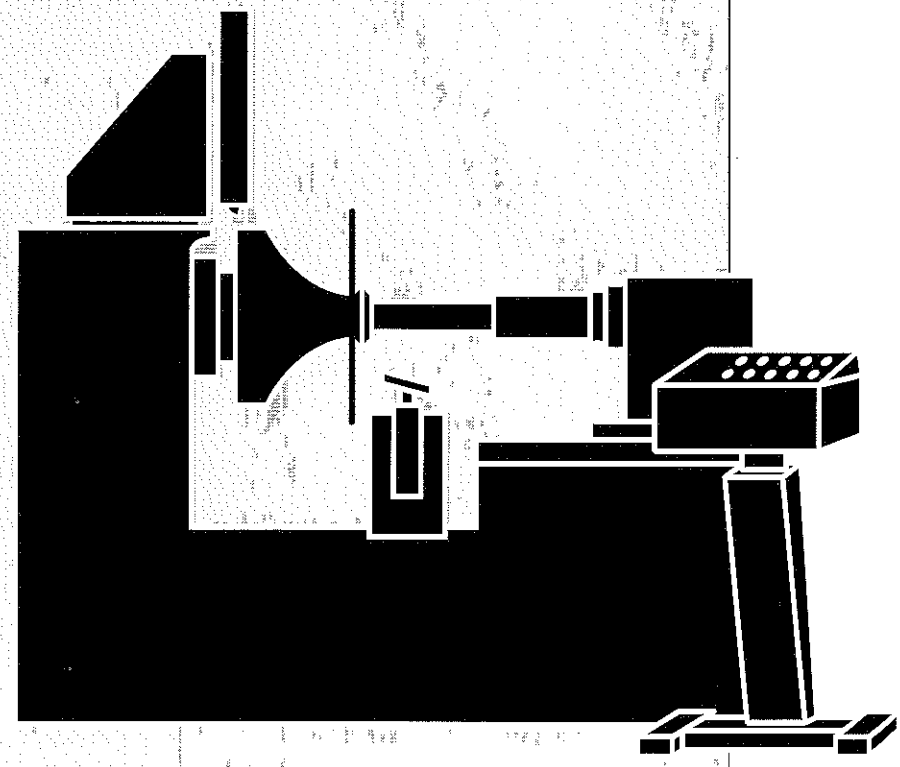
METAL SPINNING DESIGN TIPS

TURN TO METAL SPINNING



PMA
PRECISION METALFORMING ASSOCIATION

TOLERANCES

Stepped Cover

TURN TO METAL SPINNING

Metal spinning is a flexible, yet exacting method of production. Careful consultation with your spinning supplier is the first step to assuring appropriate tolerances.

Be sure to identify critical points for tolerances, don't just give an overall dimension on the print. The ability to hold tight tolerances for short runs is a specialty of metal spinning. This is not always true - cost effectively - with other alternative processes.

Generally, the tolerance that can be held directly affects the cost of the part. Tolerances of ± 0.030" (0.76 mm) are normal for most sizes, diameters and materials. If required, ± 0.005" (0.13 mm) or better may be possible. The Dimensional Tolerance Guide on page 5 may be helpful.

Specify an ID if Possible — It is best to specify an inside diameter (ID) tolerance for your spun parts. If an outside diameter (OD) tolerance is given, material thinout of up to 25 percent would be typical.

Material thickness — The thickness of the sidewall and bottom of a spun part will vary, normally up to 25 percent. The bottom of the part stays at the thickness of the original blank, while the sidewall thins depending on pressure and speed of forming.

If uniform wall thickness is critical, be sure it is specified. Secondary machining may be necessary in some cases. If you need a specific thickness or dimension on part of a sidewall, do not specify it on the whole part.

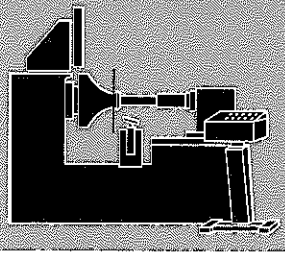
Corner Radii— Avoid sharp corners when possible. Generally, a formed radius should be specified as not less than 2 to 3 times material thickness. However, radii of up to 1 times material thickness are possible, especially on thicker materials. Secondary machining can sharpen a radius if necessary.

