

MOLEX MATERIAL SPECIFICATION – C77000 ALLOY METAL STRIPS

1.0 SCOPE

This specification covers the comprehensive technical requirements, applicable reference documents, and quality requirements for metal strips. The values listed for acceptance criteria are in SI units.

2.0 PURPOSE

The purpose of this specification is to comprehensively define the Molex requirements for alloy C77000 chemical composition, physical properties, mechanical properties, and reference other applicable documents related to quality requirements and standard default dimensional tolerances.

This specification is a merger of JIS H3130 and supplier literature for UNS alloy C77000 to meet the needs of Molex connector applications.

3.0 REFERENCE DOCUMENTS

This primary specification focuses on the physics of C77000 alloy and related mechanical properties to ensure Molex product performance. Other Molex documents are necessary to verify material characteristics that support high quality and manufacturability of products.

These reference documents are crucial to the Molex process / product and therefore all requirements contained within them must be attested to and demonstrate their conformance, within the supplier’s process certification:

- JIS H3130 and the associated normative reference documents, except for JIS Z2248 (Bend Test)
- ASTM B820 is specifically mentioned as critical to Molex formability requirements
- 2090580043 Geometric Conditions and Tolerances for Metal Strips
- 2090580044 Metal Strip Surface Conditions and Requirements

4.0 ORDER OF PRECEDENCE

This defines the priority order that should be followed when reviewing attributes and requirements of metal strip:

1. Molex Purchase Order
2. Packaging Specifications
3. Molex (Individual) Metal Strip Specification (i.e. Part Number Specification)
4. Molex Material Alloy Specification (**This document** – 2090580058– Molex Material Specification – C77000 Alloy Metal Strips)
5. Surface (2090580044) and Geometric (2090580043) Global Engineering Specifications

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REVISION DESCRIPTION	NEW RELEASE (TRANSITIONED FROM 400005033-ES)			MOLEX MATERIAL SPECIFICATION – C77000 ALLOY METAL STRIPS			
CHANGE NO.	849683						
REVISED BY	ELIJAH RESNICK	DATE	2026/04/15	DOC TYPE	DOC TYPE DESCRIPTION	DOC PART	SERIES
REV APPR BY	DANIEL MOLLA	DATE	2026/04/15	QMD	ENGINEERING STANDARD	000	209058
INITIAL RELEASE				CUSTOMER	DOCUMENT NUMBER	REVISION	SHEET
INITIAL DRWN	LAWRENCE WOJNICZ KSAMIEC	DATE	2026/01/20	MOLEX INTERNAL	2090580058	A	1 OF 5
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5.0 TECHNICAL REQUIREMENTS

5.1 Chemical Composition

UNS #	Cu wt.%	Ni wt.%	Fe wt.%	Mn wt.%	Zn wt.%
C77000	53.5 – 56.5 ⁽¹⁾⁽²⁾	16.5 – 19.5 ⁽³⁾	0.25 max	0.50 max	Rem

(1)(2) Copper + Sum of named elements (including Silver) = 99.5% min.

(3) Nickel value includes Cobalt

Limits for named and unnamed elements may be established between Molex and the supplier to satisfy certain environmental (REACH/RoHS) or other customer requirements. Reference “Molex Chemical Substances Specification for Products and Packaging: Supplier Requirements” (2014040014).

5.2 Mechanical Properties (longitudinal direction)

Mechanical Properties Table C77000				
Designation	Tensile (1)	Yield (1)	Elongation %	RTF Grain Size (2)
	(MPa)	0.2% offset (MPa)	In 50mm	(mm)
H01	470 - 540	≥ 280	≥ 11	≤ 0.030
H02	540 - 655	≥ 390	≥ 8	≤ 0.030
H04	630 - 735	≥ 500	≥ 2	≤ 0.015
H06	705 - 805	≥ 600	≥ 1	≤ 0.015
H08	765 - 865	≥ 680	-	≤ 0.015

Notes:

(1) Tensile requirements are longitudinal values in uniaxial tension in accordance with ASTM E8M

(2) Ready to Finish (RTF) grain size is measured before final rolling

5.3 Electrical Conductivity

5.3.1 The typical expected nominal value is 3.3 MS/m (6% IACS) @ 20°C

5.3.2 The test standard shall be ASTM E 1004 (eddy current) or ASTM B 193 (resistivity)

5.4 Bending properties

Bending of metal strip samples shall be in accordance with ASTM B820; Bend Test for Formability of Copper Alloy Spring Material. The requirement is that the supplier’s material when tested at finished thickness and temper shall achieve the inside bend radii as listed in the table below without observable cracking on the outside bend radius (reference 5.4.1.)

If special forming requirements are necessary, those will be listed separately on the part number document.

