



# Product Data

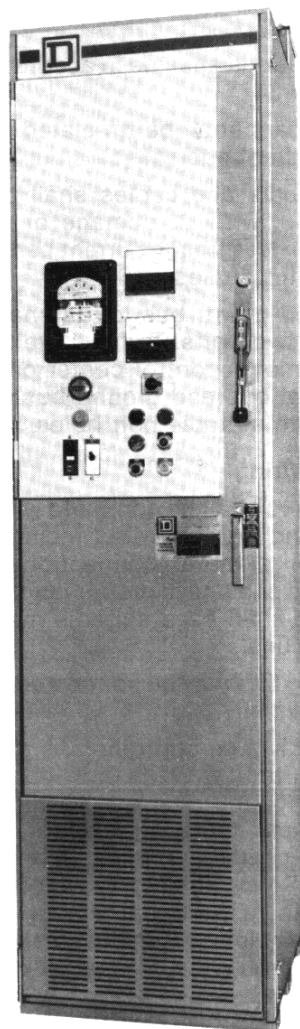
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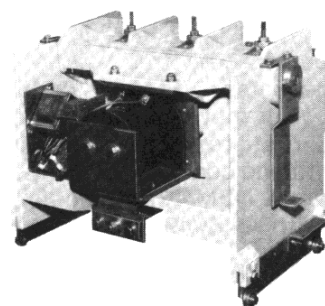
Class 8198

**Subject: Specifications**  
**5000 Volt Class Controllers**

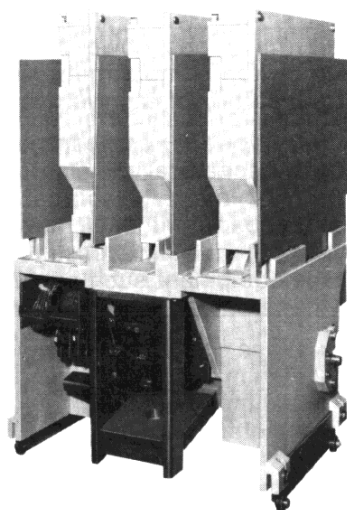


**Class 8198 ISO-flex® Model 3**  
**Motor Control Center Construction**

**Fixed or Drawout**



**Class 8110**  
**Vacuum Contactor**



**Class 8110**  
**Drawout Contactor**

## **SECTION 1 General**

This specification covers motor controllers for control and protection of 2200-4800 volts, 3 phase, 50-60 Hertz motors. Types of motors are Induction, Synchronous and Wound Rotor.

Mechanically latched contactors are also covered for applications such as transformer feeders, fire pumps and automatic transfer schemes.

Controllers shall be designed, manufactured, assembled and tested in accordance with NEMA Standard ICS-324 and UL Standard 347.

**SQUARE D COMPANY**

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## SECTION 2 Motor Control Center Construction

- 2.1 Basic structure shall consist of formed and bolted back and side plates and shall be minimum 14 gauge sheet metal. All doors shall be minimum 14 gauge sheet metal, pan type with flanges formed to provide sturdy, rigid structure. Compartment door latches and hinges shall be capable of holding door closed during maximum fault condition. Ventilation openings shall be provided where required.
- 2.2 Enclosures shall be free standing NEMA-1 NEMA-1 gasketed, NEMA-3R or NEMA-12 as specified. All metal parts to be given a thorough rust resistant treatment, then painted with one coat of ANSI-49 medium grey baked enamel. NEMA-3R enclosures shall be supplied with ANSI-49 acrylic paint finish.
- 2.3 Each indoor type vertical section shall be 91½" high, 24" wide and 30" deep for individual full voltage non-reversing controller.
- 2.4 Controllers in individual section shall have three distinct, isolated compartments as follows:
  - 2.4.1 Line terminations, power bus, and isolating switch compartment shall be at top rear portion of each vertical section.
  - 2.4.2 Medium voltage compartment shall include mechanical and electrical interlocks to minimize electrical hazards. This compartment shall have hinged door to permit easy access to medium voltage equipment such as: fuses, current transformers, and contactor.
  - 2.4.3 Low voltage control compartment shall be located in upper half of vertical section with hinged door to permit easy access to meters, relays, pilot devices and terminal strips for inspection and maintenance. When possible, compartment door and inside panel shall have pre-drilled holes for future addition of meters, pilot devices and relays.
- 2.5 Design shall provide complete front accessibility to all electrical parts when installed against walls or for back-to-back arrangements.

