AE258

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Hose Connection Vacuum Breakers for Home Backflow Prevention[1]

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INTRODUCTION

Homeowners commonly use garden hoses connected to the municipal water supply for a variety of purposes, including irrigation of lawns and flower beds, washing cars, filling swimming pools, bathing pets, applying liquid fertilizers and applying pesticides. Often hose-end sprayers are used, directly connecting reservoirs of chemicals to the garden hose. In each of these cases, the potential exists for backflow of polluted or contaminated water to the municipal water supply, possibly causing a health hazard. Hose connection vacuum breakers are simple, low-cost devices that should be used to help prevent backflow of water and possible pollutants or contaminants to the water supply.

BACKFLOW

Hose bibbs or faucets that are connected to a municipal water supply or other drinking water supply should be equipped with hose connection vacuum breakers to prevent water in the hose from moving back into the water supply. Backward movement of water is called backflow, and it can occur either by siphoning or back pressure.

Backflow can occur due to siphoning if the pressure in the water supply suddenly drops to a low level. This can happen if the municipal water pumping system fails, a municipal water line breaks or when fire trucks pump from fire hydrants. In each of these cases, the pressure in the water supply lines may drop below atmospheric pressure as the lines drain, creating a vacuum which can pull water (and any pollutants or contaminants) from a garden hose and into the water supply lines.

Backflow can occur due to back pressure if the pressure in a garden hose exceeds that in the supply pipeline. This can occur if pumps such as chemical injectors are connected to the garden hose. However, when injection pumps are used to inject chemicals into hoses or pipelines that are directly connected to municipal water supplies, hose connection vacuum breakers do not provide adequate protection of the water supply. Reduced pressure principle backflow prevention devices are the only acceptable backflow prevention devices when chemicals are injected into hoses or pipelines that are connected to municipal water supplies.

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Backflow due to back pressure can occur even when pumps are not used. For example, if a spray nozzle which can be shut off with a valve is used on the end of the garden hose, and that valve is closed but the faucet is left open, the pressure in the hose will equilibrate with the water supply pressure, and the hose will expand in response to the supply pressure. However, a sudden large water usage in the house or at another location can cause the supply pressure to drop. This will cause the hose to contract, forcing water from the hose back into the municipal supply. Pressure can also build up in a pressurized hose if air is trapped in the hose and then expands as it heats in the sun. This pressure buildup can force water from the hose backwards into the water supply pipelines. Hose connection vacuum breakers will prevent backflow from occurring from these sources by opening to relieve the pressure build-up as soon as the pressure in the hose becomes greater than the supply pressure.

BACKFLOW PREVENTION

The Plumbing Rules of the Florida Department of Health and Rehabilitative Services specify that to prevent backflow, hose connection vacuum breakers,(HVB's), must be installed on all water outlets threaded for hose attachments except those for automatic clothes washers. Many municipal utility companies also specify that HVB's be installed on all threaded water outlets connected to their water distribution system.

A hose connection vacuum breaker should be installed on each faucet or hose bibb that is connected to the potable water supply to prevent backflow to the water supply. A HVB is a small valve assembly (Figure 1) that protects an individual water outlet. HVB's are normally constructed of brass with hose threaded connectors. They are relatively inexpensive, costing approximately $5 - $10.

INSTALLING HOSE CONNECTION VACUUM BREAKERS

An HVB is simply installed by threading the assembly onto the male hose threads of the faucet or hose bibb (Figure 2). A garden hose is then connected by threading it onto the male hose threads of the

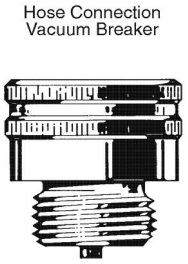

Figure 1.

HVB (Figure 3), thus it is no more difficult to connect or remove a garden hose with the HVB installed than without it.

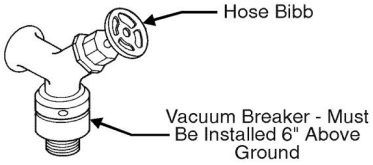

Figure 2.

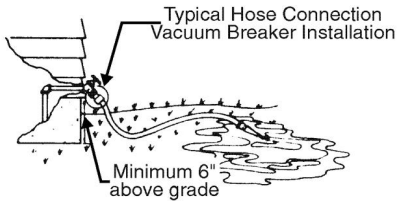

Figure 3.

HVB's must be installed at least 6 inches above the ground surface. This distance is required so that water that is vented to atmosphere will not pond around the HVB. An HVB will not work properly if it is submerged. In fact, if it is submerged, polluted water will be able to enter through the atmospheric vent.

Most HVB's have a mechanism which prevents them from being easily removed once they are installed. This prevents them from being removed when the garden hose is removed. Once the HVB is installed, no further adjustments are required.

