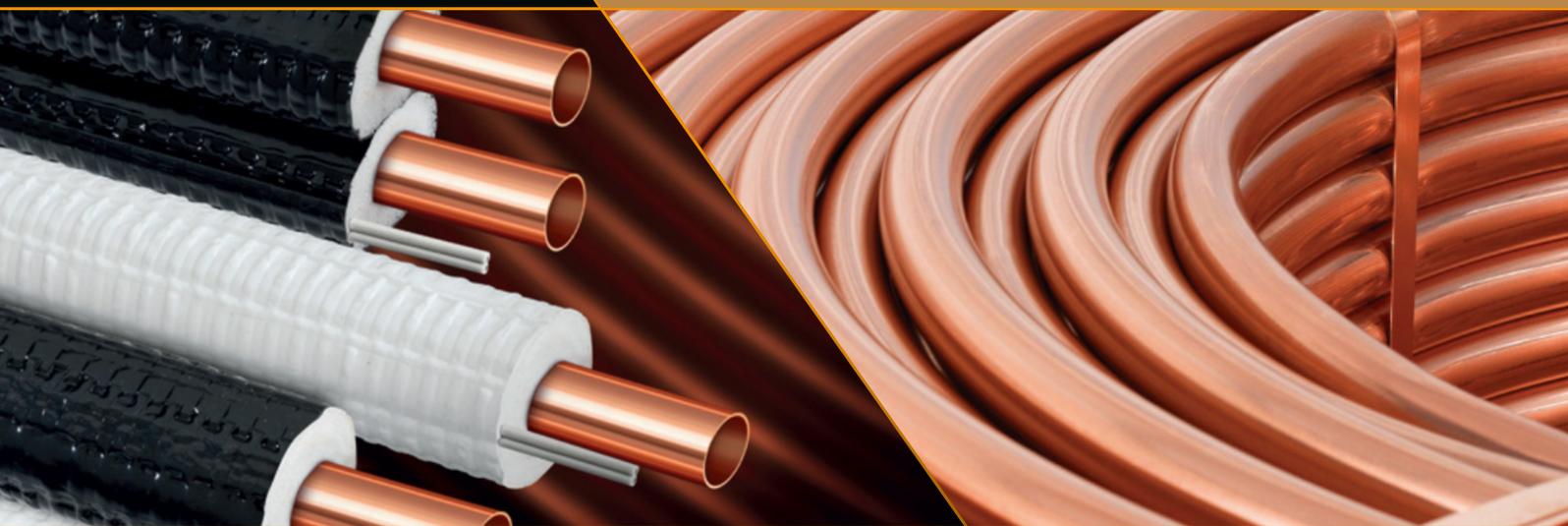


HALCOR

SOLAR THERMAL SYSTEMS





HALCOR

Member of **Copper Alliance**

Halcor is the copper tubes division of ElvalHalcor S.A., a leading copper industry that specializes in the production, processing and marketing of copper and copper alloys products with dynamic commercial presence in the European and global markets. For more than 80 years, Halcor has been offering innovative and added-value solutions that meet contemporary client demands in fields, such as plumbing, HVAC&R, renewable energy, architecture, engineering and industrial production.

Halcor and the copper subsidiaries Fitco, Sofia Med and HC ISITMA consist the copper segment of ElvalHalcor S.A. and they operate a total of five production plants in Greece, Bulgaria and Turkey. Halcor and the copper subsidiaries develop and distribute a wide range of products, including copper, brass and copper-alloy rolled and extruded products with Halcor being the sole producer of copper tubes in Greece.

High quality in production is achieved through strict controls applied throughout the production process. With a consistent quality focus, Halcor implements an ISO 9001:2008 Certified Quality Management System and leverages high technologies and expert staff.

As a result of the strategic investments in research & development, Halcor is recognized as one of the leading copper producers globally, setting new standards in copper processing. Halcor maintains a consistent focus on quality and environmental protection and a strong commitment to the principles of sustainable development. In this context, all production facilities leverage advanced technologies to bring in the market innovative products that are energy efficient and environmentally friendly.



