

BHARATI SOLUTIONS

O-RING SEALS

O-Ring & Elastomeric Sealing Solutions

TECHNICAL PRODUCT CATALOGUE

High-Performance O-Rings • Gland Design Guide
Material Selection Reference • International Size Standards

AS 568 | ISO 3601 | BS 1806 | JIS B2401 | DIN 3771

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1. About Bharati Solutions

Bharati Solutions, headquartered in New Delhi, is a specialist supplier of precision-engineered O-rings and elastomeric sealing components. We supply over 30,000 standard and custom part numbers serving the most demanding industrial applications globally, sourced from world-class manufacturers certified to ISO 9001:2015.

Our mandate is to deliver high-quality sealing products across India with professional technical guidance, assured lead times, and competitive pricing. Our customer base spans Oil & Gas, Petrochemicals, Pharmaceuticals, Food & Beverage, Water Treatment, Power Generation, Automotive, and General Engineering sectors.

Industries Served

- Oil & Gas / Petrochemicals
- Pharmaceutical & Biotech
- Food, Beverage & Dairy
- Water Treatment & Utilities
- Power Generation
- Chemicals & Solvents
- Automotive & Heavy Equipment
- General Industrial Engineering

Key Capabilities

- Wide product range — full traceability
- AS 568 / ISO 3601 / BS 1806 / JIS / DIN in stock
- Custom compounds & special sizes on request
- FFKM, HNBR, Aflas, PTFE backup rings available
- Technical gland design support for engineers
- Material selection guidance & chemical compatibility
- Dedicated application engineering team
- Express delivery across India

2. Introduction to O-Rings & Elastomeric Seals

An O-ring (toroidal seal) is the most widely used static and dynamic sealing element in industrial and fluid power systems. Comprising a circular cross-section elastomeric ring, it functions by deforming within a precision-machined groove (gland) to create a leak-tight barrier against fluids, gases, or vacuum. The efficacy of the seal depends on three interdependent variables: the compound selection (chemical and thermal compatibility), the gland geometry (groove dimensions, squeeze percentage, and fill ratio), and the surface finish (Ra requirements per the application type).

Key Dimensional Parameters

Parameter	Symbol	Definition
Inside Diameter	ID	Internal diameter of the O-ring in its free (unstretched) state
Cross-Section Diameter	CS / W	Diameter of the O-ring's circular cross-section (wire diameter)
Outside Diameter	OD	$OD = ID + 2 \times CS$
Squeeze	S%	Diametral compression of cross-section in the installed condition
Stretch	—	Circumferential elongation over a piston or mandrel; typically 1–5%
Fill Factor	FF%	Ratio of O-ring volume to gland volume; typically 75–90%

Seal Types and Applications

Seal Type	Operating Condition	Typical Pressure	Typical Squeeze %
Static Axial (Face)	No relative motion at seal interface	Up to 100 MPa with backup	15–30%
Static Radial (Bore/Piston)	No relative motion; diametral installation	Up to 35 MPa	10–25%
Dynamic Reciprocating	Linear back-and-forth shaft/piston motion	Up to 35 MPa (70 w/ backup)	10–20%
Dynamic Rotary	Continuous shaft rotation	Up to 0.5 MPa	5–12%
Oscillating / Swivel	Limited angular motion	Up to 5 MPa	8–15%

NOTE When operating above 7 MPa (1,000 psi) in dynamic applications, or above 14 MPa in static applications, PTFE or polyamide anti-extrusion backup rings are required in the downstream side of the gland to prevent elastomer extrusion into the clearance gap.

3. Material Selection Guide

The elastomer compound is the most critical selection criterion in O-ring design. An incorrect material selection will result in swelling, hardening, cracking, extrusion, or rapid degradation. The following compounds represent the standard range stocked and supplied by Bharati Solutions.

