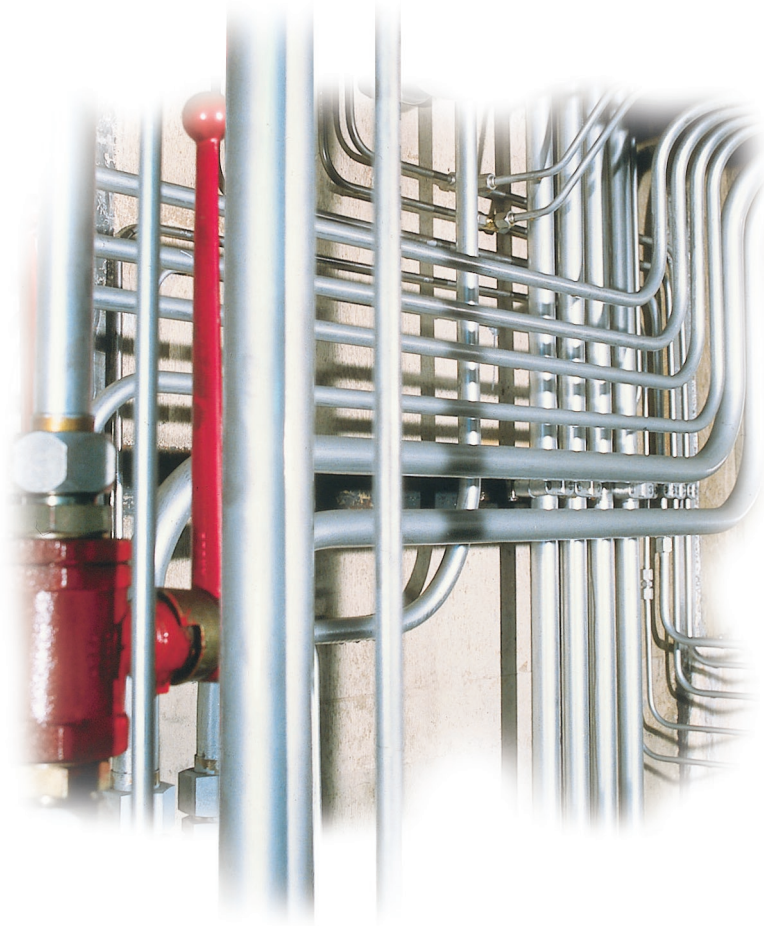


# Sandvik **THT**



## Seamless **stainless tubes**

FOR HYDRAULIC AND INSTRUMENTATION SYSTEMS



# Steel grades

STANDARDS					CHEMICAL COMPOSITION (NOMINAL), %						MECHANICAL PROPERTIES		
SANDVIK	UNS/ ASTM TP	EN Steel number	SS	AFNOR	W.-NR.	C	Cr	Ni	Mo	OTHERS	PROOF STRENGTH R <sub>p0.2</sub> MPa min.	TENSILE STRENGTH R <sub>m</sub> MPa min.	ELONG. A % min.
<b>3R12</b>	304L	1.4306	2352	Z2CN18-10	1.4306	≤0.030	18.5	10	–	–	210	515–680	45
<b>3R60</b>	316L	1.4435	2353	Z2CND17-13	1.4435	≤0.030	17.5	13	2.6	–	220	515–690	45
<b>6R35</b>	321	1.4541	2337	(Z6CNT18-10)	1.4541	0.05	17.5	10.5	–	Ti	210	515–690	45
<b>5R75</b>	(316 Ti)*	1.4571	2350	(Z6CNDT17-12)	1.4571	0.05	17	12	2.1	Ti	220	510-710	45
<b>SAF 2304</b>	S32304	1.4362	2327	Z2CN23-04AZ	1.4362	≤0.030	23	4.5	–	N	400	600–820	25
<b>2RK65</b>	N08904	1.4539	2562	Z1NCUDU25-20-04	1.4539	≤0.020	20	25	4.5	Cu	230	520-720	35
<b>Sanicro 28</b>	N08028	1.4563	2584	Z1NCUDU31-27-03	1.4563	≤0.020	27	31	3.5	Cu	220	550-750	40

Steel grades stated in our main catalogue, S-I 110, including titanium can be delivered on request.

