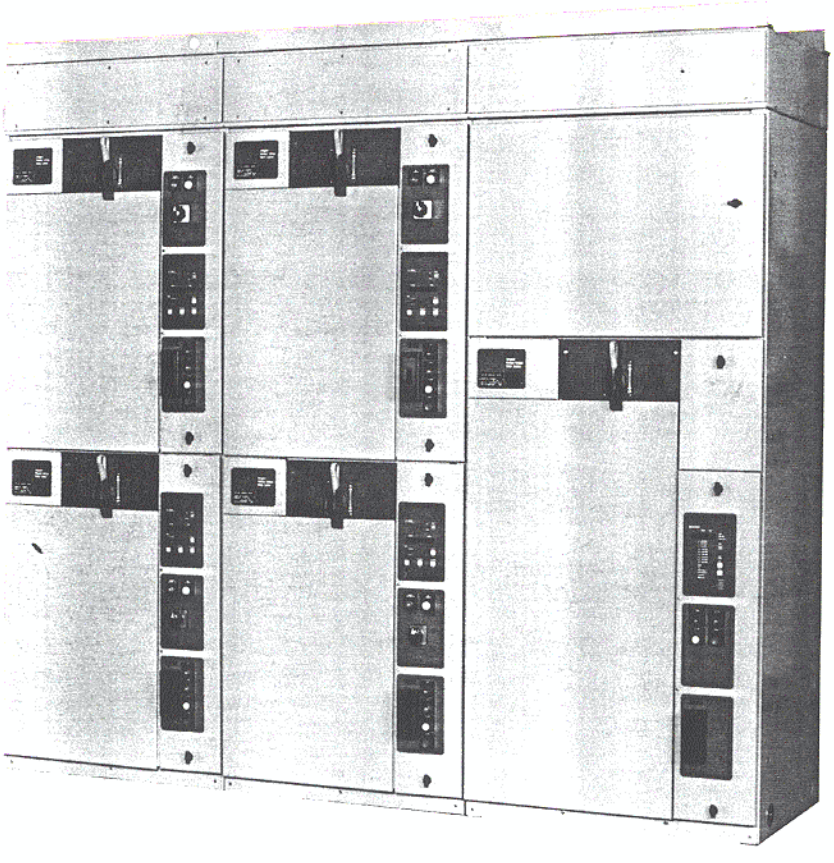
December 1998
Supersedes Descriptive Bulletin 8850,
Dated October 1989
Mailed to: E, D, C/8800A

2200-7200 volts, 50-60 Hz Ac
Up to 8000 Hp, NEMA Class E2

AMPGARD® Medium Voltage Starters



Medium Voltage Line Up
Top Mounted Horizontal Main Bus with Incoming Line
Two High 400 Amp Induction Motor Starter and One High 800 Amp Induction Motor Starter

Table of Contents

AMPGARD Medium Voltage Starters
Description

General Description

Cutler-Hammer Ampgard medium voltage starters provide complete flexibility in precisely matching a wide range of industrial motor ratings. Rated at 2500, 5000, and 7200 volts, up to 8000 Hp, Ampgard starters are the first motor starters designed as integrated, complete units. Uniformity of design throughout the Ampgard line allows the use of the optimum rating for each application within a plant, with no mixed equipment problems. And the variety of optional features that are available with Ampgard allow a user to obtain a starter unit that exactly meets a motor's starter and control requirements.

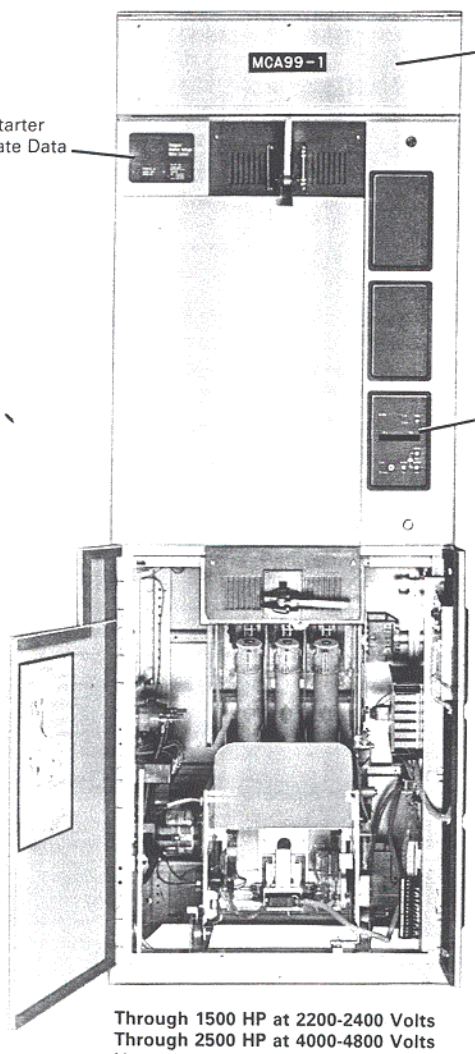
Complete front accessibility to the enclosures allows free standing, back-to-back, or against-the-wall starter mounting.

Ampgard starters are available in 400 amp and 800 amp (open rating) for 2500, 5000 and 7200 volt ratings. The 400 amp rating in a NEMA/EEMAC Type 1 enclosure is 36 inches wide, 30 inches deep and 90 inches high (100" with top mounted horizontal bus) either one or two high construction for full voltage starters. The 800 Amp rating in an enclosure is 40 inches wide, 30 inches deep and 90 inches high (100" with top mounted horizontal bus) in a one high construction for a full voltage starter. These floor-mounted units are uniform in design and easily adapted for reversing, reduced voltage, synchronous, and wound rotor motor starting.

For flexibility and space economy, no other starter can compare with the Ampgard starter line.

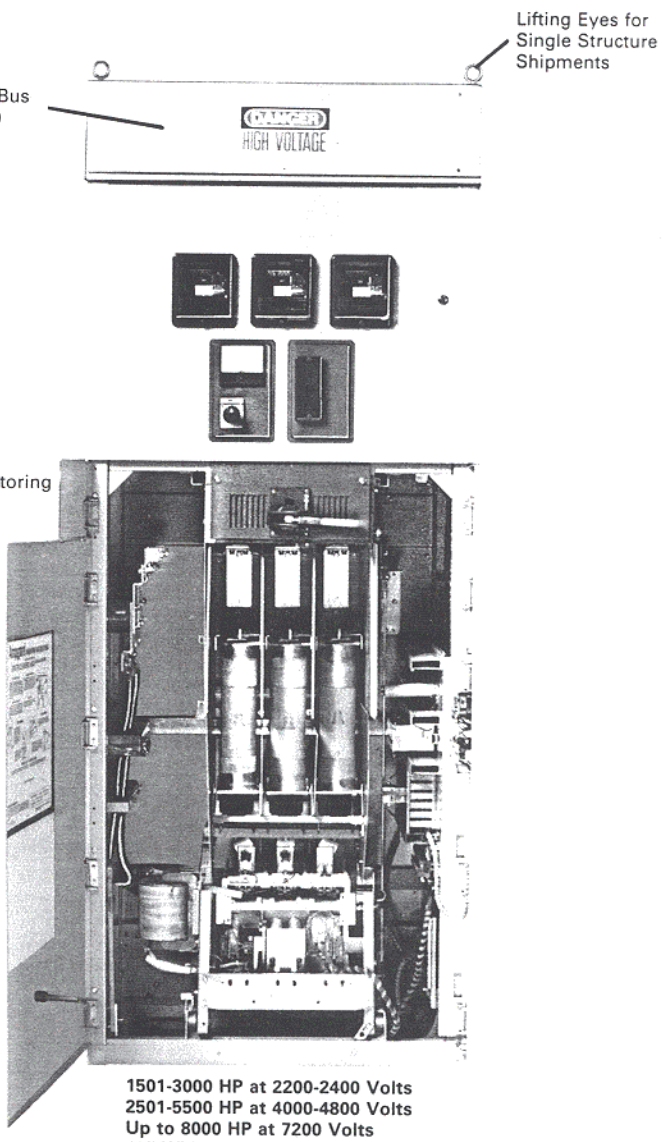
Ampgard is industry's "first family" of high voltage starters.

400 Amp Two High Construction Induction Motor Control



Through 1500 HP at 2200-2400 Volts
Through 2500 HP at 4000-4800 Volts
Up to 4000 HP at 7200 Volts
36" Wide

800 Amp With Protective Relays and Meters in Top 30" of Enclosure (When Specified)



1501-3000 HP at 2200-2400 Volts
2501-5500 HP at 4000-4800 Volts
Up to 8000 HP at 7200 Volts
40" Wide

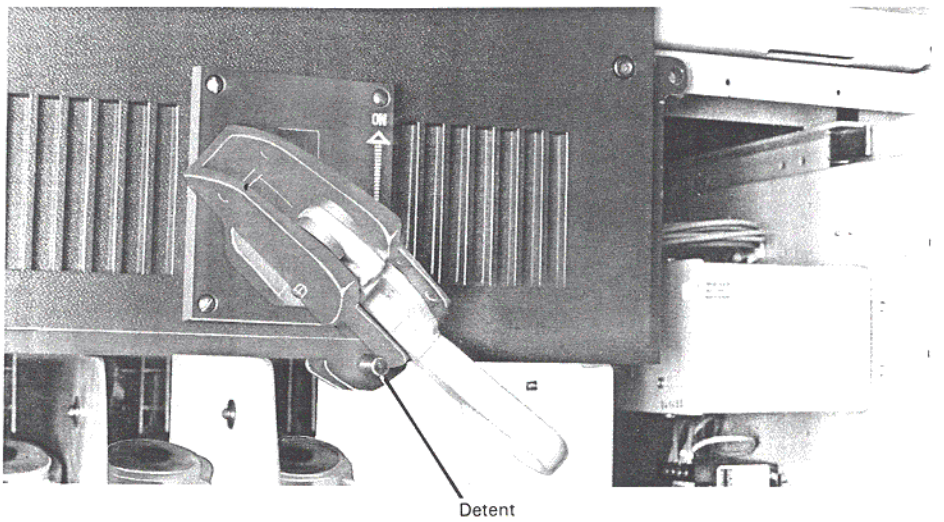
AMPGARD Medium Voltage Starters
Personnel Safety Features

Personnel Safety Features

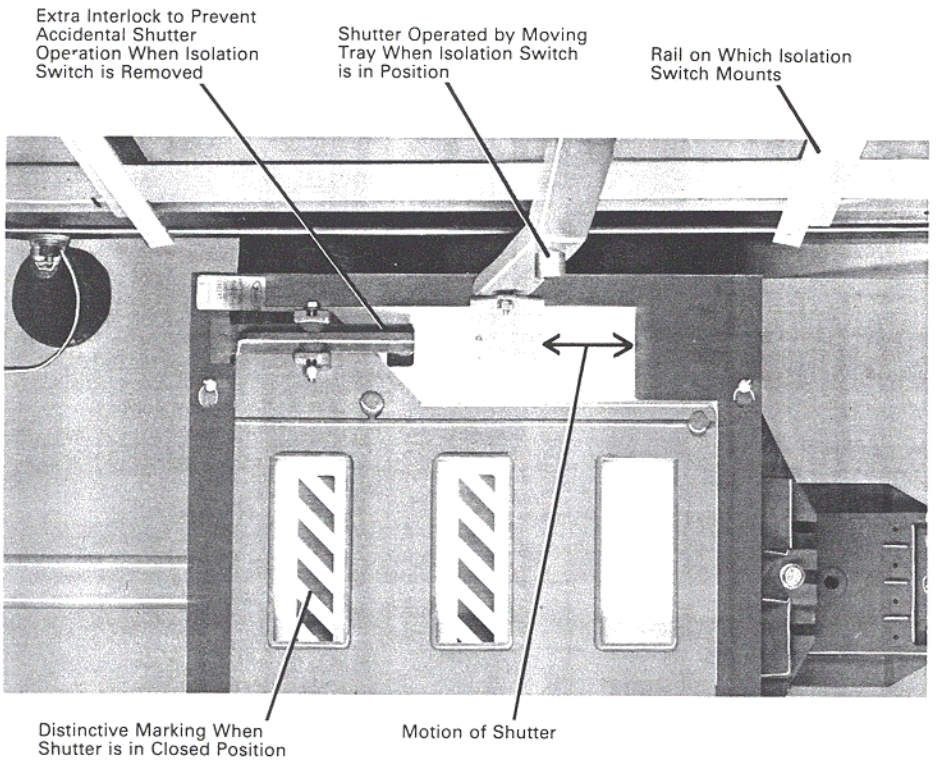
One of the most important considerations in designing the Ampgard Starter was personnel safety. The result is an extensive system of interlocks and other safety features.

Interlocks
Interlocking on Ampgard Starters includes:

- Isolating switch handle housing extends over medium voltage door when handle is in ON or OFF position, preventing door from being opened.
- Position for optional key interlocks.
- When door is open, detent prevents operating handle from being moved inadvertently to OFF or ON position.
- When contactor is energized, isolating switch cannot be opened or closed.



Shutter Barrier Between Line Terminals and Fuse Stabs



Shutter Mechanism and Finger Barrier Isolation of Incoming Line Stabs

Other Safety Features
In addition to the interlock system, Ampgard Starters include many other features designed to protect operating personnel. These features include:

- Provision for three padlocks on isolating switch handle in OFF position.
- Operating handle must be rotated 90° to the horizontal service position in order to open main door, assuring complete isolation from the main power source.
- Shutter barrier between line terminals and fuse stabs are mechanically driven in both directions. (See Photo)
- Distinctive marking on back of switch assembly appears when shutter barrier is in position and starter is completely isolated from the line.
- Visible grounding clips provide a positive ground of the starter and the enclosure when the isolating switch is opened.
- High and low voltage circuits are compartmentalized and isolated from each other.
- Illustrated selected safety features, operating instructions and renewal parts information are permanently mounted inside main enclosure door. Refer to page 4.

AMPGARD Medium Voltage Starters
Personnel Safety Features

Ampgard®

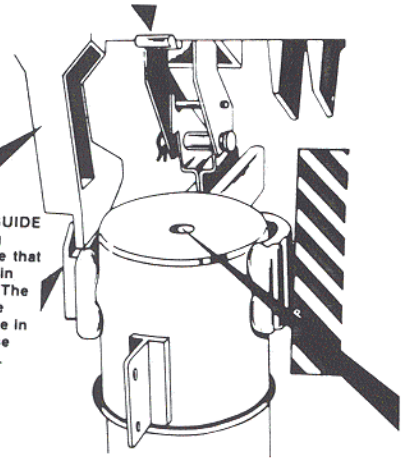
I.L. 17201

OPERATING INSTRUCTIONS

This Cutler Hammer motor starter has special features for your safety and convenience. Before removing fuses or servicing this starter, be sure to check the GROUNDING CONNECTION, VISIBLE ISOLATING SWITCH, and SHUTTER as described and illustrated below. See Instruction Manual.

GROUNDING CONNECTION

When the isolating switch is in the "OFF" position, the fuse clamps are automatically connected to ground. This assures that the starter is grounded before you open the door.



This industrial type control is designed to be installed, operated, and maintained by adequately trained personnel, with adequate supervision. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

VISIBLE ISOLATING SWITCH

In the isolating switch "OFF" position you can see the ends of the fuse clamps above the top of the fuses. In the "ON" position this is the part of the isolating switch that connects to the line. If you can see the fuse clamp ends, you can be sure that the starter is disconnected from the line. In the isolating switch "OFF" position, the fuses will appear to be loose in the top clamp. This is normal. When the isolating switch operating handle is moved to the "ON" position, adequate force is automatically applied to the fuses.

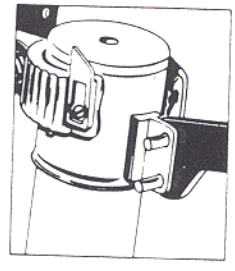
SHUTTER

This isolating switch has a mechanically driven protective shutter. This shutter provides an insulating barrier between you and the line terminals when the isolating switch handle is in the "OFF" position. You can tell when the shutter is fully closed by looking along side the main fuse. If the "barberpole" pattern is visible, the shutter is between you and the line. The "barberpole" is on both the left-hand and center poles.

BLOWN FUSE INDICATION

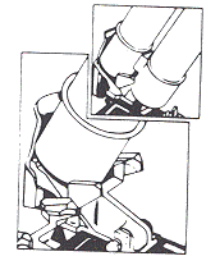
The main fuses in this starter have a blown fuse indicator. You can tell if the fuse is blown by looking at the RED indicator insert in the top end of the fuse. If the insert is flush, the fuse is good. If the insert is extended, the fuse is blown. For your convenience fuses should be installed with the indicator up.

FUSE REMOVAL



Hook fuse puller thru eyes on fuse. Pull fuse forward sharply and slide out over contactor.

FUSE INSERTION



Use fuse puller to install fuse. Make sure fuse is down as far as it will go in bottom fuse clamp. This fuse clamp will tighten automatically when the isolating switch handle is moved to "ON" position.

Inset shows how end of double barreled fuse is inserted.

ABRIDGED LIST OF RENEWAL PARTS

This motor starter provides improved motor protection. The main fuses, overload relay coils and current transformers are a coordinated protective system specially selected for your motor. To be sure of continuous protection only Cutler Hammer renewal parts should be used.

