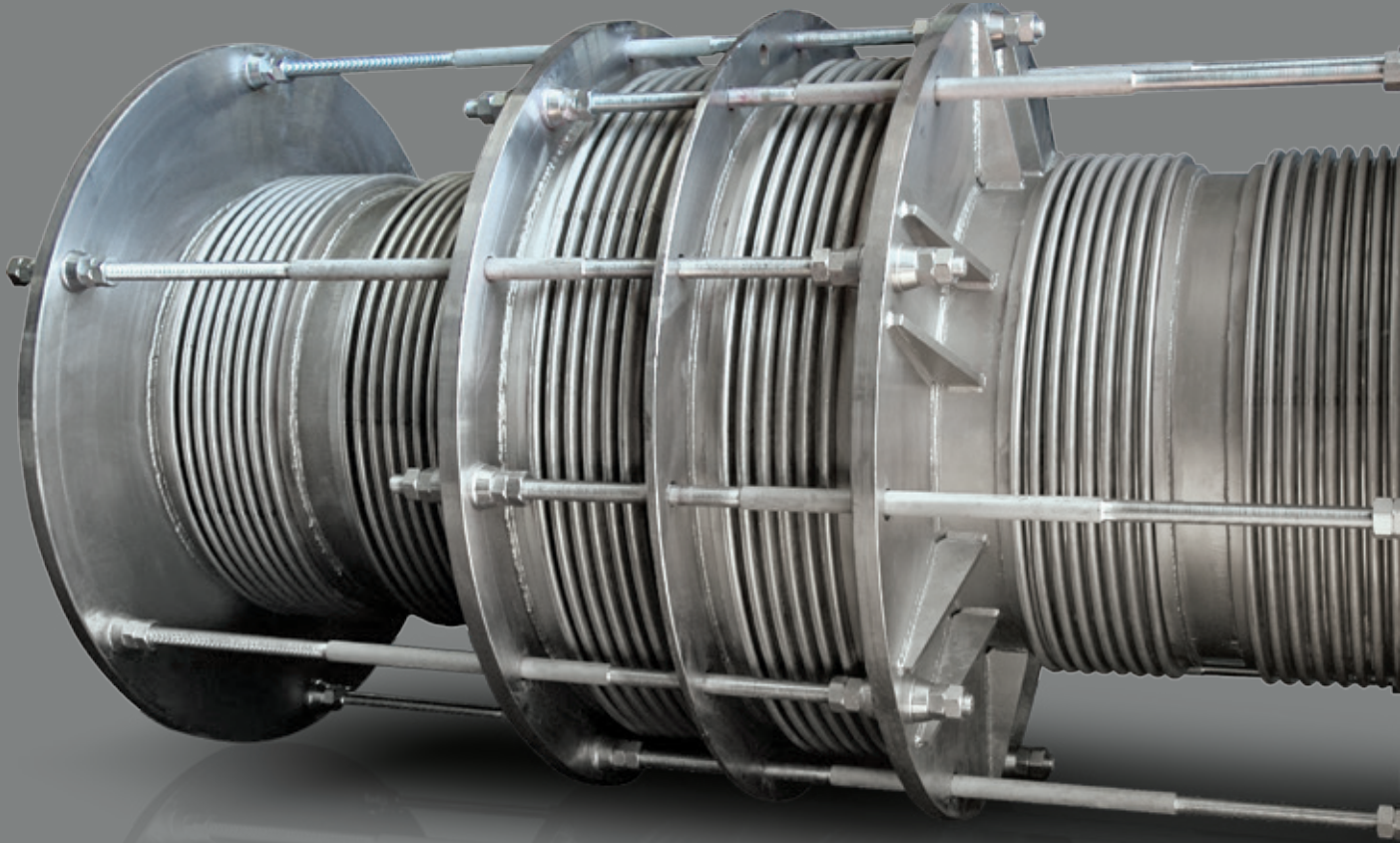


FLEXIBLE SOLUTIONS  
FOR INDUSTRY



# EXPANSION JOINTS

for **POWER GENERATION & ENERGY**









# PRESSURE BALANCED EXPANSION JOINTS

## FOR GEOTHERMAL ENERGY

Ayvaz uses its extensive experience in producing expansion joints for Geothermal power generation piping systems with a remarkably impressive reference list.

