Click Here

Metric Tube

The Fitting Authority

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

Introduction

Parker offers three types of seamless metric tubes for hydraulic, pneumatic and instrumentation applications:

- Steel seamless cold drawn tube, phosphate and oil dipped for corrosion resistance
- Steel seamless cold drawn tube, zinc Chromium-6 free plating for corrosion resistance
- Stainless steel cold drawn tube

Conformance and Material Specifications

Tests and Certificates

All tubes are subjected to a non-destructive leak test and marked accordingly. This marking is used in lieu of a works certificate DIN 50 049-2-2. Test Class 1 DIN 17458 Table 7 applies for tubes made of 1.4571 material.

Materials and Mechanical Properties

Steel Types, mechanical properties and conditions are listed in Table R1.

Welding Suitability and Weldability:

- Steel tubes of St. 37.4, R Series, are weldable according to usual techniques.
- Not recommended to weld St. 37.4, R-VZ series, Zinc Chromium-6 Free plated tubes.

Stainless steel tubes of 1.4571 are suitable for arc welding. The welding filler should be selected in accordance with DIN 8556 part 1 taking into account the type of application and the welding technique.

Assembly and Installation

Please refer to Section T for the assembly and installation instructions for Metric Tube fittings.

Applications

Recommended Bend Radius

A bend radius of 3 times the tube O.D. or greater is recommended for cold bending of Parker tubes with hand, mechanical and power bending equipment.

Use of Tube Supports

The use of VH tube supports for EO and EO-2 fittings is required in certain thinner wall tubes to ensure proper assembly. Consult the tube charts.

Temperature Range

- Parker steel (St. 37.4) metric seamless tube can be used at the full rated working pressures without pressure rating reductions within the following temperature range: -40°C to +120°C. Maximum allowable operating temperature of +250°C.
- Parker stainless steel (1.4571) metric seamless tube can be used at full rated working pressures with-out pressure reductions within the following temperature ranges: -200°C to 350°C (-60 to +20). Maximum allowable operating temperature of +400°C. Elevated temperature pressure reductions are as listed in Table R2.

As Delivered Conditions:

Standard Tube Lengths: 6 meters (approx. 20 ft)

Surface Finish:

- Steel (St. 37.4): Phosphated and oiled
  - I.D. dimensions 1.5 – 5 mm, outside and inside oiled
  - I.D. dimensions 6 mm and higher, outside and inside phosphated and oiled
- Steel (St. 37.4) R-VZ Series: Zinc Chromium-6 Free

Parker Series	Material	Tensile Strength	Yield Strength	% Elongation	Condition
R Series	Steel, fine grain quality (RR) St 37.4 per DIN 1630	340 N/mm² min. 49,000 PSI	235 N/mm² min. 34,000 PSI	25% min.	Seamless, cold drawn under inert gas, normal annealed, abbreviation NBK DIN 2391C, Part 2
R-71 Series	1.4571 X6CrNiMoTi17122	500 N/mm² min. 72,500 PSI	245 N/mm² min. 35,500 PSI	35% min.	Seamless, cold drawn free of scale, heat treated in accordance with DIN 17458 tab. 6

Table R1 — Parker Steel tubes mechanical properties and conditions

Temperature	Material	-60° up to +20° C	50° C	100° C	200° C	300° C	400° C
Pressure reductions in %	1.45	—	4.5	11	20	29	33

Note: Interpolation is acceptable for intermediate temperautre level.

