

# AEROSPACE MATERIAL SPECIFICATION



AMS 2263D

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Reaffirmed SEP 2000

Superseding AMS 2263C

## Tolerances Nickel, Nickel Alloy, and Cobalt Alloy Tubing

### 1. SCOPE:

This specification covers established inch-pound manufacturing tolerances applicable to seamless and welded thin-wall aircraft tubing of nickel, nickel alloys, and cobalt alloys ordered to inch-pound dimensions. These tolerances apply to all conditions and are based on individual measurements, unless otherwise noted. The term "exclusive" is used to apply only to the higher figure of a specified range.

1.1 MAM 2263 is the metric version of this AMS.

### 2. DIAMETER:

Mean diameter is the average of two measurements taken at right angles to each other at the same section. Ovality is the difference between the maximum and minimum diameters of any one section of a tube.

2.1 Seamless, Cold Finished:

2.1.1 Nickel-Copper Alloy, Annealed:

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TABLE 1 - Diameter Tolerances, Annealed Nickel-Copper Alloy

Specified OD Inches	Specified Wall Thickness % of OD	Tolerance, Inch OD Plus	Tolerance, Inch OD Minus	Tolerance, Inch Mean OD Plus	Tolerance, Inch Mean OD Minus	Ovality
Up to 0.400, incl	Up to 3.0, incl	--	--	0.004	0	0.004
	Over 3.0	0.004	0	--	--	--
Over 0.400 to 0.625, excl	Up to 3.0, incl	--	--	0.005	0	0.005
	Over 3.0	0.005	0	--	--	--
0.625 to 1.500, incl	Up to 3.0, incl	--	--	0.005	0.005	0.01 x OD
	Over 3.0	0.005	0.005	--	--	--
Over 1.500 to 4.500, incl	Up to 3.0, incl	--	--	0.010	0.010	0.01 x OD
	Over 3.0	0.010	0.010	--	--	--
Over 4.500 to 6.000, incl	Up to 3.0, incl	--	--	0.015	0.015	0.01 x OD
	Over 3.0	0.030	0.030	0.015	0.015	--
Over 6.000 to 7.500, incl	Up to 3.0, incl	--	--	0.020	0.020	0.01 x OD
	Over 3.0	0.040	0.040	0.020	0.020	--
Over 7.500 to 8.625, incl	Up to 3.0, incl	--	--	0.025	0.025	0.01 x OD
	Over 3.0	0.050	0.050	0.025	0.025	--

2.1.2 Nickel-Chromium-Iron Alloy, Annealed:

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TABLE 2 - Diameter Tolerances, Annealed Nickel-Chromium-Iron Alloy

Specified OD Inches	Specified Wall Thickness % of OD	Tolerance, Inch OD Plus	Tolerance, Inch OD Minus	Tolerance, Inch Mean OD Plus	Tolerance, Inch Mean OD Minus	Ovality
Up to 0.400, incl	Up to 3.0, incl	--	--	0.004	0	0.004
	Over 3.0	0.004	0	--	--	--
Over 0.400 to 0.625, excl	Up to 3.0, incl	--	--	0.005	0.005	0.005
	Over 3.0	0.005	0.005	--	--	--
0.625 to 1.500, incl	Up to 3.0, incl	--	--	0.0075	0.0075	0.01 x OD
	Over 3.0	0.0075	0.0075	--	--	--
Over 1.500 to 3.500, incl	Up to 3.0, incl	--	--	0.010	0.010	0.01 x OD
	Over 3.0	0.010	0.010	--	--	--
Over 3.500 to 4.500, incl	Up to 3.0, incl	--	--	0.015	0.015	0.01 x OD
	Over 3.0	0.015	0.015	--	--	--
Over 4.500 to 6.000, incl	Up to 3.0, incl	--	--	0.020	0.020	0.01 x OD
	Over 3.0	0.040	0.040	0.020	0.020	--
Over 6.000 to 6.625, incl	Up to 3.0, incl	--	--	0.025	0.025	0.01 x OD
	Over 3.0	0.050	0.050	0.025	0.025	--