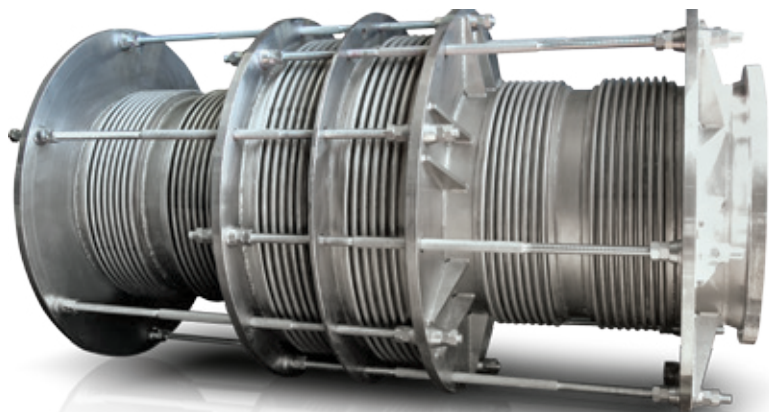
### GEOTHERMAL POWER

One common feature of most of power generation systems is to convert heat to electricity. In geothermal power plants, heat is provided by Earth (Geo) Energy is accessed by drilling water or steam wells by very similar method used for drilling for crude oil.

Geothermal power plants have similar components which are already used for traditional power generation systems likewise turbines, generators, transformers and other equipment.

### PRESSURE BALANCED EXPANSION JOINTS

- Bellows design for Isopentane vapour
- High pressure & full vacuum
- Combined axial and lateral movements



# PRESSURE BALANCED EXPANSION JOINTS FOR GEOTHERMAL ENERGY

## BENEFIT

A pressure balanced expansion joint is used to accommodate and counteract the bellows pressure thrust. An additional bellows joins to the construction to incorporate into the unit and is subject to the line pressure to generate a force equal and opposite to that on the main bellows. Connecting all these bellows together neutralizes the pressure load on the construction.

Pressure balanced expansion joints are generally installed at changes of direction in piping (elbow type) but in-line types are also available.

Use of pressure balanced expansion joints helps the piping designers not to create main anchors to accommodate combined movements at the direction changing points

Limited number of manufacturers design and manufacture pressure balanced expansion joints requires a great deal of knowledge and expertise.

Ayvaz is a member of this exclusive group.







## DIMENSIONS

Pressure balanced expansion joints designed and manufactured by Ayvaz are units typically ranging up to DN 1000-2000, 8-10 tons in weight and up to 8 meters in length.

