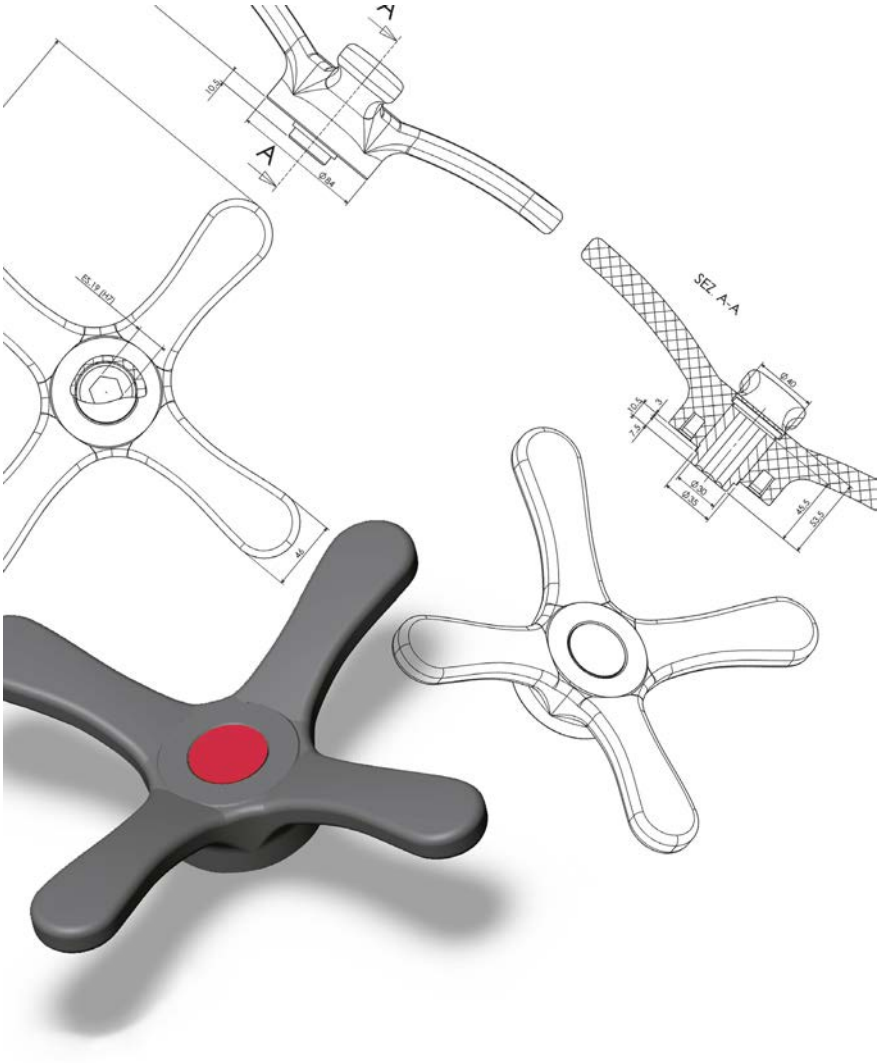
BOTECO®
YOUR MECHANICAL COMPONENT

NT



GROUP - NT

NT 1.0

TERMS AND CONDITIONS OF SALE 2020.0

1.1
The quoted or sale price for the goods is always ex our factory in Zané, with packaging at cost.

1.2
Goods shipped by Boteco Srl always travel at the risk of the customer. Boteco Srl does not accept liability for damaged goods or loss in transit of all or part of the goods.

1.3
Boteco Srl will only accept complaints in writing within 8 working days from receipt of the goods. No other form of complaint will be considered.

1.4
The products presented in this catalogue are guaranteed against raw material defects and/or workmanship errors. Defects not attributable to Boteco are excluded from the warranty. Boteco Srl denies all liability for any direct or indirect damage resulting from goods manufactured by them.

1.5
Goods deemed to be defective by the customer due to material or workmanship defects shall be returned to Boteco Srl and replaced free of charge. If it is not possible to replace the goods, the full invoice price will be credited to the customer. Boteco Srl will pay the shipping costs.

1.6
Prior written authorisation must be obtained from our sales office before goods can be returned. If goods are returned to our warehouse before written authorisation has been granted, the goods will be refused and returned to the sender at the latter's expense.

1.7
If an incorrect order is delivered to the customer, the goods shall be returned to Boteco Srl via the method agreed on with our sales office. Boteco Srl will pay the shipping expenses and credit the full value of the goods.

1.8
In the event of a customer order error, Boteco Srl will assess the return based on the quantity and only for standard materials presented in the latest edition of the general catalogue. The return method shall be agreed on with our sales office. The shipping expenses will be paid by the buyer. The full value of the goods at the invoice price minus a percentage to cover handling expenses (counting, cleaning, unpacking/re-positioning) ranging from a minimum of 10% to a maximum of 50%, will be credited to the customer.

1.9
All order cancellations must be made in writing and will only be accepted for standard material presented in the latest version of the general catalogue. Cancellation of orders for special products made to customer's specifications will only be accepted if production of any of the parts required for the product has not commenced. If production has already commenced the goods will be delivered and invoiced as usual. The company may supply more or less (between -2% and +10%) than the exact quantity of the customised goods ordered.

1.10
The data relating to dimensions or product type presented in this catalogue are non-binding. Boteco Srl reserves the right to add, modify or eliminate the products presented in this catalogue without prior notice. Normally these changes are due to technical/qualitative or commercial reasons.

1.11
Payment in full of the exact total amount stated on the invoice must be respected. Discounts and rounded off totals will not be accepted. Outstanding payments will incur a late charge of €12. If the delay extends beyond 30 days from the original due date, default interest will be applied. After a second consecutive outstanding payment, an advance payment will be required for any subsequent orders.

1.12
Invoices with taxable amount up to €50 will incur a fixed cost of €10. Payment of invoices with taxable amount up to €70 will require advance payment or payment by credit card. For all other invoices standard bank payments will be available by arrangement with our sales office.

1.13
Invoices in Italy will only be sent telematically (electronic invoice – SDI).

1.14
Title to the goods being sold shall pass to the customer, by mutual agreement of the parties, when payment of the agreed price has been made in full. Until such time, therefore, the buyer will be deemed a custodian of the goods and will be responsible for safekeeping the goods without expecting any remuneration for this service.

1.15
The Vicenza court of justice shall have exclusive jurisdiction over all disputes.

NT 2.0

RESERVES ON THE PRODUCTS

2.1 WEIGHTS
All the weights given in the tables in this catalogue are approximate and non-binding. Any differences in weights are caused by the different specific weights of the individual materials (± 10%).

2.2 DIMENSIONS OF THE PLASTIC PARTS
All the dimensions of the plastic parts shown in the tables in this catalogue were taken from samples taken from our material in stock. However, it is possible to come upon parts with dimensions that may differ (by 0.1 mm to 0.6 mm) from those indicated in the table.

2.3 CHANGES TO PRODUCTS
Boteco reserves the right to make changes to the dimensions, the geometry and/or shape of the items presented in the latest version of the catalogue at any time and without prior notice.

2.4 COLOURS
As indicated in all the chapters of the latest version of the catalogue, the majority of products are available in a variety of colours. Note that the Ral reference refers to the masterbatch used. The colour of the finished product cannot be identical to the reference charts for the following reasons:
2.41
Glass fiber cannot be coloured. Therefore the presence of 15% - 30% of fiber tends to reflect white light which normally lightens the selected colour.
2.42
The satin surface finish of the majority of our products reflects light differently. The tendency is to make the selected colour appear lighter. This effect is pointed out very clearly on our colour test tags. The shiny part of the tag appears to be darker than the part with the satin finish, even if made from the same material.
2.43
The same colour takes on different shades when moulded with different materials.

NT 3.0

CONFORMITY

3.1 CE Products
Boteco declares that products T252420 - T556350 and T556250 (safety devices) comply with harmonised standard UNI ISO 19085-5. The products are always sold accompanied by a manual and a certificate. On request we can supply these certificates in several languages.

