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**Reaction  
Vessel**



## About Us

**NSI Equipments Pvt. Ltd.** is a fast emerging company specializing in the design and manufacture of **REACTION VESSEL** for industrial use for the past four decades. Over the years NSIE has consolidated its experience in its field and has developed its expertise. Our endeavor is to supply well engineered product to the specific need of our customers. Customer satisfaction is our paramount importance, which is the foundation to our business policy. We have excellent reputation for the quality of our product range as always endeavoring to advance technology, appropriate fabrication processes at all stages of manufacture.

This has been possible with the active participation of our management, staff and workers. Everyone has contributed in his own manner and ultimately it is teamwork that has won.

## Vision

**NSI Equipments Pvt. Ltd.** vision is to excel and provide technology that is the most advanced in Asia and at par with the international league. We believe every satisfied customer is an asset and we target to satisfy each and every customer walking in through our door. We envisage achieving these ambitious growth plans as Green Progress meaning attaining the goals in symbiosis with environment and it's an integral part of our corporate vision.

### Our credo is:-

Customer orientation to develop products (machines and auxiliaries) that seek to meet customer aspirations. An organization reputation that instills confidence in the customer to seek pre-purchase counseling, validation through trials and service needs that may arise.

## Mission

**NSI Equipments Pvt. Ltd.** mission is to consolidate at the forefront of our Product Lines in Asia. We believe everything is possible with right efforts and dedication. We are confident that we will achieve our goal by:

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## Quality Policy

“To be passive and proactive in providing quality product and solutions to clients by continuously striving to exceed their expectations”

Our commitment to quality is unflinching. Our desire for growth is deep rooted and our capacity for details is amazing. We adhere to national and international standards across all operations: from sourcing the raw materials & till it transfers to the finished machinery and finally successful commissioning. All our suppliers operate quality management standards as dictated by specific markets. This measure undoubtedly reflects our royalty to quality assurance and our determination to provided the products and service our customers demand.

What set us apart is the depth of our commitment and the high level of our concern to deliver quality products, efficient services and total solutions.

And this is where our quality improvement comes from.

At NSIE, **quality is a way of life.**

## Customer Satisfaction

Customer satisfaction is the foremost concern in our work culture. That is why a few of our products are very popular among users. We have met stringent delivery schedules and accepted challenges of precision manufacturing. We have extended our services to small scale and large-scale customers equally, and bagged repeat orders.

## Reaction Vessel



Reaction Vessel is a pressure vessel for finishing closed physical and chemical reaction such called as reactor, reaction kettle, resolution boiler, polymerizing kettle etc. Reaction vessels are the heart of a chemical plant where the chemical changes and wide variety of reactions take place which include condensation, polymerization, etherification hydrolysis, hydration, reduction, oxidation, hydrogenation etc at a pressure (up to 30 kgs/cm<sup>2</sup>) and at temperature ranging -20 °C to +250 °C. Reaction needs distillation can also be conducted efficiently.

## Design Pressure Of Reaction Vessels



Standard Reaction vessels are designed for 3-4 kg/Cm<sup>2</sup> internal pressure or full vacuum. Reaction Vessels with Jackets are designed for pressure inside the jacket at 3-4 kg/Cm<sup>2</sup>. Reaction vessels for higher operating pressures are also available as per process requirement.

### Function

The ingredients for the chemical reaction are called the reactants can be loaded in to the reaction vessel either through a pump attached to the inlet valve or through feed nozzles, if it is powder or liquid.

The conditions inside the reaction vessel are controlled to give the fastest possible chemical reaction which include, heating the vessel through steam- filled pipes inside the vessel or in a jacket surrounding the vessel externally.

Cooling water flows constantly through the jacket or through a tube bundle inside the vessel and removes heat from the reaction vessel.

