MACOGA
ENGINEERED EXPANSION JOINTS

40 YEARS

M'News
Issue No.14

M'News is MACOGA's online news bulletin featuring the latest development of significant projects, achievements, events and expansion joints related news.

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IN THIS ISSUE

MACOGA RECEIVES LARGE ORDER FOR FCCU EXPANSION JOINTS FOR PETROPERU

MACOGA has been awarded a contract for the detailed engineering, manufacturing, testing and shipping 9 **FFCU expansion joints** for the Petroperu Talara Refinery.

The scope of work comprises:

- FCC Hot Wall Design Untied Universal Expansion Joint I.D. 780 mm
- FCC Tied Universal Expansion Joint I.D. 1410 mm
- FCC Cold Wall Design Untied Universal Expansion JoinT I.D. 1240
- FCC Untied Universal Expansion Joint N.D. 12"
- FCC Untied Universal Expansion Joint N.D. 8"
- FCC Untied Universal Expansion Joint I.D. 810 mm
- FCC Untied Universal Expansion Joint I.D. 2092 mm
- FCC Untied Universal Expansion Joint N.D. 32"
- FCC Untied Universal Expansion Joint I.D. 990 mm

The expansion joints include:

- 2 ply testable & packed Bellows in ASTM B443 inconel 625 LCF
- Internal sleeve, pipes, elbows, floating plates, etc. in ASTM A 240 Tp 304 H
- Internal and external Super Wool insulation
- Hexagonal Mesh, sealing anchors and sealing rope
- Abrasion Lining Rescobond AA 22 S

Talara, Peru's second biggest oil refinery base on production, is located 1,185km away from Lima, the capital of Peru.

The refinery is spread across 128.9ha and has a crude oil processing capacity of more than 65,000 barrels per day (bpd or BBL/D). It produces domestic LPG, motor gasoline, solvents, A-1 turbo, diesel, kerosene, industrial oils and asphalt for national and international markets. Peruvian state-owned oil company Petroperu operates the refinery.

A modernization and upgrade project was launched at the refinery in May 2014 and is expected to be completed by 2017. It is aimed at increasing the refinery's crude oil processing capacity from the existing 65,000 bpd to 95,000 bpd.

