



Westinghouse Electric Corporation
Control Division
Asheville, NC 28813

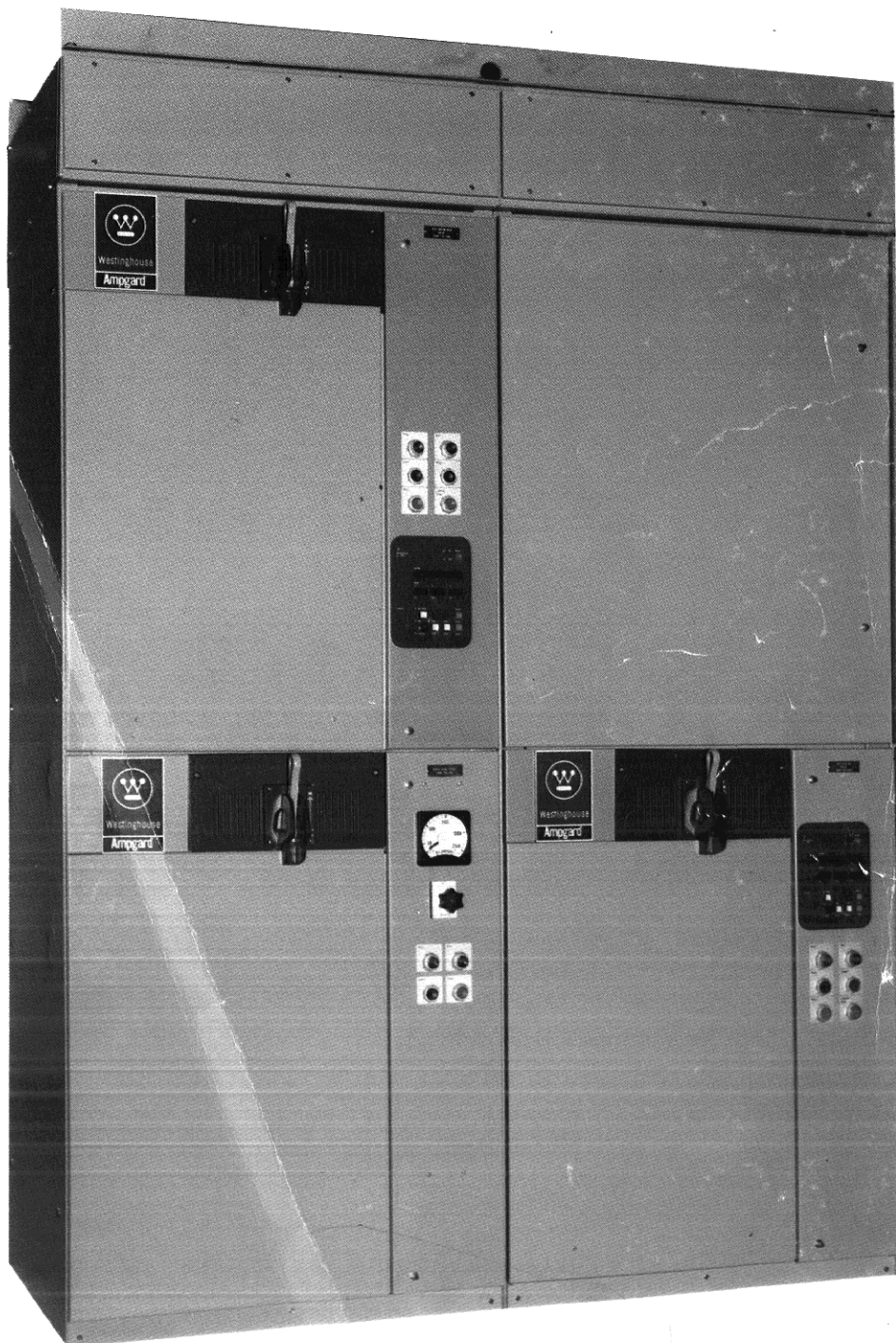
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Page 1

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2200-7200 volts, 50-60 Hz Ac
Up to 5000 Hp, NEMA Class E2

AMPGARD® Medium Voltage Starters





AMPGARD Medium Voltage Starters Description

General Description

Westinghouse Ampgard high voltage starters provide complete flexibility in precisely matching a wide range of industrial motor ratings. Rated at 2500, 5000, and 7200 volts, up to 5000 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 assemble a starter unit that exactly meets a motor's starter and control requirements.

All Ampgard starters are designed to provide component-to-component circuitry that

eliminates half the internal current-carrying junctions. Complete front accessibility to the enclosures allows free standing, back-to-back, or against-the-wall starter mounting.

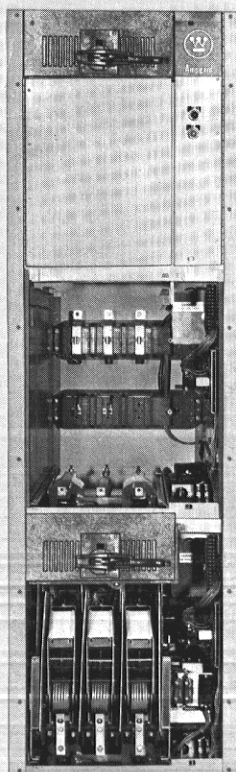
Ampgard starters for 2500 volt, 200 amp rating floor mounting are available in 26-inch wide, 30-inch deep, and 90-inch high enclosures, containing two or three full voltage starters; also available for either 2500 or 5000 volt, 400 amp rating are 36-inch wide, 30-inch deep, and 90-inch high enclosures containing one or two full voltage starters. The 700 amp rating is available in 40-inch wide, 30-inch deep and 90-inch high enclosures. These floor-mounted units are uniform in design and easily adapted for non-reversing and reversing, full and reduced voltage, for squirrel cage, synchronous, and wound rotor motor starting.

On multiple starter installations, up to 70 percent of the floor space required by other starter designs can be saved.

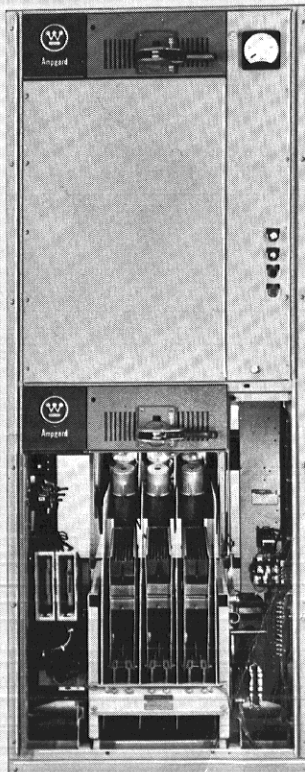
All Ampgard starters feature the same design. All are installed, operated and maintained in the same way.

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

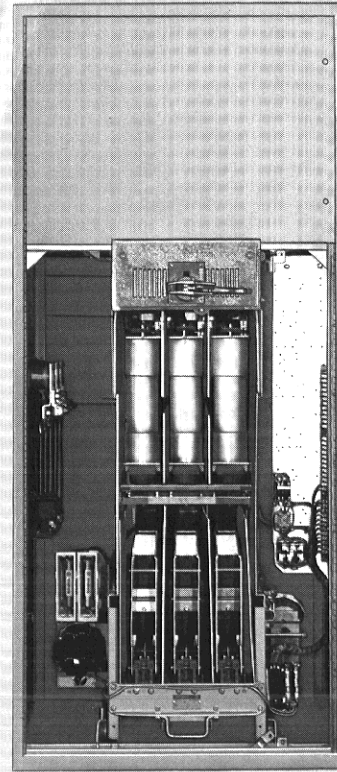
Ampgard is industry's "first family" of high voltage starters.



Through 700 HP at 2200-2400 volts.



700-1500 HP at 2200-2400 volts;
through 2500 HP at 4000-4800 volts.



1501-2500 HP at 2200-2400 Volts
2501-5000 HP at 4000-4800 Volts



AMPGARD Medium Voltage Starters User Benefits

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 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; the line and load terminals are completely accessible from the front.

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 inspection 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 Westinghouse High Power Laboratory, Ampgard Motor Starters comply with ANSI/NEMA, ICS-2, published industrial control standards. BIL ratings are established in accordance with ANSI/IEEE standards. UL-347 listed starters and components are available when required.

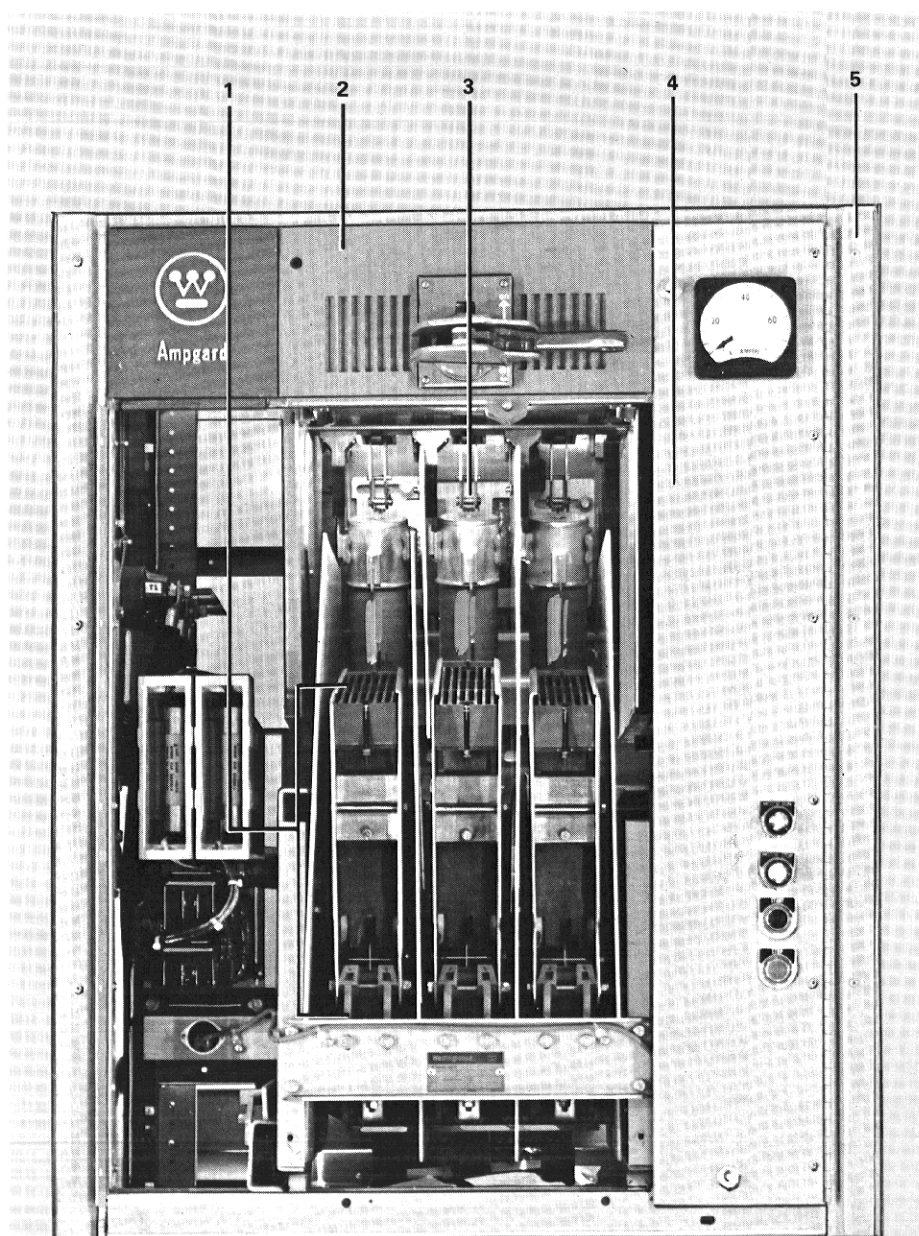
For flexibility and space economy, no other starter can compare with Ampgard Starters. All Ampgard Starters feature the same basic design and are installed, operated, and maintained the same way.

Starter Classes are available for the following non-reversing applications:

Class 11-202 Squirrel Cage Full Voltage
Class 11-502 Squirrel Cage Primary Reactor
Class 11-602 Squirrel Cage Autotransformer
Class 13-202 Wound Rotor
Class 14-202 Synchronous Full Voltage
Class 14-502 Synchronous Primary Reactor
Class 14-602 Synchronous Autotransformer
Reversing also available.

Design Features

1. Type SJ Vacuum Contactor, or Type LF Air-Break Contactor
2. Type LFR Mechanical Isolating Switch
3. Current Limiting Power Fuses
4. Control Compartment
5. Enclosure



400 Ampere Starter

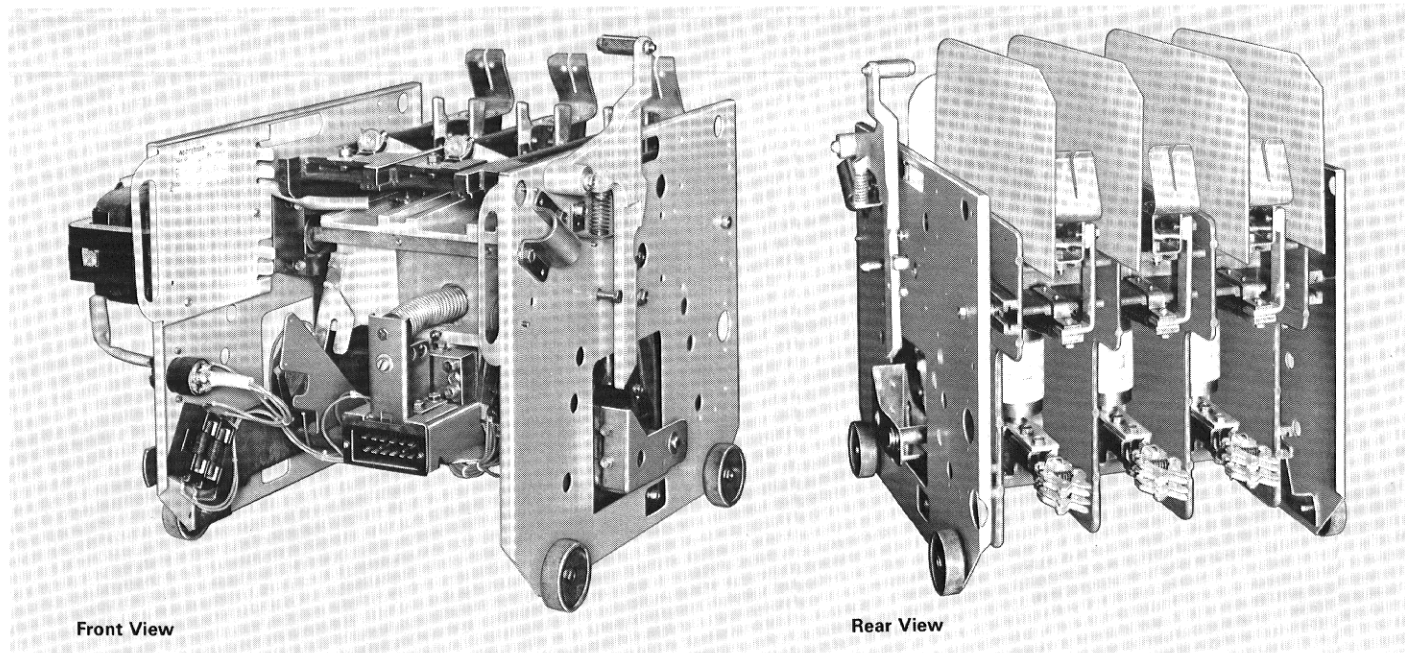
Optional Features Not Illustrated

- IQ-2000® Motor Command
- MVS4 Solid-state soft start
- UL Rating
- Type ADM Load Break Switch
- Main Bus
- Other Optional Modifications



AMPGARD Medium Voltage Starters Vacuum Contactor Features

Type SJA Vacuum Contactor



The Type SJ 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 a rating of 400 amperes.