Compound	Code	Service Temp.	Key Strengths	Key Limitations	Typical Industries
Nitrile (NBR)	NR / HN	-40 to +120°C	Excellent resistance to petroleum oils, fuels, hydraulic fluids; good abrasion resistance; cost-effective	Poor resistance to ozone, weathering, ketones, esters, chlorinated hydrocarbons	Hydraulics, pneumatics, oil & gas, automotive
Hydrogenated Nitrile (HNBR)	HN70 / HN90	-40 to +160°C	Superior to NBR in high-temperature oil service; excellent resistance to H ₂ S, steam, sour gas	Higher cost than NBR; limited compatibility with aromatic hydrocarbons	Oil & gas (sour service), automotive, compressors
Fluorocarbon (FKM / Viton®)	FK / V	-20 to +200°C	Outstanding resistance to fuels, aromatic hydrocarbons, mineral acids, weather, ozone; low gas permeability	Not recommended for ketones, esters, hot water/steam, amines	Petrochemicals, aerospace, high-temp hydraulics, fuel systems
Perfluoroelastomer (FFKM)	PF	-15 to +310°C	Near-universal chemical resistance; excellent in aggressive solvents, concentrated acids/bases; low extractables	Very high cost; limited low-temperature flexibility	Semiconductor, pharma, chemical processing
EPDM (Ethylene Propylene)	EP	-55 to +150°C	Excellent resistance to steam, hot water, ozone, weathering, polar solvents, dilute acids/bases	Not compatible with petroleum oils, fuels, mineral hydraulic fluids	Water treatment, HVAC, steam systems, food & beverage
Silicone (VMQ / PVMQ)	SI	-60 to +230°C	Very wide temperature range; food & pharmaceutical grade available; excellent electrical properties	Low tensile and tear strength; poor resistance to petroleum fuels and hydraulic oils	Food, pharma, medical, electrical, aerospace
Neoprene (CR)	CR	-40 to +120°C	Good oil resistance; excellent resistance to weathering, ozone, flame, freon refrigerants	Not compatible with strong oxidising acids, ketones, esters, aromatic hydrocarbons	Refrigeration, marine, wire & cable
Aflas® (TFE/P)	AF	-10 to +230°C	Outstanding resistance to H ₂ S, amines, steam, strong acids/bases; excellent in sour gas service	Poor low-temperature properties; limited availability; higher cost	Oil & gas downhole, geothermal, chemical processing

Compound	Code	Service Temp.	Key Strengths	Key Limitations	Typical Industries
PTFE	PT (backup)	-200 to +260°C	Chemical inertness to virtually all media; extremely low friction; non-stick; FDA compliant	Not a true elastomer — requires pre-formed or spring-energised design; no self-sealing	Food, pharma, semiconductor, anti-extrusion backup rings
Polyurethane (PU)	PU	-40 to +80°C	Exceptional abrasion resistance; high tensile strength; excellent for high-pressure hydraulics	Hydrolysis in hot water; not recommended above 80°C in aqueous service	Hydraulic cylinders, mining, construction equipment

* Compound codes are for reference only. Always specify the complete part number when placing orders. Custom hardness variants (40–90 Shore A) and special compounds available on request.

4. Chemical Compatibility & Temperature Reference Table

The table below provides a condensed compatibility rating for elastomers against common industrial media. **Ratings: E = Excellent, G = Good, F = Fair (conditional use), P = Poor (not recommended), — = Insufficient data / consult Bharati Solutions.**

Media / Fluid	NBR	HNBR	FKM	FFKM	EPDM	VMQ	CR	Aflas
Petroleum Oils (mineral)	E	E	E	E	P	F	G	E
Diesel / Gas Oil	E	E	E	E	P	P	G	E
Aromatic Hydrocarbons	P	P	E	E	P	P	P	G
Aliphatic Hydrocarbons	G	G	E	E	P	F	G	E
HCl, H ₂ SO ₄ (dilute)	F	F	E	E	E	G	F	E
Concentrated Acids	P	P	G	E	G	F	P	E
Caustic (NaOH, KOH)	F	F	F	E	E	G	G	E
Amines	P	P	P	E	G	F	P	E
Ketones (MEK, Acetone)	P	P	P	E	E	G	P	G
Esters (Ethyl Acetate)	P	P	P	E	E	G	P	G
Ozone / Weathering	P	G	E	E	E	E	E	E
Steam (up to 120°C)	F	G	P	E	E	E	F	G
Steam (>150°C)	P	F	P	G	G	F	P	E
Water / Hot Water	G	G	F	E	E	G	G	E
H ₂ S (Sour Gas)	F	E	G	E	F	F	F	E
Methanol / Ethanol	G	G	F	E	E	G	G	G
Chlorinated Solvents	P	P	G	E	F	F	P	F
Skydrol® (Phosphate Ester)	P	P	P	E	E	G	P	F
Silicone Oils / Greases	G	G	G	E	G	P	G	G
Refrigerants R134a/R410a	G	G	E	E	P	F	G	F
Freons (older CFC)	G	G	E	E	P	G	E	F
Oxygen (high pressure)	P	P	G	E	F	G	F	G
Food / Pharma (FDA/USP)	F	F	G	E	G	E	F	F
Brake Fluid (DOT 3/4)	P	P	P	E	E	G	F	G
Hydraulic Oil (synthetic)	G	E	E	E	P	F	G	G

Ratings are indicative at ambient temperature. Actual compatibility depends on concentration, temperature, pressure, and exposure duration. Always validate with compound data sheets and/or consult Bharati Solutions application engineers for critical service conditions.

