CECO Peerless



PROVEN SOLUTIONS FOR THE GAS PROCESSING AND TRANSMISSION INDUSTRY

CECO ENVIRONMENTAL

WITH OVER 80 OF YEARS EXPERIENCE, CECO PEERLESS IS THE GLOBAL LEADER IN SEPARATION TECHNOLOGIES FOR THE OIL, GAS AND PETROCHEMICAL MARKETS.

Offering systems for both onshore and offshore applications, CECO Peerless designs and supplies a wide range of compact, engineered, high-efficiency, processing, separation and filtration equipment for the global oil and gas industry.

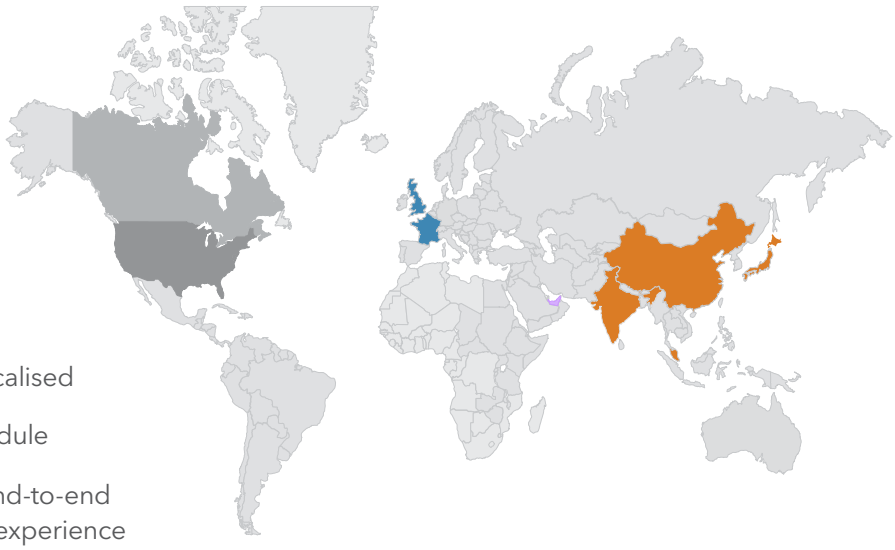
CECO ENVIRONMENTAL



CECO Environmental's energy solutions include leading technologies such as CECO Peerless separation and filtration, Burgess Manning oil and gas processing technologies and Skimovex oily water separation.

Key CECO Peerless Facts

- Over 80 years of experience
- 1000s of successful installations and millions of hours of engineering excellence
- Experienced in technology, process, engineering and turnkey solutions
- Expertise from concept through commissioning stages
- Worldwide delivery capability and vast network of local/regional/global partners
- Global presence, multi-cultural teams with localised approach to attain clean, safe, efficient and sustainable solutions within budget and schedule



CECO Peerless provides you with the seamless end-to-end solution. We combine our technologies, process experience and R&D with our multi-disciplined engineering experience to give you every advantage:

- Concept/FEED studies
- Detailed engineering
- Engineered packages
- Modular/skid design and supply
- Turnkey solutions for EPF/CPF/topsides
- Fast track delivery
- Achieve overall performance
- Customer satisfaction
- After sales service



GAS INDUSTRY SOLUTIONS

FROM EXTRACTION THROUGH DELIVERY AND PROCESSING CECO PEERLESS SUPPLIES A WIDE RANGE OF COMPACT, ENGINEERED, HIGH-EFFICIENCY, PROCESSING, SEPARATION AND FILTRATION FOR THE GAS INDUSTRY.

VANE SEPARATORS

Gas vane separators use the principles of momentum, gravity and coalescing to deliver high-efficiency, high-capacity, and low-cost gas and liquid separation with low pressure drop and high turndown. Vane separators provide liquid removal with smaller vessels, which results in lower initial cost, space savings, and minimal maintenance requirements.

CECO Peerless brand vane separators are used for slug removal applications and small footprint installations in:

- Natural gas compression
- Refineries
- Power
- Industrial steam
- Industrial gas compression
- Air separation
- Petrochemical
- Chemical production (e.g.,methanol)
- Liquefied natural gas (LNG) production
- Plastic production
- Fertilizer production



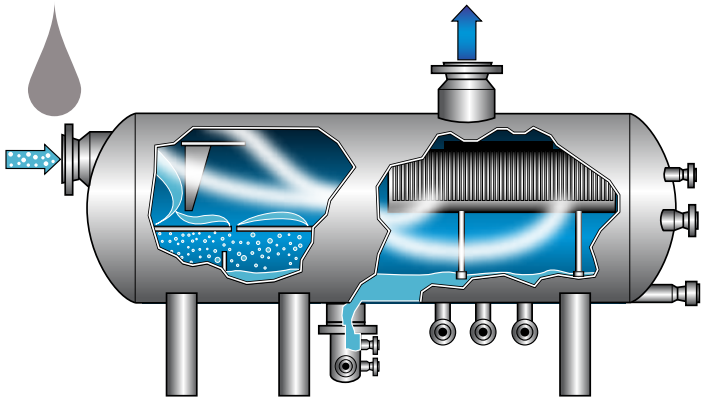


HORIZONTAL GAS SEPARATORS

CECO Peerless single-barrel separators serve effectively as liquid slug-catchers and perform especially well in 3-phase applications.

SINGLE-BARREL GAS SEPARATORS

Single-barrel separators are designed to provide efficient liquid removal at high gas flow capacities. They effectively handle large liquid slugs and are easily applied to 3-phase separation.



