

Swiss competence in GT Expansion Joints

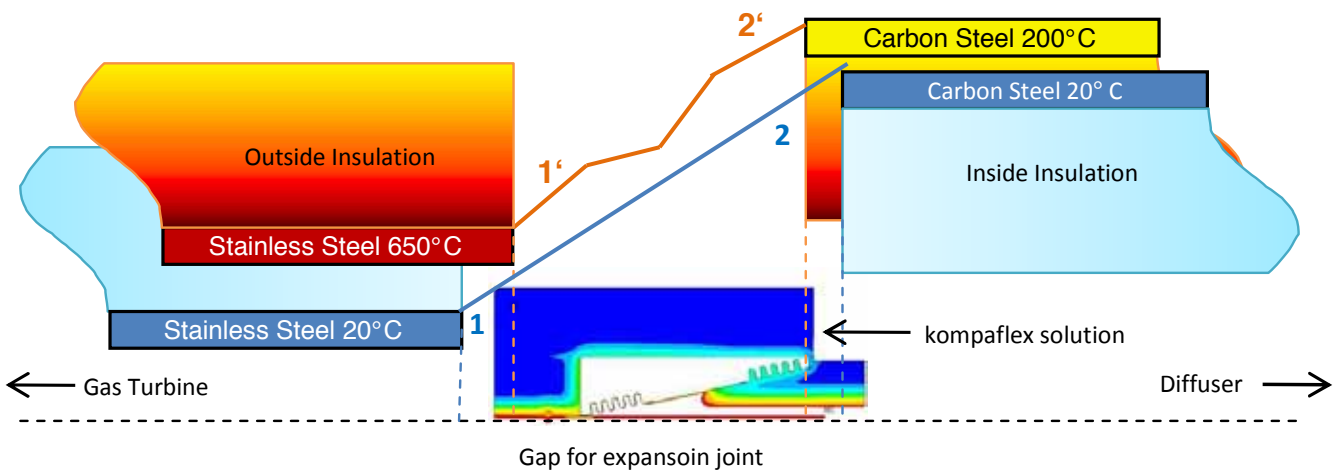


Design Specifics

THE CHALLENGE – DESIGNING A FLEXIBLE CONNECTION
BETWEEN OUTSIDE INSULATED GT AND INSIDE INSULATED
DIFFUSER

An expansion joint between the outside insulated turbine and inside isolated diffuser has to perform following tasks:

- Compensating axial thermal expansion resulting from the turbine and pipe system
- Isolating vibrations
- Compensating of differing radial expansion of the hot stainless steel GT connection and the cooler carbon steel diffuser. The temperature exposure of those materials is different due to the change from outside insulation to inside insulation. In addition stainless steel has a higher expansion coefficient, than carbon steel.

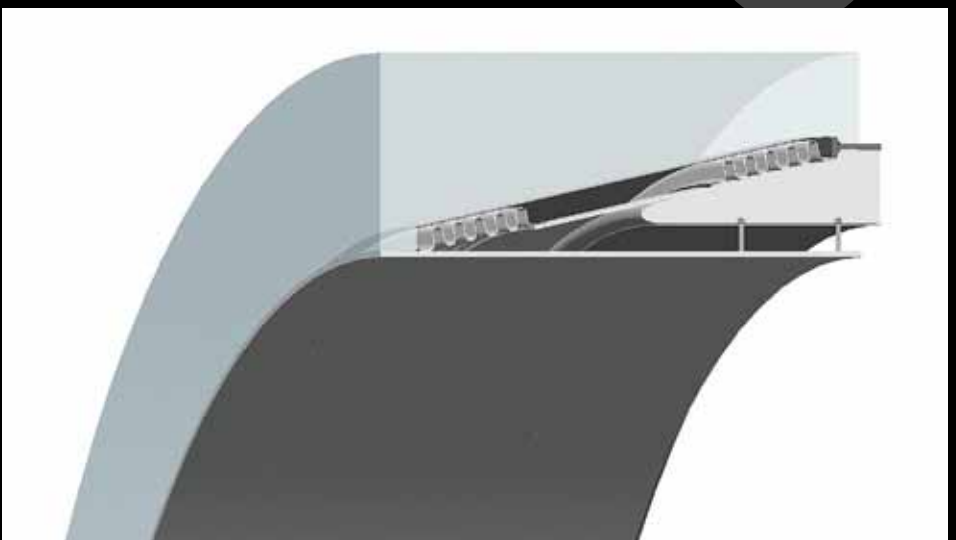


1,2 : Position of connection pieces at starting temperature

1',2' : Position of connection pieces during transients, steady state at full operation temperature