3.2 RoHS standard
Boteco declares that all the products presented in the catalogue are manufactured in compliance with the environmental protection directive RoHS 3 (2015/863/EC). Boteco guarantees that when any changes are made they carry out controls with all their suppliers to ensure that the production process complies with the standard. A copy of the certificates is available through the reserved area on our web site or through our quality assurance office.

3.2 REACH Standard
Boteco converts raw material into goods, and therefore does not introduce or create any dangerous chemical compounds. Consequently, the company is not required to inform the European Commission of REACH of any dangerous products. However, Boteco ensures that all the supplier-producers of raw materials fulfil the required obligations. Boteco checks the updated CANDIDATE LIST SVHC biannually and then updates its own declarations.

3.3 Conflicts Minerals
Boteco declares that, in accordance with the Dodd–Frank Wall Street Reform and Consumer Protection Act, US Section 1502, the products included in their catalogue do not contain minerals sourced from conflict-affected African nations (DCR Conflict Free).

3.4 Product conformity
Boteco declares that all products manufactured and sold by them comply with the technical specifications agreed on through drawings and offers stipulated with the customer.

3.5 Quality Certification
Boteco has implemented a Quality Management System in accordance with UNI EN ISO 9001:2015, certification issued by Bureau Veritas Italia (BVI) with certificate n° IT231261.

NT 4.0

COLOUR TABLE

As indicated in all the chapters of the latest version of the catalogue, the majority of products are available in a variety of colours. Note that the Ral reference refers to the masterbatch used. The colour of the finished product cannot be identical to the reference charts for the following reasons:

4.1
Glass fiber cannot be coloured. Therefore the presence of 15% - 30% of fiber tends to reflect white light which normally lightens the selected colour.

4.2
The satin surface finish of the majority of our products reflects light differently. The tendency is to make the selected colour appear lighter. This effect is pointed out very clearly on our colour test tags. The shiny part of the tag appears to be darker than the part with the satin finish, even if made from the same material.

4.3
The same colour takes on different shades when moulded with different materials.

4.4
The minimum quantity for coloured products at a competitive price is 1,000 pieces. For larger products such as those in the C-D-E product groups the quantity is determined for each separate order.

4.5
If the desired colour is not included in the standard table, it may still be available, bearing in mind that if the colour formulated by our suppliers already exists, the minimum quantity necessary to go into production will be the same as for the standard colours. If the colour is not included in the table, we would have to evaluate a minimum purchase of 25 kg of master colour, which would then be fully charged to the customer.

RAL COLOURS CODING

Colour	RAL	Code
Black	9011	01
Orange	2004	02
Orange	2011	03
White	9010	04
Blue	5015	07
Yellow	1007	09
Yellow	1021	10
Grey	7024	12
Grey	7035	13
Red	3000	16
Green	6024	17

NT 5.0
MATERIALS

We use a variety of different materials in the production of our handles. This is to ensure that we get the best result for the intended use of the product, and to achieve the best quality-price ratio.

5.1 PLASTICS

• Polyamide (PA6 - Nylon)
Polyamides (PA) are macromolecules that contain amide groups CO-NH. The general characteristics are: relatively low specific weight, shock-resistant and wear-resistant, quite good electrical insulation, resistance to solvents, oils, greases and fuels. Their high moisture absorption makes them unsuitable for contact with water or when strict tolerances must be maintained.
The many variants include the base version and those reinforced with glass fiber, glass microbeads, or mineral fillers; the filler or reinforcement percentage in the compound ranges from 15% to 50%.

• Polycarbonate (PC)
Polycarbonate is a thermoplastic polymer obtained from carbonic acid. The general characteristics are: resistance to mineral acids, aliphatic hydrocarbons, petrol, greases, oils and alcohols. Its main mechanical property is high toughness, which makes it extremely shock-resistant and impact-resistant.
It is used in pure state in orange and yellow colours mainly to produce saw guards T556. It is used in the transparent version (Crystal PC) for products T558 and T559.

• Polystyrene (PS)
Polystyrene is a polymer made from styrene, the aromatic thermoplastic type with a linear structure. The general characteristics are: it is a hard and rigid material. It has quite good mechanical properties and is resistant to most water-based chemical agents. It has very good electrical insulation properties and is practically non-hygroscopic.
It is used in the shock-resistant and self-extinguishing variants with or without reinforcing fillers. It is mainly used in product of Group 18 (terminal blocks and accessories) due to its electrical properties.

• Polypropylene (PP)
Polypropylene is a semi-crystalline thermoplastic polymer. The general characteristics are: good mouldability, shock-resistant, it has excellent electrical and thermal insulation properties, it does not absorb water. Disadvantage: it has low mechanical properties.
It is used with mineral reinforcements and special additives or in a compound with TPV rubber, SBS rubber in place of Polyethylene. It is sometimes used to produce coloured articles because of its low melting point.

• Polymethylmethacrylate (PMMA)
Polymethylmethacrylate (PMMA) is a plastic formed by methyl methacrylate polymers, the methyl ester of methacrylic acid. The main and only characteristic is its high transparency.
It replaces glass in the indicator and numerator screens of product Group 11.

• Polyoxymethylene (POM)
Polyoxymethylene (POM) is a crystalline polymer with chains of a repeating methylene bridge and oxygen atom. It is best known by one of its commercial names (Delrin). The general characteristics are: even when used in pure state (without fillers) it has good mechanical resistance and hardness, as well as dimensional stability due to low water absorption. Its hardness makes it suitable for the production of balls and nose pins for the plungers and screws of product Group 21.

• SBS thermoplastic rubber
Styrene-butadiene-styrene rubber or SBS rubber is a thermoplastic rubber, a three-block copolymer, rubbery and tough. The general characteristics are: toughness and high resistance that give it its high durability. Good resistance to chemical agents in general. Alternative solution to NBR natural rubber.
Its characteristics make it suitable for the non-slip foot base of product Group 16.

• TPV thermoplastic rubber
TPV is a vulcanised thermoplastic elastomer, made of an elastomeric phase (Dynamically Vulcanised EPDM) deeply dispersed in a polyolefinic thermoplastic matrix, which combined determine a real plasto-elastomeric alloy. The general characteristics are: great flexibility and easy mouldability, with chemical resistance similar to that of NBR rubber. Its characteristics make it suitable for the various elements that are required to be soft and durable in product Groups 16 and 19.

• Bakelite (RF)
Bakelite is the name given to a thermosetting phenolic resin obtained from formaldehyde and phenol through an electrophilic substitution reaction. The general characteristics are: great electrical and thermal insulation capability. It has a characteristic shiny surface finish.
Its characteristics make it suitable for some of the handles and electrical wire connectors of product Groups 02 and 19.

5.2 METALS AND ALLOYS
Metals and alloys are used to produce both the handles and the inserts embedded in them.

• Steel suitable for the production of small parts or high-speed steel (AVP)
AVP steel has low carbon content, with the addition of a maximum of 0.35 % of Lead (Pb). Official Italian name: CF9SMnPb36 - W.N. 1.0737. The general characteristics are: high workability for easy chip removal, a characteristic that has led to it being called "automatic steel".
Material used for all the inserts machined on a lathe that are present in the majority of the products in our catalogue.

• Steel suitable for heat treatments in the production of small parts (PR80)
Low carbon steel, with reduced Lead content, similar to C45. Official Italian name: CF35SMnPb10 - W.N. 1.0765. The general characteristics are: lower machinability on machine tools, but with higher mechanical resistance. The low lead content in this material improves its weldability, and makes it suitable for several heat treatments.
This material is used for all those inserts that require a higher mechanical resistance and heat treatments such as hardening, nitriding, or are subject to welding.

• Steel C10
This is a mild steel, a type of carbon steel, and a general construction steel, with a carbon content of 0.10 %. Official Italian name: C10 - W.N. 1.0301. The general characteristics are: very good workability for cold deformation combined with good weldability.
It is used for cold formed studs, screws and nuts.

• Steel C45
A general construction steel, with a carbon content of 0.45%. Official Italian name: C45 - W.N. 1.1730. The general characteristics are: good hardness and toughness, suitable for the construction of products subjected to stress and wear. It is suitable for processing and with a wide range of heat treatments.
It is used for finished products such as metal plungers, levers and knobs of the METALLINE series.

