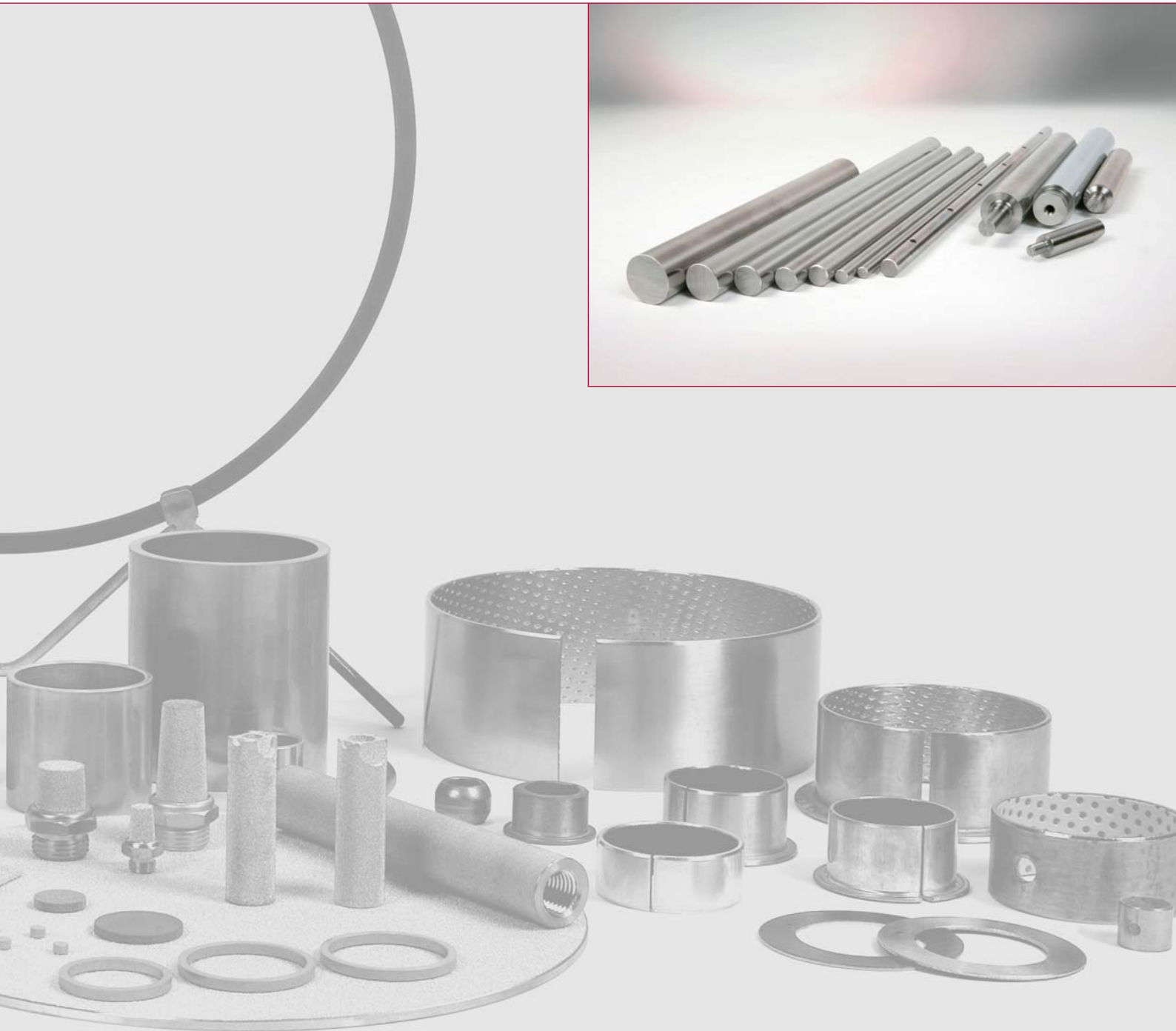




# Hardened ground shafts



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Our general term of delivery apply on all deliveries, offers and advice and can be found on the last page of this catalog.

We reserve the right to make changes due to technical developments.

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# Introduction

## General

THN (Technische Handelsonderneming Nederland b.v.) has been a leading supplier of piston rings, Fey laminar rings, slide bearings, sintered filters and hardened ground shafts since 1940. Due to the large volumes of stock we hold, we are usually able to deliver within 1–2 working days. Our aim is same day shipping for all orders placed before 3 p.m.

With more than 70 years' experience in our profession, we are glad to support you in your technical challenges in seals, bearings and filtration.

### THN is characterised by:

- Fast delivery
- Good service
- Large stocks
- Technical advice

### The range of products that THN supplies includes:

- Piston rings
- Fey laminar rings
- Slide bearings
  - Essem - Self-lubricating sintered bronze slide bearings
  - DU - Dry bearings with PTFE wearing surface
  - DX - Dry bearings with POM (acetal copolymer) wearing surface
  - B09 - Rolled phosphor tin bronze (CuSn8) slide bearings
  - JM - Turned cast bronze slide bearings (including RG5, RG7)
  - Oiles - Self-lubricating cast bronze slide bearings with graphite lubricating pins
  - Fiberglide - Dry bearings with a wearing surface of woven Teflon threads
  - POL - Plastic slide bearings
- Sintered filters and PUKS
- Hardened ground shafts
- Linear components
  - Linear ball bearings
  - Housings
  - Shaft support blocks
  - Shaft support rails

For more information about our products you can contact our sales department or visit our website [www.thn.nl](http://www.thn.nl).

