RAJ
GROUP

Process
Equipments

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Process Equipments

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Air Pollution Control Equipments
- Bag Filters
- Wet Scrubbers
- Incineration System

Material Handling Equipments
- Screw Conveyors
- Pneumatic Conveyors

Pharma Equipments
- GMP Models

Heat Transfer Equipments
- Heat Exchanger
- Hot Air Generators

Agitators

Auto Weighing & Batching Systems

Reactor / Coded Vessels
- Pressure Vessels
- Storage Tanks
- Reactors

Storage Silos

Fermenters

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Bag Filter

Recovery of particulate matter from exhaust gas is vital for any industry from two aspects

- To avoid pollution problems
- Recovery of finished product increasing the plant yield

Working Principle of Bag Filter

- The dust-laden air enters the bag filter bustle.
- The air is uniformly distributed avoiding channeling.
- Initially a coat of material forms on the bags. Subsequently, the coat acts as the filtering medium.
- The dust is accumulated on filter elements while the air passes through the filter bags from outside to inside.
- The accumulated powder is dislodged from the bags by reverse pulse-jet air or by mechanical shaking intermittently.
- The dislodged powder falls on bottom cone and is discharged through powder discharge valves.
- The dust free air is sucked by induced draft fan and is exhausted to atmosphere.
- Knockers are provided on conical portion especially for sticky/hygroscopic materials.

Features of RAJ Bag Filters

- Top Quality Media
- Temperature range from -35°C to 400°C
- Tailored to suit customer requirement.
- Easy removal of bags for cleaning.
- Various options of filter media to suit the process.
- Designed to operate at lower pressure drop thus reducing the power requirement

Main Components of Bag Filter

- Bag filter housing
- Filter bags or cartridges
- Bag cages
- Ventury assembly
- Pulse-jet air cleaning assembly or optionally mechanical shaking arrangement.
- Air bleeding assembly for over temperature protection.

Applications

- Bulk chemicals
- Food industry
- Ceramic industry
- Paint industry
- Pharmaceutical
- Mining & Minerals
- Cement
- Biochemical
- Starch
- Detergent
- Dyes & Pigments

Wet Scrubbers

Wet scrubber is a form of pollution control technology. The term describes a variety of devices that remove pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

Working Principle

The design of wet scrubbers or any air pollution control device depends on the industrial process conditions and the nature of the air pollutants involved.

Inlet gas characteristics and dust properties (if particles are present) are of primary importance. Scrubbers can be designed to collect particulate matter and/or gaseous pollutants. Wet scrubbers remove dust particles by capturing them in liquid droplets. Wet scrubbers remove pollutant gases by dissolving or absorbing them into the liquid.

Any droplets that are in the scrubber inlet gas must be separated from the outlet gas stream by means of another device referred to as a mist eliminator or entrainment separator (these terms are interchangeable) Also, the resultant scrubbing liquid must be treated prior to any ultimate discharge or being reused in the plant.

There are numerous configurations of scrubbers and scrubbing systems, all designed to provide good contact between the liquid and polluted gas stream.

Features Of RAJ Wet Scrubbers

- **Small space requirements**

  Scrubbers reduce the temperature and volume of the unsaturated exhaust stream. Therefore, vessel sizes, including fans and ducts downstream, are smaller than those of other control devices. Smaller sizes result in lower capital costs and more flexibility in site location of the scrubber.

- **No secondary dust sources**

  Once particulate matter is collected, it cannot escape from hoppers or during transport.

- **Handles high-temperature, high-humidity gas streams**

  No temperature limits for operation. No condensation problems can occur as in baghouses.

- **Minimal fire and explosion hazards**

  Various dry dusts are flammable. Using water eliminates the possibility of explosions.

Applications

- Pollution control in process industries.
- Are attached as Pollution control equipment in drying systems.

Incineration system

The incineration system consists of high temperature furnace , fired with the solid fuel like pet coke to achieve 1200 deg.c to burn the organic material and the industrial waste.

System is well equipped with the incineration chamber and the effective scrubbing systems .

Details :

- Fuel crusher and conveyor from yard to the furnace bunker.
- Blast furnace for the pet coke burning.
- Incinerator primary chamber .
- Secondary incineration system.
- Air pre heater for the heat recovery.
- Cyclone for the ash separation.
- Scrubber for the liquid pre-heating.
- Scrubber for caustic to maintain the stack ph.
- ID and FD Blower for the draft maintaining.
- High pressure pump suitable for the liquid spray.
- Well automised system for all the parameters control.

