Product Specification: S- Flexä 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 Drive Controllers, herein referred to as AC Drives, for use with NEMA® design inverter duty AC motors.
- B. The AC Drive supplier shall furnish, field test, and adjust 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 the bid date.

1.02 References

- A. ANSI*/NFPA* 70—National Electrical Code* (NEC*)
- B. UL 508—UL Standard for Industrial Control Equipment
- C. UL 508C—UL Standard for Power Conversion Equipment
- D. NEMA ICS 7.1
- E. IEC 60664-1 Annex A
- F. NEMA ICS 1
- G. ICC ES AC156

1.03 Submittals

A. A submittal package, including drawings, shall be furnished for the Engineers' approval prior to factory assembly of the AC Drives. These packages shall consist of elementary power and control wiring diagrams, and enclosure outline drawings. The enclosure outline drawings shall include front and side views of the enclosures with overall dimensions, and conduit entrance locations. 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, from date of shipment, shall be provided on materials and workmanship.

1.05 Quality Assurance

- A. The manufacturer of the AC Drive shall be a certified ISO 9001 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 designation shall be attached on the inside of the combination enclosure.
- C. The AC Drive shall be designed, constructed, and tested in accordance with UL, cUL, NEMA, IEC, and NEC standards.
- D. Every power converter shall be tested in the factory with an AC induction motor.

PART 2—Product

2.01 Manufacturers

- A. The AC Drive shall be manufactured by Schneider Electric or previously 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
- B. documentation should include a line by line review of this specification indicating whether 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 comply with the following requirements:
 - a. It shall utilize a full wave bridge design.
 - b. It shall convert AC line power of fixed voltage and frequency to fixed DC voltage.
 - c. It shall be insensitive to phase rotation of the AC line.
- C. The output power section shall change fixed DC voltage to adjustable frequency AC voltage.
- D. The adjustable frequency drive UL Type 1 enclosure package shall consist of a circuit breaker disconnect, a 2-contactor bypass power circuit, a 120 V control transformer, and a control circuit terminal block for digital and analog field wiring. The drive shall have a selector switch mounted and wired for Adjustable Frequency Controller-Off-Bypass, which shall be accessible on the front of the enclosure package.
- E. The entire drive package, including the bypass starter circuit, shall be UL508C listed and coordinated with NEMA ICS 7.1.

2.03 Construction

- A. The AC Drive power converter shall be enclosed in a UL Type 1 enclosure with a circuit breaker disconnect, user terminal block connections, and bypass controls. The enclosure shall provide dedicated user terminations for power and control device connection.
- B. Provisions shall be included for locking the disconnect in the Off position with a padlock.
- C. Provisions shall be included for using a padlock to limit enclosure access by unauthorized personnel.
- D. The UL Type 1 enclosure shall have bottom conduit knock-outs for power and control wiring.

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 Hz to a maximum speed of 200 Hz.

2.05 Environmental Ratings

- A. The AC Drive shall meet IEC 60664-1 Annex A and NEMA ICS 1, UL, and cUL standards.
- B. The AC Drive shall be designed to operate in an ambient temperature from -10 to 40 °C (+14 to 104 °F).
- C. The storage temperature range shall be -25 to 70 °C (-13 to 158 °F).
- D. The maximum relative humidity shall be 95%, non-condensing or dripping water.
- E. 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 current should be derated 1% for every 330 ft (100 m) up to 10,000 ft (3,000 m).
- F. The AC Drive shall be Seismic qualified to 2003 IBC, NFPA 5000 and ASCE 7 Building Codes in compliance with ICC ES AC156 testing criteria with an Importance Factor Ip=1.5.
- G. The AC Drive shall be UL Type 1 plenum rated, suitable for placement in a compartment circulating conditioned air to the building.

2.06 Ratings

- A. The AC Drive shall be designed to operate at 208 Vac ± 10% or 230 Vac ± 10% or 460 Vac ± 10%.
- B. The AC Drive shall operate from an input frequency range of 50 to 60 Hz \pm 5%.
- C. The displacement power factor shall not be less than 0.96 lagging under any speed or load condition.
- D. The efficiency of the AC Drive at 100% speed and load shall typically be 95% or greater.
- E. The variable-torque rated AC Drive nominal full load current limit shall be not less than 110% for 60 seconds.

