



QAEM

COPPER INDUSTRIES COMPANY



www.qaemcopper.com

Introduction

Copper articles discovered during various investigations in different parts of Iran and also remainders of primitive smelting furnaces show that Iranians have had the knowledge of mining and smelting of copper since old ages. Archeological studies show that mining activities had been relatively brisk since about 5,000 B.C. Unearthed articles during excavations which have been made of copper, bronze, gold and silver show that mining operations and metal foundry industries retained their progressing trend in later millenniums.

Copper resources of IRAN are fairly rich. Copper mines in Sarcheshmeh (Kerman province) have been categorized among important mines of the world. NICICO (National Iranian Copper Industries Company) has already started to develop its capacity in a way to achieve the goal to produce 400,000 Tons/year copper cathode within the next few years. This means producing more feeding materials for downstream industries whose raw materials are copper cathode and consequently contributes to growing these industries.

QAEM Copper industries Company, founded in 2001 in land of 71,000m² consists of production hall, utilities and office building which are located in Murchekhort industrial

zone, 40Km north of Isfahan, which is known as one of the most famous industrial and historical cities. The plant is equipped with necessary facilities to produce 24,000 Tons/year of various kinds of seamless copper tubes including LWC (Plain & I.G), Pancake and Straight.

QAEM management team is evaluating deeply to equip the plant for second phase to reach its goal up to 2020 which is production of 30,000 Tons/Year of different copper tubes. All QAEM's products are made from Cu-DHP and Cu-ETP by using high grade copper cathode with purity of 99.9% which ensures the highest trustworthy products.

QAEM Copper industries Co. Produces different kinds of seamless high quality copper tubes by Cast & Roll Technology (C&R). This technology was invented for the first time in 1992 to produce seamless copper tubes. C&R process consists of two main sections: Melting & Casting and Tube Rolling. After casting, the outside surface of the shell is milled to remove scales and oxidation. Moreover, no lubricants are used in the rolling process, and the material is protected by inert gas during hot working. As a result, the tube is bright both inside and outside, which further improves drawability and yield of the C&R process.



QAEM's products can meet the demand of industries such as:

Refrigerators, Freezers, Air Conditioners (all in both Household and Industrial types), Condensers, Evaporators, Heat Exchangers, Boilers, Hot and Cold Thermostats, Refrigerator Compressors, Electrical Connecting Element, Combustible Gas Distribution System, Sanitary System and etc.

QAEM copper tubes serve many other industries too. These include manufacturers of gas heater, dryer filters, water taps, industrial refrigeration equipments and instillation purposes. We deliver tubes for these applications in a wide range of sizes in all common tempers and delivery formats. Moreover, tubes used in assembly and installation of refrigeration systems need special care to cleanliness of the bore, and are thus delivered with closed ends. All of our mills have the capability of delivering these refrigerators grade tubes in coil as well as straight length. QAEM Copper industries Co. also can render technical service to customer as per their request.

QAEM's core values are expressed through specific policies such as customer focus (attention to customer requirements in terms of innovative products and

services), ensure quality (our investment policies and internal procedures guarantee a high level of quality throughout the production process), widespread Innovation (further to our commitment to R&D in product and process innovation, at QAEM we stimulate our employees to generate innovative ideas at every phase of their work) and working together. Besides, increasing and guaranteeing safety in the work place is a priority for QAEM. In addition, awareness of the social significance of the enterprise and our responsibility towards the environment are two values to which QAEM is dedicating increasing energy and resources, with regard to both products and industrial processes.

We are your reliable partner for your projects and we guarantee the best service for you, before and after sales. It is our sincere hope, thought, that you ultimately would choose us not only for our capability and our product, but also for our dedication to your success. We will build our core business through continuous product innovation to better serve you; we will expand our business to serve growing markets in the Middle East and East Europe where many new opportunities exist.



For QAEM, a commitment to innovation means offering products and services which meet the customer's requirements, support their need to create profitable products and also respond to the need for advanced technology on the part of the end user. These objectives are reached via constant improvement of the surface and body of the product, its form and even its packaging as specified by the customer, by improvement in quality.



Quality Policy

QAEM Copper Industries Company has established the quality management system according to ISO 9001-2000. Moreover QAEM is the only copper tube manufacturer in the Middle East who could get Certificate of Conformity with ASTM B280 and EN 1057 Standards. Top managements declare the scopes of company as follow:

- 1 Focus on customer satisfaction by commitment to continuous improvement of quality production.
- 2 Increase capacity of production and variety of products.
- 3 Increase local market share and expand trade in global market.
- 4 Focus on innovation, research and development and using the most suitable technology in the company.
- 5 Focus on health, safety, training personnel and value the human resources as one of the most integral factors for the survival and growth of the company.
- 6 To have logic relation with our suppliers.
- 7 Environmental preservation and energy saving management and improvement productivity.



Level Wound Coil (LWC) copper Tube, Bright Annealed



General Specifications

Sizes		Material	Temper		Coil Weight	Form of Packing	
Outside Diameter (mm) 4 – 19.05	Wall Thickness (mm) 0.28 – 1.10	Cu: 99.90% Phosphorous: 0.015-0.040%	Light Annealed (O50)	Soft Annealed (O60)	80-250 (kg)	With Bobbin	Bobbin-less
		C12200 DHP (ASTM B68, B75, B88)				Cardboard & Wooden Reels	Cardboard
		Cu - DHP (EN 12735, En 12449)	Also Can be supplied in Hard Drawn temper			Stacked on pallets and shrink wrapped	

Applications: Air Conditioning units and heat exchanger industries, Refrigeration and general engineering applications.

Level Wound Coil (LWC) Seamless Copper Tube is one of QAEM Copper Industries co. products. All LWC tubes are normally produced according to ASTM & European Norm specifications. These specifications were prepared to take account of the requirements of ACR industry. Level Wound Coils are specially suited to long production runs for industrial applications and it is widely applied to the Air Conditioning & Refrigeration as well as the Heat Exchanger field. Each millimeter of tubes is 100% Eddy-Current tested and any surface defects found will be clearly marked by black color. For heavy coils, we wound LWC copper tubes in "Eye to the Sky" (Jumbo) form as per customer request.

Level Wound Coils are most commonly supplied in the soft and light annealed forms, also they can be ordered in hard drawn temper. During the Annealing process, tubes are normally cleaned with Nitrogen purging both from inside and outside. Moreover to protect tubes against dust & internal oxidation during transportation or long storing, we purged inside tubes and tubes ends are sealed with plastic caps. Coils on reel are stacked on pallets and shrink wrapped

At QAEM, LWC products are usually packed with wooden or cord board reels (and even without reels) as per customers request.

