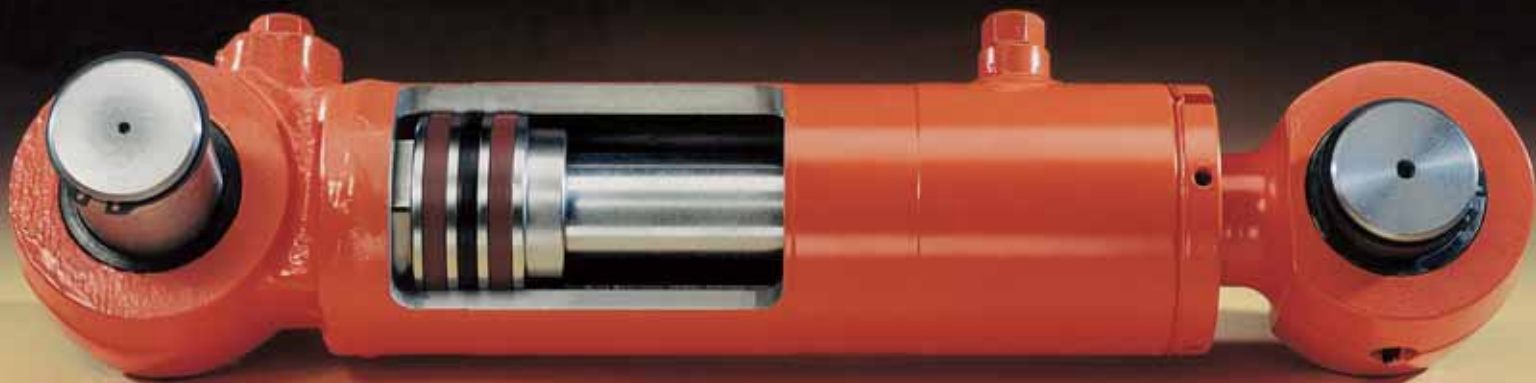




Industrial & Automotive  
Services

## Seamless precision steel tubes for hydraulic cylinders - TN 008-00



Tenaris produce a wide dimensional range of cold drawn seamless tubes suitable for the manufacturing of hydraulic cylinders. The tubes are produced with close tolerances in two dimensional series, one for skiving and roller burnishing and the other for honing on the internal diameter. Two grades of easily weldable steel are used; both grades can be supplied with inclusions specially treated in such a way as to guarantee better machinability.



Quality System Certified  
n. 110950

# Seamless precision steel tubes for hydraulic cylinders

## Product description and application

This specification is for cold-drawn seamless tubes suitable for hydraulic cylinder application. It defines the dimensions, tolerances, chemical composition, mechanical properties and technical conditions of supply.

The product can be supplied with two different series of machining allowance, "Series DL" and "Series DP".

The DL series is characterised by an internal machining allowance that makes the tubes suitable for being worked internally by honing.

The DP series is characterised by a machining allowance that allows skiving work with detachable chips and rolling on the internal diameter.

## Service Center

It is possible to request from the Tenaris Service Center additional work, including cutting to measure, chamfering, drilling, boring and agreeing quantity, marking and packaging different to that indicated in the present catalogue.

## 1. Definition of orders

### Particulars

- "Seamless precision steel tubes for hydraulic cylinders"
- Technical specification "TN 008 - 00"
- Steel grade
- Heat treatment
- Nominal dimensions - Internal diameter and wall thickness
- Machining allowance, series DP or DL
- Length
- Quantity and tolerance

### Options

- 0,020-0,035% controlled sulphur content to PHC 460 grade*
- Different mechanical properties, heat treatments or steel grades*
- Dimensions, tolerances or machining allowances different from the standard*
- Fixed lengths or in a range different to the standard*
- US inspection*
- Special surface protection*
- Different certification*
- Different marking*
- Special packing*

## 2. Standards of reference

- The overall Tenaris dimensional range is indicated in the table on pages 6-7 and includes the standard internal dimensions from 20 mm to 250 mm as specified by the ISO 3320/1987 standard "Fluid power systems and components".
- The external diameter tolerances conform to those specified on the EN10305-1 and DIN 2391/1.
- The following product Standards are used when referring to the steel grades:

### ISO 4394/1

1980 "Fluid power systems and components - Cylinder barrels"

