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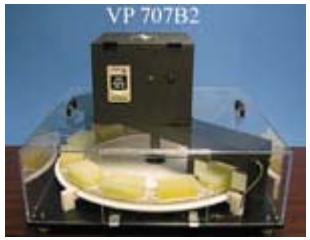
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Magnetic Levitation Stirrers

The V&P Scientific, Inc. Magnetic Levitation Stirrers (US patent #6,357,907) were designed to stir the tall narrow columns of deep well 96 and the new Whatman Polyfiltronics deep well 384 microplates. As scientists have sought to increase throughput of many processes they have turned to miniaturization and deep well microplates as a solution. However one of the problems of using deep well microplates is being able to adequately mix the well contents or to resuspend particles in these tall narrow wells. Another problem was that of getting enough oxygen exchange through the relatively small surface area of the deep well. We invented Magnetic Levitation Stirring as an efficient and inexpensive method to aerate and mix the contents of deep well microplates. We have done this by simply raising and lowering stainless steel balls in all the wells by using a very strong horizontal magnetic field. This method produces a very vigorous stirring action which stimulates growth of microorganisms, mixes with ease two or more liquids, and keeps particulates in suspension. Furthermore, if the media level in the wells is adjusted so the stir balls pass through the meniscus, aeration of a microbial culture is increased and results in greater microbial yield as well as DNA and protein production.



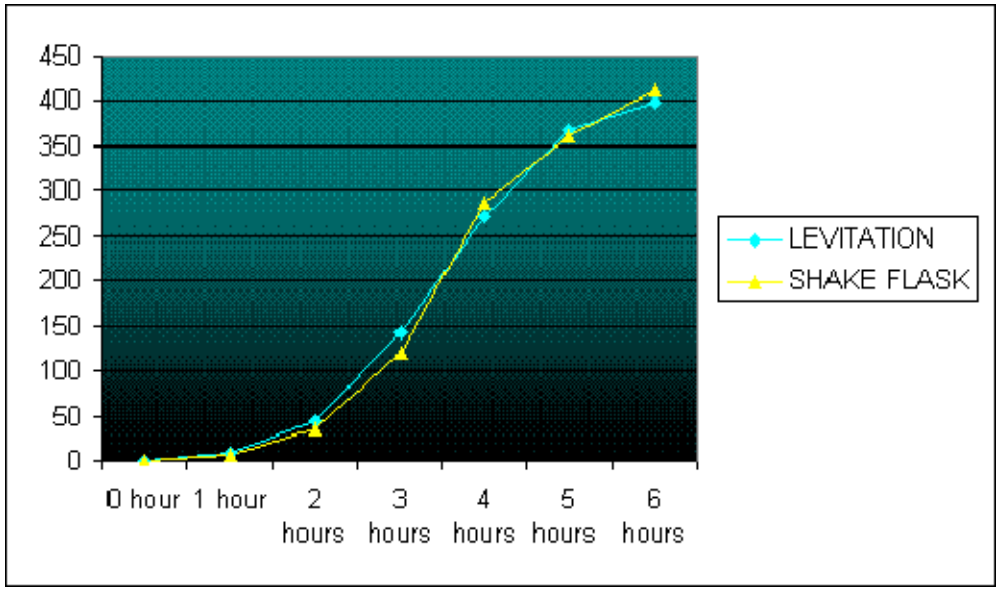
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Applications

- Rapid and efficient stirring of 96 and 384 deep well microplates
- Thorough mixing of 2 or more viscous solutions
- Keeps particulates in suspension
- Aeration of microbial cultures to increase DNA or protein yield
- Miniaturization of fermentations
- Stirring chemical reactions to speed completion

Advantages of the System

- Thorough stirring of large numbers of samples
- Will stir even viscous solutions (100,000 centistokes)
- No cross contamination – wells do not have to be sealed
- Simple to operate



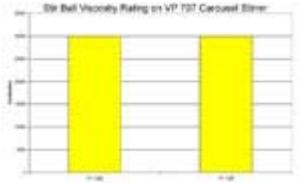
INCUBATION TIME	LEVITATION STIRRER OD	SHAKE FLASK OD
0 hour	1	1
1 hour	8.12	6.52
2 hours	44.43	35.13
3 hours	141.53	119.38
4 hours	271.38	287.38
5 hours	366.76	361.84
6 hours	398.76	412.91

Levitation Stirring Viscous Solutions

The ability to stir extremely viscous solutions is a very useful characteristic of all the V&P Levitation Stirrers. The following graphs illustrate the ability of our Levitation Stirrers and Stir Balls to mix even solutions of 100,000 centistokes or 6.6 times more viscous than honey. The following

experiments were performed with VP 707B1 Carousel Levitation Stirrer and the VP 725E and VP 725F stir Balls. A series of silicone viscosity standards was placed in the columns of a deep well microplate. The standard series viscosity was as follows: 100 cst, 1,000 cst, 5,000 cst, 10,000 cst, 12,500 cst, 30,000 cst, 60,000 cst and 100,000 cst.

