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# 7 Essential Steps to Set Up a Vibratory Finishing Process

# What Is Vibratory Finishing & Why Do You Need It?

Vibratory Finishing is a process that automates the mechanical and chemical finishing of various shaped parts. In this stage a combination of media, parts and compound are placed in a vibrating machine. The vibrations cause the contents to move in a circular motion and the media to grind against the part to get the desired finish.

Vibratory finishing processes can be configured as:

- ❑ **Batch system:** parts are loaded into the machine, processed, and unloaded before the next batch is ready.
- ❑ **Continuous system:** a process where the parts are loaded at one end and come out at the other end in the finished condition.

Vibratory finishing benefits

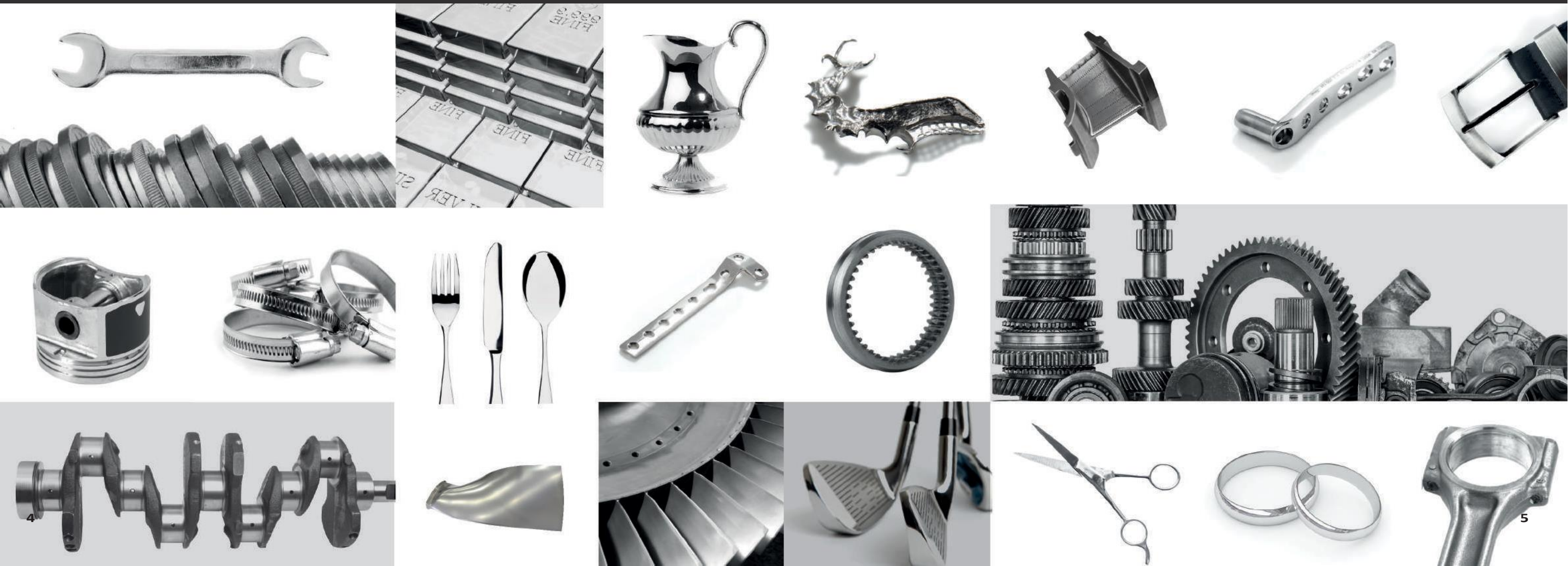
- ✓ Reduced processing times in comparison with manual finishing.
- ✓ Produces a consistent finish in comparison with manual finish, hence there is no need to carry out rework and you avoid high part rejects rates.
- ✓ It is a cost-effective finishing solution
- ✓ Vibratory finishing systems can be easily custom built to suit different applications
- ✓ There is a low probability of damaging delicate or large parts due to the circular motion of components and media.
- ✓ Parts of different shapes and materials can be processed in vibratory finishing machines.
- ✓ Vibratory finishing allows processing components with corners, holes, cavities, and slots. Vibratory finishing machines can be easily loaded and unloaded.



