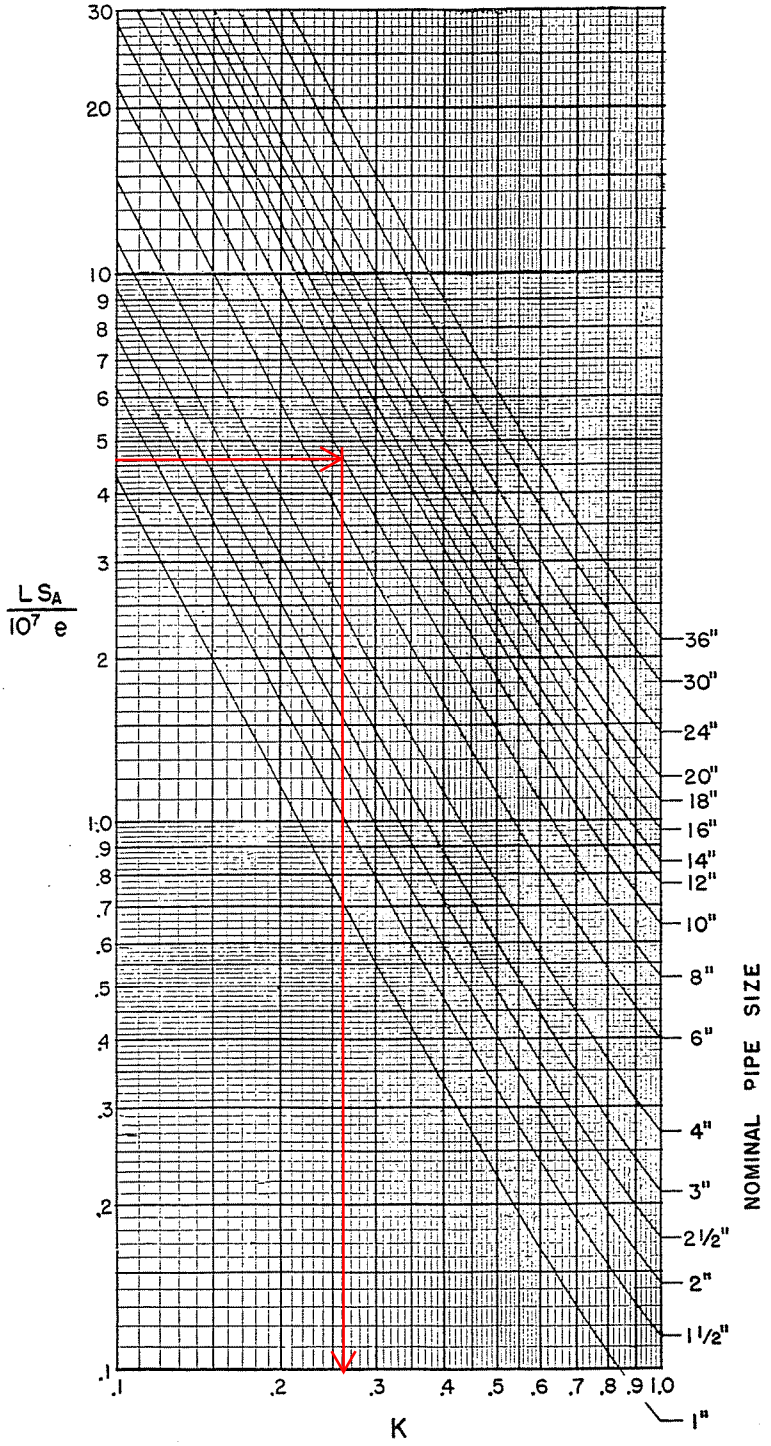
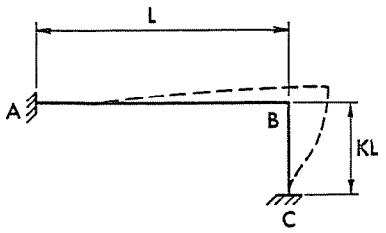
C-5. LENGTH OF LEG REQUIRED

Two-Member System, Both Ends Fixed, Thermal Expansion in Plane of Members





L = Length of leg AB, ft.

e = Unit linear thermal expansion, in./ft.

