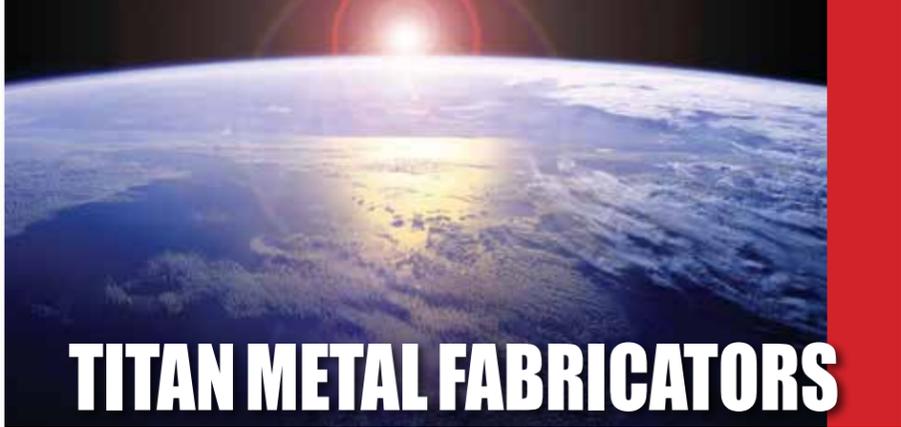


TITAN
METAL FABRICATORS

TRUSTED BY INDUSTRY AROUND THE GLOBE FOR CORROSION-RESISTANT PROCESS EQUIPMENT



TITAN METAL FABRICATORS

Trusted By Industry Around The Globe For Corrosion-Resistant Process Equipment

TITAN Metal Fabricators designs and manufactures corrosion-resistant equipment for industries and applications where chemically aggressive fluids are part of the process:

- Chemical
- Petrochemical
- Oil & Gas
- Steel Pickling
- Pharmaceutical
- Geothermal
- Water Desalination
- Liquefied Natural Gas
- Biomass
- Mining
- Nuclear Power
- Solar Power

TITAN's equipment can be found around the world, anywhere that corrosion is a problem to be solved.

TITAN's reputation for exceptional fabrication of reactive metals stems from its vast experience, proven capabilities, and high degree of personalized customer service all performed by the company's team of engineers, manufacturing professionals, quality control engineers, and skilled support team.

TITAN specializes in the design and manufacture of highly cost effective process equipment using corrosion-resistant alloys (CRA):

- Titanium
- Tantalum
- Lean Duplex
- Duplex
- Super Duplex
- Hastelloy®
- Zirconium
- High Nickel Alloys
- Monel®

Hastelloy® is a registered trademark of Haynes International.

Monel® is a registered trademark of Special Metals Corp.

Process equipment made from these metals can be used very effectively with extremely corrosive fluids and will last for decades if designed and fabricated correctly. TITAN has the knowledge and experience to make sure all aspects of your project will come together— budget, design, fabrication and schedule— to yield the most trouble-free installation possible.



HASTELLOY VESSEL



TANTALUM LINED COLUMN

PROJECT MANAGEMENT

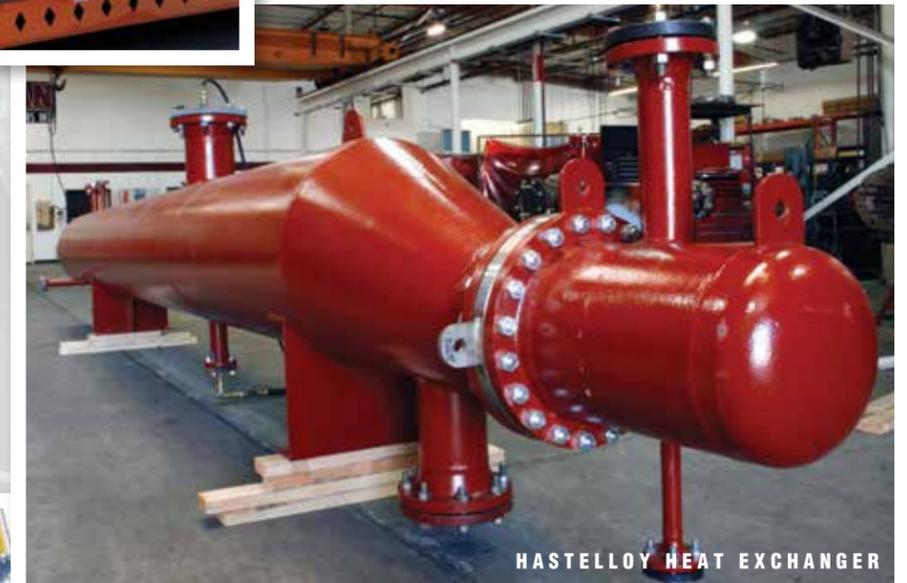
The key to the success of your project lies in the TITAN Project Management System.

■ Dedicated Project Manager

From project quote to design, fabrication and start-up, you have a single point of contact you can rely on.

■ Expertise At Every Step

TITAN's team of experts are hands-on. They have personal knowledge of your project's design, application, quality and delivery requirements.

