



# Tenaris

Industrial & Automotive  
Services

## Hollow bars TN 001-00



Hollow Bars are seamless tubes specifically produced for machining.

They are characterized by offering greater cutting speeds and longer tool life.

They are made of easily weldable fine grain steel and guarantee the production of surfaces without defects with minimum weight loss due to turning.

Tenaris produces different steel grades in a wide range of dimensions.

# Hollow bars

## General characteristics

### 1. Definition the order

Details:

- "Hollow Bar: HB" product
- Technical specification TN 001 - 00 and/or manufacturing standard
- Steel grade and heat treatment
- O.D.- I.D. dimensions (mm)
- Random lengths
- Quantity and their tolerance
- Chucking

Options

- a) Fixed or multiple lengths
- b) Special tests
- c) Protected surfaces
- d) Certification and special marking
- e) Different colour bands

### 2. Reference standard

· The ISO 2938/1974, NF 49-312/1993 standards and the forthcoming prEN 10294-1:1999 for "Hollow bars for machining" represent the basic reference for the Tenaris Mark product.

· The steel grades of Tenaris specification products comply with the following standards:

### 3. Dimensions and tolerance

The nominal, manufacturing, and guaranteed after turning dimensions are listed in the table on page 6.

### 4. Length

The products are supplied in random lengths between 5000 and 6500 mm with square cut ends.

Option a

*Lengths different from those in the specification can be agreed at the time of ordering*

### 5. Test

The product undergoes the following tests:

- Heat analysis
- Tensile test
- Impact test (for N and QT supply condition)
- Electromagnetic tests (not required by ISO 2938 and NF 49-312)
- Visual and Dimensional control

Option b

*Additional specific tests can be agreed at the time of ordering*

REFERENCE STANDARDS			
TENARIS GRADE	STEEL GRADE		
	ISO 2938	NF A 49312	prEN 10294-1:1999
HB 355 AR	Nuance1 AR		E355 + AR
HB 355 N	Nuance1 N		E355 + N
HB 470 AR		S 470 M	E470
HB 420 N			E420J2
HB 590 QT			E590K2

## 6. Surfaces

The product is supplied with hot or cold finished surfaces according to dimensions.

Option c

*Special surface protections may be agreed at the time of ordering.*

## 7. Certification

The product is supplied with 3.1.B specific test certificates, according to EN 10204 and ISO 10474.

Tenaris works with complete traceability of the product. The heat number is marked on each tube.

Option d

*Certifications according to 3.1.C or 3.2 can be agreed at the time of the ordering.*

*If a 3.2 certification is required, the client must notify the organization or the officer that will conduct the inspection at the time of ordering.*

## 8. Identification and marking

All the hollow bars are identified with the marking specified in the following table.

The manufacturer's mark and the heat number are die stamped or stamp on a varnished tag, upon the different dimensions.

An orange band at each end of the tube.

Option e

*Different colours may be agreed at the time of ordering.*

MANUFACTURER'S MARK	TECHNICAL SPECIFICATION	TENARIS GRADE	O.D.	I.D.	MANUFACTURING STANDARD	STANDARD GRADES	HEAT NUMBER
xxx	TN 001 - 00	HB 355 AR	D.E.	D.I.	ISO 2938/NF A 49312	Nuance 1 AR	yyy
xxx	TN 001 - 00	HB 355 N	D.E.	D.I.	ISO 2938/NF A 49312	Nuance 1 N	yyy
xxx	TN 001 - 00	HB 470 AR	D.E.	D.I.	ISO 2938/NF A 49312	S 470 M	yyy
xxx	TN 001 - 00	HB 420 N	D.E.	D.I.	ISO 2938/NF A 49312		yyy
xxx	TN 001 - 00	HB 590 QT	D.E.	D.I.	ISO 2938/NF A 49312		yyy

## 9. Minimum supply quantity

HB 470 AR Grade

The minimum supply quantity for the HB 470 AR is:

OUTSIDE DIAMETER	TON	TOLERANCE
≤ 125 mm	1	± 1 pipe
> 125 mm	1,5	± 1 pipe

For all other grades or lengths different from our standard the minimum supply quantity is:

OUTSIDE DIAMETER	TON	TOLERANCE
≤ 200 mm	3	± 10%
> 200 mm	10	± 10%

## 10. Packing

Diameters 200 mm: loose.

Diameters up to and including 200 mm: in bundles.

## 11. Technical assistance

Tenaris offers the option of technical consultancy for the use of its products.

# Non alloy quality steel

HB 355 AR

HB 355 N

Tenaris produces HB 355 AR and HB 355 N grades in CMn steel for applications that don't require a particularly high yield strength. Tenaris guarantees optimum Impact test values after normalisation, due to the high content of soluble aluminium.

These products can be supplied "as rolled" (AR) or normalized (N). The specific inclusion range designed by Tenaris guarantees an excellent chip formation of the material notwithstanding its non-excessive hardness. Particularly important are the high cutting speeds that can be used.

## Technical characteristics

### CHEMICAL ANALYSIS %

C	Mn	Si	P	S	Al*
< 0,2	≤ 1,50	≤ 0,50	≤ 0,025	0,020 - 0,035	0,020-0,035

\* Al sol > 85% Al tot

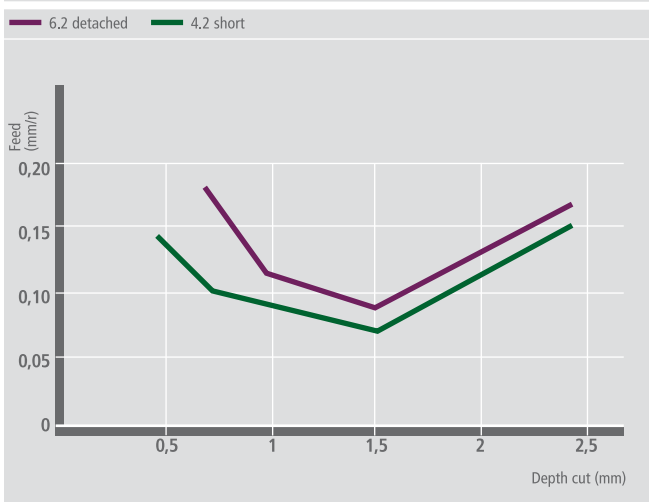
### MECHANICAL PROPERTIES

GRADE	SUPPLY CONDITION	TENSILE TEST						IMPACT TEST	
		Rp <sub>02</sub> min. (MPa)			Rm min. (MPa)			A min. %	Charpy KV <sub>1</sub> min. J
		wall thickness (mm)							
		≤ 16	≤ 25	> 25	≤ 16	≤ 25	> 25		
HB 355	AR	355	345	335	490	490	490	21	
HB 355	N	355	345	335	490	490	490	21	- 20 27

### Impact test

The shown values are related to a specimen having a width W = 10 mm. If W is lower than 10 mm, the measured energy value in J must be transformed on the basis of the formula:  
 $KV = (KV_{measured} \times 10) / W$ .

### CHIP BREAKABILITY GRAPH FOR HB 355 AR GRADE



### Machinability

For the HB 355 AR grade, the cutting speed corresponding to a 10 minute life of the cutting edge is equal to 465 m/min. The bottom graph shows the working conditions in which there is a short or detached chip for external turning, with a cutting speed of 250 m/min as a function of the cutting depth and feed values.

### Weldability

The weldability is guaranteed by a Ceq < 0,49; anyway we recommend pre-heating at a temperature of approximately 200 °C for wall thickness > 16mm and, where necessary, a stress relieving at a temperature of approximately 600 °C.

### Heat treatments

Approximate transformation temperatures are:  
 Ac1= 715 °C Ac3 = 810 °C.

The austenitisation temperature recommended for normalising heat treatment is 880 °C.

# Alloy quality steel

HB 470 AR

HB 420 N

HB 590 QT

Tenaris produces HB 470 AR, HB 420 N and HB 590 QT grades in CMnV micro-alloyed steel for applications requiring high values of yield strength and very good impact test values when normalised or quenched and tempered. Notwithstanding the high yield strength values of these products, the specific inclusion environment

designed by Tenaris and the strict control of the operative conditions in the steel plant, guarantee an excellent tool life and high cutting speeds.

These products can be supplied "as rolled" (AR), normalized (N) or quenched and tempered (QT).

## Technical characteristics

### CHEMICAL ANALYSIS %

C	Mn	Si	P	S	Al*	V
< 0,2	≤ 1,70	≤ 0,40	≤ 0,025	0,020-0,035	0,020 - 0,035	0,10 - 0,15

\* Al sol > 85% Al tot

### MECHANICAL PROPERTIES

GRADE	SUPPLY CONDITION	TENSILE TEST						IMPACT TEST	
		Rp02 min. (MPa)			Rm min. (MPa)			A min. %	Charpy KV <sub>T</sub> min.
		wall thickness (mm)						T (°C)	J
		≤ 16	≤ 25	> 25	≤ 16	≤ 25	> 25		
HB 470	AR	470	460	430	650	620	600	18	
HB 420	N	420	400	380	600	530	530	19	- 20 27
HB 590	QT	590	540	480	700	570	570	16	- 20 40*

\* For wall thickness ≤ 25 mm. For wall thickness > 25 mm values to be agreed

The cold-finished dimensions in steel grade HB 470 AR are supplied with stress relieving heat treatment of after cold drawing

### Impact test

The shown values are related to a specimen having a width W = 10 mm. If W is lower than 10 mm, the measured energy value in J must be transformed on the basis of the formula:

$$KV = (KV_{\text{measured}} \times 10) / W.$$

### Machinability

For the HB 470 AR grade the cutting speed corresponding to a 10 minute life of the cutting edge is equal to 380 m/min.

The graph shows the tool life as a function of the cutting speed variation (Taylor curve).

### Weldability

The weldability is guaranteed by a Ceq ≤ 0,57; anyway we recommend pre-heating at a temperature of 200 - 250°C for thickness > 16mm and 100 - 120 °C for thicknesses below, and a stress relieving at a temperature of 600 -620°C.

### Heat Treatments

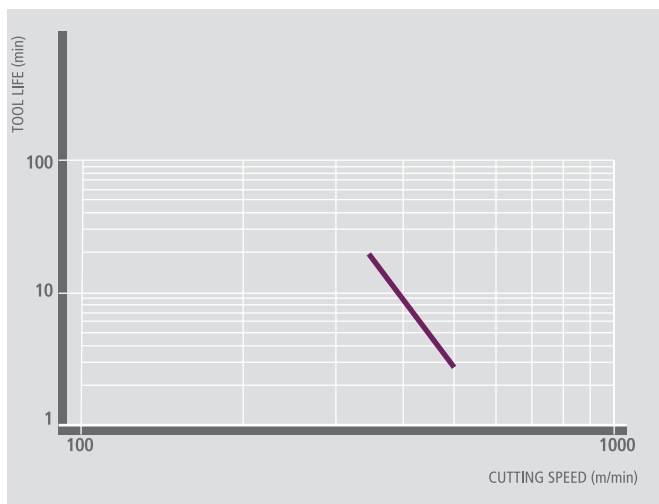
Approximate transformation temperatures are:

Ac1= 720 °C

Ac3 = 815 °C

Recommended austenitisation temperature for quenching and normalising heat treatments: 880 °C.

### TAYLOR CURVE THE HB 470 AR GRADE



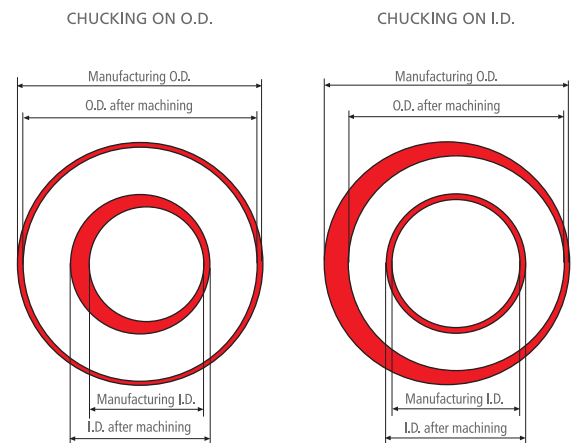
# Hollow bars - Tenaris Production

The table shows the produced dimensions: nominal dimensions, supply conditions (cold or hot finished), manufacturing dimensions and guaranteed dimensions after machining with external and internal chucking on a tube with a minimum length ranging from

at least three times the diameter to 200 mm. The figures show the differences of the guaranteed dimensions according to the chucking on O.D. and I.D.

## Tolerances

The delivery tolerances are specified in the following table with the guaranteed dimensions after machining. They comply with the current valid version of the ISO 2938 and AFNOR NF A 49312 standards.



## DIMENSIONS AND TECHNICAL CHARACTERISTICS

NOMINAL DIMENSIONS			SUPPLY CONDITION	MANUFACTURING DIMENSIONS				Weight per meter kg/m	GUARANTEED DIMENSIONS AFTER MACHINING					
O.D.	W.T.	I.D.		O.D.		Wall Thickness			CHUCKING ON O.D.			CHUCKING ON I.D.		
				min	max	min	max		O.D. max	I.D. min	W.T.	O.D. max	I.D. min	W.T.
			mm		mm		mm			mm				
32	3,5	25	hot finished	32,0	33,0	3,6	4,4	2,8	31,2	26,4	2,4	30,7	26,0	2,3
	6,0	20	cold finished	32,0	32,6	5,9	6,5	4,0	31,3	21,3	5,0	30,9	20,9	5,0
	8,0	16	cold finished	32,0	32,6	7,8	8,6	4,9	31,3	17,5	6,9	30,8	16,9	6,9
36	4,0	28	hot finished	36,0	37,0	4,1	5,0	3,6	35,2	29,4	2,9	34,6	29,0	2,8
	5,5	25	hot finished	36,0	37,0	5,3	6,3	4,4	35,2	27,1	4,0	34,5	26,6	3,9
	8,0	20	cold finished	36,0	36,6	7,8	8,6	5,7	35,3	21,5	6,9	34,8	20,9	6,9
40	10,0	16	cold finished	36,0	36,6	9,7	10,7	6,6	35,3	17,6	8,9	34,7	16,9	8,9
	4,0	32	hot finished	40,0	41,0	4,1	5,0	4,0	39,2	33,4	2,9	38,6	33,0	2,8
	6,0	28	hot finished	40,0	41,0	5,8	6,8	5,3	39,2	30,2	4,5	38,4	29,6	4,4
	7,5	25	cold finished	40,0	40,6	7,3	8,1	6,2	39,3	26,4	6,5	38,5	25,9	6,3
45	10,0	20	cold finished	40,0	40,6	9,7	10,7	7,6	39,3	21,6	8,9	38,7	20,9	8,9
	4,5	36	hot finished	45,0	46,0	4,5	5,5	5,0	44,2	37,6	3,3	43,6	37,1	3,2
	6,5	32	hot finished	45,0	46,0	6,2	7,4	6,5	44,2	34,2	5,0	43,4	33,6	4,9
	8,5	28	cold finished	45,0	45,6	8,3	9,1	7,9	44,3	29,5	7,4	43,8	28,9	7,4
50	12,5	20	cold finished	45,0	45,6	12,1	13,3	10,2	44,3	21,7	11,3	43,5	20,9	11,3
	5,0	40	hot finished	50,5	51,4	5,1	6,2	6,3	49,7	41,9	3,9	49,0	41,3	3,8
	7,0	36	hot finished	50,3	51,3	7,1	8,5	8,3	49,5	37,7	5,9	48,5	37,0	5,8
	9,0	32	hot finished	50,3	51,3	8,6	10,2	9,6	49,5	34,8	7,4	48,3	33,9	7,2
56	12,5	25	cold finished	50,0	50,6	12,1	13,3	11,8	49,3	26,7	11,3	48,5	25,9	11,3
	5,5	45	hot finished	56,6	57,4	5,5	6,7	7,7	55,7	47,0	4,3	55,0	46,5	4,2
	8,0	40	hot finished	56,5	57,3	7,7	9,4	10,1	55,6	42,5	6,5	54,5	41,7	6,4
	10,0	36	hot finished	56,5	57,3	9,6	11,4	12,0	55,6	38,9	8,4	54,3	37,9	8,2
56	14,0	28	cold finished	56,0	56,6	13,5	14,9	14,7	55,3	30,1	12,6	53,8	28,9	12,4

**DIMENSIONS AND TECHNICAL CHARACTERISTICS**

NOMINAL DIMENSIONS		I.D.	SUPPLY CONDITION	MANUFACTURING DIMENSIONS				Weight per meter kg/m	GUARANTEED DIMENSIONS AFTER MACHINING					
O.D.	W.T.			O.D.		Wall Thickness			CHUCKING ON O.D.			CHUCKING ON I.D.		
				min	max	min	max		O.D.	I.D.	W.T.	O.D.	I.D.	W.T.
		mm		mm		mm			mm					
63	5,0	53	hot finished	63,0	64,0	5,0	6,2	8,0	62,2	54,5	3,8	61,5	54,0	3,7
	6,5	50	hot finished	63,0	64,0	6,2	7,4	9,5	62,2	52,2	5,0	61,4	51,6	4,9
	9,0	45	hot finished	63,0	64,0	8,6	10,2	12,5	62,2	47,5	7,4	61,0	46,6	7,2
	11,5	40	hot finished	63,0	64,0	10,9	13,1	15,2	62,2	42,8	9,7	60,7	41,6	9,5
	13,5	36	hot finished	63,0	64,0	12,8	15,0	17,0	62,2	39,3	11,5	60,4	38,0	11,2
15,5	32	cold finished	63,0	63,6	14,9	16,5	18,4	62,3	34,2	14,1	60,7	32,9	13,9	
71	5,5	60	hot finished	71,1	72,1	5,6	7,0	10,1	70,3	61,4	4,5	69,5	60,8	4,4
	7,5	56	hot finished	71,0	71,9	7,2	8,8	12,5	70,1	58,0	6,1	69,1	57,2	6,0
	10,5	50	hot finished	71,0	71,9	10,0	12,0	16,4	70,1	52,5	8,8	68,7	51,4	8,6
	13,0	45	hot finished	71,0	71,9	12,4	14,6	19,3	70,1	47,9	11,1	68,4	46,6	10,9
	15,5	40	hot finished	71,0	71,9	14,7	17,3	21,9	70,1	43,4	13,4	68,0	41,8	13,1
17,5	36	hot finished	71,0	71,9	16,6	19,2	23,6	70,1	39,9	15,1	68,5	39,2	14,6	
75	6,0	63	hot finished	75,6	76,6	6,0	7,4	11,5	74,8	65,1	4,8	74,0	64,5	4,7
	7,5	60	hot finished	75,5	76,5	7,4	8,8	13,6	74,7	62,4	6,2	73,7	61,6	6,0
	9,5	56	hot finished	75,5	76,5	9,2	11,0	16,4	74,7	58,7	8,0	73,4	57,8	7,8
	12,5	50	hot finished	75,5	76,5	11,9	14,3	20,3	74,7	53,3	10,7	73,0	52,0	10,5
	15,0	45	hot finished	75,5	76,5	14,3	16,7	23,1	74,7	48,9	12,9	72,7	47,4	12,7
17,5	40	hot finished	75,5	76,5	16,6	19,4	25,7	74,7	44,3	15,2	72,3	42,6	14,9	
80	6,5	67	hot finished	80,0	81,2	6,5	8,1	13,2	79,3	68,6	5,3	78,3	68,0	5,2
	8,5	63	hot finished	80,0	81,0	8,1	9,7	15,7	79,1	65,4	6,9	77,9	64,6	6,7
	12,0	56	hot finished	80,0	81,0	11,4	13,6	20,9	79,1	58,8	10,1	77,4	57,6	9,9
	15,0	50	hot finished	80,0	81,0	14,3	17,1	25,1	79,1	53,0	13,1	77,0	51,5	12,8
	17,5	45	hot finished	80,0	81,0	16,6	19,4	27,7	79,1	48,8	15,2	76,7	47,1	14,8
20,0	40	hot finished	80,0	81,0	19,0	22,2	30,4	79,1	44,1	17,5	76,3	42,1	17,1	