# Vibratory Finishing Applications

Deburring  
Descaling  
Degreasing  
Oil Removal  
Cleaning  
Smoothing  
Removal of Machining Lines  
Removal of Surface Defects

Radius Formation  
Polishing  
Burnishing  
Brightening  
Drying  
Corrosion Protection  
Super-finishing



# 7 Steps to Identify the Vibratory Finishing Process Suitable for You

To identify the right finishing process for your part it implies running finishing trials. This will determine the correct media, compound, vibratory finishing machine and other process parameters which will ensure repeatability in results. For the trial to be successful we recommend going through 7 steps:

## STEP 1: Gather information regarding your part:

The recipe to achieve the required surface finish involves using the correct machinery, media, and compound. These parameters can be determined once you know the part details:

- Material
- Dimensions
- Shape
- Weight
- Surface Roughness
- Manufacturing Volumes (per day/ month/ batch quantities)
- Current Process Issues (costs/ poor finish/ long process times/ high scrap rate/ need to carry out rework/ etc.)
- Process Requirement (deburring/ descaling/ Radiusing/ polishing/ edge-breaking/ etc.)

The above component details are factors that will also help you to determine:

- ✓ the amount of parts that can be processed in a batch
- ✓ determine current issues you face when processing the parts so you can improve the finishing process
- ✓ and most important you will know what the part finishing requirement is

## Step 2: Determine which vibratory finishing machine to use

Some of the most known and used vibratory finishing machines are the **vibratory troughs, bowls, dryers, and duals**. Below you will find some facts regarding each vibratory machine that will help you to decide which machine works best for you:

### Vibratory Trough Finishing Machine

- The trough machine is perfect for **larger, longer, and irregular shaped components**.
- This is a versatile machine as it comes in various standard sizes and a choice of combination of lengths and widths.
- Vibratory trough machines suit various customer applications from **deburring, descaling, Radiusing and cleaning to polishing and surface improvement**.
- These machines include a single speed motor as a standard feature with adjustable flyweights set to transfer the optimum amount of energy to produce a finish in the most efficient manner.
- The **polyurethane lined chamber** is designed in a “U” shape and can be **sub-divided using divider plates** to provide separate compartments for **precision or delicate components**.
- Separation of parts and media is done manually for the standard trough machines. However, if required parts can be separated from media at the end of the finishing process if an accessory such as the Vibratory Separation System is included.
- For delicate **small batch works** a trough machine such as the **HT Series** can be used. This machine runs on a standard 16A socket, 1 phase, 240V AC supply and it is a very user-friendly kit for deburring or burnishing operations.



## Vibratory Bowl Finishing Machine

- Built to suit various applications from **deburring, descaling, Radiusing and cleaning** to **polishing and surface improvement**.
- The polyurethane lined work chamber is designed in a manner that the components are subjected to effective tumbling action which ensures shorter process times. **Bowl lining** ensures the **fabrication is protected** and **reduces the coefficient of friction between the media and bowl**, thereby **increasing media life expectancy**.
- Both **large and small batches of components can be processed** in this machine.
- Bowl machines can be customised to suit user application and can be designed to include **manual or autofunctionality**.
- For processing batches of parts that require a separation of components from the media at the end of the process we recommend using a **bowl finishing machine with separation system**.
- If you require to process only **small batches of parts** and you do not have the luxury of space, you can consider a **Bench Top Vibratory Machine**, commonly found in the jewellery industry.
- For **heavy duty applications** such as **ball burnishing**, we recommend using a bowl finishing machine. With a powerful drive system and special springs, this bowl machine has a special rubber lining to assist the movement of the parts during the process.
- For processing **large circular components** such as **vane rings** there are **bowl machines with narrower central section of the working bowl**. Our bowl machines can accommodate a part with a bore ID 250 mm and an overall OD not larger than 940 mm.
- To **avoid impingements** when processing small, delicate parts **divider plates can be installed** in the working chamber. In this case parts are manually loaded and unloaded.
- For a process where **100% discharge of media and part** is required at the end, we recommend a **bowl machine with pneumatically operated discharge door**. This machine is also great for **part-on-part finishing** process.
- If you need to **process, separate, and unload magnetic parts**, you can use a **bowl finishing machine with an over-band electro-magnetic separator**. The process of separation and demagnetisation is automated giving the required control of process.
- To achieve a **highly polished finish** on **automotive and motor bike wheels**, consider a **wheel polisher**. Both forged and casted wheels can be processed in this machine.



