

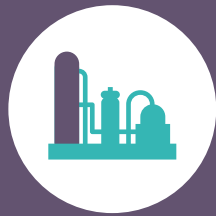


Gas Products Overview

Powering Integrated Solutions

Axens Group provides a complete range of solutions for the conversion of oil and biomass to cleaner fuels, the production and purification of major petrochemical intermediates as well as treatment and conversion options for natural gas. The integrated offer includes technologies, equipment, furnaces, modular units, catalysts, adsorbents and related services.

From feasibility studies to unit start-up and follow-up throughout the entire unit cycle life, Axens Group is ideally positioned to cover the entire value chain while ensuring the highest level of performance with reduced environmental footprint.



Over
3,000
industrial units
under license



Over
70,000
tons of catalysts and adsorbents
produced each year complemented
by catalysts regeneration services



Over
500
modular units
references



Over
2,000
process furnaces
references



Offices in
15
countries

› **Axens**

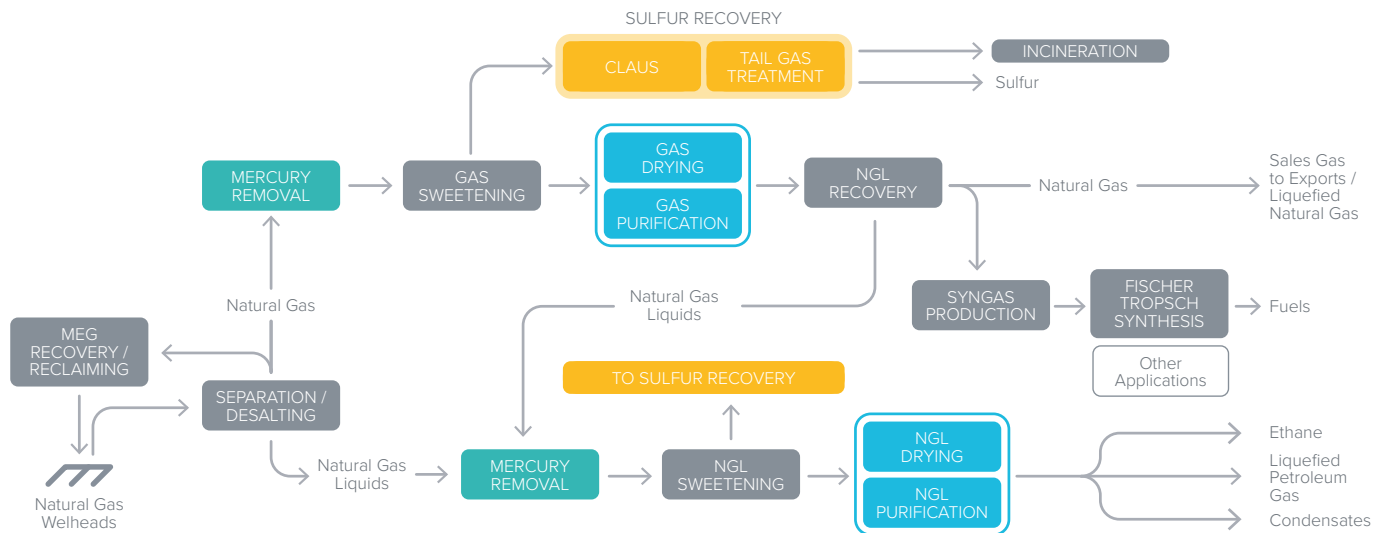
S.A. Share Capital 154752119,13 €
R.C. Nanterre B 599 815 073

› **Head Office:**

89, boulevard Franklin Roosevelt
92500 Rueil Malmaison
France

A Dedicated Products Portfolio for Natural Gas Treatment

Axens proposes complete portfolio for Natural Gas processing in order to reach increasing stringent specifications for downstream feedstocks, whether dedicated to end users or for Liquefied Natural Gas (LNG) production by providing this expanding market with Natural Gas treatment solutions.



Main Contaminant Removal

	Sulfur Recovery	COS HYDROLYSIS	H ₂ O	CO ₂	H ₂ S	COS	RSH	Hg	As
MERCURY REMOVAL									
AXTRAP™ MERCURY SERIES									✓
GAS & NGL DRYING AND PURIFICATION									
AXSORB® DRYING SERIES			✓						
AXSORB® PURIFICATION SERIES		✓	✓	✓	✓	✓	✓		
AXTRAP™ ARSINE SERIES						✓			✓
AXTRAP™ SULFUR SERIES					✓		✓		
AXTRAP™ SULFUR SCAVENGERS					✓		✓		
SULFUR RECOVERY									
CLAUS CATALYSTS	✓	✓							
ACTIVE BED SUPPORT	✓								
TAIL GAS TREATMENT CATALYSTS (LOW AND HIGH TEMPERATURE)	✓						✓		

In addition, Axens provides associated services to ensure efficient operation of Natural Gas processing plant:

- Design projections
- Basic engineering package
- Loading supervision
- Catalyst sulfiding
- Start-up supervision
- Units troubleshooting
- Side stream tests
- Design to disposal (D2D™)

Drying & Purification

The deep dehydration and purification of gas & liquid streams from Natural Gas processing requires fixed bed operation of regenerable adsorbents. The wide portfolio of AxSorb® Series includes molecular sieve desiccants with high and tunable selectivity, ideally complemented by optimized alumina products.

AxSorb® Drying series

Water removal is best performed using Axens molecular sieves in combination with protective layer in the Multibed arrangement. The very high water pick-up capacity, even at low partial pressure, helps to reach the stringent specifications required for liquefaction applications.

Selective drying preventing co-adsorption of acid compounds such as hydrogen sulfide or carbon dioxide can also be achieved through an appropriate choice of the molecular sieve aperture.

AxSorb® Purification series

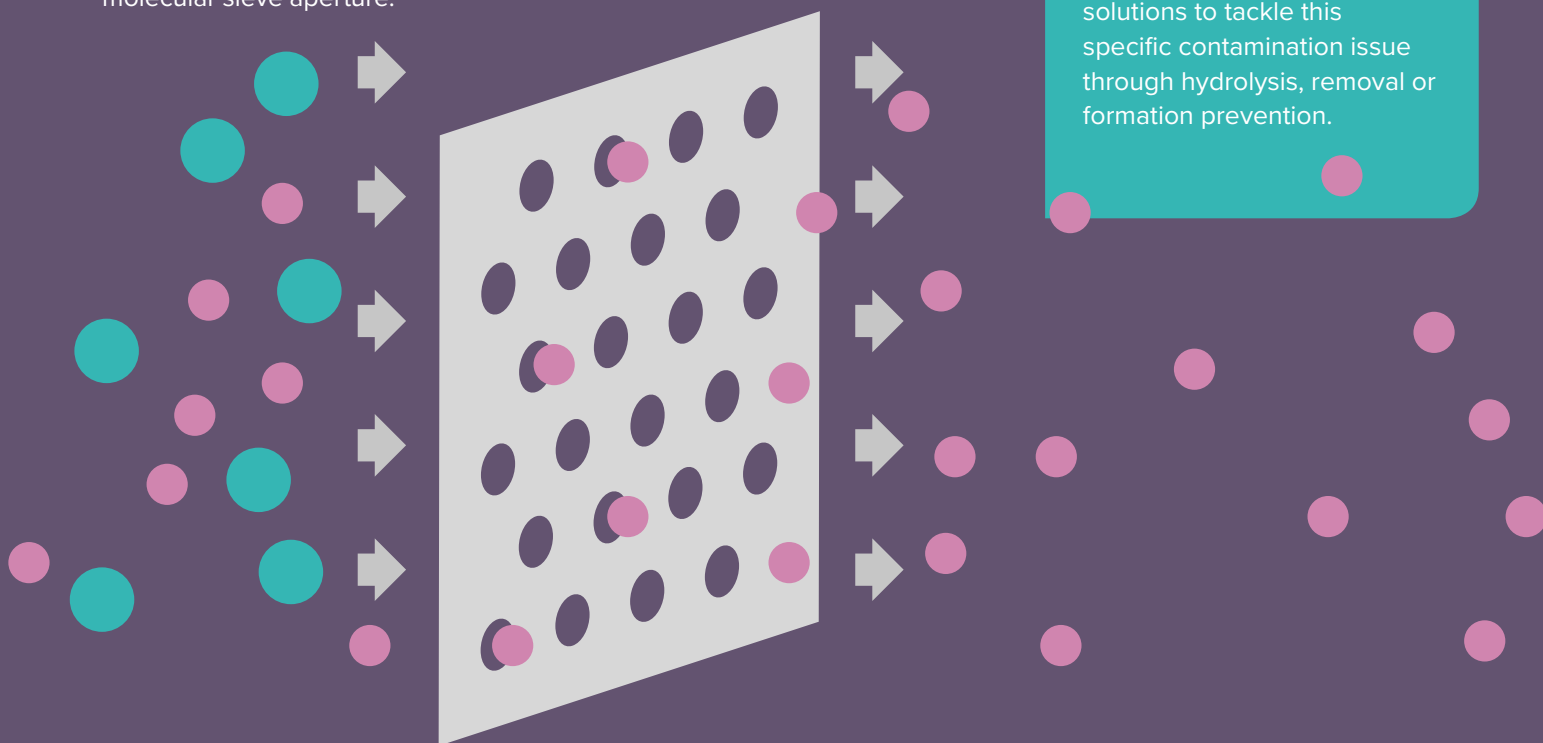
Removal of acidic contaminants like carbon dioxide or mercaptans requires using Axens molecular sieves with larger apertures. A tuned sieving effect is obtained by stacked beds configuration to remove multiple contaminants down to ppm levels.

Dedicated Axens aluminas can also handle resilient impurities displaying limited affinity for molecular sieves.



DEALING WITH ALL IMPURITIES

AxSorb® products can handle a large variety of impurities including water, carbon dioxide and sulfur species. Among those, carbonyl sulfide (COS) is present in Natural Gas but can also be formed along the processing scheme. Axens offers dedicated solutions to tackle this specific contamination issue through hydrolysis, removal or formation prevention.



↑
Impurities removal with molecular sieves

Mercury & Sulfur Removal

The removal of heavy metals and sulfur is performed using fixed bed operation of non-regenerable adsorbents also referred to as guard beds. Axens proposes tailor-made solutions for both on-shore and off-shore facilities.

AxTrap™ Mercury series

Heavy metals contamination is one of the major issues of Natural Gas processing due to health, environment and corrosion issues. AxTrap™ physical properties are optimized to minimize diffusion issues and maximize metal retention capacity. Once trapped, mercury, along with arsenic and sulfur, is then chemically bound within the product and stringent specifications can be reached.

AxTrap™ Sulfur series

Pipeline and product specifications often require a sulfur polishing step. Maximized sulfur pick-up can be reached by adequately selecting the nature of AxTrap™ Sulfur Series formulation. Axens can indeed propose dedicated products for removing any type of sulfur species (H_2S , COS, mercaptans, sulfides) or for operation either at low or higher temperatures.

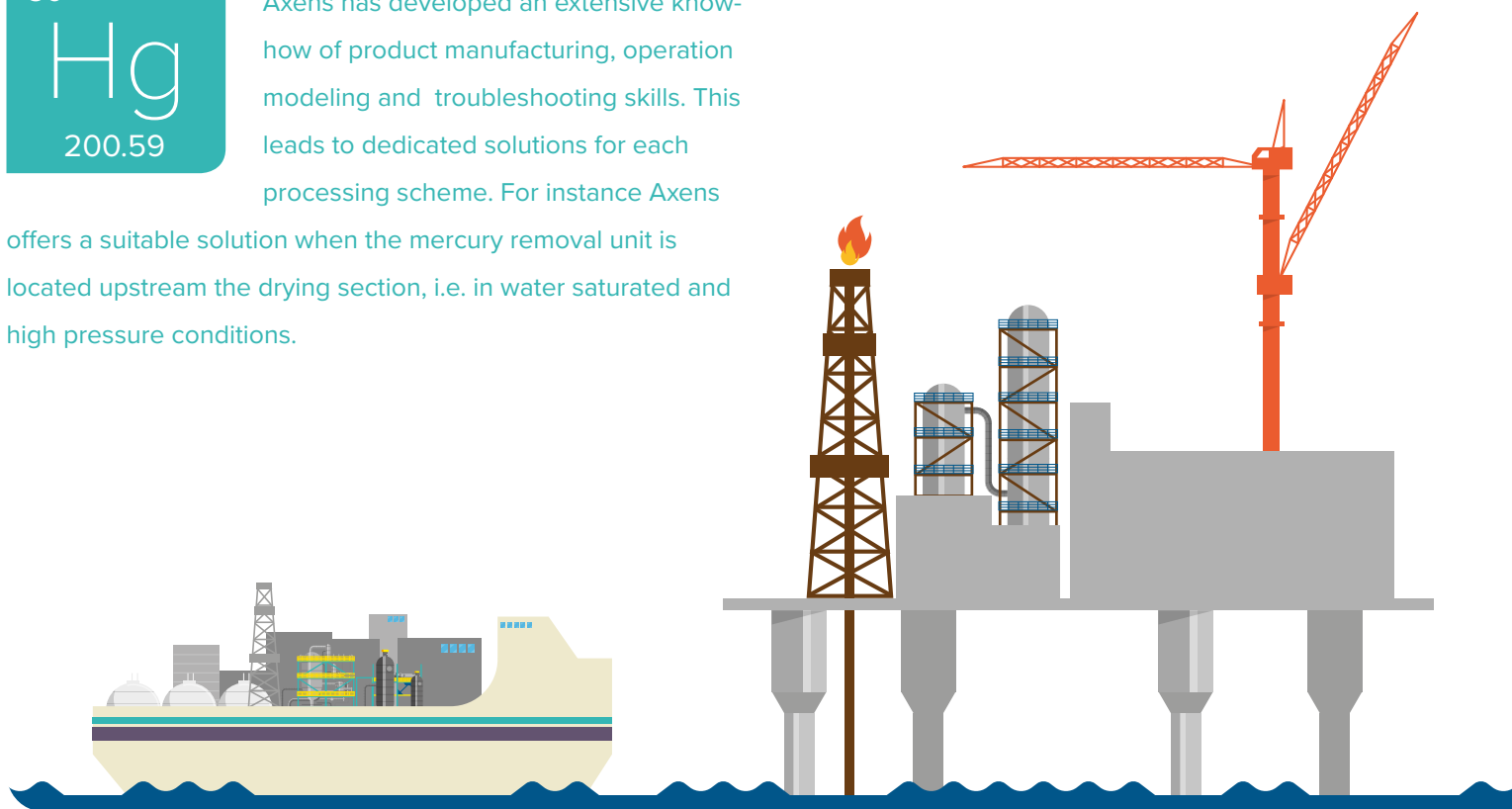
AxTrap™ Scavenger series

Axens offers eco-efficient, safe and easy to use scavengers to meet low sulfur standards and improve a variety of gas purification processes including biogas, Natural Gas and carbon dioxide. The unique formulation of AxTrap™ scavengers allows reliable performance in water saturated and non-water saturated gases depending upon specific AxTrap™ product selected.



With more than 40 years of experience, Axens has developed an extensive know-how of product manufacturing, operation modeling and troubleshooting skills. This leads to dedicated solutions for each processing scheme. For instance Axens

offers a suitable solution when the mercury removal unit is located upstream the drying section, i.e. in water saturated and high pressure conditions.



Sulfur Recovery Catalysts

Sulfur Recovery Units task is to control and reduce gas plant emissions. Elemental sulfur is produced from hydrogen sulfide (H₂S) rich streams using the Claus reaction in a mixed thermal & catalytic process. Sulfur recovery yields can be further boosted by the addition of Tail Gas Treating Units. Axens has developed a wide portfolio of catalysts suited for the processes dedicated to sulfur recovery.

Leadership comes from innovation

Axens is recognized as the world leader in sulfur recovery catalysts, offering innovative solutions to specific problems related to sulfur processing. This is best illustrated with the breakthrough launch of low temperature catalysts for the hydrogenation process.

These optimized products help maintaining high performances while lowering reaction temperature and carbon footprint. Significant operating and economic benefits can be reached using these dedicated catalysts with no adverse effect on the performances.

Claus catalysts

Promoting the Claus reaction kinetic while avoiding pore blockage in the catalyst is key to sulfur recovery maximization. Axens aluminas provide first-class performance thanks to their optimized properties. When dealing with refractory species, titanium-based catalysts, used alone or in combination with aluminas, is the solution of choice to reach outstanding performances. For lean acid gas, Axens has developed a unique promoted alumina which enables dealing with the adverse effect of aromatics on the catalyst cycle duration.



Tail Gas catalysts

To further increase recovery yields, tail gas leaving the Claus section can be treated using different processes. Axens proposes dedicated products for sub-dewpoint applications or hydrogenation process where sulfur species are reduced back to H₂S and recycled to the Claus section inlet. These optimized catalysts help reaching the ever increasing stringent specification on sulfur emissions from the gas plant.

OIL REFINING



PETROCHEMICALS



GASES



ALTERNATIVES
& RENEWABLES



WATER



Axens is a Group providing a complete range of solutions for the conversion of oil and biomass to cleaner fuels, the production and purification of major petrochemical intermediates as well as all of natural gas treatment and conversion options. The integrated offer includes technologies, equipment, furnaces, modular units, catalysts, adsorbents and related services, commercialized under “Axens Solutions”, “Heurtey Petrochem Solutions” and “Axens Horizon” brands.