

Apply of Hydro Forming For Futuristic Manufacturing

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Abstract: -- A hydrofoil is a foil which operates in water. As a hydrofoil-equipped watercraft increases in speed, the hydrofoil elements below the hull(s) develop enough lift to raise the hull up and out of the water. This results in a great reduction in hull drag, and a further corresponding increase in speed and efficiency in operation in terms of fuel consumption.

The foil is shaped to move smoothly through the water causing the flow to be deflected downward which according to Newton's Third Law of Motion exerts an upward force on the foil. This turning of the water causes higher pressure on the bottom and reduced pressure on the top of the foil. This pressure difference is accompanied by a velocity difference, via Bernoulli's principle, so the resulting flow field about the foil has a higher average velocity on one side than the other.

INTRODUCTION

Hydro Forming uses water pressure to form complex shapes from sheet or tube material. The pressure may go up about 60,000 psi depending on the component. As the automobile industry strives to make car lighter, stronger and more fuel efficient, it will continue to drive hydro forming applications. Some automobile parts such as structural chassis, instrument panel beam, engine cradles and radiator closures are becoming standard hydro formed parts.

The capability of hydro forming can be more fully used to create complicated parts. Using a single hydro formed item to replace several individual parts eliminate welding or hole punching, simplifies assembly and reduce inventory.

TAKING ADVANTAGE OF HYDRO FORMING

When considering hydro forming, companies need to ask whether this technology will make a part cheaper to produce. The real question is whether you can refine the entire manufacturing process to take advantage of hydro forming that is when it really makes.

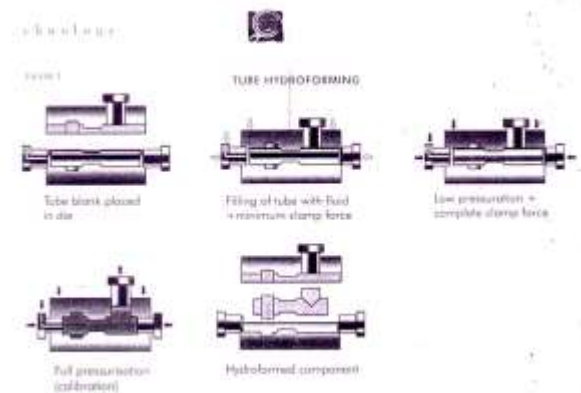
Instead of looking at a single competent to determine whether it can be hydro formed, companies need to look at a product through whole process, from material to assembly, to determine what savings can be achieved. For e.g. Hydro forming often reduces number of pieces or the amount of floor space used or eliminates the need for welding stations.

METHODS OF HYDRO FORMING

Tube Hydro forming

Straight, pre bent and or performed tubes are formed by internal water pressure with additional application of

compressive mechanical forces. In this method the tube in placed in die and as press clamps the die valves, low pressure fluid in introduced into tube to pre form it. One the maximum clamping pressure in achieved, the fluid pressure inside the tube in increased so that tube bulges to take internal shape of the die. Simultaneously additional cylinders axially compress the tube to prevent thinning and brushing swing expansion.



HOW CAN TUBE HYDRO FORMING BENEFIT

THE AUTO MANUFACTURER

Increased strength to weight ratios

Multiple cross – section reshaping or section modules increase

Improved stiffness torsion and bending rigidly

Improvement in NHV Factor

Incorporation of hole punching, slot making, embosses swing hydro forming process.

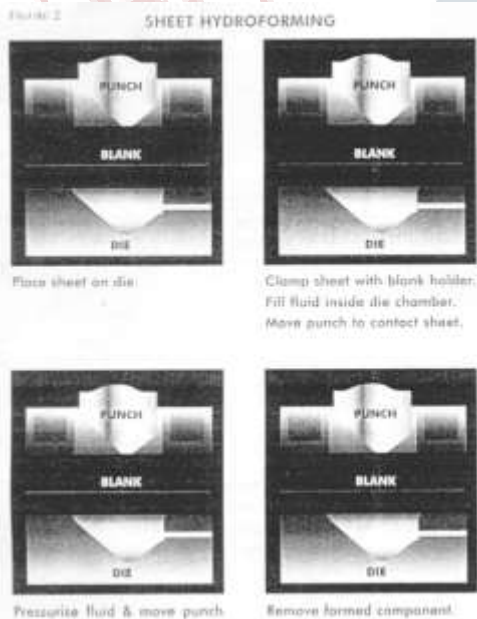
Reduction in number of manufacturing stages, hence tooling.

Reduction in welding, hence distortion and subsequent heat treatment.

