Product Name: Enclosed Adjustable Frequency Drive - Class 8839 E-*Flex* AC Drive for Variable Torque HVAC and Pumping Applications (1-100 hp, 460 V and 1-50 hp, 208/230 V)

SECTION 15
Enclosed Adjustable Frequency Drive
Variable Torque HVAC and Pumping Applications

NOTE: These specifications apply to Enclosed Adjustable Frequency Drive Controllers, herein referred to as AC Drives. The Power Converter is a component of the AC Drive. To ensure project compatibility, these specifications follow the Construction Specifications Institute (CSI) format. Copies of this specification are available from the Square D/Schneider Electric website: www.SquareD.com. Application information directly affects the type and rating of AC Drive that will be quoted. Brackets [ ] are provided where such data should be included. Please call your local Square D/Schneider Electric distributor or sales representative for specification assistance regarding a particular application. The AC Drive specification should be included in Division 15, Mechanical, for proper coordination with the system.

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section provides specification requirements for adjustable frequency drives and variable speed drives, herein referred to as AC Drives, for use with [NEMA® B] [NEMA E] design AC motors.

B. The AC Drive manufacturer 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 with the quotation.

1.02 REFERENCES

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

B. ANSI C84.1 - Voltage Tolerances for North America.

C. IEC® 60068 Part 2-3 - Basic Environmental Testing Procedures Part 2: Tests - Test Ca: Damp Heat.

D. IEC 60146.1 - Semiconductor Converters - General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements.

E. IEC 60664-1 - Insulation Coordination for Equipment within Low-Voltage Systems.

F. IEC 60447 - Man-Machine Interface Actuating Principles.

G. IEC 60439-1 - Low Voltage Switchgear and Control Gear Assemblies.

H. IEC 60947-1 - Low Voltage Switchgear and Control Gear Components.

I. IEC 60364-1 - Electrical Installation of Buildings.

J. IEC 60204-1/NFPA 79 - Electrical Equipment of Industrial Machines/Industrial Machinery.

K. IEC 60106 - Guide for Specifying Environmental Conditions for Equipment Performance Rating.

L. IEC 60529 - Degrees of Protection Provided by Enclosure.

M. IEC 61000 - Electromagnetic Compatibility.

N. IEC 60721 - Classification of Environmental Conditions.

O. IEC 60255-8 Overload Relays.

P. IEC 60801-2,-3,-4,-5 - Immunity Tests.

Q. NEMA ICS 6 - Industrial Control and Systems Enclosures.

R. NEMA ICS, Part 4 - Overload Relays.

S. NEMA Publication 250 - Enclosures for Electrical Equipment.

T. NEMA ICS 2-321 - Electrical Interlocks.

U. NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives.

V. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives.

W. UL® 50 - UL Standard for Safety Enclosures for Electrical Equipment.

X. UL 98 - UL Standard for Disconnect Switches.

Y. UL 507 - UL Standard for Safety Electric Fans.

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

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

BB. UL 991 - UL Standard for Safety Tests for Safety Related Controls Employing Solid-State Devices.

CC. OSHA® 1910.95 - AC Drive Controller Acoustical Noise.

DD. Conforming to National Safe Transit Association and International Safe Transit Association Test for Packages.

1.03 SUBMITTALS

A. [___] submittal packages including drawings shall be furnished for Engineers' approval prior to factory assembly of the AC Drives. These packages shall consist of elementary power and control wiring diagrams on one drawing and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, 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 parts warranty shall be provided on materials and workmanship from the date of purchase.

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 label shall be attached on the inside of the combination enclosure.

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

D. Every power converter shall be tested with an AC induction motor while loaded and temperature cycled within an environment chamber at 40 ˚C (104 ˚F).

E. All pilot devices shall be industrial rated and tested to verify proper operation.

PART 2: PRODUCT

2.01 MANUFACTURERS

A. The AC Drive shall be provided by Square D/Schneider Electric, Class 8839 E-FLEX, or prior approved equal. Substitutions must be submitted in writing three (3) weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.

B. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

2.02 GENERAL DESCRIPTION

A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage, as defined in the following sections.

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. This power section 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. This section shall utilize intelligent power modules (IPMs), as required by the current rating of the motor.

2.03 CONSTRUCTION

A. The AC Drive power converter shall be enclosed in a [Type 1, Type 12K, Type 3R] enclosure with a circuit breaker disconnect, industrial rated operator controls, user terminal strip connections and bypass controls [if required]. Type 1 and Type 12K enclosures shall have top and bottom conduit knockouts. Type 3R enclosures shall have conduit knockouts for bottom conduit entry only.

B. The enclosure shall provide dedicated user terminals for power and control device connection.

C. Provisions shall be included for locking the disconnect in the OFF position with a padlock.

D. All enclosure and heatsink fans shall be accessible from the front and shall not require the removal of the AC drive power converter.

