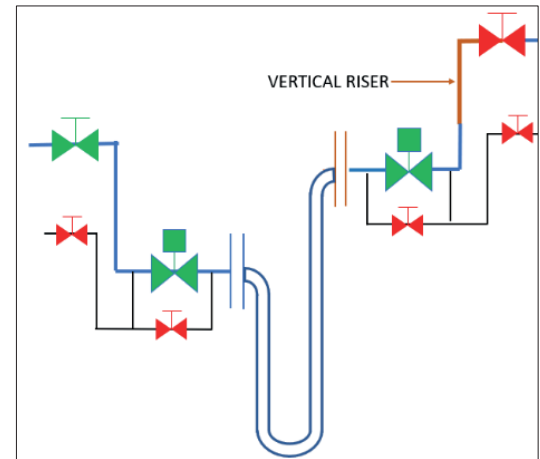


Here follows a stepwise generic procedure for the draining of LNG cargo hoses. For further details, refer to INTERTANKO's 'Practical Guide to the Draining and Purging of LNG Liquid Cargo Hoses' as available on the INTERTANKO website.

Step 1: Draining by gravity

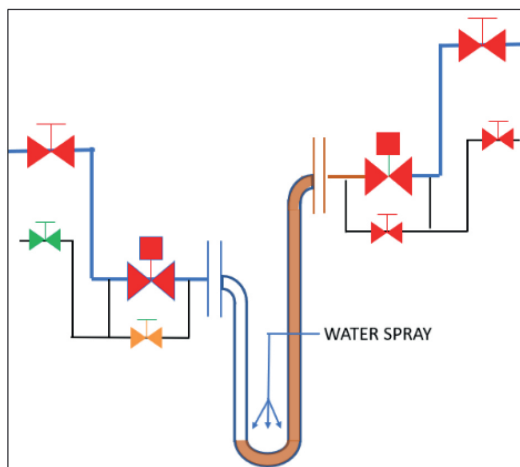
CLOSE the 'Manifold double shut valves' on the vessel with the higher manifold.
OPEN all 'Liquid Line valves' on the vessel with the lower manifold.
With gravity, the liquid will flow towards the vessel with the lower manifold.
It takes around 15 minutes to drain the **VERTICAL RISER**.



Step 2: Drain Using Pressure Piston Effect

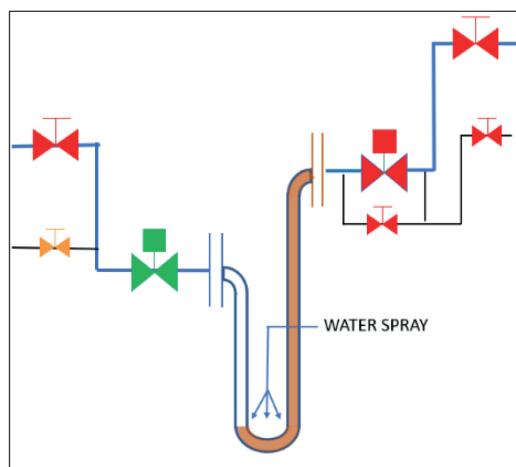
Close all 'Manifold valves' on both vessels.
Using fire hoses, spray water on the hose catenary (U-bend). The evaporation of trapped liquid will cause a rise in pressure.
Use this pressure to push the liquid LNG out of the hoses. (3 options are described below, one preferred and two alternatives)

Vessel with lower manifold 'having' Manifold Bypass Valve

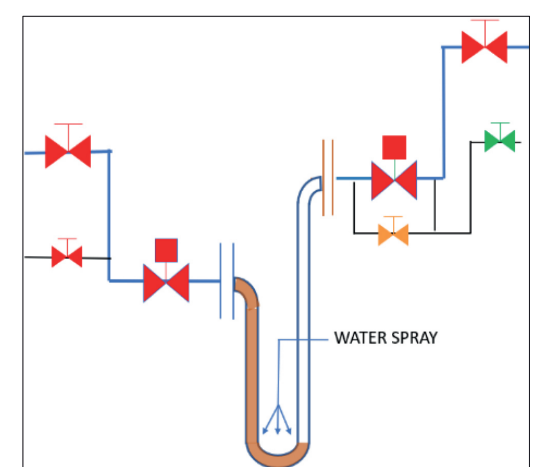


Open the 'ESD bypass valve' on the lower vessel when the pressure increases to around 4.0 bars. **Close** once the pressure drops to around 0.5 bars.
Repeat this operation (pressure release) around three times until the liquid LNG is displaced towards the lower manifold.

Vessel with lower manifold 'not having' Manifold Bypass Valve
CAUTION: Sudden release of pressure through large diameter ESD valves may cause LNG rapid phase change and subsequent collapsing of the transfer hoses.



Open the 'Manifold ESD valve' and keep it open.
Open the downstream spray valve when the pressure increases to around 4.0 bars. **Close** once the pressure drops to around 0.5 bars.
It may take more than three pressure releases to displace "liquid" LNG.
Alternatively, keep the downstream spray line valve throttled and open/close the manifold ESD valve. In such cases do not let the pressure increase more than 2.0 bars.



If the vessel with higher manifold is fitted with a Manifold bypass valve
Open the 'ESD bypass valve' on the higher vessel when the pressure increases to around 4.0 bars. **Close** once the pressure drops to around 0.5 bars.
This alternative might not effectively drain the hose

Step 3: Liquid freeing using heat transfer for evaporation

The main aim of this step is to completely liquid free the hoses by vaporising the LNG liquid remaining in the U-bend of the hose. The line-up is similar to step 2.
Either of the vessels can open their manifold ESD bypass valves to release the pressure from the hoses.
Continue this operation until no pressure rise and no icing is noted.

Step 4: Nitrogen Purging & Disconnection

Using nitrogen to gas free the hoses and transfer equipment, until the LNG gas concentration reaches at least 2% by volume (40% LEL).
The line-up is similar to Step 2. N2 can be provided by any of the vessels.
Disconnect the hoses only after the gas concentration has reached at least 2% by volume (40% LEL) and after depressurising the hoses.