For comparison 1 centistoke = 1.0760 x 10E-5 sq. ft./sec.,
water = 1 cst
molasses ~ 2,500 cst
honey ~ 15,000 cst



The follow graph illustrates that it will levitate the balls in all the standards, however it took several minutes for the ball to fall by gravity or with the assist of a pull down magnet with the 60,000 and 100,000 cst standards. Modification of the Stirrer with a stronger pull down magnet would perhaps solve this problem.

The Levitation Stir Balls are made from corrosion resistant stainless steel and come in a variety of sizes to accommodate all 96 and 384 deep well microplates. The Levitation Stir Balls are also provided encapsulated in parylene for combinatorial chemical reactions and other reactions that may be sensitive to metal ions. Also, Sterile Levitation Stir Balls are provided. Although the cost of the balls is low enough to discard them after one use, they can be recovered, washed, demagnetized and used over and over. Each of the Levitation Stir Balls is tested for magnetic energy and only those that pass our stringent testing are accepted.



Dispensers for loading the balls into the wells are also available for each size of ball. These dispensers can quickly and accurately place sterile or non-sterile balls into the wells. One of the advantages of stainless steel balls over permanent magnets is that the stainless steel may be demagnetized so they don't "clump" in the dispensers as the permanent magnets do.

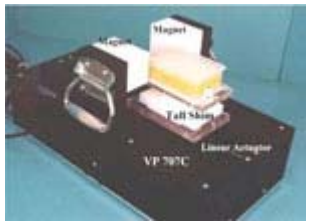
Removing the balls from the wells after they are used can be done as easily and as sterilely as your assay conditions dictate. If your assay is completed and all the liquid has been removed you can simply invert the microplate and magnetically collect the balls as they fall out. If the liquid is still in the wells and you want to remove the balls and leave the liquid behind just use the VP 770 Magnetic Plate System for stir ball extraction and the VP 384AM Magnetic Long Pin Replicator. A third way to remove the balls is with our VP 772 Magnetic Unloading System which uses a very strong magnet to remove the balls quickly and efficiently.

Scientists can apply this unique methodology to many different areas that require mixing of liquids or suspending particulates in the tall narrow wells of deep well microplates. The most cost effective is the manual Magnetic Levitation Stirrer VP 707. With as few as 10 back and forth strokes the contents of the wells are mixed. This Stirrer functions to levitate the balls by sliding the microplate through a horizontal magnetic field and then pulls the balls down by passing over a vertical magnetic field. The VP 707 is ideally suited to stir combinatorial chemical reactions or other reactions where continuous stirring is not required. The manual VP 707 has a footprint of only 20

cm wide by 64 cm long and 16 cm tall. This stirrer will stir one deep well microplate at a time at up to 100 lifts/minute.

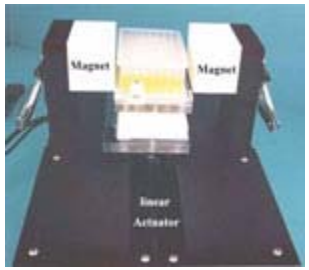
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Linear Shuttle Model For Continuous Stirring

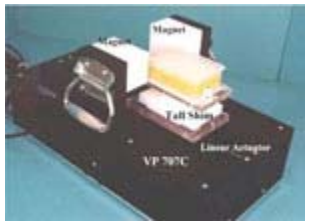
The VP 707C Linear Shuttle model (right) was designed to continuously stir one deep well microplate. If you need to have vigorous stirring in tall narrow columns this is the system for you. The Linear Shuttle Levitation Stirrer functions by moving a deep well microplate back and forth through a very strong focused magnetic on a Linear Actuator. The levitation balls in the microplate are lifted to the focal plane of the magnetic field as they pass through and then gravity causes them to fall as they emerge from the field. It is small enough (62.2 cm long by 26.7 cm wide by 22.9 cm tall) to fit into a large incubator or in a warm room.