5. Gland Design Guide — Static Axial (Face) Seals

A face seal (axial compression seal) is installed in a groove machined into a flat or flanged surface. The O-ring is compressed axially (parallel to the cylinder axis) when the mating flanges are bolted together. This configuration is preferred for high-pressure and high-vacuum applications due to its inherent resistance to extrusion.

Design Equations

Let W = cross-section diameter (CS), G = groove depth, G_w = groove width, D = O-ring ID.

Parameter	Formula / Value	Notes
Groove Depth (G)	$G = W \times (1 - S\%/100)$	Squeeze $S\%$ = 15–30% for static; use 20–25% as nominal
Groove Width (G_w)	$G_w \geq W \times 1.35$	Fill factor 75–85%; allows for thermal expansion
Corner Radius (r)	$r = 0.2\text{--}0.4$ mm (min)	Prevents cutting of O-ring on installation
O-ring Stretch	0–3% over groove ID	Minimal stretch preferred for face seals
Surface Finish (groove floor)	Ra 0.8–1.6 μm (32–63 μin)	Sealing face Ra ≤ 0.8 μm for vacuum service
Diametral Clearance (gap)	≤ 0.1 mm per side	Reduce to ≤ 0.05 mm for >35 MPa without backup

Recommended Gland Dimensions — Static Axial Face Seals (ISO 3601 Basis)

CS (W) mm	Groove Depth G mm	Groove Width G_w mm	Nominal Squeeze %	Max Gap mm	Corner Radius r mm
1.78	1.37–1.47	2.46–2.57	17–23%	0.10	0.2–0.4
2.62	2.08–2.21	3.53–3.76	16–21%	0.10	0.2–0.4
3.53	2.84–3.00	4.75–4.95	15–20%	0.13	0.4–0.8
5.33	4.34–4.57	7.16–7.49	14–19%	0.13	0.4–0.8
6.99	5.72–6.02	9.40–9.83	14–18%	0.25	0.4–0.8
8.40	6.91–7.21	11.30–11.76	14–18%	0.25	0.8–1.2
10.00	8.20–8.56	13.50–14.10	14–18%	0.25	0.8–1.2
12.00	9.84–10.22	16.20–16.92	14–17%	0.40	0.8–1.2

DESIGN TIP For vacuum applications (< 1 mbar), increase nominal squeeze to 20–25% and use VMQ or FKM compound. Groove surface finish should be Ra ≤ 0.4 μm . Anti-extrusion backup rings are not required in most vacuum applications but should be considered where there is any risk of rapid pressure reversals.

6. Gland Design Guide — Static Radial (Piston / Rod) Seals

Radial seals are installed in a groove on either a piston (OD groove — sealing against bore) or a rod (ID groove in housing — sealing against shaft OD). The O-ring is compressed diametrically. Careful attention to stretch (for piston installations) and gland fill ratio are critical.

Piston Seal (External Groove) — Design Parameters

CS (W) mm	Groove Depth G mm	Groove Width Gw mm	Radial Squeeze %	O-ring OD / Bore
1.78	1.47–1.52	2.46–2.82	15–22%	OD ≤ bore dia.
2.62	2.16–2.26	3.53–3.96	14–18%	OD ≤ bore dia.
3.53	2.90–3.07	4.75–5.33	13–18%	OD ≤ bore dia.
5.33	4.39–4.65	7.16–8.03	13–18%	OD ≤ bore dia.
6.99	5.77–6.12	9.40–10.54	12–16%	OD ≤ bore dia.

Rod Seal (Internal Groove in Housing) — Design Parameters

CS (W) mm	Groove Depth G mm	Groove Width Gw mm	Radial Squeeze %	O-ring ID / Shaft OD
1.78	1.47–1.52	2.46–2.82	15–22%	ID ≤ shaft OD by 0–3%
2.62	2.16–2.26	3.53–3.96	14–18%	ID ≤ shaft OD by 0–3%
3.53	2.90–3.07	4.75–5.33	13–18%	ID ≤ shaft OD by 0–3%
5.33	4.39–4.65	7.16–8.03	13–18%	ID ≤ shaft OD by 0–3%
6.99	5.77–6.12	9.40–10.54	12–16%	ID ≤ shaft OD by 0–3%

NOTE EXTRUSION PREVENTION: When system pressure exceeds 7 MPa (1,000 psi) in static radial applications, install one PTFE or nylon backup ring on the downstream (low-pressure) side. For bi-directional pressure, use backup rings on both sides. Backup ring thickness = 1.3–1.6 mm; width ≈ 1.25 × CS.

