Introduction to Pipe Stress

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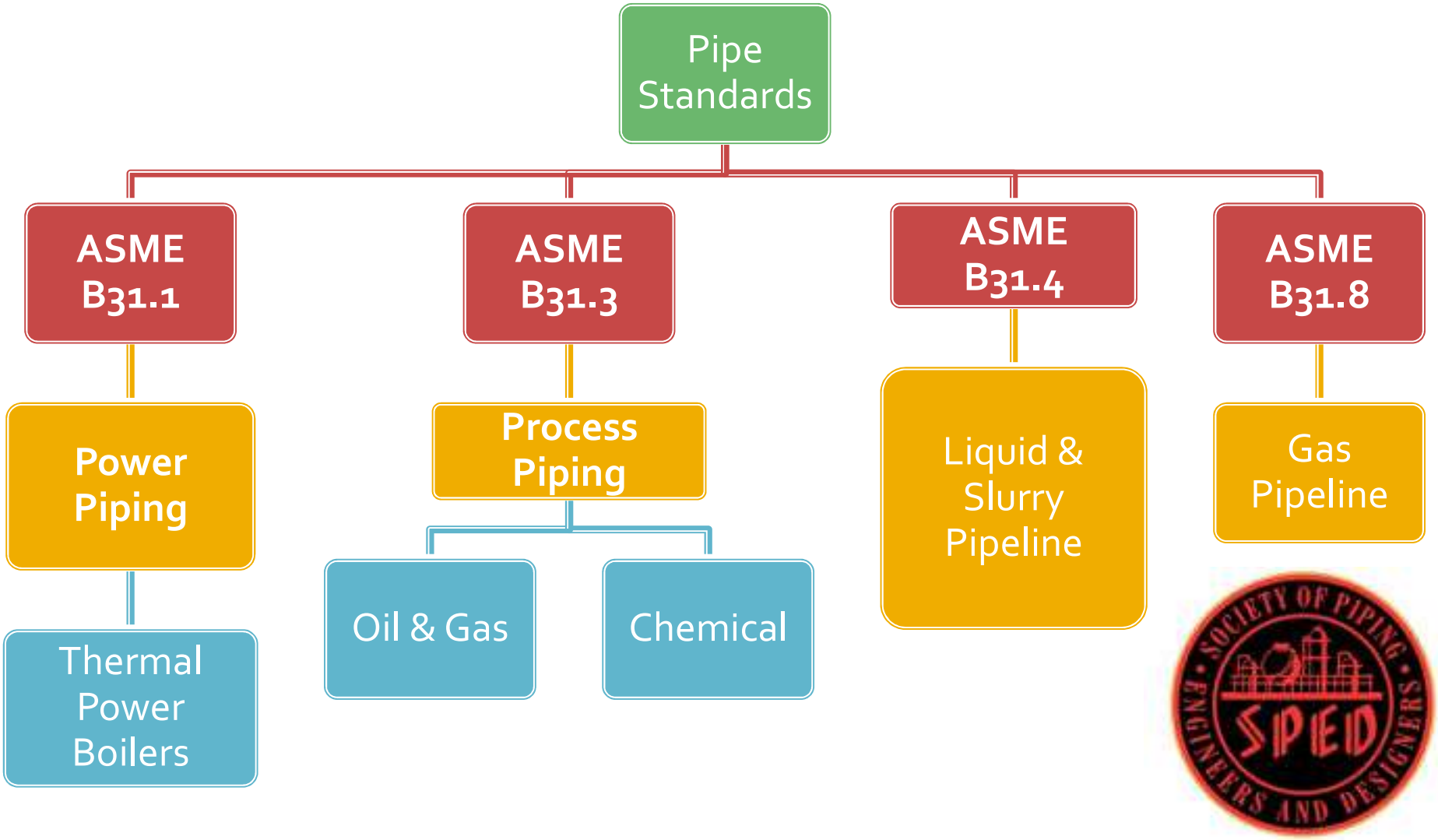
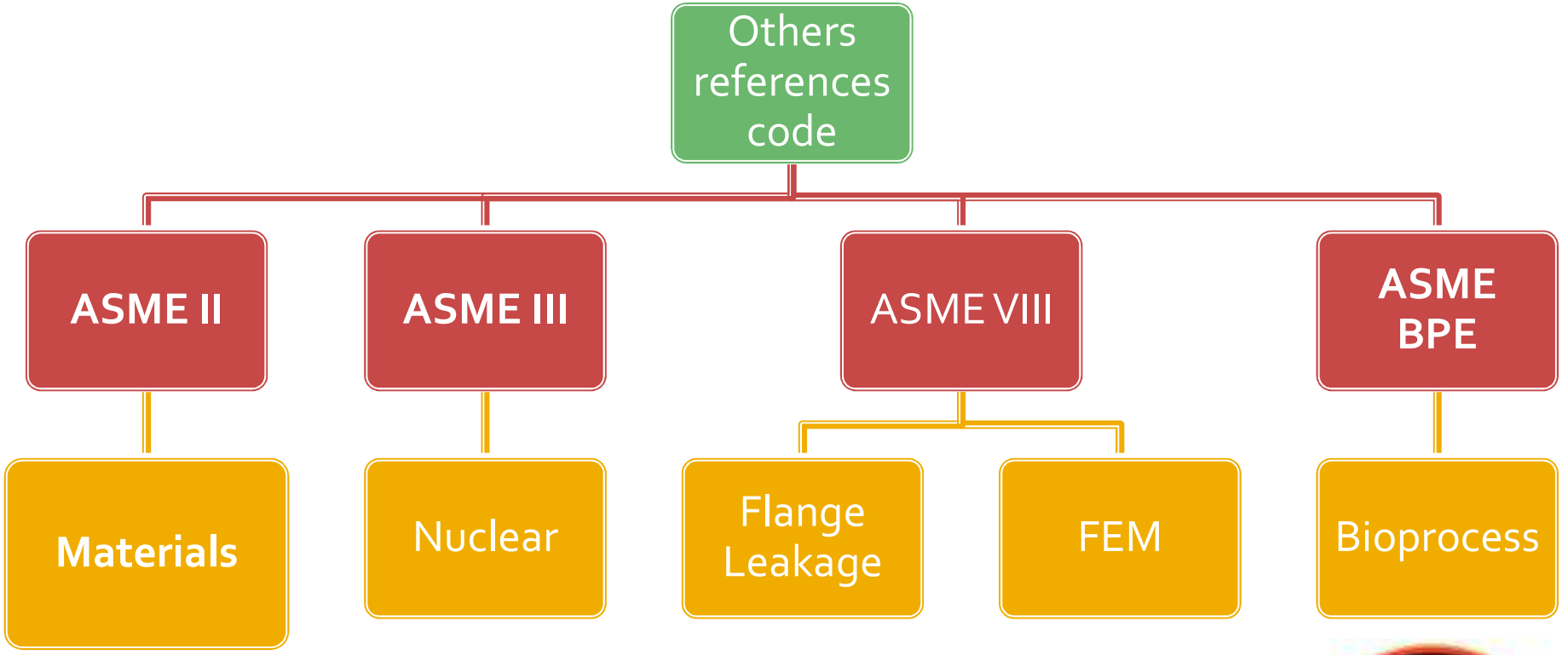
Chief Stress Engineer
Spain Chapter