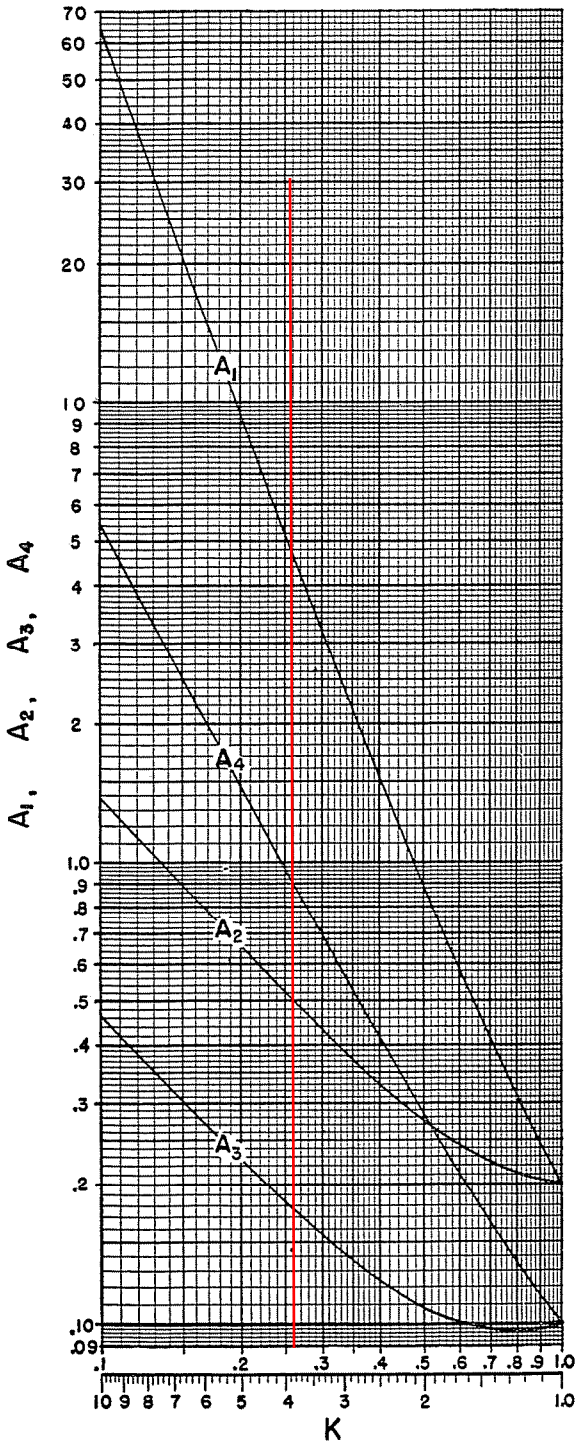
Value of E used = 29×10^6 psi.

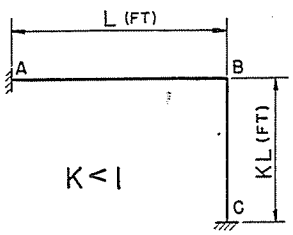
S_A = Code allowable stress range $(1.25S_c + 0.25S_h)$, psi.

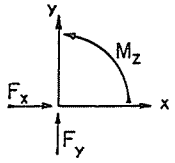
Multiply L by K to obtain length of leg BC required.

C-6. MOMENTS AND FORCES

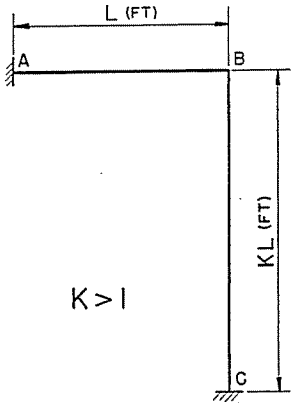
Two-Member System, Both Ends Fixed
Thermal Expansion in Plane of Members







$$F_{xA} = -F_{xC} = -10^6 A_1 Ie/L^2$$
$$F_{yA} = -F_{yC} = +10^6 A_2 Ie/L^2$$
$$M_{zA} = +10^6 A_3 Ie/L$$
$$M_{zC} = -10^6 A_4 Ie/L$$



$$F_{xA} = -F_{xC} = -10^6 A_2 Ie/(KL)^2$$
$$F_{yA} = -F_{yC} = +10^6 A_1 Ie/(KL)^2$$
$$M_{zA} = 10^6 A_4 Ie/KL$$
$$M_{zC} = -10^6 A_3 Ie/KL$$

F = Force, lb.

M = Moment, ft-lb.

First subscript denotes *direction*.

