



**TEST REPORT**

|   |                |          |                      |
|---|----------------|----------|----------------------|
| In account with<br><br>Stratasys, Inc.<br>7665 Commerce Way<br>Eden Prairie, MN 55344 | Date           | 01/30/09 | Page 1 of 6 Pages    |
|   | W O No         | T 41758  | P O No 134401/134402 |
|   | Identification | As noted | Shipper None         |

IDENTIFICATION : Thirty-six (36) 4" x 4" x 0.1" plaques were submitted and identified by the client as follows;

| <u>QUANTITY</u> | <u>SPECIMEN BAG ID</u> | <u>SPECIMEN ID</u>                  |
|-----------------|------------------------|-------------------------------------|
| 8               | EX09y0106-A FLAT       | ABS-m30, 400mc, Flat, 1 through 8   |
| 8               | EX09y0106-A UP         | ABS-m30, 400mc, Up, 1 through 8     |
| 10              | EX09y0106-B FLAT       | ABS-m30, 1200es, Flat, 1 through 10 |
| 10              | EX09y0106-B UP         | ABS-m30, 1200es, Up, 1 through 10   |

Per client instructions, the following specimens were tested.

Five (5) specimens, marked 1 through 5 from each of EX09y0106-A FLAT and EX09y0106-A UP, were selected for dielectric strength.

One (1) specimen, marked 6 from each of EX09y0106-A FLAT and EX09y0106-A UP, were selected for dielectric constant & dissipation factor and volume resistivity.

One (1) specimen, marked 1 from each of EX09y0106-B FLAT and EX09y0106-B UP, were selected for dielectric constant & dissipation factor.

SPECIFICATION : None

- REFERENCES : 1. Stratasys, Inc. Purchase Order Nos. 134401 and 134402, dated January 8, 2009
2. ASTM D 257-07, "Standard Test Methods for DC Resistance or Conductance of Insulating Materials"
3. ASTM D 150-98 (Reapproved 2004), "AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation"
4. ASTM D 149-97a (Reapproved 2004), "Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Material at Commercial Power Frequencies"

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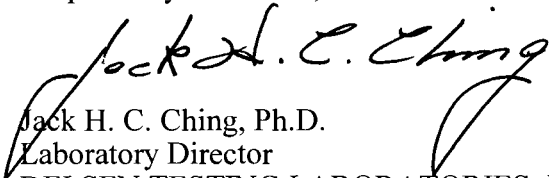
TESTING

- PERFORMED : 1. Volume resistivity per ASTM D 257-07
2. Dielectric constant and dissipation factor at 1 kHz per ASTM D 150-98 (Reapproved 2004)
3. Dielectric strength per ASTM D 149-97a (2004), Method A, short time test

REMARKS : There were no acceptance/rejection criteria applicable to the test results.

Test results are herein submitted for client evaluation.

Respectfully submitted,

  
Jack H. C. Ching, Ph.D.  
Laboratory Director  
DELSEN TESTING LABORATORIES, INC.

dsp L3 T41758 Stratasys

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**VOLUME RESISTIVITY**

TEST METHOD : ASTM D 257-07  
 MEASUREMENT METHOD : Megohm bridge  
 ELECTRODE TYPE : Aluminum foil  
 TEST VOLTAGE : 500 VDC  
 ELECTRIFICATION TIME : 60 seconds  
 PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
 TEST CONDITIONS : 75°F and 23% R.H.

| <u>SPECIMEN</u> | <u>TOP ELECTRODE DIAMETER</u><br>inches | <u>SPECIMEN THICKNESS</u><br>inches | <u>VOLUME RESISTANCE</u><br>ohms | <u>VOLUME RESISTIVITY</u><br>ohm-cm |
|-----------------|---|-------------------------------------|----------------------------------|-------------------------------------|
|-----------------|---|-------------------------------------|----------------------------------|-------------------------------------|

MATERIAL ID : EX09y0106-A FLAT, ABS-m30, 400mc, Flat

|   |      |       |                      |                      |
|---|------|-------|----------------------|----------------------|
| 6 | 2.02 | 0.101 | $5.0 \times 10^{13}$ | $4.0 \times 10^{15}$ |
|---|------|-------|----------------------|----------------------|

MATERIAL ID : EX09y0106-A UP, ABS-m30, 400mc, Up

|   |      |       |                      |                      |
|---|------|-------|----------------------|----------------------|
| 6 | 2.02 | 0.098 | $8.0 \times 10^{13}$ | $6.6 \times 10^{15}$ |
|---|------|-------|----------------------|----------------------|

REMARKS : There were no acceptance/rejection criteria applicable to the test results.

