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# SMALL-SCALE SAFETY TEST REPORT FOR RDX (SECOND CALIBRATION)

P. C. HSU, J. G. Reynolds, P. C. HSU, J. G.  
Reynolds

April 12, 2011

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LLNL IDCA Project Report

Small-scale Safety Test Report for RDX (second calibration)

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April 6, 2011

LLNL-TR-XXXX

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# LAWRENCE LIVERMORE NATIONAL LABORATORY

From: Peter C. Hsu



Title: Small-scale Safety Test Summary Report-RDX (second) (for triplicates)

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Date: April 6, 2011

Distribution: IDCA project file, SSST file, IDCA team members (Indian Head, Tyndall, LANL, SNL)

Sample: RDX was provided by Indian Head and was dried at 60 C for 16 hours, cooled and kept in a desiccator before use.

Please note that the impact testing was done on both pellets and loose powder which resulted in different data. The impact sensitivity on pressed pellets was 34 cm that is greater than that on loose powder, as expected. The impact test data on the loose powder was similar to what Indian Head and LANL got. Remarkable consistent results were observed for test results of loose powder RDX. The average impact sensitivity ( $DH_{50}$ ) was 21.8 cm and the average friction sensitivity ( $F_{50}$ ) for loose powder was 24.9 kg, respectively. DSC charts showed that peak temperatures and onset temperatures for all 3 runs of RDX samples were almost identical. All electrostatic spark sensitivity was 0/10 @ 1.0 J with a 510-ohm resistor in the discharge circuit.

## Impact Test Result Summary for RDX

| Sample ID                     | Test Date | Temperature, F | Relative Humidity (RH), % | Height for 50% Reaction ( $DH_{50}$ ), cm | Standard Deviation ( $\sigma$ ), log unit |
|-------------------------------|-----------|----------------|---------------------------|---|---|
| RDX (IH), 15089, pellets      | 09/08/10  | 75             | 32                        | 34.0                                      | 0.059                                     |
| RDX (IH), 15089, loose powder | 09/09/10  | 75             | 30                        | 22.9*                                     | 0.042                                     |
| RDX (IH), 15089, loose powder | 09/13/10  | 73             | 23                        | 20.7*                                     | 0.095                                     |

\* 180 grit paper

## Friction Test Result Summary for RDX

| Sample ID       | Test Date | Temp., F | Relative Humidity (RH), % | Friction Reaction (TIL)*<br>0/10 @ kg | Friction Reaction<br>1/10 @ kg | Load for 50%<br>Reaction ( $F_{50}$ ), kg | Standard Deviation ( $\sigma$ ), log unit |
|-----------------|-----------|----------|---------------------------|---------------------------------------|--------------------------------|---|---|
| RDX (IH), 15089 | 09/08/10  | 75       | 26                        | 16.0                                  | 16.8                           | 23.1                                      | 0.035                                     |
| RDX (IH), 15089 | 09/09/10  | 75       | 31                        | 16.8                                  | 18.0                           | 25.4                                      | 0.054                                     |
| RDX (IH), 15089 | 09/09/10  | 75       | 31                        | 16.8                                  | 19.2                           | 26.0                                      | 0.050                                     |

- TIL- Threshold initiation is the load (kg) at which zero reaction out of ten trials with at least one reaction out of ten trials at the next higher load level.

### Static Spark Test Result Summary for RDX

| Sample ID          | Test Date | Temperature, F | Relative Humidity (RH), % | Spark Reaction*<br>0/10 @ |
|--------------------|-----------|----------------|---------------------------|---------------------------|
| RDX (IH),<br>15089 | 09/08/10  | 75             | 26                        | 1.0 Joule                 |
| RDX (IH),<br>15089 | 09/08/10  | 75             | 32                        | 1.0 Joule                 |
| RDX (IH),<br>15089 | 09/10/10  | 75             | 29                        | 1.0 Joule                 |

\* With a 510 ohms resistor in the discharge circuit.

### DSC Test Result Summary for RDX

| Sample ID          | Test Date | DSC Onset/Peak Temperature, F<br>Closed Hermetic Pan, ( $\Delta H$ , J/g) | DSC Onset/Peak Temperature, F<br>Pinhole Hermetic Pan, ( $\Delta H$ , J/g) |
|--------------------|-----------|---|--|
| RDX (IH),<br>15089 | 08/27/10  | 187.3/188.3 (125.7, endotherm); 215.6/238.0 (exotherm, 3517)              | 187.4/188.4 (109.5, endotherm); 213.1/240.1 (exotherm, 2432)               |
| RDX (IH),<br>15089 | 08/27/10  | 187.3/188.3 (132.4, endotherm); 214.6/231.2 (exotherm, 3478)              | 187.5/188.6 (129.2, endotherm); 215.6/240.6 (exotherm, 2419)               |
| RDX (IH),<br>15089 | 08/27/10  | 187.4/188.3 (114.1, endotherm); 215.2/230.6 (exotherm, 3805)              | 187.4/188.4 (135.4, endotherm); 217.9/238.7 (exotherm, 2399)               |

Energetic Materials Center  
Lawrence Livermore National Laboratory



Unclassified Correspondence

DROP HAMMER TEST REPORT

Operator: Gary Hust *GH*  
 Reviewed and approved by: Peter Hsu *PH*  
 Date of Test: 9/8/10  
 Name of Explosive: RDX  
 Identification Number: 15089  
 Composition: 1 of 3  
 Requester: Peter Hsu  
 Project No: 34339  
 Task No: 108103  
 Sample Description: 35 mg Pellets  
 Test Type: 12 A  
 Temperature: 75 °F  
 Humidity: 32%  
 Book Reference: 23-96

Number of X's 8  
 Number of O's 7  
 +/- 0.5 0.5  
 Least Height for X's or O's 28.1  
 LOG of Least Height 1.4487  
 LOG of Interval 0.05  
 # of Events at Least Height 2 28.1  
 # of Events at Next Height 2 31.5  
 # of Events at Next Height 3 35.4  
 # of Events at Next Height 0 39.7  
 # of Events at Next Height 0 44.5  
 # of Events at Next Height 0 50.0

