

Product catalogue

Seamless Stainless Steel Tubes & Pipes



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CentraVis Worldwide

Centravis stainless steel tube solutions

Product portfolio

Ability to produce according to all major specifications and grades

Always striving for quality and new technologies in the production of seamless stainless steel tubes, we can produce high-quality tubes in accordance with all major specifications and grades. The mill manufactures hot-extruded pipes and cold finished tubes and pipes to more than 100 standards. Our product range covers austenitic, ferritic, austenitic-ferritic steel grades, duplex, super duplex, nickel alloys in a dimensional range OD 4 – 250mm with a wall thickness of 0.2 – 35mm and a maximum tube length of 25 metres including U-tubes OD 12.7-38.1mm (½ – 1 ½ inch) with maximum length of 25 metres.

A sound portfolio of product solutions

Our production plant in Nikopol is one of the largest mills in Europe specializing in the production of seamless stainless steel tubes and pipes. Modern plant equipment and a broad experience allows us to provide an extensive product portfolio for customers with very high standard requirements. Our seamless stainless steel solutions are frequently used in a wide range of corrosive environment and high temperatures in the chemical and petrochemical industries, nuclear and thermal power engineering, non-ferrous metallurgy, machine and shipbuilding, food and other industries, covering a number of tube segments: general pipes, boiler tubes, heat-exchanger tubing, instrumentation tubing, furnace tubes, hollow bars and Ni-alloy tubing for domestic markets.

An exceptional customer service for our partners

Centravis strives for excellence — both in products and service. In order to meet the expectations of our customers and to increase the level of customer satisfaction, we can deliver according to individual customer requirements. Use of additional finishing after rolling, different methods of testing and tube examination, heat treatment, polishing, electropolishing, individual packaging and many other features can be adapted in our production plant in Nikopol.

Special Service for our Customers

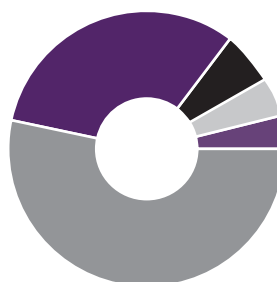
We are focused on and have proven experience in manufacturing heat exchanger tubes within the shortest terms (4-6 weeks) to satisfy our customers. This is a customized service, which is provided upon request with a case-by-case feasibility analysis.

Technological innovations

In order to continue the development Centravis has launched a new highly productive 44 MN press line producing OD 57 – 250mm, and a new streamline for heat-exchanger tubes manufacturing. The streamline includes new and highly productive cold pilger mills (KPW – 25), bright annealing furnace, straightening and grinding machines a cutting machine and testing equipment, provided by leading European suppliers.

Sales distribution by region

- EU – 55%
- CIS – 33%
- America – 5%
- ROW – 3%
- Asia – 4%



Sales distribution by product segment

- General tubes&pipes – 44%
- Heatexchanger tubes – 21%
- Hollow bars – 13%
- Boiler tubes – 10%
- Instrumentation tubes – 10%
- Furnance tubes – 2%



Quality Management

Focusing on a unique combination of process and service quality

Focusing on customer needs

In the current competitive market, we understand that we can work and develop only together with customers and for the customers. Therefore, implementation of customers' current requirements and striving to exceed their expectations is our primary mission.

CENTRAVIS has created conditions where by customer satisfaction is our priority target and purpose in daily activities. In this work, the Company follows the principles and requirements of international quality standards. The processes of consumers are regarded as a continuation of our processes, both in terms of quality and products added value increases, and in terms of reducing all types of losses.

Investing in quality

Considering the quality of products and processes as a key priority, CENTRAVIS invests heavily in production equipment.

Among them - a new SMS MEER press line and rolling mill, LOI bright annealing furnace, Koerner etching baths and finishing equipment. In addition, advanced instrumentation systems have been introduced - non-destructive testing equipment of MAC, GE, Foerster production, chemical analyzer SpectroLab F, etc.

A modernization process, introduction of new operating procedures is continual and allows CENTRAVIS to meet the requirements and expectations of customers, provide top quality products and strive for greater production efficiency.

Control - at each stage of production

In CENTRAVIS a multilevel system of products and quality control processes is applied, which guarantees high level of produced pipes and serves as a guarantee of customer satisfaction. Quality systems include pipe quality planning at the time of order signing, 100% initial quality control of billets, operational control of manufacturing processes and acceptance control of finished product, including geometrical parameter control, visual inspection of pipe inner and outer surface, nondestructive and laboratory testing.

Customer Benefits

The quality Management System is approved by most key customers in the market and proved by results of international audits and certificates.

CENTRAVIS products conform to customer standards and specifications and satisfy the reliability requirements required by the world's leading end-users and engineering companies operating in oil & gas, chemical, aerospace, automobile, nuclear and other power generating industries. The CENTRAVIS team has extensive technical experience and a deep understanding of the industry, allowing us to provide appropriate solutions for specific customer requirements.

Our business partners can verify actual Quality Certificates online on the company official website www.centravis.com.

Key customers accept CENTRAVIS

Over the past few years CENTRAVIS has paid special attention to the customers' needs operating in various industries. Our company was successfully certified by: SHELL, NAM, REPSOL, BAYER, BASF, PETROFAC, EXXONMOBIL, WEBCO, SABIC, FOSTER WHEELER, TECHNIP, PETROBRAS, ARAMCO OVERSEAS COMPANY, McJUNKIN RED MAN CORPORATION and other well-known companies.

Moreover, the process of obtaining official certification continues and in the near future CENTRAVIS expects to receive certification from the majority of key companies from different industries, proving the Company's ability to meet the highest standards of customer requirements from all over the world.

The quality management system of Centravis has been approved by the following certificates:

ISO 9001
ISO 14001
OHSAS 18001
PED 97/23/EC
AD 2000 Merkblatt W0





CENTRAVIS 

Classification of steels

Austenitic steels

The main advantage of steels of the austenitic class are their high performance characteristics (strength, plasticity, and corrosion resistance in most environments) and good processability. Hence, austenitic corrosion resistant steels are widely applied as a construction material in various mechanical engineering industries.

Austenitic-ferritic steels

The advantage of this steel group is the increased yield strength as compared to austenitic single-phase steels, no grain-growth tendency providing maintenance of double-phase structure, less content of scarce nickel and good weldability. Austenitic-ferritic steels are widely applied in various industries of the advanced technology, particularly in chemical engineering, shipbuilding, and aircraft industry.

Ferritic steels

These steels are used in the manufacture of products for application in an oxidizing environment (e.g. in nitric acid solutions), for household devices, in food and consumer goods industries, and for the heat-exchange equipment in power-plant engineering. Ferritic chromium steels keep high corrosion resistance in nitric acid, ammonia water, ammonia nitrate, mixture of nitric, phosphorus and hydrofluoric acids, and in other aggressive environments as well.

Martensitic-ferritic steels

Martensitic-ferritic steels keep high corrosion resistance in atmosphere conditions and mildly aggressive environments (diluted salt/acid solutions), and high mechanical properties. Generally these steels are used for products such as cutting tools, particularly cutters, and for springing elements and constructions in contact with mildly aggressive environments in food and chemical industries.

Nickel and iron-nickel based alloys

When manufacturing chemical apparatus, particularly for use in sulphuric and hydrochloric acid, steels maintaining corrosion resistance higher than austenitic steels such as iron-nickel, nickel-molybdenum, chrome-nickel and chrome-nickel-molybdenum based alloys shall be used.

Duplex and super duplex steels

Corrosion resistant steels keeping fine-grain mixed microstructure of ferrite and austenite and containing approximately 26% Cr and 6.5 % Ni. Corrosion resistance of duplex stainless steels is similar to austenitic stainless steels. However, duplex stainless steels keep higher strength, tensile yield strength and better resistance to stress corrosion cracking than the austenitic equivalents.

Application areas of steel grades

| Grade | Applications |
|---|--|
| 1. Austenitic steels | General purpose stainless steel with good corrosion resistance for most applications. Used for: Bar rails, Boat railings, Canopy supports, Chemical processing equipment, Chemical tubing, Column covers, Duct works, Feed-water tubes, Food preparation equipment, Food processing equipment, Heat exchanger tubes, Hypodermic needles, Ladders, Mechanical & structural components, Pharmaceutical processing equipment, Piping systems, Railings (architectural), Traffic barriers, Water pipes. |
| TP 304 | |
| TP 304LN, 316LN | Boiler, super-heater, heat-exchanger tubes. |
| TP 304H | Higher carbon content than 304L, for increased strength, particularly at elevated temperatures. |
| TP 304L | Chemical plant and food processing equipment, where freedom from sensitisation is required in plate thicknesses. |
| TP 316 / 316L | Excellent in a range of atmospheric environments and many corrosive media – generally more resistant than 304. Subject to pitting and crevice corrosion in warm chloride environments, and to stress corrosion cracking above about 60°C. Considered resistant to potable water with up to about 1000mg/L chlorides at ambient temperatures, reducing to about 500mg/L at 60°C. 316/316L is usually regarded as the standard “marine grade stainless steel”, but it is not resistant to warm sea water. In many marine environments 316 does exhibit surface corrosion, usually visible as brown staining. This is particularly associated with crevices and rough surface finish. |
| TP 316H | Similar oxidation resistance to TP 316. Main areas of application: Heat exchangers, furnaces, chemical and petrochemical plant. |
| TP 347H, 310H | Boiler, super-heater, heat-exchanger tubes providing higher creep-rupture strength. |
| TP 321 | Heat exchanger tubing, Chemical processing tubing, Pressure tank tubing. Suitable for heat resisting applications to 800°C. |
| TP 321H | This is the high carbon version of TP 321 which ensures greater creep resistance. Behaves much the same as TP 321 in oxidation resistance. Main applications: Heat exchangers, furnaces, boilers in chemical and petrochemical plant. |
| TP 316Ti | A titanium stabilised version of 316 used where good resistance to intergranular corrosion and high temperature strength is required. |
| TP 317 / 317 L | Chemical processing tubing, Dyeing equipment, Ink manufacturing equipment, Pulp & paper manufacturing equipment. |
| 2. Super-Austenitic Steels | |
| N08904 (TP 904L) | High resistance to general corrosion in e.g. sulphuric and acetic acids, crevice corrosion, stress corrosion cracking, pitting in chloride bearing solutions. |
| 3. Ferritic and Martensitic steels | |
| TP 405 | Used for applications where hardening upon cooling from high temperatures must be avoided. Has excellent long-time stability up to 1200°F. |
| TP 410 | General purpose grade for use in mildly corrosive environments. |
| TP 430 / 430 Ti | Mechanical & structural tubing, Architectural tubing, Heat exchanger tubing, Condensers, Re-heaters, Evaporators. |
| 4. Duplex | |
| S32205 / S31803 | Typically used in heat exchangers, gas scrubbers, fans, chemical tanks, flowlines, marine and refinery applications. |
| 5. Superduplex | |
| S32750 | Superduplex is an austenitic ferritic Iron Chromium-Nickel alloy with Molybdenum addition. |
| S32760 | It has good resistance to pitting corrosion, and a high tensile strength. |

