Operation Manual for *EX*-Detect, Mini XD-2

ChemSpectra, Inc.
2599 Still Meadow Lane
Lancaster, CATel: (661) 860-9015
WWW.CHEHMSPECTRA.COM

EMAIL: CHEMSPECTRA@COMCAST.NET

ChemSPECTRA incorporated

Table of Contents

TITLE	*PAGE*
Introduction	**3**
Mini XD-2 System Details	**4**
Swipe Clamp and Heating Element	**5**
Power Sources	**5**
Power Switch	**6**
Heater Button	**6**
Swipe Holder	**6**
Solutions	**6**
LED Light Sequence	**6**
Operation	**7**
Peroxide, HMTD, TATP, and Chlorate Test	**8**
TNT Test	**8**
High Explosives and Nitrate Test	**9**
Quick Reference Color Chart	**10**
System Maintenance	**11**
Cleaning Swipe Clamp Area	**11**
Battery Change-Out	**11**
Contamination	**11**
Consumables	**11**
Specifications	**12**
Safety	**12**
Limited Warranty	**13**
Appendix 1	**14**

INTRODUCTION: ChemSpectra's EX-DETECT™, MINI XD-2

The MINI XD-2 is an extremely rugged, reliable, trace-level explosives detector designed for all weather use. The MINI XD-2 is o-ring sealed and water tight, operates as a semi automated detector, is not susceptible to environmental backgrounds and does not require calibration. The time required for the operator to obtain trace-level detection for low and high explosives, and other related compounds is approximately 1 minute. The MINI XD-2 detects the entire suite of both military and home-made explosives, as well as gun propellants without calibration between samples. In addition, there is no bake-out time, humidity effects, or down time even after a positive result. The detection limits for explosive residues are in the low nanogram levels and the detection range is very large (up to milligrams levels or more) without loss in sensitivity or down time with subsequent samples.

The MINI XD-2 provides identification of explosives as determined by a specific sequence of proprietary solutions in combination with a unique heating and cooling sequence over time. The procedure causes "colorless" explosives to become colored dyes on the white swipe material.

MINI XD-2 System Details

The MINI XD-2 explosives trace detector can reliably, quickly, and easily detect military high explosives, home-made peroxide explosives, gun propellants, chlorates, and nitrates such as ammonium nitrate and black powder. A custom fitted pelican case is used to transport the MINI XD-2, storing all components. The MINI XD-2 is self-contained, ready for complete sampling and analysis, and can be fit into a cargo pocket.

EX-DETECT™ MINI XD-2

Tension Hinge

Cutout to grasp swipe

Roll of 100 swipes

Color chart for quick reference

Hinged magnetic lid to hold and cover swipes

O-Ring Seal (Water Tight)

