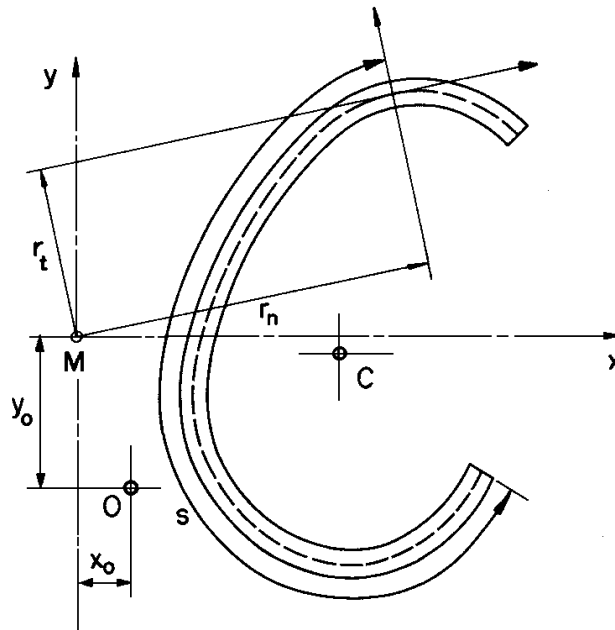


INFORMATION ON THE USE OF DATA SHEETS OF THE 00.07 SERIES

1. NOTATION

E	modulus of elasticity of material	N/m^2	lbf/in^2
G	shear modulus of material	N/m^2	lbf/in^2
I_{xx}, I_{yy}, I_{xy}	second moments of area with respect to orthogonal axes parallel to reference axes through centroid of section (point C of Sketch 1.1)	m^4	in^4
J	torsion constant of section	m^4	in^4
r_n, r_t	perpendiculars to median line of section with respect to shear centre of section (see Sketch 1.1)	m	in
S	length of median line of section (see Sketch 1.1)	m	in
s	distance along median line of section (see Sketch 1.1)	m	in
T	torque applied to section at each end of member	N m	lbf in
t	thickness of section	m	in
ω^*	warping of cross section due to unit rate of twist about shear centre	$\left(\frac{\text{m}}{\text{rad/m}}\right)$	$\left(\frac{\text{in}}{\text{rad/in}}\right)$
x, y	reference axis centred on shear centre of section (see point M of Sketch 1.1)		
x_0, y_0	coordinates of arbitrary point, O, with respect to reference axes (see point O of Sketch 1.1)		
z	distance along length of member	m	in
ϕ	twist per unit length of member	m^{-1}	in^{-1}
Γ_1	primary warping constant of section	m^6	in^6
Γ_2	secondary warping constant of section	m^6	in^6
Γ	total warping constant of section = $\Gamma_1 + \Gamma_2$	m^6	in^6
$(\Gamma_1)_0$	warping constant of section with reference to arbitrary centre O (see Sketch 1.1)	m^6	in^6

Both SI and British units are quoted but any coherent system of units may be used.



Sketch 1.1

2. NOTES

The torsion constant, J , of a member of uniform cross section is the geometrical property of the cross section by which the shear modulus, G , must be multiplied to obtain the torsional rigidity of the member. The torsional rigidity is defined as the factor by which a torque, T , applied to each end of the member has to be divided to obtain the twist per unit length, it being assumed that the ends of the member are not axially constrained (that is, Saint-Venant torsion).

$$\text{Thus, } \phi = \text{twist per unit length} = \frac{T}{GJ}. \quad (2.1)$$

Data Item No. Struct 00.07.01 gives the torsion and secondary warping constants of a bulb angle stringer section.

A further series of Data Items gives the primary and secondary warping constants, Γ_1 and Γ_2 respectively, for various open thin-walled sections.

In a uniform thin-walled open section member, with or without end constraints, subjected to torque, T , which is calculated about the shear centre and may vary along the length of the member, the twist per unit length, ϕ , with the assumption that the cross section is not distorted in its own plane, satisfies the differential equation,

$$T = GJ\phi - E\Gamma \frac{d^2\phi}{dz^2}. \quad (2.2)$$

It is assumed in Equation (2.2) that no resultant end loads act on the member. Γ is the total warping constant defined by

$$\Gamma = \Gamma_1 + \Gamma_2. \quad (2.3)$$