BACKFLOW PREVENTER REPORT

FOR:

Veterans Administration - Butler, PA

VA Project Number: 529-080-110

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I. Executive Summary

Advantus Engineers has identified several locations throughout the VA Butler campus requiring backflow preventers or indirect waste connections to prevent backflow of contaminants and pollutants into the potable water system.

Also identified are other deficiencies such as dead legs which must be removed, check valves to prevent unwanted mixing of hot and cold water in some locations, and lack of proper pipe identification in buildings that have both potable and nonpotable water.

Findings of the field survey by Advantus Engineers of individual buildings are summarized in a Field Survey Table included in this report.

II. Introduction

Advantus Engineers has been contracted to provide a study of the state of backflow prevention at the Veterans Administration Butler Facility, with recommendations for correction. Advantus was directed to survey all buildings not slated for demolition which have domestic water connections or sprinkler systems.

The facility includes buildings for offices, rehabilitation, housing, laundry, boiler and chiller plants, plumbing and electric shops, storage, fire station, day care, and data center.

III. Objectives

The objective of this report is to identify all locations of potential backflow of contamination or pollution into the potable water system, to record the status of backflow prevention at each location, and to make recommendations for correction at each location if backflow prevention is inadequate or not present.

IV. Narrative

Background:

The identification and correction of potential backflow of contaminants and pollutants into the potable water system is important to public health. Sickness and even death have resulted from incorrect backflow prevention.

Backflow occurs when there is a back-siphonage or back-pressure from a contaminant or pollutant source into the potable water system. This can occur at any location where the potable water system can potentially come in contact with non-potable liquids, solids or gases. Examples include beverage dispensers, bed pan washers, hose connections,

makeup water connections to HVAC systems, sterilizers, film processors, irrigation systems, dishwashers, sprinkler systems and more.

In addition, building codes require that domestic and sprinkler water entrances to buildings be provided with backflow prevention devices to protect the potable water mains outside of the building.

The requirements for backflow prevention which are most directly applicable to this facility include the 2006 International Plumbing Code and the Department of Veterans Affairs Office of Construction and Facilities Management Master Construction Specifications.

Protection of the potable water system from backflow is provided by the proper selection and installation of appropriate backflow devices, and by the use of indirect waste connections to the sanitary drainage system from food handling equipment, floor drains in food refrigerators and freezers, sterilizers, process tanks, relief valves from water vessels, swimming pools, process tanks, filters, drips, boilers, ice storage, dishwashers, and similar equipment.

Methodology:

Advantus Engineers provided technical personnel to survey all the buildings on site which have potable water or sprinkler systems. They were accompanied by Ray Clark of the Veterans Administration Butler Facility. Mr. Clark has many years of experience at the facility and was relied upon to direct Advantus personnel to all potable water equipment locations, drain locations, cross-connections between potable water and non-potable systems, and fire and domestic water building service entrances.

Photos were taken at each location where a backflow prevention device would be required or where one already existed. Photos were also taken wherever a drainage connection did not provide the proper protection from backflow.

Recommendations have been made for each location where a backflow prevention device is required, or where an improper connection to the drainage system must be corrected.

The following appendices have been included in this report to summarize findings and recommendations, and to provide important and useful reference information:

- Backflow Preventer Legend: this table provides an abbreviation for each type of backflow preventer existing or recommended. It should be used in conjunction with the Field Survey Table.
- Field Survey Table: this table summarizes findings and recommendations, and provides a record of the state of existing backflow prevention at the facility.
- Backflow Preventer Requirements: this table blends and summarizes the backflow preventer requirements of the 2006 International Plumbing Code (IPC) and the VA Master Construction Specifications. It was used as a resource for making recommendations for backflow preventers in the Field Survey Table.
- Table 608.1 Application of Backflow Preventers: This table is directly from the IPC and is a valuable summary of where different types of backflow preventers must be applied. In the table, Low Hazard means only aesthetic qualities (odor, taste or color) of the potable water would be affected by backflow; High Hazard means health would be affected.

- VA Master Construction Specifications, Backflow Preventer Section: This table is included to provide a ready reference of the VA's requirements for backflow preventer application and installation.
- EPA Cross-Connection Control Manual Chapter Four - Methods and Devices for the Prevention of Backflow and Back-Siphonage: this is included as an educational reference. The complete manual is available via the internet and is easily found by Google search on the term, *EPA Cross-Connection Control Manual*.
- A CD including an electronic copy of this report, and photos referenced in the Field Survey Table.

V. Findings:

Findings are detailed in the Field Survey Table, which should be used in conjunction with the Backflow Preventer Legend, both included in this report. The Field Survey Table includes the following:

1) Date of survey for each item identified.

2) Location identification by building and room.

3) Description of the equipment requiring backflow prevention.

4) Reference to photos provided on a separate CD with this report.

5) Estimated pipe sizes where applicable.

6) Notes with additional information where applicable; and

7) The recommended type of backflow preventer to be installed at each location.

In some cases, no backflow prevention device was provided where one was required. In other cases, the backflow prevention device is misapplied, and an appropriate one is recommended to replace the existing.

In other cases, we have noted where waste connections from certain types of equipment were made directly but should have made indirectly with an air gap or air break.

An air gap is defined by IPC as the unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging. An air break is defined as a piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.

In other cases, we have made recommendations (in the Notes column) where we noticed deficiencies not related to backflow prevention. For example, these include recommendations for check valves in certain locations where the unwanted mixing of hot

and cold water could occur, and the removal of dead legs in the plumbing system (which are prohibited by IPC).

Another deficiency that was noted, but not referenced in the Field Survey Table, is the lack of proper piping identification. Section 608.8 of the IPC states that potable water and non-potable water systems must be identified in buildings where both types of systems exist. Section 608.8 should be consulted for specific requirements of the identification. The survey indicates that the boiler plant in particular, and perhaps other buildings as well, are deficient in this regard.

VI. Conclusions and Recommendations:

Advantus Engineers has identified several locations throughout the VA Butler campus requiring backflow preventers or indirect waste connections to prevent backflow of contaminants and pollutants into the potable water system.

Also identified are other deficiencies such as dead legs which must be removed, check valves to prevent unwanted mixing of hot and cold water in some locations, and lack of proper pipe identification in buildings that have both potable and nonpotable water.

Advantus recommends that the VA take steps to correct all of the deficiencies noted in this report. The VA should assess their capabilities to determine which corrections can be made in-house using solely the information in this report. For example, all of the HVB (hose vacuum breaker) installations can easily be accomplished in-house without any further documentation. Other corrections will require engineering drawings and an independent contractor; examples may include the fire and domestic water building service entrances.

VII. Appendix:

Backflow Preventer Legend

Field Survey Table

Backflow Preventer Requirements

Table 608.1 Application of Backflow Preventers

VA Master Construction Specifications, Backflow Preventer Section

EPA Cross-Connection Control Manual Chapter Four - Methods and Devices for the Prevention of Backflow and Back-Siphonage

A CD including an electronic copy of this report, and photos referenced in the Field Survey Table.

Backflow Preventer Legend

Backflow Preventer Legend	
Backflow Preventer Type	**Tag**
Air Gap	AG
Atmospheric Vacuum Breaker	AVB
Beverage Dispenser Backflow Preventer	BDBP
Chemical Dispenser Backflow Device	CBD
Deck Mounted and Integral Vacuum Breakers	IVB
Double Check Detector	DCD
Double Check Valve (over 1") or Dual Check Valve (1/4" - 1")	DCV
Faucet Vacuum Breaker	FVB
Hose Connection Vacuum Breaker	HVB
Intermediate Atmospheric Vent	IAV
Pressure Vacuum Breaker	PVB
Reduced Pressure Principle	RP
Spill Proof Vacuum Breaker	SVB

Field Survey Table

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital		Outpatient Entrance	Wall Hydrant	IVB	CIMG3025	3/4		
12/4/08	1	Hospital	131	Outside Door 12 of Mechanical Room	Wall Hydrant	IVB	CIMG3026	3/4		
12/4/08	1	Hospital		By Standpipe outside Canteen	Hose Bibb		CIMG3027	3/4		HVB
12/4/08	1	Hospital		Backside next to sub basement stairwell	Hose Bibb		CIMG3028	3/4		HVB
12/4/08	1	Hospital		Backside Main Kitchen	Hose Bibb	IVB	CIMG3029	3/4		
12/4/08	1	Hospital		East End of Telephone Operator Room	Hose Bibb		CIMG3031	3/4		HVB
12/4/08	1	Hospital		Loading Dock Main Door	Wall Hydrant		CIMG3032	3/4		AVB
12/4/08	1	Hospital		Loading Dock Platform	Hose Bibb		CIMG3033	3/4		HVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital		Outside Auditorium	Hose Bibb		CIMG3034	3/4		HVB
12/4/08	1	Hospital		Left Side Main Entrance	Hose Bibb		CIMG3035	3/4		HVB
12/4/08	1	Hospital		Right Side Main Entrance	Hose Bibb	HVB	CIMG3036	3/4		
12/4/08	1	Hospital		Right Side Director's Room	Hose Bibb	IVB	CIMG3037	3/4		
12/4/08	1	Hospital		Subbasement Stairwell	Fire Entrance	Single Check Valve	CIMG3038	6		DCD
12/4/08	1	Hospital	SPSB07-1	Plumbing Shop	Sink and Hose Bibb	IVB, HB	CIMG3039	3/4		PVB for hose bibb
12/4/08	1	Hospital	SPSB01-1	Mechanical Room	Hose Bib on Column	AVB	CIMG3040	3/4		PVB
12/4/08	1	Hospital	SPSB02-1	Mechanical Room	Service Sink	IVB	CIMG3041			
12/4/08	1	Hospital			Hot Water		CIMG3042	1	Used to serve domestic water. Remove this dead leg.	
12/4/08	1	Hospital	SPB16E-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG3043		Sign on Door says Room No. B14E	

