

Ducon Technologies Inc.



Leader in Air Pollution Control Since 1938



Introduction

- Broadest Product line in the market
- ISO 9002 approved Company
- Most Technological Advanced Systems
- Equipment meets or Exceeds EPA Limits
- Over 25000 Installations Worldwide
- Excellent Name Recognition
- Over 35 Patents in past 60 years



History of Ducon

- **Founded in 1938 by Hans Held and John Weitz**
- **In 1967, purchased by U.S. Filter Co. and later acquired by Ashland Oil**
- **In 1978 became part of Riley Boiler Group, Enviroengineering, Joy, Mikropul and Manardi.**
- **Purchased by Japanese Co. Hosokawa in 1985**
- **Present ownership since 1987, privately held.**



Resources of Ducon

- Annual Sales of over \$175 million
- Locations in NY, FL, PA, IL & Canada
- Sales offices in 20 U.S. cities
- Subsidiaries in India & Mexico
- Licensees in Japan, Korea, Italy, Brazil, UAE
- Total world-wide employees: 335
- Manufacturing in IL, Mexico & India
- Installations at all FORTUNE 500 companies in US and abroad

AIR POLLUTION CONTROL SYSTEMS



MAP KEY
▲ COMPANY
■ SUBSIDIARIES
● LICENSEES & SALES OFFICES



DUCON MFG. FACILITY IN MONTERREY



Pollutants Removed

- Sulfur Dioxide
- Hydrogen Sulfide
- Nitrogen Oxides
- Chlorides, TRS
- Vapors & Acids
- Odors & Solvents
- Particulate
- Sub Micron Particles
- Blue Haze
- Fly Ash
- Product Recovery
- Toxic Exhausts
- VOC's

Industries Served



- **Pulp & Paper**
- **Mining**
- **Chemical & Plastics**
- **Metals & Steel**
- **Petrochemical**
- **Power Plants**
- **Waste Incineration**
- **Pharmaceutical**
- **Waste Water Treatment Plants**
- **Coal & Foundries**
- **Fertilizer**
- **Industrial Boilers**
- **Detergent & Food**
- **Hospitals**

Patents Received



TEM NO.	CATEGORY	ISSUE NO.	TITLE
18A	PATENT	3,410,055	Expandable Bag Filter
18B	PATENT	3,798,882	Filter Apparatus & Method
18C	PATENT	3,854,902	Method of Filtering Gas
18D	PATENT	4,047,910	Apparatus for Collecting Fine Particles
18E	PATENT	4,067,704	Particulate Filter
18F	PATENT	4,072,130	Apparatus & Method for Generating Steam
18G	PATENT	4,140,497	Flyash and Particulate Filter (Apparatus)
18H	PATENT	4,155,728	Flyash and Particulate Filter (Method)
18I	PATENT	4,262,298	Solids Discharged from Pressurized Vessel
18J	PATENT	4,305,737	Wet Acid Gas Scrubber
18K	PATENT	3,432,153	Collecting Contaminants from Gases
18L	PATENT	3,488,039	Dust Collector Filter
18M	PATENT	3,499,264	Controlling Fume & Dust Emission from Cupola Furnaces and Boilers
18N	PATENT	3,544,087	Filter Apparatus for Gas Scrubber
18O	PATENT	3,566,908	Gas Tight, Swing Type Valve Assembly
18P	PATENT	3,581,474	Acid Gas Scrubber
18Q	PATENT	3,656,279	Gas Scrubber
18R	PATENT	3,668,825	Method for Determining the Difficulty of of Removing Pollutants by Wet Scrubbing.
18S	PATENT	3,677,407	Method for Removing Sludge from Liquid.
18T	PATENT	3,680,282	Gas Absorption Scrubber
18U	PATENT	3,683,593	Gas Scrubber Having Tilttable Grids
18V	PATENT	3,685,261	Wet Scrubber for Contaminated Gas
18W	PATENT	3,712,412	Sound Suppressing System
18X	PATENT	3,738,624	Gas Scrubber for Sulfur Oxides
18Y	PATENT	3,785,119	Method for Removing Particulates & Oxide of Sulfur from Gas
18Z	PATENT	3,795,486	Wet Gas Scrubber
18AA	PATENT	3,811,247	Foam Type Gas Scrubber

Equipment & Systems



- **High Efficiency & FCC Cyclones**
- **Medium Energy Wet Scrubbers**
- **Venturi Particulate Scrubbers**
- **FGD Scrubbers**
- **Bag House Filter**
- **Electrostatic Precipitators**
- **Activated Carbon Absorbers**
- **Mist Eliminators & Separators**
- **Gas Absorption Towers**
- **Incinerators**



Multivane Scrubbers



Type L

This Ducon Scrubber is particularly well suited for low pressure drop applications involving heavy dust loads, abrasive materials, and slurry recycling. Dust collection is achieved with centrifugal and impingement actions between dust laden gas and liquid.

- **99% efficiency on particles > 2 microns**
- **Low Water rates**
- **Handles high dust loads**
- **Low water pressure**
- **Simple, heavy duty, trouble-free, design**



Cyclone Collectors



Available in several design configurations, cyclones meet a broad range of industrial applications. Custom designed cyclones are also available for unusual service conditions.

- **99.9% efficiency on particles > 10 microns**
- **Low pressure drops**
- **Multiple units with various layouts available**
- **Wide variety of construction materials**
- **Single or multiple layer refractory lining**



FCC Cyclones



Ducon has been supplying high efficiency cyclones to the world's refineries for Catalyst recovery and other Fluid Bed Processes including:

- Fluid Bed cracking
 - Elutriator Towers
 - Fluid Coking
 - Fluid Hydro forming
 - Catalyst Disposal & conveying
-
- Ducon conducts on-going research to optimize cyclone configuration & maximize efficiency for Short Contact Reaction time designs
 - Lowest catalyst loss rate guaranteed



Dynamic Scrubbers



Type UW-4

The Ducon UW-4 Scrubber features a three-way scrubbing action suitable for medium pressure drop applications involving heavy dust loads, abrasive materials and slurry recycling.

- **99% + collection efficiency in 1 to 2 micron range**
- **Low water rates**
- **Self Cleaning Wet Fan**
- **Water level control not required**
- **Unique multi-stage scrubbing action**
- **Handles High Dust Loads**



Ventri-Rod Scrubbers



Type A33

This Ducon unit incorporates our exclusive Multi-Venturi design. It offers high efficiencies at low pressure drops and liquid to gas ratios than any other conventional Venturi Scrubber. The Ventri-Rod deck works in either vertical or horizontal position to provide maximum flexibility for system layout.

- **99% + collection efficiency in sub-micron range at low pressure drop**
- **Variable ventri-rod deck (manual or automatic)**
- **Low pressure, non-clogging spray nozzles**
- **Ideal for particulate scrubbing and gas absorption**



Oriclone Scrubber



Type VVO and VO

The only Ducon venturi scrubbers with a wetted wall inlet. This important feature eliminates wet/dry line build-up and permits direct recycling of liquid with high-solids content. Spray nozzles are not needed because the scrubbing liquid is efficiently distributed over a specially designed weir or shelf, making this unit suitable for the toughest applications.

- Up to 99% + collection efficiency into sub-micron range
- Adjustable venturi throat (manual or auto)
- No spray nozzles or distribution jets
- No wet/dry line build up



Wet & Dry ESP



Type E6 and E7

This Ducon ESP unit is designed to achieve over 99.99% removal efficiency on particles down to .01 micron in size with .5" w.c. pressure drop. E-6 is a wet vertical tubular unit, while E-7 is a dry horizontal unit with cleaning sprays.

