

Oz/  
Combustible  
Meter  
Training

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## S-208, EXPLOSIMETERS (COMBUSTIBLE & OXYGEN METERS)

### **I. General Information**

- A. Scope** To specify the limitations, testing, and maintenance of explosimeters and oxygen meters.
- B. Statement of Standard** Explosimeters and Oxygen Meters are to be tested prior to use. Any meter which fails to function properly shall not be used.
- C. Definitions** Explosimeter - meter used to measure the level of oxygen and combustible gases in an area to ensure a safe work atmosphere
- D. Responsibilities**
1. Department Supervision:
    - a. Administer this standard
    - b. Designate the individual department meter contact
    - c. Ensure meters are returned to the Instrument Shop for the quarterly inspection and calibration and whenever found defective
    - d. Establish a process to maintain documentation of persons trained to use meters
  2. Instrument Department:
    - a. Train and certify Department Meter Contacts annually as instructors. Appropriately document.
    - b. Purchase meters for use in the Division, maintaining appropriate records
    - c. Maintain list of meters approved for division use
    - d. Recommend meters for Department use
    - e. Perform in-depth inspection and calibration of department meters quarterly in central Instrument Shop and repair defective meters
    - f. Maintain records of meter inspection and repair for a period of three years plus current
  3. Department Meter Contact:
    - a. Ensure proper care of these meters
    - b. Ensure the proper use of the meters
    - c. Be certified by the Instrument Department as a meter instructor
    - d. Certify others in their area in the safe use of these meters

## **II. Training Requirements**

- A. Users** Only persons who have successfully completed the Oxygen and Explosimeter Training Class, and who have valid certificates, may use meters.
- Users must demonstrate competency as a part of training.
- Recertification is required annually.
- B. Trainers** The Department Meter Contact will certify others in their area. This person must be experienced in the use of the meters, a certified user, prior to be trained as an instructor.

## **III. Selection and Purchase of Meters**

- A. Miscellaneous** Meters used will be evaluated for accuracy, reliability, and maintenance repair cost prior to division use.
- For selection of the meters most suitable for departmental needs, consult the Instrument Department. They will in turn order the appropriate meters.

## **IV. Calibration and Testing of Meters**

- A. Designated Areas** Each department using meters will have a designated place for storage, charging, and testing/calibration of the meters.
- All meters not being used should be in this area.
- B. Calibration Station Setup** The calibration station must conform to the "Explosion Meter Calibration Station" diagram in Attachment 1.
- NOTE:** Only rechargeable batteries are to be used in meters due to the explosion potential of alkaline batteries when attempting to recharge.
- C. Calibration Gases** A cylinder of 2.5% Methane in air mixture will be used for testing combustible gas meters. Use of any other mixture must be approved by the Instrument and Safety Departments.
- Calibration gases should be purchased in 220 cu. ft. cylinders. Small test cylinders should be used for field calibration only when meters are used for prolonged periods.
- D. Calibration and Testing Schedule** Meters are to be tested and calibrated prior to each use. In addition, in-depth inspection and calibration must be performed by the Instrument Department at least quarterly.

**E. Calibration Procedure**

The steps below can be applied to most meters. For a more specific check, follow the instructions for meter being used.

Units must be tested in a clean, combustible-free atmosphere.

| Step | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Remove the sample probe and tube.<br>Check cotton filter housed in meter end of probe.<br>If dirty or wet, replace filter.                                                                                                                                                                                                                                                                                                                                                                |
| 2    | Clean and dry the moisture trap (if applicable).                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 3    | Turn unit on and check battery voltage.<br><b>NOTE:</b> Never calibrate a unit plugged into charger.                                                                                                                                                                                                                                                                                                                                                                                      |
| 4    | Check pump flow and alarm (if applicable).                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 5    | Zero oxygen meter using Nitrogen. If not zero, adjust zero potentiometer until zero is obtained.                                                                                                                                                                                                                                                                                                                                                                                          |
| 6    | Check oxygen reading in air. Should be 21%.<br>If not, adjust oxygen calibrate potentiometer until 21% reading is obtained.                                                                                                                                                                                                                                                                                                                                                               |
| 7    | Check combustible meter for zero in clean air.<br>If not reading zero, adjust combustible gas zero potentiometer until zero reading is obtained.                                                                                                                                                                                                                                                                                                                                          |
| 8    | Introduce calibration gas (2.5% Methane in air).<br>Combustible gas meter should go upscale to<br>55% for Gastech GX-3, 1214, GP204<br>2.5% for BioMarine 902A.<br>If reading is incorrect, adjust combustible gas span potentiometer until correct reading is obtained.<br><b>NOTE:</b> An explosion meter with a bad combustible gas detector will appear to be working. The <b>ONLY</b> way to tell if the sensor is good is by putting a calibration gas on it and checking the span. |

**F. Confined Space Entry Post Use Testing**

Meters must be tested ~~after use but prior to entry in~~ confined space entry situations (See USA-5). Only steps 4 and 6 listed above are required for this post use function check. Do not issue the permit until this post use test is completed. If the meter requires any adjustments, do not permit the entry.

