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**AQUA-GLO
OPERATING
PROCEDURE
MANUAL**

**BULLETIN 159
(5-19)**

AQUA-GLO SERIES V WATER DETECTOR KIT OPERATING PROCEDURE MANUAL MODELS GTP-322 AND GTP-323 ASTM METHOD D3240 & D2276

INTRODUCTION

The Aqua-Glo Series V Water Detector Kit is used to measure the amount of undissolved water in kerosene-type jet fuels. It can be used on other fuels by following special procedures in the section titled, "Other Fluids."

A measured sample of fuel is passed through a treated detector pad or "test pad." Undissolved (free) water in the fuel will react with the test pad. When the pad is subsequently illuminated by ultraviolet light, the coating that was contacted by free water will fluoresce (glow) a bright yellow with the brightness increasing for increasing amounts of free water in the fuel sample. Water content is read out by the Aqua Glo instrument in parts per million by volume. By varying the fuel sample size, the standard range of the instrument of 1 to 12 ppm can be increased to as much as 60 ppm of free water.

METHOD DESCRIPTION

The following procedure is primarily applicable for dynamic line sampling; that is, taking the fuel sample while the fuel system is flowing and through the test pad without exposing the sample to the atmosphere or to a sample container. The use of sample containers such as bottles or cans for the temporary storage or transport of the sample will result in large errors due to changes in temperature, adsorption of water on container walls, etc., and is not recommended. The amount of free water in a sample is very sensitive to temperature.

For a simplified step-by-step procedure, go to the end of this manual for the Abbreviated Procedure; first time users should read the entire manual first.

