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# D. PARIKH ENGINEERING WORKS

## MANUFACTURING OF INDUSTRIAL PHARMACEUTICAL CENTRIFUGES

### INTERNSHIP STUDY REPORT BY DHEER PATEL



MFG. : CENTRIFUGES, CHEMICAL PLANTS & TEXTILE MACHINERY

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## TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dheer Patel has successfully completed his internship at D. Parikh Engineering Works in June 2024. During his internship, Dheer worked diligently on a study titled "The Manufacturing of Industrial Centrifuges."

Over the course of his two-week internship, Dheer demonstrated a high level of academic intellect and analytical capability. His work included:

**Detailed Analysis of Industrial Centrifuge Manufacturing Processes:** Dheer studied various components and processes involved in the manufacturing of industrial centrifuges. He analyzed the efficiency and effectiveness of each step in the production line.

**Practical Application of Theoretical Knowledge:** Dheer applied his academic knowledge of mechanical engineering principles to real-world scenarios. He was involved in hands-on activities that included assembling centrifuge components, testing their functionality, and ensuring quality control.

**Project Report and Presentation:** At the end of his internship, Dheer prepared a comprehensive project report. He presented his report to the senior engineering team, showcasing his understanding and insights gained during the internship.

Dheer's enthusiasm for learning and his ability to quickly grasp complex technical concepts were evident throughout his internship. His proactive approach and strong work ethic made him an asset to our team.

We are confident that Dheer will continue to excel in his academic and professional pursuits.

We wish him all the best in his future endeavours.

Thanking you

Yours faithfully



Arti Manjrekar  
(Manager Admin)



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# Introduction to D. Parikh Engineering Works

D.Parikh Engineering Works, ISO 9001 certified, came into existence in the year 1948. The company started with just, employing 2-3 workers and doing mostly repair work for textile mills.

From this modest beginning, today they are India's leading manufacturer of Basket centrifuges. In the past they have executed a large number of prestigious and complicated custom built equipments like Pressurized reaction vessels with Agitators, Heat Exchangers & Towers (distillation columns). The Company has suspended its activities in custom built equipments to concentrate on proprietary products like Centrifuges which are used for separating solids from liquids.

Their Group Company Nima Engineering Private Limited, ISO 9001certified, came into existence in the year 1990. Company started production in 1995-96. The Company is manufacturing Centrifuges under the technical and marketing support from D. Parikh Engineering Works.

# INTRODUCTION TO THEIR CENTRIFUGES

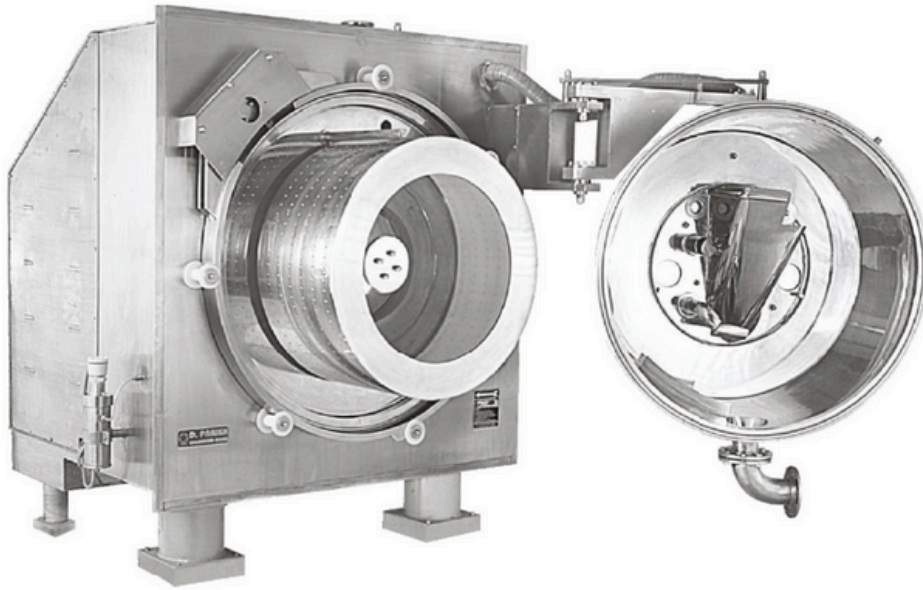
Their centrifuges have been successfully working in various industries such as Pharmaceutical (API Bulk Drug), Agro chemicals, Pesticides, Chemical Dye - Stuff, Dye Intermediates etc. There are a few also used in Flavour, Food, Textile, Herbal, Garments, Writing Instruments and Research Centre & Institutes.

They pioneered the concept of cleanable centrifuges in India and manufactured a Bottom Discharge centrifuge with a Fully opening Outer case in the year 2000. Since then they have sold many centrifuges that have a Fully Opening Outer case.

They started manufacturing Horizontal Peeler type centrifuges in 2003 and have supplied 1500 mm dia. Horizontal Pharma Peelers and 1600 mm dia. x 1000 mm depth Horizontal Chemical Peelers. These are one of the largest size of the machines made in India.

## 4 MAIN CENTRIFUGES

- Horizontal pharma peeler
- Chemical Peeler
- Laboratory Type
- Bottom Discharge



Horizontal Pharma Peeler



Bottom Discharge



Laboratory Type



Chemical Peeler

# Manufacturing Process



**1** Design and Engineering

**2** Sourcing Raw Materials

**3** Cutting and fabrication

**4** Welding and machining

**5** Assembly and Testing



# DESIGN AND ENGINEERING

The design and engineering stage is a critical phase in the manufacturing of an industrial centrifuge, as it lays the foundation for the entire production process. This stage involves several detailed steps to ensure the final product meets the necessary performance, safety, and quality standards. Here's an in-depth look at this stage:

## 1. Requirements Analysis

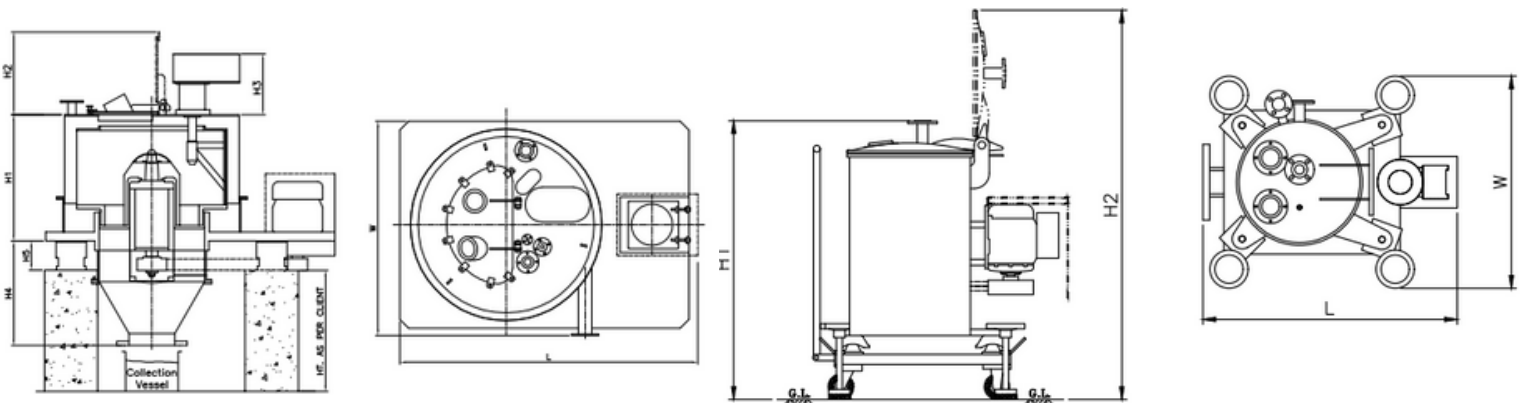
Understanding Customer Needs:

- **Application Analysis:** Identifying the specific application for the centrifuge (e.g., separating liquids, solids, or gases) and the industry it will serve (e.g., chemical, pharmaceutical, food processing).
- **Performance Specifications:** Determining the required capacity, speed, separation efficiency, and other performance criteria.
- **Regulatory Requirements:** Understanding industry-specific regulations and standards that the centrifuge must comply with (e.g., FDA for pharmaceuticals, ASME for pressure vessels).

