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Package Plants skid Mounted & Vessels PRODUCTS CATALOGUE



Products Range

PROCESS PACKAGES / SYSTEMS

- *Oil and Gas Separation & Treatment (Trains & Packages);*
- *Fuel Gas Conditioning / Treatment Packages;*
- *Electrostatic Dehydrators (Desalters);*
- *Gas Dehydration and Regeneration Packages (TEG – Mole Sieves);*
- *Gas Sweetening and Regeneration Packages;*
- *NGL Recovery Systems;*
- *Gas Compression Systems (Trains & Packages);*
- *Hot Oil Systems;*
- *Direct Fired Heaters & Indirect Fired Heaters;*
- *Chemical Injection Packages;*
- *Water Injection Systems (Trains & Packages);*
- *Flare Tips and Flare Systems;*
- *Solar and Thermodynamic Package*



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Products Range

INSTRUMENTATION PACKAGES

- *Oil & Gas Metering Systems (Custody and Non Custody);*

Products Range

PRESSURE EQUIPMENT

*Designed and Certified in full accordance with Customer Specifications
and International standards:*

ASME, ASME U- Stamp, PED, API, GOST, GOSPROMNADZOR etc.

- **REFINERY REACTORS:** *Alkylation, Cracking, Hydrocracking,
Hydrotreating, Isomerization, Reforming, etc.;*
- **COLUMNS:** *Distillation, Stripping, Splitters, Adsorption,
Fractionation, Distillation, Stabilization, Vacuum, etc.;*
- **SLUG CATCHERS:** *Vessel Type, Finger Type, Parking Loop Type;
inclusive of Internals and Process Performance Guarantees;*
- **PROCESS SEPARATORS:** *2-Phase, 3-Phase, Vertical, Horizontal inclusive of Internals and process Performance
Guarantees;*



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Products Range

Separators Internals:

Inlet Devices, Distribution / Calming Devices,

Liquid / Liquid and Gas / Liquid Coalescers, Gas / Liquid Mist

Elimination Devices, Sand Handling Devices.

As an Option GS Group

scope of supply may include the Computational Fluid Dynamic (CFD)

Analysis CFD to ensure the validity of the process design methods

and Finite Element Analysis (FEA) to confirm the integrity of the

systems to be guaranteed. CFD Analysis is warmly recommended in

cases of debottlenecking/revamping of existing Separators as well

as for consolidating the design of Process Separators installed on Floating Units.

- *Direct and Indirect Fired Heaters*
- *Waste Heat Recovery Units*
- *Shell & Tube Heat Exchangers (Tema normative)*



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PROCESS PACKAGES

Liquid and Gas Filtration and Separation

GS Group provides Filtration / Separation units such as supply of equipment on skid complete with all necessary instrumentation for the proper working and, if requested, with an eventual control system.

The main following systems are:

- **Gas Filters / Filter Separators:**
(Solid Only And Both Liquid And Solids Removal)
- **Gas Scrubbers, Gas / Liquid Separators And Three Phase Separators**
(Vane Type For Liquid Removal)
- **Process, Glycol, Water and Lube Oil Filters:**
(Solids Removal)
- **Carbon Adsorbers;**
(Fixed Bed Or Replacement Element Type)



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GAS Filters and Filter Separators

Gas Filters and Filter Separators are used to remove solids and liquids from natural GAS streams.

GS Group can supply them as skid mounted units fully equipped with all necessary instrumentation.

Furthermore, they can be supplied as part of a process package (i.e. Fuel gas Conditioning systems or Solid Bed Dehydration or Metering systems).

Typologies:



Cartridge filters:

Both in vertical and Horizontal configuration, they can be filled with different types of Replacement elements, depending on operating Conditions and micron efficiency.

Typical applications:

- Turbine meter installation;*
- Rotary meter installation;*
- Regulator station;*
- Removal of desiccant particles downstream of desiccant bed*
- Dehydrators;*
- Removal of Catalyst particles downstream of Catalyst bed;*



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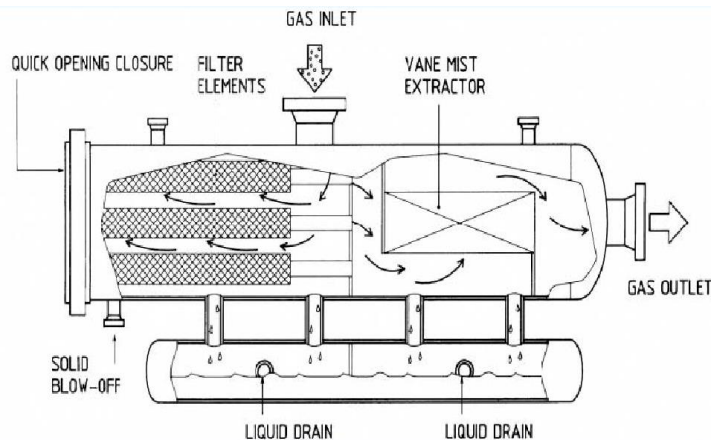
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Gas Filters and Filter Separators

Filter-separator / Filter Coalescers:

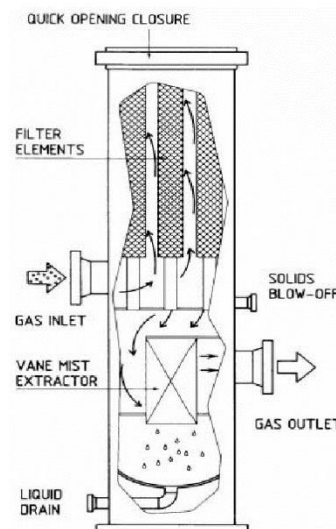
Two stage units. In the First stage the gas passes through the Filter Coalescers elements, where both the solids and large liquid particles are removed, while small liquid particles are coalesced. In the second stage the gas, with the coalesced liquid particles, passes through the mist eliminator, where the coalesced liquid droplets are stripped out and drained.

Typical applications:



Horizontal Filter

Vertical Filter solids and liquids.



- A. On the suction side of compressors to prevent wear from solids and liquid entrained in the gas stream;*
- B. Ahead of gas processing plants to remove solids and free liquids in order to prevent fouling of process equipment and poisoning of catalyst beds;*
- C. Ahead of amine, glycol, potassium, carbonate sulphinol and adsorption oil contactors to keep solution cleanliness, efficiency and reduce solution filtration costs;*
- D. Downstream of amine, glycol, potassium, carbonate sulphinol and adsorption oil contactors to recover solutions and reduce solutions losses;*
- E. Ahead of solid desiccant beds to prevent liquid fracturing and dusting of the dry desiccant and fouling with paraffin or asphaltines.*
- F. Downstream of solid desiccant beds to remove desiccant fines.*
- G. Ahead of gas storage fields to prevent the injection or withdrawal of*

Gas Filters and Filter Separators

Cyclones



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In vertical configuration, they are filled with centrifugal elements, in most cases in the multi-cyclone bundles configuration. Here several cyclone tubes are installed as one internal unit, although mono-cyclones have even been proposed depending on application.