- **Non-clogging due to widely spaced electrodes**
- **Simple, heavy duty, maintenance free design**
- **High intensity electrical field provides charge and collection of superfine particles from the gas**



Electrostatic Precipitators



Ducon provides new systems, upgrade systems and replacement parts for Electrostatic precipitators

- All welded modular design with plate heights of 10' to 30'
- Enhanced performance from microprocessor design
- Heavy duty rigid electrodes
- Increased collection surface area
- Microprocessor rapping controls



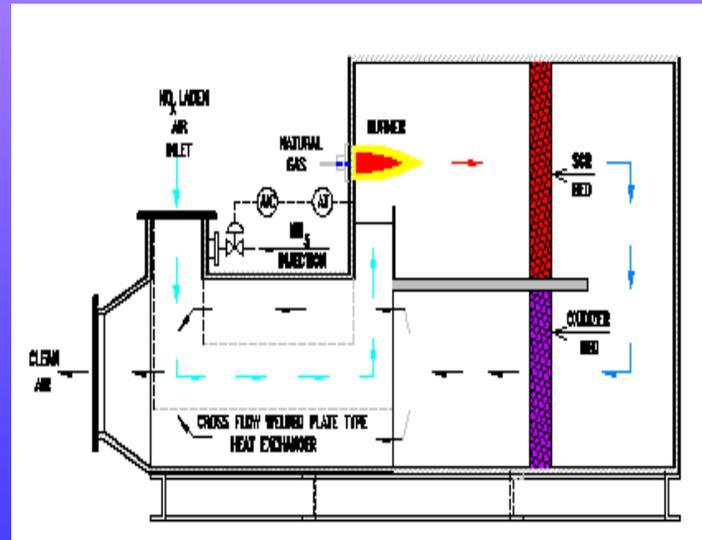
Selective Catalytic Scrubbers



Type SCR-NOX, VOC & CO

Ducon's selective Catalytic Reduction System (SCR) incorporates state of the art catalyst technology for effective reduction of NO_x , VOC's and CO emissions from combustion flue gases. For each application, Ducon uses a different catalyst from its base of proprietary Vanadium/Titanium/Platinum based catalysts.

- 90% removal of NO_x
- Temperature operating range of 440°F to 800°F
- 5-10 yrs. Catalyst life expected
- 95% reduction of CO & VOC
- Fully assembled systems & subsystems



Activated Carbon Absorber



Type CASB & CADB

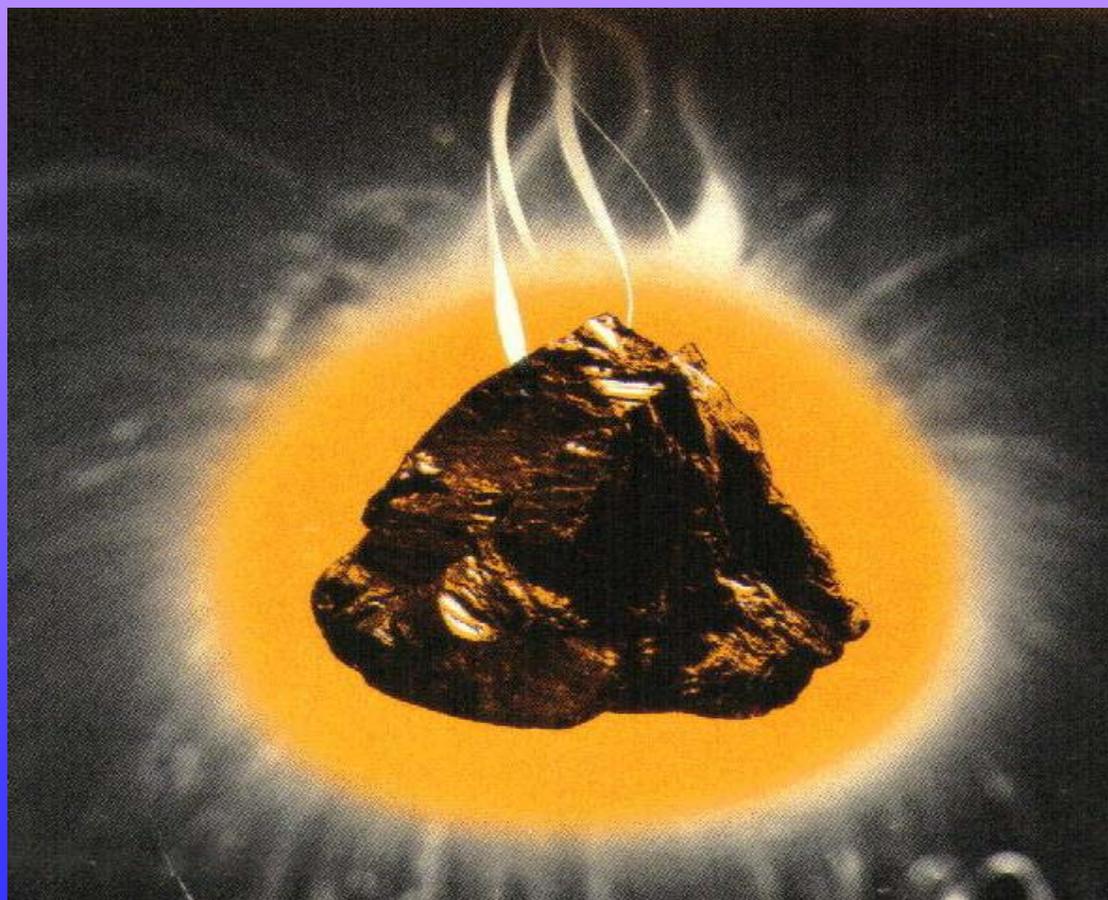
Ideal for odor control in municipal waste water plants and for removal of H₂S mercaptans, VOC's skatole, aromatic hydrocarbons, ketones, and aldehydes etc.

- **Over 99.9% removal efficiency**
- **In bed regeneration extends carbon life and reduces carbon replacement costs**
- **Vessels designed for ease and safe filling and removal of carbon without entering the vessel**





Wet Flue Gas Desulfurization Systems





Flue Gas Desulfurization Systems



DUCK CREEK FGD PLANT 400 MW FGD SYSTEM



Flue Gas Desulfurization Systems

**DUCON VENTRI
SORBER
ELEVATION**





Flue Gas Desulfurization Systems



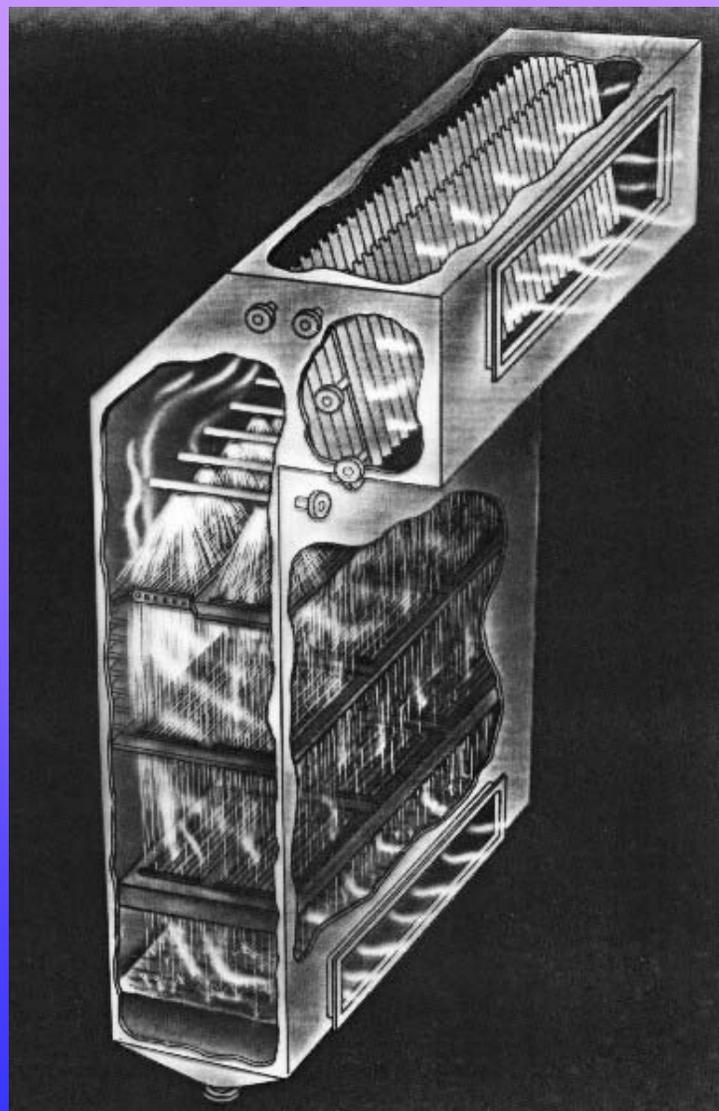
DUCON 300 MW FGD INSTALATION AT PICO



Flue Gas Desulfurization Systems

DUCON VENTRI ROD A5 FGD SCRUBBER

The Ventri Sorber multi stage wet scrubber is fourth generation absorber with cascading sprays in multiple rod-deck beds for very high sulfur dioxide removal efficiency. The upper section provides a horizontal mist elimination section.



