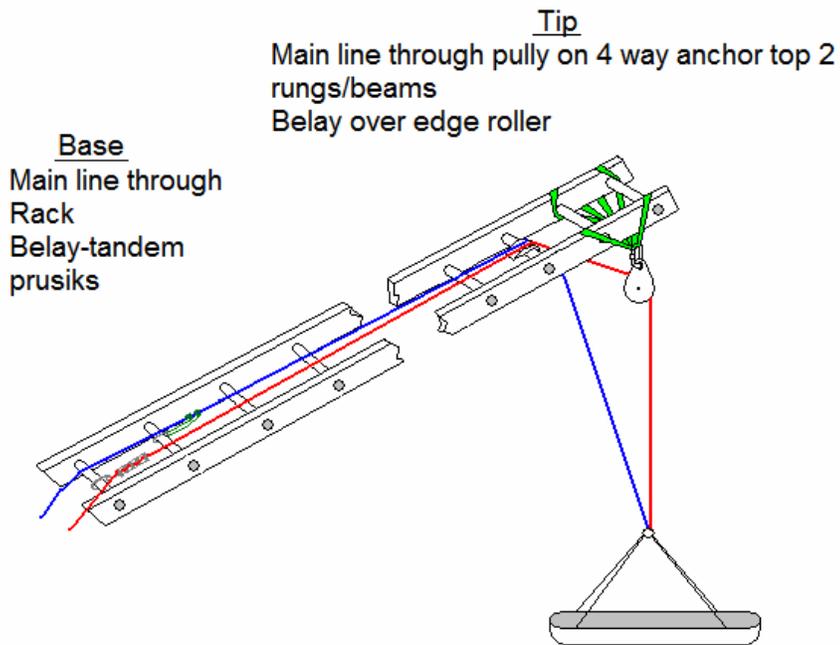


A guy (tag) line is attached to the stokes basket and controlled by a firefighter on the ground (or roof) to control the stokes basket suspended beneath the aerial ladder.

The method we will use to rig an aerial is a 4 way load sharing anchor on the 2 end fly rungs and beams and the rope roller on the 3rd rung.



The stokes can be maneuvered by raising and lowering the aerial and rotation. Extension can be used also to raise or retraction to lower the stokes. When the stokes is in position, the stokes can be lowered with the rack with someone tending the tandem prusiks without movement of the aerial.



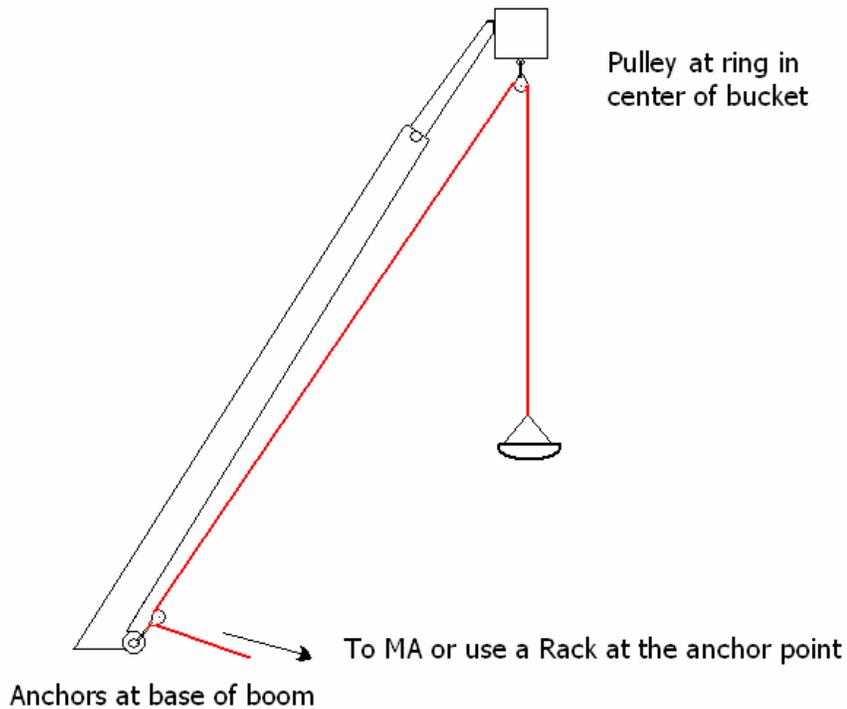
Note: The Bronto would put the stokes on the platform rather than suspend it beneath.

