22. Specialty Valves.

a. Types of Specialty Valves.

1) Use of the following specialty valves is covered in this section: Altitude Valve, Pressure Reducing Valve, Pressure Relief Valve, Swing Check Valve, Backflow Preventer, Butterfly Valve, Eccentric Plug Valve and Line Stops.

b. General Requirements for Valve and Piping Arrangement in Vaults.

1) Vault Location and Layout.

a) Location of vaults:

(1) Locate vaults out of the roadway right of way or easement. Provide rights of way and construction strips for vault and piping, see Part Three, Section 2 (Rights of Way and Construction Strips).

(2) Vaults shall be out of paved roadways.

(3) Vaults shall be located away from drainage paths to prevent storm water from flowing into the vault.

2) Design of Vault Structures.

a) Allow a minimum of six and one half (6-1/2) feet of headroom inside the vault structure. The depth of the pipeline should be based on this dimension. For other requirements, see Part Three, Section 16 (Design of Pipeline Structures).

b) Provide no less than the minimum clearance above and below the specialty valve, per the manufacturer's requirements for maintaining the valve. For minimum inside height dimensions of the vault and additional design requirements, see Part One, Section 17 (Design of Structures).

c) The top elevation the access hatches or frames and covers shall be set at an elevation equal to or higher than the roadway centerline elevation. If the location selected for the vault will not allow the access opening elevation to be equal to or higher than the roadway centerline elevation, re-select the location for the vault.

d) All pipe connections into vaults shall have a watertight seal. Provide rubber annular hydrostatic sealing device in accordance with the Specifications and Standard Details.

e) Provide a sump in the vault.

f) If equipment access is not provided directly over the specialty valve in the vault, provide lifting hooks in the under side of top slab directly over the specialty valve, see Standard Detail W/10.0. The lifting hook and top slab must be designed to handle the additional loads that will be transmitted to the lifting hook and to the top slab.

g) Access to the vault location. When the vault location requires WSSC to detour traffic or close the roadway to traffic for maintenance of the vault, provide vehicle access to the vault. (Driveway, curb cutouts, etc.)

h) For additional structural design requirements for vaults, see Part One, Section 15, Design of Structures and Part Three, Section 16, Design of Pipeline Structures.

i) See requirements under WSSC Design Guideline 28-ME-DG-03, "Mechanical and Electrical Design Guidelines for Control Valve Vaults in the Water Distribution System that are to be Electrically Operated and Remotely Controlled".

j) Standard Details.

(1) When using the Standard Details for Pressure Reducing Valves and Pressure Relief Valves, verify that the depth of the proposed pipeline is adequate for the use of the Standard Details.

(2) The maximum vertical depth from the finished grade to the top of the bottom slab of Pressure Reducing Valve Vaults and Pressure Relief Valve Vaults shall be ten (10) feet.

[a] If the mainline water pipeline requires the bottom of the vault to be greater than the ten (10) feet vertical depth, design the piping from the mainline water pipeline to the vault to meet the requirements of the ten (10) feet vertical depth. Provide this design on the drawing, showing all necessary plan and section views, and label all materials, dimensions, etc.

[b] Soil investigation requirements for the use of Standard Details for Pressure Reducing Valve and Pressure Relief Valve Vaults.

[1] Provide a soil boring at the proposed location of the Pressure Reducing Valve Vault or Pressure Relief Valve Vault, see Part Three, Section 19, Geotechnical and Corrosion Submittals, for soil boring location requirements. Use the information on the boring logs to confirm the elevation of the groundwater table, prior to using the Standard Details for Pressure Reducing Valve Vaults and Pressure Relief Valve Vaults.

[2] Elevation of groundwater table must be at least two (2) feet below the bottom slab elevation of the Pressure Reducing Valve Vaults or Pressure Relief Valve Vaults. If the actual groundwater table is higher than the above, the Standard Details must be modified or provide a specially designed structure, see requirements for Special Design Structures.

k) Special Design Structures.

(1) Special designed structures are required if the Standard Details are not adequate for the particular design. Provide details on the drawings, showing all necessary plan and section views, and label all materials, dimensions, etc.

(2) When the soil investigation indicates that the elevation of the groundwater table is higher than two (2) feet below the bottom slab elevation of the Pressure Reducing Valve Vaults or Pressure Relief Valve Vaults, including special designs for waterproofing and dampproofing. See requirements under WSSC Design Guideline 28-ME-DG-03, "Mechanical and Electrical Design Guidelines for Control Valves Vaults in the Water Distribution System that are to be Electrically Operated and Remotely Controlled".

