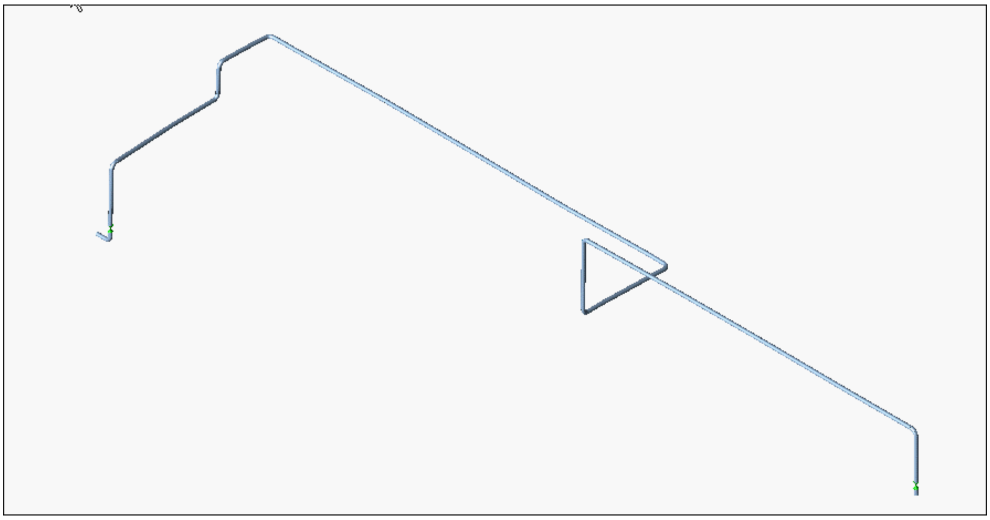
SOME UNIQUE FEATURES OF PIPENET TRANSIENT MODULE

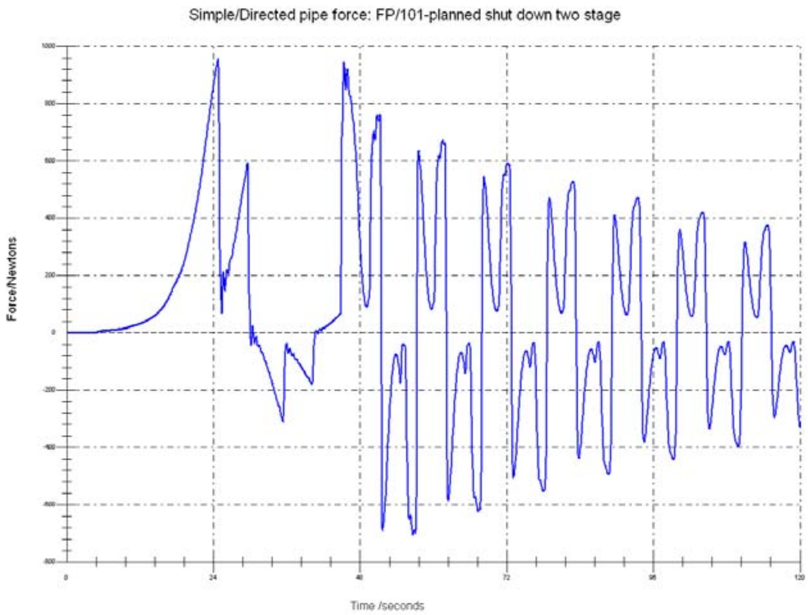
This section summarises some of the unique features of PIPENET Transient module. PIPENET Transient module is a very powerful program with a lot of excellent features and so this document merely shows a small number of unique features.

1. PIPENET Transient Module and Hydraulic Transient Forces:

- Pipes do not often get damaged simply because of pressure. It is much more common for pipes to get damaged because of large hydraulic transient forces or because of poor pipe supports.
- It is possible for a piping system to get damaged at a lower pressure surge because it is poorly supported, while it might be able to withstand a higher pressure surge because it is strongly supported.
- The missing link is the hydraulic transient force-time history. **UNBALANCED FORCES** especially are important. This is called simple force in PIPENET.
- The definitive answer to the question “Is the pipe likely to be damaged?” is provided by PIPENET’s ability to calculate hydraulic transient forces and CaesarII’s ability to import the time-history from PIPENET and perform further analysis.
- This interface is an integral part of CaesarII.



