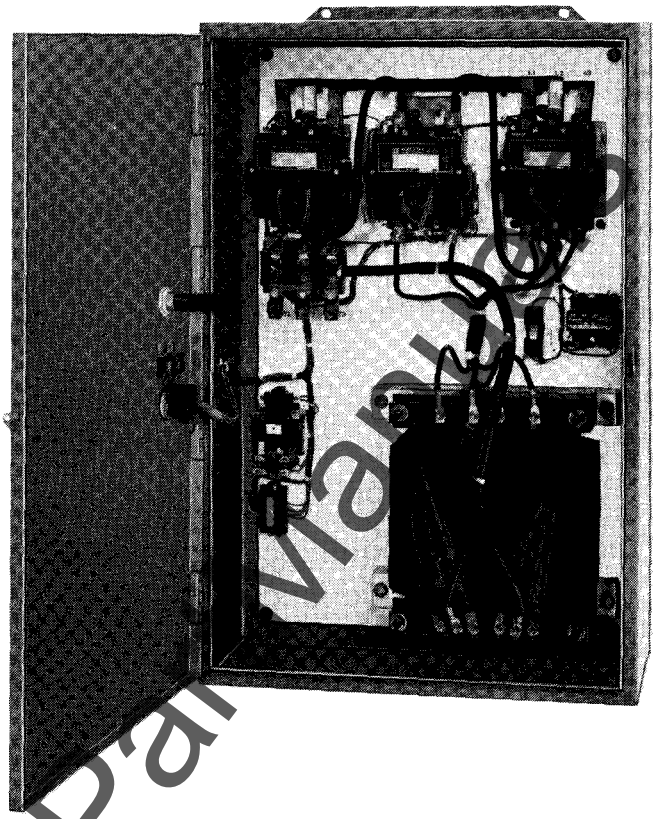


Reduced Voltage Starters

CONTENTS

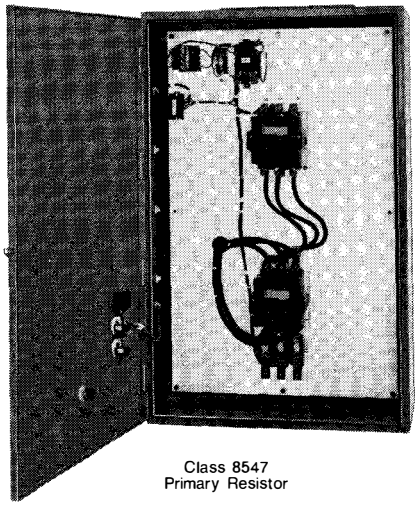
SQUARE D COMPANY

REDUCED VOLTAGE STARTERS
GENERAL APPLICATION DATA

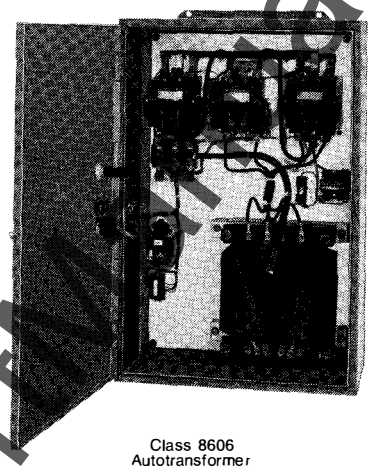
REDUCED VOLTAGE STARTING OF SQUIRREL CAGE MOTORS

Squirrel cage motors draw high starting currents, and produce high starting torques, when started at full voltage. While these values will vary for motors of different design, for a typical NEMA design B motor, the starting current will be approximately 600% of full load, and the starting torque will be approximately 150% of full load values. This current, and torque, may cause problems in the electrical system, and in the driven machine — or in the material being processed.

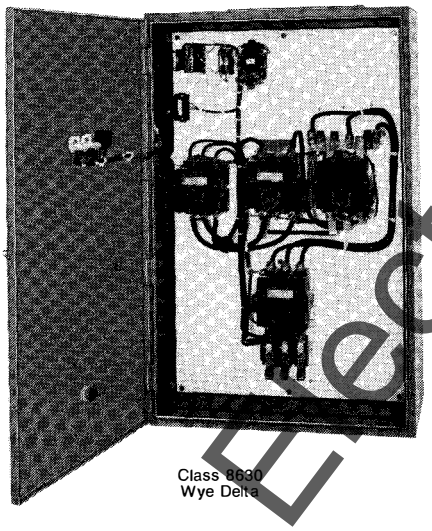
When motors are started at reduced voltage, the current at the motor terminals is reduced in direct proportion to the voltage reduction, while the torque is reduced as the square of the voltage reduction. If the "typical" motor above were started at 70% of line voltage, the starting current would be 420% and the torque would be 74% of full voltage values. Thus, reduced voltage starting provides an effective means of reducing both current and torque.



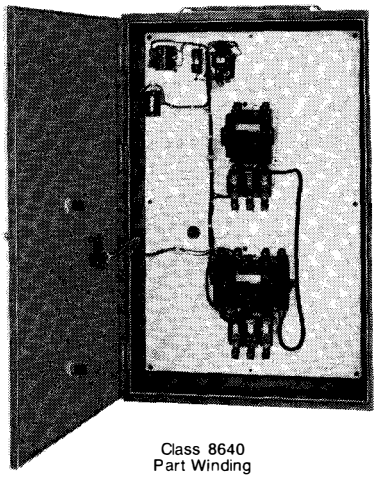
Class 8547
Primary Resistor



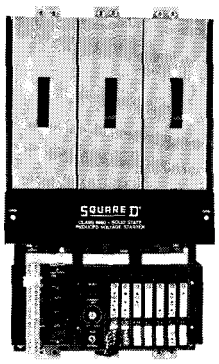
Class 8606
Autotransformer



Class 8630
Wye Delta



Class 8640
Part Winding



Class 8660
Solid State

REDUCED VOLTAGE STARTERS
GENERAL APPLICATION DATA

PRIMARY RESISTOR STARTING

In primary resistor starting, a resistor is connected in each motor line (in one line only in single phase starters) to produce a voltage drop due to the motor starting current. A timing relay causes shorting out of the resistors after motor acceleration. Thus the motor is started at reduced voltage, but operates at line voltage.

Primary resistor starters provide extremely smooth starting due to the increasing voltage across the motor terminals, as the motor accelerates. Since motor current decreases with increasing speed, the voltage drop across the resistor decreases as the motor accelerates — and motor terminal voltage increases. Thus, if a resistor is shorted out as the motor reaches maximum speed, there is little increase in current or torque.

Standard primary resistor starters provide two point acceleration (one step of resistance) with approximately 70% of line voltage at motor terminals at instant of motor start. Other starting values are available on special order. In addition, additional accelerating points are available if required by power companies, or for other considerations.

ADJUSTABLE REACTOR STARTING

Adjustable Reactor starters are used with A.C. squarrel cage motors to provide a "soft" start which lessens the strain on driven machinery and material in process. Reduced voltage starting is accomplished by means of adjustable reactors connected in series with the motor.

No sudden speed surges are encountered, either on initial starting or at the time of transfer to full voltage.

This extremely smooth starting characteristic makes VARI-TORQ® starters ideal for use on machinery requiring reduced starting torque. VARI-TORQ controllers are particularly beneficial on textile machinery such as roving frames and drawing frames, where controlled acceleration prevents breaking the yarn on starting and improves product quality. The slow, accurate jogging capability increases operator efficiency.

AUTOTRANSFORMER STARTING

Autotransformer starters provide reduced voltage starting at the motor terminals through the use of a tapped, 3 phase, autotransformer. Upon initiation of the controller pilot device, a 2 pole and a 3 pole contactor close to connect the motor to the pre-selected autotransformer taps. A timing relay causes the transfer of the motor from the reduced voltage start to line voltage operation without disconnecting the motor from the power source. This is known as closed transition starting.

Taps on the autotransformer provide selection of 50%, 65% or 80% of line voltage as a starting voltage. Starting torque will be 25%, 42% or 64% respectively of line voltage values. However, because of transformer action, the controller line current will be less than motor current, being 25%, 42%, or 64% of full voltage values. Thus, autotransformer starting may be used to provide maximum torque available with minimum line current, together with taps to permit both of these factors to be varied.

WYE-DELTA STARTING

Wye-Delta motors have 6 leads to enable the windings to be connected either in Wye, or in Delta. When connected in Wye the motor has a voltage rating 173% of its voltage rating when connected in Delta. By connecting the windings in Wye, and by operating the motor from a supply which corresponds to the Delta connected voltage rating, reduced starting current and reduced starting torque is obtained. Thus, while Wye-Delta starting is not truly a reduced voltage means, it provides the effect of reduced voltage starting (reduced current and torque), and is classified as such.

Wye-Delta starters are inherently open transition type. When the pilot device closes, two contactors close, one of which connects the windings in Wye, and the other of which energizes those windings. After a time delay, the Wye contactor opens (momentarily de-energizing the motor) and an additional contactor closes to reconnect the motor to the lines with the windings connected in Delta. With the motor starting in Wye, both starting current and starting torque are 33⅓% of Delta starting values.

Closed transition versions are available which keep the motor windings energized for the few cycles required to transfer the motor windings from a Wye connection to a Delta connection. Such starters are provided with one additional contactor, plus a resistor bank.

Wye-Delta starters can be used only with a Wye-Delta motor; the conventional motor does not have windings to permit this starting method.

PART WINDING STARTING

Part winding motors have two sets of identical windings — intended to be operated in parallel — which can be energized in sequence to provide reduced starting current and reduced starting torque. Most (but not all) dual voltage 230/460 volt motors are suitable for part winding starting at 230 volts.

When one winding of a part winding motor is energized, the torque produced is about 50% of "both winding" torque, and line current is 60-70% (depending upon motor design) of comparable line voltage values. Thus, while part winding starting is not truly a reduced voltage means, it is usually so classified because of the reduced current and torque resulting.