Color coded solution dropper bottles

Color coded LEDs displayed during analysis

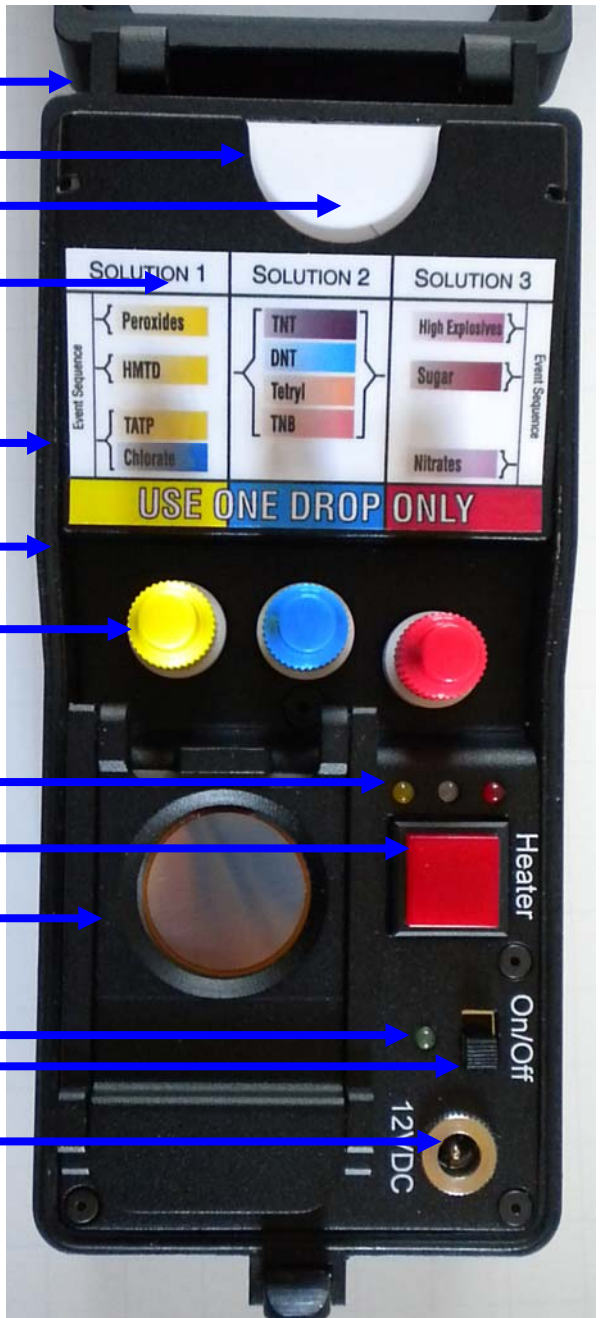
Lighted heater button

Swipe clamp to hold swipe onto heater element

Power & low battery indicator

Power Switch

Optional use 12V DC Power jack



The detection of an explosive is indicated by a colorimetric response (color change) on the swipe. The AC/DC power port (when not using batteries) is inside the sealed area. The unit is water tight when the lid is closed and is easily opened by pushing the bottom of the locking clip. The lid is then opened by the operator to the desired height and remains fixed due to the tension hinge. With the lid is open, the operator can view the instructions sticker on the lid of the Explosives Detector. On the face of the MINI XD-2 are three dropper bottles, labeled “1”, “2”, and “3”, each color coded with a color bar and matching colored cap. Make sure that each of the dropper bottles reside in their corresponding positions. To close and lock the MINI XD-2, push down on the lid until it clicks into the locking clasp.

Swipe Clamp and Heating Element: The swipe clamp is located directly below the dropper bottles and locks in and holds the swipe (pad on swipe facing up). The swipe clamp is opened by lifting the front tab up and is closed by pressing down. Beneath the swipe clamp is the circular metallic heating element. The heater uniformly heats the entire swipe providing faster heating cycles and, therefore, shorter analysis times. Care should be taken to keep the heating element and swipe clamp area clean and free of foreign substances and/or debris (see System Maintenance for more information). The light gray environmental barrier around the heating element is temperature resistant and made of soft silicone foam. Care should be taken not to tear this barrier.

Power Sources: Three different power supplies are in each kit. 6 AA batteries provide over up to 100 sample runs for high explosives and for the extended nitrate analysis. A low battery indicator will flash when a nitrate analysis may be compromised. Also included in the kit are the 110V AC to 12V DC power cord, and a 12V automobile cigarette lighter power cord for unlimited sample runs. Both auxiliary power sources are plugged into the 2.5 mm power port located next to the black power switch (i.e., accepts both the AC to DC power adaptor and the DC cigarette power lighter adaptor).

Note: AC power supply should only be used in an appropriate 110V inspected power outlet. When either the AC Power supply or the cigarette lighter power supply is connected to the MINI XD-2 the circuit board turns off the internal battery source,

preserving battery life. The internal 6 AA batteries are not rechargeable so keep additional batteries available whenever running the Mini XD-2 on battery power. DC power supply should only be used in an appropriate 12V power source (vehicle cigarette lighter power port, etc.). The MINI XD-2 converts the 12V DC to 9V DC power. When the DC Power supply is connected to the MINI XD-2, DC power overrides the internal batteries, preserving battery life.

Power Switch: The black slide power switch is located to the right of the swipe clamp. Sliding the switch toggles the power to the "ON" and "OFF" positions. When the power is on, the green LED next to the switch will remain on and steadily illuminated. If the batteries are low on power the green LED will begin to flash. Replace with 6 AA lithium batteries. *(Note: Care should be taken to turn off the power when storing the MINI XD-2 or when it is not in use to preserve battery power).*

Heater Button: The heater button (square in shape and red in color) is located directly next to the power switch. When it is flashing, press it to initiate the heat cycle. It will remain on and steadily illuminated indicating the heating element is on and the heat cycle is active.