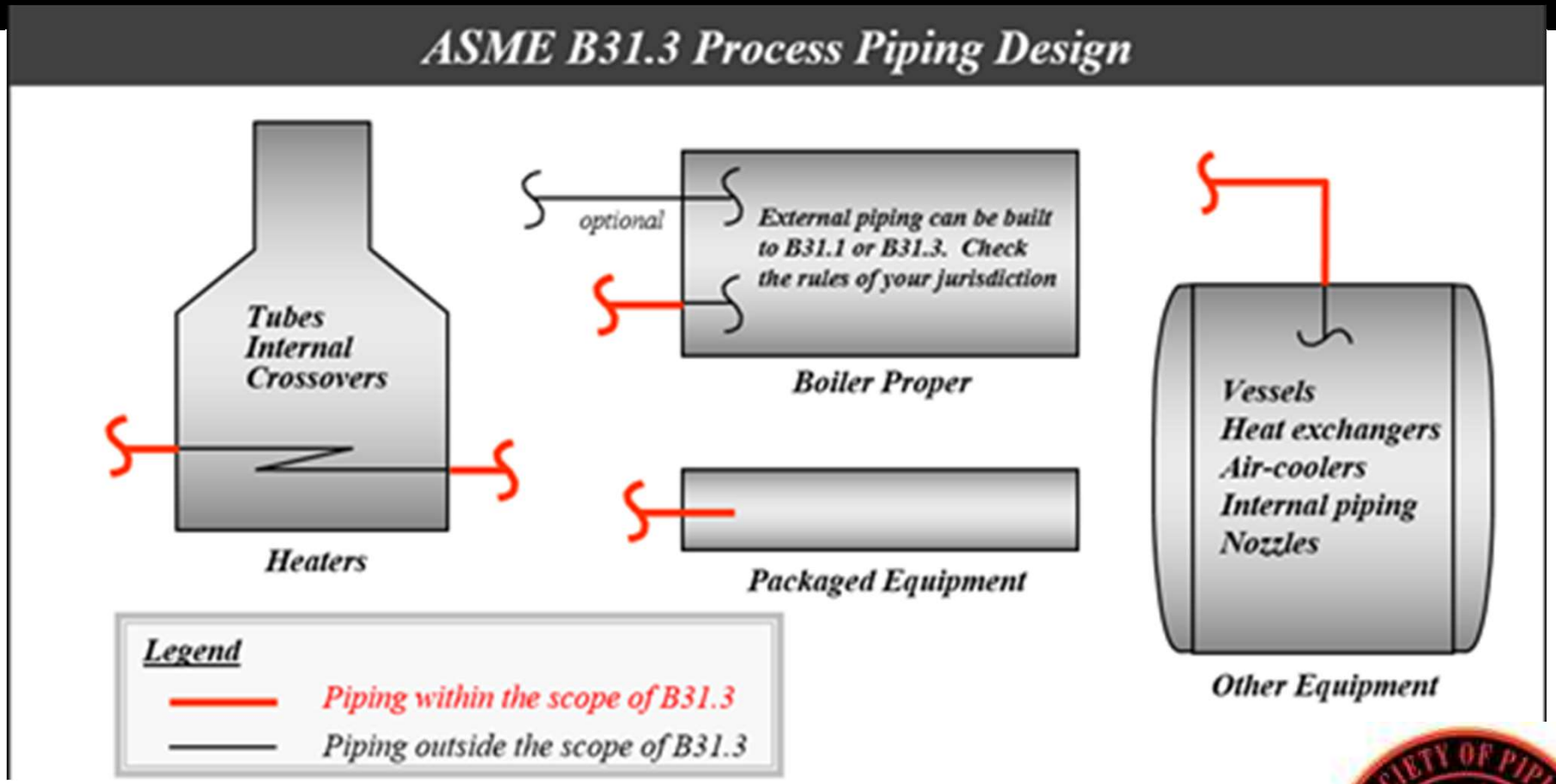
Codes & Standards



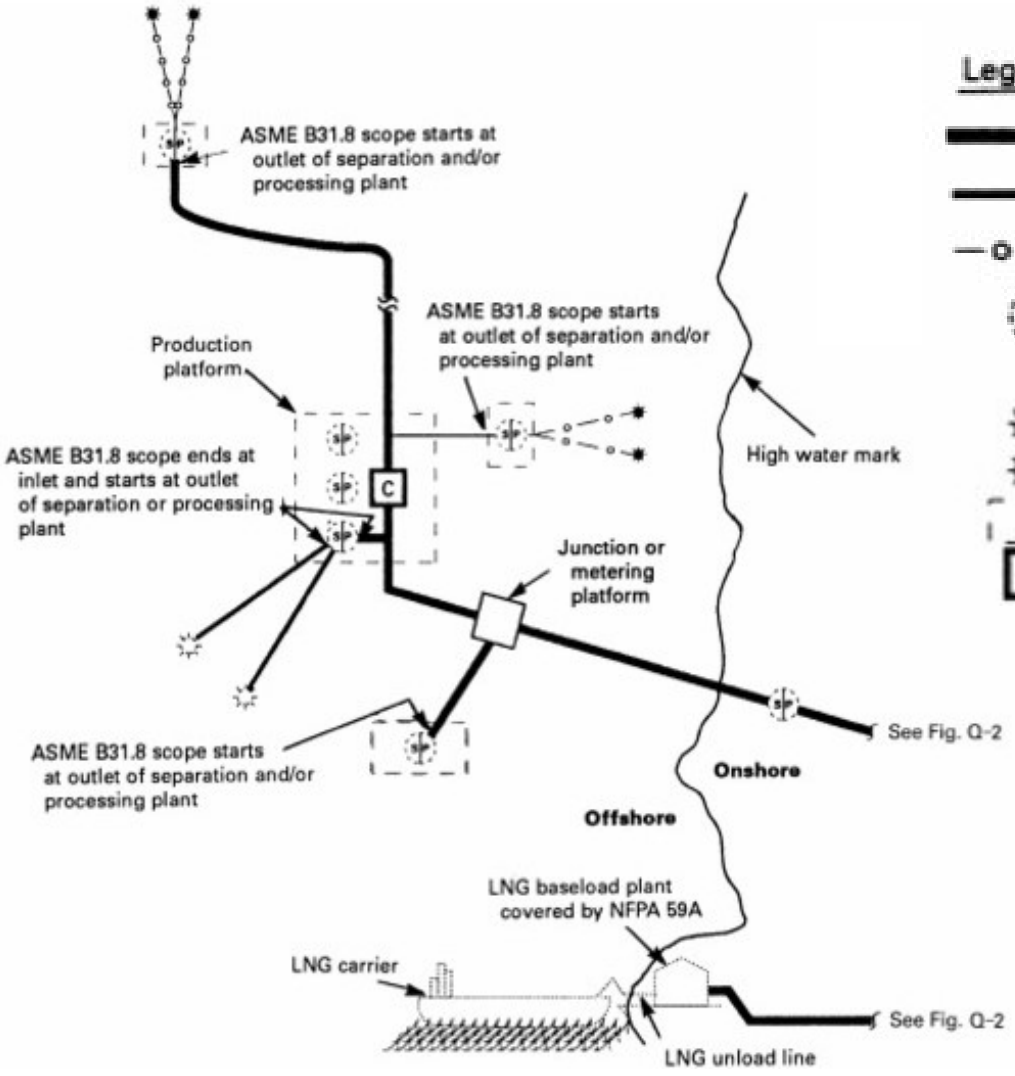
Codes & Standards. Cont.