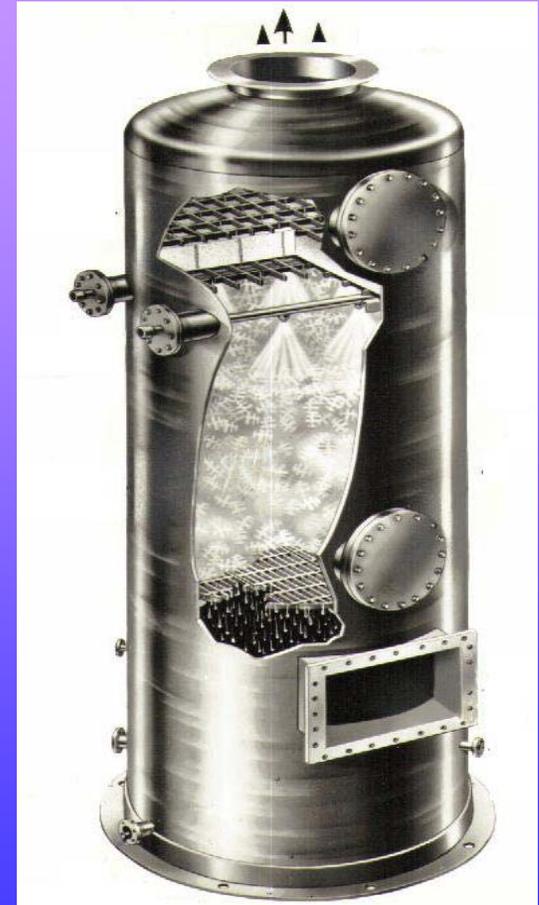
Gas Absorption Towers



Type Ventri Spray Sorber

Ducon Gas absorption Towers are used to remove acid gases, odors, fumes and other gaseous pollutants from exhaust streams.

- **Custom Engineered for each application**
- **Uses high efficiency Ducon Spray nozzles**
- **Variety of mist eliminators to remove droplets**
- **Handles inlet SO₂ loadings in excess of 4000 ppm**
- **Can be designed so a single unit can handle over 500,000 CFM gas flow**

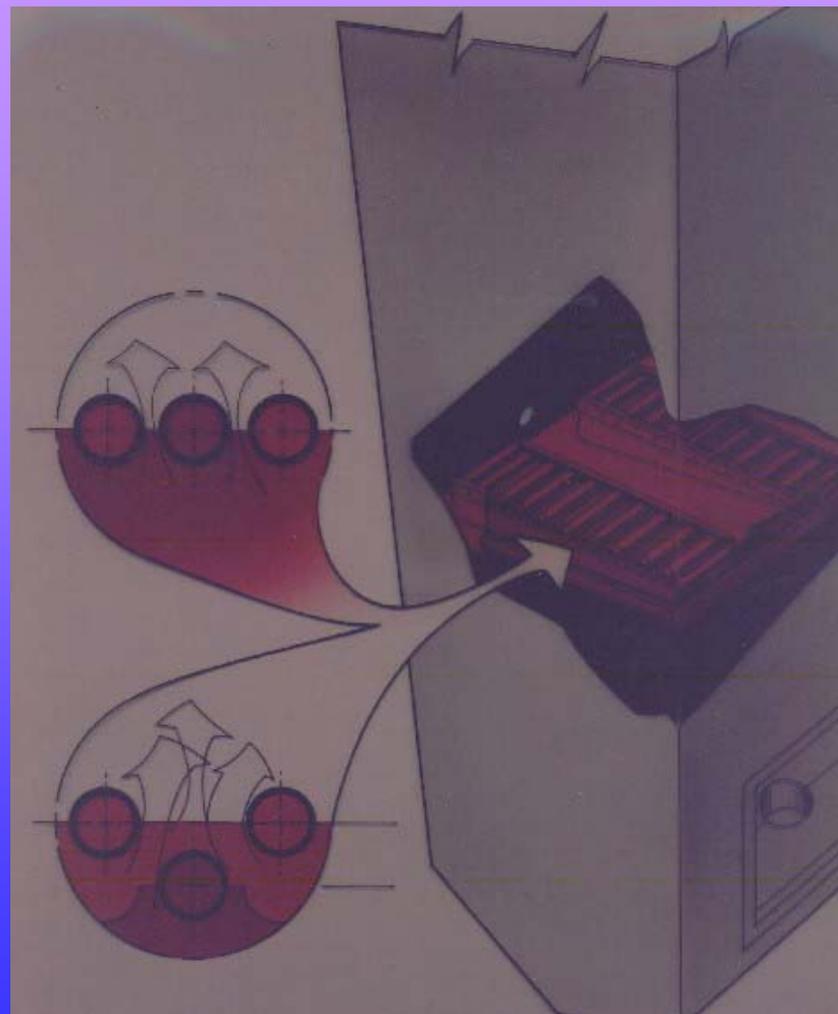




Flue Gas Desulfurization Systems

VENTRI ROD DECK

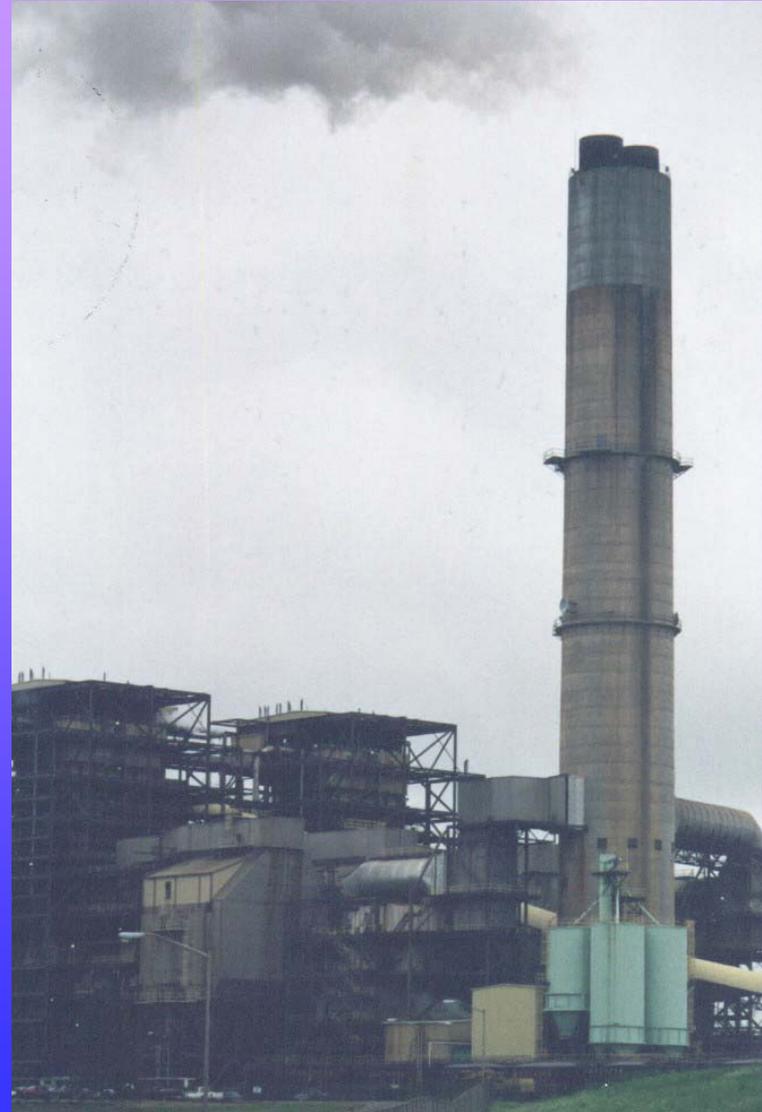
Ventri Rod Deck is an integral part of a Ventri Sorber absorber. The gas passes thru the small opening of adjacent rods providing pressure drop for particulate control and surface area for gaseous phase chemical reaction





Flue Gas Desulfurization Systems

**DUCON WET
FGD
INSTALLATION
AT SMEPA, 500
MW CAPACITY**





SCOPE OF SUPPLY FOR FGD SYSTEMS

GAS/GAS HEATER

BOOSTER FAN

GAS SCRUBBER & ALL PIPING

OXIDATION BLOWERS

WATER SUPPLY & RECYCLE PUMPS

WATER SUPPLY DUCTS

WASTEWATER BASIN & SUMP PUMPS

STRUCTURAL STEEL, PLATFORMS, ETC.