SHEET HYDRO FORMING

Sheet hydro forming involves forming of sheet with application of fluid pressure. A sheet metal blank informed by hydraulic counter pressure generated by punch drawing sheet into pressurized water chambers. The water pressure effectively punches the sheet firmly against punch to form required shape.

The major advantage of fluid forming is increased drawing ratio. The process take place in two stages performed during one press stroke. The sheet in performed by applying low fluid pressure while it is in clamped firmly by a blank holder pressure. Performing achieves on evenly distributed strengthening in the component centre. In next step fluid pressure in gradually increased and blank holder pressure in controlled relative to sheet to reformation. The real question is whether you can refine the entire manufacturing process to take advantage of hydro forming that is when it really makes. he entire process of operation takes place inside a closed die, one cannot see what actually happens during forming.



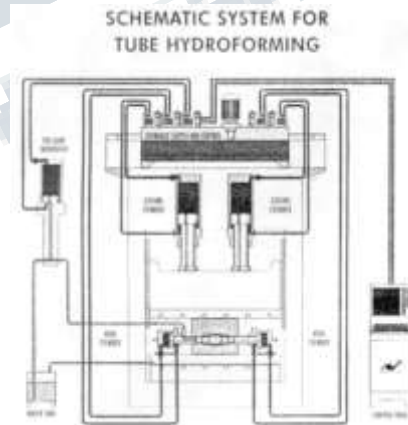
APPLICATION SPECTRUM

There are numerous automotive components well suited to hydro forming of sheets. This is especially true in area of outer skin with its extreme demand of surface quality and dimensional accuracy. Longer outer skin parts for passenger cars, utility vehicles and truck such as goods, doors and tender as well as complex structural components can be formed

HYDRO FORMING PROCESS CONTROL

A typical hydro forming system would include a press capable of developing necessary forces to clamp the die valves together when internal pressure acts on fluid; a high pressure water system to intensify water pressure for forming component, looking including aerial cylinder and punches, depending on component and a control system for process monitoring.

Since the entire process of operation takes place inside a closed die, one cannot see what actually happens during forming. Therefore the controller plays a vital role in displaying, monitoring and controlling the different parameters of forming in real time.



**NEW CONCEPT IN SHEET HYDRO FORMING
 DOUBLE SHEET HYDRO FORMING**

Structural component with closed components are formed by this process. Some advantages of this process are:- Integration of more parts, further reduction of components & thus steps. Stiffness increase and reduction in overall spring back due to closed box section & continuous weld section. A complete component is made in one single hydro forming step, with only top and bottom die .

HYDRO PATH WORK OR HYDRO FORMED TAILORED BLANK

By this method, the need for additional forming joining operation is unnecessary. It is used in areas where sound insulation and vibration damping is required & where high degree of energy absorption during crash is needed. The additional or path sheet could be of same or different material or different thickness from parent material.

HYDRO JOINING

Usually after hydro forming, additional joining operations are required to form assemblies. To reduce manufacturing time and number of process steps, joining operation are being integrated into hydro forming process. This also reduces tool cost. Two approaches to hydro joining are punch riveting hydro clinching.

In punch riveting, pressurized fluid acts on one sheet while a moving punch acts on other sheets from opposite sheet . Punch is moved against rivet and under the fluid counter pressure it spreads to form a solid , visually attractive joint . In hydro clinching, high pressure fluid action the punch. The prescribed fluid presses the material to be hydro formed part through a note in sheet to be joined .

CONCLUSION

During the last 12 years, general awareness of hydro forming has grown steadily . Although interest in hydro forming is wide ranging , the vast majority of application are in automobile industry .

Hydro Forming is not panacea for manufacturing all automotive parts. The benefits of automotive light weight resin and weight reduction achieved by hydro forming can be measured in kilogram. It cannot be applied to every components, one has to study inability of hydro forming the part and the economic and technical payback.

Just like transistor revolutionized the electronic industry, hydro forming has taken the vehicle manufacturing industry a step up to evolutionary ladder, allowing auto component for vehicle . Although hydro forming has not taken off rapidly as it should have , is only matter on time before this technology is absorbed in the industry .

REFERENCES

- [1] The Machinist Journal (October Edition)
- [2] www.howstuffworks.com
- [3] Alessia Mentella, "Introduction to hydro forming process", University of Cassino
- [4] Masaaki Mizumura, ET. al. "Development of hydro forming technology", Nippon steel technical report no.90, .
- [5] Koç, Ed. By "Hydro forming for advanced manufacturing", 2009 Wood head Publishing Limited
- [6] www.ultimatehydroforming.com
- [7] <http://www.amalco.com/hydroforming.html>