

2010

FÓRMULAS Y DATOS



Savid Jara Garrido


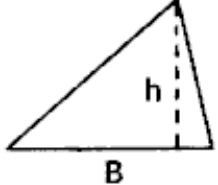
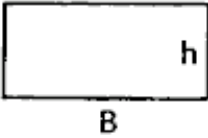
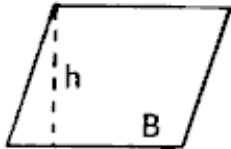
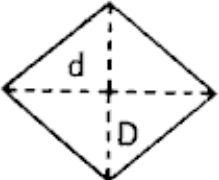
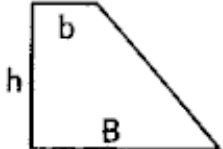
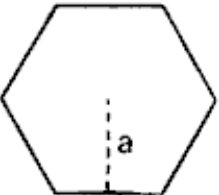
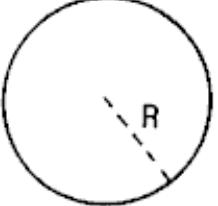
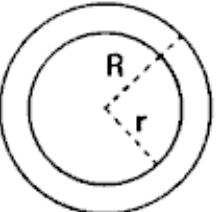
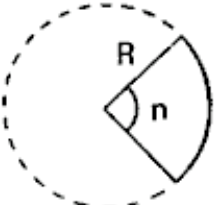
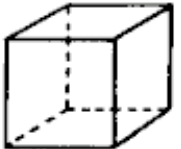
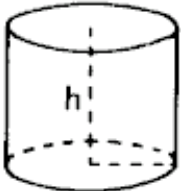
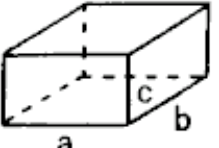
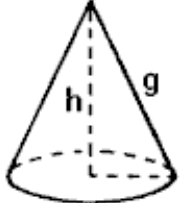
Fabricación y Montaje Industrial

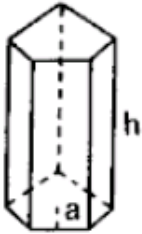
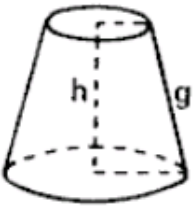
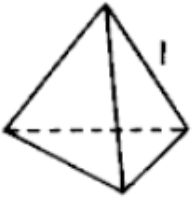
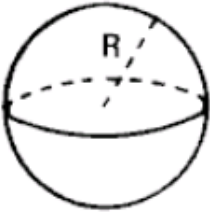
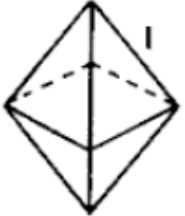

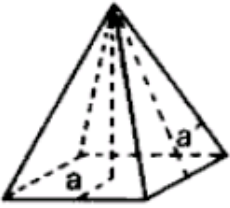
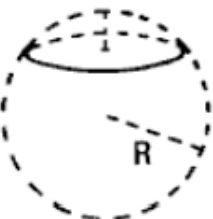
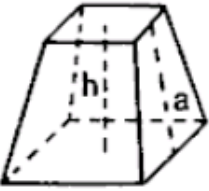
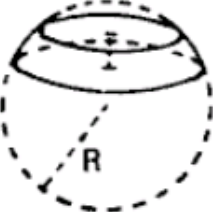
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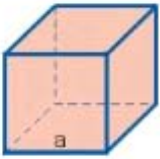
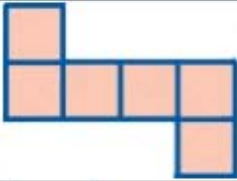

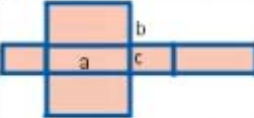
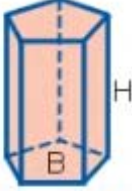
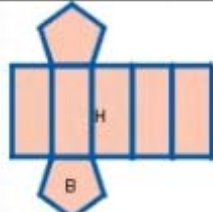
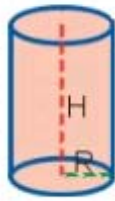
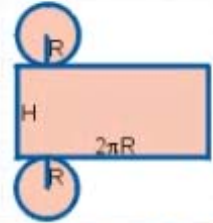

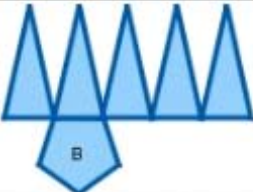
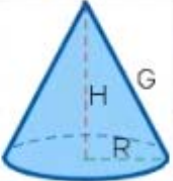
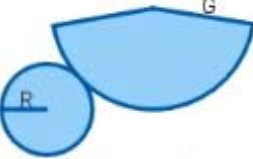
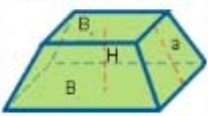

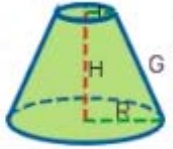

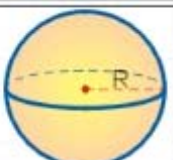
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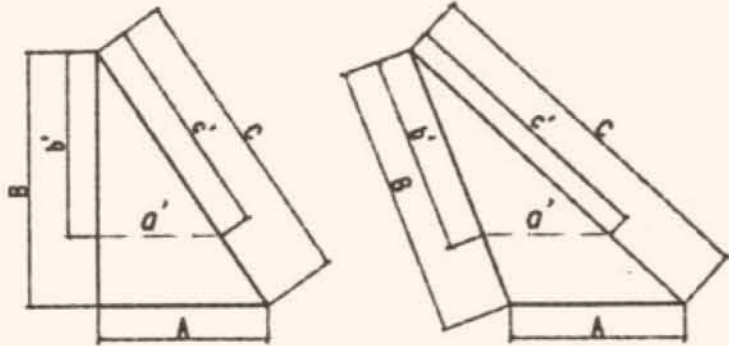
AREAS Y VOLUMEN

| | | | |
|---|--|--|---|
|  | <p>Cuadrado</p> $A = l^2$ | <p>Triángulo</p> $A = \frac{1}{2} \cdot B \cdot h$ |  |
|  | <p>Rectángulo</p> $A = B \cdot h$ | <p>Romboide</p> $A = B \cdot h$ |  |
|  | <p>Rombo</p> $A = \frac{1}{2} D \cdot d$ | <p>Trapecio</p> $A = \frac{B + b}{2} \cdot h$ |  |
|  | <p>Poligono regular</p> $A = \frac{P \cdot a}{2}$ | <p>Círculo</p> $A = \pi R^2$ $L = 2\pi R$ |  |
|  | <p>Corona circular</p> $A = \pi(R^2 - r^2)$ | <p>Sector circular</p> $A = \frac{\pi R^2}{360} n$ |  |
|  | <p>Cubo</p> $A = 6 l^2$ $V = l^3$ | <p>Cilindro</p> $A = 2\pi R(h + R)$ $V = \pi R^2 \cdot h$ |  |
|  | <p>Ortoedro</p> $A = 2(ab + ac + bc)$ $V = abc$ | <p>Cono</p> $A = \pi R \cdot (g + R)$ $V = \frac{1}{3} \pi R^2 \cdot h$ |  |

| | | | |
|---|--|---|---|
|  | <p>Prisma recto</p> $A = P(h + a)$ $V = A_b \cdot h$ | <p>Tronco de cono</p> $A = \pi[g(R + r) + R^2 + r^2]$ $V = \frac{1}{3} \pi h(R^2 + r^2 + Rr)$ |  |
|  | <p>Tetraedro regular</p> $A = l^2 \sqrt{3}$ $V = \frac{l^3 \cdot \sqrt{2}}{12}$ | <p>Esfera</p> $A = 4\pi R^2$ $V = \frac{4}{3} \pi R^3$ |  |
|  | <p>Octaedro regular</p> $A = 2 l^2 \sqrt{3}$ $V = \frac{l^3 \cdot \sqrt{2}}{3}$ | <p>Huso - Cuña esférica</p> $A = \frac{4\pi R^2}{360} \cdot n$ $V = \frac{4}{3} \cdot \frac{\pi R^3}{360} \cdot n$ |  |
|  | <p>Pirámide recta</p> $A = \frac{1}{2} P \cdot (a + a')$ $V = \frac{1}{3} A_b \cdot h$ | <p>Casquete esférico</p> $A = 2\pi R \cdot h$ $V = \frac{1}{3} \pi h^2 \cdot (3R - h)$ |  |
|  | <p>Tronco de pirámide</p> $A = \frac{1}{2} (P + P') \cdot a + A_b + A_{b'}$ $V = \frac{1}{3} h(A_b + A_{b'} + \sqrt{A_b A_{b'}})$ | <p>Zona esférica</p> $A = 2\pi R \cdot h$ $V = \frac{\pi h}{6} (h^2 + 3r^2 + 3r'^2)$ |  |