PIPENET output:



Caesar .frc format (Time-history file from PIPENET)

Time, sec	Force, N
.490280E+2	92.0075
.490960E+2	92.6033
.491640E+2	94.8967
.492320E+2	98.8628
.493000E+2	104.512
.493680E+2	111.991
.494360E+2	121.427
.495040E+2	132.911
.495720E+2	149.763
.496400E+2	231.246
.497080E+2	387.048
.497760E+2	539.206
.498440E+2	623.446
.499120E+2	622.043
.499800E+2	626.663
.500480E+2	660.159
.501160E+2	692.531
.501840E+2	704.158
.502520E+2	697.569
.503200E+2	686.454
.503880E+2	677.987
.504560E+2	674.642
.505240E+2	686.669
.505920E+2	710.677
.506600E+2	736.535
.507280E+2	754.093
.507960E+2	760.038
.508640E+2	756.395
.509320E+2	747.820
.510000E+2	740.780
.510680E+2	740.446

CaesarII Results:

DISPLACEMENT REPORT, Nodal Movements
(OCC)COMBINATION # 3

	--------Translations(in.)--------			------Rotations(deg.)---------		
NODE	DX	DY	DZ	RX	RY	RZ
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0207	0.0245	0.0101	0.0178	0.0523	0.1256
15	0.0477	0.0246	0.0111	0.0200	0.0613	0.1313
20	0.0821	0.0246	0.0139	0.0200	0.0617	0.1316
25	0.4896	0.0268	0.0700	0.0067	0.2057	0.1704
26	1.0470	0.0000	0.0701	0.0121	0.2515	0.1585
30	1.4808	0.0550	0.0722	0.0201	0.2087	0.1345
35	1.6646	0.0463	0.0780	0.0536	0.1494	0.0973
40	1.7377	0.0000	0.0780	0.0515	0.1312	0.0834
45	1.8365	0.0444	0.0773	0.0492	0.0684	0.0481
50	1.8365	0.0000	0.1377	0.0485	0.0787	0.0393
55	1.8365	0.0000	0.5337	0.0455	0.1094	0.0100
60	1.8365	0.0000	0.8986	0.0427	0.0719	0.0034
65	1.8364	0.0000	0.9622	0.0400	0.0731	0.0066
70	1.8363	0.0000	0.6983	0.0373	0.2053	0.0274
75	1.7818	0.0388	0.6780	0.0228	0.3166	0.0781
80	0.8600	0.0000	0.6780	0.0277	0.3483	0.1535
85	0.5718	0.0210	0.6777	0.0339	0.3065	0.1781
88	0.0921	0.0212	0.6817	0.0405	0.2018	0.1550
89	0.0733	0.0150	0.6813	0.0376	0.1908	0.1158
90	0.0675	0.0139	0.6789	0.0372	0.1622	0.0751

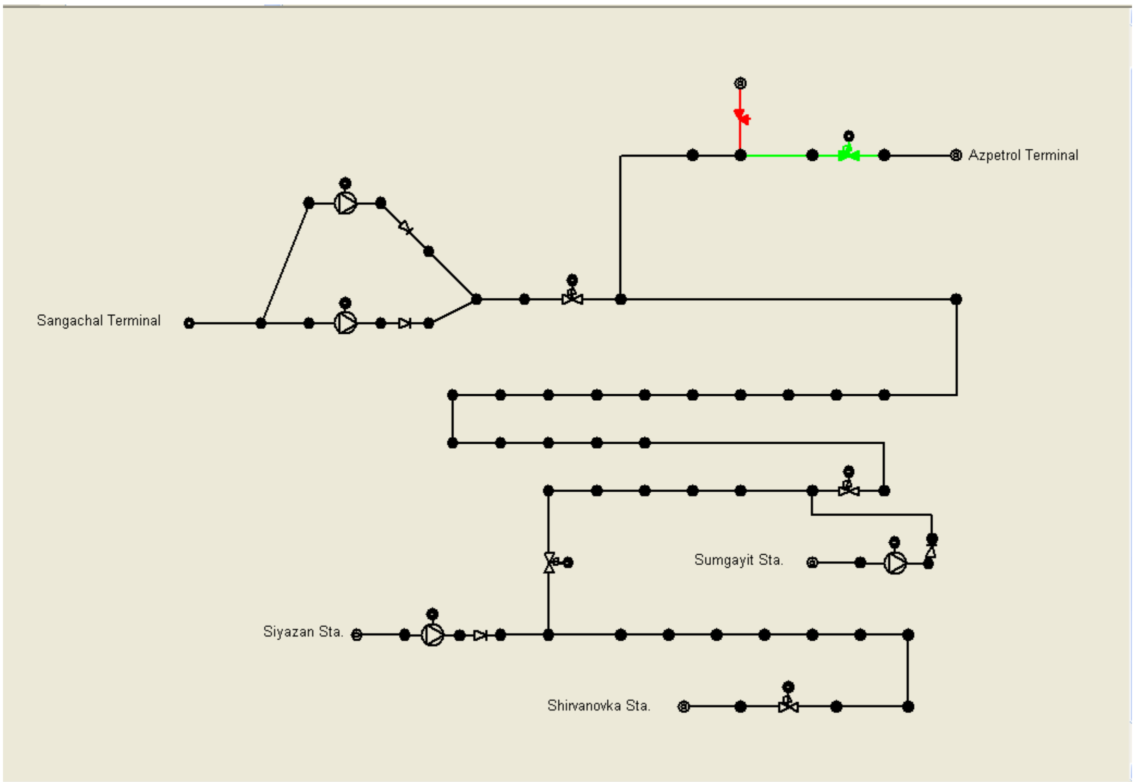
2. Modelling Surge Relief Valves/ Several Models for Check Valves:

