Cryogenic Control & On-off Angle Valve

Technical brochure

AMPO
POYAM VALVES

Commitment made of steel

1. COMPANY PROFILE

AMPO is an **international leader** in highly engineered valves and Integrated Smart Solutions for the most severe applications and industries as well as in stainless steel and high alloy castings.

Through our AMPO SERVICE team **we guarantee a prompt response** to customer needs wherever they are throughout the world: technical support in start-up stages, equipment selection, predictive and preventive maintenance, training, etc.

Fully inhouse manufacturing process

Worldwide references

Project based on people

Innovative spirit

700+ people

In more than 60 countries

Most important partners in the industry

Cutting edge technologies

Our commitment: the best service

Customer focus

Since 1964

2. APPLICATION

AMPO POYAM VALVES is a world leader in highly engineered cryogenic valves with over 40 years of expertise in cryogenic and LNG applications.

Know-how of globe cryogenic valves, as well as butterfly, gate, check and top entry or split body cryogenic ball valves **are brought into a new growing liquefied Helium and Hydrogen market.**

The processing of low molecular fluids such as Helium, Hydrogen, Neon… for cryogenics requires a high-level tightness as well as reliable operation in the most severe temperature conditions. Valves fulfill both tight shut up and fluid controlling requirement for a smooth and Kv controlled operation. Heat load is a key value for minimizing heat losses on the system, not only by conduction effects but also minimizing gas internal convections. Design robustness for easy assembling of valves into real chambers is a well-considered feature thanks to our AMPO SERVICE team knowledge.

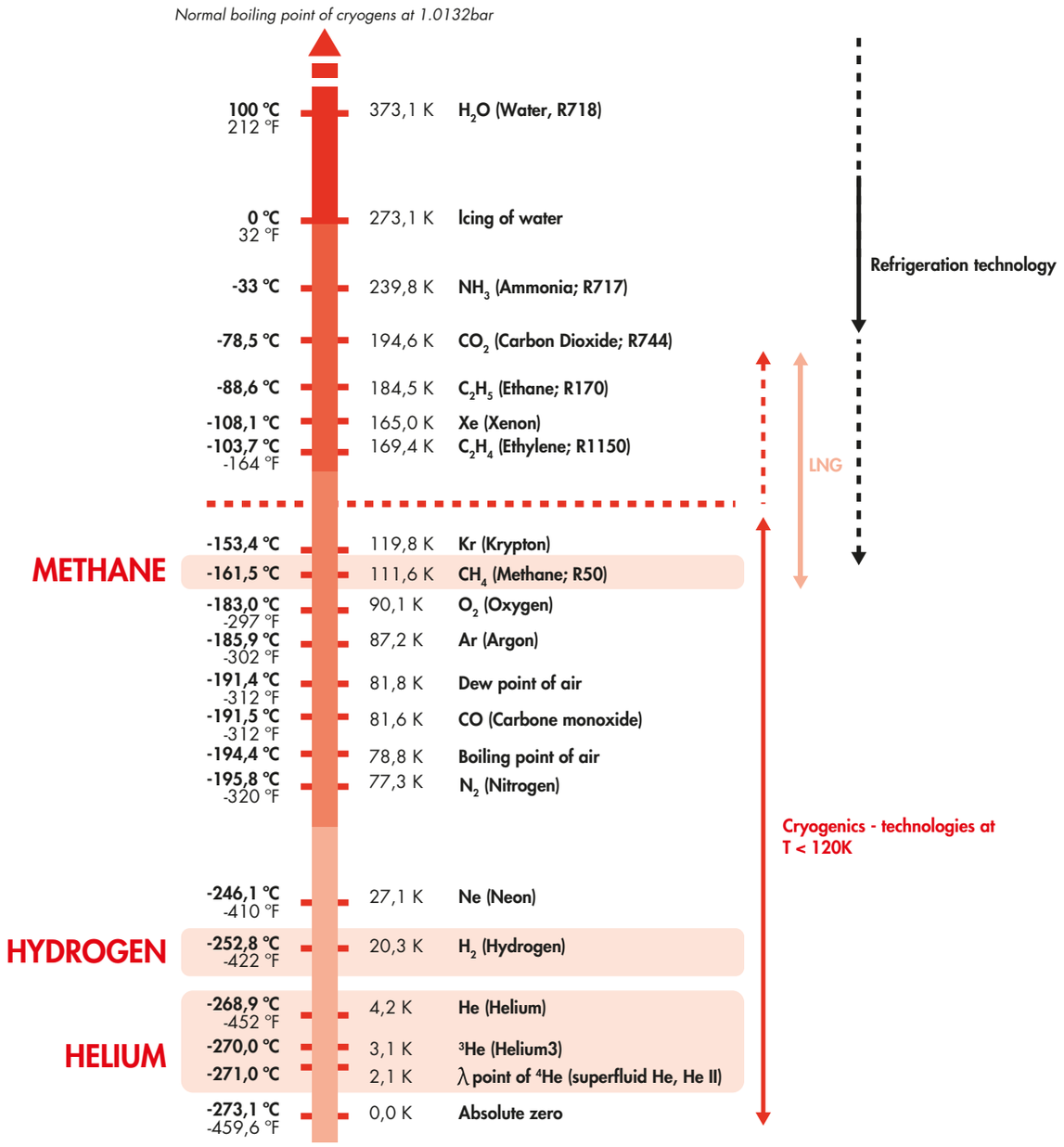
Our customized solutions and field proven solutions include the Cryogenic Control & On—Off Valve, **designed for vacuum isolated valve cold boxes or transfer-lines operating with Helium, Hydrogen, Nitrogen (other technical gases)… for a reliable liquefaction and distribution of the cold though the entire cryogenic system.**

