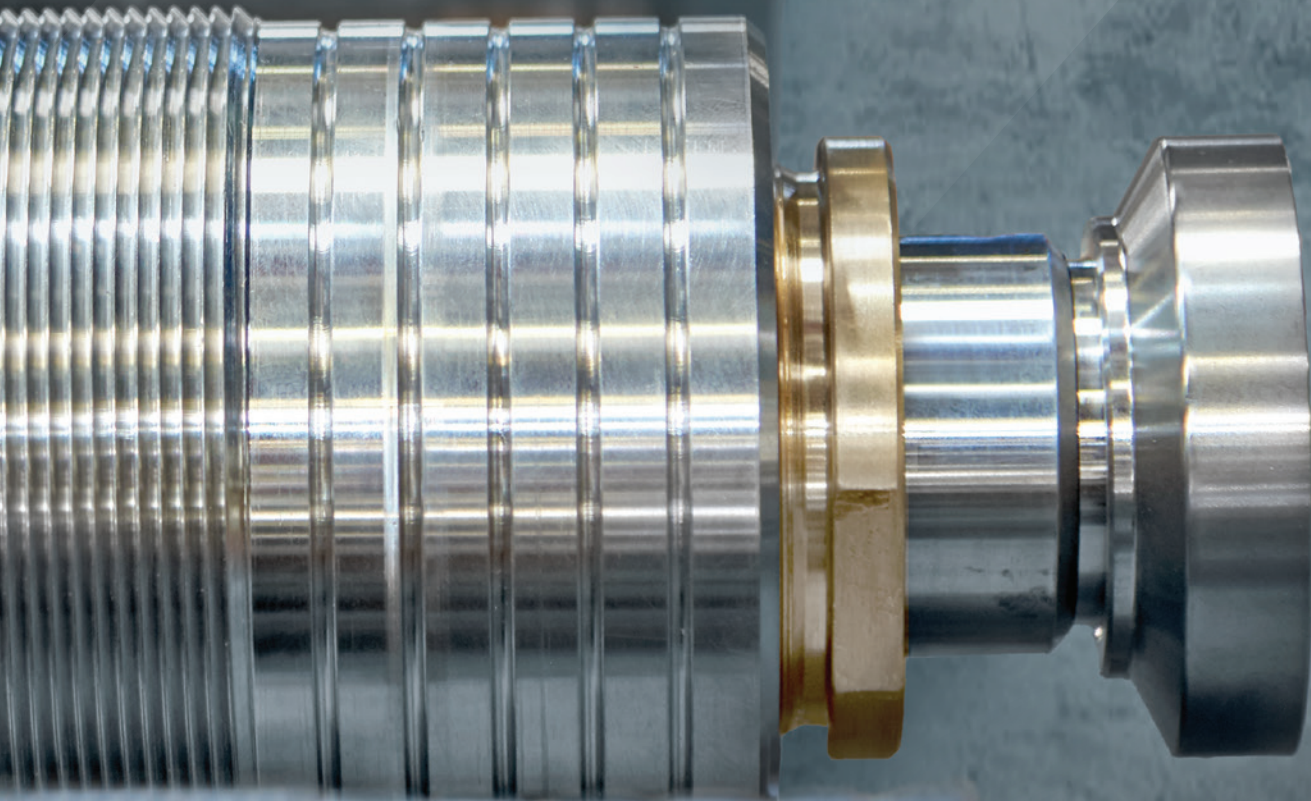


# Nikkiso Clean Energy and Industrial Gases Group

Your global choice for innovative equipment and solutions in liquid gases and beyond.

Nikkiso Cryogenic Service Edition



**NIKKISO**

# Table of Contents

## Nikkiso Cryogenic Service Edition

02

Aftermarket Services

03

Service Wheel

04

Services Offered

05

Spare Parts

06

Pump Repair & Exchange

07

Turbo Expander Repair

08

Training, Commissioning and Field Services

09

Marine Services

10

Cryogenic Process Systems Plant Services

11

Heat Exchanger Systems

12

All-Brand Support

13

Long-Term Service Agreements

14

Global Reach

16

Safety

17

Quality



# Nikkiso Cryogenic Services

Nikkiso Cryogenic Services (NCS) is the essential service arm of Nikkiso's Clean Energy & Industrial Gases Group. We have long been recognized as the leading service provider for cryogenic equipment and in addition to Nikkiso products, offer a wide variety of services for pumps and turbo expanders manufactured by other companies. Through our 18 global service facilities we service the industrial gas and air separation industries, enhanced oil recovery operations, marine and clean energy and alternative fuels projects.

State-of-the-art facilities feature a clean room, CNC 5-axis machining and turning centers, cryogenic testing capabilities, and streamlined manufacturing and assembly processes.