Swipe Holder: A compartment for a roll of swipes has been designed at the top of the MINI XD-2. There is a magnetic hinged lid that closes down securely over the swipes roll. The swipes are fed through a slot and are then torn at the perforation. A thumb cutout in the hinged magnetic lid allows for ease in grasping the next swipe.

Solutions: Solutions 1, 2, and 3 are packaged in 3 mL bottles with controlled dropper tips that are designed to deliver a controlled rate (up to 100 tests). The set of three

3 mL bottles are color coded testing reagents and are each labeled with a formulation version number and expiration date.

LED Light Sequence: The light sequence button confirms the stage of the analysis in case of interruption. If the swipe clamp is not fully depressed, the LEDs will not illuminate with the exception of the Power LED. *(Note: if the green power LED is flashing, replace the 6 AA lithium batteries).* When the swipe sample is secured in the clamp, the yellow LED will begin to flash for three seconds prompting the operator to dispense one drop from Solution 1 (yellow). The red heater button begins to flash and

continues to flash until pressed and released. Once pressed, the red heater will remain on and steadily illuminated and the heating of the swipe sample begins. The yellow LED will then remain on and steadily illuminated until the end of this first heating cycle. Both the heater button and the yellow LED light are on throughout the first heat cycle and detection sequence (see Quick Reference Color Chart for explosives detected). The same LED and Heater button lighting sequence occurs for the Solutions 2 and 3 (blue and red), each with their respective heating times.

OPERATION

To perform a test for trace or bulk explosives, the following steps must be followed:

1. Open the lid of the MINI XD-2
2. Choose to operate either off of the internal batteries or connect the power supply option to run the MINI XD-2, using either 2.5 mm AC to DC power cord, or the 2.5mm 12V DC cigarette lighter power cord.
3. Lift up the swipe clamp.
4. Switch power to ON by sliding the power switch until the green power LED illuminates. If the green LED flashes, replace the 6 AA lithium batteries.

Running a Blank to Verify Operational Cleanliness*:*

5. A blank must be run prior to analysis below. Pull one swipe from the swipe holder and tear off at the perforation. Grasp the swipe by the tab end and take care not to bring the circular cloth pad into contact with anything.
6. Insert and secure the “BLANK” swipe, cloth pad up and so the “CSI” mark is towards the operator. Place the swipe in the center using “lock and key” fit to orient the swipe fully. Close the clamp completely. The yellow LED will begin to flash.
7. If any color changes occur after following steps 11-13 as shown in the Quick Reference Color Chart below, a positive result is present. Clean hands or swipe clamp area. Refer to more detailed information in Appendix 1 if necessary.

***Running a Sample**:*

8. Pull another swipe from the swipe holder and tear off at the perforation. Grasp the swipe by the tab end and take care not to bring the circular cloth pad into contact with anything other than the surface to be tested. Then swipe the cloth pad side of the swipe on the surface of interest. Pressing the thumb on the backside of the swipe in the area behind the pad helps to apply pressure when swiping. It is not necessary to apply very heavy pressure to the swipe to collect particles for testing. This will ensure that nothing other than particulates from the target surface are collected. (The operator should swipe the area of the suspect surface most likely to contain explosives residue, such as a steering wheel or trunk lid of a vehicle, hands of a suspect, zippers or handles of luggage or briefcases, etc.).
9. Insert and secure the swipe, cloth pad up and so the “CSI” mark is towards the operator. Place the swipe in the center using “lock and key” fit to orient the swipe fully. Close the clamp completely. The yellow LED will begin to flash.
10. If any color changes occur after following steps 11-13 as shown in the Quick Reference Color Chart below, a positive result is present. Follow appropriate agency guidelines for securing the threat and for securing evidence (including the swipe). *Note: If the operator lifts the swipe clamp, the device will automatically reset itself to the beginning.*
11. **Peroxide, HMTD, TATP, and Chlorate Test:** The yellow LED flashes for 3 seconds and then stays solid, indicating that it is time to apply a single drop of Solution 1 to the center of the swipe pad. Apply one drop from the yellow capped Solution 1 to the swipe pad and then cap and replace dropper bottle back into its respective port. If peroxides are present, a yellow to gold color will instantly appear on the swipe depending on the amount present. Press and release the flashing red heater button. The red heater button will remain on after pressed. The yellow LED will also remain on during this first heat cycle. Within a few seconds, HMTD will appear, if it is present, appearing as a yellow to gold color depending on the amount. About 10 to 18 seconds later, TATP will begin to appear, if present, as a yellow to gold color depending on the amount. Also, if chlorates are on the swipe, a deep blue color will appear during the same time

frame as TATP. The time and colors indicate the type of explosive. *Note: The chlorate and/or TATP continue to develop to full color up to 5 seconds after the 13 second heat cycle and when the yellow LED and red heater lights turn off. Do not be quick to add the second Solution 2 until swipe is fully evaluated for color.*

