TECHNICAL DATA SHEET

Uniflow entered the copper tube industry in 2007, and remains to be the only manufacturer of copper tubes in South India. With extensive technical knowledge combined with stringent in-house quality controls and testing with an ISO 9001 certified quality management system, Uniflow has developed a renowned reputation for quality, reliability and service.

UNIFLOW Copper tubes are manufactured to various Indian and International Standards, and is suitable for different applications such as air conditioning, refrigeration, plumbing, medical gas, and general engineering. An extensive range of sizes and thicknesses are stocked for prompt deliveries.

Commitment to Quality:

Uniflow copper tubes are manufactured to meet the exact mechanical and chemical properties as specified by standards such as ASTM B280/ ASTM B68/ ASTM B75/ JIS H3300/ IS 2501, ensuring that the tube does not fail due to leakage or fatigue. Tubes manufactured are continuously tested for defects by eddy current test units as per ASTM E243.

At every stage of the production process, samples are tested to ensure product quality:

1. Incoming raw material is analysed to ensure it meets the required standard and the sample copper is checked for chemical content.
2. The extruded shell concentricity and dimensional checks are carried out.
3. Further dimensional checks are adopted at every step of the drawing process through to the final product.
4. Every finished length of copper tube is tested to guarantee tube soundness.
5. Finally finished tube samples are taken to carry mechanical tests (chemical analysis, tensile strength, hardness, elongation and eddy current).

By taking such care in the manufacture of its copper tube, Uniflow can guarantee excellent product quality.

As a result, Uniflow Copper Tubes holds both the ISO 9001:2015 'Quality Management System' approval and the ISO 14001:2015 'Environmental Management System' approval, in addition to the RoHS compliance certificate.

Cleanliness and Appearance:

As per the requirements of ASTM standards, any residue on the inner surface of the tube will not exceed 0.038g/m^2. Both the inside and outside surface diameters will be clean and bright, with the finish being smooth and free from slivers, scale, open grain and major metal defects or inclusions.

Uniflow's VRF/VRV range copper tubes are suitable for high-pressure refrigerants such as R410A and R32, which are ozone friendly refrigerants. These tubes are identified and protected with pink caps to designate they are "high pressure refrigerant tubes". R410A for example has a 60% higher operating pressure than R22 and requires a thicker wall tube and significantly stronger copper fittings. The tube is also identified with ink marking along its length stating the brand name, conforming standard and size.

Range:

Tubes are available from 1/4" to 2-1/8" diameter in various wall thicknesses.

Chemical and Mechanical Properties:

Uniflow uses DHP grade copper tubes with copper purity of 99.9% and phosphorous content of 0.015 – 0.040%

ACR Mechanical Properties - ASTM B280							
Temper Designation		Form	Tensile Strength (min)		Vickers Hardness HV5	Elongation in 2 inches min %	Average grain size in mm
Standard	Temper		ksi	Mpa			
O60	Soft Annealed	Coils	30	205	<60	40	0.040
H02	1/2 Hard	Straight Lengths	36	250	75-100	30	N/A
H58	Hard Drawn	Straight Lengths	42	290	>100	N/A	N/A

Barlow's formula for internal working pressure:

$$P = \frac{2st}{D - 0.08t}$$

Where,

P = Allowable pressure in psi

s = Allowable stress in psi (10,300 psi for hard drawn tubes at 150 ^{o}F or 65 ^{o}C)

t = Wall thickness in inches

D = Outside Diameter (O.D.) in inches

ACR Hard Drawn Straight Lengths - VRF/VRV Range							
O.D. in inches	O.D. in mm	WT in inches	WT in mm	Weight (kg) per foot	Weight (kg) per metre	Rated Internal working pressure at 150 °F (65 °C)	
						psi	Bar
3/8"	9.53	0.031	0.80	0.059	0.194	1742	120
1/2"	12.70	0.031	0.80	0.081	0.266	1304	90
5/8"	15.88	0.039	1.00	0.125	0.410	1304	90
3/4"	19.05	0.031	0.80	0.124	0.407	868	60
3/4"	19.05	0.039	1.00	0.156	0.512	1086	75
7/8"	22.22	0.031	0.80	0.145	0.476	744	51
7/8"	22.22	0.039	1.00	0.187	0.613	930	64
1"	25.40	0.035	0.88	0.180	0.590	716	50
1"	25.40	0.039	1.00	0.213	0.699	814	56
1-1/8"	28.58	0.039	1.00	0.234	0.768	723	50
1-1/4"	31.75	0.043	1.10	0.288	0.945	716	50
1-3/8"	34.93	0.048	1.21	0.351	1.151	716	50
1-1/2"	38.10	0.052	1.32	0.417	1.368	716	50
1-5/8"	41.28	0.056	1.43	0.488	1.601	716	50
1-3/4"	44.45	0.061	1.55	0.574	1.883	720	50
2-1/8"	53.98	0.070	1.78	0.793	2.601	681	47