When a dual voltage *Delta connected* motor is operated at 230 volts from a part winding starter having a 3 pole starting and a 3 pole running contactor, an unequal current division occurs during normal operation, resulting in overloading of the starting contactor. To overcome this defect, Class 8640 part winding starters in Sizes 1PW through 4PW are furnished with a 4 pole starting contactor and a 2 pole running contactor. Not only does such an arrangement eliminate the unequal current division obtained with a Delta wound motor, but it enables Wye connected part winding motors to be given either a ½ or a ⅔ part winding start.

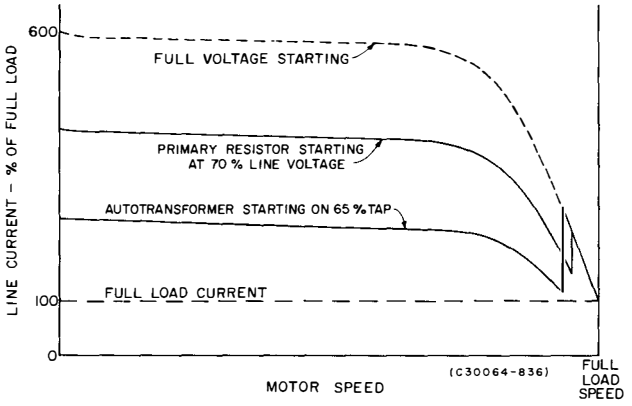
Class 8640 part winding starters have a starting contactor, a timing relay, a running contactor and necessary overload relays. Closing of the pilot device contact causes the starting contactor to close to connect the start winding, and to initiate the time cycle. After expiration of the preset timing, the run contactor closes to connect the balance of the motor windings. A time setting of one second is recommended; most motor manufactures do not permit energization of the start winding alone for longer than 3 seconds. Part winding starters provide closed transition starting.

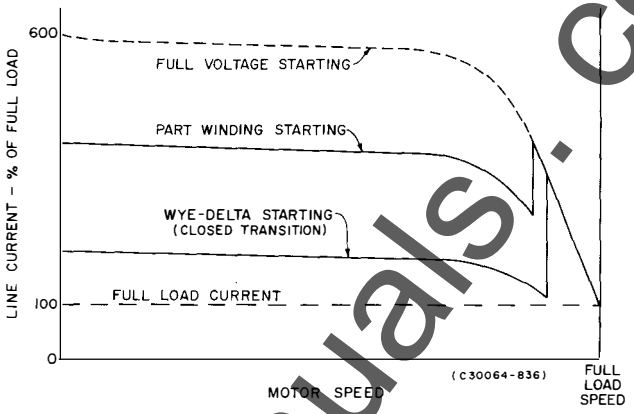
SOLID STATE STARTING

See Class 8660 catalog section for listing. Consult Local Square D Field Office if needed.

REDUCED VOLTAGE STARTERS
GENERAL APPLICATION DATA

MOTOR STARTING CURRENT CURVES





REDUCED VOLTAGE STARTING OF SQUIRREL CAGE MOTORS

COMPARISON TABLE
TO AID IN THE SELECTION OF THE TYPE OF STARTING BEST SUITED FOR THE LIMITATION INVOLVED

TYPE OF STARTER	STARTING CHARACTERISTICS IN PERCENT OF FULL VOLTAGE VALUES			ADVANTAGES	DISADVANTAGES
	Voltage at Motor	Line Current	Starting Torque		
Autotransformer (Class 8606)	Taps 80 65 50	 64 42 25	 64 42 25	1. Provides highest torque per ampere of line current. 2. Taps on autotransformer permit adjustment of starting voltage. 3. Suitable for long starting periods. 4. Closed transition starting. 5. While starting, motor current is greater than line current.	1. In lower HP ratings, is most expensive design. 2. Low power factor.
Primary Resistor (Class 8547 or 8549)	70	70	49	1. Smooth acceleration — motor voltage increases with speed. 2. High power factor during start. 3. Closed transition starting. 4. Less expensive than autotransformer starter in lower HP ratings. 5. Available with as many as 7 accelerating points.	1. Low torque efficiency. 2. Resistor gives off heat. 3. Starting time in excess of 5 seconds requires expensive resistor. 4. Starting voltage difficult to adjust to meet varying conditions.
Part Winding (Class 8640)	100	65	48	1. Least expensive reduced voltage starter. 2. Closed transition starting. 3. Most dual voltage motors can be started part winding on lower of two voltages. 4. Small size.	1. Unsuited for high inertia, long starting loads. 2. Requires special motor design for voltages higher than 230 V.
Wye-Delta (Class 8630)	100	33⅓	33⅓	1. Moderate cost — less than primary resistor or autotransformer. 2. Suitable for high inertia, long acceleration, loads. 3. High torque efficiency.	1. Requires special motor design. 2. Starting torque is low. 3. Inherently open transition — closed transition available at added cost.

SELECTION TABLE
TO AID IN THE SELECTION OF A STARTER BEST SUITED FOR A PARTICULAR CHARACTERISTIC

CHARACTERISTIC WANTED	TYPE OF STARTER TO USE (Listed in order of desirability)		COMMENTS
Minimum Line Current	1. Autotransformer 2. Wye-Delta 3. Part Winding 4. Primary Resistor	(Class 8606) (Class 8630) (Class 8640) (Class 8547)	Little choice between 1 and 2 or between 3 and 4.
Smooth Acceleration	1. Primary Resistor 2. Wye-Delta 3. Autotransformer 4. Part Winding	(Class 8547) (Class 8630) (Class 8606) (Class 8640)	.....
High Starting Torque	1. Autotransformer 2. Primary Resistor 3. Part Winding	(Class 8606) (Class 8547) (Class 8640)	The part winding motor may not be able to fully accelerate the load until the second winding is connected.
Suitability for Long Acceleration	1. Autotransformer 2. Wye-Delta 3. Primary Resistor	(Class 8606) (Class 8630) (Class 8547)	For this classification the primary resistor starter must be provided with a resistor suitable for long accelerating duty.
Suitability for Frequent Starting	1. Primary Resistor 2. Autotransformer 3. Wye-Delta	(Class 8547) (Class 8606) (Class 8630)	In general, the part winding motor is unsuited for frequent starting.

REDUCED VOLTAGE STARTERS
PRIMARY RESISTOR TYPE

CLASS 8547 8549

Class 8547 (non-reversing) or Class 8549 (reversing) primary resistor starters should be used when squirrel cage motors must be started with limited current inrush to avoid power line disturbances, or with limited torque to prevent damage to driven machinery. Standard starters are furnished with NEMA Class 116 resistors (one 5 second start each 80 seconds) and melting alloy type overload relays.

50-60 HERTZ				MELTING ALLOY THERMAL UNITS				600 VOLTS MAX.			
				Class 8547, Non-Reversing				Class 8549, Reversing			
				General Purpose Enclosure NEMA Type 1		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12		General Purpose Enclosure NEMA Type 1		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12	
No. of Poles	Maximum Horse-power	Volts	NEMA Size	Number of Thermal Units Required *	Type	Price*	Type	Price*	Type	Price*	Type	Price*
2 Pole Single Phase	2	115-230	1	1	SCG-1	$ 802.	SCA-1	$ 1682.	....	....	....	....
	3	115 230	1P 1	1 1	SCG-2 SCG-1	954. 802.	SCA-2 SCA-1	1834. 1682.	....	....	....	....
	5	230	1P	1	SCG-2	954.	SCA-2	1834.	....	....	....	....
	7½	230	2	1	SDG-1	1710.	SDA-1	2950.	....	....	....	....
	10	230	3	1	SEG-1	1902.	SEA-1	3142.	....	....	....	....
	15	230	3	1	SEG-1	1962.	SEA-1	3202.	....	....	....	....
3 Pole Three Phase	5	200-230 380-575	1	3	SCG-3	1132.	SCA-3	1732.	SCG-1	$ 1708.	SCA-1	$ 2308.
	7½	200-230 380-575	1	3	SCG-3	1172.	SCA-3	1772.	SCG-1	1748.	SCA-1	2348.
	10	200-230 380-575	2 1	3	SDG-2 SCG-3	1668. 1252.	SDA-2 SCA-3	2388. 1852.	SDG-1 SCG-1	3244. 1828.	SDA-1 SCA-1	3964. 2428.
	15	200 230 380-575	3 2 2	3	SEG-2 SDG-2 SDG-2	2388. 1788. 1788.	SEA-2 SDA-2 SDA-2	3148. 2508. 2508.	SEG-1 SDG-1 SDG-1	4052. 3364. 3364.	SEA-1 SDA-1 SDA-1	4812. 4084. 4084.
	20	200-230 380-575	3 2	3	SEG-2 SDG-2	2388. 1924.	SEA-2 SDA-2	3148. 2644.	SEG-1 SDG-1	4052. 3500.	SEA-1 SDA-1	4812. 4220.
	25	200-230 380-575	3 2	3	SEG-2 SDG-2	2428. 2004.	SEA-2 SDA-2	3188. 2724.	SEG-1 SDG-1	4092. 3580.	SEA-1 SDA-1	4852. 4300.
	30	200 230 380-575	4 3 3	3	SFG-1 SEG-2 SEG-2	5172. 2540. 2540.	SFA-1 SEA-2 SEA-2	6132. 3300. 3300.	SFG-1 SEG-1 SEG-1	8780. 4204. 4204.	SFA-1 SEA-1 SEA-1	9740. 4964. 4964.
	40	200-230 380-575	4 3	3	SFG-1 SEG-2	5172. 2636.	SFA-1 SEA-2	6132. 3396.	SFG-1 SEG-1	8780. 4300.	SFA-1 SEA-1	9740. 5060.
	50	200 230 380-575	5 4 3	3 3 3	SGG-1 SFG-1 SEG-2	8230. 5172. 2724.	SGA-1 SFA-1 SEA-2	9310. 6132. 3484.	SGG-1 SFG-1 SEG-1	12542. 8780. 4300.	SGA-1 SFA-1 SEA-1	13622. 9740. 5148.
	75	200-230 380-575	5 4	3 3	SGG-1 SFG-1	8230. 5268.	SGA-1 SFA-1	9310. 6228.	SGG-1 SFG-1	12542. 8876.	SGA-1 SFA-1	13622. 9836.
	100	200 230 380 460-575	6 5 5 4	3 3 3 3	SHG-1 SGG-1 SGG-1 SFG-1	15222. 8854. 8518. 5268.	SHA-1 SGA-1 SGA-1 SFA-1	16722. 9934. 9598. 6228.	.... SGG-1 SGG-1 SFG-1	.... 13166. 12830. 8876.	.... SGA-1 SGA-1 SFA-1	.... 14246. 13910. 9836.
	125	200-230 380-575	6 5	3 3	SHG-1 SGG-1	15222. 8518.	SHA-1 SGA-1	16722. 9598.	.... SGG-1	.... 12830.	.... SGA-1	.... 13910.
	150	200-230 380-575	6 5	3 3	SHG-1 SGG-1	15870. 8518.	SHA-1 SGA-1	17370. 9598.	.... SGG-1	.... 12830.	.... SGA-1	.... 13910.
	200	230 380 460-575	6 6 5	3 3 3	SHG-1 SHG-1 SGG-1	16438. 15998. 9630.	SHA-1 SHA-1 SGA-1	17938. 17498. 10710.	.... SGG-1	.... 13942.	.... SGA-1	.... 15022.
	250	230 380-575	7 6	3	SJG-1 SHG-1	25110. 15998.	SJA-1 SHA-1	27110. 17498.	....	....	....	....
	300	230 380-575	7 6	3	SJG-1 SHG-1	25962. 16926.	SJA-1 SHA-1	27962. 18426.	....	....	....	....
	400	230 460-575	8 6	3	KG-1 SHG-1	34346. 17414.	KA-1 SHA-1	36586. 18914.	....	....	....	....
	450	230 460-575	8 7	3	KG-1 SJG-1	36586. 27182.	KA-1 SJA-1	38086. 28682.	....	....	....	....
	500	460-575	7	3	SJG-1	27182.	SJA-1	28682.	....	....	....	....
	600	460-575	7	3	SJG-1	27830.	SJA-1	29330.	....	....	....	....
	700	460-575	8	3	KG-1	37690.	KA-1	39190.	....	....	....	....
	800	460-575	8	3	KG-1	39026.	KA-1	40526.	....	....	....	....
	900	460-575	8	3	KG-1	40430.	KA-1	41930.	....	....	....	....

