

Flexible solutions for the energy industry

WITZENMANN

managing flexibility



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Witzenmann GmbH

Östliche Karl-Friedrich-Str. 134
75175 Pforzheim, Germany
Phone +49 - (0)7231 - 581 - 0
Fax +49 - (0)7231 - 581 - 820
wi@witzenmann.com
www.witzenmann.com

HYDRA

Quality by Witzenmann



OUR ENGINEERING FOR ALL FORMS OF ENERGY



Worldwide

The Germany-based Witzenmann Group with 23 locations in 17 countries and around 3,000 employees founded the flexible metal hose and expansion joint industry more than 120 years ago. Today it is a sought-after development partner for numerous leading national and international enterprises in industries.

Power generation, processing and utilisation is one of the largest markets of the future – and one of our most important fields of business.

Whether in classic forms of energy such as coal, oil, gas, LNG and nuclear power or in renewable energies such as solar energy, wind, water and geothermal energy or even in energy distribution: Witzenmann is part of it – as a development partner and as a reliable manufacturer of well-engineered product solutions. Irrespective of whether it is a question of solutions for refineries,

coal-to-gas plants, gas transport robots or LNG loading – our core competence is called for when it comes to vibration compensation and the absorption of movements in pipeline systems.

Witzenmann constantly develops and manufactures expansion joints and flexible metal hose solutions for new tasks and fields of application – that is why Witzenmann engineers are already working with their customers today in finding the solution for experimental plants and future technologies.



Liquefied natural gas (LNG)

The exploration of offshore gas fields presents the companies involved with enormous technical challenges. The extraction and liquefaction of this gas, for example, calls for highly sophisticated solutions at each step of the LNG chain. From the extraction through to the storage. Here with its flexible pipeline elements that permit absolutely safe handling of the fuel, Witzenmann is a partner of leading companies.

OFFSHORE RAW MATERIAL EXTRACTION



During the winning of offshore natural gas under the sea bed, the transformation into liquefied natural gas (LNG) and during transport and storage, extreme demands are made on the individual components.

Witzenmann, the technology leader for flexible metallic elements, develops and produces operationally safe expansion joint and bellows solutions for the leading suppliers to the industry. For the transport robots on the sea bed they compensate thermal expansion and system movements. Or in subsea applications our titanium bellows permit volumetric expansion of oil in transformer chambers. For the pipelines on the surface, salt water-resistant metal hoses compensate the movements of the sea and the system - because leaks here are a huge threat to the environment and extremely difficult to repair. In order to be able to

transport the gas by ship it is cooled to $-162\text{ }^{\circ}\text{C}$ and thereby liquefied; compressed to just a fraction of its original volume it can then be transported cost effectively. Highly flexible stainless steel lines based on the principle of metal bellows ensure a secure connection when the liquefied gas is transferred from the offshore platform to the transport ship. The bellows/pipe system is thereby subjected to large movements such as e.g. sea movement of up to 12 metres. In addition it also compensates the expansions caused by the difference between the temperature of the liquefied gas and the ambient temperature. The material is selected such that no decrease in flexibility has to be feared despite the extremely low temperature of the medium. As far as materials and processing methods are concerned, Witzenmann can draw on a vast know-how.

RAW MATERIAL PROCESSING IN FUELS



Coal and oil

The classic energy transformation of coal into gas and and of oil into petrol or diesel fuels is a further important field of activity for Witzenmann. And an important market that constantly demands new solutions and new improvements. In this energy sector Witzenmann supplies products and developments for optimum operation and higher profitability.



Witzenmann has activities worldwide in the field of extraction and processing of coal and oil. Expansion joints from Witzenmann have been installed, for example, in refineries in Germany, Sibiria, Romania, India and Israel or in coal-to-gas plants in China. There the expansion joints compensate the expansions, pressures and movements acting on the pipelines and pipeline systems. In addition, a worldwide network of Witzenmann locations guarantees qualified on-the-spot support at any time.