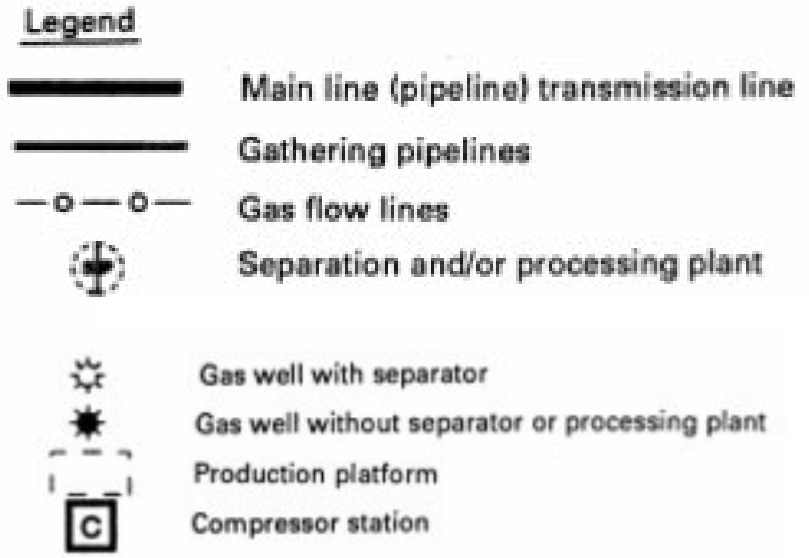


ASME B31.3 - Process Piping

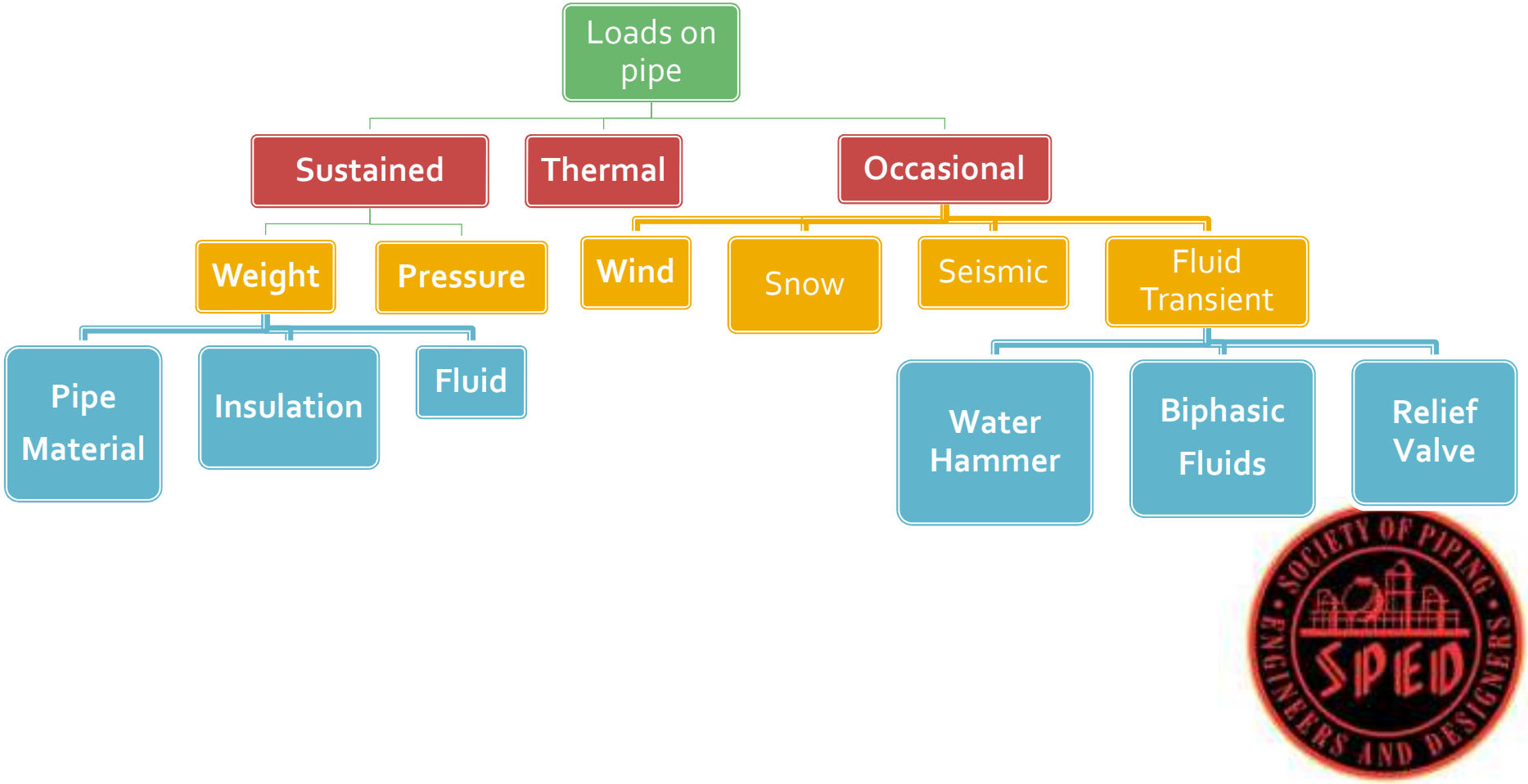


ASME B31.8 - Gas Pipeline Scope

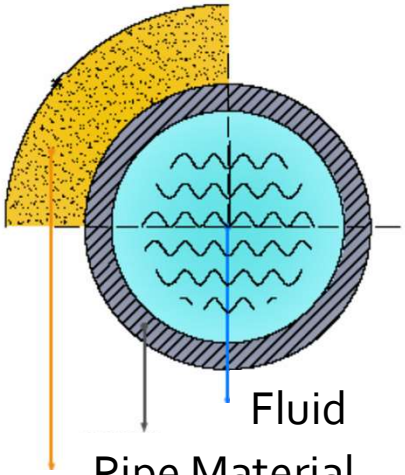


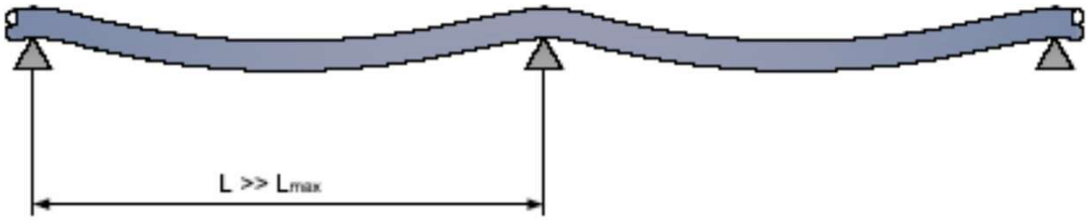


Types of loads

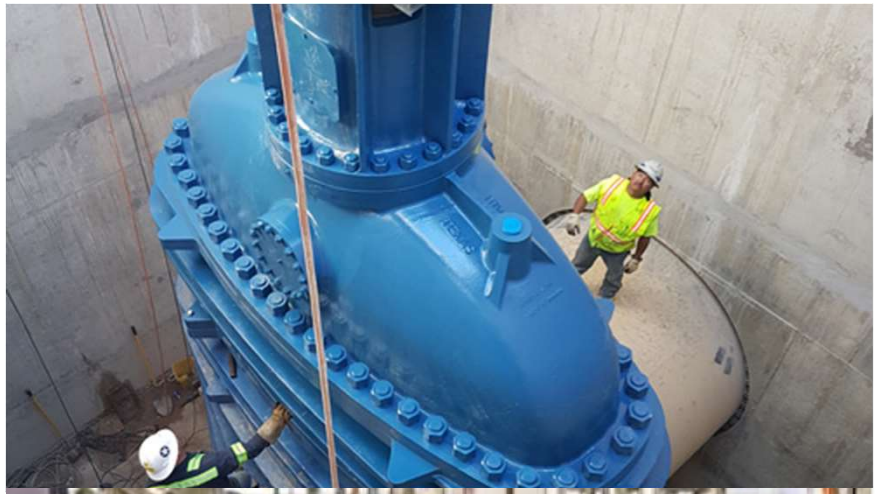


Sustained Loads. Pipe weight





Sustained Loads. Valve weight

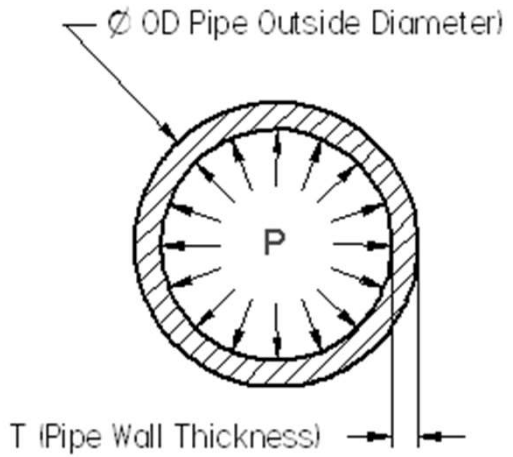


Sustained Loads. Insulation

Cryogenic insulation

Hot pipes insulation

Sustained Loads. Pressure



Sustained Loads. Pressure –Flange selection

Table 1
(from Table 2-2.2 of ASME B16.5-1996)

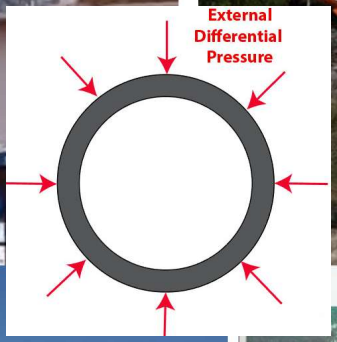
Working Pressures by Classes							
Class	150	300	400	600	900	1500	2500
Temperature	PSIG Values						
-20 to100° F	275	720	960	1440	2160	3600	6000
200° F	235	620	825	1240	1860	3095	5160
300° F	215	560	745	1120	1680	2795	4660
400° F	195	515	685	1025	1540	2570	4280
500° F	170	480	635	955	1435	2390	3980
600° F	140	450	600	900	1355	2255	3760
650° F	125	445	590	890	1330	2220	3700
700° F	110	430	580	870	1305	2170	3620
750° F	95	425	570	855	1280	2135	3560
800° F	80	420	565	845	1265	2110	3520
850° F	65	420	555	835	1255	2090	3480

NOTE: 304L material is limited to 800° F.