Dh<sub>50</sub> CALCULATION

REMARKS:  
 Sum (N<sub>i</sub> \* i) 8  
 Sum of Events for Calculation 7  
 LOG of Dh<sub>50</sub> 1.5308  
**Dh<sub>50</sub> 34.0 cm**

STANDARD DEVIATION CALCULATION

Sum (N<sub>i</sub> \* i<sup>2</sup>) 14  
**STANDARD DEVIATION 0.059**  
**MAXIMUM Dh<sub>50</sub> 4.9 38.9 cm**  
**MINIMUM Dh<sub>50</sub> -4.3 29.7 cm**



Impact (drop hammer) Test Worksheet

Test Date: 09/08/2010

Sample description: RDX (Indian Head) standard, first test of second series

ID Number: 15089

Temperature: 75 F      Relative humidity: 32%

Table 1: Impact test for determining the height for 50% reaction

| Height, cm | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | $\Sigma X$ | $\Sigma O$ |
|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|------------|------------|
| 28.1       |   |   |   |   |   | 0 |   |   |   |    |    |    |    | 0  |    |            | 2          |
| 31.5       | 0 |   |   |   | X |   | 0 |   |   |    |    |    | X  |    | X  | 3          | 2          |
| 35.4       |   | 0 |   | X |   |   |   | 0 |   | 0  |    |    | X  |    |    | 2          | 3          |
| 39.7       |   |   | X |   |   |   |   |   | X |    | X  |    |    |    |    | 3          |            |

Total: 8 7

\* X- reaction indicated by voltmeter reading  $\geq 1.3$  V  
 O- no reaction indicated by voltmeter reading  $< 1.3$  V

GH

Gary Hust  
Operator

Peter C. Hsu

Peter C. Hsu  
RI for impact test

| FRICTION TEST REPORT                   |                      |                 |           |        |           |
|--|----------------------|-----------------|-----------|--------|-----------|
| Operator:                              | Gary Hust <i>GH</i>  | Test date:      | 9/8/10    |        |           |
| Reviewed and approved by:              | Peter Hsu <i>pgf</i> |                 |           |        |           |
| Requester:                             | Peter Hsu            |                 |           |        |           |
| Project No:                            | 35339                | Book Reference: | 3-86      |        |           |
| Task:                                  | 108103               |                 |           |        |           |
|  | 1 of 3               |                 |           |        |           |
| Material:                              | RDX                  |                 |           |        |           |
| Identification Number:                 | 15089                |                 |           |        |           |
| Composition:                           | Pure RDX             |                 |           |        |           |
| Temperature:                           | 75°F                 |                 |           |        |           |
| Relative Humidity:                     | 26%                  |                 |           |        |           |
| Test Results: 1of10                    | 1/10 @ 16.8 kg       |                 |           |        |           |
| Test Results: 0of10                    | 0/10 @ 16.0 Kg       |                 |           |        |           |
| Number of X's                          | 6                    |                 | Datasheet |        |           |
| Number of O's                          | 9                    |                 | Weight    | Go (X) | No Go (O) |
| +/- 0.5                                | -0.5                 | #2              | 21.6      |        | O         |
| Least Friction Weight for X's or O's   | 21.6                 |                 | 25.2      |        | O         |
| LOG of Least Friction Weight           | 1.3345               |                 | 28.8      | X      |           |
| LOG of Interval                        | 0.06                 |                 | 25.2      |        | O         |
|  | # of Events          | Wt, kg          | 28.8      |        | O         |
| # of Events at Least Weight            | 1                    | 25.2            | 32.4      | X      |           |
| # of Events at Next Weight             | 4                    | 28.8            | 28.8      | X      |           |
| # of Events at Next Weight             | 1                    | 32.4            | 25.2      |        | O         |
| # of Events at Next Weight             | 0                    | 36.0            | 28.8      | X      |           |
| # of Events at Next Weight             | 0                    |                 | 25.2      |        | O         |
| # of Events at Next Weight             |                      |                 | 25.2      |        | O         |
| # of Events at Next Weight             |                      |                 | 28.8      | X      |           |
| Dh <sub>50</sub> CALCULATION           |                      |                 | 25.2      | X      |           |
|  |                      |                 | 21.6      |        | O         |
| Sum (N <sub>i</sub> * i)               | 6                    |                 | 25.2      |        | O         |
| Sum of Events for Calculation          | 6                    |                 | Total     | 6      | 9         |
| LOG of F <sub>50</sub>                 | 1.3645               |                 |           |        |           |
| <b>F<sub>50</sub></b>                  |                      | <b>23.1</b>     | <b>Kg</b> |        |           |
| <b>STANDARD DEVIATION CALCULATION</b>  |                      |                 |           |        |           |
| Sum (N <sub>i</sub> * i <sup>2</sup> ) | 8                    |                 |           |        |           |
| <b>STANDARD DEVIATION</b>              |                      | <b>0.035</b>    |           |        |           |
| <b>MAXIMUM F<sub>50</sub></b>          | 2.0                  | <b>25.1</b>     | <b>Kg</b> |        |           |
| <b>MINIMUM F<sub>50</sub></b>          | -1.8                 | <b>21.3</b>     | <b>Kg</b> |        |           |



ELECTROSTATIC SPARK TEST REPORT

Operator: Gary Hust GH

Test Date: 9/8/10

Reviewed and Approved by : Peter Hsu PCH

Requestor: Peter Hsu

Project No: 34339

Task No: 108103

Temp: 75 °F

Material: RDX-1

R.H: 26%

ID Number: 15089

Composition:

| CAP.<br>(pF) | VOLTS<br>(kV) | RESISTANCE<br>(ohms) | GAP<br>(in.) | ENERGY<br>(Joules) | REACTION<br>(YES or NO) |
|--------------|---------------|----------------------|--------------|--------------------|-------------------------|
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |

0 OF 10 TESTS @ 1.0 JOULES WITH 510-OHM RESISTANCE

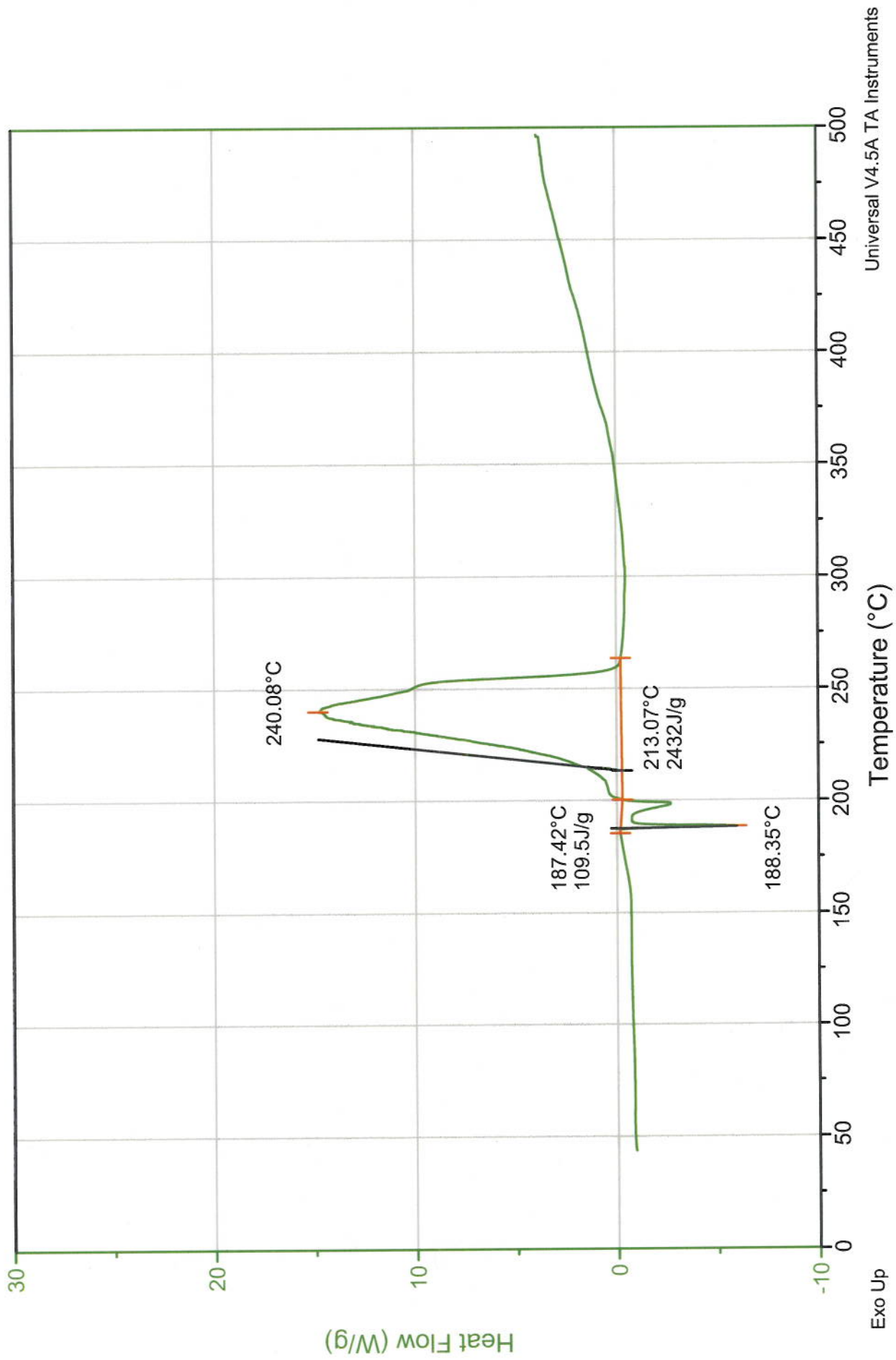
\_\_\_\_\_ IS SPARK SENSITIVE      X   IS NOT SPARK SENSITIVE

REMARKS:

File: C:\TA\DATA\Q-DSC\2010\Q10-1153.001  
Operator: Turner  
Run Date: 27-Aug-2010 18:31  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

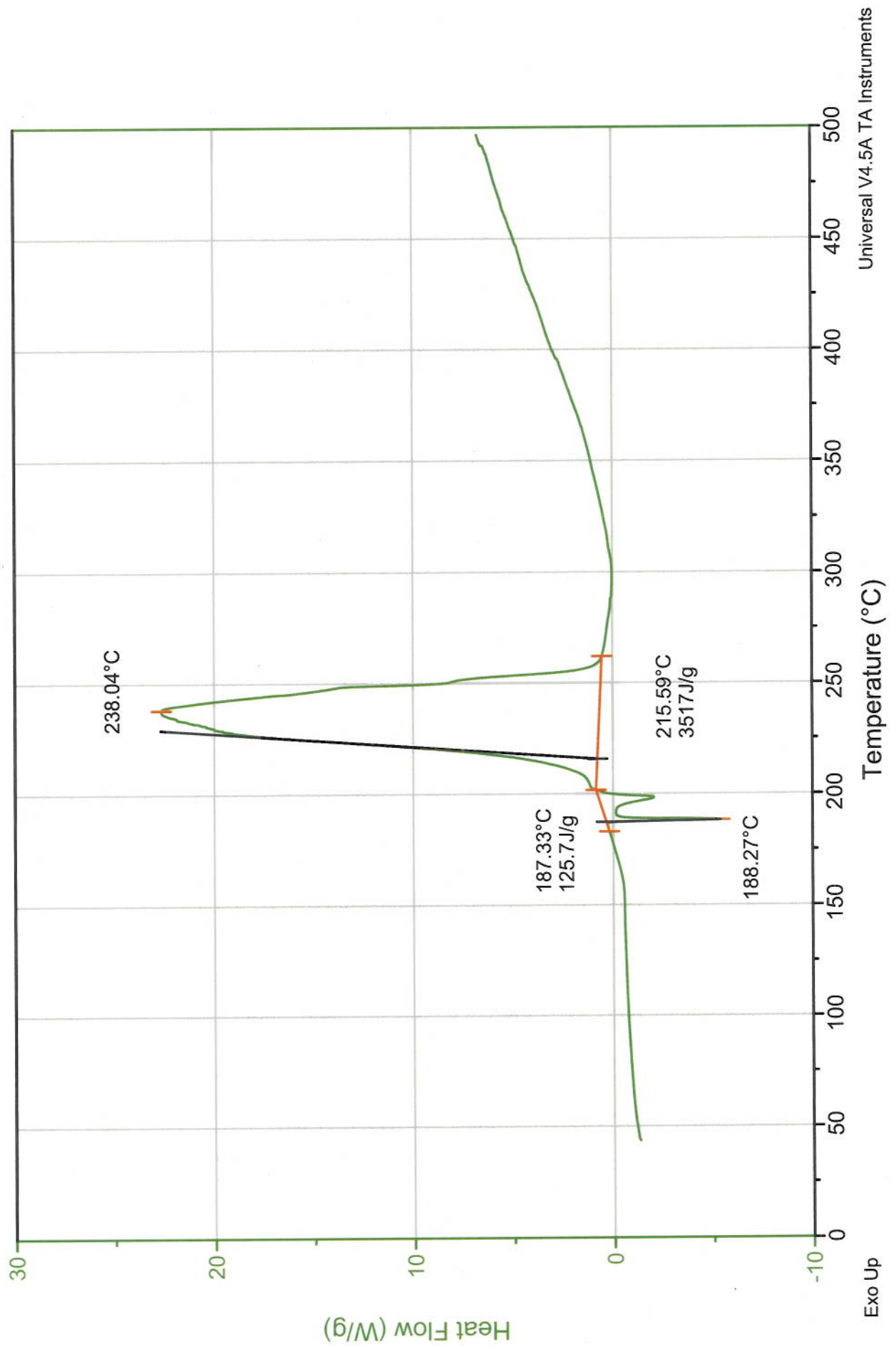
Sample: RDX IDCA #15089  
Size: 0.3880 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Pinhole hermetic