General Specification:

Quality:	Uniflow ACR Tubing is manufactured to consistently meet the demands of the air-conditioning VRF/VRV industry, and is compatible with all refrigerants including R410A
Cleanliness:	Bore quality meets the 0.038g/m^2 ASTM B280 specified limit
Material:	C12200, Cu 99.9% min, P 0.015-0.040% min
Mechanical Properties:	Tensile Strength: 290 Mpa (min) Elongation: 3% (min) Hardness: >100 HV
Temper:	Hard Drawn
Packaging:	Bored internally cleaned and capped
Bending:	Not suitable for bending
Length:	Manufactured in 10ft lengths, other lengths available on request

ACR Soft Annealed Pancake Coils - VRF/VRV Range							
O.D. in inches	O.D. in mm	WT in inches	WT in mm	Weight (kg) per foot	Weight (kg) per metre	Rated Internal working pressure at 150 °F (65 °C)	
						Psi	Bar
1/4"	6.35	0.032	0.8	0.038	0.125	1319	91
3/8"	9.53	0.032	0.80	0.059	0.194	876	60
1/2"	12.70	0.032	0.80	0.081	0.266	656	45
5/8"	15.88	0.040	1.00	0.126	0.413	656	45
3/4"	19.05	0.040	1.00	0.156	0.512	546	38

General Specifications:

Quality:	Uniflow ACR Tubing is manufactured to consistently meet the demands of the air-conditioning VRF/VRV industry, and is compatible with all refrigerants including R410A
Cleanliness:	Bore quality meets the 0.038g/m2 ASTM B280 specified limit
Material:	C12200, Cu 99.9% min, P 0.015-0.040% min
Mechanical Properties:	Tensile Strength: 205 Mpa (min) Elongation: 40% (min) Hardness: <60 HV
Temper:	Soft Annealed
Packaging:	Bored internally cleaned and capped, double layer coils
Bending:	Suitable for bending with or without specialised tooling
Length:	Manufactured in 50ft (15.24m) rolls

Packaging Details:

ACR Hard Drawn Straight Lengths - VRF/VRV Range - Packaging details								
O.D. in inches	O.D. in mm	WT in inches	WT in mm	Weight (kg) per foot	Weight (kg) per metre	Weight (kg) per pipe	Pipes per bundle	Weight (kg) per bundle
1/4"	6.35	0.031	0.8	0.038	0.125	0.38	100	38.00
3/8"	9.53	0.031	0.80	0.059	0.194	0.59	50	29.50
1/2"	12.70	0.031	0.80	0.081	0.266	0.81	40	32.40
5/8"	15.88	0.039	1.00	0.126	0.413	1.26	25	31.50
3/4"	19.05	0.031	0.80	0.124	0.407	1.24	25	31.00
3/4"	19.05	0.039	1.00	0.156	0.512	1.56	20	31.20
7/8"	22.22	0.031	0.80	0.145	0.476	1.45	25	36.25
7/8"	22.22	0.039	1.00	0.187	0.613	1.87	20	37.40
1"	25.40	0.035	0.88	0.180	0.590	1.8	20	36.00
1"	25.40	0.039	1.00	0.213	0.699	2.13	15	31.95
1-1/8"	28.58	0.039	1.00	0.234	0.768	2.34	15	35.10
1-1/4"	31.75	0.043	1.10	0.288	0.945	2.88	12	34.56
1-3/8"	34.93	0.048	1.21	0.351	1.151	3.51	10	35.10
1-1/2"	38.10	0.052	1.32	0.417	1.368	4.17	8	33.36
1-5/8"	41.28	0.056	1.43	0.488	1.601	4.88	8	39.04
1-3/4"	44.45	0.061	1.55	0.574	1.883	5.74	6	34.44
2-1/8"	53.98	0.070	1.78	0.793	2.601	7.93	4	31.72