Steel grades correlation in different standards

| | | ASTM (USA) | UNS (USA) | B.S. (UK) | EN / DIN (Germany) | AFNOR NF (France) | UNI (Italy) | SS (Sweden) | JIS (Japan) | GB/PR (China) | KS (Korea) |
|-----------------------------------|-------------|---------------|--------------|-------------------|-----------------------|--|---------------------|----------------|-------------------|--------------------|---------------|
| General service and wet corrosion | Austenitic | 304 | S30400 | 304S31 / 304S15 | 1.4301 | Z7 CN 18-09/ Z6 CN 18-09 | X5CrNi18 10 | 2333 | SUS 304 | 0Cr18Ni9 | STS 304 |
| | | 304L | S30403 | 304S11 | 1.4306 | Z2 CN 18-10 | X2CrNi18 11 | 2352 | SUS 304L | 00Cr19Ni10 | STS 304L |
| | | | | | 1.4307 | Z3 CN 18-10 | | | | | |
| | | 304LN | S30453 | 304S61 | 1.4311 | Z3 CN 18-10 Az | | 2371 | SUS 304LN | 00Cr18Ni 10N | STS 304LN |
| | | 316 | S31600 | 316S31 | 1.4401 | Z7 CND 17-11-02 | X5CrNiMo 17 12 | 2347 | SUS 316 | 0Cr17Ni 12Mo2 | STS 316 |
| | | | | 316S33/ 316S31 | 1.4436 | Z7 CND 18-12-03 | X5CrNiMo 17 13 | 2343 | | | |
| | | 316L | S31603 | 316S11/ 316S14 | 1.4404 | Z3 CND 17-11-02 / Z3 CND 18-12-02 | X5CrNiMo 17 12 | 2348 | SUS 316L | 00Cr17Ni 14Mo2 | STS 316L |
| | | | | 316S13/ 316S11 | 1.4435 | Z3 CND 18-14-03 | X2CrNiMo 17 13 | 2353 | | | |
| | | 316N | S31651 | — | — | — | | — | — | — | — |
| | | 316LN | S31653 | 316S61 | 1.4406 | Z3 CND 17-11 Az | | — | SUS 316LN | 00Cr17Ni 12Mo2N | STS 316LN |
| | | 316Ti | S31635 | 320S31 | 1.4571 | Z6 CNDT 17-12- 02 | X6CrNiMo Ti17 13 | 2350 | SUS 316Ti | 0Cr18Ni12 Mo2Ti | STS 316Ti |
| | | 316H | S31609 | 316S52 | 1.4401/ 1.4919 | Z6 CND 17-12- 02 | X8CrNiMo 17 12 | — | — | — | — |
| | | 321 | S32100 | 321S31 | 1.4541 | Z6 CNT 18-10 | X6CrNiTi18 11 | 2337 | SUS 321 | 1Cr18Ni9Ti | STS 321 |
| | | 317 | S31700 | 317S16 | 1.4449 | — | | — | SUS 317 | | |
| | 317L | S31703 | 317S12 | 1.4438 | Z3 CND 19-15-04 | | 2367 | SUS 317L | 00Cr19Ni13 Mo3 | STS 317L | |
| | 347 | S34700 | 347S31 | 1.4550 | Z6 CNNb 18-10 | X6CrNiNb 18 11 | 2338 | SUS 347 | 0Cr18Ni11 Nb | STS 347 | |
| | 904L | N08904 | 904S13 | 1.4539 | Z2 NCDU 25-20 | | 2562 | — | — | STS 317J5L | |
| | Duplex | — | S31803 | — | 1.4462 | Z2 CND 22-05 Az | | 2377 | — | — | — |
| | | — | S32205 | 318S13 | 1.4462 | Z3 CND 22-05 Az | | 2377 | SUS 329J3L | 00Cr22 Ni5Mo3N | STS 329J3L |
| | Ferritic | 405 | S40500 | 405S17 | 1.4002 | Z6 C Al 13 | | — | SUS 405 | | |
| | | 410 | S41000 | 410S21 | 1.4006 | Z12C13 | X12Cr13 | 2302 | SUS 410 | 1Cr12 | STS 410 |
| | | 430 | S43000 | 430S17 | 1.4016 | Z8 C17 | X8Cr17 | 2320 | SUS 430 | 1Cr17 | STS 430 |
| | | 430Ti | — | — | 1.4510 | Z8 CT17 | | — | SUS 430LX | — | — |
| | SuperDuplex | — | S32750 | — | 1.4410 | — | | — | — | — | — |
| | | — | S32760 | — | — | — | | — | — | — | — |
| Heat resistant | Austenitic | 304H | S30409 | 304S51 | 1.4948 | Z6 CN 18-09 | X8CrNi 18 10 | 2333 | SUS 304 | 1Cr18Ni9 | STS 304 |
| | | 321H | S32109 | 321S51 | 1.4878 | Z6 CNT 18-10 | X8CrNiTi 18 11 | 2337 | SUS 321 | | |
| | | 347H | S34709 | 347S51 | — | — | X8CrNiNb 18 11 | 2347 | — | — | — |
| | | 310S | S31008 | 310S16/ 310S24 | 1.4845 | Z8 CN 25-20/ Z12 CN 25-20 | X6CrNi 25 20 | 2361 | SUS 310S | 0Cr25Ni20 | STS 310S |
| | | 310H | S31009 | — | — | — | | — | — | — | — |
| | | 314 | S31400 | — | 1.4841 | Z15 CNS 25-20 | — | — | — | — | — |

Chemical composition

| Steel grade | Tube standard | Chemical composition, %. | | | | |
|-------------------------------|--------------------------|--------------------------|-------|--------|--------|---------|
| | | C | Mn | P | S | Si |
| Austenitic stainless steels | | | | | | |
| TP 304 | A269, A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 304L | A269, A213, A312 | ≤0.035 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 304H | A213, A312 | 0.04-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 304N | A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 304LN | A269, A213, A312 | ≤0.035 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 310S | A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 310H | A213, A312 | 0.04-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 316 | A269, A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 316L | A269, A213, A312 | ≤0.035 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 316H | A213, A312 | 0.04-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 316Ti | A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤0.75 |
| TP 316N | A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 316LN | A269, A213, A312 | ≤0.035 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 317 | A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 317L | A213, A312 | ≤0.035 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 321 | A269, A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 321H | A213, A312 | 0.04-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 347 | A269, A213, A312 | ≤0.08 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 347H | A213, A312 | 0.04-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TP 347HFG | A213 | 0.06-0.10 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| N08904 | A269, A312 | ≤0.02 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4301 | EN 10216-5 | ≤0.07 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4306 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4307 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4311 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4401 | EN 10216-5 | ≤0.07 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4404 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4435 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4429 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.040 | ≤0.015 | ≤1.00 |
| 1.4436 | EN 10216-5 | ≤0.05 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4541 | EN 10216-5 | ≤0.08 | ≤2.00 | ≤0.040 | ≤0.015 | ≤1.00 |
| 1.4571 | EN 10216-5 | ≤0.08 | ≤2.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4828 | SEW 470 | ≤0.20 | ≤2.00 | ≤0.045 | ≤0.030 | 1.5-2.5 |
| 1.4845 | SEW 470 | ≤0.15 | ≤2.00 | ≤0.045 | ≤0.030 | ≤0.75 |
| 1.4878 | SEW 470 | ≤0.12 | ≤2.00 | ≤0.045 | ≤0.030 | ≤1.00 |
| TU Z 6 CN 18 9 | NF A 49-117, NF A 49-217 | ≤0.09 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 2 CN 18 10 | NF A 49-117, NF A 49-217 | ≤0.03 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 12 CN 25 20 | NF A 49-117 | ≤0.16 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 6 CNT 18 10 | NF A 49-117 | ≤0.09 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 6 CNDT 17 12 | NF A 49-117 | ≤0.09 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 6 CNT 18 10 | NF A 49-217 | ≤0.09 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 2 CND 17 12 | NF A 49-117, NF A 49-217 | ≤0.03 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 6 CND 17 11 | NF A 49-117, NF A 49-217 | ≤0.08 | ≤2.04 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 2 CND 18 14 | NF A 49-217 | ≤0.03 | ≤2.04 | ≤0.025 | ≤0.020 | ≤1.05 |
| Ferritic stainless steels | | | | | | |
| TP 405 | A268 | ≤0.08 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| TP 410 | A268 | ≤0.15 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| TP 430 | A268 | ≤0.12 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| TP 430Ti | A268 | ≤0.10 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4002 | DIN EN 10297-2 | ≤0.08 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4006 | DIN EN 10297-2 | 0.08-0.15 | ≤1.50 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4016 | DIN EN 10297-2 | ≤0.08 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| 1.4510 | DIN EN 10297-2 | ≤0.05 | ≤1.00 | ≤0.040 | ≤0.030 | ≤1.00 |
| TU Z 12 C 13 | NF A 49-217 | ≤0.16 | ≤1.05 | ≤0.045 | ≤0.035 | ≤1.05 |
| TU Z 10 C 17 | NF A 49-217 | ≤0.13 | ≤1.05 | ≤0.045 | ≤0.035 | ≤1.05 |
| Duplex stainless steels | | | | | | |
| S31803 | A789 | ≤0.03 | ≤2.00 | ≤0.030 | ≤0.020 | ≤1.00 |
| S32205 | A789 | ≤0.03 | ≤2.00 | ≤0.030 | ≤0.020 | ≤1.00 |
| 1.4462 | EN 10216-5 | ≤0.03 | ≤2.00 | ≤0.035 | ≤0.015 | ≤1.00 |
| TU Z 2 CND 22 05 03 | NF A 49-217 | ≤0.03 | ≤2.04 | ≤0.035 | ≤0.025 | ≤1.05 |
| Super duplex stainless steels | | | | | | |
| S32750 | A789 | ≤0.03 | ≤1.20 | ≤0.035 | ≤0.020 | ≤0.80 |
| S32760 | A789 | ≤0.05 | ≤1.00 | ≤0.030 | ≤0.010 | ≤1.00 |

