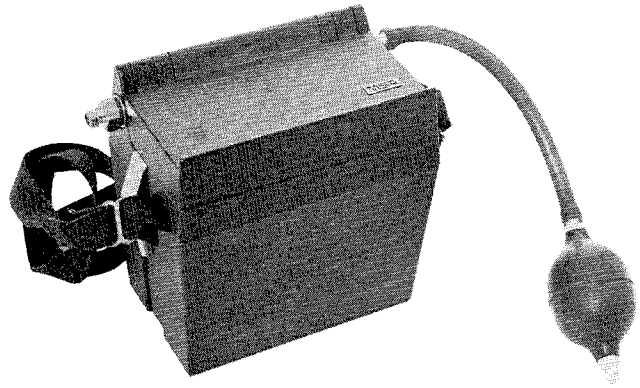
Gascope®

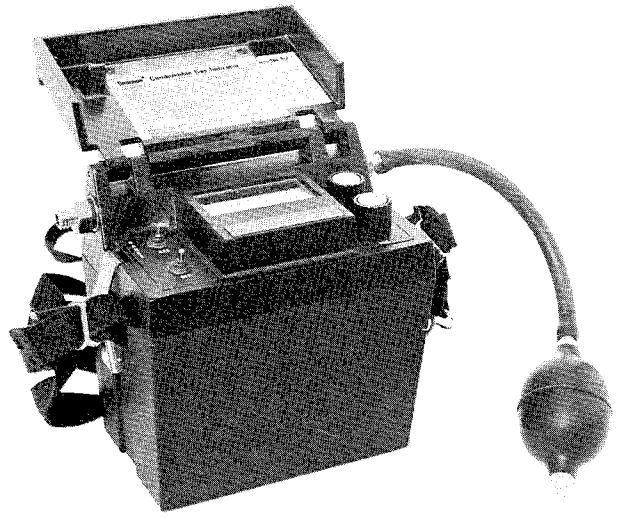
part no.
465475

MSA

MSA

Gascope®
COMBUSTIBLE GAS INDICATOR
UTILITY MODEL 60





MINE SAFETY APPLIANCES COMPANY
PITTSBURGH, PENNSYLVANIA, U.S.A., 15230

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SECTION 1
GENERAL INFORMATION

INTRODUCTION

This manual provides operating, theory of operation, maintenance and calibration information for the Gascope® Combustible Gas Indicator. Section 2 includes an initial checkout procedure, operating instructions for the Gascope and application information. Section 3 briefly describes: 1) the flammable property of methane, 2) its measurement with the Gascope and 3) the operation of the instrument's sampling system and electronic circuitry. Section 4 contains instructions on periodic and corrective maintenance, troubleshooting and parts information. Section 5 provides information on calibrating the instrument.

GENERAL SPECIFICATIONS

General specifications for the Gascope are given in Table 1-1.

SERIAL NUMBER IDENTIFICATION

The Gascope is identified by a serial number on the instruction label inside its cover (see Figure 2-1). This number should be included in correspondence with MSA which concerns the unit.

WARNING

Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the GASCOPE® COMBUSTIBLE GAS INDICATOR UTILITY MODEL 60, beyond the scope of these maintenance instructions or by anyone other than a certified MSA serviceman, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain severe bodily injury or death.

Table 1-1. General Specifications

ELECTRICAL CHARACTERISTICS

Accuracy: Factory calibrated to ±5 % of fullscale on methane

Power supply: Eight carbon-zinc "D" cells (Eveready 950 or equivalent)

Power supply life: 8 hours min. continuous usage with fresh batteries at normal ambient temperature

Ranges: 0 to 5 % and 0 to 100 % methane

PHYSICAL CHARACTERISTICS

Sample flow rate: 0.03 to 0.05 cfm (0.8 to 1.4 Lpm)

Construction: Plastic case with stainless steel hardware

Dimensions: 6-1/2 × 7-1/4 × 4 in.

Weight: 5 lb 2 oz

APPROVALS
The Gascope Model 60 is approved. It is suitable for use in Class I, Division 1, Groups C and D hazardous locations when used with Eveready 950, carbon-zinc "D" cells or equivalent and in accordance with the instruction manual (Part No. 466520).

SECTION 2
OPERATION

INTRODUCTION
This section provides instructions on unpacking and inspecting the Gascope, making initial checks, operating the instrument and using the Gascope for various applications.

INITIAL INSPECTION
Remove the instrument from its shipping container and examine the unit carefully. If damage or shortage is noted, advise the carrier promptly. Make the proper claim with the carrier and, if necessary, reorder from MSA.

INITIAL CHECKS (See Figure 2-1.)
To verify the instrument is operating properly and retains factory calibration, perform the procedure which follows in an atmosphere free of combustible gases. If the proper indications cannot be obtained, contact the local sales office or return the instrument to Mine Safety Appliances Co., Repair and Customer Services Department, Mars, PA 16046.

1. Open cover and set RANGE switch to 0-5.
2. Set ON/OFF switch to ON. READY indicator should turn on within approximately 4 seconds. BATT indicator pointer should be at least halfway into the white zone.
3. Squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Permit bulb to inflate completely after each squeeze.
4. Lift and adjust 0-5 ZERO control to obtain zero indication on meter. (NOTE: To make zero adjustments, lift and turn the outer sleeve of the ZERO controls.)
5. Set RANGE switch to 0-100. READY indicator should momentarily turn off and then turn on within approximately 4 seconds.
6. Lift and adjust 0-100 ZERO control to obtain zero indication on meter.
7. Connect source of 100% methane to inlet fitting of instrument. Pass gas through instrument and then shut off flow. Meter should indicate at least 95.

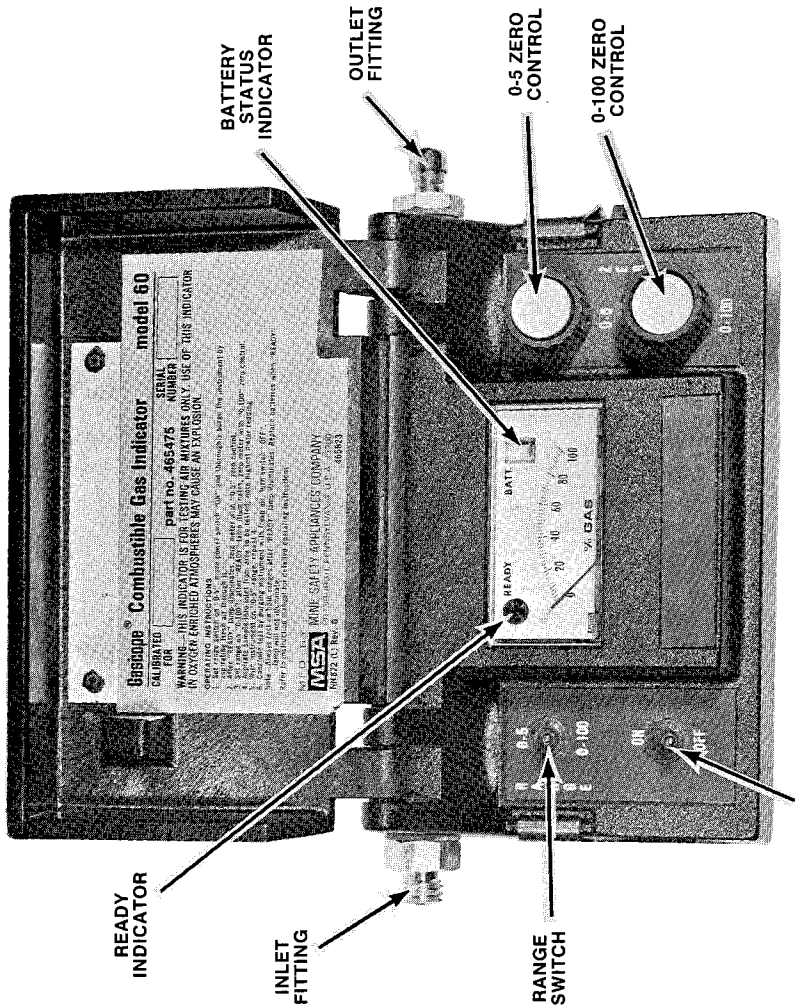

Figure 2-1. Gascope, Combustible Gas Indicator, Location of Controls and Indicators

WARNING

Do not introduce 100% methane gas to an instrument located near a source of ignition; otherwise, an explosion may occur.

