REV	ECO	Release	Drawn	REVISION HISTORY
-3	2019-023	2019-05-28	SGO	Customer Drawing

High Pressure Copper Tubing and Compression Tube Fittings

This application note provides information about High Pressure Copper Tubing and Compression Tube Fittings available from Mountain High Equipment & Supply (MH) for use in aviation oxygen systems, as well as general procedures and guidelines for Copper Tubing preparation and Compression Tube Fitting assembly and installation.

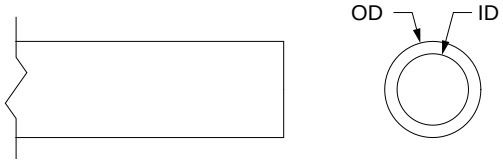
Copper Tubing - GENERAL SPECIFICATIONS

Material: UNS C12200, ASTM-B68 (99.9% Cu, 0.02% P)

Working Pressure Rating: 3074 PSIG @ 100°F
Temperature Range: -25°F to 125°F [-32°C to 52°C]

Package: Coiled Roll, 1-foot increments, Cleaned & Capped or Crimped

MH p/n	Description
19605-0002-00	1/8 inch OD, Soft Copper Tubing Bulk (per ft.)
19606-0003-00	3/16 inch OD, Hard-Drawn Copper Tubing Bulk (per ft.)



1/8" OD Soft Copper Tubing

MH Item #: **19605-0002-00**

OD: 1/8" (.125") [3.175 mm]
ID: 0.065" [1..651 mm]
Wall Thickness: 0.030" [0.762 mm]
Weight: 0.035 Lbs / Ft [0.052 Kg / m]

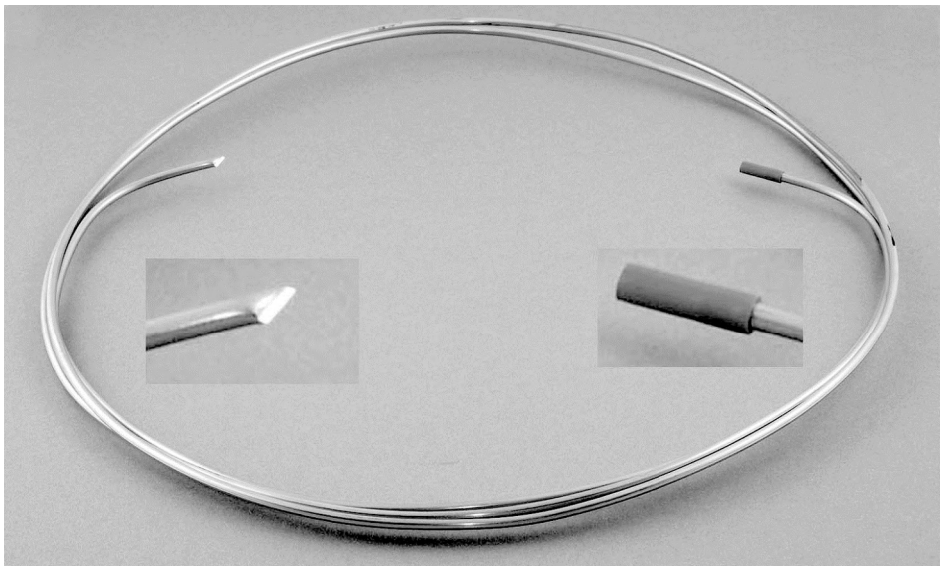
Cleaned for Oxygen Service per MH ESR-008

3/16" OD Hard-Drawn Copper Tubing

MH Item #: **19606-0003-00**

OD: 3/16" (0.1875") [4.763 mm]
ID: 0.1275" [3.329 mm]
Wall Thickness: 0.030" [0.762 mm]
Weight: 0.058 Lbs / Ft [0.085 Kg / m]

Cleaned for Oxygen Service per MH ESR-008



Packaging

Copper tubing is sold by the foot and unless otherwise specified will be shipped in a 12" dia. coil with the ends either crimped (left inset) or capped (right inset) or capped *and* crimped.

Contact Mountain High E&S for special packaging.

References

For more information about hardware and accessories available from MH:

- 5SHDW-0100-00
  High Pressure Copper Tubing and Compression Tube Fittings
- 5SHDW-0300-00
  High Pressure NPT Pipe Fittings
- 5SHDW-0500-00
  High Pressure Adapter Fittings

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
0.X ±.015 ANGLES ± 3°
0.XX ±.010 FRACTIONS ± 1/64
0.XXX ±.005
INTERPRET GD&T PER ASME 14.5
63

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

DRAWN	SGO	2017-03-07
CHECKED	EAM	2017-03-15
ENGINEER	PLM	2017-03-16
APPROVED	HBS	2017-03-16

MOUNTAIN HIGH E&S CO.
REDMOND, OR. USA

DWG TITLE: High Pressure Copper Tubing and Compression Tube Fittings [SCD]
DWG NUMBER: **5SHDW-0100-00** DWG REV. -3
CAD FILE: 5SHDW-0100-00$-3 INV. PART NUMBER: 00HDW-0xxx-xx PROD. NAME:
DWG FORMAT: ESR-002 Rev H [20] DWG SCALE DWG SHEET 1 OF 4 DWG SIZE A 8½x11

Insert #: 5IHDW-0100-00

Copper Tubing

Copper tubing supplied by Mountain High Equipment & Supply (MH) is warranted as "cleaned for oxygen service" provided both ends are sealed, crimped or capped.

