



Gate Valves for Ultraforming units

Technical brochure

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

Ultraforming is a process that was developed by Standard Oil, now part of BP, and which is also known as **Catalytic Reforming** or:

- **RHENIFORMING:** Developed by Chevron Oil Company.
- **POWERFORMING:** Developed by Esso Oil Company, now known as ExxonMobil.
- **MAGNAFORMING:** Developed by Englehard and Atlantic Richfield Oil Company.
- **HOUDRIFORMING:** Developed by the Houdry Process Corporation.
- **CCR PLATFORMING:** A Platforming version, designed for continuous catalyst regeneration, developed by UOP.
- **OCTANIZING:** A catalytic reforming version developed by Axens, a subsidiary of Institut francais du petrole (IFP), designed for continuous catalyst regeneration.



2. APPLICATION

ULTRAFORMING PROCESS OBJECTIVE:

- To convert low-octane naphtha into a high-octane reformat for gasoline blending and/or to provide aromatics (benzene, toluene, and xylene) for petrochemical plants.
- Reforming also produces high purity hydrogen for hydrotreating processes.

ULTRAFORMING PROCESS STEPS:

1. Naphtha feed and recycle hydrogen are mixed, heated and sent through successive reactor beds.
2. Each pass requires heat input to drive the reactions.
3. Final pass effluent is separated with the hydrogen being recycled or purged for hydrotreating.
4. Reformat product can be further processed to separate aromatic components or be used for gasoline blending.

Hydrogen, a significant by-product, is separated from the reformat for recycling and use in other processes. This isomerization normally takes place in the presence of platinum as a catalyst, at moderate pressures and high temperatures (around 500 °C / 930 °F).

Hydrogen finds its **way out through** the slightest casting defect or tolerance imperfection.

It is very **flammable** and to make things worse, hydrogen is **imperceptible** when ignited.

ULTRAFORMING VALVE SOLUTION:

AMPO POYAM VALVES, a leading manufacturer of highly engineered valve solutions for severe services, developed the most reliable and practically leak-proof gate valves for Ultraforming, which meet the following high temperature and corrosive fluid process conditions and design requirements:

- Designed to operate up to 1050°F (565°C) and 400 PSIG (27.5 Bar).
- Extreme cyclic service for both pressure and temperature.
- Exposed to hydrogen rich environment with many corrosive substances (HCl, H₂S, Ammonia).
- Zero hydrogen leaks.
- Rigorous QA and Inspection controls.



4. WHY CHOOSE OUR ULTRAFORMING GATE VALVES?

With our own foundry and machining shop since 1964, **CASTING PROCESS AND OVERLAY CLADDING PROCESSES** are **COMPLETELY CONTROLLED** due to our technical and material expertise.



ZERO LEAKAGE due to the **BEST SEALING PERFORMANCE** by a flexible wedge design.



LONG SERVICE LIFE assured in this extreme cyclic service operation (both pressure and temperature).



ROBUST DESIGN meeting API 600 standard.



LOW OPERATION TORQUE thanks to the flexible wedge.



REAL BI-DIRECTIONAL SEALING in low and high differential pressures.



SPECIAL AD-HOC PACKING CONFIGURATION to ensure **NO FUGITIVE EMISSIONS**, achieving a **ZERO LEAKAGE** solution and increasing plant safety.



SIMPLICITY, fewer parts than any other comparable valves leading to greater reliability.



