



**275**

**No-Clean Core Flux  
for Lead-Free**



**Supplemental Data Package**

**Developed by: Engineered Products Group, R&D  
Presented by: Market Development Group  
Issued: May 2006**

---

## 275 No Clean Core Flux Data Package Contents

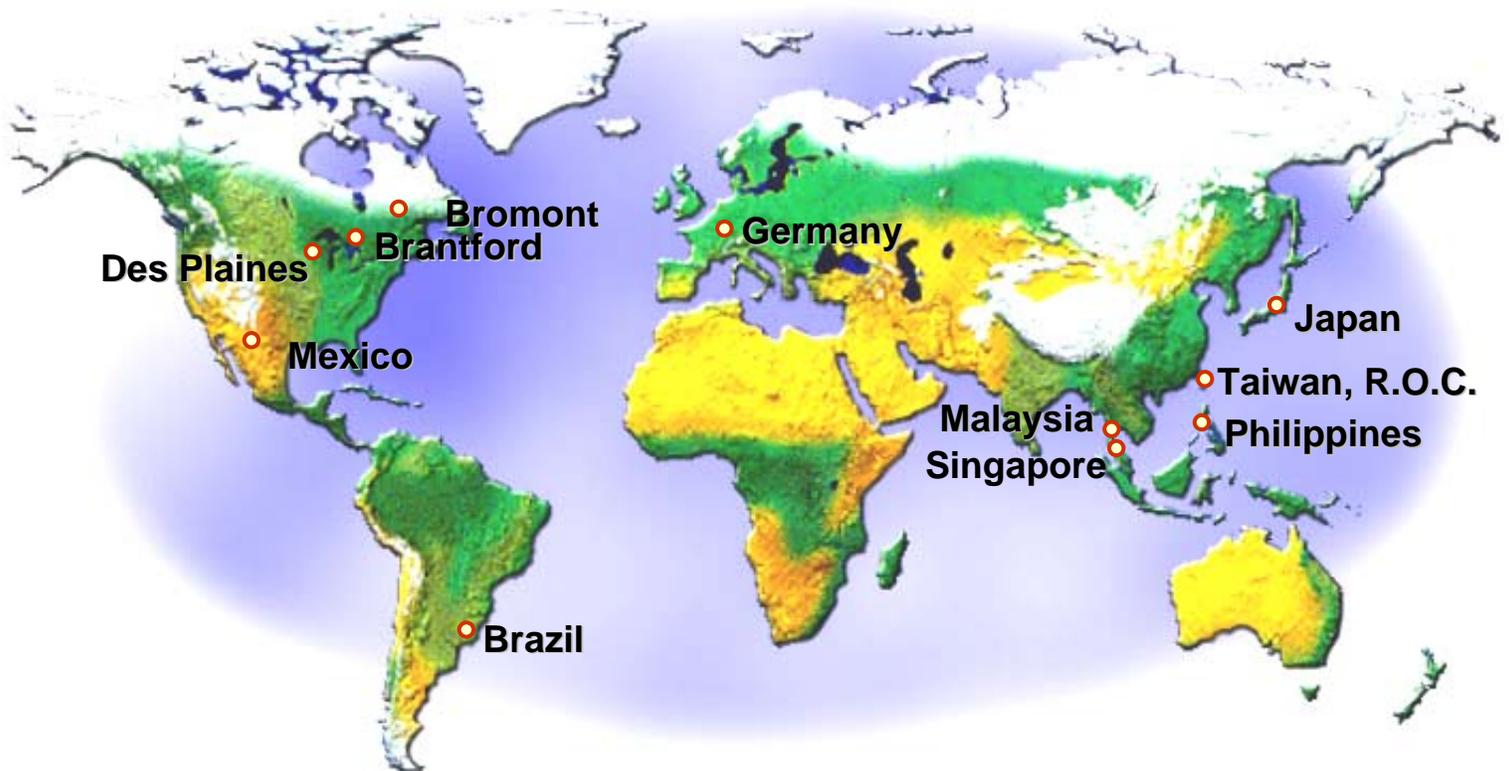
<b><u>Subject</u></b>	<b><u>Page</u></b>
IPC Testing	5 - 9
J-STD-004 Classification	5 - 8
Flux Composition	5
Copper Mirror	5
Qualitative Halide	5
Silver Chromate	5
Spot Test	6
Flux Corrosion	6
Surface Insulation Resistance (SIR)	6 - 7
Spread Test	7
Bellcore Testing	7 - 9
Surface Insulation Resistance (SIR)	7 - 8
Electromigration Resistance	8
Halides	9
Copper Mirror	9
Surface Insulation Resistance Data per IPC Test Method	10 - 11
Surface Insulation Resistance Data per Bellcore GR-78-CORE	12
Electromigration Data per Bellcore GR-78-CORE	13

