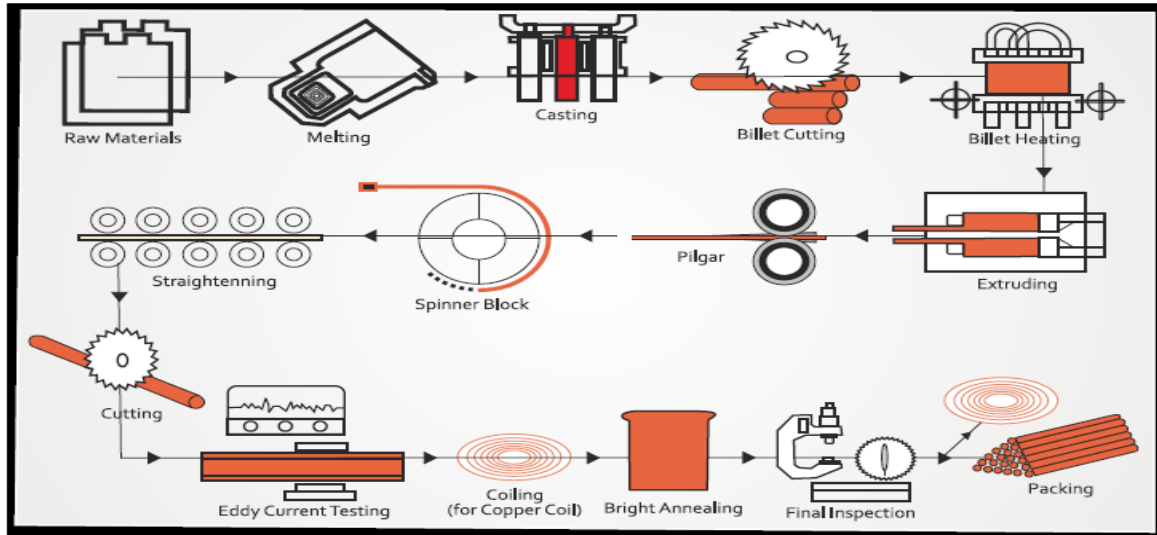


### Manufacturing Process for Copper & Copper Base Alloy Products



At Mercure highly advanced technological processes are used to manufacture products which involve Melting in induction furnaces, Extrusion by 1600 metric tonne oil hydraulic extrusion press, Cold drawing by pilger mills, sophisticated drawbenches & modern spinner block, Intermediate process annealing by gas fired furnaces, Final annealing by bright annealing furnaces, Straightening & coiling process, final inspection & testing

Incoming Raw Material is tested in laboratory and then issued to melting shop. This material is molten cast in watercooled molds. The cast logs are cut into billets of suitable length. These billets are pre-heated to proper extrusion temperature and extruded into mother Tube/ Rods/ Section undergo pickling, if required. Then undergo pointing, cold drawing and if required intermediate annealing. The Tubes, Rods, Sections are straightened. Tubes undergo Eddy current testing/ Hydrostatic testing. The products undergo annealing if customer require them in soft temper or drawn further if required Half hard/ Hard Temper. The finished products undergo visual check, Dimensional check, Flaring, Flattening test, physical properties, and grain size test are also carried out before packing and despatch.

### Quality Testing

Product quality has been one of the hallmarks at Mercure. Each product line undergoes a battery of stringent and sophisticated quality control tests to ensure that every batch of product is of the highest quality.

- ◆ Chemical Analysis
- ◆ Physical Analysis
- ◆ Hardness testing
- ◆ Hydrostatic testing
- ◆ Pneumatic testing
- ◆ Stress corrosion testing
- ◆ Dimensional inspection
- ◆ Destructive testing flattening, Drift test
- ◆ Bend test
- ◆ NDT Eddy Current Testing



- ♦ Floating Mandrel technique during Re-drawing, for 360 degree consistent CONCENTRIC TUBES.
- ♦ Total loss lubricant during Re-drawing and Inert atmospheric vacuum type Bright annealing furnace for ultra clean tubes with low residual content below 0.038 gm/sq.mtr.
- ♦ Advanced Eddy Current Testing for defect-free 100% flawless tubes
- ♦ Electronic Temperature and Process controlled Bright Annealing process for consistent Hardness uniformity along the entire tube length, circumference and bright mirror finish
- ♦ R410A Refrigerant Compatible Copper Tubes.



