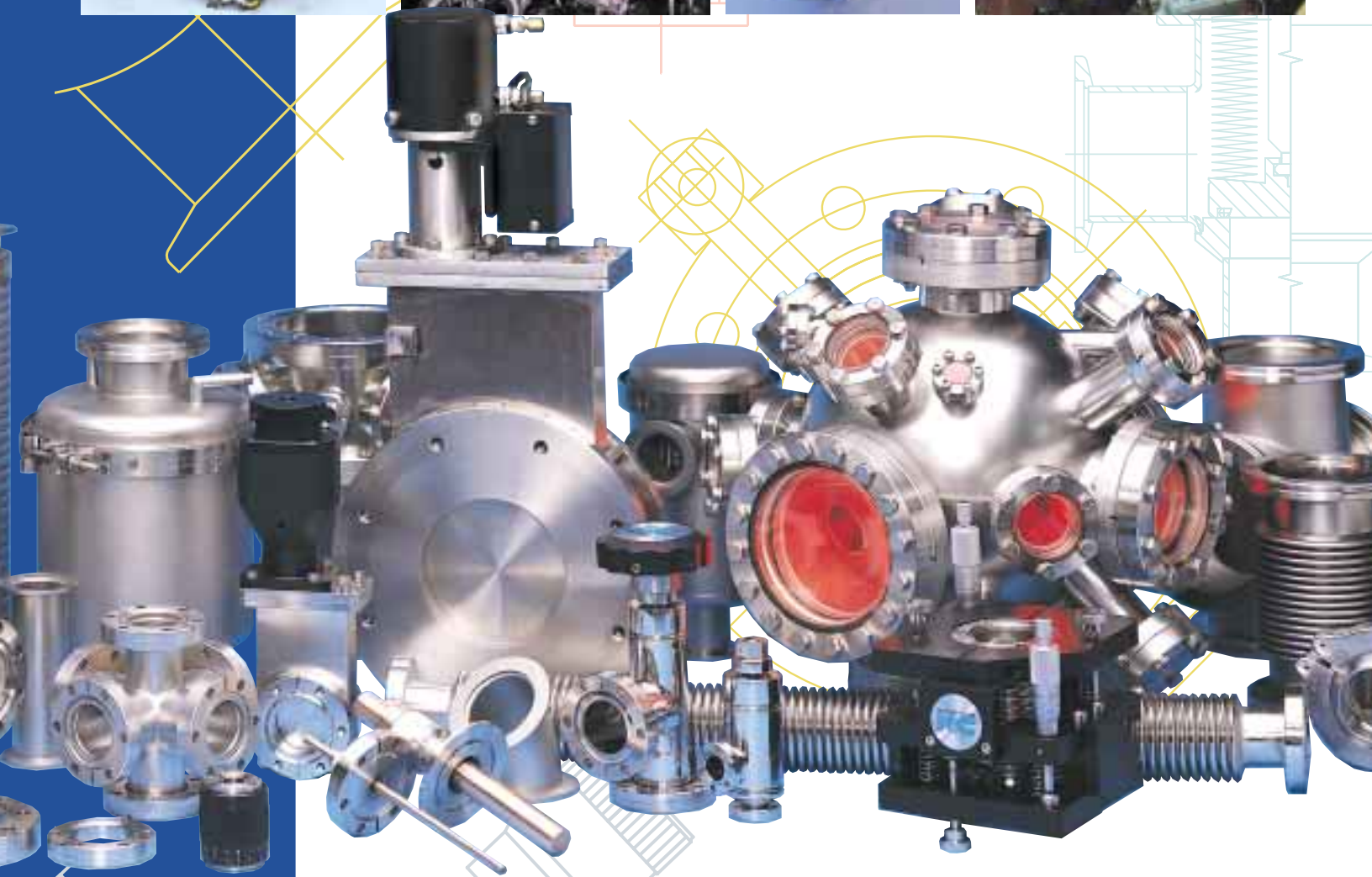


NOR-CAL PRODUCTS



Nor-Cal Products, Inc.
P. O. Box 518
1967 So. Oregon
Yreka, CA 96097 USA

Tel: **800-824-4166**
or 530-842-4457
Fax: 530-842-9130
www.n-c.com





This catalog contains general information about our company, product line, and facilities. For specific information on our products, such as dimensions and pricing, refer to the appropriate product catalog. The contents of each is described on this catalog's back cover. If you wish to receive any of these catalogs, or a binder containing all of them along with additional information, please call our corporate office at 800-824-4166 or 530-842-4457. They will be sent to you within a few days free of charge.



Tom Deany
Senior Vice President
& General Manager

Craig Hill
President

It is the goal of Nor-Cal Products to be the "BEST IN CLASS" manufacturer of vacuum equipment, producing the highest quality components at competitive prices, while meeting our customers' required delivery schedule.

We will strive for technical and market leadership by adding industry-driven products to our catalog and providing innovative customer services.



Manufacturing, Sales and Corporate Offices, Yreka, California



A Source of Experience

Nor-Cal Products' origin dates back to 1948 when the company's predecessor began designing and manufacturing stainless steel vacuum pumping stations for the dairy industry. With the development of the ion pump by Varian Associates ten years later, the vacuum industry began a rapid growth that has never slowed.