8. Repeat step 3 and set RANGE switch to LEL.

9. Connect flow control of Calibration Check Kit, Model R, to Calibration Check Gas Cylinder (2% methane) and connect adapter hose between flow control and inlet fitting of instrument, Figure 5-2.

10. Turn flow control valve counterclockwise to pass gas through instrument. Turn valve clockwise and, when needle stabilizes, meter should indicate 1.9 to 2.1.

11. Disconnect hose from inlet fitting and remove flow control from gas cylinder. Squeeze aspirator bulb eight to 10 times to purge instrument with fresh air.

OPERATING THE GASCOPE (See Figure 2-1.)

To measure the concentration of methane in air, perform the procedure which follows. Leak, flow and calibration checks should be made periodically as described in Sections 4 and 5.

1. Open cover and set RANGE switch to 0-5.

2. Set ON/OFF switch to ON. BATT. indicator should be well into white zone and the READY indicator should turn on within approximately 4 seconds. If it does not turn on, replace batteries by performing procedure under Replacing Batteries in Section 4.

3. Connect rubber tubing of aspirator bulb to outlet fitting of instrument. Squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Permit bulb to inflate completely after each squeeze. NOTE: If the bulb does not inflate within 2 seconds, check the sample flow system as described in Section 4.

4. Lift and adjust 0-5 ZERO control to obtain zero indication on meter. (NOTE: To make zero adjustments, lift and turn the outer sleeve of the ZERO controls.)

5. Set RANGE switch to 0-100.

6. When READY indicator turns on, lift and adjust 0-100 ZERO control to obtain zero indication on meter.

7. In area to be tested, squeeze aspirator bulb seven or eight times to draw sample into instrument. When the needle stabilizes, the meter indicates the concentration of methane in air in percent by volume. (When using a sampling line, squeeze aspirator bulb two additional times for each 10 feet of line. If line trap is connected, squeeze bulb four additional times.)

CAUTION

When sampling over liquids, take care that end of sampling line does not touch surface of liquid. A closed-end probe tube or line trap should be used in this type of test to prevent liquid from being drawn into instrument. Sampling dusty or smokey atmospheres may clog the flow system. If either the speed of response of the instrument decreases or the aspirator bulb does not inflate within 2 seconds, check the flow system as described under Sampling System Checks in Section 4.

8. If meter indicates less than 5, set RANGE switch to 0-5 and draw sample into instrument by squeezing aspirator bulb. When needle stabilizes, meter indicates concentration of methane between 0 and 5 %. One of the following conditions may exist, depending on the deflection of the meter needle:

   - **Explosion hazard not present** - needle moves upscale slowly and comes to rest somewhere onscale (not near 5). Methane concentration below Lower Explosive Limit (LEL). (Methane concentrations less than 5% support combustion, but do not propagate flame on contact with source of ignition.)
   - **Explosion hazard exists** - needle comes to rest near or at 5; methane concentration at LEL
   - **Explosion hazard exists** - needle deflects past 5 and remains offscale when aspirator bulb is squeezed; methane concentration above LEL and exceeds instrument range
   - **Potential explosion hazard exists** - needle deflects rapidly above 5 and then deflects rapidly downscale. Methane concentration above explosive range; however, addition of air to methane/air mixture will create concentration in explosive range.

9. In area free of combustible gases, squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Set ON/OFF switch to OFF or simply close cover.

WARNING

Do not use the instrument on the 0 to 5 % range in oxygen deficient (less than 10 % oxygen) areas; the meter may not indicate the actual methane concentration.

The instrument is not designed to test mixtures of hydrogen, acetylene or other combustible gases, in which the oxygen content exceeds that of normal air (oxygen-enriched atmospheres). The Gascope is unsafe for use in measuring concentrations of acetylene or hydrogen in pure oxygen; however, it can be used to measure hydrogen or acetylene in air mixtures. It is not suitable to test high boiling point hydrocarbons which have vaporized in ovens, and will condense in the instrument flow system at room temperature. In addition, it will not indicate the presence of combustible mists or sprays such as lubricating oil, or dusts such as grain or coal dusts.

Even though the instrument responds to such combustible gases as propane, acetylene and/or gasoline or solvent vapors, it provides accurate measurements of methane only. The indications on both ranges are affected by all combustibles and also may be affected by non-combustibles, due to their thermal conductivity effect.

CAUTION

Do not use the instrument at locations where compounds such as tetraethyl lead or hydraulic fluids or lubricants which contain silanes, silicates or silicones may be present in the atmosphere. These chemicals contaminate the sensor and thus reduce measurement accuracy. If it is suspected that such compounds may be present in the test area, check the calibration of the instrument after making a maximum of five measurements.

When testing atmospheres contaminated with leaded gasoline, replace the standard cotton filter in the inlet of the

instrument with an inhibitor filter; otherwise, the catalytic sensor may become coated with lead after several measurements, causing sensitivity to be lost.

USING OPTIONAL SAMPLING EQUIPMENT

Sampling Lines

Sampling lines permit samples to be taken at remote locations or inaccessible areas to test the atmosphere in such spaces as manholes, sewers and bar holes. The available sampling lines, which range in length from 5 to 50 feet, are made of a synthetic material specially compounded to resist the absorption of combustible vapors.

CAUTION

Do not use sampling lines made of ordinary rubber or any synthetic material which absorbs solvent vapors since the adsorption will result in erroneous indications that are usually lower than the actual value.

The shortest possible length of sampling line should always be used to minimize the number of times the aspirator bulb must be squeezed to obtain a valid indication.

To test the atmosphere at a remote location, position the male coupling of the sampling line at the desired sampling point so that dirt particles do not clog the tube or liquids are not drawn into the instrument. Connect the coupling on the other end of the line to the inlet fitting of the instrument, Figure 2-2. Make sure that the connection is gas-tight. The concentration of the gas at the sampling point can then be measured by performing the procedure under Operating the Gascope.

Probes

Probes permit samples to be taken in areas that cannot be reached with a sampling line. Barholes, manholes and sewers behind obstructions or accessible only through narrow openings can be examined by connecting the probe to a sampling line, Figure 2-2. Three probes are available for use with the Gascope: a four-foot, solid probe rod; a three-foot, hollow-brass probe tube; and a three-foot, dielectric probe tube. The probe rod may be used to prevent liquids from entering the instrument if the open end of a sampling line inadvertently dips into the liquids in tanks or other vessels. (Refer to Table 4-2 in Section 4 for the part numbers of these probes.)

WARNING

Do not use the brass probe where shock hazards exist; that is, where contact may be made with electrical equipment or power lines. The high dielectric, which does not conduct electrical current, should be used in these areas.

Line Trap

The line trap is used primarily to prevent liquids from being inadvertently drawn into the instrument when the atmospheres in tanks, sewers or sumps are sampled. (Refer to the sheet supplied with the line trap for instructions on how to install and use the trap.) See Figure 2-2.

GASCOPE APPLICATIONS

Detecting Petroleum Vapors In Natural Gas

To detect the presence of petroleum vapors in natural gas, perform the following procedure:

1. Set ON/OFF switch to ON and set RANGE switch to 0-100.
2. Aspirate sample into instrument and record meter indication when needle stabilizes. If indication is less than 5, set RANGE switch to 0-5.
3. Remove caps on both ends of activated charcoal filter cartridge and insert cartridge in external cartridge holder, Figure 2-3.
4. Connect cartridge holder to inlet fitting of instrument and, if required, connect sampling line to holder.
5. Aspirate sample into instrument and record meter indication when needle stabilizes. If this indication is less than the indication obtained in step 2, the sample contains petroleum vapors. (The filter absorbs petroleum vapors, but passes natural gas.) If both indications are the same, the sample consists entirely of natural gas.
6. Remove holder from inlet fitting for standard testing.

Leak Testing Bar Holes

The Gascope is especially useful for locating leaks in underground gas pipe lines. A series of bar holes is drilled over the pipe at 10 to 20 foot intervals, or above pipe joints if their locations are known. A systematic test of these holes with the Gascope should quickly identify the hole nearest the leak as the one which contains the highest gas concentration.