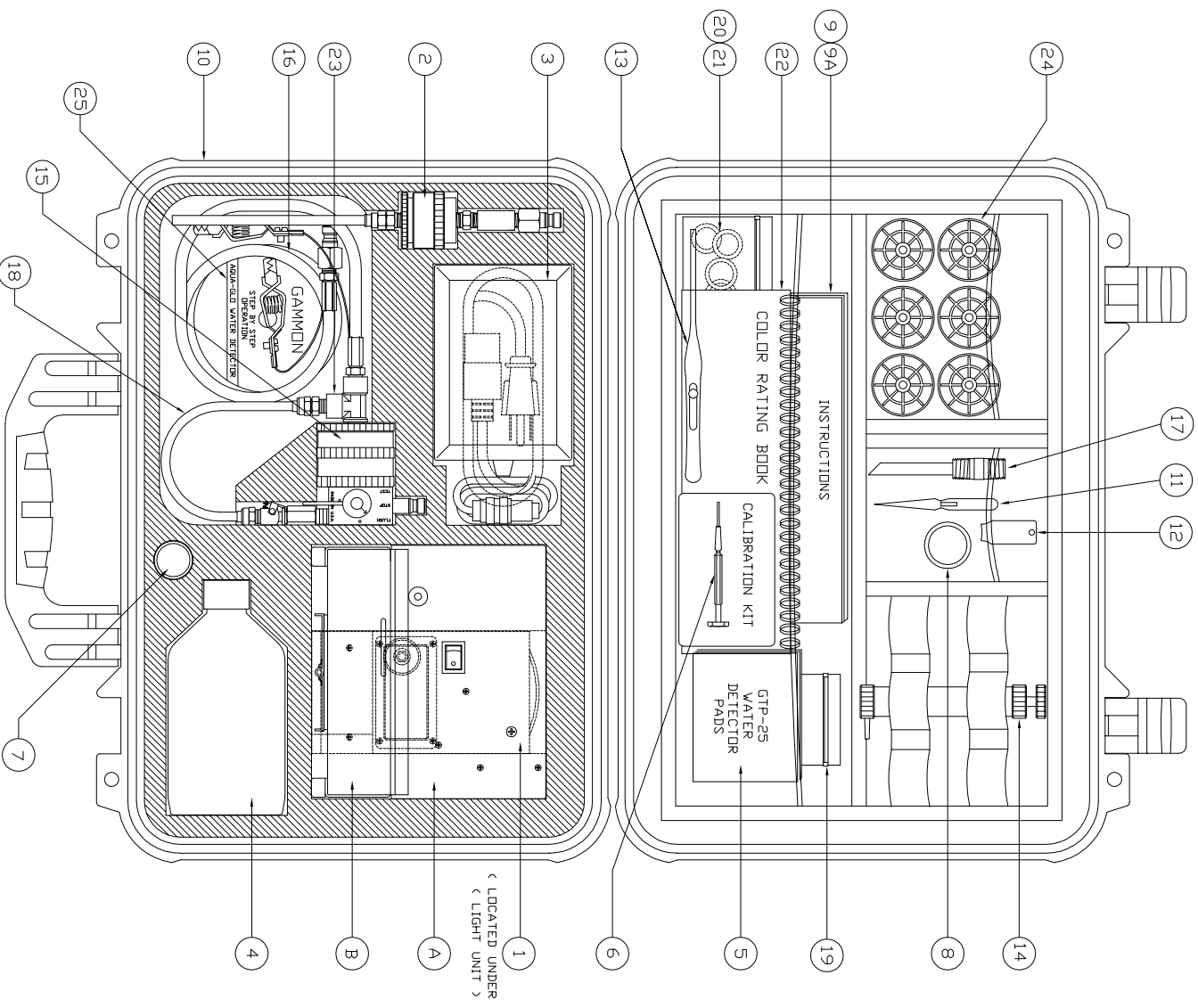
CALIBRATION

An encapsulated pad labeled "Calibrating Standard" is provided in a separate container in each kit. Note the "set" number on the back of this pad. Place the calibrating standard in the hinged flap window with the blank side (the side without the set number) facing the instrument. Turn on the ultraviolet lamp and then press and hold the switch button on the photocell comparator ("Instrument Pack"). This button is located within a cup on the instrument. Adjust the light modulating lever until the meter pointer is steady at the zero "O" in the center of the scale. Always move the light modulating lever in the same direction when zeroing the photocell comparator, when calibrating or testing, to eliminate errors caused by clearance in the mechanical linkage. This may take 45 seconds. If the reading obtained on the scale located on the back of the Aqua Glo instrument does not agree with the "set" number on the calibrating standard, adjust the photocell comparator on the side of the instrument pack (at the 45 degree bend). Insert the included small screwdriver, and adjust as necessary. Repeat the above procedure until the reading obtained agrees with the calibrating standard "set" number. **THE INSTRUMENT SHOULD BE CALIBRATED PRIOR TO EACH USE AND AFTER EACH HOUR OF USE.**

Return the calibrating standard to its container in the kit. Do not use a calibrating standard from another kit. Each calibrating standard is matched to a fluorescing standard which is secured under the panel labeled "Fluorescing Standard." The code number on the Fluorescing Standard must be the same as the code number on the Calibrating Standard **but the "set" points need not be the same.** Instruments that have been manufactured since 1998 have a small decal on the stationery face of the hinge providing the code number. NOTE: We urge our customers to label older instruments accordingly so that operators can easily determine if they are using the matching calibrating standard.

SAMPLE CONNECTION

The sample connection must be planned so that the flow path to the test pad is as short as possible and so that there are no traps or pockets that may collect water.



ITEM	DESCRIPTION	PART No.	QTY.
A	SERIES V ULTRAVIOLET LIGHT UNIT	GTP-9300-4	1
B	COMPARATOR CHAMBER	GTP-767	1
1	PHOTOCELL COMPARTOR (INSTRUMENT PACK)	GTP-768	1
2	PAD HOLDER ASSEMBLY	GTP-191	1
3	BATTERY CHARGER / POWER SUPPLY	GTP-9292	1
4	CALIBRATED BOTTLE	GTP-294	1
5	WATER DETECTOR PADS	GTP-8112	25
6	JEWELERS SCREWDRIVER	GTP-765	1
7	QUICK DISCONNECT COUPLER	GTP-992-4F	1
8	TEFLON PIPE SEALANT TAPE	GTP-813	1
9	INSTRUCTION BOOKLET	BULLETIN 101	1
9A	INSTRUCTION BOOKLET	BULLETIN 159	1
10	CASE	GTP-9459	1
11	TWEEZER (AQUA-GLO PADS)	GTP-293	1
12	PLASTIC MONITOR KEY	GTP-9182	1
13	TWEEZER (MEMBRANES)	GTP-2099	1
14	SYRINGE	GTP-165	1
15	MINI-MONITOR HOUSING W/ FLUSHING HEAD	GTP-172A	1
16	BONDING AND GROUNDING HOSE ASSY.	GTP-1110	1
17	SAMPLING PROBE	GTP-144	1
18	BY-PASS HOSE ASSY.	GTP-1250	1
19	MINI ENVELOPE	GTP-1267-15	15
20	D-RING	GTP-2200-006V	2
21	D-RING	GTP-2200-012V	2
22	COLOR RATING BOOK	GTP-1074-1	1
23	BY-PASS TEE	GTP-302C	1
24	PLASTIC MONITORS	GTP-8116	6
25	C D (Compact Disc) - INSTRUCTIONS OPERATION AQUA-GLO SERIES V WATER DETECTOR KIT		1

AQUA-GLO SERIES V WATER DETECTOR KIT

NOTE

* THESE PARTS ARE IN A GTP-323 AQUA-GLO ONLY

SAMPLE CONNECTION continued

The sampling connection may be located on the pipe before and after a filter vessel (filter separator or monitor) to allow you to compare the readings to determine the performance of the filter in removing free water. Connections should be available for obtaining Aqua-Glo test results all the way from the refinery to the aircraft refueling nozzle.

