

GAS INDUCTION REACTORS

WITH MAGNETIC SEALING TECHNOLOGY

Patented Technology
For Magnetic Seal

BATCH
CONCENTRATION
SYSTEMS



▲
CATALYST
FILTERS



OMEGA-KEMIX PVT. LTD.

About Omega-Kemix

INDIA'S ONLY COMPANY THAT PROVIDES
PATENTED MAGNETIC SEALING TECHNOLOGY

Omega-Kemix, a company promoted by qualified and experienced technical personnel, was founded in 1985. Our innovative approach to Static and Dynamic Mixing Technology has enabled us to successfully develop a wide range of Gas-Induction Reactors, with capacities upto 1,00,000 Litres.

In the ultimate analysis, our greatest source of satisfaction is that our customers have been successful, and have achieved excellent results with Omega-Kemix Gas-Induction Reactors.



OUR ENGINEERING STRENGTHS

Enhanced process performance of any equipment can only be achieved when each component is structurally sound. Our Reactor vessels are designed and manufactured as per International Standard such as ASME, BS, DIN, as well as IS Codes, using computer-aided stress analysis and drafting techniques

Design of Gas-Liquid Batch Reactors will need a variety of skills in order to arrive at a safe and practical solution. This involves proficiency in the following areas:

- › Chemistry and Stoichiometry.
- › Knowledge of reactant properties.
- › Reaction Kinetics and Thermodynamics.
- › Batch and Steady State Heat Transfer.
- › Hydrodynamics of Gas-Liquid and Gas-Slurry Mixing.
- › Mechanical Design of Pressure Vessels.
- › Stress Analysis of rotating machinery.
- › Safety Aspects and Hazop analysis.

CERTIFICATIONS & ACCREDITATIONS

- ISO 9001
- CE Marking for our products
- NSIC Crisil Rating of MSE2.
- OKPL Plant II is ASME Certified for U Designator.



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ENGINEERING ASPECTS

Inputs for designing a Reactor

- › Type of reaction, e.g., Benzene Ring Saturation.
- › Quantity of Reactants.
- › Molecular weights of Reactants.
- › Physical properties of reactants at ambient and operating conditions.
- › Are the reactants liquid, solid, or gas?
- › Description of catalyst, loading and physical properties.
- › Reaction pickup temperature and operating temperature.
- › Minimum and maximum operating pressure at which the reaction is to be carried out.
- › Whether additional reactants or catalysts need to be added during the reaction.
- › Heat of Reaction (Exotherm, Heats of mixing, etc.)
- › Whether one of the products needs to be removed in-situ.
- › Batch time obtained in lab trials.

All manufacturing processes at Omega-Kemix are carried out under the stage wise inspection of our Quality Control Engineers. Starting with testing of Raw Materials and Bought-out components, our Engineers are trained to check every stage of manufacture. We even have our own specifications for packing of Reactor components for despatch. Such attention to detail results in ease of installation and commissioning, and also ensures a long, productive and trouble-free life for your Gas-Induction Reactor.

Sector Served

- › Pharma Industry
- › Dyes & Intermediates
- › Aromatic Chemicals
- › Agro Chemicals
- › Fine Chemicals
- › Speciality Chemicals

Gas-Induction Reactors

In the Process Industry, many chemical reactions are carried out between liquids / slurries and gases. Traditionally, such gas-slurry reactions have been carried out with the help of equipment, where basically, an agitator was used to stir the liquid in the Reactor. This somewhat clumsy method resulted in less than satisfactory performance, due to non-ideal mixing, which led to poor catalyst suspension, negligible gas-liquid interfacial areas, as well as low heat and mass transfer coefficients.

An Omega-Kemix Gas-Induction Reactor offers a radical change from this conventional approach. Instead of churning the liquid reaction mass, a hollow agitator pumps gases from the head space to the lowest part of the Reactor vessel, as shown in the picture. A specially designed impeller vigorously disperses these gases into the reactor bottom, resulting in a mixture akin to a boiling liquid. Gas bubbles react with liquid / slurry as they rise. Unreacted gases are re-induced into the liquid.

The self-aspiration agitator of an Omega Gas-Induction Reactor has a highly efficient design, which leads to the following advantages:

- Vigorous Gas Liquid mixing
- Thorough suspension of solid components (e.g Catalyst)
- Large gas-liquid interfacial areas (Typical, interfacial area is 100 to 300 m² pm³ of operating volume)
- Enhanced Gas-Liquid and Liquid Mass Transfer rates
- Very high vessel side heat transfer coefficients, which approach boiling coefficients
- Reduced Batch times
- Minimal side reactions
- Excellent Batch-to-Batch Repeatability

Mixing mechanism:

A Gas-Induction Reactor is fitted with

- › Hollow rotating shaft with aspirating holes or slots
- › Blower-like impeller at its lower end.

