

BP OIL -- TOLEDO REFINERY

Document Type: Procedure	Refinery Wide	Procedure No.: SAF 023
Effective Date: 3/7/16	Using Direct Reading Gas Testing Equipment	Rev. No.: 13
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SCOPE	This procedure is to serve as a guide for the use, care, calibration and/or bump test of portable, direct reading gas testing equipment recommended for use at the Toledo Refinery. Refer to the manufacturer's technical manual for complete instructions.
HEALTH Special PPE & Special Hazards	Insure that all calibration activities are performed in clean air and in a well-ventilated room or fume hood.
SAFETY	Standard Refinery PPE Safe work practices using compressed gas cylinders
REFERENCE DOCUMENTS	Safe work procedures: <ul style="list-style-type: none"> • SAF 026 – Personal Protective Equipment (PPE) Policy • SAF 032 – Confined Space Entry • SAF 044 – Hot Work Procedure Operating manuals for: <ul style="list-style-type: none"> • BW GasAlertMicro5® and GasAlertMicro5 PID® Detectors • RAE Systems Ultra RAE • Gas Tec Tester with detector tubes • Draeger CMS, X-AM 5000 • Sperian ToxiPro personal H₂S meter • Industrial Scientific Tango Gas Detector Product Manual • MSA Altair 4x Multi gas Detector Manual • MSA Altair 5x Multi gas Detector Manual • Sirius Multigas Detector – PID Detector
SPECIAL MATERIALS & EQUIPMENT	Tubing, Probes, Calibration Gases, Regulators, Detector Tubes, and Detector Chips
QUALITY	Verify the expiration date stamped on the gas cylinder, detector tubes, detector chips, and/or the last calibration of gas detector.
ENVIRONMENTAL	N/A

OVERVIEW

Testing work atmospheres with direct reading instruments for toxicity and flammability of potentially present gases and vapors. It provides an effective means for identifying leaking and/or residual flammable gases that may supply fuel for fires and explosions. Testing work atmospheres also provides real time information of potentially harmful agents. Testing is particularly important for the safety of people and equipment during hot work, confined space entry, and/or any work near or around leaking equipment. Testing provides detection of flammable gases and vapors in prospective hot work areas, determines the effectiveness of protective measures, and reveals unsafe conditions that may be encountered during work activities.

Proper use of gas testing is critical to safe work activities. Proper gas testing encompasses more than reading the display of an instrument, and should be done based on the user’s knowledge of the gas testing equipment, the chemical properties of measured gases and vapors, and an understanding of the scope of work to be performed.

- 1.0 Acronyms and Definitions
 - 1.1. **CO:** Carbon Monoxide is a colorless odorless toxic flammable gas formed by incomplete combustion of carbon
 - 1.2. **CO2:** Carbon Dioxide is a colorless odorless gas produced by burning carbon and organic compounds and by respiration.
 - 1.3. **H2S:** Hydrogen Sulfide is a colorless poisonous gas with a “rotten egg” smell
 - 1.4. **IDLH:** Immediately Dangerous to life and Health is an atmosphere that poses an immediate threat to life or that is likely to result in acute or immediate severe health effects
 - 1.5. **IR:** Infrared is a wavelength that is greater than that of the red end of the visible light spectrum but less than microwaves emitted particularly by heated objects
 - 1.6. **LEL:** Lower Explosive Limit is the minimum concentration of vapor in air below which propagation of a flame does not occur in the presence of an ignition source
 - 1.7. **MA:** Methylamine is a colorless gas with an ammonia like odor
 - 1.8. **O2:** Oxygen is a colorless, odorless reactive gas
 - 1.9. **PEL:** Permissible Exposure Limit is a legal limit for exposure of an employee to a chemical substance or physical agent
 - 1.10. **PID:** Photoionization Detector measures volatile organic compounds and other gases
 - 1.11. **PPE:** Personal Protective Equipment is the protective clothing required via SAF-026
 - 1.12. **PPM:** Parts Per Million is used when measuring to signify how many parts out of a million
 - 1.13. **TLV:** Threshold Limit Value is the limit of exposure to a chemical substance that a worker can be exposed to, day after day, without adverse health effects
 - 1.14. **VOC:** Volatile Organic Compounds are organic chemicals that have a high vapor pressure

- 2.0 Sampling Methods for Reliable Results
 - 2.1 All direct reading portable gas detectors using catalytic bead (LEL), semiconductor (H2S), photoionization (VOC) or electrochemical sensors (O2) must be bump checked daily prior to initial use. Bump test results must be datalogged by the instrument or manually recorded.

