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Products special abrasion and sheets:**Milano:** 20040 Cambiagio - Via R. Sanzio, 7 - Tel. +39 02.95347200**Modena:** 41100 Modena - Via Salvador Allende, 63 - Tel. +39 059.251616**IMS S.p.A. - Headquarters:**

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Internet: www.ims.it www.paginegialle.it/imsspa E-mail: ims.italia@ims-group.com**Tubes division**

Seamless precision steel tubes for hydraulic cylinders, with the exclusive right on the Italian territory.

Authorized distributor **TenarisDalmine**



IMS S.p.A. distributes a wide dimensional range of cold-drawn seamless precision tubes used to manufacture hydraulic cylinders. Tubes are produced with two dimensional series with limited tolerance values, whose internal diameter can be either skived and roller burnished or honed. We use two different grades of easily weldable steel, both of which can be supplied with specially treated inclusions, so as to guarantee an improved tool machinability.

Seamless precision steel tubes for hydraulic cylinders



Product description and applications

This technical specification applies to cold-drawn seamless tubes used to manufacture hydraulic cylinders, and it defines their dimensions, tolerances, chemical composition, mechanical characteristics and technical supply conditions.

The product can be supplied with two different series of machining allowances, either the "DL Series" or the "DP Series".

The DL series is characterised by a limited internal machining allowance which makes the tubes suitable for honing and/or lapping operations.

The DP series includes a kind of machining allowance which makes it possible for the tubes to undergo both skiving treatments with detachable chips and roller burnishing on their internal diameter.

Service Centre

IMS S.p.A. has various Service Centres at its disposal, where it is possible to ask for additional machining operations, such as custom-made cuts, chamfering, drilling and boring, as well as to agree on quantities, markings, and packaging different from the ones included in this catalogue.

1. Order definition

Essential data

- Product: "Seamless precision tube for hydraulic cylinders"
- Steel grade
- Heat treatment
- Nominal dimensions: Internal diameter x Wall thickness
- Machining allowance series: DP or DL
- Lengths
- Quantities and tolerance values

Options

- a) Controlled sulphur content of 0.020-0.035% on the PHC 460 grade
- b) Different mechanical properties, heat treatments or steel grades
- c) Non-standard dimensions, tolerance values and machining allowances
- d) Non-standard lengths
- e) US control
- f) Different surface protections
- g) Different certifications
- h) Different markings
- i) Different packaging

2. Reference standards

- The overall dimensional range of the products supplied by IMS S.p.A. is listed in the tables on pages 6 and 7 and it includes internal standard diameters ranging from 30 to 265 mm, as provided for by the ISO 3320/1987 standard titled "Fluid power systems and components".
- The tolerance values on the external diameter comply with the ones foreseen by the EN10305-1 and DIN 2391/1 standards.
- The steel grades refer to the following product standards:

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 à froid ou étirés à froid"

as well as to 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"

- This specification does not apply to special application fields (structural applications, pressure vessels, low temperatures, etc.), which should refer to specific standard norms such as the DIN 17179 standard for "Seamless steel tubes with thin grain for special applications" and the EN 10216 standard.

3. Steel grades

The supplied products can be made out of two different types of steel, either the PHC 355 or the PHC 460 type, and they can be supplied in two different supply conditions, either SR (stress relieving thermal treatment after the last cold-drawing operation) or N (normalizing treatment after the last cold-drawing operation). Such supply conditions correspond to the following standards:

A Option

The PHC 460 grade can be produced with a controlled sulphur content of $0.020 \div 0.035\%$, so as to allow a better tool machinability.

B Option

It is possible to ask for different heat treatments, mechanical properties and steel grades.

4. Dimensions and tolerance values

The standard nominal dimensions and the production tolerance values for the DL and the DP series are detailed in the tables on pages 6 and 7. The nominal dimension corresponds to the dimension of the finished cylinders.

Tolerances on the external diameter

In compliance with the standard norms DIN 2391/Part 1 and EN10305-1; with an outside diameter > 260 , the tolerance value amounts to ± 1.3 mm.

Tolerances on the internal diameter

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

C Option

It is possible to ask for different dimensions, tolerance values and machining allowances.