FLUSHING

Attach the empty test pad holder assembly to the quick disconnect coupler at the sample connection. Establish system flow. Open the toggle valve by lifting the handle. Allow at least 1 liter of fluid to pass through the assembly into a collection container. Opening and closing the valve several times will insure better flushing. Remove the assembly after flushing.

SPOILAGE OF WATER DETECTOR PADS

Aqua-Glo test pads are heat sealed in aluminized composite envelopes to ensure that moisture from the air will not reach the pad. Pads that were stored for 8 years were still in good condition, but statistical studies have proven that up to 4 or 5% of the envelopes have enough water permeability to spoil the pads. This occurs in the first six months. A spoiled pad is easily identified by its **yellow** color. The operator should inspect every pad before it is used. If it is not **orange** in color, it must not be used.

TEST PROCEDURE

NOTE: An abbreviated test procedure may be found on last page of this manual.

Do not remove the test pad from the hermetically sealed package until ready to use. Do not touch the pad with fingers; use the included pointed tweezers to handle the pad at all times. Do not allow any discrete water droplets to come into contact with the pad (from rain, sneezing, coughing etc.). Exposure of the test pad to the atmosphere, especially on humid days, will also ruin the pad in a matter of minutes.

Open the test pad holder assembly and insert a test pad in the outlet half using tweezers. Be sure that the orange colored side of the pad is facing upstream (you can see the orange side with the pad in the holder). Run the test immediately.

Attach the test pad holder assembly to the quick disconnect. Open the toggle valve.

Pass 500 ml of fuel through the pad, accurately measuring the test sample quantity in the calibrated plastic bottle in the kit. Normal sample volume is 500 ml of test fuel, but if the reading is off scale (on high side), a sample volume as small as 100 ml in volume may be used in a repeat test using a new pad, by applying a correction factor, as explained below. A small graduated cylinder should be used to measure smaller sample volumes accurately. The reading must be adjusted to allow for a smaller sample volume; see Calculation on the next page.

RATING PROCEDURE

Remove the test pad from the holder using tweezers and press **between** dry paper blotters or absorbent towels to remove excess fuel. Press firmly (about 5 lb. force) 3 or 4 times with heel of hand, moving the pad with tweezers each time.

For maximum accuracy, the test pad should be read within 3-5 minutes after sampling is initiated. If the test pad is not read immediately after sampling, it must be placed in a desiccator to prevent moisture pick up from the air. However, readings made on dried test pads, that is, not damp with fuel, should be avoided if possible since they will give high and erroneous results. Conversely, rating a pad which has not been well blotted will give a low reading as the excess fuel will absorb part of the ultraviolet light and decrease fluorescence.

The ultraviolet light must be on to get a reading. This can be verified when the switch is turned on. The center of the **white indicator button** will glow a light green if the ultraviolet tube is operating. In bright sunlight, you may have to cup your hand over the indicator to see that the button is glowing.

Turn off the instrument light immediately after use to conserve battery power. If the pointer will not go all the way to the zero (center). Move the lever until the pointer is as close to the center as possible. If the lever is below the 1 mark, your fuel has less than 1 ppm of water. If the lever is at the 12 end of the scale, you have more than 12 ppm.

Record the instrument reading where the lever crosses the scale (estimated to the nearest tenth). Record the sample volume and the fuel temperature at the time of the test. See section titled "Comments."

Visual observation of the used test pad is often of value. This is easily accomplished by removing the photocell comparator assembly and viewing the test pad through the rectangular window on the side of the instrument in a darkened room with the ultraviolet light turned on. Free water in fuel is normally well dispersed and will form an even distribution of many small points of yellow fluorescence on the test pad when illuminated.

Large water drops, however, will form a few large spots of yellow fluorescence on the pad. These large spots usually are indicative of a separator element failure, rather than a coalescer element failure if the test is performed downstream of a filter separator.

CALCULATION

Correct the reading if the sample volume is other than 500 ml.

$$\text{PPM free water} = \frac{\text{scale reading} \times 500}{\text{sample volume, mL}}$$

NOTE: The velocity of the fuel through the pad will have an influence on accuracy if the flow rate is not between 600 and 800 ml/min. The 1 mm diameter orifice upstream of the test pad serves to control velocity over a wide pressure range but on site controls may be required. The orifice also serves to break up water droplets and promote uniformity of distribution on the test pad.

