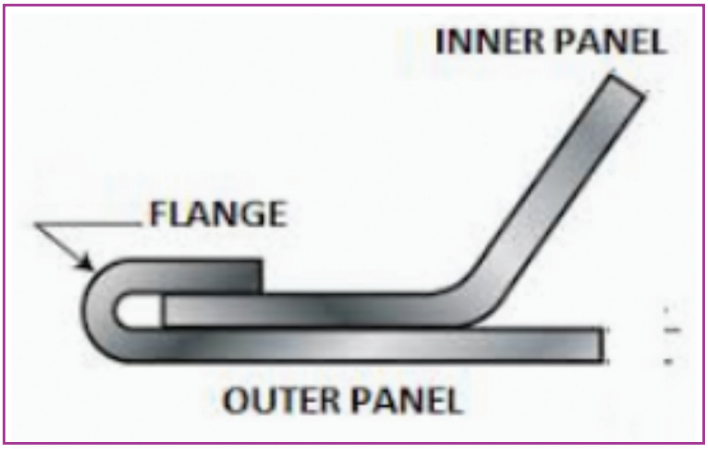
TECHNICAL REPORT

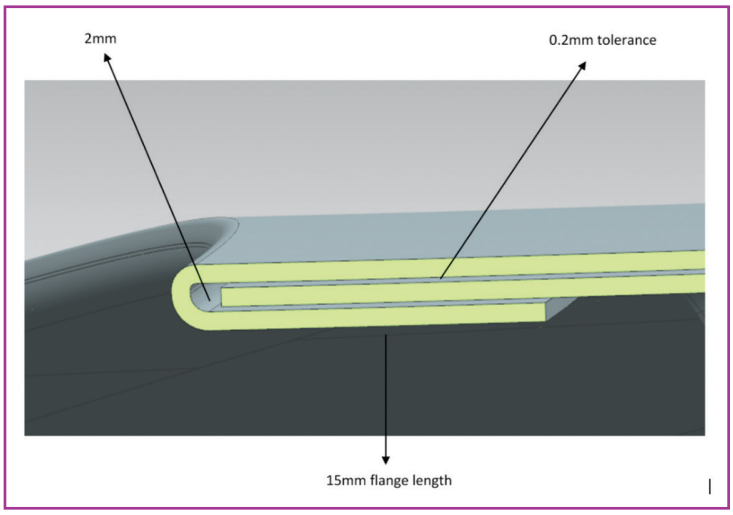
I-CAR NEW ZEALAND

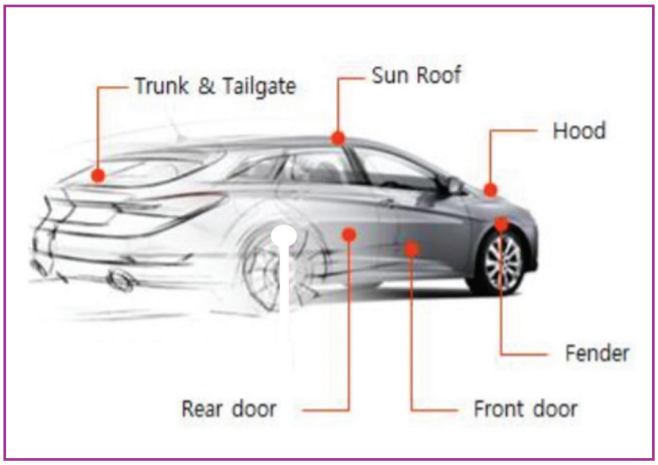
ATTACHMENT METHODS – A FOCUS ON HEM FLANGES



The process of hem flanging probably dates back to the the very beginning of auto-body manufacture – whether that be on a large scale production line or in bespoke, hand-made bodybuilding workshops.

