Dielectric Technologies

Model MGD-2002

Dielectric Technologies
154 Portland Road
Bridgton Commerce Center
Bridgton, ME 04009
(877) 247-3797 • (207) 647-9495

Service Information

Should you need to contact us please call our Customer Service Department on (207) 647-9495 or toll free at (877) 247-3797 with the appropriate extension given below.

When returning a unit for factory service or calibration, call the customer service department for a material return authorization number (MRA). The device should be boxed securely and contain contact information, contact telephone number, billing information, and return shipping information. If the device is being sent to the factory for service, a written statement of the problem or symptoms should be included. The MRA number must be on the outside of the package or indicated on the shipping label.

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Preparation

Upon delivery

1) Open the shipping package and inspect the MGD-2002 for any physical damage that may have been caused during shipping. Keep the packing material in case you ever need to return the device to Dielectric.

NOTE: The Manufacturer's warranty does not cover damage caused in transit. You must notify your carrier immediately for any damage claims.

2) Position the device face down to open the battery compartment door. Remove the battery to expose the device information placard. Write the unit serial number on the warranty information card.

3) Connect the battery plug to the main logic board. Close the battery compartment door and secure with the quarter turn fastener.

4) First, plug the universal power supply into a convenient AC wall outlet then plug the other end into the device.

NOTE: To ensure optimum battery working life, charge battery for 2 hours before operating the multi- gas detector for the first time. *See page 9 for battery charging instructions*

5) Complete the warranty information card supplied with the instrument, and return it for your warranty registration.

6) Check the moisture cartridge filter and ensure it is blue in color. Refer to page 25 for filter changing instructions.

7) Before switching the device on, connect either the needle probe or ground probe to the probe assembly and then connect the probe assembly to the detector.

Specifications

Dimensions:	(LxWxD)	33.7cm x 12.3cm x 8.3cm (13.3in x 4.9in x 3.3in)
Weight:	(MGD-2002 only)	1400 grams (3.1 lbs)
	(Shipping)	6800 grams (15.0 lbs)
Temperature Range :		-10°C to +45°C (+14°F to +113°F)
Humidity Range :		20% RH to 50% RH
Sensitivity:	(Min)	25 PPM
	(Max)	1,000,000PPM (100%)
	(Increment)	25 PPM up to 20,000 PPM .1% from 2% to 100%
Tracer gasses :		Hydrogen (H) / Helium (He)
Resolution:	(Low range)	+/- 25 PPM
	(High Range)	+/- 0.2 %
Response Time:		5 Seconds (approx.)
Audio Out :		Pulse Width Modulation
LCD:		128 Bit X 64 Bit Dot Matrix With long-life backlight
Processor:	(Type)	Infineon (16 Bit)
	(Speed)	20 MHZ
	(ROM)	512 KBytes
Battery:	(Voltage)	7.2 VDC
	(Type)	Nickel Metal Hydride
	(Weight)	383.0 grams
	(Run Time)	6-8 Hours Continuous
	(Charging Cycles)	300 - 500
	(Charging Volts)	9.5 - 14 VDC @ 2A
Power Supply: (Charger)	(AC Input)	100-240V, 1.6A, 60/50Hz
	(DC Output)	12V, 4.0A

User safety warnings

IMPORTANT: Before operating the device for the first time, read all of the following safety guidelines. To prevent personal injury, property damage, or damage to the detector, operate it only in accordance with these safety guidelines. .

- Do not operate the device if it has been damaged. Contact Dielectric for advice.

- Do not allow any part of this device to come in contact with an energized high voltage source. Injury or death may result

- Do not disassemble the device as it will void your warranty. Repairs should only be performed by qualified factory service personnel.

- Do not draw water into the helium detector. Water will not only adversely affect the device's operation, but may cause internal damage. Water found inside the unit will also void your warranty.

- Take sensible precautions to prevent the ingress of moisture when using the detector in rain, snow or other adverse conditions. Although the detector is water resistant, it is not waterproof. Do not allow water to accumulate on the detector faceplate, as it could migrate into the electronics.

- Do not use the probe tip to dig in the soil, or use it in any manner other than as directed in this manual.

- Although this device will operate with a low battery voltage, do not operate the detector when the battery indicator displays 1/4 battery or less. False readings may occur when operated under this condition. Refer to pages 9 and 10 for instructions on how to recharge or replace the battery.

- When charging: This unit should be in an indoor dry location.

Gas concentration levels

The Occupational Safety and Health Administration (OSHA) states that the lower explosive limit for hydrogen (H_2) gas is less than 5%. The lower explosive limit for a gas is the lowest concentration of gas that will explode when mixed with air. Any concentration above this level, whether intentionally mixed or accidentally trapped in a confined space, is highly explosive and unstable.

Since the MGD-2002 is capable of detecting both hydrogen and helium gas, we recommend that if you use hydrogen gas, mix the remaining 96% with helium gas for 100% usability and added safety.

Cylinders containing ready mixed hydrogen/helium gas in the correct proportions can be purchased from specialist gas suppliers.