OTHER FLUIDS

The Aqua-Glo Water Detector Kit can be used to determine the undissolved water content of fluids that are not in the jet fuel category but there are several factors that must be considered. First of all, material compatibility of the detector pad holder and its various components must be studied. The detector pad holder itself and the toggle valve are anodized aluminum. Seals are Buna N. Tubing is urethane. Components made of other materials are available and will be quoted on request. Another consideration is the detector pad itself. Certain alcohols may remove the fluorescein coating. Strong chemicals may damage the filter paper pad itself.

Low boiling point fluids, such as LNG, butane, etc., create special problems that require consideration. First of all, the volume of a fluid that evaporates rapidly cannot be determined in the open bottle that is provided in the kit. Several methods can be used, depending on the test fluid. One method is to use a sample bomb. Another is to place a graduated cylinder in a refrigerated bath. Precautions must also be taken to prevent condensation of moisture on the cold detector pad after the pad has been removed from its holder. An effective way to handle this is to immediately drop the pad in a beaker containing clean, dry kerosene. The use of dry kerosene as a "conditioner" is required whenever a test is to be performed on a non-jet fuel fluid. The reason is that the calibration of the Aqua-Glo scale is based on a jet fuel damp detector pad.

Gasoline - No special procedure is required when testing gasoline, except that the pad must be placed in clean, dry kerosene (jet fuel) briefly before blotting it between paper towels. See Rating Procedure. This is a necessary step to prevent moisture from humid air from condensing on the pad as it cools during evaporation of the gasoline. Also, the Aqua Glo instrument is calibrated with a kerosene-damp pad and this procedure will insure that condition.

Heating oil and diesel fuels- Some oils and fuels such as diesel, fuel oil and lubricating oils have a natural fluorescence (they glow in ultraviolet light). This can cause an error. You can predetermine the error to allow you to correct the reading, if any, in the Aqua-Glo. Simply dip a new pad in the oil to be tested; then blot it as instructed above and take a reading. This number must be subtracted from a test result for water. Alternatively, you can eliminate the error by flushing the pad, after testing, with known dry kerosene or jet fuel.

Additives in fuels, including jet fuel, have variable effects on readings. Generally, heating oil additives tend to mask the presence of water, but experience to date indicates that additives in jet fuel tend to cause slightly higher readings.

CARE OF THE MAIN BATTERY (GTP-2324)

Do not leave the Aqua-Glo light running continuously. Do not leave the battery charging for more than 2 days without use.

The main battery is built-in and is rechargeable. If it is ever necessary to replace it, the entire side cover of the light unit must be removed (7 screws). Then separate the wire connector having the black and red wires. The battery clamp can now be removed by first removing 2 screws, one at each end.

An external battery is not supplied with the kit but may be ordered as Model GTP-2404. It is useful when extended tests must be run when AC power is not available for recharging. To recharge the external battery, connect it to the power supply using a connector cable Model GTP-9329

To recharge the internal battery, simply connect the power supply included. It will operate correctly on 115 VAC to 240 VAC, 50/60 Hz. A full charge takes up to 16 hours.

CARE OF THE PHOTOCELL COMPARATOR (INSTRUMENT PACK)

Heavy use will eventually deplete the 9 volt battery in the instrument pack. If very frequent recalibration is necessary, this can mean that the battery is weak. If the meter responds sluggishly, this may also indicate a weak battery. Replace with any good quality 9 v battery or order our Model GTP-892. Remove the 4 battery cover screws to reach the battery.

Frequently wipe dust and finger marks from the green glass filters. Use a soft cloth or a bit of cotton. This assembly is easily damaged if it is dropped. Generally, the damage is one or more of 3 problems.

Therefore, if it is dropped, the operator should inspect as follows:

1. Bent attachment flange - This can be straightened, but any black paint that is scratched must be replaced to prevent errors due to reflection. Use dull, flat black paint.

CARE OF THE PHOTOCELL COMPARATOR (INSTRUMENT PACK) continued

2. Green glass filters broken - Return the instrument pack to the factory for replacement of the filter
3. Meter needle broken, stuck, or disengaged - Return the instrument pack to the factory for repair or replacement, depending upon extent of damage. To determine whether this type of damage has occurred, remove the instrument pack and hold it horizontally. Observe the pointer as you move the meter right and left. The needle should smoothly move a bit to each side and then re-center. Now push and hold the button and shade the photocells, first one, then the other. The needle should move quickly and smoothly from side to side. Release the button and the needle should re-center. If the needle moves in jumps, the meter is damaged. If the needle moves slowly, the battery is likely depleted. If it does not move at all, the battery needs to be replaced.

CARE OF THE COMPARATOR CHAMBER

The inside surfaces of the chamber must be kept clean. Dust and dirt often glows brilliantly in ultraviolet light and this will cause a reading error. To test for such dirt, turn on the light in a dark room with the instrument pack removed. Remove all glowing particles inside of the comparator chamber, being careful not to scratch off the black paint. Do not move or remove the iris diaphragm from its installed position because it has been carefully positioned at the factory and cannot be reset in the field without a special gauging tool.

