INTERNATIONAL STANDARD

ISO 9974-4

Second edition
2016-12-01

Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing —

Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs

Raccordements pour applications générales et transmissions hydrauliques et pneumatiques — Orifices et éléments mâles à filetage ISO 261 et joint en élastomère ou étanchéité métal sur métal —

Partie 4: Dimensions, conception, méthodes d'essai et exigences des bouchons d'orifice à six pans externes et à six pans internes

Reference number
ISO 9974-4:2016(E)

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This second edition cancels and replaces the first edition (ISO 9974-4:2006), of which it constitutes a minor revision with the following changes:

— A caution note has been added to Clause 7;

— ISO 9974-3 has been added to the Bibliography.

A list of all parts in the ISO 9974 series can be found on the ISO website.

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Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. In general applications, a fluid can be conveyed under pressure.

Components are connected through their threaded ports by stud ends on fluid conductor fittings to tubes and pipes or to hose fittings and hoses. Fluid ports are closed by inserting a plug into the port.

For threaded ports and stud ends specified in new designs in hydraulic fluid power applications, ISO/TC 131/SC 4 recommends that the ISO 6149 series be used because these International Standards specify ports and stud ends with metric threads and O-ring sealing and because the subcommittee would like to help users by recommending one preferred system. ISO/TC 131/SC 4 further recommends that threaded ports and stud ends in accordance with the ISO 1179 series, ISO 9974 series and ISO 11926 series not be used for new designs in hydraulic fluid power applications; these International Standards are maintained because they specify ports and stud ends that are currently used in hydraulic systems worldwide.

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Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing —

Part 4:
Dimensions, design, test methods and requirements for external hex and internal hex port plugs

1 Scope

This document specifies dimensions and performance requirements for metric external hex and internal hex port plugs for use with ISO 9974-1 ports.

Port plugs in accordance with this document can be used at working pressures up to 63 MPa [630 bar[1)]]. The permissible working pressure depends upon the plug end size, materials, design, working conditions, application, etc.

Conformance to the dimensional information in this document does not guarantee rated performance.

NOTE The Introduction of this document gives recommendations for ports and stud ends to be used for new designs in hydraulic fluid power applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 261:1998, *ISO general purpose metric screw threads — General plan*

ISO 1629, *Rubber and latices — Nomenclature*

ISO 4042, *Fasteners — Electroplated coatings*

ISO 4759-1:2000, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 9974-1, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*

ISO 9974-2, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 2: Stud ends with elastomeric sealing (type E)*

ISO 10683, *Fasteners — Non-electrolytically applied zinc flake coatings*

ISO 19879, *Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections*

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
plug
stud end without fluid passage, used to contain hydraulic fluid

4 Dimensions

4.1 Plug dimensions

External hex and internal hex plugs shall conform to the dimensions shown in Figure 1 and Figure 2 and given in Table 1 and Table 2, respectively.

4.2 Hex tolerances

External hex tolerances across flats shall be in accordance with ISO 4759-1:2000, product grade C. Minimum across corner dimensions are 1,092 times the nominal width across flats. The minimum side flat is 0,43 times the nominal width across flats. Internal hex tolerances shall conform to ISO 4759-1:2000, product grade A. Unless otherwise specified or shown, hex corners shall be chamfered 10° to 30° to a diameter equal to the width across flats, with a tolerance of $^{0}_{-0,4}$ mm.

4.3 Screw threads

The screw threads on the plug shall be metric screw threads conforming to ISO 261:1998, class 6g.

5 Requirements

5.1 Working pressures and working temperatures

External hex and internal hex plugs conforming to this document shall be suitable for use at the working pressures given in Table 3 when used at temperatures from −40 °C to +120 °C. For use at pressures and/or temperatures outside of this range, the manufacturer shall be consulted.

Plugs conforming to this document may contain elastomeric seals. Unless otherwise specified, plugs are made and delivered with elastomeric seals for use within the specified working temperature range with petroleum-based hydraulic fluids. The use of these plugs and elastomeric seals with other hydraulic fluids can result in a reduced working temperature range or can render the plugs unsuitable for the application. Manufacturers may supply, upon request, plugs with elastomeric seals for use with hydraulic fluids other than petroleum-based hydraulic fluids that meet the specified working temperature range of the plugs.

5.2 Performance

External hex and internal hex plugs conforming to this document shall meet the burst and impulse pressures given in Table 3, and shall be capable of withstanding a vacuum of 6,5 kPa (0,065 bar) absolute pressure when tested in accordance with Clause 7.

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6 Elastomeric sealing

Unless otherwise specified, for use at the pressure and temperature requirements in 5.1 and Table 3 and for testing, the elastomeric sealing shall

— be made of NBR (nitrile) with a hardness of (90 ± 5) IRHD, measured in accordance with ISO 48, and

— conform to the relevant dimensions given in ISO 9974-2 (see Annex A).

