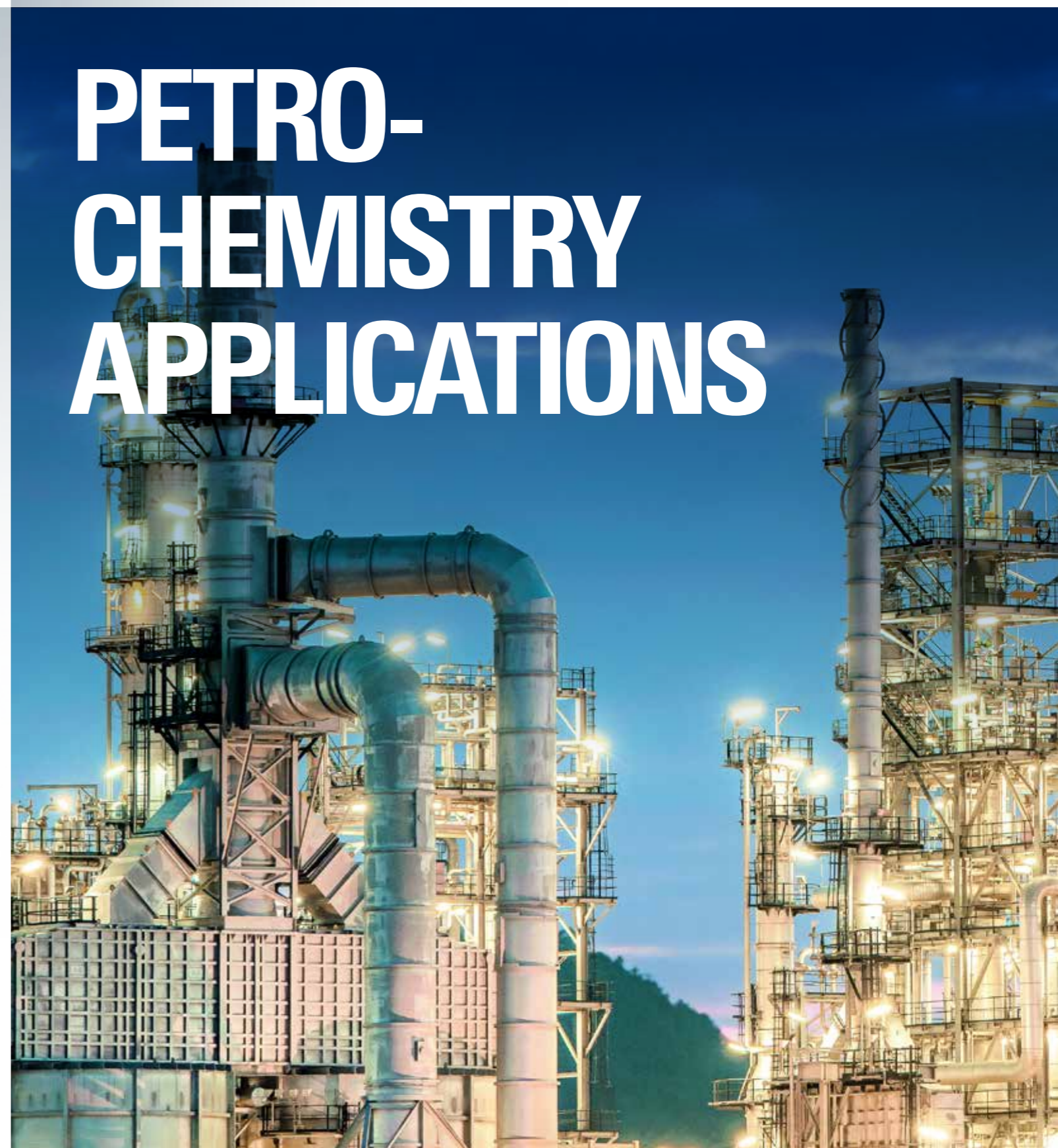




WITZENMANN
managing flexibility

PETRO- CHEMISTRY APPLICATIONS



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PROJECT MiRO GERMANY



A challenging task by
Mineral Oil Refinery (MiRO) in Karlsruhe / Germany.