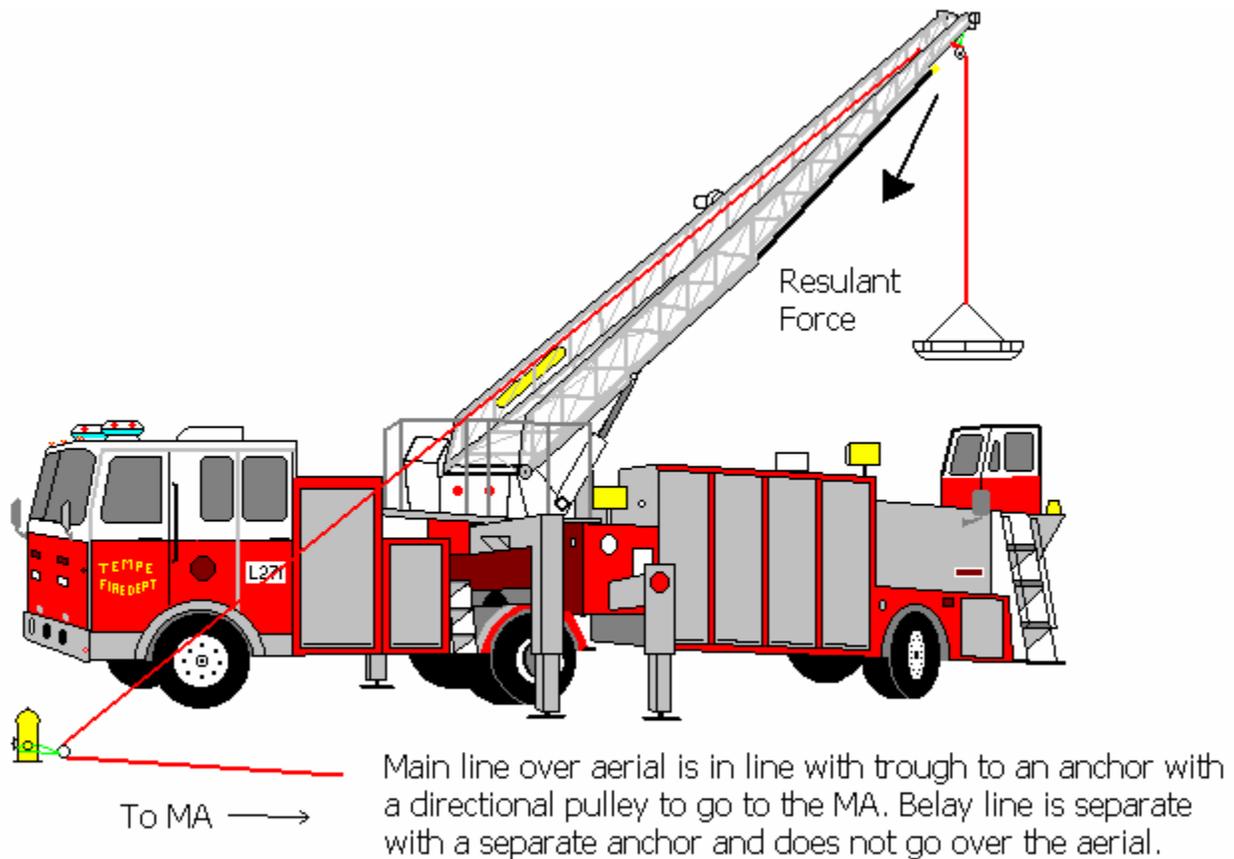
Using the Aerial as a high directional

If you use the aerial as an unmovable anchor point for a system you must always consider the total load that you place on the tip. The resultant force (bisecting the angle the rope makes through the pulley) should always be as much compression on the aerial as possible to avoid tremendous forces by leverage at the turntable. The Bronto has an attachment point beneath the platform and 2 anchor points at the base. Within its limits the Bronto has a 1000 lb. tip load. Remember to double your actual load in your calculations for this operation.

Bronto - Stokes

High Directional





RESCUE

On large occupancies, commercial structures, or when assigned as a RIC unit, a ladder company may be assigned by command to search and rescue. In this case the crew would search as a unit following the guidelines under the Search policy (207.03). The Thermal Imaging Camera is a valuable tool in searching.

However, the majority of fire calls a ladder responds to are single family residences with only a portion of the structure involved. On these types of incidents the tasks for the ladder company are usually consistent. They must work effectively with the 1st due engine company (attack team) for rescue and fire control to be effective. The engine and ladder crews need to know how each other operates and what to expect.

From the initial report or observation, the ladder officer should anticipate the tasks and be ready to react. Rescue is the primary concern, assisted by ventilation (in this case PPV), securing utilities, and other support functions for the attack team. When Command calls for a fan or PPV this could be a scenario: two firefighters should take the power fan to the entry point of the attack crew to pressurize the residence. After the fan is in place and operating, this team enters at the entry point of the house (usually the front) and begins a primary search together right or left depending on the floor plan and pre-determined by the Captain as orders are given at the truck. All the ladder crew members leave the truck with a tool, full protective gear, SCBA, radio, and flashlight.

The other two firefighters go to the rear of the building. One secures utilities and verbally tells Command. The other determines the hot door or window and opens it to facilitate effective PPV and radios a report to Command of the location of the opening and fire extent. Fan pressurization and opening should be at the same time. This team then enters the residence in an egress that is safe and not part of the fire area. They search as a team in the pre-determined direction.

It is the attack team's responsibility to search the fire area so the ladder teams will bypass the fire area as they

are conducting a rapid primary search while the attack team has a hoseline to contain and extinguish the fire.

Each team clearly identifies the areas searched by placing small furniture in the doorway or making an "X" on the door with a crayon (PP 207.03). When the 1st team finds the area already searched by the 2nd team and the 2nd team comes to the entry point (fan and hoseline) they proceed to the fire area and report to the attack team (usually Interior sector). When communication is made between both ladder teams and Interior a primary "all clear" can be reported to Command. A priority for the Ladder crew is to join up for a PAR as soon as possible. The crew is now ready for re-assignment and in position to assist Interior.

This is one method that results in no one working by themselves for long, and uses the buddy system. The initial tasks are performed simultaneously so the structure is opened prior to being pressurized.

