CGThermal

Process Technology Solutions
for Harsh and Corrosive Process Streams

Your Partner in Process Design

Focusing on your Harshest Processing Needs

- Acid Pickling
- Agri-Chemicals
- Battery
- Fertilizer
- Precious Metals
- Specialty Chemicals
- Plastics & Additives
- Chloro-Alkali
- Energy Storage
- CO_2 Capture

MADE
WITH PRIDE
IN THE USA

100% AMERICAN
OWNED & OPERATED

- TiCl
- Bromine
- Lithium Brine
- Chlorinated Organics
- Mixed Acids
- High-Temp Gas

- H_2SO_4
- HF
- HNO_3
- $P2O_5$
- HCl
- HBr

Customer Focused Process Technology Systems

Bringing Expertise and Innovation to your Design Team

It is our mission to provide the industry with process technology solutions for harsh and corrosive process streams with the purpose of minimizing operational costs and maximizing productivity.

We partner with our customers and strive to be an indispensable resource by identifying and supplying the best technologies, solutions, and expertise available worldwide to improve your competitive position.

Specializing in heat and mass transfer, storage, and transport, we provide customer specific process equipment, engineering and technical support, consulting, and turn-key solutions.

Expertise Guiding You to the Optimal Solution

Complete Process Design Services

CG Thermal fully understands the specialized needs of the markets and customers we serve, many of whom require custom process system design. Our services range from evaluation and recommendations for improving the reliability and efficiency of existing process systems to complete turn-key installations.

Custom Heat Exchanger & Process Components

Drawing upon over 200 years of collective experience in highly corrosive process applications, CG Thermal designs and fabricates process equipment to meet your specific process and plant conditions.
Our off-the-shelf and customer-specific non-metallic and metallic heat exchangers, as well as customer-specific fluoropolymer vessels and components, provide you with the lowest cost of ownership. Our highly efficient and reliable designs equate to real gains in process output.

Repair, Rebuild, Refurbish

CG Thermal's extensive experience makes us uniquely capable to evaluate and make recommendations regarding refurbishment and repair of your existing equipment, no matter how old or the original manufacturer.

Field Service

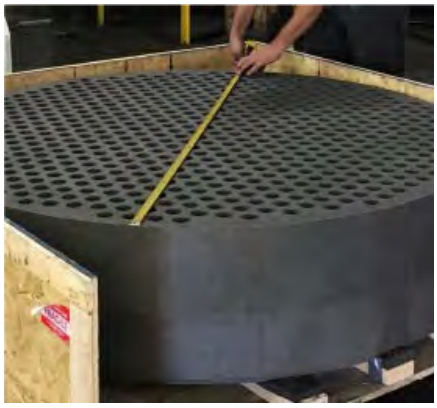
We are here to keep you in production. Find yourself down? You can count on our field service technicians to be there to get you back in operation.

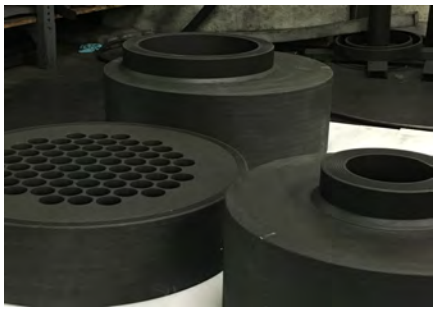
Graphite Impregnation Services

We will treat your unique graphite components to make them impervious to increase the strength and protect against the environment.
You will enjoy the benefits of our Impervite® phenolic impregnation system that has withstood the rigors of the chemical processing industry for over 50 years.

Specialty Materials Designed for Your Harshest Process Applications

Impervite® Impervious Graphite





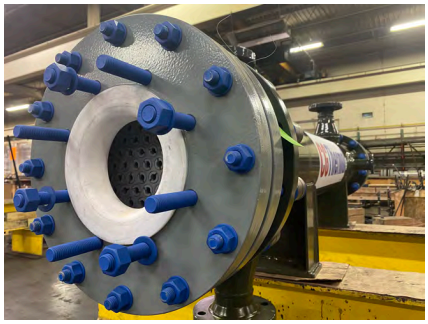
A composite material consisting of a graphite base material impregnated with a proprietary phenolic resin using a well controlled and documented process.

Impervite®, impervious graphite, is designed to the properties ideally suited to **withstand the thermal and mechanical stresses experienced within a heat exchanger**. This results in a **longer operating life with less downtime** when compared to other graphite formulations.

We have added significant impregnation capacity over the last several years. Therefore, we are capable of processing large batches of components with large diameters and long lengths.

Whether we supply the graphite or you ship us your graphite for impregnation, **you will receive the unique benefits of the Impervite® impregnation system** and we will work with you on all standards the graphite needs to meet.