For refineries of the Russian company Lukoil, Witzenmann supplied not only expansion joints but also complete pipeline systems and constant hangers. At the MiRO refinery in Karlsruhe in the south of Germany, for example, a lateral expansion joint is installed between reactor and

turbine that glows continuously due to the extreme loads. In the reactor petrol, diesel and light fuel oil are won from heavy fuel oil by catalytic cracking. At a temperature of 750 °C and a pressure of 3.8 bar, a gas is won that is fed to the turbine for the generation of electricity and the production of steam. As conventional materials become brittle here, Witzenmann had a special material melted for the production of the expansion joint in order to be able to meet the demand profile for the application.

In the Chinese province of Inner Mongolia axial and lateral expansion joints are installed in a coal-to-gas plant being built by China's second-largest public utility. The expansion joints with weights of up to 7.5 tonnes can withstand pressures of 48 bar at 150 °C.



Power stations and district heating

Witzenmann is an internationally sought-after partner for conventional power generation, such as from coal. Expansion joint solutions from Witzenmann, for example, increase the efficiency of numerous coal-fired power stations – or in the district heating pipelines ensure comfortable, relaxing warmth in apartments.

CONVENTIONAL POWER GENERATION



Our product range for piping technology is unique. Flexible metal hoses and bellows, expansion joints, hangers and connecting pieces as well as roller bearings and slide bearings form the broadest product spectrum on the market.

Expansion joint solutions from Witzenmann are installed in innumerable coal-fired power stations worldwide where they reliably absorb the expansions caused by the prevailing heat and media pressures. They are thus important functional elements that ensure trouble-free operation even under the toughest day-to-day working conditions, and with the demanded long service life enhance the overall efficiency of power stations.

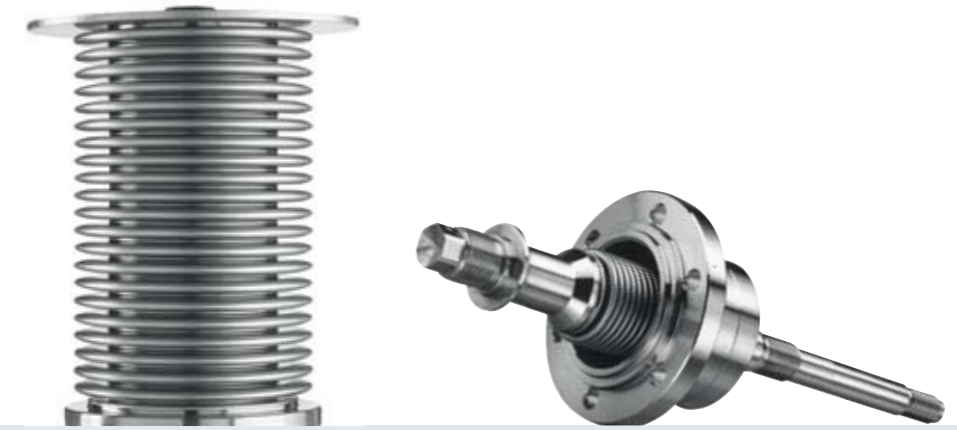
For the energy utilisation through district heating we offer axial and lateral expansion joints of stainless steel that absorb the thermal expansions of the kilometre long pipelines. Water heated in the coal-fired power station flows through these pipelines to provide whole districts of the cities with heat. In this sector Witzenmann supplies not only expansion joints for the pipelines, but also elements for the movement and vibration decoupling of turbines. One typical example is the district heating grid for the city of Munich.

Hangers and connection pieces are a further main product range in this segment. These hold pipelines with exactly designed mobility to absorb the loads resulting from media weight, thermal expansions or wind load forces. In addition they prevent inadmissible loads on expansion joint fittings or critical pipe runs.

NUCLEAR POWER GENERATION



The highest safety standards have to apply for nuclear power. It therefore goes without saying that all the components have to satisfy the highest quality demands. Not only development, design and planning have to be perfect – faults and failures have to be ruled out also during the day-to-day operation. In this segment Witzenmann serves large and renowned customers worldwide.