THE KOMPAFLEX SOLUTION – CONICAL MULTIPLY BELLOWS:

Conical multiply bellows, an unique kompaflex invention, can compensate all above mentioned movements thanks to its special shape. This includes the different radial expansions of the GT connection and diffuser.



FEM CALCULATION

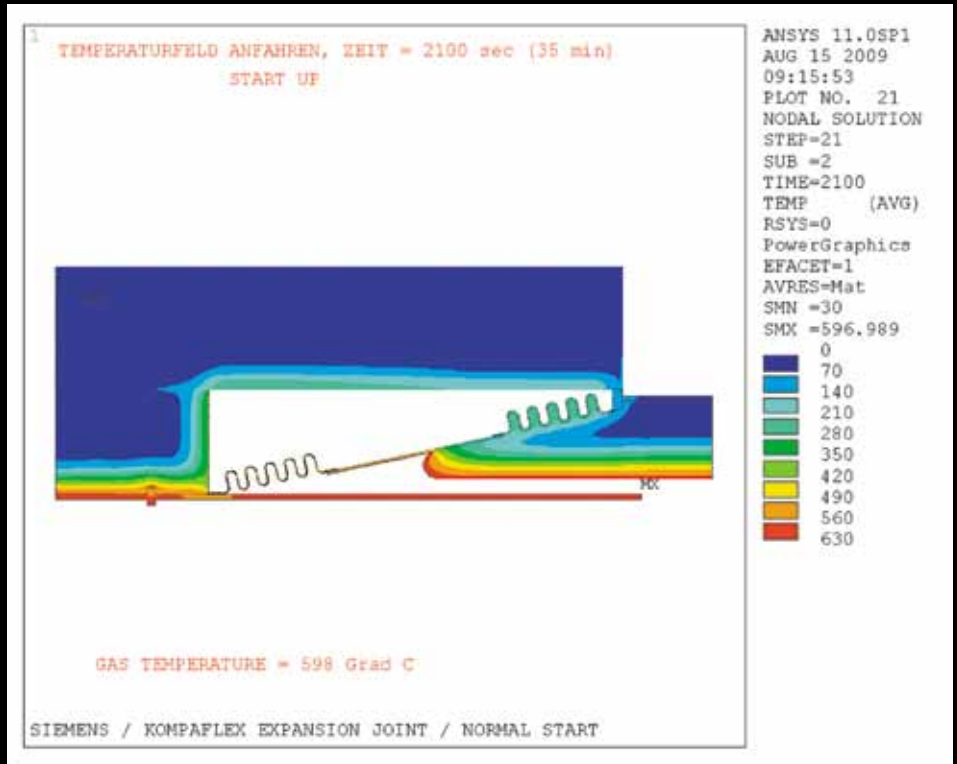
A detailed FEM calculation using ANSYS 11 with typical GT parameters (650° C operating temperature, axial movement -160 mm with design life 10'000 cycles, lateral movement 5 mm) was performed in order to optimize the design. In addition critical matters as performance peaks, vibrations and the oscillation of the protection sheet were successfully checked.

DESIGN PARAMETER

- 650° C operating temperature
- Axial movement -160 mm
- Design life 10'000 cycles
- Lateral movement 5 mm
- Radial difference of 38 mm from the SS connector and CS diffuser