Sandvik SAF 2304 is a trademark owned by Sandvik Materials Technology.

\* Not valid for tube. Only information.

## Tolerances

### Hydraulic tubing

#### Sandvik 3R12, 3R60, 6R35 and 5R75

OD mm	TOLERANCE mm	WALL THICKNESS %
6-30	±0.08	±10
32-40	±0.15	±10
42	±0.20	±10

#### Sandvik 3R60 and 5R75

##### OD <6 mm, tolerances according to ASTM A632

OD mm	TOLERANCE mm	WALL THICKNESS %
< 6- 4.76	+0.10/-0 mm	±10
< 4.76- 2.38	+0.08/-0 mm	±10
< 2.38	+0.05/-0 mm	±10

Sandvik 3R60 with OD above 42 mm and grade PW400, tolerances according to EN ISO 1127.

OD ±0.50%, but min. ±0.1 mm (D4),

WT ±10%, but min. ±0.2 mm (T3)

### Instrumentation tubing

#### Sandvik 3R12 and 3R60

##### OD 6.35-25.4 mm according to DIN 2391/EN 10305-1

##### OD >25.4 mm according to ASTM A-450

OD mm	TOLERANCE mm	WALL THICKNESS %
6.35-25.4	±0.08	±10
31.75	±0.15	±10
38.1	±0.15	±10
50.8	±0.25	±10

#### Sandvik 3R60

##### OD <6 mm, tolerances according to ASTM A-632

See tolerances for hydraulic tubing.

#### Sandvik 2RK65 and Sandvik Sanicro 28

OD mm	TOLERANCE mm	WALL THICKNESS %
≤25.4	±0.10	±10

## Standards

### 3R12 (ASTM TP 304L) and 3R60 (ASTM TP 316L), metric sizes

ASTM A213-AW (average wall), ASTM A269.

SS 219711 (condition -22, i.e. 3R12 = SS 2352-22)

DIN 17458 TC 1

NFA 49-117

ASTM A632 for OD less than 6 mm

PED/EC prEN 10216-5 TC 1

### 3R12 (ASTM TP 304L) and 3R60 (ASTM TP 316L), imperial sizes

ASTM A213-AW

ASTM A269

ASTM A632 for OD less than 6 mm

PED/EC prEN 10216-5 TC 1

### 2RK65 (UNS N08904), imperial sizes

ASTM B677

PED/EC prEN 10216-5 TC 1

### Sanicro 28 (UNS N08028), imperial sizes

ASTM B668

PED/EC prEN 10216-5 TC 1

### 6R35 (ASTM TP 321) and 5R75, metric sizes

DIN 17458 TC 1

ASTM A632 for OD less than 6 mm (tolerances only)

PED/EC prEN 10216-5 TC 1

### PW400/SAF 2304 (UNS S32304), metric sizes

ASTM A789

NGS 1607 (SS 219713)

PED/EC prEN 10216-5 TC 1



Sandvik Materials Technology has a quality management system approved by internationally recognised organisations. We hold for example: ASME Quality System Certificate as a Material Organisation, approvals to ISO 9001 and QS 9000 as well as approvals from LRQA, JIS and other organisations as a material manufacturer.