The situation

Petrol, diesel and light fuel oil are won from heavy fuel oil in the refinery by "catalytic cracking". During this process, reactor and pipework are constantly subjected to temperatures of 750 °C at pressures of 3.8 bar. An expansion joint of stainless steel would rapidly become brittle under these conditions and have to be serviced or replaced at short intervals. The consequences: High material and maintenance costs due to the heavy wear on the expansion joint and the costs associated with the standstill of the installation for every service.

The task

To develop and produce an expansion joint made from a special material that withstands the prevailing conditions longer and more reliably, and hence makes the installation safer and more economical to operate.

Key data and system data

Completing a triple-hinge system based on a DN 1500 angular expansion joint already installed. Total length: more than 12 meter.

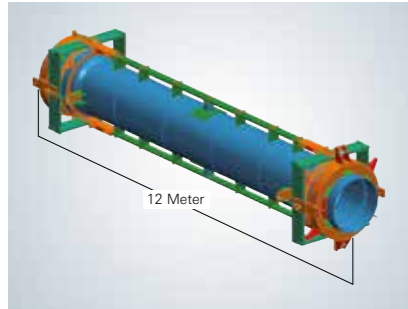


Multi-layer axial expansion joints with swivel flange from ND 30 up to ND 800 are often used as quickly available standard expansion joints during overhauls.

PROJECT MiRO MINERAL OIL REFINERY IN KARLSRUHE (D)

The solution

Application



The implementation

MiRO Mineraloelraffinerie Oberrhein GmbH & Co. KG in Karlsruhe in the south of Germany placed an order with Witzemann for the production of a tailor-made expansion joint of more resistant material than conventional stainless steel. In order to prevent the expansion joint from becoming brittle, Witzemann had a material melted to a specially defined specification from which the expansion joint was manufactured. This special material also necessitated a special welding process using special welding electrodes.

The material

1.4910: extremely fatigue-resistant, extremely difficult to weld

Further petrochemical specifications

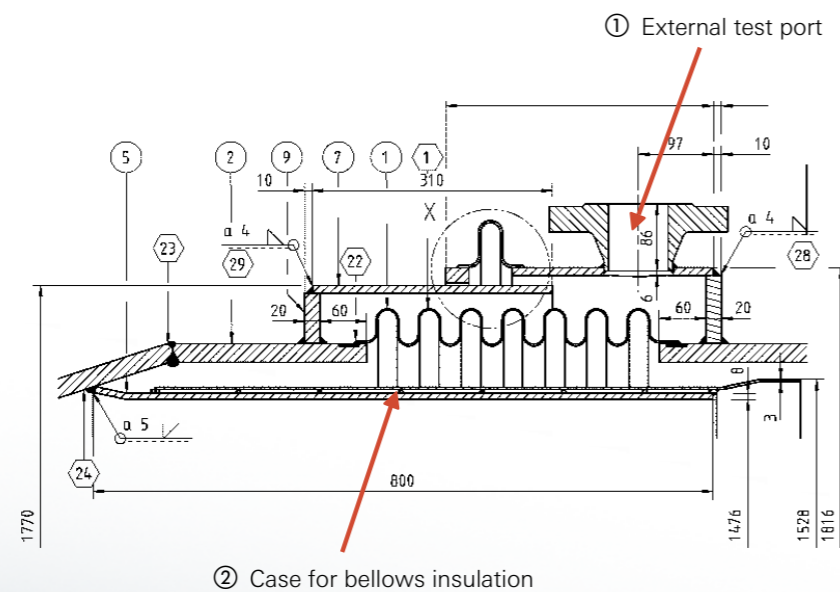
- Refractory lining
- With abrasion-resistant refractory lining to UOP or customer standards
- Purge connection for inner bellows area
- Clamp shell for encapsulation of leaking bellows
- Pantograph for uniform distribution of movements in universal expansion joints

① Design details: External test port

The two external test ports allow the bellows to be examined directly for service life, operating temperature, etc. from the outside without interrupting operation. Compared to reference material of the same charge this adds up to an idea about the aging process.