In response to the demand for the machining and metal forming required for vacuum applications, our company underwent a reorganization and Nor-Cal Products was formed in 1962. Since the vacuum industry's infancy we have kept abreast of the latest technologies and equipment in order to supply our customers with reliable vacuum components at a reasonable price.

Nor-Cal was mainly an OEM manufacturer for companies like Varian, UTI, Edwards High Vacuum and Perkin-Elmer until 1978 when we produced a thirty-page catalog of standard components. Our latest catalog has more than 200 pages of standard products including high vacuum and ultra high vacuum flanges,

fittings, valves, foreline traps, feedthroughs, manipulators and heater jackets. OEM and custom products, such as vacuum chambers, still make up a large portion of our annual sales.

Our 85,000 square foot corporate headquarters and manufacturing facility are located in Yreka, California. Approximately 200 employees manufacture nearly all of our products there and manage a worldwide network of sales representatives and stocking distributors.

In 1997 Nor-Cal Products established a 4,000 square foot research and development facility in San Diego, California. The staff is currently developing downstream pressure control devices for semiconductor processes.

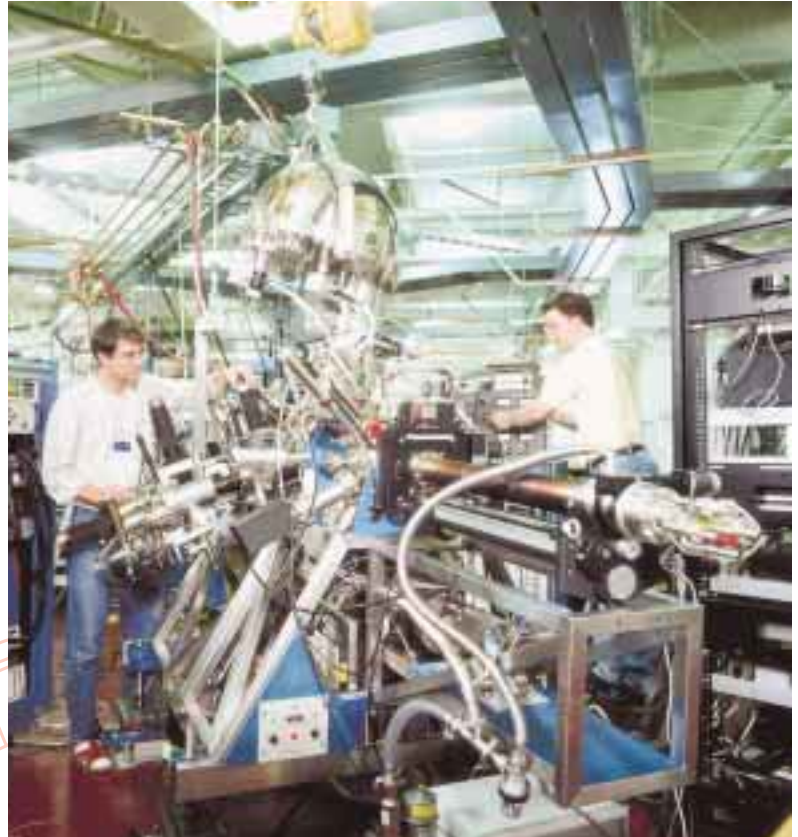


Research and Development, San Diego, California

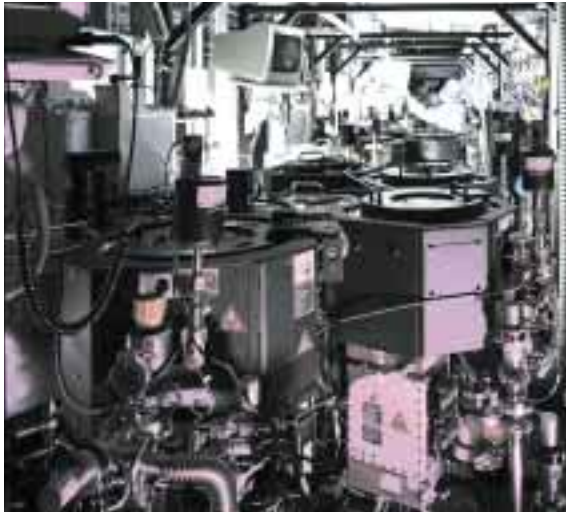


Markets Served

Over the years our customer base has been drawn from all segments of the vacuum industry. Our components are used in almost every phase of semiconductor processing. We are a preferred supplier to several semiconductor and compound semiconductor equipment manufacturers and supply mechanical contractors during fab construction. Industrial and academic researchers are frequent purchasers of standard, modified standard and custom components for physical, chemical and electrochemical experiments. Other customers who have come to value our experience are involved with thin film deposition, surface analysis, laser devices and aerospace.