### Mercure Metals meets the mandatory inspection requirements

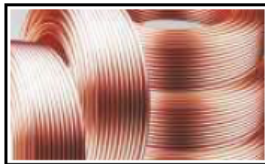
|                      |                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Chemical Composition | Copper + Silver = minimum 99.90%, Phosphorous = minimum 0.015. max 0.040%                                                         |
| Carbon content Test  | Window based software determines the content of carbon on the inner surface of copper tubes and fittings using combustion method. |
| Tensile Strength     | INDIGO pipes have been tested to the best of its tensile strength keeping in mind all the testing norms in the industry           |
| Non-Destructive Test | Each tube is subjected to an Eddy current test for detection of local defects                                                     |

|                      |                                                                                                                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <b>GRADE</b>                                                                                                                                                                 |
| <b>COPPER :</b>      | DHP, DLP, ETP, OFHC, DOW, Tellurium Copper,                                                                                                                                  |
| <b>BRASS :</b>       | 63/37Brass, 70/30 Brass, 85/15 Brass, Admiralty Brass,<br>Aluminium Brass, Naval Brass, Arsenic Brass, Aluminium Bronze,<br>Leaded Brass, Forging Brass, High Tensile Brass. |
| <b>CUPRONICKEL :</b> | 95/5, 90/10 & 70/30 Alloys.                                                                                                                                                  |

### Copper & Copper Alloy Tubes in Straight & Coil Form



|                                   |           |                                     |
|-----------------------------------|-----------|-------------------------------------|
| Bright Annealed<br>Pancake Coils: | Sizes     | : 1/8"(3.2mm)OD to 1"(25.4mm)OD     |
|                                   | Length    | : 50ft/100ft                        |
|                                   | Thickness | : 10 s.w.g(3.2mm) to 27s.w.g(0.4mm) |
|                                   | Temper    | : O                                 |



|                               |           |                                         |
|-------------------------------|-----------|-----------------------------------------|
| L.W.C(Level Wound<br>Coils) : | Sizes     | : 1/4"(6.34mm)OD to 5/8 (15.8mm)OD      |
|                               | Length    | : In continues length upto 1000mtrs     |
|                               | Thickness | : 18 s.w.g (1.21mm) to 31 s.w.g(0.27mm) |
|                               | Temper    | : O                                     |



|                                                             |                    |                                                                                 |
|-------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------|
| P. V. C. (Poly Venyl<br>Chloride) Coated Tubes<br>& Coils : | Sizes              | : 1/8"(3.2mm)OD to 1" (25.4mm)OD                                                |
|                                                             | Length             | : In cut length from 2mtr to 14mtr<br>In continues length from 15mtr to 1000mtr |
|                                                             | Temper             | : O for soft coils H/HH for straight pipes                                      |
|                                                             | P.V.C<br>Thickness | : 0.5mm to 2mm                                                                  |



Straight Pipes & Tubes : Sizes : 2mm OD to 250mm OD  
 Length : Up to 10mtr or as required  
 Thickness : 0.30mm to 20mm  
 Temper : O/HH/H



Finned Tubes : (19/26 fins per inch) Sizes : 5/8"(15.8mm)OD & 3/4"(19.044mm)OD  
 Length : Specific length or up to 10 mtr  
 Thickness : 1.6mm to 1.2mm  
 Temper : HH  
 Type : Intergroove Integrally Finned Tubes  
 Internally Grooved Tubes, Outer grooved  
 Finned Tubes, Spiral Finned Tubes.



Tubes for Plumbing & Medical Gases: Sizes : 6mm OD to 159mm OD  
 Thickness : 0.5mm to 2.5mm as per Table X, Table Y, Table Z  
 Length : 10 Feet or as required  
 Temper : H/HH



Cappillary Tubes : Sizes : 0.030"ID to 0.090" ID  
 Thickness : 0.7mm to 0.4mm  
 Length : 100ft standard or upto 500mtrs  
 Temper : O



Copper & Copper Alloy Fittings : Sizes : 6mm to 250mm  
 Shapes : Elbows, Tees, Couplings, Reducers or any non standard type.  
 Types : Seamless, Welded, Flared, Unflared  
 Shouldered, Threaded  
 Grade : Copper, CuproNickel, Brass, Gunmetal etc



Pre-Insulated Tube: Sizes : 1/4" to 3/4"  
 Tube : 1.6mm to 0.5mm  
 Thickness : 6mm to 25mm  
 Thickness : 3mtr to 30mtr or any fix length  
 Length :



### COPPER & COPPER ALLOY TUBES IN STRAIGHT & COIL FORM :



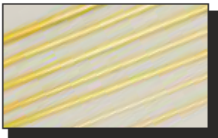
90/10 & 70/30 CuproNickel Tubes :

Sizes : 6mm to 250mm  
 Length : upto 18 mtrs  
 Thickness : 0.5mm to 10mm  
 Temper : O,HH



Admiralty & Aluminum Brass Tubes :

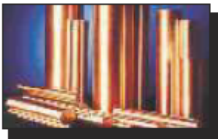
Sizes : 6mm to 150mm  
 Length : upto 18 mtrs  
 Thickness : 0.5mm to 10mm  
 Temper : O,HH



63/37 & 70/30 Brass Tubes :

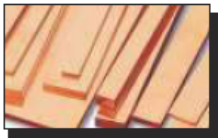
Sizes : 6mm to 150mm  
 Length : upto 10 mtrs  
 Thickness : 0.5mm to 10mm  
 Temper : O,HH  
 Shapes : Round,Oval, Reeded, Square,Rectangular or any non standard type.