If you are not familiar with this term, it describes the mechanical process of attaching sheet metal parts together, and is typically, (but importantly, not lways) used in conjunction with either brazing (earlier generations), or fusion welding (MIG, or STRSW) on newer generation body designs. It is where we observe one panel being connected to another by crimping or folding …

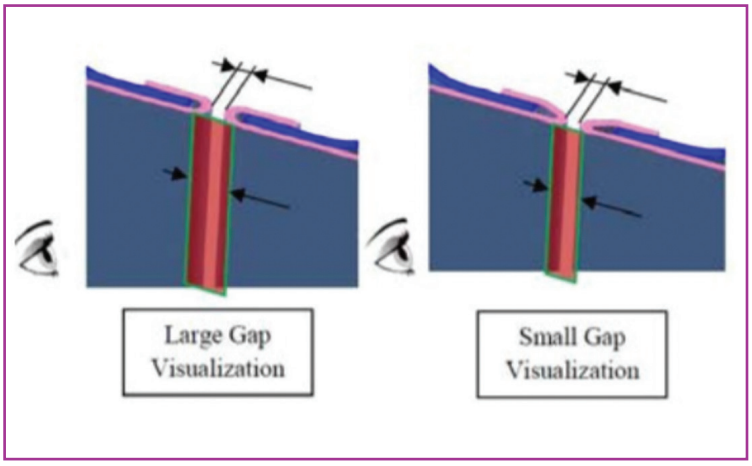




Almost exclusively, sheet metal parts joined in this way were previously restricted to “closure panels” or those parts that are “hung” or bolted onto the body structure. Essentially, doors, bonnets, bootlids and tailgates (components that open and shut).

There are numerous advantages in attaching sheet metal parts in this way – these include minimal heating/welding and high volume production-line capabilities, but there also several negatives that include poor initial corrosion protection, lower torsional rigidity (compared to welding), and the ever increasing demands for finer tolerances on body closures (or the gap reduction between adjacent body components eg. Bonnet-to-guard, guard-to-door, an so-on), these are not only required for optimal fit and finish, but also for aerodynamic enhancements, wind noise reduction, crash management systems, fuel efficiency targets, and so on.

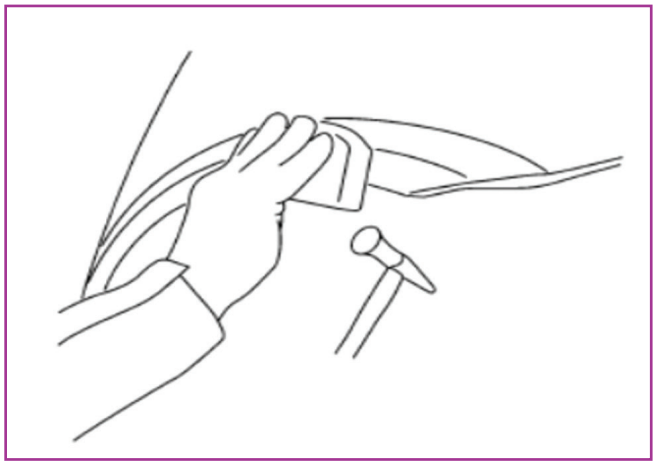
If you have been in the auto body repair industry for some time, you will have seen the gradual decline in the replacement of outer door skins – this has come about for several reasons. Aside from the economic viability of replacing just the outer door skin, many vehicle-makers no longer supply doorskins as a separate OEM part. Anecdotally, this may be because many of these closure parts are critical components for side impact protection systems - that consideration, in addition to corrosion protection requirements, creates issues for the long-term durability of hemmed sheet metal parts fitted outside of factory conditions.



Like so many other relatively recent autobody developments, the hem flange joint is still used extensively as an attachment method for closure panels, but has been modified and adapted to work with other materials to virtually eliminate historical corrosion protection issues, and at the same time, enhance structural integrity (more on that shortly).

In addition to those traditional closure parts, many vehicle-makers have now adopted the hemming process for the rear quarter panel on the unibody structure, or “Body In White” (BIW) - in particular, the area where the outer skin is attached to the inner wheelhouse or wheelbox. Traditionally, the outer quarter panel in and around this location was spot – welded to the inner wheelhouse, by way of mating right angle flanges on both parts.

Hem–flanging, or door skinning techniques using traditional tools like hammers & dollies, have always required a high level of skill from the autobody technician (to minimize damage/ distortion to the outer surfaces, as well as retaining OEM protection coatings).



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As previously mentioned, with the decline in skin only replacements, those learned skills are rapidly disappearing, and in addition to the careless use of conventional hammers and dollies creating extra work in smoothing up the hem joint, is the fact that structural strength and corrosion protection of the joint in the wheel box area, in particular, is easily compromised…

That comes about because :-

1/ Modern hem flanging systems almost universally include an adhesive bonding schedule (where the folded–over hem encapsulates a structural adhesive) – this serves to both seal the joint from moisture and contaminants, as well as substantially increasing the structural integrity and torsional stability of the connected parts **(See Fig 1).**

Careless or overly aggressive beating / bending over of the hem flange (besides creating cosmetic collateral damage), will almost always lead to the bonding area being weakened – brought about by the "Bond Line Thickness" being inconsistent in the joint area. Obviously this can also create corrosion "hotspots" and ultimately, joint failure.