3. CRYOGENIC CONTROL & ON-OFF ANGLE VALVE

Advanced top load cryogenic valve for control & on-off services. Valve is designed to handling ultracold, low-molecular weight gases over the entire temperature range from ambient to 2.2 K or even lower and from full vacuum up to medium pressure applications of 25 to 50 bar and up to 100 bar or even higher.

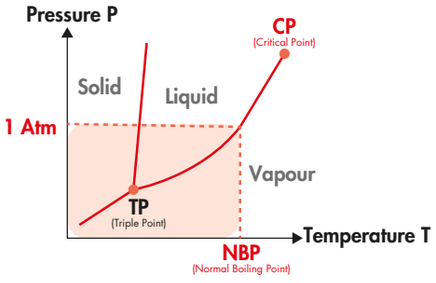
The design of the AMPO Cryogenic Valve considers extreme operating conditions in terms of temperature and pressure where precision, reliability and safety are paramount for us and our customers.

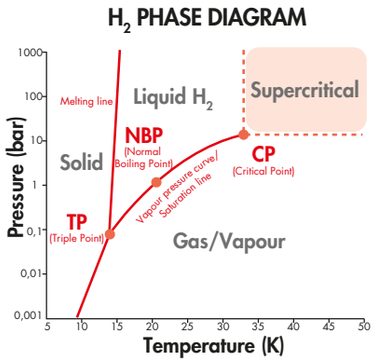
Gases such as Helium/He (NBP*[1])i. e.liquid at 4.2 K or superfluid below 2.2 K), Hydrogen/H_2 (NBP at 20.3 K) as well as Neon/Ne (NBP at 27 K), Nitrogen/N_2 (NBP at 77 K) with the other air gases Oxygen and Argon, further rare gases or also natural gas or Methane/CH_4 (NBP at 117.7 K, LNG mostly methane) are common application media for the highly engineered AMPO Cryogenic Valve.