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Advantages of Copper in Solar Systems

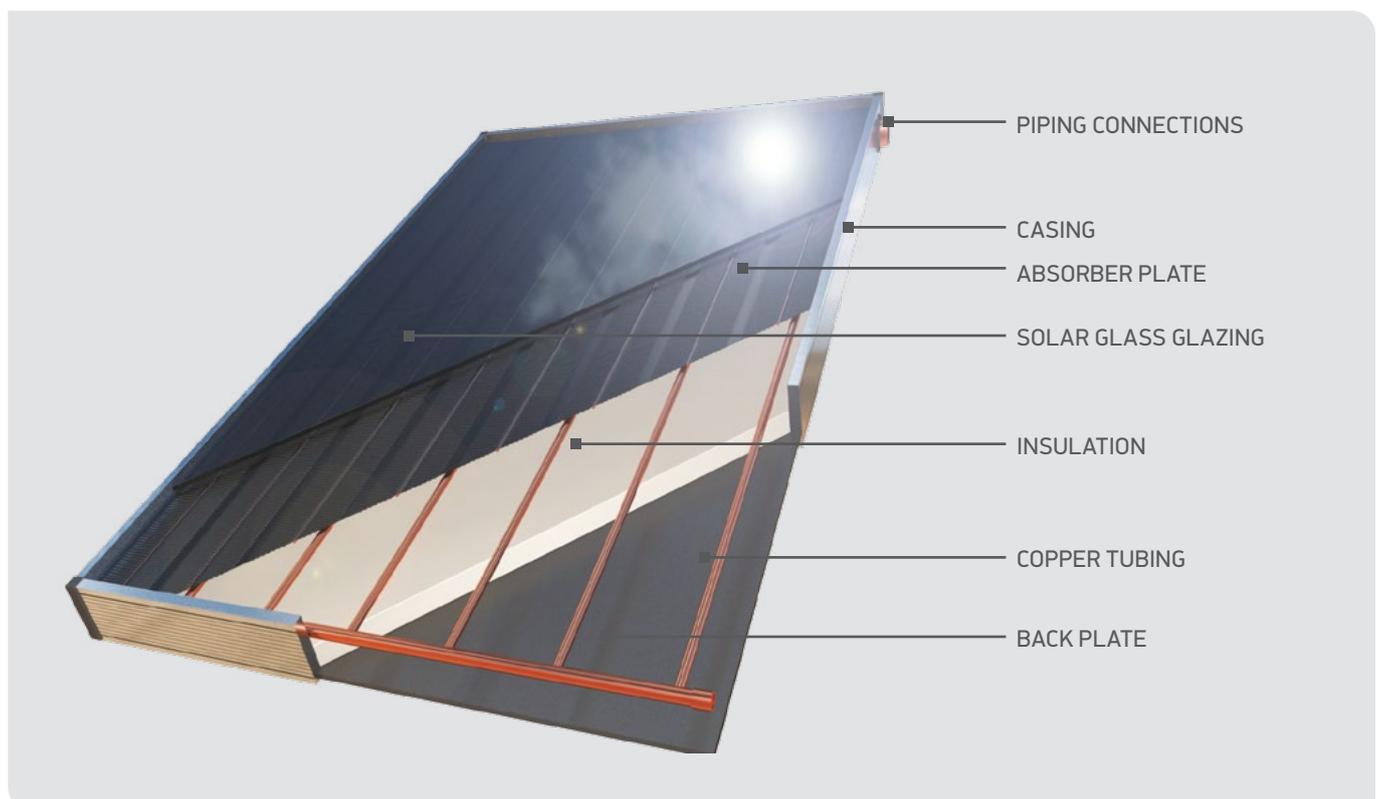
- High thermal conductivity, the highest of all industrial materials
- Stable chemical composition and mechanical behavior through time
- Inflammable and unaffected to long-term exposure to solar radiation
- High resistance to environmental conditions
- Maximum resistance to high operating pressures
- Flexible and stable material, without memory characteristics
- Material that can be processed using a number of different methods and techniques
- Fully recyclable material of fixed value
- Safe and healthy for drinking water

