



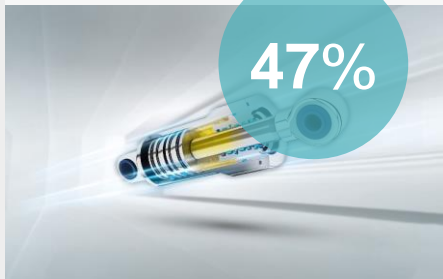
Trelleborg Sealing Solutions

Aerospace

Jan Froněk

Leading global supplier of Sealing Solutions

Industrial



47%

Key Segments:

Off-highway, Semicon, Food, Beverage & Water, Fluid Power

Auto, Truck & Transportation



31%

Key Applications:

fuel systems, steering, air conditioning, exhaust, ride control

Aerospace



11%

Key Applications:

engines, flight control actuators, landing gear, airframes, wheels, brakes, interiors

Healthcare & Medical



11%

Key Applications:

components for medical & drug eluting devices, surgical & diagnostic equipment, biopharmaceutical processing equipment



TSS Aerospace in a nutshell

+227m€

Global Aero turnover 2023

2010

founded

Zero defect

& AS 9100

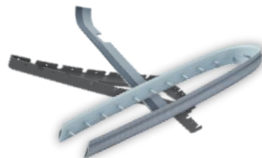
specialized



Hydraulic & Actuation



Airframe seals



Engine



Interiors



Space



Aftermarket

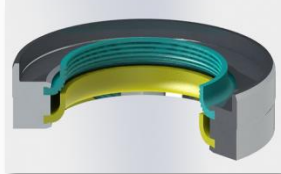


Industry Leading Aerospace Product Range

Supplied through a single point of contact



Hydraulic & Actuation
Sealing Systems



Rotary Seals



Metallic Seals & other
Trelleborg Products



Static Seals &
O-Rings



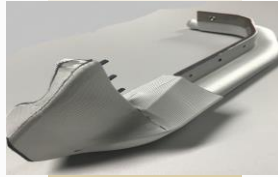
Engineered
Molded Parts



Bearings & Bushings



Engine & Fire Seals



Customized Airframe
Seals



Custom Molded
Solutions



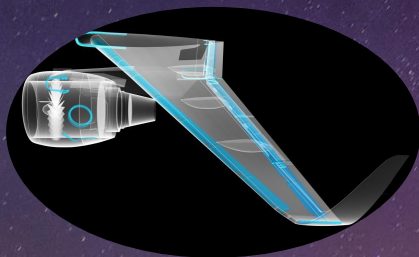
Extruded Profiles

Trelleborg Sealing Solutions Aerospace (TSSA)

Leading positions in selected segments



Hydraulic &
Actuation



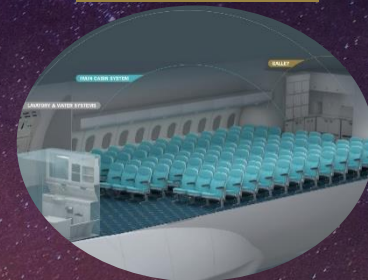
Airframes



MRO



Engines

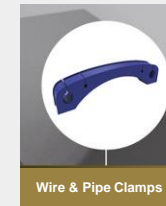
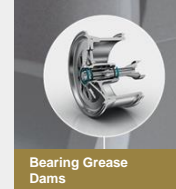
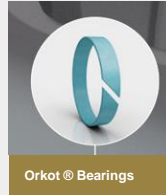
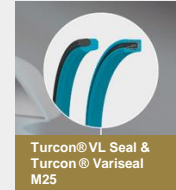


