System Name

Customer Awareness- Cross Connections and Backflow Prevention

In our industrial world, many things present a potential source of pollution to our drinking water. Pesticides and herbicides that are used in agricultural and residential activities, mining, manufacturing, automobiles, and the list goes on. Because of this potential contamination to our drinking water, all water systems are required to take samples to be analyzed by a certified laboratory to determine if the water is safe for consumption.

But after all this is done, another hazard to our water exists in the form of Cross-Connections. These are simply physical connections that create a route between our drinking water systems and contaminates that might enter into the system. A common occurrence of a cross connection is a garden hose. If this hose is placed into a water trough for example, it then creates the potential for the water in the trough to be siphoned back into the system, should the pressure in the system drop below atmospheric pressure due to maintenance or failure of the water system because of a break in the main line, etc. This is referred to as "back-siphonage". There are also other ways that undesirable or hazardous contaminates can enter into the system; Mechanical pumps that are connected to the system, and operate at a higher pressure than the system pressure, such as you find at car washes, can malfunction and pump back into the system. This is referred to as "back-pressure". Many devices exist today that can help protect these type of connections from polluting our drinking water. They form a physical barrier that, when properly installed and maintained, stop undesirable contaminates from entering into the water system. However, the most effective tool is an informed and conscientious customer who knows what to look for and how to eliminate these types of connections whenever possible.

The following pages provide some information and illustrations that will help you understand the different types of cross-connections, types of protection, and how we can prevent or protect against them.

If you have any questions concerning cross-connections within your system, please contact *insert system contact information here.*

Appendix A

Partial List of Plumbing Hazards

Fixtures with Direct Connections

Description

Air conditioning, air washer
Air conditioning, chilled water
Air conditioning, condenser water
Air line
Aspirator, laboratory
Aspirator, medical
Aspirator, weedicide and fertilizer sprayer
Autoclave and sterilizer
Auxiliary system, industrial
Auxiliary system, surface water
Auxiliary system, unapproved well supply
Boiler system
Chemical feeder, pot-type
Chlorinator
Coffee urn
Cooling system
Dishwasher
Fire standpipe or sprinkler system
Fountain, ornamental
Hydraulic equipment
Laboratory equipment
Lubrication, pump bearings
Photostat equipment
Plumber's friend, pneumatic
Pump, pneumatic ejector
Pump, prime line
Pump, water operated ejector
Sewer, sanitary
Sewer, storm
Swimming pool

Fixtures with Submerged Inlets

Description

Baptismal fount
Bathtub
Bedpan washer, flushing rim
Bidet
Brine tank
Cooling tower
Cuspidor
Drinking fountain
Floor drain, flushing rim
Garbage can washer
Ice maker
Laboratory sink, serrated nozzle
Laundry machine
Lavatory
Lawn sprinkler system
Photo laboratory sink
Sewer flushing manhole
Slop sink, flushing rim
Slop sink, threaded supply
Steam table
Urinal, siphon jet blowout
Vegetable peeler
Water closet, flush tank, ball cock
Water closet, flush valve, siphon jet

Appendix B

Illustrations of Backsiphonage

The following illustrates typical plumbing installations where backsiphonage is possible.

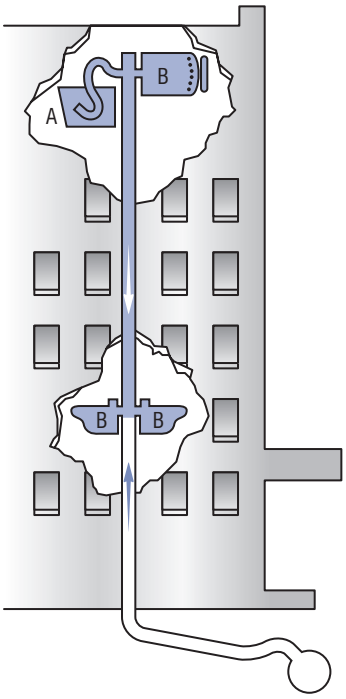
Backsiphonage

Case I (Fig. 44)

A. Contact Point: A rubber hose is submerged in a bedpan wash sink.

B. Causes of Reversed Flow: (I) A sterilizer connected to the water supply is allowed to cool without opening the air vent. As it cools, the pressure within the sealed sterilizer drops below atmospheric producing a vacuum which draws the polluted water into the sterilizer contaminating its contents. (2) The flushing of several flush valve toilets on a lower floor which are connected to an undersized water service line reduces the pressure at the water closets to atmospheric producing a reversal of the flow. C. Suggested Correction: The water connection at the bedpan wash sink and the sterilizer should be provided with properly installed backflow preventers.