GRADES AND CORRESPONDING STANDARDS								
TENARIS GRADE	SUPPLY CONDITIONS	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	$\leq 0,20$	$\leq 1,50$	$\leq 0,50$	$\leq 0,025$	$0,020 \div 0,040$			
PHC 460	$\leq 0,20$	$\leq 1,70$	$\leq 0,50$	$\leq 0,025$	$< 0,015$	$\leq 0,80$	$\leq 0,20$	

MECHANICAL PROPERTIES								
GRADE	SUPPLY CONDITIONS	TENSILE PROPERTIES				IMPACT STRENGTH*		
		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	$490 \div 630$	22	-20	27	
PHC 460	SR	620	620	700	15	-	-	
PHC 460	N	460	450	$560 \div 730$	22	-20	27	

The single values are to be intended as minimum values.

(*) The impact strength values indicated above are obtained by calculating the average value of three 10 mm wide specimens. A single value can be lower than the minimum value needed, but higher than 70% of such value.

The certification includes information on the specimen dimensions and the values measured during the test, expressed in J. If the specimen is less than 10 mm wide, the minimum KV_{10} values needed are reduced to the new KV_w value according to the following formula: $KV_w = KV_{10} \times (W/10)$

Eccentricity

We guarantee the following values of eccentricity:

EXTERNAL DIAMETER	ECCENTRICITY*
≤ 125 mm	0,05
> 125 mm	0,07

* The eccentricity degree is calculated by applying the following formula:

$$\frac{(\text{max. thickness} - \text{min. thickness})}{(\text{max. thickness} + \text{min. thickness})}$$

The maximum and the minimum thickness have to be measured on the same section.

Ovality

The ovality degree is included in the tolerance values of the diameters.

Straightness

Partial camber: 1 mm per metre of length, to be measured with a 1 m long ruler.

Total camber: max 3.5 mm for tubes with length ≤ 6 m.
max 3.5 mm + 0.5 mm per each metre after the sixth one

5. Length

The standard length of the supplied products goes from 5.5 to 9 m, varying according to the dimension; we foresee a range of 2 metres for each dimension.

D Option

It is possible to ask for tubes with non-standard fixed or varying lengths.

Service Centre

The Service Centre can supply fixed length cuts with tolerance values of - 0 + 5 mm; 0 + 3 mm with a maximum cutting verticality of 1.5 mm.

6. Controls and tests

Our products undergo the following tests:

- Tensile stress test (according to the EN10305-1 standard)
- Electromagnetic test on each tube according to the EN 10246-3 standard, E3 level
- Visual and dimensional control of each tube.

E Option

It is possible to agree on carrying out a non-destructive ultrasonic test.

7. Surface protection

The surface of the supplied products is cold-finished. The tubes are protected with oil both internally and externally, so as to guarantee a temporary protection against oxidation under cover.

F Option

It is possible to ask for specific surface protections.

8. Certification

All the supplied products have obtained a 3.1 acceptance test certification, according to the EN 10204 and ISO 10474 standards.

IMS S.p.A. guarantees the total traceability of its products. The cast number reported on the specific 3.1 acceptance test certification is also written on each tube.

G Option

At the moment of the order, it is possible to ask for a 3.2 certification. Should a 3.2 certification be necessary, then the customer will have to inform the organisation or the person who is responsible for the inspection as soon as the order is sent.

9. Identification and marking

In order to be identified, the tubes for cylinders are marked with indelible ink on their total length. The following information is written on the tubes:

- Manufacturer's trademark
- Specification No
- Internal diameter x nominal wall thickness
- Dimensional series (DP or DL)
- Steel grade + supply condition
- Cast No

H Option

It is possible to ask for different markings.

10. Packaging

The tubes are packed in strapped bundles.

STANDARD DIMENSIONS AND TOLERANCE VALUES: DL SERIES											
		WALL THICKNESS									
mm		5	6	7,5	10	12,5	15	17,5	20	22,5	
INTERNAL DIAMETER	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										Eccentricità 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											

The tolerance values and the machining allowances are expressed in mm.
 Upon request, it is possible to produce tubes with dimensions which are not included in the table.

STANDARD DIMENSIONS AND TOLERANCE VALUES: DP SERIES											
		WALL THICKNESS									
mm		5	6	7,5	10	12,5	15	17,5	20	22,5	
INTERNAL DIAMETER	30		- 0,35	- 0,55							
	35										
	40										
	45										
	50										
	55										
	60										
	63										
	65			- 0,40	- 0,70						
	70										
	75										
	80										
	85										Eccentricità 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											
185			- 0,60	- 1,40							
190											
195											
200						- 0,70	- 1,20				
205											
210											
215											
220											
225											
230											
235											
240						- 0,80	- 1,40				
245											
250											
260											
265											

The tolerance values and the machining allowances are expressed in mm.
 Upon request, it is possible to produce tubes with dimensions which are not included in the table.