ACR Soft Annealed Pancake Coils - VRF/VRV Range - Packaging Details								
O.D. in inches	O.D. in mm	WT in inches	WT in mm	Weight (kg) per foot	Weight (kg) per metre	Weight (kg) per coil	Coils per carton	Weight (kg) per carton
1/4"	6.35	0.031	0.8	0.038	0.125	1.90	15	28.50
3/8"	9.53	0.031	0.80	0.059	0.194	2.95	10	29.50
1/2"	12.70	0.031	0.80	0.081	0.266	4.05	8	32.40
5/8"	15.88	0.039	1.00	0.125	0.410	6.25	5	31.25
3/4"	19.05	0.039	1	0.156	0.512	7.80	4	31.20

Survey no. 177/11, No.49, Pappankuppam Village,
Siddirajakandigai Panchayat, Gummidipoondi Taluk, Chennai - 601201. Mobile : +91 9176679998
info@uniflowcoppertubes.com

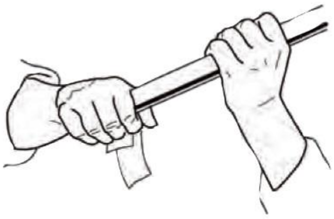
The Fine Art of Brazing

Best results will be obtained by a skilled operator employing the step-by-step brazing technique that follows:

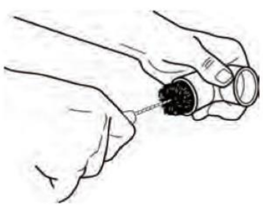
1. The tube should be cut to desired length with a square cut, preferably in a square-end sawing vise. The cutting wheel of the type specifically designed for cutting copper tube will also do a satisfactory job. The tube should be the exact length needed, so that the tube will enter the cup of the fitting all the way to the shoulder of the cup. Remove all slivers and burrs left from cutting the tube, by reaming and filing, both inside and outside.

2. To make a proper brazing joint, the clearance between the solder cup and the tube should be approximately 0.001" to 0.010" (0.0254mm to 0.254mm). Maintaining a good fit on parts to be brazed insures: Ease of Application — Excessively wide tolerances tend to break capillary force; and, as a result the alloy will either fail to flow throughout the joint or may flush out of the joint. Corrosion Resistance — There is also a direct relation between the corrosion resistance of a joint and the clearance between members. Economy— If brazing alloys are to be used economically, they, of necessity, must be applied in the joint proper and in minimum quantities, using merely enough alloy to fill the area between the members.

3. The surfaces to be joined must be clean and free from oil, grease and heavy oxides. The end of the tube need be cleaned only for a distance slightly more than it is to enter the cup. Special wire brushes designed to clean tube ends may be used, but they should be carefully used so that an excessive amount of metal will not be removed from the tube. Fine sand cloth or emery cloth may also be used with the same precautions. The cleaning should not be done with steel wool, because of the likelihood of leaving small slivers of the steel or oil in the joint.

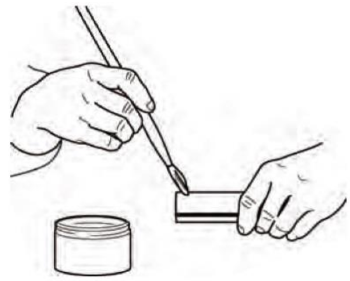


4. The cup of the fitting should be cleaned by methods similar to those used for the tube end, and care should be observed in removing residues of the cleaning medium. Attempting to braze a contaminated or an improperly cleaned surface will result in an unsatisfactory joint. Brazing alloys will not flow over or bond to oxides; and oily or greasy surfaces tend to repel fluxes, leaving bare spots which will oxidize, resulting in voids and inclusions.



5. Flux should be applied to the tube and solder cup sparingly and in a fairly thin consistency. Avoid flux on areas not cleaned. Particularly avoid getting excess flux into the inside of the tube itself. Flux has three principal functions to perform:

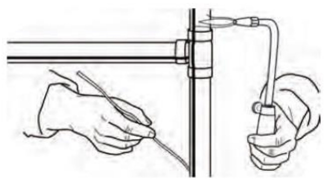
A. It prevents the oxidation of the metal surfaces during the heating operation by excluding oxygen.



B. It absorbs and dissolves residual oxides that are on the surface and those oxides which may form during the heating operation.

C. It assists in the flow of the alloy by presenting a clean nascent surface for the melted alloy to flow over. In addition, it is an excellent temperature indicator, especially if an indicating flux is used.

6. Immediately after fluxing, the parts to be brazed should be assembled. If fluxed parts are allowed to stand, the water in the flux will evaporate, and dried flux is liable to flake off, exposing the metal surfaces to oxidation from the heat. Assemble the joint by inserting the tube into the cup, hard against the stop. The assembly should be firmly supported so that it will remain in alignment during the brazing operation.