NCS is ISO 9001:2015 certified, ensuring that every component produced meets the highest standards of quality in the industry. With nearly 65 years of experience, NCS continues to offer highly engineered solutions to the most challenging problems in cryogenic equipment design and operation.

**NCS Vision:** To become the world's most respected service brand for cryogenic equipment.

**NCS Mission:** Deliver customer satisfaction for Nikkiso products by providing timely responsive service with integrity and a passion for excellence while meeting or exceeding our customer's expectations.

## Market Reach

- Industrial Gas
- Clean Energy (LNG / H<sub>2</sub>)
- Marine
- Space Exploration
- Enhanced Oil Recovery
- Electronics
- Rail
- Hydrocarbon Processing



NCS Headquarters, Irvine, CA

# Aftermarket Services



Your equipment deserves the best attention—from the provision of genuine OEM parts, spare or replacement parts—to our pump exchange program, regularly scheduled visits, repair, maintenance and product training. All these are provided to reduce your total cost of ownership. The extended lifetime of your equipment depends on it, and Nikkiso Cryogenic Service technicians are here for you at every stage.

Our goal is to provide the best possible aftermarket support for our customers. We do that by continuing to deliver high quality service that allows you to maintain reliable operations and deliver sustainable productivity.

## Aftermarket service

NCS has over 65 years experience providing know-how on equipment, parts and service. With a team of over 75 certified technicians, we stand ready 24/7 to help you keep things running smoothly.

## Expanded Service

We are continuing to expand our service capabilities globally. The new collaboration will improve NCS' presence in Europe and strengthen the Nikkiso service brand globally. The formation of this alliance will enable us to better support the aftermarket service network for our customers, and continue to deliver high quality service that allows our customers to maintain reliable operations.

## The new service centers



Busan, South Korea

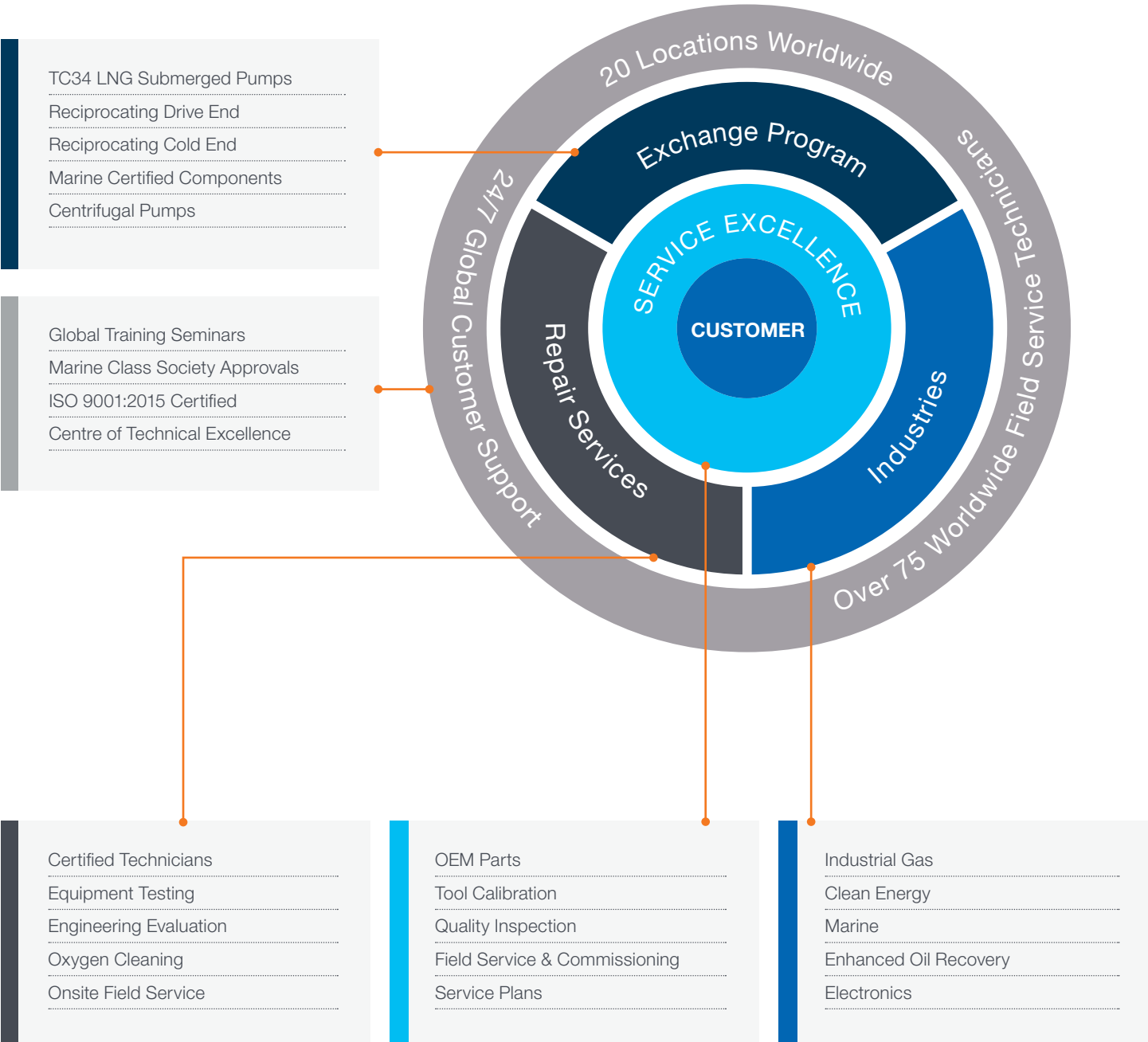
- Pump repair
- Oxygen cleaning
- Pump exchange program
- Dedicated inventory
- Product training
- 24/7 customer support from certified technicians