## 2. Conceptual Design

Initial Design Concepts:

- **Basic Configuration:** Deciding on the type of centrifuge (e.g., decanter, disc-stack, tubular, basket).
- **Preliminary Sketches:** Creating rough sketches and diagrams to visualize the overall structure and layout.
- **Feasibility Study:** Evaluating the feasibility of the design concepts, considering factors like material availability, manufacturing processes, and cost.



### 3. Detailed Engineering Mechanical Design:

- **Component Design:** Designing each component of the centrifuge, such as the rotor, housing, bearings, and drive system.
- **Material Selection:** Choosing materials based on properties like strength, durability, corrosion resistance, and suitability for the specific application (e.g., stainless steel for food and pharmaceutical applications).
- **Stress Analysis:** Performing finite element analysis (FEA) to ensure components can withstand operational stresses and loads without failure.



Lubrication system



Electrical Unit

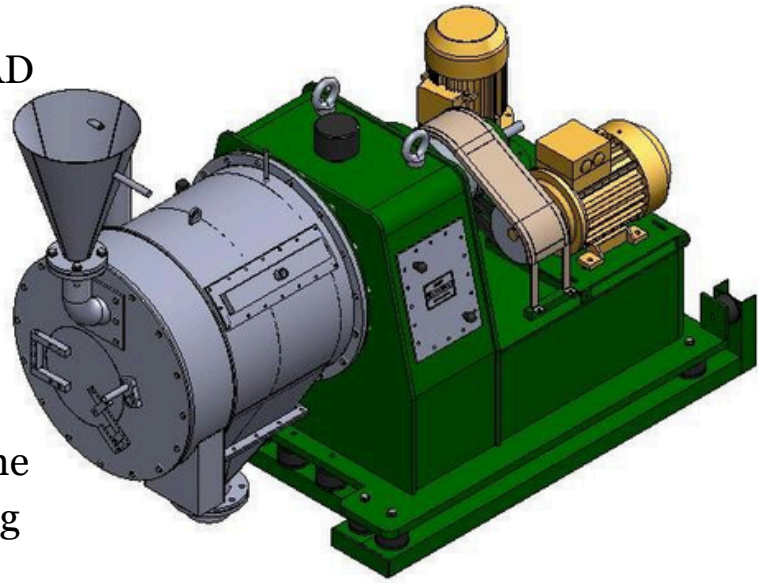
### 4. Electrical and Control System Design:

- **Motor and Drive System:** Selecting the appropriate motor and drive system to achieve the desired speed and torque.
- **Control Systems:** Designing the control systems for operation, including sensors, PLCs (Programmable Logic Controllers), and HMIs (Human-Machine Interfaces).
- **Safety Features:** Incorporating safety features such as emergency shut-off, vibration monitoring, and interlocks to prevent accidents.

## 5. Prototyping

Creating a Prototype:

- **3D Modeling:** Developing detailed 3D CAD models of the centrifuge and its components.
- **Prototype Manufacturing:** Fabricating a prototype using rapid prototyping techniques such as 3D printing, CNC machining, or other methods.
- **Prototype Testing:** Conducting tests on the prototype to validate the design, including performance testing, stress testing, and durability testing.



CAD Model

## 6. Final Design Documentation

Technical Documentation:

- **Detailed Drawings:** Creating detailed engineering drawings for each component, including dimensions, tolerances, and material specifications.
- **Assembly Instructions:** Developing comprehensive assembly instructions to guide the manufacturing process.
- **Quality Standards:** Documenting quality control procedures and standards to ensure consistent manufacturing and product quality.

## 7. Design Approval

- **Internal Review:** Conducting internal reviews to ensure the design meets all technical and safety standards.
- **Customer Approval:** Presenting the final design to the customer for approval, making any necessary adjustments based on customer feedback.
- **Regulatory Compliance:** Ensuring the design complies with all relevant industry regulations and standards, obtaining necessary certifications if required.
- This thorough and meticulous design and engineering process ensures that the centrifuge is not only functional and efficient but also safe, reliable, and compliant with industry standards.



# SOURCING RAW MATERIALS

Procuring raw materials is a crucial stage in the manufacturing of an industrial centrifuge, as the quality and characteristics of the materials directly impact the performance, durability, and safety of the final product. This stage involves several key steps to ensure the right materials are sourced, from selecting appropriate materials to ensuring they meet all necessary standards and specifications. Here's a detailed breakdown of the process:

## 1. Material Selection

### A. Identifying Requirements:

**Mechanical Properties:** The centrifuge components must withstand high rotational speeds and forces, requiring materials with high strength, toughness, and fatigue resistance.

**Chemical Resistance:** Depending on the application, materials might need to resist corrosion from chemicals, biological materials, or other substances.

**Thermal Stability:** Materials must maintain their properties under the operating temperatures expected in the centrifuge's environment.

### B. Common Materials Used:

**Metals:** Stainless steel (for its corrosion resistance and strength), aluminum (for its lightweight properties), and titanium (for its excellent strength-to-weight ratio and corrosion resistance).

**Composites and Polymers:** Used in components where weight reduction is critical without sacrificing strength.

**Specialty Alloys:** For applications involving highly corrosive or extreme environments.

## 2. Material Procurement

Request for Quotations (RFQ):

Specifications: Sending detailed material specifications, including mechanical, chemical, and physical properties required.

Volume and Delivery Schedule: Clearly stating the quantity needed and delivery timelines.

Compliance Requirements: Outlining any specific compliance or certification requirements.

