



TECHNICAL GUIDE

UNDERSTANDING RUBBER STANDARDS AND TERMINOLOGY (ASTM & ISO)

Practical reference to specify, purchase and validate rubber components

For buyers, engineers, estimators, quality teams and maintenance technicians

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1. Why standards matter (and what they do not do)

ASTM and ISO standards help everyone speak the same language. They define test methods, ways to classify compounds, and dimensional tolerance systems. This reduces ambiguity between customers, engineering, production and quality.

Important: a standard alone does not guarantee performance in your application. Two compounds compliant with the same standard can behave differently depending on formulation, hardness, cure state, ozone protection package, fillers, and processing. Real chemical compatibility always depends on the exact fluid, concentration, temperature and duty cycle.

2. Standards families: terminology, materials, test methods, tolerances

Family	Purpose	Examples
Terminology & designation	Name and classify elastomers	ISO 1629 (abbreviations), ASTM D1418 (designation)
Test methods	Measure properties (tensile, hardness, aging, swell, etc.)	ASTM D412, D2240, D395, D471 / ISO 37, ISO 7619-1, ISO 815, ISO 1817
Material specification	Classify a compound by minimum performance	ASTM D2000 (SAE J200)
Dimensional tolerances	Define acceptable accuracy for molded rubber parts	ISO 3302-1
O-rings	O-ring dimensions & tolerances	ISO 3601
Sampling / inspection	Sampling levels and acceptance criteria	ISO 2859

3. ASTM: the most common standards in North American industry

ASTM (American Society for Testing and Materials) is widely used in North America. Most ASTM rubber standards define a specific, reproducible test method.

3.1 Must-know ASTM standards (rubber)

ASTM standard	What it is used for	Key takeaway
ASTM D2000	Compound classification (SAE J200)	Used as a global material callout (mechanical, heat, oil, etc.)
ASTM D412	Tensile strength, elongation, modulus	Core method to compare compound strength and stiffness in tension
ASTM D2240	Shore hardness	Hardness is indentation, not “strength”
ASTM D395	Compression set	Critical for sealing performance
ASTM D573	Heat aging (hot air aging)	Quantifies property changes after heat exposure
ASTM D471	Liquid immersion / swell (oils/fluids)	Evaluates compatibility via volume/mass change
ASTM D624	Tear strength	Important for parts exposed to nicks, edges and tear propagation
ASTM D1149	Ozone cracking resistance	Essential for outdoor service and near electric motors
ASTM D429	Rubber-to-metal adhesion (peel)	For bonded parts; verifies adhesion performance

4. ISO: key international standards

ISO standards are common in global programs and multi-site purchasing. In rubber, ISO covers terminology, test methods, and especially dimensional tolerances.

4.1 Key ISO standards (rubber)

ISO standard	What it is used for	Key takeaway
ISO 1629	Elastomer abbreviations	EPDM, NBR, FKM, NR, SBR, CR, VMQ, etc.
ISO 37	Tensile strength & elongation	Conceptually similar to ASTM D412 (different procedure)
ISO 7619-1	Shore hardness / IRHD (by part)	Always specify scale and tolerance
ISO 48-4	IRHD hardness	Often used for quality control specifications
ISO 815-1	Compression set	Time/temperature must be stated

ISO 1817	Liquid immersion / swell	Compare volume/mass/hardness after immersion
ISO 34-1	Tear strength	Useful for cut/tear-prone parts
ISO 188	Thermal aging	Assesses long-term heat stability
ISO 1431-1	Ozone cracking resistance	Defines ozone level + strain conditions
ISO 3302-1	Dimensional tolerances for molded parts	M classes (M1 tight, M2 standard, M3 wide)
ISO 3601	O-rings: dimensions and tolerances	International reference for O-ring sizing
ISO 2781	Density / specific gravity	Useful for weight, cost and yield calculations
ISO 2859	Sampling by attributes	Defines sampling plans and AQL (contract-driven)

5. How to write a clear specification (copy/paste template)

A strong rubber specification combines: (1) geometry, (2) material, (3) tolerances, (4) environment, (5) quality acceptance criteria. It should be sufficient to obtain the right part without over-specifying.

