HHV WORLD

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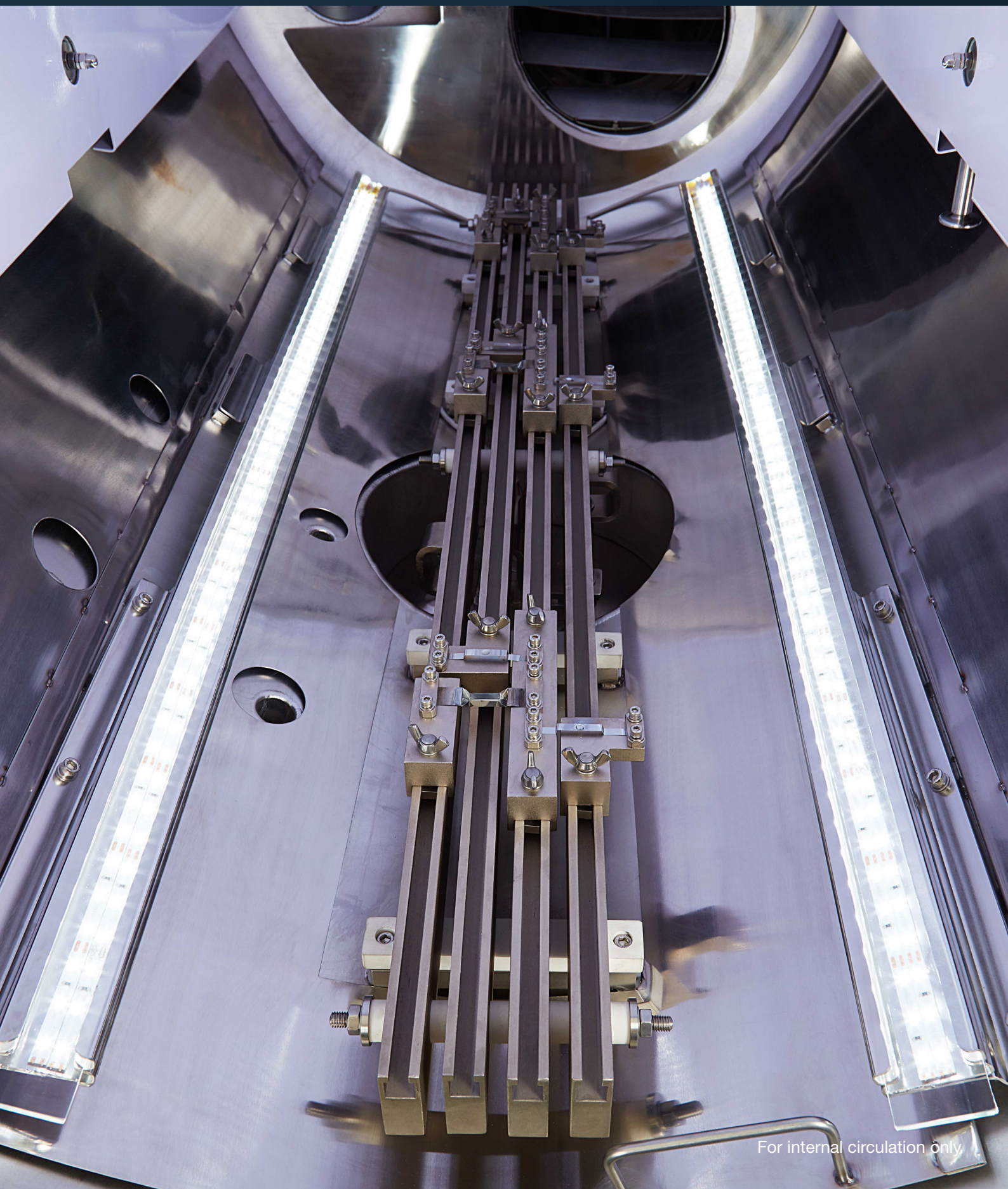

Editorial

Two quarters of the financial year are over. The HHV group is proud to announce that one hundred percent of all employees are vaccinated against COVID.

