



TYPES OF FCCU EXPANSION JOINTS

Typical types of expansion joints used in FCCU applications are: **Restrained Universal, Gimbal, Hinged and Pressure Balanced (in-line and elbow type)** and can be categorized in three major groups:

- Cold Wall
- Hot Wall
- Unlined

The **Cold Wall** units are refractory lined to ensure the shell wall temperature does not exceed the allowed parameters. The lining consists of stainless steel anchors and a high-density vibrocast/self-levelled refractory material. They incorporate internal insulation/packing made of bio-soluble ceramic fibre or silica blankets, a liner seal that keeps in place the internal insulation blankets while keeping fluid particles out of the bellows/liner cavity.

An important advantage of cold wall design Expansion Joints is that the pipe is insulated so it operates below

the media temperature reducing the pipe growth and consequently the expansion joint movement.

An insulation pillow is included to reduce the temperature. An external insulation is incorporated to prevent the bellows element from dropping below the acid dew point, the main reason of premature bellows failure.

The **Hot Wall** units incorporate an abrasion resistant lining, including hex-mesh and castable material or refractory (a multi-purpose abrasion resistant castable which can be hand-packed, vibration cast and gunned) such as RESCO AA-22. The lining is not intended to be used as a thermal fence and requires a specific and controlled drying.

The **Unlined** FCCU Expansion Joints can be exposed to very high temperatures but usually do not convey catalyst so they do not require abrasion resistant lining. This type is generally used for inlet and outlet air and transferring gases from the reactor.



Universal – Cold wall design Two ply testable Inconel 625 LCF bellows. Design temperature: 768 °C (flue gas) 538 °C (bellows)



Double Gimbal – Hot Design - Floating Ring. Two ply monitored Inconel 625 LCF bellows. Design temperature: 760 °C (flue gas) 538 °C (bellows)

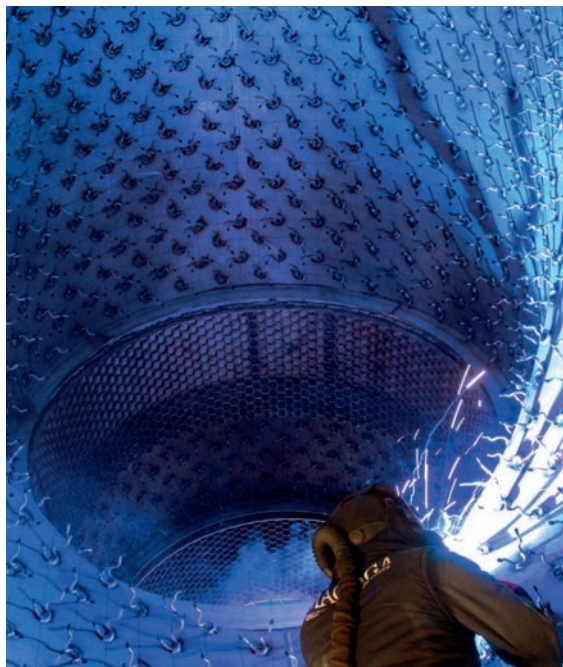
REFRACTORY MATERIALS AND INSTALLATION

Refractory is a major element of all FCC components. Without proper refractory installation the process unit is risking a costly unscheduled unit shutdown. FCC Expansion Joints are designed with a hot wall (external insulation) or cold wall (internal insulating refractory). The internals that are exposed to catalyst erosion are protected with abrasion resistant refractory even in hot wall designs.

Generally, all these critical linings are designed and installed according to the most up-to-date and demanding refractory licensors specifications as UOP 3-series, ExxonMobil Research and Engineering EMRE Gp, KBR and API 936 or proprietary own specifications.

The insulating or abrasion resistant refractory linings can be installed by casting, gunning (pneumatic application), hand-placing or pneumatic ramming. The abrasion resistant refractory installation involves several critical activities like anchor system (hexmesh or equivalent), QC of materials, prequalification, application and heat dry outs. It is very important that all refractory installation activities are, during all

the process, carefully controlled to ensure a good quality control through a good method statement with drawings, materials selection, testing frequency, installation systems and dry out curve.



