



*Aviation*



# *Get more*

Praxair Surface Technologies delivers more experience,  
more innovation, more options and more support



## *Get more with Praxair...*

**Customized answers.** Praxair Surface Technologies EXTREME Protection™ and ProtectionPLUS™ coatings combined with SermeTel®, ShorCoat®, SermaLoy™, SermaFlow™, and SermaLon® slurry coatings for the ultimate in flexibility, ensuring we have the right answer for your unique challenge.

**Design and application support.** Our coatings help bring out the best in your components, while you always get the confidence of knowing your parts have been through real-world simulations.

**Uniformity and repeatability.** Whether your parts are produced in the Americas, Europe or Asia, you know you're getting consistent results you can rely on.

**Innovation.** Our scientists, renowned throughout the coating industry, rank among the most authoritative sources in application techniques, always looking for new surface enhancement options.

# What does it mean to get more?

At Praxair, we go beyond the surface for individualized answers to your toughest problems



At Praxair Surface Technologies, we understand that your customers' requirements demand *more*. That's why we're dedicated to helping you deliver *more* product life, *more* ways to reduce operating costs, *more* ways to improve performance, *more* risk mitigation. Partner with us and you get *more* than protective coatings—you get complete access to our exclusive global network of resources.

## > Look for more

At Praxair Surface Technologies, we have *more* down to a science. Look for the “greater than” symbol (>) to find out how working with us helps you get *more*.

## > EXCLUSIVELY MORE: PRAXAIR'S INDUSTRY-LEADING EXTRAS

- Coating Design Optimization Unit
- EXTREME Protection™ and ProtectionPLUS™ Coatings
- Operational Excellence System
- Product Discovery Labs

## > More than half a century of leadership

Since the early 1950s, Praxair Surface Technologies has been partnering with original equipment manufacturers (OEMs), airlines, and maintenance, repair and overhaul companies (MROs) to extend the life cycle and performance of critical components. Our expertise in wear-, corrosion- and thermal-resistant coatings has made us the preferred supplier in the industry.

## Why does more matter?

When you get *more*, you can give *more*. Parts that include our advanced surface technologies help you improve component efficiency, performance and life—all of which enhance the overall performance of your product and the value you offer your customers while increasing your profitability. *More matters.*

## The evolution of more



## > 1904 More tradition

Concentrated Acetylene Company (later known as Prest-o-Lite) is formed, creating headlights for early automobiles. Our work with acetylene would one day lead to the discovery of today's surface coating technology. We don't just date back to the beginning—we are the beginning.

## *Fixed Wing Airframe Coating Applications*

- Actuation systems
- Auxiliary power unit components
- Environmental control components
- Landing gear components
- Propulsion structures
- Slat and flap tracks
- Starter components
- Wing components

## *Fixed Wing Airframe Coatings*

Praxair Surface Technologies has taken off with aircraft operators and OEMs in countless flight tests, providing real-world coating simulations including the replacement of chrome plating on landing gear components as well as testing for wear and corrosion on many other critical components. Time and time again, these extensive tests have shown that component life and performance can be greatly improved with the use of selected EXTREME Protection, ProtectionPLUS, D-Gun, Super D-Gun®, HVOF and plasma coatings and SermeTel® slurries.



# Coating Design Optimization Unit

More real-world component coating design and application support

The first step to finding the right answer for your needs is determining not only what those needs are, but also how a surface coating can bring out the best in your component or part. That's where our Coating Design Optimization Unit comes in. It works with your engineers and designers, integrating more than a half century of coating expertise with planning of the part's production. Partnering with our Coating Design Optimization Unit from the beginning ensures you get *more* produceable coatings, *more* protection, *more* customization and *more* performance from your part.

Our team begins by identifying:

- Function of the coating (clearance control, thermal insulation, wear/corrosion resistance, etc.)
- Geometry, composition and properties of the substrate
- Environmental and production impact (corrosion, temperature and operating environment)

Once we've narrowed down the possible coating alternatives, we test each coating on your part in environmental simulations that replicate your everyday operating environment. When this exhaustive testing process is complete, you'll have more confidence knowing exactly how coatings will perform on your part day in and day out.

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## Real-world environmental testing simulates:

- Abrasion and impact wear
- Adhesion
- Bond strength
- Cavitation
- Corrosion
- Fatigue
- Galling/sliding
- Oxidation and extreme temperatures
- Particle and water erosion
- Thermal shock

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## Answers in action:

We customize our answers to fit your individual problem. For example, if wear and/or corrosion resistance is required at ambient or high temperature, we can tailor a coating to perform in either environment.