• Stainless steel Aisi 301/302 (Aisi 301/302)
Harmonic stainless steel suitable for the production of elastic springs. Official Italian name: X10CrNiS18-8 - American: Aisi 301 - W.N. 1.4310. Steel with magnetic permeability.
It is used only for the elastic springs present in various articles.

• Stainless steel Aisi 303 (Aisi 303)
An austenitic stainless steel with a high sulphur content to increase its machinability. Official Italian name: X10CrNiS18-9 - American: Aisi 303 - W.N. 1.4305. The general characteristics are: steel with reasonable resistance to corrosion, and with good machinability on machine tools. Steel with magnetic permeability.
It is used as a base for the majority of inserts and finished products presented in our catalogue.

MATERIALS

• Stainless steel Aisi 304 (Aisi 304)
It is a non-magnetic, austenitic chromium-nickel stainless steel. Official Italian name: X5CrNi18-10- American: Aisi 304 - W.N. 1.4301. The general characteristics are: non-hardenable steel, weldable, with good corrosion resistance. Suitable for forming processes.
It is used for the majority of our threaded studs and nuts. On request it can also be used for inserts and finished products.

• Brass suitable for the production of small parts or free-cutting brass (OT58)
A leaded alloy brass with high machinability on machine tools. Official Italian name: CuZn39Pb3 - W.N. 2.0401. The general characteristics are: good corrosion resistance and very good workability for easy removal of material.
It is used for the majority of the brass threaded inserts in our products.

• Zamak alloy 15
Aluminium, copper and zinc alloy suitable for die casting processes. Official Italian name: ZnAl4Cu1. The general characteristics are: good mechanical resistance and castability. Suitable for die casting of small metal parts.
Used for the bodies of levers of product Group 01 and other parts of the locks of product Group 10.

• Aluminium alloy 6060
It is an aluminium-magnesium-silicon alloy, for general use. Official Italian name: 9006/1 EX UNI 3569 - W.N. 3.3206. The general characteristics are: good corrosion resistance and extrudability.
It is used for the tubes of the handles of product Group 02 and turned products in general.

5.3 SURFACE FINISHES AND HEAT TREATMENTS

Most of the metal products in our catalogue undergo a surface treatment and sometimes also a heat treatment. Our standard treatments are listed below.

• Standard blue galvanising (galvanic treatment)
The galvanising process is a cold galvanising treatment involving the application of zinc and trivalent chromium to the surface. It is referred to as blue or white due to its characteristic “shiny steel” colour that can take on pale or light blue tones. The standard thickness of the applied layer is between 3 and 5 µm.
The galvanic treatment is standard on all our steel inserts. Available on request where its application is not foreseen.

• Black-oxide treatment
The black oxide coating process is a surface treatment that serves to chemically colour steel. The treatment does not add or remove thickness from the product. The surface takes on a black colour and maybe covered with a light coating of protective oil. The treatment does not protect the metal from corrosion, except for the thin layer of oil, so it really only has an aesthetic value. It is used above all for inserts in zamak alloy indexed clamping levers, folding handles and other products. It is also used for inserts of the families in Groups 03-04-05 where it is necessary to maintain precise bore tolerance or where keyways are present in the product.

• Nickel plating (galvanic treatment)
Nickel plating is a cold galvanic treatment that entails the deposition of a superficial layer of nickel. It is the base for additional specific treatments such as copper plating, polished nickel plating, etc. Performed with a standard thickness between 3 and 5 µm. Good resistance to corrosion. Galvanic treatments for some products from the METALLINE family. Available on request where its application is not foreseen.

• Epoxy powder coating
Surface treatment with epoxy-polyester powder coating, with subsequent hardening in furnaces. This treatment creates a hard protective layer on the surface it is applied to. Typically used for steel, zamak and aluminium products. The standard thickness of the applied layer is between 80 and 150 µm.
Surface treatment used for Group 01 metal lever bodies and for some Group 15 zamak and aluminium hinges.

NT 6.0

MECHANICAL RESISTANCE

4.1 Mechanical resistance
Normally, for data relating to the resistance characteristics of a product, the information is provided on the accompanying technical sheet. Consequently, the product obtained from that particular material will have the same characteristics. However, this is not always the case for moulded plastics. The process of transforming plastic by injection moulding alters the resistance properties of the finished piece. Injection point, cooling stresses, inconsistent distribution of fillers and additives, etc, are the main variables that influence the mechanical characteristics of the finished piece. For this reason, Boteco has decided to provide data obtained under real conditions; that is, specific tests to determine the degree of resistance of their products by simulating their use in everyday situations. Our internal laboratory is fitted with specific machinery such as dynamometers, climatic chambers, fatigue machines, durometers, and appropriate clamping systems, which enable us to simulate the various breaking stresses applied to the handle. The results are then processed by special softwares that provide data relating to forces, applicable tightening torques, twisting moments, breaking loads, etc. A further safety coefficient of 1.3 is then applied to the result of these tests. The tensile strength data are already provided in the pages of the catalogue corresponding to the articles for which these data are most frequently requested; arrows indicate the position and the direction of the forces applied during the tests.
The complete data sheets for every test carried out are available on our web site or through our sales office. Each sheet includes the test results, a description of the test with simple drawings, details of the machinery used for the tests.
The tensile yield strength graphs processed by the dedicated software can be provided on request. Note that these tests are carried out at a constant temperature of 23°C with controlled humidity. Consequently, exposure to different temperatures and different degrees of humidity can lead to variations in the tensile strength characteristics. For specific uses contact our technical department.

NT 7.0

TEMPERATURE RESISTANCE (MANUFACTURERS' VALUES)

The temperature resistance of plastics depends on a number of external agents: the most important factors are duration of exposure to the heat source and the presence of applied forces. In fact, the greatest danger in the presence of heat is softening. In this phase, if a force (tightening) is applied it is easier to break the bond between the plastic and the metal insert embedded in it. Although the inserts are specially designed to be firmly bonded to the plastic, exceeding certain temperatures will compromise the use of the piece.
The table below sets out the official values obtained by the manufacturers through testing on standard specimens.
They are completely safe values, however, to facilitate the work of our customers, we have added a small logo on each page of the catalogue with the minimum and maximum values. You will find it below the product code. They were determined by taking into account the thicknesses, the materials and their fillers, field tests and type of inserts used.

Material	Continuous use (8> hours) °C max	Continuous use (8> hours) °C min	Continuous use (8> hours) under load HDT/A °C max	Brief use (60-120 sec.) °C max
Bakelite (thermoset)	200	-40	-	200
PA6 + GF	110	-10	100	160
PA6 (pure)	80	-10	80	120
PC	120	-40	120	140
A.B.S.	85	-40	100	100
PS	75	-10	75	90
PP Copolymer + GF	65	-50	90	90
TPV Rubber	80	-30	-	130

NT 8.0

CHEMICAL RESISTANCE

One of the principle characteristics of plastics is their resistance to chemical agents; as each type of plastic originates from different chemical elements, their resistance to chemical attacks also varies. To make your selection easier, we have summed up, in the following table, the chemical compatibility of the main materials used in our products. More detailed chemical compatibility lists are available on request.