FIGURE 44.
Backsiphonage (Case 1).



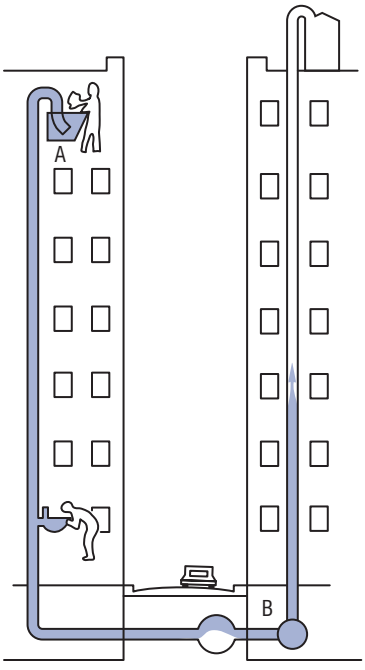
Backsiphonage

Case 2 (Fig. 45)

A. Contact Point: A rubber hose is submerged in a laboratory sink.

B. Cause of Reversed Flow: Two opposite multi-story buildings are connected to the same water main, which often lacks adequate pressure. The building on the right has installed a booster pump.

FIGURE 45.
Backsiphonage (Case 2).



When the pressure is inadequate in the main, the building booster pump starts pumping, producing a negative pressure in the main and causing a reversal of flow in the opposite building.

C. Suggested Correction: The laboratory sink water outlet should be provided with a vacuum breaker. The water service line to the booster pump should be equipped with a device to cut off the pump when pressure approaches a negative head or vacuum.

Backsiphonage

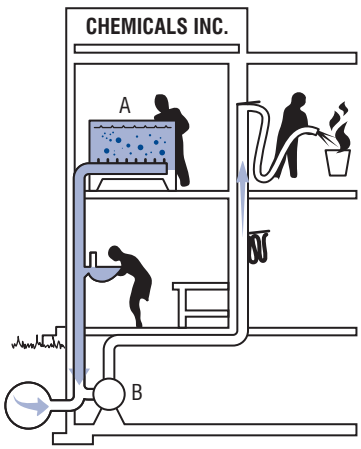
Case 3 (Fig. 46)

A. Contact Point: A chemical tank has a submerged inlet.

B. Cause of Reversed Flow: The plant fire pump draws suction directly from the city water supply line which is insufficient to serve normal plant requirements and a major fire at the same time. During a fire emergency, reversed flow may occur within the plant.

C. Suggested Correction: The water service to the chemical tank should be provided through an air gap.

FIGURE 46.
Backsiphonage (Case 3).



Backsiphonage

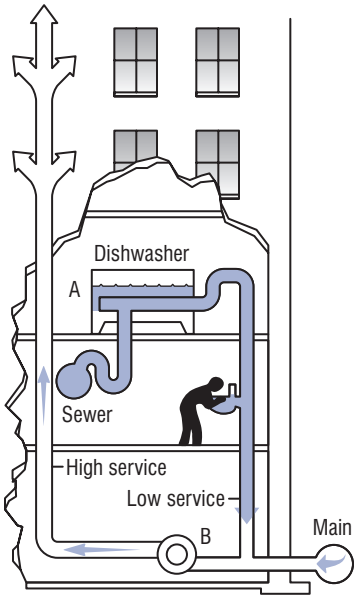
Case 4 (Fig. 47)

A. Contact Point: The water supply to the dishwasher is not protected by a vacuum breaker. Also, the dishwasher has a solid waste connection to the sewer.

B. Cause of Reversed Flow: The undersized main serving the building is subject to reduced pressures, and therefore only the first two floors of the building are supplied directly with city pressure. The upper floors are served from a booster pump drawing suction directly from the water service line. During periods of low city pressure, the booster pump suction creates negative pressures in the low system, thereby reversing the flow.

C. Suggested Correction: The dishwasher hot and cold water should be supplied through an air gap and the waste from the dishwasher should discharge through an indirect waste. The booster pump should be equipped with a low-pressure cutoff device.