Since the gas is pumped against the static liquid head, there are restrictions on the L/D ratio of these reactors. Economical designs have L/D ranging from 1 to 1.6, where L is the Tan Height of the vessel.



Applications

- › HYDROGENATION
- › AMINOLYSIS
- › OXIDATION
- › ETHOXYLATION
- › CARBOXYLATION
- › SIMILAR GAS-SLURRY REACTION
- › AMINATION



Gas-Induction Reactors

ENGINEERING ASPECTS

Heat Transfer

Jacket



Jacketed Reactor with Magnetic Seal & OKPL Efficiency Turbine

Helical Coil



Limpeted Reactor with Magnetic Seal and internal coils & Combination of OKPL Efficiency & Semi Anchor

Limpet



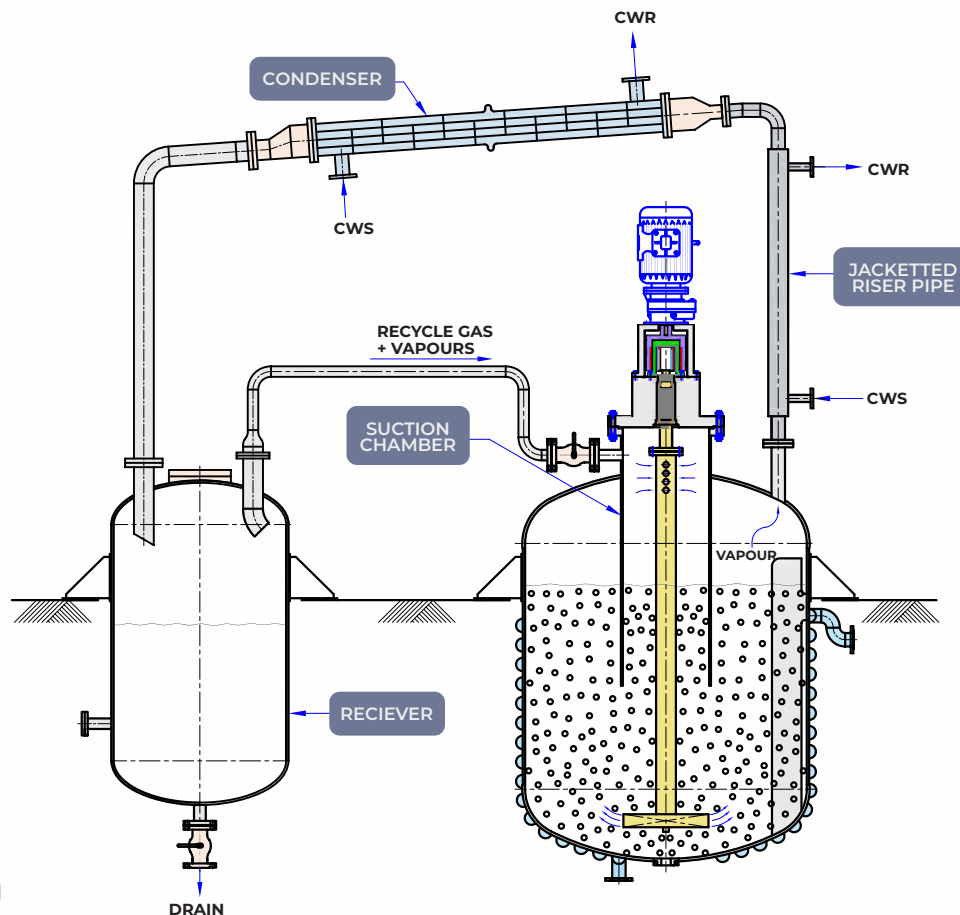
Limpeted Reactor with Mechanical Seal; Agitator Type : PBT

