FlexiderBenelux B.V.
HOLLAND

(Patented)

INSTRUCTIONS FOR USE OF SLIDE RULE

STEP 1

Determination of thermal expansion.

a) Move the slide until the piping length coincides with the arrow on the fixed part.

b) Move the transparent slide until its reference line coincides with the temperature used. For piping in unalloyed or low-alloyed steel, work on the upper temperature scale, for that in austentic stainless steel, work on the lower scale.

c) Read the expansion of the piping at + 20 °C indicated by the reference line on the transparent slide. If the temperature used is lower than + 20 °C, the expansion values read are understood to be negative or to be contractions in the piping.
For example: a piping length of 10 m operating at a temperature of + 150 °C will undergo an expansion of 15.8 mm if in unalloyed steel and 22.4 mm if in stainless steel.
The same piping operating at — 50 °C will undergo a contraction of 7.47 mm if in unalloyed steel and 11.3 mm if stainless steel.

STEP 2

Determination of end thrust of expansion joints.

a) Move the slide until the pressure value coincides with the arrow on the fixed part.

b) Corresponding to the nominal diameter *ND*, read the end thrust of the expansion joint.
For example: with a pressure of 15 Ate and an expansion joint of $ND = 500$, the end thrust will be 34000 kg.

STEP 3

Layout of hinged expansion joints.

— The assembly distances of the hinged expansion joints are calculated with reference to the shafts of their hinges.

— Total thermal expansion must include that of the parts of piping in which the expansion joints are inserted.

— In the case of predeformation of the expansion joints, to obtain the assembly distances, multiply the expansion values by the greater of the two factors

$$\left(1 - \frac{P}{100}\right) : \frac{P}{100}$$

in which *P* indicates the acceptable predeformation expressed as a percentage of total expansion.

a) Place the total expansion value $\Delta_1 + \Delta_2$ or $\Delta_1 + \Delta_3$ to correspond to the hinge run α_2.
Read the value of *a* indicated by the arrow: for the triple group, *L* if $a < b$, assume that $a = b$.

b) Place the value of *b* to correspond to $\frac{\Delta_3}{\Delta_1}$ and read the value of $c - a$ indicated by the arrow.
For example: we want to calculate the assembly distance for a group of three expansion joints at *L* having the fallowing:

maximum hinge run $\alpha_2 = 6°$	radius of curve $r = 450$ mm
thermal expansion $\Delta_1 = 400$ mm	length of expansion joint $l = 600$ mm
thermal expansion $\Delta_3 = 450$ mm	pretension $P = 30\,\%$

data:

$$(\Delta_1 + \Delta_3)\left(1 - \frac{P}{100}\right) = 500 \cdot 0.7 = 350 \text{ mm}$$

$$\frac{\Delta_3}{\Delta_1} = \frac{100}{400} = 0.25$$

$$b = 450 + \frac{600}{2} = 750 \text{ mm}$$

From this, we get:

$a = 3350$ mm

$c - a = 185$

From which:

$c = 3350 + 185 = 3535$ mm

STEP 4

Determination of the supports span.

A) Deflection function.
Place the value of weight *q* to correspond to the coefficient of expansion *E* of the material at the temperature of the piping. Read the value of *L*/*D* corresponding to the thickness *s*.
For example: a pipe thickness of 4 mm with a diameter of 100 mm, weight *q* of 20 kg/ m and a coefficient of expansion of $E = 20.000$ kg/mm² will allow an $L/D = 52.5$.
This means that if $D = 100$ mm, the maximum span *L* acceptable will be 5250 mm.

B) Stress function.
Place the thickness of the piping to correspond to the value of *L*/*D* calculated in *A*). Read the stress σ due to the weight *q* of the piping.
For example: going back to the piping in the previous case, let us put the thickness 4 to correspond to $L/D = 52.5$ and we read a $\sigma = 1.9$ kg/mm² corresponding to $q = 20$ kg/m.