Typical applications:

- A. Instrument gas polishing;*
- B. Gas Compressor discharge;*
- C. Gas injection systems;*
- D. Protective solid desiccant and molecular sieve beds;*
- E. Propane refrigeration systems;*
- F. Fuel gas for compressor engines, heaters;*
- G. Glycol / Amine recovery;*

Gas Scrubbers, Gas / Liquid Separators and Three Phase Separators

GS Group can supply gas / liquid Separation units assembled on skid and complete with all necessary instrumentation to assure the correct working of the unit. GS Group products, in this field, are always designed to satisfy Clients' specific requirements, either in terms of functionality or in terms of construction standards (i.e. reference Standards, specific control requests. The type of separator and its configuration depend on the application type (product specifications downstream requested) and on the characteristics of the inlet two-phase current.



Scrubbers

Vertical vessels designed for systems where no liquid or a small quantity is expected. Internal types: vane packs or high efficiency internals.

Typical applications:

- A. Up-stream of compressors;*
- B. Up-stream of contactors;*
- C. Fuel gas systems;*
- D. As secondary Separators, downstream of the primary separator;*



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Gas Filters and Filter Separators

Gas / liquid Separators and three-phase Separators:

The basic mechanism employed is gravity settling type. Separators can be vertical or Horizontal. Rele below listed:

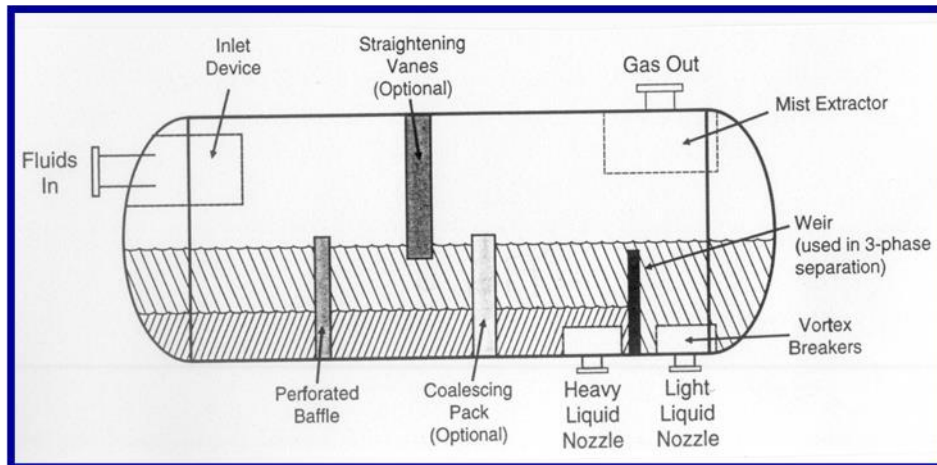
Vertical	Horizontal
<i>Generally employed in gas dominated service, where liquid quantity is low.</i>	<i>Generally employed in liquid dominated service, i.e. crude oil systems where gas flow is low.</i>
<i>Smaller footprint.</i>	<i>More interfacial area, more suitable for three-phase Separators and foaming fluids.</i>
<i>Gas handling capacity is not a function of liquid level.</i>	<i>More suitable for handling surges and slugs</i>
<i>Level vs. liquid inventory relation is linear</i>	<i>Less headroom</i>

Gas & Oil Separators

Separator components

Schematic example for a 3-Phase separator Inlet device:

Entering fluids can have a high velocity: 6-10 m/s is not unusual and, in cases where the inlet piping is undersized, 20-30 m/s have been experienced. The kinetic energy of the entering fluids is high and must be dissipated before the fluids enter the gravity separation portion of the separator. Inlet devices, used to dissipate the energy, come in several designs but often simple deflection plates can be sufficient.



Gravity separation section:

In this section, liquid droplets large enough to settle by gravity (150-300 mm) will do it. In horizontal separators, some type of vane unit may be used here, to reduce turbulences. In the liquid section of the separator, coalescing packs may be used to enhance oil-water separation.

Mist extraction:

Mist extractors are used to improve separation efficiency and, depending on their design, they will typically collect most droplets down to about 20-30 mm.

Weir:

Used in 3-phase separators to divide heavy liquid collection section and light liquid collection section.

Instead of weir it is possible to use a pot for heavy liquid collection or a configuration in which both pot and weir are present.



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Process, Glycol, Water and Lube Oil Filters

GS Group usually supplies liquid filters within Glycol Regeneration systems in order to remove the solids from glycol stream. Liquid filters that can be supplied by GS Group are Cartridge type. The element type and material depends on the fluid to be treated. The main features of liquid Cartridge filters are the following:

- *Controlled particle size removal;*
- *Low pressure losses;*
- *Wide variety of elements for all applications;*
- *Availability for all pressures;*
- *Quick opening or swing bolt closures;*

Carbon Adsorbers

The adsorbers are installed downstream the full-flow type solid filters to adsorb dissolved hydrocarbons and degradation compounds from glycol and amine systems. Furthermore, adsorbers reduce problems of foaming, fouling and corrosion and keep consistently higher solution efficiency. GS Group usually supplies carbon adsorbers within glycol regeneration systems in order to remove the impurities that the cartridge filter cannot remove. The carbon adsorber should flow from a minimum of 10 percent of the total circulation rate up to the total circulation rate.



Adsorbers can be supplied in two different configurations:

- *Fixed Bed Type;*
- *Replacement Element Type;*



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Fuel Gas Conditioning Systems

Fuel gas conditioning is done in order to obtain a Fuel gas with purity, temperature and pressure characteristics suitable to allow the proper use.

Purity, temperature and pressure values depend on Fuel gas use.

GS Group can supply Fuel gas conditioning systems able to satisfy Clients' specific requirements. Each system can consist of different treatment units in accordance with the inlet gas characteristics and final requisitions. The components that can compose a Fuel gas conditioning system are the following:

- A. Separators and Filters;*
- B. Pressure reduction stations;*
- C. Heaters;*
- D. Metering stations;*



