Product Specification: Advantage 61 Variable Frequency Drive for Pump and Fan Applications

Section 15190—Variable Frequency Motor Controllers for Pump and Fan Applications

PART 1: GENERAL

1.01 SUMMARY

A. This section provides specification requirements for solid-state, pulse-width modulated (PWM) Adjustable Frequency Drives, herein referred to as AC Drives, for use with NEMA® design [NEMA A] [NEMA B] [NEMA D] [NEMA E] AC motors, or standard IEC motors.

B. The AC Drive supplier shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.

C. Any exceptions/deviations to this specification shall be indicated in writing and submitted no less than one week prior to bid date.

1.02 REFERENCES

A. ANSI®/NFPA® 70 - National Electrical Code® (NEC®).

B. UL 508 - UL Standard for Safety Industrial Control Equipment.

C. UL 508C - UL Standard for Safety Power Conversion Equipment.

D. NEMA ICS7 : Industrial Control and Systems Variable Speed Drives

E. CSA C22.2 No. 14-M91 : Industrial Control Equipment

F. IEC 1800 : Adjustable speed Electrical power drive systems

G. SEMI-F47: Voltage Ride Thru

1.03 SUBMITTALS

A. A submittal package shall be furnished for the Engineers' approval. This package shall consist of elementary power and control wiring diagrams and outline drawings. The outline drawings shall include front and side views of with overall dimensions and weights shown. . Standard catalog specification sheets showing voltage, horsepower and maximum current ratings shall be furnished as part of the submittal package.

1.04 WARRANTY

A. An 18-month warranty shall be provided on materials and workmanship from the date of shipment.

1.05 QUALITY ASSURANCE

A. The manufacturer of the AC Drive shall be a certified ISO 14001 facility.

B. The AC Drive and all associated optional equipment shall be UL Listed according to UL 508 C - Power Conversion Equipment. As verification, a UL label shall be attached on the nameplate.

C. The AC Drive shall be designed, constructed and tested in accordance with applicable UL, CSA, IEC, NEMA, and NEC standards.

D. Every power converter shall have serial number with traceability records maintained by the manufacture.

PART 2: PRODUCT

2.01 MANUFACTURERS

A. The AC Drive shall be manufactured by Schneider Electric and branded Square D / Telemecanique or prior approved equal. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein. Supporting documentation should include a line by line review of this specification indicating if the substitution meets or does not meet each item in this specification.

2.02 GENERAL DESCRIPTION

A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage.

B. The input power section shall utilize a full wave bridge design incorporating diode rectifiers. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage.

C. The output power section shall change fixed DC voltage to adjustable frequency AC voltage.

D. The adjustable frequency drive package shall include input EMI/RFI filtering.

E. The AC drive shall have a user interface (keypad) that presents information in plain English / Spanish / French text. The user interface shall include a Local / Remote button to switch between control at the terminal strip and the user interface (keypad). This button shall also switch between network control and the user interface (keypad). The keypad shall have Run and Stop keys and a manual speed potentiometer function.

2.03 CONSTRUCTION

A. The AC Drive power converter shall be UL Plenum rated.

B. All heat sink fans shall be accessible from the front and shall not require the removal of the AC drive power converter for fan replacement.

C. All heat sink fans shall be cycled on only when required to cool the drive to maximize the life of the fan

D. The AC Drive shall have the an enclosure rating detailed below:

1-60 hp @ 200/240 V, 1-100 hp @ 380/480 V:

IP 41 on top IP21 on all other surfaces, Type 1 with optional conduit kit.

75-125 hp @ 200/240 V, 125-500 hp @ 380/480 V:

IP 41 on top, IP30 sides & front IP00 on bottom, Type 1 w/ optional conduit kit.

600 hp – 900 hp @ 380/480 V.

IP 41 on top, IP30 sides & front, IP00 on bottom

E. When a Type 1 conduit entrance kit is required. The kit shall attach and be ground to the bottom of the AC drive and provide conduit landing for incoming line power cables, motor lead cable, control wiring, and network cabling.

2.04 APPLICATION DATA

A. The AC Drive shall be sized to operate a variable torque load.

B. The speed range shall be from a minimum speed of 1.0 Hz to a maximum speed of 72 Hz.

2.05 ENVIRONMENTAL RATINGS

A. The AC Drive shall meet IEC 60664-1 Annex A and NEMA ICS 1, UL, and CSA standards.

B. The AC Drive shall be designed to operate in an ambient temperature from -10 to 50 ˚C (14 to 122 ˚F).

C. AC Drives in Type 1 enclosures shall be designed to operate in an ambient temperature from -10 to 40 ˚C (14 to 104 ˚F).

D. The storage temperature range shall be -25 to 65 ˚C (-13 to 149 ˚F).

E. The maximum relative humidity shall be 95%, non-condensing.

F. The AC Drive shall be rated to operate at altitudes less than or equal to 3300 ft (1000 m). For altitudes above 3300 ft (1000 m), the AC Drive should be de-rated per drive specifications.