| Chemical composition, %. | | | | | | |
|-------------------------------|-------------|-----------|-----------|-----------|----------------------|--------------|
| Cr | Ni | Mo | N | Nb | Ti | Others |
| Austenitic stainless steels | | | | | | |
| 18.0-20.0 | 8.0-11.0 | - | - | - | - | - |
| 18.0-20.0 | 8.0-12.0 | - | - | - | - | - |
| 18.0-20.0 | 8.0-11.0 | - | - | - | - | - |
| 18.0-20.0 | 8.0-11.0 | - | 0.10-0.16 | - | - | - |
| 18.0-20.0 | 8.0-11.0 | - | 0.10-0.16 | - | - | - |
| 24.0-26.0 | 19.0-22.0 | - | - | - | - | - |
| 24.0-26.0 | 19.0-22.0 | - | - | - | - | - |
| 16.0-18.0 | 11.0-14.0 | 2.00-3.00 | - | - | - | - |
| 16.0-18.0 | 11.0-14.0 | 2.00-3.00 | - | - | - | - |
| 16.0-18.0 | 11.0-14.0 | 2.00-3.00 | - | - | - | - |
| 16.0-18.0 | 10.0-14.0 | 2.00-3.00 | ≤0.10 | - | 5*(C+N)-0.70 | - |
| 16.0-18.0 | 10.0-13.0 | 2.00-3.00 | 0.10-0.16 | - | - | - |
| 16.0-18.0 | 10.0-13.0 | 2.00-3.00 | 0.10-0.16 | - | - | - |
| 18.0-20.0 | 11.0-14.0 | 3.00-4.00 | - | - | - | - |
| 18.0-20.0 | 11.0-15.0 | 3.00-4.00 | - | - | - | - |
| 17.0-19.0 | 9.0-12.0 | - | - | - | 5*C-0.70 | - |
| 17.0-19.0 | 9.0-12.0 | - | - | - | 4*C-0.60 | - |
| 17.0-19.0 | 9.0-13.0 | - | - | 10*C-1.00 | - | - |
| 17.0-19.0 | 9.0-13.0 | - | - | 8*C-1.00 | - | - |
| 17.0-19.0 | 9.0-13.0 | - | - | 8*C-1.10 | - | - |
| 19.0-23.0 | 23.0-28.0 | 4.0-5.0 | ≤0.10 | - | - | Cu 1.00-2.00 |
| 17.0-19.5 | 8.0-10.5 | - | ≤0.11 | - | - | - |
| 18.0-20.0 | 10.0-12.0 | - | ≤0.11 | - | - | - |
| 17.5-19.5 | 8.0-10.0 | - | ≤0.11 | - | - | - |
| 17.0-19.5 | 8.5-11.5 | - | 0.12-0.22 | - | - | - |
| 16.5-18.5 | 10.0-13.0 | 2.0-2.5 | ≤0.11 | - | - | - |
| 16.5-18.5 | 10.0-13.0 | 2.0-2.5 | ≤0.11 | - | - | - |
| 17.0-19.0 | 12.5-15.0 | 2.5-3.0 | - | - | - | - |
| 16.5-18.5 | 11.0-14.0 | 2.5-3.0 | 0.12-0.22 | - | - | - |
| 16.5-18.5 | 10.5-13.0 | 2.5-3.0 | - | - | - | - |
| 17.0-19.0 | 9.0-12.0 | - | - | - | 5*C-0.70 | - |
| 16.5-18.5 | 10.5-13.5 | 2.0-2.5 | - | - | 5*C-0.70 | - |
| 19.0-21.0 | 11.0-13.0 | - | - | - | - | - |
| 24.0-26.0 | 19.0-22.0 | - | - | - | - | - |
| 17.0-19.0 | 9.0-12.0 | - | - | - | 4*C-0.80 | 1.4878 |
| 17.0-20.2 | 8.00-11.10 | - | - | - | - | - |
| 17.0-20.2 | 9.00-12.15 | - | - | - | - | - |
| 24.0-26.2 | 19.00-22.15 | - | - | - | - | - |
| 17.0-20.2 | 9.00-12.15 | - | - | - | 5*C-0.65 | - |
| 16.0-18.2 | 10.50-13.15 | 1.9-2.5 | - | - | 5*C-0.65 | - |
| 17.0-20.2 | 9.00-12.15 | - | - | - | 5*C-0.65 | - |
| 16.0-18.2 | 10.50-13.15 | 2.0-2.5 | - | - | - | - |
| 16.0-18.2 | 10.00-12.65 | 2.0-2.5 | - | - | - | - |
| 17.0-18.7 | 13.00-16.15 | 2.2-3.1 | - | - | - | - |
| Ferritic stainless steels | | | | | | |
| 11.5-14.5 | ≤0.50 | - | - | - | - | Al 0.10-0.30 |
| 11.5-13.5 | - | - | - | - | - | - |
| 16.0-18.0 | - | - | - | - | - | - |
| 16.00-19.50 | 0.75 | - | - | - | 5*C-0.75 | - |
| 12.0-14.0 | - | - | - | - | - | Al 0.10-0.30 |
| 11.5-13.5 | ≤0.75 | - | - | - | - | - |
| 16.0-18.0 | - | - | - | - | - | Al 0.10-0.30 |
| 16.0-18.0 | - | - | - | - | (4(C+N)+0.15) - 0,80 | - |
| 11.5-13.7 | ≤0.55 | - | - | - | - | - |
| 16.0-18.2 | ≤0.55 | - | - | - | - | - |
| Duplex stainless steels | | | | | | |
| 21.0-23.0 | 4.5-6.5 | 2.5-3.5 | 0.08-0.20 | - | - | - |
| 22.0-23.0 | 4.5-6.5 | 3.0-3.5 | 0.14-0.20 | - | - | - |
| 21.0-23.0 | 4.5-6.5 | 2.5-3.5 | 0.10-0.22 | - | - | - |
| 21.0-23.2 | 4.50-6.65 | 2.5-3.6 | 0.07-0.21 | - | - | - |
| Super duplex stainless steels | | | | | | |
| 24.0-26.0 | 6.0-8.0 | 3.0-5.0 | 0.24-0.32 | - | - | Cu ≤0.50 |
| 24.0-26.0 | 6.0-8.0 | 3.0-4.0 | 0.20-0.30 | - | - | W 0.50-1.00 |

Dimensions of seamless stainless tubes (SI metric units)

ANSI/ASME B36.10M - 1996

| NPS | Outside diameter, mm | Nominal wall thickness, mm | | | | | | | |
|-------|----------------------|----------------------------|--------------|---------|--------------|-------------|----------|----------|----------|
| | | Sch. 5S (1) | Sch. 10S (1) | Sch. 30 | Sch. 40S/STD | Sch. 80S/XS | Sch. 120 | Sch. 160 | Sch. XXS |
| 1/8 | 10.29 | | 1.24 | 1.45 | 1.73 | 2.41 | | | |
| 1/4 | 13.72 | | 1.65 | 1.85 | 2.24 | 3.02 | | | |
| 3/8 | 17.15 | | 1.65 | 1.85 | 2.31 | 3.20 | | | |
| 1/2 | 21.34 | 1.65 | 2.11 | 2.41 | 2.77 | 3.73 | | 4.78 | |
| 3/4 | 26.67 | 1.65 | 2.11 | 2.41 | 2.87 | 3.91 | | 5.56 | 7.82 |
| 1 | 33.40 | 1.65 | 2.77 | 2.90 | 3.38 | 4.55 | | 6.35 | 9.09 |
| 1 1/4 | 42.16 | 1.65 | 2.77 | 2.97 | 3.56 | 4.85 | | 6.35 | 9.70 |
| 1 1/2 | 48.26 | 1.65 | 2.77 | 3.18 | 3.68 | 5.08 | | 7.14 | 10.15 |
| 2 | 60.33 | 1.65 | 2.77 | 3.18 | 3.91 | 5.54 | | 8.74 | 11.07 |
| 2 1/2 | 73.03 | 2.11 | 3.05 | 4.78 | 5.16 | 7.01 | | 9.53 | 14.02 |
| 3 | 88.90 | 2.11 | 3.05 | 4.78 | 5.49 | 7.62 | | 11.13 | 15.24 |
| 3 1/2 | 101.60 | | 3.05 | 4.78 | 5.47 | 8.08 | | 12.70 | 16.15 |
| 4 | 114.30 | | 3.05 | 4.78 | 6.02 | 8.56 | 11.13 | 13.49 | 17.12 |
| 5 | 141.30 | | | | 6.55 | 9.53 | 12.70 | 15.88 | 19.05 |
| 6 | 168.28 | | | | 7.11 | 10.97 | 14.27 | 18.26 | 21.95 |
| 8 | 219.08 | | | | 8.18 | 12.70 | 18.26 | 23.01 | 22.23 |

Correlation between inch (NPS) and metric tube dimensions (for ASTM A312, ASTM A376, ASTM A790)

| Outside diameter | | |
|------------------|-------|--------|
| NPS | inch | mm |
| 1/8 | 0.405 | 10.29 |
| 1/4 | 0.540 | 13.72 |
| 3/8 | 0.675 | 17.15 |
| 1/2 | 0.840 | 21.34 |
| 1 | 1.315 | 33.40 |
| 1 1/4 | 1.660 | 42.16 |
| 1 1/2 | 1.900 | 48.26 |
| 2 | 2.375 | 60.33 |
| 2 1/2 | 2.875 | 73.03 |
| 3 | 3.500 | 88.90 |
| 3 1/2 | 4.000 | 101.60 |
| 4 | 4.500 | 114.30 |
| 5 | 5.563 | 141.30 |
| 6 | 6.625 | 168.28 |
| 8 | 8.625 | 219.08 |

**Correlation between inch
and metric tube dimensions**
(for ASTM A213, ASTM A268,
ASTM A269, ASTM A789, ASTM A511)

| Outside diameter | | |
|------------------|-------|--------|
| inch | | mm |
| 1/8 | 0.125 | 3.18 |
| 3/16 | 0.188 | 4.76 |
| 1/4 | 0.250 | 6.35 |
| 5/16 | 0.313 | 7.94 |
| 3/8 | 0.375 | 9.53 |
| 7/16 | 0.438 | 11.11 |
| 1/2 | 0.500 | 12.70 |
| 9/16 | 0.563 | 14.29 |
| 5/8 | 0.625 | 15.88 |
| 11/16 | 0.688 | 17.46 |
| 3/4 | 0.750 | 19.05 |
| 13/16 | 0.813 | 20.64 |
| 7/8 | 0.875 | 22.23 |
| 15/16 | 0.938 | 23.81 |
| 1 | 1.000 | 25.40 |
| 1 1/4 | 1.250 | 31.75 |
| 1 1/2 | 1.500 | 38.10 |
| 1 3/4 | 1.750 | 44.45 |
| 2 | 2.000 | 50.80 |
| 2 3/8 | 2.375 | 60.33 |
| 2 1/2 | 2.500 | 63.50 |
| 2 3/4 | 2.750 | 69.85 |
| 3 | 3.000 | 76.20 |
| 3 1/2 | 3.500 | 88.90 |
| 4 | 4.000 | 101.60 |
| 4 1/2 | 4.500 | 114.30 |
| 5 | 5.000 | 127.00 |
| 5 1/2 | 5.500 | 139.70 |
| 5 3/4 | 5.750 | 146.10 |
| 6 | 6.000 | 152.40 |
| 6 1/4 | 6.250 | 158.80 |
| 6 1/2 | 6.500 | 165.10 |
| 8 | 8.000 | 203.2 |

Mechanical properties

| Grade | Yield strength min. N/mm2 (MPa) | Tensile strength min. N/mm2 (MPa) | Elongation min. % | Hardness HRB max. |
|------------|---------------------------------------|---|-------------------------|----------------------|
| 304 | 205 | 515 | 35 | 90 |
| 304L | 170 | 485 | 35 | 90 |
| 304LN | 205 | 515 | 35 | 90 |
| 316 | 205 | 515 | 35 | 90 |
| 316L | 170 | 485 | 35 | 90 |
| 316N | 240 | 550 | 35 | 90 |
| 316LN | 205 | 515 | 35 | 90 |
| 316Ti | 205 | 515 | 35 | 90 |
| 316H | 205 | 515 | 35 | 90 |
| 321 | 205 | 515 | 35 | 90 |
| 317 | 205 | 515 | 35 | 90 |
| 317L | 205 | 515 | 35 | 90 |
| 347 | 205 | 515 | 35 | 90 |
| N08904 | 215 | 490 | 35 | 90 |
| S31803 | 450 | 620 | 25 | HRC 30 |
| S32205 | 485 | 655 | 25 | HRC 30 |
| 405 | 205 | 415 | 20 | 90 |
| 410 | 205 | 415 | 20 | 90 |
| 430 | 240 | 415 | 20 | 90 |
| 430Ti | 240 | 415 | 20 | 90 |
| 304H | 205 | 515 | 35 | 90 |
| 321H | 205 | 515 | 35 | 90 |
| 347H | 205 | 515 | 35 | 90 |
| 310S | 205 | 515 | 35 | 90 |
| 310H | 205 | 515 | 35 | 90 |
| UNS S32750 | 550 | 800 | 15 | HRC 32 |
| UNS S32760 | 550 | 750 | 25 | 300 |



Hot finished tubes

General Tubes and pipes

General tubes & pipes are used as piping components and line pipe in a variety of industries such as the chemical and petrochemical industries, the oil and gas industries, power generation, processing, in the food and drink industries, in metallurgy, and many others. In subsea media general tubes & pipes are used as line pipe, flowlines, risers, and as hydraulic & gas injection lines. In topside media general tube & pipe are used as utility and process piping, sea water piping systems and LNG piping.