# Hydraulic tubing

OD	WALL THICKNESS	WEIGHT	SANDVIK GRADE					MAX. WORKING PRESSURE IN BAR AT +50°C							
			3R12 304L	3R60 316L	6R35 321	5R75 2350	PW400 2327	3R12 RN78 1) 4)	ANSI/ ASME B31.3 2)	DIN 2413 3)	3R60 2) RN78 1) 4)	DIN 2413 3)	6R35 DIN 2413 3)	5R75 DIN 2413 3)	
mm	mm	kg/m													
3	0.5 0.7	0.031 0.040		●		●		Maximum working pressure is not given since these sizes are used in the most diversified applications.							
6	1.0 1.5	0.125 0.169	●	●	●	●	●	306 522	344 591	322 523	343 585	354 575	370 601	386 628	
8	1.0 1.5 2.0	0.175 0.244 0.300	●	●	●	●	●	221 385 539	250 430 616	241 392 543	248 431 604	265 431 597	277 451 624	289 470 652	
10	1.0 1.5 2.0	0.225 0.319 0.400	●	●	●	●	●	173 297 436	196 334 481	193 314 434	194 333 488	212 345 477	222 361 499	232 377 521	
12	1.0 1.5 2.0	0.275 0.394 0.500	●	●	●	●	●	142 241 351	162 273 392	161 261 362	159 270 393	177 287 398	185 300 416	193 313 434	
14	1.0 1.5 2.0 2.5	0.325 0.469 0.600 0.719	●	●				120 203 293 380	138 231 330 425	138 224 310 388	134 227 328 426	152 246 341 427	159 258 357 446	166 269 372 466	
15	1.0 1.5 2.0	0.350 0.507 0.651	●	●	●	●	●	112 189 271	128 214 305	129 209 290	125 212 304	142 230 319	148 240 334	155 251 348	
16	1.0 1.5 2.0 2.5 3.0	0.375 0.544 0.701 0.845 0.976	●	●				105 176 252 325 403	120 200 285 365 449	121 196 272 339 407	118 197 282 364 451	133 216 299 373 448	139 225 313 390 468	145 235 326 407 488	
18	1.0 1.5 1.6 2.0 2.5	0.425 0.619 0.657 0.801 0.970	●	●				92 155 221 284	106 177 250 320	107 174 241 302	103 174 248 318	118 191 265 332	123 200 277 347	128 209 289 362	
20	1.5 2.0 2.5 3.0 4.0	0.694 0.901 1.09 1.28 1.60	●	●	●	●	●	138 196 252 310 436	158 223 285 348 482	157 217 272 326 434	155 220 282 347 488	173 239 299 359 477	181 250 313 375 499	188 260 326 391 521	
22	1.5 2.0	0.769 1.00	●	●	●	●	●	125 177	143 201	143 197	140 198	157 217	164 227	172 236	
25	1.5 2.0 2.5 3.0	0.882 1.15 1.41 1.65	●	●	●	●	●	109 154 196 241	125 176 223 272	125 174 217 261	122 172 220 270	138 191 239 287	144 200 250 300	150 209 260 313	
28	1.5 2.0 2.5	0.995 1.30 1.60	●	●	●	●	●	97 136 174	111 156 198	112 155 194	109 152 195	123 171 213	129 178 223	134 186 233	
30	2.5 2.6 3.0 4.0	1.72 1.78 2.03 2.60		●			●	161 196 271	183 223 305	181 217 290	180 220 304	199 239 319	208 250 334	217 260 348	
35	2.0 2.5 3.0	1.65 2.03 2.40	●	●	●	●	●	108 136 166	123 156 190	124 155 186	121 152 186	136 171 205	143 178 214	149 186 223	
38	2.0 3.0 3.6 4.0 5.0	1.80 2.63 3.10 3.41 4.13	●	●			●	99 152 208 267	113 175 236 301	114 171 229 286	111 170 233 299	125 188 252 315	131 197 263 329	137 205 275 343	
42	2.0 3.0	2.00 2.93		●	●	●	●	89 136	102 156	103 155	100 152	113 171	118 178	124 186	
50	4.5 5	5.13 5.63					●	196	223	217	220	239	250	260	
60	5 5.5	6.88 7.51		●				161	183	181	180	199	208	217	
65	5.5	8.19					●								
80	5	9.39		●				118	135	136	132	150	156	163	

● = size in stock

THT Ordering code: THT-3R60-10-1

1) Applies to bending radius >2.5 x outside diameter.

