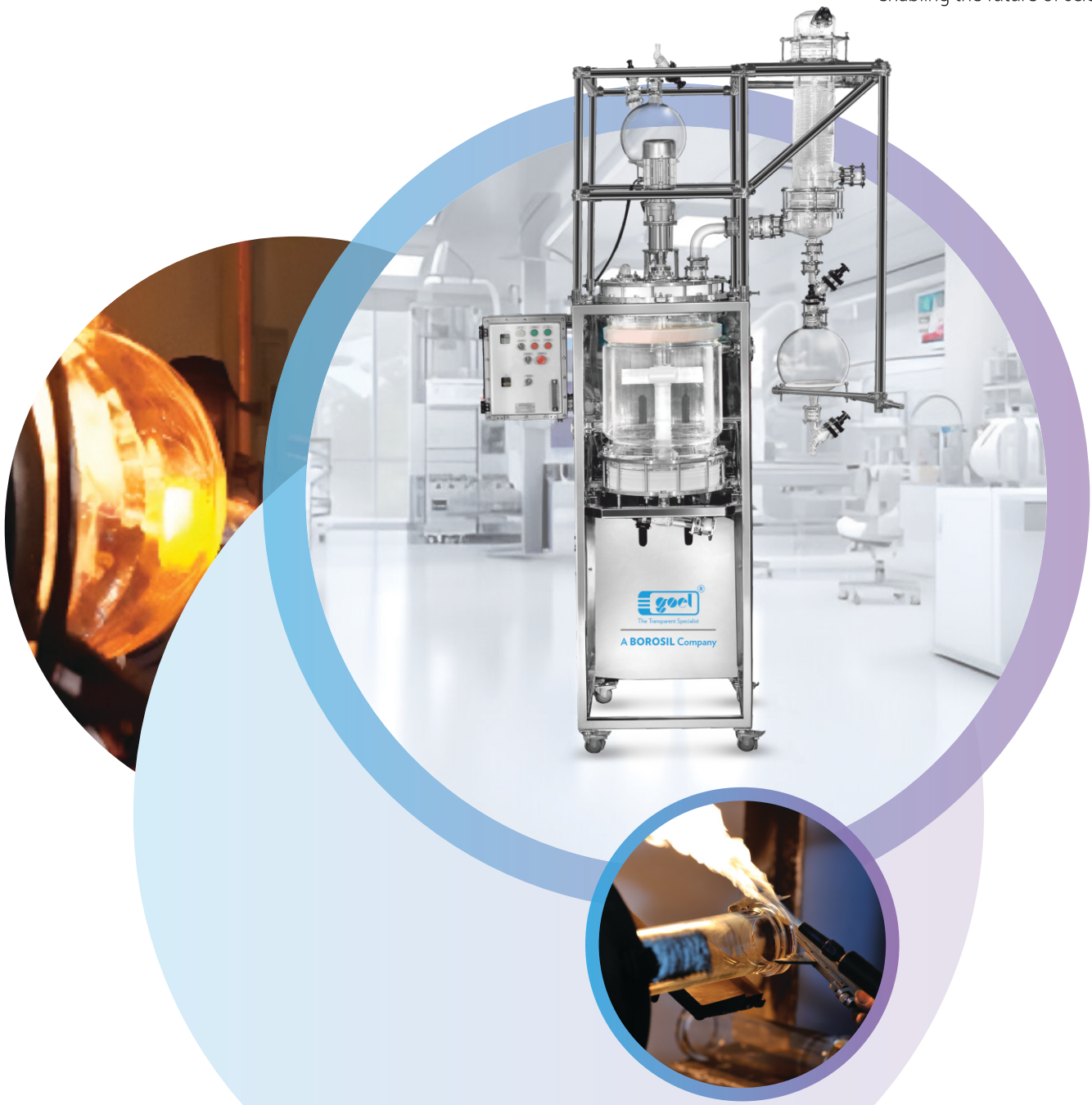
PROUDLY MADE IN india

BOROSIL®
Scientific
enabling the future of science




# Connecting Chemistry
To the world

goel®
The Transparent Specialist
A BOROSIL Scientific Company

# A Note from
# Our Leadership

**Shreevar Kheruka**

Managing Director & CEO

**Borosil Limited**

Great Place To Work.® Certified FEB 2025-FEB 2026 INDIA ™

At Borosil Scientific, our focus is on delivering world-class industrial process systems that empower precision, safety, and efficiency in every application. With Goel Scientific Glassworks now part of our ecosystem, we've strengthened our capabilities to offer even more robust and high-performance solutions to the pharmaceutical and specialty chemical industries.

This is not just an addition to our portfolio it reflects our commitment to innovation, customer-centric design, and global quality standards.

With advanced infrastructure, deep technical expertise, and the trust of the Borosil name, we are ready to set new benchmarks in process system excellence.

# A Note from
# Our Leadership


**Vinayak Patankar**

Whole Time Director & Chief Executive Officer

**Borosil Scientific Limited**


Great Place To Work® Certified FEB 2025-FEB 2026 INDIA ™

India continues to be a global force in pharmaceutical and chemical innovation and at Borosil Scientific, we are proud to contribute meaningfully to that momentum. With the integration of Goel Scientific, we've expanded our capabilities to deliver smarter, more reliable, and future-ready process systems.

This integration also reinforces our commitment to indigenous manufacturing and reducing dependency on imports strengthening the foundation for a more self-reliant scientific and industrial ecosystem.

By upgrading infrastructure, streamlining operations, and staying close to customer needs, we aim to help our partners operate with greater precision, efficiency, and confidence.

Together, we're not just meeting industry demands—we're staying ahead of them.

# Leading by Vision

## Message from our Director

**Swapnil Walunj**

Whole Time Director & Business Head

**Goel Scientific Glass Works Limited**

Great Place To Work.® Certified FEB 2025-FEB 2026 INDIA ™

At Borosil Scientific, we believe in pushing the boundaries of industrial process systems innovation. With Goel Scientific Glassworks now a part of Borosil Scientific, we are not just continuing its pioneering legacy—we are elevating it. Our vision is clear: to be a global benchmark in industrial process system technology, delivering high-performance that drives efficiency, safety, and precision in pharma & specialty chemical process industries worldwide. This is not just an extension of the product portfolio; it is an evolution of the Goel Scientific brand. With investment in world-class systems, enhanced capabilities, cutting-edge advancements, and the strength of Borosil Scientific as pioneers in time-tested quality scientific solutions, it is now positioned to serve customers better than ever before.

Together, we are shaping the future of industrial process systems

The Transparent Specialist

A BOROSIL Scientific Company

# Quality Policy

At GOEL SCIENTIFIC GLASS WORKS LTD., We are dedicated to the design, manufacturing, and supply of high-quality Scientific and Industrial Glass Equipment and Labware. We are committed to understanding and fulfilling our customers' needs on time, every time.

We strive to achieve the highest level of customer satisfaction through continuous improvement of our products and services. This is accomplished by establishing, maintaining, and enhancing a robust Quality Management System, while ensuring compliance with all applicable statutory and regulatory requirements.

To support these goals, we commit to:

- Allocating sufficient resources across the organization to achieve our quality objectives.
- Embedding a quality-first culture through clear communication, active engagement, practical leadership, and ongoing training.
- Fostering open communication with our customers to understand and meet their evolving needs.
- Continuously upgrading our technical capabilities, systems, and processes.
- Enhancing the skills and expertise of our team through regular training and performance reviews.
- Upholding our core corporate values in all aspects of our operations.

This policy is communicated within the organization and made available to all relevant interested parties, as appropriate.

**Date:** 1st April 2025,
**Place:** Vadodara
Rev: 00

**Swapnil Walunj**
Whole-time Director & Business head

# Corporate Values

## Integrity

- We conduct our business sincerely and fairly, with honesty and transparency
- We hold ourselves to the same high standards we set for others
- We uphold the values of Borosil in every action and decision
- We abide by the highest standards of ethics in all our financial dealings regardless of the amounts involved
- We stick to our values even in the most difficult of circumstances
- Judgement & decisions are taken on the basis of facts & figures not based on perception

## Customer Focus

- We give honest and constructive feedback to help people achieve their full potential
- We are on time and prepared for our appointments and meetings
- We treat/deal with ever individual with utmost dignity, empathy and professionally
- We encourage teamwork and never hesitate to give credit to others
- We actively & empathetically listen to others and respect their views, irrespective of their levels and or other abilities
- Our decisions are always neutral & data based and not person based

## Respect

- Our customer (external as well as internal) is at the center of our actions
- We build long-term relations with our customers
- We focus our attention on those activities that bring value addition to our customers
- We strive to understand our customers' needs proactively and meet these needs on time
- We provide value for money to our customers

## Continual Improvement

- We believe in continuous quality improvements in our products and processes through innovation and teamwork
- We strive to understand internal and external benchmarks and improvise to reach them
- We challenge accepted ways of doing things and suggest new approaches
- We make efforts to understand new trends in the marketplace and introduce innovative products/services to capture these trends
- We are committed to learning and bringing new ideas to the table

## Accountability

- We take ownership of our decisions and hold ourselves accountable for both successes and failures
- We find alternative paths to success rather than waiting for direction
- We speak up even if it is not the majority view
- We do what is best for the Company rather than function or for self
- We focus on outcomes and results rather than activity
- We fulfill all commitments made to colleagues and customers

## Safety

- We value human life and our bodies more than profits
- We follow practices that continuously reduce risk of loss of human life or property

# The BOROSIL Group

## Science & Industrial Products Division

**Borosil's Scientific Limited** offers an entire gamut of the finest quality scientific and laboratory glassware, laboratory instruments and primary pharmaceutical packaging. Borosil Technologies Limited located at Hinjewadi, Pune is a 100% owned subsidiary of Borosil Limited which is mandated to develop Laboratory equipments under Labquest brand. Borosil Klass Pack Ltd., a subsidiary of Borosil Limited, is one of India's leading manufacturers of Glass Ampoules and Tubular Glass Vials of USP Type 1 that are widely used as primary packaging materials by pharmaceutical companies for their life-saving drugs. We also manufacture a wide portfolio of Chromatography vials. Borosil Process Sciences, a recent introduction in the portfolio provides sophisticated offerings for chemical synthesis & process development from bench top reactors to complex pilot plants with programmable controls. This range of over 3000 products from glassware, equipment and pharma packaging finds application across diverse disciplines such as Quality Control in pharmaceutical industries, research institutes, food and soil testing, microbiology, biotechnology, agriculture and many more. Newest introduction Symbolising quality, accuracy and dependability since six decades, Borosil has earned the trust and unwavering loyalty of leading pharmaceutical companies and R&D laboratories, as well as scientific, health and educational institutions.

**Goel Scientific Glass Works Ltd.** is one of the leading Scientific glass fabricators in the world, who has provided the Glass Industry of India a big leap in the Global Market. We have made presence in all the populated continents and are representing & supplying our product & service worldwide. At present, we have over 2500 satisfied customers across the globe.

BOROSIL® Scientific an ISO 9001: 2015 certified company

## Consumer Division

For over half a century, Borosil has stood as the premier brand for heat-resistant glassware in India, epitomizing quality and durability. Recognized as the trusted choice among consumers nationwide, Borosil represents much more than just glassware. The brand has broadened its portfolio to include Larah Opal Glass dinner sets, kitchen appliances, Insulated Flasks & bottles, Cookware and pressure cookers, storage solutions, and even glass lunch boxes, that resonate to the everyday needs of today's consumers.

Borosil's expansion into small appliances has been particularly noteworthy. The brand now offers a wide array of products including Juicer Mixer Grinders, Hand Mixers, Oven Toaster Grills, Toasters, Blenders, and Rice Cookers. Each appliance is supported by Borosil's extensive nationwide customer service network, ensuring that help is always within reach, minimizing any inconvenience.

At Borosil, the pillars of quality and trust are paramount. We are dedicated to going above and beyond to ensure that our products not only meet but exceed expectations, performing beautifully across all uses. Explore our comprehensive product range at www.myborosil.com and discover how we can make every day better for you.

## Solar Division

Borosil Renewables Ltd. is the first solar glass manufacturer in India and is part of the 'Borosil Group, which has been engaged in manufacturing a wide range of consumer-ware products and scientific and laboratory glassware for over five decades. Our state-of-the-art manufacturing facility is spread over around 100 acres in Bharuch, Gujarat, with a solar glass production and processing capacity of 1000 TPD, equivalent to 6.5 GW per annum. Recently, Borosil Renewables Ltd. acquired Europe's largest manufacturer of solar glass, the Interfloat Group, which consists of Glass Manufacturing Brandenburg (GMB), located in Tschernitz, Germany, and Interfloat Corporation, based in Liechtenstein. GMB operates a solar glass plant with a production capacity of 350 TPD (tonnes per day). With this acquisition, BRL's solar glass capacity has grown to 1350 TPD. The company has a strong focus on innovation and is known for its pioneering achievements like the development of the World's First fully tempered 2 MM thick solar glass, solar glass with the lowest iron content, giving the highest glass efficiency, and being the first company in the World to successfully be able to remove an extremely hazardous substance, "antimony," from its solar glass, etc. The company has products like Selene, an anti-glare solar glass suitable for PV installations near airports, and Shakti, a very high-efficiency solar glass in a matt-matt finish.

# A Legacy of more than 6 decades…

**1962** — Corning joined as technical collaborator with Dr Lele and formed **BOROSIL Glass Works Ltd.**

**1988** — **Corning divested its shares** to the current Indian promoters

**2013** — **Manufacturing facility** in Gujarat for **Laboratory glassware**

**2016** — Entry in Pharma primary packaging market with **acquisition of Klasspack**

**2018** — **Launch of LabQuest** Laboratory Instrumentation

**2022** — **The launch of Filter Papers** Collab with Hahnemühle

Introduction of **Process Sciences**

**2023** — **Acquisition of Goel Scientific Glass Works (GSGWL)** under the umbrella of Borosil

**Borosil's Scientific business** demerged from Borosil Limited

# About us

BOROSIL®
Scientific
Borosil Scientific Limited

In Dec 2023, the scientific business of Borosil Ltd demerged to form Borosil Scientific Limited which now comprises Laboratory instrumentation, Pharmaceutical Primary packaging, Process systems, in addition to the laboratory glassware and consumables.

Our Purpose

We are driven by the belief that science holds the key to progress. As a homegrown manufacturer from India our mission is to empower the scientific community by developing superior quality products that are safe, dependable and yet affordable.

By making the best scientific tools which are accessible to all laboratories in India and across the globe, we are making a sincere effort to contribute to the growth of industries and, in turn, build a self-reliant nation where collective progress thrives.

**60+**
**Years of experience**

**4000+**
**SKUs spanningÂ over 4 verticals**

**5**
**Manufacturing locations in India**

**4**
**Warehouses PAN India**

**150+**
**Channel partners PAN India**

BOROSIL® enabling the future of science | BOROSIL KLASSPACK® pharmaceutical packaging | LABQUEST BY BOROSIL® | BOROSIL® PROCESS SCIENCES | goel® The Transparent Specialist A BOROSIL Scientific Company

goel® The Transparent Specialist
A BOROSIL Scientific Company

# Envisioning
# Our Way Ahead

## Vision

As torchbearers of India's scientific legacy and in the pursuit of a nation built on scientific temper, our vision is to make science accessible to all.

## Mission

Borosil Scientific serves as the channel linking scientific exploration and industry demands. Our mission is to provide reliable and intelligent solutions.

## Purpose

Being an Indian manufacturer our purpose is to develop safe & quality products which are accessible to all scientific industries in India and across the globe

As we enter the new year with great enthusiasm, it is also a time to reflect and plan our path towards envisioned business objectives which includes being your partner for all laboratory requirements. With that in mind, we would like to share some thoughts with you.

The laboratory equipment market is experiencing significant growth, driven by increasing demand for healthcare services, the expanding pharmaceutical industry, and various government initiatives. The Indian market, in particular, has benefited immensely from the "Make in India" initiative. The "China Plus One" strategy has further bolstered the position of Indian manufacturers. This has also contributed to a rise in export-oriented growth for Indian companies. Moreover, government initiatives aimed at enhancing healthcare infrastructure and fostering research play a pivotal role in fueling the demand for laboratory equipment, making it an exciting time for the Indian laboratory equipment industry.

In this landscape, Borosil Scientific has consistently proven to be a trusted partner in a wide range of industries, from pharmaceuticals to food and agriculture, committed to providing integrated, innovative solutions that drive success for our customers through value in service, value in quality, value in performance, and most importantly, value in the experience we offer our customers. Borosil Scientific stands as a trusted leader, renowned for our comprehensive product range—spanning over 4,000 laboratory solutions, including scientific glassware, analytical vials, laboratory equipment, and primary pharmaceutical glass packaging.

# Our manufacturing facilities across 4 strategic locations

Laboratory Glassware Manufacturing Gujarat, India

Laboratory Consumables

LABQUEST "BOROSIL"

Laboratory Equipment

Laboratory Equipment Manufacturing, Maharashtra, India

Pharmaceutical Primary Packaging Site Maharastra, India

Pharmaceutical Primary Packaging

Process Equipment

Leading manufacturer of Process Equipment Gujarat, India

Through our operations at our Bharuch facility, we lead the Indian market for laboratory glassware, continuously setting new benchmarks for durability and accuracy. Our commitment to innovation has driven the introduction of advanced features like Laser Marking, QR-coded glassware, instant access to certificates, and improved meniscus reading on Class A Glassware certificates.

Our Pune facility produces a diverse array of Laboratory Instruments and Process Science Equipment that provide industrial clients with international-quality products at competitive price points, offering genuine value for laboratory needs. Our 'Labquest' brand is synonymous with reliability, meeting both national and international standards, and reinforcing our legacy of excellence. Our advanced process systems and lab equipment cater to the chemical and petrochemical industries, enabling high-precision research and development

Our Nashik facility is recognized for our expertise in critical sectors, particularly pharmaceuticals, where our Glass Ampoules and Tubular Glass Vials made from USP Type 1 glass serve as vital primary packaging materials for injectables and also chromatography vials.

Our Goel Scientific (Vadodara) enhances the capabilities in process chemistry automation, offering customized solutions like process reactors and pilot systems used in Pharma, API and specialty chemicals. We are committed to make more investments in this venture to enhance the product portfolio and geographic reach. For food, beverage, dairy, and agriculture, we provide optimized units which deliver maximum and precise outputs with minimum effort. Our advanced manufacturing facilities, combined with cutting-edge technology and partnerships with global leaders, allow us to deliver customized solutions that meet the highest standards of quality, precision, and reliability. Our integrated CRM software facilitates seamless communication across various functional teams, ensuring that customer needs are addressed in real-time.

To summarize, we are ready to seize new opportunities and look forward to the upcoming strategic developments that pave the way for Borosil Scientific Limited.
We would like to thank each one of you for your support so far and look forward to continued collaboration and mutual growth.
Together, we are now poised to scale greater heights.

# Borosil Scientific Expands with Acquisition of Goel Scientific Glass Works Ltd


## Who we are

**Goel Scientific Glass Works Ltd.** is one of the world's leading scientific glass fabricators, propelling India's glass industry onto the global stage. With a footprint across all populated continents, we proudly supply our products and services worldwide, serving over 2,500 satisfied customers across the globe.

Our glass components are fabricated using only the finest raw materials sourced from leading global manufacturers. We specialize in producing high-precision parts from Borosilicate Glass 3.3 tubing, adhering to stringent standards such as DIN ISO 3585 and ASTM E438 Type I, Class A standards. This ensures superior accuracy, thermal stability, and excellent optical properties on par with the world's top manufacturers.

At Goel Scientific, we understand glass like no other. Our process blends the craftsmanship of a potter, blacksmith, and goldsmith - united by precision engineering. This expertise has earned us the title of **"The Transparent Specialist."** We excel in the engineering, fabrication, installation, and commissioning of Pilot Plant, Mini-Plant, and Standard Distillation Units. All our glass equipment complies with international norms such as ISO 3585, 3586, EN BS 1595, and AD 2000 Merkblatt. Upon request, we also provide CE-marked pilot plant parts with comprehensive documentation, adding value and assurance to our offerings. With a rich legacy of manufacturing a complete range of glass equipment, Goel Scientific Glass Works Ltd continues to serve both domestic and global markets with innovative, reliable, and precise glass solutions, driving scientific progress worldwide.

# Certifications

Certified for ISO 9001: 2015 Quality Management System

Certification Partner Global
ISO 9001:2015

## CERTIFICATE OF REGISTRATION

THIS IS TO CERTIFY THAT THE
QUALITY MANAGEMENT SYSTEM OF

**Goel Scientific Glass Works Limited -**
**A Borosil Scientific Company**

**C-31/A, Sardar Estate,**
**Ajwa Road, Vadodara,**
**Gujarat 390019**
**INDIA**

has been assessed and registered as complying with the requirements of the International Standard shown above for the following Goods and Services. Further clarifications regarding the scope of this certificate and the applicability of the requirements of
**ISO 9001:2015**
may be obtained by consulting the certificate issuer.

**Design, Development, Marketing, Manufacturing and Erection of Scientific and Industrial Glass Equipments and Lab wares.**

www.jas-anz.org/register

Tony Wilde
Group Chairman

| | |
|---|---|
| Registration Number: | QMS/15/R91/0146 |
| Original 9001 Registration Date: | 31-May-2018 |
| Recertification Date: | 15-May-2024 |
| Expiry Date: | 15-May-2027 |

**Certification Partner Global**

**An Australian Owned Company**
**License # 1150/2011 CC (previously known as ISC Global),**
**Level 03, Boulevard Plaza, Tower 1, Downtown Dubai, Dubai, UAE**

The Status and Validity of this Certificate maybe verified in real time by scanning the adjacent QR Code.

This certificate is valid until the Expiry Date shown on the condition that audits are conducted each year and paid for as per the Certification Agreement. Should this condition not be met, cancellation procedures will be initiated, and the cancellation status will be revealed when the QR Code is scanned.

This Certificate remains the property of CPG and must be returned upon request. It must not be altered in any way. Intentional misuse of this certificate will result in cancellation without prior notification

# Factory and Production

The Transparent Specialist

A BOROSIL Scientific Company

## About us

The Kotambi plant of Goel Scientific Glass Works Ltd., a proud member of the Borosil Scientific family, represents a significant milestone in our growth journey. About the Kotambi Plant: Goel Scientific Glass Works Ltd proudly established its Kotambi Plant as a pivotal step in its continued growth and commitment to excellence. Commissioned on 18th December 2021, this advanced manufacturing facility is dedicated to the design, fabrication, and assembly of high-performance scientific glass equipment, custom process plants, and precision-engineered glass systems.

This advanced manufacturing facility was developed to expand our capabilities and support the increasing global demand for precision scientific glassware. Strategically located in Kotambi, Gujarat, the plant features state-of-the-art equipment, robust safety protocols, and streamlined workflows, enabling efficient production while maintaining the highest standards of quality. the Kotambi plant embodies our commitment to quality, innovation, and customer-centric solutions. The facility spans a spacious and green environment, housing state-of-the-art infrastructure and streamlined workflows that ensure safety, precision, and international manufacturing standards.

## Goel Scientific Glass Works Ltd.
## Kotambi Plant
## December 18, 2021
## Kotambi, Vadodara, Gujarat, India

At Goel Scientific, we blend decades of expertise with the latest technologies to serve a global clientele with reliable, customized, and scalable process solutions from lab glassware to full-scale pilot plant systems. The Kotambi Plant, launched in 2021, marks a significant expansion of our production capacity, technological capabilities, and global supply reach.

# Leading Manufacturer of Industrial Process Equipment

**Kotambi Plant**

At a Glance: State-of-the-Art Facility Spread across a sprawling green campus with advanced glassblowing, assembly, testing, and packaging sections.

**Production Capabilities:**

Glass Reactors (1L to 500L), Pilot Plant Assemblies, Distillation Columns & Units, Rotary & Film Evaporators, HCL Gas Generators, Scrubbers, Acid Purification & Recovery Systems (Bromine, Nitric, Sulphuric), Stainless Steel Reactors, TCU (Temperature Control Units), Customized Lab Glassware.

**Certifications:**

ISO 9001:2015 Certified (Compliance with international glass design & safety standards (DIN/ASTM).

**Team & Expertise:**

Highly skilled engineers, scientific glassblowers, and process designers. Strong focus on R&D, customization, and post-sales service. Integrated design-to-delivery support for industrial and lab-scale projects.

**Commitment to Innovation & Quality:**

Goel Scientific continues to serve national and global customers with tailor-made solutions that meet complex process challenges. The Kotambi Plant is a symbol of our forward-thinking approach, quality excellence, and sustainable manufacturing practices.

All Borosil glassware products pass through annealing Lehr chamber where the stresses are eliminated under controlled heating and cooling process.

This annealing process ensures the long lasting printing quality. In order to get the highest level of precision, carefully controlled gradual heating and cooling procedures are essential.

# Leading Process System Manufacturer Since 1977

**1989** — Developed the unique XTRONG range of glass equipment, which possess a tightening strength as high as 3 times than earlier conventional ones and thuas almost eliminated leakage and breakage problems while tightening.

**1990** — Introduced Glass Shell & Tube Heat Exchanger in Indian market for the first time.

**1994** — Started “Process Plant Division” for the development of new products for catering to the needs of borosicilate glass equipments users. The process plant division is committed to the development of newer equipment tailor made to suit the user industry requirement.

**1998** — Started manufacturing Spherical Vessels from an entirely new technique first time in the country, placing us in line with other overseas manufactures of these size vessels.

**2003** — Developed 300-Litre Spherical Vessel.

**2004** — 800 DN pipe section manufactured for the first time in India.

**2005** — Manufactured 500 Ltr. spherical vessel.

**2007** — Developed FLEX-HE (Assembled Coil Type) heat exchanges.

**2009** — Manufactured for the first time 800 Ltr. Kettle.

**2010** — Introduced Glass Shell & Tube Heat Exchanger in Indian market for the first time.

**2011** — Developed Assembled Jacketed Vessel up to 200L Capacity.

**2017** — Started supplying CE-certified kilo lab distillation units.

**2018** — Successfully Design ,develop and supplied H2SO4 Concentration unit.

**2019** — Successfully Design ,develop and supplied HCL and HN03 Purification unit.

**2020** — Develop and supplied SKID mounted precious Metal Recovery unit successfully.

**2021** — Developed 1-3 Ltr. Rotary Evaporator with modular design - "Rota-E-Vap". Developed "Lab Glass Ractor" suitable for chemical Process Unit.

**2022** — Started New Plant At Kotambi And Opened New Company Goel Glass Pvt Ltd

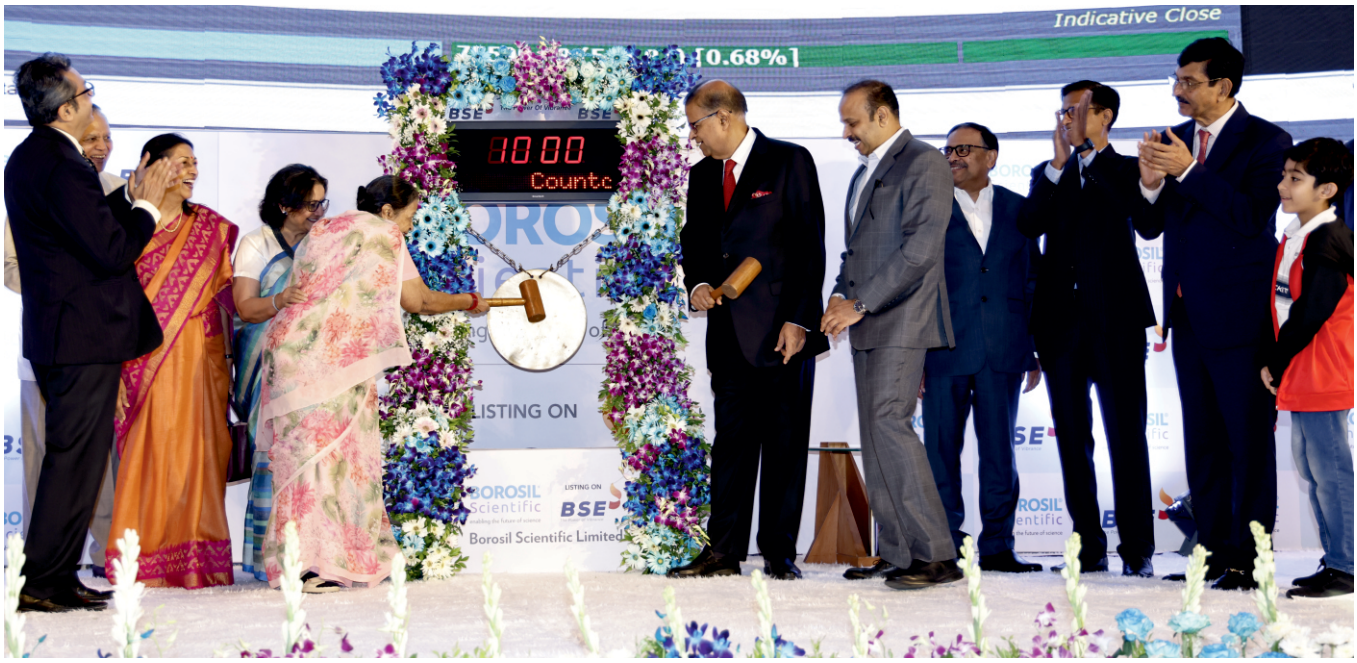
**2023** — Entry into Process System through acquisition of Goel Scientific Glass Works, Vadodara (Becomes Subsidiary of Borosil Ltd.) Goel Scientific becomes a subsidiary of Borosil Ltd.

**2024** — Continuing the legacy of innovation, global expansion, and precision-engineered solutions.

# Our Esteemed Clients

# *New Beginnings*

## **BSL Listing** on BSE and NSE on 7 June, 2024

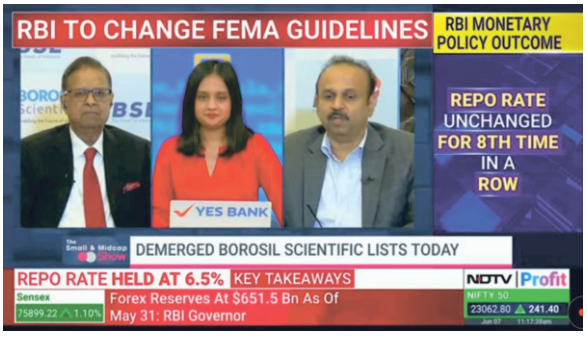



Borosil Scientific has officially been listed on the Bombay Stock Exchange Limited (BSE) and the National Stock Exchange of India Limited (NSE India)! Held on June 7th, 2024, at the Bombay Stock Exchange Limited (BSE), the bell-ringing ceremony was made possible by the steadfast support of their team.

From our beginnings to this momentous occasion, our journey has been fueled by dedication, innovation, and the unwavering support of our stakeholders.

Special thanks to Mr. Pradeep Kheruka, Chairman, Borosil Limited, Mr. Shreevar Kheruka, Managing Director, Borosil Ltd. and Mr. Vinayak Patankar, Whole-time Director & CEO of Borosil Scientific Ltd.

Their leadership and guidance have been invaluable to our journey.




**Grateful for this milestone !**

# GENERAL & TECHNICAL INFORMATION

## GOEL SCIENTIFIC PROCESS SYSTEMS

Goel Scientific has been fabricating Borosilicate glass for 60 years, thus possessing thebasic ability to form borosilicate glass.

The products manufactured in Goel Scientific are to the same high QVF standards and conform to British Standards BS 2598 and International Standards Organisation ISO 3587, and are branded Goel–Borosil.

Goel Scientific's manufacturing range will be widened commensurate with demand.

Our capabilities in process systems activity are oriented toward serving the chemical, pharmaceutical, and allied industries. Our range exceeds some 650 standard items detailed in this catalogue. Our activities comprise-
(i) Supply of standard systems for basic unit operations like reaction, distillation, evaporation, absorption, extraction and crystallisation.

(ii) Process design
(iii) Mechanical design
(iv) Procurement
(v) Installation
(vi) Commissioning
(vii) Repair Services

For more information, please contact our Head Office or any of the 4 regional offices listed in the catalogue.

## FAST AVAILABLE ITEMS

Items which are available faster are marked by * in the catalogue. Though it does not indicate any definate period of delivery, these items can be manufactured faster than the other items of its range. For example, Pipe section PS18/1000 can be supplied faster than any other pipe section of 450DN. This is because of following reasons :

- Semi finish goods or raw material for these items will be always available.
- Method of production of these items are set.
- Being fast moving items, these items may be available ex-stock with us.

## REPAIRS

Though any damaged glass equipment can be repaired, mostly it is not economical to do so. Generally, the repair which involves less than one third of its original work, is worth to carry out repairing. Repair work is costly because :

a. It generally require greater skill than making a new one.
b. Since it involves high risk of total breakage, the risk of total loss of time spent on its repairing goes along with.
c. The work involved in receiving a damaged equipment, identifying it throughout the handling, cleaning it, estimating its repairing charges, re-estimating the repairing charges in case damage extends etc are relatively expensive.
d. Each job require individual attention throughout the execution.

However, while sending an equipment for repairing, following care must be taken :

a. Inform the nature of breakage and get an estimate of repairing charges in advance to avoid the loss of transportation expenses in case it is uneconomical to go for repairing.
b. Since repairing takes longer time to fit into production schedules and completion of repairing is highly uncertain, it is generally suggested to arrange for a substitute equipment to continue the work.
c. Equipment to be repaired should be clean. Since it can be cleaned better and at less cost at owner's premises, it should be cleaned before sending it for transportation. This also makes it safer to transport.
d. Pack with extra care, since cracks in glass have a tendency to extend with every jerk.
e. If possible, send broken pieces along with it.
f. Generally repairing work is accepted only for the equipment manufactured by us, and are repaired at owner's risk only.

## DIMENSIONS, WEIGHTS AND SPECIFICATIONS

All the dimensions and weights are approximate. The specifications given in the catalogue are intended to present a general description of the items. Since manufacturing of glass equipment involves all manual operations, certain tolerances are obvious and permissible while passing the items through quality control.

## CATLOGUE REFERENCES

To avoid querries and delays in delivery, please always quote the catalogue reference in your order.

## MODIFICATIONS

We reserve the right to carry out technical modifications of products and data mentioned in this catalogue as and when require.

## STANDARDS PRACTICED

| | |
|---|---|
| DIN ISO | 3585 |
| DIN ISO | 3586 |
| DIN ISO | 3587 |
| DIN ISO | 4704 |
| BSEN | 1595 |
| DIN ISO | 718 |

## Terms & Conditions of Business at GSGWL

* Prices offered are Ex-works, Vadodara-Gujarat unless otherwise stated.

* Packing & forwarding cost will be charged extra.

* Insurance if desired, to be arranged by the buyer. However, in case of damage of goods in transit due to any reason whatsoever, the buyer has to make relevant claims from the insurance company. We implement the best practices for packing the glass product manufactured by us since more than 45 years.

* We assure and maintain the delivery terms as stated in quotation/offer. However, due to circumstances beyond control, especially in manufacturing of glass, the delivery may vary subject to circumstances.

* The warranty offered against manufacturing defect is upto 12 months from the date of Invoice but parts subject to wear & tear are excluded from warranty.

* In case of a complaint/damages of goods if any, the incident must be notified to us immediately upon receipt of material. Any claim beyond 7 days after receipt of the material shall not be entertained.

* Incase of damages proved due to our fault, we shall only be liable for the cost of item as per invoice value only. Any compensation arising due the damage/shortage shall not be applicable.

* If the consignment is held back and not dispatched from our plant beyond delivery period due to any reason at customer's end, the warehousing charges @ INR 10 per square Feet per week shall be paid by the customer towards storage and warehousing charges. (Square Foot Area shall be worked-out as per size of all the packed Cartons and the area covered by the total consignment)

* In case of delay in installation / commissioning due to the reason at customer's end/site for more than 3 months from the date of Invoice, the customer has to release the pending payment held against “Installation/Commissioning”.

* An equipment already supplied by GSGWL, if being sent to our works for repair/maintenance purposes, Customer is required to thoroughly clean the equipment before dispatch.

* Advance payment once received against an order is non-refundable, in case of cancellation of order for any reason.

**All matters in case disputes is subject to Vadodara Jurisdiction.**

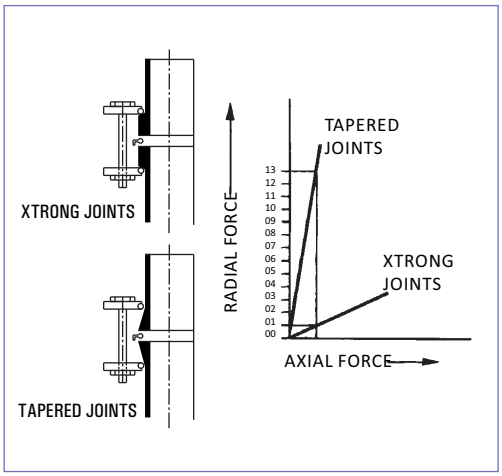
## INTRODUCTION

Tapered glass joints are predominantly used in industrial glass equipments. This design has a high ratio of radial to axial force, which frequently leads to breakage while tightening the flange joints.

A cylinder can withstand a much higher axial force than radial force plus glass has a very high compressive strength. We at GOEL recognized these features and by our innovative design practices developed XTRONG joints. The XTRONG joints are so designed that the harmful radial stresses are dramatically reduced. For a given axial force the radial forces are 14 times lesser than that in tapered joints.

XTRONG joints are practically many times stronger than conventional tapered joints, As far as tightening of joints are concern, it is tested that a XTRONG joints does not break even at a torque of 20Nm, as against tapered joints, which starts breaking at 6-7 Nm torque. At times it may happen that because of over tightening, a metal backing flange breaks or the threads of nut-bolts give way but XTRONG glass joint remains intact.

Most of the old glass installations in general contain equipments with tapered glass joints. XTRONG joints are fully compatible with these tapered joints. i.e. an XTRONG equipment can replace another tapered equipment and vice versa in any existing unit. This interchangeability makes XTRONG design more adaptable in general conditions and change over cost is negligible.




XTRONG joints

XTRONG joints have been developed, to arrest the frequent breakage and leakage problems. The XTRONG joints are so designed that the harmful radial stresses are dramatically reduced. For a given axial force the radial forces are 14 times lesser than that in tapered joints.

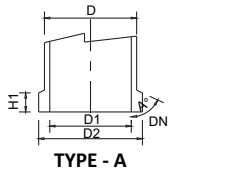
In addition to reducing the stresses, the XTRONG joint has the following advantages

- The ovality of the glass flange, present due to manufacturing process, has virtually no effect because the backing flange isn't in direct contact with the periphery.
- Continuous re-tightening of the backing flange or insert, due to bolting force & temperature effects, hence dismantling is easy. Also much smaller length threaded bolts are needed compared to the tapered joints.
- The XTRONG joint is leak-tight at all design temperatures & pressure, even with temperature cycling and frequent plant start-up as it is possible to tighten the joints upto a tightening torque of 20 Nm as against 6-7 Nm tightening torque in tapered joints. In some cases the metal backing flange breaks but nothing happens to the glass components !

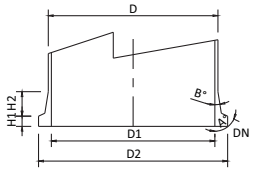
With so many benefits and particularly low breakage risk, we have adopted XTRONG design for all equipments manufactured by us. XTRONG is widely accepted and adopted by users as well as manufacturers of Glass Equipments in India.

## DIMENSIONS OF XTRONG ENDS

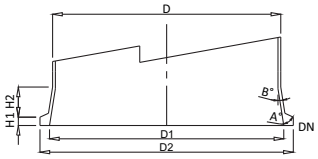
| DN | D2 | D1 | D | H1 | H2 | A | B | Type |
|---|---|---|---|---|---|---|---|---|
| 12(0.5) | 25 | 13 | 19 | 8 | 2 | 65 | 0 | A |
| 15(0.7) | 28 | 16 | 22 | 8 | 2 | 65 | 0 | A |
| 25(1) | 41 | 26 | 33 | 13 | 8 | 65 | 0 | A |
| 40(1.5) | 56 | 38 | 46 | 14 | 9 | 65 | 0 | A |
| 50(2) | 69 | 50 | 59 | 16 | 11 | 65 | 0 | A |
| 80(3) | 98 | 77 | 87 | 18 | 12 | 65 | 0 | A |
| 100(4) | 132 | 105 | 115 | 20 | 17 | 65 | 0 | A |
| 150(6) | 184 | 153 | 165 | 22 | 19 | 65 | 0 | A |
| 200(8) | 233 | 200 | 215 | 22 | 26 | 65 | 0 | A |
| 225(9) | 258 | 220 | 230 | 24 | 26 | 65 | 0 | A |
| 300(12) | 340 | 300 | 315 | 24 | 26 | 65 | 0 | A |
| 400(16) | 463 | 407 | 422 | 25 | 35 | 65 | 9 | B |
| 450(18) | 525 | 457 | 470 | 25 | 50 | 65 | 9 | B |
| 600(24) | 684 | 610 | 625 | 25 | 60 | 65 | 9 | B |
| 700(28) | 784 | 710 | 735 | 28 | 70 | 65 | 9 | C |
| 800(32) | 916 | 820 | 832 | 30 | 97 | 65 | 9 | C |
| 1000(40) | 1088 | 1020 | 1037 | 30 | 150 | 65 | 9 | C |




TYPE - A




TYPE - B




TYPE - C

Borosilicate glass represents unmatched standardized glass for construction of plant and piping in the chemical, dyestuff, food pharmaceutical, petrochemical industries. Its steadily growing use is due to many advantages over conventional materials.

- Outstanding corrosion resistence
- Smooth pore free surface
- Transparency
- Catalytic intertness.
- No effect on taste and odour
- Physiological intertness.

Borosilicate glass is chosen for its unique chemical and physical properties. Borosilicate glass can be considered as being composed of Oxides, Silica ($SIO_2$) Magnesia (MgO) and Lead oxide (PbO) are the principle modifiers/fluxes.

The chemical and physical properties of any glass depends on a varying degree on chemical composition of glass.

## CHEMICAL COMPOSITION

The composition of borosilicate glass used for chemical plants has following approximate composition.

| | |
|---|---|
| $SiO_2$ - 80.6% | $B_2O_2$ - 12.5% |
| $Na_2O$ - 4.2% | $Al_2O_3$ - 2.2% |

## RESISTANCE TO CHEMICAL

Borosilicate glass is inert to almost all materials except Hydroflouric acid (HF) Phosphoric acid($H_3PO_4$) and hot strong caustic solutions. Of these. Hydroflouric acid has the most serious effect, even when it is present in PPM (parts per million) in solutions. Where as phosphoric acid and caustic solutions cause no problems when cold but at elevated temperature corrosion occurs. In case of caustic solutions, upto 30% concentration can be handled safely at ambient temperature.

Under actual operating conditions, the effect of turbulence, and traces of other chemicals in the solution may increase or decrease the rate of attack. So it is not possible to give exact figures for corrosion by caustic solutions.

## PHYSICAL AND THERMAL PROPERTIES

**Linear coefficient of thermal expansion**

The coefficient of thermal expansion of borosilicate glass over the temperature 0-300°C is 3.3 x $10^{-6}$/°C. This is very low when compared with other glasses and metals. That is why, borosilicate glass is often called low expansion borosilicate glass.

**Specific heat**

Specific heat between 25°C and 300°C is average to be 0.233Kcal/Kg, °C

**Thermal Conductivity**

Thermal conductivity is 1.0 Kcal/hr,m°C. Over the permissible operating temperature range.

**Mean Specific Heat**

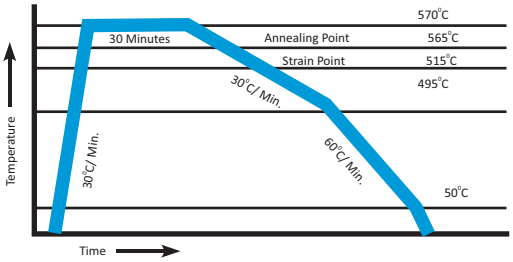
Mean specific heat capacity between 20°C and 200°C is 0.98 KJ/Kg K.

## DENSITY

Density of glass at 20°C (J)=2.23g/cc
Modulus of elasticity (E)=6.3 KN/$mm^2$
Poissions ratio=0.2

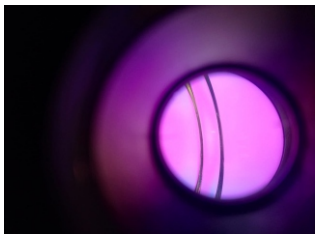
## ANNEALING

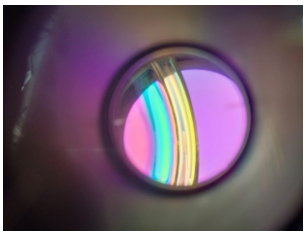
Annealing of glass is the process where the glass is heated and kept for a defined period of time to relive internal stresses. Careful cooling under controlled conditions is essential to ensure that no stresses are reintroduced by chilling/cooling.




**Instruction :**

Please Don't Accept The Pipe Section With Thermal Stress (Various Colours Shades When Seen Through polarimater).





## RESHAPING

In the below given table, it shows characteristic temperature at a determined viscosity, essential for glass reshape.

| | | |
|---|---|---|
| Lower cooling temperature | $10^{24}$ poise | 515°C |
| Upper cooling temperature | $10^{13}$ poise | 565°C |
| Softening point | $10^{7}$ poise | 795°C |
| Reshaping point | $10^{4}$ poise | 120°C |

## MECHANICAL PROPERTIES

The lack of ductility of glass prevents the equalization of stresses at local irregularities or flows and the breakage strength varies considerably about a mean value. This latter is found to occur at a tensile strength of about 700kg/$cm^2$ In order to allow for the spread of breaking stress, a large factor of safety is applied when determining the wall thickness requirement to allow operation up to values given in the table of working pressure.

## OPTICAL PROPERTIES

Borosilicate glass show no appreciable absorption in the visible region of spectrum and therefore appears clear and colorless.

In photo chemical processes, the transparency of ultra violet is of particular importance. It follows from the transmittance of material in uv region that photo chemical reactions such as Chlorination & Sulpho Chlorination can be performed in it.

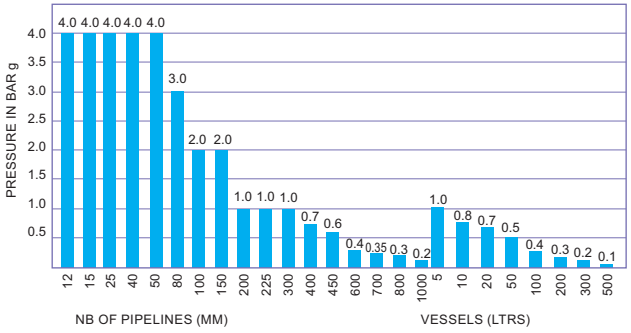
## PERMISSIBLE OPERATING CONDITIONS

**Working Pressure For Glass Pipelines & Vessels**

The permissible internal operation pressure depends upon the nominal diameter of the glass components and on working temperature.

In case of unit with various combination like vessels, filters, heat exchangers, the over all permissible internal gauge pressure is always governed by the component with the lowest permissible operating gauge pressure all components are suitable for full vacuum.

Bar is a measure of absolute pressure. The figure given for maximum recommended working pressure represents pressure above atmospheric.




**Working Temperature**

Borosilicate glass retains its mechanical strength and will deform only at temperature which approach its strain point. The practical upper limit for operating temperature is much lower and is controlled by the temperature differentials in the glass which depends on the relative temperature of the contents of the equipment and the external surroundings. Provided borosilicate glass is not subject to rapid change in temperature, creating undue thermal shock, it can be operated safely at temperatures upto 250°C

It must be realised that in complete plants, composed not only of borosilicate glass, but also include other materials such as PTFE. The recommended max. operating temperature is 200°C. Operating temperatures may have to be modified so as to compensate for the effects of other factors such as pressure, thermal cycling, rapid heating & cooling etc.

The degree of thermal shock (usually defined as sudden chilling or heating) which it can withstand depends on many factors such as stresses due to operating conditions, stresses imposed in supporting the equipment, the wall thickness of the glass. It is therefore undesirable to give sudden temperature changes. But up to 120°C can be accommodated.

As sub zero temperature, the tensile strength of borosilicate glass tends to increase and equipment can be used safely at temperatures as low as -50°C for XTRONG and components.

## ELECTRICAL CHARACTERISTICS

Glass being a poor electrical conductor, surface, conductivity is insignificant and varies with the quantity of water absorbed on glass surface. The specific conductivity is $10^{0}$ ohm/cm at temperature of 200°C. The dielectric coefficient varies with current frequency.

## COMPOSITE MATERIALS

The last two decades have seen the new or further developments of particularly corrosion resistant plant construction materials. Typical examples of these are PTFE, tantalum, titanium, graphite and of course, Borosilicate 3.3 Glass.

The combination of different corrosion resistant materials with the utilization of the specific advantages of each permits both safe and economic construction.

**Borosilicate glass/PTFE**

Borosilicate Glass with PTFE is of particularly decisive importance for construction of glass installation For example. in Seals, Bellows, Stirrers, Pumps, Heat Exchangers, Column Inserts etc.

PTFE is used with Glass because of its excellent mechanical & thermal properties. They have near universal fluid compatibility. Wear life when compared with others is very low. Particularly PTFE is maintenance free and have cryogenic stability with non wetting property.

Service temperature of PTFE is considered as - 50°C to + 200°C

## TIGHTENING TORQUE

| Diameter | Maximum bolt-tightening torque* in Nm for couplings with backing flanges | |
|---|---|---|
| DN | Made of Plastic (K) | Made of Iron/steel/ Silumin(S) |
| 12 | 1 | 1 |
| 15 | 1 | 1 |
| 25 | 2.5 | 2.5 |
| 40 | 2.5 | 3.5 |
| 50 | 2.5 | 3.5 |
| 80 | 2.5 | 3.5 |
| 100 | 3.5 | 4.5 |
| 150 | 3.5 | 4.5 |
| 200 | - | 4.5 |
| 225 | - | 4.5 |
| 300 | - | 4.5 |
| 400 | - | 6.5 |
| 450 | - | 6.5 |
| 600 | - | 11 |
| 700 | - | 20 |
| 800 | - | 20 |
| 1000 | - | 22 |

*The Indicated Tightening torques apply for ungreased bolts and are required only for the maximum operating pressures. They can be reduced.

with X-Bonding

without X-Bonding

## EXTRA PROTECTION OF GLASS COMPONENTS 'X-BONDING'

X BONDING provide an added advantage of protection of standard glass components. The major advantage of X-Bonding systems is that if the glass is subject to accidental breakage, the bonded wrapping provides additional protection against the risk of injury, release of corrosive fluids or loss of expensive products.

X BONDING is a glass reinforced fibre coating which provide a higher level of protection on the glass components. This does have a slightly adverse effect on the transparency of the glass, making it translucent & not transparent.

**Permissible Operating Temperature:**
The permissible operating temperature for X-Bonding is 130° C unless limited by the individual operating temperature of the said component.

**Permissible Operating Pressure:**
The permissible operating pressure for X-Bonded components is same to that for Standard Glass Components.

**Thermal Shock**
Despite the thermal insulating effect of X-Bonding, the thermal shock characteristics remain the same as standard glass component.

INDEX

# CATALOGUE COMPONENTS & REFERENCES

# INDEX

# INDUSTRIES WE SERVE

At Goel Scientific Glass Works Ltd. – A Borosil Scientific Limited, we take pride in serving a wide spectrum of industries with our high-quality scientific glass process equipment and turnkey solutions. Our expertise extends across diverse industries, including Agriculture, API, Chemical, Essential Oils, Life Sciences, Lighting, Pharmaceuticals, Pigments & Dyes, and R&D, among others. Our products are meticulously designed to meet the demanding needs of these sectors:

With a strong focus on innovation, quality, and customization, we provide reliable process solutions that drive efficiency, safety, and performance across every application we serve.

