Evaluating and Implementing PPV

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Positive Pressure Ventilation (PPV) is a firefighting tactic that involves the use of high-powered ventilation fans to remove smoke, heat and gases from burning structures, thereby enhancing safety for first responders. There are many considerations when deciding whether PPV is right for your fire brigade and how it will be integrated into existing tactical operations.

Positive Pressure Ventilation works on the principle that air will always flow from an area of high pressure towards an area of low pressure. To apply PPV, a gasoline or electric powered fan is positioned in front of the firefighters' access point in order to force fresh air into the structure (the high pressure point). At the same time, an exhaust opening is created where the smoke and heat are to be exhausted (the low pressure point). The air pressure created by the fan forces the air in the structure towards the exhaust opening, taking smoke and heat with it. The resulting improved visibility and reduced interior temperature make it easier and safer for firefighters to enter the structure. PPV is most often applied after the fire has been extinguished, but it can also be applied prior to extinguishment with a technique called Positive Pressure Attack (PPA).

PPV and Firefighter Safety

Positive pressure ventilation is first and foremost a tool to enhance safety for firefighters and other first responders. It gives firefighting personnel a greater level of control over a hazardous or dangerous interior environment. During fire suppression activities, PPV can dramatically improve visibility inside the structure, making it easier for firefighters to conduct search and rescue operations and locate the seat of the fire. PPV can also dramatically reduce interior temperatures, making it easier for firefighters to move within the structure and reduce the chance of flashover. Opponents of positive pressure ventilation will claim that PPV can intensify a fire by introducing fresh air, thereby making the situation more hazardous. In fact, PPV is not adding any more 21% oxygen than already exists in the interior environment and it rapidly reduces the interior temperature while removing the unburned particles of combustion. Smoke will become fuel when the temperature is high enough and PPV limits the fire's ability to reach the temperature at which smoke will ignite.

One of the most significant benefits that PPV offers firefighters is added protection from the

carcinogens in smoke. Many of the contents in a modern structure fire are made of synthetic and petroleum-based materials. The gases that are emitted when these materials burn pose serious health risks to firefighters over the course of their careers. By applying positive pressure ventilation after the fire has been extinguished and during the overhaul phase, firefighters can achieve an added layer of protection from the gases that linger after the fire has been extinguished.

a live fire training exercise. Many firefighter training academies offer a section on positive pressure ventilation. It will involve a day of classroom training on PPV concepts and hands-on training in a burn tower or fire simulator.

Demand for PPV training has prompted a number of instructor groups to begin conducting on-site training for a fee. These instructors will travel to the fire brigade's training facility to conduct both classroom and hands-on training for all

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Availability of Positive Pressure Training

For positive pressure ventilation to be implemented safely and effectively, every person on the fire ground must understand how PPV will be implemented and the role that they will play in the operation. Without a coordinated ventilation operation, PPV cannot be applied safely and effectively. To accomplish this, all personnel should go through a positive pressure ventilation training course that includes hands-on experience with a PPV blower. It is important that this training course includes some type of live fire exercise. The best way for a student to clearly understand the positive impact that PPV can have is to experience it during

incident commanders and firefighters. Once they have concluded their classroom training, every student will have the opportunity to practice implementing positive pressure ventilation in a highly realistic environment. One training group in the United States will even provide the construction plans for a 150 square meter burn building that simulates a typical American single-family dwelling.

PPV Equipment

There are numerous manufacturers of PPV equipment and all offer products that have similar features, functions and performance. A typical positive pressure ventilation fan (also referred to as

a blower) consists of a 450mm diameter fan blade, a gasoline or electric motor, and a fan shroud to protect personnel from the spinning fan blade. All of these components are mounted to a metal cart that allows the PPV fan to be rolled by one firefighter to the appropriate ventilation point.

Most PPV fans are small enough to fit inside a standard vehicle compartment. Other tools for PPV include large vehicle-mounted fans that are used to ventilate very large structures. These large fans have 1250mm or 1500mm diameter fan blades and can generate up to 255,000 cubic meters of air an hour. When evaluating which positive pressure ventilation tool to purchase, it is important to consider the compartment size of your vehicle, the types of structures you will be ventilating, and whether you prefer gasoline or electric powered blowers.

Compartment Size

Compartment size can be one of the most important considerations when purchasing a PPV blower. Today's fire brigades are called on to perform services far beyond basic firefighting. The equipment that is required for fire suppression, EMS, rescue and Hazmat response makes compartment space on a fire apparatus valuable and scarce. This issue encourages fire departments to purchase the smallest PPV blower they can find. While a 400mm blower might meet a fire brigade's compartment space limitations, it can put limitations on the effectiveness of PPV due to the smaller air pattern and reduced CFM relative to a 450mm or 530mm blower. A good rule of thumb is to purchase the largest blower that will fit into your available compartment space. Most fire departments will try to make space on their apparatus for a 530mm blower and will settle for a 450mm size when necessary.