Table R2 — Parker stainless tube elevated temperature derating factors

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

Seamless EO Steel Tubes

Material St. 37.4

St. 37.4 Phosphated & Oiled Part No.	St. 37.4 Zinc Plated & Chromium-6 Free Part No.	End Size (mm)	Toler-ance	Wall Thickness (mm)	Tube I.D. (mm)	Design Pressure (bar) DIN 2413 I Static	Design Pressure (bar) DIN 2413 III Dynamic	Burst Pressure (bar)	Weight (kg/m)	STANDARD FROM STOCK Phos & Oil	STANDARD FROM STOCK CF
R04x0.5	R04x0.5VZ	4		0.5	3	313	274	1160	0.047	•	
R04x0.75	R04x0.75VZ	4	±0.1	0.75	2.5	409	393	1820	0.063		
R04x1	R04x1VZ	4		1	2	522	502	2850	0.074	•	•
R05x1	R05x1VZ	5	±0.1	1	3	432	416	2120	0.099		•
R06x0.75	R06x0.75VZ	6		0.75*	4.5	333	289	1230	0.103		
R06x1	R06x1VZ	6		1	4	389	374	1680	0.123	•	•
R06x1.5	R06x1.5VZ	6	±0.1	1.5	3	549	528	3050	0.166	•	•
R06x2	R06x2VZ	6		2	2	692	665		0.197	•	
R06x2.25	R06x2.25VZ	6		2.25	1.5	757	728		0.208		
R08x1	R08x1VZ	8		1	6	333	289	1190	0.172	•	•
R08x1.5	R08x1.5VZ	8	±0.1	1.5	5	431	414	1860	0.240	•	•
R08x2	R08x2VZ	8		2	4	549	528	3020	0.296	•	•
R08x2.5	R08x2.5VZ	8		2.5	3	658	632		0.339		
R10x1	R10x1VZ	10		1	8	282	249	870	0.222	•	•
R10x1.5	R10x1.5VZ	10		1.5	7	373	358	1380	0.314	•	•
R10x2	R10x2VZ	10	±0.1	2	6	478	460	2100	0.395	•	•
R10x2.5	R10x2.5VZ	10		2.5	5	576	553	3180	0.462		
R10x3	R10x3VZ	10		3	4	666	641		0.518	•	
R12x1	R12x1VZ	12		1	10	235	210	760	0.271	•	•
R12x1.5	R12x1.5VZ	12		1.5	9	353	305	1150	0.388	•	•
R12x2	R12x2VZ	12	±0.08	2	8	409	393	1580	0.493	•	•
R12x2.5	R12x2.5VZ	12		2.5	7	495	476	2600	0.586	•	
R12x3	R12x3VZ	12		3	6	576	553	3200	0.666		
R12x3.5	R12x3.5VZ	12		3.5	5	651	627		0.734		
R14x1	R14x1VZ	14		1*	12	201	182	620	0.321		
R14x1.5	R14x1.5VZ	14		1.5	11	302	265	940	0.462	•	
R14x2	R14x2VZ	14		2	10	403	343	1340	0.592	•	•
R14x2.5	R14x2.5VZ	14	±0.08	2.5	9	434	417	1760	0.709		
R14x3	R14x3VZ	14		3	8	507	487	2400	0.814		
R14x3.5	R14x3.5VZ	14		3.5	7	576	553	3220	0.906		
R14x4	R14x4VZ	14		4	6	641	616		0.986		
R15x1	R15x1VZ	15		1*	13	188	171	590	0.345	•	•
R15x1.5	R15x1.5VZ	15		1.5	12	282	249	980	0.499	•	•
R15x2	R15x2VZ	15	±0.08	2	11	376	323	1250	0.641	•	•
R15x2.5	R15x2.5VZ	15		2.5	10	409	393	1690	0.771		
R15x3	R15x3VZ	15		3	9	478	460	2120	0.888		
R16x1	R16x1VZ	16		1*	14	176	160	540	0.370		
R16x1.5	R16x1.5VZ	16		1.5	13	264	234	820	0.536	•	•
R16x2	R16x2VZ	16	±0.08	2	12	353	305	1170	0.691	•	•
R16x2.5	R16x2.5VZ	16		2.5	11	386	372	1470	0.832	•	•
R16x3	R16x3VZ	16		3	10	452	435	1920	0.962	•	•
R18x1	R18x1VZ	18		1*	16	157	143	510	0.419	•	
R18x1.5	R18x1.5VZ	18		1.5	15	235	210	780	0.610	•	•
R18x2	R18x2VZ	18	±0.08	2	14	313	274	1040	0.789	•	•
R18x2.5	R18x2.5VZ	18		2.5	13	392	335	1320	0.956	•	
R18x3	R18x3VZ	18		3	12	409	393	1830	1.111		

* Tubes which need a support sleeve (VH) for assembly in EO and EO-2 fittings.

Table R3 — Seamless EO steel tubes

Pressure Calculations:

Calculation pressures given are according to DIN 2413 Part 1 for **static stress**

$$P = \frac{20 \cdot K \cdot s \cdot c \text{ (bar)}}{S \cdot d_a}$$

Material characteristic value K=235 N/mm²

and

DIN 2413 part III for **dynamic stress**

$$P = \frac{20 \cdot K \cdot s \cdot c \text{ (bar)}}{S \cdot (da + s \cdot c)}$$

Material characteristic value K=226 N/mm² (permanent fatigue strength)

Safety correction value S=1.5 for static and dynamic stress.

Factor “c” for consideration of wall thickness **divergence for static and dynamic stress** =0.8 for tube o.d. 4 and 5; 0.85 for tube o.d. 6 and 8; 0.9 for larger tube o.d.

d_a = Tube O.D. in mm

s = Wall thickness in mm

Standard Tube Length:

• 6 m (19.7 ft.)

Conversion Factors:

• Bar x 14.5 = psig
• kg/m x 0.672 = lbs/ft
• N/mm² x 145 = lb/in²

See Remarks on page R5.

