

Air Compressors and Dryers Systems

Air Compressors

CSI is the global leader for air compressor products. In addition to standard air compressor equipment, we are equipped with the expertise to design and manufacture customised equipment. Depending on the customer's requirements, CSI can fabricate the complete package and ship directly to the job site fully assembled, or assemble in place at a specified location.

Electric Motor Driven Compressors

The size of instrument and process air units range between 37kW to 350 kW, with individual output flow capacity between 200CFM to 1000CFM at 8 Bar to 14 Bar.

Our comprehensive range of compressor includes:

- Oil Free Screw Compressor
- Oil Injected Screw Compressor

Diesel Engine Driven Compressors

Our diesel engine driven compressors range between 55kW to 403 kW, with individual output flow capacity between 200CFM to 1600CFM at 6.9 to 13.8 bar.

Reciprocating Compressors

Our reciprocating start-up air compressor units range from 2.2KW to 75 KW. Starting modes may be electric or diesel engine driven at the outlet flow, between 6 ~ 300 CFM. Discharge pressure ranges from 10 ~ 30 barg each.

The start-up air compressors could be skid mounted with the following options available:

- Built in star/delta starter
- Built in horizontal air receiver
- Oil Lubricated or Oil Free type



Air Compressors and Dryers Systems

Dryers

CSI provides customer with a wide range of superior products in compressed air treatment. These dryers can be customised to most offshore stringent specification that include:

- Explosion proof according to IEC or NEMA standard (Zone 1/2 or Class 1 DIV 1 or 2).
- Carbon Steel or SS316 material in accordance to ASME VIII DIV 1 or PED Design.
- Skid mounted with interconnecting pipe work according to the customer's P&ID.
- Panel in SS316 or copper free aluminium material in ATEX/IECEX or NEMA Standard.

Our team of experience & dedicated engineers has established a proven track record in supplying:

Desiccant Dryers

Heatless Regenerative Desiccant Dryers are common in offshore operations and it is one of the reliable ways of achieving pressure dew point at -40°C by continuously drying compressed air through two identical towers, each containing the desiccant bed. While one tower is drying, the other is being regenerated. The drying and regenerating process that is continuously in contact with the wet compressed air will supply dry compressed air at the downstream of the dryers.

Heated Dryers

Heated purge regenerative dryers are common in FPSO with Marine Class certification. It applies the same working principle as heatless dryer with additional heater and blower installed. The blower draws in ambient air which is heated. The heated air flows through the desiccant bed where moisture is absorbed by the desiccant, and desorbed water is carried out of the dryer.

Membrane Dryers

Membrane dryers are originated from the nitrogen generation industry where they have been successfully used for decades. A tube is filled with hollow membranes that allow compressed air to pass but remove water vapour. The benefit of these dryers give a -40°C dewpoint and have no moving parts and require no maintenance, and therefore have a very long life span.

Refrigerant Dryers

Refrigerated air dryers provide a dew point of $3 \sim 5^{\circ}\text{C}$ which is suitable for most indoor processes. These dryers are available from 15 to 5,000 SCFM, and in premium efficient cycling, or standard efficiency non-cycling configurations.

Applications:

- Marine Industry
- Petroleum & Chemical industry
- Metallurgy
- Paint-and-varnish industry
- Pharmaceutical industry etc

Others option:

- PLC with or without HMI
- Safe or hazardous area
- Third Party Inspection / Certification
- Other customer requirements



Nitrogen Generator Systems

Beside the Air Compressors and Dryer Skid, CSI is in the unique position to supply both offshore and onshore facilities for Nitrogen Generator Systems. We are capable to provide a proven custom design systems with pressure, flow and size to meet all third party and customer requirements.