MECHANISM OF OPERATION

A hose connector vacuum breaker prevents backflow to the water supply by venting water to atmosphere (onto the ground) when backflow conditions exist. The mechanism of operation is shown in Figure 4.

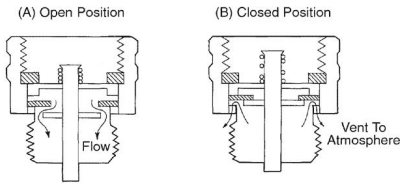

Figure 4.

A spring-loaded check valve is opened by the water supply pressure when outflow occurs through the valve (Figure 4A). When pressure is sufficient to open the check valve, flow is directed into the garden hose.

When the supply pressure is interrupted or when the pressure in the hose becomes greater than the supply pressure, outflow stops and the spring-loaded check valve closes, simultaneously opening a vent to atmosphere (Figure 4B). In this mode of operation, any water that flows backwards through the HVB is vented onto the ground.

The spring-loaded check valve does not allow drainage of water from between the hose bibb and the upper part of the HVB. Thus freeze protection must be provided, just as all outdoor plumbing would need to be protected under freezing conditions.

MAINTENANCE REQUIREMENTS

Hose connection vacuum breakers are relatively simple devices that are constructed of durable materials that require little maintenance. The metal parts are normally constructed of brass and stainless steel for durability, and neoprene rubber O-rings and washers are used. Under normal operating conditions, HVB's should work reliably for several years without the need for repair or replacement, especially with the relatively good quality water available from most municipal water supplies. However, water quality varies in its effect on HVB's and, as with all mechanical devices, failures occasionally occur.

Mechanical failures may occur due to component breakage or corrosion. Failures may also occur due to the build-up of chemical precipitates or other materials which prevent the device from operating properly.

HVB's should be inspected periodically to ensure that they are working properly. Fortunately, their mode of operation permits inspections to easily be made. Check for leaks during normal operation by visual inspection. Also, verify that the check valve closes and the atmospheric vent opens reliably whenever the water supply is shut off. It is very simple to do this if a nozzle that can be shut off is used on the end of the hose. With the nozzle shuts off, turn on the faucet and allow the hose to pressurize. Then, shut off the faucet while the hose is pressurized. After a few seconds, the hose pressure should be released in a small spray as the atmospheric vent suddenly opens.

These simple checks for proper operation of an HVB can readily be made each time the system is used: check for leaks while the system is operating and check for proper operation of the check valve and atmospheric vent whenever the system is shut off.

Leaks during normal operation may indicate the presence of chemical precipitates or particulate matter which prevent components from seating properly, or defective O-rings or washers. If leaks are detected, shut off the water supply, remove and inspect the entire HVB-faucet assembly. Replace it if components are defective. Clean it by flushing water through it while working the spring mechanism to dislodge loose particles. If cleaning does not restore it to proper operation, then replace it.

If the atmospheric vent does not operate when the faucet is shut off while the hose is pressurized, it may be because buildup of precipitates is causing this valve to stick. Disconnect the hose and exercise the valve and the spring by moving the plunger up and down and from side to side. If this does not free up the valve so that it operates properly, replace it.

Because an HVB is difficult to remove after installation on a hose bibb, it may be necessary to replace both components at the same time. However, because of the high reliability of HVB's, this should not occur frequently. Fortunately, hose bibbs are also not very expensive (less than $5).

SUMMARY AND CONCLUSIONS

Hose bibbs or faucets that are connected to a municipal water supply or other drinking water supply should be equipped with hose connection

vacuum breakers (HVB's) to prevent backflow of water from the hose to the water supply. HVB's are appropriate for many typical garden hose applications, however, when injection pumps are used to inject chemicals into hoses or pipelines that are directly connected to municipal water supplies, hose connection vacuum breakers do not provide adequate protection of the water supply. In that case, reduced pressure principle backflow preventers must be used.

HVB's are easy to install and maintain. They work by venting water to the atmosphere when backflow conditions occur. Because they are simple, spring-operated devices, little maintenance should be required. However, they must be kept free of debris and buildup of deposits. HVB's should be inspected periodically to ensure that they are working properly. These simple checks for proper operation can readily be made each time the systems is used: check for leaks while the system is operating and check for proper operation of the check valve and atmospheric vent whenever the system is shut off. With little maintenance, HVB's should provide several years of reliable service, preventing backflow of water and pollutants from garden hoses back to the water supply.

REFERENCES

Plumbing Rules of the Dept. of Health and Rehabilitative Services Health Programs. Chapter 10D-9, Plumbing. State of Florida, Tallahassee.

Backflow Prevention Handbook. Rain Bird Sprinkler Mfg. Corp. Glendora, CA.