2/ Some vehicle makers are now using modified hem folds – these can range from additional fold lines to rolled bends that are designed to retain adhesives / sealants at the fold line – (especially with aluminium components) **(See figs 2 and 3).**

Indescriminate hammering on these contours can drastically reduce the retention of the bonding materials, in addition to crushing the fold to the point where the edge can split or crack …

Whether using conventional hammer and dolly techniques or specialist flanging tools, best results are achieved by gradually turning over the hem flange (multiple passes), as below …

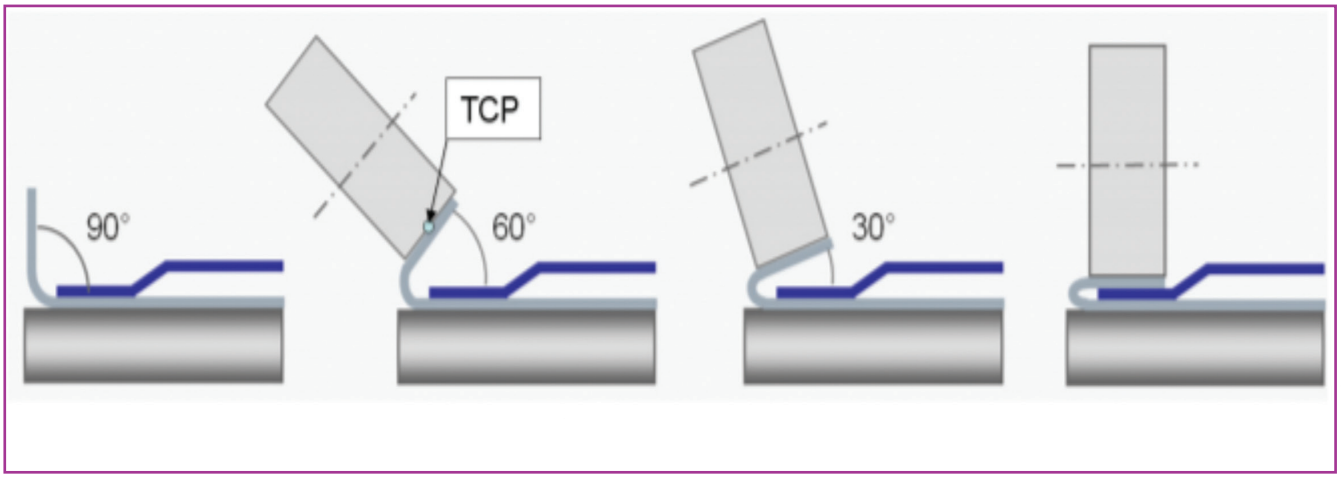


FIG 1 – TYPICAL HEM FLANGE JOINT WITH BONDING AND SEALING MATERIALS

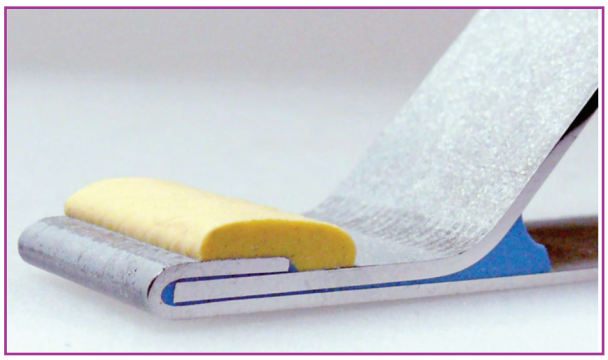


FIG 2 – CONVENTIONAL VERSUS MODIFIED HEM FOLDS

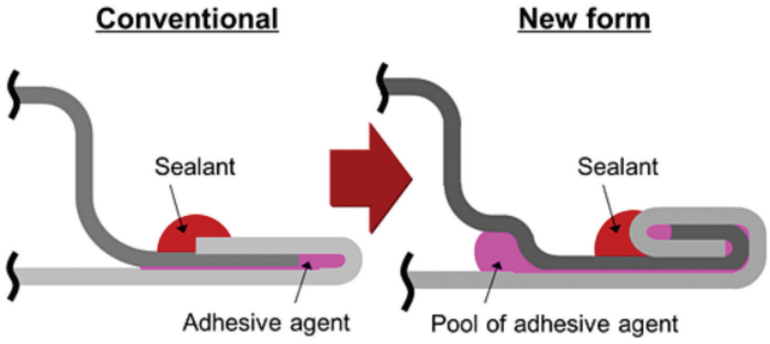
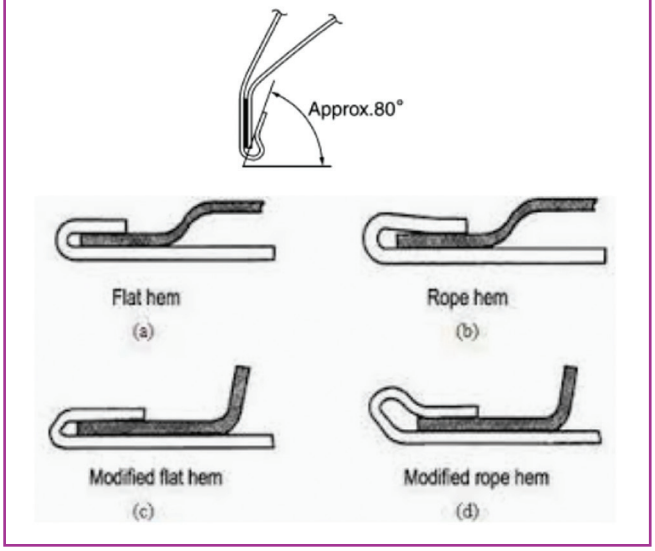


FIG 3 - OTHER HEM FOLD CONFIGURATION EXAMPLES



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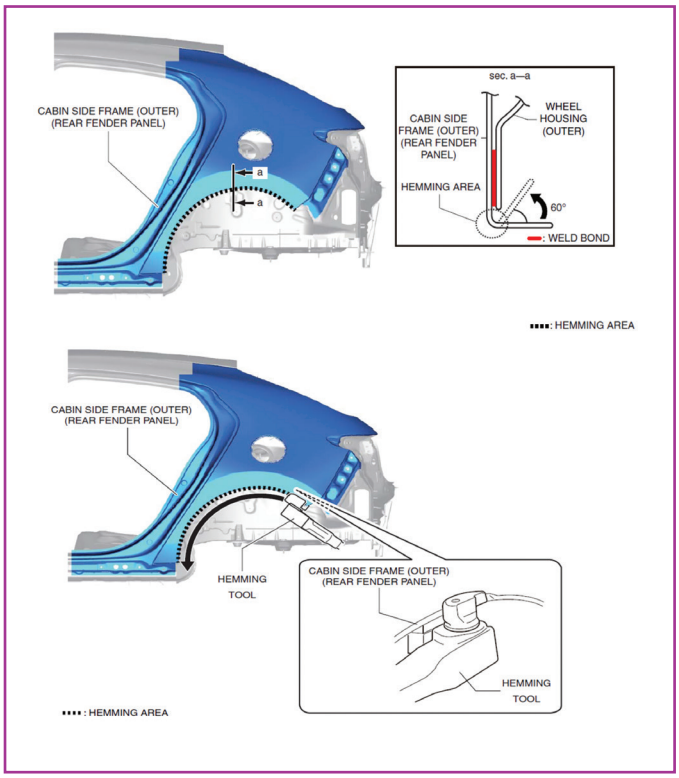
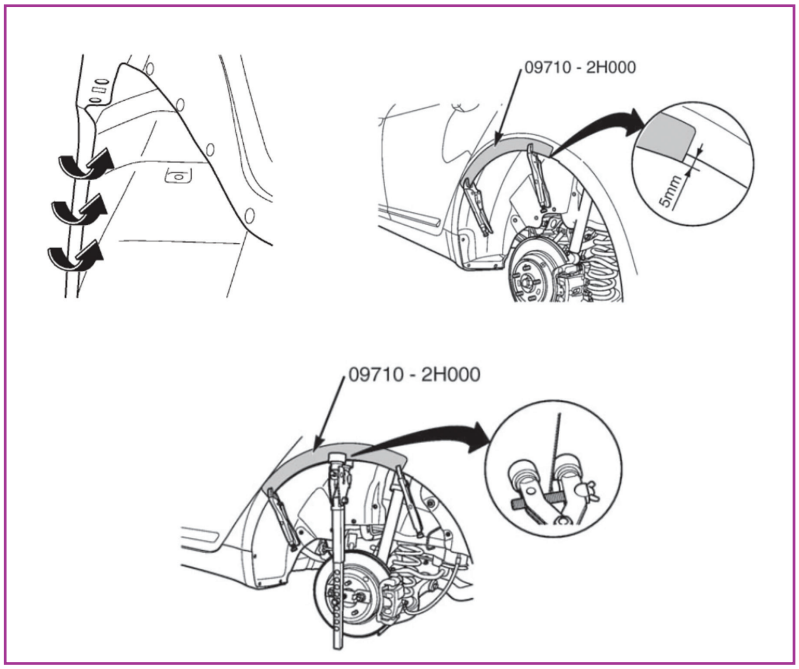
Some vehicle-makers are including / identifying specialised hem flanging tools in a number of their rear quarter replacement / sectioning procedures – as observed in the following examples :-