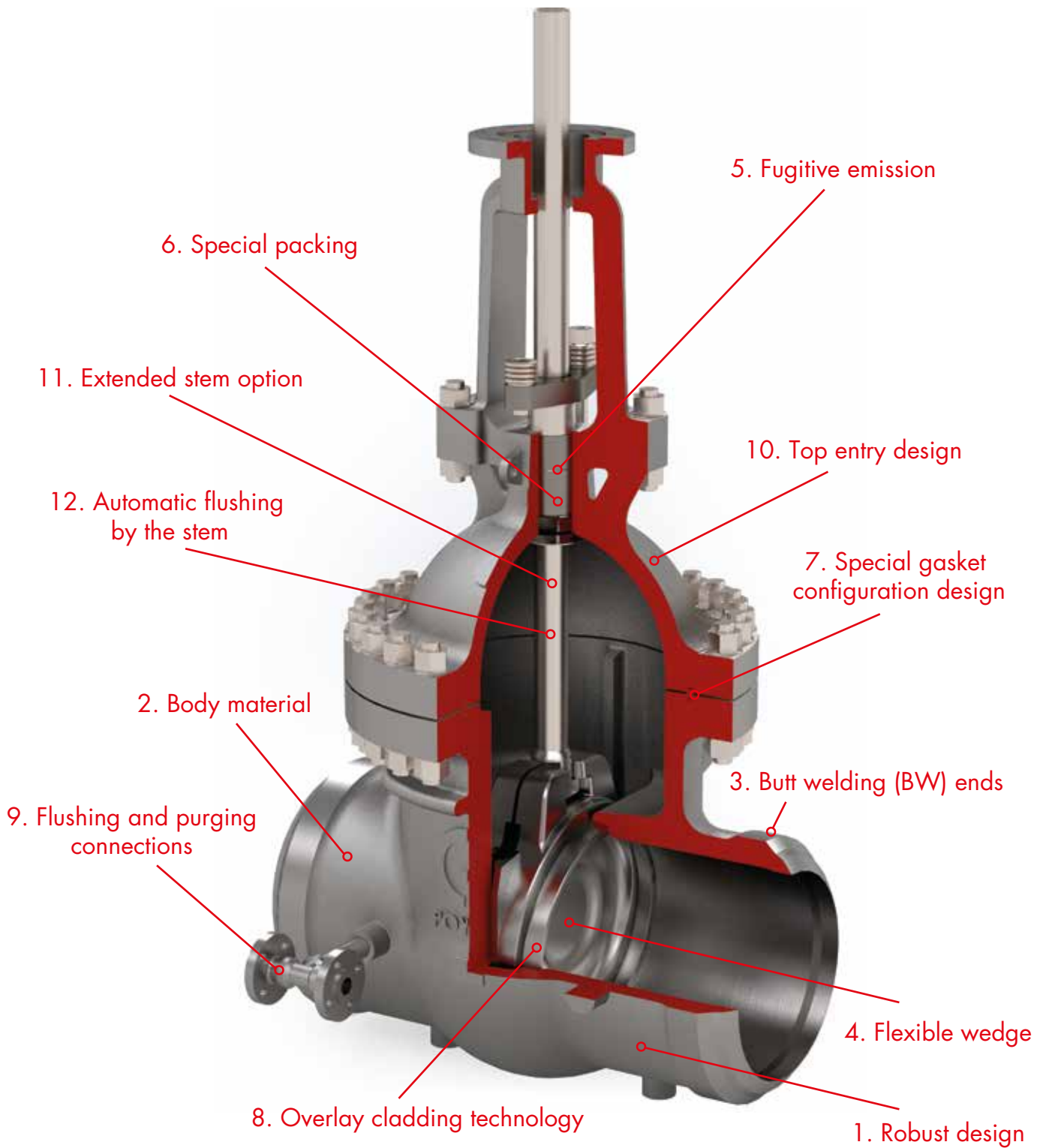
EASY MAINTENANCE with the valve in line, due to its top entry design.



MINIMAL MAINTENANCE: AMPO POYAM VALVES' gate valve is designed to provide maintenance free operation.



5. TECHNICAL FEATURES



5.1. ROBUST DESIGN:

In ultraforming processes, there are many challenges. Valves have to stand up to high operating temperatures, abrasive mediums and solids, and frequent cycling. If a valve fails during the catalytic reforming process, it can compromise operations and even result in operational failure. Consequently, valves that do not perform as expected reduce process efficiency.

As per our experience, there could be different strategies depending on the customer, but gate valves are the best solution. There are some factors, scenarios or considerations to take into account when the type of valve is selected: run lengths / life cycle, structural weight, process design, etc.