Interiors

Hydraulic and Actuation

TRENDS

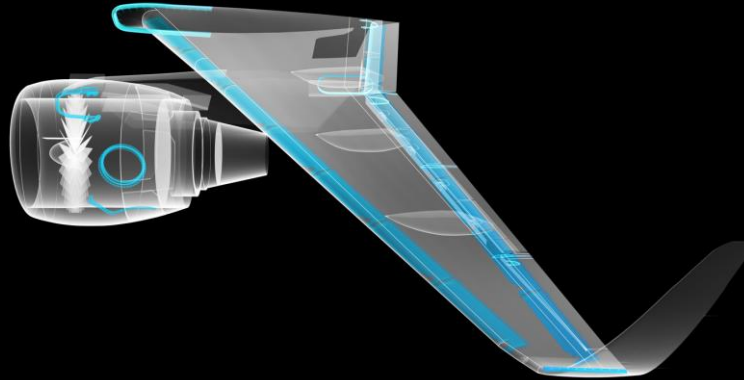
- Hydraulic seal performance are now near 100% aircraft life = Sealed for Life
- Electrification drives EMA
- TSS now focus on rotary and static seals
- TSS offers complimentary products like Wire Clamps and Grease Dams to increase share of wallet
- TSS Offers light weight bearings to replace metal bearings
- TSS targets the lucrative Brake seal aftermarket



Airframe

TRENDS

- Wing profile optimization to reduce drag challenge seal design
- Folding wingtips
- Composite parts replace metal parts
- Better fire seals reduce fire risk
- Lightweight silicone materials reduce weight of components



Strakelet
Seals



Flap Seal



Pylon Fire
Seals



Shroud
Seals



Aileron
Seals



Seals with
composite
inserts

Engine Solutions

TRENDS

- Higher temperatures increase efficiency
- Variable By-Pass Valve (VBV) system cut fuel consumption
- Seals must be compatible with Synthetic Aviation Fuel (SAF)
- Hydrogen burning engines in development runs at higher temperatures



Trust reverser seals



PDR seals for gear boxes



VBV door seals



Turbine blade seals



Metal seals

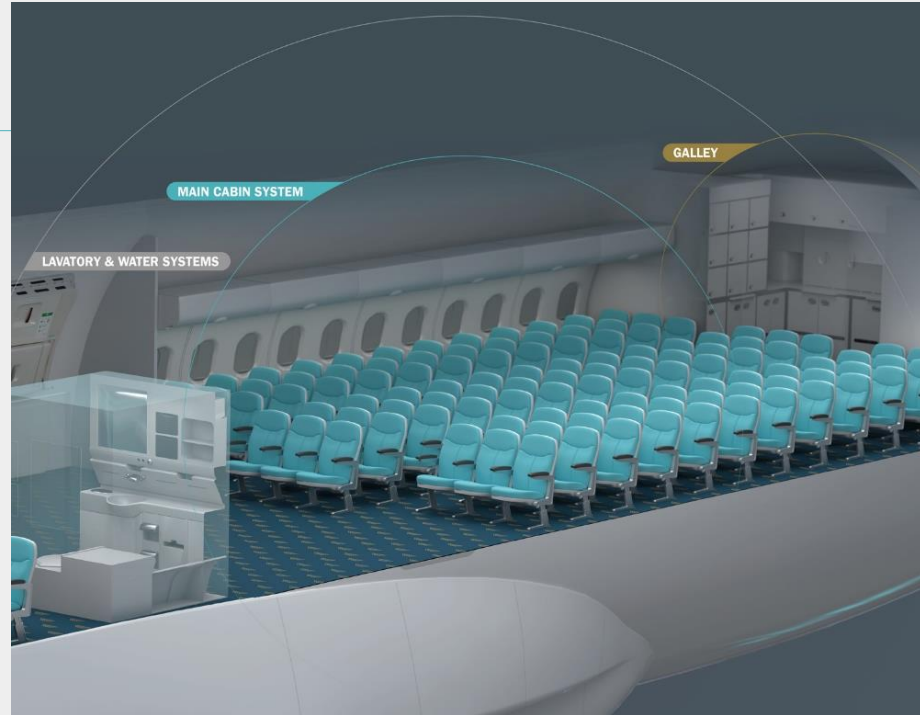


High Temperature elastomer seals

Interiors

TRENDS

- Suppliers with full range capacity are preferred
- Increased use of composites
- Continuous drive to reduce weight opens opportunities for injection molded components
- TSS capabilities suitable expansion into MRO market