# Service Wheel

Nikkiso Cryogenic Services was created solely to service our customers. For over 65 years, we have designed, developed and continue to expand our capabilities in order to provide the best possible service to you. We understand the importance of keeping your operations running smoothly and economically, and are committed to a program of service excellence.

To meet the needs of our global customers we have expanded our operations to 20 locations worldwide, enabling us to offer local service on a global basis. We stand ready to replace or repair your pumps with a regular inventory of parts. With over 75 certified field service technicians, we are also available to provide onsite field service and training.



# Services Offered

Nikkiso Cryogenic Services are directly affiliated with cryogenic pump manufacturers Nikkiso ACD and Nikkiso Cryo, the world's leaders in the design and manufacture of cryogenic reciprocating, centrifugal pumps and turbo expanders for over 65 years.

## Trained Technicians, Rapid Response

A team of highly-qualified and well trained technicians and engineers is supported by the technical expertise and resources of the NIKKISO NCS Engineering group. The advanced engineering support to field service personnel marks the difference between individuals performing a service versus having the full technological team of resources of strong established company behind.

From 20 global service locations, our team of certified technicians provide a broad range of products and services, including:

- Pump & turbo repair
- Field service and commissioning
- Pump exchange program
- Testing capabilities
- Product training seminars
- 24/7 customer support from certified technicians.
- Long term service agreements
- Lng plants, heat exchangers
- Turnkey solutions & stations

## Full Machining Capabilities

NCS Service unit provides advanced manufacturing process systems, 5 axis milling machines, quality control and testing expertise for expander components and compressor wheels. Where necessary, the complete rotating element assembly can be manufactured to the customers exacting specifications, tested and ready to be installed.

Facility machine shop includes:

- CNC 5-axis machining
- Engine lathe
- Dynamic balancing per ISO 1940 G2.5

The customer's designs are held in strict confidence and not shared with any other organization or used for any purpose other than provide the contracted services.

## Field Service

Field service capabilities include:

- Start up and commissioning assistance
- Comprehensive problems diagnostics
- Operational and maintenance training of customer's personnel
- Complete equipment evaluation and report





# Spare Parts

Downtime is costly. We understand this, which is why we have a fully-stocked spare parts department at each of our 20 global facilities. If and when your machinery breaks down, our experts will help you get up and running quickly. Whether it be sending a replacement part, or getting a technician to your site to repair the problem.

## Minimize downtime, maximize productivity

Our large spare parts inventory enables us to provide fast delivery of equipment, minimizing your downtime. It is also ideal for providing any parts needed for in-house repair by your own technicians. This allows us to have full focus on the operational needs of our customers and to deliver high quality service enabling our customers to operate reliable and deliver sustainable productivity.

Our stocked inventory, controlled through a state-of-the-art computer system, also holds dedicated products and reorder points on many of the most commonly-used parts, so we always have the parts you need—when you need them.

Before our spare parts are shipped to you, they are cleaned for oxygen service and packaged securely as not to damage the parts through shipment.

Turbo equipment and machining spares are also available.



When service matters,  
we've got you covered!



# Pump Repair & Exchange

Nikkiso Cryogenic Services offer customers a full commitment to get our products up and running smoothly. When you are ready to install your pump one of our certified technicians will provide on-site training to your staff, and offer a certificate of completion once fully trained and the equipment is fully functional.

## Pump Repair

The pump technology centers in Irvine California (ACD Pumps) and Las Vegas, NV (Nikkiso Cryo Pumps) are where engineering continually develops new and more advanced repair techniques for the pumps product line. Highly trained and skilled mechanics and technicians are developing advanced techniques under direction of the engineering department

NCS has a long standing commitment to the overhaul of cryogenic pumps. One focus is to create repair solutions that reduce costs, downtime and extend the life of the components. Our repair philosophy is to return the assembly to the best condition for long reliable service and performance!