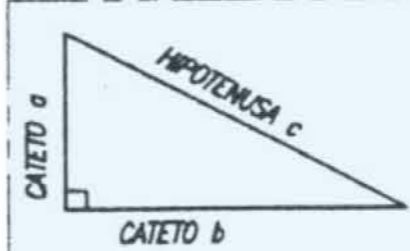
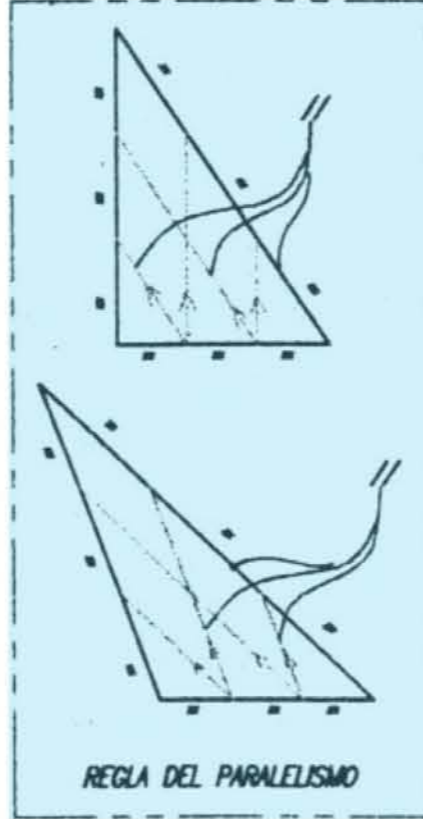
| Nombre | Dibujo | Desarrollo | Área | Volumen |
|---------------------------|---|---|--|--|
| Cubo o Hexaedro |  |  | $A = 6a^2$ | $V = 6a^3$ |
| Paralelepípedo u ortoedro |  |  | $A = 2(ab+ac+bc)$ | $V = abc$ |
| Prisma |  |  | $A_T = 2A_B + A_L$ | $V = A_B H$ |
| Cilindro |  |  | $A_T = 2A_B + A_L$ $A_B = \pi R^2$ $A_L = 2\pi R H$ | |
| Pirámide |  |  | $A_T = A_B + A_L$ | $V = \frac{1}{3} A_B H$ |
| Cono |  |  | $A_T = A_B + A_L$ $A_B = \pi R^2$ $A_L = \pi R G$ | |
| Tronco de pirámide |  |  | $A_T = A_{B1} + A_{B2} + A_L$ | |
| Tronco de cono |  |  | $A_T = A_{B1} + A_{B2} + A_L$ $A_{B1} = \pi R^2$ $A_{B2} = \pi r^2$ $A_L = \pi(R+r)G$ | $V = \frac{1}{3} (A_{B1} + A_{B2} + \sqrt{A_{B1} \cdot A_{B2}} \cdot H)$ |
| esfera |  | | $A = 4\pi R^2$ | $V = \frac{4}{3} \pi R^3$ |

RELACIÓN DE LOS LADOS DE UN TRIÁNGULO



$$\frac{A}{B} = \frac{a'}{b'} \quad \frac{A}{C} = \frac{a'}{c'} \quad \frac{B}{C} = \frac{b'}{c'}$$

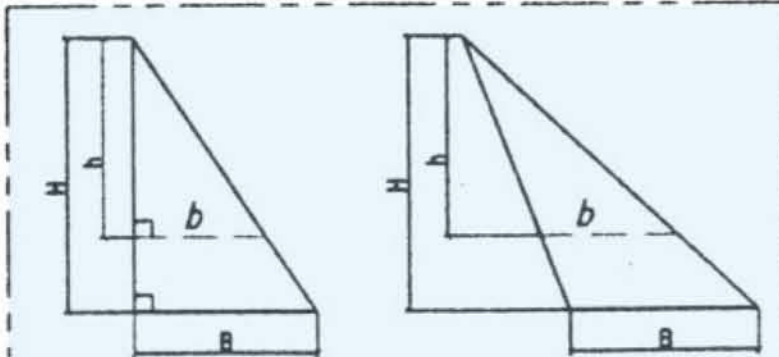
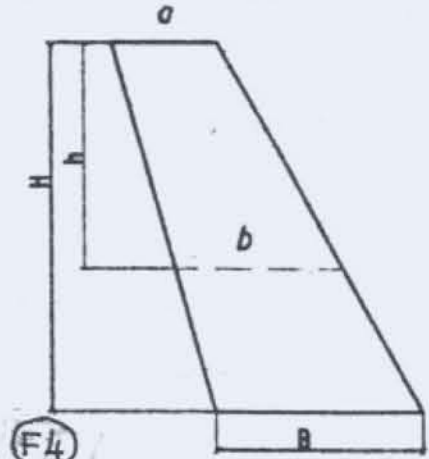
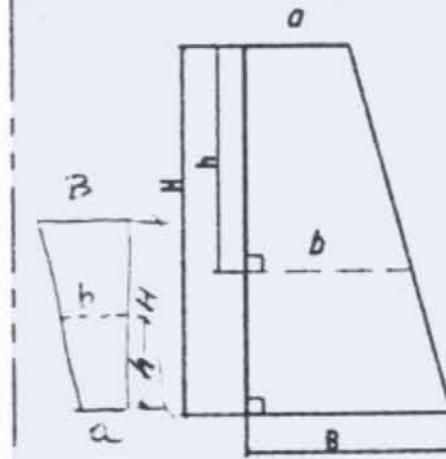
(F1) $a' = \frac{A}{B} \times b'$



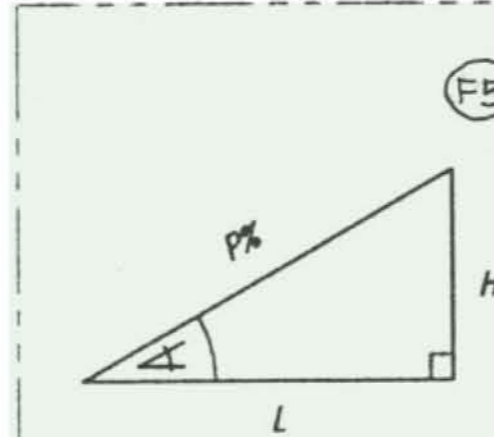
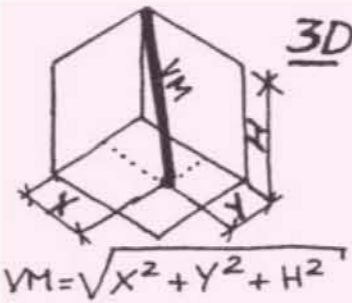
$$c = \sqrt{a^2 + b^2}$$

$$a = \sqrt{c^2 - b^2}$$

$$b = \sqrt{c^2 - a^2}$$



(F2) $b = \frac{B}{H} \times h$



(F5) $P\% = TG \alpha \times 100$

(F7) $P\% = \frac{H}{L} \times 100$

(F6) $\alpha = TG^{-1} \left(\frac{P\%}{100} \right)$

(F8) $H = \frac{P\%}{100} \times L$

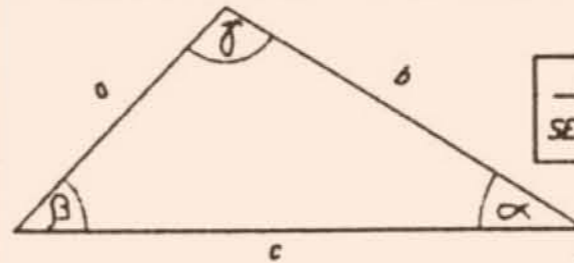
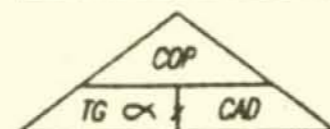
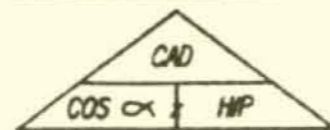
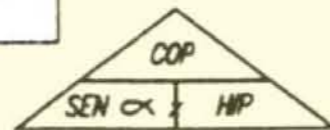
(F9) $L = \frac{H}{P\%} \times 100$



$$\text{SEN } \alpha = \frac{\text{COP}}{\text{HIP}}$$

$$\text{COS } \alpha = \frac{\text{CAD}}{\text{HIP}}$$

$$\text{TG } \alpha = \frac{\text{COP}}{\text{CAD}}$$



$$\frac{a}{\text{SEN } \alpha} = \frac{b}{\text{SEN } \beta} = \frac{c}{\text{SEN } \gamma}$$

