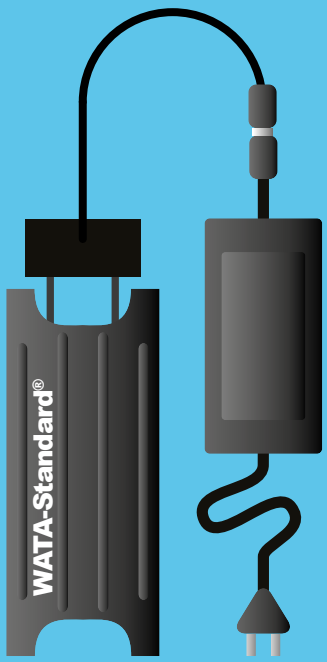
WATER AND HYGIENE

WATA-Standard®

OPERATING INSTRUCTIONS



ANTENNA FOUNDATION

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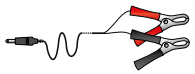
This guide explains how to use the WATA-Standard® electrolyser to produce a sodium hypochlorite solution with a 0.6% concentration of active chlorine (6 g/L) that can be used for water treatment or disinfection purposes. The WATA-Standard® produces a sodium hypochlorite solution by electrolyzing salt water. All that is needed are clear water, salt and electricity to use the WATA-Standard®. Water is chlorinated by adding a dose of sodium hypochlorite to potentially contaminated water, thereby destroying at least 99%* of pathogenic microorganisms in approximately 30 minutes.

1. PRESENTATION

The WATA-Standard® produces 2 litres of sodium hypochlorite solution in 2 hours and a half, which can treat up to 8,000 litres of water, meeting the drinking water needs of 2,000 people (4L/person/day).
The WATA-Standard® works with direct current and consumes a nominal power of 48 W.

AC/DC power supply provided to hook up to the grid:

- Input voltage: 100 – 240 VAC
- Input frequency: 47 – 63 Hz
- Input current: 0.4 A / 230 VAC
- Output voltage: 12 VDC
- Nominal output current: 5 A



For use with solar power or a battery, a pair of crocodile clips is provided, allowing for direct connection to a solar electric panel or a battery. These should deliver a voltage of 12 VDC.

⚠ **The device should be used only by a responsible person familiar with this user guide.**

⚠ **The sodium hypochlorite solution can be corrosive and irritating when in contact with the skin, eyes, mucosa and airways, causing cough and other breathing difficulties. In case of accidental contact, rinse with clear water. Do not inhale or ingest.**

⚠ **Store the sodium hypochlorite solution in an opaque, clean, labelled and well-sealed flask, out of the reach of children. Keep the flask in a cool and shady place.**

⚠ **Use the sodium hypochlorite solution within 24 hours following its production.**

⚠ **Never use metal containers for the procedure or for storage.**

⚠ **Do not use or store near fire, flames or sparks.**

*WHO, 2004, Water treatment and pathogen control, IWA publishing, p44-50

2. NECESSARY MATERIALS

- WATA-Standard® kit
- Ordinary salt
- Clear water
- Funnel
- Wooden/plastic table

3. RECOMMENDATIONS FOR THE PRODUCTION OF SODIUM HYPOCHLORITE

Choose one or several persons to be responsible for production
These persons should be trained and possess a general knowledge of chemistry. Production with the WATA-Standard® involves more than just adding salt to water. Failure to follow indicated procedures will lead to excessive energy consumption that will adversely affect the proper functioning and life span of the power supply.

Choose an appropriate area and time for production
Production should be carried out in a ventilated area, preferably at a temperature between 25 and 30°C, screened from sunlight and dust. In countries with a hot climate, it is advisable to work early in the morning or in the evening, when temperatures are lower.

Target output and concentration
The WATA-Standard® works by electrolyzing salt water at **30 g/L** to produce a sodium hypochlorite solution with **6 g/L** active chlorine. Failure to keep to these parameters for production could lead to poor quality or damage to the power supply.

In case of unstable current, use a voltage regulator
If the power grid is subject to intermittent outages, or sudden voltage dips and surges, the supply risks being destroyed (fluctuations in the intensity of the light emitted by bulbs is enough to indicate this). In this case, use a voltage regulator. Equally, if a generator has a large variation in operating regimes, the use of a voltage regulator is advised.