***Prices do not include thermal units. See note below for selection.**

ORDERING INFORMATION REQUIRED

1. Class and type number.
2. Horsepower, voltage, phase and hertz.
3. Control voltage and hertz — if different than line supply.
4. Special features or modifications.

FACTORY INSTALLED SPECIAL FEATURES — See "Modifications and Forms."

APPLICATION DATA — See Pages 2-4.

OUTLINE DIMENSIONS — See Pages 18-19.

COMBINATION STARTERS

These starters are available with circuit breaker or main disconnect. See "Modifications and Forms" for form letter and price adder.

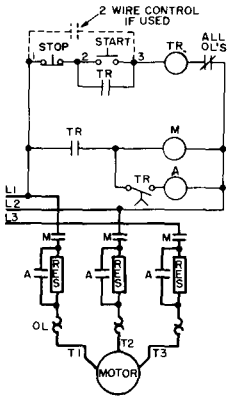
THERMAL UNITS

Thermal units should be ordered separately. For selection see "Overload and Short Circuit Protection."

MULTI-POINT VERSIONS

Multi-Point Primary Resistor Starters and Primary Resistor Starters with NEMA 156 Resistors for high inertia loads are available — see pages 6-8.

Typical Non-Reversing Primary Resistor Starter



CLASS 8547

REDUCED VOLTAGE STARTERS

MULTI-POINT PRIMARY RESISTOR TYPE

APPLICATION

Multi-point starters are designed for use on systems where the starting current limitations of the power company are such that standard across-the-line, or reduced voltage starters, will provide current increments greater than are allowed. Power companies may specify a maximum value of current which can be drawn from the line in starting a motor, which current value may be increased by the same amount in successive steps, provided that the current is not interrupted during the switching. Each current value will cause the system voltage to decrease, which decreases can be corrected by voltage regulators, providing the increments are not beyond limitations, and occur with sufficient time intervals between each.

Multi-point primary resistor starters apply reduced voltage to the motor through a series resistor when the first starting contactor is closed. The voltage across the motor terminals, and the starting current, is increased in increments as succeeding accelerating contactors close after definite timing intervals. When the last line contactor closes, the entire resistor bank is shorted out and the previous accelerating contactors are deenergized; the motor then runs at line voltage.

Each increment is the inverse of the number of accelerating points; that is, in a 4 point starter, each increment is approximately equal to ¼ of the across-the-line locked rotor motor current. Thus, the power system is subjected to equal increments of current drain during acceleration of the motor, the effects of which can be corrected by voltage regulators.

Multi-point starters give a gradual increase in starting torque, since the circuit is not open to the motor during the starting process. It cannot be assumed that the motor will start rotating on the first accelerating point, or on any definite subsequent starting point. Depending upon the torque requirements of the load, and torque developed by the motor, it is entirely possible that the motor will not start until the final accelerating contactor has closed. This effect is unimportant as the multi-point starter is designed, not to start the load on any given point, but to provide approximately equal current increments.

RATINGS

Contactor sizes given in the price table are NEMA ratings, and apply only to the final accelerating contactor. Prior accelerating contactors are proportioned to the current which may be drawn on any particular point, and may have a current rating smaller than that of the final contactor.

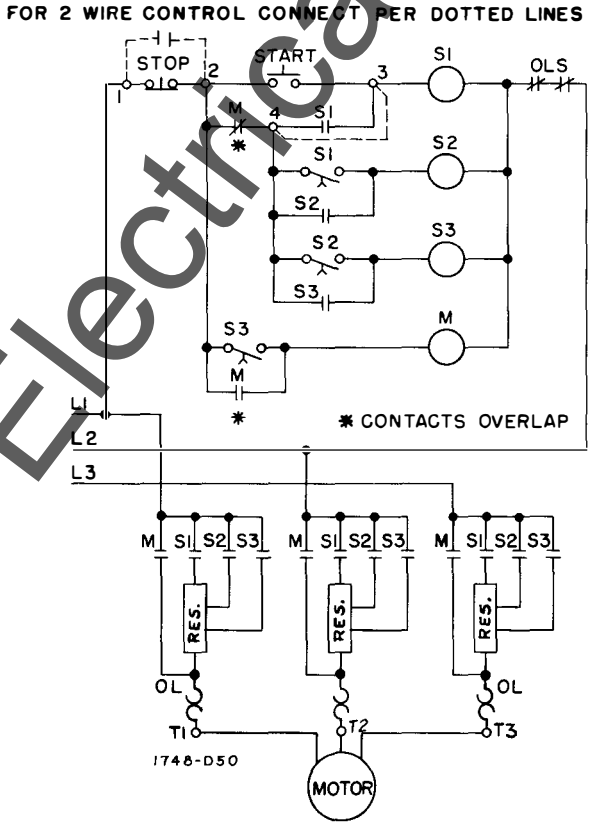
RESISTORS

Resistor units used in the resistor bank of these starters are Edgerest resistors, described in catalog section Class 6705. They are of unit ribbon construction to provide the maximum in sturdiness with light weight. The special alloy ribbon used resists oxidation, has high tensile strength, and is practically non-corrosive.

Resistor banks used in multi-point starters are designed to provide maximum starting periods of approximately 3 seconds per point on two point starters, and approximately 2 seconds per point on those having 3 or more points.

SELECTION

The required number of current increments are determined by the locked rotor current of the motor and by the maximum allowable inrush current for the power system. To determine the number of starting points, divide the value of locked rotor current by the maximum allowable starting current, and round off to the next larger whole number. For example, assume that a 100 hp, 230 volt, 60 hertz, 3 phase motor with a full load current of 230 amperes and a locked rotor current of 1000 amperes is to be used on a system where the maximum allowable starting current is 300 amperes. Dividing 1000 amperes by 300 amperes per point, the number of increments required is 3.33, which rounded off to the next higher whole number is 4 points.



Typical Wiring Diagram for 4 Point Primary Resistor Starter

REDUCED VOLTAGE STARTERS
MULTI-POINT PRIMARY RESISTOR TYPE

CLASS 8547

These primary resistor starters provide 2 to 6 equal, fixed, current increments through the use of multi-point resistors. Resistors are suitable for 3 seconds per point on 2 point starters, 2 seconds per point on starters having 3 or more points.