FOR THIS STARTER NO. XL42310-1 (1F)

DESCRIPTION	PART NO	REQUIRED	DESCRIPTION	PART NO	USE ONLY THESE PARTS REQUIRED
MAIN FUSES 200A-9R	151D933G01	3/STARTER	BOTTLE SUB-ASSY (VACUUM)	2147A47G03	1 CONTACTOR
OVERLOAD RELAY HEATERS	IQ1000-II	1 STARTER	MAIN COIL (120 V CONTROL)	2147A48G11	1 CONTACTOR
CURRENT TRANSFORMERS	2147A16G05	1 STARTER	CONTROL TRANSFORMER	2147A11G05	1/STARTER
CURRENT TRANSFORMER RATIO	150/5		CONTROL PRIMARY FUSES	2147A11G25	2/STARTER

PROTECTIVE INTERLOCKING

Positive interference type mechanical interlocks are used exclusively on this starter. They protect you by causing the mechanism to lock if incorrect operation is attempted. If this happens, or if some other symptom of incorrect adjustment is evident. DO NOT FORCE the mechanism. Refer to the instruction book before making changes or applying force.

CAUTION ---- INSTALL 4 PHASE BARRIERS BEFORE OPERATING VACUUM CONTACTOR UNDER LOAD.

Effective 4/87
Printed in USA

AMPGARD Medium Voltage Starters
Personnel Safety Features

Test-Run Circuit

A built-in test circuit permits the checking of the starter control circuit and pilot circuits. This testing is performed when the high voltage is de-energized and isolated. Thus, both visual, mechanical and electrical inspection may be performed while checking the control circuit.

The plug is disconnected from the secondary side of the control transformer and inserted into an external plug. This prevents the possibility of back feeding through the control transformer from an external test power source.

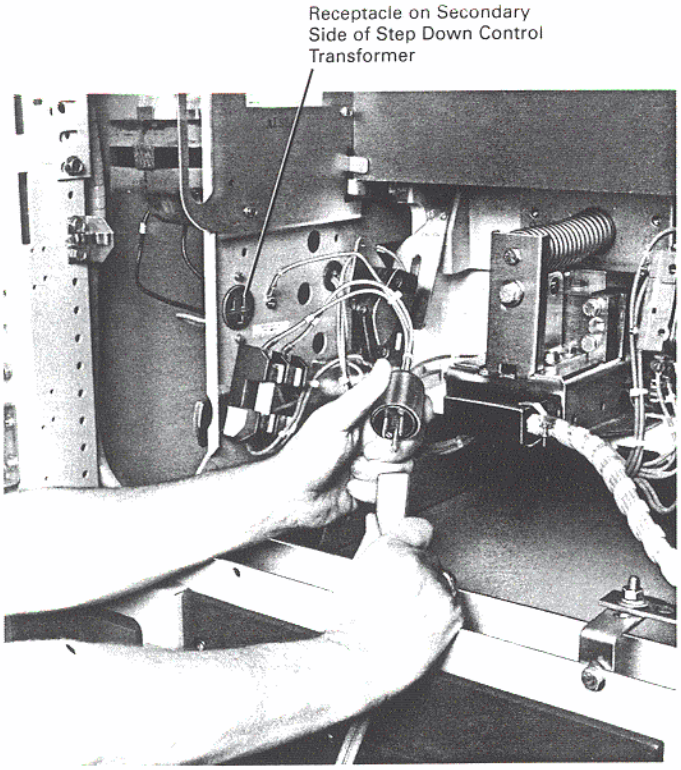
The control circuit permits testing of the contactor in its normal position or in the drawout position.

In the test mode, the polarized plug connects the control circuit to an external 115 volt, 60 Hertz supply. In the run mode, the control circuit is energized from the secondary of the control transformer.

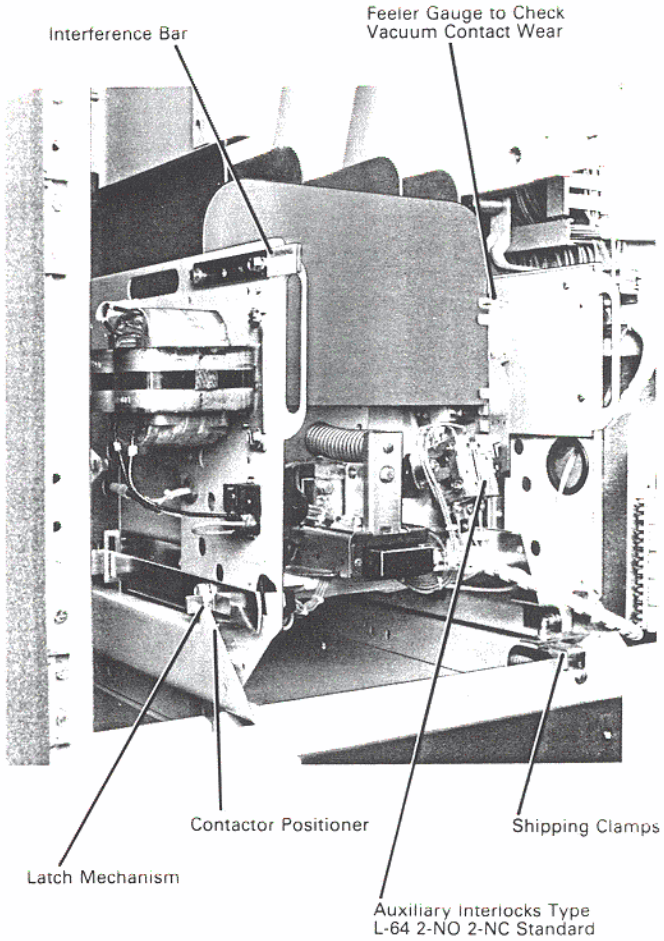
Vacuum Roll Out Design

Proper contactor load stab connection is important. The Ampgard has two visible checks.

- Contactor must be fully inserted in cell for latch mechanism to be behind contactor rail positioner.
- There is a mechanical interference bar as an additional backup. If the contactor is not in the proper position, the interference prevents closing of the high voltage door.



Polarized Plug Removed for Inserting into External 115 Volt Test Power Insures Against Back Feed Through Control Transformer



400 Ampere Vacuum Roll Out Contactor

AMPGARD Medium Voltage Starters
User Benefits

Personnel Safety: Equipped with a mechanically driven isolating shutter, the positive mechanical isolating switch completely grounds and isolates the starter from the line connectors, leaving no exposed high voltage when the door is open. The shutter mechanism is visible without the removal of any components. The high voltage door is mechanically locked/closed with the isolating switch handle; the low voltage section is separated from the high voltage section.

Ease of Installation: Current limiting fuses, contactor assembly, and isolating switch are easily removed from the enclosure. There is no need to remove any structural or mechanical barriers for accessibility to motor load terminals.

Ease of Maintenance: Because all components are front accessible, routine inspection and parts replacement is fast and easy. The control circuit permits testing of the contactor in its normal position or in the draw-out position.

Simplicity of Design: Component-to-component design eliminates half of the electrical connections normally required with other motor starters.

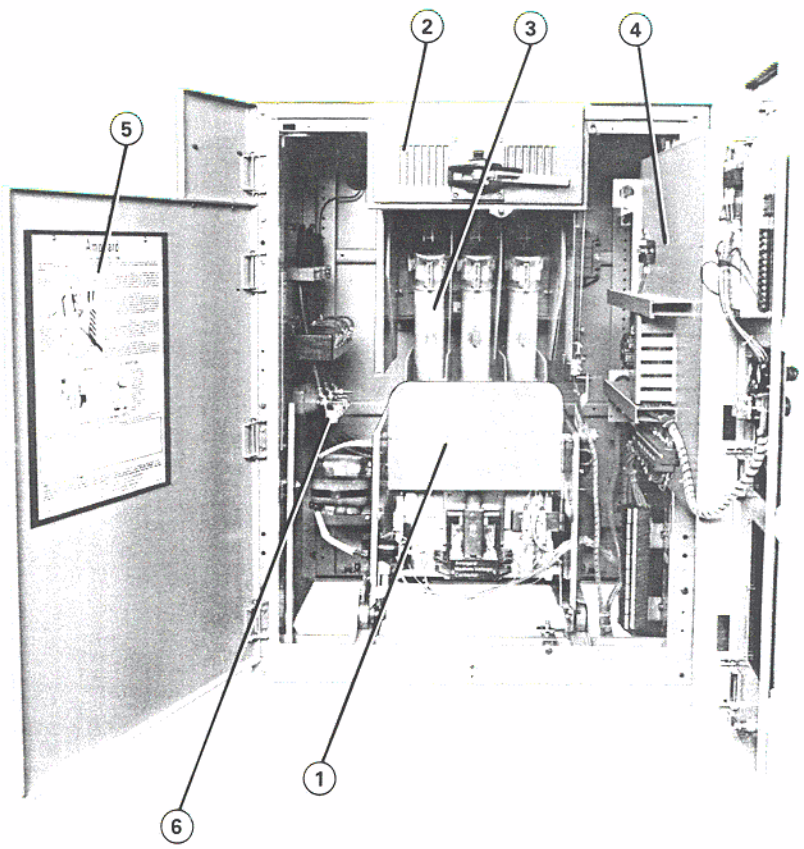
Complete Testing: Designed, tested, and verified in the Cutler-Hammer High Power Laboratory, Ampgard Motor Starters comply with ANSI/NEMA, ICS-2, EEMAC E14-1, UL 347, and CSAC22.2 No. 14, published industrial control standards. BIL ratings are established in accordance with ANSI/IEEE standards. Third party labeling is not included as standard. If the starter bill of material fits within certain restrictions, the starters can be supplied with UL, CSA or City of L.A. Certification. Contact the factory to determine if a certain starter meets the requirements for labeling.

For flexibility and space economy, no other starter can compare with Ampgard Starters. All Ampgard Starters feature the same basic design and are installed, operated, and maintained the same way.

Starter Classes are available for the following non-reversing applications:
Class S/V 202 – Induction Motor Full Voltage
Class S/V-502 – Induction Motor Primary Reactor
Class S/V 602 – Induction Motor Autotransformer
Class S/V W02 – Wound Rotor Motor
Class S/V F02 – Synchronous Motor Full Voltage
Class S/V R02 – Synchronous Motor Primary Reactor
Class S/V A02 – Synchronous Motor Autotransformer

S = Slide Out Contactor
V = Roll Out Contactor

Reversing also available.



400 Ampere Starter

Design Features

1. Type SJ 400 Amp Vacuum Contactor
2. Type LFR Mechanical Isolating Switch
3. Current Limiting Type CLS Power Fuses
4. Control Compartment
5. Illustrated Safety Features and Parts List
6. Motor Load Terminals

AMPGARD Medium Voltage Starters
Component to Component Circuitry

Component-to-Component Circuitry

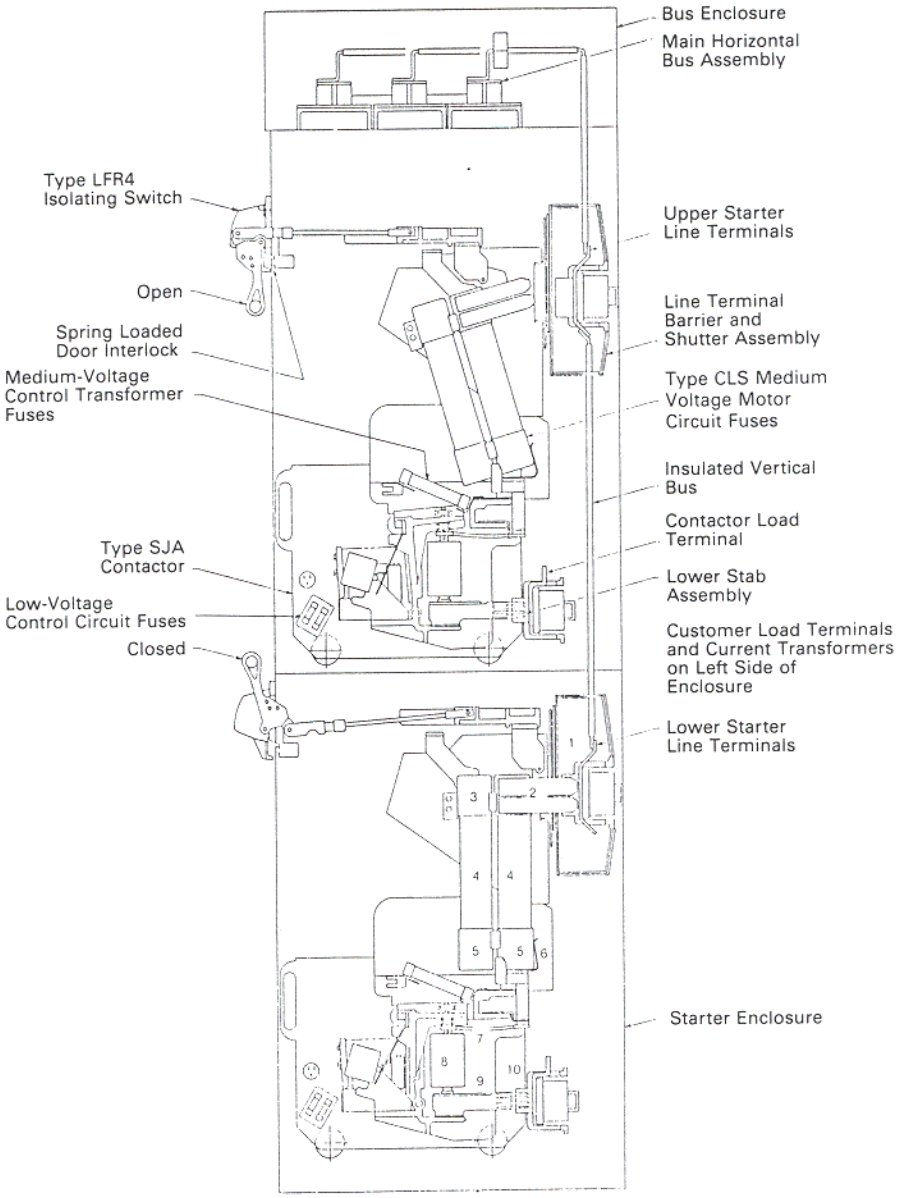
All major components of Ampgard starters-mechanical isolating switch, vacuum contactor, current transformers and control transformer – were designed specifically to function together as an integrated starter unit.

One of the most important design features, however, is the component-to-component circuit concept employed to eliminate 50% of the current carrying junctions.

The flow of power through a vacuum-break controller can be traced by referring to the lower portion of this figure where the starter is shown in the energized position. The line stab assembly mounted at the back of the enclosure also serves as the starter line terminals (1). The stabs themselves are engaged by the fuse jaws (2) of the isolating switch which is mounted on rails at the top of the enclosure. The line ferrules (3) of the current-limiting motor-starting power fuses (4), clip into the fuse jaws, and the load ferrules (5) fit into the fuse holders (6) which are part of the contactor line terminals.

Power flow through the contactor is from the load ferrules of the power fuse, through the shunts (7), and the vacuum interrupters (bottles) of the contactor (8), to the contactor load terminals (9).

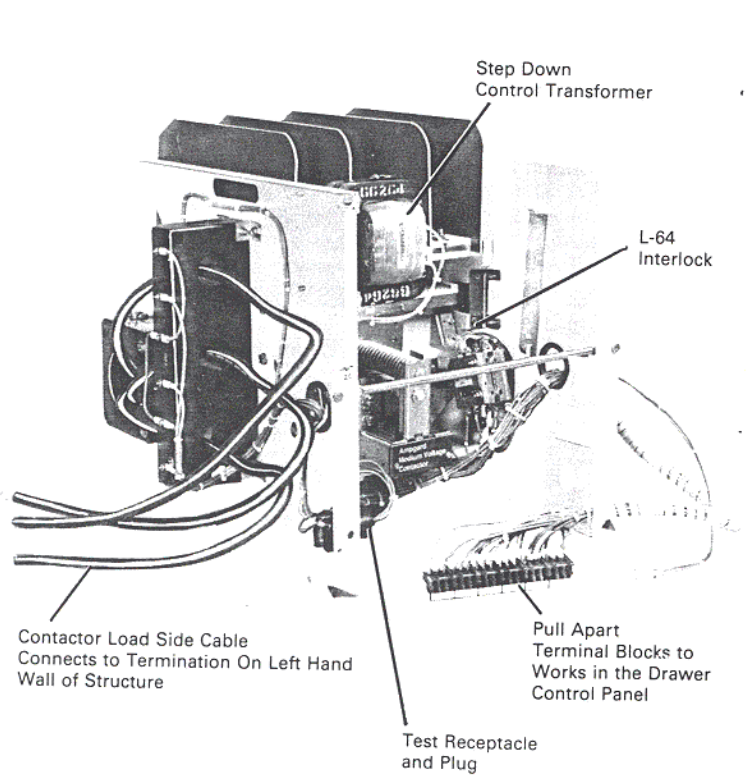
Spring loaded contact jaws mounted on the contactor load terminals (rollout only) plug into the lower stab assembly (10), providing a convenient connection through the current transformers to the motor load terminals mounted on the left hand side wall of the enclosure.