Safety Considerations:

- Rescue is to save lives. A primary search is fast to give occupants the best chance of survival.
- Know where you are. Your life is part of the rescue process. When cut off by fire, knowing where you are is the quickest way to safety. Take a tool with you.
- If lost, stay calm. Call Mayday. Look for a window or a door. Stay low and against a wall. If you find an opening, you're out. If a door, make sure it is not a closet then close it behind you. If you can't find an opening, breach an interior wall. This is fast and easy with your tool and will take you to the next room where you can continue looking for an exit. Some buildings for security are using chain link covered with sheetrock, also a Lexan sheetrock. These cannot be breached easily. Know your buildings.
- Stay with your buddy. Report problems. Use Emergency Traffic if necessary, "**Mayday**" for lost firefighter.

VENTILATION

By definition: The systematic removal of smoke, gases, products of combustion, and heated air from a structure and replacement with cooler outside air.

Advantages:

- Assists rescue efforts by giving the victim a chance and increasing visibility for the searchers.
- Assists fire attack efforts by localizing the fire, cooling the approach, and increasing visibility for the attack crew.
- Promotes loss stop by retarding fire, smoke, and heat spread.
- Reduces the chances for flashover or backdraft.
- Promotes good public relations.

Types of Ventilation:

Horizontal - Using the natural forces of existing wind and convective currents.

A structure fire wants to vent. It just needs an opening. Given enough time, the fire will make that opening with a lot of destruction. Every window or door that is opened will produce some ventilation. If done in cooperation with natural forces, the ventilation will be more effective for our purpose.

Be aware of any wind. Open the leeward side of the structure first, as high as possible. Then open the windward side as low as possible. The natural wind will then assist the convection process caused by the fire to set up a

horizontal current through the structure.

Hydraulic - The nozzle operator can use a medium fog stream out of a removed window with the sides of the fog pattern near the edges of the window. This will "mechanically" ventilate the room by hydraulics.

Mechanical or Forced - When the natural forces already mentioned are assisted by a powered fan, the ventilation process is much more effective. This can be:

- positive by blowing in
- negative by blowing out
- or both

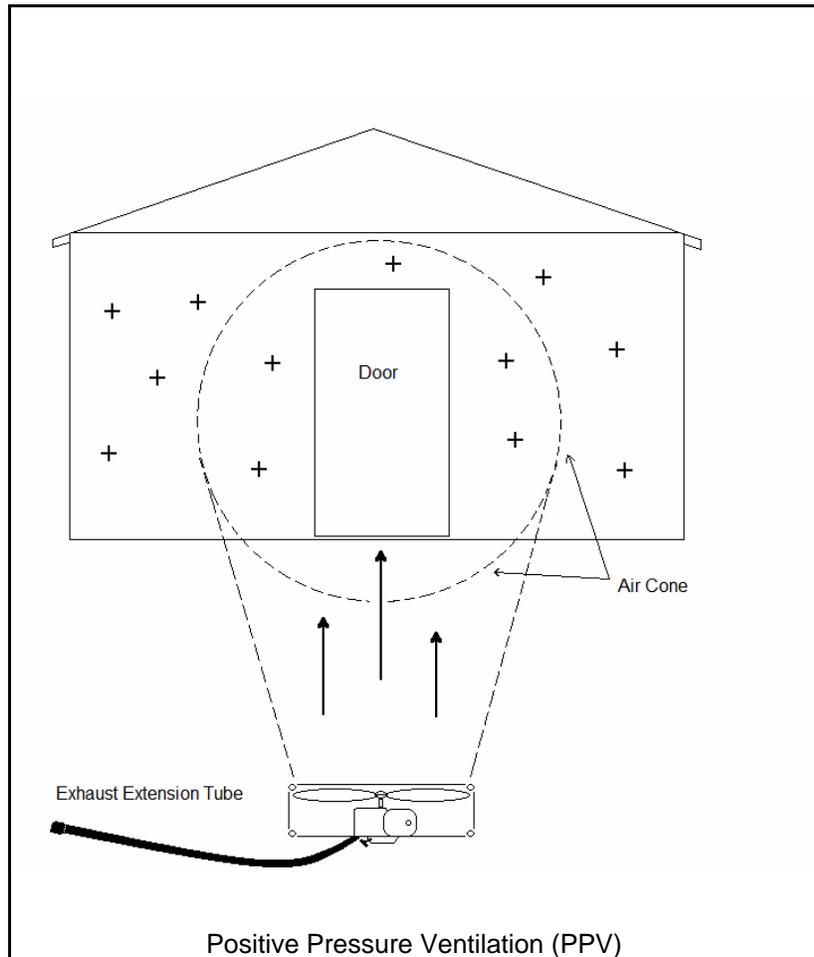
Output of powered fans:

20" Electric	6700 - 9500 cubic feet per minute (cfm)
5 hp gasoline	15,000 - 20,000 cfm
8 hp gasoline	20,000 - 25,000 cfm

Positive Pressure Ventilation (PPV) - This is the use of a high air flow powered fan to increase the total pressure of a structure's interior and then systematically opening areas of the structure to ventilate.

Procedure:

- Set the fan some distance from the opening to pressurize (usually the door of attack entry)
- With the fan at maximum power, adjust the distance and angle so that an "air cone" is formed around the doorway at least several inches on all sides. This will pump air into the structure increasing the internal air pressure.



- Open the fire area, usually a hot window or door. This will draw the smoke in the structure toward the fire and out of the structure. It will lead the attack crew to the fire in most cases if applied at the time of entry.
- Systematically open other areas of the structure to divert the air flow and ventilate them, closing those areas that are completed. This is referred to as compartmentalization.