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**DIELECTRIC CONSTANT AND DISSIPATION FACTOR**

TEST METHOD : ASTM D 150-98 (Reapproved 2004)  
ELECTRODE TYPE : Unequal size aluminum foil  
PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
TEST CONDITIONS : 75°F and 23% R.H.  
TEST FREQUENCY : 1 kHz

| <u>SPECIMEN</u>                                       | <u>TOP<br/>ELECTRODE<br/>DIAMETER</u><br>inches | <u>SPECIMEN<br/>THICKNESS</u><br>inches | <u>DIELECTRIC<br/>CONSTANT</u> | <u>DISSIPATION<br/>FACTOR</u> |
|---|---|---|--------------------------------|-------------------------------|
| MATERIAL ID : EX09y0106-A FLAT, ABS-m30, 400mc, Flat  |   |   |                                |                               |
| 6   | 2.02  | 0.101                                   | 2.70                           | 0.0051                        |
| MATERIAL ID : EX09y0106-A UP, ABS-m30, 400mc, Up      |   |   |                                |                               |
| 6   | 2.02  | 0.098                                   | 2.74                           | 0.0050                        |
| MATERIAL ID : EX09y0106-B FLAT, ABS-m30, 1200es, Flat |   |   |                                |                               |
| 1   | 2.02  | 0.102                                   | 2.66                           | 0.0048                        |
| MATERIAL ID : EX09y0106-B UP, ABS-m30, 1200es, Up     |   |   |                                |                               |
| 1   | 2.02  | 0.100                                   | 2.81                           | 0.0053                        |

REMARKS : There were no acceptance/rejection criteria applicable to the test results.

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**DIELECTRIC STRENGTH**

TEST METHOD : ASTM D 149-97a (2004), Paragraph 12.2.1, Method A, short time test  
 ELECTRODE TYPE : 2-inch diameter stainless steel (type 1)  
 TEST MEDIUM : Transformer oil  
 VOLTAGE  
 RISE RATE : 500 VAC, RMS (60 Hz)/second  
 PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
 TEST CONDITIONS : 70°F and 55% R.H.  
 MATERIAL ID : EX09y0106-A FLAT, ABS-m30, 400mc, Flat

| <u>SPECIMEN</u>               | <u>SPECIMEN THICKNESS</u><br>inches | <u>LOCATION OF FAILURE</u> | <u>BREAKDOWN VOLTAGE</u><br>KVAC, RMS (60 Hz) | <u>DIELECTRIC STRENGTH</u><br>volts/mil |
|-------------------------------|-------------------------------------|----------------------------|---|---|
| 1                             | 0.101                               | Center of Electrode        | 5.5   | 54                                      |
| 2                             | 0.100                               | Center of Electrode        | 9.2   | 92                                      |
| 3                             | 0.100                               | Center of Electrode        | 8.9   | 89                                      |
| 4                             | 0.100                               | Center of Electrode        | 6.0   | 60                                      |
| 5                             | 0.101                               | Center of Electrode        | 6.1   | 60                                      |
| AVERAGE:                      |                                     |                            |   | 71                                      |
| STANDARD DEVIATION:           |                                     |                            |   | 18                                      |
| COEFFICIENT OF VARIATION (%): |                                     |                            |   | 25.4                                    |

REMARKS : 1. It should be noted that dielectric strength varies approximately as the reciprocal of the square root of specimen thickness for relatively homogeneous solid materials. See ASTM D 149-97a (Reapproved 2004), Appendix X1, Paragraph X1.4.2 for details.

: 2. There were no acceptance/rejection criteria applicable to the test results.

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**DIELECTRIC STRENGTH**

TEST METHOD : ASTM D 149-97a (2004), Paragraph 12.2.1, Method A, short time test  
 ELECTRODE TYPE : 2-inch diameter stainless steel (type 1)  
 TEST MEDIUM : Transformer oil  
 VOLTAGE  
 RISE RATE : 500 VAC, RMS (60 Hz)/second  
 PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
 TEST CONDITIONS : 70°F and 55% R.H.  
 MATERIAL ID : EX09y0106-A UP, ABS-m30, 400mc, Up

| <u>SPECIMEN</u> | <u>SPECIMEN THICKNESS</u><br>inches | <u>LOCATION OF FAILURE</u> | <u>BREAKDOWN VOLTAGE</u><br>KVAC, RMS (60 Hz) | <u>DIELECTRIC STRENGTH</u><br>volts/mil |
|-----------------|-------------------------------------|----------------------------|---|---|
| 1               | 0.098                               | Edge/Center of Electrode   | 33  | 340                                     |
| 2               | 0.098                               | Edge/Center of Electrode   | 33  | 340                                     |
| 3               | 0.097                               | Edge/Center of Electrode   | 34  | 350                                     |
| 4               | 0.098                               | Edge/Center of Electrode   | 33  | 340                                     |
| 5               | 0.098                               | Edge/Center of Electrode   | 33  | 340                                     |