SJ Vacuum contactors have wheels which roll in guide rails and are stab-connected to load stabs. The contactor is latched in position and it can easily be removed by releasing the latch mechanism.

Design and Adjustment

The Type SJ vacuum contactor is a highly versatile, low-chop contactor that is completely interchangeable with the 2500/5000 volt, 400 ampere air-break design. The Type SJ 400-ampere vacuum contactor has been tested to withstand 60,000 volt basic impulse level. The contactor complies in all respects with published NEMA industrial control standards. It is of rollout design. Contact wear can easily be checked with the use of a feeler gauge (included). Adjustments, when required, can be made using a screwdriver and a unique "star wheel" locking mechanism. The contactor 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 the mechanical interlocks between itself, other contactors and the isolating switch.

A detent locks the contactor in the drawn-out position to allow routine inspection or replacement of coils and contacts. Flame retarding barriers are used between phases, the two outside poles, and the contactor end plates.

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 transformer.

Two L-64 electrical interlocks provide four auxiliary circuits in any combination of make-or-break.

The control test circuit permits testing of the contactor in its normal position or in the draw-out inspection position.

The Type SJ vacuum contactor consists of a molded chassis with crossbar, magnet and vacuum interruptors. The contactor is easily positioned into the unit and long-life vacuum bottles provide many operations with a minimal maintenance program. The vacuum contactor and starter employ special main contact materials for minimizing chopping current, therefore no surge suppression is required. Surge suppression may be required, however, for reasons other than the vacuum contactor. Because the Type SJ vacuum contactor is designed to use the same mechanical interlocking of the Ampgard air-break design, the vacuum starter affords the same safety and service protection of the Ampgard air-break line. Thus the

moving contactor roll out design is mechanically and electrically interchangeable with the roll out air break contactor.

The Type SJ contactor coil has a built-in fullwave silicone rectifier for Dc power.

Optional Contactor Features

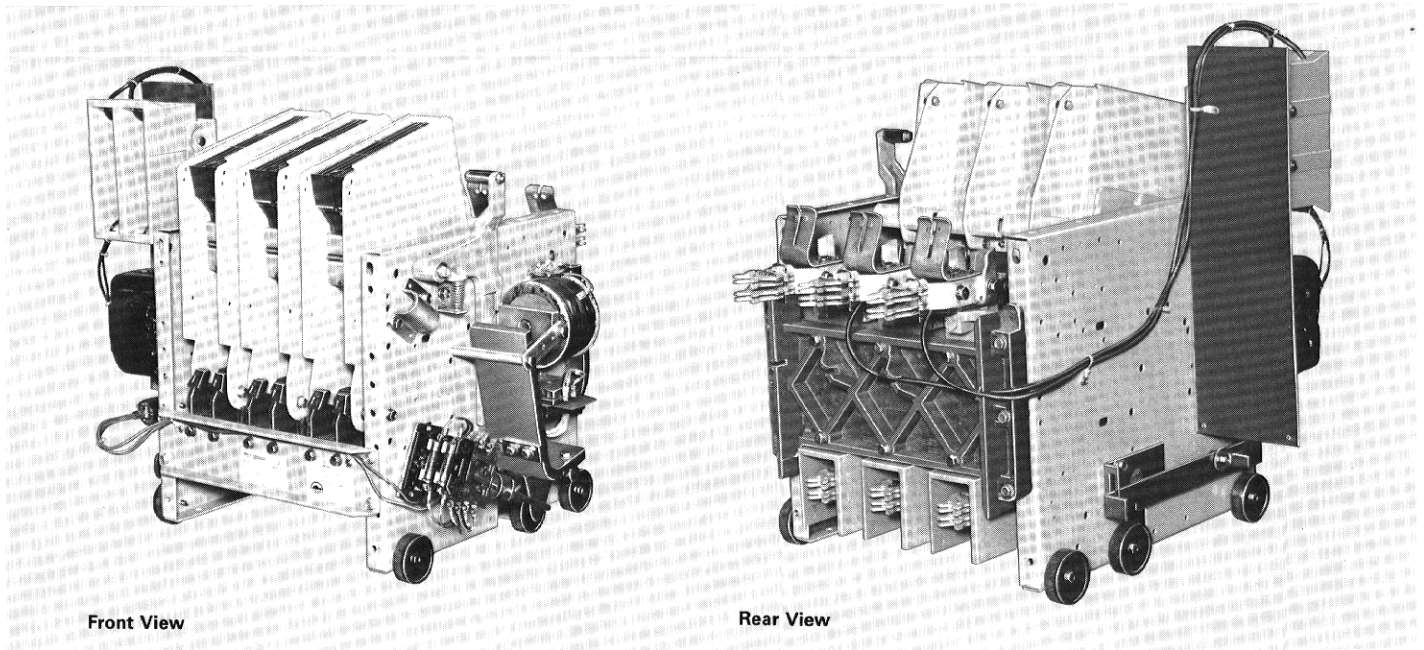
Ampgard medium voltage vacuum contactors are normally magnet-closed and magnet-held closed. They are also available with a mechanical latch attachment.

The mechanically latched design is used on applications where the contactor must remain closed through a voltage dip or failure. The contactor is opened by a separate, electrically operated solenoid with either one or two operating trip coils of different voltages.



AMPGARD Medium Voltage Starters Air Break Contactor Features

Type LF Air Break Contactor



The Type LF 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 LF contactor is available for 2200 through 7200 volts at ratings of 200, 400 and 700 amperes.

The 200 ampere contactor rests on guide rails in the enclosure bottom and is directly connected to the front terminals of the current transformers by three bolts.

Two men can easily remove the contactor once it is unbolted from the transformers.

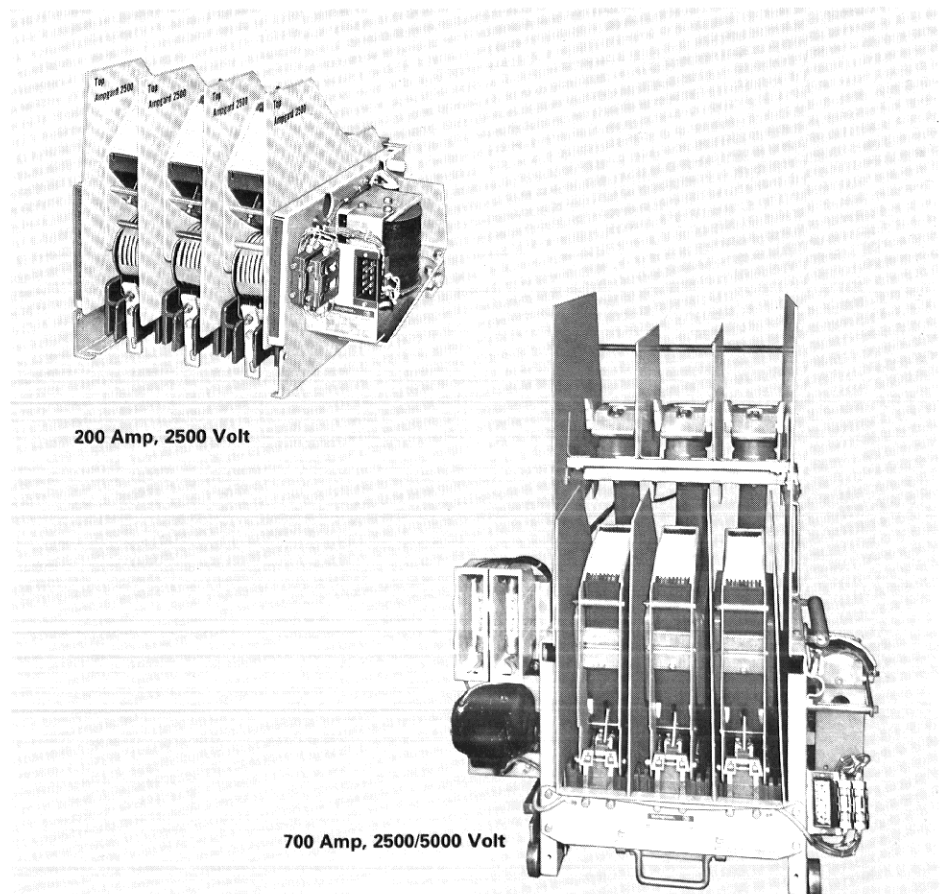
400 and 700 ampere contactors have wheels which roll in guide rails. The contactor is stab-connected to load stabs. The contactor is latched in position and it can easily be removed by releasing the latch mechanism.

A detent locks the contactor in the drawn-out position to allow routine inspection or replacement of coils and contacts. Flame retarding barriers are used between phases, the two outside poles, and the contactor end plates.

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 transformer.

Two L-64 electrical interlocks provide four auxiliary circuits in any combination of make-or-break.

The control test circuit permits testing of the contactor in its normal position or in the draw-out inspection position.



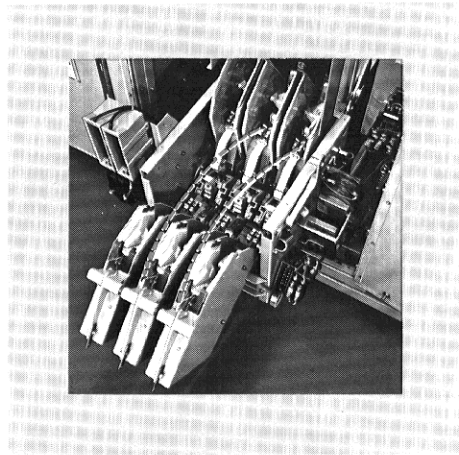
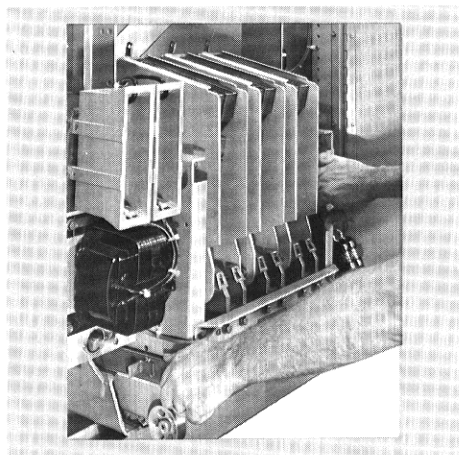


AMPGARD Medium Voltage Starters Air Break Contactor Features

Contacts are single-break, high-pressure-type weld-resistant alloy.

Blowout assemblies are series-connected with the contacts and one blowout coil covers the entire current range for each contactor. The Dc clapper-type operating magnet gives quiet, positive contactor operation. A silicon rectifier in the completely isolated and barriered low voltage section of the enclosure supplies the Dc coil power.

Arc chutes are De-ion type, tilted forward to direct hot gasses from the grid stack exhaust toward the enclosure door. With arc chutes in their normal operating position, electrical connections to the arc horns mounted in the chutes are made through knife-jaw assemblies mounted adjacent to the moving and stationary contacts. Arc chutes may be rotated out of their normal position to allow convenient access for contact inspection.

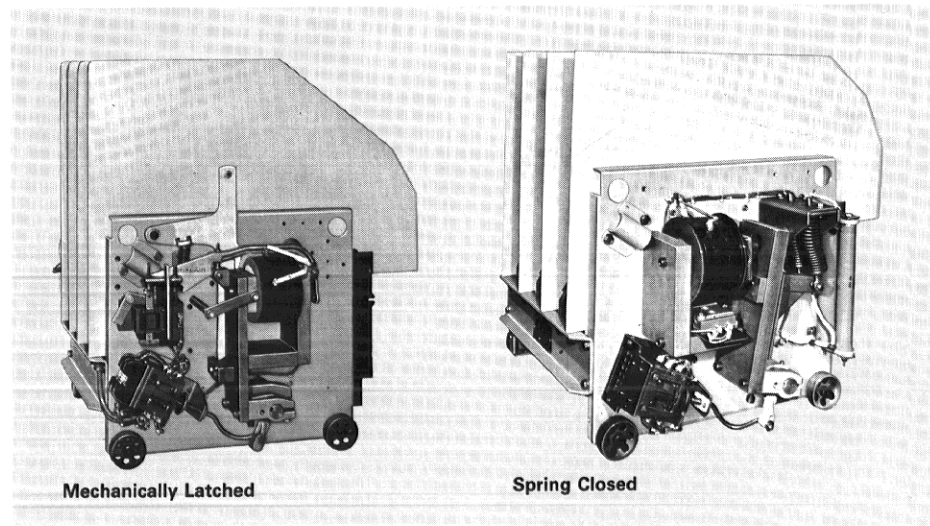


Optional Contactor Features

Ampgard medium voltage air break contactors are normally magnet-closed and magnet-held closed. They are also available with a mechanical latch attachment. The air break contactor is also available as a spring-closed contactor.

