

The tests were done by an independent contract manufacturer for the purpose of evaluating for future purchases, what they have deemed to be the best soldering station, for their respective applications. This was done in Year 2005.

Since that JBC have released an updated version of the Advanced series with even higher performance.

Soldering Iron Evaluation



Executive Summary

After completion of the first two phases of this project, it is our recommendation that the JBC Advanced Series soldering iron is more capable than the current vendor Metcal. JBC has outperformed Metcal and all other vendors in nearly every evaluation category. It is our recommendation to purchase two JBC Advanced Series units to complete an extended tip life study, as well as a complete cost justification analysis to prove a cost benefit. This would allow the last two phases of the project to be completed.

Project Overview

This project evaluates new vendors of soldering iron/rework units. The scope is to purchase units from the vendor of choice for future buys for all locations or replace existing irons when minimum capabilities cannot be met. At the least, the vendor of choice should be allowed on the approved vendor list for rework/repair situations that our current vendor cannot support. Recommendations will be based on results of the evaluation.

Purpose for Evaluation

Improvement effort for Repair UG

- Capability and technology of soldering irons
- Flexibility of workstation
- Tip life and cost comparison
- Want better control of Solder/Repair operations
- Future purchases of irons

Vendors Evaluated

- Metcal
- JBC
- Hakko
- Pace
- Ersa (only evaluated on the thermal load testing)

Equipment Used

- Hakko FM-202 Soldering Station
- Pace TW100 Soldering Station
- JBC AD4200 Soldering Station
- Metcal MX- 500S-11 Soldering Station
- Ersa PT Soldering Station (only in thermal load testing)
- Pace Process Monitor
- Wahl ST2100 Solder Iron Tester
- Ersa Thermal Load Tester

Limitations of Current Metcal Irons

- Short tip life (some last 2 weeks)
- Expensive Tips (twice as much as most competition)
- 3 tips required for varying temperatures
- No 0402 or 0201 capability
- Ground plane repairs difficult (PTH and SMT)
- IC-shaped tips are not effective
- Additional flux needed to achieve hole fill
- Process Controls

Assumptions

- Test equipment used is repeatable.
- Decision matrix scoring is objective.

Phases of Evaluation

- **Phase 1: Paper evaluation**
 - Reduce to 2 vendors (Weighted Decision Matrix)
- **Phase 2: Demo units (1-2 months)**
 - Performance based evaluation
 - Thermal performance based tests
- **Phase 3: Cost justification**
 - Tip life/cost and added capability
- **Phase 4: Implementation**

Phase 1: Paper Evaluation

The first phase of the evaluation consisted of the team compiling a matrix that lists important attributes of soldering irons. Each of the vendors evaluated were compiled into the matrix so comparisons could be made (Appendix 1.). The team then weighed each of the attributes from 0-1 (least to most importance). The weighted scores from each of the team members were then averaged and entered as the multiplier on the weighted matrix. From the information listed, a score from 1-5 (worst-best) was given to each of the attributes for each vendor. The total score is the sum of the weight multiplied by the attribute score (Appendix 2.). The total scores were as follows:

Hakko	45.975
Pace	45.75
JBC	53.175
Metcal	42.125

Phase 2: Demo Units

Part 1. Performance based evaluation.

Each of the units was used for approximately one month in three locations. All of the units were utilized at rework stations by certified experienced solderers. After each vendor rotation, the user was given a questionnaire to fill out (Appendix 3.). Five out of the 20 questions ranked the irons against the Metcal iron (3 = same as Metcal, 5 = superior to Metcal, 1 = inferior to Metcal, etc) and the results are as follows:

JBC	B2	B4	B5	Average
Ergonomics	5	4		4.5
Tip Change	4	5		4.5
Durability	5	4		4.5
Temp Recovery	5	5		5
Capability	5	4		4.5

Hakko	B2	B4	B5	Average
Ergonomics	4	4		4
Tip Change	3	3		3
Durability	3	3		3
Temp Recovery	5	4		4.5
Capability	5	3		4

Pace	B2	B4	B5	Average
Ergonomics	3	4		3.5
Tip Change	1	3		2
Durability	2	3		2.5
Temp Recovery	2	2		2
Capability	2	2		2

Part 2. Thermal performance based tests.

To evaluate the thermal performance of each of the soldering irons, we acquired the three following test units:

Pace Process Monitor



Wahl ST2100 Solder Iron



ERSA Thermal Load Tester



Soldering Iron Evaluation Results:

Tables 1 and 2 represent data collected on the first day (9-12-02) of having the Pace thermal load equipment. Representatives from JBC and Pace were there to assist the testing process. The Pace tester is certified to Government SR4 test specifications. Considerations for these types of tests are the following:

1. Use the same tip size and configuration.
2. Use the same temperature setting.
3. Use the same amount of solder wire for the tinning of the iron.
4. Tin both sides of the soldering iron prior to test.
5. Each tip is new.