AVERAGE: 340  
 STANDARD DEVIATION: 5  
 COEFFICIENT OF VARIATION (%): 1.47

- REMARKS :
1. It should be noted that dielectric strength varies approximately as the reciprocal of the square root of specimen thickness for relatively homogeneous solid materials. See ASTM D 149-97a (Reapproved 2004), Appendix X1, Paragraph X1.4.2 for details.
  2. Edge/Center of Electrode - Breakdown occurred from the edge of the electrode of one side of the specimen to the other side of the specimen inside (center) the electrode through the specimen thickness.
  3. There were no acceptance/rejection criteria applicable to the test results.

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### TEST REPORT

|   |                            |                    |
|---|----------------------------|--------------------|
| In account with<br><br>Stratasys, Inc.<br>7640 Commerce Way<br>Eden Prairie, MN 55344 | Date<br>03/16/09           | Page 1 of 5 Pages  |
|   | W.O. No.<br>T 41847        | P.O. No.<br>135598 |
|   | Identification<br>As noted | Shipper<br>None    |

**IDENTIFICATION :** Two (2) groups of ten (10) 4" x 4" x 0.1" plaques, were submitted and identified by the client as ULT9085 "Flat" and ULT9085 "On Side".

Delsen arbitrarily selected one (1) specimen from each group for volume resistivity, dielectric constant and dissipation factor, and five (5) specimens from each group for dielectric strength.

**SPECIFICATION :** None

- REFERENCES :**
1. Stratasys Purchase Order Nos. 135598, dated February 24, 2009
  2. E-mails between Paul Hopkins of Stratasys and John Moylan of Delsen, dated February 18, 2009, February 20, 2009, and February 24, 2009.
  3. ASTM D 257-07, "Standard Test Methods for DC Resistance or Conductance of Insulating Materials"
  4. ASTM D 150-98 (Reapproved 2004), "AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation"
  5. ASTM D 149-97a (Reapproved 2004), "Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Material at Commercial Power Frequencies"

- TESTING PERFORMED :**
1. Volume resistivity per ASTM D 257-07
  2. Dielectric constant and dissipation factor at 1 kHz per ASTM D 150-98 (Reapproved 2004)
  3. Dielectric strength per ASTM D 149-97a (2004), Method A, short time test

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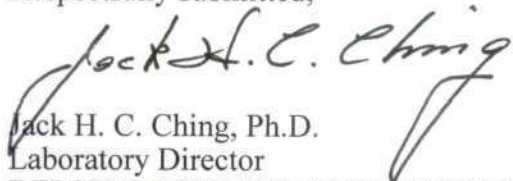


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REMARKS : There were no acceptance/rejection criteria applicable to the test results.  
Test results are herein submitted for client evaluation.

Respectfully submitted,



Jack H. C. Ching, Ph.D.  
Laboratory Director  
DELSEN TESTING LABORATORIES, INC.

dsp L3 T41847 Stratasy

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**VOLUME RESISTIVITY**

TEST METHOD : ASTM D 257-07  
 MEASUREMENT METHOD : Megohm bridge  
 ELECTRODE TYPE : Aluminum foil  
 TEST VOLTAGE : 500 VDC  
 ELECTRIFICATION TIME : 60 seconds  
 PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
 TEST CONDITIONS : 74°F and 36% R.H.

| <u>SPECIMEN</u>                 | <u>TOP ELECTRODE DIAMETER</u><br>inches | <u>SPECIMEN THICKNESS</u><br>inches | <u>VOLUME RESISTANCE</u><br>ohms | <u>VOLUME RESISTIVITY</u><br>ohm-cm |
|---------------------------------|---|-------------------------------------|----------------------------------|-------------------------------------|
| MATERIAL ID : ULT9085 "Flat"    |   |                                     |                                  |                                     |
| 6                               | 2.02                                    | 0.100                               | 6.0 x 10 <sup>13</sup>           | 4.9 x 10 <sup>15</sup>              |
| MATERIAL ID : ULT9085 "On Side" |   |                                     |                                  |                                     |
| 6                               | 2.02                                    | 0.099                               | 1.0 x 10 <sup>14</sup>           | 8.2 x 10 <sup>15</sup>              |

REMARKS : There were no acceptance/rejection criteria applicable to the test results.