Notes:

Opening everything at once will lose the effect of positive pressure and just be forced horizontal ventilation. Monitor your compartmentalization.

Using 2 fans in a "piggy back" arrangement by placing one fan in the doorway, inside the other's cone will increase air flow by 30 percent depending on fan type.

When using PPV to ventilate a light smoke or haze remember that the gasoline powered fans will pump CO into the structure from the exhaust. The exhaust extension tube placed out of the air flow is good to use here. A negative pressure might be better or an electric fan. Use the CO monitor that each ladder carries to make sure CO levels are safe before returning building to occupant or working with out SCBA. A reading of 35ppm or less is good.

Multi-floored structures can be ventilated by PPV. Use the stairways as an air channel and block all connecting doors open. Rubber door stops are nice to have in you pocket for this. Coordination with interior and command is a must.

Vertical Ventilation:

Sometimes it is necessary to open a roof to effectively ventilate a structure. In these cases the fire is so located or in an advanced stage that PPV would not be effective (ex: attic, several rooms). In cases where command calls for vertical ventilation, the ladder officer must evaluate a ventilation profile consisting of: can I cut? Where do I cut? This may mean laddering the roof and having a look. Roof construction, loading, and fire location, involvement, and time must all be considered. The crew needs to assist in this process and be ready to perform the task. Tools needed topside are: 2 pick head axes, chain saw/s, thermal imaging cameras, rubbish hook or a pike pole longer than the attic height. An extra 16' straight ladder is taken to the roof access.

Procedure:

- Be safe and fast. The roof is a dangerous place to be for very long with fire under you. Know your job. It is not the time to be deciding who does what. Minimum personnel needed are: a cut person, pull out person and the Captain to lead. The fourth crew member (usually the driver) should be the safety lookout for the roof crew. They can fetch equipment needed, but watch the crew from a safe vantage point to advise command if problems arise.
- Look at the eaves, they should tell you the type of construction and the spacing of the rafters.
- Ladder the building at a corner, hip, or valley away from the fire. These points are the strongest. You should have a pretty good idea of where the fire is from radio reports. Read the signs: smoke/fire from eaves, scuttles, vents, windows, and the like. Commercial and 2 story buildings use the aerial ladder or platform for safe egress. The Captain will lead the team and be first on the roof.
- Plan two ways off the roof. This might be the extra straight ladder which should go with you on large roofs, but should be easily available in any case. The straight ladder is not to work off of but to use for escape, rescue, or bridging weak areas.
- Climb the ladder and sound the roof before stepping on to it. Stay in single file as you advance to the desired ventilation spot, sounding as you proceed. If you have not determined the roof construction, cut an inspection hole (shown later). Smaller triangular holes are smoke indicator holes that will tell you what is happening below you. You should make these as needed. "Look" at the ridge for sagging. Use existing openings if you can: skylights, scuttles. Leave turbine vents alone, they are designed to vent. Follow safe areas: top plate, valleys, beams, and ridge (hottest). Look for signs: melted tar, sagging spots, spongy roof, flames around roof units, growing vent pipes, and things out of plumb. These will all tell you where the fire is and the best, safest place to cut. The closer to the fire the more effective the vent hole will be. Make the cut at least a couple of feet from the ridge on peaked roofs, 8' from the parapet on flat roofs. Always vent on a stable area or safe ground. Coordinate the cut with interior crews.

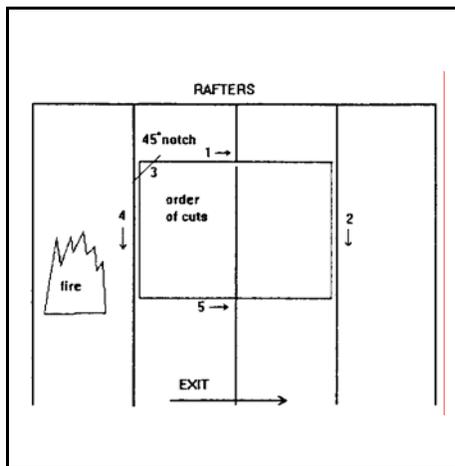
If things deteriorate, run. Have an escape route and plan in mind. Do not feel obligated to stay on a roof that shows eminent failure. Follow safe routes off, in single file as a team. Notify CMD ASAP if roof is unstable.

- The Captain marks the spot where he wants the hole cut. This can be done by sounding a rafter and marking on the inside. (This will keep support of the roof deck by the rafter near the hole.) Then measuring (with a marked axe) or sounding another rafter for the width of the cut, again marking on the inside. The length of the hole is not crucial to mark as the rafters will be perpendicular to the cut. For a tile roof, break the tiles by slapping them with the side of an axe and scrape them away. Advise command of falling tiles. You can also sound the area with a rubbish hook for stability and do a plunge cut with the chain saw and back up to a rafter.
- The cut person makes the cut by standing on as little roof area as possible and finishing toward the exit. A partner should steady the firefighter with a strap if necessary. Beware of the depth of cut and do not sever the rafters or supporting members, only the decking material. When you feel a rafter, "roll" the saw over it. Making a 45 degree notch in an upper corner toward the fire can assist in removing some roof decks.