**Pharmaceutical**

**Chemical**

**API**

**Agricluture**

**Essential Oil**

**Life Science**

**Lighting**

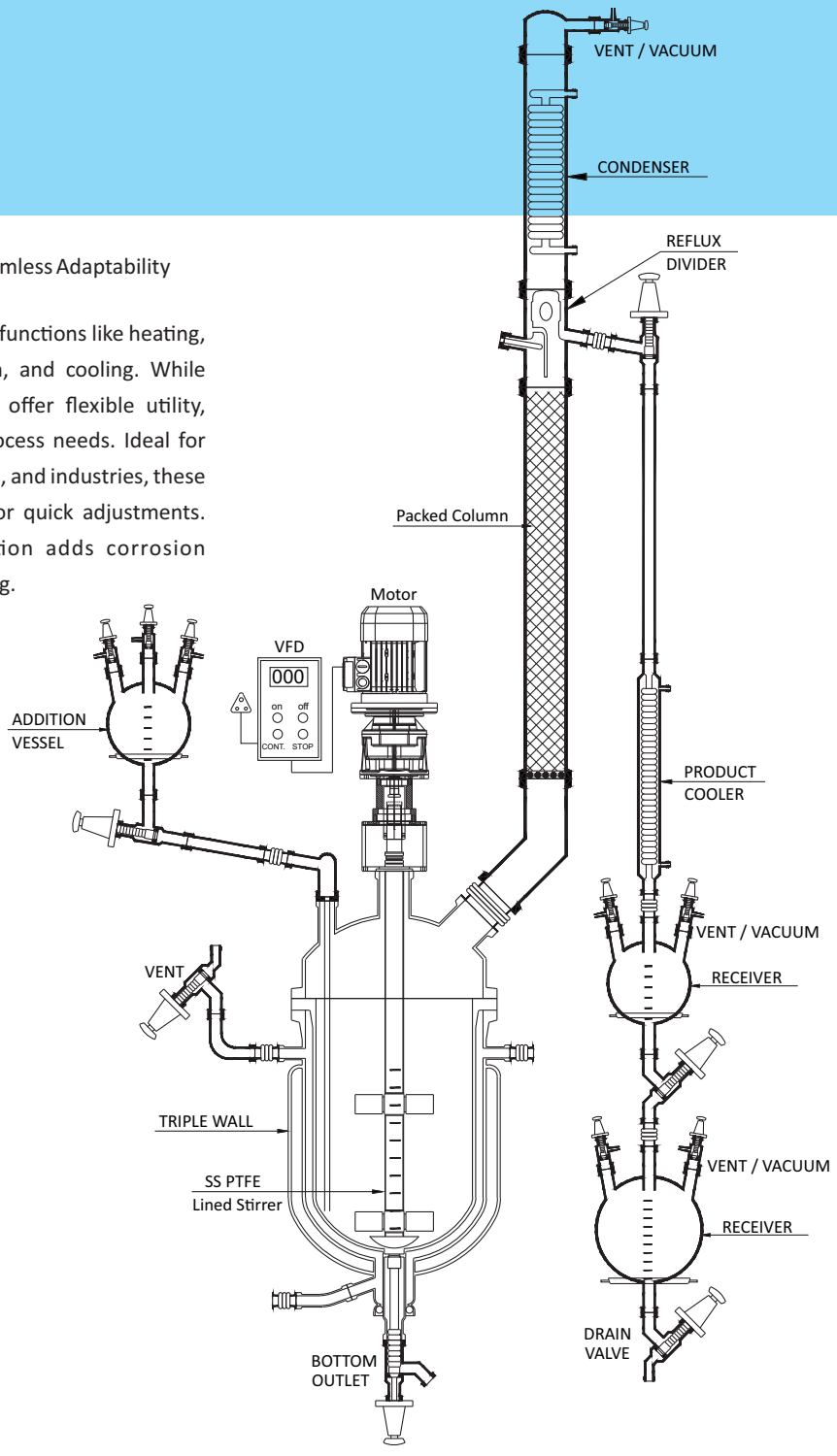
**Pigment & Dyes**

**R&D**

# STANDARD UNITS

Multi-Purpose Units Designed for Seamless Adaptability

Our Standard Units feature essential functions like heating, stirring, condensation, fractionation, and cooling. While standardized in construction, they offer flexible utility, easily modified to meet specific process needs. Ideal for educational institutions, R&D centers, and industries, these units boast modular construction for quick adjustments. The borosilicate glass construction adds corrosion resistance, clarity, and ease of cleaning.



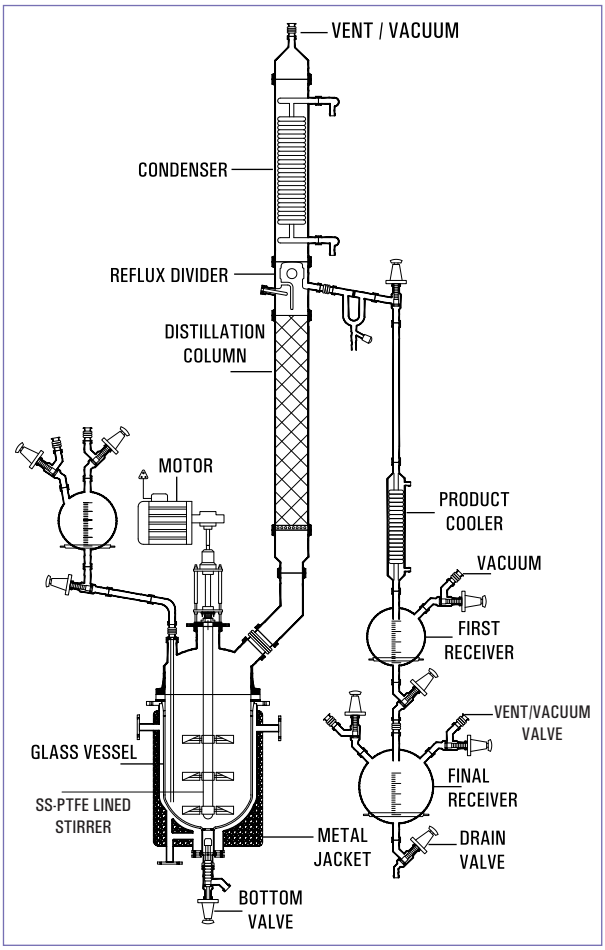
# STANDARD UNITS

1. Glass Reactor With Metal Jacket
2. Simple Distillation Unit
3. Reaction Unit
4. Fraction Distillation Unit
5. Reaction Distillation Unit
6. Liquid-Liquid Extraction Unit
7. Solid-Liquid Extraction Unit
8. Assembly over GLR
9. Gas Scrubber
10. Multi Purpose Unit
11. Mobile Mixing System

NEW 12. Essential Oil Distillation Unit

13 Agitated Glass Nutsche Filter, Peptide Synthesizer

NEW 14 HCL Adiabatic Absorption




## GLASS REACTOR WITH METAL JACKET

According to the customer's requirements and standard, we manufacture jacketed glass reactor which has many functions to satisfy kinds of experiments.

Goel Scientific offers Glass Reactor with Metal Jacket for chemical & pharmaceutical industries for process development. Glass reactor will have metal jacket and metal insulation.

**Glass Metal jacketed Reactor** 5-200 liter
**Pressure:** - up to 1 Bar
**Temperature:** -50°C to +200°C
**Material:** Borosilicate glass 3.3 /PTFE/ SS 316.

### Key Features:

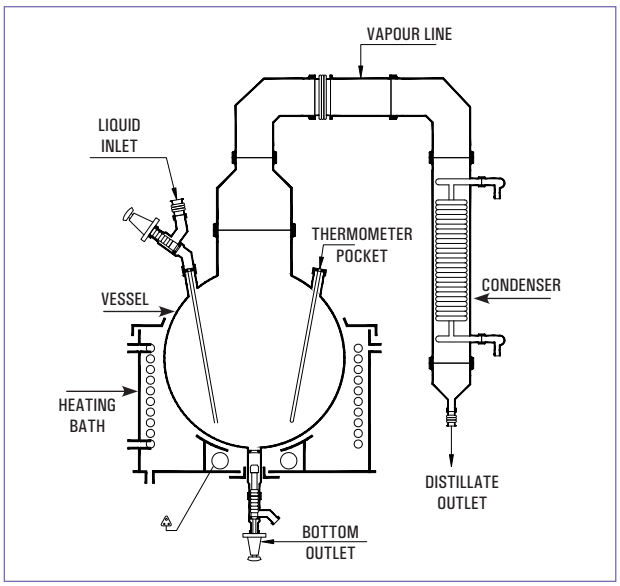
- Reactor lift for easy opening i.e optimised for easy vessel cleaning.
- Temperature monitoring and control.
- Gas purging available.
- Vacuum / exhaust piping arrangement.
- Additional feeders / receivers as per requirement.
- Solid feeding arrangement.
- Ready for Cryogenic reactions (-50°C).
- Mixed systems with pressure reactor and vacuum distillation.

## SIMPLE DISTILLATION UNIT

It consists of a vessel mounted in a heating bath and fitted with a condenser for condensing the vapours. A receiver with drain valve can be added for receiving the condensate.

The units are available in vessel sizes of 20, 50, 100, 200, 300 & 500 L and is suitable for operation under atmospheric pressure and full vacuum.

| Unit Cat.Ref. | Reactor Capacity | Bath KW | Vapour Line | Condenser $M^2$ |
|---|---|---|---|---|
| SDU20 | 20 L | 4.0 | 80 DN | 0.35 |
| SDU50 | 50 L | 6.0 | 100 DN | 0.50 |
| SDU100 | 100 L | 9.0 | 150 DN | 1.50 |
| SDU200 | 200 L | 12.0 | 150 DN | 1.50 |
| SDU300 | 300 L | 18.0 | 225 DN | 2.50 |
| SDU500 | 500L | 24.0 | 300 DN | 4.00 |



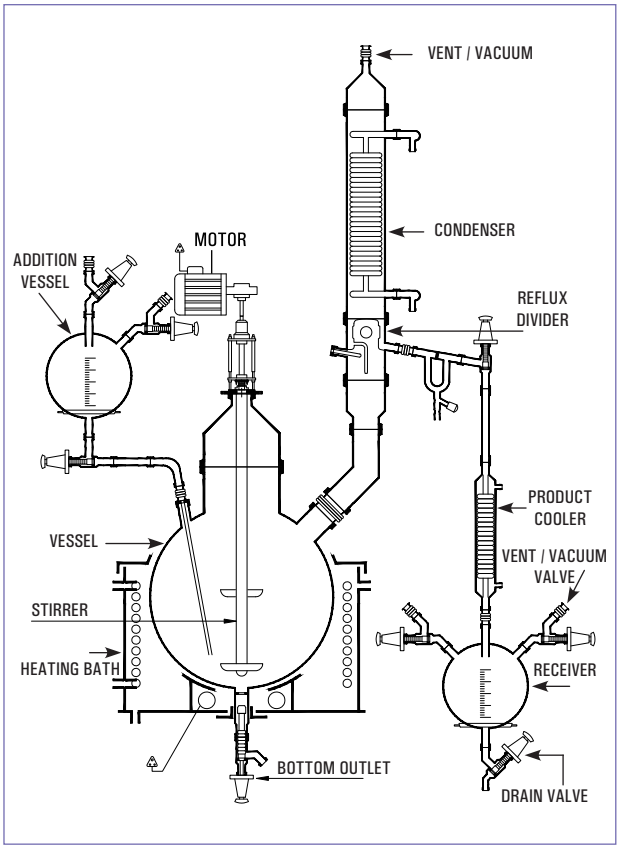

## REACTION UNIT

This unit is used for carrying out reactions under stirred condition and with provision for simple reflux distillation.

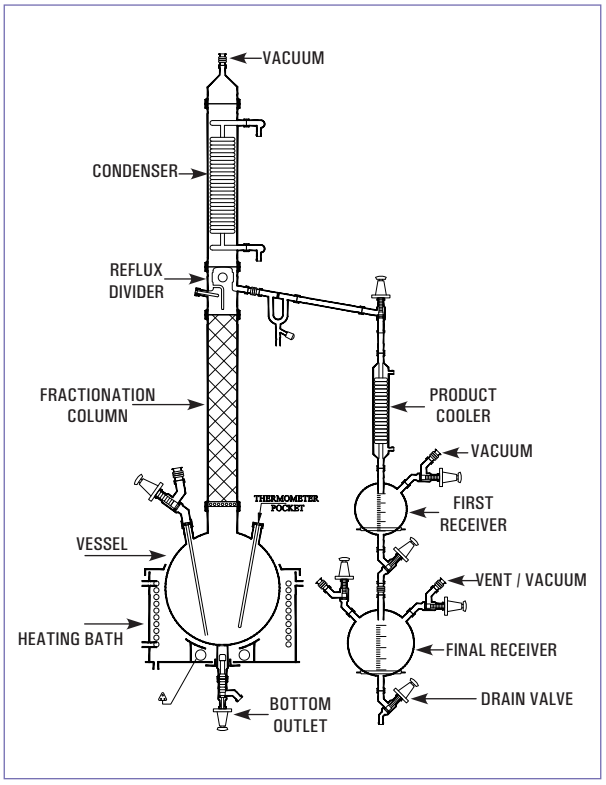
The reaction vessel is mounted in a heating bath and fitted with addition vessel, motor-driven stirrer and provision for condensation with refluxing. The product is sub-cooled and collected in a receiver.

The units are available in vessel sizes of 20, 50, 100, 200, 300 & 500 L and is suitable for operation under atmospheric pressure and full vacuum.

| Unit Cat.Ref | Reactor Capacity | Bath KW | Addition Vessel | Vapour Line | Condenser HTA $M^2$ | Cooler HTA $M^2$ | Receiver Size |
|---|---|---|---|---|---|---|---|
| RDU20 | 20 L | 4.0 | 2 L | 80 DN | 0.35 | 0.10 | 5 L |
| RDU50 | 50 L | 6.0 | 5 L | 100 DN | 0.50 | 0.20 | 10 L |
| RDU100 | 100 L | 9.0 | 10 L | 150 DN | 1.50 | 0.35 | 20 L |
| RDU200 | 200 L | 12.0 | 20 L | 150 DN | 1.50 | 0.35 | 20 L |
| RDU300 | 300 L | 18.0 | 20 L | 225 DN | 2.50 | 0.50 | 20 L |
| RDU500 | 500 L | 24.0 | 50 L | 300 DN | 4.00 | 0.70 | 50 L |



# FRACTIONAL DISTILLATION UNIT



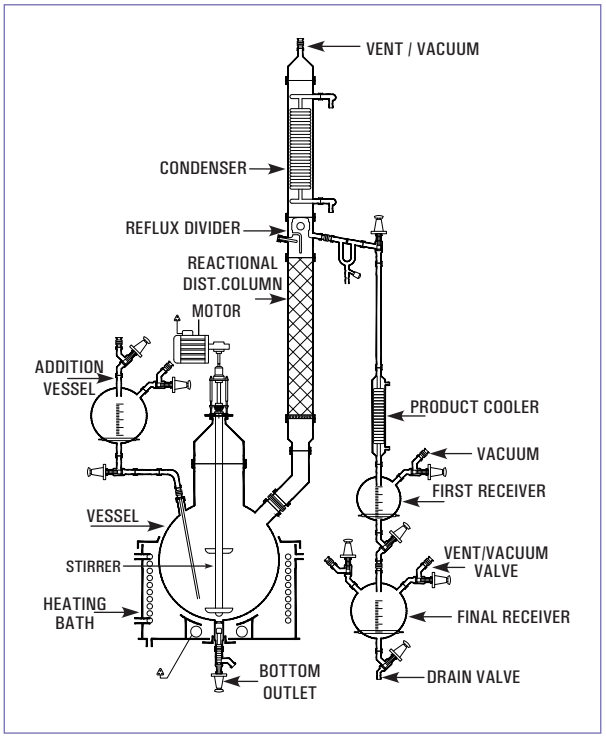

This is essentially a compact batch-type fractional distillation unit in which the reboiler consists of a vessel mounted in a heating bath and with a packed column above. The vapours from top is condensed and can be refluxed as per requirement.

The top product is sub-cooled and collected in receivers. The bottom product is finally drained from the reboiler through a drain valve.

The units are available in vessel sizes of 20, 50, 100, 200, 300 & 500 L and is suitable for operation under atmospheric pressure and full vacuum

| Unit Cat.Ref | Reactor Capacity | Bath KW | Vapour Line | Condenser HTA $M^2$ | Cooler HTA $M^2$ | Receiver Size |
|---|---|---|---|---|---|---|
| FDU20 | 20 L | 4.0 | 80 DN | 0.35 | 0.10 | 2L , 5L |
| FDU50 | 50 L | 6.0 | 100 DN | 0.50 | 0.20 | 5L , 10L |
| FDU100 | 100 L | 9.0 | 150 DN | 1.50 | 0.35 | 10L , 20L |
| FDU200 | 200 L | 12.0 | 150 DN | 1.50 | 0.35 | 20L , 20L |
| FDU300 | 300 L | 18.0 | 225 DN | 2.50 | 0.50 | 20L , 20L |
| FDU500 | 500 L | 24.0 | 300 DN | 4.00 | 0.70 | 20L , 50L |

# REACTION DISTILLATION UNIT




This is a versatile unit and can be used as Reaction Distillation Unit, Fractional Distillation Unit or a combination of both. All features of Reaction Distillation Unit and Fractional Distillation Unit are incorporated.

The units are available in vessel sizes of 20, 50, 100, 200, 300 & 500 L and is suitable for operation under atmospheric pressure and full vacuum.

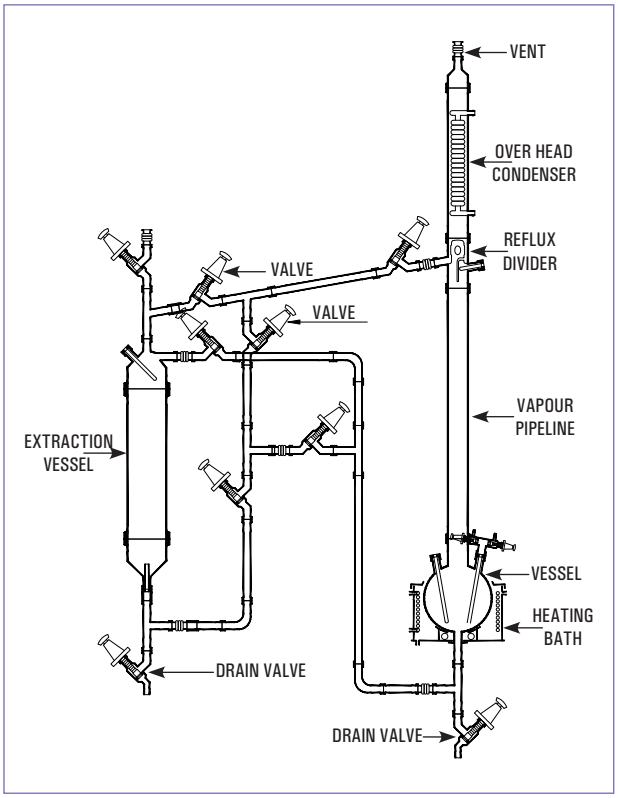
| Unit Cat.Ref | Reactor Capacity | Bath KW | Addition Vessel | Vapour Line | Condenser HTA $M^2$ | Cooler HTA $M^2$ | Receiver Size |
|---|---|---|---|---|---|---|---|
| FRU20 | 20 L | 4.0 | 2 L | 80 DN | 0.35 | 0.10 | 2L, 5L |
| FRU50 | 50 L | 6.0 | 5 L | 100 DN | 0.50 | 0.20 | 5L, 10L |
| FRU100 | 100 L | 9.0 | 10 L | 150 DN | 1.50 | 0.35 | 10L, 20L |
| FRU200 | 200 L | 12.0 | 20 L | 150 DN | 1.50 | 0.35 | 10L, 20L |
| FRU300 | 300 L | 18.0 | 20 L | 225 DN | 2.50 | 0.50 | 20L, 20L |
| FRU500 | 500 L | 24.0 | 50 L | 300 DN | 4.00 | 0.70 | 50L, 50L |

# LIQUID-LIQUID EXTRACTION UNIT

Liquid extraction, sometimes called solvent extraction, is the separation of constituents of a liquid solution by contact with another insoluble liquid. The unit described here is for a semi-batch operation.

The liquid to be extracted is poured into an extraction vessel. Solvent is boiled in a reboiler vessel and condensed in an overhead condenser, the condensed liquid collecting in a reflux divider and passing through pipework to the extraction vessel. The pipework incorporates valves in order that the solvent can enter the extraction vessel at either the base of the top, depending on the relative densities of the solvent and liquid to be extracted. The solvent and the extracted liquid pass back to the reboiler and the process is repeated until the extraction is complete. The extraction vessel is then drained and the solvent evaporated from the reboiler vessel and collected in the extraction vessel enabling the two liquids to be drained from their respective vessels.

The units are available in vessel sizes of 20, 50, 100, 200 & 300 L and is suitable for operation under atmospheric pressure.




| Unit Cat.Ref. | Reactor Capacity | Bath KW | Vapour Line | Extraction Vessel | Condenser $M^2$ |
|---|---|---|---|---|---|
| LLU10 | 10 L | 3.00 | 40mmx1m | 10 L | 0.35 |
| LLU20 | 20 L | 4.00 | 50mmx1m | 20 L | 0.50 |
| LLU50 | 50 L | 6.00 | 80mmx1m | 50 L | 1.50 |
| LLU100 | 100 L | 9.00 | 100mmx1m | 100 L | 1.50 |
| LLU200 | 200 L | 12.00 | 150mmx1m | 200 L | 2.25 |
| LLU300 | 300 L | 18.00 | 225mmx1m | 300 L | 4.00 |

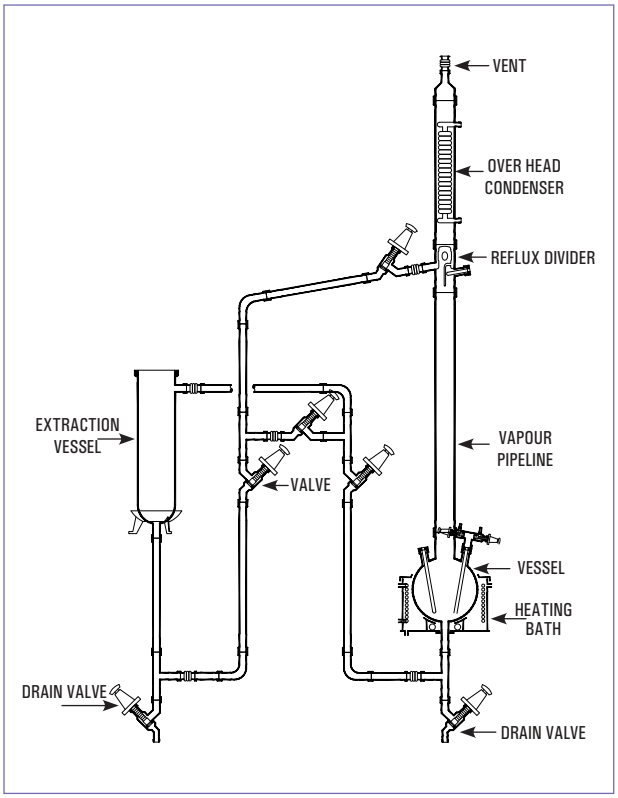
# SOLID-LIQUID EXTRACTION UNIT

This operation involves preferential solublising of one or more soluble constituents (solutes) of a solid mixture by a liquid solvent. The unit described here is for a semi-batch operation.

The solid to be extracted is put inside a glass fiber bag and placed in an extraction vessel. Solvent from the reboiler is continuously evaporated, condensed and circulated through a reflux divider by means of piping network and valves. When desired/ steady concentration of solute is achieved in the solution the operation is discontinued. The solution is drained off and collected for further use.

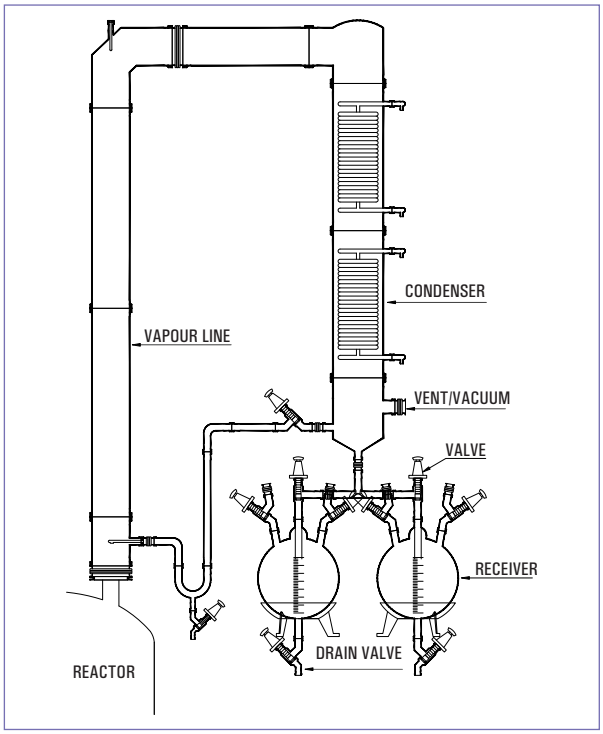
After charging fresh solid in fiber bag and solvent in reboiler, the cycle can be restarted again.

The units are available in vessel sizes of 20, 50, 100, 200 & 300 L and is suitable for operation under atmospheric pressure.




| Unit Cat. Ref. | Reactor Capacity | Bath KW | Vapour Line | Extraction Vessel | Condenser $M^2$ |
|---|---|---|---|---|---|
| SLU10 | 10 L | 3.00 | 40mmx1m | 10 L | 0.35 |
| SLU20 | 20 L | 4.00 | 50mmx1m | 20 L | 0.50 |
| SLU50 | 50 L | 6.00 | 80mmx1m | 50 L | 1.50 |
| SLU100 | 100 L | 9.00 | 100mmx1m | 100 L | 1.50 |
| SLU200 | 200 L | 12.00 | 150mmx1m | 200 L | 2.25 |
| SLU300 | 300 L | 18.00 | 225mmx1m | 300 L | 4.00 |

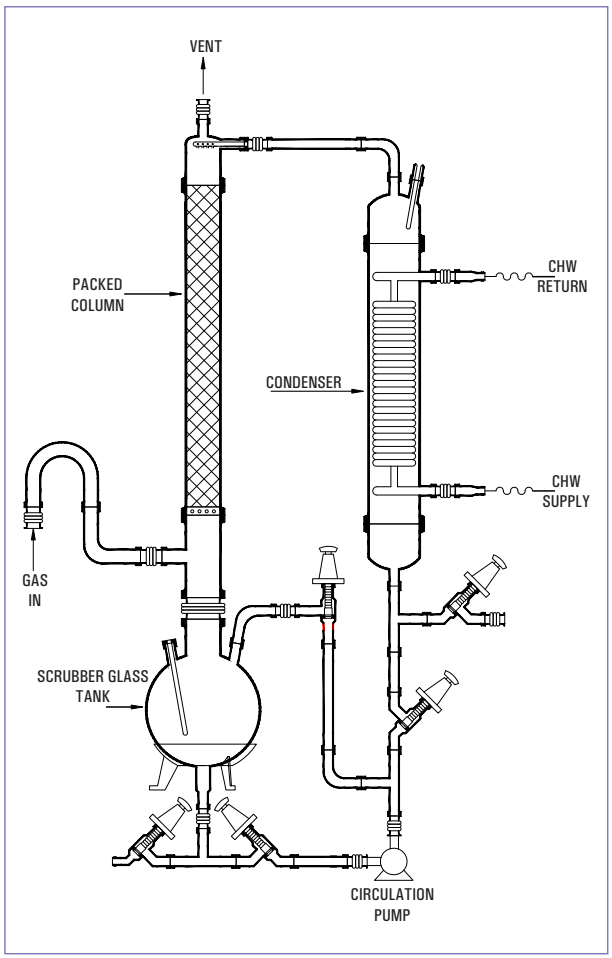
## ASSEMBLIES OVER GLASS LINED REACTOR




Glass Lined Reactors are used instead of glass reactors specially when scale of operation is large and relatively high pressure steam is to be used as heating media. Quite often assemblies like Simple Distillation Unit, Reaction Distillation Unit, Fractional Distillation Unit etc. are installed above glass lined reactors. The basic features of these assemblies remain the same but glass shell and tube heat exchanger is preferred due to large scale of operation. A typical fractional distillation unit type assembly over GLR is shown in adjacent figure.

| Cat.Ref. | Reactor Cap. | Vapour column | Condenser HTA $M^2$ |
|---|---|---|---|
| GRU 250 | 250 L | 80mmX1.5m | 1.5X2 |
| GRU 500 | 500 L | 100mmX2m | 1.5X2 |
| GRU 1000 | 1000 L | 100mmX2m | 2.5X2 |
| GRU 2000 | 2000 L | 150mmX3m | 2.5X3 |
| GRU 3000 | 3000 L | 150mmX2m | 4.0X2 |

## GAS SCRUBBER



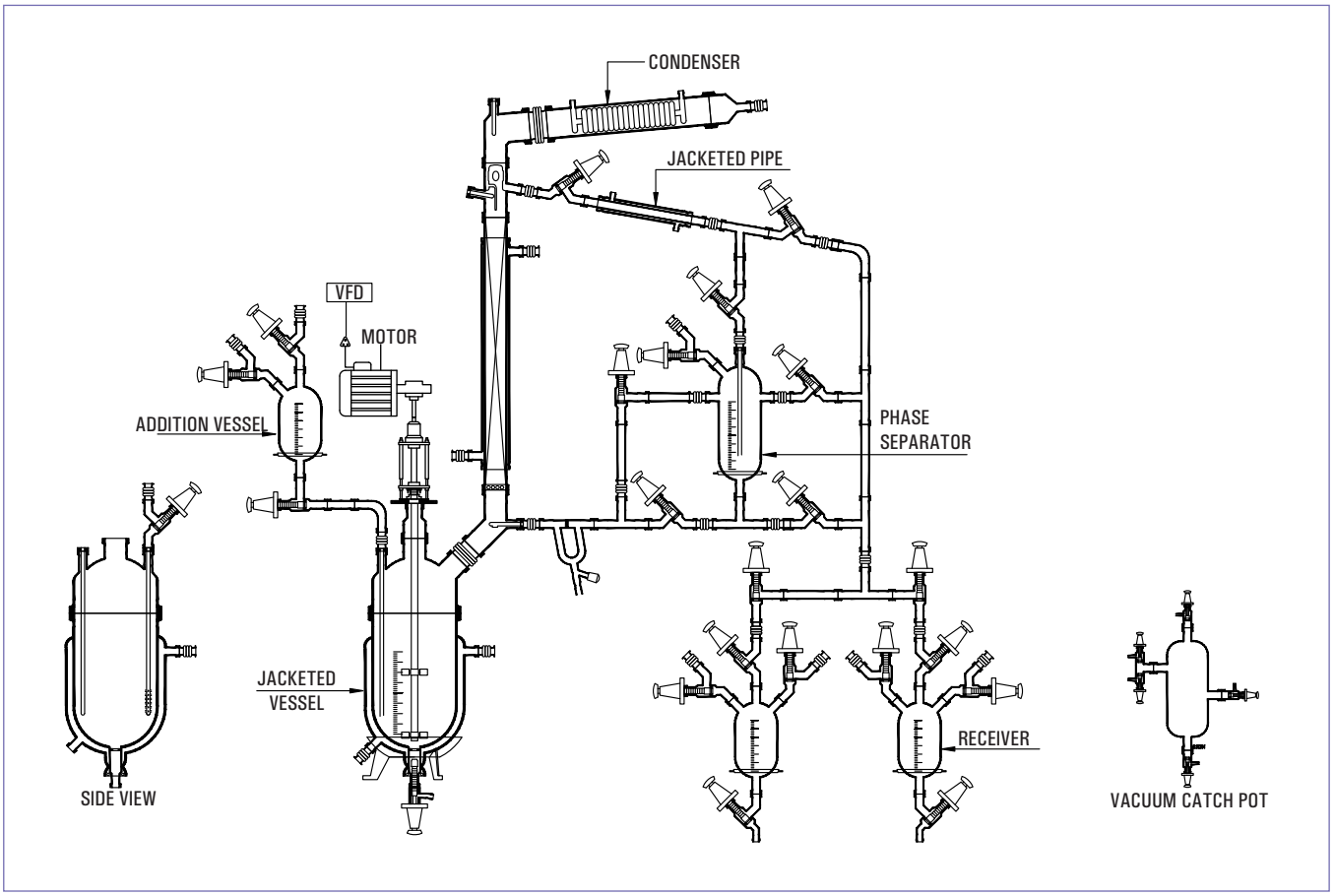

Goel offer Pilot Plant Gas Scrubber for various gases likes HCl, Cl2, SO2, Br2, HBr, NOx etc or any other corrosive gases. These scrubbers use the media as water / Aq. NaOH / any other suitable solvent which can neutralise the exhaust gases. Our Pilot plant scrubber are ranging from 20L vessel capacity to 500L vessel capacity and scrubber diameter from 80DN to 300DN.

We can also design and offer big size scrubber in Glass up to 800DN (i.e. 400/450/600/800DN). Our scrubber will be having inbuilt Cooler to remove the heat of absorption. We also offer mini Blower of PP/FRP on request along with the Pilot Plant Scrubber.

Pilot Plant Gas scrubber are mainly used in pharmaceutical, chemical, refinery & other industries. Glass scrubber offer process visibility as well as excellent corrosion resistance. Being a Glass Scrubber pressure drop across the scrubber will be minimized.

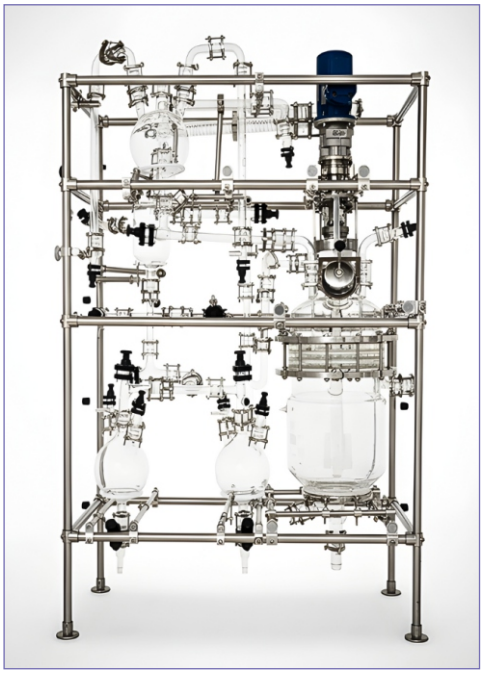
| Cat.Ref. | Size | Vessel | Condenser ($M^2$) |
|---|---|---|---|
| PGS3 | 80DN | 20 L | 0.5 |
| PGS4 | 100DN | 50 L | 1.5 |
| PGS6 | 150DN | 100 L | 2.5 |
| PGS8 | 200DN | 200 L | 5 |
| PGS12 | 300DN | 300 L | 8 |

# MULTI PURPOSE UNIT




G Goel Offer multipurpose pilot plant for chemical and pharmaceutical industries for process development, scale-up, process simulation and kilo-scale cGMP production in batch and semi-batch operation. The pilot plant used for chemical processing includes solid charging, liquid charging, reaction, heating / cooling, rectification, auto / manual reflux arrangement, layer separation, product cooler, vacuum catch pot, vacuum header etc.

G The multipurpose pilot plant designed in such a way that we can modify the same easily as per process requirement.

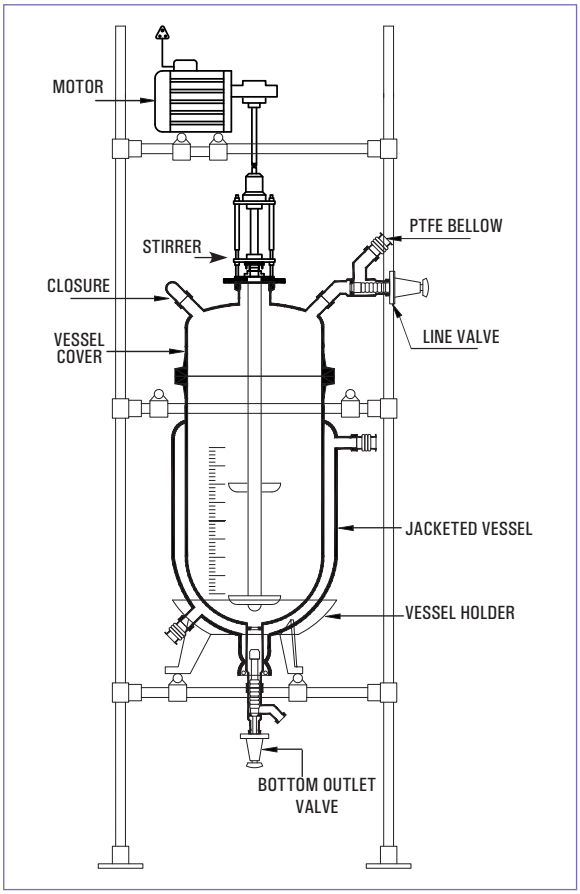


## Available with

G Jacketed full glass reactor/ Cylindrical full glass reactor with Oil heating cooling bath / Spherical full glass reactor with Oil heating cooling bath
G Multipurpose glass distillation overhead
G Stainless steel / MS epoxy coated / MS painted frame supporting
G Flame proof / Non flame proof / cGMP / non GMP models available
G Excellent corrosion resistant.
G Temp. Controller.
G Gas purging, solid charging / multi liquid addition.
G Vacuum / exhaust piping
G Additional feeders / receivers
G Solid feeding

| Unit Cat. Ref. | Reaction Capacity | Bath KW | Addition Vessel | Vapour Line | Condenser HTA ($M^2$) | Cooler HTA ($M^2$) | Receiver Size |
|---|---|---|---|---|---|---|---|
| MPU 20 | 20 L | 4.0 | 2 L | 80 DN | 0.35 | 0.10 | 2L, 5L |
| MPU 50 | 50 L | 6.0 | 5 L | 100 DN | 0.50 | 0.20 | 5L, 10L |
| MPU 100 | 100 L | 9.0 | 10 L | 150 DN | 1.50 | 0.35 | 10L, 20L |
| MPU 200 | 200 L | 12.0 | 20 L | 150 DN | 1.50 | 0.35 | 10L, 20L |
| MPU 300 | 300 L | 18.0 | 20 L | 225 DN | 2.50 | 0.50 | 20L, 20L |
| MPU 500 | 500 L | 24.0 | 50 L | 300 DN | 4.00 | 0.70 | 50L, 50L |

# MOBILE'MIXING SYSTEM




## Jacketed Mixing Reactor

The systems are available with different options, depending upon their size & their utility. Our Technical Department will glad to assist you in finding a suitable solution for your process requirement.

1. Stirrer Drive: Non-Flameproof or Flameproof Motor, 192 RPM with speed regulator.
2. Stirrer material of construction: Glass or PTFE Lined.
3. Stirrer shape: Glass Impeller Stirrer with PTFE Blades, Vortex Stirrer, propeller stirrer & anchor stirrer.
4. Stirring Assembly: Stirring Assembly with bellow seal or with mechanical seal.
5. Supporting Structure : Carbon Steel, Epoxy coated Carbon Steel, Stainless Steel 304 & Stainless Steel 316. All structure are available in Trolley mounted form.
6. Closing Valve: Drain Valve or Flush Bottom Outlet Valve.

| Cat.Ref. | Vessel Ref. | Nominal Cap.(l) |
|---|---|---|
| JGR 5 | VZD 5/6 | 5 |
| JGR 10 | VZD 10/9 | 10 |
| JGR 20 | VZD 20/12 | 20 |
| JGR 30 | VZD 30/12 | 30 |
| JGR 50 | VZD 50/16 | 50 |

# ESSENTIAL OIL DISTILLERS

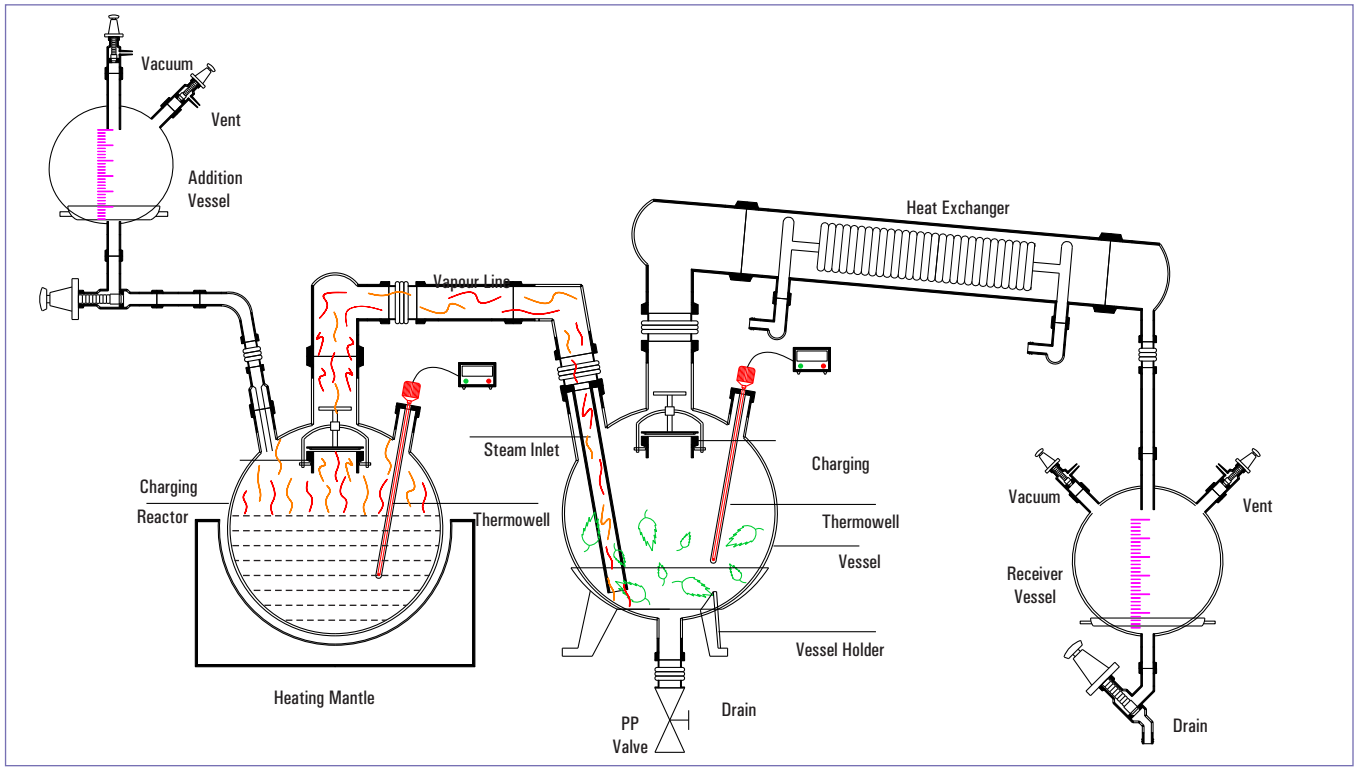
An essential oil is a concentrated hydrophobic liquid containing volatile (easily evaporated at normal temperatures) chemical compounds from plants. Essential oils are also known as volatile oils, ethereal oils, aetherolea, or simply as the oil of the plant from which they were extracted.

Essential oils are generally extracted by distillation, often by using steam. We provide two modes through which one can produce essential oils viz. Steam Distillation Unit & Vacuum Distillation Unit.

## 1. Steam Distillation Unit

The units are available in vessel sizes of 10, 20, 50, 100 & 200 L and is suitable for operation under atmospheric pressure and full vacuum.

Steam distillation as a whole is a separation process which consists of distilling water together with other volatile and non-volatile components. The water is heated up in the spherical vessel separately and the steam from the boiling water goes into the reactor where it reacts with the masses of trees and plants and further carries the vapor of the volatiles to a condenser, where both are cooled and return to the liquid or solid state; while the non-volatile residues remain behind in the reactor.




| Unit Cat.Ref. | Reactor Capacity | Mantle KW | Addition Vessel | Condenser HTA ($M^2$) | Receiver Vessel |
|---|---|---|---|---|---|
| EOSD 10 | 10 L | 1 | 5 L | 0.35 | 5 L |
| EOSD 20 | 20 L | 1.8 | 5 L | 0.50 | 5 L |
| EOSD 50 | 50 L | 3.6 | 20 L | 1.50 | 20 L |
| EOSD 100 | 100 L | 5.4 | 20 L | 1.50 | 20 L |
| EOSD 200 | 200 L | 8.1 | 50 L | 2.25 | 50 L |

## 2. Vacuum Distillation Unit

Vacuum distillation is a distillation performed under reduced pressure, which allows the purification of compounds not readily distilled at ambient pressures or simply to save time or energy. This technique separates compounds based on differences in boiling points. This technique is used when the boiling point of the desired compound is difficult to achieve or will cause the compound to decompose. A reduced pressure decreases the boiling point of compounds. The steam from the boiling water carries the vapor of the volatiles to a condenser, where both are cooled and return to the liquid or solid state; while the non-volatile residues remain behind in the boiling container.

| Unit Cat.Ref. | Reactor Capacity | Mantle KW | Addition Vessel | Condenser HTA ($M^2$) | Receiver Vessel |
|---|---|---|---|---|---|
| EOVD 10 | 10 L | 1 | 5 L | 0.35 | 5 L |
| EOVD 20 | 20 L | 1.8 | 5 L | 0.50 | 5 L |
| EOVD 50 | 50 L | 3.6 | 20 L | 1.50 | 20 L |
| EOVD 100 | 100 L | 5.4 | 20 L | 1.50 | 20 L |
| EOVD 200 | 200 L | 8.1 | 50 L | 2.25 | 50 L |

# AGITATED GLASS NUTSCHE FILTER/ PEPTIDE SYNTHESIZER

Agitated Glass Nutsche Filter is a closed vessel designed to separate solid and liquid by filtration under vacuum. The closed system ensures odourless contamination free and non-polluting working conditions maintaining product purity and hygiene. Agitated Nutsche Filters are extensively used in Herbal products, Chemical product development, kilo lab operation,pharmaceutical manufacturing, agro chemical and the food industry.

## GENERAL DESCRIPTION

A typical unit consists of a dish shape vessel vessel with a perforated plate. The entire vessel can be kept at the desired temperature by using a mixer / agitator and jacket.It's completely leak-proof for vacuum or pressure service. The base plate is having arrangement of bolting bar to hold the filter cloth. Suitable nozzles can be provided including Manhole and Side discharge nozzle. PTFE Lined Stirrersare used for Agitator shaft and solid PTFE blades are used to take high torque generation during solid discharge and re-slurring operation.Drive assembly consist of Motor with VFD, Mechanical Seal is provided for vacuum application. Borosilicate Glass Vessel with different nozzles, Manual/Hydraulic system is provided for movement of agitator as well as bottom plate. PTFE Filter Support Plate.

## PROCESS STEPS OF AGITATED NUTSCHE FILTER WITH AGITATOR :

1) Filtration.
2) Washing of Filter cake.
3) Repeat mix or washing of the cake.
4) Convection drying of the cake.
5) Smoothing with compression of the cake
6) Discharge of the wet or dried cake.

## ADVANTAGES OF GLASS NUTSCHE FILTER

- Vacuum filtration possible.
- Glass being transparent, offers visibility of processes.
- Inert gas atmosphere can be maintained.
- Minimal contamination of the cake.
- Very high solvent recovery.
- Solvents are closed systems, so no toxic vapors are let off in the atmosphere.
- Personal safety is maintained, and heat transfer surfaces can be provided to maintain filtration temperature.

Goel offer Glass ANF from 2 L to 300 L for Kilo Lab Operations with and without jacket , with and without stirrer.

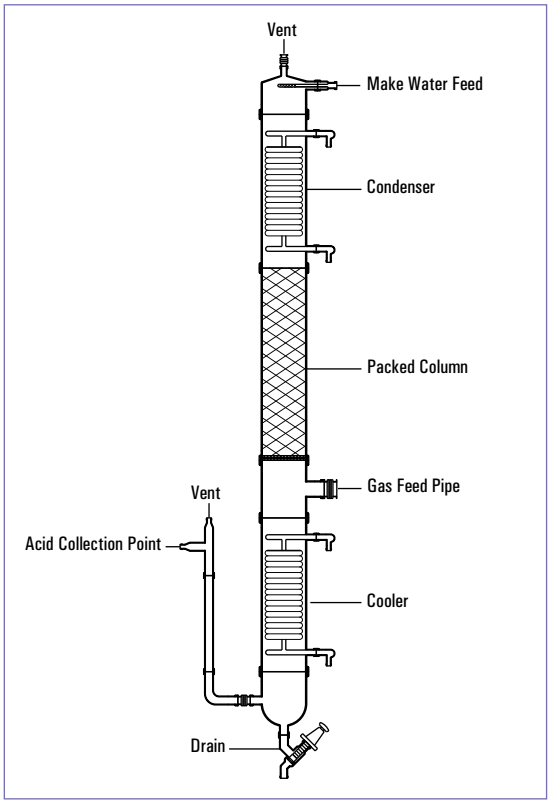
| Cat. Ref. | Working Vol (ltr) | Filter area (m2) | Vessel Dia | Vessel height | Moter Capacity HP |
|---|---|---|---|---|---|
| ANFD10 | 10 | 0.03 | 225 | 300 | 0.25/0.5 |
| ANFD20 | 20 | 0.06 | 360 | 325 | 0.5 |
| ANFD50 | 50 | 0.12 | 400 | 450 | 0.5 |
| ANFD100 | 100 | 0.16 | 450 | 700 | 0.5 |
| ANFD200 | 200 | 0.31 | 600 | 775 | 1 |
| ANFD300 | 300 | 0.31 | 600 | 1150 | 1 |

# HCL ADIABATIC ABSORPTION

HCl absorption columns are used for absorption of Hydrochloric gas, which statutorily are not permitted to vent in to the atmosphere, and to produce the HCl acid. The column is constructed with a series of packed sections, a gas introduction point below that, a condenser on the top, and a cooler at the bottom. Make water is sprayed from the top and acid is collected from the bottom.

HCl absorption column are available in 80DN to 300DN diameter (for the gas rate 10Kgs/hr to 300Kg/hr approx..)

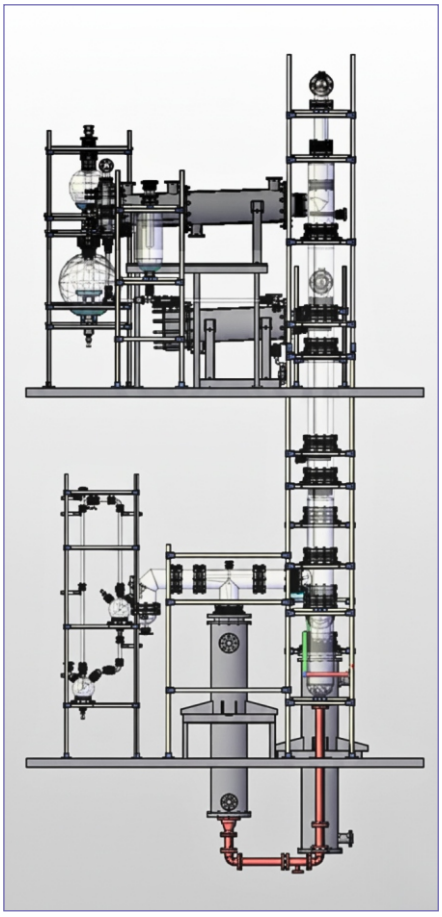
| Unit Cat. Ref. | Packed Column | Condenser HTA $M^2$ | HCl Gas Rate |
|---|---|---|---|
| HCL3 | 80mm x 3mtr. | 0.35 x 2 | 10 Kg / Hr. |
| HCL4 | 100mm x 4mtr. | 0.5 x 2 | 20 Kg / Hr. |
| HCL6 | 150mm x 4mtr. | 1.5 x 2 | 60 Kg / Hr. |
| HCL9 | 225mm x 4.5mtr. | 2.5 x 2 | 150 Kg / Hr. |
| HCL12 | 300mm x 4.5mtr. | 4.0 x 2 | 300 Kg / Hr |



# ANHYDROUS HCL GAS GENERATION UNIT

## Anhydrous HCl Gas Generation Unit!

- Are You Using Dry HCL Gas?
- Are You Using Dry HCL Gas Cylinders For the Same?
- Do You have an effluent problem in your existing dry HCL Gas Generator System?
- We have an efficient solution in which we can provide a dry HCL gas generator system to counter the above problem



## TECHNOLOGY

**Calcium Chloride Route:**
Uses calcium chloride for effective water removal and generation of dry, anhydrous HCl gas.

**Capacity :** 20Kg/Hr to 200Kg/Hr

**Unique Features:**

- Customizable to Varied Production Capacities
- User-friendly interface with Advanced Control Systems
- Compact & Robust Design ensuring Longevity
- Leak Proof System
- User Friendly & Environment Friendly
- Integrated Safety Measures
- High Conversion & Recovery Rates

**Ideal For:**

- API & Bulk Drug Pharma Companies
- Agro Chemical Manufacturers
- R&D

**Why Choose Goel Scientific's Anhydrous HCl Gas Generation Unit?**

Opt for unrivaled quality and innovative solutions with our Anhydrous HCl Gas Generation Unit. Whether you aim for purity, controlled generation, scalability, or sustainability, we promise to meet and exceed your expectations, propelling your operations to new heights of efficiency and productivity!

## HIGH PRESSURE GLASS REACTOR

Operating temperature -90 °C to +200 °C

ΔT - Thermal shock resistance 60 °C (double wall)

Pressure Upto 10 Bar

controlled and accelerated reactions

A high-pressure glass reactor is a specialized vessel designed for chemical reactions under elevated pressure, achieved by the reaction itself or externally supplied sources like hydrogen. Operating at temperatures above solvent boiling points, these reactors impact reaction dynamics by increasing concentration and collision frequency among molecules, accelerating reactions.

**Versatile Uses**

Widely used in industries requiring precise control over reactions, such as organic synthesis and pharmaceutical development, these reactors enable controlled and accelerated reactions for specific chemical compounds. Their controlled environment facilitates efficient exploration and optimization of various chemical reactions.

**Catalysis**

High pressure primarily accelerates reactions, suppressing competing reactions and maintaining cleaner reaction profiles. While temperature can speed up reactions, it may risk product decomposition. These reactors expedite reactions while preserving specificity and purity.