THERMAL ANALYSIS

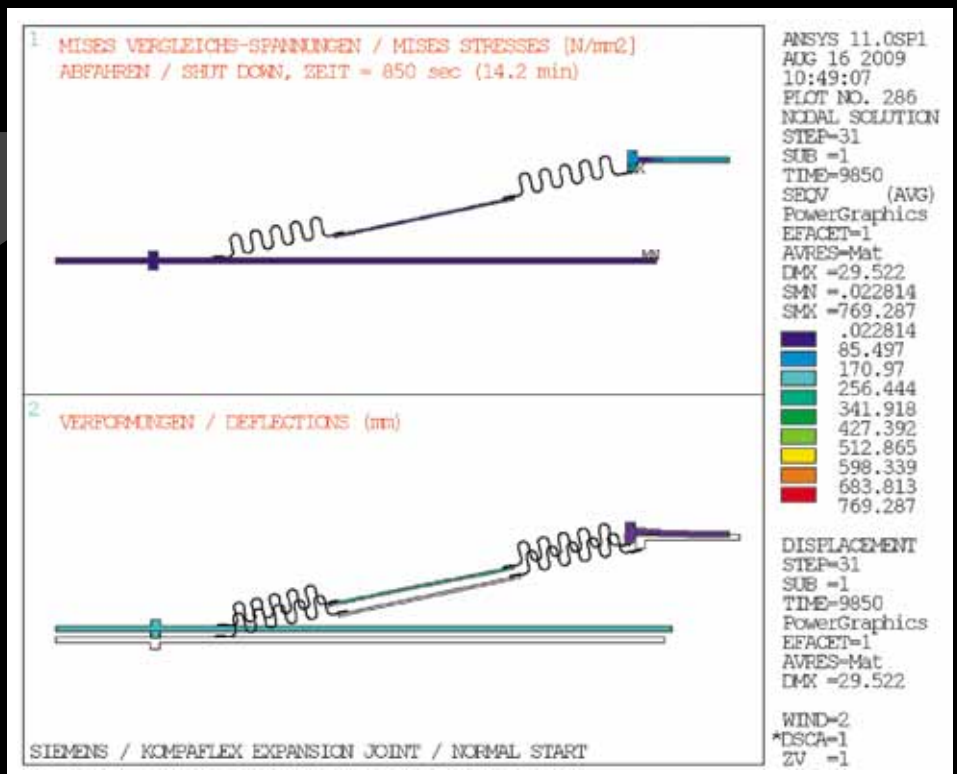
The analysis at different stages of starting and stopping, restart and trip of the engine



MISES STRESSES DISPLAY

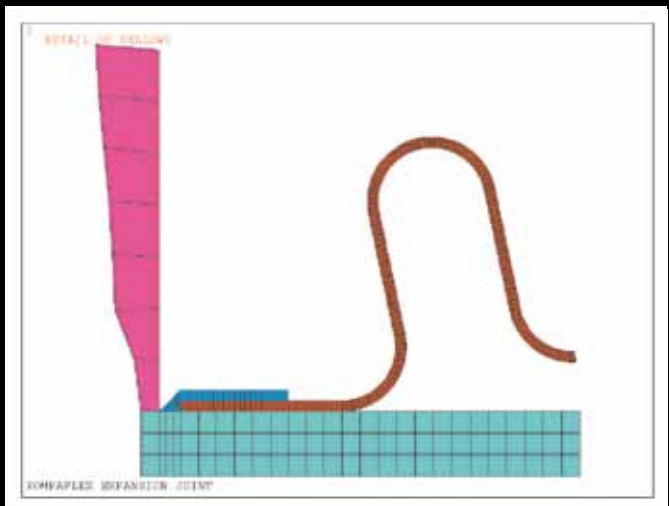
DEFLECTIONS

Are evaluated and show the movement caused by the different thermal expansion of the SS connector and CS diffuser.



A WORLD FIRST MULTIPLY CONICAL EXPANSION JOINTS

The bellows consist of multiple steel layers made of 1.4878. kompaflex has a great experience with multiply bellows for GT applications. Our multiply GT designs have been running reliable since over 15 years.



CUSTOMER BENEFITS OF A CONICAL BELLOWS

- Technical superior solution
- Low spring rates
- Economic better solution than previous designs
- No maintenance necessary
- Very high life time = plant life



Design Specifics

WORLD UNIQUE RECTANGULAR EXPANSION JOINTS

kompaflex is worldwide the only company being able to manufacture multiply rectangular expansion joints. Also in big dimensions. Thus providing the advantages of the multiply bellows concept for rectangular shapes. There are no welding seams in the corner parts, an important technical advantage in a critical area.