## 3. Inventory Management

A. Storage Conditions:

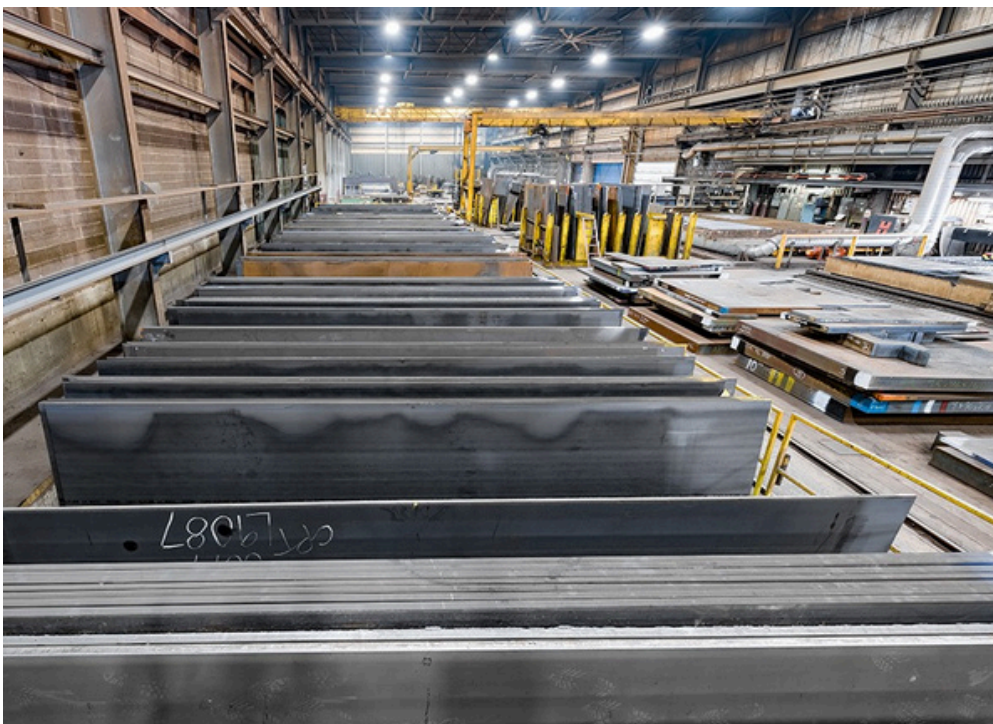
Environment: Storing materials in conditions that prevent degradation (e.g., temperature-controlled, dry, and clean storage).

Organization: Implementing a systematic approach to inventory management to ensure materials are easily accessible and traceable.

B. Inventory Control:

Tracking: Using inventory management systems to track material usage and stock levels.

Reordering: Setting reorder points to ensure continuous supply without overstocking.



Storage Area

# 3

## CUTTING AND FABRICATION

The cutting and fabrication stage is fundamental in the manufacturing process of an industrial centrifuge, ensuring that all parts are accurately shaped and constructed before assembly. This stage involves various techniques and machinery to cut, shape, and form metal components to precise specifications. Here's a detailed breakdown of the processes involved:

### 1. Cutting

**Purpose:** Cutting involves dividing raw material into smaller, more manageable pieces that will be further processed or assembled. Precision in cutting is crucial to ensure that components fit together correctly.

#### Techniques and Equipment:

##### Laser Cutting:

**Function:** Uses a high-powered laser to cut materials with extreme precision.

**Applications in Centrifuge Manufacturing:** Ideal for cutting complex shapes and patterns in metal sheets for the housing, frames, and other components.



Laser Cutting Machine

## Plasma Cutting:

**Function:** Uses a high-velocity jet of ionized gas (plasma) to cut through electrically conductive materials.

**Applications in Centrifuge Manufacturing:** Suitable for cutting thicker metal sheets or plates used in the structural components of the centrifuge.



Plasma Cutter

## Water Jet Cutting:

**Function:** Uses a high-pressure stream of water, often mixed with an abrasive substance, to cut through various materials.

**Applications in Centrifuge Manufacturing:** Useful for cutting materials that might be sensitive to heat generated by other cutting methods.



Water Cutter

## Shearing:

**Function:** Uses a shear blade to cut straight lines in metal sheets.

**Applications in Centrifuge Manufacturing:** Used for cutting metal sheets into smaller sections for further processing.



Shearing Machine

## 2. Fabrication

**Purpose:** Fabrication involves bending, forming, and assembling cut materials into specific shapes and structures needed for the centrifuge. This stage transforms flat or raw materials into three-dimensional components.

**Techniques and Equipment:**

### **Bending:**

**Function:** Deforming metal sheets or rods into curved shapes using force.

**Applications in Centrifuge Manufacturing:** Creating curved housings, frames, and brackets.

**Hydraulic Press:** Applies force through a hydraulic cylinder for bending and shaping metal.

**Steps:**

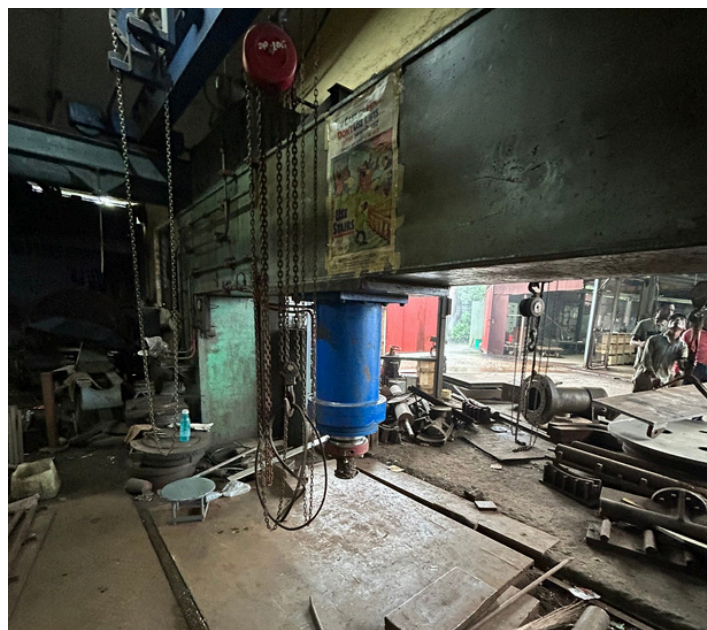
**Setup:** Positioning the metal sheet or rod on the press brake or hydraulic press.

**Bending:** Applying force to bend the material to the desired angle.

**Finishing:** Checking and adjusting the bends as necessary.

**Function:** Shaping metal into specific forms using mechanical or hydraulic force.

**Applications in Centrifuge Manufacturing:** Shaping components like conical or cylindrical parts of the rotor and housing.



Hydraulic Press

### **Roll Forming Machine:**

Continuously bends metal sheets into long shapes or profiles.

Stamping Press: Uses a die to form or emboss shapes into metal sheets.

Steps:

Setup: Configuring the forming machine with the appropriate dies and settings.

Forming: Running the material through the machine to achieve the desired shape.

Finishing: Trimming and smoothing any rough edges.



Roller



Lathe Machine

### **Lathe Machine:**

Purpose: The lathe machine shapes and finishes cylindrical parts with high precision, ensuring they meet the necessary specifications for smooth operation in the centrifuge.

Applications in Centrifuge Manufacturing:

Rotor Shaft: Machining the rotor shaft to precise dimensions and surface finish for smooth rotation.

Bushings and Bearings: Creating precise fits for bushings and bearings that support the rotor.

Flanges and Fittings: Shaping and threading cylindrical components for secure assembly.

### **Conclusion**

The cutting and fabrication stage of manufacturing an industrial centrifuge is essential for producing precise and robust components. Advanced cutting techniques like laser, plasma, and water jet cutting, along with forming and bending processes using hydraulic presses and roll forming machines, ensure that parts are accurately shaped and fit together perfectly. Welding and surface treatments further enhance the strength and durability of the components, ensuring the final centrifuge operates efficiently and reliably.

# 4

## WELDING AND MACHINING

Welding is a critical part of the manufacturing process for an industrial centrifuge. It involves joining metal parts together to form larger, robust structures that can withstand the high rotational speeds and stresses involved in centrifuge operation. Here is a detailed breakdown of the welding process, including techniques, equipment, applications, and quality control measures.

