

QUICK OPENING CLOSURE
CLAMP TYPE



QUICK OPENING CLOSURE CLAMP TYPE

Conceptual Design

What does "QUICK ACTUATING CLOSURE" mean?

- The CODE stipulates that: "Closures that permit substantially faster access than expected with a standard bolted flange connection". (i.e. Multi bolted closures are not quick actuating closures)
- Any closure that allows the opening by a single manoeuvre.

The CODE says:

To open a **Quick Actuating Closure** safely, the system must be depressurized and isolated from any incoming flow or back flow. The quick actuating closures have been provided with a device connected to the atmosphere. This Device, after the correct depressurization process, must be opened to release any residual pressure and enable the opening manoeuvre of the quick actuating closure.

The **FAI "Clamp" End Closure** fulfils the code requirements, as it has been sized and verified under code calculation.

The **FAI "Clamp" End Closure** is a proven design supported by finite element analysis, checked by strain gauges on a prototype.

The philosophy of FAI design is not only limited to complying with the code but it also focuses on the fatigue life of the closure assembly and its components, including the gasket.

It is a well-known fact that to reduce the stress in the closure components, it is common practice to minimize the elastic deformation. FAI has evaluated the distribution and localization of the stresses in each component.

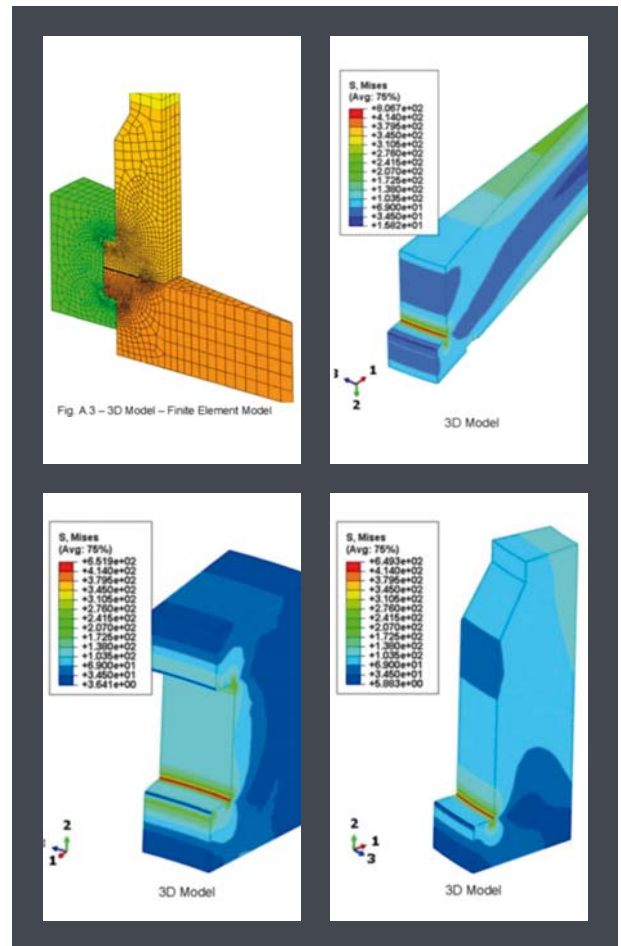
Based on FAI's knowledge and regardless the specified steel grade, the stress parameters assumed in the calculation are significantly below the allowable limit and, as a result, each component is effectively redundant.

This approach enables FAI design to have a sturdy construction, suitable to properly withstand any unforeseen peaks of stress.

The shelf-life of the gasket, whichever the geometry or the type of elastomer used, is generally double lasting. Structural components, such as the hub, the door and the clamps, are made of CTOD-supported steel.

The selected materials, basically forging, are characterized by "low cycle fatigue test" so that they suit fatigue cycles.

The choice of the correct steel, in addition to fabrication details, secures a 30000 cycles life.