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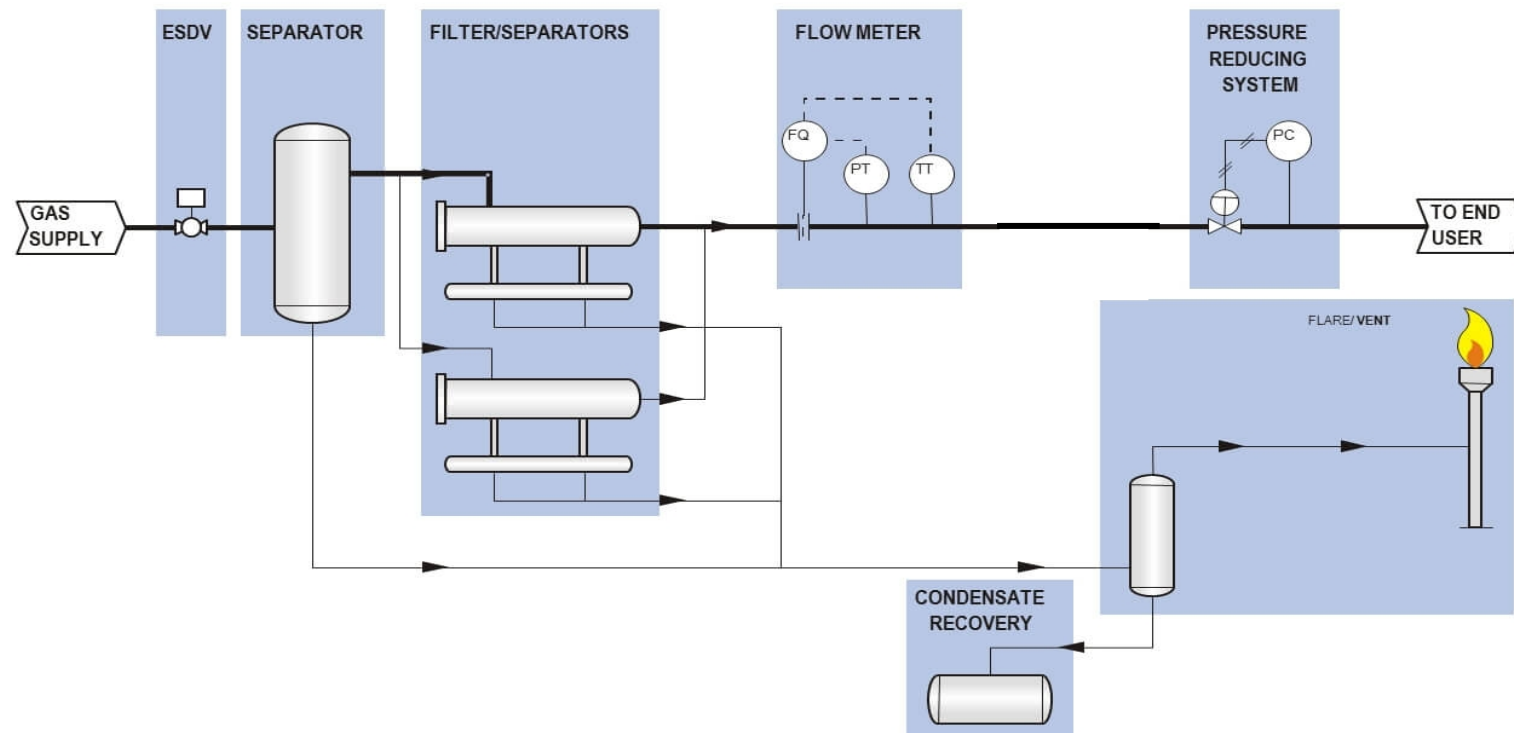


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Fuel Gas Conditioning Systems



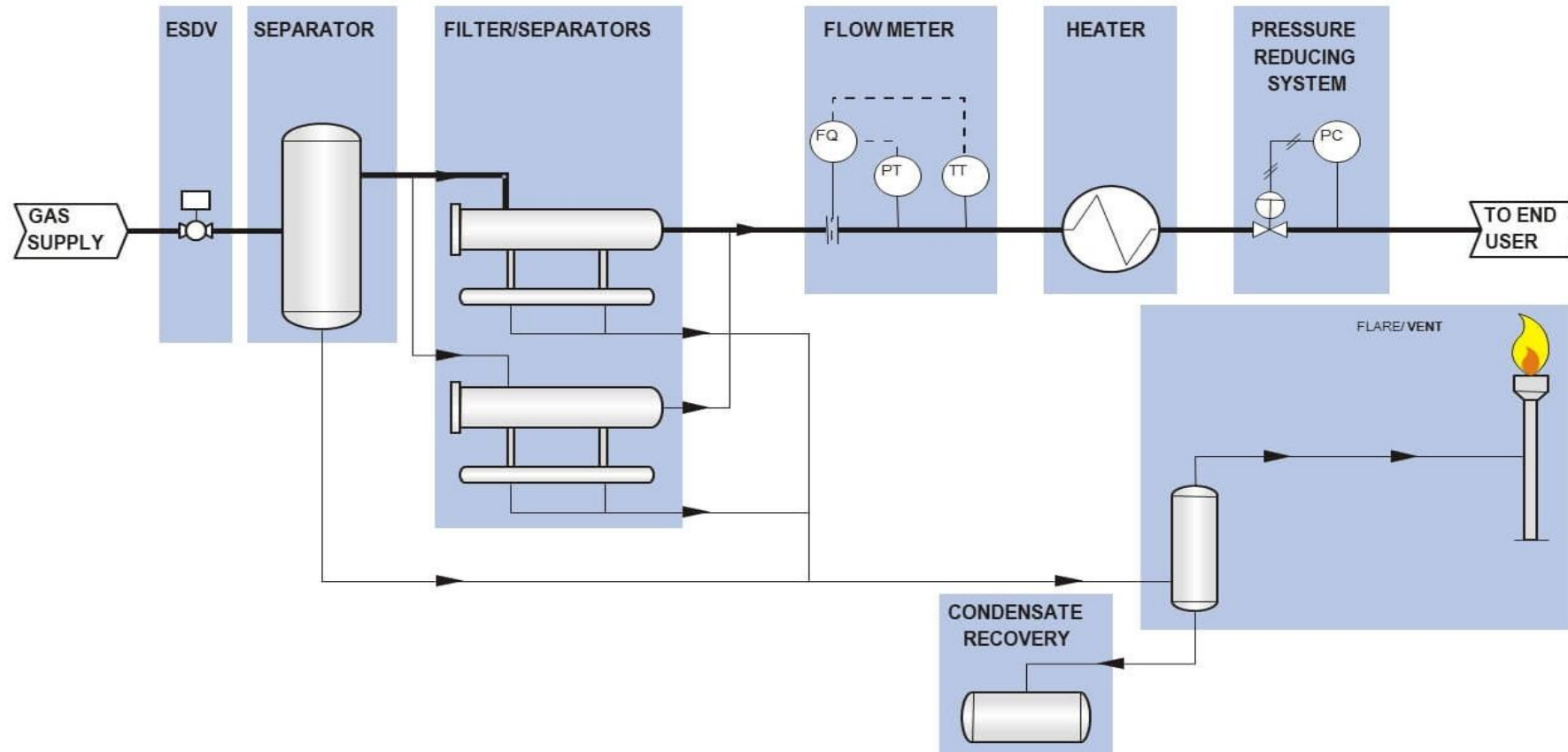
A typical and simple system lay-out can be the following:



Fuel Gas Conditioning Systems

The necessity to put a Heater before the pressure drop is given by the entity

of the pressure drop it self and by the gas temperature required by the final use.



It is even possible to add, to the above described solutions, a gas Metering system. The Fuel gas conditioning systems can be supplied with units on skid equipped with all necessary instrumentation for the proper working and, if required, with relevant control system.

Fuel Gas Conditioning Systems

Skid mounted



Gas Dehydration

The Dehydration of natural gas is almost necessary in order to eliminate the water contained in the steam phase inside the gas itself, up to a water content suitable to avoid its condensation during the further use (dew point). For gas Dehydration GS Group applies N° 2 (two) Technologies:

1) Glycol Dehydration:

Based on the adsorption of the water contained in the gas by a hygroscopic liquid (diethylenic or triethylenic glycol).