7 Test methods

CAUTION — The use of plugs conforming to this document with ports conforming to ISO 1179-1, ISO 6149-1 and ISO 11926-1 could lead to a hazardous situation.

Port plug tests shall be conducted in accordance with ISO 19879 for burst, cyclic endurance (impulse) and vacuum tests. The qualification test torques given in Table 4 shall be used in testing. Test results shall be reported on the test data form in ISO 19879.

8 Designation of port plugs

Port plugs shall be designated by an alphanumeric code to facilitate ordering. They shall be designated by the word "Plug", then a space followed by ISO 9974-4, then a dash, followed by the shape code PLEH for external hex plug or PLIH for internal hex plug, followed by sealing code S for plugs delivered with elastomeric sealing, then a dash, followed by the plug size. If desired, the code can be supplemented by a dash followed by the elastomeric sealing material code in accordance with ISO 1629, followed by a dash, followed by the plating code in accordance with ISO 4042 or ISO 10683.

EXAMPLE 1 Plug with an external hex for an ISO 9974-1 port size M12 × 1,5 is designated as follows:

Plug ISO 9974-4-PLEH-M12

EXAMPLE 2 Plug with an external hex for an ISO 9974-1 port size M12 × 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6 is designated as follows:

Plug ISO 9974-4-PLEHS-M12

EXAMPLE 3 Plug with an internal hex for an ISO 9974-1 port size M12 × 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6 but made of FKM instead of NBR is designated as follows:

Plug ISO 9974-4-PLIHS-M12-FKM

EXAMPLE 4 Plug with an internal hex for an ISO 9974-1 port size M12 × 1,5, ordered assembled with elastomeric sealing that conforms to the requirements of Clause 6 and plated with galvanized zinc in accordance with ISO 4042 is designated as follows:

Plug ISO 9974-4-PLIHS-M12-A3C

9 Manufacture

9.1 Construction

Plugs may be made from low carbon steel by forming or machined from bar stock, unless otherwise recommended.

9.2 Workmanship

Workmanship shall conform to the best commercial practice to produce high quality plugs. Plugs shall be free from visual contaminants, all hanging burrs, loose scale and slivers which can be dislodged in

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use, and any other defects that can affect the function of the parts. Unless otherwise specified, surface finish on all surfaces shall be $Ra \leq 6{,}3$ µm.

9.3 Finish

The external surface and threads on all port plugs shall be protected with an appropriate coating to pass a minimum 72-h salt spray test in accordance with ISO 9227, unless otherwise agreed upon by the manufacturer and the user. Any appearance of red rust during the salt spray test shall be considered failure.

Corrosion protection requirements do not apply to corners or edges such as hex points, serrations, the crest of threads and areas where the parts are suspended or affixed in the test chamber where condensate can accumulate.

Cadmium plating is not allowed due to environmental concerns. Parts manufactured to this document shall not be cadmium-plated. Changes in plating can affect assembly torques and require requalification, when applicable.

10 Procurement information

The purchaser should supply a description of the plug using the designation in accordance with Clause 8 when making an inquiry or placing an order. Deviations from the requirements of this document, such as materials, pressures and temperatures, shall be agreed upon by the supplier and the purchaser.

11 Marking

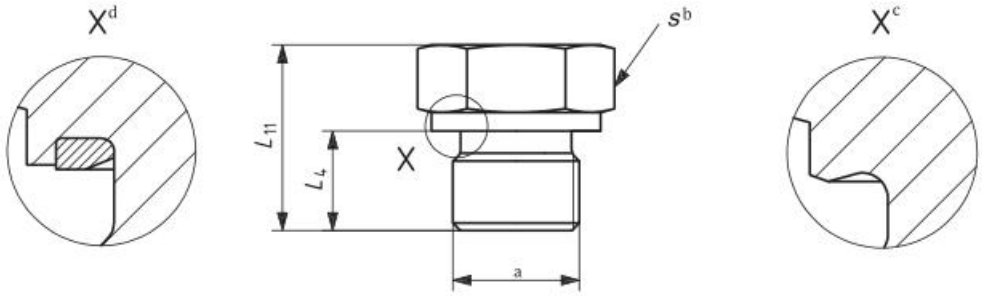
Port plugs shall be permanently marked with the manufacturer's name or trademark.

12 Identification statement (reference to this document)

It is strongly recommended to manufacturers who have chosen to conform to this document that the following statement be used in test reports, catalogues and sales literature:

"Port plugs conform to ISO 9974-4, Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 4: Dimensions, design, test methods and requirements for external hex and internal hex port plugs."