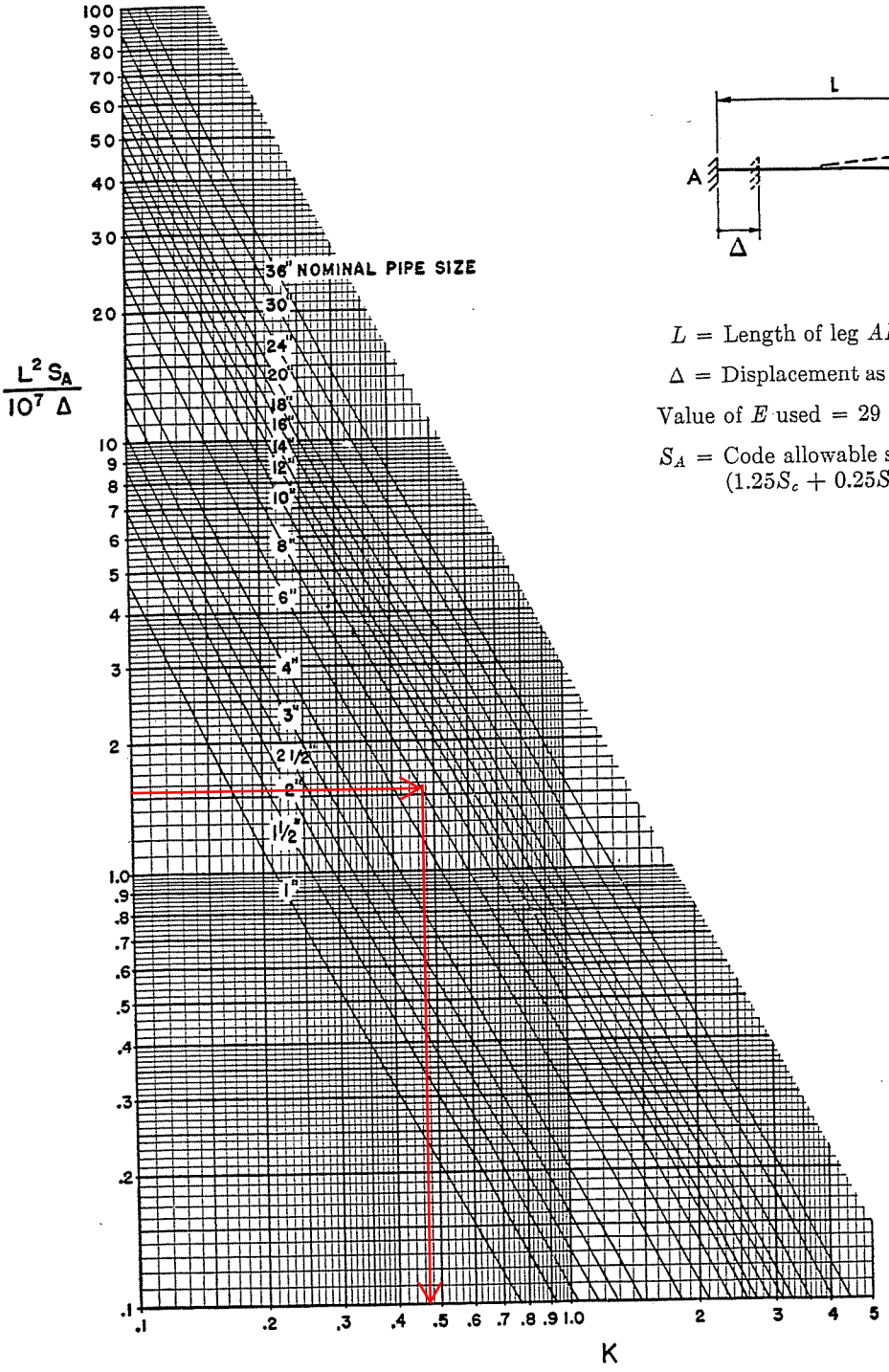
Second subscript denotes *location*.

Signs are those of forces or moments *acting* on anchors.

I = Moment of inertia of pipe, in.^{4}.
e = Unit linear thermal expansion, in./ft.
Value of E used = 29×10^6 psi.

C-7. LENGTH OF LEG REQUIRED

Two-Member System, Both Ends Fixed
One Support Displaced in the Direction of the Adjoining Member



L = Length of leg AB, ft.

Δ = Displacement as shown of end A, in.