The mechanically latched design is used on applications where the contactor must remain closed through a voltage dip or failure. The contactor is opened by a separate, electrically operated solenoid with either one or two operating trip coils of different voltages.

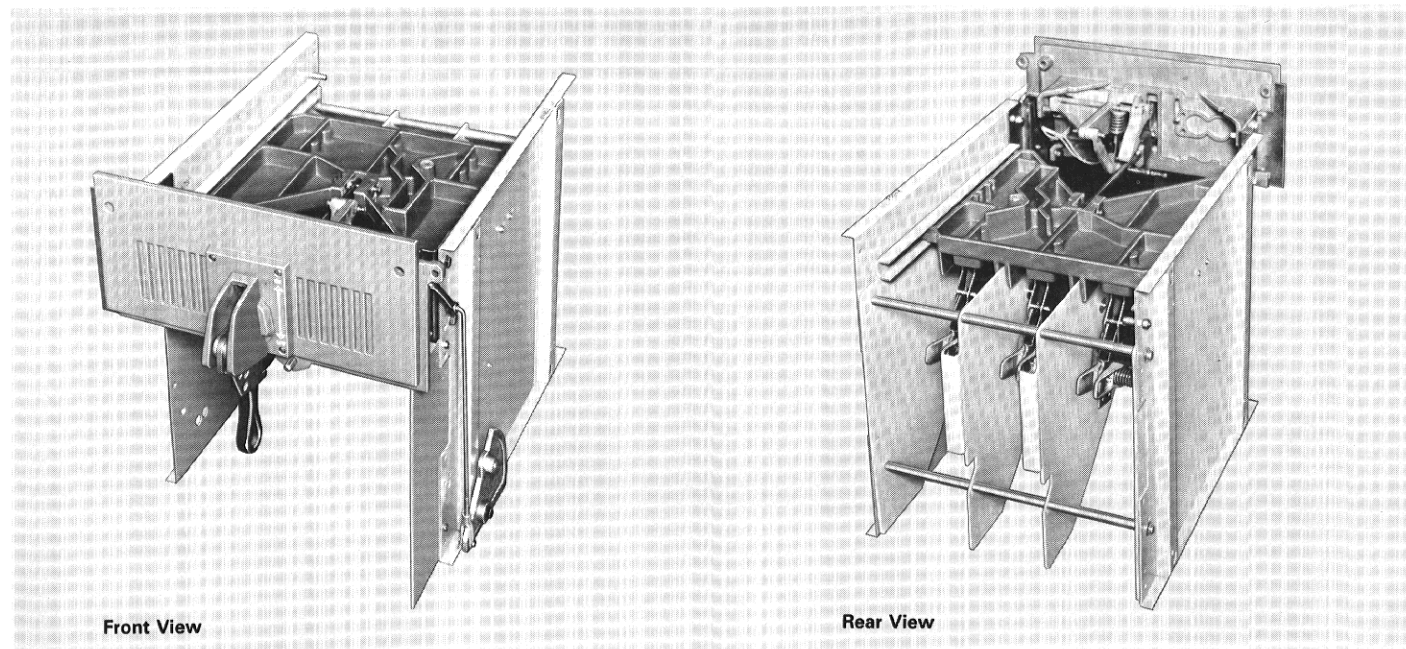
The spring-closed design can be used on such applications as a shorting contactor in primary reactor starters or as a dynamic braking contactor where the contactor must close the power circuit regardless of interruptions to the control source.





AMPGARD Medium Voltage Starters Type LFR Mechanical Isolating Switch

Type LFR Mechanical Non-Load Break Isolating Switch



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 bolts in the front casting.

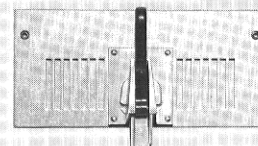
The component-to-component circuitry concept utilizes the current limiting fuses as part of the isolating switch. The switch fuse jaw is constructed so that firm pressure is applied to the fuse ferrule when the switch is in the ON position yet, also allows the fuse to be easily removed or inserted when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

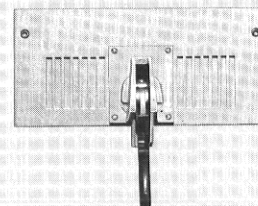
To operate the isolating switch, the operating handle is moved through a 180° vertical arc from the OFF to the ON position. In the ON and OFF position, a portion of the handle housing extends over the starter high voltage door, preventing the door from

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 horizontal service position, the handle cannot be moved to the ON position without first moving to the vertical OFF position.

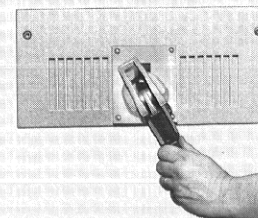
When the operating handle is moved from ON to OFF, pairs of copper fingers are withdrawn from incoming line stabs. As the fingers withdraw, they automatically tilt up so they are visible above the top of the fuses when viewed from the front, and simultaneously grounded. At the same time as the fingers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



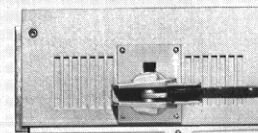
ON Position



OFF Position



Handle Being Moved to
Horizontal Service Position

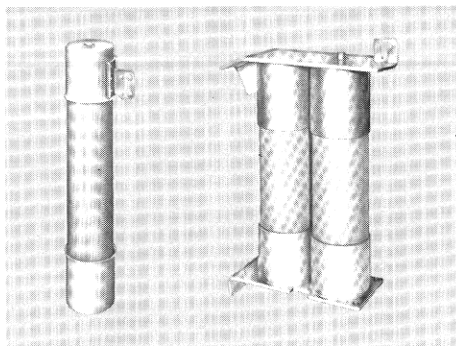


Handle In Horizontal
Service Position



AMPGARD Medium Voltage Starters Current Limiting Fuses

Current Limiting Fuses

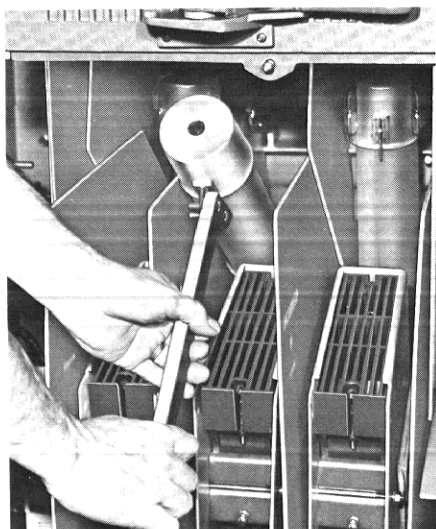


All Ampgard Starters use Westinghouse Type CLS power fuses with time/current characteristics for motor service. Type CLE power fuses are applied when the starter is used to feed a transformer. This characteristic is coordinated with the contactor and overload relay characteristics to provide maximum motor/transformer 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 and is visible over the top of the arc chutes.

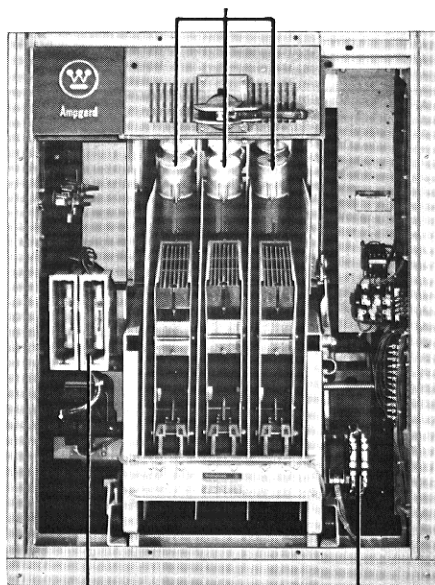
The control circuit primary fuses are also current limiting. The control circuit secondary fuses are NEC type.

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

Main Power Fuses

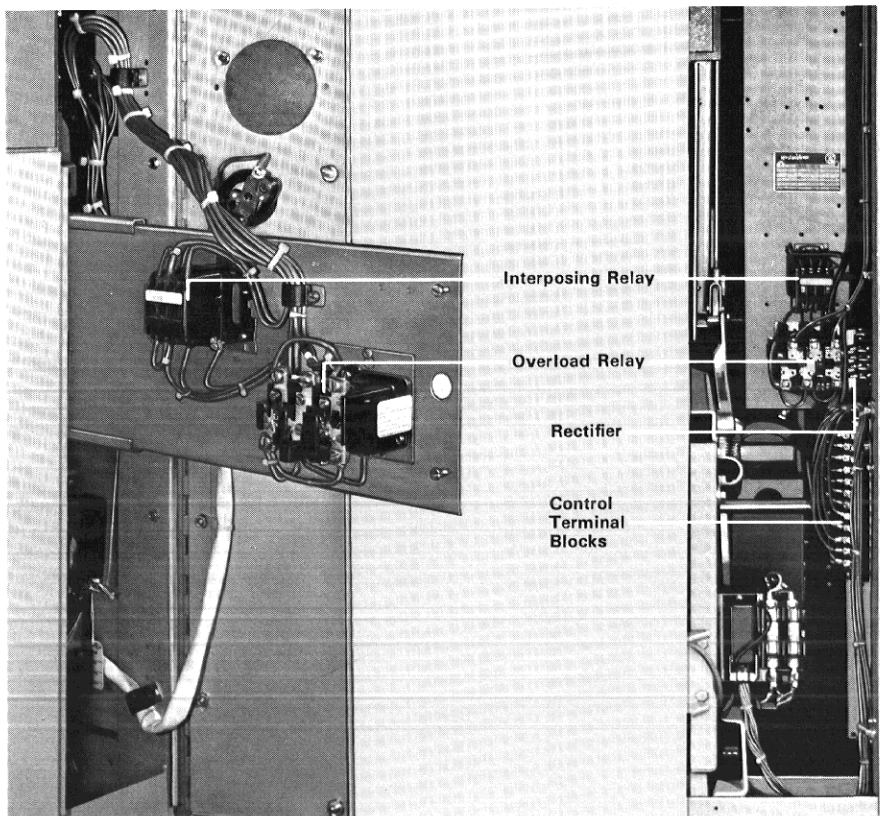


Control Circuit
Primary Fuses

Control Circuit
Secondary Fuses

Isolated Low Voltage Control

Mounted on the right side of the enclosure, the low voltage control panel is completely isolated and barred from high voltage and has a separate low voltage access door. See photos below. It contains the following components: interposing relay, overload relay and silicon rectifier. The three-pole adjustable overload relay is ambient temperature compensated for maximum motor protection. A 115 volt, single-phase full-wave silicon rectifier supplies Dc power for the Type LF airbreak contactor coil. Additional space is provided on the panel for mounting auxiliary devices.



200 Ampere Control Panel

400 and 700 Ampere Control Panel



AMPGARD Medium Voltage Starters Personnel Safety Features

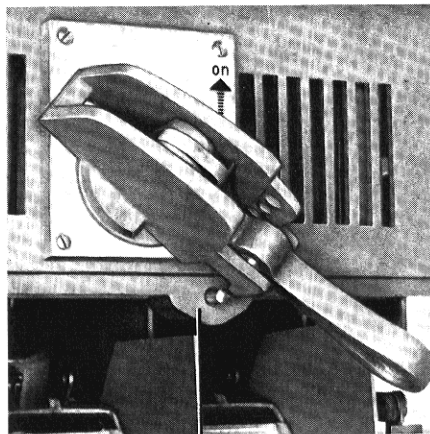
Personnel Safety Features

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 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.

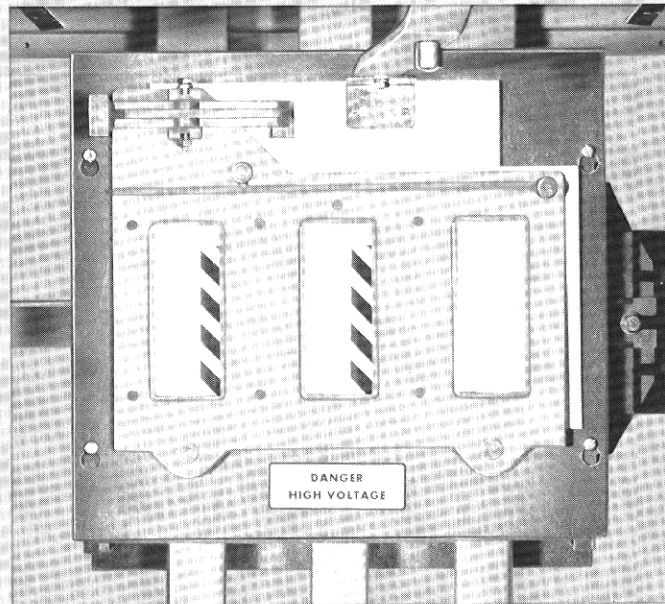


Detent

Other Safety Features

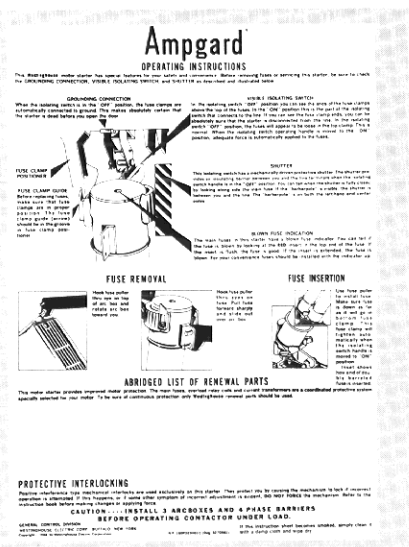
In addition to the interlock system, Ampgard Starters include many other features designed to protect operating personnel. These features include:

- 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.



Shutter Barrier Between Line Terminals and Fuse Stabs

- 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.