Type of Structure

It is important consider the types of structures you will be ventilating and choose the type of PPV blower that is best suited to your environment. If your community has many smaller single-family residences of 100 to 200 square meters, a 450mm or 530mm blower will be adequate. If your fire brigade protects commercial structures that range from 300 to 700 square meters, a larger PPV blower such as a 600mm or 680mm will be more desirable. If your fire brigade encounters incidents involving large commercial structures or high-rise buildings, it may be beneficial to have a large mobile fan of 1250mm or 1500mm diameter. In situations where a large structure must be ventilated with smaller PPV blowers, it is possible to use multiple blowers to achieve greater air volume and therefore adequate ventilation of smoke, heat and gases.

Gasoline or Electric Power

When deciding whether to purchase gasoline or electric powered blowers, the user should consider how they will implement PPV and their access to electric power. If a blower is being used for fire

attack (before fire extinguishment), a gasoline blower can be setup in much less time and will provide better airflow performance. If a blower is being use during fire overhaul (after fire extinguishment), an electric blower will introduce less carbon monoxide into the building and will generate less noise on the fire ground.

A note on the performance of electric PPV blowers. The first positive pressure ventilation blowers were gasoline powered due to the amount of air volume required for PPV to work effectively. In recent years, new developments in electric motor technology have greatly improved the power and performance of electric PPV blowers. Inverter drives allow motors up to 1.5kW to operate on a 20amp circuit and generate airflow performance that is 60% to 70% of a comparably sized gasoline powered blower. When purchasing an electric blower, it is important to consider the generator power required to operate the PPV blower in addition to all the other equipment on your vehicle.

PPV Airflow Ratings

The airflow performance of a positive pressure ventilation fan is an important consideration for users of PPV. Blower performance is measured in cubic meters per hour (m^3/hr.) or cubic feet per minute (CFM) and there are many methods for measuring the performance of a PPV fan. It is common to see the performance ratings for a 400mm PPV fan vary widely from one manufacturer to the next. For example, one manufacturer may claim that its 400mm blower with 4.1kW engine generates 43,100 m^3/hr. (25,350 CFM) and another claims that its blower with the same sized engine and blade generates 26,300 m^3/hr. (15,500 CFM). All 400mm fans with 4.2kW engines will move approximately the same amount of air. It is the way that the airflow performance is measured that will result in wide differences between the published numbers. It is important to compare airflow performance using the same test method. Many manufacturers are using a performance standard established by the Air Movement Control Association (www.amca.org) and this has proven to be a good relative measure of PPV fan performance. Some manufacturers claim that their products are AMCA tested and certified but they have no affiliation with AMCA. It is important to verify a manufacturer's association with AMCA before accepting its AMCA airflow numbers.

Positive Pressure Attack

Positive pressure ventilation began as a tool to assist with removing smoke and gases after the fire has been extinguished. As the understanding of the physics of positive pressure ventilation has evolved, it is being applied in new ways and for new purposes. The most dramatic development in PPV tactics has been its use for positive pressure attack (PPA), which refers to the use of PPV blowers during the initial phase of fire attack.

After size-up, firefighters will determine whether PPA is an appropriate tactic to use. A PPV blower is positioned at the point where firefighters will enter the structure and a firefighter is stationed at the point where the internal gases will be exhausted. When firefighters are ready to begin PPA, the exhaust opening is created by opening or breaking a window or opening a door. As soon as the exhaust opening is created, the PPV blower is started and the air pattern is aimed into the entrance opening. Once positive pressure ventilation has started, the firefighters wait up to 30 seconds for conditions inside the structure to being improving.

The most obvious indication of improving conditions is improved visibility inside the structure. Almost immediately after the PPV blower is started, visibility inside the structure will improve, allowing firefighters to see a clear path of access to the interior of the structure. Positive pressure attack allows firefighters to begin controlling the environment inside the structure before they enter it and allows them to begin reducing the interior temperature and improving visibility at the moment they begin their fire attack.

Final Words

Positive pressure ventilation (PPV) and positive pressure attack (PPA) are not for every firefighting situation and should never be attempted until all personnel on the fire ground have been trained on proper tactics and techniques. Access to PPV training materials and resources can be sourced via www.positivepressureattack.com and www.positivepressureventilation.com. IFF

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For further information, go to www.tempest-edge.com