2.07 Protection

- A. Upon power-up, the AC Drive power converter shall automatically test for valid operation of memory, valid operation of precharge circuit, loss of communication, DC-to-DC power supply, and control power.
- B. The enclosure shall provide a fully coordinated 100,000 A short circuit current rating marked on the enclosure nameplate, with short circuit coordination to UL 508C Power Conversion Equipment and NEMA ICS 7.1
- C. The AC Drive power converter shall be protected against short circuits between output phases and also phase-to-ground.
- D. Upon loss of the analog process follower reference signal, the AC Drive power converter shall be programmable to display a detected fault condition signal.
- E. The AC Drive power converter shall have a solid-state UL 508C listed overload protective device.
- F. The output frequency shall be software enabled to fold back when the motor is in an overcurrent condition.
- G. The output switching frequency of the AC Drive power converter shall be selectable from 6 to 16 kHz. Derating of the AC Drive power converter may be required if the factory setting is modified.
- H. The AC Drive power converter shall provide an auto reset feature which can provide up to 10 programmable reset attempts after a detected fault has occurred.

2.08 Adjustments and Configurations

- A. The AC Drive power converter will be factory programmed to operate all specified optional devices.
- B. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 3200 seconds.
- C. The AC Drive power converter configuration shall have provisions for an Energy Savings motor type.
- D. The AC Drive power converter shall have memory capability to retain and record drive operation and detected fault type for the past four faults.

2.09 Keypad Display Interface

- A. An operator interface shall offer the modification of AC Drive power converter adjustments through a keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, detected fault condition signals, local control, adjustment storage, and diagnostics shall be accessible.
- B. The AC Drive power converter software revision, output current, motor frequency, and motor voltage shall be readable through the drive display.

2.10 Operator Controls

- A. The control power for the digital inputs and outputs shall be 24 Vdc.
- B. The terminal block shall be used for all logic and analog signal connections to the power converter.
- C. Three voltage-free relay output contacts may be provided. One of the contacts shall indicate the detected fault status of the AC Drive and shall always be available. One of the contacts shall indicate bypass operation and shall always be available. One contact shall indicate a drive run status and shall only be available when communication cards are not used.
- D. The combination enclosure shall have dedicated operator controls for Adjustable Frequency Controller-Off-Bypass selection.
- E. The combination enclosure shall include a terminal point connection for fire/freezestat interlock, to prevent drive or bypass operation. The interlock must shut down the motor in drive and bypass modes.
- F. The combination enclosure shall include a terminal point connection for smoke/purge controls.

2.11 Serial Communication

A. ve shall have serial communications capability for the following protocols:

LonWorks[®] BACnet[®] Metasys[™] N2 Apogee[™] P1 Modbus[™]

2.12 Drive Output and Bypass Contactors

- A. The AC Drive shall include electrically interlocked bypass contactors complete with a Class 10 thermal overload relay, circuit breaker disconnect, control circuit transformer, and Adjustable Frequency Controller-Off-Bypass selector switch.
- B. The operator shall have full control of the bypass starter by operation of the Adjustable Frequency Controller-Off-Bypass selector switch.

2.13 Harmonic Mitigation

A. Shall include reduced harmonics technology to reduce power system harmonics.

PART 3—Installation

3.01 Inspection

A. Verify that the location is ready to receive work.

3.02 Protection

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

3.03 Installation

- A. Installation shall be in compliance with the manufacturer's instructions, drawings, and recommendations.
- B. The AC Drive supplier shall provide a trained representative to inspect the contractor's installation, and to test and start up the AC Drive(s) furnished under this specification.

3.04 Training

A. shall be provided by the AC Drive manufacturer.

3.05 Documentation

A. The AC Drive supplier shall supply a comprehensive 8-1/2 x 11-inch bound instruction and installation manual that includes wiring diagrams, layout diagrams, and outline dimensions.