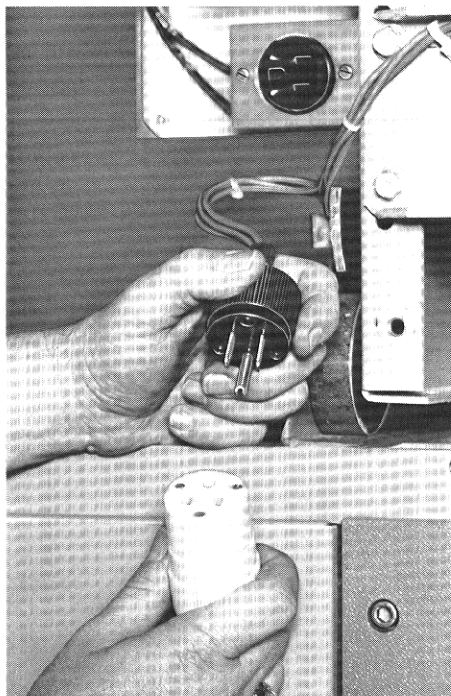
AMPGARD Medium Voltage Starters Test Run Circuit, Coordinated Protection

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

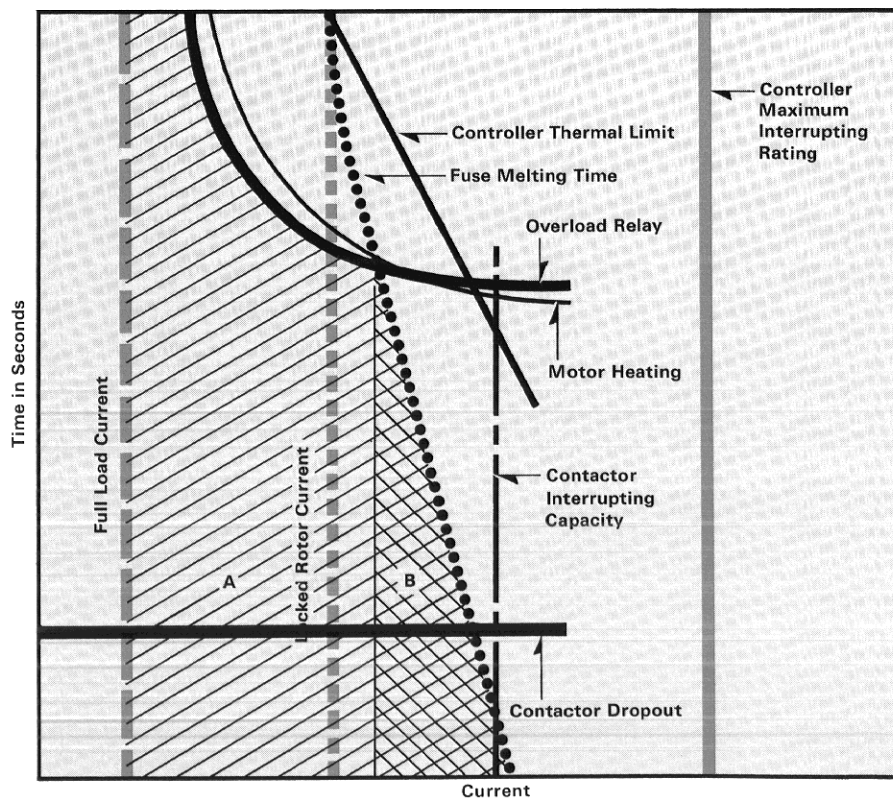


Coordinated Protection

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 needed load protection functions and power source protection functions should also be reviewed.

Such relays as Groundgard®, MOR, CO, temperature, CM and IQ-2000™ can easily be factory installed to insure full motor utilization and proper motor protection.



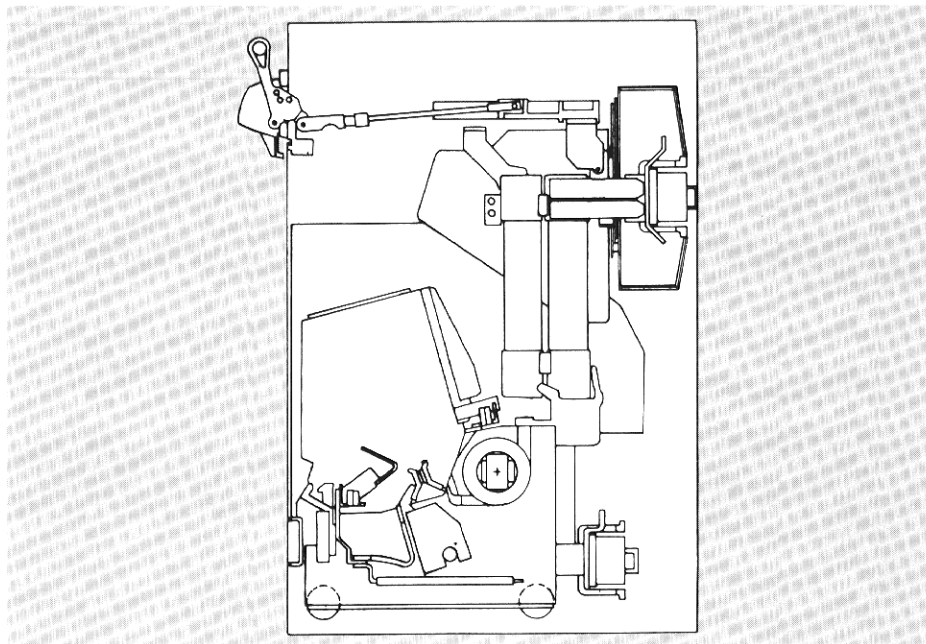


AMPGARD Medium Voltage Starters Component to Component Circuitry

Component-to-Component Circuitry

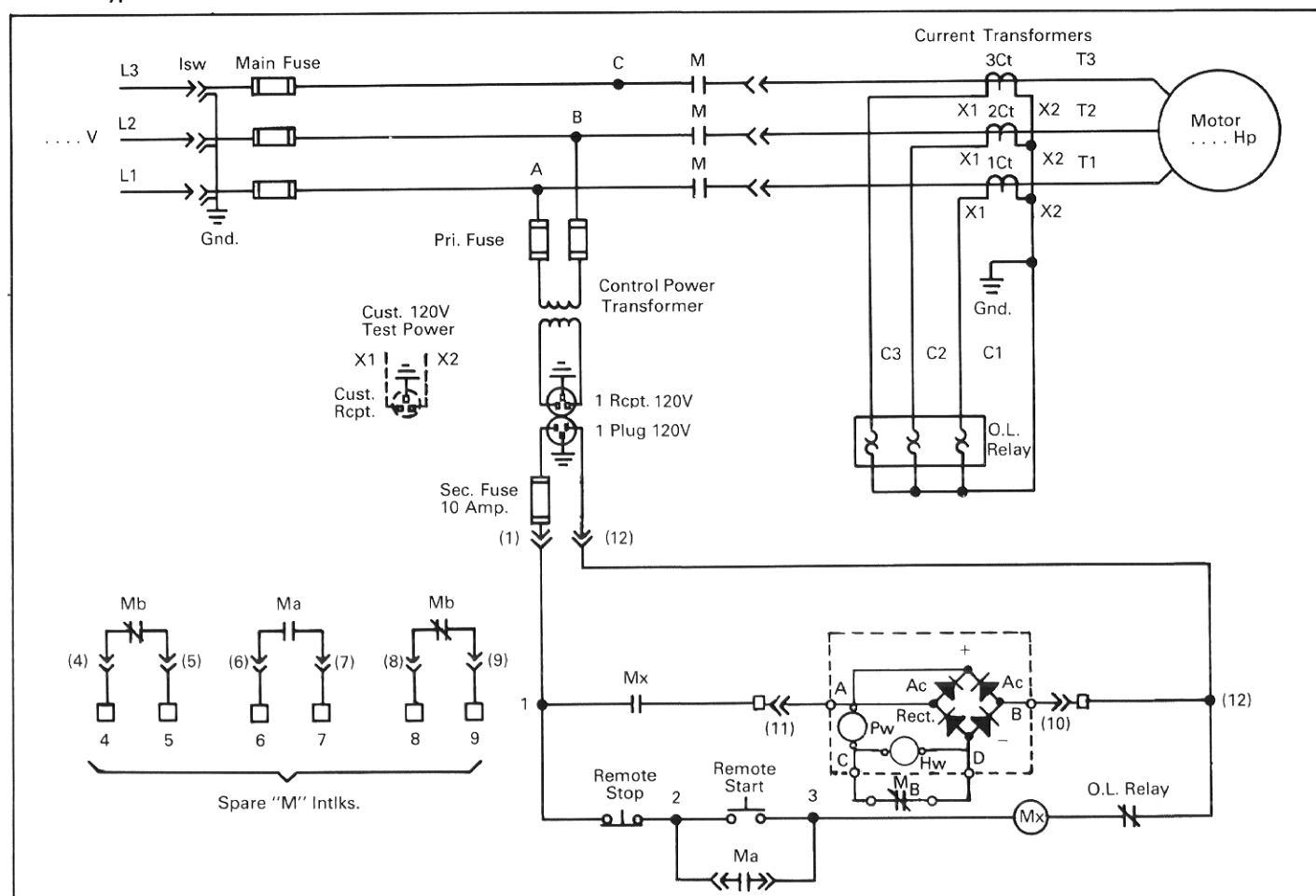
All major components of Ampgard starters—mechanical isolating switch, vacuum/air-break contactor, current transformers and control transformer—were designed specifically to function together as an integrated starter unit.

One of the most important design features, however, is the component-to-component circuit concept employed to eliminate 50% of the current carrying junctions. See drawing at right. In this concept, the isolating switch, contactor and current limiting fuses are electrically connected without use of cables. The drawing illustrates the component-to-component circuitry used in 400 ampere air-break Ampgard Starters.



Typical Wiring Diagram for Vacuum Type SJ Contactor

Component-to-Component Circuitry





AMPGARD Medium Voltage Starters Starter Installation

Starter Installation

One of the outstanding features of Ampgard starters is easy installation. Starters arrive completely assembled to order specifications, requiring only the shipping bolts to be removed. By using the illustrated instructions included with each starter, units can be installed and wired, quickly and easily, and without any special tools. The following series of photos 2 thru 8 show the installation of a typical Ampgard starter.

1. Before installation, be sure main power is turned OFF and there is no foreign power source in the starter. (Not illustrated.)

2. Ampgard starter with step-by-step pictorial installation instructions.

3. Remove main power fuses with fuse puller supplied in each structure. (Not illustrated.)

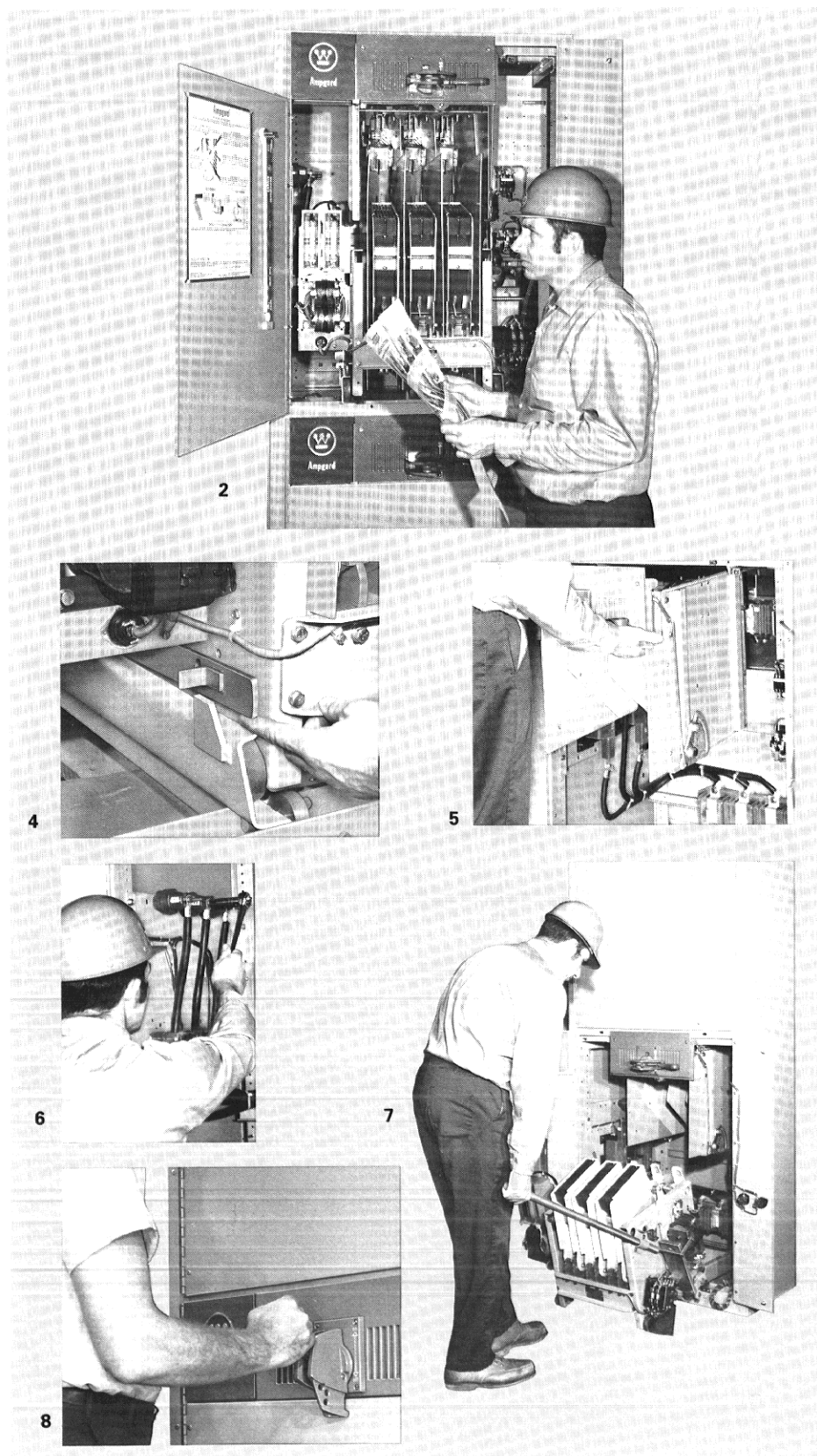
4. Release the contactor latch, easily draw out to detent position, and then remove.