Surface science research end station at Advanced Light Source, Berkeley, California



Semiconductor process equipment in the service chase of a 200mm fab



Thin film deposition systems



Heated forelines and pump exhaust lines in semiconductor subfab



Back L to R: **Denise Wilson**, Sales Representative; **Tim Nilsson**, Vice President of Marketing
Steve Greuel, UHV Product Manager; **Monica Sorcelli**, Sales Representative
Front L to R: **Diana Tudor**, Sales Manager; **Juanita Peterson**, Sales Representative
Randy Michels, Thermal Applications Product Manager

Sales and Marketing

Our corporate sales, marketing and technical support personnel provide prompt, honest answers to your technical questions and can recommend components for your particular vacuum application.

Our experience with semiconductor process equipment allows us to provide customers with comprehensive solutions to extend downstream preventative maintenance intervals and increase throughput dramatically.

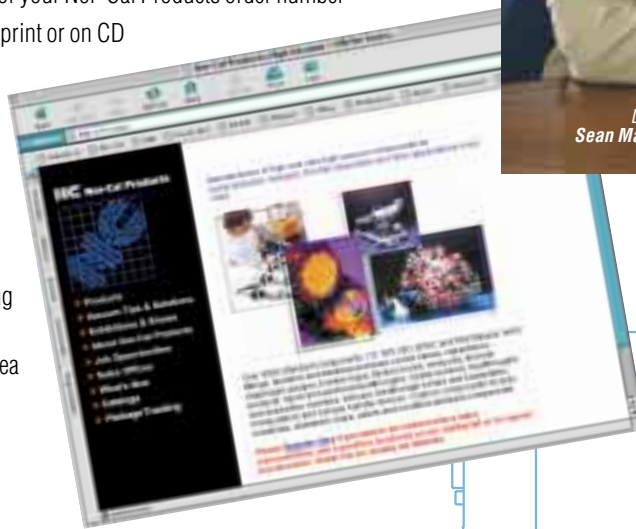
Nor-Cal Products sales representatives and stocking distributors are located throughout the United States, Canada, the Pacific Rim and Europe. Their locations, territories and contact information can be found in the General Information section of our binder catalog, on our website, or you may call our corporate sales offices at 1-800-824-4166.

Our Website

Nor-Cal Products' website features our catalog of over four thousand standard components in Adobe Acrobat PDF format. Download the complete catalog or just the sections you need. These searchable catalogs make it easy to locate components quickly.

Other website features:

- Track your Nor-Cal UPS or FedX shipments by your company's purchase order number or your Nor-Cal Products order number
- Request free catalogs in print or on CD
- Make inquiries about custom components
- Download CAD drawings of our components
- Access the latest new product information, technical data and pricing
- Locate the Nor-Cal representative in your area and link to their website



Left to Right: **Per Cederstav**, Senior Product Manager
Sean Mallory, Vice President Semiconductor Business Development

www.n-c.com



Engineering

Nor-Cal's engineering staff can design custom components from customer specifications, sketches or drawings and oversee production with in-house tooling and equipment. Our customers benefit from the combined experience of our engineers, whose input during the design phase often results in cost savings during production and a superior product. For our customers who do not have drafting personnel available and require a complex assembly, we will provide complete CAD drawings for approval upon receipt of order.

Nor-Cal's engineering department uses the latest versions of AutoCad drafting and Inventor solid modeling software. You may Email drawings direct to our engineering department at prints@n-c.com. Acceptable file formats are DXF, DWG, and IGES, SAT and STEP. You may also download drawings of our most commonly used standard components from our website.



Left to Right: *Chris Thackeray, Design Engineer; Duane Petry, Engineering Manager; Preston Rosenbaum, Product Development Manager*

Research & Development

In addition to developing new standard products and improving existing ones, our Research and Development departments design and test customer specified products for equipment manufacturers. Both our in-house and San Diego R&D facilities have prototype machining capabilities. Additionally, the San Diego lab performs pressure, conductance and thermal characterization as well as software and electronic development and testing.



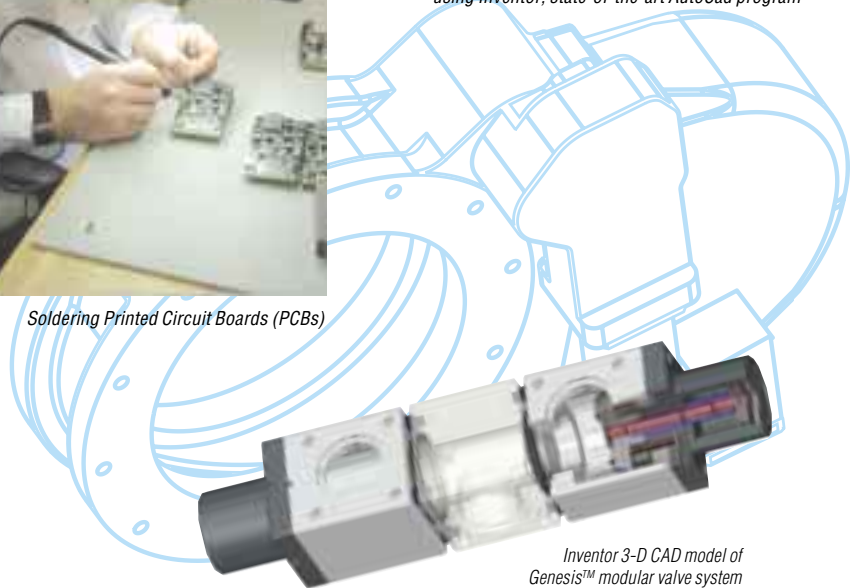
Checking wave forms on IQ Series Intellisys Throttling Valves