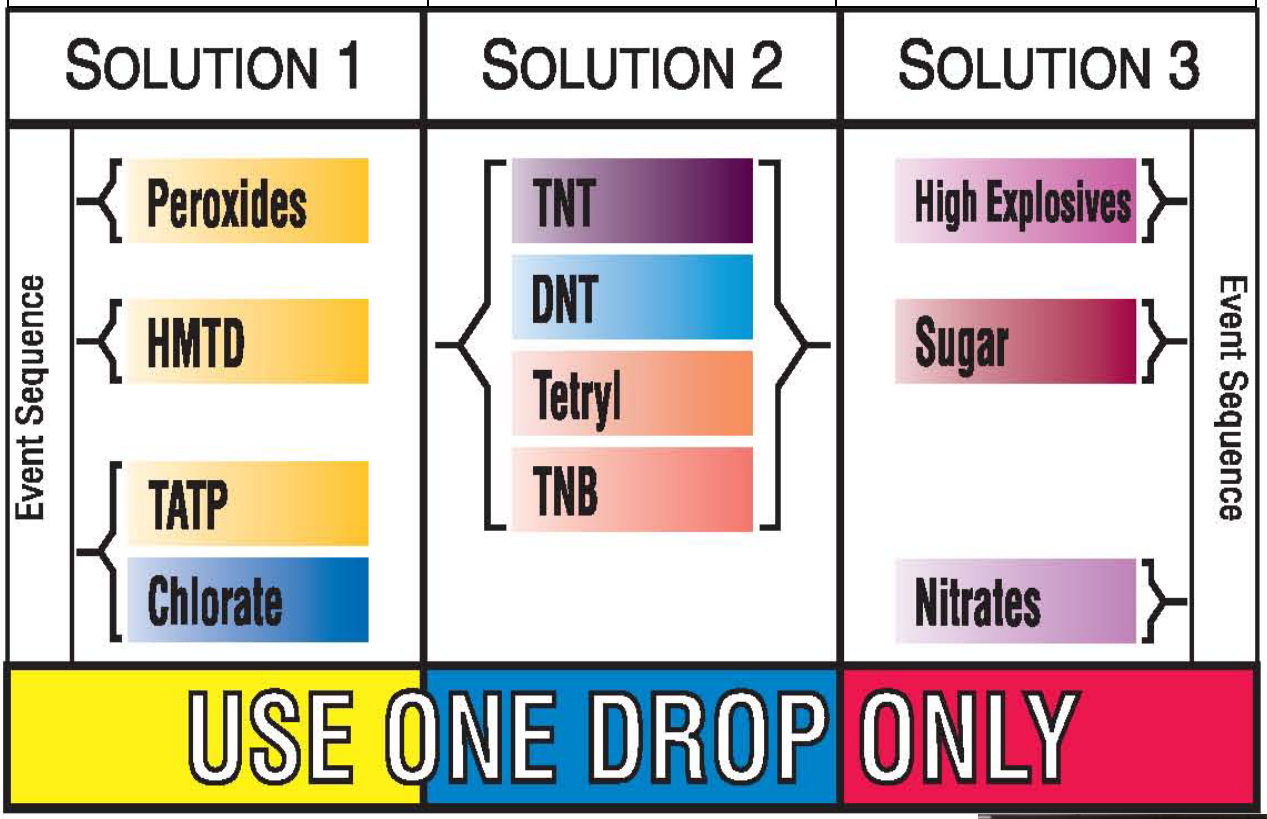
12. **TNT Test:** The blue LED flashes for 3 seconds and then stays solid, indicating it is time to apply a single drop of Solution 2 to the center of the swipe pad. Apply one drop from the blue capped Solution 2 to the swipe pad and then cap and replace dropper bottle back into its respective port. Press and release the flashing red heater button. The red heater button will remain on after pressed. The blue LED will also remain on during this first heat cycle. If TNT is present, a brick red to maroon color will appear instantly after depositing Solution 2 or will appear sometime during the second heat cycle, depending on the amount and age of the TNT. Note: some gun propellants have different combinations of DNT isomers. A green blue to blue color indicates DNT is present.