Handling

Handle copper tubing carefully as scratches or burrs on the tubing could interfere with sealing. Pinched or out-of-round tubing may not fit the ID of the Ferrules or Body bore and could also lead to leakage.

Cutting

Copper tubing should be cut with a fine-tooth saw (jeweler's coping saw) with at least 32 teeth per inch in order to minimize residual burrs. Use a cut-off guide or miter-box to assure a square cutoff.

Use of a conventional tubing cutter is not recommended as it will result in a reduced inner diameter as well as a slight flare at the outer diameter. The reduction in inner diameter can be as much as 50% which would compromise proper oxygen flow. The tube opening must therefore be restored to the original inner diameter with a drill bit or a small jeweler's reamer. The flared outer diameter may also need to be corrected as it may interfere with assembly and the proper seating of the tubing in the fitting body.

Deburring

Remove burrs from the cut end of the tubing. Burrs on the ID of the tubing can restrict flow or break loose and clog or damage the oxygen system, and pose a ***safety hazard*** (see ***"Cleaning"***). Burrs on the OD of the tubing can interfere with the proper seating of the tubing in the fitting body. Do not over-deburr the OD of the tubing.

Tubing must be purged prior to assembly in order to remove any metal particles that could contaminate the system.

Cleaning

High pressure oxygen systems must be free of grease, oil or other unapproved lubricants or cleaning agents, as well as any metal particles. Such contaminants, aside from having the potential to clog or damage critical orifices or filters in the system, pose an ***extreme safety hazard*** with the potential of fire or explosion. Therefore, cleanliness in the preparation and assembly of oxygen system components is critical.

Tubing used in oxygen systems must be examined internally just prior to final assembly and re-cleaned if necessary (NFPA 99). FAA Advisory Circular **AC 43.13-2B** also specifies the cleaning of oxygen lines and fittings that have not been previously cleaned and sealed and lists several approved methods for doing so (Paragraph 608d),

Tubing and Fittings obtained from MH have been cleaned for oxygen service and should not need to be re-cleaned so long as proper hygiene has been maintained in the assembly process. Tubing and Fittings obtained elsewhere (even if the *same* part) may therefore not be suitable for use in oxygen systems unless it is known for certain that they have been properly cleaned.

Purging

Just prior to final assembly to any associated equipment, tubing must be purged with air to remove any contaminants. Contaminants include not only metal particles generated in tubing preparation, but any cleaning fluid residue that may be present from previous cleaning procedures.

Use clean, dry compressed air to purge system tubing and fittings as required. Introduce the air in such a way that any contaminants present are completely ejected from the system rather than displaced into adjacent components.

Caution: Conventional "Shop Air" systems may have lubricating oil introduced into the system and therefore would not be suitable for the purging of oxygen system components.

Jeweler's Saw - Preferred

Tubing Cutter - Not Recommended

DWG NUMBER	5SHDW-0100-00	DWG REV.	-3	DWG SHEET	2 OF 4

Insert #: 5IHDW-0100-00

Compression Tube Fittings - GENERAL SPECIFICATIONS

Material: UNS C36000 (CDA-360) Brass
Pressure Rating: 3300 PSIG Working Pressure
Temp Range: -50°F to +130°F [-45°C to +55°C]