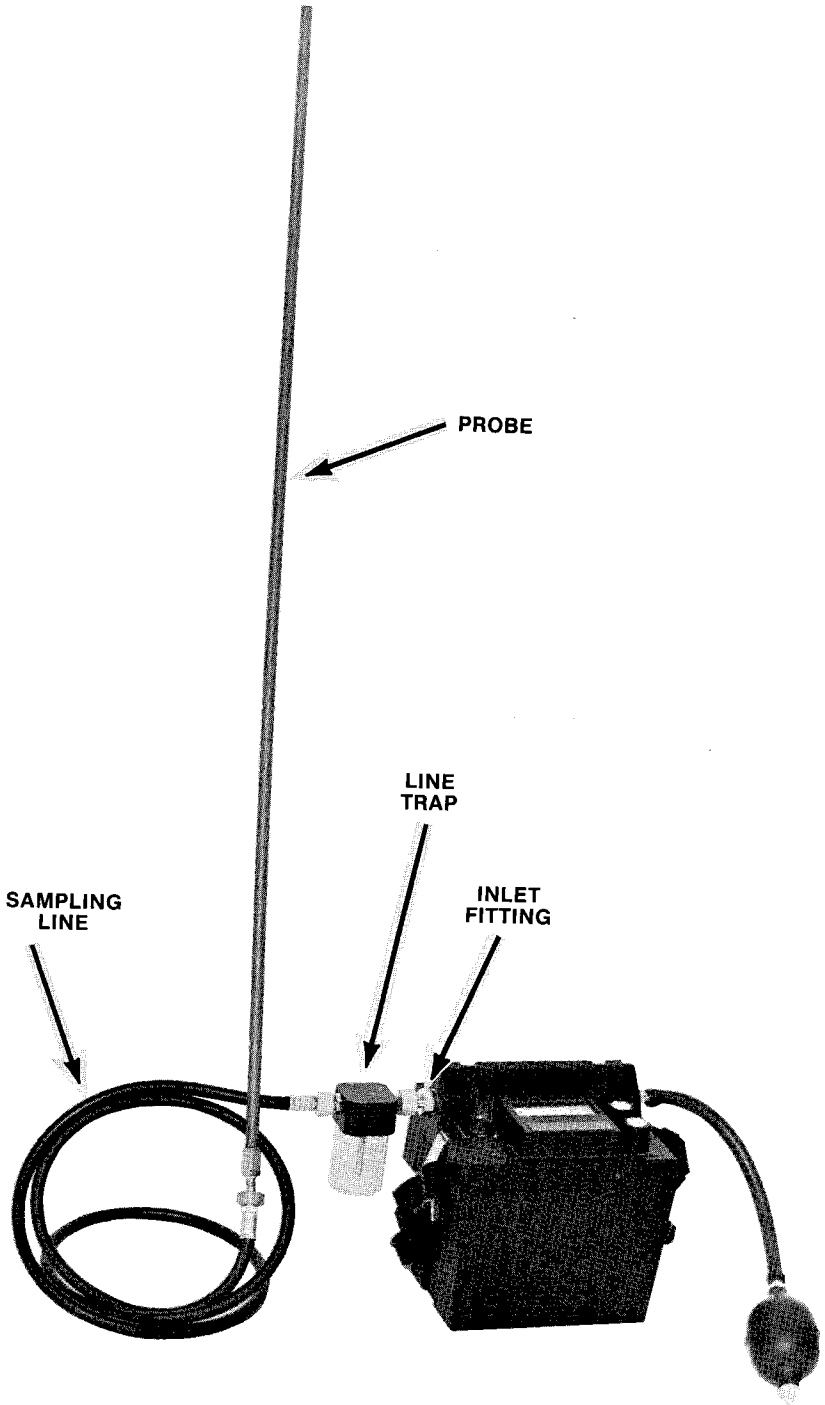

Figure 2-2. Connection of Sampling Probe

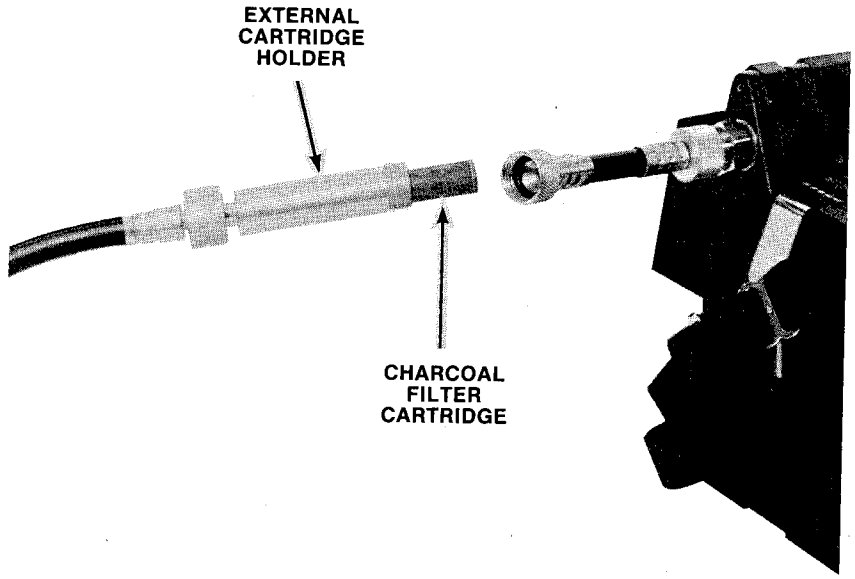

Figure 2-3. Connection of External Cartridge Holder

Pressure Testing Bar Holes

In some locations where bar holes are drilled to locate pipeline leaks, a group of holes which all contain pure gas may be encountered. This condition usually exists near a large leak under solid pavement. The gas pressure is the greatest in the bar hole nearest the leak. The Gascope may be used to locate the position of the leak by utilizing the bar hole pressure. This is accomplished by observing the time required for the pressure to force gas through the sampling line of the instrument. A probe tube equipped with a plug to seal off the bar hole into which it is inserted is required for this test. To pressure test bar holes, perform the following procedure:

1. Aspirate fresh air through instrument and disconnect the aspirator bulb tubing from the outlet fitting. Remove the flow regulating orifice, Figure 4-3.

2. Set RANGE switch to 0-5 and lift and adjust 0-5 ZERO control to obtain zero indication.

3. Insert probe tube bar in hole and seal hole with plug. Observe the time at which this is done. Pressure in the barhole forces gas through the sampling line into the instrument. The flow of gas is indicated by an upscale deflection of the meter needle as the gas reaches the filament well.

4. Determine the time required for the gas to pass through the sampling system. The bar hole which causes the highest flow rate has the greatest pressure and can be presumed to be nearest the leak.

5. When the upscale deflection of the meter needle starts, remove the probe tube from the bar hole, connect the aspirator bulb and flush out the probe line in preparation for the next test.

TESTING LEAD CONTAMINATED ATMOSPHERES

When atmospheres contaminated with leaded gasoline are tested repeatedly with the Gascope, the catalytic sensor may become coated with a solid product of the combustion of lead. To minimize the possibility of a loss in sensitivity resulting from this coating effect, the standard cotton filter in the inlet of the instrument is replaced with an inhibitor filter. Material in this filter reacts with tetraethyl lead vapors to produce a more volatile lead compound.

Before testing in a lead-contaminated atmosphere, remove the inlet fitting of the instrument and the cotton filter in the filter

chamber. Crush the inhibitor filter between the fingers and insert it in the chamber, Figure 2-4. Then replace the inlet fitting and gasket, ensuring that the connection is gas-tight. One inhibitor filter provides protection for eight continuous hours of operation.