7. Gland Design Guide — Dynamic Reciprocating Seals

Dynamic reciprocating O-rings are subjected to cyclic friction and wear. Reduced squeeze percentages (compared to static), tighter surface finish tolerances, and appropriate lubrication are mandatory. Extrusion resistance is a primary concern at elevated pressures.

Parameter	Rod / Shaft Seal	Piston Seal
Recommended Squeeze %	10–15%	10–15%
Groove Depth G	$W \times 0.85$ to 0.90	$W \times 0.85$ to 0.90
Groove Width Gw	$W \times 1.25$ to 1.50	$W \times 1.25$ to 1.50
Fill Factor	75–85%	75–85%
Surface Finish — Groove Floor	Ra 0.4–0.8 μm	Ra 0.4–0.8 μm
Surface Finish — Moving Surface	Ra 0.1–0.4 μm	Ra 0.1–0.4 μm
Lead-in Chamfer	15°–20°, radius 0.5 mm	15°–20°, radius 0.5 mm
Max Piston Speed (no backup)	0.5 m/s	0.5 m/s
Max Pressure (with 1 backup ring)	35 MPa	35 MPa
Max Pressure (with 2 backup rings)	70 MPa	70 MPa
Lubrication Requirement	Film of system fluid	Film of system fluid
Hardness Recommendation	70–90 Shore A	70–80 Shore A

Dynamic Reciprocating — Gland Dimensions by CS

CS (W) mm	Groove Depth G mm	Groove Width Gw mm	Squeeze %	Backup Ring Req.
1.78	1.52–1.57	2.46–2.67	12–15%	> 7 MPa
2.62	2.26–2.36	3.53–3.81	10–14%	> 7 MPa
3.53	3.00–3.18	4.75–5.08	10–15%	> 7 MPa
5.33	4.57–4.80	7.16–7.72	10–14%	> 7 MPa
6.99	6.02–6.30	9.40–10.16	10–14%	> 7 MPa

8. Gland Design Guide — Rotary & Oscillating Seals

O-rings in rotary service experience continuous frictional heating. Low squeeze percentages are essential to minimise heat build-up and wear. The use of low-friction compounds (PTFE-filled FKM or VMQ) and adequate lubrication is strongly recommended. Operating pressure should not exceed 0.5 MPa without engineering analysis.

Parameter	Rotary Seal	Oscillating Seal
Squeeze %	5–10%	8–15%
Groove Depth G	$W \times 0.90$ to 0.95	$W \times 0.85$ to 0.92
Groove Width Gw	$W \times 1.30$ to 1.50	$W \times 1.30$ to 1.50
Surface Finish (shaft)	$Ra \leq 0.2 \mu\text{m}$ (ground/polished)	$Ra \leq 0.4 \mu\text{m}$
Max Shaft Speed	0.5–1.5 m/s (compound-dependent)	< 2 m/s arc velocity
Max Pressure	0.5 MPa (consider lip seal above)	5 MPa
Preferred Compound	PTFE-filled FKM, VMQ, HNBR	FKM, NBR, HNBR
Lubrication	Continuous or flooded	Greased at installation

9. Surface Finish & Tolerance Requirements

Proper surface finish and dimensional tolerances are fundamental to reliable O-ring sealing. The tables below consolidate requirements per ISO 3601-3 and engineering standards. Tolerances apply to groove dimensions (depth and width) and bore/shaft diameters.

Surface	Static Seal Ra (μm)	Dynamic Seal Ra (μm)	Vacuum Seal Ra (μm)
Groove bottom (sealing surface)	0.8–1.6	0.4–0.8	≤ 0.4
Groove sides	1.6–3.2	0.8–1.6	0.8–1.6
Bore / Shaft (mating surface)	0.8–1.6	0.1–0.4	≤ 0.2
Lead-in chamfer	0.8–3.2	0.8–3.2	0.8–1.6
Flange sealing face	0.4–0.8	N/A	≤ 0.2

Dimensional Tolerances — Groove Depth (G) and Width (Gw)

CS Range (mm)	Groove Depth Tolerance (mm)	Groove Width Tolerance (mm)	Bore/Shaft Tolerance
1.0–2.0	± 0.05	+0.10 / 0.00	H8 / f8
2.0–4.0	± 0.08	+0.13 / 0.00	H8 / f8
4.0–7.0	± 0.10	+0.15 / 0.00	H8 / f8
7.0–10.0	± 0.13	+0.20 / 0.00	H8 / f8
>10.0	± 0.15	+0.25 / 0.00	H8 / f8

10. International Size Standards — AS 568B (SAE / Inch)

The Aerospace Standard AS 568B (published by SAE International) is the most widely used O-ring size standard in North America and international oil & gas procurement. Sizes are organised into series based on cross-section diameter. All dimensions are in inches (mm equivalents shown).