## REFERENCE PROJECTS

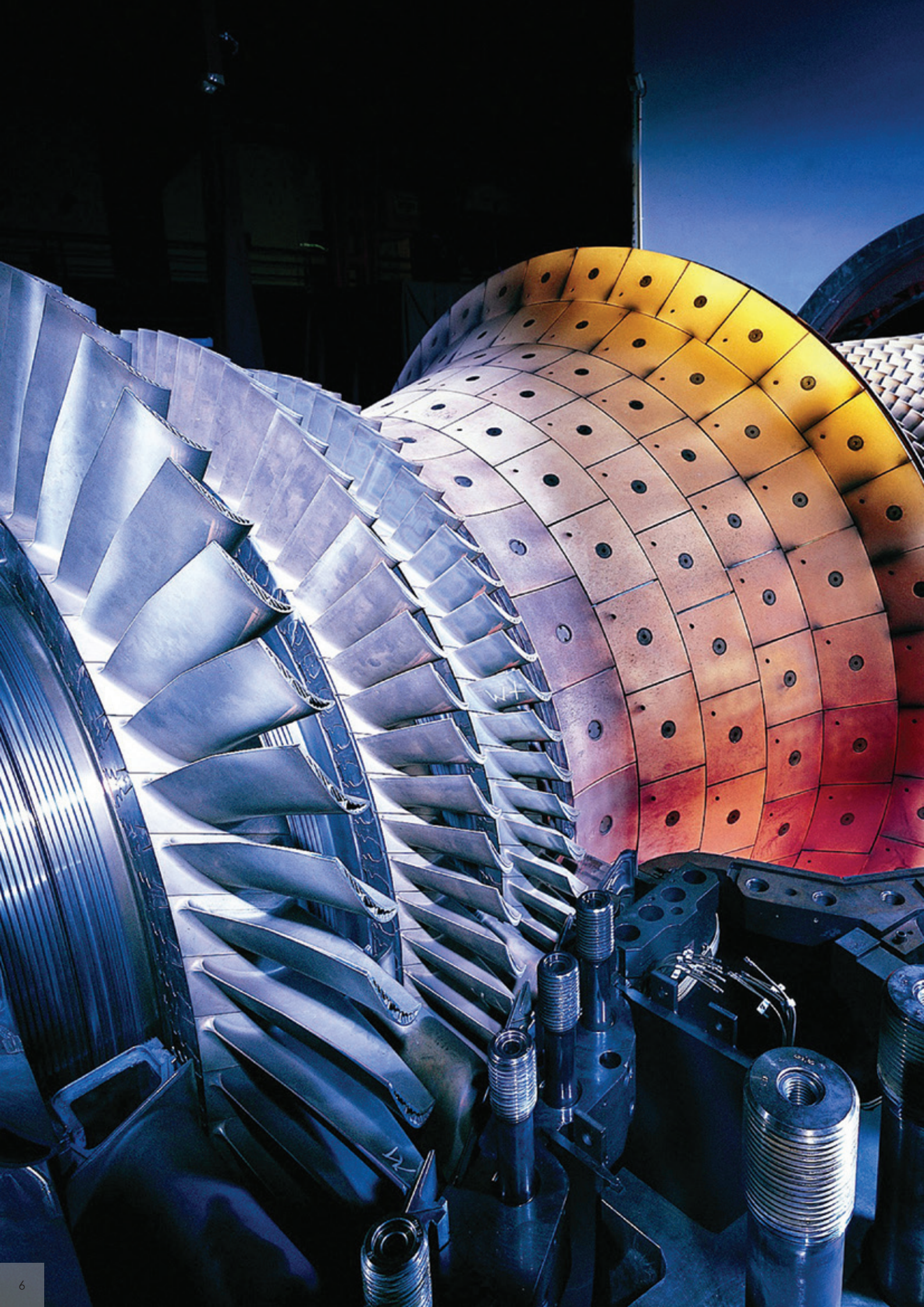
Umurlu I - II - 24 MW Geothermal Power Plant  
 GEX 1200 - 2 x 12 MW Kemaliye Geothermal Power Plant  
 GEX 2500 - 25MW Ken Kipaş 2&3 Geothermal Power Plant  
 GEX 2400 - 24 MW Kubilay Geothermal Power Plant  
 GEX 1300 - 12MW Geothermal Power Plant

**The general capability range for Ayvaz expansion joints is:**

- Dimension: DN 15-4000
- Bellows: Rolled, punch- and hydraulic formed bellows
- Design pressure: Up to 150 bar (depending on the diameter and temperature)
- Lifting capacity: Up to 16 ton











# AXIAL & LATERAL EXPANSION JOINTS FOR GAS TURBINE OUTLETS

Ayvaz produces, expansion joints with combined axial and lateral movement absorption capacity for the power conversion systems.

Ayvaz has a huge range of single and double bellowed expansion joints to be used at the exhaust lines of the Gas turbine which are used to absorb the thermal expansion of the exhaust pipelines as a result of produced exhaust gases with high temperature and high velocity.

## GAS TURBINES

The basic operation of the gas turbine is similar to that of the steam power plant except that air is used instead of water. Fresh atmospheric air flows through a compressor that brings it to higher pressure. Energy is then added by spraying fuel into the air and igniting it so the combustion generates a high-temperature flow. This high-temperature high-pressure gas enters a turbine, where it expands down to the exhaust pressure, producing a shaft work output in the process.

