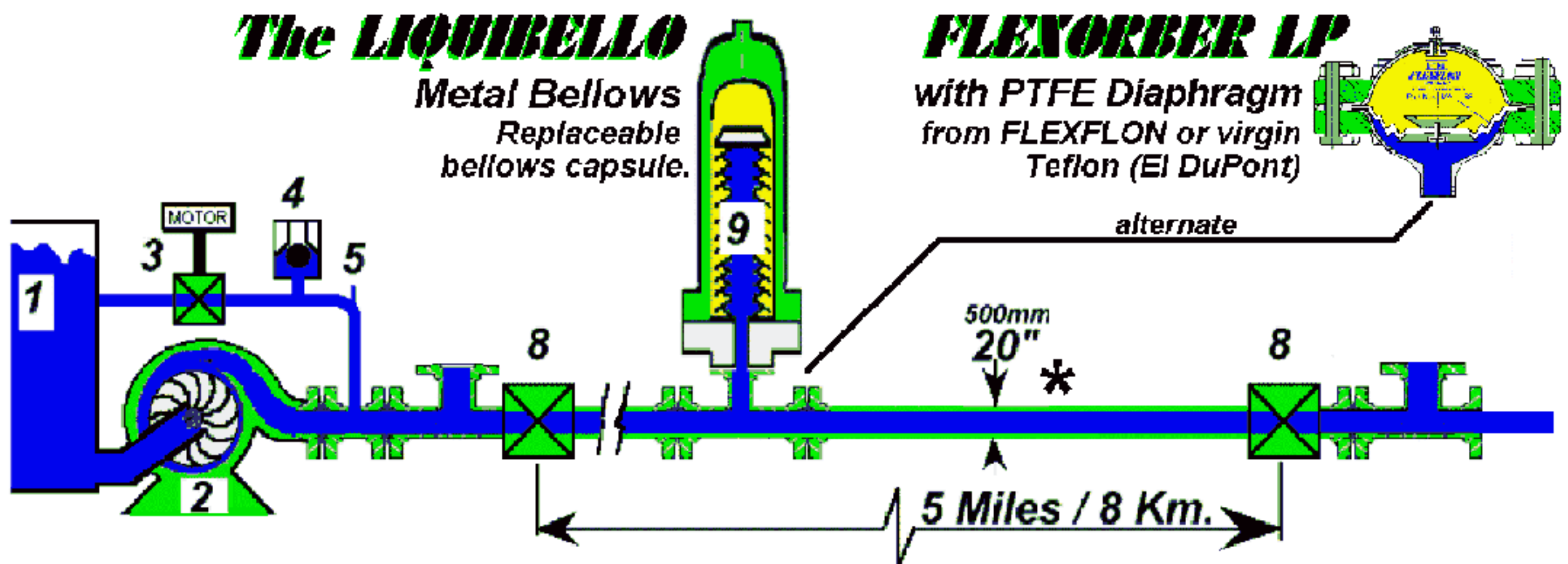


## In addition to pipeline shock solutions, we also provide: PRESSURE COMPENSATION FOR VOLUME EXPANSION OR CONTRACTION DUE TO TEMPERATURE CHANGE

Where block valves shut a volume in a pipe that may be subject to temperature change and where a relief valve piped back to source is not safe or practical, Flexorber or Liquibello volume compensators are used. [Liquibello dimensional drawing](#)



## A QUICK ESTIMATE OF THE VOLUME OF COMPENSATOR NEEDED

- "dV" ratio The volumetric expansion of the liquid over application temperature range :  
( This figure is found from the difference in SG Specific gravity at the lowest temp, to SG at the highest temp )  
Example : Liquid has a density of 1.013 at 5 Degrees C. and density 0.98 at 150 Deg, C      **EXAMPLE :**  
The value for volumetric expansion is 1.013 minus 0.98 = 0.033 ( 3.3% )      **0.033**
- " V " The volume of liquid locked in between the block valves. \* 1,637 Cu. Meters
- Pressure max "Pm". Generally less than the max pipe design pressure.      70 Bar
- "dP " Maximum allowable level of pressure change to be applied.      35 Bar

$$\frac{dV \cdot V \cdot Pm}{dP} = \frac{0.033 \times 1,637 \times 70}{35} = 108 \text{ Meters}^3$$

The equation has assumed an isothermal pressure change for the cushion gas compression or expansion which is of course absolutely incorrect. However the pipeline itself expands and contracts with temperature hereby accommodating some of the expansion or contraction volume. This is being used here as an offset, to save having to make an adiabatic calculation - to simplify the example for you.

An accurate calculation can be made with the gas laws :  $P_1 \times V_1 \times T_1 = P_2 \times V_2 \times T_2^n$  Where n=1-3  
The coefficient of expansion for the pipe material will of course then also have to be used to reduce the volume selected, because of the volume change due to pipe expansion or contraction.