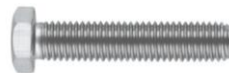


DIN 84DIN 963DIN 965DIN 7985DIN 931DIN 933DIN 933 (A2)DIN 6921DIN 6921 (A2)DIN 7380DIN 912DIN 603DIN 603 (A2)DIN 608DIN 934DIN 934 (A2)DIN 985DIN 985 (A2)DIN 1587DIN 6923DIN 6923 (A2)TU-MADIN 125DIN 125 (A2)DIN 127DIN 127 (A2)DIN 9021DIN 9021 (A2)DIN 6798TP-MT

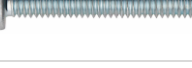
## CARACTERÍSTICAS

- Tornillería para uniones mecánicas.
- Rosca métrica.
- Requiere taladro previo roscado, o bien el empleo de tuerca métrica.
- Variedad en métricas, cabezas y longitudes: flexibilidad en el montaje.
- Recubrimiento cincado e inoxidable.

## APLICACIONES



## 1. GAMA

| ITEM | CÓDIGO        | NORMA         | FOTO                                                                                | CABEZA                                                                                                            | HUELLA                                                                                             | MATERIAL                                                                                         |
|------|---------------|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1    | <b>T084</b>   | DIN 84        |    | <br>Cilíndrica                   | <br>Ranurada     | Acero clase 4.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 2    | <b>T963</b>   | DIN 963       |    | <br>Avellanada                   | <br>Ranurada     | Acero clase 4.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 3    | <b>T965</b>   | DIN 965       |    | <br>Avellanada                   | <br>Ph           | Acero clase 4.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 4    | <b>T985</b>   | DIN 7985      |    | <br>Alomada                      | <br>Ph           | Acero clase 4.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 5    | <b>D931</b>   | DIN 931       |    | <br>Hexagonal                    | <br>Hexagonal    | Acero clase 8.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 6    | <b>D933</b>   | DIN 933       |    | <br>Hexagonal                    | <br>Hexagonal    | Acero clase 8.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 7    | <b>D933I</b>  | DIN 933 (A2)  |   | <br>Hexagonal                   | <br>Hexagonal   | Acero A2-70 (AISI 304)                                                                           |
| 8    | <b>D6921</b>  | DIN 6921      |  | <br>Hexagonal<br>brida         | <br>Hexagonal  | Acero clase 8.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 9    | <b>D6921I</b> | DIN 6921 (A2) |  | <br>Hexagonal<br>brida         | <br>Hexagonal  | Acero A2-70 (AISI 304)                                                                           |
| 10   | <b>D7380</b>  | DIN 7380      |  | <br>Redonda                    | <br>Allen      | Acero clase 10.9 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042     |
| 11   | <b>D912</b>   | DIN 912       |  | <br>Cilíndrica                 | <br>Allen      | Acero clase 8.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 12   | <b>D603</b>   | DIN 603       |  | <br>Redonda cuello<br>cuadrado | <br>Inviolable | Acero clase 4.8 UNE EN ISO 898-1.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042      |
| 13   | <b>D603I</b>  | DIN 603 (A2)  |  | <br>Redonda cuello<br>cuadrado | <br>Inviolable | Acero A2-70 (AISI 304)                                                                           |
| 14   | <b>D608</b>   | DIN 608       |  | <br>Avellanada                 | <br>Cilíndrica | Acero clase 8.8 UNE EN ISO 898-1.<br>Recubrimiento: bricromatado $\geq 3 \mu\text{m}$ s/ISO 4042 |

| ITEM | CÓDIGO        | NORMA                  | FOTO                                                                                | CABEZA                                                                                           | HUELLA | MATERIAL                                                                                |
|------|---------------|------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------|
| 15   | <b>D934</b>   | DIN 934                |    | <br>Hexagonal   |        | Acero dureza > 140 HV.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042        |
| 16   | <b>D934I</b>  | DIN 934 (A2)           |    | <br>Hexagonal   |        | Acero A2-70 (AISI 304)                                                                  |
| 17   | <b>D985</b>   | DIN 985                |    | <br>Hexagonal   |        | Acero dureza > 140 HV.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042        |
| 18   | <b>D985I</b>  | DIN 985 (A2)           |    | <br>Hexagonal   |        | Acero A2-70 (AISI 304)                                                                  |
| 19   | <b>D1587</b>  | DIN 1587               |    | <br>Hexagonal   |        | Acero al carbono<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042              |
| 20   | <b>D6923</b>  | DIN 6923               |    | <br>Hexagonal   |        | Acero al carbono<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042              |
| 21   | <b>D6923I</b> | DIN 6923 (A2)          |  | <br>Hexagonal |        | Acero A2-70 (AISI 304)                                                                  |
| 22   | <b>TU-MA</b>  | Equivalente<br>DIN 315 |  | --                                                                                               |        | Acero al carbono<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042              |
| 23   | <b>D125</b>   | DIN 125                |  | --                                                                                               |        | Acero dureza > 140 HV.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042        |
| 24   | <b>D125I</b>  | DIN 125 (A2)           |  | --                                                                                               |        | Acero A2-70 (AISI 304)                                                                  |
| 25   | <b>D127</b>   | DIN 127                |  | --                                                                                               |        | Acero clase 6 UNE EN 20898-2.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042 |
| 26   | <b>D127I</b>  | DIN 127 (A2)           |  | --                                                                                               |        | Acero A2-70 (AISI 304)                                                                  |
| 27   | <b>D9021</b>  | DIN 9021               |  | --                                                                                               |        | Acero clase 6 UNE EN 20898-2.<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042 |
| 28   | <b>D9021I</b> | DIN 9021 (A2)          |  | --                                                                                               |        | Acero A2-70 (AISI 304)                                                                  |

| ITEM | CÓDIGO | NORMA    | FOTO                                                                              | CABEZA | HUELLA                                                                                         | MATERIAL                                                                   |
|------|--------|----------|-----------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 29   | D6798A | DIN 6798 |  |        | --                                                                                             | Acero al carbono<br>Recubrimiento: cincado $\geq 5 \mu\text{m}$ s/ISO 4042 |
| 30   | TPMT   | --       |  |        | <br>Hexagonal | Polietileno (PE)                                                           |

## 2. CARACTERÍSTICAS

### 2.1 DIN-84

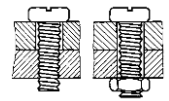
### Tornillo ranurado, cabeza cilíndrica



#### Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

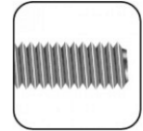
#### Propiedades



Ranura

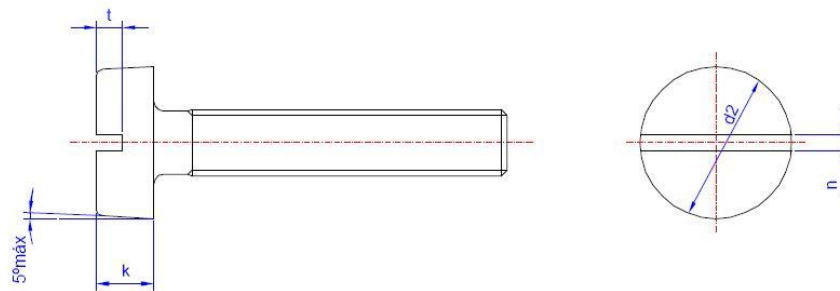


Cabeza cilíndrica



Métrica

| MÉTRICA               |      | M3   | M4   | M5   | M6  |
|-----------------------|------|------|------|------|-----|
| Ød2: diámetro cabeza  | [mm] | 5.5  | 7    | 8.5  | 10  |
| k: espesor cabeza     | [mm] | 2.0  | 2.6  | 3.3  | 3.9 |
| n: anchura ranura     | [mm] | 1.0  | 1.50 | 1.50 | 1.9 |
| t: profundidad ranura | [mm] | 1.15 | 1.5  | 1.8  | 2.2 |



## 2.2 DIN-963

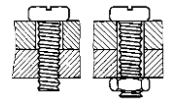
## Tornillo ranurado con cabeza avellanada