The gas Dehydration is done inside the contactor that can be equipped with plates or structured packing. Glycol must be re-concentrated in a regeneration system. The main components of a Dehydration system with glycol (and regeneration are the following:

- 1. Contactor;**
- 2. Flash Drum;**
- 3. Glycol cartridge Filters;**
- 4. Glycol charcoal Filter;**
- 5. Glycol re-boiler and Still Column;**
- 6. Overhead Condenser;**
- 7. Heat Exchangers;**
- 8. Glycol Circulation pumps;**
- 9. Glycol Surge Drum;**
- 10. Piping and instrumentation;**

Depending on the inlet gas characteristics the system can be personalised using specific components such as, for example, inlet gas and/or after scrubbers or a stripping column to increase outlet glycol concentration from the regeneration system.



Typical Gas Dehydration (Flow Diagram)

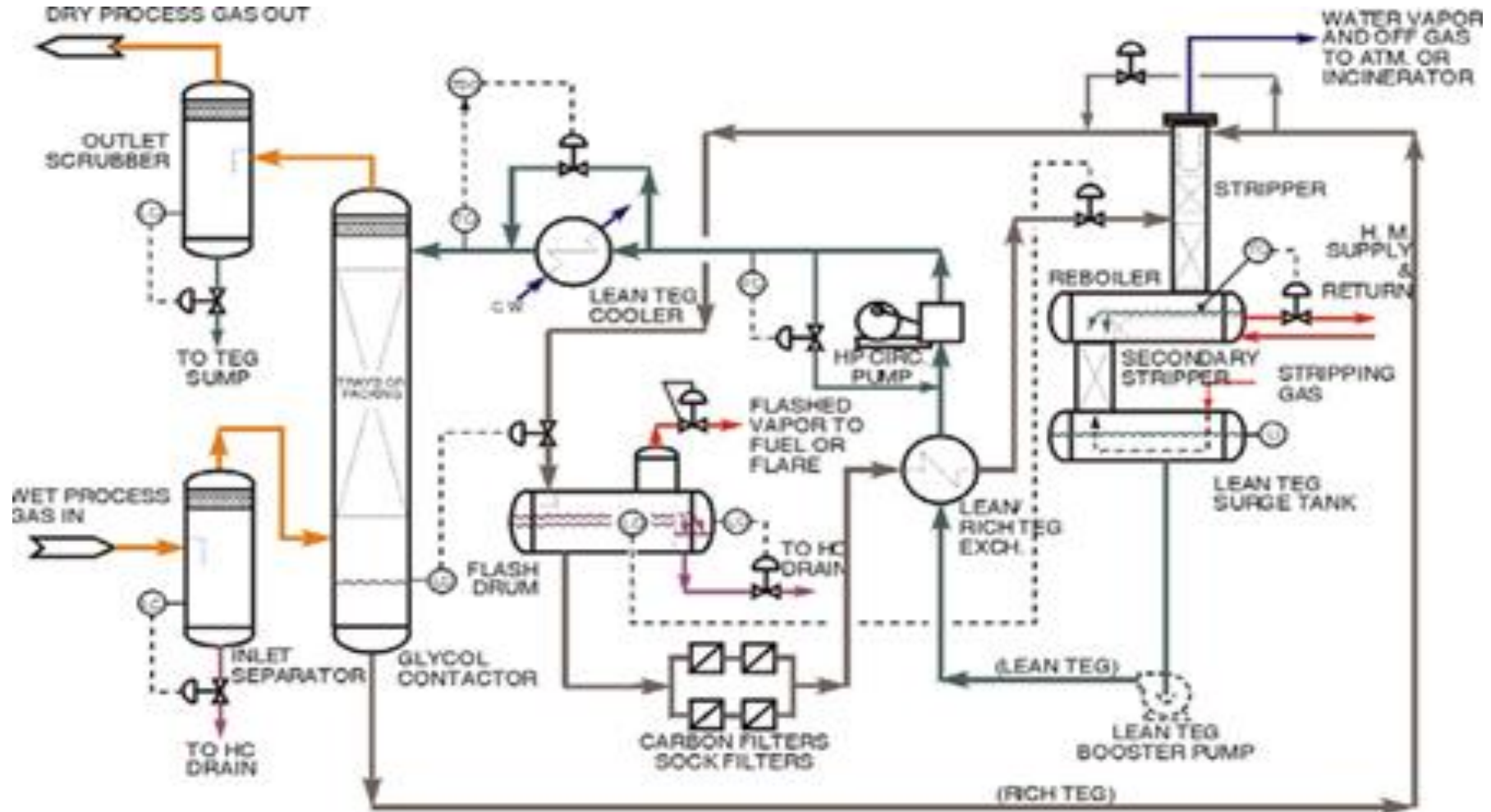


Figure 1
Basic glycol Dehydration unit typical flow Schematic

Gas Dehydration

2) Solid bed Dehydration

The Solid bed Dehydration system works on the principle of adsorption. The desiccant is a solid, granulated drying or dehydrating medium, with an extremely large effective surface area per unit weight. The essential components of any solid desiccant Dehydration system are:

- A. Inlet gas Separator / Filter;*
- B. Two or more Adsorption towers (contactors) filled with a solid desiccant;*
- C. A high temperature heater to provide hot regeneration gas to reactivate the desiccant in the towers;*
- D. A regeneration gas cooler to condense water from the hot regeneration gas*
- E. A regeneration gas separator to remove the Condenser water from the regeneration gas;*
- F. A downstream gas filter to remove solid desiccant fines from process gas*
- G. Piping, manifolds, switching valves and controls to direct and control the flow of gases according to the process requirements;*



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Solid bed Gas Dehydration (With two Tower)