Furnace tubes

Furnace tubes are mainly used in petrochemical industry as process tubes in cracking furnaces for refineries and ethylene\propylene plants. Oil refinery cracking processes allow the production of «light» products such as liquefied petroleum gas (LPG). In a typical ethylene furnace the pyrolysis reaction is endothermic and for this reason, furnace tube material must be suitable to accommodate the high process temperature.

Hollow Bars

Hollow bar – also called seamless mechanical tubing – is a tubular product made with properties and characteristics suitable for subsequent transformation into numerous cylindrical components and hollow products for different engineering purposes. Applications for hollow bar include aerospace, electronics, medical, military, food processing, transportation and the chemical and petrochemical industry. Hollow bars are widely used in general engineering industry.

Boiler tubes (nuclear industry)

Boiler tubes for nuclear power generation are used within the secondary cycle of nuclear power stations and form the tube components of a steam generation boiler. Special safety requirements are required for nuclear boiler tubes, due to their critical application.

Cold finished tubes

Heat-exchanger tubes

Heat-exchanger tubes are designed for heat transfer and mostly used in processes such as heating, cooling, ventilation, condensation and evaporation (of liquids, gases, steam and their various combinations). Heat-exchanger tubes are used in the following equipment: shell & tube heat exchangers, plate & frame heat exchangers, cooling towers, air coolers and many others.

The main industries using heat-exchanger tubing are chemical & petrochemical, power generation (including nuclear), oil & gas and others such as the food & beverage industries, pulp & paper and transportation.

Instrumentation tubes

Instrumentation tubes are widely used for hydraulic & pneumatic control systems, fuel supply lines and pressure sensors lines for the transportation industry. They are also used for onshore control panels, topside processing facilities and subsea manifolds in the oil and gas industry; for high purity tubes in the semiconductor industry, for advanced engineering fuel rods and control tubes; and for cooling circuits and brake cylinders in the automotive industry.

Boiler tubes

Boiler tubes are used in thermal power-generation and heating, as components of utility and industrial boilers. Boiler tubes in power-generation are used only for utility boilers to generate steam for the production of electricity. Boilers for industrial applications produce steam or hot water for process applications in a range of sectors such as biomass firing (in fluidized bed boilers), heating, the pulp and paper industry (recovery boilers), in waste to energy plants and in a number of chemical processes. Boilers are used in all combustion systems (including conventional coal, oil and gas) and are designed to withstand high pressure and high temperature conditions.

General Tubes and pipes

General tubes & pipes are used as piping components or line pipes in a range of industries such as the chemical and petrochemical industries, in the oil and gas industries, in power generation, processing, food and drink, metallurgy, and many others. In subsea media general tubes & pipes are used as line pipes, flowlines, risers, hydraulic & gas injection lines. In topside media general tubes & pipes are used as utility and process piping, sea water piping systems and as LNG piping.

• **Standards: ASTM A312/A312M, ASME SA-312/SA-312M** **ASTM A376/A376M, ASME SA-376/SA-376M**

Steel grades: TP 304, TP 304L, TP 304H, TP 310S, TP 310H, TP 316, TP 316L, TP 316H, TP 317, TP 317 L, TP 321, TP 321H, TP 347, TP 347H

tube and pipe sizes in NPS



CF tubes



HF and CF tubes



HF tubes

| Outside diameter | | | Wall thickness | | | | | | | | | | | | | | | |
|------------------|--------|--------|----------------|------|---------|------|---------|------|---------|-------|---------|-------|----------|-------|----------|-------|---------|-------|
| | | | Sch 5S | | Sch 10S | | Sch 30S | | Sch 40S | | Sch 80S | | Sch 120S | | Sch 160S | | Sch XXS | |
| NPS | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm |
| 1/8 | 0.405 | 10.29 | | | 0.049 | 1.24 | 0.057 | 1.45 | 0.068 | 1.73 | 0.095 | 2.41 | | | | | | |
| 1/4 | 0.540 | 13.72 | | | 0.065 | 1.65 | 0.073 | 1.85 | 0.088 | 2.24 | 0.119 | 3.02 | | | | | | |
| 3/8 | 0.675 | 17.15 | | | 0.065 | 1.65 | 0.073 | 1.85 | 0.091 | 2.31 | 0.126 | 3.20 | | | | | | |
| 1/2 | 0.840 | 21.34 | 0.065 | 1.65 | 0.083 | 2.11 | 0.095 | 2.41 | 0.109 | 2.77 | 0.147 | 3.73 | | | 0.188 | 4.78 | | |
| 3/4 | 1.050 | 26.67 | 0.065 | 1.65 | 0.083 | 2.11 | 0.095 | 2.41 | 0.113 | 2.87 | 0.154 | 3.91 | | | 0.219 | 5.56 | | |
| 1 | 1.315 | 33.40 | 0.065 | 1.65 | 0.109 | 2.77 | 0.114 | 2.90 | 0.133 | 3.38 | 0.179 | 4.55 | | | 0.250 | 6.35 | 0.358 | 9.09 |
| 1¼ | 1.660 | 42.16 | 0.065 | 1.65 | 0.109 | 2.77 | 0.117 | 2.97 | 0.140 | 3.56 | 0.191 | 4.85 | | | 0.250 | 6.35 | 0.382 | 9.70 |
| 1½ | 1.900 | 48.26 | 0.065 | 1.65 | 0.109 | 2.77 | 0.125 | 3.18 | 0.145 | 3.68 | 0.200 | 5.08 | | | 0.281 | 7.14 | 0.400 | 10.15 |
| 2 | 2.375 | 60.33 | 0.065 | 1.65 | 0.109 | 2.77 | 0.125 | 3.18 | 0.154 | 3.91 | 0.218 | 5.54 | | | 0.344 | 8.74 | 0.436 | 11.07 |
| 2½ | 2.875 | 73.03 | 0.083 | 2.11 | 0.120 | 3.05 | 0.188 | 4.78 | 0.203 | 5.16 | 0.276 | 7.01 | | | 0.375 | 9.53 | 0.552 | 14.02 |
| 3 | 3.500 | 88.90 | 0.083 | 2.11 | 0.120 | 3.05 | 0.188 | 4.78 | 0.216 | 5.49 | 0.300 | 7.62 | | | 0.438 | 11.13 | 0.600 | 15.24 |
| 3½ | 4.000 | 101.60 | | | 0.120 | 3.05 | 0.188 | 4.78 | 0.226 | 5.74 | 0.318 | 8.08 | | | 0.500 | 12.70 | 0.636 | 16.15 |
| 4 | 4.500 | 114.30 | | | 0.120 | 3.05 | 0.188 | 4.78 | 0.237 | 6.02 | 0.337 | 8.56 | 0.380 | 11.13 | 0.531 | 13.49 | 0.674 | 17.12 |
| 5 | 5.563 | 141.30 | | | | | | | 0.258 | 6.55 | 0.375 | 9.52 | 0.500 | 12.70 | 0.625 | 15.88 | 0.750 | 19.05 |
| 6 | 6.625 | 168.28 | | | | | | | 0.280 | 7.11 | 0.432 | 10.97 | 0.562 | 14.27 | 0.719 | 18.26 | 0.864 | 21.95 |
| 8 | 8.625 | 219.08 | | | | | | | 0.322 | 8.18 | 0.500 | 12.70 | 0.719 | 18.26 | 0.906 | 23.01 | 0.875 | 22.23 |
| 10 | 10.750 | 273.05 | | | | | | | 0.365 | 9.27 | 0.549 | 15.09 | 0.844 | 21.44 | | | | |
| 12 | 12.750 | 323.85 | | | | | | | 0.406 | 10.31 | 0.688 | 17.48 | | | | | | |

HF sizes in NPS

Permitted variations in outside diameter and wall thickness (acc. to ASTM A 999/ASTM A 530)

| Outside diameter, inch (mm) | Permitted variations in OD, mm | |
|--------------------------------|--------------------------------|-------|
| | over | under |
| 10.29-42.16 | 0.4 | 0.8 |
| 60.33-114.3 | 0.8 | 0.8 |
| 114.4-219.8 | 1.6 | 0.8 |

| Outside diameter, inch (mm) | Permitted variations in WT, % | |
|--------------------------------|-------------------------------|-------|
| | over | under |
| 10.29-73.03 | 20 | 12.5 |
| 88.9-219.8 WT/OD≤5% | 22.5 | 12.5 |
| 88.9-219.8 WT/OD>5% | 15 | 12.5 |

• Standards: ASTM A213/A213M, ASME SA-213/SA-213M, ASTM A269/A269M

Steel grades: (Standards: ASTM A213/A213M, ASME SA-213/SA-213M) TP304, TP304L, TP304H, TP304N, TP304LN, TP309S, TP310S, TP310H, TP316, TP316L, TP316H, TP316Ti, TP316N, TP316LN, TP317, TP317L, TP321, TP321H, TP347, TP347H

(Standard: ASTM A269/A269M) TP304, TP304L, TP304LN, TP316, TP316L, TP316LN, TP317, TP321, TP347.

| Outside diameter | | Wall thickness | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|------------|----------------|-----|-----|------|-----------|-----|--------------------|---------|--------------------|----------|----------|------|---------|---------|----------|--------------|----------|----------|---------|-----|---------|-----|-----|-----|
| | | 0.4 | 0.5 | 0.6 | 0.71 | 0.89-0.91 | 1.0 | 1.2 (1.22-1.24) | 1.4-1.5 | 1.6 (1.63-1.65) | 1.83-1.9 | 2.0-2.03 | 2.11 | 2.2-2.3 | 2.4-2.5 | 2.6-2.64 | 2.7-2.77-2.8 | 3.0-3.05 | 3.18-3.2 | 3.5-3.6 | 4.0 | 4.4-4.5 | 5.0 | 5.5 | 6.0 |
| inch | mm | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 6.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/4 | 6.35 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 7.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5/16 | 7.94 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 8.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 9.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3/8 | 9.53 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10.20 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/16 | 11.11 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 12.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/2 | 12.70 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 13.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 13.50 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9/16 | 14.0-14.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5/8 | 15.88 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 16.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11/16 | 17.2-17.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 18.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3/4 | 19.0-19.05 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 20.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 13/16 | 20.6-21.34 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/8 | 22.23 | | | | | | | | | | | | | | | | | | | | | | | | |
| 15/16 | 23.81 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 25.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 25.40 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 26.70 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 26.9 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1¼ | 31.75 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 32.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 33.40 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 33.70 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 35.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 36.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1½ | 38.10 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 40.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 42.0-42.4 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1¾ | 44.45 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 48.0-48.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 50.80 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 54.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 57.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2⅝ | 60.3-60.33 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2½ | 63.50 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2¾ | 69.85 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 76.1-76.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3½ | 88.90 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 101.60 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 108.00 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4½ | 114.30 | | | | | | | | | | | | | | | | | | | | | | | | |