A Pioneer in the Utilization of Solar Power too

Through strategic investments in the development of new copper and copper alloy products, HALCOR has become a leader both in the European and Global markets, with the emphasis placed on the innovation, competitiveness and sustainable development. A line of new, energy advanced products, such as factory insulated copper tubes for hot water, heating and air conditioning, offer optimum solutions that feature high value of use and meet the current needs of the building and processing industry.

HALCOR products are exported in over 40 countries around the world. They are distinguished for their top manufacturing quality and their compliance to international specifications in all types of applications.

Utilization of solar energy is a current global challenge on which HALCOR has placed great emphasis. For a number of different devices and applications in that sector, HALCOR has the widest range of rolled and extruded copper products, such as sheets, strips and tubes with or without insulation, that are a reliable solution for solar collectors, water heaters, etc., as well as, hot water plumbing installations in buildings.



• SOLAR PANEL APPLICATIONS



TALOS[®] SOLAR PLUS[™]

TALOS[®] SOLAR PLUS[™] tubes are specially engineered for solar panel applications. The extra clean outer surface of TALOS[®] SOLAR PLUS[™] tubes enables the optimization of the welding process between copper or aluminium absorber sheets when using ultrasonic or laser joining technologies. Increased welding speeds and minimization of pre-cleaning operation lead to savings of time and money in the manufacturing of solar absorber panels. The high thermal conductivity of copper ensures an improved thermal efficiency of the solar absorber panel.

Material Strength Specifications

Hard (R360 and R290) and Soft (R220) in level wound coils (LWC). Hard (R360 and R290), Half-Hard (R250) and Soft (R220) in straight lengths.

Material

Copper phosphorus deoxidized (DHP-Cu) with min. copper content 99,90% and P=0,015%-0,040%.

Dimensional Tolerances

According to EN 12449 or ASTM B75.

Upon request length tolerances can be set at $\pm 0,50\text{mm}$.

Advantages

- Higher welding speeds to copper and aluminium absorber sheets
- Improved thermal efficiency due to high conductivity of copper and extra cleanliness
- Increased production efficiency due to coil weights up to 580kg

SIZES

Outside diameter (mm)	6, 8, 9, 10, 11, 12, 18, 22
Wall thickness (mm)	0,30 - 1,20

AVAILABILITY

LWC coil weight (kg)	75, 85, 115, 150, 200, 290, 460, 580
Straight lengths (m)	0,30 - 6,0

