



Designation: D5902 – 05 (Reapproved 2023)

Standard Test Method for Rubber—Determination of Residual Unsaturation in Hydrogenated Nitrile Rubber (HNBR) by Iodine Value¹

This standard is issued under the fixed designation D5902; 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.

1. Scope

1.1 This test method covers the Wijs procedure for the determination of unsaturation (iodine value) in hydrogenated nitrile rubbers.

1.2 This test method is applicable only to those hydrogenated nitrile rubbers derived from copolymers of acrylonitrile and butadiene.

1.3 Iodine values are reported in centigrams of iodine per gram of HNBR [$\text{cg}(\text{I}_2)/\text{g}$]. Higher iodine values indicate higher levels of unsaturation.

1.4 This test method is appropriate for calculating the percent residual unsaturation of hydrogenated nitrile rubber if the iodine value of the base polymer before hydrogenation has been determined.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *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

D1193 Specification for Reagent Water

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.11 on Chemical Analysis.

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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.

D1959 Test Method for Iodine Value of Drying Oils and Fatty Acids (Withdrawn 2006)³

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

3. Summary of Test Method

3.1 A sample of the raw, unvulcanized rubber is dissolved in chloroform.

3.2 The dissolved sample is reacted with Wijs solution.

3.3 When the reaction is completed, potassium iodide solution is added.

3.4 The resultant solution is then back-titrated with sodium thiosulfate solution and the iodine value is calculated.

4. Significance and Use

4.1 Hydrogenated nitrile rubbers are available at different levels of unsaturation and different acrylonitrile content. Highly saturated grades offer optimum resistance to aging, such as exposure to heat, ozone and chemicals, and can be cured effectively only with peroxides or high energy radiation.

4.2 Partially unsaturated grades can be cured by sulfur systems in addition to peroxides and high energy radiation.

4.3 This test method provides a technique to determine the unsaturation level of hydrogenated nitrile rubbers in the raw, unvulcanized state. It can be used for research and development, quality control, and referee purposes.

5. Apparatus

5.1 *Erlenmeyer Flasks*, with ground glass stoppers (300 mL).

5.2 *Flask Shaker*.

5.3 *Pipets*.

5.4 *Constant Temperature Bath*.

³ The last approved version of this historical standard is referenced on www.astm.org.