Dimensional tolerances for ASTM A213/A 213M ASME SA 213/SA 213M (ASTM A450, ASTM A1016)

| Outside diameter, mm | Wall thickness, mm | Tolerance limits of | | |
|----------------------|--------------------|---------------------|-------------------|-------------------|
| | | outside diameter | wall thickness MW | wall thickness AW |
| <25.4 | 0.4-4.5 | +0.10 mm, -0.10 mm | +20%, 0% | ±10% |
| 25.40-38.10 | 1.0-6.0 | +0.15 mm, -0.15 mm | +20%, 0% | ±10% |
| 38.20-50.80 | 1.2-7.0 | +0.20 mm, -0.20 mm | +22%, 0% | ±11% |
| 50.90-63.50 | 1.8-8.0 | +0.25 mm, -0.25 mm | +22%, 0% | ±11% |
| 63.60-76.20 | 2.0-8.5 | +0.30 mm, -0.30 mm | +22%, 0% | ±11% |
| 76.30-101.60 | 3.0-8.5 | +0.38 mm, -0.38 mm | +22%, 0% | ±11% |

Dimensional tolerances for ASTM A269/A 269M

| Outside diameter, inch (mm) | Outside diameter tolerance, inch (mm) | Admissible wall thickness tolerance, % | Length tolerance, inch (mm) | | Thin wall tubes |
|---------------------------------------|---------------------------------------|--|-----------------------------|------|-----------------------------------|
| | | | more | less | |
| up to 1/2 (D<12.7) | ±0.005 (±0.13) | ±15 | 1/8 (3.2) | 0 | — |
| 1/2 - 1 1/2 excl. (12.7≤D<38.1) | ±0.005 (±0.13) | ±10 | 1/8 (3.2) | 0 | under 0.065" (1.65 mm) nominal |
| 1 1/2 - 3 1/2 excl. (38.1≤D<88.9) | ±0.010 (±0.25) | ±10 | 3/16 (4.8) | 0 | under 0.095" (2.41 mm) nominal |
| 3 1/2 - 5 1/2 excl. (88.9≤D<139.7) | ±0.015 (±0.38) | ±10 | 3/16 (4.8) | 0 | under 0.150" (3.81 mm) nominal |
| 5 1/2 - 8 excl. (139.7≤D<203.2) | ±0.015 (±0.38) | ±10 | 3/16 (4.8) | 0 | under 0.150" (3.81 mm) nominal |

Note: other sizes are available upon agreement.

● Standards: ASTM A268/A268M, ASME SA-268/SA-268M

Steel grades: TP405, TP410, TP430, TP430Ti

| Outside diameter | | Wall thickness | | | | | | | | | | | | | | | | | | | |
|------------------|------------|----------------|-----|--------------------|---------|-----|--------------------|------|----------|------|---------|---------|-----------------|----------|----------|-----|---------|------|------|-----|------|
| | | 0.89-0.91 | 1.0 | 1.2 (1.22-1.24) | 1.4-1.5 | 1.0 | 1.6 (1.63-1.65) | 1.83 | 2.0-2.03 | 2.11 | 2.2-2.3 | 2.4-2.5 | 2.7 2.77-2.8 | 3.0-3.06 | 3.5-3.68 | 4.0 | 4.4-4.5 | 5.08 | 5.16 | 6.0 | 7.14 |
| inch | mm | | | | | | | | | | | | | | | | | | | | |
| 3/4 | 19.0-19.05 | | | | | | | | | | | | | | | | | | | | |
| | 20.00 | | | | | | | | | | | | | | | | | | | | |
| 13/16 | 20.6-21.34 | | | | | | | | | | | | | | | | | | | | |
| 7/8 | 22.23 | | | | | | | | | | | | | | | | | | | | |
| 15/16 | 23.81 | | | | | | | | | | | | | | | | | | | | |
| | 25.00 | | | | | | | | | | | | | | | | | | | | |
| 1 | 25.40 | | | | | | | | | | | | | | | | | | | | |
| 1¼ | 31.75 | | | | | | | | | | | | | | | | | | | | |
| | 33.40 | | | | | | | | | | | | | | | | | | | | |
| 1½ | 38.10 | | | | | | | | | | | | | | | | | | | | |
| | 40.00 | | | | | | | | | | | | | | | | | | | | |
| | 42.0-42.4 | | | | | | | | | | | | | | | | | | | | |
| 1¾ | 44.45 | | | | | | | | | | | | | | | | | | | | |
| | 48.0-48.3 | | | | | | | | | | | | | | | | | | | | |
| 2 | 50.80 | | | | | | | | | | | | | | | | | | | | |
| | 54.0 | | | | | | | | | | | | | | | | | | | | |
| | 57.00 | | | | | | | | | | | | | | | | | | | | |
| 2¾ | 60.3-60.33 | | | | | | | | | | | | | | | | | | | | |
| 2½ | 63.50 | | | | | | | | | | | | | | | | | | | | |
| 2¾ | 69.85 | | | | | | | | | | | | | | | | | | | | |
| | 73.03 | | | | | | | | | | | | | | | | | | | | |
| 3 | 76.1-76.2 | | | | | | | | | | | | | | | | | | | | |
| 3½ | 88.90 | | | | | | | | | | | | | | | | | | | | |

Dimensional tolerances

| Outside diameter, inch (mm) | Admissible outside diameter tolerance, inch (mm) | Admissible wall thickness tolerance, % | Length tolerance, inch (mm) | | Thin-wall tubes |
|--------------------------------|--|--|-----------------------------|------|--------------------------------|
| | | | more | less | |
| up to ½ (D<12.7) | ±0.005 (±0.13) | ±15 | ⅛ (3.2) | 0 | — |
| ½ up to 1½ excl. (12.7≤D<38.1) | ±0.005 (±0.13) | ±10 | ⅛ (3.2) | 0 | under 0.065" (1.65 mm) nominal |
| 1½ - 3½ excl. (38.1≤D<88.9) | ±0.010 (±0.25) | ±10 | ⅜ (4.8) | 0 | under 0.095" (2.41 mm) nominal |

• Standards: ASTM A790/A790M; ASME SA-790/SA-790M

Steel grades: S31803, S32205, S32750, S32760

tube and pipe sizes in NPS

CF tubes

HF and CF tubes

HF tubes

| Outside diameter | | | Wall thickness | | | | | | | | | | | | | |
|------------------|-------|--------|----------------|------|---------|------|---------|------|---------|-------|----------|-------|----------|-------|---------|-------|
| | | | Sch 5S | | Sch 10S | | Sch 40S | | Sch 80S | | Sch 120S | | Sch 160S | | Sch XXS | |
| NPS | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm |
| 3/8 | 0.675 | 17.15 | | | 0.065 | 1.65 | 0.091 | 2.31 | 0.126 | 3.20 | | | | | | |
| 1/2 | 0.840 | 21.34 | 0.065 | 1.65 | 0.083 | 2.11 | 0.109 | 2.77 | 0.147 | 3.73 | | | | | | |
| 3/4 | 1.050 | 26.67 | 0.065 | 1.65 | 0.083 | 2.11 | 0.113 | 2.87 | 0.154 | 3.91 | | | | | | |
| 1 | 1.315 | 33.40 | 0.065 | 1.65 | 0.109 | 2.77 | 0.133 | 3.38 | 0.179 | 4.55 | | | | | | |
| 1 1/4 | 1.660 | 42.16 | 0.065 | 1.65 | 0.109 | 2.77 | 0.140 | 3.56 | 0.191 | 4.85 | | | | | | |
| 1 1/2 | 1.900 | 48.26 | 0.065 | 1.65 | 0.109 | 2.77 | 0.145 | 3.68 | 0.200 | 5.08 | | | | | | |
| 2 | 2.375 | 60.33 | 0.065 | 1.65 | 0.109 | 2.77 | 0.154 | 3.91 | 0.218 | 5.54 | | | 0.344 | 8.74 | 0.436 | 11.07 |
| 2 1/2 | 2.875 | 73.03 | 0.083 | 2.11 | 0.120 | 3.05 | 0.203 | 5.16 | 0.276 | 7.01 | | | 0.375 | 9.53 | 0.552 | 14.02 |
| 3 | 3.500 | 88.90 | 0.083 | 2.11 | 0.120 | 3.05 | 0.216 | 5.49 | 0.300 | 7.62 | | | 0.438 | 11.13 | 0.600 | 15.24 |
| 3 1/2 | 4.000 | 101.60 | | | 0.120 | 3.05 | 0.226 | 5.74 | 0.318 | 8.08 | | | 0.500 | 12.70 | 0.636 | 16.15 |
| 4 | 4.500 | 114.30 | | | 0.120 | 3.05 | 0.237 | 6.02 | 0.337 | 8.56 | 0.380 | 11.13 | 0.531 | 13.49 | 0.674 | 17.12 |
| 5 | 5.563 | 141.30 | | | | | 0.258 | 6.55 | 0.375 | 9.52 | 0.500 | 12.70 | 0.625 | 15.88 | 0.750 | 19.05 |
| 6 | 6.625 | 168.28 | | | | | 0.280 | 7.11 | 0.432 | 10.97 | 0.562 | 14.27 | 0.719 | 18.26 | 0.864 | 21.95 |
| 8 | 8.625 | 219.08 | | | | | | | 0.500 | 12.70 | 0.719 | 18.26 | 0.906 | 23.01 | 0.875 | 22.23 |

Dimensional tolerances (acc. to ASTM A999, ASTM A530)

| Outside diameter, mm | Outside diameter tolerances |
|----------------------|-----------------------------|
| 10.29 - 48.26 | +0.4mm, -0.8mm |
| 48.27 - 114.43 | +0.8mm, -0.8mm |
| 114.40 - 219.8 | +1.6 mm, -0.8mm |

| Outside diameter, mm | Wall thickness tolerances |
|----------------------|---------------------------|
| 10.29 - 73.03 | +20.0%, -12.5% |
| 88.9-457.2 WT/D≤5% | +22.5%, -12.5% |
| 88.9-457.2 WT/D>5% | +15.0%, -12.5% |

• Standards: ASTM B829, ASTM B407, ASTM B729, ASTM B668, ASTM B423, ASTM B163

Alloy grades: N08800, N08825, N08904, N08811, N08020, N08028, N06600

Basic product range for heat exchanger tubing

| Outside diameter | | | Nominal wall thickness, mm | | | | | | | | | |
|------------------|-------|-------|----------------------------|------|---------|------|---------|------|---------|------|---------|------|
| | | | Sch 5S | | Sch 10S | | Sch 30S | | Sch 40S | | Sch 80S | |
| NPS | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm | inch | mm |
| 1/8 | 0.405 | 10.29 | | | 0.049 | 1.24 | 0.057 | 1.45 | 0.068 | 1.73 | 0.095 | 2.41 |
| 1/4 | 0.540 | 13.72 | | | 0.065 | 1.65 | 0.073 | 1.85 | 0.088 | 2.24 | 0.119 | 3.02 |
| 3/8 | 0.675 | 17.15 | | | 0.065 | 1.65 | 0.073 | 1.85 | 0.091 | 2.31 | 0.126 | 3.20 |
| 1/2 | 0.840 | 21.34 | 0.065 | 1.65 | 0.083 | 2.11 | 0.095 | 2.41 | 0.109 | 2.77 | 0.147 | 3.73 |
| 3/4 | 1.050 | 26.67 | 0.065 | 1.65 | 0.083 | 2.11 | 0.095 | 2.41 | 0.113 | 2.87 | 0.154 | 3.91 |
| 1 | 1.315 | 33.40 | 0.065 | 1.65 | 0.109 | 2.77 | 0.114 | 2.90 | 0.133 | 3.38 | 0.179 | 4.55 |
| 1 1/4 | 1.660 | 42.16 | 0.065 | 1.65 | 0.109 | 2.77 | 0.117 | 2.97 | | | | |
| 1 1/2 | 1.900 | 48.26 | 0.065 | 1.65 | 0.109 | 2.77 | 0.125 | 3.18 | | | | |
| 2 | 2.375 | 60.33 | 0.065 | 1.65 | 0.109 | 2.77 | 0.125 | 3.18 | | | | |