NON-REVERSING WITH THREE MELTING ALLOY OVERLOAD RELAYS

50-60 HERTZ			3 POLE									200-275 VOLTS
Max. Horsepower	Volts	Final Contactor NEMA Size	NEMA 1 General Purpose Enclosure									
			2 Point Acceleration		3 Point Acceleration		4 Point Acceleration		5 Point Acceleration		6 Point Acceleration	
			Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*
10	200-230 380-575	2 1	SDG-5 SCG-7	**$1668.** **1252.**	SDG-6 SCG-8	**$2864.** **2448.**	....	....	....	....	....	....
15	200 230 380-575	3 2 2	SEG-8 SDG-5 SDG-5	**2388.** **1788.** **1788.**	SEG-9 SDG-6 SDG-6	**3476.** **2928.** **2928.**	....	....	....	....	....	....
20	200-230 380-575	3 2	SEG-8 SDG-5	**2388.** **1924.**	SEG-9 SDG-6	**3476.** **3120.**	SEG-10	**$4180.**	....	....	....	....
25	200-230 380-575	3 2	SEG-8 SDG-5	**2428.** **2004.**	SEG-9 SDG-6	**3552.** **3144.**	SEG-10	**4256.**	....	....	....	....
30	200 230 380-575	4 3 3	SFG-3 SEG-8 SEG-8	**5172.** **2540.** **2540.**	SFG-4 SEG-9 SEG-9	**6576.** **3644.** **3644.**	SFG-5 SEG-10 SEG-10	**7968.** **4356.** **4552.**	SFG-6	**$9368.**	....	....
40	200-230 380-575	4 3	SFG-3 SEG-8	**5172.** **2636.**	SFG-4 SEG-9	**6576.** **3848.**	SFG-5 SEG-10	**7968.** **4552.**	SFG-6 SFG-6	**9368.** **9368.**	....	....
50	200 230 380-575	5 4 3	SGG-4 SFG-3 SEG-8	**8230.** **5172.** **2724.**	SGG-5 SFG-4 SEG-9	**9586.** **6576.** **3848.**	SGG-7 SFG-5 SEG-10	**10978.** **7968.** **5552.**	SGG-9 SFG-6	**12374.** **9368.**	SGG-11	**$13786.** ....
60	200-230 380-575	5 4	SGG-4 SFG-3	**8230.** **5268.**	SGG-5 SFG-4	**9586.** **6672.**	SGG-7 SFG-5	**10978.** **8064.**	SGG-9 SFG-5	**12374.** **9464.**	SGG-11 SFG-6	**13786.** **10874.**
75	200-230 380-575	5 4	SGG-4 SFG-3	**8230.** **5268.**	SGG-5 SFG-4	**9586.** **6672.**	SGG-7 SFG-5	**10978.** **8064.**	SGG-9 SFG-6	**12374.** **9464.**	SGG-12	**13786.** .....
100	230 380 460-575	5 5 4	SGG-4 SGG-4 SFG-3	**8854.** **8518.** **5268.**	SGG-6 SGG-6 SFG-4	**10298.** **9874.** **6672.**	SGG-8 SGG-8 SFG-5	**11694.** **11266.** **8064.**	SGG-10 SGG-10 SFG-6	**13090.** **12662.** **9464.**	SGG-13 SGG-13	**14490.** **14074.** .....
125	380-575	5	SGG-4	**8518.**	SGG-5	**9874.**	SGG-7	**11266.**	SGG-9	**12662.**	SGG-11	**14074.**
150	380-575	5	SGG-4	**8518.**	SGG-5	**9874.**	SGG-7	**11266.**	SGG-9	**12662.**	SGG-12	**14074.**
200	460-575	5	SGG-4	**9630.**	SGG-6	**11074.**	SGG-8	**12470.**	SGG-10	**13866.**	SGG-13	**15266.**

*Prices do not include thermal units. For selection, see below.

ORDERING INFORMATION REQUIRED

1. Class and Type number of starter; indicate horsepower, voltage, frequency and phase of motor.
2. Number of points of acceleration and the complete starting current limitations to be met.
3. Give complete motor rating including full load current rating, locked rotor amperes and locked rotor kilowatts (or locked rotor power factor).
4. Special features or modifications.

THERMAL UNITS

Three thermal units are required, and should be ordered separately. For selection of thermal units, see "Overload and Short Circuit Protection."

CLASS 8547

REDUCED VOLTAGE STARTERS
PRIMARY RESISTOR TYPE

MAGNETIC STARTERS WITH NEMA 156 RESISTORS

These magnetic starters have NEMA 156 duty resistors for use with high inertia loads where the accelerating time, or starting frequency, exceeds that permissible with the standard NEMA 116 resistors. Three hand reset melting alloy overload relays are provided.

NEMA 1 GENERAL PURPOSE ENCLOSURE

50 or 60 HZ			THREE MELTING ALLOY OVERLOAD RELAYS				200-600 VOLTS
Polyphase HP	Volts	NEMA Size	Price*	HP	Volts	NEMA Size	Price*
5	200-230 380-575	1	**$2204.** **2204.**	40	200-230 380-575	4 3	**$5948.** **3656.**
7½	200-230 380-575	1	**2244.** **2244.**	50	200 230 380-575	5 4 3	**9446.** **6492.** **4196.**
10	200-230 380-575	2 1	**2660.** **2324.**	60	200-230 380-575	5 4	**9446.** **6492.**
15	200 230 380-575	3 2 2	**3172.** **2772.** **2772.**	75	200-230 380-575	5 4	**10006.** **7044.**
20	200-230 380-575	3 2	**3172.** **2772.**	100	230 380 460-575	5 5 4	**10798.** **11398.** **7212.**
25	200-230 380-575	3 2	**3292.** **2892.**	125	380-575	5	**11398.**
30	200 230 380-575	4 3 3	**5948.** **3560.** **3560.**	150	380-575	5	**11638.**
				200	460-575	5	**13290.**

*Prices do not include thermal units. For selection, see below.

Where high inertia loads are involved, requiring long accelerating times, the standard NEMA 116 resistors may have insufficient capacity. The listing above covers starters with NEMA 156 duty resistors for longer accelerating times.

NEMA 156 resistors have sufficient capacity for one 15-second start each 60 seconds. This time period is satisfactory for most high inertia, hard starting, loads. When starting is longer than 15 seconds, or occurs more frequently than each 60 seconds, complete details should be referred to the factory.

ORDERING INFORMATION REQUIRED

1. Indicate horsepower, voltage, hertz, and number of phases. Provide motor full load current, or select overload relay thermal units as indicated below.
2. Specify as "Class 8547 similar to Type except having NEMA 156 resistor". Select Type number from Class 8547 price sheets which list starters with NEMA 116 duty resistors.

THERMAL UNITS

Three thermal units are required, and should be ordered separately. For selection of thermal units, refer to "Overload and Short Circuit Protection."

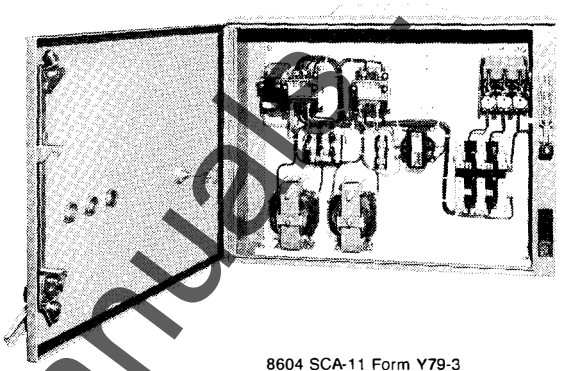
REDUCED VOLTAGE STARTERS

VARI-TORQ® ADJUSTABLE REACTOR TYPE

OPERATION

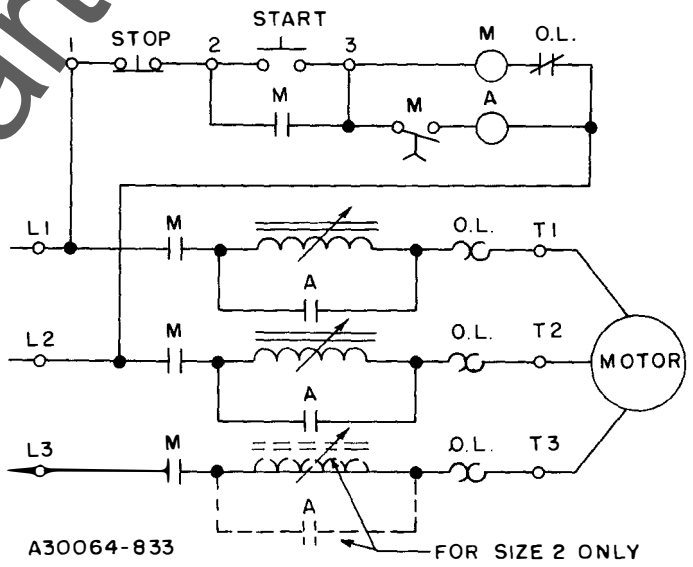
Operation is similar to Class 8547 primary resistor reduced voltage starters, except the adjustable reactors replace the resistors. Thus, reactance is inserted in series with the motor during the starting period. Reduced voltage starters provide extremely smooth starting, due to the increasing voltage across the motor terminals as the motor accelerates.

During acceleration, the voltage available at the motor terminals is reduced by the amount dropped across the reactors. Since motors initially draw locked rotor current, the voltage initially dropped across the reactors is substantial (ohms law; E = IR); approximately 30% or more. As motor speed increases, current decreases, and the voltage available at the motor terminals builds up gradually to a value very close to full line voltage. The timer should be set to time out when motor terminal voltage approximates line voltage (motor speed approximates full speed), at which time the reactors are shorted by contactor A, and the motor is connected directly across the line.



8604 SCA-11 Form Y79-3

SCHEMATIC DIAGRAM



CONSTRUCTION

GENERAL: VARI-TORQ controllers consist of one Class 8536 Type S starter (M), one Class 8502 Type S contactor (A), one Class 9999 Type SK-4 timer attachment (M), and two or three Class 8604 Type M reactors (listed separately on page 12).

VARI-TORQ starters produce NEGLIGIBLE HEAT, eliminating the fire hazard which can exist if primary resistor starters are used in areas where combustible lint and waste are present. The reactors are designed for an allowable on time of 60 seconds in each hour. If a higher duty cycle is required, refer to factory.

ENCLOSURES: Nema 1 enclosures are provided with knockouts and Nema 12 with closing plates for the field addition of pilot lights, pushbuttons, and selector switches. All panels are predrilled to accept a fused control circuit transformer.

REACTORS: The reactors are adjustable allowing motor starting torque to be increased or decreased by adjusting the air gap between the reactor frame and armature. Reactors are factory set for minimum air gap; this setting produces the lowest motor starting torque. Maximum air gap produces highest starting torque.

If the reactors are unable to provide the starting torque desired within their adjustment range, coils can be changed simply and quickly. The table on page 11 used in conjunction with the table on page 12 provides simplified coil selection.

CLASS
8604

VARI-TORQ® ADJUSTABLE REACTOR REDUCED VOLTAGE STARTERS
WITH 3 MELTING ALLOY OVERLOAD RELAYS

Revised Oct., 1983

- Continuously adjustable reactors provide continuously adjustable starting torque.
- Negligible heat is produced by the reactors, eliminating many fire hazards.
- One piece thermal units provide greater motor protection.

60 HZ. — THREE PHASE — 600 VOLTS MAX. AC

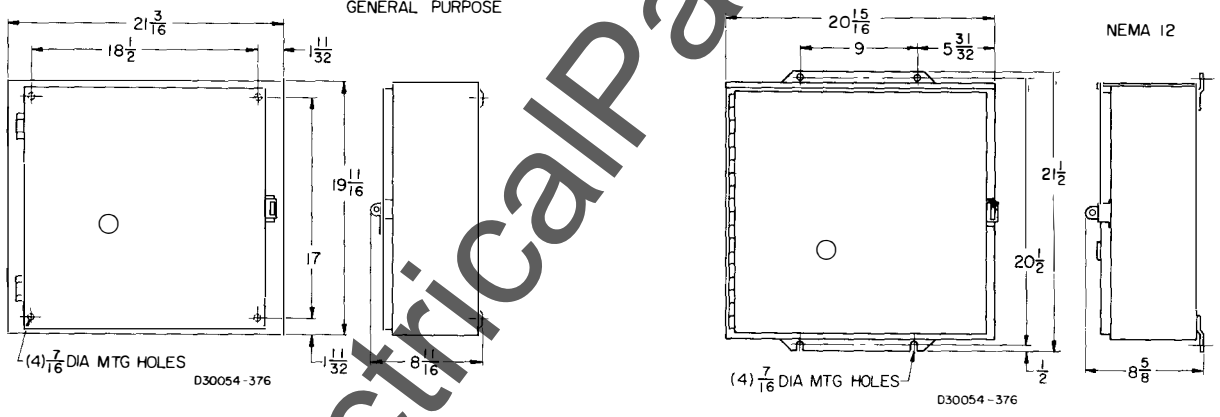
NEMA Size	Volts	Max. Horsepower	Number of reactors included in controller	General Purpose Enclosure NEMA Type 1		Lint Tight Enclosure NEMA Type 12	
				Type	Price	Type	Price
1	200-230 480-575	7½ 10	2	SCG-†	**$1172.**	SCA-†	**$1772.**
2	200 230 480-575	10 15 25	3	SDG-†	**1788.**	SDA-†	**2508.**

† Complete Type number by choosing suffix from appropriate table on page 11.
Prices do not include thermal units. See ordering information for selection.

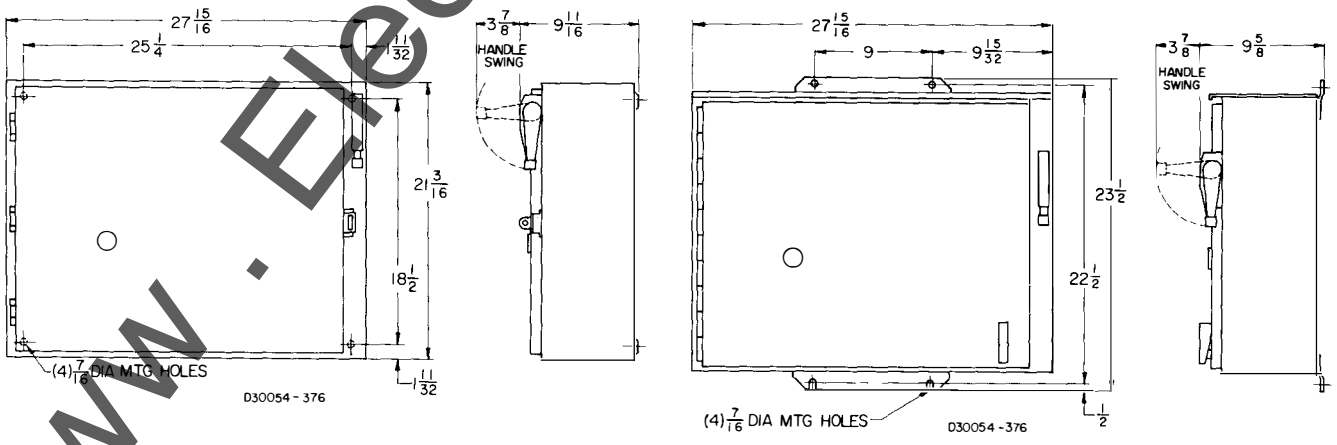
SEE COMPLETE ORDERING INFORMATION ON PAGE 11

APPROXIMATE DIMENSIONS

NEMA 1 ENCLOSURE — **NON-COMBINATION DEVICES** — GENERAL PURPOSE — **NEMA 12 ENCLOSURE**



NEMA 1 ENCLOSURE — **COMBINATION DEVICES (FORM Y79)** — **NEMA 12 ENCLOSURE**



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VARI-TORQ® ADJUSTABLE REACTOR REDUCED VOLTAGE STARTERS

SELECTION OF TYPE NUMBER SUFFIX

Values in Type number suffix columns indicate the approximate range of motor starting voltage available, expressed as a percent of rated motor voltage. Starting voltage is continuously variable within the range listed. Values given are approximate only; actual performance may vary, particularly if the motor is not being operated at rated voltage and frequency. SUFFIX NUMBER DESIGNATES COIL PROVIDED WITH REACTORS. Reactor coils are easily changed and minor experimenting may be necessary to determine the proper selection. Coils are listed on page 12.

TABLE 1 — STARTING VOLTAGE ADJUSTMENT RANGE: 200-230 VOLT 60 HZ. MOTORS

NEMA Size	Motor HP	Motor Code Letter*	Average L.R. Amps at Rated Voltage	Type Number Suffix							
				12	11	10	9	8	7	6	5
1	2	E, F or G H, J or K	28 39	40-65 35-55	50-75 50-65	65-80 60-80	70-85 70-85	80-90 75-90	85-95 85-95	....	....
	3	D, E or F G, H or J	37 53	35-60 35-50	50-70 45-60	60-80 55-70	70-85 65-80	75-90 75-85	85-95 80-90	 85-95	....
	5	D, E or F G or H	62 82	30-50	45-60 40-55	55-70 50-65	65-80 60-75	75-85 70-80	80-90 80-85	85-90 85-90	90-95 90-95
	7½	D or E F or G	88 109	....	40-50 35-50	50-65 50-60	60-75 60-70	70-80 70-80	80-85 80-85	85-90 85-90	90-95 90-95
2	10	E, F or G	137	....	....	....	35-50	50-60	60-70	70-80	75-85
	15	D, E or F	188	....	....	....	35-45	45-55	55-65	65-75	75-80

TABLE 2— STARTING VOLTAGE ADJUSTMENT RANGE: 460 VOLT 60 HZ. MOTORS

NEMA Size	Motor HP	Motor Code Letter*	Average L.R. Amps at Rated Voltage	Type Number Suffix									
				15	14	13	12	11	10	9	8	7	6
1	2	E, F or G H, J or K	14 19	40-65 40-60	55-75 50-70	65-80 60-80	70-90 70-85	75-95 75-90	 85-95	....	....	....	....
	3	D, E or F G, H or J	18 26	40-60 35-50	50-70 45-60	60-80 55-70	70-85 65-80	75-90 75-85	85-95 80-90	 85-95	....	....	....
	5	D, E or F G or H	31 41	....	40-60 40-55	55-70 50-65	65-80 60-75	75-85 70-80	80-90 75-85	85-95 85-90	 90-95	....	....
	7½	D or E F or G	44 55	....	40-50 40-50	50-65 50-65	60-75 60-70	70-80 70-80	75-85 75-85	85-90 80-90	90-95 85-95	....	....
	10	D or E F or G	59 72	....	35-50 35-45	50-60 45-55	60-70 55-65	70-75 65-75	75-85 75-80	80-90 80-85	85-95 85-90	 90-95	....
2	15	C or D E or F	79 99	....	....	....	35-50 35-45	45-60 45-55	60-70 55-65	65-80 65-75	75-85 75-80	80-90 80-85	85-95 85-90
	20	C or D E or F	105 131	....	....	....	....	40-55 40-50	55-65 55-60	65-75 65-70	75-90 70-80	80-85 80-85	85-90 85-90
	25	C or D E or F	131 164	....	....	....	....	40-50 40-45	55-60 50-55	65-70 60-65	70-80 70-75	80-85 80-85	85-90 85-90

TABLE 3 — STARTING VOLTAGE ADJUSTMENT RANGE: 575 VOLT 60 HZ. MOTORS

NEMA Size	Motor HP	Motor Code Letter*	Average L.R. Amps at Rated Voltage	Type Number Suffix									
				15	14	13	12	11	10	9	8	7	6
1	2	E, F or G H, J or K	11 16	55-75 50-65	65-80 60-75	70-90 70-85	80-95 75-90	 80-95	....	....	....	....	....
	3	D, E or F G, H or J	15 21	50-70 45-60	60-75 55-70	70-85 65-80	75-90 75-85	80-95 80-90	 85-95	....	....	....	....
	5	D, E or F G or H	25 33	45-60 40-55	55-70 50-65	65-80 60-75	70-85 70-80	80-90 75-85	85-95 85-90	 90-95	....	....	....
	7½	D or E F or G	35 44	40-55 40-50	50-65 50-60	60-75 60-70	70-80 70-75	75-85 75-85	80-90 80-90	85-95 85-95	....	....	....
	10	D or E F or G	47 58	35-45 35-45	45-60 45-55	60-70 55-65	70-75 65-75	75-80 75-80	80-90 80-85	85-95 85-90	 90-95	....	....
2	15	C or D E or F	63 79	....	....	35-50 35-45	45-60 45-55	55-70 55-65	65-80 65-75	75-85 70-80	80-90 80-85	85-90 85-90	90-95 90-95
	20	C or D E or F	84 105	....	....	....	40-55 40-50	55-65 50-60	65-75 65-70	70-80 70-80	80-85 80-85	85-90 85-90	90-95 90-95
	25	C or D E or F	106 132	....	....	....	40-50 40-45	50-60 50-55	65-70 60-65	70-80 70-75	80-85 75-80	85-90 80-85	90-95 85-90

*For motors not marked with a code letter, use locked rotor amps column as a basis for selecting Type number suffix.