13. **High Explosives and Nitrate Test:** The red LED flashes for 3 seconds and then stays solid, indicating it is time to apply a single drop of Solution 3 to the center of the swipe pad. Apply one drop from the red capped Solution 3 to the swipe pad <u>immediately after the blue LED and heater lights turn off</u> and then cap and replace dropper bottle back into its respective port. Press and release the flashing red heater button. The red heater button will continue to remain on after pressed. The red LED will also remain on during the entire third heat cycle. If high explosives are present, a very distinct fuchsia color will appear instantaneously or within a 5 second time frame after dispensing Solution 3. Nitrates are detected towards the end of the 3rd heat cycle and up to 5 seconds past this heat cycle, appearing as a deeper fuchsia color. *Note: Some explosives such as Comp. B will give a positive for TNT followed by a positive for high explosives*. *Also, continue to view the swipe while it is on the heater for up to 5 seconds after the last heat cycle.*

14. Lift the clamp, remove and discard the swipe or archive the swipe, and proceed to the next test or power off and store the MINI XD-2.

QUICK REFERENCE COLOR CHART:

SOLUTION 1 1ST HEAT CYCLE	SOLUTION 2 2ND HEAT CYCLE	SOLUTION 3 3RD HEAT CYCLE
Peroxides: immediate yellow HMTD: yellow color appearing in 2-6 sec TATP : yellow color appearing in 8-18 sec Chlorates: dark blue in 8-18 seconds	TNT: Brick Red-Maroon appearing immediately after dispensing or sometime during second heat cycle Some DNT isomers: green blue- sky blue appearing immediately after dispensing Solution 2 or sometime during second heat cycle. Ignore any brown or yellow	HMX, RDX, NG, PETN, EGDN, Nitrocellulose, CL-20, etc.: Fuchsia color appearing immediately or within 5 seconds into 3rd heat cycle Nitrates, black powder, ANFO, urea nitrate, etc.: darker purple fuchsia towards end of 3rd heat cycle. Continue to view up to 5 sec past 3rd heat cycle.



NOTES: The Perchlorate Test is a single spot test.
Purple-Fuchsia is a positive.

The Urea Test is a single spot test and requires two heat cycles; i.e., yellow LED and blue LED cycles
Yellow-Gold is a positive.

SYSTEM MAINTENANCE

The maintenance requirements of the MINI XD-2 are minimal.

Cleaning Swipe Clamp Area: Gently wipe the swipe clamp area with a clean Q-tip or cloth wetted with deionized water. Repeat as necessary. Complete the cleaning procedure by using a clean Q-tip dipped in clean alcohol or acetone to gently wipe the surface.

Battery Change-Out: When the power is on, the power indicator (green LED) will begin to flash when the batteries need to be changed. The underside of the Mini XD-2 has a removable cover for the 6 AA lithium batteries. Turning the screw counter-clockwise (using the provided screwdriver) on the battery cover loosens the cover and allows the operator to remove the cover. If the batteries of the MINI XD-2 do need to be replaced, then turn the power switch off and turn the entire unit upside down so that the underside is facing the operator. Using the small screwdriver, turn the screw head counterclockwise as far as it will go. Lift the o-ring sealed battery cover off. Remove the old batteries and insert 6 new AA lithium batteries, taking care to align the batteries according to the diagram on the battery holder.

Contamination: Test the operator's hands on MINI XD-2 unit using a new swipe. If the swipe tests positive, then the hands are contaminated. Wash hands thoroughly. Test the MINI XD-2 surfaces in the same manner. If the swipe tests positive, then wipe down the MINI XD-2 surfaces with clean, wetted paper or cloth towels (de-ionized water or de-ionized water/alcohol mixture). The best solvent is acetone, for plastic explosives, but is very flammable and care must be taken.