# Hardened ground shafts

Hardened ground shafts are steel shafts of which the outer layer is induction hardened. These shafts are well known for their use in linear applications and are often referred to as linear shafts. Because of the hard surface and the "soft" core, these shafts are very wear-resistant but yet remain flexible and do not become brittle. The shafts are available in multiple steel types and optionally with a thin chrome layer.

The THN has an continually growing stock hardened ground shafts which consists of shafts in commercial lengths of 6000 to 8200mm. The stock contains many shafts in the most common material CF53, but also in chrome and stainless steels. Our program has solid and hollow shafts and in our workshop we cut and machine the shafts to customer requirements.

We can, when the quantity requirement is sufficient, produce special sizes and tolerances. We can also stock special items if required. Optionally we can supply shafts with different types of machining, amongst others: axial and radial holes, thread (internally as well as externally) and grooves (see also page 5).

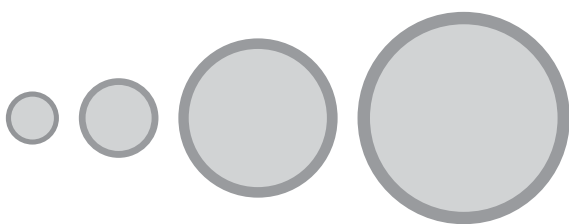
## Applications and properties

A number of much used applications for hardened ground shafts are:

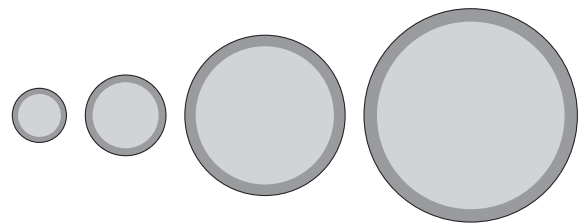
- Linear rails
- General machines instead of ground shafts for a longer service interval
- Hinge pins for heavy loads
- Angle bars for bending presses
- Base material for spindles

A number of important properties of hardened ground shafts are:

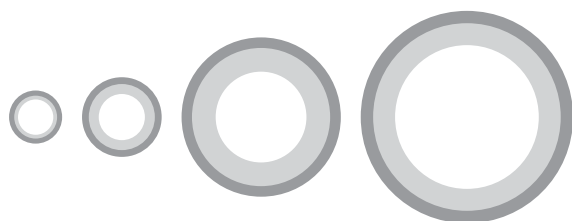
- Precise tolerances on:
  - Diameter
  - Roundness
  - Straightness
  - Parallelism
- Low surface roughness
- Good wear resistance because of the hard surface



TS Shafts with hardened surface.



TS shafts with hardened zone and chrome coating.



TT hollow shafts with hardened surface.

# Article numbers

The coding for type, size and material the THN uses is as follows:

[Type] [Diameter] [Tolerance] [Material] [Extra] X [Length]

Type	TS	For solid shafts
	TT	For hollow shafts
	TD	Pre-drilled shafts
Diameter	Nominal diameter in mm (also for imperial sizes)	
Tolerance	ISO tolerance for the diameter	
Material	Material code as described on page 4	
Extra	Optional extra specifications such as chrome coating	
Length	Length of the shaft in mm	

## Example

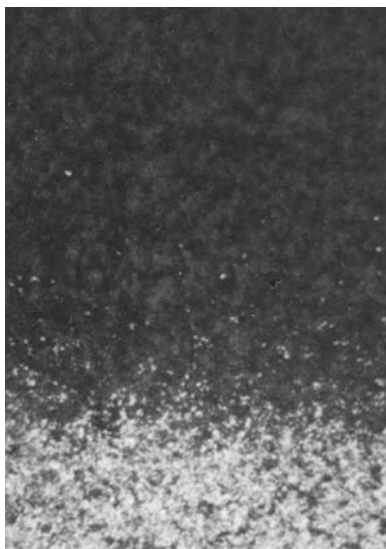
The coding for a solid hardened ground shaft in diameter 25mm, with an h7 tolerance and a chrome coating, made of the material CF53, with a length of 1244mm is:

**TS 025.00 h7 CF53 CHROME X 1244**

## Heat treatment

The hardened ground shafts supplied by the THN are induction hardened; this treatment ensures a uniform surface hardness in both axial and radial direction. The hardness achieved depends on the material and can be found on page 5.

## Micro section of the transition area between hardened and standard steel.



Hardened surface of the shaft (approx. 62HRC)

Transition area

Standard steel

# Materials

## Steel grades

Steel grade		Chemical composition (%)										
		C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V	
CF53	min.	0,50	0,15	0,40	-	-	-	-	-	-	-	-
W. nr. 1.1213	max.	0,57	0,35	0,70	0,025	0,035	-	-	-	-	-	-
CK55	min.	0,52	-	0,60	-	-	-	-	-	-	-	-
W. nr. 1.1203	max.	0,60	0,40	0,90	0,035	0,035	0,40	0,10	0,40	-	-	-
C60	min.	0,57	-	0,60	-	-	-	-	-	-	-	-
W. nr. 1.0601	max.	0,65	0,40	0,90	0,045	0,045	0,40	0,10	0,40	-	-	-

- The materials CF53 and CK55 are the most common and the standard for precision/linear shafts. The surface hardness of these shafts is high (approx. 60-64HRC). (see table: Shaft properties on page 5)

## Chrome steel grades

Steel grade		Chemical composition (%)										
		C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V	
100Cr6	min.	0,90	0,15	0,25	-	-	1,35	-	-	-	-	-
W. nr. 1.3505	max.	1,05	0,35	0,45	0,030	0,025	1,65	-	0,30	0,30	-	-
42CrMo4	min.	0,38	-	0,60	-	-	0,90	0,15	-	-	-	-
W. nr. 1.7225	max.	0,45	0,40	0,90	0,035	0,035	1,20	0,30	-	-	-	-

- The material 42CrMo4 is often used when high material tensile strengths are required.
- This material is also less sensitive to oxidation because of the added chrome.

## Stainless steel grades

Steel grade		Chemical composition (%)										
		C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V	
X46Cr13	min.	0,42	-	-	-	-	12,5	-	-	-	-	-
W. nr. 1.4034	max.	0,50	1,00	1,00	0,045	0,030	14,5	-	-	-	-	-
X90CrMoV18	min.	0,85	-	-	-	-	17,0	0,90	-	-	0,07	-
W. nr. 1.4112	max.	0,95	1,00	1,00	0,040	0,020	19,0	1,30	-	-	0,12	-
X105CrMo17	min.	0,95	-	-	-	-	16,0	-	-	-	-	-
W. nr. 1.4125	max.	1,20	1,00	1,00	0,040	0,030	18,0	0,75	-	-	-	-

- X90CrMoV18 is an acid resistant stainless steel.
- The hardness of these shafts is lower than with the standard steel grades.

# Shaft properties

Steel grade	Surface hardness HRC	Tensile strength N/mm <sup>2</sup>	Surface roughness Ra max.
CF53	min. 59	≥ 610	0,30
CK55	min. 59	≥ 700	0,30
C60	min. 59	≥ 650	0,30
100Cr6	min. 59	≥ 600	0,30
42CrMo4	min. 55	≥ 900	0,30
X46Cr13	min. 52	≥ 650	0,30
X90CrMoV18	min. 54	≥ 750	0,30
X105CrMo17	min. 53	≥ 750	0,30

- Other materials are available on request.
- Optionally these shafts can be provided with an additional chrome coating.

## Chrome coating properties

Shafts which are chrome coated have the following advantages

- Higher wear resistance.
- Lower friction coefficient
- Low "stick" effect because of the low adhesion values
- Good corrosion resistant properties on the outer diameter

### Application

Because the chrome coating does not contain Cr(VI), it is suitable for application in the food industry, medical technology etc.

### Technical data chrome layer

Chrome thickness	8-15µm
Chrome hardness	800HV – 1100HV
Number of layers	1
Corrosion resistance	Good, can be improved by polishing
Cr(VI) free	Yes

### Special coatings

Other coatings such as Zinc-Iron galvanization (ZnFe) or special chrome coatings are available on request.

# Machining

## Length cutting

The hardened ground shafts can be cut to length according to customer specification. By default the shafts are cut and deburred with a manual chamfer (fig. 1). If requested a larger manual chamfer is also possible. When a shaft must not have any deburring/chamfer we request it to be mentioned explicitly.

## Length tolerance

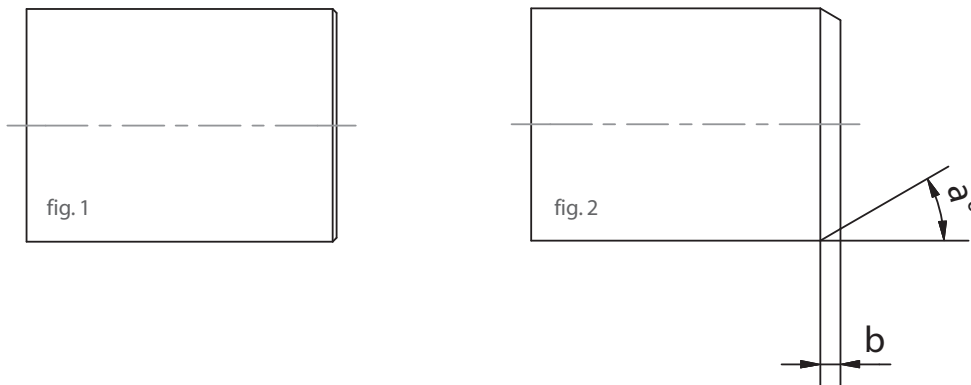
The default length tolerance for cut to length shafts is as follows:

Shaft length (La) (mm)	Length tolerance (mm)
$La \leq 400$	$\pm 0,5$
$400 < La \leq 1000$	$\pm 0,8$
$1000 < La \leq 2000$	$\pm 1,2$
$2000 < La \leq 4000$	$\pm 2,0$
$4000 < La \leq 6000$	$\pm 3,0$

Length tolerance according to ISO 13012

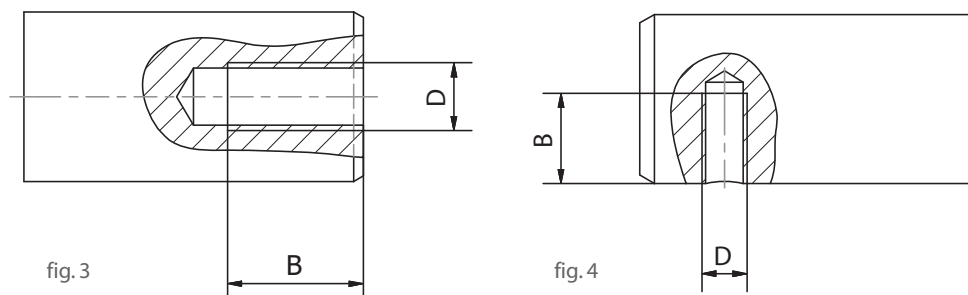
## Chamfer

In some cases the shaft has to be equipped with a specific chamfer according to drawing or specification. When requested we can supply these chamfer, some of the most common chamfers are  $a=15^\circ$ ,  $a=30^\circ$  or  $a=45^\circ$  and  $b = 1$  or  $2\text{mm}$  (fig. 2).



## Axial and radial holes

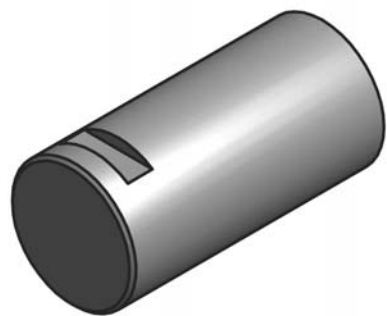
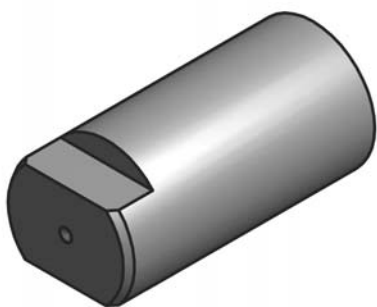
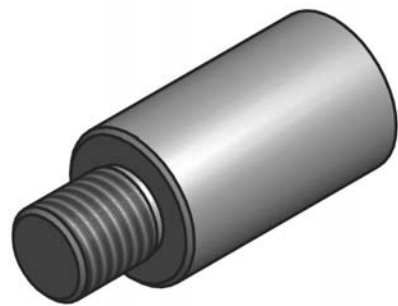
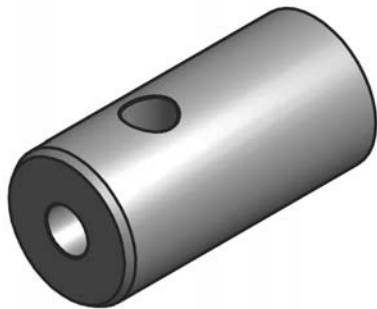
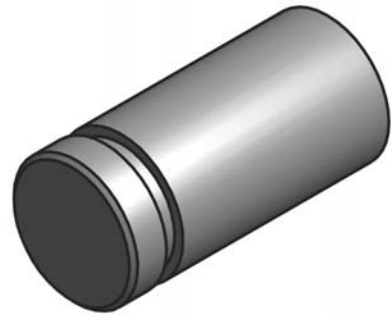
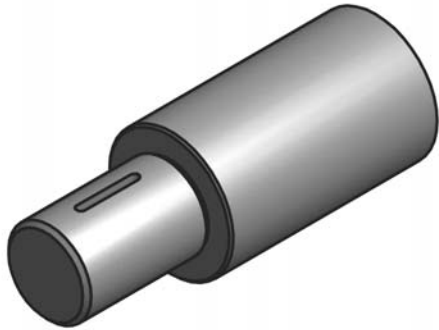
Much requested features are axial and/or radial holes, often with thread. The standard depth (B) of the thread is twice D nominal. Both are available on request.





## Other machining

Besides aforementioned features many other options are available. Below you can find some examples of the possibilities. We are also able to give advice and supply technical drawings.

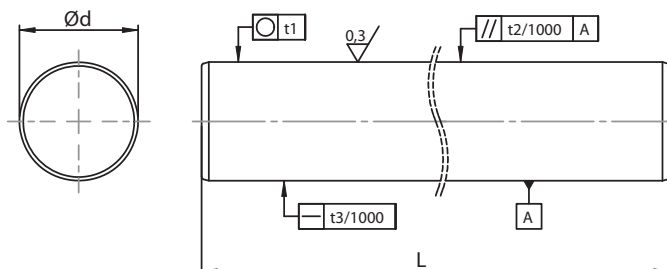


# TS Standard size list

Shaft diameter	Hardening depth <sup>1)</sup>	Standard tolerance ISO h6	Roundness	Parallelism <sup>2)</sup>	Straightness <sup>3)</sup>	Weight
d mm	(min.) mm	µm	t1 µm	t2 µm	t3 mm/m	kg/m
3	0,4	0 / -6	3	4	0,3	0,055
4	0,4	0 / -8	4	5	0,3	0,099
5	0,4	0 / -8	4	5	0,2	0,154
6	0,4	0 / -8	4	5	0,2	0,222
7	0,4	0 / -9	4	6	0,2	0,302
8	0,4	0 / -9	4	6	0,2	0,394
9	0,4	0 / -9	4	6	0,2	0,499
10	0,4	0 / -9	4	6	0,1	0,616
12	0,6	0 / -11	5	8	0,1	0,887
13	0,6	0 / -11	5	8	0,1	1,041
14	0,6	0 / -11	5	8	0,1	1,207
15	0,6	0 / -11	5	8	0,1	1,385
16	0,6	0 / -11	5	8	0,1	1,576
18	0,6	0 / -11	5	8	0,1	1,995
20	0,9	0 / -13	6	9	0,1	2,463
22	0,9	0 / -13	6	9	0,1	2,980
24	0,9	0 / -13	6	9	0,1	3,547
25	0,9	0 / -13	6	9	0,1	3,848
28	0,9	0 / -13	6	9	0,1	4,827
30	0,9	0 / -13	6	9	0,1	5,542
32	1,5	0 / -16	7	11	0,1	6,305
35	1,5	0 / -16	7	11	0,1	7,543
40	1,5	0 / -16	7	11	0,1	9,852
45	1,5	0 / -16	7	11	0,1	12,469
50	1,5	0 / -16	7	11	0,1	15,394
55	2,2	0 / -19	8	13	0,1	18,627
60	2,2	0 / -19	8	13	0,1	22,167
70	2,2	0 / -19	8	13	0,1	30,172
75	2,2	0 / -19	8	13	0,1	34,636
80	2,2	0 / -19	8	13	0,1	39,408
90	2,2	0 / -22	10	15	0,2	49,876
100	2,2	0 / -22	10	15	0,2	61,575
120	2,6	0 / -22	10	15	0,2	88,668

- Not all diameters are available in all materials, for delivery times and availability please contact our sales department.
- Other sizes, tolerances and hardening depths are available on request.
- Maximum available length is 8200mm, available on request (only for shafts > 16mm diameter).

1) Surface hardening depth according to DIN ISO 13012, 2) Diameter differential measurement, 3) Measurement according to DIN ISO 13012



# TS Chrome standard size list

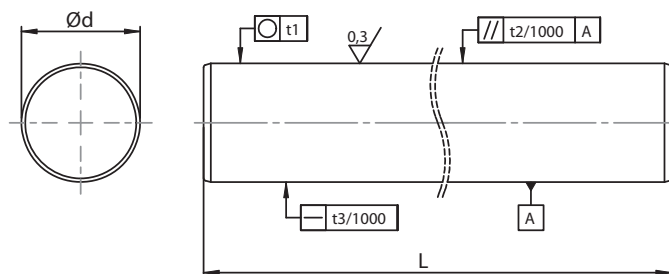
Shaft diameter	Hardening depth <sup>1)</sup>	Standard tolerance ISO h7	Roundness	Parallelism <sup>2)</sup>	Straightness <sup>3)</sup>	Weight
d mm	(min.) mm	µm	t1 µm	t2 µm	t3 mm/m	kg/m
6	0,4	0 / -12	5	8	0,2	0,222
8	0,4	0 / -15	6	9	0,2	0,394
10	0,4	0 / -15	6	9	0,1	0,616
12	0,6	0 / -18	8	11	0,1	0,887
14	0,6	0 / -18	8	11	0,1	1,207
15	0,6	0 / -18	8	11	0,1	1,385
16	0,6	0 / -18	8	11	0,1	1,576
18	0,6	0 / -18	8	11	0,1	1,995
20	0,9	0 / -21	9	13	0,1	2,463
22	0,9	0 / -21	9	13	0,1	2,98
24	0,9	0 / -21	9	13	0,1	3,547
25	0,9	0 / -21	9	13	0,1	3,848
28	0,9	0 / -21	9	13	0,1	4,827
30	0,9	0 / -21	9	13	0,1	5,542
32	1,5	0 / -25	11	16	0,1	6,305
35	1,5	0 / -25	11	16	0,1	7,543
40	1,5	0 / -25	11	16	0,1	9,852
45	1,5	0 / -25	11	16	0,1	12,469
50	1,5	0 / -25	11	16	0,1	15,394
60	2,2	0 / -30	13	19	0,1	22,167
70	2,2	0 / -30	13	19	0,1	30,172
80	2,2	0 / -30	13	19	0,1	39,408
90	3,2	0 / -35	15	22	0,1	49,876
100	3,2	0 / -35	15	22	0,1	61,575

- Chrome coated shafts are made out of CF53 material
- Standard chrome layer thickness: +/- 10µm
- Chrome layer hardness: ≥ 800 HV

1) Surface hardening depth according to DIN ISO 13012

2) Diameter differential measurement

3) Measurement according to DIN ISO 13012

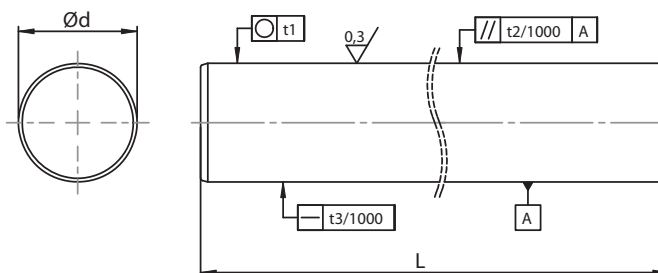


# TS standard size list (Imperial)

Shaft diameter	Shaft diameter	Hardening depth <sup>1)</sup>	Standard tolerance L	Roundness	Parallelism <sup>2)</sup>	Straightness <sup>3)</sup>	Weight
d mm	d inch	(min.) mm	µm	t1 µm	t2 µm	t3 mm/m	kg/m
6,35	1/4	0,4	-13 / -25	4	5	0,2	0,25
9,525	3/8	0,4	-13 / -25	4	6	0,2	0,56
12,7	1/2	0,6	-13 / -25	5	8	0,1	0,99
15,875	5/8	0,6	-13 / -25	5	8	0,1	1,55
19,05	3/4	0,9	-13 / -25	6	9	0,1	2,24
25,4	1	0,9	-13 / -25	6	9	0,1	3,97
31,75	1 1/4	1,5	-13 / -25	7	11	0,1	6,22
38,1	1 1/2	1,5	-15 / -28	7	11	0,1	8,95
50,8	2	1,5	-15 / -33	7	11	0,1	15,91
57,15	2 1/4	2,2	-15 / -33	8	13	0,1	20,13
63,5	2 1/2	2,2	-18 / -38	8	13	0,1	24,86
76,2	3	2,2	-20 / -43	8	13	0,1	35,80

- Not all diameters are available in all materials, for availability please contact our sales department.
- Other sizes, tolerances and hardening depths are available on request.
- Maximum available length is 8200mm, available on request (only for shafts > 5/8" diameter)

- 1) Surface hardening depth according to DIN ISO 13012
- 2) Diameter differential measurement
- 3) Measurement according to DIN ISO 13012



# TT standard size list (Hollow)

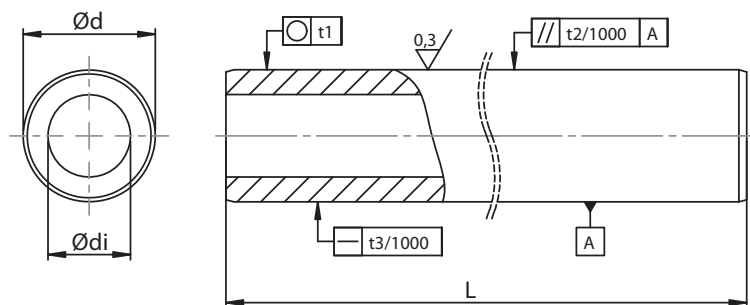
Outer diameter	Inner diameter	Hardening depth <sup>1)</sup>	Standard tolerance ISO h7	Roundness	Parallelism <sup>2)</sup>	Straightness <sup>3)</sup>	Weight
d mm	d mm	(min.) mm	μm	t1 μm	t2 μm	t3 mm/m	kg/m
12	4	0,6	0 / -18	8	11	0,3	0,79
16	7	0,6	0 / -18	8	11	0,3	1,28
20	14	0,9	0 / -21	9	13	0,2	1,25
25	15,6	0,9	0 / -21	9	13	0,2	2,35
30	18,3	0,9	0 / -21	9	13	0,2	3,5
40	28	1,5	0 / -25	11	16	0,1	4,99
50	29,7	1,5	0 / -25	11	16	0,1	9,91
60	36	2,2	0 / -30	13	19	0,1	14,2
80	57	2,2	0 / -30	13	19	0,1	19,4

- TT hollow shafts are produced mainly in C60 material
- Other tolerances and diameters are available on request

1) Surface hardening depth according to DIN ISO 13012

2) Diameter differential measurement

3) Measurement according to DIN ISO 13012



# TD standard size list (Pre-drilled)

Type	Diameter	Length <sup>1)</sup>	Pitch	Distance <sup>2)</sup>	Thread <sup>3)</sup>	Thread depth	Dimension	Dimension	No. threads
	d mm	L mm	T mm	T1 mm	G	N1 mm	N2 mm	S mm	
TD 12 TA	12	6000	75	37,5	M4	7	2	5	79
TD 12 TB	12	6000	120	60	M4	7	2	5	49
TD 16 TA	16	6000	100	50	M5	9	2,5	6	59
TD 16 TB	16	6000	150	75	M5	9	2,5	6	39
TD 16 TU	16	6000	75	37,5	M5	9	2,5	6	79
TD 20 TA	20	6000	100	50	M6	11	3	7	59
TD 20 TB	20	6000	150	75	M6	11	3	7	39
TD 20 TU	20	6000	75	37,5	M6	11	3	7	79
TD 25 TA	25	6000	120	60	M8	15	3	9	49
TD 25 TB	25	6000	200	100	M8	15	3	9	29
TD 25 TU	25	6000	75	37,5	M8	15	3	9	79
TD 30 TA	30	6000	150	75	M10	17	3,5	11	39
TD 30 TB	30	6000	200	100	M10	17	3,5	11	29
TD 30 TU	30	6000	100	50	M10	17	3,5	11	59
TD 40 TA	40	6000	200	100	M10	19	4	11	29
TD 40 TB	40	6000	300	150	M10	19	4	11	19
TD 40 TU	40	6000	100	50	M12	21	4	13	59
TD 50 TA	50	6000	200	100	M12	21	4	13	29
TD 50 TB	50	6000	300	150	M12	21	4	13	19

- Pre-drilled shafts available in CF53 material, other materials on request.
- Other patterns on request.

1) Length tolerance:  $\pm 3\text{mm}$ , cut to length and deburred

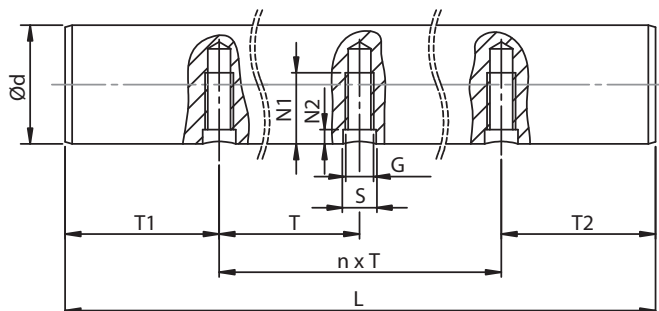
2) Distance tolerance:  $\pm 0,2\text{mm}$ ,  $T1 = T2$

3) Positional tolerance thread  $\varnothing$ :  $\pm 0,2\text{mm}$

When ordering cut to length pre-drilled shafts please specify the values T1 and T2, for example:

TD 030.00 h6 CF53 TA X 1300mm

T1 = 40mm, T2 = 60mm



# GENERAL TERMS AND CONDITIONS OF SALE

## for Technische Handelsonderneming Nederland B.V.

### Article 1 Definitions

In these terms and conditions, the terms below have the following meanings, unless specifically stated otherwise:

THN : Technische Handelsonderneming Nederland B.V.;  
Buyer : the other party;  
Agreement : the agreement between THN and the Buyer;

### Article 2 General

- 2.1 The provisions of these terms and conditions apply to all offers, quotations, agreements and any other legal relationship between THN and the Buyer, insofar as the parties have not agreed to deviate from these terms and conditions explicitly and in writing;
- 2.2 These terms and conditions also apply to all agreements between THN and the Buyer for the execution of which THN uses the services of third parties;
- 2.3 These terms and conditions shall always replace those of the Buyer, unless the parties have agreed otherwise in writing;
- 2.4 If THN and the Buyer enter into more than one agreement, these terms and conditions apply to all subsequent agreements, regardless of whether these have been explicitly declared applicable in writing;
- 2.5 If one or more of the provisions of these terms and conditions are invalid or should become invalid, the remaining provisions of these terms and conditions will remain in force.

### Article 3 Offers, quotations and agreements

- 3.1 All offers made by THN in any form are without obligation, unless the offer specifies a time scale for acceptance;
- 3.2 Agreements to which THN is party will only become enforceable:
  - a) after an agreement drawn up for that purpose has been signed by both parties; or
  - b) after receipt of and agreement with the Buyer's written acceptance of an offer made by THN; or
  - c) by the actual execution of work or delivery of goods by THN;
- 3.3 In cases of verbal agreement, the invoice will be deemed to correctly and fully represent the Agreement, unless it is disputed within 14 days of the date of the invoice;
- 3.4 If a natural person enters into an Agreement on behalf of or on account of another natural or legal person, he or she declares to have the authority to do so by signing the Agreement. Any such person, as well as the other natural or legal person, will be held personally liable for any obligations pursuant to the Agreement;
- 3.5 Prices in the aforementioned offers and quotations are in Euro, and exclusive of VAT and other taxes, as well as of any transportation and packaging costs, unless explicitly stated otherwise;
- 3.6 If acceptance deviates from the offer stated in a quotation, THN will not be bound by it. The Agreement will not be executed in accordance with any deviations in acceptance, unless THN indicates otherwise;
- 3.7 The provision of a compound quotation does not oblige THN to fulfil any part of the obligations included in the offer or quotation against a proportion of the price quoted;
- 3.8 Offers or quotations do not apply to any subsequent orders;
- 3.9 If a quotation is not accepted, THN has the right to demand fair reimbursement by the party requesting the quotation for any costs related to the production of the quotation.

### Article 4 Execution of the Agreement

- 4.1 THN cannot be held liable for damage of any kind caused by incorrect or incomplete information provided by the Buyer, unless the error or omission should have been recognised by THN;
- 4.2 THN has the right to deliver quantities that deviate within a margin of 5% either way from the quantities agreed between THN and the Buyer.

### Article 5 Supply and completion

- 5.1 The Buyer is obliged to accept goods and services produced under the Agreement at the moment these are supplied or the order is completed by THN, delivered to the Buyer, or at the moment these are made available to the Buyer pursuant to the Agreement;
- 5.2 If the Buyer refuses to accept or fails to provide information or instructions required for supply or completion, THN has the right to store the goods at the expense and risk of the Buyer;
- 5.3 If THN requires information from the Buyer with regard to the execution of the Agreement, the supply or completion term will only commence once this has been provided to THN by the Buyer;
- 5.4 If THN has set a time scale for supply or completion, it is only indicative. Any supply or completion time scale indicated shall in no case be considered binding. If any such time scale is exceeded, the Buyer must give written notice of default to THN;
- 5.5 THN has the right to supply or complete work partially, unless the Agreement states otherwise or where partial supply or completion is of no independent value. THN has the right to invoice separately for partial supply or completion.

### Article 6 Inspection and defects

- 6.1 The Buyer must inspect the supplied goods or services at the moment of supply or completion. In doing so, the Buyer should inspect whether the quality and quantity of the goods or services supplied or completed comply with what has been agreed, or with the requirements expected in normal (trading) transactions;
- 6.2 THN should be notified in writing of any visible defects within 8 days of supply or completion. Invisible defects should be reported in writing within 8 days of discovery but no later than 3 months after supply or completion;
- 6.3 THN must be allowed to inspect any reported defects;
- 6.4 If timely notice of defects was given and the defects have been verified by THN, THN will repair the defects or shortcomings within a reasonable time scale, or replace the goods or services that have been supplied or completed. Nonetheless, the Buyer will remain obliged to pay for work carried out and goods delivered;
- 6.5 If timely notice of any defect was not given or if the Buyer has put to use the goods or services supplied or completed, these will be deemed to have been supplied or completed satisfactorily;
- 6.6 If the Buyer wishes to return defective goods, this may only be done with the prior written permission of THN and in the manner indicated by THN.

### Article 7 Compensation, price and costs

- 7.1 THN has the right to demand a deposit amount of 10 to 50% of the agreed price before work is commenced;
- 7.2 If THN has agreed a fixed price with the Buyer, THN reserves the right to increase that price in the cases stated below;
- 7.3 THN has the right to pass on to the Buyer changes in costs relating to social contributions, turnover taxes, exchange rates, wages, raw materials, semi-products, packaging materials or other costs occurring after the Agreement was made.