The Linear Actuator is powered by a computer controlled servo motor thus enabling the microplate to be stopped in a precise position so it can be addressed by a robot pipetting system. Thus adding reagents or removing samples is easy. We are now working on a robotic system to exchange microplates. We designed this unit with an eye towards total integration into a robotic work station.

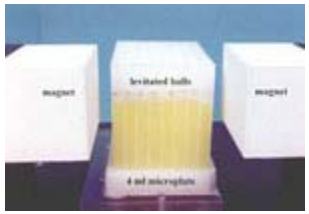
By using a system of short shims and tall shims we can also adapt this unit to stir not only 4.4 cm tall deep well 96 & 384 well blocks but also the new 9.7 cm tall 4 ml volume 96 well blocks from Innovative Microplate. The much taller 4 ml blocks are easily accommodated by using a very tall shim on the standard 2 ml deep well and removing it for the 4 ml blocks.
The VP 707C operates at speeds of 2 to 40 cycles per minute and requires 115V and 1 amp of current.

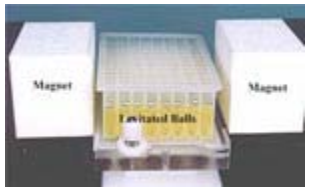
The VP 707CCE operates at speeds of 2 to 40 cycles per minute and requires 230 V and .5 amp of current. It is CE compliant.



Lease / Option to Buy Program

The Linear Shuttle is available on a lease/option to buy program. This allows you to do Proof of Principle experiments to see if Levitation Stirring will work in your application. If it works for you then the first month lease payment is applied to the purchase price of any of our Stirrers. The first month lease payment is only 10% of the purchase price. If it doesn't work in your application just send it back to us. (We don't get many returns). The second month lease is 45% of the purchase price and is **NOT** applicable to the purchase price of another stirrer.





Programmable Smart Switch

A cost effective way to automate any of our Levitation Stirrers is to use our new Programmable Smart Switch VP 700. Follow this link for more information.



NEW Heated Linear Shuttle

VP 707C2H



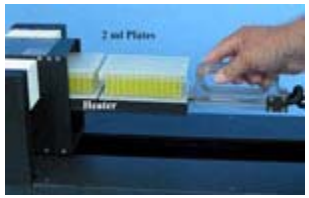
The VP 707C2H Linear Shuttle model (above) was designed to continuously stir and heat two deep well microplates. If you need to have vigorous heated stirring in tall narrow columns this is the system for you.

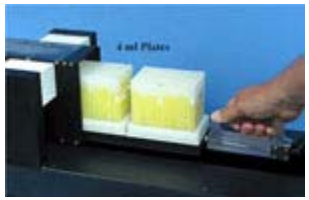
The Linear Shuttle Levitation Stirrer functions by moving a deep well microplate back and forth through a very strong focused magnetic on a Linear Actuator. The levitation balls in the microplates are lifted to the focal plane of the magnetic field as they pass through and then gravity causes them to fall as they emerge from the field. The base contains an heating element that is capable of heating the contents of the wells to 65° C. This capability can be used to culture cells or to heat reactions to speed their completion or aid in soluabilization.

The VP 707C2H operates at speeds of 2 to 40 cycles per minute and requires 115V and 2 amps of current.

The VP 707C2HCE operates at speeds of 2 to 40 cycles per minute and requires 230 V and 1 amp of current. It is CE compliant.

By using a system of grooves in the shuttle box we can also adapt this unit to stir not only 4.4 cm tall deep well 96 & 384 well blocks but also the new 9.7 cm tall 4 ml volume 96 well blocks from Innovative Microplate. See the photos to right and below





Carousel Models For Continuous Stirring Of Up To Twelve Deep Microplates

VP 707B4



The VP 707B4 Carousel model (to the right in exposed form) was designed to continuously stir twelve, deep well microplates. This Stirrer functions to levitate the balls by passing the microplates through 4 horizontal levitation magnetic fields strategically placed at intervals around the Carousel's perimeter.

Between the levitation magnetic fields and under the Carousel wheel we have also placed 4 pull down magnets that pull the balls down when they pass over. The pull down magnets are necessary only when viscous liquid are being stirred as gravity is sufficient in most aqueous solutions.