1. Assembling the MGD-2002

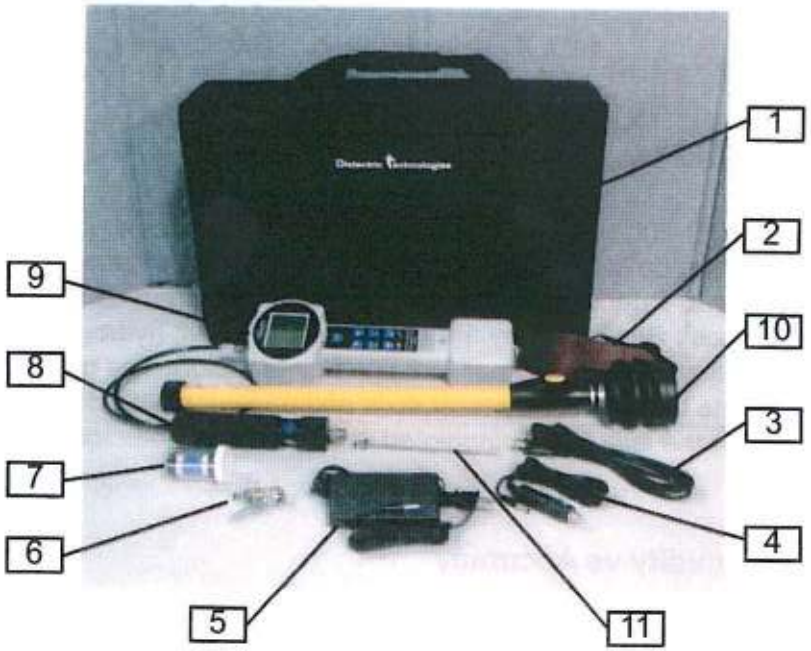
When assembling the device refer to the illustration on opposite page.

1. Clip the sampling tube quick-release connector of the sampling handle (8) onto the chrome connector on the MGD-2002 gas detector.

2. Unscrew the knurled adaptor from the sampling handle and screw the sampling handle into the extendable ground probe (10). Do not overtighten.

3. To extend the ground probe, press the lock button on the sample probe and with it pressed, gently pull on the sample collection cup. When the sample probe is at the required length, release the lock button, ensuring it engages in a locking hole.

4. To dismantle the handle from the detector, press the quick-release catch on the connector.



List of kit contents

1. Carry case
2. Sholder strap
3. European battery charger lead
4. 12VDC Auto Adaptor charger
5. 100-240 VAC universal AC charger with North American power cord
6. Filter moisture clearing adapter
7. Spare moisture filter cartridge
8. Sampling handle
9. MGD-2002 gas detector
10. Ground probe / Collection cup
11. Needle probe

2. Operation

2.1 Overview

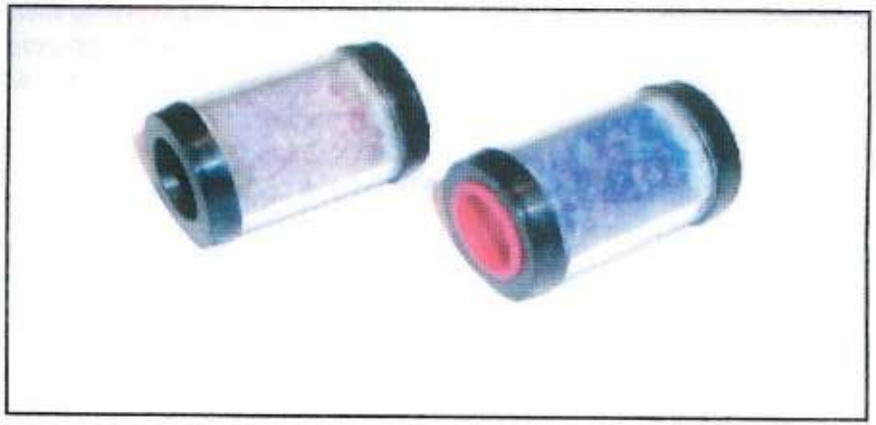
The MGD-2002 gas detector is a portable leak-locating and pinpointing device that can be used in a multitude of pressurized systems to detect both hydrogen and helium when used as a tracer gas . Because they are both lighter than air, hydrogen and helium penetrate small leakage points rapidly. The gasses permeate through the densest soils and pavements quickly enabling the leak to be pinpointed easily with the detector.

2.2 Humidity vs Accuracy

The MGD will function correctly at high relative humidity (RH) levels of 50% or greater, but its accuracy and sensitivity may be reduced.

2.3 Moisture filter

The replaceable moisture cartridge filter removes almost 100% of the moisture from the sample and is designed to enable users to quickly asses the filter daily life-span by visual inspection. A new dry cartridge will be bright blue in color, and is shown in figure 1 on page 8. The moisture cartridge will turn pink as it removes moisture from the air (Figure 1 on page 8). As it changes color, the filter cartridge is still within its useful life, but will degrade further to a clear white color if continually used in high humidity conditions or if water is present. To maintain optimum filter performance we recommend that you change it or clear it of moisture when the color changes to light pink.



Spent Cartridge Dry Cartridge

Figure 1

The useful life of the filter depends upon the relative humidity (%RH) of the working environment. For example, on an average dry day, the %RH is roughly 20%, and in this case the filter should last between 4-6 hours. If the relative humidity increases to 50% RH, the single cartridge might last only 2-3 hours. If the humidity increases to between 50-90% RH, the filter may only last one hour.

With the MGD-2002 field replaceable system, filters can be changed within seconds, or cleared and reused within minutes. Refer to page 25 for instructions on how to change the filter.

The internal filtration material has a limited useful life, and Dielectric strongly recommends that the MGD is returned for calibration at least once a year. During factory recalibration, the moisture cartridges are cleared, and the other filters have their filtration media changed. Refer to page 26 for a list of all the value-added benefits that are included in a factory recalibration.