References / Projects

ALSTOM POWER – THERMAL POWER STATIONS

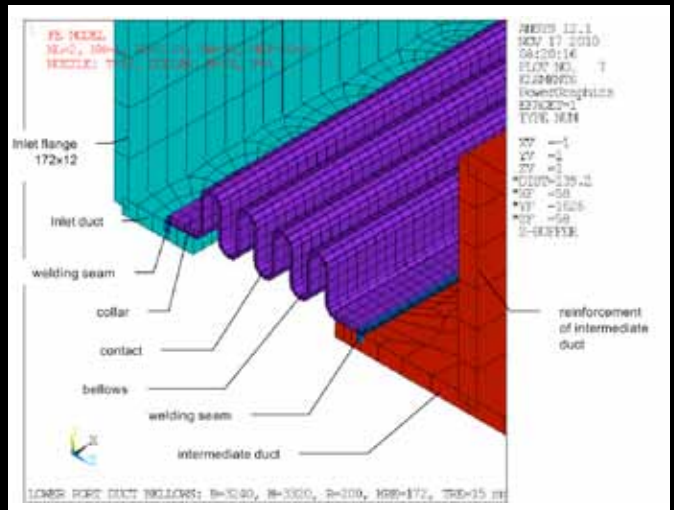
Delivery of over 800 rectangular expansion joints pieces since 1989. Different dimensions up to 2500 x 6500 mm. Some of the thermal power stations are:

- Belchatow
- Bexbach
- Boxberg
- Dürnröhr
- Eemshaven
- Goldenberg
- Grosskraftwerk Mannheim GKM
- Heilbronn
- Jänschwalde
- Ledvice
- Maritza
- Mehrum
- Neurath
- Niederaussem
- Oxyfuel
- RDK8
- Schwarze Pumpe
- Westfalen
- and many more



PROVEN QUALITY

kompaflex designs and manufactures rectangular multiply expansion joints since 1984. On the right below an example of a rectangular GT expansion joint for a Solar Turbine. Due to the superior design, the operational time of the multiply expansion joints is hugely increased.



PROVEN CALCULATIONS

The kompaflex design of rectangular expansion joints was fully verified by FEM calculations using ANSYS. For example kompaflex designs all rectangular 3320 x 3240 mm universal bellows connecting the ITER vacuum vessel and cryostat at the fusion research project in Cadarache.



DN 1671 / 816
 Movements: axial 15 mm
 lateral 5 mm
 Temperature: 580° C
 Pressure: 35 mbar

SOLAR TURBINES / TURBOMACH

kompaflex delivered over 60 rectangular expansion joints to Turbomach since 1997

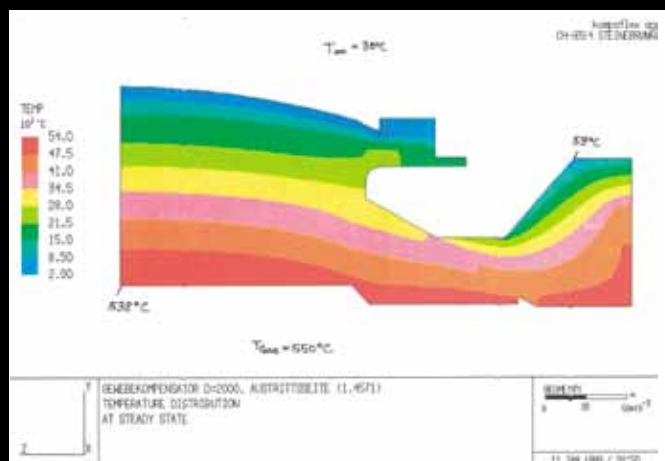
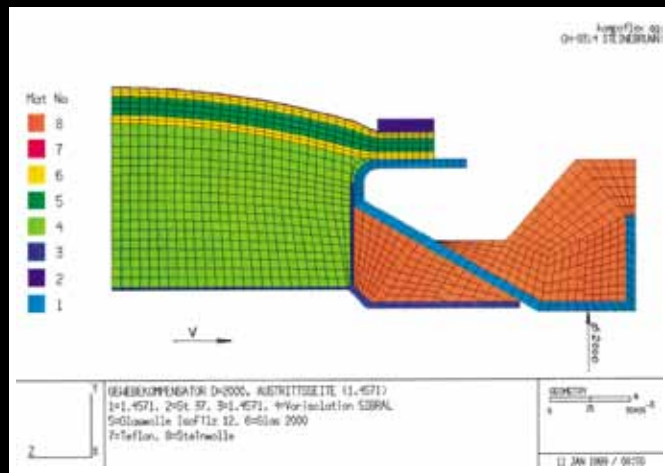
Design Specifics

