SAFEBACK | SMART AQUACULTURE | GUANGZHOU, CHINA

Solar Permanent-Magnet Impeller Aerator

TK-YL1500SP · 96 V DC · 1.5 kW · ≥2.3 kgO_2/h · 2,000–4,000 ㎡ · solar direct drive

Product datasheet (EN) · Rev. 2026-10 · Vietnam market



Fig. 1 TK-YL1500SP complete: four PV modules on a stainless frame, the float platform carrying the PMSM motor and single impeller; about 46 kg afloat, about 200 kg complete with the array

1. Overview

The TK-YL1500SP is the first impeller aerator in the TK range that does not need the grid. It takes its power from the sun instead of a wall socket: four solar panels (≥2,000 W recommended) feed an AC/DC controller, which drives a 96 V DC permanent-magnet synchronous motor turning a single impeller. Oxygen transfer is ≥2.3 kgO_2/h and one unit covers 2,000–4,000 ㎡ (3–6 mu). Hydraulically it is the same machine as the TK-YL1500 — the only difference is where the electricity comes from. The reason for building it is practical. Across Southeast Asia a great many ponds sit at the end of a rural feeder: either a single-phase service only, or no supply at all. Running a dedicated three-phase line often costs more than the aerator itself — and ponds are usually leased, so the line stays behind

when the lease ends. Solar direct drive removes that constraint: mount the panels on the bund, float the machine, connect the cable. No grid application, no electricity bill.

Overcast weather does not have to stop it. The controller takes AC as well as DC, so mains or a generator can be connected at any time and picks up when solar output drops. Its real position is therefore "solar first, mains as backup" rather than "fully off-grid".

The hardware comes in two groups. On the water: float platform, motor, gearbox, impeller, water baffle — the same float-mounted arrangement as the AC model. On the bank: the solar array and its stainless-steel frame (four panels, about 107 kg in total; frame 47 kg). A DC cable links the two, and its length and conductor size have to match the site distance.

2. Key features

- **Aeration without a power connection** — 96 V DC permanent-magnet direct drive, fed by solar. It installs where there is no three-phase, or no supply at all. This single point defines its market in Vietnam, Cambodia and Myanmar, at the end of the rural feeder.
- **Near-zero running cost** — daytime solar drives the motor directly, with no inverter stage and one less conversion loss. An AC 1.5 kW unit running 8 hours a day for 300 days consumes about 3,600 kWh; with solar that daytime consumption disappears.
- **AC/DC dual input** — the controller accepts mains or a generator. For a long rainy spell, or when you must guarantee operation before dawn, you connect a mains feed rather than buy a second machine.
- **≥2.3 kgO_2/h, covering 2,000–4,000 ㎡** — the same class as the TK-YL1500. Sizing logic is unchanged: 0.75–1 kW per 667 ㎡ for a normal intensive pond.
- **Permanent-magnet synchronous motor, low starting current** — the weak point of a solar system is the inrush at start-up. A PMSM is friendlier than an induction motor of the same rating, so the array does not need an oversized margin for starting.
- **Single impeller with water baffle, simple build** — two wear parts only, impeller and oil seal, both replaceable at the pond edge without waiting for service.
- **Dismantles and moves** — motor 33 kg, impeller 1.6 kg, support strut 3.1 kg, float 1.75 kg each, baffle 0.6 kg, controller 2.8 kg. Two people can strip it down in one trip when a pond is drained or the machine is moved.

3. The TK family and model coding

Every SAFEBACK aquaculture product carries the TK prefix: TK – category code + specification number.

The two-letter code identifies the category; the number carries the single most important figure — rated power in watts for powered equipment, measured parameters ×100 for sensors, screen size ×100 for terminals. One rule across the range, so a customer can tell from the model number what a unit is and what class it belongs to.

The factory model is YL-1.5SP. Under TK coding it becomes TK-YL1500SP: YL for impeller aerator, 1500 for rated power in watts, and the SP suffix for Solar Permanent-magnet. We recommend showing both model numbers on quotations and nameplates so that customer and factory references always match.

