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RAIN GAUGE CALIBRATOR



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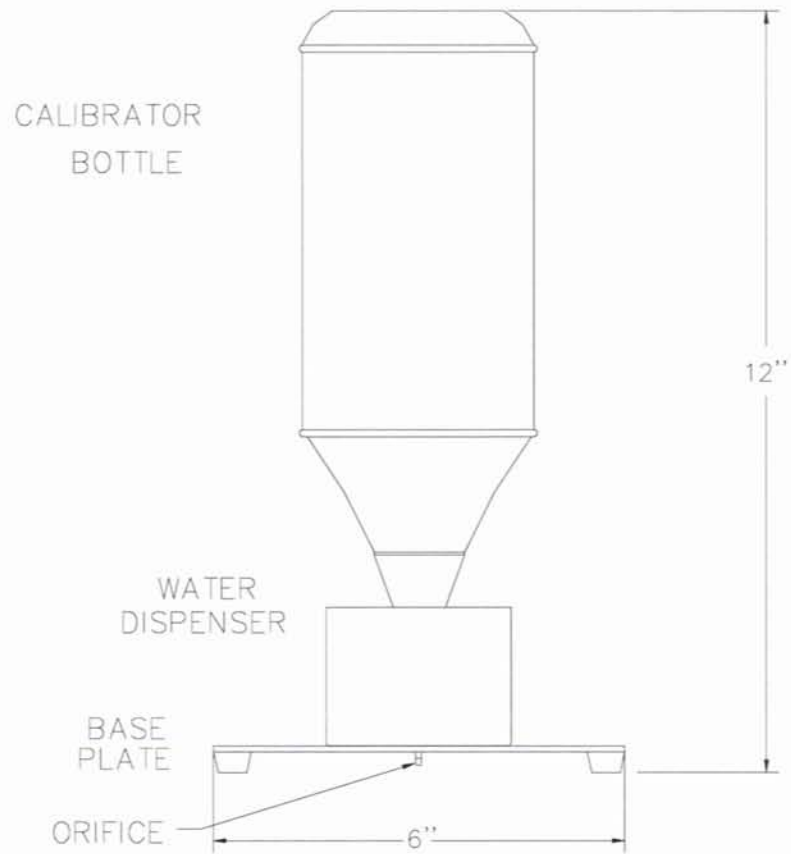
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WARNING: These products are not designed for use in, and should not be used for, human applications.

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EQUIPMENT CONFIGURATION AND PARTS IDENTIFICATION



RAIN GAUGE
CALIBRATION BOTTLE ASSEMBLY

RG-2595

RG-2595 Rain Gauge Calibrator Instruction Manual

1.0 INTRODUCTION

Calibration and verification of calibration of tipping bucket rain gauges can be a difficult and time consuming task. To meet the needs of the field technician, Omega offers a calibration bottle designed to simplify the rain gauge calibration verification process.

The design of the RG-2595 calibration bottle is unique in that it allows the use of four rather than one size of orifice to obtain four different rates of water flow. The use of more than one nozzle permits checking the dynamic operation of the rain gauge above and below the calibration point to obtain the error band of the gauge.

For the rain gauges manufactured by Omega, the factory calibrated flow rate is six inches per hour, unless otherwise specified.

By providing a controlled flow of water into the rain gauge funnel, the buckets can be made to tip at the normal rate of operation giving an output count within the specified accuracy of the gauge. Rain gauges that are in need of a calibration adjustment can be easily detected by comparing the test results to the calculated values given in the calibration tables at the end of this manual. A rain gauge that is still operating within the calibration specifications will agree with the tabulated calibration data within the acceptable percentage of error. The calibration bottle, when used with a calibrated graduated cylinder and a syringe, can be effective in setting and in correcting the calibration of the tipping buckets.

2.0 CALIBRATION BOTTLE CONFIGURATION

The precipitation gauge calibration bottle assembly, as manufactured by Omega, consists of a calibrated bottle, a circular base plate, a precision-machined combination bottle holder and water dispenser, four calibrated orifices, and a 10cc syringe.