INSTRUMENTATION & CONTROLS

SPARE PARTS & O&M MANUALS

ALL ELECTRICAL EQUIPMENT

ELECTRICAL WIRING

COMPLETE ERECTION

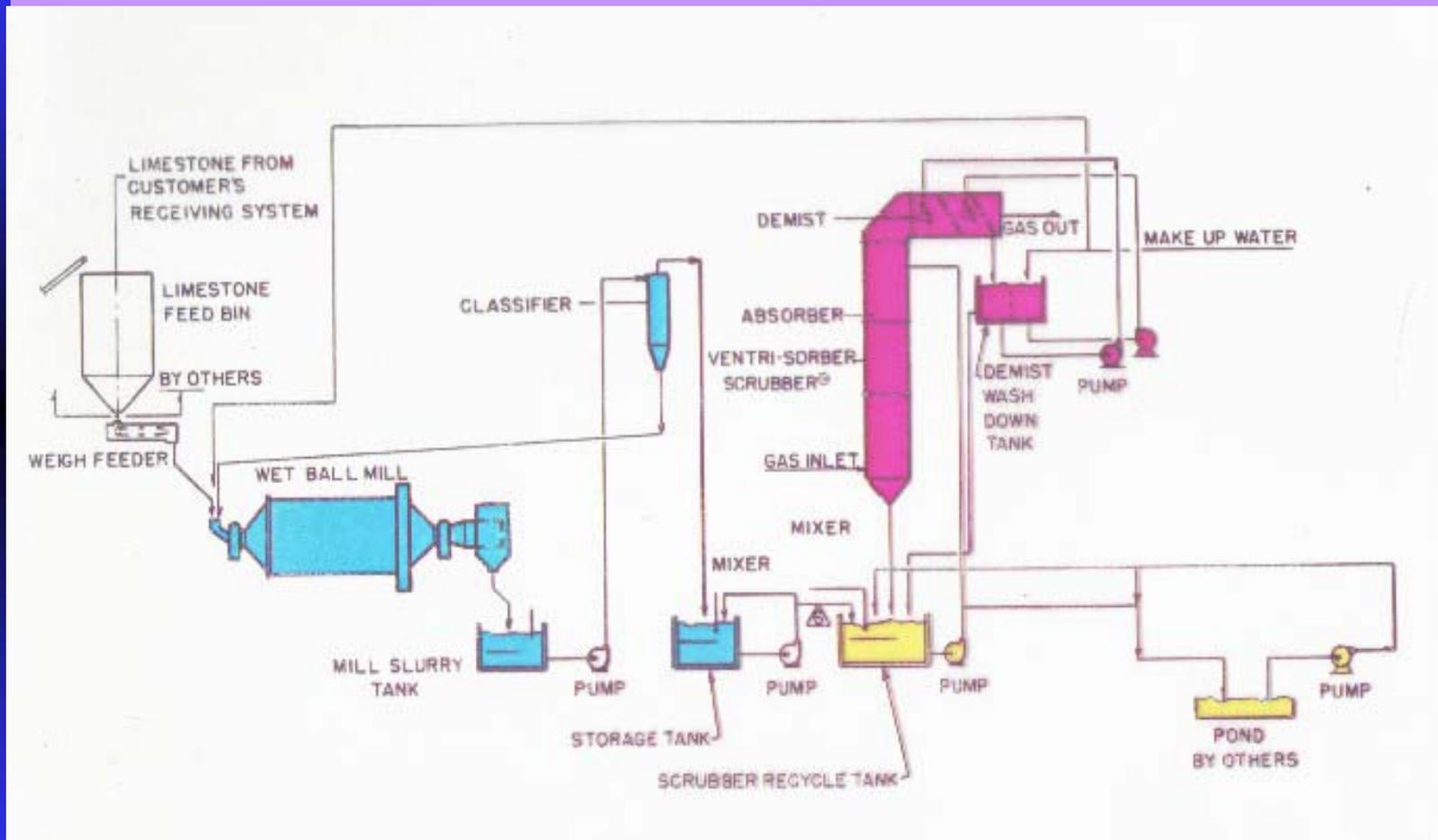
ALL ENGINEERING

STARTUP & COMMISSIONING

TURNOVER & TRAINING

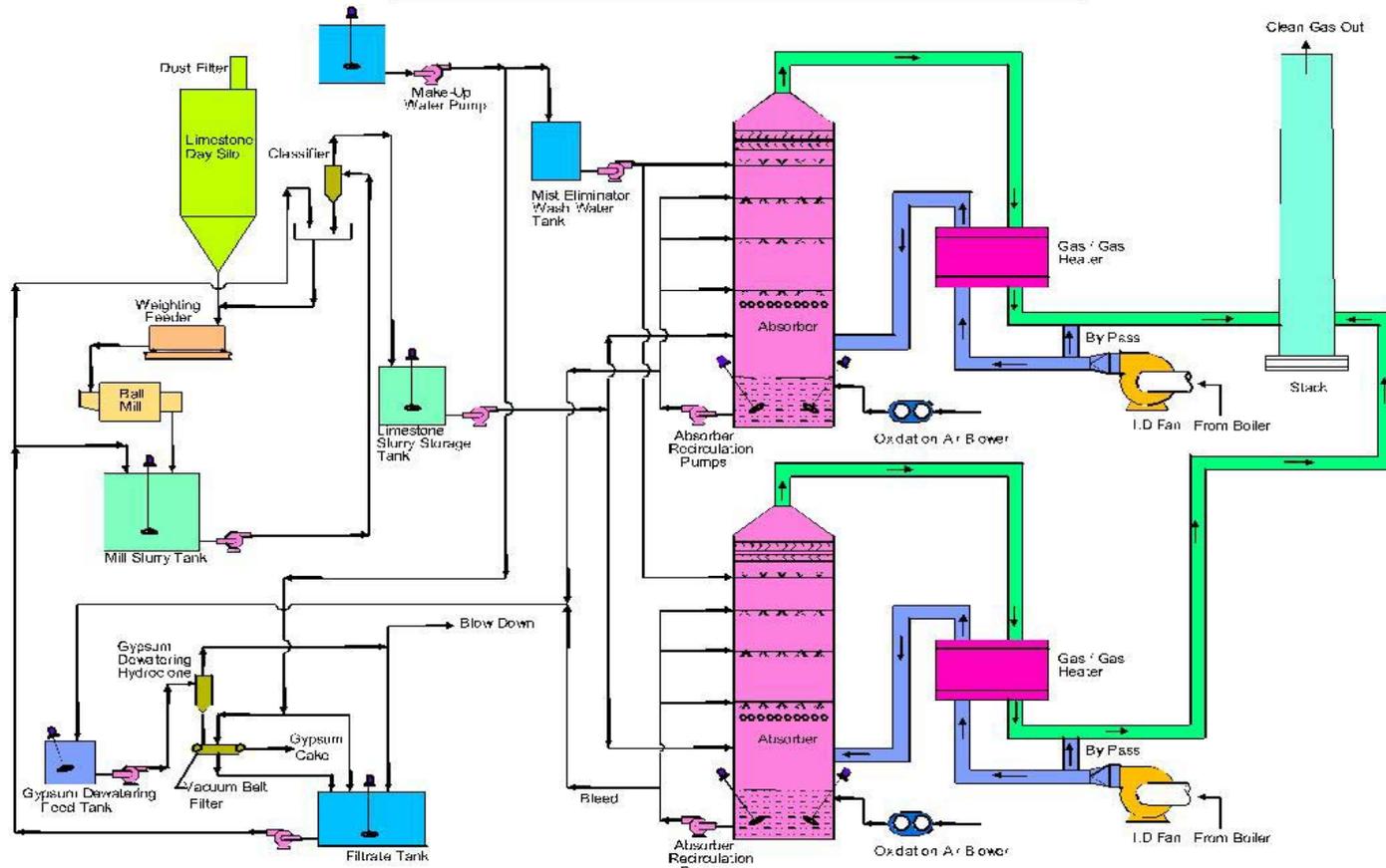


Flue Gas Desulfurization Systems



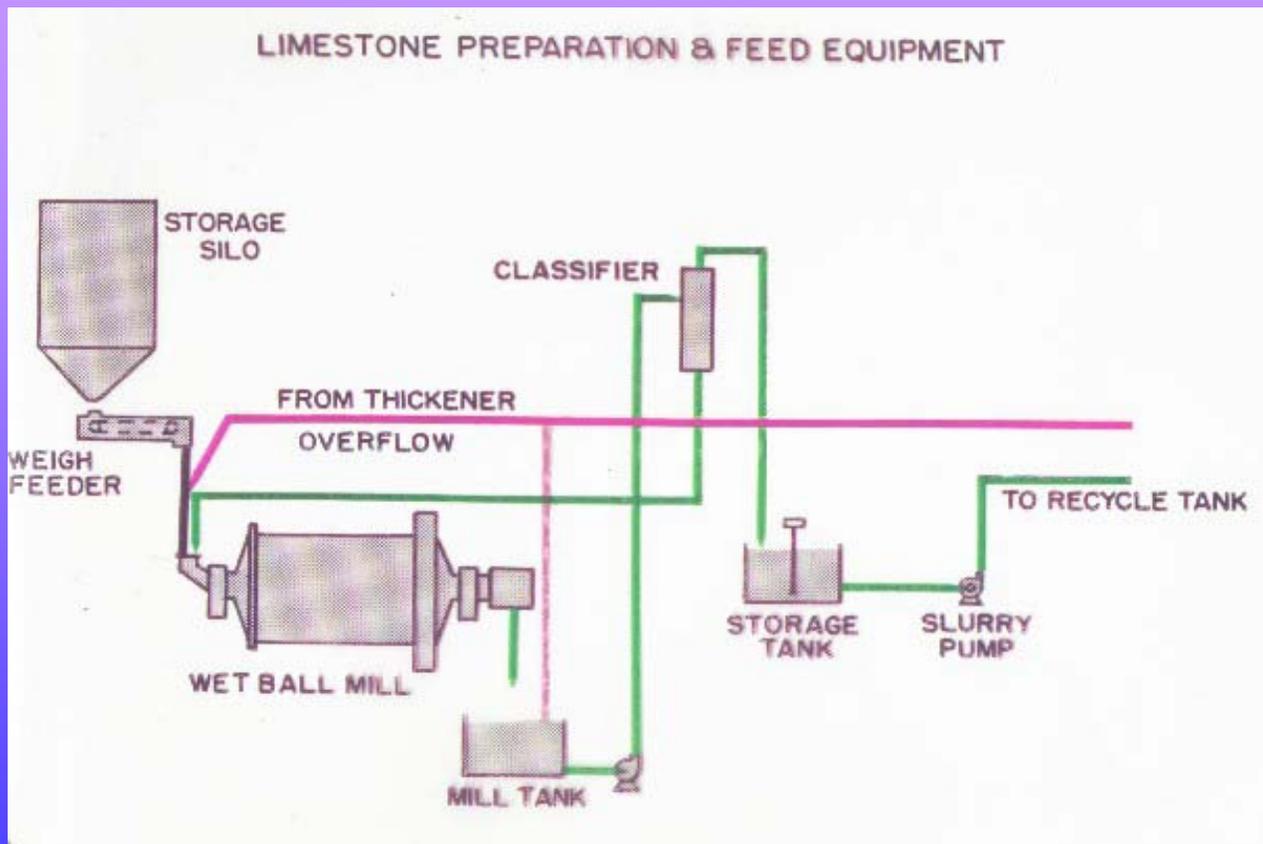
TYPICAL DUCON LIMESTONE FGD PLANT SKCHMATIC

DUCON LIMESTONE WET FGD FLOW DIAGRAM

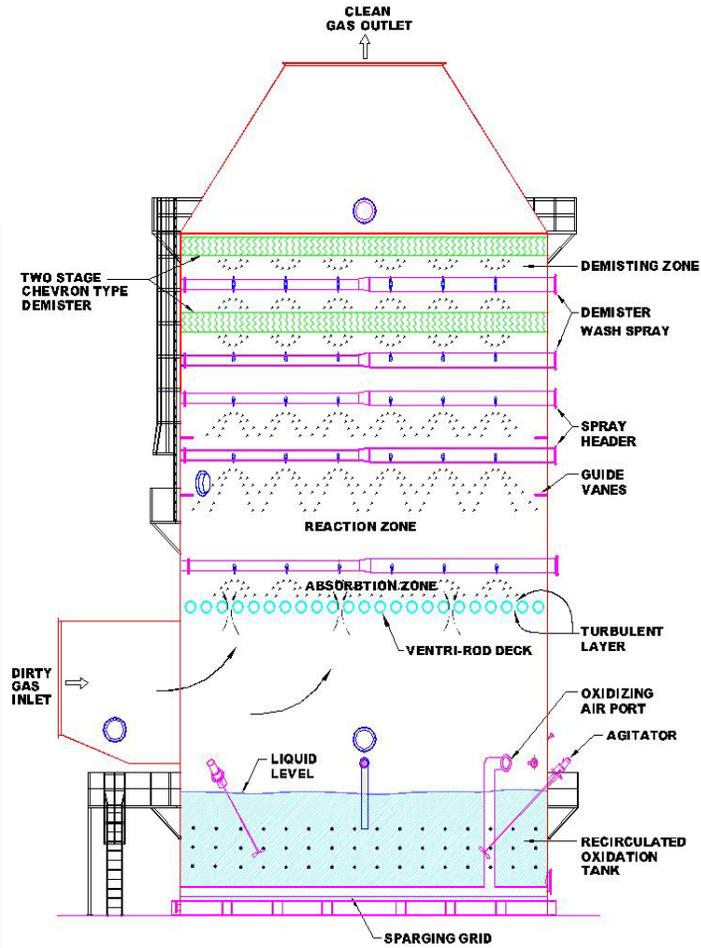




Flue Gas Desulfurization Systems



**TYPICAL FGD LIMESTONE FEED
PREPARATION SCHEMATIC**



DUCON VENTRI SPRAY SORBER



Flue Gas Desulfurization Systems