File: C:\TA\Data\Q-DSC\2010\Q10-1154.001  
Operator: Turner  
Run Date: 27-Aug-2010 19:29  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

Sample: RDX IDCA #15089  
Size: 0.3060 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Closed hermetic



# DROP HAMMER TEST REPORT

Operator: Gary Hust *GH*  
 Reviewed and approved by: Peter Hsu *PCH*  
 Date of Test: 9/13/10

Name of Explosive: RDX-3  
 Identification Number: 15089  
 Composition: 3 of 3

Requester: Peter Hsu  
 Project No: 34339  
 Task No: 108103  
 Sample Description: 35 mg Powder  
 Test Type: 12 A  
 Temperature: 75 °F  
 Humidity: 30%  
 Book Reference: 23-99

Number of X's 9  
 Number of O's 6  
 +/- 0.5 0.5  
 Least Height for X's or O's 15.8  
 LOG of Least Height 1.1987  
 LOG of Interval 0.05

|                             |   |      |
|-----------------------------|---|------|
| # of Events at Least Height | 1 | 15.8 |
| # of Events at Next Height  | 1 | 17.7 |
| # of Events at Next Height  | 2 | 19.9 |
| # of Events at Next Height  | 2 | 22.3 |
| # of Events at Next Height  | 0 | 25.0 |
| # of Events at Next Height  | 0 | 28.1 |

Dh<sub>50</sub> CALCULATION

REMARKS: USED 180 grit Garnet SAND PAPER

|                               |        |                |
|-------------------------------|--------|----------------|
| Sum (N <sub>i</sub> * i)      | 11     |                |
| Sum of Events for Calculation | 6      |                |
| LOG of Dh <sub>50</sub>       | 1.3153 |                |
| <b>Dh<sub>50</sub></b>        |        | <b>20.7 cm</b> |

STANDARD DEVIATION CALCULATION

|  |    |              |
|--|----|--------------|
| Sum (N <sub>i</sub> * i <sup>2</sup> ) | 27 |              |
| <b>STANDARD DEVIATION</b>              |    | <b>0.095</b> |

|                                |      |                |
|--------------------------------|------|----------------|
| <b>MAXIMUM Dh<sub>50</sub></b> | 5.0  | <b>25.7 cm</b> |
| <b>MINIMUM Dh<sub>50</sub></b> | -4.0 | <b>16.6 cm</b> |

Impact (drop hammer) Test Worksheet

Test Date: 09/13/2010

Sample description: RDX (Indian Head) standard, third test of second series

ID Number: 15089

Temperature: 75 F      Relative humidity: 30%

Table 1: Impact test for determining the height for 50% reaction

| Height, cm | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | ΣX | Σ0 |
|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| 15.8       |   |   |   |   |   |   |   |   |   |    |    |    | 0  |    |    |    | 1  |
| 17.7       |   |   |   |   |   |   |   |   |   |    |    | X  |    | 0  |    | 1  | 1  |
| 19.9       |   |   |   |   |   |   | 0 |   | 0 |    | X  |    |    |    | X  | 2  | 2  |
| 22.3       |   | 0 |   | 0 |   | X |   | X |   | X  |    |    |    |    |    | 3  | 2  |
| 25.0       | X |   | X |   | X |   |   |   |   |    |    |    |    |    |    | 3  |    |
| 28.1       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |
| 31.5       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |
| 35.4       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |
| 39.7       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |

Total: 9 6

\* X- reaction indicated by voltmeter reading  $\geq 1.3$  V  
 0- no reaction indicated by voltmeter reading  $< 1.3$  V