Plate Coil



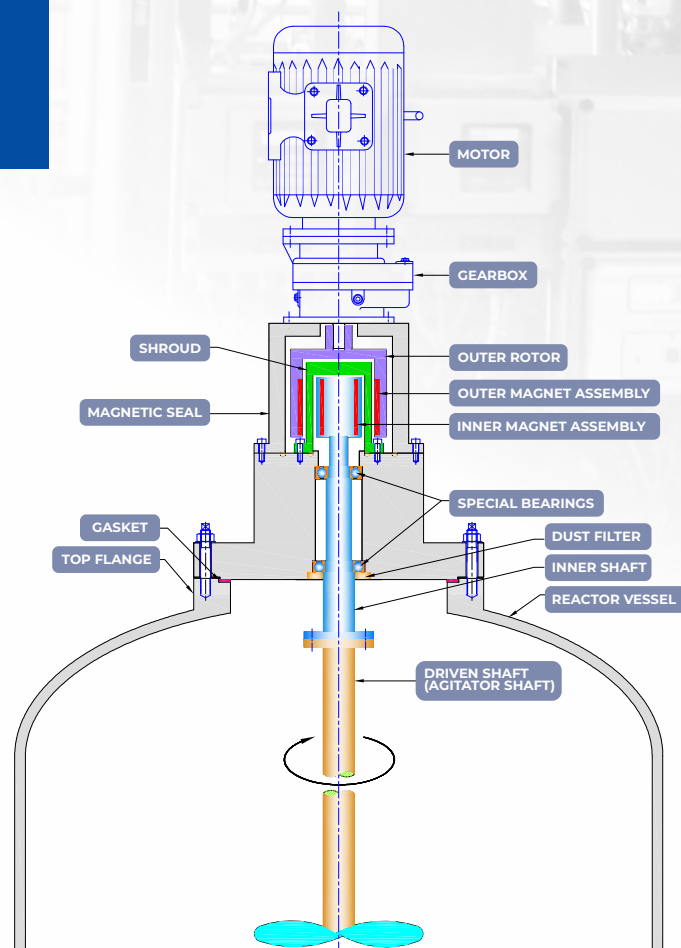
Limpeted Reactor with Magnetic Seal and Plate Coils & Gas-Induction Agitator

In-situ Removal of (By) Products



Magnetic Sealing Technology

MAGNETIC DRIVE ASSEMBLY



Several important chemical reactions are carried out in hazardous conditions. Examples of such reactions are as follows:

Pressure Reactions, such as Hydrogenation, Reactions with noxious gases, Manufacture of potent pharmaceuticals such as hormones, oncology products, etc. and any other reactions requiring zero leakage.

Omega-Kemix can supply Reactors with Top Entry Magnetic Seals. This sealing system comprehensively eliminates all possible leakage risks, by incorporating non-contact magnetic seals. The agitator shaft does not puncture the Reactor Vessel.

A Magnetic seal comprises of a sealed chamber (Shroud), which contains a rotating Inner Shaft, which is embedded with powerful Inner Magnets. This inner shaft is supported on Upper and Lower Bearings. These are special Bearings, capable of withstanding harsh environments present inside the Reactor. A special barrier filter prevents dust from entering the Bearing Area.

The output shaft of Motor / Gearbox assembly is locked on to an Outer Rotor, which is fitted with an Outer Magnet Assembly. When the Motor is switched on, the Outer Rotor Rotates, and magnetic flux causes the inner shaft to rotate synchronously with the Outer Rotor. Top Entry Magnetic Seals are the safest method for sealing agitated Reactors.

Their applications include High Pressure Autoclaves such as Hydrogenators, as well as Reactors used for handling sensitive or hazardous products.

Omega-Kemix manufactures a wide range of Top Entry Magnetic Seals, for use in their Reactors. These are suitable for Reactors of up to 50000 liters capacity, temperature up to 300° C, and for pressure up to 100 Bars. Reactors of higher capacities and ratings can be supplied with special designs.

Advantages

- › 100% Sealing. **Zero leakage.**
- › Shaft does not puncture the Reactor.
- › Zero emission of hazardous fluids.
- › Minimal friction saves power.
- › Suitable for pressure fluctuations.
- › No maintenance required. No spares required.
- › Extremely safe, No External Contamination.
- › Cutting edge of shaft sealing technology.
- › Various capacities available, Customizable.
- › Compact Design.
- › Eliminates use of Barrier Fluids (Thermosyphon, Forced Lubrication).

PATENTED PRODUCT

Omega-Kemix's Top Entry Magnetic Seals for Agitators is patented in

- › India
- › Switzerland
- › USA
- › France
- › China
- › Korea
- › UK
- › Japan
- › Germany

Largest Magnetic Seal supplied by OKPL was designed for Torque exceeding 2500Nm.



