

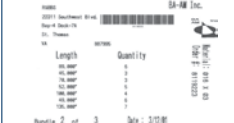




Printing/Marking Systems Comparison Grid

	Drop-on-Demand (DOD)	Continuous-Ink-Jet (CIJ)	Thermal Transfer (Paper Labels)	Permanent (Emboss)	Permanent (Laser)
<i>Sample print image</i>					
<i>Marking size capability</i>	DOD: 0.5 - 2 inch (12-50MM) per head DOD valve: 0.125 - 5 in. (3-127MM) per head	0.125 -0.5 inch (3-12MM) per head	Highly flexible and customizable	0.118 - 0.472 inch (3-12MM)	Highly flexible & customizable Range: 2" x 2" to 8" x 8"
<i>Resolution level required</i>	Lower resolution, larger dot size	Higher resolution, smaller dot size	Highly flexible and capable of numerous fonts, barcode symbols and graphic images	Limited resolution	High resolution
<i>Coolant or oils present on the surface of the part before or after it is printed</i>	May need to adjust drying times to allow inks to penetrate the oil and adhere to the metal	May need to adjust drying times to allow inks to penetrate the oil and adhere to the metal	Does not work well on oiled surface	Not affected	Not always a good option should there be any VOCs present
<i>Secondary processes that may affect the mark (ovens, painting, forming, etc.)</i>	May need to select an ink or dye that can bleed through the paint. Mark can be obscured by paint.	May need to select an ink or dye that can bleed through the paint. Mark can be obscured by paint.	Does not work well with heat treatments	Works well with secondary processes.	Laser marking provides a colorless etched mark into the surface of the substrate. If a contrasting mark is required, a second process may be necessary.
<i>Speed of the machine running</i>	800+ Feet/Min Speed does not affect print height	900+ Feet/Min Speed drastically limits print height	15+ Inches/Sec	Approx. 5 characters per second	500+ Feet/Min. Speeds vary greatly depending on the overall size and depth of the marking requirement.
<i>Cost of initial investment</i>	\$5,000-10,000 for single head solution	\$10,000-20,000 for single head solution	\$1,000-\$2,500	\$500-\$2,000	\$20,000-\$100,000 depending on the type of metal and depth of mark
<i>Consumable cost</i>	\$\$\$	\$\$\$	\$\$	None	None
<i>Maintenance cost/effort</i>	Minimal - daily flushing	Monthly filter replacement	Loading of print media, regular printhead cleaning	Basic equipment maintenance	Basically no maintenance required