## POWERSHIPS

Powership is the name given to a barge or ship mounted fully integrated floating power plants. They deliver fast track, utility size & grade power plants, with no completion or construction risk, ready for power supply directly into the transmission network from its onboard high-voltage substation.

## AYVAZ EXPANSION JOINTS

- Bellows design for exhaust gasses
- High temperature & high speed
- Combined axial and lateral movements

Expansion joints to be used at Gas turbine exhaust lines are completed with stainless steel internal sleeves in order to maintain service security due to high velocity of the outlet gas.

## Reference Projects

2x225 MW Ghana Project  
5x125 MW Indonesia Project  
2x125 MW Lebanon Project  
1x100 MW Zambia Project









# AXIAL & LATERAL EXPANSION JOINTS FOR GAS TURBINE OUTLETS

## DESIGN

Generally speaking pressure balanced expansion joints can be divided into 3 main categories:

### BELLOWS DESIGN

Bellows of pressure balanced expansion joints are designed according to EJMA 10 code. For high pressure applications multi layered bellows (5/7 plies) with reinforcing rings.

According to the requested features like type of transported media, spring rate values (axial, lateral, angular) or operation temperature, pressure & life cycle bellows material could be customized.

**Most commonly used bellows materials are;**

\*300 Series stainless steel (any type of general service:

H=High temperature  
L=Low carbon content  
300, 304L, 316, 316L, 309, 310, 321

\*High Nickel Materials

Monel 400 (Sea water, high corrosive) and Inconel 600 (sea water & marine) Inconel 625 LCF (low cycle fatigue): oil refineries & chemical plants in high temperature service due to high strength at high temperatures

Ayvaz cooperates only with the most qualified and experienced material providers.

### CONSTRUCTION

Expansion Joints are the parts of piping system of pressurized equipment. In this respect construction of the expansion joints are designed and produced according to European pressurized equipment directive (PED 97/23/EC) as well as American National Standard for piping process ASME B 31.3.

All components of the expansion joints like, pipes, caps, flanges, tie rods etc... are checked by piping stress analyzing software thus enable us to select material type & thickness according to permissible stress values.

### TESTS & CERTIFICATION

All welding operations for the construction of expansion joints are completed according to European norms. All WPS are issued acc.to EN 15609-1 All PQR are issued acc.to EN 15614-1 All welder certifications are issued acc. to EN 9606-1

#### NDT Controls

Non-destructive testing for welding controls are completed in house by the TÜV accredited third party inspectors. Following controls and standards are applicable.