### Purpose of Welding in Centrifuge Manufacturing

Welding serves several key purposes in the construction of an industrial centrifuge:

**Structural Integrity:** Ensures the components are securely joined to handle the operational stresses.

**Durability:** Creates strong, durable joints that can withstand long-term use and exposure to harsh environments.

**Precision:** Allows for precise assembly of complex parts, ensuring they fit together perfectly.

### Welding Techniques

Several welding techniques are used in the fabrication of centrifuge components, each with specific applications and benefits:

#### Tungsten Inert Gas (TIG) Welding:

**Function:** Uses a non-consumable tungsten electrode to produce the weld, with an inert gas (usually argon) to protect the weld area from contamination.

**Applications:** Ideal for welding thin materials and parts that require a high-quality, clean weld. Commonly used for stainless steel and aluminum components.

**Advantages:** Provides precise control over the welding process, produces clean welds with minimal spatter.

## **Metal Inert Gas (MIG) Welding:**

**Function:** Uses a consumable wire electrode fed through a welding gun, with an inert gas to shield the weld area.

**Applications:** Suitable for thicker materials and components that require faster welding speeds. Used for welding structural frames and larger parts.

**Advantages:** Easier to learn and faster than TIG welding, good for welding a variety of materials and thicknesses.

## **Stick Welding (Shielded Metal Arc Welding - SMAW):**

**Function:** Uses a consumable electrode coated in flux to lay the weld, with the flux providing shielding gas and slag to protect the weld.

**Applications:** Used for heavy-duty welding, especially in outdoor or adverse conditions where other methods might not be practical.

**Advantages:** Versatile and effective for thicker materials, can be used in less controlled environments.

## **Equipment Used in Welding**

The following equipment is essential for the welding processes in centrifuge manufacturing:

**Welding Machines:** Depending on the technique, TIG, MIG, or stick welding machines are used.

**Electrodes and Filler Materials:** Specific to the welding method and material being welded.

**Shielding Gas Supplies:** Argon, helium, or gas mixtures for TIG and MIG welding.

**Welding Fixtures and Jigs:** Tools to hold parts in place accurately during welding.

**Personal Protective Equipment (PPE):** Including welding helmets, gloves, aprons, and respirators to ensure safety.

## Applications of Welding in Centrifuge Manufacturing

### **Housing and Frame:**

**Description:** The outer casing and structural frame of the centrifuge.

**Welding Tasks:** Welding metal sheets and structural components to form the main body and support frame.

**Considerations:** Ensuring strong, continuous welds to maintain structural integrity and prevent leaks.



Assembled Housing

### **Rotor Assembly:**

**Description:** The rotating part of the centrifuge, which is critical for its operation.

**Welding Tasks:** Welding components of the rotor, such as the hub, blades, and shaft.

**Considerations:** Achieving precise balance and alignment to prevent vibrations during operation.



Assembly Station



Welding Station

### **Supports and Mounts:**

Description: Various supports, brackets, and mounts that secure internal components and accessories.

Welding Tasks: Attaching supports and mounts to the housing and frame.

Considerations: Ensuring accurate positioning and strong welds to support the weight and stresses.

### **Piping and Tubing:**

Description: Systems for fluid and gas transport within the centrifuge.

Welding Tasks: Welding pipes and tubes to ensure leak-proof connections.

Considerations: Ensuring smooth internal surfaces and avoiding contamination.

Quality Control in Welding



Welding station 2

# 5

## ASSEMBLY AND TESTING

### 1. Assembly

**Purpose:** The assembly process integrates all the individual components and sub-assemblies into a complete centrifuge unit. This stage ensures that all parts fit together correctly and function as intended.

**Steps in Assembly:**

**Preparation:**

**Component Inspection:** Thorough inspection of all parts and sub-assemblies to ensure they are free of defects and meet specifications.

**Workstation Setup:** Organizing tools, fixtures, and components to streamline the assembly process.

**Sub-Assembly:**

**Rotor Assembly:** Assembling the rotor, which includes installing the rotor shaft, balancing the rotor, and securing it with appropriate fasteners and bearings.

**Motor and Drive System:** Installing the motor and drive system, including any belts, pulleys, or gears needed for operation.



Assembled Centrifuge

## **Main Assembly:**

Mounting the Rotor: Securing the rotor assembly within the centrifuge housing or frame.

Installing the Housing: Assembling and installing the outer housing, including any access panels, doors, or covers.

Control System Integration: Integrating the control system, which includes installing sensors, control panels, and wiring.

Balancing and Alignment: Ensuring that all rotating components are properly balanced and aligned to prevent vibrations and ensure smooth operation.

## **Final Assembly:**

Safety Features: Installing safety features such as guards, emergency stop buttons, and interlock systems.

Sealing and Fastening: Ensuring all parts are securely fastened and sealed to prevent leaks and ensure structural integrity.

Lubrication: Applying lubricants to bearings and moving parts to ensure smooth operation.



**Final Assembly Station**

## Testing

**Purpose:** The testing process verifies that the assembled centrifuge operates correctly, meets performance criteria, and adheres to safety standards. This stage is critical to identify and rectify any issues before the centrifuge is delivered to the customer.

## Types of Testing:

### Visual Inspection:

**Purpose:** Ensures that there are no visible defects, misalignments, or assembly errors.

**Process:** Inspecting the entire assembly for any signs of damage, improper assembly, or missing components.

### Dimensional and Alignment Checks:

**Purpose:** Verifies that all components are within specified tolerances and properly aligned.

**Process:** Using calipers, micrometers, and alignment tools to measure and adjust as necessary.



Inspection

## Operational Testing:

**Purpose:** Ensures that the centrifuge operates as expected under normal conditions.

**Process:**

**Initial Startup:** Powering up the centrifuge and observing its operation.

**Speed Testing:** Running the centrifuge at various speeds to ensure it reaches and maintains the desired RPMs.

**Vibration Analysis:** Monitoring for excessive vibrations, which could indicate imbalances or alignment issues.

**Performance Testing:**

**Purpose:** Verifies that the centrifuge meets specific performance criteria such as separation efficiency, throughput, and power consumption.

**Process:**

**Load Testing:** Running the centrifuge with typical loads to evaluate performance under operational conditions.

**Efficiency Testing:** Measuring the centrifuge's ability to separate materials at different speeds and loads.



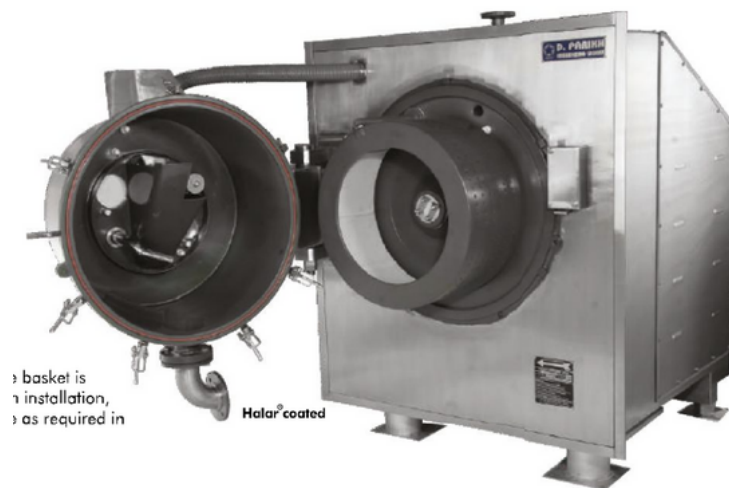
Testing Station

# Details of each Centrifuge

1

## HORIZONTAL PHARMA PEELER

It is a batch type automatic /semi automatic filtering Centrifuge. The axis of rotation of the basket is horizontal. It is ideally suited for a clean room installation, "through the wall" using a flexible membrane as required in pharmaceutical applications.

