

## 1K RESERVOIR: EB WELDER, CE69412 REQUALIFICATION

Federal Manufacturing & Technologies

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## **Abstract**

*The EB Welder was qualified to produce the 1K retainer weld in February 2001. Since that time, several parts were replaced and metallography results from a review indicated that the welder was not operating properly. After testing the EB Welder, it was requalified to produce the 1K retainer weld.*

## **Summary**

The EB Welder was qualified to produce the 1K retainer weld in February 2001. Since that time, several parts were replaced and metallography results from a review indicated that the welder was not operating properly. In May of 2005, it was determined that 9 parts would be welded to demonstrate the welder capability. Metallography results from this evaluation verify that the welder is unchanged and capable of producing the 1K Retainer to Stem Weld.



# Discussion

## Scope and Purpose

The purpose of this document is to demonstrate the capability of the EB welder to make the 1K Retainer to Stem Weld.

## Activity

### Background

The EB Welder was qualified to produce the 1K retainer weld in February 2001. However, in early 2005, the high voltage transformers on the EB welder were replaced. After the replacement of the high voltage transformers, a review was conducted (in March of 2005) to requalify the EB welder to produce the 1K Retainer to Stem Weld. Metallography results from that review indicated that the welder was not yet operating properly.

Following the March review, the roughing pump and focus power supply on the EB welder were replaced. In addition to these changes, Honeywell FM&T proposed a change to the beam current setting.

In May of 2005, it was determined that an additional 9 parts at 3 high, 3 low, and 3 nominal would be welded to demonstrate the welder capability.

## Accomplishments

Nine WR-quality 1K Retainer to Stem parts were welded in July 2005. The nominal parameters of this evaluation were unchanged from the WR parameters used to weld the 1K Retainer to Stem since 2001. See Tables 1 and 2a for information about these parameters.

Metallography results from this evaluation verify that the welder is unchanged and capable of producing the 1K Retainer to Stem Weld. The results of these evaluation welds are illustrated in Figures 1 through 3.

FM&T opted not to pursue the proposed change to the beam current setting since it is not possible to adequately characterize due to the limited availability of war reserve (WR) parts.

**Table 1. WR Nominal Penetration and Cosmetic Weld Settings**

Parameter	Nominal Penetration Value	Nominal Cosmetic Value
Accelerating Voltage	82	82
Beam Current	16	12
Focus Current	601	731
Spindle Speed	22	22

**Table 2a. Run Order, Parameter Settings, and Penetration Results**

Run Order & Date Welded	S/N	High Voltage(kV)	Beam Current (mA)	Sharp Focus (mA)	Focus from Sharp (mA)	Spindle Speed (RPM)	Penetration	Width @ 0.070 inch depth
1, 7-1-05	14717**	81	15.5	627	(-34) 593	23	0.124	0.042
2, 7-1-05	14854**	82	16	631	(-30) 601	22	0.158	0.048
3, 7-1-05	14985**	83	16.5	635	(-26) 609	21	0.189	0.045
4, 7-5-05	14855	81	15.5	627	(-34) 593	23	0.127	0.044
5, 7-5-05	14096	81	15.5	627	(-34) 593	23	0.119	0.038
6, 7-5-05	13822*	83	16.5	635	(-26) 609	21	0.180	0.073
7, 7-5-05	14773	83	16.5	635	(-26) 609	21	0.190	0.046
8, 7-5-05	14991	82	16	631	(-30) 601	22	0.157	0.046
9, 7-5-05	14989	82	16	631	(-30) 601	22	0.150	0.044