All the high temp equipments are made of mild steel is 2062 and lined inside portion with the high alumina.

Fire bricks and backed up by insulation bricks confirming to is 2042 grades to withstand high temp upto 1250 deg.c

Screw Conveyor

Screw conveyors in modern industry are often used horizontally or at a slight inclination as an efficient way to move semi-solid materials. These can have a greater pitch spacing, resulting in a higher capacity without an increase in rotation speed. They usually consist of a trough containing either a spiral coiled around a shaft, driven at one end and held at the other, or a Shaftless Spiral, driven at one end and free at the other.

Screw Conveyors can be operated with the flow of material inclined upward. When space allows, this is a very economical method of elevating and conveying. It is important to understand, however, that as the angle of inclination increases, the allowable capacity of a given unit rapidly decreases.

RAJ Speciality in Screw Conveyor

- Designed to ensure smooth operation
- Jacketed designs to heat or cool the material during conveying
- Designs with hollow shafts for cooling or heating media
- Rugged screw flights to handle abrasive material with ease
- Various options for material of constructions depending upon product properties
- Designs with mechanical seals for operations under vacuum
- Cantilever screw designs
- Designed for easy operation and maintenance
- Easy removal of screw for cleaning
- GMP designs for food and pharmaceutical industry

Application

Fuels: chippings, straw, sawdust, wood dust, peat, pellets, carbon, etc.

Waste matter: sludge, slaughter waste, manure, garbage, ash, bark, machine grindings, etc.

Food products: grain, powder, sugar, salt, flour, rest products, etc.

Various chemicals, minerals, dyes, pigments, starch, detergents etc.

Pneumatic Conveyors

In the last decade RAJ has expanded into the area of pneumatic conveying systems and now offers a range of solutions using this technology. We can engineer and supply lean phase and dense phase systems for the transportation of products such as powders, granules, grains and flakes or extraction systems for paper and similar waste products.

Design Options

In a pneumatic conveyor system products are moved through various tubes via air pressure, allowing for extra vertical versatility. Pneumatic conveyors are either carrier systems or dillute-phase systems. Carrier systems simply push items from one entry point to one exit point. Dillute-phase systems use push/pull pressure to guide materials through various entry and/or exit points.

Features of
RAJ Pneumatic Conveying System

- Easy material aspiration and dust-free loading of machines
- Gentle conveying, no separation of material mixtures
- Optimum hygiene conditions
- Simple to install and to operate
- Low energy consumption
- Favorable investment and operating costs

Applications

1 Chemical Industry
2 Pharmaceuticals industry
3 Food Industry
4 Mining and minerals

GMP Models

Raj designs & manufactures advanced equipments required for pharmaceutical industry. Through continuous efforts & refinements we have developed GMP models in dryers, blenders, evaporators, autoclaves etc.

Pharmaceutical Applications:

Spray Dryers- Spray Dryers are provided to make powder from Slurry/ Emulsions/ slurry.

Fluid Bed Dryers- Powders are dried into Fluid Bed Dryer.

Spray Cooler – Spray Coolers are used to cool the hot powder.

Blenders- Blenders are used to prepare Creams, Gels, Ointments by adding different ingredients. Raj Mixers used for powder-powder, liquid- liquid & powder- liquid mixing. Spraying arrangement for liquids in small quantity can be provided.

Autoclave- It can be used for heating or cooling of the product while reaction takes place. Limpet or Jacket can be used depending upon heating media.

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Heat Exchanger

In chemical industry, Heat Exchangers are used for transferring heat from liquids, gases and vapours. These are also used as a condenser for the recovery of the solvent.

Features of RAJ Heat Exchanger

RAJ is a well established name in manufacturing of high efficiency heat exchangers. These are extensively used to transfer heat energy from one medium (fluid, liquid and gas) to another medium (fluid, liquid and gas) without mixing them. We design and develop heat exchangers as per application and requirement of customer. Special corrugated tube design heat exchangers increase the heat transfer area with the same quantity of tubes thus reducing the initial costs. The corrugated design also helps in breaking the scaling by creating turbulence in the fluid flow.
Options of various materials of construction from stainless steel to Nickel are available depending upon the circulating media to be used in heat exchangers.
Capacity
Heat exchangers with heat transfer areas from 1 sq.m to 1000 sq.m can be designed and supplied.

