**SECTION 26 36 23**

**AUTOMATIC TRANSFER SWITCHES**

1. – GENERAL
	1. RELATED DOCUMENTS
		1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
	2. SUMMARY
		1. This Section includes transfer switches rated to 208Vac, including the following:
			1. Integrated Automatic Transfer Switch and Dual Purpose Docking Station
	3. SUBMITTALS
		1. Product Data:
			1. Submit manufacturer’s descriptive literature and product specifications. These shall include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
		2. Drawings:
			1. Single-line diagram or schematic of arrangement of ATS and Docking Station unit shall be submitted. Show connections between transfer switch, power sources, and load.
			2. Manufacturer’s product drawings.
			3. As applicable: dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
		3. Operation and Maintenance Data:
			1. For each type of product include manuals for installation, operation, and maintenance.
			2. In addition, documentation shall define features and operating sequences for both automatic and manual operation.
		4. Manufacturer and Supplier Qualification Data:
			1. The transfer switch manufacturer shall be certified to International Quality Standard (ISO) 9001, with third party certification verifying quality assurance in design/development and production.
	4. QUALITY ASSURANCE
		1. Transfer switches shall be free of defects in material and workmanship.
		2. Transfer switches shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.
		3. Transfer switch applications and installations shall comply with the requirements of the codes and standards listed below. Where required, certified test reports substantiating the compliance shall be submitted upon request.
			1. UL 1008 - Standard for Transfer Switch Equipment
			2. IEC 60947-6-1 Low-voltage switchgear and controlgear – Part 6-1: Multiple function equipment – Transfer switching equipment
			3. NFPA 70 - National Electrical Code; particularly, transfer switches shall be suitable for usage in accordance with Articles 517 - Health Care Facilities, 700 - Emergency Systems, 701 - Legally Required Standby Systems, 702 - Optional Standby Systems
			4. NFPA 99 - Healthcare Facilities Code
			5. NFPA 110 - Standards for Emergency and Standby Power Systems
			6. IEEE 241 - Recommended Practice for Electrical Power Systems in Commercial Buildings
			7. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
			8. IEEE 602 - Recommended Practice for Electrical Power Systems in Health Care Facilities
			9. NEMA ICS 10-2005 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment
2. – PRODUCTS
	1. MANUFACTURERS
		1. Manufacturers: Subject to compliance with requirements, provide products by the following:
			1. TRYSTAR Product Family: Service Entrance Rated ATS with Integrated Dual Purpose Generator Docking Station
			2. TRYSTAR Model No.: TATS-063W-LLLMF-AKQR
			3. TRYSTAR Representative: Jeff Naumann jnaumann@vanjen.net 832-244-3332
			4. Or Engineer’s Approved Equal,
				1. Submitted 30 Days prior to bid date
			5. Must Bare UL 1008 Listing
				1. No PE, 891, or 508 Listings are Acceptable\
			6. Single pre-wired and bussed Service Entrance Breaker, Automatic Transfer Switch and Dual Purpose Docking Station.
	2. GENERAL TRANSFER SWITCH PRODUCT REQUIREMENTS
		1. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
		2. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
		3. Microcontroller: Shall provide selectable nominal voltages from 200Vac to 480Vac for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to +/- 1% of nominal voltage. Frequency sensing shall be accurate to +/- 0.5%. The unit shall be capable of operating over a temperature range of -20 to +70 °C and storage from -40 to +70 °C.
		4. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements and voltage-impulse withstand requirements of IEC 60947-6-1.
		5. Electrical Operation: Accomplish by a momentarily energized single solenoid, mechanically and electrically interlocked in both directions.
		6. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
			1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
			2. The contacts shall have the following construction characteristics:
				1. Knife-blade type construction
				2. Specialized first-touch contact tips with specialized material and design to isolate and dissipate arc to limit wear of the normal fully closed contact point
				3. Self-cleaning contact design
				4. The contacts shall last the lifetime of the switch
				5. Fully enclosed contacts to mitigate dust ingress, and prevent incidental contact by personnel
			3. Electrical operation of contacts shall allow high speed transfer between sources in less than 50 ms (< 3 cycles) from signal. Operating transfer speed shall be fixed and not vary depending on the voltage level conditions.