Positioning and selection of Surge Relief Valves are two very important tasks.

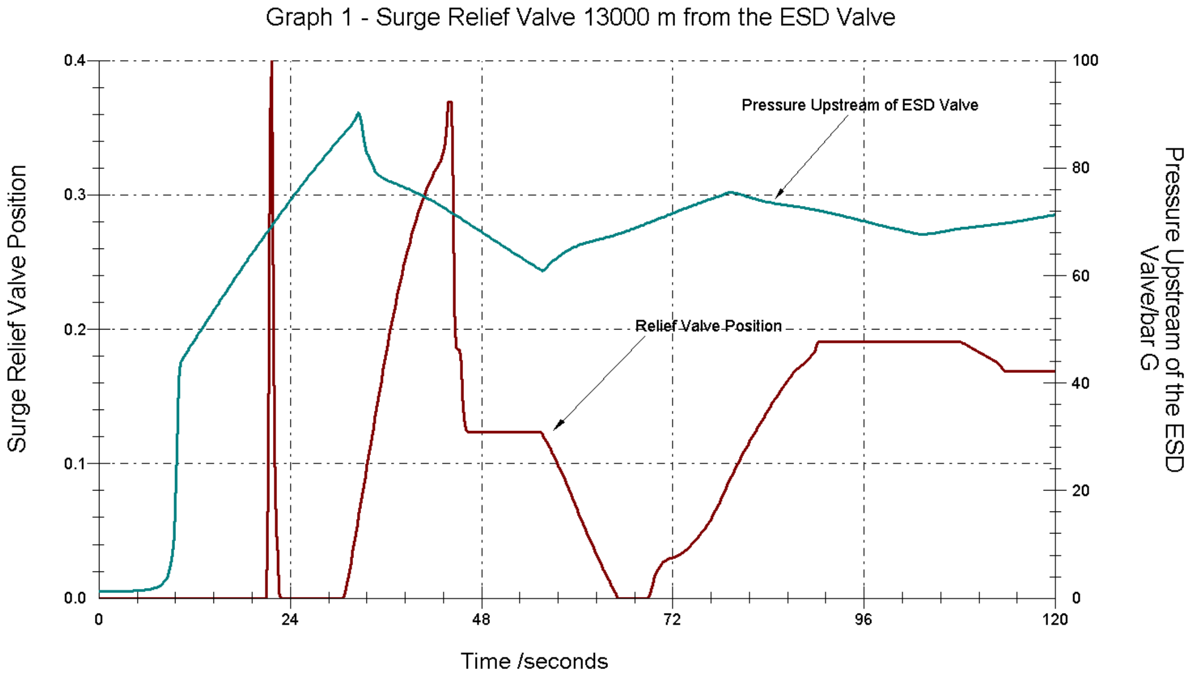
They are very expensive and it is important to optimise their size
It is very important to optimise their position
It is important to fine-tune its set point

The scenarios below show how PIPENET Transient module can be used for finding the answers to the important requirements above.

The following is a network modelled by Kellogg Brown & Root in the Azerbaijan pipeline.