GH  
 Gary Hust  
 Operator

Peter C. Hsu  
 Peter C. Hsu  
 RI for impact test



FRICTION TEST REPORT

|  |                     |                 |           |        |           |
|--|---------------------|-----------------|-----------|--------|-----------|
| Operator:                              | Gary Hust <i>GH</i> | Test date:      | 9/9/10    |        |           |
| Reviewed and approved by:              | Peter Hsu <i>PH</i> |                 |           |        |           |
| Requester:                             | Peter Hsu <i>PH</i> |                 |           |        |           |
| Project No:                            | 35339               | Book Reference: | 3-86      |        |           |
| Task:                                  | 108103              |                 |           |        |           |
| Material:                              | RDX                 |                 |           |        |           |
|  | 2 of 3              |                 |           |        |           |
| Identification Number:                 | 15089               |                 |           |        |           |
| Composition:                           | Pure RDX            |                 |           |        |           |
| Temperature:                           | 75°F                |                 |           |        |           |
| Relative Humidity:                     | 31%                 |                 |           |        |           |
| Test Results: 1of10                    | 1/10 @ 18.0 kg      |                 |           |        |           |
| Test Results: 0of10                    | 0/10 @ 16.8 Kg      |                 |           |        |           |
| Number of X's                          | 7                   |                 | Datasheet |        |           |
| Number of O's                          | 8                   |                 | Weight    | Go (X) | No Go (O) |
| +/- 0.5                                | -0.5                | #2              | 21.6      |        | O         |
| Least Friction Weight for X's or O's   | 25.2                |                 | 25.2      |        | O         |
| LOG of Least Friction Weight           | 1.4014              |                 | 28.8      |        | O         |
| LOG of Interval                        | 0.06                |                 | 32.4      | X      |           |
|  | # of Events         | Wt, kg          | 28.8      | X      |           |
| # of Events at Least Weight            | 4                   | 25.2            | 25.2      | X      |           |
| # of Events at Next Weight             | 2                   | 28.8            | 21.6      |        | O         |
| # of Events at Next Weight             | 1                   | 32.4            | 25.2      | X      |           |
| # of Events at Next Weight             | 0                   | 36.0            | 21.6      |        | O         |
| # of Events at Next Weight             | 0                   |                 | 25.2      |        | O         |
| # of Events at Next Weight             |                     |                 | 28.8      | X      |           |
| # of Events at Next Weight             |                     |                 | 25.2      | X      |           |
| <u>Dh<sub>50</sub> CALCULATION</u>     |                     |                 | 21.6      |        | O         |
|  |                     |                 | 25.2      | X      |           |
| Sum (N <sub>i</sub> * i)               | 4                   |                 | 21.6      |        | O         |
| Sum of Events for Calculation          | 7                   |                 |           | 7      | 8         |
| LOG of F <sub>50</sub>                 | 1.4057              |                 |           |        |           |
| <b>F<sub>50</sub></b>                  |                     | <b>25.4</b>     | <b>Kg</b> |        |           |
| <b>STANDARD DEVIATION CALCULATION</b>  |                     |                 |           |        |           |
| Sum (N <sub>i</sub> * i <sup>2</sup> ) | 6                   |                 |           |        |           |
| <b>STANDARD DEVIATION</b>              |                     | <b>0.054</b>    |           |        |           |
| <b>MAXIMUM F<sub>50</sub></b>          | 3.4                 | <b>28.8</b>     | <b>Kg</b> |        |           |
| <b>MINIMUM F<sub>50</sub></b>          | -3.0                | <b>22.5</b>     | <b>Kg</b> |        |           |

ELECTROSTATIC SPARK TEST REPORT

Operator: Gary Hust *GH*

Test Date: 9/9/10

Reviewed and Approved by : Peter Hsu *PHS*

Requestor: Peter Hsu

Project No: 34339

Task No: 108103

Temp: 75 °F

Material: RDX-2

R.H: 32%

ID Number: 15089

Composition:

| CAP.<br>(pF) | VOLTS<br>(kV) | RESISTANCE<br>(ohms) | GAP<br>(in.) | ENERGY<br>(Joules) | REACTION<br>(YES or NO) |
|--------------|---------------|----------------------|--------------|--------------------|-------------------------|
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |

0 OF 10 TESTS @ 1.0 JOULES WITH 510-OHM RESISTANCE

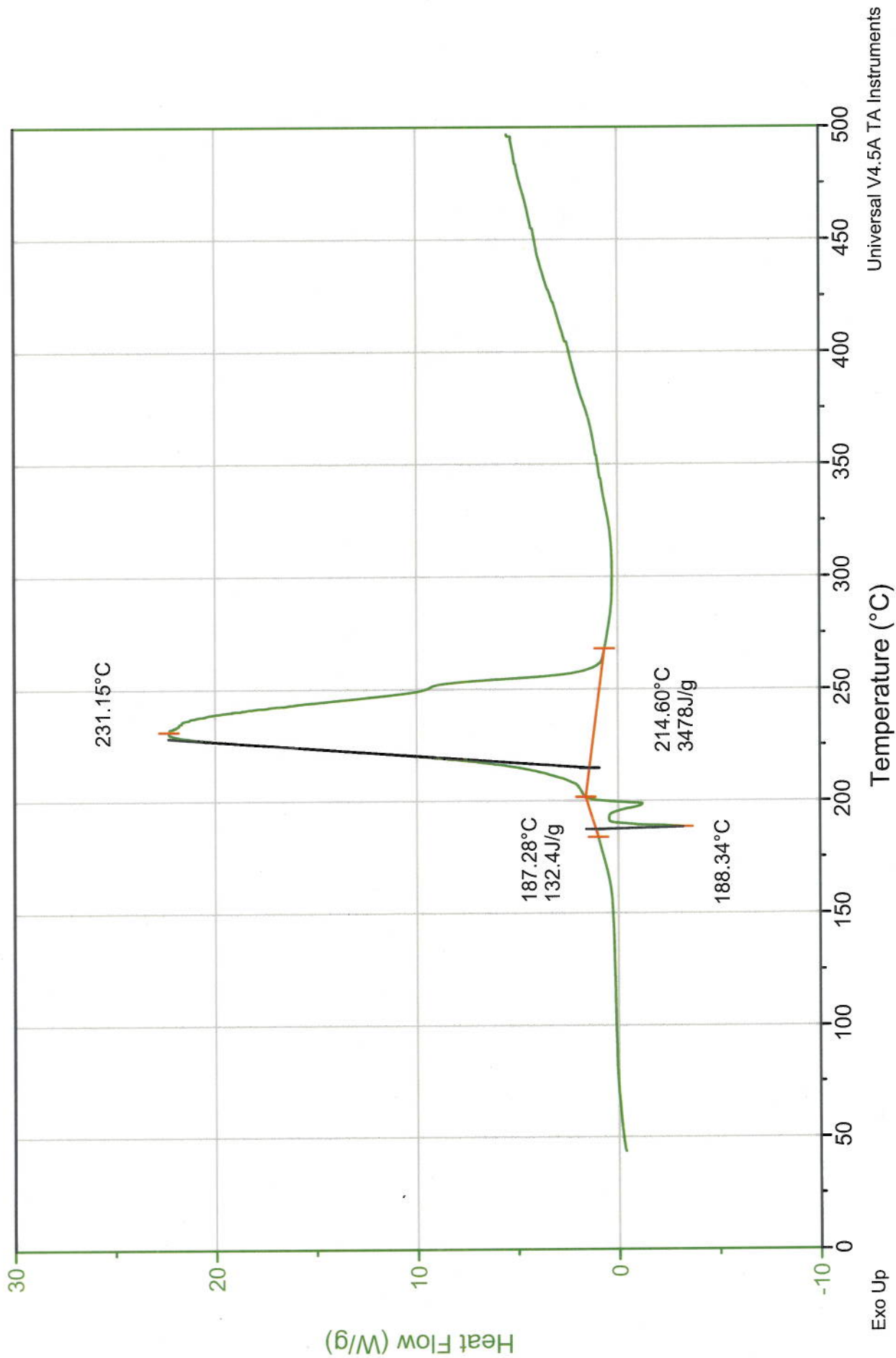
\_\_\_\_\_ IS SPARK SENSITIVE      X   IS NOT SPARK SENSITIVE