## Alternator Repair & Exchange Program

The North American Cryogenic Industries Service Companies have offered an alternator exchange program for over 15 years. The program offers brushless alternators. All of the exchange units are repaired to the most current specifications. Customers will have 30 days to return the used alternator, freight prepaid, to the nearest Cryogenic Industries Service Company.

## Pump Exchange Program

Our exchange program is designed and administered with the concept of keeping your cryogenic pumps pumping, while minimizing or eliminating costly downtime. To do this our members maintain an inventory of most-frequently-used components. These components are repaired to factory specifications and are exchanged in "like new" condition. The exchange program provides a vehicle for obtaining the absolute minimum downtime by having the exchange item on the shelf ready for shipment to you, while you are in production. The Cryogenic Industries Service Companies have offered the program on both reciprocating and centrifugal pump products since 1982.

Custom exchange programs are available upon request. To learn more, contact our customer service team at [info@NikkisoCIService.com](mailto:info@NikkisoCIService.com).





# Turbo Expander Repair



## Turbo Expander Repair

The turbo expander technology center in Irvine California is where engineering continually develops new and more advanced repair techniques for the turbo expanders product line. Highly trained and skilled mechanics and technicians are developing advanced techniques under direction of the engineering department.

NCS has a long standing commitment to the overhaul of turbo expanders. One focus is to create repair solutions that reduce costs, downtime and extend the life of the components. Our repair philosophy is to return the assembly to the best condition for long reliable service and performance!

## Additional Services

- Redesign and upgrades
- Preventive maintenance & service plans

## Typical tear down and repair evaluation includes:

Complete evaluation of all parts during disassembly

Thorough cleaning of all parts per NCS rigorous specifications

100% visual inspection of all parts with emphasis on detecting erosion, corrosion, deposition and other metallurgical evaluation

Detail measurement of all critical parts including:

- Shaft – journal diameters, thrust faces
- Wheel journals
- Seal diameters
- Check of electrical run-out at vibration probe sensing areas
- Expander and compressor wheel
  - Fluorescent Penetrant (Zyglo) inspection for cracks,
  - Visual check for erosion
  - Detailed measurement of bores
- Seals
  - Measure seal bore for proper size and wear detection
  - Inspect all porting for debris.
- Bearings
  - Disassemble and clean all bearings
  - Inspect pad curvature
  - Inspect thrust faces
  - Measure pad thickness
  - Reassemble or repair as required
- Variable inlet guide vanes (nozzles):
  - Inspect for wear against drive pins
  - Check for galling or erosion damage

Assemble rotor and check balance

Clean and inspect all bearing housing porting

Upon completion, a detailed report including disassembly observations, photographs (if applicable), probable cause of failure and corrective action necessary are submitted to the customer.

Detailed and itemized repair price including new parts, repaired parts and reassembly labor is submitted for customer approval.

# Training, Commissioning and Field Services

Nikkiso Cryogenic Services offer customers a full commitment to get your equipment up and running smoothly. When you are ready to install your equipment one of our certified technicians will provide on-site training to your staff, and offer a certificate of completion once fully trained and the equipment is fully functional.