			4. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
		7. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.
		8. Neutral Switching: Transfer switches designated on the drawings as “4-pole” shall be provided with a neutral pole which is switched simultaneously with phase poles.
		9. Neutral Terminal: Transfer switches designated on the drawings as “3-pole” shall be provided with a 100% rated solid neutral bus and lugs, unless otherwise indicated.
		10. Enclosures: General-purpose NEMA 250 as specified below, complying with NEMA ICS 6 and UL 50, unless otherwise indicated.
			1. Type 1 for indoor applications
			2. Type 12 for indoor applications (drip protection)
			3. Type 3R for outdoor applications (rain proof)
			4. Type 4 or 4X (stainless steel) for outdoors or uncontrolled environment applications
	3. AUTOMATIC TRANSFER SWITCHES
		1. Comply with Level 2 equipment according to NFPA 110.
		2. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
		3. Automatic transfer switches (ATS) shall be available in Open (without stable OFF position)and Delayed (with stable OFF position) transition versions
		4. ATS shall be available in version with 2-poles for single phase load, 3 poles and 4 poles for three phase loads, as per indication on single line diagram.
		5. ATS shall be available in different frame sizes from 30A to 1200A and selection of size shall be in accordance with project drawings.
		6. Manual Operation: It shall be possible to perform emergency manual operation, with the door closed and under load conditions.
		7. In-phase monitor: ATS shall have embedded feature that when enabled by user, allows transfer from Source 1 (S1) to Source 2 (S2) and back only when phases are sufficiently synchronized (phase angle difference between sources within ±15 degrees). Load supply transfer is delayed or disabled in conditions that are considered invalid for the application:
			1. Phase difference between sources is out of range
			2. Phase order between sources is not the same
			3. Voltage amplitude is out of range
			4. Phase is missing
			5. Voltage is asymmetric
			6. Frequency is out of range
		8. All-in-one Construction: The ATS shall be purpose-built for the application and one seamless unit to guarantee easy and fast installation and reliable operation. Automatic transfer switches made from loose items like mechanical components, controller units, and displays, connected together with external wiring shall not be allowed.
		9. The ATS shall be available in top and bottom feed configurations, however, the switch unit itself shall be capable of mounting in any orientation thus allowing easy cable entry from the desired direction of choice.
		10. Automatic Transfer Switch Control Functions:
			1. Functions managed by ATS control shall include adjustable time-delays:
				1. Override momentary Source 1 Outage adjustable from 0…60 s
				2. Transfer from Source 1 to Source 2 adjustable from 0…3600 s
				3. Override momentary Source 2 Outage adjustable from 0…60s
				4. Transfer from Source 2 to Source 1, adjustable from 0…120min
				5. Generator stop delay, adjustable from 0…60 min
				6. Center-OFF delay, adjustable from 0…300s
				7. Pre-transfer delay S1 to S2 adjustable from 0…60s
				8. Post-transfer delay S1 to S2 adjustable from 0…60s
				9. Pre-transfer delay S2 to S1 adjustable from 0…60s
				10. Post-transfer delay S2 to S1 adjustable from 0…60s
				11. Load shed delay adjustable from 0…60s
			2. Functions managed by ATS control shall include undervoltage sensing for each phase of both sources, with the following thresholds:
				1. Pick-up: 81…99%
				2. Drop out Voltage: 80…98%
				3. Accuracy: 1%
			3. Functions managed by ATS control shall include overvoltage sensing for each phase of both sources, with the following thresholds:
				1. Pick-up: 101…119%
				2. Drop out Voltage: 102…120%
				3. Accuracy: 1%
			4. Functions managed by ATS control shall include underfrequency sensing for each phase of both sources, with the following thresholds:
				1. Pick-up: 80.5…99.5%
				2. Drop out Voltage: 80…99%
				3. Accuracy: 0.5%
			5. Functions managed by ATS control shall include overfrequency sensing for each phase of both sources, with the following thresholds:
				1. Pick-up: 100.5…119.5%
				2. Drop out Voltage: 101…120%
				3. Accuracy: 0.5%
			6. ATS shall be able to detect the following faults:
				1. No voltage present
				2. Undervoltage
				3. Overvoltage
				4. Phase loss
				5. Voltage unbalance
				6. Invalid frequency
				7. Incorrect phase sequence
		11. HMI Characteristics
			1. ATS shall be equipped with dip switch HMI.
			2. ATS shall have a display module/HMI which has two mounting possibilities; 1) mounted to the ATS frame 2) detachable for door mounting with one single standard Cat 5/Ethernet/RJ45 cable.
			3. ATS shall provide the following diagnostics in the display unit:
				1. Number of total operations
				2. Number of load transfers
				3. Transfer time
				4. Source fail transfers
				5. Days energized
				6. Total time on Source 1
				7. Total time on Source 2
				8. Time Source 1 available
				9. Time source 2 available
				10. Last generator start
				11. Generator starting time
				12. In-phase time
			4. ATS shall provide the last 250 events in the display, with time and date.
			5. ATS shall be equipped with a large multi-line display and supporting the following languages:
				1. English
				2. French
				3. German
				4. Italian
				5. Spanish
				6. Russian
				7. Chinese
				8. It shall be possible to download more languages if required
			6. ATS shall be fully operational even when the HMI is disconnected
			7. ATS HMI shall indicate in an LED one-line diagram which source the load is connected to, and which sources are available.
		12. Auxiliary Contacts: ATS shall be offered with NC and NO contacts for position indication rated 6A at 240Vac, with the ability to place four contacts per position of each source.
		13. Generator Start/Stop Contacts: One isolated and normally closed, and one isolated and normally open; rated 5A at 250Vac/30Vdc.
		14. Engine-Generator Exerciser: Programmable function starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable between daily or 7, 14, or 28 days. Running periods can be adjustable in minutes. On-load or off-load exercising is selectable.
		15. Test: Ability to simulate normal source failure and test on-load or off-load
		16. Position Indication: reliable indication of contact position shall be visible on the ATS unit via a mechanical indicator directly driven by the switching mechanism
		17. Operational Requirements:
			1. The complete ATS solution shall be compatible with the following temperature conditions:
				1. Operating temperature without derating: -20°C…+40°C
				2. Operating temperature with derating: +41°C…+70°C
				3. Transportation and storage temperature: -40°C…+70°C
			2. ATS shall be capable of operating in 200 to 480Vac voltage range with +/-20% tolerance and without additional devices like external voltage transformers.
			3. The display module/HMI shall be communicating with the ATS controller via local communication bus and shall be completely isolated from the dangerous line voltages
			4. It shall be possible to program the ATS by using 12-24Vdc auxiliary power supply when mains or generator power is not available
			5. It shall be possible to program the ATS without any power (no mains, generator or auxiliary power supply) via laptop + software
			6. Generator start time delay shall be adjustable up to maximum 60 secs without using additional batteries, external power supplies or similar accessories
			7. It shall be possible to equip the ATS with a power supply module integrated into the ATS able to supply the unit with 12-24 Vdc auxiliary power to keep the controller, display and connectivity modules alive during power outages
	4. OPTIONAL FEATURES
		1. Connectivity and Communication
			1. ATS shall be capable of communicating, without external gateways and data converters, with the following listed communication protocols. Use of two modules/protocols shall be possible.
				1. Modbus RS485
				2. Modbus/TCP
				3. Profibus DP
				4. Profinet
				5. DeviceNet
				6. Ethernet/IP
				7. IEC61850
			2. Accessorizing with communication modules shall not take additional space inside the panel
		2. Metering
			1. ATS shall have capability for in-built power metering capabilities without using additional devices like external current transformers, display modules and external wiring
			2. ATS shall have capability to show on its display: the current flowing through the ATS both in numeric format and in analogue format on ammeter (0-125% scale).