COMMENT

The water content of jet fuel is constantly changing as the humidity of the air above it changes. Temperature has a substantial influence. As a general rule, 1 ppm of water will come out of solution for every degree of temperature reduction if the fuel sample is water saturated. The average jet fuel will have about 70 ppm of water in solution at 70°F. At 60°F, the dissolved content is only 60 ppm. Sampling connections that are long enough to permit temperature changes will always cause unreliable results. If cooling takes place, the reading will be high and vice versa.

It is possible for free water to remain for several hours in jet fuel that is not saturated. Why water will dissolve almost instantly up to saturation in one jet fuel and not in another has never been explained.

The Aqua-Glo Water Detector Kit has been used very extensively in the testing of filter separators. The Aqua Glo method only measures the free water - undissolved. It does not detect dissolved water, which monitors and filter separators cannot remove.

NOTE

The Aqua-Glo Water Detector Kit Series V replaced the Series III in 2005. We are pleased to advise you that several improvements have been made:

1. The power supply is external. It is easily replaced if necessary without taking the Aqua-Glo apart, as was necessary before.
2. The power supply is modern, self-switching and regulating. It will perform properly on 120 VAC to 240 VAC, 50/60 Hz. We will no longer have two models for different power..
3. There is no change in the ASTM test method procedure or calibration because only the power supply to the UV bulb was changed.
4. The new Series V light unit is much more field repairable. See Field Repair for details.

OVERHAUL AND REPAIR POLICY

If the Aqua-Glo ever needs more complete repair than can be done in the field, return it to the factory using the procedure below:

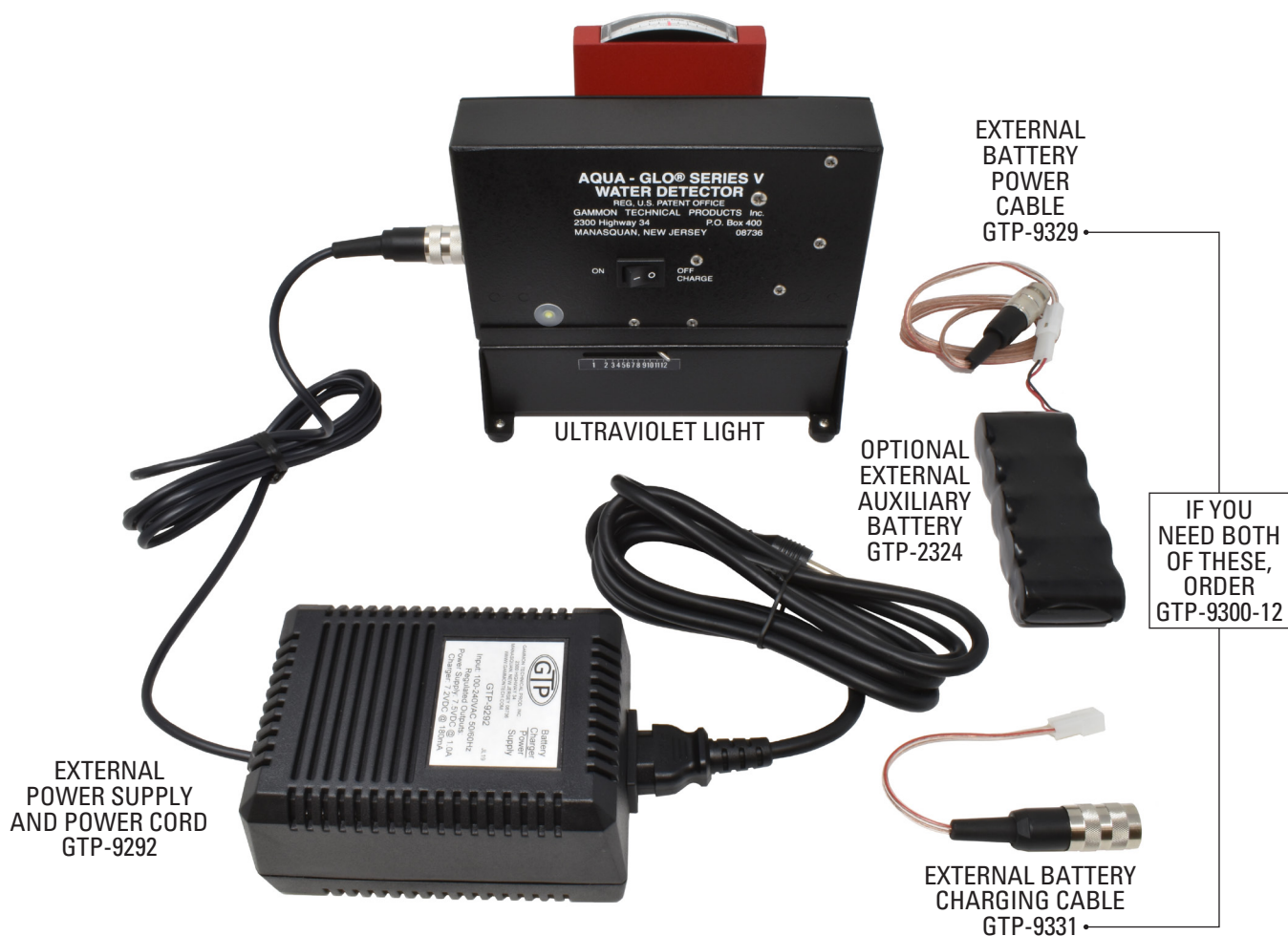
1. Call our Order Entry department at 1-800-524-0287, fax 732-223-5778 or email us at gammontech@gammontech.com.
2. Request a RFR (Returned for Repair) number and mark your package with this number.
3. Ship the complete instrument to us, including the calibrating standard, well packed and insured. You may leave the unit in the carrying case, but properly packaged.
4. We will examine the Aqua-Glo and advise you of the estimated price to repair it. If the unit is under 12 months old and has not been abused, the repair will be at no charge.
5. Should you decide not to repair the Aqua-Glo, we will return it at no charge, at our expense.