Witzenmann technology and products are to be found, for example, in an experimental pebble-bed reactor in South Africa that is regarded as the power station of the future. Calculation and design of the necessary flexible components was extremely complex, as a reactor is in place here that is made of graphite rather than metal in which pebbles containing uranium are surrounded by methane gas.

The resulting combination of temperatures of 900 °C and enormous pressures of almost 100 bar reduces the strength of any metal to practically zero. Since the downstream metal pipework system cannot be welded to the graphite reactor, Witzenmann engineers developed a reliable connection between pipes and reactor: A special expansion joint presses the pipework system so precisely against the graphite reactor that it is not depressed, but nevertheless maintains a leak-tight joint.

That was a particular challenge for the design and calculation of the expansion joint, as it not only had to ensure a leak-tight joint between pipework system and reactor, but also reliably absorb the expansion of the pipework installation resulting from the enormous temperatures.

In the classic sector of nuclear power generation, Witzenmann has been a quality-certified and listed manufacturer of flexible components for years. Metal bellows are to be found, for example, in high and low-pressure applications, in safety and control valves, or expansion joints as compensators in the pipeline system of nuclear power stations. Apart from the classic stainless steel 1.4541 it is predominantly high-alloy stainless steel such as Inconel 625 that are employed here. No problem for the Witzenmann welding experts who are regarded as the most highly qualified in the branch – even when more difficult materials have to be precisely welded.



Solar energy

With its solutions for solar energy, the Witzenmann Group is also present in the future market for renewable energies. Here the Witzenmann engineers constantly develop new technologies and improve established processes such as the flexible metallic connections between glass pipes and the metal holders - in large projects at home and abroad as well as in day-to-day applications.

SOLAR POWER GENERATION



Specially developed metal bellows such as those used in heat collector elements on parabolic mirrors enable an efficient utilisation of the solar energy.

The solutions from Witzenmann are employed in large industrial plants such as solar energy parks and solar power stations that are predominantly built in deserts or semi-deserts. Here we are present in all the technologies of the CSP (concentrated solar power) market. In solar farms with parabolic mirrors or Fresnel-technology, in solar towers such as that built in Jülich or in „parabolic dishes“ that make the highest demands on the bellows solutions employed with an operating temperature of around 750 °C.

Several thousand bellows made from chrome nickel alloy are installed, for example, in the mirror parks of solar farms where they compensate the miniature thermal expansion of the glass pipes connecting the collectors. When exposed to full sunlight, thermal energy is collected in the glass pipes at temperatures of up to 400 °C. This causes minute thermal expansion in the 25 kilogram glass pipes that would otherwise cause the glass pipes to break. The gas-tight bellows compensate these changes in length so precisely that the glass pipes remain intact. And designed for over 10,000 load cycles, they do that over the whole system service life of 25 years – a huge profitability factor.

RENEWABLE POWER GENERATION



In view of the ecological and economic demands, wind and water power and geothermics are becoming ever more important. Here again, Witzenmann provides product solutions for their efficient and profitable utilisation.



Witzenmann expansion joints are employed, for example, in tidal power stations such as in the Netherlands where many years of reliability are demanded under tough day-to-day operating conditions.

Or in points heating systems that utilise geothermal processes to protect railway tracks from freezing. Currently still in the trial phase, millions of euros in operating costs could be saved here in the next few years compared with conventional solutions.

Witzenmann has flexible pipeline elements in the product range also for offshore wind farms. The movements caused by the prevailing wind and water flow conditions there as well as the movements of the huge wind turbines have to be continuously reliably absorbed. The flexible metal hoses and expansion joints employed here also have to offer lasting resistance to the aggressive salt in wind and water. That calls for special materials in order to minimise the very costly maintenance and repairs at sea.

Here Witzenmann can call on its many years of experience in shipbuilding, with solutions for the offshore energy extraction such as the whole LNG chain.



Power distribution

With its solutions, Witzenmann plays a role in the whole energy chain. From the extraction through to the distribution in switchgears and distribution boards around the globe, whether metal bellows in vacuum interrupter chambers or load cells for the oil circuits in transformers.

