EXPERT KNOWLEDGE
TEST PROCEDURES
OF ELASTOMER COMPONENTS

An offer of

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TESTING CONSULTING DEVELOPING

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Identity Verification: Finding Matches

Identity tests allow the conformity of an inspection lot with reference values from sampling or previous deliveries within a defined framework. This involves simple test methods, which can be supplemented by more complex and meaningful ones if required. The following tests are used for incoming goods inspections:

Density:

Applied standards: DIN EN ISO 1183-1, ISO 2781

The density is a substance constant that is independent of the dimensions of the test specimen.[1] It is one of the simplest and quickest tests to perform, which in many cases can provide information about changes in the elastomer compound.

We determine the density using the "Archimedean Principle", meaning that we weigh the specimen first in air and then in ethanol or spirit (water is preferred for simplicity's sake, but due to its high surface tension it more easily leads to measurement errors). With the help of buoyancy, our special density scales (see Fig. 1) automatically calculate the density of the material, an apparently simple test method, which nevertheless requires some experience. It is important, for example, that no air bubbles adhere to the specimen or that there are no

[1] vgl. NAGDI, Khairi: Gummi-Werkstoffe Ein Ratgeber für Anwender, Ratingen, ²2002, S.335

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bubbles or cavities in the specimen, as these would change the buoyancy when weighing in water.
Of course, the density of foamed elastomers can also be determined. However, the problem here is that they generally have a lower density than ethanol. With the aid of special wire baskets, the buoyancy force of closed-cell foams can be determined. In the case of open-cell foams, a cube is cut out of the foamed component so that its volume can simply be calculated and then the density of the test specimen can be determined with the aid of a scale.

Figure 1: Density scale: First the mass of the O-ring is determined in air, then in the oval vessel filled with ethanol below.

Because the density depends not only on the basic elastomer but also on the many fillers and additives in an elastomer compound, there are density ranges for the individual elastomer families. Most of these density ranges overlap, but in most cases fluoroelastomers (FKM/FFKM) can already be identified by their high density.

Typical Density [g/cm³]	Elastomer Base
1.00 – 1.30	EPDM, EPM
1.10 – 1.45	NBR
1.10 – 1.40	HNBR
1.10 – 1.45	VMQ
1.20 – 1.40	ACM, AEM
1.25 – 1.50	ECO bleifrei
1.30 – 1.50	CR
1.40 – 1.60	FVMQ
1.80 – 2.60	FKM
1.90 – 2.40	FFKM

Density is a simple but effective tool to avoid mix-ups of the compound in many cases. It may move within a tolerance range of +/- 0.02g/cm³ (FKM/FFKM +/- 0.03g/m³) to the sample value or the average value of the formulation.

Dimensions:

In this form of identity verification, it is determined whether the dimensions are within the agreed tolerances (e.g. DIN ISO 3601/1 Class B). For this purpose, we use high-precision and non-contact measuring machines. Further information can be found under "Dimensional Inspection".

Hardness:

Standards or procedures applied: ISO 48 M, DIN ISO 48 M, ISO 7619-1, Shore A und Shore D, DIN ISO 7619-1 Shore A und Shore D, DIN ISO 868, Shore A, ASTM D 2240, Shore A.

Hardness - relatively easy to measure - is one of the most popular and widely used identity testing methods in the elastomer industry. Although at first glance it appears to be a meaningful test method, it should be used with caution. There are many possible failures that can seriously alter the hardness value and lead to incorrect results and decisions about good/bad parts. Based on the many years of experience, we would be pleased to support and advise you to prevent such errors.

The hardness should be within the tolerance range of the formulation. Usually in the elastomer industry a deviation from the nominal hardness of +/- 5 Shore A or +/- 5 IRHD-M points is allowed. A common mistake in practice is that the customer only specifies a general hardness value for the elastomer processor when ordering, which then formally refers only to a standard specimen of the material used. However, it is recommended to generally specify hardness values for finished parts (so-called "apparent hardness"). For many finished parts it is also possible here to ensure the specified hardness value within +/-5 points (see e.g. ISO/DIS 3601-5 (2013-7)).

Further information can be found under " Hardness test".

If any of these three identity verifications reveal deviations, further investigation is recommended. If an unacceptable deviation in the formulation is suspected, a further check can be carried out using thermogravimetry and/or infrared spectroscopy of the extracts. If there is a suspicion of under-cure, which can partly be detected by a hardness deviation, a compression set test is recommended.

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