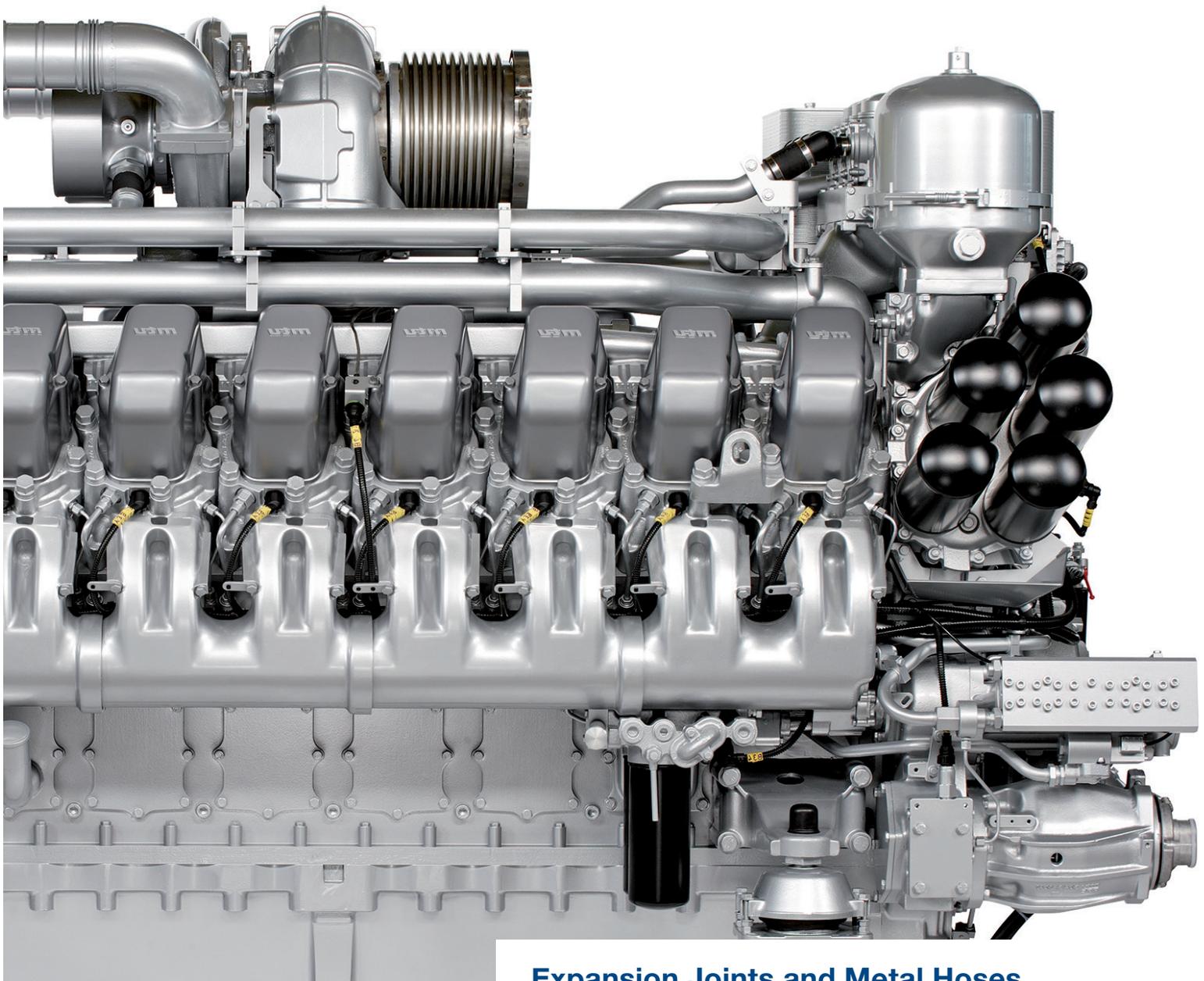




**BOA industrial**  
Build On Advantages



**Expansion Joints and Metal Hoses  
for Heavy Engines, Shipbuilding and  
Rail Cars**

# BOA Group – The Global Player – Your Local Partner!

The BOA Group is one of the world's leading manufacturers of flexible mechanical elements for the automotive industry, for the aerospace industry and for a wide range of industrial applications.

The headquarter is based in Stutensee near Karlsruhe / Germany. With its 20 subsidiaries in 11 countries, BOA is one of the largest international companies developing and producing expansion joints, metal bellows and flexible metal hoses for any kind of piping system transporting fluids or gases.

## BOA Diesel Exhaust Technology and Competencies

Over decades BOA has become an expert in design and manufacture of flexible metal hoses and expansion joints for Diesel & Gas Engine Exhaust and Emissions Technology.

Whether the exhaust system is installed in a passenger car, in a heavy truck, in agricultural or other commercial special vehicles, in Diesel locomotives or in ocean liners, BOA develops the right flexible solutions:

- Durable
- Engine vibration resisting
- Vibration damping
- Leakage free
- Economical

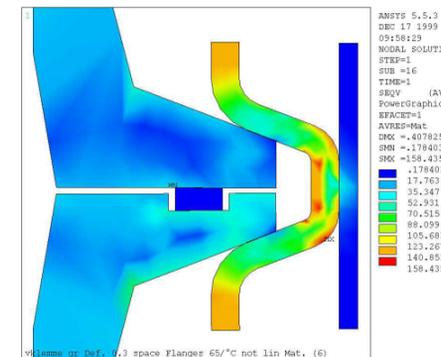
### Competencies:

- Design of specific customized solutions
- State of the art CAD and FEM engineering tools
- Expertize in vibration analysis
- Multilayer bellows technology for optimum vibration performance
- Exhaust pipe system and interface expertize
- Welding / assembling of systems or subsystems



## Special products according to individual requirements

Our customers may choose between flexible components only or complete system solutions including all interfaces.



