



TECHNICAL GUIDE

INSPECTION, MAINTENANCE & DIAGNOSTICS FOR RUBBER COMPONENTS

Technical molded parts & Rubber Lining (tank/pipe lining)

Manual for operators, maintenance technicians, and end users

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1. Introduction and key concepts

Rubber is a material that changes over time. Even without mechanical loading, it can age under heat, light (UV), ozone, and chemicals. Real-world performance depends on the elastomer family, hardness, cure state, environment, and installation quality.

This guide covers two product families:

- Technical molded parts: mounts/silentblocks, bumpers, dampers, bellows, seals, guards, rubber-to-metal parts.
- Rubber lining: bonded protective linings in tanks, pipes, chutes, reactors and process equipment.

Useful definitions

- Aging: gradual loss of flexibility/elasticity, surface cracking, hardening or softening.
- Creep: slow deformation under constant load.
- Compression set: permanent deformation after prolonged compression.
- Debonding: loss of adhesion between rubber and substrate (metal or existing lining).

2. Safety and installation rules (golden rules)

Most premature failures come from poor installation, misalignment, incompatible lubrication, or a service environment that does not match the elastomer. A small nick can quickly become a tear under fatigue.

2.1 Molded parts (mounts, bellows, seals)

1. No twist during installation: prevent rubber from rotating while tightening. A twisted mount will shear quickly.
2. Alignment is mandatory: never force a rubber component to compensate for misaligned holes or shafts.
3. No sharp tools: avoid screwdrivers/metal picks. Use rounded tools or dedicated installation guides.
4. Use only compatible lubricants: prefer soapy water or an approved lube. Avoid oils/greases/petroleum jelly unless the material is specified as oil-resistant.
5. Controlled tightening: follow torque values and avoid over-tightening (permanent set, cracking, bond damage).

2.2 Rubber lining (bonded linings)

6. No welding on a rubber-lined wall: heat can destroy the bonding layer and cause rapid debonding and fire risk.
7. Avoid any hot spot: localized heating, prolonged grinding, torches, or thermal cutting near lined walls.
8. Prevent impacts and sharp edges: protect impact zones (inlets/outlets, elbows, transitions, chutes).
9. Follow controlled cleaning procedures: avoid unknown solvents, uncontrolled abrasives, and close-range high-pressure jets.

3. Inspection plan: frequency, method and tools

Adjust inspection frequency based on equipment criticality (safety risk, downtime cost, aggressiveness of the medium). Use simple traceability: date, area inspected, observations, photos, actions.

3.1 Recommended frequencies

Level	Who	Frequency	Goal
Operational	Operator	Each shift / weekly	Spot visible issues: cracks, leaks, noise, vibration, blisters
Preventive	Maintenance	Monthly / quarterly	Simple checks: sag, alignment, fasteners, critical lining zones
In-depth	Maintenance + supervisor	Semi-annual / annual	Wear mapping, lining thickness trending, repair planning

3.2 Useful tools

- Headlamp, inspection mirror, ruler/calipers, marker.
- Systematic photos (same angle) to compare over time.
- Light hammer/rubber mallet for lining sound test (debond detection).
- Lining thickness gauge (if available) or reference measurements (fixed points).
- IR thermometer (hot spot detection), vibrometer (mounts), durometer (if required).
- Standardized inspection sheets (see Section 8).

4. Visual and functional inspection – molded parts

4.1 Inspection points (table)

Check point	What to look for	Risk	Action
Bond line (rubber-to-metal)	Separation, lifting at edges, cracks, rust under the lip	Structural loss, drop/break	Replace immediately; analyze cause (corrosion, overload, installation)
Sag / creep	Reduced height, machine leaning, uneven loading	Vibration, overload on remaining mounts	Replace as a full set; verify alignment and load
Fatigue cracking	Oriented cracks, striations, cracks at flex zones	Crack growth to failure	Plan replacement; check cycles, over-stroke, interference
Swelling / softening	Tacky surface, swollen geometry, solvent smell	Rapid chemical attack	Identify fluid; fix leak; replace with compatible elastomer

Thermal hardening	Plastic/wood-like feel, microcracks, reduced elasticity	Loss of damping, faster cracking	Reduce temperature; specify high-temp compound; replace
Nicks / cuts	Small cuts from install, sharp edges, abrasion marks	Tear initiation	Fix installation; protect edges; replace if cut is active
Bellows	Cracks at fold roots, holes, external rubbing	Loss of protection, contamination	Replace; address rubbing/over-stroke/alignment

4.2 Simple decision criteria

Immediate replacement if: rubber-to-metal debonding, through-cracks, deformation preventing function, chemical swelling, unstable part, dangerous clearance, or metal-to-metal contact.

Monitor if: superficial non-through cracks, cosmetic wear without loss of function, non-critical bloom, controlled light abrasion.

5. Inspection and maintenance – Rubber Lining (tanks, pipes, chutes)

Rubber lining is a protective barrier. A local defect (blister, debond, cut) can allow fluid to reach the steel and cause rapid corrosion. The goal is early detection and repair before propagation.

5.1 Priority inspection zones

- Inlets/outlets, baffles, elbows, and cross-section changes (impact/turbulence zones).
- Sheet joints, seams, transitions, nozzles, and metal-to-lining interfaces.
- Areas near flanges, historical hot-work locations, hot spots, supports and anchors.
- High abrasion zones: chutes, trommels, rock boxes, slurry impact areas.