CSI is able to provide the air separation technology in form of

- **PSA (Pressure Swing Adsorption)**
- **Nitrogen Membrane Technology**

PSA (Pressure Swing Adsorption)

Using the Carbon Molecular Sieve (CMS) technology, the PSA system is able to produce high-purity nitrogen from air of up to 99.9995% purity which membrane systems are unable to provide. Although cryogenic systems are able to produce such high purity levels as well, they are considerably more complex and justified only by large consumption volumes.

Nitrogen Membrane Technology

Membrane technology will be the best solution when the size and weight becomes an issue with flow and pressure taken into consideration. The membrane technology is able to produce nitrogen purity up to 99.9% purity.

By substituting out-of-date air separation plants, nitrogen production savings largely exceed 50%. The net cost of nitrogen produced by nitrogen generators is 20 to 30 times less than the cost of bottled or liquefied nitrogen.

Nitrogen Booster Compressor

Where required, CSI also provides custom-built Nitrogen Booster Compressor to boost up N2 pressure for facility usage or filling of nitrogen bottles for backup. Options of oil free or oil injected booster compressor are available to boost up N2 pressure till 200 Barg or more. N2 bottle racks for filling are also available as part of our offer.

Applications:

- Marine Industry
- Petroleum & Chemical industry
- Metallurgy
- Paint-and-varnish industry
- Pharmaceutical industry
- Glass industry etc

Other option:

- PLC with or without HMI
- Oxygen Analyser or Transmitters
- Safe or hazardous area
- Heater or without heater
- Other customer requirements



Flow Metering Systems

Together with our business partner and principal of Krohne Oil & Gas, CSI supplies complete flow metering system solutions for custody transfer oil and gas projects throughout the world. The innovative and proven metering systems are based on advanced technologies. Our engineered metering solutions are based on the latest technologies in line with the application and operational requirements and in accordance with international standards.

From Upstream to Downstream

We deliver flow metering systems for offshore and onshore locations, from platforms and FPSO's, to and off loading facilities and terminals and for pipeline operations and refineries. Metering systems have been designed for crude oil and hydrocarbon products such as condensate, LPG, lubricants, fuel oil, kerosene, naphtha and for natural gas applications.

Liquid and Gas Metering Systems

As part of the package, we provide turnkey flow metering systems including:

- Fully integrated metering skids.
- Flow meters (Ultrasonic, Coriolis mass, etc).
- Valves and piping.
- Instrumentation (Temperature, pressure, etc).
- Metering houses with Sampling systems / Analyzer systems.
- Density, viscosity.
- Gas composition.
- Supervisory and flow computer systems including flow computers, control panels and customer interfaces.
- Validation systems.
- Meter Prover Systems (for liquid applications).