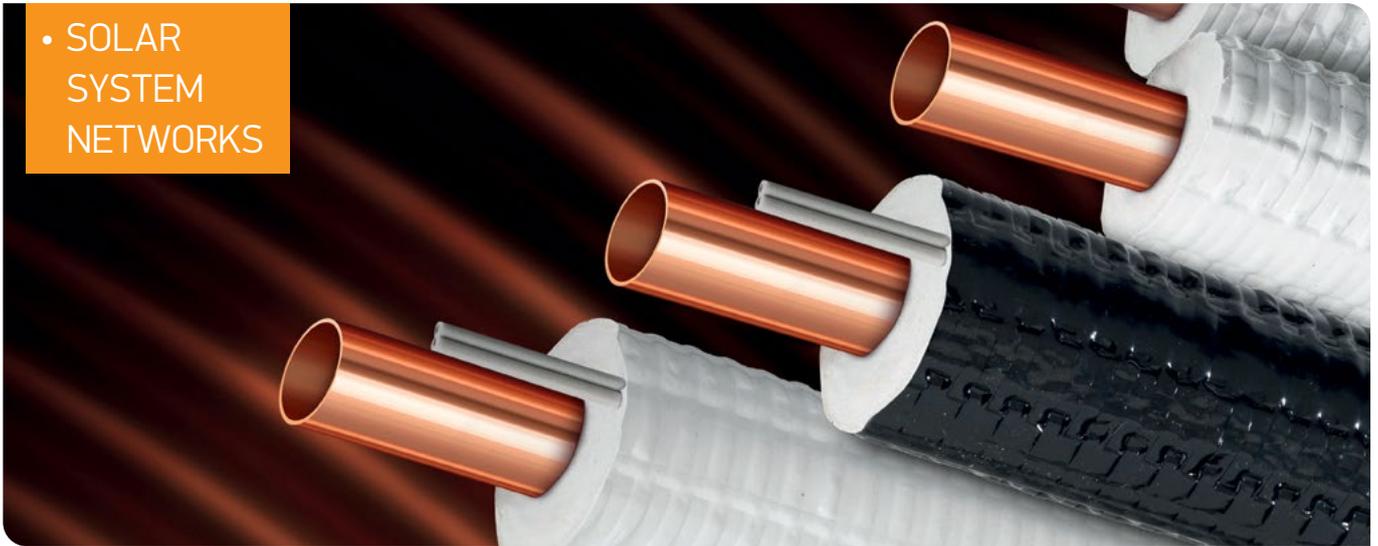
COIL GEOMETRY

Outer diameter	max. 1350
Inner diameter	610
Height	150-600

PACKAGING

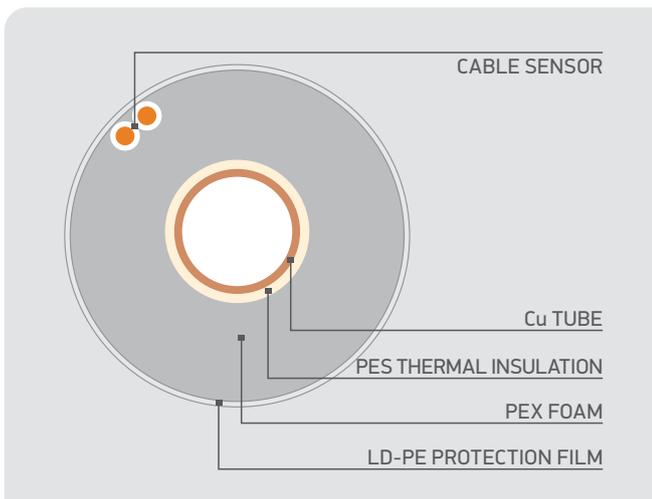
Coils	On wooden pallet, with cardboard inserts and corrosion inhibitor (VCI) protective film
Straight lengths	Bundles wrapped in corrosion inhibitor (VCI) protective film in wooden boxes.

• SOLAR
 SYSTEM
 NETWORKS



Due to its superior physical and chemical properties, engineers have always relied on copper for thermo-hydraulic systems. The exploration of solar energy has also unveiled this red metal's advantages in solar systems, the most important being its high thermal conductivity and corrosion resistance. These systems are easy to install, efficient (both in energy consumption and maintenance) and reliable (comparably long life cycle). The use of factory insulated TALOS[®] ECUTHERM[™] now greatly improves the solar system by offering even more advantages to copper tubes.

TALOS[®] ECUTHERM[™] SOLAR copper tubes are manufactured in pairs (one for supply and one for return), in standardized dimensions which sufficiently cover the usual requirements of solar systems. The two pieces are attached throughout their length, while the tubes also include an incorporated cable for the connection of temperature sensors. For easy connection, separation between the two lines is also possible.



Modern Technology in Solar Installations

The unique advantages of copper with regards to strength and durability combined with the high efficiency factory insulation make up an integral assembly that is easy and fast to install, ensuring professional results and offering high energy saving. Given this competitive advantage and the low cost of installation, it constitutes the optimum choice for any modern structure.