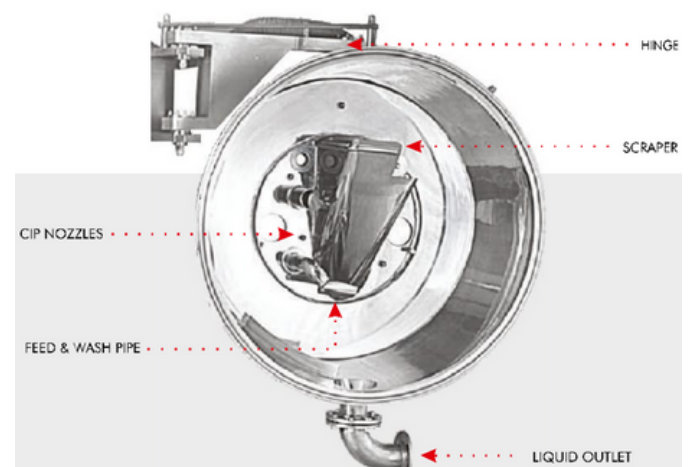
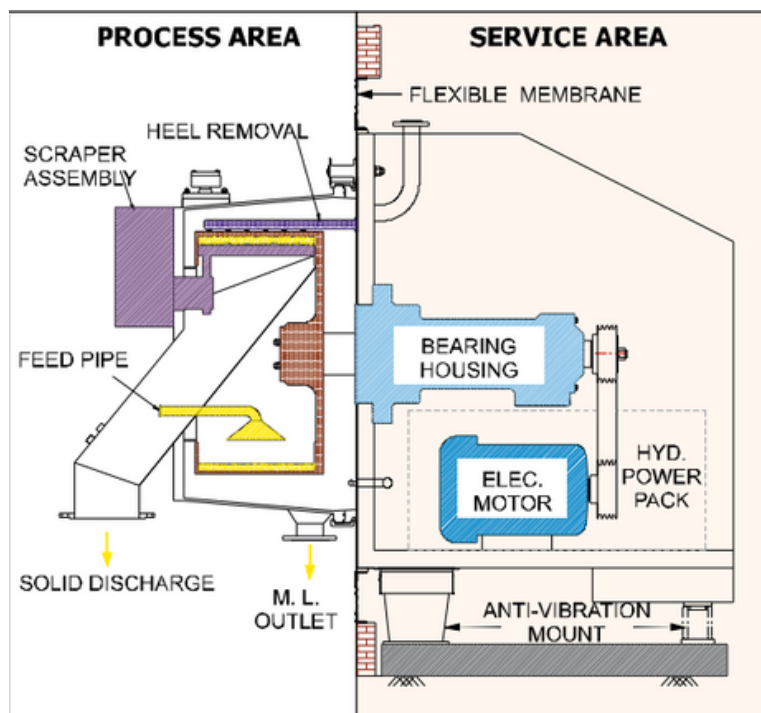


### Phases of operation

- Feeding - A filter media is fixed to the cylindrical surface of a perforated basket. The feed slurry is directed to the basket wall using a feed pipe. Feeding is carried out while the basket is rotating at an appropriate speed. After the required cake is built, feeding is stopped. The Centrifuge is run for some time to partially de-water the solids. Feeding can be repeated if there is adequate space for further build up of cake.
- Washing - After feeding, washing is carried out by pumping wash liquid through the feed cum wash pipe.
- Spinning - The Basket is run at Spinning Speed to complete the de-watering process.
- Scraping - The speed of the basket is reduced to Scraping Speed. A Scraper Knife cuts the Solids, discharging them through the chute.
- Heel Removal (Optional) - Some material remains on the filter media after scraping and is called residual heel. This heel can be removed by using the heel removal system.
- Cleaning In Place (Optional) - Centrifuge can be cleaned using a CIP system.

## Advantages

- Ideally suited for a "Through the wall" Installation - with complete separation of the process area (feed, wash, solid discharge, liquid outlet) from the service area (motor, hydraulic power pack, bearing housing). The entire bearing housing is bolted to the frame and is removable from the service area.
- Fully opening outer body giving full access to basket (inside, outside and rear up to the shaft), peeler knife and other inner parts for cleaning, inspection, validation and swab tests. This design is much easier to validate than the Bottom Discharge Type.
- Higher Centrifugal force for drier and purer products.
- Splashing of slurry in solid discharge chute is negligible as compared to the Bottom Discharge Type.
- Integrated inertia mass with Anti vibration mounts - eliminating the need for a separate inertia mass and heavy foundation.
- Residual Heel removal for optimum solids recovery.
- CIP for easy cleaning and faster product changes.
- Entire operation in a Nitrogen blanketed atmosphere.
- Self draining design for minimum retention of liquid.
- Uniform cake formation - Gravity does not hamper this process.



# Parts of the Horizontal Pharma Peeler

## **OUTER BODY**

Outer body is a stationary part enclosing the rotating basket. In the standard design, it is held with quick action clamps to the main frame (as shown alongside).

As an option, the Outer body can be held to the frame with single clamping ring (as shown on the front cover page) avoiding individual clamps.

## **BASKET**

Basket supports the filter media, slurry and solid cake. It has a flat bottom to improve cleanability.

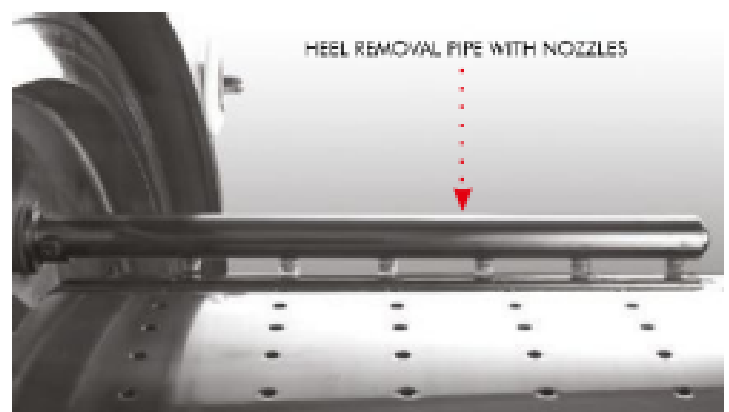
## **CAKE MONITORING SYSTEM**

Thickness of the cake actually built up in the Centrifuge is monitored continuously with the help of a Cake Monitoring system.

## **SCRAPER**

Scraper is used to cut and guide the solids to a discharge hopper. The Length of scraper equals the height/depth of Basket. Thus only angular motion is required to discharge the solids. The design of the scraper is such that minimal solids collect on the blade and supporting brackets.

The discharge hopper guides the product to the solid discharge outlet. It is welded to the outer body to reduce crevices for product collection and contamination. The surface of the discharge hopper is highly polished to ease the flow of product. As an option, it can also be coated with an anti stick coating.