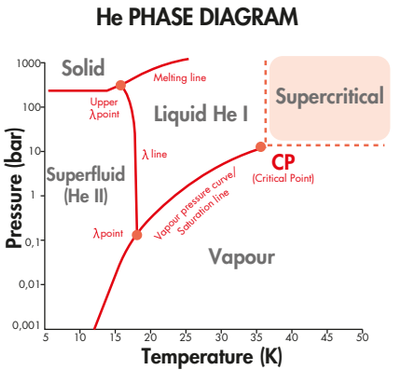


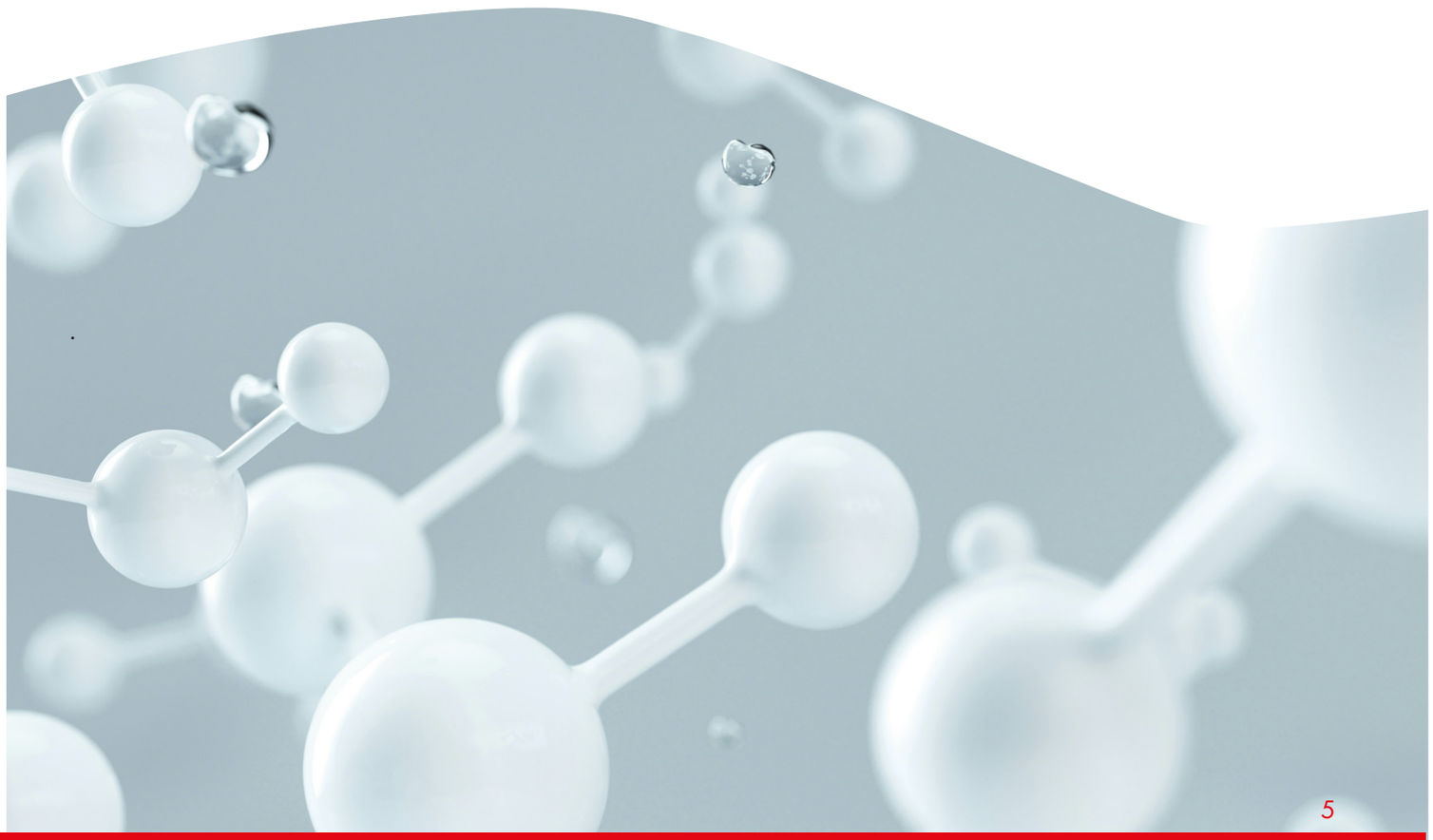
The AMPO's quality tradition, our dep experience in development of valves for extreme operating conditions both, and together with our careful manufacturing with the defined, fabrication inherent testing, guarantee the fulfilment of the requirements placed on the AMPO cryogenic valve.

**1) NBP = Normal Boiling Point*









Valve design: Top load cryogenic valve with cryogenic extension, integral vacuum weld-in flange to mount into a vacuum isolation(cold-box, transfer-line, cryostat etc.).

- **Boa-flex inset design:** Body-guided Boa-flex inset design with integral anti Taconis oscillation damping devises shows a high adaptability to possible body deforming's which may introduced by pipe loads. The advanced Boa-flex inset design may compensate in a wide range piping stress introduced body deformations, enables an exact,backslash free reversible travel control and so an accurate flow,control and secures a high quality of the internal seat tightness.

- **Up-to-date FEM design:** Use of up-to-date FEM design tools regarding pressure, thermal conduction and flow in combination with the advanced body-guided Boa-flex inset design confirms a valve design with high specific flow capacity, low thermal mass and very low thermal conductivity, results in a very low heat load on to the cryogenic system.

- **Warm valve option:** Derived from the described cryogenic valve, a so-called "warm" valve for ambient operation temperature with identical design features and characteristics regarding function and flow, however without cryogenic extension and without vacuum weld-in flange, is at the same available.

Valve sizes: DN2 –DN400
On request: *DN450, DN500, DN600, DN700 or even larger size.*

Kv range resp. Cv range: <0.004 –4'400 m3/h resp. <0.004 –4'460 US gal/min
On request: *10'000 or even larger size.*

Pressure range / PN: Sub-atmosphere / vacuum up to 50 bar i. e. standard PN25, depending on application and size also PN6 or PN10 or PN16, PN50
On request: *Pressure up to PN100, cryo-compressed up to PN420, specific applications for high pressure hydrogen compression up to 1'000bar.*

Functionality: Control combined with shut-off digital applications, depending on specified flow plug and actuator type with the accessories, design inherent bidirectional tight shut—off and control function.