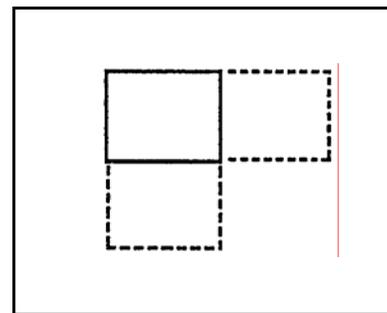
- The crew then removes the roof deck. Be aware that the heated gases may ignite at the opening. If the fire is below the attic, punch the ceiling in with the rubbish hook or the butt of the pike pole.
- Exit the roof by the same path you came, sounding as you go, all together in single file.

Type and Size of Hole:

For the majority of buildings, a hole of 3' X 4' will vent a room and a hall. This is fast and recommended for most cuts. The order of cuts will have the least amount of steps in the same area with the last cut toward the exit. For rafter construction it is a louver cut that allows the decking to pivot for removal. It is easily enlarged. You could make a 3' X 8' with 2 louver cuts initially if a larger vent hole is desired.



Recommended Hole

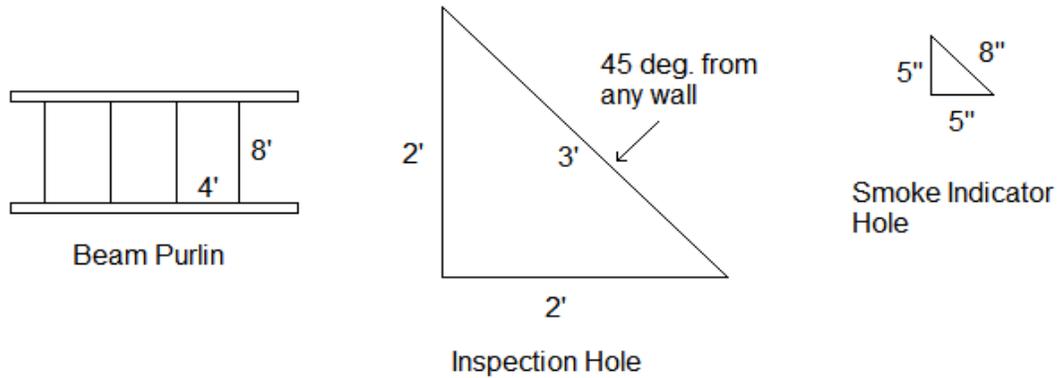


Enlarging First Hole

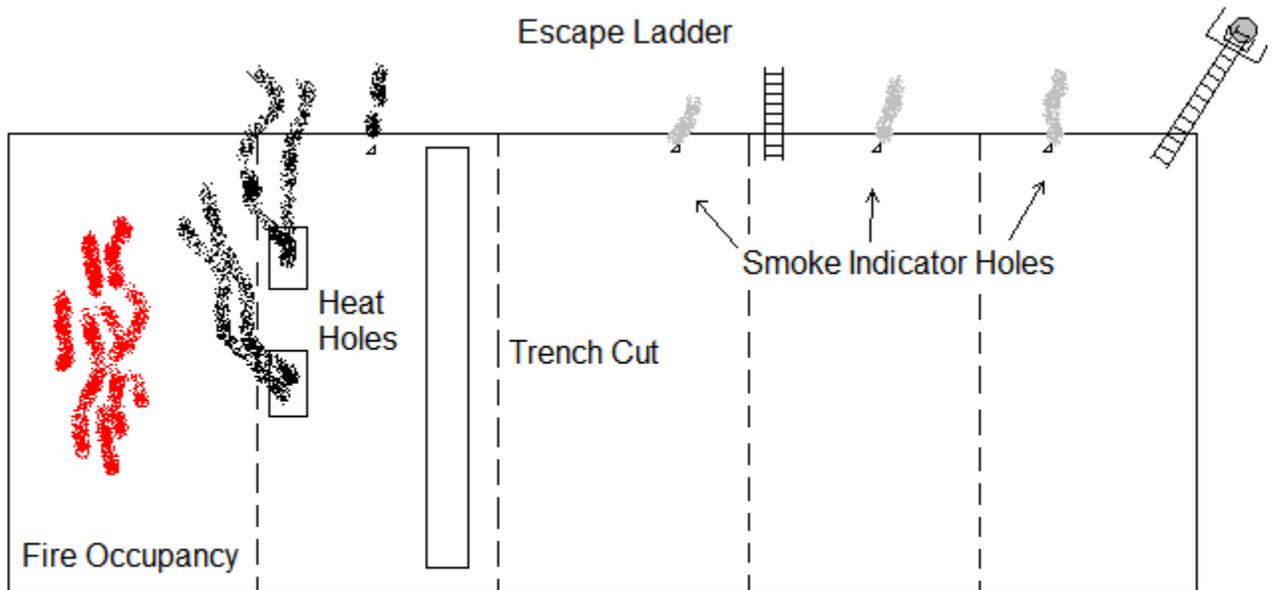
Large Buildings:

Some commercial buildings have large flat roofs. Some of these roofs are of lightweight construction and do not hold up well in fire conditions. Your ventilation profile must consider whether vertical ventilation is possible for a light weight roof. For a more stable roof such as a beam/purlin, walk along a beam to the desired spot and cut perpendicular to the beam across the deck to the adjacent beam for the length. Then along the adjacent beam for the width. Then back to the original beam. This 3 sided cut should be about plywood size and just fall in. Exit along the original beam.

Inspection holes can be cut to check on the fire spread or to check on the construction. Cut 45 degrees to any wall and then finish with 2 more cuts to make a triangle. If you use the large hole, replace the decking after you see roof deck and construction, unless you want it to be a vent hole. A kerf (single line) cut can be made just to check fire movement. Make a small inspection hole/s (or smoke indicator) to continually tell you what is happening below.