## RESIDUAL HEEL REMOVAL

The scraping process always leaves some solid material on the filter cloth. This residual material (heel) is sometimes useful while at other times it hampers filtration in subsequent batches. Special high pressure nozzles are provided through which Nitrogen / air is blown at high pressure while the basket rotates at a slow speed. Gas passes through the basket perforations and pushes the filter cloth inwards to dislodge the residual heel. The operator has the option of using this system.

The effectiveness of this system depends on the nature of residual heel and the pressure at which N<sub>2</sub>/Air is blown and hence cannot be guaranteed.

## INERTIA MASS AND MOUNTING

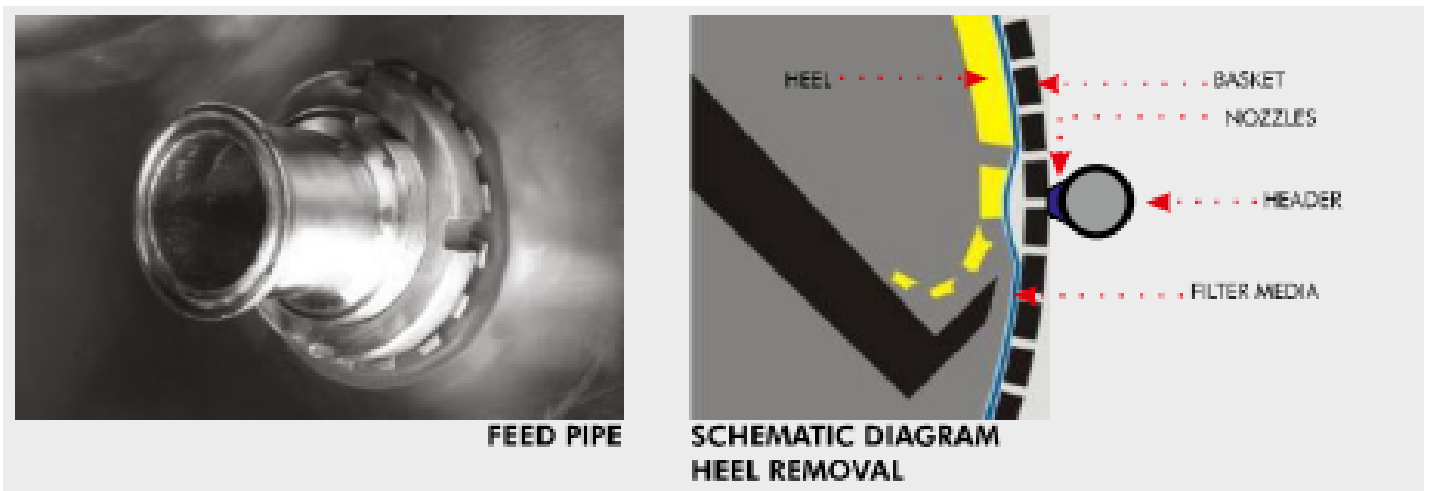
The machine has an integrated mass and is mounted on Anti Vibration Mounts. The integrated inertia mass eliminates the necessity of separate concrete block/inertia block for mounting of the Centrifuge. The mounts isolate the foundation from the vibrating forces. Hence, the machine can be easily installed without heavy foundation.

## BEARING HOUSING

Bearing housing is bolted to the main frame of the Centrifuge. Hence for replacement of bearings it can be taken to the maintenance area.

The Alloy steel shaft is supported on two heavy duty roller contact bearings. A shaft protection sleeve prevents the process vapours from coming in contact with the shaft, thereby protecting it.

Sealing between the process area and the bearings is done by using Lip/Oil seals. These can be of PTFE / Viton / Nitrile depending on the process requirement.





# LABORATORY TYPE

## LABORATORY CENTRIFUGE

A Centrifuge is the most energy efficient machine for separating solids from liquid. The filtration type of centrifuge has a Dynamically Balanced rotating basket which supports the filter media within itself. The slurry is fed inside the rotating basket. Due to centrifugal force liquid is forced out through the filter media while solids are retained inside the rotating basket. The solids are manually scooped out from top of the basket.

This centrifuge is meant for taking small trial batches in Plant and R & D Laboratory.

In a centrifuge, results like dryness and cake thickness depend on centrifugal force developed in the basket. To know the result that would be obtained on a larger Centrifuge (where Centrifugal force generally varies between 500 G and 2100 G), the machine can be run at a speed to give an equivalent Centrifugal force.



## ADVANTAGES OF TROLLEY

- No foundation is required
- Easily moveable between different operation areas



INVERTER PANEL

## MATERIAL OF CONSTRUCTION

- Stainless Steel
- Carbon Steel
- Rubber lined
- Fluoropolymer coating - PFA (Teflon), Halar (ECTFE)
- Hastelloy

## OTHER TYPES

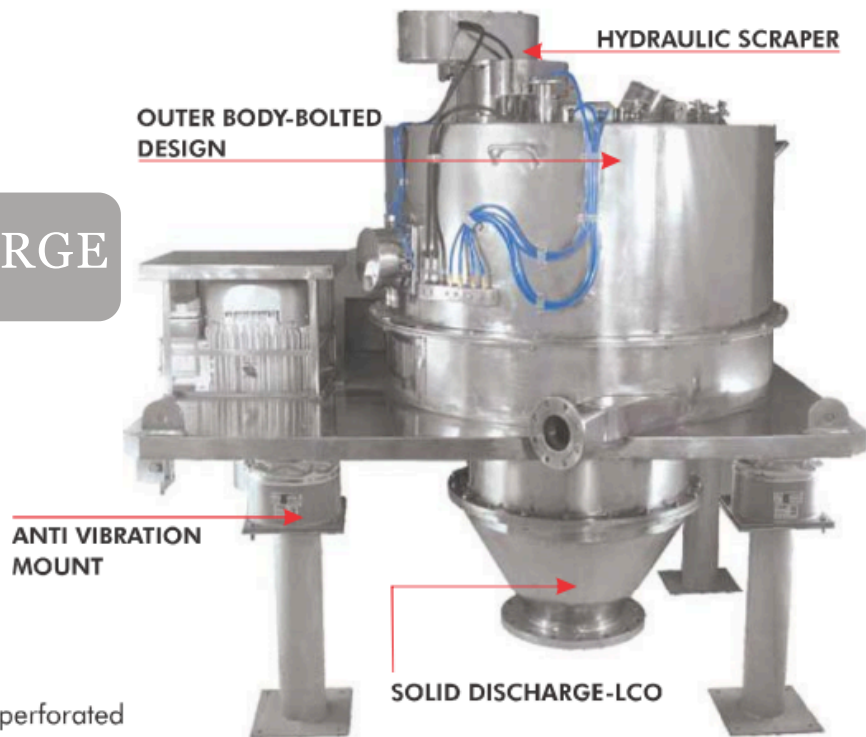
- Horizontal Peeler
- Manual Top Discharge
- Lifting Bag Type
- Bottom Discharge
- Special Purpose Centrifuges

## TECHNICAL DATA

Model	Basket Diameter (mm/inch)	Basket Height (mm/inch)	Basket Speed (RPM)	Maximum Permissible load (kg)	Volume under Lip (Lt.)	Filter Area (M <sup>2</sup> )	Centrifugal force ('G' Units)	Motor (Kw)
LAB CEN 14 2000/3000	355/14"	175/7"	2000/3000	10	10	0.195	796/1791	1.5 / 2.2
LAB CEN 12 2000/3000	305/12"	175/7"	2000/3000	6	6	0.168	682/1535	1.5 / 2.2

# 3

## BOTTOM DISCHARGE



### TYPICAL BOTTOM DISCHARGE CYCLE FEEDING

#### FEEDING

A filter media is fixed to the cylindrical surface of a perforated basket. The feed slurry is directed to the basket wall using a feed pipe. Feeding is carried out while the basket is rotating at an appropriate speed. After the required cake is built, feeding is stopped. The centrifuge is run for some time to partially de-water the solids. Feeding can be repeated if there is adequate space for further build up of cake.