Series	CS (inch)	CS (mm)	ID Range (inch)	ID Range (mm)	Part # Range
000–099	0.070 ± 0.003	1.78 ± 0.08	0.029 – 0.239	0.74 – 6.07	AS 001 – 099
100–199	0.103 ± 0.003	2.62 ± 0.08	0.301 – 1.239	7.65 – 31.47	AS 101 – 199
200–299	0.139 ± 0.004	3.53 ± 0.10	0.301 – 4.239	7.65 – 107.67	AS 201 – 299
300–399	0.210 ± 0.005	5.33 ± 0.13	0.301 – 6.739	7.65 – 171.17	AS 301 – 399
400–499	0.275 ± 0.006	6.99 ± 0.15	0.301 – 25.99	7.65 – 660.14	AS 401 – 499

AS 568B Selected Part Numbers — 100 Series (CS = 2.62 mm / 0.103")

Part #	ID (in/mm)	OD (in/mm)	Part #	ID (in/mm)	OD (in/mm)
AS 104	0.301 / 7.65	0.507 / 12.88	AS 110	0.364 / 9.25	0.570 / 14.48
AS 105	0.489 / 12.42	0.693 / 17.60	AS 112	0.612 / 15.54	0.816 / 20.73
AS 108	0.614 / 15.60	0.820 / 20.83	AS 116	0.864 / 21.95	1.068 / 27.13
AS 110	0.739 / 18.77	0.943 / 23.95	AS 120	1.114 / 28.30	1.318 / 33.48
AS 112	0.864 / 21.95	1.068 / 27.13	AS 125	1.364 / 34.65	1.568 / 39.83
AS 114	0.989 / 25.12	1.193 / 30.30	AS 130	1.614 / 40.99	1.820 / 46.23
AS 116	1.114 / 28.30	1.318 / 33.48	AS 135	1.864 / 47.35	2.068 / 52.53
AS 118	1.239 / 31.47	1.443 / 36.65	AS 140	2.114 / 53.70	2.318 / 58.88
AS 120	1.489 / 37.82	1.693 / 43.00	AS 145	2.364 / 60.05	2.568 / 65.23
AS 122	1.614 / 40.99	1.818 / 46.18	AS 150	2.614 / 66.40	2.818 / 71.58

11. International Size Standards — ISO 3601 (Metric)

ISO 3601 is the international metric O-ring standard, widely used in Europe, India, and globally in engineering specifications. It comprises four parts: ISO 3601-1 (dimensions and tolerances), ISO 3601-2 (housing dimensions for general applications), ISO 3601-3 (quality acceptance criteria), and ISO 3601-4 (anti-extrusion devices). Limited sizes shown below, for more sizes, contact Bharati Solutions.

ISO 3601 — Standard Cross-Section Diameters

CS Code	CS Nominal (mm)	CS Tolerance (mm)	Typical Application
W1.5	1.50	± 0.08	Small instrument seals, miniature hydraulics
W1.78	1.78	± 0.08	Corresponds to AS 568 000-series
W2.0	2.00	± 0.08	General metric hydraulics, pneumatics
W2.62	2.62	± 0.08	Corresponds to AS 568 100-series
W3.0	3.00	± 0.10	Standard European hydraulics & pneumatics
W3.53	3.53	± 0.10	Corresponds to AS 568 200-series
W4.0	4.00	± 0.10	Heavy industrial / general engineering
W5.0	5.00	± 0.13	Large bore cylinders, high-pressure systems
W5.33	5.33	± 0.13	Corresponds to AS 568 300-series
W6.0	6.00	± 0.15	Flanges, pipe joints
W6.99	6.99	± 0.15	Corresponds to AS 568 400-series
W8.0	8.00	± 0.20	Large flanges, subsea applications
W10.0	10.00	± 0.25	Very large bore / subsea / pipeline
W12.0	12.00	± 0.25	Extreme diameter sealing applications

ISO 3601 — Selected Metric Sizes (CS = 3.00 mm, W3)

ID (mm)	CS (mm)	OD (mm)
6.00	3.00	12.00
8.00	3.00	14.00
10.00	3.00	16.00
12.00	3.00	18.00
14.00	3.00	20.00
16.00	3.00	22.00
18.00	3.00	24.00
20.00	3.00	26.00
22.00	3.00	28.00
25.00	3.00	31.00
28.00	3.00	34.00
30.00	3.00	36.00
32.00	3.00	38.00
35.00	3.00	41.00