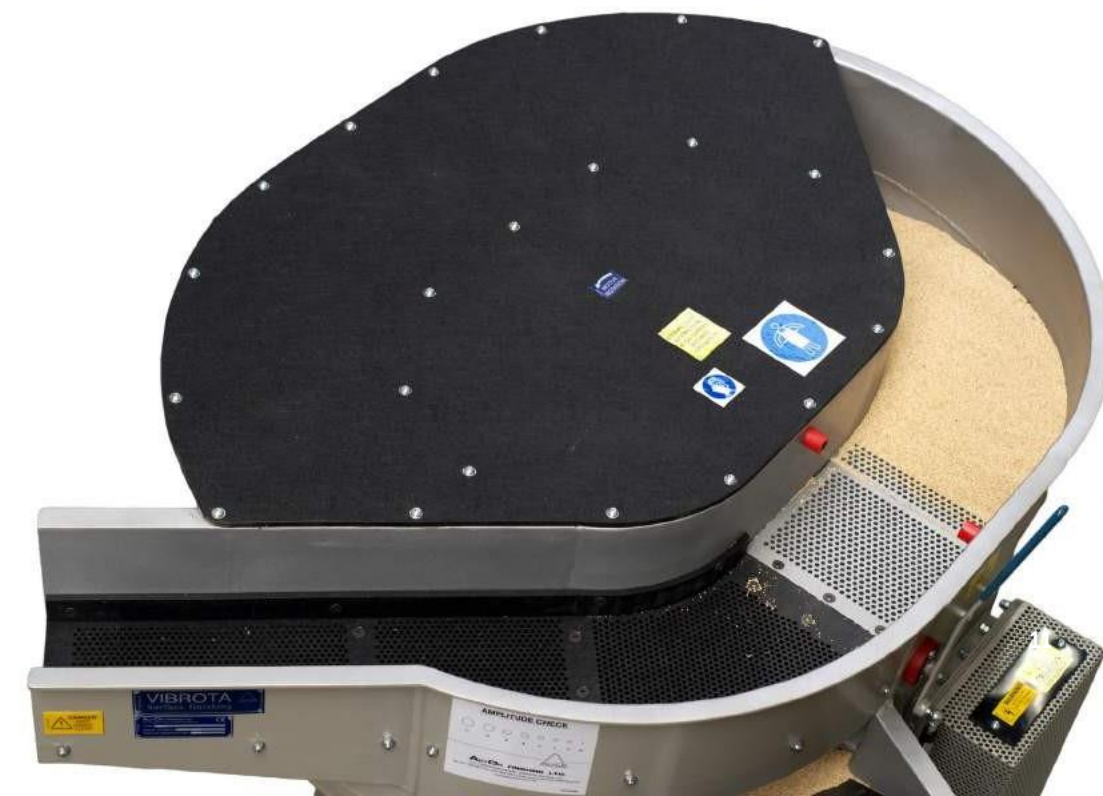
## Vibratory Dual Finishing Machine

- The **Dual Finishing machine** design integrates two process chambers: an inner chamber that can be used for **wet process application**, and the outer chamber for **dry process applications**.
- The **inner chamber** has a hot cured polyurethane lining and can be used from **deburring, descaling, Radiusing** and **cleaning** to **polishing** and **surface improvement**.
- The **heated outer chamber** can be used for **drying/cleaning** the parts after being processed in the inner chamber. Parts can also be **polished** in the outer chamber using 3P media.
- The Dual finishing machine typically **includes a separation system** for each chamber to separate media from parts. At the end of finishing process in the inner chamber media is screened through the separation screen and is retained in the bowl, while the parts are discharged to the outer chamber for drying. This operation is repeated once the parts have been processed in the outer chamber and then suitably collected.