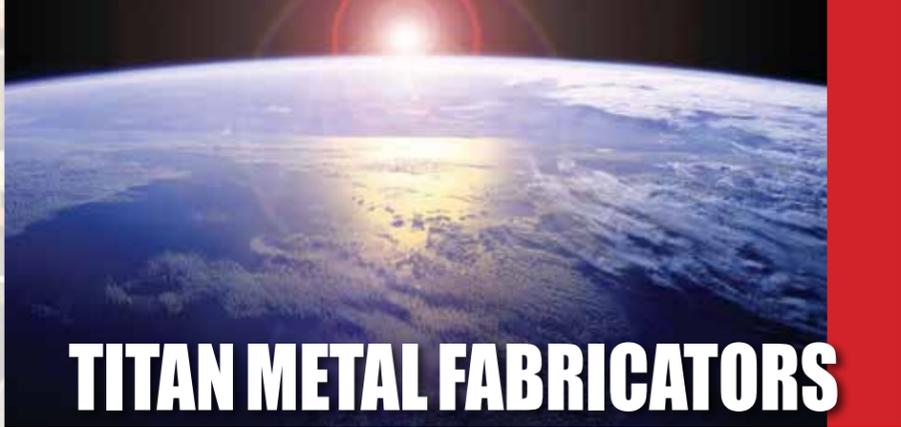


HASTELLOY HEAT EXCHANGER

TITANIUM HEAT EXCHANGER



TITANIUM PTA HEAT EXCHANGER



TITAN METAL FABRICATORS

World Class Capabilities In Design And Fabrication

Though TITAN is most widely known for its strong track record in the production of custom heat exchangers, the company's fabrication and engineering covers a very broad spectrum of custom corrosion-resistant process equipment.

TRUSTED DESIGN EXPERTISE

TITAN brings long-term experience and the latest design expertise to your project.

- Columns
- Reactors
- Condensers
- Spargers
- Dip Tubes
- Storage Tanks
- Piping
- Vessels
- Heat Exchangers
- TITAN's in-house staff of Mechanical, Thermal, and Chemical Engineers.
- World-class expertise in industry processes where Corrosion Control is mandatory.
- All facets of the design—the intended process application and the unique properties of reactive metals—are studied and analyzed to assure success.

SUPERIOR MANUFACTURING SKILL

Known around the world, TITAN means quality in fabrication of reactive metals.

- TITAN is the go-to fabricator when it comes to process equipment manufactured from the reactive metals.
- Experience, proven ability in welding reactive and complex alloys.
- TITAN's track record is our customers' assurance of a project's ultimate success.

DESIGNS AND CAPACITIES

- Diameter: 24 feet / 7 meters
- Length: 175 feet / 50 meters
- Weight: 100 tons

QUALITY CONTROL

TITAN's Project Management and Design Expertise mean your project receives the utmost scrutiny throughout all phases of fabrication.

- Comprehensive quality control is top priority at every inspection and test point.
- A corporate culture of conscientious attention to detail is at the core of TITAN's strong product reputation.

INDUSTRY CERTIFICATION

TITAN Metal Fabricators, Inc. is certified to the major standards of the industry:

- ASME
- PED
- TEMA
- Chinese SELO
- ASTM
- Japanese JIS
- API
- AD2000
- AWS

HEAT EXCHANGERS

TITAN's heat exchanger product line includes many variations of the shell and tube family and all TEMA designs as follows:

- Fixed Tubesheet
- U-bundle
- Packed Head, Floating Tubesheet
- Kettle Reboilers
- Falling Film Evaporators/Absorbers
- Bayonet
- Helical Coil
- Immersion Coil
- Double Pipe

Trust TITAN to analyze your project in all of these very critical areas:

- Material Selection
- Corrosion Allowance
- Thin Wall Tubing
- Vibration Analysis
- Tube Expansion
- Hydrogen Embrittlement Protection
- Nozzle Design
- Explosion Clad Design
- Loose-Lined vs. Clad Tubesheets
- Expansion Joint Selection
- NDT Procedures
- Helium Mass Spectrometer Procedures
- Welding and Purge Procedures
- Heat Treat Requirements



TANTALUM HEAT EXCHANGERS



TANTALUM HEAT EXCHANGERS

SHIPPING WORLDWIDE

TITAN has shipped, delivered and installed throughout the world.

- Global Access Capabilities
- Overland—Truck and Rail
- Ocean Freight —Major ports on the USA west and Gulf Coasts, Ports of Shanghai, and Gujarat

INSTALLATION, REPAIR AND FIELD MAINTENANCE

TITAN's capabilities extend to:

- Customer site installation services
- Piping system installation and repair
- Planned schedule of maintenance services
- Field repair
- Emergency repair



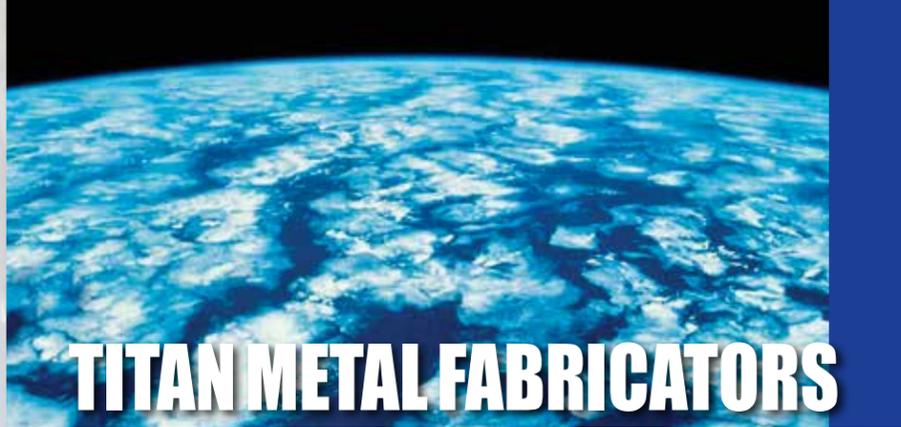
ZIRCONIUM COLUMN



TITANIUM HEAT EXCHANGER



NICKEL ALLOY COLUMN



TITAN METAL FABRICATORS

Chemical Process Equipment

Today's global economy means increased competition.