5.1 Specification template (copy/paste)

PART: _____ | DRAWING/REF: _____ | REV: _____
APPLICATION: static/dynamic _____ | TEMPERATURE: ____°C (continuous) / ____°C (peak)
ENVIRONMENT: water, steam, oil, acid, abrasives, UV/ozone _____
MATERIAL: (elastomer) _____ | HARDNESS: ____ Shore A (± ____)
MATERIAL SPEC (if applicable): ASTM D2000: _____
TESTS (if required): tensile (ASTM D412 / ISO 37), compression set (ASTM D395 / ISO 815-1), immersion (ASTM D471 / ISO 1817), ozone (ASTM D1149 / ISO 1431-1)
DIMENSIONAL TOLERANCES: ISO 3302-1 class ____ (or drawing tolerances)
APPEARANCE & FINISH: max flash ____, parting line ____, prohibited defects (porosity, cuts, blisters) _____
BONDING (rubber-to-metal): adhesion method/test (ASTM D429 or equivalent) _____
TRACEABILITY: lot/batch required (yes/no) | CERTIFICATE: (COC / test report) _____
PACKAGING: _____

6. Reading an ASTM D2000 material callout (examples and decoding)

ASTM D2000 (SAE J200) provides a compound classification system. The material callout looks like a code and is used to impose minimum performance requirements.

6.1 Simplified structure of a D2000 callout

Generic example: M2BG 714 A14 B13 EA14

- M2: metric units and grade level
- BG: performance category / type

- 714: nominal hardness and minimum tensile requirement (per D2000 tables)
- A14 / B13 / EA14: optional suffix requirements (heat aging, oil immersion, etc.)

Note: exact decoding depends on the D2000 tables and the specific suffixes. In practice, D2000 defines the framework and you add application-critical requirements (compression set, ozone, immersion, temperature).

6.2 Best practices with ASTM D2000

- Always include the real service environment (fluid, concentration, temperature, exposure time).
- Specify the critical test: compression set for sealing, ozone for outdoor service, immersion for oils/solvents.
- Avoid over-specifying: each requirement increases cost and reduces supplier options.
- For critical parts, require traceability (lot) and a certificate of compliance.

7. Dimensional tolerances: ISO 3302 and best practices

ISO 3302-1 defines dimensional tolerance classes for molded rubber parts. Tighter tolerance classes increase tooling complexity, process control and inspection cost.

7.1 Quick view of classes

ISO 3302-1 class	Typical use	Comment
M1	High precision / demanding applications	More expensive; justify by functional need
M2	Industrial standard (high quality)	Good cost/risk balance; commonly recommended
M3	General purpose	Wider tolerances; design assemblies accordingly

7.2 Don't forget

- Rubber deflects: design tolerant geometries and realistic assembly clearances.
- If critical, define measurement condition (free state, compressed, at ambient temperature).
- For O-rings, use ISO 3601 rather than custom dimensions.

8. Essential terminology (A–Z glossary)

AQL: Acceptable Quality Level used with sampling plans (e.g., ISO 2859).

Elastomer abbreviation: Standard elastomer code (EPDM, NBR, FKM, NR, CR, VMQ) defined by ISO 1629.

Elongation at break: Percent stretch at rupture (ASTM D412 / ISO 37).

Bloom: Migration of additives to the surface; may be normal or problematic for bonding/painting.

Compression set: Permanent deformation after compression + time + temperature (ASTM D395 / ISO 815-1).

Compound: Base mix (polymer + fillers + oils + cure package) before vulcanization.

Cure / vulcanization: Crosslinking reaction that turns a compound into elastic rubber.

Shore A hardness: Indentation hardness measure (ASTM D2240 / ISO 7619-1).

IRHD: Alternate hardness scale (ISO 48-4), frequently used in QC specs.

Sampling: Statistical lot inspection method (e.g., ISO 2859).

Creep: Slow deformation under constant load.

Swell: Volume/mass change after liquid immersion (ASTM D471 / ISO 1817).

Lot / batch: Traceability identifier linking parts, material and process parameters.

100% / 300% modulus: Stress required to reach 100%/300% elongation in tensile testing.

Ozone cracking: Ozone-induced cracking, often under strain (ASTM D1149 / ISO 1431-1).

Parting line: Line where mold halves meet; can create flash.

ISO 3302-1 tolerance: M1/M2/M3 classes defining dimensional accuracy of molded rubber parts.

Tensile strength: Maximum stress before break (ASTM D412 / ISO 37).

Traceability: Ability to trace to raw material lot, parameters and inspection records.

Thermal aging: Property loss after heat exposure (ASTM D573 / ISO 188).