The manufacturing sector is slowly picking up and labour forces are starting to stabilize again. HHV has developed new technology in the last six months and aims to increase market share and sales through its innovative high technology products.

HHV's vacuum furnaces serve a variety of applications. Our horizontal vacuum furnace for treating alloys uses gas quenching to produce enhanced tools. HHV furnaces are used for large industrial purposes as well as R and D applications. Compact vacuum furnaces from HHV are completely automated and used by laboratories to develop and test new materials.

HHV continues to build thin film systems for a range of applications. HHV's ID500 and ID750 coat series of coaters are specially designed for the development of finger marks in forensic laboratories. Vacuum Metal Deposition (VMD) are used by the forensic science and police communities for several years.

Thin film coating applications continue to be popular. HHV has developed a laser scan mirror for topographical mapping. HHV has developed a unique process to hermetically seal mirror glass to a titanium base to improve mechanical strength. The scanners are used for terrain mapping.

HHV Crystals has developed concavo-convex glass for the horological industry. The challenge in producing the product consistently is to maintain radii on both sides of the glass without sagging. The product can be metallized and printed in a range of colours.

HHV Pumps new DS 150 is a single stage, dry claw vacuum pump built for continuous operation. The pumps are used for a range of industrial applications from food packaging to thermoforming.

HHV had a host of events in the last two quarters. HHV's annual foundation day was held on a small scale due to the ongoing pandemic. HHV celebrated National Safety Day and World Environment Day as well. HHV has also introduced a 5S programme with the best zone awarded with a rolling trophy every month.

HHV recently launched a new website which takes into the company's state-of-the-art and cutting-edge ethos. The website covers technology capabilities of the company, career openings, webinar recordings, publications and updates on events at the company.

HHV continues its journey to develop and build high quality state of art equipment for diverse applications involving vacuum and thin film technology. With its international reach through its wide network of highly trained and committed distributors, HHV can provide superior service and support globally even in these challenging times.

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Horizontal Vacuum Furnace for Heat Treatment of Tool Steels

The growth in demand for high-precision components of enhanced quality for developing new technologies leads to advancements in manufacturing techniques.

Vacuum heat treatment with high pressure gas quenching process is one such process that has improved the product quality with reduction in cycle time and became an environment-friendly process. It prevents distortion of the material and provides an oxidation-free bright surface.

Recently, HHV has commissioned a horizontal type, automated, high vacuum ($1x10^{-5}$ mbar) heat treatment furnace with a high pressure gas quenching facility. This design meets NADCAP standards. The product is meant mainly for the heat treatment of HSS, HDS, HCHCR, and other tool steel applications.

The challenges involved in developing such high temperature, high vacuum, and high-pressure furnaces is that they must be specifically designed and built with appropriate materials and pumping systems. These systems are capable of ensuring a high level of vacuum integrity despite the hugely increased surface areas from the various components and loads. In addition to appropriate heat shielding and insulation.

It has an effective hot zone of Ø 900 mm x 900 mm height x 1200 mm depth to accommodate 1500 Kgs of charge weight. A motorized trolley provides a support system to load & unload the job. The vacuum furnace operates at a temperature of 1375 °C, with a heating rate of 8 to 10° C/min.

The gas quenching operation is carried out at 10 bar (absolute) pressure. Quenching by gas (high pressure) requires specially designed seals that ensure leak tightness at both lower and higher pressures. The importance of gas quenching is that it doesn't cause the metal to deform or experience dimensional changes. In this furnace, the 1500 Kg job at 1375°C can be brought to 150 °C with a cooling rate of 20°C/min to 70 °C/min by the forced cooling.

The automated heat treatment furnace is provided with an auto-mode facility for operation with a temperature controller, programmable logic controller, SCADA, measuring and control instrumentations, etc. for a user-friendly operation.