ORDERING INFORMATION REQUIRED

1. Class and Type number.
2. Voltage, horsepower, frequency.
3. Control voltage and frequency if different from line voltage.
4. Any special features required.

THERMAL UNITS

Thermal units should be ordered separately. For selection see "Overload and Short Circuit Protection."

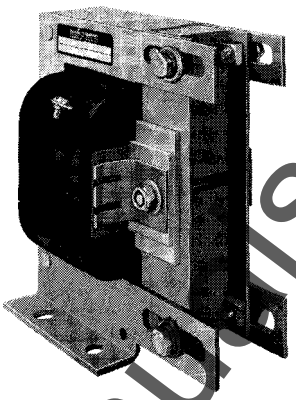
FACTORY INSTALLED SPECIAL FEATURES — See "Modifications and Forms".

CLASS 8604

VARI-TORQ® ADJUSTABLE REACTORS FOR REDUCED VOLTAGE STARTERS

Revised Oct., 1983

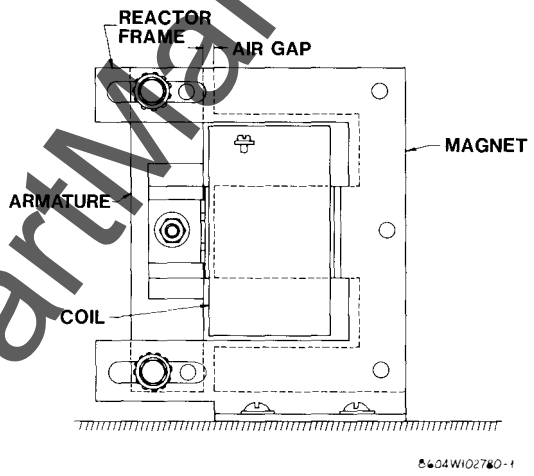
Class 8604 adjustable reactors may be purchased as separate components for those wishing to assemble their own reactor starters. The reactors are identical to those supplied in Class 8604 VARI-TORQ starters and described on pages 9 through 11.



REACTOR ASSEMBLIES

Complete Reactor Assembly Type	Type No. Suffix Shown in Selection Tables on Page 11	Coil Furnished in Reactor Assembly◐	List Price for Complete Reactor
MO-105	5	2938-S1-F5B*	**$260.**
MO-106	6	2938-S1-F6B*	**260.**
MO-107	7	2938-S1-F7B*	**260.**
MO-108	8	2938-S1-F8B*	**260.**
MO-109	9	2938-S1-F9B*	**260.**
MO-110	10	2938-S1-F10B*	**260.**
MO-111	11	2938-S1-F11B	**260.**
MO-112	12	2938-S1-F12B	**260.**
MO-113	13	2938-S1-F13B	**260.**
MO-114	14	2938-S1-F14B	**260.**
MO-115	15	2938-S1-F15B	**260.**
MO-100	—	(Without Coil)	**152.**

* Coil terminal hardware kit furnished with these coils.
◐ Separate coils available. Consult local Square D Field Office.



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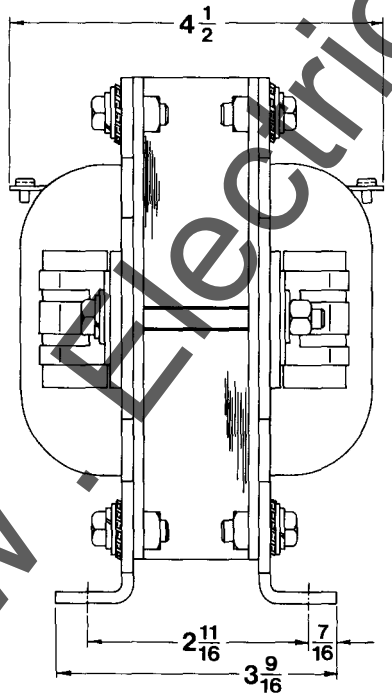

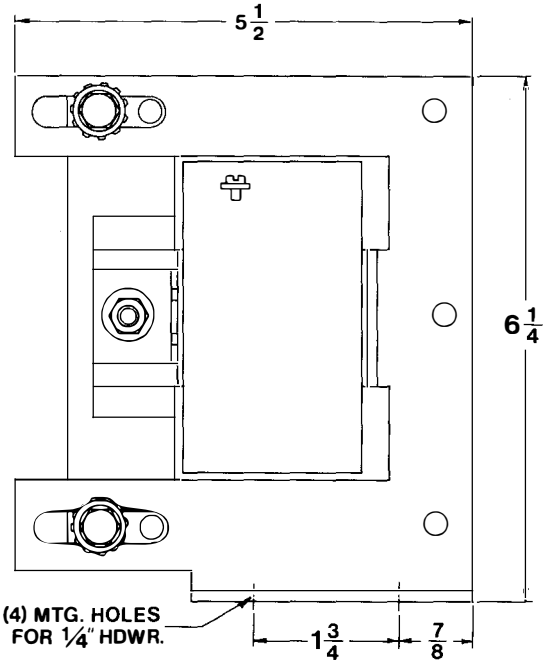

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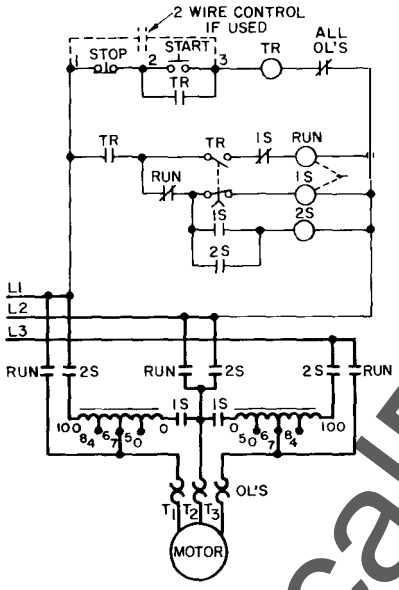
REDUCED VOLTAGE STARTERS
AUTOTRANSFORMER TYPE

Taps are provided on the autotransformer to permit the user to select either 50%, 65% or 80% of line voltage to the motor during start. These taps permit adjustment so the voltage can be selected to insure the proper amount of torque for the driven equipment.

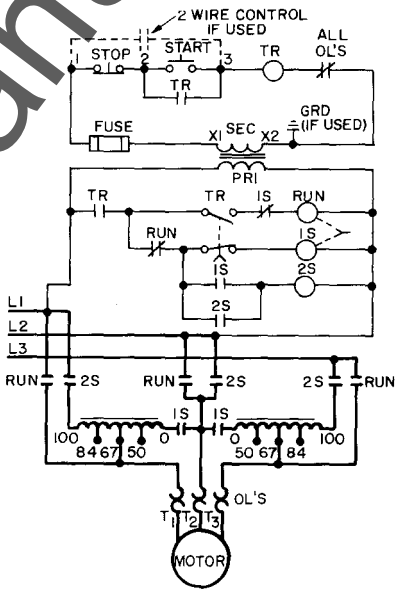
Autotransformer type starters are one of the most popular types of reduced voltage starters because they can start squirrel cage motors with less line current draw than other starting methods. This starter uses an autotransformer between the motor and the electrical distribution system to reduce the voltage to the motor during the starting period.

For motors greater than 200 hp, this starter is suitable for one 30 second on period each minute for three times total. For motors rated at 200 hp or less, the starting duty is one 15 second on period each four minutes for an hour.

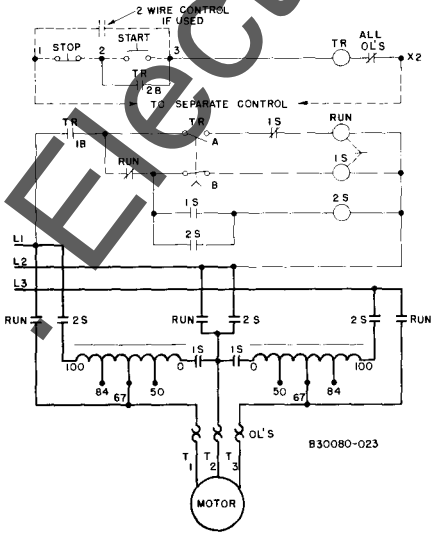
Listed below are some typical wiring diagrams for autotransformer type starters.



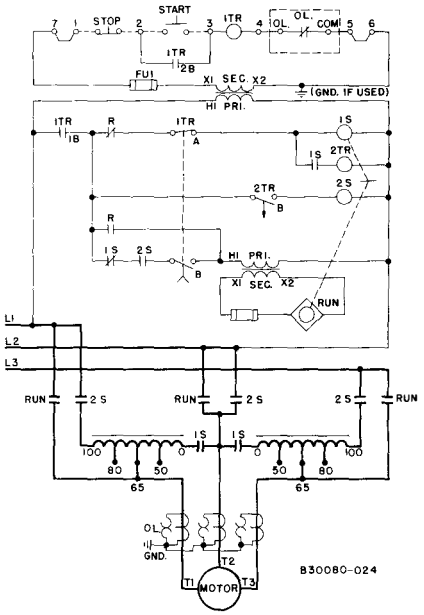
Typical Autotransformer Starter Size 2-5



Typical Autotransformer Starter with Fused Control Transformer Size 2-5



Typical Autotranformer Starter with Separate Control Source Size 2-5



Typical Size 6 Autotransformer Starter

CLASS 8606

REDUCED VOLTAGE STARTERS
AUTOTRANSFORMER TYPE

Class 8606 Autotransformer type starters apply a reduced voltage to the motor through the use of an autotransformer with taps to permit starting at 50, 65 or 80% of line voltage. Closed transition starting is provided. Autotransformer starters provide a maximum torque with a minimum of line current. Starters are furnished with three hand reset melting alloy overload relays.