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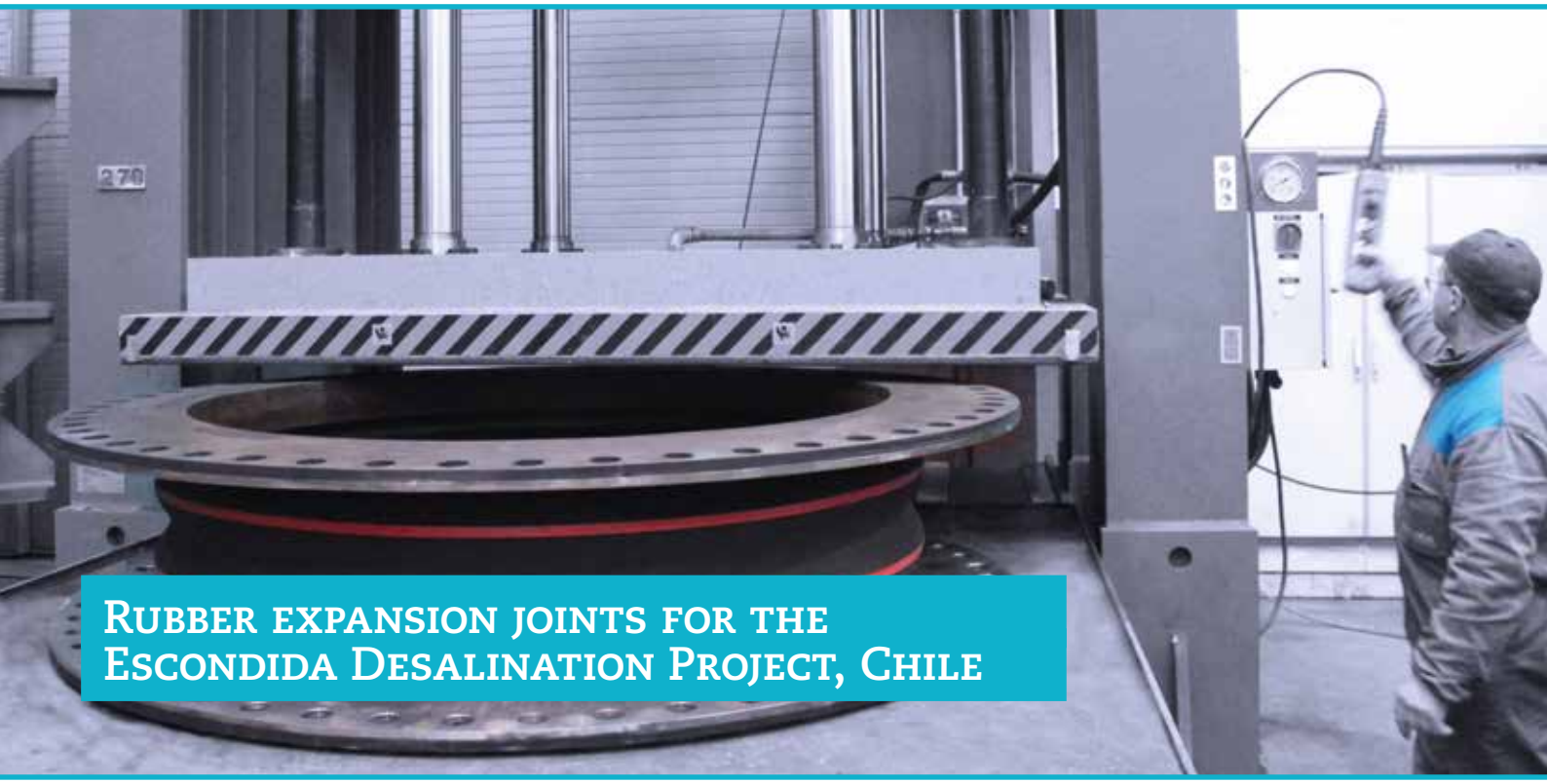

Rubber expansion joints for the Escondida Desalination Project, Chile

MACOGA has designed, manufactured, tested and delivered a large number of MAC-F2 DN1500 expansion joints for the Escondida Water Supply Project in Chile. Each expansion joint incorporates a Double Arch EPDM bellows and Superduplex S32750 flanges.

The plant will include an offshore intake and outfall system more than 65 feet (20 meters) below the surface of the Pacific Ocean. The system will bring seawater into the desalination plant, filter much of its dissolved mineral and biological content using a reverse-osmosis process, and circulate extracted brine and other material back into the ocean. The desalinated water will be pumped to the mine.

The Escondida Water Suppy project team will construct a new seawater desalination plant, which will be linked to the Escondida mine site in the Andes by two 112-mile (180-kilometer), 42-inch (107-centimeter-) diameter lined pipelines.

Four high-pressure pumping stations will move water east from the port across the Atacama Desert and up to a reservoir at the mine, 10,500 feet (3,200 meters) above sea level.