Compact Vacuum Furnaces for R&D Applications

Vacuum furnace technology is well-known and used by engineering industrialists who have had the foresight to develop new materials and process technologies. To keep the R&D sectors in the fore front and to create a sustainable manufacturing eco-system, HHV invests into developing new products and new technologies in the furnace manufacturing sector.

HHV is a pioneer in developing compact vacuum furnaces with automatic, precise measuring, and control instrumentation to support the scientific and industrial community for material processing and growing research.

Vertical Vacuum Furnace for Laboratory Applications

One of HHV's recent developments is an automated vacuum furnace that is vertically mounted, has double-walled, water-cooled process chambers and with an ante-chamber for loading and unloading substrates and an isolation valve that separates them.

A vacuum system enables evacuation of the 8" square shape ante-chamber to a vacuum level of 10^{-3} mbar. This ante-chamber has the facility to add alloy/powder into the charging crucible encompassing it. The charge crucible can be manually tilted to transfer the alloy/powder into the melting crucible placed inside the hot zone of the process chamber, pre-evacuated to 10^{-3} mbar by opening the isolation valve.

High-density graphite heating elements enable achieving a maximum temperature of 1000°C placed inside a hot zone of size Ø 350mm x 300mm height which can accommodate 20 Kgs. The maximum temperature achievable with a heating rate of 1-10°C/min and a temperature uniformity ±50°C is above 600°C.

An electromechanical lifting mechanism with an 8 mm diameter shaft holds the charge crucible provided through the top of the ante-chamber. The shaft is connected to the motor for rotation. This lifting mechanism will lift or lower the rotary motor assembly with a stroke length of 750 mm. A controlled gas inlet system allows gradual gas flow into the chamber

This completely automated vertical vacuum furnace has been provided with temperature controllers, programmable logic controller, SCADA, measuring and control instrumentations, for user friendly operations.

Pilot Scale Vacuum Furnace for Sintering

Vacuum sintering is a process that converts powder material into dense material in an atmospheric controlled condition to produce ceramics, refractories and ultra-high temperature materials.

Technological developments in atmosphere-controlled sintering furnaces develop high pressure and vacuum environment in one place and therefore, it saves time, cost and also leads to new development ideas for researchers.

HHV's pilot-scale automated vacuum sintering furnace designed with a hot zone of size 200 mm (W) x 200 mm (Ht.) x 350 mm (D) can accommodate 30 Kgs of the job to be sintered. The furnace chamber houses the resistance heating system that aids to heat the 30 Kg of charge up to 1400°C with a heating rate of 10 to 15°C/min.

The measuring and control instrumentations monitor the temperature and vacuum level in the furnace. The cooling system accelerates cooling the vacuum sintering furnace, which can vastly improve the efficiency and life of the furnace.

With the continuous optimization and improvement of various parameters in the vacuum sintering furnace, the equipment performance will improve to ensure product quality. The high vacuum system enables to achieve the ultimate vacuum of 1 x 10^{-3} mbar after backfilling the chamber with dry Nitrogen in a cold, clean, dry, empty, de-gassed chamber.

A closed-loop inert gas (argon/nitrogen) fast cooling system with a canned motor, a blower, and a water-cooled heat exchanger cools down the job from 1380°C to 300°C in less than 90 minutes. However, the cooling rate depends on the charge weight to surface area ratio.

This completely automated sintering furnace has been provided with temperature controllers, programmable logic controller, SCADA, measuring and control instrumentations, for user friendly operations.

Vacuum Ageing Furnace for Alloys

Heat treatment furnaces aim to change the properties of a metal without changing its shape. Different heat treatment processes are used by application on the metal component.

Ageing is a process used for strengthening alloys like Ni-based super alloys, Titanium alloys, and other alloys. The ageing of metals adds important properties to metal components making it suitable for industrial and specialized applications, particularly defense and general manufacturing applications. The heat treatment process of ageing is performed under controlled atmospheric conditions to ensure a high degree of quality and accuracy to meet the standards of precise specifications.

