SHORE HARDNESS TEST & ELASTOMER MATERIAL VALIDATION TOOLKIT

Engineering guide | Test method selection, measurable acceptance, material qualification and supplier evidence

Purpose. This guide supports a controlled Shore hardness inspection workflow. It is not a reproduction of an ASTM/ISO standard, nor evidence that a particular sample has passed testing.

Deliverable workflow

STEP	OUTPUT	RECORD LOCATION
01 | Specify	Commercial grade, lot, method/edition, scale and agreed acceptance rule	Acceptance workbook: 02
02 | Qualify setup	Specimen geometry, spacing, preparation, instrument checks and reading interval	Acceptance workbook: 03-04
03 | Measure	Individually traceable point values, specimen identifiers, environmental conditions	Acceptance workbook: 05
04 | Decide	Method readiness first; hardness pass/fail only when prerequisites are satisfied	Acceptance workbook: 06-09
05 | Qualify material	Independent functional evidence for sealing, compression, fatigue and service limits	Material validation workbook: 02-08

Decisions the worksheets deliberately separate

- Method readiness is not inferred from the numeric Shore value.
- Hardness compliance is not evidence of stiffness, compression set, chemical resistance or seal performance.
- Supplier approval requires traceability and application-specific functional evidence.

Software compatibility

Both Excel workbooks are ordinary XLSX files. Inputs are highlighted, decision cells use formulas, and RFQ buttons open only the EPOC CRAFTER website. No macros, external workbooks or off-site data connections are required.

01 | Quick start and data ownership

Begin with the approved drawing / purchase specification, not with a supplier hardness chart.

OWNER	RESPONSIBILITY
Design / NPI	Define functional requirements, material class, specimen route and acceptance method.
Supplier / production	Identify commercial grade, manufacturing state, batch/lot and test coupon origin.
Test operator	Verify equipment, conditions and independent measuring locations; record raw points.
Quality reviewer	Confirm method validity, specification approval, statistics and retest dispositions.
Technical authority	Review non-hardness performance evidence and grant or withhold material qualification.

Minimum information before a test

- Part number / revision / process / supplier / lot, plus material grade and condition.
- Governing standard and complete edition; approved Shore type and documented test interval.
- Hardness lower and upper limits, required point count and approved acceptance statistic.
- Specimen geometry/support, full calibration evidence and production lot traceability.

Control rule: Missing or contradictory specifications produce INCOMPLETE or HOLD - never PASS. Review and sign-off cannot be replaced by an automatically calculated hardness average.

02 | Shore type and method selection

Do not treat Shore A, Shore D or other durometer types as one numeric scale.

TEST METHOD	INTENDED SCOPE / DECISION
ASTM D2240-15(2021)	Durometer hardness of rubber-property materials, with multiple named durometer configurations. Confirm the correct configuration and procedure.
ISO 868:2003	Plastics and ebonite; Shore A or Shore D indentation hardness. Do not assume scope covers every soft rubber product.
ISO 48-4:2018	Vulcanized/thermoplastic rubber; Shore durometer method. Use the appropriate Type A, D, AO or AM arrangement as applicable.
Other instrument / method	Specify a separate controlled method and acceptance criteria; do not repurpose A/D acceptance data.

Selection prompts

- Is the product rubber, thermoplastic elastomer, plastic, ebonite or a multilayer component?
- Is the specimen a fully supported standard coupon or a constrained finished part?
- Is Type A/D within the useful working region of the selected instrument?
- Are reference values tested using the exact same standard, scale and timing?

Prohibited shortcut: This toolkit contains no Shore A-to-D conversion, no universal polymer hardness ranking, and no hardness-to-modulus correlation.

03 | Geometry and specimen readiness

A nominally correct hardness can be invalid when the indentation is influenced by geometry or support.

FIELD	WHAT TO DOCUMENT	ACTION IF NOT VERIFIED
Specimen thickness	Actual measured thickness and minimum required by the selected method/configuration.	HOLD; approved coupon or authorized alternate approach.
Edge clearance	Closest distance from each indentation to a free edge; applicable minimum.	HOLD; use a compliant position.
Point spacing	Distances between indentation positions; method minimum.	HOLD; new layout.
Shape and flatness	Curvature, face roughness, flat support, voids and backing.	HOLD; resolve fixture or specimen.
Stacked specimens	Number of layers and whether the method permits the stack.	HOLD unless controlled method confirms allowance.
Specimen origin	Same batch / grade / process state and traceability.	INCOMPLETE until linked.

Planning values versus acceptance authority

A frequently used planning screen is a nominal >=6 mm thickness and >=12 mm edge clearance for ordinary ASTM D2240 Type A/D arrangements, versus >=4 mm thickness and >=9 mm clearance for ordinary ISO 868 arrangements. These are not substitute method text: the workbook requires the inspector to enter and confirm limits from the controlled standard/specification for the actual arrangement.

