Basic parameter of the shock tube is the diaphragm pressure ratio $p_4/p_1$.

The two chambers may be at different temperatures, $T_1$ and $T_4$, and may contain different gases having different gas constants, $R_1$ and $R_4$.

At the instant when the diaphragm is broken, the pressure distribution is a step function. It then splits into a shock and an expansion fan as shown in the figure.
The shock propagates into the expansion chamber with speed $V_{\text{shock}}$. An expansion wave propagates into the high pressure chamber with speed $a_4$ at its front. Condition of the shock traversed by the shock is denoted by 2 and that traversed by the expansion wave is denoted by 3.

The interface between Regions 2 and 3 is called the contact surface. It marks the boundary between the fluids which were originally separated by the diaphragm. The contact surface is like the front of a piston driving into the low pressure region creating a shock front ahead of it.

The following conditions apply on either side of the contact surface:

\[
p_2 = p_3
\]

and

\[
u_2 = u_3
\]

Temperatures and densities will be different in Regions 2 and 3. The above two conditions are used to determine the shock strength $p_3/p_4$ and expansion strength $p_2/p_1$. 

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The above expression gives shock strength $p_2/p_1$ implicitly as a function of the diaphragm pressure ratio $p_4/p_1$.

The expansion strength can then be obtained as

$$\frac{p_3}{p_4} = \frac{p_3}{p_1} = \frac{p_2}{p_4} = \frac{p_2}{p_1}$$
The temperature behind the shock is obtained from the Rankine-Hugoniot relations

\[
\frac{T_2}{T_1} = \frac{1 + \frac{\gamma_1 - 1}{\gamma_1 + 1} \frac{p_2}{p_1}}{1 + \frac{\gamma_1 - 1}{\gamma_1 + 1} \frac{p_1}{p_2}}
\]