FIGURE 47.
Backsiphonage (Case 4).

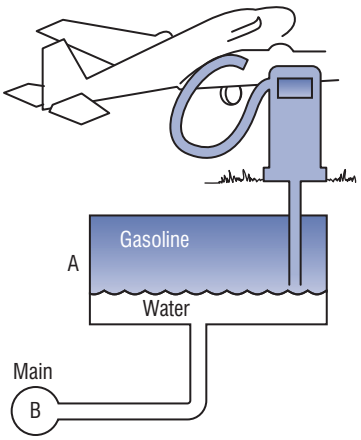


Backsiphonage

Case 5 (Fig. 48)

A. Contact Point: The gasoline storage tank is maintained full and under pressure by means of a direct connection to the city water distribution system.

FIGURE 48.
Backsiphonage (Case 5).



B. Cause of Reversed Flow: Gasoline may enter the distribution system by gravity or by siphonage in the event of a leak or break in the water main.

C. Suggested Correction: A reduced pressure principle backflow preventer should be installed in the line to the gasoline storage tank or a surge tank and pump should be provided in that line.

Backsiphonage

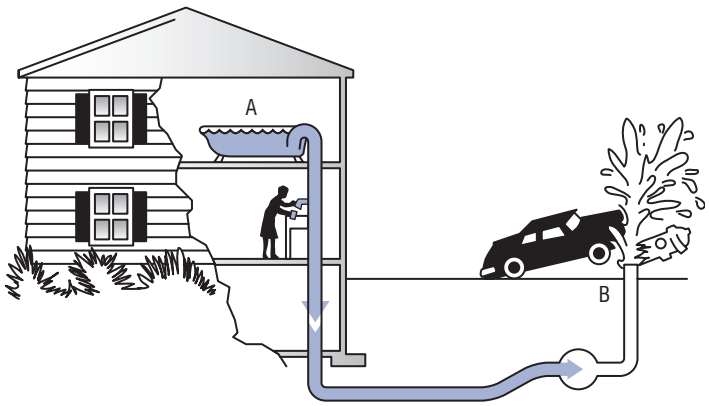
Case 6 (Fig. 49)

A. Contact Point: There is a submerged inlet in the second floor bathtub.

B. Cause of Reversed Flow: An automobile breaks a nearby fire hydrant causing a rush of water and a negative pressure in the service line to the house, sucking dirty water out of the bathtub.

C. Suggested Correction: The hot and cold water inlets to the bathtub should be above the rim of the tub.

FIGURE 49.
Backsiphonage (Case 6).



Illustrations of Backpressure

The following presents illustrations of typical plumbing installations where backflow resulting from backpressure is possible.

Backflow

Case I (Fig. 50)

A. Contact Point: A direct connection from the city supply to the boiler exists as a safety measure and for filling the system. The boiler water system is chemically treated for scale prevention and corrosion control.

B. Cause of Reversed Flow: The boiler water recirculation pump discharge pressure or backpressure from the boiler exceeds the city water pressure and the chemically treated water is pumped into the domestic system through an open or leaky valve.

C. Suggested Correction: As minimum protection two check valves in series should be provided in the makeup waterline to the boiler system. An air gap separation or reduced pressure principle backflow preventer is better.

FIGURE 50.
Backflow (Case 1).