Code	Category	Model	What the number means
GW	4G IoT gateway	TK-4G-GW	4G Cat.1 uplink (role-based code)
YL	Impeller aerator	TK-YL1500	Rated power 1500 W
YC	Waterwheel aerator (mains)	**TK-YC750SL**	Rated power 750 W, twin impeller
YC	Waterwheel aerator (mains)	**TK-YC1500SL**	Rated power 1500 W, four impellers
YL-SP	Solar impeller aerator	TK-YL1500SP	1500 W solar direct drive, PMSM
FS	Pneumatic (air-blower) feeder	TK-FS2000	Rated power 2000 W, 30 m throw
—	Two-bag feeder	TK-150D	150 kg/h class; D = dual hopper
DO	Fluorescence DO sensor	TK-DO100	Single parameter
PH	pH sensor	TK-PH100	Single parameter
ORP	ORP sensor	TK-ORP100	Single parameter
MP	Multi-parameter probe	TK-MP500	Five parameters

Aerators handle oxygen, feeders handle feed, and the sensors and terminal let you see what is happening. Buy one at a time or as a package from the configuration table in section 7. The interfaces and protocol are the same, so adding monitoring later does not mean replacing anything.

4. Technical specifications

Item	Specification	Notes
Model	TK-YL1500SP (factory model YL-	Impeller type, float-mounted,

Item	Specification	Notes
	1.5SP)	solar direct drive
Rated power	1,500 W	—
Motor type	Permanent-magnet synchronous motor (PMSM)	DC input, with gear reducer
Rated voltage	96 V DC	DC bus voltage
PV open-circuit voltage range	100–200 V DC	Controller input window; array wired to suit
Recommended PV capacity	≥2,000 W	Four panels in this configuration
Oxygen transfer rate	≥2.3 kgO_2/h	Same class as TK-YL1500
Impellers	1	Engineering-plastic lifting blades
Water area served	2,000–4,000 ㎡ (3–6 mu)	Varies with depth, stocking density and species
Control	AC/DC controller	Solar DC plus mains/generator AC input
Water baffle	19 × 19 × 5 cm, 0.6 kg	Limits splash, directs flow
Support strut	Stainless steel, 75 × 15 × 11 cm, 3.1 kg	Fresh and brackish water
Float	36 × 36 × 50 cm, 1.75 kg each	3
Solar panel	228 × 113.5 × 3.5 cm, 26.75 kg each × 4	About 107 kg total
Stainless-steel frame	47 kg	Crossbeams and braces carrying the array
Weight, on-water assembly	Approx. 46 kg	Motor 33 + impeller 1.6 + strut 3.1 + floats 5.25 + baffle 0.6 + controller 2.8
Weight, complete set	Approx. 200 kg	46 on water + 107 panels + 47 frame
Warranty	12 months on the machine, from date of manufacture	Wear parts (impeller, oil seal) excluded

Component weights (for packing and shipping):

Component	Dimensions (cm)	Unit weight (kg)	Qty
Motor	30 × 25 × 72	33	1
Impeller	65 × 65 × 21	1.6	1

Component	Dimensions (cm)	Unit weight (kg)	Qty
Stainless support strut	75 × 15 × 11	3.1	Per configuration
Float	36 × 36 × 50	1.75	3
Water baffle	19 × 19 × 5	0.6	1
AC/DC controller	30.5 × 21.5 × 11.5	2.8	1
Solar panel	228 × 113.5 × 3.5	26.75	4
Stainless frame (beams + braces)	—	47	1 set

Values marked "≥" are the manufacturer's lower limits; "approx." values are indicative. Actual oxygen transfer depends on water temperature, salinity, barometric pressure and impeller submergence — acceptance should be tested on site. Real PV output depends on irradiance, cell temperature and panel cleanliness; at solar noon on a clear day expect about 70–80% of nameplate.

5. How it works

PV array — four panels wired to land inside the controller's 100–200 V open-circuit window; daylight becomes DC current.

Controller — the AC/DC controller brings solar DC and mains/generator AC onto a common 96 V DC bus for the motor, switching to mains when solar output falls short.

Drive — the 96 V PMSM drives the vertical shaft through the gearbox, turning a single impeller.

Lift — the blades lift water from below and throw it outward along the tangent, forming a ring of water curtain.

Transfer — the curtain breaks into droplets and spray, multiplying the surface area in contact with air; oxygen dissolves at that interface.