50-60 HERTZ		THREE MELTING ALLOY THERMAL RELAYS								600 VOLTS MAX.	
Max. HP Ratings	Volts	NEMA Size	General Purpose Enclosure NEMA Type 1		Watertight and Dusttight Enclosure NEMA Type 4▲		For Hazardous Locations Class II Group E, F & G NEMA Type 9		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12‡		Open Type	
			Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*
10	200-230 380-575	2	SDG-1	$ 2268.	SDW-1	$ 3508.	SDE-1	$ 3858.	SDA-1	$ 2988.	SDO-1	$ 2172.
15	200 230 380-575	3 2 2	SEG-1 SDG-1 SDG-1	2668. 2268. 2268.	SEW-1 SDW-1 SDW-1	3908. 3508. 3508.	SEE-1 SDE-1 SDE-1	4298. 3858. 3858.	SEA-1 SDA-1 SDA-1	3428. 2988. 2988.	SEO-1 SDO-1 SDO-1	2364. 2172. 2172.
25	200-230 380-575	3 2	SEG-1 SDG-1	2668. 2268.	SEW-1 SDW-1	3908. 3508.	SEE-1 SDE-1	4298. 3858.	SEA-1 SDA-1	3428. 2988.	SEO-1 SDO-1	2364. 2172.
30	200 230 380-575	4 3 3	SFG-1 SEG-1 SEG-1	5172. 2780. 2780.	SFW-1 SEW-1 SEW-1	7452. 4020. 4020.	SFE-1 SEE-1 SEE-1	8196. 4422. 4422.	SFA-1 SEA-1 SEA-1	6132. 3540. 3540.	SFO-1 SEO-1 SEO-1	4732. 2476. 2476.
40	200-230 380-575	4 3	SFG-1 SEG-1	5172. 2876.	SFW-1 SEW-1	7452 4116.	SFE-1 SEE-1	8196. 4526.	SFA-1 SEA-1	6132. 3636.	SFO-1 SEO-1	4732. 2572.
50	200 230 380-575	5 4 3	SGG-1 SFG-1 SEG-1	8230. 5172. 2876.	SGW-1 SFW-1 SEW-1	10510. 7452. 4116.	.... SFE-1 SEE-1	.... 8196. 4526.	SGA-1 SFA-1 SEA-1	9310. 6132. 3636.	SGO-1 SFO-1 SEO-1	7342. 4732. 2572.
75	200-230 380-575	5 4	SGG-1 SFG-1	8230. 5268.	SGW-1 SFW-1	10510. 7548.	.... SFE-1	.... 8302.	SGA-1 SFA-1	9310. 6228.	SGO-1 SFO-1	7342. 4828.
100	200 230 380 460-575	6 5 5 4	SHG-1 SGG-1 SGG-1 SFG-1	15222. 8854. 8518. 5268.	SHW-1 SGW-1 SGW-1 SFW-1	18222. 11134. 10798. 7548.	.... SFE-1	.... 8302.	SHA-1 SGA-1 SGA-1 SFA-1	16722. 9934. 9598. 6228.	SHO-1 SGO-1 SGO-1 SFO-1	13798. 7966. 7630. 4828.
125	200 230 380-575	6 6 5	SHG-1 SHG-1 SGG-1	15222. 15222. 8518.	SHW-1 SHW-1 SGW-1	18222. 18222. 10798.	....	....	SHA-1 SHA-1 SGA-1	16722. 16722. 9598.	SHO-1 SHO-1 SGO-1	13798. 13798. 7630.
150	200 230 380-575	6 6 5	SHG-1 SHG-1 SGG-1	15870. 15870. 8518.	SHW-1 SHW-1 SGW-1	18870. 18870. 10798.	....	....	SHA-1 SHA-1 SGA-1	17370. 17370. 9598.	SHO-1 SHO-1 SGO-1	14446. 14446. 7630.
200	230 380 460-575	6 6 5	SHG-1 SHG-1 SGG-1	16438. 15870. 9630.	SHW-1 SHW-1 SGW-1	19438. 18870. 11910.	....	....	SHA-1 SHA-1 SGA-1	17938. 17370. 10710.	SHO-1 SHO-1 SGO-1	15014. 14446. 8742.
250	230 380-575	7 6	SJG-1 SHG-1	25110. 15998.	SJW-1 SHW-1	28110. 18998.	....	....	SJA-1 SHA-1	26610. 17490.	.... SHO-1	.... 14574.
300	230 380-575	7 6	SJG-1 SHG-1	25962. 16926.	SJW-1 SHW-1	28962. 19926.	....	....	SJA-1 SHA-1	27462. 18426.	.... SHO-1	.... 15502.
400	230 460-575	8 6	KG-1 SHG-1	34346. 17414.	KW-1 SHW-1	37346. 20414.	....	....	KA-1 SHA-1	36586. 18914.	.... SHO-1	.... 15990.
450	230 460-575	8 7	KG-1 SJG-1	36586. 27182.	KW-1 SJW-1	39586. 30182.	....	....	KA-1 SJA-1	38086. 28682.	....	....
500	460-575	7	SJG-1	27182.	SJW-1	30182.	....	....	SJA-1	28682.	....	....
600	460-575	7	SJG-1	27830.	SJW-1	30830.	....	....	SJA-1	29330.	....	....
700	460-575	8	KG-1	37690.	KW-1	40694.	....	....	KA-1	39190.	....	....
800	460-575	8	KG-1	39026.	KW-1	42026.	....	....	KA-1	40526.	....	....
900	460-575	8	KG-1	40430.	KW-1	43430.	....	....	KA-1	41930.	....	....

* **Prices do not include thermal units. For selection, see below.**
‡ NEMA Type 12 enclosures may be field modified for outdoor applications. For details refer to Class 9991 section.
▲ NEMA Type 4 enclosures are painted sheet steel. Where required, stainless steel enclosures are available at extra cost. Specify as Form Y56. See "Modifications and Forms" for price adder.

ORDERING INFORMATION REQUIRED

1. Class and type number.
2. Horsepower, voltage, phase and hertz.
3. Control voltage and hertz — if different than line supply.
4. Special features or modifications.

FACTORY INSTALLED SPECIAL FEATURES —See "Modifications and Forms."

APPLICATION DATA — See Pages 2-4 and 13.

OUTLINE DIMENSIONS — See Pages 15-16.

COMBINATION STARTERS

These starters are available with circuit breaker or main disconnect. See "Modifications and Forms" for form letter and price adder.

THERMAL UNITS

Thermal units should be ordered separately. For selection see "Overload and Short Circuit Protection."

REVERSING VERSIONS

Reversing versions are available at extra cost. Specify as Form Y64. See "Modifications and Forms" for Price Adder.

REDUCED VOLTAGE STARTERS
WYE-DELTA TYPE

CLASS 8630

Class 8630 Wye-Delta starters may only be used with Wye-Delta (6 lead) motors. These starters connect the motor windings in wye (for starting) and then in delta (for running). Starting torque and inrush current in wye are ⅓ of their value for a line voltage, delta connected start. All sizes utilize three melting alloy overload relays.