Operating temperature range: <2.2K –355K / <–271 °C –80 °C
On request: *Higher upper temperature, up 200 °C for vacuum bake-out or cleaning process.*

Cryogenics design: Top load cryogenic valve for control & on-off services, with cryogenic elongation and body integral weld-in flange for mounting in vacuum isolation envelope or cold-box top plate. Optimised design for low heat load.
On request:
- *Thermal shield contacts at e. g. 80K or TBD, in cupper, brazed on valve body, to reduce basically the body heat load.*
- *Boa-flex inset in compound design stainless steel with G10 glass-epoxy fibre for applications in ultra-low temperature as for superfluid helium<2.2K requesting very low heat load.*
- *Other lengths for cryogenic extension.*
- *Different diameter of the vacuum weld-in flange, pipe-cuff or further specific design for vacuum isolation envelope integration.*
- *Without vacuum weld-in flange, cryogenic extension only.*

Body type: Angle pattern with butt weld ends and integral flange for mounting in vacuum isolation envelope or cold-box top plates
On request:
- *Straight globe pattern, y-pattern, Z-pattern, etc.*

Body materialisation: Welded design, tubed and forged or bar stainless steel, welding's quality factor 1.

Sealing design to outside: Integral parachute double sealing concept with a guard space and plugged test port, He-tight for pressure and vacuum conditions.
This double seal concept confirms that the valve itself does not create an explosion risk area if used with flammable or explosive fluids like hydrogen, oxygen or methane. Furthermore, the testing port allows optionally to connect He guard gas to protect the process space against air inleak in case of sub-atmosphere or vacuum applications as typical for Hell service.

- **Warm dynamic sealing:** 1st and 2nd seal of the double gland sealing with spring energised high tight lip seal rings in thermoplastic polymer, sliding on a micro-finished spindle for.
- **Bellows sealed option:** Metallic bellows seal for 1st followed by a spring energised high tight lip seal ring in thermoplastic polymer, sliding on a micro-finished spindle for 2nd seal.
- **Warm static sealing:** Double sealing with synthetic rubber O-rings, grooves design rated for vacuum and pressure service.

Internal seat sealing design: Bidirectional high tight internal sealing / valve seat sealing.
Soft seal fixed on valve inset in high quality thermoplastic polymer seals against micro-finished surface integral in the valve body.
The advanced design of the seat seal secures low sealing forces and high seat tightness –He-tight!

Flow control: Linear stroke valve, shaped flow plug into a narrow-tolerated orifice bore. The high ratio of valve orifice bore versus valve travel allows a high specific flow capacity.
Equal-% or linear characteristic, special or on-off flow characteristics are available.
Standard flow plugs with equal-% flow characteristic resolution 1:20 or 1:50 an modified to zero a travel starts, flow plugs with linear characteristics.
On request:
- *Flow plugs with higher flow characteristic resolution up to 1:1000.*
- *Flow plugs outside of standard values and specific flow characteristics.*

Materials:

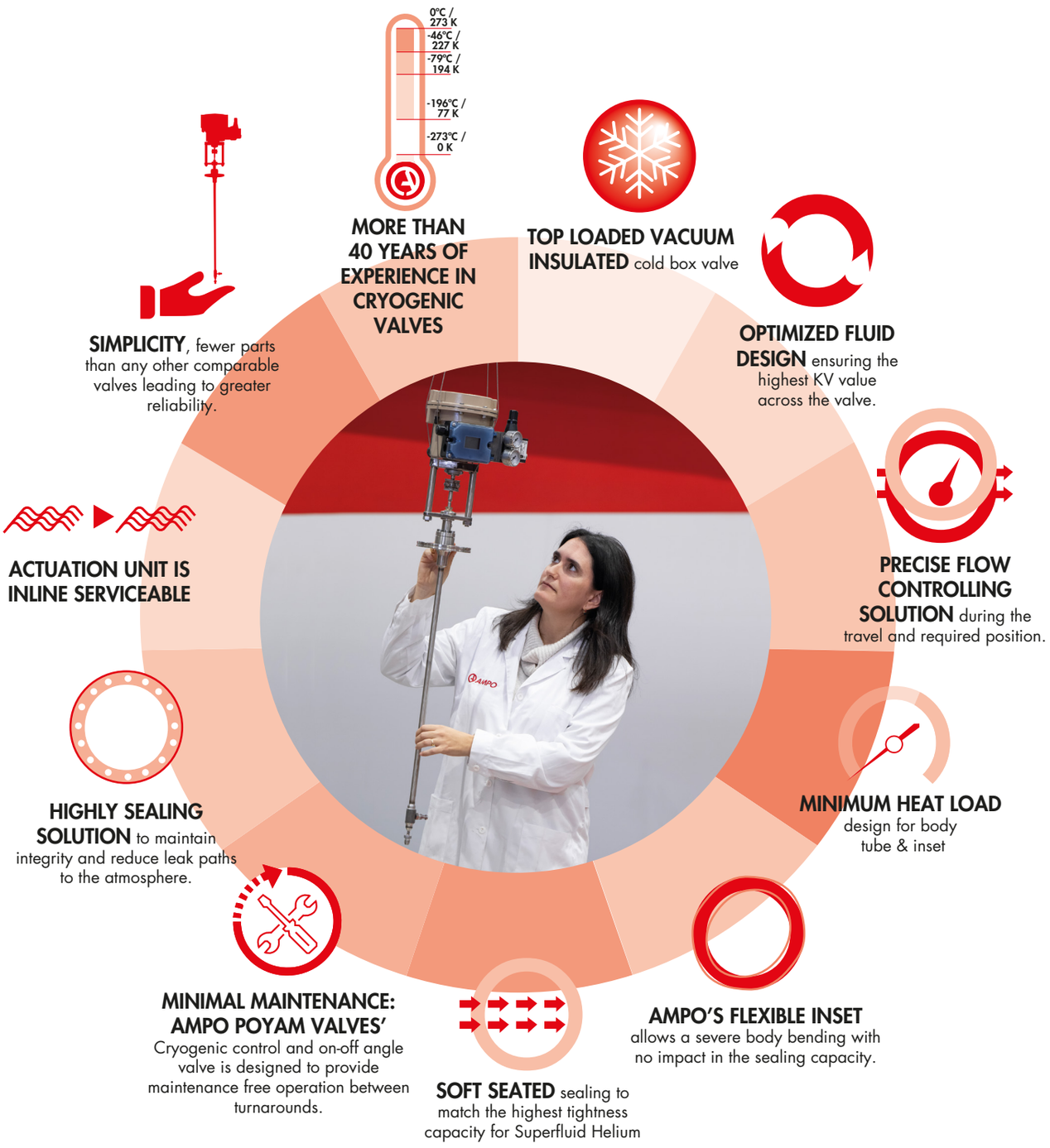
Valve body and inset:	Tubed, forged or bar stainless steel grade 316&316L / EN 1.4401&1.4404, dual certified; to confirm high tightness to isolation vacuum and to outside.
Flow plug:	Aluminium bronze; allows narrow tolerances of orifice bore versus plug and guiding, to achieve high flow resolution.
Guiding tacks, load transmission:	Aluminium bronze and SiN ceramic for low frictional anti-galling and high cycling bearing and load transmission.
Seat seal:	PCTFE or PEEK
O-ring seals:	NBR
Gland sealings:	Spring energised lip seal rings PTFE based
Bellows seal:	Stainless steel 316L / EN 1.4404

On request:
- *Radiation proof materials for synthetic rubber of O-rings joints and for thermoplastic polymer of the seat seal and spring energised lip seal rings.*
- *Other stainless-steel grades for valve body e. g. grade 304&304L / EN 1.4301&1.4306/4307 dual certified.*

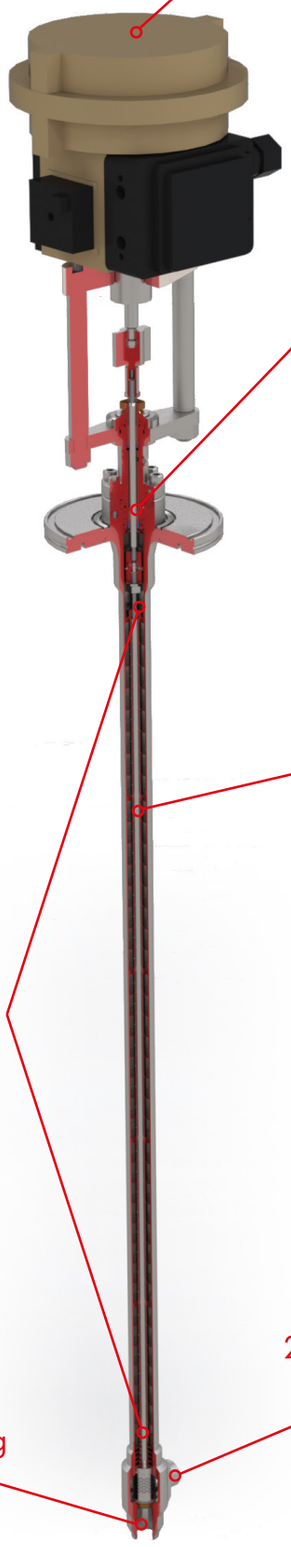
Valve actuator:
- *Pneumatic multi-spring diaphragm actuator, including control accessories like e-p positioner, 3-2-way electric solenoid valve, switches or sensors to indicate open or/and close position(s) etc.*
- *Manual valve drive, either for shut-off or control, also with backlash manual drive for fine control applications*
- *Electric actuator, with or without fail safe position etc.*

