Designation: D3832 – 79 (Reapproved 2017)

Standard Specification for Rubber Seals Contacting Liquids in Solar Energy Systems[1]

This standard is issued under the fixed designation D3832; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the general requirements for materials used in preformed rubber seals that contact the circulating liquid in solar energy systems. Particular applications may necessitate other requirements that would take precedence over these requirements when specified.

1.2 This specification does not include requirements pertaining to the design, fabrication, or installation of the seals.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D1229 Test Method for Rubber Property—Compression Set at Low Temperatures

D1349 Practice for Rubber—Standard Conditions for Testing

D1415 Test Method for Rubber Property—International Hardness

D1566 Terminology Relating to Rubber

D2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products

2.2 *Other Standards:*

RMA Handbook—Rubber Products: Molded, Extruded, Lathe Cut, and Cellular[3]

3. Terminology

3.1 Refer to the definitions of terms in Terminology D1566.

4. Classification

4.1 *Types:*

4.1.1 *Type C,* intended for use in cold climates (below −10°C in winter).

4.1.2 *Type W,* intended for use in warm climates (above −10°C in winter).

4.2 *Grades:*

4.2.1 Grade designations represent differing degrees of hardness in accordance with Test Method D1415 as follows:

4.2.1.1 *Grade 3,* hardness of 30 ± 5.

4.2.1.2 *Grade 4,* hardness of 40 ± 5.

4.2.1.3 *Grade 5,* hardness of 50 ± 5.

4.2.1.4 *Grade 6,* hardness of 60 ± 5.

4.2.1.5 *Grade 7,* hardness of 70 ± 5.

4.2.1.6 *Grade 8,* hardness of 80 ± 5.

NOTE 1—The grade to be used in a particular application depends on the design of the seal and must be specified by the designer.

4.3 *Classes:*

4.3.1 Seals shall be classified as follows:

4.3.1.1 *Class A,* seals for use with aqueous liquids at a maximum service temperature of 100°C.

4.3.1.2 *Class AT,* seals for use with aqueous liquids at a maximum service temperature above 100°C.

4.3.1.3 *Class N,* seals for use with nonaqueous liquids.

NOTE 2—Aqueous liquids include water and antifreeze solutions.

[1] This specification is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.37 on Coated Fabrics, Rubber Threads and Seals.

Current edition approved May 1, 2017. Published July 2017. Originally approved in 1979. Last previous edition approved in 2011 as D3832 – 79 (2011). DOI: 10.1520/D3832-79R17.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from the Rubber Manufacturers Association (RMA), 444 Madison Ave., New York, NY 10022.

5. Ordering Information

5.1 Orders for seals under this specification shall include the following information:

5.1.1 ASTM designation and year of issue,
5.1.2 Type, grade, and class,
5.1.3 Design and dimensions of seal,
5.1.4 Contacting liquid,
5.1.5 Maximum service temperature, and
5.1.6 Quantity.

6. Dimensions

6.1 The tolerances in dimensions shall conform to the following designations in the RMA Handbook.

6.1.1 *Molded Seals:*
6.1.1.1 *Commercial Dimensions*—RMA A3-F3-T.032.
6.1.1.2 *Critical Dimensions*—RMA A2-F3-T.032.
6.1.2 *Extruded Seals:*
6.1.2.1 *Commercial Dimensions*—RMA A2-F3.

7. Workmanship, Finish, and Appearance

7.1 Seals shall be free of blisters, checks, cracks, and other imperfections that can affect their ability to make or maintain a liquid-tight seal.

8. Test Methods

8.1 Prepare the specimens in accordance with Practice D3183 and test the specimens in accordance with the test methods given in 8.2. For control of production, specimens may be taken from standard test sheets prepared in accordance with Practice D3182, using the same unvulcanized material used to prepare the seals and vulcanizing the material at the same temperature used for the seals to an equivalent state of vulcanization.

8.2 Determine ultimate elongation in accordance with Test Methods D412. Determine other requirements in accordance with the methods specified in Table 1.

8.3 Test Class A seals for heat resistance and compression set at a temperature of 125°C and for resistance to liquids at a temperature of 100°C.

8.4 Test Class AT and Class N seals for heat resistance and compression set at the standard test temperature in accordance with Practice D1349, that is, between 25 and 49°C above the maximum service temperature, and for resistance to liquids at the standard test temperature, that is, between 1 and 25°C above the maximum service temperature. The standard test temperatures shall not be less than those for Class A seals. Above 125°C, the standard test temperatures are 150, 175, 200, 225, and 250°C.

8.5 Using the liquid in service for the particular heat-transport system, test in accordance with Test Method D471.

9. Requirements

9.1 Seals shall be vulcanized from suitable rubber compounds and conform to the requirements given in Table 2 and Table 1.

10. Precision and Bias

10.1 A precision and bias statement is not necessary for this specification as it is a listing of material requirements.

11. Inspection and Rejection

11.1 Manufacturers of seals may use their quality-control systems for production inspection to assure the seals conform with this specification, provided appropriate records are kept. In case of dispute regarding the quality of a delivered product, a sample of five seals shall be taken from the lot and tested for compliance with this specification. If one of the five seals does not conform, a second sample of five seals may be taken and tested. If two or more of the ten seals do not conform, the lot may be rejected.

12. Product Marking

12.1 The following information may be marked on either the seal, packaging, label or tag:

12.1.1 Name, brand, or trademark of the manufacturer,
12.1.2 Type and grade,
12.1.3 Compliance with this specification, ASTM Specification D3832, and

TABLE 1 Other Requirements for Rubber Seals in Liquid Heat-Transport Systems

Property	Unit	Requirement	ASTM Test Method
Compression set:			
High temperature[A]	%	30 max	D395, Method B
Low temperature[B]	%	60 max	D1229
Resistance to Heating:[C]			
Hardness change	IRHD	10 max	D1415
Ultimate elongation change	% of original	30 max	D412
Resistance to ozone,[D] 100 mPa, for 166 h at 40°C	—	no cracking	D1149
Resistance to low temperature[E]	°C	–40 max	D2137
Resistance to Liquid:[F]			
Volume change	%	+ 40 to – 10	D471
Hardness change	IRHD	±10	D1415

[A] After compression for 70 h at the temperature specified in 8.3 or 8.4.
[B] After compression for 166 h at –10°C. Set shall be measured at 10 s after force is released. Lubricated plates or polytetrafluoroethylene film is recommended if the rubber adheres to the metal plates during the test.
[C] Condition for 166 h at the temperature specified in 8.3 or 8.4.
[D] This requirement applies only to seals that are exposed to outside atmospheres.
[E] This requirement applies to Type C seals only.
[F] Rubber shall be immersed in liquid used in service for 166 h at the temperature specified in 8.3 or 8.4.

TABLE 2 Elongation Requirements for Rubber Seals in Liquid Heat-Transport Systems

Grade	Ultimate Elongation, min, %
3	350
4	300
5	250
6	200
7	150
8	100

12.1.4 Any other information required by the manufacturer or the purchaser.

13. Packaging

13.1 Material shall be protected by suitable packaging to prevent damage during shipment or storage prior to installation in solar collector.

14. Keywords

14.1 liquids; rubber seals; solar energy systems