Implementation: Actual and required specimen geometry are separately entered. The spreadsheet does not auto-certify a method merely because a planning threshold was met.

04 | Equipment, calibration and conditioning

Record how the value was produced - not just the value.

CHECK	RECORD
Instrument	Instrument ID, serial/model, applicable Shore configuration, stand/handheld use.
Calibration	Calibration reference, validity date and reviewer confirmation.
Daily / periodic check	Reference check or other required verification and result.
Environment	Actual temperature, relative humidity where relevant and conditioning record.
Operating mode	Contact/pressing procedure, force/angle control, readout/peak-hold mode.
Reading interval	Specified and actual elapsed time from contact; approved timing conformity.
Operator	Named operator, test date, specimen IDs, station and deviations.

Why reading interval matters

Elastomers can creep under indentation. An ASTM operating procedure read near one second must not be reported as equivalent to an ISO 868 15-second result without testing to the same approved method. The workbook records the actual interval and requires explicit verification against the controlling procedure.

> Do not infer calibration: A reference block check helps monitor instrument performance but does not independently demonstrate full calibration validity.

05 | Measuring and recording

Keep raw data, measurement position, setup evidence and calculations traceable.

Repeatable operator sequence

- Confirm the governing standard, edition, scale and approved criteria before taking measurements.
- Use a qualified specimen, suitable support and verified durometer.
- Mark spatially separated locations and assign stable location IDs.
- Apply the durometer according to its method and record the reading interval.
- Record each independent reading individually; note any anomaly and nonconformance.
- Preserve the raw data before calculating averages or deciding disposition.

Raw reading table format

SPECIMEN	POINT	SHORE VALUE	TIME (s)	LOT / REMARK
Coupon-A	P01	[enter]	[enter]	Production lot identifier
Coupon-A	P02	[enter]	[enter]	Same support and method
Coupon-A	P03	[enter]	[enter]	Location separated
Coupon-A	P04	[enter]	[enter]	Record anomalies
Coupon-A	P05	[enter]	[enter]	Retain numeric raw value

Sample ID table shown here is a blank format, not evidence of measurements. Enter measured values only in the Excel workbook; do not backfill assumed observations.

06 | Statistics and acceptance logic

Acceptance is based on a defined decision rule, not whichever statistic looks most favorable.

COMPUTATION	FORMULA / RULE
Count	Number of valid numeric values (the required count is a specification field).
Arithmetic mean	Sum of observed values / count.
Median	Middle ordered value; for even count, mean of two central values.
Range	Maximum minus minimum.
Sample standard deviation	Square root of sum of squared deviations divided by (n-1).
Mean / median rule	Compare only the pre-approved statistic against the inclusive lower/upper bounds.
All-individual rule	Every recorded value must lie within the inclusive bounds.

Precedence of statuses

- INCOMPLETE: missing method, specification, calibration confirmation, required measurements or identifiers.
- HOLD / METHOD REVIEW: geometry, scale, calibration or method conformance check fails.
- FAIL: an otherwise valid test exceeds an approved acceptance limit.
- PASS: all prerequisites are met and the preselected acceptance rule passes.

Default conservatism: The workbooks start with no supplied acceptance limits, no invented readings and no preapproved supplier/lot.

07 | Polymer families and material identity

Generic polymer names do not establish equivalent hardness or service properties.

FAMILY	PRIMARY HARDNESS QUESTION	SEPARATE FUNCTIONAL EVIDENCE
TPU / TPE	Commercial grade, Shore type, process state and molding/printing history?	Creep, tensile, fatigue, temperature, chemical exposure.
Silicone / LSR	Cure and post-cure state, durometer timing, test plaque geometry?	Compression set, tear, temperature, compatibility.
EPDM	Hardness versus compound formulation and service fluid?	Compression set, ozone/aging, hot-water/media exposure.
NBR / HNBR	Grade/compound and specified test method?	Oil/fuel compatibility, compression set, aging.
FKM	Compound specification, post-cure, temperature?	Media compatibility, low-temperature performance, compression set.
PU casting	Cure state and lot-specific hardness method?	Tear, abrasion and dimensional stability.

A shared Shore value does not establish identical modulus, friction, tear resistance, seal compression force or long-term behavior. Use the companion validation workbook to store evidence, test method, exposure and result for every claimed property.

08 | Functional validation by application

Select the tests required by the failure modes and duty cycle of the intended component.