**G. Procedure for Defective Meters**

If the unit fails any of the steps above, doesn't hold calibration or function properly, or if the user is not satisfied that the unit is working properly, **DO NOT USE IT**. Tag the unit and send it to the Instrument Department for repair.

## II. Additional Procedures

- A. Isolation** If one of the accepted methods for isolating equipment listed in Section IV.A.2.a. of USA-5 cannot be performed then the alternate method to be used must be approved by the Superintendent/Department Head.
- If blinds or pancakes are used to provide isolation, then the blind thickness shall meet Dow Engineering Details L4G-6420-01 for RF and FF flanges and L4G-6420-02 for RTJ flanges (See Attachments 2 and 3).
- B. Air Quality Testing** Air quality tests will be performed at all expected entry points into the confined space.
- Consider also the possibility of stratification of the atmosphere within the confined space. If it is possible, testing must be done at a variety of points within the space.
- The post use functional check required by USA-5, Section IV.C.3, need not include recalibration of the instrument. Checking it against a known reference sample is sufficient.
- C. Ventilation** If forced or induced ventilation is used, it
- should provide a minimum of ten volume changes per hour,
  - must have a valve or switch readily accessible to allow fast shutoff of the air should a spill occur
- D. Testing for Concentration of Last Contained Compound** Confined spaces should be cleaned below the Threshold Limit Value (TLV) of the last contained compound (see Attachment 1). If not, entry procedures must be reviewed and approved by Industrial Hygiene.
- If there is no simple method to determine the TLV or the chemical does not have a published exposure guideline and/or it is known that the chemical does not cause acute inhalation toxicity (i.e., death or serious illness), then a procedure which includes cleaning or decontamination, the use of ventilation or PPE, and which has been approved by Industrial Hygiene, can be used in lieu of obtaining a TLV.
- E. Lighting** Low voltage, explosion proof, lighting is preferred. If the situation however requires more lighting than this can provide, the lighting used must be 115VAC industrial grade with a caged protector and protected by a Ground Fault Circuit Interrupter (GFCI) located outside of the space.