HIGH TEMPERATURES AND EXHAUST VELOCITIES

kompafler fabric expansion joints are designed and optimized with the help of FEM calculations. This guarantees a reliable GT operation also under high temperatures and exhaust gas velocities. A special focus is laid on the insulation for high temperature applications.



Round and Rectangular fabric expansion joints for a GT application in Moscow



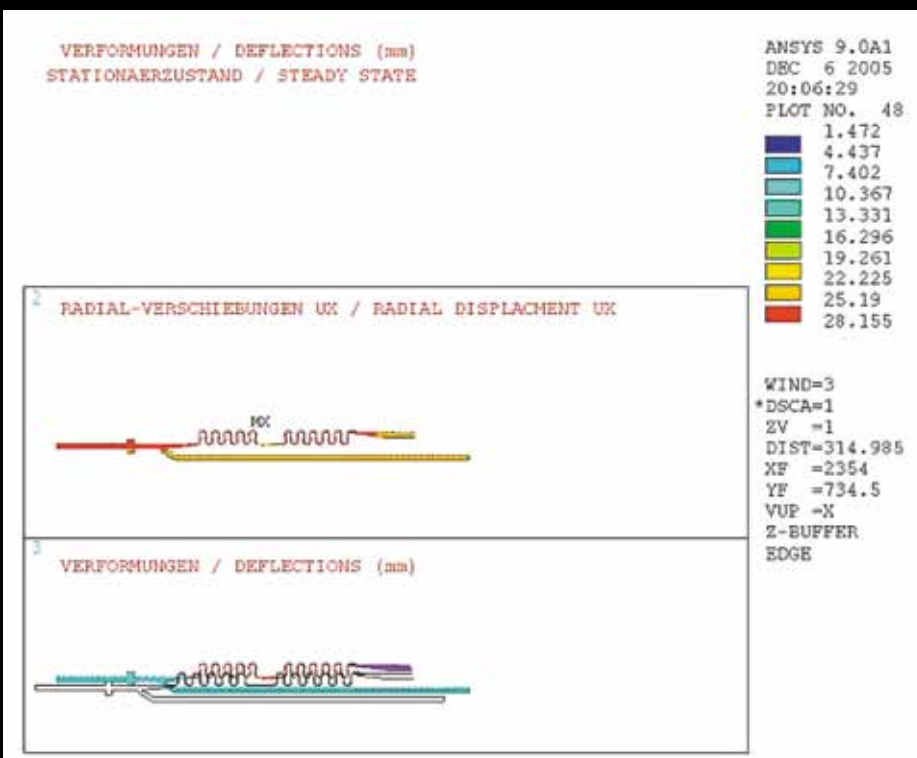
PROJECT	MEDIUM	TEMPERATURE	PRESSURE	DIMENSIONS
PAINIPAT, India	Exhaust gases	+510°C	-300 Pa	5905 x 10337 mm
Borsodchem, Hungary	Exhaust gases	+480°C	7580 Pa	8300 x 3300 mm, 3555 x 3075 mm
HRSG in MICHELIN, UK	Exhaust gases	+620°C	+/- 5 kPa	Ø 3760 mm
HRSG in BLACKBURN	Exhaust gases	+300°C	5 kPa	618 x 618 mm, L = 11900 mm
KW Niederaussem, Germany	Fresh air	+ 40 °C	-30 / + 20 mbar	8150 x 3650 mm, BL = 350 mm
SÖK Salzburg, Austria	Exhaust gases	+250°C	35 mbar	Ø 2172 mm, 3232 x 1482 mm
HRSG Moskau, Russia	Exhaust gases	+650°C	+/-5 kPa	3575 x 4535 mm, Ø 3575 mm
KAKANJ	Exhaust gases	+550°C	+/- 5 kPa	6512 x 382 mm, Ø 500 mm
KISPEST	Exhaust gases	+650°C	+/-5 kPa	Ø 3400 mm, 3727 x 6635 mm
MHKW SOLINGEN, Germany	Exhaust gases	+450°C	+/-50 mbar	1688 x 3788 mm
HRSG RUNCORN, UK	Exhaust gases	+500°C	12 kPa	1360 x 1060 mm, 1160 x 3960 mm
TPP1 RIGA, Litauen	Exhaust gases	+150°C	86 mbar	12928 x 3658 mm, Ø 3000 mm
HPP Sandreuth, Germany	Exhaust gases	+620°C	6 kPa	3724 x 4676 mm, Ø 3440 mm
Nürnberg	Exhaust gases	+620°C	6 kPa	Ø 3440 mm, 3724 x 4676 mm
GKM Mannheim, Block 6, Germany	Exhaust gases	+420°C	-70/+40 mbar	9850 x 5050 mm, 3490 x 11467 mm
Kelenföld II., Hungary	Exhaust gases	+400°C	5,6 kPa	4052 x 2945 mm, Ø 2010 mm
RYA Göteborg, Sweden	Exhaust gases	+620°C	+/- 5kPa	13275 x 3875 mm, Ø 3100 mm
USS Smederevo, Serbia	Exhaust gases, Air	+200°C	5 kPa	2960 x 3070 mm
Bucuresti VEST CHPP, Rumania	Exhaust gases	610°C	6 kPa	8204 x 3817 mm

