Crane Copper Tube

# Copper Tube - NZS3501

## VERSATILE, TRUSTED QUALITY

COPPER TUBE → PLUMBING → GASFITTING → SANITATION

Crane Copper Tube

Crane copper tube is manufactured to NZS3501 using the highest grade raw materials and modern drawing technology to provide superior products for water, gas and sanitation waste in domestic, commercial and industrial applications.

# Crane Copper Tube – NZS3501

- **Compliance**: Crane copper tube complies with New Zealand Standard NZS3501 : 1976 Copper tubes for water, gas and sanitation.
- **Internal Surface Quality**: Crane Copper Tube uses special manufacturing processes to provide enhanced internal bore characteristics that offer improved corrosion resistance and levels of carbon residue well below the values set by the Standard.
- **Quality Manufacturing**: Crane copper tube is manufactured and inspected to the highest quality assurance standards.
- **Multi Applications**: Copper tube has great versatility for multiple uses including water, gas and sanitation drainage applications.
- **Inherent Strength**: Copper tube has inherent strength, providing good resistance to external damage, puncture, abrasion, vibration bumps, and has a wide operating range for pressure and vacuum.
- **Impervious**: Copper tube is impervious to oxygen, insecticide, solvents and toxins.
- **Non-Flammable**: Copper tube is non-flammable and does not emit toxic fumes during fire.
- **Full Flow Joints**: Copper tube jointing does not reduce the bore of the tube.
- **Low Friction Loss**: Copper tube provides high flow rates with minimal external dimensions.
- **U.V. Resistant**: Copper tube does not degrade from direct sunlight or become brittle with age.
- **Resists Rodent Attack**: Copper tube is not prone to damage due to rodent attack.
- **Multi Applications**: Copper tube is made to universal size not a unique brand size.
- **Stability**: Copper tube does not creep with age and has 7 to 15 times less lineal expansion than other materials with heat, and continues to perform at high temperatures.
- **Healthier & Non-tainting**: Copper tube does not adversely affect the taste of water, and *reduces the number of harmful micro-organisms in water.

  *Study conducted by INCRA under project Nº348 – 1984 using water contaminated with coliforms.
- **Proven Track Record**: Crane copper tube is part of a superior system with a proven track record.
- **Add Value For Life**: Copper tube adds to a home's resale value.
- **Recyclable**: Copper tube is a valuable recyclable material.

## Table 1 – NZS3501 Copper Tube for Water & Gas – Straights

| Crane Item Number | Nominal Size | Outside Diameter (mm) | Wall Thickness (mm) | Nominal Weight (Per length) | Length (m) | Temper | Hydrostatic Test Pressure (MPa) | Annealed State Safe Working Pressure (MPa) |
|---|---|---|---|---|---|---|---|---|
| 50200129 | 15 | 14.73 | 1.02 | 1.96 | 5 | Half Hard | 5.55 | 6.84 |
| 50200131 | 20 | 21.08 | 1.02 | 2.87 | 5 | Half Hard | 3.90 | 4.68 |
| 50200133 | 25 | 27.43 | 1.02 | 3.78 | 5 | Half Hard | 2.95 | 3.55 |
| 50200132 | 25 | 27.43 | 1.02 | 3.78 | 5 | Annealed | 2.95 | 3.55 |
| 50200224 | 32 | 34.19 | 1.22 | 5.65 | 5 | Hard Drawn | 2.85 | 3.40 |
| 50200225 | 32 | 34.19 | 1.22 | 5.65 | 5 | Half Hard | 2.85 | 3.40 |
| 50200226 | 40 | 40.54 | 1.22 | 6.74 | 5 | Hard Drawn | 2.40 | 2.85 |
| 50200227 | 40 | 40.54 | 1.22 | 6.74 | 5 | Half Hard | 2.40 | 2.85 |
| 50200228 | 50 | 53.24 | 1.22 | 8.91 | 5 | Hard Drawn | 1.85 | 2.16 |
| 50200229 | 50 | 53.24 | 1.22 | 8.91 | 5 | Half Hard | 1.85 | 2.16 |
| 50200230 | 65 | 65.94 | 1.22 | 11.09 | 5 | Hard Drawn | 1.50 | 1.73 |