(3) For other design requirements, see information listed under each type of specialty valve.

3) Vault Access.

a) For additional requirements for vault access, see requirements listed under each type of specialty valve.

b) When hatches are provided, design the hatch drain as follows:

(1) When the top slab is set above grade, design the hatch drain to discharge outside the vault.

(2) When the hatch is set to grade, design the hatch drain to discharge into the vault, see Standard Details W/4.2, W/4.3 and W/4.4 for additional requirements.

4) Vault Piping.

a) Provide adequate space between the bolted flanges and the wall where pipes enter and exit the vault, see Part Three, Section 14 (Pipe Joint Clearances within Structures).

b) Provide adequate support for all valves and piping within the vault, see Standard Detail W/2.4 for typical design requirements.

c) Provide a mechanical coupling, see Standard Detail B/3.0, or a mechanical joint solid sleeve with wedge action retainer gland, see Standard Detail B/2.7.

d) Provide flanged ends with pressure ratings similar to gate valves (Class 125 or 250 valves), see Part One, Section 19 (Pipeline Valves) for requirements.

e) Verify the pressure rating of the specialty valve. Provide the setting information on the Drawings in accordance with Standard Detail W/4.4.

f) For additional requirements for vault piping, see requirement listed under each type of specialty valve.

c. Altitude Valves.

1) In most cases, altitude valves are designed for installation at water storage facilities (elevated tanks, standpipes or reservoirs). The altitude valve controls the water level in the facility at a specified level and prevents overflow. Altitude valves can be designed to operate in two ways.

a) The first way is to only control the filling or refilling of the facility when the water level is low. A check valve or other means to control the withdrawal of water from the facility is required. This type of altitude valve is called a single acting altitude valve.

b) The second way is to control both the filling/refilling and the withdrawal of water from the facility. This valve will control both the water level of the facility and the operating pressure of the piping system. When the water level in the facility is low, the valve will open and allow the facility to refill and when the piping system is below the system operating pressure, the valve will open and allow the facility to maintain a level of pressure in the piping to operate the piping system. The valve will close when both the facility and the piping system are at the designed operating level. This type of altitude valve is called a double acting altitude valve.

c) WSSC normally designs systems using the single acting altitude valve. WSSC will provide guidance on the type of altitude valve to be used.

2) Altitude valve and piping arrangements.

a) Design a vault to house the altitude valve and appurtenances. For additional requirements, see General Valve and Piping Arrangements in Vaults, in this section. Do not design the altitude valve for direct buried service.

b) Access Openings. Provide two openings, an equipment access opening directly over the center of the altitude valve for removal of the altitude valve and a personnel access opening located between the altitude valve and the bypass piping or offset to one side. If only the altitude valve is located within the vault, locate the personnel access opening in such a way that there are no obstructions to climb up and down the ladder.

c) Piping Layout. Provide valves on each side of the altitude valve for maintenance or removal of the valve. Design a bypass line with a closed plug or gate valve around the altitude valve. WSSC will provide guidance on the type of valves to be used.

d. Pressure Reducing Valves (PRV).

1) WSSC will provide project specific requirements when the installation of a pressure reducing valve is necessary.

2) In most cases, pressure reducing valves are designed for connecting a higher pressure zone to a lower pressure zone.

3) A pressure reducing valve is used whenever a water pipeline of high working pressure needs to be reduced to a lower working pressure.

4) In most cases when a pressure reducing valve is required, the installation of a pressure relief valve will also be required, see requirements for Pressure Relief Valves, in this section.

5) Pressure reducing valves can be designed to operate in three ways.

a) The first way is to reduce the head in a transmission main connecting to a distribution system or reinforce the low pressure zone during periods of high demands. Typically, only one pressure reducing valve is installed with bypass piping.

b) The second way is to install two pressure reducing valves; a larger one to handle peak flows or fire flows and a smaller one to handle low flows. Usually the smaller valve is adjusted for a discharge pressure setting of five (5) psi above the setting of the larger valve so that the smaller valve will handle the low flow requirements. The larger valve opens only when demands exceed the capacity of the smaller valve, causing the pressure to drop to the pressure setting of the larger valve.

c) The third way is for use with water house connections. When the working pressure in the distribution main is over eighty (80) psi (static), the installation of a pressure reducing valve on the water house connections is required. This pressure reducing valve is typically installed after the meter, inside the house/building. For requirements, see The Plumbing Code.

d) Pressure reducing valves can be designed to operate in other ways not listed above, such as in cases when the design requires a device to control surges or to reverse the direction of the pipe flow. If the above types of conditions are encountered, follow the requirements stated in this section.