Use with a generator
The generator should not run out of fuel while the WATA-Standard® is in use. Wait until the generator is stable before plugging in the WATA-Standard®. When the procedure is complete, first unplug the WATA-Standard®'s power supply and then turn off the generator.

Respect the prescribed production volumes.
The recommended volume of each production run is 2L.

Overheating of the power supply
If overheating occurs, power will automatically shut off and then restart when its internal temperature falls below 70°C. However, it is advisable to stop the procedure and allow the power supply to cool down for 15 minutes.

Respect the 6 g/L concentration
The WATA-Standard® is designed to produce a sodium hypochlorite solution with a 1 to 6 g/L concentration of active chlorine. The concentration must not exceed 0.7%. Prolonged use or excessive salt will result in raising the temperature of the bath, not in increasing the concentration. If this occurs, there is a risk of damaging the power supply and/or not achieving the 6 g/L concentration. Use WataTest® to measure concentration once the procedure is complete.

Water temperature for production
To begin the procedure, use water with a temperature between 20 and 27°C. Check the temperature using a clean thermometer.

Use a log book
To facilitate the monitoring of chlorine production and to trace the origin of any problems that might arise, use a log book to record, each time the WATA-Standard® is used, the name of the person responsible for production, the starting and finishing times of production and a short description of the procedure. You'll find examples in the "tool kit" on our website, www.antenna.ch.

Regularly check production
Production should be checked at least every hour or more frequently. Watch for bubbles in the solution; this is proof that electrolysis is working properly. Make sure that the power supply does not overheat. Check the temperature of the solution. A high temperature causes a loss of efficiency during the production of active chlorine. If there is a possibility that dust or other substances could fall into the solution, cover it with a mosquito net type lid. This will allow the gas to escape and, if the area is well ventilated, to dissipate.

Always clean the WATA-Standard® after use
After each use, rinse the WATA-Standard® with clean water. If after several uses you notice white marks on the WATA-Standard®, prepare a solution of 50% vinegar (or lemon juice) and 50% clean water. Leave the device to soak for several hours (overnight for example) and then rinse it with clear water. Never scrub the titanium plates.

⚠ **Precautions**
Do not bend the electrical cables.

⚠ **Maintenance and repairs**
Do not attempt to perform electrical repairs if you are not competent to do so. Contact Antenna or a specialist who will assist you or refer you to appropriate services. If the power supply or device is defective, we recommend to dispose them in proper treatment plants, for appropriate recycling.

⚠ **Failure to comply with the operating instructions described in this manual will void the warranty.**

4. WATER QUALITY

The initial quality of the water used affects the efficiency of the sodium hypochlorite production and the efficacy of the water disinfection. The main parameters characterizing the initial quality required for the water are pH and turbidity.

PH

The pH is a measure of a solution's acidity or alkalinity on a scale from 0 to 14, with a pH of 7 indicating a neutral solution (such as pure water), <7 indicating an acid solution (such as lemon juice) and >7 indicating an alkaline solution (such as soap). The pH affects chlorine's ability to destroy microbes and viruses. Based on World Health Organization recommendations*, to effectively disinfect water with sodium hypochlorite, the water used should have a pH between 6.5 and 8.5. It is therefore recommended to measure pH.

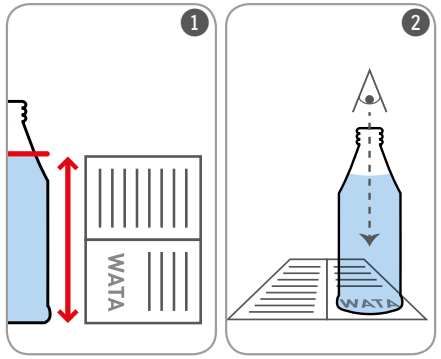
TURBIDITY

Turbidity measures the opacity of a liquid. Turbidity of water is caused by the presence of solid particles in suspension (clay, sand, bacteria, chemical or metallic residues, etc.) that make the water cloudy. Water with an elevated turbidity could lead to the formation of undesirable products during the production of sodium hypochlorite. During the chlorination process, elevated turbidity could diminish the treatment's efficacy. Following recommendations in the Sphère Handbook**, to guarantee optimal efficiency in producing sodium hypochlorite and chlorinating drinking water, **the water used should measure less than 5 units of turbidity (NTU)**.