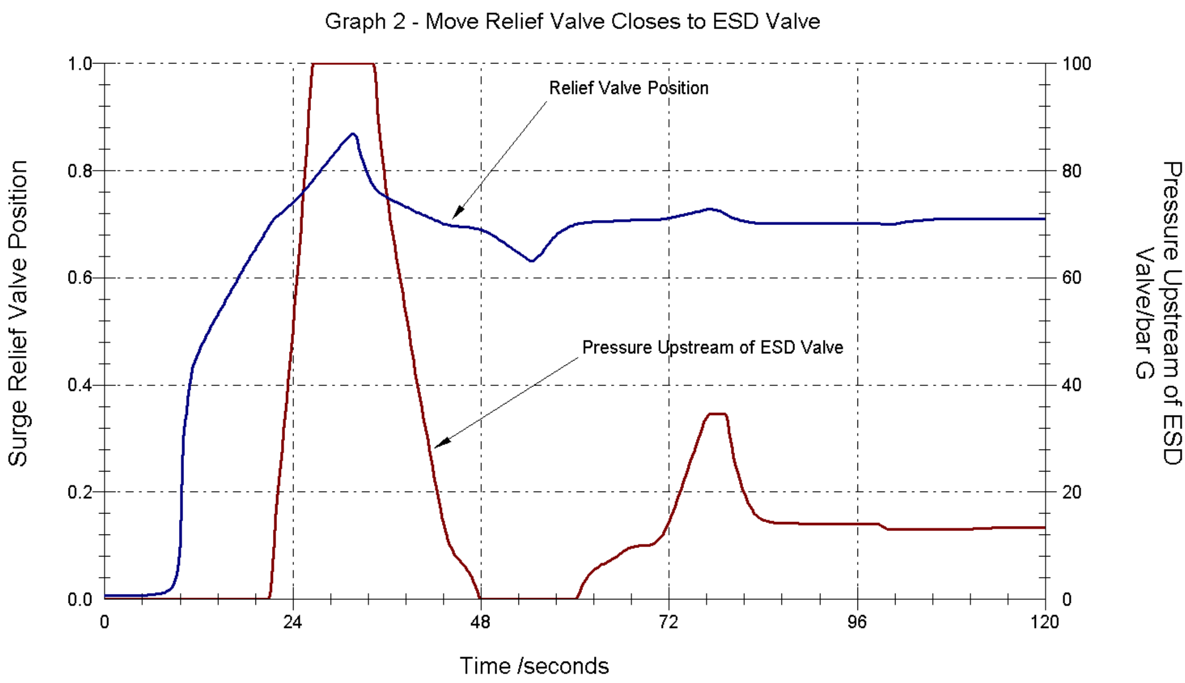


CASE 1 – POSITION SURGE RELIEF VALVE 13000 M FROM ESD VALVE



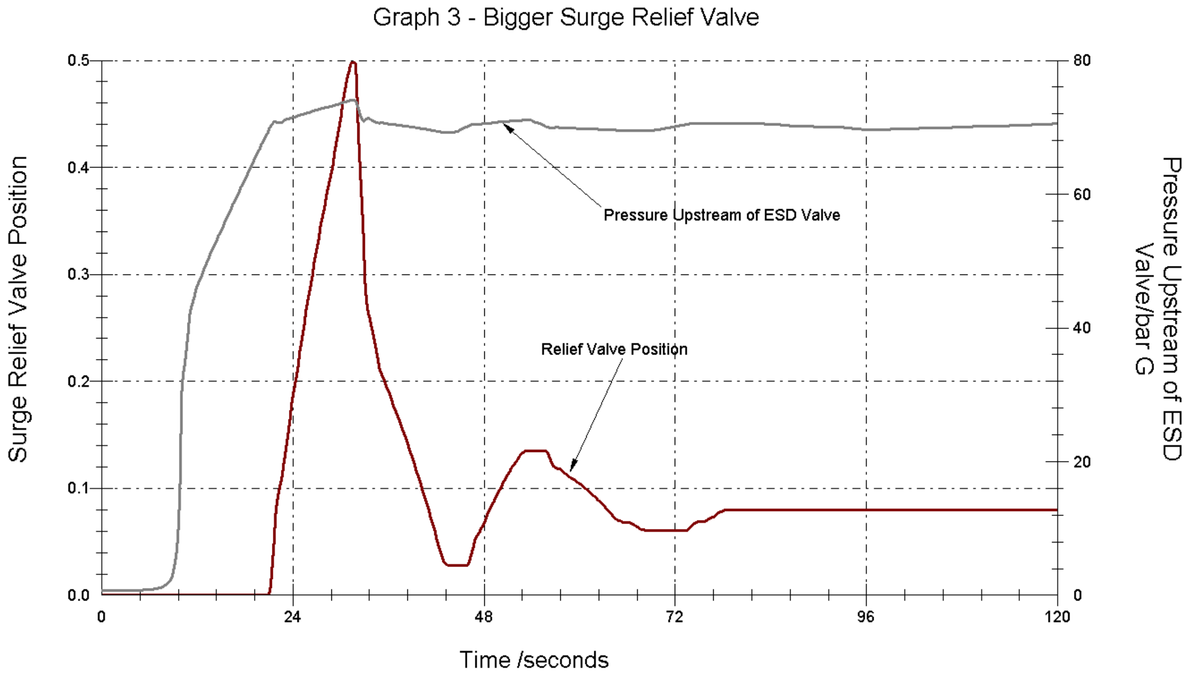
This indicates that the closer the Relief Valve is to the ESD Valve the better