TEOREMA DEL SENO

(F10) $a = \frac{b}{\text{SEN } \beta} \times \text{SEN } \alpha$

(F11)

$$a^2 = b^2 + c^2 - 2bc \times \text{COS } \alpha$$

TEOREMA DEL COSENO

(F12) $\alpha = \text{COS}^{-1} \left[\frac{b^2 + c^2 - a^2}{2bc} \right]$

Circunferencia

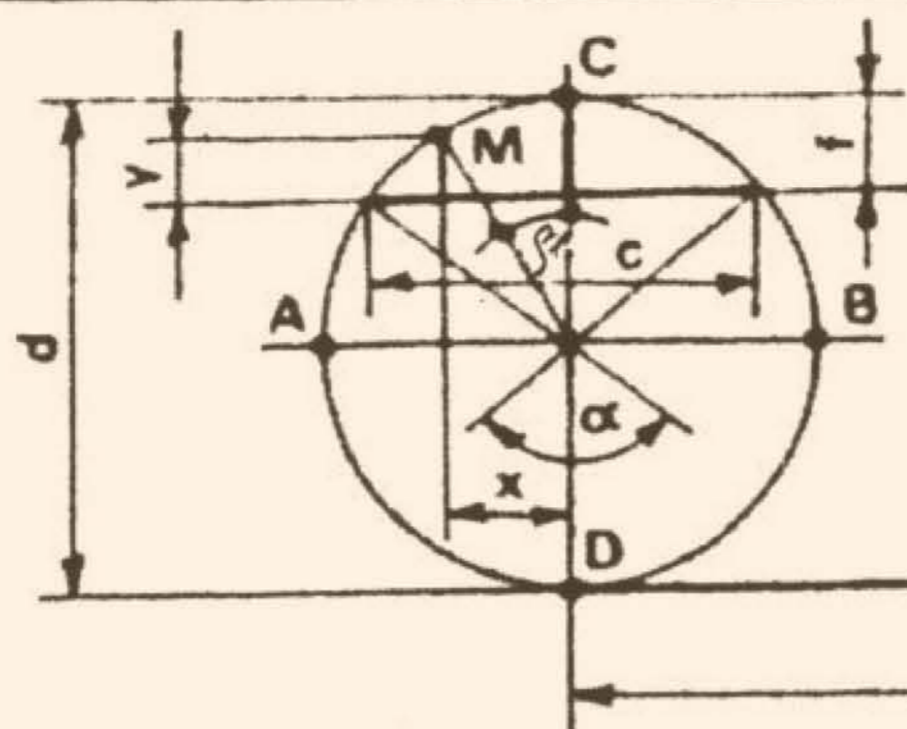
$$f = r + y - \sqrt{r^2 - x^2};$$

$$f = r \left(1 - \cos \frac{\alpha}{2} \right).$$

$$x = \sqrt{r^2 - (r + y - f)^2};$$

$$x = r \operatorname{sen} \beta$$

$$y = \sqrt{r^2 - x^2} + f - r; y = [f - r (\cos \beta)]_{x-1}$$



$$\text{Desarrollo, } c = \pi \cdot d (= 2 \cdot \pi \cdot r)$$

$$\pi = 3,141592654 \approx 3,1416$$

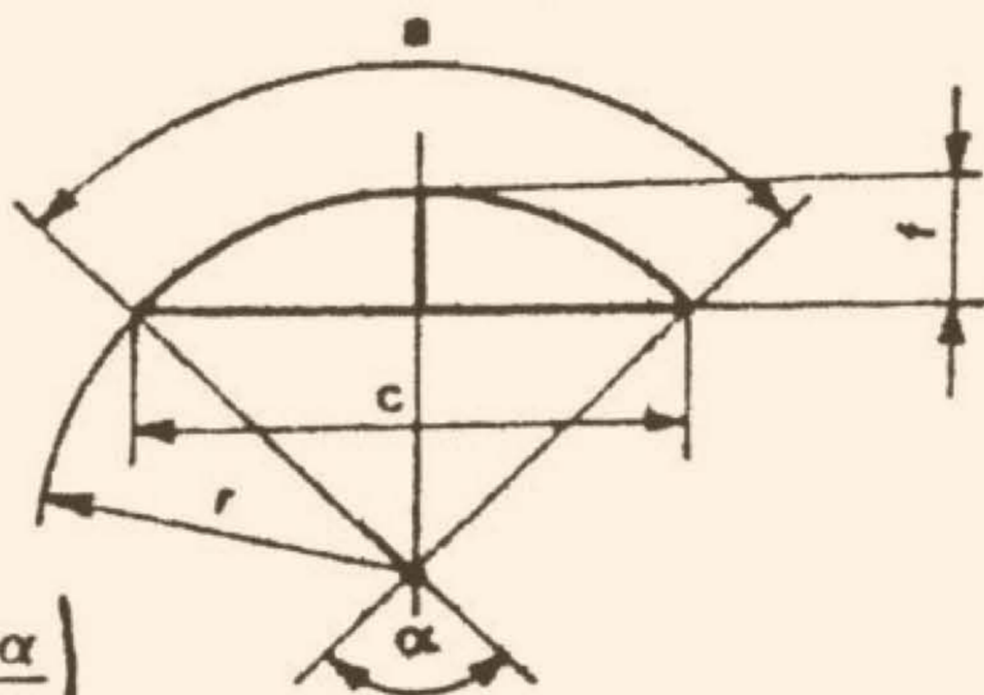
$$d = 0,31831 \cdot c$$

(Tablas 7 · 1)

$$r = \frac{c^2}{8f} + \frac{f}{2}; r = \frac{c}{2} : \operatorname{sen} \frac{\alpha}{2}$$

$$c = \sqrt{8f \left(r - \frac{f}{2} \right)}; c = 2r \operatorname{sen} \frac{\alpha}{2}$$

$$f = r - \sqrt{r^2 - \left(\frac{c}{2} \right)^2}; f = r \left(1 - \cos \frac{\alpha}{2} \right)$$



$$\operatorname{sen} \frac{\alpha}{2} = \frac{c}{2r} \quad \alpha = 2 \times \left[\operatorname{SEN}^{-1} \left(\frac{c}{2r} \right) \right]$$

$$a = \frac{\pi \cdot r \cdot \alpha^{\circ}}{180} = 0,017453 \cdot r \cdot \alpha^{\circ}$$

(Tablas 8₁ · 1 y 8₂ · 1)

Arco de circunferencia

r = RADIO

a = PERÍMETRO DEL ARCO

f = FLECHA

 α = ÁNGULO DEL CENTRO

c = CUERDA

d = DIÁMETRO

x = DESPLAZAMIENTO HORIZONTAL DE UN PUNTO CONTENIDO EN EL ARCO

y = DESPLAZAMIENTO VERTICAL DE UN PUNTO CONTENIDO EN EL ARCO

 β = ÁNGULO SUSTENTADO POR UN PUNTO CUALQUIERA, CONTENIDO EN EL ARCO

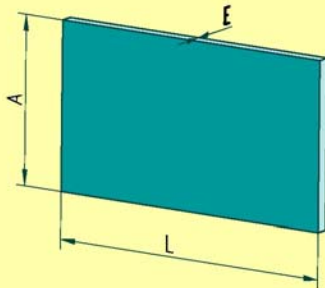
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CUBICACION DE PIEZAS DE ACERO

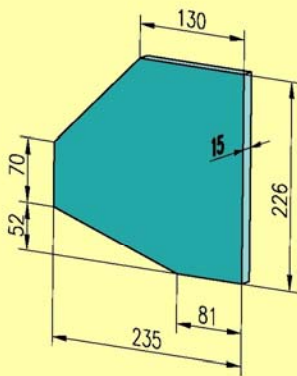
$$\text{PESO PLANCHA (Kg)} = \frac{\text{ÁREA (mm}^2) \times E \text{ (mm)} \times 7,85 \text{ Kg/dm}^3}{1000000}$$