# HIGH PRESSURE GLASS REACTOR

## Why Choose Goel – A Borosil Pressure Reactor?

When considering a pressure reactor for your specific industrial or laboratory needs, the Goel- A Borosil Company Pressure Reactor stands out as a superior choice. Meticulously designed by industry experts, this reactor is engineered to offer users exceptional control over pressure, high performance, and utmost safety. Goel - A Borosil Company leverages its extensive expertise in scientific glass fabrication and its proficiency in catering to diverse chemical processing ndustries to create a state-of-the-art system with several distinct advantages:

### 1. Pressure Control:

The Goel-Borosil Scientific Limited Pressure Reactor provides an operating pressure capability of up to 10 barG Ranges with different size capacity. This range allows for precise pressure control, catering to a wide array of processes that require varying pressure conditions.

### 2. Removable Flush Valve:

Equipped with a flush valve featuring a removable glass shaft, the reactor offers ease of maintenance and cleaning. This design element allows for convenient cleaning procedures and ensures smooth operation.

### 3.Safety Assurance:

The reactor prioritizes safety by incorporating a protective cage and undergoing individual pressure testing to ensure optimum safety standards. These safety measures are integrated to safeguard both the user and the integrity of the processes carried out within the system.

### 4.Visual Monitoring:

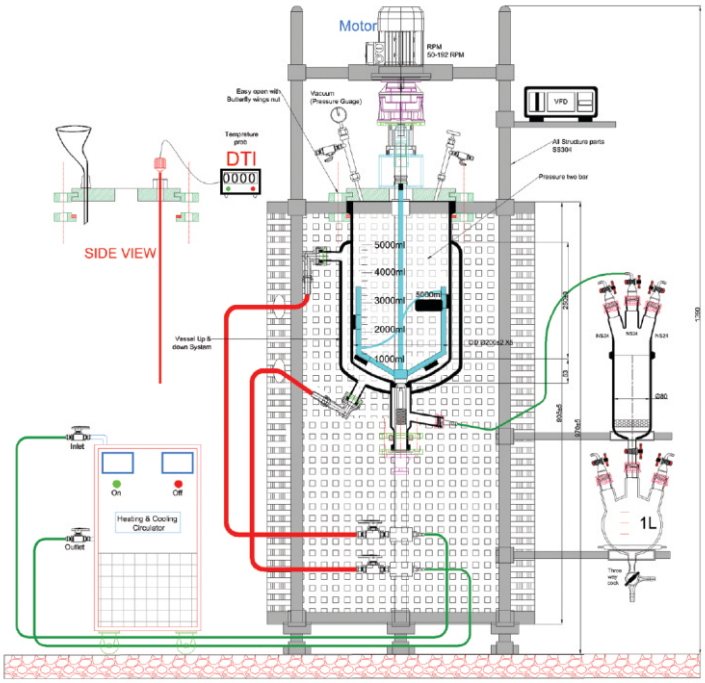
An all glass body construction An all glass body construction enables real-time visual monitoring of the ongoing processes. This transparency allows users to observe and analyze reactions as they progress, ensuring a comprehensive understanding of the processes taking place inside the reactor.

### 5.Wide Temperature Range:

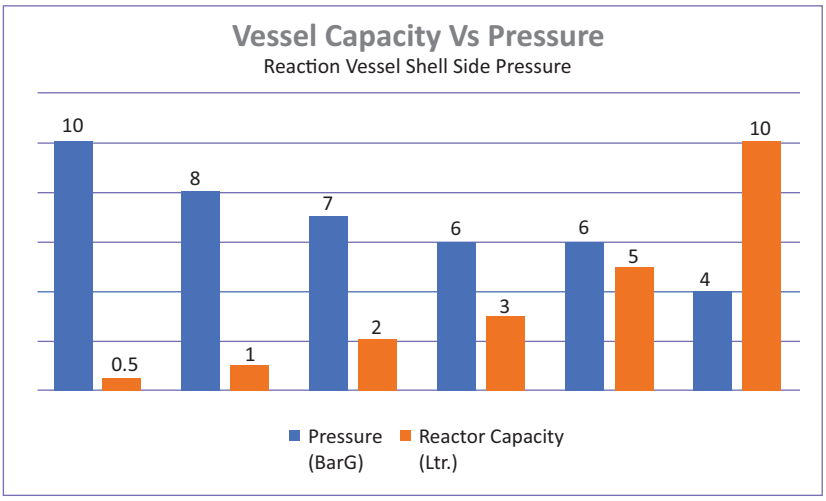
The Goel -A Borosil Company Pressure Reactor offers a wide process temperature range, from -90 °C to +200 °C (with the option to reach up to 300 °C). This expansive range of temperatures enhances the reactor's versatility, enabling it to accommodate a variety of processes requiring specific temperature conditions.

### 6.Efficient Stirring and Mixing:

Equipped with a high-speed motor capable of reaching up to 1000 revolutions per minute, the reactor ensures efficient stirring and thorough mixing of substances. This feature is particularly beneficial for handling products with a wide range of viscosities, ensuring excellent heat transfer within the system.




Operating Jacket Pressure
Up to +0.5 barG (0.05 MPa)
***Automation on Request**

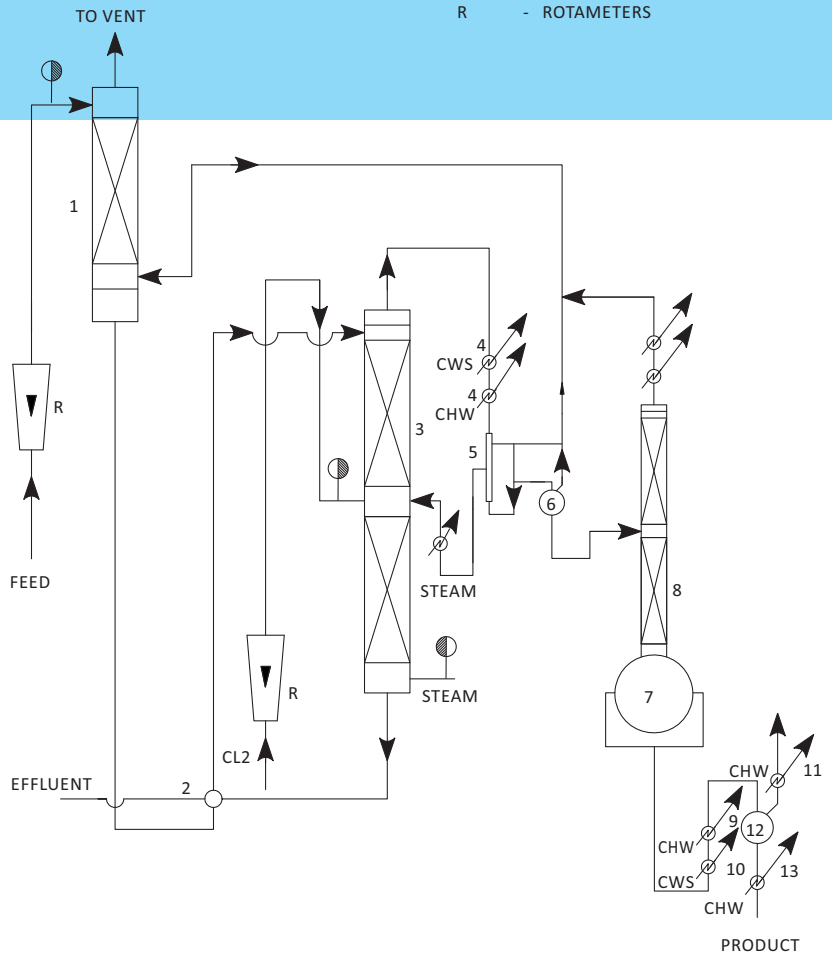



### 7. Chemical Resistance:

Crafted from corrosion-resistant materials such as SS316, the reactor ensures durability and resilience against chemical corrosion. This feature ensures longevity and reliability, even in the presence of corrosive substances.

# TECHNICAL PACKAGES

CWS - COOLING WATER SUPPLY
CWR - COOLING WATER RETURN
CHW - CHILLED WATER
R - ROTAMETERS




**We form a combination of Chemical Engineers in the field of Process engineering and its application in the glass equipments/process packages.**

## DESIGN AND SUPPLY OF VARIOUS UNITS as per client's requirement are as under:

1. Absorption systems for gases such as HCl, Cl2, SO2, HBr. Nh3, Br2, NOx etc.
2. Anhydrous HCl Gas Generation Unit by different routes viz.
   - Sulphuric Acid Route - Boiling Route
   - Calcium Chloride Route - Cyclic Route
3. HBr Gas Generator (By Boiling Route)
4. Sulphuric Acid Dilution Units.
5. Hypochlorite Manufacturing Units
6. MCA Condensation Assembly
7. Distillation - Conversion of Batch Process to Continuous Process.
8. Solvent Recovery
9. Iodine Recovery
10. Raw DCB Plant.

## KNOW-HOW WITH PLANT

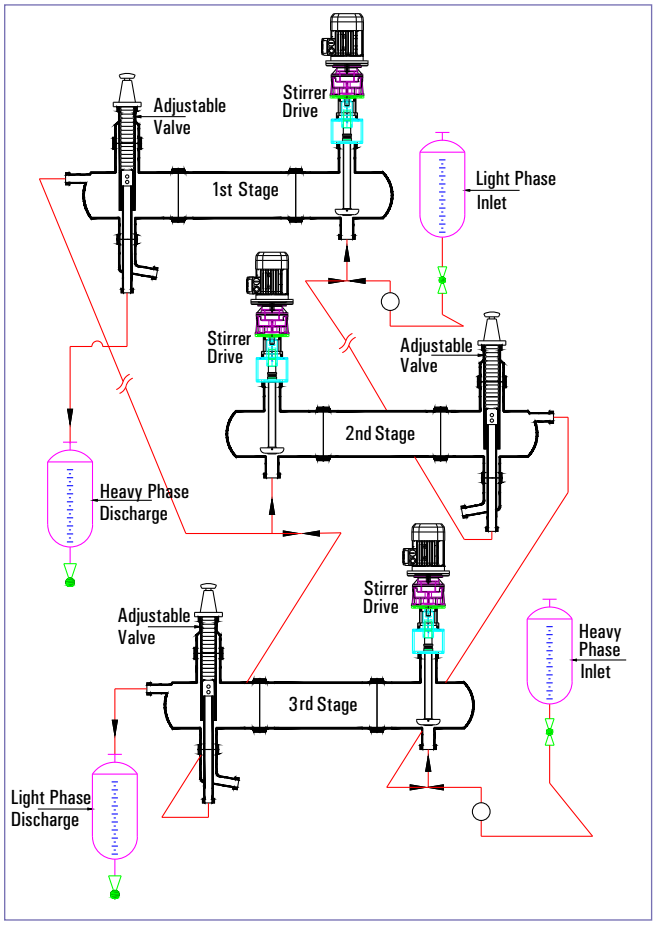
for the following products :

1. Bromine recovery from industrial waste / salt bittern.
2. Nitric Acid Concentration
3. Sodium Hypochlorite

## TROUBLE SHOOTING

in above units as well as client's existing plant.

# GOEL® GLASS MIXER-SETTLER




The **Goel® Mixer-Settler** is an innovative device that simplifies and automates phase separation, regardless of the concentration of the two phases or the interface height. It is a type of extractor that alternates between mixing and settling chambers arranged in series. In the mixing chambers, efficient mass transfer is achieved through thorough mixing of the two phases using pumps and stirrers. The basic configuration of the Goel® Mixer-Settler includes an adjustable overflow valve, a stirrer drive assembly, and a settling zone.

**Applications**

The Goel® Mixer-Settler has versatile applications in the process industry, particularly in:

- G Azeotropic Distillation
- G Extractive Distillation
- G Steam Distillation
- G Esterification Distillation

## Key Features

**Stirrer Drive Assembly**

The mixing chamber features a cylindrical borosilicate glass cover with a variable-speed stirrer drive. A glass impeller stirrer creates negative pressure at the inlet, allowing liquid to be drawn from a preceding stage in the process. In the mixing zone, a turbine stirrer with a variable-speed unit ensures thorough mixing of the two phases, facilitating effective mass transfer during dispersion.

**Separation Zone**

The separation of phases occurs in two steps:

1. The turbulent flow in the mixing zone is controlled and transformed into axial flow.
2. The mixture passes into the separation zone, where the two phases separate based on their specific gravity differences.

**Auto Continuous Separation**

An adjustable overflow valve assembly at one end of the vessel allows precise setting of the interface height. The position of the overflow weir can be externally adjusted using a handwheel to match the relative densities of the two phases. This ensures continuous and efficient phase separation, with the flexibility to reset the interface height based on process conditions.

**Visual Monitoring**

The transparency of borosilicate glass enables real-time visual monitoring of the separation process. Any changes in process conditions that alter the interface height can be quickly corrected by adjusting the overflow valve. This adjustment is easily achieved by rotating the handwheel clockwise or counterclockwise.

**Large Interface Plane Area**

The horizontal design of the glass vessel provides a large interface area for separating immiscible liquid phases within a given volume. This maximizes the efficiency of the separation process.

## System Overview

The Goel® Mixer-Settler system includes the following components:

- G Adjustable overflow valve
- G Stirrer drive assembly
- G Settling zone

This highly efficient and user-friendly system by **Goel®** is ideal for various distillation and separation applications in the process industry, ensuring precision and reliability.

**Overview**

Settlers and mixer-settlers are traditional extraction apparatus used for liquid-liquid extractions.

The three sections of the **Goel® Mixer-Settler** perform the following extraction tasks:

1. Intensive mixing of the two liquid phases in the mixing section.
2. Separation of the light and heavy phases in the settling section.
3. The heavy aqueous phase and the light organic phase drain through the phase weir, which is connected to further process steps or storage vessels.
4. The phase interface is adjustable through an overflow valve, providing hydrodynamic control.

## Main Characteristics of Goel® Mixer-Settlers

**Goel® Mixer-Settlers** are corrosion-resistant as all product parts are made exclusively from **PTFE** or **Borosilicate glass**.

For various applications, a tempering jacket for heating or cooling can be integrated. The unique design of **Goel®** units minimizes the need for reference products.

The agitator system, equipped with a turbine stirrer, is used for dispersion, featuring an adjustable gap to optimize suction efficiency. This is especially useful for larger mixer-settler systems.

These units are designed with a compact mixing chamber to ensure efficient and homogeneous dispersion, and they include a height-adjustable overflow valve for precise operation.

The **Goel® Mixer-Settlers** are available in sizes ranging from **DN 50** to **DN 600**.

The **Goel® Vertical Settler** is available in laboratory scale sizes from **0.5 L to 10 L**, designed for small hold-up volumes, particularly suitable for distillation and rectification tops with low distillate mass flow. The vertical settler features phase level adjustment for the two liquid phases via a siphon, with the option to reverse phase operation by rotating the apparatus.

## Corrosion-Resistant Materials

All Goel® Settlers and Mixer-Settlers are constructed from borosilicate glass 3.3 and glass-lined materials for superior corrosion resistance.

Our engineers and technicians work closely with you to troubleshoot your existing process design and implement process upgrades, ensuring optimal performance and efficiency.

# WIPING FILM EVAPORATOR

**Introduction**

Heat sensitive products like vitamins, hormones, enzymes or aromatic substances get adversely affected by way of material degradation due to higher temperature and residence time. This can be avoided if the reactions are carried under vacuum which allows the working temperature to be lowered, and by forming a thin film to reduce residence time, especially in case of liquids of high viscosity, or low thermal conductivity.

For these, GOEL introduces a specially designed range of Evaporators made of Borosilicate Glass. The range varies from laboratory size (80DN) to production plants (300DN).

**Construction**

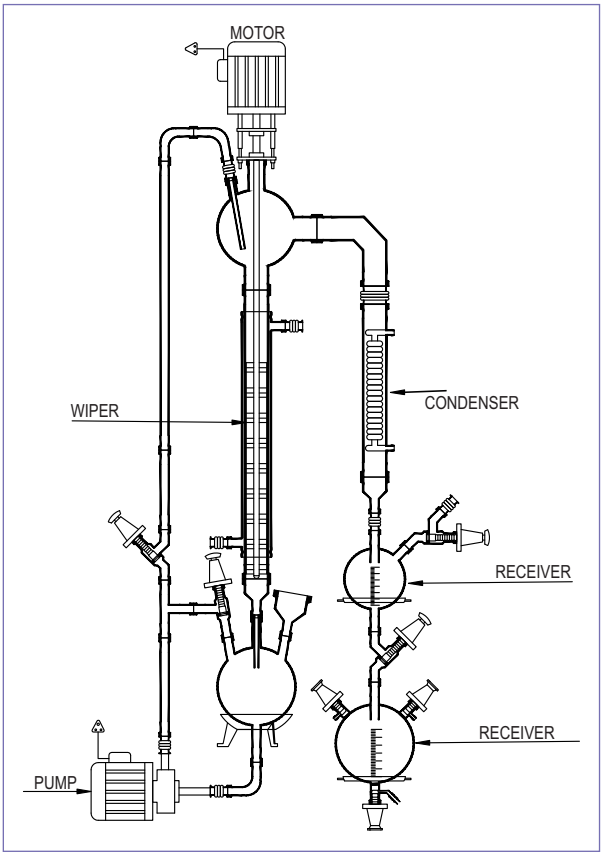
The core of the unit is a rotating, fully corrosion resistant wiper system. This has four rows of PTFE wipers. These rows of wipers are divided into vertical segments and each wiper is mounted between two glass rods.

A liquid distributor is located above the wipers. It distributes the medium, fed in through the feed pipe uniformly around the circumference of the evaporator before the medium is finally picked up by the wiper system itself.

The Evaporator has a vapour outlet which can be connected to a descending coil condenser and a receiver.

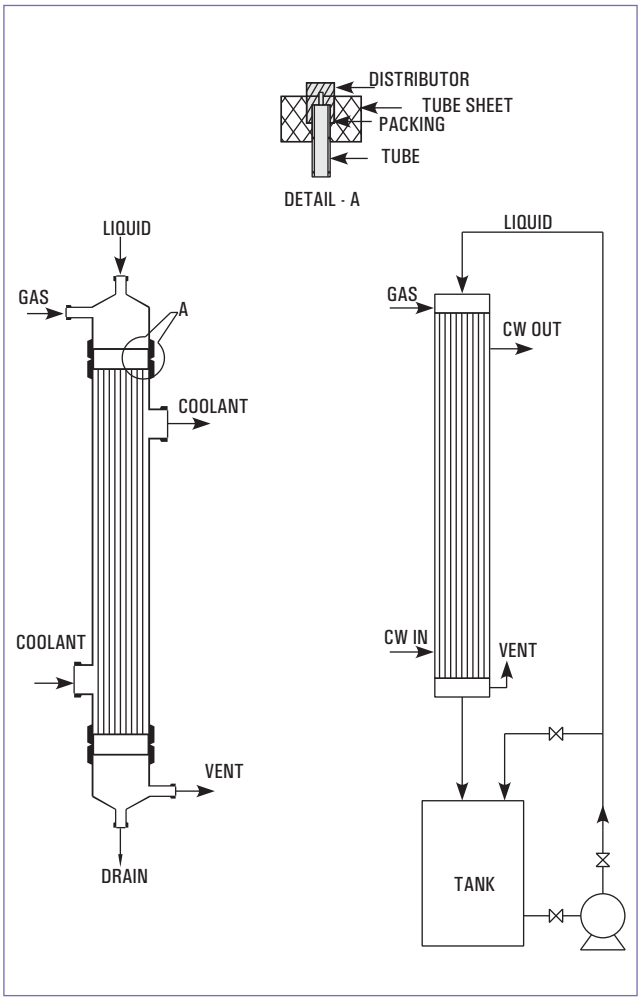
The drive used for the wiper system is a standard geared-motor with an AC speed regulator. The wiper shaft is sealed by means of a mechanical seal. The evaporator body is constructed as a jacketed pipe. For heating, thermic fluid upto 150 C can be circulated in the jacket.

The unit is designated by the jacketed pipe size. And the capacity of the unit depends on the evaporation rate which in turn depends on the HTA available, the type of heating media, and the evaporation environment i.e. vacuum conditions.




| Model | Size DN (mm) | HTA ($M^2$) |
|---|---|---|
| WFE3 | 80 | 0.35 |
| WFE4 | 100 | 0.47 |
| WFE6 | 150 | 0.70 |
| WFE9 | 225 | 1.06 |
| WFE12 | 300 | 1.41 |

# FALLING FILM ABSORBER




Efficient gas absorption depends on the following :

**1. Intimate contact. 2. Efficient Heat Transfer.**

This is achieved in a Falling Film Absorber which is essentially a shell & tube heat exchanger in which both gas to be absorbed and absorbing liquid flow co-currently downward with extraction of heat by circulation of coolant in the shell. The absorbing liquid is circulated through a tank till desired concentration is achieved. The liquid flows at such a rate that the tubes do not flow full of the liquid but instead, descends by gravity along the inner walls of the tubes as a thin film. Obviously, this produces a much greater linear velocity for a given rate flow than could be obtained if the tube flowed full.

The equipment works as a number of water cooled wetted-wall columns in parallel and each tube is provided with distribution system on top to effect uniform distribution of both liquid and gas and also formation of a thin liquid film on the inner surface of the tube.

## SALIENT FEATURES

1. The heat of absorption is continuously removed. This ensures better absorption and product concentration as compared with conventional packed tower.
2. Low residence time and operating temperature ideally suited to heat sensitive materials.
3. Borosilicate glass and PTFE contact parts ensure corrosion/ contamination free operation.
4. Both standard and custom built units are available.
5. Capable of operating from zero to maximum gas flow rate.
6. Ease of installation due to light weight.
7. Trouble free and consistent performance with minimal attention.
8. Wide application e.g. HCl, HBr, $NH_3$, $SO_2$, $H_2S$, $Br_2$ etc.
9. Less cost.
10. Negligible pressure drop compared to conventional columns.
11. Compact design Sleek and slender.
12. Both heat and mass transfer operations are incorporated in a single equipment.
13. Very high heat transfer coefficient as the liquid falls instead of flowing.
14. Scaling of process fluid is minimal due to high velocity and ease of cleaning by simple acid circulation.
15. Hot conditions are eliminated at all stages namely pipe, tanks and pumps etc.

## LIMITATIONS

1. Not recommended for gases containing high proportion of inert (insoluble).
2. Not applicable if the gases are not highly soluble.

## SPECIFICATIONS

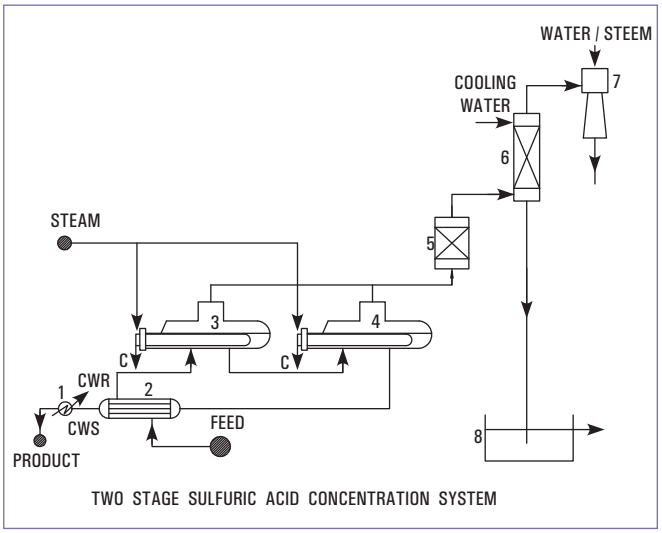
| Sr. No. | Nominal Size (mm) | Absorber Area (m2) | No.of Tubes/ Tube OD (mm) | Max.Gas Absorption Rate (Pure HCl) * (kg/hr) | Max.Acid Prod. Rate (As 30 % HCl) (kg/hr) * | Height (m) |
|---|---|---|---|---|---|---|
| 1. | 80 | 1.00 | 4/ 20 | 30 | 100 | 4400 |
| 2. | 100 | 1.76 | 7/ 20 | 60 | 200 | 4500 |
| 3. | 150 | 4.80 | 19/ 20 | 150 | 500 | 4600 |
| 4. | 225 | 7.80 | 31/ 20 | 250 | 833 | 4920 |
| 5. | 300 | 15.30 | 61/ 20 | 500 | 1667 | 5050 |
| 6. | 400 | 36.00 | 143/ 20 | 1175 | 3917 | 5300 |
| 7. | 450 | 47.00 | 187/ 20 | 1500 | 5000 | 5700 |
| 8. | 600 | 84.00 | 333/ 20 | 2700 | 9000 | 5800 |

# SULPHURIC ACID CONCENTRATION SYSTEM

Commercial sulfuric acid is a cheap commodity and in its dilute and impure form does not have good market potential.

Disposal by neutralization with lime is associated with, problems of solid (calcium sulfate) handling and also adds to the cost.

To overcome these problems GOEL offers know-how, design engineering services of sulfuric acid concentration system in which the dilute sulfuric acid generated is reconcentrated to desired level for reuse. That is to say a twofold benefit of eliminating the disposal problem and minimizing fresh commercial acid requirement.



TWO STAGE SULFURIC ACID CONCENTRATION SYSTEM

## PROCESS DESCRIPTION

The process is extremely simple & involves concentration of dilute sulfuric add by evaporation using steam/thermic fluid as heating media under vacuum. The dilute feed is preheated & fed to a series of evaporators in stages to achieve the concentration level. The vapors from the evaporators are condensed and drained out through barometric legs and non-condensables are removed by an ejector. The final product is cooled and drawn in the storage tank.

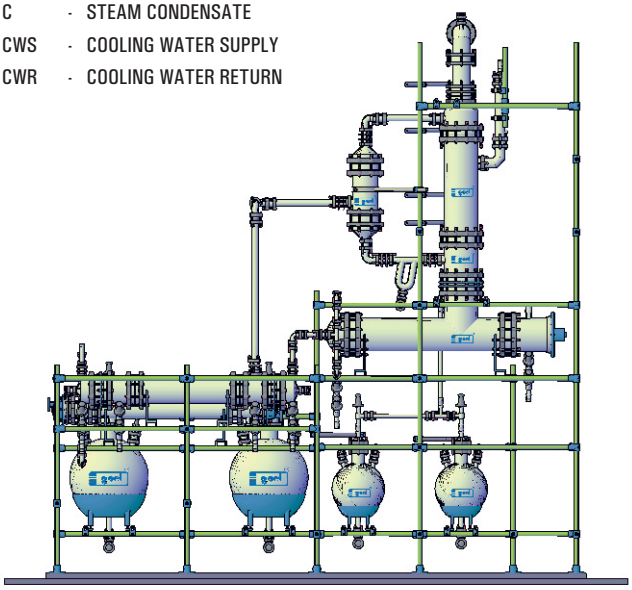
## REQUIREMENT OF UTILITIES

The requirement of utilities viz. steam/thermic fluid, cooling water and power vary widely depending on feed rate, feed concentration and product concentration. For example for a plant having 50TPD feed containing 50% H2S04 the consumption of utilities for achieving 70% concentration are given below.

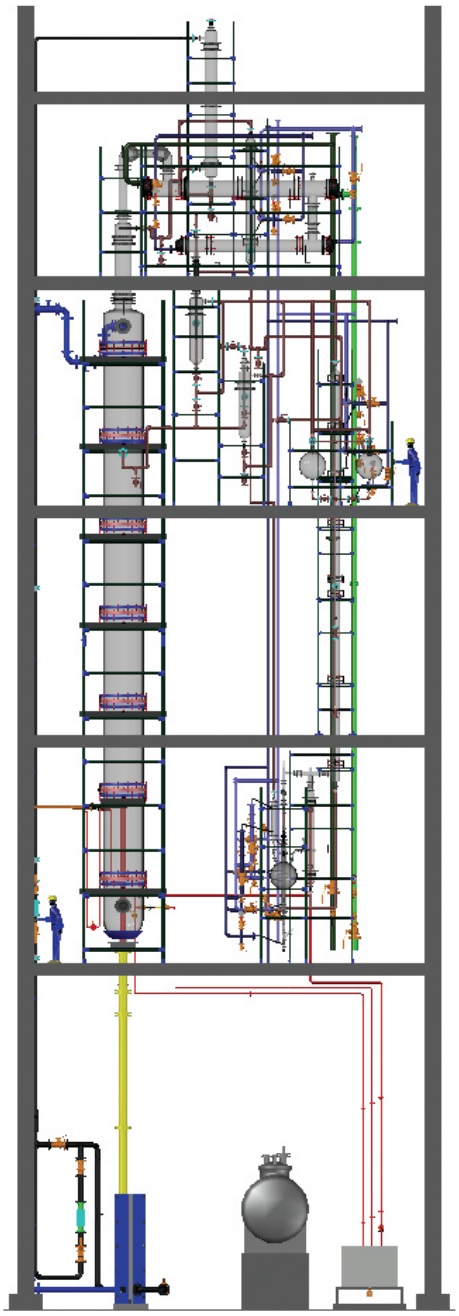
| | |
|---|---|
| 1. Steam@ 6 bar{g) pressure | 800 Kg/hr |
| 2. Cooling water @ 30 °C | 70 Cu M/hr |
| 3. Power | 15 KW |

**KEY**

| | | |
|---|---|---|
| 1 | - | PRODUCT COOLER |
| 2 | - | FEED PREHEATER |
| 3 | - | 1ST, STAGE EVAPORATOR |
| 4 | - | 2ND, STAGE EVAPORATOR |
| 5 | - | MIST ELIMINATOR |
| 6 | - | DIRECT COOLER |
| 7 | - | EJECTION |
| 8 | - | SEAL POT |
| C | - | STEAM CONDENSATE |
| CWS | - | COOLING WATER SUPPLY |
| CWR | - | COOLING WATER RETURN |



# BROMINE RECOVERY SYSTEM



Bromine is available in the sea bittern, as well as Industrial waste e.g. Aq. HBr / Aq. NaBr / Aq. KBr. The Bromine concentration in the feedstock varies from 2 gpl to 300 gpl from industry to industry.

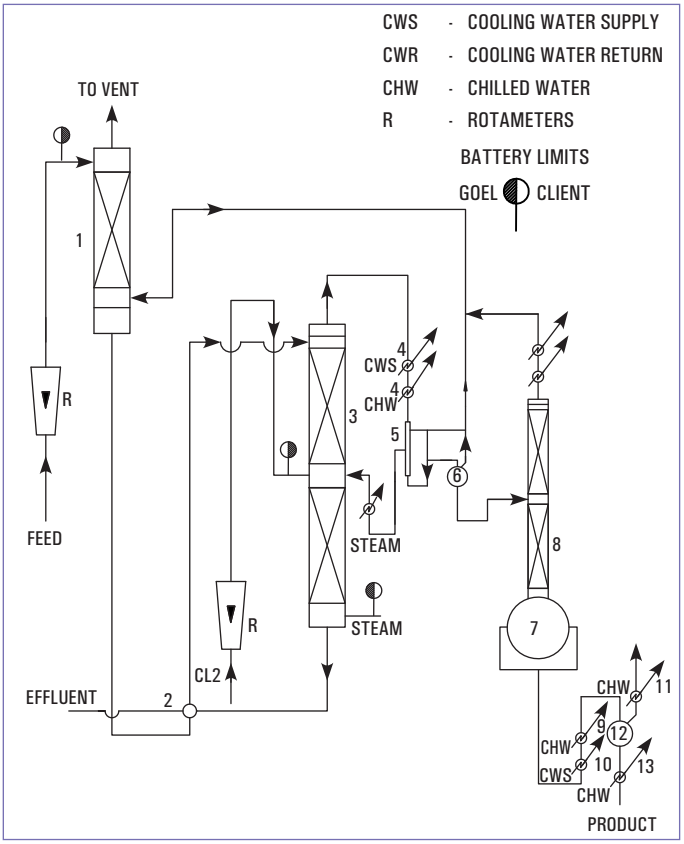
Goel Offer suitable bromine recovery plant for the various feedstock based on his 20 years expertise in this field. Goel suggest cold process for bromine concentration below 3 gpl and Hot process above 3 gpl.

The package considered is schematically shown in drawing enclosed herewith.

The process consists of simultaneous chlorination & steam blowing. The feed stock acidic in nature is preheated to near its boiling in feed pre heater and then fed to the main column where steam and chlorine are blown simultaneously. The bromine as set free by chlorine are steam distilled. The liberated bromine together with steam and some excess chlorine is condensed in the condenser. The condensate is taken to a gravity separator where bromine and bromine water are separated. While bromine is taken in the purification column the aq. layer is recycled into the main column. Crude bromine is purified under reflux and pure bromine is collected in the receiver. All uncondensed vapour pass through the tail scrubber to recover the last traces of bromine.

| SR. | DESCRIPTION |
|---|---|
| 1. | TAIL SCRUBBER |
| 2. | FEED PREHEATER |
| 3. | $Br_2$ STRIPPING COLUMN |
| 4. | $Br_2$ CONDENSERS |
| 5. | PHASE SEPERATOR |
| 6. | CRUDE $Br_2$ RECEIVING VESSEL |

| | |
|---|---|
| 7. | REBOILER |
| 8. | PURIFICATION COLUMN |
| 9. | PRODUCT COOLER |
| 10. | PRODUCT COOLER |
| 11. | VENT CONDENSER |
| 12. | PRODUCT RECEIVER VESSEL |
| 13. | PRODUCT COOLER |



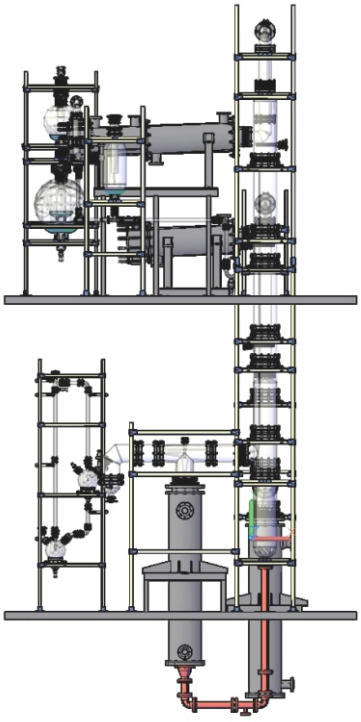
# ANHYDROUS HCL GAS GENERATOR

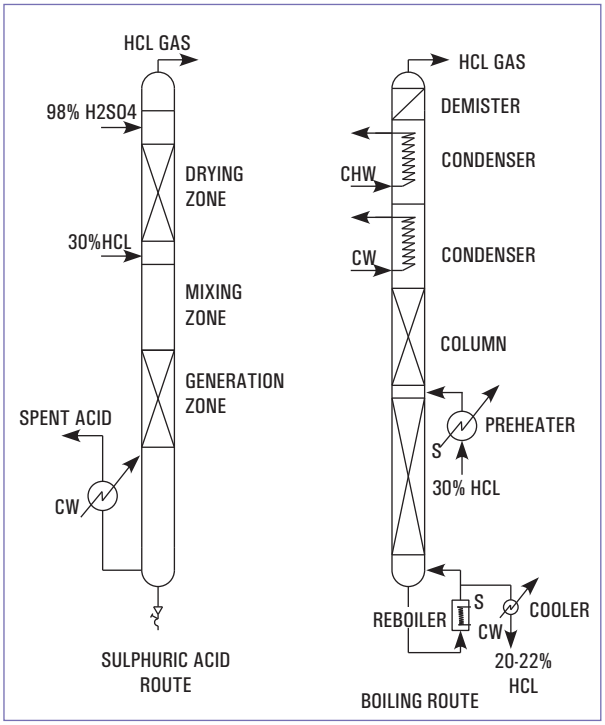
Commercial Hydrochloric Acid is available in the market as 30% aqueous solution. But for certain applications e.g. bulk drug and pharmaceuticals, HCl is required in anhydrous state for critical reactions where moisture cannot be tolerated. Such users generate anhydrous HCl from commercial grade for their captive consumption.

## METHOD

Several methods have been adopted by industries. But generation by Sulphuric Acid Route and Boiling Route are commonly practiced.

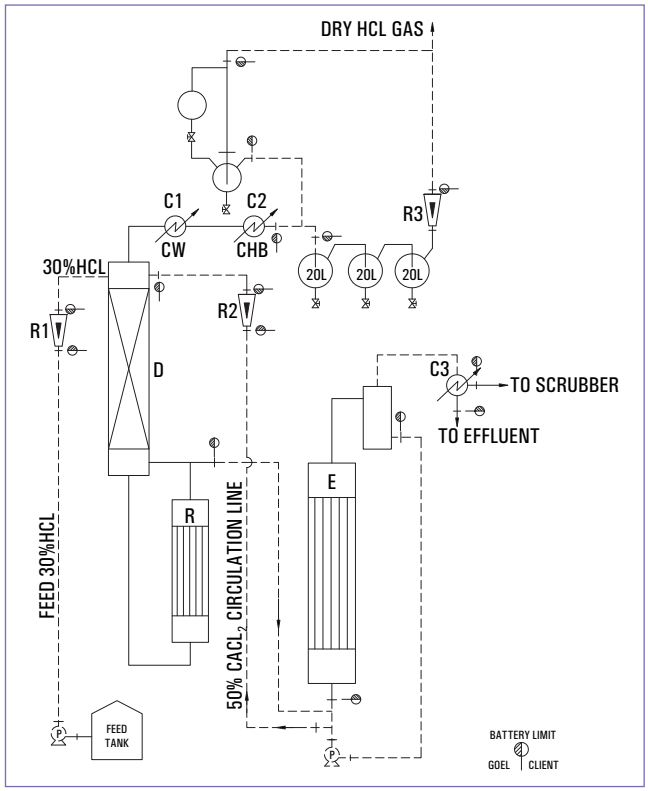
We offer Calcium Chloride Route also.






| Route | Sulphuric Acid Route | Boiling Route |
|---|---|---|
| Working Principle | Hydrochloric acid is highly soluble in water but the solubility diminishes in presence of H2SO4 and at 70 to 75% H2SO4 concentration its solubility is negligible. Thus by adding (98%) commercial Sulphuric acid to commercial hydrochloric acid (30%) in proper ratio the entire HCl can be liberated in gaseous form leaving 75% H2SO4 as spent acid. | Aqueous hydrochloric acid forms a maximum boiling point azeotrope at 110°C containing 20.24% HCl at atmospheric pressure. Thus by distilling commercial hydrochloric acid (30%) pure HCl gas can be generated and spent acid will contain over 20.24% HCl. |
| Process Outline | Metered quantities of commercial sulphuric acid hydrochloric acids are fed to the unit where they mix in the Mixing Zone. The gas generated forms a froth and enters the Generation Zone where while traveling through a bed gas is released which travels upwards through the Drying Zone. Here the gas comes in intimate contact with downward flow of 98% H2SO4. The dry gas leaving the unit passes through a rotameter. The spent liquor containing 70-75% H2SO4 passes through the Cooling Zone before being discharged. | Metered quantity of commercial hydrochloric acid is preheated in a preheater by steam and fed to a fractionating column with steam as heating media in the reboiler. The vapours leaving the column are condensed with coolant as cooling water and chilled brine in stages.The relatively dry gas passes through a mist eliminator and then through a rotameter. The spent acid containing 22% HCl is cooled through a cooler and then discharged. |
| Salient Features | - Operational reliability the unit can be started/ stopped in seconds.<br>- Available in wide range of capacities from 5 to 200 kg/hr of dry HCl.<br>- Except cooling water no other utility e.g. steam chilled water etc. required.<br>- Anhydrous gas.<br>- Capable of operating from 25 to 120%.<br>- Ease of installation.<br>- Negligible pressure drop.<br>- High efficiency 99%. | - Operational reliability.<br>- Available in wide range capacities from 5 kg/hr to 200 kg/hr of dry HCl.<br>- Except commercial hydrochloric acid, no other raw-material is required.<br>- Anhydrous gas.<br>- Capable of operating from 25-100%.<br>- Ease of installation.<br>- Negligible pressure drop. |
| Indicative Raw-material & Utilities for 20 kg/hr HCl | 30% HCl - 70 kg/hr<br>98% H2SO4 - 170 kg/hr<br>Cooling Water - 2 $m^3$/hr | 30% HCl - 200 Kg/hr<br>Saturated Steam - 50 kg/hr<br>Cooling Water - 3.5 $m^3$/hr<br>Chilled Brine - 4 $m^3$/hr |

# ANHYDROUS HCl GAS GENERATOR - CALCIUM CHLORIDE ROUTE




**Working Principle:**

Hydrochloric acid and water form a maximum boiling point azeotrope at 11O°C corresponding to a concentration of 20.24%; (w/w) HCl. By adding concentrated $CaCl_2$ solution to commercial hydrochloric acid the azeotrope point is eliminated and the entire' HCl becomes available for liberation by distillation. Anhydrous HCl gas generation through Calcium Chloride Route is the most environmental friendly technique.

**Process Description:**

The above principle- is achieved in practice by feeding metered quantities of commercial HCl and 50% $CaCl_2$-solution to a stripping column with a steam heated re-boiler at bottom. The effluent from bottom of the column is a dilute acidic calcium chloride solution which is concentrated to 50% in a evaporator and re-used. The vapor leaving is condensed stage wise with cooling water and chilled brine as coolant. The relatively dry gas passes through a mist eliminator and then through a rotameter to the point of consumption.

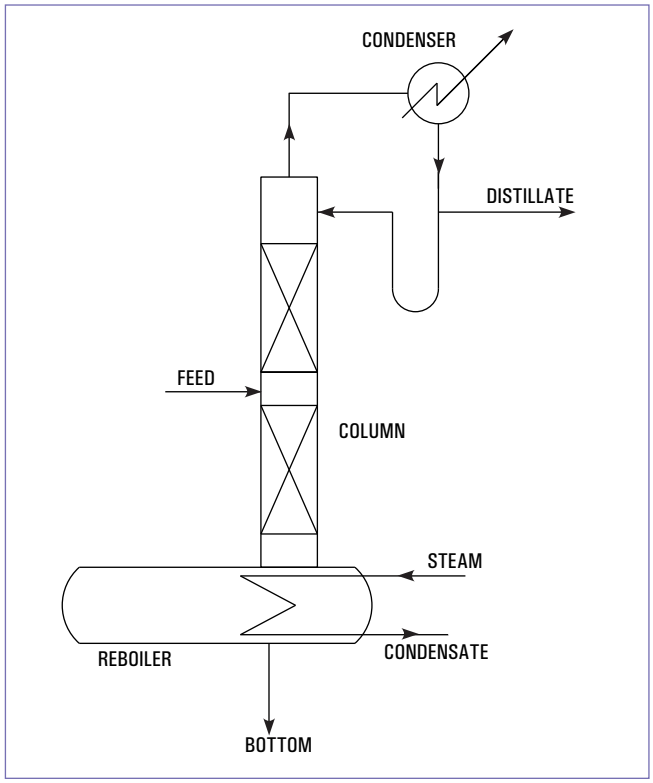
**Raw material utility requirements:**

The indicative requirements for 20 Kg/hr HCl gas generator are given below.

| | | | |
|---|---|---|---|
| 1. | 30-32 % HCl, (Kg/hr) | : | 66 |
| 2. | Cooling water at 30 °C ($M^3$/hr) | : | 4 |
| 3. | Chilled brine at -10 °C ($M^3$/hr) | : | 3 |
| 4. | Steam at 6 Kg/$cm^2$ (g) | : | 150 |

| LEGEND | LEGEND | LEGEND |
|---|---|---|
| R - REBOILER | C2 - SECONDARY CONDENSER | CW - COOLING WATER |
| D - COLUMN | R1 - FEED HCL ROTAMETER | CHB - CHILLED BRINE |
| E - EVAPORATOR | R2 - FEED $CACL_2$ ROTAMETER | C3 - CONDENSER |
| C1 - PRIMARY CONDENSER | R3 - DRY HCL GAS ROTAMETER | P - PUMP |

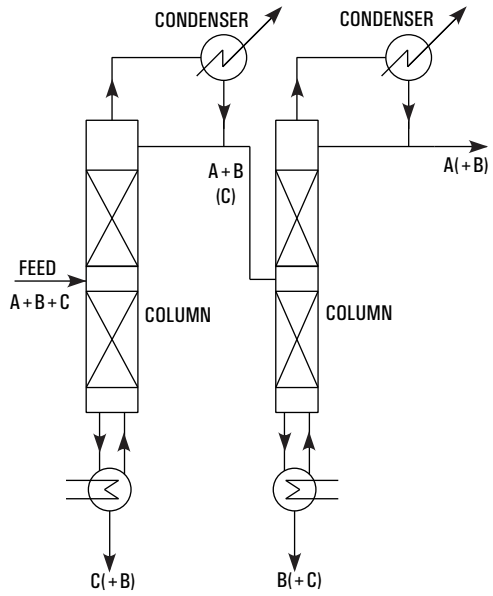
# CONTINUOUS DISTILLATION SYSTEM

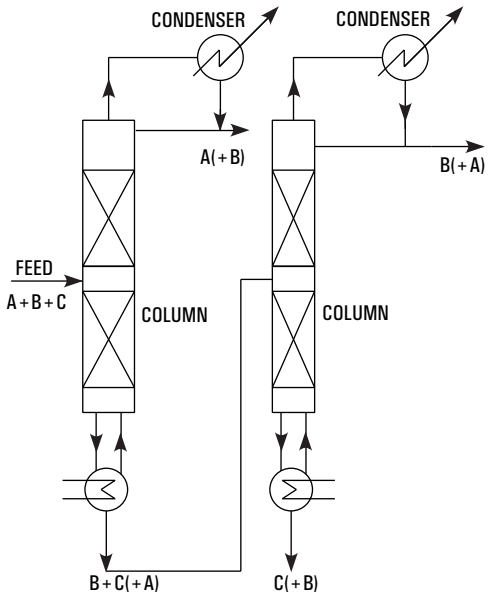



The limitations of batch distillations are naturally circumvented in continuous distillation as shown in fig.2 which is a typical fractionating unit comprising of ratification &stripping sections. Here feed is continuously fed to the column with withdrawal of top & bottom products. The process takes care on its own by simply maintaining the flow rates of feed & Utilities.

However when more than two products are desired as in case of multicomponent systems additional columns are required as each column is capable of giving two products only. That is to say, for multicomponent system only one product is obtain in relatively pure form from each column. The other product containing the remaining components is fed to a subsequent column where again one product is obtained in relatively pure form. The addition of columns continue till the system becomes binary & both components are separated in the final column.

An important principle to be emphasized is that a total n-1 fractionators are required for complete separation of system of n components. Which of the two products in a column is to be obtained in relatively pure form depends on relative volatility of each component in the feed stock. For example consider a ternary solution consisting of a components A, B & C whose relative volatilities are in that order (A most volatile). In order to obtain three substances in substantially pure form either of the schemes shown in fig-3 may be used. Which of the two schemes would be used depends on the relative difficulties of separation in each method and the choice calls for finer considerations of principles of distillation. However scheme (b) is usually preferred since it requires one vaporization of substance A.




**Component given in bracket are in small quantities.**

## SOLVENT RECOVERY

Solvents are universally used in wide variety of industries, their use by no means being limited to the chemical industry. The choice of solvents such as xylene, acetone, butyl acetate, methanol etc. depends on the type of application and economical considerations.

In many cases, the solvent - after use - is contaminated and not in a reusable condition. Purchase of fresh solvent and disposal costs of the contaminated solvent can prove expensive operations. Therefore, it makes sound economic sense to investigate the recovery of contaminated solvents for re-use.

GOEL design and supply solvent recovery plants which are capable of recovering solvents from a few kg/day to many tons/day.

Applications:

1. GOEL Solvent Recovery Units are carefully designed to cater the specific requirement for each duty for wide range of solvents.

2. Continuous Distillation Units have distinct advantages, such as

2.1. Ease of Operation due to steady state working.

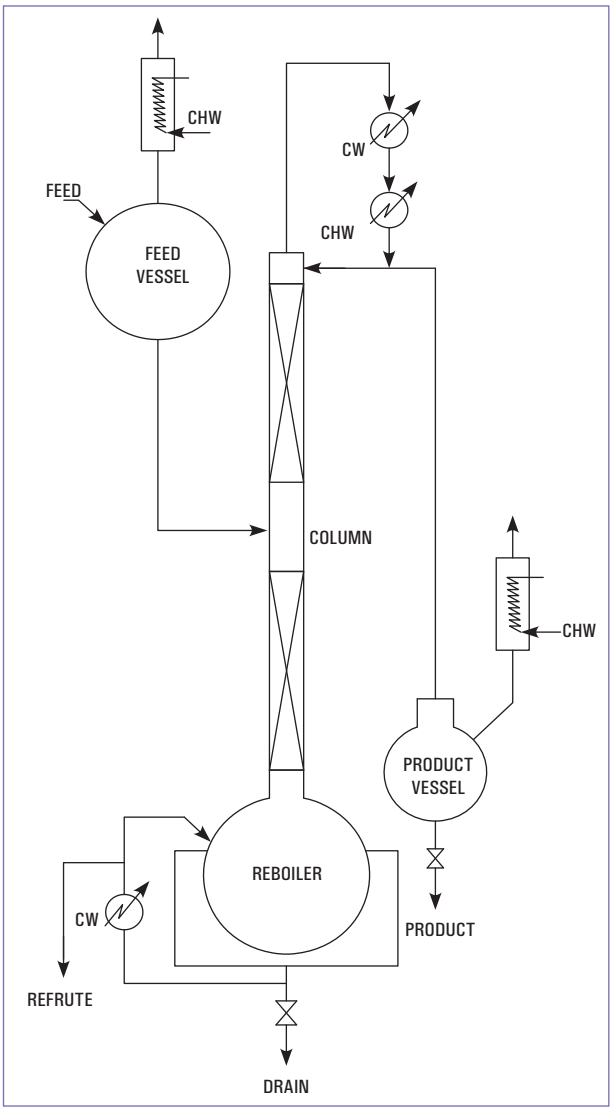
2.2 Economical design as each equipment viz. column, condenser reboiler is designed for uniform and steady-load.

2.3 Uniform product quality,

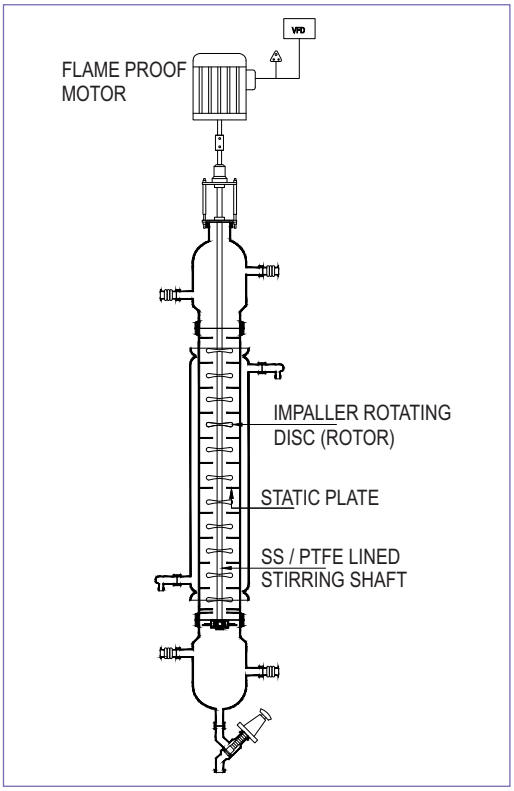
2.4 Uniform & low consumption of utilities.

2.5 Higher productivity as down time for start-up, emptying etc. is eliminated.

The outline flow-sheet of the plan is shown in Figure. Regulated quantity of feed is fed to a distillation column from an overhead vessel. The overhead vessel is provided with a vent condenser with chilled water circulation to arrest loss of acetone vapor. The reboiler at the bottom of column in this case was a steam heated oil-bath. The vapors from top of the column pass through primary and secondary condensers with cooling water and chilled water circulation. The condensate is partially refluxed and balance continuously drawn out and collected in receiver provided with a vent condenser. The residue from the re-boiler is continuously drained out.



# ROTATING DISC EXTRACTION COLUMN




## Introduction

Separation will be carried out normally with the help of distillation but when it is not feasible by distillation or ineffective liquid-liquid extraction is one of the process to consider. There few mixtures are having close boiling points components or heat sensitive components which can not withstand the temperature of distillation, even under vacuum may often be separated from impurities by extraction which utilize the chemical properties like specific gravity, solubility etc. instead of vapour pressure differences.

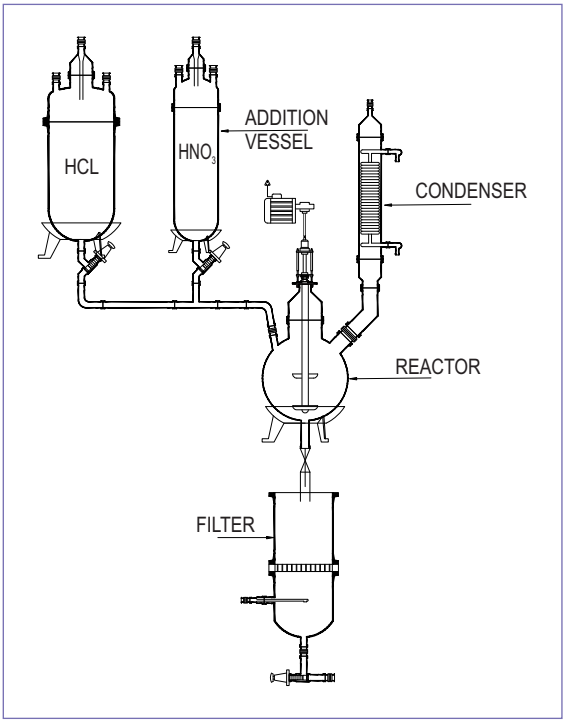
Separations by liquid-liquid extraction can be defined as the selective removal of one or more components either from a homogenous liquid mixture or from a solution, using a second liquid or solvent, which is partially or wholly immiscible with the first.

