IGE Division
Heat and Mass Transfer Equipment, Systems and Services for Corrosive Chemical Applications

- Thermal and Process Design
- Engineering
- Project management
- Manufacturing
- After Sales Service

Everything under one roof

References in more than 50 countries
Since 1983, Impervious Graphite Equipment (IGE) Division manufactures impregnated graphite heat & mass transfer equipment as well as systems employed in corrosive chemical applications.

### Overview

- Graphite is an allotrope of carbon (softer than diamond but fragile) having crystalline form categorized as a non metal still conducts electricity.
- Synthetic graphite is impregnated with resins (Phenolic or PTFE) and is suitable for handling various corrosive applications.
- It offers excellent corrosion resistance to many chemicals, possesses good thermal conductivity and resistance to thermal and mechanical shocks.

#### CERTIFICATIONS

- [Certificate](#)
- [ASME](#)
- [R](#)
- [NB](#)

<table>
<thead>
<tr>
<th>Properties</th>
<th>Blocks</th>
<th>Tubes</th>
</tr>
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<tbody>
<tr>
<td>Density gm/cc</td>
<td>1.8-1.9</td>
<td>1.8-1.9</td>
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<tr>
<td>Thermal Conductivity W/m°C</td>
<td>170-213</td>
<td>74-89</td>
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<tr>
<td>Tensile Strength N/mm²</td>
<td>20-24</td>
<td>27-33</td>
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<tr>
<td>Flexural Strength N/mm²</td>
<td>30-36</td>
<td>45-56</td>
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<tr>
<td>Compressive Strength N/mm²</td>
<td>60-70</td>
<td>75-90</td>
</tr>
<tr>
<td>Co-efficient of thermal expansion mm/mm/°C x 10⁻⁶</td>
<td>3-4</td>
<td>3-4</td>
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<tr>
<td>Permeability cm²/sec x 10⁻⁶</td>
<td>2-3</td>
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**General Suitability:** Phenolic Impregnated Graphite: 190° C, PTFE Impregnated Graphite: 230° C

GRAPHITE INDIA LIMITED is based in India also having multiple product lines such as Graphite Electrodes for steel industry, Special Purpose Graphite, Glass Fibre Reinforced Plastics Pipes and Tanks, etc.
Product Range

**Equipment**
- Graphite Heat Exchangers (Block / Shell & Tube)
- Graphite Columns
- Graphite Ejectors
- Graphite Pump
- Acid Dilution & Cooling unit
- Sulphuric acid Concentration unit

**Process Systems**
- HCl Synthesis unit
- HCl Absorption unit
- Dry HCl gas generation unit

**Services**
- Engineering
- Maintenance and Repair
- Supervision of Erection & Commissioning
- Troubleshooting

**Specific Product Requirements can be met like:**
- U stamp
- “CE” marking as per PED/2014/68/EU
- Japan Pressure Vessel Class
- KOSHA
- DOSH
- EAC
- SANS 347
  And many more

**Products are well established in sectors like:**

<table>
<thead>
<tr>
<th>Chlor-Alkali</th>
<th>Chlorinated Organic Chemicals</th>
<th>Drugs and Pharmaceuticals (API)</th>
<th>Agrochemicals, Phosphate Fertilizer &amp; Phosphoric Acid</th>
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<tbody>
<tr>
<td>Rayon</td>
<td>Steel Pickling</td>
<td>Metal Processing</td>
<td>Polymers like VCM</td>
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<td>Paper &amp; Pulp</td>
<td>Dyes &amp; Intermediates</td>
<td>Incineration</td>
<td>Batteries &amp; Gelatin</td>
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</table>
Graphite Heat Exchangers

Graphite heat exchangers are available in 2 types - Block heat exchangers and Shell & Tube heat exchangers

BLOCK HEAT EXCHANGERS

• Construction can be Monoblock, Cylindrical Polyblock, Cubical Polyblock
• Suitable material of construction can be offered for corrosive service on process and service sides
• Multi-pass arrangement enabling optimized design solution
• Process side hole diameter ranging from 8 mm up to 35 mm

Material:
• Impervious Graphite block and Graphite lateral chambers for process fluid
• Metallic Shell or Lateral chambers for service fluid. (Suitable Fluoropolymer or rubber lining can be provided if required)
• End chambers can be offered in Graphite and in different materials like Plastic, Fluoropolymer or Rubber lined carbon steel.

Monoblock Heat Exchanger

- Compact design resulting in less space requirement
- Simple construction resulting in ease in maintenance
- General design pressure rating: 6 bar G / Full vacuum

Applications as coolers, condensers and interchangers
Cylindrical Polyblock Heat Exchanger

- Surface area can be offered from 0.1 m² up to more than 1000 m²
- Maximum surface area per block – 73 m²
- Application and Pressure rating wise around 170 block models to provide optimised solutions
- General design pressure rating up to 12 bar G / Full vacuum on process and service sides depending on block model.

Applications as coolers, heaters, condensers, heat interchangers, isothermal falling film absorbers, reboilers, evaporators

Cubical Polyblock Heat Exchanger

- Application and Pressure rating wise around 20 block models to provide optimised solutions
- Easy maintenance
- General design pressure rating up to 11 bar G / Full vacuum on process and service sides depending on block model.