Applications

- Chemical Industries
- Pharmaceutical Industries
- Distillery Industries
- Breweries Industries
- Food Processing Industries
- Sugar Industries

Hot Air Generators

RAJ Hot Air Generators are tailor-made to suit individual requirements. The units are self-contained, ready to install immediately after power supply is given.

RAJ Direct Fired Hot Air Generator:

The combustion chamber is enclosed in a concentric shell with suitable lining. The fresh air from dynamically and statically balanced blower is fed to the chamber tangentially. The air envelopes the combustion chamber and absorbs the radiant heat from its surface and then mixes with completed combustion gases in a conical chamber.

Hot air, thus generated is let out from Hot Air generator at controlled temperature to the process. Most of the times the combustion chamber is refractory lined. The thermal efficiency is almost 100% with proper insulation and air temperature can be up to 1100 deg.C.

RAJ Indirect Fired Hot Air Generator:

The Combustion Chamber is made out of SS 316 to withstand high temperatures. The combustion is completed within the chamber. Hot gases, after complete combustion are passed through Tube Heat exchanger, comprising of second & third pass.

The systems are available with Light fuel oil and/or Gas fired, backed by fully automatic burners.

Fresh Air from atmosphere is fed onto the surface of combustion chamber through a statically & dynamically balance blower. The shape of passage ensures to form an envelope on the combustion chamber to extract maximum heat, thus higher heat transfer efficiency. The air continues to pass through outer surface of heat exchanger, gaining heat & is collected at the other end of hot air generator. The generation of hot air is within minutes of its start.

Indirect fired hot air generator types are,

a) Fuel fired HAG.

This consists of multiple shell in shell construction or shell and tube construction. The process air does not come in contact with the flame or the combustion gases. The combustion gas path and process air paths are different. The heat from flue gases is recovered for maximum thermal efficiency. Thermal efficiency up to 88% are easily achieved in these hot air generators. Air temperatures up to 350 degree C are possible in these types of heaters. The material of construction of combustion

chamber is SS 310 and the outer shells are either made up of carbon steel and spray galvanised or are made up of stainless steel. For GMP plants the complete construction is in stainless steel.

b) Steam/ Thermic Fluid heated air heater.

These consist of a bank of fin tube radiators. The process air passes over the fin tubes through which either steam or thermic fluid flows. Thus indirect heating of air takes place. Temperatures from 250 to 300 deg. C are achievable depending upon the steam and thermic fluid temperatures. The material of construction of tubes is either carbon steel or stainless steel depending upon process requirement. The mounting of these heaters can be either horizontal or vertical.

Design Aspects:

- The HAG direct fired design is suitable for Light oil, Heavy oil, Natural Gas, LPG, Dual firing for Oil and Gas.
- The HAG in-direct fired design is suitable for Thermic Fluid, steam any other suitable heating media to increase the temperature of process air.
- The HAG design is suitable for high turn down ratio.
- Higher thermal efficiency to reduce fuel cost.
- Steam Heater design is suitable for vertical installations also.
- The tube can be in various constructions like stainless steel, copper, aluminum etc.

Features of RAJ Hot Air Generators:

- These Hot Air generators are manufactured upto capacity of 5.0 million Kcal/hr. Higher capacities are also available.
- Efficiency in these hot air generators is nearly 100% since surface losses are taken care of with proper insulation. Specially designed systems can be offered suitable for temperatures upto 700 degree C.
- Direct Fired and Indirect Fired HAG are available.

Applications

- Raw mill, Coal mill & Cement – clinker grinding.
- Dryers (Fluidised Bed, Flash, Husk, Rotary & spray.
- Calciners
- Auxiliary in line heaters etc.

Hot Air Generator-Solid Fuel Fired

Raj solid fuel fired hot air generators are offered in vertical or horizontal designs, either as standard models or tailor-made models to match customer's specifications and applications. Designed in DIRECT and INDIRECT heating types, these systems are practically free from any maintenance and are highly efficient.

Direct systems find their applications in high temperature drying, whereas the indirect systems are used where pure air is required for drying. The design is compact & hence space saving. Units are designed for continuous round the clock operation. Air temperature up to 350 degree C is possible in indirect type and 800 degree C in direct type air heaters.

