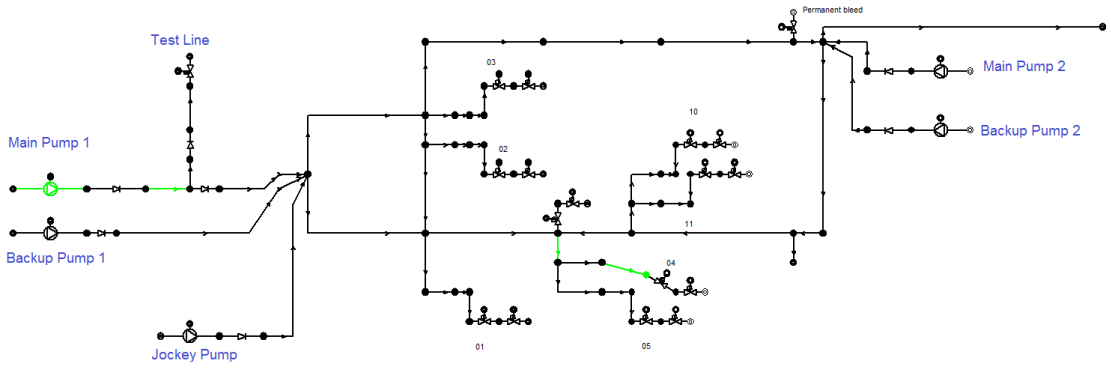
Application Bulletin – Power Industry
PIPENET® Transient Module Case Study

PUMP STARTUP IN OFFSHORE OIL RIG FIREWATER SAFETY SYSTEM

BACKGROUND

In this offshore oil rig near Norway, the initial stages of the firewater safety system needed to be modelled in order to calculate the flowrates at pump startup, checking for occurrence of steam hammer.