2.4 Power supplies

The MGD-2002 is powered by a replaceable, rechargeable nickel metal hydride (NiMh) battery and comes supplied with a universal AC/DC adapter, AC charging lead, and 12 volt DC charging lead for use with a vehicle cigarette lighter socket.

When Charging: This unit should be in an indoor dry location.

2.5 Charging the battery

Note: It is not possible to use the MGD-2002 during battery charging as the detection capability is automatically. disabled when the battery charger is plugged in.

The battery is equipped with a temperature sensing element to ensure the battery will not overheat during the charging cycle. If the ambient temperature is too high, battery charging may shut off prematurely. Ensure that the MGD-2002 is charged away from any heat sources.

2.5.1 Charging the battery using the universal power supply.

1. Plug the AC charging lead into the AC/DC adapter and plug the other end into a standard power outlet

2. Plug the DC adapter lead into the charging connector located on the right hand side of the MGD-2002

Note: When the charger is plugged into the MGD-2002 the LCD will illuminate and display the battery recharging symbol.

Once charging is complete the symbol will change back to a plug

2.5.2 Charging the battery from a 12VDC auto adapter

1. Plug the auto adapter into the vehicle cigarette light socket

2. Plug the output jack into the charging connector located on the right hand side of the MGD-2002.

2.6 Replacing the MGD-2002 battery

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Warning.

Do not mutilate, puncture, or dispose of batteries by placing them in a fire. The batteries can burst or explode, releasing hazardous chemicals.Discard used batteries in accordance with the battery manufacturer's instructions and your local regulations.

1. Lay the device face down on a flat surface and, using a flat headed screwdriver, turn the battery cover retaining screw 1/4 of a turn counterclockwise and remove the battery-housing-cover

2. Lift out the battery and gently pull up the battery connector lead.

3. Before installing the new battery, attach the three pin connector to the circuit board ensuring it is connected in the correct orientation. Ensure that the battery is fitted in the correct position and that it lies flat in the housing.

4. Install the battery cover taking care to avoid pinching the wires. Tighten the retaining screw 1/4 turn clockwise.

2.7 Button functions and operation

The MGD-2002 features membrane buttons, and has a large multi-function liquid crystal display (LCD). Each button has a raised embossed edge that is designed to be felt by a user even when wearing protective gloves. When they are pressed, the buttons make a noticable "click" that is both felt and heard. The following is a description of each key on the MGD:

CONTROL — BUTTON DESCRIPTION

(I/O) ON/OFF

The ON/OFF button supplies power to the device. Once switched on, the device will initialize, then conduct a 60 second power on self test (POST).

BACKLIGHT

The light button is used to switch the LCD backlight on and off. By default the LCD backlight is turned off to conserve battery life. When the button is pressed, the back-light will illuminate and will remain on until the button is pressed again, or the unit is turned off.

SOUND

The sound button is used to switch the audio output of the internal speaker on and off, allowing the operator to listen for the detection of the tracer gas and not have to watch the display. By default the audio output is turned off.

PUMP SPEED

Allows manual selection of various pump speeds to increase accuracy of the sample reading in situations with very small leaks. At slower speeds the unit draws in less ambient air with the sample.

RESET

The Reset button allows the unit to remain powered up while clearing all the internal logic circuitry. When the button is pressed, the device goes through its zeroing routine to determine a new baseline for future samples. Using this button to reset the device is preferred to turning the device off and back on as it maintains power to the sensing elements, thus maintaining sensor stability. Only press this button in a zero tracer gas environment.

A/M

The Mode button controls what is being displayed on the LCD. By default the unit is set to automatic mode (A) and will constantly show what the sensing elements have detected in both concentration as well as time. If the unit is placed in manual (M) mode, the device will continue to draw in samples as normal. However, when the sample button is pressed, the LCD no longer shows time, but will only show what the sensors are detecting at that particular moment.

SAMPLE

(Only available in manual mode) When the sample button is pressed, one sample read-ing is taken. The device calculates the time it should take for the sample to reach the detec-tor, takes the sample, and then displays the result. The sample button must be pressed for every sample needed.

2.8 Liquid Crystal Display (LCD)

The LCD is a near real-time display of the tracer gas concentration the unit has detected. The refresh rate is slightly greater than ten times every second.

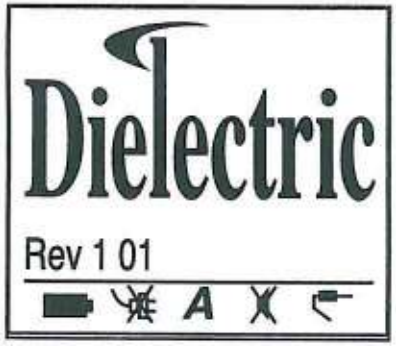


Figure 2

Figure 2 shows the LCD after the unit is switched on. This screen will remain displayed while the processor conducts a power on self test, which lasts for approximately 60 seconds.

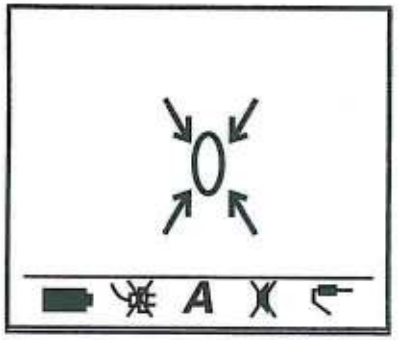


Figure 3

The LCD in figure 3 is displayed upon successful completion of the power on self test or when the unit has just been reset. This display is showing that the unit is setting a zero point of reference.