## Table 2 – NZS3501 Copper Tube for Sanitation – Straights

| Crane Item Number | Nominal Size | Outside Diameter (mm) | Wall Thickness (mm) | Nominal Weight (Per length) | Length (m) | Temper | Hydrostatic Test Pressure (MPa) | Annealed State Safe Working Pressure (MPa) |
|---|---|---|---|---|---|---|---|---|
| 50200133 | 25 | 27.43 | 1.02 | 3.78 | 5 | Half Hard | 2.95 | 3.55 |
| 50200224 | 32 | 34.19 | 1.22 | 5.65 | 5 | Hard Drawn | 2.85 | 3.40 |
| 50200226 | 40 | 40.54 | 1.22 | 6.74 | 5 | Hard Drawn | 2.40 | 2.85 |
| 50200228 | 50 | 53.24 | 1.22 | 8.91 | 5 | Hard Drawn | 1.85 | 2.16 |
| 50200230 | 65 | 65.94 | 1.22 | 11.09 | 5 | Hard Drawn | 1.50 | 1.73 |
| 50200231 | 80 | 79.04 | 1.42 | 15.48 | 5 | Hard Drawn | 1.45 | 1.68 |
| 50200232 | 100 | 104.85 | 1.63 | 23.62 | 5 | Hard Drawn | 1.25 | 1.45 |
| 50200233 | 150 | 156.06 | 1.83 | 39.63 | 5 | Hard Drawn | 0.95 | 1.09 |

| Table 3 – NZS3501 Light Gauge Copper Tube for Water & Gas – Straights | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Crane Item Number | Nominal Size | Outside Diameter (mm) | Wall Thickness (mm) | Nominal Weight (Per length) | Length (m) | Temper | Hydrostatic Test Pressure (MPa) | Annealed State Safe Working Pressure (MPa) |
| 50200128 | 15 | 14.73 | 0.70 | 1.38 | 5 | Half Hard | 3.80 | 4.59 |
| 50200130 | 20 | 21.08 | 0.90 | 2.55 | 5 | Half Hard | 3.40 | 4.10 |

| Table 4 – NZS3501 Copper Tube for Water & Gas – Coils | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Crane Item Number | Nominal Size | Outside Diameter (mm) | Wall Thickness (mm) | Nominal Weight (Per length) | Length (m) | Temper | Hydrostatic Test Pressure (MPa) | Annealed State Safe Working Pressure (MPa) |
| 50200318 | 15 | 14.73 | 1.02 | 5.89 | 15 | Annealed | 5.55 | 6.84 |
| 50200328 | 20 | 21.08 | 1.02 | 8.62 | 15 | Annealed | 3.90 | 4.68 |

## Safe Working Pressure

The safe working pressure at temperatures up to 65°C in Table 1 & 3 are calculated using the following formula:

$$P = \frac{2S \times t}{D - t}$$

where
P = working pressure (MPa)
t = wall thickness (mm)
D = outside diameter (mm)
S = stress (MPa)
annealed condition, S = 46 MPa
half hard condition, S = 60 MPa
as drawn condition, S = 70 MPa

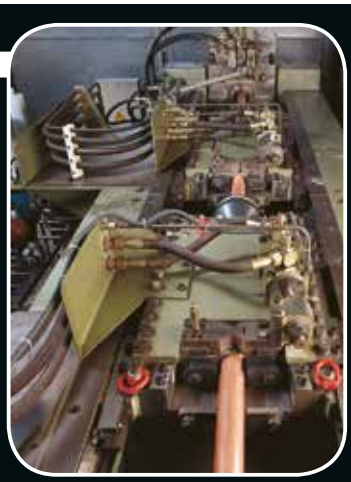
Where heating softens the copper tube, including by brazing, the maximum working pressure of annealed temper must apply. These values are shown in tables as the Annealed State Safe Working Pressure.

## Hydrostatic Test Pressure

$$P = \frac{80 \times t}{D}$$

where
P = working pressure (MPa)
t = wall thickness (mm)
D = outside diameter (mm)




## Table 5 - Copper Tube Flow & Friction Coefficients

| Table | Nominal Size | Max. Outside Diameter (mm) | Wall Thickness (mm) | c (litres/metre) | F @ 15°C | F @ 65°C |
|---|---|---|---|---|---|---|
| 1 | 10 | 11.35 | 0.91 | 0.0713 | 2524.36 | 2119.46 |
| 3 | 15 | 14.73 | 0.70 | 0.1396 | 400.208 | 336.134 |
| 1 | 15 | 14.73 | 1.02 | 0.1265 | 546.875 | 459.097 |
| 3 | 20 | 21.08 | 0.90 | 0.2919 | 80.6739 | 67.6599 |
| 1 | 20 | 21.08 | 1.02 | 0.2847 | 84.5755 | 70.9309 |
| 1 & 2 | 25 | 27.43 | 1.02 | 0.5063 | 20.1612 | 16.8973 |
| 1 & 2 | 32 | 34.19 | 1.22 | 0.7917 | 6.61590 | 5.55338 |
| 1 & 2 | 40 | 40.54 | 1.22 | 1.140 | 2.83052 | 2.37777 |
| 1 & 2 | 50 | 53.24 | 1.22 | 2.027 | 0.68157 | 0.57163 |
| 1 & 2 | 65 | 65.94 | 1.22 | 3.167 | 0.22769 | 0.19206 |
| 2 | 80 | 79.04 | 1.42 | 4.560 | 0.094847 | 0.079555 |
| 1 | 80 | 79.45 | 1.63 | 4.559 | 0.094893 | 0.079593 |
| 1 | 90 | 92.56 | 1.83 | 6.207 | 0.044758 | 0.037577 |
| 2 | 100 | 104.85 | 1.63 | 8.106 | 0.023916 | 0.020085 |
| 1 | 100 | 105.66 | 2.03 | 8.107 | 0.023936 | 0.020102 |
| 2 | 150 | 156.06 | 1.83 | 18.24 | 0.003431 | 0.002879 |
| 2 | 200 | 194.5 | 3.00 | 27.91 | 0.001446 | 0.001213 |