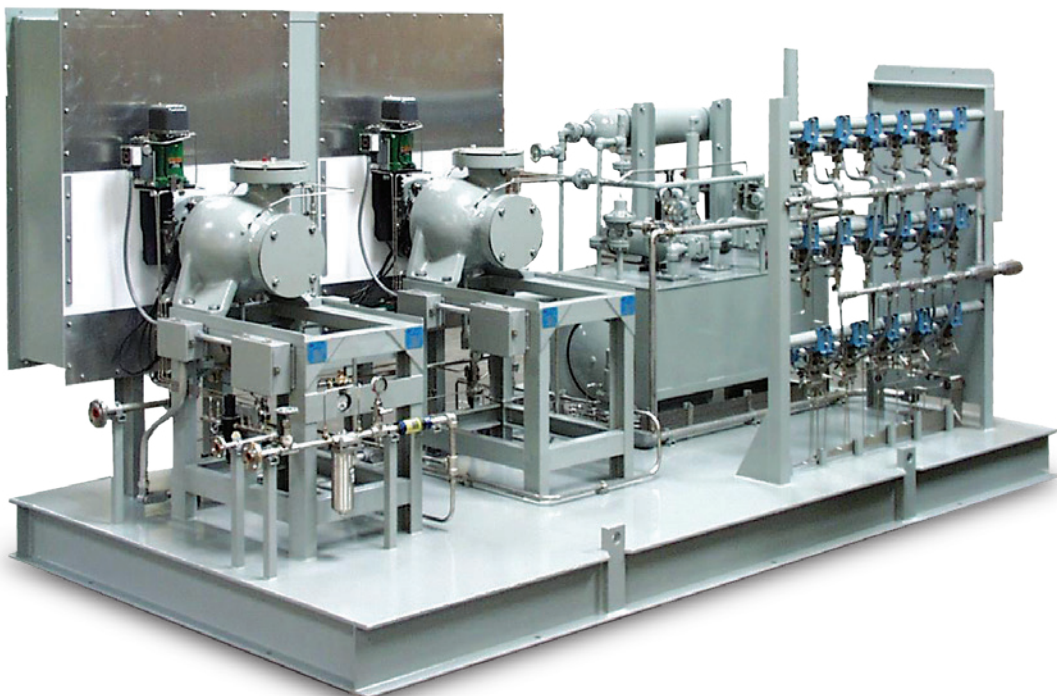
## Training Seminars

Nikkiso Cryogenic Services Centers offer an in-house comprehensive Pump and Turbo Expander Training, which provides training in theory, as well as hands-on experience. This training is generally offered twice a year (Spring & Fall) at each of our service facilities.

Our training courses are designed to improve the depth of knowledge for plant operators and maintenance technicians and to provide a more complete vision on the operation and maintenance of cryogenic equipment for industrial gas, LNG and clean energy fields.

The training programs provided by NCS team include:

- Introduction to basic air separation processes and liquefaction
- Theory of operation
- Design and construction
- Auxiliary systems and instrumentation
- Operation basic start up, operating procedures and safety precautions
- Maintenance – philosophy





# Marine Services

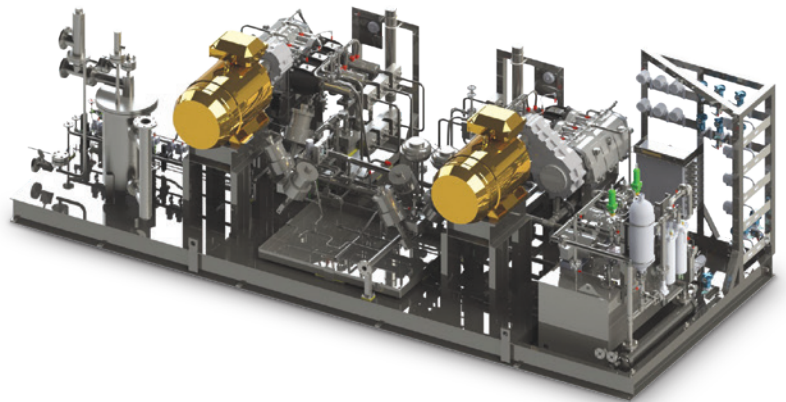
Marine service team is committed to maintain and service low pressure and high pressure fuel pumping systems. Our expertise extends past repairs and parts to include control systems, seal gas systems and lube oil upgrades.

Marine Services include:

- Commissioning
- Gas trials
- Sea trials
- On shore/off shore field service support
- Long term service agreements

Gas and Sea Trials include:

- Visual inspection and walk through of equipment
- Connection point and instrumentation verification
- Lube Oil (LO) system verification
- System valves verification
- Electrical motor alignment verification
- Pulley alignment and belt tension check
- VFD or HPU parameter and program verification
- Control unit check



# Cryogenic Process Systems Plant Services

With over 60 years of experience designing and building cryogenic process plants, Nikkiso Cryogenic Services companies can add value to your plant assets with services that maximize the investment return from your air separation plant or natural gas liquefier.

## Services Offered

- Process performance/efficiency evaluation and optimization
- Debottlenecking
- Equipment upgrades
  - NG pretreatment
  - Cooling systems
  - Compressors
  - Liquefiers/turboexpanders
- Control systems upgrades
- OPEX reduction
- Operator training
- On site services
- Remote troubleshooting and training reinforcement

## Expertise

- Cryogenic air separation plants
- Oxygen and nitrogen liquefiers
- Natural gas liquefiers

- Argon recovery
- Nitrogen expander refrigeration cycles
- Single Mixed Refrigerant (SMR) refrigerant cycles
- Amine wash and molecular sieves adsorption system
- Natural gas treatment systems
- Hydrocarbon separation
- Nitrogen rejection units for natural gas
- Boil off gas management systems
- Turboexpanders

We value the relationships that we have built for over 60 years in the industry and we are committed to ensuring that our customers are satisfied with their cryogenic equipment, whether it is a Nikkiso product or not. Our experts will work with your team to evaluate your challenge and provide solutions to repair, replace or improve your processes.

Our company has provided quality support dating back to the early Apollo missions, and we continue to serve industries such as aerospace, utilities, LNG merchants, major industrial gas suppliers, and owner operated industrial gas plants.





# Heat Exchanger Systems

A global leader in the engineered solutions and fabrication of cryogenic vaporizers and industrial gas equipment. Our capabilities span from cold boxes used to produce liquefied gases to the equipment that stores and vaporizes them.