CASE 2 – POSITION SURGE RELIEF VALVE 500 M FROM ESD VALVE



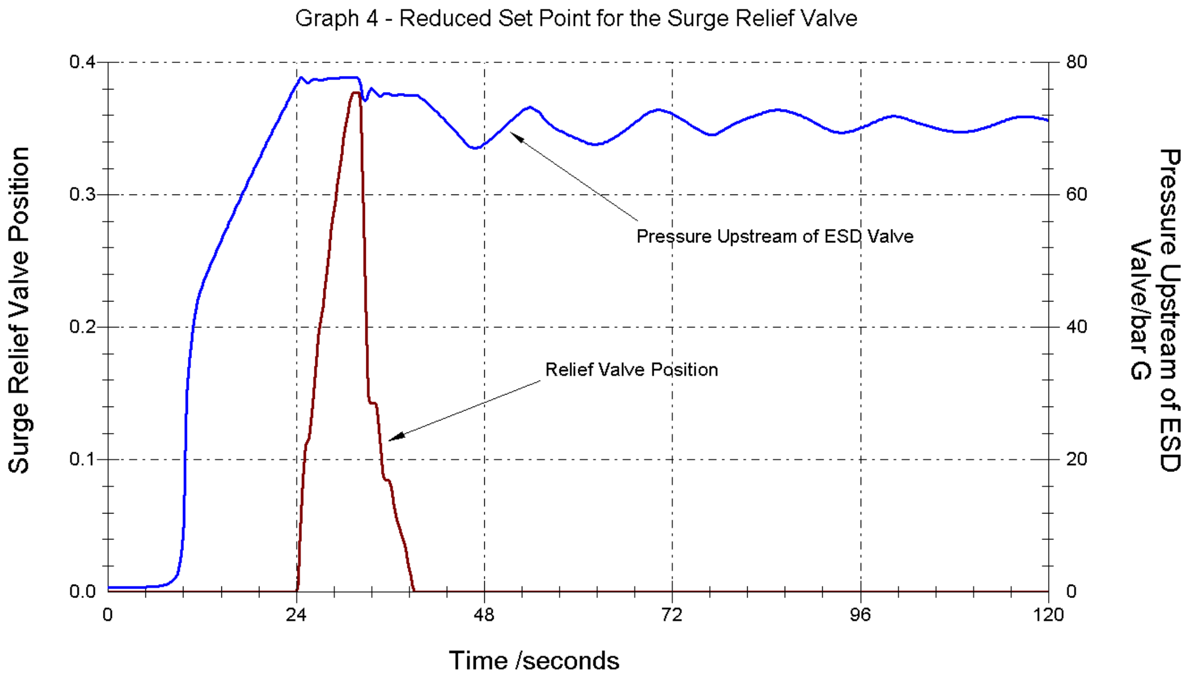
This indicates that the maximum pressure might come down if the valve is made bigger. This is because the calculation shows that the surge relief valve fully opens but is not able to control the pressure.

CASE 3 – INCREASE SIZE OF SURGE RELIEF VALVE



This indicates that the relief valve will remain open as long as the pumps are running. So it is necessary to increase the set point of the surge relief valve.