ID (mm)	CS (mm)	OD (mm)
40.00	3.00	46.00
45.00	3.00	51.00
50.00	3.00	56.00
55.00	3.00	61.00
60.00	3.00	66.00
65.00	3.00	71.00
70.00	3.00	76.00
80.00	3.00	86.00
90.00	3.00	96.00
100.00	3.00	106.00
110.00	3.00	116.00
120.00	3.00	126.00
130.00	3.00	136.00
150.00	3.00	156.00

12. International Size Standards — BS 1806 (British Standard)

BS 1806 is the British Standard for O-ring dimensions, historically prevalent in UK engineering and Commonwealth countries. Sizes follow an inch-based system but use unique part numbering (BS 1806 No. xxx). Cross-sections are similar to AS 568 series. Limited sizes shown below, for more sizes, contact Bharati Solutions.

BS 1806 No.	ID (inch)	CS (inch)	ID (mm)	CS (mm)	OD (mm)
009	0.171	0.070	4.34	1.78	7.90
010	0.224	0.070	5.69	1.78	9.25
012	0.301	0.103	7.65	2.62	12.88
110	0.364	0.103	9.25	2.62	14.48
210	0.301	0.139	7.65	3.53	14.71
214	0.489	0.139	12.42	3.53	19.48
218	0.614	0.139	15.60	3.53	22.66
222	0.739	0.139	18.77	3.53	25.83
225	0.864	0.139	21.95	3.53	29.01
230	1.114	0.139	28.30	3.53	35.36
332	1.239	0.210	31.47	5.33	42.13
340	1.864	0.210	47.35	5.33	58.01
350	2.614	0.210	66.40	5.33	77.06
440	3.614	0.275	91.80	6.99	105.77
460	5.614	0.275	142.60	6.99	156.57

13. International Size Standards — JIS B 2401 (Japanese Industrial Standard)

JIS B 2401 defines O-ring dimensions for use in hydraulic and pneumatic equipment manufactured to Japanese standards. It is organised into series G (general), P (piston), and S (static). Widely used in Japan and by Japanese OEMs globally. Dimensions are in millimetres. Limited sizes shown below, for more sizes, contact Bharati Solutions.

JIS Series	CS (mm)	Application	ID Range (mm)	Increments (mm)
P (Piston)	2.4	Dynamic piston seals	3.8 – 200	0.5 / 1.0 / 2.0
G (General)	3.1	General static/dynamic	6.0 – 280	1.0 / 2.0 / 5.0
G (Wide)	5.7	Large bore static	50 – 600	5.0 / 10.0
V (Vacuum)	3.0	Vacuum flanges	25 – 250	5.0 / 10.0
S (Static)	3.5	Static face seals	6.0 – 600	1.0 / 2.0 / 5.0

JIS B 2401 — P-Series Selected Sizes (CS ≈ 2.4 mm)

JIS No.	ID (mm)	CS (mm)	OD (mm)
P-3	2.8	2.4	7.60
P-4	3.8	2.4	8.60
P-5	4.8	2.4	9.60
P-6	5.8	2.4	10.60
P-7	6.8	2.4	11.60
P-8	7.8	2.4	12.60
P-9	8.8	2.4	13.60
P-10	9.8	2.4	14.60
P-10.5	10.3	2.4	15.10
P-11	10.8	2.4	15.60
P-11.2	11.0	2.4	15.80
P-12	11.8	2.4	16.60
P-14	13.8	2.4	18.60
P-15	14.8	2.4	19.60

JIS No.	ID (mm)	CS (mm)	OD (mm)
P-16	15.8	2.4	20.60
P-18	17.8	2.4	22.60
P-20	19.8	2.4	24.60
P-22	21.8	2.4	26.60
P-22.4	22.1	2.4	26.90
P-24	23.7	2.4	28.50
P-25	24.7	2.4	29.50
P-26	25.7	2.4	30.50
P-28	27.7	2.4	32.50
P-29	28.7	2.4	33.50

14. International Size Standards — DIN 3771 (German Standard)

DIN 3771 specifies O-ring dimensions used predominantly in German and wider European engineering. Published by Deutsches Institut für Normung (DIN). The standard is closely harmonised with ISO 3601, and many sizes are interchangeable. Dimensions in millimetres. Limited sizes shown below, for more sizes, contact Bharati Solutions.