APPLICATION	FUNCTIONAL TEST PROGRAM	CRITICAL CONDITIONS
Seal / gasket	Leakage, compression response, compression set, media aging.	Seal squeeze, gap, pressure, fluid, temperature and duration.
Vibration isolator	Static/dynamic stiffness, creep and fatigue.	Displacement, frequency, amplitude, preload.
Protective bumper	Impact response, rebound, tear, abrasion.	Impact energy, geometry, temperature, cycles.
Overmolded grip	Bond integrity, wear, thermal and exposure durability.	Substrate, primer, process and end-use agents.
FDM/SLS flexible part	Build-direction response, print porosity, fatigue, deformation.	Wall thickness, infill, orientation, post-process.

Record for each functional test

- Named specimen and material lot; test method and full version/edition.
- Applicable loading, temperature, duration, conditioning and fixture.
- Explicit acceptance limits or approved qualitative criterion; raw observations and evidence ID.
- Independent status; no auto-approval if mandatory evidence is missing.

09 | Standards and edition register

Verified standards identifiers; consult purchased controlled documents for normative clause-level requirements.

STANDARD / EDITION	ENGINEERING ROLE
ASTM D2240-15(2021)	Durometer hardness of rubber-property materials.
ISO 868:2003	Plastics and ebonite Shore A/D indentation hardness.
ISO 48-4:2018	Rubber hardness by Shore durometer method.
ISO 48-9:2018	Calibration and verification of rubber hardness test instruments.
ASTM D395-18(2025)	Rubber compression set, independent of Shore hardness.
ISO 815-1:2019	Rubber compression set at ambient or elevated temperatures.
ASTM D412-16(2021)	Tensile properties of vulcanized rubber and elastomers.
ISO 37:2024	Tensile stress-strain properties of rubbers.

Control statement

Standards identifiers and currently listed editions were cross-checked against the official ASTM and ISO catalog listings on 20 November 2026. This guide intentionally paraphrases high-level scope and workflow only; it does not reproduce copyrighted test methods. A laboratory must use its purchased/controlled standard for normative specimen, apparatus, timing, calculation, and reporting requirements.

> Never assume: The presence of a standard in a material datasheet means the supplied product was actually tested under that edition, or that it meets the application acceptance criteria.

10 | Supplier evidence and incoming inspection

The minimum acceptable evidence connects a numerical measurement to an identifiable lot and a controlled method.

EVIDENCE	REVIEW CONDITION
Material grade / TDS	Full commercial formulation designation and TDS revision, not just polymer family.
Lot traceability	Batch/heat/compound lot, PO and specimen-to-lot link documented.
Instrument evidence	ID, calibration status and verification records linked to test date.
Specimen evidence	Origin, measured thickness, support, spacing, edge distances and any deviations.
Raw readings	Individual Shore readings, count, interval, scale, environment and date.
Acceptance authority	Drawing specification, edition, lower/upper bounds and approved decision rule.
Functional evidence	Separate test records for performance properties required by application.

Incoming inspection rejection triggers

- Supplier only gives “85A” without method, timing, specimen or tested lot.
- Inspection uses an unapproved alternate Shore scale or unverified specimen geometry.
- A passing mean masks one or more outliers when all-individual acceptance was specified.

11 | Failure modes and corrective action

Treat a questionable hardness record as a measurement-system investigation before attributing it to bad material.

SYMPTOM	REVIEW PATH
Unexpectedly high reading	Scale selection, sample support, surface condition, conditioning, instrument checks.
Unexpectedly low reading	Coupon thickness, backing, early/late read interval, uncured material, voids.
High reading variation	Location spacing, heterogeneous compound, orientation, operator/fixture repeatability.
Lot-to-lot shift	Commercial grade, compound batch, cure/process state, supplier changes.
Seal fails despite acceptable Shore	Compression stress, gland geometry, compression set, pressure/media and leak test.
Cannot measure thin part	Use a traceable process-equivalent test plaque or validated alternate method.

NCR workflow: Record what failed, quarantined lot or specimen, hypothesized root cause (not fact), authorized retest plan, new test ID, review evidence and final disposition.

12 | Acceptance example: ILLUSTRATIVE ONLY

This fictional numeric exercise checks formula behavior. It is not a measurement record or supplier qualification.

ITEM	EXAMPLE INPUT / RESULT
Specified scale and method	Shore A; approved method and reading time assumed for this arithmetic exercise only.
Illustrative readings	84, 85, 86, 85, 85 - invented values for demonstrating formulas.
Specified acceptance	80 to 90 Shore A inclusive; MEAN rule; required points = 5.
Mean	(84+85+86+85+85) / 5 = 85.0.
Median / range	Median = 85; range = 86 - 84 = 2.
Arithmetic criterion	85.0 is within the illustrative acceptance bounds.
Real-world disposition	HOLD until actual calibration, geometry, specimen/lot and method evidence are provided.