## SECTION 3 Power and Ground Bus (Motor Control Center Construction Only)

- 3.1 Horizontal power bus, when required, shall be in isolated compartment mounted within vertical section. Bus shall have minimum continuous current carrying capacity of 1000

amperes, and shall be supported on 5 KV fiberglass polyester insulators.

- 3.2 Ground bus, when required, shall be continuous and extend from one end of motor control center to other through each vertical section. Bus shall be located in bottom front of each vertical section. Minimum continuous rating shall be 375 amperes.
- 3.3 All bus ratings shall be in accordance with UL Standard 347.
- 3.4 All bus bars shall be tin-plated aluminum or tin-plated copper.
- 3.5 All bus bars and cables shall be braced to withstand, without damage or deformation, maximum let through current permitted by current limiting fuses.
- 3.6 All bolted power bus joints shall have minimum of two bolts. To facilitate future extension of motor control center on either side, horizontal bus and ground bus shall be provided with suitable bolt holes.

## SECTION 4 Wiring

- 4.1 Controllers shall be complete with all internal power and control wires including terminations for external connections. Phase sequencing shall have proper identification and all wires shall have suitable markings at all terminations.
- 4.2 Incoming line may be connected to one of the following:
  - 4.2.1 Individual controllers:
    - a. For 91½" high individual controllers: To incoming line terminations in line and isolating switch compartment located at top rear in vertical section. Space shall be provided for terminating a maximum of 2-250 or 1-500 MCM cables per phase for top or bottom entry.
  - 4.2.2 Motor Control Centers:
    - a. To horizontal bus located on top rear of vertical section, for small line-ups.
    - b. To separate incoming line section provided with bus connections to horizontal bus.
- 4.3 Motor cables requiring stress cones shall be connected to contactor or load connection box on left side wall. Space shall be provided for terminating a maximum of 1-500 MCM cable per phase for top or bottom entry.
- 4.4 Space shall be provided for stress cones for incoming line and load cables on all types of construction.

**SECTION 5 Contactor**

- 5.1 Contactors shall be drawout or fixed, airbreak or vacuum, depending on specific application. Basic contactor assemblies shall be interchangeable.
- 5.2 Airbreak contactor shall be 3 pole, NEMA Type H3, heavy duty, clapper type, designed for long operating life. It shall be rated for 5000 volts, 360 amperes (enclosed), 60kv BIL, with three phase interrupting capacity of 50 MVA, RMS symmetrical.
- 5.3 Vacuum contactor shall be 3 pole, designed for long operating life in contaminated atmosphere. The vacuum bottles shall have low chop current (0.3 Amperes, average) to minimize voltage spikes and shall have interrupting rating of 6000 Amperes.
- 5.4 Drawout design shall permit removal of contactor from the enclosure without physically disconnecting any medium voltage cables. Low voltage connections to contactor shall be made with quick disconnect plug.
- 5.5 Fixed design shall have cable terminations easily accessible to disconnect cables.
- 5.6 Line and load connection fingers for drawout design shall be located on contactor for ease of inspection and maintenance.
- 5.7 Movable and stationary contacts on airbreak design shall be identical and shall be of silver tungsten carbide faced copper to prolong operating life. Contactor operation shall provide self-cleaning contact action under mild atmospheric contamination.
- 5.8 Airbreak design shall have intermittent blowout coils to minimize heat losses.
- 5.9 Contactor shall have a dc operating coil to ensure quiet operation. Control voltage for coil shall be connected through a heavy duty full wave bridge silicon rectifier mounted on contactor.
- 5.10 Contactor shall include minimum of two single pole, double throw auxiliary contacts rated at 10 amperes continuous for customer's use. Maximum of five such contacts shall be provided on contactor when specified.
- 5.11 Mechanically latched contactor
  - 5.11.1 Mechanically latched contactor shall be provided when specified for transformer feeder circuits, fire pumps, automatic

transfer applications, and other uses when it is required to have contactor remain closed, should voltage dip or fail.

- 5.11.2 Mechanically latched contactor shall be closed electrically from local or remote "ON" push button and tripped by mechanical linkage to externally-operated manual trip device. When specified an electrically operated solenoid shall be supplied to trip contactor from remote location.

- 5.12 Contactor shall be lightweight (no more than 70 lbs.), to eliminate the need for lifting device such as contactor lift jack.

**SECTION 6 Power Fuses**

Power fuses shall be integral part of medium voltage compartment and shall be vertically mounted and front accessible for ease of inspection and removal without special tools. Power fuses shall be current limiting type with three phase symmetrical interrupting ratings of 200MVA at maximum of 2500 volts, and 350MVA at maximum of 5000 volts, and shall have blown-fuse indication.