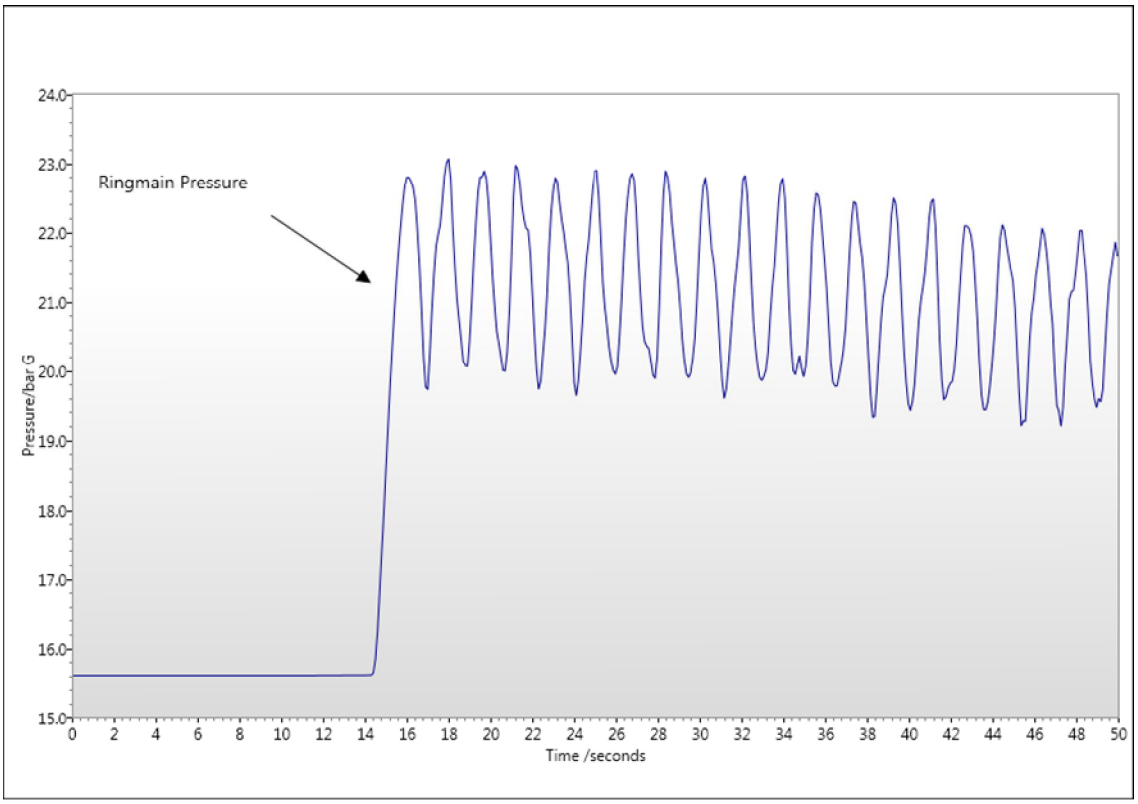


MODEL

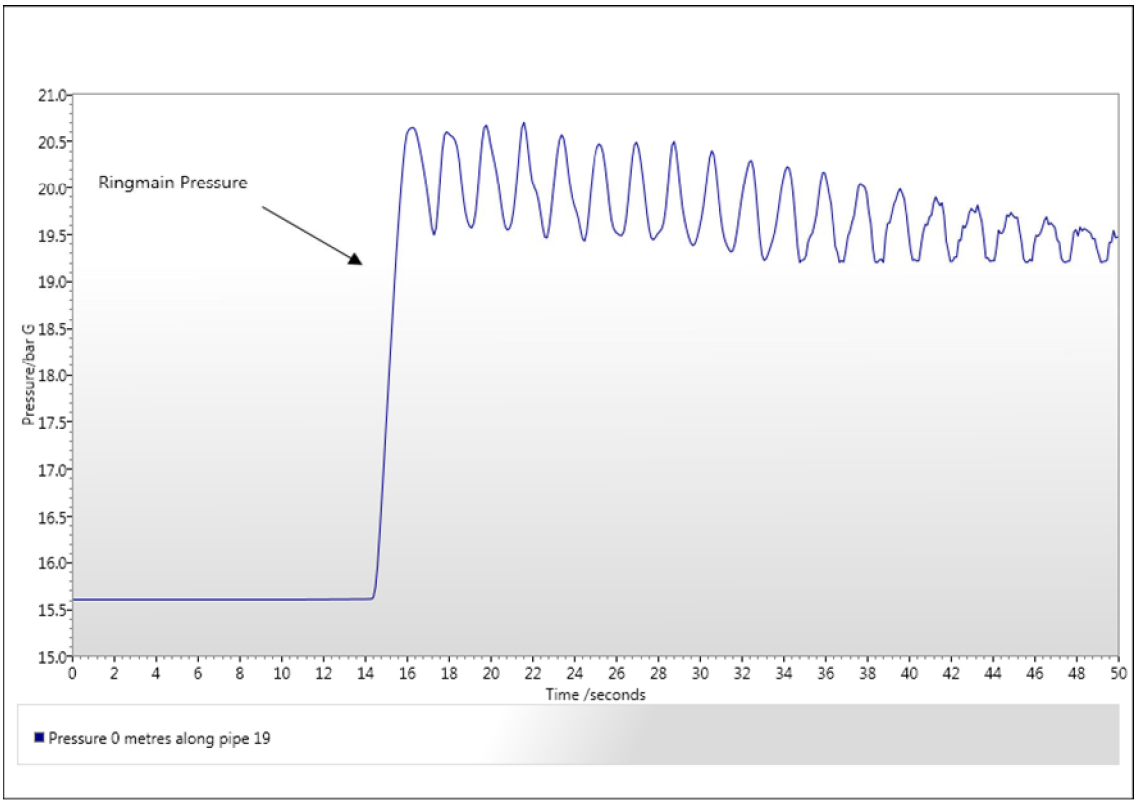
The aim of the model was to minimise design time, therefore the whole deluge system was not modelled in its entirety. Instead, as can be seen, pairs of operating valves were used to model the deluge system. The pressure in the ringmain under normal operation is 19.3 Bar G. When the pumps are off, the pressure is maintained by the jockey pump, which is always operational.