			3. Accuracy shall be: 0.5% Current, 1.0% Voltage
			4. The following metering functions shall be available:
				1. Current (A)
				2. Voltage (V); L-N and L-L for each pole of S1 and S2
				3. Frequency (Hz)
				4. Power (kW); active, apparent, and reactive
		3. ATS shall have the ability to embed a cloud based monitoring system for online real-time supervision.
			1. Supervision system shall have a data logging interval of 30 seconds to ensure a fast reaction in case of warning or alerts and continuous measures for reliable efficiency analysis. Supervision system shall be designed to monitor following data, without storage limitation capability.
			2. Consumption measures:
				1. Real time phase currents
				2. Voltages
				3. Active Power
				4. Reactive Power
				5. Apparent Power
				6. Active Energy
				7. Reactive Energy
				8. Apparent Energy
				9. Power Factor
				10. Peak active Power
			3. Maintenance data:
				1. Contact wear
				2. Total operations
			4. It shall be possible to monitor status of devices and alarms. It shall be possible for web user to set up alerts, identifying alerts for specific devices or on all devices, in order to schedule maintenance and to check health of installation. Alerts shall include:
				1. Phase and neutral currents
				2. Phase to phase and phase to neutral voltages
				3. Total active power
				4. Total reactive power
				5. Total apparent power
				6. Power factor
				7. Number of operations
				8. Contact wear
				9. ATS position
			5. It shall be possible to set alarms and define type of notification through SMS or e-mail for each user.
			6. Analytics and reports:
				1. Supervision system shall be provided with web app with pre-configured widget to allow immediate overlook of plant consumption and analytics based on collection of data on selectable period of one day, one week, one month, one semester, one year or on custom period.
				2. Widget should be designed to display single or multi-site information and shall include both power utility consumption and power generated on site.
				3. Web app shall allow the creation and customization of “digital” representation of asset, allowing creation of synoptic representation of switchboard, importation of single line diagram or switchboards’ front view. It shall be possible to activate the graphics by connection with markers or tags, to easily access to device data.
				4. Export of data and trends in excel shall be possible both on-demand and via automatic report scheduling function. It shall be possible to generate reports for all information managed or generate customize reports selecting specific measures and devices. Benchmark on multi-site level shall also be possible in order to compare plants and systems and identify best practices.
			7. Commissioning and maintenance:
				1. System shall allow final user to execute the commissioning with the simple use of free software provided by manufacturer. Automatic recognition of devices shall be ensured so that there is no need of programming and free software shall include wizard for commissioning directly from web. Free software provided by manufacturer shall allow execution of system implementation without requiring system integrator.
			8. Interface:
				1. System shall be supplied with pre-set graphic pages with dashboard for immediate evaluation and management of power consumption. It shall be possible to display dashboard on tablet or smartphone.
			9. Security:
				1. Authentication system shall be provided to access to data. Encrypted communication channel and certification for communication to cloud and from cloud to web app shall be guaranteed. Encrypted communication channel and certification shall follow TSL protocol to ensure maximum safety level available. TSL protocol shall be provided embedded in the module for supervision and cloud connection.
			10. Level of users:
				1. It shall be possible to define at least 4 different profiles for users. Only one of the users can be identified as owner. The owner shall sign up the EULA to start the data transmission and has the rights to renew license of use. Only owner and administrator can send invitation to other users and have rights to change roles.
			11. It shall be possible to define staff profile with the rights to access to asset and device view, alerts view, analytics view and control view. It shall be possible to assign visitor profile for enabling users to access only to alerts view.
