VENTILATION OF FIRE PUMP ROOMS

INTRODUCTION

Internal combustion engines require large amounts of air for proper combustion, for removal of heat during operation, and for removal of fuel vapors. In addition, pump rooms require ventilation to control excessive moisture while maintaining suitable temperatures.

POSITION

Provide adequate fresh air intake and room exhaust ventilation to meet the needs of pump room air quality and for combustion air for internal combustion engine driven fire pumps. A variety of methods can provide the necessary ventilation. Use the method or combination of methods that best fits the situation. The following ventilation methods are arranged in descending order of reliability:

- Screened openings
- Vent stacks
- Spring-loaded (weight compensated) louvers
- Gravity louvers
- Powered louvers
- Powered fans

Obtain specifications for the necessary amount of effective ventilation area for combustion air from the engine manufacturer or estimate the amount of air required by using the values in Table 1. The values in Table 1 are based on 1¼ in.^{2}/hp (10.81 cm^2/kW) at a velocity of 5.8 fps (1.77 m/s). Design powered venting to achieve 3 cfm (0.085 m^3/min) per hp (0.75 kW) at 90°F (32.2°C) and at least 28.33 in. (11.15 cm) of Hg which is equivalent to an elevation of 1500 ft (457 m) above sea level.

DISCUSSION

If the necessary amount of incoming air is not provided, the engine will not operate at rated horsepower. This is similar to operating an engine at reduced atmospheric pressure at altitudes well above sea level, a condition that also derates the engine's performance.

The air temperature in the pump room should not exceed the range for personal comfort, as this usually ensures good pump performance as well. When inadequate exhaust is provided in a pump room while an engine is running, the radiated heat from the engine and exhaust pipe will increase the room temperature. If the combustion air is taken from within the pump room and the room temperature rises excessively, the engine will operate at reduced horsepower.

TABLE 1
Effective Ventilation For Combustion Engines

Maximum Hp	Area (in^2)	Diameter (in)	Cfm
40	50	8	120
80	100	11	240
120	150	14	360
160	200	16	480
200	250	18	600
240	300	20	720
280	350	21	840
320	400	23	960
360	450	24	1080
400	500	25	1200
440	550	26	1320
480	600	28	1440
520	650	29	1560
560	700	30	1680
600	750	31	1800
640	800	32	1920
680	850	33	2040
760	950	35	2280
800	1000	36	2400
840	1050	37	2520
880	1100	37	2640

SI Units: 1 hp = 0.746 kW
1 in. = 2.54 cm
1 $in.^2$ = 6.45 cm^2
1 cfm = 2.83 $\times$ 10^{-2} m^3/min

The amount of ventilation necessary to maintain an acceptable air temperature when an engine is running can usually be satisfied by the provisions for combustion air, particularly if:

- The room ventilation opening is located opposite the engine air intake. Air will sweep over the engine when it is running.
- The hot exhaust piping within the room is insulated. Keep exhaust piping away from the engine air intake.
- The muffler is located outside the pump room.

The danger of a toxic or explosive atmosphere created by the vapor from leaking fuel is primarily associated with existing fire pump engines that use gasoline, LP gas or natural gas. Gasoline and LP gas vapors are heavier than air. Remove these vapors at floor level. Natural gas vapors are lighter than air; remove them at the ceiling.

Since 1974, diesels have been the only internal combustion engine allowed by NFPA 20 on new installations. Due to its ignition temperature, diesel fuel does not present a serious fuel vapor hazard.

Locate fuel fired suction tank heaters in separate cutoff 1 hr rated rooms with a combustion air supply independent of that provided for the fire pump.

Gas fired air heaters in pump houses may accidentally discharge gas into the room, resulting in an explosion. With some engines, natural gas leaks could cause a “run-away” condition even when engine overspeed shutdown devices are provided. Steam or hot water heating coils are preferred.

Combustion air and ventilation for engine-driven fire pumps normally provide enough air replacement to prevent undue moisture. Electric-motor-driven fire pump rooms need either a dry location or heated windings. In some very humid areas, ventilation alone may not keep the pump room dry and additional dehumidification may be required.

Screened openings easily meet all ventilation requirements in warmer climates. Locate adequately sized screened inlet openings in the walls at floor level. Place screened exhaust openings high in the

wall at the other end of the room. Screen mesh openings should be small enough to prevent the entrance of foreign materials.

In climates subject to freezing, provide sufficient heat to maintain the pump room temperature above 40°F (5°C). Fire pump engines must be able to assume full load flows immediately. Engine block heaters are used to maintain engine oil temperature at 120°F (49°C) and remove water condensation from the engine. Additional auxiliary heater can be used in extra cold climates.

Vent stacks conserve heat by exhausting a moderate amount of air from floor level by natural ventilation and allowing air to be drawn back down the stack to satisfy the combustion air needs of fire pump engines. The stack should begin about 6 in. (15 cm) above the floor and should terminate 2 ft (0.6 m) or more above roof level. Equip the top of the stack with a rain shield or turboventilator.

Protect movable louvers against mechanical damage, snow, sleet, freezing rain, corrosion, and nesting insects or birds. Louvers should preferably open inward and should be recessed to ensure proper operation. Louver types include the following:

- Spring-operated louvers are arranged to open upon engine operation. They may use the fire pump engine batteries as a power source. This is acceptable because the drain on the batteries is minor. They are dependable and practically fail-safe.
- Some louvers are held closed mechanically by water or shop-air pressure. The air or water power is supplied to the louver-operator through a restricted orifice. In colder climates, air is more practical. A solenoid-operated bleeder valve, arranged to open when the engine operates, is powered by dc current from the engine batteries.
- Motor-driven solenoid-operated louvers, powered by dc current from the engine batteries only when the engine is running, are dependable but place an undesirable load on these important batteries.
- Electrically operated louvers using ac power are no more dependable than the power supply and should be arranged to open on power failure. However, a power failure when the engine is not running could lead to freezing conditions within the pump room.
- Gravity-operated louvers are easily jammed and require frequent inspection to ensure their proper operation.

Ventilating fans are no more reliable than the electric power supply. Arrange induced-draft fans to draw air across the engine for more efficient cooling. Provide sufficient openings for make-up air to keep a negative pressure from developing in the room. If combustion air for engines is taken from within the pump room, forced-draft fans must be of sufficient capacity to provide both cooling and combustion air.