## Dryer Machine

- Choosing the correct dryer depends on the finishing applications and part specification. Hence you can choose between a Conveyorised Electrically Heated Drying Oven, a Vibratory Finishing Dryer, a Rotary Dryer, or a Centrifugal Dryer.
- The **Conveyorised Electrically Heated Drying Oven** is best suited for **drying** a variety of **parts**, which are **large in nature** or where the **3P media cannot be used** due to the risk of lodgement. Parts are loaded on the metal conveyor belt, which travels through the heated drying chamber and collected at the discharge end.
- The **Vibratory Finishing Dryer** has an **elliptical shaped work chamber** which gives an **extra drying area**, thus **minimising the drying time**. Both large and small batches of components can be dried, using heated drying media, either as a batch process or a continuous single lap process.
- The design of the **Rotary Dryer** includes an inner rotating chamber where the **components get dried using** appropriate **3P media** which absorbs the moisture from the components. Some of the advantages of this dryer are: **100% separation** of components and media; **re-circulation of drying media** with **continuous output of parts**; **energy efficient** unit with minimum loss of heat.
- The **Centrifugal Drier** is best suited for **drying large volumes of small components** where the **3P media cannot be used** due to the risk of lodgement. The machine works with the circulation of open loop hot air. The finished parts are stain-free and protected against corrosion.
- When there is a **space restriction**, and you need to **dry small and medium sized components** consider using a smaller vibratory dryer finishing. Both machines can be used for **drying and polishing** small and medium parts **using 3P media**. These are very **quiet in operation** and are **easy to move around** as they are mounted on castor wheels. HD3000 is great for **sanitation of cutlery** due to the UV lamp provided on the lid.



### Step 3: Calculate the amount of parts you can process/ batch

The amount of parts to be processed per batch also known as workload can be determined through media to part ratio. To do so you would need to calculate the part volume and know the usable volume of the finishing machine work chamber (approx. 90% for vibratory machine).

The guidelines below will help you in determining the right media to part ratio for your process:

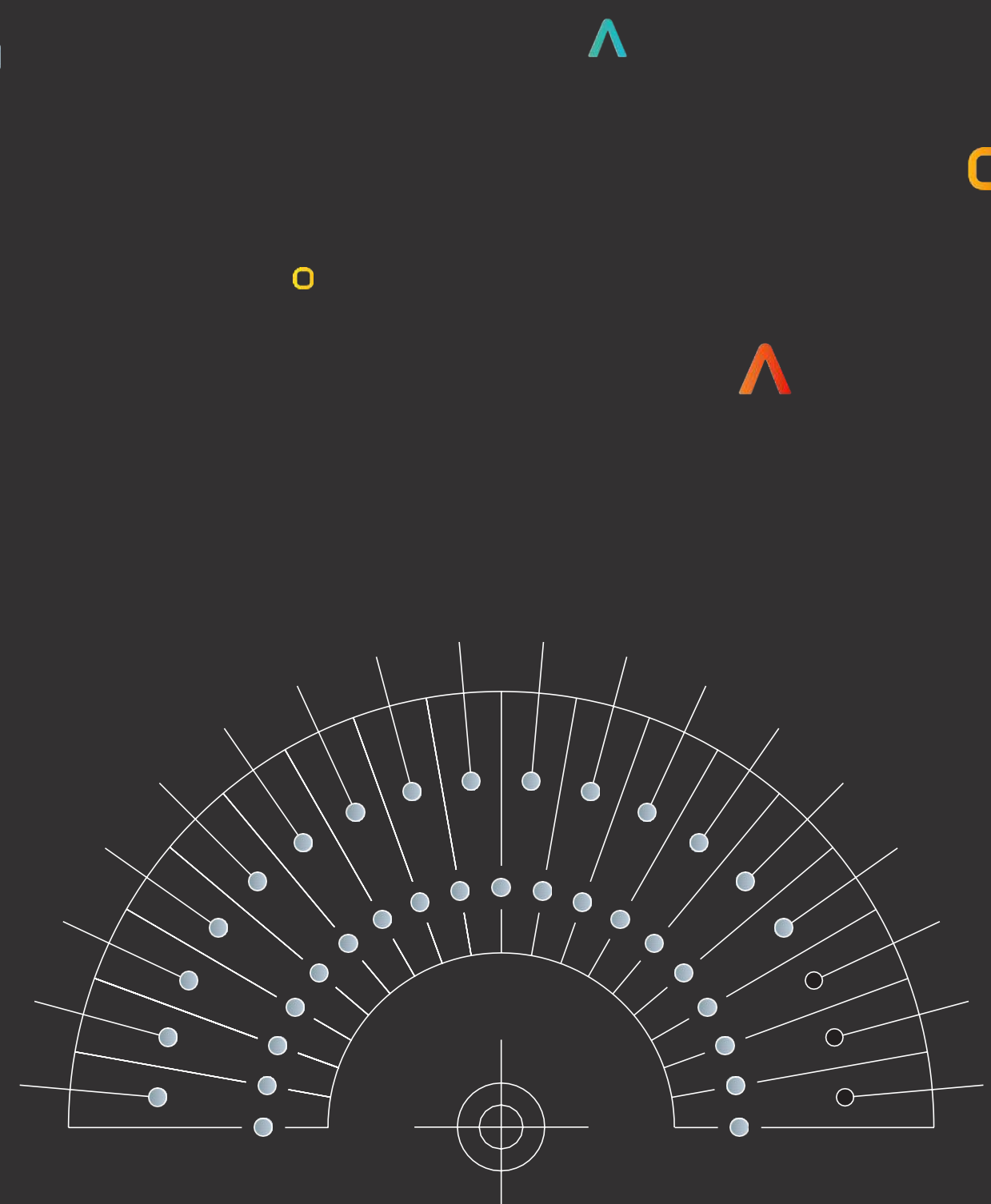
- 0:1** Part on part finishing (no media)
- 1:1** Equal parts of media and components; for a rough surface finish on castings, forgings, or stampings.
- 2:1** A lower ratio of media to part, which can be used for very small parts; will still produce a rough finish on castings, forgings, or stampings.
- 3:1** Minimised part to part interaction; great for moderate deburring and surface finishing on ferrous metals.
- 4:1** A good ratio for ferrous metals but average for non-ferrous parts; also minimised part to part interaction
- 5:1** A minimum part on part interaction; great for non-ferrous and softer materials
- 6:1** Used when processing non-ferrous and fragile parts for pre-plate and decorative finish
- 8:1** Recommended for bright burnished finish and high-quality pre-plate finish
- 10:1** Great for finishing parts with irregular shapes and fragile components

For precision or delicate components, we recommend finishing these individually, in work chambers sub-divided using divider plates. This will avoid part on part interaction

### Step 4: Set up the finishing machine amplitude

The amplitude of a vibratory finishing machine controls the final finish of the component. The amplitude can vary from 1mm to 8mm, with 3mm to 6mm being the normal operating range. The required amplitude can be obtained by adjusting the motor weights.

While for finishing delicate parts, you can use a lower amplitude, a higher set amplitude is best for heavier cutting, rolling burrs or peening edges. For a polished finish or for deburring parts with slots and wholes consider a small amplitude and a fast speed.



## Step 5: Identifying the right media for the finishing process

As we have previously explained in this eBook the recipe to achieve the required surface finish involves using the correct machinery, media, and compound. The following factors must be considered when choosing the right media:

### Media Type

On the market there is a wide range of media types such as **Ceramic, Plastic, 3P, Pre-Treated, Stainless Steel, natural Corn Cob, Aluminium Oxide** and many more.

Media transmits the energy generated by the equipment to the parts being processed and are capable of heavy burr removal, edge RADIUSING to smooth and bright surfaces.

**Ceramic Media** is recommended for **removing burrs, edge RADIUSING, burnishing** and to **quickly remove polishing lines** on components made from harder materials. Faster cut Medias are designed to be softer, thus allowing the cutting elements to be exposed. **Polishing Medias** are harder and are used for **burnishing**. In general, the slower the cut, the harder the media.