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital	SPB09E-1	Office Staff	Laundry Tub		CIMG3044			AVB or FVB
12/4/08	1	Hospital	SPB16EC-1	Loading Dock	HW & CW Hose Connection	AVB	CIMG3045	3/4	Recommend check valves to avoid Hot / Cold mixing	
12/4/08	1	Hospital	SPB22E W-1	Mechanical Room	Laundry Sink		CIMG3046			AVB or FVB
12/4/08	1	Hospital		Main Kitchen	HW & CW Hose Connection attached to ECOLAB Control Tower IV Quart Sanitizer, by dishwasher.	AVB	CIMG3047, CIMG3048, CIMG3049	3/4		PVB or RP
12/4/08	1	Hospital		Main Kitchen	Double Sink with sprayer by dishwasher		CIMG3050			AVB
12/4/08	1	Hospital		Main Kitchen	Ecolab dispenser line by dishwasher		CIMG3051	1/4		RP
12/4/08	1	Hospital		Main Kitchen	Direct Drain for Dishwasher		CIMG3055	2		AG
12/4/08	1	Hospital		Main Kitchen	Direct Drain for 2 bowl sink		CIMG3056	2		AG
12/4/08	1	Hospital		Main Kitchen	Softener by Chemical Storage Door		CIMG3057	1/2	cold water	AVB
12/4/08	1	Hospital		Main Kitchen	Coffee Urn 529 EE6725		CIMG3058		picture is in back of equipment	BDBP
12/4/08	1	Hospital		Main Kitchen	Cleveland Steamer 529 EE15 994	Watts 27/P2 BP	CIMG3059	3/8	picture is with door open	AVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital		Main Kitchen	Disconnected Filter		CIMG3062	1/2	Remove dead leg.	
12/4/08	1	Hospital		Main Kitchen	Valve with Separate Hose Connection	AVB	CIMG3063			
12/4/08	1	Hospital		Main Kitchen	Ball valve with hose connection and hose by large mixer		CIMG3064		Hose has no handle	Needs ABP
12/4/08	1	Hospital		Main Kitchen	Single Bowl Sink with Hose Spray	IVB on sink	CIMG3065			AVB for hose spray
12/4/08	1	Hospital		Main Kitchen	Drain from juice dispenser	air break	CIMG3066			AG
12/4/08	1	Hospital		Main Kitchen	Juice Dispenser	None	CIMG3067, CIMG3068	1/2		BDBP
12/4/08	1	Hospital		Main Kitchen	Javo Fine Coffee Dispenser	None	CIMG3069	1/2		BDBP
12/4/08	1	Hospital	SPB03E	Barber Shop	Sink and Washer		CIMG3070			FVB for spray attachment
12/4/08	1	Hospital	B03EH-1	Bio Med	Service Sink				No entry to room	
12/4/08	1	Hospital	SPB01E-1	Kitchen Canteen	Direct Drain from 2 bowl Sink		CIMG3071			AG
12/4/08	1	Hospital	SPB01E-1	Kitchen Canteen	Proofer		CIMG3072, CIMG3073	1/4		AVB (or PVB if under continuous pressure)
12/4/08	1	Hospital	SPB01E-1	Kitchen Canteen	Steamer		CIMG3074			AVB (or PVB if under continuous pressure)

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital	SPB01E-1	Kitchen Canteen	3 Bowl Sink, Soap connection		CIMG3075			PVB or RP
12/4/08	1	Hospital	SPB01E-1	Kitchen Canteen	3 bowl sink, drain connection		CIMG3076		Provide grease trap	
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Steam Table		CIMG3077			DCV
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Water Hose Connection		CIMG3078			PVB
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Sink with hose spray, and garbage disposer	AVB	CIMG3079			
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Ice Dispenser		CIMG3080			DCV
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Water to Pop Dispenser		CIMG3081			BDBP
12/4/08	1	Hospital	SPB03C-1	Kitchen Canteen	Water to coffee and iced tea		CIMG3082			BDBP
12/4/08	1	Hospital	SPB06CA-1	ZZSPD	Faucet on wall for mop bucket	AVB	CIMG3083			
12/4/08	1	Hospital	SPB06CA-1	ZZSPD	3 bowl sink, 1 faucet has hose connection		CIMG3084			FVB for faucet with hose connection
12/4/08	1	Hospital	SPB06CA-1	ZZSPD	Underneath Sink		CIMG3085		Recommend grease trap	
12/4/08	1	Hospital	SPB06CA-1	ZZSPD	Steris AMSCE Sonic Bath	IVB	CIMG3086			
12/4/08	1	Hospital	SPB0060ED-1	Housekeeping	Mop Receptor	IVB	CIMG3087			

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital	SPB04CD-1	Mechanical Room	Hose Bibb		CIMG3088	3/4		HVB
12/4/08	1	Hospital	SPB04CDB-1	Utility Room Soiled	Connection to sterilizer		CIMG3089	1		RP
12/4/08	1	Hospital	SPB04CDB-1	Utility Room Soiled	Domestic Water Line		CIMG3090, CIMG3091	6		
12/4/08	1	Hospital	SPB07-1	Shop Plumbing	Domestic and Fire Lines		CIMG3092, CIMG3093	6		RP for Domestic, DCD for Fire
12/4/08	1	Hospital	SPB03A-1	Mechanical Room	Cross Connection, 6" Domestic, 6" Fire		CIMG3094	6		DCD on fire
12/4/08	1	Hospital	SPB02-1	Mechanical Room	6" Fire splits off 6" domestic		CIMG3095			DCD
12/4/08	1	Hospital	SPB10W-1	Housekeeping	Service Sink	AVB	CIMG3096		If shut-offs remain, recommend check valves to avoid Hot / Cold water mixing.	PVB, or remove hose shut-off piece.
12/4/08	1	Hospital	SPB02WH-1	Lab	Sink with hose		CIMG3097			AVB or FVB
12/4/08	1	Hospital	SPBB100WH	Lab	1/2 CW to DI Water		CIMG3098	1/2		RP
12/4/08	1	Hospital	SPB07WH-1	Storage	1/2 CW to DI Water		CIMG3099	1/2		RP
12/4/08	1	Hospital	SPB07WH-1	General Storage	Mop Receptor	AVB	CIMG3100			

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	1	Hospital	SPCA16-1	General Film Processing			CIMG3101		Remove dead leg.	
12/4/08	1	Hospital	SPCA05-1	Mechanical Room	Hose Connection		CIMG3102			HVB
12/4/08	1	Hospital		Outpatient Client Hallway	Ice Machine		CIMG3103	1/2		DCV
12/4/08	1	Hospital	SPCA65-1	Utility Room	Bed Pan Sink	AVB	CIMG3104			
12/4/08	1	Hospital	SPCA68-1	Housekeeping Aid Closet	Mop Receptor	AVB	CIMG3105			
12/11/08	1	Hospital	SP136E-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG0007			
12/11/08	1	Hospital	SP106WN-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG0008			
12/11/08	1	Hospital	SP233W-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG0009			
12/11/08	1	Hospital		Hallway by Room 240W	Ice Machine		CIMG0011, CIMG0012	1/2		DCV

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/11/08	1	Hospital	SP232E-1	Housekeeping Aid Closet	Service Sink	AVB	CIMG0013		If shut-off valve on hose remains, recommend check valves to eliminate HW / CW mixing.	PVB or remove shut-off valve on hose.
12/11/08	1	Hospital	SP334W-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG0014			
12/11/08	1	Hospital	SP307E-1	Utility Room Soiled	Bedpan Washer	AVB	CIMG0015			
12/11/08	1	Hospital	SP307E-1	Utility Room Soiled	Bedpan Washer	AVB	CIMG0016			
12/11/08	1	Hospital	SP307E-1	Utility Room Soiled	Soiled Utility Sink	IVB	CIMG0017			
12/11/08	1	Hospital	SP322E-1	Kitchen Nourishment	Ice Machine		CIMG0018, CIMG0019, CIMG0020	1/2		DCV
12/11/08	1	Hospital	SP330E-1	Housekeeping Aid Closet	Mop Receptor		CIMG0021		If shut-off valves remain on hose, recommend check valves to eliminate blending of HW/CW.	PVB if shut-off valves remain on hose. AVB otherwise.

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/11/08	1	Hospital	SP419E-1	Housekeeping Aid Closet	Mop Receptor	IVB	CIMG0022			
12/11/08	1	Hospital	SP407E-1	Utility Room Soiled	Bedpan Washer	AVB	CIMG0023			
12/11/08	1	Hospital		Stairwell B, 4th Floor	Ice Machine		CIMG0024, CIMG0025	1/2		DCV
12/11/08	1	Hospital	402C	BK Kitchen	Ice Machine		CIMG0026, CIMG0027	1/2		DCV
12/11/08	1	Hospital	SP433W-1	Housekeeping Aid Closet	Mop Receptor	IVB	CIMG0028			
12/11/08	1	Hospital	SP509W	Housekeeping Aid Closet					Locked	
12/11/08	1	Hospital	SP501C-1	Housekeeping Aid Closet	Service Sink	IVB	CIMG0029			
12/11/08	1	Hospital	SP505CA-1	Lab	Dental Equipment Water Connection		CIMG0030	1/2		AVB
12/11/08	1	Hospital	SP503CA-1	Film Processing	Dead Leg		CIMG0031		Remove dead leg.	
12/11/08	1	Hospital	SP503CA-1	Film Processing	Vacuum Pump	AVB	CIMG0032			

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/11/08	1	Hospital	SP602-1	Mechanical Room	HW and CW Hose Connection	IVB	CIMG0033			
12/11/08	1	Hospital	SP602-1	Mechanical Room	Makeup Water to HVAC System	RP	CIMG0034	3/4		
12/11/08	1	Hospital	SP604E-1	Mechanical Room	Makeup Water to HVAC System	RP	CIMG0035	3/4		
12/11/08	1	Hospital	SP519E-1	Lab	Sink with Eye Wash	IVB	CIMG0036			
12/11/08	1	Hospital	SP519E-1	Lab	Sink	AVB	CIMG0037			
12/11/08	1	Hospital	SP519E-1	Lab	Model Trimmer		CIMG0038	1/2		AVB or PVB
12/11/08	1	Hospital	SP511E-1	Housekeeping	Service Sink	IVB	CIMG0039			
12/11/08	1	Hospital		East Penthouse	Makeup Water to HVAC System	RP	CIMG0040			
12/11/08	1	Hospital	SPB03EN-1	Shop BioMed	Sink	IVB	CIMG0042			
12/11/08	1	Hospital	SPB03EN-1	Shop BioMed	HB Above Sink		CIMG0043	3/4		HVB
12/11/08	1	Hospital		Paint Room	Fire Service Entrance from Fire Pump		CIMG0044	4		DCD
12/2/08	2	Office/Rehab	SPB06-2	Mechanical Room	4" Domestic, 4" Cap for Fire		CIMG0049, CIMG0050	4		RP
12/2/08	2	Office/Rehab	SPB06-2	Mechanical Room	Hose Connection		CIMG0051	3/4		HVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/2/08	2	Office/Rehab	SPB04-2	Wheel Chair Repair Shop	Domestic Water Entrance		CIMG0052	1-1/2		RP
12/2/08	2	Office/Rehab	SPB05-2	Mechanical Room	Generator Hose Bibb		CIMG0053			HVB
12/2/08	2	Office/Rehab	SPB010-2	Weight Room Crawl Space	Fire Entrance		CIMG0054, CIMG0055	6	In Crawl Space	DCD
12/2/08	2	Office/Rehab	SP117-2	Housekeeping	Hose Bibb Service Sink	IVB	CIMG0056			
12/2/08	2	Office/Rehab	SP219-2	Housekeeping	Hose Bibb Service Sink	IVB	CIMG0057			
12/2/08	2	Office/Rehab		2nd floor hallway	Ice Maker		CIMG0058			DCV
12/2/08	2	Office/Rehab		Outside	Hose Bibb by Main Entrance		CIMG0059			HVB
12/2/08	2	Picnic Shelter	SP101-129	Outside	Sink Outside	IVB	CIMG0060			
12/2/08	2	Office/Rehab		Outside East Side	Hose Bibb		CIMG0061			HVB
12/2/08	2	Office/Rehab		Outside West Corner	Hose Bibb		CIMG0062			HVB
12/2/08	3	Housing	SPB05-3	Mechanical Room	4" Fire Entry; 2 1/2"Domestic	DCD on fire	CIMG0039	4, 2-1/2		RP on domestic