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$$\text{PESO ESPECIFICO DEL ACERO} = 7,85 \text{ Kg/dm}^3$$



$$\text{PESO PLANCHA (Kg)} = \frac{A \times L \times E \times 7,85 \text{ Kg/dm}^3}{1000000}$$



PESO NETO= PESO REAL DE LA PIEZA DESCONTANDO LOS CORTES
 (SE USA PARA CONTRATAR EL SERVICIO DE CONFORMADO)

PESO BRUTO= PESO DEL RECTANGULO QUE CONTIENE A LA FIGURA REAL
 (SE USA EN PLANOS DE FABRICACIÓN Y MONTAJE)

DETERMINE :

- ① PESO BRUTO DE LA PIEZA MOSTRADA

$$\text{PESO} = \frac{235 \times 226 \times 15 \times 7,85}{1000000}$$

$$\text{PESO} = 6,25 \text{ Kg}$$

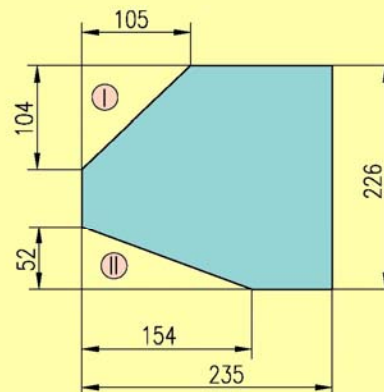
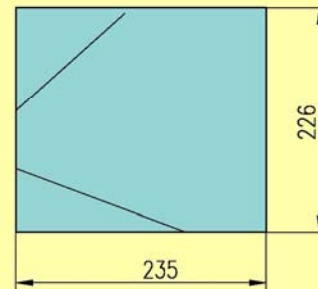
- ① PESO NETO DE LA PIEZA MOSTRADA

$$\text{AREA TOTAL} = (226 \times 235) - \frac{(105 \times 104)}{2} - \frac{(154 \times 52)}{2}$$

$$\text{AREA TOTAL} = 43646 \text{ mm}^2$$

$$\text{PESO} = \frac{43646 \times 15 \times 7,85}{1000000}$$

$$\text{PESO} = 5,14 \text{ Kg}$$



| PESO ESPECIFICO DE MATERIALES DE CONSTRUCCIÓN | | |
|--|--------------------------|--|
| Material | Peso específico aparente | |
| | Kg/dm ³ | |
| A. Rocas | | |
| Arenisca | 2,6 | |
| Arenisca porosa y caliza porosa | 2,4 | |
| Basalto, diorita | 3 | |
| Calizas compactas y mármoles | 2,8 | |
| Granito, sienita, diabosa, pórfido | 3,8 | |
| Gneis | 3 | |
| Pizarra de tejados | 2,8 | |
| B. Piedras artificiales | | |
| Adobe | 1,6 | |
| Amiantocemento | 2 | |
| Baldosa cerámica | 1,8 | |
| Baldosa de gres | 1,9 | |
| Baldosa hidráulica | 2,1 | |
| Hormigón ordinario | 2,2 | |
| Ladrillo cerámico macizo (0 a 10% de huecos) | 1,8 | |
| Ladrillo cerámico perforado (20 a 30% de huecos) | 1,4 | |
| Ladrillo cerámico hueca (40 a 50% de huecos) | 1 | |
| Ladrillo de escorias | 1,4 | |
| Ladrillo silicocalcáreo | 1,9 | |
| C. Maderas | | |
| <u>Maderas resinosas:</u> | 0 | |
| Pino, pinabete, abeto | 0,6 | |
| Pino tea, pino melis | 0,8 | |
| <u>Maderas frondosas:</u> | | |
| Castaño, roble, nogal | 0,8 | |
| <u>D. Metales</u> | | |
| Acero | 7,85 | |
| Aluminio | 2,7 | |
| Bronce | 8,5 | |
| Cobre | 8,9 | |
| Estaño | 7,4 | |
| Latón | 8,5 | |
| Plomo | 11,4 | |
| Zinc | 7,2 | |
| <u>E. Materiales diversos</u> | | |
| Alquitran | 1,2 | |
| Asfalto | 1,3 | |
| Caucho en plancha | 1,7 | |
| Linoleo en plancha | 1,2 | |
| Papel | 1,1 | |
| Plástico en plancha | 2,1 | |
| Vidrio plano | 2,6 | |

FACTORES DE CONVERSIÓN

| Multiplique Unidades Métricas | Por | Para obtener Unidades Inglesas |
|-------------------------------|----------|--------------------------------|
| Kilómetros (Km) | 0,06214 | Millas |
| Metros (m) | 1,0936 | Yardas |
| Metros (m) | 3,28 | Pies |
| Centímetros (cm) | 0,0328 | Pies |
| Milímetros (mm) | 0,03937 | pulg |
| Km ² | 0,03861 | Millas ² |
| Hectárea (ha) | 2,471 | acres |
| M ² | 10,764 | pie ² |
| M ² | 1550 | pulg ² |
| Cm ² | 0,1550 | pulg ² |
| Cm ³ | 0,061 | pulg ³ |
| M ³ | 1,308 | yd ³ |
| Litro (L) | 61,02 | pulg ³ |
| Litro (L) | 0,001308 | yd ³ |
| Km/h | 0,621 | MPH |
| Litro (L) | 0,2642 | gal EE.UU. |
| Litro (L) | 0,22 | gal inglés |
| Ton Métricas (t) | 0,984 | ton larga |
| Ton métricas (t) | 1,102 | ton corta EE.UU. |
| Kilogramo (kg) | 2,205 | libras |
| Gramos (gr o g) | 0,0353 | onzas |
| Kilonewton (kN) | 225 | libras |
| Newton (N) | 0,225 | libras |
| Cm ³ | 0,0338 | onzas |
| Kg/m ³ | 1,686 | lb/yd ³ |
| Kg/m ³ | 0,062 | lb/pie ³ |
| Kg/cm ² | 14,225 | lb/pulg ² |
| Kilocalorías (kcal) | 3,968 | Btu |
| Kg.m (kilogrametros) | 7,233 | pie-lb |
| m.kg | 7,233 | pie-lb |
| CV o HP (hp métricos) | 0,9863 | hp (EE.UU) |
| KW | 1,341 | hp (EE.UU) |
| Kilopascal (kPa) | 0,145 | lb/pulg ² |
| Bar | 14,5 | lb/pulg ² |
| Tons/m ³ | 1692 | lb/yd ³ |

| Multiplique Unidades Inglesas | Por | Para obtener Unidades Métricas |
|-------------------------------|-----------|--------------------------------|
| Milla (terrestre) | 1,609 | km |
| Yarda | 0,09144 | m |
| Pie | 0,3048 | m |
| pulg (pulgada) | 25,4 | mm |
| milla ² | 2,590 | km ² |
| acre | 0.4047 | hectárea (ha) |
| pie ² | 0,0929 | m ² |
| pulg ² | 6,45 | m ² |
| yg ³ | 0,7645 | m ³ |
| ln ³ | 16,387 | cm ³ |
| pie ³ | 0,0283 | m ³ |
| pulg ³ | 0,0164 | litros (L) |
| yd ³ | 764,55 | litros (L) |
| MPH | 1,61 | km/h |
| ton-MPH | 1,459 | t-km/h |
| gal EE.UU. | 3,785 | litros (L) |
| gal EE.UU. | 0,833 | gal inglés |
| ton larga | 1,016 | t (ton métricas) |
| ton corta EE.UU. | 0,907 | t |
| lb | 0,4536 | kg |
| onza (onz) | 28,35 | gramos (gr) |
| lb | 0,00445 | kN |
| lb | 4,45 | N |
| onza líquida | 29,57 | cm ³ |
| lb/pie ³ | 16,018 | kg/m ³ |
| lb/pulg ² | 0,0703 | kg/cm ² |
| lb/yd ³ | 0,5933 | kg/m ³ |
| lb/pulg ² | 0,0689 | bar |
| lb/pulg ² | 6,89 | kPa |
| Btu | 0,2520 | kcal |
| pie-lb | 0,1383 | kg.m |
| hp (EE.UU) | 0,014 | CV o HP (mét) |
| hp (EE.UU) | 0,7457 | KW |
| lb/yd ³ | 0,0005928 | tons/m ³ |
| Libras (diésel N*2) | 0,1413 | Galón EE.UU. |

Nota: algunos de los factores indicados se han redondeado. Los factores para conversiones exactas son los de las tablas del Sistema Internacional de Unidades (SI).