Soldering Printed Circuit Boards (PCBs)



3D modeling of Throttling Pendulum Valve using Inventor, state-of-the-art AutoCad program



Inventor 3-D CAD model of Genesis™ modular valve system



Cleaning

All stainless steel parts are passivated in a light acid solution to remove weld scale and oxide. A biodegradable detergent is used to remove machine lubricants before the parts are washed and rinsed with deionized water. Special cleaning recipes can be provided to our customer's specifications.

Nor-Cal offers tumbling, bead blasting, chem cleaning and electropolishing of vacuum components in-house. Tumbling in ceramic media deburrs components, such as weld fittings, while providing a uniform finish. Glass shot cleans, hones, polishes and peens while removing scale. Some customers request bead blast on exterior surfaces with electropolish on the interior.

Electropolishing is by far the most desirable cleaning process for stainless steel vacuum

Chem cleaning vacuum chambers

components. This electrochemical process benefits the finished part in a number of ways simultaneously. Deburring, passivation and stress relieving are achieved while the machine produced surface roughness is eroded.

Electropolishing attacks the microscopic "peaks" of the surface more rapidly than the "valleys", thereby maintaining critical dimensions while improving surface finishes. Normally .0003 to .0004 inch is removed to lower the micro-finish from 32 to 8 RMS. Electropolishing results in a 90% friction decrease over a similar microfinish achieved mechanically, while surface area is reduced by a similar amount. This is most important for vacuum chambers because it produces faster pumpdown and higher conductance.

In addition to the improved mechanical properties of the surface, iron is removed electro-chemically. This leaves the



Valve assembly in Class 1000 clean room

surface rich in chromium and nickel, which have extremely low vapor pressures. The result is the lowest outgassing rates possible from stainless steel.

Chem cleaning is typically used for production parts such as valve bodies or "process critical" parts fabricated for semiconductor equipment manufacturers. The component is immersed in a series of controlled chemical baths before deionized water rinse and filtered hot air dry. Chem cleaned parts are immediately packaged in sealed clean room bags.

Semiconductor and UHV applications require that our valves and manipulators be assembled in a 3000 square foot, Class 1000 clean room. All components receive a secondary cleaning and thorough inspection to make absolutely sure they are free of dust, machine oils and other contaminants.



Electropolishing vacuum chamber



Proven Performance

An independent study ranked Nor-Cal Products number one in price and availability out of the five major vacuum component manufacturers. Orders for stock items received in the morning can be shipped that afternoon. Guaranteed overnight delivery is available throughout the continental United States from our corporate headquarters, and also from our five stocking distributors' locations. Exceptional service has won us many loyal customers who have had an assembly line down and been surprised to find that we would weld, clean, leak check and ship a non-stock item the same day without an expedite charge.

Over the years Nor-Cal has added in-house capabilities, such as chem cleaning and electropolish, in order to eliminate dependence on outside suppliers. Additionally, this has allowed us to shorten lead times and reduce overall manufacturing costs.

Materials

Nor-Cal Products uses only the highest grade materials for the manufacturing of vacuum components. Vapor pressure, corrosion resistance and permeability are important considerations taken into account during the material selection process. We start with select grade 304 stainless steel tubing, spheres or roll-ups to fabricate the vacuum vessel. If required, 304L, 316 or 316L can be supplied. Normally our standard material is in the low carbon range for 304. Flanges and baseplates are made from 304 that has been specially treated to remove impurities inherent in 300 series steels. Flanges 4.50 inches OD and smaller are made from 304 electroslag remelt (ESR) bar stock. ESR is a refining process that produces stainless steel with higher purity, fewer inclusions and more uniform grain structure to eliminate microscopic leak paths. Larger flanges are made from Argon Oxygen Decarburization (AOD) 304 stainless steel. This material is certified to meet ASTM-240 and has less than .01% sulfur to prevent sulfur stringers. Grain size is 3 to 6 per ASTM E-112. Maximum inclusion size is 2.5 per ASTM E-45. As specials, 304L and 316L material can be supplied in AOD or roll-forged rings.



CNC Machining Center with dual spindles, live tooling and robotic gantry





Machining

Machining procedures are consistent with good UHV practices. Machine coolant is sulfur free to reduce outgassing. All Nor-Cal components are designed to minimize entrapments, which cause virtual leaks under vacuum. State-of-the-art CNC machining equipment is available to produce parts with consistently high quality.

Most valve and trap body ports and weld fittings are die-formed using the pulled-port method.

A ball is pulled through a smaller opening resulting in a crevice-free, smooth, tapered opening. This eliminates sharp inside corners that can entrap contaminants, and allows faster pumpdown and lower outgassing.