Products Range

W.T. O.D.	mm	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.63	0.7	0.76	0.8	0.9	1	1.2
mm	inch	0.012	0.014	0.016	0.018	0.020	0.022	0.024	0.025	0.028	0.030	0.031	0.035	0.039	0.047
4	----			✓	✓	✓	✓	✓	✓	✓	✓	✓			
4.76	3/16			✓	✓	✓	✓	✓	✓	✓					
6.35	1/4		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
7.93	5/16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
9.52	3/8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12	----		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12.7	1/2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15.87	5/8			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	----					✓	✓	✓	✓	✓	✓	✓	✓	✓	
18	----							✓	✓	✓	✓	✓	✓	✓	
19.05	3/4							✓	✓	✓	✓	✓	✓	✓	✓

Note: Other sizes can be made as per customer requirement according to mutual agreement.

Inner Grooved Copper Tube

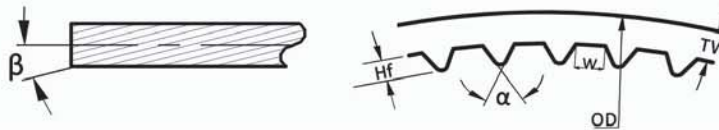
General Specifications

Outside Diameter (mm)	Temper		Coil Weight	Delivery Form
5.00 - 15.87	Light Annealed O50 (ASTM B75, B68)	Hard Drawn H85 (ASTM B75, 68)	80 - 170 Kg	LWC and Straight length

Application: Air Conditioning & Refrigeration Industry

Inner Grooved copper tube is one of the QAEM Products. To improve the heat transfer characteristics of tube, the inner surface of tube is provided with spirally running grooves. Increased internal surface area, turbulent flow of refrigerant and uniform distribution of refrigerant around the periphery of tube cause increment

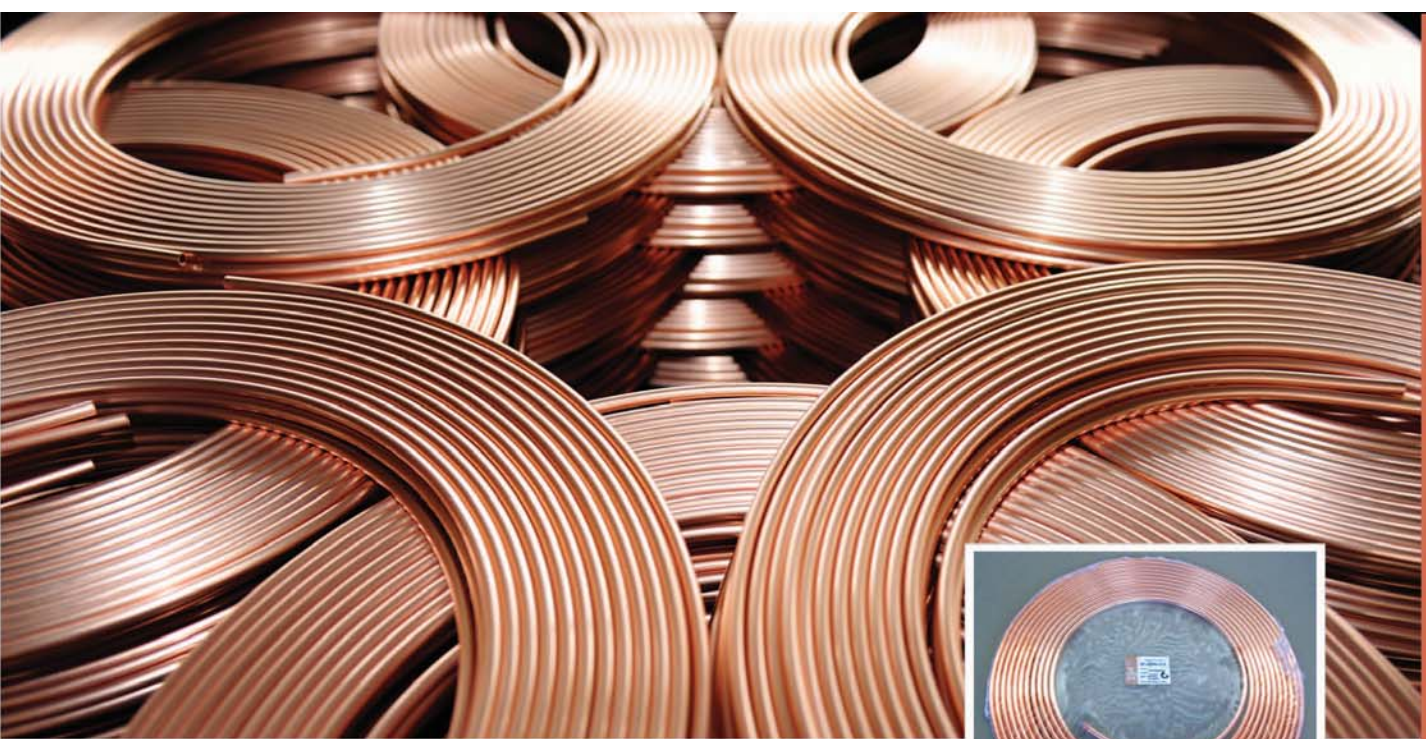
of efficiency. Heat transfer coefficient of these tubes is about 1.8-2 times of the same specification of plain tube. It is widely applied in Air Conditioning and Refrigeration Industries, which are in conformance with the developing tendency of air conditioner to high efficiency, energy saving, environment-friendly and healthy.