### > 1948 More explosive discoveries

Explorations into acetylene detonations lead to the discovery of a new groundbreaking flame-plating process. The technique developed from this breakthrough—which uses a “detonation gun”—forms the foundation of the modern thermal spray industry. To this day, we are the only company that can offer D-Gun and Super D-Gun® coatings, both benchmarks of the industry.

# ***EXTREME Protection™ and ProtectionPLUS™ Coatings***

More options for customized answers



There is no one coating answer to every surface problem. Your unique problems require unique answers. That's why we created our EXTREME Protection™ and ProtectionPLUS™ lines of surface coatings.

Our EXTREME Protection™ proprietary coatings are designed to provide customizable answers you can't get anywhere else.

Our ProtectionPLUS™ coatings are used throughout the industry and feature the additional, exclusive application techniques and knowledge-base of Praxair Surface Technologies. In fact, we originally developed and patented many of these methods and materials.

## **➤ *Engineered for aviation***

The aviation industry presents unique challenges: components need to withstand extreme environmental, thermal and wear conditions at exceptionally high temperatures and pressures. That's why our surface enhancement solutions are designed with the toughest jobs in mind. Our advanced technology is designed to help your customers:

- Extend product life of critical parts
- Improve performance
- Increase repair/replacement cycles
- Increase the use of advanced materials and component designs
- Employ environmentally friendly technologies to replace chrome and cadmium plating

## ***Answers in action:***

We not only protect but also restore. We have in-house services that can strip, restore and remachine worn components.

## ***More coating options***

### **COATING SERVICES**

- Abradable coatings
- Corrosion-resistant coatings
- Fatigue-resistant coatings
- Oxidation-resistant coatings
- Release coatings
- Rub-tolerant coatings
- Solid particle erosion-resistant coatings
- Thermal barrier coatings
- Wear-resistant coatings



### **➤ *1958 More exclusive innovations***

The innovations continue as we develop our exclusive plasma coating technique—which once again revolutionizes the thermal coating industry, delivering an exceptionally versatile solution.



### **➤ *1962 More flexibility***

A breakthrough coating process, high-velocity oxy-fuel (HVOF), is developed that introduces powders of metals or ceramics into a high-temperature, high-velocity gas stream. The stream then heats and propels them against a prepared surface. The result is excellent wear and corrosion resistance.

# Operational Excellence System

More uniformity, consistency and repeatability

From the initial conversation to the final inspection, the application of your coating follows our strict Operational Excellence System. This process guides our industry-leading quality control programs and guarantees consistent, uniform results that are on time, every time.

At the core of Operational Excellence are Six Sigma quality tools and a complete set of lean manufacturing techniques. Instead of batch production, we focus on one-piece-flow pull production that improves quality and shortens cycle and changeover times—which greatly improves turntimes for your applications.

Operational Excellence also allows us to deliver uniform, repeatable results you can rely on. You can be confident that whether your part is coated in the Americas, Europe or Asia, the processes—and coatings—are indistinguishable. *More usable parts, less risk.*

## ➤ Vertical integration

Praxair Surface Technologies controls the entire coating process from receipt of your component to completed coated part. Not only do we manufacture the gases, powders and slurries used to make the coatings, but we also invented many of the processes used to apply them.

## Certified to serve

Our facility certifications include:

- AS9100 and 9100B
- ASD-EASE
- CAAC
- CAA/JAA
- DOD
- EASA
- FAA
- ISO 9001:2000 and 9001:2008
- MOD
- NADCAP
- Op Specs

## Industry-leading OEM qualifications

- Airbus
- Augusta-Westland
- Bell Helicopter
- Boeing
- Bombardier
- Cessna Aircraft
- ELEB
- Embraer
- General Electric
- Gulfstream Aerospace
- Hamilton Sundstrand
- Honeywell
- Messier-Dowty
- Pratt & Whitney
- Rolls-Royce
- Sikorsky
- Snecma
- Solar Turbine
- Williams International



### ➤ 1965-69 More global uniformity

The first overseas production plants open in England, Japan and Switzerland as our unique quality control process begins to develop, ensuring uniformity and repeatability regardless of the component or continent.



### ➤ 1992 More efficiency

We become the independent company you know today: Praxair Surface Technologies. The change gives us greater control over raw materials and resources, enabling us to become the first vertically integrated operation in the industry. In 1998, ASM International recognized the Speedway (Indianapolis) Laboratories as a historical landmark.