Cosmetic Pass Parameters for all Nine Welds

ALL 82 12 631 +(100) 731 22

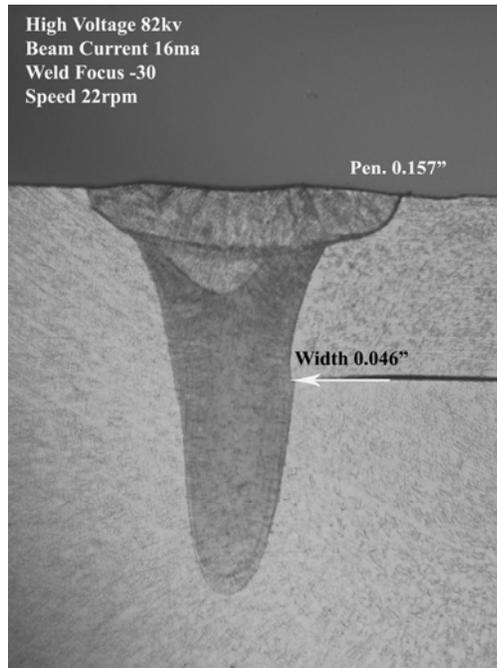
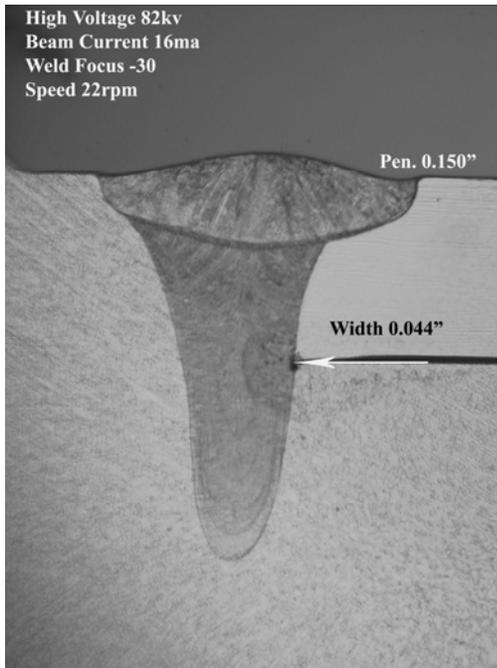
\* Grove on O.D. surface prior to welding.

\*\*Wire Brushed prior to welding

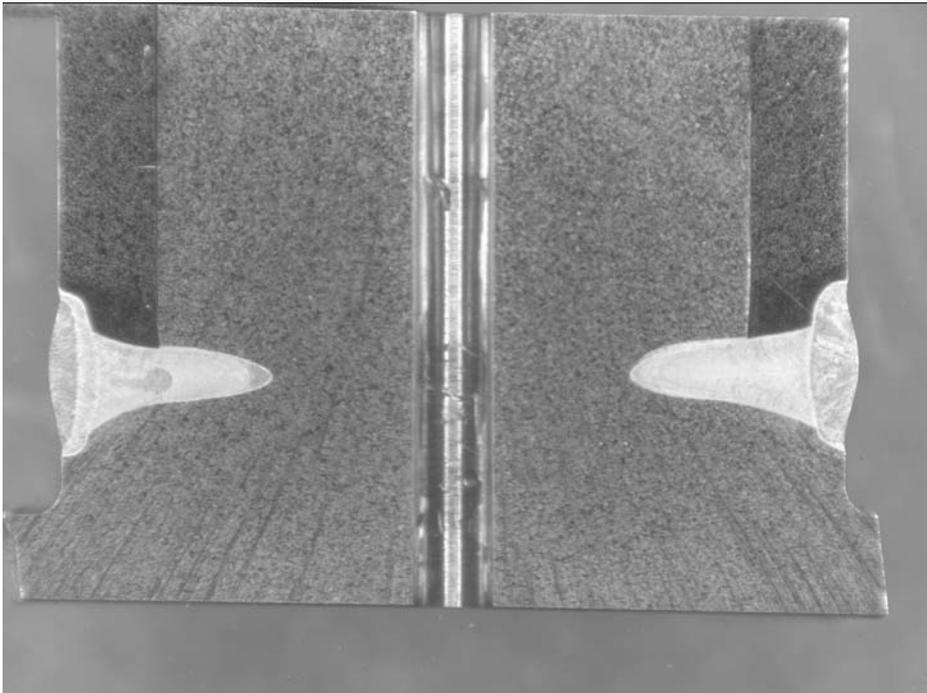
**Note:** See Table 2b for the calibration and evaluation limits used.

**Table 2b. Calibration Limit vs. Evaluation Limit Used for High and Low**

Parameter	Calibration Limit	Evaluation Limit
Accelerating Voltage	+/-0.5 kV	+/-1.0 kV
Beam Current	+/-2% of reading	+/-0.5 mA
Focus Current	+/-2.0 mA	+/-4.0 mA
Spindle Speed	+/-0.05% of reading	+/-1.0 RPM