### Article 8 Changes to the Agreement

- 8.1 If during the execution of the Agreement it becomes apparent that in order to deliver satisfactory results it is necessary to change or supplement the work being carried out, the parties should amend the Agreement to that effect in a timely and mutually agreed manner;
- 8.2 If the parties change and/or supplement the Agreement, the time of completion may be affected. THN will notify the Buyer of this as soon as possible;
- 8.3 If changes and/or additions to the Agreement have financial and/or qualitative consequences, THN will notify the Buyer of this in advance;

### Article 9 Payment

- 9.1 Payment must be made either in cash upon supply or completion, or within 30 days of the date of the invoice, in the manner indicated by THN and in the currency on the invoice. Disagreements about the amount of an invoice do not defer the Buyer's obligation to pay;
- 9.2 If the Buyer fails to pay within the 30-day term, he or she is considered to be in default in the eyes of the law. The Buyer shall then owe interest of 1% per month or part thereof, unless the statutory interest or the statutory commercial interest (after 30 days) is higher, in which case the higher interest applies. The interest on the outstanding amount will be calculated from the moment the Buyer enters default until the moment the full amount has been received;
- 9.3 If the Buyer enters into liquidation, petitions for or enters into bankruptcy, requests or is granted debt rescheduling under the Dutch Natural Persons Debt Rescheduling Act, is repossessed or is granted (temporary) suspension of payment, the outstanding sums the Buyer owes THN will become due immediately;

### Article 10 Retention of title

- 10.1 All materials and other goods delivered by THN will remain the property of THN until the Buyer has met all obligations towards THN;
- 10.2 The Buyer has no authority to sell, provide as security or otherwise encumber goods falling under retention of title rights;
- 10.3 With immediate effect, the Buyer gives unconditional and irrevocable permission for THN or any third parties it appoints to enter any premises that contain THN's property and to repossess these goods, should THN wish to exercise its retention of title rights as defined in this article.

### Article 11 Transfer of risk

- 11.1 The risk of loss of or damage to goods produced by THN will be transferred to the Buyer from the moment these goods are legally or actually supplied or the order is completed, and thus brought into the ownership of the Buyer or a third party appointed by the Buyer.

### Article 12 Collection costs

- 12.1 If the Buyer defaults on or neglects to fulfil his obligations (in a timely manner), the Buyer will be liable for all reasonable costs incurred in extrajudicial enforcement. In any case, the Buyer must pay collection costs if a monetary demand is made. Collection costs will be calculated in accordance with the collection cost rate recommended for collection cases by the Netherlands Bar, with a minimum cost of EUR 350.
- 12.2 If THN has incurred higher costs, and these were necessary and reasonable, the Buyer will also be liable for these costs. Any reasonable legal and execution costs incurred will also be charged to the Buyer.

### Article 13 Suspension and dissolution

- 13.1 In addition to the provisions of the law, THN has the authority to defer the fulfilment of its obligations or dissolve the Agreement if it becomes apparent to THN after the Agreement has been made that there are circumstances as a consequence of which THN has good reason to expect that the Buyer will not fulfil, or only partially fulfil his or her obligations, or not fulfil them in a timely manner. If there is good reason to expect that the Buyer will only partially or not satisfactorily fulfil his or her obligations, the dissolution of the Agreement is only permitted if justified by the short-coming, or if the Buyer was asked to guarantee the fulfilment of his or her obligations at the time the Agreement was made, and this guarantee is not provided or is insufficient.
- 13.2 In addition, THN has the authority to dissolve or cause the Agreement to be dissolved if circumstances are such that fulfilment of the Agreement is impossible or can reasonably and fairly be deemed to no longer be possible, or if other circumstances mean that fulfilment of the Agreement in its present form cannot reasonably be expected, without THN becoming liable for damages to the Buyer;
- 13.3 If the Agreement is dissolved, any sums owed to THN by the Buyer will become due immediately. If THN defers the fulfilment of its obligations, it will retain its rights under the law and the Agreement;
- 13.4 THN reserves the right to demand damage compensation in any case.

### Article 14 Liability

- 14.1 If THN should incur any liability, it will be limited in accordance with the provisions of this article.
- 14.2 THN can only be held liable for wilful damage or damage resulting from neglect by THN or its subordinates.
- 14.3 If THN is held liable, liability will be limited to the maximum compensation amount due to be paid by THN's insurer, and liability shall not exceed the invoice amount for the (partial) work concerned.
- 14.4 THN will not in any case be held liable for damage caused by advice it provides. Any advice will be given based on the facts and circumstances known to THN and in mutual discussion with the Buyer, in which THN will take the Buyer's intentions as a guide and starting point.
- 14.5 THN will never be held liable for indirect damage, being consequential damage, lost profit, missed savings and damage from business stagnation.
- 14.6 THN must be notified immediately and in writing of any damage claims and in any case no later than within five working days of the damage occurring.

### Article 15 Force majeure

- 15.1 THN is not bound to the fulfilment of any obligation if it is impeded from doing so by circumstances not caused wilfully or through neglect by THN and not attributable to THN either in the eyes of the law, through a legal exchange or by general accepted industry opinion;
- 15.2 In addition to the provisions of the law and the courts, in these general terms and conditions force majeure includes any expected or unexpected external causes which THN cannot influence, and which cause THN to be unable to fulfil its obligations. This includes labour strikes at THN, staff illness, theft, traffic delays, frost, rain and failure of suppliers to deliver materials;
- 15.3 THN also has the right to seek recourse to force majeure if the circumstances that impede (further) fulfilment occur after THN should have fulfilled its obligation;
- 15.4 THN can defer its obligations for the duration of the force majeure circumstances. If this period is longer than two months, THN has the right to dissolve the Agreement without incurring liability for damages to the Buyer;
- 15.5 If THN has partially fulfilled or will be able to partially fulfil its obligations under the Agreement at the time of the force majeure circumstances and the fulfilled part or part to be fulfilled respectively is deemed to have independent value, THN has the right to invoice separately for the fulfilled part or part to be fulfilled respectively. The Buyer must pay this invoice as if it were a separate Agreement.

### Article 16 Disputes

- 16.1 The court of law in THN's locality has the exclusive jurisdiction to settle any disputes.

### Article 17 Governing law

- 17.1 The laws of the Netherlands apply to any Agreement between THN and the Buyer.



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