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/2/08	3	Housing	SPB05-3	Mechanical Room	Fire Line and Domestic Cross-Connection		CIMG0040			DCV
12/2/08	3	Housing	SPB06-3	Laundry	Fire Protection Entry	6" BFP (Single Check)	CIMG0037, CIMG0038			DCD
12/2/08	3	Housing	SP114R-3	Toilet Congregate	Mop Sink	IVB	CIMG0041			
12/2/08	3	Housing	SP219A	Toilet Congregate	Mop Sink	IVB	CIMG0042			
12/2/08	3	Housing	SP202R-3	Toilet Congregate	Hose bibb off of shower	None	CIMG0043			HVB
12/2/08	3	Housing	SP320-3	Housekeeping	Service Sink	IVB	CIMG0044			
12/2/08	3	Housing	Outside		Hose Bibb outside front entrance left side		CIMG0045			HVB
12/2/08	3	Housing	Outside		Hose Bibb outside by Siamese Connection		CIMG0046			HVB
12/2/08	3	Housing	Outside		Hose Bibb outside back of building left side by stairway		CIMG0047			HVB
12/2/08	4	Housing	SP02-4	Shop Plumbing	2" Domestic, 4" Fire Line	RP on Domestic, DCD on fire	CIMG0023			

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/2/08	4	Housing	SPB05-4	Unassigned	Dead Leg		CIMG0024	1	Remove dead leg.	
12/2/08	4	Housing	SPB05-4	Unassigned	Laundry Tub and 4 Hose Bibbs on Wall	AVB on hose bibbs	CIMG0025			add AVB to laundry tub
12/2/08	4	Housing		Outside	HB Outside		CIMG0026	3/4		HVB
12/2/08	5	Housing	SPB02-5	Mechanical Room	Fire Line In	DCD	CIMG0001	2-1/2	Ames BP Size 25 300033 Serial No. 105737 ASSE 1048	
12/2/08	5	Housing	SPB02-5	Mechanical Room	Domestic Water Service	RP	CIMG002	3	009RP Watts 3" Serial 13824 ASSE 1013	
12/2/08	5	Housing	SPB02-5	Mechanical Room	Hose Bibb	HVB	CIMG0003			
12/2/08	5	Housing	SPB02-5	Mechanical Room	Pipe through exterior wall		CIMG0004	1	To frost fee hydrant	
12/2/08	5	Housing	SPB02-5	Mechanical Room	Dead Leg		CIMG0005	1/2	Remove dead leg.	
12/2/08					Frost Free Hydrant		CIMG0006		Intersection of B St. and Hospital Rd.	HVB
11/25/08	6	Laundry	SPB05A	General Storage (Basement)	Main water into building		CIM2765	2		RP
11/25/08	6	Laundry	SPB01	Mechanical Room	Cross connection to inactive service		CIM2766, CIM2767		Needs to be disconnected.	
11/25/08	6	Laundry	SPB01	Mechanical Room	Hose Bibb		CIM2768			HVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
11/25/08	6	Laundry		Main Laundry	hose bib/hot & cold taps behind washer		CIM2770	1/2		HVB on hose bibb
11/25/08	6	Laundry		Main Laundry	hose reel		CIM2771	3/4		DCV
11/25/08	6	Laundry		Main Laundry	hot and cold to washing machine		CIM2772	2		RP
11/25/08	6	Laundry		Main Laundry	cold water to washer and detergent		CIM2773	1/2		AVB or PVB if installed 6" above flood level rim.
11/25/08	6	Laundry		Main Laundry	Y connector to hose bib		CIM2774			HVB
11/25/08	6	Laundry		Main Laundry	Faucet double sink		CIM2775			AVB
11/25/08	6	Laundry		Main Laundry	hot/cold connection to chemical detergent system & hose bib		CIM2776	1/2		AVB or PVB if installed 6" above flood level rim.
11/25/08	6	Laundry		Main Laundry	mop hose faucet	IVB	CIM2777			
11/25/08	6	Laundry		Main Laundry	Main fire		CIM2778	4		DCD
11/25/08	6	Laundry		Main Laundry	Fire hose cabinet		CIM2779		disconnect from DW water line and connect to fire line.	
11/25/08	7	Boiler Plant		Basement	Incoming water service		CIM2729, CIM2730	4	2 lines, 1 from main, 1 from tower	RP on each
11/25/08	7	Boiler Plant		Basement	Main fire line entrance		CIM2731, CIM2732	4		DCD
11/25/08	7	Boiler Plant		Basement	Air Compressor		CIM2733	3/8		RP

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
11/25/08	7	Boiler Plant		Basement	Emergency Water Supply		CIM2735		Hook-up from fire hydrant on loss of water	DCV
11/25/08	7	Boiler Plant		Basement	Water Softener		CIM2736, CIM2737	2		DCV
11/25/08	7	Boiler Plant		Sub Basement	Softened water connection to condensate drain		CIM2738	2		RP
11/25/08	7	Boiler Plant		Basement	Connection between soft and domestic water - bypass.		CIM2739	2		DCV
11/25/08	7	Boiler Plant		1st Floor	Domestic or soft water at high pressure steam Boiler #1		CIM2740	2		RP
11/25/08	7	Boiler Plant		1st Floor	Hose bibb at Boiler #1		CIM2741	3/4		HVB
11/25/08	7	Boiler Plant		1st Floor	Hose bibb at Boiler #2	HVB	CIM2743	3/4		HVB
11/25/08	7	Boiler Plant		1st Floor	Domestic or soft water at high pressure steam Boiler #2		CIM2744	2		RP
11/25/08	7	Boiler Plant		1st Floor	Hose bibb at Boiler #3		CIM2746	3/4		HVB
11/25/08	7	Boiler Plant		1st Floor	Domestic or soft water at high pressure steam Boiler #3		CIM2748	1-1/4		RP
11/25/08	7	Boiler Plant		1st Floor	Hose connection		CIM2748	3/4		HVB
11/25/08	7	Boiler Plant		1st Floor	Ice Dispenser near Boiler #3		CIM2749	3/8		DCV

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
11/25/08	7	Boiler Plant		1st Floor	Sink		CIM2751	3/8		FVB for hose spray connection under sink.
11/25/08	7	Boiler Plant		1st Floor	Boiler feed pump, 2 connections		CIM2754	3/8		AVB
11/25/08	7	Boiler Plant		Upper Level	Cross connection soft water and pump line feeding boiler feed tank		CIM2755	2		RP
11/25/08	8	Plumbing Shop	105	Locker Room	Water service to building		CIM2756	2	hidden beneath manhole	RP
11/25/08	8	Plumbing Shop	109	Shop	Double sink with threaded connections		CIM2757		recommend check valves to eliminate hot and cold water blending	PVB on faucet
11/25/08	8	Plumbing Shop	109	Shop	Hose faucet	HVB	CIM2758			
11/25/08	8	Plumbing Shop	109	Shop	Hose bibs ouside	HVB	CIM2759, CIM2760			
11/25/08	8	Plumbing Shop	109	Shop	Main fire line entrance		CIM2761	4		DCD
11/25/08	10	Electric Shop		Garage Stroage	Main fire line entrance		CIM2763		No Bathroom	DCD
11/25/08	9	Storage		Office Area	Main fire line entrance and hose bib		CIM2764			DCD, and HVB
11/25/08	11	Offices		United Way Basement	Double Sink		CIM2780			FVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
11/25/08	11	Offices		United Way Basement	Make-up water to boiler		CIM2781, CIM2782	1/2		RP
11/25/08	11	Offices		United Way Basement	Main water into building		CIM2783	2		RP
11/25/08	11	Offices		Life steps basement	Make-up water to boiler		CIM2784	1/2		RP
11/25/08	11	Offices		Life steps basement	Laundry Tub		CIM2785			FVB
11/25/08	11	Offices		Life steps basement	Hose bib		CIM2786			HVB
12/2/08	16	Vacant/Storage	SP112-16	Closet Telephone	Service Sink	IVB	CIMG0030			
12/2/08	16	Vacant/Storage	SP103-16	Shop Carpenter	Domestic Entrance		CIMG0031	1-1/2	In Cabinet	RP
12/2/08	16			Hallway outside of 16	Fire Entrance		CIMG0032	4		DCD
12/2/08	17	Vacant/Storage	SP103-17		Domestic Entrance		CIMG0033	1-1/2	In Box on Floor	RP
12/2/08	17	Vacant/Storage	SP109-17		Service Sink	IVB	CIMG0034			
12/2/08	18	AC Plant	SP101-1B	Shop A/C	Make-Up water to chiller	RP	CIMG0012	3		
12/2/08	18	AC Plant	SP101-1B	Shop A/C	Utility sink faucet with hose connection		CIMG0013	1/2		FVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/2/08	18	AC Plant	SP101-1B	Shop A/C	Ice Machine next to pic 13		CIMG0015	3/8		DCV
12/2/08	18	AC Plant	SP101-1B	Shop A/C	Hose Bibb		CIMG0016	3/4		PVB if hose shut-off valve is used. Otherwise, HVB
12/2/08	18	AC Plant	SP101-1B	Shop A/C	Serving Cooling Tower Outside	DCV	CIMG0017, CIMG0018	1-1/2		RP
12/2/08	18	AC Plant	SP101-1B	Bathroom	Potable Water Entrance		CIMG0019	3		RP
12/2/08	18	AC Plant		Generator Room	Generator Radiator hose	HVB	CIMG0020	3/4		
12/2/08	18	AC Plant		Outside	Hose Bibb by Cooling Tower		CIMG0021	3/4		HVB
12/2/08	18	AC Plant		Shop A/C	Miss Marked Potable/Non Potable		CIMG0022		Prior to CT Make-up	
11/25/08	46	Offices	114	Men's Room	Main water into building/ threaded faucet		CIM2799	2		RP and HVB
11/25/08	46	Offices	114	Men's Room	Utility Sink		CIM2800			FVB
11/25/08	46	Offices		Paint Shop	Main fire entrance		CIM2801	6		DCD
11/25/08	46	Offices		Paint Shop Utility	Make-up water to condensate return		CIM2803	1		RP
11/25/08	46	Offices		Outside	Hose bibb	HVB	CIM2804	3/4		
11/25/08	46	Offices		Carpenter Shop	Hose connection		CIM2805	3/4		HVB
11/25/08	47	Warehouse		Main Storage	Main fire line in		CIM2790	6		DCD