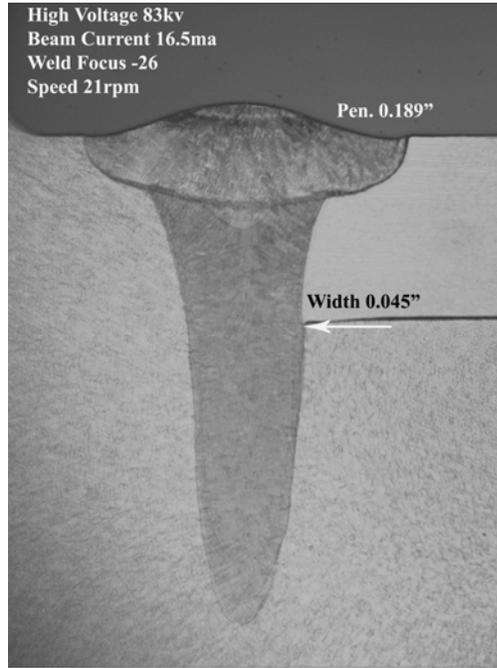
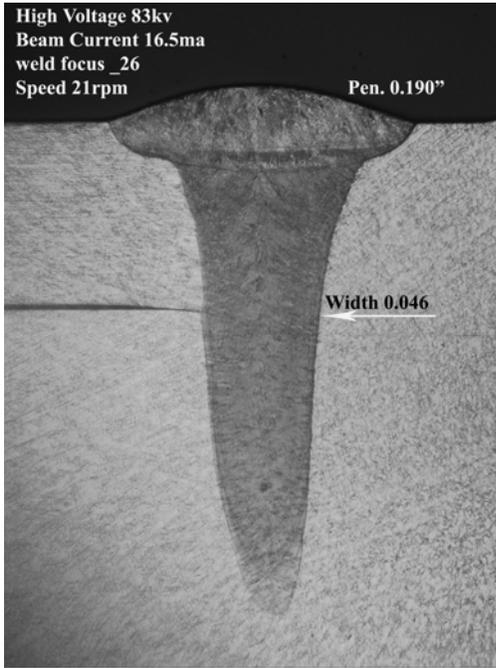


Profiles of the Nominal penetration pass welds. The parameters are: Voltage: 82 kV, Beam Current: 16 mA, Sharp Focus: -30mA, Spindle Speed: 22 RPM, Penetration 0.150 and 0.157 inches.