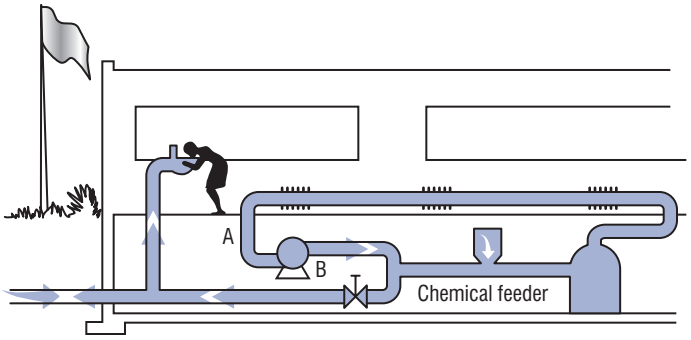
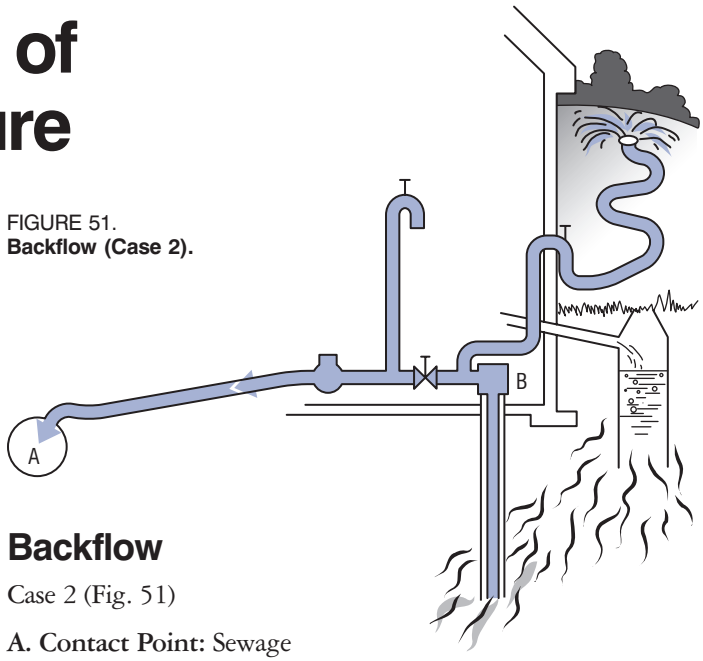


FIGURE 51.
Backflow (Case 2).



Backflow

Case 2 (Fig. 51)

A. Contact Point: Sewage seeping from a residential cesspool pollutes the private well which is used for lawn sprinkling. The domestic water system, which is served from a city main, is connected to the well supply by means of a valve. The purpose of the connection may be to prime the well supply for emergency domestic use.

B. Cause of Reversed Flow: During periods of low city water pressure, possibly when lawn sprinkling is at its peak, the well pump discharge pressure exceeds that of the city main and well water is pumped into the city supply through an open or leaky valve.

C. Suggested Correction: The connection between the well water and city water should be broken

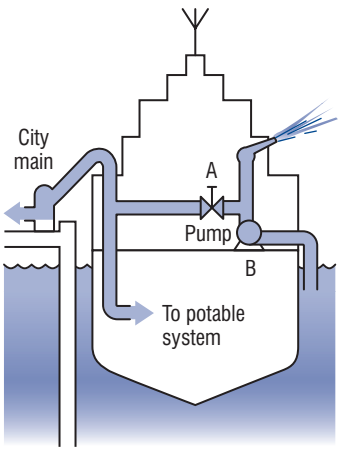
Backflow

Case 3 (Fig. 52)

A. Contact Point: A valve connection exists between the potable and the non potable systems aboard the ship.

B. Cause of Reversed Flow: While the ship is connected to the city water supply system for the purpose of taking on water for the potable system, the valve between the potable and nonpotable systems is opened, permitting contaminated water to be pumped into the municipal supply.

FIGURE 52.
Backflow (Case 3).



C. Suggested Correction: Each pier water outlet should be protected against backflow. The main water service to the pier should also be protected against backflow by an air gap or reduced pressure principle backflow preventer.

Backflow

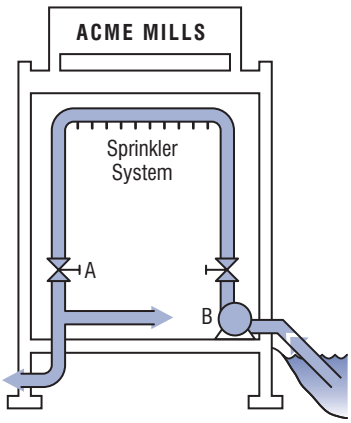
Case 4 (Fig. 53)

A. Contact Point: A single-valved connection exists between the public, potable water supply and the fire-sprinkler system of a mill.

B. Cause of Reversed Flow: The sprinkler system is normally supplied from a nearby lake through a high-pressure pump. About the lake are large numbers of overflowing septic tanks. When the valve is left open, contaminated lake water can be pumped to the public supply.

C. Suggested Correction: The potable water supply to the fire system should be through an air gap or a reduced pressure principle backflow preventer should be used.

FIGURE 53.
Backflow (Case 4).