Nikkiso Cryoquip has over 50 years' experience in the industry, providing technical expertise and factory support to our full line of engineered Heat Exchanger systems.

## Scheduled Tuning service

Whether used as a back up to an industrial gas pipeline, power generation fueling, primary process or peak shaving vaporizer, providing scheduled tuning and factory support of gas fired water bath vaporizers can help ensure your unit is meeting emissions requirements and performance.

## Field Evaluations

Cryogenic vaporizers are critical to operations requiring minimal to zero downtime, whether for back up supply or primary process vaporization. Age and operating conditions may require inspection and product support. We offer evaluations of in-service vaporizers, providing multi-point inspections to address issues before they become a problem – minimizing downtime and costs.

## Equipment Training – Educational Services

Learn more about the proper installation and operation of Nikkiso Cryoquip products and equipment through our customized training courses covering:

- Ambient vaporizers
- Natural gas fired vaporizers
- SF<sub>6</sub> equipment
- Steam heated vaporizers

## Field Service

Nikkiso's team of engineers, factory trained technicians and network support staff are available to help with:

- Burner tuning
- Preventive maintenance
- Equipment troubleshooting
- Start-up and commissioning
- Service plans and repairs
- ... and more



# All-Brand Support

Nikkiso Cryogenic Services support a full range of turbomachine parts, services, repairs and upgrades.

In addition to Nikkiso products, we specialize in repairing all cryogenic pumps and turbo expander equipment including cryogenic centrifugal and reciprocating pumps and equipment manufactured by J.C. Carter, CVI, Cryomach, CCI, Cosmodyne, CS&P, and Cryostar. NCS can supply all spare parts including wheels, inlet guide vanes, bearings and other components for expanders that are no longer being effectively serviced by OEMs. NCS will provide any and all services timely and reliably by the NCS team of field service technicians.

## Pumps

- ACD
- Nikkiso Cryo
- J.C. Carter
- Ebara
- Cosmodyne
- Cryostar
- Vanzetti
- CVI
- Cryomach
- CCI
- CS&P
- MAN

## Turbo Expanders

- ACD
- Air Liquide
- Atlas Copco
- Rotoflow
- Cryostar
- Texas Turbine
- LA Turbine





# Long-Term Service Agreements

A long term service plan should be straightforward and simple. No hidden costs, no confusing language or exceptions.

Our plans are designed to provide full transparency to parts costs. We also offer set service rate prices on field service work, as well as reduced rates on parts. So from day one through the contract's end your pricing will remain consistent. Improved costs, consistent forecasting.

NCS service plans offer on-time servicing by trained field service personnel, along with top quality genuine OEM pump and cartridge spare parts designed to ensure our equipment's top reliability and performance. Regularly scheduled maintenance will let you sleep better at night. We'll work with your team and schedule for your maximum convenience, and minimal disruption. Knowing your parts are being serviced routinely allows for worry-free operations, and more time for you to focus on other business, and providing a reduction of total cost of maintenance.

## Benefits

- Reduction of total maintenance cost
- Scheduled, regular service visits and preventative maintenance
- Protect your machinery with genuine OEM spare parts
- Priority assistance at short notice
- Dedicated inventory
- Eliminate on-site downtime
- Discounted field service rates
- Spare parts inventory management

To Learn more, contact our customer service team at [info@NikkisoCIService.com](mailto:info@NikkisoCIService.com).





# Global Reach

NCS provides service and support through a broad network of global facilities. Our worldwide coverage is provided by over 75 field service technicians from 20 global locations...and growing.

All 20 facilities offer a full line of services including oxygen cleaning, a pump exchange program, dedicated inventory, product training, field services and 24/7 customer support.

**CryoCanada**

Ontario, Canada

**CryoCanada**

Alberta, Canada

ACD, Cosmodyne, Cryoquip,  
Integrated Cryogenic Solutions,  
Nikkiso Cryogenic Services

Southern California

**Cryogenic Industries Inc.**

California (Headquarters)