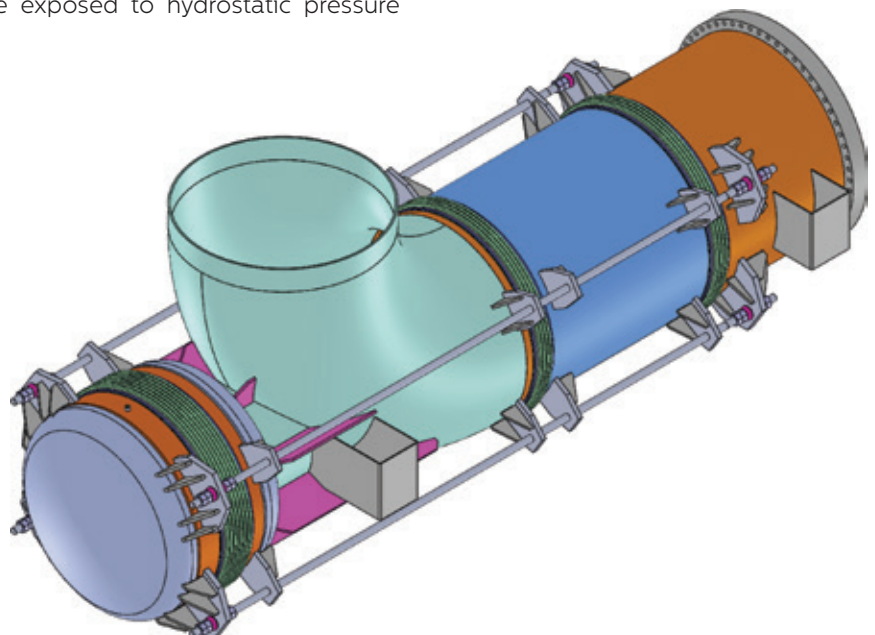
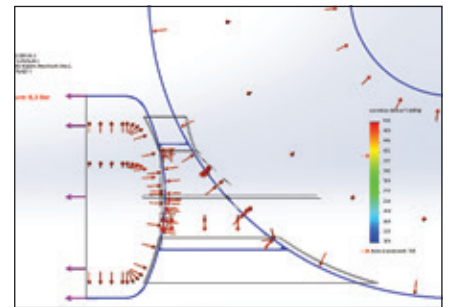
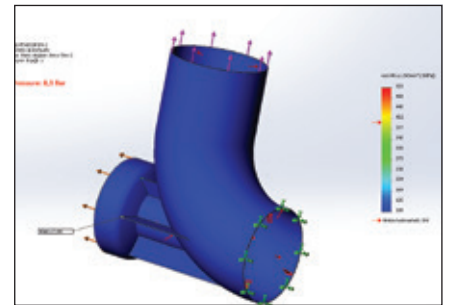
100%PT acc.to EN3452-1, EN23277  
100% MT acc.to EN17638,  
100%VT for Fillet welds  
100%RT acc.to EN ISO 10675-1, EN 17636  
100%UT acc. to EN 17640, EN 11666

### PRESSURE TEST & LEAK DETECTION

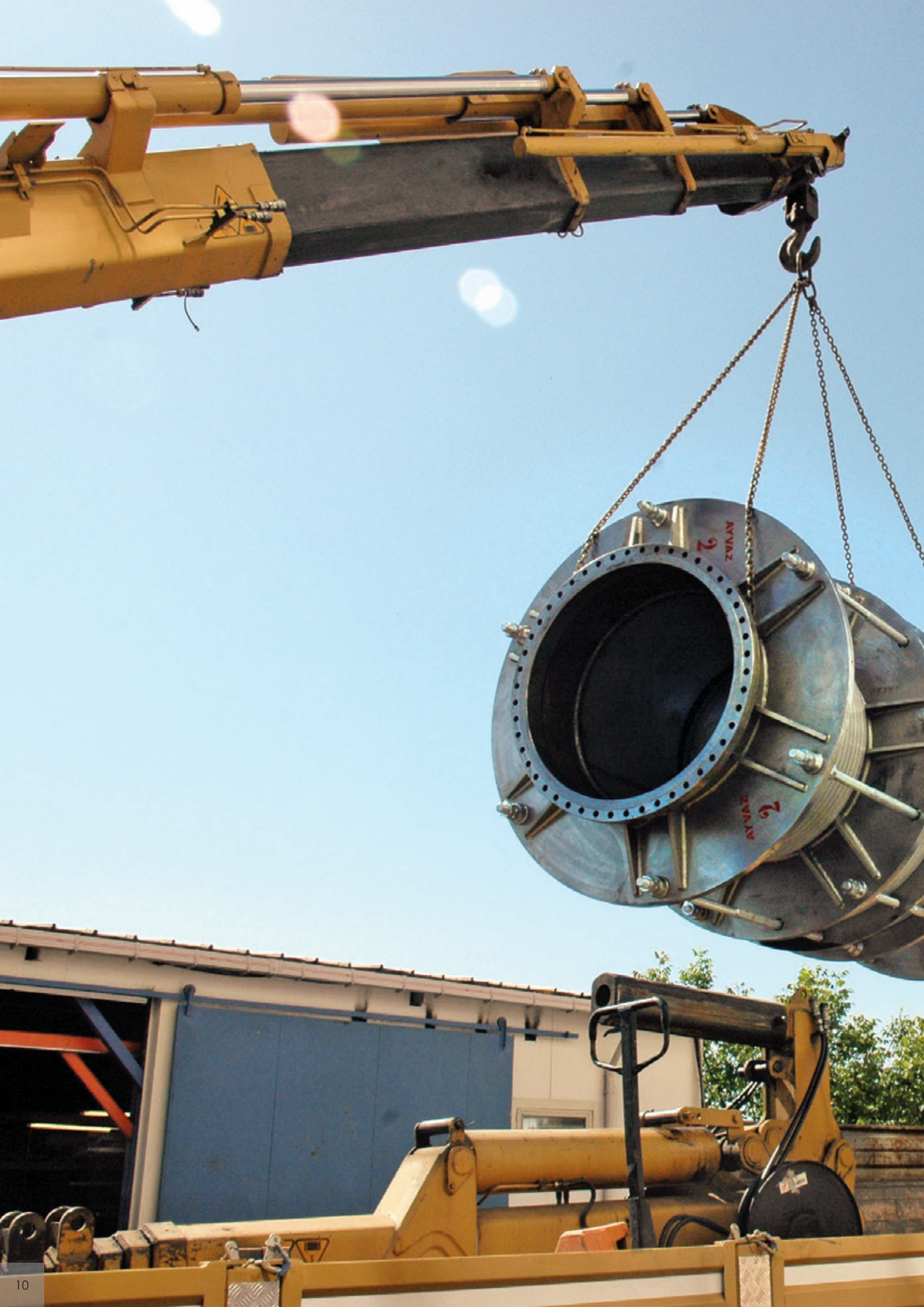
Pressure balanced expansion joints are exposed to hydrostatic pressure