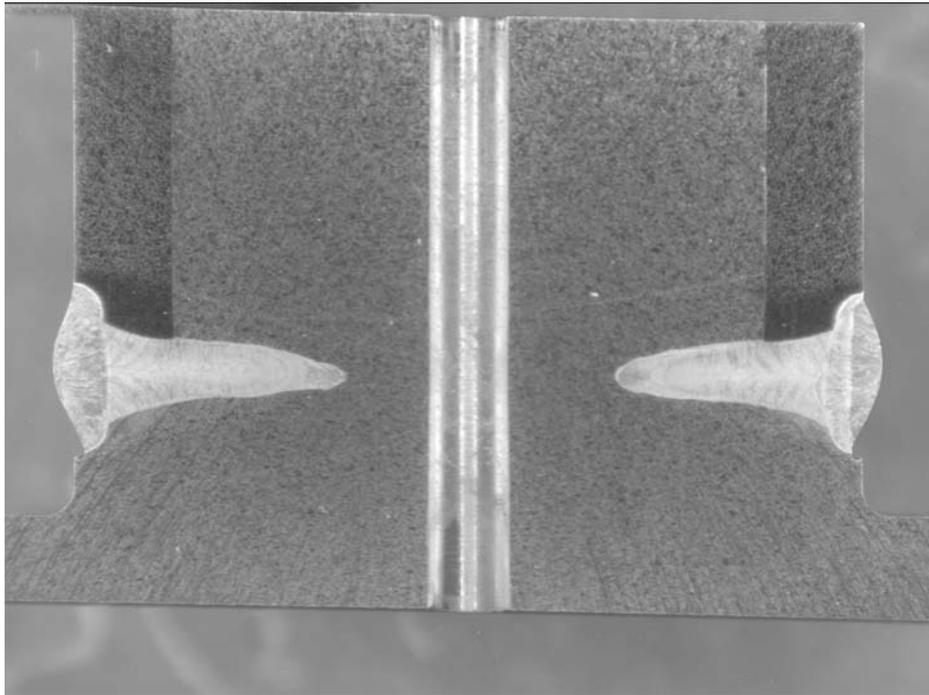


Overall nominal penetration profile

**Figure 1. Nominal Cross Sections Results**

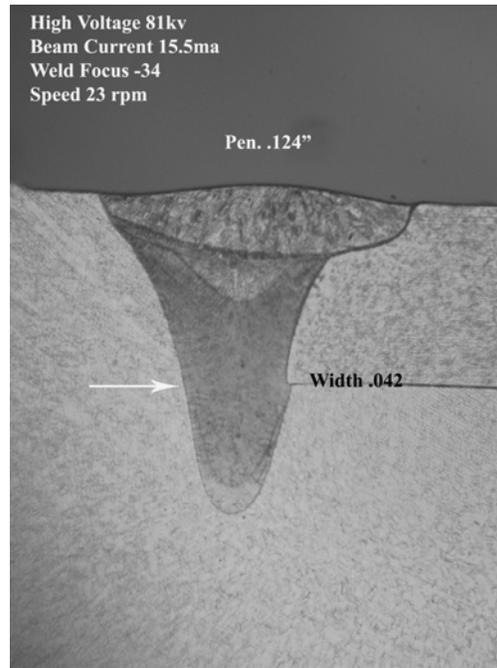
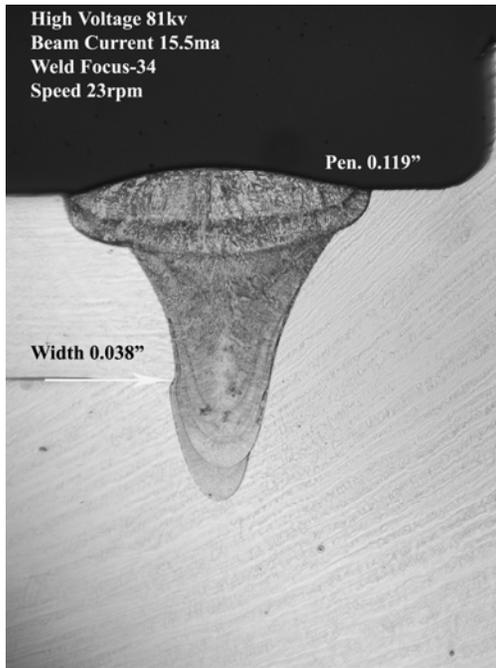


Profiles of the high penetration pass welds. The parameters are: Voltage: 83 kV, Beam Current: 16.5 mA, Sharp Focus: -26 mA, Spindle Speed: 21 RPM, Penetration 0.190 and 0.189 inches.

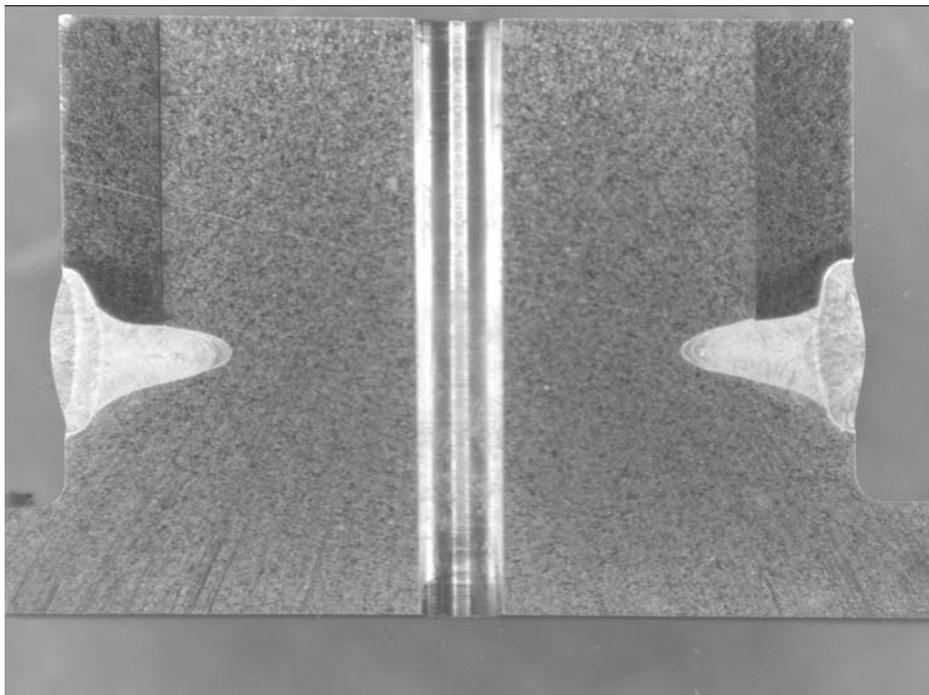


Overall high penetration profile

**Figure 2. High Cross Sections Results**



Profiles of the Low penetration pass welds. The parameters are: Voltage: 81 kV, Beam Current: 15.5 mA, Sharp Focus: -34 mA, Spindle Speed: 23 RPM, Penetration 0.119 and 0.124 inches.



Overall low penetration profile

**Figure 3. Low Cross Sections Results**