Total Indicated Roundness (TIR) — Concentricity is affected by diameter and material thickness. For parts up to 8 feet (2400 mm) in diameter, in lighter materials, a $^1/_2$" (12.7 mm) variation in unrestrained TIR is typical. The buyer needs to advise if part TIR is important and whether measurement is to be restrained or unrestrained.

Be sure to evaluate the cost vs. tolerance when comparing manufacturing processes. For example, deep drawing may be capable of a tighter tolerance, but the tooling cost is much higher. If you do not need too tight a tolerance, especially for shorter runs, metal spinning can save money.

GEOMETRICS

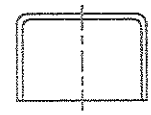
Flanged and Dished Head



Round symmetrical shapes are normal with metal spinning. However, parts can be sectioned to achieve a wide variety of geometry.

Conical, hemispherical, cylindrical, reentrant, parabolic, venturi, flanged and dished shapes are specialties.

SURFACE FINISHES

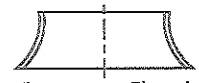


Cylindrical Shell

Surface finish generally depends on the material, thickness, type of tooling and diameter of the part. It also depends on the technique used to spin it and the machine on which it is done. An automatic metal spinning machine can generally produce parts with more consistent finishes than can be produced on hydraulic or hand spinning machines.

A 125 microinch finish is normal forming best for many spun parts. A finish of 32 microinch or better is possible in special situations. Polishing or machining secondary operations can be performed to obtain a better finish if desired.

MATERIALS



Re-entrant Flared

Any formable alloy of metal can be formed by metal spinning. Material that can be formed by deep drawing or forming on a press, hydroform or press brake is usually suitable.

The size of spun parts can range from a fraction of an inch up to 25 feet (7600 mm) in diameter.

Thickness of materials ranges from 0.015" (0.38 mm) for most materials, and up to 3" (76.2 mm) for aluminum or 1.5" (38.1 mm) for steel.

COST FACTORS

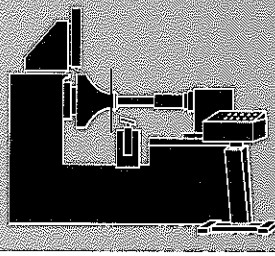
Flanged Cover

Tooling for metal spinning costs less than tooling for deep draw metal forming due to its simplicity. Tools are machined from steel, tool steel or mehanite™. For shorter runs, maple block or composite materials can be used for tooling.

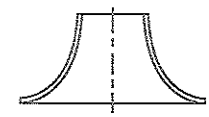
Ease of tooling allows shorter lead times with metal spinning. The customer can get parts more quickly, saving considerable time and cost.

Naturally, each job stands on its own merit. If tolerances are tight, tooling may cost more than for generous tolerances — but the designer/engineer can specify what is needed.

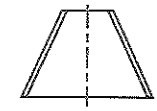
Another cost advantage of metal spinning is the ease of design change. This lowers the overall cost — from prototyping through production.



BENEFITS OF METAL SPINNING VS. OTHER PROCESSES

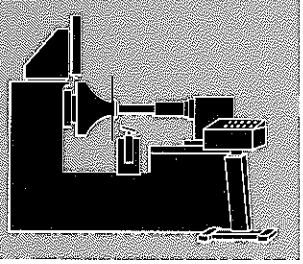


Venturi

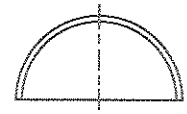


Cone

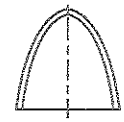
- Short turnaround due to tooling methods.
- Flexibility in tooling, depending on volume, tolerance and capability of the part needed.
- Spinning allows the designer and engineer to obtain function and performance as needed. Tolerances can be adjusted as necessary.
- Ease of design changes — especially if changes are dimensionally smaller – since the original tool can be machined as needed. Tooling costs less due to its simplicity. It is machined from steel, tool steel or mehanite™. For shorter runs, maple block or composite materials can be used for tooling.
- The development of new automatic metal spinning machines using CNC and CNC Playback technology allows high volume production, with tight tolerances and consistent repeatability. Metal spinning is not just a "short run" process.
- Metal spinning can be combined with other technologies. Preforms are often produced by deep drawing or forging. Rolled and welded cylinders are used as preforms too.
- The metal spinning process actually improves the raw material metallurgically by realigning grain structures. Tensile strength can be improved, allowing thinner materials to be used. Part integrity may be better with spinning than with other processes.
- Typical lead times for finished parts are 4 to 6 weeks. This is generally significantly shorter than lead times for just the stamping tooling.