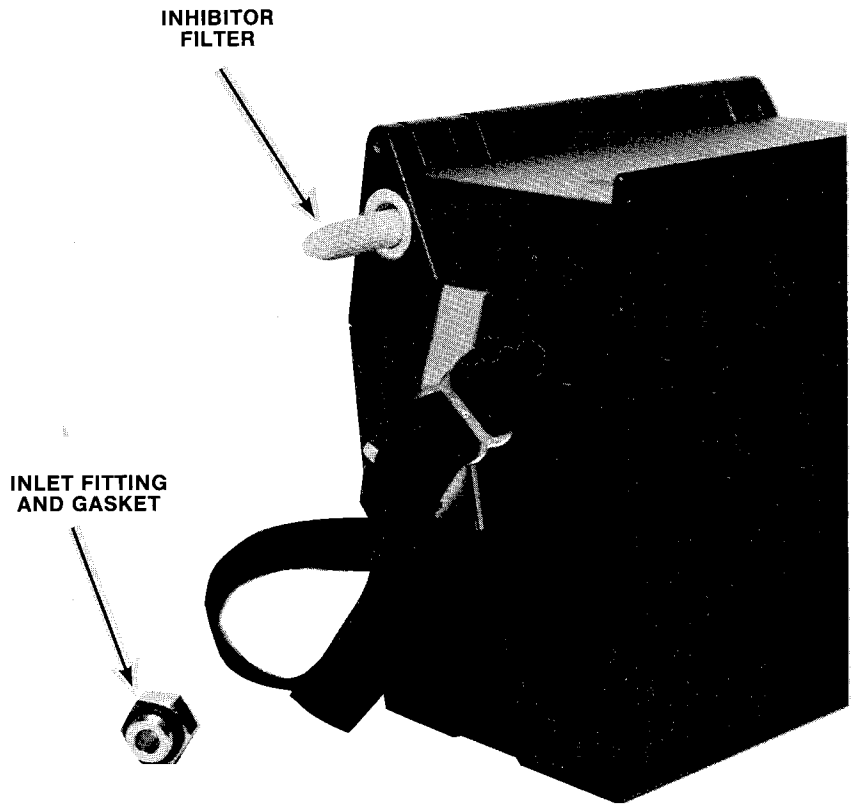

Figure 2-4. Insertion of Inhibitor Filter

SECTION 3
THEORY OF OPERATION

INTRODUCTION
This section contains a summary of the flammable property of methane, a brief discussion on how the Gascope measures high and low concentrations of methane in air and a functional description of the Gascope's flow system and circuitry.

FLAMMABLE PROPERTY OF METHANE
When methane is introduced into an area, fresh air is gradually displaced until the area may be completely filled with the gas. During this process, the air/methane mixture passes through three specific regions: lean, explosive and rich.

Mixtures in the lean region, which extends from fresh air to the lower explosive limit (LEL), contain too little gas in relation to the amount of air to burn; that is, propagation of flame does not occur on contact with a source of ignition. A mixture at the LEL, 5% by volume, is the lowest concentration of methane in air that will explode or burn when ignited. Mixtures in the explosive or flammable region, which extends from the LEL to the upper explosive limit (UEL), will propagate flame. Large volumes of combustible gases or vapors in these concentrations, if ignited, can cause damage and personal injury. A mixture at the UEL (15 %) has the highest concentration of combustible gas in air that will burn. Mixtures in the rich region, which extends from the UEL to 100 % methane, contain too much gas in relation to air to be combustible. However, since the addition of air to these high concentrations of methane creates mixtures in the flammable region, they must be considered equally dangerous.

METHANE CONCENTRATION MEASUREMENTS
Low-Range Operation
The Gascope utilizes the flammable property of methane to measure its concentration in air below the LEL of the mixture. The instrument contains a catalytic platinum filament which comprises one arm of a bridge circuit, Figure 3-1B. This hot wire filament is activated to permit methane to combine with oxygen at a much lower temperature than would be required for normal combustion. In the event that a flammable mixture is drawn into the hot-wire filament well where ignition can occur, the flashback arresters, Figure 3-1A, prevent propagation of flame.

When methane gas in the atmosphere enters the catalytic filament well and makes contact with the catalyst on the surface of the filament, a methane-oxygen reaction occurs which increases the temperature of the filament. This increase in temperature causes a corresponding increase in filament resistance which unbalances the bridge. The resultant bridge signal voltage is read out on the meter as the concentration of methane between 0 and 5 % by volume in air.

High-Range Operation
To measure the concentration of methane in air above 5 %, the Gascope employs a heated thermal conductivity (TC) filament which comprises one arm of a second bridge circuit, Figure 3-1B. This filament, a catalytically inert wire which has a high temperature coefficient of resistance, is specially treated to ensure stable

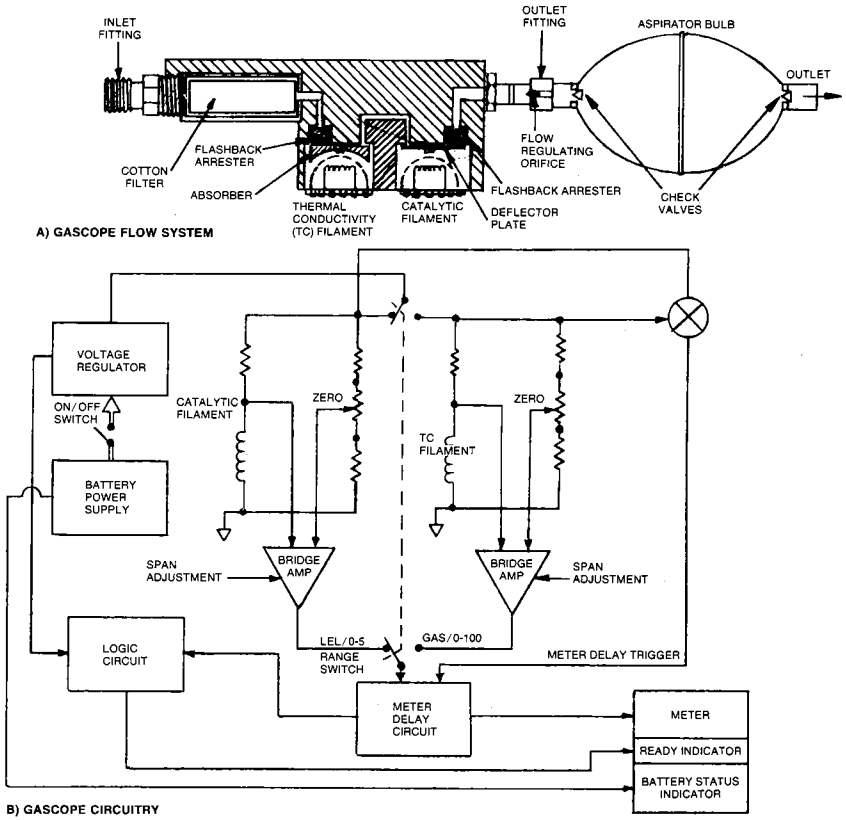

Figure 3-1. Gascope, Combustible Gas Indicator, Functional Block Diagram

measurements. When methane in the atmosphere enters the TC filament well and passes over the filament, it lowers the temperature of the filament. This decrease in temperature causes a corresponding decrease in filament resistance which unbalances the bridge. The resultant bridge signal is read out on the meter as the percentage of methane in the atmosphere between 0 and 100 % by volume.

FUNCTIONAL DESCRIPTION OF OPERATION (See Figure 3-1.)
When the aspirator bulb is squeezed, a sample of the atmosphere being tested is drawn through the cotton filter, into the TC filament and catalytic filament wells and then through the flow regulating orifice in the outlet fitting. The sample enters the TC filament well through a flashback arrester, flows around an absorber and diffuses into the filament area. It then enters the catalytic filament well, strikes a deflector plate and exits through a flashback arrester.

The rubber suction bulb, fitted with double-acting check valves, creates a suction at the outlet to draw the sample through the instrument. The cotton filter prevents large particles of dust and dirt from entering the filament wells. The flow regulating orifice maintains the flow rate of a sample through the instrument between 0.03 and 0.05 cubic feet per minute (0.8 to 1.4 liters per minute).

If the RANGE switch is set to the 0-100 position and the instrument is turned on, the meter and READY indicator circuits are deenergized for approximately 4 seconds to allow the TC filament to warm up and stabilize. Once the stabilization is complete, the READY indicator turns on to signify that the instrument can be used.