COURTESY OF MAZDA :-

The rear quarter in this example is for the new model Mazda 3, with the likelihood that other new model BRM's will include similar specifications, as they become available.



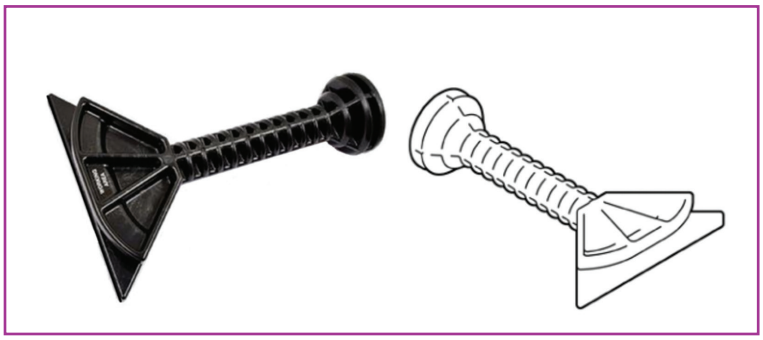
COURTESY OF HYUNDAI :-



SPECIALIST HEMMING TOOLS – (TOOL MAKER & PART NUMBER) : -

1/ Manually Operated Models :-

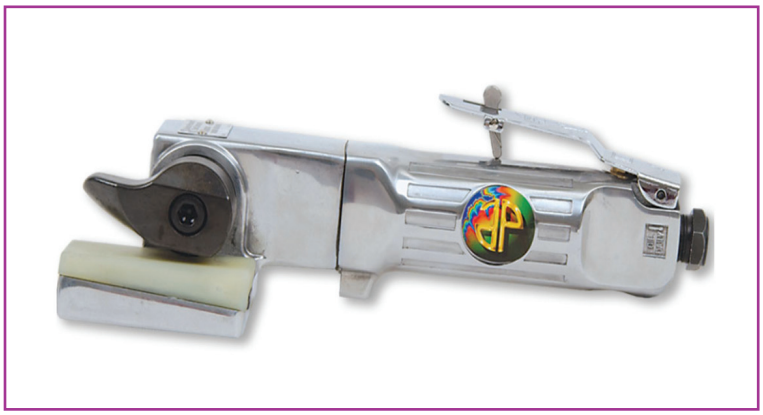
OTC Tools & Equipment - Part # OT501 – 080 (Recommended by Ford USA for hemming aluminium panels)



Sykes Pickavant - Part # 0431000

2/ Power Operated Models :-

Astro Pneumatic Tool Co. – Part # DS1000



Steck Manufacturing - Part # 21890 (For Steel)

- Part # 21892 (For Aluminium)

(Air Chisel attachment tool)

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1/

2/

Malco Products

– 1/ Part # QHT1A (Dedicated Tool)

– 2/ Part # QHT1 (Drill Attachment)

Killer Tools – Part # ART – 12DX

I-CAR would like to thank Mazda New Zealand for their assistance in identifying current and future tool/ equipment requirements when completing collision repairs to their vehicles...

These articles have been written by Martyn Lane : I-CAR Instructor, Weld Test Administrator and Technical Specialist to the auto body industry.