Illustrations of Air Gaps

The following illustrations describe methods of providing an air gap discharge to a waste line which may be occasionally or continuously subject to backpressure.

FIGURE 54.
Air gap to sewer subject to backpressure—force main.

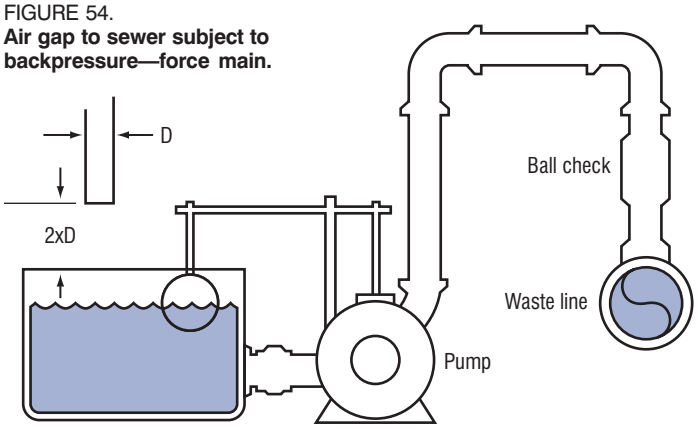


FIGURE 55.
Air gap to sewer subject to backpressure—gravity drain.

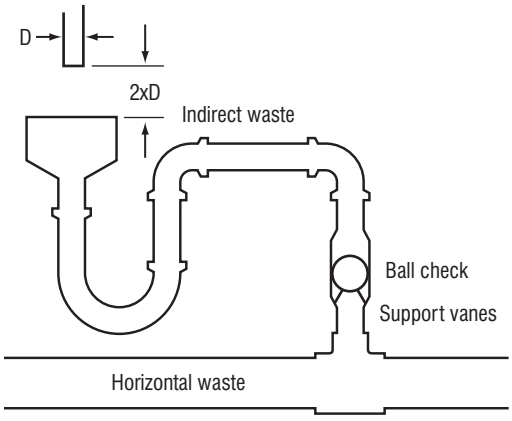
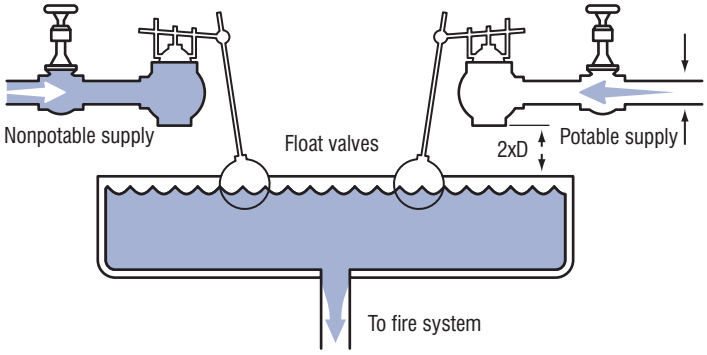


FIGURE 56.
Fire system makeup tank for a dual water system.



Illustrations of Vacuum Breakers

FIGURE 57.
Vacuum breakers.