Benefits:

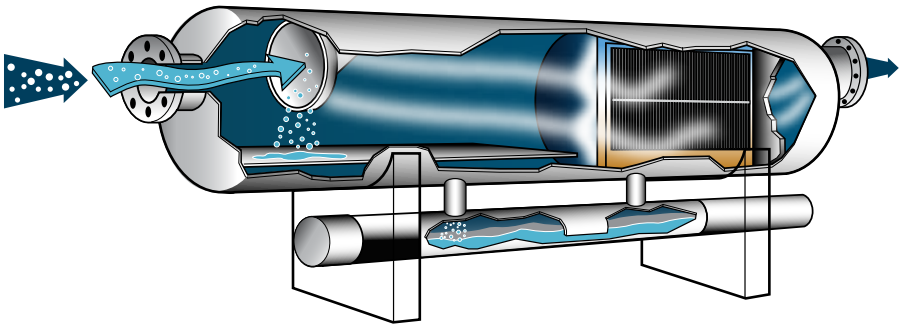
- High efficiency liquid removal
- Wide liquid handling operating range, including slug
- Extremely high gas throughput
- Customized for 3-phase flow applications
- Large liquid retention volume

THREE-PHASE PRODUCTION AND TEST SEPARATORS

Double-barrel separators are designed to provide efficient liquid removal. Additionally, they can achieve higher gas-flow capacities through the longitudinal arrangement of separation elements in the upper barrel. The lower barrel gets the separated liquid away from the gas flowing in the upper barrel, thus eliminating re-entrainment. Additionally, the lower barrel acts as a retention chamber that provides residence time for gas bubbles to emerge from the liquid.

Benefits:

- High-efficiency liquid slug removal
- No liquid re-entrainment
- Extremely high gas throughput
- Lower barrel acts as a quiet retention chamber



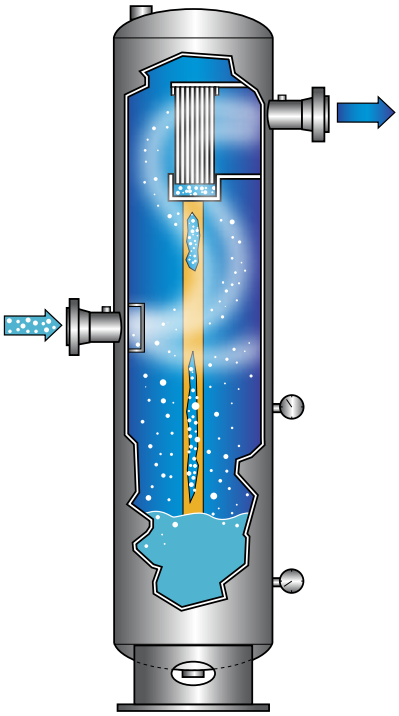
VERTICAL GAS SEPARATORS

CECO Peerless vertical gas separators are designed to handle both high and low liquid-to-gas ratios. They are especially recommended for applications where heavy liquid entrainment causes a slugging problem. CECO Peerless proprietary devices provide smaller vessel configurations when compared to mesh-pad or other separation devices.

Benefits:

- High-efficiency liquid removal from gas streams
- Broad operating range
- Effective slug removal
- Minimal footprint
- High and low liquid gas ratios compatibility
- Available as a retrofit to existing vertical separators



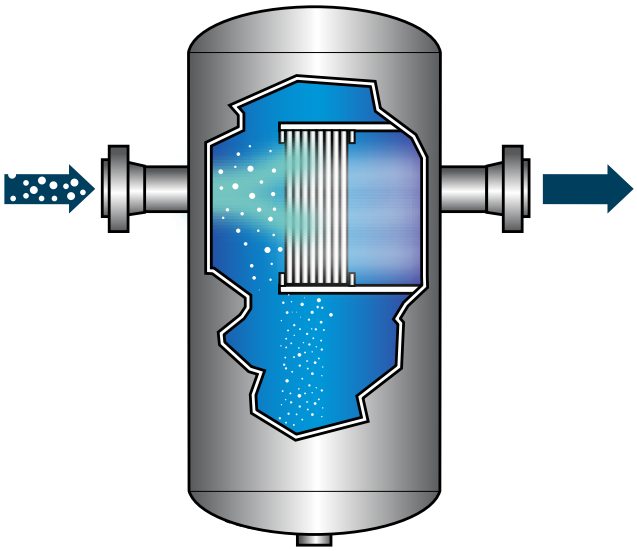


LINE SEPARATORS

For applications where space is at a premium and piping limitations prevent the use of a straight-through line separator, CECO Peerless line separators are designed with several nozzle configurations. Internal baffling permits nearly any combination of inlet and outlet connection locations.

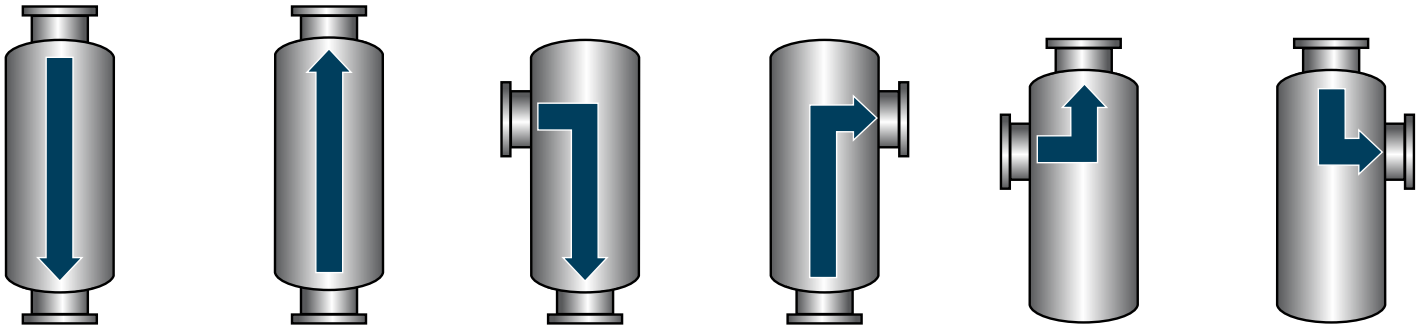
Benefits:

- Efficient removal of liquids from gas streams
- Ideal for limited space installations
- Negligible pressure drop
- Wide range of gas capacities and pressure ratings
- Custom designs



CUSTOM-DESIGNED VARI-LINE™ SEPARATORS

For applications where space is at a premium and piping limitations prevent the use of a straight-through line separator, CECO Peerless VARI-LINE Separators are designed with several nozzle configurations. Internal baffling permits nearly any combination of inlet and outlet connection locations.



GAS TREATMENT

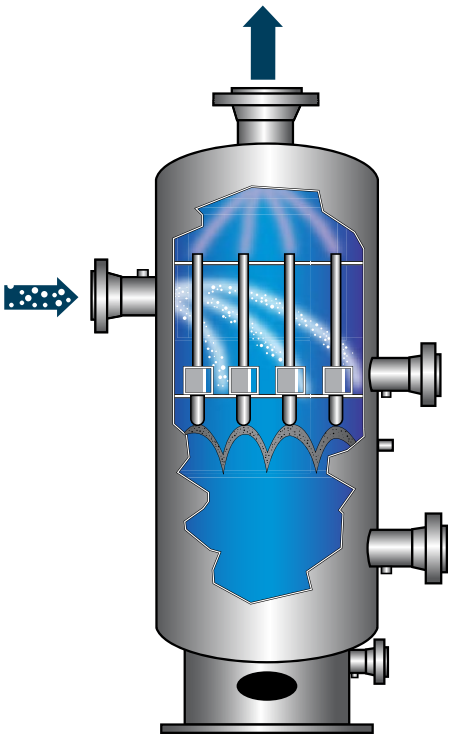
CYCLONES

For high-efficiency separation of liquid and solid contaminants at low cost, CECO Peerless offers both centrifigal and inertial cyclones in horizontal and vertical configurations to fit your application.

MULTI-CYCLONE SCRUBBER

Multi-cyclone scrubbers use centrifugal force to effectively remove solid particles and liquids from gas without moving parts. CECO Peerless multi-cyclone scrubbers are constructed to resist many years of abrasive wear and be rugged enough to withstand a wide variety of gas stream applications. In erosive gas applications, the critical parts of CECO Peerless cyclone tubes may be constructed of erosion-resistant steel alloys.

Peerless Multi-Cyclone Scrubbers require no maintenance and have a comparatively low initial cost. Vertical and horizontal configurations are available.



Applications:

- Distribution systems
- Mainline transmission stations
- Industrial process applications
- Gas gathering systems
- Petrochemical plants
- Slug catching
- Absorption processes
- Recip compressor protection

Benefits:

- High-efficiency removal of entrained liquid
- Maintenance free
- Increased liquid handling
- No moving parts

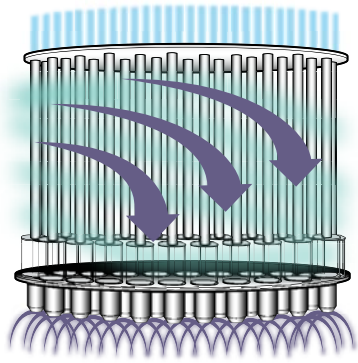
Performance Guarantee:

Solids removal efficiencies:

- 100% of 8-micron particles
- 99% of 6- to 8-micron particles
- 90% of 4- to 6-micron particles
- 85% of 2- to 4-micron particles

Liquid removal efficiencies:

- Outlet gas will contain less than 0.10 gallon of entrained liquid per million standard cubic feet of gas passed through the separator
- 100% of all droplets 8-microns in diameter and larger



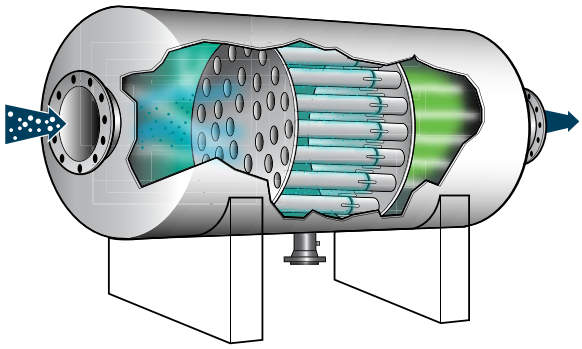
CECO Peerless uses multiple, small-diameter cyclones arranged in parallel to achieve separation of small and large size particles. Depending upon the application, a bank of cyclones my contain as many as 200. Selection of 2" or 4" diameter cyclones will depend upon the system gas flow rate.

GAS TREATMENT

SWIRL CYCLONES

CECO Peerless swirl tube separators provide superior performance across an array of applications including condensate removal from gas streams, entrainment removal following a distillation or absorption process, and removal of liquid from inter-stage and final discharge stages in reciprocating compressors.

An aerodynamically designed helicoid maximizes the inertial force utilized to remove entrained liquids. The two-stage liquid extraction system with a gas recycle stream is designed to maximize the liquid handling requirements of this unique system. It is the key to high-efficiency, low-cost separation.