If the sample drawn into the TC filament well contains no methane, the bridge remains balanced; the bridge signal is read out on the meter as zero. If the sample contains up to 100 % methane, the amplitude of the bridge signal is proportional to its actual concentration. The resultant signal is read out on the meter as the percentage of methane in the atmosphere by volume.

If the RANGE switch is now set to the 0-5 position, the meter and READY indicator circuits are deenergized for approximately 4 seconds to allow the catalytic filament to warm up and stabilize. After the stabilization period, the READY indicator turns on to signify that the instrument can be used.

If the sample now drawn into the catalytic filament well contains no methane, the bridge remains balanced and the meter indicates zero. If the sample contains up to the LEL of methane (5 %), the amplitude of the bridge signal is proportional to its actual concentration. The resultant signal is read out as the percentage of methane in the atmosphere by volume. If the sample contains more than 5 % methane, the bridge signal is not proportional to the actual concentration. If the sample contains between 5 and 14 % methane, the bridge remains unbalanced and the resultant signal causes the meter needle to deflect and remain offscale. If the concentration exceeds 15 %, the bridge initially becomes unbalanced and the needle deflects offscale. The needle then deflects rapidly downscale because the gas absorbs heat from the filament, increasing its resistance.

The zero adjustments are used to null the bridge signals for both ranges so that the meter indicates zero when air free of combustible gases is drawn into the instrument. The span adjustments are used to set the meter indications on both ranges to a given concentration of methane.

The voltage regulator circuit maintains a constant 0.94 V across the bridges, even as the battery voltage decreases from its nominal value of 1.5 V to 1.1 V. When the battery voltage decreases below 1.1 V, the regulator drops out of regulation. When the drop-out point is reached, the READY indicator turns off to automatically signify the end of battery life. The BATT indicator pointer will either be in or very near the red zone at the end of battery life.

SECTION 4
MAINTENANCE

INTRODUCTION
This section contains information on cleaning the instrument, checking the sampling system, troubleshooting to locate defective components, replacing parts and ordering replacement parts.

PERIODIC MAINTENANCE
Instrument Cleaning
The case of the instrument and the meter face should be cleaned periodically with a soft cloth dampened with water.

CAUTION

Do not use compressed air to purge the instrument because it may contain entrained oil and/or water which may damage internal components.

Sampling System Checks
The sampling system of the Gascope should be checked on a regular basis to verify that no leaks are present and the sample flow rate is proper.

LEAK CHECKS. To check for leaks in the sampling system, seal the inlet fitting with a finger of the left hand and squeeze the aspirator bulb. Then immediately seal the outlet of the aspirator bulb with a finger of the right hand. If the bulb remains deflated while the inlet fitting and the bulb outlet are sealed, the system is free of leaks. If it inflates, a filament seal, the aspirator bulb or gasket on the inlet or outlet fitting of the instrument is leaking. Check the filament seals first by opening the case and tightening both filaments, Figure 4-1. Repeat the leak check described above; if the bulb still inflates, then check the gaskets and bulb. To check the aspirator bulb for leakage, seal the inlet fitting with a finger and squeeze the bulb. If the bulb inflates in less than 6 seconds, obtain a replacement bulb.

FLOW RATE CHECKS. A sample should flow through the instrument at 0.03 to 0.05 cubic feet per minute (0.8 to 1.4 liters per minute). To check that the flow rate is proper (after checking for leaks), perform the following procedure:

1. Squeeze aspirator bulb without sealing inlet fitting or bulb outlet and observe that bulb inflates completely in 1 to 2 seconds.

2. If it does not, replace cotton filter by removing inlet fitting and gasket and removing filter, Figure 4-2, using tweezers.

3. Disconnect aspirator bulb tubing from outlet fitting and remove flow regulating orifice, Figure 4-3, from fitting to verify that it is open. If it is clogged, insert a No. 23 gauge (0.0225 in. diameter) wire through the opening.

4. Reconnect aspirator bulb and repeat step 1.

5. If bulb still does not inflate within 2 seconds, perform procedure under Replacing Flashback Arresters. If bulb does not now inflate within 2 seconds, return instrument to MSA.

TROUBLESHOOTING
Table 4-1 lists the symptoms of the most common problems which may occur with their probable cause(s) and the action required to correct each problem. The troubleshooting guidelines in the

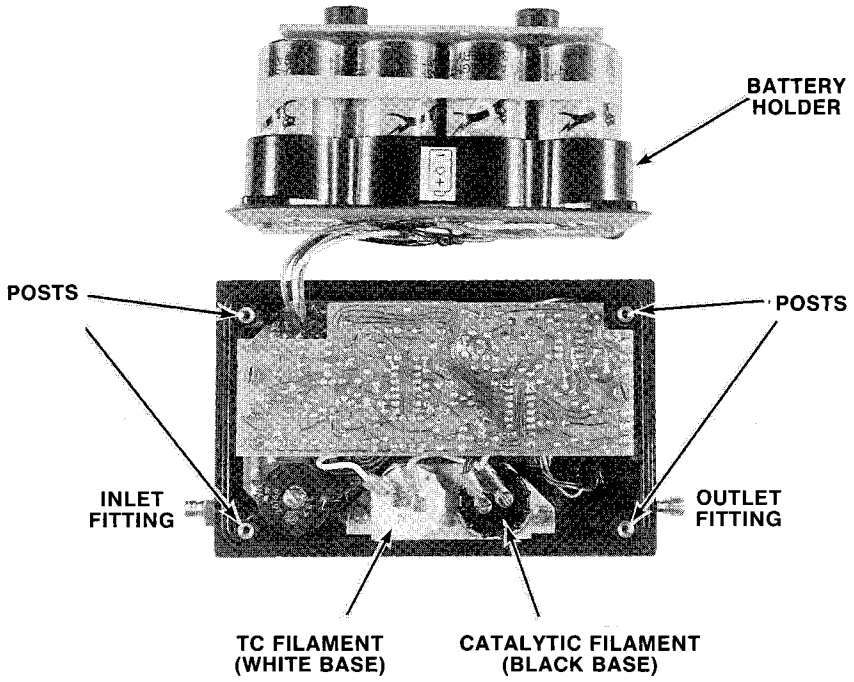

Figure 4-1. Location of Filaments

Table 4-1. Troubleshooting Guidelines

Symptom	Probable Cause	Corrective Action
NOTE: Perform troubleshooting in an area free of combustible gases.		
Needle deflects beyond upper end of scale when ON/OFF switch is set to ON with RANGE switch in 0-5. Meter cannot be zeroed with ZERO control. READY indicator turns on.	1) Connection to catalytic (black base) filament may be loose or 2) filament may be open.	1) Tighten screws securing filament wires to black base (see Figure 4-1) or 2) replace filament by performing procedure under Replacing Catalytic Filament.
Needle deflects below zero and cannot be adjusted with ZERO control with RANGE switch set to 0-5. READY indicator does not turn on.	Catalytic filament terminals may be short circuited.	Remove short circuit between terminals (see Figure 4-1).
Needle deflects below zero when ON/OFF switch is set to ON with RANGE switch in 0-100. Meter cannot be zeroed with ZERO control. READY indicator turns on.	1) Connection to TC (white base) filament may be loose or 2) filament may be open.	1) Tighten screws securing filament wires to black base (see Figure 4-1) or 2) replace filament by performing procedure under Replacing TC Filaments.
Needle deflects beyond upper end of scale when ON/OFF switch is set to ON with RANGE switch in 0-100. Meter cannot be zeroed with ZERO control. READY indicator does not turn on.	TC filament terminals may be short circuited.	Remove short circuit between terminals (See Figure 4-1).
Needle deflects away from zero when RANGE switch is set to 0-100 with ON/OFF switch set to ON. READY indicator does not turn on. (BATT indicator pointer in or very near red zone.)	Power supply voltage too low. (Note BATT. status indication.)	Replace batteries by performing procedure under Replacing Batteries.
READY indicator does not turn on when ON/OFF switch is set to ON.	1) Battery contacts loose, 2) power supply voltage too low or 3) circuit malfunction.	1) Tighten nuts, Figure 4-6, on hex battery posts; 2) replace batteries by performing procedure under Replacing Batteries or 3) return instrument to MSA.
Needle deflects upscale more than one division when fresh air is aspirated through instrument with RANGE switch set to 0-5.	1) Cotton filter clogged or 2) flashback arresters clogged.	Check sample flow rate by performing procedure under Flow Rate Check. 1) Replace cotton filter. 2) If necessary, replace flashback arresters by performing procedure under Replacing Flashback Arresters.
Aspirator bulb must be squeezed more than specified number of times to obtain stable meter indication.	Leak may be present in sample flow system. 1) Cotton filter may be plugged, 2) flow regulating orifice may be clogged or 3) flashback arresters may be clogged.	Check sample flow system for leaks by performing procedure under Flow Rate Checks. If necessary, 1) replace cotton filter, 2) open orifice, Figure 4-3, using No. 23 gauge wire or 3) replace arresters by performing procedure under Replacing Flashback Arresters.