2.04 MOTOR DATA

A. The AC Drive shall be sized to operate the following AC motor:

1. Motor horsepower [ ]
2. Motor full load ampere [ ]
3. Motor rpm will be [3600] [1800] [1200] [900] at 60 Hz
4. Motor voltage will be [208] [230] [460]

5. Motor service factor will be [1.15] [1.25]
6. NEMA MG1 [Part 30] [Part 31]

2.05 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 60 Hz.

2.06 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 0 to 40 ˚C (32 to 104 ˚F) for Type 1 and Type 12K enclosures. AC Drives in Type 3R enclosures shall be designed to operate in an ambient temperature from -10 to 50 ˚C (14 to 122 ˚F).

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

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

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), de-rate the AC Drive by 1% for every 330 ft (100 m).

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

2.07 RATINGS

A. The AC Drive shall be designed to operate from an input voltage of [460 Vac (±) 10%] [230 Vac (±) 10%] [208 Vac (±) 10%].

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 of the AC Drive shall be programmable at 0.5, 1, 2, 4 or 8 kHz. In addition, the output carrier frequency shall be randomly modulated about the selected frequency.

2.08 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 enclosure shall provide a fully coordinated [5 kAIC 1-50 hp, 10kAIC 60-100 hp] [22 kAIC] rating marked on the enclosure nameplate. Short circuit coordination to UL 508C Power Conversion Equipment and NEMA ICS 7.1.

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

D. The AC Drive shall have a minimum AC undervoltage power loss ride-through of 200 milliseconds (12 cycles).

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. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 6 programmable restart attempts. The time delay before restart attempts will be 30 seconds.

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 508 C 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.

2.09 ADJUSTMENTS & CONFIGURATIONS

A. The AC Drive will be factory programmed to operate all specified optional devices.

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 8 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.

2.10 KEYPAD DISPLAY INTERFACE

A. The keypad display interface shall offer the modification of AC Drive adjustments via 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 in plain English. There will be a standard selection of 4 additional languages built-in to the operating software as standard.

B. The display will be a high-resolution, LCD, backlit screen.

C. 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.

D. The keypad display shall have a hardware selector switch that allows the keypad to be locked out from unauthorized personnel.

2.11 OPERATOR CONTROLS

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

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. Pull-apart 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.

E. The combination enclosure shall have the following dedicated operator controls:

1. Hand-Off-Auto switch [Start-Stop push button and Hand-off-Auto switch] [Start-Stop push button]
2. Manual Speed Potentiometer
3. AFC-Off-Bypass switch (when bypass is specified)
4. Test-Normal Selector switch (when bypass is specified)
5. Power On (red) LED indicator
6. Drive Run (green) LED indicator
7. Drive Fault (yellow) LED indicator
8. Auto Mode (yellow) or Bypass Run (yellow) LED indicator

F. The combination enclosure shall include a 120 Vac smoke purge relay option [if required]. A user-supplied 120 Vac signal shall be sequenced in accordance with local fire protection codes and will switch the AC drive to 60 Hz operation for maximum fan motor speed. If drive bypass is supplied, the smoke purge relay will isolate the AC Drive and run the fan motor full speed on bypass.

G. The combination enclosure shall include terminal point connection for fire /freeze state interlock, to prevent drive [or bypass] operation.

2.12 SERIAL COMMUNICATION

A. The AC Drive shall have serial communication options of LONWORKS®, MODBUS®, or METASYS® N2.

2.13 DRIVE ISOLATION AND BYPASS CONTACTORS

A. The AC Drive shall include mechanically and electrically interlocked isolation and bypass contactors complete with Class 20 thermal overload relay, circuit breaker disconnect, control circuit transformer, AFC/OFF/BYPASS switch and TEST/NORMAL selector switch.

B. The operator shall have full control of the bypass starter by operation of the AFC/OFF/BYPASS selector switch.

C. In the AUTOMATIC mode of operation the bypass contactors shall be sequenced by the 120-volt rated auto start contact provided by the user.

D. The isolation contactor for the bypass shall be sequenced to provide motor isolation during a drive ready state of operation.

E. A TEST/NORMAL selector switch shall provide test operation of the power converter while operating the motor in bypass.

2.14 HARMONIC MITIGATION

A. The electrical distribution system has been designed to meet IEEE-519-1992 with the addition of line reactors. These line reactors shall be mounted inside the drive enclosure.

PART 3: INSTALLATION

The Enclosed AC Drive shall be an E-FLEX by Square D/Schneider Electric, Class 8839.

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 site contaminants.

3.03 INSTALLATION

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

B. The AC Drive manufacturer shall provide a factory certified technical representative to inspect the contractor's installation, test and start-up the AC Drive(s) furnished under this specification for a maximum total of [ ] days. The start-up service shall be quoted as a separate line item.

3.04 TRAINING

A. An on-site training course of [ ] training days shall be provided by a representative of the AC Drive manufacturer to plant and/or maintenance personnel.

3.05 DOCUMENTATION

A. The AC Drive manufacturer shall supply a comprehensive 8-1/2 x 11-inch bound instruction/installation manual that includes wiring diagrams, layout diagrams, and outline dimensions. This manual must be 3-hole punched for insertion in a shop manual supplied by the installing contractor.