Specification of Inner Grooved Copper Tubes Manufactured in QAEM

Specification	Outside Diameter OD (mm)	Bottom Wall Thickness TW (mm)	Groove Depth Hf (mm)	Apex Angle α (degree)	Helix Angle β (degree)	Number of Tooth (Num.)	Unit Weight (gr/m)
Φ5.00 × 0.20 + 0.15	5.00 ^{±0.05}	0.20 ^{±0.03}	0.15 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	40	34
Φ7.00 × 0.22 + 0.10	7.00 ^{±0.05}	0.22 ^{±0.03}	0.10 ^{±0.02}	40 ^{±7°}	15 ^{±2°}	65	47
Φ7.00 × 0.25 + 0.10		0.25 ^{±0.03}	0.10 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	65	52
Φ7.00 × 0.25 + 0.18		0.18 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	50	58	
Φ7.00 × 0.28 + 0.15		0.28 ^{±0.03}	0.15 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	50	62
Φ7.93 × 0.28 + 0.15		7.93 ^{±0.05}	0.28 ^{±0.03}	0.15 ^{±0.02}	40 ^{±5°}	18 ^{±2°}	50
Φ9.52 × 0.27 + 0.16	9.52 ^{±0.05}	0.27 ^{±0.03}	0.16 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	70	82
Φ9.52 × 0.28 + 0.12		0.12 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	65	80	
Φ9.52 × 0.28 + 0.15		0.28 ^{±0.03}	0.15 ^{±0.02}	40 ^{±7°}	18 ^{±2°}	60	86
Φ9.52 × 0.28 + 0.20		0.20 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	60	89	
Φ9.52 × 0.30 + 0.20		0.30 ^{±0.03}	0.20 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	60	95
Φ9.52 × 0.34 + 0.15		0.34 ^{±0.03}	0.15 ^{±0.02}	50 ^{±7°}	18 ^{±2°}	60	103
Φ9.52 × 0.45 + 0.20		0.45 ^{±0.04}	0.20 ^{±0.03}	48 ^{±7°}	18 ^{±2°}	60	132
Φ12.00 × 0.41 + 0.20		12.00 ^{±0.05}	0.41 ^{±0.04}	0.20 ^{±0.03}	65 ^{±7°}	18 ^{±2°}	60
Φ12.70 × 0.35 + 0.25	12.70 ^{±0.05}	0.35 ^{±0.03}	0.25 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	65	155
Φ12.70 × 0.45 + 0.20		0.45 ^{±0.04}	0.20 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	50	180
Φ15.87 × 0.40 + 0.30	15.87 ^{±0.05}	0.40 ^{±0.04}	0.30 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	60	218
Φ15.87 × 0.45 + 0.30		0.45 ^{±0.04}	0.30 ^{±0.03}	53 ^{±7°}	18 ^{±2°}	75	239

Note: Other sizes can be manufactured as per customer requirement with mutual agreement.



Pancake Coil Copper Tube (PCC)

General Specifications

Sizes		Coil Length	Temper Designation
Outside Diameter 3/16" - 7/8" (4.76 - 22.22 mm)	Wall Thickness 0.35 - 1.2 mm	50' - 180' (and/or 15 - 50 meter)	Soft Annealed (O60) (ASTM B88 , B280 , EN12735)

Application: Air Conditioning & Refrigeration Field Service

Pancake Coil Copper Tube (PCC) intended for use in the connection, repairs, or alternations of air conditioning or refrigerator units in the field. QAEM Pancake tube is in accordance with specifications given in ASTM Standard (B88 , B280) and European Norm (EN12735) and other general norms. According to EN standard, Pancake tube has good bending properties for using in utility supplies

such as plumbing installations, gas transport networks, air conditioning systems and refrigerant piping. These products are usually supplied in the annealed form. All coils are cleaned and capped to keep it away from entering any contaminants. These are individually labeled, shrink wrapped and boxed in cardboard cartons for ease of handling and distribution.

Products Range

W.T. O.D.	mm	0.35	0.4	0.45	0.5	0.55	0.6	0.63	0.65	0.7	0.76	0.8	0.81	0.89	1	1.07	1.14	1.2	
mm	inch	0.014	0.016	0.018	0.020	0.022	0.024	0.025	0.026	0.028	0.030	0.031	0.032	0.035	0.039	0.042	0.045	0.047	
4.76	3/16																		
6.35	1/4									ASTM									
7.93	5/16																		
9.52	3/8												ASTM						
12.7	1/2												ASTM						
15.87	5/8													ASTM					
19.05	3/4																	ASTM	
22.22	7/8																		ASTM

Note: Other sizes can be made as per customer requirement according to mutual agreement. **ASTM:** ASTM B280 Standard Sizes

Straight Length Copper Tube



General Specifications

Sizes		Length	Temper Designation			
Outside Diameter 4 - 66.67 (mm)	Wall Thickness 0.35 - 2.41 (mm)	10" - 20" 3000 - 6000 (mm)	Hard (H)	Half Hard (1/2 H)	Light Annealed (O50)	Soft Annealed (O60)
<small>(ASTM B280, B88, JIS H3300, EN 1057, EN 13600, EN 12733)</small>						

Application: Used for Air Conditioning & Refrigeration Ind., Piping Systems (i.e. piping, connections, repairs) Electrical and Sanitary Ind.

These products are usually capped (both ends) and packed with Wrapped Plastic

Straight copper tubes are used for air conditioning & refrigeration industries, electrical industries and sanitary purposes. Straight length Seamless Copper Tubes with high precision, ultra clean surfaces, bright finish, even structure, high efficient heat exchanging, welding easily, corrosion resistant and good for mobility, are

manufactured by QAEM Copper Industries Co. By customer request, straight length with high electrical conductivity could be supplied.

Straight copper tubes are usually delivered in hard drawn and half hard tempers; also annealed straight lengths are available as per customer request.

Products Range

W.T. O.D.	mm	0.35	0.4	0.45	0.5	0.55	0.6	0.63	0.7	0.76	0.81	0.9	1.02	1.07	1.14	1.24	1.27	1.4	1.47	1.52	1.65	1.78	1.83	2.03	2.10	2.41		
mm	inch	0.014	0.016	0.018	0.020	0.022	0.024	0.025	0.028	0.030	0.032	0.035	0.040	0.042	0.045	0.049	0.050	0.055	0.058	0.060	0.065	0.070	0.072	0.080	0.083	0.095		
6.35	1/4																											
7.93	5/16																											
9.52	3/8							M		L		K																
12.7	1/2							M				L																
15.87	5/8								M				L															
19.05	3/4									M				L														
22.22	7/8										M				L													
28.57	1 1/8											M					L											
34.9	1 3/8													M				L										
41.28	1 5/8															M					L							
53.98	2 1/8																		M					L				K
66.67	2 5/8																											

Note: Other sizes can be made as per customer requirement according to mutual agreement. K: Type K M: Type M L: Type L

Copper Tube for Sanitary Purposes

Since 1940's, copper has become the pre-eminent plumbing material in the developed countries of the world. Nowadays contamination of drinking water via plastic piping is increasingly recognized as a potentially serious problem.

The unique characteristics of copper piping combining long trouble-free service life, safety and weight savings due to the ability to use smaller diameters and its recyclability even after long time used readily explain the success of copper in building applications.

The main properties that make copper tube as a preferred material for domestic water services include the following:

Ease of installation, ability to be easily joined and manipulated, high strength beside good toughness and ductility, ultra cleaned inner surfaces, corrosion resistance, suitability for use with potable and other waters, potential as bactericide, bio-fouling resistance and availability in a

wide metric sizes compatible with fitting and other system components. In addition, the ease of fabrication and installation of copper tubing, results in improved cost-effectiveness of copper.