### COPPER & COPPER ALLOY PROFILES & SEMIS :



Copper & Copper Alloy Rods :

Sizes : 6mm to 150mm  
 Temper : HH,O  
 Length : As per customers specification  
 Grade : Copper :Commercial,EC,ETP,OFHC & Arsenical,  
 Copper Alloys : Admiralty, Aluminum Brass, 70/30,90/10 CuproNickel.  
 Copper alloy rods in any alloy composition can be developed.



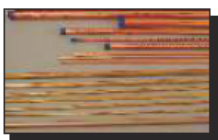
Copper & Copper alloy Flats & Bus bars :

Sizes : Width upto 250mm  
 Thickness upto 25mm  
 Temper : HH,O  
 Length : As per customers specification  
 Grade : Copper : Commercial,EC,ETP,OFHC & Arsenical.  
 Copper Alloys : Admiralty, Aluminum Brass, 70/30,90/10 CuproNickel.



Copper & Copper Alloy Fittings :

Sizes : 6mm to 250mm  
 Shapes : Elbows,Tees,Couplings,Reducers or any non standard type.  
 Types : Seamless,Welded,Flarred,Unflarred  
 Shouldered,Threaded  
 Grade : Copper, CuproNickel, Brass, Gunmetal etc



Copper & Copper Alloy Sections :

Sizes : 3mm to 108mm  
 Temper : O,HH  
 Length : As per customers specifications,  
 Shapes : Round,Oval,Rectangular,Square or any non standard type.  
 Grade : Copper, Brass, CuproNickel



## TECHNICAL SPECIFICATION COPPER ALLOY TUBES

### CHEMICAL COMPOSITION MECHANICAL PROPERTIES

#### 63/37 BRASS TUBES

**Product Application Areas:** General Engineering, Furniture, Architectural Grill Work,

| Standard              | ASTMB-135 | JIS H3300 | JIS H3300 | DIN 17671 | DIN 17671 | IS 407    |
|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Symbol                | C 27200   | *C 2720   | *C 2280   | CuZn 37   | -         | CuZn 37   |
| Cu                    | 62.0-65.0 | 63.0-67.0 | 59-63.0   | 62.0-64.0 | -         | 62.0-65.0 |
| Sn                    |           | -         | -         | 0.10      | -         | -         |
| Al                    |           | -         | -         | 0.03      | -         | -         |
| Pb                    | 0.07      | 0.07Max   | 0.10      | 0.10      | -         | 0.30      |
| Ni                    |           | -         | -         | 0.30      | -         | -         |
| Fe                    | 0.07      | 0.05Max   | 0.07      | 0.10      | -         | 0.1       |
| Zn                    | Remainder | Remainder | Remainder | Remainder | Remainder | Remainder |
| As                    |           | -         | -         | -         | -         | 0.06      |
| Total Impurities Max. |           | -         | -         | 0.10      | -         | 0.06      |
| Condition             | H58       | O         | O         | F 29      | F 44      | O         |
|                       | H80       | 1/2H      | 1/2H      | F 37      | F 54      | TA        |
|                       |           | H         | H         |           |           | HD        |
| Yield                 |           |           |           | 180 Max   | 340 Min   |           |
| Strength              |           | -         | -         | 200 Min   | 470 Min   | -         |
| N/mm2                 |           |           |           |           |           |           |
| Tensile               | 370 Min   | 294 Min.  | 314 Min.  | 290-370   | 440-540   | 285 Min   |
| N / mm2               | 455 Min   | 373 Min.  | 373 Min.  | 370-440   | 540 Min   | 320 Min   |
|                       |           | 450 Min   | 451 Min.  |           |           | 400 Min   |
| Elongation            |           | -         | -         | -         | 45 Min.   | 40 Min    |
| %                     |           | -         | -         | -         | 45 Min.   | 35 Min    |
| -                     |           | -         | -         | -         | 20 Min.   | -         |
| Hardness HV 5         | 150 Min   |           |           | 75 Max    | -         | 80 Max    |
|                       | 85-110    |           | 80-105    | 80-110    |           | 80-105    |
|                       | 75 Min    |           |           | 135 Min   | -         | 95-130    |
|                       |           |           |           |           |           | 150 Min   |
| Grain Size            | 0.05 Max  | -         | 010-045   | -         | 025-060   | 065 Max   |
|                       |           | -         |           | -         |           |           |
| Mm (75X)              |           |           |           |           | 035 Min   | 035 Min   |