The control of costs including plant equipment, manufacturing, production and maintenance is paramount to survival. The chemical industry knows that increasing temperature, pressure and concentrations can increase efficiency in many operations. The reactive metals—Titanium, Zirconium and Tantalum—are frequently required to control corrosion in these demanding applications.

The largest cost of all can be downtime, lost production and maintenance. To stay competitive you first have to stay in production. It is no coincidence that the world's best, most progressive and profitable companies use the reactive metals to solve their corrosion problems.

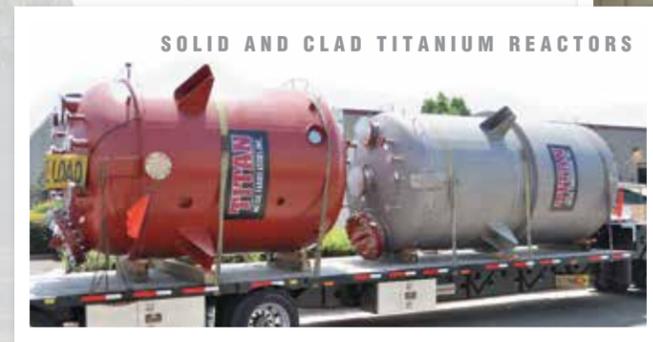
The relative high cost of the reactive metals is offset by their extremely low corrosion rates and long lifetime. Life cycle costs need to be evaluated.

TITAN is good at many things, however its core competency is the design and fabrication of corrosion-resistant equipment using the reactive metals, Hastelloy, and the duplex stainless steels. Our reputation and experience proves we are trusted by industry around the globe for corrosion-resistant process equipment.

APPLICABLE PROCESSES

TITAN Metal Fabricators' dedication has led the company to its expertise in process equipment for a broad variety of chemical, oxidizing and reducing environments for chemical and pharmaceutical processes:

- Acetic Acid
- Agricultural Chemicals
- Ammonium Nitrate
- Bromine
- Chlorine
- Formic Acid
- Hydrochloric Acid
- Multi-Purpose Pharmaceutical Plants
- Polycarbonate Production
- Nitric Acid
- Seawater Cooling
- Silicone Production
- Sulfuric Acid Concentration
- Purified Terephthalic Acid
- Vinyl Chloride Monomer
- Polysilicon
- Plastics





TITAN METAL FABRICATORS

Pharmaceutical Equipment: The Evolution Of Condenser Design

TITAN has been designing and fabricating Tantalum and Hastelloy overhead condensers for the pharmaceutical industry for decades. Over this period, condenser design has changed dramatically, influenced by the FDA, EPA, spiraling product costs, expense of downtime, and global competition.

The company has been on the leading edge developing new innovations and designs to address these issues.

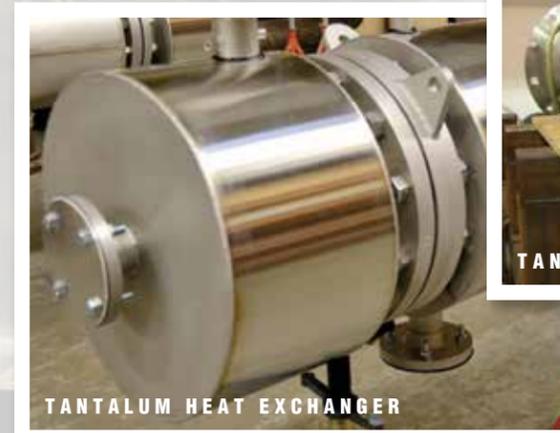
TITAN's Tantalum condensers are:

- Corrosion and contamination-resistant
- Fully drainable
- Compatible with silicone-based heat transfer fluids
- Fully welded tube bundle
- Rugged and maintenance-free
- Designed and fabricated for longer equipment life

TITAN's Tantalum Active Pharmaceutical Ingredient (API) overhead condensers have met all of these challenges and are the industry's most progressive in design and manufacture.

ASK TITAN ABOUT THERMAL SIZING OF OVERHEAD CONDENSERS

Typically, a production plant will use an overhead condenser in the manufacture of various pharmaceuticals. Proper sizing of overhead condensers can be difficult as they are frequently used for many different products. Even during the same production cycle, the reactor and condenser may be asked to perform properly using many different operating chemicals, temperatures and pressures. TITAN can thermally size the condensers by analyzing your operating temperatures, pressures, reactor size, reactor jacket, heating temperature and coolant temperature.