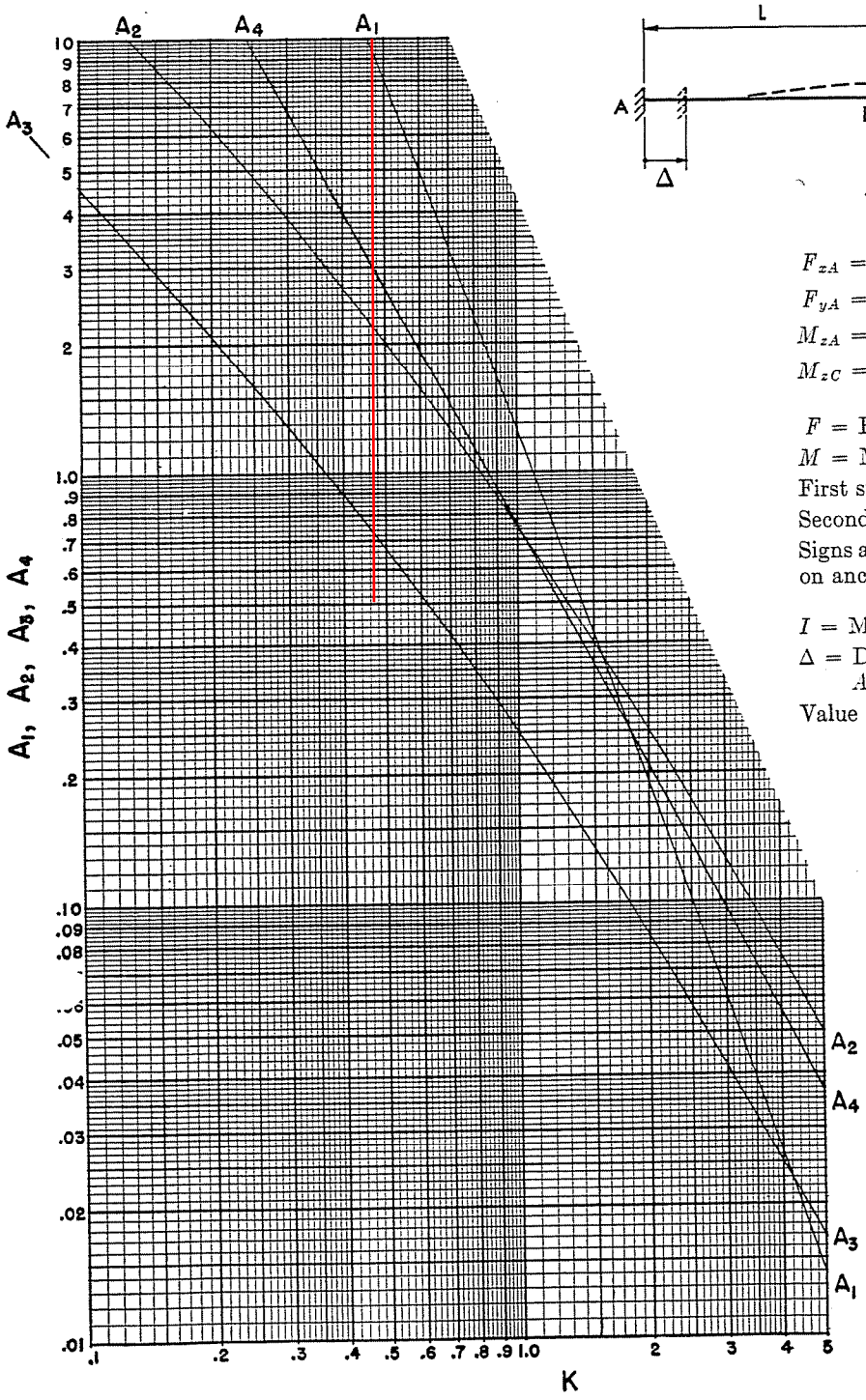
Value of E used = 29×10^6 psi.

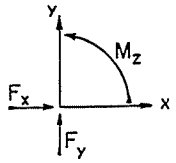
S_A = Code allowable stress range $(1.25S_c + 0.25S_h)$, psi.

Multiply L by K to obtain length of BC required.