## Propiedades



Acero

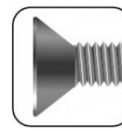
Recubrimiento  
cincado

Unión chapas

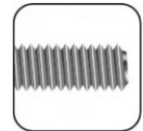
## Propiedades



Ranura

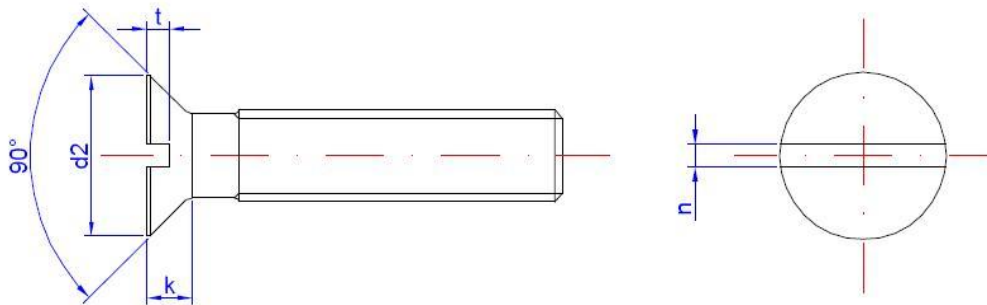


Cabeza avellanada



Métrica

| MÉTRICA               |      | M4  | M5  | M6  | M8   |
|-----------------------|------|-----|-----|-----|------|
| Ød2: diámetro cabeza  | [mm] | 7.5 | 9.2 | 11  | 14.5 |
| k: espesor cabeza     | [mm] | 2.2 | 2.5 | 3   | 4    |
| n: anchura ranura     | [mm] | 1.5 | 1.5 | 1.9 | 2.3  |
| t: profundidad ranura | [mm] | 1.1 | 1.3 | 1.6 | 2.1  |



## 2.3 DIN-965

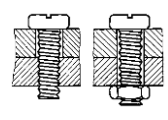
## Tornillo de cabeza avellanada y huella Ph



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

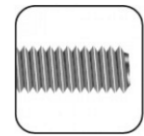
## Propiedades



Ph

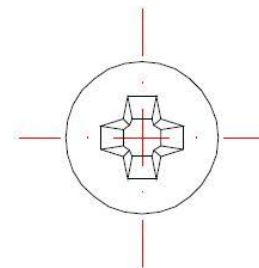
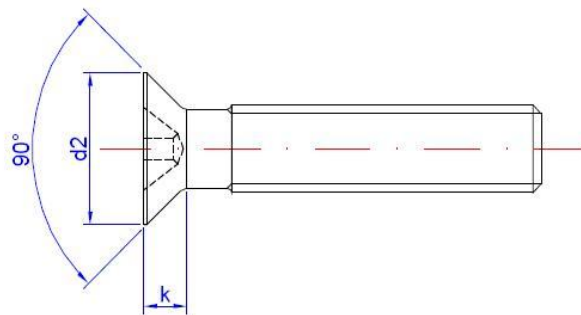


Cabeza avellanada



Métrica

| MÉTRICA              |      | M3                 | M4                  | M5                 | M6                 |
|----------------------|------|--------------------|---------------------|--------------------|--------------------|
| Ød2: diámetro cabeza | [mm] | 5.6                | 7.5                 | 9.2                | 11.0               |
| k: espesor cabeza    | [mm] | 1.65               | 2.2                 | 2.5                | 3.0                |
| Hueco Ph             |      | 1                  | 2                   | 2                  | 3                  |
| Punta colocación     |      | PUPHC01<br>PUPHL01 | PUPHC02<br>PUPHL002 | PUPHC02<br>PUPHL02 | PUPHC03<br>PUPHL03 |



## 2.4 DIN-7985

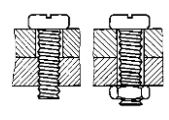
## Tornillo de cabeza alomada y huella Ph



## Propiedades



Acero

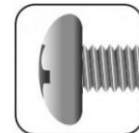
Recubrimiento  
cincado

Unión chapas

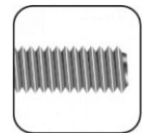
## Propiedades



Ph

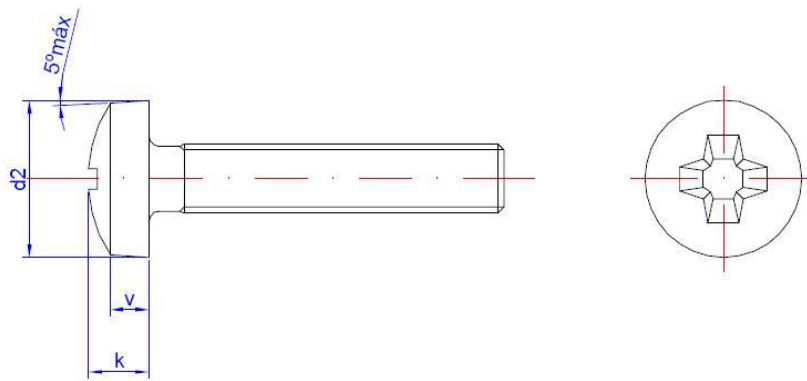


Cabeza alomada



Métrica

| MÉTRICA              |      | M3                 | M4                  | M5                 | M6                 |
|----------------------|------|--------------------|---------------------|--------------------|--------------------|
| Ød2: diámetro cabeza | [mm] | 6                  | 8                   | 10                 | 12                 |
| k: espesor cabeza    | [mm] | 2.4                | 3.1                 | 3.8                | 4.6                |
| v                    | [mm] | 1.6                | 2.0                 | 2.5                | 3.0                |
| Hueco Ph             |      | 1                  | 2                   | 2                  | 3                  |
| Punta colocación     |      | PUPHC01<br>PUPHL01 | PUPHC02<br>PUPHL002 | PUPHC02<br>PUPHL02 | PUPHC03<br>PUPHL03 |



## 2.5 DIN-931

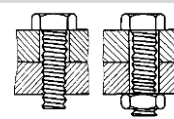
## Tornillo rosca métrica hexagonal



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

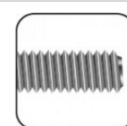
## Propiedades



Hexagonal

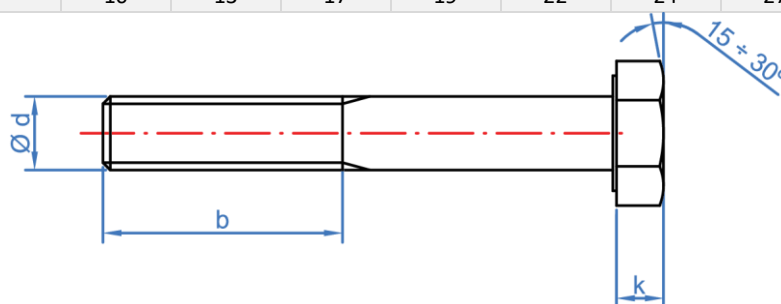
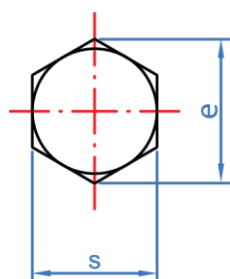


Cabeza hexagonal



Métrica

| MÉTRICA                                   |      | M6    | M8    | M10   | M12   | M14   | M16   | M18   | M20   |
|-------------------------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| s: distancia entre caras                  | [mm] | 10    | 13    | 17    | 19    | 22    | 24    | 27    | 30    |
| k: espesor cabeza                         | [mm] | 4     | 5,3   | 6,4   | 7,5   | 8,8   | 10    | 11,5  | 12,5  |
| e: distancia entre vértices               | [mm] | 10,89 | 14,20 | 18,72 | 20,88 | 23,91 | 26,17 | 29,56 | 32,95 |
| b(min): longitud de rosca $l \leq 120$ mm | [mm] | 18    | 22    | 26    | 30    | 34    | 38    | 42    | 46    |
| b(min): longitud de rosca $l > 120$ mm    | [mm] | --    | 28    | 32    | 36    | 40    | 44    | 48    | 52    |
| Llave de instalación                      |      | 10    | 13    | 17    | 19    | 22    | 24    | 27    | 30    |



## 2.6 DIN-933

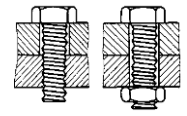
## Tornillo rosca métrica hexagonal



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

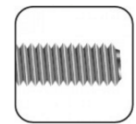
## Propiedades



Hexagonal

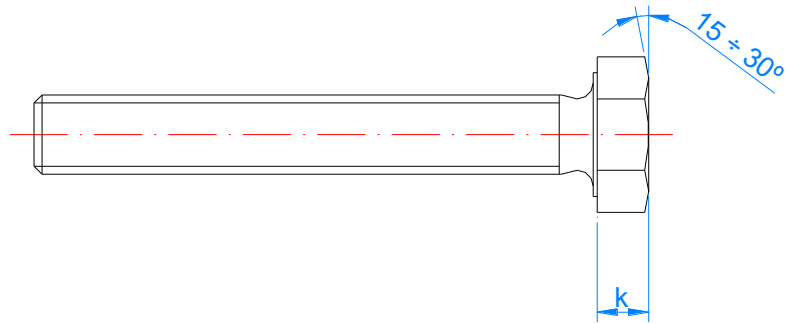
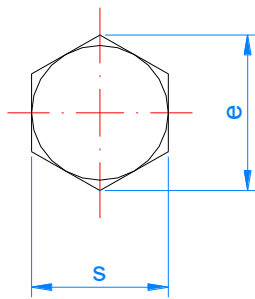