Micro flow valves: Specifically designed AMPO Cryogenic and Warm Valve for high precision flow control of micro, small or low flow requests, gland or bellows sealed.
· Size DN2 - DN25 and Kv range of <0.004 - 17.0/19-dig
· Size DN 32 and Kv range of 29.0/32-dig

4. WHY CHOOSE OUR CRYOGENIC CONTROL & ON-OFF ANGLE VALVE?



5. TECHNICAL FEATURES



5.1 MINIMIZED HEAT LOAD

Inset design for a minimum conduction load across the inset. Special composites materials are available upon request. Thermal acoustic oscillation mitigation breaks included on flexible inset design for a minimal heat load and fluid convection brakes. Depending on Cryogenic length up to 40 convection brake points can be installed..

Low heat load, low thermal mass: The up-to-date FEM design tools regarding pressure load, thermal conduction and flow in combination with the body-guided Boa-flex inset design confirm a valve design with low thermal mass and very low thermal conductivity, resulting in a very low heat load on to the cryogenic system.

5.2 OPTIMIZED KV VALUES

Fluid dynamics aided sealing cone design for the highest flow capacity. Optimized design significantly reduces the turbulences and backflow of standard plane seal design.

A high ratio of valve orifice bore to valve travel allows a high specific flow capacity.

5.3 FLEX INSET AVAILABLE

Pipeline transmitted loads will no longer compromise the tightness of valve. Flexible solutions allow the inset match to body deformation shape in operation conditions, ensuring a perfect alignment between sealing components. Highly engineered multicomponent made flexible head gives the perfect adaptability between sealing surfaces. R&D department aided engineered solutions for existing valve upgrade are also available.

Body-guided Boa-flex inset design with integral anti Taconis oscillation damping devices.

5.4. DUAL BARRIER SOLUTION

External static and dynamic sealing real double barriered for the highest tightness. NBR based O-rings and PTFE based lip seals as standard. Bellow sealed stem available upon requested. Self-supporting first sealing barrier allows for secondary sealing replacement, under internal vacuum conditions, allowing an easy and fast sealing replacement.

Integral parachute double sealing concept with guard space and plug closed testing port.

5.5.FLUID CONTROLLING

On/Off, Linear and eq. % as Standard flow control. Microflow special range valves controlling capacity is achieved with a combination of long flow plug and opening flow diverting cone. Micromachining precision available for highly engineered components matching the most demanding Kv control values.

User defined Kv and curve can be used for an engineered solution.

Flow plug which travel out of a narrow-tolerated orifice bore, with equal -% or linear characteristic, special or on-off characteristics.