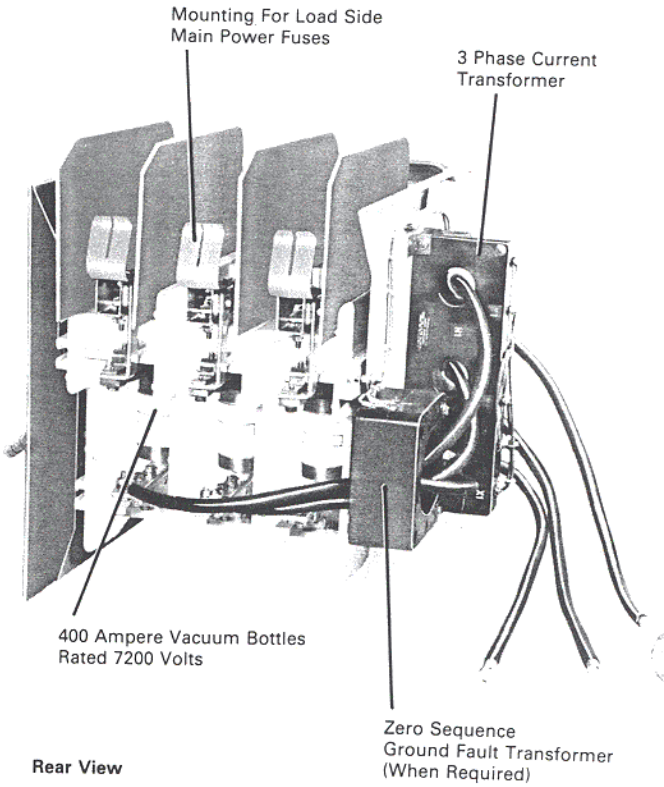


Component-to-Component Circuitry

AMPGARD Medium Voltage Starters
Drawout Vacuum Contactor Features

Type SJA 400 Amp Vacuum Contactor Slide Out





Rear View

The Type SJ Vacuum Contactor was designed and engineered specifically for use in Ampgard Starters. It is a self-supporting, compact, drawout, three-pole, Dc Magnet closed contactor. To permit application matching of the starter to the motor rating, the SJ Contactor is available for 2200 through 7200 volts at ratings of 400 and 800 amperes. The 400 amp contactor is available in both the standard slide out configuration and the optional roll out design. The 800 amp contactor is available in the roll out design only.

Design
The Type SJ Vacuum Contactor is a highly versatile, low-chop contactor that has been designed and tested to withstand a 60,000 volt basic impulse level. The contactor complies in all respects with published NEMA Industrial Control standards and is a UL recognized component. The SJ is designed for starting and controlling 3-phase, 50/60 hertz ac motors on nominal 2500, 5000, and 7200 volt systems.

The Type SJ accommodates mechanical interlocks between itself and other contactors and the isolating switch. These time proven interlocks provide unmatched safety and service protection.

The Type SJ Vacuum Contactor consists of a molded chassis with crossbar, magnet, and vacuum interrupters. The contactor is easily positioned into the starter and long-life vacuum bottles provide many operations with a minimal maintenance program. The contactor employs special main contact materials that exhibit an extremely low chopping current which minimizes switching surge. Surge protection is therefore not required due to the use of the vacuum contactor. Surge suppression may be required, however, for reasons other than the vacuum contactor.

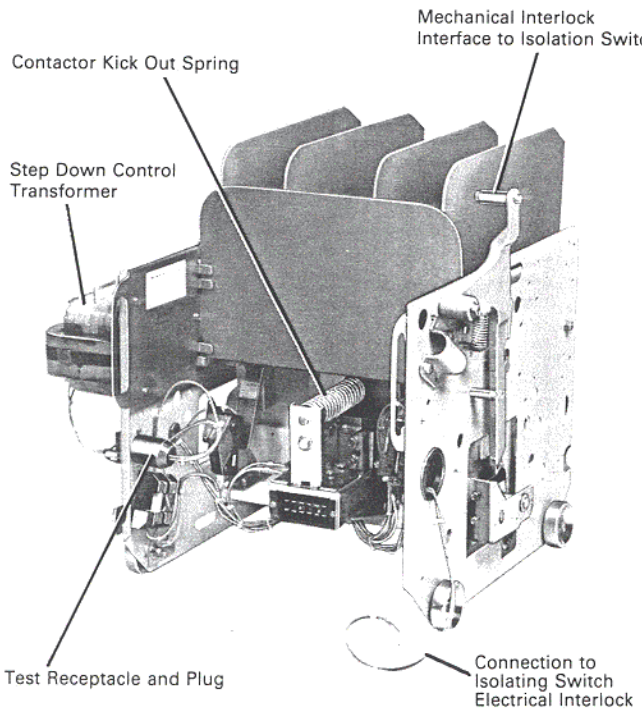
The contactor design incorporates fuse clamps for the load side of the current limiting fuses and provides for connection to the high voltage side of the control power transformer. CPT's of up to 2 KVA capacity are mounted on the contactor. The contactor operating coil has a built-in full wave silicone rectifier which supplies DC power for quiet operation and allows for proper contactor-fuse coordination.

Refer to pages 26 and 27 for complete technical specifications.

Maintenance
Ease of maintenance is one of the outstanding features of the Cutler-Hammer Vacuum Contactor line. A simple go/no go gauge for checking contact wear is included with each contactor. It is not necessary to drawout the contactor to check for contact wear or to replace the main operating coil or electrical interlocks mounted on the contactor. All are front accessible. The vacuum contactors are also much lighter than the previous generation airbreak contactors, which allows for easier insertion and removal from the starter structure.

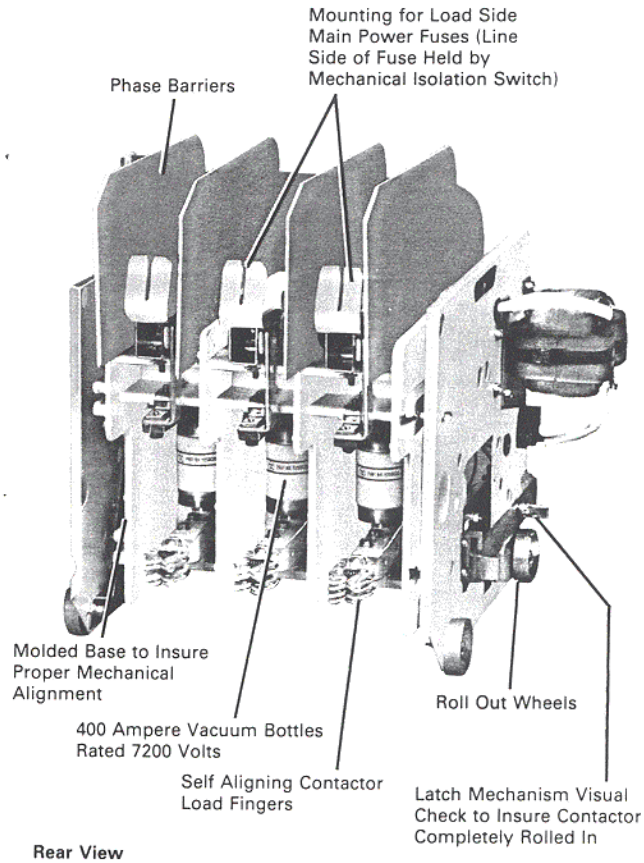
AMPGARD Medium Voltage Starters
Drawout Vacuum Contactor Features

Type SJA 400 Amp Vacuum Contactor Roll Out with Wheels and Load Fingers



Note: Each Contactor supplied with a Feeler Gauge to Check Contact Wear from Front of Starter

Front View



Rear View

400 Amp Slide Out
The slide out version of the SJ Contactor is supplied as standard for those applications requiring a 400 Amp Contactor. The contactor slides into the Ampgard structure on steel rails. Medium Voltage cables connect the contactor load terminals to the lug landings for the motor load cables. A 3-phase current transformer and, when required, 3-phase potential transformer and ground fault zero sequence current transformer, are mounted on the contactor. A pull apart terminal block connects the contactor to the low voltage control panel.

The contactor is easily removed from the structure by removing 3 bolts securing the load cables, 1 bolt in each of the two mounting rails and one bolt connecting the isolating switch interlock arm.

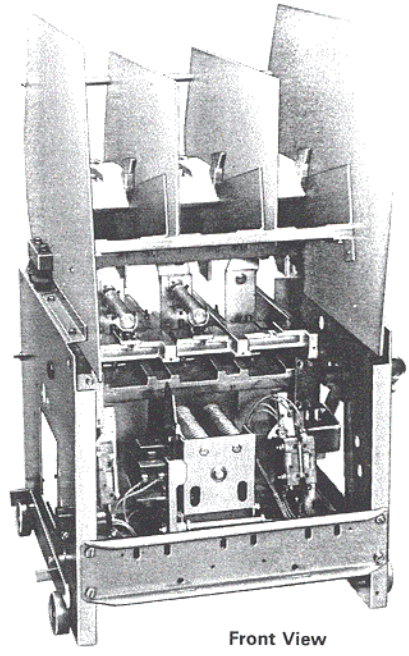
400 Amp Roll Out
A roll out version of the 400 Amp Contactor is an available option. The roll out contactor is mounted on wheels and simply rolls into the Ampgard structures. Contactor load fingers engage a load stab as the contactor is inserted into the structure. The contactor is latched in position and it can easily be removed by releasing the latch mechanism (refer to Page 5). This allows the contactor to be removed from the starter without disconnecting any medium voltage cables.

The 400A roll out contactor is electrically and mechanically interchangeable with the previous generation 2500/5000V, 400 ampere airbreak contactor.

800 Amp Roll Out
The 800 ampere Vacuum Contactor is available in a roll out design only. It has the same basic features as the 400 amp roll out.

Optional Contactor Features
All Ampgard Medium Voltage Contactors are available with a mechanical latch attachment (mechanically latched versus magnetically held closed). The latched design is used on applications where the contactor must remain closed through a voltage dip or voltage failure. The contactor is opened (tripped) by energizing a separate electrically operated solenoid with either one or two operating trip coils of different voltages.

Reversing, reduced voltage and multi-speed contactors are also available.

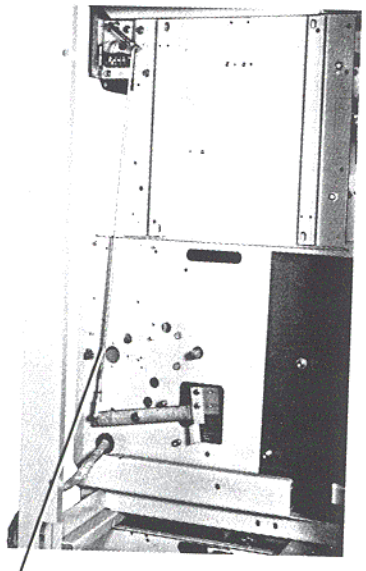


Front View

**800 Amp Vacuum Break Contactor
7200 Volt Maximum
Roll Out with Wheels and Load Fingers**

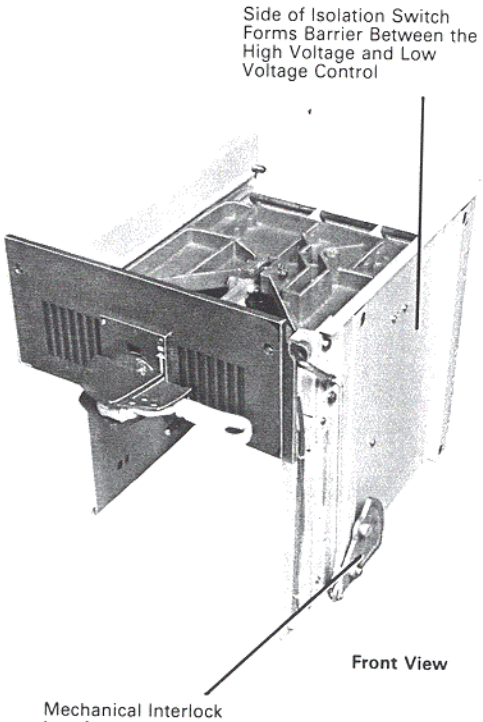
AMPGARD Medium Voltage Starters
Type LFR Mechanical Isolating Switch
Type LFR Mechanical Non-Load Break Isolating Switch

400 Amp Isolation Switch

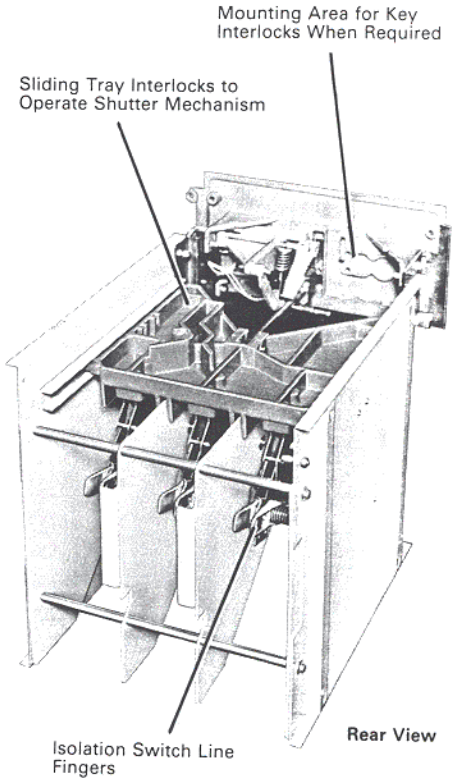


Mechanical Interlock Between Isolation Switch and Contactor Slide Out Design

Side View



Front View



Rear View

The LFR draw out, light weight, three pole, manually operated isolating switch is mounted on slide rails in the top of the enclosure. It may be easily removed by loosening two bolts in the front casting.

The component-to-component circuitry concept utilizes the current limiting fuses as part of the isolating switch. The switch fuse jaw is constructed so that firm pressure is applied to the fuse ferrule when the switch is in the ON position, yet also allows the fuse to be easily removed or inserted when the switch is open.

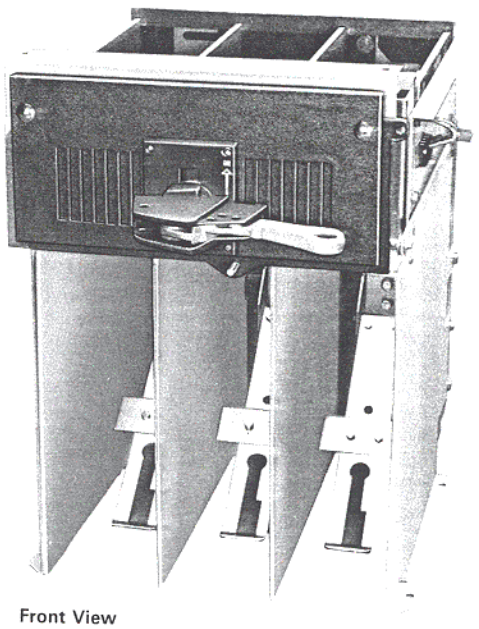
A positive mechanical interlock between the isolating switch and contactor prevents the isolating switch from being opened when the contactor is closed and from being closed if the contactor is closed.

The isolating switch handle is designed to break off, if the operator uses too much force in trying to open the non-load break isolating switch when the contactor is closed.

To operate the isolating switch, the operating handle is moved through a 180° vertical arc from the ON to the OFF position. In the ON and OFF position, a portion of the handle housing extends over the starter high voltage door, preventing the door from being opened. From the OFF position, the handle must be rotated 90° counterclockwise to a horizontal service position which allows the high voltage door to be opened. When the high voltage door is open, a door interlock prevents the handle from being inadvertently returned to the OFF position. From the horizontal service position, the handle cannot be moved to the ON position without first moving to the vertical OFF position.

When the operating handle is moved from ON to OFF, copper fingers are withdrawn from incoming line stabs. As the fingers withdraw, they automatically tilt up so they are **visible** above the top of the fuses when viewed from the front, and simultaneously **grounded**. At the same time as the fingers are withdrawn, a mechanically-driven insulating shutter moves across the back barrier to prevent front access to the line connections. As the shutter slides into position, distinctive markings appear on the back barrier, making it easier to check the position of the fuses and barriers. Refer to page 3.

