Where:

A = Surface area of the water in the pipeline, in m^2

D = inside diameter of main pipeline, in m

δ = angle of slope, in degrees

7.5.6. Actuators

There are three operating methods for valve actuators: multi-turn (used for gate, globe, and diaphragm valves), quarter-turn (used for ball, and butterfly valves), and linear (used for gate, diaphragm, and globe valves).

Manual or power actuated valve decision criteria are shown in Table 7-6.

Manual Operation	Where valve is easily accessible does not require automatic operation operated infrequently valves with a size ≥ DN 350 shall be provided with a gearbox
Power Actuators	where valves are remotely located frequent operation is required automatic operation is necessary due to system considerations power actuators shall be provided for isolation valves in pumping stations power source must be capable of exceeding the torque required by the actuator by an adequate safety factor

Table 7-6 – Manual vs Power Operated Valves

7.5.7. Equipment Isolation Valves

Gate valves shall be specified for equipment isolation. In line equipment shall have isolating valves upstream and downstream. Off-line equipment require only one isolating valve located upstream.

For small diameter pipes, e.g. on instrumentation, ball valves are permitted, but are not intended for controlling the rate of flow or pressure of water.

Wet well pumps, tubewell pumps and self-priming pumps shall have isolating valves at the discharge side.

7.5.8. Check and Flap Valves

Check valves shall be specified at the discharge of each pump and in surge vessels fitted with bypass.

Flap valves shall be provided at discharge chambers and outfalls.

Check valves shall avoid slamming after flow stoppage

Installation of check valves in vertical position is not permitted.

7.5.9. Air Release and Vacuum Valves

Air valves shall be specified at 1.0km intervals and the following locations: