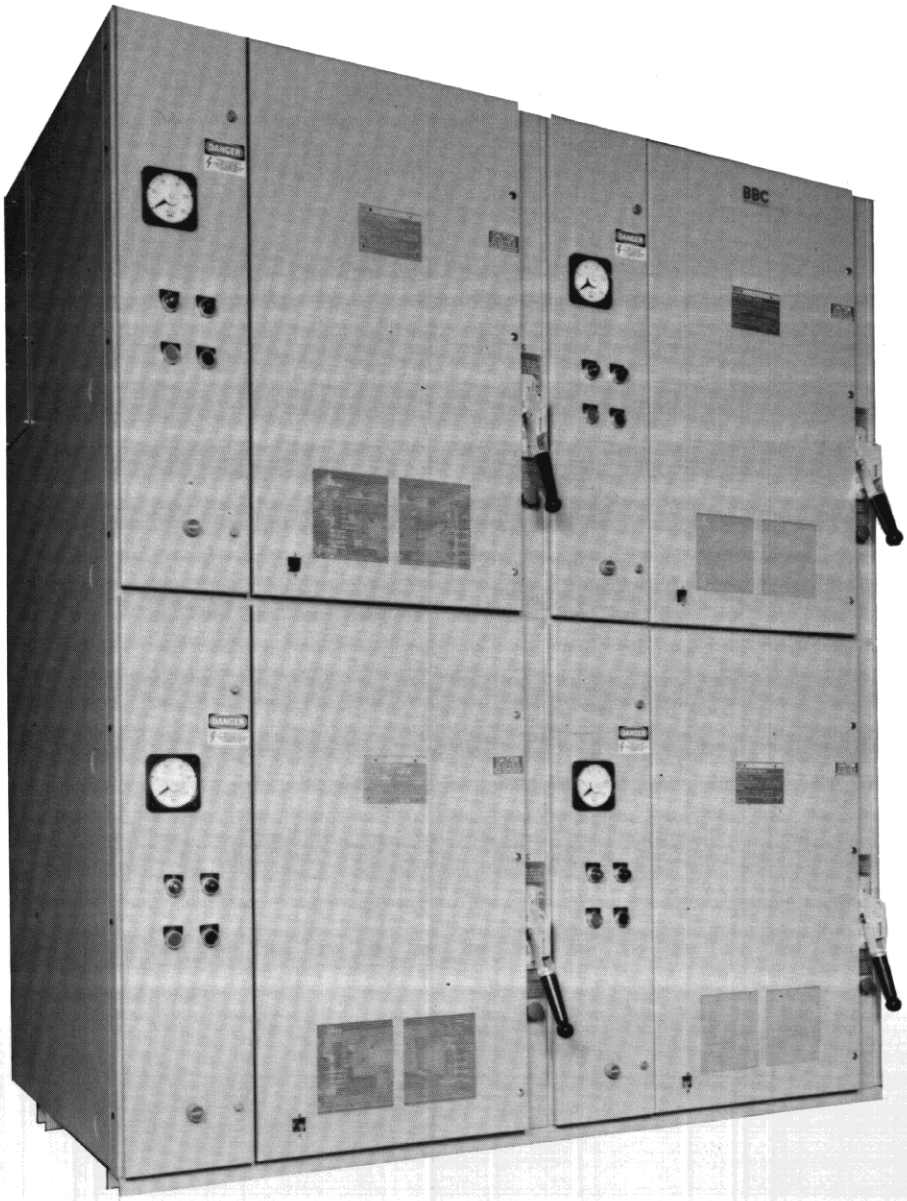
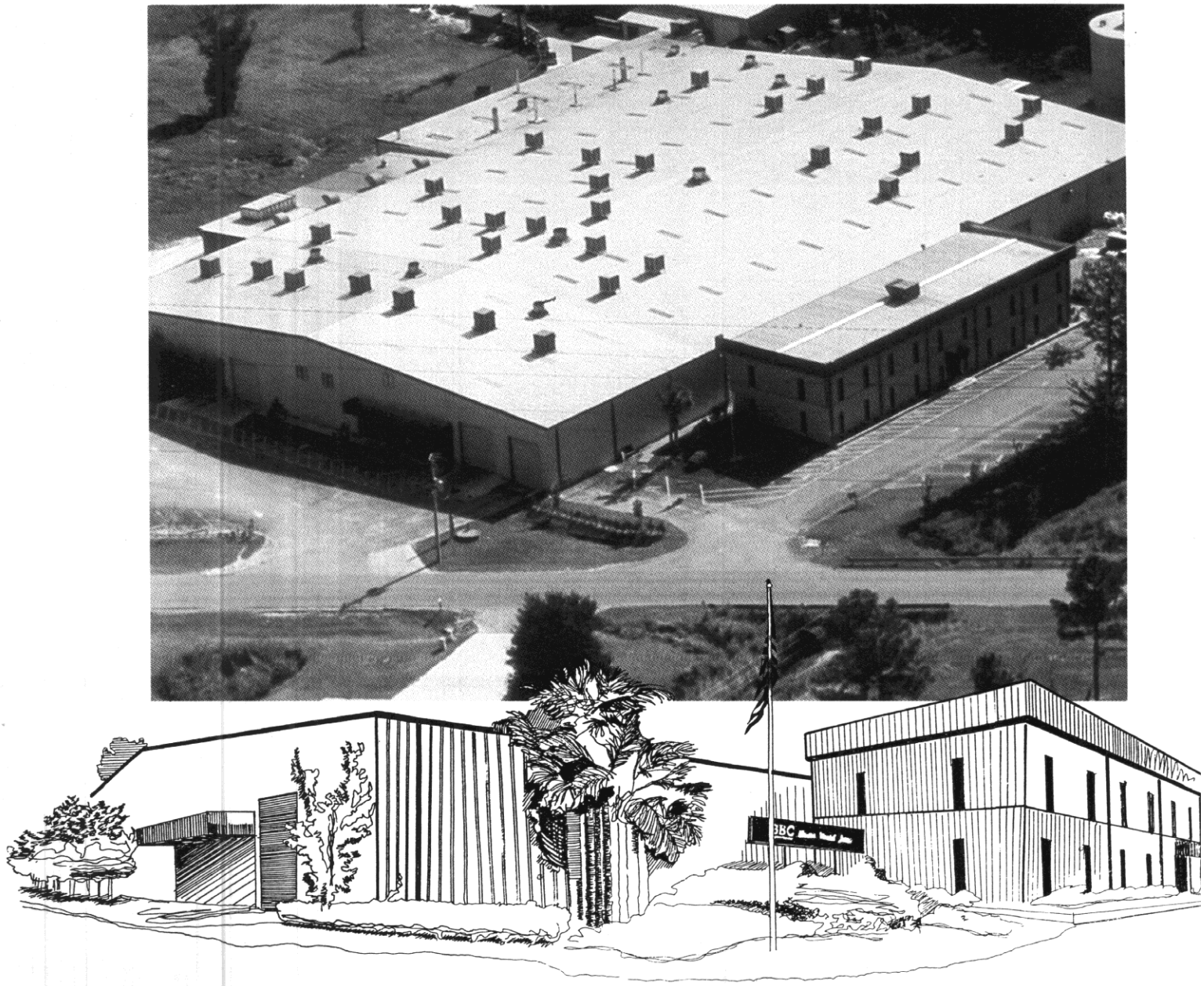
BROWN BOVERI

- Compact contactor for 400-ampere applications
- Extra wiring room
- Internal bussing
- Overall space savings
- All wiring accessible from front
- All current-carrying parts made of copper
- Easy to inspect
- Several exclusive features, including blown fuse indication
- Self-contained control transformer
- Adapts easily to changing motor needs



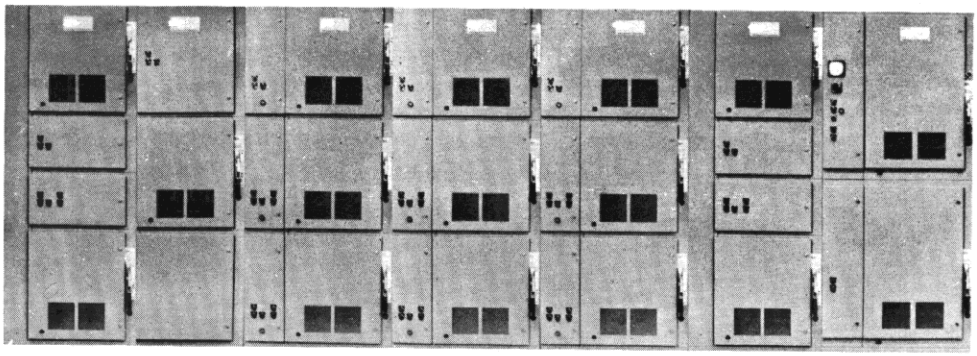
Series 7850VAC Medium Voltage Motor Starters

BBC



Manufacturing and office facilities, Sanford, Florida.

Series 7850VAC Medium-Voltage Vacuum Motor Starters



A new answer to some old problems

You always wished someone would pack more starter in less space. Or that someone would design some real innovations that would make a starter truly flexible. Well, BBC has done it with the new 7850VAC—a high-voltage, high-current motor starter that complements BBC's distinguished line of switchgear products.

The 7850VAC is not just an ordinary high-voltage starter. It's one that takes advantage of the well-known expertise of BBC in medium voltage.

Mix and Match

In step with the trend to ever higher voltages and larger motors, BBC has applied the latest advances in insulating materials to come up with a rugged, compact NEMA H3 Class E1 and E2 motor starter designed for 400 amperes, fusible for up to 6900 volts—and does it in five different modular enclosures. It's a design, in other words, that simplifies the whole approach to high-voltage motor control.

When you use it at 400 amperes, you get the size of a traditional 200-ampere starter—but you also get more wiring room than usual. Switching from one motor horsepower to another? Simply change fuses and heater coils. When changing from 2300 to 4160 volts simply change fuse clip spacing and fuses, re-coordinate overloads and change CPT.

Flexibility? It's all here. Floor or wall mounting. As many as three starter modules in the floor-mounted versions. In the past, you usually had to use starters and enclosures from the limited selection traditionally offered; then modify your installation to use what was available. With the Series 7850 that's all been changed. You can now tell BBC what you need and we will select from our very broad, flexible line of enclosures—and still the one basic starter—to come up with the equipment to meet your needs, whatever they are. On rare occasions, slight modifications of our standards will be in order, but they can be handled very simply. No need for you to change your system or layout to use the Series 7850.

A basic module is 29 inches wide by 30 inches high by 29 inches deep. Low-voltage compartments are integral on the side, or can be integrated into a two-high stack. Maximum height, no matter what the combination, is always 91½ inches with the floor sill—and that includes room for internal bussing and wiring.

With the operating handle mounted on the enclosure, plus other design features, you can install a starter for 400 Ampere service simply by plugging it in and adding whatever fuses you need.

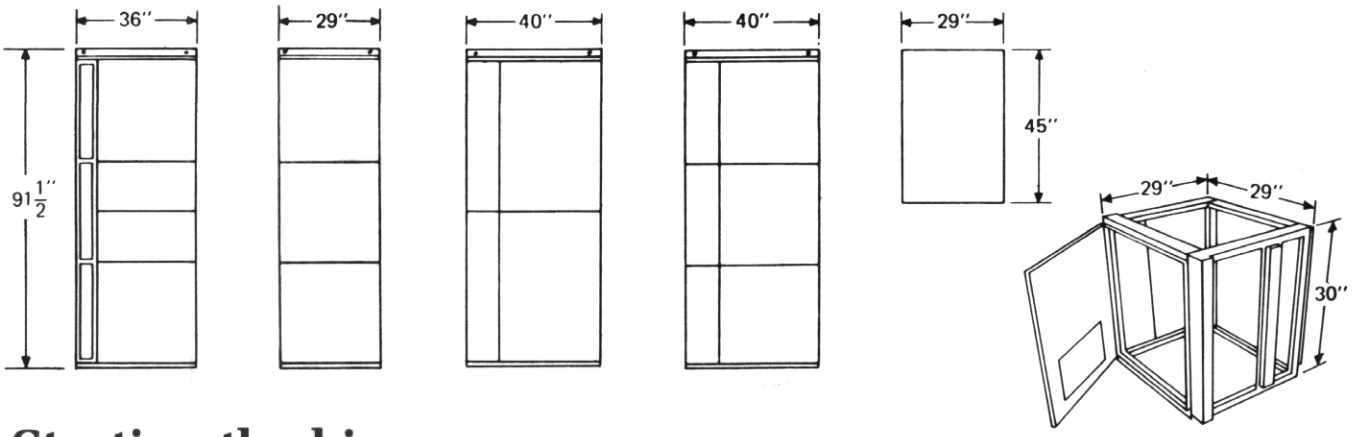
Another BBC exclusive is its use of Class 1C wiring method for high voltage. With three 30-inch modules you can have two starters in the lower modules and use the top as pull space—with a barrier above the starters. BBC will pre-wire the load wiring to the top module; you simply bring in your load connections to the top. (This approach requires both line and load stab aperture shutters.) No need to remove the starter to do any wiring. This type of arrangement is especially useful when installing the enclosures against a wall or for easy installation of stress cones.

The Series 7850, a mix-and-match concept at its best, uses a Class E1 contactor even though fusing is included. The unit meets NEMA requirements for interrupting capability of 50 MVA. But you can also get it with 200 or 350 MVA fuses. BBC is serious when it speaks of ruggedness.

And the starter incorporates some industry exclusives, such as the TRIGGER® bar for anti-single phasing; a visual ON/OFF indicator. (The DC used in the starting circuit is available from a rectifier that is an integral part of the starter.)

Is the 7850VAC really a revolutionary idea in starters? Follow us through the next few pages. Then judge for yourself.

Table of Contents



Starting the big ones

The 7850VAC motor starter represents a new concept in motor control. And it's targeted at those industries that have been among the first to take on higher voltages and larger motors... industries like chemical processing, paper manufacture, steel production, water treatment, mining, rubber making, construction. It's aimed at all types of installations where motors turn large pumps, compressors, fans and other devices that run a long time between starts.

Operating at 2200 through 6900 volts, 50-60 Hertz, the starter combines a sturdy, high-performance NEMA Class E1 contactor with the capabilities of a NEMA Class H3 starter. It's an industry first that means you get a rugged contactor, designed for higher-than-needed performance, in a fused starter.

It doesn't stop there. The starters are matched to a NEMA Size H3 controller and contactor, which makes them suitable for H2 and H3 service (200 and 400 amperes).

The result: a compact, tough, lightweight controller for 400-ampere service in a 200-ampere enclosure—yet still generous room for 400-ampere wiring. If your motor horsepower needs change, the 7850VAC changes right along with them. All you do is switch fuses and heater coils. As a bonus, a single design throughout translates into fewer spares, less inventory.

Choice of many enclosures

Five enclosures (four floor standing, one wall-mounted) accommodate virtually any starter combination. And they do it in less space than comparable starters now available.

The standard module is 29 inches wide, 29 inches deep and 30 inches high—though a 45 inch high version is available if needed. When assembled into a finished enclosure with side panels, the depth of the overall assembly is 36 inches.

The unusually low 30-inch height is only the beginning. Width has been shaved, too—to 29 inches. And, if space is at a real premium, and only one starter is needed, you can use the wall-mounted enclosure. You get the same flexibility, of course.

You can stack floor-mounted starters two or three high. Low-voltage controls can mount across the enclosure in 15-inch-high by 29-inch-wide compartments. Or they can be attached alongside the enclosure, adding 7 to 11 inches in overall width. You can stack three 400-ampere starters in one enclosure. If small width is vital, stack two starters and two low-voltage compartments. If not, put the low-voltage compartments alongside and get an extra starter in the same 91½-inch height.

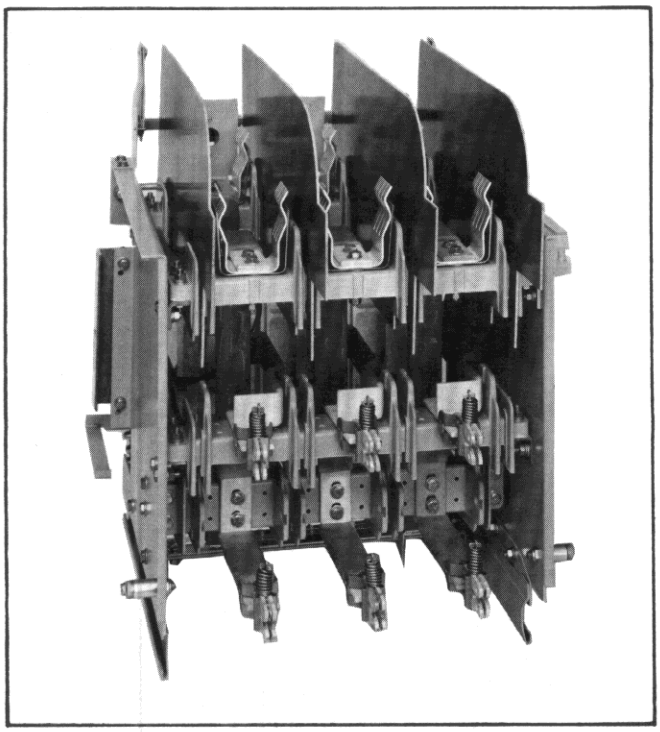
Types of 7850VAC Series Medium-Voltage Motor Starters

Squirrel Cage
Full voltage (non-reversing)
Full voltage (reversing)
Reduced voltage primary reactor (non-reversing)
Reduced voltage autotransformer (non-reversing)
Full voltage mechanically latched contactor (non-reversing)
Synchronous
Full voltage (non-reversing)
Full voltage brushless (non-reversing)
Reduced voltage primary reactor (non-reversing)
Reduced voltage autotransformer (non-reversing)
Fused or non-fused load-break switch

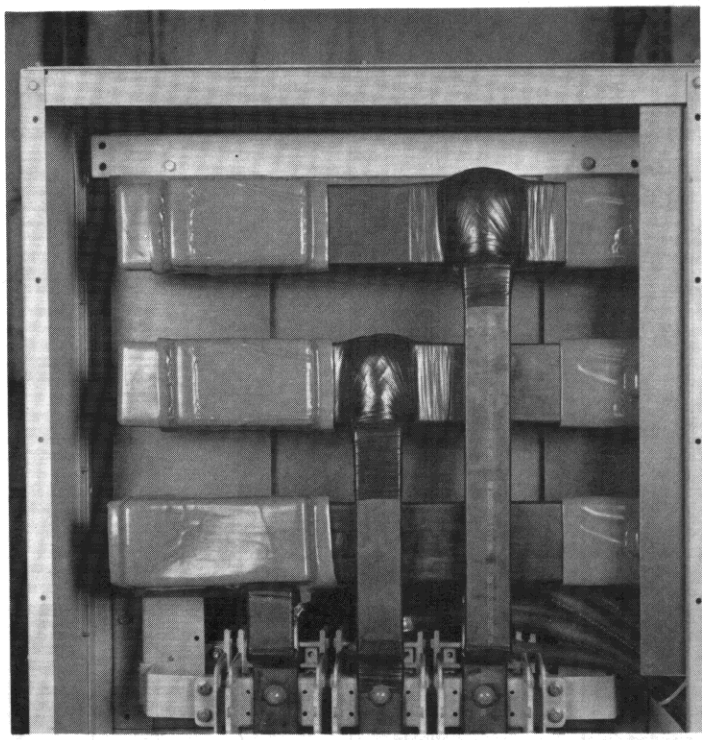
Note: For wound-rotor motors, contact the factory for details.

Maximum Ratings, NEMA Class E2

Ratings	2.5 kV 50 or 60 Hz	5kV 50 or 60 Hz
Squirrel Cage Motor HP	1750 HP	3000 HP
Synchronous Motor HP (1.0 PF)	2000 HP	3500 HP
Interrupting Ratings (Sym.)	200 MVA	400 MVA
Basic Impulse Level Rating	60 kV	60 kV



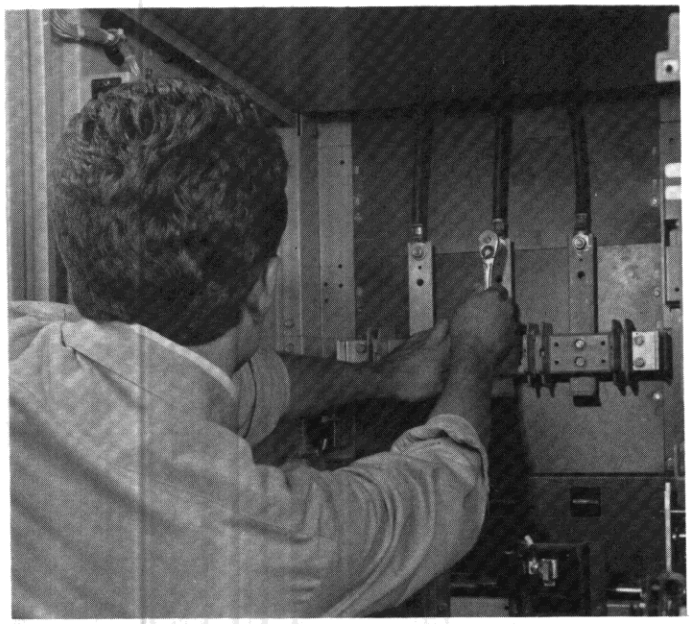
The latest insulating materials and a number of design innovations make the 7850VAC the most compact, yet rugged, 400 ampere starter ever built.



The bus fits inside

No need for added enclosure height

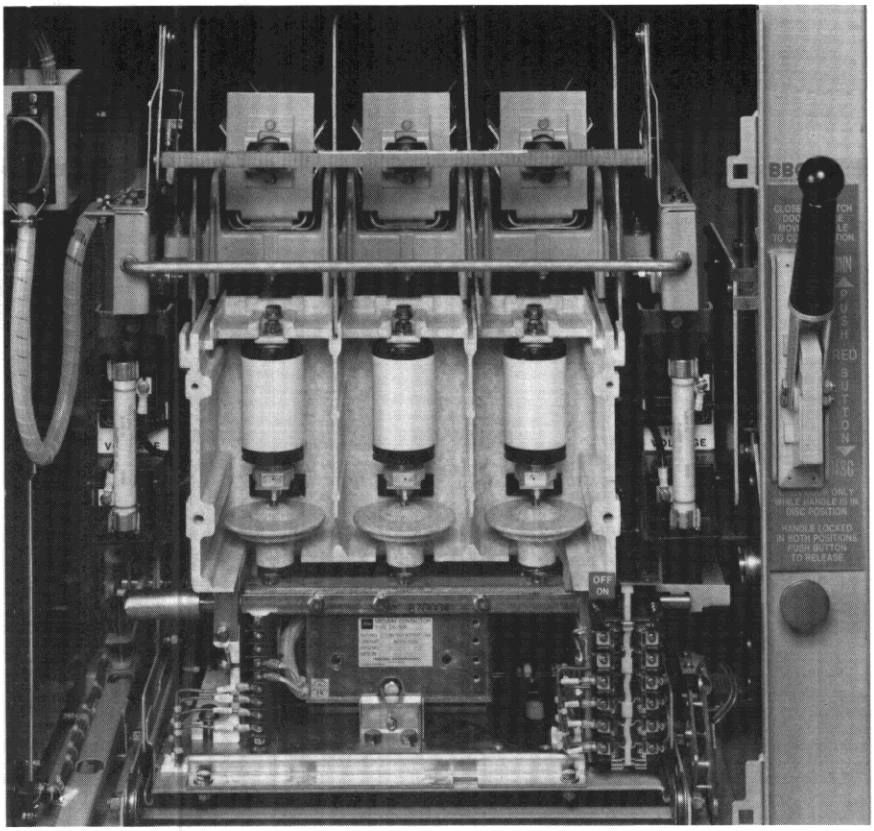
There's no additional compartment along the top of the 7850 enclosure to house bus. It all fits snugly inside—in any one of three locations in the rear. The main bus, braced for 55,000 AIC, is at the rear of the enclosure. Again there's no increase in enclosure size. When BBC says maximum enclosure height 91½ inches, it's exactly that. Horizontal bus is rated for 1200 or 2400 amperes—and it's all copper, silver plated.



Room to maneuver

Field changes a snap

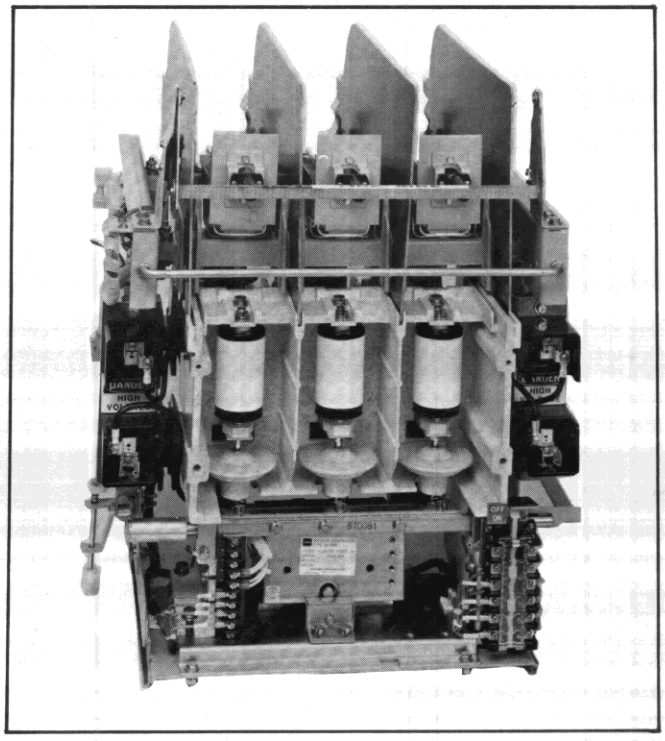
Compress a starter into a more compact unit, and the immediate effect is to create more room for hand tools, elbows and fingers. That's what BBC has done in designing its 7850 Series starter from the ground up. Notice the room available for a 400-ampere starter. Then imagine what it would be if you were using it for 200-ampere service with smaller cable diameters.



Built-in protection for maximum safety

Starter and motor protection provided with blown fuse protection

With the 7850VAC starter, one blown fuse won't do you in. You get this exclusive: the TRIGGER® bar, which gives better protection against damage from single phasing than separate anti-single phasing relays. When a fuse blows, the TRIGGER pops out the bottom of the blown fuse, moves a bar down, and opens all three phases. Conventional triggers do exist, of course, but just as indicators that show which fuse has blown. No one else has the bar to simplify and increase reliability of anti-single phasing protection.

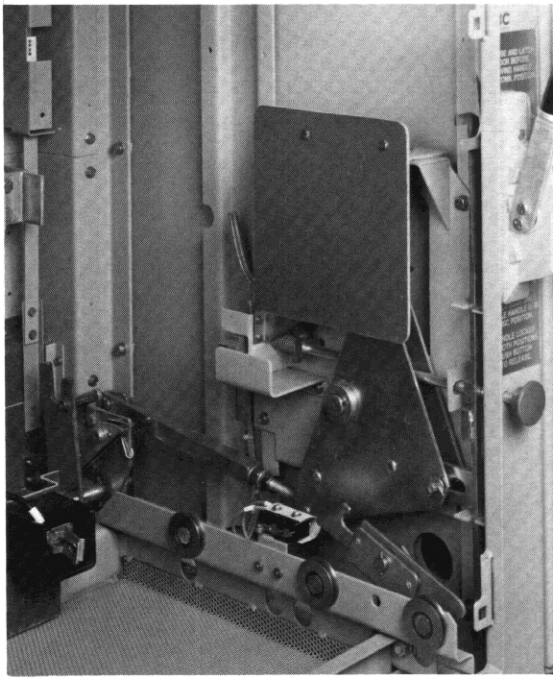


Small, light, easy to handle

Expansion easy, too

Newer insulating materials and design innovations mean more compactness in a high-amperage design. They also slice excess weight and reduce bulkiness to ease installation.

Compact starter enclosures offer yet another benefit. Since they take up less room, it's easy to install a 91½-inch cubicle with only one starter—or two—leaving space for future expansion. When you grow, it's a simple matter to mount current transformers, a low-voltage control panel, and necessary door equipment. (The drawout mechanism and line terminal shutter assembly are already in place.) The contactor and fuse assembly can simply be lifted into place, and you're ready to go.



Foolproof Interlock

You can't get in with high voltage on

The interlock system of the 7850VAC starter is safety–simplicity–personified. Nothing happens when you try to move the flange-mounted handle down with one hand without depressing the release button with the other. When both hands are safely in place, moving the handle down draws out the contactor and fuse assembly, automatically disconnecting both line and load connections and electrically isolating the starter. Try to move the handle up with the door open: it won't budge. When–and only when–the door is shut properly, raising the handle re-engages the contactor and fuse assembly with the line and load.

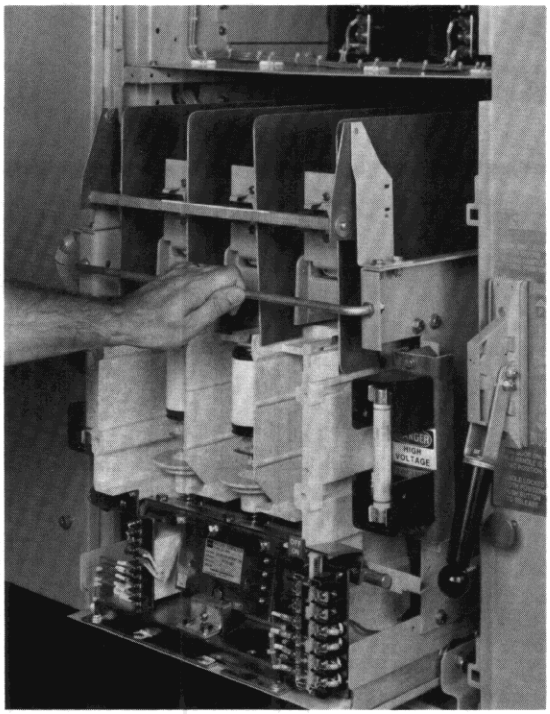
Put another way, the interlock system is a series of "can'ts." You can't withdraw an energized high-voltage unit because the interlock rotates with it, mechanically mating with the track bracket to lock it in place. You can't close the contactor unless it's positively engaged with the line stabs. You can't open the compartment door unless high voltage disconnects correctly. You can't close the interlock with the door open.

A hidden defeater mechanism requires removal of a large diameter screw to give access to the actual defeater screw, which is of smaller diameter.

All of the interlock protection is made even more effective with a new disconnect arrangement now available. The disconnect is an integral part of the starter, not a separate unit or attachment. When the isolating switch handle is moved, three things happen: the line connections are shuttered closed; the starter is automatically grounded; and the primary of the control transformer is opened. With the disconnect an integral part of the starter, all of these functions, together with the basic disconnect functions, provide completely positive isolation and interlocking, electrically and mechanically.

Going one step further, in terms of safety, the enclosure isolates control wiring from high-voltage cables. On all floor-mounted enclosures, separation is made positive by the design of the Series 7850 line. Enclosures with separate doors are available to give access to the two separate compartments–the starter module and the control wiring compartment. On wall-mounted enclosures, there's a removable barrier inside the single door–to separate the high and low voltages. This latter type of separation is also available in floor-mounted enclosures. All control wiring is up front, motor connections are in the rear, but are front accessible.

In the control compartment, two N/O and two N/C contacts are standard for any use desired. Also standard is undervoltage protection that requires manual resetting unless a time-delay device is specified.



Simple drawout–rugged, too

Safe, fast, easy to test

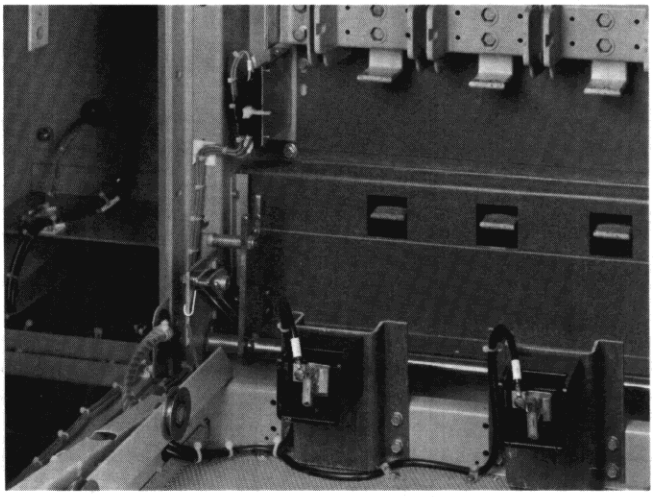
The totally self-contained drawout mechanism keeps all wheels and moving parts right in the enclosure. Wheels in the enclosure instead of on the contactor and fuse assembly mean you get a lighter assembly–and no frustrations from bent wheels when you're in a hurry to get in and out of the compartment. Convenient handles make it easy to move the unit. And when it moves, it glides easily to the front end of the enclosure for maximum accessibility. The starter assembly automatically latches in the TEST position when drawing it out. To move it either in or out from the test position, a manual release lever must be operated.

In testing, there's no need to remove the control cable or connect separate test leads. The Series 7850 starter comes with a built-in test switching circuit (standard) that by-passes the control transformer secondary, allowing the user to apply 110 V AC for checking the unit in the test position. A safety limit switch prevents energizing the control circuit with the test switch in the ON position.

Shutting out unwary fingers

Line terminals hidden by safety shutter

With the contactor in place, its stabs connect it through the rear compartment wall to the line terminals. With the contactor disengaged, the rear-wall apertures could expose the fingers of an unsuspecting electrician to high voltage. They could. But they won't. Sliding shutters cover the line terminals when you activate the drawout mechanism. When re-inserting the contactor, the shutter rises to accept contactor stabs and re-engage the terminals behind the insulating wall. (One available option is shutters for the load connection.)

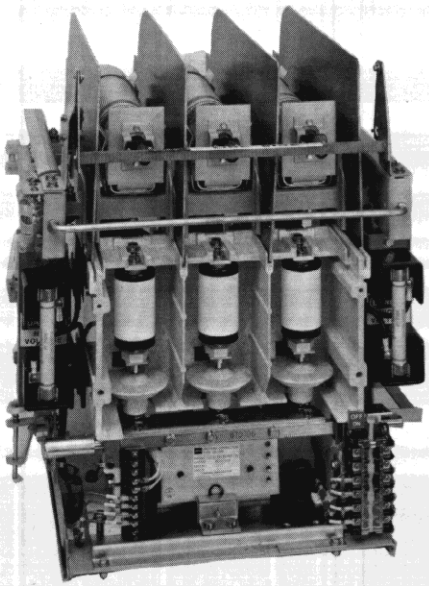


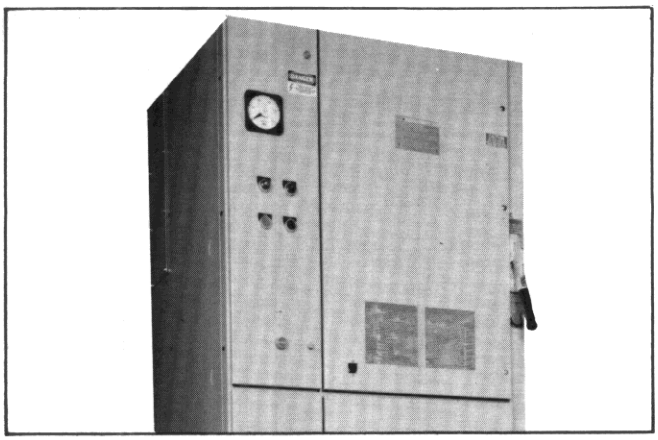
Going from 2300 to 4160 volts

Easy as 1-2-3

That's right. All you do is move the fuse clips and change fuses, overloads and CPT. The starter sits still–no wiring changes, the same ampere rating, no cumbersome replacement of one unit with another. One size starter fits all. And fuses are isolated by removable barriers, simplifying replacement.

BBC calls it design flexibility. You'll probably call it a God-send. Particularly if your motor needs change from time to time... or if you've surveyed your spare parts inventory lately.

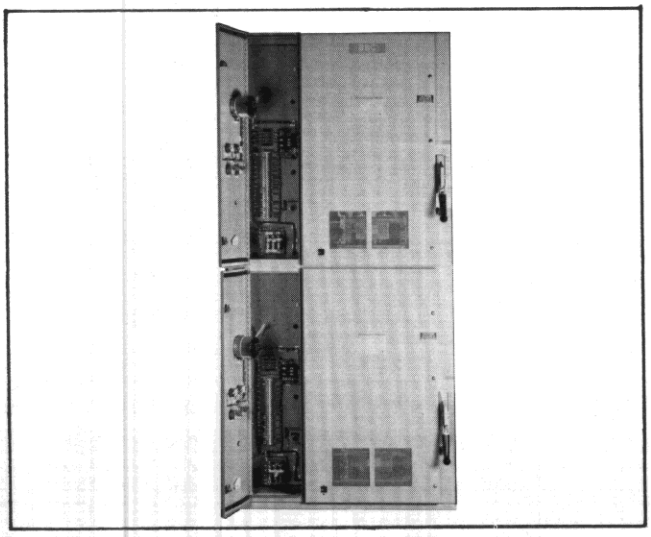




Control starter from one panel

No need to open door to reset

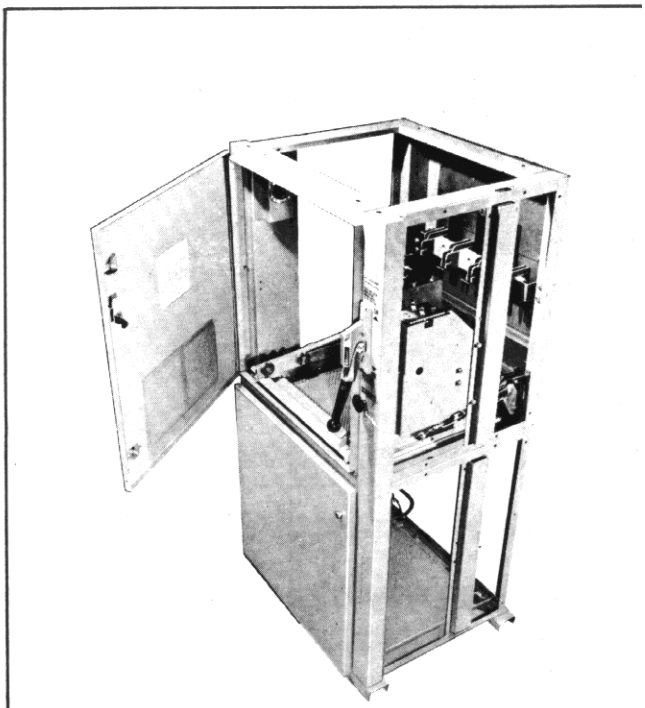
The low-voltage compartment houses all the meters and pushbuttons necessary for starter operation. One handy extra: the overload relay can be reset *without* opening the compartment door. Another: in addition to the connected/disconnected indication on the door handle, an indicator to the lower left of the starter compartment door shows whether the contactor is energized. It's a mechanical device positioned by the contactor magnet. You can tell whether the contactor is open or closed at a glance.



Control wiring segregated

In the enclosure shown here, the side-mounted low-voltage compartments, each with its own door, contain all necessary control wire harnesses and ambient-compensated overload relays for their respective starters.

Overload protection never varies—even after repeated closings. But, if desired, magnetic type or switchboard overcur-



Built to last

Welded construction, removable barriers

Series 7850 is built to take abuse. Rugged, heavy gage steel and welded modular construction make the difference.

Enclosures meet the requirements of NEMA 1 service—and optional NEMA types 3 and 12 are available for various environments.

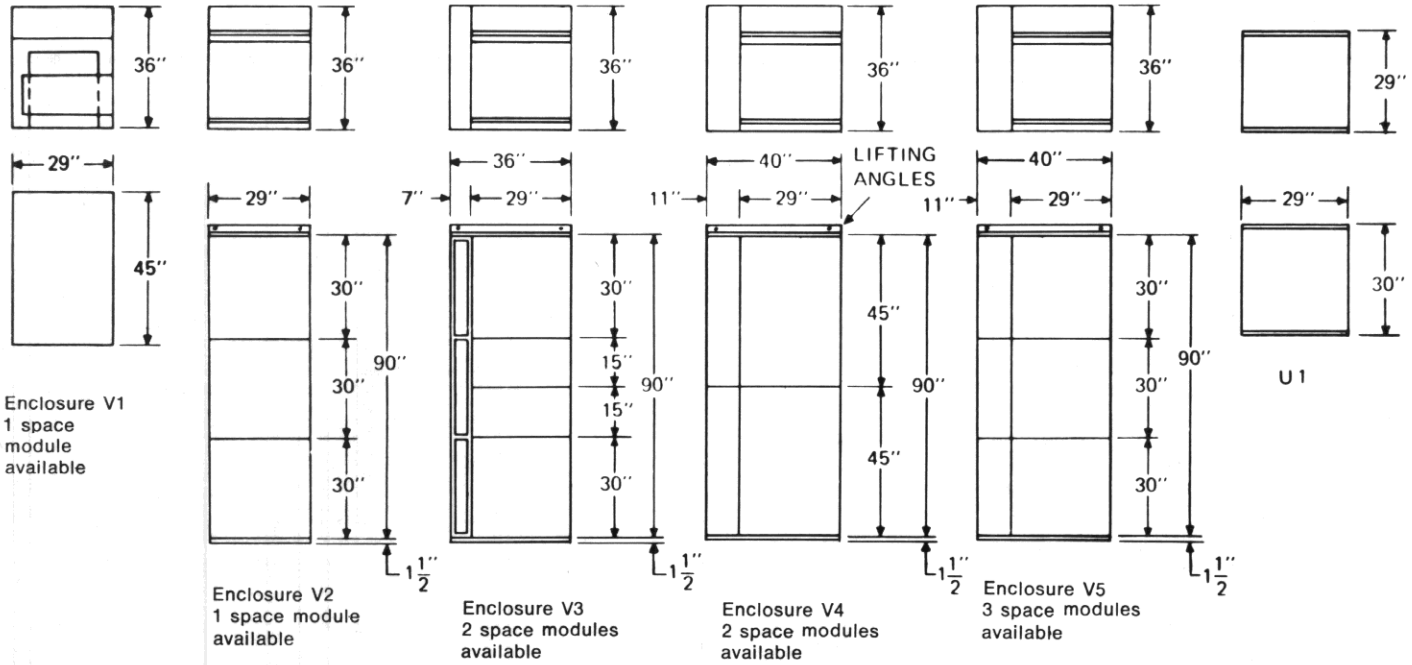
Removable barriers isolate accessible power and control fuses, simplifying fuse and contact changes.

Heat buildup poses no hardship either. Starter module doors and the horizontal separations have ventilation openings to dissipate heat. Also a louvre at the top of the enclosure means even better heat dissipation. The louvre is shielded from dust and moisture entering the starter module from above.

Durable enclosure finish

Finish, too, stands up to long use. The ANSI-61 gray color goes on electrostatically in polyester dry powder form. It's then cured at 425°F. When ready for shipment, the finish meets a 500-hour salt spray test. Even indoor equipment

Enclosure Dimensions and Data



Enclosure V1
1 space module available

Enclosure V2
1 space module available

Enclosure V3
2 space modules available

Enclosure V4
2 space modules available

Enclosure V5
3 space modules available

7850VAC Medium Voltage Starters

Types, Available Horsepowers, Standard Components

SQUIRREL CAGE

Maximum Horsepower		Standard Components	Space Modules
FNVR Full Voltage Non-Reversing[2]			
2200-2400V	4000-4800V		
700 1000 1250 1500	700 1000 1250 1500 2500	1—400A, 50 MVA, 3-pole drawout contactor 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—1KVA Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Pushbutton 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers[1] 1—Test Switch & Circuit	1
FVR Full Voltage Reversing[2]			
2200-2400V	4000-4800V		
700 1000 1250 1500	700 1000 1250 1500 2500	2—400A, 50MVA, 3-pole drawout contactors, mechanically interlocked 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—1KVA Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Pushbutton 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers 1—Test Switch & Circuit	2[4]

Maximum Horsepower		Standard Components	Space Modules
RVPRNR Reduced Voltage Primary Reactor Non-Reversing[2]			
2200-2400V	4000-4800V		
100 200 400 700 1000 1250 1500	100 200 400 700 1000 1250 1500 1750 2000 2250 2500	2—400A, 50MVA, 3-pole drawout contactors 3—Current Limiting Fuses 1—Anti-Single Phase Protection 1—Primary Reactor with 50, 65 & 80% voltage taps 1—Automatic Transfer Relay 1—Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Bushbutton 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers[1] 1—Test Switch & Circuit	3[4]
RVATNR Reduced Voltage Autotransformer Non-Reversing[2]			
2200-2400V	4000-4800V		
100 200 400 700 1000 1250 1500	100 200 400 700 1000 1250 1500 1750 2000 2250 2500	2—400A, 50MVA, 3-pole drawout contactors 1—400A, 50MVA, 2-pole drawout contactors 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—Autotransformer, 50, 65 & 80% voltage taps 1—Automatic Transfer Relay 1—Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Pushbutton 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers[1] 1—Test Switch & Circuit	4[3]

[1]Standard CTs suitable for standard overcurrent protection and one panel type ammeter; for non-standard, substitute with instrument type CT modification No. 6.

[2]Select enclosure from page 10.

[3]Consult factory for arrangement.

[4]Space modules indicated must be available in one vertical section.

7850VAC Medium Voltage Starters

Types, Available Horsepowers, Standard Components

SYNCHRONOUS

FVSNR Full Voltage Synchronous Non-Reversing[2]

Maximum Horsepower				Standard Components	Space Modules
2200-2400V		4000-4800V			
1.0PF	0.8PF	1.0PF	0.8PF		
				1—400A, 50MVA, 3-pole drawout contactor 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—1KVA Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay 1—Start/Stop Pushbutton	1
900	700	900	700	3—Ambient Compensated Thermal Overload Relays	
1250	1000	1250	1000		
1500	1250	1500	1250	3—Current Transformers[1]	2[4]
1750	1500	1750	1500	1—Test Switch & Circuit 1—AC Ammeter 1—DC Ammeter 1—DC Field Contactor with field discharge contact 1—AC/DC Relay 1—Squirrel Cage Protector Relay 1—Field Discharge Resistor 1—Automatic Field Application Removal System using a polarized field frequency relay	
		3000	2500		

FVBSNR Full Voltage Brushless Synchronous Non-Reversing[2]

Maximum Horsepower				Standard Components	Space Modules
2200-2400V		4000-4800V			
1.0PF	0.8PF	1.0PF	0.8PF		
				1—400A, 50MVA, 3-pole drawout contactor 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Pushbutton	
900	700	900	700	3—Ambient Compensated Thermal Overload Relays (external reset)	
1250	1000	1250	1000		
1500	1250	1500	1250	3—Current Transformer[1]	2[4]
1750	1500	1750	1500	1—Test Switch & Circuit 1—Exciter Field Contactor 1—Incomplete Sequence Relay 1—DC Power Supply 1—Field Discharge Resistor 1—Powerstat for exciter-field adjustment 1—Exciter-field Loss Relay 1—Pull-out Relay 1—AC Ammeter 1—DC Ammeter	
		3000	2500		

[1] Standard CTs suitable for standard overcurrent protection and one panel type ammeter; for non-standard, substitute with instrument type CT modification No. 6.

[2] Select enclosure from page 10.

[3] Consult factory for arrangement.

[4] Space modules indicated must be available in one vertical section.

Consult factory for 6900 volt starters.

RVSPRNR Reduced Voltage Synchronous Primary Reactor Non-Reversin

Maximum Horsepower				Standard Components	Space Modul
2200-2400V		4000-4800V			
1.0PF	0.8PF	1.0PF	0.8PF		
				2—400A, 50MVA, 3-pole drawout contactors 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—Primary Reactor, 50, 60 & 80% voltage taps 1—Automatic Transfer Relay 1—Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers[1] 1—Test Switch & Circuit 1—AC Ammeter 1—DC Ammeter 1—DC Field Contactor with field discharge contact 1—AC/DC Relay 1—Squirrel Cage Protector Relay 1—Field Discharge Resistor 1—Automatic Field Application Removal System using a polarized field frequency relay	
125	100	125	100		
250	200	250	200		
500	400	500	400		
900	700	900	700		
1250	1000	1250	1000		
1500	1250	1500	1250		4[3]
1750	1500	1750	1500		
		2000	1750		
		2500	2000		
		3000	2500		

RVSATNR Reduced Voltage Synchronous Autotransformer Non-Reversin

Maximum Horsepower				Standard Components	Space Modules
2200-2400V		4000-4800V			
1.0PF	0.8PF	1.0PF	0.8PF		
				2—400A, 50MVA, 3-pole drawout contactors 1—400A, 50MVA, 2-pole drawout contactor 3—Power Current Limiting Fuses 1—Anti-Single Phase Protection 1—Autotransformer, 50, 65 & 80% voltage taps 1—Automatic Transfer Relay 1—Control Transformer with 2 primary and 1 secondary current limiting fuses 1—Master Control Relay (2NO & 2NC) 1—Start/Stop Pushbutton 3—Ambient Compensated Thermal Overload Relays (external reset) 3—Current Transformers[1] 1—Test Switch & Circuit 1—AC Ammeter 1—DC Ammeter 1—DC Field Contactor with field discharge contact 1—AC/DC Relay 1—Squirrel Cage Protector Relay 1—Field Discharge Resistor 1—Automatic Field Application Removal System using a polarized field frequency relay	
125	100	125	100		
250	200	250	200		
500	400	500	400		
900	700	900	700		
1250	1000	1250	1000		
1500	1250	1500	1250		5[3]
1750	1500	1750	1500		
		2000	1750		
		2500	2000		
		3000	2500		

LOAD BREAK INTERRUPTER SWITCHES[2]

NON-FUSED		
Maximum KVA		Space Modules
2200-2400 Volts 60HZ	4000-4800 Volts 60HZ	
1000	1000 2500	2
FUSED		
200 500 750 1000 1500	200 500 750 1000 1500 2500	3

NON-REVERSING CONTACTORS[2]

FVMLNR—Full Voltage Mechanically Latched		
Maximum KVA		Space Modules
2200-2400 Volts 60HZ	4000-4800 Volts 60HZ	
500 700 1000	500 700 1000 2000	1

Catalog Number	Description & Dimensions
7850-U1	Open Starter Cell, with Controller, and Fuse Clips, Less Fuses and Control Transformer, 29" W × 30" H × 29" D

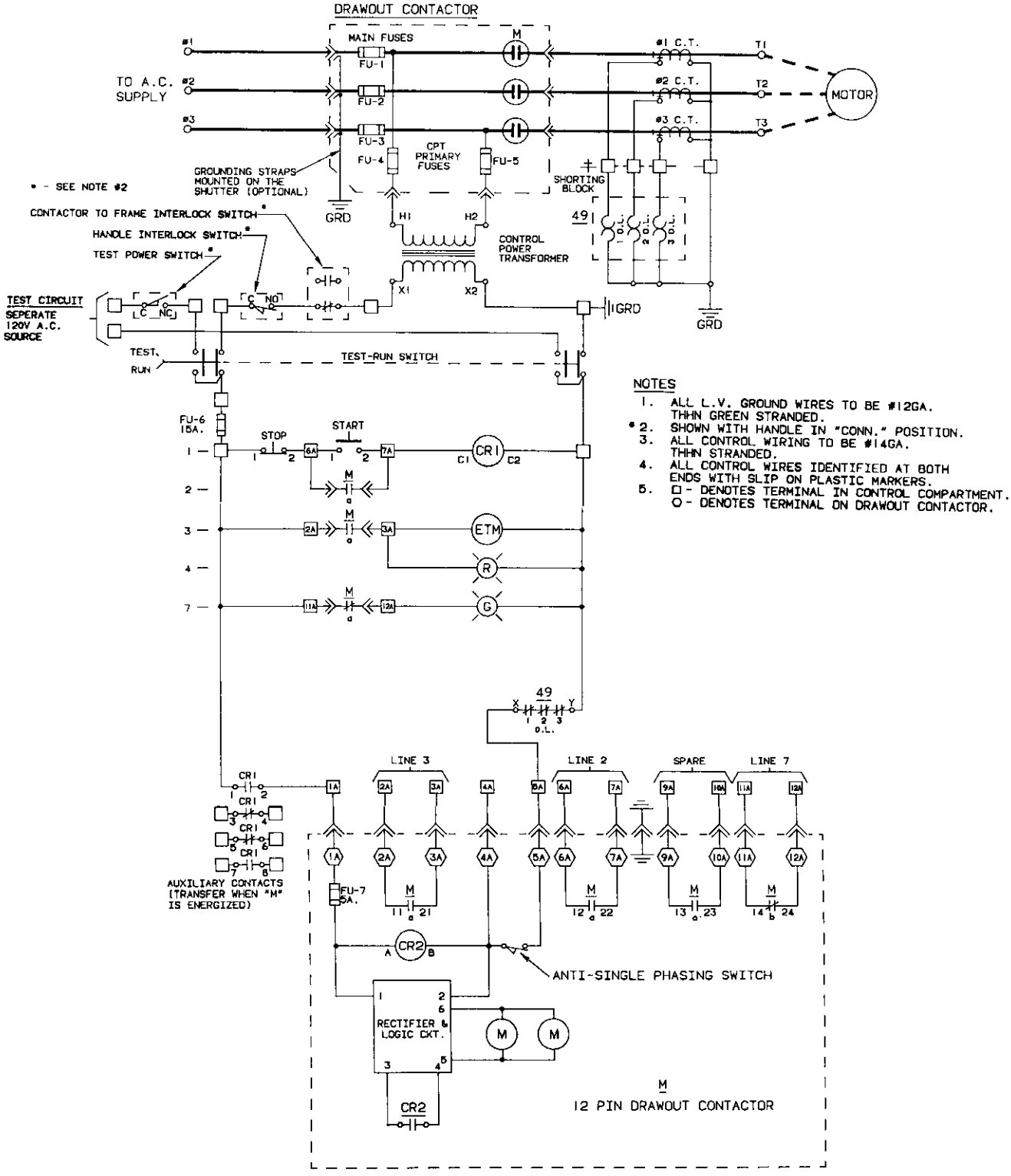
STARTER MODIFICATIONS

Modification No.	Item Description
	CONTROL CIRCUIT MODIFICATIONS
	Control Transformers, Space Heaters, etc.
	1KVA (2400V/120V or 4160V/120V or 4800V/120V) Control Transformer 500VA Extra capacity available for customer use (standard)
—1	1000VA Extra Capacity
—2	110V/220V Control Trans. for Motor Space Heater
—3	Cabinet Space Heater (150 watts) wired to Normally Closed Contact
—4	Cabinet Space Heater (150 watts) with manual "ON-OFF" Switch
—5	Cabinet Space Heater (150 watts) with Thermal Switch for temperature regulation
	Current Transformers
	3-current Transformers suitable only for a panel type Ammeter and Thermal Overload Relays (standard)
—6	Substitute Instrument Type—Current Transformer for Standard
—7	Current Transformers—Instrument Type (1) 400/5 Maximum (2) 600/5 Maximum (3) 1200/5 Maximum
—8	Current Transformer Surge Protection
	Potential Transformers
	Potential Transformer-Instrument Type
—9	(1) 2200-2400V 60 Cycles
—10	(2) 4000-4800V 60 Cycles
—11	Draw-out Mechanism for each Potential Transformer
—12	Potential Circuit Cabling (This is required when one set of P.T.'s is used for more than one starter)
	Miscellaneous (Safety Interlocks, etc.)
—13	Circuit Breaker substitute for Low Voltage Control Fuse
—14	Additional Circuit-Breaker 2-Pole 120/240V 15A AC for Control Circuit
—15	Control Circuit Cabling, including 120V Disconnect Switch. (This is required when control circuit power is obtained from separate source, rather than integral mounted control trans.)
—16	Extra Control Wires—Connected to Terminal Strip
—17	Door Operated Interlock
—18	Wire Markers Per Squirrel Cage Starter
—19	Per Synchronous Starter Contactor Control Circuit Contacts 2NO & 2NC (standard)
—20	Additional Auxiliary Contacts NO or NC Maximum of 12 available for customer use
—21	Thyrite or Resistor used as Load-Sensing Device for Air Conditioners
—22	Mechanically Latched Control Relay (4-Pole Maximum)
—23	Pneumatic Timer
—24	Motor Driven Timer
—25	Incomplete Sequence Relay
	Protective Relays
	Ambient Compensated Thermal Overload Relay —3 Pole (with Standard Current Transformers) (standard)
—26	N.O. Contact on Overload Relay (not available on magnetic overloads)
—27	Magnetic Overload Relay
—28	Locked Rotor OL (Stalled Protection)[1]
—29	Time Delay Undervoltage Circuit
—29A	Undervoltage and Overvoltage Relay
—30	Under Current Relay
—31	Ground Fault Protection for Grounded System including Donut type C.T. and Pilot Light mounted on door. Will fit in Standard Starter (Specify Manual or Electric Reset)
—32	Reverse Phase—Phase Failure Relay[1]
—33	Phase Balance Current Relay[1]
—34	Differential Current Relay[1]
—35	Temperature Relay for Operation from (1) 10 OHM Resistor Temperature Detectors (RTD)[1]
—36	(2) Thermistor Unit(s) Mounting and Wiring only. (Guardistor, Motor Guard, etc.)
—37	Switchboard Type Overcurrent Relay[1]
	PILOT DEVICES
—38	Start-Stop Pushbutton (standard)
—39	Hand-off-auto Selector Switch (standard)
—40	Indicating Light (Specify color)
—41	Push-to-Test Indicating Light
—42	Other Push Button Units
—43	Maintained Contact Pushbutton
	POWER CIRCUIT MODIFICATIONS
—44	Power Bus-Silver Plated (Copper) 1200A
—45	2400A
—46	Ground Bus-Silver Plated-(Copper) ¼ x 1"
—47	Insulation for Power Bus
—48	Prepared Space for future mounting of full voltage, non-reversing starter
—49	Pothead (one 3 phase unit or 3 single phase units) G & W Type NT or TRA. (Give cable size with order)
—50	Power Factor corrective Capacitors—3 phase with fuses KVAR 25 50 75 100 125 150 200 250
—51	Surge Capacitor—3 phase (1) 2200-2400 Volts (2) 4000-4160 Volts (3) 4600-4800 Volts
—52	Distribution Type Lightning Arrestors, 3 phase (1) 3000 Volts (2) 6000 Volts
—53	Station Type Lightning Arrestors—3 phase (1) 3000 Volts (2) 6000 Volts
	METERING EQUIPMENT (MOUNTED)
—54	AC Ammeter—Panel Type
—55	AC Ammeter—Switchboard Type (180° or 250° Scale)[7]
—56	Recording Type AC Ammeter[7]
—57	Ammeter Transfer Switch
—58	AC Voltmeter—Panel Type
—59	AC Voltmeter—Switchboard Type (180° or 250° Scale)
—60	Recording Type AC Voltmeter[2]
—61	DC Voltmeter
—62	Voltmeter Transfer Switch[2]
—63	Combination Ammeter & Voltmeter Transfer Switch[2]
—64	Watthour Meter (Drawout Type)[7]
—65	Watthour Meter with Demand Register[7]
—66	Wattmeter[7]
—67	Recording Type Wattmeter[7]

Modification No.	Item Description
—68	Varmeter[7]
—69	Power Factor Meter[7]
—70	Frequency Meter
—71	Elapsed Time Meter
—72	Operation Counter
—73	Test Blocks (1) 4 Pole (2) 6 Pole (3) 8 Pole (4) 10 Pole
	NEMA 1 Enclosure[3]
	ENCLOSURE MODIFICATIONS
—74	Gasketed doors for NEMA 1 enclosure
—75	Gasketed door for Wall Mount Str.
—76	Steel bottom plate for NEMA 1 enclosure
—77	NEMA 12 Enclosure
—78	NEMA 3 (Non walk-in enclosure)
—79	NEMA 3 (Walk-in enclosure)[5]
—80	Window in door of NEMA 3 enclosure
—81	Key Interlock (Kirk-Key)
—82	NEMA 1 Top Hat
—83	NEMA 3 Top Hat
	Throat Connection 36″ long max. —
—84	(1) 1200A NEMA 1
—85	(2) 1200A NEMA 3
—86	(3) 2400A NEMA 1
—87	(4) 2400A NEMA 3
—88	Incoming Line Section—(24″ wide vertical section) 91½″ high
	TRANSITION SECTIONS (NEMA 1)
	24″ wide, 36″ deep, 91½″ high
—89	1200A
—90	2400A
	SYNCHRONOUS MOTOR STARTER MODIFICATIONS:
—91	Equipment for Field Excitation Motor Field Resistor or Rheostat if an existing source is supplying direct current at a fixed voltage, adjustment of the field excitation can be made by means of a resistor (with adjustable taps) or a rheostat in series with the field (1) 1.0 KW (2) 1.5 KW (3) 2.0 KW (4) 3.0 KW (5) 5.0 KW (6) 7.5 KW (7) 10.0 KW (8) 15.0 KW (9) 20.0 KW
—92	Static Exciter Consisting of 3 phase fused transformer, silicon rectifiers and surge protective device connected to the loadside of contactor.
	The static exciter package provides ac to dc power conversion required for individual synchronous motor field excitation. No field rheostat or resistors required since voltage adjustment can be made on static exciter transformer by changing taps. Input: 2300/4160 volts, 3 phase, 60 Hz. Output: 125 or 250V DC
—93	(1) NEMA Size 1
—94	(2) NEMA Size 2
—95	Cabling to Feed more than one—Synchronous Motor Field from a Single Source (1) 250 amp 2 wire per section (2) 500 amp 2 wire per section (3) Fused Disconnect Switch with Discharge Circuit (required for each Starter connected to separate dc excitation source)
—96	**Exciter Field Rheostat** If a separate motor-generator (M-G) set is used to supply the motor field excitation, the exciter field rheostat is used to adjust the generator voltage. Rheostat is mounted in door of starter. (1) Drilling only for customer's rheostat (2) Mounting and wiring of customer's rheostat (3) Rheostat supplied, mounted & wired
	Relays for Synchronous Motors
—97	Field Loss Relay
—98	Pull Out Relay
	ACCESSORY AND SPARES
—99	Parts Kit for making empty compartment suitable for field mounting a full voltage non-reversing starter Spare Contactor Assembly consisting of (1) 3-pole contactor with 2 NO and NC Auxiliary Contacts (2) Power Fuse Clips (less fuses) (3) Rectifier for dc coil power (4) Internal wiring
—100	Spare Fuses[6]
—101	Portable Lift Device
—102	1 KVA Control Transformer 2400V/120 or 4160/120V or 4800/120V

[1]Requires Instrument Type CTs, Modification No. 6.
[2]Requires Instrument Type Pts (2), Modification 9 or 10.
[3]Select desired NEMA 1 Enclosure from Page 10.
[4]Consult factory for 6900 Volt Applications.
[5]Contact factory.
[6]Consult factory for fuse sizing.
[7]Requires instrument Type CTs, Modification No. 6 or 7.

SCHEMATIC DIAGRAM



NOTES

1. ALL L.V. GROUND WIRES TO BE #12GA. THHN GREEN STRANDED.
2. * SHOWN WITH HANDLE IN "CONN." POSITION.
3. ALL CONTROL WIRING TO BE #14GA. THHN STRANDED.
4. ALL CONTROL WIRES IDENTIFIED AT BOTH ENDS WITH SLIP ON PLASTIC MARKERS.
5. □ - DENOTES TERMINAL IN CONTROL COMPARTMENT. ○ - DENOTES TERMINAL ON DRAWOUT CONTACTOR.

SCHEMATIC DIAGRAM 5000 VOLT STARTER

Suggested Specifications for BBC Series 7850VAC

General

These specifications cover NEMA Class E2 high-voltage control for _____ volt, _____ phase, _____ cycle motors as follows:

Controller No. 1:

(Full-voltage) (reduced voltage)
(non-reversing) (reversing) controller for (squirrel-cage induction) (wound-rotor induction) (synchronous) (brushless synchronous) motor rated _____ hp.

Controller No. 2, Etc. (Describe As Above)

Controller(s) shall be fused-type employing current-limiting power fuses and shall have an interrupting capacity of (200 MVA symmetrical at 2300 volts) (350 MVA symmetrical at 4600 volts). Line contactors shall be vacuum interupter with rating of 400 amp, 5000 volts, and interrupting capacity of 50 MVA, 3 phase, symmetrical. Controller(s) shall be (in a line-up of NEMA type _____ enclosures with common 3 phase _____ amp, A-C power bus) (in free-standing individual NEMA type _____ enclosure(s) having incoming power terminal board). Squirrel-cage non-reversing controllers shall be contained in (1-high) (2-high) (3-high) modular type enclosures.

Enclosures shall be constructed so the incoming line is barriered off after installation, and motor cables can be installed later without exposing personnel to high voltage. Enclosures shall be built with separate low-voltage and high-voltage compartments. The compartments shall be arranged and barriered so that the low-voltage compartment can be entered with controller energized without exposure of personnel to high voltage.

Each controller shall be isolated by an externally operated mechanism. The primary and secondary of the control power transformer shall be opened by the isolating device. Interlocks shall be provided to prevent (1) inadvertent operation of the isolating mechanism under load, (2) opening of the high-voltage compartment before the controller is isolated, (3) closing of line contactor while door is open, and (4) racking the contactor into the engaged position while the contactor is energized from a separate (test) source. Ambient-compensated thermal-overload relays shall be provided in three phases. Anti-single phasing shall be provided should any of the power fuses blow. An indication, either direct or by a mechanical indicator, shall be provided to show main contactor position, i.e., open or closed. Power fuses shall be mounted so that they can be tested or removed easily.

Line contactor shall be draw-out type. Line bus shall be automatically shuttered when contactor is in disconnected position and disconnection shall be clearly indicated. Line bus shall be isolated from normally accessible

Control For:

Wound-Rotor Induction Motors

Secondary control for wound-rotor motors shall be fully magnetic. It shall provide automatic acceleration through _____ starting steps with uniform torque peaks, using a NEMA Class _____ resistor.

Speed Regulation Of Wound-Rotor Motors

The control shall provide for continuous speed regulation with _____ points of speed reduction with a maximum reduction of _____ percent from full-load speed at _____ percent full-load torque.

Synchronous Motors

DC field control for synchronous motors shall be (magnetic) (static). Operation shall be fully automatic and shall provide (a) precision angle switching to apply field at point of maximum flux, and (b) load-angle field removal to disconnect the (field) (field and armature) before the motor pulls out of step on overload.

Protection for squirrel-cage starting winding of synchronous motors shall be provided by graduated ambient-compensated thermal relay.

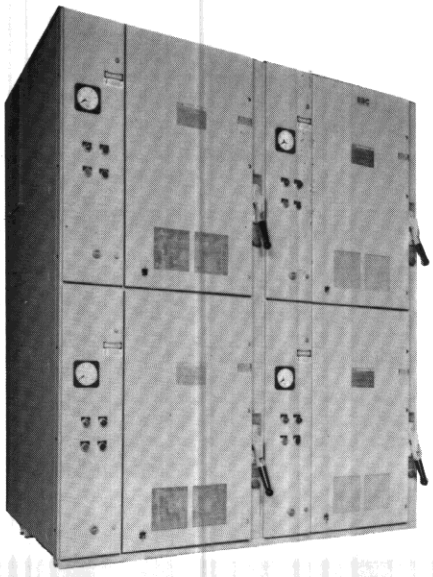
Additional Functions

Control power at 120 volts shall be provided from a self-contained control-power transformer in each controller. Transformer shall be protected by current limiting fuses.

Controller(s) shall provide instantaneous undervoltage protection when momentary-contact pushbutton is used undervoltage release when maintained-contact switch is used. (Pushbutton) (switch) to be (mounted on door) (remotely located).

Finish

Gray ANSI-61. Provide a five stage iron phosphate cleaning system. A polyester dry powder is then to be applied electrostatically to a minimum thickness of 1 mil and baked at a temperature of 425 degrees.



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Low Voltage Systems Division
Sanford, FL 32771

Bulletin 3.7.3-1A