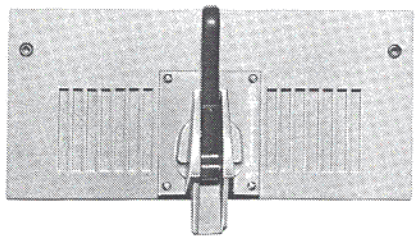
800 Amp Isolation Switch



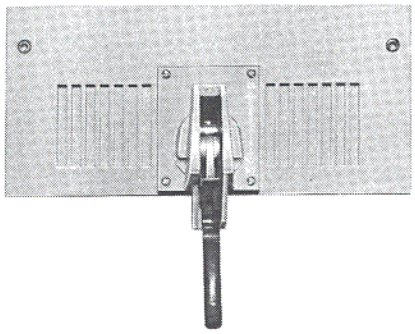
Front View

AMPGARD Medium Voltage Starters
Current Limiting Fuses

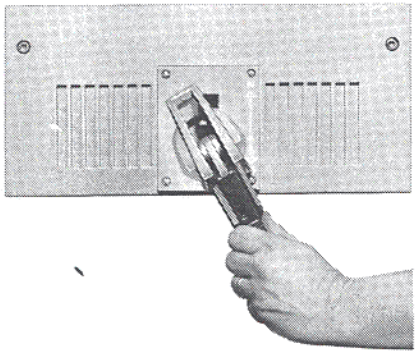
Isolation Switch



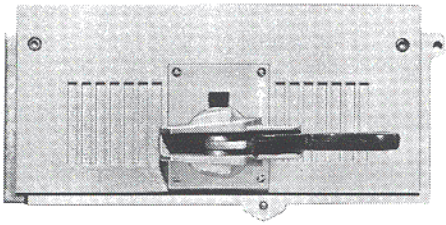
ON Position



OFF Position



Handle Being Moved to Horizontal Service Position



Handle In Horizontal Service Position

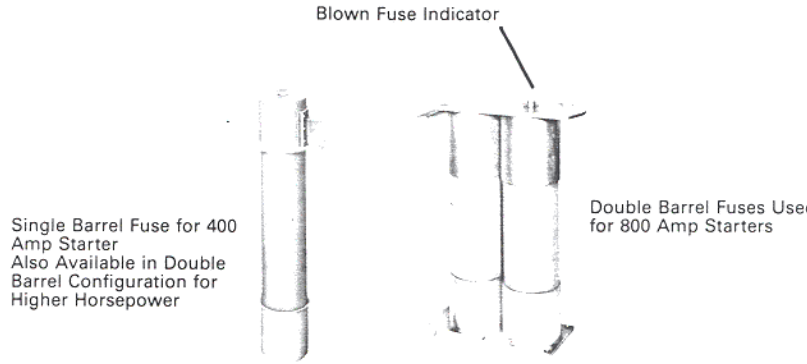
Current Limiting Fuses

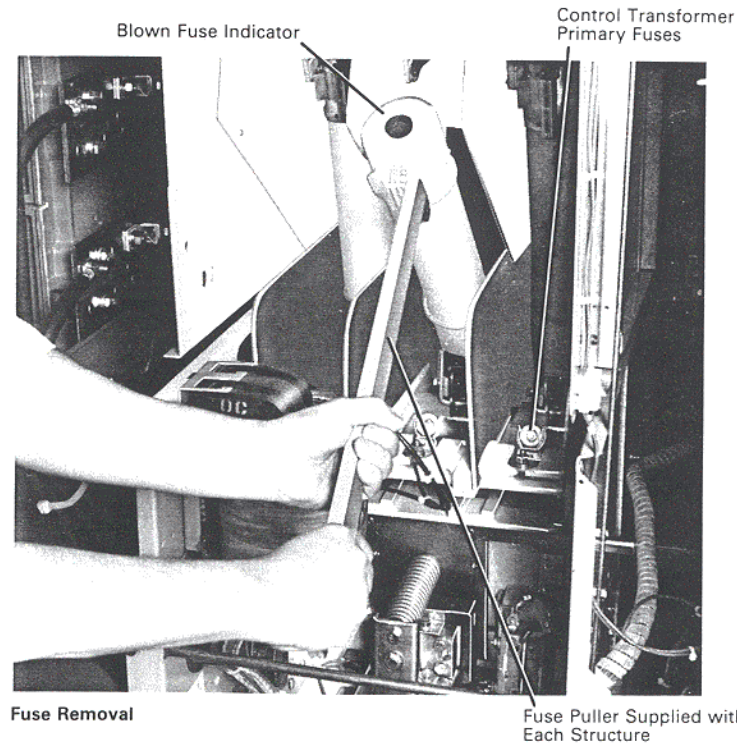
All Ampgard Starters use Cutler-Hammer Type CLS power fuses with time/current characteristics for motor service. Type CLE power fuses are applied when the starter is used to feed a transformer. This characteristic is coordinated with the contactor and overload relay characteristics to provide maximum motor/transformer utilization and protection.

Interruption is accomplished without expulsion of gasses, noise or moving parts. Type CLS/CLE fuses are completely self-protecting. They are mounted in a vertical position to insure maximum rating reliability, proper operation and to eliminate the possibility of dust and dirt collecting and causing a short circuit. When a fault has been cleared, a plastic indicator in the top of the fuse, normally depressed, pops up to give visible blown fuse indication.

The control circuit primary fuses are also current limiting. The control circuit secondary fuses are NEC type.

Blown fuses may be removed and replaced without removing or drawing out the contactor, by using the fuse puller mounted in the starter.



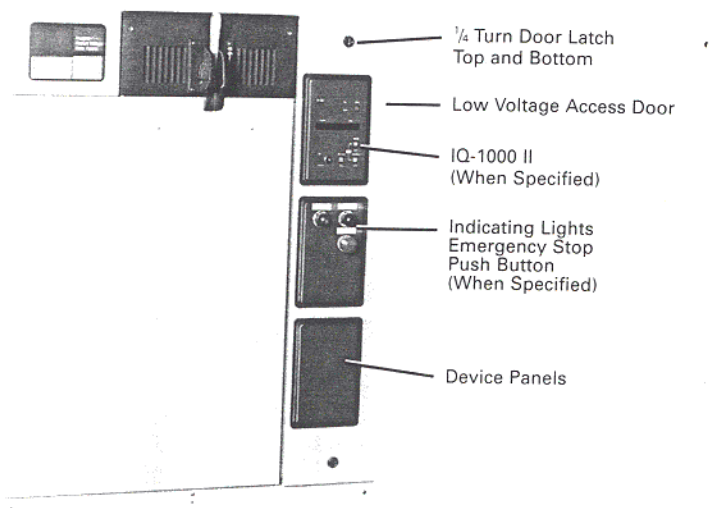


Fuse Removal

AMPGARD Medium Voltage Starters
Low Voltage Control

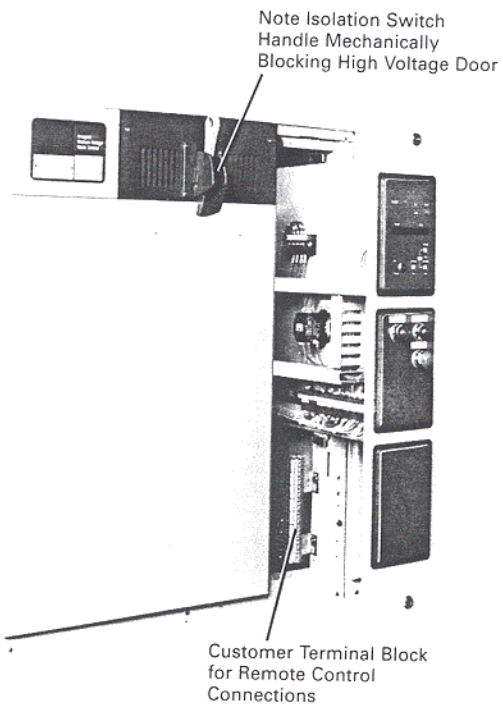
Isolated Low Voltage Control (Works in the Drawer)

Mounted on the right side of the enclosure, the low voltage control panel is completely isolated and barriered from high voltage and has a separate low voltage access door.

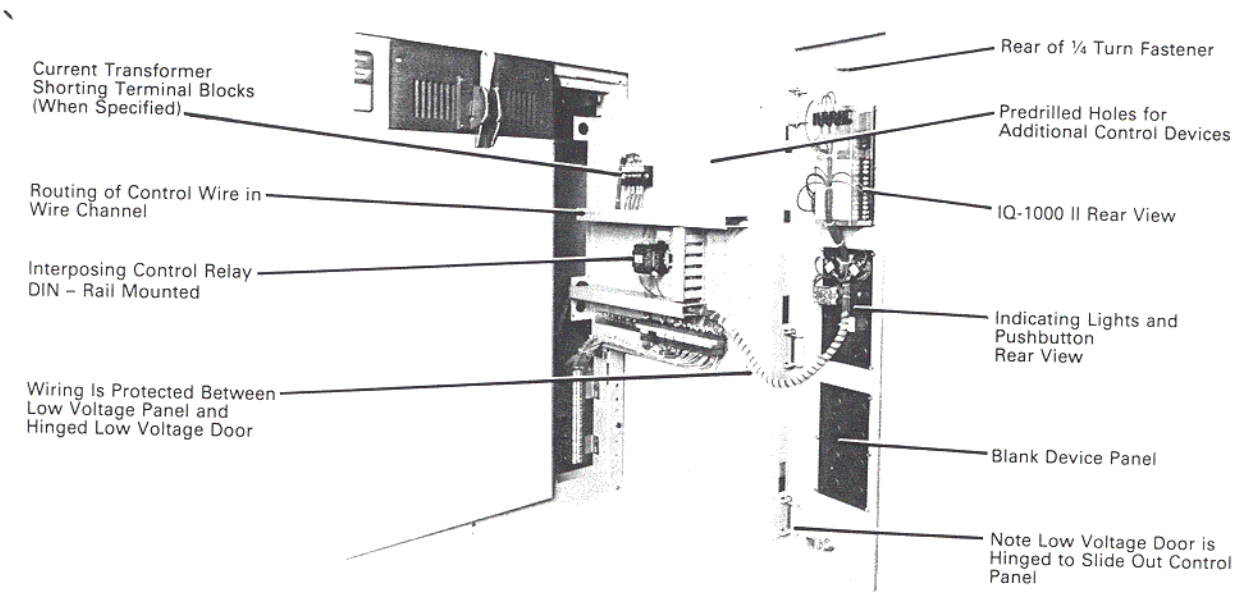


Low Voltage and High Voltage Doors Closed

The Device Panels, IQ-1000 and IQ Data Plus II All Fit in this Same Size Low Voltage Door Cutout



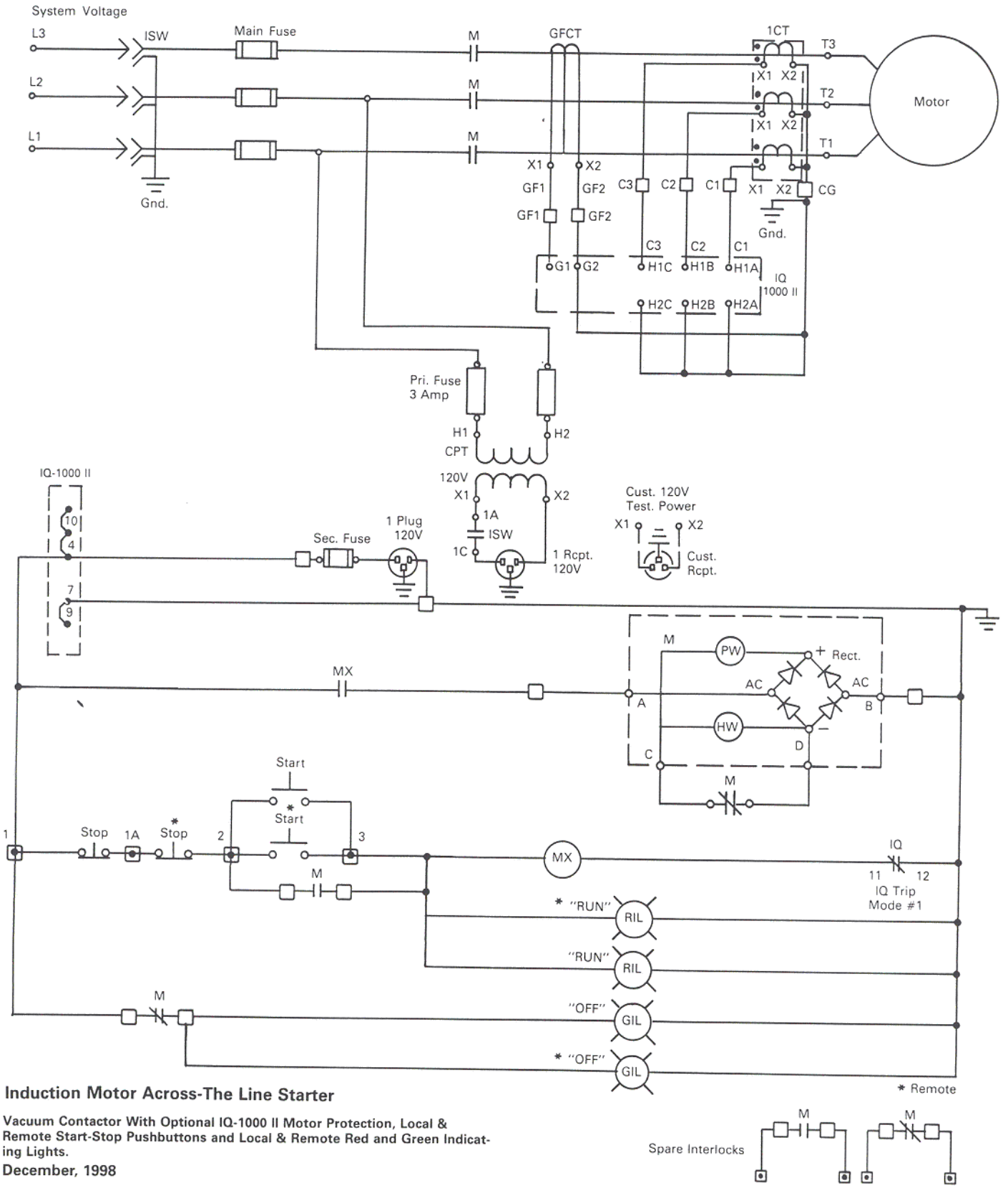
Low Voltage Door Open – Low Voltage Panel Partially Drawn Out – High Voltage Door Closed



Low Voltage Panel Completely Extended

AMPGARD Medium Voltage Starters
Typical Control Schematic

Typical Diagram for Vacuum Type SJ Contactor



Induction Motor Across-The Line Starter

Vacuum Contactor With Optional IQ-1000 II Motor Protection, Local & Remote Start-Stop Pushbuttons and Local & Remote Red and Green Indicating Lights.

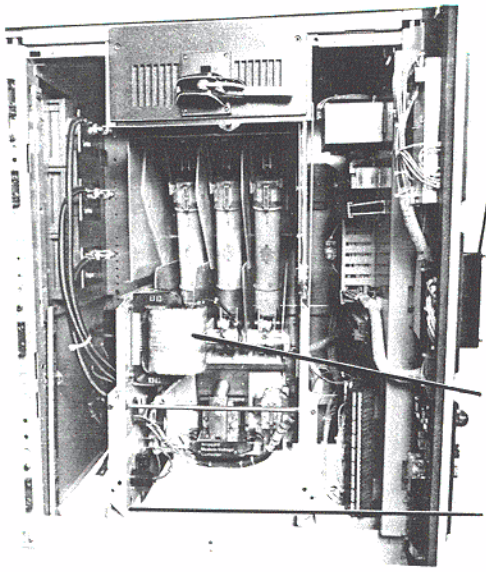
December, 1998

AMPGARD Medium Voltage Starters

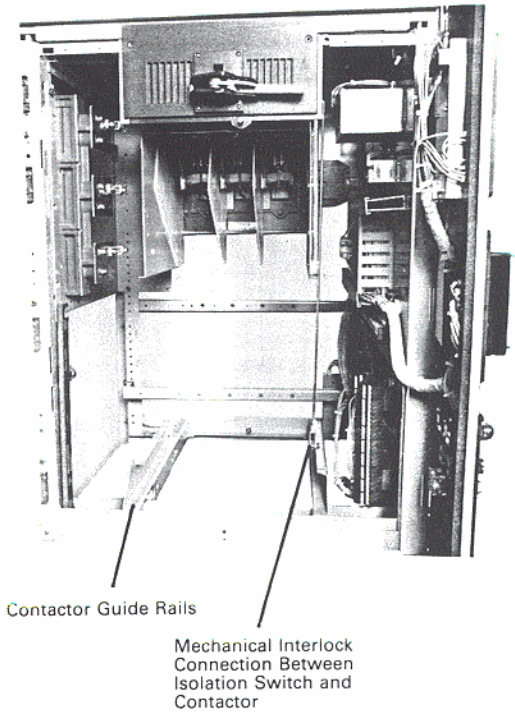
Starter Types

Induction Motor Across-The-Line Starter

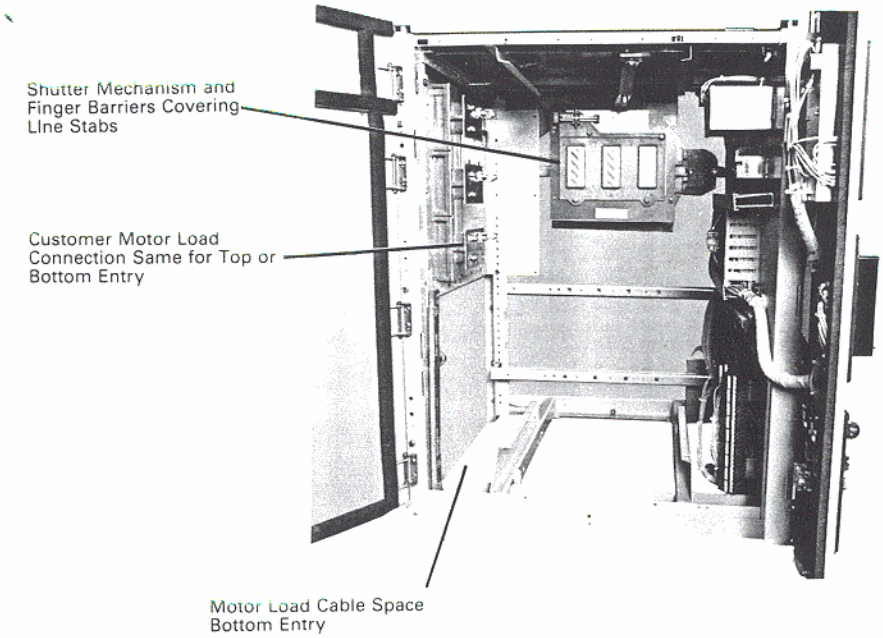
400 Ampere Cell Slide Out Design



400 Ampere Cell with Main Fuses and Slide Out Contactor Removed

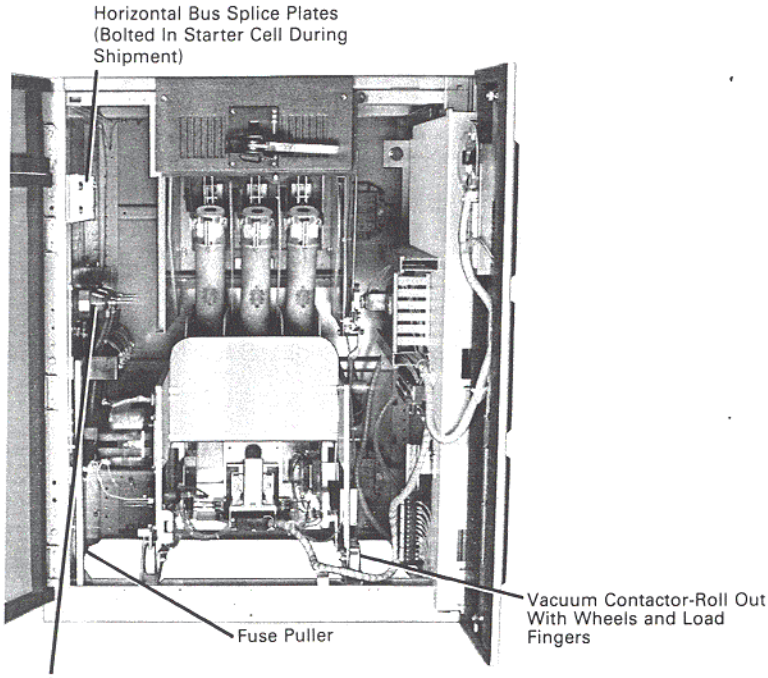


400 Ampere Cell with Main Power Fuses, Slide Out Contactor and Isolating Switch Removed

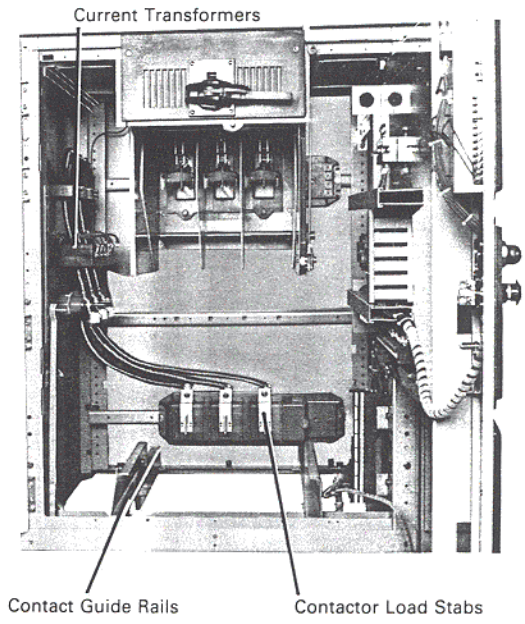


AMPGARD Medium Voltage Starters
Starter Types

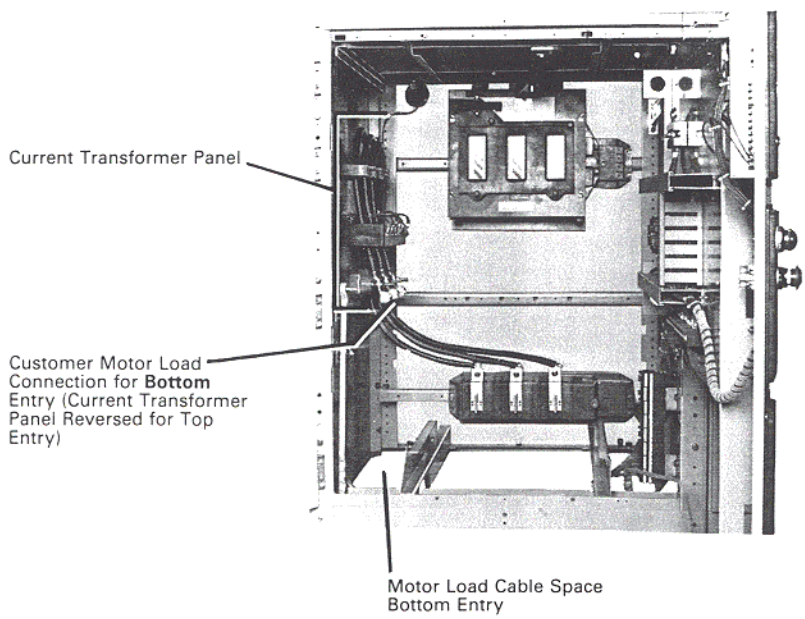
400 Ampere Cell with Roll Out Contactor Design



400 Ampere Cell With Main Power Fuses and Roll Out Contactor Removed



400 Ampere Cell With Main Power Fuses, Roll Out Contactor and Isolating Switch Removed

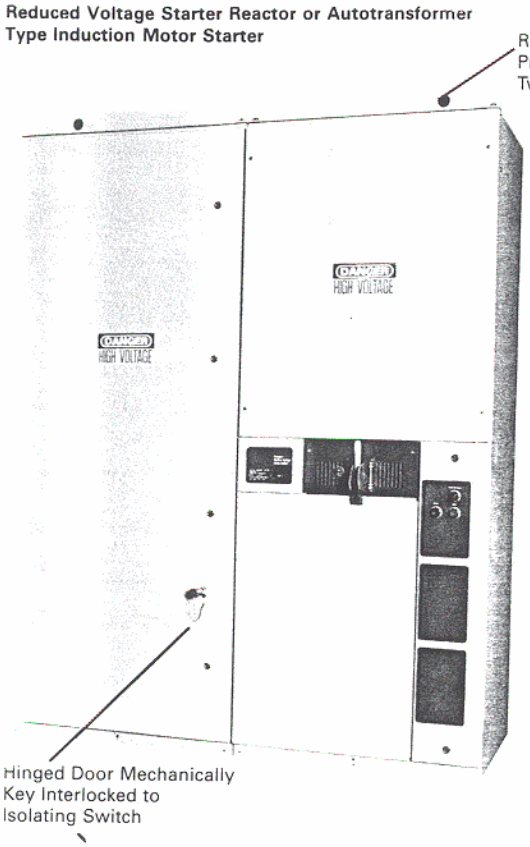


AMPGARD Medium Voltage Starters
Starter Types
Reduced Voltage Starting

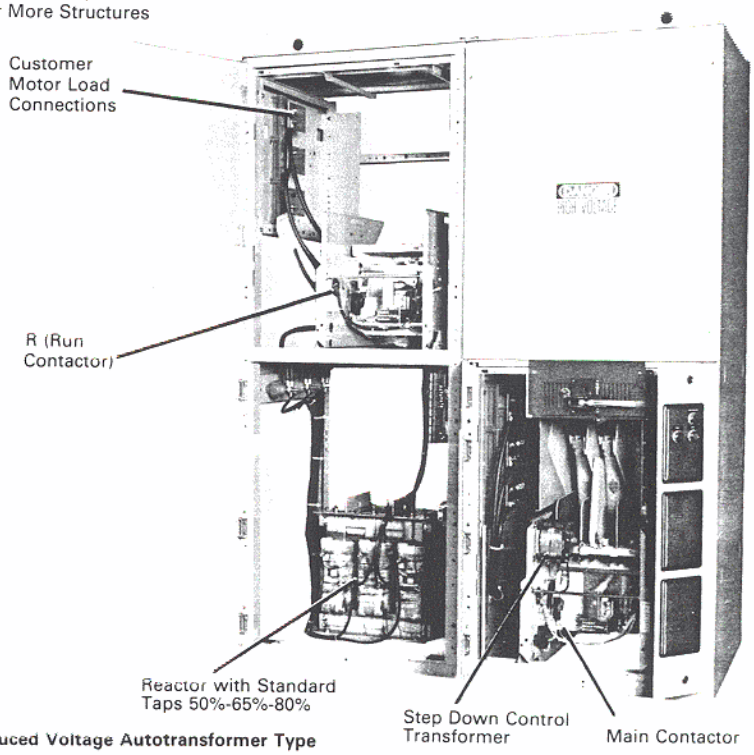
Starters for synchronous motors are also available in either reactor or autotransformer type. Both provide closed transition from reduced voltage to full voltage.

The 400 ampere 2300-7200 volt reduced voltage starters are structured two wide for a total of 72" width, 30" deep and 90" high (without Main Bus).

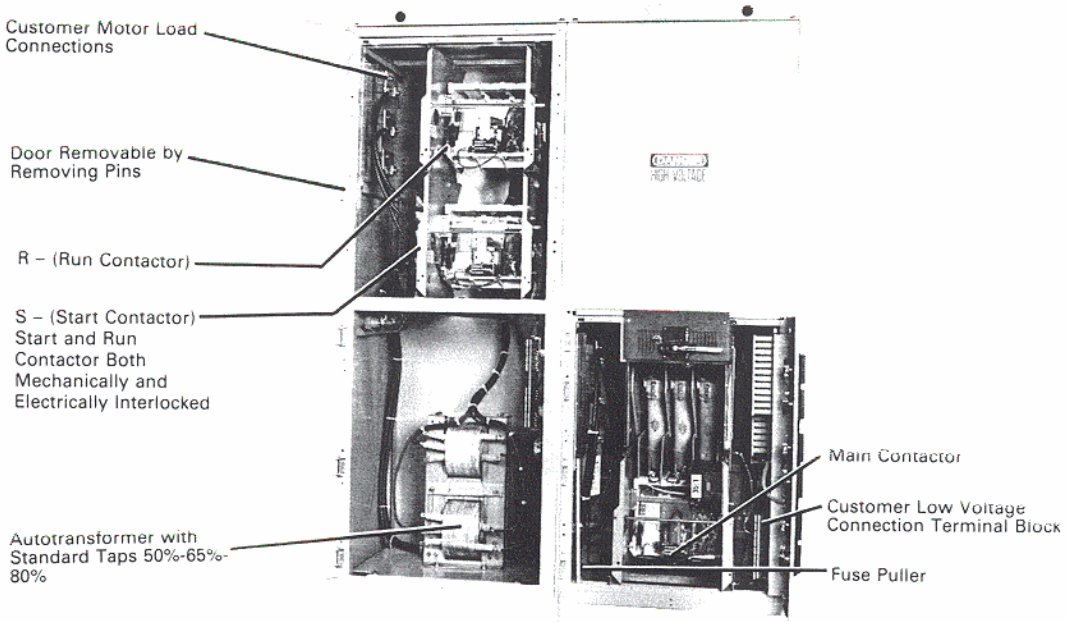
Reduced Voltage Starter Reactor or Autotransformer Type Induction Motor Starter



Reduced Voltage Reactor Type Slide Out Contactor Design



Reduced Voltage Autotransformer Type Slide Out Contactor Design



AMPGARD Medium Voltage Starters
Starter Types

Synchronous Motor, Brush Type Solid State Field Control

The synchronous motor starter includes the basic induction motor control in the bottom half of the structure. The synchronous control and protection function fit easily in the upper compartment.

The step down static excitation transformer is connected to the load side of the main contactor and is protected by its own current limiting fuses.

The static exciter is an SCR type. Its DC voltage output is adjustable via a door mounted potentiometer.

The synchronous control board monitors the induced field during acceleration and energizes the DC rotor field at the optimum speed and rotor-stator pole relationship.

Solid state, brush type synchronous motor control includes the following protective features:

Locked Rotor Protection

Incomplete Sequence

Failure to Synchronize

Fuse Failure

Pull Out Protection

The motor windings are protected by the conventional induction motor control protection (thermal, MOR, IQ-1000).

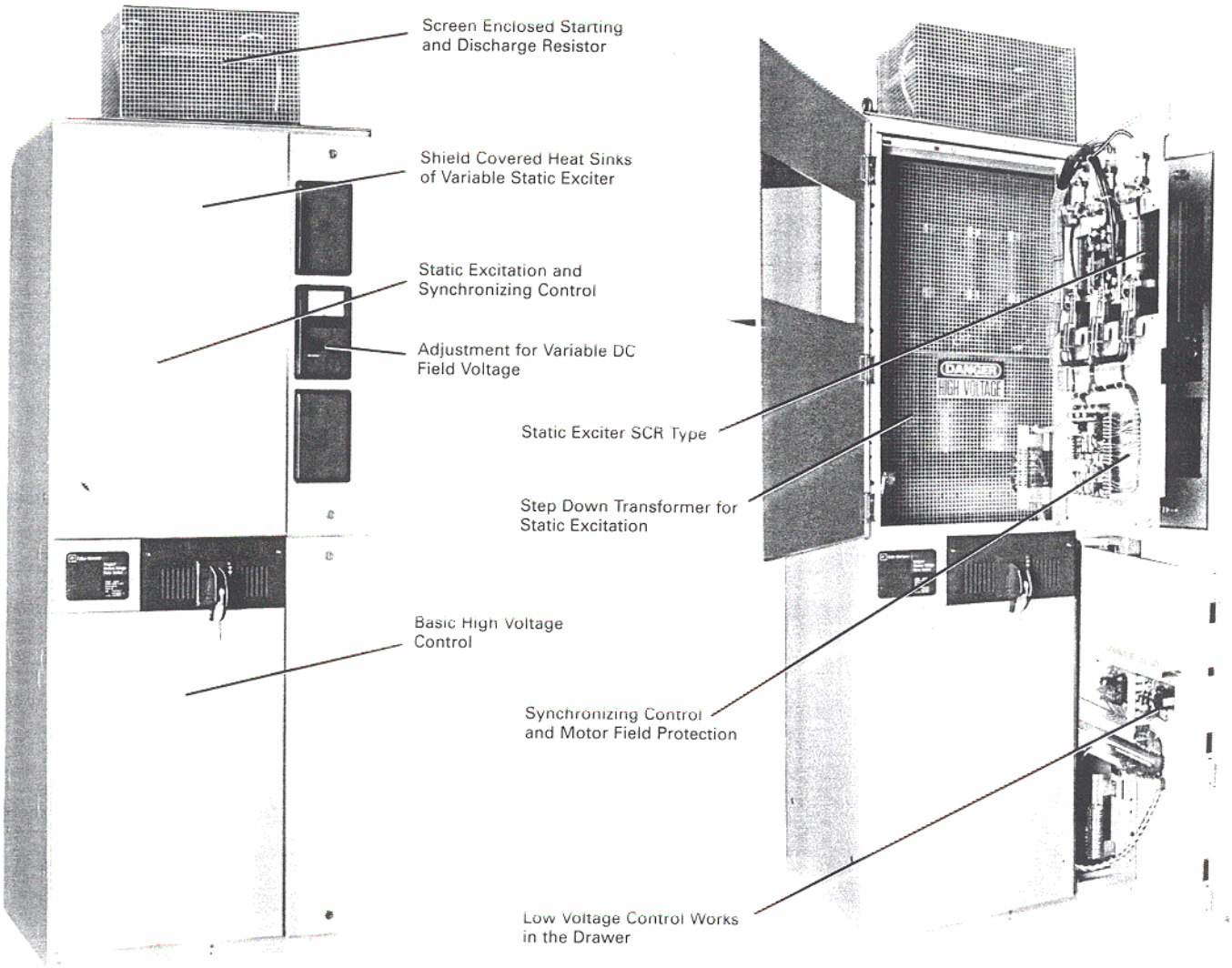
Also available are controls for:

Multi-Speed Motors

Reversing Motors

Wound Rotor Motors

Synchronous Motor Brush-Type Across-The-Line Starter



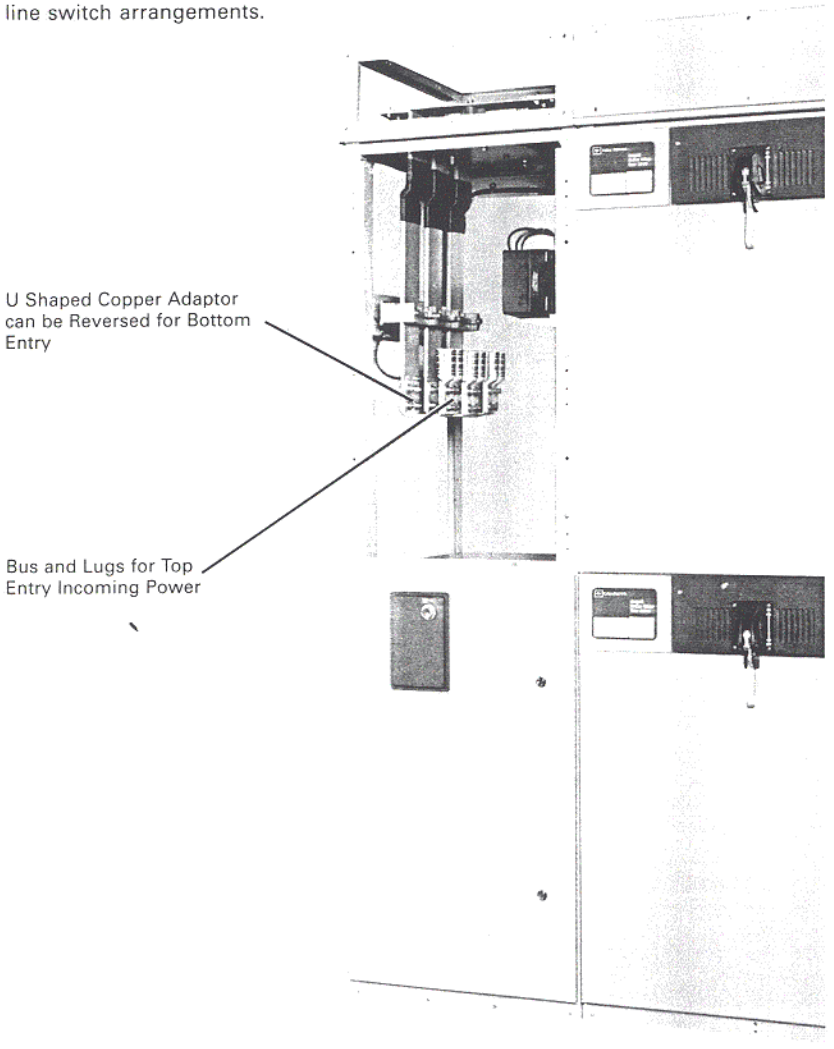
AMPGARD Medium Voltage Starters
Optional Modifications

Incoming Line
An incoming line enclosure is recommended, depending upon the size and number of incoming cables. Different designs are available for incoming power for top or bottom entry.