TANTALUM HEAT EXCHANGER



TANTALUM HEAT EXCHANGER



TITANIUM REACTOR

MATERIAL COMPARISON

	TANTALUM	IMPREGNATED GRAPHITE	HASTELLOY
Production Downtime	None	Often	Seldom
Maintenance Costs	None	Very High	Little
Capital Costs	High	Low	Medium
Product Purity	No Contamination	Graphite Flakes	Heavy Metals Contamination
Corrosion	None	Yes	Yes
Drainability	Complete	Liquid Holdup	Complete
Heat Transfer Fluid Compatible	Yes	No	Yes
Potential Catalyst to Process	No	No	Highly Catalytic
Dual Containment Design	Standard	Impossible	Optional

STANDARD DESIGN PHARMACEUTICAL CONDENSERS

	SHELLSIDE	TUBESIDE
Design Pressure PSI (BAR)	150/FV (10.34 BAR/FV)	150 (10.34 BAR/FV)
Max. Design Temp. °F (°C)	400°F (204.4°C)	400°F (204.4°C)
Min. Design Temp. °F (°C) CS/SS: °F (°C)	-20°F/-150°F (-28.9°C/-101.1°C)	(-20°F/-150°F) (-28.9°C/-101.1°C)
Design Corrosion Allowance: IN (MM)	.0625" (1.58 MM)	0" (0 MM)
Materials of Construction	Carbon Steel or Stainless Steel	Tantalum with 2.5% W
Hydrotest Pressure PSI (BAR)	195 (13.44 BAR)	195 (13.44 BAR)



TANTALUM HEAT EXCHANGERS



HASTELLOY HEAT EXCHANGER



TITAN METAL FABRICATORS

Oil, Gas & Petrochem: Not All Corrosion Is The Same . . .

The Oil, Gas & Petrochem industries are experiencing more and different corrosion problems as crude oils are increasingly contaminated with naphthalenic acid, sulfur, carbon dioxide and hydrogen sulfide. Corrosion, hydrogen embrittlement, pitting corrosion, crevice attack, stress corrosion cracking and sulfide stress cracking are just some of the issues facing corrosion engineers in the oil, gas, and petrochem industries today.

Such environments call for planning against corrosion from the very beginning. Duplex stainless steels, high nickel alloys, Hastelloy and Titanium are now being specified more frequently in the oil, gas & petrochem industries.

TITAN can help. TITAN brings its many years of experience in design, fabrication and welding of complex materials to the oil, gas & petrochem environments. Working together with customers, the TITAN Team makes sure the best materials are chosen, the equipment designed correctly, the optimum QC plan developed, and equipment fabricated to yield the longest life possible.

Count on TITAN to collaborate with you on preliminary thermal or mechanical design, budget pricing and material comparisons, and corrosion test coupons and analysis.

THE DUPLEX STAINLESS STEELS

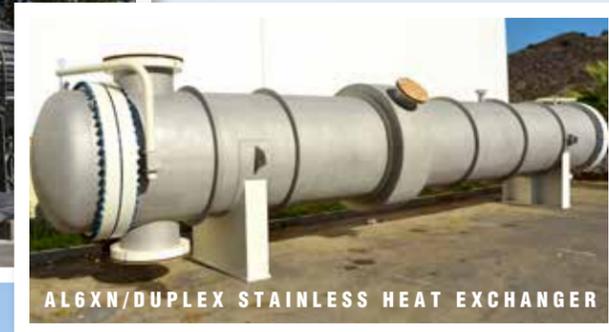
Duplex stainless steels are frequently the answer to today's issues. Their combination of increased corrosion resistance, low use of Nickel, modest price and high strength make them the viable choice for many new installations.

Duplex stainless steels' higher thermal conductivity gives them a distinct advantage over the austenitic stainless steels in heat transfer applications. The downside is in their difficulty in welding and quality control.

Heat input, cooling rates and interpass temperatures must be controlled or the corrosion resistance, strength, toughness, ductility and resistance to stress corrosion cracking will be compromised.



INCONEL® 825 HEAT EXCHANGER



AL6XN/DUPLEX STAINLESS HEAT EXCHANGER



NICKEL ALLOY HEAT EXCHANGER

TITAN's experience in welding reactive metals makes us more qualified to handle the duplex stainless steel alloys compared to fabricators who have a history in only austenitic stainless steel.

We concentrate on bringing the very best solutions to our clients' corrosion issues. TITAN's team—together with leading metallurgists and the major mills—works to resolve even the most demanding corrosion-resistance challenges.

At TITAN, we take pride in bringing the right people and experience to the problem in order to insure that your project is specified correctly for durability and maximum service.

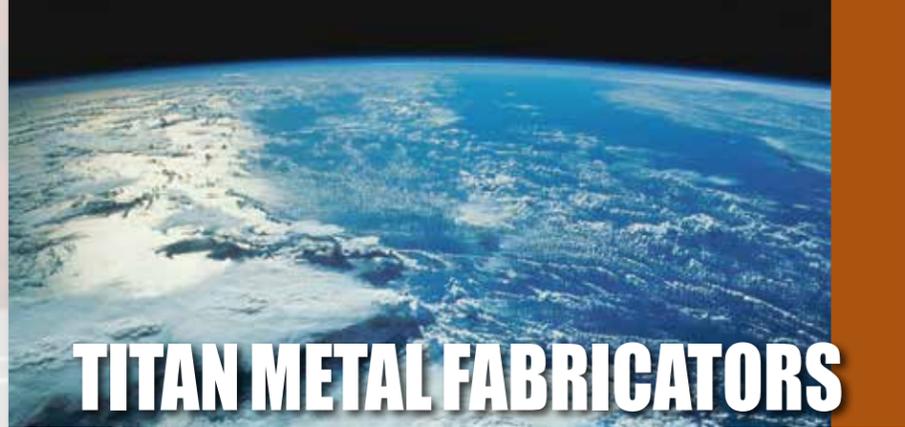
Inconel® is a registered trademark of Special Metals Corp.



