ELECTRON BEAM & ARC WELD COMPARISON

As a comparison between electron beam and more conventional arc welding processes, side by side welds were made on flat steel plates at three thickness levels. The following three pages give the corresponding weld parameters for:

1) gas tungsten arc weld (GTAW or TIG) and electron beam weld at 0.5" thickness;

2) gas metal arc weld (GMAW or MIG) and electron beam weld at 1" thickness;

3) submerged arc weld (SAW) and electron beam weld at 2” thickness.

Photomicrographs of the weld cross sections are also given as a graphic example of the weld differences. The base material in all cases was the equivalent of AISI 1020.

An item of particular note is the energy input (kJ/in) differences between the arc weld processes and the electron beam process. The excess energy involved with arc welding acts to raise the overall part temperature and can contribute to part distortion.

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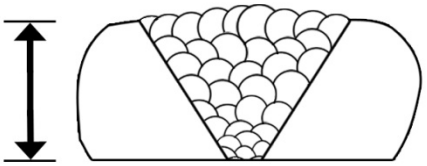
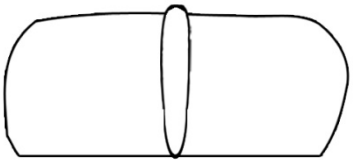
ELECTRON BEAM & ARC WELD COMPARISON

Weld Process:	**GTAW**	**EBW-HV**
Material:	AISI 1020 Steel	AISI 1020 Steel
Thickness:	0.5”	0.5”
Joint Preparation:	V groove with backing 60° included angle	bead on plate no joint
0.5”		
Number of Passes:	9	1
Weld Speed:	Manual	30”/min
Current/Voltage:	4 passes – 135A/13V 5 passes – 245A/18V (All D-C Reverse)	1 pass - .022A/150kV
Energy/unit length:	Approx.150 kJ/in	6.6 kJ/in
Filler Wire -Type:	Mild Steel	None
-Speed:	Manual	N/A
-Size:	1/16” and 1/8”	N/A

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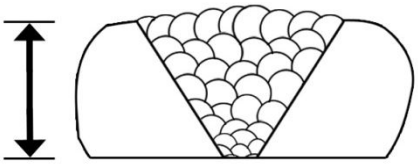
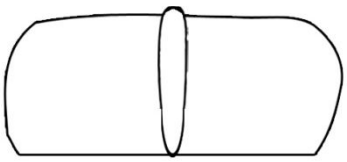
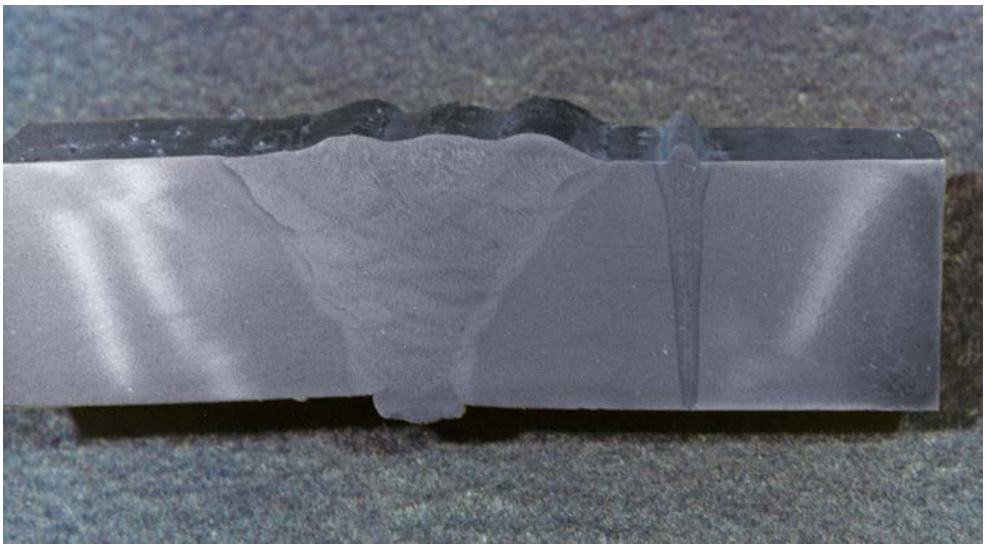
ELECTRON BEAM & ARC WELD COMPARISON

Weld Process:	**GMAW**	**EBW-HV**
Material:	AISI 1020 Steel	AISI 1020 Steel
Thickness:	1.0”	1.0”
Joint Preparation:	V groove with backing 60° included angle	bead on plate no joint
1.0”		
Number of Passes:	18	1
Weld Speed:	15”/min/pass	30”/min
Current/Voltage:	18 passes – 270A/13V (All D-C Reverse)	1 pass - .065A/150kV
Energy/unit length:	Approx. 600 kJ/in	19.5 kJ/in
Filler Wire -Type:	Mild Steel	None
-Speed:	400”/min	N/A
-Size:	.045”	N/A



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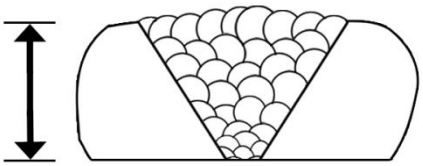
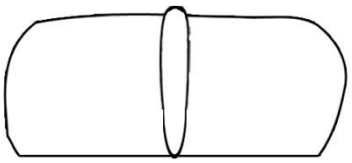
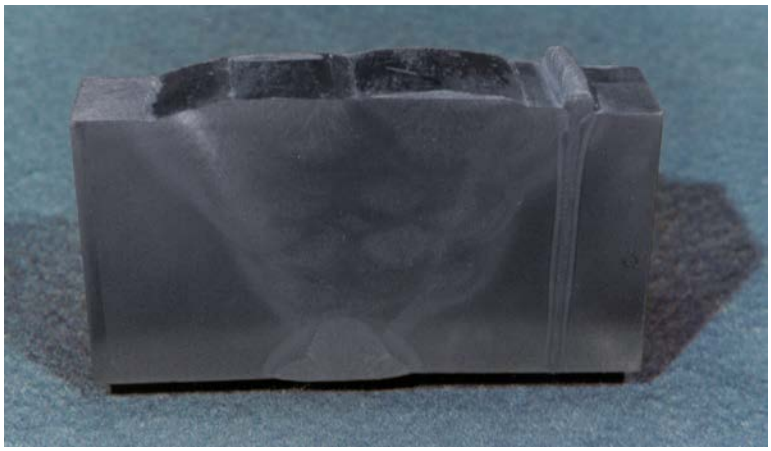
ELECTRON BEAM & ARC WELD COMPARISON

Weld Process:	**SAW**	**EBW-HV**
Material:	AISI 1020 Steel	AISI 1020 Steel
Thickness:	2.0”	2.0”
Joint Preparation:	V groove with backing 60° included angle	bead on plate no joint
2.0”		
Number of Passes:	37	1
Weld Speed:	30”/min/pass	15”/min
Current/Voltage:	1 pass – 450A/26V 36 passes – 700A/34V (All D-C Reverse)	1 pass - .10A/150kV
Energy/unit length:	Approx. 1750 kJ/in	60 kJ/in
Filler Wire -Type: -Speed: -Size:	Mild Steel 66”/min 5/32”	None N/A N/A



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