Shown is a 26" Wide Incoming Line Structure

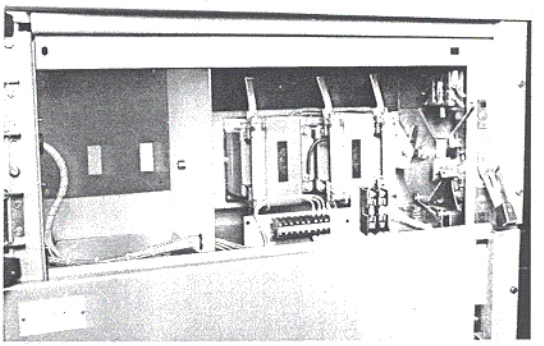
The addition of incoming line metering requires a 36" wide strucure in lieu of a 26" wide structure.

Refer to Price List 8810, structure modifications, for different line cable and incoming line switch arrangements.

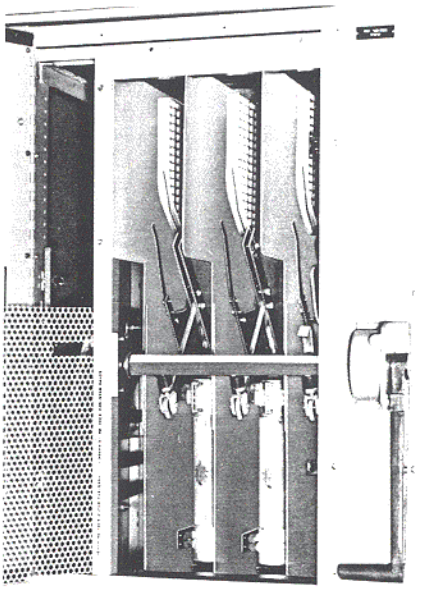


Draw out Potential Transformers and Fuses

Draw out trunnion-mounted potential transformer design with fuses is available to meet specific application requirements or code regulations.



Draw-out Potential Transformer and Fuses Mounted in a 36" Wide Structure, Height 15"



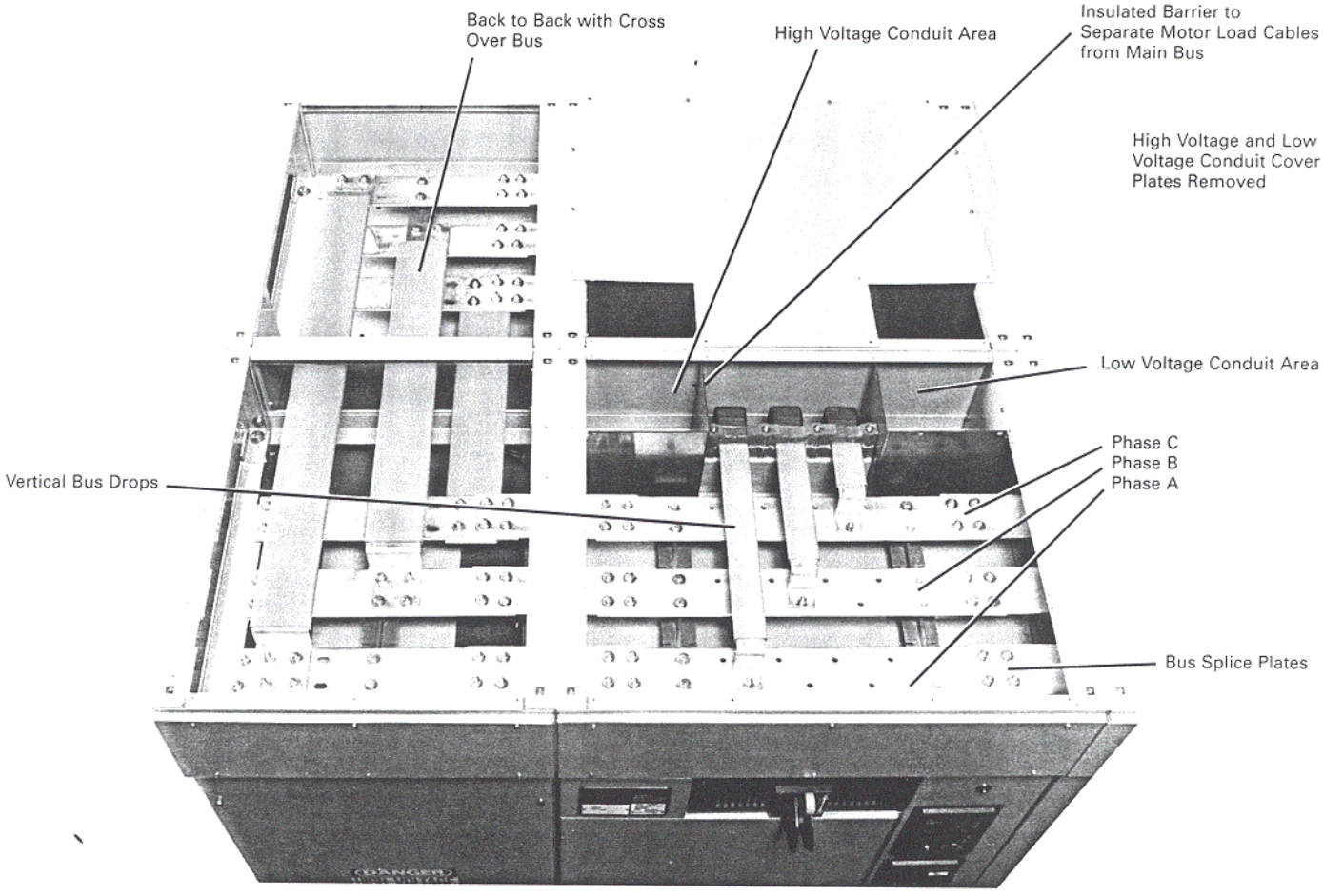
Type ADM Load Break Switch Shown With Safety Screen Removed

ADM Switch Ratings

Maximum Voltage (Kilovolts)	BIL Rating (kV)	Continuous Current (Amperes)	Interrupting Capacity (Amperes)		Momentary Current		Fault Current Closing Asymmetrical (Amperes)
			at 80% PF	at 10% PF	10 cycles Asymmetrical (Amperes)	4 seconds Symmetrical (Amperes)	
5.5	60	600	600	80	40,000	25,000	40,000
5.5	60	1200	1600	300	61,000	38,000	61,000

AMPGARD Medium Voltage Starters
Optional Modifications

Main Bus
When starters are grouped together in a line-up, a typical option is the main bus. The Ampgard main bus is mounted in its own 10-inch high enclosure, which isolates it from the starter. The connection from the main bus to the starter is done with rigid vertical bus. Insulated barriers are provided for separate top entry of power and control cables. The main bus is top, side and front accessible, which allows for ease of maintenance or extension of line-ups without disassembling the starters. All bus is braced to withstand the let through energy allowed by the starter fuses during a 50,000 amp (symmetrical) fault.



Type ADM Load Break Switch
For application needs with loads rated 600 or 1200 amps at 2500, 5000 and 7200 volts, Ampgard is available with the Type ADM load-break switch. This device, a three-pole, manually operated, quick make-quick break switch, is used primarily as a disconnect switch in Ac power systems. This switch is fixed mounted and will fit in one half of a standard 90-inch high, 36-inch wide vertical structure. Power fuses up to 400E amperes can be mounted within the half high structure. Mechanical interlocks are incorporated so that the door cannot be opened when the switch is on, and when the door is open the switch cannot be closed. A safety screen is supplied behind the switch door. The Type ADM switch can be supplied with a total of four electrical interlocks.

Other Optional Modifications
In addition to the options previously described, Ampgard starters are available with a variety of accessories and modifications to satisfy a wide range of application requirements. Some of the broad areas covered include:

- Bus and cable entrance enclosures (See photos)
- Transformers
- Power factor correction capacitors
- Pilot devices
- Instruments and meters
- Control relays and timers.
- Solid state or selected electro-mechanical protection devices

For more details on available accessories and modifications, refer to PL 8810.

AMPGARD Medium Voltage Starters
Optional Motor Protection, Metering & Communications

IQ-1000 II

Maximizes Motor Utilization
The IQ-1000 II is a microprocessor based multifunction, motor protective relay that monitors three phase AC current and makes separate trip and alarm decisions based on pre-programmed motor current and temperature conditions.

It is capable of combining the effects of temperature, time, current (both positive and negative sequence) and true RMS into a single, protective system. By including all possible protection functions, whether utilized or not, a degree of standardization is achieved for the consultant, user and manufacturer. The IQ-1000 II allows the motor to run as long as possible, allowing full utilization of the motor in addition to its basic function of protecting the motor.

Optimum Motor Protection
By simply programming the IQ-1000 II with the motor's electrical characteristics (such as full load current and locked rotor current), the IQ-1000 II's algorithm will automatically tailor the optimal protection curve to the motor being monitored. No approximation is needed in selecting a given protection curve because the IQ-1000 II matches the protection from an "infinite" family of curves, to each specific motor.

Application-related motor load problems are further addressed through the use of such functions as Jam, Underload, and Ground Fault protection. The IQ-1000 II provides a cost effective alternative to several conventional protective relays including short-time and long time-time current relays, instantaneous overcurrent relays, ground fault relays, phase loss or phase unbalance relays, and more protection features.

Features
- The IQ-1000 II provides a "snapshot" of all monitored values immediately prior to the time of trip providing valuable trouble shooting/maintenance information.

- A minimum number of Electrical Connections are required for basic protection
  6 – Current Transformers
  2 – Ground Fault Transformer
  2 – 115 Volt Ac Input
  2 – Trip Contact Output
  12

- UL recognized
- Instantaneous overcurrent trip level and start delay: Device 50
- Locked rotor current: Device 51
- Maximum allowable stall time.
- Ultimate trip current level: Device 51
- I^2t alarm level: Device 74
- Zero Sequence Ground Fault trip level with start and run time delays: Device 50G/51G
- Separate trip and alarm motor temperature set points (eleven RTD inputs are available as an option):
  Six Stator Windings-Overtemperature: Device 49
  Two Motor Bearings-Overtemperature: Device 38
  Two Load Bearings-Overtemperature: Device 38
  One Auxiliary Overtemperature Device 38
- Jam trip level with start and run time delays.
- Underload trip level with start and run time delays: Device 37
- Phase Loss and Phase Unbalance trip and alarm level with run delay: Device 46
- Number of motor "starts" allowed per time period: Device 66
- Anti-backspin time delay.
- Transition signal: Transition based upon current level with a back-up timer and transition or trip selection: Device 19
- Incomplete sequence
- Current Transformer Ratio Selection
- Full load amps
- Trip Mode:
  Mode 1: Trip relay energizes on trip condition
  Mode 2: Trip relay energizes on power up and de-energizes on trip condition
- Phase reversal for non-reversing starters: Device 46; Selection of non-reversing or reversing starters.
- Selection of remote trip, remote reset, or differential trip.
- Frequency selection – 50Hz or 60Hz
- Selection of auto or manual reset (for I^2t trip).
- Positive and negative (unbalance) sequence current algorithm automatically determines protection curve for a given motor.
- Transducer Output, 4-20 mA

IQ-1000 Monitored and Displayed Values
- Motor current for each phase.
- Motor current as a percent of full load amps for each phase.
- Eleven Resistance Temperature Detectors (RTDs) – optional.
- Operations count.
- Run Timer (in hours).
- Remaining starts.
- Oldest start: Time remaining before "oldest" start is restored to "remaining starts".
- Percent of I^2t Trip Level.
- Ground current.

IQ Data Plus II™

IQ Data Plus II The Ultimate In Monitoring
The IQ Data Plus II is a microprocessor based monitoring and protective device that provides complete electrical metering *plus* affords system voltage protection. In one compact, standard package, the IQ Data Plus II provides an alternative to individually mounted and wired ammeters, voltmeters, ammeter and voltmeter switches, wattmeters, watthour meters, and more.

Direct Reading Metered Values
- AC Ampere — Phase A, Phase B, Phase C
- AC Voltage
  Phase A-B — Phase A-Neutral
  Phase B-C — Phase B-Neutral
  Phase C-A — Phase C-Neutral
- Watts
- Vars
- Power Factor
- Frequency
- Watt Hours
- Demand
- Pulse Initiator
- Demand Synchronizing Pulse

Field Settable Protection Functions
- Phase Loss (Voltage or Current)
- Phase Unbalance (Voltage)
- Phase Reversal (Voltage)
- Overvoltage
- Undervoltage

UL Recognized

Communications

IMPACC
The IQ-1000 II and IQ-Data Plus II can be tied into a local area network with the addition of a communication module: All the data that is available on the Face Plate is also available at a control operators location. The information is transmitted via a two-wire, twisted pair daisy chained between the IQ modules back to a computer.

IMPACC utilizes the Incom chip to provide reliable communications over its local area network. It ties together multiple Ampgards with IQ-1000 II and IQ-Data Plus II. Other Westinghouse Equipment, (DS Switchgear, Motor Control Centers, VCP-W Switchgear) also has the capability of being tied into the IMPACC System.

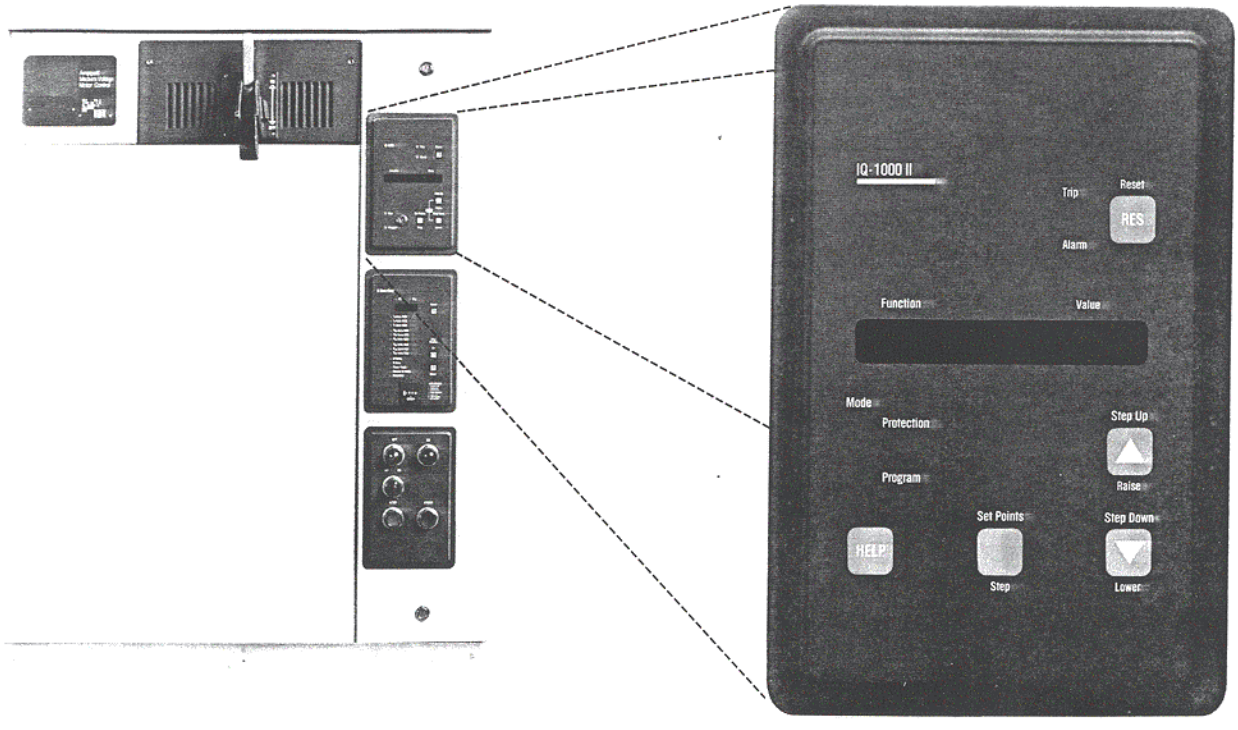
Three levels of communication are available with pre-packed software for the operation station.