*WHO, 2011, Guidelines for Drinking-water Quality - Fourth edition, p227
**Sphère Handbook, 2011, p100

For more than 5 units of turbidity, when the water is mildly turbid (<30 units of turbidity), a double dose of sodium hypochlorite can be used, and when the water is even more turbid (>30 units of turbidity), it must be filtered and/or decanted and then disinfected with a double dose of sodium hypochlorite. **However, it is absolutely necessary to verify that residual chlorine remains in the water 30 minutes after disinfection (see chapter 10)**. If it is not possible to use a turbidity meter, we suggest an alternative, though imprecise, method to measure turbidity.

To determine whether the water can be used to produce sodium hypochlorite or to chlorinate drinking water, fill a water bottle to the height of this manual when it is open and in a vertical position ❶. Then place the bottle over the WATA® logo and look at it from above through the bottle ❷. If you can read the WATA® logo through the water, this means the water measures less than 5 units of turbidity.



⚠ **There should be ample illumination but the light should not be blinding. The bottle should be transparent, colourless, clear and without scratches or dirt. A flat-bottomed bottle is preferable. Since it is not always possible to meet all of these conditions, catching a slight glimpse of the WATA® logo is acceptable.**

5. SOURCES OF ELECTRICITY/ENERGY

The WATA-Standard® can function with a variety of power options.

USING THE POWER GRID

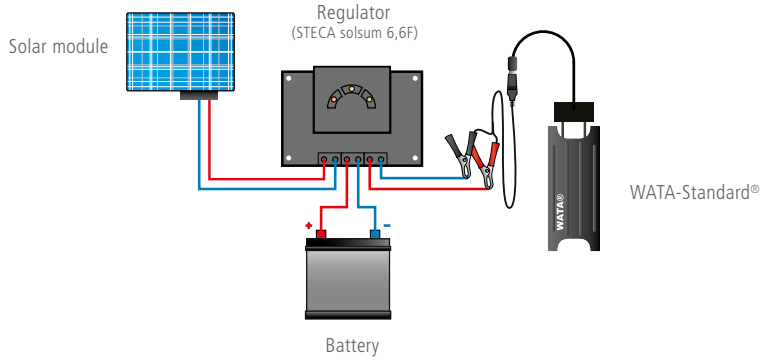
To use the device with a power grid or an alternating current generator, simply plug in the power supply provided.

USING DIRECT SOLAR POWER

For use with direct solar power, plug the WATA-Standard® device directly to a solar electric panel using the crocodile clips provided. The solar panel should deliver a voltage of 12 VDC, its size depending on the amount of solar radiation at the point of use. Example: With 1.2 kWh/m²/h hourly radiation (Ouagadougou region (12.4°N,-1.5°E) at midday in May), a solar electric panel with a peak capacity of at least 70 Wp is needed for production with the WATA-Standard®.

USING A SOLAR MODULE

For use with a solar module: since the energy generated by a solar electric panel varies depending on the amount of sunshine, it is strongly recommended to use a solar module (see diagram) whose regulator will supply constant energy to the WATA-Standard® and protect your battery, ensuring that the sodium hypochlorite solution is produced in the necessary conditions. The size of the solar panel always depends on the amount of solar radiation at the point of use. The battery should function with 12 VDC.



To determine the size of your solar module (solar electric panel, battery and regulator), we recommend that you consult a specialist. To give an idea of what is required, the tables below show approximately the capacity of the battery and peak power of the solar panel that are necessary depending on your needs and on the amount of solar radiation.

SOLAR MODULE: CHOOSING THE BATTERY, CAPACITY NEEDED [AH]

	Minimum capacity needed for a lead-acid battery (12 V) with a depth of discharge of 50%
1 production run of 2 L per day	20 Ah
2 production runs of 2 L per day	40 Ah
3 production runs of 2 L per day	60 Ah
4 production runs of 2 L per day	80 Ah
5 production runs of 2 L per day	100 Ah

SOLAR MODULE: CHOOSING THE SOLAR ELECTRIC PANEL, PEAK POWER NEEDED [WP]