SCENARIO 1 – Effect of Valve Closure Time

In this scenario, the test line, needs to be shut before the flow starts through the deluge system to achieve correct pressures and flowrates in the deluge system. The valve must have a sensible shutdown time as in the event that the deluge valve does not open, water hammer might occur. Although there is a permanent bleed (a safety feature), it may not be able to handle the full effect of water hammer, so it must be safe for the test valve to close when no other valves are open (except the bleed valve). Initially a valve closure time of 1s is selected.



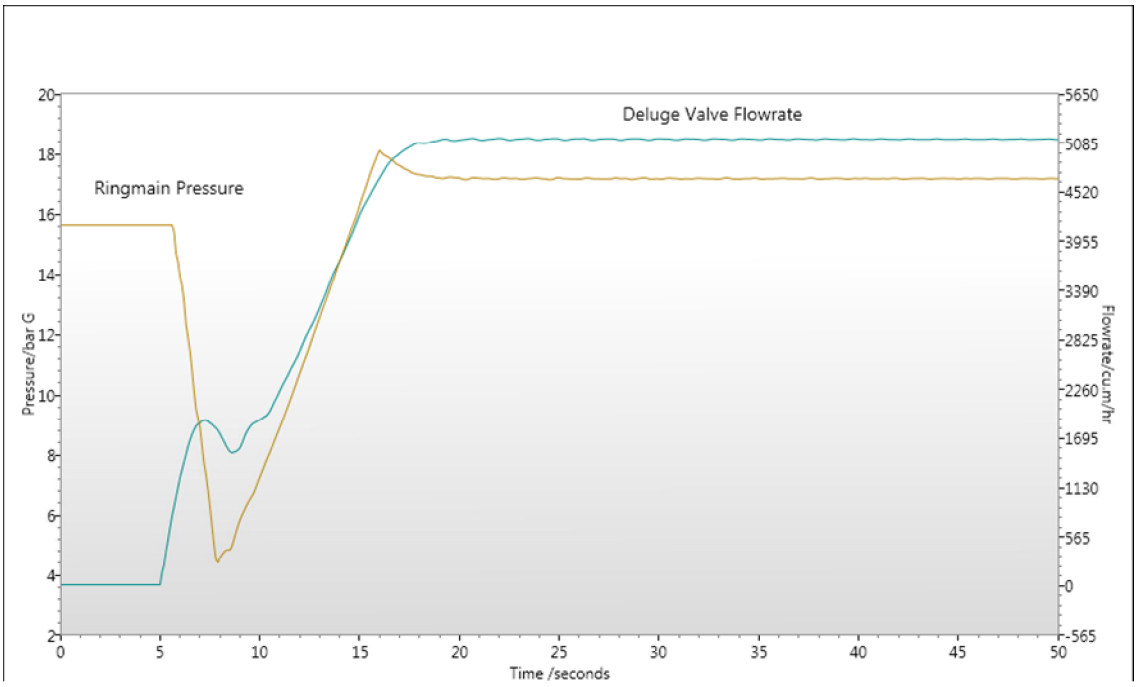
As can be seen, there is a considerable fluctuation in the pressure (around 3 Bar), oscillating around the working pressure. However, this pressure fluctuation is unacceptable. The valve closure time was gradually increased from 1s until an acceptable pressure fluctuation was achieved. This turned out to be at 20s. The graph below shows the reduced pressure fluctuation due to water hammer.



As can be seen, not only has the maximum pressure fluctuation reduced to around 1 Bar, the fluctuation itself decreases over time. This was deemed acceptable

SCENARIO 2 – Pump Startup into Ringmain

In this scenario, the results from the previous scenario have been applied (thus have the sensible test valve closure time of Xs). The aim here is to generate the required flowrate into deluge system 04, whilst observing the effects of pump startup. The pumps take 15 s to start up. In order to generate the correct pressure, the two main pumps must be switched on.



What can be seen here is a large drop in ringmain pressure, resulting in a small drop in deluge valve flowrate around the 10 s mark. The pressure drop, although large, is fairly gradual and therefore this does not impact upon the performance of the network.

CONCLUSIONS

This shows that PIPENET Transient module can be used to realistically test the effect of water hammer, without having to create a particularly complex network. It can also be used to check what happens at pump startup in a firewater safety system.

If you have any questions about this case study, or any other of PIPENETÕs capabilities, please email us at Pipenet@sunrise-sys.com.