C-8. MOMENTS AND FORCES

Two-Member System, Both Ends Fixed
One Support Displaced in the Direction of the Adjoining Member





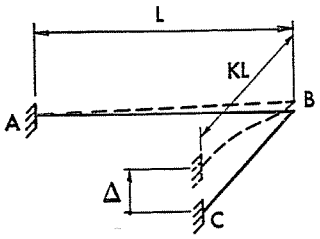
$$F_{zA} = -F_{zC} = -10^5\, I\Delta A_1/L^3$$
$$F_{yA} = -F_{yC} = +10^5\, I\Delta A_2/L^3$$
$$M_{zA} = +10^5\, I\Delta A_3/L^2$$
$$M_{zC} = -10^5\, I\Delta A_4/L^2$$

F = Force, lb.
M = Moment, ft-lb.
First subscript denotes *direction*.
Second subscript denotes *location*.
Signs are those of forces or moments *acting* on anchors.

I = Moment of inertia of pipe, in.^{4}.
Δ = Displacement in x-direction of end A, in.
Value of E used = 29×10^6 psi.

C-9. LENGTH OF LEG REQUIRED

Two-Member System, Both Ends Fixed
One Support Displaced Normal to Plane of Members

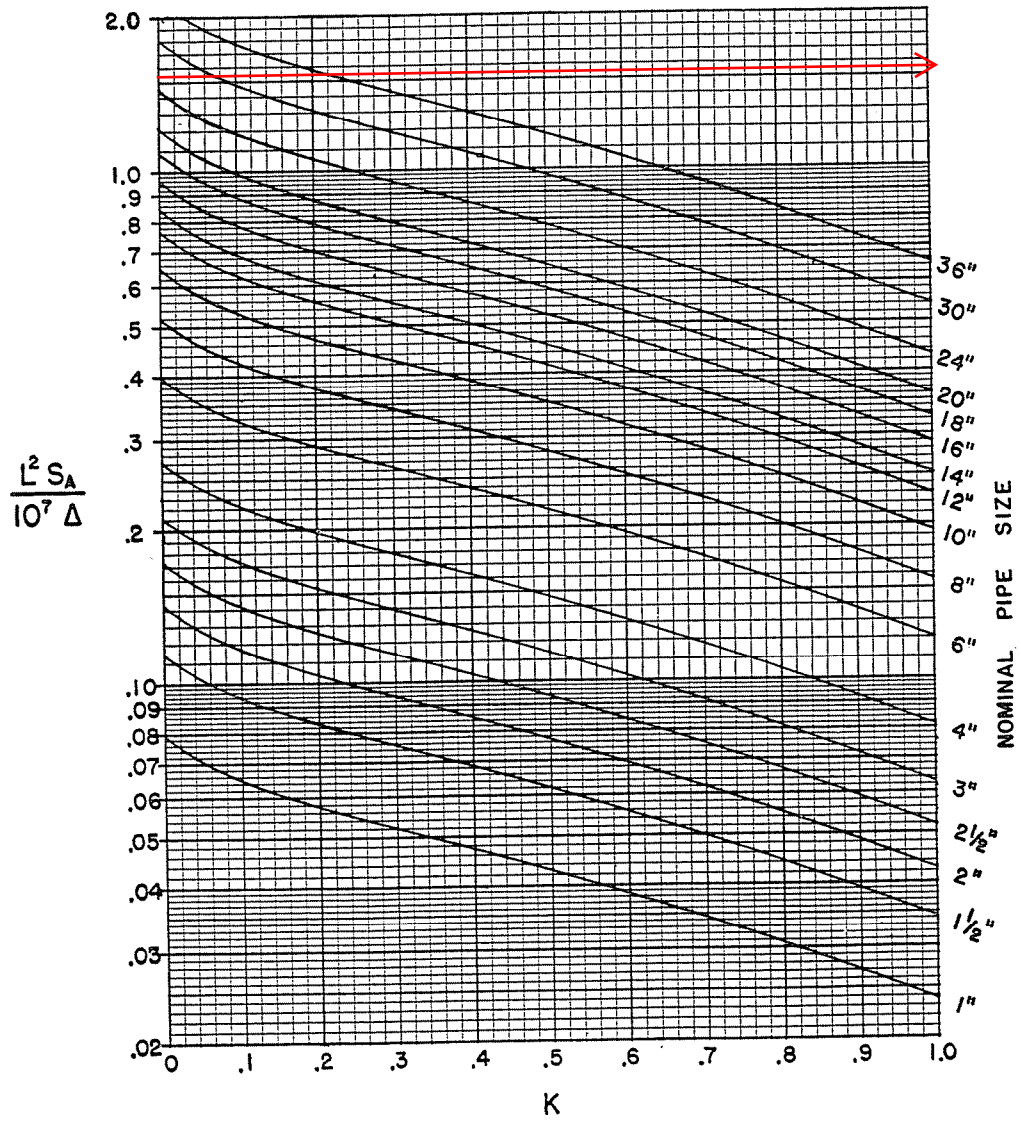


L = Length of leg AB, ft.

