UNION ENGINEERING
CO_2 EXTRACTION PLANTS
FOR BOILER SYSTEMS

CO_2 EXTRACTION BOILER SYSTEM

CO_2 Extraction Plants (EBU) are based on importing flue gas from boilers fired with various fossil fuels such as diesel oil, heavy fuel oil, kerosene, natural gas, LPG or LNG. If steam and flue gas supply are continuously available significant energy savings up to 45% can be achieved with an CO_2 extraction plant compared with traditional combustion based plants.

Through appropriate scrubbing, stripping and separation technology, the CO_2 generating plants meet the strictest CO_2 quality requirements regardless of the fuel type. All Union generating plants are based on the latest technologies for amine plants, including NOxFlash and PUR-D.

Extraction Plants are based on absorption of CO_2 from flue gas into a monoethanolamine (MEA) based solution, which is subsequently heated by the steam heated reboiler to release the raw CO_2 gas. To achieve the best combination of performance and long life of the equipment, a 9% MEA / water solution is used. Under this condition, the optimal balance between CO_2 load in the solution and avoidance of the corrosive effects of MEA are met.

The NOxFlash technology is the result of innovative research and has been proven in our installations since 2006. Among other advantages, the NOxFlash technology replaces the traditional use of scrubbing with PPM (potassium permanganate) solution, thereby reducing cost and environmental impact. Furthermore, the NOxFlash system acts as proven abatement of benzene (aromatic hydrocarbons) in the final product.

The PUR-D technology is the final purification step, consisting of a distillation column which enables separation/blow-off of noncondensable gasses, thereby reducing the O_2 content in the final product to max. 5 ppm (v/v) and obtaining corresponding CO2 purity of min. 99.99% (v/v).

The electrical system for the CO_2 generating plant consists of a local control panel and a LV (low voltage) MCC panel. From the control panel, which comprises the latest PLC technology, the plant is operated and monitored on a touch colour TFT display, ensuring easy and continuous trouble-free operation.

The plant is started by an automatic start sequence and the operation is fully automatic. The entire process is easily surveyed on the operator panel, showing the status of all drives, readings of all transmitters and alarm warnings, which will also be indicated by audible alarm.

All instruments installed on the skids are wired to junction or remote I/O boxes prior to shipment, thus reducing installation and commissioning time on site.

The plants are designed for high efficiency, availability and reliability through components selected for long life and 24/7 operation.

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GENERAL DESCRIPTION OF CO_2 EXTRACTION PLANTS

The plant is based on drawing flue gas from boiler exhaust systems. The flue gas will have a CO_2 content of 10-14% v/v and is directed to a flue gas scrubber, in which thegas is cooled and water condensed.

Any SO_2 present in the flue gas will be removed by means of a chemical reaction with sodium carbonate (soda ash). The soda ash is automatically added to the scrubbing water by means of pH control.

After cooling and scrubbing, the gas is led via an exhauster through an absorber, in which the gas flows counter-current with a MEA solution flow. By chemical reaction, the MEA solution absorbs the CO_2 from the flue gas.

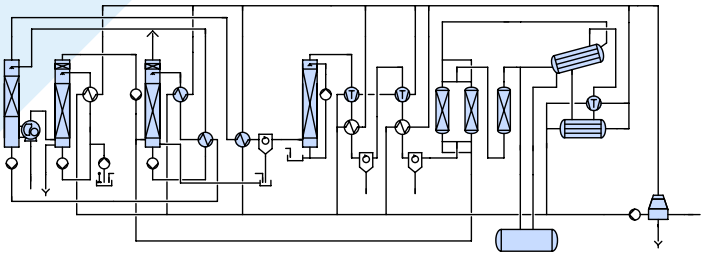
The MEA solution containing the absorbed CO_2 (referred to as rich MEA solution) is first pressurised and heated in the cross heater (lean/rich heat exchanger) and then led to the NOxFlash column. Here most of the contaminants are removed from the rich MEA solution by flashing to the absorber pressure.

Further heating is added to the bottom of the NOxFlash column for further reduction of the contaminants in the MEA solution. This optimises the process yield to the best possible CO2 product without any use of expensive chemicals (Union patent pending).

Afterwards, the rich MEA solution is pumped to a stripper, where the CO_2 is released from the MEA solution by means of the steam heated MEA reboiler. The CO_2 depleted MEA solution (referred to as lean MEA solution) is recycled to the absorber.

After exiting the top of the stripper, the CO_2 rich gas is cooled in a gas cooler and washed in an after-scrubber for removal of potential MEA carry-over. The gas is then compressed in two stages to approx. 15-18 bar(g) by the CO_2 compressor.

Prior to liquefaction, the gas is dried to a dew point of approx. -60°C (10 ppm v/v H_2O) in the dehydrator. Regeneration is done automatically by electrical heating and use of dry purge gas from the CO_2 condenser.



CO_2 Generating Plant standard sizes (measured as liquid food-grade CO_2 produced):

145 kg/hr
285 kg/hr
500 kg/hr
1000 kg/hr
1500 kg/hr
2000 kg/hr

- other sizes available on request.

Traces of acetaldehyde are also removed in the dehydrator. The CO_2 gas then passes through a carbon filter for removal of any odour substances.

To remove the last non-condensable gases, the CO_2 gas first passes a distillation process in the purification column (type PUR-D). It is then condensed at a temperature of approx. -27°/-23°C in a CO_2 condenser, where the non-condensed gases are purged off. Finally, the liquefied CO_2 is led to an insulated storage tank.

A refrigeration unit, controlled by the CO_2 pressure in the CO_2 condenser, supplies the required refrigeration capacity. The liquid CO_2 is stored under a pressure of approx. 15-18 bar(g) and a corresponding temperature of approx. -27°/-23°C. During a non CO_2 production period, the refrigeration unit is able to operate independently of the rest of the CO_2 plant in order to maintain the correct CO_2 storage tank temperature/pressure.

The CO_2 produced has a minimum purity of 99.99% (v/v) and fulfills quality standards for food/beverage ingredient purpose worldwide.

Pentair Union Engineering's main activities are worldwide sales, engineering, installation and commissioning of modular and individually designed CO_2 plants. Union Engineering is headquartered in Denmark and belongs to Pentair plc (www.pentair.com).

PENTAIR

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