



AEROSPACE RECOMMENDED PRACTICE

ARP5555™

Issued

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Recommendations for Installation of Seals in Standard Glands

RATIONALE

There is a need to provide information regarding hardware design considerations and installation procedures for O-rings and other elastomeric seals in hydraulic components that use standard glands. This document meets this need.

FOREWORD

This SAE Aerospace Recommended Practice (ARP) provides recommendations for the installation of seals and seal assemblies of the type that was previously included in MIL-G-5514 (Inactive for New Design) in a SAE document to be used in conjunction with AS4716, AS4832, AS4088, AS4052, AS5857, and AS6235.

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) contains guidance regarding hardware design and installation procedures for seals in hydraulic components that utilize standard seal glands in accordance with AS4716, AS4832, AS4088, AS4052, AS5857, and AS6235.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS568	Aerospace Size Standard for O-rings
AS1300	Port - Ring Locked Fluid Connection Type, Standard Dimensions for
AS1986	Fitting Assembly, Adapter, Ring Locked Port Connection to Beam Seal, 4000 psi and 5000 psi
AS4052	Gland Design: Scraper, Landing Gear, Installation
AS4088	Aerospace Rod Scraper Gland Design Standard
AS4099	Adapter, Assembly - Port Connection Ring Locked to Flareless Tube End
AS4395	Fitting End, Flared, Tube Connection, Design Standard
AS4396	Fitting End, Bulkhead, Flared, Tube Connection, Design Standard
AS4716	Gland Design, O-ring and Other Elastomeric Seals
ARP4752	Aerospace - Design and Installation of Commercial Transport Aircraft Hydraulic Systems
AS4832	Gland Design: Nominal 3/8 in Cross Section for Custom Compression Type Seals
ARP4925	Aerospace Design and Installation of Commercial Transport Helicopter Hydraulic Systems
AS5202	Port or Fitting End, Internal Straight Thread, Design Standard
AS5440	Hydraulic Systems, Military Aircraft, Design and Installation, Requirements For
AS5781	Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Scarf-Cut, For Use in AS4716 Glands
AS5782	Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Un-Cut, For Use in AS4716 Glands
AS5857	Gland Design, O-ring and Other Elastomeric Seals, Static Applications

AS5860	Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Static Gland
AS5861	Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Static Gland
AS6235	Face Seal Gland Design, Static, O-ring and Other Seals for Aerospace Hydraulic and Pneumatic Applications
AS8791	Hydraulic and Pneumatic Retainers (Back-Up Rings), Polytetrafluoroethylene (PTFE) Resin
AS28772	"D" Ring Seal for Shock Struts Molded from AMS-P-25732 Material
AS28775	Packing, Preformed - MS28775 O-ring
AS28778	Packing, Preformed, Straight Thread Tube Fitting Boss
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
AS33515	Fitting End, Standard Dimensions for Bulkhead Flareless Tube Connections
AS83461/1	M83461 O-ring Molded from AMS-P-83461 Rubber
AS83461/2	O-ring M83461 Straight Thread Tube Fitting Boss
AMS-P-5510	Packing, Preformed, Straight Thread Tube Fitting Boss, Type I Hydraulic (-65° to 160°F)

2.1.2 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

Also available at <http://webstore.ansi.org/>.

ISO 4287-1	Geometrical Product Specifications (GPS) - Surface Texture: Profile Method - Terms, Definitions and Surface Texture Parameters
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2.1.3 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B46.1	Surface Texture (Surface roughness, waviness & lay)
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2.1.4 NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS1611	Packing, Preformed O-Ring, Phosphate Ester Resistant
NAS1612	Packing, Preformed, Straight Thread Tube Fitting Boss, Phosphate Ester Resistant

2.1.5 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

MS21344	Fittings - Installation of Flared Tube, Straight Threaded Connectors
MS28773	Retainer, Packing Backup, Continuous Ring, Tetrafluoroethylene, Straight Thread tube Fitting Boss (Inactive for New Design)
MS28782	Retainer, Packing, Backup, Teflon (Inactive for New Design)
MS28783	Ring, Gasket, Backup, PTFE (Inactive for New Design)
MIL-G-5514	Gland Design; Packing, Hydraulic, General Requirements For (Inactive for New Design)

2.2 Definitions

2.2.1 ANTI-EXTRUSION DEVICE OR BACKUP RING

A ring or similar device assembled with a seal to prevent the seal extruding into the clearance gap. Backup Ring is an alternative description for Anti-Extrusion Device.

2.2.2 GLAND

A housing or cavity defined by the boundaries of the metallic hardware for accommodating a compression packing or sealing ring or seal assembly.

2.2.3 PACKING

A compression type static or dynamic seal housed in a gland. Also applicable to the materials used in this type of seal.

2.2.4 SEAL

A device that joins two systems or elements in such a way as to prevent leakage.

3. GENERAL DESIGN REQUIREMENTS FOR HYDRAULIC UNITS

This section is intended to provide the reader with some background information regarding the design considerations applied to seal installations and seal assemblies resulting from the overall system requirements.