Main Features

Typical Application:

Pipeline pig launcher and receiver
Filters
Valves
Separators
to any Customer and Country specification

Dyeing
Strainers
Skid system

Design

Size range & Class rating

■ FABRICATED
■ DESIGN AVAILABLE
■ UNDER DEVELOPMENT

ANSI Class dia. (inc)	150#	300#	600#	900#	200 barg	1500#	API 5000	2500#	API 10000	API 15000	API 20000
4 to 10	■	■	■	■	■	■	■	■	■	■	■
12 to 18	■	■	■	■	■	■	■	■	■	■	■
20 to 26	■	■	■	■	■	■	■	■	■	■	■
28 to 40	■	■	■	■	■	■	■	■	■	■	■
42 to 64	■	■	■	■	■	■	■	■	■	■	■
66 to 80	■	■	■	■	■	■	■	■	■	■	■

Conditions

design pressure up to 1380 barg (API 20000)
design temperature from minus 100°C to 300°C

Code

ASME VIII Div. 1 (U Stamps), ASME VIII Division 2, PD 5500 / BS EN 13445

Certification

ASME U1 or U2 Stamp to National Board
PED, C.E. marking, ATEX

Orientation

Horizontal or Vertical

Optional Features

As standard feature, the **FAI "Clamp" End Closure** is spark proof and vacuum duty.

In addition, through an implementation of minor modification, the FAI end closures suit different services such as:

- Fire safe
- Gas Sealing (cyclic gas service)
- Cryogenic service
- Fatigue life (FAI quick closure is granted for 30000 cycles from zero to design pressure)

To demonstrate the suitability to withstand these services, dedicated tests have been developed in house under Third Party supervision for certification purpose, while tests capability are always available for:

- Pneumatic cyclic gas leaking test by nitrogen or helium up to 430 barg
- Hydrotest in cooled box under cryogenic condition
- Cyclic pressure test (continuous recorded) to simulate fatigue test over 30,000 cycles (from 0 to 250 barg) for quick closure working in dyeing sector.

Additional instrumentation can be designed and supplied in support of the closure:

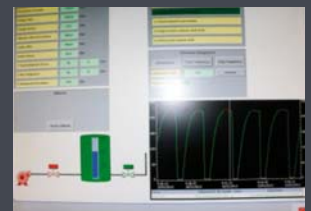
- key interlock
- proximity switch
- control system

When required or due to heavy sizes, operation may be assisted and supported by:

- hydraulic or electrical opening/closing
- mobile pneumatic tool



Cryogenic test



Cyclic test



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Safety And Environment

SAFETY is a priority:

a SAFE design means safe operations.

SAFETY DEVICE

The safety device is "mandatory for ASME UG35". Located in the upper point of the door, to be unaffected by sediment or wax formation, the device has been improved to be self-energized and suitable to prevent opening in case of positive pressure in the system or accidental opening. This peculiarity obliges the operator to properly depressurize the system, ensuring the opening in absence of pressure and preventing any accident.

When opened, the safety device is connected to the atmosphere to meet the code requirement. For safety reasons, in the event of hydrogen sulfide in the system, the vent outlet is connected far from the operator.

The safety device body and internal are manufactured, as a standard practice, with 316 stainless steel, while the locking pins, which retain the clamps, are duplex material. The knurled hand-wheel is in bronze. Upon request internal in Alloy 625 or any other Nickel Alloy could be provided.

When the system is in the closed position, the locking pins, being self-pressure activated, lock the clamps closed.

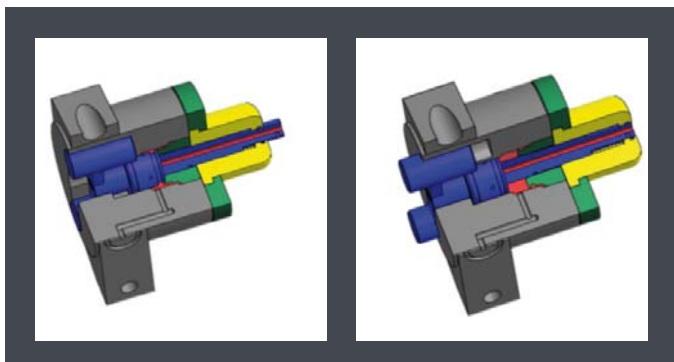
When the system is in open position, the locking pins are withdrawn, the clamps are therefore free and the vent hole through the piston is connected to the atmosphere.