At QAEM plant, copper tubes are intended for water and gas in sanitary and heating applications usually manufactured in accordance with specifications given in ASTM (B88) and European Norm (EN 1057).

EN 1057 specification is applicable to seamless copper tubes having an outside diameter from 6 mm up to and including 66.7 mm for distributing networks for hot water and cold water, hot water heating systems (including under floor heating systems), solar system, domestic gas and liquid fuel distribution and waste water sanitation.

QAEM Copper Industries normally delivers these tubes in Straight length form and supplies Hard, Half Hard and Light Annealed tempers designation, as per customer request.

QAEM Current Copper tubes Range for Sanitary purposes

EN 1057 Type X Copper Tube

Outside Dia. (mm)	Wall Thickness (mm)	Unit Weight (gr/m)	Form of Delivery	Allowed working Pressure* (Bar)
12	0.6	192	Straight length	63
15	0.7	281	Straight length	59
18	0.8	386	Straight length	56
22	0.9	533	Straight length	51
28	0.9	685	Straight length	40
35	1.2	1139	Straight length	42
42	1.2	1375	Straight length	35
54	1.2	1780	Straight length	27
66.7	1.2	2208	Straight length	20

* Allowed working pressure at up to 65 °C

EN 1057 Type Y Copper Tube

Outside Dia. (mm)	Wall Thickness (mm)	Unit Weight (gr/m)	Form of Delivery	Allowed working Pressure* (Bar)
12	0.8	252	Straight length	86
15	1.0	293	Straight length	86
18	1.0	477	Straight length	71
22	1.2	701	Straight length	69
28	1.2	903	Straight length	54
35	1.5	1411	Straight length	55
42	1.5	1706	Straight length	45
54	2.0	2921	Straight length	47
66.7	2.0	3634	Straight length	37

* Allowed working pressure at up to 65 °C

Mechanical Properties

Standards	Material Designation	Composition %		Temper Designation	Nominal Outside Diameter (mm)	Tensile Strength (Mpa)	Elongation	Hardness (HV)	
		Cu	P			min.	min.		
BS EN1057 (1996) Copper and copper alloys-Seamless, round copper tubes for water and gas in sanitary and heating applications	Cu - DHP* or CW024A	≥ 99.90	0.015 - 0.040	Annealed	R220	6 - 54	220	40	40 - 70
				Half Hard	R250		250	30**	75 - 100
				Half Hard	R250	6 - 66.7	250	20**	
				Hard	R290		290	3	min. 100

*Deoxidized High Residual Phosphorous (DHP) ** Note: Elongations for half hard tubes depend on the ratio of outside dia. To wall thickness (for more informations see EN 1057 Standard, page 5, table 2)



Copper Tube for Electrical Applications

General Specifications

Outside Diameter (mm)	Wall Thickness (mm)	Material	Temper Designation	Product Form
4 – 26	0.75 – 3.25	Cu: 99.95% Phosphorous: 0.001 - 0.005% TPC (ASTM B75, EN 13600)	Soft Annealed (O60) Can be supplied in other tempers by request	Straight Length

About Copper Tube, besides its application in plumbing, air conditioning and refrigeration industries, because of its high electrical conductivity and excellent formability, it can be used in Electrical Industries as Cable lug.

QAEM Copper Industries Co. is able to produce copper tubes for electrical purposes. Copper Cable Lug is one of the equipments which are used as a connecting terminal in electric power transfer. It is suitable for connection of

copper conductors in power cable with electronic equipment. To get high electrical conductivity, it shall be made of Cu-TPC with 99.95% purity.

These tubes are produced according to EN13600 and ASTM B75 standards and usually supplied in straight length with different tempers, as per customer request. These products are usually capped and packed with wrapped plastic or in wooden box.



Available Sizes of Copper Tubes Produced For Electrical Application By QAEM

Outside Dia. (mm)	4.0	5.0	5.5	6.0	7.0	7.0	8.0	8.0	8.5	8.5	10.0	10.5	12.0	12.5
Inside Dia. (mm)	2.4	3.2	3.8	4.0	4.5	5.4	5.5	5.0	5.5	6.5	7.0	8.2	8.5	10.0
Wall Thickness (mm)	0.80	0.90	0.85	1.00	1.25	0.80	1.25	1.50	1.50	1.00	1.50	1.15	1.75	1.25
Outside Dia. (mm)	12.5	14.0	14.0	14.5	16.5	16.5	16.5	18.0	18.0	19.0	19.5	21.0	21.0	24.0
Inside Dia. (mm)	8.2	10.0	11.0	10.0	12.0	13.0	11.5	13.5	15.0	13.5	15.0	16.5	15.5	19.0
Wall Thickness (mm)	2.15	2.00	1.50	2.25	2.25	1.75	2.50	2.25	1.50	2.75	2.25	2.25	2.75	2.50

Note: Other sizes can be made as per customer requirement according to mutual agreement.

Working Pressure

Allowable internal pressure for any copper tube in service is based on Barlow's formula for thin-walled, hollow cylinders used in ASME B31 Code for Pressure Piping. Barlow's formula relates the internal pressure that tube can withstand to its dimensions and the strength of the material.

$$P = \frac{2St_m}{D - 0.8t_m}$$

Where:

P = Allowable pressure (psi)

S = Maximum allowable stress in tension (psi)

t_m = Wall thickness (in)

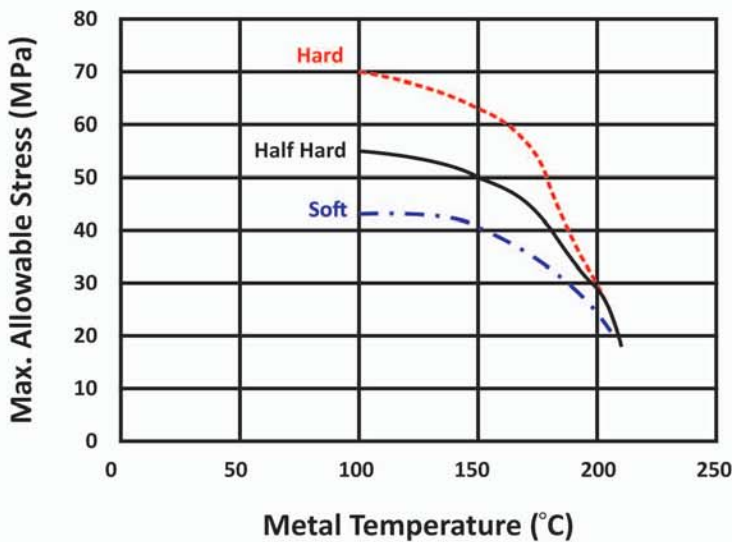
D = Outside diameter (in)

Value of S is the allowable design strength for continuous long-term service of the tube, as determined by ASME B31 Boiler and Pressure Vessel Code, Section 1-Materials.