Applications:

- Distribution systems
- Mainline transmission stations
- Industrial process applications
- Gas gathering systems
- Petrochemical plants
- Slug catching
- Absorption processes
- Recip compressor protection

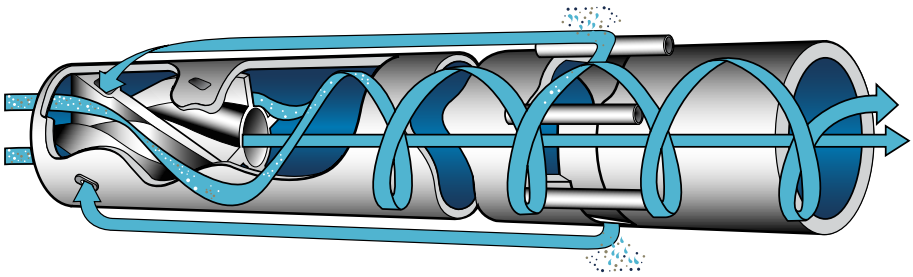
Benefits:

- High-efficiency removal of entrained liquid
- Maintenance free
- Increased liquid handling
- No moving parts

Performance Guarantee:

Liquid removal efficiencies:

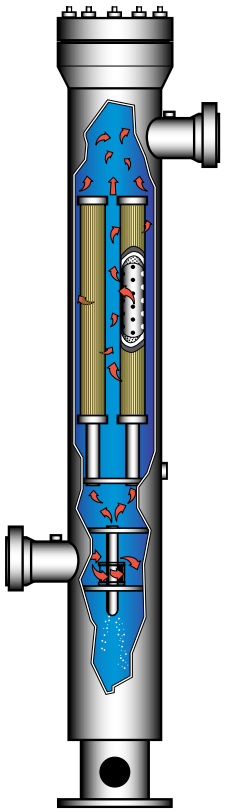
- Outlet gas will contain less than 0.10 gallon of entrained liquid per million standard cubic feet of gas passed through the separator
- 100% of all droplets 8-microns in diameter and larger
- 99% of 4- to 6-micron droplets
- 98% of 2- to 4-micron droplets



Swirl Tubes can be installed in either vertical or horizontal configurations without affecting the performance of the system.

ABSOLUTE COALESCERS

The CECO Peerless absolute separator is a single- or multi-stage device. At the inlet of the primary separation section, small diameter cyclones or vanes remove liquid and solid particles by utilizing the dynamics of centrifugal force and gravity. By removing the bulk of the entrained liquid in this stage, the CECO Peerless design increases the life of the high-efficiency coalescing elements and holds the pressure drop buildup to a minimum. This process allows for more time between changing the elements, reducing operating costs and downtime.



Replacement of the coalescer elements can be accomplished in a minimum amount of time and effort through the use of a full diameter closure. Both cyclone or vane mist extractor separators are completely maintenance-free, self-cleaning and contain no replacement or moving parts to cause a shutdown.

Applications:

- Ammonia and urea plants
- Chemical plants
- Critical gas processes
- Desiccant bed protection
- Fuel gas conditioning
- Gas transmission/metering
- Molecular sieve protection
- Oil mist removal
- Power plants

PRINCIPLE OF OPERATION:

CYCLONE TUBE

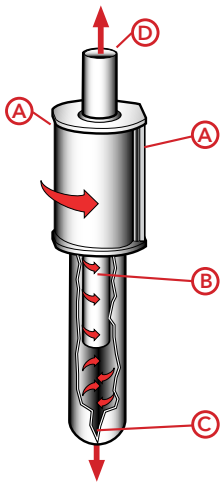
As the mist- and solid-laden gas enters the primary separation section of the vessel, the entrained liquids and solid particles are subjected to centrifugal force.

A. Dirty gas enters the cyclone tube tangentially at two locations.

B. The tube housing forces the gas into a cyclonic flow pattern. Centrifugal force throws solids and liquids against inner cyclone tube wall.

C. Solid and liquid particles drain down the cyclone tube walls and collect at bottom.

D. Clean gas flows down and then up through the center annulus and exits at the top.



VANE ELEMENT

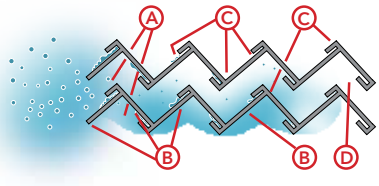
In applications where solid particles are not a factor, vane mist extractors are used as the primary separator.

A. Contaminated gas entering the vane unit is directed into adjacent vertical channels where each one subjects the gas to rapid multiple changes in direction.

B. Inertial forces resulting from rapid direction change force liquid droplets against vane walls. Liquid droplets coalesce on the vane wall surface.

C. Gravity, surface tension, and momentum drive coalesced liquid into the vane pockets. Liquid flows down the pockets and collects in liquid reservoir.

D. Clean gas exits the tail end of the vane pack.



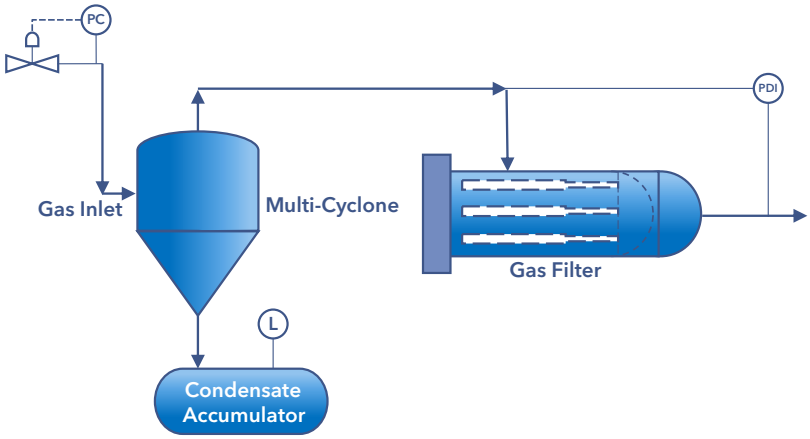
BLACK POWDER

For higher solids and liquids loading requirements, CECO Peerless upstream cyclonic separators offer high-efficiency black powder removal and long filter service life.