5. Remove the isolating switch after removing two bolts.

6. Connect the easy-to-wire line and load cables to the terminals.

7. Replace the isolating switch and contactor; test the low voltage circuit.

8. Close high voltage door, turn isolating switch to ON position and motor is ready to be turned ON.





AMPGARD Medium Voltage Starters Optional Modifications

UL Rating

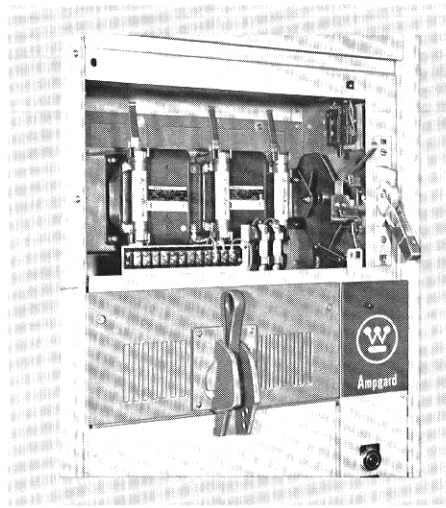
The Ampgard starter can be built to meet UL Specification 347. An Ampgard starter with this option is built to the same dimensions as the standard Ampgard starter with main horizontal bus.

Other Optional Modifications

In addition to the options previously described, Ampgard starters are available in 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
- Operators and pilot devices
- Instruments and meters
- Control relays and timers.
- Static or selected electro-mechanical protection devices

For more details on available accessories and modifications, refer to PL 11-120.

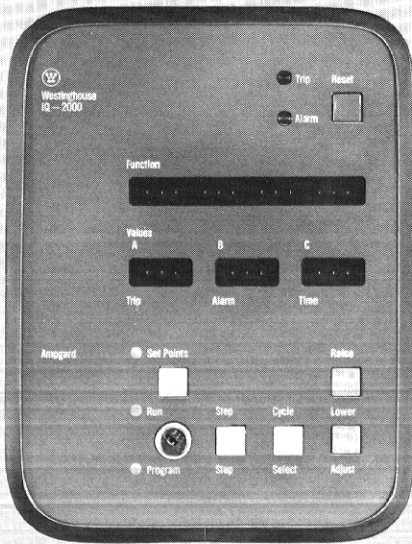
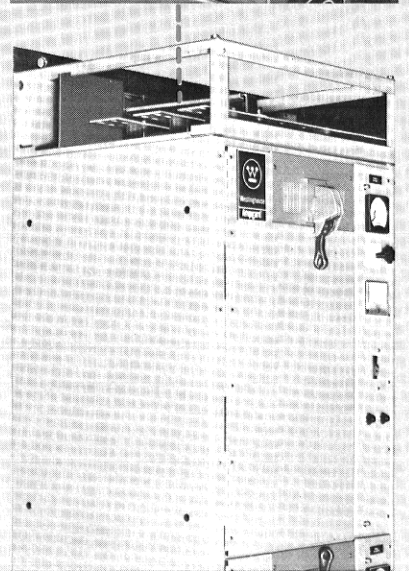
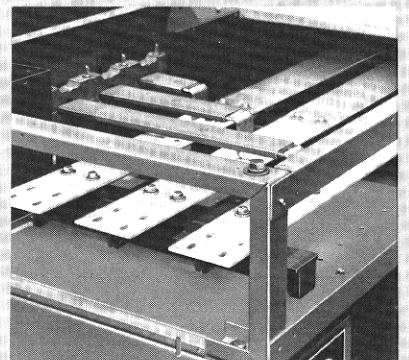


Draw-out Potential Transformers and Fuses

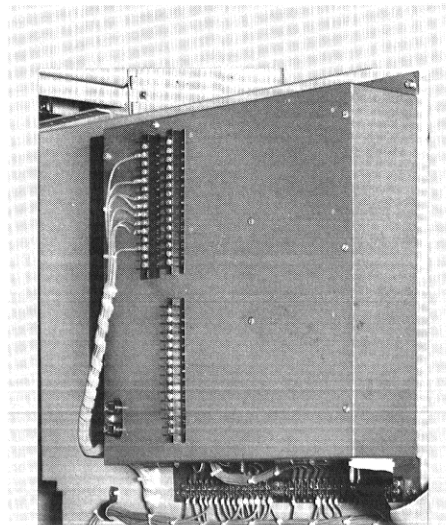
Draw-out potential transformer design with fuses is available to meet specific application requirements or code regulations. See photo above.

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 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-up without disassembling the starters. Ampgard line-ups can be supplied with incoming line enclosure for top or bottom entry.



IQ-2000 Faceplate (see page 14)



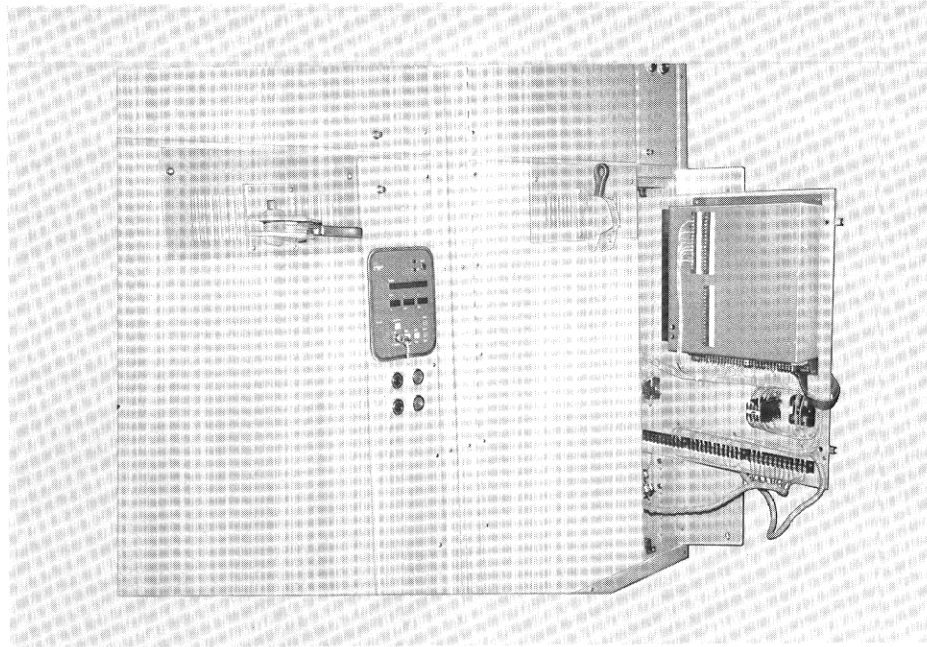
IQ-2000 Processor on Slide-out Panel, Mounted In Ampgard Starter (see page 14)



AMPGARD Medium Voltage Starters

Optional Modifications

IQ-2000 Motor Command Center



The IQ-2000 Motor Command Center is a control, monitoring and protection module that provides unparalleled motor control through the incorporation of microprocessor technology.

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, metering and control functions, whether utilized or not, a degree of standardization is achieved for the consultant, user and manufacturer. The IQ-2000 allows for full utilization of the motor in addition to its basic function of protecting the motor.

The microprocessor performs many of the sequencing functions that in the past were usually performed by a combination of relays. The IQ-2000 offers complete flexibility of control because the time intervals of pre-start, pre-stop and post-stop and post-stop required to safely start and stop the motor are all field programmable through the operator's panel.

The IQ-2000 can be programmed for control of:

- Across-the line starters
- Reversing starters
- Reduced voltage starters
- Synchronous starters
- PAM starters
- Wound rotor starters
- MVS4 Solid State Starter

The IQ-2000 has been designed to fit in the existing space available on the low voltage

side of the assembly. IQ-2000 is available for use with vacuum or air-break motor control.

When required, a separate RTD module is available for connection to the IQ-2000 processor for use with motor and load monitoring inputs, from Resistance Temperature Detectors.

Addition of an optional integrated circuit chip will allow multiple IQ-2000 processors to communicate with an in-plant integral computer. Also available is an RS-232C computer data port. Use of the data port permits the user to remotely monitor and data log all 52 discrete annunciator functions, besides reviewing the 28 groups of set-points.

The processor is housed in the control compartment of the Ampgard medium voltage starter and has a slide-out mounting arrangement for easy connection to the external circuits. The operator's panel is mounted on the face of the low voltage compartment. The panel displays in words all the functions and numerically all the values. The processor is programmed in the field by use of the operator's panel using actual motor data.

The IQ-2000 permits an operator to enter the programming-related inputs by using only simple pushbutton controls. A raise/lower pushbutton with a function window displays alpha-numeric information. Simple instructions are displayed that do not require special codes or cross-references for interpretation. Values that are in place, or

are being changed, are quickly identified in the function window. The control capabilities of the IQ-2000 also eliminate many heat-producing electromechanical devices, thus reducing airconditioning requirements for control rooms.

The IQ-2000 can be programmed to match any given motor, taking into consideration the special load protection and power source requirements of the motor. The memory function of the IQ-2000 permits the user to program or select those values that will customize the program to suit a particular motor's application and load requirement. While these stored values are maintained indefinitely, they can be easily modified should circumstances or operating conditions change. The memory is non-volatile and, in the event of a power loss, it is maintained indefinitely and does not require a battery for support.

The following protection functions can be incorporated into the IQ-2000 Motor Command module:

Overload: Trip based on the motor's I^2t damage curve as determined by the maximum allowable stall time at locked rotor current. The effects of both positive and negative (phase unbalance) sequence are taken into consideration in the processors' protective algorithm.

Instantaneous Current: Trip based on current in excess of an adjustable set point for one cycle or longer.

Ground Current: Independent trip and alarm, with adjustable time delay, based on the output of a ground current transformer.

Power Source Disturbances: Trip based on voltage for overvoltage and undervoltage (adjustable set point and time delay) and phase reversal and loss (instantaneous).

Load Disturbances: Trip based on jammed load or underload (adjustable set point and time delay). Both can be adjusted out if not desired.

Stator Overtemperature: Trip and alarm (each independent) based on the RTD temperature in the stator winding. The Module will select the hottest RTD and will automatically ignore a shorted RTD circuit.

Motor and Load Bearing Temperature: Trip and alarm (each independent) based on RTD in each location.



AMPGARD Medium Voltage Starters Optional Modifications

Type MVS4 Solid State Soft Starter

The MVS4 offers a state-of-the-art alternative to wound rotor or other reduced voltage starting methods. Soft start has the advantage of stepless load acceleration with standard or high-torque induction motors. Controlled torque reduces the stress on conveyor belts and gear trains and also reduces inrush shock. Other applications include pumps or compressors that are normally started unloaded.

The MVS4 soft starter uses a series of thyristor assemblies that allows for control of the motor terminal voltage and acceleration profile with easily adjustable potentiometers. Starting features include flex time (for belt take-up), initial voltage set point, current limit, instantaneous overcurrent protection and adjustable acceleration time. The set point potentiometers are located on the operator's panel behind the hinged cover (See photo). Open loop (voltage control) or tachometer-controlled acceleration can be provided.

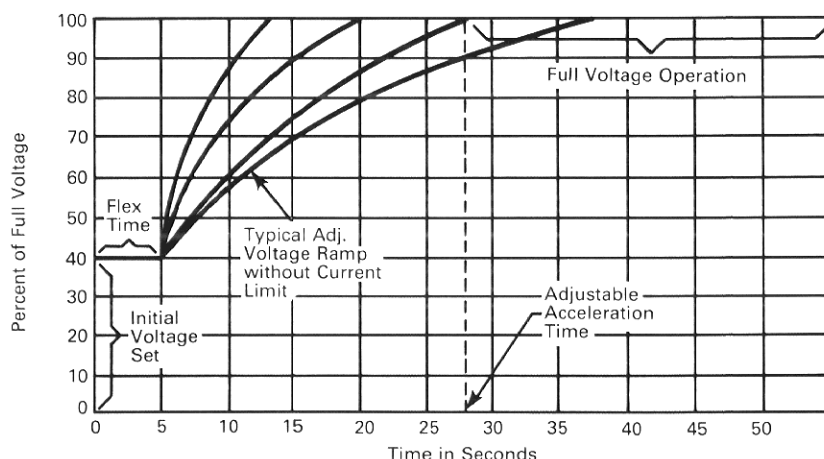
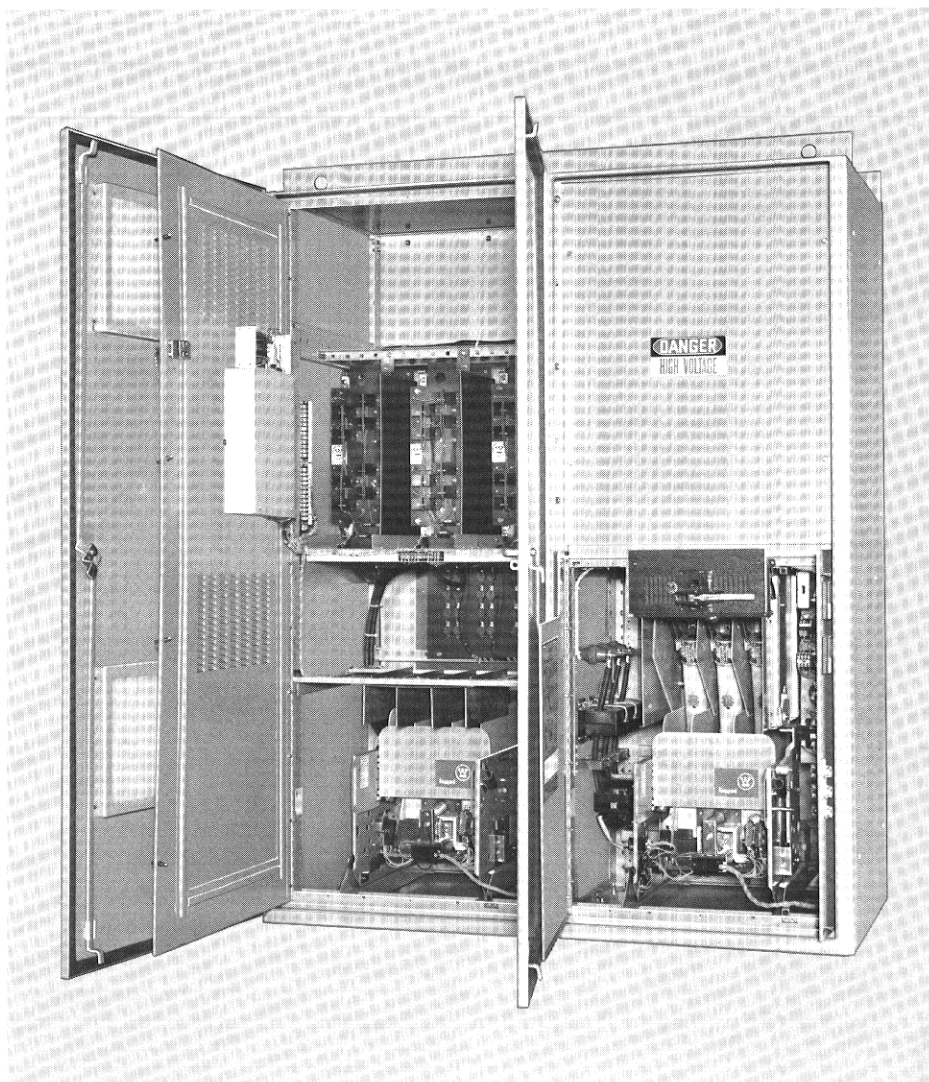
The main contactor responds to normal control circuitry, supplying source voltage (1500 to 5000 volts) to the thyristor assemblies. The electronic control panel supplies firing signals to the thyristors for controlling the motor voltage and acceleration time. After a successful start, the bypass contactor is closed to continue running the motor at full voltage.