**Plastic Media** is light-weighted and is manufactured out of soft bonding agents, which allows it to **remove burrs without rolling the burr** onto the part. Furthermore, we recommend using this media to achieve a **very smooth surface finish**, or a **bright or matte finish** on components made from softer materials.

**3P Media** can be used for **surface brightening** or **final finish refinement**. **Pre-treated Media** is recommended for achieving a **high lustre** or **mirror finish**.

Applications for **Stainless Steel Media** include **burnishing, cleaning, improving strength and light deburring**.

### Media Shape

When choosing the shape of the media it is important to consider the geometry of the part - hence any lodgement of media can be avoided, and the part finish will be consistent.

A **flat sided media**, such as triangles, tri-stars, wedges, and the end side of cones, can generate longer surface contact time on edges for **deburring and RADIUSING**. However, **round shaped media**, such as balls, cylinders and cones **generate a single point contact** concentrating energy in one small point, therefore producing more work in that area.

For components which have corners, holes, and slots both Tri-Star media and wedge media are recommended, minimising the possibility of media lodgement.

For surface improvement of hard to reach areas, an ellipse or cylinder shape can be considered.

### Media Size

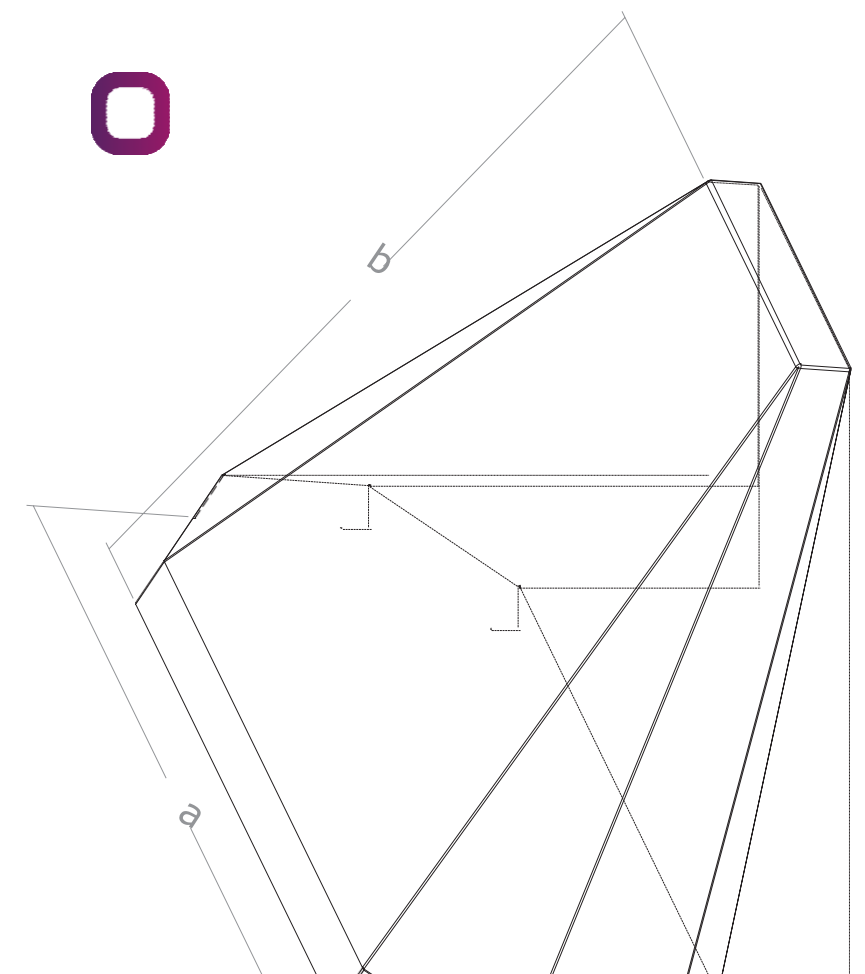
The component finish is also subject to the size of media chosen. A **larger media** will generate higher energy; hence it will **cut and finish faster** with higher wear rates. This is also **recommended for processing larger parts**.