6) Pressure reducing valve and piping arrangements.

a) Piping layout.

(1) See requirements under General Valve and Piping Arrangements in Vaults, in this section and the following requirements:

(a) For pressure reducing valve sizes 12-inch and smaller diameter, see Standard Details W/4.2, W/4.3 and W/4.4.

(b) For pressure reducing valve sizes larger than 12-inch, provide details on the drawings. Design the vault to house the pressure reducing valve and appurtenances. For additional requirements, see General Valve and Piping Arrangements in Vaults, in this section.

(c) Do not design a pressure reducing valve for direct buried service.

(d) Restrain all joints, see Standard Detail W/4.4.

b) Vault design.

(1) For pressure reducing valve sizes 12-inch and smaller diameter, see Standard Details W/4.2 and W/4.3.

(2) Top slab design for pressure reducing valve vaults.

(a) For 4-inch diameter pressure reducing valves, provide top slab with opening over valve; see Standard Details W/4.2, W/4.3 and W/5.23.

(b) For 6-inch to 12-inch diameter pressure reducing valves, provide opening over valve for valve removal, see Standard Details W/4.2, W/4.3 and W/5.22.

(3) Soil investigations for determining groundwater elevations must be provided at the location of the pressure reducing valve vault, see General Valve and Piping Arrangements in Vaults in the section.

(4) For pressure reducing valve sizes larger than 12-inch, see General Valve and Piping Arrangements in Vaults in this section and requirements under WSSC Design Guideline 28-ME-DG-03, "Mechanical and Electrical Design Guidelines for Control Valves Vaults in the Water Distribution System that are to be Electrically Operated and Remotely Controlled".

c) Valves.

(1) Pressure reducing valve.

(a) Provide 3-inch and larger pressure reducing valves with flanged ends and a pressure rating designed similar to gate valves (Class 125 or 250 valves); see Part One, Section 18 (Pipeline Valves). For smaller than 3-inch pressure reducing valves, provide threaded ends in accordance with National Pipe Threads (NPT).

(b) Indicate on the Drawing the pressure reducing valve setting information, see Standard Detail W/4.4.

(2) Other Valves.

(a) Provide gate valves on each side of the pressure reducing valve to be located in the vault, for maintenance or removal of the pressure reducing valve.

(b) Provide bypass line with a closed gate valve around the pressure reducing valve. Typically the pressure reducing valve is located off the water pipeline and a gate valve is installed between the two branch connections of the pressure reducing valve.

(c) Provide corporation stops on each side of the pressure reducing valve, in the vault, see Standard Details W/4.2 and W/4.3.

d) Access Openings.

(1) Equipment access opening for pressure reducing valves.

(a) For 4-inch to 10-inch pressure reducing valves, provide an aluminum hatch in the top slab of the vault, see Standard Detail W/5.22 and W/5.23 for opening sizes.

(b) For 12-inch pressure reducing valves, provide an aluminum hatch in the top slab of the vault see Standard Detail W/5.22 for opening size.

(c) Locate the opening in the top slab of the vault directly over the center of the pressure reducing valve or as shown on Standard Detail W/5.22 and W/5.23. When two (2) pressure reducing valves are designed to be installed in the vault, provide an opening over the larger valve.

(2) Personnel access openings are to be located in the top slab of the vault in such a way that there are no obstructions to climb up and down the ladder steps.

(a) Provide an aluminum hatch for personnel access, rated for H20 loading, see Standard Details W/4.2 and W/4.3, and Part Three, Section 16, Design of Pipeline Structures.

(b) If two pressure reducing valves are designed, provide opening located between the valves; see Standard Details W/4.2 and W/4.3.

(3) Location of access openings, see General Valve and Piping Arrangements in Vaults in this section.

e) Vault Location.

(1) Locate the vault as follows:

(a) Vault shall not be located in roadway.

(b) Vault access openings shall be within ten (10) feet of edge of the roadway and outside the road right of way.

(c) Vault shall not be located in low areas (ditches, swales, etc.).

(2) If possible, provide access drive for off street parking of maintenance personnel.

e. Pressure Relief Valves (Relief Valve).

1) WSSC will provide project specific requirements when the installation of a pressure relief valve and vault is necessary.

2) In most cases pressure relief valves are designed to protect the water pipeline against excessive pressure.

3) A pressure relief valve should be used for the following conditions:

a) When the water pipeline has a pressure reducing valve connection from a higher pressure zone.

b) At a water pumping station on the discharge side of the pumps.