The utilization of IMPACC gives the operating and maintenance personnel the opportunity to monitor and record
Status
Running Conditions
Alarm and Trip Conditions*

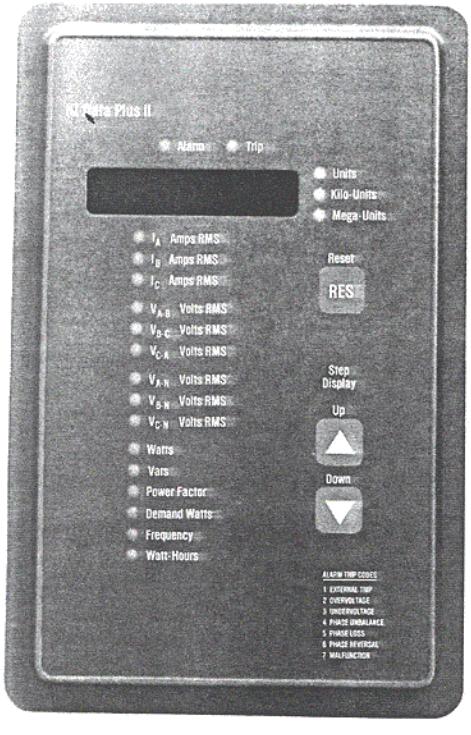
*All the operating data at time of trip is recorded and stored for later evaluation. Now it is possible to not only know what is happening but also what did happen. Valuable information to perform maintenance and keep a system running is always available.

AMPGARD Medium Voltage Starters
With IQ-1000 II and IQ Data Plus II Low Voltage Door Mounted

IQ-1000 II – Protection

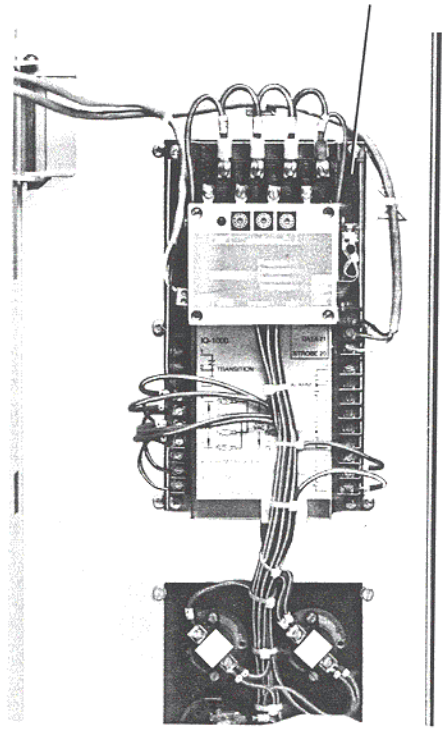


IQ Data Plus II – Monitoring



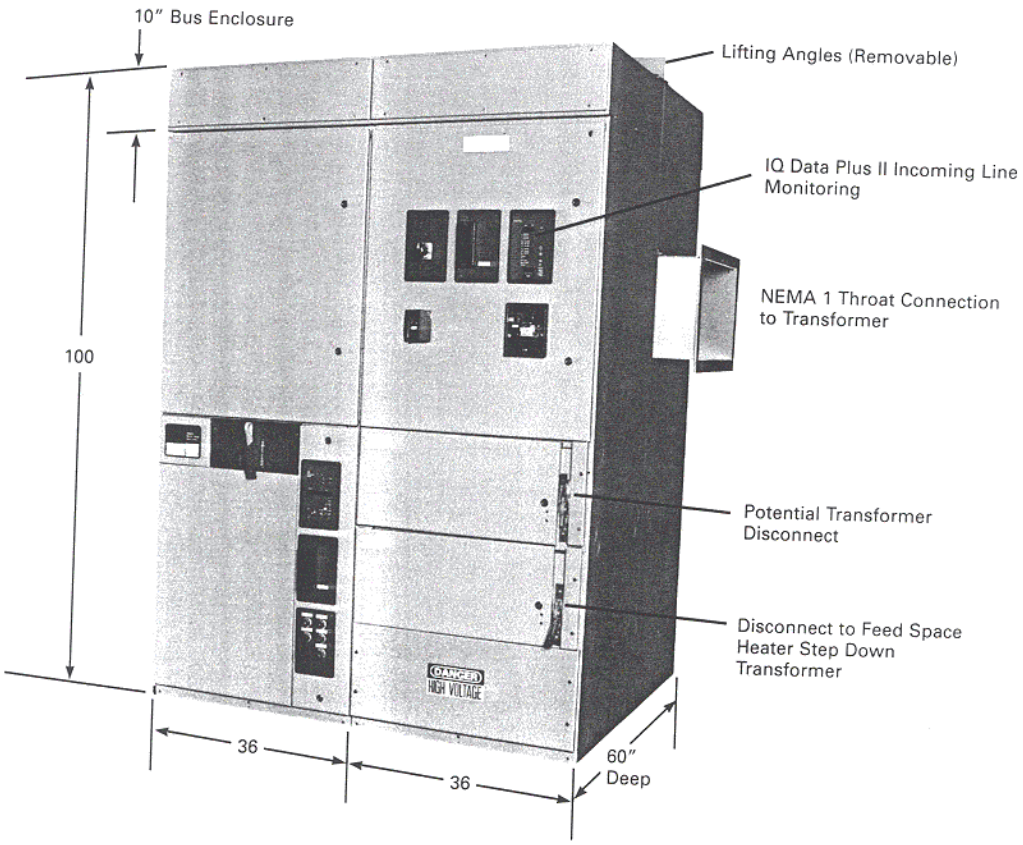
IMPACC – Communications

Communication Module (PONI)
Mounted on Rear of IQ 1000 II

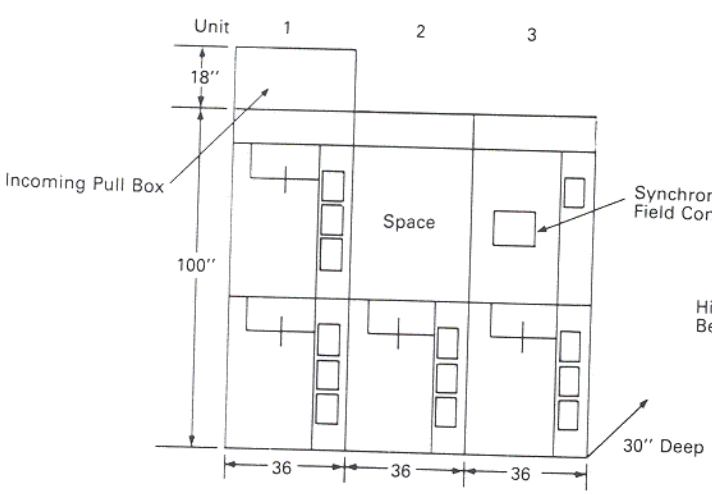


AMPGARD Medium Voltage Starters
Starter Configurations

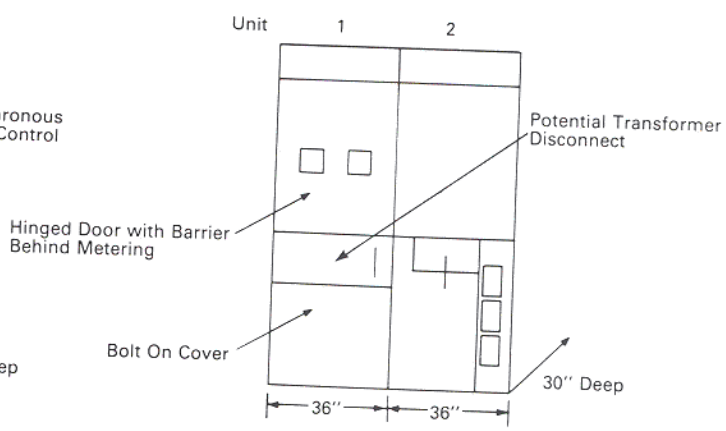
Back to Back Arrangement



Top Entry Incoming Line – No Line Metering

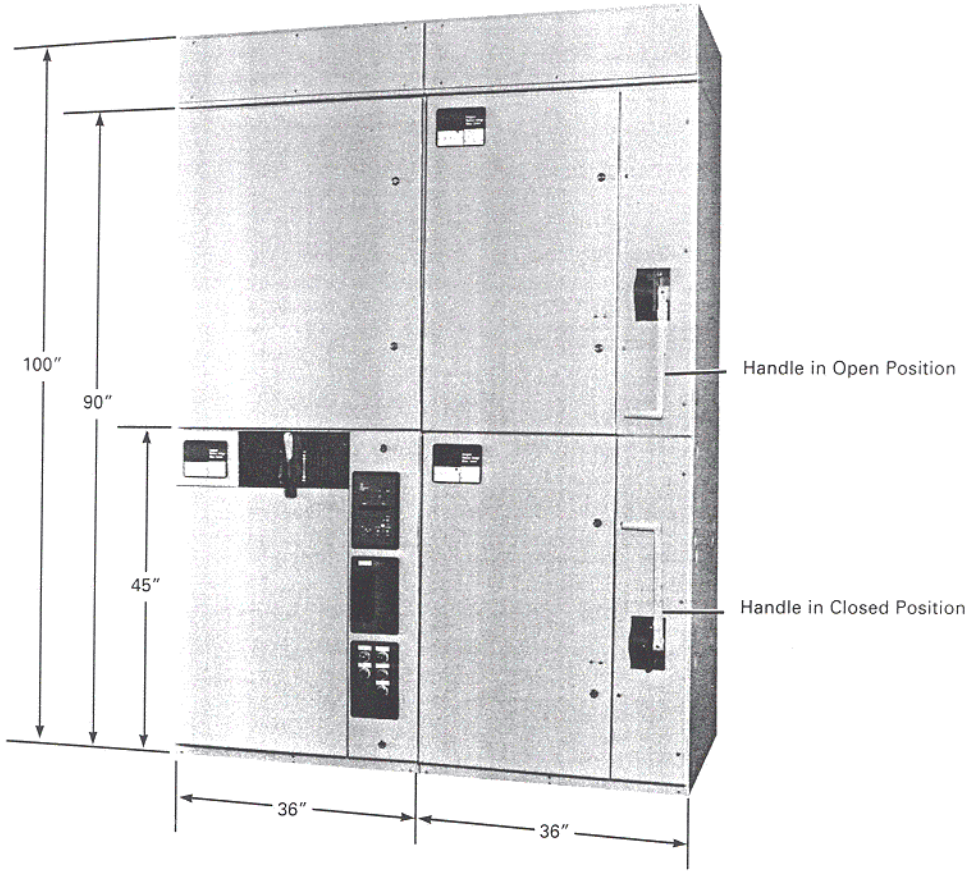


Incoming Line Top or Bottom Entry with Metering
Other Incoming Line Arrangements are Shown in Price List 8810 Structure Modifications

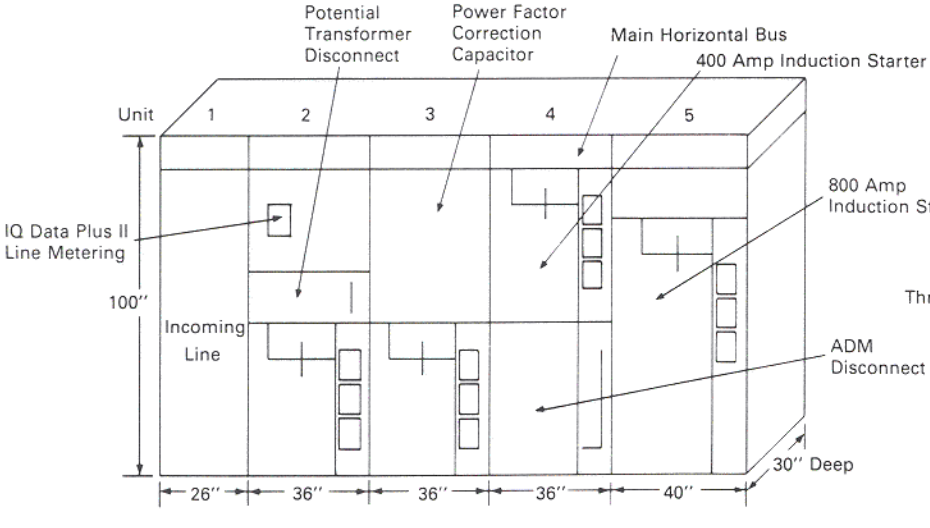


AMPGARD Medium Voltage Starters
Starter Configurations

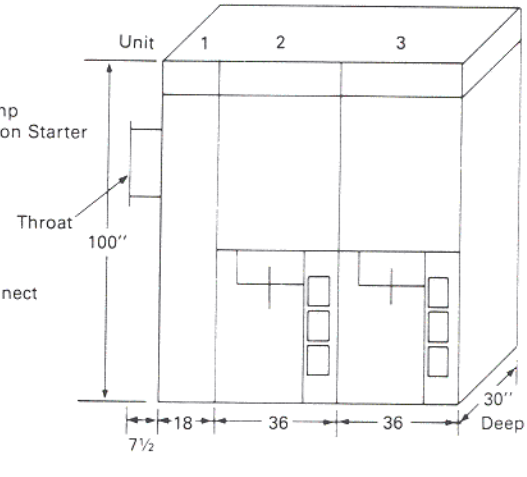
ADM Load Break Switch and Induction Motor Starter



400 Amp and 800 Amp Motor Starters



Typical Transition to Transformers NEMA Type 1 Enclosure



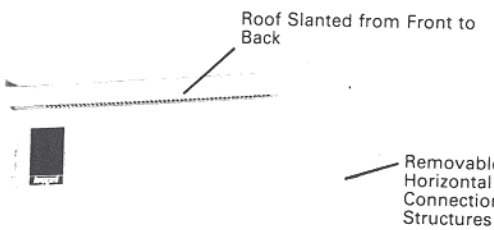
AMPGARD Medium Voltage Starters
Enclosure Types

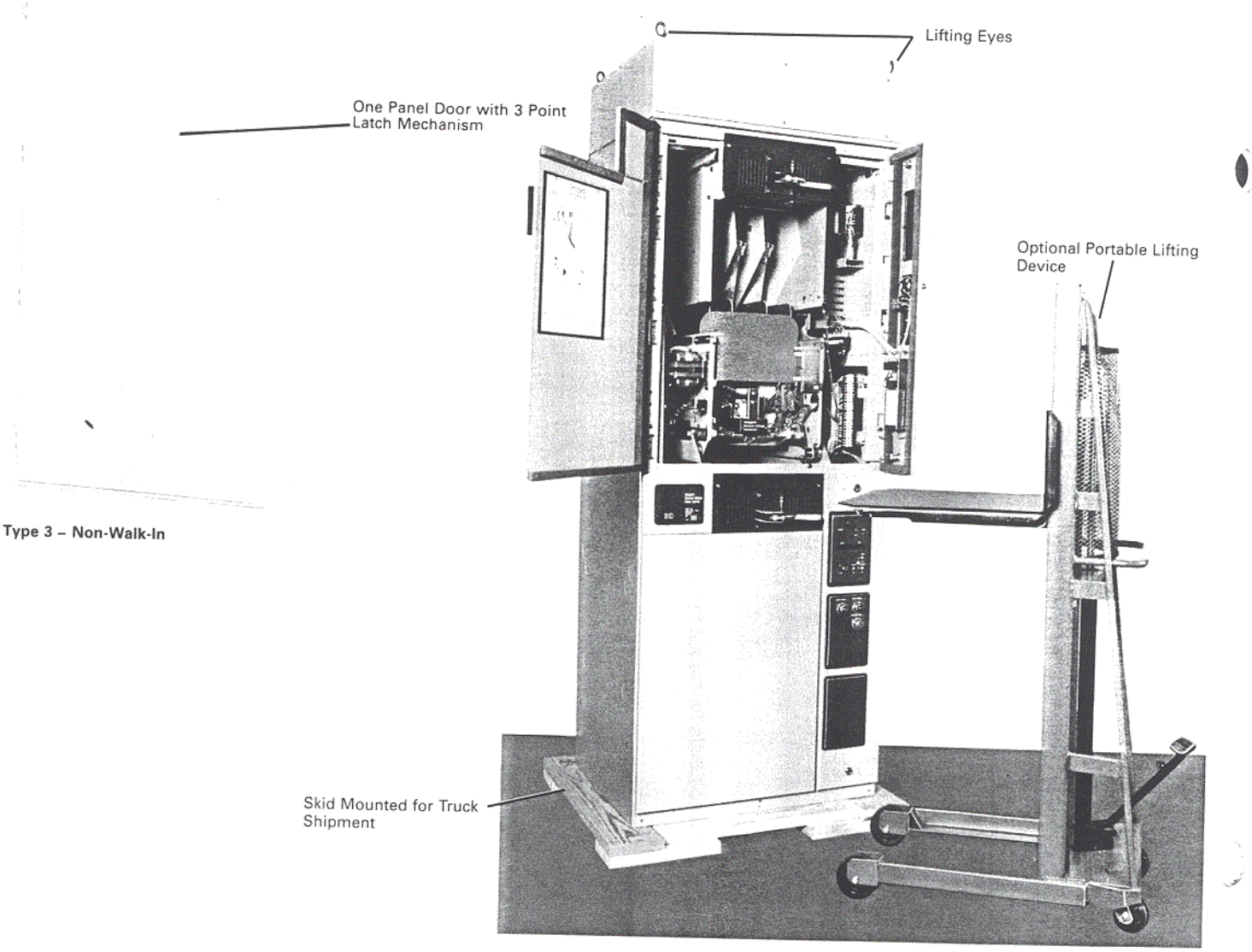
Enclosures

Ampgard medium voltage starters are available in many types of enclosures. These include Type 1 general purpose enclosures for general indoor applications, Type 1A gasketed, Type 3 out-door walk-in or non walk-in, and Type 12 for locations with extreme dust conditions.