For a common attic in a row of occupancies a trench cut may be in order. This cut is more time consuming and should have at least 4 personnel and 2 saws. You have to get well ahead of the fire and cut between rafters clear across the roof. Heat holes for relief of pressure between you and the fire will give you more time. One saw makes a parallel cut to a rafter and the other makes "L" cuts following the first cut the width of one rafter. This is with construction. Cutting across the rafters is against construction. Either way "roll" the saw over the rafters and keep them intact. The sheeting is pulled out as you go. No ceiling is punched here for you are stopping a running attic fire. The building is written off up to the trench. Attack crews have to pull ceiling and fight the fire from beneath. Consider having a hoseline with you for protection. Hose streams should not be directed down vent holes.



Trench Cut On A Strip Mall Common Attic

Notes:

Even though it seems there is a lot to do, the recommended hole should be cut and the crew should get off the roof quickly.

If the roof is too steep to walk on, you shouldn't be on it. If vertical ventilation is called for a small hole could be cut with the chain saw while leaning off the aerial ladder. The cut man must be attached to the ladder with a ladder belt. The Bronto platform can parallel a roof for some distance over a parapet. Some holes may be cut from the step on the front of the platform without stepping to the roof. There is also an outlet here for using hydraulic saws. Roof operations from this truck can be safer working on or near the platform. It is a good idea to be tethered.

Ladder companies should carry two chain saws for roof operations.

Weather can effect ventilation. Wind will move the fire in the wind direction and intensify it. Humidity will reduce the convective effects. A temperature inversion will cause the smoke to spread out at the inversion rather than rise.

FORCIBLE ENTRY

Whether it is for rescue or firefighting we need to know how to gain access when there are locked doors, windows, or gates in the way.

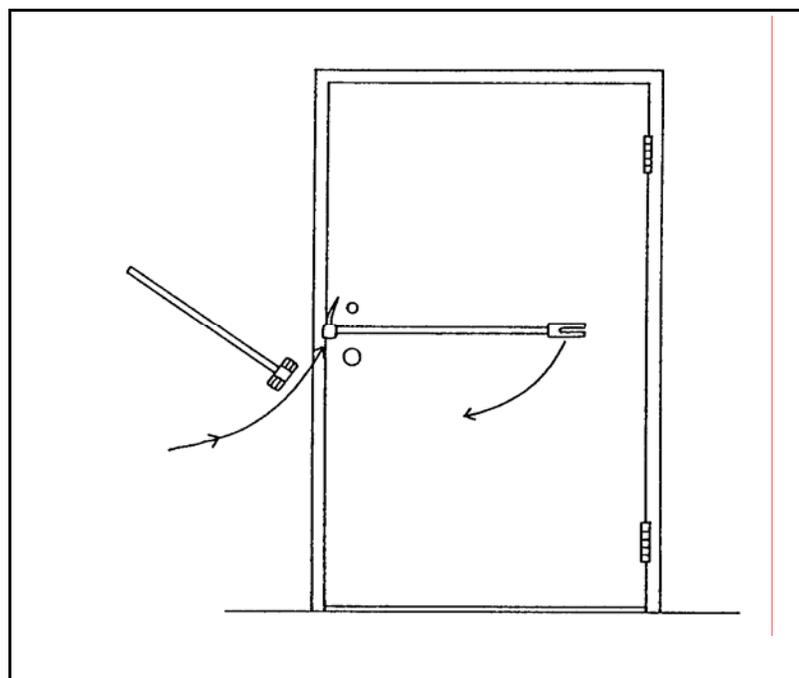
First check to see if the barrier is indeed locked, try before you pry. Then quickly ask if there is a key handy from a KNOX box or responsible party. This may save a lot of time and damage. KNOX boxes should be marked on the maps and preplans.

Basic tools: flathead axe, haligan, sledge hammer, pry bar, and bolt cutters.

Advanced tools: slice pac, circular saw, air bags, rabbet tool, and Hurst tool.

Doors:

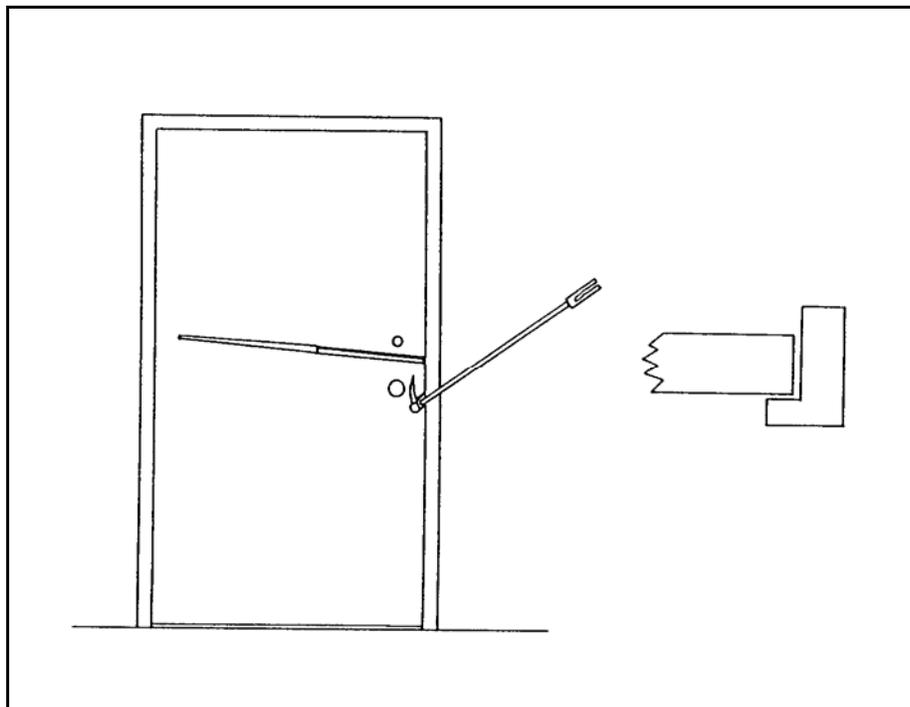
You can tell the way a door swings by the side the hinges are on. If you can see them it opens toward you. These are the easiest to force.