REMARKS:

File: C:\TAIData\Q-DSC\2010\Q10-1152.001  
Operator: Turner  
Run Date: 27-Aug-2010 17:34  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

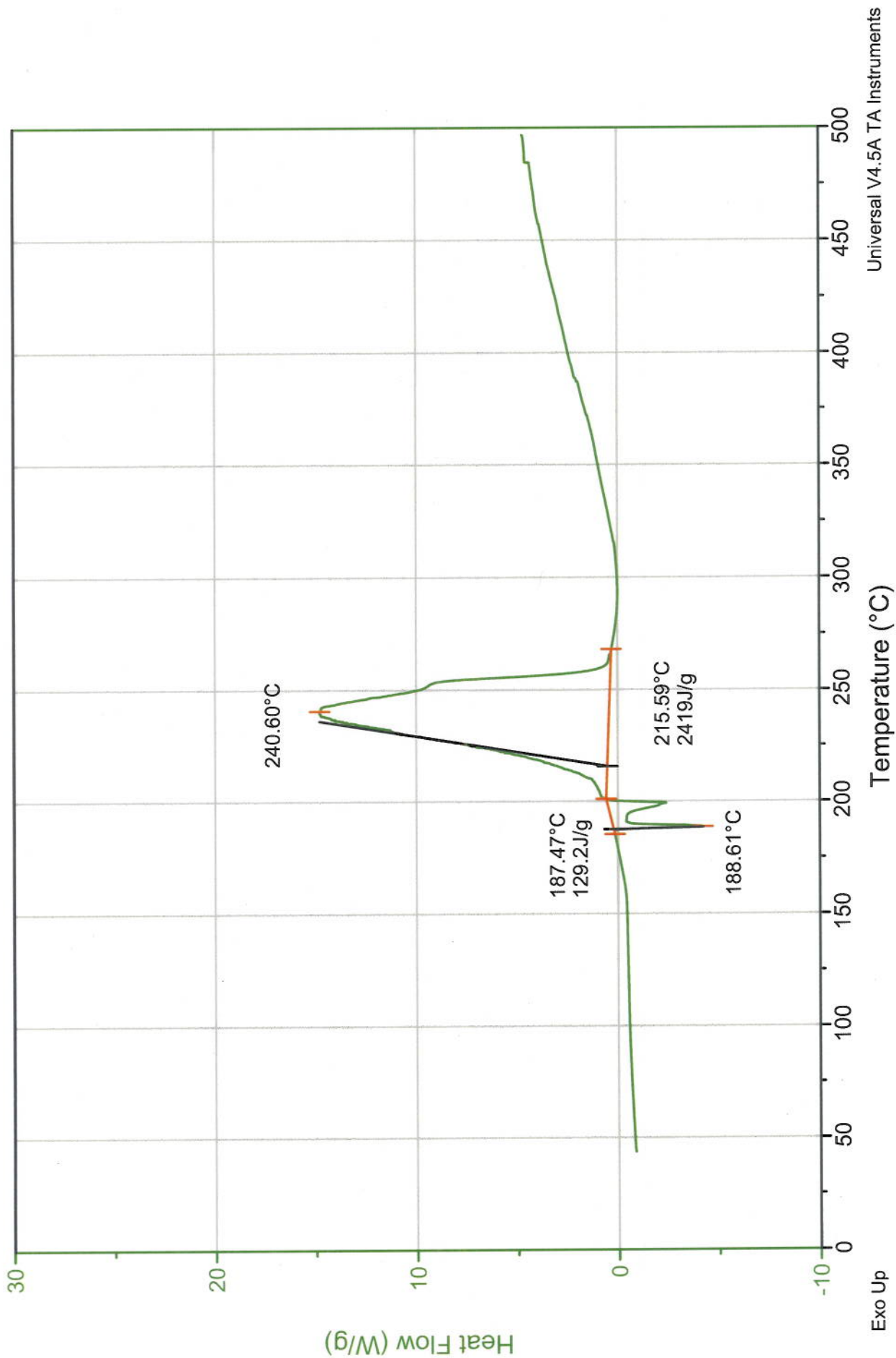
Sample: RDX IDCA #15089  
Size: 0.3190 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Closed hermetic



File: C:\TAIData\Q-DSC\2010\Q10-1151.001  
Operator: Turner  
Run Date: 27-Aug-2010 16:36  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

Sample: RDX IDCA #15089  
Size: 0.3920 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Pinhole hermetic