The four orifices have been selected to provide the range of rainfall rates typically expected for all of the rain gauges manufactured by Omega. Some of the rainfall rates will be close to the calibration value of the rain gauge while others will be greater than or less than the calibrated value. Choose the orifices best suited for the rain gauge model and for the rates of rainfall expected at the location of the gauge. Some of the orifices may not be suited to the particular rain gauge being used and these orifices may be stored away for future use. Refer to the calibration data tables located at the end of this manual to determine the orifice needed to test a particular rain gauge.

If the model number of the rain gauge to be tested is not included in the tabulated data, please contact Omega for assistance.

The orifices are best identified by the nozzle lengths and orifice diameters. If it is not possible to measure or gauge the orifice diameter, use the nozzle length to distinguish

one from another. Nozzle lengths are measured from the face of the hexagon shoulder outward to the tip of the nozzle. Orifice diameters are the inside diameter of the nozzle. For the four orifices used, the orifice diameters and the nozzle lengths are:

ORIFICE DIAMETER	NOZZLE LENGTH
1/32"	3/16"
1/16"	5/16"
3/32"	3/8"
1/8"	5/8"

The orifices are made of a soft plastic and are easily damaged. Handle the base assembly carefully to protect the orifice after it has been installed. Whenever the base assembly has been attached to the bottle, always place the bottom of the bottle onto the table. The orifice can be removed and stored separately for protection during transit of the calibration bottle assembly. When inserting an orifice into the base assembly, carefully align the threads into the threaded hole and tighten gently by hand. Do not over-tighten. There should be no reason for using any tool to tighten or to loosen the orifice. Finger tight is sufficient. If the orifice seems difficult to remove, use a soft cloth to cover the orifice and loosen it by hand.

Always check the orifice to ensure that it is free of debris prior to installing it into the water dispenser housing. Rinse with clean water to remove any debris that may be inside the orifice. Avoid using any type of metal tool or instrument to remove debris from the orifice. Damage may occur, resulting in a change in the calibrated flow rate. If the orifice has been damaged or the flow rate has changed, replace the orifice with a new one. The orifice can be tested by measuring the time required for the bottle to empty when filled with a volume of water equal 1.00 inches of rainfall. The measured time should give a flow rate that matches the one for the orifice in the tables at the end of this manual.

3.0 USE OF CALIBRATION BOTTLE

The calibration bottle is relatively simple to use. For the best accuracy, fill the bottle to the **Black Fill Mark Line** on the neck of the bottle. The bottle has been calibrated at 946 ml and there is a black line marked at 946 ml. This line is normally 1/4" below the molded line on the bottle. This is the maximum capacity of the bottle and the calibration tables are based on this volume of 946 ml.

Another option is to use a graduated cylinder to accurately measure the water that is poured into the bottle.

The syringe may also be used to test for the exact amount of water that causes one bucket to tip. This method will verify the rough calibration of the bucket for a single tip and can be used to change or to correct the gauge calibration.

The base assembly is inverted and carefully threaded onto the bottle. Do not over-tighten or force the two threaded pieces together as this may damage the threads on the bottle. The entire assembly is then placed into the rain gauge funnel with the orifice facing downward so that the water flows out of the bottle and into the funnel. The bumper pads on the base plate should rest against the rain gauge funnel surface.

The bottle must be **turned over quickly and smoothly** to avoid splashing water out of the slots in the top of the water dispenser. For small amounts of water, less than 450 ml, there is a greater chance that water will splash out of the dispenser as the bottle is turned over. Some practice may be required to accomplish this maneuver successfully. Placing a fingertip against the end of the orifice can prevent water from coming out of the bottle prematurely whenever the unit is rotated slowly into position.

Hold the orifice and dispenser over the rain gauge funnel as the bottle is turned over so any spilled water will be caught and counted in the total amount of water.

At the end of the test, lift the bottle slightly to observe the stream of water from the orifice. The water may still be dripping out of the nozzle. Keep the calibration bottle over the funnel until the water flow stops. The stream will stop abruptly at the end of the flow. Some water will remain in the water dispenser part of the calibrator. Hold the calibrator bottle over the rain gauge funnel and tip the bottle so that the residual water spills out of the slot in the dispenser and falls into the funnel. Rotate the calibrator slowly to release any water left inside the dispenser. Avoid tapping the rain gauge in order to prevent accidental activation of the tipping bucket.

