

Cross Cowl Member Stamping Trials

This document summarizes the work with the Cross Cowl Member conducted under the umbrella project featuring the A/SP Master Shoe. The project is examining die (forming) processes and material grades for their effect on:

- Part quality/dimensional accuracy.
- Press force/energy requirements.

Overall, the goal is to develop product/process design guidelines for AHSS.

The Cross Cowl Stamping trials covered the following materials:

HSLA 350	DP 600
DP 780	DP 980

The following three stamping configurations were examined:

- Cushion Draw with 340 mm wide blank.
- Crash Form with 340 mm wide blank.
- Crash Form with 280 mm wide blank.



Cross Cowl. Part is approx. 1100 mm long.

The goal of the experiment was to form three parts for each material/stamping combination. Following stamping, each test part was scanned, laser trimmed, and re-scanned. Thus, only one set of parts were used for this study. Binder Force (cushion draw) and Pad Force (all forming processes) were established experimentally prior to conducting the trials and all trials were conducted under a single press set-up.

Overall, satisfactory parts were stamped from all four materials and the three forming processes. Two areas were prone to wrinkles; the top surfaces near each end of the part. It is noted that production parts exhibit this same condition. Splits did occur with DP 980 but they were confined to an area off-part and could have been induced by holes laser cut for locating the blank.

The parts were examined through strain analyses, dimensional analyses (untrimmed and trimmed), and forming tonnage requirements. Production drawn (toggle) and trimmed parts were included where appropriate comparisons could be constructed. Highlights of the analyses are;

- Surface strains were measured in four areas. Major and minor strain levels for DP 780 and DP 980 appear to be more uniform than HSLA 350 and DP 600.
- In the plan view this part exhibits curvature on one side and is straight on the other side. The side with curvature had more side-wall curl but less opening angle (spring-back) than the straight side. For the respective side, there was more opening angle in the center but curl increased towards the ends.
- The majority of spring-back is material related. Trimming had the second largest effect on overall spring-back followed by forming process and blank width.
 - The amount of spring-back increased parabolically with the material strength. For example, DP980 had three times the spring-back of DP600.
 - Trimming caused spring-back to increase by approx. 30%.
 - Drawing produced about 20% more spring-back than crash form.
 - Spring-back increased about 10% with the reduced blank size (crash form process).
- A typical increase in forming tonnage due to material grade was less than half the increase in tensile strength.

It is emphasized this part has open ends. Parts with closed ends create an entirely different forming condition and thus many of the aforementioned observations may not hold.