- 2.2 Prior to use, verify that the instrument is within the manufacturer's recommended calibration interval for the instrument and sensor type.
- 2.3 Select the appropriate sampling accessories based on the location to be sampled. Common sampling accessories include rigid and collapsible wands, floats and sintered filters. Each is available in variety of lengths.
- 2.4 Prior to drawing a sample through a pump, wand or other accessory, the entire sample train must be tested for leakage. This should be accomplished by blocking the inlet at the point furthest from the instrument and ensuring a pump fault alarm is obtained.

CAUTION

Most refinery gases are heavier than air and settle or flow to the lowest level within a space. At the same time, some hazardous gasses are lighter than air. Hydrogen and natural gas are both much lighter than air and will normally rise and diffuse into upper atmospheric levels. They will be trapped at the top of the unvented spaces of vessels, fireboxes, roofs and platforms. Make sure gas testing is performed at various elevations within every space to ensure proper characterization of the atmosphere.

- 2.5 When gas testing a confined space place the probe inlet at the lowest level of the space being tested. Continue to check each open manway or at various elevations in open spaces to obtain representative gas test results.
- 2.6 Keep sampling probe inlet above flammable liquid or water levels. Liquids drawn into the instrument will make it inoperative and unreliable. The purpose of gas testing is to measure vapors, not the liquid. The use of a float accessory on the sample wand will help prevent liquid from entering the equipment.

WARNING

Taking samples in extreme temperatures and in atmospheres with condensing liquids or high humidities (i.e. steam filled areas, and during activities such as power washing) may damage gas testing equipment and/or give inaccurate measurements. Consult the instrument user's manual for sample length limitations as well as recommended sampling times.

- 2.7 If a space is oxygen deficient and flammability needs to be assessed, a special gas tester capable of accurately detecting LEL (IR sensor technology) will be used. Contact a safety advisor for this assessment. Note that IR technology will not detect hydrogen gas.

WARNING

Catalytic bead LEL sensors generally require a minimum of 10% Oxygen in the stream being sampled to function properly. Consult the manufacturer's manual to determine the percent Oxygen needed to function properly. If it is necessary to determine the concentration of flammable gas in an oxygen deficient (Less than 19.5% Oxygen) atmosphere, consult a Safety Advisor or Process Engineer for additional guidance. Specialized equipment will be utilized to obtain accurate gas test results.

- 3.0 Training
- 3.1 Prior to new equipment roll out, notification and training of affected personnel will be conducted. Initial user training for the operation of portable gas testing equipment will be provided by a competent trainer. This may include, but is not limited to, the area trainer, the area safety representative, the union safety representative, or an asset supervisor. This training alone is not sufficient for utilizing this equipment for gas testing associated with the control of work process. Additional training as a Level 1, Level 2 or Level 3 Authorized Gas Tester is also necessary. This training will be part of the required training for individuals expected to conduct gas testing as part of their job responsibilities.
- 4.0 Exemptions
- 4.1 There are times when an exemption from the use of gas detection equipment is allowable. The PPE policy (SAF 026) allows traveling to a green zone area from a green zone area within an enclosed motor vehicle to be in regular clothes without the standard refinery PPE. Therefore, no H₂S meter is required. Some work tasks may decrease the function of or damage the equipment. Examples include:
- High pressure water blasting
 - Sand blasting
 - Live flare work with a supplied air respirator
 - IDLH work with a supplied air respirator
 - Arc gouging
- 4.2 These and possibly other work tasks may be exempted if a risk assessment has been conducted with all involved parties and a BP Safety Advisor. The risk assessment shall document how gas testing will be performed to make sure the atmosphere remains safe. For example, inside a confined space, the Confined Space Attendant could conduct the continuous gas monitoring.
- 4.3 The risk assessment should consider controls such as ventilation before the use of PPE.
- 5.0 Visitors and Short-Term Duration Contractor Employees
- 5.1 **Visitors**
For one day visitors, the Security reception area will have access to loaner H₂S meters. The BP contact bringing in the visitor must notify Security that an H₂S meter is needed. An instruction card will be provided and a sign off that he/she has been issued a loaner personal H₂S meter and they understand how to use it. Should a four gas meter be needed visitors can obtain a loaner from the Fisher Safety Store.

5.2 **Short-term Duration Contractor Employees**

For other contract workers who will be in the plant for 30 days or less, the Fisher Safety Store will have a rental supply of H₂S meters. An instruction sheet will be given with the personal H₂S meter to insure that the user understands its function. A work order number is needed to account for these meters when issued. The BP contact will be responsible to locate an accessible bump test/calibration station for the rental meter.