The Carousel models although larger than the Elevator model are still small enough (76.2 cm by 76.2 cm by 52 cm tall) to fit into large conventional incubators. The Carousel model VP 707B4 has 4 magnetic lift stations and four magnetic pull down stations and is powered by a 110 volt, 60 Hz 1.6 amp DC motor. The speed is controlled from 1 to 28 RPM or 4 to 112 lifts and falls per minute. A potentiometer on the control panel allows you to control the speed of the VP 707B4 Carousel. The VP 707B4 Carousel is operated with a simple speed control and on/off switch.

The Carousel model VP 707B1 is a more economical version of the VP 707B4. It has the same footprint as the VP 707B4 and can stir 12, deep well microplates at the same time. However it has only 1 magnetic lift station and one magnetic pull down station. The speed is controlled from 1 to 28 RPM (1 to 28 lifts/minute) and the VP 707B1 Carousel is operated with a simple speed control and on/off switch.

VP 707B2

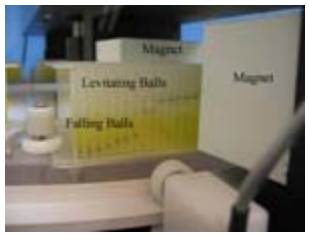


The Carousel model VP 707B2 is also a more economical version of the VP 707B4. It has the same footprint as the VP 707B4 and can stir 12, deep well microplates at the same time. However it has 2 magnetic lift stations and two magnetic pull down stations. The speed is controlled from 1 to 28 RPM (2 to 56 lifts/minute) and the VP 707B2 Carousel is operated with a simple speed control and on/off switch.

We provide an acrylic cover for the Carousel wheel to protect the Carousel and for safety considerations (see right). These units are capable of being operated inside temperature controlled environmental cabinets at temperatures ranging up to 37°C and at a humidity up to 90%.

On the right is a Whatman Polyfiltronics 384 deep well microplate with VP 725 Levitation Stir Balls lifted through the meniscus and then falling after they pass through the magnetic levitation field.

The photo on the right shows a 96 deep well microplate with VP 725F Levitation Stir Balls being lifted through the meniscus and then falling after they pass the magnetic levitation field.



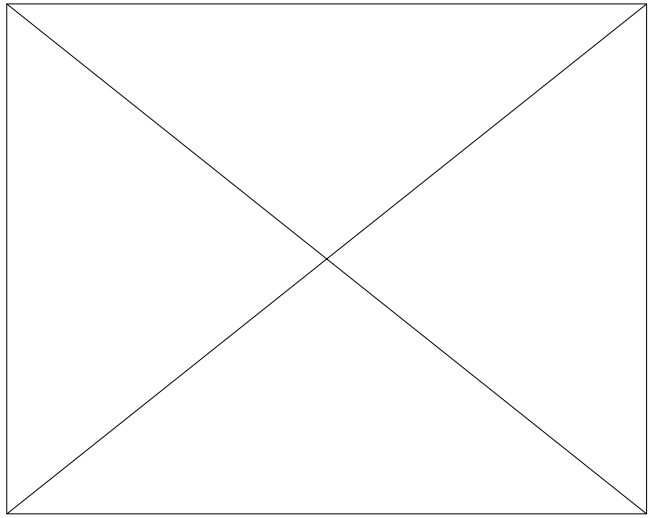


How Do You Determine Which Magnetic Levitation Stirrer Fits Your Needs?

For reactions that require only intermittent stirring of one deep well microplate, choose the VP 707. For reactions or culturing of microorganisms that require continuous stirring of 1, deep well microplate choose the VP 707C as it will fit into many incubators. For reactions or culturing of microorganisms the require continuous stirring of many deep well microplates and will fit into large incubators choose the VP 707B1. If you do not have an incubator that is large enough to accommodate the VP 707B1 then order a VP 707B1 with the optional VP 707-1 Temperature Controlled Environmental Chamber built in. The "CE" designation after the catalog number indicates a motor and control that will run on international electrical circuits of 230 Volts at 50 HZ and are CE compliant.

If your requirements are unique, contact us and we will build a custom Magnetic Levitation Stirrer for your application.

Movie Of The Carousel In Action



Download Video of VP 707B2 in action
(mpeg movie- 700KB)

Press the play button to view the video in a flash format, flash must be installed, or click the download link to download a mpeg version.