Characteristics of RAJ Solid Fuel Fired HAG

1. The payback period will be 2 to 10 months against oil/gas fired or electrical Hot Air Generators.
2. Multiple pass design, less space, Maximum Efficiency.
3. Very High Thermal Efficiency up to 85% due to perfect combustion, minimal radiation loss & higher heat transfer area.
4. Less maintenance due to minimum usage of refractory in furnace, Horizontal & Vertical design, easy access for maintenance.
5. Less pollution by using Dust Collectors.
6. PLC based completely automated operation to control the temperature accurately.
7. Option of direct & indirect firing available.

Fuel :
Bagasse, Coal, Wood, Agro Waste, Husk Etc.

Capacity :
20,000 Kcal/hr to 50, 00,000 Kcal/hr

Material of Construction :
Carbon Steel/SS 304/ SS 316.

Agitators

Features of RAJ Agitators

1 Rugged cast or fabricated housing.
2 Heavy duty bearings.
3 Accommodates standard packing or single or double mechanical seals.
4 Simplified design ensures quick, easy and inexpensive installation and maintenance.
5 Dynamically balanced to ensure vibration-free operation.
6 Custom built designs to suit specific applications.
7 Efficient blade profiles reduce energy requirements.

Configuration
Side entry, top entry or bottom entry agitators are available.

Designs
Paddle type, Turbine, Anchor type, Propeller design and other product specific custom built designs are available.

Applications
1 Pharmaceutical
2 Food
3 Chemical processing
4 Petroleum
5 Pulp & Paper
6 Ceramics
7 Biochemicals
8 Winery
9 ETP
10 Detergent Plants

Material of Construction
Various options for materials of construction are available depending upon the product to be handled and the duty conditions. Most common materials are stainless steel grades 304, 304L, 316, 316L. Exotic materials like Titanium and Nickel can also be offered.

Capacity
Agitators suitable for tank capacities right from 50 litre to 100 kilolitre volumes can be designed and supplied.

Auto Weighing & Batching Systems

Description

Auto-Weighing and Batching System, as the name suggests, is used for precise weighing of multiple products to prepare a batch.

which is then further mixed and then packed.

The system can be used for Powders, Cakes and Liquids. The system is a completely pre-engineered system with instruments provided for automation. Fully automatic and semi-automatic versions of this system are available.

Construction and Operation

The system consists of Multiple Storage Hoppers, with or without Agitators, depending upon the nature of product. These Storage Hoppers are fitted with coarse and fine screws at the bottom.

The screw feeders discharge the material into the Weighing Hopper, which is placed on load cells.

Pre- determined quantity of material from each Storage Hopper is fed to the Weighing Hopper.

The batch controller controls the starting and stopping of the coarse and fine screws as per the program and quantity given in it.

Once the required quantity of material is fed to the Weighing Hopper, the bottom valve is opened to discharge the material to mixer.

The mixer can be any type like, Ribbon Blender, Cone Screw Mixer, Agitated Vessel etc. Once the Weighing Hopper is empty, the next batching cycle starts. The system can be programmed for any number of batching cycles.

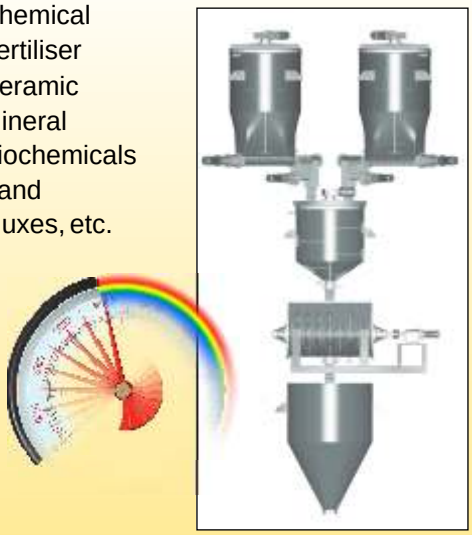
Features

- Minimum handling of product.
- Uniform product quality.
- Weighing accuracies up to 0.1 percent.
- High mixing accuracy and minimum mixer idle time.
- Continuous and automatic operation.
- No product loss.
- Low floor space requirement.

The system is made to suit the specific requirement of the customer as regards batch size, number of products to be mixed and their quantities etc. The material of construction of product contact parts is either carbon steel or stainless steel, depending upon product nature.

Applications

- Pharmaceutical
- Food
- Chemical
- Fertiliser
- Ceramic
- Mineral
- Biochemicals
- Sand
- Fluxes, etc.