Allowable stress value depends on the service temperature and on the temper of the tube, hard drawn or annealed.

Allowable stresses for annealed and drawn temper

copper tube are shown in the below table and diagram. They are only a small fraction of copper's ultimate tensile. In system design, joint ratings must also be considered, as the lower of the two ratings (tube or joint) will govern the installation. The rated joint strength in soldered tube systems often governs design. However, annealed ratings must be used in brazed systems since the brazing operation may anneal the tube near the joints.



Allowable stresses for copper tube as a function of temperature

Temperature		Allowable Stress			
		Annealed Temper		Hard Drawn Temper	
°F	°C	psi	Mpa	psi	Mpa
100	38	6000	41	10300	71
150	65	5100	35	10300	71
200	94	4900	34	10300	71
250	121	4800	33	10300	71
300	150	4700	32	10000	69
350	177	4000	27	9700	66
400	205	3000	20	9400	64

Conversion Factors

Stress:

$$\text{psi} \times 0.006895 = \text{MPa}$$

$$\text{MPa} \times 145.04 = \text{psi}$$

Temperature:

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = 9/5 ^{\circ}\text{C} + 32$$

Quality Control

QAEM Copper industries Company's quality assurance system is certified to meet the requirements of ISO 9001-2000. Quality control is carried out by highly skilled personnel and with the most modern equipments in production line as well as in laboratory. QAEM Copper Industries Co. is well aware of the importance of products quality and on time deliveries.

QAEM tubes are manufactured according to ASTM, EN & JIS by using the highest grade raw material (99.9% purity copper cathode) and modern technology to provide

superior products for air conditioning, refrigeration industries and also for sanitary and electrical purposes. QAEM Company can also produce based on customer special demands.

Special attention is paid to uniform temper, allowable tolerance, freedom from defect & special internal cleanliness.

The below table shows both specifications of the material which QAEM uses and mechanical properties of its tubes with different tempers.

Standard			Chemical Composition		Mechanical Properties					
ASTM	EN	JIS	Cu (%)	P (%)	Temper Designation		Tensile Strength (MPa)	Elongation (%)	Grain Size (mm)	Hardness (HV)
C12200	Cu-DHP*	C1220	≥99.90	0.015-0.04	Soft Annealed	O60	205-240	≥40	0.025-0.06	55
					Light Annealed	O50	220-270	≥40	≤0.04	60
C11000 C10300	Cu-TPC** (CW020A)	C1100 C1201	≥99.95	0.0010-0.0060	Half Hard	1/2H	270	≥30	0.02-0.04	80
							350	≥8		110
					Hard	H	≥350	≥3	----	110

*Deoxidized High residual Phosphorous (DHP) **Tough Pitch Copper (TPC)

Standards for Copper Tubes

Applications	Standard Code
Air Conditioning and Refrigeration	ASTM B280, B68, EN 12735
Gas and Oil Lines	ASTM B68, B360, EN 1057
Condenser Tubes	ASTM B111
Water and Sanitary Tubes	ASTM B88, EN 1057
Electrical Purposes	EN 13600
General Purposes	ASTM B75, JIS 3300, EN 12449



Test Facilities

QAEM copper industries test facilities are equipped with modern equipment such as:

- 1) Eddy Current Testing Apparatus
- 2) Optical Emission Spectrometer
- 3) Tensile Tester
- 4) Optical Microscope

Eddy Current Test Apparatus (Foerster-Germany)



Eddy Current testing uses electromagnetic induction to detect flaws and defects in conductive materials.

Each millimeter of tube is controlled by eddy current testing machine and defects, if any, shall be marked by black ink and correspondingly is reported on coil label.

Optical Emission Spectrometer (Quantron-Germany)



Detectors (photomultiplier tubes) measure the presence or absence of the spectrum extracted for each element and the intensity of the spectrum to perform qualitative and quantitative analysis of the elements.

We adapt advanced Magellan optical emission spectrometer made by Quantron which is a pioneer German company. The machine is composed of optical system and equipped with powerful functions, windows and calibrating systems. The optical emission spectrometer has merit of good stability, high precision, low limit of inspection and good accuracy.

In Optical Emission Spectroscopy technique, energy of spark, formed between sample and electrode, caused the electrons in the sample to emit light which is converted into a spectral pattern.

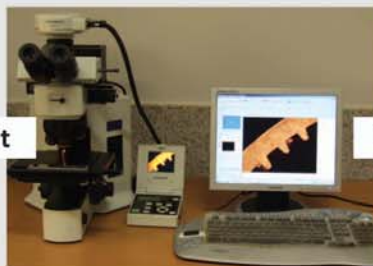
Tensile Tester (Tinius Olsen-England)



Optical Microscope (Olympus-Japan)



Section of I.G Tube



Result

Result



Microstructure of Copper Tube

ASTM B280 (2008)	Standard specification for Seamless copper tube for air conditioning and refrigeration field service	C 12000 (DLP)	99.90 min.	0.004 - 0.012	060 (Soft)	≥ 205 (Coils)	≥ 40	≥ 40	Coil (4.76 - 15.88) ^{10.001} (13.05) ^{10.001} (22.22) ^{10.001} (28.57) ^{10.001} (34.50) ^{10.001} (41.27) ^{10.001}	Straight (09.52-22.22) ^{10.001} (28.57-34.90) ^{10.001} (41.3-54.00) ^{10.001}	Coil (0.76-0.81) ^{10.001} (0.89 - 1.14) ^{10.001} (1.27) ^{10.001} (1.40 - 1.52) ^{10.001}	Straight (0.76) ^{10.001} (0.89) ^{10.001} (1.07 - 1.14) ^{10.001} (1.27) ^{10.001} (1.4) ^{10.001} (1.52) ^{10.001} (1.78) ^{10.001}	Phosphorous deoxidized, Low residual phosphorous	Plain copper tubes with high precision, clean surface, bright finish, even structure, high-precision size, high efficient heat exchanging, welding easily, corrosion resistant and good formability. This Specification establishes the requirements for seamless copper tube intended for use in the connection, repairs, or alternation of air conditioning units in the field and heat exchanger industry.
	C 12200 (DHP)	99.90 min.	0.015 - 0.040	H58 (Drawn)	≥ 250 (Straight lengths)	-----	-----	-----	-----	-----	-----	-----	Phosphorous deoxidized, High residual phosphorous	

BS EN1057 (1996)	Copper and copper alloys- Seamless, round copper tubes for water and gas in sanitary and heating applications	Cu - DHP or CW024A	99.90 min.	0.015 - 0.040	R220 (Annealed)	≥ 220	≥ 40	-----	Temper / OD	All Temper To Mean Diameter	R290 (Hard) / R250 (Half Hard) To Any Diameter	OD	OD < 18 : (e < 1) ± 10 % e (e ≥ 1) ± 13 % e	Phosphorous deoxidized, High residual phosphorous	Copper tube and fitting are chosen for the majority of new and modern installation in many countries, because the advantages of copper systems provide long, trouble-free service at low, total installed cost. The inner surface shall not contain any detrimental film nor present a carbon level high enough to allow the formation of such a film during installation. This Specification is applicable to seamless round copper tubes having an outside diameter from 6 mm up to and including 54 mm for distributing networks for hot water and cold water, hot water heating systems, including underfloor heating system, solar system, domestic gas and liquid fuel distribution, waste water sanitation.