Cleaned for Oxygen Service

Compression Tube Fittings

MH p/n	Fitting	Tube OD	Thread	Weight Oz. [g]	Dim "A"	Dim "B"	Wrench "W1"	Wrench "W2"	Fig.
00HDW-0104-00	Straight	1/8	5/16-24 UNF (SAE-2M)	0.44 [13]	1.18 [30.0]		7/16	7/16	1A
00HDW-0108-00	Straight	1/8	7/16-20 UNF (SAE-4M)	0.88 [25]	1.24 [31.5]		7/16	9/16	1A
00HDW-0108-05	Straight (w/ filter)	1/8	7/16-20 UNF (SAE-4M)	0.90 [26]	1.24 [31.5]		7/16	9/16	1A
00HDW-0110-00	Straight	3/16	7/16-20 UNF (SAE-4M)	0.98 [28]	1.30 [33.0]		1/2	9/16	1A
00HDW-0110-05	Straight (w/ filter)	3/16	7/16-20 UNF (SAE-4M)	1.00 [28]	1.30 [33.0]		1/2	9/16	1A
00HDW-0118-00	Straight	1/8	1/8-27 MNPT	0.64 [18]	1.20 [30.5]		7/16	7/16	1B
00HDW-0120-00	Straight	1/8	1/8-27 FNPT	0.81 [23]	1.13 [28.7]		7/16	9/16	1C
00HDW-0122-00	Straight	3/16	1/8-27 MNPT	0.69 [20]	1.23 [31.2]		1/2	7/16	1B
00HDW-0124-00	Straight	3/16	1/8-27 FNPT	0.89 [25]	1.17 [29.7]		1/2	9/16	1C
00HDW-0134-00	Straight	1/8	1/4-18 MNPT	0.99 [28]	1.40 [35.6]		7/16	9/16	1B
00HDW-0138-00	Straight	3/16	1/4-18 MNPT	1.23 [35]	1.43 [36.3]		1/2	9/16	1B
00HDW-0145-00	Straight	3/16	1/4-18 FNPT	1.58 [45]	1.35 [34.3]		1/2	3/4	1C
00HDW-0150-00	Elbow	1/8	1/8-27 MNPT	0.88 [25]	.93 [23.6]	.70 [17.8]	7/16	---	2A
00HDW-0152-00	Elbow	1/8	1/8-27 FNPT	1.48 [42]	.97 [24.6]	.75 [19.0]	7/16	---	2B
00HDW-0174-00	Union	1/8	---	0.80 [23]	1.40 [35.6]		7/16	7/16	3
00HDW-0176-00	Union	3/16	---	1.00 [28]	1.47 [37.3]		1/2	7/16	3
00HDW-0182-00	Bulkhead Union	1/8	---	1.15 [33]	2.02 [51.3]		7/16	1/2	4
00HDW-0204-00	Tee	1/8	---	1.32 [37]	1.76 [44.7]	.88 [22.4]	7/16	---	5
00HDW-0206-00	Tee	3/16	---	1.84 [52]	1.92 [48.8]	.96 [24.4]	1/2	---	5

Compression Fittings Spare Parts	MH Part Number	
	1/8 OD Tube	3/16 OD Tube
Ferrule and Nut Set, Brass	00HDW-0212-00	00HDW-0214-00
Back Ferrule, Brass	00HDW-0212-BB	00HDW-0214-BB
Front Ferrule, Brass	00HDW-0212-FB	00HDW-0214-FB
Nut, Brass	00HDW-0212-NB	00HDW-0214-NB

Spare/replacement O-Ring for SAE-4M port-adapter fittings	
Part Number	**Description**
09001-3904-70	O-ring, EPDM, 3-904 (SAE-4), E70

(Applies to MH p/n's 00HDW-0108-xx, 00HDW-0110-xx [Fig 1A])