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
11/25/08	47	Warehouse	SP105FB-47	Mechanical Room	Mop Sink	IVB	CIM2791			
11/25/08	47	Warehouse	SP105FA-47	Toilet Male	Domestic water service entrance		CIM2792	1-1/4		RP
11/25/08	47	Warehouse		Grounds	Hose Bibb		CIM2793	3/4		HVB
11/25/08	47	Warehouse		Grounds	Hose bibb / hand wash	AG	CIM2793	3/4		
11/25/08	47	Warehouse		Grounds	ice and water dispenser		CIM2794	1/2		DCV
11/25/08	47	Warehouse		Grounds Garage	hose connection and laundry connection		CIM2795	3/4		HVB on each
11/25/08	47	Warehouse		Outside	Hose connection		CIM2796	3/4		HVB
11/25/08	47	Warehouse		Generator Room	Hose connection		CIM2797	3/4		PVB
11/25/08	47	Warehouse		Generator Room	Fill connection to generator radiator		CIM2798	3/4		HVB
11/25/08	48	Fire station		Garage	Main water into building		CIM2787, CIM2788	2	threaded connection that comes off and on	RP, and HVB
11/25/08	48	Fire station		Garage	hose connection	IVB	CIM2789			
12/2/08	68	Vacant	SP103-68	Housekeeping	Service Sink	IVB	CIMG0035			
12/2/08	68	Vacant	SP103-68		Water service		CIMG0036	2		RP
12/2/08	69	Day Care		Outside	Hose Bibb		CIMG0027			HVB
12/2/08	69	Day Care		Mechanical Room	Domestic Entrance		CIMG0028, CIMG0029	1-1/2		RP
12/11/08	99	Switchgear / Generator		Generator Room	Hose Bibb		CIMG0001	3/4		HVB

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/2/08	125	Smoking Shelter	Outside		Hose Bibb		CIMG0048			HVB
12/2/08	131	Data Center	SP101-131	Telecom Equipment	Liebert - Emerson AC Unit		CIMG0007, CIMG0008	1/4	Pipe under floor to Unit #2	DCV
12/2/08	131	Data Center	SP101-131	Telecom Equipment	Liebert - Emerson AC Unit		CIMG0009		Unit #2	
12/2/08	131	Data Center	SP101-131	Telecom Equipment	Liebert - Emerson AC Unit		CIMG0010		Unit #1	
12/2/08	131	Data Center	SPB01-131	Basement	Line to Liebert - Emerson AC Unit #1		CIMG0011	1/2		DCV
12/4/08	131			Mechanical Room	Hose Bibb		CIMG3106	1/2		HVB
12/4/08	131			Mechanical Room	Hose Bibb		CIMG3107	1/2		HVB
12/11/08	133	Patient Greenhouse			Water entry			3/4	No photo. It's near the water heater.	RP
12/11/08	133	Patient Greenhouse			Sink	IVB	CIMG0002			
12/11/08	133	Patient Greenhouse			Hose Bibb drain at water heater.		CIMG0003			
12/11/08	133	Patient Greenhouse			Hose Bibb (North End)	HVB	CIMG0004			
12/11/08	133	Patient Greenhouse			Hose Bibb (South End)	HVB	CIMG0005			
12/11/08	133	Patient Greenhouse			North end Water entry		CIMG0006	3/4	No backflow preventer. Filter is in backwards, and there is a dead leg.	RP

Date	Building Number	Building Description	Room No.	Room Description	Equipment Description	Type of Existing BFP	Photo (s)	Line Size (inches)	Notes	Recommended BFP
12/4/08	134	Employee Smoking			Laundry Tub		CIMG3030			FVB

Backflow Preventer Requirements

Backflow Preventer Requirements

Based on Department of 2006 International Plumbing Code (IPC) and Department of Veterans Affairs Office of Construction and Facilities Management Master Construction Specifications

Equipment	Type of BFP Required	Tag	Notes
Autopsy	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Bed Pan Washer	Atmospheric Vacuum Breaker	AVB	Locate AVB 5' min. AFF.
Beverage Dispenser	Air Gap	AG	See Table 608.15.1 for minimum air gaps
Beverage Dispenser	Beverage Dispenser Backflow Preventer	BDBP	
Chemical Dispenser			AG, RP, PVB, AVB, SVB, CBD (SVB = spill proof vacuum breaker, and CBD = chemical dispenser backflow device)
Cleaning Equipment (portable)			AG, RP, IAV, DCV, SVB (DCV=Double Check Valve)
Coffee Machine	Beverage Dispenser Backflow Preventer	BDBP	
Coffee Machine	Air Gap	AG	
Connection subject to back-pressure	Reduced Pressure Principle	RP	
Deionizer	Reduced Pressure Principle	RP	
Dental Pump			AG, IAV, PVB, AVB, SVB
Dental Equipment	Pressure Vacuum Breaker	PVB	At least 6" above flood level rim
Dental Equipment	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Detergent System	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
DI Water System	Reduced Pressure Principle	RP	
Dialysis	Reduced Pressure Principle	RP	
Disposer	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Film processor	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Fire Service	Double Check Detector	DCD	
Fume Hood	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Glassware Washer	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Hose bibb	Atmospheric Vacuum Breaker	AVB	Hose connection vacuum breakers and pressure type vaccuum breakers are permitted by IPC.
Hose connection in health care or lab area	Hose Connection Vacuum Breaker	HVB	Locate HVB 6' min. AFF
Hospital Equipment	Reduced Pressure Principle	RP	
Hospital Equipment	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim

Backflow Preventer Requirements

Based on Department of 2006 International Plumbing Code (IPC) and Department of Veterans Affairs Office of Construction and Facilities Management Master Construction Specifications

Equipment	Type of BFP Required	Tag	Notes
Hospital Equipment	Air Gap	AG	See Table 608.15.1 for minimum air gaps
Hydrotherapy Unit	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Irrigation System (lawn)	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Irrigation System (lawn)	Pressure Vacuum Breaker	PVB	At least 6" above flood level rim
Kitchen equipment not protected by air gap	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Makeup Water to Boiler (no chemicals)	Intermed Atmospheric Vent	IAV	IPC requirement
Makeup Water to Boiler (with chemicals)	Reduced Pressure Principle	RP	IPC requirement
Makeup Water to Boiler (with chemicals)	Air Gap	AG	IPC requirement
Makeup Water to boilers, cooling towers, chillers and generators	Reduced Pressure Principle	RP	
Makeup Water to boilers, cooling towers, chillers and generators	Pressure Vacuum Breaker	PVB	At least 6" above flood level rim
Potable water outlet	Air Gap	AG	See Table 608.15.1 for minimum air gaps
Potable water outlet	Reduced Pressure Principle	RP	
Potable water outlet	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Potable water outlet	Pressure Vacuum Breaker	PVB	At least 6" above flood level rim
Potable water outlet	Intermed Atmospheric Vent	IAV	
Potable water outlet	Deck Mounted and Integral Vacuum Breakers	IVB	At least 1" above flood level rim
Print Washer	Pressure Vacuum Breaker	PVB	At least 6" above flood level rim
RO Water System	Reduced Pressure Principle	RP	
Shower (telephone type)	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Sink with threaded outlet	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Sterilizer	Reduced Pressure Principle	RP	
Still	Reduced Pressure Principle	RP	
Ventilating hood with washdown system	Atmospheric Vacuum Breaker	AVB	At least 6" above flood level rim
Water service entrance	Reduced Pressure Principle	RP	

Table 608.1 Application of Backflow Preventers

TABLE 608.1
APPLICATION OF BACKFLOW PREVENTERS

DEVICE	DEGREE OF HAZARD[a]	APPLICATION[b]	APPLICABLE STANDARDS
Air gap	High or low hazard	Backsiphonage or backpressure	ASME A112.1.2
Air gap fittings for use with plumbing fixtures, appliances and appurtenances	High or low hazard	Backsiphonage or backpressure	ASME A112.1.3
Antisiphon-type fill valves for gravity water closet flush tanks	High hazard	Backsiphonage only	ASSE 1002, CSA B125
Backflow preventer for carbonated beverage machines	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$"- $^3/_8$"	ASSE 1022, CSA B64.3.1
Backflow preventer with intermediate atmospheric vents	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$" - $^3/_4$"	ASSE 1012, CSA B64.3
Barometric loop	High or low hazard	Backsiphonage only	(See Section 608.13.4)
Double check backflow prevention assembly and double check fire protection backflow prevention assembly	Low hazard	Backpressure or backsiphonage Sizes $^3/_8$" - 16"	ASSE 1015, AWWA C510, CSA B64.5, CSA B64.5.1
Double check detector fire protection backflow prevention assemblies	Low hazard	Backpressure or backsiphonage (Fire sprinkler systems) Sizes 2" - 16"	ASSE 1048
Dual-check-valve-type backflow preventer	Low hazard	Backpressure or backsiphonage Sizes $^1/_4$" - 1"	ASSE 1024, CSA B64.6
Hose connection backflow preventer	High or low hazard	Low head backpressure, rated working pressure, backpressure or backsiphonage Sizes $^1/_2$"-1"	ASSE 1052, CSA B64.2.1.1
Hose connection vacuum breaker	High or low hazard	Low head backpressure or backsiphonage Sizes $^1/_2$", $^3/_4$", 1"	ASSE 1011, CSA B64.2, CSA B64.2.1
Laboratory faucet backflow preventer	High or low hazard	Low head backpressure and backsiphonage	ASSE 1035, CSA B64.7
Pipe-applied atmospheric-type vacuum breaker	High or low hazard	Backsiphonage only Sizes $^1/_4$" - 4"	ASSE 1001, CSA B64.1.1
Pressure vacuum breaker assembly	High or low hazard	Backsiphonage only Sizes $^1/_2$" - 2"	ASSE 1020, CSA B64.1.2
Reduced pressure principle backflow preventer and reduced pressure principle fire protection backflow preventer	High or low hazard	Backpressure or backsiphonage Sizes $^3/_8$"- 16"	ASSE 1013, AWWA C511, CSA B64.4, CSA B64.4.1
Reduced pressure detector fire protection backflow prevention assemblies	High or low hazard	Backsiphonage or backpressure (Fire sprinkler systems)	ASSE 1047
Spillproof vacuum breaker	High or low hazard	Backsiphonage only Sizes $^1/_4$"-2"	ASSE 1056
Vacuum breaker wall hydrants, frost-resistant, automatic draining type	High or low hazard	Low head backpressure or backsiphonage Sizes $^3/_4$", 1"	ASSE 1019, CSA B64.2.2

For SI: 1 inch = 25.4 mm.

a. Low hazard–See Pollution (Section 202).
High hazard–See Contamination (Section 202).

b. See Backpressure (Section 202).
See Backpressure, low head (Section 202).
See Backsiphonage (Section 202).