The purpose of safety device can be summarized as follows:

- to lock the clamp in the fully closed position
- to avoid opening if residual pressure is still present
- to warn the operators if pressure is still present

The Safety device system is manufactured in six (6) different sizes to be installed on a different closure size and rating.

The safety device locking pins are sized to withstand any wrong attempt of the operator to unscrew the tie rod and have been tested and certified by a Third Party Inspection body also as supplementary retaining system to held the clamp closed in event of tie rod failure.



Additional Safety Features

The **FAI "Clamp" End Closure** is also designed to ensure that, after the system depressurization and the safety device open, the possible presence of liquid static head cannot cause any undesirable door slam.

The seal in the **FAI "Clamp" End Closure** is face-to-face type (door & hub not diametral), therefore the pre-asset of the Gasket is completely nullified after the first turn of the tie rod, as the door hub teeth is conical.

As a consequence the minimal opening loosens the seal and the liquid, if any, is free to drop through the drain hole located in the bottom segment of the clamp, giving a warning signal to the operator.

At this stage the door is still engaged in the clamp and cannot slam. Any additional monitoring device can be provided upon request.

Environment

FAI's care in the design of the end closure looks at the ENVIRONMENT where the closure is generally working.

FAI's engineers are skilled and have direct field experiences in Onshore, Offshore, Deserts environments at every latitude.

This experience is transferred to the **FAI "Clamp" End Closure**, designed with the aim of minimizing maintenance and make all operations easy under any condition/circumstance.

This is also evident looking at the choice of the materials extensively used (stainless, duplex, aluminum bronze, alloy 625, etc...) to reduce the atmospheric corrosion.

This, in a few words, is the reason why the lifetime of the FAI "Clamp" End Closure is more than thirty-five years.

MAIN COMPONENTS

END CLOSURE

Hub And Door

The Hub and Door are manufactured from forged materials or to any Customer specification. Both CNC machined, the sealing faces and gasket groove are weld overlaid with AWS ER 316 as standard practice. Alternatively AWS ER 625 weld overlay can be provided. Any other welding consumables are available upon request.

Clamps

Clamps are manufactured from forged materials and to any Customer specification. Each section, CNC machined to the final profile, is manufactured from a single tailored forging and sized to obtain the tie-rod and pin lugs as a solid single piece.

Clamp Pins

Manufactured from forged round bar. As FAI standard practice, the pins are constructed in UNS 31803 material to prevent corrosion and seizing onto carbon steel clamp lug.

Tie Rod

Threaded left/right tie-rod is designed to be operated alternatively from both ends ensuring a single opening point of the clamp.

It's Manufactured as standard from UNS 31803 material to prevent corrosion.

The Nuts pivot, designed to allow removal of sediment or debris on the threaded area, are manufactured from solid SB 150 UNS C63000 materials to prevent sizing.