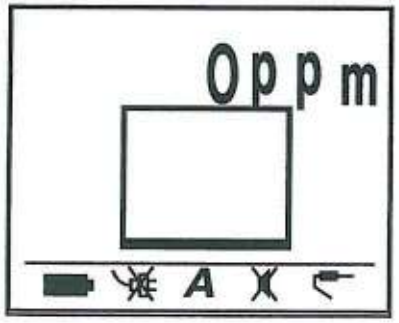


Figure 4

Figure 4 shows the display upon successful completion of the initial zeroing routine. This screen will be displayed until the sensor elements sense the presence of a tracer gas. The real time graph is updated once per second and shows 60 seconds of history.

2.9 LCD status icons

There are five small icons shown at the bottom of the LCD screen. The icon as well as its function is displayed below. The icons are listed in the order in which they are displayed on the LCD, from left to right.

NOTE: A function that has been turned off, will have an X

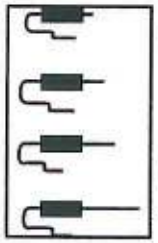
ICON

BATTERY STATUS
This icon gives a visual indicator of the relative life-span remaining on the battery. When the battery level drops below 1/4, a warning beep will sound. The unit will automatically shut off when the empty battery icon is shown

RECHARGE STATUS
This icon is either displayed, or crossed out. If the unit is recharging, the icon will change to a lightning bolt and back to a plug when charging is complete.

MODE
Shows whether automatic (A) or manual (M) mode is selected. The default is automatic.

SOUND STATUS
By default the speaker is disabled to conserve battery power and the speaker symbol will initially have an X through it. Pressing the speaker button once removes the X and enables the audio out circuitry.



PUMP SPEED
Pump speed can be adjusted for more accurate sampling. Pressing repeatedly will slow the pump

3.0 Charging the cable with helium/hydrogen

3.1 Charging direct buried cable with helium/hydrogen

Buried cables are charged with helium/hydrogen at the valve points closest to the leak, on the air source side of the leak, (figure 5).

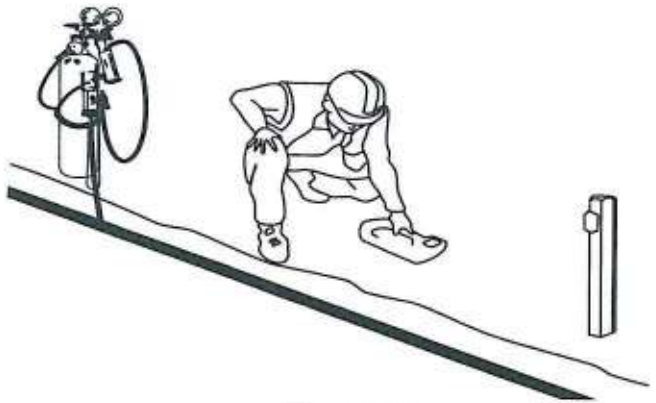


Figure 5
Charging cables

We suggest that the cables be charged from the central office unless a section leak has been identified by graphing the leak. Attach a bottle to the manifold or the pipe/distribution panel and meter the gas into the cable as directed for a minimum of several hours or overnight when possible. This will allow the gas to completely saturate the cables and rise to the surface where it can be readily detected. The helium/hydrogen can then be detected with the MGD without the need to bore test holes (figure 7).

Note: Helium/hydrogen will diffuse to the surface through loose soil faster than through compacted or frozen soil.

The highest concentration of helium/hydrogen will be along the cable path, with the highest reading directly over the cable leak. Before using the MGD-2002, mark the path of the cable. Precise cable location can be accomplished while the cable is being

3.2 Charging underground cable systems with helium/ hydrogen

To find leaks in underground systems, feed helium/hydrogen from the central office pipe or distribution panel (figure 6).

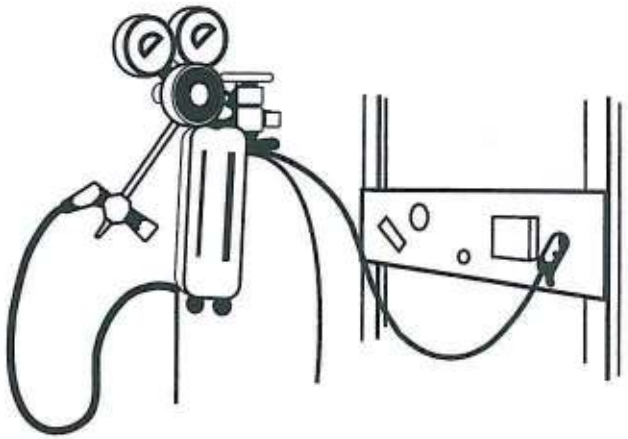


Figure 6
Charging a pipe system

When applying the helium/hydrogen to a distribution panel use the model 525 panel application kit. If you do not use the model 525, or a locally assembled equivalent, the cables may not all be charged with the helium/hydrogen.

Helium/hydrogen will escape from faults in manhole or duct structures once the system is properly charged. Helium/hydrogen will rise to the top of the manhole and out through the lid where it can be detected .

