ASTM D2240-Durometer Hardness

Durometer Hardness Testing measures the hardness of rubber elastomers and plastic materials.

The most widely used hardness measuring instrument is called the Durometer. It measures hardness values in points-that range from 0 to 100.

0 points represent a very soft material, while 100 points represent a very hard material.

Rubber elastomers are measured using the Shore Type-A scale.

Test Procedure:

- Test specimens are placed on a hard flat surface.
- The indentor of the durometer gauge is pressed into the specimen making sure that it is parallel to the specimen surface.
- The hardness value is read within one second of firm contact with the specimen.

JET Rubber, Inc. uses an ASKER durometer gauge that has a peak-load indicator to ensure that value readings are recorded within one second.

The gauge is installed on a 1000g constant-load operating stand. This arrangement keeps specimens flat and parallel to prevent variance in measurement values.

Test Parameters:

Specimen Shape: Cylindrical Disk
Specimen Diameter: 1.14” ± 0.02”
Specimen Thickness: 0.49” ± 0.02”
Number of Specimens Tested: 3 to 5
Conditioning and Testing Temperature: 73.4 ± 3.6 °F
Conditioning and Testing Relative Humidity: 50 ± 5%
ASTM D395 Compression Set

Compression Set Testing determines the ability of an elastomeric material to maintain its elastic properties after exposure to prolonged compressive stress.

ASTM D-395 describes two types of Compression set tests:

- Method A, compression set under constant load; and
- Method B, compression set at constant deflection of 25%.

JET Rubber, performs Compression testing using method B.

Test Procedure:

- The thickness of the original specimen is measured and recorded.
- The specimen is then placed between the plates of the compression set assembly.
- The specimen is compressed to 75% of its original height. Spacers are used to ensure that the compression force is accurately maintained.
- The loaded compression set assembly is placed in an oven at a specified temperature for the suggested periods of 22 hours or 70 hours.
- The specimen is removed from the oven and conditioned for 30 minutes on a wooden plank.
- The final thickness of the specimen is then measured.
- Compression set is expressed as a percentage of the original deflection and is calculated using the following formula:

\[ CB = \left( \frac{to - ti}{to - tn} \right) \times 100 \]

CB = Compression Set
\(to\) = Original thickness of the specimen
\(ti\) = Final thickness of the specimen
\(tn\) = Thickness of the space bars

Typical Test Parameters:

Specimen Shape: Cylindrical Disk
Specimen Diameter: 1.14” ± 0.02”
Specimen Thickness: 0.49” ± 0.02”
Number of Specimen Tested: 2 or 3
Conditioning and Testing Temperature: 73.4 ± 3.6 °F
Conditioning and Testing Relative Humidity: 50 ± 5%
ASTM D412 Tension

This test method evaluates the tensile properties of vulcanized thermoset rubbers and thermoplastic elastomers and describes two types of Tension tests:
- Method A, using dumbbells and straight section specimens; and
- Method B, using cut ring specimens.

To determine tension properties such as tensile strength, ultimate elongation, yield point, yield strain and yield stress, JET Rubber, Inc. uses an Instron 3365 testing machine equipped with Blue Hill software.

Test Procedure:
- Using a standard dumbbell specimen cutting die, five specimens are cut from a vulcanized sheet prepared to ASTM D3182 and ASTM D3183 procedures.
- The dumbbells are conditioned for at least 30 minutes prior to beginning the test.
- The thickness of the reduced (gauge length) section of the dumbbells is measured and recorded.
- The specimen is carefully placed between the grips of the testing machine to provide uniform alignment.
- An extensometer is used to grip the specimen at the reduced section of the dumbbell.
- The testing machine is activated and the grips begin to separate at the rate of 20 ± 2 inches/minute.
- The test ends once the specimen breaks.

Typical Test Parameters:
- Specimen Shape: Dumbbell
- Specimen Gauge Length: 1.31”
- Specimen Thickness: 0.08” ± 0.008”
- Number of Specimen Tested: 5
- Conditioning and Testing Temperature: 73.4 ± 3.6 °F
- Conditioning and Testing Relative Humidity: 50 ± 5%
ASTM D624 Tear Strength

This test method measures the property resistance of vulcanized rubber and thermoplastic elastomers known as ‘tear strength’.

Tear strength is measured using the force per unit thickness required to rupture, initiate or propagate a tear through the specimen tested.

To perform Tear Strength Testing, JET Rubber, Inc. uses an Instron 3365 testing machine equipped with Blue Hill software.

Test Procedure:

- Using a type ‘C’ specimen cutting die, five specimens are cut from a vulcanized sheet, prepared to ASTM D3182 and ASTM D3183 procedures.
- The specimens are conditioned for at least 30 minutes prior to testing.
- The thickness of the specimen at the apex is measured and recorded.
- The specimen is carefully placed between the grips of the testing machine to provide uniform alignment.
- The testing machine is activated and the grips begin to separate at the rate of 20 ± 2 inches/minute.
- The test ends once the specimen breaks.

Typical Test Parameters:

Specimen Shape: Die “C” cut specimen
Number of Specimen Tested: 5
Conditioning and Testing Temperature: 73.4 ± 3.6 °F
Conditioning and Testing Relative Humidity: 50 ± 5%
ASTM D2084 Vulcanization Using Oscillating Disc Cure Meter

This test method describes the use of the ODR- oscillating disk cure meter. Jet Rubber, Inc. uses a Monsanto R-100 ODR, equipped with MonControl Software to measure the curing and processing characteristics of vulcanizable rubber compounds.

**Test Procedure:**
A test specimen of vulcanizable rubber compound is inserted into the ODR test cavity.
- After the ODR closes, it is contained in a sealed cavity under positive pressure.
- The cavity is heated to a specified temperature.
- The rubber completely surrounds the bi-conical disk after the platens are closed.
- The disk oscillates at small rotary amplitude (1°/3°) to exert a shear strain on the test specimen.
- The test is completed when the recorded torque either rises to an equilibrium or maximum value, or when a predetermined time has elapsed.

**Typical Test Parameters:**
Number of Specimen Tested: 1-3  
Conditioning Temperature: 73.4 ± 3.6 °F  
Conditioning and Testing Relative Humidity: 50 ± 5%
ASTM D297 – Density

This test method determines the density of a vulcanized specimen, known as ‘Specific Gravity’. The standard includes the following methods:

- Pycnometer Method;
- Hydrostatic Method; and
- Compressed Volume Densimeter Method.

JET Rubber, Inc. uses the Hydrostatic Method to determine the density or ‘Specific Gravity’ of vulcanized rubber.

Test Procedure

- The mass of a specimen disc is measured.
- A beaker is filled with de-ionized water and placed in a universal specific gravity kit as shown.
- A milligram balance is used to determine density.
  - The mass of the specimen in air-Air (g) is measured.
  - The mass of the specimen in water-Water (g) is measured.
- ‘Specific Gravity’ is calculated using the following formula:

\[
\text{Specific Gravity} = \frac{\text{Mass of Specimen in Air\,(g)}}{\text{Mass of Specimen in Air\,(g)} - \text{Mass of Specimen in Water\,(g)}}
\]

Test Parameters

Specimen Shape: Cylindrical Disk
Specimen Diameter: 1.14” ± 0.02”
Specimen Thickness: 0.49” ± 0.02”
Number of Specimen Tested: 1
Conditioning and Testing Temperature: 76.1°F – 77.9°F