C2700=65/37 \*C2800=60/40

## TECHNICAL SPECIFICATION COPPER ALLOY TUBES

### CHEMICAL COMPOSITION MECHANICAL PROPERTIES

**70/30 BRASS TUBES** Product Application Areas: Sugar Industry, Hand Pumps, Plumbing, Furniture, General Engineering, Ammunitions And it is Commonly known as "Sugar Brass Tubes"

| Standard              | BS 2871 Part | ASTM B-135  | NFA 51 102  | IS 407      | JIS H3300 | AS 1572     | DIN 17671     | IS 1545     |
|-----------------------|--------------|-------------|-------------|-------------|-----------|-------------|---------------|-------------|
| Symbol                | CZ 126       | C 26000     | CuZn 30     | CuZn 30As   | C2600     | 259         | CuZn 30 20265 | CuZn 30 As  |
| Cu                    | 69.0 - 71.0  | 68.5 - 71.5 | 68.5 - 71.5 | 68,5 - 71,5 | 68.5-71.5 | 69.0-71.0   | 69.0-71.0     | 69.0-71.0   |
| Sn                    | -            | -           | -           | -           | -         | -           | .05           | -           |
| Al                    | -            | -           | -           | -           | -         | -           | .02           | -           |
| Pb                    | 0.07         | 0.07        | 0.07        | 0.07        | 0.07      | 0.05        | 0.05          | 0.07        |
| Ni                    | -            | -           | -           | -           | -         | -           | 0.2           | -           |
| Fe                    | 0.06         | 0.05        | 0.06        | 0.06        | 0.05      | 0.05        | 0.05          | 0.06        |
| Zn                    | Remainder    | Remainder   | Remainder   | Remainder   | Remainder | Remainder   | Remainder     | Remainder   |
| As                    | 0.02-0.06    | -           | 0.02 - 0.06 | -           | -         | 0.02 - 0.06 | -             | 0.02 - 0.06 |
| Total Impurities Max. | 0.03         | -           | 0.03        | 0.03        | -         | -           | 0.1           | 0.30        |
| Condition             | M            | H58         | -           | O           | O         | O           | F28           | O           |
|                       | TA           | H80         | -           | TA          | OH        | 1/4H        | F35           | TA          |
|                       | O            |             |             | HD          | 1/2H      | 1/2H        | F42           | HD          |
| Yield                 |              |             |             |             |           | H           | 180 Max       |             |
| Strength              | -            | -           | -           | -           | -         | -           | 200 Max       | -           |
| N/mm2                 |              |             |             |             |           |             | 320 Max       |             |
| Tensile               |              | 370 Min     | -           | 285Mps/Min  | 275 Min   | 280-350 Mps | 280-350       | 375 Max     |
| N / mm2               |              | 455 Min     |             | 300Mps/Min  | 275 Min   | -           | 350-420       | 340 Min     |
|                       |              |             |             | 400Mps/Min  | 373 Min   | 320 Mps Min | 420 Min       | 385 Min     |
|                       |              |             |             |             | 451 Min   |             |               |             |
|                       |              |             |             |             |           | 400 Mps Min |               |             |
| Elongation            | -            |             |             |             | 45 Min    | 40 Min      |               |             |
| %                     | -            | -           | -           | -           | 45 Min    | 35 Min      | -             | 55 Min      |
|                       | -            |             |             |             | 20 Min    |             |               |             |
| Hardness HV 5         | 150 Min      |             |             | 75 Max      |           | 80 Max      |               | 80 Max      |
|                       | 85-105       | -           | 80-105      | 80-110      | -         | 80-105      | -             | 80-105      |
|                       | 75 Min       |             |             | 135 Min     |           | 95-130      |               | 130 Min     |
|                       |              |             |             |             |           | 150 Min     |               |             |
| Grain Size            | 0.05 Max     | -           | 010 - 045   | -           | 025 - 060 | 0,065Max    |               |             |
| Mm (75X)              |              | -           |             | -           | 035 Min   | 0,035Min    |               |             |



## TECHNICAL SPECIFICATION COPPER ALLOY TUBES

### CHEMICAL COMPOSITION MECHANICAL PROPERTIES

**ADMIRALITY BRASS TUBES** **Product Application Areas:** Heat Exchangers, Refineries Power Plants, Desalination Plants, Ship Building & Ship Repairs, Condensers, Ferrules, Distillers