② Case for bellows insulation

A sleeve welded to the inner catalyst tube creates a continuous vacuum gap that shields the actual bellows from the medium temperature. By contrast with the mineral rock wool conventionally used that is destroyed over the course of time by the high temperatures, this solution offers permanent and reliable insulation.



PROJECT MiRO MINERAL OIL REFINERY IN KARLSRUHE (D)

Technical data

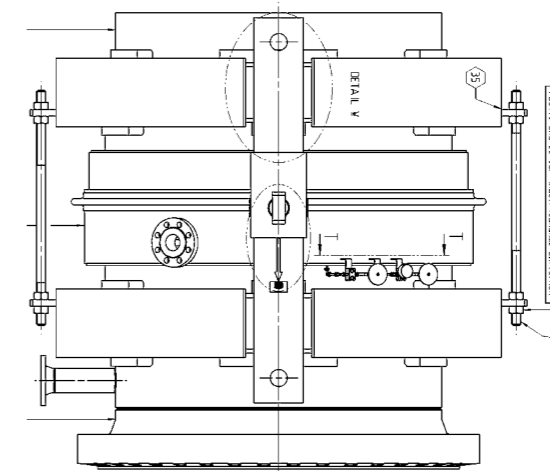
Application



Project MiRO	
Product	Lateral expansion joint – Hot wall design
Bellows construction	Two-layer, each layer capable of withstanding pressure
Quantity	1
Nominal length (NL)	12200 mm
Diameter (ND)	1500 mm
Weight	29000 kg
Material	1.4910 / 1.4878
Design pressure (bar)	3,8
Design temperature (°C)	780
Applications	FCC-Flue gas line
Customer	Miro, Karlsruhe
Country	Germany
Medium	Hot gas
Design standards	EJMA, AEQ(Euroqualiflex), DGRL

Special Expansion joint features

Anchored lateral expansion joint that withstands extreme heat (700 - 900 °C) during continuous operation. Designed in accordance with EJMA and AEQ for 30,000 operating hours.



PROJECT VOLGOGRAD RUSSIA



Replacing the complete piping-system of the Lukoil Petrochemical plant in Volgograd (Russia)

The situation

The pipework system in the refinery of the Russian energy giant, Lukoil, had to be completely replaced for safety and operational reasons as it could no longer reliably withstand the high tensile and compressive strains caused by the temperature-related expansions. High wind and snow loads (icy Siberian winds and seasons sandstorms) place additional loads on the system. The natural spring-back of the lines was not sufficient to compensate these forces. High axial, angular and lateral forces occur at the supports. The consequences: Leaks, detonations, environmental pollution and accelerated corrosion due to escaping chemicals.

The task

Modernisation and expansion of the complete pipework system with a reliable solution guaranteeing long-term (XY years) fail-safe continuous operation.

Key data

- Ambient temperature: -35 °C (winter), +50 °C (summer)
- Wind loads of up to 400 N/m².
- Snow load of approx. 70 kg/m² on the pipes

System data

- Seven stainless steel pipelines (DN 900) linking the reactors and heat exchangers
- Highly inflammable hydrocarbon gas mixture flowing through the pipework system
- Pressure: 23.2 bar
- Medium temperature: approx. 545 °C



Heavy angular expansion joints are suitable for absorbing defined angular movements in 3-dimensional pipe runs.