Forcing a Out Swinging Door

- Place the flat blade (adz) of the haligan above the bolt with the arm across the door.
- Strike the haligan with a sledge hammer, driving it between the door and the jamb.
- Pull the arm toward you. This will either pry the bolt from the strike or break it. If you have trouble with the latch, pull the pins from the hinges and pry from that side. If you can't pull the pins, cut the hinges off with the slice pac or circular saw.

If you cannot see the hinges, the door swings away from you. This type of door is more difficult to force as the latch is hidden by the stop, especially if the jamb is rabbeted.



**Forcing a In Swinging Door
or Rabbeted Jamb**

- Use the rabbet tool to force, driving the wedge portion between the jamb and door and using the hydraulic cylinder pump to force the door away from the jamb.
- If the stop is nailed on, pry it off and use prying tools to force in.
- If rabbeted and you don't have a rabbet tool: Drive the pry bar into the jamb above the bolt and try to pry the bolt from the strike.
- Drive the adz of the haligan below the bolt to hold the distance of the pry bar spread and reset the pry bar. The flathead axe can also be used as a wedge.

- Continue prying and wedging until you can get the pry bar past the jamb and pry the door.

If the door has metal reinforcing plates covering the areas you need to pry, you may have to cut the lock mechanism from the door with a metal cutting blade on the circular saw, or the slice pac.

On a metal door with only a cylinder key hole and guard showing, if prying is not working, try using the fork of the haligan and placing it under the circular guard ring and driving it off. The key plug should come out. Then you should be able to work the bolt mechanism with a screwdriver. You may have to start the process with the adz.

On double swinging doors try to pry the one that is not latched at the floor and jamb, using the adz of the haligan with the arm across the door.

Some metal roll up doors have a cross bar that locks on both sides from the inside. You can cut one side or the other to try and find the release, the operators switch if it is electric, or chain if mechanical. Probably the fastest is to cut a large upside down "V" in the center of the door with the saw or slice pac. This will fall in and give you entry. If you can pry the door up enough to slip an air bag under it the lifting force should break the latch.

Glass doors are expensive. Consider an adjacent window before breaking.

Windows:

Usually windows are easier to break and may be less damaging than forcing a door. One firefighter can enter and open the door from the inside. Make sure and clean the glass from the frame with an axe to prevent injury. Break the window high while standing at the side with your tool.

Tempered glass, Lexan, and the like, are very hard to break. You should try another entry. If this is the only choice, hit in a corner with the pick of an axe.

Casement windows, break a pane and reach in to unlock and work the crank. They are real time and labor intensive to break away from the frame.

Barred windows are usually set into block. The settings must be broken free from the block with a sledge hammer.

Fences, walls, and gates:

If the fence is not too high it can be bridged with an A frame ladder or 2 straight ladders lashed together, or facing each other beam by beam on either side of the fence.

If a gate is locked with a padlock and chain, use bolt cutters on the chain close to the lock. This allows the owner to re-secure.

If the gate is mechanical, the mechanism must be disconnected to operate the gate. Look for a pin or bolt before cutting.

A padlock is designed to take a lot of abuse and is hardened steel. If you can hit down on the body of the lock with a hammer it will usually snap open. The mechanism holding it closed is the weakest point.

Breaching walls can be done in several ways, but should be a last resort. On wood frames use normal cutting tools. Block that is not reinforced, use a sledge hammer to fracture and mark the perimeter of the breach, and then strike in the middle. Reinforced block must have the concrete broken from the rebar and the rebar cut with the slice pac or saw. A small breach can be done next to a tough door to reach in and unbolt it from the inside.

Aircraft:

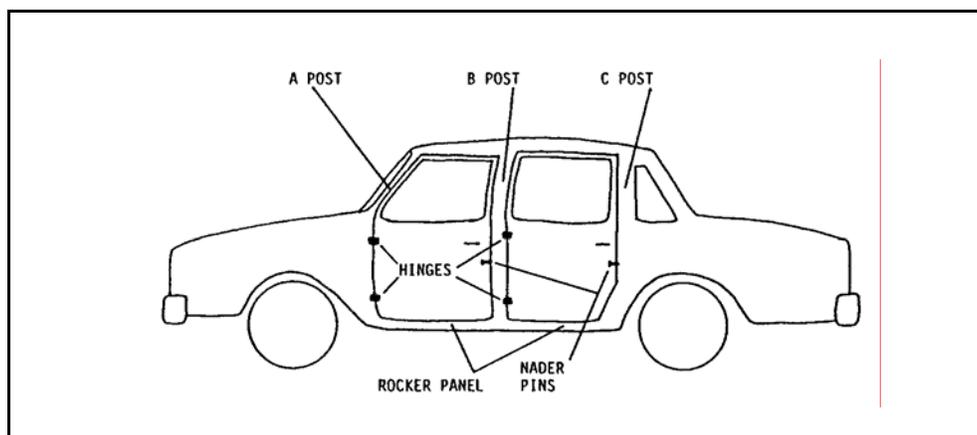
The doors and windows are usually reinforced and difficult to force, more so on commercial airlines. The easiest is to go through the skin which is light aluminum and bracing is minimal. The hydraulic and power lines are just

below the floor which is about 3' below the windows on airliners. Avoid serious injury by cutting above the floor. Drive a flathead axe and use the cutting tips on the HURST tool. Once entry is made a door can be opened from the inside.