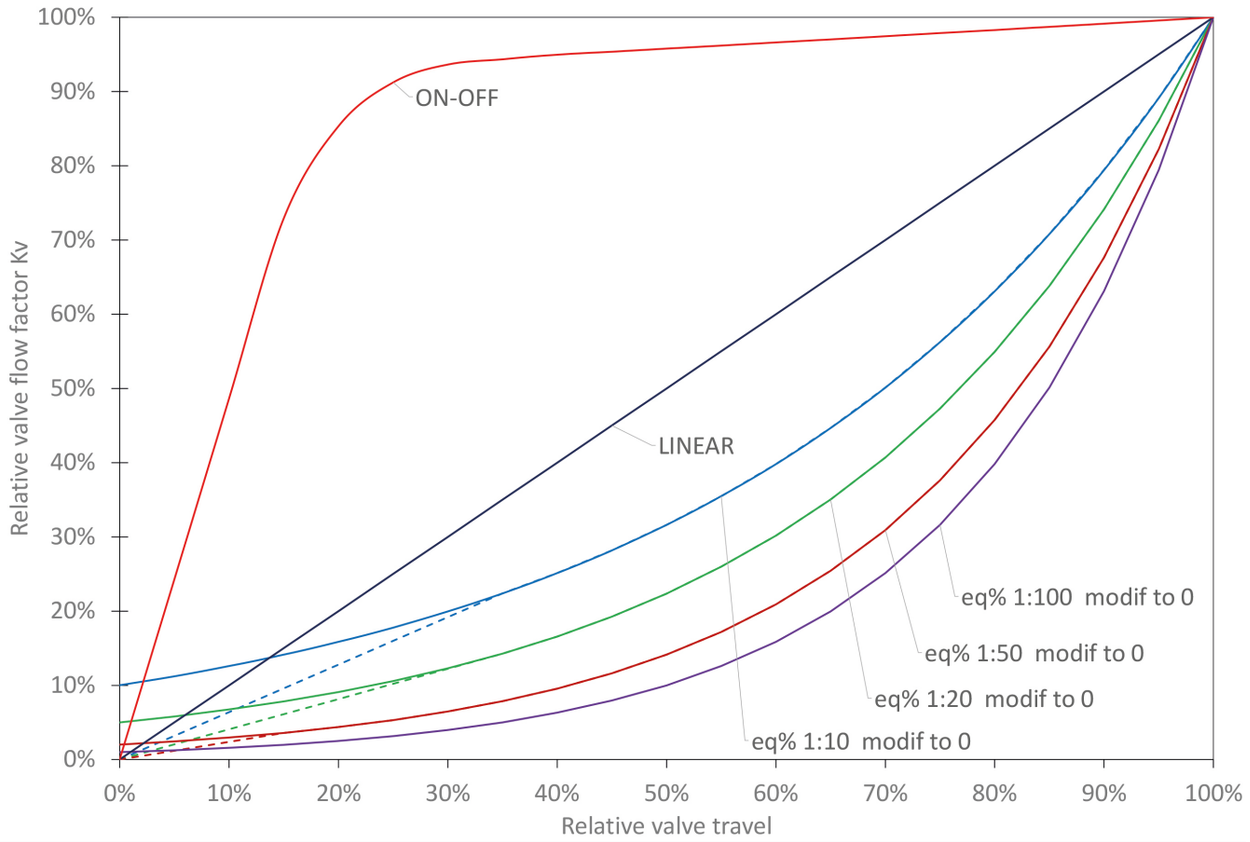
5.6. ACTUATION

Pneumatic multi-spring diaphragm actuator, including control accessories like e-p positioner, 3-2-way electric solenoid valve, switches or sensors to indicate open or/and close position(s) etc. Electric actuator, with or without fail safe position etc. Manual shut-off or reversable backlash free control handle, with switches or sensors to indicate open or/and close position(s).

5.7. SEVERE CONDITIONS

Additional features available for the most severe conditions:

- Oxygen service: degreasing and clean room assembly for a complete clean guarantee.
- Explosive area: ATEX
- Radiation exposure: Material selection for proper metallic and non-metallic configuration (Seat seal in Peek and external sealing in EPDM and metallic bellow)
- Engineered solutions for reparation and/or replacement of valve components at field.



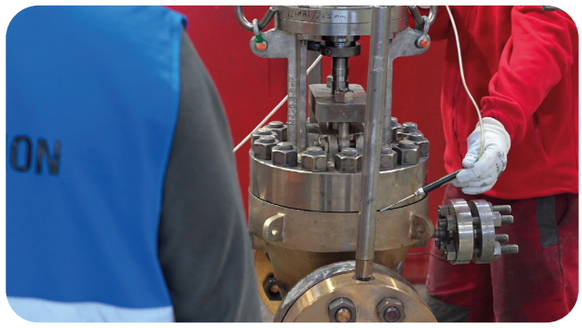
6. IN-HOUSE FACILITIES

At AMPO we have cutting edge valve assembly, testing, painting and packing facilities, fully equipped with the most advanced technologies, which gives us fully integrated process capacity. This allows us to develop and manufacture new, highly engineered solutions, and also to repair and retrofit any existing valve at our facilities.

We also have our own foundry and a 12,500 sqm cutting-edge machining plant, where we also develop internal weld overlay and cladding operations.

Here we present some of our key in-house cutting-edge facilities for the manufacturing of cryogenic control & on-off angle valves:

ISO 7 Clean room



Helium testing

Cryogenic testing lab

Product performance test lab

Vacuum testing

7. QUALIFICATION

AMPO POYAM VALVES values quality and therefore our operating and production processes are implemented and controlled by a quality assurance system, certified since 1991 under the ISO 9001 Standard and accredited by the POYAM VALVES holds international standard approvals and completely fulfills international standard requirements reinforcing its leading position on the LNG market.

A summary of the most demanded standards is presented hereafter, although the qualification list can be extended upon each customer request.