## Construction

The core of the unit is a rotating disc with varied no of stages between 1 m to 2 m height. The RDC blade can be made of PTFE or SS 304 or SS 316 depending on the customer requirement.
The system can be supplied with or without dosing pump and two feed vessels as well as two receivers.The drive used for the rotation of the disc is a standard geared-motor with an AC speed regulator. The agitator shaft is sealed by means of a mechanical seal.
The outer column can be constructed as a jacketed pipe or without jacket as per the customer requirement. The unit is designated by the diameter of the extraction column and no. of stages as per the customer specification depends on the flowrates and properties of the chemical used.

| Model | Size | DN (mm)Hight |
|---|---|---|
| RDC3 | 80 | 2.0 |
| RDC4 | 100 | 2.0 |
| RDC6 | 150 | 2.0 |
| RDC9 | 225 | 2.0 |
| RDC12 | 300 | 2.0 |
| RDC16 | 400 | 2.0 |

# PRECIOUS METAL REFINING



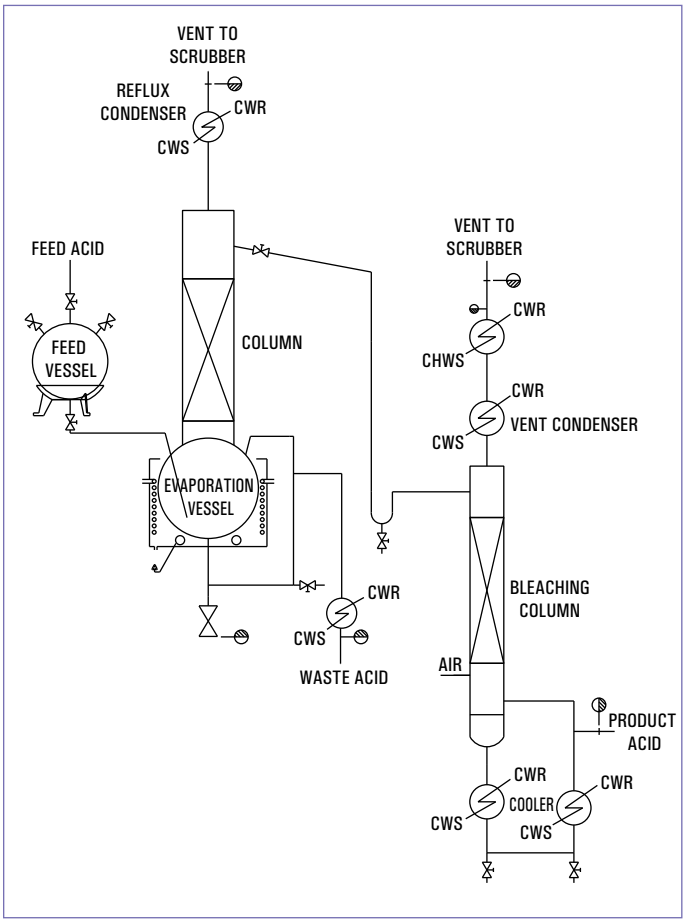

Borosilicate glass is inert to almost all materials. Due to which it is now widely used in Precious Metal Refining Industry. Borosilicate Glass is the only material which doesn't absorb precious metals. Its transparency allows ease of visualization & smooth surface allows ease of cleaning.

We have supplied various capacity glass assemblies in precious metal refinery for Aqua Regia solution. Our Glass Container/Vessel are also used as dissolution, precipitator and separator for Gold /silver/ platinum recovery with Aqua Regia / Hydrazine solution.

Scrubbing Unit :The fumes generated by Aqua Regia in a gold refining process are toxic. We design & offer suitable capacity Glass Scrubber Unit for removal of NOX Fumes.
Filer Unit :We also offer Glass Filter Unit on wheels for removing of precious metal from the Aqua Regia solution.
Nitric Acid Boiling Apparatus :Nitric Acid Boiling Apparatus with condenser for Laboratory testing is also available with us.
Sampling Tubes :Vacuum Tubes (VPT 111 ) for removal of samples from the batch are also manufactured by us.

# NITRIC ACID PURIFICATION SYSTEM

The process to purify industrial/technical grade nitric acid involves a single stage distillation to leave non- volatile impurities in the still bottoms. 69% – 70% concentrated nitric fluid is delivered by means of a metering pump from a storage tank into the glass still which is equipped with Electrically heated Oil Bath. The acid vapors flow through a mist removing packed section to the Glass condenser. Depending on the desired concentration high pure water can be added as a diluent to the condensed product before entering the bleach column. Clean air is introduced at the base of the bleacher. Air and oxides of nitrogen are vented through a condenser to a scrubber. Entrained nitric acid is not returned to the bleaching column but collected separately. Removing of all NOx out of electronic grade nitric acid.

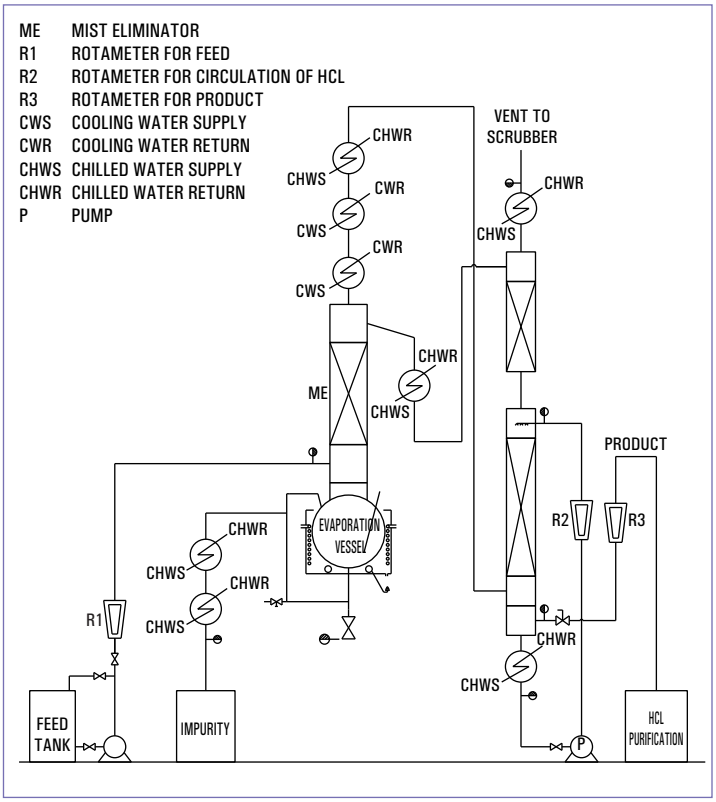



Design Basis & Requirement of Utilities :

| Capacity | 40 | kg/hr |
|---|---|---|
| Commercial grade Nitric Acid - 69-70% | 44 | kg/hr |
| Electric Heater | 48 | kw |
| Cooling Water @ 7 deg. C* | 4-5 | Cu.M/hr |
| Space Requirement | 3 x 3 x 8 m | |

Size Available 5 kg/hr to 500 kg/hr

# HCL PURIFICATION SYSTEM



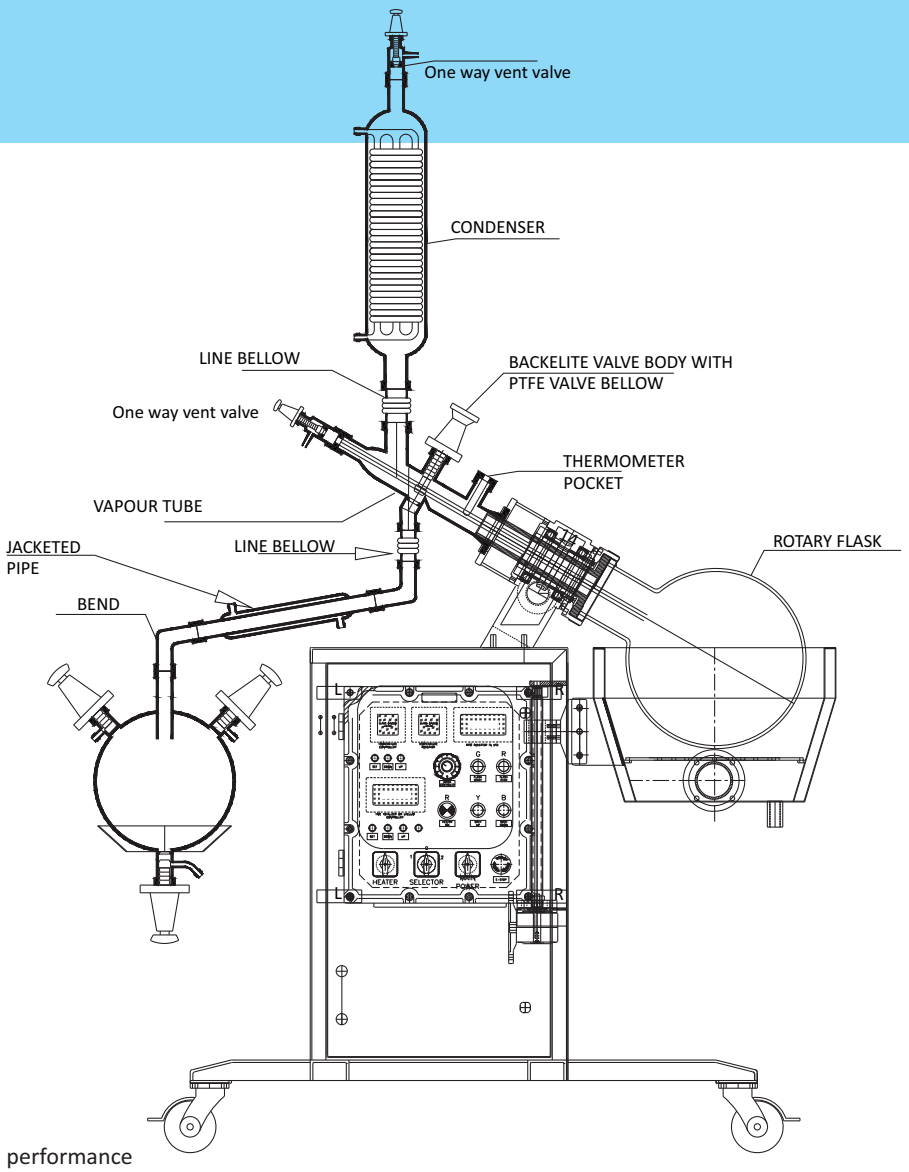

Commercial Grade Acid (30% HCL) is feed to the Reboiler through Flow meter. The feed will be heated in Re-Boiler by heating media to evaporate the 20-22% HCL. The 20-22% HCL+ Water Vapour generated will be condensed in Top Cooler with Cooling water & chilled water. The gas leaving the top will be of pure HCL gas will fed to the scrubber wherein it will be scrub further with condensed Azeotropic solution or with fresh process water to make ultrapure HCl.

There are various option s to make ultrapure HCL Depending on following factor : 1. feed quality 2. Effluent generation 3. Capital investment etc...

**Goel offers various solution for HCL purification based on customer need.**

| Sr. No. | Feed 30% HCl (w/w) | Product 36-37% HCl | Cooling Water @32 deg. C | Chilled Water @8 deg. C | Power |
|---|---|---|---|---|---|
| | Kg/hr | Kg/hr | Cu. m. / hr * | Cu. m. / hr * | KWH (Max.) |
| 1 | 15 | 12.5 | 8-10 | 5-6 | 10 |

# ROTARY FILM EVAPORATOR




**Rotary Film Evaporator - Jumbo range**

The largest in the world

Offering unmatched scale and performance

**Rotary Film Evaporator**

Efficient Evaporation for Heat-Sensitive Materials

The Rotary Film Evaporator is a thin film evaporator designed for rapid heat transfer by rotating the flask, ensuring a uniform heat distribution without localized heating. Operating under full vacuum allows for evaporation at low temperatures, significantly reducing both boiling point and residence time. These features make it ideal for heat-sensitive materials and applications like crystallization, powder/granule drying, and more.

The Goel Rotary Film Evaporator (GRFE) is widely used in laboratories, chemical, pharmaceutical, and biotechnological industries, trusted for both research and production scale operations.

## 5 TO 100 LITERS



## SALIENT FEATURES

1. Universal corrosion resistance.
2. Auto controlled digital display of rotational speed and bath temperature.
3. Digital display of process time.
4. Automatic bath lifting.
5. Automatic bath lowering in case of power failure.
6. Withstands full vacuum.
7. Ideally suited for heat sensitive material.
8. Maintenance free working - Operational reliability.
9. Available in large sizes upto 400 Litre.

## CONSTRUCTION

Goel Rotary Film Evaporators are completely self-contained units consisting mainly of:

G An electrically heated SS heating bath with facility for raising and lowering the height.

G Rotating flask of corrosion resistant borosilicate glass which is connected to drive by a coupling.

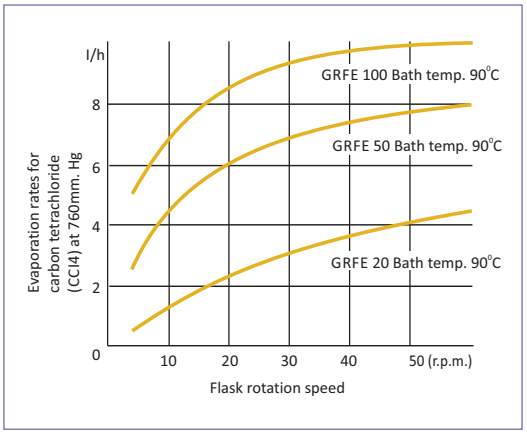
G The drive is a hollow GFT glass shaft which also acts as vapor off-take pipe. The drive shaft is sealed on condenser/receiver with Teflon seal. Power is transmitted to the shaft by a motor driven gear with provision for varying speed.

G Condenser/receiver arrangements are of standard design depending on the model/size.

G **GOEL'S Specialty: Mechanical Seal Arrangement and T shaft (Made from GFT) with Ceramic Seal plate which results optimum vacuum Without Breakage.**

## PERFORMANCE DATA

The performance of Rota-evaporator depends on various parameters such as temperature differential between bath and contents of flask, RPM, flask capacity and working pressure. An indicative comparison of boil-up of CCl4 rates for 20L, 50L and 100L is given in adjacent figure




## Technical informations related to various models are furnished below :

| Model | Rotating Flask Cap. (Ltrs.) | Rotating Speed (rpm) | Electric Motor Rating | Condenser Cooling Area M² | Receiver Flask Cap. (Ltrs.) | Power Supply (Volt/Hz) | Bath Rating KW |
|---|---|---|---|---|---|---|---|
| GRFE 5 | 5 | 20-280 | 180 Watt | 0.2 | 2 | 230 V, 50 Hz 1 Phase | 2 |
| GRFE 20/ GRFE 10 | 10 | 20-135 | 0.25 HP | 0.5 | 10 | 415 V, 50 Hz 3 Phase | 4 |
| GRFE 50 | 50 | 20-135 | 0.50 HP | 1.5 | 20 | 415 V, 50 Hz 3 Phase | 6 |
| GRFE 100 | 100 | 20-90 | 1 HP | 2.5 | 50 | 415 V, 50 Hz 3 Phase | 12 |

GOEL **brand is associated with quality & reliability and as a company is trend-setter in this business in India.**

# 5 TO 100 LITERS

## 5, 10, 20, 50, 100 Ltrs.

**Salient Features:**

* all GRFE can comply GMP And Non GMP norms according to customer requirement.
* Attractive Vertical Orientation
* Digital RPM indicator & VFD based speed control.
* Digital Temperature Indicator & Controller
* Digital Process Time Indication
* Digital vapor temperature indicator
* Motorized VFD based UP & down of bath.
* S.S. bath with insulated & electrical heaters with overflow nozzle & drain valves.

* Durable S.S. gearbox cover , with motor encased into the Mechanical Assembly.
* Complete glass assembly as per the specs in the table
* Anti-splashing hood
* In non GMP model body will be M.S. Powder coated.
* The whole unit is mounted on lockable wheels.*
* Fully tested & ready to use!!

**Optional:**

* Chiller unit
* PTFE COATED DIAPHRAM / OIL SEALED Vacuum pump with setup

**Note:**

20 Liter Unit can be supplied with adjustable 10Ltr. Main Flask in 20Ltr. Rotary Film Evaporator so it can be operated at lower volume as and when required.

5 Liter Unit can Accommodate Interchangeable 1, 2, 3, & 5 Liter Flasks. Main flasks will be 5 Liter. So, it can be operated at lower volume as and when required.

# (5 LTR. TO 50 LTR.)

SS GMP Model

Flameproof Model

# ROTARY FILM EVAPORATOR
# JUMBO RANGE
## 200 TO 800 LITERS

The Largest Size in the World !!

# ROTARY FILM EVAPORATOR
# JUMBO RANGE
## 200 TO 800 LITERS

## INTRODUCTION

**A brief Introduction of evolution of CYLINDRICAL SHAPED Rotary Film Evaporator made of Borosilicate Glass!! - ALL NEW Innovation from GOEL, INDIA.**

Rotary Film Evaporator is regularly used product in the R & D of chemical & pharmaceutical industry. It is also being used nowadays for manufacturing purpose for high value pharmaceutical & specialty chemical products. The existing rotary film evaporators, which are used, with spherical evaporating flasks. When the requirement of volume for process increases it is practically very difficult to handle the sizes beyond 50 Liters.

Chemical reactors are cylindrical in shape with a particular L/D ratio in general, which are given for a particular reaction surface area. The cylindrical vessel has a higher surface area than spherical vessel. This prompted us to think in the direction, why only spherical vessel is used when we can exploit the advantage of cylindrical shape evaporation flask in a rotary film evaporator.

***Thus the innovation for a better rotary film evaporator with better efficiency in terms of rate of evaporation was done.*** The results showed that the rate of evaporation was enhanced to 20 % as compared to conventional spherical shaped rotary film evaporator. Also the mechanical stability was far superior to spherical vessel, inclined drive rotary film evaporator.

Then we designed the largest Rotary Film Evaporator **Jumbo Rotary**, capacity 400 Ltrs made from Borosilicate Glass 3.3 Cylindrical Evaporation flask. In spherical flask rotary film evaporator the drive is inclined and the flask is held from it's neck only. Thus a inclined cantilever type of loading happens on the rotating assembly. This is highly unstable mechanically as for the same neck size of flask, higher stresses develop in the flask neck compared to a horizontal drive simply supported flask as in the case of cylindrical rotary film evaporator. The cylindrical flask of the jumbo rotary evaporator is also held by the neck, but the drive centerline is not inclined, instead it is horizontal.

The rotating flask is also supported axially at two cross-sectional circumference over it's whole length, thus making the loading effectively a simply supported one and not a cantilever type. This reduces the stresses on the neck of the flask and is the only safer solution for making higher size rotary film evaporator. Another advantage of the cylindrical flask is it's lower diameter compared to a spherical flask for a particular volume, which is a very critical factor for glass MOC as the pressure rating goes down drastically with the increase in diameter. Also material removal & cleaning becomes easier from the cylindrical rotary film evaporator. It is simply opening the quick release coupling from one end. The material can be easily scooped out where as in spherical rotary film evaporator the whole flask is to be separated out & spherical flasks becomes too bulky and handling becomes very difficult for sizes above 200 Ltrs.

***This development has overcome the constraint of the size in Rotary Film Evaporators from laboratory scale applications to industrial applications for sizes above 100 Liters i.e.***

**Up to 800 Liters with a diameter of 800 mm !!**

200 TO 800 LITERS

| TECHNICAL SPECIFICATIONS | | |
|---|---|---|
| **ITEM** | **MODEL : GRFE 200 J** | **MODEL : GRFE 400 J** |
| Cylindrical Flask | 200 Ltr. | 400 Ltr. |
| Heating Bath | SS 304<br>6 Kw x 3 = 18 Kw<br>Flameproof | SS 304<br>9 Kw x 3 = 27 Kw<br>Flameproof |
| Canopy | Polycarbonate Canopy | Polycarbonate Canopy |
| Drive Motor | 3 HP (Flame proof),<br>50 Hz 415 V, 3 phase motor<br>RPM : 2-50 RPM, Variable, VFD Based | 5 HP (Flame proof),<br>50 Hz 415 V, 3 phase motor<br>RPM : 2-50 RPM, Variable, VFD Based |
| Glass Specification | All contact Parts are made of<br>Borosilicate - 3.3 glass / PTFE<br>Heat Exchanger - 1.5 m2 x 2 Nos.<br>Heat Transfer, 6'' Small Diameter<br>Receivers 20 Ltrs with Drain,<br>Vacuum & Vacuum Release Valve<br>Seals & Gasket PTFE & GFT<br>Tubular Structure & Structure<br>Parts SS 304 | All contact Parts are made of<br>Borosilicate - 3.3 glass / PTFE<br>Heat Exchanger - 2.5 m2 x 2 Nos.<br>Heat Transfer, 6'' Small Diameter<br>Receivers 20 Ltrs with Drain,<br>Vacuum & Vacuum Release Valve<br>Seals & Gasket PTFE & GFT<br>Tubular Structure & Structure<br>Parts SS 304 |
| Dimension (Approx) | 2500(L) x 1200(W) x 2200(H) mm | 3600(L) x 1500(W) x2500(H) mm |



# JUMBO RANGE

## The Largest Size in the World !!

# CHEMICAL RESISTANT DIAPHRAGM PUMP

The chemical resistant diaphragm pumps are ideally suited for handling aggressive gases and vapors, offering a vacuum range down to 2 mbar.

## FEATURES

- All wetted parts are made of chemical resistant materials
- Fast pumping speed
- Low noise
- Overheat protection
- Vacuum can be controlled by regulator or vacuum controller
- Easy and convenient for maintenance

| Rotary Evaporator Model | Vacuum Pump Model | Ultimate Vacuum | Pumping Speed | | Hose Connections | Max. Power | Dimensions | Weight |
|---|---|---|---|---|---|---|---|---|
| | | mbar | L/min | $M^3/h$ | mm | W | W×D×H (mm) | Kg |
| GRFE 5 | GS410 | 13 | 25 | 1.50 | 10 | 95 | 294×156×195 | 8.5 |
| | GS510 | 8 | 34 | 2.04 | 10 | 245 | 380×156×226 | 13.2 |
| | GS610 | 2~4 | 37 | 2.22 | 10 | 270 | 380×171×226 | 13.8 |
| GRFE 10<br>GRFE 20 | GS960T | ＜2 | 60 | 3.6 | 10 | 370 | 440×270×240 | 21.5 |
| GRFE 50<br>GRFE100 | GS2000T | ＜2 | 180 | 10.8 | KF25 or 16mm barbed fitting | 750 | 615×285×386 | 41 |
| **Vacuum regulator and vacuum controller** | | | | | | | | |
| GS 169311-06 | Vacuum trap, regulator and vacuum gauge | | | | | | | |
| GS 169312-06 | Vacuum trap, regulator and digital meter DVM150C | | | | | | | |
| GS 900414-1 | Vacuum controller DVR480 | | | | | | | |
| GS 900580 | Vacuum controller DVR580 | | | | | | | |

Please note that vacuum regulator or vacuum controller need to be ordered separately

# CHEMICAL RESISTANT DIAPHRAGM PUMP, VARIABLE FREQUENCY

The chemical resistant diaphragm pumps are ideally suited for handling aggressive gases and vapors, offering a vacuum range down to 2 mbar.

## FEATURES

- All wetted parts are made of chemical resistant materials
- Variable frequency motor for fast pumping speed
- Low noise
- Overheat protection
- Vacuum can be controlled by variable frequency controller
- Easy and convenient for maintenance

| Rotary Evaporator Model | Vacuum Pump Model | Ultimate Vacuum | Pumping Speed | | Hose Connections | Max. Power | Dimensions | Weight |
|---|---|---|---|---|---|---|---|---|
| | | mbar | L/min | $M^3/h$ | mm | W | W×D×H (mm) | Kg |
| GRFE 10 | GS C960TEF | ＜2 | 60 | 3.6 | 10 | 400 | 220×400×495 | 21.5 |
| GRFE 20 | | | | | | | | |
| GRFE 50 | GS C2000TEF | ＜2 | 210 | 12.6 | KF25 or 16mm barbed fitting | 750 | 615×285×386 (pump only) | 41 |
| GRFE100 | | | | | | | | |

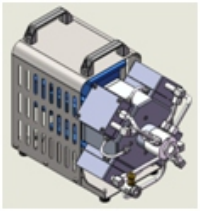
Please note that the vacuum controller is already included in the package

## CHEMICAL RESISTANT DIAPHRAGM PUMP, EX VERSION

The chemical resistant diaphragm pumps are ideally suited for handling aggressive gases and vapors, offering a vacuum range down to 3 mbar.

### FEATURES

- All wetted parts are made of chemical resistant materials
- Typical applications are rotary evaporators with potentially explosive atmospheres
- Low noise
- Overheat protection
- Vacuum can be controlled by regulator or vacuum controller
- Easy and convenient for maintenance



| Rotary Evaporator Model | Vacuum Pump Model | Ultimate Vacuum | Pumping Speed | | Hose Connections | Max. Power | Dimensions | Weight |
|---|---|---|---|---|---|---|---|---|
| | | mbar | L/min | $M^3/h$ | mm | W | W×D×H (mm) | Kg |
| GRFE 10<br>GRFE 20 | GS C960T-EX | ＜2 | 60 | 3.6 | KF25 or 16mm barbed fitting | 550 | 434×270×365 | 30 |
| **Vacuum regulator and vacuum controller** | | | | | | | | |
| GS 169311-06 | Vacuum trap, regulator and vacuum gauge | | | | | | | |
| GS 169312-06 | Vacuum trap, regulator and digital meter DVM150C (Non-EX version) | | | | | | | |
| GS 900414-1 | Vacuum controller DVR480 (Non-EX version) | | | | | | | |
| GS 900580 | Vacuum controller DVR580 (Non-EX version) | | | | | | | |

Please note that vacuum regulator or vacuum controller need to be ordered separately

## VACUUM SOLVENT RECOVERY SYSTEM

The CSC system has all the features of a chemical resistant diaphragm pump, in addition to integrating a vacuum controller, as well as a glass condenser, collection bottle, etc.,prevent the release of toxic gases into the atmosphere, causing damage to the health of the operators.

### FEATURES

- CSC system integrated vacuum pump, vacuum controller and glassware
- All wetted parts are made of chemical resistant materials
- Low noise
- Overheat protection
- Easy and convenient for maintenance

| Rotary Evaporator Model | Vacuum Pump Model | Ultimate Vacuum | Pumping Speed | | Hose Connections | Max. Power | Dimensions | Weight |
|---|---|---|---|---|---|---|---|---|
| | | mbar | L/min | $M^3/h$ | mm | W | W×D×H (mm) | Kg |
| GRFE 5 | GS CSC410 | 13 | 25 | 1.50 | 10 | 95 | 323×267×545 | 16 |
| | GS CSC510 | 8 | 34 | 2.04 | 10 | 245 | 323×267×545 | 19.3 |
| | GS CSC610 | 2~4 | 37 | 2.22 | 10 | 270 | 323×267×545 | 20.1 |
| GRFE 10 | GS CSC960T | ＜2 | 60 | 3.6 | 10 | 400 | 220×400×495 | 25 |
| GRFE 20 | | | | | | | | |
| GRFE 50 | GS CSC2000T | ＜2 | 210 | 12.6 | KF25 or 16mm barbed fitting | 750 | 615×285×386 | 41 |
| GRFE100 | | | | | | | | |

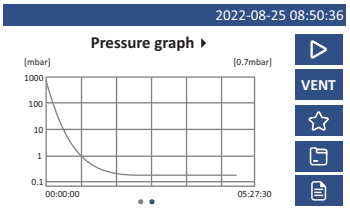
# CHEMICAL RESISTANT VACUUM CONTROLLER

Innovative vacuum control technology from has been used to produce the new generation vacuum controller, ideal for demanding vacuum control applications, and simple control of complex applications.

> Continuously adjustable
> Large, high-resolution TFT touch display with multilingual user interface
> Parts being in contact with the medium made of chemical resistant material
> Integrated programmer
> USB connection
> RS232 / RS485 interface for communication
> Integrated two vacuum control modes, valve control and frequency conversion control

## Specifications

| | |
|---|---|
| Model | GS -VC -850 |
| Voltage | 100-240V/ 50Hz |
| Displayed Vacuum Accuracy | 0.1 mbar Controllable Range 0.1~1010 mbar |
| Measurement Accuracy | 0.25%F.S |
| Display | Touch screen |
| Control Mode | Turning knob |
| Timer / Program | Yes, Max. 6 steps |
| Pressure Release Feature | Continuous / intermittent pressure relief Protection Category IP40 |
| Communicate interface. | RS232, RS485, USB |
| Corrosion resistance | All parts that come into contact with gases are made of PTFE or highly durable. ceramic to ensure the resistance to various acid, base, or organic solvent gases. |




# CIRCULATING CHILLER WATER BATH

The parameter will be customizable as per customer requirement

| Rotary Evaporator Model | Chiller Model | Temperature Range | Cooling Capacity Ton of Refrigeration | Kw | Tank Capacity | Process Pump | Drive Motor Required H.P. |
|---|---|---|---|---|---|---|---|
| GRFE 5 | GC-500 | +5°C to +25°C | 0.5 | 1 Kw | 40 Ltr | 40 LPM | 0.5 HP |
| GRFE 20/GRFE 10 | GC 1000 | +5°C to +25°C | 1 | 2 Kw | 40 Ltr | 40 LPM | 0.5 HP |
| GRFE 50 | GC 2000 | +5°C to +25°C | 2 | 2.7 Kw | 80 Ltr | 50 LPM | 0.5 HP |
| GRFE 100 | GC 5000 | +5°C to +25°C | 5 | 6 Kw | 140 Ltr | 80 LPM | 0.5 HP |


# DUALIS

## Heating-Cooling Circulators

# Precision In Every Degree

## Advanced Temperature Control for Unmatched Performance

## FEATURES


### Advanced Temperature Control
A feedforward controller ensures precise temperature regulation with no overshoot or callback.

### High-Lift Design
Designed for efficient long-distance fluid transter

### Reliable Performance
Featuring a Reliable compressor and a magnetic drive pump for reliable and efficient performance

### Built-in Safety
Equipped with self-diagnostic capabilities, overload protection, and multiple other safety features for reliable operation

### Sealed Oil Circulation System
Designed to prevent leaks.enhancing safety and extending fluid lifespan

### Programmable Operation
Stores up to 25 programs,each with 45 steps, for precise temperature control across different materials. Preset options enhance accuracy, minimize manual adjustments, and improve stability.

## temperature range : -25 ~+ 200 °C

High temperature can be extended to 300 °C/ 350°C

| Model | Heating (KW) | Temp range (°C) | Accuracy (± °C) | Cooling Capacity (KW) | | | | | | Pump flow ( L / min) | Pressure bar | Approx Dimensions in mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 200 °C | 100 °C | 50 °C | 20 °C | -5 °C | -20 °C | | | |
| HC-10-200-25-A<br>HC-10-200-25-W | 3.5 | -25 ~+ 200 | ≤ 0.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3 | 1.8 | 35 | 2 | 490*580*1300 |
| HC-20/30-200-25-A<br>HC-20/30-200-25-W | 5.5 | -25 ~+ 200 | ≤ 0.5 | 5.5 | 5.5 | 5.5 | 5.5 | 4.5 | 2.8 | 50 | 2 | 490*580*1300 |
| HC-50-200-25-A<br>HC-50-200-25-W | 7.5 | -25 ~+ 200 | ≤ 0.5 | 7.5 | 7.5 | 7.5 | 7.5 | 6.6 | 3.8 | 75 | 2 | 530*650*1400 |
| HC-100-200-25-A<br>HC-100-200-25-W | 10 | -25 ~+ 200 | ≤ 0.5 | 10 | 10 | 10 | 10 | 8 | 4.6 | 110 | 2.5 | 650*700*1400 |

## temperature range : -45 ~+ 250 °C

High temperature can be extended to 300 °C/ 350°C

| Model | Heating (KW) | Temp range (°C) | Accuracy (± °C) | Cooling Capacity (KW) | | | | | | Pump flow ( L / min) | Pressure bar | Approx Dimensions in mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 250 °C | 100 °C | 20 °C | 0 °C | -20 °C | -40 °C | | | |
| HC-10-250-45-A<br>HC-10-250-45-W | 3.5 | -45 ~+ 250 | ≤ 0.5 | 3.5 | 3.5 | 3.5 | 3 | 1.5 | 0.45 | 35 | 2 | 490*580*1300 |
| HC-20/30-250-45-A<br>HC-20/30-250-45-W | 5.5 | -45 ~+ 250 | ≤ 0.5 | 5.5 | 5.5 | 5.5 | 5 | 2.9 | 0.9 | 50 | 2 | 490*580*1300 |
| HC-50-250-45-A<br>HC-50-250-45-W | 7.5 | -45 ~+ 250 | ≤ 0.5 | 7.5 | 7.5 | 7.5 | 7 | 4.2 | 1.5 | 75 | 2 | 530*650*1400 |
| HC-100-250-45-A<br>HC-100-250-45-W | 10 | -45 ~+ 250 | ≤ 0.5 | 10 | 10 | 10 | 10 | 6 | 2 | 110 | 2.5 | 650*700*1400 |

## temperature range : -80 ~+ 250 °C

High temperature can be extended to 300 °C/ 350°C

| Model | Heating (KW) | Temp range (°C) | Accuracy (± °C) | Cooling Capacity (KW) | | | | | | Pump flow ( L / min) | Pressure bar | Approx Dimensions in mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 250 °C | 50 °C | 0 °C | -40 °C | -60 °C | -75 °C | | | |
| HC-10-250-80-W | 3.5 | -80 ~+ 250 | ≤ 0.5 | 3.5 | 3.5 | 3.5 | 2.6 | 1.4 | 0.42 | 35 | 2 | 490*580*1300 |
| HC-20/30-250-80-W | 5.5 | -80 ~+ 250 | ≤ 0.5 | 5.5 | 5.5 | 5.5 | 3.3 | 1.6 | 0.7 | 50 | 2 | 650*700*1400 |
| HC-50-250-80-W | 7.5 | -80 ~+ 250 | ≤ 0.5 | 7.5 | 7.5 | 7.5 | 5.8 | 3 | 1.3 | 75 | 2 | 700*800*1560 |
| HC-100-250-80-W | 10 | -80 ~+ 250 | ≤ 0.5 | 10 | 10 | 10 | 6.4 | 3.5 | 1.5 | 110 | 2.5 | 750*1300*1400 |

# HEAT EXCHANGERS

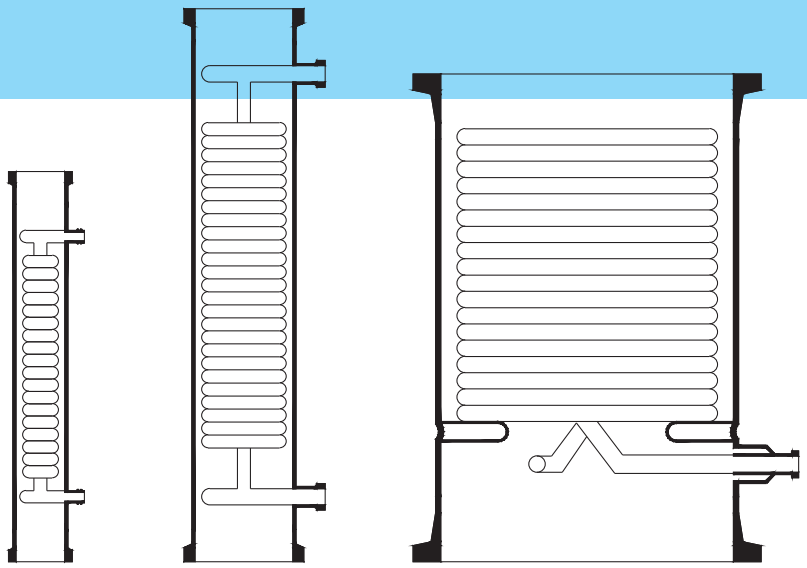
Optimized Heat Exchange for Enhanced Efficiency

Borosilicate glass equipment offers a favorable heat transfer coefficient, thanks to its smooth surface, which enhances thermal efficiency and reduces fouling. Our heat exchangers come in two designs:

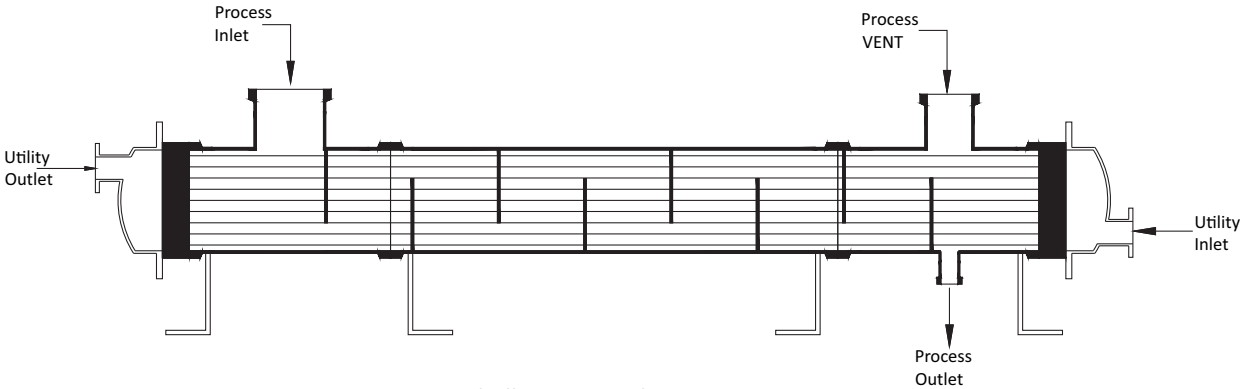
1. Conventional Coil Type Condensers
2. Shell & Tube Type

Both options ensure efficient heat transfer for your demanding applications.

Crystal-Clear Performance for Critical Processes



Coil Condenser




Shell & Heat Exchanger

# SHELL AND TUBE HEAT EXCHANGERS

## INTRODUCTION

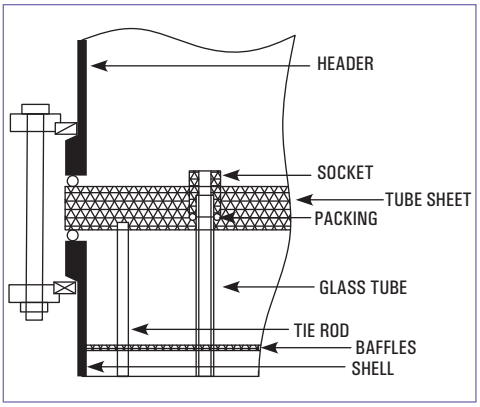
Shell & tube heat exchangers offer large surface area in combination with efficient heat transfer and compactness. These are widely used in industries for various duties like cooling, heating, condensation, evaporation etc. GOEL are the pioneers in the field of glass shell and tube heat exchangers in India and their product has a wide market acceptability.

## SALIENT FEATURES

1. Universal corrosion resistance an excellent alternative to expensive MOCs like graphite, hastelloy, copper titanium, tantalum and other exotic metals.
2. Excellent heat transfer as fouling does not occur on smooth glass surfaces.
3. Flexibility of installation vertical / horizontal.
4. Easy replacement of tubes for repair and cleaning.
5. Available in wide range of HTAs.
6. Ease of installation due to light weight.
7. Economical.
8. Suitable for applications where large HTAs are required in limited space.

## ADVANTAGES OVER CONVENTIONAL COIL TYPE HEAT EXCHANGERS

(1) The overall heat transfer coefficient in shell and tube heat exchanger is about 3 times higher than in coil type heat exchanger.
(2) The pressure drop in shell and tube heat exchanger is minimal compared to 2-3 kg/cm$^2$ in coil side of coil type heat exchanger.
(3) For requirement of higher heat transfer areas shell and tube heat exchanger is the only alternative.




## CONSTRUCTION FEATURES

The glass tubes are sealed individually into PTFE tube sheet with special PTFE sockets and packing. This unique ferrule type sealing arrangement permits easy replacement and cleaning of tubes. Baffles on shell side ensure improved heat transfer by increased turbulance. Further details of construction can be seen in the diagram.
- Made from SCHOTT DURAN.
- Joint less tubes offer better pressure rating.

## TYPE

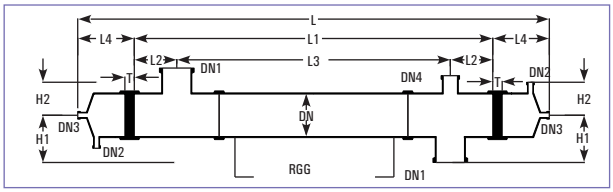
Three basic versions * are available :

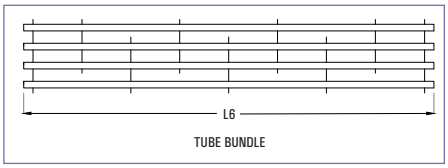
| Material Of Construction | | | | |
|---|---|---|---|---|
| **Model** | **Shell** | **Tube** | **Header** | **Duty** |
| RGG | Glass | Glass | Glass | For heat transfer between two agressive media. |
| RGM | Glass | Glass | Steel/ FRP | For heat transfer between agressive media in shell & non-aggressive media in tubes. |
| RMG | Steel/FRP | Glass | Glass | For heat transfer between aggressive media in tubes & non-aggressive media in shell. |

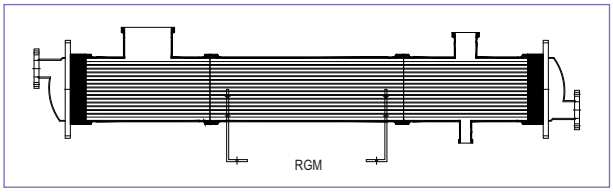
* GOEL provides assistance to clients for selecting the right model for specific duty.

## DIMENSIONAL SPECIFICATIONS

| Cat. Ref. RGG/RMG | 6/3 | 6/4 | 6/5 | 6/6 | 9/6 | 9/8 | 9/10 | 9/12 | 12/12 | 12/16 | 12/21 | 12/25 | 16/21 | 16/25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area ($m^2$) | 3 | 4 | 5 | 6 | 6 | 8 | 10 | 12 | 12 | 16 | 21 | 25 | 21 | 25 |
| DN | 150 | | | | 225 | | | | 300 | | | | 400 | |
| DN1 | 80 | | | | 100 | | | | 150 | | | | 225 | |
| DN2 | 50 | | | | 80 | | | | 80 | | | | 100 | |
| DN3 | 25 | | | | 40 | | | | 40 | | | | 50 | |
| DN4 | 50 | | | | 50 | | | | 50 | | | | 80 | |
| H1 | 175 | | | | 250 | | | | 300 | | | | 450 | |
| H2 | 150 | | | | 200 | | | | 250 | | | | 300 | |
| L | 2500 | 3100 | 3700 | 4300 | 2620 | 3220 | 3820 | 4520 | 2550 | 3150 | 3950 | 4550 | 3100 | 3500 |
| L1 | 1900 | 2500 | 3100 | 3700 | 1900 | 2500 | 3100 | 3800 | 1800 | 2400 | 3200 | 3800 | 2000 | 2400 |
| L2 | 150 | 150 | 150 | 150 | 225 | 225 | 225 | 225 | 225 | 225 | 225 | 225 | 400 | 400 |
| L3 | 1600 | 2200 | 2800 | 3400 | 1450 | 2050 | 2650 | 3350 | 1350 | 1950 | 2750 | 3350 | 1200 | 1600 |
| L4 | 250 | 250 | 250 | 250 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 550 | 550 |
| L5 | 125 | 125 | 125 | 125 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 225 | 225 |
| L6 | 1980 | 2580 | 3180 | 3780 | 2000 | 2600 | 3200 | 3900 | 1930 | 2530 | 3330 | 3930 | 2185 | 2585 |
| T | 50 | | | | 60 | | | | 75 | | | | 100 | |
| No. of Tubes | 37 | | | | 73 | | | | 151 | | | | 241 | |
| No. of Baffles | 11 | 15 | 19 | 23 | 7 | 9 | 13 | 17 | 5 | 7 | 9 | 11 | 5 | 7 |




## RANGE OF APPLICATIONS

Permissible temperature range for both shell & tube sides - 40°C to 150°C.
Maximum permissible temperature difference between shell & tube sides 120°C.
All sizes & models are suitable for full vacuum on both side. Maximum limiting pressures are tabulated here below :

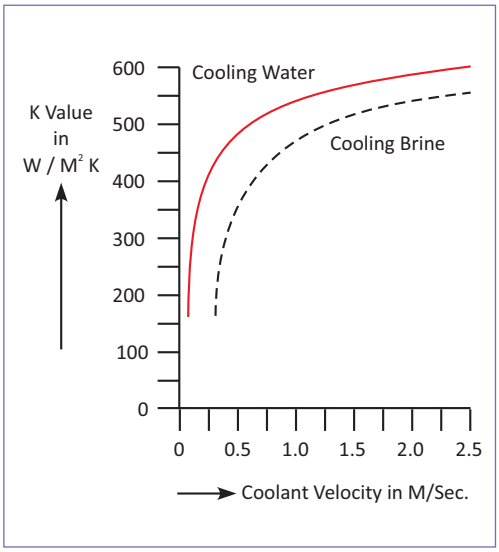
| Model | Side | Maximum Permissible Pressure Range, Kg/cm² (g) 150 DN | 225 DN | 300 DN |
|---|---|---|---|---|
| RGG | Shell-Glass | 2.0 | 1.0 | 1.0 |
| | Tube-Glass | 2.0 | 1.0 | 1.0 |
| | Dome-Glass | | | |
| RGM | Shell-Glass | 2.0 | 1.0 | 1.0 |
| | Tube-Glass | 3.5 | 3.5 | 3.5 |
| | Dome-Metal | | | |
| RMG | Shell-Metal | 3.5 | 3.5 | 3.5 |
| | Tube-Glass | 2.0 | 1.0 | 1.0 |
| | Dome-Glass | | | |

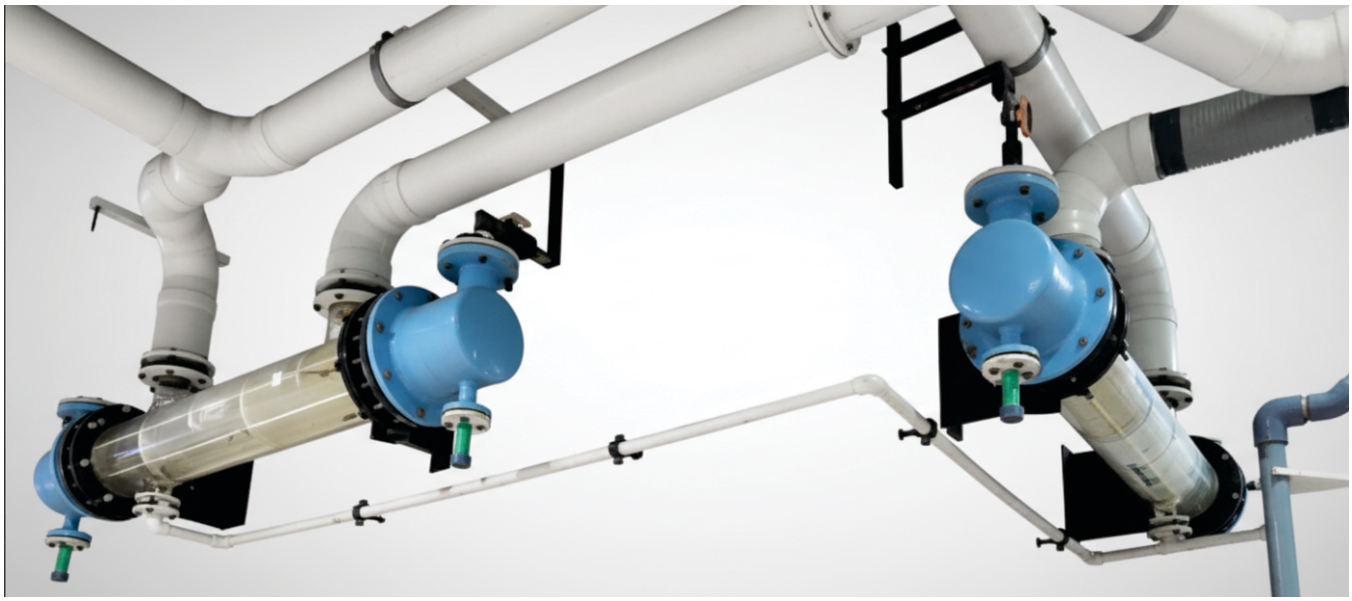
The above ranges of application are admissible limiting values. For each specific case GOEL recommends the admissible operating data based on the relations between pressure and temperature, size and model.

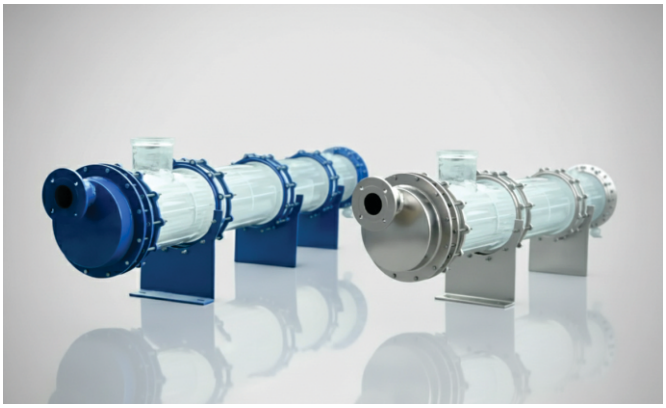
# PERFORMANCE & DESIGN DATA

The particular advantage of shell & tube heat exchanger is high heat transfer performance. The relation between heat transfer and velocity of flow can be easily seen in the diagram. On receipt of the operating data from client the most favourable shell and tube heat exchanger is selected. This accurate design combined with most reliable quality assurance ensure economy and operational reliability for the user. For approximate sizing some typical heat transfer coefficients are given here below :

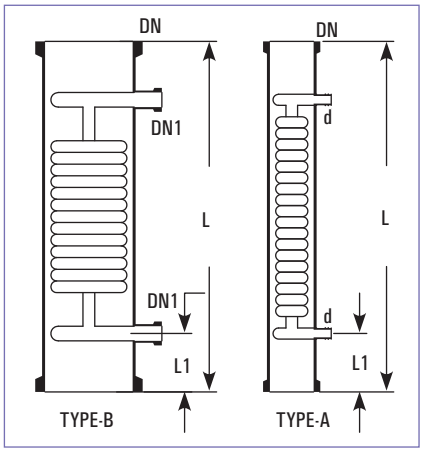
| | | U-Values | |
|---|---|---|---|
| **Media** | **use** | **kcal/m²hr k** | **W/m²k300** |
| Steam water | Condensation | 350-550 | 410-640 |
| Water-Water | Cooling | 250-350 | 290-410 |
| Water-air | Cooling | 30-60 | 35-70 |

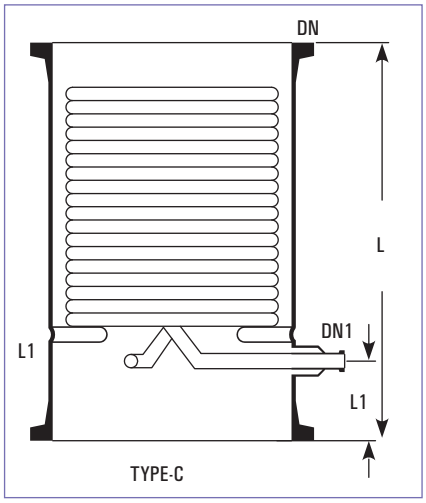




# CONDENSERS




Condensers are used for condensation of vapours and cooling of liquids. Condensers are made by fusing number of parallel coils in a glass shell. Coils are made in different diameters using tubes of different bores.