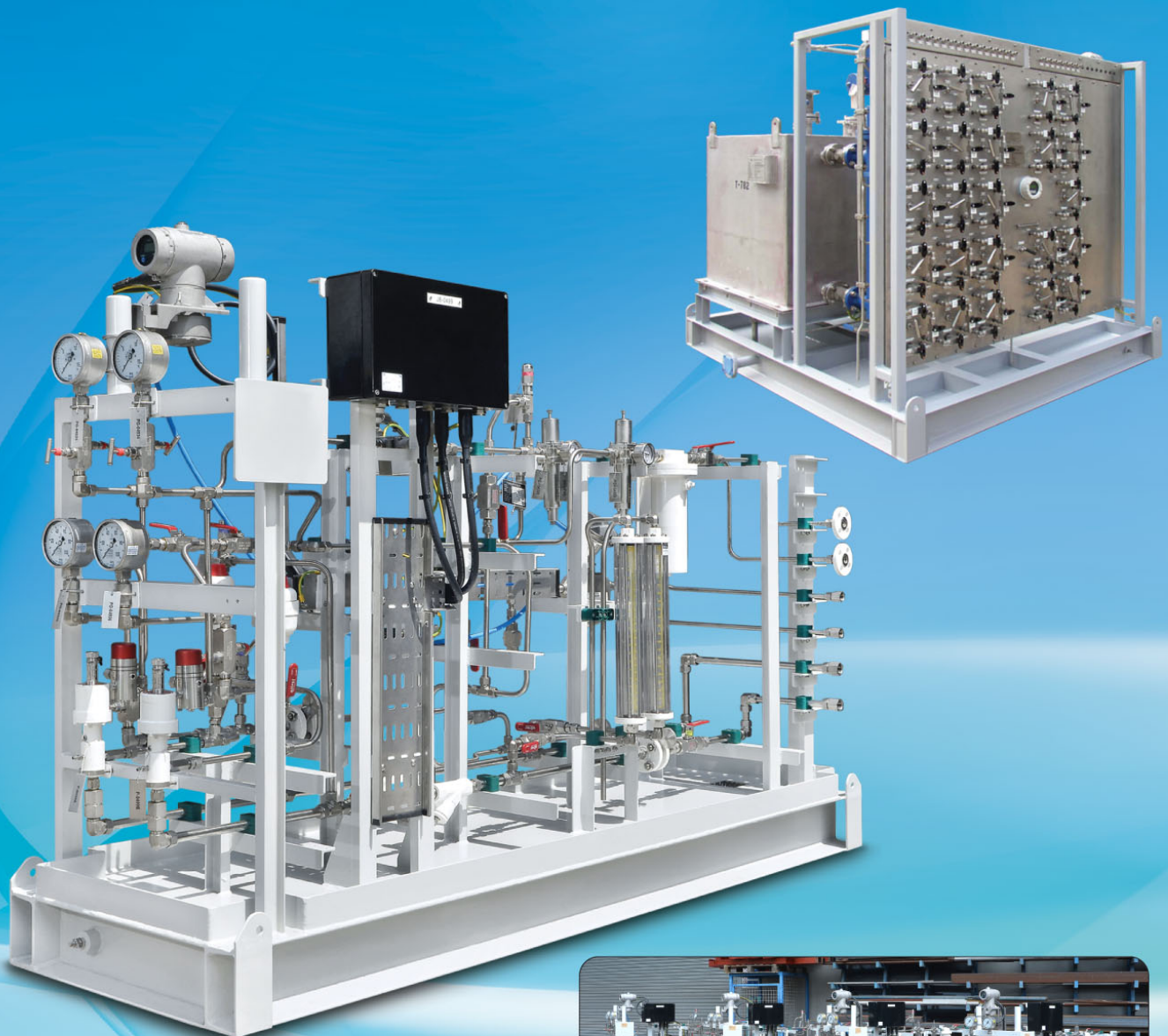
Chemical Injection and Injection Rate Control Systems



Chemical Injection System

CSI offers Chemical Injection Package that range from single stage pump package to multi-point injection system, whether it is electrical, air or gas driven. Features can include local or remote operation. Local or remote alarms, with option of variable speed or stroke control to vary injection or dosing rate in proportion to the main flow stream. The pumps and compartment tanks in stainless steel or other materials can be installed in a single skid fitted with level transmitters, alarms and other monitoring devices.

The packages are designed and built in accordance with the applicable industry standards, including ANSI, API, ASME and IEC. All packages are tested to client's requirements before being released for shipment.



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IRCD (Individual Rate Control Devices)

The IRCD is a unique system for multi-injection of chemicals into oil & gas production systems. It can be supplied as individual units or in a panel configuration. They require high pressure feed line from either an air or electric driven chemical injection pump. CSI's IRCD is capable of handling flow rates as low as 20 ml/hr and up to 5,000 LPH with injection pressures up to 15,000 psi.