| Standard              | BS 2871 PART 3 | ASTM B-111  | DIN 1785    | NFA 51 102  | JIS H3300   | IS 1575         |
|-----------------------|----------------|-------------|-------------|-------------|-------------|-----------------|
| Symbol                | CN 111         | C 44300     | CuZn28 Sa 1 | CuZn 29 Sa1 | C4430       | CuZn 29 SN 1 As |
| Cu                    | 70.0 - 73.0    | 70.0 - 73.0 | 70.0 - 72.5 | 70.0 - 73.0 | 70.0 - 73.0 | 70.0 - 73.0     |
| Sn                    | 1.0 - 1.5      | 0.9-1.2     | 0.9-1.3     | 0.9 - 1.2   | 0.9 - 1.2   | 0.9 - 1.5       |
| Pb                    | 0.07           | 0.07        | 0.07        | 0.07        | 0.05Max     | 0.07            |
| Ni                    | -              | -           | 0.1         | -           | -           | -               |
| Fe                    | 0.06           | 0.06        | 0.07        | 0.06        | 0.05Max     | 0.06            |
| Zn                    | Remainder      | Remainder   | Remainder   | Remainder   | Remainder   | Remainder       |
| As                    | 0.02-0.06      | 0.02-0.06   | 0.02-0.035  | 0.02-0.06   | 0.02-0.06   | 0.02-0.06       |
| P                     | -              | -           | 0.1         | -           | -           | -               |
| Total Impurities Max. | 0.30           | -           | 0.1         | 0.30        | -           | 0.30            |
| Condition             | M              | O 61        | F36         | -           | O           | O               |
|                       | TA             |             | F 32        |             |             | TA              |
|                       | O              |             |             |             |             | HD              |
| Yield                 | -              | 105         | 140 - 220   | -           | -           | -               |
| Strength              | -              |             | 100 - 170   |             |             |                 |
| N/mm2                 |                |             |             |             |             |                 |
| Tensile               | -              | 310         | 360 Min     | -           | 315Min      | 375 Mps Max     |
| N / mm2               | -              | -           | 320 Min     | -           | -           | -               |
|                       |                |             |             |             |             | 340 Mps Min     |
|                       |                |             |             |             |             | 385 Mps Min     |
| Elongation            | -              | -           | 45 Min      | -           | 30 Min.     | -               |
| %                     | -              | -           | 55 Min      | -           |             | 35 Min          |
| Hardness HV 5         | 150 Min        | -           | -           | 80-120      | -           | 80 Max          |
|                       | 85-105         |             |             | 80-110      |             | 80-105          |
|                       | 75 Min         |             |             |             | -           | 130 Min         |
|                       |                |             |             |             |             | 150 Min         |
| Grain Size            | 0.05 Max       | 010 - 045   | -           | 010-045     | 010-045     | 010-045         |
| Mm (75X)              |                |             |             |             |             |                 |

Characteristics: A Copper Zinc Alloy containing tin and small amount of arsenic which is added as an inhibitor against dezincification. The presence of Tin imparts to the alloy good corrosion resistance in a moderately polluted river water and clean sea water, either stagnant or slow moving (up to about 2 mtrs/sec.). The most common and wrought form of tube is tube for heat exchange equipment.

GUIDE TO THE SELECTION OF TUBE MATERIAL: CLEAR, RIVER, LAKE OR CANAL WATER. : a) Dissolved salts more than from 2000 ppm • b) Suspended solids more than 25 ppm • c) H<sub>2</sub>S or Ammonia is less than 1 ppm • d) Chloride less than 20 ppm • e) For temperature more than 200°C and less than 450°C Permissible average velocity of water 2.0 – 2.5 meters/sec.

## ALUMINIUM BRASS TUBES

**Product Application Areas:** Heat Exchangers, Refineries Power Plants, Desalination Plants, Ship Building & Ship Repairs, Condensers, Ferrules, Distillers.

| Standard              | BS 2871 PART 3 | ASTM B-111  | DIN 1785    | NFA 51 102  | JIS H3300   | IS 1545        |
|-----------------------|----------------|-------------|-------------|-------------|-------------|----------------|
| Symbol                | CZ 110         | C 68700     | CuZn20 Ai 1 | CuZn Ai 2   | C 6870      | CuZn21 Ai 2 As |
| Cu                    | 76.0 - 78.0    | 76.0 - 79.0 | 76.0 - 79.0 | 76.0 - 79.0 | 76.0 - 79.0 | 76.0 - 78.0    |
| Al                    | 1.8 - 2.3      | 1.8 - 2.5   | 1.8 - 2.3   | 1.8 - 2.5   | 1.8 - 2.5   | 1.8 - 2.3      |
| Pb                    | 0.07           | 0.07        | 0.07        | 0.07        | 0.05        | 0.07           |
| Ni                    | -              | -           | 0.1         | -           | -           | -              |
| Fe                    | 0.06           | 0.06        | 0.07        | 0.06        | 0.06        | 0.06           |
| Zn                    | Remainder      | Remainder   | Remainder   | Remainder   | Remainder   | Remainder      |
| As                    | 0.02-0.06      | 0.02-0.06   | 0.02-0.35   | 0.02-0.06   | 0.02-0.06   | 0.02-0.06      |
| P                     | -              | -           | 0.1         | -           | -           | -              |
| Total Impurities Max. | 0.30           | -           | 0.1         | 0.30        | -           | 0.30           |
| Condition             | M              |             | F 39        |             |             | O              |
|                       | TA             | O 61        |             | -           | O           | TA             |
|                       | O              |             | F 34        |             |             | HD             |
| Yield                 | -              |             | 150 - 230   | -           | -           | 400 Mps Max    |
| Strength              | -              | 125         | 120-180     | -           | -           | 355 Mps Max    |
| N/mm2                 | -              |             |             |             |             | 415 Mps Max    |
| Tensile               | -              |             | 390 Min     |             |             | -              |
| N / mm2               | -              | 345         | 340 Min     | -           | 375         | -              |
|                       | -              |             |             |             |             | -              |
| Elongation            | -              | -           | 45 Min      | -           | -           | 85 Max         |
| %                     | -              | -           | 55 Min      | -           | 40          | 80-110         |
|                       | -              |             |             |             |             | 130 Min        |
| Hardness HV 5         | 150 Min        | -           | -           | -           | -           | -              |
|                       | 85-110         |             | 80-130      | -           |             | -              |
|                       | 75 Min         |             |             |             | -           | -              |
| Grain Size            | 0.05 Max       | 010 - 045   | -           | 010-045     | 010-045     | 010-045        |
| Mm (75X)              |                |             |             |             |             |                |