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Key

a Screw thread (d1 × P).

b Width across flats.

c Type B (PLEH).

d Type E (PLEHS).

NOTE Stud end details in accordance with ISO 9974-2.

Figure 1 — External hex port plug (PLEH and PLEHS)

Table 1 — Dimensions of external hex port plugs

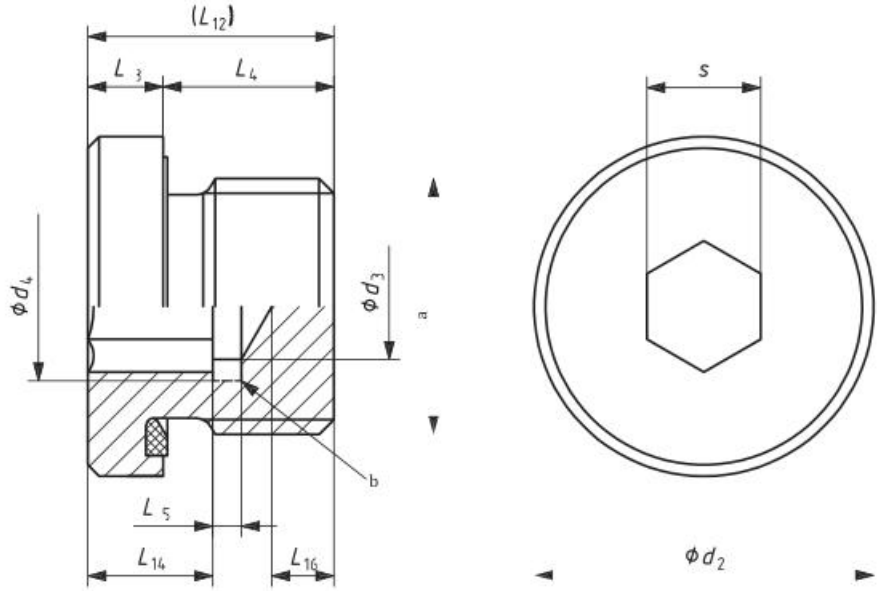
Dimensions in millimetres

Screw thread ($d_1 \times P$)	L_4 ±0,2	L_{11} ±0,5	s[a]	**Sealing type**
M8 × 1	8	15	12	B
M10 × 1	8	16	14	E
M12 × 1,5	12	20	17	
M14 × 1,5	12	20	19	
M16 × 1,5	12	22	22	
M18 × 1,5	12	23	24	
M20 × 1,5[b]	14	25	27	
M22 × 1,5	14	26	27	
M26 × 1,5	16	29	32	
M27 × 2	16	29	32	
M33 × 2	16	34	41	
M42 × 2	16	36	50	
M48 × 2	16	37	55	

a See 4.2 for tolerance.

b For measurement applications.

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Key

a Screw thread ($d_1 \times P$).

b Optional socket undercut $d_4 \times L_{15}$.

NOTE Stud end details in accordance with ISO 9974-2.

Figure 2 — Internal hex port plug (PLIHS)

Table 2 — Dimensions of internal hex port plugs

Dimensions in millimetres

Screw thread ($d_1 \times P$)	d_2 $^{0}_{-0,2}$	d_3 ±0,1	d_4 $^{+0,25}_{0}$	L_4 ±0,2	L_{12} ref.	L_{13} ±0,1	L_{14} min.	L_{15} max.	L_{16} min.	s^a	Sealing type
M10 × 1	14	5	5,9	8	12,3	4,3	5	2	3	5	E
M12 × 1,5	17	6	7	12	17,3	5,3	7	2	3	6	
M14 × 1,5	19	6	7	12	17,3	5,3	7	2	3	6	
M16 × 1,5	22	8	9,3	12	17,3	5,3	7	2	3	8	
M18 × 1,5	24	8	9,3	12	17,3	5,3	7	2	3	8	
M20 × 1,5[b]	26	10	11,6	14	19,3	5,3	7,5	2	3	10	
M22 × 1,5	27	10	11,6	14	19,3	5,3	7,5	2	3	10	
M26 × 1,5	32	12	14	16	21,3	5,3	9	2,4	3	12	
M27 × 2	32	12	14	16	21,3	5,3	9	2,4	3	12	
M33 × 2	40	17	19,7	16	22,8	6,8	9	2,5	3	17	
M42 × 2	50	22	25,5	16	22,8	6,8	10,5	2,5	3	22	
M48 × 2	55	24	27,8	16	22,8	6,8	10,5	2,5	3	24	

a See 4.2 for tolerance.

b For measurement applications.