In these severe service conditions, where the run lengths are not very long and the weight of the valve is important, the most effective solution is a gate valve. AMPO POYAM Gate valves do achieve all needed sealing conditions (zero leakage), saving cost benefits for users as compared to other type of valves such as ball valves. Besides, following API 600 standard for design and **wall thickness** (robust design), the lifetime of the valve is assured in this cyclic service operation. The reduction in maintenance requirements is moreover a reality.



5.2. BODY MATERIAL:

The properties of the **ASTM A217 WC9 (2 ¼ Cr – 1 Mo)** material are the most appropriate to avoid corrosion in an environment exposed to substances like HCl, H₂S or Ammonia. But beyond the material's selection, there are more points to consider during casting process to ensure a longer lifetime.

When a steel is exposed to hydrogen service, cracks could appear for different reasons such as: solidification of castings, when there is not enough liquid metal to fill in, thermal stresses, stress corrosion cracking, etc. If those parameters are controlled, and according to experiences collected by API 941, satisfactory performance of components has been experienced even with long exposure periods of up to 60 years.

It is known that both high levels of primary design stresses (internal pressure, clamp loads) and secondary stresses (functional thermal stresses) can accelerate the rate of development of HTHA (High Temperature Hydrogen Attack). That's why we empathize on the quality of the process.

On the other hand, we suggest casting material instead of forged configuration because of:

- Quality & Cost balance
- Weight
- Geometry
- AMPO Foundry: perfect quality control
- Remember:
 - Both types have defects: cast and forged valves start out the same way—molten metal is poured into a mold or ingot.
 - Cast: are inclusions, porosity, misrun and hot tears.
 - Forged: inclusions, laps, seams, cold shuts and cracks.
 - Mechanical properties:
 - Cast: Uniform
 - Forged: Non uniform (formed in one direction, impact strength)

*Note: A217 C12 material is also acceptable for this process.

5.3. BUTT WELDING (BW) ENDS:

In order to avoid other possible point of leakage in the connection between valve and pipeline, valves in this process are butt welded. Compared with other type of steel pipe fittings, butt welding pipe fittings have these advantages:

- Butt welded joint is permanently sealed and powerful.
- The direction of gradual change reduces the pressure loss and turbulence of the system and protect from the corrosion and erosion.
- They are perfect to be used in applications with high pressure and temperatures.

5.4. FLEXIBLE WEDGE:

The purpose of the wedge shape is to introduce a high supplementary seating load that enables metal-sealed wedge gate valves to seal against not only high but also low fluid pressure.

Wedge valves' sealing is performed by the closing manual (or actuated) force. This means that the force applied by the operator has direct impact on valve sealing performance.

Flexible wedge gate valves are considered a higher performance solution than solid wedge gate valves: they require lower closing force and due to its flexibility, the sealing performance increases with pressure drop. Manufacturing adjustments are higher in solid wedge designs.



5.5. FUGITIVE EMISSION:

Evidences in a wide range of gate valves with a leakage class AH as per ISO 15848-1 following operating conditions of 538°C (1000°F) and after hundreds of cycles (Endurance Class: CO1).

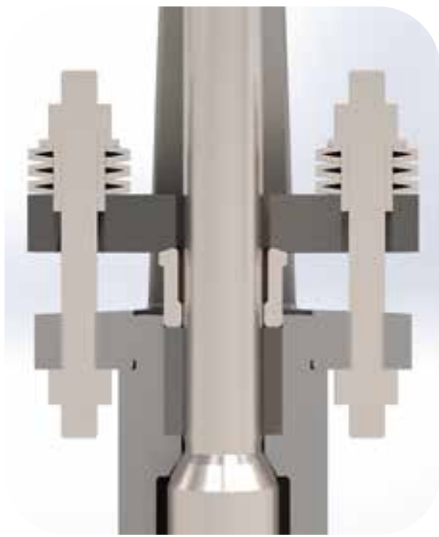
Clean conditions where parts after testing shall be chemically cleaned to bare metal.