**Nikkiso Cryo**

Las Vegas, NV

**NCS**

Houston, TX

**Cryoquip**

Houston, TX

**NCS**

Imperial, PA

**NCS**

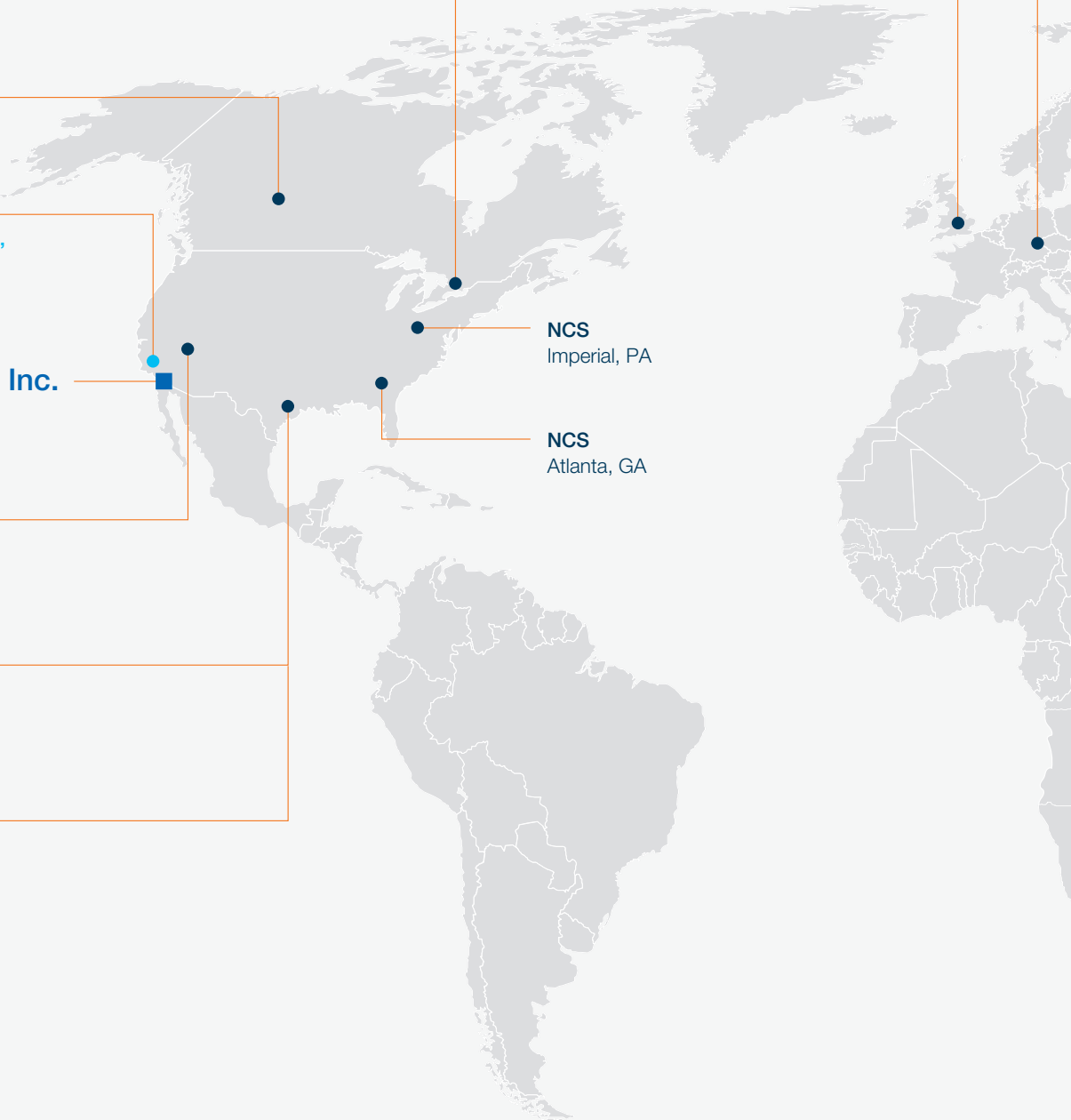
Atlanta, GA

**Nikkiso CE&IG GmbH**

Germany

**Cryoquip**

England





**Nikkiso CE&IG GmbH**  
Poland

**Nikkiso CE&IG GmbH**  
Finland

**Nikkiso CE&IG GmbH**  
Turkey

**Nikkiso Industrial**  
Russia

**Nikkiso CE&IG**  
Korea

**Nikkiso Co. Ltd.**  
Japan (Headquarters)

**Nikkiso**  
Miyazaki, Japan

**Taikkiso Co. Ltd.**  
Taiwan

**Cryogenic Industries/  
Cryoquip**  
China

**Nikkiso CE&IG (SEA)**  
Malaysia

**Cryoquip**  
Australia

**Nikkiso Cosmodyne**  
India

**Cryogenic Industries**  
UAE

**Cryogenic Industries**  
Egypt

# Safety

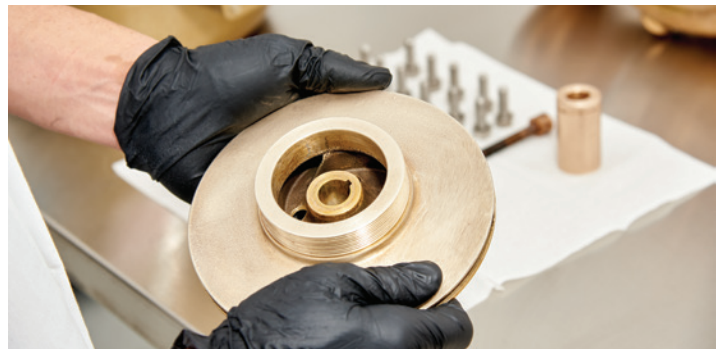
## Risk Assessment

Our Service Center procedures consists of a risk assessment which was created as a method to identify and assess hazards before any work begins. Proper controls are implemented to mitigate identified hazards. This risk assessment is also used to determine if a Safe Work Permit is required and what level of Personnel Protective Equipment (PPE) will be used.