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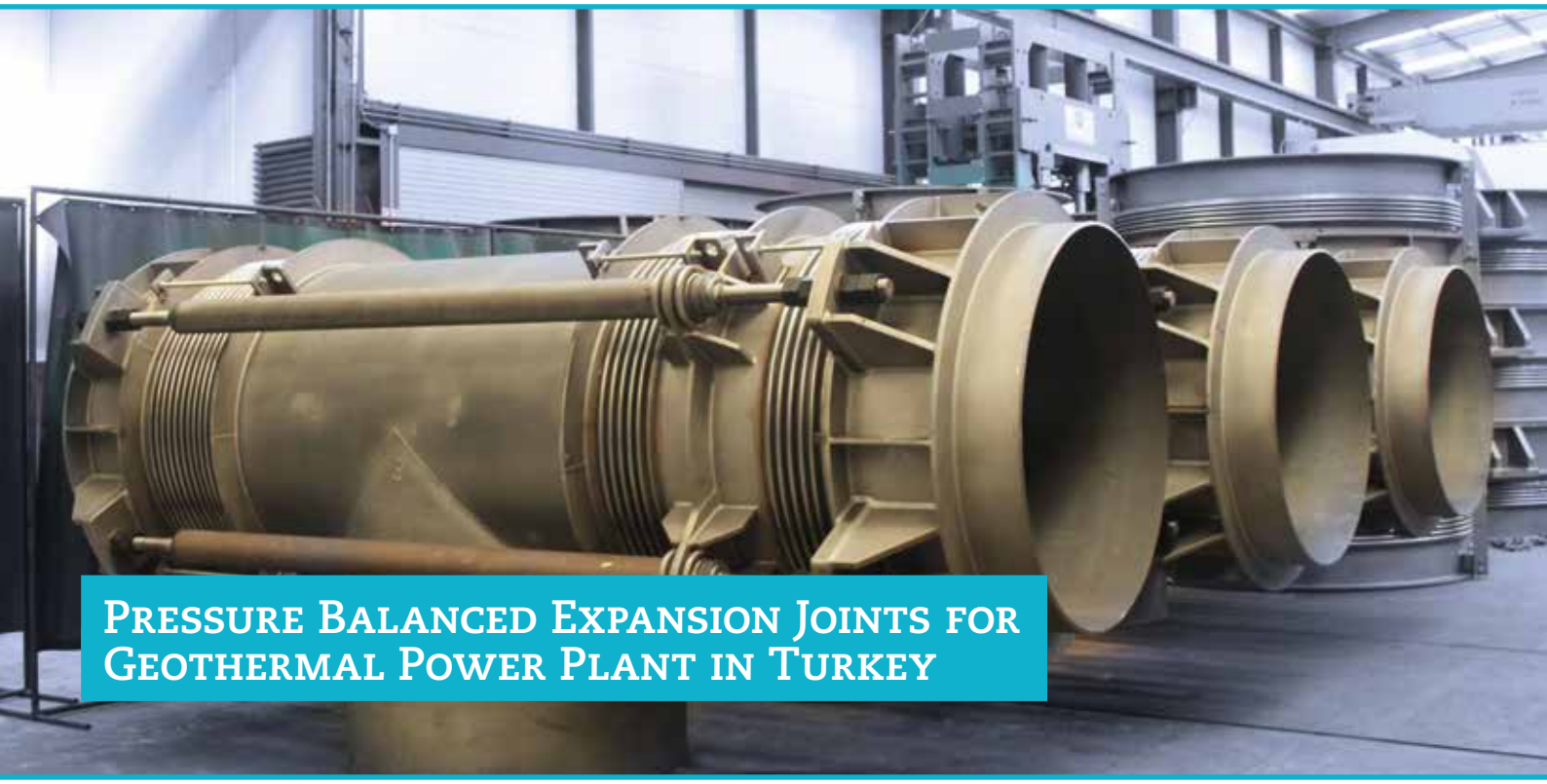

Pressure Balanced Expansion Joints for Geothermal Power Plant in Turkey

MACOGA has designed, manufactured and tested three **Elbow Pressure Balanced Expansion Joints** DN1400 for the GEX 2500 – 25 MW Maren Geothermal Power Plant in Turkey.

Most power plants, whether fueled by coal, gas, nuclear power, or geothermal energy, have one feature in common: they convert heat to electricity. Heat from the Earth, or geothermal - Geo (Earth) + thermal (heat) - energy is accessed by drilling water or steam wells in a process similar to drilling for oil.

Geothermal power plants have much in common with traditional power-generating stations. They use many of the same components, including turbines, generators, transformers, and other standard power generating equipment.