BOA V-Clamp



BOA exhaust systems / BOA expansion joints for exhaust manifold



BOA metal hoses for turbo chargers

## Diesel and Gas engines – BOA technology for integrated systems

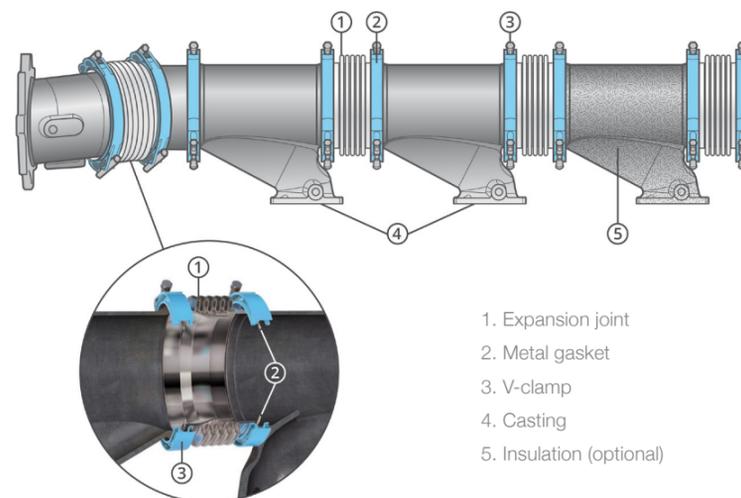
Being the global pioneer of high temperature, pressure and vibration resistant multilayer bellows technology, BOA has been extending its expertise in the field of 2 stroke and 4 stroke engine exhaust technology and offers today full system capabilities including:

- Light weight and quick fit expansion joints
- Temperature and load resistant castings made of SiMo or Ni Resist (over 700 °C)
- Metal gasket interface
- FEM analyzed leakage free V-clamp

### Customer benefits:

- Leakage free system with engineered interfaces
- Full BOA quality responsibility for entire system
- Lower number of suppliers, easier logistics
- Up to 50% weight and 30% system cost reduction compared to standard flange solutions
- Easy maintenance and 50% assembling time compared to standard flange solutions
- Compact design

Example for exhaust manifold in detail



## On track with performance – BOA solutions for railway technology

Diesel locomotives have specific exhaust system requirements related to leakage, vibration and noise damping. Accumulated know-how and our long experience are making BOA a valued partner for exhaust components and systems within the railway industry.

Electric motors, transformers and more and more comfortable cabins require reliable cooling systems. BOA metal hoses fulfill the rail industry standards.

### Product applications include:

- Expansion joints
- Metal hoses
- PTFE insulating hoses for pantographs

Passengers comfort – performance in the cargo division: Rail vehicles run with BOA products for vibration and noise damping, for air conditioning systems, electrical insulation and to compensate thermal expansion.



## Less vibration, more performance – BOA solutions for shipbuilding

BOA is particularly strong where Ships need to reduce vibration. BOA Multilayer Expansion Joints are typically used in the engine manifold of ship engines (main engine, auxpac units, bow thruster) and in the Ship Exhaust System.

Reliable engineering for reliable products. Our engineering services include:

- Exhaust pipeline design analysis for proper integration of bellows and support brackets
- Expansion Joint sketch sheet showing design conditions and materials
- Bellows Design analysis including number and thickness of plies, resulting stress values, fatigue life cycle, resulting stiffness values and bellows pressure thrust
- Bellows frequency analysis for optimized number of plies, thickness and bellows geometry

### Product applications include:

- Expansion joints for exhaust manifold and exhaust pipe
- Expansion joints for pressure piping systems
- Metal transfer hoses or “Dock Hoses” used to transfer cargo from the ship to the dock or special storage locations

## Energy for the world – technology for LNG carriers

Huge vessels with a total gross weight of up to 350.000 tonnes are transporting liquefied natural gas across the oceans. These specific tankers carry up to 265.000 cubic meters of gas at a temperature of  $-163\text{ }^{\circ}\text{C}$ . Expansion Joints type “SFZ” which are integrated in the gas pipelines on board have to fulfill most severe conditions due to high temperature differences between  $+50\text{ }^{\circ}\text{C}$  and  $-163\text{ }^{\circ}\text{C}$  and sometimes stormy weather conditions including stresses in the body of the carrier and its

pipelines. Our specific expansion joints type “SFZ” have to survive 2.000.000 cycles under 10 bar working pressure and have to be fulfill highest safety requirements of the IGC (International Gas Code) as well as International Maritime Organization. The BOA Group is in this demanding business since 1972 and is supplier to all well known Asian shipyards. Special bellows geometries and forming processes have been invented in order to fulfill highest product and market requirements.

### Product applications:

- Liquid line
- Gas line
- Gas Dome
- Deck pieces
- Punching devices



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