KEY:
A = RESISTANT
B = FROM RESISTANT TO LIMITED RESISTANCE
C = LIMITED RESISTANCE
D = FROM LIMITED RESISTANCE TO NOT RESISTANT
E = NOT RESISTANT

Chemical element	PA6	PS	A.B.S.	PP	PC	PE-LD	PE-HD
Water	A	A	A	A	A	A	A
Weak acids	E	A	A	A	A	A	A
Strong acids	E	B	B	B	D	A	A
Hydrofluoric acid	E	B	A	B	B	A	A
Weak alkalis	B	B	A	A	E	A	A
Strong alkalis	A	A	A	A	E	A	A
Inorganic salts	A	A	A	A	B	A	A
Halogens	E	E	E	D	A	E	E
Oxidising compounds	E	C	D	E	C	E	E
Paraffin hydrocarbons	B	D	C	B	B	D	-
Halogens-Alkalis	B	E	C	B	B	D	-
Alcohols	B	A	B	A	B	A	A
Ethers	A	D	E	C	E	D	C
Esters	A	E	E	B	C	B	A
Ketones	A	E	E	B	C	B	A
Aldehydes	B	D	D	A	E	B	-
Amines	A	A	A	A	E	A	-
Organic acids	B	B	A	B	C	A	A
Aromatic compounds	B	D	E	D	E	B	B
Fuels	A	D	A	B	B	B	B
Mineral oils	A	C	A	A	A	B	B
Greases	A	A	A	A	A	B	A
Oils	A	A	A	A	A	B	A

Resistance to chemical agents specifically for material >PA6<
Key:
A -> GOOD resistance
B -> QUITE GOOD resistance
C -> ATTACKED
D -> strongly ATTACKED

No.	Chemical Agent	Resistance
1	Acetaldehyde	B
2	Acetamide	B
3	Amyl acetate	A
4	Butyl acetate	A
5	Methyl acetate	A
6	Lead acetate	A
7	Ethyl acetate	B
8	Acetone	A
9	Acetic acid	D
10	Benzoic acid	B
11	Boric acid	B
12	Butyric acid	B
13	Hydrochloric acid	D
14	Chromic acid	D
15	Citric acid	D
17	Formic acid	D
18	Phosphoric acid	D
19	Phthalic acid	B
20	Water	A
21	Hydrogen peroxide	D
22	Lactic acid	D
23	Oleic acid	A
24	Oxalic acid	B
25	Salicylic acid	A
26	Sulphuric acid	D
27	Tartaric acid	B
28	Acrylonitrile	A
29	Allyl alcohol	B
30	Amyl alcohol	A

No.	Chemical Agent	Resistance
31	Benzyl alcohol	C
32	Butyl alcohol	B
33	Ethyl alcohol	B
34	Isopropyl alcohol	B
35	Methyl alcohol	B
36	Propyl alcohol	B
37	Ammonia	A
38	Aniline	B
39	Benzaldehyde	C
40	Petrol	A
41	Benzene	A
42	Alcoholic beverages	B
43	Potassium dichromate	B
44	Sodium bisulfite	A
45	Bitumen	B
46	Potassium bromide	B
47	Butter	A
48	Butylene Glycol	B
49	Camphor	A
50	Potassium carbonate	A
51	Sodium carbonate	A
52	Chlorine gas	D
53	Chloroform	D
54	Aluminium chloride	A
55	Ammonium chloride	A
56	Barium chloride	A
57	Calcium chloride	D
58	Ethyl chloride	A
59	Magnesium chloride	A

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CHEMICAL RESISTANCE

Resistance to chemical agents specifically for material >PA6<
Key:
A -> GOOD resistance
B -> QUITE GOOD resistance
C -> ATTACKED
D -> strongly ATTACKED

No.	Chemical Agent	Resistance
60	Methyl chloride	C
61	Sodium chloride	A
62	Thionyl chloride	D
63	Vinyl chloride	A
64	Zinc chloride	B
65	Ferric chloride	A
66	Mercuric chloride	D
67	Cyclohexane	A
68	Cyclohexanol	A
69	Decalin	A
70	Dichlorofluoroethylene	A
71	Dimethylformamide	A
72	Dioxane	A
73	Heptanol	A
74	Hexane	B
75	Aniseed essence	A
76	Clove essence	A
77	Petroleum ether	A
78	Ethyl ether	A
79	Phenol water solution	D
80	Formaldehyde	A
81	Freon-12	A
82	Butyl phthalate	A
83	Octyl phthalate	A
84	Glycerin	B
85	Ethyl glycol	A
86	Dietary fats	A
87	Hydrogen sulfide	A
88	Sodium hypochlorite	A
89	Isooctane	A
90	Milk	A
91	Mercury	A
92	Naphthalene	A
93	Silver nitrate	A
94	Potassium nitrate	A
95	Sodium nitrate	B
96	Nitrobenzol	B
97	Nitromethane	B
98	Oleum	D
99	Edible oils	A
100	Coconut (copra) oil	A
101	Linseed oil	A
102	Paraffin oil	A
103	Silicone oil	A
104	Diesel oil	A
105	Mineral oil	A
106	Oil for transformers	A
107	Zinc oxide	A
108	Ozone	D
109	Perfumes	B
110	Potassium permanganate	D
111	Petroleum	A
112	Caustic potash	A
113	Sodium metasilicate	B
114	Caustic soda	A
115	Aluminium sulfate	A
116	Copper sulfate	A
117	Sodium sulfate	A
118	Carbon disulfide	A
119	Iodine disulfide	D
120	Soap solution	A
121	Lead stearate	A
122	Iodine tincture	D
123	Tetrahydrofuran	A
124	Tetralin	A
125	Sodium thiosulfate	A
126	Toluol	A
127	Trichloroethylene	B
128	Triethanolamine	A
129	Trifluoroethanol	D
130	Vaseline	A
131	Wine	B
132	Xylol	A
133	Sulfur	A

NT 9.0

MACHINING OF THE THREADED STUD ENDS

We use different types of threaded studs in our handles that differ according to the type of thread end. The two standard ends we use are type A and type Z.
For productive reasons the type of end used in the product is not specified on the pages of the catalogue. Therefore, if a bevelled thread end is required ensure you specify this when placing the order. Upon request and for special quantities, Boteco can supply threaded stud ends that are different to the standard supply. To make your selection easier, the most commonly used types are described below. In your order please specify the letter that identifies the type of end you require and the measurements needed to make it.

Please note that Boteco has the facilities and equipment, including multi-axis CNC lathes, to produce studs or other types of insert to customer's drawings. For further information contact our sales office; for technical clarifications on the feasibility of the product contact our technical office.

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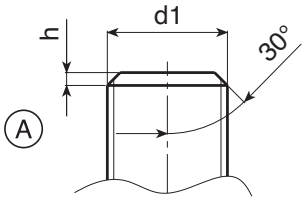
MACHINING OF THE THREADED STUD ENDS

TYPE A • STANDARD BEVEL

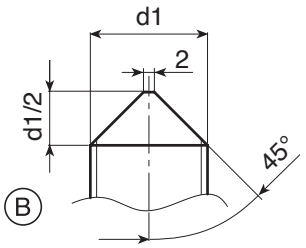
The standard bevel is a 30° angle. The bevels are as indicated in the table below:

Thread d1	Bevel
M5	0,8x30°
M6	0,9x30°
M8	0,9x30°
M10	1,1x30°
M12	1,3x30°
M14	1,5x30°
M16	1,5x30°
M18	1,8x30°
M20	1,8x30°



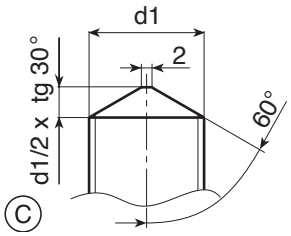
TYPE B • 45° CONE END

The 45° cone end starts from the diameter of the thread and ends on a plane with Ø 2mm. The length of the taper part is slightly less than half the diameter of the stud.



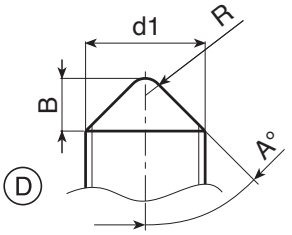
TYPE C • 60° CONE END

The 60° cone end starts from the diameter of the thread and ends on a plane with Ø 2mm. The length of the taper part is equal to half the thread diameter multiplied by the tangent of 30° (d1/2 x tg30°).



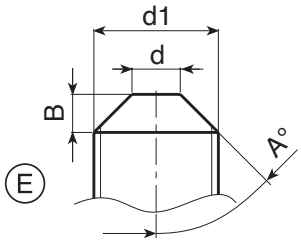
TYPE D • ROUNDED CONE END

The rounded cone end is like the normal cone end. The difference is that instead of ending with a vertex, the end is rounded. When placing your order please specify the following measurements:
R = Radius
A = Taper angle
B = Distance of the radius from the beginning of the cone.