## Table 6 – Fitting Friction Coefficients

| Nominal Size | 90° Elbow (Sharp) | 90° Elbow (Long Rad.) | Tee (Branch Flow) | Tee (Line Flow) | Reducers | Stop Taps | Gate Valves | Swing Check Valves |
|---|---|---|---|---|---|---|---|---|
| 10 | 0.118 | 0.064 | 0.125 | 0.046 | 0.051 | 0.714 | 0.019 | 0.300 |
| 15 | 0.105 | 0.057 | 0.118 | 0.046 | 0.051 | 0.714 | 0.017 | 0.253 |
| 20 | 0.083 | 0.046 | 0.104 | 0.046 | 0.051 | 0.714 | 0.013 | 0.177 |
| 25 | 0.074 | 0.038 | 0.095 | 0.046 | 0.051 | 0.714 | 0.012 | 0.147 |
| 32 | 0.067 | 0.031 | 0.088 | 0.046 | 0.051 | 0.714 | 0.010 | 0.124 |
| 40 | 0.059 | 0.026 | 0.081 | 0.046 | 0.051 | 0.714 | 0.009 | 0.102 |
| 50 | 0.050 | 0.020 | 0.075 | 0.046 | 0.051 | 0.714 | 0.009 | 0.102 |
| 65 | 0.045 | 0.017 | 0.069 | 0.046 | 0.051 | 0.714 | 0.008 | 0.102 |
| 80 | 0.040 | 0.015 | 0.060 | 0.046 | 0.051 | 0.714 | 0.007 | 0.102 |
| 90 | 0.038 | 0.013 | 0.058 | 0.046 | 0.051 | 0.714 | 0.007 | 0.102 |
| 100 | 0.036 | 0.012 | 0.056 | 0.046 | 0.051 | 0.714 | 0.007 | 0.102 |

## Pressure Loss & Flow Rates for copper tube and fittings

### Flow Rate

$Q = v \times c$

where:

Q = Flow rate (litres/sec)
v = flow velocity in (metres/sec)
c = tube flow co-efficient, refer table 4

### Head or Pressure Loss due to friction of tube

$H = F \times Q^{1.8}$

$P = H \times 9.81$

where:

H = Head loss (metres/100 metres)
P = Pressure loss (kPa/100 metres)
F = friction co-efficient from table 4 below
Q = flow rate in (litres/sec)

### Head or Pressure Loss due to friction of fitting

$$H = f \times \left[\frac{Q}{c}\right]^2$$

$P = H \times 9.81$

where:

f = Fitting friction co-efficient from table 5
Q = Flow rate (litres/sec)
c = tube flow co-efficient, refer table 4

### Recommended Flow Velocity

Correct pipe sizing is essential to obtain acceptable water velocities and volumes. It is necessary to design all pipe work to have a minimum flow velocity greater than 0.5m/s, where velocities below this may allow suspended solids in the water to be deposited on the tube. Conversely flow rates greater than 3.0m/s can cause turbulence, which may destroy the protective surface film that is essential for the longevity of the system.

## Physical Properties of Copper Tube

| | |
|---|---|
| Composition | Alloy C12200 Copper = 99.90%min; Phosphorus=0.015-0.040% |
| Melting point | 1083°C |
| Density | 8.94 x $10^3$kg/$m^3$ |
| Thermal Expansion | 0.177mm/10°C.m |
| Modulus of Elasticity | 17,000 MPa |

| Tube Temper | Annealed | Bendable | As drawn |
|---|---|---|---|
| Hardness | 70 max. | 80-100 | 100 min. |
| Yield (0.2% proof), (MPa) | 70 | 220 | 350 |
| Ultimate (MPa) | 220 | 280 | 380 |

**Crane Copper Tube**

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