Cabeza hexagonal



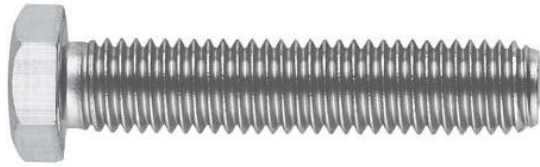
Métrica

| MÉTRICA                     |      | M4   | M5   | M6    | M8    | M10   | M12   | M14   | M16   | M18   | M20   |
|-----------------------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| s: distancia entre caras    | [mm] | 7    | 8    | 10    | 13    | 17    | 19    | 22    | 24    | 27    | 30    |
| k: espesor cabeza           | [mm] | 3    | 3,5  | 4     | 5,3   | 6,4   | 7,5   | 8,8   | 10    | 11,5  | 12,5  |
| e: distancia entre vértices | [mm] | 7,50 | 8,63 | 10,89 | 14,20 | 18,72 | 20,88 | 23,91 | 26,17 | 29,56 | 32,95 |
| Llave de instalación        |      | 7    | 8    | 10    | 13    | 17    | 19    | 22    | 24    | 27    | 30    |



## 2.7 DIN-933 A2

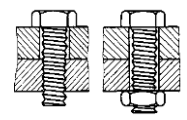
## Tornillo rosca métrica hexagonal inoxidable



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

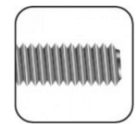
## Propiedades



Hexagonal

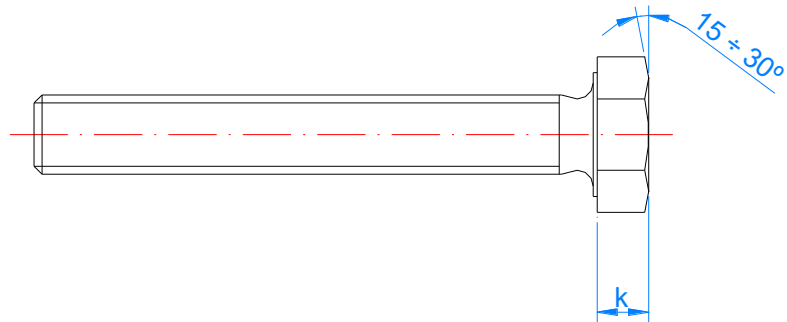
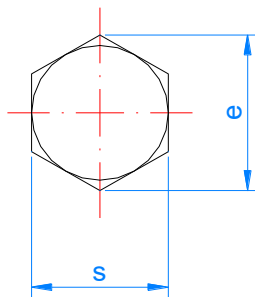


Cabeza hexagonal



Métrica

| MÉTRICA                     |      | M4   | M5   | M6    | M8    | M10   | M12   | M14   | M16   | M18   |
|-----------------------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| s: distancia entre caras    | [mm] | 7    | 8    | 10    | 13    | 17    | 19    | 22    | 24    | 27    |
| k: espesor cabeza           | [mm] | 3    | 3,5  | 4     | 5,3   | 6,4   | 7,5   | 8,8   | 10    | 11,5  |
| e: distancia entre vértices | [mm] | 7,50 | 8,63 | 10,89 | 14,20 | 18,72 | 20,88 | 23,91 | 26,17 | 29,56 |
| Llave de instalación        |      | 7    | 8    | 10    | 13    | 17    | 19    | 22    | 24    | 27    |



## 2.8 DIN-6921

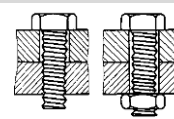
## Tornillo rosca métrica hexagonal con arandela estampada



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

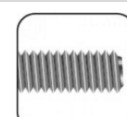
## Propiedades



Hexagonal

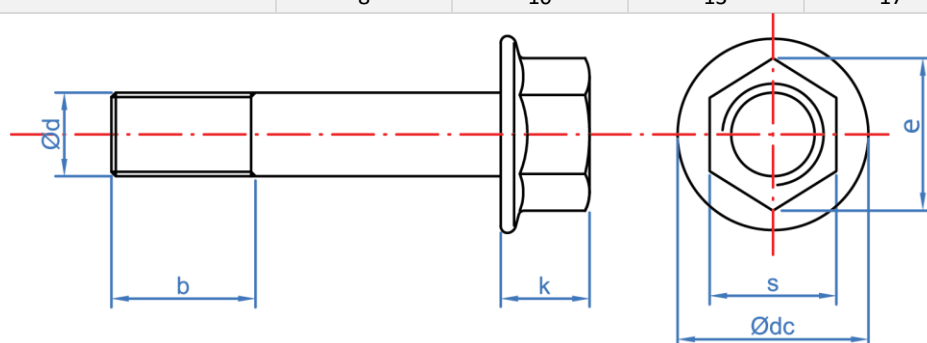


Cabeza hexagonal



Métrica

| MÉTRICA                     |      | M5                   | M6                   | M8                   | M10                  | M12                  |
|-----------------------------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| s: distancia entre caras    | [mm] | 8                    | 10                   | 13                   | 17                   | 19                   |
| k: espesor cabeza           | [mm] | 5,4                  | 6,6                  | 8,10                 | 9,2                  | 11,5                 |
| e: distancia entre vértices | [mm] | 8,71                 | 10,95                | 14,26                | 16,50                | 17,62                |
| Ødc: diámetro de arandela   | [mm] | 11,8                 | 14,2                 | 18,0                 | 22,3                 | 26,6                 |
| b(min): longitud de rosca   | [mm] | Completa /<br>16 min | Completa /<br>18 min | Completa /<br>22 min | Completa /<br>26 min | Completa / 30<br>min |
| Llave de instalación        |      | 8                    | 10                   | 13                   | 17                   | 19                   |



## 2.9 DIN-6921 A2

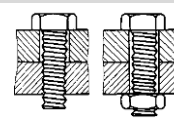
## Tornillo rosca métrica hexagonal con arandela inoxidable



## Propiedades



Acero

Inoxidable A2-70  
(AISI 304)

Unión chapas

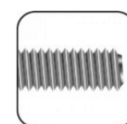
## Propiedades



Hexagonal

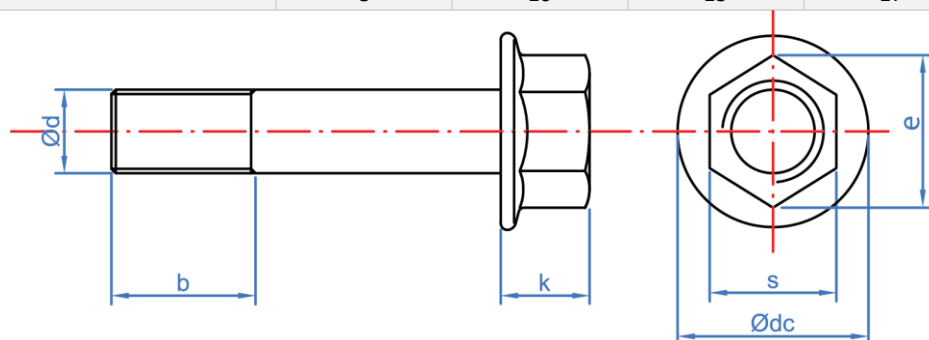


Cabeza hexagonal



Métrica

| MÉTRICA                     |      | M5                   | M6                   | M8                   | M10                  | M12                  |
|-----------------------------|------|----------------------|----------------------|----------------------|----------------------|----------------------|
| s: distancia entre caras    | [mm] | 8                    | 10                   | 13                   | 17                   | 19                   |
| k: espesor cabeza           | [mm] | 5,4                  | 6,6                  | 8,10                 | 9,2                  | 11,5                 |
| e: distancia entre vértices | [mm] | 8,71                 | 10,95                | 14,26                | 16,50                | 17,62                |
| Ødc: diámetro de arandela   | [mm] | 11,8                 | 14,2                 | 18,0                 | 22,3                 | 26,6                 |
| b(min): longitud de rosca   | [mm] | Completa /<br>16 min | Completa /<br>18 min | Completa /<br>22 min | Completa /<br>26 min | Completa / 30<br>min |
| Llave de instalación        |      | 8                    | 10                   | 13                   | 17                   | 19                   |