Mechanical properties

| Steel grade | Tensile strength, min, N/mm ² | Yield strength, min, N/mm ² | Elongation in 2" or 50 mm, min, % |
|-------------|---|---|--------------------------------------|
| N08904 | 490 | 215 | 35 |
| N08800 | 520 | 205 | 30 |
| N08811 | 450 | 170 | 30 |
| N08020 | 550 | 240 | 30 |
| N08028 | 500 | 214 | 40 |
| N08825 | 586 | 241 | 30 |
| N06600 | 552 | 241 | 30 |

Dimensional tolerances

| Outside diameter, inch (mm) | Permitted variations in OD, inch (mm) | | Permitted variations in wall thickness, % | |
|--------------------------------|---------------------------------------|---------------|---|-------|
| | over | under | over | under |
| Over 0.400 (10) to ½ (16) excl | 0.005 (0.13) | 0.005 (0.13) | 15 | 15 |
| ½ (16) to 1 ½ (38) incl. | 0.0075 (0.19) | 0.0075 (0.19) | 10 | 10 |
| Over 1 ½ (38) to 3 (76) incl. | 0.010 (0.25) | 0.010 (0.25) | 10 | 10 |

• Standard: EN 10216-5

Steel grades:

| Steel code | Designation |
|------------|--------------------|
| 1.4301 | X5CrNi 18 10 |
| 1.4306 | X2CrNi 19 11 |
| 1.4541 | X6CrNiTi 18 1 |
| 1.4401 | X5CrNiMo 17 12 2 |
| 1.4404 | X2CrNiMo 17 12 2 |
| 1.4436 | X3CrNiMo 17 13 3 |
| 1.4435 | X2CrNiMo 18 14 3 |
| 1.4571 | X6CrNiMoTi 17 12 2 |
| 1.4462 | X2CrNiMoN 22 5 3 |

| Steel code | Designation |
|----------------------|-----------------|
| " + DIN EN 10297-2 " | |
| 1.4006 | X12Cr 13 |
| 1.4016 | X6Cr 17 |
| 1.4510 | X3CrTi 17 |
| "+SEW 470" | |
| 1.4878 | X12CrNiTi 18 9 |
| 1.4845 | X12CrNi 25 21 |
| 1.4828 | X15CrNiSi 20 12 |
| 1.4841 | X15CrNiSi 25 20 |

HF tubes

[illegible]

• Additional requirements (acc. to DIN 28180)

Steel grades:

| Steel code | Designation |
|------------|--------------------|
| 1.4301 | X5CrNi 18 10 |
| 1.4401 | X5CrNiMo 17 12 2 |
| 1.4541 | X6CrNiTi 18 10 |
| 1.4571 | X6CrNiMoTi 17 12 2 |

| Outside diameter,mm | Wall thickness,mm | | | | |
|---------------------|-------------------|-----|---|-----|-----|
| 16 | 1.2 | 1.6 | 2 | 2.6 | 3.2 |
| 20 | 1.2 | 1.6 | 2 | 2.6 | 3.2 |
| 25 | 1.2 | 1.6 | 2 | 2.6 | 3.2 |
| 30 | 1.2 | 1.6 | 2 | 2.6 | 3.2 |
| 38 | 1.2 | 1.6 | 2 | 2.6 | 3.2 |

Tolerances:

Outside diameter tolerances tubes from austenitic stainless steel

| Outside diameter, mm | Tolerance class 1, mm | Tolerance class 2, mm |
|----------------------|-----------------------|-----------------------|
| 16 | ± 0.10 | ± 0.30 |
| 20 | | |
| 25 | ± 0.12 | |
| 30 | ± 0.15 | |
| 38 | ± 0.20 | ± 0.40 |

Wall thickness tolerances

| Outside diameter | Wall thickness tolerances: | |
|-------------------------|----------------------------|---------------------------------|
| | Up to 2 | More than 2 |
| Tolerance class 1 and 2 | ± 0.20 | ±10% from wall thickness |
| Tolerance class 3 | ± 0.20 | + 15% - 10% from wall thickness |

Length tolerances

| Length | Tolerances |
|---------------------|----------------|
| ≤ 5 000 | +5 0 |
| > 5 000 ≤ 10 000 | + 10 0 |
| > 10 000 | Upon agreement |



CENTRAVIS 

• U-bent tubes

Steel grades

| Ferrite | Austenite | Duplex | Superduplex | Ni – alloys* |
|---------|-----------------------------|--------------------------|-------------|--------------|
| TP410 | TP 304/304L | UNS S31803 | UNS S32750 | UNS N06600 |
| | TP 316/316L | UNS S32205 | UNS S32760 | UNS N08020 |
| | TP 316Ti | 1.4462(X2CrNiMoN 22 5 3) | | UNS N00880 |
| | TP 317/317L | | | UNS N08825 |
| | TP 321 | | | UNS N08904 |
| | TP 347 | | | |
| | 1.4301 (X5CrNi 18 10) | | | |
| | 1.4401 (X5CrNiMo 17 12 2) | | | |
| | 1.4541 (X6CrNi 18 10) | | | |
| | 1.4571 (X5CrNiMoTi 17 12 2) | | | |

* – Tubes of other alloys and steel grades can be produced in trial lots.

Technical requirements

Straight tubes for bending (ASTM/ASME A/SA 213; ASTM B 163; ASTM B 729; ASTM B 407; ASTM B 423; ASTM A 789; DIN 28180; EN 10216-5)

U-BENT TUBES:

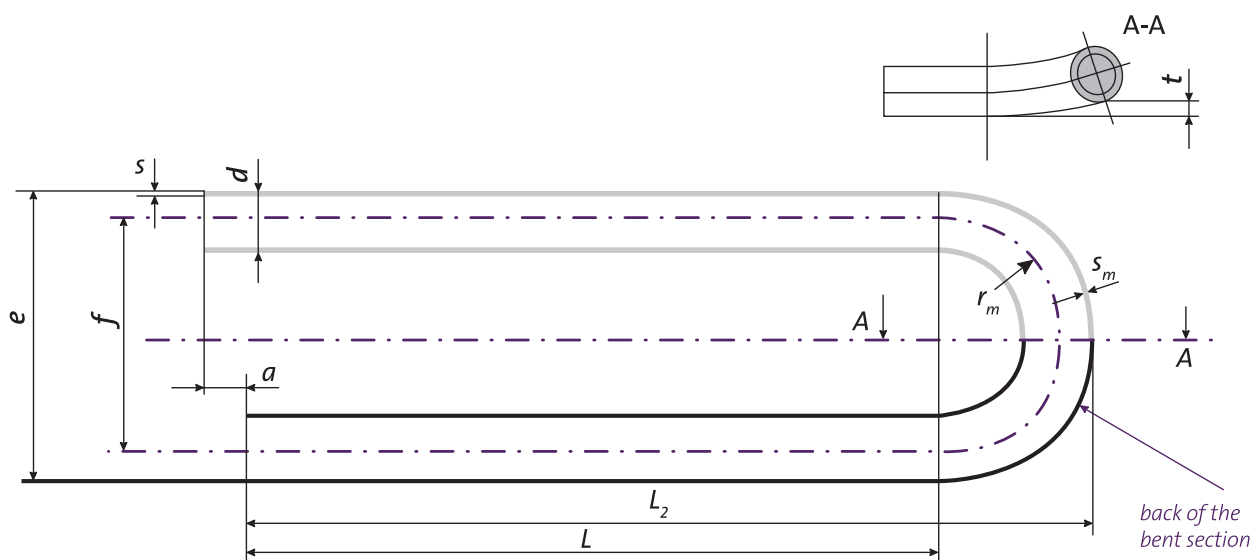
TEMA RCB 2.31 – Standards of the Tubular Exchanger Manufacturers Association (9th edition).

ASTM A688 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Feedwater Heater Tubes.

ASTM B163 – Standard technical requirements for tubes of nickel and nickel alloy for condensers and heat exchangers.

DIN 28179 – Steel U-tubes for tubular heat exchangers - Technical delivery conditions.

Customer specifications.



Available range:

| OD mm | Wall thickness, mm | | | | | | | | | | | | | | | | | | |
|----------|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 0.81 | 0.89 | 0.91 | 1.00 | 1.20 | 1.25 | 1.40 | 1.50 | 1.60 | 1.65 | 1.80 | 2.00 | 2.11 | 2.20 | 2.40 | 2.60 | 2.77 | 2.80 | 3.00 |
| 12.70 | | | | | | | | | | | | | | | | | | | |
| 13.72 | | | | | | | | | | | | | | | | | | | |
| 14.00 | | | | | | | | | | | | | | | | | | | |
| 15.88 | | | | | | | | | | | | | | | | | | | |
| 15.90 | | | | | | | | | | | | | | | | | | | |
| 16.00 | | | | | | | | | | | | | | | | | | | |
| 17.20 | | | | | | | | | | | | | | | | | | | |
| 19.05 | | | | | | | | | | | | | | | | | | | |
| 20.00 | | | | | | | | | | | | | | | | | | | |
| 21.30 | | | | | | | | | | | | | | | | | | | |
| 25.00 | | | | | | | | | | | | | | | | | | | |
| 25.40 | | | | | | | | | | | | | | | | | | | |
| 26.90 | | | | | | | | | | | | | | | | | | | |
| 30.00 | | | | | | | | | | | | | | | | | | | |
| 31.80 | | | | | | | | | | | | | | | | | | | |
| 38.10 | | | | | | | | | | | | | | | | | | | |

BENDING RADIUS – from 1.5 OD to 1250 mm.

When ordering tubes with $R \leq 1.5D$ it is necessary to agree precision of geometrics.

STRAIGHT TUBES MAXIMUM LENGTH (before bending) – 26 000 mm upon agreement

LEG LENGTH – min 1 meter, max 10.5 meters (for max $R=1250$ mm)

HYDROSTATIC TEST – maximum test pressure 600 bar, soaking 10 sec. with demineralized water. Compressed air cleaning after hydro-test.

Heat Treatment:

Heat treatment is carried out by resistometric method on a curved part of the tube and on straight parts 300 mm in length by heating the tube to the required temperature (see table below), and then soaking and rapid cooling of the tube to the temperature 370 C & below. Nitrogen blow-off tubes used before and during the process of heat treatment to protect the inner and outer surface from oxidation.

| Grades | Temperature, C° | Soaking time, sec. |
|---|-----------------|--------------------|
| TP410 | 780-800 | 30...55 |
| TP 304/304L/316/316L/316Ti/ 317/317L/321/347 | 1050 ± 10 | 20...45 |
| UNS S31803/ UNS S32205 | 1070 | 30...40 |
| UNS S32750 | 1075 | 55...60 |
| UNS S32760 | 1120 | 40...60 |
| UNS N08904 | 1120 | 20...30 |
| UNS N08800/ UNS N08020 / UNS N08028 | 1150 | 15...20 |
| UNS N08825 | 1070 | 20...30 |
| UNS N06600 | 1070 | 15...20 |

Marking – before bending by marking machine all over the tube length (bent section after heat treatment without marking). Marking is also possible after bending on the straight parts of U-bent tube.

Packaging – closed wooden boxes of corresponding dimensions for each tube length, radius, diameter, according to PO requirements or in bundles wrapped in polyethylene film with plastic clamping spacers on each tube.

