26. Air Valves.

a. General.

1) Ideally, the vertical alignment of sewage force main(s) and grinder pump pressure sewer systems should have only one high point at the discharge point to the gravity sewer. Air release and air and vacuum valves require frequent maintenance in order for them to function as intended. Consider the cost of maintaining the air valves versus the cost associated with eliminating high points on the profile and constructing the force main, or pressure sewer deeper to accommodate the air release, and air and vacuum valves.

b. Design Requirements.

1) First, consider the cost of constructing the force main or pressure sewer deeper to eliminate the need for air valves.

2) Determine the appropriate location and size for all air release, and air and vacuum valves and submit the design computations.

3) Sulfide build-up in the force main usually can be prevented by injection of compressed air into the force main at the pumping station. Unfortunately, air cannot always be used because of an irregular profile of the force main. Where air release, and air and vacuum valves will be used, determine the process of controlling sulfide buildup and coordinate with the design of the pumping station.

4) On profile, determine the invert of the pipeline using the design depth shown on the details for the air valve vaults and manholes, see the requirements under Part Two, Section 10 (Design of Structures).

5) Include coating of the interior of the air valve vault/manhole in the design, see Specifications.

c. Type and Piping Configuration.

1) The type of air release and air/vacuum valves used shall be for sewage application only. The air release and air/vacuum valves for sewage applications must be equipped with a back-flushing system. Do not use the type of air release and air/vacuum valves, which are for water mains.

2) Piping configuration.

a) Determine the piping configuration for air release, and air and vacuum valves in vaults or manholes and provide details on the drawings.

b) Take into account odor from sulfide buildup and locate the vent piping so as not to discharge odor into the air near homes, schools, churches or businesses. If venting of the air release, and air and vacuum valves must be discharged near homes, churches, schools or businesses, provide a deodorizing system.

d. Design of Air Vacuum Valves and Air Release Valves.

1) Air vacuum valves and air release valves for force mains and pressure sewers generally serve similar purposes as the valves designed for water pipelines. Attempt to avoid and minimize the use of air vacuum and air release valves in force mains and pressure sewers, because these valves

generally require regular maintenance to ensure proper performance. The same principles recommended for sizing and locating air valves on water pipelines may be considered applicable for force mains and pressure sewer applications. However, note the following differences.

a) Air valve design.

(1) Design pressure sewer system, air/vacuum valves and air release valves at the high point in the piping systems as a minimum requirement. High flow velocities generated during simultaneous operation of the maximum number of pumps, may remove some of the air entrapped in a downwardly sloping pipe. However, exact criteria for the velocity is lacking. Air valves would be needed if the volume of downwardly sloping pipe from a high point to the next low point is in excess of that which can be pumped out during a continuous pumping interval. Under these situations, air valves would be needed at intermediate points along the downward sloping pipe.

(2) Sizing.

(a) Since blowoff valves generally are not used for the maintenance of force mains or pressure sewer piping, air vacuum valves need not be sized for line draining through blowoff valves for normal maintenance. Air vacuum valves must be sized for line filling. In case of downhill pumping conditions, vacuum pressure can occur at high points elevated above the transition manhole, when pumps shut down. If vacuum pressure is to be prevented, then air vacuum valves should be sized to break the vacuum. However, downhill pumping conditions should be avoided in force main and pressure sewer systems.

(b) Evaluate the possibilities of catastrophic conditions such as column separation due to waterhammer effects, and buckling of force main due to internal vacuum. Large size sewage air vacuum valves may be used to alleviate these negative impacts. Air intake through air vacuum valves must be eventually released through small-orifice air release valves. Waterhammer analysis by computer modeling maybe needed for complex systems.

(c) Base the operating pressure to be used for sizing of air release valves for a force main on the HGL, developed for the sewage pumping/force main system, assuming new force main conditions, i.e., lower friction losses and lower HGL elevations.

(d) Consider the range of pumping rates (minimum to maximum) with estimated range of air release rate to arrive at optimum valve sizes. If the HGL profile elevations exceed the force main elevations during the minimum flow and accumulation of air or sewer gases is not of concern, air release valves may not be needed.