2.10 DIN-7380

Tornillo ISO 7380 con huella Allen y cabeza redonda



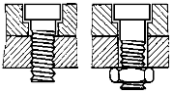
Propiedades



Acero



Recubrimiento  
cincado

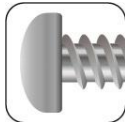


Unión chapas

Propiedades



Allen

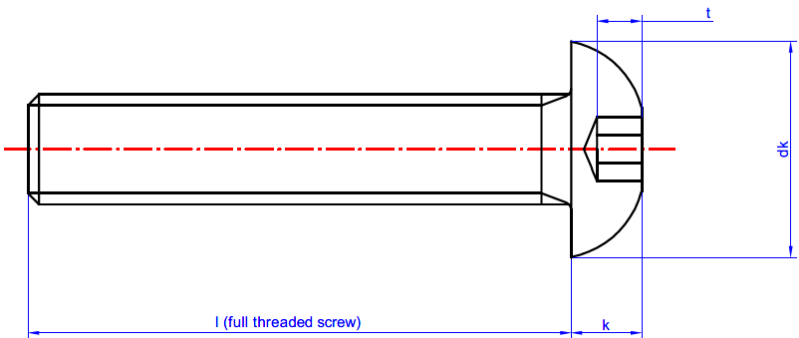
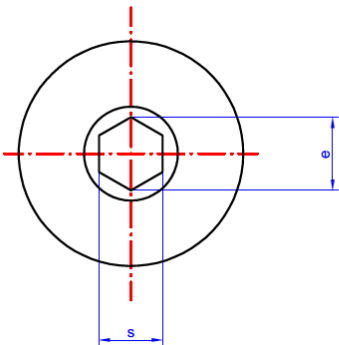


Cabeza redonda



Métrica

| MÉTRICA                    |      | M3      | M4        | M5      | M6      | M8      | M10     |
|----------------------------|------|---------|-----------|---------|---------|---------|---------|
| Ødk: diámetro de la cabeza | [mm] | 5,50    | 7,50      | 9,30    | 10,30   | 13,75   | 17,30   |
| k: espesor cabeza          | [mm] | 1,50    | 2,00      | 2,50    | 3,00    | 4,10    | 5,20    |
| L: Longitudes disponibles  | [mm] | 12 - 20 | 8 - 40    | 10 - 50 | 8 - 60  | 10 - 60 | 16 - 60 |
| Llave de instalación       |      | Allen 2 | Allen 2.5 | Allen 3 | Allen 4 | Allen 5 | Allen 6 |



## 2.11 DIN-912

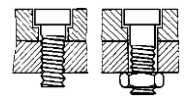
## Tornillo Allen



## Propiedades



Acero

Recubrimiento  
cincado

Unión chapas

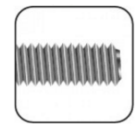
## Propiedades



Allen



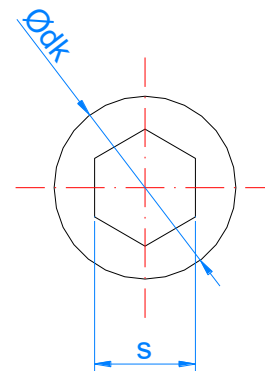
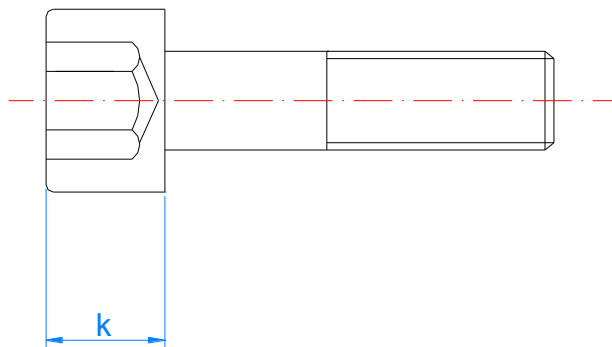
Cabeza cilíndrica



Métrica

## MÉTRICA

|                                       |      | M4      | M5      | M6      | M8      | M10     | M12      |
|---------------------------------------|------|---------|---------|---------|---------|---------|----------|
| Ødk: diámetro de la cabeza            | [mm] | 7       | 8,5     | 10      | 13      | 16      | 18       |
| s: distancia entre caras de la huella | [mm] | 3       | 4       | 5       | 6       | 8       | 10       |
| k: espesor cabeza                     | [mm] | 4       | 5       | 6       | 8       | 10      | 12       |
| Llave de instalación                  |      | Allen 3 | Allen 4 | Allen 5 | Allen 6 | Allen 8 | Allen 10 |



## 2.12 DIN-603

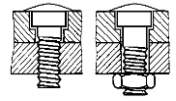
## Tornillo DIN-603 y tuerca DIN-934



## Propiedades



Acero

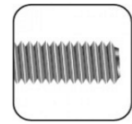
Recubrimiento  
cincado

Unión chapas

## Propiedades

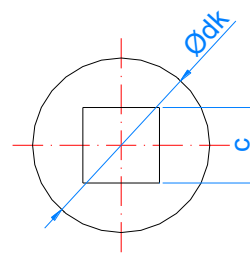
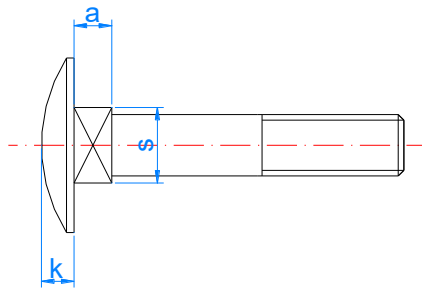


Cabeza redonda cuello cuadrado



Métrica

| MÉTRICA                 |      | M5  | M6  | M8  | M10  | M12  |
|-------------------------|------|-----|-----|-----|------|------|
| Ødk: diámetro cabeza    | [mm] | 13  | 16  | 20  | 24   | 30   |
| k: espesor cabeza       | [mm] | 3   | 3,5 | 4,5 | 5    | 6,5  |
| a: espesor del cuadrado | [mm] | 3,5 | 4   | 5   | 6    | 8    |
| s                       | [mm] | 5   | 6,2 | 7,8 | 9,85 | 11,6 |
| c                       | [mm] | 5   | 6   | 8   | 10   | 12   |



## 2.13 DIN-603 A2

## Tornillo DIN-603 inoxidable



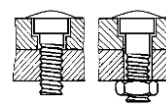
## Propiedades



Acero



Inoxidable A2-70 (AISI 304)

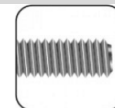


Unión chapas

## Propiedades

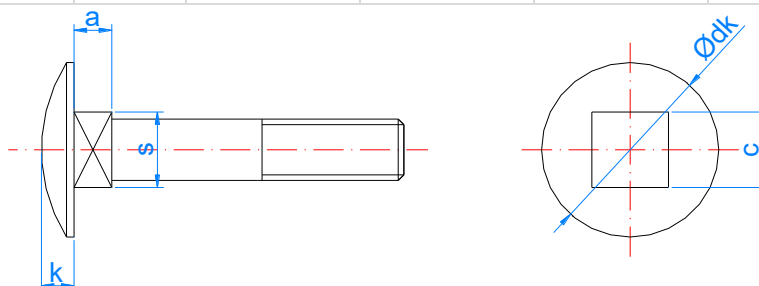


Cabeza redonda cuello cuadrado



Métrica

| MÉTRICA                 |      | M5  | M6  | M8  | M10  | M12  |
|-------------------------|------|-----|-----|-----|------|------|
| Ødk: diámetro cabeza    | [mm] | 13  | 16  | 20  | 24   | 30   |
| k: espesor cabeza       | [mm] | 3   | 3,5 | 4,5 | 5    | 6,5  |
| a: espesor del cuadrado | [mm] | 3,5 | 4   | 5   | 6    | 8    |
| s                       | [mm] | 5   | 6,2 | 7,8 | 9,85 | 11,6 |
| c                       | [mm] | 5   | 6   | 8   | 10   | 12   |