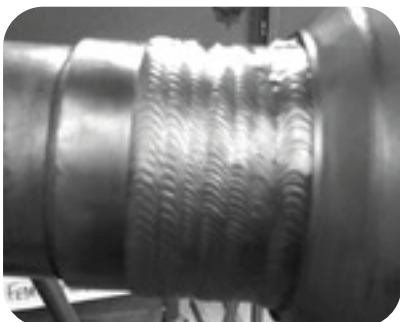
5.6. SPECIAL PACKING CONFIGURATION DESIGN:

- Tolerances of packing and stem area very restrictive.
- Good surface finishes in the contact area. 0.4-0.8 Raµm.
- The installation of the valve in vertical position is strongly recommended (stem in horizontal position is not recommended). For other orientations, please contact us.
- Live loaded packing

Live loaded packing to ensure the perfect sealing of the packing during longer time in case the fluid damages the graphite. The Belleville springs provide a constant packing load to compensate for packing consolidation and thermal effects.

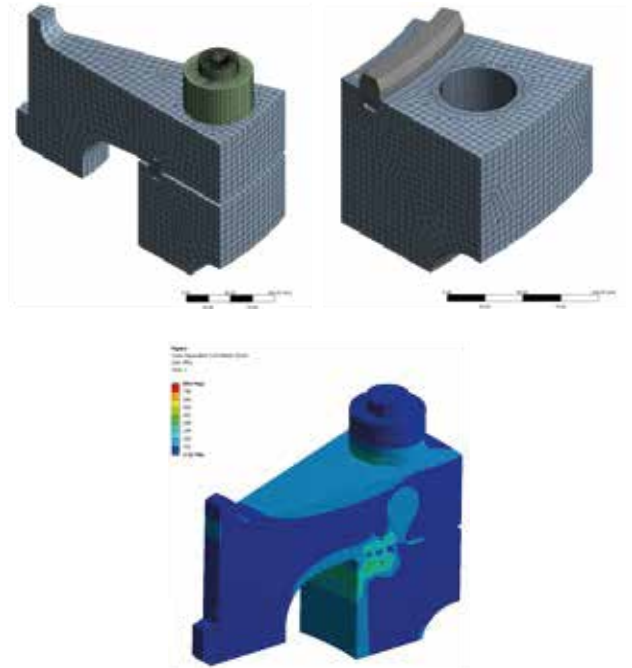


- No emission to the outside, the special packing must comply with following conditions:
 - Certified API 622 (Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions) packing.
 - Design certified as per API 624 (Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions).
- **Special alloy** material hard face in the contact area of the stem.
- **Objective:** not loose hydrogen (no emission to the outside).



5.7. SPECIAL GASKET CONFIGURATION DESIGN:

- Perfect machined areas for RTJ gasket area (when a 5Cr silver dipped RTJ gasket is assembled).
- Combination of Spiral Wound gasket + Mica Heat Transfer Fluid filler option available.
- Zero defects allowed.
- **Objective:** not loose hydrogen.



5.8. OVERLAY CLADDING TECHNOLOGY:

The selection of the overlays and hard-faced materials is key. The alloy content of internals must be equal or greater than the body (including gaskets and seat rings). Preferably, our Special alloy or Stellite-21 coating on seat ring surfaces, disc seating surfaces, disc guide slots, and backseat bushing. 2 Passes minimum. When the contact of the surfaces is between the same material (i.e., STELLITE-21) a hardness difference of 50 HV10 shall be obtained.

Seat rings shall be seal welded to the valve body, the transition from the body to the seat ring shall be smooth. Backseat bushing shall be tack welded to the bonnet in three equally spaced tacks, 1/2" to 1" long.