Table should be used if the Gascope cannot be calibrated with the procedure in Section 5 or if the instrument cannot be operated properly. If the problem cannot be located or corrected using thise guidelines, contact the local sales office or return the instrument to Mine Safety Appliances Co., Repair and Customer Service Department, Walden Road, Mars, PA 16046. An understanding of the Theory of Operation in Section 3 is very helpful in troubleshooting the Gascope. Procedures for replacing flashback arresters, filaments and batteries are given under CORRECTIVE MAINTENANCE; replacement parts are listed in Table 4-2. Note that troubleshooting should be performed in an area known to be free of combustible gases.

CORRECTIVE MAINTENANCE

When a defective or inoperative part is located by following the troubleshooting guidelines included in Table 4-1, it must be replaced according to one of the procedures which follow. Refer

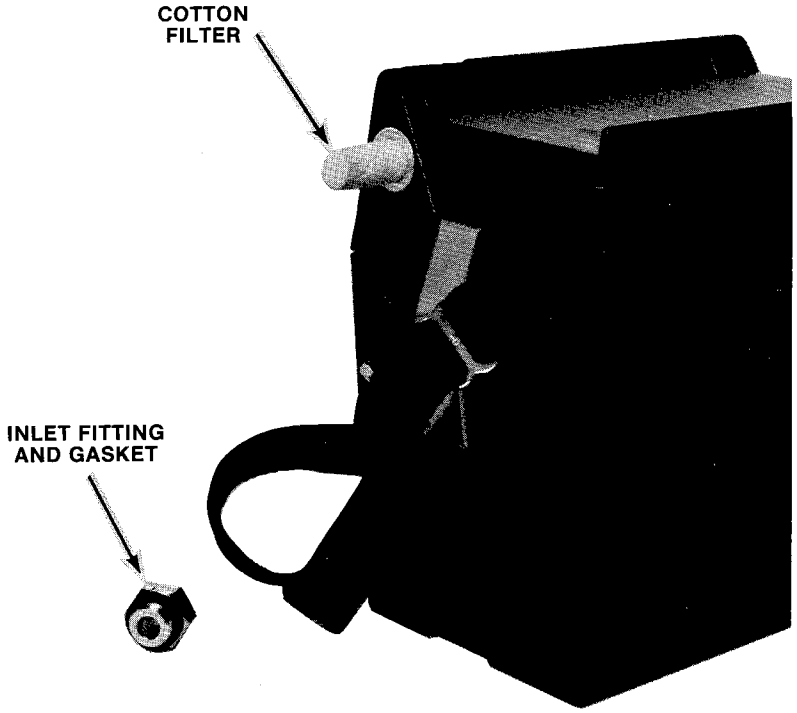

Figure 4-2. Replacement of Cotton Filter

to ORDERING PARTS for information on how to obtain replacement parts.

Replacing Catalytic Filament

To replace the catalytic filament, perform the following procedure:

1. Lift cover and loosen clasps securing top and bottom sections of case together. Close cover.

2. Invert instrument and place it on its cover. Turn instrument so that inlet and outlet fittings are positioned as shown in Figure 4-1. Lift off bottom section of case.

3. Remove four screws and lockwashers securing battery holder to posts, Figure 4-1. Lift off battery holder and place it on its side as shown.

4. Remove two screws securing lugs on filament wires to black base, Figure 4-1.

5. Remove filament by turning black base counterclockwise until it is free of well.

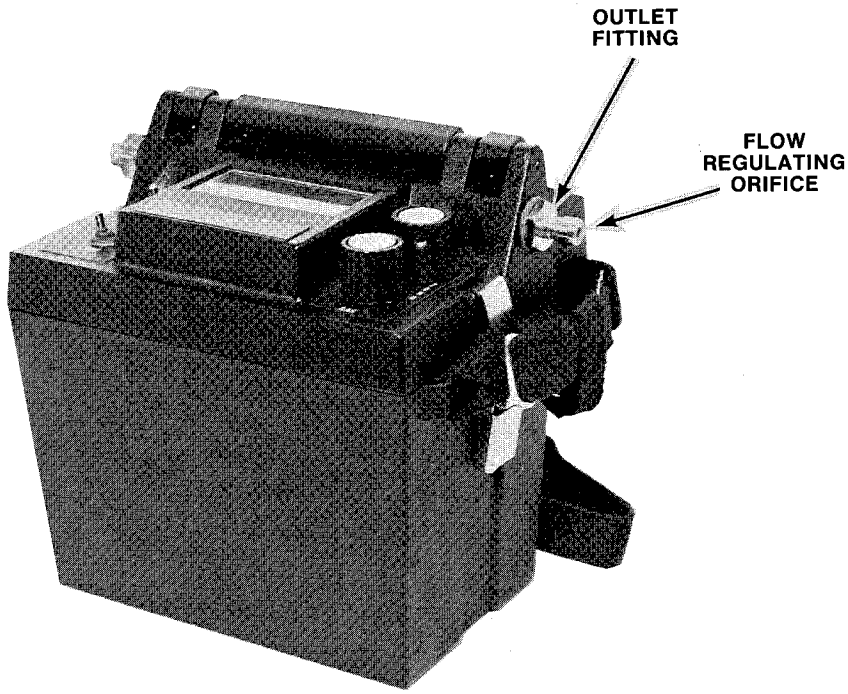

Figure 4-3. Removal of Flow Regulating Orifice

6. Insert replacement filament having black base in well. Tighten filament in well by turning base clockwise so that its gasket is firmly seated against block.

7. Verify that seal around base does not leak by sealing the inlet fitting with finger of left hand, squeezing aspirator bulb and immediately sealing bulb outlet with finger of right hand. If bulb inflates, check filament gasket and re-tighten filament.

8. Secure lugs on filament wires to base using two screws.

9. Mount battery holder on posts and secure it using four screws and lockwashers.

10. Calibrate instrument by performing procedure in Section 5.

Replacing TC Filament

To replace the thermal conductivity (TC) filament, perform the procedure under Replacing Catalytic Filament, making sure to remove only the filament having the **white** base.

Replacing Flashback Arresters

To replace the flashback arrester in the catalytic and thermal conductivity (TC) wells, perform the following procedure:

1. Lift cover and loosen clasps securing top and bottom sections of case together. Close cover.

2. Invert instrument and place it on its cover. Lift off bottom section of case. Turn instrument so that inlet and outlet fittings are positioned as shown in Figure 4-1.

3. Remove four screws and lockwashers securing battery holder to posts, Figure 4-1. Lift off battery holder and place it on its side as shown.