GTAW fusion welding is used exclusively for a vacuum-tight metal bond. Purging with an inert gas reduces or eliminates oxygen entrapment and carbide precipitation, which cause outgassing. Whenever possible, welds are made on the inside or are full penetration to eliminate entrapments and virtual leaks.



GTAW Fusion Welding



Production Scheduling

Production scheduling and capacity planning at Nor-Cal employ a lean manufacturing technique that combines bottleneck management and KANBAN with traditional MRP. Small lot sizes and standardized routings maximize scheduling flexibility and increase visibility of jobs in the manufacturing stream, while reducing manufacturing cycle time.



Quality Assurance

After extensive audits, Nor-Cal Products received Semitech SSQA Preferred Supplier status from two large semiconductor equipment manufacturers.

An ongoing effort is made to control and improve manufacturing processes. Periodic defect analysis results in process improvements with narrower acceptable limits on subsequent production runs. Our goal is to reach six-sigma process capability. Our quality system is ISO compliant, SSQA certified and MIL-Q-9858 and MIL-I-45208 approved.

Every weld is leak checked with a helium mass spectrometer to insure a leak rate of 10^{-9} std. cc/sec or less. Our chamber qualification test benches can be used on components requiring lower leak rates. They were developed for customers who request residual gas analyzer (RGA) scans of their chambers after a 24 hour vacuum bake. A test bench contains vacuum pumps, gauges, RGA, quartz heaters, nitrogen back fill and a leak detector. Once water and other background are eliminated by the 150°C bakeout, we can provide the customer with customized scans to detect the slightest contamination in the chamber.

Whatever the sensitivity of our customer's application, we can guarantee that contaminants will be within acceptable limits.

A coordinate measuring machine (CMM) is used for in-process and final mechanical inspections of vacuum chambers and other complex or close tolerance parts. CMM printouts of chamber final inspections can be furnished upon request.



Calibrating Intellisys™ Adaptive Pressure Controllers



Mechanical inspection of process chamber with Coordinate Measuring Machine (CMM)



Chamber Qualification Test Bench

Quality Statement

Nor-Cal Products, Inc. is dedicated to continual improvement of our manufactured and purchased goods through the implementation of a carefully planned quality program. Quality improvements at Nor-Cal have been mandated and implemented with the full support of senior management.

It is our belief that quality is built into a product. We will eliminate defects by reducing the variables in all processes relating to manufacturing. We will strive to meet our primary goal of 100% customer acceptance by manufacturing defect-free

parts with on-time delivery, competitive pricing and the best possible customer service. Nor-Cal's use of statistical methods in manufacturing, training programs and continuous improvement of equipment are evidence of our commitment to this goal.

While management takes the ultimate responsibility for Nor-Cal quality, service and productivity, each employee can take credit for his or her contribution to our success, and is responsible for the implementation of quality in their particular area.

We are all participants in the creation of a "quality ethic." Senior management fosters an atmosphere of cooperation not only throughout Nor-Cal, but also with customers as well as suppliers. Our purpose is to create a team dedicated to the improvement of quality by finding creative solutions to our industries' manufacturing problems.

Building quality into Nor-Cal components is our most important task.



Intellisys™ Adaptive Pressure Control Components

Intellisys adaptive pressure controllers and throttle valves reduce time to pressure setpoint, while increasing tool throughput with over 100,000 control resolution steps and a 20 times valve speed increase. Non-sealing butterfly valves are available with or without on-board control. Throttling pendulum valves provide unequalled pressure control as well as isolation for large bore high vacuum pumps. Heated and unheated Capacitance Diaphragm Gauges and Heater Jackets are available as options.



Isolation Valves

Nor-Cal offers vacuum isolation valves for a broad range of sizes, pressures and applications. Our pneumatically actuated poppet valves are the standard in the semiconductor equipment industry because of their robust design and edge-welded AM 350 stainless steel bellows which provide full-opening conductance. Genesis™ valves were designed specifically for semiconductor equipment that require million-cycle reliability, small footprint and low-cost soft start and heating options. Copper seal bonnet and manual all-metal valves are available for UHV applications. Additionally, Nor-Cal provides traditional linear as well as low-particulate pendulum style gate valves for isolation of high vacuum pumps and UHV chambers.



Foreline Traps

We have more than 25 year's experience manufacturing foreline traps for the vacuum industry. They range in complexity from sealed coaxial traps, which prevent mechanical pump oil from backstreaming to the chamber, to the three-stage LPCVD TEOS trap, which incorporates a stainless steel gauze filter media with a 10 micron fiberglass particle filter for the removal of silicon dioxide. We have the largest selection of standard traps, which utilize woven metal, polyester or fiberglass gauze; molecular sieve; a liquid nitrogen reservoir or water-cooled coils to remove contaminants from the vacuum system or chamber.



Crystal Deposition Monitors, Feedthroughs & Sensors

Nor-Cal thin film monitors, crystal sensors and feedthroughs, represent those most commonly used for thermal deposition processes. A variety of feedthrough configurations with KF or CF flanges are available for single or dual crystal sensors, with or without water-cooling and pneumatic shutters. Custom feedthroughs and bakeable sensors are also available on request. Our standard monitor measures film thickness and rate or frequency from two independent channels. The two channels can be used to monitor different films or average readings to provide more uniform deposition measurement. The monitor is expandable to six channels. Controllers are also available.