HHV designs, develops and customizes vacuum heat-treatment ageing furnaces for industrial and classified applications. In recent years, HHV has developed a high vacuum, heat treatment furnace for ageing applications to build classified components of different sizes.

Each different metal goes through the ageing process at a unique range of time-temperature combinations to which the metal component responds. The benefits of ageing include an increase in strength of metal alloys, fatigue life, desired microstructural changes, texture modification, and other physical properties.

The vacuum ageing furnace is a horizontal type, double-walled, water-cooled chamber. This design is as per the requirements of ASME Section VIII, unfired pressure vessels.

The vacuum system achieves an ultimate vacuum level of 5 x 10^{-5} mbar or better in a clean, dry, empty chamber. The vacuum ageing furnace has a hot zone size of 2000 mm diameter and 2300 mm depth, designed for a maximum temperature of 800° C, and ±5°C temperature uniformity. It has a loading and unloading trolley designed to carry a charge weight of 500 kgs.

This completely automated ageing furnace has been provided with temperature controllers, programmable logic controller, SCADA, measuring and control instrumentations, for user friendly operations.

It is an indigenously developed technology by HHV which enables the manufacturing of advanced structural and high-performance materials in India for different applications.

Development of advanced materials using this capability is possible for applications related to defense, space and manufacturing industries.

Laser Scan Mirror for Topographical mapping

In recent years, laser-based scanning produces accurate images of the ground from aircraft/ combat vehicles. Laser beams are fired towards the ground and the intensity/time of flight of the reflected beams are measured. In addition, GPS (Global positioning system) and IMU (Inertial measurement unit) provide the position and altitude of the mapped features.

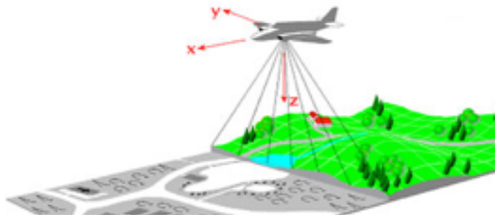
Laser scanners are silver-coated mirrors, which oscillate or rotate at certain speeds to direct the laser beams onto the ground. It should possess lightweight, stiffness, strength, and higher reflectivity in the required wavelength. A clock records the time of firing and receiving pulse. With the time data, the distance will be calculated and the features will be mapped.

Laser reflective coating can be done on flattened glass and embedded in fixtures that lack strength and accuracy. We at HHV used a most robust process to make these mirrors. To improve the mechanical strength and stiffness of the mirror, the mirror glass has been hermetically sealed with a metal base using a special process. This specific manufacturing strategy suits the mirror for high-speed scanning applications.

The reflective mirror coating on the front side reflects the laser pulses without ghost effects. The vacuum-deposited silver layer is also protected with an oxide layer to prevent oxidation and scratch. The coating passed the MIL-C-675C durability test.

Applications:

- Laser scanners for terrain mapping
- Aerospace instruments
- Scientific instruments



