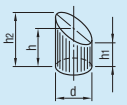
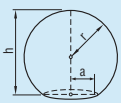
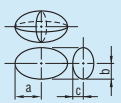
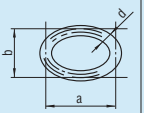
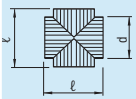
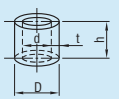
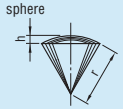
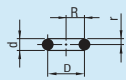
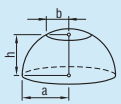
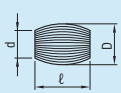
3D shape	Volume V
Truncated cylinder 	$V=\frac{\pi}{4}d^2h$ $=\frac{\pi}{4}d^2\left(\frac{h_1+h_2}{2}\right)$
Pyramid 	$V=\frac{h}{3}A=\frac{h}{6}arn$ A=Bottom surface area r=Radius of inscribed circle a=Length of 1 side of regular polygon n=Number of regular polygon sides
Spherical crown 	$V=\frac{\pi h^2}{3}(3r-h)$ $=\frac{\pi h}{6}(3a^2+h^2)$ a is the radius.
Ellipsoidal body 	$V=\frac{4}{3}\pi abc$ In the case of a rotating ellipsoidal body (b=c): $V=\frac{4}{3}\pi ab^2$

3D shape	Volume V
Ellipsoidal ring 	$V=\frac{\pi^2}{4}d^2\frac{\sqrt{a^2+b^2}}{2}$
Crossing cylinders 	$V=\frac{\pi}{4}d^2\left(\ell+\ell'\cdot\frac{d}{3}\right)$
Hollow cylinder (tube) 	$V=\frac{\pi}{4}h(D^2-d^2)$ $=\pi th(D-t)$ $=\pi th(d+t)$
Truncated pyramid 	$V=\frac{h}{3}(A+a+\sqrt{Aa})$ A,a=Surface area of each end

3D shape	Volume V
Conical section of sphere 	$V=\frac{2}{3}\pi r^2h$ $=2.0944r^2h$
Circular ring 	$V=2\pi^2Rr^2$ $=19.739Rr^2$ $=\frac{\pi^2}{4}Dd^2$ $=2.4674Dd^2$
Cone 	$V=\frac{\pi}{3}r^2h$ $=1.0472r^2h$
Sphere 	$V=\frac{4}{3}\pi r^3=4.1888r^3$ $=\frac{\pi}{6}d^3=0.5236d^3$

3D shape	Volume V
Zone of sphere 	$V=\frac{\pi h}{6}(3a^2+3b^2+h^2)$
Barrel shape 	When curve has circumference that is an arc: $V=\frac{\pi\ell}{12}(2D^2+d^2)$ When curve has circumference that is a parabola $V=0.209\ell(2D^2Dd+1/4d^2)$

■Physical properties of metal materials

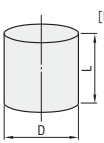
M	Density [g/cm³]	Young's modulus E [kgf/mm²]	Coefficient of thermal expansion [M10⁻⁶/°C]
Soft steel	7.85	21000	11.7
SKD11	7.85	21000	11.7
Powdered high-speed steel (HAP40)	8.07	23300	10.1
Carbide V30	14.1	56000	6.0
Cast iron	7.3	7500 ~ 10500	9.2 ~ 11.8
SUS304	8.0	19700	17.3
Oxygen-free copper C1020	8.9	11700	17.6
6/4 brass C2801	8.4	10300	20.8
Aluminum A1100	2.7	6900	23.6
Duralumin A7075	2.8	7200	23.6
Titanium	4.5	10600	8.4

1kgf/mm² =9.80665×10⁶ Pa

■Finding the weight

Weight W[g]=Volume[cm³]×Density

[Example] Material: Soft steel



Weight when D=φ16 and L=50 mm is found as follows.

$W=\frac{\pi}{4}D^2\times L\times$Density

$=\frac{\pi}{4}\times1.6^2\times5\times7.85$

≒79[g]

■Finding dimensional changes resulting from thermal expansion

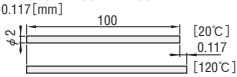
Example: Material: SKD11

Example: The amount of dimensional change δ which occurs when a pin of D=φ2, L=100 mm is heated to 100°C is the following.

δ =Coefficient of thermal expansion×Total length×Temperature change

=11.7×10⁻⁶×100 mm×100°C

=0.117[mm]



■Finding dimensional changes resulting from Young's modulus E

Example: Find strain λ when load P=1000 kgf is applied to a φ10×L60 pin. (Material: SKD11)

$E=\frac{PL}{\lambda\lambda}$

$\lambda=\frac{PL}{AE}=\frac{1000\times60}{78.5\times21000}$

≒0.036mm

Cross-section area $A=\frac{\pi}{4}D^2=78.5$