Industry Standards

- Vessels Code Stamped ASME Section VIII & National Board Registered
- Single or compartmental tanks API 650 / Roarks formula
- Piping Designed to ANSI B31.1/ANSI B31.3
- Pipe Fabrication to ASME Section IX
- Structural Steel Assembly Designed to AWS D1.1

Standard Features

- Multi-Point Injection of Chemicals by:
 - Individual Metering Pumps
 - Multi-Headed Metering Pumps
 - Injection Rate Control Device (IRCD) with Metering Pump or Fixed Stroke Pump
- API 675 Metering Pumps & API 674 Reciprocating Pumps with:
 - Packed Plunger Fluid End
 - Single Diaphragm Fluid End
 - Double Diaphragm Fluid End with Leak Detection
- Reciprocating Pumps with:
 - Packed Plunger Fluid End
 - Single Diaphragm Fluid End
- Electric Motor or Gas/Air Driven Pumps
- Instrumentation with HART or Fieldbus Communication
- Materials of Construction:
 - Carbon Steel
 - 316SS
 - Alloy 20
 - Non-Metallic (PVC, Fiberglass)
- Complete Function Test

Optional Features

- Rack Mounted Bulkhead Controls for Ease in Operator Interface.
- NEMA or IEC Rated Enclosures and Components for Class 1, Div.1 or Div.2 Hazardous Areas, Zone 1 or Zone 2 to ATEX Directives.
- PLC Control System with Data Highway.
- IEC/UL/CSA Listed Control Panel Assembly.
- Class 1, Div. 2 Hazardous Locations.
- Third Party Inspection by ABS, Lloyd's and DNV Structural Analysis.
- Installation/Training/Start-Up Supervision.

Testing

Each system undergoes a series of tests prior to delivery. Common requirements are non-destructive testing (NDT) of pipe welds and skids, hydrostatic testing of the pipe work and tank leak test. Finally package function test will be performed.

Documentation

All Chemical Injection systems provided by CSI are fully documented with operating and maintenance manuals.

After Sales Service and Commissioning

CSI's team of qualified and experienced field service engineer is ready to commission the systems, provide maintenance and training for end users.

Fuel Gas Conditioning Systems

CSI offers complete Fuel Gas Conditioning Package that includes a combination of all/or either following equipment:

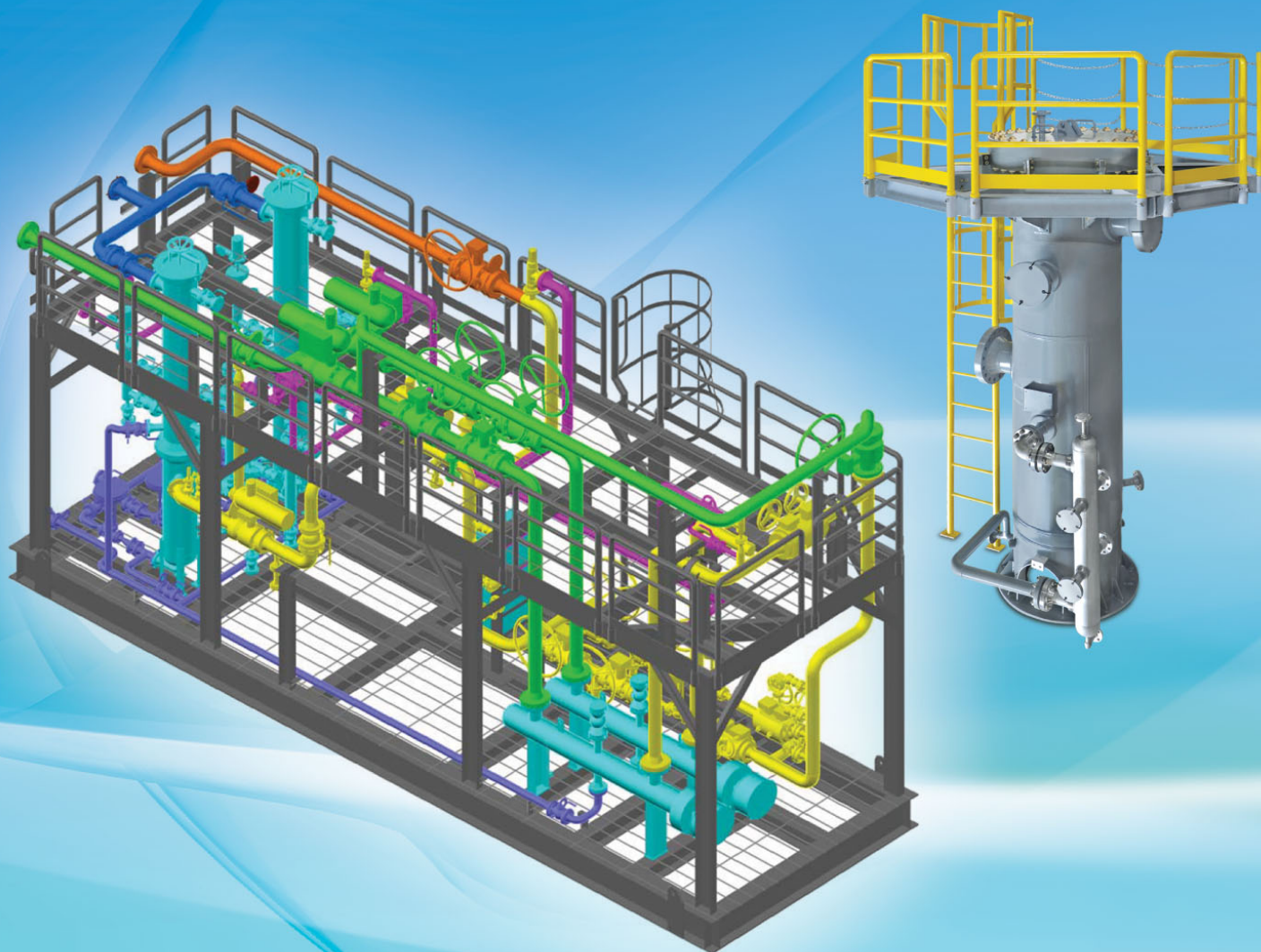
- Fuel gas scrubber & pre filters/after filters
- Fuel gas electric super heater
- Fuel gas pre cooler