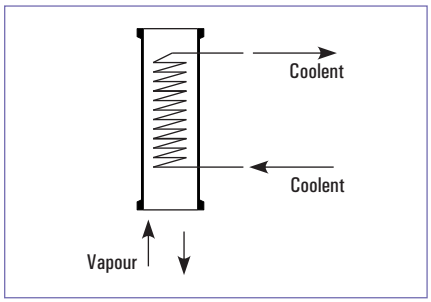
The average co-efficient of heat transfer in coil condenser is considered as-
Condensation 200 - 270 Kcal/$m^2$,hr,°C appx.
Cooling 100 - 150 Kcal/$m^2$,hr,°C appx.

| Cat. Ref. | DN | d/ DN1 | L | L1 | Type | Actual H.T.A. $m^2$ | Cross Area $Cm^2$ | Free Coolant Rate Kg/hr. | Max. Jacket Cap. Litre |
|---|---|---|---|---|---|---|---|---|---|
| HE3/3.5* | 80 | 16 | 600 | 75 | A | 0.35 | 5 | 1300 | 2 |
| HE4/5* | 100 | 19 | 600 | 75 | A | 0.50 | 30 | 2400 | 4 |
| HE4/6* | 100 | 19 | 750 | 100 | A | 0.60 | 30 | 2400 | 6 |
| HE6/10 | 150 | 25 | 600 | 100 | B | 1.00 | 52 | 2600 | 9 |
| HE6/15* | 150 | 25 | 850 | 100 | B | 1.50 | 52 | 2600 | 11 |
| HE9/25* | 225 | 25 | 800 | 110 | B | 2.50 | 125 | 3300 | 18 |
| HE12/25 | 300 | 25 | 600 | 125 | B | 2.50 | 175 | 5700 | 25 |
| HE12/40* | 300 | 25 | 900 | 125 | B | 4.00 | 175 | 5700 | 35 |
| HE16/40 | 400 | 25 | 600 | 125 | B | 4.00 | 450 | 6200 | 60 |
| HE16/50 | 400 | 25 | 700 | 125 | B | 5.00 | 450 | 6200 | 70 |
| HE18/60 | 450 | 40 | 750 | 150 | C | 6.00 | 820 | 4800 | 100 |
| HE18/80 | 450 | 40 | 900 | 150 | C | 8.00 | 820 | 6200 | 110 |
| HE24/120 | 600 | 50 | 1250 | 300 | C | 12.00 | 1520 | 6200 | 265 |

## Precautions to be taken in use of condensers

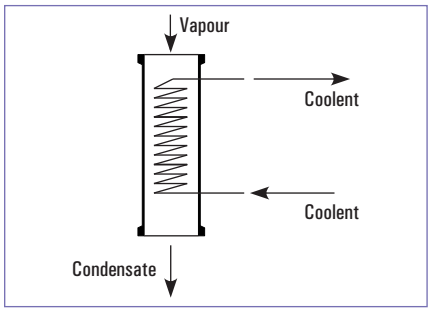
- Vapours should be passed through shell only.
- Maximum pressure of coolant should be 2.7 bars.
- Adequate flow of coolant should be used.
- Steam should not be used in coils.
- Coolant should not be heated to boiling point.
- Coolant control valve should be turned slowly.
- Coolant should be allowed to drain freely.
- Brine can be used in coils in a closed circuit.
- Water main should be connected with flexible hose.
- Ensure no freezing of water remaining in the coils.
- Condensers should be mounted vertically only.
- Condensers can be mounted in series to provide larger surface area.

## METHODS OF USE




### Vapours from bottom

This method is simple to install over a reactor. However this results in condensate returning substantially at its condensing temperature. In this method care must be taken that condensate is not excessive that it can lead to "logging" the coils and create back pressure in the system. Generally a reflux divider is used below the condenser to take out the distillate.




### Vapours from top

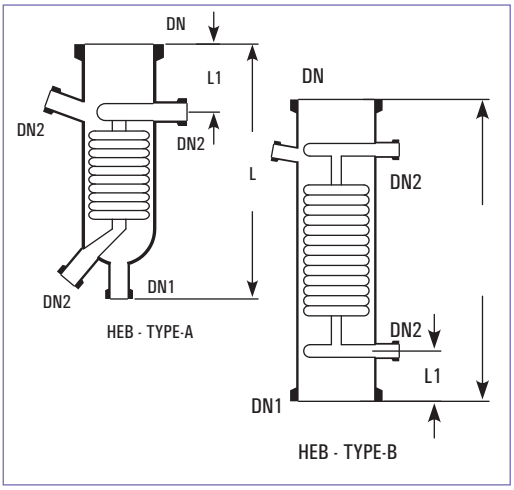
This method produce a cool condensate using the entire cooling surface area.
This method should be used where the condensate can lead to "logging" of coils.

* marked items are available fast.

## BOILERS

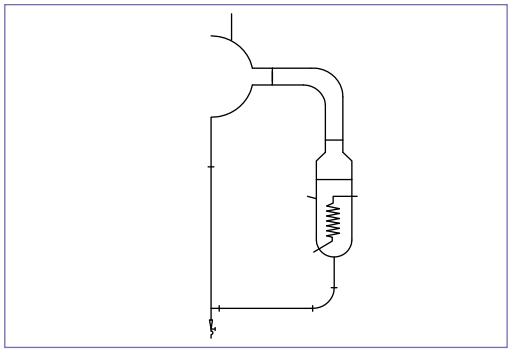
Boilers are used for vaporization of liquids by passing the steam in the coils. Boilers are made by fusing number of parallel coils in a glass shell. In Boilers, coils are designed to provide bigger cross section in the shell side as compared to condensers.
The average heat transfer in Boilers is considered as 350 Kcal/m2,hr,°C at a steam pressure of 3.5 bar.

| Cat. Ref. | DN | DN1 | DN2 | L | L1 | Type | Actual H.T.A. $m^2$ | Free Cross Area $Cm^2$ | Jacket Cap. Litre |
|---|---|---|---|---|---|---|---|---|---|
| HEB4 | 100 | 25 | 25 | 375 | 100 | A | 0.15 | 40 | 2 |
| HEB4/4 | 100 | 100 | 25 | 400 | 100 | B | 0.15 | 40 | 3 |
| HEB6 | 150 | 40 | 25 | 450 | 100 | A | 0.35 | 50 | 5 |
| HEB6/6 | 150 | 150 | 25 | 500 | 100 | B | 0.35 | 50 | 7 |
| HEB9 | 225 | 40 | 25 | 700 | 100 | A | 1.00 | 150 | 16 |
| HEB9/9 | 225 | 225 | 25 | 700 | 100 | B | 1.00 | 180 | 20 |
| HEB12/12 | 300 | 300 | 25 | 700 | 125 | B | 1.30 | 330 | 40 |




### Notes on use of Boilers :

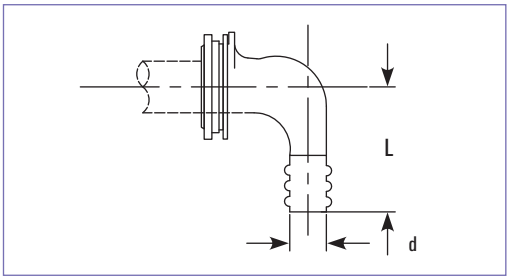
- Steam should be passed in the coils at a maximum pressure of 3.5 bar which is equivalent to a temperature of 147°C.
- For higher temperature (maximum upto 200°C) heat transfer fluids can be passed in the coils. - Cold liquids
- Cold liquids should be preheated for better results.
- Boilers should bemounted in an external circulatory loop (as shown in figure) and not direct at the bottom of flask or column
- Under certain circumstances, boilers can be mounted in series to provide larger heat transfer area.



## ANGLED HOSE CONNECTOR ASSEMBLIES

Metal / Plastic angled hose connector assemblies are available to connect the flexible hose to the condensers. These are provide with a mating flange, a rubber gasket and nut bolts.

| Cat.Ref. | DN | d | L |
|---|---|---|---|
| PMC1 | 25 | 22 | 70 |

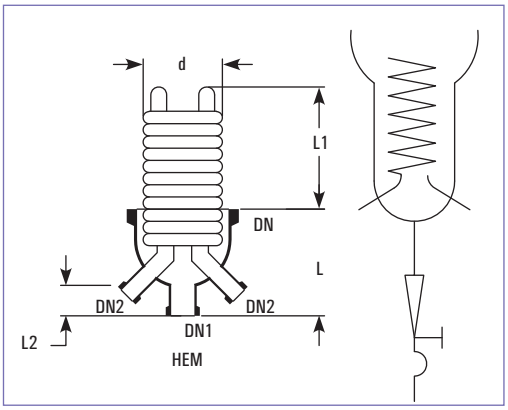



## IMMERSIONS

Immersion heat exchangers are used to control exothermic reaction in glass vessels. They can be used with vessels having wider bottom outlet (type VSR and VSE). These are provided with a central hole through the coil battery so that a special, extended type, stirrer can be fitted which extends to the bottom of heat exchanger and provide through action.

In most applications, cooling water is used in coils (max. pressure 2.7 bar g.), but they can also be used with steam (max. pressure 3.5 bar g.). In latter case the coils must be completely immersed in liquid. Immersions are not recommended for use with products which have a tendency to crystalise.

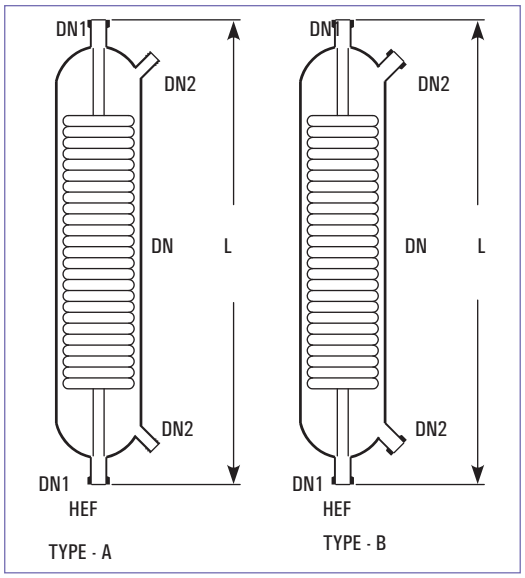
| Cat. Ref. | DN | DN1 | DN2 | L | L1 | L2 | d | Actual H.T.A. $m^2$ |
|---|---|---|---|---|---|---|---|---|
| HEM6 | 150 | 40 | 25 | 200 | 200 | 75 | 145 | 0.4 |
| HEM9 | 225 | 40 | 25 | 300 | 200 | 75 | 200 | 0.6 |






# HEAT EXCHANGERS

## PRODUCT COOLERS



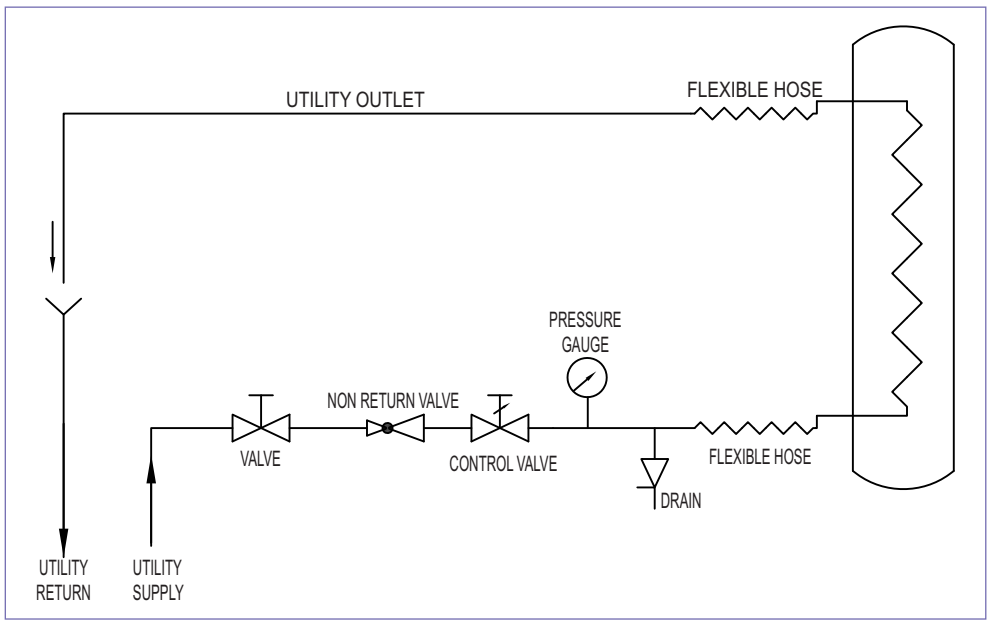

Product coolers are used for cooling of liquids, typically, for the cooling of distillates from the distillation columns.

Unlike coil condensers, in product coolers, product travels through the coil battery and coolant through shell. This provides more resident time to the product to be cooled. For direct connection with distillate lines, all the product coolers are provided with 25 DN connections.

| Cat.Ref. | DN | DN1 | DN2 | L | Actual HTA $m^2$ | Type |
|---|---|---|---|---|---|---|
| HEF1/1* | 50 | 25 | 12 | 450 | 0.1 | A |
| HEF1/2* | 50 | 25 | 12 | 600 | 0.2 | A |
| HEF1/3.5* | 80 | 25 | 16 | 600 | 0.35 | A |
| HEF1/5* | 100 | 25 | 19 | 600 | 0.5 | A |
| HEF1/10 | 150 | 25 | 25 | 600 | 0.7 | B |
| HEF1/15 | 150 | 25 | 25 | 850 | 1.25 | B |

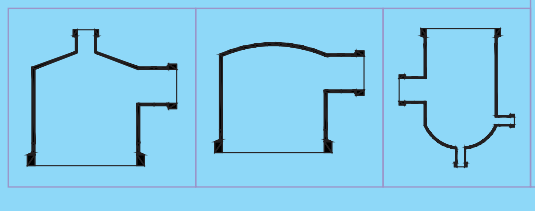
## UTILITY CONNECTION FOR CONDENSER

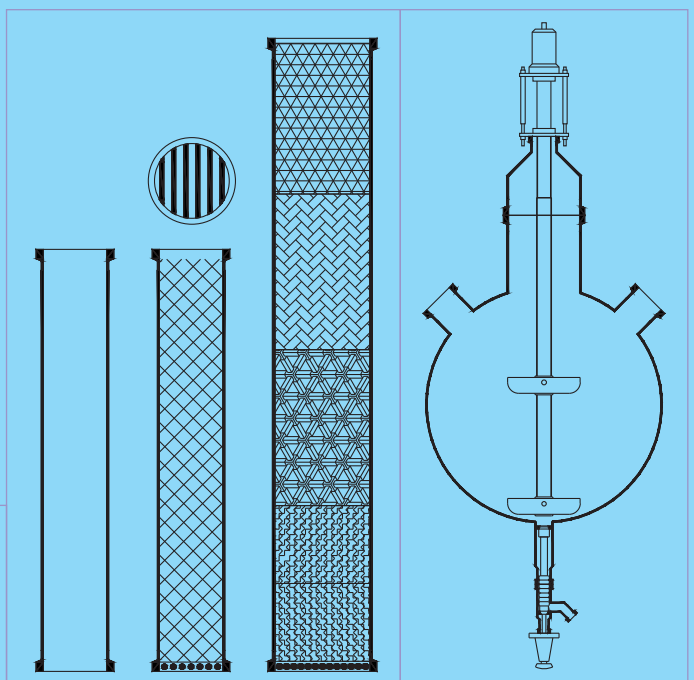
When installing coil type heat exchangers appropriate precautions should be taken. The main points to be taken into account when planning to use these items as coolers are (See also flow chart below).



# GLASS & ACCESSORIES PARTS

* Pipeline Components
* Vessel
* Stirrers
* Column Components
* Valves





**Pipeline components**

Superior Borosilicate Glass Pipelines for High-Performance Applications

Borosilicate 3.3 glass pipelines offer key advantages for industries like chemical, pharmaceutical, precious metal refining, dye works, and electroplating due to their remarkable characteristics:

1. Inert to most chemicals, eliminating contamination and ensuring pure products.
2. Transparency allows for visual monitoring of processes, flow patterns, and color changes.
3. Universal corrosion resistance ensures a long service life.
4. Smooth surface reduces pressure drop and aids in easy cleaning.
5. Easy to clean and resistant to fouling.

All components are designed to perform efficiently under full vacuum conditions. Available from DN 15 to DN 800, with DN 1000 parts available on request.

**Vessels**

Versatile Glass Vessels for Every Process

Our glass vessels serve as reactors, receivers, separators, and feed vessels, ensuring versatility in process applications.

Available in spherical (5L to 500L) and cylindrical (5L to 800L) designs, with optional glass jackets for temperature control.

Double wall jacketed Glass reactor ( 5 L to 200 L) and Triple wall jacketed Glass reactor ( 5 L to 100 L)

Each vessel features a bottom outlet, compatible with our range of valves for seamless operation.

**Stirrers**

Comprehensive Stirrer Options for Safe and Efficient Agitation

A range of stirrers and stirrer drives are available for use with glass vessels in agitated reaction equipment

1. Material Options: Glass, Stainless Steel, or PTFE Lined.
2. Design Options: Impeller, Vortex, Propeller, and Anchor Stirrers.
3. Drive Options: Non-flameproof or Flameproof, with Variable Frequency Drive at 192 RPM.
4. Sealing Options: Stirring assembly with bellow seal or mechanical seal.

**Column components**

In processes like reaction, extraction, and absorption, the transparency of borosilicate glass offers distinct advantages:

1. Inert to almost all chemicals, eliminating contamination risks.
2. Visual monitoring of flow patterns and color changes.
3. Universal resistance to corrosion for long-lasting performance.
4. Smooth surface ensures easy cleaning and prevents fouling.

**Valves**

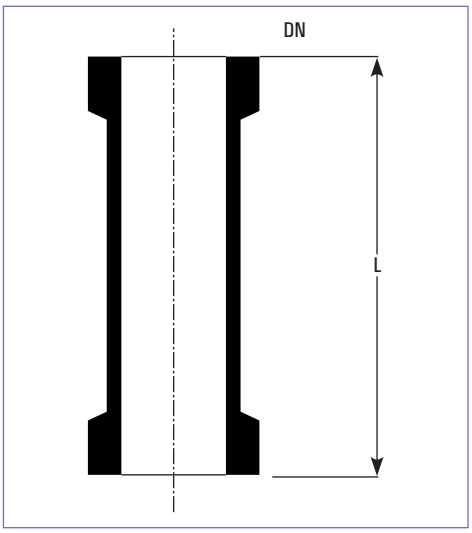
Borosilicate Valves: Seamless control for demanding applications

Borosilicate glass valves offer unmatched durability and chemical resistance. Featuring a borosilicate glass body and PTFE plug, they ensure that only glass and PTFE come in contact with process fluids—maintaining purity and integrity.

Their transparent body allows easy monitoring, while they withstand full vacuum conditions and temperatures up to 200°C.

Available in DN 15 to DN 50, with larger sizes on request.

## PIPE SECTIONS




| DN | 12 | 15 | 25 | 40 | 50 |
|---|---|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 100 | PS0.5/100 | PS0.7/100 | PS1/100* | PS1.5/100* | PS2/100* |
| 150 | PS0.5/150 | PS0.7/150 | PS1/150* | PS1.5/150* | PS2/150* |
| 200 | PS0.5/200 | PS0.7/200 | PS1/200* | PS1.5/200* | PS2/200* |
| 250 | PS0.5/250 | PS0.7/250 | PS1/250 | PS1.5/250 | PS2/250 |
| 300 | PS0.5/300 | PS0.7/300 | PS1/300* | PS1.5/300 | PS2/300 |
| 400 | PS0.5/400 | PS0.7/400 | PS1/400 | PS1.5/400 | PS2/400 |
| 500 | PS0.5/500 | PS0.7/500 | PS1/500* | PS1.5/500 | PS2/500 |
| 600 | PS0.5/600 | PS0.7/600 | PS1/600 | PS1.5/600 | PS2/600 |
| 750 | PS0.5/750 | PS0.7/750 | PS1/750 | PS1.5/750 | PS2/750 |
| 900 | PS0.5/900 | PS0.7/900 | PS1/900 | PS1.5/900 | PS2/900 |
| 1000 | PS0.5/1000 | PS0.7/1000 | PS1/1000* | PS1.5/1000* | PS2/1000* |

| DN | 80 | 100 | 150 |
|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 150 | PS3/150 | PS4/150 | PS6/150 |
| 200 | PS3/200 | PS4/200 | PS6/200 |
| 250 | PS3/250 | PS4/250 | PS6/250 |
| 300 | PS3/300 | PS4/300 | PS6/300 |
| 400 | PS3/400 | PS4/400 | PS6/400 |
| 500 | PS3/500 | PS4/500 | PS6/500 |
| 600 | PS3/600 | PS4/600 | PS6/600 |
| 750 | PS3/750 | PS4/750 | PS6/750 |
| 900 | PS3/900 | PS4/900 | PS6/900 |
| 1000 | PS3/1000* | PS4/1000* | PS6/1000* |

**World Largest Pipe Section 1000 DN**

| DN | 225 | 300 | 400 |
|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 300 | PS9/300 | PS12/300 | PS16/300 |
| 400 | PS9/400 | PS12/400 | - |
| 500 | PS9/500 | PS12/500 | PS16/500 |
| 600 | PS9/600 | PS12/600 | - |
| 750 | PS9/750 | PS12/750 | PS16/750 |
| 900 | PS9/900 | PS12/900 | - |
| 1000 | PS9/1000* | PS12/1000* | PS16/1000 |
| 1200 | PS9/1200 | PS12/1200 | PS16/1200 |
| 1500 | PS9/1500 | PS12/1500 | PS16/1500 |

| DN | 450 | 600 | 800 | 1000 |
|---|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 300 | PS18/300 | - | - | - |
| 500 | PS18/500 | PS24/500 | PS32/500 | PS40/500 |
| 750 | PS18/750 | - | - | - |
| 1000 | PS18/1000 | PS24/1000 | PS32/1000 | PS40/1000 |
| 1200 | PS18/1200 | - | - | - |
| 1500 | PS18/1500* | PS24/1500* | PS32/1500 | - |

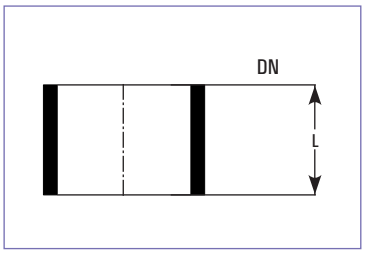
* marked items are available fast.

## SPACERS

Spacers are used to make-up small increaments in length.

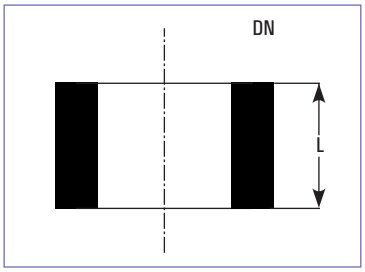
| DN | 12 | 15 | 25 | 40 | 50 |
|---|---|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 5 | SS0.5/5 | SS0.7/5 | SS1/5 | SS1.5/5 | SS2/5 |
| 15 | SS0.5/15 | SS0.7/15 | SS1/15 | SS1.5/15 | SS2/15 |
| 25 | SS0.5/25 | SS0.7/25 | SS1/25 | SS1.5/25 | SS2/25 |

* L= 50 DN or other size available on request.




## PTFE SPACERS

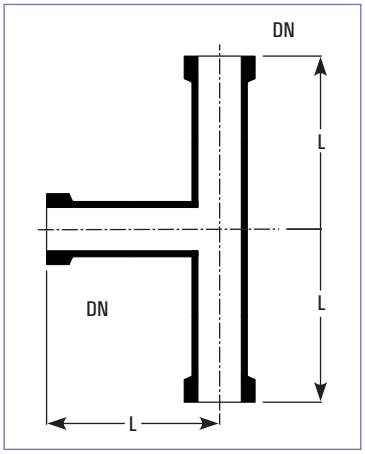
| DN | 12 | 15 | 25 | 40 | 50 |
|---|---|---|---|---|---|
| L | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. | Cat.Ref. |
| 5 | SST0.5/5 | SST0.7/5 | SST1/5 | SST1.5/5 | SST2/5 |
| 10 | SST0.5/10 | SST0.7/10 | SST1/10 | SST1.5/10 | SST2/10 |
| 15 | SST0.5/15 | SST0.7/15 | SST1/15 | SST1.5/15 | SST2/15 |
| 20 | SST0.5/20 | SST0.7/20 | SST1/20 | SST1.5/20 | SST2/20 |



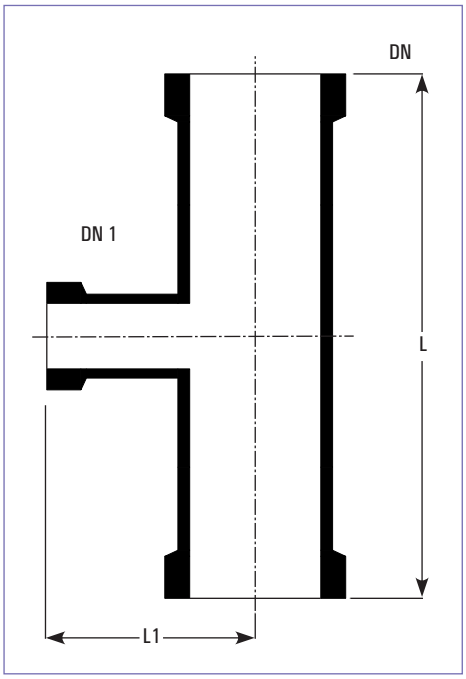

## EQUAL TEES

| Cat.Ref. | DN | L |
|---|---|---|
| PT0.5 | 12 | 50 |
| PT0.7 | 15 | 50 |
| PT1* | 25 | 100 |
| PT1.5* | 40 | 150 |
| PT2* | 50 | 150 |
| PT3 | 80 | 200 |
| PT4 | 100 | 250 |
| PT6 | 150 | 250 |
| PT9 | 225 | 375 |
| PT12 | 300 | 450 |

* marked items are available fast.



## UNEQUAL TEES

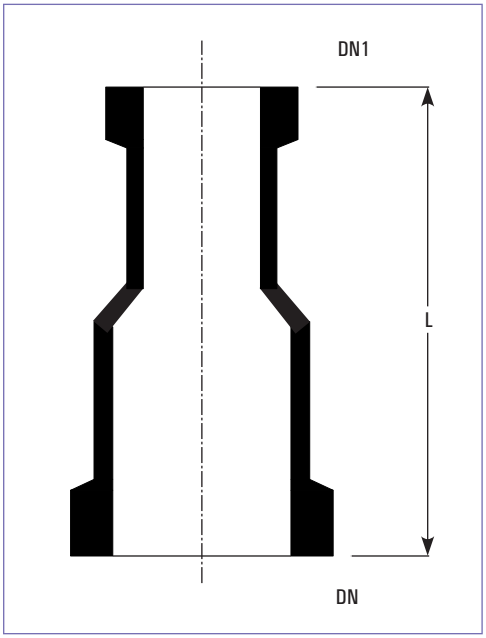



| Cat.Ref. | DN | DN1 | L | L1 |
|---|---|---|---|---|
| PTU1/0.5 | 25 | 12 | 150 | 75 |
| PTU1/0.7 | 25 | 15 | 150 | 75 |
| PTU1.5/1 | 40 | 25 | 200 | 75 |
| PTU2/1 | 50 | 25 | 200 | 80 |
| PTU2/1.5 | 50 | 40 | 200 | 100 |
| | | | | |
| PTU3/1 | 80 | 25 | 250 | 100 |
| PTU3/1.5 | 80 | 40 | 250 | 100 |
| PTU3/2 | 80 | 50 | 250 | 115 |
| | | | | |
| PTU4/1 | 100 | 25 | 250 | 110 |
| PTU4/1.5 | 100 | 40 | 250 | 125 |
| PTU4/2 | 100 | 50 | 250 | 125 |
| PTU4/3 | 100 | 80 | 300 | 150 |
| | | | | |
| PTU6/1 | 150 | 25 | 250 | 150 |
| PTU6/1.5 | 150 | 40 | 250 | 150 |
| PTU6/2 | 150 | 50 | 250 | 150 |
| PTU6/3 | 150 | 80 | 300 | 175 |
| PTU6/4 | 150 | 100 | 300 | 200 |
| | | | | |
| PTU9/1 | 225 | 25 | 300 | 185 |
| PTU9/1.5 | 225 | 40 | 300 | 185 |
| PTU9/2 | 225 | 50 | 300 | 185 |
| PTU9/3 | 225 | 80 | 300 | 210 |
| PTU9/4 | 225 | 100 | 450 | 250 |
| PTU9/6 | 225 | 150 | 450 | 275 |
| | | | | |
| PTU12/1 | 300 | 25 | 400 | 230 |
| PTU12/1.5 | 300 | 40 | 400 | 230 |
| PTU12/2 | 300 | 50 | 400 | 230 |
| PTU12/3 | 300 | 80 | 400 | 275 |
| PTU12/4 | 300 | 100 | 400 | 275 |
| PTU12/6 | 300 | 150 | 450 | 300 |
| PTU12/9 | 300 | 225 | 600 | 300 |
| | | | | |
| PTU16/1.5 | 400 | 40 | 400 | 275 |
| PTU16/2 | 400 | 50 | 400 | 275 |
| PTU16/3 | 400 | 80 | 400 | 300 |
| PTU16/4 | 400 | 100 | 400 | 300 |
| PTU16/6 | 400 | 150 | 500 | 350 |
| PTU16/9 | 400 | 225 | 800 | 450 |
| PTU16/12 | 400 | 300 | 800 | 450 |
| | | | | |
| PTU18/1.5 | 450 | 40 | 400 | 300 |
| PTU18/2 | 450 | 50 | 400 | 300 |
| PTU18/3 | 450 | 80 | 400 | 320 |
| PTU18/4 | 450 | 100 | 400 | 320 |
| PTU18/6 | 450 | 150 | 600 | 380 |
| PTU18/9 | 450 | 225 | 800 | 400 |
| PTU18/12 | 450 | 300 | 800 | 400 |
| | | | | |
| PTU24/4 | 600 | 100 | 600 | 450 |
| PTU24/6 | 600 | 150 | 600 | 450 |
| PTU24/9 | 600 | 225 | 800 | 525 |
| PTU24/12 | 600 | 300 | 800 | 525 |

* marked items are available fast.

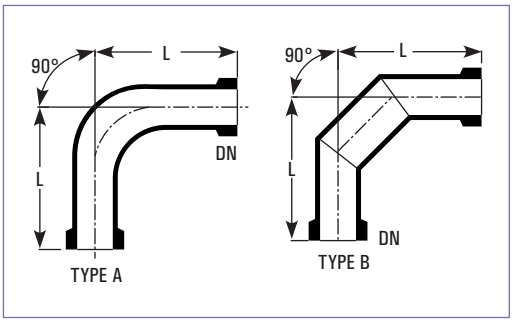
# REDUCERS

| Cat.Ref. | DN | DN1 | L |
|---|---|---|---|
| PR1/0.5 | 25 | 12 | 100 |
| PR1/0.7 | 25 | 15 | 100 |
| PR1.5/1* | 40 | 25 | 100 |
| PR2/1* | 50 | 25 | 100 |
| PR2/1.5* | 50 | 40 | 100 |
| | | | |
| PR3/1* | 80 | 25 | 125 |
| PR3/1.5* | 80 | 40 | 125 |
| PR3/2* | 80 | 50 | 125 |
| | | | |
| PR4/1* | 100 | 25 | 150 |
| PR4/1.5* | 100 | 40 | 150 |
| PR4/2* | 100 | 50 | 150 |
| PR4/3* | 100 | 80 | 150 |
| | | | |
| PR6/1* | 150 | 25 | 200 |
| PR6/1.5* | 150 | 40 | 200 |
| PR6/2* | 150 | 50 | 200 |
| PR6/3* | 150 | 80 | 200 |
| PR6/4* | 150 | 100 | 200 |
| | | | |
| PR9/1* | 225 | 25 | 250 |
| PR9/1.5* | 225 | 40 | 250 |
| PR9/2* | 225 | 50 | 250 |
| PR9/3* | 225 | 80 | 250 |
| PR9/4* | 225 | 100 | 250 |
| PR9/6* | 225 | 150 | 250 |
| | | | |
| PR12/1* | 300 | 25 | 300 |
| PR12/1.5* | 300 | 40 | 300 |
| PR12/2* | 300 | 50 | 300 |
| PR12/3* | 300 | 80 | 300 |
| PR12/4* | 300 | 100 | 300 |
| PR12/6* | 300 | 150 | 300 |
| PR12/9* | 300 | 225 | 300 |
| | | | |
| PR16/1.5 | 400 | 40 | 350 |
| PR16/2 | 400 | 50 | 350 |
| PR16/3 | 400 | 80 | 350 |
| PR16/4 | 400 | 100 | 350 |
| PR16/6 | 400 | 150 | 350 |
| PR16/9 | 400 | 225 | 350 |
| PR16/12 | 400 | 300 | 350 |
| | | | |
| PR18/1.5 | 450 | 40 | 375 |
| PR18/2 | 450 | 50 | 375 |
| PR18/3 | 450 | 80 | 375 |
| PR18/4 | 450 | 100 | 375 |
| PR18/6 | 450 | 150 | 375 |
| PR18/9 | 450 | 225 | 375 |
| PR18/12 | 450 | 300 | 375 |
| | | | |
| PR24/4 | 600 | 100 | 400 |
| PR24/6 | 600 | 150 | 400 |
| PR24/9 | 600 | 225 | 425 |
| PR24/12 | 600 | 300 | 425 |




* marked items are available fast.

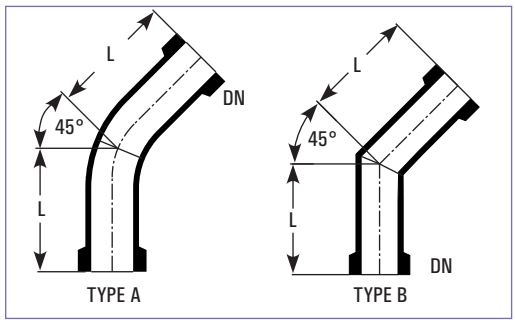
## BENDS 90$^0$




| Cat.Ref. | DN | L | TYPE |
|---|---|---|---|
| PB0.5/90 | 12 | 50 | A |
| PB0.7/90 | 15 | 50 | A |
| PB1/90* | 25 | 100 | A |
| PB1.5/90* | 40 | 150 | A |
| PB2/90* | 50 | 150 | A |
| PB3/90* | 80 | 200 | B |
| PB4/90* | 100 | 250 | B |
| PB6/90* | 150 | 250 | B |
| PB9/90* | 225 | 375 | B |
| PB12/90* | 300 | 450 | B |

Bends in 80 and 100 degree are also available with same dimensions.
Bends DN 400/DN 450/DN 600 are available on request.

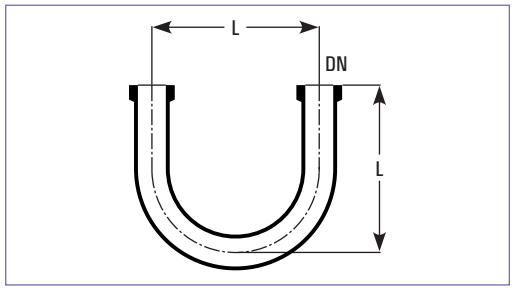
## BENDS 45$^0$




| Cat.Ref. | DN | L | TYPE |
|---|---|---|---|
| PB0.5/45 | 12 | 50 | A |
| PB0.7/45 | 15 | 50 | A |
| PB1/45* | 25 | 75 | A |
| PB1.5/45 | 40 | 100 | A |
| PB2/45 | 50 | 100 | A |
| PB3/45 | 80 | 125 | B |
| PB4/45* | 100 | 175 | B |
| PB6/45 | 150 | 250 | B |
| PB9/45 | 225 | 375 | B |

Bends in 10 and 30 degree are also available with same dimensions.

## U BENDS

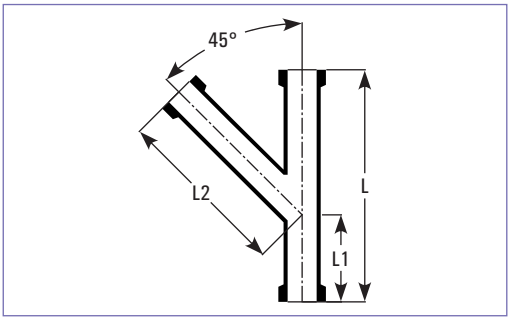



| Cat.Ref. | DN | L |
|---|---|---|
| PU0.5 | 12 | 75 |
| PU0.7 | 15 | 75 |
| PU1* | 25 | 150 |
| PU1.5* | 40 | 175 |
| PU2 | 50 | 175 |
| PU3 | 80 | 225 |

* marked items are available fast.

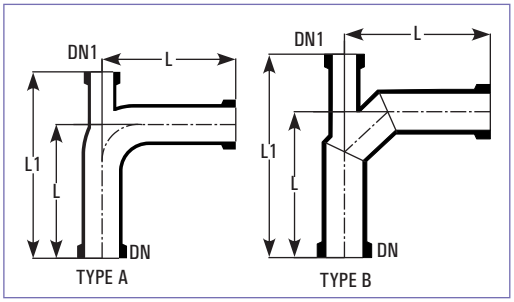
## Y BENDS

| Cat.Ref. | DN | L | L1 | L2 |
|---|---|---|---|---|
| PY0.5 | 12 | 125 | 50 | 80 |
| PY0.7 | 15 | 125 | 50 | 80 |
| PY1 | 25 | 200 | 75 | 150 |
| PY1.5 | 40 | 250 | 100 | 175 |
| PY2 | 50 | 300 | 125 | 200 |
| PY3 | 80 | 350 | 150 | 250 |
| PY4 | 100 | 450 | 150 | 350 |



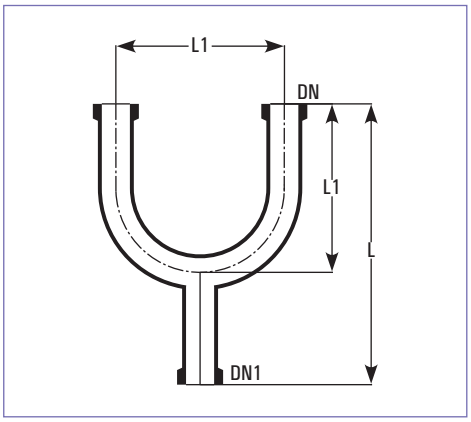

## BENDS 90° WITH THERMOMRTER BRANCH

| Cat.Ref. | DN | DN1 | L | L1 | TYPE |
|---|---|---|---|---|---|
| PBT1.5 | 40 | 25 | 150 | 225 | A |
| PBT2 | 50 | 25 | 150 | 225 | A |
| PBT3* | 80 | 25 | 200 | 275 | B |
| PBT4* | 100 | 25 | 250 | 325 | B |
| PBT6* | 150 | 25 | 250 | 325 | B |
| PBT9* | 225 | 25 | 375 | 490 | B |
| PBT12* | 300 | 25 | 450 | 560 | B |




## U BENDS WITH BOTTOM OUTLET

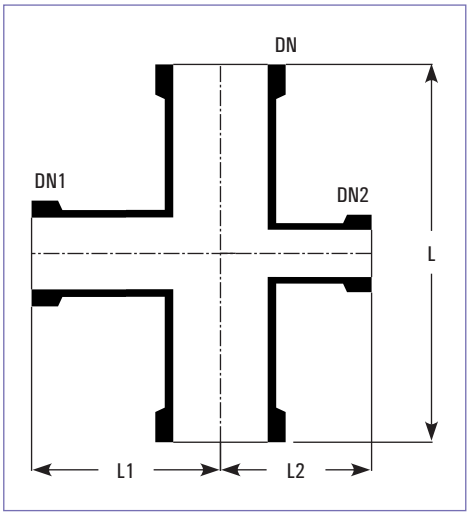
| Cat.Ref. | DN | DN1 | L | L1 |
|---|---|---|---|---|
| PUO0.5 | 12 | 12 | 150 | 100 |
| PUO1/0.5 | 25 | 12 | 250 | 150 |
| PUO0.7 | 15 | 15 | 150 | 100 |
| PUO1/0.7 | 25 | 15 | 250 | 150 |
| PUO1* | 25 | 25 | 250 | 150 |
| PUO1.5* | 40 | 40 | 275 | 175 |
| PUO1.5/1* | 40 | 25 | 275 | 175 |
| PUO2 | 50 | 50 | 275 | 175 |
| PUO2/1* | 50 | 25 | 275 | 175 |
| PUO3/1 | 80 | 25 | 350 | 225 |




* marked items are available fast.

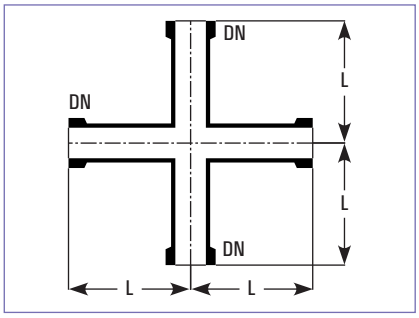
## UNEQUAL CROSSES

| Cat.Ref. | DN | DN1 | DN2 | L | L1 | L2 |
|---|---|---|---|---|---|---|
| PXU2/1/1 | 50 | 25 | 25 | 200 | 80 | 80 |
| PXU2/1.5/1 | 50 | 40 | 25 | 200 | 100 | 80 |
| | | | | | | |
| PXU3/1/1 | 80 | 25 | 25 | 250 | 100 | 100 |
| PXU3/1.5/1 | 80 | 40 | 25 | 250 | 100 | 100 |
| PXU3/2/1 | 80 | 50 | 25 | 250 | 115 | 100 |
| | | | | | | |
| PXU4/1/1 | 100 | 25 | 25 | 250 | 110 | 110 |
| PXU4/1.5/1 | 100 | 40 | 25 | 250 | 125 | 110 |
| PXU4/2/1 | 100 | 50 | 25 | 250 | 125 | 110 |
| PTU4/3/1 | 100 | 80 | 25 | 300 | 150 | 150 |
| | | | | | | |
| PXU6/1.5/1 | 150 | 40 | 25 | 250 | 150 | 150 |
| PXU6/2/1 | 150 | 50 | 25 | 250 | 150 | 150 |
| PXU6/3/2 | 150 | 80 | 50 | 300 | 175 | 150 |
| PXU6/4/2 | 150 | 100 | 50 | 300 | 200 | 150 |
| | | | | | | |
| PXU9/1.5/1.5 | 225 | 40 | 40 | 300 | 185 | 185 |
| PXU9/2/1.5 | 225 | 50 | 40 | 300 | 185 | 185 |
| PXU9/3/1.5 | 225 | 80 | 40 | 300 | 210 | 185 |
| PXU9/4/2 | 225 | 100 | 50 | 450 | 250 | 185 |
| PXU9/6/3 | 225 | 150 | 80 | 450 | 275 | 210 |
| | | | | | | |
| PXU12/2/1.5 | 300 | 50 | 40 | 400 | 230 | 230 |
| PXU12/3/1.5 | 300 | 80 | 40 | 400 | 275 | 230 |
| PXU12/4/1.5 | 300 | 100 | 40 | 400 | 275 | 230 |
| PXU12/6/2 | 300 | 150 | 50 | 450 | 300 | 230 |
| PXU12/9/3 | 300 | 225 | 80 | 600 | 300 | 275 |
| | | | | | | |
| PXU16/1.5/1.5 | 400 | 40 | 40 | 400 | 275 | 275 |
| PXU16/3/1.5 | 400 | 80 | 40 | 400 | 300 | 275 |
| PXU16/4/1.5 | 400 | 100 | 40 | 400 | 300 | 275 |
| PXU16/6/3 | 400 | 150 | 80 | 500 | 350 | 300 |
| PXU16/9/4 | 400 | 225 | 100 | 800 | 450 | 300 |
| | | | | | | |
| PXU18/1.5/1.5 | 450 | 40 | 40 | 400 | 300 | 300 |
| PXU18/3/1.5 | 450 | 80 | 40 | 400 | 320 | 300 |
| PXU18/4/1.5 | 450 | 100 | 40 | 400 | 320 | 300 |
| PXU18/6/3 | 450 | 150 | 80 | 600 | 380 | 320 |
| PXU18/9/4 | 450 | 225 | 100 | 800 | 400 | 320 |



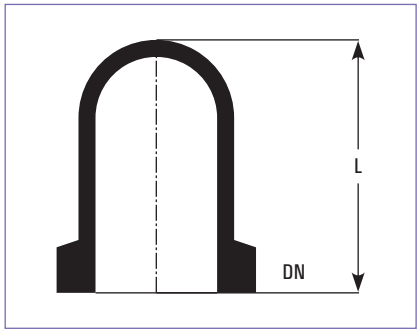

* marked items are available fast.

## EQUAL CROSSES



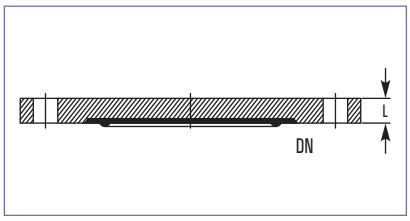

| Cat.Ref. | DN | L |
|---|---|---|
| PX0.5 | 12 | 50 |
| PX0.7 | 15 | 50 |
| PX1 | 25 | 100 |
| PX1.5 | 40 | 150 |
| PX2 | 50 | 150 |
| PX3 | 80 | 200 |
| PX4 | 100 | 250 |

## CLOSURES



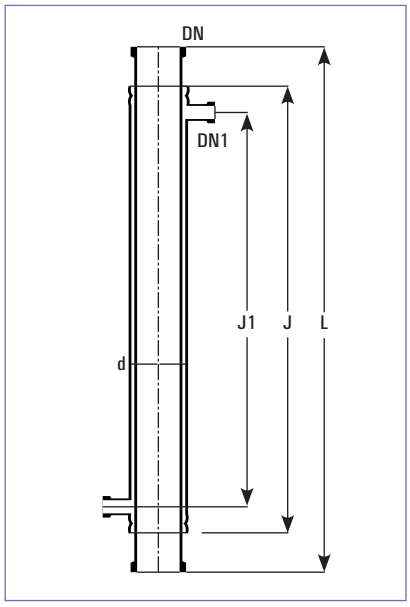

| Cat.Ref. | DN | L |
|---|---|---|
| PBE0.5 | 12 | 40 |
| PBE0.7 | 15 | 40 |
| PBE1* | 25 | 50 |
| PBE1.5* | 40 | 75 |
| PBE2* | 50 | 75 |
| PBE3* | 80 | 100 |
| PBE4* | 100 | 125 |
| PBE6* | 150 | 125 |
| PBE9 | 225 | 150 |
| PBE12 | 300 | 150 |

## BLINDS




| Cat.Ref. | DN | L |
|---|---|---|
| PBF1 | 25 | 8 |
| PBF1.5 | 40 | 8 |
| PBF2 | 50 | 8 |
| PBF3* | 80 | 8 |
| PBF4* | 100 | 8 |
| PBF6 | 150 | 9 |
| PBF9 | 225 | 9 |
| PBF12 | 300 | 9 |

## JACKETED PIPE SECTIONS




**Glass Jackets**

For heating of pipe and for controlling the temperature throughout the column, the jacketed pipe sections are provided. Glass jacket is sealed to the pipe section using Viton 'O' ring and other sealing compositions. The seal prevents impermissibly high stresses between two tubes and allows the movement which comes due to thermal expansion. Maximum operating pressure in the jacket :

| | |
|---|---|
| DN 80 - DN 150 | 1.0 bar |
| DN 225 - DN 300 | 0.5 bar |

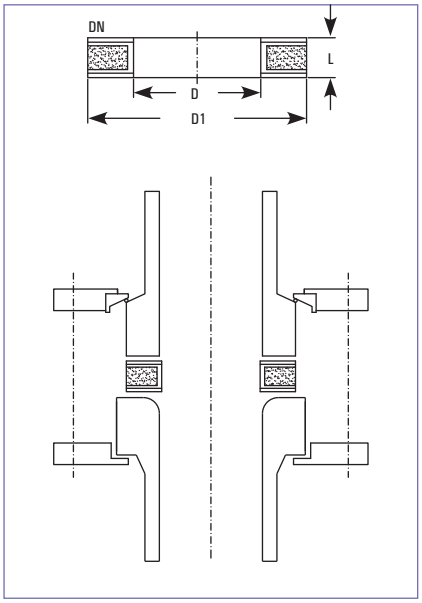
| Cat.Ref. | DN | L | d | DN1 | J | J1 |
|---|---|---|---|---|---|---|
| PSD3/1000 | 80 | 1000 | 100 | 25 | 850 | 750 |
| PSD4/1000 | 100 | 1000 | 150 | 25 | 850 | 750 |
| PSD6/1000 | 150 | 1000 | 225 | 25 | 850 | 700 |
| PSD9/1000 | 225 | 1000 | 300 | 25 | 850 | 700 |
| PSD12/1000 | 300 | 1000 | 400 | 25 | 850 | 650 |

## ADAPTOR PLATE FOR REACTORS

When reactors have a curved end nozzle, these adaptors are used as interface spacer to connect the glass/bellow with reactor.

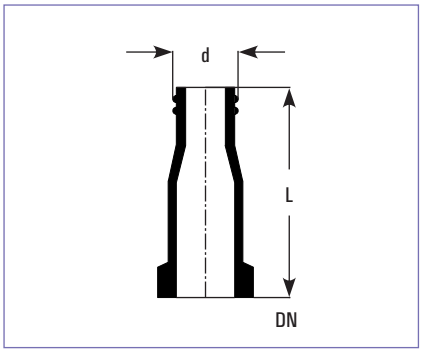
A flat metal ring with rubber cusions is enveloped with PTFE, to provide ideal sealing. Only PTFE comes in the contact of process fluid.

| Cat.Ref. | DN | D | D1 | L |
|---|---|---|---|---|
| EMP1 | 25 | 25 | 60 | 10 |
| EMP1.5 | 40 | 37 | 80 | 10 |
| EMP2 | 50 | 50 | 100 | 10 |
| EMP3 | 80 | 75 | 120 | 12 |
| EMP4* | 100 | 100 | 155 | 12 |
| EMP6* | 150 | 150 | 210 | 12 |
| EMP9* | 225 | 200 | 260 | 15 |
| EMP12* | 300 | 300 | 360 | 15 |



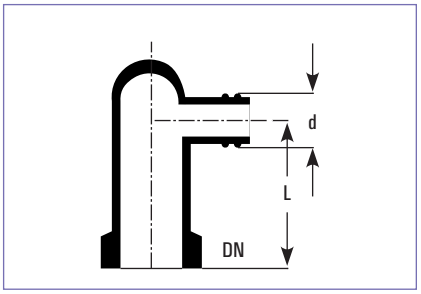

## HOSE CONNECTORS

| Cat.Ref. | DN | Thread | d | L |
|---|---|---|---|---|
| PHC0.5/0.25 | 12 | GL14 | 13.75 | 70 |
| PHC0.7/0.25 | 15 | GL14 | 13.75 | 70 |
| PHC1/1* | 25 | GL25 | 24.5 | 90 |
| PHC1/0.75 | 25 | GL18 | 17.5 | 90 |
| PHC1/0.5 | 25 | GL18 | 17.5 | 90 |
| PHC1/0.25 | 25 | GL14 | 13.75 | 90 |
| PHC1.5/1 | 40 | GL25 | 24.5 | 100 |
| PHC1.5/0.75 | 40 | GL18 | 17.5 | 100 |




## BEND HOSE CONNECTORS

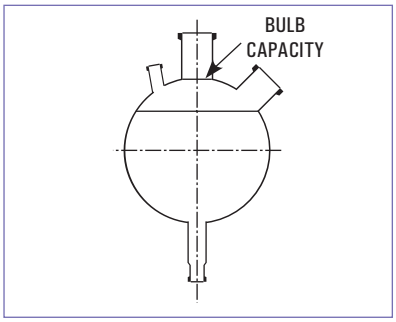
| Cat.Ref. | DN | Thread | d | L |
|---|---|---|---|---|
| PBHC0.5/0.25 | 12 | GL14 | 13.75 | 50 |
| PBHC0.7/0.25 | 15 | GL14 | 13.75 | 50 |
| PBHC1/1* | 25 | GL25 | 24.5 | 60 |
| PBHC1/0.75 | 25 | GL18 | 17.5 | 60 |
| PBHC1.5/0.75 | 40 | GL18 | 17.5 | 75 |
| PBHC2/0.75 | 50 | GL18 | 17.5 | 100 |



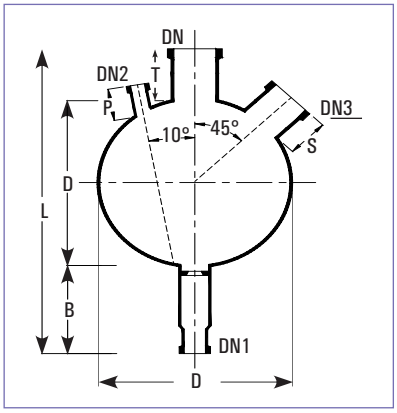

* marked items are available fast.