## 2.14 DIN-608

## Tornillo DIN-608 y tuerca DIN-934



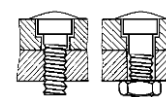
## Propiedades



Acero

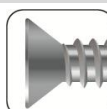


Recubrimiento bicromatado

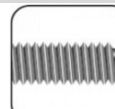


Unión chapas

## Propiedades

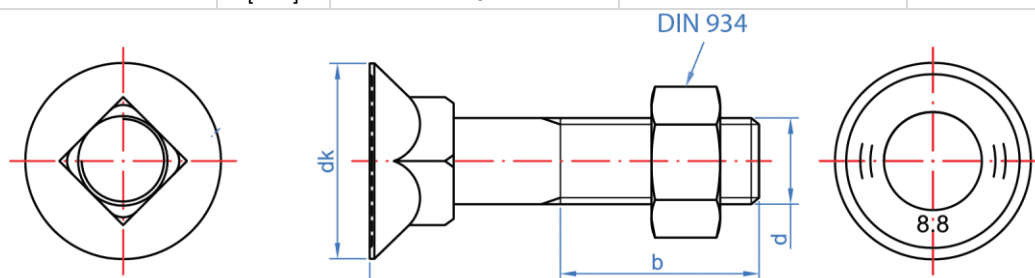


Cabeza avellanada



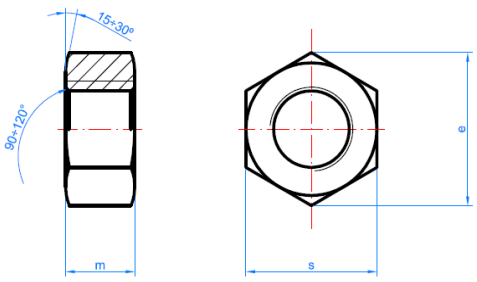
Métrica

| MÉTRICA              |      | M10  | M10  | M12  |
|----------------------|------|------|------|------|
| Ødk: diámetro cabeza | [mm] | 19,5 | 21,5 | 23,5 |
| b: longitud de rosca | [mm] | 25   | 27   | 28,5 |
| d: métrica           | [mm] | 10   | 11   | 12   |



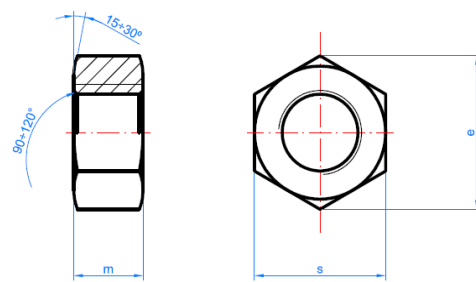
## 2.15 DIN-934

## Tuerca hexagonal

|                                                                                   |     |     |     |                                                                                    |      |      |      |      |      |      |      | Propiedades                                                                         |      |                                                                                     |      |      |      |
|-----------------------------------------------------------------------------------|-----|-----|-----|------------------------------------------------------------------------------------|------|------|------|------|------|------|------|-------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|------|------|------|
|  |     |     |     |  |      |      |      |      |      |      |      |  |      |  |      |      |      |
|                                                                                   |     |     |     |                                                                                    |      |      |      |      |      |      |      | Acero                                                                               |      | Recubrimiento<br>cincado                                                            |      |      |      |
| M                                                                                 | M3  | M4  | M5  | M6                                                                                 | M8   | M10  | M12  | M14  | M16  | M18  | M20  | M22                                                                                 | M24  | M27                                                                                 | M30  | M33  | M36  |
| s                                                                                 | 5,5 | 7   | 8   | 10                                                                                 | 13   | 17   | 19   | 22   | 24   | 27   | 30   | 32                                                                                  | 36   | 41                                                                                  | 46   | 50   | 55   |
| e                                                                                 | 6,0 | 7,7 | 8,8 | 11,1                                                                               | 14,4 | 18,9 | 21,1 | 24,5 | 26,8 | 29,6 | 32,9 | 35,0                                                                                | 39,6 | 45,2                                                                                | 50,9 | 55,4 | 60,8 |
| m                                                                                 | 2,4 | 3,2 | 4   | 5                                                                                  | 6,5  | 8    | 10   | 11   | 13   | 15   | 16   | 18                                                                                  | 19   | 22                                                                                  | 24   | 26   | 29   |
| Llave                                                                             | 5,5 | 7   | 8   | 10                                                                                 | 13   | 17   | 19   | 22   | 24   | 27   | 30   | 32                                                                                  | 36   | 41                                                                                  | 46   | 50   | 55   |

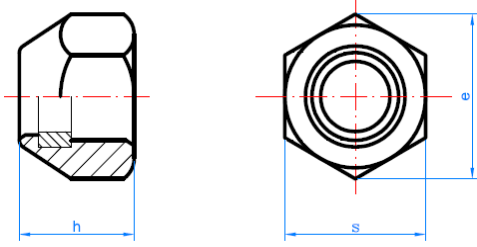
## 2.16 DIN-934 A2

## Tuerca hexagonal inoxidable

| <div></div> |     |     |      |      |      |      |      |      | <div></div> |      |      |      | <div>Propiedades</div> <div><div></div><div>Acero</div></div> <div><div></div><div>Inoxidable A2<br/>(AISI 304)</div></div> |  |  |  |
|-----------------------------------------------------------------------------------------------|-----|-----|------|------|------|------|------|------|------------------------------------------------------------------------------------------------|------|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| M                                                                                             | M4  | M5  | M6   | M8   | M10  | M12  | M14  | M16  | M18                                                                                            | M20  | M22  | M24  |                                                                                                                                                                                                                                                                                                     |  |  |  |
| s                                                                                             | 7   | 8   | 10   | 13   | 17   | 19   | 22   | 24   | 27                                                                                             | 30   | 32   | 36   |                                                                                                                                                                                                                                                                                                     |  |  |  |
| e                                                                                             | 7,7 | 8,8 | 11,1 | 14,4 | 18,9 | 21,1 | 24,5 | 26,8 | 29,6                                                                                           | 32,9 | 35,0 | 39,6 |                                                                                                                                                                                                                                                                                                     |  |  |  |
| m                                                                                             | 3,2 | 4   | 5    | 6,5  | 8    | 10   | 11   | 13   | 15                                                                                             | 16   | 18   | 19   |                                                                                                                                                                                                                                                                                                     |  |  |  |
| Llave                                                                                         | 7   | 8   | 10   | 13   | 17   | 19   | 22   | 24   | 27                                                                                             | 30   | 32   | 36   |                                                                                                                                                                                                                                                                                                     |  |  |  |

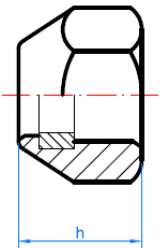
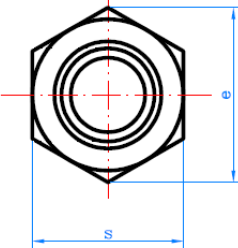
## 2.17 DIN-985

## Tuerca autoblocante

|                                                                                     |     |     |     |                                                                                      |      |      |      |      |      |      |      | Propiedades                                                                           |      |                                                                                       |      |
|-------------------------------------------------------------------------------------|-----|-----|-----|--------------------------------------------------------------------------------------|------|------|------|------|------|------|------|---------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------|------|
|  |     |     |     |  |      |      |      |      |      |      |      |  |      |  |      |
|                                                                                     |     |     |     |                                                                                      |      |      |      |      |      |      |      | Acero                                                                                 |      | Recubrimiento<br>cincado                                                              |      |
| M                                                                                   | M3  | M4  | M5  | M6                                                                                   | M8   | M10  | M12  | M14  | M16  | M18  | M20  | M22                                                                                   | M24  | M27                                                                                   | M30  |
| s                                                                                   | 5,5 | 7   | 8   | 10                                                                                   | 13   | 17   | 19   | 22   | 24   | 27   | 30   | 32                                                                                    | 36   | 41                                                                                    | 46   |
| e                                                                                   | 6,0 | 7,7 | 8,8 | 11,1                                                                                 | 14,4 | 18,9 | 21,1 | 24,5 | 26,8 | 29,6 | 32,9 | 35,0                                                                                  | 38,6 | 45,2                                                                                  | 50,9 |
| h                                                                                   | 4   | 5   | 5   | 6                                                                                    | 8    | 10   | 12   | 14   | 16   | 18,5 | 20   | 22                                                                                    | 24   | 27                                                                                    | 30   |
| Llave                                                                               | 5,5 | 7   | 8   | 10                                                                                   | 13   | 17   | 19   | 22   | 24   | 27   | 30   | 32                                                                                    | 36   | 41                                                                                    | 46   |

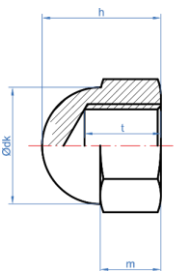
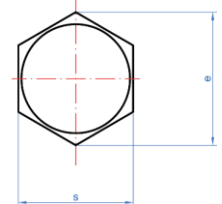
## 2.18 DIN-985 A2