SiC Umax® Advanced Ceramic



Your universal value-added replacement for expensive metals, nickel-alloys, graphite, not-so-conductive Teflon, and brittle glass.

Because of its **extreme hardness, excellent strength properties, and absence of free silicon**, we offer a **universal corrosion and erosion guarantee** on our Umax® materials.

The tight structure of SiC ceramic makes for a smooth surface, which is **inherently resistant to fouling.** This increases the operational time between maintenance downtimes as compared with other heat transfer materials and thereby your overall productivity.

Specialty Materials Designed for Your Harshest Process Applications

PPS-GR Tube

The PPS-GR tube combines the benefits of graphite and polymer materials to provide efficiency and reliability for water treatment, heat recovery, and process chemistries.

This tube material provides an unequaled combination of resilience to operating stresses, corrosion resistance, thermal efficiency, low fouling, and maintainability. The PPS-GR composite tube has been subjected to testing in corrosive acid streams at elevated temperatures with excellent results.

Fluoropolymer Linings

Out-performing glass or exotic metals for your most aggressive process applications.

Our lining selections include a full array of materials and application techniques to provide the best solution to corrosion, erosion, conductivity, vacuum pressure, frequent cycling, and other operational challenges.

Nickle-Based Alloys and Stainless Steel

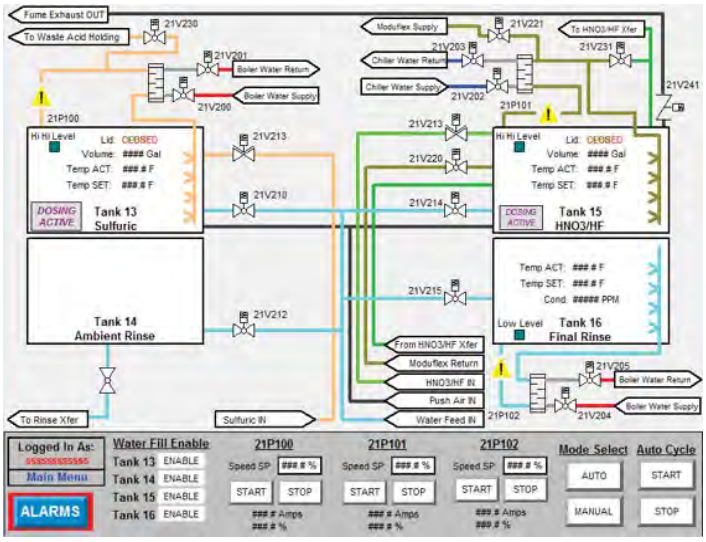
Providing the required corrosion resistance to minimize CAPEX/OPEX is central to our mission. So when designing your system, **we will recommend the most appropriate material for your process conditions.**

Our capabilities include a wide array of common and special metal alloy technologies. You can count on thermal sizing with guaranteed performance.

Process System Design

Partnering for Optimal Plant Productivity

Looking for Design Assistance? Our Areas of Expertise Include:



Dilution

Skid-mounted, sulfuric acid dilution systems that can be custom-designed to address a variety of process requirements.

Synthesis

Equipped with the expertise and experience to design a SAFE and RELIABLE synthesis system as well as survey existing systems trouble shoot and recommend safety features to ensure safe operations moving forward.

Scrubbers

For air pollution control and stream conditioning in chemical processing, steel production, and other industries. Common systems including sour gas and VOC streams.

Absorption

The absorption process increases acid concentrations for feedstock, either isothermally or adiabatically.

Desorption

Thermal desorption systems use heat to increase contaminant volatility so that it can be removed from production for reuse or disposal.

Recovery

Acid waste is one of the most hazardous manufacturing byproducts — and also among the most expensive in terms of disposal. We have expertise to address the harshest and most corrosive waste streams.

Azeotrope Breaking

A required process when producing AHCL from HCL, azeotrope breaking involves adding components to increase relative volatility of HCl towards water. At CG Thermal, we can design vacuum-pressure or positive-pressure azeotrope breaking systems.

Temperature Control

Temperature control is vital in chemical milling, pickling, and other applications in which thermal precision is necessary to maintain product quality. We design for reliability and the level of accuracy required.

Process System Design

Partnering for Optimal Plant Productivity

We will partner with you to provide technologies best suited for your success. Services range from review of existing system performance to a complete engineering and equipment package.

Our design/project management team, with an aggregated experience of well over 200 years, includes mechanical and chemical engineers with extensive expertise in specialized heat and mass transfer systems and design.

Engineering expertise and experience is the real difference in providing the lowest CAPEX/OPEX solution.

Heat and Mass Transfer

We have in-house software and expertise to design and fabricate a wide array of heat and mass transfer devices. These devices can commonly include graphite, ceramic, and alloy heat exchangers, packed towers, tray towers, condensers, evaporaters, falling film absorbers, and more.