MAIN CABIN SYSTEM



Elastomer/Composite parts



Window Seal

GALLEY



FoodPro® Static & Dynamic Seals



Engineered Molded Parts

LAVATORY & WATER SYSTEMS



Injection Molded Components



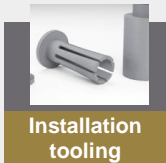
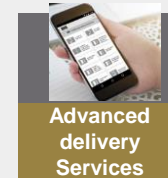
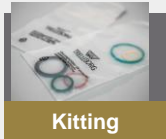
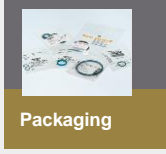
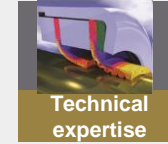
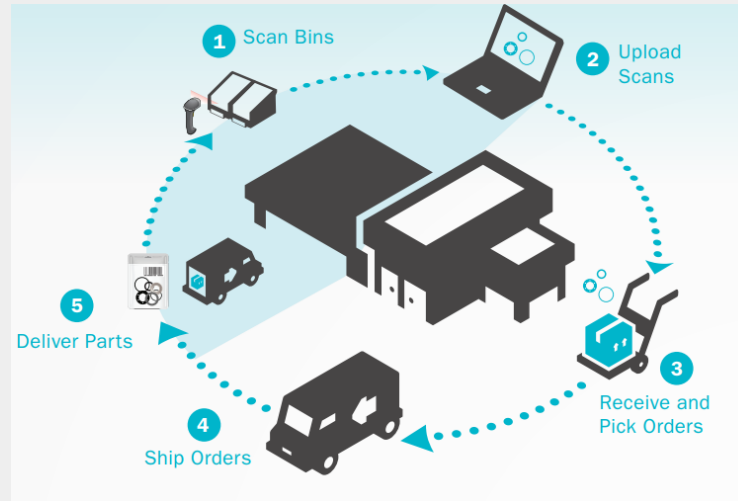
Custom-Molded Elastomers

- Components

Maintenance Repair & Overhaul (MRO)

TRENDS

- Few, but big distribution companies controls the market
- Suppliers with large portfolio and technical expertise preferred
- Request for Special Packaging and Kitting
- Requests for Advanced Delivery
- TSS ServicePLUS is ideal for this Market



Landing Gear Sealing Solutions



- ▶ Seals, Bearings, Scrapers, Line Blocks & Clamping Bands
- ▶ Resistance to high peak pressures
- ▶ High side-load applications
- ▶ High frequency operation
- ▶ Nitrogen & oil separation
- ▶ -54°C operational requirements

TSS has proven that with proper design of the seal and bearing system 25.000 landings is achievable.

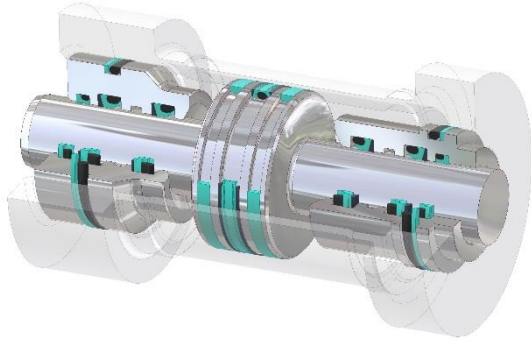


Wheel & Brake System Sealing Solutions

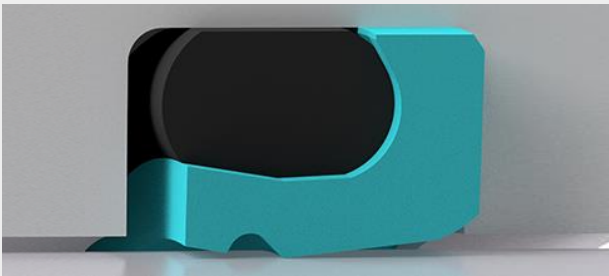


- ▶ Rotary & linear sealing
- ▶ High & low temperature extremes
- ▶ Contaminated environment
- ▶ Aggressive fluid resistance
- ▶ Arduous duty cycles
- ▶ Zero leakage requirements