Sustained Loads. Test Pressure

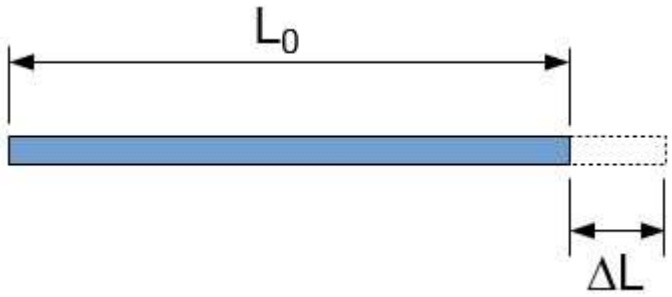
Fail due to
Pneumatic Test

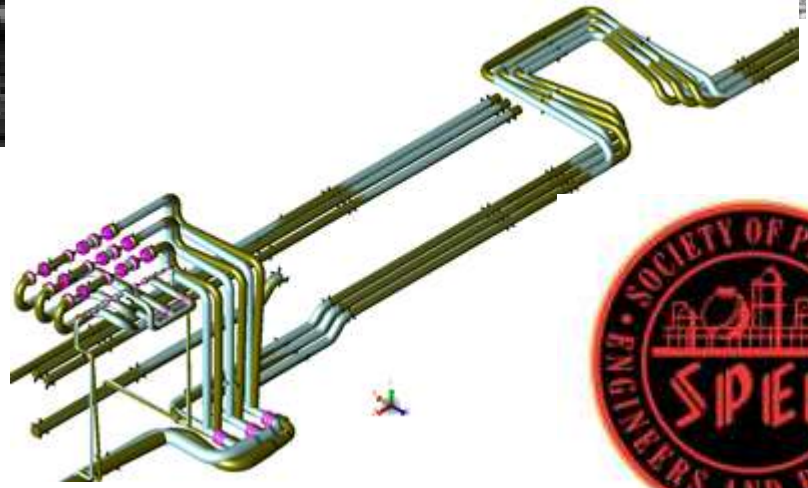
Sustained Loads. External Pressure



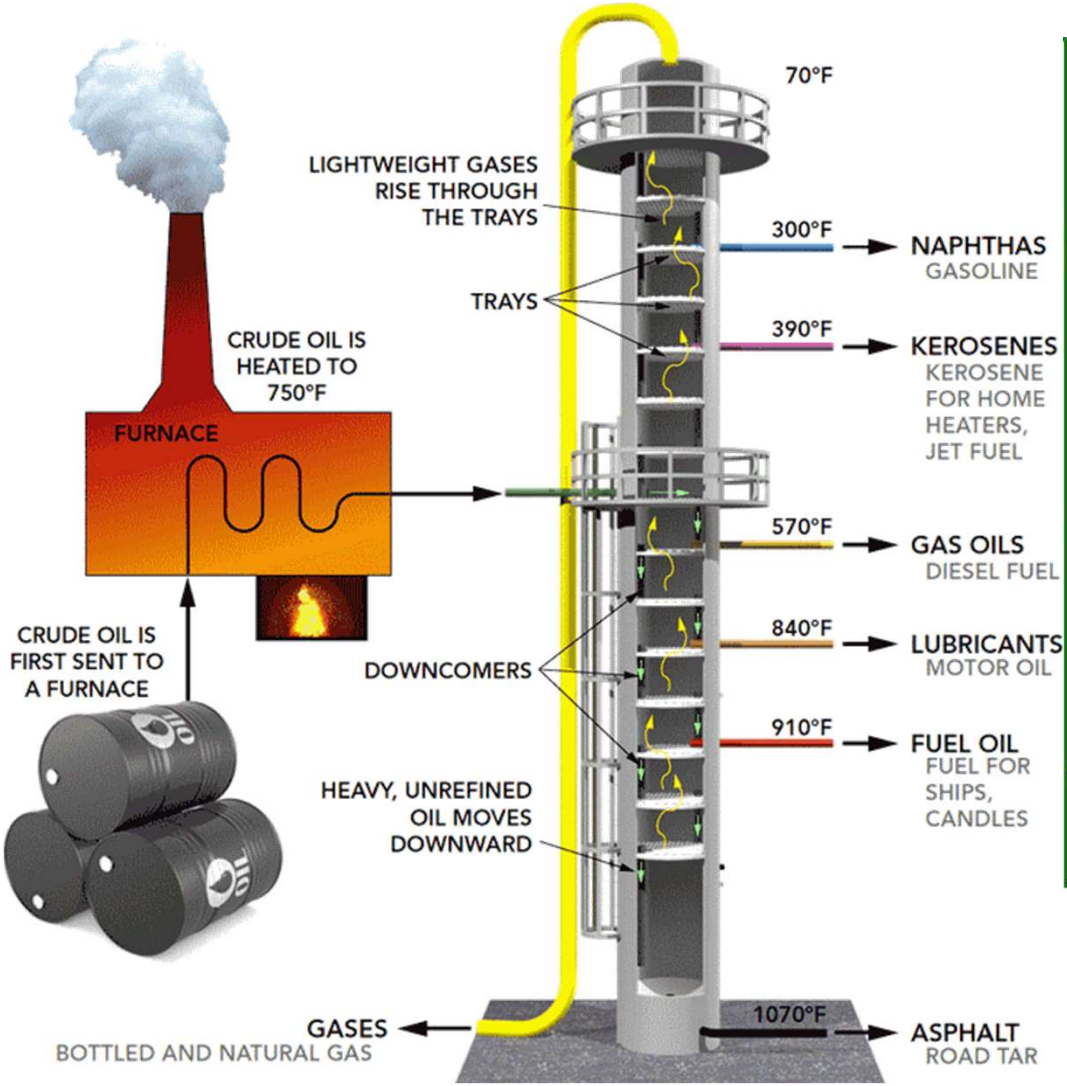
Stiffners for external pressure

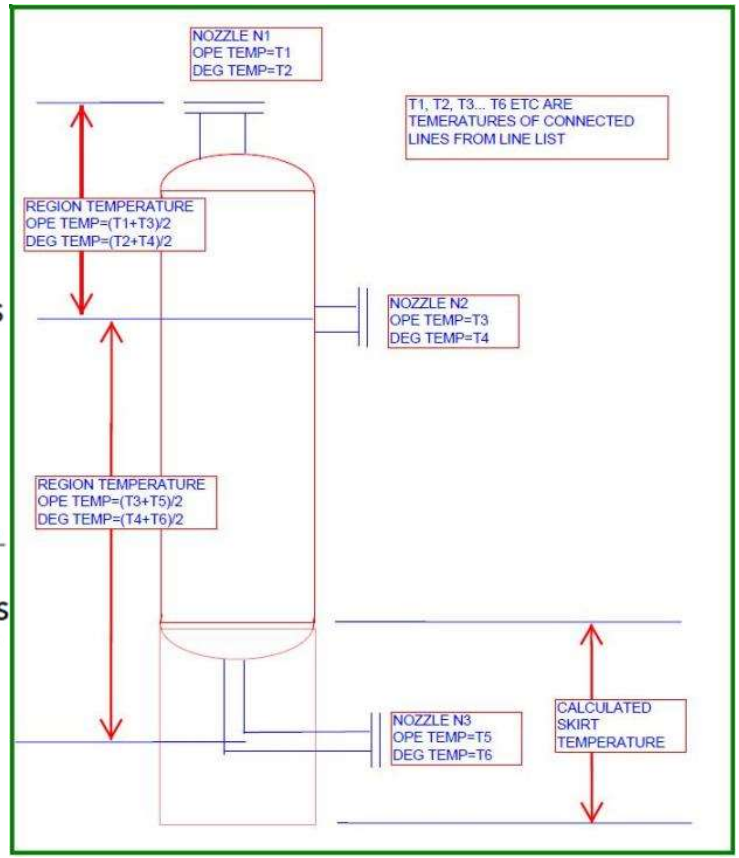
Thermal Loads. Pipe Expansion



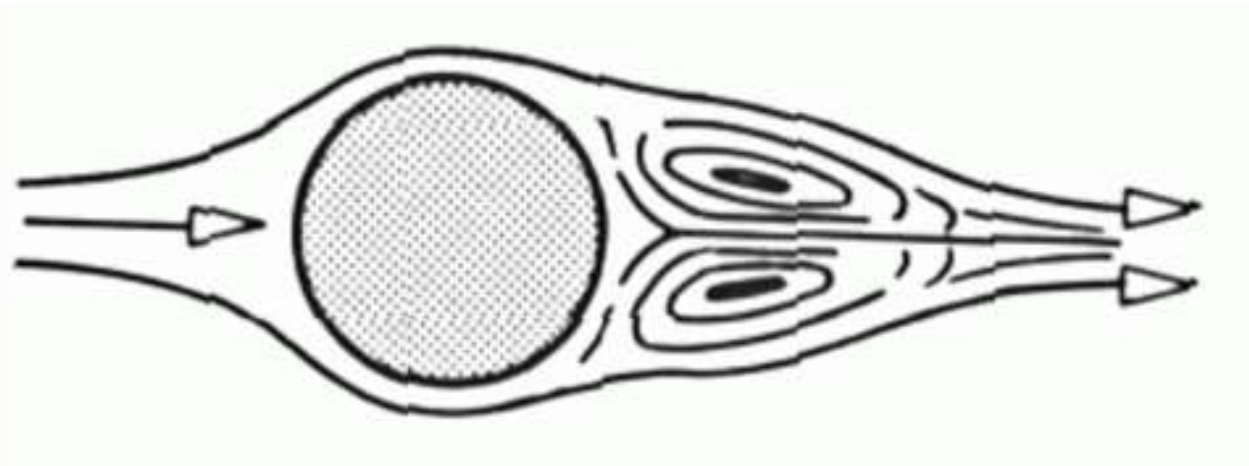