## SPHERICAL VESSEL - GENERAL DATA

| Nominal Capacity (Ltrs.) | Maximum Pressure (Bar) |
|---|---|
| 5 | 1 |
| 10 | 0.8 |
| 20 | 0.7 |
| 50 | 0.5 |
| 100 | 0.4 |
| 200 | 0.3 |
| 300 | 0.2 |
| 500 | 0.1 |

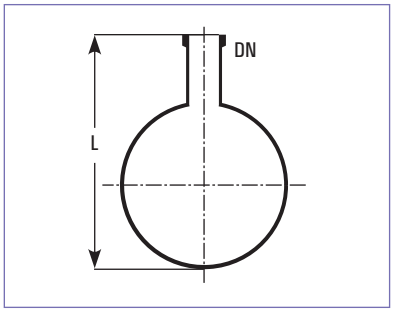



| Nominal Capacity (Ltrs.) | L | D | DN | T | DN1 | B | DN2 | P | DN3 | S |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 500 | 225 | 50 | 75 | 25 | 200 | 25 | 50 | 40 | 75 |
| 10 | 575 | 285 | 80 | 90 | 25 | 200 | 25 | 50 | 40 | 75 |
| 20 | 650 | 350 | 100 | 100 | 25 | 200 | 25 | 50 | 40 | 75 |
| 50 | 840 | 490 | 100 | 150 | 40 | 200 | 40 | 75 | 100 | 100 |
| 50A | 840 | 490 | 150 | 150 | 40 | 200 | 40 | 75 | 100 | 100 |
| 100 | 950 | 600 | 150 | 150 | 40 | 200 | 40 | 75 | 100 | 100 |
| 100A | 950 | 600 | 225 | 150 | 40 | 200 | 40 | 75 | 100 | 100 |
| 200 | 1200 | 750 | 225 | 250 | 40 | 200 | 40 | 75 | 100 | 100 |
| 200A | 1200 | 750 | 300 | 250 | 40 | 200 | 40 | 75 | 100 | 100 |
| 300 | 1310 | 860 | 300 | 250 | 50 | 200 | 50 | 75 | 100 | 100 |
| 300A | 1310 | 860 | 400 | 250 | 50 | 200 | 50 | 75 | 100 | 100 |
| 500 | 1400 | 1000 | 450 | 200 | 50 | 200 | 50 | 75 | 150 | 165 |

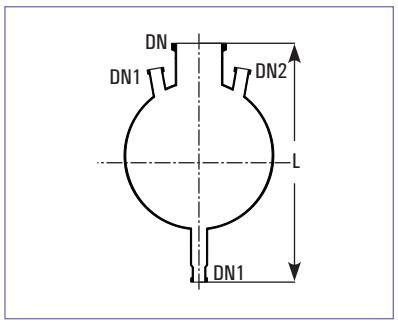



## SINGLE NECK SPHERICAL VESSELS

| Cat. Ref. | Nominal Capacity | L | DN |
|---|---|---|---|
| VSA5 | 5 L | 300 | 50 |
| VSA10 | 10 L | 375 | 80 |
| VSA20 | 20 L | 450 | 100 |
| VSA50 | 50 L | 640 | 100 |
| VSA50A | 50 L | 640 | 150 |
| VSA100 | 100 L | 750 | 150 |
| VSA100A | 100 L | 750 | 225 |
| VSA200 | 200 L | 1000 | 225 |
| VSA200A | 200 L | 1000 | 300 |
| VSA300 | 300 L | 1110 | 300 |
| VSA300A | 300 L | 1110 | 400 |
| VSA500 | 500 L | 1200 | 450 |

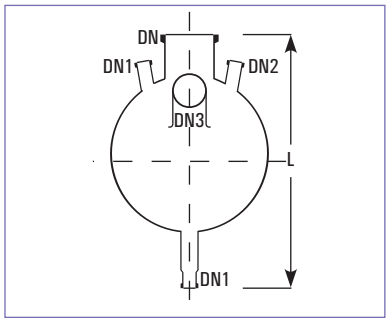


## THREE NECK BOTTOM OUTLET SPHERICAL VESSELS



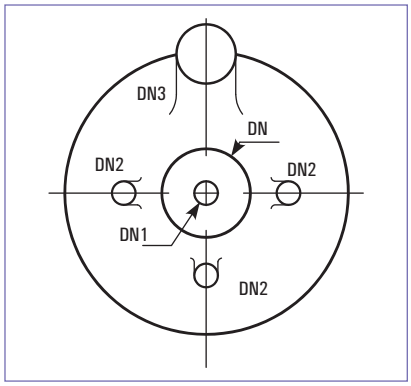

| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 |
|---|---|---|---|---|---|
| VSM5 | 5 L | 500 | 50 | 25 | 25 |
| VSM10 | 10 L | 575 | 80 | 25 | 25 |
| VSM20* | 20 L | 650 | 100 | 25 | 25 |
| VSM50* | 50 L | 840 | 100 | 40 | 40 |
| VSM50A | 50 L | 840 | 150 | 40 | 40 |
| VSM100 | 100 L | 950 | 150 | 40 | 40 |
| VSM100A | 100 L | 950 | 225 | 40 | 40 |
| VSM200 | 200 L | 1200 | 225 | 40 | 40 |
| VSM200A | 200 L | 1200 | 300 | 50 | 50 |
| VSM300 | 300 L | 1310 | 300 | 50 | 50 |
| VSM300A | 300 L | 1310 | 400 | 50 | 50 |
| VSM500 | 500 L | 1400 | 450 | 50 | 50 |

## FOUR NECK BOTTOM OUTLET SPHERICAL VESSELS




| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 | DN3 |
|---|---|---|---|---|---|---|
| VSPL5 | 5 L | 500 | 50 | 25 | 25 | 40 |
| VSPL10 | 10 L | 575 | 80 | 25 | 25 | 40 |
| VSPL20 | 20 L | 650 | 100 | 25 | 25 | 40 |
| VSPL50 | 50 L | 840 | 100 | 40 | 40 | 100 |
| VSPL50A | 50 L | 840 | 150 | 40 | 40 | 100 |
| VSPL100 | 100 L | 950 | 150 | 40 | 40 | 100 |
| VSPL100A | 100 L | 950 | 225 | 40 | 40 | 100 |
| VSPL200 | 200 L | 1200 | 225 | 40 | 40 | 100 |
| VSPL200A | 200 L | 1200 | 300 | 40 | 40 | 100 |
| VSPL300 | 300 L | 1310 | 300 | 50 | 50 | 100 |
| VSPL300A | 300 L | 1310 | 400 | 50 | 50 | 100 |
| VSPL500 | 500 L | 1400 | 450 | 50 | 50 | 150 |

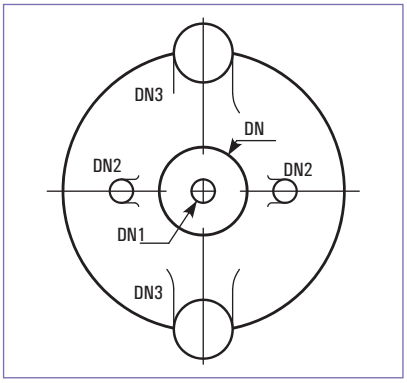
## FIVE NECK BOTTOM OUTLET SPHERICAL VESSEL




| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 | DN3 |
|---|---|---|---|---|---|---|
| VSL5 | 5 L | 500 | 50 | 25 | 25 | 40 |
| VSL10 | 10 L | 575 | 80 | 25 | 25 | 40 |
| VSL20 | 20 L | 650 | 100 | 25 | 25 | 40 |
| VSL50* | 50 L | 840 | 100 | 40 | 40 | 100 |
| VSL50A | 50 L | 840 | 150 | 40 | 40 | 100 |
| VSL100* | 100 L | 950 | 150 | 40 | 40 | 100 |
| VSL100A | 100 L | 950 | 225 | 40 | 40 | 100 |
| VSL200* | 200 L | 1200 | 225 | 40 | 40 | 100 |
| VSL200A | 200 L | 1200 | 300 | 50 | 50 | 100 |
| VSL300 | 300 L | 1310 | 300 | 50 | 50 | 100 |
| VSL300A | 300 L | 1310 | 400 | 50 | 50 | 100 |
| VSL500 | 500 L | 1400 | 450 | 50 | 50 | 150 |

## FIVE NECK BOTTOM OUTLET SPHERICAL VESSEL

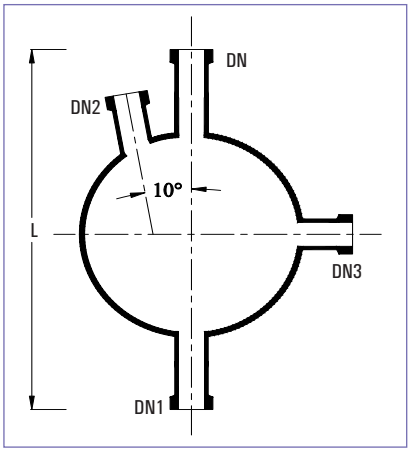
| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 | DN3 |
|---|---|---|---|---|---|---|
| VS 5 | 5 L | 500 | 50 | 25 | 25 | 40 |
| VS 10 | 10 L | 575 | 80 | 25 | 25 | 40 |
| VS 20 | 20 L | 650 | 100 | 25 | 25 | 40 |
| VS 50* | 50 L | 840 | 100 | 40 | 40 | 100 |
| VS 50A | 50 L | 840 | 150 | 40 | 40 | 100 |
| VS 100* | 100 L | 950 | 150 | 40 | 40 | 100 |
| VS 100A | 100 L | 950 | 225 | 40 | 40 | 100 |
| VS 200* | 200 L | 1200 | 225 | 40 | 40 | 100 |
| VS 200A | 200 L | 1200 | 300 | 40 | 40 | 100 |
| VS 300 | 300 L | 1310 | 300 | 50 | 50 | 100 |
| VS 300A | 300 L | 1310 | 400 | 50 | 50 | 100 |
| VS 500 | 500 L | 1400 | 450 | 50 | 50 | 150 |




## SPHERICAL VESSELS WITH NOZZLE AT 90°

These vessels are used in Circulatory Boiler System and are to be supported on a vessel holder. More nozzles can be provided on the equator on request for special requirements.

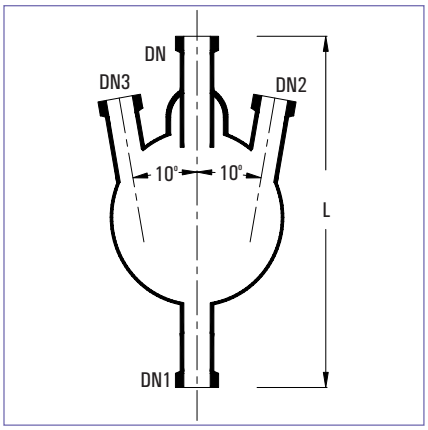
| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 | DN3 |
|---|---|---|---|---|---|---|
| VSD5 | 5 L | 425 | 50 | 25 | 25 | 40 |
| VSD10 | 10 L | 500 | 80 | 25 | 25 | 40 |
| VSD20 | 20 L | 575 | 100 | 25 | 25 | 40 |
| VSD50 | 50 L | 765 | 100 | 40 | 40 | 100 |
| VSD50A | 50 L | 765 | 150 | 40 | 40 | 100 |
| VSD100 | 100 L | 875 | 150 | 40 | 40 | 100 |
| VSD100A | 100 L | 875 | 225 | 40 | 40 | 100 |
| VSD200 | 200 L | 1125 | 225 | 40 | 40 | 100 |
| VSD200A | 200 L | 1125 | 300 | 40 | 40 | 100 |
| VSD300 | 300 L | 1235 | 300 | 50 | 50 | 100 |
| VSD300A | 300 L | 1235 | 400 | 50 | 50 | 100 |
| VSD500 | 500 L | 1375 | 450 | 50 | 50 | 150 |




## SPHERICAL RECEIVERS

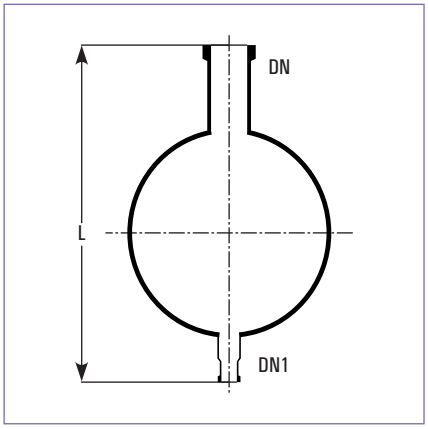
Receivers are provided with builtin Dip Pipe. These are to be supported on a vessel holding ring.

| Cat. Ref. | Nominal Capacity | L | DN | DN1 | (100) DN2 | (100) DN3 |
|---|---|---|---|---|---|---|
| VR5* | 5 L | 350 | 25 | 25 | 25 | |
| VR10* | 10 L | 425 | 25 | 25 | 25 | |
| VR20* | 20 L | 500 | 25 | 25 | 25 | |
| VR50 | 50 L | 675 | 40 | 25 | 25 | |
| | | | | | | |
| VRB5* | 5 L | 350 | 25 | 25 | 25 | 25 |
| VRB10* | 10 L | 425 | 25 | 25 | 25 | 25 |
| VRB20* | 20 L | 500 | 25 | 25 | 25 | 25 |
| VRB50 | 50 L | 675 | 40 | 25 | 25 | 25 |




* marked items are available fast.

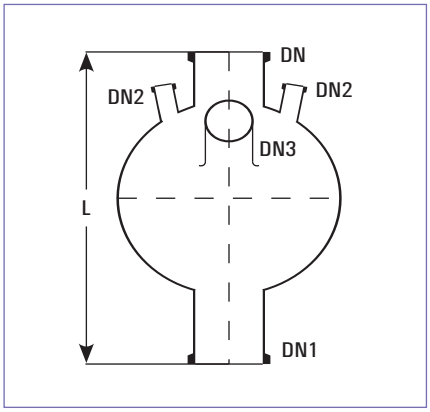
## ADDITION VESSELS




These vessels are provided with a short bottom outlet. These should be supported on a vessel holder/ holding ring.

| Cat. Ref. | Nominal Capacity | L | DN | DN1 |
|---|---|---|---|---|
| VA5 | 5 L | 375 | 50 | 25 |
| VA10 | 10 L | 450 | 80 | 25 |
| VA20 | 20 L | 525 | 100 | 25 |
| VA50 | 50 L | 715 | 100 | 40 |
| VA50A | 50 L | 715 | 150 | 40 |
| VA100 | 100 L | 875 | 150 | 40 |
| VA100A | 100 L | 875 | 225 | 40 |
| VA200 | 200 L | 1125 | 225 | 40 |
| VA200A | 200 L | 1125 | 300 | 40 |
| VA300 | 300 L | 1235 | 300 | 50 |
| VA300A | 300 L | 1235 | 400 | 50 |
| VA500 | 500 L | 1375 | 450 | 50 |

## SPHERICAL VESSELS WITH WIDE BOTTOM OUTLET




These vessels are generally used to fit immersion exchangers in the bottom. Special heating mantle or bath should be used if used with.

| Cat. Ref. | Nominal Capacity | L | DN | DN1 | DN2 | DN3 |
|---|---|---|---|---|---|---|
| VSR50 | 50 L | 790 | 100 | 150 | 40 | 100 |
| VSR50A | 50 L | 790 | 150 | 150 | 40 | 100 |
| VSR100 | 100 L | 900 | 150 | 150 | 40 | 100 |
| VRS100A | 100 L | 900 | 225 | 150 | 40 | 100 |
| VSR200 | 200 L | 1150 | 225 | 150 | 40 | 100 |
| VSR200A | 200 L | 1150 | 300 | 150 | 40 | 100 |
| | | | | | | |
| VSE50 | 50 L | 840 | 100 | 100 | 40 | 100 |
| VSE50A | 50 L | 840 | 150 | 150 | 40 | 100 |
| VSE100 | 100 L | 950 | 150 | 150 | 40 | 100 |
| VSE100A | 100 L | 950 | 225 | 225 | 40 | 100 |
| VSE200 | 200 L | 1200 | 225 | 225 | 40 | 100 |
| VSE200A | 200 L | 1200 | 300 | 300 | 40 | 100 |

* marked items are available fast.

# VESSELS WITH BOTTOM OUTLET VALVE SEAT

To fit a bottom outlet valve (BAL type) all spherical and cylindrical vessels can be supplied with valve seat in bottom outlet. For this, Add a suffix "/B" to the catalogue reference of a vessel, for e.g. 'VSL50' should be mentioned as 'VSL50/B'.

**Notes on use of Spherical vessels.**

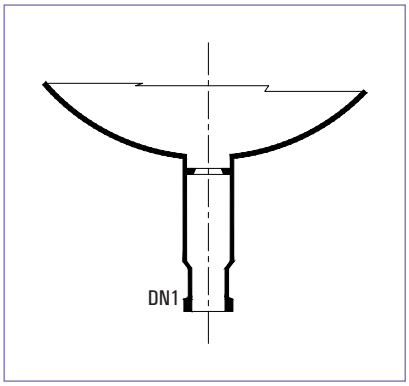
1. Generally, the centre nozzle, referred as DN in all types of vessels, is used for either stirrer fixing or if stirrer is not fixed, for vapour outlet.

2. The bottom outlet, referred as DN1 in all types is used for drain. However, in type VSR & VSE, it is also used for fixing immersion heat exchanger.

3. The small side nozzles, referred as DN2 in all types, are used
   (a) to fix thermometer pocket or,
   (b) to fix dip pipe for liquid inlet or,
   (c) to fix sparger for gas purging or,
   (d) to fix vacuum control or vent valve or,
   (e) for solid addition.

4. The bigger side nozzle, referred as DN3, is used for vapour outlet where stirrer is fixed on centre neck. It can also be used for cleaning in case centre neck is used for vapour outlet.

5. Vessels having long bottom outlet, viz VSM, VSPL, VSL, VS etc, can be supported in a heating mantle of heating bath. However, vessels having short bottom outlet, viz VSD, VR, VA etc. are to be supported on a vessel holder only. In case of vessels upto 20L size, vessel holding rings can be used instead of vessel holder.

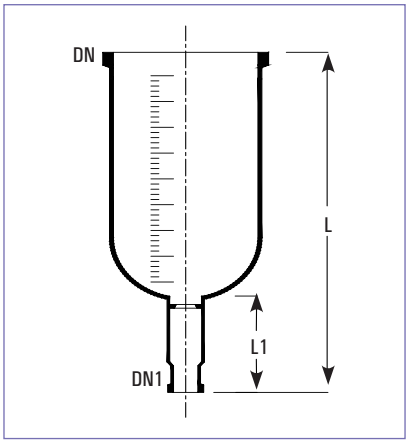



# CYLINDRICAL VESSELS

Cylindrical vessels of 50 Litres and above must be supported in a vessel holder.

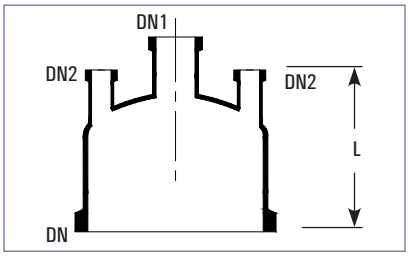
| Cat. Ref. | Nominal Capacity | DN | DN1 | L | L1 |
|---|---|---|---|---|---|
| VZ5/4 | 5 L | 100 | 25 | 875 | 200 |
| VZ10/6 | 10 L | 150 | 25 | 800 | 200 |
| VZ20/9 | 20 L | 225 | 25 | 775 | 200 |
| VZ20/12 | 20 L | 300 | 40 | 600 | 200 |
| VZ50/12 | 50 L | 300 | 40 | 1025 | 200 |
| VZ50/16 | 50 L | 400 | 40 | 735 | 200 |
| VZ100/16 | 50 L | 400 | 40 | 1075 | 200 |
| VZ100/18 | 100 L | 450 | 40 | 925 | 200 |
| VZ150/16 | 150 L | 400 | 40 | 1475 | 200 |
| VZ150/18 | 150 L | 450 | 40 | 1250 | 200 |
| VZ200/18 | 200 L | 450 | 40 | 1525 | 200 |
| VZ300/24 | 300 L | 600 | 50 | 1365 | 200 |

Note : For graduation required on vessel, additional charges will be applicable.

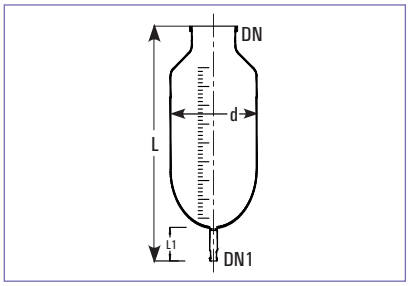



# CYLINDRICAL VESSEL COVERS

| Cat. Ref. | DN | DN1 | DN2 | L |
|---|---|---|---|---|
| VZA4 | 100 | 40 | 2x25 | 200 |
| VZA6 | 150 | 40 | 2x40 | 200 |
| VZA9 | 225 | 50 | 3x25 | 250 |
| VZA12 | 300 | 80 | 3x40 | 300 |
| VZA16 | 400 | 100 | 3x40 | 350 |
| VZA18 | 450 | 100 | 4x40 | 350 |
| VZA24 | 600 | 100 | 4x40 | 400 |



## KETTLES

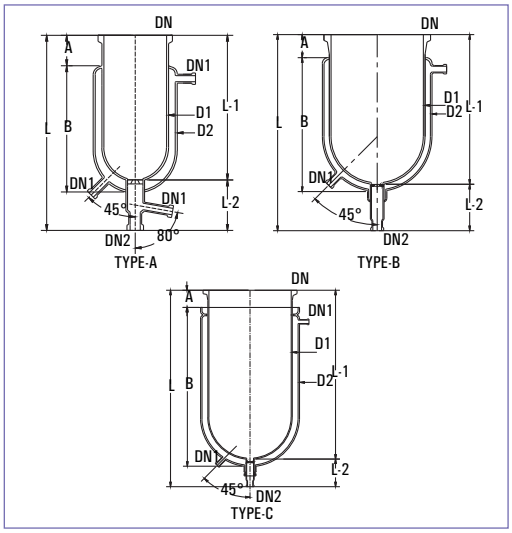



Kettles are similar to cylindrical vessels but having a reduced top neck.

| Cat. Ref. | Nominal Capacity | DN | DN1 | L | L1 | d |
|---|---|---|---|---|---|---|
| KZ200 | 200 L | 300 | 40 | 1400 | 175 | 540 |
| KZ350 | 350 L | 400 | 50 | 1500 | 175 | 620 |

Note : For graduation required on kettles, additional charges will be applicable.

## JACKETED VESSELS (Double Wall)



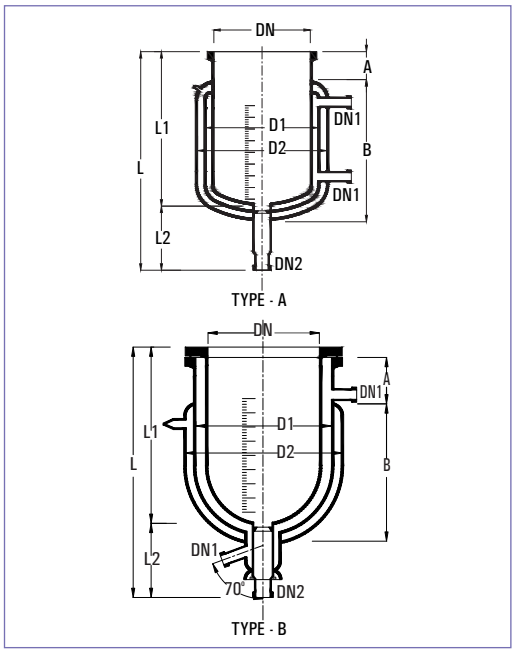

For special applications, cylindrical vessels can be supplied with a jacket for heating or cooling. Jacket is sealed to the vessel with Viton 'O' ring and other sealing compositions. The seal prevents high stresses between vessel and jacket by allowing the movement flexibility between two due to thermal expansion.

**Glass Jackets**

Glass Jacket can be used for a maximum operating pressure of 0.5 bar and a maximum operating temperature of 130°C in jacket. The temperature difference between jacket & vessel should not be exceed than120°C

| Cat. Ref. | L | L1 | L2 | A | B | D1 | D2 | DN | DN1 | DN2 | TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VZD5/6 | 575 | 450 | 125 | 75 | 400 | 165 | 215 | 150 | 15 | 25 | A |
| VZD10/9 | 650 | 450 | 200 | 90 | 385 | 230 | 280 | 225 | 25 | 25 | B |
| VZD20/12 | 700 | 500 | 200 | 100 | 430 | 315 | 370 | 300 | 25 | 40 | B |
| VZD30/12 | 800 | 600 | 200 | 100 | 535 | 315 | 370 | 300 | 25 | 40 | B |
| VZD50/12 | 1050 | 850 | 200 | 100 | 775 | 315 | 375 | 300 | 25 | 40 | B |
| VZD50/16 | 850 | 650 | 200 | 100 | 675 | 415 | 475 | 400 | 25 | 40 | B |
| VZD100/18 | 1080 | 880 | 200 | 125 | 785 | 470 | 530 | 450 | 25 | 40 | B |
| VZD200/24 | 1250 | 1050 | 200 | 125 | 975 | 615 | 720 | 600 | 25 | 40 | C |
| VZD125/24 | 1430 | 1230 | 200 | 125 | 1135 | 615 | 720 | 600 | 25 | 40 | C |
| VZD300/28 | 1400 | 1200 | 200 | 150 | 1100 | 720 | 825 | 700 | 25 | 50 | C |

## JACKETED VESSELS (TRIPLE WALL)




Goel is presenting Fused type & Detachable "Transparent Double Jacketed Vessel" to maintain the leading position in industry by way of developing indigenously newer products with higher value towards their Mission and to cater the customer via innovation.

**Salient Features**

Vacuum Jacket ensures
- Transparent insulation.
- Minimum heat loss
- Process visibility.
- Minimize frost formation for cryogenics operation.

Vacuum Jacket & main vessels are detachable ensures
- Ease of cleaning.
- No breakages due to thermal expansion.
- Partial Replacement of any part can be possible to reduce the maintenance cost.

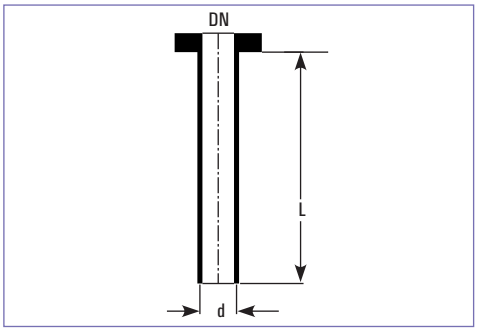
| Cat. Ref. | L | L1 | L2 | A | B | D1 | D2 | DN | DN1 | DN2 | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VZT5/6/8 | 525 | 350 | 175 | 75 | 310 | 215 | 275 | 150 | 25 | 25 | A |
| VZT10/9/12 | 595 | 420 | 175 | 90 | 370 | 315 | 390 | 225 | 25 | 25 | A |
| VZT20/12/14 | 675 | 500 | 175 | 125 | 368 | 365 | 423 | 300 | 25 | 40 | A |
| VZT50/16/18 | 825 | 650 | 175 | 200 | 350 | 465 | 523 | 400 | 25 | 40 | B |

* Fused Jacketed upto 20 Ltr. - Triple Wall
* 100 Ltr. request on available (Type-B)

## DIP PIPES

Dip pipes are used as liquid inlet for spherical vessels.

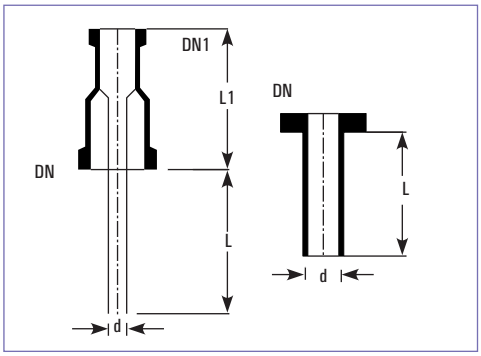
| Cat. Ref. | For Vessel | DN | DN1 | d | L |
|---|---|---|---|---|---|
| DP20/1* | 20 L | 25 | 25 | 12 | 300 |
| DP50/1.5* | 50 L | 40 | 25 | 19 | 400 |
| DP100/1.5* | 100 L | 40 | 25 | 19 | 500 |
| DP200/1.5* | 200 L | 40 | 25 | 19 | 600 |




## SHORT DIP PIPES

Short dip pipes are used as re-entry tubes for vessels, heat exchangers etc.

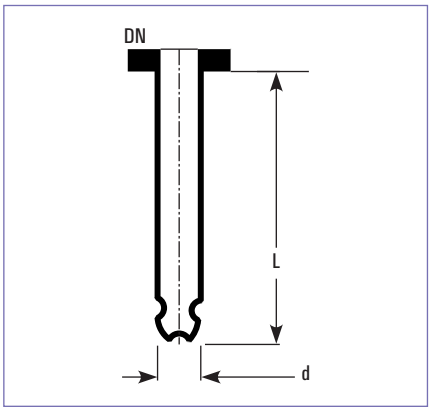
| Cat.Ref. | DN | DN1 | d | L | L1 |
|---|---|---|---|---|---|
| DP1/1 | 25 | 25 | 12 | 100 | 100 |
| DP1.5/1 | 40 | 25 | 19 | 100 | 100 |
| DP1.5/1.5 | 40 | 40 | 19 | 100 | 100 |
| DP2/1 | 50 | 25 | 25 | 100 | 100 |
| DP2/1.5 | 50 | 40 | 25 | 100 | 100 |
| DP3/1.5 | 80 | 40 | 37 | 100 | 125 |
| DP4/1 | 100 | 25 | 25 | 100 | 150 |
| DP4/2 | 100 | 50 | 50 | 100 | 150 |



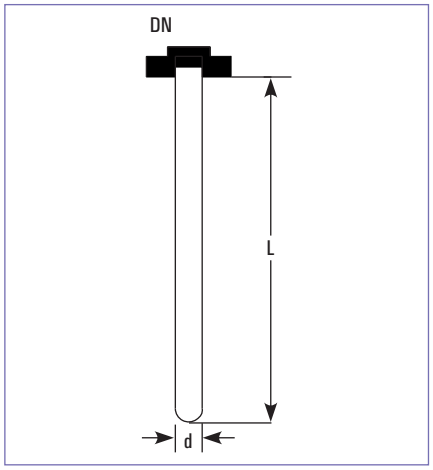

## GAS SPARGERS

Gas spargers are used for gas feed/sparging in the vessels.

| Cat.Ref. | For Vessel | DN | DN1 | d | L | No.of Holes |
|---|---|---|---|---|---|---|
| SPG20/1 | 20 L | 25 | 25 | 12 | 300 | 5x1mm |
| SPG50/1.5 | 50 L | 40 | 25 | 19 | 400 | 5x1mm |
| SPG100/1.5 | 100 L | 40 | 25 | 19 | 500 | 5x1mm |
| SPG200/1.5 | 200 L | 40 | 25 | 19 | 600 | 5x1mm |

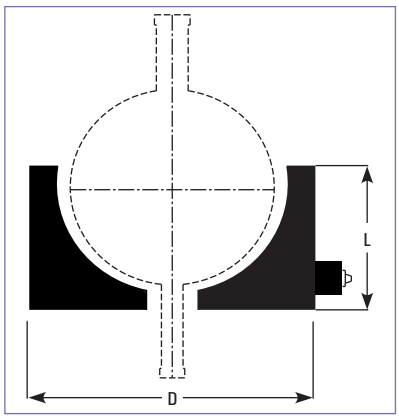


## THERMOMETER POCKETS




| Cat. Ref. | For Vessel | DN | d | L |
|---|---|---|---|---|
| TP20/1* | 20 L | 25 | 12 | 300 |
| TP50/1.5* | 50 L | 40 | 19 | 400 |
| TP100/1.5* | 100 L | 40 | 19 | 500 |
| TP200/1.5* | 200 L | 40 | 19 | 600 |

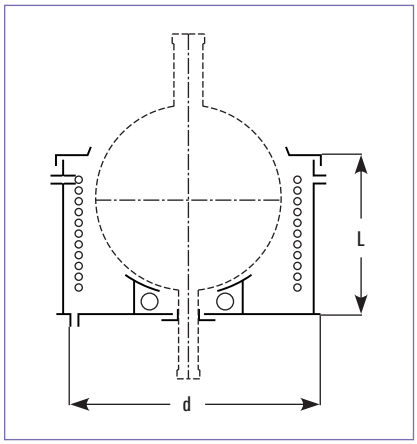
## HEATING MANTLES




Heating Mantle is used for electrical heating of cylindrical as well as spherical vessels.

| Cat.Ref. | Vessel Size | D | L | Watts | Circuits | Supply Volts |
|---|---|---|---|---|---|---|
| JMD5 | 5 L | 320 | 190 | 600 | 1 | 230 |
| JMD10 | 10 L | 380 | 220 | 1000 | 2 | 230 |
| JMD20 | 20 L | 485 | 285 | 1800 | 3 | 230 |
| JMD50 | 50 L | 600 | 345 | 3600 | 3 | 415 |
| JMD100 | 100 L | 790 | 470 | 5400 | 3 | 415 |
| JMD200 | 200 L | 920 | 530 | 8100 | 3 | 415 |

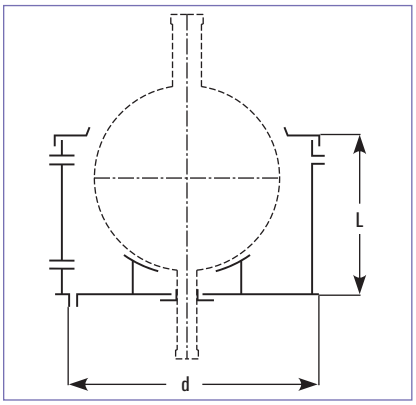
## HEATING BATHS




Heating baths are used for electrical or steam heating of glass vessels. Depending upon the temperature requirements, different types of thermic fluids or water can be used as heating media. Heating baths are provided with a pair of encased heaters with controller box, a coil for passing the steam or cooling water, a cushioned vessel holding ring, a bottom outlet sealing arrangement, a lid and threaded socket type intlets and outlets.

| Cat.Ref. | Vessel Size | d | L | Watts | HTA Vessel | HTA Coils |
|---|---|---|---|---|---|---|
| SBH20 | 20 L | 615 | 355 | 2x2000 | 0.25 | 0.4 |
| SBH50 | 50 L | 720 | 420 | 2x3000 | 0.5 | 0.6 |
| SBH100 | 100 L | 825 | 535 | 2x4500 | 0.7 | 1 |
| SBH200 | 200 L | 1000 | 630 | 2x6000 | 1 | 1.5 |
| SBH300 | 300 L | 1150 | 750 | 3x6000 | 1.85 | 2.5 |
| SBH500 | 500 L | 1385 | 880 | 4x6000 | 2.5 | 4.0 |

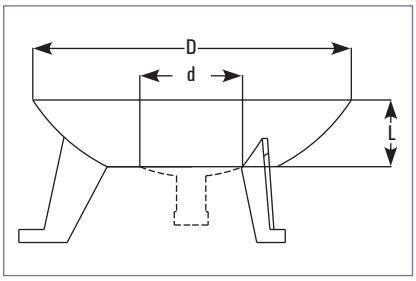
## COOLING BATHS




Cooling baths are used for cooling the glass vessel with ice crystals. Cooling Baths are provided with a vessel holding ring, bottom outlet sealing arrangement and a lid.

| Cat.Ref. | Vessel Size | d | L |
|---|---|---|---|
| BHC20 | 20 L | 480 | 340 |
| BHC50 | 50 L | 615 | 415 |
| BHC100 | 100 L | 720 | 535 |
| BHC200 | 200 L | 900 | 620 |

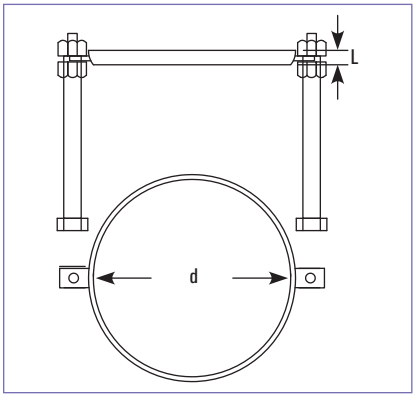
## VESSEL HOLDERS




Vessel holders are made of cast aluminum with a plaster lining shaped to fit the vessel. These are to be supported on 3 jacking bolts.

| Cat.Ref. | Vessel Size | D | d | L |
|---|---|---|---|---|
| VSS10* | 10 L | 265 | 160 | 90 |
| VSS20* | 20 L | 325 | 230 | 100 |
| VSS50* | 50 L | 390 | 230 | 100 |
| VSS100* | 100 L | 410 | 250 | 100 |
| VSS200 | 200 L | 700 | 400 | 215 |

## VESSEL HOLDING RINGS




These metal rings are wrapped with asbestos rope and are to be supported on two jacking bolts.

| Cat.Ref. | Vessel Size | d | L |
|---|---|---|---|
| VRS2 | 2 L | 100 | 15 |
| VRS5* | 5 L | 150 | 15 |
| VRS10* | 10 L | 215 | 15 |
| VRS20* | 20 L | 310 | 15 |

* marked items are available fast.

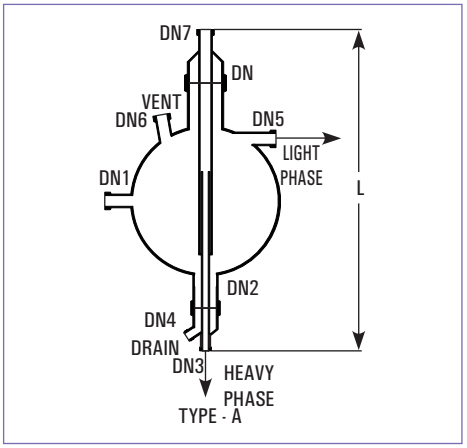
# DECANTORS

Decantation is a process of separation of two immiscible liquids having different densities. When these liquids allowed to settle forms two distinct layers, heavier at bottom and lighter at top. Goel has developed a Decantor which is suitable for continuous decantation.

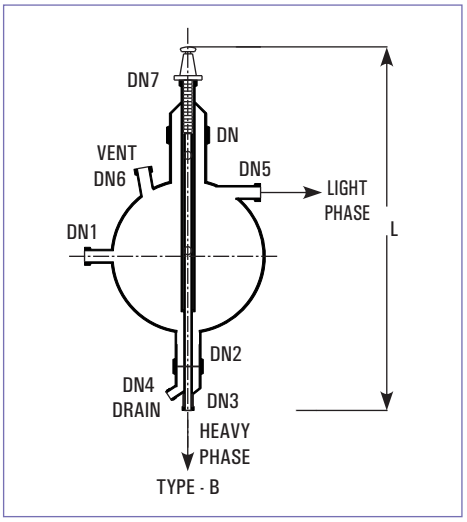
The mixture of liquids is continuously fed in the Decantor at low velocity. This allow sufficient residence time for the formation of separate layers. The light phase liquid is continuously removed from the light phase outlet at the top. The heavy phase liquid enters the dip pipe at lower end and overflow in the discharge pipe and is removed from the bottom.

Goel's Decantor provides continuous separation, visual monitoring, and ensure separation even after feed is stopped.

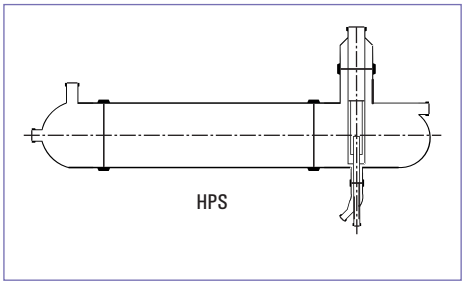
Decantors can be provided with Adjustable overflow valve, (Type B) to adjust the position of interface for different operating situations.

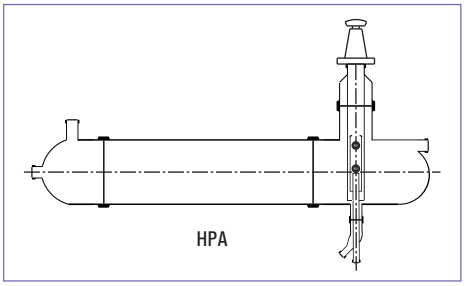



| Cat. Ref. | Nominal Capacity | L | DN | Inlet DN1 | DN2 | Heavy Phase Outlet DN3 | Drain DN4 | Light Phase Outlet DN5 | Vent DN6 | DN7 | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPS20 | 20 L | 800 | 80 | 25 | 50 | 25 | 25 | 25 | 25 | 50 | A |
| SPS50 | 50 L | 1025 | 100 | 40 | 50 | 25 | 25 | 40 | 40 | 50 | A |
| SPS100 | 100 L | 1175 | 150 | 40 | 50 | 25 | 25 | 40 | 40 | 50 | A |
| SPS200 | 200 L | 1475 | 225 | 40 | 50 | 25 | 25 | 40 | 40 | 50 | A |
| | | | | | | | | | | | |
| SPA20 | 20 L | 1000 | 80 | 25 | 50 | 25 | 25 | 25 | 25 | 50 | B |
| SPA50 | 50 L | 1225 | 100 | 40 | 50 | 25 | 25 | 40 | 40 | 80 | B |
| SPA100 | 100 L | 1375 | 150 | 40 | 50 | 25 | 25 | 40 | 40 | 80 | B |
| SPA200 | 200 L | 1675 | 225 | 40 | 50 | 25 | 25 | 40 | 40 | 80 | B |



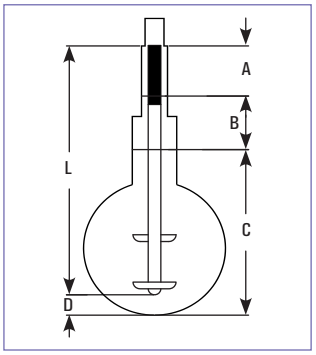

Decantors can also be constructed with horizontal cylindrical vessels (Cat.ref. HPS or HPA) to provide larger separating surface.



# STIRRERS

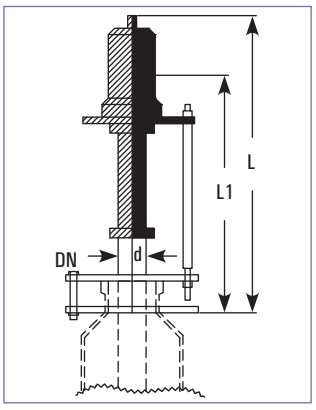
Stirrers are assembled in a vessel using a chuck, seal & a reducer. A typical arrangement of stirrer fitted in a vessel is shown in the diagram.




| Size | A | B | C | D | L |
|---|---|---|---|---|---|
| 20 L | 250 | 150 | 450 | 25 | 825 |
| 50 L | 300 | 200 | 600 | 50 | 1050 |
| 100 L | 300 | 250 | 700 | 50 | 1200 |
| 200 L | 300 | 300 | 900 | 50 | 1450 |
| 300L | 300 | 25 | 1000 | 50 | 1275 |

## CHUCK & SEAL

This unit is suitable for use under corrosive conditions. Only glass and PTFE are exposed to process fluids. Bellow seal can be used under vacuum down to 10mm Hg absolute. Mechanical seal can be use under vacuum 1mm Hg absolute or under pressure permitted into glass vessels. Generally a reducer is require to connect the chuck and seal to top neck of the vessel

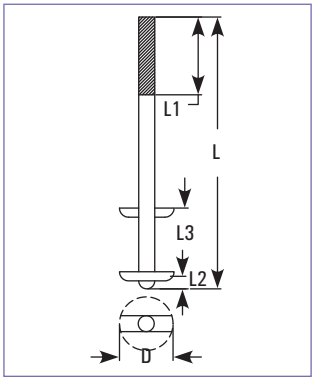



| Cat.Ref. Bellow Seal | Cat.Ref. Mechanical Seal | Vessel | DN | L | L1 | d |
|---|---|---|---|---|---|---|
| CSA1* | CSM1* | 20 L | 50 | 300 | 250 | 25 |
| CSA1.5* | CSM1.5* | 50,100, 200 L | 80 | 360 | 300 | 47 |

## STIRRER WITH TEFLON BLADES

These stirrers are used with liquid of low viscosity.

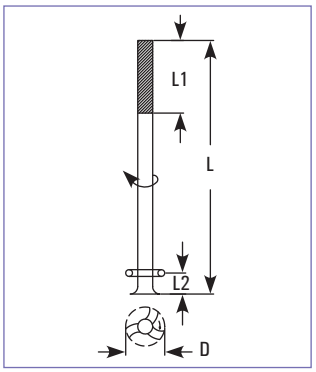
| Cat.Ref. | Vessel | L | L1 | L2 | L3 | d | D |
|---|---|---|---|---|---|---|---|
| STB10 | 10 | 600 | 300 | 15 | 175 | 25 | 100 |
| STB20 | 20 | 825 | 300 | 25 | 200 | 25 | 100 |
| STB50* | 50 | 1050 | 300 | 25 | 200 | 47 | 150 |
| STB100* | 100 | 1200 | 300 | 30 | 250 | 47 | 175 |
| STB200* | 200 | 1450 | 300 | 30 | 325 | 47 | 200 |
| STB300 | 300 | 1550 | 350 | 30 | 425 | 59 | 275 |




## VORTEX STIRRER

These stirrers are used with liquid of low viscosity containing small solid particles.

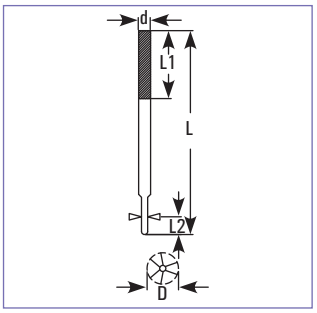
| Cat.Ref. | Vessel | L | L1 | L2 | d | D |
|---|---|---|---|---|---|---|
| STV50 | 50 | 1050 | 300 | 50 | 47 | 95 |
| STV100 | 100 | 1200 | 300 | 65 | 47 | 140 |
| STV200 | 200 | 1450 | 300 | 65 | 47 | 190 |




## PROPELLER STIRRER

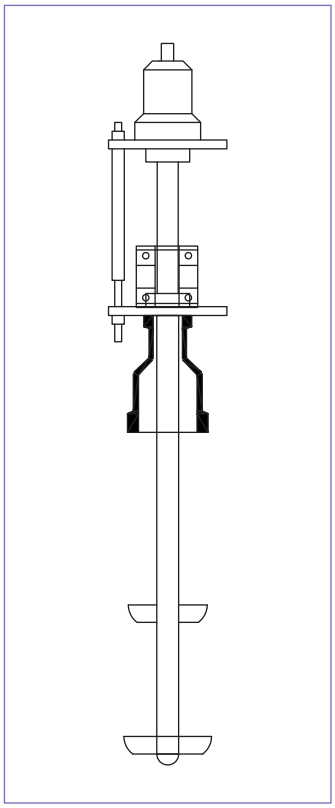
These stirrers are used with liquid of high viscosity or liquid with big solid particles.

| Cat.Ref. | Vessel | L | L1 | L2 | d | D |
|---|---|---|---|---|---|---|
| STP50 | 50 | 1050 | 300 | 50 | 47 | 95 |
| STP100 | 100 | 1200 | 300 | 65 | 47 | 145 |
| STP200 | 200 | 1450 | 300 | 65 | 47 | 210 |




* marked items are available fast.

## STIRRING ASSEMBLY WITH MECHANICAL SEAL

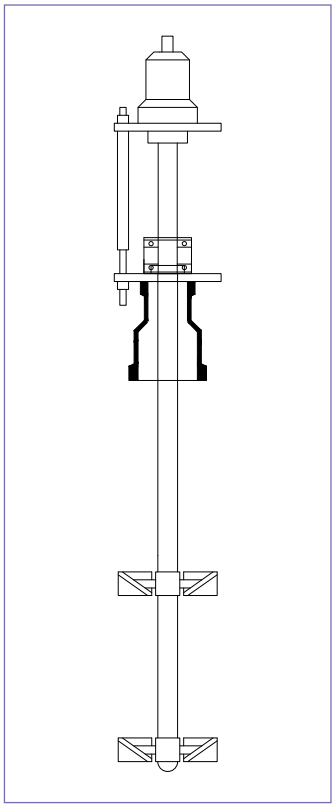


A stirrer is assembled in chuck with mechanical seal and appropriate reducer. This assembly is convenient to install on a vessel. The assembly consist of :

a. Glass stirrer STB/STV/STP
b. Chuck and mechanical seal CSM
c. Reducer PR

| Cat. Ref. | For Vessel | Stirrer Used | Chuck & Seal | Reducer Used |
|---|---|---|---|---|
| STBM20 | 20L | STB20 | CSA1 | PR4/2 |
| STBM50* | 50L | STB50 | CSA1.5 | PR6/3 |
| STBM100* | 100L | STB100 | CSA1.5 | PR9/3 |
| STBM200 | 200L | STB200 | CSA1.5 | PR12/3 |
| STBM300 | 300L | STB300 | CSA2 | PR16/3 |
| | | | | |
| STVM50 | 50L | STV50 | CSA1.5 | PR6/3 |
| STVM100 | 100L | STV100 | CSA1.5 | PR9/3 |
| STVM200 | 200L | STV200 | CSA1.5 | PR12/3 |
| STVM300 | 300L | STV300 | CSA2 | PR16/3 |
| | | | | |
| STPM50 | 50L | STP50 | CSA1.5 | PR6/3 |
| STPM100 | 100L | STP100 | CSA1.5 | PR9/3 |
| STPM200 | 200L | STP200 | CSA1.5 | PR12/3 |
| STPM300 | 300L | STP300 | CSA2 | PR16/3 |

## STIRRING ASSEMBLY SS PTFE LINED



| Cat. Ref. | For Vessel | Stirrer Used | Chuck & Seal | Reducer Used |
|---|---|---|---|---|
| STBM20/P | 20L | SS PTFE LINED | CSA1 | PR4/2 |
| STBM50/P | 50L | SS PTFE LINED | CSA1.5 | PR6/3 |
| STBM100/P | 100L | SS PTFE LINED | CSA1.5 | PR9/3 |
| STBM200/P | 200L | SS PTFE LINED | CSA1.5 | PR12/3 |
| STBM300/P | 300L | SS PTFE LINED | CSA2 | PR16/3 |
| | | | | |
| STVM50/P | 50L | SS PTFE LINED | CSA1.5 | PR6/3 |
| STVM100/P | 100L | SS PTFE LINED | CSA1.5 | PR9/3 |
| STVM200/P | 200L | SS PTFE LINED | CSA1.5 | PR12/3 |
| STVM300/P | 300L | SS PTFE LINED | CSA2 | PR16/3 |
| | | | | |
| STPM50/P | 50L | SS PTFE LINED | CSA1.5 | PR6/3 |
| STPM100/P | 100L | SS PTFE LINED | CSA1.5 | PR9/3 |
| STPM200/P | 200L | SS PTFE LINED | CSA1.5 | PR12/3 |
| STPM300/P | 300L | SS PTFE LINED | CSA2 | PR16/3 |

* marked items are available fast.

## FLAMEPROOF STIRRER DRIVES

A 1400 RPM 3 Phase flameproof motor coupled with reduction gear is supplied along with a flexible shaft. Motor is mounted on a metal base frame, which is designed to install easily with a Glass Assembly.

| Cat.Ref. | HP | RPM |
|---|---|---|
| FSD 0.5* | 0.5 | 192 |
| FSD 1 | 1 | 192 |

## VARIABLE FREQUENCY DRIVE (VFD)

3 Phase Non-Flameproof and Flameproof VFD Type are available to control the speed of stirrer drives, 50-192 RPM, Speed controller.

| Cat.Ref. | Phase | Type |
|---|---|---|
| VFD 0.5* | 3 | VFD |

## EXPLOSION PROOF PANEL

3 Phase explosion proof panel are also available.

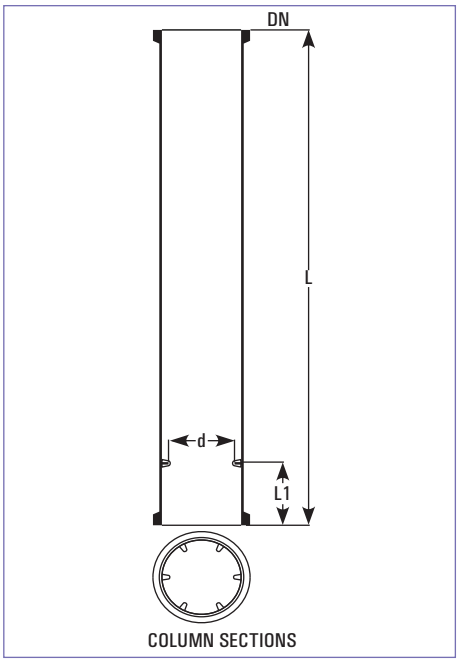
## EXPLOSION PROOF STIRRER DRIVE

We also offer Ex certified motor coupled with bonfiglioli gearbox for better safety and performance.

| Cat.Ref. | HP | RPM |
|---|---|---|
| FSD 0.5/ Ex | 0.5 | 192 |

* marked items are available fast.

# COLUMN SECTIONS



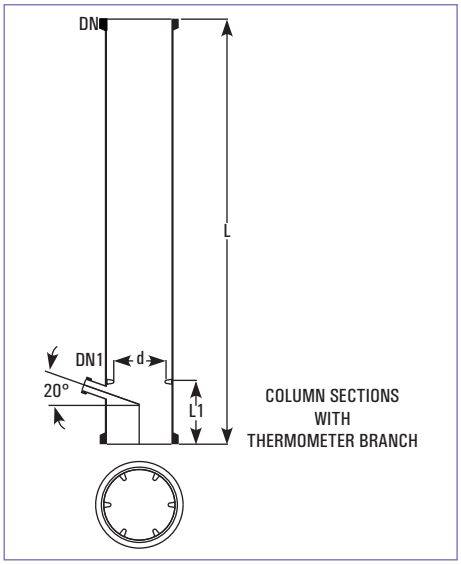
COLUMN SECTIONS

Column can be constructed either by using pipe sections with support plates or using column sections with packing supports.