Our services provide complete design, integration of the equipment, including valves, instrumentation and control systems and interconnecting piping. Where applicable, simulation function test can be performed prior to shipment.

Our scrubbers offered guarantee efficiency of 100% removal of liquid droplets 8-10 μ m or larger. Our filters offered guarantee efficiency of 99.98 % removal of liquid/solids 3 μ m or larger. The vessels for the equipment are designed as per ASME code/European code based on client requirements.

Applications:

Fuel gas conditioning systems protect gas-fuelled engines and turbines from over-pressure, liquids, solids and aerosols. The treated gas can also be used as seal gas, blanketing gas or utility gas. The fuel gas is superheated above the hydrocarbon to prevent liquid condensation in the turbine's combustion chambers.



Portable / Emergency Diesel Generators

Together with our associates, CSI has the capability to provide turnkey solutions for power supply, be it for continuous, standby or emergency power applications. Our Zone 2 Diesel Generator sets are tailored to suit customer's requirements. The equipment offered meets the requirements of ATEX Directive 94/9/EC equipment and protective systems. The generator set and accessories are integrated on a skid with a provision of fork-lift pockets (for smaller units) and certified lifting equipment for ease of transportation.

Our product includes the following but not limited to:

- Hazardous Area Diesel Engine protection package.
 - Air intake shut off valve, including integral flame arrestor.
 - Exhaust outlet spark arrestor
 - Exhaust flame arrestor
- Zone 2 approved Ex n alternator.
- Ex d control panel complete with control systems with options for manual start, remote stop and Emergency Shut Down.
- Ex d Power and Control Socket terminal outlets.
- Fuel Tank with a capacity dictated by client's requirement on the running hours.
- Weatherproof acoustic enclosure.
- Options for the following Start system.
 - Spring
 - Electric
 - Hydraulic
 - Pneumatic