General standards: 2014/68, EN 13445, ASME B16.34, ASME VIII

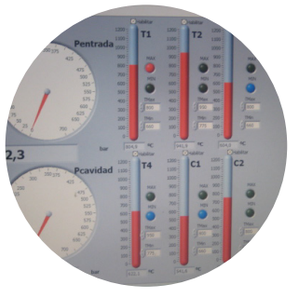
Assembly: EN 23208

Testing: ISO 21011, 28921, ISO 5208, MSS SP-134

Fully vacuum tightness: ISO 15848 Part1&2 up to Class A

Type approvals: Bureau Veritas, ABS, Lloyds, TUV, DNV, NORSOK, etc.

Country based certifications: GOST, TSG, CRN, KGS, 2014/34EU (ATEX), 2014/68(PED). Etc.



8. AMPO SERVICE

AMPO SERVICE has a wide experience in guaranteeing a **prompt response** (72 hours at site if needed) to customer needs **all over the world** with a highly experienced, customer oriented and specialized team. It provides a wide range of **ad-hoc and high added value services:**

- **MRO SERVICES**. Plug and play valves. Fast track.
- **SPARE PARTS**. Optimized Management Program. Fast track services.
- **TRAINING SERVICES**
- **FIELD ENGINEERING SERVICES (FES):** Consulting services during plant construction. Commissioning and start-up services. Planned shut-down services. Troubleshooting.
- **PREDICTIVE MAINTENANCE SERVICE:** Patented AMPO RCM system (Remote Control Valve Monitoring Service)
- **PREVENTIVE MAINTENANCE SERVICE:** Maintenance Plan developments.
- **WORLDWIDE REPAIR AND MAINTENANCE CENTERS**
- **TAILORED ENGINEERING SOLUTIONS**
- **MASTER SERVICE AGREEMENTS WITH END USERS**

Our main aim is to fufill customer needs worldwide with the following key premises: **reliability, safety, trust and efficiency.**

9. WORLDWIDE SALES AND MANUFACTURING NETWORK

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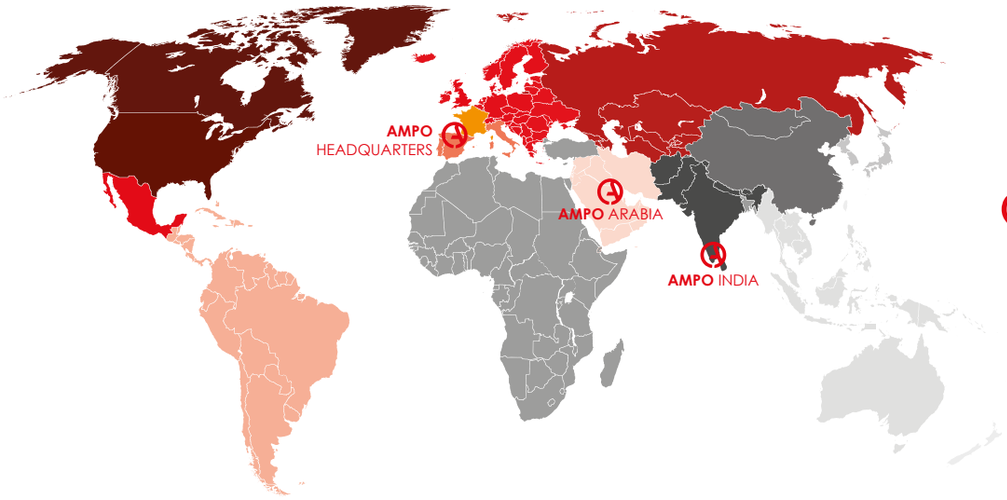

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Dammam - Saudi Arabia

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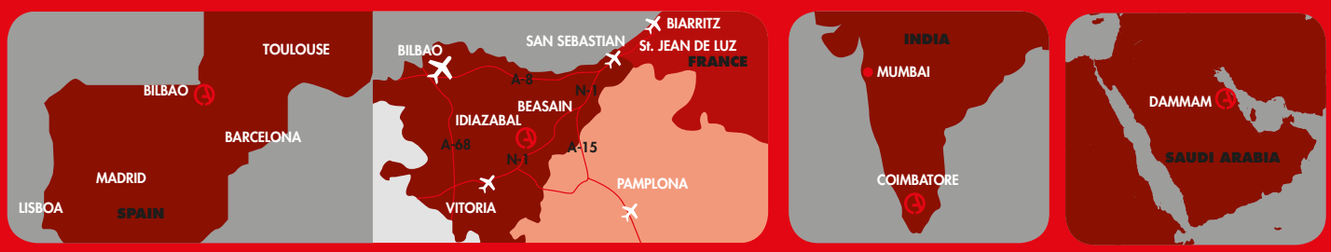
AMPO is just 1 hour drive away from BILBAO (International Airport) and at the following distances from other important places:
65 km west of Pamplona/45 km south of San Sebastian/ 70 km south of the French border.



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