## Tuerca autoblocante inoxidable A2

|                                                                                   |     |     |                                                                                   |      |      |                                                                                    |      |      | Propiedades                                                                         |      |                                                                                     |      |
|-----------------------------------------------------------------------------------|-----|-----|-----------------------------------------------------------------------------------|------|------|------------------------------------------------------------------------------------|------|------|-------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|------|
|  |     |     |  |      |      |  |      |      |  |      |  |      |
|                                                                                   |     |     |                                                                                   |      |      |                                                                                    |      |      | Acero                                                                               |      | Inoxidable A2<br>(AISI 304)                                                         |      |
| M                                                                                 | M4  | M5  | M6                                                                                | M8   | M10  | M12                                                                                | M14  | M16  | M18                                                                                 | M20  | M22                                                                                 | M24  |
| s                                                                                 | 7   | 8   | 10                                                                                | 13   | 17   | 19                                                                                 | 22   | 24   | 27                                                                                  | 30   | 32                                                                                  | 36   |
| e                                                                                 | 7,7 | 8,8 | 11,1                                                                              | 14,4 | 18,9 | 21,1                                                                               | 24,5 | 26,8 | 29,6                                                                                | 32,9 | 35,0                                                                                | 38,6 |
| h                                                                                 | 5   | 5   | 6                                                                                 | 8    | 10   | 12                                                                                 | 14   | 16   | 18,5                                                                                | 20   | 22                                                                                  | 24   |
| Llave                                                                             | 7   | 8   | 10                                                                                | 13   | 17   | 19                                                                                 | 22   | 24   | 27                                                                                  | 30   | 32                                                                                  | 36   |

## 2.19 DIN-1587

## Tuerca ciega

|  |     |     |      |      |      |    |      |      |   |  |  | Propiedades |  |  |
|------------------------------------------------------------------------------------|-----|-----|------|------|------|--------------------------------------------------------------------------------------|------|------|--------------------------------------------------------------------------------------|--|--|-------------|--|--|
|                                                                                    |     |     |      |      |      |  |      |      |  |  |  |             |  |  |
|                                                                                    |     |     |      |      |      | Acero                                                                                |      |      | Recubrimiento<br>cincado                                                             |  |  |             |  |  |
| M                                                                                  | M4  | M5  | M6   | M8   | M10  | M12                                                                                  | M14  | M16  |                                                                                      |  |  |             |  |  |
| s                                                                                  | 7   | 8   | 10   | 13   | 17   | 19                                                                                   | 22   | 24   |                                                                                      |  |  |             |  |  |
| e                                                                                  | 7,7 | 8,8 | 11,1 | 14,4 | 18,9 | 21,1                                                                                 | 24,5 | 26,8 |                                                                                      |  |  |             |  |  |
| h                                                                                  | 8   | 10  | 12   | 15   | 18   | 22                                                                                   | 25   | 28   |                                                                                      |  |  |             |  |  |
| m                                                                                  | 3   | 4   | 5    | 6,5  | 8    | 10                                                                                   | 11   | 13   |                                                                                      |  |  |             |  |  |
| t                                                                                  | 5,5 | 7,5 | 8    | 11   | 13   | 16                                                                                   | 18   | 21   |                                                                                      |  |  |             |  |  |
| Ødk                                                                                | 6,5 | 7,5 | 9,5  | 12,5 | 16   | 18                                                                                   | 21   | 23   |                                                                                      |  |  |             |  |  |
| Llave                                                                              | 7   | 8   | 10   | 13   | 17   | 19                                                                                   | 22   | 24   |                                                                                      |  |  |             |  |  |

## 2.20 DIN-6923

## Tuerca brida grafilada

|       |     |      |      |      |      | Propiedades |                       |      |
|-------|-----|------|------|------|------|-------------|-----------------------|------|
|       |     |      |      |      |      |             |                       |      |
|       |     |      |      |      |      | Acero       | Recubrimiento cincado |      |
| M     | M4  | M5   | M6   | M8   | M10  | M12         | M14                   | M16  |
| s     | 7   | 8    | 10   | 13   | 15   | 18          | 21                    | 24   |
| e     | 7,7 | 8,8  | 11,1 | 14,4 | 18,9 | 21,1        | 24,5                  | 26,8 |
| m     | 4,5 | 5    | 6    | 8    | 10   | 12          | 14                    | 16   |
| ØdC   | 10  | 11,8 | 14,2 | 17,9 | 21,8 | 26          | 29,9                  | 34,5 |
| Llave | 7   | 8    | 10   | 13   | 17   | 19          | 22                    | 24   |

## 2.21 DIN-6923 A2

## Tuerca brida grafilada inoxidable

|       |     |      |      |      |      | Propiedades |                          |      |
|-------|-----|------|------|------|------|-------------|--------------------------|------|
|       |     |      |      |      |      |             |                          |      |
|       |     |      |      |      |      | Acero       | Inoxidable A2 (AISI 304) |      |
| M     | M4  | M5   | M6   | M8   | M10  | M12         | M14                      | M16  |
| s     | 7   | 8    | 10   | 13   | 15   | 18          | 21                       | 24   |
| e     | 7,7 | 8,8  | 11,1 | 14,4 | 18,9 | 21,1        | 24,5                     | 26,8 |
| m     | 4,5 | 5    | 6    | 8    | 10   | 12          | 14                       | 16   |
| ØdC   | 10  | 11,8 | 14,2 | 17,9 | 21,8 | 26          | 29,9                     | 34,5 |
| Llave | 7   | 8    | 10   | 13   | 17   | 19          | 22                       | 24   |

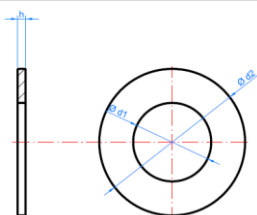
## 2.22 TU-MA

## Tuerca mariposa

|                           |    |    |    |    |    |     | Propiedades |                       |     |
|---------------------------|----|----|----|----|----|-----|-------------|-----------------------|-----|
|                           |    |    |    |    |    |     |             |                       |     |
|                           |    |    |    |    |    |     | Acero       | Recubrimiento cincado |     |
| M                         | M3 | M4 | M5 | M6 | M8 | M10 | M12         | M14                   | M16 |
| ØD1:<br>diámetro interior | M3 | M4 | M5 | M6 | M8 | M10 | M12         | M14                   | M16 |

## 2.23 DIN-125

## Arandela plana



## Propiedades



Acero

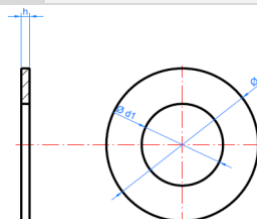


Recubrimiento cincado

| M                            | M3  | M4  | M5  | M6  | M8  | M10  | M12  | M14  | M16  | M18  | M20  | M22  | M24  | M27  | M30  | M33  | M36  |
|------------------------------|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| Ød1:<br>diámetro<br>interior | 3,3 | 4,3 | 5,3 | 6,4 | 8,4 | 10,5 | 13,0 | 15,0 | 17,0 | 19,0 | 21,0 | 23,0 | 25,0 | 28,0 | 31,0 | 34,0 | 37,0 |
| Ød2:<br>diámetro<br>exterior | 7   | 9   | 10  | 12  | 16  | 20   | 24   | 28   | 30   | 34   | 37   | 39   | 44   | 50   | 56   | 60   | 66   |
| h:<br>espesor                | 0,8 | 0,8 | 1   | 1,6 | 1,6 | 2    | 2,5  | 2,5  | 3    | 3    | 3    | 3    | 4    | 4    | 4    | 5    | 5    |

## 2.24 DIN-125 A2

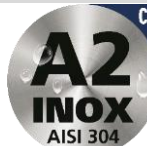
## Arandela plana inoxidable



## Propiedades



(AISI 304)

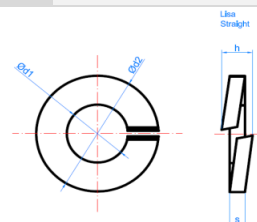


Acero Inoxidable A2

| M                            | M4  | M5  | M6  | M8  | M10  | M12  | M14  | M16  | M18  | M20  | M22  | M24  |
|------------------------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|
| Ød1:<br>diámetro<br>interior | 4,3 | 5,3 | 6,4 | 8,4 | 10,5 | 13,0 | 15,0 | 17,0 | 19,0 | 21,0 | 23,0 | 25,0 |
| Ød2:<br>diámetro<br>exterior | 9   | 10  | 12  | 16  | 20   | 24   | 28   | 30   | 34   | 37   | 39   | 44   |
| h:<br>espesor                | 0,8 | 1   | 1,6 | 1,6 | 2    | 2,5  | 2,5  | 3    | 3    | 3    | 3    | 4    |