BS EN12735-1 (2001)	Copper and copper alloys- Seamless, round copper tubes for air conditioning and refrigeration Part 1 :tubes for piping systems	Cu - DHP or CW024A	99.90 min.	0.015 - 0.040	R220 (Light)	≥ 220	≥ 40	-----	Temper / OD	All Temper To Mean Diameter	R290 (Hard) / R250 (Half Hard) To Any Diameter	OD	OD < 18 : (e < 1) ± 10 % e (e ≥ 1) ± 13 % e	Phosphorous deoxidized, High residual phosphorous	The seamless round copper tubes manufactured according to this standard usually used for refrigeration and air-conditioning, piping systems (i.e. piping, connections, repairs). These tubes are supplied in straight lengths in the hard and half-hard tempers, or in coils in the annealed temper.

BS EN12735-2 (2001)	Copper and copper alloys- Seamless, round copper tubes for air conditioning and refrigeration Part 2 :Tubes for equipment	Cu - DHP or CW024A	99.90 min.	0.015 - 0.040	Y035 (Soft)	≥ 210 (Nominal wall thickness > 0.6)	≥ 40	30 - 60	Plain	6.35 7.00 12.00 12.70 7.94 15.00 8.00 15.87 9.52 16.00 10.00	Inner grooved (Nominal dimensions)	Thickness / OD	6.0 < OD ≤ 54	Phosphorous deoxidized, High residual phosphorous	The seamless round copper tubes manufactured according to this standard, plain or inner grooved, usually used for heat exchangers and their internal connecting pipes in the manufacturing of refrigeration and air conditioning equipment. Tube in the annealed temper can be joined by the simple techniques and is also commonly joined by the use of flare-type and compression fittings. It is also possible to expand the end of one tube so that it can be joined to another by soldering or brazing without a capillary fitting.

BS EN13600 (2002)	Copper and copper alloys- Seamless copper tubes for electrical purposes	Cu-PHC or CW020A or Cu-HCP or CW021A	99.95 min.	0.001 - 0.006	R200	200 - 250	≥ 40	-----	(5.0 < OD < 10) ± 0.05	R290	290 - 360	≥ 6	-----	Deoxidized copper - low amount of residual deoxidizer	Seamless drawn copper tubes produced according to this standard usually used for electrical purposes and delivered in straight lengths including diameter range 5 - 54 mm and wall thickness range 0.5 - 20 mm. These copper tubes may be heat-treated, welded or brazed without the need for special precautions to avoid hydrogen embrittlement.



Specifications & Standards for Copper Tube

Standards	Material Designation	Composition %		Mechanical Properties			Preferred Dimensions (mm)		Name	Informative References			
		Cu	P	Temper	Tensile Strength (Mpa)	Elongation (%)	Grain Size (µm)	Outside Diameter & Tolerance (Applicable to mean diameter)			Thickness & Tolerance		
JIS H 3300 (1997)	C 1201	99.90 min.	0.004 - 0.015	O (Soft)	> 205	> 40	25-60	(4.0 < OD ≤ 15) ^{±0.08} (15 < OD ≤ 25) ^{±0.09} (25 < OD ≤ 50) ^{±0.12}	$\frac{OD}{Thickness}$ 4.0 < OD < 15 15 < OD < 25 25 < OD < 50	±0.06 ±0.07 ±0.10 ±0.13 ±0.15 ±0.18	±0.07 ±0.08 ±0.10 ±0.15 ±0.18 ...	Phosphorous deoxidized copper	Copper tubes manufactured according to this standards have good flaring and bending properties, drawability, weldability, corrosion and weathering resistance and heat conductivity. C1220 is free from hydrogen embrittlement heated at elevated temperature in reducing atmosphere. C 1201 has better electrical conductivity than C 1220. Applicable to heat exchanger, chemical industry, gas pipe, etc. C 1220 may be also used for water supply and hot water supply.
				OL (Light)	> 205	> 40	< 40						
ASTM B68 (2002)	C 12000	99.90 min.	0.004 - 0.012	O60 (Soft)	> 205	> 40	> 40	(04.76 < OD ≤ 15.88) ^{±0.05} (15.88 < OD ≤ 25.40) ^{±0.06} (25.40 < OD ≤ 50.80) ^{±0.07}	$\frac{OD}{Thickness}$ 4.76 < OD < 15.87 15.87 < OD < 25.4 25.4 < OD < 50.8	±0.025 ±0.050 ±0.060 ±0.075 ±0.090 ±0.100 ±0.100	±0.04 ±0.05 ±0.06 ±0.075 ±0.090 ±0.100 ±0.100	Phosphorous deoxidized, Low residual phosphorous	This specification establishes the requirement for bright annealed seamless copper tube suitable for use in refrigeration, oil lines, gasoline lines, where tube with an interior surface essentially free from scale and dirt is required.
				O50 (Light)	> 205	> 40	15 - 40						
ASTM B75 (2002)	C 10300 (TPC)	99.95 min.	0.001 - 0.005	O60 (Soft)	> 205	-----	> 40	(04.76 < OD ≤ 15.88) ^{±0.05} (15.88 < OD ≤ 25.40) ^{±0.06} (25.40 < OD ≤ 50.80) ^{±0.07}	$\frac{OD}{Thickness}$ 4.76 < OD < 15.87 15.87 < OD < 25.4 25.4 < OD < 50.8	±0.025 ±0.050 ±0.060 ±0.075 ±0.090 ±0.100 ±0.100	±0.04 ±0.05 ±0.06 ±0.075 ±0.090 ±0.100 ±0.100	Phosphorous deoxidized, Low residual phosphorous	This specification established the requirements for seamless round copper tube suitable for general engineering applications. Long length copper tube is a favorite choice for plumbing, heating, cooling, electrical and other systems.
				O50 (Light)	> 205	-----	< 40						
ASTM B88 (2009)	C 12000 (DLP)	99.90 min.	0.004 - 0.012	H55 (Light-Drawn)	250 - 325	-----	-----	(04.76 < OD ≤ 15.88) ^{±0.05} (15.88 < OD ≤ 25.40) ^{±0.06} (25.40 < OD ≤ 50.80) ^{±0.07}	$\frac{OD}{Thickness}$ 4.76 < OD < 15.87 15.87 < OD < 25.4 25.4 < OD < 50.8	±0.025 ±0.050 ±0.060 ±0.075 ±0.090 ±0.100 ±0.100	±0.04 ±0.05 ±0.06 ±0.075 ±0.090 ±0.100 ±0.100	Phosphorous deoxidized, High residual phosphorous	This specification establishes the requirements for seamless round copper tube suitable for general engineering applications. Long length copper tube is a favorite choice for plumbing, heating, cooling, electrical and other systems.
				H58 (Drawn)	> 250	-----	-----						
Standard specification for Seamless copper tube	C 12200 (DHP)	99.90 min.	0.015 - 0.040	H80 (Hard-Drawn)	> 310	-----	-----	(04.76 < OD ≤ 15.88) ^{±0.05} (15.88 < OD ≤ 25.40) ^{±0.06} (25.40 < OD ≤ 50.80) ^{±0.07}	$\frac{OD}{Thickness}$ 4.76 < OD < 15.87 15.87 < OD < 25.4 25.4 < OD < 50.8	±0.025 ±0.050 ±0.060 ±0.075 ±0.090 ±0.100 ±0.100	±0.04 ±0.05 ±0.06 ±0.075 ±0.090 ±0.100 ±0.100	Phosphorous deoxidized, High residual phosphorous	This specification establishes the requirements for seamless round copper tube suitable for general engineering applications. Long length copper tube is a favorite choice for plumbing, heating, cooling, electrical and other systems.
				H58 (Drawn)	> 250	-----	-----						
Standard specification for Seamless copper water tube	C 12200 (DHP)	99.90 min.	0.015 - 0.040	O60 (Soft)	> 205	-----	> 40	(04.76 < OD ≤ 15.88) ^{±0.05} (15.88 < OD ≤ 25.40) ^{±0.06} (25.40 < OD ≤ 50.80) ^{±0.07}	$\frac{OD}{Thickness}$ 4.76 < OD < 15.87 15.87 < OD < 25.4 25.4 < OD < 50.8	±0.025 ±0.050 ±0.060 ±0.075 ±0.090 ±0.100 ±0.100	±0.04 ±0.05 ±0.06 ±0.075 ±0.090 ±0.100 ±0.100	Phosphorous deoxidized, Low residual phosphorous	This specification establishes the requirements for seamless round copper tube suitable for general engineering applications. Long length copper tube is a favorite choice for plumbing, heating, cooling, electrical and other systems.
				O50 (Light)	> 205	-----	> 25						

