August 2018

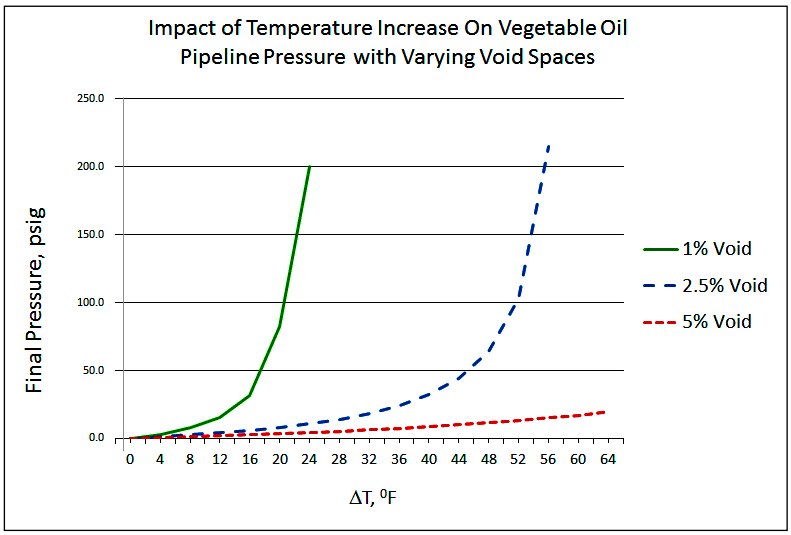
from experience

Under Pressure: Pressure Buildup in Pipelines

While leaks and ruptures in pipelines may be due to a number of factors, one culprit can be temperature change: Increasing temperatures resulting from the transfer from an outdoor tank to a warm production room or solar heating on an external line will cause liquids to expand and increase the internal pipe pressure, resulting in leaks or ruptures at the weakest point(s) in the line.

To prevent unsafe pressure rises, it is wise to monitor the temperature variations to which pipes are exposed. It is also important to recognize the relationship between temperature and specific liquids that commonly exist within a GMP facility, since different liquids will exhibit different degrees of expansion (see *Experience in Brief*).

Excessive pressure buildup can be managed by either blowing lines clear using air or nitrogen, draining liquid from the pipes, or leaving lines open to a production or storage tank. For example, the quantity of a typical vegetable oil that would need to be drained from a pipe can be estimated using the graph below. The graph depicts the final pressure in a pipeline (starting from atmospheric pressure) depending on the fullness of the piping, and degree of temperature rise. In essence, the smaller the void in the pipe, the higher the final pressure will be.



As shown, more void space within a pipe provides room for typical vegetable oils to expand. While a drastic pressure rise could be experienced with only a 20°F increase were there very little void space (1%), a relatively small pressure increase would be realized if the void space were 5% instead.

This article is part of a series on piping hydraulics. To catch up on what you may have missed, check out the March 2018 issue of *From Experience*, "Designing Piping Systems for Thermal Expansion," or the May 2018 issue on "Controlling Water Hammer."

experience in brief

A temperature increase of 20°F in a pipeline with a 1% void space will result in a pressure increase of approximately:

- 90 psig for citrus or soya oils
- 24 psig for high fructose corn syrup
- 6 psig for water or milk

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