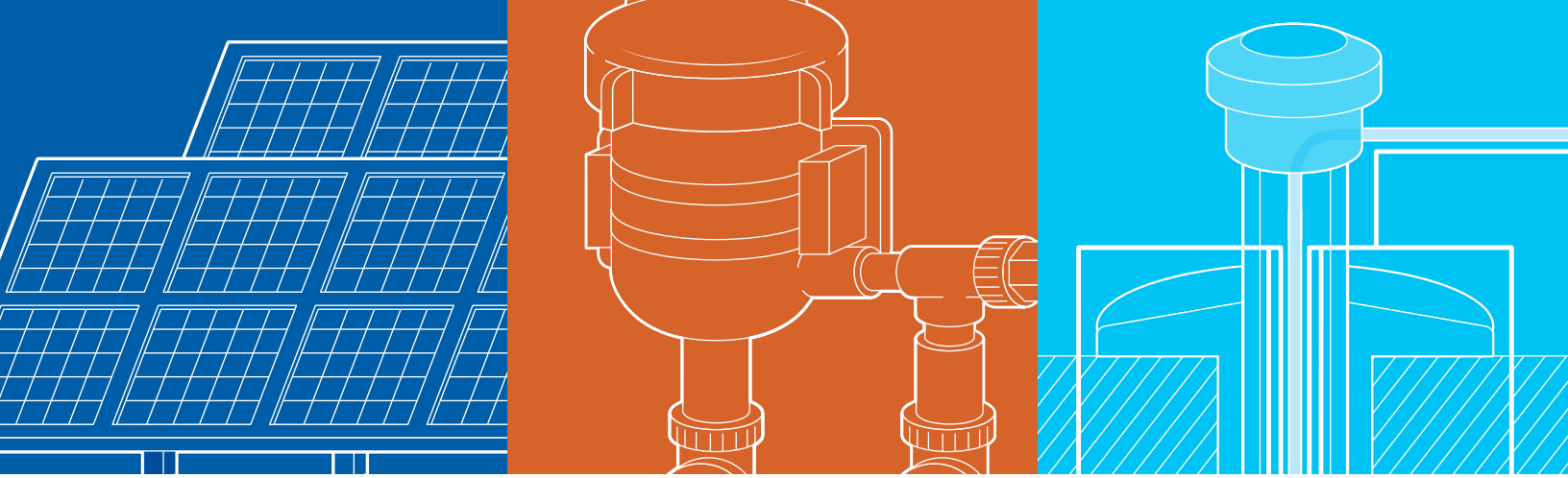

Global Water CENTER

unicef for every child

SPWS Design Evaluation Checklist

Work through this checklist before submitting any specification or tender.
Items marked ★ are critical for supplier compliance.

Five Principles for Better Specifications

1. Name items specifically	Don't write "surge protection" or "DC fuses." Write "AC SPD Type II, 40 kA" and "gPV fuses on both positive and negative DC lines." The more specific the specification, the harder it is for a supplier to substitute a cheaper alternative.
2. Name the standard	Reference the standard directly: "dV/dT filter in accordance with VFD manufacturer's installation requirements" is much harder to ignore than "appropriate filtering." A named standard gives you grounds to reject non-compliant submissions.
3. Require a compliance schedule	Ask each tenderer to submit a compliance declaration — item by item, confirm compliance or explain the deviation in writing. This surfaces substitutions before the contract is signed, not after installation.
4. Make documentation a deliverable	Include O&M manuals (English AND local language), as-built wiring diagrams, and commissioning test reports in the schedule of deliverables. Withhold final payment until all are delivered.
5. Include a Bill of Materials	Require the contractor to submit a full Bill of Materials with their tender response. This makes it straightforward to spot missing items before award — not after the system is installed.

If it is not written into the specification, it will not be supplied.