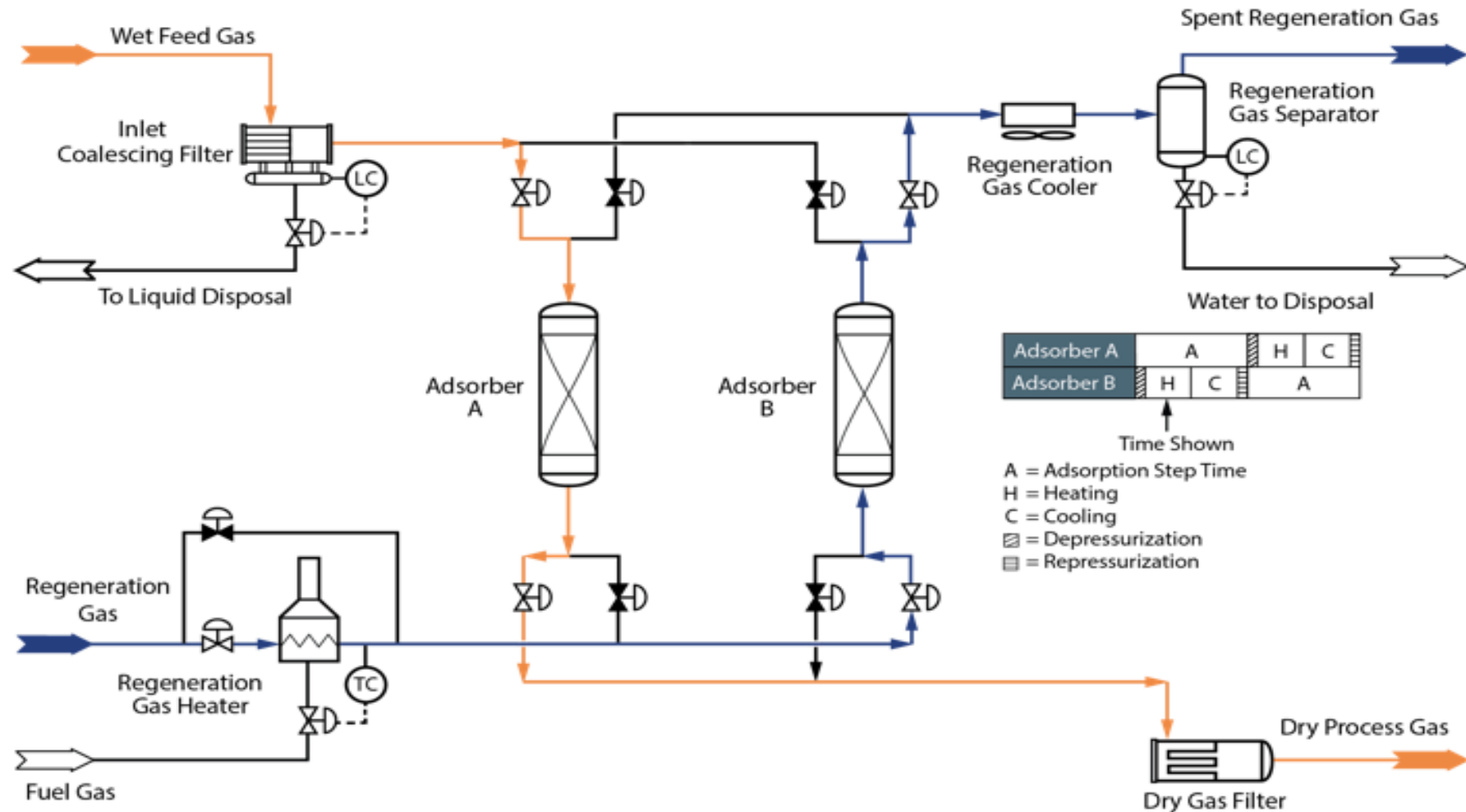


Figure 2 Molecular Sieves are used upstream of turboexpander units and LNG facilities to dehydrate natural gas to < 0.1 ppmv water content. In the natural gas industry, the molecular sieves employ heat to drive off the adsorbed water.

Figure 2 shows a typical flow schematic for a 2 tower system.

Gas Dehydration Package Skid Mounted

Reboiler



Dehydration Columns



Glycol Pumps



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Gas Dehydration Package Skid Mounted

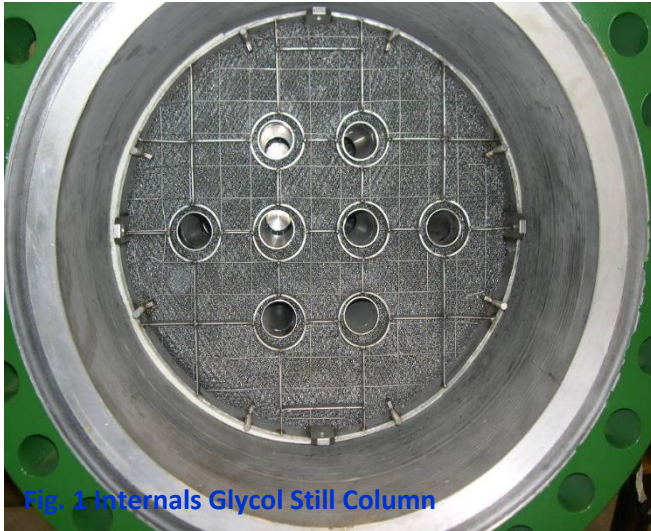


Fig. 1 Internals Glycol Still Column



Fig. 2 Internal Cladding Glycol Still Column



Fig. 3 Internal distributor Glycol Still Column



Fig. 4 Glycol Still Column Lower side



Fig. 5 Glycol Still Column Upper side

Gas Dehydration Package Skid Mounted



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Contactor

GS Group supplies gas - glycol contactors some typologies and can satisfy all Clients' needs either in terms of process or in terms of codes.

The contactors can be supplied with different types of internals, in accordance with the Clients' and Project specific requirements.

Normally the following internals typologies are used:

1. **Bubble cap trays**
2. **Structured packing**

Other types of internals, such as random packing or valve trays, are seldom employed and are unadvisable for this kind of application for the following reasons: the former because the structured packing has higher capacity, better turndown and superior performance at low liquid rates; the latter because 'weeping' (when the liquid flows through the gas opening) can present a problem at low gas or liquid rates.



Structured Packing



Bubble Cap Tray



Internal Pall Rings



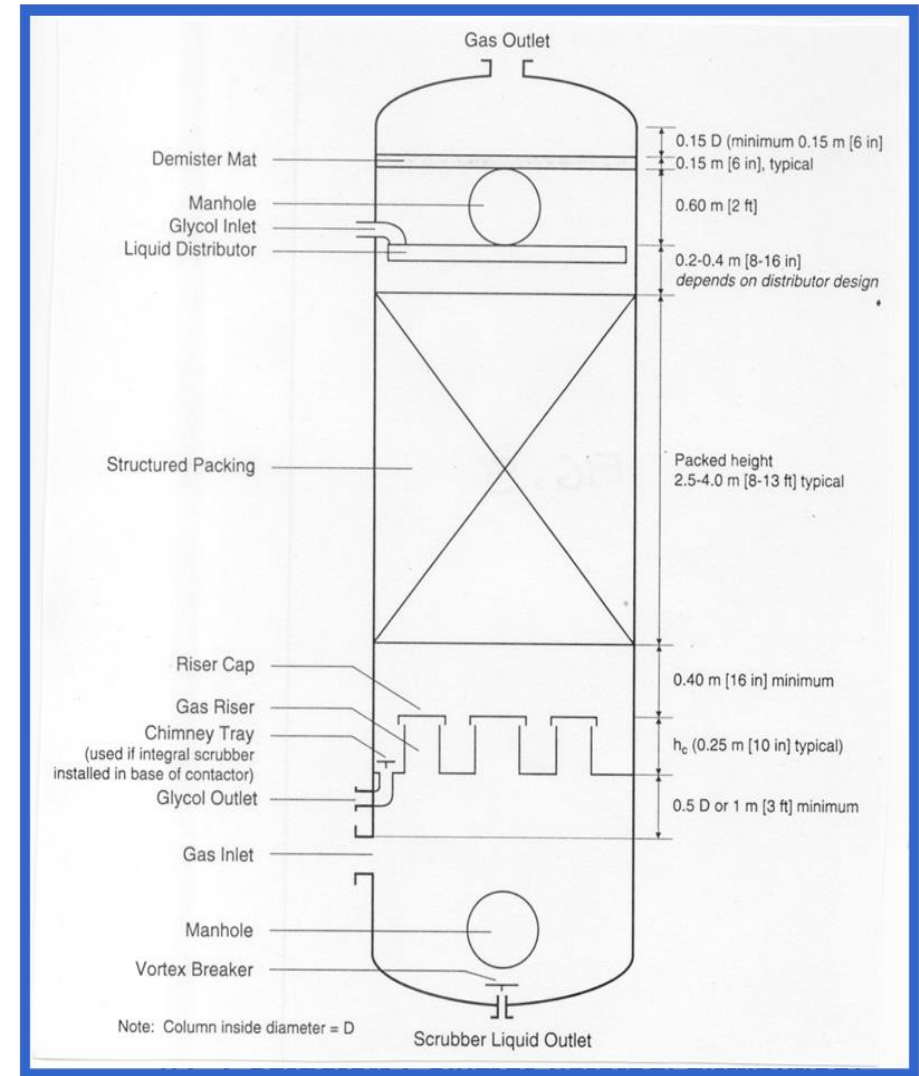
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Contactor

As it is possible to see in the figure, besides the internals in which the real absorption is done, the contactor contains other types of internals:

- Liquid distributor
- Demister mat
- Chimney tray (if integral scrubber, designed to remove entrained droplets and solids from the gas prior to entering the absorption section, is provided).