Δ = Displacement normal to plane, in.

Value of E used = 29×10^6 psi.

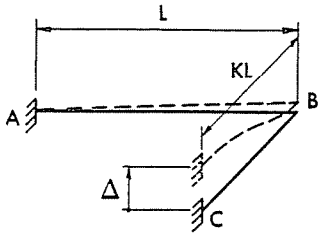
S_A = Code allowable stress range $(1.25S_c + 0.25S_h)$, psi.

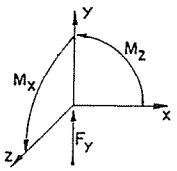


Multiply L by K to obtain length of leg BC required.

C-10. MOMENTS AND FORCES

Two-Member System, Both Ends Fixed
One Support Displaced Normal to Plane of Members





$$F_{yA} = -F_{yC} = 10^3 \frac{I\Delta}{L^3} A_1$$

$$M_{xA} = -10^3 \frac{I\Delta}{L^2} A_2$$

$$M_{zA} = +10^3 \frac{I\Delta}{L^2} A_3$$

$$M_{xC} = -10^3 \frac{I\Delta}{L^2} A_4$$

$$M_{zC} = 10^3 \frac{I\Delta}{L^2} A_5$$

F = Force, lb.

M = Moment, ft-lb.

First subscript denotes *direction.*

Second subscript denotes *location.*

Signs are those of forces or moments *acting* on anchors.

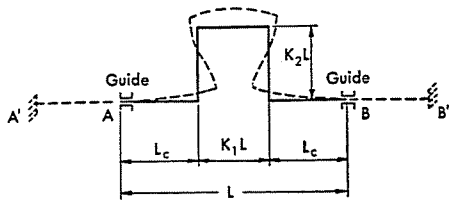
I = Moment of inertia of pipe, in.^{4}.

Δ = Displacement normal to plane, in.

Value of E used = 29×10^6 psi.

C-11. REQUIRED HEIGHT

Symmetrical Expansion Loop



L = Length from A to B, ft.

$L_c = \frac{1}{2}L(1 - K_1)$

Δ = Expansion from A' to B', in.

D = Outside diameter of pipe, in.

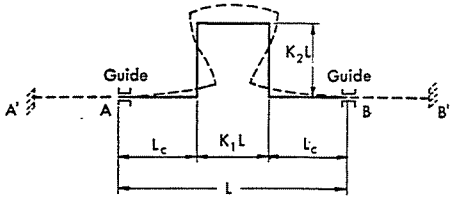
Value of E used = 29×10^6 psi.

S_A = Code allowable stress range $(1.25S_c + 0.25S_h)$, psi.

Multiply L by K_1 and K_2 to obtain dimensions of loop.