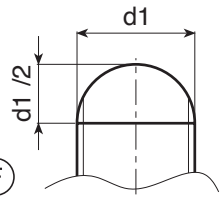
TYPE E • TRUNCATED CONE END

The truncated cone end is like the normal cone end. The difference is that instead of ending with a vertex, its end is a truncated vertex. When placing your order please specify the following measurements:
A = Taper angle
d = Diameter of the base
B = Distance from the base to the cone



TYPE F • BALL END

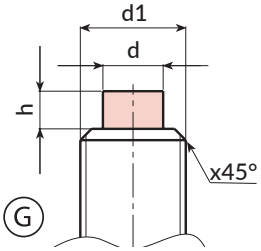
The ball end has a sphere with a diameter equal to the diameter of the thread. The length of the ball is half the diameter.



TYPE G • PLASTIC FASTENING TIP

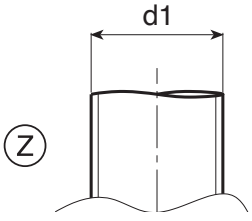
The tip is a plastic cylinder that is pushed into a hole in the end of the stud. The tip is used if the part to be tightened needs to be protected from scratching. The stud is supplied with the tip already mounted. The diameters and the projection of the tip are given in the following table:

Thread d1	d x h
M5	3x2
M6	3x2
M8	5x3
M10	6x3
M12	6x3
M14	8x4
M16	8x4
M18	10x5
M20	10x5



TYPE Z • UNMACHINED END

This type of end is found on all moulded studs. It is not bevelled and its surface is not even.



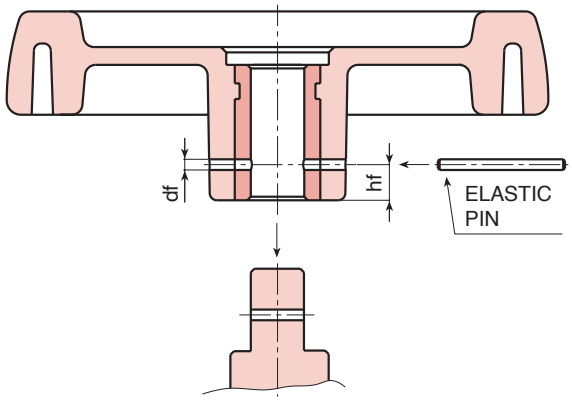
NT 10.0

FIXING SYSTEMS

Fixing systems:
There are various methods for fastening any handle or handwheel with a smooth hole. Two of the most common methods are with diametrical pinning and the use of one or more diametrical thrust pins. Either method can be used for our handles, as the hubs are made from a material (technopolymer) that does not splinter during re-machining with removal of material. So customers can safely carry out these operations without any concern or risk of damaging the product. In any case, to avoid accidental damage you will find advice on methods for reworking our products on page 14 of this section. To make it easier for our customers we can supply the handles with the fixing holes already made. Our experience and with the equipment we have in our workshop make it possible for us to supply ready-to-use products at competitive prices. When placing your order please specify the letter that identifies the type of hole you have selected and the measurements required to make it.

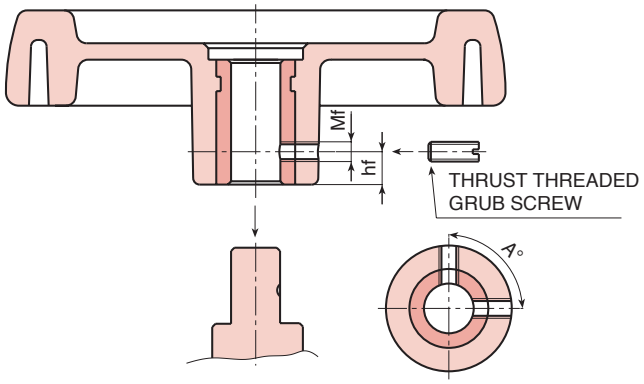
TYPE F1 – HOLE FOR DIAMETRICAL PIN

This type of fastening requires a through-hole for a spring pin. Specify the distance from the hub "hf" and the diameter of the hole. The spring pin is not supplied.
ATTENTION:
It is not always possible to position the hole at particular angles with respect to the geometry of the handle.



TYPE F2 - DIAMETRICAL THREADED HOLE FOR THRUST PIN

This fixing system requires a threaded blind hole for threaded grub screws. Specify the distance from the hub "hf" and the diameter of the thread "Mf". If several threaded holes are required specify the angle "A" that the holes must have as well. The threaded grub screws are not supplied.
ATTENTION:
It is not always possible to position the hole at particular angles with respect to the geometry of the handle.



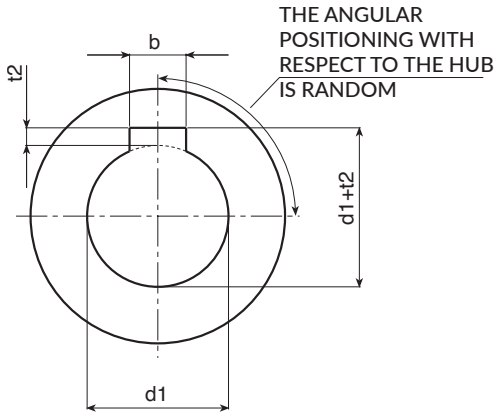
NT 11.0

KEYWAYS

Boteco can machine keyways in your inserts with through hole. The standard measurements available are those given in the table below. For non-standard keyways please contact our technical office/sales office.

Attention:
During the moulding process, the angular positioning of the key with respect to the handwheel hub, is random.

Diameter shaft d1 (mm)	Width by height bxh (mm)	t2	tolerance t2
da 6 a 8	2 (JS9) x 2	1,0	-0 +0,1
da 8 a 10	3 (JS9) x 3	1,4	-0 +0,1
da 10 a 12	4 (JS9) x 4	1,8	-0 +0,1
da 12 a 17	5 (JS9) x 5	2,3	-0 +0,1
da 17 a 22	6 (JS9) x 6	2,8	-0 +0,1
da 22 a 30	8 (JS9) x 7	3,3	-0 +0,2

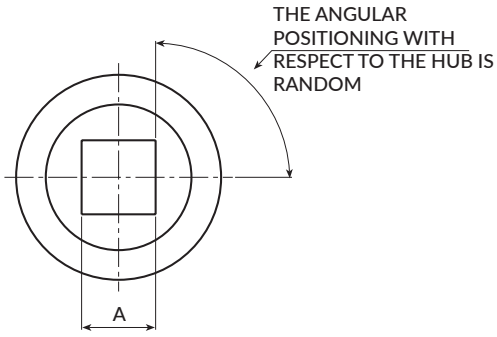


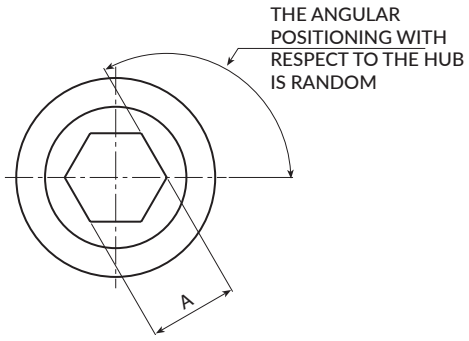
NT 12.0

SQUARE AND HEXAGONAL HOLES

Boteco can supply your inserts with square or hexagonal through holes. If the final application allows it, the same square or hexagonal holes can be obtained in the plastic through a moulding process. The tensile strength of the walls is considerable due to the fact that the material we use to produce our handles is always reinforced with glass fiber. If a metal insert is not used then this solution is particularly suitable for applications in the medical and food industries or in outdoor applications as there are no metal parts that could oxidise or rust. The only issue to note is that the tolerance of the hole will be less precise. This is a natural consequence of material that is injection moulded. The standard measurements available are as follows:

Attention:
During the moulding stage, the angular positioning of the square / hexagon with respect to the handwheel hub is random.