VA Master Construction Specifications
Backflow Preventer Section

strainer on inlet side of, and same size as pressure reducing valve. Install pressure gage on low pressure side of line.

2.3 AIR PRESSURE REDUCING VALVE AND CONNECTIONS

Under seventy-five millimeters (3 inches), bronze body and trim, 75 mm (3 inches) and over, cast-iron body with bronze trim. Single seated, for dead end service for 200 to 1025 kPa (30 to 150 pounds) range on low pressure side. Composition diaphragm and bronze spring to act directly on valve stem. Delivered pressure shall not vary more than one kPa for each 10 kPa (one pound for each 10 pounds) variation in inlet pressure.

2.4 BACKWATER VALVE

Flap type, hinged or pivoted, with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, pivot, disc and seat shall be nonferrous metal. Normal position of disc shall be slightly open. Extend the cleanout to the finished floor and fit with threaded countersunk plug. Provide clamping device wherever the cleanout extends through the membrane waterproofing.

2.5 BACKFLOW PREVENTERS

A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be certified by the American Society of Sanitary Engineers. Listed below is a partial list of connection to the potable water system which shall be protected against backflow or back siphonage.

B. Reduced Pressure Backflow Preventer: ASSE 1013.
   1. Deionizers.
   2. Sterilizers.
   3. Stills.
   4. Dialysis, Deionized or Reverse Osmosis Water Systems.
   5. Water make-up to heating systems, cooling tower, chilled water system, and generators.
   6. Water service entrance from loop system.

C. Pressure Type: ASSE 1020
   1. Water make-up to heating systems, cooling tower, chilled water system, and generators.
   2. Dental equipment.
   3. Print washer.

D. Atmospheric Vacuum Breaker: ASSE 1001

1. Hose bibs and sinks w/threaded outlets.
2. Disposers.
3. Showers (telephone type).
4. Hydrotherapy units.
5. Autopsy - on each hot and cold water outlet at each table or sink.
6. All kitchen equipment, if not protected by air gap.
7. Ventilating hoods w/washdown system.
8. Film processor.
9. Detergent system.
10. Dental equipment.
11. Fume hoods.
12. Glassware washers.

E. Double Check Detector Backflow Prevention Assembly: Fire service. ASSE 1015.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the PHCC National Standard Plumbing Code and the following:

1. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
2. Install union and shut-off valve on pressure piping at connections to equipment.
3. Backflow prevention device shall be installed in an accessible location, 5 (five) feet above finish floor.

- - E N D - - -

EPA Cross-Connection Control Manual Chapter Four - Methods and Devices for the Prevention of Backflow and Back-Siphonage

Methods and Devices for the Prevention of Backflow and Back-Siphonage

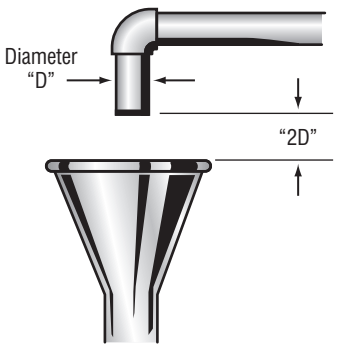
A wide choice of devices exists that can be used to prevent backsiphonage and backpressure from adding contaminated fluids or gases into a potable water supply system. Generally, the selection of the proper device to use is based upon the degree of hazard posed by the cross-connection. Additional considerations are based upon piping size, location, and the potential need to periodically test the devices to insure proper operation.

There are six basic types of devices that can be used to correct cross-connections: air gaps, barometric loops, vacuum breakers—both atmospheric and pressure type, double check with intermediate atmospheric vent, double check valve assemblies, and reduced pressure principle devices. In general, all manufacturers of these devices, with the exception of the barometric loop, produce them to one or more of three basic standards, thus insuring the public that dependable devices are being utilized and marketed. The major standards in the industry are: American Society of Sanitary Engineers ASSE), American Water Works Association (AWWA), and the University of California Foundation for Cross-Connection Control and Hydraulic Research.

Air Gap

Air gaps are non-mechanical backflow preventers that are very effective devices to be used where either backsiphonage or backpressure conditions may exist. Their use is as old as piping and plumbing itself, but only relatively recently have standards been issued that standardize their design. In general, the air gap must be twice the supply pipe diameter but never less than one inch. See Figure 12.

FIGURE 12.
Air gap.



An air gap, although an extremely effective backflow preventer when used to prevent backsiphonage and backpressure conditions, does interrupt the piping flow with corresponding loss of pressure for subsequent use. Consequently, air gaps are primarily used at end of the line service where reservoirs or storage tanks are desired. When contemplating the use of an air gap, some other considerations are:

(1) In a continuous piping system, each air gap requires the added expense of reservoirs and secondary pumping systems.

(2) The air gap may be easily defeated in the event that the "2D" requirement was purposely or inadvertently compromised. Excessive splash may be encountered in the event that higher than anticipated pressures or flows occur. The splash may be a cosmetic or true potential hazard—the simple solution being to reduce the "2D" dimension by thrusting the supply pipe into the receiving funnel. By so doing, the air gap is defeated.

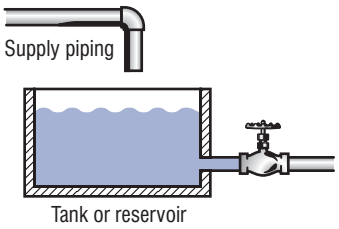
(3) At an air gap, we expose the water to the surrounding air with its inherent bacteria, dust particles, and other airborne pollutants or contaminants. In addition, the aspiration effect of the flowing water can drag down surrounding pollutants into the reservoir or holding tank.

(4) Free chlorine can come out of treated water as a result of the air gap and the resulting splash and churning effect as the water enters the holding tanks. This reduces the ability of the water to withstand bacteria contamination during long term storage.

(5) For the above reasons, air gaps must be inspected as frequently as mechanical backflow preventers. They are not exempt from an in-depth cross-connection control program requiring periodic inspection of all backflow devices.

Air gaps may be fabricated from commercially available plumbing components or purchased as separate units and integrated into plumbing and piping systems. An example of the use of an air gap is shown in Figure 13.

FIGURE 13.
Air gap in a piping system.



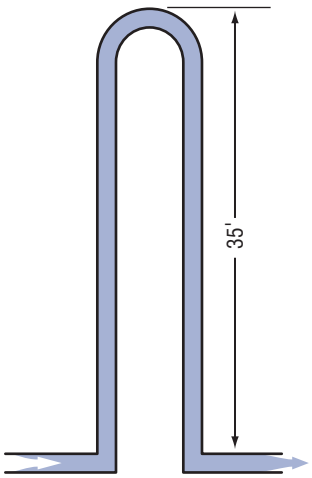
Barometric Loop

The barometric loop consists of a continuous section of supply piping that abruptly rises to a height of approximately 35 feet and then returns back down to the originating level. It is a loop in the piping system that effectively protects against backsiphonage. It may not be used to protect against back-pressure.

Its operation, in the protection against back-siphonage, is based upon the principle that a water column, at sea level pressure, will not rise above 33.9 feet (Ref. Chapter 3, Fig. 4 Page 13).

In general, barometric loops are locally fabricated, and are 35 feet high.

FIGURE 14.
Barometric loop.



Atmospheric Vacuum Breaker

These devices are among the simplest and least expensive mechanical types of backflow preventers and, when installed properly, can provide excellent protection against back-siphonage. They must not be utilized to protect against backpressure conditions. Construction consists usually of a polyethylene float which is free to travel on a shaft and seal in the uppermost position against atmosphere with an elastomeric disc. Water flow lifts the float, which then causes the disc to seal. Water pressure keeps the float in the upward sealed position. Termination of the water supply will cause the disc to drop down venting the unit to atmosphere and thereby opening downstream piping to atmospheric pressure, thus preventing backsiphonage. Figure 15 shows a typical atmospheric breaker.

In general, these devices are available in ½-inch through 3-inch size and must be installed vertically, must not have shutoffs downstream, and must be installed at least 6-inches higher than the final outlet. They cannot be tested once they are installed in the plumbing system, but are, for the most part, dependable, trouble-free devices for backsiphonage protection.

FIGURE 15.
Atmospheric vacuum breaker.

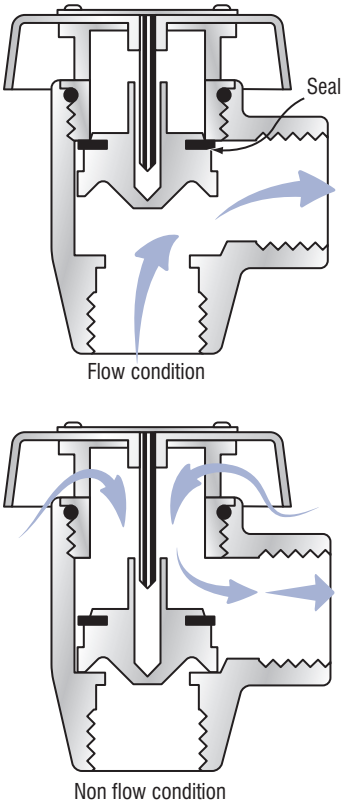


Figure 16 shows the generally accepted installation requirements—note that no shutoff valve is downstream of the device that would otherwise keep the atmospheric vacuum breaker under constant pressure.

Figure 17 shows a typical installation of an atmospheric vacuum breaker in a plumbing supply system.

FIGURE 16.
Atmospheric vacuum breaker typical installation.

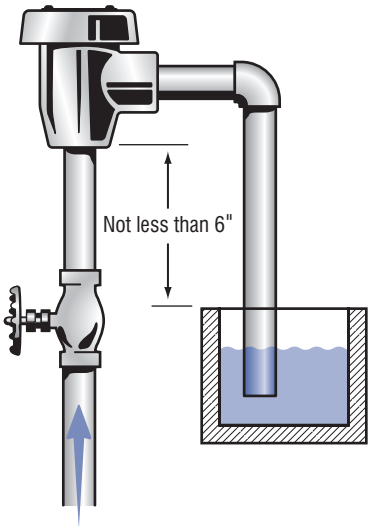


FIGURE 17.
Atmospheric vacuum breaker in plumbing supply system.

Hose Bibb Vacuum Breakers

These small devices are a specialized application of the atmospheric vacuum breaker. They are generally attached to sill cocks and in turn are connected to hose supplied outlets such as garden hoses, slop sink hoses, spray outlets, etc. They consist of a spring loaded check valve that seals against an atmospheric outlet when water supply pressure is turned on. Typical construction is shown in Figure 18.

When the water supply is turned off, the device vents to atmosphere, thus protecting against backsiphonage conditions. They should not be used as backpressure devices. Manual drain options are available, together with tamper-proof versions. A typical installation is shown in Figure 19.

FIGURE 19.
Typical installation of hose bibb vacuum breaker.