**A PHOTO OF A5
VENTRI SORBER
ON A UTILITY
FGD
INSTALLATION.**





Flue Gas Desulfurization Systems

BALL MILL





Flue Gas Desulfurization Systems

VACUUM BELT FILTER



- Polypropylene filter trays are corrosion resistant.
- No sliding parts means no vacuum loss thru seals.
- Hydroclone use improves limestone utilization
- Cloth support grids are polypropylene and long life.
- Belt speed is automatically adjusted to maintain uniform cake thickness.



Flue Gas Desulfurization Systems

SPRAY HEADER



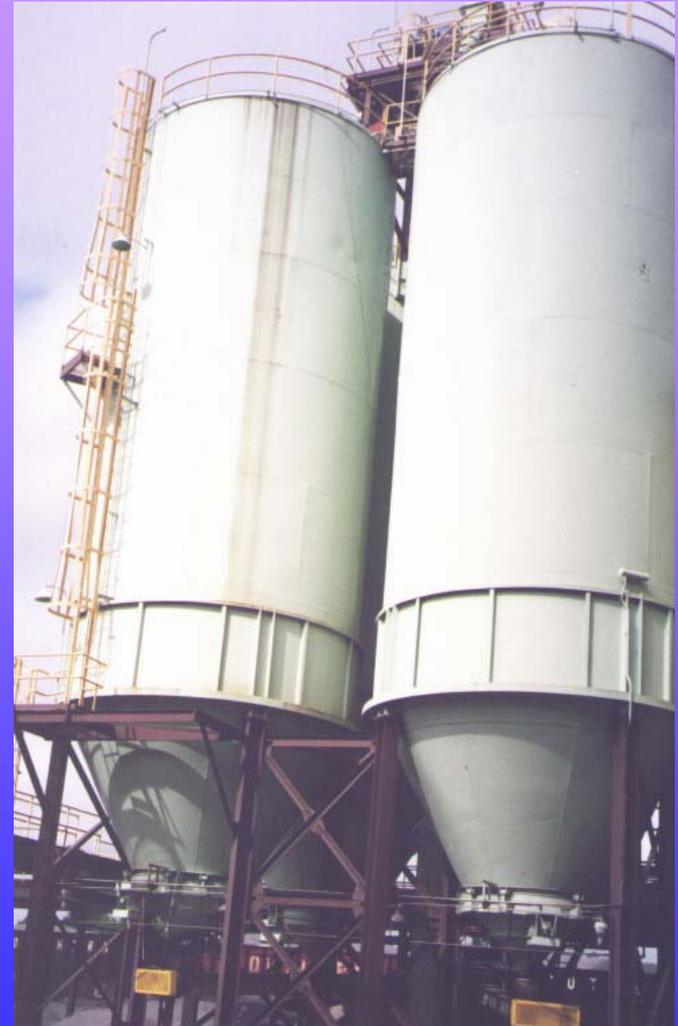
The picture shows the inlet recycle spray header at the top of Ducon Ventri Sorber absorber.