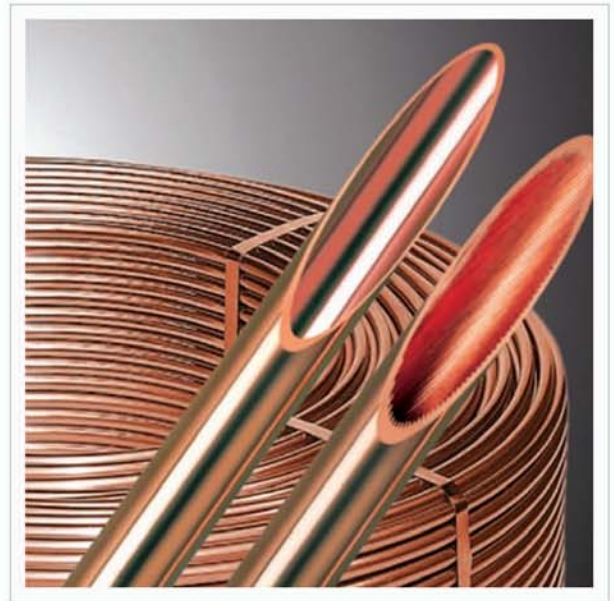
This specification establishes the requirement for seamless copper water tube suitable for general plumbing, similar applications for the conveyance of fluids, and commonly used with solder, flared, or compression-type fittings.

Packing

Level wound coils (LWC) Packing

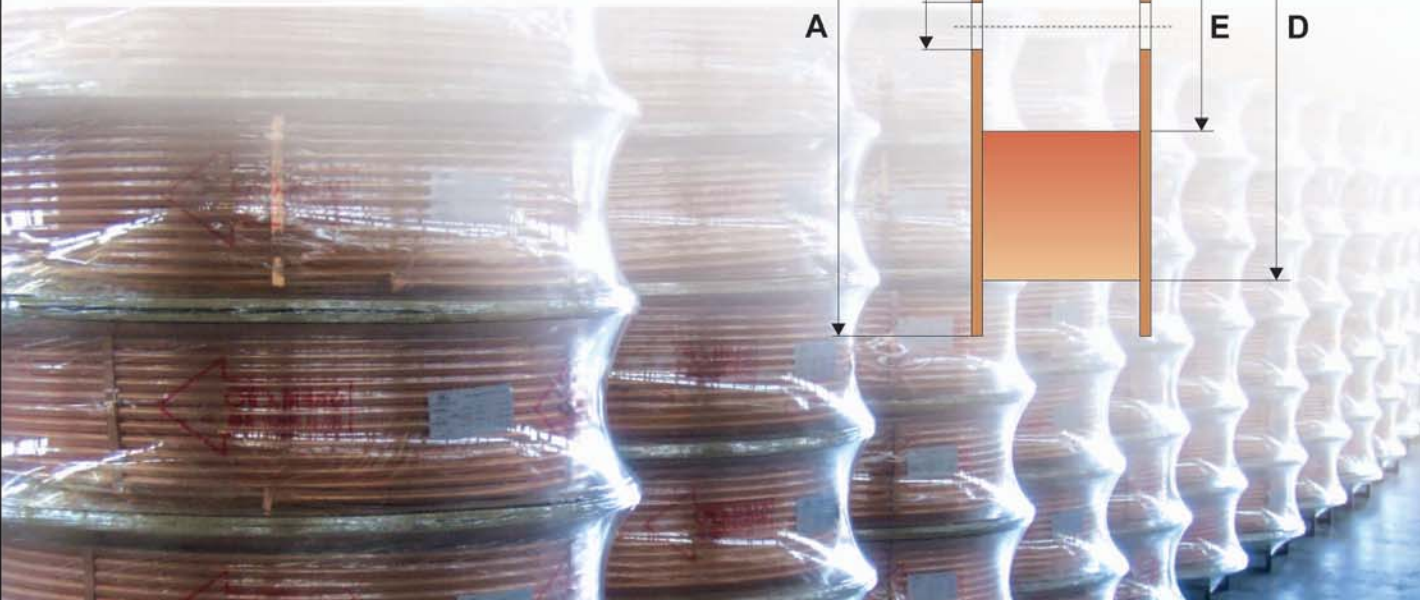
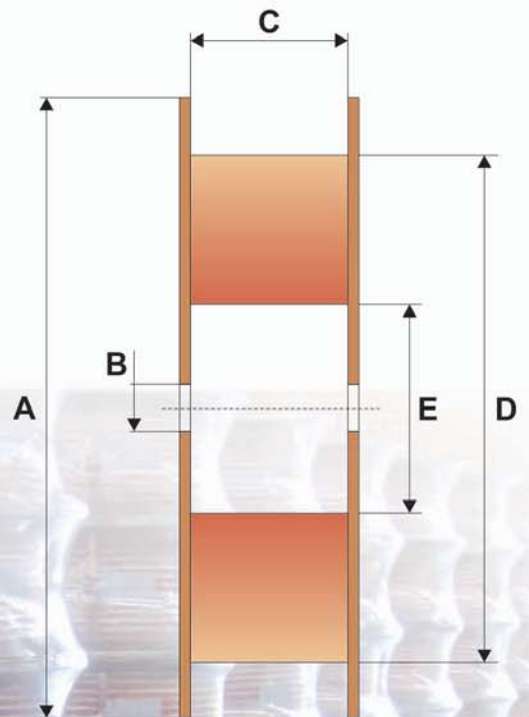
- A level wound coil (LWC) is a continuous length of tube tightly wound in layers and is available in following 4 specifications
 - Standard LWC on wooden reels or cardboard reels
 - Standard LWC (bare coils)
 - LWC jumbo coils (bare coils)
 - LWC eye to the sky (bare coils)

