CURTISS-WRIGHT

Shot Peen Forming & Laser Peen Forming

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Peen forming is the preferred method of forming large complex aerodynamic contours into aircraft wing skins, it is a dieless forming process that is performed at room temperature.

The process is ideal for forming wing and tail plane panel shapes for even the largest aircraft with complicated boundaries and variable thicknesses. It is best suited for forming curvatures where the radii are within the elastic range of the metal. These are large bend radii without abrupt changes in contour.

When it was decided to use the super-critical wing design, in order to improve efficiency and consequently save fuel, the design usually required double curvature in the lower wing surface.

This is double curvature in a fully machined panel, which means that neither the previous methods of pulling to shape in the build fixture, nor more conventional forming methods can be considered. Peen forming is the only method available to create such severe double curvatures consistently to the required accuracy in this type of complex machined panel

The skins are peened in non-uniform patterns depending on the different thicknesses and the contour required. Residual compressive stress acts to elastically stretch the surface and it will bend or “arc” towards the peened side.

The resulting curvature will force the lower surface into a compressive state. Typically aircraft wing skins have a large surface area and thin cross sectional thickness. Therefore, significant forces are generated from the shot peening residual stress over this large surface area.

Peen Forming has the following advantages:

- No forming dies are required.
- Process is performed at room temperature.
- Wingskin design changes are easily accomplished by altering the peen forming procedure. There is no expensive modification of dies required.
- All forming is accomplished using residual compressive stress. Peen formed parts exhibit increased resistance to flexural bending fatigue and stress corrosion cracking as a result.
- Peen formed skins exhibit compressive stress on top and bottom surfaces.

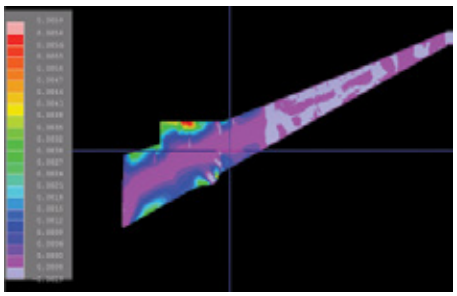
The size, velocity, and angle of impingement of the shot/beam as well as the distance from the work piece are automatically controlled in specially designed machines. Peen forming can be performed with or without an external load applied on the work piece. The nonequal compressive residual stresses from peening on one side of the Almen strip, causes a degree of curvature, which is measured to give the intensity of controlled shot peening.

In the process of peen forming, there are three methods used to create panel curvature. Firstly chord wise curvature is achieved with peening on one surface only in this instance; the compressive stress on the peened surface stretches the metal to cause the change in shape. To obtain greater degrees of curvature, pre-stressed peening is used in which the component is held in a unidirectional pre-stressed condition and then it is peened on the tensile stressed surface.

This means that when the component is released from this stressed condition after peening, the compressive stress is greater in one direction than the other, and it is greater in the direction of curvature formed from the pre-stressing process.

The third method of peen forming is by peening on the edges on both sides of a piece of material at the same time. This gives elongation to the component because of the stretched material on both faces overcoming the resistance of the core in elastic deformation.

Selectively using two or more of these processes, different shapes with different degrees of curvature can be created using peening alone. These are only shallow curvatures, which makes them particularly suitable for aircraft components, be they fuselage, wing, or tail plane items. They are however very accurate in their shape and because peen forming is carried out cold the reproduceability of forming is very good.



Curtiss-Wright Surface Technologies utilises its own bespoke software to show the areas of stretch and strain required to create curvature to meet customer design.

We can accurately determine the intensities required in selected areas of the wing panel by inputting the material properties and thicknesses.

For more information please view www.cwst.co.uk or contact our Chester facility on 01244 534999

CURTISS-WRIGHT

Surface Technologies

www.cwst.co.uk

Why should you choose Curtiss-Wright Surface Technologies (CWST) to deliver your surface treatments:

A worldwide supported network service of over 75 facilities, including on site field crews

We offer a diverse range of quality surface treatments including:

- Controlled shot peening
- Shot peen forming
- Laser peening
- Engineered coatings
- C.A.S.E.™ super finishing
- Surface texturing
- Material testing
- Repair and overhaul

Proud history of experience and innovation dating back to the Wright Brothers and Glen Curtiss who formed the Curtiss-Wright Corporation in 1929

As a single source for all your surface treatments we can improve your turnaround times and save you money

Customer's trust us to improve the performance, strength and life of their components, including the repair and overhaul of worn components

Long experience in protecting components from fatigue, corrosion, wear, galling, fretting and environmental attack in key industries

We maintain all appropriate customer and industry quality approvals including ISO 9001:2008, NADCAP, AS9100 Rev C and ISO 13485

Tailoring our services to meet your needs

The Dublin Spire – a stunning example of our surface texturing technique showing the versatility of controlled shot peening

EUROPEAN CORPORATE OFFICE

Metal Improvement Company
Curtiss-Wright
Hambridge Lane, Newbury
Berkshire RG14 5TU, UK

- **T: +44 (0)1635 279621**
- **E: eurosales@cwst.com**
- **W: www.cwst.co.uk**

USA COMPANY HQ

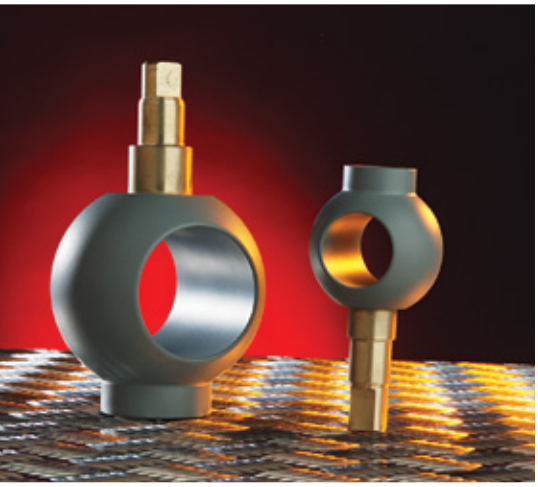
Metal Improvement Company
Curtiss-Wright
80 Route 4 East, Suite 310
Paramus, New Jersey 07652, USA

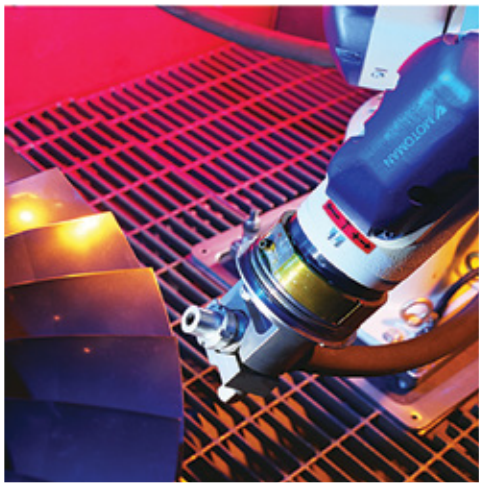
- **T: +1 (201) 843 7800**
- **E: info@cwst.com**
- **W: www.cwst.com**

PARENT COMPANY HQ

Curtiss-Wright Corporation
13925 Ballantyne Corporate Place
Suite 400, Charlotte, NC 28277

- **T: +1 (973) 541 3700**
- **F: +1 (973) 541 3699**
- **W: www.curtisswright.com**





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