A **pressure balanced expansion joint** accommodates axial and lateral movements and counteracts the bellows pressure thrust. An additional bellows is incorporatedinto the unit and is subject to the line pressure to generate a force equal and opposite to that on the main bellows. Tying these bellows together neutralizes the pressure load on the unit. These joints are often installed at changes of direction in piping (MPB-E) but in-line designs (MPB-I) are also available.

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MACOGA Expansion Joints for FLUOR / SASOL Chemicals USA

MACOGA has designed, manufactured, tested and delivered one **Lateral tied** DN2600, 12 DN800 and one **Rectangular** MRU 2000 x 630 expansion joints to Fluor for Sasol Chemicals in the USA.

Sasol is an international integrated energy and chemicals company with more than 31 000 people working in 37 countries.

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MACOGA approved by Korea Hydro & Nuclear Power

Nuclear industry is one of the most regulated and complex industries. MACOGA has successfully passed the strict certification audit and has been approved as a supplier of expansion joints and bellows to Korea Hydro & Nuclear Power Plants.

Korea Hydro & Nuclear Power Co., Ltd. (KHNP) is KEPCO's wholly-owned subsidiary which owns and operates Korea's 21 Nuclear Power Plants along with 27 hydro-electric power plants.

Services provided by KHNP – ranked 3rd globally in NPP capacity – range from feasibility studies and technical assistance on plant design modification and improvement to overseas operation of Korean NPPs. KHNP employs roughly 7.600 employees.

KHNP accounts for nearly 25% of Korea's generation facilities and supplies over 34% of the country's total power.

KHNP

유자격공급자 등록증

Certificate of Registration

등록번호 (Certificate No.) : 201501121

상 호 (Company Name) : MACOGA

공장주소 (Factory Location) : LEIRA S/N 15680 ORDENES LA CORUNA SPAIN

대 표 자 (Chief Executive officer) : Diego Concheiro

상기 업체는 우리 회사의 공급자관리지침에 따라 심사한 결과 예비품목 기자재 공급업체로 등록되었음을 증명합니다.

This is to certify that according to KHNP's qualification procedure, this company has been registered on KHNP's Approved Spare Parts Vender List for the below items.

NO	품목코드 Item Code	품 명 Item Description	품질등급 Quality Class	유효기간 Authorized Period
1	117(Q)	EXPANSION JOINTS	Q	2016.03.08~2019.03.07
2	116(Q)	BELLOWS	Q	2016.03.08~2019.03.07

2016.03.08

한국수력원자력(주)

KOREA HYDRO & NUCLEAR POWER CO., LTD

1/1

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MACOGA at the 21st Iran Oil, Gas, refining and Petrochemical Exhibition

MACOGA will be present at the **Iran Oil Show 2016**, the most important Oil and Gas Exhibition in Middle East, exhibiting the complete range of metal and rubber expansion joints.

From the 5th to the 8th of May 2016 over 100.000 trade visitors from some 40 countries/regions are expected to attend the show and 2.000 participating companies from 35 nations are expected to be there.

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FFCU Expansion Joint for one of the largest refineries in Europe

MACOGA has successfully designed, manufactured, tested and shipped a large tied universal **FFCU expansion joint** for one of the largest crude oil processing locations in the North of Europe.

The scope of work at the refinery comprises a high-tech Flue Gas Line expansion joint DN1290 (hot wall) and 8660 mm long.

The expansion joint includes:

- 2 ply testable & packed Bellows in ASTM B443 Inconel 625 LCF
- Internal sleeve, pipes, elbows, floating plates, etc. in ASTM A 240 Tp 304 H Internal and external Super Wool insulation
- Hexagonal Mesh, sealing anchors and sealing rope
- Abrasion Lining Rescobond AA 22 S

Bellows were post formed Heat treated in a vacuum furnace with molybdenum shell (in order to avoid surface contamination): annealing at 960°C with cooling system under N2 or Ar.

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World-class Quality Commitment

MACOGA is fully committed to a quality management process with quality as a foundational business principle. The core of the process is achieving customer satisfaction by meeting our internal and customer requirements on time.