Design Specifics

LARGE MULTIPLY STEEL GT EXPANSION JOINTS FOR SIEMENS

kompaflex ag is proud to be the main supplier for GT expansion joints for Siemens. Our proven robust design has been flawlessly in operation since over 15 years. The advantages of a multiply steel GT expansion joints are:

- Long-lasting, no breakdowns during plant life
- No maintenance work / replacements needed compared to fabric expansion joints
- Low spring rates
- Compact design
- Thus the most economic solution

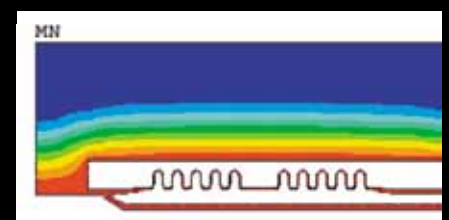


FEM-CALCULATIONS FOR GT EXPANSION JOINTS

The conventional solution is a kompaflex multiply double bellows.

The expansion joint and bellows has been fully calculated by FE.

The successful on-going operation of over 300 expansion joints in the field confirm the kompaflex calculations.



References / Projects

All major power generation companies like Siemens, Alstom and GE rely on kompafler expansion joints. We have an experience of over 30 years in this field.

SIEMENS – GAS TURBINES DELIVERIES

kompafler delivery of over 300 GT expansion joints for Siemens gas turbines such as SGT-4000 and SGT-8000. Sizes from DN 2390 to DN 4469. Just a few examples of deliveries for Siemens GT's:

- Chania, Kreta
- Nehuenco, Chile
- Peterhead, Scotland
- Seabank, England
- Donaustadt, Austria
- Jebel Ali, Dubai
- Shuweihat, Abu Dhabi
- Gezer, Haifa
- Kuo Kuang, Taiwan
- Ribatejo, Portugal
- Rinjmond, Netherlands
- Chonburi, Thailand
- Palos de la Frontera, Spain
- Shidongkou, China
- Zhengzhou, China
- Ras-Laffan, Qatar
- BASF Antwerpen
- Senkang, Singapore
- Antalya, Turkey
- Misurata, Libya
- Irsching, Germany
- and many more



SIEMENS – PRESSURE BALANCED EXPANSION JOINTS

kompafler provides Siemens also with corner balanced expansion joints for GT application. These expansion joints are usually installed on the turbine. There are various dimensions and expansion joints type available.



CONTACT

kompafler ag