Exchange — the thrown surface water spreads, then sinks, carrying oxygen-rich surface water down and pushing oxygen-poor bottom water up.

Circulation — the flow expands radially, drifting uneaten feed, faeces and dead algae toward the pond centre and easing bottom deterioration.

The difference from the AC model is only the energy path: same hydraulics, same transfer mechanism — what changes is where the power comes from and what regulates it. So the operating experience carries over directly: submergence depth, when to run, how to clear the impeller.

6. Installation and operating points

- **Panel orientation and tilt** — face due south in the northern hemisphere; for southern Vietnam

(around 10°N) a tilt of 10–15° is enough. Shading is the killer: a tree, a shed, even a single pole casting a shadow across one panel will collapse the output of the whole string.

- **Clean the panels** — wipe every one to two weeks. Bird droppings, dust and leaves are the first cause of falling output, more common than any fault. Put this in the instruction booklet.
- **Impeller submergence 1–2 cm** — identical to the AC model. Too deep and the motor overloads and current climbs; too shallow and it spins in spray with lower transfer efficiency.
- **Jog the motor before first run** — a DC motor reverses if the polarity is swapped; reversed it lifts nothing and damages blades. Confirm the lifting direction, then run continuously.
- **Size the DC cable to the distance** — at 96 V DC the current is not small; an undersized conductor drops voltage and shows up as "panels are generating but the impeller is slow". Keep the controller close to the motor and follow the maker's recommended conductor size for extensions.
- **Keep the controller out of sun and rain** — mount it in shade with airflow; do not let the sun beat on the controller itself. At 2.8 kg it can be repositioned to suit the site.
- **Anchor ropes and floats** — check before the monsoon and typhoon season so the unit does not drift into the bund or capsize.
- **Ballast the bank-side frame** — four panels plus frame is about 154 kg with a large wind area; it must sit on a firm base with ballast or ground anchors, or one squall will take it. This part fails more often than anything on the water.
- **Brackish and salt water** — strut and frame are stainless; the motor and controller sit in the splash zone, so inspect oil seal and paint annually in high-salinity areas.

7. Configuration and selection

The aerator is the actuator; the PV side decides how far it can sit from the grid. Choose by the power supply the pond actually has and by when you need to run:

Configuration	Composition	Supply	Suits
A Solar direct	TK-YL1500SP + 4 panels + stainless frame + AC/DC controller	PV	Ponds with no grid, or where a line costs too much; daytime operation
B Solar + mains	A + mains/generator input	PV + 220 V mains	Long rainy seasons; where pre-dawn running must be guaranteed

Configuration	Composition	Supply	Suits
C Solar + storage	A/B + battery bank (support to be confirmed)	PV + battery	Fully off-grid, must run at night; weigh cost against battery life
D Monitored	B/C + TK-4G-GW + TK-DO100	As above	On-demand aeration; controller communication port to be confirmed

How many units: as with the AC model, allow 0.75–1 kW per 667 ㎡ on a normal intensive pond; one unit covers 2,000–4,000 ㎡. Above 4,000 ㎡ use two units diagonally — better coverage and a spare. How much PV: size the array at 1.3–1.5 × motor rating, i.e. 2,000–2,500 W for a 1.5 kW machine; go higher where the rainy season is long or sunshine is poor. Err on the large side — the array is the only part you can expand later, and adding panels is cheaper than replacing the machine.

8. Notes for regional markets

The drive side of this unit is DC (PV direct), so grid frequency does not affect it; only the mains fallback side sees voltage and frequency. What differs between countries is solar resource, mains voltage and certification. Check the table first, then read the note for your region.

Country / region	Single-phase	Three-phase	Frequency	Relation to this unit
Vietnam	220 V	380 V	50 Hz	Identical
Thailand	220 V	380 V	50 Hz	Identical
Indonesia	220 V	380 V	50 Hz	Identical
Cambodia	220 V	380 V	50 Hz	Identical
Bangladesh	220 V	380 V	50 Hz	Identical
Mongolia	220 V	380 V	50 Hz	Identical
Myanmar	230 V	400 V	50 Hz	+5%
Singapore	230 V	400 V	50 Hz	+5%
Malaysia	240 V	415 V	50 Hz	+9%
India	230 V	400 / 415 V	50 Hz	+5–9%
Philippines	220 V	380 / 480 V	60 Hz	Frequency differs

8.1 Fully compatible — 380 V / 50 Hz

Vietnam, Thailand, Indonesia, Cambodia, Bangladesh, Mongolia — These six markets use the same low-voltage system as China: 380 V three-phase, 220 V phase-to-neutral, 50 Hz. The machine connects directly — no transformer, no re-wound motor. This is where the TK series is easiest to sell

against European or American equipment.