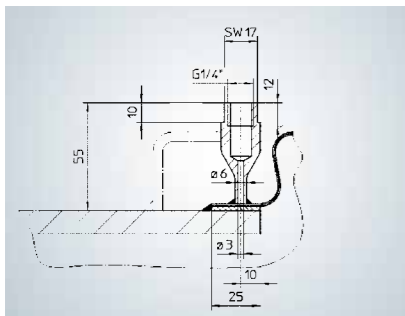
PROJECT PETROCHEMICALS PLANT (FCU) IN VOLGOGRAD (RUSSIA)

The solution

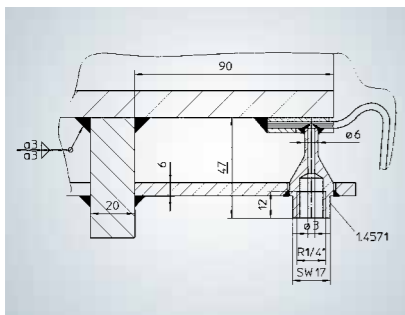
Application



Two-layer



Multi-layer



The implementation

The Russian company placed an order with Witzemann for the design and calculation of the pipework system. This was carried out using the Caesar II standard software in accordance with the international ASME B31.3-2002 standard. The Flexperte software (www.flexperte.de) was employed for the design of the expansion joints. Witzemann equipped the pipeline system with 21 stainless steel ND 900, PN 40 angular expansion joints, some of which single-hinged and some gimbal-hinged. In addition, a combination of flexible mounting and defined guidance and bearing of the pipework was necessary. This design was carried out using the load chain program in Flexperte. Witzemann supplied guide frames, insulating saddles, spring and constant hangers and the installation material here for a weightless installation and practically force-free connection technology of the whole pipework system.

Leak monitoring

The multi-layer structure of the bellows allows the component leak-tightness to be continuously monitored. This permanent monitoring is a particular benefit especially with toxic, explosive or otherwise critical media. Both multi-layer and two-layer bellows are used in the petrochemicals industry.

Advantages of the multi-layer bellows structure

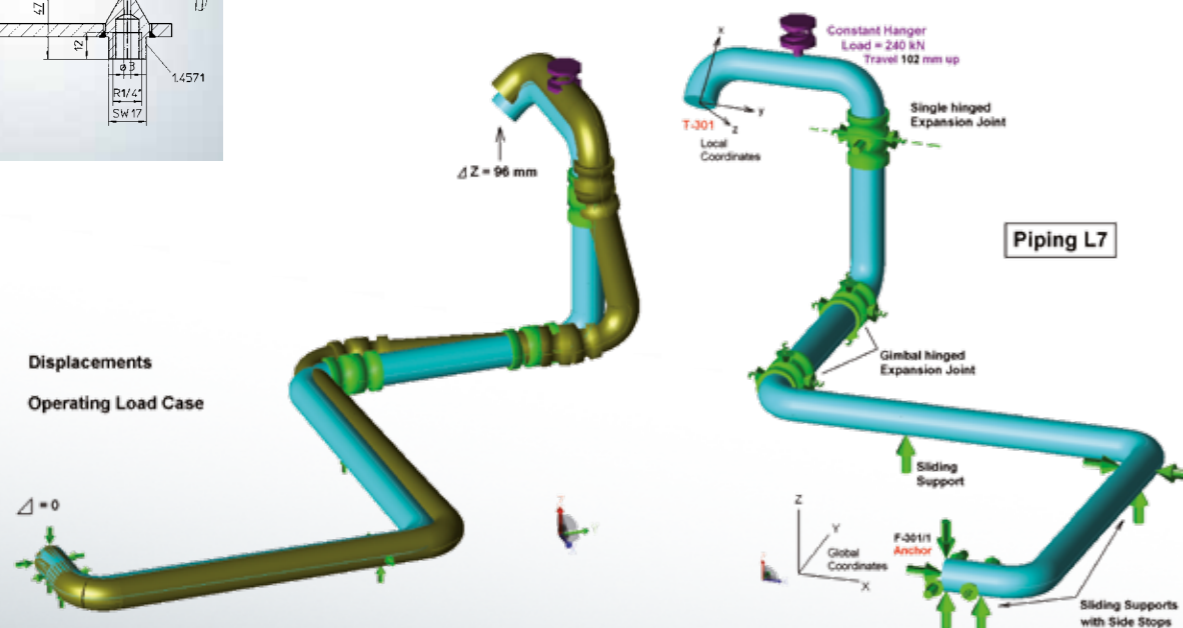
Two-layer

- Specification for design: Each layer capable of withstanding the internal pressure
- Double service life on exposure to corrosion