Electrical & Liquid Feedthroughs

Our electrical feedthroughs are manufactured from ultra-high vacuum grade materials, such as high alumina ceramic insulators, OFHC® copper and nickel conductors, and 304 stainless steel flanges. Types include thermocouple, instrumentation, medium current, high current, BNC, and MHV feedthroughs. Liquid and liquid nitrogen feedthroughs are available with or without industry standard Cajon® VCR or Swagelok® fittings.

Sample Transfer & Positioning Devices

Our Series II sample transfer and manipulation devices offer the researcher a series of complimentary components that are manufactured for demanding UHV bakeouts and environments. They are guaranteed to be free from defects in materials and workmanship for five years. Each standard component can readily be customized to meet specific requirements with options such as sample heating and cooling, special lengths or stepper motor drivers. Standard components include XYZ precision manipulators, magnetic linear/rotary feedthroughs, rotary motion feedthroughs, differentially pumped rotary seals, sample transfer systems, alignment gimbals and rotary wobble sticks.



Viewports

Zero-length viewports are offered with fully annealed 7056 glass, for a large, distortion-free viewing area, or fused silica to provide superior UV radiation transmission. Special materials and coatings, such as sapphire and anti-reflective (AR) coating are also available.

Thermal Products

Silicone foam and fiberglass insulated heaters with thermostat or PID control are available to heat our components to temperatures up to 200°C. Typical applications are downstream from CVD or metal etch systems, where unreacted by-products condense on the inside of the vacuum lines, valves and other components. Our thermal engineers can provide entire turn-key heater/control systems for the process tool manufacturer or fab installation.



Flanges and Weld Fittings

Our flanges are made from ESR or AOD 304 stainless steel material, which is specially processed to reduce impurities, grain size and microscopic leak paths. They are available in all commonly used high and ultra-high vacuum flange types, including ASA, KF, ISO, CF and wire seal flanges. We also offer EVAC flanges with metal seals to convert a high vacuum KF flange into an ultra-high vacuum connection.

Weld fittings are available with or without flanges. Fittings without flanges are typically sold to mechanical contractors for use during the fit up phase of new fab construction. They are available with tumbled, bead-blasted or electropolished finishes.

All standard components can be modified for your specific application.



A list of the standard products offered by Nor-Cal Products is on the back cover of this catalog. Almost half of our annual sales are for modified standard and custom components. This page describes a few of our custom products and services that you may not be aware of.

Traps

We have years of experience designing and building custom foreline traps to protect pumps and eliminate buildup of condensable by-products in forelines and exhaust lines. Examples of these include water-cooled and particle traps for LPCVD, PECVD, metal CVD, MOCVD and metal etch.

Others are particle traps for crystal growers, liquid traps for reclamation of photo resist and oil reclamation traps for industrial applications. Often times our customers see a 200% increase in preventative maintenance intervals after installing one of these traps.

Chambers

We have developed a reputation at national laboratories, universities and UHV equipment manufacturers for being the premier vacuum chamber fabricator. The quality, appearance and performance of our chambers are unequaled. Some of the chambers we make include load locks, sample preparation chambers, analysis chambers, monochrometers, beam line collimators, reactors and coating chambers. We frequently supply cylindrical and rectangular chambers with doors, stands and water jackets. Our engineering staff can design a chamber from customer sketches or specifications and supply complete manufacturing drawings for customer approval.

Comprehensive Downstream Solutions

Our experience coupled with a broad product offering allows us to integrate components, providing comprehensive solutions to semiconductor fabs and equipment manufacturers. To improve overall system performance and achieve customer defined goals, a thorough evaluation of the system is conducted. A cost of ownership model can be provided showing payback as a result of increased tool utilization and decreased planned and unplanned maintenance costs.

Foreline traps, thermal products, Intellisys™ pressure control valves, Genesis™ soft start valves and foreline weldments can be provided as turnkey foreline modules. Thermal and vacuum characterization can be performed at Nor-Cal before the assembly is supplied, leak checked, blanked off and clean room packaged.