DIN Size Designation	ID × CS (mm)	OD (mm)	ID Tol. (mm)	CS Tol. (mm)
3 × 1.5	3.0 × 1.5	6.00	± 0.10	± 0.08
4 × 1.5	4.0 × 1.5	7.00	± 0.10	± 0.08
5 × 1.5	5.0 × 1.5	8.00	± 0.10	± 0.08
6 × 1.5	6.0 × 1.5	9.00	± 0.10	± 0.08
8 × 1.5	8.0 × 1.5	11.00	± 0.15	± 0.08
10 × 2	10.0 × 2.0	14.00	± 0.15	± 0.08
12 × 2	12.0 × 2.0	16.00	± 0.15	± 0.08
14 × 2.5	14.0 × 2.5	19.00	± 0.20	± 0.09
16 × 2.5	16.0 × 2.5	21.00	± 0.20	± 0.09
18 × 2.5	18.0 × 2.5	23.00	± 0.20	± 0.09
20 × 3	20.0 × 3.0	26.00	± 0.21	± 0.10
22 × 3	22.0 × 3.0	28.00	± 0.21	± 0.10
25 × 3	25.0 × 3.0	31.00	± 0.26	± 0.10
28 × 3	28.0 × 3.0	34.00	± 0.26	± 0.10
30 × 3	30.0 × 3.0	36.00	± 0.26	± 0.10
32 × 3	32.0 × 3.0	38.00	± 0.30	± 0.10
35 × 3	35.0 × 3.0	41.00	± 0.30	± 0.10
38 × 3	38.0 × 3.0	44.00	± 0.30	± 0.10
40 × 4	40.0 × 4.0	48.00	± 0.35	± 0.10
45 × 4	45.0 × 4.0	53.00	± 0.35	± 0.10
50 × 4	50.0 × 4.0	58.00	± 0.40	± 0.10
55 × 4	55.0 × 4.0	63.00	± 0.40	± 0.10
60 × 5	60.0 × 5.0	70.00	± 0.45	± 0.13
70 × 5	70.0 × 5.0	80.00	± 0.45	± 0.13
80 × 5	80.0 × 5.0	90.00	± 0.50	± 0.13
90 × 5	90.0 × 5.0	100.00	± 0.55	± 0.13
100 × 6	100.0 × 6.0	112.00	± 0.55	± 0.15
120 × 6	120.0 × 6.0	132.00	± 0.60	± 0.15
150 × 8	150.0 × 8.0	166.00	± 0.70	± 0.20
200 × 8	200.0 × 8.0	216.00	± 0.80	± 0.20

15. Product Range & Compound Codes

Bharati Solutions supplies a comprehensive range of O-rings and elastomeric sealing products manufactured to ISO 9001:2015 quality standards, with over 30,000 standard sizes and in-house compound development and testing. The following is a summary of key product families available.

Product Family	Designation	Standards Met	Available Compounds	Shore Hardness
Standard O-Rings	Series G	AS 568 / ISO 3601 / DIN	NBR, FKM, EPDM, VMQ, CR, HNBR	40–90 ShA
Metric O-Rings	Series M	ISO 3601 / DIN 3771	All standard + FFKM	50–90 ShA
British Standard O-Rings	Series BS	BS 1806	NBR, FKM, EPDM, VMQ	60–90 ShA
JIS O-Rings	Series J	JIS B 2401 P/G/V/S	NBR, FKM, EPDM, HNBR	60–80 ShA
FFKM / Kalrez® Type	Series FF	ISO 3601	FFKM various grades	65–80 ShA
Food Grade O-Rings	Series FG	FDA 21 CFR, EC 1935	VMQ, EPDM, FKM, Silicone	50–80 ShA
High-Temperature FKM	Series HT	ISO 3601	FKM 75 ShA – Bi-component	70–90 ShA
Low-Temp Silicone	Series LT	ISO 3601	VMQ, PVMQ	40–80 ShA
HNBR (Sour Service)	Series SG	NORSOK M-710 compatible	HNBR 70/80/90 ShA	70–90 ShA
Encapsulated (FEP/PFA)	Series ENC	ISO 3601	FEP/PFA jacket, FKM/VMQ core	—
PTFE Backup Rings	Series BR	ISO 3601-4	Virgin PTFE, Filled PTFE	—
Coloured O-Rings	Series COL	Customer spec.	All compounds, 12 colours	Per base compound
Custom / Non-standard	Series CS	Per customer drawing	All compounds incl. Aflas, XNBR, PU	40–95 ShA