TITANIUM HEAT EXCHANGERS



TITANIUM LNG HEAT EXCHANGER



TITAN METAL FABRICATORS

Steel Pickling: Corrosion-Resistant Heating For HCL Applications

The Steel Industry has traditionally used PTFE immersion coils, graphite block heat exchangers and direct steam spargers to heat their HCL acid tanks and pickle baths. Continuous high maintenance costs, soaring hazardous waste disposal costs and expensive downtime has forced the steel industry to look for alternative methods.

They found their answer in **Tantalum**. Completely inert and offering total corrosion resistance when exposed to pickle bath chemistries, Tantalum heat exchangers offer better heat transfer characteristics and higher pressure capabilities than PTFE or graphite, allowing smaller sized heat exchangers. Tantalum heat exchangers are fully welded, all metal designs that are robust and 100% helium leak tested prior to leaving our facility. Corrosion is zero—Tantalum is unaffected by HCL at pickle line temperatures and concentrations. Maintenance and downtime are eliminated, meaning the pickle line can run all the time, every day, every month. The life expectancy of a Tantalum heat exchanger is far superior to traditional non-metallic heat exchangers, further reducing downtime and maintenance costs.

TITAN introduced Tantalum heat exchangers for pickle lines and has since grown to be the worldwide leader and standard in the industry. Tantalum pickle line heat exchangers have eliminated all of the potential problems associated with PTFE immersion coils, graphite block heat exchangers and direct steam sparging.

TANTALUM HEAT EXCHANGER BENEFITS

- Cost-competitive with PTFE coils and carbon block heat exchangers
- Easily retrofittable into the existing equipment footprint
- Elimination of downtime due to equipment failure
- No spare parts to keep in inventory
- Superior corrosion resistance
- High heat transfer
- High steam pressures to increase the LMTD and reduce the required surface area
- Fully-welded metal design eliminates breakage during handling, installation and operation
- Elimination of acid leaks into steam condensate
- Non-fouling or plugging
- TITAN tested and proven thermal designs
- TITAN worldwide reputation and experience as the leader in Tantalum pickle line heat exchangers

SERPENTINE, GRID AND U-SHAPED COILS: OLD-STYLE DEEP TANKS

TITAN set the standard for the industry with our extensive experience in sizing and designing the most innovative and efficient Tantalum immersion coils for the customer's specific requirements. Our units are designed to be located on the side wall of the pickle tank and tuck tightly against it to allow for maximum tank space. U-shaped and serpentine coils will be for applications with smaller heat transfer requirements, while grid-style coils can be used to achieve greater heat transfer area in the least amount of dimensional in-tank space.