## KESTER IS A FULL LINE MANUFACTURER OF SOLDER AND RELATED MATERIALS

Solder Paste  
Soldering Fluxes & Chemicals  
Cored Wire Solder  
Tacky Soldering Fluxes (TSF's)  
SE-CURE™ Polymer Products  
Flux Pens™  
Temporary Solder Masks

Bar Solder  
Solid Wire Solder  
Solder Preforms  
Plating Anodes  
Solder Reclaim Service  
Solder Analysis Program  
Solder Recycling Program

## KESTER HAS WORLDWIDE PLANTS



[www.kester.com](http://www.kester.com)

## Kester 275 No Clean Core Flux

Scope: The purpose of this report is to provide supplemental testing information for Kester 275 No Clean Core Flux.

### Characteristics:

- Colorless translucent residues
- Excellent solderability and fast wetting to a variety of surface finishes
- Eliminates the need and expense of cleaning
- Low smoke
- Low odor
- Low spattering
- Bright, shiny solder connections
- Bellcore Compliant
- Classified per ANSI/J-STD-004 as ROL0

### Summary of Testing:

#### A. IPC Testing

1. J-STD-004 Classification
  - 1.1. Flux Composition
  - 1.2. Copper Mirror
  - 1.3. Qualitative Halide
    - 1.3.1. Silver Chromate
    - 1.3.2. Spot Test
  - 1.4. Flux Corrosion
  - 1.5. Surface Insulation Resistance (SIR)
2. Spread Test

#### B. Bellcore Testing

1. Surface Insulation Resistance (SIR)
2. Electromigration Resistance
3. Halides
4. Copper Mirror

## Kester 275 No Clean Core Flux

### 1.1. Flux Composition

275 Core Flux is a Rosin-based No Clean flux. The non-volatile portion of the material is classified as an rosin type (symbol RO) per IPC J-STD-004.

Results: Type RO

### 1.2. Copper Mirror

This test is designed to help define the level of activity of the Core flux and determine the corrosive properties of the material per IPC-TM-650, Test Method 2.3.32.

Conditions: Non-activated rosin flux used as the control, polished glass slide with a 50nm layer of copper that was vacuum deposited, and a drop of the test sample (5% solution) are the major materials needed for this test. The test begins by preparing and cleaning the copper mirror. As the copper mirror is placed on a flat surface with the copper foil side up one drop of the control flux and one drop of the test flux is placed on the slide. The test states that the flux droplets are not allowed to touch. Then the slide is placed in an environmental chamber ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and  $50 \pm 5\%$  RH) for 24 hours. The slide is then removed and cleaned. The copper mirror is then evaluated.

If there is no removal or breakthrough of the copper foil then the flux is classified as “L”.

If there is less than 50% breakthrough or complete removal of the copper along the perimeter of the drop then the flux is defined as “M”.

If there is greater than 50% breakthrough or complete removal of the copper than the flux is placed in the “H” category.

Results: L (no breakthrough)

#### 1.3.1. Silver Chromate Test

This test is used to determine the presence of chlorides and bromides per IPC-TM-650, Test Method 2.3.33. The presence of free chlorides and bromides may indicate a material having ionic, corrosive, and conductive properties.

Conditions: One drop, approximately 0.05 ml, of 5% test flux solution is needed along with 6 silver chromate test papers (51 mm x 51mm). The test flux is placed on each of the test papers. The material remains on the paper for a minimum of 15 seconds and then the test papers are cleaned to remove any residual organic materials. The test papers are allowed to dry before the visual examination is performed.

If there is a color change of the dark silver chromate paper to off-white or yellow-white indicates the presence of chlorides or bromides.

Results: Pass (no chlorides or bromides detected)

## Kester 275 No Clean Core Flux

### 1.3.2. Spot Test

The Spot Test is used to determine if any fluorides which are not detectable in the Silver Chromate Test per IPC-TM-650, Test Method 2.3.35.1.

Conditions: A solution of zirconium nitrate and sodium alizarin sulfate is made. One drop of each solution is placed on a white spot plate to form three purple lakes of solution. One drop of the 5% test flux solution is then placed into each purple spot. A clean glass rod is used to combine the test flux and the solutions.

The test is positive for fluorides if there is a change in color from purple to yellow.