6.0 Instrument Requirements

6.1 **Personal H₂S Monitors Must**

- Have an audible, visual, and vibration alarms
- Display the current gas concentration on the screen
- Have 10 ppm low alarm; 20 ppm high alarm settings
- Have peak reading which is cleared by the bump test
- Have a field audit ability for bump test or calibration (such as flashing red light, or sticker)
- Be intrinsically safe; Class 1, Div. 2 minimum

6.2 **Multi Gas and PID**

- Have an audible, visual, and vibration alarms
- Display the current gas concentration on the screen
- Have a field audit ability for bump test or calibration (such as flashing red light, or sticker)
- Be intrinsically safe; Class 1, Div. 2 minimum
- The following alarm levels are recommended to provide a timely warning:
 - H₂S - 10 ppm low and 20 ppm high
 - O₂ - 19.5% low and 23.5% high
 - LEL – 10% low and 20% high
 - CO – 35 ppm low and 100 ppm high
 - Total Hydrocarbons – 50 ppm low and 100 ppm high

Revision history

The following information documents at least the last 3 changes to this document, with all the changes listed for the last 6 months.

Date	Revised By	Changes
7/17/14	Todd Flippin	Added New RKI Eagle 2 Quick Guide info. MOC# M20142346-001
10/23/2015	Emily Stewart	Standardized format, added MSA Altair 4x, MSA Altair 5x multigas detector, MSA Sirius multigas detector – PID Detector, standardized quick guide format, added quick guides for MSA Altair 4x, MSA Altair 5x, and MSA Sirius, added pictures to quick guides. Removed Cannonball 3. MOC# M20152189-001

3/7/2016	Emily Stewart	Added New Tango H2S Meters Quick Guide info. MOC# M2016406-001
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Dräger X-am 5000

Turning On the Monitor:

1. Press the green "OK" button
2. If the monitor goes into alarm, press the green "OK" button to stop the alarm

Bump Test (daily):

1. Allow the monitor to warm up for five minutes
2. Place the monitor into the bumping station until it clicks into place
3. Once every number is flashing "OK" remove the monitor from the docking station
4. If all of the sensors are showing a number value: bump was successful. The monitor is ready for use
5. If one or more of the sensors have "-- --" in place of a number after the bump, a calibration will be required.



Calibration Test (every 30 days)

1. Hold the blue "+" button. This will display "000" on the screen.
2. Press the green "OK" button twice and the blue "+" once.
3. The screen should now show "001". Press the green "OK" button to enter the calibration screen.
4. The following icons will be displayed on the right of the screen:
5. Use the blue "+" button to navigate the menu. The fresh air calibration icon will be highlighted
6. Press the green "OK" button to select the fresh air calibration. (the screen will show numerical readings)
7. When the values on the screen stabilize press the green "OK" button. All of the sensors will be flashing "OK"
8. Press the green "OK" button to return to the calibration menu.
9. Select the 1 Button Calibration Icon. Numerical values will be shown on the screen
10. Place the monitor into the bumping station. (The numerical values will begin to change).
11. Once the values stabilize, press the green "OK" button. Each of the sensors will now be flashing "OK"
12. Remove the monitor from the bump station
13. Switch the calibration gas cylinder from the mixed gas to the Ammonia cylinder.
14. On the calibration menu select the Span Calibration Icon.
15. Use the blue "+" button to skip sensors until "MA ppm" is flashing. Use the green "OK" button to select the sensor for calibration
16. Place the monitor into the bumping station and press the green "OK" button
17. Once the value has stabilized (this could take up to a minute), press the green "OK" button. "OK" will be flashing where the value was located.
18. Press the blue "+" button until the main reading screen appears.
19. Record the Calibration on the log sheet. The monitor will store the values of the calibration.

Calibration Gas Values	
O2	18%
MA	Ammonia- 50 ppm
CO2	100ppm
LEL	Methane – 2.5% (50% LEL)
H2S	25 ppm

Turning Off the Monitor:

To turn off the monitor, hold the blue "+" and the green "OK" button until the countdown is completed.