SQUARE ON INSERT AXA (mm) Tolerance H9	SQUARE ON PLASTIC AXA (mm) Tolerance +0,1 +0.2	HEXAGON ON INSERT A (mm) Tolerance H9	HEXAGON ON PLASTIC A (mm) Tolerance +0,1 +0.2
5 x 5	5 x 5	5	5
6 x 6	6 x 6	6	6
8 x 8	8 x 8	8	8
10 x 10	10 x 10	10	10
12 x 12	12 x 12	11	12
14 x 14	14 x 14	12	14
-	16 x 16	14	16
-	17 x 17	16	17

NT 13.0

GENERAL TOLERANCES

13.1 TOLERANCES FOR THREADED STUDS
The tolerances with which the threaded studs are made:
- Metric thread diameter with normal pitch or fine pitch: 6g ISO UNI 5545-65;
- Projection of the threaded stud from the plastic hub: ± 1 mm.

13.2 TOLERANCES FOR SMOOTH STUDS
- External diameter : h9 – h11 (standard tolerance for drawn bars UNI 5105);
- Projection of the smooth stud from the plastic hub: ± 1 mm.

13.3 TOLERANCES FOR PARTIALLY THREADED SMOOTH STUDS
The tolerances with which the partially threaded smooth studs are made:
• External diameter : h9 – h11 (standard tolerance for drawn bars UNI 5105);
• Metric thread diameter with normal pitch or fine pitch: 6g ISO UNI 5545-65;
• Projection of the smooth stud from the plastic hub: ± 1 mm;
• Length of the threaded section: ± 0.2 mm.

13.4 TOLERANCES FOR THREADED BLIND HOLES
The tolerances with which the threaded blind holes are made are:
• Metric thread diameter with normal pitch or fine pitch: 6H ISO UNI 5545-65;
• Depth of thread: as this measurement is greatly influenced by the type of insert used for the measurement, the data given in the tables have been collected using a plug gauge with a 6g tolerance and entry bevel of 1mm x 45°. In any case the tolerance is –0 to + 1 mm.

13.5 TOLERANCES FOR THREADED THROUGH-HOLES
The tolerances with which the threaded through holes are made are:
• Metric thread diameter with normal pitch or fine pitch: 6H ISO UNI 5545-65;
• Depth of thread: ± 0.2 mm.

13.6 TOLERANCES FOR SMOOTH THROUGH-HOLES
The tolerances with which the smooth through holes are made are:
• **Galvanized insert** Smooth through hole diameter: H10-H11 ISO UNI 5545-65;
• **Black-oxide treated insert:** Smooth through hole diameter: H7 ISO UNI 5545-65;
• For holes with a 5/8 mm diameter used for subsequent widening: H10;
• Depth of the smooth hole : ± 0.5 mm.

13.7 TOLERANCES FOR THREADED HOLES OBTAINED BY MOULDING THE PLASTIC
It is not possible to specify a tolerance for threads moulded in the plastic. This is due to the nature of the material which is affected by various factors (shrinkage, density, pressure, etc.). Normally the threaded hole is kept slightly larger which makes assembly a little easier without compromising the thread grip. For durable fastenings we recommend using threadlockers or other types of sealants.

13.8 TOLERANCES FOR SMOOTH HOLES OBTAINED BY MOULDING THE PLASTIC WITH PUSH-FIT ASSEMBLY
In order to ensure its correct assembly on different types of shafts Boteco machines a series of coaxial compensator lines having a smaller diameter than the hole, inside the smooth hole. During assembly these compensator lines deform to compensate for the different diameters of the shaft, while at the same time providing a very good seal.
• Hole depth : ± 1 mm.

13.9 GENERAL TOLERANCES OF PLASTIC PRODUCTS
The plastic products presented in our catalogue do not generally have a fixed tolerance. In most cases a difference of ±0.5 mm in the diameter or length of a product is insignificant.
For product groups B-Handles and O-Hinges, which have to be assembled in the pre-machined holes, a tolerance of ± 0.5 mm is provided for the centre to centre distance of the fixing holes.
Note that in some cases this difference can be recovered using the larger diameter of the holes that have to accommodate the fixing screws.

NT 14.0

RE-MACHINING OF THE PRODUCTS

RE-MACHINING OF PRODUCTS (ADVICE)

Boteco products can be re-machined without any problems whatsoever as they are made from thermoplastic materials (reinforced technopolymer) and the inserts are made from machinable materials. However, the possibility of making errors that could compromise the functionality of the product can be avoided by following a few simple rules.

14.1 GENERAL

- When machining thermoplastics to remove material, use low cutting speeds and slow feed rates. This is to avoid excessive overheating of local areas of the material that can reach softening temperature and lead to deterioration of the mechanical properties of the part, wear of the cutting tools, formation of burrs which then have to be removed.
- For continuous machining over long periods of time, use hard metal tools. HSS tools have a short life. The cutter must always be kept sharp.
- It is essential to ensure adequate cooling of the part during machining by applying ordinary emulsified water. This helps achieve good dissipation of the heat.

14.2 WIDENING OF THE PILOT AXIAL HOLE

- The hole in a metal insert can be widened without too much trouble. We recommend machining the hole from the pilot hole part in order to achieve a better centring of the hole.
- If there is considerable difference between the pilot hole and the final hole, then machine the hole in several passes with increasing diameters. The reason for this is that removal of large chips generates great heat which is immediately transmitted from the insert to the surrounding plastic. Sometimes the heat softens the plastic that is in contact with the metal which ruins the physical bond between the insert and the plastic and causes the insert to slip.
- For handwheels with small diameters, we recommend mounting the piece on the spindle, while gripping it by the hub.
- For handwheels of the C and D product groups, we recommend mounting the piece on the spindle, while gripping it by the rim. This will ensure better centring between the hole and the handwheel. Make sure that the handwheel is accurately centred on the spindle.
- It is essential to ensure adequate cooling of the part during machining by applying ordinary emulsified water. This helps achieve good dissipation of the heat.
- When transforming a blind hole into a through hole the plastic will not splinter when the drill bit exits the plastic.

14.3 MAKING A SMOOTH OR THREADED RADIAL HOLE

- Note that a threaded hole in plastic tends to be narrower than normal. Consequently, the plastic generates a light braking force on the grub screw.
- To avoid premature wear of male elements, when making a threaded hole we recommend making it slightly larger.

NT 15.0

SPECIAL REQUESTS

Demands made by the ongoing technological advances of different applications motivate technical departments to explore alternative solutions; and Boteco is stepping forward as the ideal partner.
Our technical office is always available to work side by side with customers to deliver targeted solutions.
From the possibility of modifying a standard catalogue product to creating a fully customized product. Or simply modifying the metal insert to meet your needs. Whatever it takes to deliver a simple, targeted, and reasonably-priced solution.
This is made possible through the excellent organization of BOTECO's departments: a well-equipped modern mould workshop for the production and modification of our moulds; a reworking workshop dedicated to post-moulding operations; and lastly our turning workshop fitted out with a battery of 8 multi-axis CNC lathes for the production of standard and custom inserts.

NT 16.0

PAD PRINTING

Increasing requests for personalized products has led to the development of a "pad printing" service. This technique which involves the transfer of ink makes it possible for us to print any design on many of the handles presented in our catalogue.
We can reproduce logos, normative and functional texts. This is an additional feature that our company provides to enhance the look and personalization of the product in order to make it stand out, to decorate it and to make it more attractive through a simple, cost-effective system.
We can print up to a maximum of four colours. Our technical office will set up the printing system based on the graphic design or drawing provided by the customer.
We have a team of designers available to assist customers requiring original logos or graphic elements for their products. For texts, logos and symbols we prefer the customer to provide us with vector graphic files (.DWG -.DXF -.EPS -.AI). For images JPG, EPS, TIFF etc. files are also acceptable.
If the logos are in image format, our technical office will be required to reconstruct them and they may not be able to produce a perfect copy of the originals as CAD systems are different to graphic software systems, particularly in terms of lettering and fonts.

16.1 USE AND MAINTENANCE OF PAD PRINTED ELEMENTS:

Direct light, extreme temperatures, maintenance and cleaning can shorten the life and impact the resistance of the printing over time.
For cleaning or other operations, we advise against using products containing chemical solvents or aggressive substances (thinners, acetone, abrasive products, etc.). It is also important not to use sharp, abrasive or hard objects that could damage the pad printing.