Flue Gas Desulfurization Systems

LIMESTONE SILOS

Ducon custom designs the limestone handling and feeding system that includes silo and weigh feed system that delivers grounded limestone to the mixing tank.





Flue Gas Desulfurization Systems

MIST ELIMINATOR

Ducon uses multi-pass (3-4) chevron type mist eliminators configured in horizontal gas flow position so as to maximize the collection efficiency of the droplets. There is intermittent wash spray that washes the chevrons automatically every 30-45 minutes. The material of construction is FRP, or SS.316 .





Ducon Limestone Wet FGD

REACTION CHEMISTRY

Sulfur dioxide Dissolution



Sulfur dioxide absorption is increased by reduced hydrogen ions or by reduced HSO₃ or SO₃ ions.



Ducon Limestone Wet FGD

REACTION CHEMISTRY

Limestone Dissolution



Reaction with Dissolved SO₂





Flue Gas Desulfurization Systems

Ducon uses proprietary nozzles to generate specific droplet size for maximizing SO₂ removal efficiency in the scrubber. The chart shows droplet sizes for various nozzle liquid pressure.

Nozzle Pressure (Psig)	Avg. Droplet Size (microns)
10	1000
15	700
20	500



Ducon Limestone Wet FGD

REACTION CHEMISTRY

Oxidation





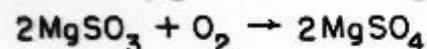
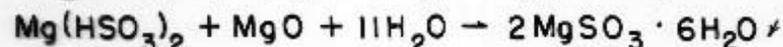
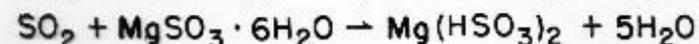
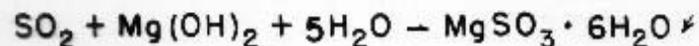
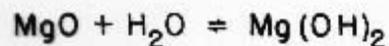
Flue Gas Desulfurization Systems

CHEMISTRY OF MAGNESIUM OXIDE SCRUBBING

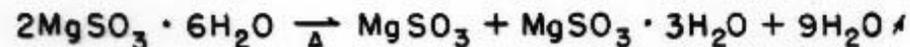
MgO is more reactive than limestone or lime but is almost 7 times more expensive than limestone. Hence is not used frequently.

MgO RECOVERY SYSTEM

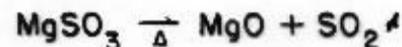
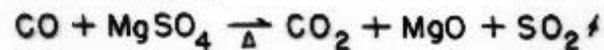
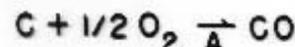
SO₂ SCRUBBING