Upon completing the calibration procedure, carefully remove the rain gauge cover or funnel. If there is still water left in the bucket, use the syringe to determine how many additional milliliters of water are needed to produce another tip of the bucket. In many cases, the amount of water needed will be two or three milliliters. Add the water slowly from the syringe, one milliliter at a time, allowing time for the water to drop into the bucket before adding the next milliliter of water. Count the number of milliliters of water as they are added, until the bucket tips. In some cases this additional amount of water will give the final tip count that is needed for the exact calibration table value. In other cases, the additional water may result in a final total that is within one count, higher or lower than, the table value.

Bucket tips may counted manually or electronically. Omega can provide a digital counter with a liquid crystal display to totalize the bucket tips. The counter has a reset button on the display face and is easily readable in bright sunlight. The tipping bucket assembly may be left connected into its monitoring equipment for electronic counting of the bucket tips if the operator has the ability to obtain the data from the equipment at the gauge site. As an alternative, the bucket tips can be counted manually by listening for the sound of the bucket hitting the bucket stop.

Should the bucket calibration require adjustment, the following methods are recommended:

- > Move the bucket stop upward to decrease the amount of water required to tip the bucket. This will result in a higher count per 1.00 inch volume of water.
- > Move the bucket stop downward to increase the amount of water required to tip the bucket. This will result in a lower count per 1.00 inch volume of water.
- > Make adjustments to the bucket stop calibration screws by turning the screws only a small amount. Use turns of 1/4 or 1/8 of the full rotation per adjustment (90 or 45 degrees). Turn both stop screws for both buckets by the same amount and at the same time.
- > Retest the volume of water per tip for both buckets after each adjustment of the bucket stop screws.

Note that the bucket stop screws or the calibration adjustment screws are the screws that the bucket rests on top of after it tips and dumps out the water. The screw is on the opposite side of the gauge from the bucket that it affects. In some Omega rain gauges the bucket stop screw has a white acorn nut placed on the end of the screw for the bucket to rest against. Some other gauges use nylon screws and have the bucket come to rest on the end of the screw. Remember to lock the screws into place at the end of the adjustments, using the hardware furnished with the particular gauge.

4.0 TEST RESULTS

Each calibration test of the rain gauge should be performed at least twice with an average value computed from the total of the results. This method is used by Omega to calibrate the gauges in our lab. Normally, five repetitions of the test are sufficient to obtain valid results. For best accuracy at slow rates of rainfall, the test should be performed ten times.

If a glass calibrated cylinder is being used to fill the calibrator bottle, be sure to account for the meniscus of the water level. The calibrator bottle and plastic graduated cylinders do not cause a meniscus to form. Meniscus is the reaction of the water with the sides of a container causing the actual level of the water to be lower than the slightly higher water level along the sides. Use the lowest point of the surface of the water as viewed through the side of the container to obtain the actual water level.

The values shown in the calibration tables at the end of this manual are based upon actual tests made with the calibrator bottle. The numbers shown as inches or as millimeters of water should equal or be close to the number of bucket tips counted during the testing.

For a correctly calibrated gauge, the number of tips will usually equal the number shown in the table with a small amount of water left in one of the buckets. Sometimes,

however, the number of tips may be one less than the table value. In this case, one of the buckets is usually almost full of water. Several additional milliliters of water will cause the bucket to tip. Both of these situations are normal and are accepted as being within the calibration specification of the rain gauge.

5.0 REPLACEMENT PARTS

Part No	Orifice Diameter	Nozzle Length	Typical Use
16000201	1/32" (smallest)	3/16"	For 8" dia & less .01" cal
16000202	1/16"	5/16"	For 12" & 8" dia .01" & 1mm cal
16000203	3/32"	3/8"	For 12" dia 1mm cal
16000204	1/8" (largest)	5/8"	For 12" dia 1mm cal & above
16000200	Plastic Bottle 32 oz		
16000205	Syringe 10 cc (10 ml)		

6.0 CALIBRATION TABLES

Factory calibration uses the 1/16" diameter orifice at 6" per hour for an 8" rain gauge. This rate gives good overall results.