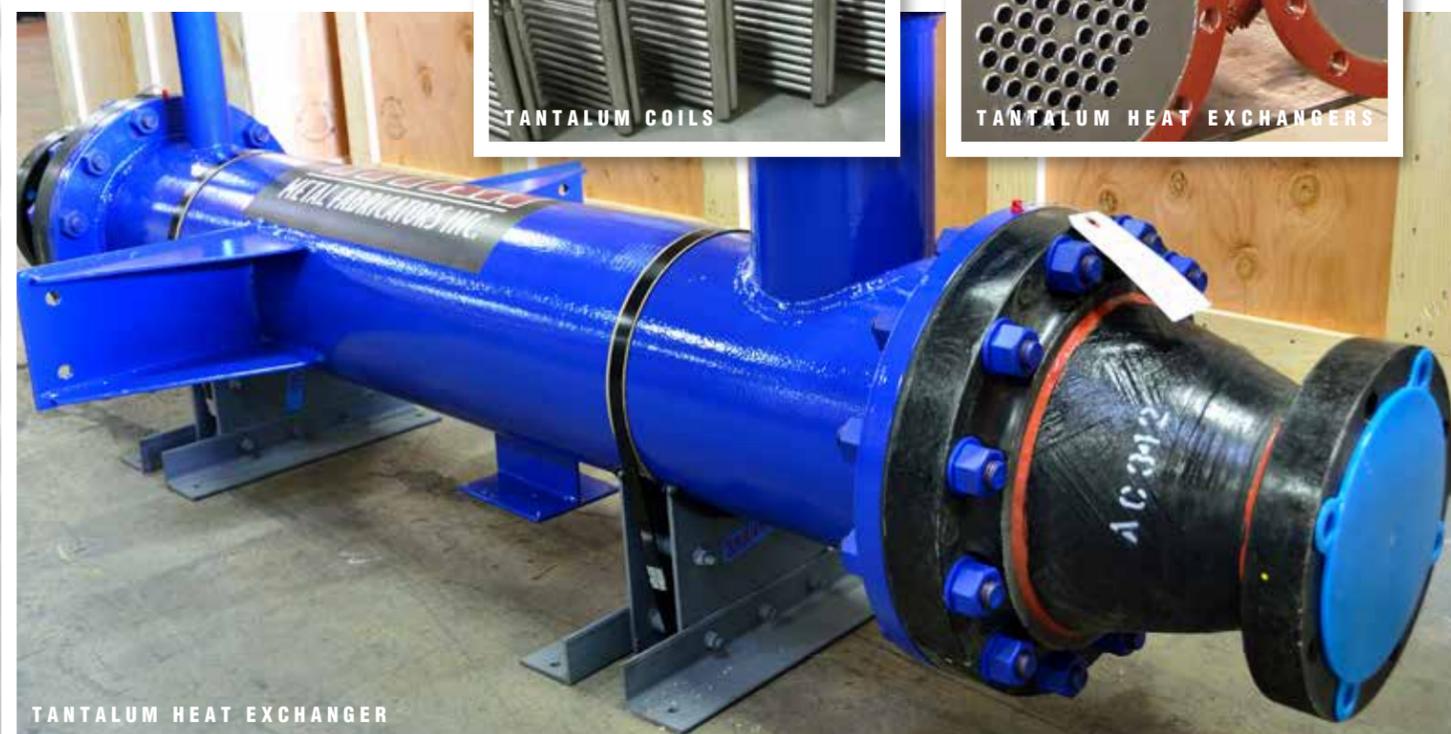
SHELL & TUBE HEAT EXCHANGERS

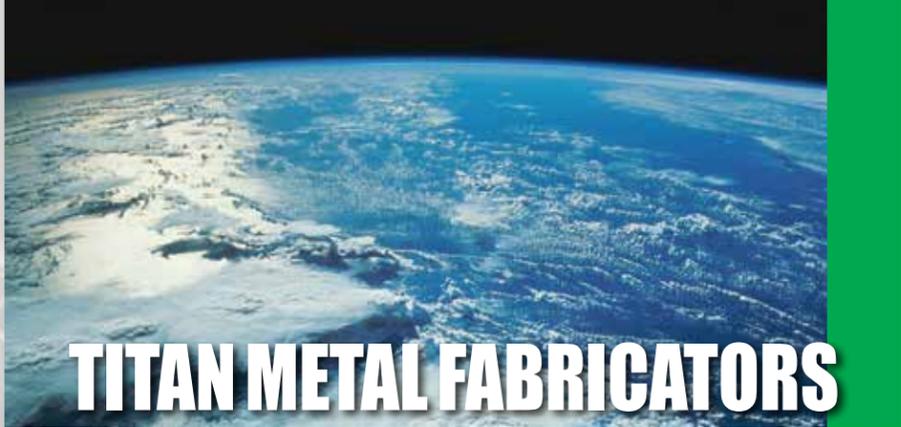
Tantalum shell and tube heat exchangers virtually eliminate all of the problems associated with the traditional carbon block exchangers with a robust, fully-welded design. The multi-gasketed designs and fragile nature of graphite heat exchangers requires continuous maintenance and repair which results in expensive downtime and spare parts. The use of Tantalum also allows for high velocity, low fouling, non-plugging designs for maintenance-free operation. TITAN Tantalum shell and tube exchangers have become the standard for most North American steel companies.



SKID-MOUNTED SYSTEMS

TITAN can supply Tantalum shell and tube exchangers skid-mounted for customers who have the old-style deep tanks. This allows these customers to take advantage of the robust, high efficiency, non-fouling nature of TITAN shell and tube exchangers. These skids are custom-designed and include a pump and filter.





TITAN METAL FABRICATORS

Build-to-Print: Equipment Built to Specification

All products are custom engineered and fabricated per your requirements. Mixers, agitators, and column internals require 3rd party process design from OEM manufacturers. TITAN then can perform the mechanical design and fabrication using any of the corrosion resistant alloys.

These items are just as important as the larger equipment. They are also a great place to try out a new material of construction such as the reactive metals to see if they will work for you in your application.

ITEMS OFFERED

- Fan Wheels
- Column Internals
- Spargers
- Injectors
- Tank Liners
- Flare Tips
- Strainers
- DipTubes
- Thermowells
- Blind Flanges
- Filters
- Plenums
- Ejectors
- Nozzle Liners
- Pipe Fittings