MACOGA closely cooperates world leader refractory consultants and engineers, who provide specialized refractory inspection and supervision services.

FCCU EXPANSION JOINT ON-SITE SERVICES

We help you get them properly installed. In any refining facility the FCCU Expansion Joints are critical units that require a high level of expertise during installation and maintenance to ensure that the refining process is not disrupted and optimal production can be achieved.

MACOGA offers its customers in the oil and gas, refinery and petrochemical industries a complete field

service package.

We provide a professional variety of site services including assembly, supervision of installation and inspection that minimize risks of unplanned shutdowns and help to avoid failures and breakdowns.

Assembly of the Expansion Joints

Our site team is trained and consists of qualified welders, technicians and engineers who work in plants



and refineries worldwide. Thanks to our many years of experience in manufacturing and installing FCCU Expansion Joints we know what matters.

A site-specific erection plan is developed during one or more pre-construction conferences and site inspections involving the customer, the contractor, and others such as the project engineer.

MACOGA manages all aspects of site work for the Expansion Joints supplied. From initial delivery of the equipment to site, installation to agreed standards, and final commissioning, MACOGA will manage the project.

Assembly Supervision

Qualified and trained engineers are available for guidance and instruction during assembly and/or erection process (by others) of our Expansion Joints. We offer pre-instruction and guidance for assembly and periodical inspections that guarantee the correct

procedures are being carried out and unquestionably a Final Inspection after completion of the assembly and/or erection works.

Additional services available include Nondestructive Examination.



FCCU EXPANSION JOINTS ON-SITE INSPECTION SERVICE

Whether your operations follow predictive maintenance or corrective maintenance procedures, detecting early signs of Expansion Joint fatigue or failure can save you on costly repairs and extend your asset lifecycle for optimal refining operations.

Why FCCU Expansion Joints On-Site Inspection?

The life of the expansion joints varies with the design, storage conditions, installation practices, application, and service.

Appropriately timed inspections, repairs, and/or replacement of critical joints will ensure the reliable operation of the associated equipment and of the whole refinery.

Premature or unexpected failure of the expansion joints and emergencies can be avoided carrying on-site scheduled inspections. On-site Inspections will provide valuable information about the conditions of the Expansion Joints and will allow the refinery to take appropriate actions in due time.

What is Site Inspection?

Site visits typically include in-depth analysis and

visual review of the Expansion Joints (in hot and cold conditions) identified by the customer. Our staff will collect any monitoring data and operating schedules available from the facility to aid in the analysis. We collect equipment specifications and operating information on specific forms and checklists. Using checklists ensures that the engineers collect consistent and critical information. In addition, we take photographs of the Expansion Joints, equipment, and controls for accurate documentation while on site.



On-Site Inspection at BPOil Refinery

MACOGA
ENGINEERED EXPANSION JOINTS

What are the key benefits?

MACOGA can offer on-site inspection of FCC Expansion Joints well in advance your next planned outage, during the beginning stages of a turnaround to aid in planning and expediting the turnaround, during installation of new Expansion Joints, during start-up and periodical inspections.

After every site inspection, MACOGA will issue a report that will assist plant personnel in understanding the types and functions of expansion joints, operation and failure mechanisms of expansion joints, condition monitoring and troubleshooting techniques. Maintenance, repair, and replacement issues are also discussed. This document will assist plant personnel in determining if new expansion joints or revamping are required, the design features of new or replacement

expansion joints as well as provide guidance in the handling, storage, installation, and inspection of these types of joints in the refinery.

MACOGA on-site staff can provide you:

- Installation guidance for new FCCU Expansion Joints
- Inspection in cold conditions (plant shutdown)
- Inspection in hot conditions (plant in operation)
- Periodical Inspections
- Maintenance and refurbishment
- Problem resolution
- Immediate response to site inspections needs
- Quick-turn expansion joint replacement during shutdowns and turnarounds



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