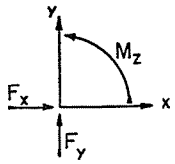
C-12. MOMENTS AND FORCES

Symmetrical Expansion Loop



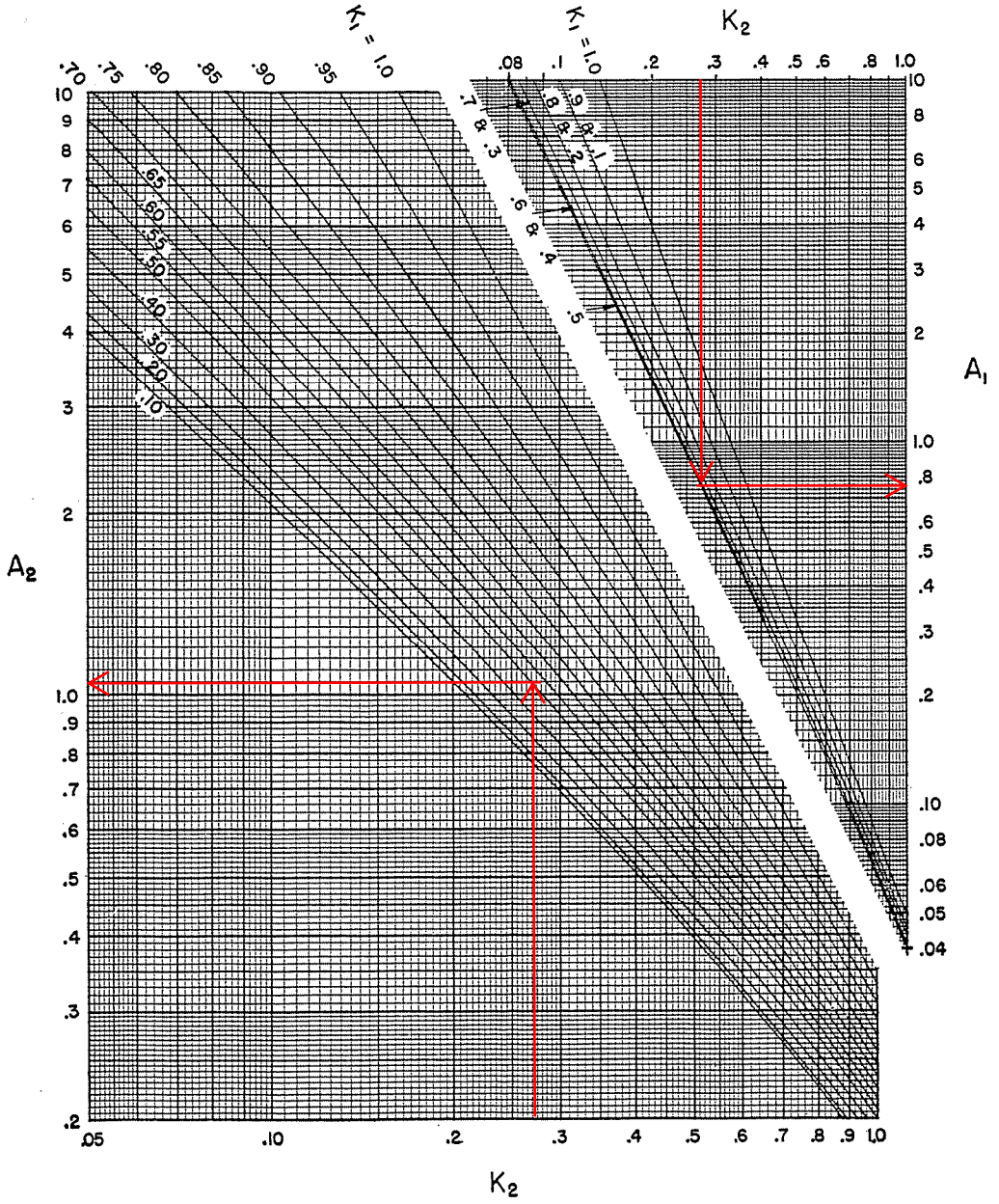
$$F_{xA'} = -F_{xB'} = -10^6 A_1 I\Delta/L^3$$

$$M_{zA} = -M_{zB} = 10^5 A_2 I\Delta/L^3$$

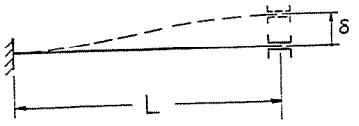


I = Moment of inertia of pipe, in.^{4}.
Δ = Expansion from A' to B', in.
Value of E used = 29×10^6 psi.

F = Force, lb.
M = Moment, ft-lb.
First subscript denotes *direction*.
Second subscript denotes *location*.
Signs are those of forces or moments *acting* on anchors.