**SECTION 7 Control Power Transformer**

Control transformer with 120 volt secondary and primary current limiting fuses shall be mounted separately in vertical section, and shall be rated at minimum of 750VA providing 500VA spare capacity for customer's use.

**SECTION 8 Power Circuit Isolating Means**

- 8.1 Externally operable, gang operated, non-load break medium voltage isolating switch with quick make quick break action shall be included for each controller. It shall be capable of closing and interrupting no load current of control transformer supplied with controller. The switch shall have viewing window to verify blade position.
- 8.2 Isolating switch shall be vertically operated by external handle operating through approximately 180° arc to accomplish the following:
  - 1. Isolate medium voltage contactor and power fuses from power supply.
  - 2. Disconnect primary of control transformer.
  - 3. Release door interlock so that medium voltage door can be opened.
- 8.3 Isolating switch handle shall be rugged, simple and shall have provision for padlocking in open position.

**SECTION 9 Interlocking**

- 9.1 Mechanical interlocking shall *prevent* the following:

- 9.1.1 Opening isolating switch when contactor is closed.
- 9.1.2 Opening medium voltage compartment door with isolating switch handle in up position and isolating switch closed.
- 9.1.3 Closing isolating switch with door open.
- 9.1.4 Closing isolating switch with contactor placed in its normal operating position and closed while testing contactor operation.

9.2 Electrical interlocking shall be provided to assure that the contactor operating coil is de-energized, before the isolating switch can be opened.

#### SECTION 10 Control

- 10.1 Control power shall be 120 volt ac from a 750VA control transformer mounted separately in the vertical section.
- 10.2 Control transformer shall be fused on primary and secondary for proper coordination. Two fuses shall be supplied on primary and one fuse on secondary side with one leg grounded. Primary of control transformer shall be disconnected from power supply with isolating switch in open position.
- 10.3 Control wires shall be minimum 14 gauge stranded, rated for 600 volts.
- 10.4 Terminal blocks shall be rated for 600 volts and be suitable for terminating maximum 10 gauge wire. Both ends of control wires shall be marked for identification.
- 10.5 Push buttons, pilot lights and control relays shall be heavy duty, rated for 600 volts.
- 10.6 Controller shall include circuit to test contactor and control circuit when isolating switch is in open position. Test circuit shall consist of receptacle and plug mounted in medium voltage compartment and accessible only when medium voltage compartment door is open. In test position, plug may be removed from receptacle and connected to an external 120 volt source of power. This shall isolate control transformer and prevent energizing control transformer secondary from test voltage source.
- 10.7 All devices mounted in low voltage compartment shall be suitably identified.

#### SECTION 11 Protection and Metering Equipment

- 11.1 Overload protection shall be provided by means of three phase thermal overload relay, bi-metallic ambient compensated type, and shall be operated through current trans-

formers. Relays shall be mounted on low voltage panel with external reset on compartment door. Pressing overload reset button shall not open control circuit nor stop motor if it is running.

- 11.2 Current transformers used for overload protection shall be of linear response through six times full load motor current and shall have adequate burden capacity for devices they supply. Linear response shall be per ANSI accuracy classification.
- 11.3 Preferably, all control, protection and metering equipment shall be mounted in separate isolated low voltage compartment as described under paragraph 2.4.3.

#### SECTION 12 Miscellaneous

- 12.1 Servicing  
Servicing shall be possible with contactor inside the enclosure. However contactor can be removed, if desired.
- 12.2 Nameplates
  - 12.2.1 Suitable nameplates shall be included on contactor and controller door identifying manufacturer's factory order, and wiring diagram numbers.
  - 12.2.2 Drive identification plates shall be 5½" x 1½" with ¾" black letters on white background.

#### SECTION 13 Reduced Voltage Controllers

- 13.1 Reduced voltage controllers shall be closed transition, adjustable time limit acceleration type. When specified:
  - 13.1.1 Primary reactor type controllers shall consist of start contactor, run contactor, and 3 phase primary reactor with 50, 65 and 80% voltage taps.
  - 13.1.2 Autotransformer type controllers shall consist of main contactor, start contactor and run contactor mechanically interlocked and two-winding autotransformer connected in open delta with 50, 65 and 80% voltage taps.
  - 13.1.3 Wound rotor motor controllers shall consist of primary controls which include main contactor with control and protective relays, and secondary control that includes secondary accelerating contactors, set of relays for time limit acceleration and set of NEMA Class 135 starting duty resistors. Secondary resistors shall be mounted in separate 91½" high vertical section for maximum

heat dissipation. Resistors shall be heavy duty pressed stainless steel type with welded end connections.