Pulgadas ↓ Milímetros ⇄

| Fracción | Decimal | mm | 1" | 2" | 3" | 4" | 5" | 6" |
|----------|---------|-------|--------|--------|--------|---------|---------|---------|
| | | | 25.400 | 50.800 | 76.200 | 101.600 | 127.000 | 152.400 |
| 1/64" | 0.0156 | 0.397 | 25.797 | 51.197 | 76.597 | 101.997 | 127.397 | 152.797 |
| 1/32" | 0.0313 | 0.794 | 26.194 | 51.594 | 76.994 | 102.394 | 127.794 | 153.194 |
| 3/64" | 0.0469 | 1.190 | 26.590 | 51.990 | 77.390 | 102.790 | 128.190 | 153.590 |
| 1/16" | 0.0625 | 1.588 | 26.988 | 52.388 | 77.788 | 103.188 | 128.588 | 153.988 |
| 5/64" | 0.0781 | 1.984 | 27.384 | 52.784 | 78.184 | 103.584 | 128.984 | 154.384 |
| 3/32" | 0.0938 | 2.381 | 27.781 | 53.181 | 78.581 | 103.981 | 129.381 | 154.781 |
| 7/64" | 0.1094 | 2.778 | 28.178 | 53.578 | 78.978 | 104.378 | 129.778 | 155.178 |

| | | | | | | | | |
|--------|--------|-------|--------|--------|--------|---------|---------|---------|
| 1/8" | 0.1250 | 3.175 | 28.575 | 53.975 | 79.375 | 104.775 | 130.175 | 155.575 |
| 9/64" | 0.1406 | 3.572 | 28.972 | 54.372 | 79.772 | 105.172 | 130.572 | 155.972 |
| 5/32" | 0.1562 | 3.969 | 29.369 | 54.769 | 80.169 | 105.569 | 130.969 | 156.369 |
| 11/64" | 0.1718 | 4.366 | 29.766 | 55.166 | 80.566 | 105.966 | 131.366 | 156.766 |
| 3/16" | 0.1875 | 4.762 | 30.162 | 55.562 | 80.962 | 106.362 | 131.762 | 157.162 |
| 13/64" | 0.2031 | 5.159 | 30.559 | 55.959 | 81.359 | 106.759 | 132.159 | 157.559 |
| 7/32" | 0.2188 | 5.556 | 30.956 | 56.356 | 81.756 | 107.156 | 132.556 | 157.956 |
| 15/64" | 0.2344 | 5.953 | 31.353 | 56.753 | 82.153 | 107.553 | 132.953 | 158.353 |

| | | | | | | | | |
|--------|--------|-------|--------|--------|--------|---------|---------|---------|
| 1/4" | 0.2500 | 6.350 | 31.750 | 57.150 | 82.550 | 107.950 | 133.350 | 158.750 |
| 17/64" | 0.2656 | 6.747 | 32.147 | 57.547 | 82.947 | 108.347 | 133.747 | 159.147 |
| 9/32" | 0.2813 | 7.144 | 32.544 | 57.944 | 83.344 | 108.744 | 134.144 | 159.544 |
| 19/64" | 0.2969 | 7.541 | 32.941 | 58.341 | 83.741 | 109.141 | 134.541 | 159.941 |
| 5/16" | 0.3125 | 7.937 | 33.337 | 58.737 | 84.137 | 109.537 | 134.937 | 160.337 |
| 21/64" | 0.3281 | 8.334 | 33.734 | 59.134 | 84.534 | 109.934 | 135.334 | 160.734 |
| 11/32" | 0.3438 | 8.731 | 34.131 | 59.531 | 84.931 | 110.331 | 135.731 | 161.131 |
| 23/64" | 0.3594 | 9.128 | 34.528 | 59.928 | 85.328 | 110.728 | 136.128 | 161.528 |

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| 3/8" | 0.3750 | 9.525 | 34.925 | 60.325 | 85.725 | 111.125 | 136.525 | 161.925 |
| 25/64" | 0.3906 | 9.922 | 35.322 | 60.722 | 86.122 | 111.522 | 136.922 | 162.322 |
| 13/32" | 0.4063 | 10.319 | 35.719 | 61.119 | 86.519 | 111.919 | 137.319 | 162.719 |
| 27/64" | 0.4219 | 10.716 | 36.116 | 61.516 | 86.916 | 112.316 | 137.716 | 163.116 |
| 7/16" | 0.4375 | 11.113 | 36.513 | 61.913 | 87.313 | 112.713 | 138.113 | 163.513 |
| 29/64" | 0.4531 | 11.509 | 36.909 | 62.309 | 87.709 | 113.109 | 138.509 | 163.909 |
| 15/32" | 0.4688 | 11.906 | 37.306 | 62.706 | 88.106 | 113.506 | 138.906 | 164.306 |
| 31/64" | 0.4844 | 12.303 | 37.703 | 63.103 | 88.503 | 113.903 | 139.303 | 164.703 |

Pulgadas ↓ Milímetros ⇄

| Fracción | Decimal | mm | 1" | 2" | 3" | 4" | 5" | 6" |
|----------|---------|--------|--------|--------|--------|---------|---------|---------|
| 1/2" | 0.5000 | 12.700 | 38.100 | 63.500 | 88.900 | 114.300 | 139.700 | 165.100 |
| 33/64" | 0.5156 | 13.097 | 38.497 | 63.897 | 89.297 | 114.697 | 140.097 | 165.497 |
| 17/32" | 0.5313 | 13.494 | 38.894 | 64.294 | 89.694 | 115.094 | 140.494 | 165.894 |
| 35/64" | 0.5469 | 13.891 | 39.291 | 64.691 | 90.091 | 115.491 | 140.891 | 166.291 |
| 9/16" | 0.5625 | 14.288 | 39.688 | 65.088 | 90.488 | 115.888 | 141.288 | 166.688 |
| 37/64" | 0.5781 | 14.684 | 40.084 | 65.484 | 90.884 | 116.284 | 141.684 | 167.084 |
| 19/32" | 0.5938 | 15.081 | 40.481 | 65.881 | 91.281 | 116.681 | 142.081 | 167.481 |
| 39/64" | 0.6094 | 15.478 | 40.878 | 66.278 | 91.678 | 117.078 | 142.478 | 167.878 |

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| 5/8" | 0.6250 | 15.875 | 41.275 | 66.675 | 92.075 | 117.475 | 142.875 | 168.275 |
| 41/64" | 0.6406 | 16.272 | 41.672 | 67.072 | 92.472 | 117.872 | 143.272 | 168.672 |
| 21/32" | 0.6563 | 16.669 | 42.069 | 67.469 | 92.869 | 118.269 | 143.669 | 169.069 |
| 43/64" | 0.6719 | 17.066 | 42.466 | 67.866 | 93.266 | 118.666 | 144.066 | 169.466 |
| 11/16" | 0.6875 | 17.463 | 42.863 | 68.263 | 93.663 | 119.063 | 144.463 | 169.863 |
| 45/64" | 0.7031 | 17.859 | 43.259 | 68.659 | 94.059 | 119.459 | 144.859 | 170.259 |
| 23/32" | 0.7188 | 18.256 | 43.656 | 69.056 | 94.456 | 119.856 | 145.256 | 170.656 |
| 47/64" | 0.7344 | 18.653 | 44.053 | 69.453 | 94.853 | 120.253 | 145.653 | 171.053 |

