Industrie Meccaniche di Bagnolo
“The only source of knowledge is experience”.

A. Einstein
Polysilicon: Process and Equipment

Polysilicon can be produced by Chemical Vapour Deposition (CVD), mixing trichlorosilane (SiHCl₃) and hydrogen (H₂) in a reactor at extremely high temperature (up to 1150 Celsius degrees) through the deposition of silicon on a filament run by electric current. VRV has been the leading manufacturer of CVD Reactors and STC Converters for the last 30 years with the supply of more than 400 reactors and has the strongest track records for this type of equipment supplied to the polysilicon industry. In consideration of the growing demand of the photovoltaic industry, since 2004, VRV developed the first ever 36-rod design for the Polysilicon Reactor. Over the years, due to the market demand for more efficiency and reduced power consumption in the polysilicon production, VRV has designed and supplied the 48, 54 and - in 2012- 96-rod design for several customers.

In addition to the equipment, VRV can deliver Process Design Packages (PDP), which can be converted into Basic and Detail Design by any qualified EPC contractor. VRV provides the following products and services:

- CVD Reactor, 36 rods, in operation at DAQO Polysilicon plant (China)
- CVD reactor, 96 rods, for Hanwha Chemical Corporation (South Korea)
About the VRV Group

The VRV Group is a diversified multinational corporation made up of several companies, many with highly automated, purpose-built facilities that are some of the world’s most state-of-the-art manufacturing sites for cryogenic equipment.

- **VRV S.p.A.**, Ornago, Italy
- **VRV SERVICES S.r.l.**, Ornago, Italy
- **CRYO DIFFUSION S.A.S.**, Léry, France
- **VRV Asia Pacific Pvt Ltd.**, Chennai, India
- **FEMA S.r.l.**, Busto Arsizio, Italy
- **VRV South América Equipamentos Criogênicos Ltda.**, Estado de Sao Paulo, Brazil
- **Industrie Meccaniche di Bagnolo S.r.l.**, Bagnolo Cremasco, Italy

**VRV S.p.A.** established in 1956 and headquartered in Ornago, near Milan, is organized into two divisions: the **Energy & Petrochemical** and the **Cryogenic Division**.

**VRV Energy & Petrochemical Division** specializes in the design and manufacturing of high pressure and high temperature containing equipment (such as: Shell and Tube Heat Exchangers, Reactors, Drums, Separators, Proprietary Components) for the following fields of applications and industries: **refining, petrochemical, fertilizer and offshore**.

VRV manufactures equipment in a wide range of materials, including the most exotic alloys, like:
- High strength CS, low alloy steel with or without clad
- Austenitic, ferritic and martensitic stainless steel, duplex and super duplex steel
- Incoloy, Inconel, Hastelloy, titanium

The **Cryogenic Division** is specialized in vacuum insulated products used in the distribution and storage of cryogenic liquefied gases and exports the majority of its products to the world’s largest industrial companies in more than 80 countries worldwide.

**CRYO DIFFUSION S.A.S.** established in 1965 and part of the VRV Group since 2001, specializes in the design and manufacture of vacuum superinsulated cryogenic equipment for liquefied gases, with focus on products for long-term cryogenic preservation of biological samples, including a wide range of transportable super-insulated nitrogen tanks for laboratories, industries and oil field service applications and turnkey Cryobank Management Systems with fully automated controls. Cryo Diffusion has extensive experience in high value engineered products such as cryostats and valve boxes for scientific and industrial research.

**VRV SERVICES S.r.l.**, established in 2005, provides a full range of services for cryogenic storage and transport equipment, refurbishment, repair, training, spare parts, rental of cryogenic equipment and turnkey project management.

**VRV Asia Pacific Pvt Ltd.**, established in 2008 and based near Chennai (India), specializes in the design and manufacture of vacuum insulated equipment used in the distribution and storage of cryogenic liquefied gases such as cryogenic storage tanks, semi-trailers and micro bulk products.

**FEMA S.r.l.**, established in 1952 and part of the VRV Group from 2010, specializes in the design and manufacturing of safety, control and actuated valves for the cryogenic industry, as well as safety and changeover valves for oil and gas and petrochemical plants. FEMA is also involved in aerospace production as a supplier of safety and check valves that are installed over the propulsion lines of launching pads (Ariane, Vega and Soyuz projects).

**VRV South América Equipamentos Criogênicos Ltda.**, established in 2013, specializes in the repair, aftersales and technical services, applying the same technology and manufacturing processes of the Group.

To ensure that the local needs are met in various geographical markets VRV has established offices in the major geographical markets across the world: Germany, the Czech Republic, France, the United Kingdom, Saudi Arabia, India (Mumbai), Malaysia and Brazil.

The story of the Group has been created by our biggest strength, our people and is dedicated to the quality, safety and innovation of our highly engineered products. The VRV Group has built its success and reputation on the experience and passion of our people who work day in and day out to bring our clients solutions that suit their needs.
About Industrie Meccaniche di Bagnolo S.r.l.

Industrie Meccaniche di Bagnolo S.r.l. (IMB) established in 1961 in Bagnolo Cremasco, 40 Km south-east from Milan, Italy. Since its foundation, IMB has been expanding and developing its capacity and fabrication techniques to become a worldwide leader in design and manufacture of Shell & Tube Heat Exchangers for the Oil, Petrochemical and Chemical Industries. Most of the major Companies in these fields are now within our consistent Customers.

In 1982, ABB Lummus Heat Transfer became the licensor for the worldwide marketing of high pressure exchangers patenting the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger. Already in 1982, and continuously since that time, IMB became the first ABB LHT licensee largely contributing in the last 30 years to the development of the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger internals design in full co-operation and partnership with Licensor. The long partnership history with Lummus (today Lummus Heat Transfer BV - a CB&I Company) created an entire generation of technicians grown up in IMB who are leading experts in all sectors related to the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchangers construction.

In 2005 IMB became Koch Heat Transfer Company S.r.l., member of Koch Chemical Technology Group (KCTG). The acquisition by Koch Group injected a conspicuous focus on heat transfer challenges which are today the crucial items in almost any applications in Industry. Following consistent efforts in last years, IMB is nowadays well recognized for the design and construction of efficient equipment operating in different plants worldwide.

Starting from late 2015 IMB is part of the VRV Group, leader in the design and engineering of specialty equipment for the chemical, petrochemical and energy Industry. This transaction was part of a strategic diversification project achieved through the internationalization and acquisition of technologies enabling the VRV Group to constantly grow on the markets.

Today, IMB Customers appreciate our constant attention to quality, competitiveness, responsibility for “on time” deliveries and cooperative way of doing business. Years of experience combined with dedicated and professional staff in all departments, produced the favorable results outlined in this site.

The main field of application of our products are mainly Oil & Gas (Gas Treatment, LNG, GTL), Refining (Hydrocracking, Hydrotreating), Chemical & Petrochemical Industry (Styrene, Ammonia, Urea). Having manufactured more than 5,000 units for Oil, Petrochemical and Chemical Industries, in almost all type of material, we successfully operate worldwide in the most demanding services and critical applications.

IMB is specialized in the manufacture of Heat Exchangers up to 200 metric-tons weight. Shell & Tube Heat Exchangers (High Pressure / High Temperature) are our specialty products, a wide range of Shell & Tube Heat Exchanger is supplied in compliance with all the International Codes and Standards and according to the Specifications of the world’s major Oil Companies, Engineering Firms and Licensors. IMB scope of supply includes, but is not limited to, HELIXCHANGER® Heat Exchangers, Hairpin Type Multi-Tube/Double-Pipe Heat Exchangers, Tank Heaters, Tube Inserts to offer completely customized solutions to the Customer in terms of heat transfer and optimized design.

In addition to design and manufacturing of new equipment, IMB invests its best professional resources to assist Customers in all phases of project cycle. Consultancy service, training, site assistance are provided as requested, always looking at full cooperation with a unique attitude to partner with our valued Customers to offer them an outstanding satisfactory experience with IMB.
LUMMUS ADVANCED BREECH-LOCK EXCHANGER®
Heat Exchanger

HELIXCHANGER®
Heat Exchanger

ENGINEERED HEAT EXCHANGERS
FOR SPECIFIC APPLICATIONS

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LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger Technology

We designed and built more than 700 LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchangers, more than 50% of the operating units in the world.
Successfully used for many years, the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger features a special threaded ring to hold the channel cover and contain channel pressure. This unique and innovative technology eliminates the large channel cover flange and bolting of other conventional high-pressure exchanger designs. The hydrostatic pressure load is taken by the channel body and not by heavy bolting (bolts are only sized for gasket compression loading). This allows an optimized design of the channel (no flange or channel distortion due to bolting) with consequent reduction in the exchanger size and weight.

LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger is fabricated and supplied by Industrie Meccaniche di Bagnolo S.r.l. under fabrication license from Lummus Technology, Inc.

Applications & Reliability

LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger is suitable for high-temperature, high-pressure applications with rich hydrogen streams in hydrocracking and hydrotreating gas compression, ammonia/urea synthesis, methanol and other such processes. It is suitable for applications with both shell and tube sides at high pressure (H/H type) and for applications with high pressure only on the tube side (H/L type).

Industrie Meccaniche di Bagnolo S.r.l. has supplied the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger for some of the most critical services with high pressures and temperatures for many major oil companies. Known worldwide as a leader in the design and fabrication of high-pressure Heat Exchanger, Industrie Meccaniche di Bagnolo S.r.l. also offers technology for the most demanding and critical high-pressure applications with the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger closure system.
LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger Advantages

Advantages of the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger design compared with a conventional welded diaphragm design include:

- More economical across a certain combination of exchanger sizes and design conditions
- The overall exchanger is lighter with a thinner channel and is easier to handle
- No internal threaded holes in the channel-forging or in the cladding
- The internal tubesheet-to-shell gasket can be tightened from the outside during operation
- No cutting and/or grinding of welded parts (i.e. channel diaphragm weld) is required to open the channel for maintenance
- No welding is required to close and seal the channel after maintenance; there is no need for line flushing, welding permits, skilled qualified welders, PWHT’s and country boiler authority supervision and inspection during maintenance
- There is no need for hydraulic bolt tensioning devices to remove the channel cover and reassemble the exchanger, thus eliminating the number of tightening cycles and straining of gauge measurements.

Bolt size – Comparison between conventional design and LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger

These advantages allow much easier operation and maintenance of the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger closure. These exchangers are easy to operate and comparatively easy to dismantle and reassemble, which results in more reliable operation and shorter shutdown time.

### LOWER CAPITAL EXPENDITURE

**Conventional design Heat Exchanger**
- Design Pressure: 168 barg
- Design Temperature: 345 °C
- Shell ID: 1,470 mm.
- Bolt size: 5” ¾ (# 20)
- Bolt weight: 120 Kg/each

### EASIER MAINTENANCE

**LUMMUS ADVANCED BREECH-LOCK EXCHANGER®**
- Design Pressure: 200 barg
- Design Temperature: 450 °C
- Shell ID: 1,730 mm.
- Bolt size: 1” ½ (# 72)
- Bolt weight: 1,1 Kg/each

### SHORTER SHUTDOWN TIME

**HIGHER PLANT RELIABILITY + LOWER TOTAL LIFE-CYCLE COST**

3 Conventional design Heat Exchanger
Design Pressure: 168 barg
Design Temperature: 345 °C
Shell ID: 1,470 mm.
Bolt size: 5” ¾ (# 20)
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4 LUMMUS ADVANCED BREECH-LOCK EXCHANGER®
Design Pressure: 200 barg
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LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger is not just another Breech-Lock Exchanger

Industrie Meccaniche di Bagnolo S.r.l. can demonstrate, over hundreds of successful applications, a product that is designed and manufactured with the closest tolerances and highest attention to detail for reliability, easy maintenance and enhanced safety.

The unique design of the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchangers internals offers exceptional maintenance advantages over competitors’ Breech-Lock exchanger closures:

- Minimal tolerance for channel & lock ring threads for safer operation
- Internal bolts are not prone to deformation or to overstressing
- The seal gasket, thanks to the advanced design, follows the relative movement of the diaphragm with respect to the channel due to differential thermal expansion, thus guaranteeing the sealing even during critical transient conditions
- Detailed design has been improved and optimized over the years, with specific focus even on minor details that can substantially affect reliability and maintenance and that are provided and regularly updated to assist our Customers worldwide.
- Effective operations and maintenance manual including a detailed plan for preventive maintenance
- Dedicated team with extensive experience for training, site support and supervision during LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger shutdown and maintenance

5 One of the Biggest Ever Built /
Design Pressure:
179 bar shell side – 200 bar tube side
2596 PSI shell side – 2,900 PSI tube side
Design Temperature:
454 °C shell side – 427 °C tube side
850 °F shell side – 800 °F tube side
Shell ID: 1,981 mm (78”)
Weight: 180 Tons/each
Assembled at Cremona river port and shipped to the site in stacked condition

6 Stacked exchangers for Saudi Arabia
Easy installation – Special Proprietary Dismantling Premium Jig

IMB has developed a unique, proprietary Premium Jig assembly designed to facilitate dismantling and reassembling operations of the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger. With our Premium Jig, it is possible to open the channel, remove the internals, and then reassemble and reclose the LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger in a very short time without the need for heavy cranage.

The Premium Jig’s sophisticated design includes ball bearing supports, fine pitch adjustment screws, and close-fit tolerance machined mounting/contact surfaces. All of this, together with its ergonomic design, makes the Premium Jig the best tool of its kind for LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger maintenance.

The Premium Jig is adjustable so that one Premium Jig can be used for different exchangers and threaded ring sizes. The Premium Jig is mounted on a machined surface on the channel of the exchanger. This allows autonomous operation with no need for other plant facilities, such as cranes, etc. Once the Premium Jig is lifted and positioned on the mounting surface, opening the channel and removing the threaded ring and cover takes approximately 10 minutes. The entire sequence of activities, from completion of shutdown to full disassembly of the internals, can usually be performed in one to three hours depending on the size of the exchanger.

Once disassembled, the Premium Jig can be split into parts and easily handled and stored.

A different version of the Premium Jig is also available for use with the vertical LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger.

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7 By Courtesy of SHELL PERNIS, Hydrocracker Unit

8 IMB Proprietary Premium Jig - Bagnolo Shop
We delivered units among the largest HELIFIN® Heat Exchangers (HELIXCHANGER® Heat Exchanger with low-finned tubes) and Helitowers (“Texas Tower” Heat Exchanger with HELIXCHANGER® bundle) in the world.
Applications

HELIXCHANGER® Heat Exchangers are the best choice when a high shellside heat transfer coefficient is desired and/or shellside pressure drop is controlling. They also allow reduced shellside fouling and represent the optimal solution when flow-induced vibrations are a concern. Shellside media may range from hydrogen-rich gas to water or viscous fluids with high fouling tendencies, in single-phase or two-phase flow. HELIXCHANGER® Heat Exchangers can be designed with TEMA E, J or special multi-pass shells with multi-pass tube bundles.

Applications are in the gas processing, refining, petrochemical and chemical industries, as well as the power, food and pharmaceutical industries. Some examples are:

- Crude preheat Exchangers
- Feed preheaters
- Oil coolers
- Process gas coolers
- Compressor aftercoolers
- Reactor feed-effluent exchangers
- Overhead condensers
- Column reboilers

HELIXCHANGER® Heat Exchangers provide substantial cost benefits for new plants and for revamps of existing units. Reductions in surface area of up to 30%, with smaller size or fewer number of shells, can be achieved. This provides significant savings in capital costs, piping/structural costs and plot space.

HELIXCHANGER® Heat Exchangers are particularly suited for plant revamps. Increases in process capacity of up to 40% can be achieved with replacement HELIXCHANGER® Bundles while also reducing maintenance requirements. Reuse of existing shells and piping provides significant savings in investment costs.

Since 1998 IMB has been delivering through the world for different process such as:

- Crude Distillation
- Catalytic Reforming (CCR)
- Hydro treating
- Offshore
- Vacuum Distillation
- Crude Distillation
- LNG
- Crude Distillation
- Hydrocracking

4/6 Pre-Cooling Cycle Compressor Condenser:
11,000 fine finned Titanium Gr.2 tubes
Weight 165 tons
I.D. 3,800 x Length 22,000 mm
HELIXCHANGER® Heat Exchanger

5 Texas Tower with HELIXCHANGER® Bundle
Main features

- Less shell-side fouling
- Higher shell side heat transfer
- Lower shell side pressure drop
- Reduction of vibration hazards
- Better two-phase flow distribution
- Cost Saving on Total Life Cycle Basis

Compared with conventional perpendicular segmentally baffled shell and tube heat exchangers, HELIXCHANGER® Heat Exchangers offer the following advantages:

- Enhanced heat transfer
- Lower shellside pressure drop
- Reduced investment costs
- Increased process capacity
- Lower shellside fouling
- Extended run-length and service life
- Reduced vibration hazards
- Reduced maintenance costs

How to Recognize Potential for HELIXCHANGER® Heat Exchanger?

- Where conventional design is NTIW
- Where conventional design is Rod Baffle
- Where shell side thermal resistance is > 50%
- Where shell side fouling is > 40%
- Where E-stream is > 10%
- Where conventional design has Re(shell) > 10,000
- Where conventional design has large baffle spacing or double segmental baffles
- Where conventional design is with low-fin tubes
IMB background of solid Heat Exchangers manufacturer is reflected by a large number of special equipment which operate in different applications and sectors of the Oil & Gas Industry. In addition to construction under licensed design of proprietary equipment, thermal design optimization, mechanical features, enhanced construction materials are all ingredients of IMB recipe to approach Customers and satisfy their needs.
Engineered Heat Exchangers For Specific Applications

IMB is specialized in the design and manufacturing of Shell & Tube Heat Exchangers in all materials up to 200 metric tons weight.

Shell & Tube Heat Exchangers (High Pressure) are our historical specialty products thus enabling IMB to focus its extensive engineering and fabrication facilities on the production of these equipment, ensuring IMB customers to receive the best design and highest quality equipment available anywhere in the world.

IMB products range over conventional TEMA type, licensed design and Licensors’ proprietary units. In-house enhanced designs, tailored devices and alternative configurations like hairpin and tank heaters allow IMB to provide optimized solutions aimed to reach highest effectiveness.

Having manufactured more than 5,000 units for oil, petrochemical and chemical industries in all types of materials, Industrie Meccaniche di Bagnolo S.r.l. successfully operates worldwide in some of the most demanding services and critical applications.

1. ExxonMobil France - RHU Reactor Feed Preheater - 20” Horizontal Hairpin - High Pressure H₂ Service
2. Canada - Feed Effluent - LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchanger
3. Lean Amine Cooler - 10” Stacked Vertical Hairpin
4. Abu Dhabi National Oil - Sulphur Recovery Unit
Hairpin Heat Exchangers - A Valuable Alternative to Conventional Shell & Tube Heat Exchangers

Hairpin Heat Exchangers use true counter-current flow. Unlike multi-pass shell-and-tube designs where correction factors are used to account for inefficiencies resulting from co-current passes, this process maximizes temperature differences between shellside and tubeside fluids. Owing to its fewer sections and less surface area, a hairpin Heat Exchanger is the most efficient design, when a process requires a temperature cross (hot fluid outlet temperature is below cold fluid outlet temperature).

Double-pipe Heat Exchangers utilize a single pipe-within-a-pipe design and are commonly used for high fouling services such as slurries where abrasive materials are present, and for smaller duties. Standard shell diameters range from 2" to 6". Multi-tube Heat Exchangers are used for larger duties with standard designs for shell diameters up to 30" and surface areas in excess of 10,000 square feet per section.

When to use Hairpin Heat Exchangers
- The process results in a temperature cross
- High pressure tubeside application
- Cyclic service
- High flowrate ratios between shellside and tubeside fluids
- High terminal temperature differences (300°F/149°C or greater)
- The exchanger is subject to thermal shock
- Heating or cooling vapors
- Complete vaporization is required
- Solids are present in the process stream

Why Hairpin should be preferred
- Separate tubesheets: Handle high temperature differences and cycling more effectively than shell-and-tube exchangers.
- Durable baffle cage construction: Welded to the tie rods without the need for “sleeves” or internal nuts.
- Moveable support brackets: Allow shell expansion and contraction and eliminate the need for sliding plates commonly used for fixed supports. Brackets are slotted for anchor bolts on all four sides for flexibility in installation, and offer the ability to add sections in the future.
- Easy installation and piping, as tubeside and shellside connections on the same end.
- There is no internal bolting.
- Double-pipe exchangers utilize pipe instead of thin wall tubing to enhance integrity.
Closure Design
Our closure designs offer an effective means of providing a removable tube bundle for a variety of design conditions and applications. All of our closures have the following features:
External Split rings - Split rings are used to lock the bundle to the shell. On outdated models these rings were internal and came into contact with the shellside fluid. Internal split-rings are still used by others.
Better gasketing - Our gaskets do not seat on the tubesheet face where misalignment easily can occur and the potential for erosion exists. Our shellside gaskets are easier to remove than wedge gasketing used by competitors.
Separate tubeside and shellside gaskets - Prevent interstream leakage.
Round flanges - More effective gasket seating than square flanges.

Hairpins with finpipes
Double pipe exchangers and multtube hairpin exchangers with longitudinal fin pipes and fin tubes provide augmented heat transfer area in a compact arrangement, allowing effective space savings for applications where shell side heat transfer coefficient is limiting, as with low pressure gases and high or very high viscous fluids.
The adoption of IMB periferal baffles can further enhance extended surface effectiveness, while keeping pressure drop very limited.
Shell & Tube Heat Exchangers for Petrochemical Applications - Ammonia

The synthesis of ammonia uses a form of magnetite, iron oxide, as the catalyst of a reaction held at 15-25 Mpa and between 300-550 °C, passing the gaseous nitrogen and hydrogen over multiple beds of catalyst, with cooling after each pass with a conversion rate up to 15% and a recycling mechanism to achieve up to 98% conversion.

The major source of hydrogen is methane from natural gas, however, sometimes coal may be used as a source through a process called coal gasification. Initially, methane is cleaned primarily to remove sulphur impurities that would poison the catalyst, then clean methane reacts with steam in the primary reforming stage and with air in the secondary reforming stage, over a catalyst of nickel oxide.

The water-gas shift reaction yields more hydrogen from carbon monoxide and steam, then the gas mixture goes through a methanator, which converts the remaining carbon monoxide into methane for recycling purposes.

The production of ammonia is based on proprietary technology by a number of licensors (Haldor Topsoe, KBR, Ammonia Casale) for which IMB is an approved vendor.

7 Chiller

TEMA type: DKU
Design Press.: 25 ss / 213 ts bar
Design Temp.: 70 °C
Material: Carbon Steel
Dia. x Length: 1,810/3,150 x 4,983 mm

8 High Pressure Heat Exchangers for Ammonia Synthesis Loop Hot Heat Exchanger

TEMA type: DET vertical
Design Press.: 213 bar
Design Temp.: 300 °C
Material: 1¼Cr-½Mo
Dia. x Length: 1,730 x 16,360 mm
Weight: 190 ton

9 High Pressure Heat Exchangers for Ammonia Synthesis Loop Purge Gas Chiller

TEMA type: DKU
Design Press.: 25 ss / 213 ts bar
Design Temp.: 70 °C
Material: Carbon Steel
Dia. x Length: 350/770 x 4,194 mm
Shell & Tube Heat Exchangers for Petrochemical Applications - Styrene

Styrene, one of the most important monomers produced by the petrochemical industry, is the basic building block for the manufacturing of a broad range of plastics. Our equipment covers different services on licenced plants where Ethylbenzene (EB) is dehydrogenated to styrene over potassium-promoted iron oxide catalyst in the presence of low steam to oil to achieve high styrene selectivity.

A typical styrene plant consists of two or three reactors in series, which operate under vacuum to enhance the conversion and selectivity. Selectivity to styrene is 93-97%.

Improving conversion and so reducing the amount of ethylbenzene that must be separated is the chief impetus for researching alternative routes to styrene like POSM, SM/PO or involving the reaction of benzene and ethane.

IMB is referenced for the following equipment mainly as per SSW and Badger and Snamprogetti’s licence and has an extensive experience in manufacturing specifically Reactor Reheaters and 3 Car Garages.
Shell & Tube Heat Exchangers for Power Applications - CSP Plants

For a number of years the world has experienced a continually growing energy demand and it will be the trend also for the future. All major countries are looking for alternative energy sources. In this scenario, renewable energies are one of the solutions to environmental problems and Concentrated Solar Thermal Power (CSP) generation is among the most promising.

In a CSP system, a heat transfer fluid is heated while circulating in a net of parabolic solar receivers and returned to a series of heat exchangers in the power block, where the fluid is used to generate high pressure superheated steam. The steam is then fed to a conventional reheat steam turbine/generator to produce electricity.

The use of heat exchangers and IMB technologies in steam generation combined with IMB experience in the field of heat transfer has proved to be a key factor to win this new challenge, where heavy cyclic loads and unsteady conditions of Solar radiation result in state-of-the-art changing standards and design approaches.

Among our references in the Solar Thermal Power for the Spanish Market, IMB Hairpin design turned out to be a convenient and compact configuration to for the Steam Reheater unit.
Two 28” IMB Hairpin Multitube exchangers with fixed tubesheets for the first plant and two 33” IMB Hairpin Multitube with Separated Heads closure for the second plant were awarded to IMB representing fully new design standards for the market sector.

The original design included four conventiona Shell & Tube exchangers for each plant. Reduction in installed surface and number of units has been achieved by Hairpin design. The free-floating U tube bundles also compensate for differential shell-tube expansion and eliminates needs for expansion joints. Large radius Ubends are easily cleanable with flexible shaft tube cleaners and the separate tube sheets design handle high temperature differences and cycling more effectively than shell and tubes exchangers, being integrated in the piping overall system of the plant. The IMB solution offered costs savings both in initial investment and in future maintenance, with no pareil robust design. One of the contract consists of multiple items, including high pressure boiling feed water heaters, kettle type steam generators, steam super heaters and low/high pressures feed water heaters.
Shell & Tube Heat Exchangers for Gas Treatment Applications

The ever increasing processing capacity of LNG storage and processing plants challenges for even bigger hairpin exchangers, often the preferred design to withstand the demanding process requirements of this application. IMB is a leader in the manufacturing of big hairpins (ND > 20") and has references of this and other types of equipments manufactured specifically for the LNG storage and processing plants.

Why Gas Storage
The reuse of depleted reservoirs allows the sites to remain unchanged and the gas to be stored under the same conditions of safety as nature has preserved it for million years.
IMB has successfully contributed with Hairpin for Undergroung Gas Storage and is involved in strategic partnerships to provide compact effective design.
IMB is also active in LNG.

16 Bonny Island Nigeria, Kettle for LNG
17 Hairpin for Underground Gas Storage – Low pressure drop shellside configuration for plant footprint optimization.
18 Titanium Heat Exchangers for Offshore Platform - North Sea
IMB technological team is always focused on looking for more effective materials selection and cooperation with metallurgy specialists, frequently adopted to provide a consistent solution to our customers.

Materials we routinely fabricate:

- Stainless steel, all grades
- Super austenitic stainless steels (e.g. 254 SMO)
- Duplex and superduplex stainless steels
- Titanium all grades
- Inconel, Incoloy, Hastelloy, all grades
- Carbon Steel
- Low-Alloy Steels (1¼Cr, 2¼Cr, 2½CrV, 3Cr, 5Cr, 13Cr)
- Low Temperature Steels (3½Ni, 9Ni)
- Monel and Cu-Ni alloys
We supplied critical equipment to the first Subsea Gas Compression Plant in the World.
Strict space requirements is the most critical aspect of every offshore installation. Being involved in this business for a long time, IMB has provided tangible value in the identification of the best compromise to match the required process target within the minimum plot space. From big hairpins installations to sub-sea coolers, IMB expertise in tailoring every time the perfect customized solution has been well recognized by our satisfied clients.

Looking always to contribute in developing more effective process heat transfer technologies, Industrie Meccaniche di Bagnolo S.r.l. today is able to combine its technical expertise and many years of industry experience to provide one of the most comprehensive selection of tubular heat exchanger products and solutions.

From thermal and mechanical design, through best-in-class manufacturing, technical consultancy, training and aftermarket service, our engineers help you optimize your heat transfer systems to make your operations more efficient and productive.
Subsea Coolers

Since the very beginning in early 2000, IMB participated in the study and pilot phases for subsea coolers equipment for the North Sea, from engineering to manufacturing.
IMB is proud of being part of the Åsgard Subsea Compression Project completed in 2015, as the first of its kind in the world. Compressors are installed on the seabed, instead of on a platform. This will improve recovery from the Mikkel and Midgard reservoirs by around 280 million barrels of oil equivalents.
From preliminary modelling to the sinking yard off the coast of Norway.
IMB follows up its clients from very early engineering phases to after-sale activities, with the aim to satisfy customer in all phases of process.
IMB invests its best professional resources to assist Customers with consultancy service, training and site assistance when requested, always in a view of full cooperation and with unique attitude to offer them an outstanding satisfactory experience.

Our focus is to fully satisfy Customer by offering a superior level of service and reliability from the start of a project, i.e. in the design phase where we can help optimizing the design through our thermal and engineering departments, through fabrication and after delivery of the equipment to site.

Our technical skills and long experience in this market (a large number of interventions carried out in refineries all over the world) allowed us to have a dedicated team that can support and satisfy all Customer’s needs offering technical consultancy, training, enhanced replacement, spare parts and onsite supervision activities. This has always shown our Customers that we are interested in building a long-term relationship, so to earn their loyalty for a mutual growth of business profit.

For LUMMUS ADVANCED BREECH-LOCK EXCHANGER® Heat Exchangers, an exhaustive Installation and Operation Manual is supplied together with the possibility of multimedial training courses for refinery maintenance personnel.
Industrie Meccaniche di Bagnolo S.r.l. has always been seeking for supporting new needs and technological challenges of the Oil & Gas Industry operators.
Industrie Meccaniche di Bagnolo S.r.l. (IMB) has always been seeking for supporting new needs and technological challenges of the Oil & Gas Industry operators with consistent efforts in optimizing consolidated solutions, reducing life cycle costs, favoring investments, following the up-to-date trends in business approach and looking for innovative solutions. The wide experience of IMB personnel in all the phases of a project, from the very early step of feasibility study, through the design, the start-up and then the follow-up of the equipment operation, is the outstanding factor which drives IMB to consistently pursue the vision of providing our Customer with top-class service and superior supply experience.

Established in 1961 thanks to the entrepreneurship of the founder families Arpini and Zannoni, IMB has grown from handcraft style, typical of Italian Industry of the 60’s focused on high quality simple products for local market, to more and more complex designs and constructions of equipment for International Projects and Customers during the last decades of 20th century as dictated by the new ownership of a tycoon of the Italian Steel Industry, Mr. Giorgio Falck. Also the most recent history under the insignia of Koch Group, the worldwide colossus of the American Industry, has been characterized by great focus on value creation and Customer satisfaction through corporate alliances and partnerships with top class Industry players.
From 70s’ till nowadays, IMB approach is to find high prospect individuals and make them grow inside the Company to accrue step by step knowledge creating skilled professionals strongly connected with Company culture and its business orientation.

Also the ground experience accumulated in more than 30 years of site supervision and co-operation with Plants Managers and operations people worldwide, is instrumental for our personnel to determine suitable and feasible solutions always viable for site implementation.

The IMB culture natural soil is not however only strictly fed looking at products and technology. Environmental and safety requirements have grown in the last decade querying Operators to look for integrated solutions for a sustainable business model which may look at a long term future. In IMB people fully share this vision which becomes part of our daily activities driving our choices at work.

Internal processes, professional skills, challenging expectations for each employee, investments on new machine tools, facility layout and human resources have grown together with the higher demand coming from the market with no limitations to technological improvements, software acquisition, processes and personnel qualifications.
Advanced mechanical and thermal design, material testing, partnerships with laboratories, Universities and Professional Institutions, as well as with mechanical part designers and suppliers are regularly performed.

IMB innovation team is capable to co-operate with technology team of major steel mills, tools and welding consumables suppliers and specialists ranging from metallurgy to process in order to investigate alternative options to submit to our Customers.

We trust in professionals who can use their technical skills and cultural attitudes to play an active role in current market. This is the challenging, highly sensitive, competitive scenario where we are used to spend every day all our devotion to root our energy and passion.
Also today, after the acquisition in October 2015 by the VRV Group, our values and vision remain unchanged. VRV is an outstanding Italian firm operating in several industrial sectors, well-structured to compete on worldwide basis thanks to its organization and vision oriented to an organic growth in Oil & Gas and Cryogenic markets. Their history and business culture are the best clue to drive us in the next years to step up the new challenges with highest confidence in accomplishing IMB historical heritage.