CECO Peerless multi cyclones are non-plugging and provide enhanced separation over prior generation mono and internal free cyclone designs. This higher efficiency means down stream filters last longer, reducing owners opex.

1st stage multi-cyclone separator:

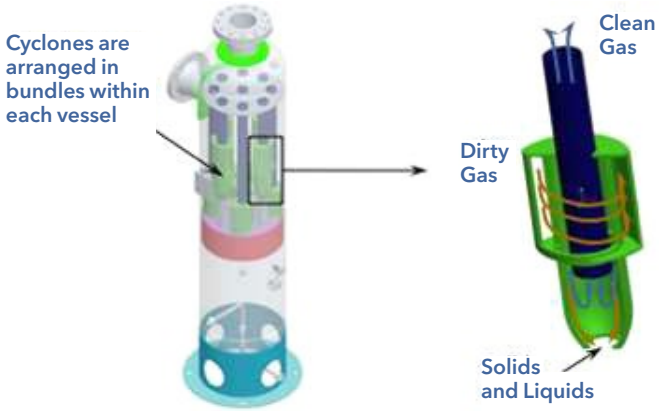
- 100% of all solid particles 8 or more microns in diameter
- 99% by mass of incoming solid/liquid particles with diameters in range 6 to 8 microns
- 90% by mass of incoming solid/liquid particles with diameters in range 4 to 6 microns
- 85% by mass of incoming solid/liquid particles with diameters in range 2 to 4 microns

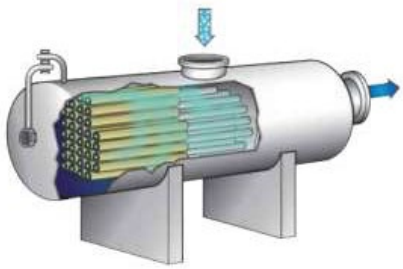


2nd stage gas filter:

- 100% of all solid particles 1 micron and larger in diameter
- 99% for all solid particles 0.5 to 1 micron in size in diameter





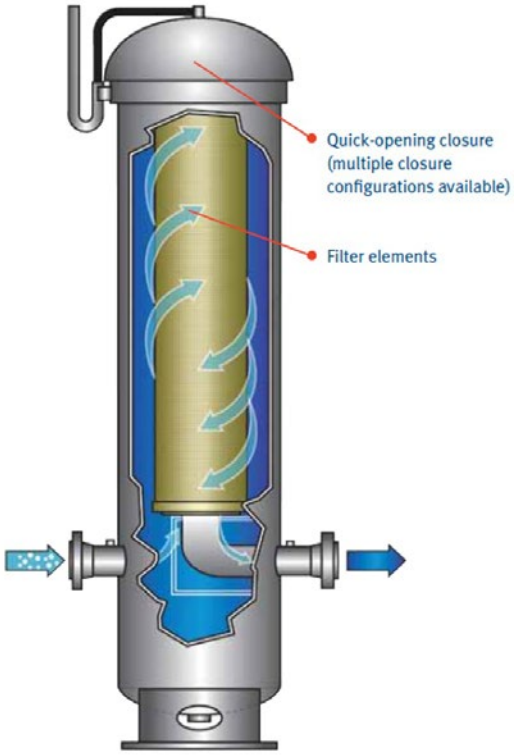


GAS FILTERS

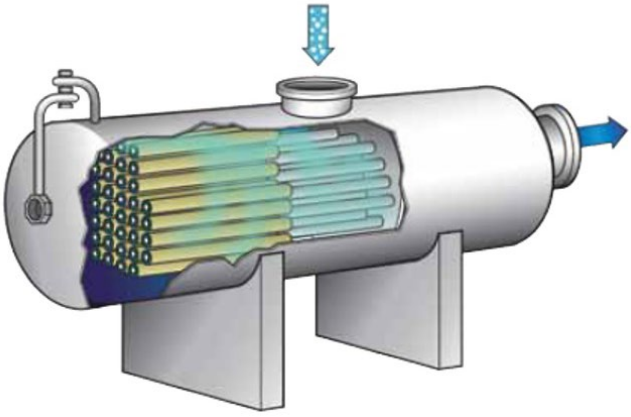
CECO Peerless gas filters provide effective, efficient, and economical removal of solid particles from various types of gas streams.

Applications:

- Pipeline stations
- Chemical plants
- Refineries
- Town border stations for distribution systems
- Various other industrial plants



In-Line Gas Filter



HorizontalFilter

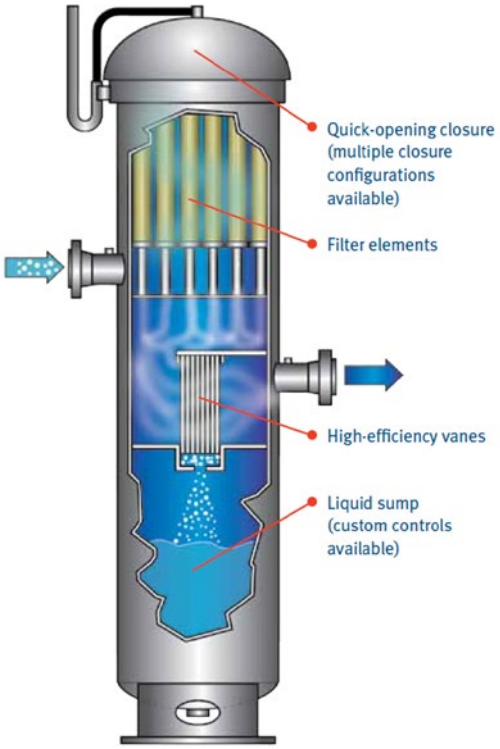
FILTER SEPARATOR

For both solid and liquid contaminants, CECO Peerless filter separators provide economical, effective, highly-efficient removal of solid and liquid particles from gas streams. This helps protect valuable mechanical equipment and optimise the efficiency of processes.

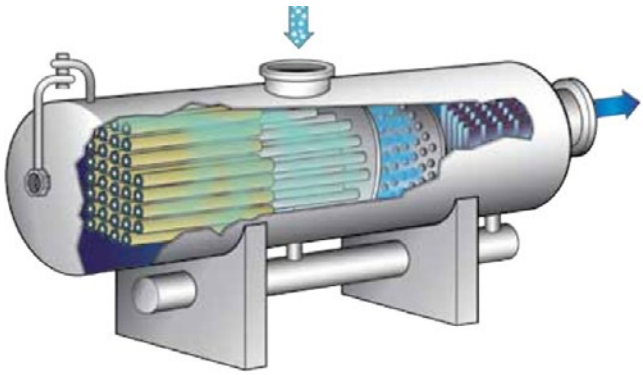
CECO Peerless filter separators are available in vertical or horizontal, and single or double-barrel configurations. Access to the filter elements can be either full or reduced diameter and either bolted or quick opening closure designs.

Applications:

- Gas distribution systems
- Compressor stations
- Pipelines
- Metering and regulation stations
- Natural gas plants
- Power plants
- Refineries
- Petrochemical plants
- Chemical plants



Vertical Filter Separator



Horizontal Filter Separator

GAS SWEETENING UNITS

H_2S and CO_2 are most common sour (acid) gas contaminants present in natural gas. In order to make natural gas fit for commercial usage, it is mandatory to remove these contaminants. The process of removing H_2S and CO_2 from natural gas is called gas sweetening. Depending upon the process requirement, there are various technology available to remove H_2S and CO_2.

Amine-based is the most economical and widely used process for gas sweetening. However, for smaller flow rates, membrane-based or solid bed adsorbents may also be used.



To have an optimum design, the type of amine selected is very important. CECO Peerless can assist customers not only with the correct selection of amine, but also design of units from FEED to commissioning stage. We can offer a complete package design using any the following amine types:

- MEA (Mono-ethanol amine)
- DEA (Di-ethanol amine)
- MDEA (Methyl-di-ethanol amine)
- Specialty amines

Applications:

- Offshore-process platforms/ FPSO/ MOPU
- Onshore-gas processing plant/refinery/epf/well testing site

Benefits:

- Proven and reliable design
- High-efficiency CECO Peerless internals ensures minimal system downtime
- CECO Peerless black powder filter separator can be offered at inlet
- Optimised design to optimised project schedule and delivery time
- Low cost of operation an maintenance
- Compliance to stringent HSEQ requirement
- Modular solution requires minimum site works

Continued...

PROCESS TYPES:

1. AMINE ABSORPTION METHOD

The process is a chemical reaction that occurs by contacting lean amine solution with the acid gas in the inlet gas stream in amine absorber at low system pressure.

In the amine absorber, the downflowing amine solution absorbs H_2S and CO_2 from the up-flowing sour gas to produce a sweetened gas stream (a gas free of hydrogen sulfide and carbon dioxide) as a product and an amine solution rich in the absorbed acid gases. The resulting "rich" amine is then flown into the amine flash drum to remove volatile HC gas. It's then sent to cartridge filters to remove solids and polymeric HC and carbon bed filters to remove any traces of oil. It is then taken into the amine regenerator (a stripper column with a reboiler) to produce regenerated amine or "lean" amine that is recycled for reuse in the amine absorber. The stripped overhead gas from the regenerator column is concentrated mix of H_2S and CO_2 gas.

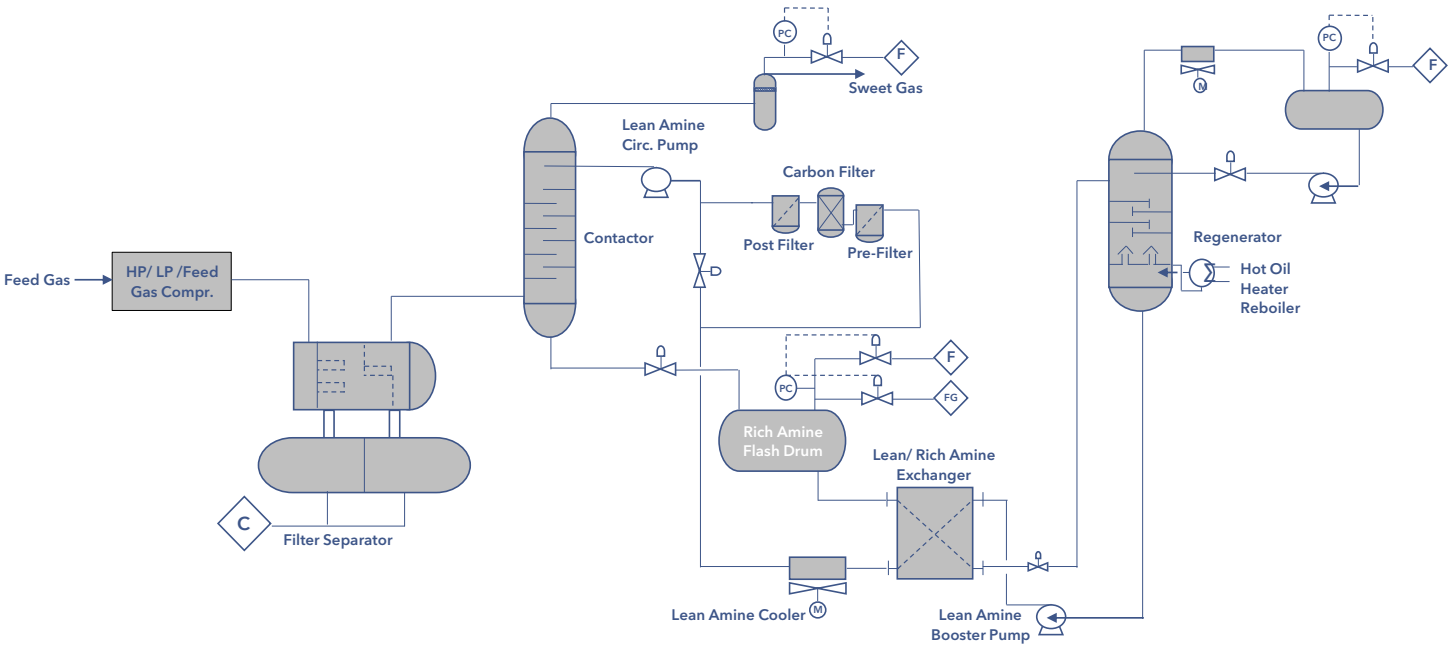
Reboiler heat duty for the amine regeneration is provided by either hot oil system or direct-fired heaters.

2. MEMBRANE METHOD

Membrane-based acid gas removal is a low-cost method for low gas flow rates. Natural gas, with acid gases, is pre-heated and sent to the membrane unit. The acid gas, H_2S and CO_2, selectively moves into the permeate phase and while HC gas moves around the membrane and collected in export gas stream. H_2S removal up to 10 ppm and CO_2 removal up to 2-4% is achievable using this process.

3. ABSORPTION BED MEDIA METHOD

This method utilizes selective adsorption of H_2S and CO_2 in a reactant media by moving the gas downflow in the reactor vessel. The H_2S and CO_2 gas reacts with the bed media to form a chemically stable byproduct. This process can be offered in 1+1 vessel configuration for maximum efficiency and extraction of acid gases.



NATURAL GAS DEHYDRATION UNITS

Gas dehydration is a widely used application in gas processing plants. This process is carried out to remove moisture from natural gas to achieve the required water dew point for pipeline specification or for downstream processing like NGL extraction. This process is required to prevent hydrates formation at low temperatures and reduce corrosion. problems due to the presence of carbon dioxide or hydrogen sulfide present in natural gas.

Based on the required outlet gas specification, gas dehydration process is classified into the following processes:

- Glycol Based Gas Dehydration Process
- Molecular Sieve Gas Dehydration Process



Applications:

- Offshore – process platforms/FPSO/MOPU
- Onshore – gas processing plant/refinery/epf/ well testing site

Benefits:

- 20+ Years of field performance
- Proven and reliable design
- High-efficiency CECO Peerless internals ensures minimal downtime
- Can be offered with peerless black powder filter separator at inlet
- Compact footprint
- Low cost of operation and maintenance
- Compliance to stringent HSEQ requirements
- Modular solution requiring minimum site works

Additional services:

- Custom-built or pre-engineered solutions
- Fast-track delivery
- Modular solution for offshore and FPSO
- Rental option also available
- Site support including installation and commissioning supervision

Continued...

PROCESS TYPES:

1. GLYCOL BASED GAS DEHYDRATION PROCESS

Tri-ethylene glycol (TEG) is the most widely used chemical for gas dehydration units (GDU). This process can achieve 3-7 lb/MMSCF of gas which is suitable for most pipeline transportation specifications. CAPEX and OPEX of this process is significantly lower than molecular sieve-based dehydration.

The wet gas from the well or compressor station is brought into contact with lean glycol in the contactor column. The column is normally provided with structured packing which provides mass transfer surface.

Moisture present in the gas is absorbed in the lean glycol in a countercurrent absorption process resulting in reduction of water dew point. The rich glycol then flows from the absorber to TEG regeneration system in which the entrained gas and moisture is fractionated in a column and reboiler. The heating allows boiling off the absorbed water vapor. The lean glycol is cooled and pumped back into the absorber.

To achieve a higher degree of water removal from amine, fuel gas is used for stripping in the regenerator in order to achieve a higher glycol concentration.

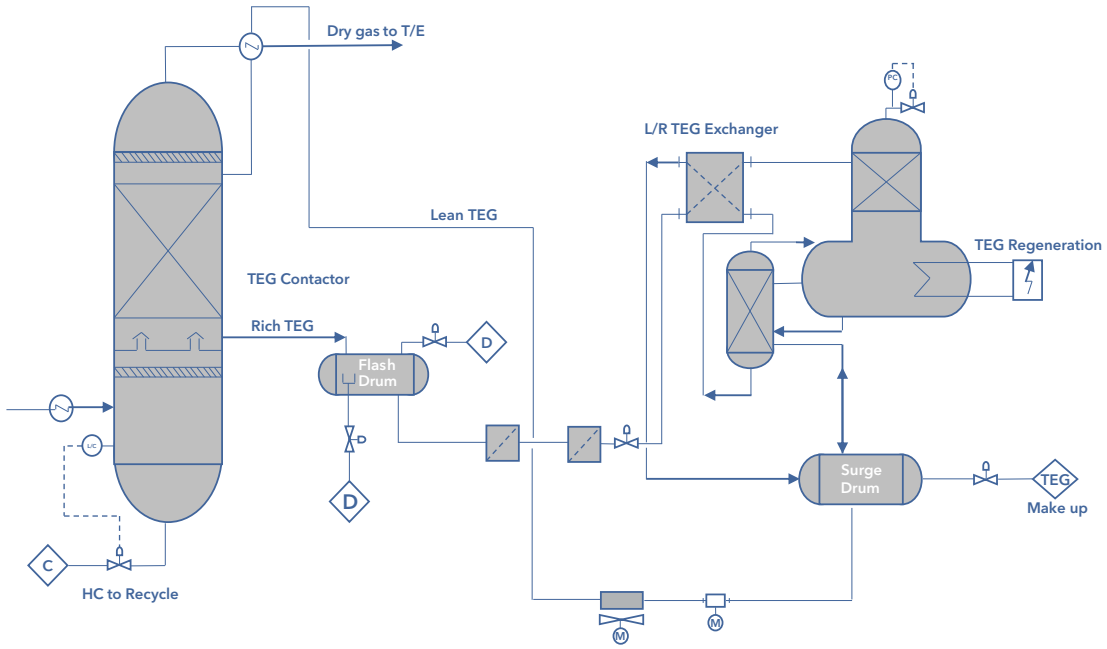
2. MOLECULAR SIEVE BASED GAS DEHYDRATION PROCESS

In order to avoid any hydrate formation during cryogenic process like LPG or NGL recovery, a molecular sieve-based gas dehydration process is employed.

The molecular sieve based dehydration utilizes an adsorption process where moisture present in the gas is adsorbed on the surface of zeolite beds. The zeolite particles are available in various pore sizes (3-5 Å). Selection of media is critical for efficient operation of the system. CECO Peerless offers design with optimised operation cycles resulting in extended life and higher efficiency.

In a standard process, two or three vessel design is used where one or two vessels is under a drying cycle and the remaining one will be under regeneration mode. Rising steam switching valves are used for switching from dehydration to regeneration mode.

A slip-up gas stream from the GDU outlet is compressed, superheated and then introduced to the vessel which is in regeneration mode. The principle of heating the molecular sieve removes the adsorbed water and the regeneration gas flows back to inlet of the unit gas.



MERCURY REMOVAL UNITS

Mercury causes severe hazardous corrosion (liquid-metal embrittlement) of aluminum heat exchangers in cryogenic plants, pipes, fittings and control valves containing non-ferrous metals by amalgam formation. Being toxic, Mercury can easily dissolve in aqueous streams or produced water streams and poison catalysts at the downstream equipment.

Mercury removal is a three-stage process that starts with natural gas flowing into the inlet gas coalescer for bulk removal of liquid followed by fine removal of liquid in the coalescing section. Liquid droplets of sizes more than 0.3µm are removed to ensure dry gas flows into the mercury removal bed. This is vital for the long life of the bed media. In the second stage, this liquid-free gas flows into the mercury removal unit, where the elemental mercury is absorbed by proprietary media absorbent (mixed metal sulphides). In the third stage the mercury-free gas is taken to an After Filter to remove any solid dust carried over from the mercury removal bed unit.

Applications:

- Offshore – process platforms, wellheads and FPSOs
- Onshore – oil and gas processing facilities, EPF

Offering:

- Absolute separator with high-performance internals for 99.99% removal of liquid droplets of sizes > 0.3 µm
- Mercury removal unit
- Post-bed dust filters with long design life and efficiency to remove 100% of particle up to 3 microns
- Optional offer for complete package including piping, E&I and structural skid

Features:

- Compact and high-efficiency design for mercury removal
- Designed to handle wide range of process conditions
- Extended life of bed due to absolute pre-separation
- Reduced CAPEX and OPEX for customers

Benefits:

- Over 20+ years of experience in providing solutions for oil and gas separation systems
- Rich industry expertise for fast track delivery of units
- Custom-made design to meet customer specific requirements
- Extended life of bed due to absolute pre-separation
- Reduced CAPEX and OPEX for customers



FUEL GAS CONDITIONING / DEW POINT CONTROL SYSTEM

Fuel gas conditioning (FGC) system is primarily provided to treat fuel gas by removing any solids and liquid content and set the gas process conditions such as temperature and pressure to meet emission norms and improve the life of downstream equipment.

If unconditioned process gas is sent directly to the gas engine turbines/ generators/ burners, it can damage their internal components. Hence, process gas, sourced from a slip-up stream of GDU or sales gas pipelines, requires pre-treatment prior to being used as fuel gas. Presence of even a minute quantity of liquid droplets or solids can severely damage the combustion engine of the turbines, resulting in failure of the equipment and voiding its warranty.



CECO Peerless fuel gas conditioning packages includes the following items:

- FG pre-heater
- Pressure reduction manifold
- Knock out drum
- Gas scrubber and fine filters
- Heater control panel (thyristor control panel)
- Piping, E&I and structural skid

Applications:

- Offshore process platforms/wellheads/FPSO/ MOPUs/drilling rigs
- Onshore – oil and gas processing, early production, well testing, refineries, gas plants, produced water treatment units

Benefits:

- Efficiency of 99.99% removal of liquid droplets > 0.3 µm from gas
- Meet dew point guarantee using process software
- Modular design to suite onshore or offshore applications
- Designed to handle wide range of process conditions
- Meet stringent performance guarantee
- Overall low CAPEX and OPEX for customers

CECO Peerless

CECO Peerless is an experienced and reliable global leader in designing and supplying a wide range of compact, high-efficiency, separation and filtration equipment. Founded in 1933, CECO Peerless also serves the oil and gas production, gas pipeline transmission and power generating industries around the world.

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