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| 3/4" | 0.7500 | 19.050 | 44.450 | 69.850 | 95.250 | 120.650 | 146.050 | 171.450 |
| 49/64" | 0.7656 | 19.447 | 44.847 | 70.247 | 95.647 | 121.047 | 146.447 | 171.847 |
| 25/32" | 0.7813 | 19.844 | 45.244 | 70.644 | 96.044 | 121.444 | 146.844 | 172.244 |
| 51/64" | 0.7969 | 20.241 | 45.641 | 71.041 | 96.441 | 121.841 | 147.241 | 172.641 |
| 13/16" | 0.8125 | 20.638 | 46.038 | 71.438 | 96.838 | 122.238 | 147.638 | 173.038 |
| 53/64" | 0.8281 | 21.034 | 46.434 | 71.834 | 97.234 | 122.634 | 148.034 | 173.434 |
| 27/32" | 0.8438 | 21.431 | 46.831 | 72.231 | 97.631 | 123.031 | 148.431 | 173.831 |
| 55/64" | 0.8594 | 21.828 | 47.228 | 72.628 | 98.028 | 123.428 | 148.828 | 174.228 |

| | | | | | | | | |
|--------|--------|--------|--------|--------|---------|---------|---------|---------|
| 7/8" | 0.8750 | 22.225 | 47.625 | 73.025 | 98.425 | 123.825 | 149.225 | 174.625 |
| 57/64" | 0.8906 | 22.622 | 48.022 | 73.422 | 98.822 | 124.222 | 149.622 | 175.022 |
| 29/32" | 0.9063 | 23.019 | 48.419 | 73.819 | 99.219 | 124.619 | 150.019 | 175.419 |
| 59/64" | 0.9219 | 23.416 | 48.816 | 74.216 | 99.616 | 125.016 | 150.416 | 175.816 |
| 15/16" | 0.9375 | 23.813 | 49.213 | 74.613 | 100.013 | 125.413 | 150.813 | 176.213 |
| 61/64" | 0.9531 | 24.209 | 49.609 | 75.009 | 100.409 | 125.809 | 151.209 | 176.609 |
| 31/32" | 0.9688 | 24.604 | 49.854 | 75.254 | 100.654 | 126.054 | 151.454 | 176.854 |
| 63/64" | 0.9844 | 25.003 | 50.403 | 75.803 | 101.203 | 126.603 | 152.003 | 177.403 |

Rosca Whitworth corriente



$$D = 0.6403 \times P$$

$$H = 0.9605 \times P$$

$$H/6 = 0.16 \times P$$

$$r = 0.1373 \times P$$

Rosca Corriente «Whitworth» B. S. F.
Aceptada por la British Engineering Standards Association

| Diámetro en Pulgadas | Diámetro en m/m | N.º de Hilos por Pulgada | Paso en m/m | Diámetro medio m/m | Diámetro al fondo m/m | Diámetro de la broca para agujeros roscados con 75% (aproximadamente de altura del filete) |
|----------------------|-----------------|--------------------------|-------------|--------------------|-----------------------|--|
| 1/8 | 3,17 | 40 | 0,635 | 2,76 | 2,36 | 2,5 |
| 3/16 | 4,76 | 24 | 1,058 | 4,08 | 3,40 | 3,7 |
| 1/4 | 6,35 | 20 | 1,270 | 5,53 | 4,72 | 5 |
| 5/16 | 7,93 | 18 | 1,411 | 7,03 | 6,13 | 6,5 |
| 3/8 | 9,52 | 16 | 1,588 | 8,50 | 7,49 | 8 |
| 7/16 | 11,11 | 14 | 1,814 | 9,95 | 8,78 | 9,25 |
| 1/2 | 12,70 | 12 | 2,117 | 11,34 | 9,99 | 10,5 |
| 5/8 | 15,87 | 11 | 2,309 | 14,39 | 12,91 | 13,75 |
| 3/4 | 19,05 | 10 | 2,540 | 17,42 | 15,79 | 16,5 |
| 7/8 | 22,22 | 9 | 2,822 | 20,41 | 18,61 | 19,5 |
| 1" | 25,40 | 8 | 3,175 | 23,36 | 21,33 | 22,2 |
| 1 1/8 | 28,57 | 7 | 3,629 | 26,25 | 23,92 | 25,5 |
| 1 1/4 | 31,75 | 7 | 3,629 | 29,42 | 27,10 | 28 |
| 1 3/8 | 34,92 | 6 | 4,233 | 32,21 | 29,50 | 30,25 |
| 1 1/2 | 38,10 | 6 | 4,253 | 35,39 | 32,68 | 33,5 |
| 1 5/8 | 41,27 | 5 | 5,080 | 38,02 | 34,77 | 36 |
| 1 3/4 | 44,45 | 5 | 5,080 | 41,19 | 37,94 | 39,5 |
| 1 7/8 | 46,62 | 4,5 | 5,645 | 44,01 | 40,39 | 42 |
| 2" | 50,80 | 4,5 | 5,645 | 47,18 | 43,57 | 45 |
| 2 1/8 | 53,97 | 4,5 | 5,645 | 50,36 | 46,74 | 48 |
| 2 1/4 | 57,15 | 4 | 6,350 | 53,08 | 49,02 | 51 |
| 2 3/8 | 60,32 | 4 | 6,350 | 56,26 | 52,19 | 53,5 |
| 2 1/2 | 63,50 | 4 | 6,350 | 59,43 | 55,37 | 57 |
| 2 5/8 | 66,67 | 4 | 6,350 | 62,61 | 58,54 | 60 |
| 2 3/4 | 69,85 | 3,5 | 7,257 | 65,20 | 60,55 | 62,5 |
| 2 7/8 | 73,02 | 3,5 | 7,257 | 68,38 | 63,73 | 65 |
| 3" | 76,20 | 3,5 | 7,257 | 71,55 | 66,90 | 69 |



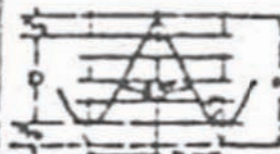
Z = Diámetro de la broca para agujeros roscados en materiales blandos 88% de la altura del filete.
Fórmula: $Z = \text{Diámetro. Rosca} - 1,1328 \times \text{Paso}$

El diámetro de la broca para agujeros roscados debe ser el indispensable para que no rompa el macho y dar al filete la resistencia necesaria, y está demostrado en general que los filetes de la tuerca con el 70 a 75% de la profundidad del filete ofrecen una resistencia muy suficiente.

En materiales muy duros 65 - 70%. Aluminio y fundición 80%.

* Debe emplearse lo menos posible las roscas marcadas

Rosca Whitworth fina



$$D = 0.6403 \times P$$

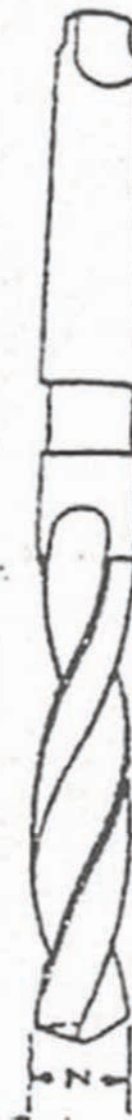
$$H = 0.9605 \times P$$

$$H/6 = 0.16 \times P$$

$$r = 0.1373 \times P$$

Rosca fina Whitworth B. S. F.
aceptada por la British Standards Association.

| Diámetro en pulgadas | Diámetro en m/m | Número de hilos por pulgada | P A S O en m/m | Diámetro medio m/m | diámetro al fondo m/m | Diámetro de la broca para agujeros roscados m/m |
|----------------------|-----------------|-----------------------------|----------------|--------------------|-----------------------|---|
| 7/32 | 5,55 | 28 | 0,9057 | 4,97 | 4,39 | 4,5 |
| 1/4 | 6,35 | 26 | 0,9779 | 5,72 | 5,08 | 5,2 |
| 9/32 | 7,14 | 26 | 0,9779 | 6,51 | 5,89 | 6 |
| 5/16 | 7,93 | 22 | 1,1545 | 7,18 | 6,45 | 6,7 |
| 3/8 | 9,52 | 20 | 1,270 | 8,71 | 7,89 | 8 |
| 7/16 | 11,11 | 18 | 1,411 | 10,21 | 9,29 | 9,5 |
| 1/2 | 12,7 | 16 | 1,588 | 11,68 | 10,66 | 10,75 |
| 9/16 | 14,28 | 16 | 1,588 | 13,26 | 12,24 | 12,7 |
| 5/8 | 15,87 | 14 | 1,814 | 14,70 | 13,53 | 13,9 |
| 11/16 | 17,46 | 14 | 1,814 | 16,29 | 15,13 | 15,5 |
| 3/4 | 19,05 | 12 | 2,117 | 17,67 | 16,33 | 16,7 |
| 13/16 | 20,63 | 12 | 2,117 | 19,27 | 17,91 | 18,25 |
| 7/8 | 22,22 | 11 | 2,309 | 20,73 | 19,26 | 19,85 |
| 1" | 25,40 | 10 | 2,54 | 23,77 | 22,13 | 22,6 |
| 1 1/8 | 28,57 | 9 | 2,822 | 26,76 | 24,95 | 25,4 |
| 1 1/4 | 31,75 | 9 | 2,822 | 29,93 | 28,13 | 28,5 |
| 1 3/8 | 34,92 | 8 | 3,175 | 32,89 | 30,85 | 31,35 |
| 1 1/2 | 38,1 | 8 | 3,175 | 36,06 | 34,03 | 34,5 |
| 1 5/8 | 41,27 | 8 | 3,175 | 39,24 | 37,21 | 37,7 |
| 1 3/4 | 44,45 | 7 | 3,629 | 42,12 | 39,80 | 40,5 |
| 2" | 50,80 | 7 | 3,629 | 48,47 | 46,15 | 46,8 |
| 2 1/4 | 57,15 | 6 | 4,234 | 54,43 | 51,73 | 52,4 |
| 2 1/2 | 63,50 | 6 | 4,234 | 60,78 | 58,07 | 58,75 |
| 2 3/4 | 69,85 | 6 | 4,234 | 67,13 | 64,42 | 65,1 |
| 3" | 76,20 | 5 | 5,080 | 72,94 | 69,69 | 69,85 |