2) The working pressures acc. to ANSI are identical for 3R12 and 3R60.

3) Applies to bending radius >6 x inside diameter.

4) Condition -22 for use at max 160 bar and 120°C

5) Up to 400 bar acc. to DIN 2413.

# Instrumentation tubing

OD mm	WALL THICKNESS mm	IMPERIAL SIZE <sup>1)</sup>	WEIGHT kg/m	SANDVIK GRADE				MAX. WORKING PRESSURE AT +50°C		
				3R12 SS 2352 ASTM TP 304L	3R60 2353 316L	2RK65 2562 UNS N08904	Sanicro 28 2584 N08028	ANSI/ASME <sup>2)</sup> B31.3 bar	psi	
1.59	0.36	1/16" x 28 BWG	0.011		●			Maximum working pressure is not given since these sizes are used in the most diversified applications.		
	0.51		0.014		●					
3.18	0.71	1/8" x 22 BWG	0.044		●					
	0.89		0.051		●					
4.76	0.89	3/16" x 20 BWG	0.086		●					
6.35	0.71	1/4" x 22 BWG	0.100		●				190	2800
	0.89		0.122	●	●	●	●		280	4100
	0.91	20 SWG	0.124	●	●	●	●		280	4100
	1.22	18 SWG	0.157	●	●	●	●		430	6300
	1.24	18 BWG	0.159	●	●	●	●		430	6300
	1.63	16 SWG	0.193		●	●	●	680	9000	
	1.65	16 BWG	0.194		●	●	●	680	9000	
7.94	0.89	5/16" x 20 BWG	0.157		●			250	3650	
	0.91		0.160		●			250	3650	
9.53	0.71	3/8" x 22 BWG	0.156		●			125	1800	
	0.89		0.193	●	●	●	●	180	2600	
	0.91	20 SWG	0.196	●	●	●	●	180	2600	
	1.22	18 SWG	0.254	●	●	●	●	270	3900	
	1.24	18 BWG	0.257	●	●	●	●	270	3900	
	1.63	16 SWG	0.322		●	●	●	405	5800	
	1.65	16 BWG	0.326		●	●	●	405	5800	
	2.03	14 SWG	0.381		●			480	7000	
	2.11	14 BWG	0.391		●			480	7000	
12.7	0.71	1/2" x 22 BWG	0.213		●			90	1300	
	0.89		0.263	●	●	●	●	130	1900	
	0.91	20 SWG	0.268	●	●	●	●	130	1900	
	1.22	18 SWG	0.350	●	●	●	●	200	2900	
	1.24	18 BWG	0.356	●	●	●	●	200	2900	
	1.63	16 SWG	0.452	●	●	●	●	295	4200	
	1.65	16 BWG	0.456	●	●	●	●	295	4200	
	2.03	14 SWG	0.542		●	●		390	5700	
	2.11	14 BWG	0.559		●	●		390	5700	
15.88	1.22	5/8" x 18 SWG	0.448		●			170	2400	
	1.24		0.454		●			170	2400	
	1.63	16 SWG	0.582		●		●	225	3200	
	1.65	16 BWG	0.588		●		●	225	3200	
19.05	1.22	3/4" x 18 SWG	0.544		●		●	130	1900	
	1.24		0.553		●		●	130	1900	
	1.63	16 SWG	0.711		●			185	2700	
	1.65	16 BWG	0.718		●			185	2700	
	2.11	14 BWG	0.895		●			250	3600	
	2.41	13 BWG	1.00		●			290	4200	
	2.77	12 BWG	1.13		●		●	350	5050	
25.4	1.22	1" x 18 SWG	0.739		●			100	1500	
	1.24		0.750		●			100	1500	
	1.65	16 BWG	0.981		●			140	2000	
	2.11	14 BWG	1.23		●			180	2600	
	2.41	13 BWG	1.39		●		●	210	3050	
	3.20	-	1.78		●			290	4150	
31.75	3.96	1 1/4" -	2.76		●			280	4100	
38.1	2.41	1 1/2" x 13BWG	2.15		●			135	1950	