Daily solar radiation at the place of use*	7 kWh/m2/d	5 kWh/m2/d	3 kWh/m2/d	1 kWh/m2/d
1 production run of 2 L per day	26 Wp	37 Wp	62 Wp	185Wp
2 production runs of 2 L per day	52 Wp	94 Wp	123 Wp	369 Wp
3 production runs of 2L per day	78 Wp	111 Wp	185 Wp	554 Wp
4 production runs of 2 L per day	104 Wp	148 Wp	246 Wp	738 Wp
5 production runs of 2 L per day	131 Wp	185 Wp	308 Wp	923 Wp

*For an example, refer to the website: https://eosweb.larc.nasa.gov/

USING A BATTERY

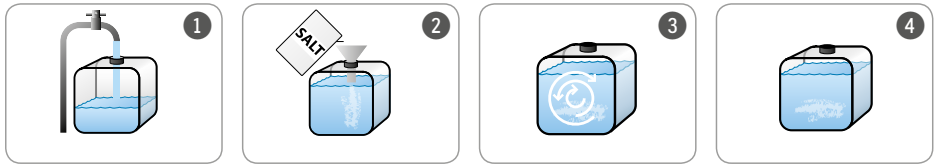
For use with a battery, plug the WATA-Standard® device directly to a pre-charged battery using the crocodile clips provided. The battery should deliver 12 VDC. A 2L production run with the WATA-Standard® consumes 10 Ah of the battery's capacity. For an idea of the capacity possible when using a battery with the WATA-Standard®, the table below shows maximum time of use for several batteries if only the WATA-Standard® is plugged in and the batteries are lead-acid with a 50% depth of discharge.

MAXIMUM TIME OF USE BEFORE RECHARCHING BATTERY (12 V BATTERY)

Battery capacity [Amp-hours]	40 Ah	60 Ah	80 Ah	100 Ah
Number of possible production runs with a WATA-Standard®	2	3	4	5

6. PROCEDURE FOR PRODUCING SODIUM HYPOCHLORITE SOLUTION

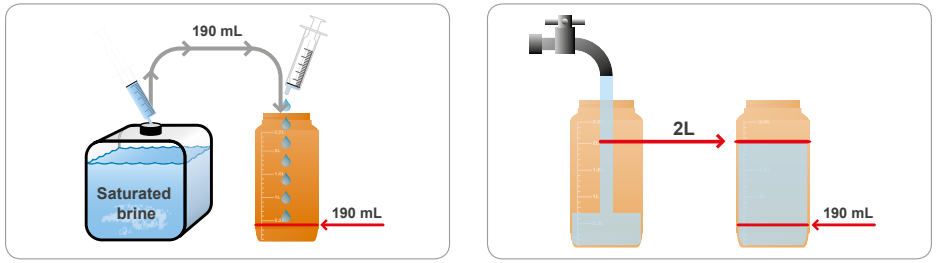
6.1 PREPARING THE SATURATED BRINE



1. Take a container of any size (but it must not be of metal) and fill it with water.
2. Add large quantities of salt (approximately 400 g of salt per litre of water). Preferably use refined salt.
3. Shake/mix steadily for 15 minutes to dissolve a maximum of salt.
4. Ensure that the salt remains at the bottom of the container. Close and label it. If no salt remains at the bottom of the container, add more salt and resume from step number 3.

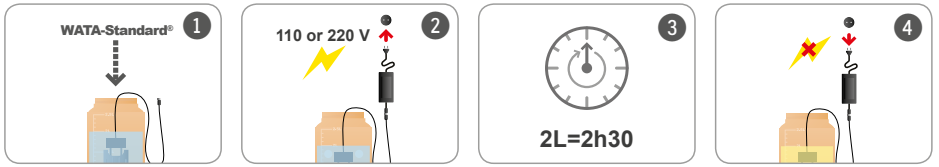
The brine so prepared will keep for 5 to 6 months. Do not forget to check whether the salt remains undissolved at the bottom of the container after each use.

6.2 PREPARING THE SOLUTION FOR ELECTROLYSIS



Using the large syringe (50 mL, supplied in the kit), inject **190 mL of saturated brine for 2 L of water to be electrolysed**, then top up your container using clean water (total volume 2 L).