Valves

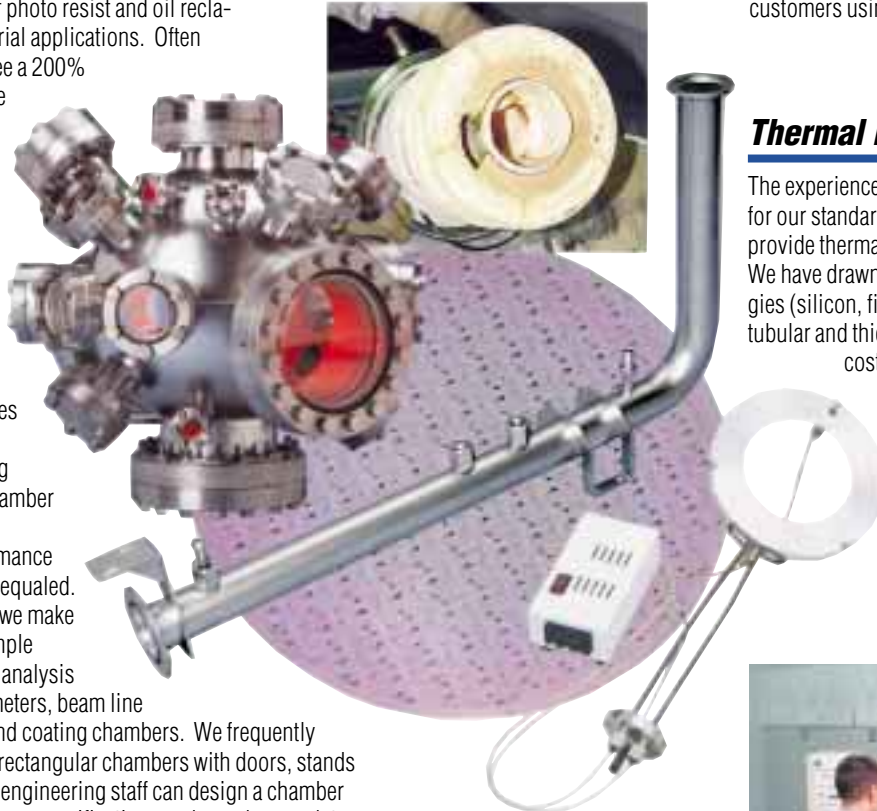
Our valves are offered with a number of options, making it easy for our customers to specify nonstandard O-rings, actuators, fittings and air solenoids. We also provide customer specified valves with special port configurations, pumpouts, materials and other features.

Weldments

Because we manufacture tees, elbows and other weld fittings in-house, Nor-Cal can fabricate exhaust weldments for semiconductor equipment from a single piece of tubing. Welds and other manufacturing steps are eliminated, improving cleanliness and fit while reducing cost. We have demonstrated as much as 30% savings to our customers using this technique.

Thermal Products

The experience gained designing heaters for our standard products has allowed us to provide thermal products for special applications. We have drawn from a number of heating technologies (silicon, fiberglass, cartridge, strip, band, tubular and thick film) in order to provide the most cost-effective solutions. Examples include heated traps, internal heaters for vacuum chambers, gas delivery systems and ion pump heaters.



System Integration

On request, Nor-Cal can assemble an entire system including chamber, frame, pumps, gauges, valves, manipulators and other components to customer specifications. Our vacuum technicians can complete a thorough qualification of system performance, including time to base pressure and RGA scan, before the system is back filled with nitrogen and shipped to the customer.



Warranty

Products manufactured by Nor-Cal Products, Inc. (hereinafter referred to as "Nor-Cal") are warranted against defects in material and workmanship for a period of twelve (12) months from the date of shipment from Nor-Cal to the buyer. Any modification to the product by the buyer or their agent voids this warranty. Liability under this warranty is expressly, limited to replacement or repair (at Nor-Cal's option) of defective parts. Nor-Cal may at any time discharge its warranty as to any of its products by refunding the purchase price and taking back the products. This warranty applies only to parts manufactured, and labor provided, by Nor-Cal under valid warranty claims received by Nor-Cal within the applicable warranty period and shall be subject to the terms and conditions hereof.

Expendable items such as tubes, heaters, sources, bellows, etc., by their nature may not function for one year; if such items fail to give reasonable service for a reasonable period of time, as determined solely by Nor-Cal, they will be repaired or replaced by Nor-Cal at its election.

All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Nor-Cal, are due or traceable to defects in original materials or workmanship. Malfunctions caused by abuse or neglect of the equipment are expressly not covered by this warranty. Nor-Cal expressly disclaims responsibility for any loss or damage caused by the use of its products other than in accordance with proper operating and safety procedures. Reasonable care must be taken by the user to avoid hazards.

In-warranty repaired or replacement parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the parts which have been repaired or replaced.

After expiration of the applicable warranty period, the buyer shall be charged at Nor-Cal's then current prices for parts and labor plus transportation.

Except as stated herein, Nor-Cal makes no warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated herein, Nor-Cal shall have no liability for special or consequential damages of any kind or from any cause arising out of the sale, installation, or use of any of its products. Statements made by any person, including representatives of Nor-Cal, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Nor-Cal unless reduced to writing and approved by an officer of Nor-Cal.

Return Policy

Merchandise may be returned at the sole discretion of Nor-Cal Products, but not more than 60 days after shipment. A fee may be charged for restocking the item. An RMA number must be obtained from Nor-Cal before returning any merchandise.

Cancellations

Any request by customers for cancellation in total or part of any purchase order must be approved at the sole discretion of Nor-Cal Products and shall be subject to the following conditions:

1. Nor-Cal must receive written notice of Request for Cancellation, stating the reasons therefore.
2. Customer shall be liable for payment of the following charges to Nor-Cal in the event of cancellation.
 - A) For all charges incurred (including overhead, G&A, and profit) prior to the date that notice of cancellation is received by Nor-Cal for all parts peculiar to customer's requirements. Upon payment by customer of these charges such parts become the property of the customer, Nor-Cal will store said parts for a reasonable period of time pending the receipt of customer's instruction for disposition. Such storage is at the customer's risk and may be subject to storage charges if stored by Nor-Cal for longer than 30 days from the cancellation date; plus:
 - B) Charges to convert modified standard parts for return to Nor-Cal's inventory; plus
 - C) A restocking charge of up to 25% of the purchase price of the cancelled item.