FIELD REPAIR (Voltage testing must be done by a qualified technician)

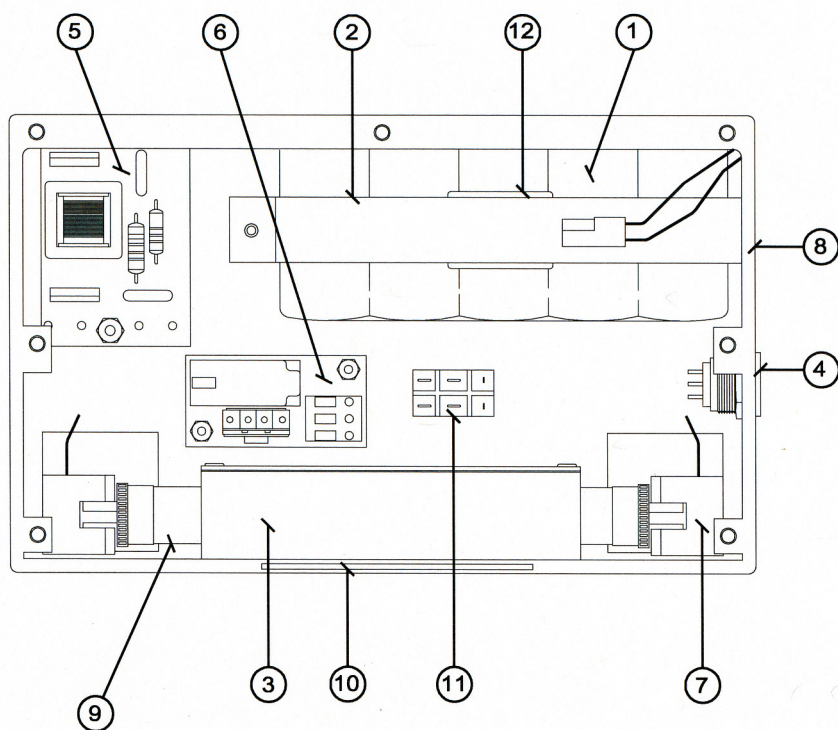
1. If the bulb will not light on AC or Internal Battery power, remove the power supply, turn off and replace the bulb.
2. Do NOT attempt to repair the instrument pack, except to replace the 9 volt meter battery.
3. Do NOT attempt to replace or repair the iris in the base except to replace the lever, should it loosen