C-13. Guided Cantilever Chart



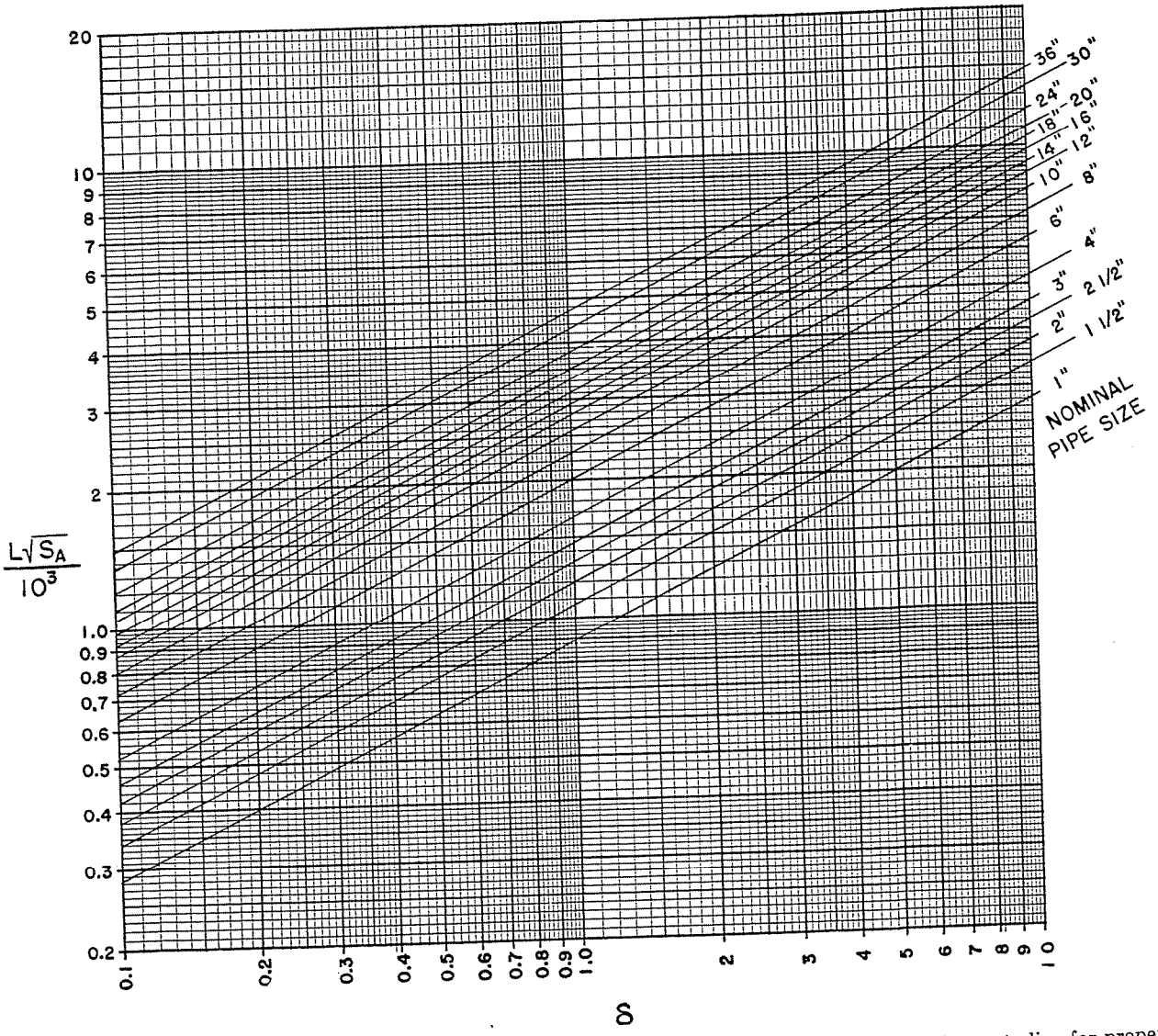
Assumed mode of deflection of guided cantilever.

L = Length of leg, ft.

δ = Lateral deflection, in.

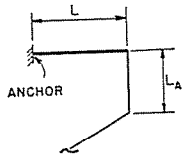
Value of E used = 29×10^6 psi.

S_A = Code allowable stress range $(1.25S_c + 0.25S_h)$, psi.

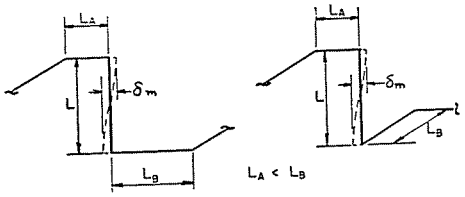


Instructions: Determine value of $L\sqrt{S_A}/10^3$. Enter with this value of ordinate scale and read over to line for proper nominal pipe size. Read down to abscissa scale. The value obtained will be the permissible lateral deflection for leg.

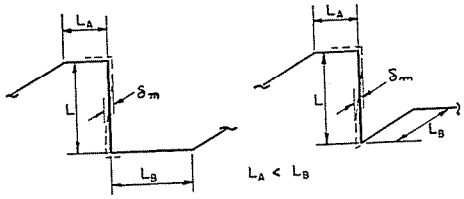
C-14. Correction Factor f, Guided Cantilever Method



Case I. For any exterior leg L.



Case II. For any interior leg L whose maximum deflection is in the plane of L and L_A where L_A is the shorter of the connecting legs.



Case III. For any interior leg L whose maximum deflection is perpendicular to the plane of L and L_A where L_A is the shorter of the connecting legs.