Seamless EO Steel Tubes (cont'd.)

St. 37.4 Phosphated & Oiled Part No.	St. 37.4 Zinc Plated & Chromium-6 Free Part No.	End Size (mm)	Toler-ance	Wall Thickness (mm)	Tube I.D. (mm)	Design Pressure (bar) DIN 2413 I Static	Design Pressure (bar) DIN 2413 III Dynamic	Burst Pressure (bar)	Weight (kg/m)	STANDARD FROM STOCK Phos & Oil	STANDARD FROM STOCK CF
R20x1.5	**R20x1.5VZ**	20		1.5*	17	212	191	570	0.684	•	
R20x2	**R20x2VZ**	20		2	16	282	249	920	0.888	•	•
R20x2.5	**R20x2.5VZ**	20	±0.08	2.5	15	353	305	1220	1.079	•	•
R20x3	**R20x3VZ**	20		3	14	373	358	1450	1.258	•	•
R20x3.5	**R20x3.5VZ**	20		3.5	13	426	410	1720	1.424		
R20x4	**R20x4VZ**	20		4	12	478	460	2080	1.578	•	
R22x1.5	**R22x1.5VZ**	22		1.5	19	192	174	590	0.758	•	•
R22x2	**R22x2VZ**	22	±0.08	2	18	256	228	850	0.986	•	•
R22x2.5	**R22x2.5VZ**	22		2.5	17	320	280	1040	1.202	•	
R22x3	**R22x3VZ**	22		3	16	385	329		1.406		
R25x2	**R25x2VZ**	25		2	21	226	202	670	1.134	•	•
R25x2.5	**R25x2.5VZ**	25		2.5	20	282	249	920	1.387	•	•
R25x3	**R25x3VZ**	25	±0.08	3	19	338	294	1050	1.628	•	•
R25x4	**R25x4VZ**	25		4	17	394	379	1520	2.072	•	
R25x4.5	**R25x4.5VZ**	25		4.5	16	437	420	1780	2.275		
R25x5	**R25x5VZ**	25		5	15	478	460	2120	2.466		
R28x1.5	**R28x1.5VZ**	28		1.5	25	151	139	450	0.980		
R28x2	**R28x2VZ**	28		2	24	201	182	620	1.282	•	•
R28x2.5	**R28x2.5VZ**	28	±0.08	2.5	23	252	224	770	1.572	•	
R28x3	**R28x3VZ**	28		3	22	302	265	920	1.850	•	
R28x4	**R28x4VZ**	28		4	20	403	343		2.368		
R28x5	**R28x5VZ**	28		5	18	434	417		2.836		
R30x2	**R30x2VZ**	30		2*	26	188	171	620	1.381	•	
R30x2.5	**R30x2.5VZ**	30		2.5	25	235	210	770	1.695	•	
R30x3	**R30x3VZ**	30	±0.08	3	24	282	249	920	1.998	•	•
R30x4	**R30x4VZ**	30		4	22	376	323	1250	2.565	•	•
R30x5	**R30x5VZ**	30		5	20	409	393	1580	3.083		
R35x2	**R35x2VZ**	35		2	31	161	147	470	1.628	•	•
R35x2.5	**R35x2.5VZ**	35		2.5	30	201	182	620	2.004		
R35x3	**R35x3VZ**	35	±0.15	3	29	242	216	720	2.367	•	•
R35x4	**R35x4VZ**	35		4	27	322	281	960	3.058	•	
R35x5	**R35x5VZ**	35		5	25	403	343		3.699		
R35x6	**R35x6VZ**	35		6	23	419	403		4.291		
R38x2.5	**R38x2.5VZ**	38		2.5*	33	186	168	550	2.189		
R38x3	**R38x3VZ**	38		3	32	223	200	660	2.589	•	
R38x4	**R38x4VZ**	38	±0.15	4	30	297	261	970	3.354	•	•
R38x5	**R38x5VZ**	38		5	28	371	319	1350	4.069	•	•
R38x6	**R38x6VZ**	38		6	26	390	375		4.735	•	
R38x7	**R38x7VZ**	38		7	24	446	429		5.352	•	
R42x2	**R42x2VZ**	42		2*	38	134	124	390	1.973	•	•
R42x3	**R42x3VZ**	42	±0.2	3	36	201	182	580	2.885	•	•
R42x4	**R42x4VZ**	42		4	34	269	238	850	3.749	•	
R50x6	**R50x6VZ**	50	±0.2	6	38	338			6.511		
R50x9	**R50x9VZ**	50		9	32	437			9.100		
R65x8	**R65x8VZ**	65	±0.3	8	49	347			11.246		
R80x10	**R80x10VZ**	80	±0.35	10	60	353			17.263		

* Tubes which need a support sleeve (VH) for assembly in EO and EO-2 fittings.