RAIN GAUGE CALIBRATION TABLE
FOR 8" DIAMETER RAIN GAUGES USING THE 1/16" ORIFICE

Rain Gauge Model #	Funnel Size	Calibrated Volume of Water			
		150ml	450ml	750ml	946ml (typical)
RG-2500 (.01")	8.0"	0.18"	0.55"	0.91"	1.15"
RG-2500M (1mm)	8.0"	4.6 mm	13.8 mm	23. mm	29. mm

FOR 8" DIAMETER RAIN GAUGES USING THE 1/32" ORIFICE
(This orifice produces a flow rate of 2"/hour and will take 35 minutes to complete.)

Rain Gauge Model #	Funnel Size	Calibrated Volume of Water			
		150ml	450ml	750ml	946ml (typical)
RG-2500 (.01")	8.0"	0.19"	0.56"	0.94"	1.19"
RG-2500M (1mm)	8.0"	4.8 mm	14.2 mm	24. mm	30. mm

ORIFICE FLOW RATES FOR 8" DIAMETER RAIN GAUGES

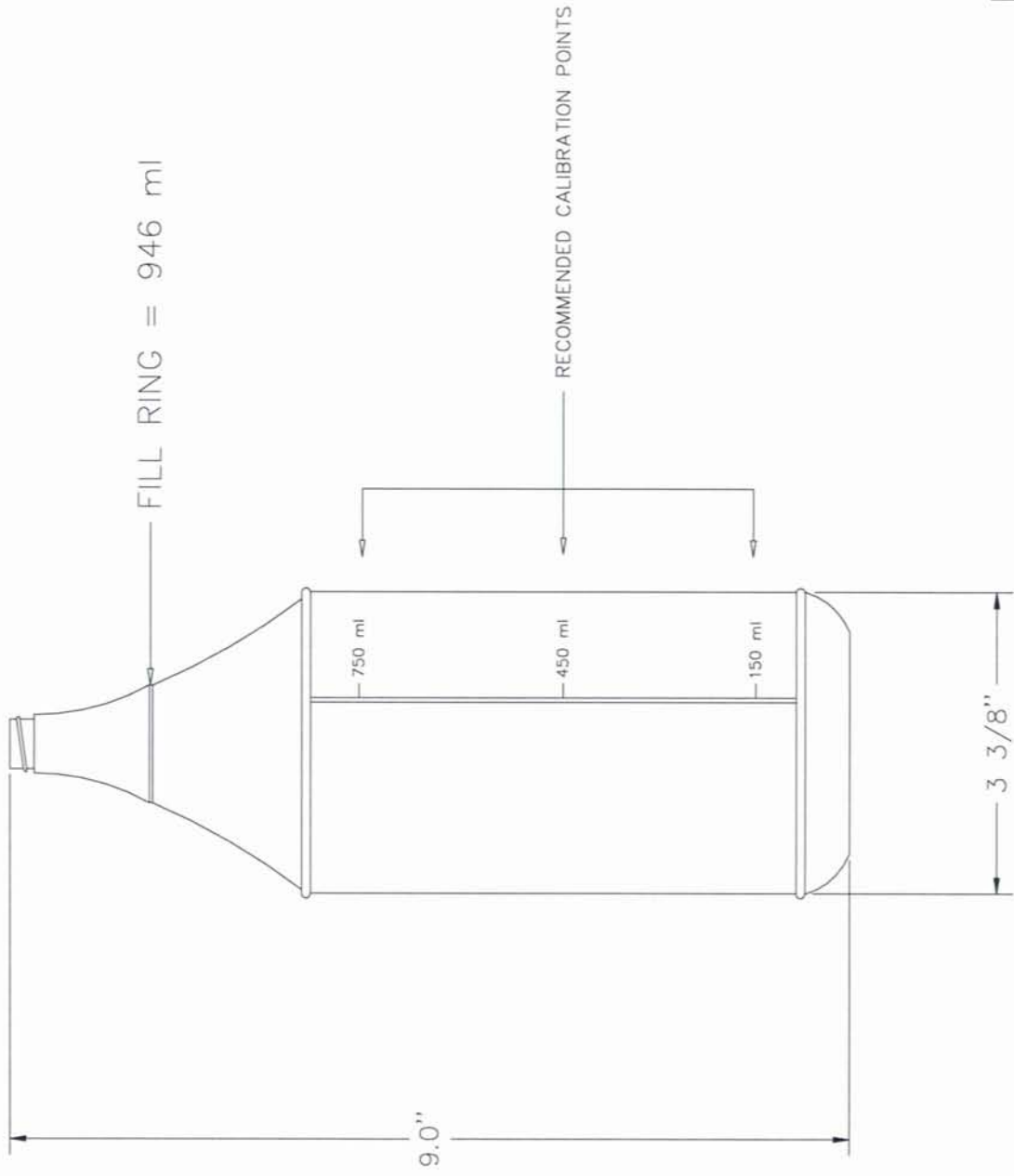
Orifice Size	Flow Rate in/hr	Flow Rate mm/hr
1/32"	2	50.8
1/16"	6	152.4
3/32"	12	304.8
1/8"	26	660.4
For RG-2500 0.01" of water = 8.24 ml 1 mm of water = 32.43 ml		