## *Aircraft Engine Applications*

- Actuator components
- Afterburner assemblies
- Bearings and accessories
- Combustion chambers
- Combustion flame tubes
- Compressor air foils
- Compressor drums
- Discs and shafts
- Fuel nozzles and swirlers
- Rim cover plates
- Rings and seals
- Turbine air foils
- Turbine discs
- Turbine shrouds

## *Aircraft Engine Coatings*

From the beginning of gas turbine flight, aircraft engine OEMs have come to Praxair Surface Technologies when they needed to make jet engine components functional and last longer between overhauls. Our EXTREME Protection and ProtectionPLUS coatings have become synonymous with gas turbine engine performance.



# *Product Discovery Labs*

More innovative answers

At Praxair Surface Technologies, we have a long-standing tradition of excellence in innovation. Many of the materials and processes in use today throughout the industry began in our world-class Product Discovery Labs. The focus of these labs is singular: develop next-generation surface coating technologies that solve the performance problems you face today and tomorrow.

## ➤ *Top research scientists*

We provide access to the most renowned scientists in the coatings industry. These highly qualified professionals have published extensively and, in many cases, literally *written the book* when it comes to application techniques. Working with a staff of experienced lab technicians, specialists and research engineers, our scientists are continually developing new coating processes and products that are designed to find real-world, groundbreaking answers to even your toughest performance problems.

## ➤ *More discovery*

Coating processes that are the foundation of today's surface technologies were invented by Praxair Surface Technologies, including:

- Detonation gun (D-Gun) coating process\*
- Super D-Gun® coating process\*
- HVOF (High-Velocity Oxy-Fuel) coating process
- Plasma spray coating process
- Tribomet® electrodeposition coating process\*

\* Exclusive, proprietary Praxair Surface Technologies process



Ongoing testing is critical for discovering new ways to solve your performance problems.