A **smaller media** can hold more water and compound resulting in **less part-on-part damage**. Also, a smaller media has a gentler impact on part, which results in **longer processing times, better finishes, and less media wear**.

Generally, media size must be of a different size to the part to allow complete separation at the end of the finishing process. If media is larger than parts, then an inverse separation system can be used. For ferrous components, consider magnetic separation.

### Media Hardness

To avoid damaging the component, it is important to consider the part material and the hardness of the media. Ceramics are harder than plastic; hence it may cause damage to soft materials.





## Step 6: Identifying the right compound for the finishing process

**Compounds are integral to the success of a process. These have many functions such as suspending the dirt, oils and media residues and flushing them from the system, as well as keeping the components and media clean, which brings stability to the process. Other advantages include corrosion inhibition, brightening of different materials and removing scale post heat treatment. As the compound acts as a lubricant, it extends the media life.**

Here are the 3 considerations when choosing the compound

**Process requirement:** such as parts that need a compound with corrosion inhibitor; flat parts that can stick to each other in process will require a separating compound; or removal of heavy machine marks and burrs can be accelerated using an abrasive powder compound.

**Finish requirement:** from removing heat treatment, descaling, cleaning to brightening, polishing, and burnishing you need to choose a compound that has been designed for that particular finishing requirement

**Component material:** compounds are formulated to finish ferrous and non-ferrous parts.

As it can be tricky to determine a compound that ticks all 3 considerations, we have put together a list of our compounds which includes the compound details, application guide and characteristics and type of part materials. You can find this list in our Consumables Brochure (<http://acton-finishing.co.uk/consumables>).



## Step 7: Run the vibratory finishing trial

The final step is to run the finishing trial. This will enable you to test, improve and ascertain the finishing process parameters and establish a repeatable solution.

As this is a trial you should consider having a number of part samples to use for testing. Make sure these samples are the exact replica of the component to be finished, to ensure the solution is viable.

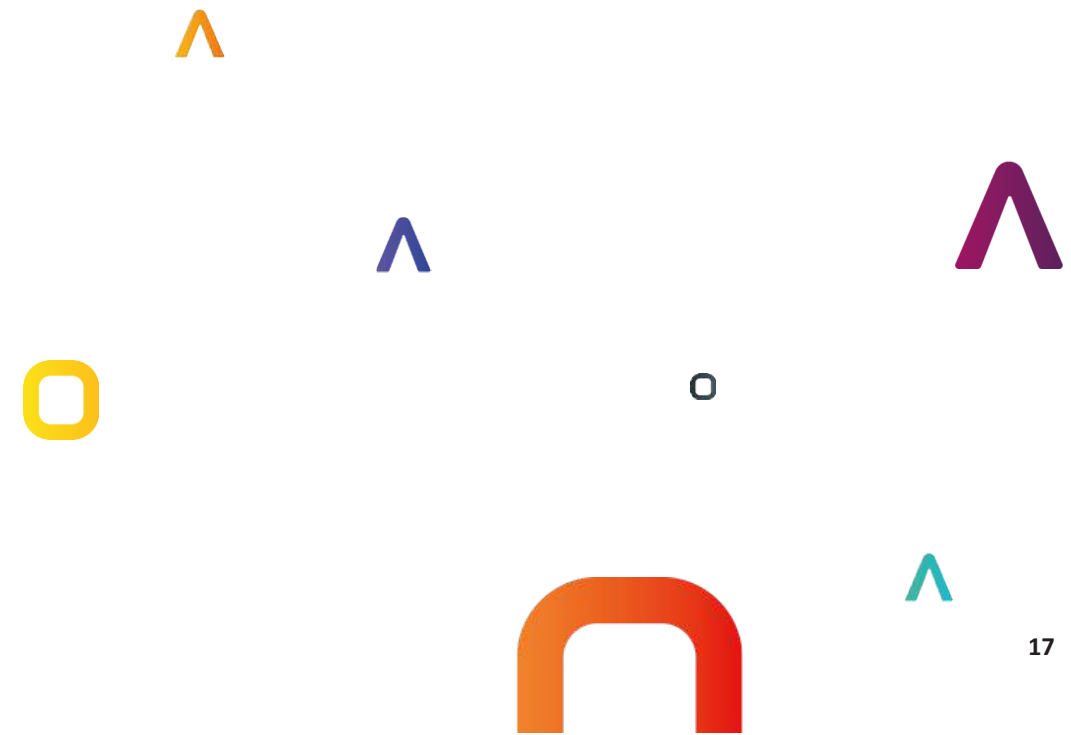
Once you have carried out the finishing trial, we recommend recording every stage in a trial report. This will be helpful as you might need to carry out more than one trial and it will help you review and improve the final finishing process.