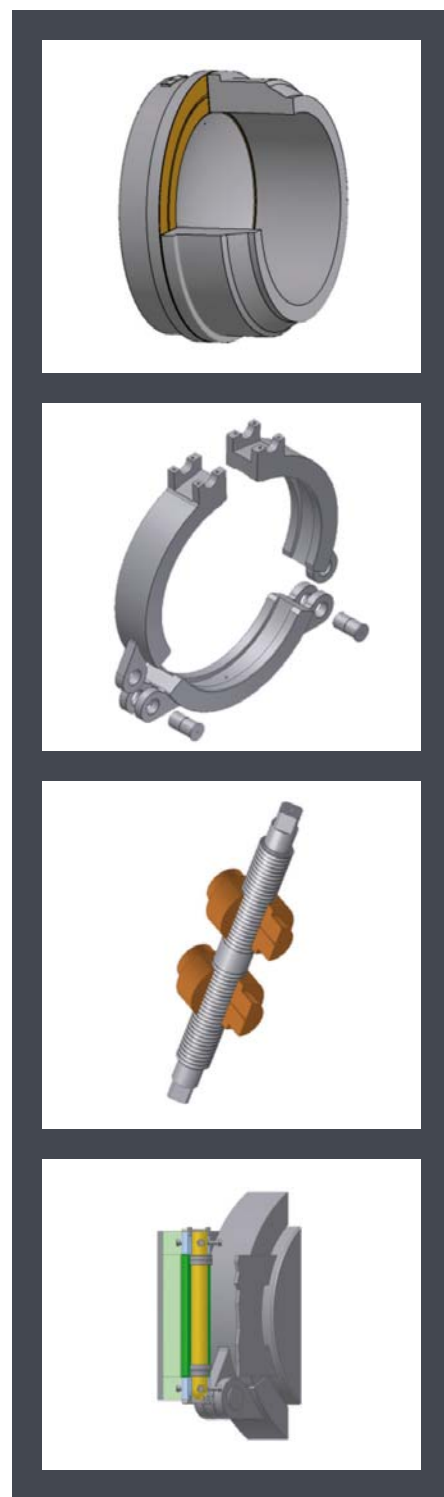
The combination of tie-rod and nuts pivot materials allows the closure operation even with poor maintenance.

Hinge

The Hinge is directly connected to the hub and designed to assist the door opening.

All Hinge components are basically made in structural painted carbon steel while the hinge pivot is hot dip galvanized carbon steel, fitted on a self-lubricated bearing. Alignment and realignment is always possible by stainless steel screws.

When required, the Door is provided with a retainer screw to prevent door slamming.



SEALING END CLOSURE

Sealing Type

FAI "Clamp" End Closure is designed to suit different types of gaskets either shape and elastomer grade.

The gasket groove is designed to install O-RING gasket as well as special designed CHEVRON gasket.

The sealing face and gasket groove is made of corrosion resistant alloy (CRA) weld overlay.

Gasket Pre-Asset

Tightening the clamp onto the conical teeth, door and hub sealing faces come in contact, the initial gap is nullified and the gasket pre-compression granted. Sealing under low pressure and vacuum is ensured.

Sealing Material

The gasket material is normally selected to withstand the fluid and corrosion inhibitor (if any), but could be to any other Customer specification. Standard gasket elastomers are HNBR / FKM both explosion decompression grade.

The gasket elastomer whatever is the grade, could be reinforced by TEX spring and PTFE covered.

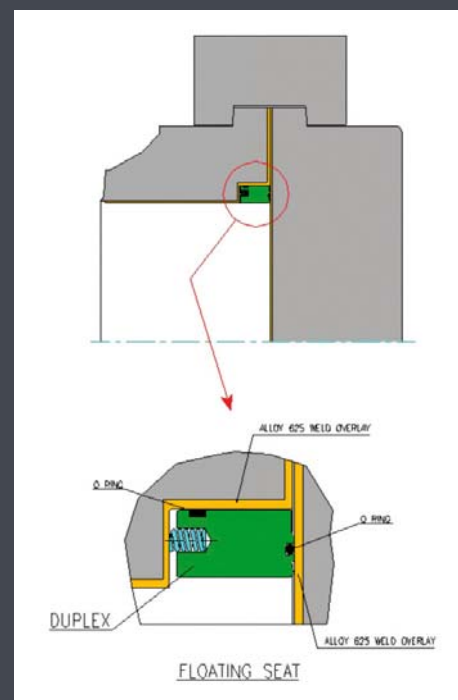
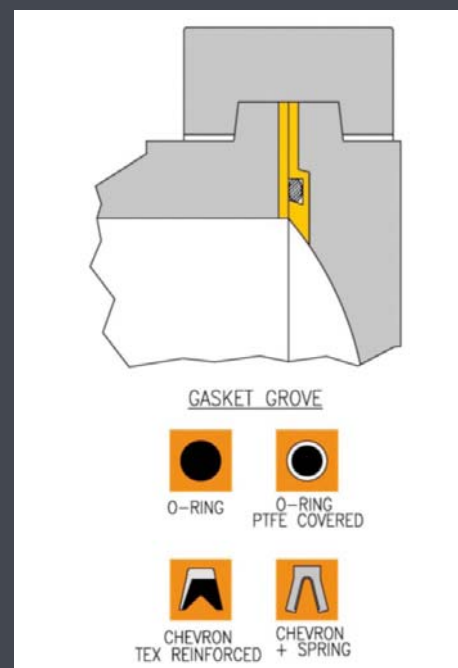
Standard temperature range is minus 45°C to 150°C.