16.2 DURABILITY OF THE PRINTING AND COMPLAINTS:

Please note that we cannot guarantee the durability of the pad printing as the service provider offers no guarantee in this respect. For this reason, any complaints regarding printing defects or imperfections must be reported on receipt of the goods.

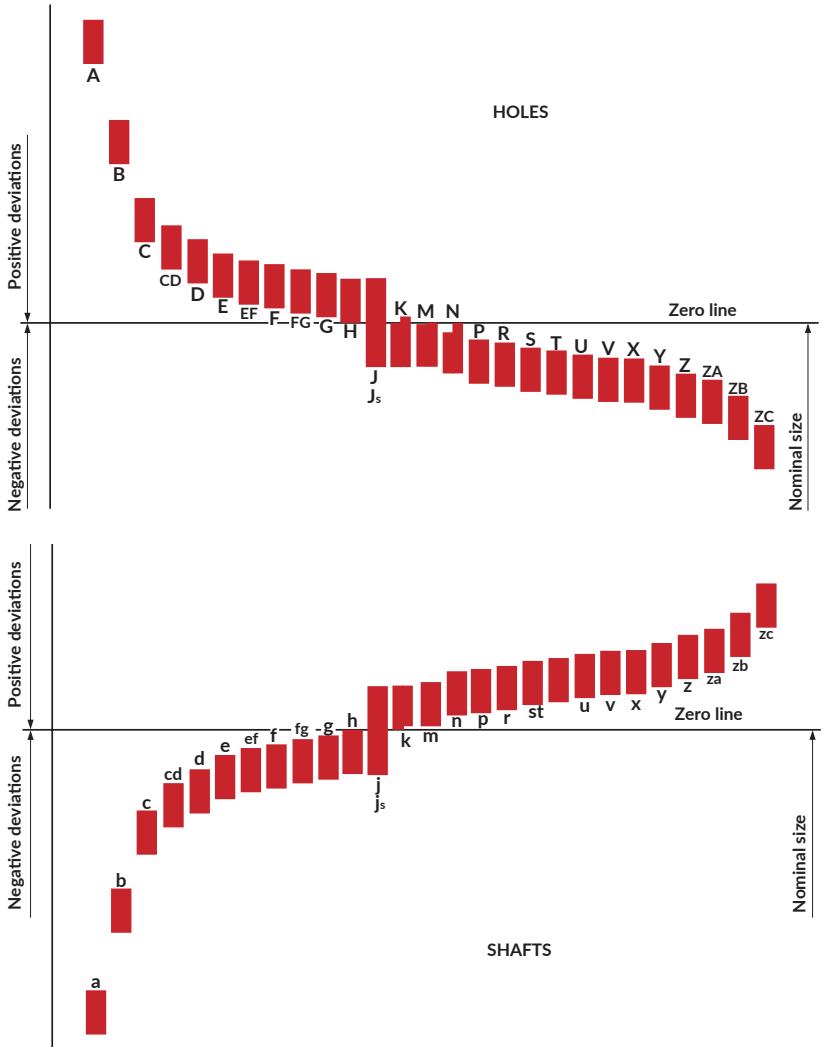
NT 17.0

CONVERSION TABLES

From Metric System	To Imperial System	Multiply by:
mm	inches	0,039
cm	inches	0,39
m	feet	3,28
mm2	square inches	0,00155
m2	square feet	10,76
litre (l)	gallon US	0,264
litre (l)	gallon UK	0,219
g	ounce	0,035
kg	pound US	2,22
°C	°F	33,91
N	Kg-force	0,01
N	Ounce-force	3,59
N	UK pound-force	0,224
Nm	Ounce-force per foot	11,8
Nm	UK pound-force per foot	0,737
Nm	Ounce-force per inch	141,61
Nm	UK pound-force per inch	8,85

NT 18.0

HOLE / SHAFT TOLERANCES



References for HOLES

Dimensions (mm)	H5	H6	H7	H8	H9	H10	H11
da 1 a 3	+0,004 +0	+0,006 +0	+0,010 +0	+0,014 +0	+0,025 +0	+0,040 +0	+0,060 +0
>3 a 6	+0,005 +0	+0,008 +0	+0,012 +0	+0,018 +0	+0,030 +0	+0,048 +0	+0,075 +0
> 6 a 10	+0,006 +0	+0,009 +0	+0,015 +0	+0,022 +0	+0,036 +0	+0,058 +0	+0,090 +0
> 10 a 18	+0,008 +0	+0,011 +0	+0,018 +0	+0,027 +0	+0,043 +0	+0,070 +0	+0,110 +0
> 18 a 30	+0,009 +0	+0,013 +0	+0,021 +0	+0,033 +0	+0,052 +0	+0,084 +0	+0,130 +0
> 30 a 50	+0,011 +0	+0,025 +0	+0,025 +0	+0,039 +0	+0,062 +0	+0,100 +0	+0,160 +0

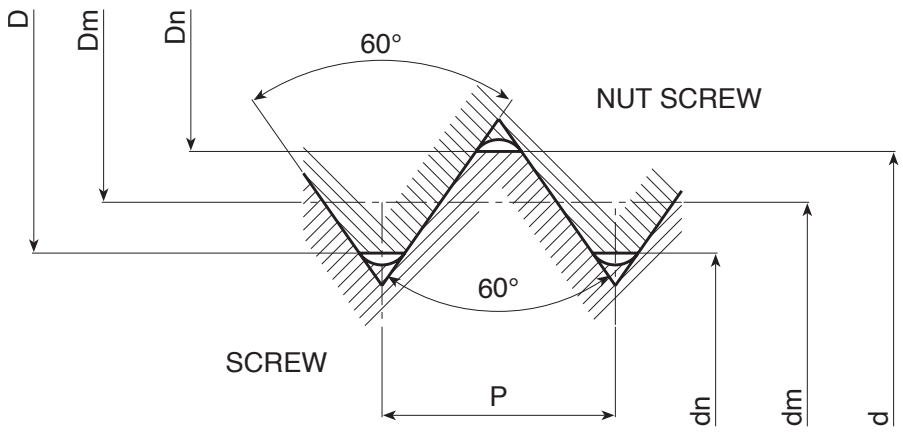
References for SHAFTS

Dimensions (mm)	h5	h6	h7	h8	h9	h10	h11
da 1 a 3	+0 -0,004	+0 -0,006	+0 -0,010	+0 -0,014	+0 -0,025	+0 -0,040	+0 -0,060
>3 a 6	+0 -0,005	+0 -0,008	+0 -0,012	+0 -0,018	+0 -0,030	+0 -0,048	+0 -0,075
> 6 a 10	+0 -0,006	+0 -0,009	+0 -0,015	+0 -0,022	+0 -0,036	+0 -0,058	+0 -0,090
> 10 a 18	+0 -0,008	+0 -0,011	+0 -0,018	+0 -0,027	+0 -0,043	+0 -0,070	+0 -0,110
> 18 a 30	+0 -0,009	+0 -0,013	+0 -0,021	+0 -0,033	+0 -0,052	+0 -0,084	+0 -0,130
> 30 a 50	+0 -0,011	+0 -0,025	+0 -0,025	+0 -0,039	+0 -0,062	+0 -0,100	+0 -0,160