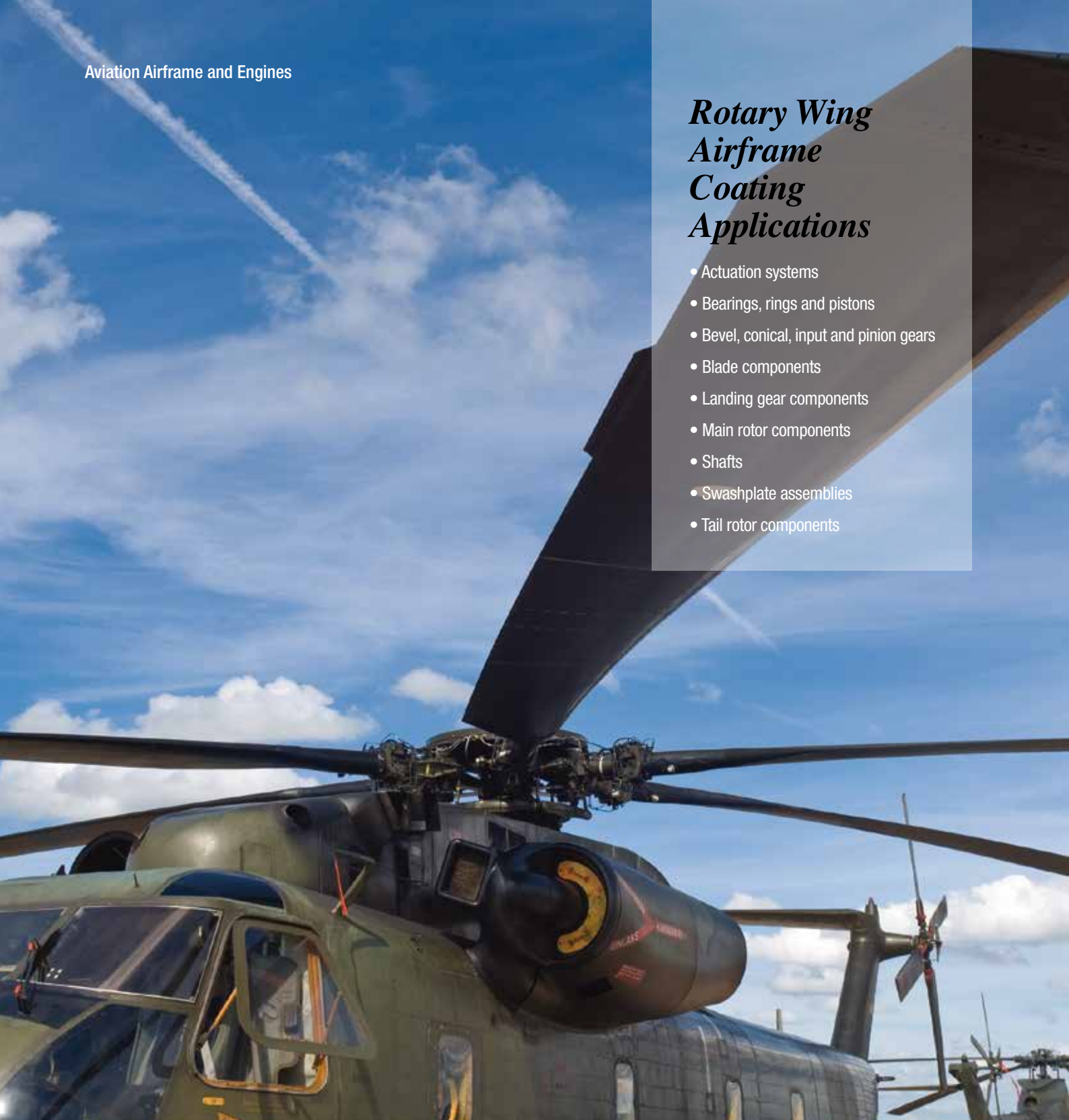


## ➤ *2009 More capabilities*

Praxair Surface Technologies expands its product and service offerings by acquiring Sermatech International and its line of SermeTel®, SermaLoy™ and ShorCoat® high-performance slurries. The partnership delivers coating options and capabilities unmatched throughout the industry.

## *Rotary Wing Airframe Coating Applications*

- Actuation systems
- Bearings, rings and pistons
- Bevel, conical, input and pinion gears
- Blade components
- Landing gear components
- Main rotor components
- Shafts
- Swashplate assemblies
- Tail rotor components



### *Rotary Wing Airframe Coatings*

High vibrations cause unique forms of stress in helicopter components, making our low-fatigue coatings particularly well-suited for these applications. And because our state-of-the-art coatings are compatible with stronger, lighter materials (e.g., aluminum, titanium, magnesium), designers can improve performance and reduce weight—without compromising structural integrity.

# What can more mean for you?

Let's work together to find your answers



It starts with a conversation. It ends with an answer to even your toughest performance problems. The unmatched service, experience, innovation and dedication between those two points? That's *more*. We offer *more* support, *more* coatings, *more* knowledge, *more* testing, *more* consistency. No one else even comes close. For answers to the tough problems, demand *more*.

## Coating processes

- Cold Spray – LOXPlate® coating
- Diffusion
  - Diffused Slurry – SermaLoy™ and SermAlcote™ coatings
  - Pack Diffusion
  - Platinum Aluminide
  - Vapor Diffusion
- Electrodeposition – Tribomet® coating
- Electroless Plating
- High-Performance Slurries
  - SermaLon® metallic ceramic polymers
  - SermeTel® metallic ceramics
  - ShorCoat® light metal coatings
- High Power Laser Processing
  - Laser Cladding/Hardfacing
  - Laser Hardening
  - Laser Welding
- Thermal Spray Coatings
  - D-Gun and Super D-Gun® coatings
  - Gator Gard® coating
  - High-Velocity Oxy-Fuel (HVOF)
  - Plasma Spray
  - Wire Arc Spray
- Vapor Deposition
  - Cathodic Arc Physical Vapor Deposition
  - Chemical Vapor Deposition
  - Electron Beam Physical Vapor Deposition
  - Physical Vapor Deposition

## Finishing and machining

- Blending
- Brushing
- Honing
- Lapping
- Machining
- Polishing
- Precision grinding
- Sanding
- Super finishing
- Surface grinding
- Vibratory

## Inspecting and testing

- Air flow
- CMM digital laser scanning
- Fluorescent penetrant
- Gaging and dimensioning
- Laser holography
- Magnetic particle
- Moment weighing
- Nital etch
- Profilometer
- Radiography
- X-Ray