Employee participation in a continuous improvement effort develops reviews and implements the quality assurance system, procedures, and practices needed to meet the highest standards. The end goal is to continue meeting world-class standards for the mutual benefit of our customers and employees.

Quality is the engine for improvement in our Company. It is the combination of actions that increase efficiency and output in activities and processes to provide added advantages to both the company and customers.

Our vision is to create value through innovation and continual improvement. And we apply it to all areas in our company, from the purchasing of raw materials to the final tests and controls carried out on each expansion joint, from design control and verification to the perfect efficiency of all departments.

MACOGA management fully supports and provides the necessary resources for continual implementation of the quality assurance system. All management levels participate in quality assurance activities incorporated into daily functional requirements.

No product is shipped to the customer until its quality and conformance to customer specifications is assured.

Management assesses the effectiveness of the quality system on a regular basis and directs internal efforts towards continual improvement.

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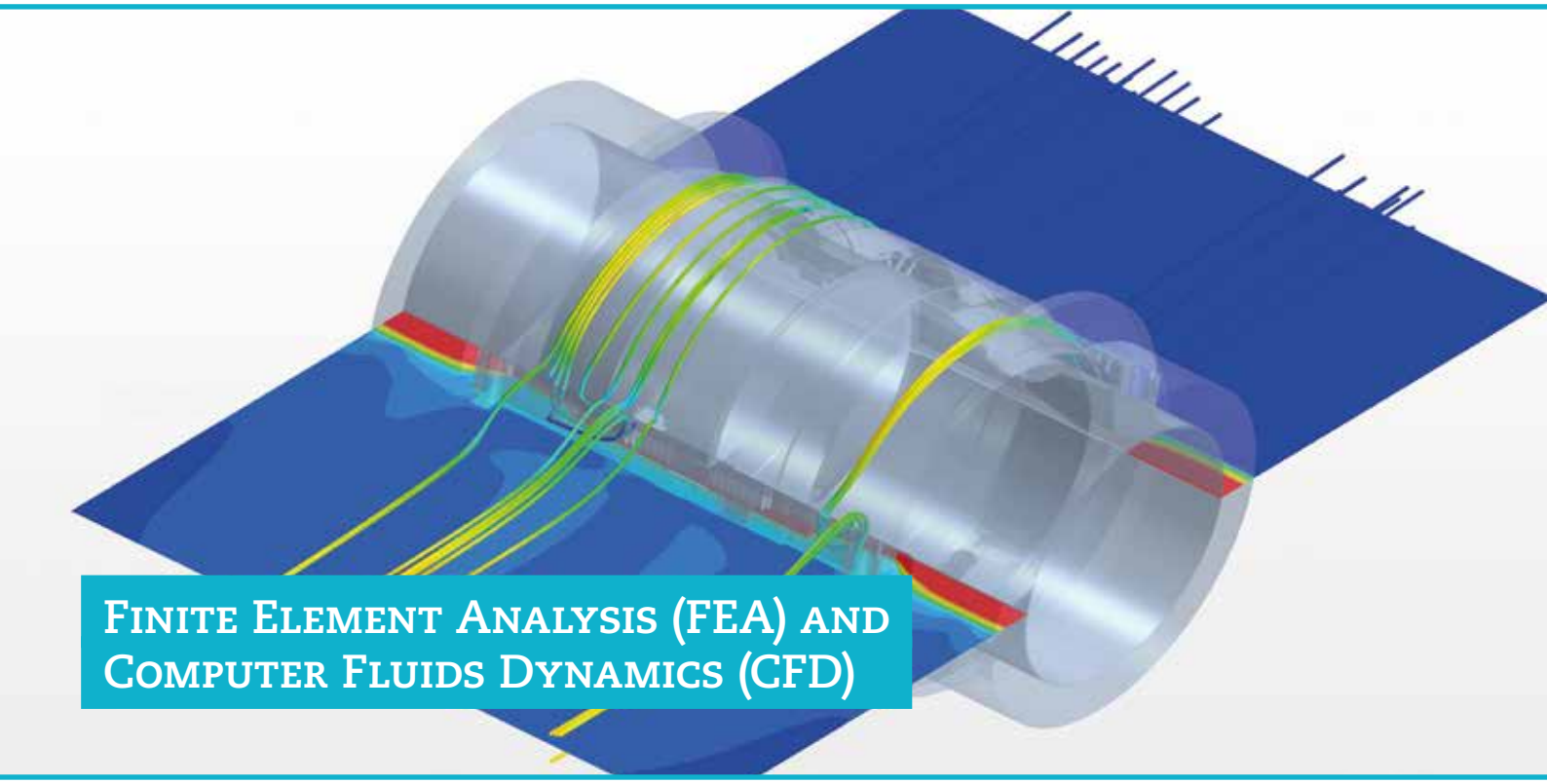