Standard Compound Code Reference

Code	Compound	Hardness (ShA)	Base Color	Temp Range
N50 / N60 / N70	Nitrile (NBR)	50 / 60 / 70	Black	-40 to +120°C
HN70 / HN90	Hydrogenated Nitrile (HNBR)	70 / 90	Black	-40 to +160°C
V60 / V70 / V75	Fluorocarbon (FKM)	60 / 70 / 75	Black / Brown	-20 to +200°C
V80-LT	Low-Temp FKM (GF-S)	75–80	Brown / Green	-40 to +200°C
PF70	Perfluoroelastomer (FFKM)	70	Beige / Black	-15 to +310°C
E50 / E70	EPDM	50 / 70	Black / Grey	-55 to +150°C
S40 / S50 / S70	Silicone (VMQ)	40 / 50 / 70	Red / Translucent	-60 to +230°C
CR70	Neoprene (CR)	70	Black	-40 to +120°C
AF70	Aflas (TFE/P)	70	White / Grey	-10 to +230°C
PU80	Polyurethane	80	Brown / Tan	-40 to +80°C

16. Quality, Certifications & Testing Standards

Products supplied by Bharati Solutions are manufactured under a rigorous quality management framework. All products carry full material traceability and are supported by material test reports (MTR) upon request.

Standard / Certification	Scope	Availability
ISO 9001:2015	Quality Management System — full manufacturing process	Factory certified
ISO 3601-3 Grade N	O-ring quality acceptance — defect classification and AQL levels	Standard supply
ISO 3601-3 Grade S	Stricter AQL — critical / safety applications	On request
FDA 21 CFR 177.2600	Food contact compliance — elastomeric materials	FG-series parts
EC Regulation 1935/2004	EU food contact materials	FG-series parts
NORSOK M-710 Ed.3	Qualification of non-metallic seals for oil & gas	HNBR/FKM/FKM on request
RoHS / REACH	Restriction of hazardous substances	Standard compliance
USP Class VI	Biocompatibility — pharmaceutical / medical applications	VMQ/FKM grades
AMS 7276 / AMS 7291	Aerospace material specifications	Select compounds
ASTM D2000 / SAE J200	Classification of rubber compounds	Referenced in data sheets
DIN 53504 / ISO 37	Tensile strength & elongation testing	Per compound batch
ISO 48-4	Hardness testing (IRHD / Shore A)	Per compound batch
ISO 1817 / ASTM D471	Resistance to liquids (volume change)	Qualification testing

17. Storage, Handling & Installation Guidelines

Parameter	Recommendation	Standard Reference
Storage Temperature	10–25°C preferred; never exceed 40°C	ISO 2230, DIN 7716
Humidity	45–75% RH; avoid condensation	ISO 2230
UV / Ozone Exposure	Store away from fluorescent lights and ozone sources (motors, welding equipment)	ISO 2230
Packaging	Store in original sealed polyethylene bags; avoid coiling or stressing	ISO 2230
Shelf Life (NBR/EPDM)	5 years from manufacture date when stored correctly	ISO 2230 Class 3
Shelf Life (FKM/VMQ)	20 years from manufacture date when stored correctly	ISO 2230 Class 1
Shelf Life (CR / PU)	5 years from manufacture date	ISO 2230 Class 3
Installation — Lubrication	Use compatible lubricant (system fluid, silicone grease, or PTFE spray)	Installation guide
Installation — Stretch Limit	Do not stretch O-ring >50% of free ID during installation	ISO 3601-1
Installation — Temperature	Allow cold O-rings to reach ambient temperature before installation	Installation guide
Installation — Tooling	Use smooth, radius-chamfered assembly tools; never use metal picks or sharp instruments	Installation guide
Thread / Spline Lead-In	Cover threads with sleeve or tape to prevent cutting during assembly	Installation guide

18. Ordering & Technical Support

Bharati Solutions provides direct access to a comprehensive O-ring and elastomeric sealing product range. Standard catalogue items are ex-stock from our Delhi inventory. Non-standard, large-quantity, or critical-service orders are fulfilled on a lead-time basis.

How to Specify an O-Ring Order

Information Required	Example	Why It Matters
Size standard & part number	AS 568-214 or ISO 3601 20x3	Unambiguous dimension reference
Inside Diameter x Cross Section (mm)	ID 20.00 x CS 3.00 mm	Required if no standard part number
Compound Code / Material	V75 (FKM 75 ShA)	Ensures correct chemical/thermal grade
Shore Hardness	70 ShA (if not in compound code)	Controls deformation and extrusion resistance
Quality Grade	ISO 3601-3 Grade N or S	Acceptance quality level
Quantity	500 pieces	Stock or indent order planning
Application Details	API 6A gate valve, sour gas service	Enables technical validation
Certifications Required	MTR, NORSOK M-710, FDA	Documentation for QA/QC

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For technical queries, material selection assistance, non-standard O-ring design, or compound data sheets, contact our engineering team. We provide site visits for critical applications.

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