Order Information

How to place an Order

To place an order, request catalogs or obtain information about our products and services call 800-824-4166 or 530-842-4457. You may also send Email requests to ncsales@n-c.com or send us a Fax at 530-841-9189.

Minimum Orders

The minimum order that will be processed for domestic orders is \$40.00. The minimum international order is \$100.00.

Terms of Payment

Terms are net 30 days from the date of invoice once credit has been approved. Otherwise terms are COD. Visa, Mastercard or American Express charges are accepted.

Establishing Credit

Contact our sales department to establish credit with Nor-Cal Products.

Discounts

OEM and quantity discounts are available to qualified customers.

FOB Point

All shipments are FOB Yreka, California unless quoted otherwise.

Method of Shipment

Shipments will be UPS Surface, Prepay and Add, unless quoted otherwise.

Prices and Dimensions

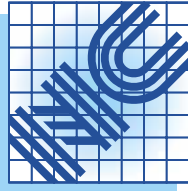
In order to meet the changing needs of our customers we periodically make design revisions in our standard product line. As a result, the dimensions, pricing and specifications in all catalog sections are subject to change without notice. International pricing may also vary.

The following registered trademarks appear in this catalog:

Alumel® is a registered trademark of Hoskins Mfg. Co.
 Cajon® is a registered trademark of The Cajon Co.
 Chromel® is a registered trademark of Hoskins Mfg. Co.
 Conflat® is a registered trademark of Varian Associates
 Kalrez® is a registered trademark of DuPont Dow Elastomers
 Kovar® is a registered trademark of Westinghouse Electric Corp.
 Microdot® is a registered trademark of Microdot Corp.
 OFHC® is a registered trademark of American Metals Climax, Inc.
 Omicron® is a registered trademark of Omicron Corp. GmbH
 Pyrex® is a registered trademark of Corning Glass Works
 Swagelok® is a registered trademark of Crawford Fittings Co.
 Teflon® is a registered trademark of DuPont Dow Elastomers
 VCR® is a registered trademark of The Cajon Co.
 Viton® is a registered trademark of DuPont Dow Elastomers

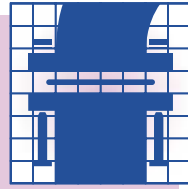


For information and pricing on other components, click on the appropriate catalog below.
To request a free printed version of our catalog, please [CLICK HERE](#) and fill out the quick request form.
You will receive the free catalogs or complete binder promptly. *Thank you for your interest in Nor-Cal Products!*



General Information

- Manufacturing • Engineering • Research and Development • Sales Offices
- Quality Assurance • Product Overview • Order Information
- Catalog Request Cards and Rolodex Cards



Flanges & Fittings

- NW and ISO Flanges, Fittings, Adapters, Viewports and Flexhose • NW PVC Hose
- EVAC Flanges and Metal Seals • CF Flanges, Fittings, Adapters, Viewports and Flex Hose
- Wire Seal Flanges • ASA Flanges, Fittings, Adapters and Flex Hose
- Aluminum/Stainless Steel Transitions



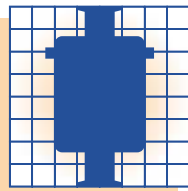
Chambers & Accessories

- Custom Chambers • Surface Analysis Chambers • Bell Jars • Feedthrough Collars
- Baseplates • Add-a-doors • Viewports • Crystal Sensors, Feedthroughs and Monitors
- Liquid and Electrical Feedthroughs • Load Locks • Manipulators



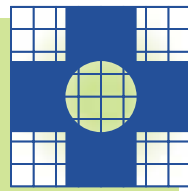
Isolation & Control Valves

- Angle Valves • Angle-in-line Valves • In-Line Valves • Tee Valves
- Fail-Safe Valves • Straight-through Valves • Bakeable All-Metal Valves
- Gate Valves • Intellisys™ Throttling Valves and Controllers
- Genesis™ Modular Vacuum Valve System • Capacitance Diaphragm Gauges



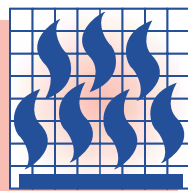
Foreline Traps

- Semiconductor Process Traps • Sealed Coaxial Traps • Metal Sieve Traps
- Water-cooled Traps • Liquid Nitrogen Traps • Molecular Sieve Traps
- Particulate Traps • Replacement Parts



Weld Fittings

- Weld Fittings • Weldable Flex Hose • Stainless Steel Tubing
- Flexible Stainless Steel Hose



Thermal Products

- Semiconductor Process Benefits • Applications
- Designing Heated Systems • Heater Jackets • Insulators
- Controllers • Accessories

Prices subject to change without notice. International product pricing will vary.