**Characteristics:** A Copper Zinc Alloy containing Aluminium and small amount of arsenic which is added as an inhibitor against dezincification. Inhibited Aluminium Brass resists the action of high velocity salt and brackish water and is commonly used for condenser tube. The outstanding characteristics of Aluminium Brass is the high resistance to impingement attack. Tubes of this alloy are recommended for use in marine and land power stations where cooling water velocity are high and where inhibited admiralty brass has failed from impingement

### GUIDE TO THE SELECTION OF TUBE MATERIAL:

**Sea Water:** (a) Dissolved salts more than from 2000 ppm. • (B) Suspended solids more than 30 ppm • (C) H<sub>2</sub>S or Ammonia is less than 1 ppm. Permissible average velocity of water 2.0 – 2.5 meters/sec.

**TECHNICAL SPECIFICATION COPPER ALLOY TUBES**  
CHEMICAL COMPOSITION MECHANICAL PROPERTIES

**70/30  
CUPRONICKEL  
TUBES**

**PRODUCT APPLICATION AREAS:** Heat Exchangers, High Capacity Power Plants, Ship Building & Ship Repairs, Condensers, Offshore Oil rigs, Distiller Tubes, Evaporators, Ferrules.

| Standard              | BS 2871 PART 3 | ASTM B-111  | DIN 1785               | NFA 51 102     | JIS H3300                  | IS 1545         |
|-----------------------|----------------|-------------|------------------------|----------------|----------------------------|-----------------|
| Symbol                | CN 107         | C 71500     | CuNi30 Mn 1 Fe         | CuNi30 Mn 1 Fe | C 7150                     | CuZn 30 Mn 1 Fe |
| Cu                    | Remainder      | Remainder   | Remainder              | Remainder      | Remainder                  | Remainder       |
| Pb                    | 0.01           | 0.05        | 0.03                   | 0.05           | 0.05                       | 0.05            |
|                       |                |             |                        | Sn+Pb          |                            |                 |
| Ni                    | 30.00 - 32.0   | 29.0 - 33.0 | 30.0 - 32.0            | 29.0- 32.0     | 29.0- 33.0                 | 29.0- 33.0      |
| Fe                    | 0.4 - 1.0      | 0.4 - 1.0   | 0.4-1.0                | 0.4 - 0.7      | 0.4 - 0.7                  | 0.4 - 1.0       |
| Mn                    | 0.5 - 1.0      | 1.0         | 0.5 - 1.5              | 0.5 - 1.5      | 0.2 - 1.0                  | 0.5 - 1.0       |
| S                     | 0.05           | -           | 0.05                   | 0.02           | -                          | -               |
| C                     | 0.06           | -           | 0.30                   | 0.10           | -                          | 0.30            |
| Total Impurities Max. | 0.30           | -           | 0.1                    | 0.30           | Rem (Cu+Ni+Fe+Mn 99.5 Min) | 0.30            |
| Condition             | M              | O 61        | F37                    | -              | O                          | O               |
|                       | O              | HR 50       | F 42                   |                |                            | D               |
| Yield                 | -              | 125 Min     | 120 - 220<br>150 - 260 | -              | -                          | -               |
| Strength              | -              | 345 Min     |                        |                |                            |                 |
| N/mm <sup>2</sup>     |                |             |                        |                |                            |                 |
| Tensile               | -              | 360 Min     | 370 Min                | -              | 363 Min                    | 360 Min         |
| N / mm <sup>2</sup>   | -              | 495 Min     | 420Min                 | -              | -                          | 480 Min         |
| Elongation            | -              | 12/15*      | 35 Min                 | -              | 30 Min.                    | -               |
| %                     | -              | -           | 30 Min                 | -              |                            |                 |
| Hardness HV 5         | 150            | -           | -                      | 90-130         | -                          | 115 Max         |
|                       | 90 - 120       |             |                        |                |                            | 140 Min         |
| Grain Size            | 0.05 Max       | -           | -                      | 010-045        | 010-045                    | -               |
| Mm (75X)              |                |             |                        |                |                            |                 |

\* 12% Wall thickness upto 1.21mm, including: 15% wall thickness over1.21mm characteristics:

A Copper Nickel alloy having small amount of iron and manganese to improve corrosion resistance in high velocity (from 1 to about 4 mtrs/sec.) waters, including sea water. The alloy is relatively insensitive to stress corrosion. It has good cold and hot working properties and is readily weldable.

**GUIDE TO THE SELECTION OF TUBE MATERIAL:**

a) Dissolved salts from 10000 ppm. • b) Absence of abrasive suspended solids. • c) Polluted with H<sub>2</sub>S and Ammonia. Permissible average velocity of water 3 – 4 meters/sec.