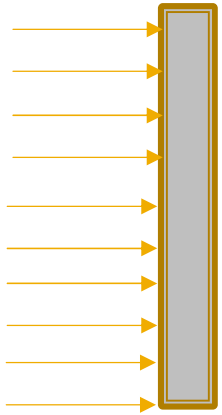
Thermal Loads. Equipment displacements



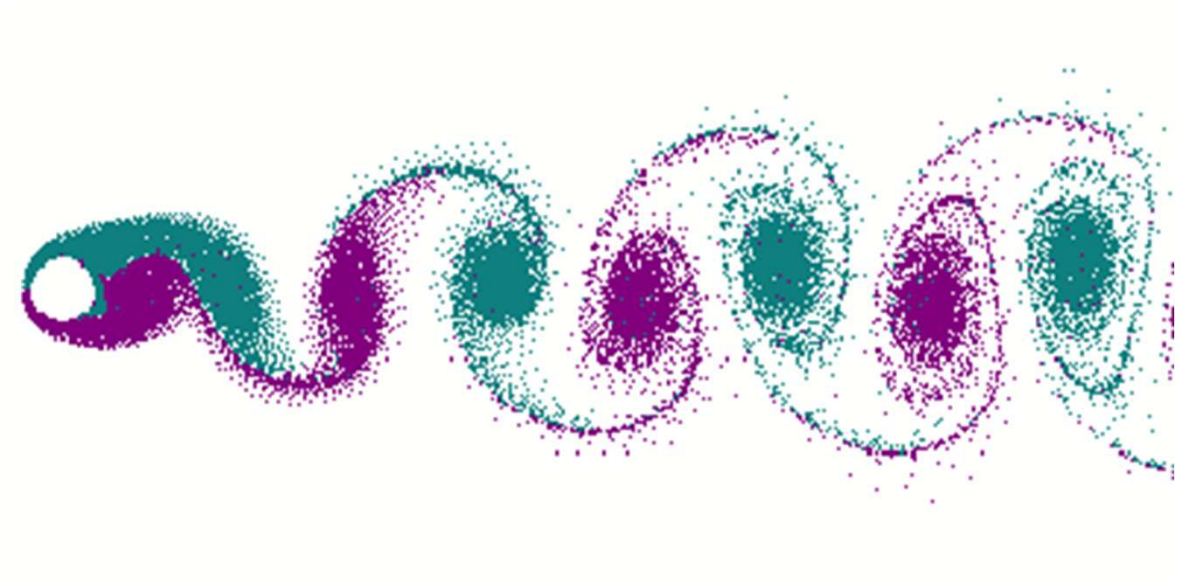


Occasional Loads. Wind

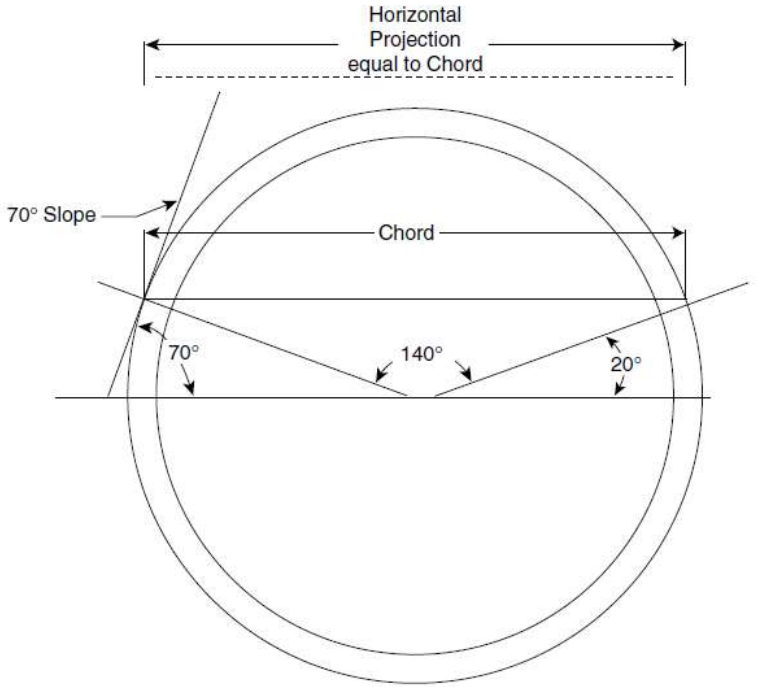




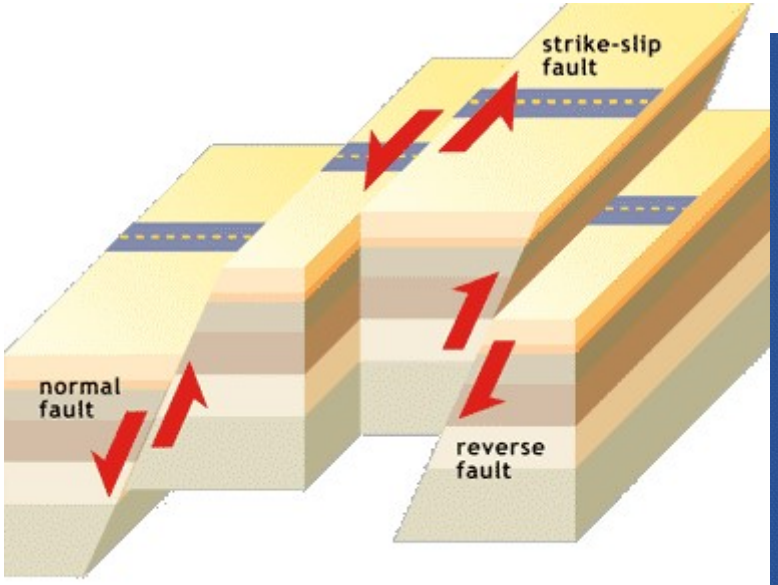
Pipe span

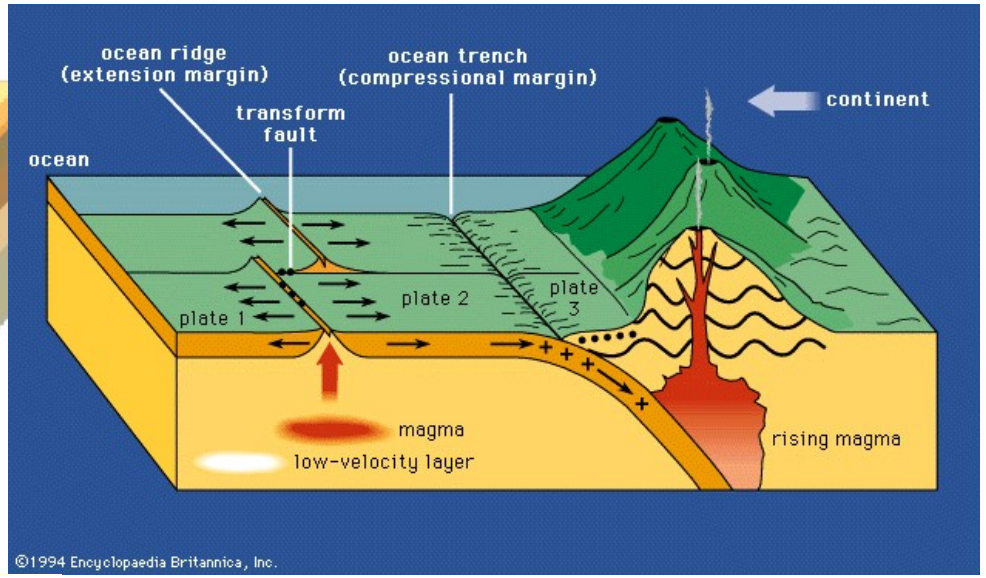


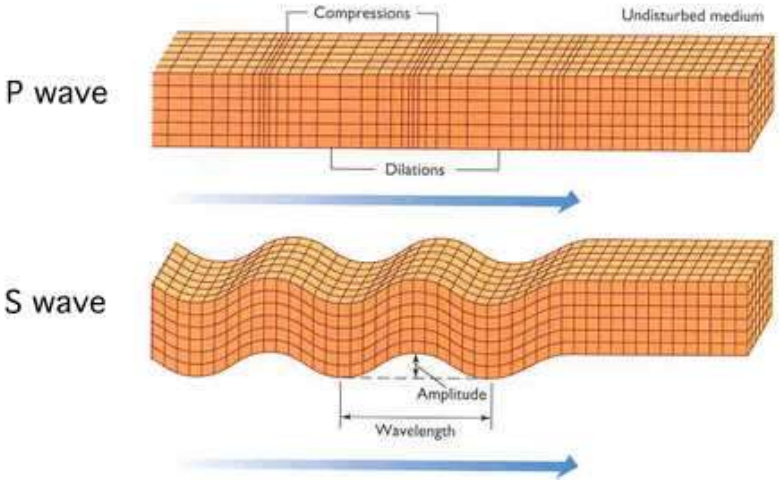
Occasional Loads. Snow & Ice

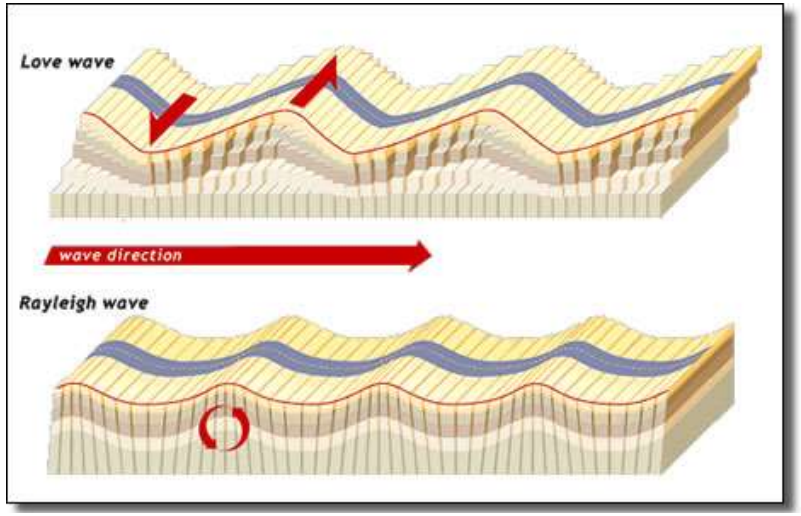


Occasional Loads. Seismic I

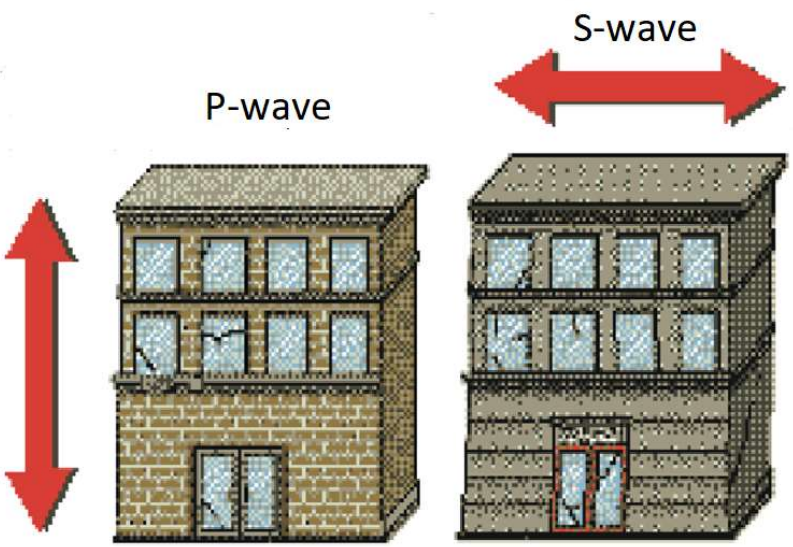






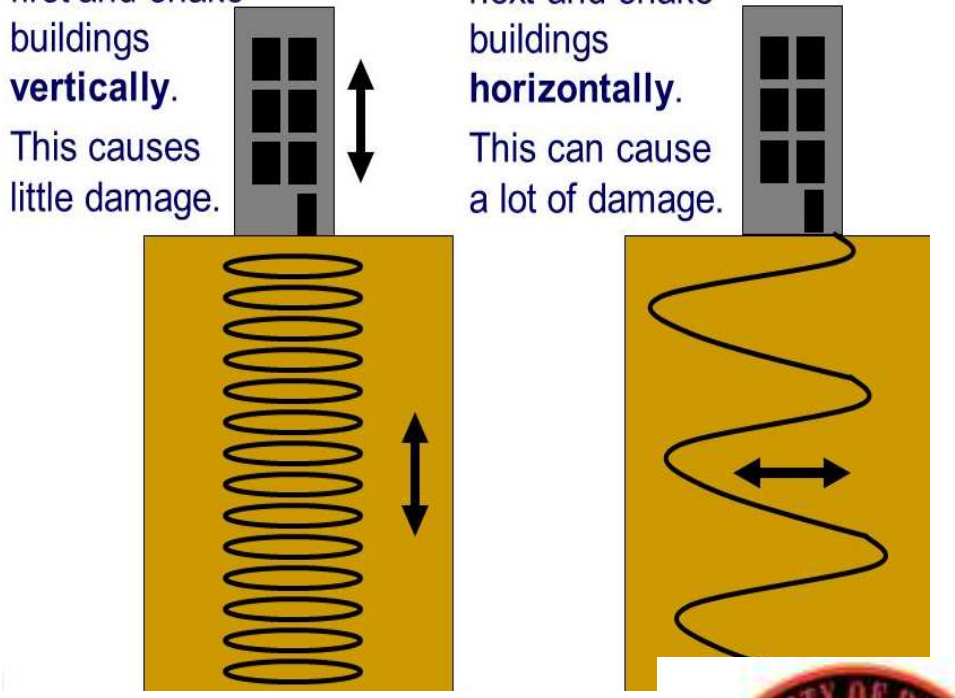


Occasional Loads. Seismic II



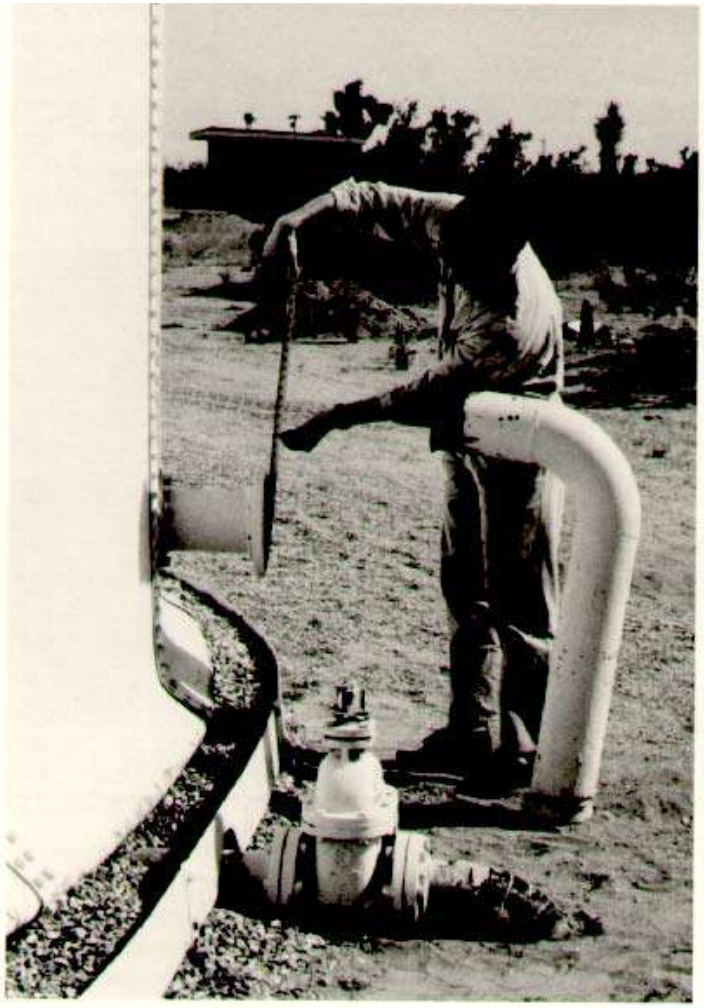
P-waves arrive first and shake buildings **vertically**. This causes little damage.

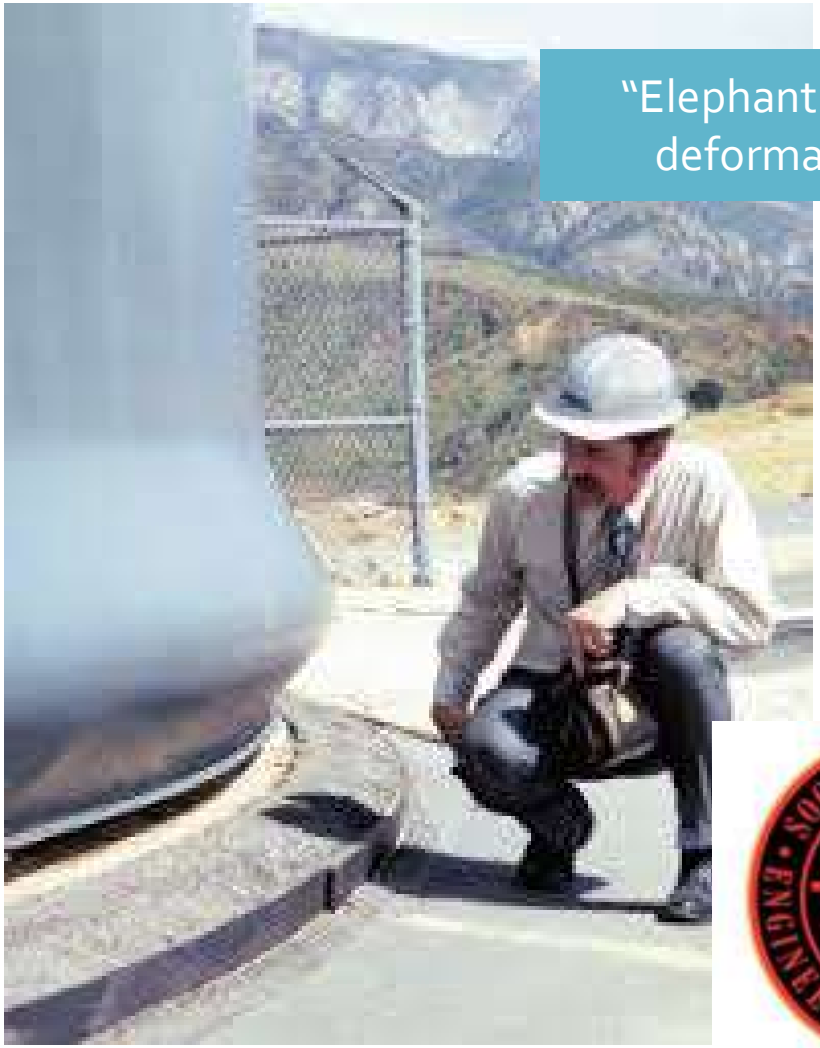
S-waves arrive next and shake buildings **horizontally**. This can cause a lot of damage.