Column sections are provided with fused shelf where packing support can rest.

| Cat.Ref. | DN | L | L1 | Minimum packing Size | Usual packing Size |
|---|---|---|---|---|---|
| CS3/1000 | 80 | 1000 | 75 | 9 | 12 |
| CS4/1000 | 100 | 1000 | 75 | 12 | 15 |
| CS6/1000 | 150 | 1000 | 75 | 15 | 25 |
| CS6/1500 | 150 | 1500 | 75 | 15 | 25 |
| CS9/1000 | 225 | 1000 | 100 | 20 | 25 |
| CS9/1500 | 225 | 1500 | 100 | 20 | 25 |
| CS12/1000 | 300 | 1000 | 100 | 25 | 25 |
| CS12/1500 | 300 | 1500 | 100 | 25 | 25 |
| CS16/1000 | 400 | 1000 | 150 | 25 | 25 |
| CS16/1500 | 400 | 1500 | 150 | 25 | 25 |
| CS18/1000 | 450 | 1000 | 150 | 25 | 25 |
| CS18/1500 | 450 | 1500 | 150 | 25 | 25 |
| CS24/1000 | 600 | 1000 | 200 | 40 | 40 |

# COLUMN SECTIONS WITH THERMOMETER BRANCH



COLUMN SECTIONS WITH THERMOMETER BRANCH

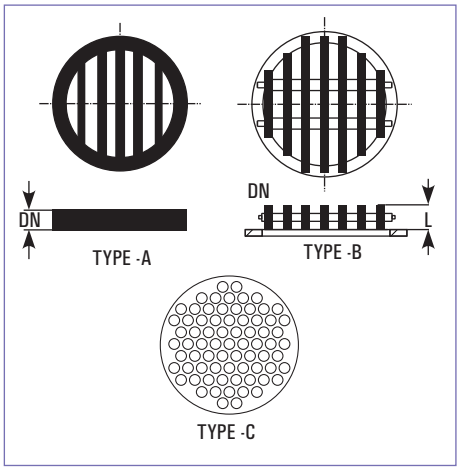
Above column sections can be provided with a thermometer branch below the packing shelf at 20° slope

| Cat.Ref. | DN | DN1 | L | L1 | d |
|---|---|---|---|---|---|
| CST3/1000 | 80 | 25 | 1000 | 125 | 50 |
| CST4/1000 | 100 | 25 | 1000 | 125 | 75 |
| CST6/1000 | 150 | 25 | 1000 | 125 | 125 |
| CST6/1500 | 150 | 25 | 1500 | 125 | 125 |
| CST9/1000 | 225 | 25 | 1000 | 150 | 175 |
| CST9/1500 | 225 | 25 | 1500 | 150 | 175 |
| CST12/1000 | 300 | 25 | 1000 | 150 | 250 |
| CST12/1500 | 300 | 25 | 1500 | 150 | 250 |
| CST16/1000 | 400 | 25 | 1000 | 200 | 250 |
| CST16/1500 | 400 | 25 | 1500 | 200 | 350 |
| CST18/1000 | 450 | 25 | 1000 | 200 | 400 |
| CST18/1500 | 450 | 25 | 1500 | 200 | 400 |
| CST24/1000 | 600 | 25 | 1000 | 250 | 540 |

## PACKING SUPPORTS

Packing supports Type A are made of fused glass rods. Packing supports Type B (heavy duty) are made of PTFE Blocks with holes.

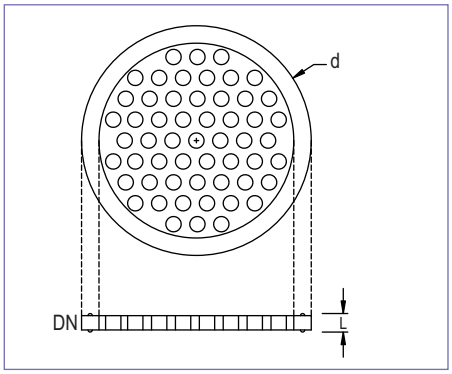
| Cat.Ref. Size | DN | L | Cross Section Area | Max. Load Kgs. | Minimum Packing | Type |
|---|---|---|---|---|---|---|
| CP3* | 80 | 10 | 45% | 10 | 12 | A |
| CP4* | 100 | 12 | 50% | 15 | 15 | A |
| CP6* | 150 | 15 | 55% | 30 | 25 | A |
| CP9* | 225 | 19 | 60% | 50 | 25 | A |
| CP12* | 300 | 19 | 65% | 75 | 25 | A |
| | | | | | | |
| HD16 | 400 | 70 | 70% | 150 | 25 | B |
| HD18 | 450 | 70 | 70% | 200 | 25 | B |
| HD24 | 600 | 95 | 70% | 300 | 40 | B |
| | | | | | | |
| HDP16 | 400 | 45-50 | 57% | 100 | 25 | C |
| HDP18 | 450 | 45-50 | 54% | 100 | 25 | C |
| HDP24 | 600 | 45-50 | 58% | 150 | 40 | C |




## PTFE PERFORATED PLATES

These are used as packing retainers to prevent the packing from lifting due to vapour velocity. These can be clamped between two components without using any gasket.

| Cat.Ref. | DN | d | L |
|---|---|---|---|
| TCP3 | 80 | 99 | 7 |
| TCP4 | 100 | 132 | 9 |
| TCP6 | 150 | 184 | 10 |
| TCP9 | 225 | 254 | 12 |
| TCP12 | 300 | 340 | 16 |
| TCP16 | 400 | 463 | 25 |
| TCP18 | 450 | 525 | 25 |
| TCP24 | 600 | 689 | 30 |




### Packings require for various pipe sections (Kgs.)

| Pipe Section | Packing size Vol (L) | FCB | FCB 12 | FCB 15 | FCB 25 | FCB 40 | FCB 50 |
|---|---|---|---|---|---|---|---|
| PS3/1000 | 5 | 3 | 3 | 2 | - | - | - |
| PS4/1000 | 8 | - | 4 | 3 | 3 | - | - |
| PS6/1000 | 18 | - | 9 | 7 | 7 | - | - |
| PS9/1000 | 37 | - | - | 15 | 15 | 15 | - |
| PS12/1000 | 66 | - | - | 17 | 30 | 25 | - |
| PS16/1000 | 125 | - | - | - | 65 | 50 | 53 |
| PS18/1000 | 165 | - | - | - | 90 | 65 | 70 |
| PS24/1000 | 295 | - | - | - | - | 115 | 125 |

### Notes of use of Column Packing

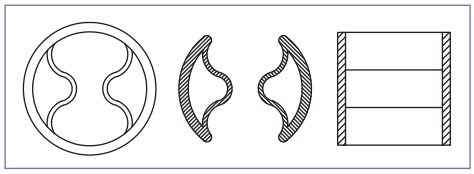
- Due to their low bulk densities, Glass Raschig rings are particularly suitable for packing glass columns.
- Generally, the ratio of Column diameter to packing diameter should not be less than 8:1.
- When using smaller packing size, a small layer of larger packing should be used on packing support, to prevent the smaller packing falling through.
- In vacuum application and applications involving high vapour velocities, packing may be lifted and may damage to other parts. To prevent this, a packing retainer (PTFE perforated plates) should be used above the packed section.

## COLUMN PACKING-RASCHIG RINGS

Raschig ring ranging from 8 mm to 50 mm are available in 3.3. Borosilicate glass.

| Cat. Ref. | Size | Bulk Density Kg/Ltr | Specific Surface $m^2/m^3$ | Glass |
|---|---|---|---|---|
| FCB8 | 8x8 | 0.66 | 633 | Borosilicate |
| FCB10 | 10x10 | 0.52 | 487 | Borosilicate |
| FCB12 | 12x12 | 0.48 | 425 | Borosilicate |
| FCB15 | 15x15 | 0.43 | 330 | Borosilicate |
| FCB20 | 20x20 | 0.30 | 300 | Borosilicate |
| FCB25 | 25x25 | 0.28 | 240 | Borosilicate |
| FCB30 | 30x30 | 0.27 | 180 | Borosilicate |
| FCB40 | 40x40 | 0.22 | 160 | Borosilicate |
| FCB50 | 50x50 | 0.19 | 120 | Borosilicate |

## PALL RINGS

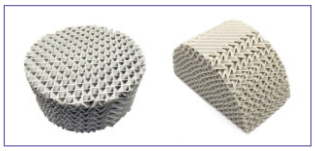


Pall Rings are also available for column packing as per below specification.

| Cat.Ref. | Size | Bulk Density Kg/Ltr | Specific Surface $m^2/m^3$ | Glass |
|---|---|---|---|---|
| FCP30 | 30x30 | 0.38 | 234 | Borosilicate |
| FCP40 | 40x40 | 0.32 | 187 | Borosilicate |
| FCP50 | 50x50 | 0.26 | 140 | Borosilicate |

## CERAMIC PACKAGING

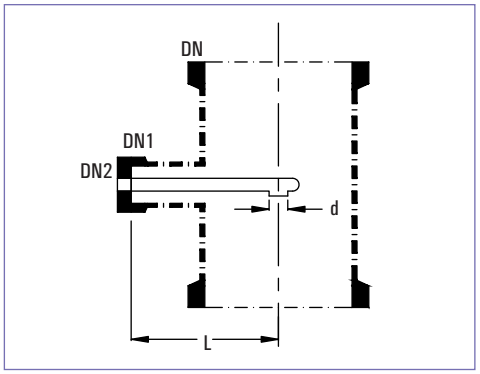
Ceramic Saddles/Rings



Ceramic Structured

Available on Request

## COLUMN FEED PIPE

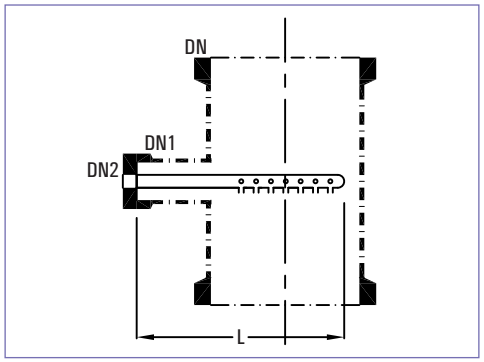



Feed pipe directs the process fluid to the centre of the column.

| Cat.Ref. | DN | DN1 | DN2 | L | d |
|---|---|---|---|---|---|
| FP3 | 80 | 25 | 25 | 100 | 12 |
| FP4 | 100 | 25 | 25 | 125 | 12 |
| FP6 | 150 | 40 | 25 | 150 | 19 |
| FP9 | 225 | 40 | 25 | 175 | 19 |
| FP12 | 300 | 40 | 25 | 225 | 19 |
| FP16 | 400 | 40 | 25 | 275 | 19 |
| FP18 | 450 | 40 | 25 | 300 | 19 |
| FP24 | 600 | 50 | 40 | 450 | 25 |

DN refers the nominal diameter of the column.

## COLUMN FEED SPARGERS




In column feed spargers, holes are provided at three sides of pipe.

| Cat.Ref. | DN | DN1 | DN2 | L | Holes |
|---|---|---|---|---|---|
| SPG3 | 80 | 25 | 25 | 125 | 21x2mm |
| SPG4 | 100 | 25 | 25 | 150 | 21x2mm |
| SPG6 | 150 | 40 | 25 | 200 | 27x2mm |
| SPG9 | 225 | 40 | 25 | 275 | 27x2mm |
| SPG12 | 300 | 40 | 25 | 350 | 30x3mm |
| SPG16 | 400 | 40 | 25 | 450 | 39x3mm |
| SPG18 | 450 | 40 | 25 | 500 | 39x3mm |
| SPG24 | 600 | 50 | 40 | 650 | 60x3mm |

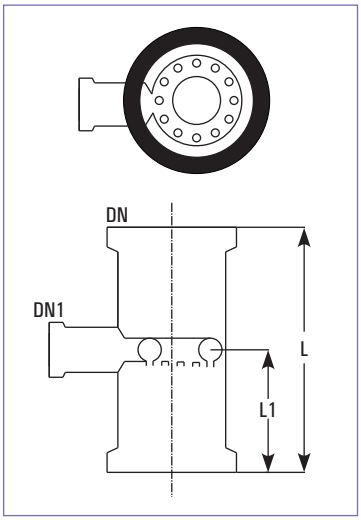
DN refers the nominal diameter of the column.

## SPRAY FEED SECTION

Spray feed section are provided with circular tube having holes at the bottom.

| Cat.Ref. | DN | DN1 | L | L1 | Holes |
|---|---|---|---|---|---|
| FR3 | 80 | 25 | 200 | 100 | 21x2mm |
| FR4 | 100 | 25 | 250 | 125 | 21x2mm |
| FR6 | 150 | 40 | 250 | 125 | 27x2mm |
| FR9 | 225 | 40 | 250 | 125 | 27x2mm |
| FR12 | 300 | 40 | 300 | 150 | 30x3mm |

For bigger columns, Spray feed pipe with Unequal Tee should be used.

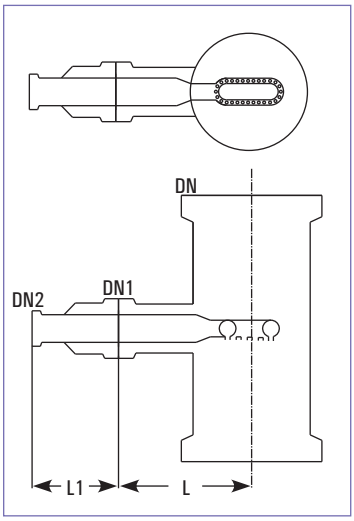



## SPRAY FEED PIPES

Spray feed pipes are provided with oval tube having holes at the bottom.
These should be used with unequal tees.

| Cat.Ref. | DN | DN1 | DN2 | L | L1 | Holes Size | Tee Suitable |
|---|---|---|---|---|---|---|---|
| FD6 | 150 | 80 | 25 | 225 | 125 | 27x2mm | PTU6/3 |
| FD9 | 225 | 100 | 25 | 325 | 150 | 27x2mm | PTU9/4 |
| FD12 | 300 | 150 | 25 | 400 | 200 | 30x3mm | PTU12/6 |
| FD16 | 400 | 150 | 50 | 500 | 200 | 39x3mm | PTU16/6 |
| FD18 | 450 | 150 | 50 | 550 | 200 | 39x3mm | PTU18/6 |
| FD24 | 600 | 150 | 50 | 700 | 200 | 60x3mm | PTU24/6 |

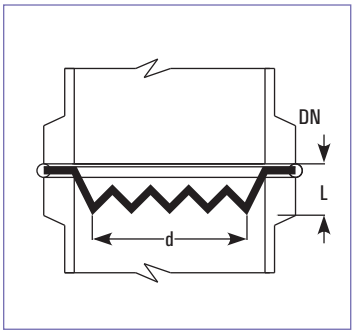
DN refers the nominal diameter of the column.



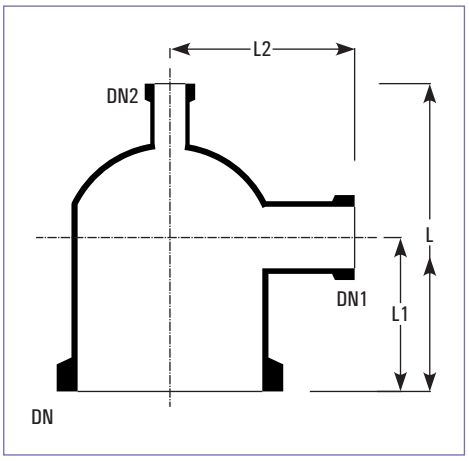

## PTFE REDISTRIBUTORS

PTFE redistributors are used to prevent channeling in columns. These can be clamped between two components without using any gasket.

| Cat.Ref. | DN | d | L |
|---|---|---|---|
| TL3 | 80 | 55 | 20 |
| TL4 | 100 | 80 | 20 |
| TL6 | 150 | 100 | 20 |
| TL9 | 225 | 175 | 22 |
| TL12 | 300 | 215 | 25 |
| TL16 | 400 | 315 | 25 |
| TL18 | 450 | 365 | 30 |
| TL24 | 600 | 420 | 30 |



# COLUMN ADAPTORS




| Cat.Ref. | DN | DN1 | DN2 | L | L1 | L2 |
|---|---|---|---|---|---|---|
| CA3/1/1 | 80 | 25 | 25 | 150 | 75 | 100 |
| CA3/1.5/1 | 80 | 40 | 25 | 175 | 100 | 100 |
| CA3/2/1 | 80 | 50 | 25 | 175 | 100 | 100 |
| CA4/1/1 | 100 | 25 | 25 | 150 | 75 | 125 |
| CA4/1.5/1 | 100 | 40 | 25 | 175 | 100 | 125 |
| CA4/2/1 | 100 | 50 | 25 | 225 | 125 | 125 |
| CA4/3/1 | 100 | 80 | 25 | 225 | 125 | 125 |
| CA6/1/1 | 150 | 25 | 25 | 200 | 100 | 150 |
| CA6/1.5/1 | 150 | 40 | 25 | 200 | 100 | 150 |
| CA6/2/1 | 150 | 50 | 25 | 250 | 125 | 150 |
| CA6/3/1 | 150 | 80 | 25 | 250 | 150 | 150 |
| CA6/4/1 | 150 | 100 | 25 | 275 | 150 | 175 |
| CA9/1.5/1.5 | 225 | 40 | 40 | 250 | 150 | 175 |
| CA9/2/1.5 | 225 | 50 | 40 | 250 | 150 | 175 |
| CA9/3/1.5 | 225 | 80 | 40 | 300 | 175 | 200 |
| CA9/4/1.5 | 225 | 100 | 40 | 350 | 175 | 200 |
| CA9/6/1.5 | 225 | 150 | 40 | 400 | 200 | 250 |
| CA12/1.5/1.5 | 300 | 40 | 40 | 300 | 150 | 225 |
| CA12/2/1.5 | 300 | 50 | 40 | 300 | 150 | 225 |
| CA12/3/1.5 | 300 | 80 | 40 | 300 | 150 | 250 |
| CA12/4/1.5 | 300 | 100 | 40 | 350 | 175 | 250 |
| CA12/6/1.5 | 300 | 150 | 40 | 425 | 225 | 250 |
| CA12/9/1.5 | 300 | 225 | 40 | 450 | 225 | 300 |
| CA16/2/2 | 400 | 50 | 50 | 400 | 200 | 300 |
| CA16/3/2 | 400 | 80 | 50 | 450 | 250 | 300 |
| CA16/4/2 | 400 | 100 | 50 | 450 | 250 | 300 |
| CA16/6/2 | 400 | 150 | 50 | 550 | 300 | 350 |
| CA16/9/2 | 400 | 225 | 50 | 550 | 300 | 350 |
| CA18/2/2 | 450 | 50 | 50 | 400 | 200 | 325 |
| CA18/3/2 | 450 | 80 | 50 | 450 | 250 | 350 |
| CA18/4/2 | 450 | 100 | 50 | 450 | 250 | 350 |
| CA18/6/2 | 450 | 150 | 50 | 550 | 300 | 350 |
| CA18/9/2 | 450 | 225 | 50 | 550 | 300 | 400 |
| CA18/12/2 | 450 | 300 | 50 | 750 | 400 | 400 |
| CA24/2/2 | 600 | 50 | 50 | 450 | 200 | 400 |
| CA24/3/2 | 600 | 80 | 50 | 500 | 250 | 400 |
| CA24/4/2 | 600 | 100 | 50 | 500 | 250 | 400 |
| CA24/6/2 | 600 | 150 | 50 | 650 | 300 | 450 |
| CA24/9/2 | 600 | 225 | 50 | 650 | 300 | 450 |
| CA24/12/2 | 600 | 300 | 50 | 800 | 400 | 500 |

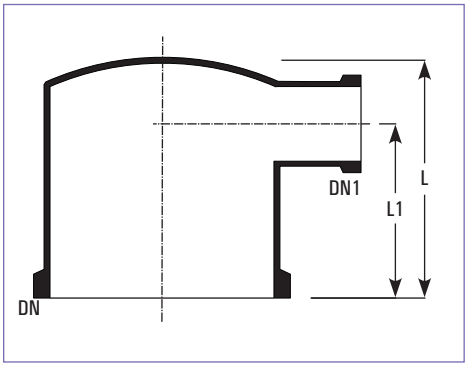
Column adaptors with DN2 of different size(maximum equaling to DN1) can be manufactured with the same dimensions.

* marked items are available fast.

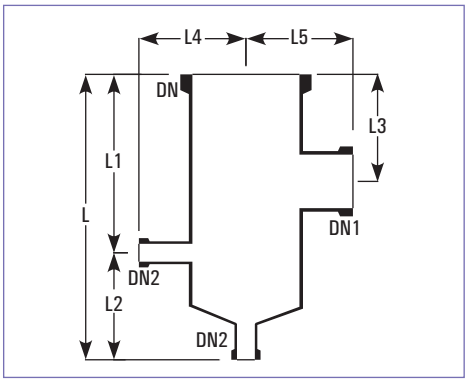
# FLAT TOP COLUMN ADAPTORS

These are generally used as headers of shell and tube heat exchangers and columns.

| Cat.Ref. | DN | DN1 | L | L1 |
|---|---|---|---|---|
| CA3/1 | 80 | 25 | 100 | 75 |
| CA3/1.5 | 80 | 40 | 125 | 100 |
| CA4/1 | 100 | 25 | 100 | 75 |
| CA4/1.5 | 100 | 40 | 125 | 100 |
| | | | | |
| CA6/1 | 150 | 25 | 150 | 100 |
| CA6/1.5 | 150 | 40 | 150 | 100 |
| CA6/2 | 150 | 50 | 200 | 125 |
| CA6/3 | 150 | 80 | 200 | 150 |
| | | | | |
| CA9/1.5 | 225 | 40 | 200 | 150 |
| CA9/2 | 225 | 50 | 200 | 150 |
| CA9/3 | 225 | 80 | 250 | 175 |
| CA9/4 | 225 | 100 | 250 | 175 |
| | | | | |
| CA12/2 | 300 | 50 | 250 | 150 |
| CA12/3 | 300 | 80 | 250 | 150 |
| | | | | |
| CA12/4 | 300 | 100 | 300 | 175 |
| CA12/6 | 300 | 150 | 350 | 225 |




| Cat.Ref. | DN | DN1 | DN2 | L | L1 | L2 | L3 | L4 | L5 |
|---|---|---|---|---|---|---|---|---|---|
| CAM4/2/1/1 | 100 | 50 | 25 | 450 | 300 | 150 | 200 | 125 | 125 |
| CAM6/3/1/1 | 150 | 80 | 25 | 450 | 300 | 150 | 200 | 150 | 150 |
| CAM9/3/1/1 | 225 | 80 | 25 | 450 | 300 | 150 | 200 | 175 | 200 |
| CAM12/3/1/1 | 300 | 80 | 25 | 450 | 300 | 150 | 200 | 225 | 250 |

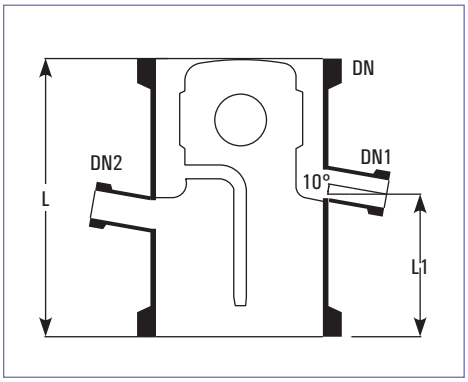



# REFLUX DIVIDERS

## Manually Operated

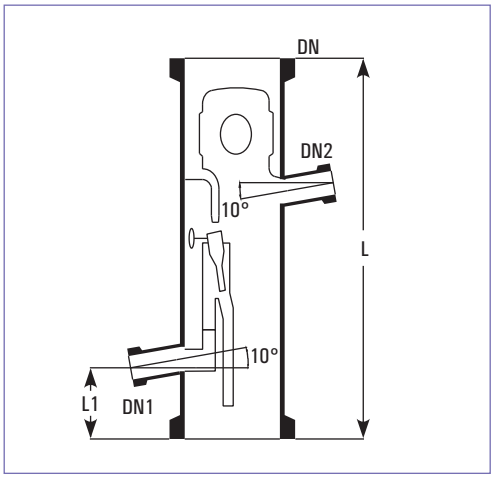
Reflux dividers are used to take off the distillate from the column. Usually a valve is to be fitted on distillate outlet which controls the reflux coarsely.

| Cat.Ref. | DN | DN1 | DN2 | L | L1 | Free Corss Section Cm2 | Max. Product L/hr |
|---|---|---|---|---|---|---|---|
| RDA3* | 80 | 25 | 25 | 200 | 100 | 20 | 300 |
| RDA4* | 100 | 25 | 25 | 250 | 150 | 50 | 500 |
| RDA6* | 150 | 25 | 25 | 250 | 150 | 100 | 700 |
| RDA9* | 225 | 25 | 25 | 375 | 150 | 150 | 900 |
| RDA12* | 300 | 25 | 25 | 375 | 150 | 250 | 1100 |
| RDA16 | 400 | 40 | 40 | 500 | 200 | 350 | 1300 |
| RDA18 | 450 | 40 | 40 | 600 | 275 | 500 | 1500 |




DN2 is used for insertion of a thermometer pocket. A bellow is recommended on the distillate outlet DN1.

## Magnetically Operated

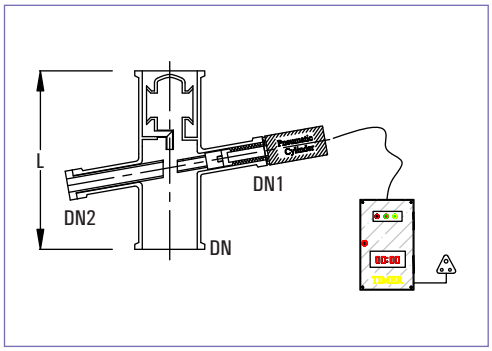



These reflux dividers are to be used with a electro -magnet and a timer. These have a swinging funnel machanism which is operated magnetically from outside to remove the condensate or to return the reflux. Through this, correct control of reflux-ratio is possible. Funnel remains at 100% reflux position while magnet is inactive.

| Cat.Ref. | DN | DN1 | DN2 | L | L1 | Free Corss Section Cm2 | Max. Product L/hr |
|---|---|---|---|---|---|---|---|
| RHM3 | 80 | 25 | 25 | 375 | 75 | 20 | 90 |
| RHM4 | 100 | 25 | 25 | 400 | 75 | 50 | 180 |
| RHM6 | 150 | 25 | 25 | 450 | 100 | 100 | 300 |
| RHM9 | 225 | 25 | 25 | 550 | 100 | 150 | 500 |
| RHM12 | 300 | 25 | 25 | 700 | 100 | 250 | 650 |
| RHM16 | 400 | 40 | 40 | 800 | 150 | 350 | 1000 |
| RHM18 | 450 | 40 | 40 | 900 | 150 | 500 | 1300 |

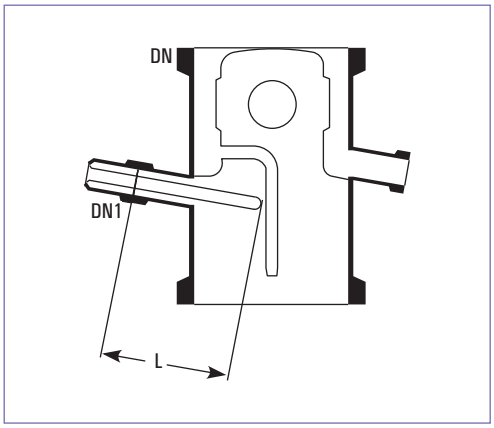
DN2 is used for insertion of a Thermometer Pocket. A liquid seal is recommended on the distillate outlet of this reflux divider to prevent the vapour passing directly to the receiver.

# PNEUMATIC REFLUX DIVIDER




| Cat.Ref. | DN | DN1 | DN2 | L |
|---|---|---|---|---|
| RPH3 | 80 | 25 | 25 | 250 |
| RPH4 | 100 | 25 | 25 | 250 |
| RPH6 | 150 | 40 | 25 | 250 |
| RPH9 | 225 | 40 | 50 | 375 |
| RPH12 | 300 | 40 | 50 | 375 |

# THERMOMETER POCKETS FOR REFLUX DIVIDER




These thermometer pockets are to be used with reflux dividers or column sections. DN refers to the nominal diameter of the Reflux divider or Column.

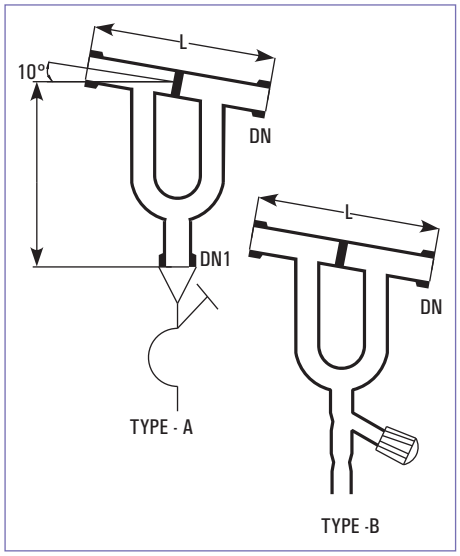
| Cat.Ref. | DN | DN1 | d | L |
|---|---|---|---|---|
| TP3* | 80 | 25 | 12 | 75 |
| TP4* | 100 | 25 | 12 | 100 |
| TP6* | 150 | 25 | 12 | 125 |
| TP9* | 225 | 25 | 12 | 150 |
| TP12* | 300 | 25 | 12 | 200 |
| TP16 | 400 | 40 | 19 | 250 |
| TP18 | 450 | 40 | 19 | 300 |

## LIQUID SEALS

Liquid seals are to be fitted on the distillate outlet of magnetically operated reflux divider. This prevent the passing of vapour directly to the receiver.

| Cat.Ref. | DN | DN1 | L | Type |
|---|---|---|---|---|
| LS1* | 25 | 25 | 200 | A |
| LS1.5 | 40 | 25 | 300 | A |
| LSV1 | 25 | - | 200 | B |

* marked items are available fast.



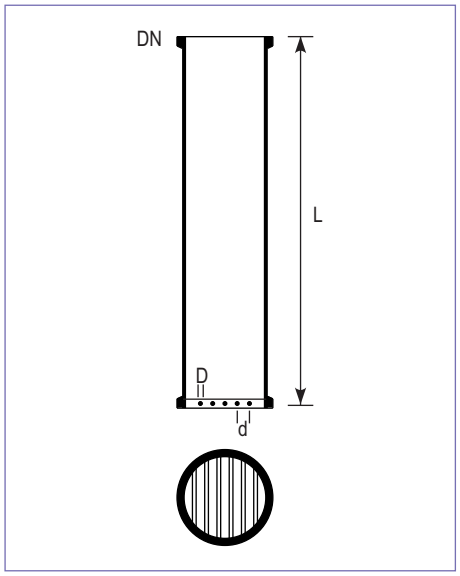

## COLUMN SECTION WITH INBUILT PACKING SUPPORT

Goel introduce single piece column section with inbuilt packing support.

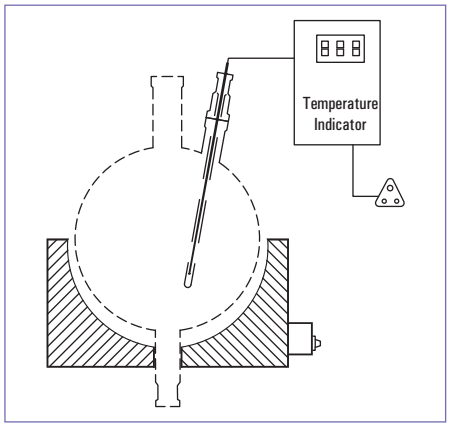
**Advantages of this column against conventional column section:**

- Ease in installation being a single piece instead of two pieces.
- There is no need to maintain stock of CS and packing support.
- Increases effective packed height which results in to increase in efficiency.
- Zero maintenance against column flooding.

| Cat.Ref. | DN | D | d | L | Max Load Kgs | Suitable Packing Size |
|---|---|---|---|---|---|---|
| CSP3/1000 | 80 | 10 | 10 | 1000 | 20 | 12 |
| CSP4/1000* | 100 | 10 | 14 | 1000 | 30 | 15 |
| CSP6/1000* | 150 | 12 | 22 | 1000 | 60 | 25 |
| CSP9/1000* | 225 | 12 | 22 | 1000 | 90 | 25 |
| CSP12/1000* | 300 | 12 | 22 | 1000 | 150 | 25 |



## DIGITAL TEMPERATURE INDICATOR



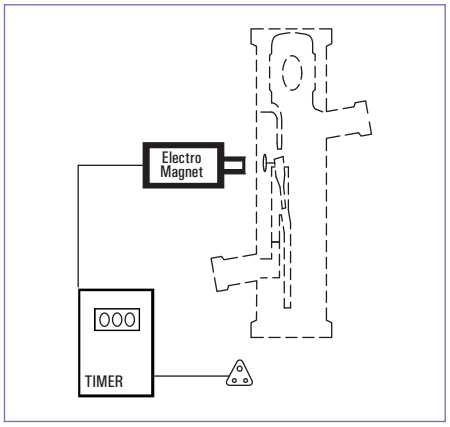

These are generally used as headers of shell and tube heat exchangers and columns.

This instrument is mainly used to monitor the temperature of liquid in a glass vessel in a typical Glass Distillation Unit.

The instrument consists of a Temperature indicator and a Resistance Temperature Detectors (RTD). The instrument works on 230V, 50Hz power supply. This displays the temperature in degree Centigrades in three and half digits of 12.5mm character height.

| Cat.Ref. | Vessel size | RTD Length |
|---|---|---|
| DTI20 | 20 | 400 |
| DTI50 | 50 | 500 |
| DTI100 | 100 | 600 |
| DTI200 | 200 | 700 |

## ELECTRO-MAGNETS




Electro - magnets are used to operate Magnetically operated Reflux dividers. When 'On' the magnet attracts the swinging funnel of the reflux divider so that distillate can be taken off.
Electro-magnets are to be mounted outside the glass column, just near to the reflux divider,with the help of adjustable fittings. These are designed to use with Timers to maintain correctratio between 'Off' and 'On' timings of its activation.
Electro-magnets work on 220V DC power supply,for which a output socket is provided in the Timers.

| Cat. Ref. | Type |
|---|---|
| RPM | Non-flameproof |
| RPF | Flameproof |

## TIMERS

Timers are designed to use with Electro-magnets to provide a correct ratio of reflux and distillate when operating a Magnetically operated reflux divider.

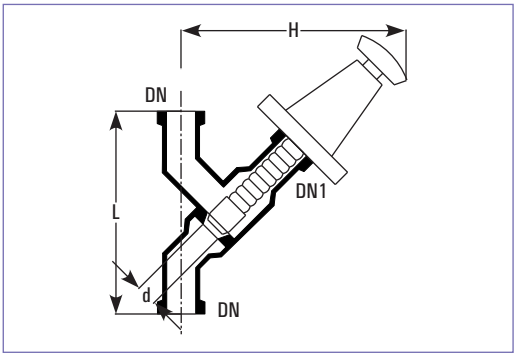
Timers work on a power supply of 230V, 50Hz.

| Cat. Ref. | Type |
|---|---|
| QRT | Flameproof |

## STRAIGHT THROUGH VALVES

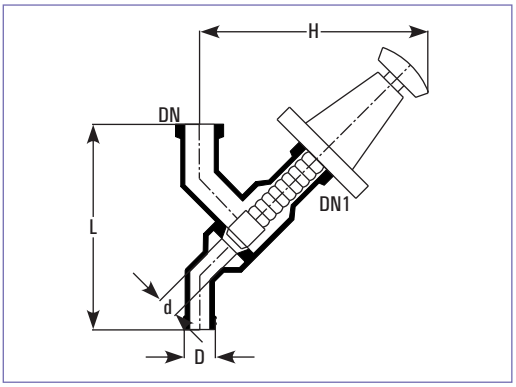
| Cat.Ref. | DN | DN1 | d | L | H |
|---|---|---|---|---|---|
| PV0.5 | 12 | 12 | 10 | 125 | 125 |
| PV0.7 | 15 | 15 | 10 | 125 | 125 |
| PV1* | 25 | 25 | 18 | 175 | 175 |
| PV1.5/1 | 40 | 25 | 18 | 225 | 175 |
| PV1.5* | 40 | 40 | 26 | 225 | 200 |
| PV2* | 50 | 50 | 38 | 300 | 220 |

Spindles are made of PTFE.



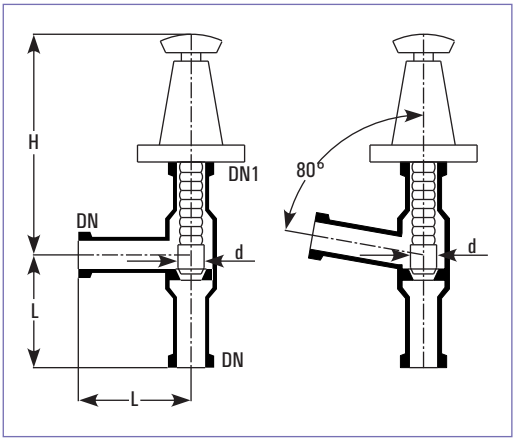

## DRAIN VALVES

| Cat.Ref. | DN | DN1 | d | L | H | D |
|---|---|---|---|---|---|---|
| PVD0.5 | 12 | 12 | 10 | 125 | 125 | 22 |
| PVD0.7 | 15 | 15 | 10 | 125 | 125 | 22 |
| PVD1* | 25 | 25 | 18 | 175 | 175 | 28 |
| PVD1.5/1* | 40 | 25 | 18 | 225 | 175 | 28 |
| PVD1.5* | 40 | 40 | 26 | 225 | 200 | 42 |
| PVD2* | 50 | 50 | 38 | 300 | 220 | 50 |




## ANGLE VALVES

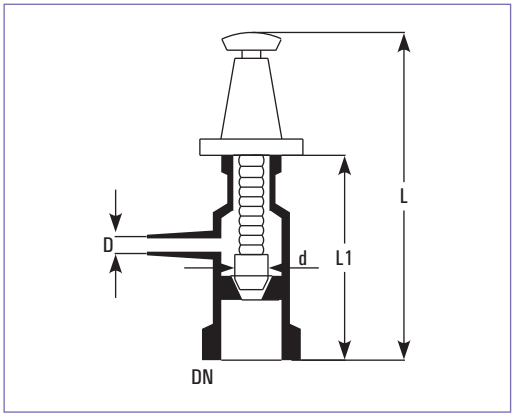
| Cat.Ref. | DN | DN1 | d | L | H | Degree |
|---|---|---|---|---|---|---|
| PVE0.5 | 12 | 12 | 10 | 50 | 85 | 90 |
| PVE0.7 | 15 | 15 | 10 | 50 | 85 | 90 |
| PVE1* | 25 | 25 | 18 | 100 | 175 | 90 |
| PVE1/80* | 25 | 25 | 18 | 100 | 175 | 80 |
| PVE1.5* | 40 | 40 | 26 | 150 | 200 | 90 |
| PVE2 | 50 | 50 | 38 | 150 | 220 | 90 |




* marked items are available fast.

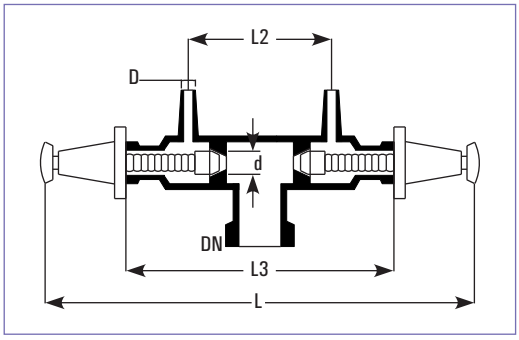
## VENT VALVES

| Cat.Ref. | DN | D | d | L | L1 |
|---|---|---|---|---|---|
| PVV0.5 | 12 | 12 | 10 | 125 | 90 |
| PVV0.7* | 15 | 12 | 10 | 125 | 90 |
| PVV1* | 25 | 12 | 10 | 150 | 90 |
| PVV1.5* | 40 | 12 | 10 | 150 | 100 |




## VENT / VACUUM VALVES

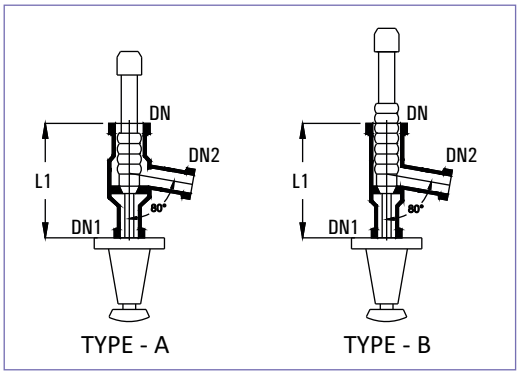
| Cat.Ref. | DN | D | d | L | L1 | L2 | L3 |
|---|---|---|---|---|---|---|---|
| PVW 1/0.7* | 25 | 12 | 10 | 280 | 55 | 85 | 160 |
| PVW 1.5/0.7* | 40 | 12 | 10 | 280 | 65 | 85 | 160 |



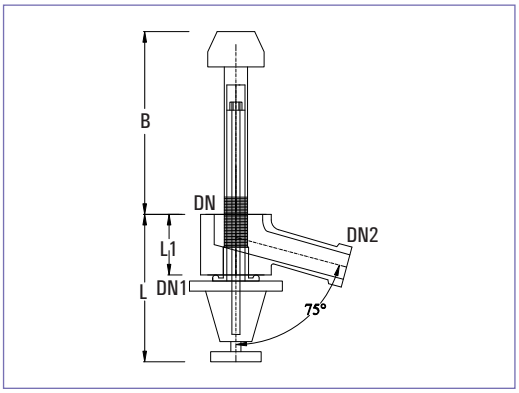

## BOTTOM OUTLET VALVES

These valves prevent the accumulation of solids or liquid in the bottom outlet of a vessel. This valve can be incorporated in any spherical or cylindrical vessel.

| Cat.Ref. | DN | DN1 | DN2 | L1 | Type |
|---|---|---|---|---|---|
| BAL1* | 25 | 25 | 25 | 150 | A |
| BAL1.5* | 40 | 25 | 25 | 150 | B |
| BAL2 | 50 | 25 | 40 | 150 | B |

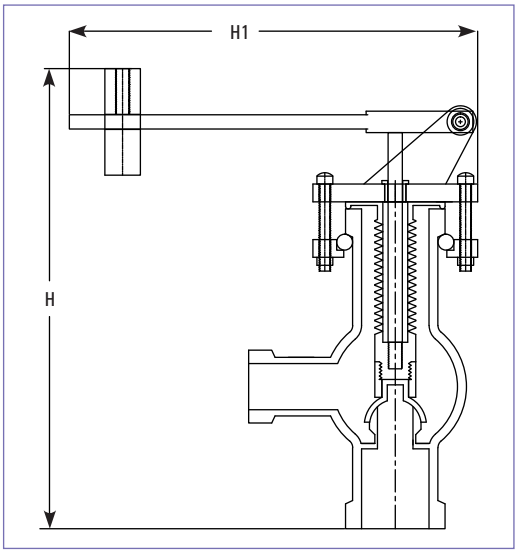


## SPACER BOTTOM OUTLET VALVES




| Cat.Ref. | DN | DN1 | DN2 | L1 | L | B |
|---|---|---|---|---|---|---|
| SBAL1 | 25 | 25 | 15 | 40 | 110 | 175 |
| SBAL1.5 | 40 | 40 | 25 | 60 | 160 | 175 |
| SBAL2 | 50 | 50 | 25 | 60 | 160 | 175 |

## WEIGHT OPERATED PRESSURE RELIEF VALVE




The pressure relief valve (WPRV) is a valve used to control or limit the pressure in a system or vessel which can build up by a process upset, instrument or equipment failure, or fire.

The pressure is relieved by allowing the pressurized gas/fluid to flow out of the system. The pressure relief valve is designed or set to open at a predetermined set pressure to protect Glass vessels and other equipment from being subjected to pressures that exceed their design limits. When the set pressure is exceeded, the pressure relief valve is forced open and a portion of the gas/fluid is released maintaining the required system pressure.

Weight operated pressure relief valve is constructed of glass and PTFE. Sealing of moving parts is effected by a PTFE bellows.
The maximum recommended operating temperature is 150$^{0}$C and a range of pressure as mentioned below.

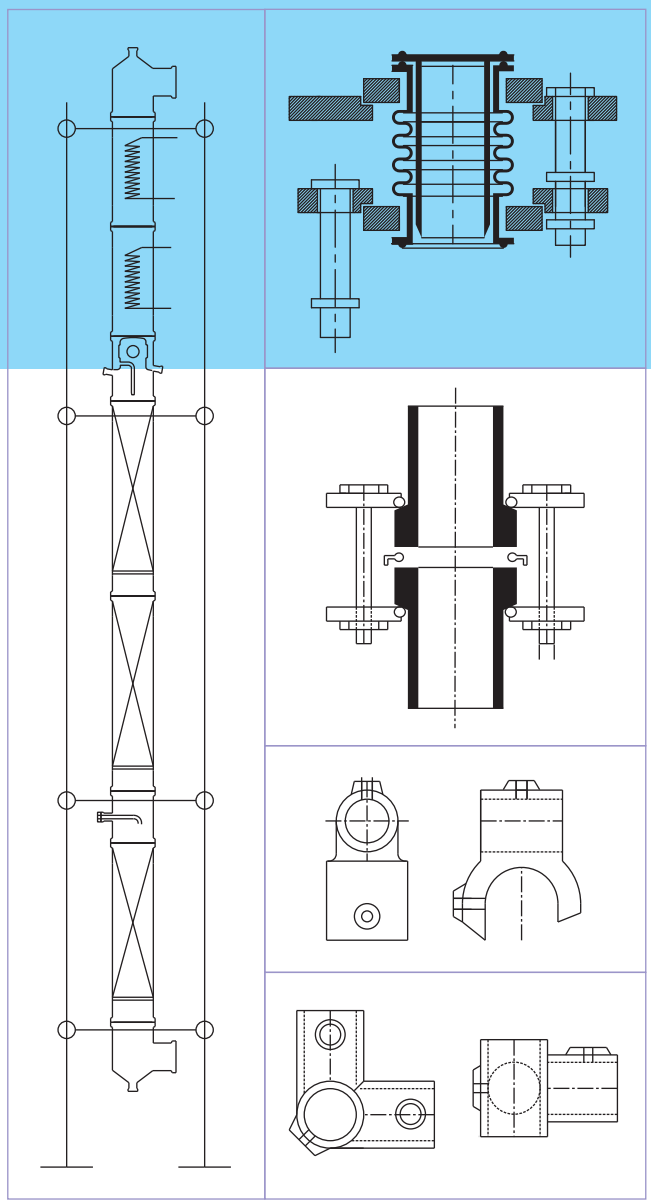
It should be installed with the spindle vertical and adequate support should be given.

| Model | Size | Pr. range (BAR.g) | Appx. Height (H) | Appx. Width (H1) |
|---|---|---|---|---|
| WPRV-1.5 | DN40 | 0.4/0.7/0.9 | 240mm | 275mm |
| WPRV-2 | DN50 | 0.1/0.2/0.3 | 270mm | 275mm |

* marked items are available fast.

# JOINING, PACKAGING & SUPPORTING STRUCTURE

* Coupling & Gasket
* Structure And Supports



### Coupling & Gaskets

Reliable Couplings for Secure and Stress-Free Connections

Couplings are critical for ensuring a secure seal and preventing undue stress on glass equipment.

They must be reliable in all service conditions.

Our range includes couplings to join glass components as well as connect glass to metal equipment.

For both normal and vacuum applications, PTFE bellows are available, along with flanges for seamless connections to glass or non-glass equipment.

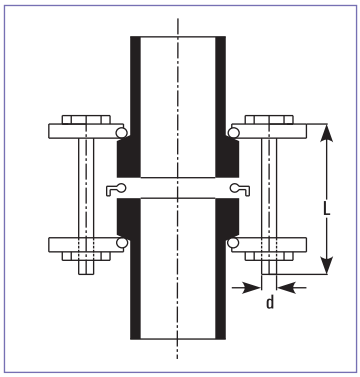
### Structure & Supports

Reliable Structural Support for Long-Term Performance

Glass plants are typically supported by tubular structures made from galvanized steel tubes or mild steel, with options for epoxy-coated or stainless steel 304 & 316. This type of structure has proven to be robust and flexible, offering sturdy support for various applications over time.

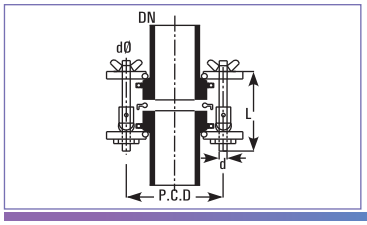
## COMPLETE COUPLINGS

A complete coupling is a set of two backing flanges with insert and nut-bolts. Complete set of flanges require to make a joint & standard one are available in Cast Iron & Mild Steel. Also available in other MOC like Stainless Steel 304 & 316, Siliumin, Bakelite.




| Cat.Ref. | DN | Flanges | | inserts | | Nuts-Bolts | | |
|---|---|---|---|---|---|---|---|---|
| | | Cat.Ref. | Qty | Cat.Ref. | Qty | d | L | Qty |
| CT0.5 | 12 | CF0.5 | 2nos | CN0.5 | 2nos | 1/4" | 50 | 3nos |
| CT0.7 | 15 | CF0.7 | 2nos | CN0.7 | 2nos | 1/4" | 50 | 3nos |
| CT1* | 25 | CF1 | 2nos | CN1 | 2nos | 5/16" | 70 | 3nos |
| CT1.5* | 40 | CF1.5 | 2nos | CN1.5 | 2nos | 5/16" | 70 | 3nos |
| CT2* | 50 | CF2 | 2nos | CN2 | 2nos | 5/16" | 70 | 3nos |
| CT3* | 80 | CF3 | 2nos | CN3 | 2nos | 5/16" | 100 | 6nos |
| CT4* | 100 | CF4 | 2nos | CN4 | 2nos | 5/16" | 100 | 6nos |
| CT6* | 150 | CF6 | 2nos | CN6 | 2nos | 3/8" | 125 | 6nos |
| CT8 | 200 | CF8 | 2nos | CN8 | 2nos | 3/8" | 125 | 8nos |
| CT9* | 225 | CF9 | 2nos | CN9 | 2nos | 3/8" | 125 | 8nos |
| CT12* | 300 | CF12 | 2nos | CN12 | 2nos | 3/8" | 150 | 12nos |
| CF with inbuilt insert above size of 12 | | | | | | | | |
| CT16 | 400 | CF16 | 2nos | | | 1/2" | 150 | 12nos |
| CT18* | 450 | CF18 | 2nos | | | 1/2" | 150 | 12nos |
| CT24 | 600 | CF24 | 2nos | | | 1/2" | 150 | 12nos |
| CT28 | 700 | CF28 | 2nos | | | 1/2" | 150 | 12nos |
| CT32 | 800 | CF32 | 2nos | | | 1/2" | 150 | 24nos |

## QUICK RELEASE COUPLINGS



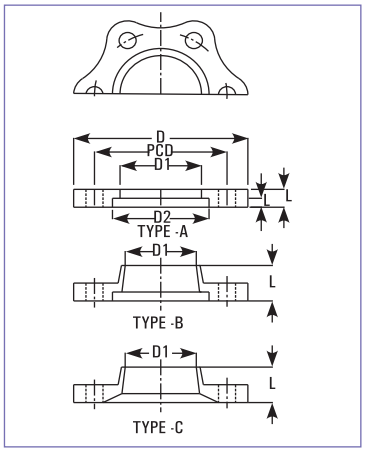

| Cat.Ref. | DN | PCD | nxdØ |
|---|---|---|---|
| QCT3 | 80 | 133 | 6x9Ø |
| QCT4 | 100 | 178 | 6x9Ø |
| QCT6 | 150 | 254 | 6x9Ø |
| QCT9 | 225 | 310 | 8x11Ø |
| QCT12 | 300 | 395 | 12x11Ø |

For easy & fast opening or closing of couplings as quick as possible without using tools, the Quick Release Coupling is an ideal solution. In case of solid charging material to reaction or addition vessels, we recommend to use our Quick Release Coupling.

Quick Release coupling are offered in cast iron & stainless steel material as per the requirement. Quick Release Coupling is available from DN 80 to DN 300 sizes.