G. The AC Drive shall meet the IEC 60721-3-3-3M3 operational vibration specification.

2.06 RATINGS

A. The AC Drive shall be designed to operate at the input line voltage indicated on the equipment schedule.

B. The AC Drive shall operate from an input frequency range of 60 Hz (±) 5%.

C. The displacement power factor shall not be less than .98 lagging under any speed or load condition.

D. The efficiency of the AC Drive at 100% speed and load shall not be less than 97%.

E. The variable torque rated AC Drive over current capacity shall be not less than 110% for 1 minute.

F. The output carrier frequency shall be randomly modulated about the selected frequency. The output carrier frequency of the AC Drive shall be selectable from 1 to 16 kHz, 12kHz nominal rating for 1-60 hp @ 200/240 V, 1-100 hp @ 380/480 V. Selectable: 2.5 to 8 kHz, 2.5kHz nominal rating for 75-125 hp @ 200/240 V, 125-900 hp @ 380/480 V.

2.07 PROTECTION

A. Upon power-up, the AC Drive shall automatically test for valid operation of memory, loss of analog reference input, loss of communication, DC-to-DC power supply, control power and pre-charge circuit.

B. The AC drive shall be rated for UL minimum short circuit currents per given horsepower rating.

C. The AC Drive shall be protected against short circuits, between output phases and to ground.

D. The AC Drive shall have under-voltage power-loss ride through performance per the SEMI F-47 voltage ride through standard and certified by a third party.

E. The AC drive shall have a programmable ride-through function, which will allow the logic to maintain control for a minimum of one-second (60 cycles) without faulting.

F. An auto restart function will provide selectable time for restart attempts after the fault has disappeared and other operating conditions permit the restart. The restart shall be performed by a series of automatic attempts separated by increasingly longer periods of time. This period of time shall be selectable.

G. Upon loss of the analog process follower reference signal, the AC Drive shall be programmable to display a fault.

H. The AC Drive shall have a solid-state UL 508C listed overload protective device and meet IEC 60947.

I. The output frequency shall be software enabled to fold back when the motor is overloaded.

J. There shall be three skip frequency ranges that can be programmed to a bandwidth of 2.5 Hz.

2.08 ADJUSTMENTS & CONFIGURATIONS

A. The AC Drive shall be capable of storing the configuration in the keypad.

B. The acceleration and deceleration ramp times shall be adjustable from 0.05 to 999.9 seconds.

C. The memory shall retain and record run status and fault type of the past eight faults.

D. The software shall have an energy economy function that, when selected, will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load. Selectable volts/Hz ratio patterns does not meet specification, the function must be automatically optimized.

E. The AC Drive shall have macro configurations for HVAC and pump applications, PID regulator set-up and network set-up.

2.09 KEYPAD DISPLAY INTERFACE

A. A keypad display interface shall offer the modification of AC Drive adjustments through a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, and adjustment storage, and diagnostics shall be accessible.

B. The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall be listed on the drive identification portion of the LCD display.

C. The keypad display shall have password protection that allows the keypad to be locked out from unauthorized personnel.

D. The keypad shall be capable of displaying I/O assignment and status.

2.10 CONTROL CONNECTIONS

A. The control power for the digital inputs and outputs shall be 24Vdc.

B. The internal power supply shall incorporate automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and will not be damaged if shorted.

C. Removable terminal strips shall be used on all logic and analog signal connections in the power converter

D. Two voltage-free relay output contacts will be provided. One of the contacts will indicate AC Drive fault status. The other contact shall indicate a drive run status. These relays shall be configurable for other status indicators.

E. The AC drive shall have a power removal logic input. The drive shall not allow the motor to operate until this input is closed. If this input is opened while the connected motor is running, the AC drive shall stop applying power to the motor. This power removal function shall be certified by an independent agency.

F. The control section of AC drive shall be supplied separately if necessary with 24V DC, to keep the network communication always available even if the power supply is OFF.

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2.11 SERIAL COMMUNICATION

A. The AC Drive shall have an integrated RJ45 port, selectable for Modbus or CanOpen.

B. The AC drive shall have the capability for internal mounted communication card. The following protocols shall be the minimum available :

Industrial Installations	HVAC building Installations
- Ethernet TCP/IP - Modbus Plus - FIPIO - Profibus DP - Device Net - InterBus-S	-Lonworks -BACnet -METASYS N2 -APOGEE FLN

2.12 HARMONIC MITIGATION

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<u>Note to Specifier</u>: *Guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", which suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers. Collectively, all facility loads and the building electrical distribution network determine the harmonic levels at the user & electric utility interface. The Electrical Power Research Institute (EPRI) recognizes the 'Point of Common Coupling' or PCC as the interface between user and electric utility (energy meter) in the electrical distribution network. The AC Drives manufacturer can provide calculations through computer modeling, specific to the installation, showing total harmonic voltage distortion. Contractor to provide one line diagram drawings to supplier including transformer impedance. The AC Drive manufacturer needs this information.*

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A. Each drive shall include a combination of integrated filters and DC link reactors to provide effective harmonic mitigation equivalent to 3% impedance without requiring additional panel space.

PART 3: INSTALLATION

3.01 INSPECTION

A. Verify that the location is ready to receive work and the dimensions are as indicated.

3.02 PROTECTION

A. Before and during the installation, the AC Drive equipment shall be protected from water and site contaminants.

3.03 INSTALLATION

A. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.

B. The AC Drive supplier shall provide a representative to inspect the contractor's installation, test and start-up the AC Drive(s) furnished under this specification.

3.04 TRAINING

A. On-site training shall be provided as part of the start-up service.

3.05 DOCUMENTATION

A. The AC Drive supplier shall supply a comprehensive bound instruction and installation manual that includes wiring diagrams, layout diagrams, and outline dimensions. This manual must be insertion in a shop manual supplied by the installing contractor.

Copies of this specification are available from the Square D/Schneider Electric website: www.us.SquareD.com