Figure 7
Searching for helium/hydrogen

4.0 Helium/hydrogen charging times

4.1 Directly charging the cable.

When applying the helium/hydrogen directly to a cable refer to Appendix A (page 29). This chart shows the amount of time needed for the helium/hydrogen to flow to the suspected leak location. This chart should be used whenever helium/hydrogen is introduced directly into the cable. This applies to both direct buried and underground cable types. You will need the following information before using the chart:

a. Cable type and gauge

b. Estimated distance to the leak (DTL) established through analysis

c. Total length (TL) of the cable section from the helium/hydrogen feed point to the bleed valve. If analysis cannot be accomplished easily due to the lack of recent cable pressure monitoring data consider DL and TL to be the same length, usually the end of the cable run.

A second method for determining cable filling times uses the chart in Appendix B (page 30). This method does not account for the gauge and resistance.

a.Determine the amount of flow in the cables you wish to charge by using one of the following methods:

(i) Observe the panel-mounted flow rater in the central office

(ii) Manually read the flow rate into a cable with a portable flow rater at the central office distribution panel.

(iii) Take a manual flow reading using a portable flow rater at the manifold or bypass location in the field

b. Determine the outside diameter of the cable from the cable charts or by manually measuring the cable diameter.

c. Find the cable diameter on the left hand column of the table. If the exact diameter is not shown, use the next larger one.

d. Find the flow time per thousand feet of cable by looking down the "Flow rate" column and across the cable diameter row. If the flow rate into the cable is greater than 10 standard cubic feet per hour (SCFH), divide the number found in the column for one SCFH by the flow rate. The result is the number of hours per thousand feet for that flow rate and cable diameter.

e. Multiply the time found by the length of cable you want to charge. This is done in number of thousands of feet. The result is the total amount of time required for the helium/hydrogen to flow from the entry point to the desired end point.

Example:

1) The cable flow rate at the bypass is 7 SCFH. This will push the helium/hydrogen 4200 feet from this reading point.

2) Cable diameter is 2.35 inches.

3) Go to the line for 2.4 inches in the left column of the table.

4) Go across to the column titled 7". Your flow time per 1000 feet is 2.24 hours

5) Multiply 2.24 hours by 4.2 (number of thousands of feet) to find your total flow time of 9.41 hours. This is the time it will take the helium/hydrogen to flow from the reading point to a point 4200 feet distant in the cable.

4.2 Direct Buried Cables:

(a) Introduce helium/hydrogen at the valve point closest to the area of the suspected leak.

(i) Attach a model 530 helium flow controller to the helium/hydrogen tank regulator (see the "530 helium flow controller operations manual").

(ii) Attach the inlet hose of a model 526 portable flow rater to one of the valves at the end of the model 530.

(iii) Attach the outlet hose of a model 526 portable flow rater to the pressure valve of the system to be charged. If the hose of the model 526 is not long enough to reach from the regulator to the valve on the cable, add additional lengths of pressure hose.

(iv) Set the pressure gauge on the tank regulator to 50 PSI. The resulting flow into the system will be approximately five SCFH of helium/hydrogen. This will register on the model 560 portable flow rater as approximately two SCFH of air or five SCFH of helium/hydrogen. These readings indicate that the charging process is correct.

(b) Refer to Appendix A, or the cable filling times chart at Appendix B, to determine the time needed to for the helium hydrogen to flow to the point of the suspected leak.

Note : When charging direct buried cables allow extra time for the helium/hydrogen to escape from the cables and rise up through the ground.

A typical helium/hydrogen tank contains 240 standard cubic feet of helium/hydrogen when full. At a constant flow rate of five SCFH, a full tank will keep adding helium/hydrogen to the system for approximately 48 hours.

4.3 Underground cables:

a. Introduce helium/hydrogen at the meter panel in the central office that feeds the leaking cable.

b. The helium/hydrogen will flow into the underground cable from manhole locations or riser pole valves instead of the central office. This may reduce the charging time.

c. Introducing helium/hydrogen directly into an underground cable from a central office is accomplished as outlined on page 16.

4.4 Charging air pipe systems

Introduce helium/hydrogen into the pipe system at the pipe panel in the central office. Find the outlet side of the pipe panel and flow helium/hydrogen into the pipe at five SCFH.

a. Place the helium/hydrogen tank close to the pipe panel to be charged. Ensure the tank is secure.

b. Use a model 530 helium flow controller and model 526 portable flow rater as described in the same way as for direct buried cables.

Note: To determine the number of hours of helium/ hydrogen available from a tank, divide the number of standard cubic feet (SCF) remaining in the tank by the flow rate in SCFH.

For example: If the tank regulator shows 150 SCF and you are using a flow rate of 5SCFH, the number of hours of flow would be 150/50 = 30 hours.

Helium/hydrogen will travel to the end of a normal pipe run (approximately 30,000 feet) in five or six hours. Additional time should be allowed for the helium/hydrogen air mixture to permeate the pipe system beyond the manifold points.

We recommend that the charging is started at least 18 hours before samples are taken.

If you want to survey a complete system, charge the pipe from the central office manifold. This allows the helium/hydrogen to completely permeate the cables between the central office and the first manifold location.