### EN 10305-1

"Steel tubes for precision applications"

### BS 5242/1

1987 "Tubes for fluid power cylinder barrels"

### NF A 49-323

1978 "Vérins pour transmissions hydrauliques - tubes sans soudure laminés a froid ou étirés a froid"

and the following Standards for precision tubes:

### DIN 2391 part 2

1994 "Seamless precision steel tubes"

### NF A 49-310

1990 "Tubes sans soudure de précision pour usage mécanique"

- The present specification does not cover special applications (structural, pressure vessels, low temperatures, etc.), for which there are other Standards such as DIN 17179 for "Seamless circular tubes of fine grain steels for special requirements" and the EN 10216.

### 3. Steel grades

The product is supplied in two different types of steel, PHC 355 and PHC 460, with two possible delivery conditions, SR (Stress relieving treatment after cold drawing) or N (normalisation treatment after cold drawing), that have the following indicative correspondencies to the standards:

#### Option a

The PHC 460 grade can be produced with a controlled sulphur content of 0.020 - 0.035% to facilitate machinability.

#### Option b

Different heat treatments, mechanical properties and steel grades can be requested.

### 4. Dimensions and tolerances

The standard nominal dimensions and the production tolerances are detailed on the table on pages 6-7 for both the DL and DP series. By 'nominal dimensions' the dimensions of the finished cylinder are meant.

#### Outer diameter tolerances

According to DIN 2391/part 1 and EN10305-1 standards; O.D. > 260 the tolerance is  $\pm 1.3$  mm.

#### Inner diameter tolerances

In accordance with the DP and DL tables on pages 6-7.

#### Option c

It is possible to agree different dimensions, tolerances and machining allowances.

GRADE AND CORRESPONDING STANDARD								
TENARIS GRADE	DELIVERY CONDITION	ISO 4394	BS 5242	NF A 49323	NF A 49310	DIN 2391	DIN 17179	EN 10305-1
PHC 355	SR	HP 5	HP 5	Tu 52-b BKS	Tu 52-b BKS	St 52 BKS		E 355 SR
PHC 355	N					St 52 NBK		E 355 N
PHC 460	SR	HP 6	HP 6		Tu 20 MV6 BKS		StE460*	E 410 SR
PHC 460	N				Tu 20 MV6 NBK		StE460*	E 410 N

\* Chemical analysis

CHEMICAL ANALYSIS %								
GRADE	C	Mn	Si	P	S	Ni	V	
PHC 355	≤ 0.2	≤ 1.50	≤ 0.50	≤ 0.025	0.020 - 0.040			
PHC 460	≤ 0.2	≤ 1.70	≤ 0.50	≤ 0.025	< 0.015	≤ 0.80	≤ 0.20	

MECHANICAL PROPERTIES								
GRADE	DELIVERY CONDITION	TENSILE PROPERTIES				IMPACT TEST*		
		Rp02 (MPa)		Rm (MPa)	A %	Charpy KV Long		
		WALL THICKNESS				T °C	J min	
		≤ 16 mm	> 16 mm					
PHC 355	SR	520	490	600	14	-	-	
PHC 355	N	355	355	490 - 630	22	-20	27	
PHC 460	SR	620	620	700	15	-	-	
PHC 460	N	460	450	560 - 730	22	-20	27	

The impact test values indicated are meant to be calculated as the average of the three width samples  $W = 10$  mm. One individual value may be below the minimum, but not less than 70% of that value.

The certificate reports the dimension of the sample and the values measured in the test in J. If the sample width  $W$  is less than 10mm, the minimum requested KV10 values are reduced in the new  $KV_W$  value according to the formula:  $KV_W = KV_{10} \times (W/10)$

## Eccentricity

The following values of eccentricity are guaranteed:

OUTSIDE DIAMETER	ECCENTRICITY*
≤ 125 mm	0.05
> 125 mm	0.07

\* Eccentricity is measured according to the formula:

$$\frac{(WT_{max} - WT_{min})}{(WT_{max} + WT_{min})}$$

Where WT<sub>max</sub> and WT<sub>min</sub> are understood to be measured on the same section

## Ovality

Ovality is guaranteed within the diameter tolerances

## External straightness

### Local deviation from straightness:

max 1 mm per each meter of length. It shall be measured as the distance between the tube surface and a chord linking two random points 1000 mm apart.