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Table 3 — Pressures for external hex and internal hex port plugs

Thread	Plug				Test pressures			
	External hex		Internal hex					
	Working pressure[a]				Burst		Impulse[b]	
	MPa	(bar)	MPa	(bar)	MPa	(bar)	MPa	(bar)
M8 × 1	63	(630)	—	—	252	(2 520)	83,8	(838)
M10 × 1	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M12 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M14 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M16 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M18 × 1,5	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M20 × 1,5[c]	63	(630)	—	—	252	(2 520)	83,8	(838)
	—	—	40	(400)	160	(1 600)	53,2	(532)
M22 × 1,5	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M26 × 1,5[d]	16	(160)	16	(160)	64	(640)	21,3	(213)
M27 × 2	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M33 × 2	40	(400)	40	(400)	160	(1 600)	53,2	(532)
M42 × 2	25	(250)	25	(250)	100	(1 000)	33,2	(332)
M48 × 2	25	(250)	25	(250)	100	(1 000)	33,2	(332)

[a] These pressures were established using plugs made of low carbon steel, when tested in accordance with the requirements of Clause 7.

[b] Cyclic endurance test pressures.

[c] For measurement applications.

[d] Used in light-duty (L series) application only.

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Table 4 — Torques for external hex and internal hex port plug qualification test

Thread	Plug	
	External hex	Internal hex
	Torque[a] N·m $^{+10}_{0}$ %	
M8 × 1	15	—
M10 × 1	20	12
M12 × 1,5	30	25
M14 × 1,5	45	35
M16 × 1,5	60	50
M18 × 1,5	80	60
M20 × 1,5[b]	100	70
M22 × 1,5	80	80
M26 × 1,5	120	120
M27 × 2	135	135
M33 × 2	225	225
M42 × 2	360	360
M48 × 2	400	400

[a] For zinc-plated carbon steel, lubricated by hydraulic oil.

[b] For measurement applications.

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Annex A
(informative)

Elastomeric sealing for use with ISO 9974-4 port plugs

NOTE The information given in Figure A.1 and Table A.1 are taken from ISO 9974-2.

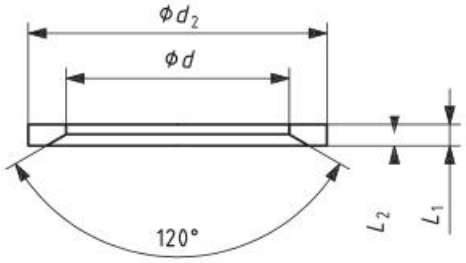


Figure A.1 — Elastomeric sealing

Table A.1 — Dimensions of elastomeric sealing

Dimensions in millimetres

Thread of the plug	Dimensions of the seal		
	$d_1 \times d_2$	L_1 ref.	L_2 ref.
M10 × 1	8,4 × 11,9	1,0	0,5
M12 × 1,5	9,8 × 14,4	1,5	0,8
M14 × 1,5	11,6 × 16,5		
M16 × 1,5	13,8 × 18,9		
M18 × 1,5	15,7 × 20,9		
M20 × 1,5	17,8 × 22,9		
M22 × 1,5	19,6 × 24,3		
M26 × 1,5	23,9 × 29,2		
M27 × 2			
M33 × 2	29,7 × 35,7	2	1
M42 × 2	38,8 × 45,8		
M48 × 2	44,7 × 50,7		

NOTE For complete dimensional specifications for elastomeric sealing, see ISO 9974-2.

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Bibliography

[1] ISO 1179-1, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports*

[2] ISO 1179-2, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 2: Heavy-duty (S series) and light-duty (L series) stud ends with elastomeric sealing (type E)*

[3] ISO 1179-3, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 3: Light-duty (L series) stud ends with sealing by O-ring with retaining ring (types G and H)*

[4] ISO 1179-4, *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 4: Stud ends for general use only with metal-to-metal sealing (type B)*

[5] ISO 5598, *Fluid power systems and components — Vocabulary*

[6] ISO 6149-1, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 1: Ports with truncated housing for O-ring seal*

[7] ISO 6149-2, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 2: Dimensions, design, test methods and requirements for heavy-duty (S series) stud ends*

[8] ISO 6149-3, *Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 3: Dimensions, design, test methods and requirements for light-duty (L series) stud ends*

[9] ISO 9974-3, *Connections for general use and fluid power — Ports and stud ends with ISO 261 threads with elastomeric or metal-to-metal sealing — Part 3: Stud ends with metal-to-metal sealing (type B)*

[10] ISO 11926-1, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 1: Ports with O-ring seal in truncated housing*

[11] ISO 11926-2, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 2: Heavy-duty (S series) stud ends*

[12] ISO 11926-3, *Connections for general use and fluid power — Ports and stud ends with ISO 725 threads and O-ring sealing — Part 3: Light-duty (L series) stud ends*

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