Catalyst Filters



Catalyst Filters for Hydrogenators and Autoclaves

Catalyst filtration is an important aspect of a Hydrogenation system. Omega- Kemix supplies a cost effective system, which incorporates.

- › Complete filtration
- › Operational safety
- › Full backwash
- › Minimal holdup of the reaction mass

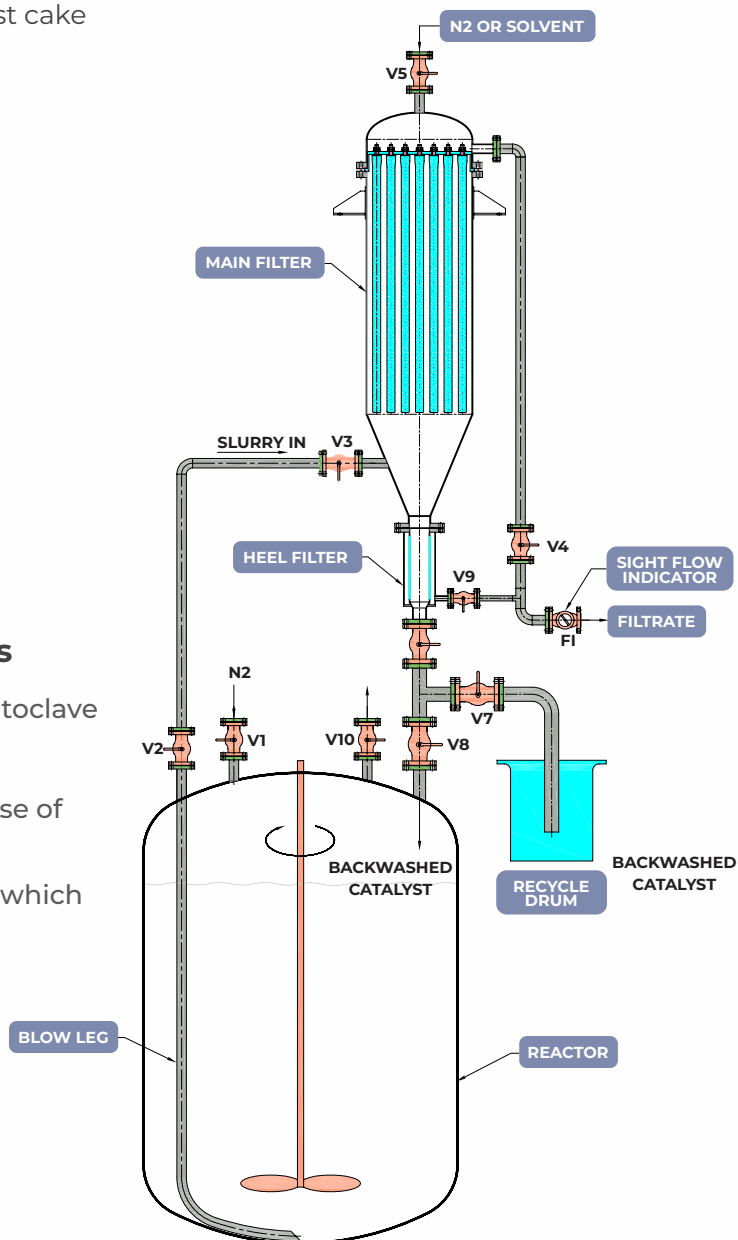
The filter is

- › Fitted with sintered candles
- › Has a special Heel filter
- › Provided with a sight flow indicator
- › Provided with special valves for effective dislodgement of catalyst cake

Omega-Kemix

make filter has the following advantages

- Safe procedure for catalyst filtration from the Autoclave
- There is no spillage of expensive catalyst
- Closed circuit operation avoids fire hazards in case of pyrophoric catalysts
- High efficiency candles result in very low losses, which are often below measurable limits
- The filtration system pays for itself through high rate of catalyst recovery



Batch Concentration Systems

Introduction

Batch type concentration of liquid mixtures is a standard and often used operation in the Chemical Process Industry. Batch Distillation, Solvent Recovery, and Solution Concentration are typical examples.

A conventional method is the use of a stirred vessel with jacket. This is an outdated inefficient process, as heat transfer area decreases as the liquid level falls. Also, there may be difficulties in discharging tarry residues from the vessel bottom.

OMEGA-KEMIX BATCH CONCENTRATION SYSTEMS, have several unique features:

- › Full Submergence and Utilisation of Heat Transfer Area throughout the Batch.
- › Heats from ambient to Boiling Point in 1 hour*.
- › Concentration Time 3.5 Hours*.
- › No Moving Parts.
- › For Batch Concentration, Distillation and Solvent Recovery.

