Automotive Manufacturing Solutions

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As long as car body panels – specifically closures such as boot and hood lids – are made out of metal they are likely to continue to be subject to hemming as a means of joining different parts together. The basic technique is simple and well-established; one panel is made to overlap the other and the two are joined by means of the extended edge being folded back around the other, probably with the aid of some adhesive. There are currently three ways of accomplishing the task – two established methods and another that is relatively new.

Established techniques

The two well-established techniques are those of press and tabletop hemming. Superficially similar, press hemming involves a single operation in a large hydraulic press, whereas tabletop hemming uses a series of electrically-actuated heads. There are also differences in their applicability, with press hemming able to produce different parts in the same operation, something that is beyond tabletop hemming – although the latter scores in its ability to produce more complex geometries. Of the two methods, tabletop hemming is the one that now predominates. However, recently both have come under an increasing challenge from a third approach; robot roller hemming. As the name suggests a robot runs a roller around the edge of the sheet so that hemming takes place as a continuous, sequential, localised operation. Not the least of the differences between it and the other two is that the forces involved are much lower – perhaps just a hundred kilograms at the point of contact rather than a hundred tonnes overall.

Which technique is chosen depends on a number of factors, some of which may be quite subjective, such as simple familiarity with one technique or another, or it involves a trade-off between the perceived ease-of-control of, say, tabletop hemming versus the greater flexibility and intrinsic reprogrammability of robot roller hemming.

Paul Meeson, advanced engineering director with Stadco, has been in the business long enough to remark on two general trends that have developed over the years. The first was the enhancement of tabletop hemming by robotised loading and unloading techniques to provide it with a mix of flexibility and volume production capacity; making it the market-leading procedure at the turn of the millennium. The second has been the advance of robot roller hemming to at least an equal status in the industry at large.

For Stadco, robot roller hemming is now definitely the technique of choice. Meeson says this is entirely to do with what the company regards as its procedural advantages – nothing to do with final product quality which is identical in either case. As such, he confirms, that when vehicle OEMs come to the company for hemmed parts they do not specify a tabletop ability – although the latter scores in its ability to produce more complex geometries.

Another advocate for the technology is Alan Stapelberg, BIW product manager for robot roller hemming supplier and system integrator ABB Engineering in Shanghai. One perhaps under-appreciated aspect of the approach, he argues, is its ability “to handle variation”, not least variations in the geometry of the metal sheets that are joined together in the process. This is an attribute likely to prove particularly useful at the very start of the production of a newly designed part where, as can be the case, the quality of the parts coming from the press shop has not yet stabilised. He says that it will facilitate the ability to use these parts, which might otherwise have to be scrapped, in order to prepare trial-out sub-assemblies needed for the testing of the rest of the production line. This results in direct savings during the commissioning as well as earlier start up of production.

Push and pull

In the case of ABB’s own products, Stapelberg states, that capability is very much a consequence of the hemming head – the tool at the end of the robot arm that actually comes into contact with parts being hemmed – as well as the path accuracy of the robot itself. Which is why the company has two main such products: one entirely ‘push’ and the other ‘push-pull’, the latter meaning it can be inserted into an assembly and pulled back up to an inner surface. Stapelberg confirms that in operation a hemming head can usually achieve a speed of around 1,000mm per second when moving in a straight line, a figure that will necessarily decrease when it has to be manoeuvred around more complex shapes. But he also suggests that it is wrong to use this metric when assessing the suitability of the technology for a particular application, instead, the right one is “jobs per hour”, a measure that more closely relates the technology to the overall line-speed.