Z = Diámetro de la broca para agujeros roscados en materiales blandos 88 - 90% de la altura del filete.
Fórmula: $Z = \text{Diámetro de la rosca} - 1,1328 \times \text{Paso}$

Rosca Métrica corriente



$$D = 0,6495 \times P$$

$$H = 0,8660 \times P$$

$$H/8 = 0,108 \times P$$

$$a = 0,05 \times P$$

$$r = 0,125 \times P$$

$$r = 0,053 \times P$$

Rosca corriente Sistema Internacional S. I. Normalizada por la International Standards Association «I. S. A.»

| Diámetro m/m | Paso m/m | diámetro medio m/m | TORNILLO | | TUERCA | | Diámetro de la broca para agujeros roscados con 70 — 75 % altura de rosca |
|--------------|----------|--------------------|----------------------|--------------------------|-------------------|-------------------|--|
| | | | diámetro al fondo mm | Área en m/m ² | diámetro mayor mm | diámetro menor mm | |
| 6 | 1 | 5.350 | 4.59 | 16.57 | 6.11 | 4.70 | Para roscar con macho. Fórmula. Z = Diámetro del tornillo — Paso. Ejemplo: Tornillo 20 m/m diámetro. Paso 2,5 Diámetro broca 17,5 m/m |
| 7 | 1 | 6.350 | 5.59 | 24.57 | 7.11 | 5.70 | |
| 8 | 1.25 | 7.188 | 6.24 | 30.69 | 8.14 | 6.38 | |
| 9 | 1.25 | 8.188 | 7.24 | 41.18 | 9.14 | 7.38 | |
| 10 | 1.5 | 9.026 | 7.89 | 48.88 | 10.16 | 8.05 | |
| 12 | 1.75 | 10.863 | 9.54 | 71.44 | 12.19 | 9.73 | |
| 14 | 2 | 12.701 | 11.19 | 98.26 | 14.22 | 11.40 | |
| 16 | 2 | 14.701 | 13.19 | 137 | 16.22 | 13.40 | |
| 18 | 2.5 | 16.376 | 14.48 | 165 | 18.27 | 14.75 | |
| 20 | 2.5 | 18.376 | 16.48 | 213 | 20.27 | 16.75 | |
| 22 | 2.5 | 20.376 | 18.48 | 268 | 22.27 | 18.75 | |
| 24 | 3 | 22.051 | 19.78 | 307 | 24.32 | 20.10 | |
| 27 | 3 | 25.051 | 22.78 | 407 | 27.32 | 23.10 | |
| 30 | 3.5 | 27.727 | 25.07 | 494 | 30.38 | 25.45 | |
| 33 | 3.5 | 30.727 | 28.07 | 619 | 33.38 | 28.45 | |
| 36 | 4 | 33.402 | 30.37 | 724 | 36.43 | 30.80 | |
| 39 | 4 | 36.402 | 33.37 | 875 | 39.43 | 33.80 | |
| 42 | 4.5 | 39.077 | 35.67 | 999 | 42.49 | 36.15 | |
| 45 | 4.5 | 42.077 | 38.67 | 1174 | 45.49 | 39.15 | |
| 48 | 5 | 44.752 | 40.96 | 1318 | 48.54 | 41.50 | |
| 52 | 5 | 48.752 | 44.96 | 1588 | 52.54 | 45.50 | |
| 56 | 5.5 | 52.428 | 48.26 | 1829 | 56.60 | 48.86 | |
| 60 | 5.5 | 56.428 | 52.26 | 2145 | 60.60 | 52.86 | |
| 64 | 6 | 60.103 | 55.56 | 2424 | 64.65 | 56.21 | |
| 68 | 6 | 64.103 | 59.56 | 2786 | 68.65 | 60.21 | |
| 72 | 6 | 68.103 | 63.56 | 3173 | 72.65 | 64.21 | |
| 76 | 6 | 72.103 | 67.56 | 3584 | 76.65 | 68.21 | |
| 80 | 6 | 76.103 | 71.56 | 4021 | 80.65 | 72.21 | |

El diámetro de la broca para agujeros roscados debe ser el indispensable para que no rompa el macho y dar al filete la resistencia necesaria, y está demostrado en general que los filetes de la tuerca con el 70 a 75 % de la profundidad del filete ofrecen una resistencia muy suficiente.
En materiales muy duros 65 — 70 %. Aluminio y fundición 80 %.

Rosca Métrica Fina



$$D = 0,6495 \times P$$

$$H = 0,8660 \times P$$

$$H/8 = 0,108 \times P$$

$$a = 0,05 \times P$$

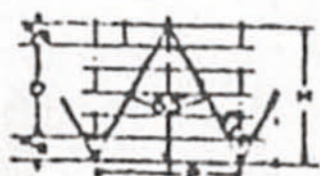
$$r = 0,125 \times P$$

$$r = 0,058 \times P$$

Rosca fina Sistema internacional S. I. Normalizada por la International Standards Association «I. S. A.»

| Diámetro m/m | Paso m/m | diámetro medio m/m | TORNILLO | | TUERCA | | Diámetro de la broca para agujeros roscados con 70 — 75 % altura de rosca |
|--------------|----------|--------------------|----------------------|--------------------------|-------------------|-------------------|---|
| | | | diámetro al fondo mm | Área en m/m ² | diámetro mayor mm | diámetro menor mm | |
| 1 | 0.2 | 0.570 | 0.72 | 0.41 | 1.02 | 0.74 | Para roscar con macho. Fórmula. Z = Diámetro del tornillo — Paso. Ejemplo: Tornillo 16 m/m diámetro Paso 1,5 Diámetro broca 14,5 m/m |
| 1.2 | 0.2 | 1.070 | 0.92 | 0.66 | 1.22 | 0.94 | |
| 1.4 | 0.2 | 1.270 | 1.12 | 0.98 | 1.42 | 1.14 | |
| 1.7 | 0.2 | 1.570 | 1.42 | 1.58 | 1.72 | 1.44 | |
| 2 | 0.25 | 1.838 | 1.65 | 2.13 | 2.03 | 1.68 | |
| 2.3 | 0.25 | 2.138 | 1.95 | 2.98 | 2.33 | 1.98 | |
| 2.6 | 0.35 | 2.373 | 2.11 | 3.49 | 2.64 | 2.15 | |
| 3 | 0.35 | 2.773 | 2.51 | 4.94 | 3.04 | 2.55 | |
| 3.5 | 0.35 | 3.273 | 3.01 | 7.10 | 3.54 | 3.05 | |
| 4 | 0.5 | 3.675 | 3.30 | 8.53 | 4.05 | 3.35 | |
| 4.5 | 0.5 | 4.175 | 3.80 | 11.32 | 4.55 | 3.85 | |
| 5 | 0.5 | 4.675 | 4.30 | 14.50 | 5.05 | 4.35 | |
| 6 | 0.75 | 5.513 | 4.94 | 19.20 | 6.08 | 5.03 | |
| 7 | 0.75 | 6.513 | 5.94 | 27.75 | 7.08 | 6.03 | |
| 8 | 1 | 7.350 | 6.59 | 34.14 | 8.11 | 6.70 | |
| 9 | 1 | 8.350 | 7.59 | 45.28 | 9.11 | 7.70 | |
| 10 | 1 | 9.350 | 8.59 | 57.99 | 10.11 | 8.70 | |
| 12 | 1.5 | 11.026 | 9.89 | 76.81 | 12.16 | 10.05 | |
| 14 | 1.5 | 13.026 | 11.89 | 111 | 14.16 | 12.05 | |
| 16 | 1.5 | 15.026 | 13.89 | 152 | 16.16 | 14.05 | |
| 18 | 1.5 | 17.026 | 15.89 | 198 | 18.16 | 16.05 | |
| 20 | 1.5 | 19.026 | 17.89 | 251 | 20.16 | 18.05 | |
| 22 | 1.5 | 21.026 | 19.89 | 311 | 22.16 | 20.05 | |
| 24 | 2 | 22.701 | 21.19 | 353 | 24.22 | 21.40 | |
| 27 | 2 | 25.701 | 24.19 | 459 | 27.22 | 24.40 | |
| 30 | 2 | 28.701 | 27.19 | 580 | 30.22 | 27.40 | |
| 33 | 2 | 31.701 | 30.19 | 716 | 33.22 | 30.40 | |
| 36 | 3 | 34.051 | 31.78 | 793 | 36.32 | 32.10 | |
| 39 | 3 | 37.051 | 34.78 | 950 | 39.32 | 35.10 | |
| 42 | 3 | 40.051 | 37.78 | 1121 | 42.32 | 38.10 | |
| 45 | 3 | 43.051 | 40.78 | 1306 | 45.32 | 41.10 | |
| 48 | 3 | 46.051 | 43.78 | 1505 | 48.32 | 44.10 | |
| 52 | 3 | 50.051 | 47.78 | 1793 | 52.32 | 48.10 | |
| 56 | 4 | 53.402 | 50.37 | 1993 | 56.43 | 50.80 | |
| 60 | 4 | 57.402 | 54.37 | 2322 | 60.43 | 54.80 | |
| 64 | 4 | 61.402 | 58.37 | 2676 | 64.43 | 58.80 | |
| 72 | 4 | 69.402 | 66.37 | 3460 | 72.43 | 66.80 | |
| 80 | 4 | 77.402 | 74.37 | 4344 | 80.43 | 74.80 | |