In addition to normal motor protection devices, the MVS4 includes additional protection for instantaneous overcurrent, current unbalance, high temperature, exceeded acceleration time and failed tachometer. Light-emitting diodes on the control panel cover provide indication of the cause of the shutdown.

The IQ-2000 is easily incorporated into the MVS4 starter to provide maximum motor utilization and protection, with either vacuum or air contactors.

The graph at right shows the flexibility of the solid state voltage control. The acceleration profile can be easily field changed for proper matching of load and power system requirements. The user can set the initial voltage and flex time – the period when shock is removed from the driven load. Acceleration is continued by increasing the voltage to full voltage. This acceleration time can also be adjusted.

The IQ-2000 measures true RMS values and therefore is readily compatible with the MVS4 solid state starter. The MVS4 is available with either vacuum or air break contactors.





AMPGARD Medium Voltage Starters Optional Modifications

Type ADM Load Break Switch

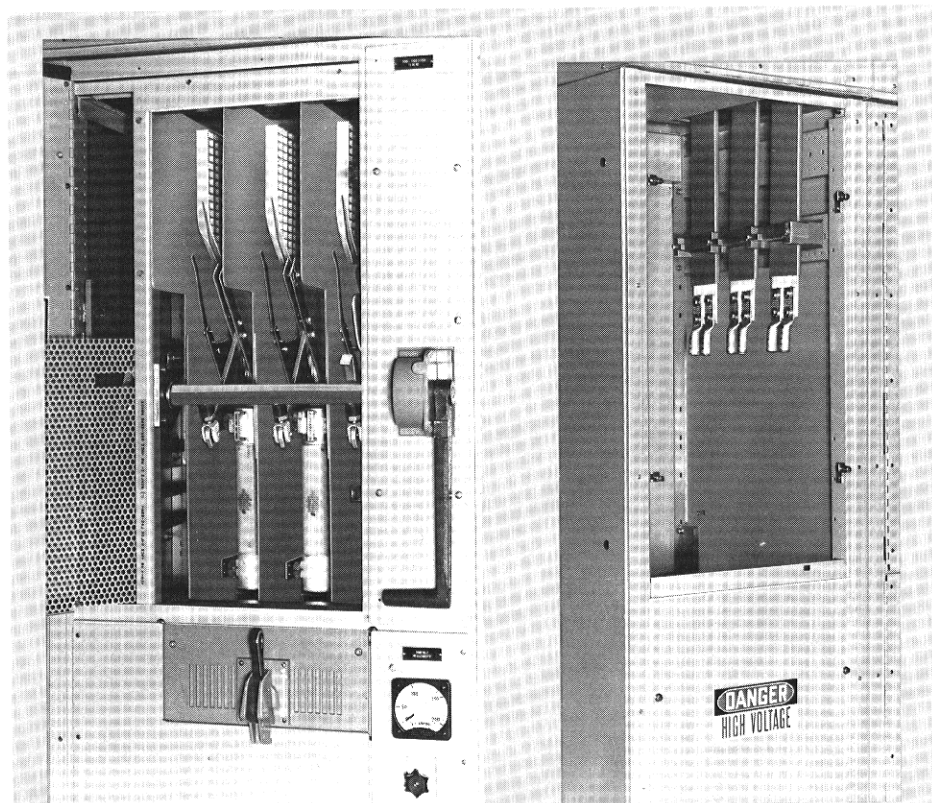
For special application needs with loads rated 600 or 1200 amps at 2500, 5000 and 7200 volt, Ampgard is available with the Type ADM load-break switch. This device, a three-pole, manually operated, quick make-quick break switch, is used primarily as a disconnect switch in Ac power systems. This switch is fixed mounted and will fit in one half of a standard 90-inch high, 36-inch wide vertical structure. Power fuses up to 450E 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.

Incoming Line Bus

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 an incoming line enclosure for bottom entry. With the main bus in the vertical position, a straight run is possible with the incoming cable.

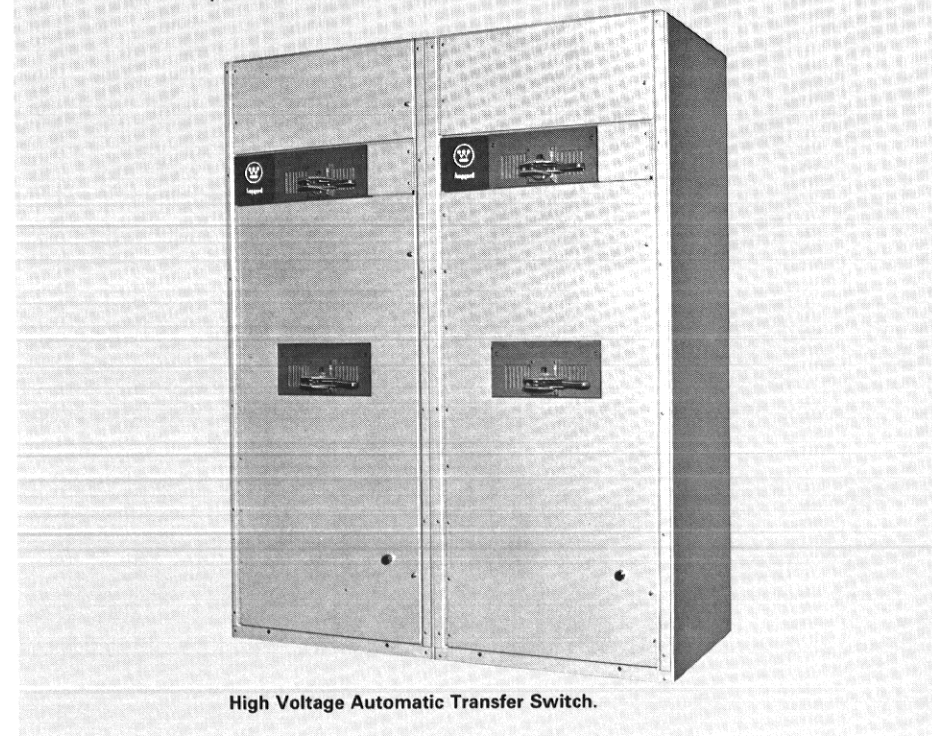
Automatic Transfer Switch

For critical applications where two power sources are available, the 2500/5000 volt, 400 ampere automatic transfer switch can be supplied. Line and load isolating switches prevent exposure to high voltage back feed during maintenance of either power source.



Type ADM Load Break Switch
Shown With Safety Screen Removed

Incoming Line Bus



High Voltage Automatic Transfer Switch.



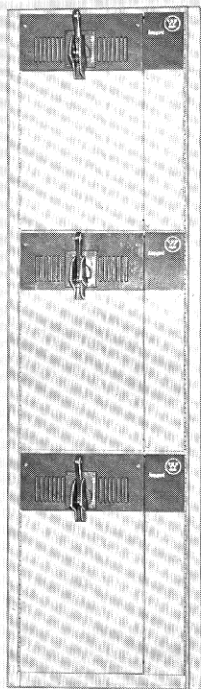
AMPGARD Medium Voltage Starters Starter Types

2500 Volt, 200 Ampere, Air Break

The only motor starter specifically built for 2300 volt motor application, this Ampgard starter complies in all respects with NEMA industrial control standards. The entire unit has been tested to withstand 45,000 volt basic impulse level. The contactor has an interrupting capacity of 25,000 KVA. Contactor with fuses has been tested beyond 200,000 KVA short circuit interruption. The starter is rated at 2500 volts, 200 ampere, 3-phase, 60 Hertz for motors up to 700 Hp and for power systems with up to 200,000 KVA fault capacity. It is available in 90" high enclosures, 26" wide, 30" deep.

When to Specify

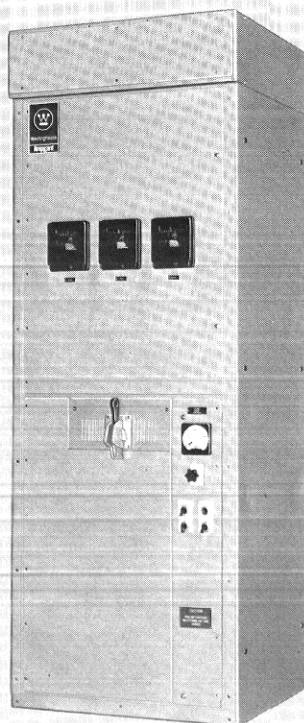
The 2500 volt, 200 ampere rating Ampgard starter is the best starter available for motors rated up to 700 Hp. Its efficient use of space provides exceptional economies, as well as allowing starter location efficiency not possible with other type starters. On multiple installations, users have saved up to 70% of floor space that other starters would require. Uniformity of design throughout the Ampgard family allows use of the optimum rating for each application within a plant with no "mixed equipment" problems. Easy installation and maintenance insures the lowest costs.



7200 Volt, 800 Ampere, Vacuum

The features and benefits of Ampgard medium voltage starters, proven in thousands of demanding industrial installations, are now available in those applications requiring 7200 volts. This latest Ampgard starter is available in vacuum contactor design. The starter with a vacuum contactor design is rated 800 amperes at 7200 volts in a NEMA E2 configuration. The starter with an air-break contactor is rated 400 amperes. This starter meets all NEMA published standards.

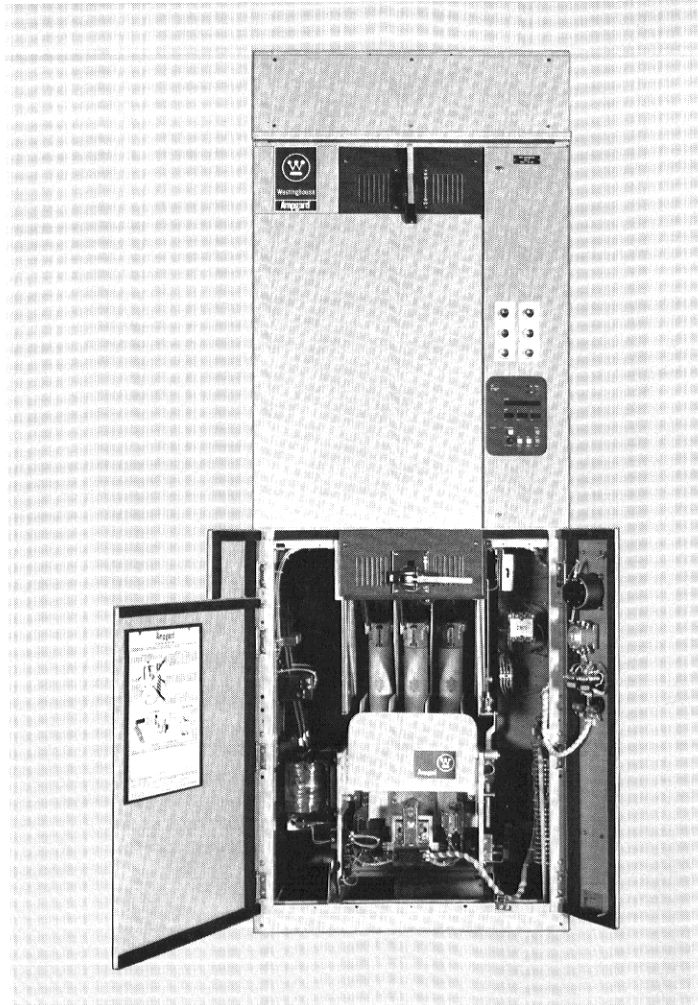
The features and benefits of the Ampgard high Voltage starter family, proven in thousands of industrial installations, are now available in 7200 Volt applications, in either vacuum or air-break contactor designs.





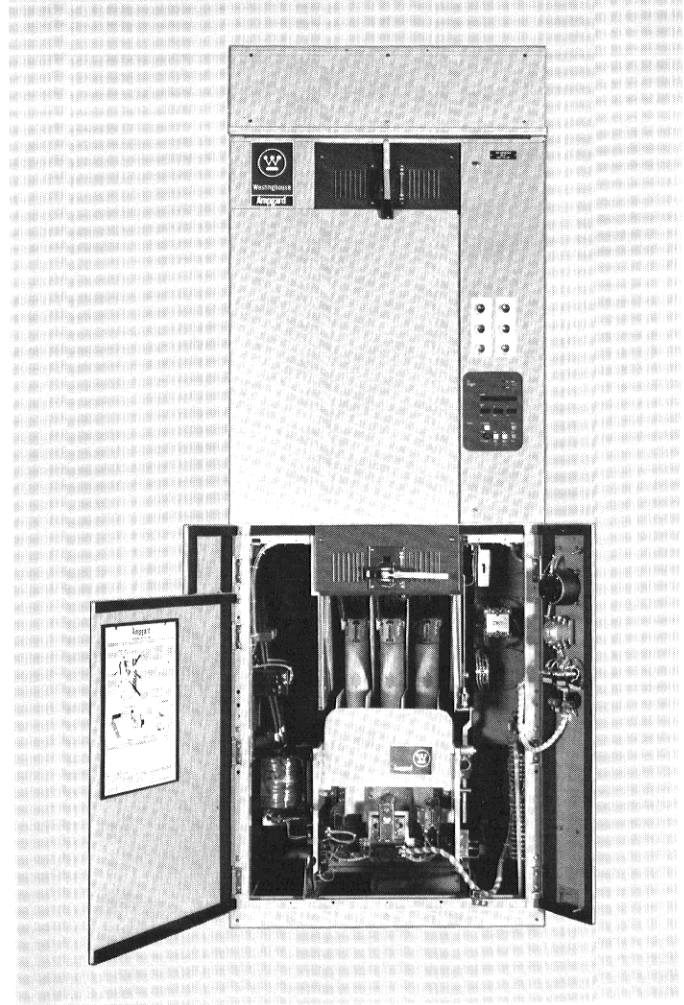
AMPGARD Medium Voltage Starters Starter Types

2500 Volt, 400 Ampere, Vacuum



Engineered specifically for 2500 volt, 400 ampere service, the rating of this Ampgard starter complies in all respects with published NEMA industrial control standards. It has been tested to withstand 60,000 volt basic impulse level. The contactor with fuses has been tested beyond 200,000 KVA short circuit interruption. The Starter is rated 2500 volt, 400 ampere, 3-phase, 60 Hertz, for motors up to 1750 Hp at 1.0 pf, for 1500 Hp motors at 0.8 pf, and for power systems up to 200,000 KVA fault capacity. This model is available in 90-inch-high floor-mounted enclosures, 36 inches wide, 30 inches deep, and can contain one or two Starters. Complete front access allows for free-standing, back-to-back, or against-the-wall installation.

