

**technical bulletin**

March 24, 1975

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TO: VF P&PG MARKETING & SALES PERSONNEL
ALL DISTRICT MANAGERS
ALL TERRITORY MANAGERS
ALL ADMINISTRATIVE ASSISTANTS
ALL PRODUCT MANAGERS
ALL INSIDE SALES PERSONNEL
ALL FIELD SERVICE MANAGERS
ALL SALES ENGINEERS

FM: T. A. SWITALSKI *TA Switalski*

RE: WATERHAMMER IN PIPELINES

Enclosed are two technical papers describing waterhammer in pipelines. The papers are rather technical in nature, so I will summarize some of the main points.

The first paper was presented to the American Society of Agricultural Engineers in June 1973 by W. R. Seipt, Manager of Sales Engineering. Although it primarily discusses PVC Pipelines in Irrigation Systems, much of the subject matter also pertains to any pressure pipelines. Basically, the paper explains in considerable detail, the cause, extent and effect of waterhammer and explains how to contain waterhammer forces through proper design, installation and use of an irrigation system.

Some of the points stressed in this paper are as follows:

1. Waterhammer can be contained by adequate design, proper installation and responsible use.
2. Waterhammer occurs when water under pressure in a pipeline is subjected to a change in its velocity. The intensity of the waterhammer depends upon the rapidity with which the velocity is altered.
3. The seriousness of entrapped air is not generally realized nor understood. With PVC piping, the effect of air entrapment is suspected to be more pronounced because air bubbles appear to "stick" more to plastic surfaces; hence the quantity of air entrapped at a particular point would be greater than that at surfaces of more wettable material.
4. Unless steps are taken to restrict waterhammer pressures, damage may occur to one or many of the irrigation system elements, such as pumps, valves, or piping.

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5. While gasketed joints do not remedy waterhammer damage, at least they generally reduce the extent of the damage considerably.
6. Low head (50 ft.) irrigation pipe should be used only for gravity flow systems, and should not have a valve in the discharge end of the line.
7. By stopping flow at rates slower than critical time, waterhammer pressures will be reduced from their maximums. A table for critical flow stoppage times vs. SDR is given. Also a table for recommended valve closing times vs. SDR is given.
8. The design water velocity should not exceed 5 ft. per second unless additional measures or ancillary equipment are used and that in no case should the velocity exceed 10 ft. per second.
9. Air is compressible and, if carried along a pipeline, can act like a spring, being compressed at the bottom of a draw and expanding at the top of a rise. Such alternate compression and expansion produces velocity fluctuations and pressure variations which, if great enough, can produce serious waterhammer pressures.
10. Water-column separation can also result in excessive waterhammer pressures when the separated column rejoins at high velocity.
11. To prevent damage as a result of air entrapment during initial filling of a pipeline and to keep air from getting into the line from operating pumps, provisions should be made to remove air from the line at all high points.
12. Each type of irrigation system has its peculiarities of operating pressures and potential for surge which must be taken into account.
13. Rough handling, dropping the pipe, allowing it to strike or be struck by objects either before or after installation can seriously damage and weaken the pipe.
14. The responsible use of an irrigation system is proper system start-up. It is suggested not to fill at a velocity in excess of 1 ft./sec.
15. When stopping an irrigation system at any time for any reason, it is just as important that it be done with the same due care and caution as that for start-up.

The second paper discusses "Problems Encountered with Air Entrapped in Pipelines", and was presented at the 1974 Technical Conference of the Sprinkler Irrigation Association. Much of the subject matter discussed in this paper was covered in the previous paper. In addition, it des-

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cribes some of the examples of laboratory tests and field studies which have been done to understand more clearly this problem of air in pipelines. Also actual examples of destructive action resulting from the release of entrapped air are described, which occurred in the laboratory at Colorado State University and also in the field. Two examples of asbestos-cement pipe failures as a result of entrapped air are also described. The paper closes with recommendations for avoiding problems with entrapped air.

If you require additional copies of these papers, please contact the Sales Engineering Department.

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