Toxipro H₂S Monitors

Turning On the Monitor:

1. Press the power button

Perform Bump Test (daily):

1. Place on the H₂S docking station
2. Bump test will automatically be completed.
3. Remove when test passes
4. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Perform Calibration Test (every 30 days):

1. Place on the H₂S docking station
2. Calibration test will automatically be completed.
3. Remove when test passes
4. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Turning Off the Monitor:

1. Press and hold the power button until the screen goes black




Industrial Scientific Tango TX1 Gas Detector






Perform Bump Test:

1. Bump tests are required after each alarm event
2. Place meter face down on the docking station
3. The docking station will then perform a bump test and data transfer
4. Once complete there will be a green light on the docking station

Perform Calibration Test (every 28 days):

1. When calibration is required a  will appear on the front screen
2. Place meter face down on the docking station
3. The docking station will then perform a calibration and data transfer
4. Once complete there will be a green light on the docking station

Clearing Peak Readings:

1. Press  to navigate to the screen that contains the image: 
2. Press and hold  until the screen goes back to 00.



RKI Eagle 2 Quick Guide

Turning On the Monitor:

1. Press and hold the “Power, Enter, Reset” button

Perform Pump Test:

1. While instrument is running plug the end of the wand. A “Fail Low Flow Level” message will appear.
2. Press the “Power, Enter, Reset” button to return to normal operation



Bump Test (daily):

1. Perform Demand Zero Air by pressing the “Air, Yes” button and holding until the display shows the release air message.
2. Perform the bump test by connecting the Span Cal Gas to the wand.
3. Wait 30 seconds or until the readings stabilize. If readings are within $\pm 5\%$ of the Span Cal Gas the instrument has passed the bump test

Calibration Test (every 30 days):

1. Perform Demand Zero Air by pressing the “Air, Yes” button and holding until the display shows the release air message.
2. Perform the Calibration by pressing the “Range, Shift” button and the “Display, Adjust, No” button simultaneously.
3. Be sure the arrow is on Auto Calibration and press the “Power, Enter, Reset” button.
4. Press “Power, Enter, Reset” button to begin cal.
5. Connect the Span Cal Gas to the wand and wait 2 minutes.
6. When readings match the Span Cal Gas values press the “Power, Enter, Reset” button
7. The display will move you to the LEL Calibration. Press the “Power, Enter, Reset” button to begin, and wait 2 minutes.
8. When the reading matches the Span Cal Gas values press the “Power, Enter, Reset” button.
9. Remove the Span Cal Gas from the wand.
10. Press the “Range, Shift” button until the arrow is next to the Normal Option, and press the “Power, Enter, Reset” button.

Turning Off the Monitor:


1. Press and hold the “Power, Enter, Reset” button until the instrument displays the Good Bye message.

NOTE: When using a wand follow the Manufacturer’s Response Time Guidelines below

Hose Used	Typical Time to 90% of Response (T90)
Probe Only	12 seconds
Probe & 5 Foot Hose	15 seconds
Probe & 25 Foot Hose	25 seconds
Probe & 50 Foot Hose	35 seconds
Probe & 75 Foot Hose	45 seconds
Probe & 100 Foot Hose	60 seconds
Probe & 125 Foot Hose	75 seconds

ALTAIR 4X

Turning On the Monitor:

1. Press the “” button

Bump test (daily):

1. Place the monitor on docking station backward until it clicks.
2. Bump test will automatically be completed.
3. Remove when test passes
4. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Calibration test (every 30 days):

1. Place the monitor on docking station backward until it clicks.
2. Calibration test will automatically be completed.
3. Remove when test passes
4. If test does not pass, take to fisher safety store or contact BP Safety Advisor



Turning Off the Monitor:

1. Press and hold the “” button until the countdown is complete.



ALTAIR 5X

Turning On the Monitor:

1. Press the “

Bump Test (daily):

1. Place monitor on docking station backwards
2. Once in place move the whole unit forward and upward so the pump fits into the air inlet
3. Once bump test is complete, to remove pull the monitor forward and downward
4. Bump test will automatically be completed.
5. Remove when test passes
6. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Calibration Test (every 30 days):

1. Place monitor on docking station backwards
2. Once in place move the whole unit forward and upward so the pump fits into the air inlet
3. Once bump test is complete, to remove pull the monitor forward and downward
4. Calibration test will automatically be completed.
5. Remove when test passes
6. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Turning Off the Monitor:

1. Press and hold the “

NOTE: When using a sample wand follow the Manufacturer’s Response Time Guideline of 3 seconds per meter of sample line to allow the sample to be drawn through the sensors.



SIRIUS

Turning On the Monitor:

1. Press the "On/Off" button

Bump Test (daily):

1. Place the monitor in the docking station backwards and upside-down fitting the air pump into the air inlet
2. Once in place, close the lid of the docking station to begin the bump test.
3. Bump test will automatically be completed.
4. Remove when test passes
5. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Calibration Test (every 30 days):

1. Place the monitor in the docking station backwards and upside-down fitting the air pump into the air inlet
2. Once in place close the front piece of the docking station to begin the calibration.
3. Calibration test will automatically be completed.
4. Remove when test passes
5. If test does not pass, take to fisher safety store or contact BP Safety Advisor

Turning Off the Monitor:

1. Press and hold the "On/Off" button until the countdown is complete.

NOTE: When using a sample wand follow the Manufacturer's Response Time Guideline of 3 seconds per meter of sample line to allow the sample to be drawn through the sensors.