Applications as coolers, condensers, heat interchangers, isothermal falling film absorbers
SHELL & TUBE HEAT EXCHANGERS

- Tube sizes available – 7/8” ID x 1 ¼” OD
  1” ID x 1 ½” OD
  1 ½” ID x 2” OD
- Surface area can be offered from 1.5 m² up to 1500 m²
- General Design pressure rating: 9 Bar G / Full vacuum on process and 8 Bar G / Full vacuum on service side depending on requirement. Higher pressure rating can be offered if requested.
- Tubes with carbon fibre reinforcement for improved strength
- Tube sheets with chromium oxide coating to resist erosion due to solid content in Phosphoric acid evaporators
- Impervious Graphite tubes, tube-sheets
- Metallic or Impregnated graphite baffles
- Domes in Impervious graphite or exotic materials (suitable Fluoropolymer or rubber lined carbon steel can be offered if required)
- Metallic shell (suitable Fluoropolymer or rubber lining can be offered if required)

Applications as coolers, heaters, condensers, heat interchangers, isothermal falling film absorbers, reboilers, evaporators, quenchers
Graphite Column

- Columns are available in Tray type or Packed type or Combination of both
- Tray types – bubble cap, turbo grid, sieve type
- Packed columns with variety of suitable internals (Ceramic Intalox Saddles, graphite raschig rings)
- Column internal diameter ranging from 100 mm ID to 2400 mm ID
- General design pressure: 5 Bar G / Full vacuum

Applications in absorption and distillation

Graphite Ejectors

- Single stage and multi stage depending on vacuum required
- Steam jet and liquid jet
- Capacity to ensure vacuum of 0.5 Torr
- The ejector system can be supplied with surface condensers or mixing condensers
- Skid mounted unit

Graphite Pumps

- Flow rates of 1 m$^3$/hr up to 200 m$^3$/hr with a differential head of 40 mtr.
- Single mechanical seal and double mechanical seal (with cooling arrangement)
- All wetted parts are in Graphite

Acid Dilution & Cooling unit

- Units are offered for dilution of Sulphuric acid and Hydrochloric acid
- Compact arrangement of mixer and cooler
- Cooler in Polyblock type or Shell and tube type
- Unit is supplied with necessary accessories

Sulphuric Acid Concentration Unit

- Units are designed and manufactured for producing sulphuric acid of around 70% strength from dilute acid having strength as low as 20%.
- Unit can be single stage or multi stage depending on inlet acid concentration
- Unit consists of thermosiphon reboilers, gas liquid separators, condensers, ejector system, product acid cooler.
- With multiple effect concentration, steam economy can be achieved thereby reducing operating cost.
**HCl Synthesis Unit**

- Top fired unit to produce commercial grade 30% to 37% Hydrochloric acid with minimum free chlorine content or Dry HCl gas in Chlor alkali, Paper & pulp, Metal extraction industry.
- Complete skid mounted system consisting of equipment, ancillary equipment, interconnecting piping, instrumentation and necessary automation.
- Capacity ranging from 1 TPD up to 200 TPD (100% HCL basis)

- Efficient burner design to ensure smooth functioning with Chlorine purity as low as 21%.
- Suitable for moist feed conditions.
- HCl in vent < 5 ppmv.
- Heat recovery in the form of Steam generation.
- Online cleaning / washing facility of burner.
- Automatic start-up.
- Start-up with compressed air.
- Turn-down capacity of 25%.
- Supplied more than 100 HCl Synthesis units worldwide.

**Material:**
- Combustion chamber (furnace), falling film absorber & Burner too in – Impervious Graphite (Steel jacketed).
- Tail Gas Tower – Impervious Graphite.
HCl Absorption Unit

- Absorption of HCl / HF / HBr gases required in Monochloro benzene / Sulphate of Potash production / MDI-TDI/ CPW etc
- Falling film absorbers in Shell & tube and Polyblock construction
- Product Hydrochloric acid concentration ranging from 5% to 37%
- Absorbers can be designed to handle dilute gas (for less than 2% to 3%)
- Absorption can be continuous as well as in batch operation
- Complete skid mounted system consisting of Falling film absorber, Tail gas tower (Packed bed scrubber), Intermediate tank, Recirculation cum product transfer pump, interconnecting piping, instrumentation and necessary automation
• Commercial grade 30% to 38% Hydrochloric acid is used to produce dry HCl gas via 2 routes based on byproduct: **22% HCl Azeotropic Solution Byproduct** or **1% HCl solution Byproduct** required in API, chloro-sulphonic acid & speciality chemicals
• Dry HCl gas purity is more than 99.9%
• Capacity ranging from 25 Kg/hr to 5000 Kg/hr of HCl gas
• Maximum operating pressure of HCl gas produced by 22% HCl solution byproduct route is 3 bar G
• Maximum operating pressure of HCl gas produced by 1% HCl solution byproduct route is 1 bar G
• Complete skid mounted system consisting of equipment, ancillary equipment, interconnecting piping, instrumentation and necessary automation
## Services

Wide network ensuring prompt and effective services by qualified and experienced team comprising:

- Supervision of Erection and Commissioning activities
- Trouble-shooting and Technical support
- Maintenance and repairing of Graphite equipment and systems (on site or GIL workshop)
- Training programs for operating process systems
- Supply of spare parts

## OUR GLOBAL CUSTOMER BASE

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