Consumables: One swipe is used per test, and a maximum of one drop from each of the three reagent bottles is required per test. To replace either the swipes or the reagent solutions, contact Spectrex Corporation at:

Spectrex Corp.
3580 Haven Avenue
Redwood City, CA 94063
Phone: 800-822-3940 | 650-365-6567
Fax: 650-365-5845
E-Mail: info@spectrex.com

SPECFICATIONS

Dimensions	6”L x 2.9”W x 2.54”h
Weight	1.6 lbs
Power Supplies	6 each, AA lithium batteries
	1 each AC to DC power cord
	1 each 12V cigarette lighter jack power cord
Tools	1 each small screwdriver
Kit Consumables	100 Swipes
	3 mL Solution 1 (yellow)
	3 mL Solution 2 (blue)
	3 mL Solution 3 (red)
Case	UN approved water tight case with foam
MINI XD-2	Water tight, O-ring lid and battery cover

SAFETY

The formulation of Solutions 1, 2 and 3 are designed to be safe for the operator. The proprietary solutions are manufactured and QA/QC controlled in-house and by Sigma-Aldrich and ChemSpectra. Used swipes may be disposed when finished or held for evidence. No concentrated battery acid is used, or DMSO, or sprays, nor do the operators hold the swipe during the chemical procedure. Refer to the MSDS for additional information. The MINI XD-2 is compliant with OSHA electrical standards, 29 CFR 1910.303 (a) and 1910.303 (b) (1) (i).

LIMITED WARRANTY

ChemSpectra, Inc will repair the MINI XD-2 after receipt for any fault or failed components not caused by misuse during the first year. Contact Spectrex Corporation at:

Spectrex Corp.
3580 Haven Avenue
Redwood City, CA 94063
Phone: 800-822-3940 | 650-365-6567
Fax: 650-365-5845
E-Mail: info@spectrex.com

APPENDIX 1

NOTES FOR MINI XD-2 EXPLOSIVES DETECTOR

Solution	Cap Color	Comments/Notes	Colors/Detection
1	Yellow	Used also as individual spot test for peroxides, HMTD, TATP and chlorates HMTD appears slower than peroxides. TATP needs 13 sec of heat. More heat time may result in greenish yellow false positive If there is mixture of TATP or HMTD with peroxides, then peroxides will, of course, develop first as described above, and the other will not be as distinguishable If peroxide compounds and chlorate are not sought by the operator , Solution 1 does not need to be used prior to the Solutions 2 and Solution 3 in the Mini XD-2 sequence but a ”dry” first heat cycle must be performed with the sample swipe in the clamp	Peroxide instantaneous Yellow. Gold for more concentrated. 50 ng HMTD slower to develop Yellow in 3-6 seconds with heat. Gold for more concentrated. 50 ng TATP needs 13 sec heat for Yellow; may appear after 5 sec. after heat cycle. Gold for more concentrated. 200 ng Chlorate needs 13 sec heat for Dark Blue; may appear after 5 sec. after heat cycle. 400 ng

Solution	Cap Color	Comments/Notes	Colors/Detection
2	Blue	Solution 2 detects nitro-aromatics, some such as TNT and TNB instantaneously, but color develops better with heat. Some isomers of DNT's will decompose giving off NO_2^- which are later detected with the Solution 3 step Solution 2 with heat cycle prepares all HE and nitrates (ANFO, mining explosives, black powder, etc.) for detection in Solution 3 with heat cycle step Solution 1 diminishes detection of TNT when diffused onto the swipe through direct application of diluted solvent but does not diminish later detection of HE with Solution 3 OPTION: Solution 2 does not need to have Solution 1 applied prior to its use on the Mini XD-2. Just run the Mini XD-2 through the first heat cycle w/o Solution 1. When the blue light flashes apply Solution 2 and proceed as normal.	2,6-DNT Blue 2,4-DNT Blue-Green. Also gives fuchsia with Solution 3 TNT Maroon to Brick Red depending on the age and sometimes solvent. 5-10 ng Tetryl is Orange TNB is Orange 1,2-DNB Fuchsia

Solution	Cap Color	Comments/Notes	Colors/Detection
3	Red	Solution 3 causes all HE and other compounds (decomposed from Solution 2) to appear instantaneously as a Fuchsia color but could develop more intensely within 6 sec. within the third heat cycle and detects nitrates as a more purple fuchsia at the end of this 3rd heat cycle. Sugars can appear as a blood red well into the second heat cycle; different time and not fuchsia in color. All nitrates appear as a more purple fuchsia at end of 3rd heat cycle	HE appears as fuchsia. Detection is less than 10 ng for CL-20, RDX, HMX, PETN, NG, C-4, EGDN, Lead Styphanate, GSR, etc. ANFO, black powder, etc, mining gels). 50- 100 ng