Upon request, gasket suitable to minus 100°C to 250°C could be provided.

Sealing Floating Pack

FAI, based on the large experience acquired in more than a hundred different applications, has developed a floating self-engineered pack to ensure sealing even when the gap between the seal faces under the steel elastic deformation (severe pressurization, cyclic service etc.) is high and reduces the life of the conventional gasket.

The floating pack consists of two gaskets: the first works on diameter allowing the pack under the pressure to slide toward the seal face, absorbing the gap of the steel elastic deformation. The second, working between the seal faces, allows the gasket (O-ring) to work whatever is the pressure value in the same condition, being the two seal faces always in contact granting the tight sealing of closure.



OPERATION & MAINTENANCE

END CLOSURE

Operational safety has been developed into FAI "Clamp" End Closure at every stage.

Before attempting to open the Closure, ensure that:

- the vessel isolating valve is fully closed
- the system is depressurized
- vessel is fully drained and isolated from any source.

Operation

Turn the safety device knurled hand wheel clockwise to withdraw the locking pins. Without this operation the clamps cannot be opened. If some residual pressure is present, the same will be vented to the atmosphere. If an indication of residual pressure is given, close the safety device and re-check the isolation of the vessel.

When the safety device is fully opened, the End Closure will be safe and can be opened.

Engage the operating key in the "square end" of the lead screw.

Turn the operating key anticlockwise until complete opening of clamps. At this stage the operating key can be removed. Open the door using the handle.

Lock the door in the opening position closing a door retainer system provided

To close **FAI "Clamp" End Closure** simply repeat the operations in the reverse sequence.