## Manufacturing

- Large diameter machining
- Large milling capabilities

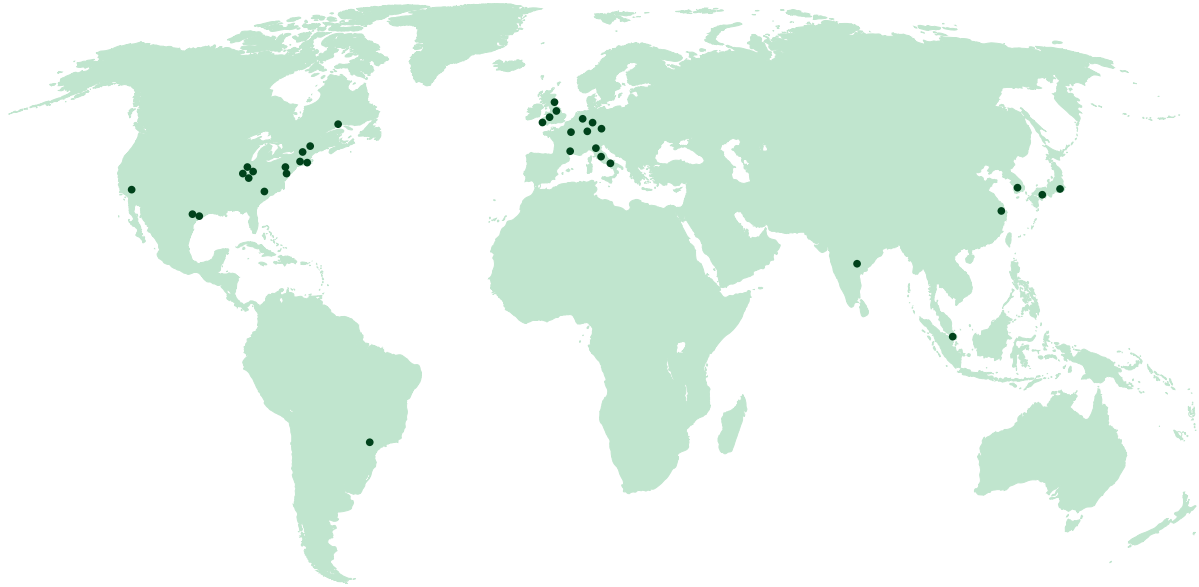
## Other service operations

- Abrasive blasting
- Acid stripping
- Aluminum oxide blasting
- Brazing
- Ceramic peening
- Chemical stripping
- CMM
- De-brazing (disjoining)
- Electrolytic stripping
- Gaging and dimensioning
- Glass bead peening
- Graphite varnishing
- Grit blasting
- Mechanical stripping
- On-site services
- Sealing
- Shot peening
- Silicon carbide blasting
- Stress relief
- Turnkey operations
- Ultrasonic cleaning
- Vacuum heat treating
- Vibratory tumbling
- Welding

\* Capabilities listed not available at all production facilities.


# Aviation

2,500 people, more than 30 facilities and 13 countries




## Primary Facilities


### Brazil

 Pinhais, Brazil  
Tel. +55.41.3661.6200


### Canada

 Dorval, Quebec, Canada  
Tel. 514.631.2240

### China

 Changzhou, China  
Tel. +86.519.8622.9000

### France

 St. Etienne, France  
Tel. +33.4.77.42.62.62

### Germany

 Ratingen, Germany  
Tel. +49.2102.495.0

 Heiligenhaus, Germany  
Tel. +49.2056.93090

 Schluechtern, Germany  
Tel. +49.6661.96780


### India

Coimbatore, India  
Tel. +91.4255.324743

### Italy


Fornovo, Italy  
Tel. +39.0525.401704

Monte Marenzo, Italy  
Tel. +39.0341.601111

 Novara, Italy  
Tel. +39.0321.674803

### Japan


Kozuki, Japan  
Tel. +81.790.88.0564

 Okegawa, Japan  
Tel. +81.48.5.91.0731

### Singapore

 Singapore  
Tel. +65.6542.2765


### South Korea


 Changwon, South Korea  
Tel. +82.55.260.2482


### Switzerland


Meyrin, Switzerland  
Tel. +41.22.989.8989

### United Kingdom


 Lincoln, England  
Tel. +44.1522.878200


 Southam, England  
Tel. +44.1926.81.2348


 Swindon, England  
Tel. +44.1.793.512.555

 Weston-super-Mare, England  
Tel. +44.1934.411301

### United States

 Compton, CA  
Tel. 310.604.0018

 Manchester, CT  
Tel. 860.646.0700

 North Haven, CT  
Tel. 203.287.2700

 Indianapolis, IN  
Tel. 317.240.2500

 Biddeford, ME  
Tel. 207.282.3787

Charlotte, NC  
Tel. 704.921.5400

New Castle, PA  
Tel. 724.598.1300

Houston, TX  
Tel. 713.849.9474

Tel. 713.991.8700

Praxair Surface Technologies maintains additional coating and administrative facilities not listed above.



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Praxair and the Flowing Airstream design, EXTREME Protection, GatorGard, LOXPlate, ProtectionPLUS, SermaFlow, SermaAlcote, SermaLon, SermaLoy, SermaTel, ShorCoat, Super D-Gun and Tribomet are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and in other countries. Other trademarks used herein are the registered trademarks of their respective owners.

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