# DROP HAMMER TEST REPORT

Operator: Gary Hust *GH*  
 Reviewed and approved by: Peter Hsu *PH*  
 Date of Test: 9/9/10

Name of Explosive: RDX  
 Identification Number: 15089  
 Composition: 2 of 3

Requester: Peter Hsu  
 Project No: 34339  
 Task No: 108103  
 Sample Description: 35 mg Powder  
 Test Type: 12 A  
 Temperature: 75 °F  
 Humidity: 30%  
 Book Reference: 23-97

Number of X's 8  
 Number of O's 7  
 +/- 0.5 0.5  
 Least Height for X's or O's 19.9  
 LOG of Least Height 1.2989  
 LOG of Interval 0.05

|                             |   |      |
|-----------------------------|---|------|
| # of Events at Least Height | 3 | 19.9 |
| # of Events at Next Height  | 3 | 22.3 |
| # of Events at Next Height  | 1 | 25.1 |
| # of Events at Next Height  | 0 | 28.1 |
| # of Events at Next Height  | 0 | 31.5 |
| # of Events at Next Height  | 0 | 35.4 |

Dh<sub>50</sub> CALCULATION  
**REMARKS: USED 180 grit Garnet SAND PAPER**

|                               |        |                |
|-------------------------------|--------|----------------|
| Sum (N <sub>i</sub> * i)      | 5      |                |
| Sum of Events for Calculation | 7      |                |
| LOG of Dh <sub>50</sub>       | 1.3596 |                |
| <b>Dh<sub>50</sub></b>        |        | <b>22.9 cm</b> |

STANDARD DEVIATION CALCULATION

|  |   |              |
|--|---|--------------|
| Sum (N <sub>i</sub> * i <sup>2</sup> ) | 7 |              |
| <b>STANDARD DEVIATION</b>              |   | <b>0.042</b> |

|                                |      |                |
|--------------------------------|------|----------------|
| <b>MAXIMUM Dh<sub>50</sub></b> | 2.3  | <b>25.2 cm</b> |
| <b>MINIMUM Dh<sub>50</sub></b> | -2.1 | <b>20.8 cm</b> |



Impact (drop hammer) Test Worksheet

Test Date: 09/09/2010

Sample description: RDX (Indian Head) standard, second test of second series

ID Number: 15089

Temperature: 74 F      Relative humidity: 30%

Table 1: Impact test for determining the height for 50% reaction

| Height, cm | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | $\Sigma X$ | $\Sigma O$ |
|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|------------|------------|
| 19.9       |   |   | 0 |   |   |   | 0 |   |   |    |    |    |    |    | 0  |            | 3          |
| 22.3       |   | X |   | 0 |   | X |   | 0 |   | 0  |    |    |    | X  |    | 3          | 3          |
| 25.0       | X |   |   |   | X |   |   |   | X |    | 0  |    | X  |    |    | 4          | 1          |
| 28.1       |   |   |   |   |   |   |   |   |   |    |    | X  |    |    |    | 1          |            |
| 31.5       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |            |            |
| 35.4       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |            |            |
| 39.7       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |            |            |

Total: 8 7

\* X- reaction indicated by voltmeter reading  $\geq 1.3$  V  
 O- no reaction indicated by voltmeter reading  $< 1.3$  V

GH

Gary Hust  
 Operator

Peter C. Hsu

Peter C. Hsu  
 RI for impact test

FRICTION TEST REPORT

|  |                      |                 |           |        |           |
|--|----------------------|-----------------|-----------|--------|-----------|
| Operator:                              | Gary Hust <i>GH</i>  | Test date:      | 9/9/10    |        |           |
| Reviewed and approved by:              | Peter Hsu <i>PJH</i> |                 |           |        |           |
| Requester:                             | Peter Hsu            |                 |           |        |           |
| Project No:                            | 35339                | Book Reference: | 3-86      |        |           |
| Task:                                  | 108103               |                 |           |        |           |
| Material:                              | RDX                  |                 |           |        |           |
|  | 3 of 3               |                 |           |        |           |
| Identification Number:                 | 15089                |                 |           |        |           |
| Composition:                           | Pure RDX             |                 |           |        |           |
| Temperature:                           | 75°F                 |                 |           |        |           |
| Relative Humidity:                     | 31%                  |                 |           |        |           |
| Test Results: 1of10                    | 1/10 @ 19.2 kg       |                 |           |        |           |
| Test Results: 0of10                    | 0/10 @ 16.8 Kg       |                 |           |        |           |
| Number of X's                          | 7                    |                 | Datasheet |        |           |
| Number of O's                          | 8                    |                 | Weight    | Go (X) | No Go (O) |
| +/- 0.5                                | -0.5                 | #2              | 21.6      |        | O         |
| Least Friction Weight for X's or O's   | 25.2                 |                 | 25.2      | X      |           |
| LOG of Least Friction Weight           | 1.4014               |                 | 21.6      |        | O         |
| LOG of Interval                        | 0.06                 |                 | 25.2      |        | O         |
|  | # of Events          | Wt, kg          | 28.8      | X      |           |
| # of Events at Least Weight            | 3                    | 25.2            | 25.2      |        | O         |
| # of Events at Next Weight             | 3                    | 28.8            | 28.8      | X      |           |
| # of Events at Next Weight             | 1                    | 32.4            | 25.2      |        | O         |
| # of Events at Next Weight             | 0                    | 36.0            | 28.8      |        | O         |
| # of Events at Next Weight             | 0                    |                 | 32.4      | X      |           |
| # of Events at Next Weight             |                      |                 | 28.8      | X      |           |
| # of Events at Next Weight             |                      |                 | 25.2      | X      |           |
| Dh <sub>50</sub> CALCULATION           |                      |                 | 21.6      |        | O         |
|  |                      |                 | 25.2      | X      |           |
| Sum (N <sub>i</sub> * i)               | 5                    |                 | 21.6      |        | O         |
| Sum of Events for Calculation          | 7                    |                 |           | 7      | 8         |
| LOG of F <sub>50</sub>                 | 1.4143               |                 |           |        |           |
| <b>F<sub>50</sub></b>                  |                      | <b>26.0</b>     | <b>Kg</b> |        |           |
| <b>STANDARD DEVIATION CALCULATION</b>  |                      |                 |           |        |           |
| Sum (N <sub>i</sub> * i <sup>2</sup> ) | 7                    |                 |           |        |           |
| <b>STANDARD DEVIATION</b>              |                      | <b>0.050</b>    |           |        |           |
| <b>MAXIMUM F<sub>50</sub></b>          | 3.2                  | <b>29.2</b>     | <b>Kg</b> |        |           |
| <b>MINIMUM F<sub>50</sub></b>          | -2.8                 | <b>23.1</b>     | <b>Kg</b> |        |           |