MgSO₃ GENERATION



MgO REGENERATION

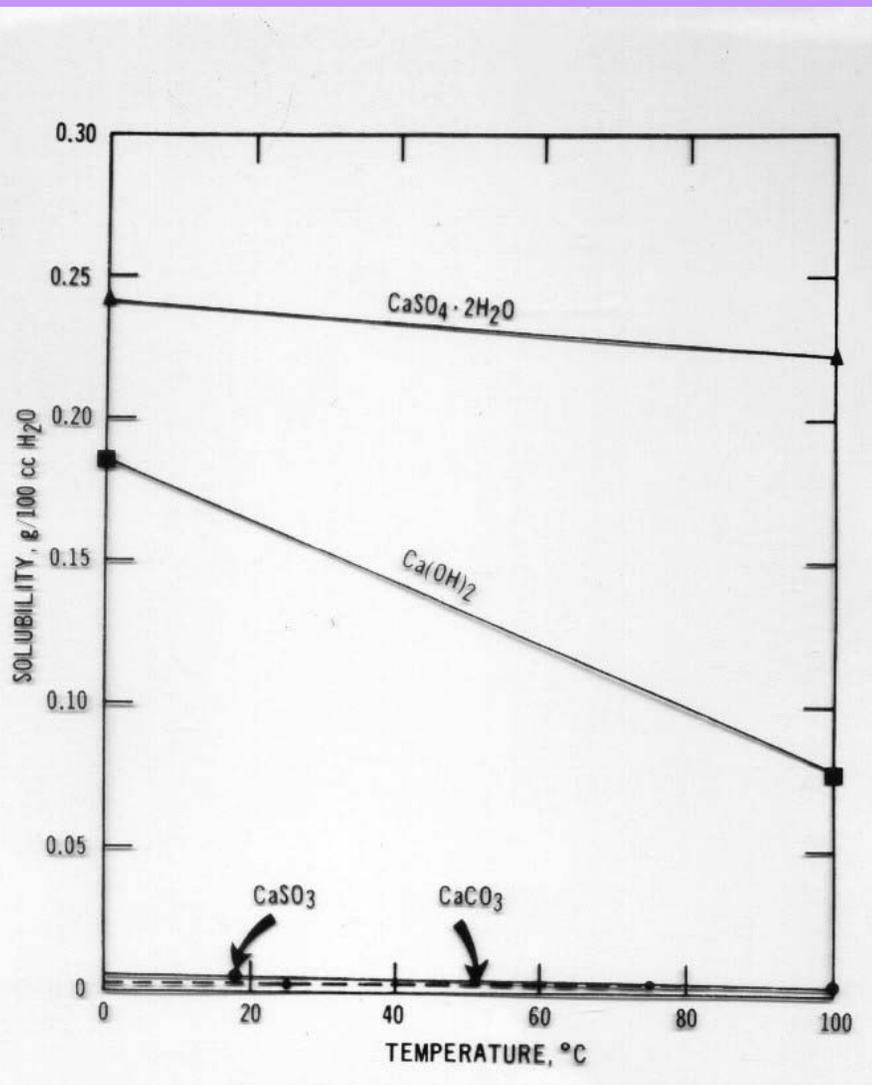




Flue Gas Desulfurization Systems

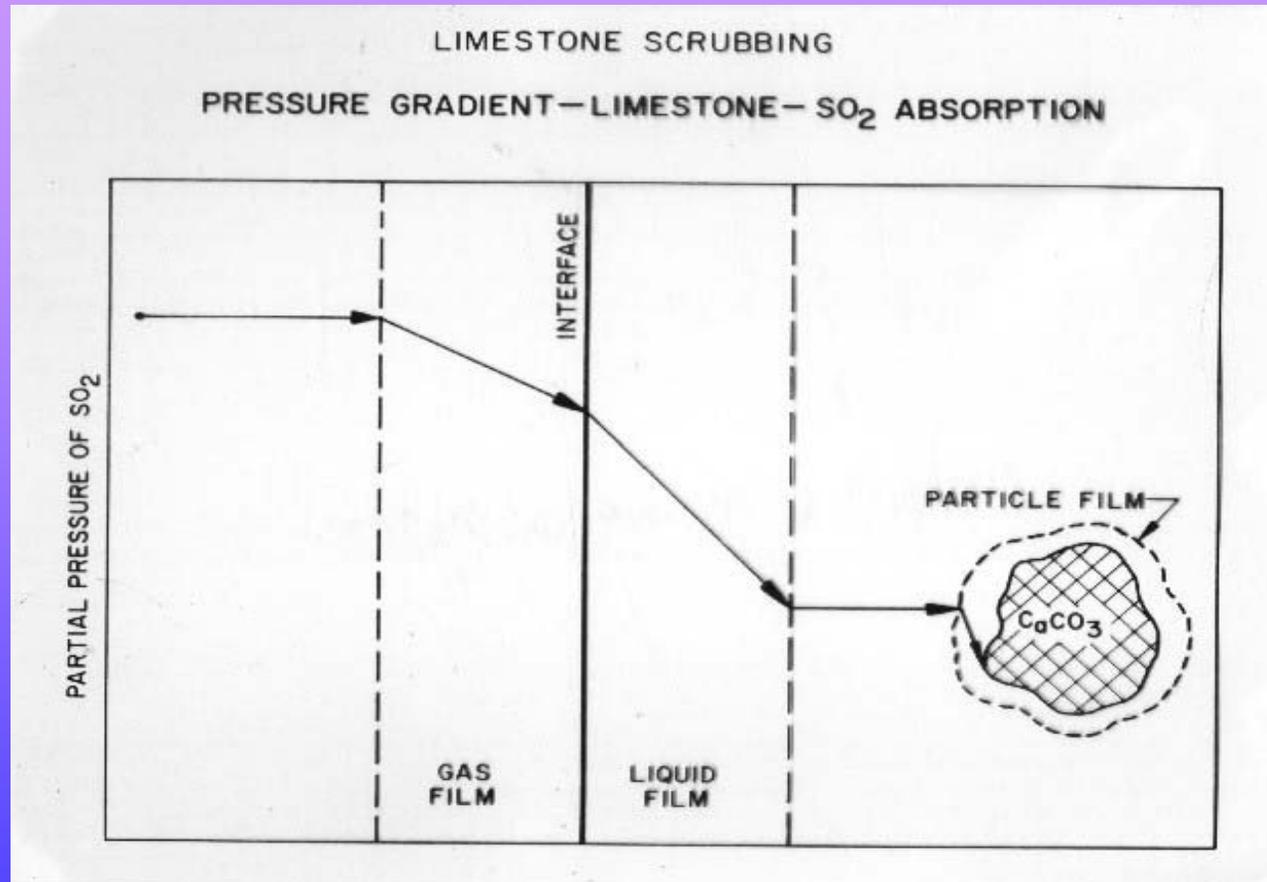
SOLUBILITY DATA

The chart shows that the solubility of Ca(OH)_2 and CaSO_4 is more dependant upon temperature as compared to that of CaSO_3 and CaCO_3 .





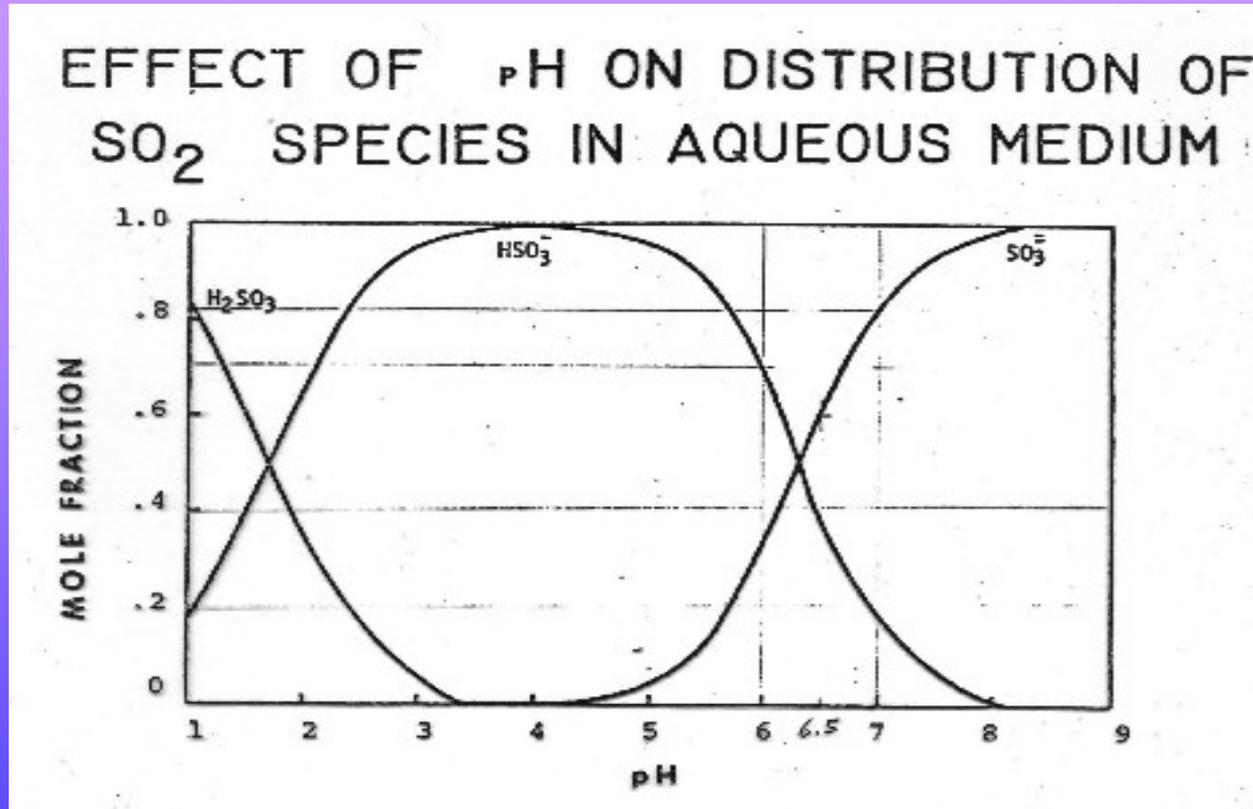
Flue Gas Desulfurization Systems



The chart shows pressure gradient of SO₂ as it goes from gaseous phase into the liquid film. The lower pressure allow it to penetrate the film and react with the reagent molecule.



Flue Gas Desulfurization Systems

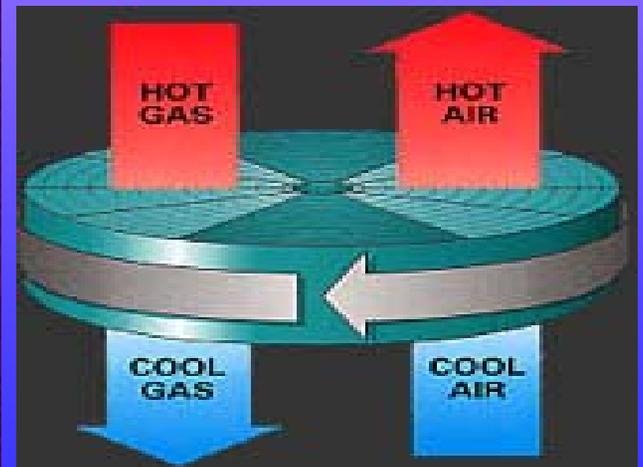


Correct pH is very important in maximizing the dissolution of SO_2 into HSO_3^- and $\text{SO}_3^{=}$ ions. The equilibrium is at around pH of 6.5.

Air Preheaters



- Available in broad range of sizes, arrangements and materials
- Custom engineered for each application
- Rotating media surfaces
- Modular heat transfer surfaces
- Easily field assembled components
- High heat transfer efficiency
- Alloy steels or coatings for corrosive applications
- Advanced axial & radial seal system
- Low maintenance and readily accessible components





Flue Gas Desulfurization Systems



I.D. FAN AXIAL TYPE ON A 400 MW FGD
System



Flue Gas Desulfurization Systems



Ducon FGD System on W.
Illinois Power Co.



Flue Gas Desulfurization Systems



Ducon FGD System on Southern
Mississippi Power Plant



Seawater Scrubber

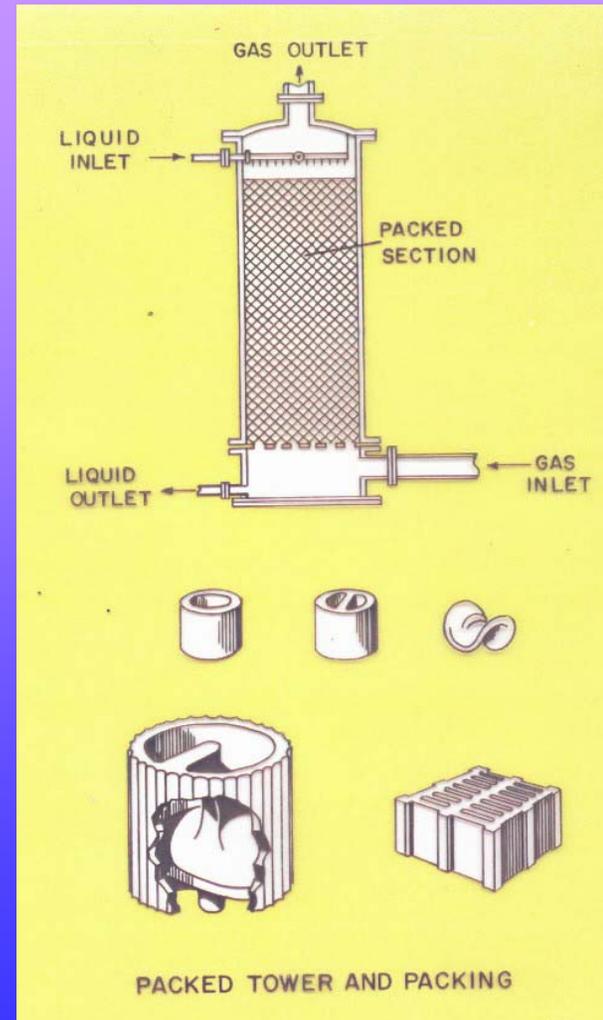
- Used for Sulfur dioxide removal
- Simple operation requiring no chemicals
- Seawater pH of 8.0-8.5 used for alkalinity in once-thru system
- Ducon Q-pack packing provides high removal efficiency and low pressure drop
- Water flows via gravity from scrubber to aeration basin.
- No sludge; aerated water discharged to sea
- Low investment cost and minimal controls



Flue Gas Desulfurization Systems

PACKED TOWER FGD SCRUBBERS

Ducon utilizes Packed Tower type scrubber configuration for applications where caustic (water soluble) or sea water can be used as reagents. Different types of packings can be utilized for high removal efficiency with low pressure drop..



