

Tenaris products for mechanical applications



Highly performing
and reliable products
for mechanical needs

Tenaris expertise

Proven engineering expertise to serve any mechanical challenge	4
Used to go beyond the standards	5
A dedicated mill for mechanical applications	6
Serving a vast spectrum of mechanical components	7
—	—

Our products for mechanical applications

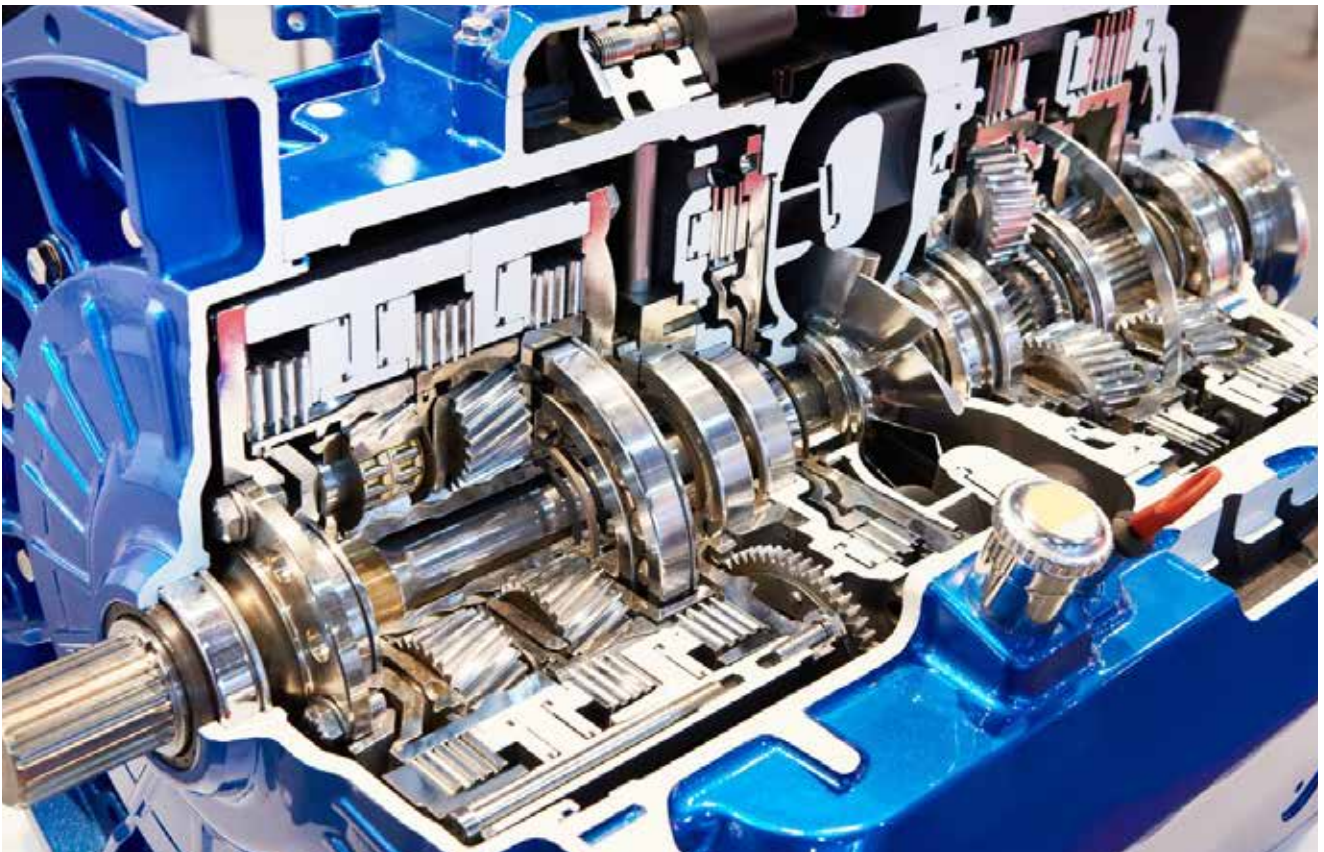
Hot Rolled seamless steel tubes	8
TAM® Plus	12
Hollow Bars	16
TAM® High M	20
Cold Drawn seamless steel tubes	24
—	—

Proven engineering expertise to serve any mechanical challenge

As leading global manufacturer and supplier of seamless steel pipe products and related services for the world's energy industry and other industrial applications, Tenaris can offer a solid expertise which positions it as a reliable partner for engineering companies operating in different segments.

Tenaris strong know-how represents a plus also when serving the mechanical industry, where improved characteristics in terms of quality, reliability and performance are required to face demanding applications.

—
Drive system section



Used to go beyond the standards

In our fully-integrated manufacturing process, from steelmaking to tube-rolling, coldrawing, heat treatments and tubular parts processing, we focus on designing tailor-made products to meet our customers' needs and ensure a longer product life, guaranteeing high mechanical properties and optimizing their operations.

A highly skilled Tenaris team guarantees constant technical assistance during product development phases and after sales.

We offer value added to each customers' request and a continuous product improvement according with their needs.

—
Drilling rig



A dedicated mill for mechanical applications

Thanks to its mill in Arcore, Italy, Tenaris has an extremely solid offer in terms of:

- dimensional range and restricted tolerances
- high level of compliance
- customized service

The Diescher mill, thanks to a particular transversal rolling direction, allows Arcore plant to deliver tubes with an exceptional concentricity and tight tolerances.

The use of a new recently installed gag press can guarantee a superior straightness than the normative requirements and a lower residual stress.

Flexible production lots and customized deliveries with ad-hoc lead times are here assured.

Moreover, the presence of a Service Center inside the plant offers tailor-made solutions for cutting and packaging.

All the latest investments aim to increase production flexibility and plant reliability, enhance automation and controls, grant top safety standard and reduce our environmental impact.

This all places the Arcore mill among the leaders in Europe in the production of pipes tubes for precision mechanical.

TenarisDalmine plant in Arcore



Serving a vast spectrum of mechanical components



Hot rolled seamless tubes

PRODUCT HIGHLIGHTS



Extended dimensional range



The longest lengths in the market



Customized steels and sizes

Tenaris produces hot-rolled tubes in a wide dimensional range used for mechanical and engineering applications, satisfying the European norm EN 10297-1.

Excellent combination of mechanical properties and very good weldability is what makes Tenaris products your best choice.

Thanks to a fully integrated process, from steel making to tubes hot rolling, we are able to design steel chemicals and sizes according with our customers' requests.

CLASSIFICATION OF STEEL GRADES | EN 10297-1

MECHANICAL APPLICATION

- E 235
- E 275
- E 355

ENGINEERING APPLICATION

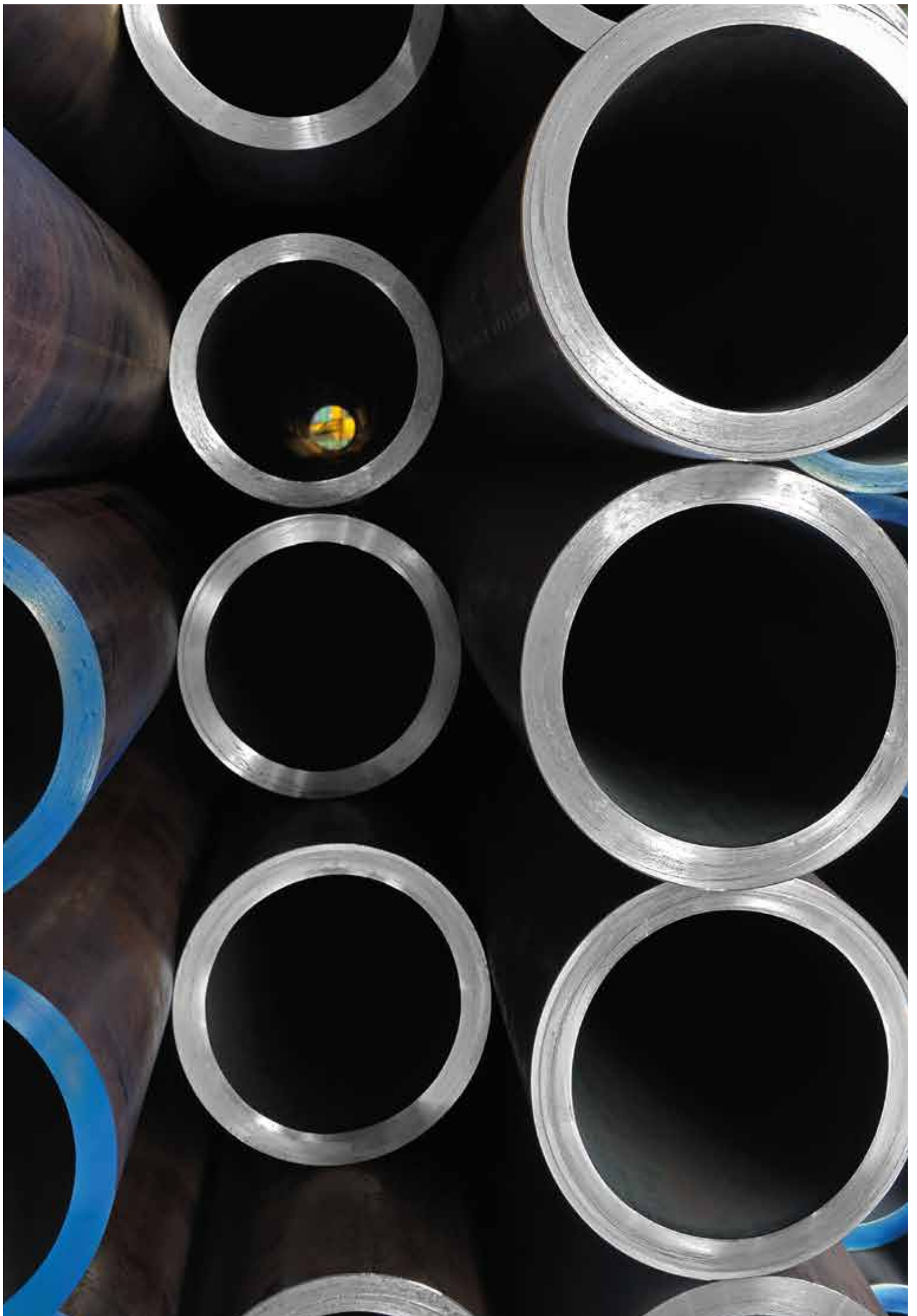
- E 470
- E 355 K2
- E 420 J2
- E 460 K2
- E 590 K2
- E 730 K2

QUENCH & TEMPERED

- C 22 E
- C 35 E
- C 45 E
- C 60 E
- 38 Mn6
- 25 CrMo 4
- 34 CrMo 4
- 42 CrMo 4
- 34 CrNiMo 6

CASE HARDENING

- C 10 E
- C10E
- C15R
- C45R
- 16 MnCrS5
- 16 MnCr5
- 20 MnCrS5
- 20 NiCrMo 2-2
- 20 NiCrMoS 2
- 16 NiCrMoS 2-2
- 42 CrMo S4

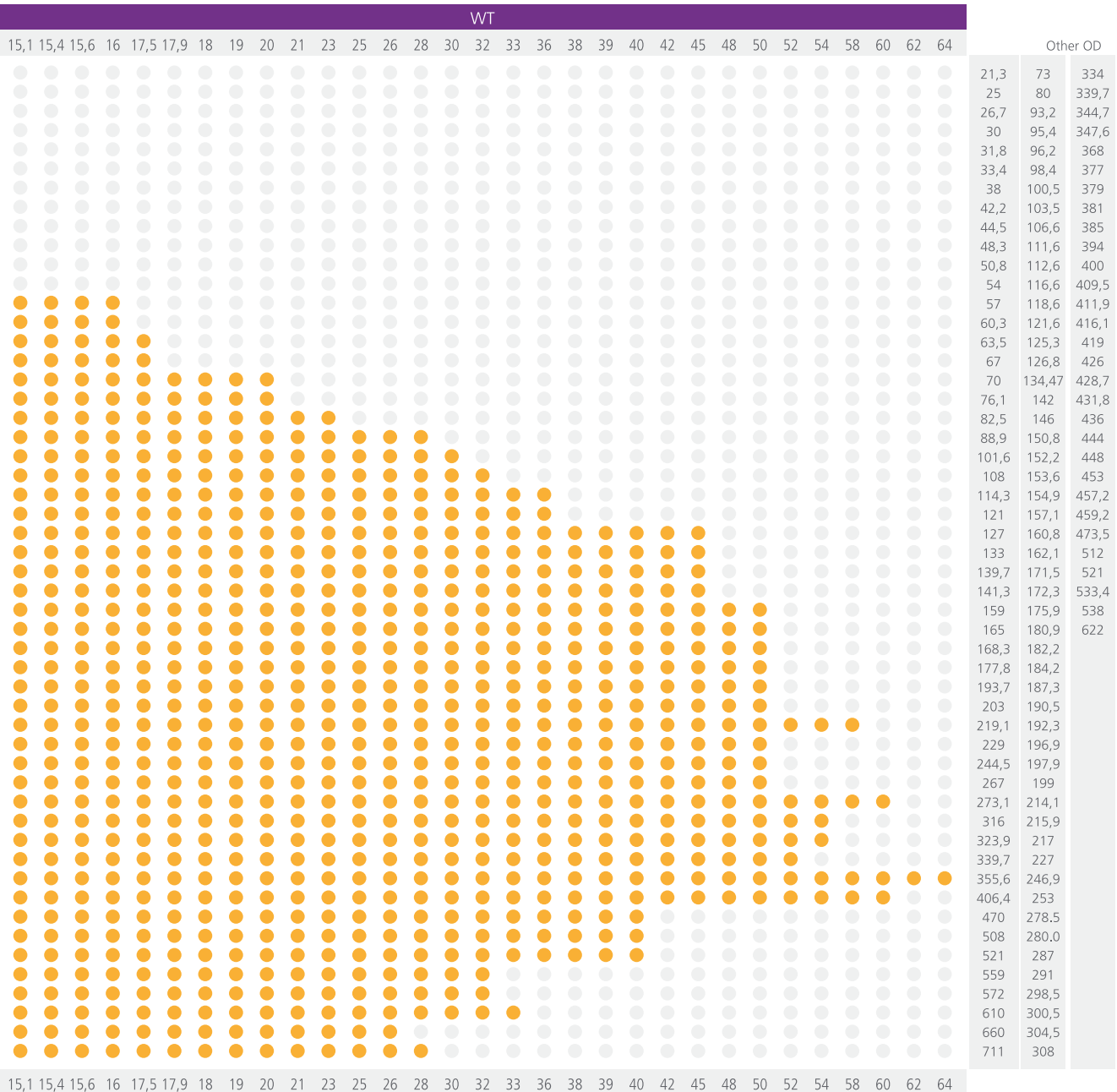


Mechanical applications MECHANICAL PROPERTIES

Grade	DELIVERY CONDITION	YELD STRENGTH MIN (Mpa)			TENSILE STRENGTH MIN (Mpa)			ELONG. A
		≤ 1,20	≤ 0,35	≤ 0,030	≤ 0,035			
E 235	+AR	235	225	215	360	360	360	25
E 275	+AR	275	265	255	410	410	410	22
E 355	+AR	355	345	335	490	490	490	20

Engineering applications MECHANICAL PROPERTIES

Grade	DELIVERY CONDITION	YELD STRENGTH MIN (Mpa)			TENSILE STRENGTH MIN (Mpa)			ELONG. A LONG. MIN (%)	IMPACT TEST CHARPY KV LONG@T=-20°C MIN (J)
		WT≤16 mm	16≤WT≤40 mm	>40=>65	WT≤16 mm	16≤WT≤40 mm	>40=>65		
E 470	+AR	470	430	430	650	600	600	17	-
E 355 K2	+N	355	345	335	490	490	470	20	40
E 420 J2	+N	420	400	390	600	560	530	19	27
E 460 K2	+N	460	440	430	550	550	550	19	40
E 590 K2	+QT	590	540	480	700	650	570	16	40
E 730 K2	+QT	730	670	620	790	750	700	15	40



TAM[®] Plus

PRODUCT HIGHLIGHTS



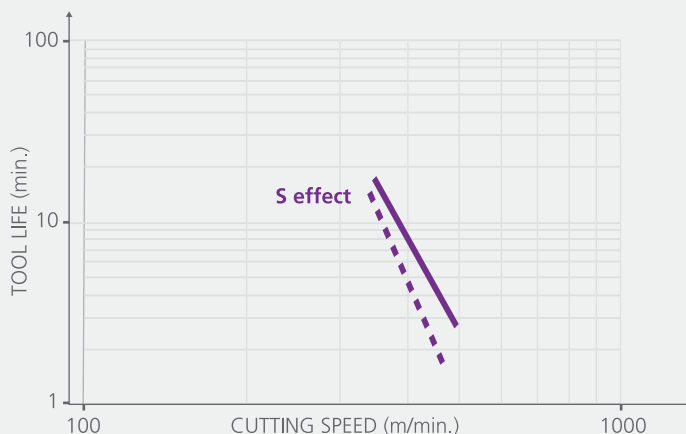
TAM[®] Plus is the new range of hot rolled mechanical tubes, designed by Tenaris to better meet the needs of industrial sector. Market required a product with resulfured steel, close tolerances and, on request, improved straightness.

Within the production process, a fusion and casting procedure was set up to obtain the minimum inclusion level, with uniform distribution of sulfur, to improve steel machinability.

Formation of short, detached chips guaranteed by the use of re-sulphured steel allows high machining speeds with consequent reduction in time and production costs.

Thanks to the Diescher mill in our production unit located in Arcore (Italy), TAM[®] Plus is the most suitable product for high end mechanical applications in outer diameter 48 – 219,1 mm dimensional range.

TAYLOR CURVE E470 - 10297 NORM



Improvement in tool life is illustrated through Taylor Curves for steel grades TAM[®] Plus and E 470 HL compared to the same grade non re-sulfured steel. With a tool life conventionally fixed at 10 minutes, laboratory tests have demonstrated that steel undergone re-sulfurisation is more machinable compared to standard steel, allowing greater machining speeds.



Chemical analysis

CHEMICAL ANALYSIS %

Grade	C	Si	Mn	P	S	V	Cr	Mo	Ni	Al	Nb	Ti
E355 HL	≤ 0,20	≤ 0,50	≤ 1,60	≤ 0,030	0,020-0,035	-	-	-	-	-	-	-
E470 HL	0,16±0,22	0,10±0,50	1,30±1,70	≤ 0,030	0,020-0,035	0,08±0,15	-	-	-	≥ 0,010	-	≤ 0,070
E420J2 HL	0,16±0,22	0,10±0,50	1,30±1,70	≤ 0,030	0,020-0,035	0,08±0,15	≤ 0,30	≤ 0,80	≤ 0,40	≥ 0,010	≤ 0,050	≤ 0,070
42CRMO4 HL	0,38±0,45	≤ 0,40	0,60±0,90	≤ 0,035	0,020-0,035	-	0,90±1,20	0,15±0,30	-	-	-	-
C45E HL	0,42±0,50	≤ 0,40	0,50±0,80	≤ 0,035	0,020-0,035	-	-	-	-	-	-	-
16MnCr5 HL	0,14±0,19	≤ 0,40	1,0±1,30	≤ 0,025	0,020-0,040	-	0,80±1,10	-	-	-	-	-
20MnCr5	0,17±0,22	≤ 0,40	1,10±1,40	≤ 0,025	0,020-0,040	-	1,00±1,30	-	-	-	-	-

TAM® Plus Feasibility Matrix

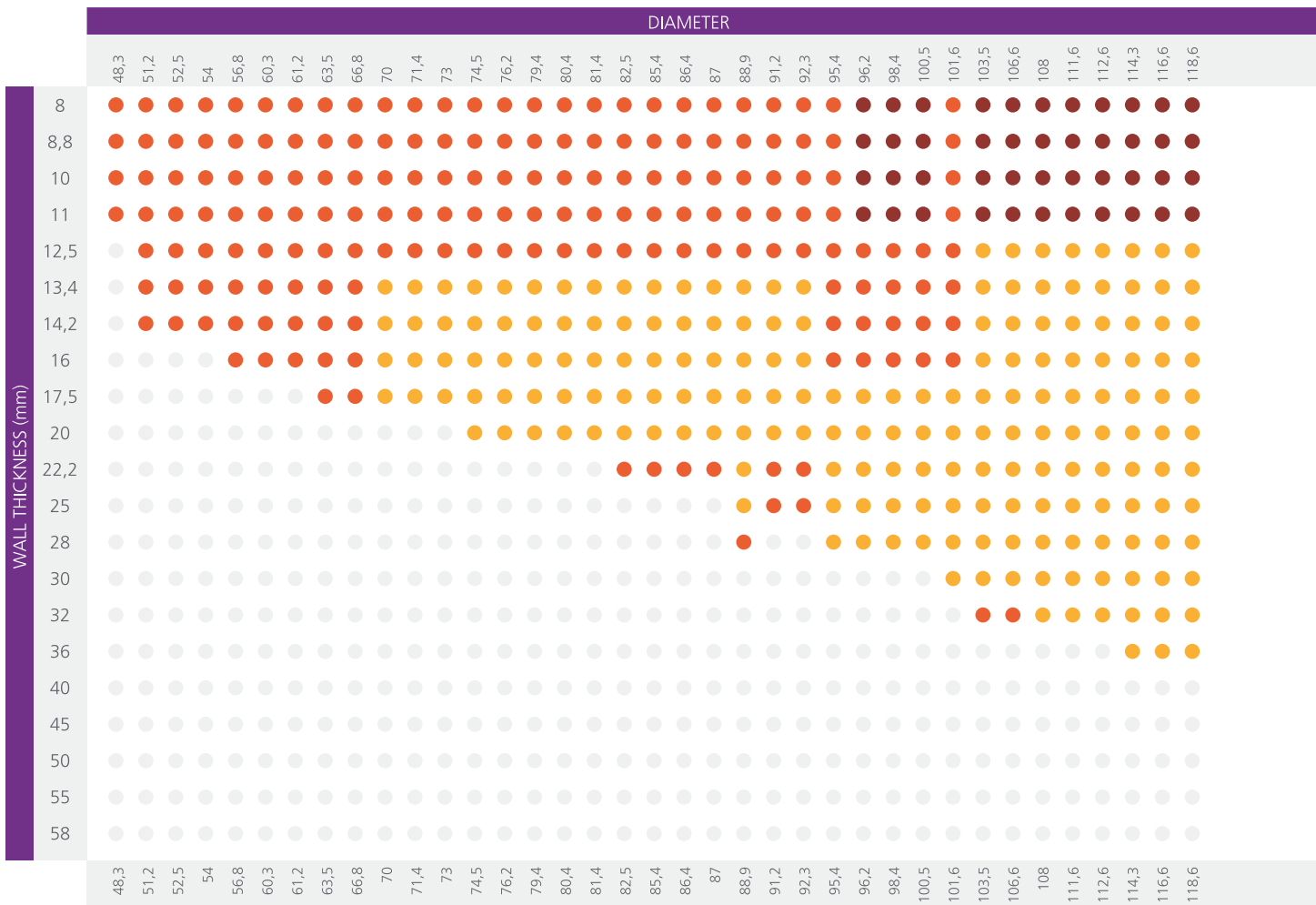
DIMENSIONAL TOLERANCES

Tolerance W.T.

● ± 10% ● ± 7,5% ● ± 5%

Tolerance O.D.

≤80 ± 0,4 mm | >80 ± 0,5%

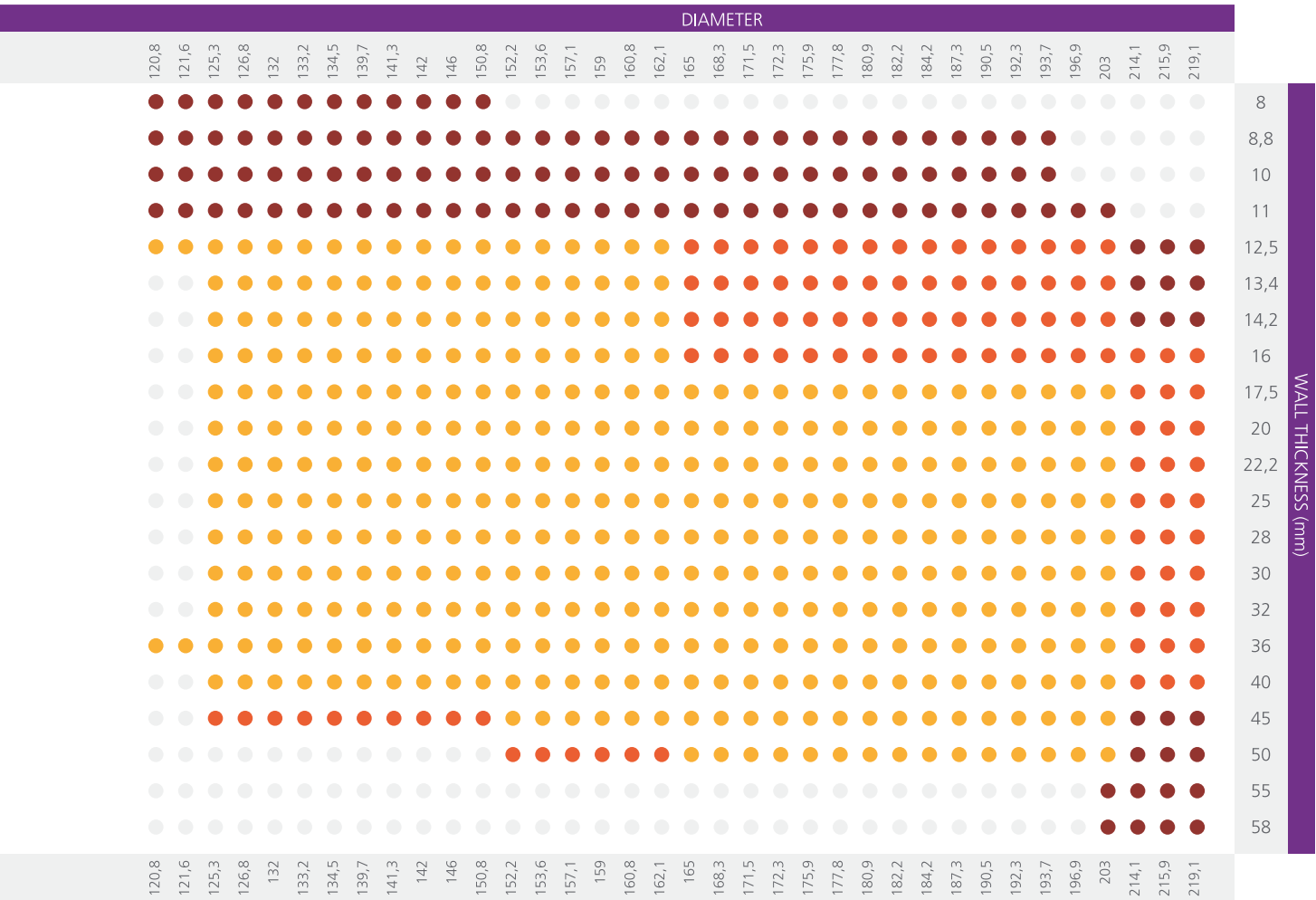


Mechanical properties

STEELS FOR MECHANICAL FABRICATION

Grade	Delivery condition*	Tensile properties (wall thickness mm)						A % long. min	Impact test charpy kV long	
		Rp 0.2 (MPa) min			Rm (MPa) min				T °C	J Min
		≤16	>16≤40	>40≤65	≤16	>16≤40	>40≤65			
E355 HL	AR	355	345	335	510-650	510-650	510-650	21	-	-
E470 HL	AR	470	430	-	650	650	-	17	-	-
E420J2 HL	N	420	400	390	600	560	530	19	20	27

* AR = as rolled (not treated) - n = normalized | Normalization can be done online or in the furnace.



Hollow Bars

PRODUCT HIGHLIGHTS



Improved
machinability
steels



High surface
quality & without
defects



Tight
dimensional
tolerances

Reference norm EN 10294-1

Tenaris Hollow Bars are specifically produced for machining and they are characterized by offering greater cutting speeds and longer tool life. Along with improved machinability performance, Tenaris Micro-Alloyed Hollow Bars, thanks to their low CE content, allow very good results in welding procedures.

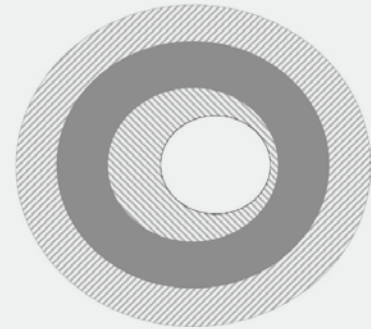
Moreover, Tenaris Hollow Bars, due to a very extensive number of items - more than 300 - and better tolerances in wall thickness and roundness, allows to choose the closest size that fits the request of the market in terms of material cost savings and time machining saving.

HOLLOW BAR COMPARISON

**TENARIS
HOLLOW BAR**



**OTHER
HOLLOW BARS**





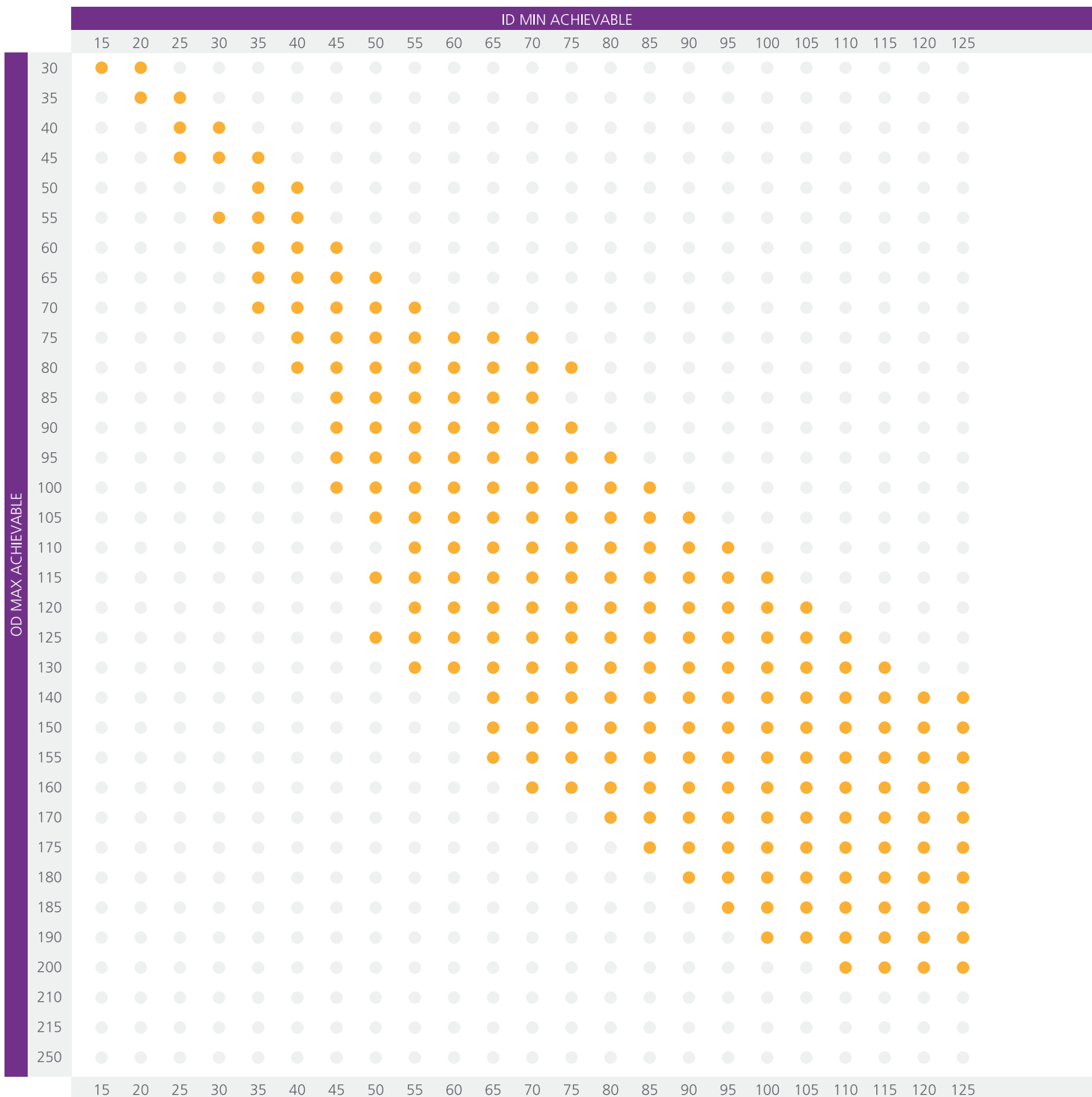
Reference standard

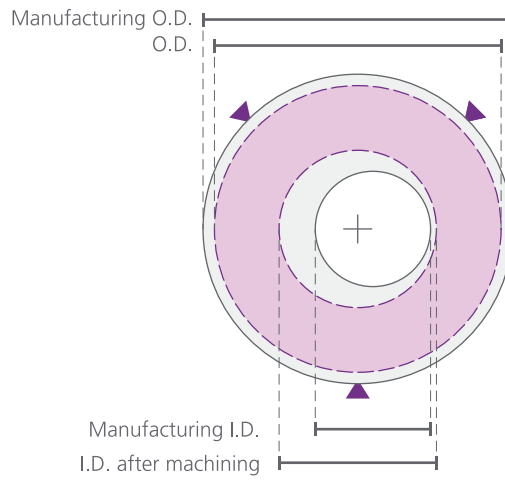
TENARIS GRADE	EN 10294-1:2005 GRADE
HB 355 AR	E355
HB 355 N	E355J2
HB 470 AR	E470
HB 420 N	E420J2
HB 590 QT	E590K2

Hollow Bars Feasibility Matrix

GUARANTEED DIMENSION

● Dimensions feasible by Tenaris



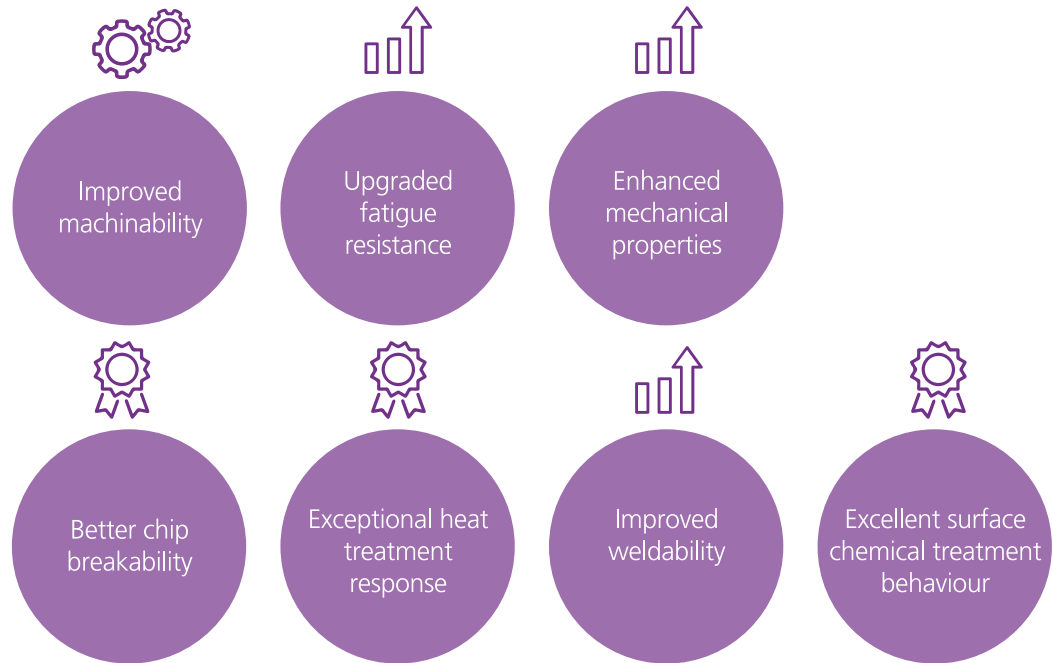


External chucking
 OD Chucking means that the clamping (centering) during the first machining operation is performed on the Outside diameter of the delivered tubes.

ID MIN ACHIEVABLE		OD MAX ACHIEVABLE																						
130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240		
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	30
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	35
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	40
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	45
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	50
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	55
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	60
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	65
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	70
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	75
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	80
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	85
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	90
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	95
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	100
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	105
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	110
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	115
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	120
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	125
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	130
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	140
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	150
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	155
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	160
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	170
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	175
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	180
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	185
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	190
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	200
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	210
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	215
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	250
130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240		

TAM[®] High M

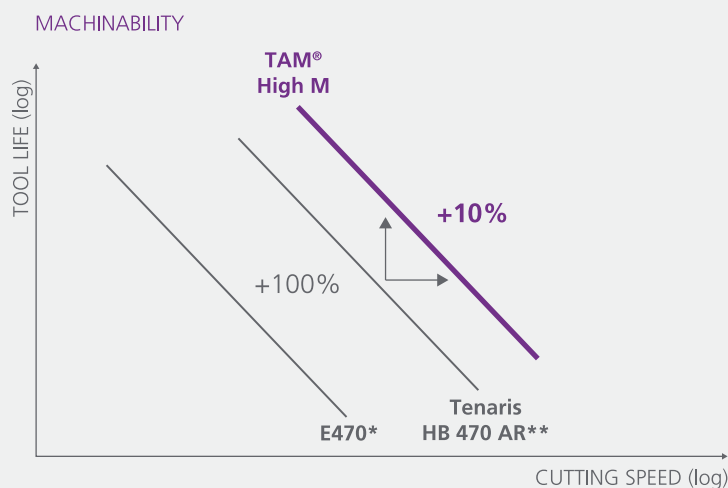
PRODUCT HIGHLIGHTS



Reference norm EN 10294-1

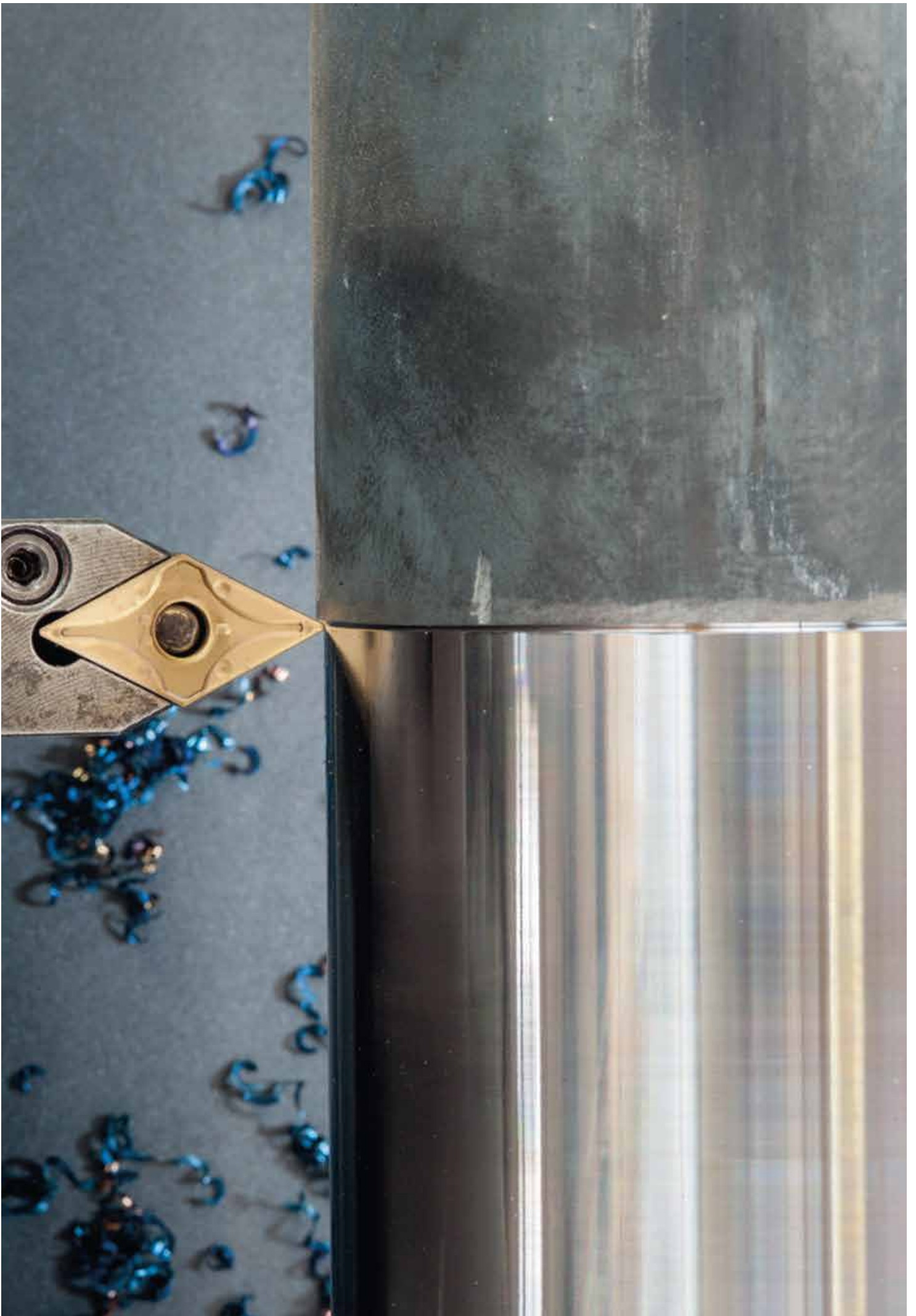
TAM[®] High M is a new generation hollow bar designed by Tenaris to enhance material performance in the most demanding engineering applications.

TAM[®] High M is an optimization of HB 470 Tenaris steel grade, characterized by offering greater cutting speed and longer tool life while guaranteeing strong reductions in machining costs.



* **E470**
according to
EN 10294-01

** **Tenaris HB 470 AR**
according to
TN 294-04



Reference standard

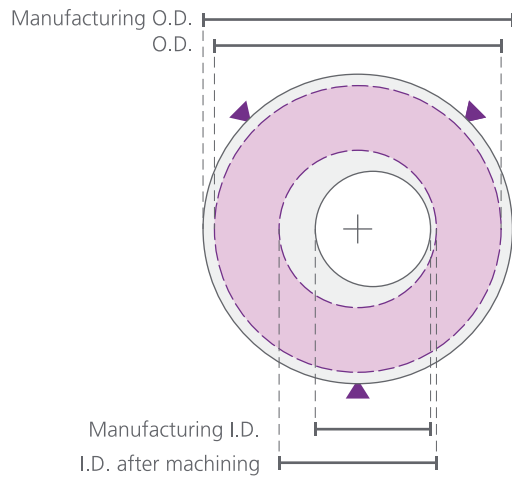
TENARIS GRADE	EN 10294-1:2005 GRADE
TAM® HIGH M	E470

TAM® High M Feasibility Matrix

GUARANTEED DIMENSION

● Dimensions feasible by Tenaris

	ID MIN ACHIEVABLE																							
	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	
30	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
35	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
40	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
45	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
50	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
55	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
60	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
65	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
70	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
75	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
80	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
85	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
90	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
95	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
105	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
110	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
115	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
120	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
125	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
130	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
140	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
150	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
155	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
160	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
170	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
175	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
180	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
185	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
190	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
200	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
210	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
215	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
250	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●



External chucking
 OD Chucking means that the clamping (centering) during the first machining operation is performed on the Outside diameter of the delivered tubes.

ID MIN ACHIEVABLE		OD MAX ACHIEVABLE																						
130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	30	
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	35
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	40
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	45
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	50
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	55
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	60
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	65
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	70
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	75
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	80
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	85
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	90
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	95
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	100
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	105
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	110
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	115
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	120
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	125
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	130
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	140
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	150
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	155
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	160
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	170
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	175
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	180
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	185
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	190
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	195
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	200
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	205
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	210
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	215
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	220
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	225
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	230
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	235
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	240