CASE 4 – INCREASE SET POINT OF SURGE RELIEF VALVE

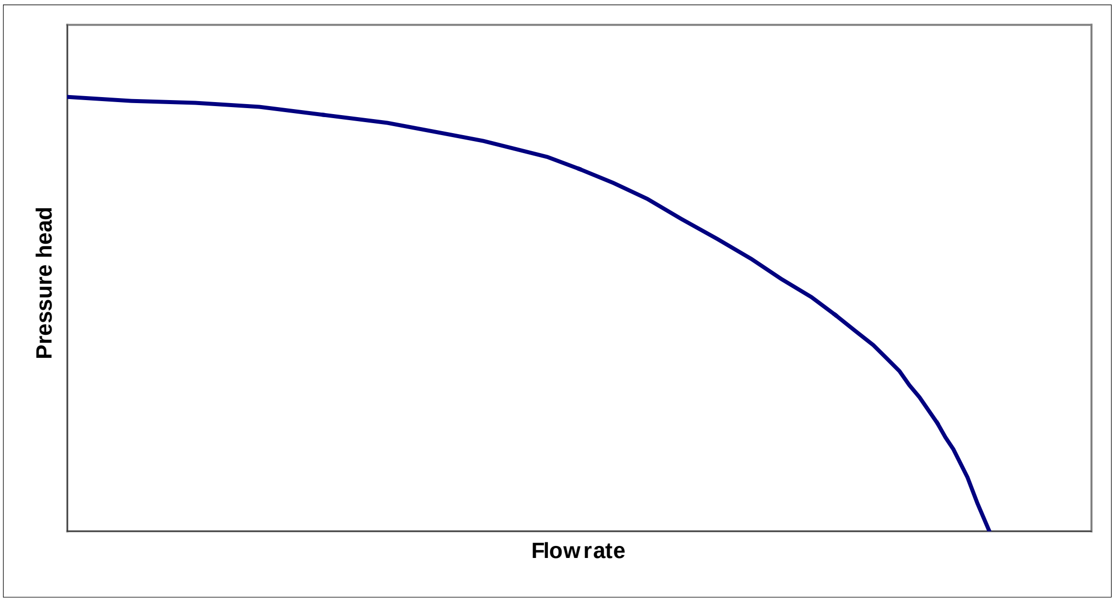


3. Modelling Complex Pump Trip Event:

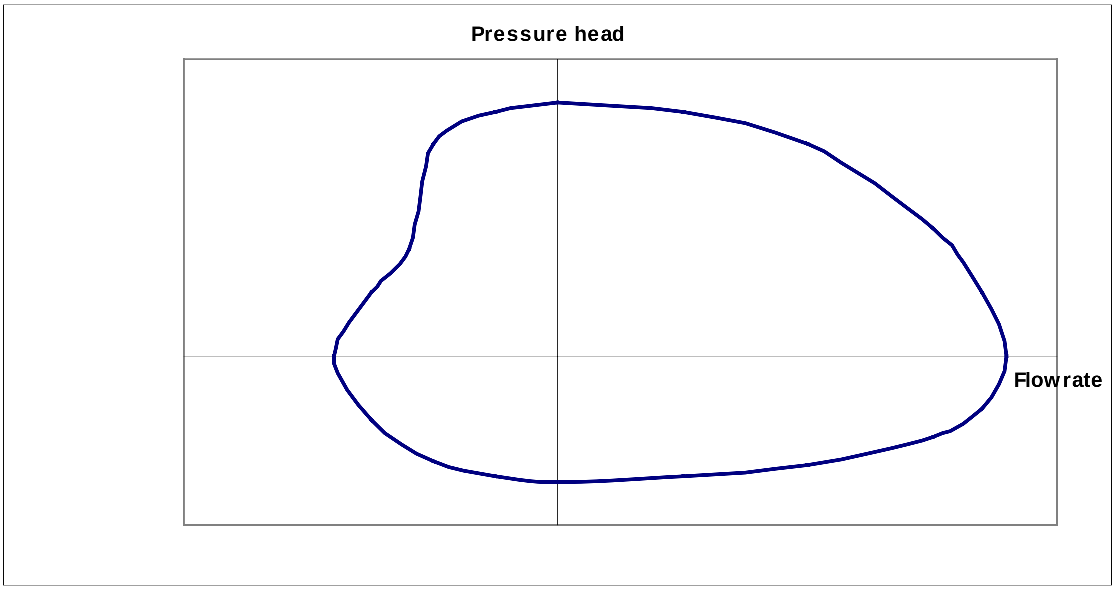
During a pump trip event, the pump itself behaves rather like a valve closure and offers a pressure loss.

PIPENET offers two different models for pumps. The simple pump model would suffice in many cases where the behaviour of the pump itself need not be studied in great detail. In cases like pump trip where the behaviour of the pump is of key importance PIPENET offers the turbo pump model.

The typical pump curve provided by a manufacturer shows the pressure head against the flowrate, with both the flowrate and the pressure head positive. This is called a “Simple Pump” in PIPENET terminology.