## 2.2 Copper Furnace Brazed, Cold Finished:

## 2.2.1 Nickel-Copper Alloy, Annealed:

TABLE 3 - Diameter Tolerances, Annealed Nickel-Copper Alloy

Specified OD Inch	Specified Wall Thickness Inch	OD Tolerance Inch Plus	OD Tolerance Inch Minus
0.125	0.028	0.001	0.001
0.188	0.028	0.001	0.001
0.250	0.028	0.003	0
0.312	0.028	0.003	0
0.375	0.028	0.003	0
0.500	0.028	0.005	0
0.625	0.028	0.005	0
0.625	0.035	0.005	0

## 2.3 Welded, All Alloys:

OD tolerances apply to mean OD for tubing with specified wall thickness of 3% or less of specified OD. OD and ID tolerances shall not both apply to the same lot of tubing.

TABLE 4 - Diameter Tolerances and Ovality, All Alloys, Welded Tubing

Specified OD Inches	Specified Wall Thickness % of OD	Tolerance, Inch Plus and Minus OD	Tolerance, Inch Plus and Minus ID	Ovality
Up to 0.094, incl	Up to 3.0, incl	0.001	0.001	0.001
	Over 3.0	0.001	0.001	--
Over 0.094 to 0.1875, excl	Up to 3.0, incl	0.0015	0.0015	0.002
	Over 3.0	0.0015	0.0015	--
0.1875 to 0.500, excl	Up to 3.0, incl	0.003	0.005	0.004
	Over 3.0	0.003	0.005	--
0.500 to 1.000, excl	Up to 3.0, incl	0.004	0.006	0.01 x OD
	Over 3.0	0.004	0.006	--
1.000 to 1.500, excl	Up to 3.0, incl	0.005	0.007	0.01 x OD
	Over 3.0	0.005	0.007	--
1.500 to 2.000, excl	Up to 3.0, incl	0.006	0.008	0.01 x OD
	Over 3.0	0.006	0.008	--
2.000 to 2.500, excl	Up to 3.0, incl	0.007	0.010	0.01 x OD
	Over 3.0	0.007	0.010	--
2.500 to 3.500, excl	Up to 3.0, incl	0.010	0.014	0.01 x OD
	Over 3.0	0.010	0.014	--
3.500 to 5.000, excl	Up to 3.0, incl	0.015	0.020	0.01 x OD
	Over 3.0	0.015	0.020	--

## 3. WALL THICKNESS:

## 3.1 Seamless, Cold Finished:

3.1.1 Wall thickness of all tubes except for those alloys and sizes shown in 3.1.2 and 3.1.3 shall not vary more than  $\pm 10\%$ .

## 3.1.2 Nickel-Copper Alloy, Seamless:

3.1.2.1 Wall thickness may vary  $\pm 12.5\%$  for the following sizes:

3.1.2.1.1 Tubes with specified OD over 0.400 to 0.625 inch, exclusive, with specified wall thickness of 0.040 inch and over.

3.1.2.1.2 Tubes with specified wall thicknesses more than 25% of the specified OD.

3.1.2.1.3 Tubes over 4.500 inches in specified OD.

3.1.3 Nickel-Chromium-Iron Alloy, Seamless:

3.1.3.1 Wall thickness may vary  $\pm 15\%$  for the following sizes:

3.1.3.1.1 Tubes with specified OD over 0.400 to 0.625 inch, exclusive, with specified wall thicknesses of 0.042 inch and over.

3.1.3.1.2 Tubes with specified wall thicknesses more than 25% of the specified OD.

3.1.3.2 Wall thickness may vary  $\pm 12.5\%$  for tubes over 4.500 inches in specified OD.

3.2 Copper Furnace Brazed, Cold Finished:

Wall thickness of nickel-copper alloy tubes shall not vary more than  $\pm 0.002$  inch.

3.3 Welded, All Alloys:

For tubes with specified OD 0.625 inch, and under, wall thickness tolerances of seamless tubing apply. Wall thickness tolerances are  $\pm 10\%$  for redrawn welded tubing.