Results: Pass (no fluorides detected)

### 1.4. Flux Corrosion

This test is used to determine the corrosive properties of flux residues under extreme environmental conditions. 1 gram of cored wire solder is placed on a copper coupon. The coupon is placed on a surface of molten solder at  $235 \pm 5^\circ\text{C}$  until it melts and is held there for an additional  $5 \pm 1$  seconds. The coupon is then preheated to  $40 \pm 1^\circ\text{C}$  for  $30 \pm 2$  minutes. Finally the coupon is placed in a humidity chamber at  $40 \pm 1^\circ\text{C}$  and  $93 \pm 2\%$  R.H. for 240 hours (10 days). After the exposure period, coupon is examined under 20X magnification for evidence of corrosion.

Results: L (no evidence of corrosion)

### 1.5. Surface Insulation Resistance (SIR)

This test is to determine the degradation of electrical insulation resistance of printed circuit boards after exposure to the test flux. SIR testing is performed at elevated an elevated temperature and humidity ( $85^\circ\text{C} \pm 2^\circ\text{C}$  and  $85\% \pm 2\%$  RH for 168 hours).

Conditions: IPC-B-24 test patterns are unpreserved bare copper comb patterns on bare FR-4 laminate with 0.4 mm lines and 0.5mm spacing. A standing bias potential of  $-50$  volts DC is required as well as a meter capable of recording high resistance ( $10^{12}$  ohms) and a test voltage of 100 volts. The test coupons used are prepared with a 75% 2-propanol, 25% deionized water solution to remove all ionic contaminants. The test matrix for this type of flux is found below (Table 1).

Table 1

Sample Set	Processed	Coupon Preparation	Post Cleaning	Number of Coupons
Pattern Up	Yes	Precleaned	No	3
Pattern Down	Yes	Precleaned	No	3
Control	No	Precleaned	N/A	3

## Kester 275 No Clean Core Flux

Resistance measurements of the test specimens shall be taken at 24, 96, and 168 hours. The test coupons are examined under a 10x to 30x microscope within 24 hours of test completion. If dendrites are present and spans more than 25% of the original spacing then this constitutes a failure. The resistance values must also be greater than  $1 \times 10^8$  ohms.

Results: Pass (for detailed results refer to Table 2 or Appendix A)

Table 2

	Blank	275 ( <i>pattern up</i> )	275 ( <i>pattern down</i> )
Day 1	1.62E+10	1.14E+10	1.23E+10
Day 4	1.21E+10	9.24E+09	1.01E+10
Day 7	1.11E+10	8.57E+09	7.20E+09

### 2. Spread Test

This test is used to give an indication of the activity of a flux per IPC-TM-650, Test Method 2.4.46.

Conditions: Five oxidized copper coupons (1.5 in x 1.5 in x 0.020 in), a solid 1 gram solder preform ring (Sn63/Pb37), and test flux are used for this test. The solder ring is placed in the center of the coupon and 10 mL of the test specimen is placed in the center of the preform. The coupon is then placed carefully on the surface of a solder bath ( $260 \pm 10$  °C) for 15 seconds. The coupon is then removed from the bath and the residues cleaned. The solder spread area is then measured.

Results: 0.654 in<sup>2</sup> (422 mm<sup>2</sup>)

### C. Bellcore Testing (GR-78-CORE, Issue 1, September 1997)

A flux shall be considered Bellcore compliant if it conforms to four tests: copper mirror, halides, surface insulation resistance, and electromigration resistance. Core fluxes for SIR will be tested in as-received condition.

#### 1. Surface Insulation Resistance (SIR)

This test is to determine the degradation of electrical insulation resistance of printed circuit boards after exposure to the test flux. SIR testing is performed at elevated an elevated temperature and humidity ( $35^\circ\text{C} \pm 2^\circ\text{C}$  and a minimum of 85% RH).

Conditions: The test patterns used were unpreserved bare copper comb pattern, IPC-B-25, on bare FR-4 laminate with 0.0125 inch spacing. Standing bias potential of -50 volts DC, a meter capable of recording high resistance ( $10^{13}$  ohms) as well as a test voltage of 100 volts is required. The test matrix for SIR testing for this flux is summarized in Table 3.

## Kester 275 No Clean Core Flux

Table 3

Sample Set	Processed	Coupon Preparation	Post Cleaning	Number of Coupons
Soldered	Yes	Precleaned	No	3
Control	No	Precleaned	N/A	3

Resistance measurements of the test specimens shall be taken at 24 hours and at 4 days. The resistance values must also be greater than  $2 \times 10^{10}$  ohms for IPC-B-25 coupons. Discoloration of the patterns (green, blue-green, blue, or blue-black) shall be considered a and filament growth greater than 20% of the spacing is not considered a failure.

Results: Pass (for detailed results refer to Table 4 or Appendix B)

Table 4

	Blank	<b>275</b> (soldered)
Day 1	4.58E+12	4.75E+12
Day 4	3.49E+12	4.78E+12

## 2. Electromigration Resistance Test

This is a laboratory test used to characterize the chemical reactions of flux residues with an applied bias in an elevated temperature and humidity chamber. This test is used as a reliability predictor of flux residues.

Conditions: IPC-B-25 test coupons are prepared and the test flux is applied to the coupons. The environmental chamber is maintained at  $65 \pm 2^\circ\text{C}$  and a minimum of 85% RH. A bias voltage of 10 volts and a test voltage of 100 volts are required. The sample set of boards is summarized below in Table 5.

Table 5

Sample Set	Processed	Coupon Preparation	Post Cleaning	Number of Coupons
Soldered	Yes	Precleaned	No	3

A material passes this test when the resistance data does not degrade by more than a decade and there is no evidence of electromigration (filament growth) that reduces the conductor spacing by more than 20%. This visual examination is performed with backlighting at 10x magnification.

Results: Pass (for detailed results refer to Table 6 or Appendix C)

Table 6

	<b>275</b> (soldered)
Day 4	4.64E+10
Day 21	7.09E+10

## Kester 275 No Clean Core Flux

### 3. Halides

Bellcore refers to IPC-TM-650, Test Method 2.3.33 that is summarized in Section 1.3.1. of this report. Test flux solution is a 35% solution by weight in alcohol.

Results: Pass

### 4. Copper Mirror

Bellcore refers to IPC-TM-650, Test Method 2.3.32 that is summarized in Section 1.2. of this report. Test flux solution is a 35% solution by weight in alcohol.

Results: L

## Surface Insulation Resistance Data per IPC Test Method

**R & D Project:** DW1209      **Date Performed:** 01May03 to 08May03  
**Formula:** 275      **Operator:** JWT  
**Lot#:** Lab      **Result Location:**  
**Method Used:** IPC-J-STD-005,      **Equipment Used:** See below  
 Test method 2.6.3.3

### Procedure:

**275** extract was processed through the NU/ERA Solderwave with a belt speed of 4.9 ft/min. Bias voltage was -50 volts, test voltage was 100 volts. Temperature was 85°C humidity was 85%RH

#### Blank Day 1

Coupon#	A	B	C	D
1	1.83E+10	1.70E+10	1.43E+10	1.68E+10
2	1.77E+10	1.74E+10	1.53E+10	1.60E+10
3	1.62E+10	1.61E+10	1.46E+10	1.43E+10

Day 1 Avg. Resist. 1.62E+10
--------------------------------------

#### Blank Day 4

Coupon#	A	B	C	D
1	1.32E+10	1.23E+10	1.06E+10	1.21E+10
2	1.32E+10	1.30E+10	1.14E+10	1.19E+10
3	1.24E+10	1.22E+10	1.13E+10	1.12E+10

Day 4 Avg. Resist. 1.21E+10
--------------------------------------

#### Blank Day 7

Coupon#	A	B	C	D	Visual	Day 7 Avg. Resist. 1.11E+10
1	1.21E+10	1.13E+10	9.70E+09	1.10E+10	Pass	
2	1.21E+10	1.17E+10	1.03E+10	1.09E+10	Pass	
3	1.12E+10	1.14E+10	1.03E+10	1.08E+10	Pass	

#### 275 Day 1 (down)

Coupon#	A	B	C	D
1	2.19E+10	NA	1.25E+10	1.51E+10
2	1.64E+10	1.70E+10	1.28E+10	1.37E+10
3	1.41E+10	1.47E+10	9.36E+09	NA

Day 1 Avg. Resist. 1.23E+10
--------------------------------------

#### 275 Day 4 (down)

Coupon#	A	B	C	D
1	1.57E+09	NA	9.38E+09	1.13E+10
2	1.25E+10	1.24E+10	9.77E+09	1.07E+10
3	1.58E+10	1.41E+10	1.00E+10	NA

Day 4 Avg. Resist. 1.01E+10
--------------------------------------

#### 275 Day 7 (down)

Coupon#	A	B	C	D	Visual	Day 7 Avg. Resist. 7.20E+09
1	2.00E+09	NA	8.61E+09	1.04E+10	Pass	
2	1.18E+10	1.14E+10	9.08E+09	9.64E+09	Pass	
3	1.10E+10	1.08E+10	1.62E+09	NA	Pass	