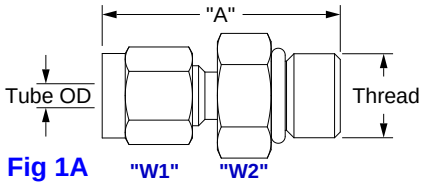


Fig 1A

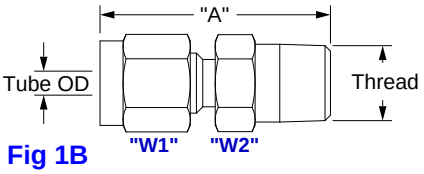


Fig 1B

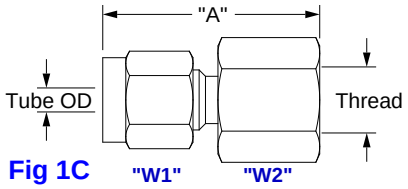


Fig 1C

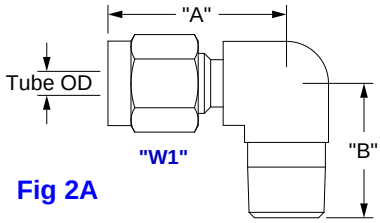


Fig 2A

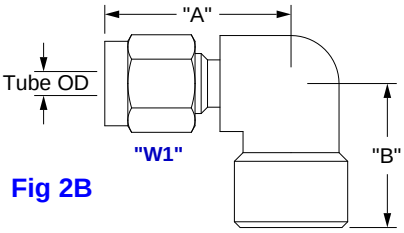


Fig 2B

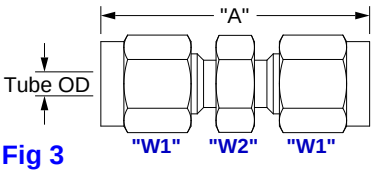


Fig 3

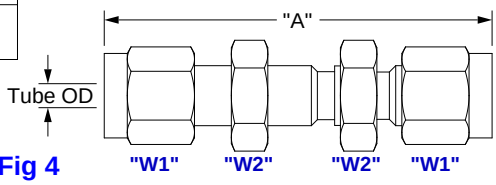


Fig 4

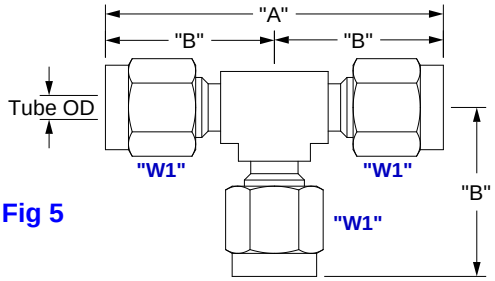


Fig 5

DWG NUMBER	5SHDW-0100-00	DWG REV.	-3	DWG SHEET	3 OF 4

Insert #: 5IHDW-0100-00

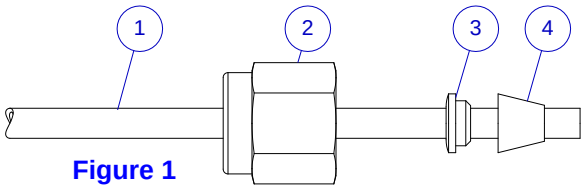


Figure 1

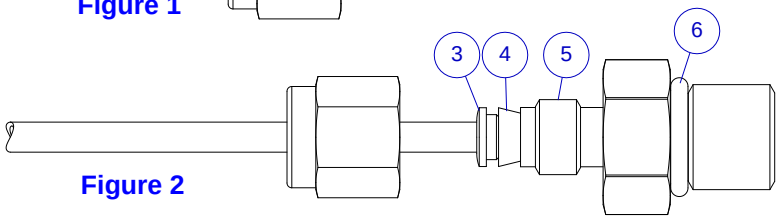


Figure 2

REF	Description
1	Copper Tubing
2	Nut
3	Back Ferrule
4	Front Ferrule
5	Tube-Fitting Body
6	O-Ring

Compression Fitting Assembly

The following instructions are applicable to all 1/16", 1/8" and 3/16" OD Compression Tube Fittings available from MH.

Note: Illustration depicts SAE-4M port-adapter fitting (O-ring applies only to this type of fitting)

Note: Threaded port-adapter fittings (SAE, NPT) must be installed into the port before the tubing connection is made

Note: Apply oxygen-compatible Teflon tape (e.g., MIL-SPEC T27730A) to NPT threads prior to installation (see 5SHDW-0300-00 "High Pressure NPT Pipe Fittings" for more information on installation of NPT fittings)

1) Remove the Nut from the Compression Tube Fitting and retain the 2 Ferrules

2) Slide the Nut and 2 Ferrules over the end of the Tubing in the same order and orientation as shown [Figure 1]

3) Push the Tubing into the fitting Body until the Tubing bottoms-out on the internal shoulder [Figure 2]

4) Push the 2 Ferrules down against the fitting Body and turn the Nut to finger-tight, making sure that the Tubing remains seated against the shoulder and does not back out

5) Holding the fitting Body steady, use a wrench to turn the Nut an additional 3/4 turn (turn the Nut only, not the Body)

Note: Rather than removing the Nut and disassembling the Fitting, it may be possible to merely loosen the Nut and push the Tubing through the Ferrules and into the Fitting until it bottoms-out on the shoulder. Turn the Nut finger-tight, and then an additional 3/4 turn.

Re-assembly

Connections may be disassembled and reassembled as required, but re-assembly is subject to a different procedure. Initial assembly swages the Ferrules onto the Copper Tubing, and reassembling the connection with the same procedure (3/4 turn) would ***over-compress the Tubing and Ferrules and compromise the connection.***

Caution: Always depressurize the system before disassembly

1) Before disassembly, mark the Tube at the back of the Nut, and also mark a line across the flats of the Nut and fitting Body. These reference lines will be used to confirm that the Tube has been fully seated and that the Nut has been returned to it's previous pulled-up position upon re-assembly.

2) Disassemble the fitting and make changes or adjustments as required

3) Re-insert the Tube (with pre-swaged Ferrules) into the Fitting until the front Ferrule seats against the fitting Body [Figure 2]. Engage the Nut and turn to finger-tight. Hold the fitting Body steady and turn the Nut with a wrench to the previous pulled-up position using the marks made prior to disassembly as references. There should be a significant increase in resistance at this point. Further tighten the Nut slightly.

Note: If the Tubing is being shortened and the pre-swaged Ferrules are cut off, then follow the directions for initial assembly. Cut, deburr and purge the tubing as previously directed. Do not attempt to re-use the previously swaged Ferrules - replacement Ferrules are available from MH. The Nut may be re-used.