5.2 Inspection points (table)

Check point	What to look for	Criticality	Action
Blistering	Bumps/bubbles under rubber; soft spots	Critical	Schedule rapid shutdown; isolate area; repair before steel exposure
Peeling / edge lift	Debond at edges, seams or sharp features	High	Cut back cleanly, prep, re-bond and seal; prevent full tear-off
Cuts / gouges	Clean cut, tear-out, impact damage	High	Local patch; remove root cause; add impact protection if recurrent
Wear / thinning	Grooving, roughness, reduced thickness	Variable	Measure remaining thickness; plan patch or re-line based on threshold

Cracking	Crack network, seam crack, flex crack	Variable	Assess depth; correct cause (movement, UV/ozone, chemistry)
Edge sealing loss	Fluid ingress at perimeters or under lips	High	Re-seal edges and eliminate the entry point

5.3 Practical detection methods

- Sounding test: tap lightly (light hammer/rubber mallet). A hollow sound may indicate debonding.
- Mapping: mark zones, measure and trend vs a reference (thickness, worn length, surface condition).
- Touch inspection: abnormal stiffness, soft area, lifted edge.
- Hot spot check: use an IR thermometer to identify local anomalies.
- Controlled cleaning: remove deposits to reveal the surface without damaging the lining.

5.4 Maintenance – allowed vs prohibited

Allowed: gentle cleaning, controlled rinsing, non-sharp tools, compatible products, impact protection.
 Prohibited: welding, torches, prolonged grinding near lined walls, unknown solvents, close-range high-pressure jets, metal scrapers on the lining surface.

6. Diagnostics: symptoms → root causes → actions

Use the tables below to identify the likely cause, correct the underlying issue, and prevent recurrence.

6.1 Mechanical issues – molded parts

Symptom / appearance	Likely root cause	Corrective action
Progressive break with striations (fatigue)	Excess cycles, end of life, under-design, interference	Review loads/cycles; remove rubbing; optimize design/compound; replace as a set
Sudden irregular break (shock)	Impact, overload event, emergency stop	Add protection/stops; increase section/hardness; review procedures
Diagonal shear cut	Twist during install, misalignment, lateral displacement	Correct installation/alignment; add guidance; replace
Polished surface + black dust	Continuous rubbing/interference	Eliminate interference; reposition; add shielding; replace

6.2 Rubber-to-metal bonding issues

Metal condition after failure	Likely cause	Interpretation
Clean bare metal (gray)	Surface prep / primer / bonding deficiency	Adhesive plane failure (debond at interface)

Rust under rubber	Ingress and underfilm corrosion in aggressive environment	Adhesion loss driven by corrosion; improve sealing/protection
Metal covered with torn rubber	Mechanical overload (bond holds)	Rubber failed before the bond; review load/design/compound

6.3 Environmental issues (compound compatibility)

Appearance	Likely cause	Effect	Action
“Puzzle” surface cracks	Ozone/UV exposure, outdoor storage, near electric motors	Surface cracking, reduced flexibility	Protect from ozone/UV; select resistant compound; reduce tensile strain
Soft / jelly-like / swollen	Chemical incompatibility (oil, solvent, fuel)	Dimensional growth, strength loss	Eliminate leak; select compatible elastomer; validate with testing
Hard / plastic-like	Thermal aging / overheating	Cracking, loss of damping	Lower temperature; specify high-temp compound; insulate heat source
Excessive bloom impacting bonding	Incompatible bloom, contamination, off-spec material	Bonding/painting difficulty	Clean per procedure; tighten spec; confirm with supplier

6.4 Quick diagnostics – Rubber lining

Symptom	Likely cause	Action
Blisters / bubbles	Fluid ingress, underfilm corrosion, local defect, pressure/temperature effects	Isolate area; check conditions; repair quickly; inspect steel
Edge debond	Ingress, impact, movement, insufficient prep	Cut back and re-bond; improve edge sealing; add impact protection
Localized wear	Abrasives, impact, high velocity, turbulence	Measure remaining thickness; protect; add deflector; repair
Cut / tear-out	Hard object, sharp edge, handling damage	Patch; remove cause; reinforce inlet/outlet zones

7. Spare-part storage and best practices

10. Dark storage: keep parts in closed packaging (boxes/opaque bags) away from UV.
11. Temperature: ideally 15°C to 25°C, away from heaters and extreme variations.
12. No stacking: do not compress seals/bellows; avoid permanent set (compression set).
13. Ozone: avoid proximity to electric motors, arcs, welders, transformers.

- 14. Rubber-covered rolls: store on proper supports; rotate periodically if applicable to prevent flat spots.
- 15. Traceability: record receipt date, lot/batch, elastomer, hardness and target equipment.

Maintenance rule: when an assembly includes multiple identical mounts (e.g., four machine feet), replace the full set. A new mount is stiffer than aged mounts; if only one is replaced, it can take overload and fail early.

8. Quick sheets: field checklists

8.1 Checklist – molded parts (quick inspection)

Check	OK / Monitor / Action
Rubber-to-metal debonding or crack at bond edge	
Visible sag / leaning machine / uneven height	
Through-cracks / cuts / abnormal abrasion	
Swelling, tacky surface, solvent smell	
Hardening, loss of elasticity, cracking	
Interference: rubbing against metal part	
Fastener torque/alignment verification	

8.2 Checklist – Rubber lining (quick inspection)

Check	OK / Monitor / Action
Blisters / bumps / soft spots	
Edge lift or seam debonding	
Localized wear / thinning / abnormal roughness	
Cuts / tear-outs / impact marks	
Cracks at seams or flex zones	
Hollow sound during sounding test	
Hot spots (IR) or suspicious corrosion	