- Eddy Current tested
- Protection gas: Nitrogen gas inside tube
- level wound coils (LWC) are delivered on wooden pallets and wrapped with plastic film
- Ink marked to show defects according to EN and ASTM
- End caps



Specifications

A (Wooden Reel Diameter)	max. 1200 mm
B (Core Diameter)	133 mm
C (Coil Height)	200-390 mm
D (Coil Outside Diameter)	max. 1200 mm
E (Coil Inside Diameter)	600 mm
Weight	100-250 Kg



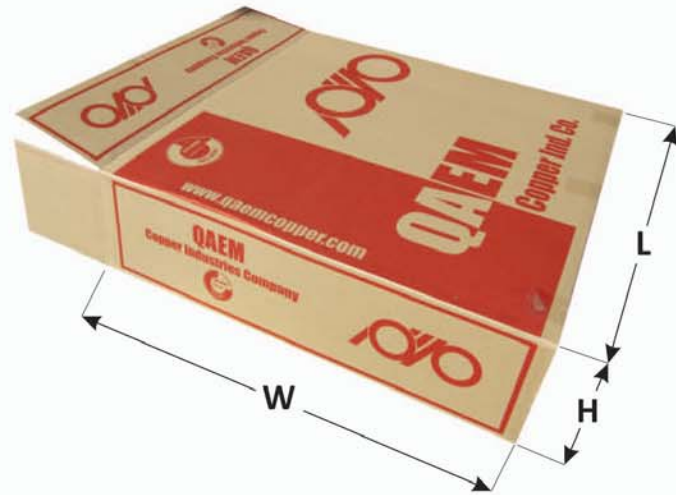
Straight Lengths Packing

- Bundles
- Plastic film
- End caps
- End plugs



Pancake Coil Packing

- Pancakes are packed in cardboard box ,with shrink film bags.
- Pancakes are delivered on wooden pallets and wrapped with plastic film.
- Layer of pancake : 1,2,3 layers
- End caps
- Optional :
Silica gel
Print on tubes



Pancake Coil Packing Specification

Size of Tube	15 M		15.24 M (50')		30 M		50 M		Size of Cardboard Box (mm)		
	No. of Coil / Box	No. of Layer / Coil	No. of Coil / Box	No. of Layer / Coil	No. of Coil / Box	No. of Layer / Coil	No. of Coil / Box	No. of Layer / Coil	W	L	H
(3/16") 4.76 mm * T	14	1	16	1	10	2	8	2	500	500	120.5
(1/4") 6.35 mm * T	12	1	12	1	8	2	6	3	500	500	120.5
(5/16") 7.93 mm * T	10	1	12	1	7	2	4	3	500	500	120.5
(3/8") 9.52 mm * T	10	1	10	1	6	2	3	3	570	570	150
(1/2") 12.70 mm * T	6	2	6	2	4	3	5	4	570	570	180.5
(5/8") 15.87 mm * T	6	1	6	1	3	2	2	3	700	700	130
(3/4") 19.05 mm * T	7	1	4	2	3	3	2	4	700	700	190
(7/8") 22.22 mm * T	4	2	2	3	2	4	-	-	700	700	190

Production Process



Melting & Casting



Surface Mill



Spinner Block



Online Annealer & Inner Grooving Line



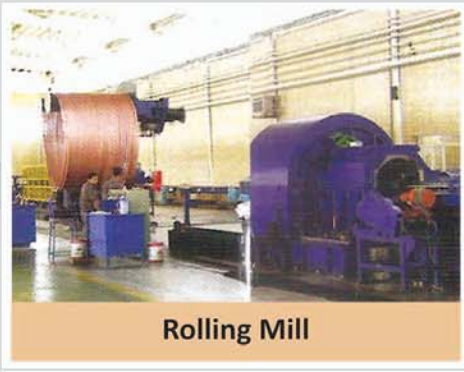
Level Rewinder



Market



Packing



Rolling Mill



Recoiler



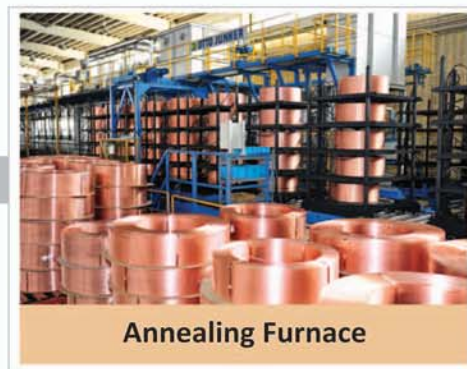
Mother Tubes



3 Combined Drawing Machine



Combined Drawing Machine



Annealing Furnace



Products



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