

TECHNICAL SPECIFICATION

No. TS49™

ELASTOMERIC TOROIDAL SEALING RINGS (O-RINGS)

Manufacturing & Inspection Standards for Aerospace Application



Aerospace Standards Part Qualification Program

A Program of SAE ITC

RATIONALE

Third issue of Technical Spec.

Clarification of O-Ring cure date shelf-life age limit, for the manufacturer being allowing to supply to the Customer.

For full details of changes, refer to supplementary SAE ITC Amendment Record document TS49-AR.

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1. SCOPE

1.1 General :

- 1.1.1 This Technical Specification controls surface condition, manufacturing defects, inspection requirements and defines the methods of measurement for Elastomeric Toroidal Sealing Rings (O-Rings).

1.2 Limitations :

- 1.2.1 It is applicable to static (including gasket) applications only, not dynamic.
- 1.2.2 It refers only to fully formed O-Rings produced by moulding processes and does not cover scarf-jointed O-Rings created from fully-cured round cords.

2. REFERENCED DOCUMENTS

- 2.1 **NORMATIVE** - The following documents, in whole or in part, are normatively referenced in this Technical Specification and are indispensable for its application. For dated / revision listed references, only the issue cited applies. For undated / revision listed references, the latest issue of the referenced document (including any amendments) applies.

2.1.1 British Standards Institution (bsi.)

- BS 1134 Assessment of surface texture - Guidance and general information
- BS F 68 Controlled storage of vulcanized rubbers for use in aerospace applications
- BS F 69 Specification for Packaging and identification of vulcanized rubber items

2.2 BIBLIOGRAPHY – Informative.

2.2.1 SAE Industry Technologies Consortia (ITC)

- RS611 Recommendations for the Identification & Packaging of Rubber Components
- RS612 Recommended Storage Procedure for Rubber and Rubber Components
- RS613 Recommended Storage Life for Rubber & Rubber Components
- RS614 Recommended Colour Code for the Identification of Rubbers in Aircraft

2.2.2 SAE International

- AS871 Manufacturing and Inspection Standards for Preformed Packings (O-Rings)

3. DEFINITIONS

3.1 For the purposes of this specification, the following definitions apply : -

3.2 O-Ring Standard Features

3.2.1 **Toroid** : In this specification's context; of round ring form with circular cross-section (similar to a ring donut).

3.2.2 **Cord** : The form of the extruded or moulded lengths of cylindrical elastomer (i.e. round cord). Its context here is just to distinguish the physical elastomer from the internal diameter air hole (see limitation clause 1.2.2).

3.2.3 **Cross Section** : The cross sectional diameter (**CSD**) of the Cord elastomer and not to be confused with a section thru a whole O-Ring. The CSD is an inspectable feature and can be used for size ordering.

3.2.4 **Internal Diameter (ID)** : The diameter of the hole thru the centre of an O-Ring when measured and supported in the truly round state (with no freeform distortion). The ID is an inspectable feature and can be used for size ordering.

3.2.5 **Outside Diameter (OD)** : This is normally an auxiliary size, being a resultant of the ID + 2xCSD and therefore not an inspectable feature nor used for size ordering.

3.3 Mould Tool Forming Defects

3.3.1 **Parting-line Projection** : Better known as **Flash** and lesserly **Spew**.

a) A ridge of material situated around the mould split-line (Parting-line). It is caused by worn or excessively rounded mould edges.

b) **Feather Flash** is a very thin extension of the **Flash** which radiates outward even further.

3.3.2 **Combined Flash** : Various combinations of moulding Flash, Offset and other Parting-line Projections.

3.3.3 **Parting-line Indentation** : A shallow saucer-like recess sometimes triangular in shape, located adjacent to the mould split-line. They are caused by deformation of the mould edge at the mould split-line.

