

# EDGE-WELDED METAL BELLOWS SOLUTIONS FOR OIL & GAS APPLICATIONS

Enhancing Reliability, Longevity, and Efficiency in Extreme Environments





## ENGINEERED FOR DURABILITY, CORROSION RESISTANCE, AND MAINTENANCE-FREE OPERATION

In the oil and gas industry, equipment reliability is paramount, especially in demanding downhole conditions. Senior Metal Bellows' edge-welded metal bellows solutions deliver unmatched performance for critical systems, including artificial gas lift valves, volume compensators, and protective barrier seals for electronics. Engineered for durability, corrosion resistance, and maintenance-free operation, our products are designed to withstand extreme pressures, temperatures, and aggressive media encountered in exploration and production environments.

### Gas Lift Valve Seal Assembly

*Optimize Oil Recovery While Reducing Downtime*



As the oil and gas industry advances into deeper waters, working pressures have significantly increased, rendering traditional gas lift valves ineffective. Conventional gas lift valve bellows often fail prematurely under such extreme conditions, leading to costly interventions and reduced production rates.

Senior Metal Bellows has developed a high-pressure patented bellows seal assembly to address these challenges. This innovative design enables gas lift with high injection pressures while delivering an exceptionally long cycle life. The assembly operates reliably at pressures up to 15,000 psi and has been rigorously tested to exceed twice the required cycle life, with plans to push testing to three times the standard.

Our all-metal gas lift valve seal assemblies provide unmatched reliability and consistent performance, optimizing wellbore efficiency and ensuring maximum uptime and productivity.

#### KEY ADVANTAGES:

- Consistent pressure integrity to maximize oil recovery
- Reduces repair costs and extends operational life for long-term performance
- Minimizes downtime and maintenance for uninterrupted production cycles
- High-pressure and high-temperature solutions available for extreme environments



# Volume Compensators

*Reliability for Downhole Tools in Harsh Environments*

Edge-welded metal bellows volume compensators provide essential thermal management and pressure compensation for downhole tools. These components address the challenges posed by dielectric fluid expansion and extreme temperature fluctuations, improving the durability and performance of critical tools in aggressive environments.



## KEY ADVANTAGES:

- Compensates for pressure and temperature variations in dynamic environments
- Eliminates failure-prone rolling bladders and elastomeric components
- Supports high-pressure applications for greater depths and demanding conditions
- Enhances tool reliability in corrosive and high-pressure environments
- Pressure balance across hermetic seal

# Sealing Solutions

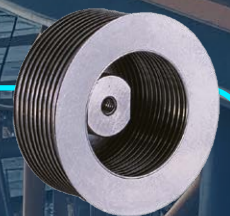
*Protect Critical Equipment and Maintain System Integrity*

Senior Metal Bellows' sealing solutions ensure reliable protection for critical downhole equipment while managing complex thermal and pressure conditions. Our all-metal designs are tailored for maximum compatibility with a wide range of fluids, making them ideal for the most demanding oil and gas applications.



## KEY ADVANTAGES:

- Electronics Cooling: Compensates for pressure changes while isolating dielectric and working fluids
- Protect Critical Equipment: Safeguards accelerometers and sensitive components during downhole activities
- Chemical Compatibility: All-metal construction ensures compatibility with various fluids, including those used in sour gas wells
- Compact and Lightweight: Perfect for space-constrained systems while maintaining superior performance



# EDGE-WELDED VS. FORMED METAL BELLOWS

## *Technical Advantages Comparison*

When selecting a bellows solution for critical applications, it is essential to understand the differences between edge-welded and formed metal bellows. Each technology offers distinct advantages depending on the operational requirements, such as cycle life, flexibility, and space constraints.



### Edge-Welded Metal Bellows

*Superior Performance for Demanding Applications*

Edge-welded bellows are specifically designed for applications that require high cycle life, precision movement, and the ability to operate within constrained spaces.

#### KEY ADVANTAGES:

##### High Cycle Life

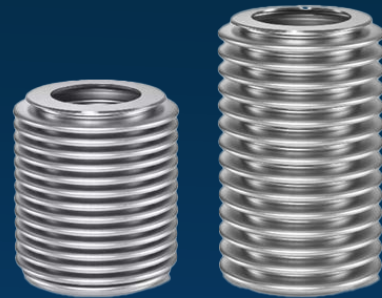
Edge-welded bellows are ideal for applications requiring frequent and consistent operation without compromising performance

##### Extended Stroke Capability

They can achieve up to 90% stroke in compression and up to 20% in extension, depending on the design, allowing for greater flexibility

##### Compact Design

Ideal for space-constrained environments where maximum efficiency is required within minimal packaging



### Formed Bellows

*Traditional Design with Limitations*

Formed bellows, while widely used in various applications, have inherent limitations compared to edge-welded designs.

#### KEY CONSIDERATIONS:

##### Higher Spring rates

Formed bellows typically exhibit much higher spring rates, which can create operational inefficiencies in sensitive applications

##### Limited Stroke

They generally allow only about 10% of their overall length in stroke capacity, which can restrict their effectiveness in applications requiring significant expansion or contraction

##### Envelope Constraints

While formed bellows can be effective for applications without strict packaging limitations, they do not provide the same level of flexibility and adaptability as edge-welded designs

# Technical Advantages of Edge-Welded Metal Bellows Solutions

*Engineered for The Most Extreme Conditions*

## ALL-METAL CONSTRUCTION

Long-lasting performance under extreme conditions

## CORROSION RESISTANCE

Materials like stainless steel, titanium, and high-nickel alloys for use in sour gas and corrosive environments

## MAINTENANCE-FREE DESIGN

Eliminates common issues such as wear, stiction, and leakage

## COMPACT & LIGHTWEIGHT

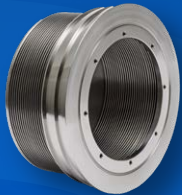
Optimized for high-performance in space-limited applications

## Applications at a Glance *Trusted Solutions Across Oil & Gas Operations*



### Gas Lift Valve Seal Assemblies:

Edge-welded metal bellows technology allows for optimized stroke at higher pressure, enabling deeper wells



### Volume Compensators:

Provides reliable thermal management and pressure compensation for downhole tools



### Sealing Solutions:

Protects sensitive electronics and maintains fluid isolation in critical applications

# Vertically-Integrated Facility from Design to Production Manufacturing



## DESIGN

The design process begins with a thorough understanding of the customer's specific requirements for their custom engineered metal bellows solution.



## PROTOTYPING

Prototypes can be created and tested to validate the design, ensuring proper function and performance before the manufacturing process begins.



## TESTING

All products undergo thorough testing, including pressure, life cycle and/or leak testing, to verify its ability to perform as required in real-world applications.



## PRODUCTION MANUFACTURING

The final design is then manufactured using advanced techniques to produce consistent, high-quality metal bellows components that meet the customer's specific requirements and specifications.