3.1 Pressure

The normal working pressure used in many aircraft and helicopter hydraulic systems is 3000 psi (20680 kPa). At this system pressure seal installations utilizing standard gland dimensions will require protection of the sealing element with an anti-extrusion device from premature wear and extrusion. A schematic of the behavior of a standard O-ring assembly (with and without backup rings) under varying pressure loads is shown in Figure 1.

For system pressures between 1500 psi (10340 kPa) and 3000 psi (20680 kPa) it is also recommended to use anti-extrusion devices unless the extrusion gaps are reduced to less than recommended in the applicable gland standard. The latter approach should be validated and qualified by similarity, analysis and test as applicable.

Lower system pressures, 1500 psi (10340 kPa) and below, will generally not require anti-extrusion devices with standard gland extrusion gaps.

Where higher working pressures are specified careful consideration should be given to the seal installation requirements. Systems up to 5000 psi (34470 kPa), may require smaller extrusion gaps and/or tougher anti-extrusion device materials to be used. Some of the applicable backup ring standards provide material choices for high pressure systems. In these instances it is recommended to validate and qualify the component installation by similarity, analysis and test as applicable.

Military and commercial aircraft systems may have different operating pressure requirements and reference should be made to the either AS5440 or ARP4752 or ARP4925 for guidance on specific types of aircraft hydraulic system pressures.

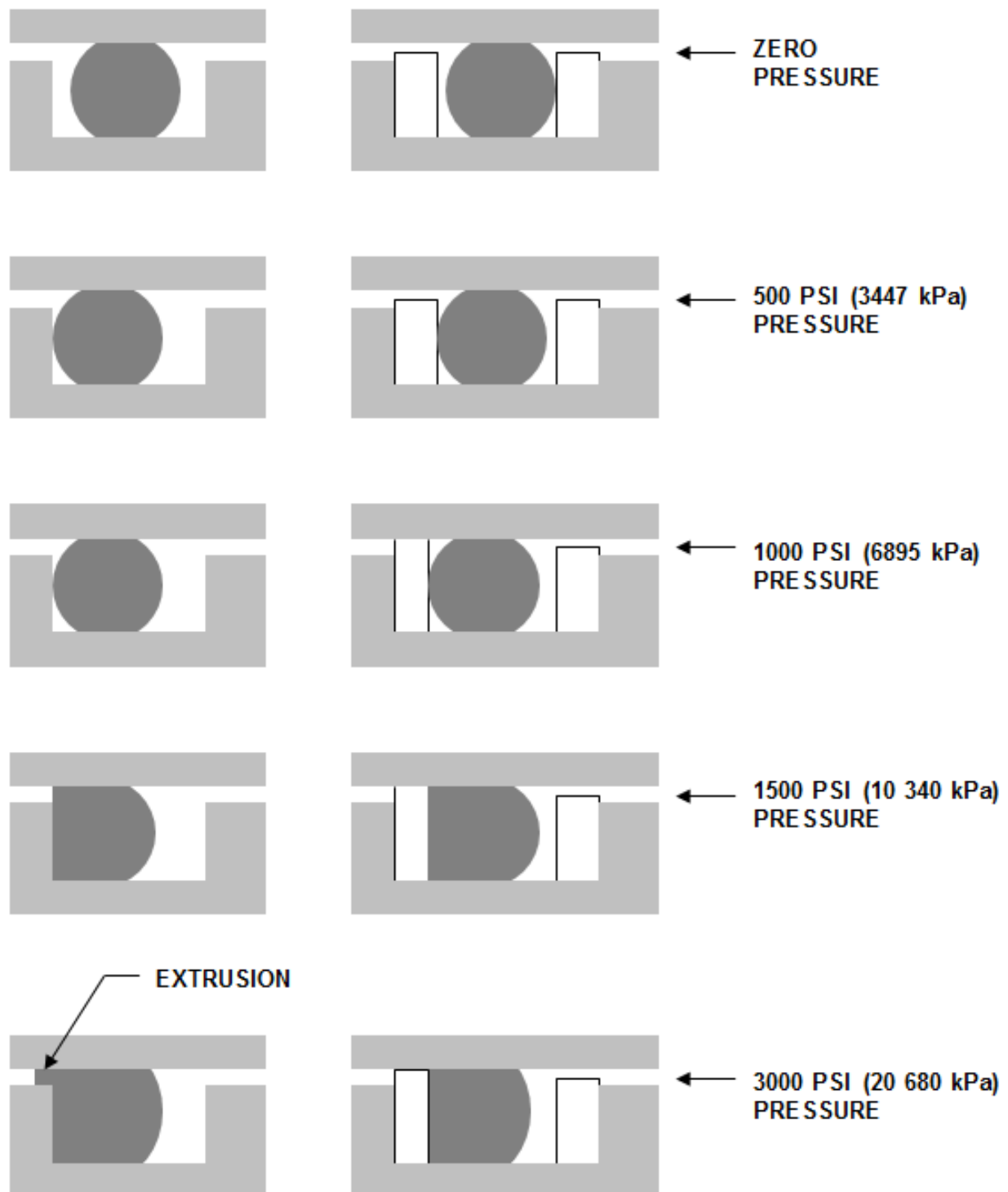


Figure 1 - Relative positions of O-ring in grooves at increasing pressure for a typical 80 shore A elastomer