## 2.25 DIN-127

## Arandela muelle Grower



## Propiedades



Acero

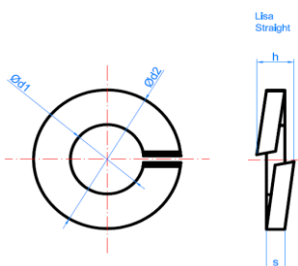


Recubrimiento cincado

| M                            | M3  | M4  | M5  | M6   | M8   | M10  | M12  | M14  | M16  | M18  | M20  | M22  | M24  | M27  | M30  | M36  |
|------------------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ød1:<br>diámetro<br>interior | 3,1 | 4,1 | 5,1 | 6,1  | 8,1  | 10,2 | 12,2 | 14,2 | 16,2 | 18,2 | 20,2 | 22,5 | 24,5 | 27,5 | 30,5 | 36,5 |
| Ød2:<br>diámetro<br>exterior | 6,2 | 7,6 | 9,2 | 11,8 | 14,8 | 18,1 | 21,1 | 24,1 | 27,4 | 29,4 | 33,6 | 35,9 | 40   | 43   | 48,2 | 58,2 |
| h:<br>anchura<br>lisa        | 1,8 | 2   | 2,6 | 3,3  | 4,3  | 4,8  | 5,4  | 6,5  | 7,6  | 7,7  | 8,7  | 8,7  | 10,9 | 10,9 | 13,1 | 13,1 |
| s:<br>espesor                | 0,8 | 0,9 | 1,2 | 1,6  | 2    | 2,2  | 2,5  | 3    | 3,5  | 3,5  | 4    | 4    | 5    | 5    | 6    | 6    |

## 2.26 DIN-127 A2

## Arandela muelle Grower inoxidable



## Propiedades



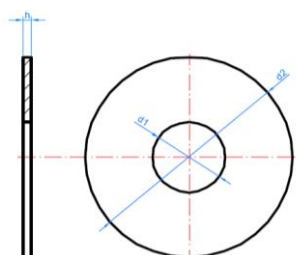
Acero

Inoxidable A2  
(AISI 304)

| M                            | M3  | M4  | M5  | M6   | M8   | M10  | M12  | M14  | M16  | M18  | M20  | M22  | M24  | M27  | M30  | M36  |
|------------------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ød1:<br>diámetro<br>interior | 3,1 | 4,1 | 5,1 | 6,1  | 8,1  | 10,2 | 12,2 | 14,2 | 16,2 | 18,2 | 20,2 | 22,5 | 24,5 | 27,5 | 30,5 | 36,5 |
| Ød2:<br>diámetro<br>exterior | 6,2 | 7,6 | 9,2 | 11,8 | 14,8 | 18,1 | 21,1 | 24,1 | 27,4 | 29,4 | 33,6 | 35,9 | 40   | 43   | 48,2 | 58,2 |
| h:<br>anchura<br>lisa        | 1,8 | 2   | 2,6 | 3,3  | 4,3  | 4,8  | 5,4  | 6,5  | 7,6  | 7,7  | 8,7  | 8,7  | 10,9 | 10,9 | 13,1 | 13,1 |
| s:<br>espesor                | 0,8 | 0,9 | 1,2 | 1,6  | 2    | 2,2  | 2,5  | 3    | 3,5  | 3,5  | 4    | 4    | 5    | 5    | 6    | 6    |

## 2.27 DIN-9021

## Arandela plana ancha



## Propiedades



Acero

Recubrimiento  
cincado

| M                            | M3  | M4  | M5  | M6  | M8  | M10  | M12  | M14  | M16  | M18  | M20  | M22  | M24  |
|------------------------------|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|
| Ød1:<br>diámetro<br>interior | 3,2 | 4,3 | 5,3 | 6,4 | 8,4 | 10,5 | 13,0 | 15,0 | 17,0 | 20,0 | 22,0 | 24,0 | 26,0 |
| Ød2:<br>diámetro<br>exterior | 9   | 12  | 15  | 18  | 24  | 30   | 37   | 44   | 50   | 56   | 60   | 66   | 72   |
| h:<br>espesor                | 0,8 | 1   | 1,2 | 1,6 | 2   | 2,5  | 3    | 3    | 3    | 4    | 4    | 5    | 5    |

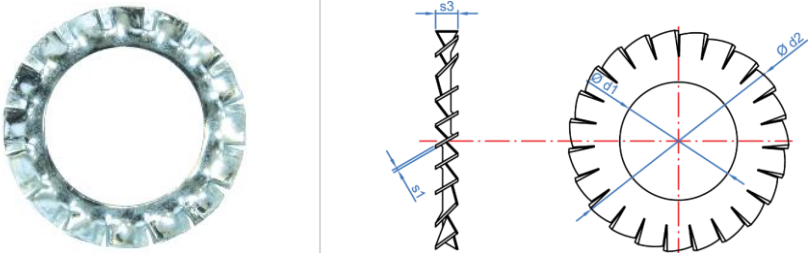
## 2.28 DIN-9021 A2

## Arandela plana ancha inoxidable

|                           |     |     |     |     |      |      |      |      | Propiedades |      |                          |      |
|---------------------------|-----|-----|-----|-----|------|------|------|------|-------------|------|--------------------------|------|
|                           |     |     |     |     |      |      |      |      |             |      |                          |      |
|                           |     |     |     |     |      |      |      |      | Acero       |      | Inoxidable A2 (AISI 304) |      |
| M                         | M4  | M5  | M6  | M8  | M10  | M12  | M14  | M16  | M18         | M20  | M22                      | M24  |
| Ød1:<br>diámetro interior | 4,3 | 5,3 | 6,4 | 8,4 | 10,5 | 13,0 | 15,0 | 17,0 | 20,0        | 22,0 | 24,0                     | 26,0 |
| Ød2:<br>diámetro exterior | 12  | 15  | 18  | 24  | 30   | 37   | 44   | 50   | 56          | 60   | 66                       | 72   |
| h:<br>espesor             | 1   | 1,2 | 1,6 | 2   | 2,5  | 3    | 3    | 3    | 4           | 4    | 5                        | 5    |

## 2.29 DIN-6798

## Arandela dentada exterior

|    |       |     |     |     |     |      | Propiedades                                                                          |     |     |
|--------------------------------------------------------------------------------------|-------|-----|-----|-----|-----|------|--------------------------------------------------------------------------------------|-----|-----|
|  |       |     |     |     |     |      |  |     |     |
| Acero                                                                                |       |     |     |     |     |      | Recubrimiento cincado                                                                |     |     |
| M                                                                                    | M3    | M4  | M5  | M6  | M8  | M10  | M12                                                                                  | M14 | M16 |
| Ød1:<br>diámetro interior                                                            | 3,2   | 4,3 | 5,3 | 6,4 | 8,4 | 10,5 | 13                                                                                   | 15  | 17  |
| Ød2:<br>diámetro exterior                                                            | 6     | 8   | 10  | 11  | 15  | 18   | 20,5                                                                                 | 24  | 26  |
| s1: espesor                                                                          | 0,4   | 0,5 | 0,6 | 0,7 | 0,8 | 0,9  | 1                                                                                    | 1   | 1,2 |
| s3: anchura                                                                          | ~3*s1 |     |     |     |     |      |                                                                                      |     |     |

## 2.30 TP-MT

## Tapón plástico para cabeza hexagonal

|    |      |      |      |      |      | Propiedades |  |
|----|------|------|------|------|------|-------------|--|
|    |      |      |      |      |      |             |  |
|    |      |      |      |      |      | Polietileno |  |
| M  | M6   | M8   | M10  | M12  | M16  |             |  |
| SW | 10   | 13   | 17   | 19   | 24   |             |  |
| ØD | 12,5 | 15,5 | 20,5 | 23,5 | 29,5 |             |  |
| H1 | 8,5  | 9,0  | 11,5 | 11,5 | 14,0 |             |  |
| L1 | 14   | 15,5 | 20,5 | 21,5 | 27,0 |             |  |

### 3. PAR DE APRIETE PARA LOS TORNILLOS

Para tornillos y tuercas de acero la norma UNE 17-108-81 establece unos parámetros para la instalación específicos.

Esta norma tiene por objeto indicar el valor del momento de apriete necesario para montar, mediante herramientas dinamométricas que no introduzcan vibraciones ni impactos, la tornillería normal de acero, sobre apoyos rígidos y sometida únicamente a solicitaciones axiales de valor constante.

Para uniones entre materiales cincados el coeficiente de rozamiento establecido por la norma es  $\mu=0,14$ . Los momentos de apriete para cada métrica están especificados en la tabla de abajo.

