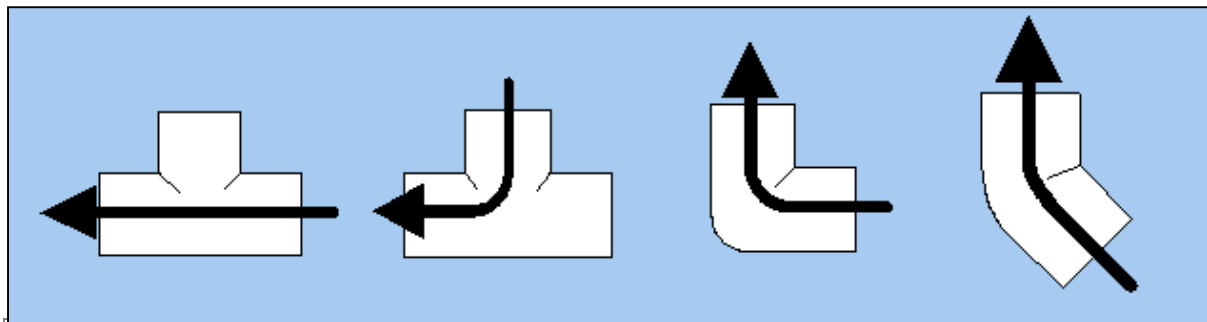


Appendix 8: Other Pipeline Friction Losses

Another major cause of head loss is in any fittings you might use. Avoid sharp corners in planning your pipeline, because sharp corners will cause turbulence and hence increase friction. The table below lists friction losses associated with various common plumbing fittings. It shows how many feet of pipeline length the fitting is equivalent to, in terms of friction loss. For example: A 'T' in a 4-inch pipeline represents 22ft of head lost – OUCH! Your goal in planning your pipeline is to keep it as straight as possible. Bends and curves should be less than 22 degrees. This is best accomplished with smooth, flexible hose sections making gradual curves where necessary, or by carefully heating and bending straight pipe sections to your needs.



Pipe Diameter	Tee-Run	Tee-Branch	90° Ell	45° Ell
1/2	1.0 feet	4.0 feet	1.5 feet	0.8 feet
3/4	1.4 feet	5.0 feet	2.0 feet	1.0 feet
1	1.7 feet	6.0 feet	2.3 feet	1.4 feet
1 1/4	2.3 feet	7.0 feet	4.0 feet	1.8 feet
1 1/2	2.7 feet	8.0 feet	4.0 feet	2.0 feet
2	4.3 feet	12.0 feet	6.0 feet	2.5 feet
2 1/2	5.1 feet	15.0 feet	8.0 feet	3.0 feet
3	6.3 feet	16.0 feet	8.0 feet	4.0 feet
3 1/2	7.3 feet	19.0 feet	10.0 feet	4.5 feet
4	8.3 feet	22.0 feet	12.0 feet	5.0 feet

Some other sources of potential head loss to be aware of:

- **Trash-rack/screen – clogged or poorly designed**
- **Pipe inlet – clogged inlet or inlet not properly submerged**
- **Valves – use gate, butterfly, or ball valves only in hydro systems as they allow unobstructed flow when open**
- **Size transitions in pipeline diameter, both increase or decrease**
- **Poorly sealed joints which allow air to be sucked into the pipeline**