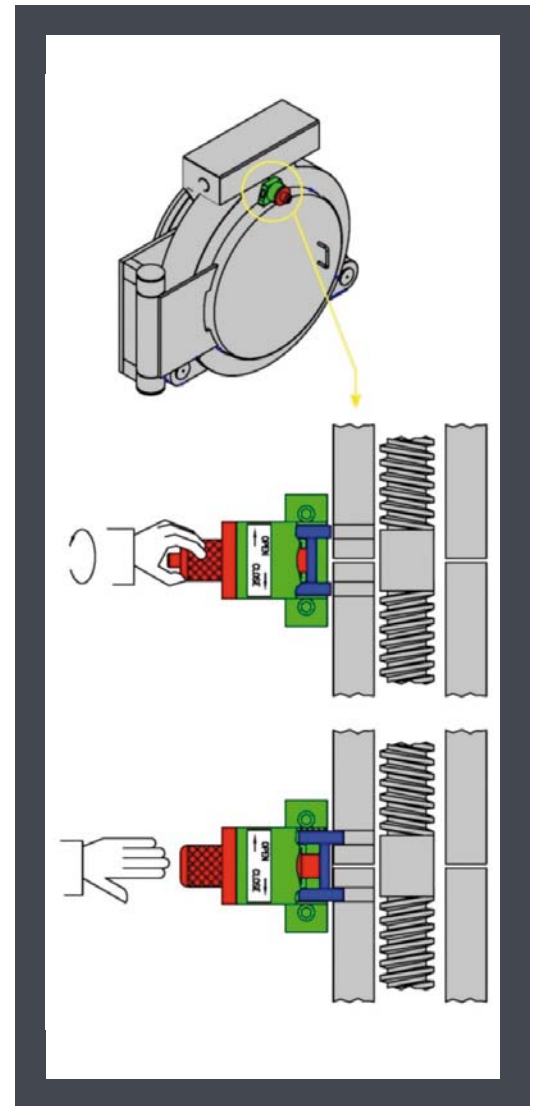
Maintenance

FAI "Clamp" End Closure is designed to minimize maintenance operations, However preventive maintenance could be arranged to extend service life and efficiency.

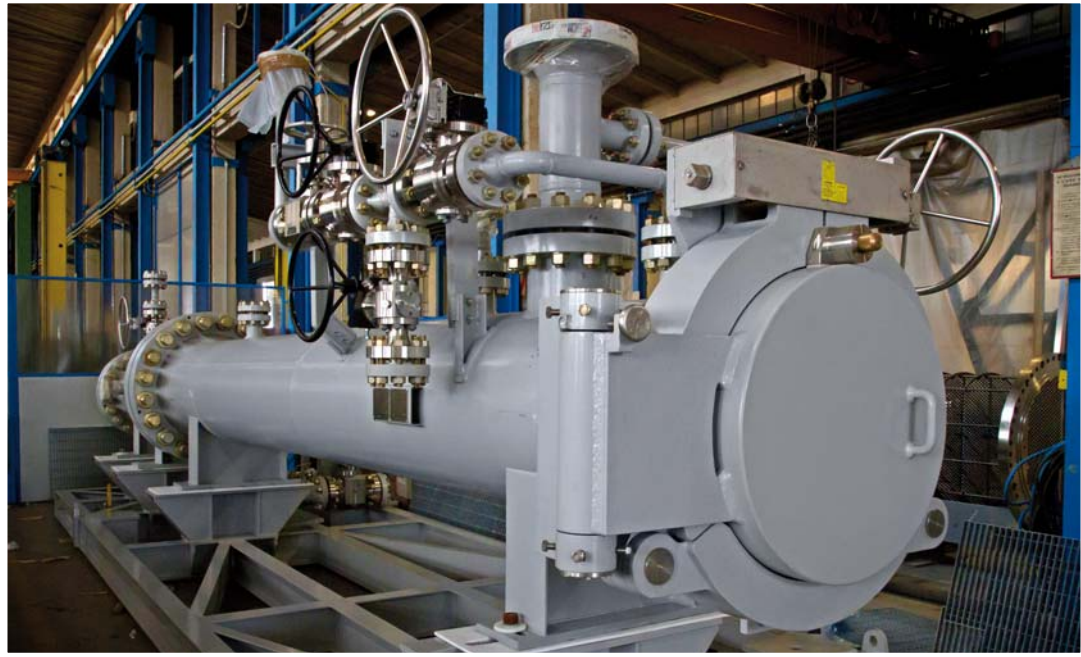
ROUTINE MAINTENANCE

(each time end closure is operated) includes:

- visual check all sealing faces
- Replacement of gasket if damaged or in presence of cuts or abrasions
- lightly smearing with a thin film of oil: gasket, sealing face and all inclined teeth surfaces for corrosion protection and lubrication.



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Via Don Pedrinelli, 36 - 24030 Carvico (Bg) - Italy
Tel. +39.035.43909 - Telefax +39.035.791272 e_mail: fai@faicarvico.it
Cod. Fisc., P.Iva e Registro Imprese di Bergamo N. 00226290161
C.C.I.A.A. di Bergamo N. 96385
Capitale Sociale € 720.000,00 i.v.