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Modeling of Methane Tank Depressurization in Cold Weather

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After closing the valve, the vessel remains at the outlet pressure of the valve, indicated by the horizontal pressure lines. At this point, mass can no longer leave the vessel and the valve is shut. Therefore, the vessel valve should be closed before this time to maintain vapor state.

As time progresses, the pressure in the vessel decreases, causing a decrease in the pressure of the methane. Additionally, the decrease in pressure causes a decrease in the temperature of the methane. This can be seen by following any starting temperature line.

At approx. 1.35 hours, the pressure inside the vessel reaches the outlet pressure of the valve, indicated by the horizontal pressure lines. At this point, mass can no longer leave the vessel and the valve is shut. Therefore, the vessel valve should be closed before this time to maintain vapor state.

For all starting temperatures and mass flow rates below 0.300 kg/s, the methane did not reach saturation conditions. At mass flow rates below 0.300 kg/s, the methane did not reach saturation conditions.

At high mass flow rates, the methane will become a mixture. Therefore, the vessel valve should be closed before this time to maintain vapor state.

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