

PRESS METALFORMING FOR THE AUTOMOTIVE SECTOR

AIDA demonstrates how automotive parts manufacturing efficiency can still be attained through its press metalforming without compromising corrosion resistance.

Among the various metalforming systems, press metalforming is the one technology that enables high-quality, high-volume production of metal parts at a low cost. Press metalforming is a forming method with outstanding efficiency that can form a small amount of raw material into a final shape using minimal energy. When it comes to making huge volumes of products with identical shapes, nothing outperforms high-productivity, resource & energy-efficient press metalforming.

Press forming technologies are utilised in many familiar products that are indispensable to our daily lives, from electronic devices, electrical appliances, bicycle pedals and brakes to automotive component parts. Market globalisation and growing environmental and energy concerns are giving rise to new industrial manufacturing environment requirements.

Since 1917, AIDA has been a global leader in the press manufacturing industry, and has been a key contributor in the manufacturing of products essential for daily life. AIDA's presses are used to manufacture vehicle bodies and frames as well as other vehicle parts and components. With society's ever-increasing demands for automobiles to be more environmentally friendly and safer and to have more sophisticated designs, AIDA is responding to the diverse needs of automotive-related industries and contributing to the evolution of automobiles by breaking new ground in technical sophistication for its presses and its other manufacturing technologies.

Pursuing Resource And Energy Conservation Through Net-Shape Forming With Precision Forming UL Series

Net-shape forming is a forming method that results in a final "net" shape requiring no post-forming machining or grinding. The closer a forming process gets to the net shape, the lower the requirements become for materials and other resources. This includes electricity, as less is needed if there are fewer processes.

Located in Nagano Japan, automotive parts maker Sugimura Seiko Company, established in 1980, has succeeded in developing "Net-Shape Forming of a

Sprocket" using an AIDA UL Series precision forming press. The UL Series is perfect for forming precision automotive components that can affect vehicle performance.

A sprocket is a gear part that uses a chain to transmit power. For example, it is used in the camshaft, which is one of the internal structural parts of an engine. The camshaft incorporates a chain and sprockets to transmit the rotational motion of the crank to the cam. AIDA's precision forming UL Series is well-known for its high rigidity and outstanding dynamic accuracy. It is described as "being more accurate than the die." These combined UL Series traits make net-shape forming possible.

The "Net-Shape Forming of a Sprocket Using a UL Press" application was awarded the MF Technical Grand Prize in 2019. The UL Series press that performed the precision forming for that application enables the



 Precision Forming Press Series UL-6000



production of shapes previously unachievable with a press. It also reduces the environmental impact and improves the working environment by increasing the material yield by about 20 percent, through producing less sludge and heavy metal-contaminated wastewater, and requiring less electricity and die lube.

The net shape forming ratio was improved by developing a unique forming methodology based on the plasticity theory tenets of "constant volume," "plastic flow control," and the "reduction of loss due to external friction." High-precision press forming was used to eliminate the keyway area broaching process and to reduce subsequent machining (the amount of cutting and grinding). Eliminating the bonderizing process that had been previously required contributes to a smaller environmental impact by reducing sludge and the amount of heavy metal-laden wastewater.

The Development Purpose

Primarily due to dynamic accuracy issues, conventional presses cannot be used for a multi-stage layout, and thus single-strike press forming was used, which necessitated rough forming that relied on downstream processes. During development, the forming methodology was revamped and a high-precision press was introduced. This enabled stable high-speed forming, making the press forming process the main forming process in order to 'reduce downstream processes, manhours and costs of the overall operation.'

Unique Characteristics of the UL Series:

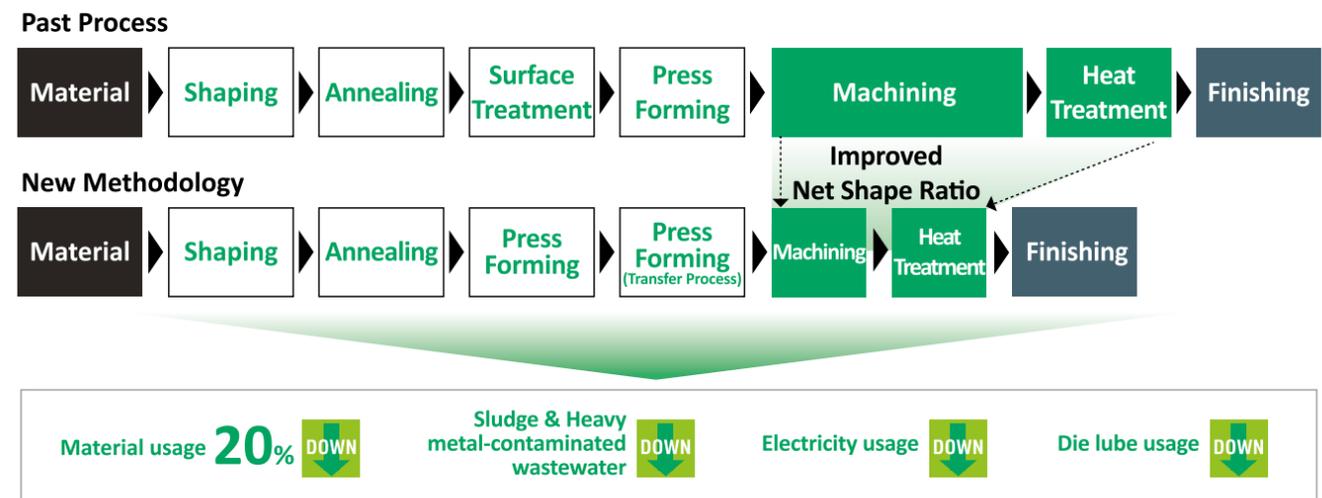
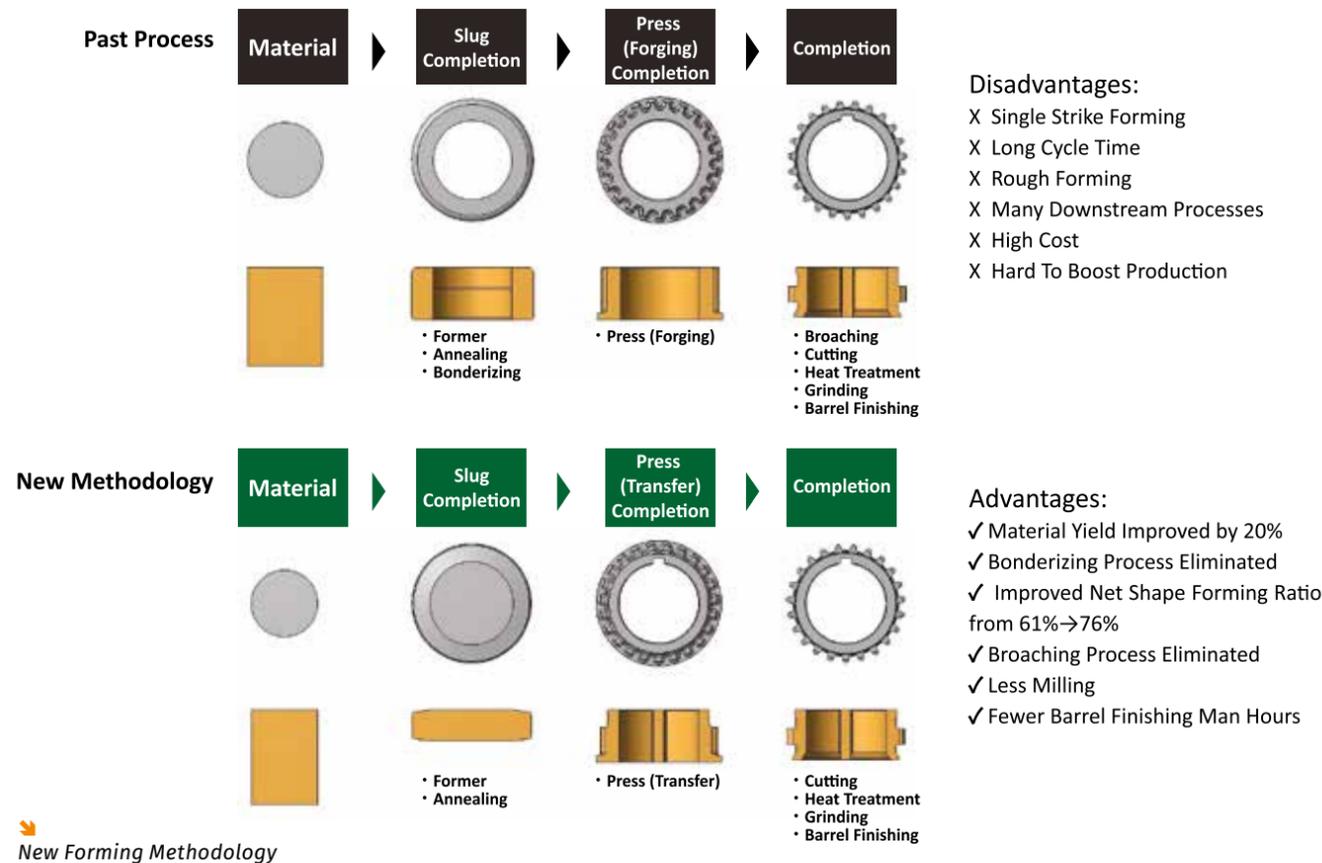
- 1** A single center point design with no connecting rod
- 2** Zero slide clearances (via spherical shoes and 4-surface guides)
- 3** A highly rigid unibody frame