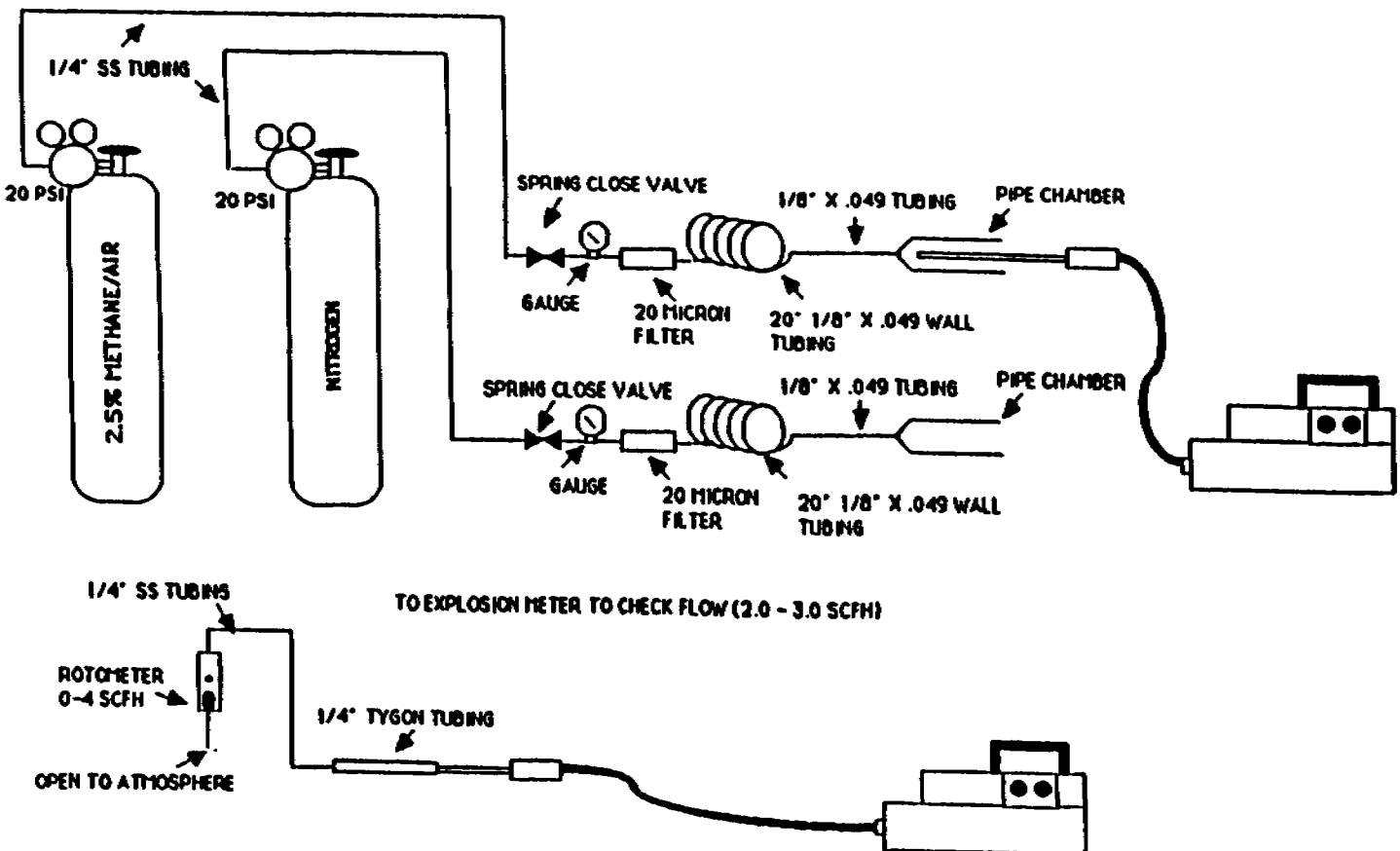
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is  
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## V. Limitations and Other Considerations

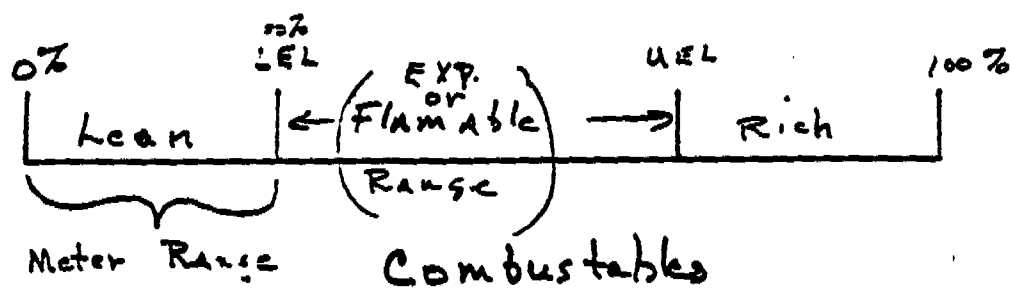
- A. Temperature Exposure** The approved explosimeters are not good for temperatures below 5 °F or above 140 °F.
- When used at 100 to 140 °F, the meter must be recalibrated in the field at a temperature which approximates the one at which it will be used.
- B. Extended Usage** Meters used continuously for extended periods, such as to monitor welding or hot work for a whole shift, should be tested and calibrated periodically (as conditions warrant but at least every 4 hours) to correct any drift due to temperature changes, sample changes, degradation of sensor, etc.
- C. Different Explosive Limits than Checked** The meter is calibrated with 2.5% Methane in air. The compounds to be checked may have a different explosive limit. In addition, permanently mounted meters may be calibrated for a different explosive limit other than the meter.
- Consult the Instrument Department in these situations.
- D. Oxygen Deficient or Oxygen Rich Atmospheres** An explosion meter cannot be used to measure combustible gas in atmospheres that are oxygen deficient, below 10%, or oxygen rich, more than 25%, oxygen by volume. These conditions will cause erroneous readings.
- Special fittings are available for these instances, such as sampling in nitrogen or other inert atmospheres. These meters and fittings must be clearly labeled for their special use and stored separately from the normal meters. It is recommended that they be placed under lock and key.
- These meters require special training not included in the regular explosion meter training classes. Improper use of this fitting could result in a false sense of safety. For the correct training in the use of this type of fitting, contact your Department Meter Contact or the Analyzer Department.
- E. Silicone Compounds** Tetraethyl lead or compounds containing silicon may poison combustible gas sensors, and give inaccurate readings.
- F. Concentrations > 100 % LEL** In combustible gas concentrations above 100% L.E.L., the explosion meter will give erroneous readings.
- G. Liquids** These units are not made to take liquid samples. If liquid is drawn into the unit, it is no longer safe for use and should be tagged and sent to the Central Instrument Shop immediately.