4) Determine the appropriate location for the pressure relief valve. Design the pressure relief valve hydraulically, so that the opening of the valve will occur relatively gradually to prevent pressure shock or water hammer conditions. Part of this design should include the distance between the pressure relief and pressure reducing valves, to eliminate the possibility of pressure shock or water hammer conditions causing the other valve to activate. This condition may cause the two valves to start opening and closing due to drastic fluctuations in pipeline pressure. When the valves are designed to be hydraulically distant, the piping system itself can help dampen the pressure change seen by both valves.

5) Pressure relief valve and piping arrangements.

a) For pressure relief valve sizes 6-inch and smaller, see Standard Detail W/4.5. Indicate pressure relief valve settings on the drawings along with a profile view of the pressure relief discharge piping.

b) For pressure relief valve sizes larger than 6-inch, provide details on the drawings. Design the vault to house the pressure relief valve and appurtenances. For additional requirements, see General Valve and Piping Arrangements in Vaults, in this section. Do not design the pressure relief valve for direct buried service.

c) Restrain all joint(s) on pressure relief piping and also provide thrust blocking on all fittings from the pressure relief valve to the flap valve.

d) Provide adequate cover over the pressure relief piping, see Part One, Section 4 (Selection of Pipe Material).

e) Piping Layout.

(1) See requirements under General Valve and Piping Arrangements in Vaults, in this section and the following requirements:

(a) For pressure relief valve sizes 6-inch and smaller diameter, see Standard Detail W/4.5.

(b) For pressure relief valve sizes larger than 8-inch, provide details on the drawings. Design the vault to house the pressure relief valve and appurtenances. For additional requirements, see General Valve and Piping Arrangements in Vaults, in this section.

(c) Do not design the pressure relief valve for direct buried service.

(d) Restrain all joints, from the mainline tee to the discharge outlet.

f) Vault design.

(1) For pressure relief valve sizes 6-inch and smaller diameter, see Standard Detail W/4.5.

(2) Soil investigation for determining groundwater elevation must be provided at the location of the pressure relief valve vault, see General Valve and Piping Arrangements in Vaults in this section.

(3) For pressure relief valve sizes larger than 8-inch, see General Valve and Piping Arrangements in Vaults in this section and requirements under WSSC Design Guideline 28-ME-DG-03, "Mechanical and Electrical Design Guidelines for Control Valves Vaults in the Water Distribution System that are to be Electrically Operated and Remotely Controlled".

g) Valve Design.

(1) Pressure relief valve.

(a) Provide 3-inch and larger pressure relief valves with flanged ends and a pressure rating designed similar to gate valves (Class 125 or 250 valves), see Part One, Section 18 (Pipeline Valves).

(b) Indicate on the Drawing, the pressure relief valve setting information; see Standard Detail W/4.5.

(2) Provide corporation stops on the pressure side of the pressure relief valve, in the vault, see Standard Details W/4.5.

h) Access Openings.

(1) Equipment access opening in the vault for pressure reducing valves larger than 8-inch: Design the access opening in the top slab of the vault so that it is large enough to remove the pressure relief valve. Place the opening directly over the center of the pressure reducing valve.

(2) Personnel access opening shall be located in such a way that there are no obstructions to climb up and down the ladder steps.

(a) Provide an aluminum hatch for personnel access, rated for H20 loading, see Standard Details W/4.5, and Part Three, Section 16, Design of Pipeline Structures.

(3) Location of access openings, see General Valve and Piping Arrangements in Vaults in this section.

i) Vault location.

(1) Locate the vault as follows:

(a) The vault shall not be located in a roadway.

(b) Vault access openings shall be within ten (10) feet of edge of the roadway and outside the

road right of way.

(c) The vault shall not be located in low areas (ditches, swales, etc.).

(2) If possible, provide an access drive for off street parking of maintenance personnel.

j) Discharge from the pressure relief valve.

(1) Design the discharge from the pressure relief valve to release to the atmosphere. Make adequate provisions to dispose of the discharged water.

(2) Under no circumstances shall the discharge piping be connected directly into a storm drain pipe or sanitary sewer pipe and/or any other type of storm drain or sanitary sewer structure (inlet, manhole, etc.).

(3) Provide a flap valve and end wall at the point of discharge, see Standard Detail W/4.6.

(4) The discharge piping must drain by gravity from the pressure relief valve to the end wall.

(5) Include protection of the channel against erosion caused by the discharge of water from the pressure relief valve into an open channel, see Standard Detail W/4.6. If discharge point is located near a ditch, stream, etc., see Part Three, Section 9 (Pipeline Stream Crossings). Provide design calculations showing that the stream and channel have the capacity to handle the volume of discharged water without causing downstream flooding, erosion or damage.

f. Swing Check Valves.