Independent review of limits

If the approved rule instead required ALL INDIVIDUAL readings between 84 and 85, the example would FAIL because 86 is outside the upper bound - even though the average lies inside the interval. The selected rule must never change after seeing the results.

> Do not copy example values into supplier inspection reports. Both delivered workbooks contain blank real-data rows and cannot display PASS without declared prerequisites.

13 | Acceptance workbook operating guide

A completed specification is the prerequisite for a meaningful measurement record.

SHEET	ACTION / REQUIRED OUTPUT
01_Start_Here	Read permitted scope, input legends and stop rules.
02_Test_Specification	Enter lot and part IDs, method and edition, Shore type, tolerance and rule.
03_Specimen_Check	Measure actual geometry; enter method-required limits and verified status.
04_Equipment_Verification	Record instrument setup, date, calibration and timing conformity.
05_Hardness_Readings	Enter raw numerical values and separate specimen/point identifiers.
06_Results_and_Decision	Check count, statistics, gating conditions and acceptance result.
07_Lot_Traceability	Record supplier records, evidence IDs and production link.
08_Nonconformance	Record failure investigations, containment and authorized retest.
09_Inspection_Report	Review printable report; enter reviewer and archive reference.

Input protection philosophy

Formulas live in visibly identified output cells; blank spaces are operator fields. A decision of PASS applies to the stated hardness acceptance only. The material approval workbook makes the separate material qualification decision.

14 | Material validation workbook operating guide

Material selection is evidence-based; never infer unseen material properties from durometer class.

SHEET	ACTION / REQUIRED OUTPUT
01_Start_Here	Instructions and limits.
02_Application_Requirements	Service envelope, geometry, critical failure mode and objective.
03_Candidate_Materials	Full commercial grade, manufacturer, test claim and documentation.
04_Property_Evidence	Record strength, strain, compression set, modulus etc. with test method.
05_Process_Compatibility	Confirm process route, cure, orientation, shrinkage and other constraints.
06_Functional_Validation	Compare measured functional performance with explicit acceptance limits.
07_Supplier_Evidence	Track TDS/CoC/test reports, lot relationship and open items.
08_Approval_RFQ	Aggregate evidence; only approve when required reviews/tests are complete.

Qualification logic

The final material qualification formula requires candidate identity, reviewer sign-off, no failed or incomplete functional test rows for that candidate, at least one documented function test, and independently confirmed supplier/grade/lot evidence. Users must still determine which tests are mandatory for the particular application.

15 | RFQ and drawing specification template

Copy the fields below into an engineering RFQ or controlled purchase specification.

REQUIREMENT	FIELD TO COMPLETE
Part / revision	[Part No.] / [Drawing Rev.] / [PO or Project ID]
Material identity	[Manufacturer] [Full commercial grade] [Compounding / cure state]
Required hardness	[Shore type] [lower] to [upper] [decision statistic]
Test method	[ASTM/ISO designation, edition, specific configuration]
Coupon / specimen	[Dimensions] [Lot link] [Support/stack allowance]
Testing conditions	[Temperature] [Humidity if relevant] [Conditioning] [Reading time]
Sampling / reporting	[Required points] [Locations] [Raw values] [Instrument/calibration ID]
Functional verification	[Test method] [Acceptance criterion] [Service envelope]
Review and records	[Evidence IDs] [Reviewer] [Approval authority] [Deviation process]

Recommended purchase note: "Matching Shore hardness alone does not demonstrate elastomer material equivalence or component-level sealing, stiffness, fatigue, or environmental performance. Supply independent test evidence for each specified functional requirement."

16 | Final technical review checklist

Close every open measurement-method and functional-performance question before approving the lot or material.

Hardness acceptance readiness

- Part, drawing, material grade, process state and batch/lot identity recorded.
- Standard and edition selected; Shore type within method scope.
- Measured geometry documented; actual limits checked against the controlled standard.
- Instrument calibrated; verification, operator, conditioning and timing recorded.
- Required points supplied; accepted decision rule declared before measurement.
- Raw readings preserved; automatic calculations independently reviewed.

Material qualification readiness

- Application failure modes and environmental envelope documented.
- Critical non-hardness property and functional tests specified with acceptance criteria.
- Valid report IDs and traceability linked to each required test.
- Supplier/engineering/quality approvals signed and outstanding NCRs dispositioned.

Standard control and document limitations

This is a planning and recording toolkit, not a normative test procedure. Controlled ASTM and ISO publications supersede guidance summaries. Standards listed on page 10 were verified by their issuing organizations on 20 November 2026. No external website links are embedded in this file; all website and RFQ links point only to EPOC CRAFTER.

Next step: Record the test in the Acceptance workbook; qualify the material separately in the Material Selection and Validation workbook. For manufacturing review or RFQ, use the linked EPOC CRAFTER buttons in the header or footer.