#### WASHING

After feeding, washing is carried out by pumping wash liquid through the wash pipe.

#### SPINNING

The basket is run at the spinning speed to complete the de-watering process.

#### SCRAPING

The speed of the basket is reduced to the scraping speed (slow speed). A scraper knife cuts the solids, discharging them through the chute.

#### HEEL REMOVAL – OPTIONAL

Some material remains on the filter media after scraping and is called residual heel. This heel can be removed by using the heel removal system.

#### CLEANING IN PLACE – OPTIONAL

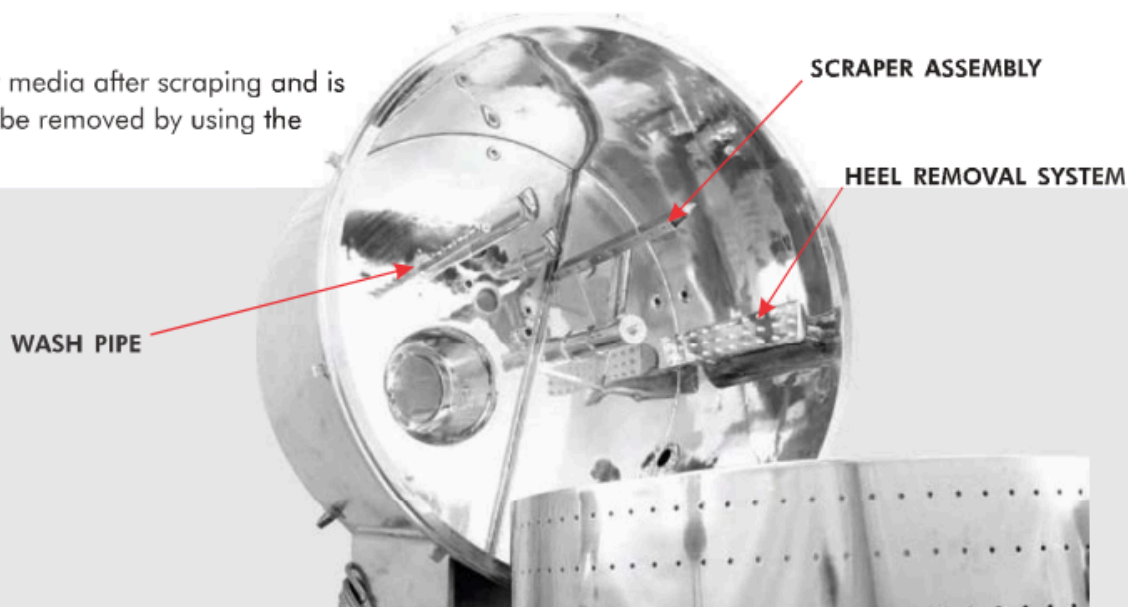
The centrifuge can be cleaned using a CIP system.

#### ADVANTAGES OF BOTTOM DISCHARGE CENTRIFUGE

- Avoidance of human contact.
- Toxic, allergic or hazardous material can be safely handled.
- Cake discharge in powder form.
- Solid discharge in a closed environment.
- Drastic reduction in manual labour for unloading of material.
- Fully automatic operation is possible using a PLC.

#### NOTE

Bottom Discharge Centrifuge is advised for a non-sticky crystalline product which can be easily cut by the scraper blade.



## PARTS OF CENTRIFUGE

### OUTER BODY

The outer body is a stationary part enclosing the rotating basket. In the standard design, it is bolted to the Bottom base / trough (Shown on page alongside). As an option, the Outer body can be designed to hinge open using a hydraulic system in a few minutes. (Shown on cover page)

### ADVANTAGES OF FULL BODY OPENING

- Easy access to Basket, Bottom Trough and inner surface of Outer Body for quick and effective cleaning, inspection and validation.
- Unobstructed approach to Basket allows speedy and effortless changing of filter media.
- Outer Body opens sufficiently to allow vertical lift of Basket and Bearing Housing. This greatly reduces the effort and time required for maintenance.

The above features coupled with the Cleaning in Place System, allow faster changes of products and makes the centrifuge extremely suitable for multiple products.

### LID

The Lid can be offered in the following executions :

- Half Lid – Operated Hydraulically
- Partial Lid – Manually Opened • Round Lid – Manually Opened

### CAKE MONITORING SYSTEM

The thickness of the cake actually built up in the Centrifuge is monitored continuously with the help of a Cake Monitoring system.

- **Mechanical Cake thickness Sensing** – A mechanical feeler swings in and out touching the slurry cake. Its position is sensed and an indication is given to the operating station.
- **Electronic Capacitance Type** : The sensor gives an electrical output when it dips sufficiently into the slurry.

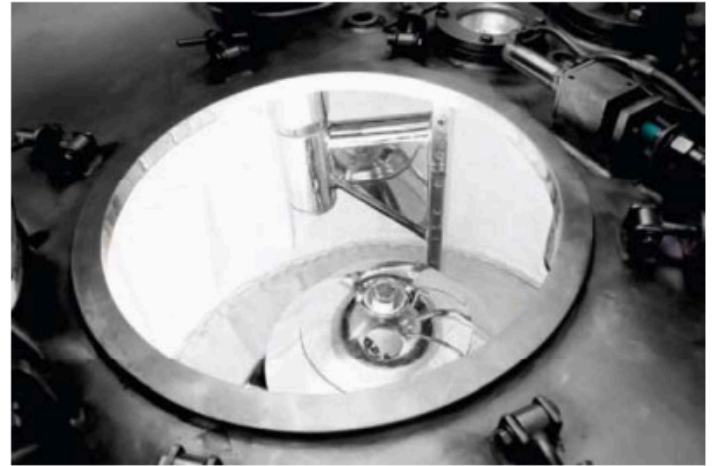
### BASKET

The Basket supports the filter media, slurry and solid cake. The design of Basket bottom varies depending on design of the Solid Discharge

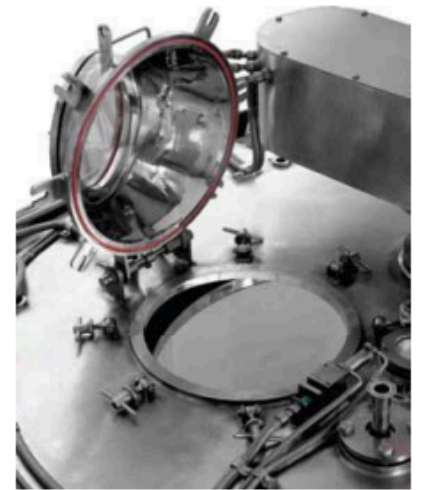
### SCRAPER

The scraper is used to cut and discharge the solids. It is of full height. The length of scraper equals the depth of Basket. Thus, only angular motion is required to discharge the solids. This angular motion can be imparted in the following ways:

- Hydraulically
- Motorised – Using an electric motor & gear box
- Manually through a gear box.