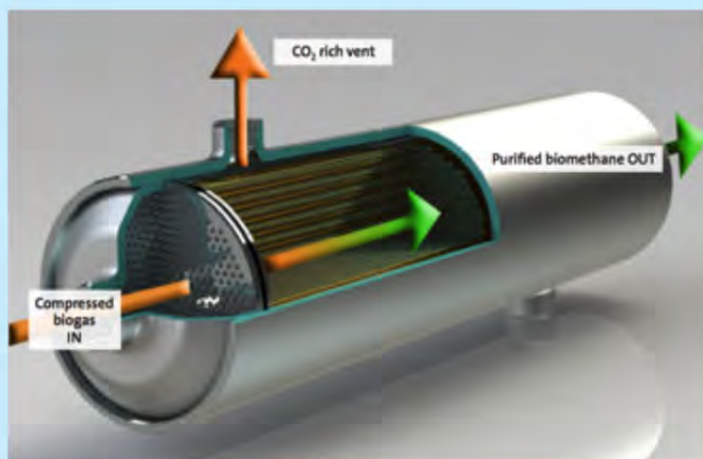
CO₂ Removal Systems

CSI works closely with our associates to develop the CO₂ removal system using membrane technology. It will remove CO₂ & water vapour from the feed gas. The membrane system is a tried and accepted natural gas treating technology with distinct advantages in a variety of processing applications. The membranes have become an established technology for carbon dioxide (CO₂) removal since 1981.

System Performance is per below :

- > 90-95% removal of CO₂
- < 2-5% CO₂ content in product gas
- Purity ranging from 90-97%

PRISM Membrane biogas separators contain thousands of tiny hollow fibers. Some gas molecules, like carbon dioxide and water vapor, permeate through the membrane walls while other molecules like methane are transported the length of the fibers and exit from the end of the separator.



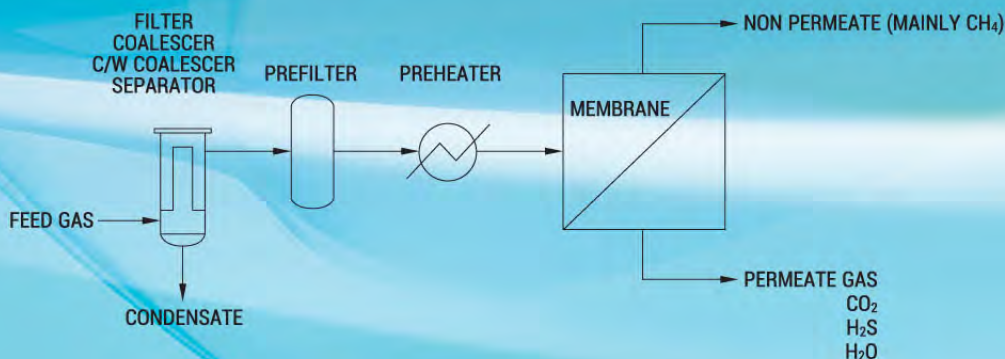
To improve the performance of the CO₂ membrane, the system includes pre-treatment which has separators to remove the condensation/oil content from the hydrocarbon gas, coalescing filters to remove solid particulate, particulate filters to remove dust, and heaters to provide uniform gas temperature. The vessels for the equipment are designed according to ASME code/European code based on client requirements.

Our CO₂ Removal Systems will be custom built to suit the customer requirements.

Applications:

- Pipeline gas applications
- Biogas or digester gas
- Fuel gas conditioning
- Methanol cracking
- Methanol Production
- Bulk removal upstream of an amine plant

Typical Flow Scheme for CO₂ Removal System



Other Mechanical and Process Skids

CSI designs and manufacture other range of Mechanical and Process packages for the Oil & Gas industry.

Some of our popular packages include as follows:

- Closed and Open Drain Pump Skid
- Deoiling and Desander Skid
- Pressure Reducing Station Skid
- Filtration Skids
- Static API Tanks & ASME Pressure Vessels
- Shell & Tube Heat Exchangers