★ = Critical — must be named in the tender specification

SECTION A — ARRAY & SITE DESIGN

✓	Item	Reference	Notes
☐	Structural calculations for wind load and anchoring included in tender response ★	*IEC 61215 / local building code*	
☐	Seasonal shading analysis completed and results documented	*PVsyst / SolarPathfinder*	
☐	Shading loss confirmed <3% during peak production hours (9am–3pm)	*Shading analysis output*	
☐	Storm drainage plan included in civil works specification ★	*Civil design requirement*	
☐	Inverter and control equipment elevated above site maximum flood level	*Site flood assessment*	
☐	Security fencing specified: height, material, lockable gate ★	*UNICEF guidance*	
☐	Security system schematic (CCTV / motion sensors) included in design docs	*Site risk assessment*	
☐	Mounting structure material specified (galvanized steel or anodized aluminum minimum)	*Corrosion protection*	

SECTION B — SPWS DESIGN TOOL & PUMP SELECTION

✓	Item	Reference	Notes
☐	Pump manufacturer selected based on local supply chain availability and serviceability	*Design decision*	
☐	Pump sizing verified using manufacturer's own sizing tool (WebCAPS, COMPASS, etc.)	*Manufacturer tool*	
☐	At least two pump manufacturers' options investigated ★	*UNICEF brand agnosticism requirement*	
☐	TDH calculation reviewed: safety factor applied only where justified (e.g. old pipework)	*Design judgment*	
☐	Water quality test results obtained and documented (Step 2B)	*Site requirement*	
☐	Borehole yield confirmed sufficient for system peak demand ★	*Hydrogeological assessment*	
☐	Performance cross-checked against at least two seasonal scenarios (peak / low yield month)	*SPWS Design Tool*	
☐	Pump materials verified as compatible with source water quality (sand content, iron, manganese, salinity, pH, and corrosivity)		

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SECTION C — ELECTRICAL PROTECTION & ISOLATION

✓	Item	Reference	Notes
☐	gPV fuses on BOTH positive and negative DC lines from each string ★	*Combiner box spec / IEC 61643-31*	
☐	DC breaker: DC-rated (not AC), sized to Isc × 1.25 ★	*Manufacturer selection chart*	
☐	DC disconnect (lockable, LOTO-capable) specified for DC side ★	*Water Mission 5.2 / Safety requirement*	
☐	DC SPD Type II in combiner box ★	*IEC 61643-31*	
☐	AC breaker sized to inverter AC output current rating ★	*Inverter installation manual*	
☐	AC isolator (lockable, LOTO-capable) specified on AC side ★	*AC isolator (lockable, LOTO-capable) specified on AC side*	
☐	AC SPD Type II at distribution board ★	*IEC 61643-31*	
☐	All protection devices labelled with rating and function	*Tender specification*	
☐	All enclosures rated NEMA 3R / IP55 minimum — even for indoor installations near water ★	Water Mission 5.2.3	
☐	Stored energy wait period documented for VFDs/ inverters (typically 1–5 min before opening) ★	Water Mission 5.2.4 / equipment manual	

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SECTION D — CABLING & WIRING

✓	Item	Reference	Notes
☐	Cable sizes specified for all runs: DC string, DC main, AC output, submersible drop cable ★	*Verify using voltage drop chart*	
☐	Voltage drop ≤3% on DC runs, ≤5% on AC runs ★	*Use free online voltage drop calculator*	
☐	Ampacity confirmed against operating current for each cable segment ★	*Manufacturer cable ampacity table*	
☐	Cable type specified: PV-rated DC cables, UV-resistant outer sheath for outdoor runs	*Tender specification*	
☐	Shielded cable specified for all VFD-to-motor runs exceeding 20 m	*VFD manufacturer guidance*	
☐	All wiring to be labelled at both ends per an as-built wiring diagram ★	*Make this a contract deliverable*	
☐	DC colour coding specified: red positive, black negative (or per local standard)	*Local standard*	

SECTION E — VFD SYSTEMS (AC PUMPS ONLY)

✓	Item	Reference	Notes
☐	dV/dT filter specified for VFD-to-motor cable runs exceeding 50 m ★	*UNICEF guidance*	
☐	Output reactor specified as minimum protection for ALL VFD installations	*VFD manufacturer guidance*	
☐	Shielded motor cable specified for runs exceeding 20 m	*VFD manufacturer guidance*	
☐	VFD enclosure IP rating specified to match installation environment	*Site environmental assessment*	
☐	Bypass / manual start provision considered for critical water supply sites	*Design decision*	