Table 1: Thermal Load Test – Small Coupon (3/4" square) Pace 2100 (9-12-02)

Vendor	Tip #	Ave.
ERSA (PT)	832VD	22.1
Pace (HW)	0010 177	22.3
Pace (TW)	0010 177	25.7
Hakko		18.9
JBC	2245-008	10.3
Metcal	STTC-117	18.6

Table 2: Thermal Load Test – Large Coupon (1 1/2" square) Pace 2100 (9-12-02)

Vendor	Tip #	Ave.
ERSA (PT)	832VD	120
Pace (HW)	0010 177	116
Pace (TW)	0010 177	120
Hakko		82
JBC	2245-008	30
Metcal	STTC-117	43

Table 3: Thermal Loading Tests – Small Coupon Pace 2100 (9-16-02)

Vendor	Tip #	Temp. (Set Point)	Temp. (Actual)	Run #1 (John)	Run #2 (Shawn)	Run #3 (Brian)	Ave.
ERSA (TT)	612ED	700	707	20.8	25.5	23.7	23.3
ERSA (PT)	832VD	700	698	24.5	17.1	16.6	19.4
Pace (HW)	0010 177	700	690	29.7	24.9	29.7	28.1
Pace (TW)	0010 177	700	645	31.4	33.5	29.5	31.5
Hakko		700	675	22.1	19.2	26.0	22.4

JBC	2245-008	700	715	12.2	13.2	15.7	13.7
Metcal	STTC-117	700	726	17.9	14.9	12.7	15.2

Table 4: Thermal Loading Tests – ERSa Solder Pot (9-16-02)

Vendor	Tip #	Temp. (Set Point)	Temp. (Actual)	Ave.
ERSA (TT)	612ED	700	750	54
ERSA (PT)	832VD	700	702	52
JBC	2245-008	700	702	48
Metcal	STTC-117	700	737	57

Table 5: Thermal Loading Tests – Small Coupon Pace 2100 (9-20-02)

Vendor	Tip #	Temp. (Set Point)	Temp. (Actual)	Run #1 (John)	Run #2 (John)	Ave.
ERSA (TT)	612ED	700	720-725	22.5	25.4	24.0
ERSA (PT)	832VD	700	720-725	17.7	23.7	20.7
JBC	2245-008	700	720-725	15.2	13.7	14.5
Metcal	STTC-117	700	720-725	20.9	22.0	21.5

Table 6: Thermal Loading Tests – Large Coupon Pace 2100 (9-20-02)

Vendor	Tip #	Temp. (Set Point)	Temp. (Actual)	Run #1 (John)	Run #2 (John)	Ave.
ERSA (TT)	612ED	700	720-725	72.5	100	86.2
ERSA (PT)	832VD	700	720-725	66.3	93.5	79.9
JBC	2245-008	700	720-725	39.9	46.5	43.2
Metcal	STTC-117	700	720-725	31.4	69.8	50.6

Table 7: Thermal Loading Tests – ERSa Solder Pots (9-20-02)

Vendor	Tip #	Temp. (Set Point)	Temp. (Actual)	Ave.
ERSA (TT)	612ED	700	701-707	63
ERSA (PT)	832VD	700	714-717	58
Pace (HW)	0010 177	700	703-708	93

Hakko		700	674-676	69
JBC	2245-008	700	700-705	48
Metcal	STTC-117	700	716-720	61

Thermal Load Tests Overall Results: (JBC vs. Metcal)

Table 1: 44.6% faster

Table 2: 30.2% faster

Table 3: 9.8% faster

Table 4: 15.8% faster

Table 5: 14.6% faster

Table 6: 21.3% faster

Recommendation

After completion of the first two phases of this project, it is our recommendation that the JBC Advanced Series soldering iron is more capable than the current vendor Metcal. JBC has outperformed Metcal and other evaluated vendors in nearly every evaluation category. It is our recommendation to purchase two JBC Advanced Series units to complete an extended tip life study, as well as a complete cost justification analysis to prove a cost benefit. This would allow the last two phases of the project to be completed.

Appendix 1.