Vietnam is the reference market — 0.4 kV three-phase four-wire, 380 V between phases, 220 V phase-to-neutral, 50 Hz — the same as China. Small ponds in the south often have only a single-phase 220 V service, or three-phase with too little capacity; tell us the service type, transformer rating and existing load before ordering. If a single-phase machine is required, specify the D configuration.

Phase loss and voltage sag — Voltage sag at the end of a rural feeder, and phase loss, are the number-one cause of burnt motors — not the voltage level. Fit a phase-failure overload relay per machine; if you run demand-based aeration (C configuration), the control board already provides that protection.

8.2 Wide-range coverage — 400 to 528 V / 50 Hz

Malaysia 415 V, India 400–415 V, Singapore 400 V, the Philippines 480 V — no transformer needed — These voltages look higher than 380 V, but they are not a problem for our machines: the control supply is a 90–528 VAC wide-range input. Single-phase 220 V, 380 V phase-to-phase, 440 / 480 V — all accepted, and 100–745 VDC as well. No step-down transformer, no country-specific model. One machine covers Southeast Asia.

CE covers 100–400 VAC only — say so plainly — Operation between 480 and 528 VAC is fine, but it sits outside the CE certification range. Quote within 400 VAC for tenders and certification files; where 480 V is genuinely used, state it in the technical deviation sheet rather than glossing over it — this is exactly what a customer's acceptance engineer will check.

The motor side still deserves a glance — A wide-range control supply does not make the motor wide-range. A 380 V three-phase motor on a 415 V supply sees +9.2%, which is inside the ±10% window of IEC 60034-1 and will run; but in hot, humid pond-side enclosures the thermal margin is thin, so for continuous full-load duty confirm the actual voltage once, or take one frame size up. Same logic for 240 V single-phase in Malaysia.

8.3 Different frequency — the Philippines at 60 Hz

A 50 Hz motor must not be connected to a 60 Hz supply — The Philippines runs 220 V / 60 Hz nationwide, with 380 V or 480 V three-phase for industry. On 60 Hz a 50 Hz motor turns 20% faster; for impeller and fan loads shaft power rises with the square to cube of speed, so the demand reaches 1.4–1.7 times rated power — this is not 'a bit faster', it is guaranteed overload.

Three ways out — decide before ordering — ① Order a 60 Hz motor; cleanest. ② Run a VFD with the frequency clamped to 50 Hz, at the cost of about 17% of output. ③ Size up one frame and run it at 60 Hz. This has to be settled at the order stage; it cannot be fixed in the field.

Confirm the three-phase voltage as well — Both 380 V and 480 V three-phase exist in the Philippines — legacy US-era projects are usually 480 V, local distribution usually 380 V. Ask the

customer to photograph the panel nameplate before ordering.

8.4 Running cost — PV first, mains as backup

No mains during daylight — Four panels (≥2000 W) support 6–8 hours of running on a clear day in southern Vietnam, Thailand and Indonesia; on overcast days the mains takes over without interruption.

Cost of the mains backup — Assuming 30% overcast days and 3 hours of mains top-up, about 400 kWh a year: Vietnam about USD 32–38; Thailand about 50; the Philippines 46–54. An order of magnitude below a mains-only machine.

Size the array on annual yield, not peak sun — Array sizing follows equivalent full-load hours, not midday peak. Southern Vietnam about 1,400–1,600 h, Thailand 1,300–1,500 h, Indonesia 1,200–1,400 h; use the low end and keep margin.

8.5 Climate and corrosion

Hot and humid — Southern Vietnam, central Thailand, the Philippines, Indonesia, Malaysia: year-round humidity plus afternoon convective storms. Control enclosures IP55 or better, surge protection on the incoming supply; check mooring lines and floats before typhoon season.