### Total deviation from straightness:

max 3,5 mm for tubes with length less than 6 m; for tubes with length greater than 6 m, the tolerance shall be increased by 0,5 mm for each 1 m over 6 m

## 5. Lengths

The length range is between 5.5 – 9 m. The average production length varies according to the dimensions. For every dimension the length is variable within a range of 2 m.

### Option d

*Manufacture of tubes in fixed lengths or in a range of lengths different to standard can be agreed upon.*

## 6. Inspection and testing

The following tests are carried out

- Tensile tests (according to those required by EN10305-1)
- Electromagnetic check on every tube according to EN 10246-3 level 3
- Visual and dimensional check on every tube

### Option e

*Ultrasonic inspection can be agreed upon.*

## 7. Protection of the surfaces

The product is supplied with a cold finished surface. The tubes are protected internally and externally with an oil that provides temporary protection against oxidation

### Option f

*Special surface protection can be agreed upon.*

## 8. Certification

The product is supplied with 3.1.B certificate, in accordance with EN 10204 and ISO 10474.

Tenaris work with complete product traceability. The cast number is indicated on the 3.1.B control certificate and is carried on every tube.

### Option g

*Certification in accordance with 3.1.C or 3.2 can be agreed upon at time of ordering. In case a 3.2 certificate is requested, the customer must notify at the time of ordering the organisation or the individual responsible who must conduct the inspection.*

## 9. Identification and marking

The identification of the tubes for cylinder is carried out through the following continuous marking, in indelible ink, along the entire length:

- Product mark
- specification number
- nominal ID x WT
- dimensional series (DP o DL)
- steel grade + Delivery condition
- cast number

### Option h

*Different marking can be agreed upon at the time of ordering*

## 10. Packing

The tubes are packed in strapped bundles.

The minimum weight is as shown:

OUTSIDE DIAMETER	MINIMUM BUNDLE WEIGHT
30 - 100 mm	1500 kg
> 100 - 160 mm	2000 kg
> 160 mm	2000 kg and 4 pieces

The maximum weight of the bundle is 5000kg with a minimum of 4 pieces.

### Option i

*Other types of packing can be agreed upon at time of ordering:*

- wrapped in polyethylene sheets.
- bungs at the ends

## 11. Minimum quantity supplied

The minimum quantity supplied varies based upon the dimensions and additional requirements (options) and have to be agreed upon when ordering.

The tolerance on quantity is ± 10% for each lot.

Tenaris offers technical consultancy for the planning and use of custom-made products.

STANDARD DIMENSIONS AND TOLERANCES: DL SERIES

INSIDE DIAMETER	WALL THICKNESS											
	mm		5	6	7.5	10	12.5	15	17.5	20	22.5	
20												
25												
30			- 0.15 - 0.35		- 0.20 - 0.40							
35												
40												
45												
50												
55												
60					- 0.20 - 0.45							
63												
65												
70												
75												
80					- 0.25 - 0.55							
85												Eccentricity 0.05
90												0.07
95												
100												
105												
110												
115												
120						- 0.30 - 0.70						
125												
130												
135												
140												
145												
150						- 0.30 - 0.80						
155												
160												
165												
170												
175												
180												
185			- 0.40 - 1.20									
190												
195												
200												
205												
210												
215												
220												
225												
230												
235												
240												
245												
250												
260												
265												

Tolerance and machining allowance values are in mm  
 Dimensions outside of the areas indicated can be produced upon request

STANDARD DIMENSIONS AND TOLERANCES: DP SERIES

INSIDE DIAMETER mm	WALL THICKNESS									
		5	6	7.5	10	12.5	15	17.5	20	22.5
20										
25										
30			- 0.35	- 0.55						
35										
40										
45										
50										
55										
60										
63										
65			- 0.40	- 0.70						
70										
75										
80										Eccentricity
85										0.05
90										0.07
95										
100										
105										
110										
115										
120					- 0.50	- 0.90				
125										
130										
135										
140										
145										
150					- 0.50	- 1.00				
155										
160										
165										
170										
175										
180			- 0.60	- 1.40						
185										
190										
195										
200										
205										
210										
215										
220										
225										
230										
235										
240										
245										
250										
260										
265										

Tolerance and machining allowance values are in mm  
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