CERTAINTEED

AVOIDING SURGE IN ASBESTOS CEMENT PIPELINES

Code No. 40-23-06
Date 6/1/75
Revised — —
Page 1

Whenever the rate of a fluid flowing in a pipeline is altered, this change in fluid velocity causes a Surge. Many things that happen in a pipeline, resulting in a change to the fluid velocity, are sources of surge. The principle ones are: 1) closing or opening a valve; 2) starting or stopping a pump; 3) movement of air pockets or air accumulations in the pipeline.

Most pipeline systems are designed or/and operated to reduce the effect of surge from valves and from pumps. Too often, however, enough attention is not given to protection from emergency shutdown especially from pump-power shutoff. If the pump is protected by a check valve there may be, however, no provision made to protect the pipeline from the sudden stopping of flow and from the sudden closing of the check valve at the return or "rebound" surge.

A very important factor of protection from surge is to avoid or reduce the effect from the movement of air pockets. The seriousness of entrapped air is not generally realized or understood. When an air pocket suddenly dislodges, the extent of the change in "local" fluid velocity and its subsequent pressures are far and above that of most other sources of surge; pressures of several hundred psi or more are believed to be the average. Therefore, it is most important to get rid of air either by venting or by trying to keep it out of the system. The problem of getting rid of air at startup is particularly difficult and with irrigation systems the problem is compounded because of the many times the system is stopped and later restarted.

We urge that the following steps be considered when designing, installing and operating a pipeline system in order to reduce the chances of a damaging surge from occurring:

1. The velocity should not exceed 7.5 feet per second, and preferably not more than 3 to 4 feet per second. Velocity at startup should be kept low; i.e., not more than 1 foot per second, until it's certain that all air has been flushed out and pressure has been brought up.

2. Get rid of the air at startup; then at shutdown or at emergency shutoff allow air to re-enter so as to prevent possible damage from "column separation". The protective device that performs this dual function is an air-vacuum relief valve. Such valves should be located at all high points, low points, changes in grade and in the center of straight long runs of pipe.

3. Keep air from accumulating while the line is operating and delivering water. Prevent air from being drawn in by the pump, and particularly use a pump-feed level-control. Get rid of the air that tends to accumulate in full lines of an operating system by installing pressure air-release valves (most always used in combination with vacuum-air relief valves) at all high points and at all changes in grade. Air has a tendency to accumulate especially at high points in the crown of the pipe; i.e., at the crests, and along the downside from the crests. Hence, vents should be located downstream from the crest and should be vented through a manifold into the air-release valve located at the crests.

4. Provide all other necessary protective equipment for the system and any of its parts as conditions may determine: such as pressure relief valves; gate valves to be opened or closed slowly prior to startup and shutdown, respectively; controlled-closing check valves in combination with surge arrestors or shock absorbers; etc.
5. PUMP STARTUP

   Whenever a system is to be started up (i.e., starting with an empty line) or is to be restarted (i.e., where the entire line is presumed to be filled or nearly so) the following procedures and precautions should be adhered to, particularly where the system has the minimum of surge protection:

   A) close pump discharge gate valve
   B) open any air exhaust valves or vents at the end of the line

C) start the pump
D) start to open the gate valve slowly and allow the line to fill. Do not fill the line faster than a velocity of one ft/sec.
E) provide for adequate air relief. As a means of control, it is suggested that at the point of maximum air entrapment (i.e., of air build-up) a hand operated globe valve be installed and left open until the pressure starts to rise (i.e., water begins to shoot out)
F) As soon as the line is filled with water (caution: there are still many pockets of entrapped air), continue to flush the water through at the rate of one ft/sec. all the while the pressure continues to rise. During this time the pressure air-release valve should function to release any entrapped air. Also if a hand operated globe valve is in the system it should be opened frequently to bleed out air.
G) When the pressure maximizes, continue the flushing until little or no air exhausts for approximately a 15 minute period.
H) Increase the pressure slowly up to the operating pressure. As a guide this should require a period of time amounting to

$$\frac{\Delta PLd}{50{,}000}\text{, minutes}$$

For example: if d = 10 inches,
ΔP = 100 psi,
L = 2250 feet, then the time required for the pressure increase is 45 minutes.

One of the problems encountered in filling or refilling a line occurs when a steep water-front (i.e., a wall of water) slams into the back of a stationary or a slow moving water-boundary, or in a partially filled line where such water-front dams up a rear-boundary for the advancing -boundary to strike. This kind of violent water-boundary slamming occurs when filling a pipe line too rapidly over a crest or it occurs following column-separation on a downhill slope as a result of momentary pump shut-off. In any of these situations a sort of hydraulic jump phenomenon takes place. A similar case occurs when a negative pressure generates a vapor space, it thereby effects column-separation, and finally, when positive pressure returns and thus condenses the vapor space, the fronts . mash together head-on.

CERTAIN-TEED PRODUCTS CORPORATION
PIPE & PLASTICS GROUP
P.O. Box 860
Valley Forge, Pa. 19482 215/687-500
CERTAINTEED

Code No. 40-23-06