RAIN GAUGE CALIBRATION TABLE
FOR 12" DIAMETER RAIN GAUGES

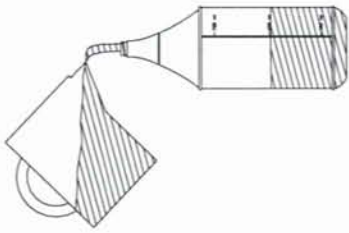
Rain Gauge Model #	Calibrated Volume of Water			
	150ml	450ml	750ml	946ml (typical)
RG-2500-12 (.01")	0.08"	0.24"	0.40"	0.51"

ORIFICE FLOW RATES FOR 12" DIAMETER RAIN GAUGES

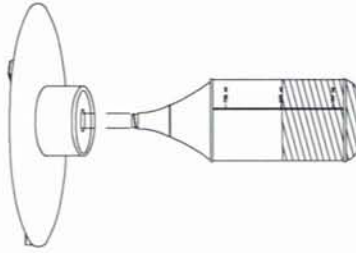
Orifice Size	Flow Rate in/hr	Flow Rate mm/hr
1/32"	0.77"	n/a
1/16"	2.47"	n/a
3/32"	4.93"	n/a
1/8"	11.39"	n/a
For RG-2500-12 0.01" of water = 18.53 ml		



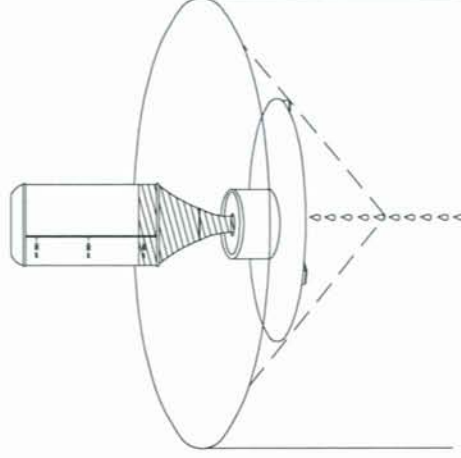
C	
TITLE	
OUTLINE, CALIBRATION BOTTLE PRECIPITATION	
MODEL USAGE RG-2595	
BY	RCN
DATE	3-28-95
SCALE	NONE
DWG. NO.	950418
SHEET 1 OF 1	



1
ADD WATER TO BOTTLE
WITH BOTTLE IN NORMAL
POSITION, FILL TO
CALIBRATED MARK



2
SCREW WATER DISPENSER
AND BASE ONTO BOTTLE
WITH BOTTLE IN NORMAL
POSITION AND DISPENSER
AND BASE UPSIDE DOWN



3
QUICKLY INVERT BOTTLE
WITH BASE ATTACHED
AND PLACE INTO RAIN
GAUGE FUNNEL

C		TITLE	
		OUTLINE, CALIBRATION BOTTLE ILLUSTRATED PROCEDURE	
MODEL USAGE RG-2595		SHEET 1 OF 1	
BY	RCN	SCALE	DWG. NO.
DATE	4-26-95	NONE	950419



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