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Chemical Injection Packages (Skid Mounted)

GS Group provides chemical injection units such as supply of equipment on skid complete with all necessary instrumentation for the proper working and, if requested, with an eventual control system.

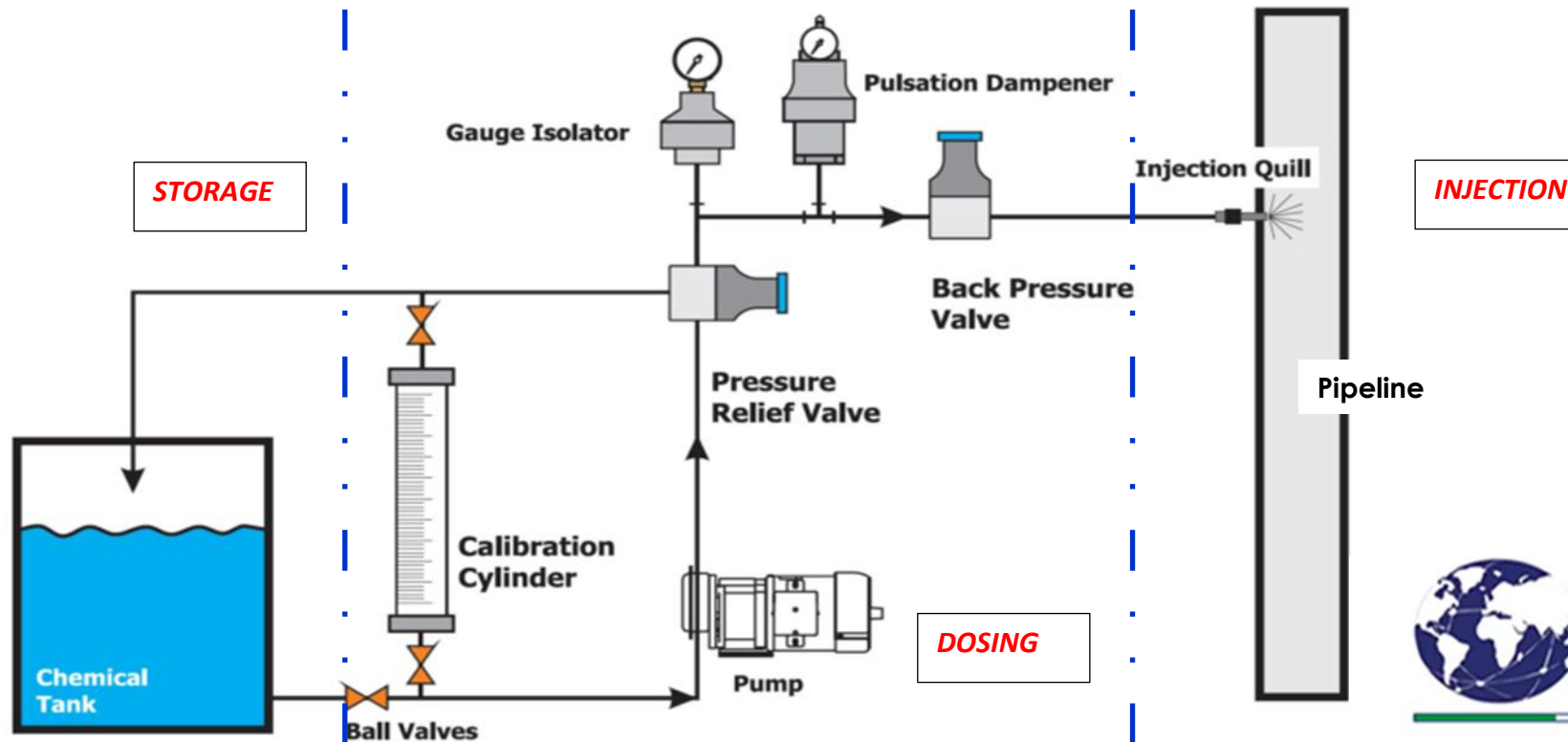
Purpose: To inject and dose continuously small quantities of chemicals in a main stream;

Oil & Gas Application: Injection and dosing of glycol, methanol, corrosion inhibitor, emulsion breaker, wax preventer, etc.;

Water Treatment: Injection and dosing of antiscaling biocide, remineralizator agents, corrosion inhibitor, etc.;

Chemical Plant: Injection and dosing of minor components such as catalyst, additives, etc.;

Typical chemical injection package configuration (Simplified P&ID)



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Chemical Storage Tank

Chemical storage tank has the purpose to keep stored the chemicals near the dosing and injection system.

Capacity shall be designed in order to avoid refilling too frequently. For chemicals with limited shelf time capacity shall be designed in order to avoid too long storage.

Dosing Pumps

Dosing pumps are normally positive displacement pumps.

Piston / plunger pumps

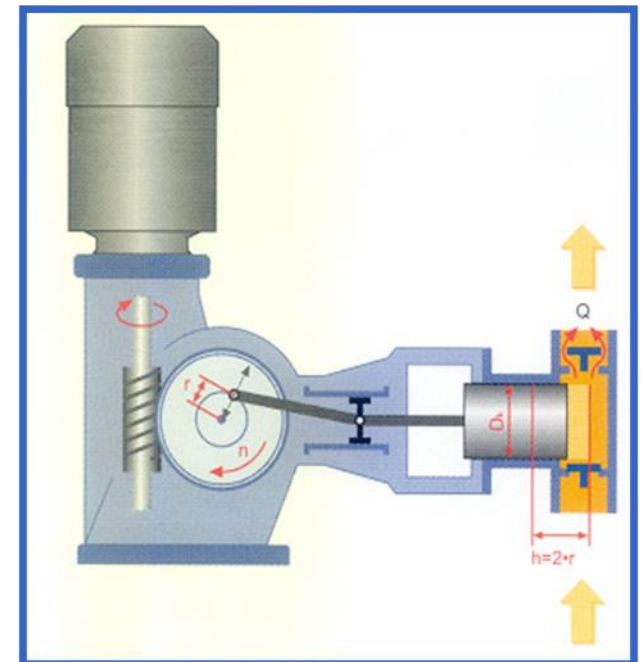
They are used to dose in a simple way not dangerous fluids.