## BACKING FLANGES

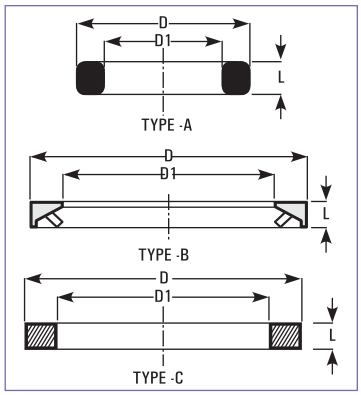
Backing flanges are used to couple a glass end to a glass end or to a bellow. Backing flanges are made of cast iron and are used with Inserts.




| Cat.Ref. | DN | D | D1 | D2 | PCD | n x dØ | L | L1 | Type |
|---|---|---|---|---|---|---|---|---|---|
| CF0.5 | 12 | 50 | 27 | 35 | 48 | 3 x 7Ø | 6 | 3 | A |
| CF0.7 | 15 | 65 | 29 | 37 | 48 | 3 x 7Ø | 6 | 3.5 | A |
| CF1 | 25 | 90 | 43 | 51 | 70 | 3 x 9Ø | 10 | 6 | A |
| CF1.5 | 40 | 105 | 58 | 66 | 86 | 3 x 9Ø | 10 | 8 | A |
| CF2 | 50 | 120 | 72 | 81 | 98 | 3 x 9Ø | 12 | 8 | A |
| CF3 | 80 | 155 | 101 | 112 | 133 | 6 x 9Ø | 12 | 8 | B |
| CF4 | 100 | 200 | 134 | 148 | 178 | 6 x 9Ø | 12 | 8 | B |
| CF6 | 150 | 275 | 186 | 196 | 254 | 6 x 9Ø | 15 | 8 | B |
| CF8 | 200 | 315 | 236 | 258 | 280 | 8x 11Ø | 14 | 8 | A |
| CF9 | 225 | 350 | 260 | 282 | 310 | 8 x 11Ø | 25 | 8 | B |
| CF12 | 300 | 425 | 342 | 363 | 395 | 12 x 11Ø | 30 | 8 | B |
| CF16 | 400 | 535 | 467 | 476 | 505 | 12 x 14Ø | 20 | 8 | A |
| CF18 | 450 | 630 | 537 | 557 | 585 | 12 x 14Ø | 37 | 8 | B |
| CF24 | 600 | 755 | 643 | 690 | 710 | 12 x 14Ø | 50 | 6 | C |
| CF28 | 700 | 860 | 750 | 782 | 820 | 16 x 20Ø | 26 | 6 | C |
| CF32 | 800 | 990 | 861 | 922 | 950 | 24 x 20Ø | 67 | 5 | C |

## INSERTS

Split ring type inserts are used with backing flanges. In addition, insert made of suitable composite rubber material for 25 DN to 150 DN size. New PTFE (make Champion, Klinger) insert are being introduced for 25DN to 800DN.




| Cat.Ref. | DN | D | D1 | L | Type |
|---|---|---|---|---|---|
| CN0.5 | 12 | 34 | 20.5 | 8 | A |
| CN0.7 | 15 | 37 | 22 | 8 | A |
| CN1 | 25 | 50 | 34 | 7 | A |
| CN1.5 | 40 | 65 | 48 | 8 | A |
| CN2 | 50 | 80 | 62 | 8 | B |
| CN3 | 80 | 110 | 91 | 9 | B |
| CN4 | 100 | 145 | 119 | 10 | B |
| CN6 | 150 | 195 | 170 | 10 | B |
| CN8 | 200 | 256 | 216 | 8 | B |
| CN9 | 225 | 280 | 240 | 10 | B |
| CN12 | 300 | 361 | 322 | 12 | B |

* marked items are available fast.

# ADAPTOR BACKING FLANGES

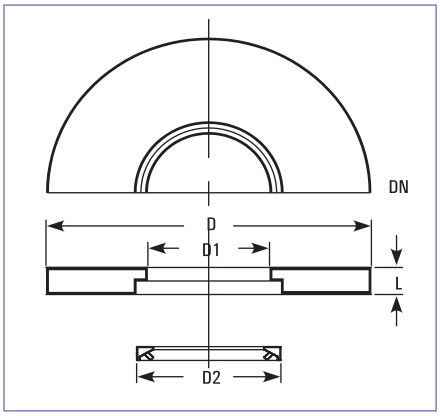
Adaptor backing flanges are used to couple a glass end to the flange having different bolt configuration. These flanges are made of cast iron and are supplied with inserts. These are particularly used to fit a glass equipment on a non-glass equipment like Glass-lined Reactor etc. Adaptor backing flanges are generally supplied undrilled. However, if specified, these can be supplied drilled as per "Table E", "Table F" and "ASA150" standards.

**Drilled to Table E**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| CFA0.5/E | 62 | 4 x 7Ø |
| CFA0.7/E | 62 | 4 x 7Ø |
| CFA1/E | 82 | 4 x 14Ø |
| CFA1.5/E | 98 | 4 x 14Ø |
| CFA2/E | 114 | 4 x 14Ø |
| CFA3/E | 146 | 4 x 14Ø |
| CFA4/E | 178 | 8 x 14Ø |
| CFA6/E | 235 | 8 x 14Ø |
| CFA9/E | 324 | 12 x 14Ø |
| CFA12/E | 406 | 12 x 14Ø |

**Undrilling flanges**

| Cat.Ref. | DN | D | D1 | D2 | L |
|---|---|---|---|---|---|
| CFA0.5 | 12 | 80 | 25 | 28 | 6 |
| CFA0.7 | 15 | 85 | 29 | 37 | 6 |
| CFA1 | 25 | 115 | 43 | 51 | 10 |
| CFA1.5 | 40 | 150 | 58 | 66 | 10 |
| CFA2 | 50 | 165 | 70 | 81 | 12 |
| CFA3 | 80 | 200 | 101 | 112 | 12 |
| CFA4 | 100 | 220 | 134 | 148 | 12 |
| CFA6 | 150 | 285 | 186 | 196 | 15 |
| CFA9 | 225 | 395 | 260 | 282 | 15 |
| CFA12 | 300 | 445 | 342 | 363 | 18 |




**Drilled to ASA 150**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| CFA0.5/A | 62 | 4 x 7Ø |
| CFA0.7/A | 62 | 4 x 7Ø |
| CFA1/A | 79 | 4 x 14Ø |
| CFA1.5/A | 98 | 4 x 14Ø |
| CFA2/A | 121 | 4 x 14Ø |
| CFA3/A | 152 | 4 x 14Ø |
| CFA4/A | 190 | 8 x 14Ø |
| CFA6/A | 241 | 8 x 14Ø |
| CFA9/A | 298 | 8 x 14Ø |
| CFA12/A | 432 | 12 x 14Ø |

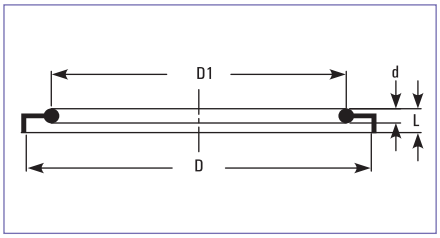
**Drilled to Table F**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| CFA0.5/F | 67 | 4 x 7Ø |
| CFA0.7/F | 67 | 4 x 7Ø |
| CFA1/F | 87 | 4 x 14Ø |
| CFA1.5/F | 105 | 4 x 14Ø |
| CFA2/F | 127 | 4 x 14Ø |
| CFA3/F | 165 | 8 x 14Ø |
| CFA4/F | 190 | 8 x 14Ø |
| CFA6/F | 260 | 12 x 14Ø |
| CFA9/F | 356 | 12 x 14Ø |
| CFA12/F | 438 | 16 x 14Ø |

# PTFE "O" RING WITH LOCKING COLLAR

These PTFE O rings are specially made to use as gaskets in glass fittings. These are provided with a collar which helps to locate it on the glass end correctly.

| Cat.Ref. | DN | D | D1 | d | L |
|---|---|---|---|---|---|
| TR0.5 | 12 | 26 | 18 | 3 | 5 |
| TR0.7 | 15 | 28 | 17 | 3 | 5 |
| TR1* | 25 | 42 | 33 | 3 | 5 |
| TR1.5* | 40 | 57 | 48 | 3 | 5 |
| TR2* | 50 | 70 | 59 | 3 | 5 |
| TR3* | 80 | 100 | 88 | 3 | 5 |
| TR4* | 100 | 134 | 119 | 4 | 6 |
| TR6* | 150 | 186 | 168 | 4 | 6 |
| TR8* | 200 | 235 | 215 | 4 | 7 |
| TR9* | 225 | 259 | 238 | 4 | 7 |
| TR12* | 300 | 341 | 320 | 4 | 7 |
| Above 12" TM used | | | | | |




| TM SIZE | OD | ID | THICKNESS |
|---|---|---|---|
| TM16 | 465 | 400 | 5 |
| TM18 | 530 | 455 | 5 |
| TM20 | 590 | 500 | 5 |
| TM24 | 690 | 600 | 5 |
| TM28 | 790 | 700 | 5 |
| TM32 | 920 | 835 | 5 |

# PTFE BELLOWS - GLASS TO GLASS

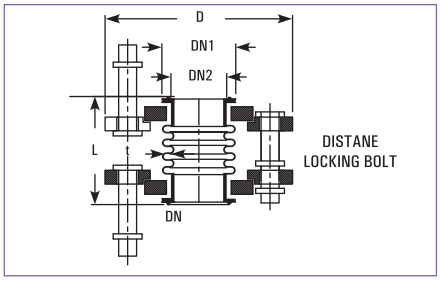
These bellows are used in installation of glass equipment for following purposes :
- to provide safe branching of pipelines from the main glass equipment.
- to accommodate odd degrees and variation in length.

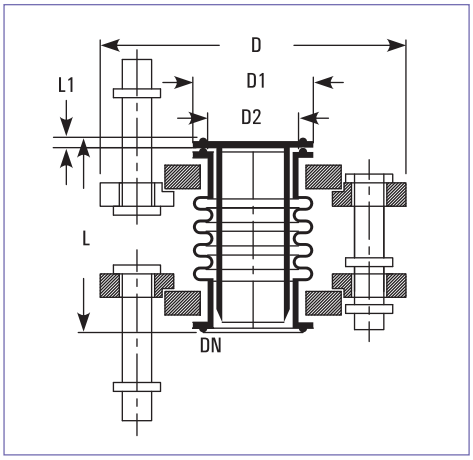
Bellows are supplied along with required bellow flanges and nut-bolts.
Distance - locking bolts are provided to avoid excessive compression or contraction of the bellow. Gaskets are not required where bellows are used. For drilling details, refer "Bellow flanges"

**Line bellows**

These can withstand a temperature of 200°C under normal atmospheric conditions.

* marked items are available fast.





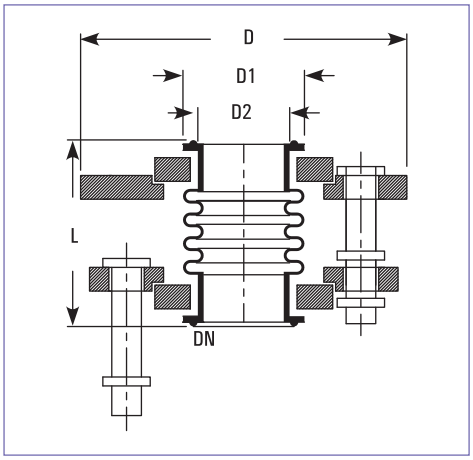

| Cat.Ref. | DN | D | D1 | D2 | L |
|---|---|---|---|---|---|
| FBN0.5 | 12 | 50 | 24 | 16 | 50 |
| FBN0.7 | 15 | 64 | 28 | 17 | 55 |
| FBN1* | 25 | 95 | 41 | 31 | 65 |
| FBN1.5* | 40 | 105 | 56 | 43 | 65 |
| FBN2* | 50 | 120 | 69 | 55 | 65 |
| FBN3* | 80 | 155 | 98 | 82 | 65 |
| FBN4* | 100 | 200 | 132 | 111 | 65 |
| FBN6* | 150 | 275 | 184 | 162 | 65 |
| FBN9* | 225 | 350 | 258 | 230 | 65 |
| FBN12 | 300 | 420 | 340 | 308 | 65 |

**Vacuum bellows**

For pipelines of 80DN and above operating under vacuum, the bellows are provided with an internal sleeve which supports the convolutions without affecting the flexibility of the bellow. These bellows can withstand a temperature of 200°C under full vacuum.
For size upto 50DN, line bellows can be used for these applications.

| Cat.Ref. | DN | D | D1 | D2 | L | L1 | t |
|---|---|---|---|---|---|---|---|
| VB3 | 80 | 155 | 98 | 82 | 70 | 5 | 3.0 |
| VB4 | 100 | 200 | 132 | 111 | 70 | 5 | 3.5 |
| VB6 | 150 | 275 | 184 | 162 | 70 | 5 | 4.0 |
| VB9 | 225 | 350 | 253 | 230 | 70 | 5 | 5.0 |
| VB12 | 300 | 420 | 338 | 308 | 70 | 5 | 5.0 |

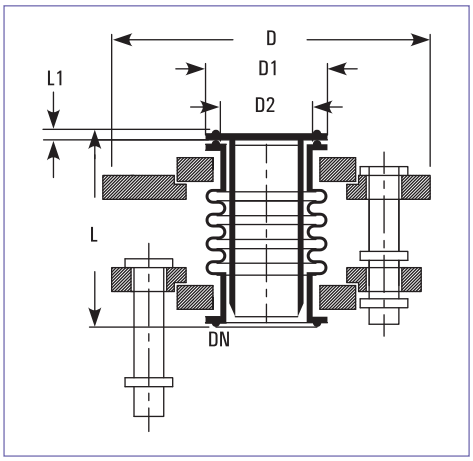
## PTFE BELLOWS - GLASS TO METAL




These bellows are used in installation of glass equipment for following purposes :

- to minimize the transfer of vibrations from the rotating equipments which are connected to the glass assembly.
- to accommodate the thermal expansion of any metallic (non-glass) equipment which are connected to the glass pipeline.

These are similar to the bellows for glass-to-glass in construction, but having adaptor bellow flange at one end. Generally this adaptor flange is supplied undrilled so that it can be drilled as per the configuration of mating flange. However, this adaptor bellow flange can be supplied drilled AS per "Table E", "Table F" or "ASA 150" standards, if Specified.




**Line bellows**

| Cat.Ref. Undrilled | Cat.Ref. Table E | Cat.Ref. Table F | Cat.Ref. ASA 150 | DN | D | L |
|---|---|---|---|---|---|---|
| FBF0.5 | FBF0.5/E | FBF0.5/F | FBF0.5/A | 12 | 80 | 50 |
| FBF0.7 | FBF0.7/E | FBF0.7/F | FBF0.7/A | 15 | 85 | 55 |
| FBF1* | FBF1/E | FBF1/F | FBF1/A | 25 | 115 | 60 |
| FBF1.5* | FBF1.5/E | FBF1.5/F | FBF1.5/A | 40 | 150 | 65 |
| FBF2* | FBF2/E | FBF2/F | FBF2/A | 50 | 165 | 65 |
| FBF3* | FBF3/E | FBF3/F | FBF3/A | 80 | 200 | 65 |
| FBF4* | FBF4/E | FBF4/F | FBF4/A | 100 | 220 | 65 |
| FBF6* | FBF6/E | FBF6/F | FBF6/A | 150 | 285 | 65 |
| FBF9* | FBF9/E | FBF9/F | FBF9/A | 225 | 395 | 65 |
| FBF12 | FBF12/E | FBF12/F | FBF12/A | 300 | 445 | 65 |

**Vacuum bellows**

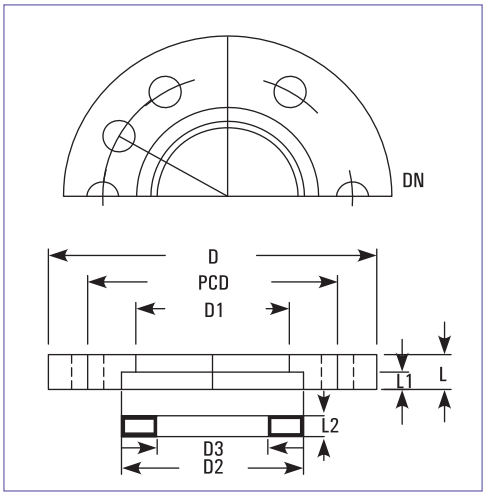
| Cat.Ref. Undrilled | Cat.Ref. Table E | Cat.Ref. Table F | Cat.Ref. ASA 150 | DN | D | L |
|---|---|---|---|---|---|---|
| VBF3 | VBF3/E | VBF3/F | VBF3/A | 80 | 200 | 70 |
| VBF4 | VBF4/E | VBF4/F | VBF4/A | 100 | 220 | 70 |
| VBF6 | VBF6/E | VBF6/F | VBF6/A | 150 | 285 | 70 |
| VBF9 | VBF9/E | VBF9/F | VBF9/A | 225 | 395 | 70 |
| VBF12 | VBF12/E | VBF12/F | VBF12/A | 300 | 445 | 70 |

* marked items are available fast.

# BELLOW FLANGES

Bellow flanges are used to fit a bellow to a glass component. Standard Bellow are made Cast Iron. Cast Iron with Epoxy Coated, Cast Iron with PTFE coated, Aluminum, Silumin, Stainless Steel, 304 & 316 and are used in FBV, VB, FB type bellows. These are provided with two holes at 180° for Distance - locking bolts and are supplied with a split ring.

| Cat.Ref. | DN | D | D1 | D2 | D3 | L | L1 | L2 |
|---|---|---|---|---|---|---|---|---|
| BF0.5 | 12 | 50 | 25 | 28 | 20 | 6 | 3 | 6 |
| BF0.7 | 15 | 65 | 29 | 37 | 22 | 6 | 3 | 6 |
| BF1* | 25 | 95 | 43 | 51 | 33 | 7 | 3 | 6 |
| BF1.5* | 40 | 110 | 58 | 66 | 45 | 7 | 3 | 6 |
| BF2* | 50 | 120 | 70 | 81 | 57 | 7 | 3 | 6 |
| BF3* | 80 | 155 | 101 | 112 | 84 | 7 | 3 | 6 |
| BF4* | 100 | 200 | 134 | 148 | 113 | 8 | 3 | 6 |
| BF6* | 150 | 275 | 186 | 196 | 164 | 8 | 3 | 6 |
| BF9* | 225 | 350 | 260 | 282 | 234 | 8 | 3 | 6 |
| BF12 | 300 | 425 | 342 | 363 | 310 | 10 | 5 | 8 |




**Drilling details**

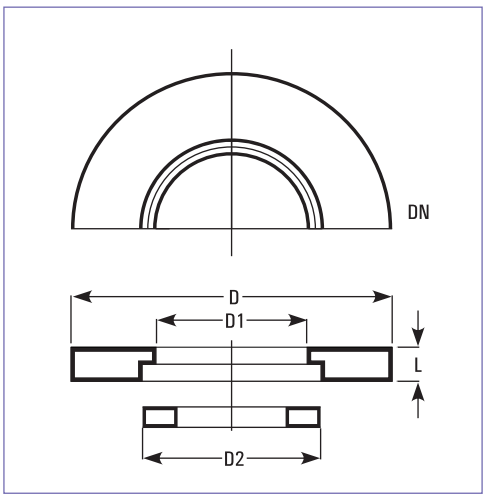
| Cat.Ref. | PCD | n x dØ | n x d1Ø |
|---|---|---|---|
| BF0.5 | 38 | 3 x 9Ø | 2 x 9Ø |
| BF0.7 | 48 | 3 x 9Ø | 2 x 9Ø |
| BF1 | 70 | 3 x 9Ø | 2 x 9Ø |
| BF1.5 | 86 | 3 x 9Ø | 2 x 9Ø |
| BF2 | 98 | 3 x 9Ø | 2 x 9Ø |
| BF3 | 133 | 6 x 9Ø | 2 x 9Ø |
| BF4 | 178 | 6 x 9Ø | 2 x 9Ø |
| BF6 | 254 | 6 x 9Ø | 2 x 9Ø |
| BF9 | 310 | 8 x 11Ø | 2 x 11Ø |
| BF12 | 395 | 12 x 11Ø | 2 x 11Ø |

# ADAPTOR BELLOW FLANGES

Adaptor bellow flange are used to fit a bellow to a flange having different bolt configuration. These flanges are made of cast iron and are supplied with a split ring.

These are particularly used to fit a bellow with a non-glass equipment like Glass-lined Reactor etc. These are used in FBF, VBF type PTFE bellows.

Adaptor bellow flanges are generally supplied undrilled. However, if specified , these can be supplied drilled as per "Table E", "Table F" and “ASA150" standards.




**Undrilling flanges**

| Cat.Ref. | DN | D | D1 | D2 | L |
|---|---|---|---|---|---|
| BFA0.5 | 12 | 80 | 25 | 28 | 6 |
| BFA0.7 | 15 | 85 | 29 | 37 | 6 |
| BFA1* | 25 | 115 | 43 | 51 | 7 |
| BFA1.5* | 40 | 150 | 58 | 66 | 7 |
| BFA2* | 50 | 165 | 70 | 81 | 7 |
| BFA3* | 80 | 200 | 101 | 112 | 7 |
| BFA4* | 100 | 220 | 134 | 148 | 8 |
| BFA6* | 150 | 285 | 186 | 196 | 8 |
| BFA9* | 225 | 395 | 260 | 282 | 8 |
| BFA12 | 300 | 480 | 342 | 363 | 10 |

**Drilled to Table E**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| BFA0.5/E | 62 | 4 x 7Ø |
| BFA0.7/E | 62 | 4 x 7Ø |
| BFA1/E | 82 | 4 x 14Ø |
| BFA1.5/E | 98 | 4 x 14Ø |
| BFA2/E | 114 | 4 x 14Ø |
| BFA3/E | 146 | 4 x 14Ø |
| BFA4/E | 178 | 8 x 14Ø |
| BFA6/E | 235 | 8 x 14Ø |
| BFA9/E | 324 | 12x14Ø |
| BFA12/E | 406 | 12x14Ø |

**Drilled to Table F**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| BFA0.5/F | 67 | 4 x 7Ø |
| BFA0.7/F | 67 | 4 x 7Ø |
| BFA1/F | 87 | 4 x 14Ø |
| BFA1.5/F | 105 | 4 x 14Ø |
| BFA2/F | 127 | 4 x 14Ø |
| BFA3/F | 165 | 8 x 14Ø |
| BFA4/F | 190 | 8 x 14Ø |
| BFA6/F | 260 | 12 x 14Ø |
| BFA9/F | 356 | 12 x 14Ø |
| BFA12/F | 438 | 12 x 14Ø |

**Drilled to ASA 150**

| Cat.Ref. | PCD | n x dØ |
|---|---|---|
| BFA0.5/A | 62 | 4 x 7Ø |
| BFA0.7/A | 62 | 4 x 7Ø |
| BFA1/A | 79 | 4 x 14Ø |
| BFA1.5/A | 98 | 4 x 14Ø |
| BFA2/A | 121 | 4 x 14Ø |
| BFA3/A | 152 | 4 x 14Ø |
| BFA4/A | 190 | 8 x 14Ø |
| BFA6/A | 241 | 8 x 14Ø |
| BFA9/A | 298 | 8 x 14Ø |
| BFA12/A | 432 | 12x14Ø |

* marked items are available fast.

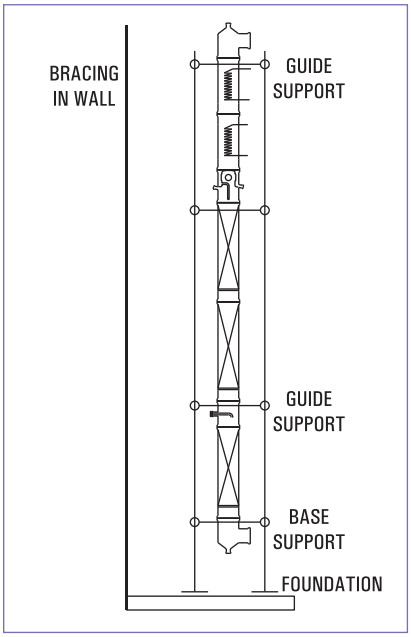
## SUPPORT OF COLUMN

Glass plants and pipeline should be supported correctly. To prevent inducing undesirable stresses in the glass, support should be rigid. When supported, glass should be in compression.

Generally, glass plant and equipment are supported in a rectangular tubular structure. This structure is formed of galvenised mild steel tubing with the cast iron fittings which are described in this catalogue. This type of structure provides enough flexibility for future modifications and is strong enough to support a glass unit.

Following rules should be followed while supporting a glass unit in a tubular structure.

1. The structure must be rigid. To give lateral support it must be braced back to the nearest wall or any rigid feature.
2. All glass columns are build up from a fixed point on which whole weight of the column should be taken.
3. With change in temperature, glass column and tubular structure expands at different rate. Therefore glass unit must be free for vertical movement above the fixed point. Hence, above the fixed point, guides supports should be used to give lateral support.




## STRUCTURE TUBES, GALVANISED

For forming the structure,"B" class galvanised tubes, Mild Steel with Epoxy Coated, Stainless Steel 304 & 316 are used in size of 1/2", 1", 1.1/4", 1.1/2" and 2". Cut tubes are available in required length to form a standard size structure. Cut tubes are provided with rubber plug at both the ends.

**Tube size**

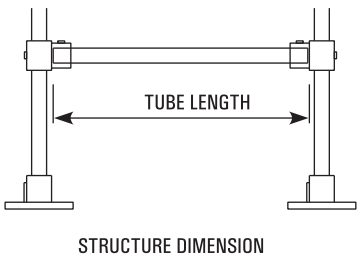
| NB Inches | NB mm | External Diameter |
|---|---|---|
| 1/2" | 15 | 19.5 |
| 1" | 25 | 32.5 |
| 1.1/4" | 30 | 41.5 |
| 1.1/2" | 40 | 48.3 |
| 2" | 50 | 60.3 |

**Available cut lengths**

| Structure | NB (mm) | | | | |
|---|---|---|---|---|---|
| Dimension | 15* | 25* | 30* | 40* | 50* |
| **For Vertical installation** | | | | | |
| 2500 | - | 2500 | - | - | - |
| 3000 | - | 3000 | 3000 | - | - |
| 3500 | - | 3500 | 3500 | - | - |
| 4000 | - | - | 4000 | - | - |
| 6000 | - | 6000 | 6000 | 6000 | 6000 |
| **For Frames** | | | | | |
| 400 | - | 365 | 355 | 345 | 335 |
| 500 | - | 465 | 455 | 445 | 435 |
| 600 | - | 565 | 555 | 545 | 535 |
| 800 | - | 765 | 755 | 745 | 735 |
| 1000 | - | 965 | 955 | 945 | 935 |
| 1200 | - | 1165 | 1155 | 1145 | 1135 |
| 1500 | - | 1465 | 1455 | 1445 | 1435 |

**For Support**

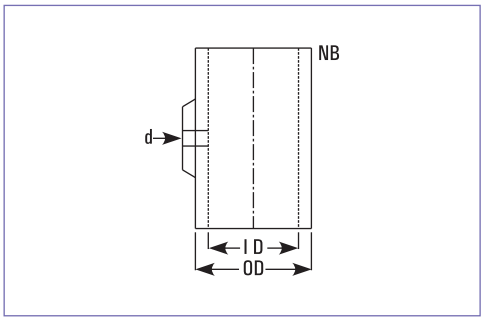
| | | | |
|---|---|---|---|
| 400 | 450 | 450 | 450 |
| 500 | 550 | 550 | 550 |
| 600 | 650 | 650 | 650 |
| 800 | 850 | 850 | 850 |
| 1000 | 1050 | 1050 | 1050 |
| 1200 | 1250 | 1250 | 1250 |




STRUCTURE DIMENSION

Cat. Ref. TBG (NBmm/Cut length)
for e.g. TBG 25/365

# STRUCTURE FITTINGS




Following structure fittings are available to use with galvanised tubes in order to form a tubular structure for a glass plant. These fittings are made of cast iron. Also available in Stainless Steel 304 & 316 and are suitable to the galvanised tubes described earlier.

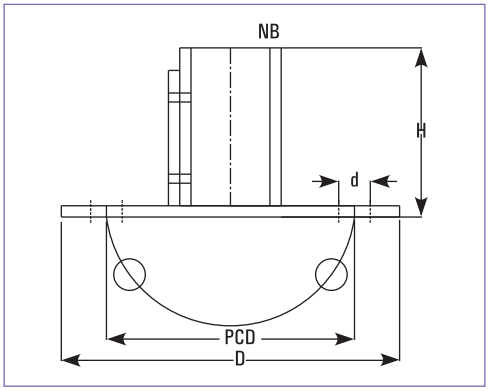
These slidable fittings are provided with grub screws to fix it at required position on a galvanised tube.

These fittings are specially made to construct a tubular structure which provides enough flexibility for future modifications without involving any hammering and welding.

## STRUCTURE FITTINGS - GENERAL DATA

| NB | TUBE DIA | ID | OD | d |
|---|---|---|---|---|
| 25 | 32.5 | 35 | 45 | 1/2" |
| 30 | 42.5 | 45 | 55 | 1/2" |
| 40 | 48.3 | 51 | 61 | 1/2" |
| 50 | 60.3 | 63 | 73 | 1/2" |

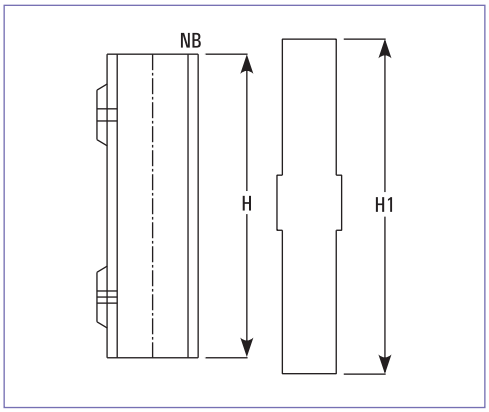
## STRUCTURE FITTINGS - BASE




These are to be used with vertical tubes. Holes are provided for foundation.

| Cat.Ref. | NB | D | H | PCD | dØ |
|---|---|---|---|---|---|
| BS25* | 25 | 102 | 52 | 110 | 4 x 11Ø |
| BS30* | 30 | 102 | 52 | 110 | 4 x 11Ø |
| BS40 | 40 | 140 | 60 | 110 | 3 x 14Ø |
| BS50 | 50 | 162 | 125 | 125 | 4 x 14Ø |

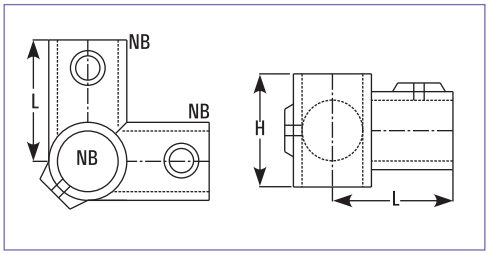
## STRUCTURE FITTINGS - COUPLER




These are generally used to couple the vertical tubes where more length is require.

| Cat.Ref. | NB | H | H1 |
|---|---|---|---|
| CL25 | 25 | 100 | 180 |
| CL30 | 30 | 100 | 178 |
| CL40 | 40 | 150 | 200 |
| CL50 | 50 | 150 | 200 |

## STRUCTURE FITTINGS - BEND




These are used to build frames on vertical tubes.

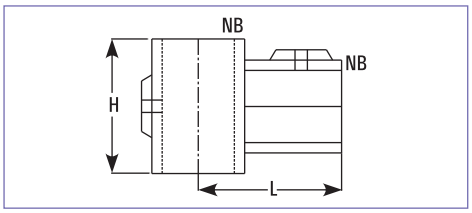
| Cat.Ref. | NB | H | L |
|---|---|---|---|
| BN 25* | 25 | 50 | 53 |
| BN30* | 30 | 60 | 65 |
| BN40 | 40 | 65 | 70 |
| BN50 | 50 | 85 | 95 |

* marked items are available fast.
We can also supply structure fittings & support in SS

STRUCTURE FITTINGS -

## TEE

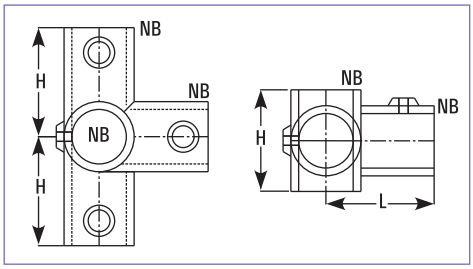
| Cat.Ref. | NB | H | L |
|---|---|---|---|
| T25* | 25 | 55 | 55 |
| T30* | 30 | 64 | 64 |
| T40 | 40 | 78 | 68 |
| T50 | 50 | 85 | 95 |




STRUCTURE FITTINGS -

## DOUBLE BEND

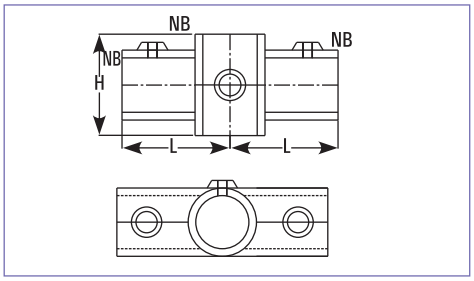
| Cat.Ref. | NB | H | L |
|---|---|---|---|
| DBN 25 | 25 | 51 | 52 |
| DBN30 | 30 | 62 | 67 |
| DBN40 | 40 | 68 | 70 |
| DBN50 | 50 | 85 | 95 |




STRUCTURE FITTINGS -

## DOUBLE TEE

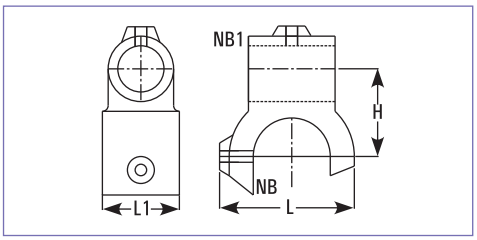
| Cat.Ref. | NB | H | L |
|---|---|---|---|
| DT25 | 25 | 55 | 55 |
| DT30 | 30 | 64 | 64 |
| DT40 | 40 | 78 | 68 |
| DT50 | 50 | 85 | 95 |




STRUCTURE FITTINGS -

## EQUAL BRACKET

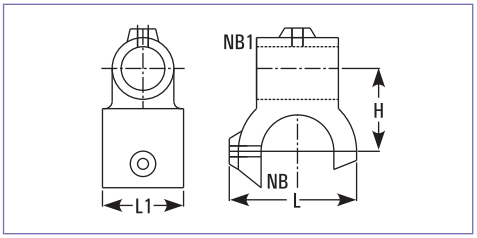
| Cat.Ref. | NB | H | L | L1 |
|---|---|---|---|---|
| EBT25* | 25 | 47 | 63 | 47 |
| EBT30* | 30 | 52 | 76 | 52 |
| EBT40 | 40 | 60 | 85 | 60 |
| EBT50 | 50 | 70 | 95 | 60 |




STRUCTURE FITTINGS -

## UNEQUAL BRACKET

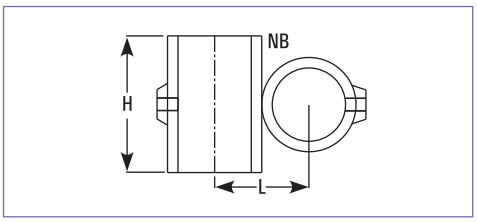
| Cat.Ref. | NB | NB1 | H | L | L1 |
|---|---|---|---|---|---|
| UBT25/15* | 25 | 15 | 42 | 65 | 35 |
| UBT30/15* | 30 | 15 | 50 | 72 | 35 |
| UBT40/25 | 40 | 25 | 70 | 78 | 50 |
| UBT50/25 | 50 | 25 | 90 | 99 | 53 |



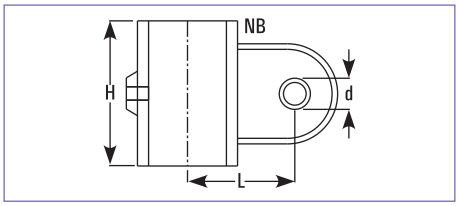

STRUCTURE FITTINGS -

## CROSS

| Cat.Ref. | NB | H | L |
|---|---|---|---|
| X25 | 25 | 50 | 45 |
| X30 | 30 | 65 | 55 |
| X40 | 40 | 65 | 70 |
| X50 | 50 | 65 | 85 |



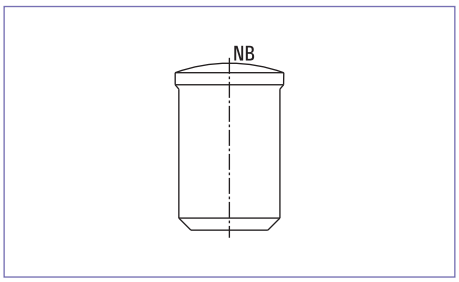
## STRUCTURE FITTINGS - SUPPORT




| Cat.Ref. | NB | h | L | d |
|---|---|---|---|---|
| SPT15* | 15 | 30 | 32 | 11 |
| SPT25* | 25 | 35 | 37 | 11 |
| SPT30* | 30 | 39 | 45 | 11 |
| SPT40 | 40 | 50 | 62 | 13 |
| SPT50 | 50 | 55 | 67 | 13 |

## STRUCTURE FITTINGS - PLUGS

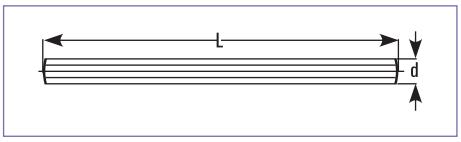
These are used to plug the open ends of galvanised tubes.




| Cat. Ref. | NB |
|---|---|
| PLUG15* | 15 |
| PLUG25* | 25 |
| PLUG30* | 30 |
| PLUG40 | 40 |
| PLUG50 | 50 |

## STRUCTURE FITTINGS - STUDS

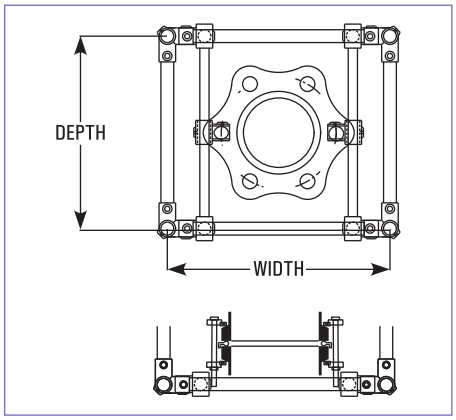
These are used as screwed rods with supports



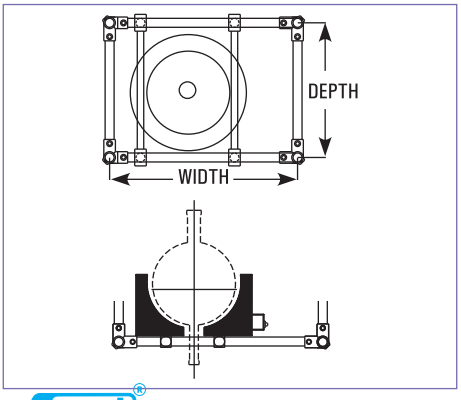

| Cat.Ref. | d | L |
|---|---|---|
| STUD5/16-150* | 5/16" | 150 |
| STUD3/8-150* | 3/8" | 150 |
| STUD1/2-200 | 1/2" | 200 |

## STRUCTURE DIMENSIONS

### FOR COLUMNS




| DN | Recommended tube size NB (mm) | Minimum Structure size Depth X Width |
|---|---|---|
| 80 | 25 | 500 x 500 |
| 100 | 25 | 500 x 500 |
| 150 | 25,30 | 600 x 600 |
| 225 | 30 | 800 x 800 |
| 300 | 30 | 800 x 800 |
| 400 | 30 | 1000 x 1000 |
| 450 | 30,40 | 1000 x 1000 |
| 600 | 40,50 | 1200 x 1200 |



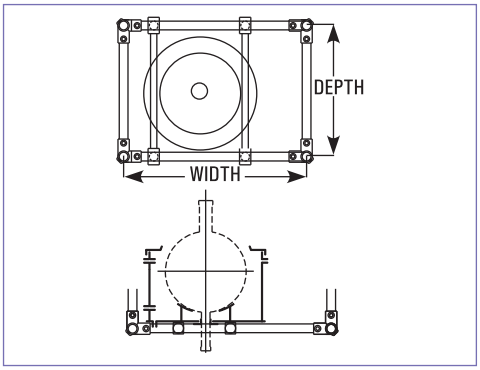

### FOR VESSELS (IN HEATING MENTLES)

| Size (Litres) | Recommended tube size NB (mm) | Minimum Structure size Depth X Width |
|---|---|---|
| 20 | 25 | 400 x 600 |
| 50 | 25 | 600 x 800 |
| 100 | 25,30 | 800 x 800 |
| 200 | 30 | 800 x 1000 |

* marked items are available fast.

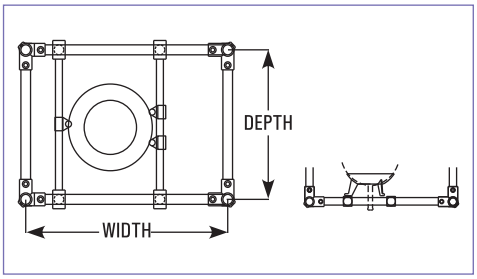
**FOR VESSELS** (IN HEATING BATHS)

| Size (Litres) | Recommended tube size NB (mm) | Minimum Structure size Depth X Width |
|---|---|---|
| 20 | 25 | 500 x 600 |
| 50 | 25 | 600 x 800 |
| 100 | 25,30 | 800 x 1000 |
| 200 | 30 | 800 x 1200 |




**FOR VESSELS** (IN VESSEL HOLDERS)

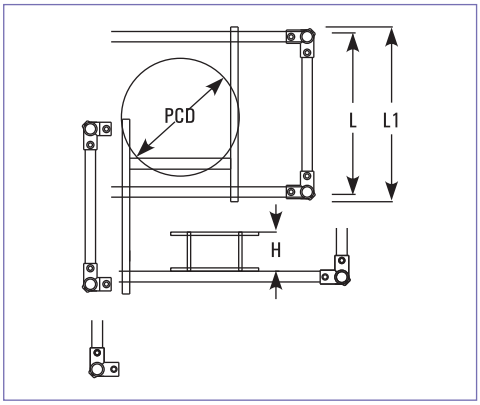
| Size (Litres) | Recommended tube size NB (mm) | Minimum Structure size Depth X Width |
|---|---|---|
| 20 | 25 | 500 x 600 |
| 50 | 25 | 600 x 800 |
| 100 | 25,30 | 1000 x 1000 |
| 200 | 30 | 1000 x 1000 |



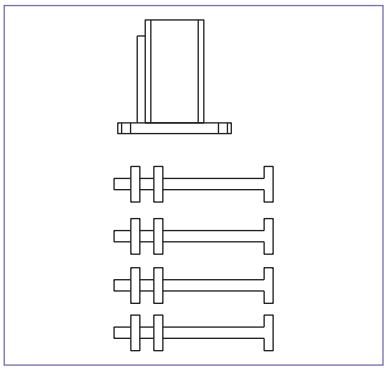

## COLUMN BASE SUPPORT FRAMES

These channel frames are used as fixed support in erection of columns. These are supplied with full threaded jacking rods and U bolts.

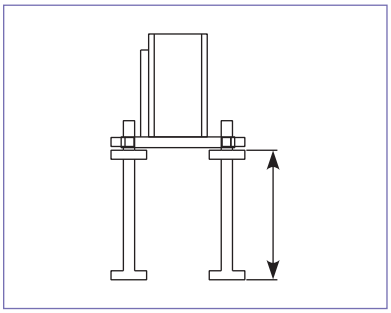
| Cat.Ref. | PCD | L1 | L | H |
|---|---|---|---|---|
| FCSH225 | 310 | 1000 | 800 | 75 |
| FCSH300 | 395 | 1000 | 800 | 75 |
| FCSH400 | 495 | 1200 | 1000 | 75 |
| FCSH450 | 585 | 1200 | 1000 | 100 |
| FCSH600 | 710 | 1400 | 1200 | 100 |



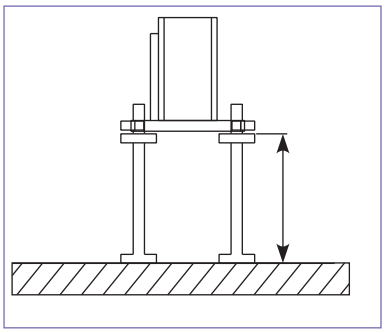
## GROUTING OF BASE



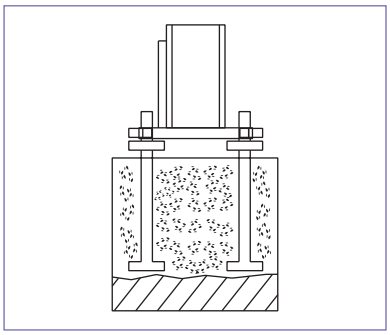
1. Take one Cast Iron BASE and four foundation Bolts, each with 2 nuts.



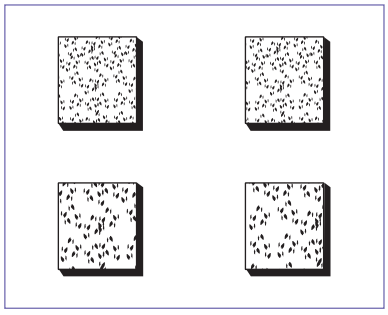
2. Fit the bolts in BASE so that base is raised upto 150mm from head of bolts.



3. Put this assembly on the floor and prepare a rough surface for proper bonding of grouting.

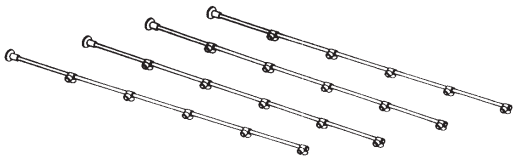


4. Make a concrete block over the bolts of about 200 x 200 mm upto the base of BASE i.e. 150mm high.

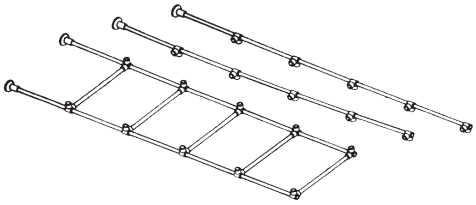


5. Prepare separate block for each BASE instead of making one big common block. For all BASES.

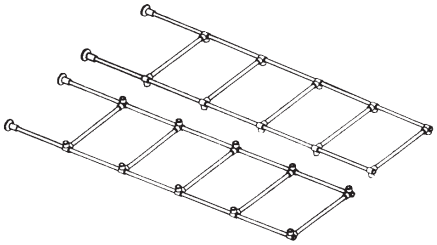
## ASSEMBLING OF STRUCTURE



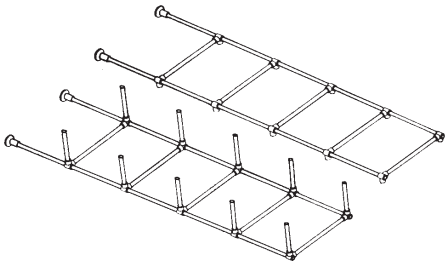
(1) Mark the position of required fittings on all the Vertical tubes, slide them in correct sequence and lightly Tighten.



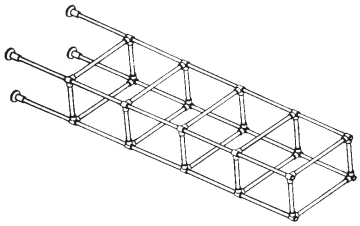
(2) Assemble one side frame of the structure by adding the cross tubes between two vertical tubes.



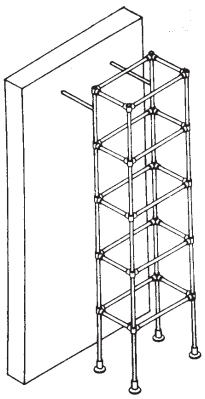
(3) Assemble other side frame of the structure by adding the cross tubes between other two vertical tubes.



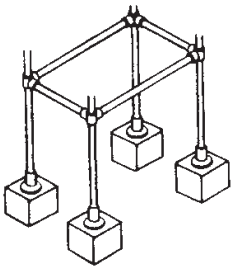
(4) Build up the cross tubes in one side frame and Tighten lightly.



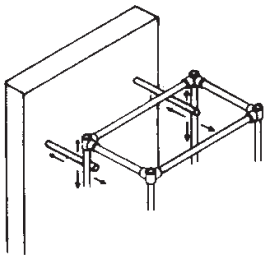
(5) Add the other side frame on it and tighten all the fittings firmly.



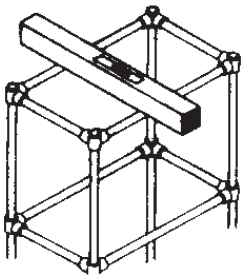
(6) Hoist the structure and brace it to some existing rigid feature.



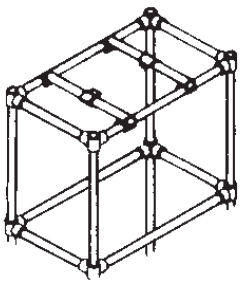
(7) Grout the foundation bolts and fix the structure bases with that.



(8) Adjust bracing to obtain a correct plumb in Structure.



(9) Adjust the horizonatal frames in correct level.



(10) Assemble the support tubes at their positions.

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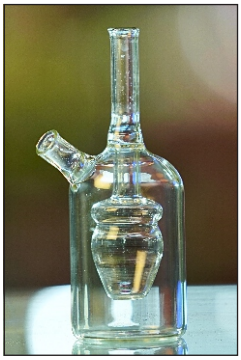
## Borosilicate Architecture Lamp Shades





## Decorative Vases




## Process Custom Glassware











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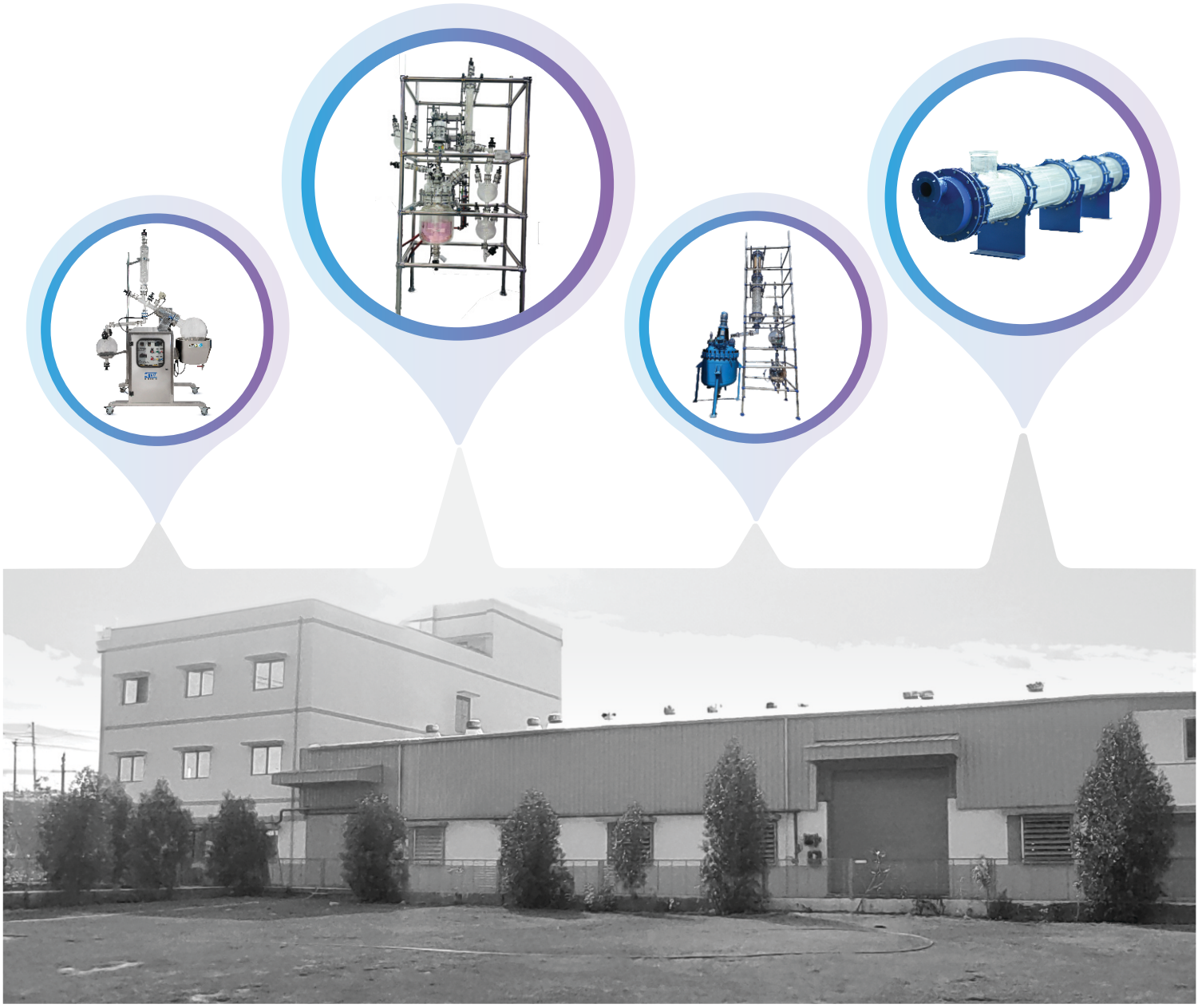

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