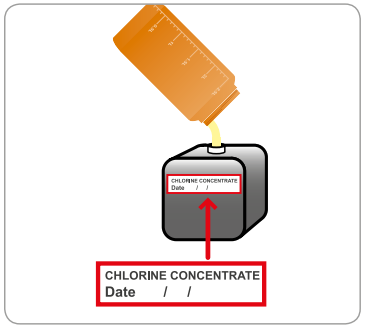
6.3 INSTALLING AND CONNECTING THE WATA-STANDARD® DEVICE



1. Once the brine solution is ready, totally immerse the WATA-Standard® device in the solution.
2. Connect the WATA-Standard® device to the electrical mains (110 or 220 V). When using solar energy, connect the WATA-Standard® device's connector clips to the rechargeable battery or the solar panel, taking care to connect them to the right terminals. Bubbles are immediately seen to be given off in the bottle
3. Wait 2 hours and a half to obtain 2 litres of sodium hypochlorite solution (6 g/L).
4. At the end of the process, disconnect the WATA-Standard® device, remove it from the sodium hypochlorite solution, rinse it with clean water and store it.

7. STORAGE AND STABILISATION

7.1 STORAGE



Store the sodium hypochlorite solution in a clean, tightly-closed, opaque, non-metallic container, and label it with the production date. Place the container in a cool place, out of the reach of children. Do not expose to sunlight.

⚠ **Sodium hypochlorite can keep for 24 hours without any need for testing. After that time has elapsed, measure the concentration with the WataTest® and adapt the dilutions accordingly.**

7.2 STABILISING THE CHLORINE SOLUTION

⚠ **To use a sodium hypochlorite solution produced by the WATA-Standard® electrical chlorinator device after more than 24 hours, we propose a stabilisation method using caustic soda (NaOH).**
This new process requires the use of a pH meter or pH testing strips. Laboratory skills and equipment are also required, but the process ensures a six-month minimum storage life. Information about this procedure is available at www.antenna.ch

⚠ **If you would like to produce sodium hypochlorite for the purposes of distributing it in vials, stabilisation will be required. You must comply with legislation effective in the country where you operate. A quality control procedure validated by the local authorities must be implemented.**

8. MEASURING ACTIVE CHLORINE CONCENTRATION WITH WATATEST®

It is essential to test the quality of the sodium hypochlorite solution produced in order to determine the dosage to apply depending on its use.

The WataTest® reagent allows to perform this control easily and quickly. Please refer to the WataTest® user's manual.

9. USING A SODIUM HYPOCHLORITE SOLUTION TO CHLORINATE DRINKING WATER

⚠ **It is important to chlorinate only water of sufficient quality, i.e. with a turbidity of less than 5 units, and a pH between 6.5 and 8.5 (see section 4). If the water is muddy, cloudy or coloured, it is crucial to filter or clarify it beforehand.**

The dose of active chlorine to add to the water so as to make it drinkable depends on how contaminated the water is initially. To ensure that 99% of pathogenic organisms are destroyed 30 minutes after chlorination, it is sufficient to check whether any residual chlorine remains in the water. For this purpose, we propose a pragmatic method that is ideal for visual checking using the WataBlue® reagent to determine whether a sufficient quantity of residual chlorine remains in the water.

To guide you for the first dosage, we recommend a dose of 1.5 mg/L of sodium hypochlorite. At this dose, 1 litre of sodium hypochlorite at a 6 g/L concentration produced by the WATA® device can be used to treat approximately 4,000 litres of water, if the initial water quality is compliant with the above-mentioned turbidity and pH criteria.

⚠ **Drinking water must contain between 0.5 et 1 mg/L of free residual chlorine.**

⚠ **The treated water must be stored in a clean, opaque, closed tank.**

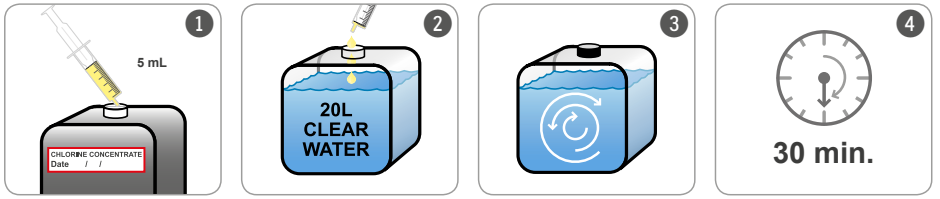
⚠ **Chlorination must be performed under the supervision of a qualified person.**