5.0 Leak location

5.1 Locating tips;

- Locate and mark the cable path in the projected search area

- Ensure the rubber collection cup is placed on the ground directly over the path of the cable during the "sample" and read" cycles

- Samples should be taken approximately every three feet over normal soil and less than three feet over compacted soils

- Frozen ground may cause helium/hydrogen to migrate a considerable distance from the actual leak

- It may be necessary to make holes at curbings or road expansion joints to help the helium/hydrogen to rise to the surface

- When helium/hydrogen is detected, continue to sample the adjacent area until you determine the highest concentration of the helium/hydrogen. Boring holes with a t-bar may be helpful at this point. This location will be directly over the cable fault.

Underground system

If you are surveying a complete pipe system, begin your sampling at the central office vault. It is advisable to check the central office vault plugs and other plant before proceeding with the outside survey.

At the manholes, set up work-area protection according to local practice.

Without removing the manhole cover do the following:

a. Switch on the MGD-2002 and following the startup cycle, insert the extension tip of the probe through one of the holes in the manhole cover.

b. Take a sample and record the result.

c. Take a second sample on the opposite side of the cover and record the result.

d. Proceed to the next manhole and repeat the procedure.

Survey all the manholes in the projected search area and record the results

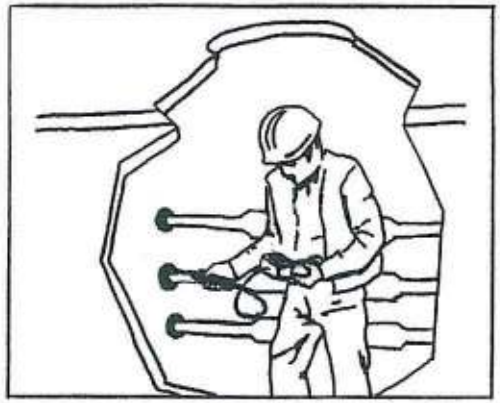


Figure 8
Verifying leak location

Return to the manholes with the highest percentages of hydrogen/ helium readings. When entering manholes always follow local safety practices and search for leaks using the Model1805 Multisonic translator/detector.

If no faults are found in the manhole, check the ducts using the MGD-2002. Do this using the needle probe extension tip. Insert the probe into the duct as far as you can, taking care not to get moisture into the unit. Take a sample and record the result. Examine and clean the probe tip, if necessary, after each sample.

Figure 9
Using duct probe with multisonic tip to pinpoint leaks in conduit

If helium/hydrogen is detected in a duct the model 1802 mini duct probe may be used to establish the exact location of leaks between manholes (fig 9).

If pressure leaks are not found in the manholes or adjacent ducts, the pressure leaks may be in riser cables or riser cable plugs.

6.0 Maintenance

6.1 Cleaning & inspection

Instrument:
Clean away any debris or moisture accumulation with a clean, soft, damp cloth being careful not to scratch the protective LCD lens cover. Check the exhaust ports on the top right side of the unit (small brass fitting) for any obstructions.

Ground Probe/Collection Boot:
Clean with compressed air or with soap and water to remove mud and debris. Dry the collection boot thoroughly when done. Clean the small filter in the collection boot with a small brush as necessary.

Small Probe Tip:
Clean with compressed air or with soap and water to remove mud and debris. Dry the tip thoroughly when done.

Moisture Filter cartridge:
Check the filters in the handle before every use. If the cartridge is pink or whitish in color replace the cartridge following the instructions below. The handle can be cleaned with soap and water as long as the silica filter is in place and the knurled cap section is tightened firmly.

Note: Do not allow water to enter the wand - if water is encountered check the color change indicator in the wand handle!

6.2 Moisture Filter replacement

In order to replace the Moisture (silica gel) filter, firmly grip the filter handle with one hand and turn the knurled cap assembly counter clockwise until they separate. Once the cap assembly is removed, push the filter out by using the viewing holes in the handle.

To restore these cartridges to a dry deep blue useful condition. backflush the hand held probe with compressed Dry Air or Dry Nitrogen. Use the Needle Probe connected to the front end of the

probe handle and the clearing adaptor assembly connected to the hose. The needle probe must be installed in order to defeat the one way check valve and allow air to flow back through the filter. This process will take approxameately 10 minutes per silica gel filter to turn them back to a deep blue color.

An alturnative method is to place the moisture filter cartriges in an oven at a maxamum temperature of 225°F for approxamatly 60

6.3 Calibration:

The MGD-2002 is a precision measuring device that requires factory calibration in order to ensure continued and sustained optimum operating performance. The amount of time between calibration cycles is dependant upon the environment in which the device is to be used, the end user's criteria for the equipment, and the amount of time the equipment is used throughout the year.

If you frequently use this device, or extremely high accuracy is required, the unit should be calibrated a minimum of once per year. If, however, the device is used infrequently or the accuracy is not as critical, factory recalibration can be delayed to as much as every two years.

Sending the unit back for calibration is not limited to the annual or biannual calibration cycle chosen. For example, the user may suspect inaccurate operation that may be the result of the filters or plumbing being blocked with oil residue, oil vapors, water, dirt, petroleum vapors, grass, and insects or some other foreign material.

During the factory re-calibration, the following value added steps and procedures will be accomplished:

1) Inspection
2) Light cleaning (as required)
3) Moisture cartridge filter dried (as required)
4) All internal filter media replaced
5) Air volume checked
6) Software updates installed (as available)
7) Calibration procedure completed
8) Calibration Certificate (optional)

7.0 Parts lists

A) Standard package

Upon initial receipt of the MGD-2002 multi-gas detector, the following components come included as standard items. Numbers in parenthesis indicate the quantity included.