90/10

**CUPRONICKEL  
TUBES**

**TECHNICAL SPECIFICATION COPPER ALLOY TUBES**  
CHEMICAL COMPOSITION MECHANICAL PROPERTIES

**Product Application Areas:** Heat Exchangers, Application, Refineries, Power Plants, Desalination Plants, Ship Building & Ship Repairs, Condensers, Offshore Oil rigs, Car Braking Systems etc...

| Standard              | BS 2871 PART 3 | ASTM B-111 | DIN 1785       | NFA 51 102     | JIS H3300                      | IS 1545     |
|-----------------------|----------------|------------|----------------|----------------|--------------------------------|-------------|
| Symbol                | CN 102         | C 70600    | CuNi28 Fe 1 Mn | CuNi10 Fe 1 Mn | C 7060                         | CuNi 10 Fe1 |
| Cu                    | Remainder      | Remainder  | Remainder      | Remainder      | Remainder                      | Remainder   |
| Pb                    | 0.01           | 0.05       | 0.03           | 0.05<br>Sn+Pb  | 0.05                           | 0.05        |
| Ni                    | 10.0-11.0      | 9.0 - 11.0 | 9.0-11.0       | 9.0-11.0       | 9.0-11.0                       | 9.0-11.0    |
| Fe                    | 1.0-2.0        | 1.0 - 1.8  | 1.0 - 1.8      | 1.0 - 2.0      | 1.0-1.8                        | 1.0-1.8     |
| Mn                    | 0.5-1.0        | 1.0        | 0.5 - 1.0      | 0.3 - 1.0      | 0.2 - 1.0                      | 0.5 - 1.0   |
| Zn                    | -              | 1.0        | 0.5            | 0.5            | 0.5                            | 0.5         |
| S                     | 0.05           | -          | 0.05           | 0.05           | -                              | -           |
| C                     | 0.06           | -          | 0.05           | 0.05           | -                              | -           |
| Total Impurities Max. | 0.30           | -          | 0.01 Max       | 0.02           | Rem (Cu+Ni+<br>Fe+Mn 99.5 Min) | 0.30        |
| Condition             | M              | O 61       | F 29           | -              | O                              | O           |
|                       | O              | HR 55      |                |                |                                | HD          |
| Yield                 | -              | 105 Min    | 90-180         | -              | -                              | -           |
| Strength              | -              | 240 Min    |                |                |                                |             |
| N/mm2                 |                |            |                |                |                                |             |
| Tensile               | -              | 275 Min    | 290 Min        | -              | 275 Min                        | 295 Min     |
| N / mm2               | -              | 310 Min    |                | -              | -                              | 285 Min     |
| Elongation            | -              | -          | 30 Min         | -              | 30 Min.                        | 35 Min      |
| %                     | -              | -          |                | -              |                                |             |
| Hardness HV 5         | 150            | -          | -              | 70-100         | -                              | 110 Max     |
|                       | 80 - 110       |            |                |                |                                | 130 Min     |
| Grain Size            | 0.05 Max       | -          | -              | 010-045        | 010-045                        | 0.01-0.05   |
| Mm (75X)              |                |            |                |                |                                |             |

Characteristics: This alloy has very high erosion and corrosion resistance. It has very high weldability, easy for installation and high anti fouling properties against sea microorganisms. Relatively high iron content provides better impingement attack resistance. The alloy is unique to stress corrosion cracking.

**GUIDE TO THE SELECTION OF TUBE MATERIAL:**

a) Dissolved salts more than from 1500 to 3000 ppm. • (b) Suspended solids more than 25 ppm. • (c) H<sub>2</sub>S or Ammonia is less than 1 ppm. Permissible average velocity of water 2.5 – 2.7 meters/sec



## PHYSICAL PROPERTIES OF COPPER & COPPER BASED ALLOY

| Density z<br>Gms/Cm    |          | Melting Point       |                      | Coefficient of<br>thermal<br>expansion<br>(20-300 °C)<br>X 10 | Specific heat<br>(at 20 °C)<br>Cal/gm/ | Thermal<br>Conductivity<br>(at 20 °C Cal)<br>CM/Sec/ | Electrical<br>Conductivity<br>at 20 °C % IACS |
|------------------------|----------|---------------------|----------------------|---------------------------------------------------------------|----------------------------------------|------------------------------------------------------|-----------------------------------------------|
|                        |          | Solidus<br>Temp. °C | Liquidus<br>Temp. °C |                                                               |                                        |                                                      |                                               |
| Electrolytic Cu (ETP)  | 8.89-8.9 | 1069                | 1083                 | 17.7                                                          | 0.092                                  | 0.934                                                | 101%                                          |
| DHP Cu                 | 8.94     | 1065                | 1083                 | 177.7                                                         | 0.092                                  | 70-87                                                | 70-80                                         |
| DPA Cu                 | 8.94     | 1065                | 1082                 | 18.0                                                          | 0.092                                  | 35-45                                                | 35-45                                         |
| Tellurium Cu (0.5 Tel) | 8.94     | 1050                | 1080                 | 17.8                                                          | 0.092z                                 | 0.88                                                 | 95%                                           |
| 70/30 Cartridge Brass  | 8.53     | 915                 | 955                  | 19.9                                                          | 0.090                                  | 0.29                                                 | 28%                                           |
| Admiralty Brass        | 8.53     | 900                 | 935                  | 20.2                                                          | 20.2                                   | 0.090                                                | 0.26 25%                                      |
| Aluminium Brass        | 8.33     | 930                 | 970                  | 18.5                                                          | 0.090                                  | 0.24                                                 | 23%                                           |
| 70/30 Cu. Ni.          | 8.94     | 1100                | 1150                 | 17.1                                                          | 0.090                                  | 0.11                                                 | 9%                                            |
| 90/10 Cu. Ni.          | 8.94     | 1170                | 1240                 | 16.2                                                          | 0.090                                  | 0.07                                                 | 4.6%                                          |