# Attachment 1

## Explosion Meter Calibration Station Diagram



**THE NATIONAL BRAND**



DO A 037190  
CONFIDENTIAL

NAME: \_\_\_\_\_

MASTER # \_\_\_\_\_

DEPARTMENT: \_\_\_\_\_

DATE: \_\_\_\_\_

1. Why do we use the portable combustible gas/oxygen meters in the Division?

\_\_\_\_\_  
\_\_\_\_\_

2. What does the scale on the combustible gas meter indicate?

\_\_\_\_\_  
\_\_\_\_\_

3. If a person is not certified in the use of the explosimeter, is it O.K. for him/her to use it? \_\_\_\_\_

4. At what oxygen meter reading would you start to get concerned about your safety? \_\_\_\_\_

5. At what elevated temperature is re-calibration required? \_\_\_\_\_

6. What is meant by lower explosive limit (LEL) and upper explosive limit (UEL)?

LEL \_\_\_\_\_

UEL \_\_\_\_\_

Why is this important for you to know? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

7. Describe the meter reactions to these mixtures.

A. Lean mixture \_\_\_\_\_

B. Explosive mixture \_\_\_\_\_

C. Rich mixture \_\_\_\_\_

8. What is the correct meter setting when calibrating the oxygen meter in normal atmospheric air? \_\_\_\_\_

9. What is meant by the vapor density of a gas?

\_\_\_\_\_  
\_\_\_\_\_

Why is this important for you to know? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

10. When checking for combustible gas, the oxygen meter should read with in what range? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

11. If you have purged a line with inert gas , such as nitrogen, what should you check first? \_\_\_\_\_  
Why? \_\_\_\_\_
12. What is the only way for you to know that a combustible gas sensor is working properly? \_\_\_\_\_
13. When a liquid is drawn into the explosimeter, is it safe to reuse the meter after you have thoroughly dried it? \_\_\_\_\_
14. Are the Divisions combustible gas/oxygen meters accurate between the LEL and the UEL? \_\_\_\_\_
15. If you are using the explosimeter and the combustible gas meter pegs up scale, what action should you take? \_\_\_\_\_
16. If you zero the combustible gas meter and put 2.5% methane/air calibration gas on the unit and the meter reads 35% LEL, what should you do? \_\_\_\_\_
17. What should the combustible gas meter read with 2.5% methane/air calibration gas applied? \_\_\_\_\_
18. Is it acceptable to check calibration of the explosimeter while they are plugged into the charge unit? \_\_\_\_\_
19. List three conditions that would cause an explosimeter to require re-calibration.
- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
20. Where should you test and calibrate the explosimeter? \_\_\_\_\_

NAME: \_\_\_\_\_

MASTER # \_\_\_\_\_

DEPARTMENT: \_\_\_\_\_

DATE: \_\_\_\_\_

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\_\_\_\_\_

Why is this important for you to know? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

10. When checking for combustible gas, the oxygen meter should read with in what range? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

DO A 037193  
CONFIDENTIAL

11. If you have purged a line with inert gas, such as nitrogen, what should you check first? \_\_\_\_\_  
Why? \_\_\_\_\_  
\_\_\_\_\_
12. What is the only way for you to know that a combustible gas sensor is working properly? \_\_\_\_\_  
\_\_\_\_\_
13. When a liquid is drawn into the explosimeter, is it safe to reuse the meter after you have thoroughly dried it?  
\_\_\_\_\_
14. Are the Divisions combustible gas/oxygen meters accurate between the LEL and the UEL? \_\_\_\_\_
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\_\_\_\_\_
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\_\_\_\_\_  
\_\_\_\_\_

Why is this important for you to know? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

10. When checking for combustible gas, the oxygen meter should read within what range? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

DO A 037195  
CONFIDENTIAL

11. If you have purged a line with inert gas , such as nitrogen, what should you check first? \_\_\_\_\_  
Why? \_\_\_\_\_  
\_\_\_\_\_
12. What is the only way for you to know that a combustible gas sensor is working properly? \_\_\_\_\_  
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