

## Instruction Manual

# HI 38074 Boron Test Kit for Irrigation Water



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Dear Customer,

Thank you for choosing a Hanna Product.

Please read the instruction sheet carefully before using the test kit. It will provide you with the necessary information for correct use of the kit. If you need additional information, do not hesitate to e-mail us at [tech@hannainst.com](mailto:tech@hannainst.com).

Remove the chemical test kit from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer or the nearest Hanna office immediately.

Each kit is supplied with:

- HI 38074A-0 Boron Reagent, 1 bottle with dropper (30 mL);
- HI 38074B-0 Boron Reagent, 1 bottle with dropper (30 mL);
- HI 38074C-0 Boron Reagent, 1 bottle (100 mL);
- Mannitol, powder in packets (100 pcs);
- HI 38074E-0 Boron Reagent, 1 bottle (100 mL);
- HI 70004, 1 sachet;
- HI 70007, 1 sachet;
- 1 Checker<sup>®</sup>, pocket-sized pH-meter;
- 1 screwdriver;
- 1 empty bottle (120 mL) with cap;
- 1 calibrated plastic vessel (50 mL);
- 2 plastic pipettes (1 mL).

Note: Any damaged or defective item must be returned in its original packing materials.

## SPECIFICATIONS

Range	0 to 5 mg/L (ppm) as Boron
Smallest Increment	0.2 ppm Boron
Analysis Method	Titration
Sample Size	50 mL
Number of Tests	100
Case Dimensions	235x175x115 mm (9.2x6.9x4.5")
Shipping Weight	780 g (27.5 oz.)

## SIGNIFICANCE AND USE

Boron is one of the micronutrients essential for plant growth. It may be present naturally in water or may find its way into a watercourse through industrial waste effluents. Boron in excess of 2.0 mg/L in irrigation water is detrimental to many plants, but some plants may even be affected adversely by concentrations lower than 1.0 mg/L.

The US Department of Agriculture reports the following classification:

ppm of Boron	effect on crops
< 0.5	good (except for very sensitive crops)
0.5-2.0	some risks (many crops must be excluded)
> 2.0	dangerous (may only be used for very tolerant crops)

Note: mg/L is equivalent to ppm (parts per million).

## CHEMICAL REACTION

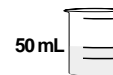
The Hanna Test Kit allows the determination of boron concentration in irrigation waters by direct titration of boric acid.

## INSTRUCTIONS

READ THE ENTIRE INSTRUCTIONS BEFORE USING THE KIT

- Calibrate the pH electrode following the instructions in the Checker<sup>®</sup> instrument manual.

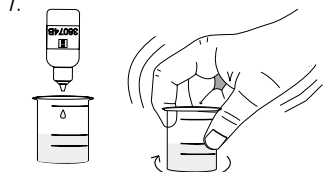
- Fill the plastic vessel with 50 mL of sample (up to the mark).



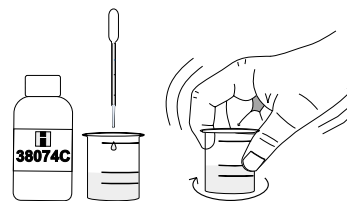
- Add 3 drops of HI 38074A-0 Boron Reagent and swirl to mix.



- Insert the Checker<sup>®</sup> pH electrode into the vessel and measure the pH. The pH must be lower than 7. If pH is higher than 7, add HI 38074B-0 reagent drop by drop, swirling after each drop, until pH becomes lower than 7.



- Using one of the plastic pipettes, add drops of HI 38074C-0 Boron Reagent, swirling after each drop.



- Keep on adding HI 38074C-0 reagent until the pH reaches the  $7.8 \pm 0.2$  value. Write down the exact pH value and report it as  $pH_{start}$  (e.g.:  $pH_{start} = 7.85$ ).

Note 1: If pH stabilizes at a value higher than 8, too many drops of HI 38074C-0 reagent have been added. In this case, add 1 drop of HI 38074B-0 reagent and swirl, then add again drops of HI 38074C-0 to adjust the pH to  $7.8 \pm 0.2$ .

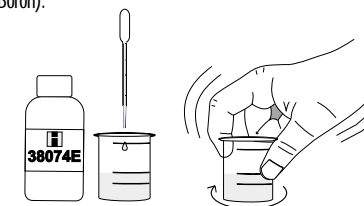
Note 2: If carbonates are present, the pH readings will show a drift after each addition. Wait until the pH stabilizes before adding the next drop of HI 38074C-0 reagent.

- Add 1 packet of Mannitol reagent and swirl gently to dissolve.



- Measure the pH:

- If pH is lower than  $pH_{start}$  (e.g.:  $pH = 7.52$ ), use the other plastic pipette to add HI 38074E-0 Boron Reagent drop by drop, swirling after each drop, while keeping an accurate count of the number of drops being added to the solution. Keep adding the reagent until pH becomes equal or higher than  $pH_{start}$  (7.85). Use the Boron Conversion Table below to convert the number of drops added in mg/L (or ppm) of Boron (e.g.: 10 drops of HI 38074E-0 reagent correspond to 2.0 mg/L of Boron).



- If pH does not change after addition of the powder packet, boron is absent. As a confirmation, add one drop of HI 38074E-0 reagent and pH will immediately increase a lot.

## BORON CONVERSION TABLE

number of drops	mg/L Boron	number of drops	mg/L Boron
1	0.2	14	2.8
2	0.4	15	3.0
3	0.6	16	3.2
4	0.8	17	3.4
5	1.0	18	3.6
6	1.2	19	3.8
7	1.4	20	4.0
8	1.6	21	4.2
9	1.8	22	4.4
10	2.0	23	4.6
11	2.2	24	4.8
12	2.4	25	5.0
13	2.6	26	5.2

### Interferences

- Compounds with buffering capacity (substances that keep the pH of sample at a constant value, e.g. phosphate buffer, ammonia buffer): if after Mannitol reagent has been added pH of sample does not change, verify if pH increases a little (0.05 pH units) by adding HI 38074E-0 reagent drop by drop. In this case boron may be present, but a buffer interferes with boron determination. It is possible to have only an indication for boron concentration. Use the Boron Conversion Table below to convert the number of drops added in mg/L (or ppm) of Boron and record the concentration of boron in your sample as lower than the value found (e.g.: 2 drops correspond to 0.4 mg/L of Boron, thus boron concentration in your sample is lower than 0.4 mg/L).
- Bicarbonates: if hardness of sample is about 150 ppm  $\text{CaCO}_3$ , bicarbonates are present at pH 8.3, and they interfere with boron determination. In this case the sample needs to be pretreated before analysis as described in the following paragraph.

### Pretreatment to eliminate carbonate interference

- Fill the plastic vessel with 50 mL of sample and pour it into the empty bottle.
- Add HI 38074B-0 reagent until pH is lower than 4.5. Place the cap, but DO NOT SCREW IT.
- Heat the sample for about 45 seconds in a microwave oven at 500W (do not boil the sample). Swirl several times to eliminate air bubbles and allow the sample to cool down to room temperature. Pour the sample into the plastic vessel and perform the test as described above.

## REFERENCES

P.Sequi, *Chimica del suolo*, Patron editore, Ed. 1991

## HEALTH AND SAFETY

The chemicals contained in this kit may be hazardous if improperly handled. Read the relevant Health and Safety Data Sheet before performing this test.