1) In most cases, check valves are used when the design requires an automatic valve to prevent backflow. However they are not adequate to prevent backflow of contaminated water or potable water from another system into the WSSC water system.

2) Check valves are mainly used in water pumping stations. The location of the check valve should be on the discharge side of the pumps to control the water pressure in the pipeline when the pumps are off and thereby preventing water from flowing back through the pumps.

3) Check valves can also be designed for used at the connection point between two different pressure zone pipelines. In this case, when the higher pressure zone pipeline pressure drops below the lower pressure zone pipeline, the check valve will open and allow water from the lower pressure zone to flow into the higher pressure zone. When the higher pressure zone goes back to the normal higher pressure, the check valve will close.

4) Determine the appropriate location for the check valve and submit. After location is determined, WSSC will provide the required sizes and the type of check valve to be used.

5) Check valve and piping arrangements.

a) Design a vault to house the check valve and appurtenances, for additional requirements, see General Valve and Piping Arrangements in Vaults, in this section. Do not design the check valve for direct buried service.

b) Equip check valves with a lever and weight for controlling the operation of the valve. No spring operated check valves will be permitted.

c) Access Opening.

(1) Provide an equipment access opening in the top slab of the vault, directly over the center of the check valve. Provide an opening large enough to allow for removal of the check valve.

(2) Provide a personnel access opening in the top of the slab of the vault, located in such a way that there are no obstructions to climb up and down the ladder.

g. Backflow Preventers.

1) Backflow preventers are required when the design has a direct connection between the WSSC water system (potable) and other water systems or equipment containing water or unknown substancees, including but not limited to the following:

a) Fire sprinkler service connection

b) Fire hydrant meter

c) Irrigation system

d) Commercial and industrial connections

2) See requirements for installing and testing backflow preventers in The Plumbing Code.

3) During the design, determine if the design requires a backflow preventer to be installed.

h. Butterfly Valves.

1) WSSC will determine if the design requires the use of butterfly valves in lieu of gate valves and will provide design requirements. Typically, butterfly valves are not permitted.

2) See requirements under Design Guideline 28-ME-DG-03, "Mechanical and Electrical Design Guidelines for Control Valves Vaults in the Water Distribution System that are to be Electrically Operated and Remotely Controlled".

i. Eccentric Plug Valves.

1) In most cases, plug valves are used as the bypass valve in altitude valve vaults and in some cases for pressure reducing valve vaults.

2) Plug valves can be used for direct buried service, see Part One, Section 18 (Pipeline Valves).

3) The plug rotates and has a passageway or port through it. The plug valve requires a one-quarter turn to move from the fully open to fully closed position. Plug valves may be used for throttling the flow of water through the pipeline.

4) WSSC will determine if the design requires the installation of plug valves.

5) Determine the appropriate location for the plug valve and submit design for approval.

6) Plug valve and piping arrangements.

a) Design a vault to house the plug valve and appurtenances. For additional requirements, see General Valve and Piping Arrangements in Vaults, in this section. For information on using plug valves for direct buried service, see requirements for gates valves, Part One, Section 18 (Pipeline Valves).

b) Eccentric plug valves shall have the plug stored in the upper quadrant of the valve body when the valve is fully open. The plug would then have to rotate downward to close. Show on the drawing the location of the plug seat when closed on the drawings.

c) Orient the plug so that the seat is opposite the high pressure side of the piping when in the closed position.

d) Access Opening.

(1) Provide an equipment access opening in the top slab of the vault directly over the center of the plug valve. The opening must be large enough to allow for removal of the plug valve.

(2) Provide a personnel access opening in the top slab of the vault in such a way that there are no obstructions to climb up and down the ladder or manhole steps. If the design requires two (2) parallel valves and piping, provide the opening between the valves.

e) Piping Layout.

(1) For requirements for vault piping when using eccentric plug valves, see gate valves, Part One, Section 18 (Pipeline Valves). Also see altitude and pressure reducing valves, in this section.

(2) The ends of the plug valves are to have flanged ends for vault installation and mechanical joint ends for direct burial installation.

j. Line Stop.

1) When shutdowns are determined to be impossible, line stops can be designed to temporarily shut down the existing water pipeline, see the Specification for requirements. Special thrust restraint will be required to restrain the line stop, see Part Three, Section 27 (Thrust Restraint Design for Buried Piping).

2) WSSC will determine if the design requires the installation of line stop.

3) Line stops provide a way to insert a temporary plug into an existing water pipeline through a tapping tee, stopping the flow of water to facilitate repairs, maintenance or connections without disrupting service.