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**DIELECTRIC CONSTANT AND DISSIPATION FACTOR**

TEST METHOD : ASTM D 150-98 (Reapproved 2004)  
ELECTRODE TYPE : Unequal size aluminum foil  
PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
TEST CONDITIONS : 74°F and 36% R.H.  
TEST FREQUENCY : 1 kHz

| <u>SPECIMEN</u> | <u>TOP<br/>ELECTRODE<br/>DIAMETER</u><br>inches | <u>SPECIMEN<br/>THICKNESS</u><br>inches | <u>DIELECTRIC<br/>CONSTANT</u> | <u>DISSIPATION<br/>FACTOR</u> |
|-----------------|---|---|--------------------------------|-------------------------------|
|-----------------|---|---|--------------------------------|-------------------------------|

MATERIAL ID : ULT9085 "Flat"

|   |      |       |      |        |
|---|------|-------|------|--------|
| 6 | 2.02 | 0.100 | 3.04 | 0.0027 |
|---|------|-------|------|--------|

MATERIAL ID : ULT9085 "On Side"

|   |      |       |      |        |
|---|------|-------|------|--------|
| 6 | 2.02 | 0.099 | 3.15 | 0.0026 |
|---|------|-------|------|--------|

REMARKS : There were no acceptance/rejection criteria applicable to the test results.

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**DIELECTRIC STRENGTH**

TEST METHOD : ASTM D 149-97a (2004), Paragraph 12.2.1, Method A, short time test  
ELECTRODE TYPE : 2-inch diameter stainless steel (type 1)  
TEST MEDIUM : Transformer oil  
VOLTAGE  
RISE RATE : 500 VAC, RMS (60 Hz)/second  
PRE-CONDITIONING : 40 hours minimum at 23°C and 50% R.H.  
TEST CONDITIONS : 70°F and 46% R.H.

| <u>SPECIMEN</u>               | <u>SPECIMEN THICKNESS</u><br>inches | <u>LOCATION OF FAILURE</u> | <u>BREAKDOWN VOLTAGE</u><br>KVAC, RMS (60 Hz) | <u>DIELECTRIC STRENGTH</u><br>volts/mil |
|-------------------------------|-------------------------------------|----------------------------|---|---|
| MATERIAL ID : ULT9085 "Flat"  |                                     |                            |   |   |
| 1                             | 0.100                               | Center of Electrode        | 19  | 190                                     |
| 2                             | 0.101                               | Center of Electrode        | 6   | 60                                      |
| 3                             | 0.099                               | Center of Electrode        | 10  | 100                                     |
| 4                             | 0.100                               | Center of Electrode        | 7   | 70                                      |
| 5                             | 0.101                               | Center of Electrode        | 11  | 110                                     |
| AVERAGE:                      |                                     |                            |   | 110                                     |
| STANDARD DEVIATION:           |                                     |                            |   | 51                                      |
| COEFFICIENT OF VARIATION (%): |                                     |                            |   | 46.4                                    |

|                                 |       |                   |    |      |
|---------------------------------|-------|-------------------|----|------|
| MATERIAL ID : ULT9085 "On Side" |       |                   |    |      |
| 1                               | 0.099 | Edge of Electrode | 32 | 320  |
| 2                               | 0.098 | Edge of Electrode | 24 | 240  |
| 3                               | 0.099 | Edge of Electrode | 24 | 240  |
| 4                               | 0.099 | Edge of Electrode | 23 | 230  |
| 5                               | 0.099 | Edge of Electrode | 25 | 250  |
| AVERAGE:                        |       |                   |    | 260  |
| STANDARD DEVIATION:             |       |                   |    | 37   |
| COEFFICIENT OF VARIATION (%):   |       |                   |    | 14.2 |

- REMARKS : 1. It should be noted that dielectric strength varies approximately as the reciprocal of the square root of specimen thickness for relatively homogeneous solid materials. See ASTM D 149-97a (Reapproved 2004), Appendix X1, Paragraph X1.4.2 for details.
2. There were no acceptance/rejection criteria applicable to the test results.

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