TITANIUM GRADE 7 FAN WHEEL



TANTALUM-LINED TITANIUM
GRADE 12 ACID SPARGERS



TANTALUM-LINED SPRAY NOZZLE



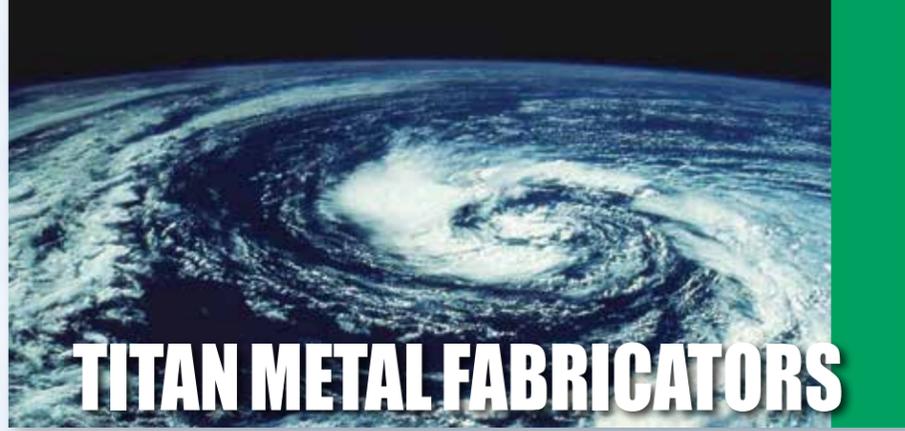
POLISHED HASTELLOY
C-22 DIP PIPE



TITANIUM GRADE 7 EJECTOR



ZIRCONIUM COLUMN SUPPORT



TITAN METAL FABRICATORS

Field Fabrication and Repair Services

TITAN offers a wide variety of shop and field services to compliment its specialty metal fabrication capabilities including the following:

The company has been on the leading edge developing new innovations and designs to address these issues.

EQUIPMENT INSTALLATIONS

- Shell and Tube Heat Exchangers
- Pressure Vessels
- Piping
- Columns

SHOP AND FIELD FABRICATION OF PIPING

TITAN has extensive experience in the fabrication of small and large diameter piping for industrial applications.

ASME CODE REPAIRS AND ALTERNATIONS

- Pressure Vessels
- Tanks
- Heat Exchangers
- Dip Pipes / Spargers
- Piping Systems



HEAT EXCHANGER CLEANING, REFURBISHMENT, AND REPAIR

TITAN offers the cleaning, inspection, repair / refurbishment of tubular heat exchangers.

- Heat Exchanger Cleaning
- Repair and Retubing Services
- Bundle Extraction
- ASME Code Welding

FIELD ERECTED TANKS / PRESSURE VESSELS

TITAN offers the design, fabrication, and repair services of storage tanks per API 620 / API 650 and ASME Code VIII Division 1 pressure vessels in the alloys that it specializes in.

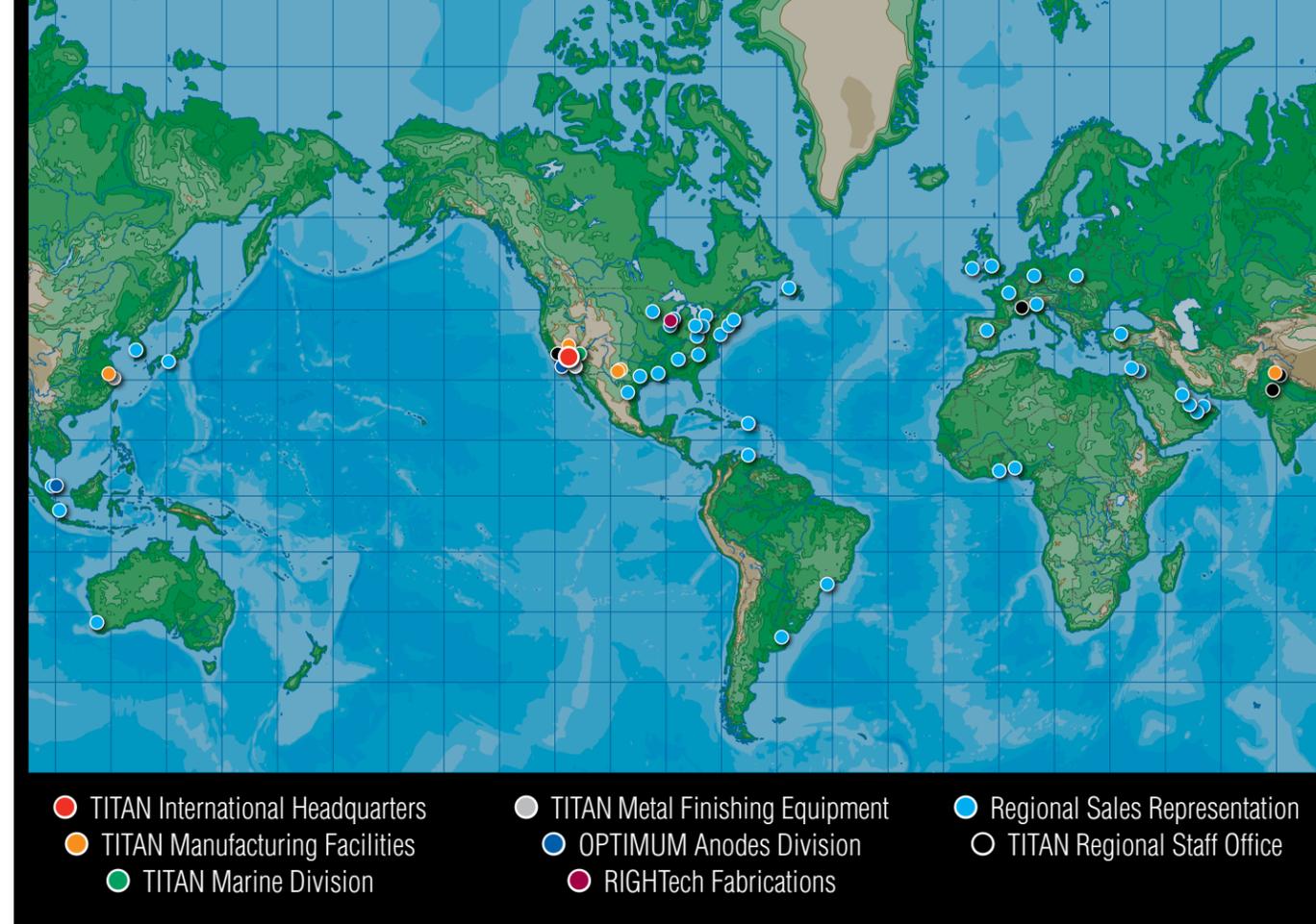




Trusted By Industry Around The Globe For Corrosion-Resistant Process Equipment

TITAN Metal Fabricators is comprised of various specialized divisions, all with one objective: to bring innovative reactive metal products to industry to solve corrosion problems.