Controls

We can design wide array of control networks/ systems to accompany our skid mounted equipment offering. Systems can range from pre-wired, pre-configured, pre-programmed networks to field instruments ready to plug into existing networks. We can utilize any communications protocol, including, but not limited to: HART, Modbus, Profinet, and more.

Materials of Construction

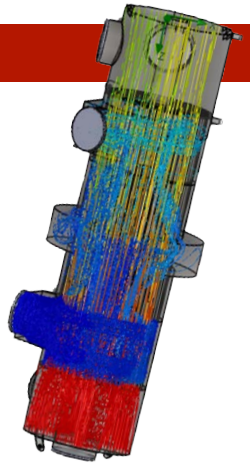
We have experience with a variety of materials for harsh and corrosive processes including graphite, SiC, TFE lined components, alloys, thermoplastics, FRP, and more. We know when to use these materials to provide the lowest CAPEX/OPEX.

Process Modeling

We have in-house programs and expertise to accurately predict process conditions, equipment size and performance, and phase compositions for simple and highly non-ideal systems.

Reliable and Resilient Forward Facing Engineering

AirBTU VPRR



AirBTU Variable Pitch Radial Recuperators (VPRR) are highly engineered gas-to-gas heat exchangers designed for rapid, high-temperature transfer commonly required by thermal oxidizers, catalytic reactions (such as those commonly found in sulfuric acid plants), CO2 & bioenergy recovery, green hydrogen, high-temperature energy storage, steel mills & foundries, and incinerators.

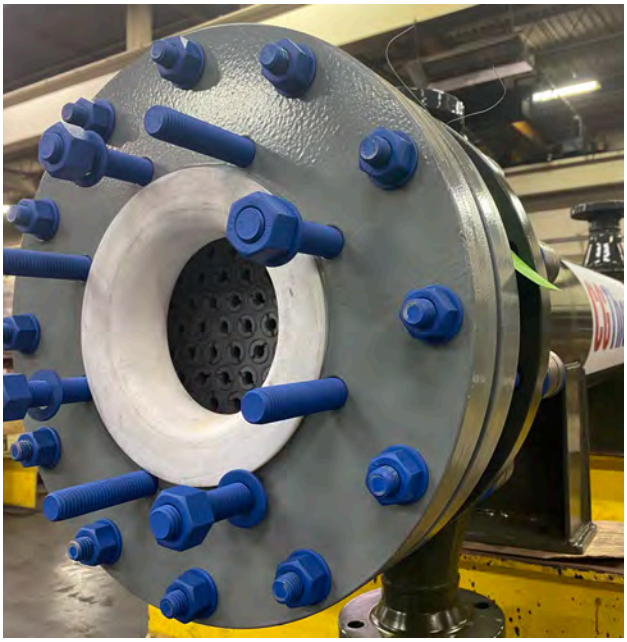
Uniform and symmetrical tube wall temperatures promote uniform stresses throughout the tube-to-tube sheet connections, and mitigate cold-end corrosion. Our rigorous thermal modeling and CFD analysis ensure a design that significantly extends useful life.

Reliable and Resilient Engineered to Outperform

Umax® Advanced Ceramic Heat Exchangers

The preferred technology in demanding, corrosive and erosive applications. The alpha sintered ***SIC ceramic*** has no fillers and is extremely hard.

Additionally, this material has superior heat transfer efficiency. Its design allows for easy access to the tubes for cleaning and maintenance.

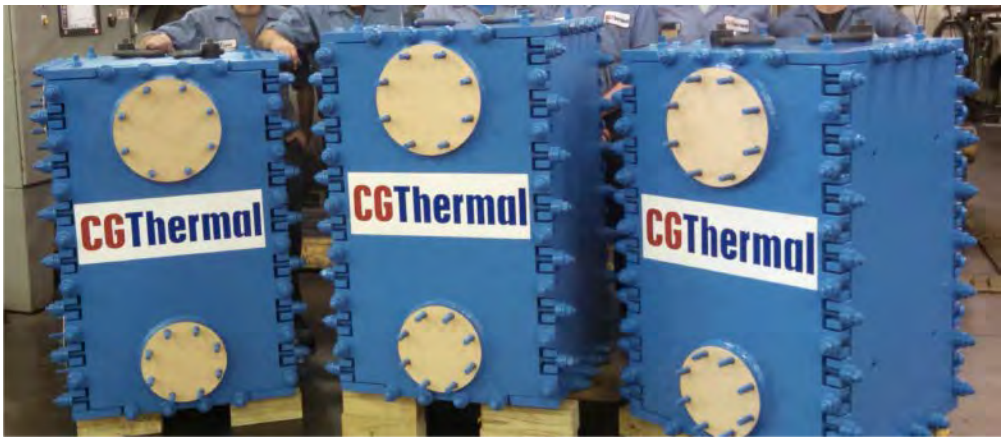


Reliable and Resilient Designed to Withstand Rigorous Operation

Impervite® Graphite Heat Exchangers

Available in ***Shell and Tube, Cylindrical Block, Cubic Block, and Plate*** configurations.