1) SWG = Standard Wire Gauge, BWG = Birmingham Wire Gauge  
 28 BWG = 0.014 inch    25 BWG = 0.020 inch    22 BWG = 0.028 inch    20 BWG = 0.035 inch    20 SWG = 0.036 inch    18 BWG = 0.049 inch    18 SWG = 0.048 inch  
 16 BWG = 0.065 inch    16 SWG = 0.064 inch    14 BWG = 0.083 inch    14 SWG = 0.080 inch    13 BWG = 0.095 inch    12 BWG = 0.109 inch    11 BWG = 0.120 inch

2) 2RK65 and Sanicro 28 withstand higher pressure than 3R12/3R60.

# Seamless stainless tubes made by Sandvik offer many advantages

- High resistance to corrosion. Sandvik 316L is supplied in the high molybdenum version, minimum 2.5%.
- High quality. Consistent from delivery to delivery.
- A wide variety of sizes and grades from stock.
- SAF 2304/PW400. All sizes are capable of withstanding a working pressure of up to 400 bar in accordance with DIN 2413. PW 400 can also be used in tough environments. It has an especially high resistance to stress corrosion.

## Testing of stock standard tubing in THT

Sandvik hydraulic and instrumentation tubing are tested according to the standards as follows.

S = Sampling  
T = 100%

STANDARD	TESTS CHEMICAL ANALYSIS	TENSILE	HARDNESS	FLATTENING	RING- EXPANDING	FLARING	CORROSION	HYDROSTATIC
SS 219711	S	S	–	S 1)	S 1)	–	S 5a)	T 2)
SS 219713	S	S	–	T 1)	T 1)	–	S	T 2)
DIN 17458 TC1 7)	S	S	–	S 1)	S 1)	–	– 4)	T 2)
NFA 49–117	S	S	S	S	–	S	S 5a)	T 2)
ASTM A269	S	–	S	–	–	S	– 5)	T 2)
ASTM A213	S 3)	S	S	S	–	S	– 5)	T 2)
ASTM A789	S 3)	S	S	–	–	S	–	T 2)
ASTM B677	S	S	– 6)	–	–	–	–	T 2)
ASTM B668	S	S	– 6)	–	–	S	–	T 2)
ASTM A632	S	S	–	–	–	S	– 5)	T

1) Either flattening or ring expanding test, depending on tube size.

2) Hydrostatic test is replaced by Eddy current test at option of Sandvik.

3) Also product analysis of a billet or tube from each heat.

4) Sandvik Materials Technology performs EN ISO 3651-2 Method A (DIN 50914).

5) Sandvik Materials Technology performs ASTM A262 PrE.

5a) Sandvik Materials Technology also performs ASTM A262 PrE.

6) Sandvik Materials Technology performs hardness test.

7) (prEN 10216-5 generally according to DIN 17458 TC1).

## Marking

The grades 3R12 and 3R60 are dual marked, TP 304/304L and TP 316/316L respectively.

## Lengths

Stock standard length is 6000 mm.

Random lengths min. 5 metres may also be included in a delivery from stock. Tubes in other lengths are available on request.

## Weldability

Sandvik hydraulic tube is very easy to weld. 3R12 and 3R60 have low carbon content. Sandvik also supplies a complete range of filler materials for welding.

## Plugged ends

From stock all tubes with OD larger than 5 mm are supplied with transport protection against inside contamination.

## Surface finish

Sizes OD up to 30 mm are supplied bright annealed.

Outside diameters larger than 30 mm are supplied in the annealed and pickled condition.

## Certification

Testing performed according to the standard is reported in Material and Test Certificates issued by our Quality Assurance department.

Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice.

# Sales and service all over the world

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