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Pressure Vessels

Pressure vessels are an inseparable part of the process industry. Many critical reactions need to be carried out in closed vessels at elevated pressures and temperatures. Some reactions can be explosive in nature. Pressure vessels are carefully designed and manufactured equipment to handle such extreme conditions of temperature and pressure.
Pressure vessels may theoretically be almost any shape, but shapes made of sections of spheres, cylinders, and cones are usually employed. A common design is a cylinder with hemispherical or torispherical end caps called heads.

Specialty

We manufacture all type of Carbon Steel and Stainless steel Pressure Vessels as per ASME code.
We are one of the leading manufacturer of pressure vessels, which are extensively used in various applications of processing industries.
We, at RAJ manufacture the pressure vessels of different types according to the needs of customer.

Applications

1 Pharmaceutical Industry
2 Chemical Industry
3 Process Engineering Industry
4 Off shore Activities
5 Food Processing Industry
6 Petrochemical industry
7 Refineries

Storage Tanks

Storage tanks are used in many configurations which depend upon functional requirement. These functional requirements includes operating temperature, storage media etc.

Various configurations of storage tanks available are:

- Horizontal Storage Tanks
- Vertical storage tanks
- Elliptical shaped storage Tanks
- Flat storage Tanks
- Conical Head Storage Tanks

We also undertake customization of this range to suit the needs of our clients.

- Storage tanks
- Storage vessels
- Chemical storage vessels
- Chemical storage tanks
- Fabricated storage tanks
- Custom storage vessels
- Stainless steel storage vessels
- Carbon steel storage tanks
- Acid storage tank
- Fuel storage tanks

Capacities ranging from 1kL to 5000 kL can be offered.

Reactors

Reactors, unlike mixing tanks, are totally sealed from the atmosphere. Mixing tanks are designed to disperse two or more chemicals together. Reactors on the other hand, allow the chemicals inside to go through a reaction phase which ultimately produces material with new and different chemical properties.

Types of Reactors

Half-Pipe Jacketed (Limpet) Reactors
Half-pipe jacketing provides very good heat transfer by allowing high flow rates. It is best suited for high temperatures and pressure applications utilizing hot oil or other high temperature media. Half-pipe is formed from a continuous coil and is "wrapped" around the vessel exterior in single or multiple zones to provide greater latitude for process capabilities. We use a 180 - degree half-pipe configuration that minimizes pressure and increases fluid velocity.

Dimple Jacketed Reactors
Dimple jacketing provides good heat transfer with low flow rates at lower pressures and temperatures. It is best used with steam for heating or chilled water for cooling. We roll from the dimpled jacket to the vessel radius and then "plug weld" the individual dimples to the vessel. This allows for a secure fit.

Conventional Jacketed Reactors
Also known as open jacket, conventional jacketing is a secondary external shell wrapped around the primary vessel to provide a space for heat transfer fluids. We add a spiral formed internal baffle to direct the heating media around the vessel form the inlet to the out. Conventional jacketing is best used on smaller diameter vessel.

Features of RAJ Reactors

- We fabricate in MS, SS 304, SS 304L, SS 310, SS 316 SS 316L, SS 317 and CS as per requirement of the customer.
- We undertake Design of these reactors.
- We provide Reactors with sealing arrangements as Mechanical Seals, Stuffing Box with /without cooling arrangements and with Magnetic drives.
- Reactors are fabricated as per standards i.e ASME ,DIN etc
- cGMP models are available.

Applications

- Specialty Chemical Industry
- Pharmaceuticals Industry
- Fertilizers Industry.
- Biochemical Industry.

Storage Silo

A silo is a structure for storing bulk materials.. Silos are more commonly used for bulk storage of grain, coal, cement, carbon black, wood chips, food products.

Features of RAJ Storage Silos:

- bolted, smooth-wall, & welded silos
- available in epoxy-coated carbon steel, stainless steel, carbon steel with stainless steel cladding, carbon steel with FRP coating.

Typical Silo Applications

- foodstuffs and flour silos
- chemical silos
- coal silo
- cement and fly ash silo
- grain silos
- ceramic powder silo

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Site Fabrication

We have expertise in any critical and semi-critical heavy engineering fabrication. We specialize in both carbon steel and stainless steel fabrication as per customer requirement. All the fabricated items are passed through srtingent inspection and tests.

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