7. Brazing is started by applying heat to the parts to be joined. The preferred method is by the oxyacetylene flame. Propane and other gases are sometimes used on smaller sizes. A slightly reducing flame should be used, with a slight feather on the inner blue cone; the outer portion of the flame, pale green. Heat the tube first, beginning at about one inch from the edge of the fitting. Sweep the flames around the tube in short strokes up and down at right angles to the run of the tube. It is very important that the flame be in continuous motion and should not be allowed to remain on any one point to avoid burning through the tube. Generally, the flux may be used as a guide as to how long to heat the tube, continuing heating after the flux starts to bubble or work, and until the flux becomes quiet and transparent, like clear water. The flux will pass through four stages:

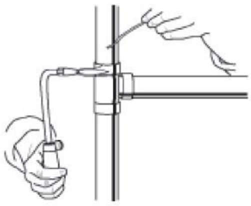
A. At 212°F (100°C) the water boils off.

B. At 600°F (315.6°C) the flux becomes white and slightly puffy and starts to work.

C. At 800°F (426.7°C) it lays against the surface and has a milky appearance.

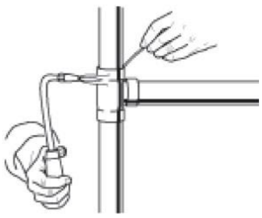
D. At 1100°F (593.3°C) it is completely clear and active and has the appearance of water.

8. Now switch the flame to the fitting at the base of the cup. Heat uniformly, sweeping the flame from the fitting to the tube until the flux on the fitting becomes quiet. Avoid excessive heating of cast fittings.

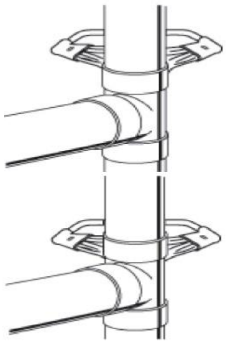


9. When the flux appears liquid and transparent on both the tube and the fitting, start sweeping the flame back and forth along the axis of the joint to maintain heat on the parts to be joined, especially toward the base of the cup of the fitting. The flame must be kept moving to avoid burning the tube or the fitting.

10. Apply the brazing wire or rod at a point where the tube enters the socket of the fitting. The temperature of the joint should be hot enough to melt the brazing alloy. Keep the flame away from the rod or wire as it is fed into the joint. Keep both the fitting and the tube heated by moving the flame back and forth from one to the other as the alloy is drawn into the joint. When the proper temperature is reached, the alloy will flow readily into the space between the tube outer wall and the fitting socket, drawn in by the natural force of capillary attraction. When the joint is filled, a continuous fillet of brazing alloy will be visible completely around the joint. Stop feeding as soon as the joint is filled.



NOTE: For tubing one inch and larger, it is difficult to bring the whole joint up to heat at one time. It frequently will be found desirable to use a double-tip torch to maintain the proper temperature over the larger area. A mild pre-heating of the whole fitting is recommended. The heating then can proceed as in steps 7, 8, 9, and 10. If difficulty is encountered in getting the whole joint up to heat at one time, then when the joint is nearly up to the desired temperature the alloy is concentrated in a limited area. At the brazing temperature the alloy is fed into the joint and the torch is then moved to an adjacent area and the operation carried on progressively all around the joint.



HORIZONTAL JOINTS — When making horizontal joints, it is preferable to start applying the brazing alloy at the 5 o'clock osition, then move around to the 7 o'clock position and then move up the sides to the top of the joint, making sure that the operations overlap.

VERTICAL JOINTS — On vertical joints, it is immaterial where the start is made. If the opening of the cup is pointed down, care should be taken to avoid overheating the tube, as this may cause the alloy to run down the tube. If this condition is encountered, take the heat away and allow the alloy to set. Then reheat the solder cup of the fitting to draw up the alloy.

After the brazing alloy has set, remove residual flux from the joint area as it is corrosive and presents an unclean appearance and condition. Hot water or steam and a soft cloth should be used. Wrot fittings may be chilled; however it is advisable to allow cast fittings to cool naturally to some extent before applying a swab. All flux must be removed before inspection and pressure testing.

TROUBLE SPOTS If the alloy fails to flow or has a tendency to ball up, it indicates oxidation on the metal surfaces, or insufficient heat on the parts to be joined. If work starts to oxidize during heating, it indicates too little flux, or a flux of too thin consistency. If the brazing alloy refuses to enter the joint and tends to flow over the outside of either member of the joint, it indicates this member is overheated, or the other is underheated, or both. In both cases, operations should be stopped and the joints disassembled, recleaned and fluxed.