Flight Control Sealing Solutions



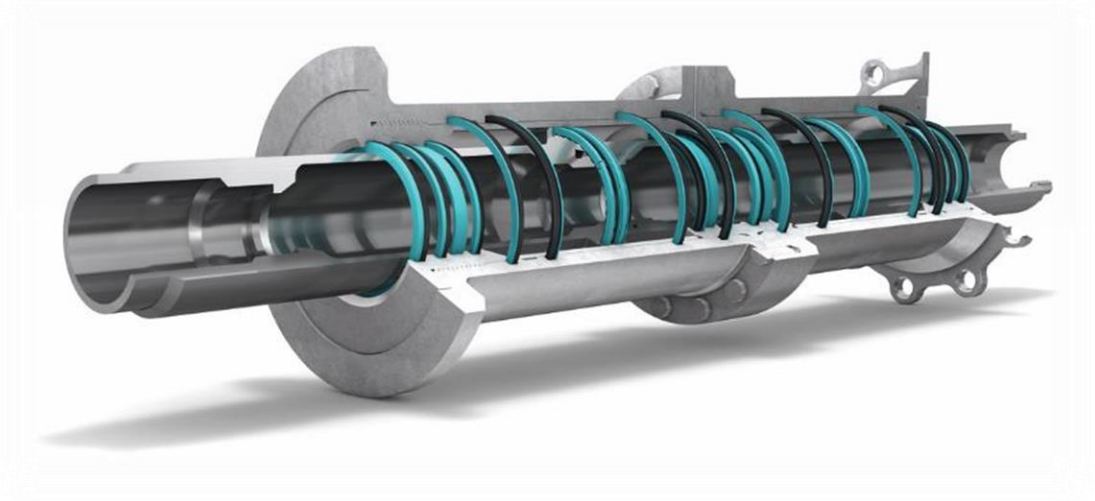
- ▶ Primary & secondary flight controls
- ▶ High frequency tandem sealing
- ▶ Low friction
- ▶ Up to 5000 psi environment
- ▶ Low hysteresis
- ▶ Phosphate Ester compatibility
- ▶ Bespoke hardware compatibility
- ▶ Stick slip free
- ▶ Low torque requirements
- ▶ Universal fluid resistance



TSS tandem VL-seal system has been qualified at 185.000 FH = Sealed for Life!
The Turcon® VL Seal® II is now available and shows even better performance.

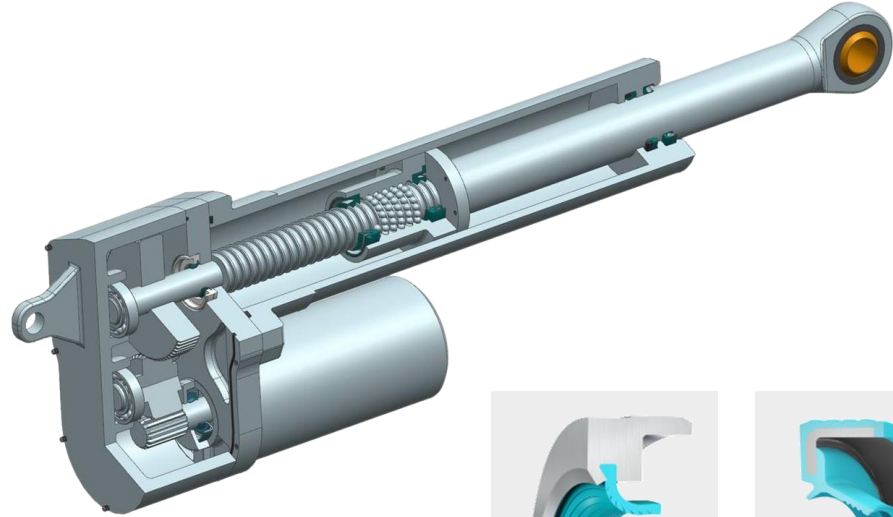
Helicopter Rotor Actuation Sealing Solutions

- ▶ Short stroke actuation
- ▶ Millions of cycles
- ▶ Titanium hardware
- ▶ -54°C - 135°C operational environment
- ▶ Focus on exclusion of dust and sand

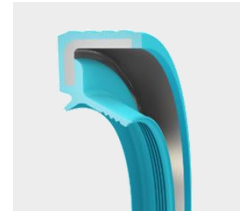


EMA Sealing Solutions

- ▶ Electro Mechanical Actuation (EMA)
- ▶ Rotary sealing
- ▶ Low, but varying pressure +/- 1 Bar
- ▶ Sealing against water ingress
- ▶ Compatibility with grease & lubrication oils
- ▶ -54°C - 135°C operational environment
- ▶ TSS offers conductive PTFE and elastomer seals (EMI protection)



