HEAVY WIRE WEDGE BONDING CYCLES

ADVANCED TECHNOLOGY FOR RESEARCH & INDUSTRY

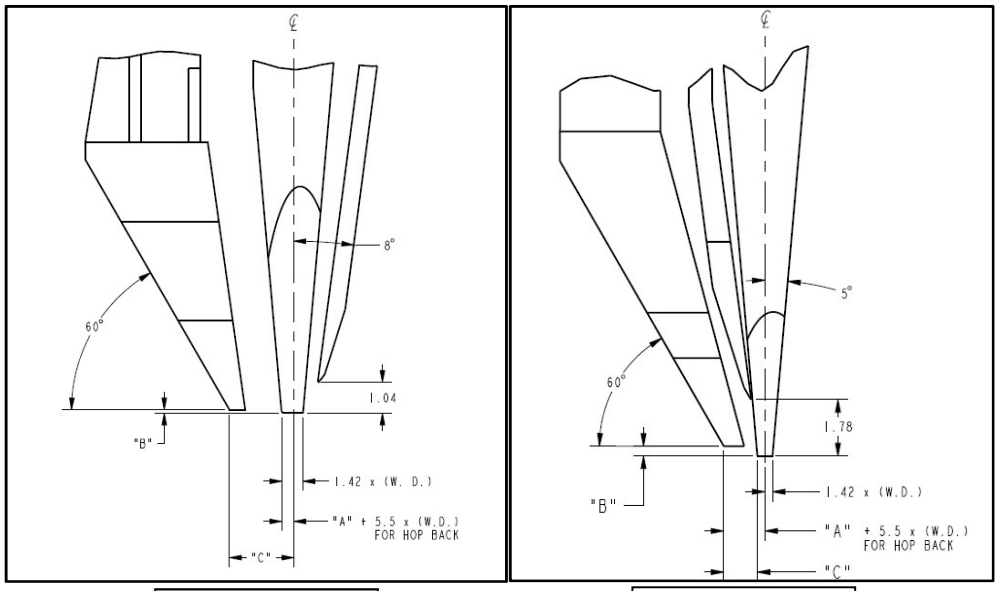
KNOWLEDGE BASE FACT SHEET

- SCOPE: An overview of the different bond head movements on an automated heavy wire wedge bonder.

In a bond cycle the bond head on an automated heavy wire wedge bonder makes a series of moves to achieve the desired bond and loop profiles. Some options for the programmed bond will add or remove movements but the general bond head movements are similar. This factsheet gives an overview of the bond head motions to create a two-bond wire.

Front or Rear Cut?

For heavy wire wedge bonding applications, there are two configurations of bond head: **front** cut and **rear** cut. **Front** cut bond heads sees the cutter blade sit forward of the bond tool and wire guide/clamp assembly and **rear** cut sees the cutter blade sit behind the bond tool, in-between the bond tool and wire guide/clamp assembly.



FRONT CUT REAR CUT

Each bond head, whether it is front or rear cut, could include a wire clamp that assists with looping and wire break movements by clamping the wire, preventing unwanted wire slip or feeding. In the latest generations of bond head, wire clamps are now included as standard on all machines for this purpose.

Selection of front or rear cut bondhead is driven by the assemblies being bonded. Front cut bondheads are preferred as the wire termination and wire break moves are simpler and easier to perform in comparison to rear cut.

On a two-bond wire, the bonding sequence will go from the active part to the packaging or substrate; on front cut bondheads there is the potential for the cutter blade to mark or contact the surface as the cutter blade cuts through 95 - 100% of the wire diameter during the termination bond. If process dictates the bonding sequence must be reversed and the termination bond is located on the active device, then front cut is not ideal as there is the risk of the cutter blade causing damage to active components. In this instance a rear cut bondhead would be preferred, as the wire break moves only need to weaken the termination bond wire, cutting through 75 - 80% of the wire diameter, thus enabling the termination bond to be placed on an active device.

Another driving factor for selection of a rear cut bond head over a front cut bond head would be clearance issues. Comparing the images above you can see the clearance to the front of the bond tool on the rear cut is better compared to the front cut. If you are requiring to bond close up to a ledge (inside a package) or other component (on a board / substrate) then the rear cut bondhead has obvious benefits.

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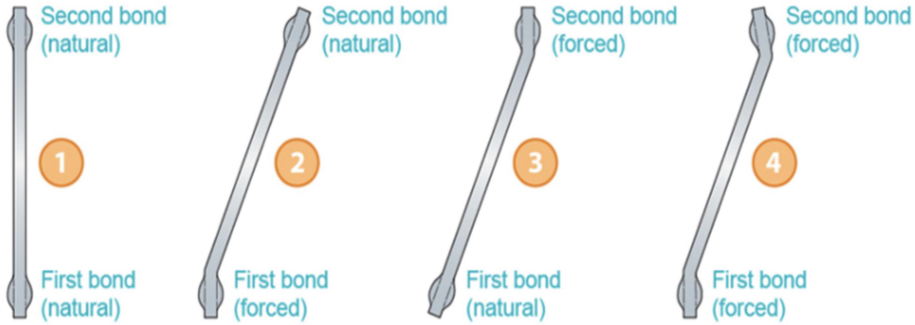
Natural or Forced Bond Angles?