## Surface Insulation Resistance Data per IPC Test Method

275 Day 1 (up)

Coupon#	A	B	C	D
1	1.10E+10	1.27E+10	9.63E+09	1.01E+10
2	1.16E+10	1.03E+10	1.05E+10	1.12E+10
3	1.28E+10	1.22E+10	1.24E+10	1.24E+10

Day 1 Avg. Resist. 1.14E+10
--------------------------------------

275 Day 4 (up)

Coupon#	A	B	C	D
1	8.26E+09	9.98E+09	8.48E+09	8.77E+09
2	9.78E+09	9.02E+09	8.60E+09	9.04E+09
3	1.02E+10	9.88E+09	9.03E+09	9.82E+09

Day 4 Avg. Resist. 9.24E+09
--------------------------------------

275 Day 7 (up)

Coupon#	A	B	C	D	Visual	Day 7 Avg. Resist. 8.57E+09
1	8.80E+09	9.40E+09	8.05E+09	8.28E+09	Pass	
2	9.25E+09	8.47E+09	8.00E+09	8.43E+09	Pass	
3	9.68E+09	9.02E+09	6.41E+09	9.04E+09	Pass	

## Surface Insulation Resistance Data per Bellcore GR-78-CORE

<b>R &amp; D Project:</b>	DW1209	<b>Date Performed:</b>	15 May 03 to 19 May 03
<b>Formula:</b>	275	<b>Operator:*</b>	JWT
<b>Lot#:</b>	Lab	<b>Result Location:</b>	
<b>Method Used:</b>	GR-78-CORE, Test method 13.1.3	<b>Equipment Used:</b>	See below

**Procedure:**

**275** was hand soldered to the fingers of the test vehicle. Bias voltage was -50 volts, test voltage was 100 volts. Temperature was 35°C humidity was 85%RH

Blank Day 1

Coupon#	A	B	C	D	
1	4.56E+12	1.08E+13	6.14E+12	6.84E+12	Day 1 Avg. Resist. 4.58E+13
2	6.14E+12	4.20E+14	2.92E+12	3.06E+12	
3	2.04E+12	4.45E+12	3.52E+11	5.62E+11	

Blank Day 4

Coupon#	A	B	C	D	Visual	
1	4.46E+12	3.68E+13	5.96E+12	8.23E+12	Pass	Day 4 Avg. Resist. 3.49E+13
2	6.40E+12	3.40E+11	2.95E+12	3.49E+12	Pass	
3	1.84E+12	4.91E+12	1.42E+12	1.39E+12	Pass	

275 Day 1 (soldered)

Coupon#	A	B	C	D	
1	7.98E+12	4.28E+13	2.05E+12	2.25E+12	Day 1 Avg. Resist. 4.75E+12
2	1.20E+12	7.86E+11	8.03E+11	8.21E+11	
3	1.89E+13	3.75E+13	1.17E+13	1.64E+13	

275 Day 4(soldered)

Coupon#	A	B	C	D	Visual	
1	8.07E+12	1.32E+13	2.34E+12	2.49E+12	Pass	Day 4 Avg. Resist. 4.78E+12
2	1.00E+12	7.39E+11	1.82E+12	2.01E+12	Pass	
3	1.46E+13	5.00E+13	1.01E+13	1.15E+13	Pass	

## Electromigration Data per Bellcore GR-78-CORE

<b>R &amp; D Project:</b>	DW1209	<b>Date Performed:</b>	11Mar 03 to 02Apr. 03
<b>Formula:</b>	275	<b>Operator:*</b>	JWT
<b>Lot#:</b>	Lab	<b>Result Location:</b>	
<b>Method Used:</b>	GR-78-CORE, Test method 13.1.4	<b>Equipment Used:</b>	See below

**Procedure:**

**275** was hand soldered to the fingers of the test vehicle. Bias voltage was 10 volts, test voltage was 100 volts. Temperature was 65°C humidity was 85%RH

275 Day 4 (soldered)

Coupon#	A	B	C	D	
1	3.61E+10	4.79E+10	4.84E+10	3.83E+09	Day 1 Avg. Resist. 4.64E+10
2	8.03E+09	5.10E+10	2.22E+10	2.84E+10	
3	1.19E+11	3.33E+10	1.44E+11	1.51E+10	

275 Day 21 (soldered)

Coupon#	A	B	C	D	Visual	
1	5.49E+10	7.60E+10	7.40E+10	2.08E+09	Pass	Day 4 Avg. Resist. 7.09E+10
2	2.16E+10	4.88E+10	3.58E+10	4.04E+10	Pass	
3	9.40E+10	2.15E+11	1.71E+11	1.70E+10	Pass	