Each is designed to your unique process requirements: both thermally and mechanically. Impervite® graphite is particularly well-suited for use with sulfuric acid, hydrochloric acid, phosphoric acid, chlorinated hydrocarbons, and many other highly corrosive fluids.



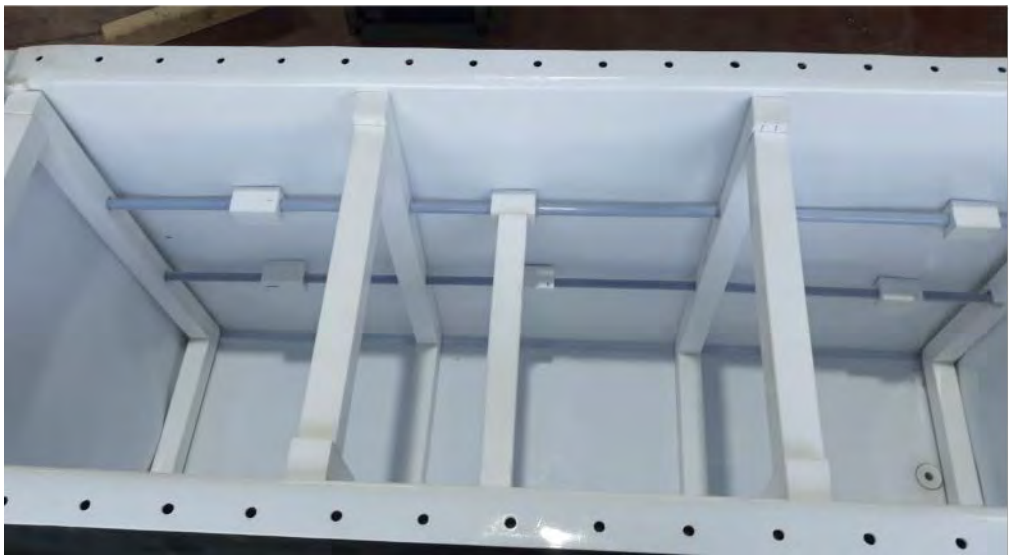
Reliable and Resilient The Longterm Solution

Our Custom Fluoropolymer Lined Components

We utilize a full array of materials and techniques to line your columns, vessels, pipe sections, filter housing, dip pipes, and other custom designed components.

In addition to superior chemical resistance, we design for ***resistance to abrasion and non-bonding surfaces.***

Let us know your fluid composition, temperature and pressure requirements, and component geometry and we will provide you with a custom solution.



Typical Information for Thermal Sizing

Fluid Allocation		Shell Side	Tube Side
Fluid Composition			
Fluid quantity, Total	lb/h		
Vapor (In/Out)	lb/h		
Liquid	lb/h		
Noncondensable	lb/h		
Temperature (In/Out)	°F		
Dew / Bubble point	°F		
Density (Vap / Liq)	lb/ft3		
Viscosity	cp		
Specific heat	BTU/lb*F		
Thermal conductivity	BTU/(h*f*F)		
Latent heat	BTU/lb*F psi		
Inlet Pressure	psi		
Pressure drop, allowable	ft2*h*F/BTU		
Fouling resist. (min)			

Equations

$$Q = U \cdot A \cdot \Delta T$$

U = overall heat transfer coefficent $\frac{Btu}{hr \cdot ft^2 \cdot °F}$

A = area of heat transfer ft^2

ΔT = temperature difference between hot & cold steams °F

$$LMTD = \frac{\Delta T_a - \Delta T_b}{\ln\left(\frac{\Delta T_a}{\Delta T_b}\right)}$$

ΔT_a = temperature difference at entrance

ΔT_b = temperature difference at exit

$$U = \frac{1}{\frac{1}{h_o} + \frac{1}{h_i} + \frac{x}{k} + FF}$$

h_i = inside film coefficient

h_o = outside tube film coefficent

x = tube wall thickness

k = thermal conductivity of tube material

FF = fouling factor

$14.7\ psi = 1bar$

$3412\ \frac{BTU}{Hr} = 1kw$

$1000\ \frac{BTU}{Hr \cdot ft^2 \cdot F} = 5678\ \frac{kw}{m^2 C}$

CGThermal

Process Technology Solutions

for Harsh and Corrosive Process Streams

Innovating to maximize your plant productivity

Experts in highly corrosive & erosive process environments

Customer Specific Process Equipment

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