TITAN designs and manufactures products from corrosion-resistant alloys (CRA)—Tantalum, Titanium, Zirconium, Niobium, Hastelloy and Duplex Stainless Steel—in order to provide the customer with solutions to corrosion in highly aggressive applications:



■ PROCESS EQUIPMENT

Corrosion-resistant equipment for the Chemical Processing, Pharmaceutical, and Steel Industries



■ SERVICES – FIELD/SHOP

Equipment installations, pressure vessel / heat exchanger repair & alterations, field erected tanks



■ TITAN MARINE

Corrosion-resistant and high performance Titanium products for the consumer and industrial Marine Industry



■ METAL FINISHING

Anodes, baskets, steam immersion coils and auxiliary anodes for the Plating and Anodizing Industry



■ RIGHTECH FABRICATIONS

Anodizing and plating equipment for the metal finishing industry.



■ OPTIMUM ANODE TECHNOLOGIES

Manufacturing dimensionally-stable anode coatings for industry

LOCATION	TITAN Metal Fabricators, Inc. Camarillo, CA USA		TITAN Metal Fabricators, Texas Waller, TX USA		RAM, A Division of TITAN Metal Fabricators Waller, TX USA		TITAN Metal Fabricators (Wuxi) Co Ltd Wuxi, China		ISGEC-TITAN Metal Fabricators Private Limited Yamunanagar, India	
DIAMETER	15 ft	4 mtrs	24 ft	7 mtrs	24 ft	7 mtrs	15 ft	4 mtrs	15 ft	4 mtrs
LENGTH	140 ft	40 mtrs	175 ft	55 mtrs	175 ft	55 mtrs	100 ft	31 mtrs	98 ft	30 mtrs
WEIGHT (IN HOUSE)	50,000 lbs	23,000 kg	50,000 lbs	23,000 kg	50,000 lbs	23,000 kg	50,000 lbs	23,000 kg	88,000 lbs	40,000 kg
WEIGHT (CONTRACT)	220,000 lbs	100,000 kg	220,000 lbs	100,000 kg	220,000 lbs	100,000 kg	180,000 lbs	81,818 kg	440,000 lbs	200,000 kg
DESIGN CODES	ASME, PED, CRN, SELO, AD 2000		ASME, PED, CRN, SELO, AD 2000		ASME, CRN		ASME, PED, CRN, SELO, AD 2000, GOST		ASME, PED, CRN, SELO, AD 2000, GOST	
EQUIPMENT	Heat Exchangers, Pressure Vessels, Columns, Piping, Build-to-Print		Heat Exchangers, Pressure Vessels, Columns, Piping, Build-to-Print, Autoclaves		Pressure Vessels, Columns, Piping, Build-to-Print		Heat Exchangers, Pressure Vessels, Columns, Piping, Build-to-Print		Heat Exchangers, Pressure Vessels, Columns, Piping, Build-to-Print	
MATERIALS FABRICATED	Stainless Steel, Duplex, High Nickel Alloys, Hastelloy, Titanium, Zirconium, Niobium, Tantalum		Stainless Steel, Duplex, High Nickel Alloys, Hastelloy, Titanium, Zirconium, Niobium, Tantalum		Stainless Steel, Duplex, High Nickel Alloys, Hastelloy, Titanium, Zirconium		Stainless Steel, Duplex, High Nickel Alloys, Hastelloy, Titanium, Zirconium, Niobium, Tantalum		Stainless Steel, Duplex, High Nickel Alloys, Hastelloy, Titanium, Zirconium, Niobium, Tantalum	
SHIPPING AVAILABLE	Truck, Ship, Train		Truck, Ship, Train		Truck, Ship, Train		Truck, Ship, Train		Truck, Ship, Train	
NEAREST PORTS	Port Hueneme, Port of Long Beach, Port of Los Angeles		Port of Houston Port of Ingleside		Port of Houston, Port of Ingleside		Port of Shanghai		Port of Mumbai, Port of Kandla	
PRIMARY REGIONS SUPPORTED	North America, South America, Europe, Africa, Australia		North America, South America, Europe, Africa, Australia		North America, South America,		China, Taiwan, Japan, S Korea, North America, Europe, Australia		North America, South America, Europe, Africa, Australia	
AREAS SUPPORTED BY CUSTOMER REQUEST	Middle East, China		Middle East, China		Middle East, Offshore US GOM, China, North Sea, Brazil, Vietnam		North America, South America, Europe, Africa, Australia		India, Middle East, Southeast Asia, Former Soviet States, USA, China, Australia	



TITAN

METAL FABRICATORS

INTERNATIONAL HEADQUARTERS

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