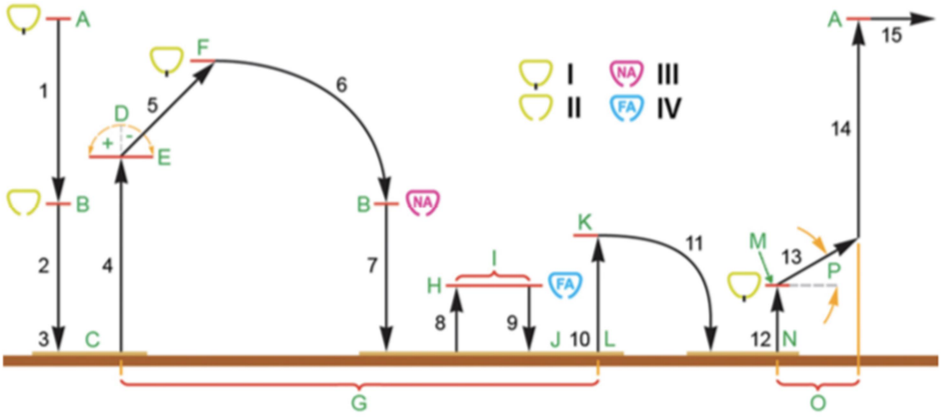
In a two-bond wire the locations of the bonds determine the direction of the wire or loop. If the bond angle is in line with the angle of the loop, then this is referred to as a natural angle, which is usually the case as this requires minimal bondhead movement and will not impact throughput; however it is possible to select a distinct angle to place the first bond and second (termination) bonds; this is called “forcing” the bond angle. Bond angles are usually forced to allow for narrower bond pitch or smaller bonding sites.



Note: Natural or forced angle diagram above shows a two dimensional bond head movement; actual movement occurs in three dimensions with rotation.

Large Wire Bond Head Movements

This diagram shows the entire movements of the bondhead for a two-bond wire.



I	ALC clamp closed	D	Step-forward angle	K	Tail length height
II	ALC clamp open	E	Twist height	L	Rear-cut cutting surface
III	ALC clamp open (natural angle)	F	Loop top	M	Break height
IV	ALC clamp open (forced angle)	G	Repeat for stitch bonds	N	Front-cut cutting surface
A	Interwire height	H	Touch twist height	O	Break distance
B	Search height	I	Forced-angle bond only	P	Positive break angle
C	First or stitch bondpad	J	Stitch or last bondpad		

Note: Above shows a two dimensional bond head movement, Actual movement occurs in three dimensions with rotation.

Move Number	Name	Description	
		Rear Cut	Front Cut
1	Interwire height to search height	The bond head moves rapidly to a point directly over the first bond and bond pad at the pre-set bond rotation. ALC wire clamp closes.	
2	Search height to first bond pad	The bond head moves straight down at a slower, constant rate. The Bond tool and wire touch the first bond pad.	
3	First bond	The first bond is made. For natural angle bond with a start force > 300 grams, the ALC wire clamp is open; otherwise it is closed.	
4	First bond pad to twist height	The bond head ascends rapidly straight up. ALC wire clamp stays open.	
5	Twist height to loop top	Motion shifts to the step forward angle. If the last bond had a forced angle, the bond head turns to the natural angle for the next bond and ascends rapidly to loop top to form the loop. (Loop top is calculated by the distance between the bonds and the programmable loop factor). ALC wire clamps closes.	
6	Loop top to search height	The bond head arcs down rapidly to finish the loop. The bond head is directly over the bond pad at search height. Rotation is at the natural wire angle.	
7	Search height to last bondpad	The bond head descends at a slower, constant rate. The bond tool touches the bond pad. Note: For forced angle bonds the ALC wire clamp is closed and the bond head goes to Move 8. For natural angle stitch bonds, the bond tool descends and completes the bond. For the last bond, the bond head goes to Move 10.	
8	Last bond to touch twist height	(Forced angles only) The bond head ascends rapidly to the touch twist height rotating to the last bond angle.	
9	Touch twist to last bond	(Forced angle only) The bond head descends straight down at a slower constant rate to the last bond. See note in Moves 1 & 3 about ALC wire clamp being open or closed.	
10	Last bond pad to tail length	The cutter blade cuts the wire at the surface. The bond head ascends rapidly to the tail length height. Bond head rotation stays at the last bond angle. ALC wire clamp is open.	The bond head ascends rapidly to the tail length height. Bond head rotation stays at the last bond angle. ALC wire clamp is open.
11	Tail length height to surface (hop move)	The bond head moves rapidly to a point on the surface directly behind the last bond. ALC wire clamp is open	
12	Surface to break height	Go to Move 13	The cutter blade cuts the wire at the surface. The bond head ascends rapidly to the break height. ALC wire clamp closes.
13	Break height to break move	The bond head moves rapidly along the break distance at the break angle. ALC clamp closes.	
14	End of break move to interwire height	The bond head ascends rapidly to the interwire height. ALC wire clamp closes.	
15	Move to the first bond of the next wire or the Park position	The bond head moves rapidly at interwire height to a point directly over the first bond position of the next wire (ready for Move 1). Or the Park position if the assembly is complete. ALC clamp closes.	