Finite Element Analysis (FEA) and Computer Fluids Dynamics (CFD)

Our engineers are skilled in using Finite Element Analysis (FEA) and Computer Fluids Dynamics (CFD) to analyze the thermal-mechanical performance of different kind of systems.

Finite Element Analysis (FEA) based structural stress analysis is a valuable tool in the evaluation and optimization of product designs for systems including structural stress due to mechanical and thermal loading.

Since the majority of industrial components are made of metal, most FEA calculations involve metallic components. The analysis of metal components can be carried out by either linear or nonlinear stress analysis. Which analysis approach you use depends upon how far you want to push the design: If you want to ensure the geometry remains in the linear elastic range (that is, once the load is removed, the component returns to its original shape), then linear stress analysis may be applied, as long as the rotations and displacements are small relative to the geometry. For such an analysis, factor of safety (FoS) is a common design goal.

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Evaluating the effects of post-yield load cycling on the geometry, a nonlinear stress analysis should be carried out. In this case, the impact of strain hardening on the residual stresses and permanent set (deformation) is of most interest.

The analysis of nonmetallic components (such as, plastic or rubber parts) should be carried out using nonlinear stress analysis methods, due to their complex load deformation relationship.

MACOGA uses FEA methods to calculate the displacements and stresses in our expansion joints due to operational loads such as:

- Forces
- Pressures
- Accelerations
- Temperatures
- Contact between components

Using FEA/CFD as part of our product design process allows for the rapid and cost effective virtual testing and optimization of our designs.

This will reduce overall product development costs, improving design performance and also give your team greater insights into how your design is likely to respond to a range of operating conditions. Some samples of FEA/CFD studies:

- Design/Analysis to ASME, API, PD and UNE standards
- stress analysis
- Thermo-mechanical analysis. Heat transfer
- Fatigue
- Vibration Analysis
- Dynamic analysis
- Shock analysis
- Resonance analysis
- Coupled fluid structure interaction
- HVAC analysis

The results obtained in this kind of analysis may be used to assess design safety as well as predict the expected fatigue life of the design.

CCI Baja California Sur V

The Federal Electricity Commission (CFE) of Mexico has selected MACOGA for supplying the expansion joints to the power plant of Baja California Sur V.

The plant, located in La Paz, capital of Baja California Sur, will have a net capacity of 46.8 MW.

The thermal power plant uses residual fuel oil for electricity generation from internal combustion engines, which optimizes the cycle of oil with minimal environmental impact in an environment of high ecological value such as the Peninsula Baja California Sur.

The plant contributes to greater energy efficiency in the area, meeting international standards of the World Bank on emissions.

MACOGA supplies a large number of **lateral tied expansion joints** from DN1600 up to DN2700.

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MACOGA
ENGINEERED EXPANSION JOINTS
40 YEARS

GLOBAL PRESENCE
World-Class Commitment

Our expansion joints are present in more than 80 countries across all continents performing demanding tasks. MACOGA is always ready to provide support exceeding customer expectations.

We are conveniently located in NW Spain near two international airports (SCQ and LCG) and two deepwater oceanic sea ports (Vigo and La Coruna).