Transportation – a truck with capacity of 20 tonnes, body length 13.6 m, width 2.46 m.

• Hollow Bars

CENTRAVIS PRODUCTION UKRAINE PJSC produces standard sizes range most requested by machinery manufacturers, specified in the table. Requirements to hollow bars are in accordance with EN 10216-5 and ASTM A312.

The company produces a range of additional sizes not included in the standards. Also production of hollow bars according to NF A 49-317 is possible.

Hollow Bar – Standard sizes

| Outside diameter, mm | Inside diameter, mm | Pipe length, m | | Theoretical weight, kg/m | Outside diameter, mm | Inside diameter, mm | Pipe length, m | | Theoretical weight, kg/m |
|----------------------|---------------------|----------------|------|--------------------------|----------------------|---------------------|----------------|------|--------------------------|
| | | min | max | | | | min | max | |
| 50.0 | 32.0 | 3.0 | 11.0 | 9.1 | 118.0 | 90.0 | 3.0 | 11.0 | 35.9 |
| 56.0 | 40.0 | 3.0 | 12.0 | 9.5 | 118.0 | 80.0 | 3.0 | 9.0 | 46.4 |
| 56.0 | 45.0 | 3.0 | 17.0 | 6.8 | 118.0 | 71.0 | 3.0 | 7.5 | 54.8 |
| 56.0 | 36.0 | 3.0 | 12.0 | 11.3 | 118.0 | 63.0 | 3.0 | 7.0 | 61.4 |
| 56.0 | 30.0 | 3.0 | 12.5 | 13.8 | 125.0 | 100.0 | 3.0 | 10.5 | 34.7 |
| 60.0 | 50.0 | 3.0 | 14.0 | 6.8 | 125.0 | 95.0 | 3.0 | 9.5 | 40.7 |
| 60.0 | 45.0 | 3.0 | 13.0 | 9.7 | 125.0 | 90.0 | 3.0 | 8.5 | 46.4 |
| 60.0 | 40.0 | 3.0 | 13.0 | 12.3 | 125.0 | 80.0 | 3.0 | 7.0 | 56.9 |
| 63.0 | 45.0 | 3.0 | 12.0 | 12.0 | 125.0 | 71.0 | 3.0 | 6.5 | 65.3 |
| 63.0 | 40.0 | 3.0 | 11.5 | 14.6 | 132.0 | 106.0 | 3.0 | 9.5 | 38.2 |
| 63.0 | 36.0 | 3.0 | 9.5 | 16.5 | 132.0 | 98.0 | 3.0 | 8.0 | 48.2 |
| 63.0 | 32.0 | 3.0 | 9.0 | 18.2 | 132.0 | 90.0 | 3.0 | 7.0 | 57.5 |
| 63.0 | 50.0 | 3.0 | 12.0 | 9.1 | 132.0 | 80.0 | 3.0 | 6.0 | 68.0 |
| 65.0 | 54.0 | 3.0 | 14.5 | 8.1 | 132.0 | 71.0 | 3.0 | 5.5 | 76.3 |
| 70.0 | 50.0 | 3.0 | 10.5 | 14.8 | 140.0 | 112.0 | 3.0 | 8.0 | 43.5 |
| 71.0 | 60.0 | 3.0 | 12.0 | 8.9 | 140.0 | 106.0 | 3.0 | 7.0 | 51.6 |
| 71.0 | 56.0 | 3.0 | 12.0 | 11.7 | 140.0 | 100.0 | 3.0 | 6.5 | 59.2 |
| 71.0 | 45.0 | 3.0 | 8.5 | 18.6 | 140.0 | 90.0 | 3.0 | 5.5 | 70.9 |
| 71.0 | 40.0 | 3.0 | 11.5 | 21.2 | 140.0 | 80.0 | 3.0 | 5.0 | 81.4 |
| 71.0 | 36.0 | 3.0 | 7.0 | 23.1 | 150.0 | 132.0 | 3.0 | 9.5 | 31.3 |
| 75.0 | 60.0 | 3.0 | 11.5 | 12.5 | 150.0 | 125.0 | 3.0 | 7.5 | 42.4 |
| 75.0 | 56.0 | 3.0 | 9.5 | 15.3 | 150.0 | 118.0 | 3.0 | 6.5 | 52.9 |
| 75.0 | 50.0 | 3.0 | 13.5 | 19.3 | 150.0 | 112.0 | 3.0 | 5.5 | 61.4 |
| 75.0 | 40.0 | 3.0 | 11.5 | 24.8 | 150.0 | 106.0 | 3.0 | 5.0 | 69.4 |
| 75.0 | 45.0 | 3.0 | 12.0 | 22.2 | 150.0 | 90.0 | 3.0 | 6.5 | 88.8 |
| 80.0 | 63.0 | 3.0 | 12.0 | 15.0 | 150.0 | 95.0 | 3.0 | 6.5 | 83.1 |
| 80.0 | 56.0 | 3.0 | 12.0 | 20.1 | 150.0 | 80.0 | 3.0 | 6.0 | 99.3 |
| 80.0 | 50.0 | 3.0 | 11.5 | 24.0 | 160.0 | 132.0 | 3.0 | 6.0 | 50.4 |
| 80.0 | 45.0 | 3.0 | 10.5 | 27.0 | 160.0 | 122.0 | 3.0 | 6.0 | 66.1 |
| 80.0 | 44.0 | 3.0 | 10.0 | 27.5 | 160.0 | 120.0 | 3.0 | 6.5 | 69.1 |
| 80.0 | 40.0 | 3.0 | 9.5 | 29.6 | 160.0 | 112.0 | 3.0 | 7.0 | 80.5 |
| 85.0 | 45.0 | 3.0 | 8.5 | 32.1 | 170.0 | 140.0 | 3.0 | 6.5 | 57.3 |
| 88.0 | 70.0 | 3.0 | 11.5 | 17.5 | 170.0 | 130.0 | 3.0 | 7.0 | 74.0 |
| 90.0 | 75.0 | 3.0 | 12.5 | 15.3 | 170.0 | 118.0 | 3.0 | 6.0 | 92.3 |
| 90.0 | 71.0 | 3.0 | 12.0 | 18.9 | 170.0 | 106.0 | 3.0 | 5.0 | 108.9 |
| 90.0 | 68.0 | 3.0 | 11.5 | 21.4 | 175.0 | 145.0 | 3.0 | 5.0 | 59.2 |
| 90.0 | 63.0 | 3.0 | 10.0 | 25.5 | 175.0 | 159.0 | 3.0 | 6.5 | 32.9 |
| 90.0 | 56.0 | 3.0 | 8.5 | 30.6 | 180.0 | 150.0 | 3.0 | 6.5 | 61.0 |
| 90.0 | 50.0 | 3.0 | 8.0 | 34.5 | 180.0 | 140.0 | 3.0 | 6.0 | 78.9 |
| 95.0 | 75.0 | 3.0 | 11.5 | 21.0 | 180.0 | 130.0 | 3.0 | 5.5 | 95.6 |
| 95.0 | 67.0 | 3.0 | 9.0 | 28.0 | 180.0 | 125.0 | 3.0 | 5.0 | 103.4 |
| 95.0 | 50.0 | 3.0 | 11.0 | 40.2 | 190.0 | 160.0 | 3.0 | 6.5 | 64.7 |
| 100.0 | 80.0 | 3.0 | 10.5 | 22.2 | 190.0 | 150.0 | 3.0 | 5.5 | 83.8 |
| 100.0 | 71.0 | 3.0 | 8.0 | 30.6 | 190.0 | 140.0 | 3.0 | 4.5 | 101.7 |
| 100.0 | 63.0 | 3.0 | 10.5 | 37.2 | 190.0 | 132.0 | 3.0 | 4.5 | 115.1 |
| 100.0 | 56.0 | 3.0 | 10.5 | 42.3 | 190.0 | 123.0 | 3.0 | 4.0 | 129.3 |
| 106.0 | 90.0 | 3.0 | 11.0 | 19.3 | 190.0 | 118.0 | 3.0 | 4.0 | 136.7 |
| 106.0 | 85.0 | 3.0 | 9.0 | 24.7 | 190.0 | 106.0 | 3.0 | 3.5 | 153.3 |
| 106.0 | 80.0 | 3.0 | 8.0 | 29.8 | 200.0 | 170.0 | 3.0 | 5.5 | 68.4 |
| 106.0 | 71.0 | 3.0 | 11.0 | 38.2 | 200.0 | 160.0 | 3.0 | 5.0 | 88.8 |
| 106.0 | 63.0 | 3.0 | 10.5 | 44.8 | 200.0 | 150.0 | 3.0 | 4.0 | 107.9 |
| 106.0 | 56.0 | 3.0 | 9.0 | 49.9 | 200.0 | 140.0 | 3.0 | 3.5 | 125.8 |
| 112.0 | 95.0 | 3.0 | 9.5 | 21.7 | 200.0 | 130.0 | 3.0 | 3.5 | 142.4 |
| 112.0 | 90.0 | 3.0 | 10.5 | 27.4 | 212.0 | 180.0 | 3.0 | 5.0 | 77.3 |
| 112.0 | 80.0 | 3.0 | 11.0 | 37.9 | 212.0 | 170.0 | 3.0 | 5.0 | 98.9 |
| 112.0 | 71.0 | 3.0 | 9.0 | 46.3 | 224.0 | 180.0 | 3.0 | 4.0 | 109.6 |
| 112.0 | 63.0 | 3.0 | 8.5 | 52.9 | 236.0 | 206.0 | 3.0 | 3.5 | 81.8 |
| 118.0 | 95.0 | 3.0 | 10.5 | 30.2 | 236.0 | 216.0 | 3.0 | 4.5 | 55.7 |
| | | | | | 236.0 | 220.0 | 3.0 | 5.0 | 45.0 |
| | | | | | 240.0 | 220.0 | 3.0 | 4.0 | 56.7 |
| | | | | | 240.0 | 224.0 | 3.0 | 4.5 | 45.8 |
| | | | | | 250.0 | 234.0 | 3.0 | 3.5 | 47.7 |

Tolerances:

Under Hollow Bars production permissible variations in OD are plus tolerance, in ID are minus tolerance.

| Outside diameter range | Machining tolerances | | | |
|------------------------|-----------------------------|----------------------------|------------------------------------|---------------------------|
| | For the outside diameter OD | For the inside diameter ID | For eccentricity (centre offset) E | For out-of-straightness h |
| 50 ≤ D ≤ 250 | -0/+2% (min +1/-0 mm) | +0/-2% (min +0/-1 mm) | 10% | 1 mm/m |

One of the key parameters in hollow bar production is eccentricity. In order to keep eccentricity to the minimum CPU employs a process where billets are pre-drilled and expanded prior to extrusion. Other operations used to minimize eccentricity include vertical pre-heating before extrusion and a system of precision calibration of tooling. This ensures uniform wall thickness in cross section, which directly affects eccentricity.

Thanks to the above process improvements CPU has a distinct advantage over other manufacturers of hollow bars.