Occasional Loads. Seismic III

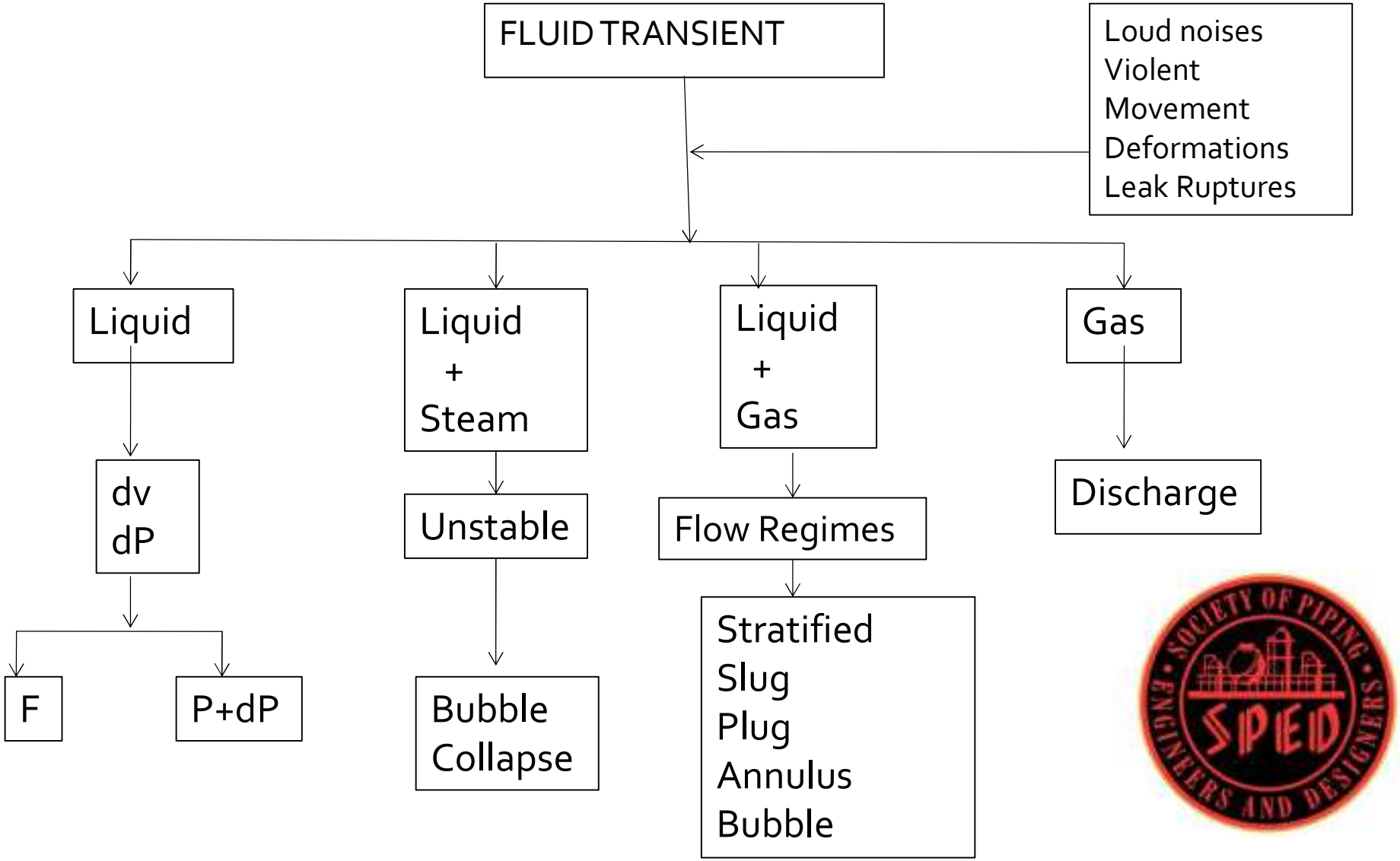
Occasional Loads. Seismic III



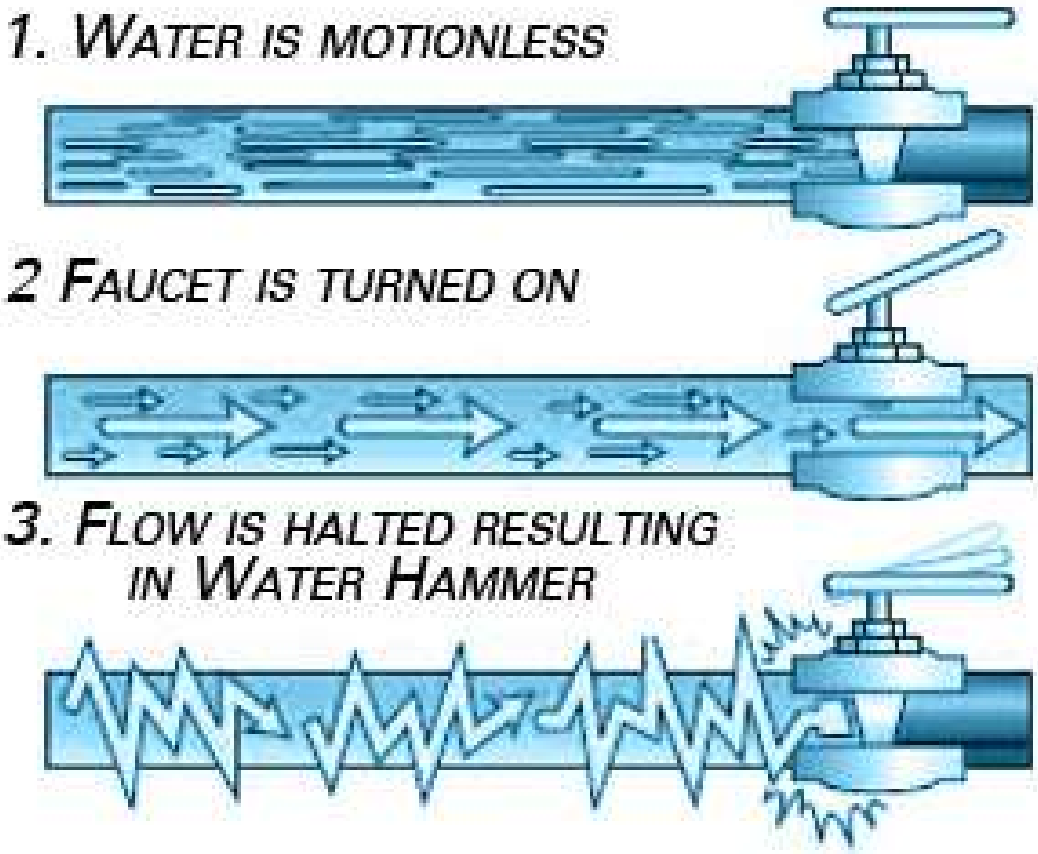


"Elephant Foot" deformation

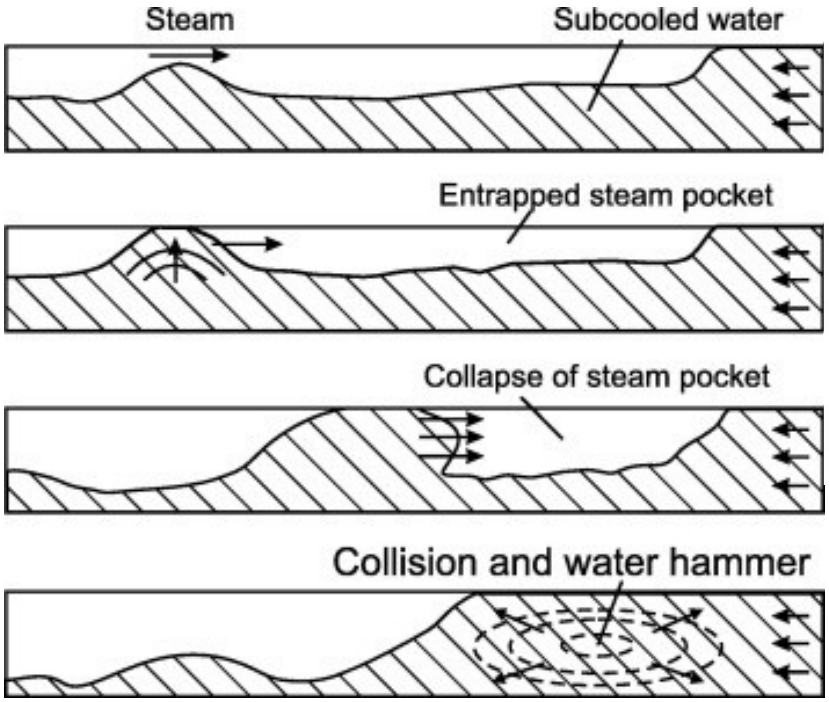
Occasional Loads. Fluid Transient

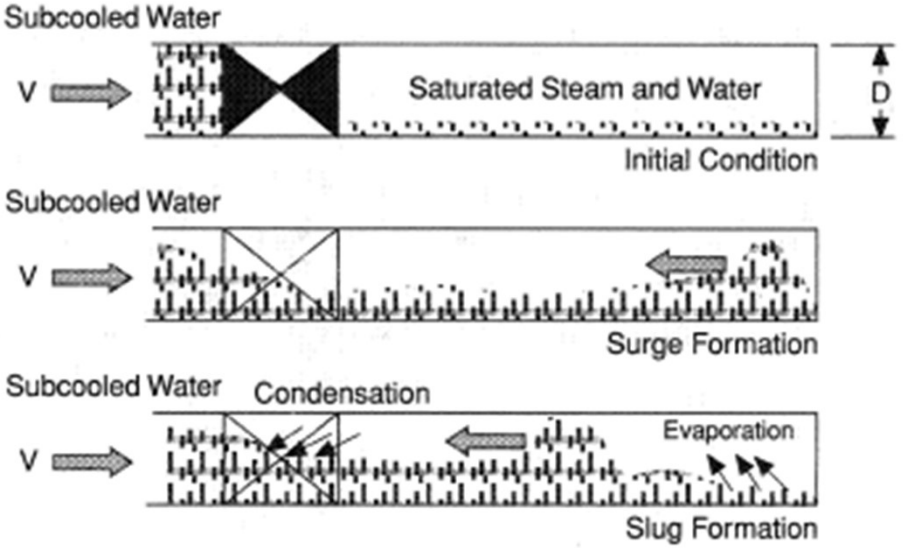


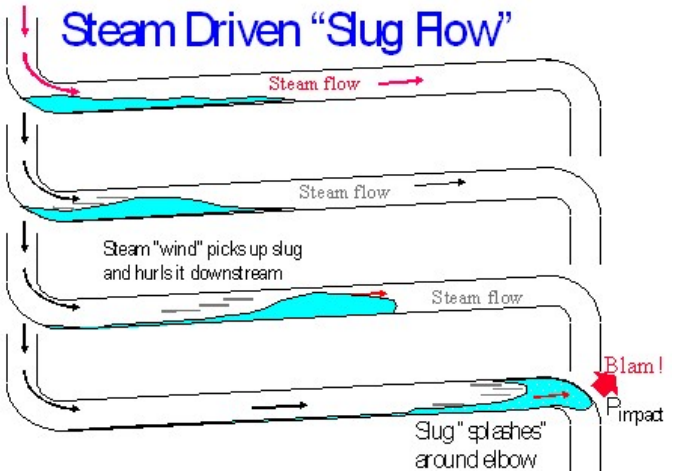
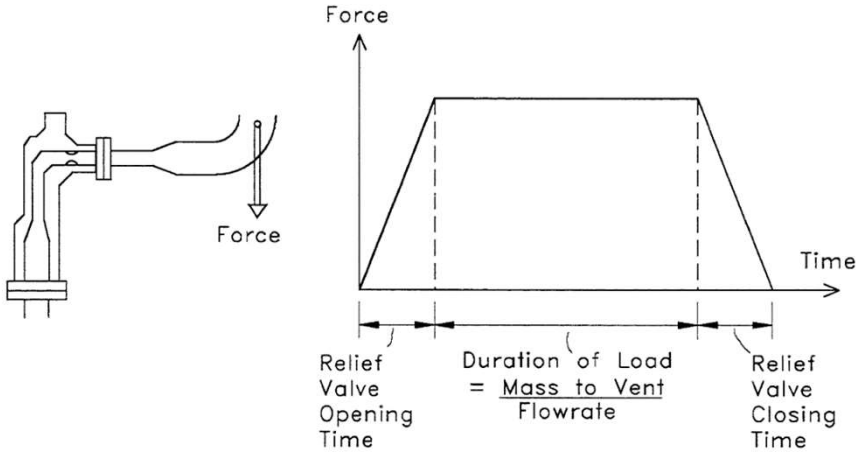
Occasional Loads. Fluid Transient. Water Hammer



Occasional Loads. Fluid Transient. Biphasic Fluids







Occasional Loads. Fluid Transient. Relief Valve