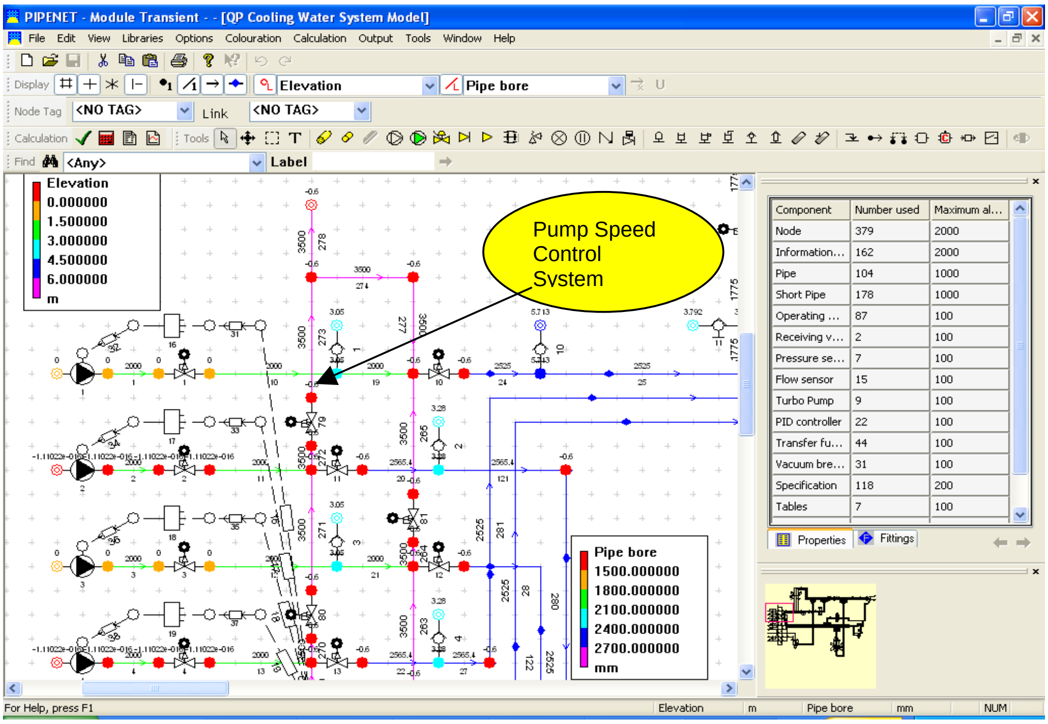
This model is in adequate for modelling pump trip events, especially for large pumps. When a pump trips the pressure downstream of the pump can become a vacuum pressure. Furthermore, the flow can reverse and the pump can rotate backwards. In order to model this phenomenon PIPENET offers a model called the “Turbo Pump” model. This can model the behaviour of the pump in all the 4 quadrants of operation. The pump curve for a Turbo Pump is shown below and it covers all 4 quadrants.

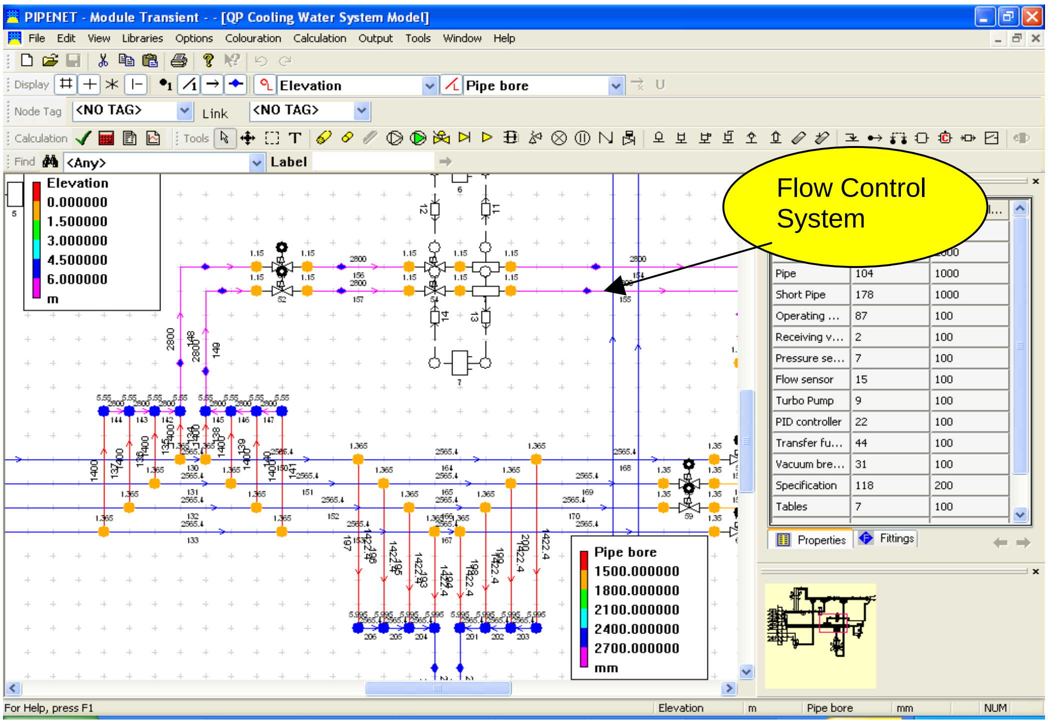


4. Modelling Complex Control Systems:

PIPENET offers many comprehensive and useful components for modelling control systems. Some examples are the following:

Sensors – pressure, flow, differential pressure
Transfer functions for modelling the dynamics of instruments and other items
Control valves
Switches
PID controllers
Split level control function
Digital or analogue sampling
Cascade control





5. Miscellaneous Items:

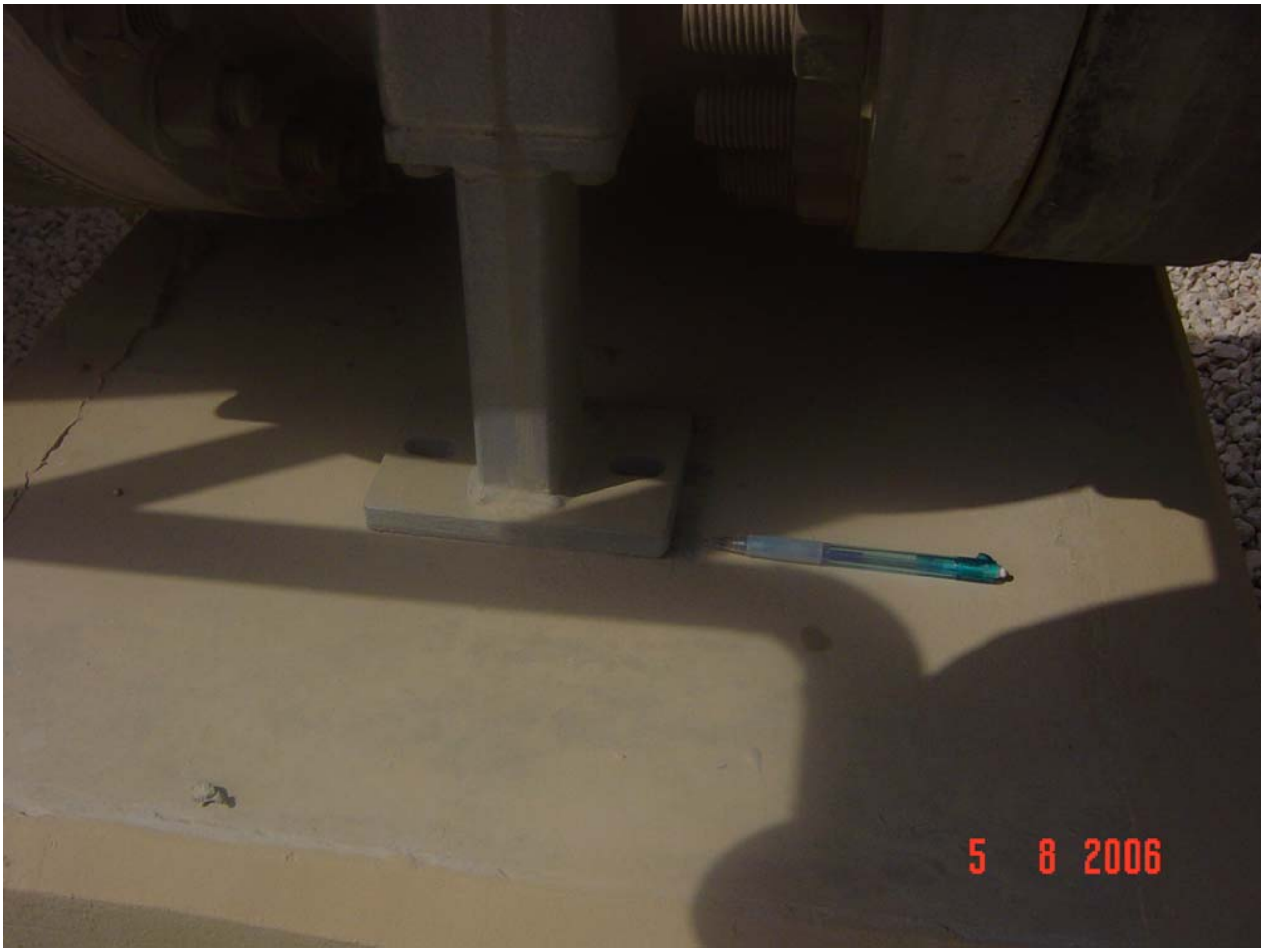
Long pipes and Complex Networks – In certain types of network it is necessary to model long pipelines as well as complex networks in one system. PIPENET Transient module can easily handle such problems.

Complex Loops – In applications such as firewater systems and cooling water systems, typically a large number of complex networks can be found. PIPENET Transient module is ideal for modelling such systems.

Ease of Use – PIPENET modules are renowned for their ease of use. As soon as one enters the program everything looks in place and familiar.

6. Photos of Damage on a Pipeline System from Customer.

Some photographs from a Customer in Italy. PIPENET was used in the investigation of this damage and for rectification measures.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