at 1,5 times (acc.to EJMA code) or 1,43 times (acc. to. PED 97/23/EC) of the design pressure.

For full vacuum applications, vacuum test at 760 Hg/mm is also applicable. Additionally, gas leakage detection with helium is advised for proper tightness.









# QUALITY & SERVICES

We are very much involved in projects, where expansion joints are a part of a critical piping systems, we are aware of the importance of the supporting documentation.

## QUALITY ASSURANCE

We are very much involved in projects, where expansion joints are a part of a critical piping systems, we are aware of the importance of the supporting documentation. Thus detailed quotation, supporting calculations, extensive quality control and testing procedures will generally be a part of the project documentation.

This also includes a study of provided specifications, close dialogue with the customer, inspection of welding consumables, materials and a sub-supplies audit, test, documentation and initial inspection.

## DOCUMENTATION AND TESTS

Complete traceability and welding documentation. Among others: WPS WPQR PQR NDT

We undertake the required tests such as: Positive material identification (PMI), radiographic examination, dye penetrant, magnetic particle exami-

nation, hardness testing, ultra sound, pressure testing and leak detection.

## SERVICE

### Engineering services

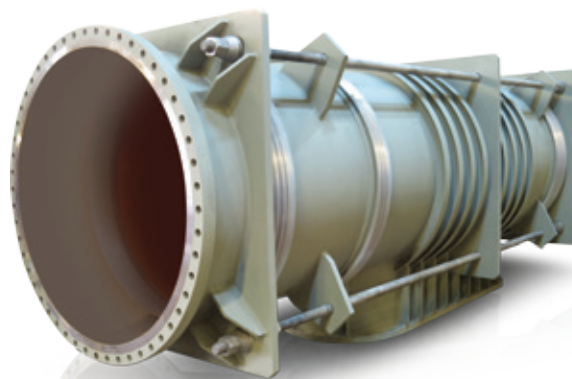
We are used working with complex specifications and advanced technical solutions and as part of our service we provide: CAD, 3D parametric design and pipe stress analysis.

## ON-SITE SERVICES

Installation of expansion joints is complex and calls for experienced installers.

Therefore customers often require our assistance and advice. In addition to design and manufacture pressure balanced expansion joints in general, we have an experienced service team that assists customers on all kinds of onsite work including:

- Full installation
- Supervision of installation
- Repair/refurbishment





# EXPANSION JOINTS

## for POWER GENERATION & ENERGY



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