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C77000 H02								
		90° GW	180° GW			90° BW	180° BW	
	Thickness	10:1 w/t	10:1 w/t		Thickness	10:1 w/t	10:1 w/t	
	≤ 0.5 mm	0.5 r/t	1.5 r/t		≤ 0.5 mm	1.0 r/t	3.0 r/t	
C77000 H04								
		90° GW	180° GW			90° BW	180° BW	
	Thickness	10:1 w/t	10:1 w/t		Thickness	10:1 w/t	10:1 w/t	
	≤ 0.5 mm	1.0 r/t	2.0 r/t		≤ 0.5 mm	2.0 r/t	4.0 r/t	
C77000 H06								
		90° GW	180° GW			90° BW	180° BW	
	Thickness	10:1 w/t	10:1 w/t		Thickness	10:1 w/t	10:1 w/t	
	≤ 0.5 mm	1.5 r/t	3.0 r/t		≤ 0.5 mm	4.0 r/t	6.0 r/t	

Notes:

(1) W/t = width to thickness ratio (defining bending width). r/t = inside bend radius to thickness ratio

5.4.1 Acceptance Criteria for Bending

Bending Observations	Acceptance Criteria	Rank
	"Accepted", smooth, no orange peel, no cracks	1
	"Accepted", small orange peel, no cracks	2
	"Accepted", heavy orange peel, no cracks	3
	"Rejected", heavy orange peel, shallow cracks	4
	"Rejected", heavy orange peel, deep cracks	5

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5.5 Stress Relaxation Resistance minimum expectation (in accordance with ASTM E328)*

C77000 Alloy Stress Relaxation in Percent Retained @ 1000 Hours						
Temp °C	50% R_{p0.2}	80% R_{p0.2}	100% R_{p0.2}	50% R_{p0.2}[†]	80% R_{p0.2}[†]	100% R_{p0.2}[†]
75	97%	93%	75%	93%	87%	69%
100	95%	91%	73%	91%	85%	67%
125	92%	87%	67%	85%	79%	59%
150	85%	79%	62%	77%	71%	54%

*Annual test data certification required

6.0 CERTIFICATION REQUIREMENTS

Certification at P.O. Level	Supplied Data at P.O. Level	Annual Capability Statement	Engineering Data by Request
Chemical Composition (data)		Chemical Capability	
Tensile (data)		Tensile Capability	Transverse properties
Yield (data)		Yield Capability	Spring Bending Limit
Elongation (data)			
Grain size (data)			
			Elastic Modulus (data)
Thickness (data)		Thickness Capability	
Width (data)		Width Capability	
Camber (pass/fail)			
Surface Roughness (data)			
		Stress Relaxation Verification	
Burr (pass/fail)			
Bend Formability (pass/fail)			ASTM B820 Appendix narrow beam reporting table, or other
Electrical Conductivity (data)			
			Other Physical Properties
Reference Documents (pass/fail)			

6.1 Requirements for “Annual Capability Assessment” of critical characteristics

- 6.1.1** Chemical composition requires a statistical assessment on an annual basis to verify capability. This assessment be on file and available to Molex when requested.
- 6.1.2** Mechanical properties, requires a statistical assessment on an annual basis to verify capability. This assessment be on file and available to Molex when requested.
- 6.1.3** Dimensional tolerances, requires a statistical assessment on an annual basis to verify capability. This assessment be on file and available to Molex when requested.
- 6.1.4** Stress relaxation resistance is to be verified for a temper and a process in the H04 to H08 designation range at 80% of yield strength for 1000 hours at 75°C and 125°C. The supplier shall select and active Molex item to fulfill this requirement. It is acceptable to utilize Larson Miller Parameters to facilitate this annual verification audit.

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6.2 Engineering Data

Acceptance of this material specification and the requirements includes the supplier’s commitment to provide other engineering data when requested. These types of data may include transverse properties, spring bending limits or other physical properties of this material.

6.3 Recent Change Summary

Document ID# Change from **400005033-ES** → **2090580058**.

Updated **Section 3: Reference Documents** to reflect new **2090580043** and **2090580044** titles and content.

Changed **Section 4: Definitions** (with no entries) to **Section 4: Order of Precedence**.

Removal of what was previous **Section 6: Dimensional Requirements**

- All current Geometric and Dimensional Requirements are contained in **2090580043: GEOMETRIC CONDITIONS AND TOLERANCES FOR METAL STRIPS**. Including:
 - Strip Thickness
 - Strip Width
 - Burr
 - Camber
- All current Surface Condition Requirements are contained in **2090580044: METAL STRIP SURFACE CONDITIONS AND REQUIREMENTS**. Including:
 - Surface Roughness

Therefore, the previous **Section 7: Certification Requirements** and associated 7.X.Y subsections have decreased by one to become **Section 6: Certification Requirements** and associated 6.X.Y subsections.

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