5000 Volt, 400 Ampere, Vacuum

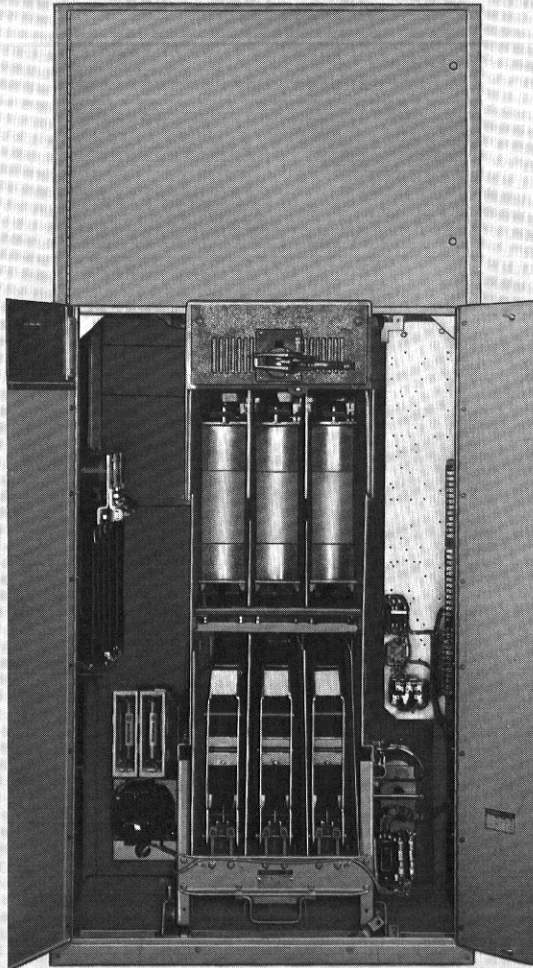


This starter is specifically engineered for 4000-4800 volt motors rated up to 3000 Hp at 1.0 pf, and for motors up to 2500 Hp at 0.8 pf. This model meets all NEMA published standards and has been tested to withstand 60,000 volt basic impulse level. The contactor with fuses has been tested above 400,000 KVA short circuit interruption. The Starter is rated 5000 volt, 400 ampere, 3-phase, 60 Hertz. It is available in 90-inch-high floor-mounted enclosures, 36 inches wide and 30 inches deep, that can contain one or two Starters. With complete front access, the starter can be mounted free outstanding, against the wall, or back-to-back.



AMPGARD Medium Voltage Starters Starter Types

2500/5000 Volt, 700 Ampere, Air Break



Air-Break Contactor

Ampgard medium voltage motor starters are available in an exclusive 700 ampere model that offers a flexible array of user benefits and operational economies. This starter is specifically engineered for 2200-5000 volt motors rated up to 5000 Hp at 1.0 pf, and for motors rated up to 4500 Hp at 0.8 pf.

The starter meets all NEMA published standards and has been tested to withstand 60,000 volt basic impulse level. The contactor has an interrupting capacity of 75,000 KVA. The contactor with fuses has been tested above 400,000 KVA short circuit interruption. The starter is rated 2500/5000 volt, 700 ampere, 3-phase, 60 Hertz. This model is available in 90-inch-high floor-mounted enclosures, 40 inches wide and 30 inches deep, that contain one starter. With complete front access, this Ampgard starter can be mounted free standing, against the wall, or back-to-back.

Typical Specification For all Ampgard Starters

Ac magnetic, fused-type medium voltage starter, NEMA Class E-2 employing current limiting power fuses, and magnetic contactors. Each medium voltage starter will be completely self-contained, prewired, with all components in place when delivered. Vacuum or air break contactors will be current rated based upon motor horsepower requirements. Starter to provide (full or reduced) voltage starting of a () volt, 3 phase, () Hertz, () Hp () rpm, () % power factor motor with () ampere full load current. Starters will be mounted in a sheet steel, free standing, front accessible enclosure with segregated high and low voltage sections. Starter will provide an interrupting fault capacity of (200,000 KVA symmetrical on 2300 volt systems, 400,000 KVA symmetrical on 4600 volt systems). This starter will conform to NEMA Industrial Control Standard ICI class E-2 controllers and applicable IEEE and ANSI published industrial control standards. Starters to be Westinghouse Ampgard or approved equal.

For IQ-2000

The protective, metering and control functions are to be provided by using a multi-purpose micro-processor module. The micro-processor shall monitor the effects of true current RMS. The protective algorithm shall calculate the effects of positive and negative (unbalance) sequence. The operator's panel shall display in words its functions and numerically the values.

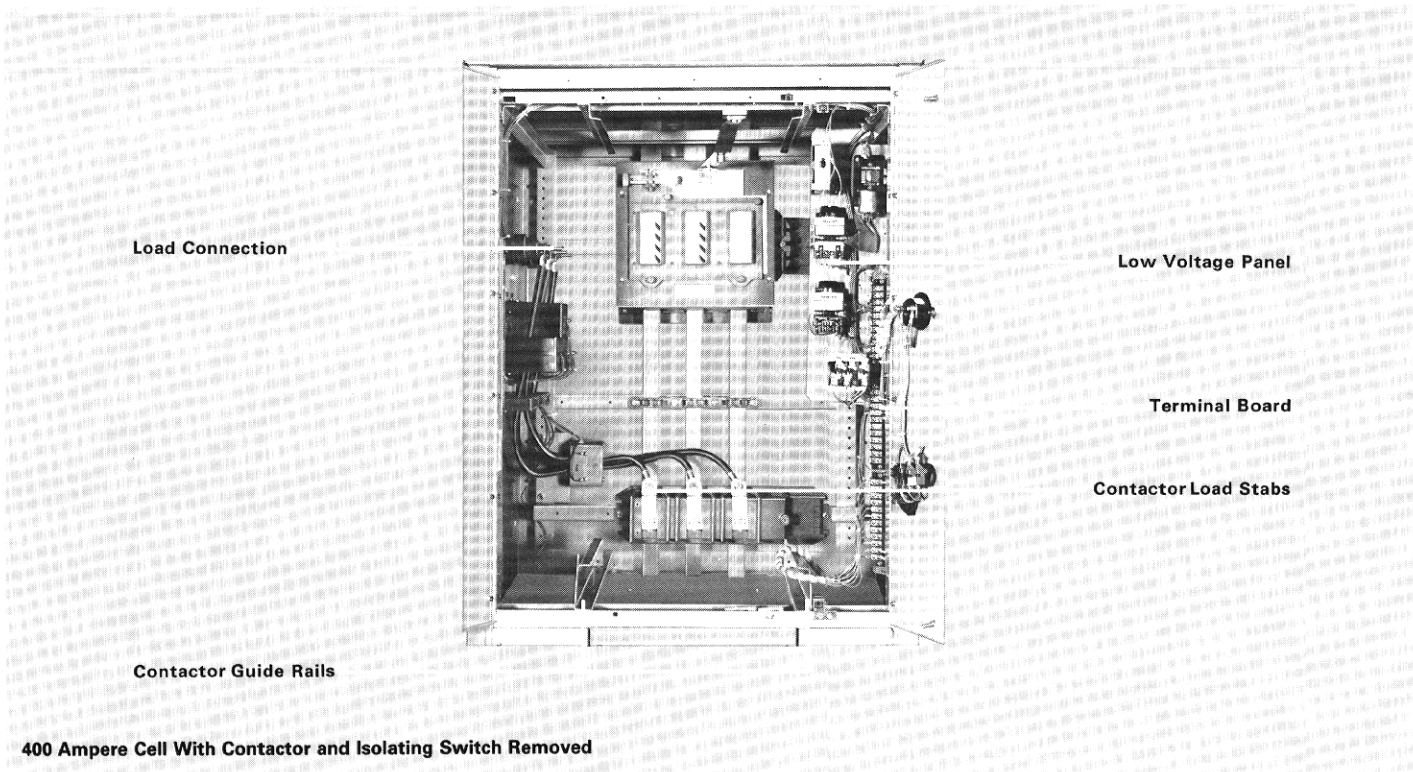
When to Specify

With a 2500/5000 volt, 700 ampere rating, this Ampgard starter is engineered for ratings that cannot be served by the 200 or 400 ampere Ampgards. It can deliver 2200-5000 volt service for those motors rated up to 5000 Hp. The Ampgard starter is easy to install and offers the lower cost maintenance of any similar rating starter. All Ampgard ratings feature long wearing, weld-resistant silver alloy contacts that are simple to replace and maintain. Fuses are vertically mounted for best dielectric strength and are easily replaced.



AMPGARD Medium Voltage Starters Enclosures

Enclosures



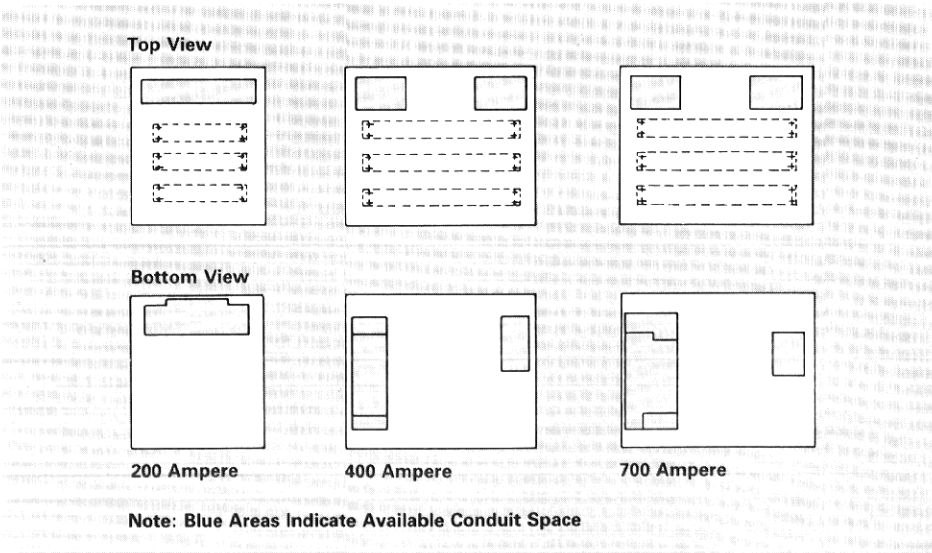
Ampegard medium voltage starters are mounted in free-standing sheet steel enclosures that meet ANSI/NEMA ICS-6 enclosure standards and specifications. They are completely front accessible, allowing for free standing, against-a-wall, or back-to-back mounting.

The floor-mounted structures are 90 inches high, 30 inches deep, and either 26, 36 or 40 inches wide. Each design will accommodate one or more full voltage starters, allowing up to 70 percent savings in floor space.

Line, Load, and Control Cable Space

Ampegard's open-starter cell design provides easy access for line and load cable, top or bottom. Available cable space is shown in blue on the plan views to the right.

Cable Space

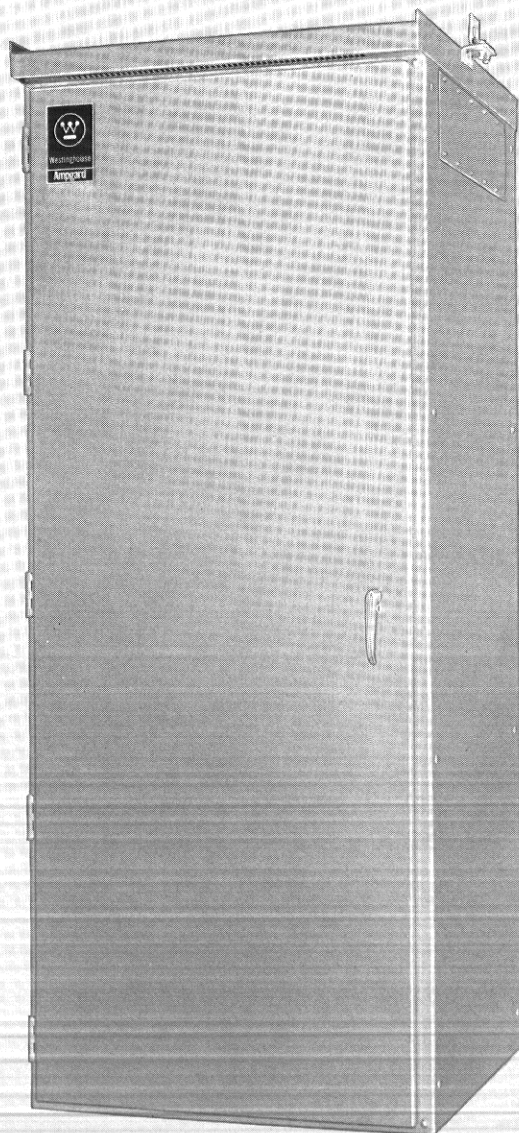




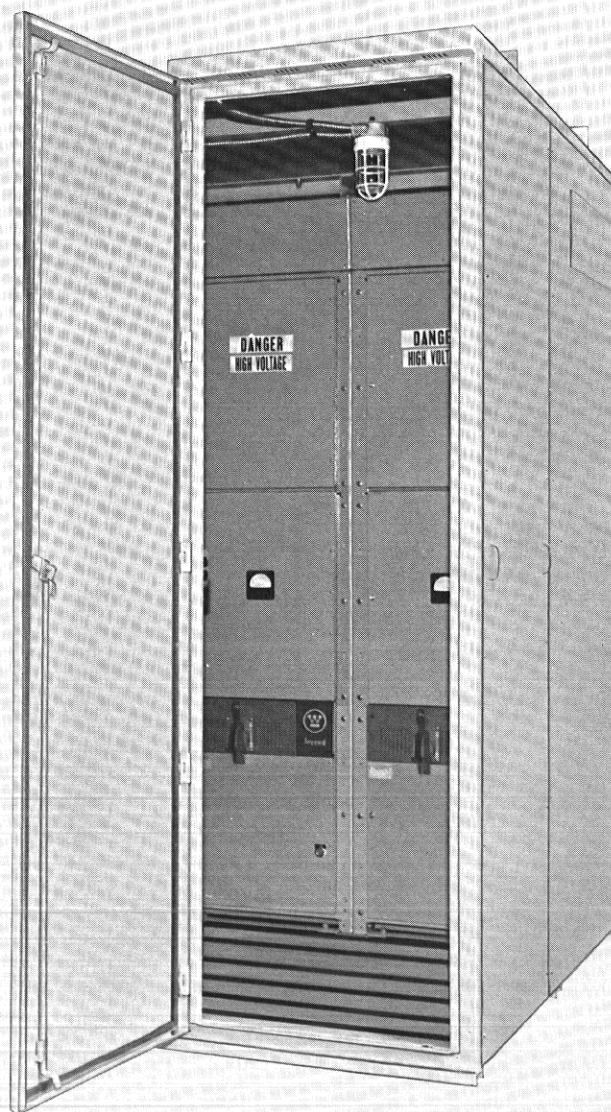
AMPGARD Medium Voltage Starters Enclosure Types

Enclosures

Ampgard medium voltage starters are available in many types of enclosures. These include Type 1 general purpose enclosures for general indoor applications, Type 3 outdoor walk-in or non walk-in, and Type 12 for locations where dust exists.