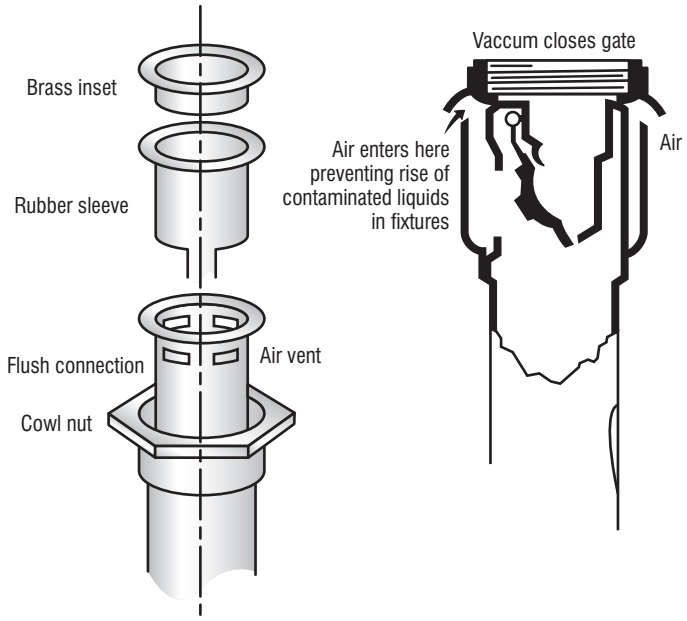
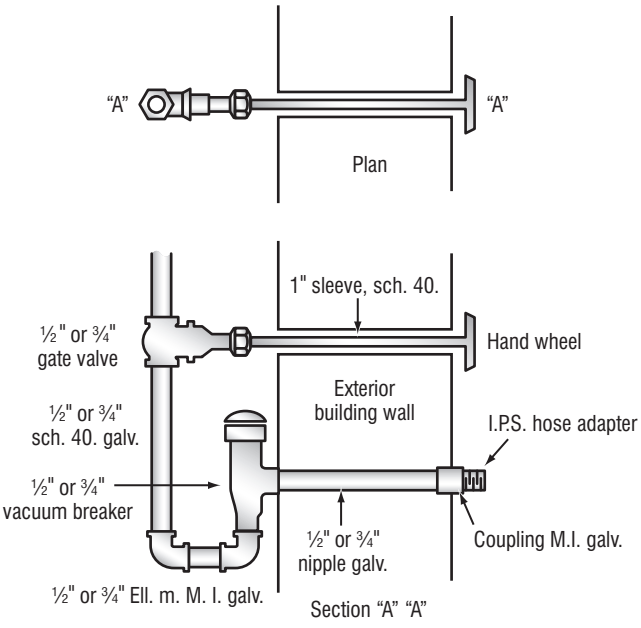


FIGURE 58.
Vacuum breaker arrangement for an outside hose hydrant.



(By permission of Mr. Gustave J. Angele Sr., P.E. formerly Plant Sanitary Engineer, Union Carbide Nuclear Division, Oak Ridge, Tenn.)

Cross-Connection Survey Form

Date: _____

Name of Company, Corporation, or Business: _____

_____

Address: _____

Name of Contact: _____

Type of Use: Industrial _____ Commercial _____ Governmental _____ Other

Location of Service: _____

Size of Service: _____ Inch	Metered?	Yes ☐	No ☐
Require non-interrupted water service?		Yes ☐	No ☐
Does Boiler Feed utilize chemical additives?		Yes ☐	No ☐
Is Backflow protection incorporated?		Yes ☐	No ☐
Are air conditioning cooling towers utilized?		Yes ☐	No ☐
Is Backflow protection incorporated?		Yes ☐	No ☐
Is a Water Saver utilized on condensing lines or cooling towers?	N/A ☐	Yes ☐	No ☐
Is the make-up supply line backflow protected?		Yes ☐	No ☐
Is process water in use, and if so, is it potable supply water or "Raw" water		N/A ☐	Potable ☐
	Raw ☐	Protected ☐	Unprotected ☐
Is fire protection water separate from the potable supply?		Yes ☐	No ☐
Are Containment Devices in place?		Yes ☐	No ☐

Summary

Degree of Hazard:		High ☐	Low ☐
Type of Device recommended for containment:	RPZ ☐	DCV ☐	None ☐
Fixture Outlet protection required?		Yes ☐	No ☐

If so, where?

_____

Backflow Prevention Device Test and Maintenance Report

To: _____
(water purveyor or regulatory agency)

_____

_____

Attn: Cross-connection Control Section

The cross-connection control device detailed hereon has been tested and maintained as required by the *(rules or regulations)* of *(purveyor or regulatory agency)* and is certified to comply with these *(rules or regulations)*.

Make of device _____ size _____

Model Number _____ located at _____

Serial Number _____ _____

_____

	Reduced Pressure Devices			Pressure Vacuum Breaker	
	Double Check Devices		Relief Valve	Air Inlet	Check Valve
	1st Check	2nd Check			
Initial Test	DC - Closed Tight ☐ RP - _____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Opened at _____ psid	Opened at _____ psid Did not open ☐	_____ psid Leaked ☐
Repairs and Materials Used					
Test After Repair	DC-Closed Tight RP- _____ psid	Closed Tight ☐	Opened at _____ psid	Opened at _____ psid	_____ psid

The above is certified to be true.

Firm Name _____ Certified Tester _____

Firm Address _____ Cert. Tester No. _____ Date _____

_____