HiSpin™ PDR RT



HiSpin™ HS40

Airframe Sealing Solutions

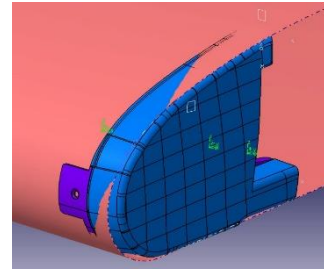
Comprehensive range of aerodynamic and environmental airframe seals

- ▶ Leading Edge / Trailing Edge Wing Seals
- ▶ Fairings
- ▶ Fuselage Seals
- ▶ Panel Seals
- ▶ Door Seals
- ▶ Nacelle Applications

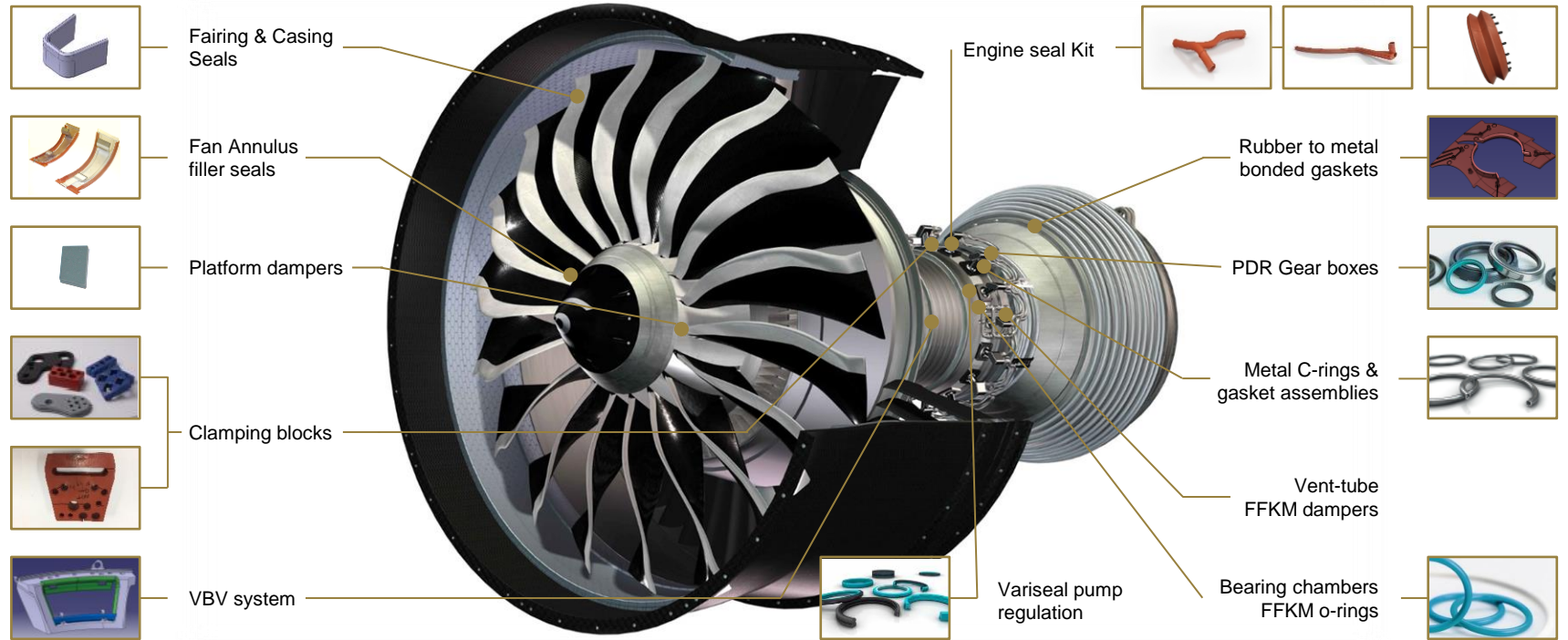


Air Frame Seals Capabilities

A320 Cushion Seals



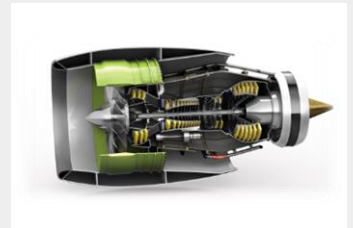
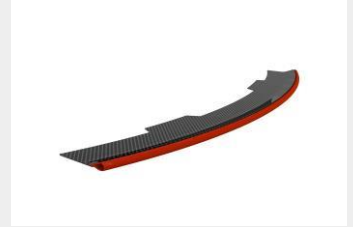
Trelleborg Aero Engine Sealing Solutions



Aero Engine Sealing Solutions

Comprehensive range of aero engine & ducting seals

- ▶ Annulus Fillers Seals
- ▶ Bleed Air Seals
- ▶ Ducting
- ▶ Fire Seals
- ▶ Custom Geometries
- ▶ VBV Door Seals
- ▶ Metal Seals



Sealing Civil Aviation

- ▶ **Airbus:** A220, A320, A340, A380, A350, A320NEO, A330 NEO, A321XLR
- ▶ **Boeing:** 717, 737, 747, 757, 767, 787, 737Max
- ▶ **Bombardier:** CRJ200/700,
- ▶ **Embraer:** ERJ135, ERJ145, 170
- ▶ **Dassault:** Falcon 7X & 8X
- ▶ **Other:** ARJ-21, C919,



Sealing Military Aviation

- ▶ **BAE Systems:** Harrier, Hawk, Tornado
- ▶ **Boeing:** F/A-18, T-45, V-22, B-1B, C-17
- ▶ **Lockheed Martin:** C-130J, F-117, F-22, F-35,
- ▶ **McDonnell Douglas:** F-15,
- ▶ **General Dynamics:** F-16
- ▶ **Eurofighter:** Typhoon,
- ▶ **BAE:** Tempest
- ▶ **Dassault:** Mirage 2000, Rafale,
- ▶ **SAAB:** Gripen JAS 39 & JAS 39 NG



Sealing Helicopters