FULL HEIGHT SCRAPER BLADE



HALF LID



PARTIAL LID



ROUND LID

**SOLID DISCHARGE**

The material, after being scraped, falls through the Basket into the Bottom Main Base and finally in the Discharge Chute. The bottom base can be designed in two ways:

- **Large Central Opening – LCO** : The Bottom main base, through which the solid product falls, is designed to provide large multiple openings for easy and efficient product discharge. The ribs and cover on the Vee belts are sloped, further reducing hold up of material.
- **Side Port Discharge** : One or two openings / ports are provided in the Bottom base. The sweeper under the basket pushes the material to the solid discharge port. There is a clearance between the sweeper and the bottom main base.



**BASKET - LCO**



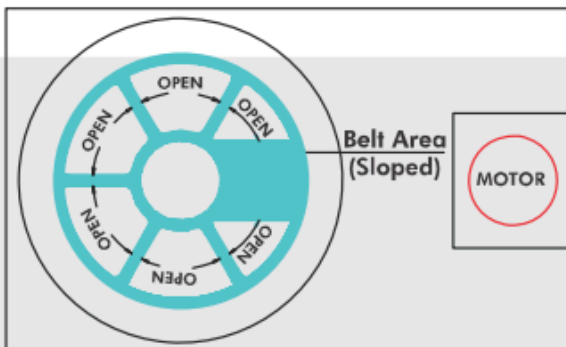
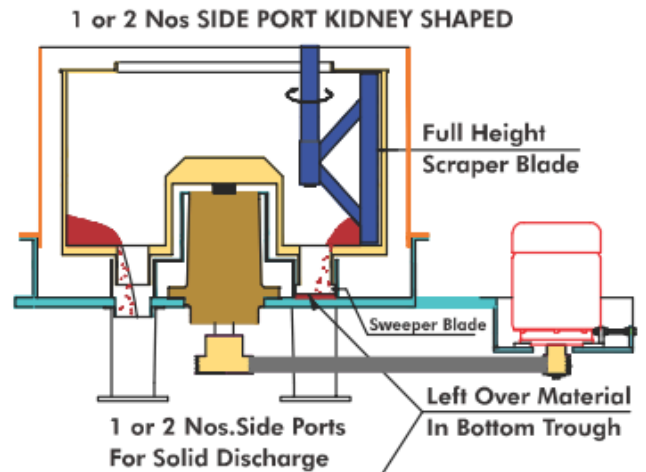
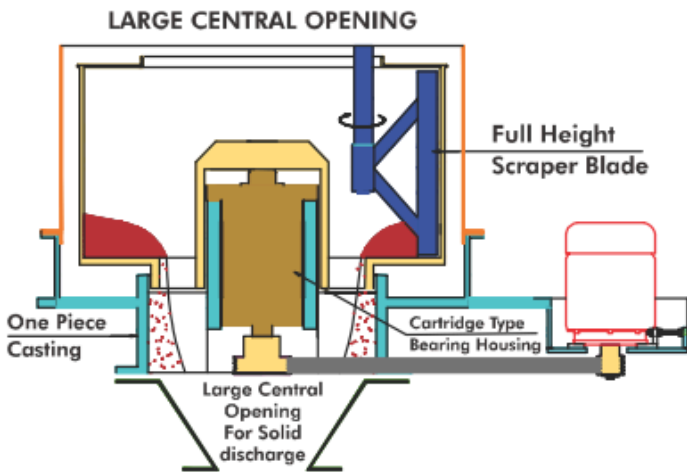
**BASKET - SIDE PORT**



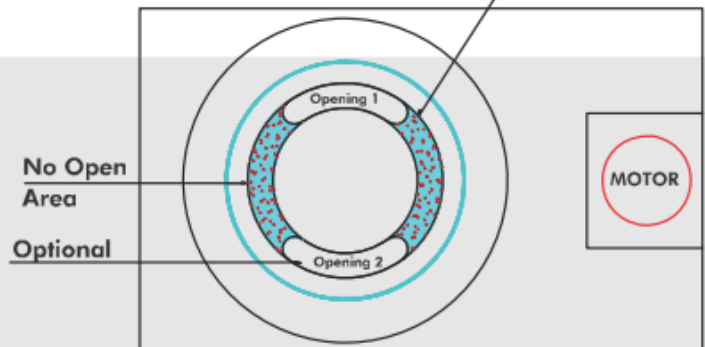
**BOTTOM BASE-LCO**



**BOTTOM BASE-SIDE PORT**



**BOTTOM BASE / TROUGH**



**BOTTOM BASE / TROUGH**

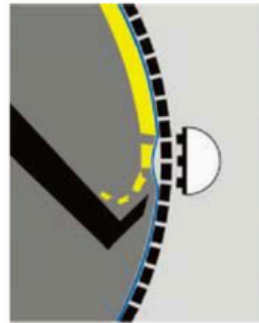
## ADVANTAGES OF LARGE CENTRAL OPENING

- No sweeper below basket – Reduces hold up of solids.
- Larger opening lowers the possibility of choking / blocking of openings during solid discharge.

## RESIDUAL HEEL REMOVAL – OPTIONAL

The scraping process always leaves some solid material on the filter cloth. This residual material (heel) is sometimes useful while at other times, it hampers filtration in subsequent batches. Special High Pressure Nozzles are provided through which Nitrogen / Air is to be blown at high pressure while the basket rotates at a slow speed. Gas passes through the basket perforations and pushes the filter cloth inwards to dislodge the residual heel. The operator has the option of using this system.

The effectiveness of this system depends on the nature of residual heel and the pressure at which N<sub>2</sub> / Air is blown and hence cannot be guaranteed.



SCHEMATIC DIAGRAM  
HEEL REMOVAL



HEEL REMOVAL

## MOUNTING

The machine is mounted on Anti Vibration mounts and inertia plate. These mounts isolate the foundation from the vibrating forces. Hence, the machine can be easily installed without heavy foundation. The maintenance of Suspension system usually associated with Pendulum Suspension machine is eliminated.

## PRESSURE TEST

Machine is tested for leak tightness at a pressure of 400 mm of water column, pressure drop being restricted to 60 mm per hour. This reduces solvent losses and creates a better working environment.



BOTTOM DISCHARGE CENTRIFUGE  
WITH SIDE PORT DISCHARGE

## CLEANING IN PLACE – OPTIONAL

Special nozzles are provided at strategic locations in the machine. When solvents / water are pumped through these nozzles they reach most of the area inside the centrifuge for effective cleaning.

## SPEED INDICATOR WITH ZERO SPEED INTERLOCK

The speed indicator displays the actual speed of the basket (in RPM). It prevents the Lid from being opened above a predetermined safe speed.

## REMOTE OPERATING SYSTEM

**Conventional :** With push button, rotary switches and indicator lamps. Various options for Hazardous areas like Intrinsically safe or Exd / FLP can be provided.

**HMI :** With text / graphic display that shows process details and allows selection and setting of various cycles from the operating point. Various options for Hazardous areas like intrinsically safe or purged panels can be provided. A PLC is necessary for this option.



INTRINSICALLY SAFE OPERATING  
STATION IN SS ENCLOSURE



FLAME PROOF  
OPERATING STATION  
IN SS ENCLOSURE



HUMAN MACHINE  
INTERFACE (HMI)  
WITH GRAPHIC DISPLAY