Advantages:

- Good precision and repeatability
- Relatively inexpensive

Disadvantages:

- Not suitable for dangerous fluids (leakage through seals may happen)
- Not suitable for dirty fluids



Piston Plunger Dosing Pump Simplified Configuration



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Dosing Pumps

Dosing pumps are normally positive displacement pumps.

Diaphragm pumps

They are used when the product is dangerous or toxic or to avoid fluid contamination.

Advantages:

- No product leakage due to the absence of mechanical seals on fluid circuit
- Very high precision and reliability

Disadvantages:

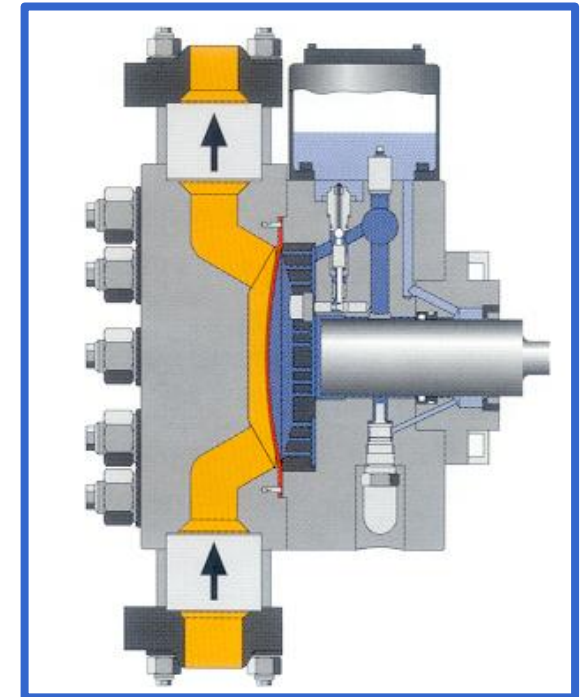
- High price



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Diaphragm Dosing Pump Simplified Configuration

Chemical Injection System Flow rate regulation

With piston / plunger and diaphragm pumps it is normally possible to regulate the flow rate by means of stroke length adjustment.

The stroke length adjustment can be:

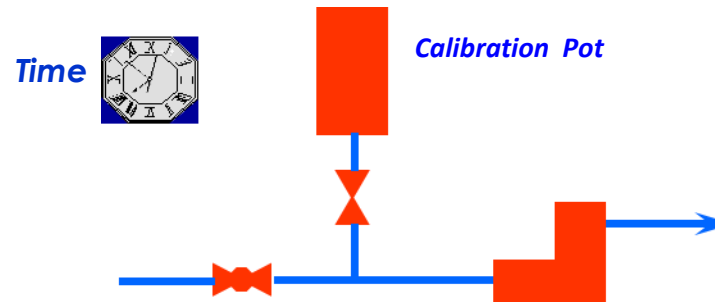
- Manual
- Automatic (electric or pneumatic)

Flow rate measurement

In order to know the flow rate of the dosing pump it is possible to go to different ways.

1) Manual measurement:

Flow rate measurement is carried out by means of a calibrated pot installed in suction line and a clock



2) Automatic measurement: Flow rate measurement is carried out by means of a flow meter installed on delivery line.



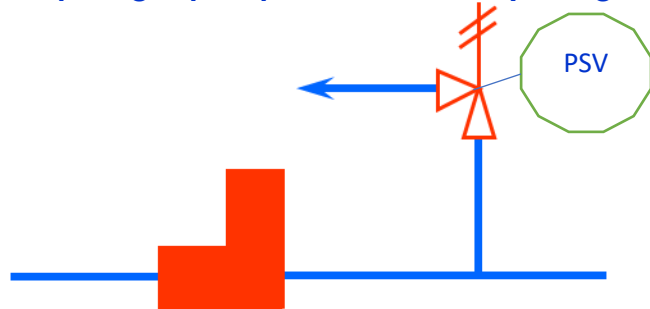
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Other accessories for dosing pumps

1) Pressure Relief Valves

Pressure relief valve on delivery line is mandatory to be installed to avoid dangerous over pressure.

Diaphragm pumps have normally integral pressure relief valves on hydraulic circuit



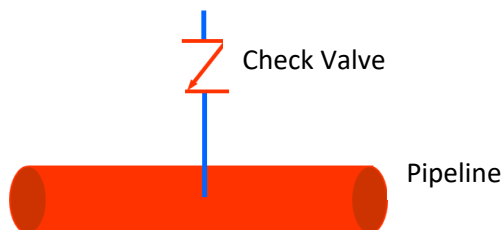
2) Pulsation Dampener:

To avoid pulsating flow it is recommended to install a pulsation dampener on delivery line.



Injection quills and accessories

To inject chemicals in the main line it is necessary to use special devices named injection quills. They are normally composed by an injector and a spread loaded non return valve. It is normally set several bars more than the pressure of the main line. This is to avoid return of product to the chemical injection line.

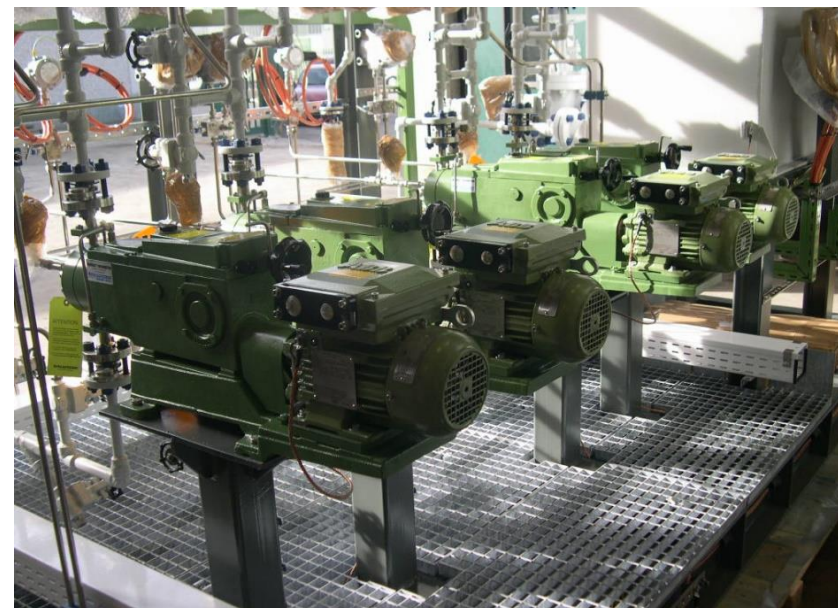


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Chemical Injection Packages (Skid Mounted)



Chemical Injection Packages (Skid Mounted)



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GS Group some Packages skid mounted Fabricated



GS Group some Packages skid mounted Fabricated

Pressure Reducing Gas Skid



Demulsifier Chemical
Skid



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GS Group some Packages skid mounted Fabricated



GS Group some Special Pressure Fabricated



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GS Group some Packages skid mounted Fabricated



Crude Oil Three
Phase Production



Indirect Water Bath
Heater Skids Train 1 & 2



1ST Stage Electrostatic
Desalter Package Skid



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GS Group some Packages skid mounted Fabricated