		4. Predictive Maintenance
			1. For predictive maintenance purposes, the ATS shall be capable of indicating the following measurements:
				1. Contact wear
				2. Temperature measurement on load terminals for loose contact indication
				3. Temperature measurement on the device for panel internal temperature indication
				4. Temperature measurement on the HMI for ambient temperature indication where the ATS panel is installed to (when HMI is mounted to the door)
		5. Advanced ATS Controller Features
			1. ATS shall have auto configuration feature for automatically detecting the source 1 and source 2 rated voltage, rated frequency, phase distribution system, location of neutral and phase rotation (ABC, ACB)
			2. ATS shall have capability to be equipped with real time clock (RTC) with a capacitor back-up to maintain time and date for minimum 48 hours if both source 1 and source 2 become unavailable. RTCs with battery back-up shall not be not allowed.
			3. It shall be possible to program the generator to be source 1 or source 2
			4. ATS shall have an input for 24Vdc fire fight signal for operating the ATS to OFF-position in case of emergency
	5. Integrated Docking Station
		1. Enclosures:
			1. Wall Mounted cabinet.
				1. Front, side, and back accessible for maintenance.
				2. Top, side, bottom, and back accessible for cabling.
			2. Rated for environmental conditions at installed location:
			3. Outdoor Locations: NEMA 250, Type 3R
				1. 3 Point Latching Handle for Front Door, Must be Padlockable
				2. All Aluminum – No Painted Steel Acceptable.
			4. Front Cover:
				1. Hinged.
				2. Gasketed.
				3. Pad-lockable latch
			5. Finishes:
				1. Powder Coated Only.
			6. Hammer Gray ANSI 61
		2. Phase, Neutral, and Ground Buses:
			1. Material: Silver-plated hard-drawn copper
			2. Equipment Ground Bus: 100% of Phase Size
			3. Ground Bus: 25% of phase size.
			4. Round edges on bus.
		3. Bus Connectors:
			1. Located behind access plate inside front cover.
			2. Lugs: Number and size as indicated on project drawings.
		4. Output Connectors
			1. Located inside front cover
			2. Female Cam style w/ Protective Flip Covers mounted on 45° angle plate.
		5. Inputs Connectors:
			1. Located inside front cover.
			2. Male Cam style w/ Protective Flip Covers mounted on 45° angle plate.
			3. Male Cam style receptacles behind a Kirk Key Access Door
		6. Hinged cable access door on bottom of unit.
		7. Padlockable front access cable trap door to reduce cable theft.
		8. Voltage & Phase:
			1. 120/208V – 3 phase – 4w
		9. Amperage
			1. 600A
		10. Accessories
			1. A – 2 Wire Auto Start
			2. K – 1 Kirk Key Lock in cabinet, 1 Lock to Ship Loose, 1 Key
			3. Q – ML2-PB Load Dump Receptacle
		11. Manufacturer to supply load dump cable
		12. Short Circuit and Withstand Rating
			1. Must be Factory Rated at 65KAIC SCCR
3. – EXECUTION
	1. INSTALLATION
		1. Preparation shall be in accordance with the reviewed product data, final shop drawings and the manufacturer’s recommendations.
		2. Installation shall be in accordance with manufacturer’s instructions and recommendations.
		3. Identify components according to Division 26 section “Identification for Electrical Systems”.
	2. CONNECTION
		1. Wiring for the ATS equipment shall be in accordance with manufacturer’s instructions.
		2. Connections and wiring shall be according to Division 26 section “Low-Voltage Electrical Power Conductors and cables”.
	3. FIELD QUALITY CONTROL
		1. Manufacturer onsite startup services. One site visit to perform commissioning and testing by local certified service organization.
	4. DEMONSTRATION
		1. Provide owner training class on same visit as startup call.
	5. SERVICE AND SUPPORT
		1. Serviceability
			1. ATS shall have modular construction, enabling:
				1. Field service, including but not limited to: controller, HMI, power module, and/or mechanism unit replacement without requirement for disconnecting the power cabling and removing the ATS from the panel. Replacement of any of these individual components shall be possible in a few minutes or less
				2. Mechanism can be replaced even under load conditions - no need to disconnect load nor touch live parts