These characteristics enable superior performance, including high dynamic accuracy, low thermal displacement, and superior slide motion straightness. UL Series presses enable high value-added high-precision forming, multi-stage forming (5-7 stages) and the usage of flow control forming (FCF) methodologies.

New Methodology

Flow Control Forming (FCF) developed by AIDA combines sheet forming and forging concepts. This enabled the forming of high value-added shapes from sheet metal material, such as localised thin and thick walls, stepped contours, and toothed shapes. Products that could not be made without using machining, sintering, or die casting processes or without welding two parts together can now be manufactured using only press processes, and this translates into overwhelming cost benefits and enables the usage of more compact production equipment and fewer process steps.

Moreover, FCF methodologies have also garnered attention as being environmentally-friendly manufacturing methods that help conserve resources and energy and enable more lightweight products.



Forming methodology

As FCF methodologies involve the high-deformation forming of materials, die designs must take into account stress concentrations, elastic deformation of the die, and dimensional changes and seizing resulting from thermal expansion, and thus press machines with high rigidity are also required. AIDA provides high value-added solutions to support the manufacturing activities of its customers that include both tangible elements like press

machines and intangible elements such as metalforming methodologies and dies.

New Methodology Results

1 Improved Net Shape Forming Ratio And Higher Material Yield

The net shape ratio was improved from 61 to 76 percent by leveraging high-precision press forming to form the

entire product shape, which had not been possible using conventional press forming methods. Material yield also improved by approximately 20 percent.

2 Elimination Of The Broaching Process For The Keyway Area

A unique methodology was used that assured the precision forming of the keyway area during the press forming process, thereby eliminating the broaching process.

3 Improved Exterior Spline Precision And Surface Smoothness

The unique forming methodology not only improved the dimensional accuracy of the exterior spline, it also improved the smoothness of the tooth surfaces.

4 Eliminating The Bonderizing Process

Thanks to the unique forming methodology based on plasticity theory, the bonderizing process was no longer necessary, enabling the product to be formed using only die lube.

Sprocket monthly production was boosted 240 percent by designing processes that enabled high productivity. Changing the manufacturing process has not only reduced the environmental impact and improved the work environment, compared to conventional products it also conserves resources, reduces the creation of sludge and of heavy metal-laden wastewater, and also lowers electricity and die lube consumption.

Automotive parts manufacturing requirements are constantly changing due to the technological innovations and resource risks as well as in response to social factors. For these reasons, it is important to actively utilise both new and existing technologies to ultimately provide optimal systems for the industry.

Many automotive parts have been traditionally produced using a combination of press forming and machining processes, but using a UL Series precision forming press, AIDA has succeeded in enabling the production of automotive parts using press forming alone (with no machining). This not only improves material yields, it also significantly improves net shape ratios. With forming systems that deliver high rigidity and high dynamic accuracy, AIDA is committed to developing technologies that turn conventional wisdom on its head. but using a UL Series precision forming press, AIDA has succeeded in enabling the production of automotive parts using press forming alone (with no machining). This not only improves material yields, it also significantly improves net shape ratios. <https://www.aida.co.jp> & <http://www.aida.com.sg>

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