## Components of Reaction Vessel Agitator Shaft Sealing

The shaft sealing arrangement for the reaction vessel could be offered depending upon suitability, either in

1. Stuffing box - Gland Rope Packing type
2. Mechanical seal - Single Mechanical type / Double mechanical seal with Thermo-syphon system

### Mechanical Seal

Mechanical seals are designed to prevent leakage between a rotating shaft and its housing under conditions of extreme pressure, shaft speed and temperature. Mechanical seals can be single acting or double acting. Single (acting) mechanical seals have one sealing gap. The following type of mechanical seal:



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### a) Single Mechanical Seal



A single mechanical seal consists of two very flat surfaces that are pressed together by a spring and slide against each other. Between these two surfaces is a fluid film generated by the product. This fluid film prevents the mechanical seal from touching the stationary ring. An absence of this fluid film (dry running of the pump) results in frictional heat and ultimate destruction of the mechanical seal.

Mechanical seals tend to leak a vapor from the high pressure side to the low pressure side. This fluid lubricates the seal faces and absorbs the heat generated from the associated friction, which crosses the seal faces as a liquid and vaporizes into the atmosphere. So, it's common practice to use a single mechanical seal if the product poses little to no risk to the environment.

### b) Double Mechanical Seal



A double mechanical seal consists of two seals arranged in a series. The inboard, or "primary seal" keeps the product contained within the housing. The outboard, or "secondary seal" prevents the flush liquid from leaking into the atmosphere.

Double mechanical seals are offered in two arrangements:  
Back to back

Two rotating seal rings are arranged facing away from each other. The lubricating film is generated by the barrier fluid. This arrangement is commonly found in the chemical industry. In case of leakage, the barrier liquid penetrates the product.

Face to face

The spring loaded rotary seal faces are arranged face to face and slide from the opposite direction to one or two the barrier liquid penetrates the product. If the product is considered "hot", the barrier liquid acts as a cooling agent for the mechanical seal.

Double mechanical seals are commonly used in the following circumstances:

- When aggressive media is used at high pressures or temperatures.
- For many polymerizing, sticky media stationary seal parts. This is a popular choice for the food industry, particularly for products which tend to stick in case of leakage.

## Thermosyphon



Thermosyphon Vessel is used as a storage & unpressurising unit. Used for double mechanical seals in tandem seal arrangement. This is equipped with cooling coil inside the shell to bring down the temperature of buffer fluid coming from seal to Thermosyphon Vessel.

## Agitators

Agitators are incorporated in most of the reaction vessels for stirring the contents of the reaction vessel for a thorough mixing and to make sure that the reaction goes as quickly as possible and that all of the reactants are involved in the reaction. A variety of paddles can be used with speeds of rotation that range from 30-40 revolutions to a higher rotation per minute depend on material

### Types Of Agitators

A variety of agitators are used depend on character of material and the common types are Anchor Type, Turbine Type, Paddle Type, Propeller Type and Pitched Blade types.

### Hydrofoil Implers



These are most efficient axial flow impeller. It is recommended for blending, solid suspension, heat transfer etc. It provides maximum flow at minimum power. Mostly available in three blade version. But different number & width of bade are also common in special applications. This is also called as fabricated propeller.

### Piched Blade Turbines



These are axial mixing impeller with considerable amount of radial flow. It produces suction when placed near the liquid surface. Hence used for blending of immiscible liquids, solid incorporation etc. It is also a preferred choice for applications where the viscosity change during the process is large. These are mostly available in four blades @ 45 degree. But different numbers of blade with various angles are also used depending on application.

### Disk Impullers



Mostly used for gas dispersion application. Curve blade (Concave, parabolic etc.) disc can handle 2 to 6 times more gas than flat blade disk turbine. Power drop between gassed and un-gassed condition is very less than conventional flat blade disk impellers. Hence it is preferred choice for gas dispersion application viz. Fermentation, Hydrogenation, Oxidation, Carbonisation, Ethylation etc.

### Anchor/gate Type Impeller



Anchor/Gate type impellers are close-clearance impeller that fit the contour if the vessel. This impeller provides adequate mixing under the laminar flow conditions encountered viscosity applications for heat transfer. These are many applications that other type of impellers is integrated with the anchor. This impeller sweeps the whole wall surface of the vessel and agitates most of the fluid batch through physical contact. Anchor impellers are used for liquid viscosities between 5,000 and 50,000 cP. When reaction /mixing homogeneity is required, other type of impellers are recommended.

## High Speed Disperser



Disperser disk provides large amount of shear and mostly used for liquid-liquid dispersion and powder dissolution or de-agglomeration etc.