### WEIGHT CALCULATING FORMULA

| Tubes                                      |          | Kgs. Per foot (TUBES) (D & t in inches)            | Kgs. per meter (TUBES) (D & t in mm)                                                          |
|--------------------------------------------|----------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Copper Tubes/<br>Cu. Ni. Tubes             |          | (D-t) x t x 5.529                                  | (D-t) x t x 0.0281                                                                            |
| 70/30 Brass &<br>Ad Brass                  |          | (D-t) x t x 5.269                                  | (D-t) x t x 0.0268                                                                            |
| Al Brass                                   |          | (D-t) x t x 5.149                                  | (D-t) x t x 0.0262                                                                            |
| D = Outside diameter<br>t = Wall Thickness |          |                                                    |                                                                                               |
| RODS                                       |          | Kgs. Per foot (RODS) (D in inches)                 | Kgs. per meter (RODS) (D in mm)                                                               |
| Copper                                     |          | 81                                                 | D <sup>2</sup> x 0070                                                                         |
| Pb Brass                                   |          | D <sup>2</sup> x 1.304                             | D <sup>2</sup> x 00663                                                                        |
| D = Outside diameter                       |          |                                                    |                                                                                               |
| STRIPS                                     | BUS BARS | Kgs. Per foot (STRIPS)                             | Kgs. per meter (STRIPS)                                                                       |
| Copper                                     |          | $\frac{\text{Width} \times \text{Thickness}}{369}$ | $\frac{\text{Width} \times \text{Thickness}}{369} \times 3.281$ or Width x Thickness x 0.0089 |

### TOLERANCES ON WALL THICKNESS

| Specified<br>Wall<br>Thickness | Tolerances<br>on Specified<br>Wall Thickness<br>(Plus and Minus) | Maximum<br>Wall<br>Thickness<br>at any point | Minimum<br>Wall<br>Thickness<br>at any point |
|--------------------------------|------------------------------------------------------------------|----------------------------------------------|----------------------------------------------|
| (1)<br>MM                      | (2)<br>MM                                                        | (3)<br>MM                                    | (4)<br>MM                                    |
| 0.5                            | 0.05                                                             | 0.58                                         | 0.43                                         |
| 0.6                            | 0.07                                                             | 0.71                                         | 0.51                                         |
| 0.8                            | 0.07                                                             | 0.91                                         | 0.71                                         |
| 1.0                            | 0.10                                                             | 1.16                                         | 0.86                                         |
| 1.2                            | 0.10                                                             | 1.37                                         | 1.06                                         |
| 1.5                            | 0.12                                                             | 1.70                                         | 1.35                                         |
| 2.0                            | 0.15                                                             | 2.23                                         | 1.82                                         |
| 2.5                            | 0.16                                                             | 2.70                                         | 2.2                                          |
| 3                              | 0.20                                                             | 3.25                                         | 2.64                                         |
| 4                              | 0.25                                                             | 4.47                                         | 3.66                                         |
| 5                              | 0.31                                                             | 5.5                                          | 4.6                                          |
| 6                              | 0.36                                                             | 6.50                                         | 5.50                                         |
| 8                              | 0.39                                                             | 8.50                                         | 7.50                                         |
| 10                             | 0.50                                                             | 11.00                                        | 9.30                                         |
| 12                             | 0.60                                                             | 13.00                                        | 11.00                                        |
| 16                             | 0.80                                                             | 17.00                                        | 15.00                                        |
| 20                             | 1.00                                                             | 21.00                                        | 19.00                                        |

### TOLERANCES ON MEAN OUTSIDE DIAMETER

| TOLERANCE                         |        |         |
|-----------------------------------|--------|---------|
| Outside Diameter<br>Specification | Normal | Reduced |
| mm                                | mm     | mm      |
| —                                 | +      | +       |
| Up to 10                          | 0.08   | 0.045   |
| Over 10 to 18                     | 0.10   | 0.045   |
| Over 18 to 32                     | 0.12   | 0.055   |
| Over 32 to 50                     | 0.15   | 0.070   |
| Over 50 to 80                     | 0.20   | —       |
| Over 80 to 125                    | 0.25   | —       |
| Over 125 to 200                   | 0.50   | —       |
| Over 200 to 250                   | 0.80   | —       |
| Over 250 to 315                   | 1.00   | —       |