4. Remove two screws securing lugs on filament wires to white base, Figure 4-1.

5. Remove two screws securing lugs on filament wires to black base, Figure 4-1.

6. Remove filament having white base by turning base counterclockwise until it is free of well.

7. Remove filament having black base by turning base counterclockwise until it is free of well.

8. Loosen screw securing absorber (bowl-shaped part) in TC filament well, Figure 4-4, and remove absorber and screw.

9. Remove flashback arrester, Figure 4-5, by grasping pin using long-nose pliers and pulling arrester out of sleeve.

10. Insert replacement arrester in sleeve.

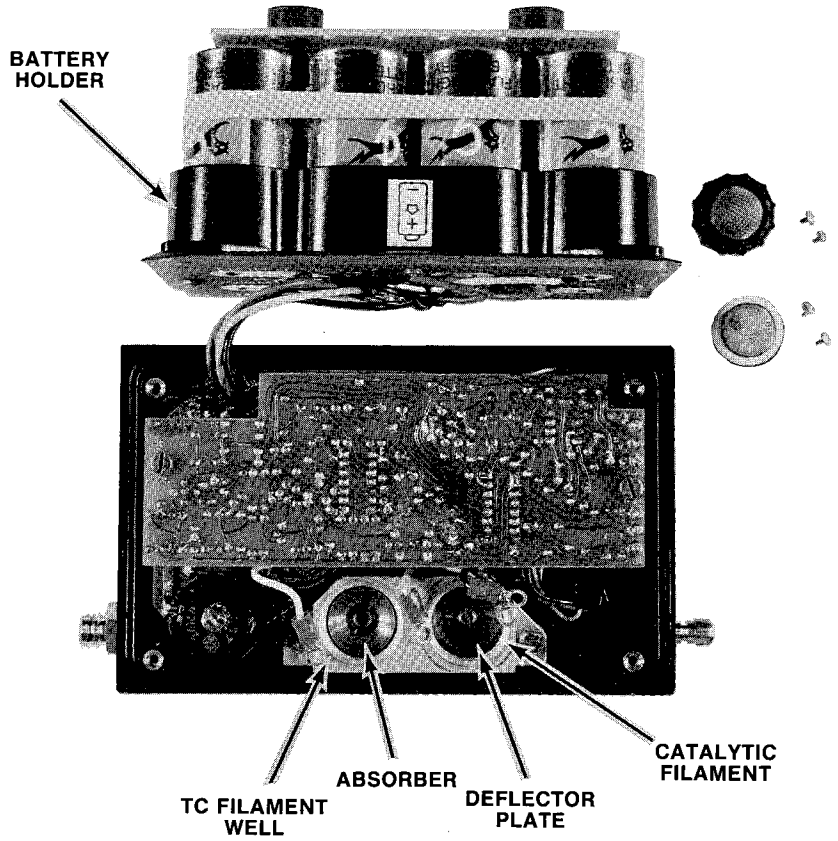

Figure 4-4. Location of Parts in Filament Wells

WARNING

The flashback arresters must be installed in the instrument to prevent the possibility of flame propagation from the filament wells. Do not attempt to reuse a flashback arrester because it will not fit properly in the sleeve and thus may not adequately prevent flame propagation. Install the arrester so that it fits snugly in the sleeve.

11. Place absorber and screw in well and secure it by tightening screw.

12. Loosen screw securing deflector plate (disc-shaped part) in catalytic filament well, Figure 4-4, and remove deflector and screw.

13. Repeat steps 9 and 10.

14. Align spacer, Figure 4-5, over center hole and place deflector in well. Insert screw through hole in deflector and spacer. Secure deflector by tightening screws.

15. Insert filament having black base in well nearest outlet fitting. Tighten filament by turning base clockwise so that its gasket is firmly seated against block. See Figure 4-1.

16. Insert filament having white base in remaining well. Tighten filament by turning base clockwise so that its gasket is firmly seated against block.

17. Verify that seal around both bases does not leak by sealing the inlet fitting with finger of left hand, squeezing aspirator bulb and immediately sealing bulb outlet with finger of right hand. If bulb inflates, check filament gaskets and retighten filaments. Perform procedure under FLOW RATE CHECKS.

18. Secure lugs on white and orange wires to white base and lugs on black and orange wires to black base using four screws.

19. Mount battery holder on posts and secure it using four screws and lockwashers.

20. Place bottom section of case on instrument so that its thumbscrews, Figure 4-2, are positioned away from inlet and outlet fittings.

21. Open cover and clasp top and bottom sections of case together.

22. Perform calibration procedure in Section 5.

Replacing Batteries

To replace the cells in the battery holder, perform the following procedure:

1. Lift cover and loosen clasps securing top and bottom sections of case together. Close cover.

2. Invert instrument and place it on its cover. Lift off bottom section of case.

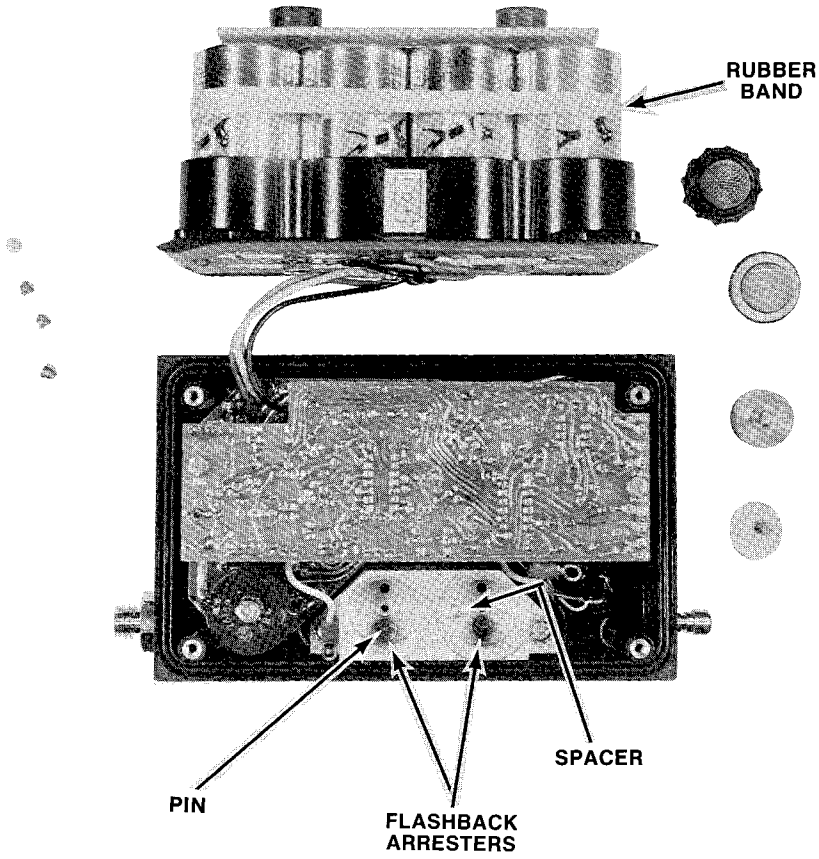

Figure 4-5. Location of Flashback Arresters

3. Remove rubber band, Figure 4-5.

4. Remove two nuts, Figure 4-6, and lift off contact plate.

5. Remove all batteries from holder and replace them with eight fresh Eveready 950 or equivalent. Install batteries with positive (+) pole down.

6. Replace contact plate and secure it to support posts using two nuts. NOTE: Firmly tighten nuts to make a good electrical contact between the plate and the negative (−) poles of the batteries.

7. Place rubber band around batteries.

8. Place bottom section of case on instrument so that thumbscrews, Figure 4-2, are positioned away from inlet and outlet fittings.

9. Open cover and clasp top and bottom sections of case together.

ORDERING PARTS

The Gascope and its associated parts and equipment are listed in Table 4-2 with their MSA part numbers. To obtain parts, service or information, contact the local MSA sales office, Mine Safety Appliances Co., Instrument Division, P.O. Box 427, Pittsburgh, PA 15230, or call our toll-free number: 1-800-MSA-2222.