NT 19.0

SCREW THREADS

19.1 ISO METRIC SCREW THREAD

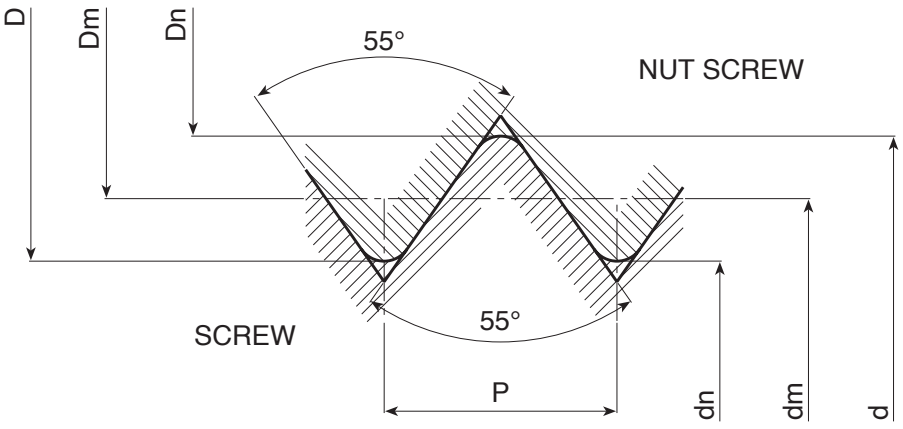


Thread (screw) with 6g tolerance

Thread (nut) with 6H tolerance

.	.	Ø major d	Ø major d	Ø pitch dm	Ø pitch dm	Ø minor dn	Ø pitch Dm	Ø pitch Dm	Ø minor Dn	Ø minor Dn
Thread	P (mm)	max (mm)	min (mm)	max (mm)	min (mm)	(mm)	max (mm)	min (mm)	max (mm)	min (mm)
M4	0,7	3,978	3,383	3,523	3,220	2,979	3,545	3,663	3,242	3,422
M5	0,8	4,976	4,826	4,456	4,110	3,842	4,480	4,605	4,134	4,334
M6	1	5,974	5,974	5,324	4,891	4,563	5,350	5,500	4,917	5,153
M8	1,25	7,972	7,760	7,160	6,619	6,230	7,188	7,348	6,647	6,912
M10	1,5	9,968	9,732	8,994	8,344	7,888	9,026	9,206	8,376	8,676
M12	1,75	11,966	11,701	10,829	10,072	9,543	10,863	11,063	10,106	10,441
M14	2	13,962	13,682	12,663	11,797	11,204	12,701	12,913	11,835	12,210
M16	2	15,962	15,682	14,663	13,797	13,204	14,701	14,913	13,835	14,210
M18	2,5	17,958	17,623	16,334	15,252	14,451	16,376	16,600	15,294	15,744
M20	2,5	19,958	19,623	18,334	17,252	16,541	18,376	18,600	17,294	17,774

19.2 WHITWORTH BSW – BSF SCREW THREAD



Standard BSW – coarse pitch

Standard BSF – fine pitch

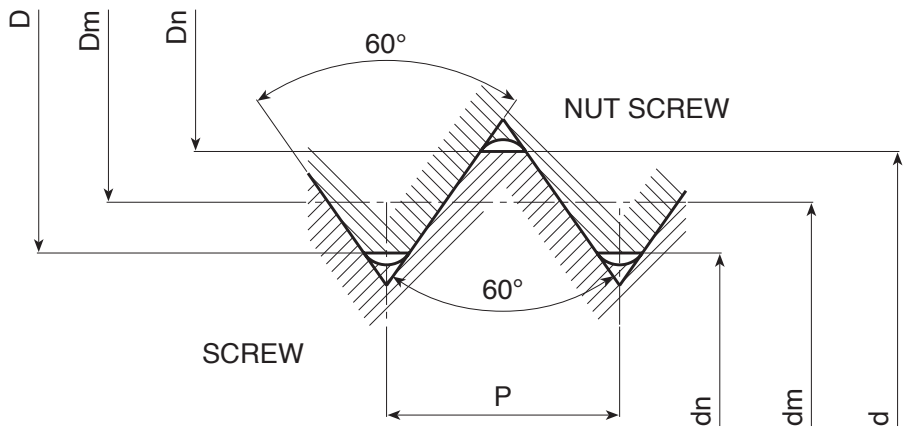
BSW	Threads per inch	Major diameter d	Pitch diameter Dm	Minor diameter dm	BSF	Threads per inch	Major diameter d	Pitch diameter Dm	Minor diameter dm
1/4-20	20	0,2500	0,2128	0,1860	1/4-26	26	0,2500	0,2254	0,2008
5/16-18	18	0,3125	0,2769	0,2413	5/16-22	22	0,3125	0,2834	0,2534
3/8-16	16	0,375	0,3350	0.2950	3/8-20	20	0,375	0,3430	0,3110
1/2-12	12	0,5000	0,4466	0.3932	1/2-16	16	0,5000	0,4600	0,4200
5/8-11	11	0,6250	0,5668	0.5086	5/8-14	14	0,6250	0,5793	0,5336
3/4-10	10	0,7500	0,6860	0.6220	3/4-12	12	0,7500	0,6966	0,6432

Table expressed in decimal inches.

NT 19.0

SCREW THREADS

19.3 AMERICAN STANDARD UNC-UNF THREADS



UNC thread (screw) with 2A tolerance

Thread	Threads per inch	Ø major d	Ø major d	Ø pitch dm	Ø pitch dm	Ø minor dn
UNC	.	max (mm)	min (mm)	max (mm)	min (mm)	(mm)
8-32	32	0,1631	0,1570	0,1428	0,1399	0,1259
10-24	24	0,1890	0,1818	0,1619	0,1586	0,1394
1/4-20	20	0,2489	0,2408	0,2164	0,2127	0,1894
5/16-18	18	0,3113	0,3026	0,2752	0,2712	0,2452
3/8-16	16	0,3737	0,3643	0,3331	0,3287	0,2992
1/2-13	13	0,4985	0,4876	0,4485	0,4435	0,4069
5/8-11	11	0,6234	0,6113	0,5644	0,5589	0,5152
3/4-10	10	0,7482	0,7353	0,6832	0,6773	0,6291
1-8	8	0,9980	0,9830	0,9168	0,9100	0,8492

UNC thread (nut) with 2B tolerance

Ø major D	Ø major D	Ø pitch Dm	Ø pitch Dm	Ø minor Dn
max (mm)	min (mm)	max (mm)	min (mm)	(mm)
0,1300	0,1390	0,1437	0,1475	0,1640
0,1450	0,1560	0,1629	0,1692	0,1900
0,1960	0,2070	0,2175	0,2224	0,2500
0,2520	0,2650	0,2764	0,2817	0,3125
0,3070	0,3210	0,3344	0,3401	0,3750
0,4170	0,4340	0,4500	0,4565	0,5000
0,5270	0,5460	0,5660	0,5732	0,6250
0,6420	0,6630	0,6850	0,6927	0,7500
0,860	0,8900	0,9188	0,9276	1,0000

Table expressed in decimal inches.

UNF thread (screw) with 2A tolerance

Thread	Threads per inch	Ø major d	Ø major d	Ø pitch dm	Ø pitch dm	Ø minor dn
UNF	.	max (mm)	min (mm)	max (mm)	min (mm)	(mm)
8-36	36	0,1632	0,1577	0,1452	0,1424	0,1301
10-32	32	0,1891	0,1831	0,1688	0,1658	0,1519
1/4-28	28	0,2490	0,2492	0,2158	0,2208	0,2064
5/16-24	24	0,3114	0,3042	0,2843	0,2806	0,2618
3/8-24	24	0,3739	0,3667	0,3468	0,3430	0,3143
1/2-20	20	0,4987	0,4906	0,4662	0,4619	0,4392
5/8-18	18	0,6236	0,6105	0,5875	0,5805	0,5575
3/4-16	16	0,7485	0,7391	0,7079	0,7029	0,6740
1-12	12	0,9982	0,9868	0,9441	0,9382	0,8890

UNF thread (nut) with 2B tolerance

Ø major D	Ø major D	Ø pitch Dm	Ø pitch Dm	Ø minor Dn
max (mm)	min (mm)	max (mm)	min (mm)	(mm)
0,1340	0,1420	0,1460	0,1496	0,1640
0,1560	0,1640	0,1697	0,1736	0,1900
0,2110	0,2200	0,2268	0,2333	0,2500
0,2670	0,2770	0,2854	0,2902	0,3125
0,3300	0,3400	0,3479	0,3528	0,3750
0,4460	0,4570	0,4675	0,4731	0,5000
0,5650	0,5780	0,5889	0,5980	0,6250
0,6820	0,6960	0,7094	0,7159	0,7500
0,9100	0,9280	0,9459	0,9535	1,0000

Table expressed in decimal inches.