1) MGD-2002 Multi-gas Detector	PN: 79766
2) Drying adapter for Moisture Cartridge	PN: 84972
3) Handle Assembly	PN: 83174
4) 7.2V Nickel Metal Hydride Battery	PN: 82492
5) Carrying Strap	PN: 84923
6) 12VDC auto plug in adapter	PN: 84677
7) 100-24VAC Universal AC charger W / North American power cord	PN: 84673
8) European power cord	PN: 84674
9) Ground probe	PN: 90664
10) Instruction Booklet (IB-417)	PN: 84671
11) Warranty Card (Serialized)	PN: 84973
12) Needle Probe	PN: 84165
13) Moisture Filter Cartridge (2)	PN: 83220
14) Carrying Case	PN: 84672

B) Replaceable parts

If for any reason a field replaceable unit (FRU) is required, the following list of items is provided to ease the ordering process.

Note: Only user replaceable items are listed. If for any reason an item is needed that is not on this list, the device should be sent back to Dielectric for repair and recalibration:

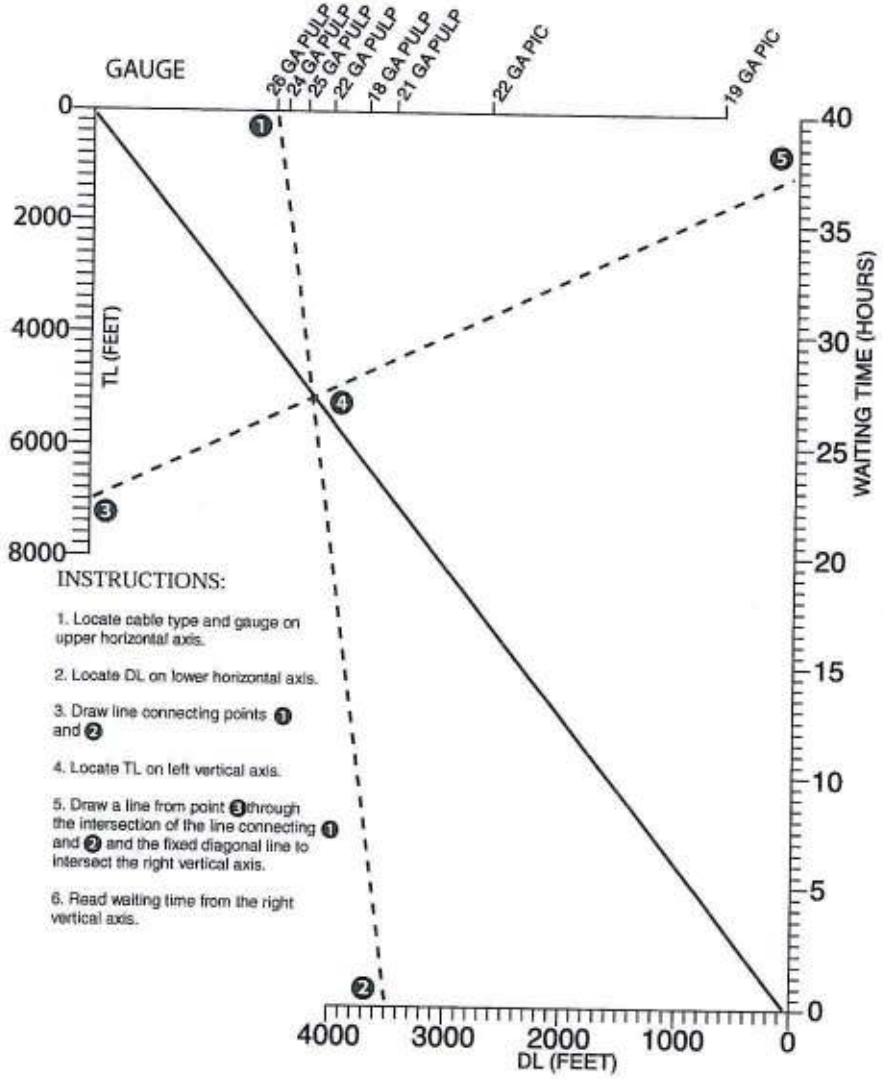
1) Moisture Filter Cartridge	PN: 83220
2) Spare Battery	PN: 82492
3) 12VDC auto plug in adapter	PN: 84677
4)100-24VAC Universal AC charger	PN: 84673
5) Eurpoean power cord	PN: 84674
6) Ground probe assembly	PN: 90664
7) Needle Probe	PN: 84165

C) Optional accessories

The following optional accessories are recommnended for use with the MGD-2002 Multi-gas detector but do not come as a standard item. Items without part numbers are still in the design phase and part numbers have not yet been assigned. (N/A)

1) Head Phones	PN: 882-0007
2) Overhead Wire Boot	PN: N/A
3) Non-metallic Probe Assembly	PN: N/A
4) Downloadable Software Revisions	PN: N/A
5) Serial Port	PN: N/A
6) Power Cord (Specify Country)	PN N/A