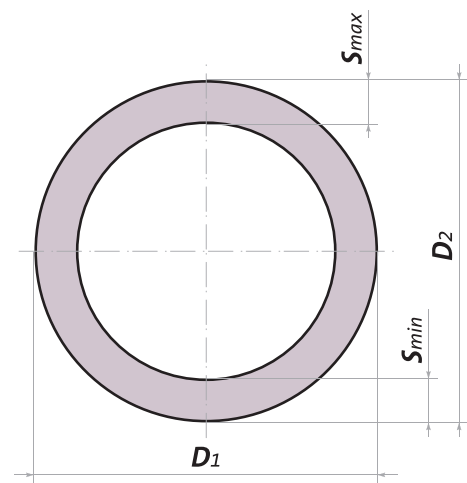
Hollow Bar eccentricity (displacement of tube ID with respect to its OD, i.e. deviation from a common center) is given by formula 1 (in %) or by formula 2 (in mm):

$$\text{where } E \text{ is eccentricity, \%}; \quad E = \frac{(S_{\max} - S_{\min})}{(S_{\max} + S_{\min})} \times 100\% \quad (1)$$

S_{\min}, S_{\max} – actual tube WT (min, max), mm.

$$\text{where } E \text{ is eccentricity, mm}; \quad E = \frac{(S_{\max} - S_{\min})}{2}, \text{ mm} \quad (2)$$

S_{\min}, S_{\max} – actual tube WT (min, max), mm.



The Company also produces Mechanical Tubing according to ASTM A511.

Mechanical tubing according to ASTM A511 – Standard sizes

| Outside diameter inches | Wall thickness inches | Outside diameter mm | Wall thickness mm | Outside diameter inches | Wall thickness inches | Outside diameter mm | Wall thickness mm |
|-------------------------|-----------------------|---------------------|-------------------|-------------------------|-----------------------|---------------------|-------------------|
| 2.00 | 0.188 to 0.500 | 50.80 | 4.78 to 12.70 | 6.00 | 0.250 to 1.000 | 152.40 | 6.35 to 25.40 |
| 2.25 | 0.188 to 0.750 | 57.15 | 4.78 to 19.05 | 6.25 | 0.250 to 1.500 | 158.75 | 6.35 to 38.10 |
| 2.50 | 0.188 to 0.750 | 63.50 | 4.78 to 19.05 | 6.50 | 0.250 to 1.500 | 165.10 | 6.35 to 38.10 |
| 2.75 | 0.188 to 0.875 | 69.85 | 4.78 to 22.23 | 6.75 | 0.375 to 1.500 | 171.45 | 9.53 to 38.10 |
| 3.00 | 0.188 to 0.875 | 76.20 | 4.78 to 22.23 | 7.00 | 0.375 to 1.500 | 177.80 | 9.53 to 38.10 |
| 3.12 | 0.188 to 0.875 | 79.38 | 4.78 to 22.23 | 7.25 | 0.375 to 1.500 | 184.15 | 9.53 to 38.10 |
| 3.25 | 0.188 to 0.875 | 82.55 | 4.78 to 22.23 | 7.50 | 0.375 to 1.500 | 190.50 | 9.53 to 38.10 |
| 3.50 | 0.188 to 0.875 | 88.90 | 4.78 to 22.23 | 7.75 | 0.375 to 1.500 | 196.85 | 9.53 to 38.10 |
| 3.75 | 0.250 to 0.875 | 95.25 | 6.35 to 22.23 | 8.00 | 0.375 to 1.500 | 203.20 | 9.53 to 38.10 |
| 4.00 | 0.250 to 0.875 | 101.60 | 6.35 to 22.23 | 8.25 | 0.375 to 1.500 | 209.55 | 9.53 to 38.10 |
| 4.25 | 0.250 to 1.000 | 107.95 | 6.35 to 25.40 | 8.50 | 0.375 to 1.500 | 215.90 | 9.53 to 38.10 |
| 4.50 | 0.250 to 1.000 | 114.30 | 6.35 to 25.40 | 8.75 | 0.500 to 1.500 | 222.25 | 12.70 to 38.10 |
| 4.75 | 0.250 to 1.000 | 120.65 | 6.35 to 25.40 | | | | |
| 5.00 | 0.250 to 1.000 | 127.00 | 6.35 to 25.40 | | | | |
| 5.25 | 0.250 to 1.000 | 133.35 | 6.35 to 25.40 | | | | |
| 5.50 | 0.250 to 1.000 | 139.70 | 6.35 to 25.40 | | | | |
| 5.75 | 0.250 to 1.000 | 146.05 | 6.35 to 25.40 | | | | |

Tolerances:

Permissible Variations in Outside Diameter, Wall Thickness (Hot-Finished Round Tubing)

| Specified Nominal Inch Size, Outside Diameter, in. [mm] | Prevailing Range of Commercially Available Metric Sizes, mm | Ratio of Wall Thickness to Outside Diameter | Outside Diameter and Wall Thickness Tolerances | | | | | |
|---|---|---|--|-------------|--|-------|--------------------------|-------|
| | | | Outside Diameter, in. [mm] | | Wall Thickness, % | | | |
| | | | | | Over 0.172 [4.37] to 0.203 in. [5.16 mm], incl | | Over 0.203 in. [5.16 mm] | |
| | | | Over | Under | Over | Under | Over | Under |
| Under 3 [75] | Under 76.1 | all wall thickness | 0.023 [0.6] | 0.023 [0.6] | 14 | 14 | 12.5 | 12.5 |
| 3 [75] to 5½ [140], excl | 76.1 to 139.7, excl | all wall thickness | 0.031 [0.8] | 0.031 [0.8] | 14 | 14 | 12.5 | 12.5 |
| 5½ [140] to [200], excl | 139.7 to 203.2, excl | all wall thickness | 0.047 [1.2] | 0.047 [1.2] | 14 | 14 | 12.5 | 12.5 |
| 8 [200] to 10¾ [275], excl | 203.2 to 273.1, excl | 5 % and over | 0.047 [1.2] | 0.047 [1.2] | - | - | 12.5 | 12.5 |
| 10¾ [275] to 12¾ [325], incl | 273.1 to 323.9, incl | under 5 % | 0.063 [1.6] | 0.063 [1.6] | - | - | 12.5 | 12.5 |

Standard steel grades

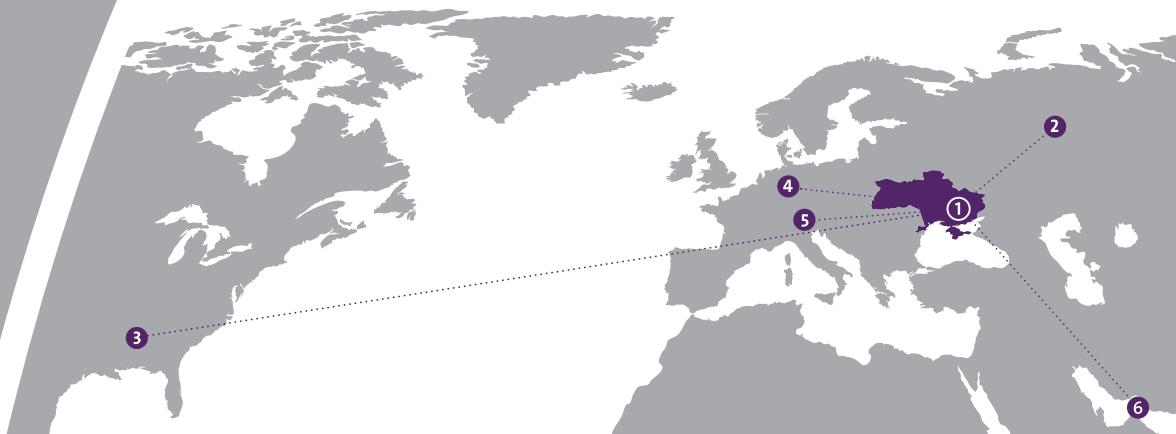
Hollow bars and Mechanical tubing are supplied in a range of specially selected stainless and acid-resistant standard grades chosen to cover the majority of corrosion and processing problems that occur in daily practice.

| USA | | | France | | Germany | | |
|---------|---------------------|---------------|-------------|-------------------|--------------|-----------------|--------------|
| UNS | Designation (Grade) | Standard ASTM | Designation | Standard NF | Material No. | Designation DIN | Standard DIN |
| S 30400 | MT 304 (TP 304) | A 511 (A312) | Z6CN18.09 | A49-117 | 1.4301 | X5CrNi18.10 | EN 10216-5 |
| S 30403 | MT304L (TP 304L) | A 511 (A312) | Z2CN18.10 | A49-317 (A49-117) | 1.4306 | X2CrNi19.11 | EN 10216-5 |
| S 31600 | MT316 (TP 316) | A 511 (A312) | Z6CND17.11 | (A49-117) | 1.4401 | X5CrNiMo17.12.2 | EN 10216-5 |
| S 31603 | MT316L (TP 316L) | A 511 (A312) | Z2CND17.12 | A49-317 (A49-117) | 1.4404 | X2CrNiMo17.12.2 | EN 10216-5 |



List of standards in production

1. **ASTM A213/A213M, ASME SA213/SA213M**
Seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes
2. **ASTM A268/A268M, ASME SA268/SA268M**
Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
3. **ASTM A269/A269M**
Seamless and Welded Austenitic Stainless Steel Tubing for General Service
4. **ASTM A312/A312M, ASME SA312/SA312M**
Seamless and welded austenitic stainless steel pipes
5. **ASTM A376/A376M, ASME SA376/SA376M**
Seamless austenitic steel pipes for high-temperature central-station service
6. **ASTM A511**
Seamless stainless steel mechanical tubing
7. **ASTM A789/A789M, ASME SA789/SA789M**
Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service
8. **ASTM A790/A790M, ASME SA790/SA790M**
Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe
9. **ASTM B167, B407, B444, B829**
Standard specifications for Nickel and Nickel Alloys Seamless Pipe and Tube
10. **DIN 17459**
Seamless circular high-temperature austenitic stainless steel tubes
11. **DIN 28180**
Seamless steel tubes for tubular heat exchangers
12. **EN 10216-5**
Seamless steel tubes for pressure purposes
13. **NF A 49-117**
Seamless plain-end ferritic and austenitic stainless steel tubes for pipelines and other use
14. **NF A 49-217**
Seamless ferritic, austenitic and austenitic-ferritic stainless steel tubes for heat exchangers
15. **NF A 49-317**
Seamless plain-end austenitic stainless steel mechanical tubing
16. **UNI 6904**
Seamless tubes of special alloyed corrosion and heat resisting stainless steel



Our global offices at the heart of stainless steel

CentraVis Worldwide

1 Ukraine

CentraVis Production Ukraine
56 Trubnikov Avenue, Nikopol,
Dnipropetrovsk Region, 53201,
Phone/fax: +38 0566 63 01 00

2 Russia

CentraVis Sales Rus
115191, Moscow,
19, 4th Roschinsky passage,
Phone: +7 495 419 13 80

620100, Yekaterinburg,
23 Tkachey Str., office 1205
Phone/fax: +7 343 311 66 77

3 USA

CentraVis Sales America
3730 Kirby Suite 1200
Houston, TX 77098
Phone: +1 832 274 56 59

4 Germany

CentraVis Sales Germany GmbH
Wuestenhoefenstr, 234
45355 Essen
Phone: +49 201 729 467 0
Fax: +49 201 729 467 11

5 Switzerland

CentraVis Sales Switzerland S.A.
Via San Salvatore, 13
PO Box 609, CH-6902
Lugano-Paradiso
Phone: +41 91 960 5060
Fax: +41 91 960 5061

**Representative office CentraVis
Sales Switzerland S.A. in Poland**
19 Mariana Domagaly Str.,
30-741 Krakow, Poland
Phone : +48 602 834 112
Fax: +41 91 960 5061

**Italian Branch CentraVis Sales
Switzerland S.A.**
Piazza IV Novembre, 4
20124 Milano
Phone: +39 02 6679 61

6 UAE

Jebel Ali, Dubai, United Arab Emirates
Phone: + 971 5 61670509