BW GasAlert Micro 5 Gas Detector

Turning On the Monitor:

1. Press “on/off” button on the instrument

Perform Pump Test:

1. Ensure the instrument indicates a successful self-test of all sensors
2. The instrument will prompt to block the pump inlet
3. Cover pump inlet until test is complete

Bump Test (daily):

1. Place the monitor face down in the docking station and close the lid
2. A successful bump test is indicated by a green “pass” light on the docking station

Calibration Test (every 30 days):

1. Place the monitor face down in the docking station and close the lid
2. A successful calibration test is indicated by a green “pass” light on the docking station

Turning Off the Monitor:

1. Press the “on/off” button on the instrument

NOTE: When using a sample wand follow the Manufacturer’s Response Time Guideline of 1 second per meter of sample line to allow the sample to be drawn through the sensors.



UltraRAE 3000 User's Guide (PGM 7360)

Turning On the Monitor:

1. Press and Hold MODE Key to power on instrument.
2. Wait for UltraRae 3000 to perform self-tests.
3. When tests are complete, UltraRae 3000 is ready for use (Wait to see a numerical reading screen with icons).

Perform Pump Test:

1. While instrument is running, plug the end of the inlet port of the UltraRae. Wait for sound of alarm
2. Press the [Y/+] button to return to normal operation

Bump Test (daily):

1. Perform Demand Zero Air by pressing the MODE and [N/-] button. Press MODE button to skip password.
2. Perform the bump test by connecting the Span Cal Gas to the inlet port of the UltraRae
3. Wait for 30 seconds or until the readings stabilize. If readings are within $\pm 5\%$ of the Span Cal Gas the instrument has passed the bump test.

Calibration Test (every 30 days):

1. Press the MODE and [N/-] button until you see the password screen.
2. Enter calibration by pressing the MODE button. Calibration screen displays "Zero Calib" and "Span Calib".
3. To perform a Zero Air calibration press the [Y/+] button on the highlighted "Zero Calib".
4. Zero Calibration starts a 30-second countdown by displaying the message "Zeroing..."
5. Zero Air calibration is done when instrument reads "Zeroing is done!" and "Reading = 0.0ppm"
6. After Zero Air calibration is done, connect one end of the calibration hose to the inlet port of the UltraRae and the other to the calibration gas cylinder regulator. Use isobutylene gas cylinder for calibration OR if testing for benzene, calibrate with 5 ppm benzene calibration gas for Rae Systems.
7. Select the highlighted "Span Calib" by pressing [Y/+] to perform Span calibration.
8. Span calibration starts a 30-second countdown by displaying the message "calibrating..."
9. Span calibration is done when instrument reads "Span 1 is done!" and "Reading = 100.0ppm" (100.0ppm is just an example but the value should be close to the span gas value).

Compound-Specific Operation:

1. To test for Benzene, press the N/- button till you see the message "Test: Benzene, Start Sampling?"
2. Prepare separation tube by breaking both ends and inserting with its indicator arrow pointing toward the instrument
3. Start Measurement by pressing the Y/+ button and wait for 60 seconds.
4. UltraRAE 3000 displays and logs measurement on display screen after 60 seconds.

Turning Off the Monitor:

1. Press and hold the Mode Key until shuts off.



Dragger CMS

1. Select appropriate chip for gas to be measured. Ensure that chip is not past expiration date.
2. Power on Instrument by sliding switch to position 1. Allow instrument to perform a function test.
3. Insert the chip through the bottom inlet and in the direction of the chip arrow by pushing it upwards and sliding it completely into the inlet.
4. Wait for Dragger CMS to read the barcode and display the measuring range
5. Slide switch to position 2. A chip test is performed and ready for measurement. It should display "chip ok".
6. Slide switch to position 3 to begin measurement. The sample gas is drawn through the gas inlet at the top of the instrument.
7. Measurement is being done with a display of the gas measured
8. When measurement is complete, the results are displayed on the screen. Results below range indicate "<lower measuring range", results above range indicate ">upper measuring range: and results outside range indicate "OR".
9. Slide switch back to position 1. For longer measurements, follow instructions on screen.
10. Slide switch to position 0 to power off the instrument and remove chip



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