The reason for our Service Center Procedure SOP-K200 is to conduct a risk assessment before any work begins to identify and assess hazards. Proper controls must be implemented to mitigate identified hazards. This risk assessment will also be used to determine if a Safe Work Permit is required and what level of Personnel Protective Equipment (PPE) will be used.

## Oxygen Cleaning

Each of the Nikkiso Service Companies strictly adhere to a CGA approved oxygen cleaning procedure for medical grade oxygen. In both the medical and industrial gas markets, each and every wetted pump component, whether used in oxygen service or not, is cleaned to specification. Throughout the repair process, ensuring the safety of your personnel and customers is a measure that must always be taken, without exception. It is a risk that must not be taken.





# Quality

## Clean Energy & Industrial Gases Group Quality Statement

Nikkiso's Clean Energy and Industrial Gases group is the global leader in providing innovative cryogenic and clean energy solutions, products, systems and services.

We are committed to a continuous improvement philosophy by focusing our entire organization on Safety, Customer Service, Operational Excellence, Technology Leadership and Quality.

### Safety Standards



Committed to setting standards for safety and excellence as one of the world's leading ship classification organizations, the American Bureau of Shipping (ABS) establishes the best solutions for the industries we serve, and is at the forefront of marine and offshore innovation.



LR is a leading international provider of classification, compliance and consultancy services to the marine and offshore industries, helping our clients design, construct and operate their assets to the highest levels of safety and performance.



Bureau Veritas develops rules, rule notes and guidance notes to benefit our clients, partners, and the marine industry overall. We use the vast experience of our engineers, gained through years of service in the marine industry, combined with advanced research into structure and hydrodynamics, to ensure development of the most relevant and up-to-date rules.



IECEx and ATEX equipment certification from SGS – meet legal requirements for products used in explosive atmospheres.



DNV GL is the world's leading classification society and a recognized advisor for the maritime industry. We enhance safety, quality, energy efficiency and environmental performance of the global shipping industry—across all vessel types and offshore structures.



Over a million companies benefit from a quality management system certified according to ISO 9001, enjoying peak process performance and an international competitive advantage. ISO 9001 certification ensures that quality orientation is lived by each of your employees every day.

## Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. **01 100 041395**

Certificate Holder:

**NIKKISO**  
ACD  
**ACD CRYO GmbH**  
Rheinauenstr. 2  
79415 Bad Bellingen  
Germany

Scope:

Manufacturing, Sales and Service  
of Cryogenic Pumps and Systems

Proof has been furnished by means of an audit that  
the requirements of ISO 9001:2015 are met.

Validity:

The certificate is valid from 2019-12-17 until 2022-12-16.  
First certification 2004

2019-10-21

*T. K. K.*  
TÜV Rheinland Cert GmbH  
Am Grauen Stein · 51105 Köln

**Cryogenic Industries, Inc.**

27710 Jefferson Avenue, Ste. 301  
Temecula, CA 92590  
USA  
Tel: +1.951.677.2081  
Fax: +1.951.698.7484  
info@cryoind.com

**Cryogenic Industries Service Companies, LLC**

1851 Kaiser Avenue  
Irvine, CA 92614  
USA  
Tel: +1.714.568.0201  
Fax: +1.714.641.1921  
service@NikkisoCIService.com

**ACD, LLC**

2321 S. Pullman Street  
Santa Ana, CA 92705  
USA  
Tel: +1.949.261.7533  
Fax: +1.949.261.6285  
acd@acdllc.com

**Cosmodyne, LLC**

3010 Old Ranch Parkway, Ste. 300  
Seal Beach, CA 90740  
USA  
Tel: +1.562.795.5990  
Fax: +1.562.795.5998  
info@cosmodyne.com

**Cryoquip, LLC**

25720 Jefferson Avenue  
Murrieta, CA 92562  
USA  
Tel: +1.951.677.2060  
Fax: +1.951.677.2066  
sales.us@cryoquip.com

**Nikkiso Cryo, Inc.**

4705 Copper Sage Street  
Las Vegas, NV 89115  
USA  
Tel: +1.702. 643.4900  
Fax: +1.702.643.0391  
info@nikkisocryo.com

**Integrated Cryogenic Solutions**

2835 Progress Place  
Escondido, CA 92029  
USA  
Tel: +1.760.233.9880  
Fax: +1.702.643.0391  
info@nikkisosolutions.com