Table R3 — Seamless EO steel tubes (cont'd.)

Material St. 37.4

Remarks:

Corrosion — Additional allowances are not considered for the calaculation of pressures

$$\frac{\text{da (bar)}}{\text{di max.}} \geq 1.35$$

are calculated for static stress in accordance with DIN 2413 Part III, but with K = 235 N/mm^2

When a specific factor of safety is required, calculations should be based upon the burst pressures shown in the above tables.

Temperature range: -40°C up to 120°C without pressure reductions.

Surface finish:

Tubes with I.D. 1.5 to 5 mm: outside and inside oiled.

Tubes from 6 mm I.D. and above: outside and inside phosphated and oiled.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

Seamless EO Stainless Steel Tubes

Material-No.: 1.4571

Part No.	End Size (mm)	Toler-ance	Wall Thickness (mm)	Tube I.D. (mm)	Design Pressure (bar) DIN 2413-1 Static	Design Pressure (bar) DIN 2413-1 Dynamic	1.4571 Burst Pressure (bar)	Weight (kg/m)	STANDARD FROM STOCK Stainless Steel (71)
R6x171	6	±0.1	1	4	426	330	2340	0.125	•
R8x171	8	±0.1	1	6	368	256	1660	0.175	•
R8x1.571	8		1.5	5	472	366	2800	0.244	•
R10x171	10		1	8	294	209	1290	0.225	•
R10x1.571	10	±0.1	1.5	7	389	301	1930	0.319	•
R10x271	10		2	6	498	386	3100	0.401	•
R12x171	12		1	10	245	177	1220	0.275	•
R12x1.571	12	±0.08	1.5	9	368	256	1580	0.394	•
R12x271	12		2	8	426	330	2380	0.501	•
R14x1.571	14		1.5	11	315	223	1550	0.469	•
R14x271	14	±0.08	2	10	420	289	2180	0.601	•
R14x2.571	14		2.5	9	452	351	2800	0.720	
R15x171	15		1*	13	196	143	860	0.351	•
R15x1.571	15	±0.08	1.5	12	294	209	1140	0.507	•
R15x271	15		2	11	392	271	1750	0.651	
R16x271	16		2	12	368	256	1800	0.701	•
R16x2.571	16	±0.08	2.5	11	403	312	2120	0.845	
R16x371	16		3	10	472	366	2800	0.977	
R18x1.571	18	±0.08	1.5	15	245	177	1050	0.620	•
R18x271	18		2	14	327	230	1520	0.801	•
R20x271	20		2	16	294	209	1250	0.901	•
R20x2.571	20	±0.08	2.5	15	368	256	1550	1.095	
R20x371	20		3	14	389	301	1960	1.277	•
R22x1.571	22	±0.08	1.5	19	200	146	720	0.770	•
R22x271	22		2	18	267	192	1020	1.002	
R25x2.571	25	±0.08	2.5	20	294	209	1190	1.408	•
R25x371	25		3	19	353	247	1520	1.653	
R28x1.571	28	±0.08	1.5	25	158	117	620	0.995	
R28x271	28		2	24	210	153	880	1.302	•
R30x371	30	±0.08	3	24	294	209	1140	2.028	
R30x471	30		4	22	392	271	1650	2.605	•
R35x271	35	±0.15	2	31	168	124	670	1.653	•
R38x471	38	±0.15	4	30	309	219	1240	3.405	
R38x571	38		5	28	387	268	1680	4.131	
R42x271	42	±0.2	2*	38	140	104	520	2.003	•
R42x371	42		3	36	210	153	860	2.930	

* Tubes which need a support sleeve (VH) for assembly in EO and EO-2 fittings.

Table R4 — Seamless EO stainless steel tubes

Pressure Calculation:

Pressure calculation given are according to DIN 2413 part I for **static stress**

$$P = \frac{20 \cdot K \cdot s \cdot c \text{ (bar)}}{S \cdot d_a}$$

Material characteristic value K=235 N/mm² (1.4571), K=235 N/mm² (1.4571) (1% proof stress)

Safety factor S = 1.5

Factor “c” for consideration of wall thickness divergence: 0.9

d_a = Tube O.D. in mm

s = Wall thickness in mm

Remarks:

Corrosion — Additional allowances are not considered for the calculation of pressures.

Tubes with a diameter ratio da/di ≥ 1.35 are calculated according to DIN 2413 part III (formula see page R4) with above characteristic K value.

Conversion Factors:

- Bar x 14.5 = psig
- kg/m x 0.672 = lbs/ft
- N/mm² x 145 = lb/in²

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd