



Engineered by **Passion**

Company Profile

Anti-Corrosion Equipment & Systems for the Chemical Process Industry
Core Values: **Engineering Excellence** and **Customer Delight**

- History, People & Competencies

- ✓ **ECARB** was founded in 2009
- ✓ Motivated team with **long and valuable experience** in design and production of graphite equipment & process packages
- ✓ Design standards & manufacturing practices are inherited from our long-standing domain experience
- ✓ Production site in Narni (central Italy) – 12,000 m² with 1,200 m² workshop, 6,000 m² covered area and 2 solar panels plants
- ✓ **FLAMINIA ECARB** India was founded in 2023
- ✓ Production site in Pune will replicate the setup in Italy
- ✓ International presence and worldwide service and delivery capabilities
- ✓ Impressive and comprehensive reference list for all relevant applications



Quality Policy



ISO:9001 CERTIFICATION
(SINCE FOUNDATION)

European Pressure Directive Certification

(Since 2011) Ecarb has higher possible certification degree (module H/H1).

Material Producer according to EN 10204 (Since 2015)

U-stamp available on demand

GOST Certification available on demand



Graphec® ST Heat Exchanger: The Universal Unit

- ✓ Graphite bundle + metallic shell + headers
- ✓ Gaskets less and seamless tube/tube-sheets joint: thermal cementing
- ✓ High tube diameter reduces plugging risk
- ✓ High flexibility in sizing (no standard tube length or shell diameters)
- ✓ Easy maintenance
- ✓ Double and separate tightening system



Graphite Tubes: Simply The Best

- ✓ Top graphite grade
- ✓ Max available length 9,000 mm
- ✓ Available 4 diameters: 16/25 mm, 22/32 mm, 25/37 mm, 38/51 mm.
- ✓ **CFX** carbon fibre wrapping of tubes enhances lifetime and minimize consequences of cracks.



Construction Options

- ✓ Shell: CS, SS, rubber lined, PTFE lined, ECPTF coated, Roto lining, etc.
- ✓ Tube-sheets: iSP or iLP. Options with carbon fibres and anti-erosion device.
- ✓ Headers: iSP, iLP, rubber or PTFE lined steel, carbon fibres reinforcement.

- Graphec® RB Heat Exchangers – Cylindrical Blocks: The Workhorse

- ✓ Stack of blocks drilled axially and on the radial plane.
- ✓ Block and holes diameter are sized acc. service specifications
- ✓ Material grade: iSP or iLP, eventually **CFX** reinforced.
- ✓ ECARB standpoints:
 - ✓ - flexibility in model definition (models stick only to customer needs)
 - ✓ - advanced design and manufacturing standards

| | RB | RB D |
|------------------------------------|---|--|
| Process side holes path | Single row | Double rows |
| |  |  |
| Materials | iSP, iLP | iSP, iLP |
| Process holes diameter, mm | 8, [10], 12, 15, [20] | 8, 15 |
| Service holes diameter, mm | 8, 10 | 8, 10 |
| Blocks diameter, mm | Da 160 a 910 | Da 160 a 910 |
| Blocks height, mm | 255 | 255 |
| Heat exchange area, m ² | 0,30 - 471 | 0,45 - 678 |



- Graphec® SB Heat Exchangers – Cubical Blocks

- ✓ Prismatic blocks, ideal to segregate process and service medias

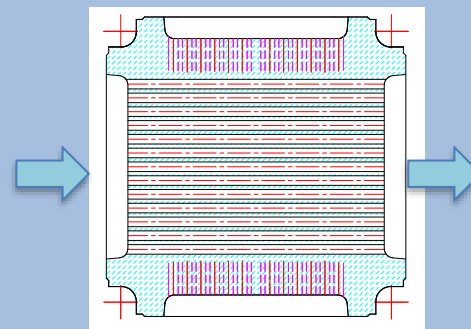
This gasket-free heat exchanger features a single monolithic graphite block that includes embedded baffles on the product and service sides.

Holes are drilled along short dimensions (X and Y) of the block.

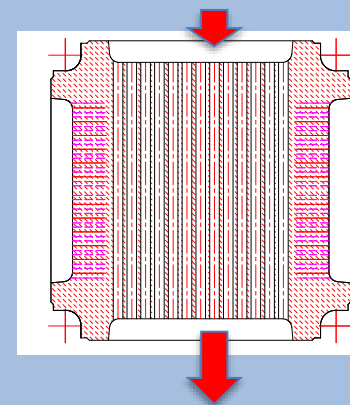
The graphite block is sealed on four faces with PTFE-lined steel plates, which are braced together.



X-Axe DRILLING: COLD SIDE



Y-Axe DRILLING: HOT SIDE



Main Features:

- ✓ Corrosive media, e.g. HCl/H₂SO₄ on both (product and service) sides are possible
- ✓ Small temperature differences and/or cross temperatures between service and process side can be managed
- ✓ Single graphite block design without gaskets
- ✓ Flexible arrangement of passes, fully counter-current
- ✓ Easy cleaning of the graphite block removing side plates

Graphite Columns



- Graphite Columns

- ✓ Dimension up to ND 2,000 mm
- ✓ Packed and plates columns
- ✓ Combination of sections with different materials
- ✓ Material iSP or iLP
- ✓ **CF^x** reinforcement enhances safety and lifetime.


- Graphite Columns Internals

- ✓ Bell plates, Sieved plates, bubble caps
- ✓ Distributor, chimney plates, dip pipes
- ✓ Support grids, retention grids
- ✓ Raschig rings and special packings



- Graphec® Quenchers

Service: sudden decrease of temperature of acidic hot gases (up to 1800 ° C), due to spray vaporization of water

- ✓ PQ: pipe quencher.
- ✓ MQ: Monopipe quencher: simple design
- ✓ VQ: Venturi quencher: variable throat.
- ✓ Material iSP or iLP
- ✓  reinforcement enhances safety and lifetime.

Each design best fits specific process conditions, such as high solid content, low pressure drops or flow rate fluctuations.

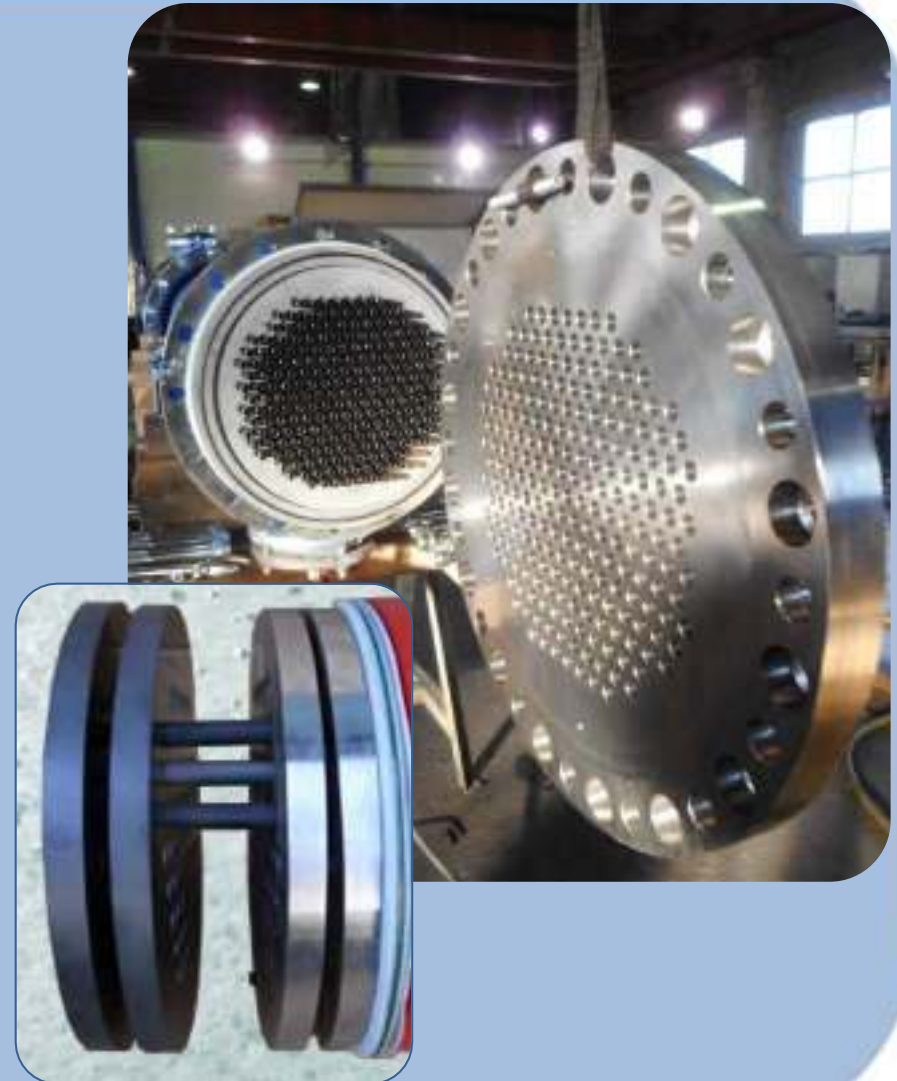


Silicon Carbide Typical Properties:

- ✓ Extreme hardness
- ✓ High strength
- ✓ High temperature stability
- ✓ High thermal conductivity

ECARB can provide SiC heat exchangers with different tubes-tubesheet sealing systems:

- ✓ ALL SiC - Double tube sheets: massive SiC primary sheet (process side) + AISI sheet (service side). Sealing is ensured by a couple of O-rings for each tube/tubesheet joint. O-rings are encapsulated into caves machined into the tube sheets, so to release any stress on the tubes.
- ✓ PTFE/PFA - Double tube sheets: massive massive PTFE or PFA lined steel primary sheet (process side) + AISI sheet (service side). O-rings are pushed inside tubesheets caves by threaded bushes.
- ✓ Double tube sheet: each tubesheet is made into two parts, which are coupled to host O-ring set in the middle.



Linings & Coatings

- Always the Optimal: we investigate a wide range of materials to ensure the best
- We Hate to Say No to our Customer!
 - ✓ PTFE (extruded, sheet lining, moulded).
 - ✓ Halar® (ECTFE)
 - ✓ PFA, FEP, PVDF, ETFE
 - ✓ Vacuum resistant systems
 - ✓ Rubber and ebonite
 - ✓ Epoxydic or phenolic based coatings
 - ✓ Multilayer protection.
- Product Excellence
 - ✓ Excellence in process calculation
 - ✓ Item ↔ service
 - ✓ Excellence in mechanical design -> every detail must be adequate for the specific liner
 - ✓ Best practice in construction



Skid Mounted Packages

- Scope of Supply

- ✓ Engineering (basic + detailed) & Main items
- ✓ Skid mounted turn-key packages

- Technologies

- ✓ HCl Synthesis units
- ✓ HCl recovery (quenching and absorption, distillation)
- ✓ FeCl₃: from synthesis or exhaust pickling solution
- ✓ H₂SO₄ Dilutions systems
- ✓ Pickling solution heating/circulation

- Design Principles

- ✓ “1 button” logic



HCl Synthesis Units

- Manufactured in Italy & India
- Bottom & Top burner technologies
- Skid mounted fully automated units
- “One button” logic
- Cost efficiency and ergonomic design
- Triple “Zero” philosophy
 - ✓ Zero emissions
 - ✓ Zero electric power consumption
 - ✓ Zero chlorine residuals
- Capacity from 1 to 155 TPD (100% HCl)
- Concentration up to 37%
- HCl dry gas production
- Single or double scrubber
- Steam or hot water generation



HCl Treatment Packages

- Full set of technologies for hydrochloric acid processing is available
 - ✓ HCl absorption
 - ✓ HCl purification by stripping or distillation
 - ✓ HCl hyper-azeotropic distillation
 - ✓ HCl recovery units
 - ✓ HCl dry gas production
- Skid mounting available for small scale plants



Parts & Services

- **Graphite Spare Parts**
 - ✓ Equivalent material grades (same homologation for the construction materials) and geometries in comparison to main historical manufacturer.
 - ✓ Wide range of spares: blocks, tube, headers, steel parts, etc.
 - ✓ Parts interchangeable with the original ones.
 - ✓ Fair price policy: no overcharges for spares to drop
 - ✓ → Reduction of maintenance costs
- **Services – Nothing Less than Customer Delight!**
 - ✓ Repair of graphite heat exchangers and columns
 - ✓ On site assembly and maintenance
 - ✓ Inspections and tests
 - ✓ Expertise on your process
 - ✓ Commissioning and startup of our equipment





ecarbtechnologies



the world around **Chlorine**

Agenda



- **Company Profile**
- **Partners and Competencies**
- **Unique Strengths**
- **Technologies Portfolio**
- **Projects Portfolio and Contacts**

Company Profile

- EPC and Technology company based in Milan with specific knowhow in Chlor Alkali and Chlorine Derivatives
- Founded in January 2017 to harness our huge rich background of professional experiences and unique competences in the chlorine derivatives industry
- Ecarbtechnologies selected worldclass technological partners, providing unique one-stop-shop advantages to customers
- Delivery capability varies from process consultancy to LSTK EPC contracts



Partners and Competencies

- Company's founders have combined their passion and wide process competencies to create a comprehensive network of industrial proficiency



- High-level process expertise arising from several years of practical experience in the field
- Project management, process expertise and troubleshooting based on field experiences

Partners and Competencies

- European partner of Bluestar, the engineering company of Sinochem Group



- Ecarbtechnologies are capable of delivering all over the world
- Full set of technologies related to chlorine and caustic soda (or potash) for production and transformation
- The **smart alternative** which drastically reduces the investment cost and minimizes the total cost of ownership

- **BLUESTAR** Robust Design: Efficient, Simple and Durable
 - ✓ Over 150 installation worldwide. Overall installed capacity over 35 Million Tons of NaOH
 - ✓ Internal and fully-automated production of all critical part of electrolyzers
 - ✓ Optimal material selection for each component (e.g. anodic panel is made of Ti-Pd, preventing crevice corrosion)
 - ✓ Electric consumption below 2,000 KWh/ton of Cl_2 (at highest available levels)
 - ✓ Safe and regular operation is continuously monitored by a proprietary and dedicated control system
 - ✓ Electrode reconditioning can be done on site and is quick, cheap and guarantees same efficiency as new ones



- Brine saturation is adapted on the basis of NaCl feedstock quality
 - ✓ Loading system is embedded in the plant
 - ✓ Agitated vertical saturator is used in case of pre-purified NaCl
 - ✓ Horizontal pots are used for raw salt. Saturators are equipped with slurry removal devices.
 - ✓ Beside standard treatment with carbonate and caustic soda, saturated brine can be further treated to eliminate specific impurities contained in the raw salt (e.g. Aluminium, Iodine...)
 - ✓ Conventional or lamellar decanter can be used before filtration
 - ✓ For specific cases, floatation separation may replace decantation



Brine Filtration and Purification

- Filtration
 - ✓ Special ceramic filters designed by Bluestar provide simple operation (no pre-coat is needed, lower investment cost, enhanced efficiency, lower operational costs)
 - ✓ Multiple filtration stations (two or three) may be installed
- Secondary Purification Section
 - ✓ Colloidal suspension are destroyed inside a dedicated two-stage system
 - ✓ Three columns system (2 + 1) are used in order to enhance the availability of the system
 - ✓ Efficient purification ensures long lifetime of membranes and low electrical consumption
- Final Conditioning: Temperature and pH Adjustment



Chlorine and Chlorate Elimination

- Chlorine Elimination (Dechlorination)

- ✓ 1st stage: addition of HCl under vacuum
- ✓ 2nd stage: bi-sulphite addition

- Chlorate Destruction

- ✓ Chlorate is produced inside cells due to parasitic reaction
- ✓ Proprietary FRP reactor design, with special thickness in order to enhance lifetime
- ✓ Basification stage before to re-circulate weak brine to saturation



Caustic Soda (Potash) Concentration

- Caustic Soda (or Potash) produced by membrane electrolyzers has low concentration (approx 32%). High concentration is obtained by evaporation of water.
 - ✓ Double or triple effect evaporators are designed, to reduce steam consumption
 - ✓ Selection of proper working conditions and right construction materials are relevant to determine low consumption and long lifetime
 - ✓ Energy savings system includes 6 heat exchangers, working as preheaters or intercoolers
- Steam consumption is reduced at lowest available level
- Main items manufacturing in Europe, India or China
- Skid mounted solutions are also available



Solid Caustic Soda/Potash

- Solid caustic soda is produced as solid pearls or flakes, by further water evaporation which requires very high temperatures
 - ✓ Molten salts are used as thermal media
 - ✓ Specific Ecarbtechnologies proprietary design for flakes production devices enable long-term maintenance-free operation



- 35% solution and solid production
- Top-in-class materials and equipment
 - ✓ Lined carbon steel reactors v/s plastic ones
 - Longer lifetime
 - Resistant to operators' mistakes
 - ✓ Candle filters (DrM) v/s standard filter press
 - Quality of filtration cake is adjustable
 - Fully automated and flexible operation
 - ✓ Fluidized bed granulator v/s granulation tower
 - No need of long on-site construction works
 - Higher energy efficiency
 - No steam consumption
- Automated process with reduced workload demand
- Rational and ergonomic layout
- Modular capacity from 10,000 Tons per Year



Poly Aluminium Chloride (PAC)

- PAC 9 high basicity or PAC 18 production
- Extraordinary product quality:
 - ✓ White and clean product
 - ✓ Very high stability (over 6 months)
 - ✓ Flexibility: wide range of production formulas
 - ✓ High basicity (up to 74%)
- Automated process with reduced workload demand
- Compact and quick production procedure
- High capacity due to reduction of batch times
- Modular capacity from 10,000 Tons per Year
- Skid mounted solutions are available



Hypochlorite and Chlorine Treatment

- Emergency Hypochlorite Unit / Chlorine Scrubber
 - ✓ Chlorine is feed into a safety scrubber, to eliminate any trace from all vent lines
 - ✓ Full availability is ensured by main items duplication and redundant start-up system
- Hypochlorite Production Plant
 - ✓ Very stable hypochlorite is obtained by temperature optimisation, final filtration and material selection
 - ✓ Construction materials must be selected to avoid critical failures
- Chlorine Treatment
 - ✓ Chlorine drying, cooling and compression sections can be integrated in the plant
 - ✓ Chlorine bottling and liquefaction units are available
 - ✓ Sulphuric acid concentration system may reduce consumption and disposal cost



Ferric Chloride

- Feedstock variety:
 - ✓ From ferric oxide etching with HCl
 - ✓ From mixed oxides, with additional chlorination section
 - ✓ From iron scraps
 - ✓ From exhausted pickling solutions
- Commercial concentration 40%
- Purity according to EN 888:2005 (potable water)
- Safe design preventing from critical situations
 - ✓ No hydrogen development
- Low energy consumption of concentration section
- Automated process with reduced workload demand
- Modular capacity from 10,000 Tons per Year
- Turn-key solution
- Skid mounted



- Chlorite Turnkey Plant

- ✓ NaClO_2 is produced starting from HCl , H_2O_2 , NaOH , using process design developed in cooperation with Todisco Group and other technological partners
- ✓ Top quality product with high stability and reduced amount of impurities
- ✓ Process design is optimized to mitigate risks connected to critical services
- ✓ Chlorite is produced using chlorate cells, available from primary technology suppliers
- ✓ Ecarbtechnologies has successfully implemented turn-key plant design according to severe European environmental and safety regulation



Reference Projects



Multisource Ferric Chloride Plant

- Site: North of Italy
- Type of contract: feasibility study and Basic Engineering package
- Year: 2017



Chlor Alkali Plant Conversion

- Site: North of Italy
- Type of contract: BEP for EPC contract
- Year 2018



Caustic Soda Concentration Unit

- Site: Central Italy
- Type of contract: EPC
- Year 2018



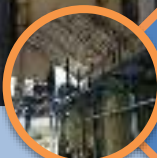
PAC Complete Plant

- Site: Central Italy
- Type of contract: EPC
- Year: 2018



PAC Plant – Revamping

- Capacity increase
- Alum + PAC9 production
- Year 2019



PAC Plant – EPC Contract

- Site: Sardinia
- Year 2021



New Chlorite Complete Plant

- Site: South Europe
- Type of contract: EPC Turn key
- Including: HCl synthesis unit
- Year: 2020



Electrolysis Plant: Transfer of Utilities

- Disassembling of packages and equipment
- Recovery for usage in other plant
- Year 2020



Technical Due-diligence

- Site: Assemini (Italy)
- Chlor Alkali plant
- Year: 2020



HCl Synthesis Unit

- Site: Egypt
- 8,5 TPD
- Skid mounted
- Year: 2017



Calcium Chloride Plant

- Site: Kazakhstan
- Liquid and granules production
- Year: 2020
- EP contract



Caustic Soda Concentration

- Site: Sardinia
- Year: 2021
- BEP

Flaminia ECARB India

- Established in 2023
- Highly passionate team with **proven experience** in technical sales, repairs and maintenance, graphite manufacturing processes and project engineering/management
- Experienced mechanical design team and a competent chemical process design team
- 930 m² Pune hub with 850 m² workshop will replicate the graphite machining setup in Italy in phases, with both Phenolic and the premium avantgarde PFA resin impregnation
- Complements the ECARB Narni manufacturing site and the ECARB Technologies office in Milan by offering cost-competitive pricing, robust engineering, dynamic delivery, quick after-sales support and comprehensive LSTK solutions worldwide
- Impressive experience in supplying solutions to the toughest chemical applications:
 - ✓ High-Pressure Steam Generation HCl Synthesis & High-Pressure HCl Gas Synthesis to Chlor Alkali
 - ✓ Gigantic ST HX with Carbon Fibre Wrapping to Phosphoric Acid
 - ✓ Block HX in complex geometries like Double/Triple-deck mounting & Split-Utility arrangement
 - ✓ Silicon Carbide ST HX



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