ELECTROSTATIC SPARK TEST REPORT

Operator: Gary Hust *GH*

Test Date: 9/10/10

Reviewed and Approved by : Peter Hsu *PGH*

Requestor: Peter Hsu

Project No: 34339

Task No: 108103

Temp: 75 °F

Material: RDX-3

R.H: 29%

ID Number: 15089

Composition:

| CAP.<br>(pF) | VOLTS<br>(kV) | RESISTANCE<br>(ohms) | GAP<br>(in.) | ENERGY<br>(Joules) | REACTION<br>(YES or NO) |
|--------------|---------------|----------------------|--------------|--------------------|-------------------------|
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |
| 20K          | 10            | 510                  | .007         | 1.00               | NO                      |

0 OF 10 TESTS @ 1.0 JOULES WITH 510-OHM RESISTANCE

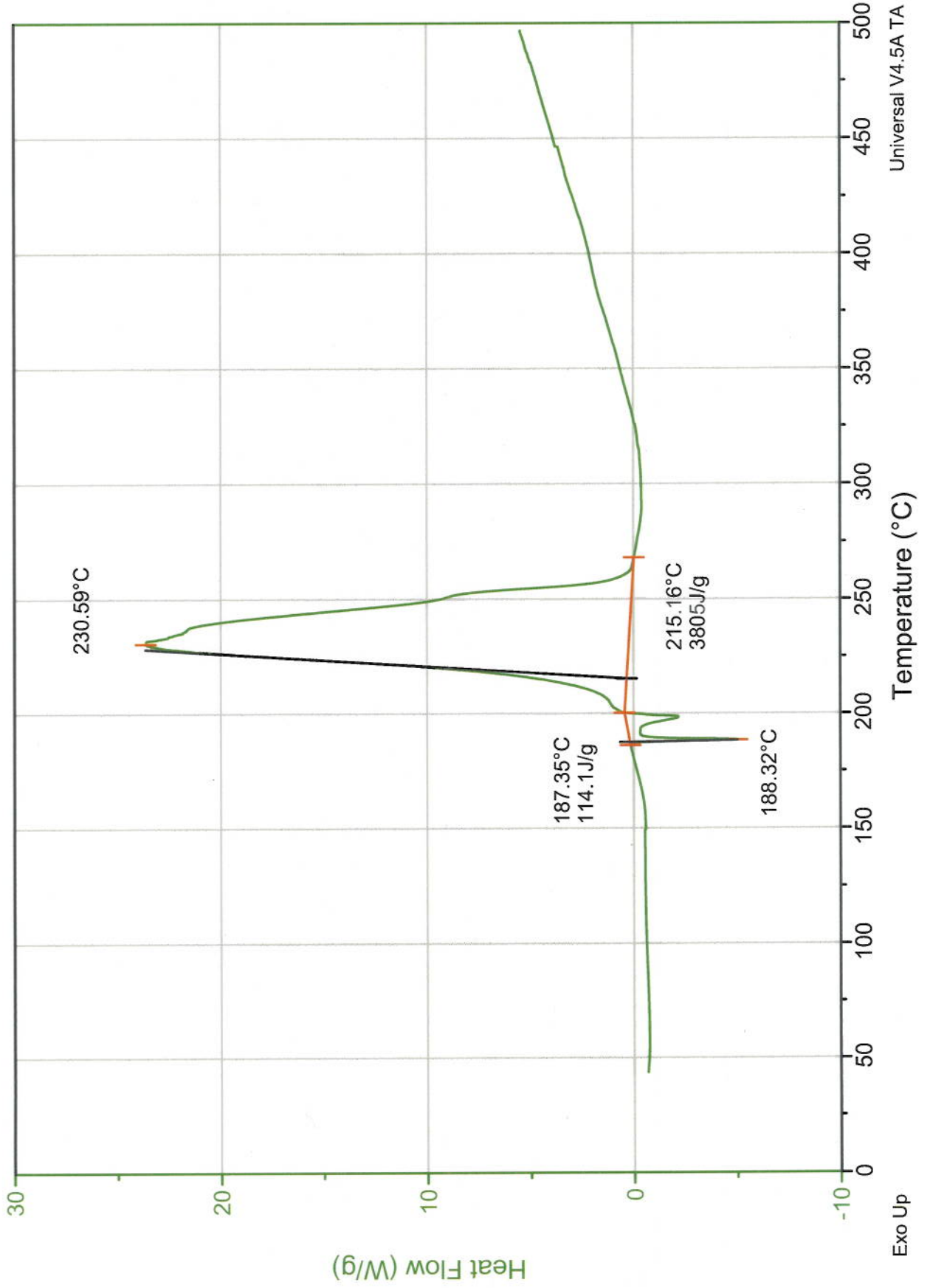
\_\_\_\_\_ IS SPARK SENSITIVE      X   IS NOT SPARK SENSITIVE

REMARKS:

File: C:\TA\Data\Q-DSC\2010\Q10-1150.001  
Operator: Turner  
Run Date: 27-Aug-2010 15:38  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

Sample: RDX IDCA #15089  
Size: 0.3040 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Closed hermetic





File: C:\TA\DATA\Q-DSC\2010\Q10-1155.001  
Operator: Turner  
Run Date: 27-Aug-2010 20:26  
Instrument: DSC Q2000 V24.4 Build 116

# DSC

Sample: RDX IDCA #15089  
Size: 0.3950 mg  
Method: RT - 500 @ 10cpm  
Comment: Hsu\_Pinhole hermetic