Ampgard medium voltage starters are mounted in free-standing sheet steel enclosures that meet ANSI/NEMA ICS-6 enclosure standards and specifications. They are completely front accessible, allowing for free standing, against-a-wall, or back-to-back mounting.

The Type 1 floor-mounted structures are 100 inches high with main bus, 30 inches deep, and either 26, 36 or 40 inches wide for indoor installation.





Type 3 – Non-Walk-In

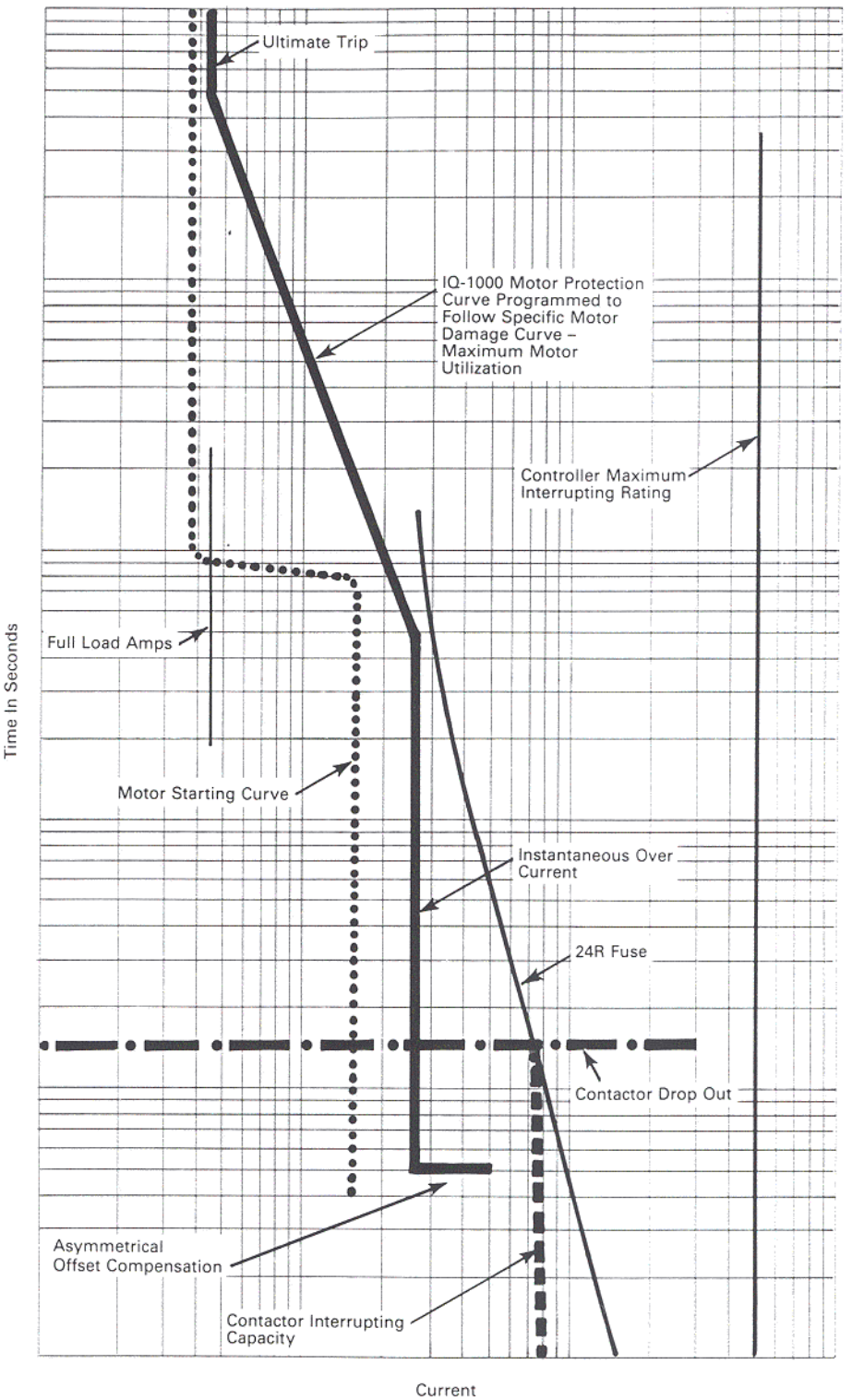
AMPGARD Medium Voltage Starters
Contactor-Fuse Coordination

Coordinated Protection Insures Maximum Motor Utilization

Coordinated with the motor's characteristics, the protective devices in the Ampgard Starter provide motor protection from overload to full system capacity faults.

The industry standard, bi-metallic overload relay provides motor protection against sustained overloads. The relay's inverse time characteristic curve normally falls within the motor's safe allowable stall heating curve. However, the particular application/motor requirements should be reviewed to insure both full utilization and proper protection of the motor. To be considered are excessive accelerating time, locked rotor stalled conditions, changing motor ambient conditions, and varying load conditions. Additional motor protection considerations are over temperature, instantaneous overcurrent, ground fault and phase unbalance. Also, the load protection functions and power source protection functions should also be reviewed.

Such relays as Ground Gard, MOR-A, SVM-3, IQ1000 II and IQ-Data Plus II can easily be factory installed. The use of multifunction relays that can be easily adjusted for each motor application assures maximum motor utilization.



Typical fuse – contactor – overload coordination for a 400 amp vacuum contactor.

AMPGARD Medium Voltage Starters
Technical Data

Type SJ Vacuum Contactor Ratings 400 Amp

	SJO 72V430			
	SJA 25V430	SJA 33V430	SJA 50V430	SJA 72V430
Rated Utilization Voltage	2200 to 2500 Volts	3000 to 3300 Volts	3800 to 5000 Volts	6000 to 7200 Volts
Interrupting Rating				
NEMA Unfused (E1)	25 MVA	25 MVA	50 MVA	50 MVA
NEMA Fused (E2)	200 MVA @ 2300 V	285 MVA @ 3300 V	400 MVA @ 4600 V	570 MVA @ 6600 V
Application Table				
Induction Motor	1500 HP	2000 HP	2500 HP	4000 HP
Synchronous Motor (0.8 PF)	1500 HP	2000 HP	2500 HP	4000 HP
(1.0 PF)	1750 HP	2500 HP	3000 HP	5000 HP
Transformer	1250 KVA	1750 KVA	2250 KVA	3000 KVA
Capacitor 3 Phase	1200 KVAC	1800 KVAC	2100 KVAC	2400 KVAC
Maximum Insulation Voltage	7200 Volts			

Max. Interrupting Current (3 OPS.)	7600 Amps	**Arcing Time**	12 MS (0.75 Cycle) or Less
Rated Current	360 A Enclosed 400 A Open	**Pickup Voltage**	80% Rated Coil Voltage
Chop Current	0.3 Amps Avg.	**Dropout Voltage**	60% Rated Coil Voltage
IEC Make-Break Capability-AC4 Class 3		**Control Voltages** (AC)/(DC)	110/120 Volts (50/60 Hz) 125 Volts (DC)
Make	4000 A	**Control Circuit Burden (Rated Volt)**	
Break	3200 A	Closing (AC)/(DC)	1300 VA/1500 VA
Short Time Current		Holding (AC)/(DC)	25 VA/28 VA
30 sec	2160 A	**Auxiliary Contact Rating (L-64)**	
1 sec	5400 A	Voltage (Max)	600 V
8.7 MS (0.5 Cycle)①	55 KA Peak	Continuous Current	10 A
Switching Frequency	1200/Hour	Making Capacity (AC)	7200 VA
Mechanical Life	2.5 Million	(DC)	200 VA
Electrical Life	250,000 OPS At Rated Current	Breaking Capacity (AC)	720 VA
		(DC)	200 VA
Impulse Withstand	60 KV (1.2x50 Microseconds)	**Latch (When Specified)**	
Dielectric Strength (60 Hz)	18 KV (1 Minute)	Mechanical Life	250,000 Operations
Closing Time (Energization To Contact Touch)	50 Milliseconds (3.0 Cycles)①	Trip Voltages (DC)	24 Volts
		(DC)	48 Volts
		(DC)	96 Volts
Closing Time (Energization To Armature Seal)①	65 Milliseconds (3.5 Cycles)①	(AC)	110 Volts (50/60 Hz)
		(AC)	220 Volts (50/60 Hz)
Opening Time (Deenergization To Contacts Separate)	115 Milliseconds (7.0 Cycles)①	Tripping Voltage	80% Rated Coil Voltage
		Tripping Burden	
Opening Time (Deenergization To Full Open)①	130 Milliseconds (8.0 Cycles)①	(24 VDC)	600 VA
		(48 VDC & 96 VDC)	200 VA
		(110 VAC & 220 VAC)	250 VA
		Weight	
		SJ Assembled	125 Lbs. Including 600 VA Control Transformer
		SJ O.E.M.	70 Lbs.

① Time Stated in Cycles on 60 HZ Base

AMPGARD Medium Voltage Starters
Technical Data

Type SJ Vacuum Contactor Ratings 800 Amp

	SJO 72V830			
	SJA 25V830	SJA 33V830	SJA 50V830	SJA 72V830
Rated Utilization Voltage	2200 to 2500 Volts	3000 to 3300 Volts	3800 to 5000 Volts	6000 to 7200 Volts
Interrupting Rating				
NEMA Unfused (E1)	50 MVA	50 MVA	75 MVA	100 MVA
NEMA Fused (E2)	200 MVA @ 2300 V	285 MVA @ 3300 V	408 MVA @ 4600 V	570 MVA @ 6600 V
Application Table				
Induction Motor	3000 HP	4000 HP	5000 HP	8000 HP
Synchronous Motor (0.8 PF)	3000 HP	4000 HP	5000 HP	8000 HP
(1.0 PF)	3500 HP	5000 HP	6000 HP	10000 HP
Transformer	2500 KVA	3500 KVA	4500 KVA	6000 KVA
Capacitor 3 Phase	2400 KVAC	3200 KVAC	4000 KVAC	4800 KVAC
Maximum Insulation Voltage	7200 Volts			

Max. Interrupting Current (3 OPS.)	13200
Rated Current	720 A Enclosed 800 A Open
Chop Current	0.5 Amps Avg.
IEC Make-Break Capability-AC4 Class 3	
Make	8000 A
Break	6400 A
Short Time Current	
30 sec	4320 A
1 sec	10800 A
8.7 MS (0.5 Cycle)[1]	86 KA Peak
Switching Frequency	1200/Hour
Mechanical Life	1 Million
Electrical Life	250,000 OPS At Rated Current
Impulse Withstand	60 KV (1.2 x 50 Microseconds)
Dielectric Strength (60 Hz)	18.2 KV (1 Minute)
Closing Time (Energization To Contact Touch)	50 Milliseconds (3.0 Cycles)
Closing Time (Energization To Armature Seal) ①	65 Milliseconds (3.5 Cycles)
Opening Time (Deenergization To Contacts Separate)	115 Milliseconds (7.0 Cycles)
Opening Time (Deenergization To Full Open) ①	130 Milliseconds (8.0 Cycles)

Arcing Time	12 MS (0.75 Cycle) or Less
Pickup Voltage	80% Rated Coil Voltage
Dropout Voltage	60% Rated Coil Voltage
Control Voltages	
(AC)/(DC)	110/120 Volts (50/60 Hz) 125 Volts (DC)
Control Circuit Burden (Rated Volt)	
Closing (AC)/(DC)	2600 VA/3000 VA
Holding (AC)/(DC)	50 VA/56 VA
Auxiliary Contact Rating (L-64)	
Voltage (Max)	600 V
Continuous Current	10 A
Making Capacity (AC)	7200 VA
(DC)	200 VA
Breaking Capacity (AC)	720 VA
(DC)	200 VA
Latch (When Specified)	
Mechanical Life	250,000 Operations
Trip Voltages (DC)	24 Volts
(DC)	48 Volts
(DC)	96 Volts
(AC)	110 Volts (50/60 Hz)
(AC)	220 Volts (50/60 Hz)
Tripping Voltage	80% Rated Coil Voltage
Tripping Burden	
(24 VDC)	1200 VA
(48 VDC & 96 VDC)	400 VA
(110 VAC & 220 VAC)	500 VA
Weight	
SJ Assembled	210 Lbs.
SJ O.E.M.	95 Lbs.

① Time Stated in Cycles on 60 HZ Base

AMPGARD Medium Voltage Starters

Typical Specification for Medium Voltage Starters

General

- These specifications define requirements for vacuum medium voltage starters of the sizes, types and ratings indicated herein.

- All starters shall be designed and tested to meet the latest applicable Industrial Control NEMA and ANSI standards. The starters shall be fused type, NEMA Class E2, as defined by NEMA Industrial Control Standard ICS2-324.

- Starters shall be equipped with current limiting power fuses, and shall have integrated interrupting ratings of 200 MVA on 2300V systems through 2500 HP, and 400 MVA on 4600V systems through 5500 HP.

Construction

- Isolating switch and contactor assemblies, including current limiting fuses, shall be of the component-to-component design without any interconnecting cables or flexible shunts. They shall be easily removed from the front of the enclosure. Line and load cable terminations shall be completely accessible from the front.

- The isolating switch shall be externally operated manual three-pole draw-out, such that in the open position it completely grounds and isolates the starter from the line connectors with a mechanically driven isolating shutter leaving no exposed high voltage. Integral mechanical interlocks shall prevent entry into the high voltage areas while the starter is energized and shall block accidental opening or closing of the isolating switch when the door is open or contactor is closed. The isolating switch handle shall have provisions for padlocks in the off position.

- Current limiting power fuses shall be of the self-protecting type with visible fuse condition indicators, and with special time/current characteristics for motor service allowing proper coordination with the contactor and overload relay for maximum motor protection. This coordination shall be such that under a low fault condition the interrupting rating and drop-out time of the contactor shall be properly coordinated with all possible fuse sizes to eliminate contactor racing. The power fuses shall be located to permit easy inspection and replacement without starter disassembly.

- The vacuum contactor shall be of the drawout type either slideout or rollout with single-break high pressure type main contacts with weld-resistant alloy contact faces. The 400 ampere contactor design shall limit chop current to 0.3 ampere average and have an E1 unfused rating capable of interrupting 7600 amperes from 2300 volts to 7200 volts. The vacuum contactor contact wear shall be easily checked from the front with the use of a feeler gauge.

- A built-in test circuit shall be included to permit checking of the starter control and pilot circuit with the high voltage de-energized and isolated, with the contactor in its normal position or in the draw-out position. In the test mode, the control circuit shall be capable of being energized through a polarized plug connector from an external 115 volt supply.

- Control power shall be 120 volt AC and obtained from individual starter cubicle control power transformer.

- Enclosures for the high voltage starters shall meet NEMA ICS-6 enclosure standards and shall be NEMA 1, unless otherwise noted, completely front accessible and allowing free-standing against a wall or back-to-back mounting. Standard indoor floor-mounted structures shall be 90 inches high and 30 inches deep. Where multiple starter/structure installations are required, the horizontal power bus to connect between structures shall be copper rated a minimum of 1000A and located on the top in a separate 10-inch high enclosure with removable front, top and end panels, including a barriered section for top entry cables. An incoming line structure shall have provisions for terminating cables. Vertical bus to connect tiered starter units shall be insulated and integral to the enclosure's 30-inch depth.

Equipment Details

- Each squirrel cage motor full voltage starter shall include:

  3 – Isolated vertical line connectors
  1 – Drawout three-pole gang-operated line isolating switch
  3 – Current limiting power fuses
  1 – Drawout three-pole vacuum contactor
  1 – Control circuit transformer
  1 – Control circuit secondary fuse
  1 – Control circuit disconnect plug
  1 – Run-test circuit
  3 – Spare electrical interlocks
  3 – Current transformers
  3 – Load terminals
  1 – Operating and maintenance instructions mounted inside M.V. door

Motor Protection (When Specified)

The protection and metering function are to be provided by using a multi-purpose microprocessor module. The protection shall calculate the effects of positive and negative (unbalance) sequence currents of true current RMS.

Protection functions shall include:
Instantaneous overcurrent – Device 50

Locked Rotor current – Device 51

Time/Current – Device 49

Maximum allowable stall time

Ultimate trip current level

I^2T Alarm level – Device 74

Zero Sequence Ground Fault – Device 50G/51G

Phase Loss or Phase Unbalance – Device 46

Number of Motor Starts – Device 66

Anti Backspin Time Delay

Phase Reversal for Non-Reversing Starters – Device 46

Separate alarm and trip for 6 motor RTD inputs, 2 motor bearing RTD inputs, 2 load bearing RTD inputs, and 1 aux. input (optional).

The metering functions shall include:
Motor current in each phase

Motor current as a percent of full load amperes

Eleven resistance temperature detectors (optional)

Operation counts

Run Time (Hours)

Remaining Starts

Oldest Start

Further Information

Price List 8810
Renewal Parts Data 8855A
8855V
8855C
8855S
Catalog 55-000
Catalog 25-000
Service Guide 8800