SAFEBACK | SMART AQUACULTURE | GUANGZHOU, CHINA

Variable-Frequency Impeller Aerator TK-YL1500-VF

1.5 kW three-phase · PMSM variable frequency, 210 rpm · ≥2.3 kgO_2/h · one unit for 3–5 mu (0.2–0.33 ha) of water

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

1. Overview

The TK-YL1500-VF is the variable-frequency build of the TK-YL1500 platform: a 1.5 kW permanent-magnet synchronous motor with the frequency controller built into the machine, 380 V three-phase, 210 rpm, about 28 kg complete, carried on three HDPE floats. It delivers the same oxygen transfer as the fixed-speed model. What differs is that it can be turned down: speed is adjustable between 30 and 100 %, continuously or in steps, so the machine gives exactly the aeration the pond needs.

A fixed-speed aerator has two states — full speed, or off. Oxygen falls, the machine starts; oxygen recovers, it stops, and the dissolved oxygen trace becomes a sawtooth. A variable-frequency machine flattens that trace: speed rises as oxygen falls and drops back as it approaches target, so the machine keeps running without wasting power. Overnight, when oxygen declines slowly, 40 % speed holds the pond where a fixed-speed unit would be switching on and off all night.

Why pay for the VFD at 1.5 kW: you are not buying oxygen capacity, you are buying the start. A fixed-speed motor draws five to seven times rated current every start; at five or six starts a night, the winding and the gearbox take that shock repeatedly. A VFD ramps from zero to 210 rpm smoothly. The extra money goes into the electronics and comes back out of mechanical life.



Fig. 1 TK-YL1500 platform: three-float mount, vertical motor, impeller disc lifting and spreading water (photograph shows the fixed-speed build; the VF motor and controller look different)

2. Key features

- **≥2.3 kgO_2/h oxygen transfer — the value specified by SC/T 6010 for this power class, with standard aeration efficiency ≥1.5 kgO_2/(kW·h). Variable speed does not change the figure at the rated point; it changes everything below it. At 70 % speed the power draw roughly halves while more than half the oxygen transfer remains — the range a fixed-speed machine cannot reach.**
- **380 V three-phase, the same standard Vietnam uses** — Vietnam's low-voltage network is 0.4 kV, three-phase four-wire: 380 V between phases, 220 V phase-to-neutral, 50 Hz. The motor drops straight onto it — no transformer, no rewind.
- **Oxygen, mixing and circulation in one** — it does not just dissolve oxygen; it turns the water column over, brings oxygen-poor bottom water and waste to the surface, and drifts solids toward the pond centre.
- **Float-mounted, relocate at will** — three HDPE floats, no foundation, no bund space taken. Move it between ponds with a rope.
- **Permanent-magnet direct drive, cheaper at low speed — a permanent-magnet synchronous motor drives the impeller directly, with no gearbox and no slip losses. Below rated speed the efficiency advantage over an induction motor with a reducer is clear, which is where this machine spends most of its running hours.**
- **VFD built in, speed follows dissolved oxygen — the frequency controller is already on the machine, so no separate cabinet is needed. Pair it with the TK-4G-GW gateway and a TK-DO100 probe and the gateway sets the frequency over RS485, four speed steps against**

four oxygen bands. The machine finds its own balance point.

- **Few service points, cheap spares** — three routine checks: oil level, weed around the impeller, cable clamps. Impeller and oil seal are wear parts and can be replaced individually.

3. The TK family and model coding

How SAFEBACK numbers its models — TK – category code + specification number, with a suffix for derived models. TK-YL1500 is the fixed-speed base model; the VF suffix on TK-YL1500-VF stands for variable frequency and marks the VF build of the same platform. Power, impeller and floats are shared; only the drive and the controls differ.