Chemical Dosing Unit
Antifoam Square Tank



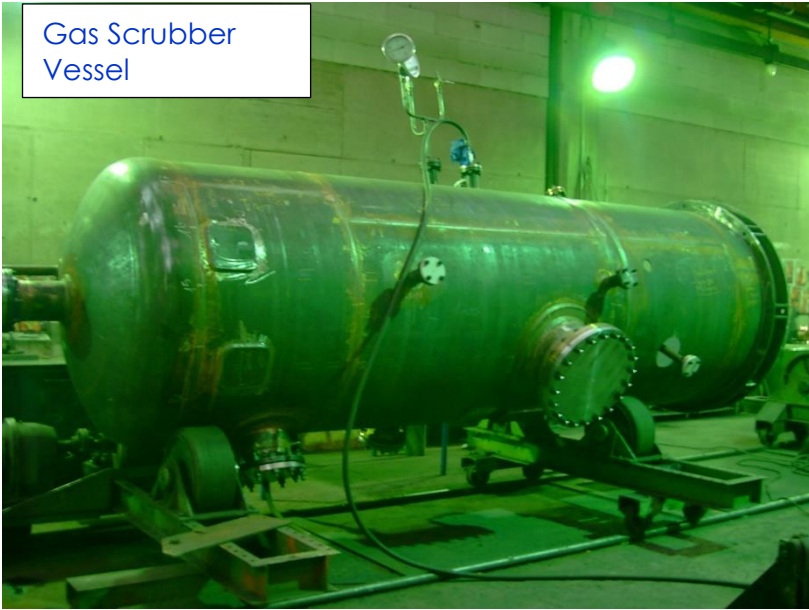
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GS Group some Pressure Vessel Fabricated

Gas Scrubber
Vessel



High Pressure Gas
Separator Aisi 316



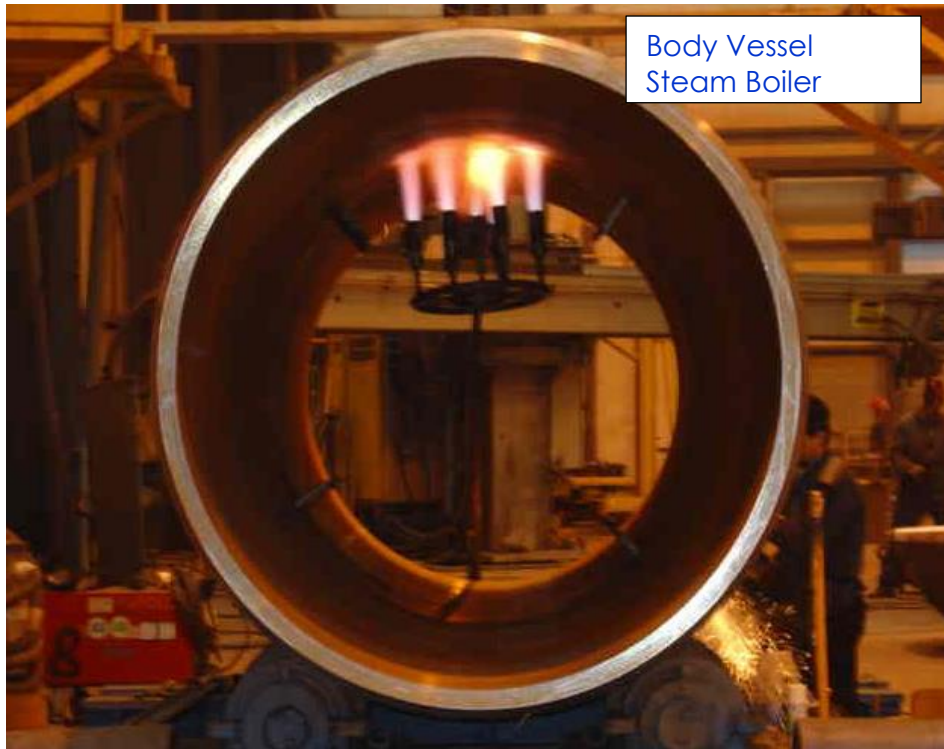
High Pressure Gas
Separator Aisi 316



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Body Vessel
Steam Boiler



Internal Bundle Coils Water Bath
Heater



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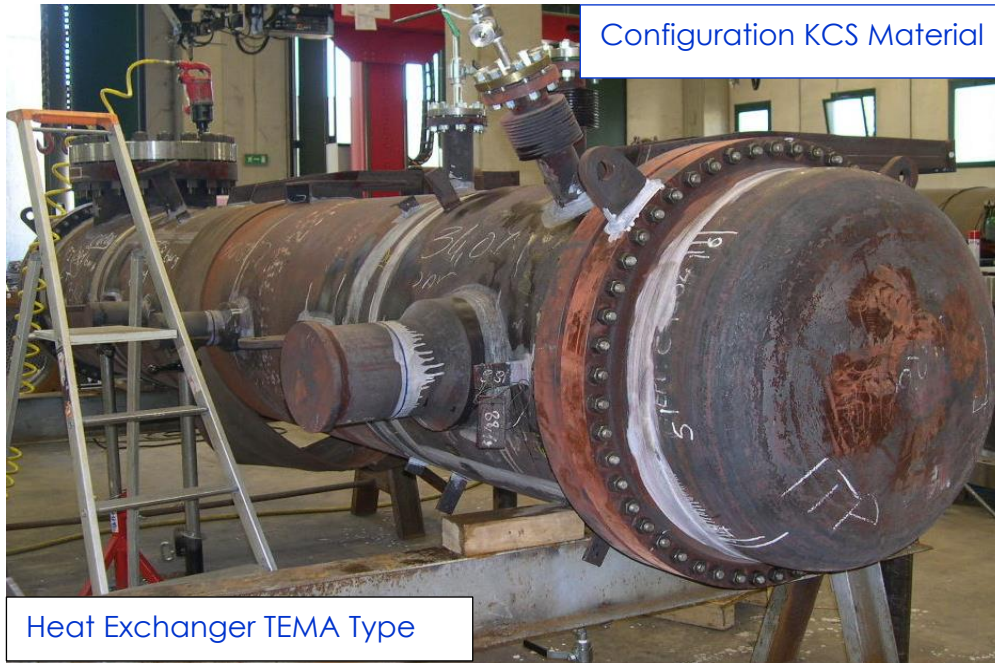


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GS Group some Shell & Tube Heat Exchangers Fabricated



GS Group some Shell & Tube Heat Exchangers Fabricated



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CONTACTS

For any further details, please contact:

Sig. Davide Gambino davidegambino@gsindustrial.it (General Manager)

Ing. Gabriele Barboni gabrielebarboni@gsindustrial.it (Engineering Department)

- Sede Legale: Via Pianette n. 16 - 26010 - Bagnolo Cremasco (CR) - Italy
- Sede Operativa: Via delle Industrie n. 8 Ripalta Cremasca Fraz. San Michele (CR) - Italy
- Tel. 0373-1974790 - Mail: gs.industrialsrl@gmail.com - PEC gssrl@ricevutacerta.it Numero Rea CR – 192933
C.F. / P.IVA 01678370196