POWER DISTRIBUTION IN THE VOLTAGE RANGE

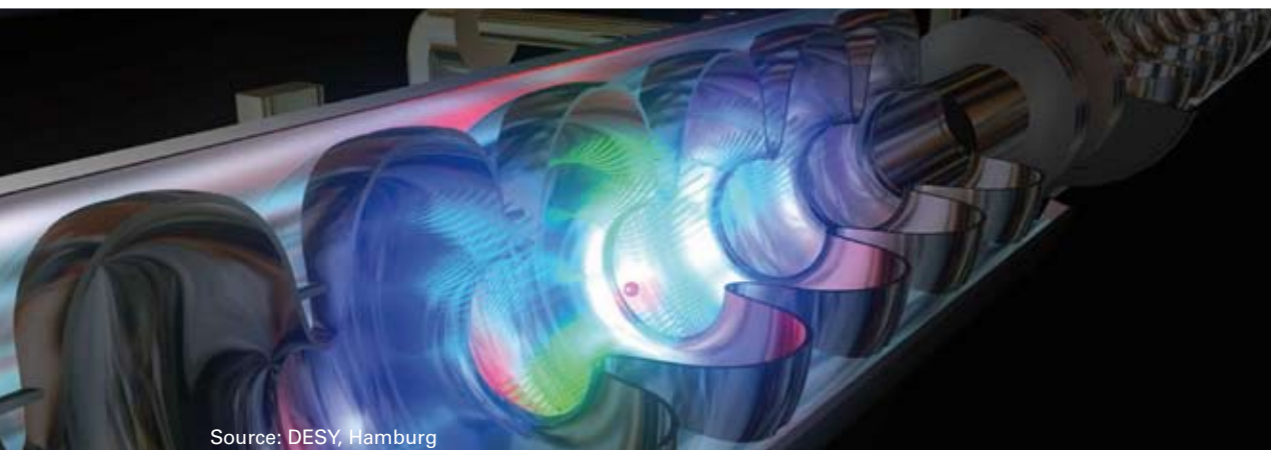


Special metal bellows in the vacuum interrupter chambers used worldwide in switchgears, predominantly in the medium voltage range, guarantee the reliable disconnection of the power flow in the event of a short circuit. Here the bellows have to fulfil an extremely important function.

In an emergency they have to interrupt the power circuit within milliseconds by means of exactly defined movements in the vacuum interrupter chambers. At the same time, their function has to be guaranteed without maintenance for decades: In order to permit the fastest possible reaction, the bellows here have a single wall. That demands the ultimate precision during production in order to meet the demanding requirement profile.

Volume equalising elements such as load cells of sheet stainless steel also form part of the product range for power engineering. These flexible special elements are installed in the closed-centre oil circuit of the transformers where they compensate the temperature changes in the oil by expansion. That demands high reliability in the switchgears employed worldwide.

NEW ENERGIES, ENERGIES OF THE FUTURE



Source: DESY, Hamburg

... and the future starts every day.

Continuous new developments and ideas call for continuous new solutions. And Witzemann is no exception here. The solutions to today's demands often focus on the problems of the future. As a result we are not just geared for the future – we play a role in forming that future – every day!



The research into new energies is in full swing – and Witzemann is on board, because only by staying constantly up-to-date, conducting continuous further development and being open to new technologies and ideas you can play an active role in the process.

That is why Witzemann as technology leader in the branch also conducts fundamental research and constantly develops new solutions for new fields of application. We contribute developments to trendsetting technologies such as the fuel cell that supplies energy from climate-neutral hydrogen. For the German Electron Synchrotron DESY, too, one of the world's leading accelerator centres that researches the structure of material through photon research and particle physics, we are a sought-after development partner with our product range.

But also for nuclear fusion that generates energy without radioactive waste such as at the new ITER international test reactor in the south of France, the "natural born engineers" from Witzemann develop the right solutions. Through our active response to such problems we also lay the foundation stone at the same time for solving the challenges of the future. With our know-how we are therefore a key development partner when it comes to exploring new and innovative fields of technology.