- Overlays in stem, sealing surfaces and wedge guides. Best combinations between surfaces in contact:

BODY GUIDES & WEDGE GUIDES	SEAT RING & WEDGE	BACK SEAT BUSHING & STEM
SPECIAL ALLOY & STE-21	STE-21 & STE-21	STE-21 & SPECIAL ALLOY
STE-21 & STE-21	STE-6 & STE-21	-
STE-6 & STE-21	STE-21 & SPECIAL ALLOY	-

- High quality tests and inspections:
 - Special alloy dilutions
 - Good finishes coated 0.4-0.8 Raµm
 - Hardness requirements

5.9. FLUSHING AND PURGING CONNECTIONS:

All types of purging configurations, flushing, partial and full jacketing and manifolds are provided for application specific requirements. Tandem valves for DBB (Double Block & Bleed) performance also available.



The purpose of the flushing is to supply a clean fluid via the cavity. This clean fluid is an inert gas, and it serves as isolation for the system. The flushing fluid being at a higher pressure (it is absolutely essential) than the line hydrogen creates a chamber between upstream and downstream (Double Block & Bleed). This inert gas ensures that the sealing contacts are clean for a perfect sealing.

The purpose of the purging is to ensure no leakage of the line media takes place past the sealing areas or past the gland packing. Leakage of the valve would be detected by an increase in the flow of the purge fluid through the lines.

A result of the purge is that the gland is subjected only to the inert gas rather than the line media. This is an important safety factor when handling products like hydrogen.

Bosses are available tapped, socket weld or butt-welded.

5.10. TOP ENTRY DESIGN:

With this Top Entry design, inspection of the internal parts of the valve without removing the valve from the line is possible. In case of the valve needs any small maintenance, it is possible to carry out it with the valve in line.



5.11. EXTENDED STEM OPTION:

The extended stem is normally applied when the valves are not close to the operator location (not like with extended bonnet, where the function is to isolate the gland from the high or low temperatures to maintain the integrity of the stem seal and the operation of the valve). The goal is to protect the operator and/or the equipment to operate the valve. In these units it is a common practice for small valves.

5.12. AUTOMATIC FLUSHING BY THE STEM:

With the same aim than the flushing concept, AMPO is including (when required) an automatic flushing in the bonnet area when the valve operates. It is a mechanism connected to the stem which allows to apply an inert gas inside the cavity to create a protection chamber when the main valve is in close position.

6. 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 most important external organizations. Moreover AMPO POYAM VALVES holds international standard approvals and completely fulfills international standard requirements, reinforcing its leading position on severe service applications.

Highlights of the QUALITY & DOCUMENTATION REQUIREMENTS for Ultraforming units:

- Iron dilution documentation of the test specimen (Iron dilution content shall be less than 10%).
- Records of stem straightness and damage test after hydro-test.
- Copy of final machinist traveler sheet for each valve.
- Heat Treatment performed after each welding.
- Hard facing test report shall include a hardness survey and finished surface chemical analysis.
- 100% Dye-penetrant test for cracks on stem and hard.
- Repairs shall not extend to more than 25% of the surface.
- PWHT at 1350° - 1375 ° F (730 - 745 ° C) for three hours, support piece to avoid warpage. Slow cool in still air.
- The maximum weld hardness to be between 230-250 Brinell
- Tolerances, Finishes and Clearances
- Straightness

Highlights of NON-DESTRUCTIVE EXAMINATIONS:

- Welding dossier (WPS/PQR) as per ASME IX (NDE operators qualification according to ASNT SNT TC-1A)
- Radiography prototype castings certificate as per ASME B16.34 App. I (100% critical areas)
- Magnetic particle examination for Body and Bonnet as per ASME B16.34 Section 8 (100%)
- X-ray examination for Body and Bonnet as per ASME B16.34 App. I or ASME SECTION VIII Div. I App. 7 (100%)
- Dye penetrant examination on Body, Bonnet, machined areas, BW ends, Stem, Disc, Wedge, Seat, seat ring welding, Stellite overlay, studs and bolts (100%).
- Surface finish measurement (100% in critical areas)
- Hardness test for overlays/hard facings (100%)
- Dimensional control for wall thicknesses of Body and Bonnet (100%)
- Helium Test (seat and shell) as per API 598 (10% per type, size and rating)



8. AMPO SERVICE

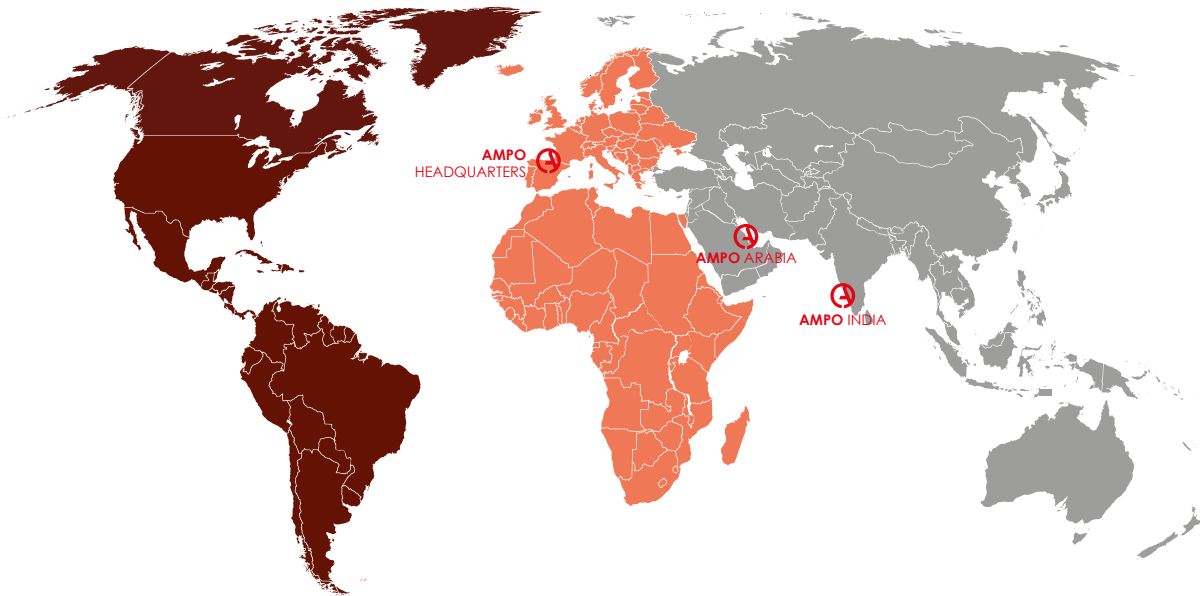
AMPO SERVICE has a wide experience in guaranteeing a **prompt response** (72 hours at site if needed) to customer needs **all over the world** with a highly experienced, customer oriented and specialized team. It provides a wide range of **ad-hoc and high added value services**:

- **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 fulfill customer needs worldwide with the following key premises: **reliability, safety, trust and efficiency.**



9. WORLDWIDE SALES AND MANUFACTURING NETWORK



AMPO Manufacturing plants
Idiazabal - Spain
Coimbatore - India
Dammam - Saudi Arabia

HYDROCARBON TEAM

Europe & Africa
Iñaki Elizegi
ielizegi@ampo.com

America
Iñaki Aizpeolea
inaki@ampo.com

Asia & Australia
JP Jayaprakash
jjay@ampo.com

AMPO SERVICE

AMPO SERVICE Sales Manager
Aitor Lizarraga
alizarraga@ampo.com

MANUFACTURING PLANTS:

AMPO HEADQUARTERS

Katea Auzoa s/n. 20213 Idiazabal, Gipuzkoa, Spain.
Tel. +34 943 188 000
ampo@ampo.com

AMPO INDIA

SF.No.27/2 & 28/3B, Ponnandampalayam,
Arasur, Sulur, Coimbatore - 641 659 - India
Tel. 0422 7140900
ampoindia@ampo.com

AMPO ARABIA

#3848 Road 86, Dammam 2nd Industrial city
Dammam 34326 - 2817, Saudi Arabia
ampoarabia@ampo.com

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.