85	7,5	70	hot finished	85,0	86,2	7,1	8,8	15,2	84,2	72,5	5,8	83,2	71,8	5,7
	9,0	67	hot finished	85,0	85,8	8,6	10,2	17,6	84,0	69,5	7,2	82,8	68,6	7,1
	12,0	61	hot finished	85,0	85,8	11,4	13,6	22,5	84,0	63,8	10,1	82,4	62,6	9,9
	15,0	55	hot finished	85,0	85,8	14,3	17,1	27,0	84,0	58,0	13,0	82,0	56,5	12,7
	17,5	50	hot finished	85,0	85,8	16,6	19,4	29,9	84,0	53,8	15,1	81,6	52,1	14,8
20,0	45	hot finished	85,0	85,8	19,0	22,2	32,9	84,0	49,1	17,4	81,3	47,1	17,1	
90	7,5	75	hot finished	90,6	91,4	7,6	9,4	17,3	89,5	76,9	6,3	88,5	76,1	6,2
	9,5	71	hot finished	90,6	91,4	9,2	11,0	20,2	89,5	73,9	7,8	88,3	72,9	7,7
	11,5	67	hot finished	90,6	91,4	11,0	13,2	23,5	89,5	70,2	9,7	88,0	69,1	9,5
	13,5	63	hot finished	90,6	91,4	12,8	15,4	26,7	89,5	66,6	11,5	87,7	65,2	11,3
	17,0	56	hot finished	90,6	91,4	16,2	19,0	31,9	89,5	60,2	14,7	87,3	58,5	14,4
20,0	50	hot finished	90,6	91,4	19,0	22,2	35,8	89,5	54,7	17,4	86,8	52,7	17,1	
95	7,5	80	hot finished	95,0	95,8	7,6	9,4	18,2	93,9	81,3	6,3	92,8	80,6	6,1
	10,0	75	hot finished	95,0	95,8	9,6	11,6	22,2	93,9	77,4	8,3	92,6	76,4	8,1
	12,0	71	hot finished	95,0	95,8	11,5	13,7	25,7	93,9	73,7	10,1	92,3	72,5	9,9
	13,0	69	hot finished	95,0	95,8	12,4	14,8	27,4	93,9	71,9	11,0	92,2	70,6	10,8
	14,0	67	hot finished	95,0	95,8	13,3	15,9	29,1	93,9	70,1	11,9	92,0	68,7	11,7
	16,0	63	hot finished	95,0	95,8	15,1	18,1	32,3	93,9	66,4	13,7	91,8	64,8	13,5
	18,0	59	hot finished	95,0	95,8	17,1	20,1	35,2	93,9	62,8	15,6	91,5	61,0	15,3
	19,5	56	hot finished	95,0	95,8	18,5	21,7	37,3	93,9	60,0	16,9	91,3	58,1	16,6
22,5	50	hot finished	95,0	95,8	21,3	25,1	41,3	93,9	54,4	19,7	90,9	52,1	19,4	
100	7,5	85	hot finished	100,0	101,0	7,6	9,4	19,3	98,9	86,5	6,2	97,9	85,7	6,1
	10,0	80	hot finished	100,0	101,0	9,6	11,6	23,5	98,9	82,5	8,2	97,6	81,5	8,1
	12,5	75	hot finished	100,0	101,0	11,9	14,3	28,2	98,9	77,9	10,5	97,3	76,7	10,3
	14,5	71	hot finished	100,0	101,0	13,8	16,6	32,0	98,9	74,1	12,4	97,0	72,6	12,2
	18,5	63	hot finished	100,0	101,0	17,6	20,6	38,3	98,9	67,0	16,0	96,5	65,1	15,7
22,0	56	hot finished	100,0	101,0	20,9	24,5	43,6	98,9	60,4	19,3	96,0	58,2	18,9	

## DIMENSIONS AND TECHNICAL CHARACTERISTICS

NOMINAL DIMENSIONS			SUPPLY CONDITION	MANUFACTURING DIMENSIONS				Weight per meter kg/m	GUARANTEED DIMENSIONS AFTER MACHINING					
O.D.	W.T.	I.D.		O.D.		Wall Thickness			CHUCKING ON O.D.			CHUCKING ON I.D.		
				min	max	min	max		O.D.	I.D.	W.T.	O.D.	I.D.	W.T.
		mm		mm				mm		mm				
106	8,0	90	hot finished	106,0	107,2	8,2	10,0	21,9	105,0	91,5	6,7	103,9	90,7	6,6
	10,5	85	hot finished	106,0	107,2	10,1	12,1	26,1	105,0	87,7	8,6	103,6	86,7	8,5
	13,0	80	hot finished	106,0	107,2	12,4	14,8	31,2	105,0	83,1	10,9	103,3	81,9	10,7
	15,5	75	hot finished	106,0	107,2	14,7	17,5	35,9	105,0	78,6	13,2	103,0	77,0	13,0
	17,5	71	hot finished	106,0	107,2	16,7	19,5	39,5	105,0	74,9	15,0	102,7	73,2	14,8
	21,5	63	hot finished	106,0	107,2	20,6	23,6	46,1	105,0	67,6	18,7	102,2	65,5	18,3
25,0	56	hot finished	106,0	107,2	24,0	27,0	51,0	105,0	61,5	21,8	101,7	59,0	21,3	
112	8,5	95	hot finished	112,0	113,2	8,1	10,1	23,2	111,0	97,6	6,7	109,8	96,7	6,6
	11,0	90	hot finished	112,0	113,2	10,5	12,5	28,7	111,0	93,0	9,0	109,5	91,9	8,8
	13,5	85	hot finished	112,0	113,2	12,7	15,3	34,0	111,0	88,5	11,3	109,2	87,1	11,0
	16,0	80	hot finished	112,0	113,2	15,1	18,1	39,3	111,0	83,7	13,6	108,9	82,1	13,4
	20,5	71	hot finished	112,0	113,2	19,4	22,8	47,6	111,0	75,5	17,7	108,3	73,5	17,4
24,5	63	hot finished	112,0	113,2	23,3	26,8	54,0	111,0	68,4	21,3	107,7	66,0	20,9	
118	9,0	100	hot finished	118,0	119,2	9,4	11,2	27,5	116,9	101,4	7,8	115,6	100,5	7,6
	11,5	95	hot finished	118,0	119,2	10,9	13,1	31,5	116,9	98,1	9,4	115,4	97,0	9,2
	14,0	90	hot finished	118,0	119,2	13,3	15,9	37,4	116,9	93,4	11,8	115,1	92,0	11,5
	16,5	85	hot finished	118,0	119,2	15,7	18,7	43,0	116,9	88,6	14,1	114,8	87,0	13,9
	19,0	80	hot finished	118,0	119,2	18,0	21,6	48,2	116,9	83,9	16,5	114,4	82,0	16,2
	23,5	71	hot finished	118,0	119,2	22,3	26,1	56,3	116,9	75,9	20,5	113,8	73,5	20,1
27,5	63	hot finished	118,0	119,2	26,1	30,1	62,7	116,9	68,8	24,1	113,3	66,1	23,6	
125	9,5	106	hot finished	125,0	126,2	9,9	11,9	30,8	123,9	107,4	8,2	122,5	106,4	8,1
	12,5	100	hot finished	125,0	126,2	11,9	14,3	36,3	123,9	103,2	10,3	122,2	101,9	10,2
	15,0	95	hot finished	125,0	126,2	14,3	17,1	42,6	123,9	98,4	12,7	121,9	96,9	12,5
	17,5	90	hot finished	125,0	126,2	16,7	19,9	48,4	123,9	93,7	15,1	121,6	91,9	14,8
	22,5	80	hot finished	125,0	126,2	21,4	25,2	58,8	123,9	84,6	19,7	120,9	82,3	19,3
27,0	71	hot finished	125,0	126,2	25,9	29,7	67,1	123,9	76,4	23,8	120,3	73,7	23,3	
132	10,0	112	hot finished	132,0	134,0	9,5	11,9	32,3	131,2	115,2	8,0	129,9	114,2	7,8
	13,0	106	hot finished	132,0	134,0	12,4	14,8	40,0	131,2	109,7	10,8	129,5	108,4	10,6
	17,0	98	hot finished	132,0	134,0	16,1	19,3	50,3	131,2	102,2	14,5	129,0	100,5	14,2
	21,0	90	hot finished	132,0	134,0	20,1	23,5	59,8	131,2	94,7	18,2	128,4	92,6	17,9
	26,0	80	hot finished	132,0	134,0	24,7	28,9	70,2	131,2	85,6	22,8	127,8	83,0	22,4
30,5	71	hot finished	132,0	134,0	29,0	34,0	78,8	131,2	77,1	27,1	127,1	74,0	26,6	
140	11,0	118	hot finished	140,2	142,4	10,4	12,9	37,2	139,2	122,0	8,6	137,8	121,0	8,4
	14,0	112	hot finished	140,2	142,4	13,3	15,9	45,6	139,2	116,4	11,4	137,4	115,1	11,2
	17,0	106	hot finished	140,2	142,4	16,2	19,4	54,2	139,2	110,6	14,3	137,0	108,9	14,1
	20,0	100	hot finished	140,2	142,4	18,9	22,7	61,8	139,2	105,1	17,1	136,6	103,1	16,8
	25,0	90	hot finished	140,2	142,4	23,9	28,1	73,9	139,2	95,6	21,8	135,9	93,1	21,4
30,0	80	hot finished	140,2	142,4	28,5	32,7	83,5	139,2	87,2	26,0	135,3	84,3	25,5	
150	9,0	132 <sup>1</sup>	hot finished	150,0	151,6	8,5	10,7	33,4	148,7	135,3	6,7	147,5	134,5	6,5
	12,5	125	hot finished	150,0	151,6	11,8	14,8	45,1	148,7	128,6	10,1	147,0	127,4	9,8
	16,0	118	hot finished	150,0	151,6	15,2	18,2	55,2	148,7	122,1	13,3	146,6	120,6	13,0
	22,0	106	hot finished	150,0	151,6	20,9	25,1	72,5	148,7	110,6	19,0	145,8	108,4	18,7
	27,5	95	hot finished	150,0	151,6	26,1	30,7	85,7	148,7	100,8	23,9	145,0	98,0	23,5
35,0	80	hot finished	150,0	151,6	33,2	39,0	102,1	148,7	86,8	31,0	144,0	83,3	30,4	
160	12,0	136	hot finished	160,0	161,6	11,4	14,2	46,7	158,6	139,5	9,5	157,0	138,4	9,3
	14,0	132	hot finished	160,0	161,6	13,3	16,5	53,6	158,6	135,7	11,4	156,8	134,4	11,2
	19,0	122	hot finished	160,0	161,6	18,1	21,7	69,1	158,6	126,3	16,1	156,1	124,5	15,8
	24,0	112	hot finished	160,0	161,6	22,8	27,4	84,0	158,6	116,8	20,9	155,4	114,4	20,5
	30,0	100	hot finished	160,0	161,6	28,5	33,5	99,2	158,6	106,1	26,2	154,6	103,1	25,8
35,0	90	hot finished	160,0	161,6	33,2	38,2	110,1	158,6	97,5	30,5	154,0	94,1	29,9	

<sup>1</sup> Length from 4,5 to 6,0 meters

## DIMENSIONS AND TECHNICAL CHARACTERISTICS

NOMINAL DIMENSIONS		I.D.	SUPPLY CONDITION	MANUFACTURING DIMENSIONS				Weight per meter kg/m	GUARANTEED DIMENSIONS AFTER MACHINING					
O.D.	W.T.			O.D.		Wall Thickness			CHUCKING ON O.D.			CHUCKING ON I.D.		
				min	max	min	max		O.D. max	I.D. min	W.T.	O.D. max	I.D. min	W.T.
		mm		mm		mm			mm					
170	12,5	145	hot finished	170,0	172,0	11,8	14,8	51,7	168,7	148,9	9,9	167,1	147,7	9,7
	15,0	140	hot finished	170,0	172,0	14,2	17,8	61,2	168,7	144,0	12,4	166,8	142,5	12,1
	20,0	130	hot finished	170,0	172,0	19,0	22,8	77,4	168,7	134,8	17,0	166,1	132,8	16,7
	26,0	118	hot finished	170,0	172,0	24,7	29,5	96,2	168,7	123,5	22,6	165,3	120,9	22,2
	30,0	110	hot finished	170,0	172,0	28,5	33,5	107,0	168,7	116,3	26,2	164,8	113,4	25,7
	35,0	100	hot finished	170,0	172,0	33,2	39,0	120,1	168,7	107,1	30,8	164,1	103,6	30,3
180	12,5	155	hot finished	180,0	181,8	11,8	14,8	55,0	178,5	158,8	9,8	176,9	157,7	9,6
	15,0	150	hot finished	180,0	181,8	14,2	17,8	65,1	178,5	153,9	12,3	176,6	152,5	12,0
	20,0	140	hot finished	180,0	181,8	19,0	22,8	82,5	178,5	144,7	16,9	176,0	142,8	16,6
	27,5	125	hot finished	180,0	181,8	26,1	31,3	107,7	178,5	130,5	24,0	174,9	127,7	23,6
	34,0	112	hot finished	180,0	181,8	32,3	37,9	126,2	178,5	118,8	29,9	174,1	115,4	29,3
	40,0	100	hot finished	180,0	181,8	38,0	43,8	141,2	178,5	108,3	35,1	173,2	104,3	34,5
190	12,5	165	hot finished	190,0	192,0	13,0	16,2	63,5	188,6	166,6	11,0	186,8	165,3	10,7
	15,0	160	hot finished	190,0	192,0	14,2	17,8	69,1	188,6	164,1	12,2	186,6	162,7	12,0
	20,0	150	hot finished	190,0	192,0	19,3	23,1	88,8	188,6	154,3	17,1	186,0	152,3	16,8
	22,0	146	hot finished	190,0	192,0	21,0	25,2	95,6	188,6	150,9	18,9	185,7	148,7	18,5
	29,0	132	hot finished	190,0	192,0	28,0	33,6	121,7	188,6	136,8	25,9	184,7	133,9	25,4
	36,0	118	hot finished	190,0	192,0	34,2	40,2	141,1	188,6	125,1	31,7	183,8	121,6	31,1
	42,0	106	hot finished	190,0	192,0	40,8	47,8	160,3	188,6	112,2	38,2	182,8	107,9	37,4
200	20,0	160	hot finished	202,0	204,0	19,6	23,4	96,2	200,5	165,9	17,3	197,8	163,8	17,0
	30,0	140	hot finished	202,0	204,0	28,7	34,3	133,2	200,5	147,6	26,4	196,5	144,6	26,0
	44,0	112 <sup>n</sup>	hot finished	202,0	204,0	41,9	49,1	176,7	200,5	122,1	39,2	194,6	117,7	38,5
212	21,0	170	hot finished	212,5	215,7	20,6	25,2	108,0	211,5	174,5	18,5	208,7	172,3	18,2
	31,0	150	hot finished	212,5	215,7	29,5	36,1	146,7	211,5	156,4	27,6	207,4	153,2	27,1
224	22,0	180	hot finished	224,7	229,3	21,5	26,3	119,7	223,7	186,1	18,8	220,9	183,9	18,4
	32,0	160 <sup>s</sup>	hot finished	224,7	229,3	30,4	37,2	160,3	223,7	167,9	27,9	219,6	164,8	27,4
250	25,0	200	hot finished	250,7	254,5	24,5	29,9	151,2	249,7	205,3	22,2	246,5	202,8	21,8
	35,0	180	hot finished	250,7	254,5	33,3	40,7	196,7	249,7	187,4	31,1	245,1	183,9	30,6

<sup>n</sup> Length from 4,0 to 5,0 meters

<sup>s</sup> Length from 5,0 to 6,8 meters



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