Multi-layer

- Monitoring of the highly corrosion-resistant inner layer
- Greater movement
- More load cycles (service life)
- Smaller adjustment forces
- Residual safety (no immediate shutdown at the first signal)

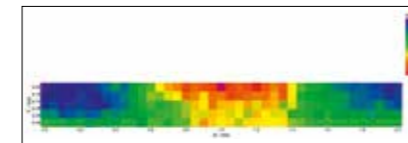
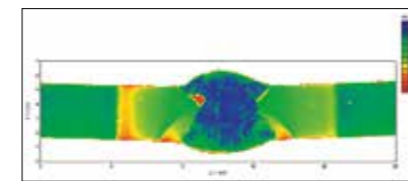
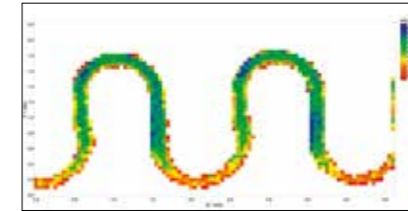
Stress calculation



PROJECT PETROCHEMICALS PLANT (FCU) IN VOLGOGRAD (RUSSIA)

Technical data

Hardness scan



Quality assurance

Hardness scanning of longitudinal weld and bellows profile. The bellows are subjected to random sample testing for stress concentrations in the material. The results of this testing then have a direct influence on the production.

Longitudinal weld (undressed)

The hardness scan shows that no hardening occurs in the surrounding area of the weld seam or in the weld seam proper, and that no undesirable embrittlement of the material takes place.

Longitudinal weld (dressed)

In the area of the dressing, a slight surface hardening of the weld seam occurs with a barely perceptible embrittlement of the material.

FCCU Facility Volgograd (RU), Petrochemicals	
Product	Angular Expansions-Joint Constant and spring hangers Guidance systems Stress calculation (CESAR II) After sales service (Deblocking)
Bellows construction	Multi-Layer
Quantity	21
Nominal length (NL)	1500 mm
Diameter (ND)	900 mm
Weight	2800 kg/pc.
Material	Bellow: 1.4571 (316 TI) Weld-Ends: 1.4878 (3321 H)
Design pressure (bar)	40
Design temperature (°C)	545
Applications	Carbon-monoxide gas pipe
Customer	Horst Kürvers GmbH, DE Lukoil, RU (final customer) PMP, St. Petersburg, RU Flexitech-Faber, CH
Country	Russia
Medium	Cracking Gas
Design standards	EJMA, ASME B31.3, ASTM

OUR RANGE OF PRODUCTS

The components work as a system and lead to an economical and reliable solution.



Metal Hoses

corrugated hoses from DN 6 to DN 300, for operating pressures up to 400 bar for temperatures from -270 °C to max. 600 °C.

Expansion Joints

axial-, lateral- or angular expansion joints from DN 15 up to DN 12.000 with rotating flared flanges, fixed flanges, ends prepared for welding, ... in various materials like stainless steel, Tantal, Incoloy, ...

Metal Bellows

corrugated high pressure resistant bellows and membrane bellows for different applications.

Hangers and Pipe Supports

different types of maintenance-free hangers and supports for load bearing up to 500 kN.

Bearings

floating-, guide- and fixed bearings, roller bearings for insulated and non-insulated pipelines in the nominal diameter range from DN 15 to DN 600.

Flexperte – Sizing Software

Flexperte was developed especially for planners and designers for the selection of metal hoses, expansion joints, metal bellows and pipe supports with interface to PDMS, PDS.