Compatibility With Deep Well Blocks

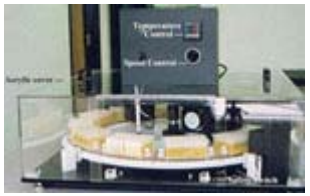
All Levitation Stirrers are equipped with microplate "hold down shoes" designed to fit the Polyfiltronic/Whatman 384 deep well blocks (Uni Plate 400 - 400 ul volume) and ABgene's 96 deep well blocks (2.2 ml volume) #AB-0661. Both these deep well blocks have a broad flat flange on the bottom and no skirt. This feature allows us to easily capture the plate and hold it securely in the strong magnetic field. Hold down shoes for other manufacture's microplates will be done on a custom basis.

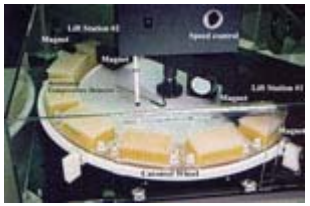
We also have microplate "hold down shoes" for Innovative Microplate's 4 ml 96 well blocks to fit on the VP 707C Linear Levitation Shuttle. We have also made custom "hold down shoes" for Innovative Microplate's 4 ml 96 well blocks that fit on the VP 707B Carousel.

Accessories

Temperature Controlled Environmental Chamber VP 707-1

We also can build any of the Carousels (VP 707B series) with a Temperature Controlled Environmental Chamber (VP 707-1) incorporated into the design. The VP 707-1 incorporates a simple heating system and temperature control under the acrylic cover to provide a stable temperature controlled environment. The VP 707-1 Temperature Controlled Environmental Chamber can control the temperature from 23°C to 41°C. This optional accessory can only be installed at the factory while we are building the Carousel. The photo below is of a VP 707B2 that has an Temperature Controlled Environmental Chamber built into the design.
We also have a CE compliant version of the Temperature Controlled Environmental Chamber the VP 707-1CE.





Count Down Timer Control VP 707-2

Another optional feature for the Carousel series of Levitation Stirrers is a count down timer control (VP 707-2). It allows you to stir for a predetermined time from 99 hours to 1 second before it shuts the motor off. This optional feature must be installed at the factory as we are building the Carousel.

Computer Controlled Operation VP 707-3

Another optional feature for the Carousel series of Levitation Stirrers is the software to control on/off, speed, acceleration and timer function via a RS 232 Serial Port connection to a PC. This optional feature must be installed at the factory as we are building the Carousel.

Manual Magnetic Levitation Stirrer - stirs one, deep well microplate at up to 100 lifts/minute	**VP 707**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 28 lifts/minute, 1 lift station, 115 Volts AC, 60 HZ	**VP 707B1**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 28 lifts/minute, 1 lift station, 230 Volts AC, 50 HZ, CE compliant	**VP 707B1CE**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 56 lifts/minute, 2 lift stations, 115 Volts AC, 60 HZ	**VP 707B2**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 56 lifts/minute, 2 lift stations, 230 Volts AC, 50 HZ, CE compliant	**VP 707B2CE**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 112 lifts/minute, 4 lift stations, 115 Volts AC, 60 HZ	**VP 707B4**
Carousel Magnetic Levitation Stirrer - stirs twelve, deep well microplates at up to 112 lifts/minute, 4 lift stations, 230 Volts AC, 50 HZ, CE compliant	**VP 707B4CE**
Linear Shuttle Magnetic Levitation Stirrer - stirs one deep well microplate at up to 40 lifts/minute, 1 lift station, 115 Volts AC, 60 HZ	**VP 707C**
Linear Shuttle Magnetic Levitation Stirrer - stirs one deep well microplate at up to 40 lifts/minute, 1 lift station, 230 Volts AC, 50 HZ, CE compliant	**VP 707CCE**
Linear Shuttle Magnetic Levitation Stirrer - stirs and heats two deep well microplates at up to 40 lifts/minute, 1 lift station, 115 Volts AC, 60 HZ	**VP 707C2H**
Linear Shuttle Magnetic Levitation Stirrer - stirs and heats two deep well microplates at up to 40 lifts/minute, 1 lift station, 230 Volts AC, 50 HZ, CE compliant	**VP 707C2HCE**
Temperature Controlled Environmental Chamber for Carousel Series Levitation Stirrers	**VP 707-1**
Temperature Controlled Environmental Chamber for Carousel Series Levitation Stirrers CE compliant	**VP 707-1CE**
Count Down Timer Control for Carousel Series Levitation Stirrers	**VP 707-2**
Computer Controlled Operation for Carousel Series Levitation Stirrers	**VP 707-3**

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