AQUA-GLO SERIES V ABBREVIATED PROCEDURE

1. Locate or provide a suitable quick disconnect fitting to obtain a sample from a flowing pipe.
2. Inspect the instrument pack: Remove the instrument pack(meter unit) from the slide rails on the side of the comparator chamber. Hold it in a horizontal position with the photocells facing upward at an angle. Depress and hold the switch button with a finger of the same hand. Move your other hand to shade first one photo cell, then the other. If the meter moves rapidly back and forth across the full scale, it is in good condition. If not, replace the 9VDC battery. If the meter has been damaged return the instrument pack to GTP for inspection.
3. Calibration: Place the calibrating standard in the test pad window, blank (unlabeled) side inward, noting the "set point". Check the code number on the calibrating standard to be sure it has the same code as the fluorescing standard. You must not use the calibrating standard from one Aqua-Glo on another unit. Turn on the ultraviolet light. Watch the green indicator on the side of the comparator chamber and make sure it illuminates. If it does not illuminate, the main battery (GTP-2324) needs recharging. (Alternately, you can run the Aqua Glo on 115-240 VAC, even while the battery is recharging.)
4. Depress the push button on the instrument pack. Move the lever on the back of the comparator chamber to the end of its travel, below the "1" mark on the scale. Move it up the scale until the needle on the meter settles for 10-15 seconds at the "O" point. Read the position of the lever along the calibrated scale. If the reading is not the same as the "set point", make an adjustment of the potentiometer with the screw driver. Using the small jeweler's screwdriver in the kit, adjust the potentiometer located at the 45 degree angle on the instrument pack with slight movements.
5. Repeat the reading process until you get the correct scale reading. Remove and store the calibrating standard. Turn off the UV light.
6. Flush the sampling port (quick disconnect,) by connecting the Pad Holder without a water detector pad installed. Lift the handle of the inlet valve and allow 1 liter to pass into a jar or other convenient container.
7. After disconnecting the Pad Holder assembly from the sampling port, install a water detector pad from the sealed envelope. The pad fits in the outlet half. Be careful not to touch the orange coating with fingers or to allow any water contact. The orange coating must face toward the inlet. If the pad is yellow, it is unusable.
8. Assemble the pad holder. Run the test immediately, or the pad will spoil. Hold the calibrated bottle so that the outlet flow from the discharge tube enters the bottle.
9. Open the toggle valve. Close it again when you have collected 500 ml.
10. Remove the Pad Holder assembly from the quick disconnect and take the pad from the holder with tweezers. Blot the pad 3 or 4 times between dry paper towels using the heel of your hand for pressure. Do not rub.
11. Place the pad under the hinged flap with the orange side facing in.
12. Switch on the ultraviolet light using the rocker switch. Make sure the light indicator on the side of the comparator chamber is illuminated (green tint). Depress the push button on the instrument pack.
13. Move the lever on the back of the comparator chamber until the meter needle settles for 10-15 seconds at the "O" point.
14. Turn off the UV light using the switch and read the position of the lever along the calibrated scale; estimate to one tenth, such as 3.7. This means 3.7 ppm free water content.
15. If you cannot center the meter, move the lever to the position where the needle is closest to the zero. Look at the lever. If the lever is below the "1" mark, you have less than 1 ppm. If the lever is at the "12" end of the scale, you have more than 12 ppm (and a problem).



GTP-9300-4 ULTRAVIOLET HOUSING ASSEMBLY



ITEM	PART No.	DESCRIPTION
1	GTP-2324	BATTERY PACK
2	GTP-2203	BATTERY BRACKET
3	GTP-9300-11	REFLECTOR ASSEMBLY
4	GTP-9300-6	POWER CONNECTOR ASSEMBLY
5	GTP-9300-7	LIGHT BOARD ASSEMBLY
6	GTP-9300-8	RELAY BOARD ASSEMBLY
7	GTP-9300-9	LAMP HOLDER ASSEMBLY
8	GTP-9300	HOUSING
9	GTP-2380	ULTRAVIOLET LAMP
10	GTP-2204	ULTRAVIOLET FILTER
11	GTP-9320	SWITCH
12		FOAM PAD