3.3.4 **Offset** : Where the two halves of the mould are misaligned to each other, resulting in a continuous or partial stepped edge around the mould split-line.

a) A **Mismatch** is when the CSD radii are different sizes in each half of the mould.

b) An **Off-register** can be caused through the two halves of the mould being out of register to each other i.e. not concentric.

c) A combination of both a) & b).

3.3.5 **Mould Deposit Imprints** : Surface indentations, irregular in shape, with a rough surface texture. They are caused by the build-up of hardened deposits adhering to the mould cavities. They are not to be confused with loose deposits that embed into the O-Ring surface (see clause 3.4.2).

3.4 O-Ring Surface Condition Defects

3.4.1 **Foreign Material** : Any extraneous matter embedded into the surface of the O-Ring. It shall normally require its removal by the manufacturer (see clause 3.4.2).

3.4.2 **Indentation & Inclusion** :

a) Any inclusion depression resulting from the removal of embedded Foreign Matter loose in the mould.

b) Surface indentations, irregular in shape having a rough surface texture, caused by a build-up of hardened deposits adhering to the mould.

3.4.3 Backrind : A longitudinal defect in which the elastomer immediately adjacent to the mould split-line shrinks below the level of the moulding (a groove), with the resulting flash-line often appearing ragged and torn. This is caused by mould pre-cure of the flash (uneven curing).

3.4.4 Non-fill : A surface discontinuity most commonly shaped as irregular flat spots or ribbon-like stripes with variable orientation. They are generally coarser than the normal O-Ring surface texture. They are caused by incomplete filling of the mould due to air-trapping etc.

3.4.5 Flow Mark : A thread-like recess, usually curved, with very slight depth in the unflexed state. They have normal O-Ring surface texture and a radiused edge. They are caused by two portions of flowing elastomer material coming together with incomplete coalescence.

3.5 O-Ring Rectification Defects

3.5.1 Excessive Trimming : Flattened (**Flats**) and often roughened areas around the inner and/or outer mould split-line caused by excessive trimming to remove Offset and Flash.

4. MANUFACTURING REQUIREMENTS

4.1 Mould Condition

4.1.1 Surface Texture

The general finish of the O-Rings will be determined by the finish and cleanliness of the mould cavities from which they are produced. The surface texture of the mould's forming cavities shall be $\leq 16 \mu\text{in}$ ($0,4 \mu\text{m}$), when measured in accordance with BS 1134. The surfaces shall be clean prior to their use.

4.2 O-Ring Quality

4.2.1 Dimensional Tolerance & Form

The finished dimensions of the O-Rings shall conform to those stated in their relevant component standard, based upon the typical dimensions shown in Figure 1 of $\varnothing D$ (Internal Diameter) and $\varnothing C$ (Cross-sectional Diameter).

The preferred methods of measurement are described in Section 5.

Important : All variations in final shape including the permitted defects described in clauses 4.2.3 to 4.2.6, shall fall within the CSD encompassing envelope limits stated for each component standard.

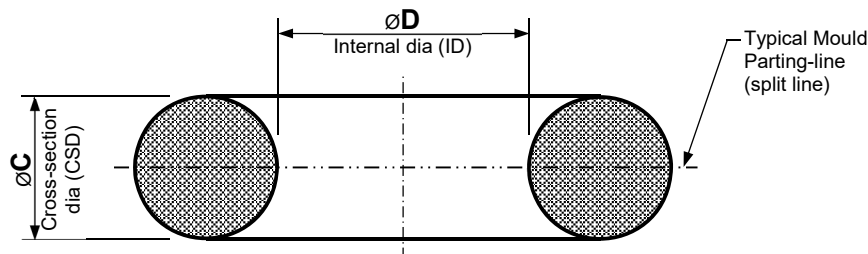


Figure 1
Section thru a typical Toroidal O-Ring

4.2.2 Surface Condition

Surface defects such as inclusions and indentations, backrind, flow marks and other indicated faults, shall not exceed the limits described in Appendix-A.

Unless otherwise stated, an O-Ring's surface shall be inspected for defects using 2x magnification with a minimum illumination of 4000 lux.