Brackish and salt water — Ca Mau, Bac Lieu, Soc Trang and Ben Tre in Vietnam, southern Thailand, coastal Indonesia: high salinity, aggressive corrosion. Shaft and frame are stainless; the motor and gearbox sit in the splash zone, so inspect oil seals and paint annually. Tell us in advance for long-term high-salinity sites.

Monsoon flooding — India, Bangladesh, Myanmar: monsoon flooding with salt spray. Raise the enclosure base, keep every cable joint on the bank.

8.6 Certification and documents

Mandatory certification differs by country — Vietnam CR (QCVN 4:2009/BKHCN for low-voltage equipment), Thailand TISI, Indonesia SNI, the Philippines BPS/PS or ICC, Malaysia SIRIM / ST, India BIS. Most schemes are mandatory only for certain power ranges — confirm against the local customs requirement.

CE and IEC reports are the passport — Beyond the local schemes, a CE declaration and IEC test reports are the two documents customers ask for most, tenders in particular. Ask before ordering and we ship them with the goods.

Language of the documents — Standard documentation is bilingual Chinese/English. Vietnamese, Thai, Indonesian or Tagalog manuals and nameplates must be requested in advance — they are typeset separately, priced separately, and extend the lead time.

8.7 Five questions before ordering

① Is the pond service three-phase or single-phase? What is the transformer rating?

② What is the measured voltage on site? — the actual reading, not the nominal figure.

③ Is the frequency 50 Hz or 60 Hz? — the Philippines must be confirmed separately.

④ Is the water fresh, brackish or salt? Roughly what salinity?

⑤ Which language do you need for the manual and the nameplate?

This table is a general judgement. Province-level differences — a rural feeder that sits low all year, an extra clearance step at a particular port, a local subsidy scheme — should be added by the local sales team to the project file. For a country not listed here, judge by the same three dimensions: voltage, frequency, certification; if in doubt, ask the factory.

9. Frequently asked questions

Does it work in overcast weather? PV output falls with irradiance and the controller can switch to mains or a generator. Do not expect a solar-only build to carry a long rainy spell — take configuration B for the rainy season.

Do I need batteries? Not for daytime direct drive. Running at night needs a battery bank: lead-acid is cheap but replaced every 2–3 years, lithium costs more but lasts 5–8 years — work out the total cost of ownership.

Is 2,000 W of panels enough for a 1.5 kW motor? Enough for the daytime load. Panel ratings are peak; real output is about 70–80%, so 2,000 W gives roughly 1.4–1.6 kW at solar noon — just covering the motor, with a shortfall morning and evening, which is normal. For all-day coverage, go to 2,500–3,000 W.

Is the oxygen transfer really enough? ≥2.3 kgO_2/h, the same class as a 1.5 kW AC impeller aerator, covering 2,000–4,000 ㎡. The figure is the manufacturer's rating; this model has not yet been independently tested.

Can water get into the motor? The motor sits on the float platform above the waterline. Ingress protection class needs factory confirmation; for open ponds we recommend IP54 or better.

Can it be used in brackish water? The stainless strut and frame are fine; motor and controller need annual inspection in high-salinity areas — tell us in advance for a corrosion-protected build.

Is maintenance a burden? Three things: wipe the panels, clear the impeller, check the anchor ropes. Cleaning panels is the most neglected and the most damaging to output.

What does the warranty cover? Twelve months on the machine from the date of manufacture; panels usually carry a separate power warranty under the panel maker's terms; impeller and oil seal are wear parts and can be ordered separately.

10. Packing, delivery and commercial terms

Packing — components packed separately: motor, impeller, support strut, floats, water baffle and controller. Panels ship in the panel maker's original packing (crate/carton); the stainless frame is broken down and bundled. Carton dimensions and gross weight confirmed at order.

Container loading — about 200 kg per set, with the four panels (228 × 113.5 × 3.5 cm) taking most of the volume; 20GP/40HQ loading quantity to be measured and confirmed.

Lead time — scheduled after order confirmation; stock availability advised separately.

Port of loading — Nansha / Yantian, China.

Documents supplied — installation and operating instructions in English or Chinese; Vietnamese version available on request in advance.

Not included — battery bank, extension cable, anchor rope, concrete base/ground anchors, installation service.

11. Contact

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Specifications are subject to change without notice as the product is improved; confirm current data before tendering or volume orders.