Tracer gas charging times



Approximate Cable fill times

Approximate cable fill times based upon head end flow rates stated in hours per 1000 feet										
Cable diameter in inches	1	2	3	4	5	6	7	8	9	10
1.0	2.75	1.4	1.0	.75	.55	.50	.50	.35	.30	.25
1.2	3.9	2.0	1.3	1.0	.80	.65	.55	.50	.45	.40
1.4	5.5	2.7	1.8	1.35	1.1	.90	.75	.70	.60	.55
1.6	7.0	3.5	2.35	1.75	1.4	1.15	1.0	.90	.80	.70
1.8	8.85	4.4	2.95	2.2	1.8	1.5	1.25	1.1	1.0	.90
2.0	10.9	5.45	3.65	2.75	2.2	1.8	1.55	1.4	1.2	1.1
2.2	13.2	6.6	4.4	3.3	2.65	2.2	1.85	1.65	1.5	1.35
2.4	15.7	7.82	5.25	3.9	3.15	2.6	2.25	2.0	1.75	1.6
2.6	18.45	9.2	6.15	4.6	3.7	3.1	2.65	2.3	2.05	1.85
2.8	21.4	10.7	7.15	5.35	4.3	3.6	3.05	2.7	2.4	2.15
3.0	24.55	12.3	8.2	6.15	4.9	4.1	3.5	3.1	2.75	2.45
3.2	27.9	14.0	9.3	7.0	5.6	4.65	4.0	3.5	3.1	2.8
3.4	31.5	15.75	10.5	7.9	6.3	5.25	4.5	3.95	3.5	3.15

Frequently asked questions (FAQ's)

Q: Why do sudden movements cause the detector to react?

A: Sudden movements such as rapidly swing the unit from a horizontal position to a vertical position can make the detector temporally display between 25 & 50ppm . This is caused by air movement disruptions inside the control unit and is normal.

Q: Directly following charging the detector gives false readings where there is no Helium/Hydrogen?

A: The battery heats up as it charges raising the temperature of the air inside the detector above room air, causing false readings. Allowing the unit to cool for approx. 15-20 min. after charging will correct this problem. Opening the battery compartment during charging can reduce this cooling time.

Q: How do I dry the Humidity cartridge without a source of dry air?

A: As another alternative the humidity cartridge can be baked in an oven at no more than 225°F for approx. 30-60 min. We do recommend in application where dry air is not available that you purchase extra humidity cartridges.

Q: Will gasses other than Helium/Hydrogen effect my readings?

A: Yes, other gasses can affect the readings but most are absorbed within the internal filters or have a lower thermal conductivity as compared to air which will have little or no effect on the readings.

Q: Will 100% helium/Hydrogen "burn out" the sensor?

A: No. This sensor is not damaged by high concentrations of helium/ hydrogen.

Q: Can my MGD be used to locate water or natural gas lines?

A: Yes, Contact our customer service department for information on proper usage in these applications.

Q: Will this detector completely eliminate the need to drill holes in pavement or concrete?

A: No, although it can reduce this need it will not eliminate it. Several inches of pavement will substantially slow the permeation of Helium/ Hydrogen to the surface, which can cause pluming of gas under the pavement making it more difficult to pinpoint the leak.

Q: The detector displays a negative zero shortly after taking a reading with high helium levels. What does the mean?

A: The sensor is recovering after being cooled by the high concentration of Helium/Hydrogen in a few moments it will again stabilize and automatically zero usually within one minute. If it remains at a negative zero for more than three minutes, the detector may need to be serviced. Contact customer service.

Trouble Shooting

The pump seams to be straining and no air is exiting from the outlet port (brass) on the right side of the control unit.

- Check that the handle section and the ground probe or needle probe is properly installed.
- Check to see if the humidity filter is clogged.
- Check to see if the filter at the boot end of the ground probe is clogged
- Contact customer service. This is an indication of a clogged internal filter.

The detector continuously "counts up" without helium/hydrogen present.

- Check to see that the handle section and the ground probe or needle probe is properly installed and not clogged.
- If the unit was recently charged allow it approx. 15 min of cool-off time.
- Allow the unit to run for approx. 10 min and then press "Reset" to zero the detector.
- Contact customer service. This is an indication of a clogged internal filter or an internal leak.

Working on a busy street with heavy traffic the detector is giving false reading.

- Place the boot end of the ground probe up in the air as far away from Helium/Hydrogen/Auto emissions and press the reset button.This may be an indication that the catalyst filter built into the base of the handle is no longer functioning properly contact customer service.

WARRANTY

The Manufacturer warrants that all goods supplied hereunder, whether or not of its own manufacture, will be of the kind described herein or in any specification and drawing approved by the Manufacturer and of merchantable quality and free from defects in material or workmanship under normal use and prescribed maintenance for a period of one (1) year, with the exception of air dryers utilizing water sealed compressors as well as the compressors themselves which shall be for two (2) years. Neither this warranty nor any other, expressed or implied, shall apply to goods delivered hereunder which have been damaged or subjected to alteration or negligence after delivery. The Manufacturer's only obligation for breach of this warranty shall be the repair, without charge, or the furnishing F.O.B. Bridgton, Maine, of a similar part to replace any part which within one (1) year, with the exception as noted above, from date of shipment is proven to have been defective, provided that (i) the Purchaser shall have notified the Manufacturer within ten (10) days of the discovery of such defect and not later than ten (10) days after the last day of this warranty, and (ii) the Manufacturer shall have the option of requiring the return of the defective material (transportation prepaid) to establish the claim. The Manufacturer shall not in any event be liable for the Purchaser's manufacturing costs, loss of profits, good will or any other special, consequential, incidental, or other damages resulting from such defects. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH EXTEND BEYOND THE WARRANTY SET FORTH HEREIN.

Dielectric Technologies
Bridgton Commerce Center