Factory insulated TALOS[®] ECUTHERM[™] SOLAR copper tubes by HALCOR represent an innovation which guarantees significant advantages for Solar System installers.

- Simplification of installation process and reduction of working time
- Safe operation of networks with high strength in mechanical strain and weather conditions
- Reduction of total cost of construction for the networks
- Reliable operation of installation and significant energy saving
- 30 year warranty for the copper tube

Reliability offered only by TALOS[®] Copper Tubes.

TALOS[®] copper tubes are manufactured according to European and U.S. Specifications and have been certified by most international quality organizations (RAL/DVGW, BSI, AFNOR, AENOR, CSTB, NSAI, KIWA / GASTEC-QA, GOST, VIK, SITAC, STF VTT).

High Performance Technological Product

TALOS[®] ECUTHERM[™] SOLAR copper tubes are coated with a 3-layer system. Firstly, a high temperature resistant PES insulation layer is positioned on the outside of the copper tube. Secondly, an industrial insulation of cross-linked polyethylene (PE-X) foam structured in closed micro-cells provides

thermal insulation. Thirdly, an external covering creates an integral resistance barrier against the external environment.

Copper Tube Technical Characteristics

Phosphorus deoxidized copper (DHP-CU) in soft temper (R220), according to EN 1057.

Insulation Technical Properties



Cross-linked Polyethylene



RESISTANCE

FOAM MATERIAL	PES/PE-X
DENSITY ACCORDING TO DIN 53420 ASTM D 1667	30-33 Kg/m ³
THERMAL CONDUCTIVITY COEFFICIENT ($\bar{\alpha}$) ACCORDING TO ASTM C 335 ISO 12572	0,039 W/m.K
VAPOUR-WATER DIFFUSION RESISTANCE COEFFICIENT (μ) ACCORDING TO	> 9.000
WORKING TEMPERATURE	-80°C to +150°C
FIRE RESISTANCE	Class E, EN 13501
RESISTANCE TO CHEMICAL AGENTS ACC. TO ASTM 543-56 T	Very good
SOUND ABSORPTION ACC. TO DIN 4109 300-2500Hz	~60%
PROTECTIVE FILM (White or Black Color)	30µm UV RESISTANT

Values are listed, as obtained under standard laboratory conditions and may be amended, without prior notice.

Standardized Dimensions (Roll Lengths 10, 15, 20, 25 meters) TALOS[®] ECUTHERM[™] SOLAR

The values of the maximum working pressure refer to the material condition R220. A safety factor of 3.5 is used. The minus tolerance of the wall thickness is considered. No further processing is taken into account. For temperature up to 150°C.

Outside diameter of copper tube	mm	10	11	12	15	18	22
Wall thickness	mm	0.50	0.60	0.60	0.70	0.75	0.90
Total diameter with 13mm thick insulation	mm	36	37	38	41	44	48
Working pressure (at 150°C)	bar	52	57	52	48	43	42
Bend radius	4xOD						

Outside diameter of copper tube	mm	10	11	12	15	18	22
Wall thickness	mm	1.0	1.0	1.0	1.0	1.0	1.0
Total diameter with 13mm thick insulation	mm	36	37	38	41	44	48
Working pressure (at 150°C)	bar	104	94	86	68	55	44
Bend radius	4xOD						

Standardized Dimensions TALOS[®] ECUTHERM[™] SOLAR 2

12/12, 15/15, 18/18, 22/22

Cable Sensor Technical Characteristics

CONDUCTOR MATERIAL	COPPER
FLEXIBILITY OF CONDUCTOR	FLEXIBLE, CLASS E
COLOR	WHITE
NO. OF POLES	2
NOMINAL VOLTAGE V_0/V	300/300
NOMINAL CROSS SECTION OF CONDUCTOR	2x0.75mm ²

COPPER STRIPS
DOMA[®]