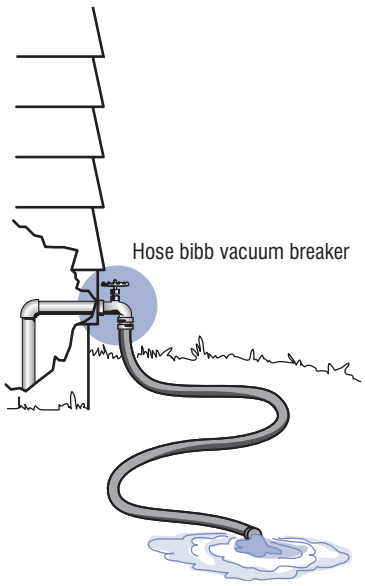
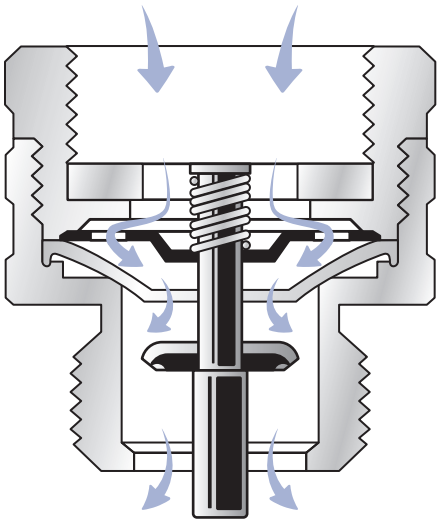


FIGURE 18.
Hose bibb vacuum breaker.



Pressure Vacuum Breakers

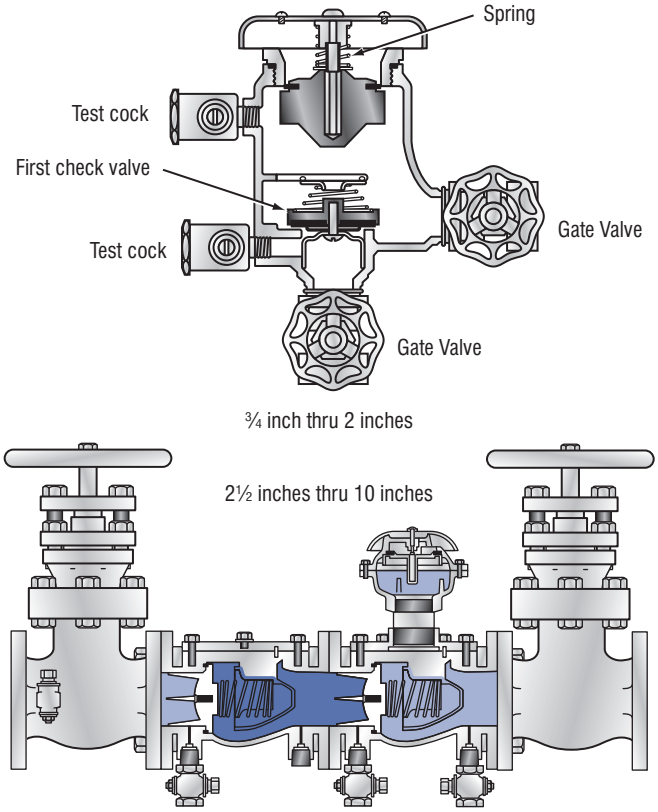
This device is an outgrowth of the atmospheric vacuum breaker and evolved in response to a need to have an atmospheric vacuum breaker that could be utilized under constant pressure and that could be tested in line. A spring on top of the disc and float assembly, two added gate valves, test cocks, and an additional first check, provided the answer to achieve this device. See Figure 20.

These units are available in the general configurations as shown in Figure 20 in sizes ½-inch through 10-inch and have broad usage in the agriculture and irrigation market. Typical agricultural and industrial applications are shown in Figure 21.

Again, these devices may be used under constant pressure but do not protect against backpressure conditions. As a result, installation must be at least 6- to 12-inches higher than the existing outlet.

A spill resistant pressure vacuum breaker (SVB) is available that is a modification to the standard pressure vacuum breaker but specifically designed to minimize water spillage. Installation and hydraulic requirements are similar to the standard pressure vacuum breaker and the devices are recommended for internal use.

FIGURE 20.
Pressure vacuum breaker



Double Check with Intermediate Atmospheric Vent

The need to provide a compact device in ½-inch and ¾-inch pipe sizes that protects against moderate hazards, is capable of being used under constant pressure and that protects against backpressure, resulted in this unique backflow preventer. Construction is basically a double check valve having an atmospheric vent located between the two checks (See Figure 22).

Line pressure keeps the vent closed, but zero supply pressure or backsiphonage will open the inner chamber to atmosphere. With this device, extra protection is obtained through the atmospheric vent capability. Figure 23 shows a typical use of the device on a residential boiler supply line.

FIGURE 21.
Typical agricultural and industrial application of pressure vacuum breaker.

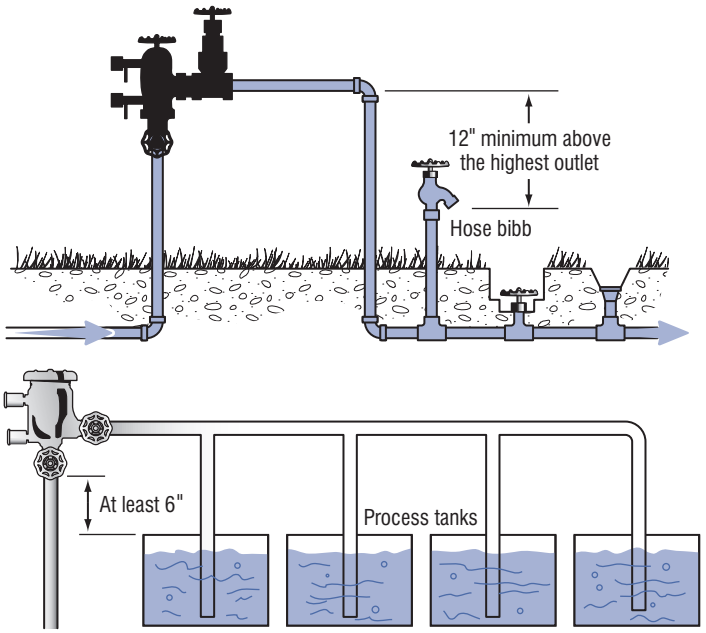


FIGURE 22.
Double check valve with atmospheric vent.

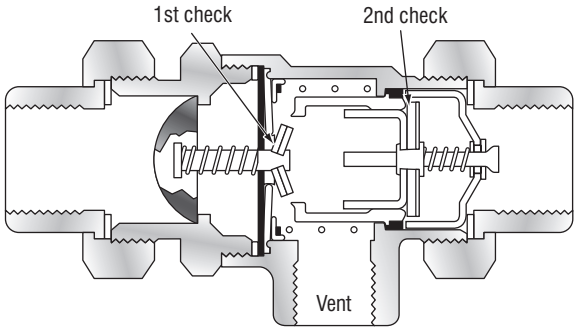
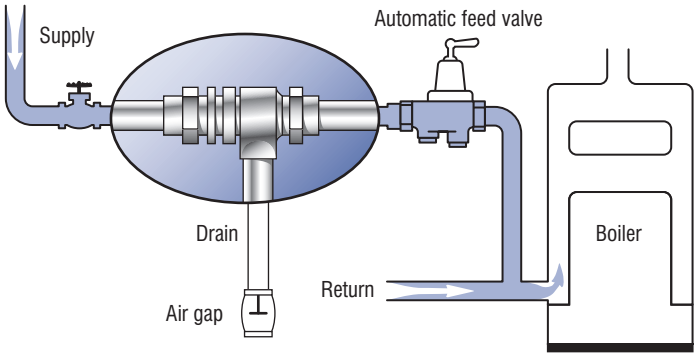


FIGURE 23.
Typical residential use of double check with atmospheric vent.



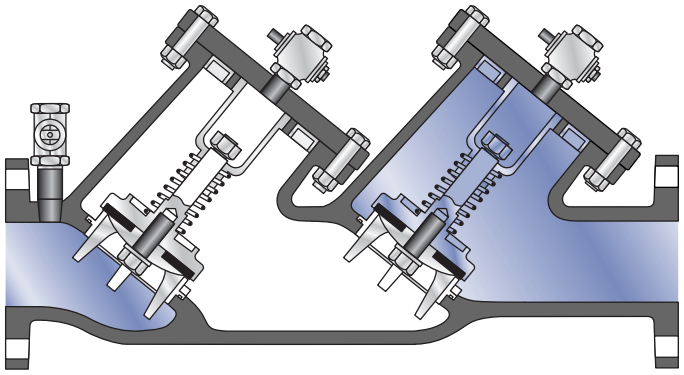
Double Check Valve

A double check valve is essentially two single check valves coupled within one body and furnished with test cocks and two tightly closing gate valves (See Figure 24).

The test capability feature gives this device a big advantage over the use of two independent check valves in that it can be readily tested to determine if either or both check valves are inoperative or fouled by debris. Each check is spring loaded closed and requires approximately a pound of pressure to open.

This spring loading provides the ability to "bite" through small debris and still seal—a protection feature not prevalent in unloaded swing check valves. Figure 24 shows a cross section of double check valve complete with test cocks. Double checks are commonly used to protect against low to medium hazard installations such as food processing steam kettles and apartment projects. They may be used under continuous pressure and protect against both backsiphonage and backpressure conditions.

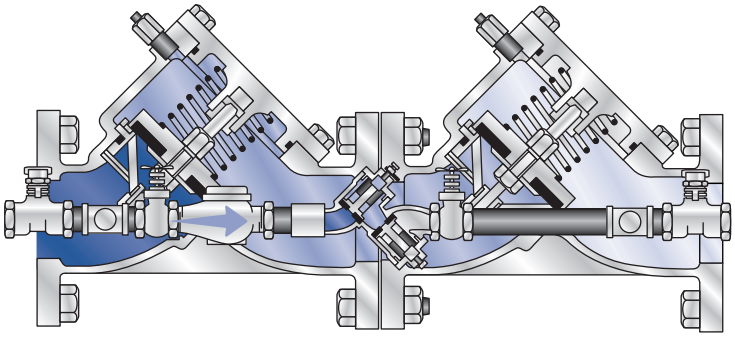
FIGURE 24.
Double check valve.



Double Check Detector Check

This device is an outgrowth of the double check valve and is primarily utilized in fire line installations. Its purpose is to protect the potable supply line from possible contamination or pollution from fire line chemical additives, booster pump fire line backpressure, stagnant "black water" that sits in fire lines over extended periods of time, the addition of "raw" water through outside fire pumper connections (Siamese outlets), and the detection of any water movement in the fire line water due to fire line leakage or deliberate water theft. It consists of two, spring loaded check valves, a bypass assembly with water meter and double check valve, and two tightly closing gate valves. See Figure 25. The addition of test cocks makes the device testable to insure proper operation of both the primary checks and the bypass check valve. In the event of very low fire line water usage, (theft of water) the low pressure drop inherent in the bypass system permits the low flow of water to be metered through the bypass system. In a high flow demand, associated with deluge fire capability, the main check valves open, permitting high volume, low restricted flow, through the two large spring loaded check valves.