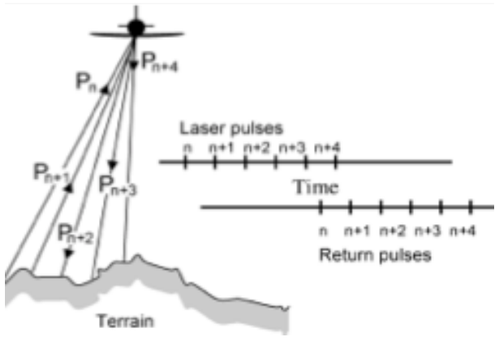


Figure 1. Concept of laser scanning and TOF measurement

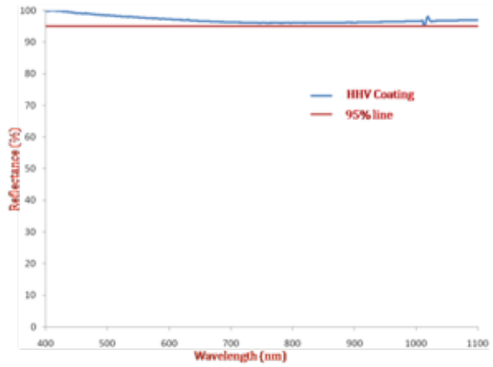


Figure 2. Reflectance spectrum of front surface silver mirror

Figure 3. Laser scan mirror

Thin Film Coaters for Forensic Applications

HHV's ID500 and ID750 coat series of coaters are specially designed for the development of finger marks in forensic laboratories. Vacuum Metal Deposition (VMD) are used by the forensic science and police communities for several years.

In the VMD coating process, the evidence is placed in a vacuum chamber and then tiny amounts of metals like gold, Tin, Aluminum, and zinc are resistively heated and vaporized. These metallic vapors are deposited onto the evidence or fingerprint and make any invisible or latent fingerprints visible to the naked eye.

VMD is widely used for those items that are exposed to harsh or extreme environments. Fingerprints re-produced using VMD are having higher quality with recognizable contrast and ridge clarity. Fingerprints developed by VMD are also of a much higher definition and have excellent contrast and these prints were developed using cyanoacrylate fuming and other techniques. VMD develops latent fingerprints on evidence that is 20-30 years old. The technique has also provided remarkable results on exhibits that have been affected by water and objects which are buried underground. VMD is one of the only available techniques capable of developing fingerprints on fabrics. Previous research has shown that VMD can develop ridge detail and reveal areas of touch on a wide range of fabrics.

Both these models utilize the proven VMD (Vacuum Metal Deposition) technique which was developed for the detection of finger marks on difficult substrates such as plastic bags and sheeting.

The ID500 is a compact and economical system designed for research applications and this is used for small volume samples. The ID750 is a fast-cycle system designed for the rapid processing of larger batch quantities of evidence with minimal cycle times.

Both systems feature a slide-out evidence holder with a 4-position facility (45 °, 90 °, 135 ° and 180 °) to enable the evidence materials to be attached easily to the holder.

The evidence holder accommodates flat, flexible materials with dimensions up to 72cm x 56cm for the case of ID500, and 120 cm x 84 cm for the case of ID750. A motor drive is provided through the rear of the chamber for the processing of cylindrical evidence.

Straight forward VMD process

Three banks of metal deposition sources are provided with a source selection option. These sources can evaporate all metals currently used in the VMD process including Gold, Zinc, and Silver. The ID 500 system features an HMI for an automated vacuum cycle, in combination with manual controls for the evaporation sources.

The ID750 system features a full-color touch screen IPC system for a seamless user interface. The system allows programming for different recipes into the repository, which can easily be recalled by the operator as per the requirement for a single touch operation for the entire cycle. The system also allows for pre-setting the time at which the pumping system needs to turn on so that the system is ready for deposition by the time the user is in office. The ID 750 is provided with comprehensive interlocks to protect personnel, evidence, and the system. The system comes with a built-in remote access capability for swift support and troubleshooting from the factory.

The system is provided with a large chamber viewport combined with an integrated chamber lighting system for providing clear, and visual monitoring of the coating process.

High-capacity vacuum system

The ID750 is fitted with a high-capacity vacuum system. A 3000 Ltrs diffusion pump is combined with a mechanical booster plus rotary pump set and this provides a rapid pump down to the pre-set base vacuum. An optional cryo-cooled 'cold finger' can also be provided to improve the pumping efficiency of the system. The rough vacuum pump-set is mounted onto a trolley for ease of maintenance. A typical process cycle with vacuum pump down, metalizing process and chamber venting to the atmosphere can be completed in less than 10 minutes.

The chamber is provided with a set of removable liners to prevent deposition onto the interior surfaces, and for ease of maintenance.