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 / TK-YL1500-VF**	Rated power 1500 W; -VF is the VF build of the same platform
YC	Waterwheel aerator (mains)	**TK-YC750SL**	Rated power 750 W, twin impeller
YC	Waterwheel aerator (mains)	**TK-YC1500SL**	Rated power 1500 W, four impellers
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 them 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-YL1500-VF**	Impeller type, float-mounted; 210 rpm at rated, 30–100 % adjustable
Rated power	1500 W (2 HP)	—
Rated voltage	380 V, 3-phase, 50 Hz	Three-phase four-wire; matches Vietnam's 0.4 kV LV network
Rated current	To be confirmed by the factory	Nameplate current differs from the fixed-speed unit; confirm before order
Oxygen transfer rate	≥2.3 kgO_2/h	SC/T 6010 value for this power class
Aeration efficiency	≥1.5 $kgO_2/(kW·h)$	As above
Water area served	3–5 mu (2,000–3,333 ㎡)	Adjustable on site; 5 mu is the shallow, low-density limit
Impeller	Engineering-plastic lifting blades,	Diameter and blade count to be confirmed at

Item	Specification	Notes
	vertical shaft	order
Reduction	Direct PMSM drive, no gearbox	No gear oil, no oil changes
Floats	3 × HDPE hollow float	UV-stable, acid/alkali resistant, impact resistant
Frame and shaft	Stainless steel	Suitable for fresh and brackish water
Net weight	approx. 28 kg	One person can move it, two can lift it
Noise	≤80 dB(A)	SC/T 6010 limit
Cable	Length confirmed at order	Run along the bund and clamp it; do not drag it
Warranty	12 months on the machine, from the date of manufacture	Controller included; wear parts (impeller) excluded

Values marked "≥" for oxygen transfer and efficiency are the SC/T 6010 acceptance floor for this power class, not the measured maximum; values marked "approx." are indicative. Actual oxygen transfer depends on water temperature, salinity, barometric pressure and impeller submergence, so acceptance testing should be done on site.

5. How it works

1. **Lift** — the motor drives the vertical impeller shaft through the gearbox; the blades lift water from below and throw it outward along the tangent, forming a ring of water curtain.
2. **Transfer** — the curtain breaks into droplets and spray, multiplying the surface area in contact with air; oxygen dissolves into the water at that interface.
3. **Exchange** — the thrown surface water spreads, then sinks, carrying oxygen-rich surface water downward and pushing oxygen-poor bottom water up. This is the layer exchange that resolves stratification.
4. **Circulation** — the flow expands radially from the machine, drifting uneaten feed, faeces and dead algae slowly toward the pond centre or drain, easing bottom deterioration.
5. **Repeat** — these four steps run continuously; dissolved oxygen and water-column structure improve noticeably within a few hours and gasping fish recover.

Impeller aerator versus bottom diffuser: the impeller pushes oxygen-rich surface water down and is the fast way to break stratification; a diffuser injects oxygen at the bottom, uses less power, but does much less for the whole water column. Running the impeller for two or three hours on a hot sunny afternoon — pushing the supersaturated surface layer down — is the cheapest aeration you can do.

6. Installation and operating points

- **Impeller submergence 1–2 cm** — the single most important adjustment. Too deep and the motor overloads, current rises and power bills climb; too shallow and it spins in spray with lower transfer efficiency.
- **Check rotation before running** — after wiring, jog the motor: the impeller must lift water clockwise. Reversed rotation lifts nothing and damages blades; swap any two phases immediately.
- **Clamp the cable to the frame** — a cable that works loose while the machine is being moved or in wind is the number one cause of single-phasing and burnt motors. Tie it to the frame, leave

slack for water-level change, keep it out of the mud.

- **Fit phase-loss and overload protection** — phase loss and voltage sag are common at the end of rural feeders. The protector costs very little and saves the motor. Keep voltage within ±5% of rated.
- **Check oil before the season** — fill the gearbox with 10#–30# oil to the sight plug before first use, then check monthly. Milky oil means a failed seal: replace it before running again.
- **When to run** — sunny afternoon for layer exchange; the morning after an overcast day; the middle of the night during prolonged rain. **Do not run at dusk or at midday in rainy weather**: running at dusk disperses the surface oxygen and speeds up night-time depletion, which is exactly how you get a 4 a.m. kill.
- **Clear the impeller** — weeds, rope and plastic bags wrap the blades and push current up. Check every one to two weeks, and always before and after harvest.
- **Storms** — the southern Vietnamese rainy season brings violent squalls. Check anchor ropes and floats beforehand so the machine does not drift into the bund or capsize.