FIGURE 25.
Double check detector check.



Residential Dual Check

The need to furnish reliable and inexpensive backsiphonage and backpressure protection for individual residences resulted in the debut of the residential dual check. Protection of the main potable supply from household hazards such as home photograph chemicals, toxic insect and garden sprays, termite control pesticides used by exterminators, etc., reinforced, a true need for such a device. Figure 26 shows a cutaway of the device.

It is sized for ½-, ¾-, and 1-inch service lines and is installed immediately downstream of the water meter. The use of plastic check modules and elimination of test cocks and gate valves keeps the cost reasonable while providing good, dependable protection. Typical installations are shown in Figures 27 and 28.

FIGURE 26.
Residential dual check.

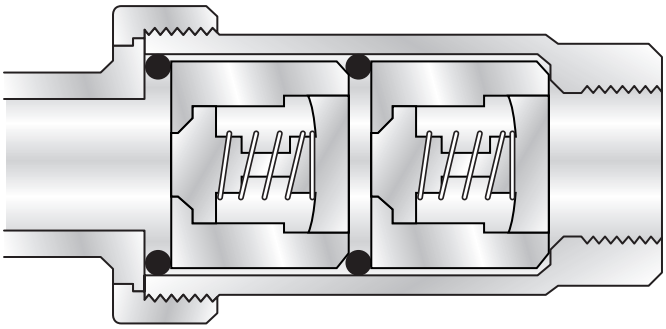


FIGURE 27.
Residential installation.

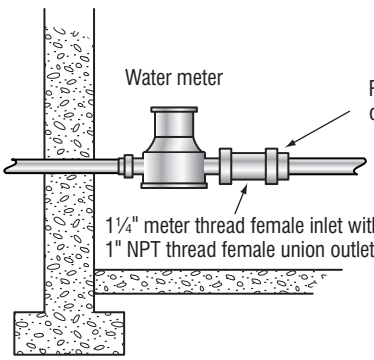
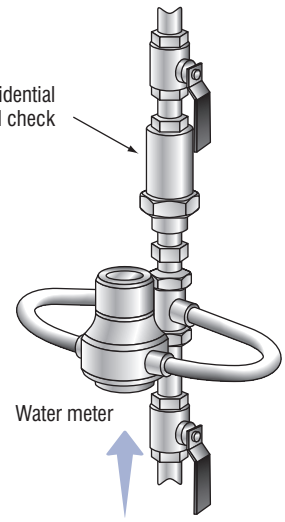


FIGURE 28.
Copper horn.



Reduced Pressure Principle Backflow Preventer

Maximum protection is achieved against backsiphonage and backpressure conditions utilizing reduced pressure principle backflow preventers. These devices are essentially modified double check valves with an atmospheric vent capability placed between the two checks and designed such that this "zone" between the two checks is always kept at least two pounds less than the supply pressure. With this design criteria, the reduced pressure principle backflow preventer can provide protection against backsiphonage and backpressure when both the first and second checks become fouled. They can be used under constant pressure and at high hazard installations. They are furnished with test cocks and gate valves to enable testing and are available in sizes ¾-inch through 10 inch.

Figure 29A shows typical devices representative of ¾-inch through 2-inch size and Figure 29B shows typical devices representative of 2½-inch through 10-inch sizes.

FIGURE 29A.
Reduced pressure zone backflow preventer (¾-inch thru 2-inches).

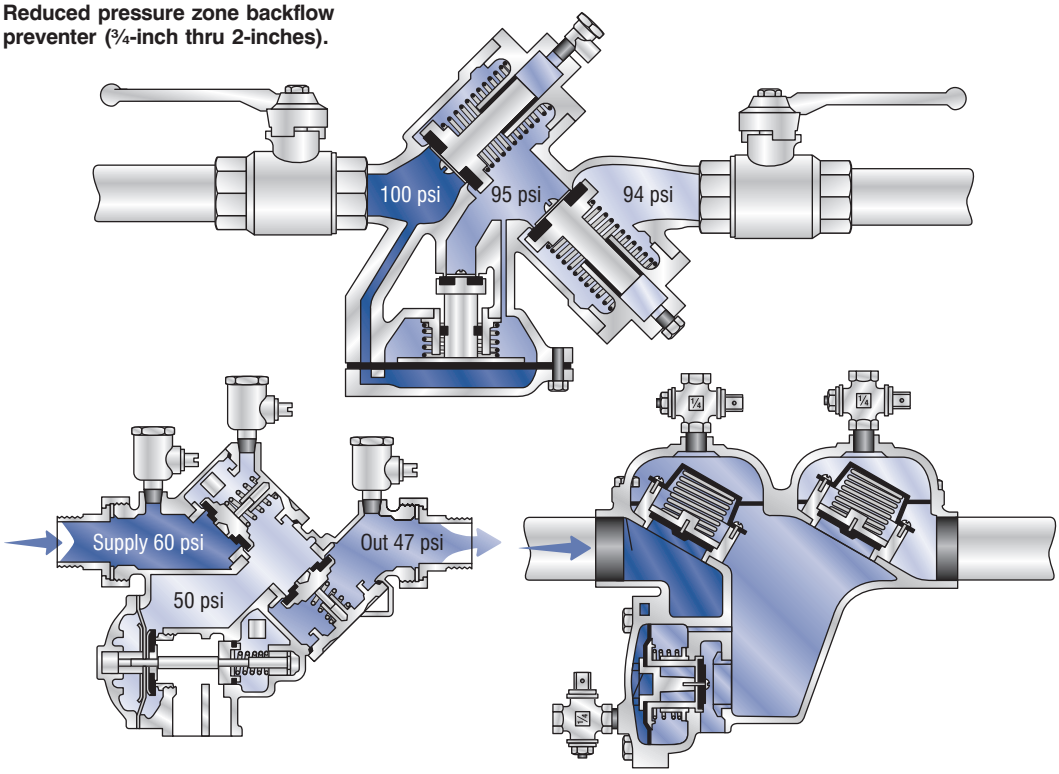
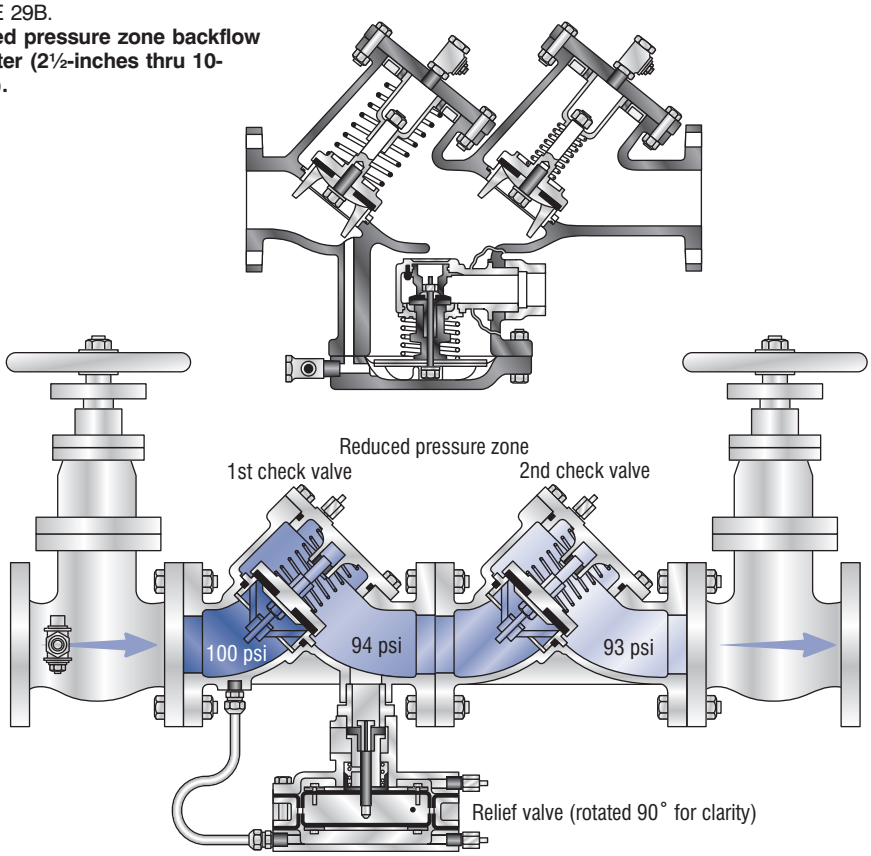


FIGURE 29B.
Reduced pressure zone backflow preventer (2½-inches thru 10-inches).



The principles of operation of a reduced pressure principle backflow preventer are as follows:

Flow from the left enters the central chamber against the pressure exerted by the loaded check valve 1. The supply pressure is reduced thereupon by a predetermined amount. The pressure in the central chamber is maintained lower than the incoming supply pressure through the operation of the relief valve 3, which discharges to the atmosphere whenever the central chamber pressure approaches within a few pounds of the inlet pressure. Check valve 2 is lightly loaded to open with a pressure drop of 1 psi in the direction of flow and is independent of the pressure required to open the relief valve. In the event that the pressure increases downstream from the device, tending to reverse the direction of flow, check valve 2 closes, preventing backflow. Because all valves may leak as a result of wear or obstruction, the protection provided by the check valves is not considered sufficient. If some obstruction prevents check valve 2 from closing tightly, the leakage back into the central chamber would increase the pressure in this zone, the relief valve would open, and flow would be discharged to the atmosphere.

When the supply pressure drops to the minimum differential required to operate the relief valve, the pressure in the central chamber should be atmospheric. If the inlet pressure should become less than atmospheric pressure, relief valve 3 should remain fully open to the atmosphere to discharge any water which may be caused to backflow as a result of backpressure and leakage of check valve 2.

Malfunctioning of one or both of the check valves or relief valve should always be indicated by a discharge of water from the relief port. Under no circumstances should plugging of the relief port be permitted because the device depends upon an open port for safe operation. The pressure loss through the device may be expected to average between 10 and 20 psi within the normal range of operation, depending upon the size and flow rate of the device.

Reduced pressure principle backflow preventers are commonly installed on high hazard installations such as plating plants, where they would protect against primarily backsiphonage potential, car washes where they would protect against backpressure conditions, and funeral parlors, hospital autopsy rooms, etc. The reduced pressure principle backflow preventer forms the backbone of cross-connection control programs. Since it is utilized to protect against high hazard installations, and since high hazard installations are the first consideration in protecting public health and safety, these devices are installed in large quantities over a broad range of plumbing and water works installations. Figures 31 and 32 show typical installations of these devices on high hazard installations.