#### SECTION 14 Synchronous Motor Controllers

14.1 Synchronous motor controllers shall be suitable for conventional or brushless synchronous motors where constant speed and plant power factor correction are desired. Controllers shall be full voltage or reduced voltage type depending upon the specific requirement.

14.2 Synchronous motor controllers shall have field control panel mounted on door for ease of inspection. Field panel for conventional synchronous motor shall consist of:

- 14.2.1 Solid-state module for automatic synchronization and motor protection from:
- Stalled rotor condition
  - Failure to accelerate to synchronizing speed
  - Loss of excitation
  - Pull-out under excessive load.

14.2.2 Field application contactor

14.2.3 Field discharge resistor

14.2.4 DC field ammeter

14.3 When specified, three phase, full wave bridge static exciter shall be furnished as part of conventional synchronous motor controller. The static exciter package shall provide ac to dc power conversion required for individual synchronous motor field excitation. No field

rheostat nor resistors shall be required since voltage adjustment shall be made on static exciter-transformer by changing taps. Static exciter shall consist of:

14.3.1 Three phase fused transformer with four 5% primary taps, two above and two below nominal voltage and seven 2½% secondary taps below nominal voltage.

14.3.2 Silicon rectifier and surge protective devices.

14.3.3 Exciter shall be connected to load side of medium voltage contactor. Exciter shall have:

- Input: 2300, 4160 or 4800 volts, 3 phase 60 Hz.
- Output: 125 or 250V dc as specified. KW rating of exciter shall be based on actual motor data to be supplied by purchaser.

14.4 Field panel for brushless synchronous motor shall consist of:

- Exciter field contactor
- Incomplete sequence relay
- DC power supply for exciter field with thyrite protector.
- Powerstat for exciter field adjustment
- Exciter field loss relay
- Pull out relay
- DC field ammeter

Control equipment for synchronization shall be part of brushless synchronous motor.

#### SPECIFICATIONS CHECK LIST

##### CONTROLLERS: GENERAL

- ☐ 5 KV design per NEMA Standard ICS 2-324 and UL Standard 347
- ☐ NEMA Type 1, 1 Gasketed, 3R or 12 enclosures
- ☐ Complete front accessibility to all parts for easy installation and maintenance.
- ☐ Mechanical and electrical interlocking system to prevent opening or closing isolation switch under load and for personnel protection.
- ☐ Simple isolating switch.
- ☐ Power fuses vertically mounted and front accessible. No tool required for removal.
- ☐ 600 volt class relays, pilot devices and terminal boards.
- ☐ Control power transformer with primary and secondary fuses.

- ☐ Modifications available to meet special needs.
- ☐ Complete line available for squirrel cage, synchronous and wound rotor motors.

##### CONSTRUCTION

##### CONTROLLERS: MOTOR CONTROL CENTER

- ☐ Available in individual 91½" high, 24" wide, 30" deep floor mounted vertical section. Each controller section with three distinct and isolated compartments.
  - Isolated line, horizontal bus, and isolating switch compartment
  - Isolated medium voltage compartment
  - Isolated, low voltage control compartment.
- ☐ Ground bus — Copper.

Continued

## SPECIFICATIONS CHECK LIST (CONT'D)

### CONTACTOR

- ☐ Airbreak or vacuum type, interchangeable.
  - ☐ Drawout or fixed arrangement.
  - ☐ Airbreak contactor with intermittent blowout coil to minimize heat losses.
  - ☐ 3 pole, heavy duty clapper type, rated 5,000 volts 360A (enclosed), 60 KV BIL.
  - ☐ Identical movable and stationary contact tips for airbreak contactor. Design shall allow contact tips inspection without having to remove contactor from enclosure.
  - ☐ Airbreak contactor to have 3 Phase interrupting capacity of 50 MVA.
  - ☐ Vacuum bottles to have interrupting rating of 6,000 Amperes at 5 KV.
  - ☐ Vacuum contactor bottles with low chop current (0.3 Amperes, average) to minimize voltage spikes.
- ☐ Lightweight (70 pounds maximum) to eliminate need for a lifting device.
  - ☐ Control power transformer and medium voltage fuses to be mounted separately from the contactor.
  - ☐ Line and load fingers located on contactor for easy access in case of drawout design.
  - ☐ Mechanically latched type available with option of electrical solenoid for remote tripping.

### ISOLATING SWITCH

- ☐ Non load break type, with viewing window to verify blade position.
- ☐ Electrically and mechanically interlocked with contactor to ensure operation under no load.
- ☐ Quick make - Quick break mechanism.

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