EXTRICATION

The majority of extrication calls are dealing with automobiles. We will cover some basic terms and recommended techniques for dealing with the trapped patient.

- The extrication zone is a hazard zone. Pull a 1 3/4" line and have a firefighter in full gear and SCBA stand by with it charged. An extinguisher close by is a good precaution. All people working inside the zone are in full gear. SCBA not required if no fire or hazardous atmosphere.
- An attendant needs to address the patient while the extrication is in progress. While another crew is doing this, supply them with a small salvage cover and cover the patient to prevent further injury. The patient needs to be comforted and informed of what is going on by the attendant.
- Stabilize the vehicle: chock tires, use cribbing, flatten the tires (cut valve stem off), chains, air bags, or any combination.
- Remove the glass, so no one will be hurt by it. Small chops with a flat head axe will cut the windshield free,



Auto Anatomy

- or a screwdriver under and then around the rubber insert can be used on some. The handheld glass saw works nicely. A punch, drill bit, or other pointed tool will break the rest of the glass with a firm tap.
- Make an assembly point for all your tools. Usually a small salvage cover to keep the HURST connections clean.
 - Attach the jaws, ram, and shears to the manifold. Attach the manifold to the HURST power plant a hose distance (25') away for noise and possible ignition source. Even though you think you might only need 1 tool, having the rest is a good idea in case you're wrong. Pre-connected tools are fast, you have to park close enough to use them. The small power plants and multi-tools are good for simple jobs (popping a door), as they are portable and fast.

Note:

Many cars today have driver or passenger air bags that inflate on impact. Several models have side impact and/or knee bags, too. These bags inflate with an explosion of sodium azide. The force is enough to cause serious injury to a firefighter working on extrication from bags not deployed. Disconnecting the battery will not disable the air bags because of a capacitor in the computer system of the car that will store power for 15 min to 1 hr. For GM and Toyota there are florescent yellow wires under the steering column and the dash board that operate the air bags. These wires have a pull apart connection near the computer box. Do not cut them. That may cause the bag to deploy. Pull the connections apart. This will automatically engage a shorting bar that will disarm the air bags. Most other makes will have something similar.

Techniques:

- Removing the door:

Make an opening at the latch side with the adz of a haligan by inserting and twisting. An opening can be made on the hinge and latch side by spreading the jaws vertically against the top and the bottom of the door window frame.

Use the jaws to pry the locking mechanism away from the Nader pin.

Use the jaws to break the hinges by standing them vertical and spreading at each hinge.

- Moving the seat back:

Try it by hand. If not: Place the jaws between the A post and the seat frame and spread. This should break the latches and bolts holding the seat.

- Rolling the dash board:

Cut a relief notch in the fender above the wheel well with the shears.

Cut a folding notch in the A post above the rocker panel for solid frame vehicles. For uni-frame vehicles cut a folding notch in the rocker panel just to the rear of the A post on both sides

Place the ram base at the bottom of the B post and the piston end at the top of the A post. Use appropriate tips. If too short, you can use the point tip for the base and drive it through the rocker panel or use the ram jig which also reinforces the rocker panel.

Extend the ram and the dash will roll into the fender, folding at the notch. If the ram is too long you can set the base on the street and extend the ram until the distance is enough between the A and B posts. Now block the vehicle (which will raise) under the notch at the rocker panel and retract the ram. This should hold the distance while the ram is reset.

- Pulling the steering wheel:

Set 2 4 X 4's perpendicular to the dash board on either side of the steering wheel extending out on the hood making a track.

Place another one on top of the two above the edge of the dash (a log is better here).

Attach the HURST chains to the steering wheel and to the front frame.

Attach the chain hooks to the jaws and spread to maximum.

Lay the jaws on the hood and attach the 2 chains. The one on the steering wheel goes over the block on top of the track.

Close the jaws far enough to bend the steering wheel away from the patient. The block on the track will slide (or roll) pulling the steering wheel shaft up.

Note:

Tilt steering wheels and several modern cars have U joints, some at the floor. Pulling this type of wheel can cause a failure of the U joint which will whip the end of the shaft into the patient. Use the "roll the dash" technique on this type.

- Flap the roof:

Remove front doors.

Cut A and B posts close to the door frame with the shears.

Notch the roof where you want it to fold on both sides.

Have a firefighter lift from each side of the front while another taps the resulting peak on the rear of the roof down so it will fold back. Another method for the rear is to lay a pike pole across the rear with 2 personnel holding it down at the notches. The roof will bend easily around it without a peak.

There are many tasks that a Ladder Company is required to perform. There are indeed books written about some of the basics that are covered here. This policy is designed to aid new personnel in becoming familiar with the basic duties and giving them a guide in which to refer.