Dry Claw Vacuum Pump - DS 150

With over a decade of experience in manufacturing wet and dry vacuum pumps catering to a wide variety of applications. HHV Pumps now brings another unique model of dry vacuum pump for industrial uses.

The dry vacuum pump Model: DS 150 is a single-stage dry claw, direct driven, and air-cooled vacuum pump. The pump is designed in modular construction concept having two compartments, pumping area and gearbox, separated by a piston ring and rotary shaft seals. As the two rotating claws in the pump chamber rotate in opposite directions, the air is drawn inside and compressed out from the exhaust. The pump inlet port is protected by a metal wire mesh strainer to save the guard pump from an entry of solid particles.

Timed gear arrangement is used to maintain consistent clearance between two rotating claws. Oil-lubricated bearings run noiseless and provide a smoother rotary motion transfer.

The enclosure on the vacuum pump is designed to have cooling air circulation, thus radiating heat from the pump surface.

Features

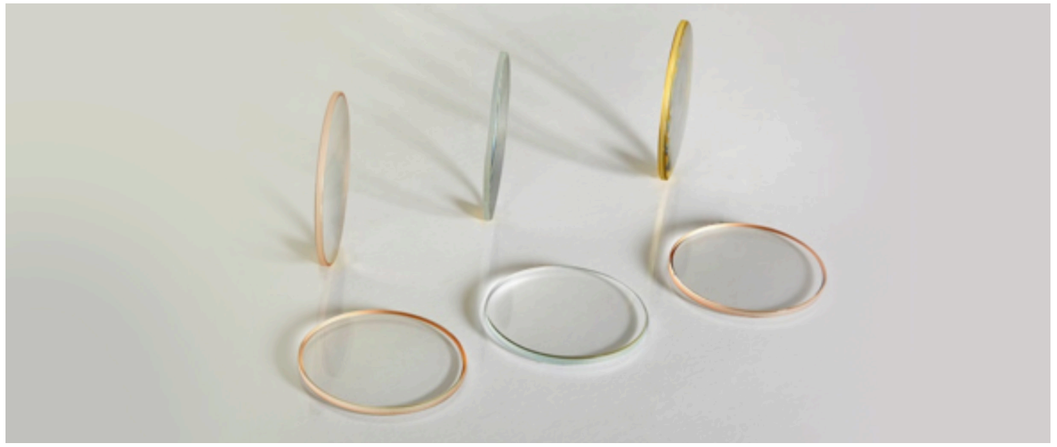
- Modular construction
- Completely dry pumping chamber
- Totally air cooled with efficient mechanism
- Compact design offers a lower footprint
- Inlet pressure regulator with minimum operating set pressure
- Self-balanced anti-suck back valve
- Easy access to silencer helping during maintenance
- Angular inlet port
- Built for continuous operation

Typical Applications

- Vacuum Conveying
- Vacuum Holding
- Powder Transfer
- Food Packaging
- Thermoforming
- Woodworking
- Medical Vacuum

Concavo-Convex Glass For the Horological Industry

HHV Crystals is India's premier watch crystal manufacturing company with over 25 years of expertise in manufacturing intricate and complex watch crystals at global quality standards.



By leveraging over five decades of HHV's expertise in vacuum science and technology development and manufacturing, HHV Crystals has established state-of-the-art machinery and operations that ensure repeatability for mass production.

One of HHV Crystal's recent innovations is a double domed glasses. The challenge in producing this profile consistently is to maintain radii on both sides of the glass without sagging and maintaining an optically superior finish.

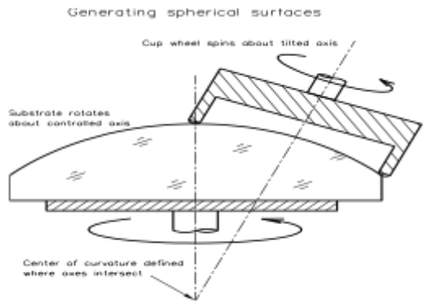
The double dome glass is also known as concavo-convex glass.Double dome glasses go through many steps for production starting with glass cutting, curve generation, beveling, toughening and cleaning.