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SECTION F — ELECTRICAL SAFETY & INSTALLATION

✓	Item	Reference	Notes
☐	Safety signage on ALL electrical enclosures: "Warning — Electrical Hazard / Authorised Personnel Only" ★	*Water Mission 5.2 Appendix C*	
☐	Enclosure labels include equipment name, voltage type, and max voltage/current ★	*Water Mission 5.2 Appendix C*	
☐	"Multiple Power Sources" label on any enclosure with both AC and DC supply	*Water Mission 5.2 Appendix C*	
☐	"Lockout Before Servicing" label on all isolator/ disconnect enclosures ★	*Water Mission 5.2 Appendix C*	
☐	LOTO directory diagram (showing all isolation points) included in design docs and posted on site	*Water Mission 5.2 Appendix C*	
☐	Water and electrical systems separated as much as practicable (opposite walls or separate rooms)	*Water Mission 5.2.3*	
☐	No water piping or equipment installed above electrical equipment ★	*Water Mission 5.2.3*	
☐	GFCI / RCD protection specified for any receptacles near water sources	*Water Mission 5.2.3*	
☐	Conduit entries sealed (conduit foam) to prevent water ingress and condensation ★	*Water Mission 5.2.3*	

SECTION G — GROUNDING & LIGHTNING PROTECTION

✓	Item	Reference	Notes
☐	Earth resistance test conducted or planned at site ★	*Engage local utility or qualified engineer*	
☐	Earth resistance ≤10 ohms confirmed (or mitigation plan documented)	*IEC 62305 / local standard*	
☐	All metallic structures bonded and connected to common earth point ★	*IEC 62305*	
☐	Earth rod material and depth specified (copper rod per site resistivity)	*Site-specific assessment*	
☐	Lightning protection assessment completed for high-risk sites	*IEC 62305*	
☐	Lightning protection design reviewed by qualified engineer if required	*Qualified engineer required*	
☐	Grounding plan included in design documentation package ★	*UNICEF guidance*	

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SECTION H — OPERATIONS & MAINTENANCE CONSIDERATIONS

✓	Item	Reference	Notes
☐	Isolators and disconnects positioned for single-person access without confined space entry ★	*Design for Maintainability*	
☐	Spare parts stocking location specified: on-site or named local distributor ★	*Design for Maintainability*	
☐	Spare parts accessible within reasonable timeframe for remote sites (consider buffer stock)	*Design for Maintainability*	
☐	All enclosures labelled with equipment name, voltage type, max voltage and current ★	*Water Mission 5.2 Appendix C*	
☐	Stored energy wait period for VFDs/inverters documented in O&M manual AND on equipment label ★	*Water Mission 5.2.4*	
☐	SPDs included on annual maintenance inspection schedule (check failure indicators)	*Design for Maintainability*	
☐	VFD output reactor / dV/dT filter included on annual maintenance schedule	*Design for Maintainability*	
☐	Commissioning test report structured as baseline reference for future maintenance checks ★	*Design for Maintainability*	
☐	Community operator training on basic system indicators and when to call for support	*Best practice*	
☐	Emergency contact information posted at site	*Best practice*	

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SECTION I — SPARE PARTS, LABELING & DOCUMENTATION

✓	Item	Reference	Notes
☐	Manufacturer-recommended spare parts list included in tender ★	*Manufacturer documentation*	
☐	Spare parts duration specified: 2-year minimum (3–5 year for remote sites) ★	*Tender specification*	
☐	Laminated wiring schematic to be posted in panel — required deliverable ★	*As-built requirement*	
☐	O&M manual required in English AND local language(s) ★	*UNICEF guidance*	
☐	As-built wiring diagrams: mandatory handover deliverable ★	*Contract schedule*	
☐	Commissioning test report: mandatory handover deliverable ★	*Contract schedule*	
☐	Maintenance schedule (minimum annual) included in O&M manual	*Best practice*	

SECTION J — FIRE PROTECTION

✓	Item	Reference	Notes
☐	CO_2 or dry powder extinguisher specified: type, size (min. 2 kg), mounting location ★	*UNICEF guidance*	
☐	Smoke or heat detector specified for enclosed equipment rooms	*Best practice*	
☐	Equipment room: non-combustible construction materials specified ★	*Fire safety*	
☐	Cable entry points into equipment rooms: fire-rated sealing specified ★	*Water Mission 5.2.3 / fire safety*	
☐	“No smoking / no open flame” signage specified in installation requirements	*Safety requirement*	