7. Configuration and selection

The aerator is the actuator; combined with SAFEBACK monitoring and control products it forms four configurations. Choose by the power supply your pond actually has and by how you manage the farm:

Configuration	Composition	Supply	Suits
A Manual	TK-YL1500-VF ×1	380 V 3-phase	3–5 mu; speed set by hand on the panel; lowest entry cost
B Timed	TK-YL1500-VF ×1	380 V 3-phase	3–5 mu; runs on the built-in schedule at reduced speed, no night calls
C On-demand	TK-YL1500-VF + TK-4G-GW + TK-DO100	380 V 3-phase	3–5 mu; speed follows DO in four steps — the most economical way to run
D Hybrid	TK-YL1500-VF + TK-YL1500 + gateway	380 V 3-phase	Over 5 mu; the VF unit holds the night, the fixed-speed unit cuts in below the floor

How many units: for a normal intensive pond (about 2 m deep, roughly 1,000 kg per 667 ㎡), allow 0.75–1 kW per 667 ㎡. One 1.5 kW unit covers 3–6 mu; above 6 mu use two units placed diagonally, which both covers the area and gives you a spare — if one fails the other is still running. Denser stocking, deeper water, or oxygen-sensitive species such as grass carp and bighead carp all call for more power.

8. Notes for regional markets

This unit is built for 380 V three-phase, 50 Hz. What differs between countries is not whether it fits, but three things: voltage level, frequency 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 at local tariffs

- **1.5 kW with a VFD: speed control beats on/off** — A fixed-speed machine only starts and stops; a VFD lets the impeller follow the oxygen deficit. For impeller loads power tracks roughly the square of speed, so at 70% average speed consumption falls to about half.
- **Annual cost at local tariffs (2025 public data, tax included, indicative)** — At 8 h a day, 300 days, 70% average load — about 2,500 kWh: Vietnam about USD 200 – 235; Thailand 315; Indonesia 195–220; the Philippines 285–335; Malaysia 250–350. Check the local bill.
- **The VFD itself draws a little** — Standby and switching losses are about 2–3% of rated power. Isolate the control supply when the machine is idle for long periods.

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

How many mu does 1.5 kW really cover? What it covers depends on depth, stocking density and species: for a 2 m deep pond producing around 1,000 kg per 667 ㎡, one unit over 3–5 mu is a safe call. The VF model covers slightly less than the fixed-speed one because a reduced speed narrows the flow pattern — that is a reach limit, not an oxygen limit. For deeper or denser ponds allow 0.75–1 kW per 667 ㎡.

I cannot get up at night — what are my options? Take configuration C: the DO probe raises speed below your threshold and lowers it or stops the machine above it, and you watch the curve on your phone. This is where a VF machine earns its price — instead of switching on and off, it settles at the speed that just holds the pond. Quieter at night, and less power.

How long should it run each night? Do not run by the clock. Two to three hours on a sunny

afternoon for layer exchange, then decide by DO value on overcast days and during prolonged rain; 2–5 a.m. is the danger window. If you have monitoring, watch the curve; if not, at least keep to two rules: start the morning after an overcast day, and run through the night during sustained rain.

Will it injure fish or shrimp? The impeller flow expands radially and is gentler than a paddlewheel; for grow-out fish and shrimp there is no injury problem. For hatcheries, nursery ponds and very small water bodies, 1.5 kW is too much flow and will stress the fry.

My pond has no three-phase supply — can I still use it? This model is 380 V three-phase. Where only a single-phase supply reaches the bank, take the 220 V version, or drive it through a single-phase-input, three-phase-output VFD — speed control is kept either way. The cost is one more conversion stage, and surge protection in lightning areas.

What does it cost to run for a year? At 8 hours a day for 300 days that is about 3,600 kWh, roughly VND 7.15 million (about USD 270) at Vietnamese industrial tariffs. That is the ceiling for continuous running; your own switching strategy will bring it down.

What does the warranty cover? Twelve months on the machine, counted from the date of manufacture — motor, gearbox, frame. Impeller, oil seal and cable are wear parts and are excluded, but they are inexpensive and can be ordered separately.

How noisy is it? ≤80 dB(A). Normal conversation at the pond edge is unaffected; for ponds close to housing, run at lower load at night.

10. Packing, delivery and commercial terms

- **Packing** — impeller, frame, floats and motor packed separately in cartons and woven bags, one set per package; carton dimensions and gross weight confirmed at order.
- **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** — phase-loss protector, extension cable, anchor rope, 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.