#### PAR DE APRIETE [da N·m] (con $\mu=0,14$ )

| ITEM        | MÉTRICA |      |      |      |      |      |      |      |       |       |       |
|-------------|---------|------|------|------|------|------|------|------|-------|-------|-------|
|             | M3      | M4   | M5   | M6   | M8   | M10  | M12  | M14  | M16   | M18   | M20   |
| T084        | 0,063   | 0,14 | 0,29 | 0,49 | 1,2  | 2,4  | 4,1  | 6,5  | 10    | 14    | 19,5  |
| T963        |         |      |      |      |      |      |      |      |       |       |       |
| T965        |         |      |      |      |      |      |      |      |       |       |       |
| T985        |         |      |      |      |      |      |      |      |       |       |       |
| D603        |         |      |      |      |      |      |      |      |       |       |       |
| D931        | 0,12    | 0,27 | 0,54 | 0,93 | 2,2  | 4,5  | 7,7  | 12,5 | 19    | 27    | 38    |
| D933        |         |      |      |      |      |      |      |      |       |       |       |
| D6921       |         |      |      |      |      |      |      |      |       |       |       |
| D912        |         |      |      |      |      |      |      |      |       |       |       |
| D933 (A2)*  | 0,10    | 0,17 | 0,34 | 0,59 | 1,45 | 3,00 | 5,00 | 7,90 | 12,10 | 17,40 | 22,40 |
| D603 (A2)*  |         |      |      |      |      |      |      |      |       |       |       |
| D6921 (A2)* |         |      |      |      |      |      |      |      |       |       |       |

\*Valores según DIN EN ISO 3506 para acero inoxidable A2-70 y coeficiente de rozamiento  $\mu_{\text{total}}=0,10$ . Estos valores son orientativos y dependerán siempre de que la tuerca y el tornillo tengan la lubricación adecuada.

#### 4. RESISTENCIAS

La norma ISO-898-1 "Características mecánicas de los elementos de fijación fabricados de aceros al carbono y aceros aleados" establece unos valores de cargas mínimas de rotura a tracción.

De acuerdo a las tabla 6 de la norma mencionada se muestran los valores correspondientes a los tornillos anteriormente mostrados.

Los valores de resistencia a cortante son equivalentes al 50% de la resistencia a tracción.

#### CARGA DE ROTURA TEÓRICA A TRACCIÓN [kN] ( $A_s, \text{nom} \times R_m, \text{min}$ )

| MÉTRICA    |      |      |       |       |       |       |       |       |        |        |        |
|------------|------|------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| ITEM       | M3   | M4   | M5    | M6    | M8    | M10   | M12   | M14   | M16    | M18    | M20    |
| T084       | 2,01 | 3,51 | 5,68  | 8,04  | 14,64 | 23,20 | 33,72 | 46,00 | 62,80  | 77,20  | 98,00  |
| T963       |      |      |       |       |       |       |       |       |        |        |        |
| T965       |      |      |       |       |       |       |       |       |        |        |        |
| T985       |      |      |       |       |       |       |       |       |        |        |        |
| D603       |      |      |       |       |       |       |       |       |        |        |        |
| D608       | 4,02 | 7,02 | 11,36 | 16,08 | 29,28 | 46,40 | 67,44 | 92,00 | 125,60 | 154,40 | 196,00 |
| D931       |      |      |       |       |       |       |       |       |        |        |        |
| D933       |      |      |       |       |       |       |       |       |        |        |        |
| D6921      |      |      |       |       |       |       |       |       |        |        |        |
| D912       |      |      |       |       |       |       |       |       |        |        |        |
| D933 (A2)  | 3,52 | 6,15 | 9,94  | 14,07 | 25,62 | 40,60 | 59,01 | 80,50 | 109,90 | 135,10 | 171,50 |
| D603 (A2)  |      |      |       |       |       |       |       |       |        |        |        |
| D6921 (A2) |      |      |       |       |       |       |       |       |        |        |        |

#### CARGA MÁXIMA RECOMENDADA A TRACCIÓN [kN] ( $A_s, \text{nom} \times R_m, \text{min} \times 0,5$ )

| MÉTRICA    |      |      |      |       |       |       |       |       |       |        |        |
|------------|------|------|------|-------|-------|-------|-------|-------|-------|--------|--------|
| ITEM       | M3   | M4   | M5   | M6    | M8    | M10   | M12   | M14   | M16   | M18    | M20    |
| T084       | 1,37 | 2,39 | 3,86 | 5,47  | 9,96  | 15,78 | 22,94 | 31,29 | 42,72 | 52,52  | 66,67  |
| T963       |      |      |      |       |       |       |       |       |       |        |        |
| T965       |      |      |      |       |       |       |       |       |       |        |        |
| T985       |      |      |      |       |       |       |       |       |       |        |        |
| D603       |      |      |      |       |       |       |       |       |       |        |        |
| D608       | 2,74 | 4,78 | 7,73 | 10,94 | 19,92 | 31,56 | 45,88 | 62,59 | 85,44 | 105,03 | 133,33 |
| D931       |      |      |      |       |       |       |       |       |       |        |        |
| D933       |      |      |      |       |       |       |       |       |       |        |        |
| D6921      |      |      |      |       |       |       |       |       |       |        |        |
| D912       |      |      |      |       |       |       |       |       |       |        |        |
| D933 (A2)  | 2,40 | 4,18 | 6,76 | 9,57  | 17,43 | 27,62 | 40,14 | 54,76 | 74,76 | 91,90  | 116,67 |
| D603 (A2)  |      |      |      |       |       |       |       |       |       |        |        |
| D6921 (A2) |      |      |      |       |       |       |       |       |       |        |        |

CARGA DE ROTURA TEÓRICA A CORTANTE [kN] ( $A_{s,nom} \times R_{m,min}$ )

| MÉTRICA    |      |      |      |      |       |       |       |       |       |       |       |
|------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| ITEM       | M3   | M4   | M5   | M6   | M8    | M10   | M12   | M14   | M16   | M18   | M20   |
| T084       | 1,01 | 1,76 | 2,84 | 4,02 | 7,32  | 11,60 | 16,86 | 23,00 | 31,40 | 38,60 | 49,00 |
| T963       |      |      |      |      |       |       |       |       |       |       |       |
| T965       |      |      |      |      |       |       |       |       |       |       |       |
| T985       |      |      |      |      |       |       |       |       |       |       |       |
| D603       |      |      |      |      |       |       |       |       |       |       |       |
| D608       | 2,01 | 3,51 | 5,68 | 8,04 | 14,64 | 23,20 | 33,72 | 46,00 | 62,80 | 77,20 | 98,00 |
| D931       |      |      |      |      |       |       |       |       |       |       |       |
| D933       |      |      |      |      |       |       |       |       |       |       |       |
| D6921      |      |      |      |      |       |       |       |       |       |       |       |
| D912       |      |      |      |      |       |       |       |       |       |       |       |
| D933 (A2)  | 1,76 | 3,07 | 4,97 | 7,04 | 12,81 | 20,30 | 29,51 | 40,25 | 54,95 | 67,55 | 85,75 |
| D603 (A2)  |      |      |      |      |       |       |       |       |       |       |       |
| D6921 (A2) |      |      |      |      |       |       |       |       |       |       |       |

CARGA MÁXIMA RECOMENDADA A CORTANTE [kN] ( $A_{s,nom} \times R_{m,min} \times 0,5$ )

| MÉTRICA    |      |      |      |      |      |       |       |       |       |       |       |
|------------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| ITEM       | M3   | M4   | M5   | M6   | M8   | M10   | M12   | M14   | M16   | M18   | M20   |
| T084       | 0,68 | 1,19 | 1,93 | 2,73 | 4,98 | 7,89  | 11,47 | 15,65 | 21,36 | 26,26 | 33,33 |
| T963       |      |      |      |      |      |       |       |       |       |       |       |
| T965       |      |      |      |      |      |       |       |       |       |       |       |
| T985       |      |      |      |      |      |       |       |       |       |       |       |
| D603       |      |      |      |      |      |       |       |       |       |       |       |
| D608       | 1,37 | 2,39 | 3,86 | 5,47 | 9,96 | 15,78 | 22,94 | 31,29 | 42,72 | 52,52 | 66,67 |
| D931       |      |      |      |      |      |       |       |       |       |       |       |
| D933       |      |      |      |      |      |       |       |       |       |       |       |
| D6921      |      |      |      |      |      |       |       |       |       |       |       |
| D912       |      |      |      |      |      |       |       |       |       |       |       |
| D933 (A2)  | 1,20 | 2,09 | 3,38 | 4,79 | 8,71 | 13,81 | 20,07 | 27,38 | 37,38 | 45,95 | 58,33 |
| D603 (A2)  |      |      |      |      |      |       |       |       |       |       |       |
| D6921 (A2) |      |      |      |      |      |       |       |       |       |       |       |