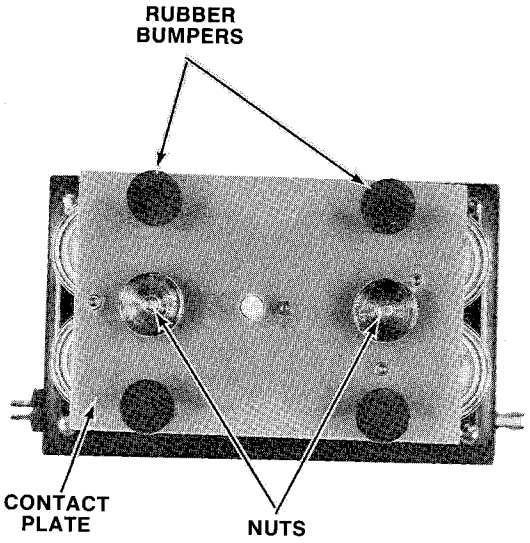

Figure 4-6. Removal of Batteries

Table 4-2. Parts List

Component/Assembly	MSA Part Number
Rubber band	66474
Line trap (for use with special sampling lines)	468428
5 ft sampling line (complete w/couplings)	11354
10 ft sampling line (complete w/couplings)	11955
15 ft sampling line (complete w/couplings)	11912
25 ft sampling line (complete w/couplings)	11913
35 ft sampling line (complete w/couplings)	11957
50 ft sampling line (complete w/couplings)	11958
4 ft solid probe tube	11960
3 ft hollow brass probe tube	11961
4 ft plastic probe tube	73743
Catalytic filament (black base)	11355
Thermal conductivity filament (white base)	74730
Flashback arrester	15264
Detector Block Assembly (includes flashback arrester Part No. 15264)	803761
Batteries, Eveready 950 or equivalent (eight "D" cells required)	30052
External cartridge holder	14273
Charcoal filters, pkg. of six (required for detecting petroleum vapors in natural gas)	14318
Inhibitor filters, pkg. of six (for measurements in lead contaminated atmospheres)	47740
Cotton filters, pkg. of six	16499
Line trap (for use with MSA sampling lines	74814
Aspirator bulb (complete w/check valves)	16839
Calibration Check Kit, Model R	
Flow control (1.5 Lpm)	459948
Adapter hose	449482
Calibration check gas cylinder (2% methane)	459945
Calibration check gas cylinder (2.5% methane)	459942
Instruction manual	466520

SECTION 5
CALIBRATION

INTRODUCTION

This section contains a detailed procedure for calibrating the Gascope. Read the entire procedure which applies before making any adjustments. Note that the instrument is factory calibrated on methane or natural gas.

CALIBRATION PROCEDURE

The Gascope should be calibrated periodically by performing the procedure which follows in an atmosphere free of combustible gases. This procedure should also be used if either the catalytic or thermal conductivity filament has been replaced. If the instrument cannot be calibrated with this procedure, refer to TROUBLESHOOTING in Section 4.

1. Open cover and loosen clasps securing top and bottom sections of case.

2. Remove bottom section of case and place instrument on rubber bumpers, Figure 5-1, so that meter can be read.

3. Set RANGE switch to 0-5 and ON/OFF switch to ON. Needle should come to rest near 0 and READY indicator should turn on. If indicator does not turn on, refer to Table 4-1 in Section 4.

4. Squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Permit bulb to inflate completely after each squeeze.

5. Lift and adjust 0-5 ZERO control to obtain zero indication on meter.

6. Connect flow control of Calibration Check Kit, Model R, to Calibration Check Gas Cylinder (2 % methane) and connect adapter hose between flow control and inlet fitting of instrument, Figure 5-2.

7. Turn flow control valve counterclockwise. When needle stabilizes, meter should indicate 2. If it does not, turn LEL span adjustment, Figure 5-1, to obtain 2 on meter. If 2 cannot be obtained by turning LEL span adjustment, perform procedure under Replacing Catalytic Filament in Section 4 and then repeat this procedure. Turn valve clockwise.

8. Disconnect adapter hose from inlet fitting.

9. Squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Meter should indicate 0. If it does not, lift and adjust 0-5 ZERO control to obtain zero indication on meter; then connect adapter hose to inlet fitting and repeat steps 7 and 8. Remove flow control from gas cylinder.

10. Set RANGE switch to 0-100 and, when READY indicator turns on, lift and adjust 0-100 ZERO control to obtain zero indication on meter.

11. Connect source of 100 % methane to inlet fitting. Pass gas through instrument and then shut off flow. Meter should indicate 100. If it does not, turn GAS span adjustment,

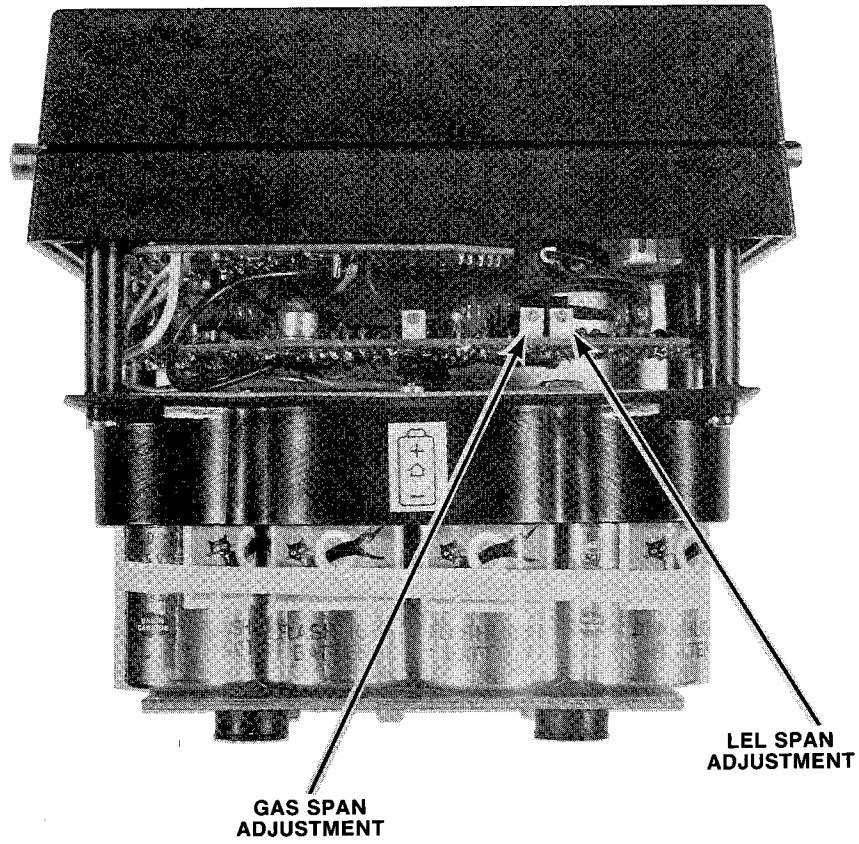

Figure 5-1. Location of Span Adjustments

Figure 5-1, to obtain 100 on meter. If 100 cannot be obtained by turning GAS span adjustment, refer to Replacing TC Filament in Section 4 and then repeat this procedure.

WARNING

Do not introduce 100 % methane gas to an instrument located near a source of ignition; otherwise, an explosion may occur.

12. Disconnect source of methane and squeeze aspirator bulb eight to 10 times to purge instrument with fresh air. Meter should indicate 0. If it does not, adjust 0-100 ZERO control to obtain zero indication on meter; then repeat steps 11 and 12.

13. Place instrument in bottom section of case and clasp top and bottom sections together. Close cover.

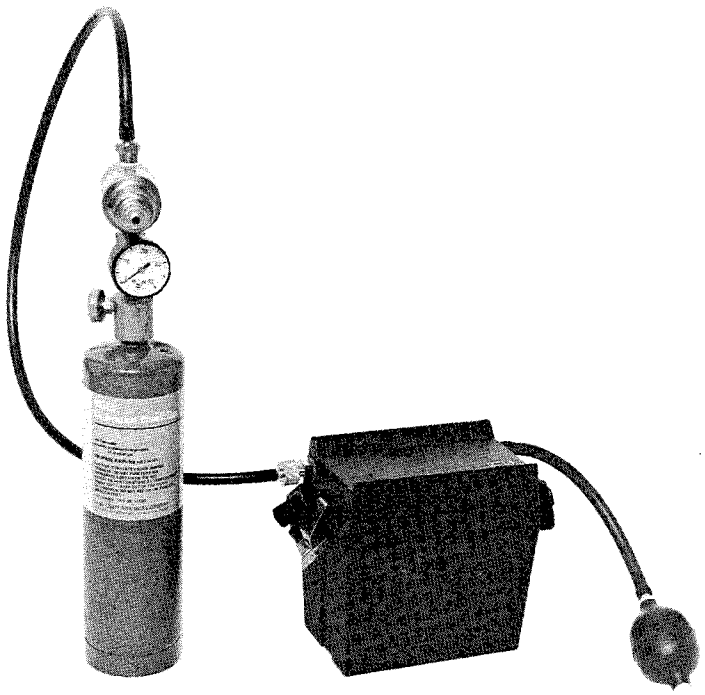

Figure 5-2. Connection of Calibration Equipment