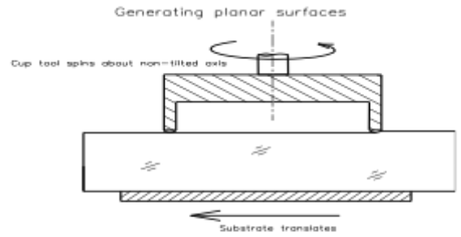
HHV Crystals has developed Concavo-convex glasses in multiple radii.

We can metallize and print on the curved surface without compromising on clarity. HHV Crystals has the capacity to produce 1.2 Lakh crystals per annum.

Plano-convex manufacturing process:

Cut Glass → **Curve Generation** → **Beveling** → **Toughening & Cleaning** → **Final QC**





National Safety Day Celebration 4th March 2021

Every year, HHV celebrates its National Safety Day in the month of March, as employee safety is the priority. This year it was celebrated on 4th March. This year is not an exception that the celebration took place with all the employees participating enthusiastically.

It is the occasion that comes once in a year where all the employees are joined together at one place for the required introspection and revive on safety in and around the workplace. It became an event for all the employees to play the quiz program and all the winners were awarded with prizes. At the end, all HHV employees pledged together to ensure zero accidents by adopting a good and safe work culture.

HHV's Annual Foundation Day 10th Apr 2021

April 10, 2021 was HHV's 57th foundation day. Usually, it has been an event for all the divisions to present achievements of the past year and putting forth future plans.

Due to the COVID pandemic, HHV was unable to hold its foundation day in 2020 and the management decided to celebrate the 57th foundation day for this year 2021 at respective location.

As HHV was not able to host the function with all the employees together, a gift and sweets were distributed to each employee. The employees rendering long service of 20 years in HHV were awarded a watch by the Managing Director in their respective campuses.

COVID 19 Vaccination Drive at HHV 9th Jun 2021

With the second wave of COVID-19 appearing to be on the vane, the focus has moved to preparation for third wave through vaccination in work places. At HHV, 100% of its employees have been vaccinated with their first dose. All employees and admin support staff were provided the first dose in two phases, above 45 years and below 45 years. HHV ensured all employees were given the first dose of the COVID-19 vaccination by the fantastic team from Apollo Hospitals.

World Environment Day Celebration 18th Jun 2021

5th June is World Environment day. Due to the covid-19 pandemic, this year, HHV organized the program on 18th June 2021 following the guidelines for safety and protection from covid-19. During this program, Mr. Prasanth Sakhamuri, Managing Director –HHV addressed the gathering and emphasized the importance of the environment and the theme of the year 2021.

The HHV Dabaspet campus has greenery all around the campus where the campus is surrounded by so many trees and plants.

HHV has been committed to protecting the environment and regularly following it for years. In addition to the existing greenery at HHV Dabaspet, HHV planted a few trees as a part of this year's program.

5S programmes for Process Improvement

The 5S housekeeping technique is a global tool used to improve manufacturing processes, efficiency, productivity and quality by making the work place orderly, pleasant and organised.

As one of the global leaders in vacuum technology, it has been a way of life in HHV to practise the lean manufacturing system which regards the use of the resources, creation of value for the end customers, and aims to eliminate waste.

HHV has a systematic periodical review that monitors the 5S implementation programme in various sections of the organisation to encourage employees to get the best output from the programme.

HHV Launches New Website

We are delighted to announce the launch of our newly designed website which takes into consideration HHV's rich history and cutting-edge technology products.

Our website showcases and updates all HHV news from ongoing research to product builds and company events and webinars. HHV endeavors to provide accurate, up-to-date information, knowledge, and expertise in design, product development, and services to all our customers. Visit us at www.hhv.in

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