FIGURE 30.
Reduced pressure zone backflow preventer — principle of operation.

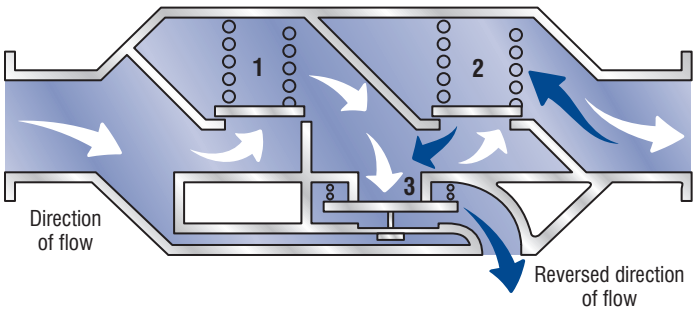


FIGURE 31.
Plating plant installation.

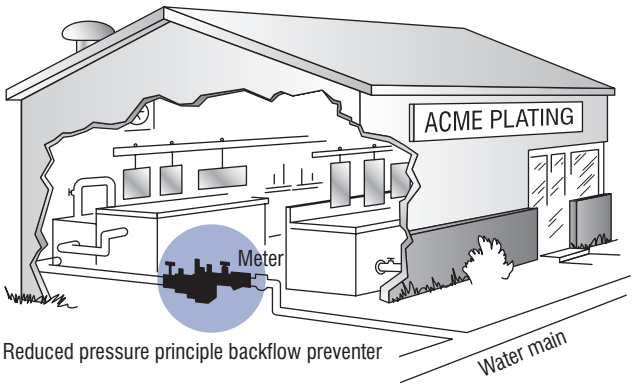


FIGURE 32.
Car wash installation.

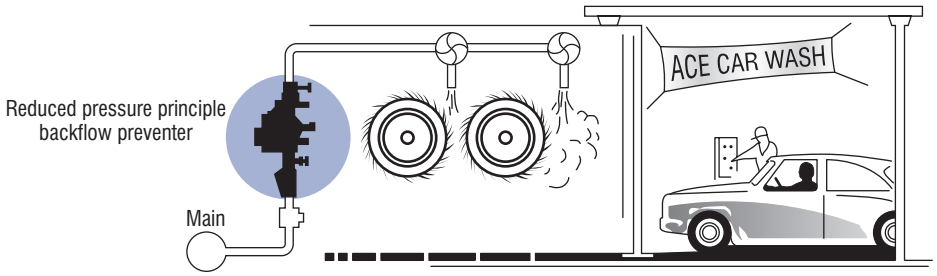
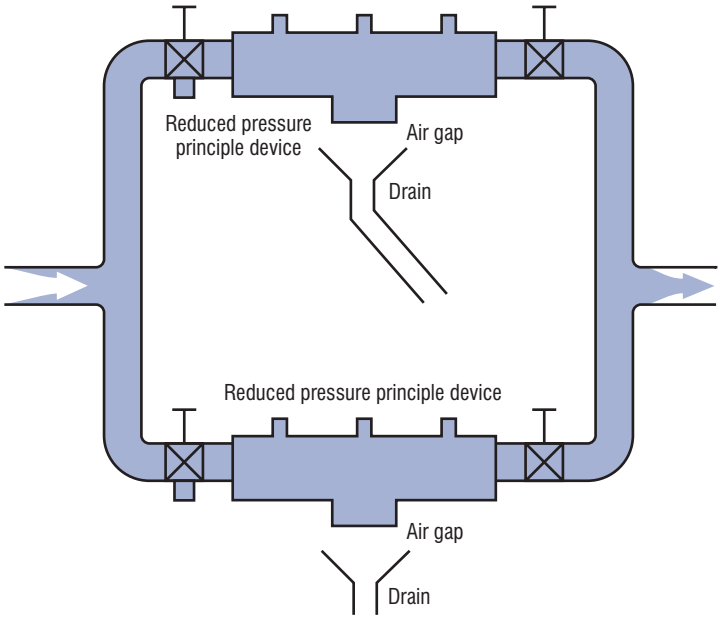


FIGURE 33.
Typical bypass configuration reduced pressure principle devices



Note: Devices to be set a min. of 12" and a max. of 30" from the floor and 12" from any wall.

FIGURE 34.
Typical installation reduced pressure principle device horizontal illustration.

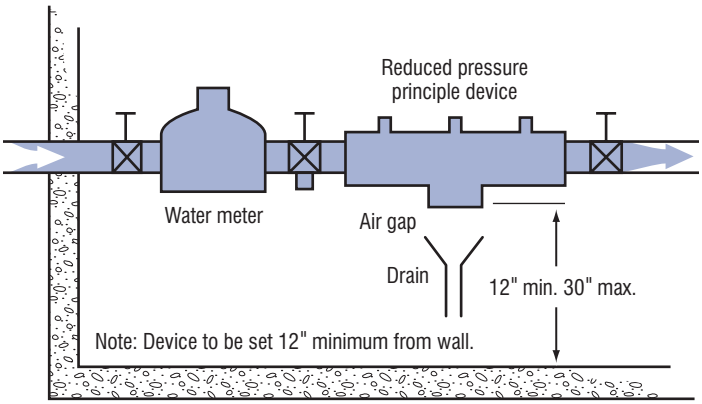
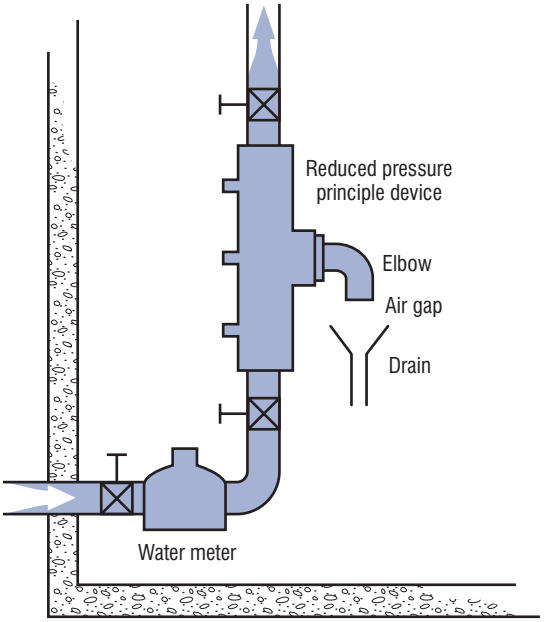


FIGURE 35.
Typical installation reduced pressure principle device vertical illustration.



Note: (1) Refer to manufacturers installation data for vertical mount.
(2) Unit to be set at a height to permit ready access for testing and service.
(3) Vertical installation only to be used if horizontal installation cannot be achieved.

Typical fire line installation double check valve vertical installation.

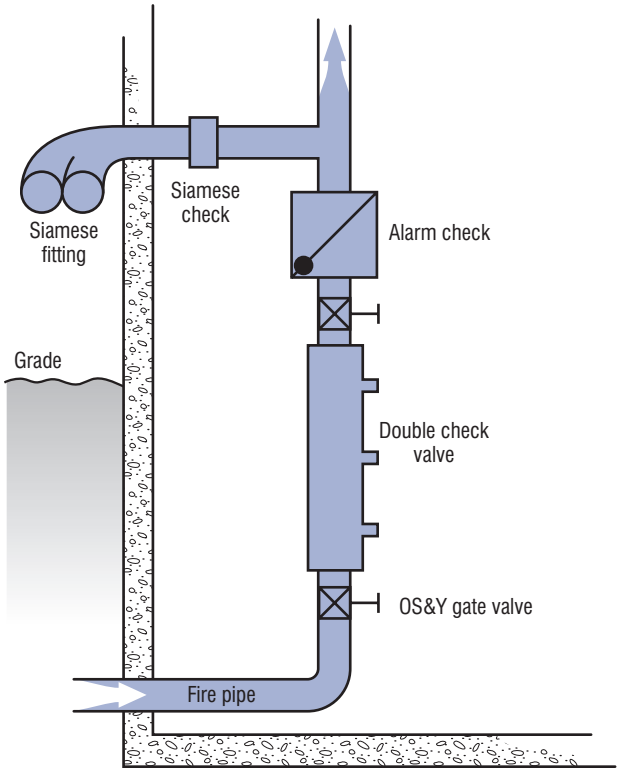
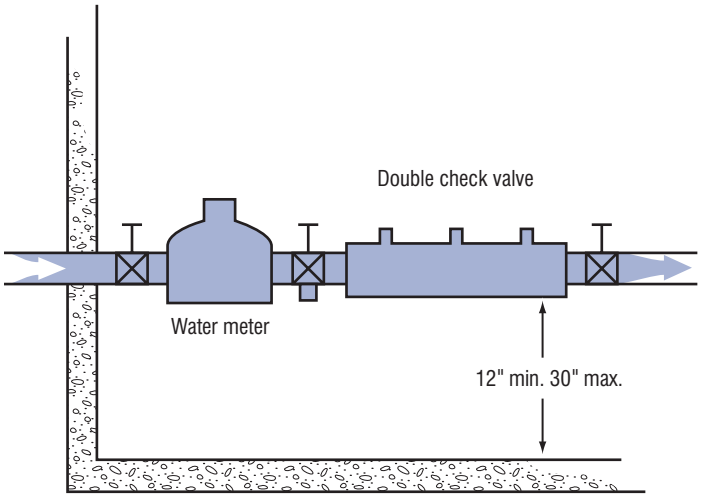
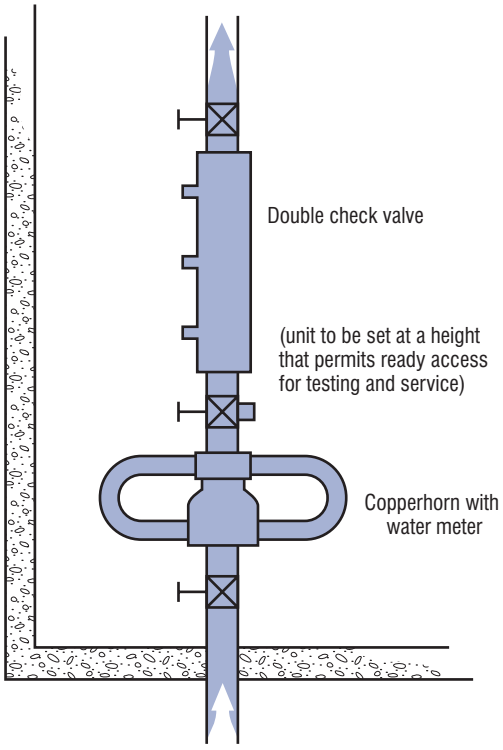


FIGURE 36.
Typical installation double check valve horizontal and vertical installation.





Note: Vertical installation only to be used if horizontal installation cannot be achieved.

FIGURE 37.
Typical installation residential dual check with straight set and copperhorn.