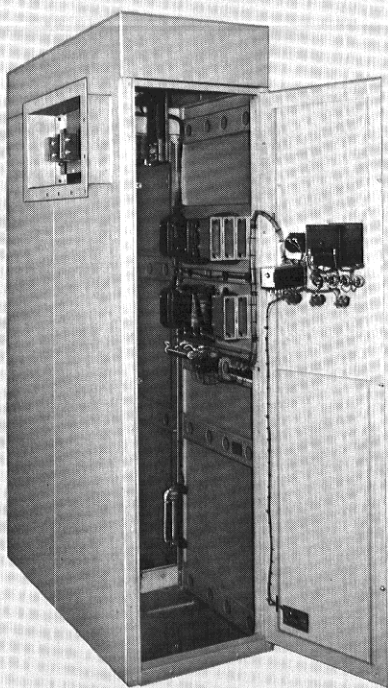
Type 3 - Non-Walk-In



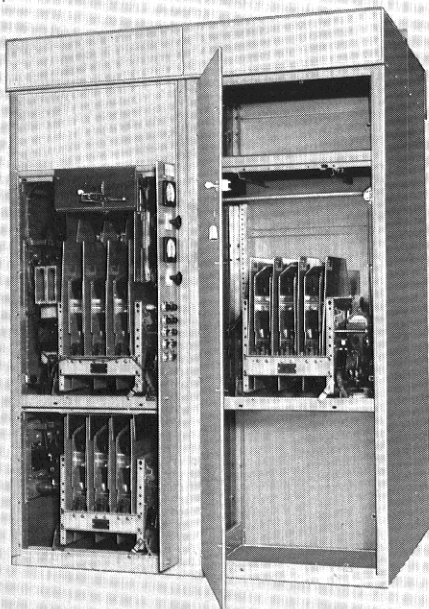
Type 3 - Walk-In



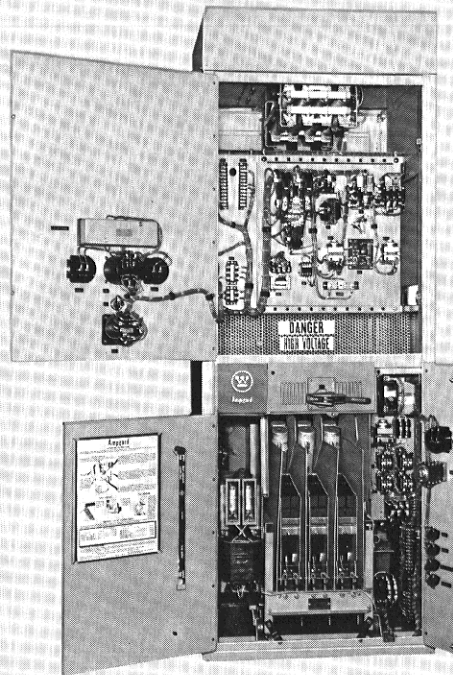
AMPGARD Medium Voltage Starters Special Application Starters



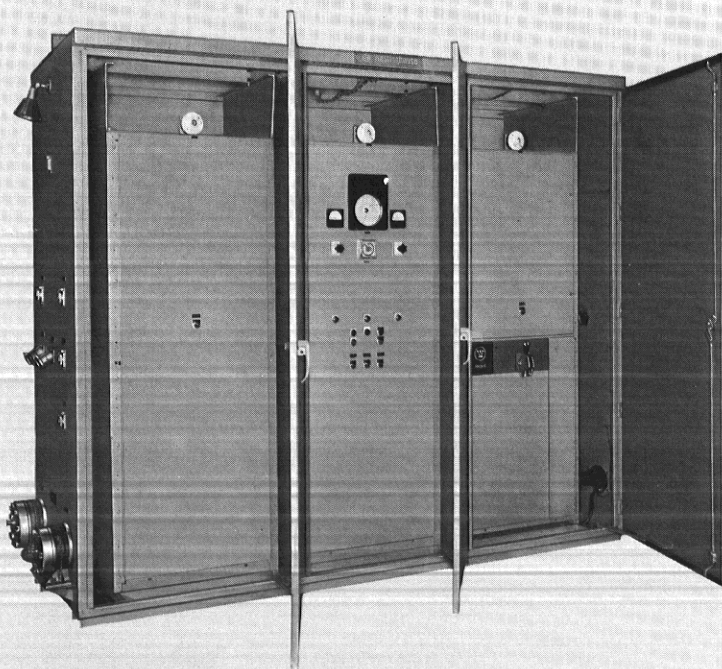
Incoming Line and Metering Section With
Transition Throat



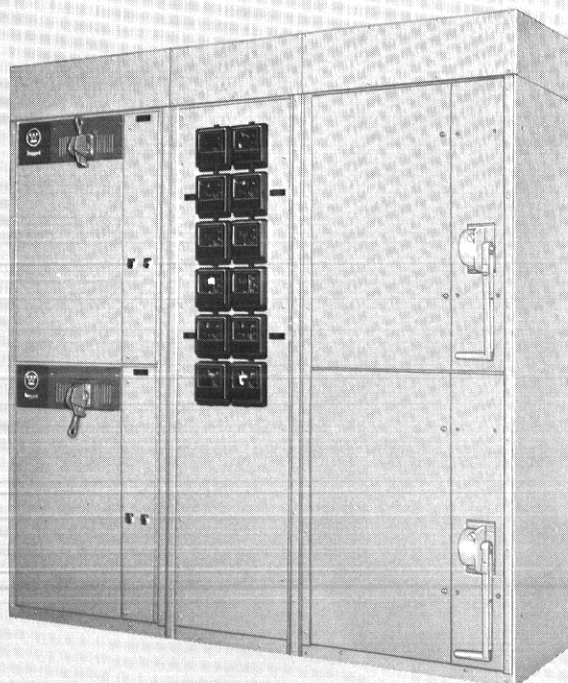
PAM Motor Starter (Multi-speed)



Synchronous Motor Control With Built-in Static
Exciter and Field Panel



Wound Rotor Motor Control in Outdoor Enclosure



5KV Loadbreak Type ADM Switches, Fused or
Unfused, Available for Ampgard Starter Lineups.



AMPGARD Medium Voltage Starters Special Application Starters

Incoming Line
Metering and
Protection

Potential
Transformer
Disconnect

Incoming Line
ADM Switch

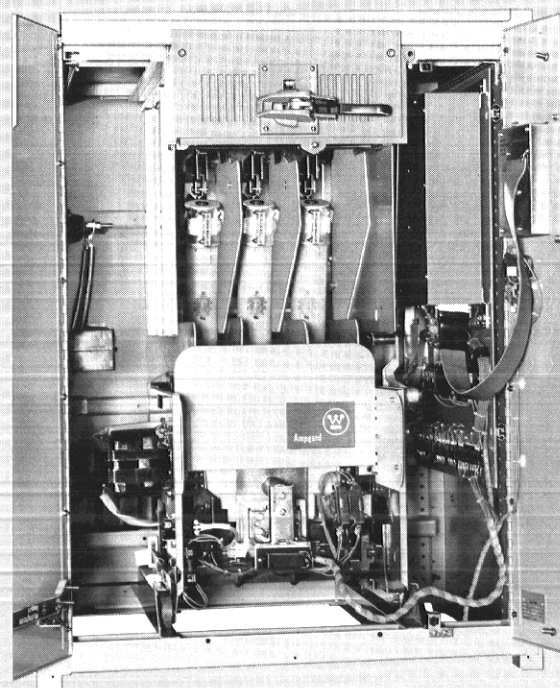
2500 Volt
400 Amp
Starter

Main Horizontal
Bus Compartment

Metering and
Protection for
2500 Volt
400 Amp
Starter

2500 Volt
200 Amp
Starters

Typical Ampgard Starter Lineup



400 Ampere, 5KV Starter with SJ Vacuum
Contactor and IQ-2000



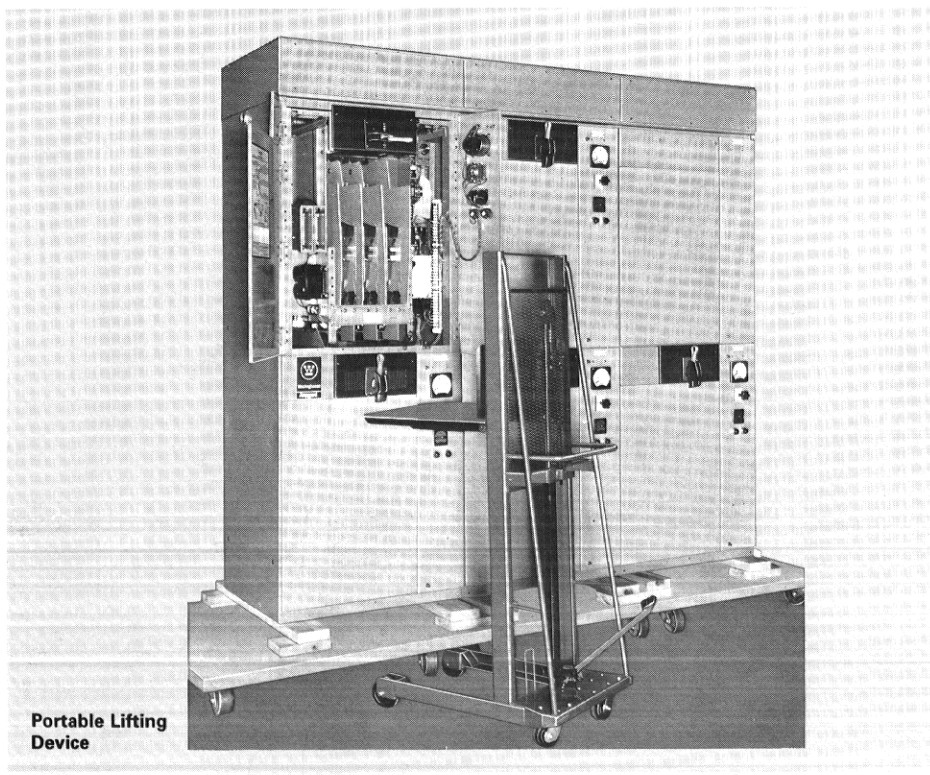
AMPGARD Medium Voltage Starters

Technical Data

Electrical, Mechanical and Dimensional Data

	2500 Volt, 200 Ampere Air	2500 Volt, 400 Ampere Air	2500 Volt, 700 Ampere Air	5000 Volt, 400 Ampere Vacuum/Air	5000 Volt, 700 Ampere Air	7200 Volt, 400 Ampere Vacuum
Type	25L2	25L4	25L7	50J4	50L7	72J4
Maximum Voltage	2,500	2,500	2,500	5,000	5,000	7,200
Maximum Horsepower 0.8 pf	700	1,500	2,500	2,500	4,500	4,500
Maximum Horsepower 1.0 pf	900	1,750	2,750	3,000	5,000	5,000
Interrupting Capacity (KVA)	200,000	200,000	200,000	400,000	400,000	570,000
Contactor:						
Current Rating (Amperes)	200	400	700	400	700	400
Interrupting Capacity (KVA)	25,000	50,000	75,000	50,000	75,000	50,000
Closing Capacity (KVA)	25,000	50,000	75,000	50,000	75,000	50,000
Basic Impulse Level (KV)	45	60	60	60	60	60
Floor Mounted Linestarter (Inches)	26 x 30 x 90	36 x 30 x 90①	40 x 30 x 90	36 x 30 x 90①	40 x 30 x 90	36 x 30 x 90
Horizontal Bus (Inches in Additional Height)	10	10	10	10	10	10
Floor Space Requirements (Square Inches)						
With 1 starter	780	1,080	1,200	1,080	1,200	1,080
With 2 starters	780	1,080	2,400	1,080	2,400	1,080
With 3 starters	780	2,260	3,600	2,160	3,600	2,160
With 4 starters	1,560	2,260	4,800	2,160	4,800	2,160
With 6 starters	1,560	3,240	7,200	3,240	7,200	3,240

① Also available in 45 inch high structure containing one starter only.



Portable Lifting
Device

Further Information

Price List 11-120

Instruction Leaflets:

11-202-12

Isolating Switch: 16-200-23

Vacuum Contactor: 16-200-32

Air Break Contactors: 16-200-25

ADM Disconnect Switch: 16-200-10

IQ-2000 Processor: TD 11-720

Westinghouse Electric Corporation
Control Division
Asheville, NC 28813