INDICATIVE DOSAGES FOR CHLORINATING DRINKING WATER DEPENDING ON THE CONCENTRATION PRODUCED BY WATA®:

		Volume of water to be disinfected		
		10L	20L	100L
Active chlorine concentration using the WataTest®	3 g/L	5.0 mL	10.0 mL	50.0 mL
	4 g/L	3.8 mL	7.5 mL	37.5 mL
	5 g/L	3.0 mL	6.0 mL	30.0 mL
	6 g/L	2.5 mL	5.0 mL	25.0 mL
	7 g/L	2.1 mL	4.3 mL	21.4 mL

⚠ **It is absolutely necessary to test for residual chlorine using the WataBlue® test 30 minutes after chlorinating your drinking water. Only this test result will guarantee protection against waterborne diseases.**

EXAMPLE OF CHLORINATION FOR 20L OF DRINKING WATER



1. Using a small syringe, collect 5 mL of your sodium hypochlorite solution.
2. Add 5 mL of sodium hypochlorite per 20L of plain water.
3. Shake vigorously (for chlorinating a water tank, add the sodium hypochlorite to the half-full tank, then add the rest of the water).
4. Wait 30 minutes for the sodium hypochlorite to act to inactivate the microbes.
5. Test for the presence of residual chlorine using the WataBlue® reagent.

10. TESTING DRINKING WATER WITH WATABLUE® (DETERMINATION OF RESIDUAL CHLORINE)

It is important to test the concentration of residual chlorine to protect the treated water against a possible recontamination and to avoid a strong taste of chlorine.

The WataBlue® reagent test determines the concentration of residual chlorine in the treated water. Please refer to the WataBlue® user's manual.

11. USING THE SODIUM HYPOCHLORITE SOLUTION FOR DISINFECTION/CLEANING

Disinfection is a process that eliminates pathogenic organisms, designed to halt or prevent infection by microorganisms.

PREPARING DISINFECTANT SOLUTIONS AT HOME

Use	Advised concentration of chlorinated solution	Vol. of sodium hypochlorite equivalent to a concentration of 6 g/L	Vol. of water	Procedure
Washing hands	0,5 g/L	1	10	Rub hands with the chlorinated solution for 30 seconds; allow to dry.
Floors (including floors and walls of latrines)	0,8 g/L	1	6	Wash with chlorinated solution; leave in contact for 5 min., then rinse.
Washing food and fresh vegetables	0,05 g/L	1	100	Soak food items in the chlorinated solution for 5 min., rub, and then rinse.
Dishwashing	0,5 g/L	1	10	Rinse the dishes in the chlorinated solution and then wash as usual.
Clothing / laundry	0.2 g/L	1	30	Soak garments in the chlorinated solution for 5 min then rinse carefully. Do not use chlorine to disinfect wool, silk or nylon.

PREPARING DISINFECTANT SOLUTIONS AT HEALTH CENTRES

⚠ **Surgery and sterilisation : disinfection by sodium hypochlorite is not sterilisation. Surgical instruments must be sterilised in an autoclave or a Poupinel sterilising oven.**

Use	Advised concentration of chlorinated solution	Vol. of sodium hypochlorite equivalent to a concentration of 6 g/L	Vol. of water	Procedure
Washing hands	0,5 g/L	1	10	Clean and dry the hands, then rub with the chlorinated solution for 30 seconds; allow to dry.
Disinfecting wounds (Dakin's solution) only with chlorine at 6 g/L	6 g/L	1	-	Use the solution pure, on a clean compress applied directly to the wound.
Floors (including floors and walls of latrines)	2 g/L	1	2	First sweep the floors and wash them with soap and water. Next apply the chlorinated solution for 10 min., then rinse and allow to dry.
Clothes, gowns and bed linen	2 g/L	1	2	Soak the clothes in the chlorinated solution for 10 min., rinse then wash as usual. Hang out to dry.
Containers and objects	2 g/L	1	2	Soak in the chlorinated solution for 10 min., then rinse and dry.

⚠ **The sodium hypochlorite must be diluted in cold water.**

⚠ **Never mix the sodium hypochlorite solutions with soap, detergents or other household cleaning products, since mixing with strong acids generates chlorine gas fumes.**

All the scientific references used in compiling this manual are available on request.
Kindly translated by Translators Without Borders.

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