• COPPER STRIPS
 FOR SOLAR PANEL
 THERMAL SYSTEMS



Description

Pure copper strips
 Alloys available: ETP - electrolytic copper
 DHP - phosphorus deoxidized copper

Advantages

The most important role of a solar selective surface is to absorb the maximum of the solar energy. The most suitable elements for this reason are dark surfaces on a copper background element. These kinds of constructions absorb almost the total solar radiation and then they convert it into heat energy. An ideal selective absorber must absorb as much as possible of solar radiation and on the same time must emit the minimum possible back to the environment in order to prevent heat losses. The modern coating methods exclusively on a copper strip base can reach 95% of absorption with exceptionally low opposite losses by emission, less than 5%.

The copper strips have also the advantage of withstanding resistance to very high temperatures, mechanical stability and they are suitable for all joining methods.

Recycling of the copper elements is straightforward and offers environmental and economic benefits by preventing waste of useful materials.

Technical Characteristics

Products conform to EN 1652 requirements.

Dimensions:	≥ 0,12 mm thickness x 50 - 450 mm width ≥ 0,18 mm thickness x 50 - 1200 mm width
Mechanical properties:	As required in EN 1652 standard
Temper:	R240 or other on request
Surface characteristics:	Residual carbon: 0,1 mg/dm ² Min Wetability: 42 dyn Roughness Ra: 0,2-0,4 m

Packing

Coil weight:	max 10,5 kg/mm width
Inner Diameter of the coil:	all widths can be produced at CID 300, 400 or 500 mm

HALCOR

HALCOR

62nd km Athens – Lamia National Road,
GR-32011 Inofita-Viotia, GREECE
Tel.: +30 22620 48111, Fax: +30 22620 48911
E-mail: info@halcor.com www.halcor.com

Member of **Copper Alliance**

COPPER TUBES DIVISION of:



SOFIA MED S.A.

4 Dimitar Peshev str., Gara Iskar, 1528 Sofia, BULGARIA
Tel.: +359 2 960 6209, +359 2 960 6350, Fax: +359 2 960 6393
E-mail: info@sofiamed.bg www.sofiamed.bg

METAL AGENCIES LIMITED

Suite 4, Cobb House, 2-4 Oyster Lane, Byfleet, Surrey KT14 7DU, UNITED KINGDOM
Tel.: +44 1932 33 1111, Fax: +44 1932 33 1190 www.metalagencies.com

REYNOLDS CUIVRE S.A.s.

1 rue François Jacob, CS 60099, 92508 Rueil Malmaison Cedex, FRANCE
Tél: +33 1 55 47 24 60, E-mail: contact@reynolds-cuivre.fr

GENECOS S.A.

1 rue François Jacob, CS 60099, 92508 Rueil Malmaison Cedex, FRANCE
Tel.: +33 1 4527 0754, Fax: +33 1 4527 0708, E-mail: info@genecos.vionet.gr

MKC / Metall KundenCenter GmbH

Ursulastr. 33-41, D-50354 Hürth, GERMANY
Tel.: +49 2233-3962 340, Fax: +49 2233-3962 349, E-mail: info@metallkc.de www.metallkc.de

ALURAME S.p.A

Via Antonio Stradivari 10, 20 131 Milano (MI), ITALIA
Tel.: +39 02 971 78 111, Fax: +39 02 971 78 115, E-mail: info@alurame.vionet.gr

STEELMET ROMANIA S.A.

42 Drumul intre Tarlale street, 3rd sector, 73644 Bucharest, ROMANIA
Tel.: +40 21 209 0570, Fax: +40 21 256 1464, E-mail: office@steelmet.ro

BASE METAL

Barbaros Mah. Sarkak Sok. No:1 D:46 My Prestige Binasi Bati Atasehir, Istanbul, TURKEY
Tel.: +90 216 688 76 40-44, Fax: +90 216 688 76 18, E-mail: info@base-metal.com.tr
www.base-metal.com.tr