## High Shear Mxer



Tremendous amount of shear is required to produce stable emulsion and fine dispersion. Hence all the impeller blades are designed at high tip speed and high shear rate.

For low and medium viscosity fluid premixing and De-agglomeration of particles to every fine and stable dispersion is a well known use.

For high viscosity fluid co-axial or multi-shaft agitators are recommended with stator rotor or pump may be used for flow through inline homogenizer.

This machine is used for producing stable emulsions and very fine dispersion in micron range. Ultra high shear mixer can be used for sub micron range dispersion and emulsification.

## Reaction Vessel For Distillation



DISTILLATION is a method of separating mixtures based on differences in volatility of components in a boiling liquid mixture. Distillation is unit operation or physical separation process and not a chemical reaction.

Reaction Vessels are also used for the distillation process where the source material is heated and the vapor generated is passed to a Condenser, normally shell and tube type, where the vapor is cooled to liquid state and collected in a Receiver.

## Simple Distillation



In simple distillation, the vapor is immediately channeled into a condenser and the condensate is collected in a receiver. Consequently, the distillate may not be pure but rather its composition is identical to the composition of the vapors at the given temperature and pressure.

## Fractional Distillation



Fractional distillation is used when separating a mixture of two liquids that do not behave well enough to use a simple distillation. Fractional distillation is used in order to separate the components by repeated vaporization - condensation cycles within a packed fractionating column. This packing material can either be random dumped packing (1-3" wide) such as Raschig rings or structured sheet metal. Liquids tend to wet the surface of the packing and the vapors pass across this wetted surface, where mass transfer takes place.

## Vacuum Distillation



Some compounds which are having high boiling point are to be boiled at a lower pressure instead of increasing the temperature. Once the pressure is lowered to the vapor pressure of the compound, the distillation process commences. This technique is also very useful for compounds which boil beyond their decomposition temperature at atmospheric pressure.

## Reaction Vessels In GMP Construction



- Could be offered complete in GMP systems with Basic & Process Engineering, Layout & Detail Engineering.
- Also meeting 'cGMP' Standards and stringent requirements of International regulatory bodies like USFDA, UKMCA, TGA etc.
- Designed in accordance with the various international codes for Pressure parts
- Internal surface finish' up to 600 Grits with Mechanical / Electro-polishing having Crevice-free Internals to avoid contamination and facilitate thorough cleaning during product changeovers
- Condenser vapour side is removable to facilitate manual cleaning
- Pre - insulation for hot and cold service with removable SS304 cladding
- Specially designed sealing mechanisms for bearing housing to prevent grease leakage even in a solvent atmosphere
- Offered Italian Helical gearbox having high efficiency and Quadralip Oil Seal to prevent frequent seal failure resulting in oil leakages, also available with oil leakage collection chamber
- Offered with various types of agitators such as Anchor, Turbine, MIG, Hydrofoil, Propeller, Helical and Contra mixer etc.
- The Vessel, Receiver, Column & Condensers with bolted openings can be dismantled to facilitate manual cleaning periodically or between product changeovers
- The Nozzle & the Reflux line connections can be provided with Sanitary Triclamp, DIN, SMS, IDF or flange ends as specified by the user



## TECHNICAL SPECIFICATIONS

MODEL	Working Capacity (Ltrs.)*	Std.Vessel Dimension Dia.x st.Ht (mm)*	Motor HP*	Shaft Diameter*
NSI-RV-250	250	600 x 900	2.0	30
NSI-RV-400	400	700 x 1050	3.0	40
NSI-RV-1000	1000	1000 x 1400	5.0	50
NSI-RV-1600	1600	1100 x 1700	5.0	50
NSI-RV-2000	2000	1200 x 1800	7.5	60
NSI-RV-2500	2500	1300 x 1900	10.0	70
NSI-RV-3000	3000	1400 x 2000	10.0	75
NSI-RV-4000	4000	1500 x 2270	12.5	100
NSI-RV-5000	5000	1600 x 2500	15.0	100

\*The design and dimensions are subject to alterations due to constant development for better performance.

## Photo Gallery



## Applications



Contact Us



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