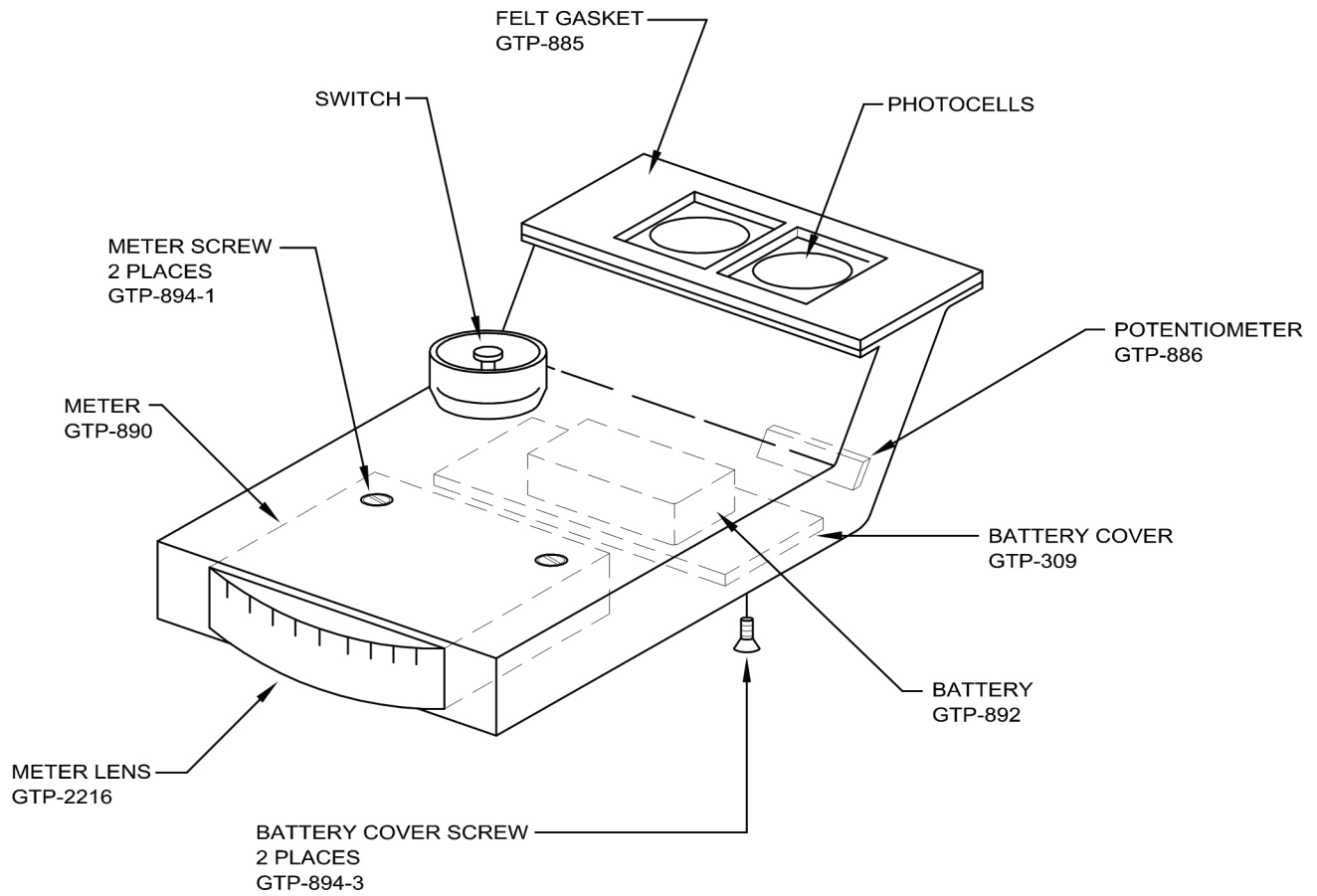


FIGURE 5
PHOTOCELL COMPARATOR
" INSTRUMENT PACK "
GTP-768

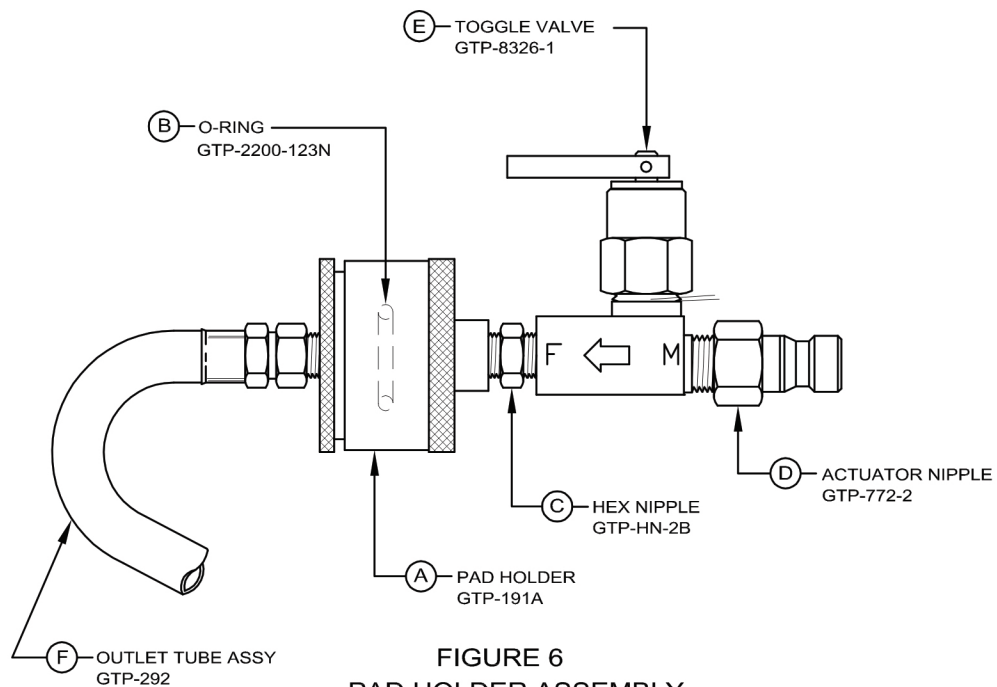


FIGURE 6
PAD HOLDER ASSEMBLY
GTP-191