Cold Drawn seamless steel tubes

PRODUCT HIGHLIGHTS



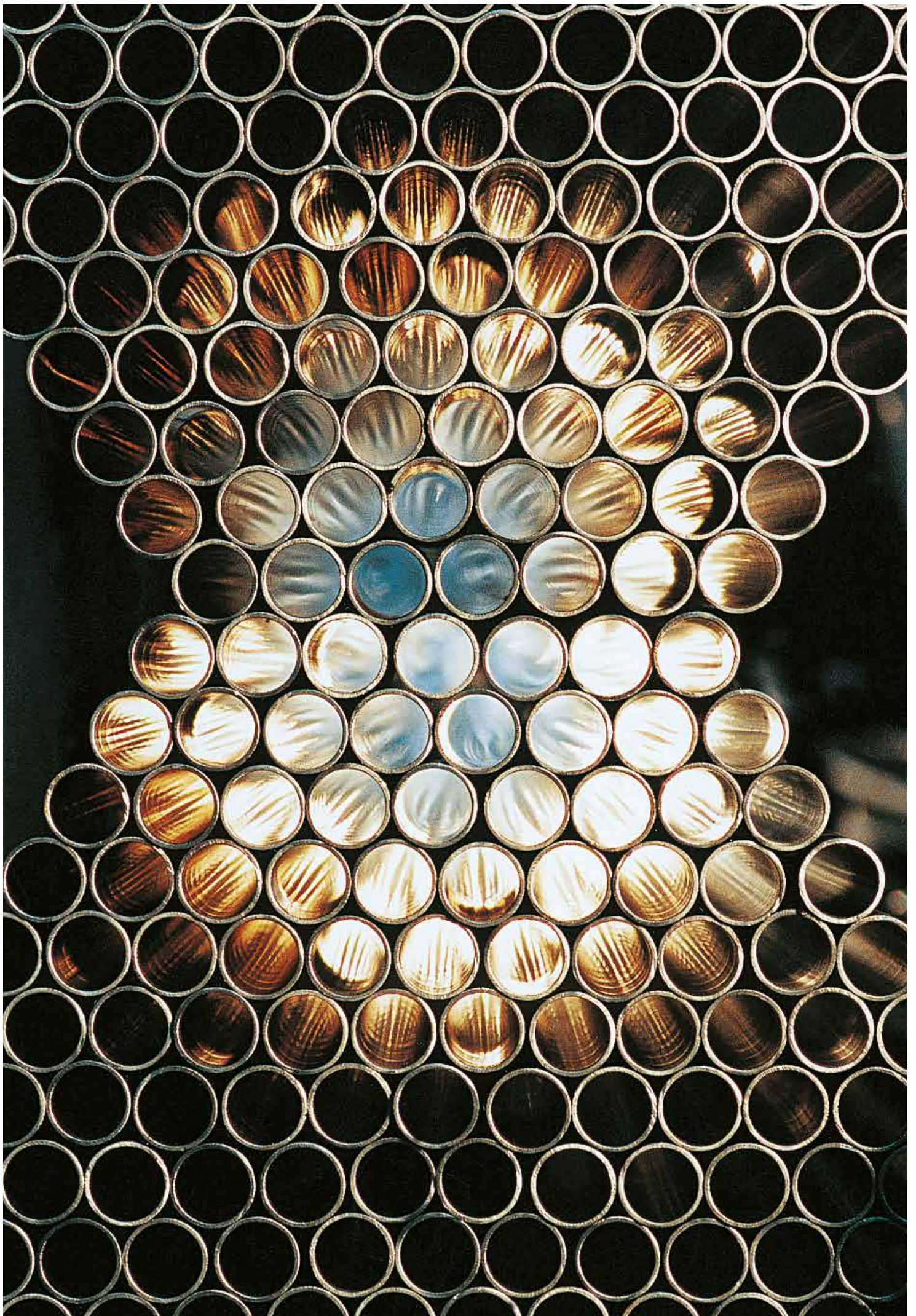
Optimum
dimensional
tolerances



Customized
steels
and sizes

Tenaris produces Cold Drawn seamless precision tubes in a wide dimensional range used for mechanical and engineering applications, satisfying the European norm EN 10305-1.

We can supply the tubes in different final treatment states according with customers' needs. Certain grades can be delivered with a limited sulfur content to assure superior machinability.



Chemical analysis

CHEMICAL ANALYSIS %

Grade	C	Si	Mn	P	S	V	Cr	Mo	Ni	Al	Ti
E235	≤ 0,17	0,15-0,35	0,40-1,20	≤ 0,025	≤ 0,025	-	-	-	-	-	-
E255	≤ 0,22	0,10-0,35	0,40-1,10	≤ 0,025	≤ 0,025	-	-	-	-	-	-
E355	≤ 0,20	0,15-0,35	1,00-1,60	≤ 0,025	≤ 0,025	-	-	-	-	-	-
E410	0,16-0,22	0,15-0,50	1,30-1,70	≤ 0,030	≤ 0,035	0,08-0,15	-	-	-	0,010-0,060	-
C10	0,07-0,13	0,15-0,40	0,30-0,60	≤ 0,035	≤ 0,035	-	-	-	-	-	-
20NICRMO2-2	0,17-0,23	0,15-0,40	0,65-0,95	≤ 0,035	≤ 0,035	-	0,35-0,70	0,15-0,25	0,40-0,70	-	-
16MNCRS5	0,14-0,19	≤ 0,40	1,00-1,30	≤ 0,035	0,020-0,040	-	0,80-1,10	-	-	-	-
C35	0,32-0,39	0,15-0,40	0,50-0,80	≤ 0,035	≤ 0,035	-	≤ 0,40	≤ 0,10	-	-	-
C45	0,42-0,55	0,15-0,40	0,50-0,80	≤ 0,035	≤ 0,035	-	≤ 0,40	≤ 0,10	-	-	-
C60	0,57-0,65	0,15-0,40	0,60-0,90	≤ 0,035	≤ 0,035	-	≤ 0,40	≤ 0,10	≤ 0,40	-	-
25CRMO4	0,22-0,29	0,15-0,40	0,60-0,90	≤ 0,035	≤ 0,035	-	0,90-1,20	0,15-0,30	-	-	≤ 0,050
30CrMo4	0,28-0,33	0,15-0,35	0,40-0,60	≤ 0,035	≤ 0,035	-	0,80-1,10	0,15-0,25	-	-	-
42CrMo4	0,38-0,45	0,15-0,40	0,60-0,90	≤ 0,035	≤ 0,035	-	0,90-1,20	0,15-0,30	-	-	-

Cold Drawn Feasibility Matrix

DIMENSIONAL TOLERANCES

● Dimensions feasible by Tenaris

mm toll. OD	DIAMETER																													
	16	18	20	22	24	26	28	30	32	35	38	40	42	45	48	50	55	60	65	70	75	80	85	90	95	100	110	120		
	±0,08								±0,15				±0,20				±0,25		±0,30		±0,35		±0,40		±0,45		±0,50			
1,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
4	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
4,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
5,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
6	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
7	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
7,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
8	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
9	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
10	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
11	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
12	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
14	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
15	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
16	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
17	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
18	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
22	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
25	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
27,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
30	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
32,5	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Mechanical properties

STEELS FOR MECHANICAL FABRICATION

Grade	N				SR			C		LC		A		
	Rs	Rm	Rm	A	Rs	Rm	A	Rm	A	Rm	A	HB	Rm	A
	(MPa) min	(MPa) min	(MPa) max	% min	(MPa) min	(MPa) min	% min	(MPa) min	% min	(MPa) min	% min	max	(MPa) min	% min
E235	235	340	480	25	350	420	16	480	6	420	10		315	25
E255	255	440	570	21	375	520	12	580	5	520	8		390	21
E355	355	490	630	22	450	580	10	640	4	580	7		450	23
E410	410	550	700	22	590	690	12	750	4	620	8		520	22
C10										540	7	131		
16MnCr55										670	6	207		
20NiCrMo2-										670	6	212		
C35	310	460		21				590	5	670	6		440	22
C45	340*	540		18				720	4				510	20
C60	380/340*	710/670*		10								260		
25CrMo4								720	4					
30CrMo4														
42CrMo4								720	4					

*For WT ≤ 16/ WT > 16 ≤ 100 mm

DIAMETER																												
130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390		
±0,70	±0,80	±0,90	±1,00	±1,10	±1,20	±1,30	±1,40	±1,50	±1,60	±1,70	±1,80	±1,90																
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	1,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	2
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	2,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	3
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	3,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	4
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	4,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	5,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	6
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	7
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	7,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	8
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	9
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	10
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	11
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	12
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	14
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	15
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	16
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	17
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	18
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	20
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	22
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	25
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	27,5
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	30
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	32,5

Eccentricity: $(Wt_{max} - Wt_{min}) / (Wt_{max} + Wt_{min}) * 100 \leq 10\%$ | WT Tolerance +/- 10% | The ID Tolerance are shown in the Grid



For further information
www.tenaris.com

For assistance please contact
standardmechanical@tenaris.com