Once you are happy with the final vibratory finishing process, we recommend making a data card. This should contain process parameters, inspection criteria and any other notes to ensure repeatability in results.

**Itching to apply all this good stuff? Great. Armed with your newfound knowledge of vibratory finishing, it's time to dive into the challenge of finding the right vibratory finishing technology for your needs.**

**To help you along the journey and make sure you keep on track, our specialists with decades of experience in this field are available to answer your specific questions in vibratory finishing. You can contact them via email at [spirepl@singnet.com.sg](mailto:spirepl@singnet.com.sg) or call at +65 68621403.**

**Good luck!**



# About Spire Pte Ltd

Established in 2002, Spire's main specialty is to serve industries requiring mass finishing needs, such as Deburring, Polishing, Radiusing, Degreasing, Descaling, and Derusting. We serve Aerospace, Tooling, Medical, Jewellery and Precision industries.

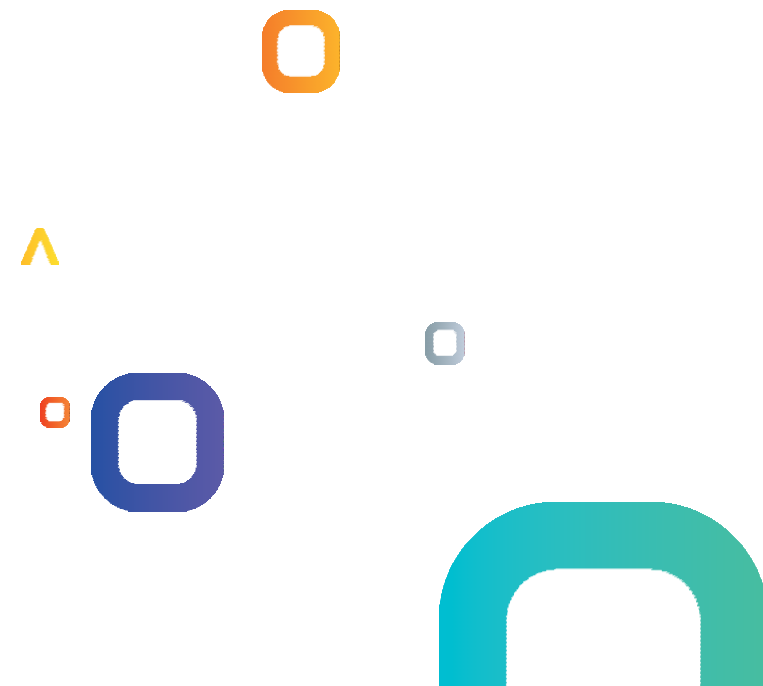
We provide a one-stop solution for our customers: Starting with trial tests, installation of equipment and supply of consumables, system integration into our customer's factory systems, and finally aftersales services.

As the world is transiting towards Industry 4.0. Spire has too, also begun our Industry 4.0 adoption journey. Working with technology providers from around the world and Singapore's A\*STAR, we provide solutions for companies to be Industry 4.0-ready as well. Our solutions also extend to training modules for academic institutes and companies to train their students or staff through training simulations and training prototyping via digital twin solutions.

With a strong and experienced working force, Spire's delivery of quality service is constant and unparalleled.

Our products and services include:

- Vibratory Machines
- High Energy Machines
- Fully Automated Systems
- Wastewater Treatment
- Finishing Consumables
- High Energy & Vibratory Finishing Services
- Shot Blasting & Peening
- Precision Polishing
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