Rosca para cañerías



$$D = 0.6403 \times P$$

$$H = 0.9605 \times P$$

$$H/6 = 0.16 \times P$$

$$r = 0.1373 \times P$$

**Rosca de Gas Whitworth
B. S. P.**
Adoptada por la «British Standard
Pipe» para roscas en tubos de
hierro y acero

| Diámetro Nominal en pulgadas | Diámetro en m/m | N.º de Hilos por pulgada | Paso en m/m | Diámetro medio m/m | Diámetro al fondo m/m | Diámetro de la broca para agujeros roscados |
|------------------------------|-----------------|--------------------------|-------------|--------------------|-----------------------|---|
| 1/8 | 9,728 | 28 | 0,907 | 9,14 | 8,56 | 8,75 |
| 1/4 | 13,158 | 19 | 1,337 | 12,30 | 11,44 | 11,5 |
| 3/8 | 16,66 | 19 | 1,337 | 15,80 | 14,95 | 15 |
| 1/2 | 20,95 | 14 | 1,814 | 19,79 | 18,63 | 19 |
| 5/8 | 22,91 | 14 | 1,814 | 21,75 | 20,58 | 21 |
| 3/4 | 26,44 | 14 | 1,814 | 25,28 | 24,11 | 24,5 |
| 7/8 | 30,20 | 14 | 1,814 | 29,04 | 27,87 | 28 |
| 1 | 33,25 | 11 | 2,309 | 31,77 | 30,29 | 30,5 |
| 1 1/8 | 37,89 | 11 | " | 36,42 | 34,94 | 35,3 |
| 1 1/4 | 41,91 | 11 | " | 40,43 | 38,95 | 39,3 |
| 1 3/8 | 44,32 | 11 | " | 42,84 | 41,36 | 41,75 |
| 1 1/2 | 47,80 | 11 | " | 46,32 | 44,84 | 45,25 |
| 1 3/4 | 53,74 | 11 | " | 52,27 | 50,79 | 50,8 |
| 2 | 59,61 | 11 | " | 58,13 | 56,65 | 57,15 |
| 2 1/8 | 65,71 | 11 | " | 64,23 | 62,75 | |
| 2 1/4 | 75,18 | 11 | " | 73,70 | 72,23 | |
| 2 3/4 | 81,53 | 11 | " | 80,05 | 78,58 | |
| 3 | 87,88 | 11 | " | 86,40 | 84,93 | |
| 3 1/8 | 93,98 | 11 | " | 92,50 | 91,02 | |
| 3 1/4 | 100,33 | 11 | " | 98,85 | 97,37 | |
| 3 3/4 | 106,68 | 11 | " | 105,20 | 103,72 | |
| 4 | 113,03 | 11 | " | 111,55 | 110,07 | |
| 4 1/2 | 125,78 | 11 | " | 124,25 | 122,77 | |
| 5 | 138,43 | 11 | " | 136,95 | 135,47 | |
| 5 1/2 | 151,13 | 11 | " | 149,65 | 148,17 | |
| 6 | 163,83 | 11 | " | 162,35 | 160,87 | |
| 7 | 189,23 | 10 | 2,54 | 187,61 | 185,98 | |
| 8 | 214,63 | 10 | " | 213,01 | 211,38 | |
| 9 | 240,03 | 10 | " | 238,41 | 236,78 | |
| 10 | 265,44 | 10 | " | 263,81 | 262,18 | |
| 11 | 290,84 | 8 | 3,175 | 288,80 | 286,77 | |
| 12 | 316,24 | 8 | 3,175 | 314,20 | 312,17 | |



Z = Diámetro de la broca para agujeros roscados en materiales blandos.

FORMULA
Z = Diámetro de la roca - 1,1328 x Paso
En materiales tenaces y duros aumentar ligeramente el diámetro de la broca.

* Debe emplearse lo menos posible

Rosca para automóviles americanos

ROSCA DE LA SOCIEDAD DE INGENIEROS DE AUTOMOVILES AMERICANOS

S. A. E. (STANDARD)

N. F.

Las fórmulas de esta rosca, es igual a la U. S. S.
La rosca fina es muy empleada en aviación

| Diámetro de la rosca | Hilos por pulgada | | Diámetro de la rosca | Hilos por pulgada | | Diámetro de la rosca | Hilos por pulgada | |
|----------------------|-------------------|------|----------------------|-------------------|------|----------------------|-------------------|------|
| | Corriente | Fino | | Corriente | Fino | | Corriente | Fino |
| 1/4 " | 28 | 36 | 1 7/8 " | 12 | 16 | 4 " | 10 | 16 |
| 5/16 " | 24 | 32 | 2 " | 12 | 16 | 4 1/8 " | 10 | 16 |
| 3/8 " | 24 | 32 | 2 1/8 " | 12 | 16 | 4 1/4 " | 10 | 16 |
| 7/16 " | 20 | 28 | 2 1/4 " | 12 | 16 | 4 3/8 " | 10 | 16 |
| 1/2 " | 20 | 28 | 2 3/8 " | 12 | 16 | 4 1/2 " | 10 | 16 |
| 9/16 " | 18 | 24 | 2 1/2 " | 12 | 16 | 4 5/8 " | 10 | 16 |
| 5/8 " | 18 | 24 | 2 5/8 " | 12 | 16 | 4 3/4 " | 10 | 16 |
| 11/16 " | 16 | 24 | 2 3/4 " | 12 | 16 | 4 7/8 " | 10 | 16 |
| 3/4 " | 16 | 20 | 2 7/8 " | 12 | 16 | 5 " | 10 | 16 |
| 7/8 " | 14 | 20 | 3 " | 10 | 16 | 5 1/8 " | 10 | 16 |
| 1 " | 14 | 20 | 3 1/8 " | 10 | 16 | 5 1/4 " | 10 | 16 |
| 1 1/8 " | 12 | 18 | 3 1/4 " | 10 | 16 | 5 3/8 " | 10 | 16 |
| 1 1/4 " | 12 | 18 | 3 3/8 " | 10 | 16 | 5 1/2 " | 10 | 16 |
| 1 3/8 " | 12 | 18 | 3 1/2 " | 10 | 16 | 5 5/8 " | 10 | 16 |
| 1 1/2 " | 12 | 18 | 3 5/8 " | 10 | 16 | 5 3/4 " | 10 | 16 |
| 1 5/8 " | 12 | 16 | 3 3/4 " | 10 | 16 | 5 7/8 " | 10 | 16 |
| 1 3/4 " | 12 | 16 | 3 7/8 " | 10 | 16 | 6 " | 8 | 16 |