Advantages

An Omega-Kemix Concentrator (OKC) offers:

- › Optimal consumption of Steam and Cooling water.
- › Cooled solvent sent to storage by gravity flow.
- › Minimal solvent loss during storage.
- › Low batch time & Low residual volume.
- › Non-fouling design with GMP or Non-GMP construction.
- › Easy draining of viscous and tarry residues.
- › Reboiler Heat Transfer surfaces are submerged.
- › Condenser promotes venting of non-condensibles.
- › Heat Transfer surfaces are easy to clean.
- › Skid Mounted assembly.
- › Low payback time due to effective solvent recovery.
- › Complete Package for Concentration with Solvent recovery.



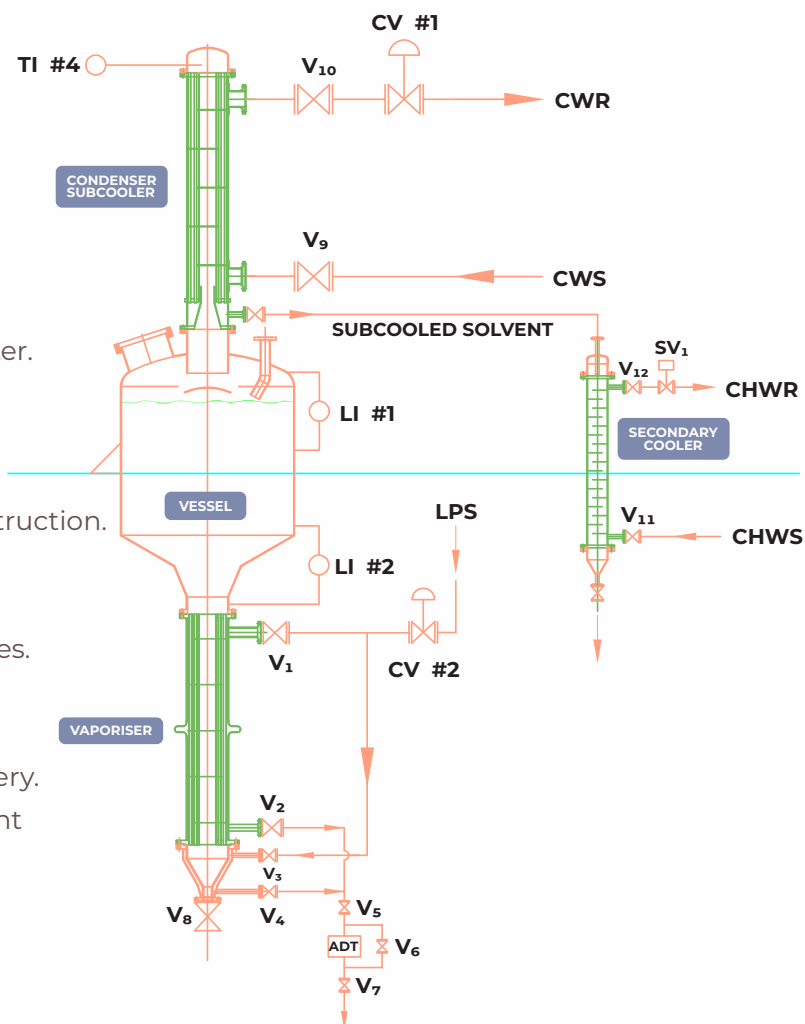
Operating Scheme

The Holding Vessel is charged with solution up to the desired level.

Steam Heating is started in the Reboiler. In most cases, LP Steam is adequate. Thermosyphon currents are quickly established due to density difference between hot solution in the tubes and cold solution in the Vessel and Downcomer. A proprietary design ensures that the entire mass is quickly heated up to its boiling point, after which high boilup rates result in fast vaporisation.

After starting Steam heating in the Reboiler, Cooling Water supply to the condenser is started. The control scheme ensures that Condenser cooling water and Vaporiser steam flow rates are continuously adjusted, to ensure optimal solvent recovery. The condenser is designed to condense and subcool vaporised solvent. The Secondary Cooler further cools this stream below ambient temperature, to minimise evaporation losses during storage.

Liquid level falls as the solvent evaporates. Once the level reaches a minimum value, the concentrated solution is discharged through bottom drain valve, and Steam supply is terminated.





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