Packing Materials of Construction



- Polypropylene (PP)
- Polyethylene (PE)
- Glass-Filled Polypropylene (GFPP)
- Polyvinylidene Fluoride (PVDF)
- Ethylene-Chlorotrifluoroethylene Copolymer (ECTFE)
- Ethylene – Tetrafluoroethylene Copolymer (ETFE)
- Perfluoroalkyl vinyl ether-Tetrafluoroethylene Copolymer TEFLON

Ducon Limestone Wet FGD



Unique Parameters of Ventri Spray Sorber

- **L/G Ratios: 40 – 80 gpm/1000 cfm**
- **pH range: 5.5 – 6.5**
- **Gas Velocity: 9 –15 fps**

Ducon Limestone Wet FGD



Materials of Construction

- **Absorber:** **Stainless steel 316L**
 FRP lined Mild steel
- **Nozzles:** **SS 316L, silicon carbide**
- **Piping:** **FRP, rubber lined mild steel**
- **Tanks:** **rubber lined mild steel**

Ducon Limestone Wet FGD



Unique Parameters of Ventri Spray Sorber

Inlet absorption Zone

Contains Ventri Rod Deck to:

- **Saturate the incoming flue gas**
- **Distribute the gas evenly across scrubber**
- **Provide turbulence for mass transfer from gaseous phase to liquid phase.**
- **Provides more contact time with less pressure drop than a sieve tray.**
- **Allows operation at lower L/G ratios.**

Ducon Limestone Wet FGD



Unique Parameters of Ventri Spray Sorber

Demisting Zone

Contains chevron type Demisters to:

- Two stage demisters ensures removal of entrained droplets
- Each stage is 3 or 4 pass demister with less than 0.15" w.g. pressure drop per stage.
- Second stage can be horizontal configuration if needed.
- First stage has front & back wash sprays; Second stage has only back wash sprays.

Ducon Limestone Wet FGD



Unique Parameters of Ventri Spray Sorber

Middle Reaction Zone

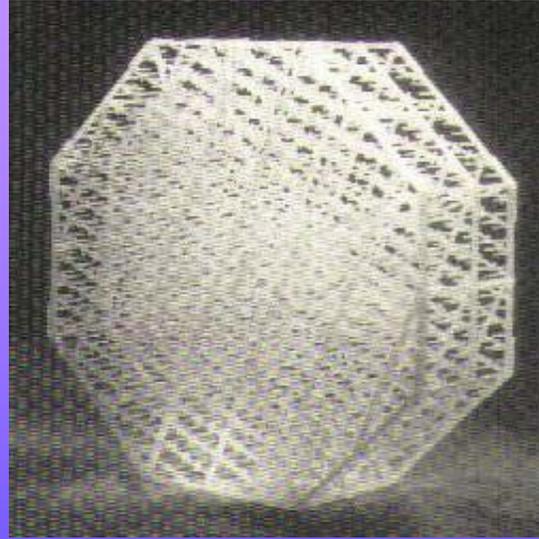
Contains Spray Headers to:

- Promote reaction of SO₂ with lime stone slurry through diffusion.
- Full cone low pressure Nozzles provide droplets from 1000-1500 u in size.
- Two spray headers blanket the entire scrubber cross-section area.
- Optimum gas velocity provides Entrained Droplet Region for longer residence time.
- Vessel shell has guide vanes to provide additional turbulence for higher efficiency.

Packing Materials



SADDLE



DUCON Q-PACK



PALL RING

Comparison of Packings

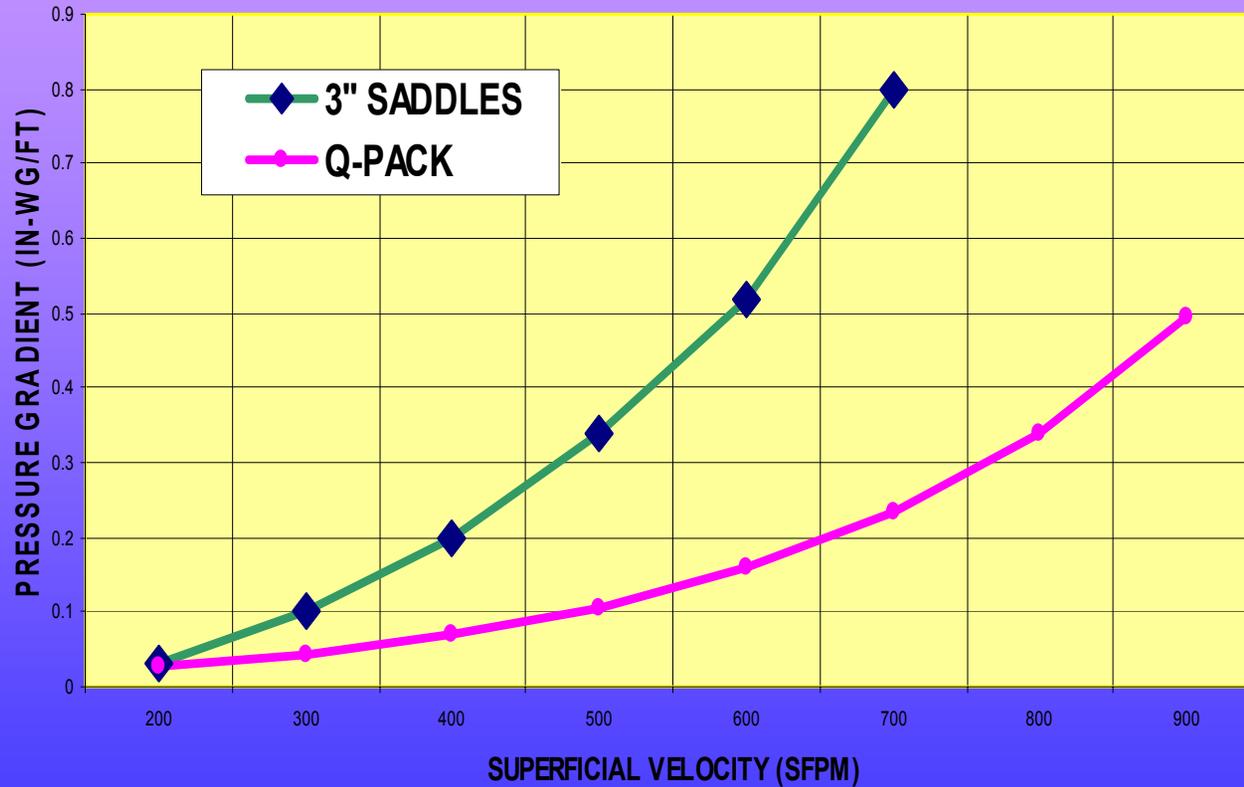


TYPE	SADDLES	Q-PACK	PALL RING
SIZE	3"	12"	3"
WEIGHT (lb/cu.ft)	3	1.6	3.45
Void Fraction (%)	90	97.5	92
Pressure drop* (inch. w.g./ft)	0.34	0.1	0.22

Comparison of Packings



PRESSURE DROP COMPARISON BETWEEN 3" SADDLES AND Q-PAC



Dry Scrubber Baghouse



The Ducon Dry Scrubber utilizes baghouse to remove Sulfur dioxide, hydrogen chloride, and other toxic components. Ducon can also recover Mercury, Dioxins, and other heavy metals by injecting activated carbon in the spray reactor.

- **Over 90% SO₂ removal**
- **Dry waste product**
- **Over 99.99% particulate removal**
- **Removes mercury, dioxins and metals**
- **No stack plume**
- **No sludge processing equipment**