- ▶ **Airbus Helicopter:** NH90, Tiger, HS125, H135, H145, H155, H160, H175, H215, H225
- ▶ **Sikorsky (LM):** S-92, S-76 , Blackhawk
- ▶ **Boeing:** CH-47, AH-64 Apache, V-22, RAH-66
- ▶ **Leonardo:** AW109, AW101, AW139, AW159, AW169, AW609
- ▶ **Bell:** B525
- ▶ **Robinson:** R66



Learn more...



Films

- ▶ [Sealing Solutions for Aerospace](#)
- ▶ [Sealing Solutions for Jet Engines](#)

Webinars

- ▶ [Ultra High Temperature Seal](#)
- ▶ [Counter Surfaces - Aerospace Applications](#)
- ▶ [Orkot® C620](#)
- ▶ [Zurcon® Excluder® ESA](#)
- ▶ [Airframe Manufacturing Capabilities](#)
- ▶ [Turcon® VL Seal® II](#)
- ▶ [Aircraft Galley Polymer Capabilities](#)
- ▶ [Aircraft Interior Solutions](#)
- ▶ [Simulation for Customer Projects](#)



Catalogs

- ▶ [Aerospace Sealing Systems – Product Guide & Engineering catalog](#)
- ▶ [Hydraulic seal main catalog](#) metric version
- ▶ [Hydraulic seal main catalog](#) inch version

Brochures

- ▶ [Aerospace Sealing Capabilities](#)
- ▶ [Aerospace Airframe & Engine Seals](#)
- ▶ [Orkot® C620](#)



Apps

- ▶ [O-Ring Selector](#)
- ▶ [Aerospace SAE Groove Selector App](#)
- ▶ [Unit & Hardness Converter](#)
- ▶ [Mechanical Engineering Formula Calculator](#)

Web tools

- ▶ [CAD Service](#)
- ▶ [Material search tool](#)
- ▶ [Chemical Compatibility Check](#)
- ▶ [Aerospace Groove Selector](#)
- ▶ [O-Ring Calculator](#)
- ▶ [Area & Volume Calculator](#)
- ▶ [ServicePLUS Website](#)