Initial Soldering Iron Attribute Matrix: Before Demo, Info from Mfg

	Hakko	PACE	JBC	Metcal
1 Model	FM-202	TW100	AD4200(Dual) AD2200(Single)	MX- 500S-11
2 Unit Cost	\$ 599.00	\$ 350.00	\$377(Single Unit) \$570.00(Dual With Tweezers)	\$ 670.00
3 Average Tip Cost	\$ 9.97	\$ 10.00	\$ 18.00	\$ 21.95
4 Configuration (dual iron capabilities?)	No	No	Yes	2 irons, 1 iron and 1 talon, 1 iron and 1 desolder gun
5 Ease of Tip Change	Pull out / Push in	Pull out / Push in	Pull out / Push in	Pull out / Push in
6 Temp Controlled by Tip or Unit?	Unit	Unit	Unit	Tip
7 Temperature Setting Controls	Card Protection	hi/lo password	Dial (temp limits can be set)	None, temperature is managed by tip selection
8 Auto Temp Configuration for Tip Mass	Process Gate - Tip ID	INSTACALL Sensor - calibration needed	Yes	N/A, already controlled by tip selection
9 Large Tip Selection (# of tips)	50	75	100	90
10 Time to 660°F Claim by Mfg (sec)	8	3	2	10
11 Thermocouple Location	Tip	Tip	Tip	Uses RF energy to create heat, no thermocouple is required
12 Temperature Accuracy (+/- °F)	18	2	3% (21° at 700°C)	2
13 Temperature Stability (+/- °F)	9	5 F (TC) / 45.7sec (1/8" 100 TO 500)	Recovers in under a second to set temperature (no exact # given).	2
14 Temperature Display	Digital	Digital	Analog (Digital Station is now available)	Temperature is laser marked on tip cartridge
15 High/Low Temp Alarm	Yes	No	No	Not required
16 Auto Low Temp Sleep Mode	No	Yes	Yes	Not available at this time
17 Auto Shutoff	Yes	Yes	Yes	Yes
18 Hot Tweezer Option	9/2/02	PROPOSED	yes	Yes
19 Rework/Desoldering on same Unit	Yes/	Yes/No	Yes – The AM6000 can handle everything	Yes
20 No Charge Training/Service	Yes	Yes	Yes	Yes
21 Std. Warranty	1 year	3 years	4 years	8 years
22 Calibration	Not required	INSTACALL Sensor	Not required	Not required
23 0201 Rework tip	Yes (released 11/02)	Yes	Yes	Yes, 5 rework styles available in 4 different temperature ranges
24 Tip life Claim	3-8 times longer than Metcal	2 months	5 times longer than competition	Operator dependent, tips have gone as long as 2 years
25 ESD Safe	Yes	Yes	Yes	Yes

Appendix 2.



Weighted Decision Matrix: 1-5 (worst-best)

	Weight (0-1)	Score (1-5)	Weighted	Score (1-5)	Weighted	Score (1-5)	Weighted	Score (1-5)	Weighted
		Hakko	Hakko	PACE	PACE	JBC	JBC	Metcal	Metcal
1 Unit Cost	0.7	2	1.35	5	3.375	4	2.7	1	0.675
2 Average Tip Cost	0.8	5	4.125	5	4.125	2	1.65	1	0.825
3 Configuration (dual iron capabilities?)	0.3	1	0.325	1	0.325	5	1.625	5	1.625
4 Ease of Tip Change	0.8	3	2.25	3	2.25	3	2.25	3	2.25
5 Temp Controlled by Tip or Unit?	0.7	3	2.025	3	2.025	3	2.025	1	0.675
6 Temperature Setting Controls	0.6	5	3	2	1.2	3	1.8	1	0.6
7 Auto Temp Configuration for Tip Mass	0.7	4	2.8	1	0.7	3	2.1	3	2.1
8 Large Tip Selection (# of tips)	0.8	2	1.6	3	2.4	5	4	5	4
9 Time to 660°F Claim by Mfg (sec)	0.6	2	1.25	4	2.5	5	3.125	1	0.625
10 Thermocouple Location	0.5	3	1.575	3	1.575	3	1.575	1	0.525
11 Temperature Accuracy (+ °F)	0.8	2	1.5	5	3.75	1	0.75	5	3.75
12 Temperature Stability (+ °F)	0.8	1	0.75	3	2.25	5	3.75	5	3.75
13 Temperature Display	0.4	5	2.125	5	2.125	3	1.275	1	0.425
14 High/Low Temp Alarm	0.5	3	1.5	1	0.5	1	0.5	1	0.5
15 Auto Low Temp Sleep Mode	0.6	1	0.6	3	1.8	3	1.8	1	0.6
16 Auto Shutoff	0.7	3	2.1	3	2.1	3	2.1	3	2.1
17 Hot Tweezer Option	0.7	3	1.95	1	0.65	3	1.95	3	1.95
18 Rework/Desoldering on same Unit	0.4	3	1.2	3	1.2	5	2	5	2
19 No Charge Training/Service	0.7	3	2.1	3	2.1	3	2.1	3	2.1
20 Std. Warranty	0.8	1	0.75	2	1.5	4	3	5	3.75
21 Calibration	1.0	3	2.85	1	0.95	3	2.85	3	2.85
22 0201 Rework tip	0.7	5	3.5	5	3.5	5	3.5	5	3.5
23 Tip life Claim	1.0	5	4.75	3	2.85	5	4.75	1	0.95
24 ESD Safe	1.0	3	3	3	3	3	3	3	3
Total			45.975		45.75		53.175		42.125

HEI assumes no responsibility or liability for the accuracy or validity of these tests. The tests were done by an independent contract manufacturer for the purpose of evaluating for future purchases, what they have deemed to be the best soldering station, for their respective applications.

Source: HEI