DIMENSIONAL TOLERANCE GUIDE



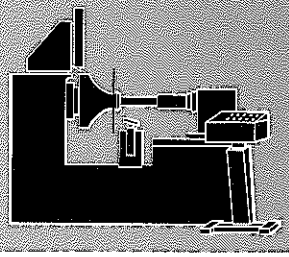
Hemispherical

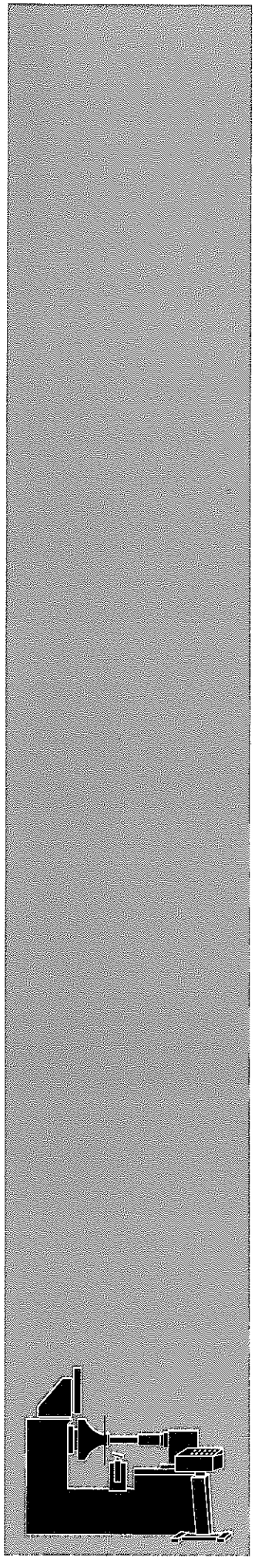


Parabolic Nose Shape

Diameter of Finished Part	As Spun-For Most Commercial Applications	Special Applications
Up to 24" Diameter (600 mm)	± 0.015" to 0.031" (0.38 mm to 0.79 mm)	±0.001" to 0.005" (0.02 mm to 0.13 mm)
25" to 36" Diameter (600 mm to 900 mm)	±0.031" to 0.047" (0.79 mm to 1.19 mm)	±0.005" to 0.015" (0.13 mm to 0.38 mm)
37" to 48" Diameter (900 mm to 1200 mm)	±0.047" to 0.062" (1.19 mm to 1.57 mm)	±0.010" to 0.030" (0.25 mm to 0.76 mm)
49" to 72" Diameter (1200 mm to 1800 mm)	±0.062" to 0.094" (1.57 mm to 2.39 mm)	±0.015" to 0.045" (0.38 mm to 1.14 mm)
73" to 96" Diameter (1800 mm to 2400 mm)	±0.094" to 0.125" (2.39 mm to 3.17 mm)	±0.020" to 0.060" (0.15 mm to 1.52 mm)
97" to 120" Diameter (2400 mm to 3000 mm)	±0.125" to 0.156" (3.17 mm to 3.96 mm)	±0.025" to 0.090" (0.64 mm to 2.29 mm)

PMA MEMBERS PROVIDE THE BEST METAL SPINNING CAPABILITY





PMA
PRECISION
METALFORMING
ASSOCIATION

Precision Metalforming Association represents the $31 billion metalforming industry of North America -- the industry which gives utility to sheet metal by shaping it with tooling in machines.

Its over 1,100 member companies include metal stampers, fabricators, roll formers and spinners, as well as suppliers of equipment, materials and services to the industry.

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