600 VOLTS MAX. — **THREE MELTING ALLOY OVERLOAD RELAYS** — **50-60 HERTZ**

Max. HP	Voltage	NEMA Size	OPEN TRANSITION STARTING								CLOSED TRANSITION STARTING							
			General Purpose Enclosure NEMA Type 1		Watertight and Dusttight Enclosure (Stainless Steel, Sizes 1YD-4YD) NEMA Type 4		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12‡		Open Type		General Purpose Enclosure NEMA Type 1		Watertight and Dusttight Enclosure (Stainless Steel, Sizes 1YD-4YD) NEMA Type 4		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12		Open Type	
			Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*	Type	Price*
10	200–230	1YD	SCG-1	$ 1374.	SCW-11	$ 1854.	SCA-1	$ 1774.	SCO-1	$ 1350.	SCG-2	$ 2098.	SCW-12	$ 2578.	SCA-2	$ 2498.	SCO-2	$ 2074.
	380–575	1YD	SCG-1	1374.	SCW-11	1854.	SCA-1	1774.	SCO-1	1350.	SCG-2	2098.	SCW-12	2578.	SCA-2	2498.	SCO-2	2074.
15	200–230	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2350.	SDW-12	2890.	SDA-2	2850.	SDO-2	2286.
	380–575	1YD	SCG-1	1374.	SCW-11	1854.	SCA-1	1774.	SCO-1	1350.	SCG-2	2098.	SCW-12	2578.	SCA-2	2498.	SCO-2	2074.
20	200–230	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2374.	SDW-12	2914.	SDA-2	2874.	SDO-2	2310.
	380–575	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2374.	SDW-12	2914.	SDA-2	2874.	SDO-2	2310.
25	200	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3190.	SEW-12	3970.	SEA-2	3790.	SEO-2	2942.
	230	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2374.	SDW-12	2914.	SDA-2	2874.	SDO-2	2310.
	380–575	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2374.	SDW-12	2914.	SDA-2	2874.	SDO-2	2310.
30	200–230	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3190.	SEW-12	3970.	SEA-2	3790.	SEO-2	2942.
	380–575	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2374.	SDW-12	2914.	SDA-2	2874.	SDO-2	2310.
40	200–230	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3278.	SEW-12	4058.	SEA-2	3878.	SEO-2	3030.
	380–575	2YD	SDG-1	1626.	SDW-11	2166.	SDA-1	2126.	SDO-1	1562.	SDG-2	2462.	SDW-12	3002.	SDA-2	2962.	SDO-2	2398.
50	200	4YD	SFG-1	4934.	SFW-11	6162.	SFA-1	5734.	SFO-1	4490.	SFG-2	6190.	SFW-12	7418.	SFA-2	6990.	SFO-2	5746.
	230	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3278.	SEW-12	4058.	SEA-2	3878.	SEO-2	3030.
	380–575	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3278.	SEW-12	4058.	SEA-2	3878.	SEO-2	3030.
60	200–230	4YD	SFG-1	4934.	SFW-11	6162.	SFA-1	5734.	SFO-1	4490.	SFG-2	6266.	SFW-12	7494.	SFA-2	7066.	SFO-2	5822.
	380–575	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3374.	SEW-12	4154.	SEA-2	3974.	SEO-2	3126.
75	200	5YD	SGG-1	8870.	SGW-1	11150.	SGA-1	9950.	SGO-1	7982.	SGG-2	10774.	SGW-2	13054.	SGA-2	11854.	SGO-2	9886.
	230	4YD	SFG-1	4934.	SFW-11	6162.	SFA-1	5734.	SFO-1	4490.	SFG-2	6458.	SFW-12	7686.	SFA-2	7258.	SFO-2	6014.
	380–575	3YD	SEG-1	2366.	SEW-11	3146.	SEA-1	2966.	SEO-1	2118.	SEG-2	3706.	SEW-12	4486.	SEA-2	4306.	SEO-2	3458.
100	200–230	5YD	SGG-1	8870.	SGW-1	11150.	SGA-1	9950.	SGO-1	7982.	SGG-2	10774.	SGW-2	13054.	SGA-2	11854.	SGO-2	9886.
	380–575	4YD	SFG-1	4934.	SFW-11	6162.	SFA-1	5734.	SFO-1	4490.	SFG-2	6714.	SFW-12	7942.	SFA-2	7514.	SFO-2	6270.
150	200–230	5YD	SGG-1	8870.	SGW-1	11150.	SGA-1	9950.	SGO-1	7982.	SGG-2	10870.	SGW-2	13150.	SGA-2	11950.	SGO-2	9982.
	380–575	4YD	SFG-1	4934.	SFW-11	6162.	SFA-1	5734.	SFO-1	4490.	SFG-2	6810.	SFW-12	8038.	SFA-2	7610.	SFO-2	6366.
250	200–230	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
	380–575	5YD	SGG-1	8870.	SGW-1	11150.	SGA-1	9950.	SGO-1	7982.	SGG-2	11134.	SGW-2	13414.	SGA-2	12214.	SGO-2	10246.
300	200–230	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
	380	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
	460–575	5YD	SGG-1	8870.	SGW-1	11150.	SGA-1	9950.	SGO-1	7982.	SGG-2	11738.	SGW-2	14018.	SGA-2	12818.	SGO-2	10850.
350	200	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
	230	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
	380–575	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
500	200–230	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
	380–575	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
600	200–230	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	43702.	KW-2	46702.	KA-2	45202.	KO-2	42278.
	380	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
	460–575	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
700	200–230	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	44854.	KW-2	47854.	KA-2	46354.	KO-2	43430.
	380	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
	460–575	6YD	SHG-1	18982.	SHW-1	21982.	SHA-1	20482.	SHO-1	17558.	SHG-2	23878.	SHW-2	26878.	SHA-2	25378.	SHO-2	22454.
750	200–230	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	44854.	KW-2	47854.	KA-2	46354.	KO-2	43430.
	380–575	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
800	230	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	44854.	KW-2	47854.	KA-2	46354.	KO-2	43430.
	380–575	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
1000	380	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	45458.	KW-2	48458.	KA-2	46958.	KO-2	44034.
	460–575	7YD	SJG-1	25602.	SJW-1	28602.	SJA-1	27102.	SJO-1	24178.	SJG-2	33198.	SJW-2	36198.	SJA-2	34698.	SJO-2	31774.
1500	460–575	8YD	KG-1	35430.	KW-1	38430.	KA-1	36930.	KO-1	34006.	KG-2	45458.	KW-2	48458.	KA-2	46958.	KO-2	44034.

*** Prices do not include thermal units. For selection, see below.**
‡ NEMA Type 12 enclosures may be field modified for outdoor applications. For details refer to Class 9991.

ORDERING INFORMATION REQUIRED

1. Class and type number.
2. Horsepower, voltage, phase and hertz.
3. Control voltage and hertz — if different than line supply.
4. Special features or modifications.

FACTORY INSTALLED SPECIAL FEATURES — See "Modifications and Forms."

APPLICATION DATA — See Pages 2-4.

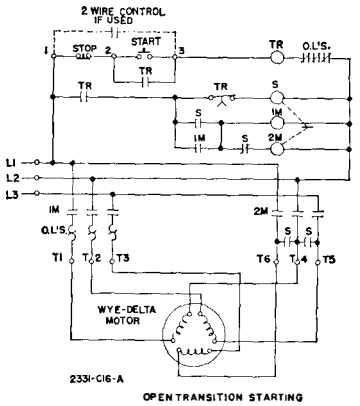
OUTLINE DIMENSIONS — See Pages 18-19.

COMBINATION STARTERS

These starters are available with circuit breaker or main disconnect. See "Modifications and Forms" for form letter and price adder.

THERMAL UNITS

Thermal units should be ordered separately. For selection see "Overload and Short Circuit Protection."



Typical Open Transition Wye-Delta Starter

REDUCED VOLTAGE STARTERS — PART WINDING

Revised Oct., 1983

Part winding starters are used with motors having two sets of windings, and which are suitable for starting with only one set of windings energized. After starting, the controller connects the second winding in parallel with the first winding. Two sets of hand reset melting alloy thermal units (one set for each winding) are used.

A four pole starter (S) and a two pole starter (RUN) are used on NEMA Size 1PW through 4PW (as pictured below). NEMA Sizes 5PW, 6PW and 7PW use a three pole starter (S) and a three pole starter (RUN) configuration.

SIX MELTING ALLOY OVERLOAD RELAYS — **600 VOLTS MAX.**

Motor Voltage	Max. HP Poly-phase	NEMA Size	General Purpose Enclosure **NEMA Type 1** Type	Price*	Watertight and Dusttight Enclosure (Stainless steel, sizes 1PW-4PW) **NEMA Type 4** Type	Price*	Hazardous Locations Class II, Groups E, F & G Enclosure **NEMA Type 9** Type	Price*	Dusttight and Driptight Industrial Use Enclosure **NEMA Type 12‡** Type	Price*	**Open Type** Type	Price*
200	10	1PW	SCG-1	$ 876.	SCW-11	$ 1356.	SCE-1	$1544.	SCA-1	$ 1276.	SCO-1	$ 852.
	20	2PW	SDG-1	1248.	SDW-11	1788.	SDE-1	2244.	SDA-1	1748.	SDO-1	1184.
	40	3PW	SEG-1	1760.	SEW-11	2540.	SEE-1	3096.	SEA-1	2360.	SEO-1	1648.
	75	4PW	SFG-1	3764.	SFW-11	4992.	SFE-1	5856.	SFA-1	4564.	SFO-1	3556.
	150	5PW	SGG-1	7884.	SGW-1	10164.	....	....	SGA-1	8964.	SGO-1	7444.
230	10	1PW	SCG-1	876.	SCW-11	1356.	SCE-1	1544.	SCA-1	1276.	SCO-1	852.
	25	2PW	SDG-1	1248.	SDW-11	1788.	SDE-1	2244.	SDA-1	1748.	SDO-1	1184.
	50	3PW	SEG-1	1760.	SEW-11	2540.	SEE-1	3096.	SEA-1	2360.	SEO-1	1648.
	75	4PW	SFG-1	3764.	SFW-11	4992.	SFE-1	5856.	SFA-1	4564.	SFO-1	3556.
	150	5PW	SGG-1	7884.	SGW-1	10164.	....	....	SGA-1	8964.	SGO-1	7444.
	300	6PW	SHG-1	16484.	SHW-1	18912.	....	....	SHA-1	18484.	SHO-1	15060.
	450	7PW	SJG-1	25184.	SJW-1	27796.	....	....	SJA-1	27584.	SJO-1	22664.
460-575	15	1PW	SCG-1	876.	SCW-11	1356.	SCE-1	1544.	SCA-1	1276.	SCO-1	852.
	40	2PW	SDG-1	1248.	SDW-11	1788.	SDE-1	2244.	SDA-1	1748.	SDO-1	1184.
	75	3PW	SEG-1	1760.	SEW-11	2540.	SEE-1	3096.	SEA-1	2360.	SEO-1	1648.
	150	4PW	SFG-1	3764.	SFW-11	4992.	SFE-1	5856.	SFA-1	4564.	SFO-1	3556.
	350	5PW	SGG-1	7884.	SGW-1	10164.	....	....	SGA-1	8964.	SGO-1	7444.
	600	6PW	SHG-1	16484.	SHW-1	18912.	....	....	SHA-1	18484.	SHO-1	15060.
	900	7PW	SJG-1	25184.	SJW-1	27796.	....	....	SJA-1	27584.	SJO-1	22664.

***Prices do not include thermal units. For selection, see below.**

‡ NEMA Type 12 enclosures may be field modified for outdoor applications. For details refer to Class 9991.

ORDERING INFORMATION REQUIRED

1. Class and type number.
2. Horsepower, voltage, phase and hertz.
3. Control voltage and hertz — if different than line voltage.
4. Special features or modifications.

FACTORY INSTALLED SPECIAL FEATURES — See "Modifications and Forms."

APPLICATION DATA — See Pages 2-4.

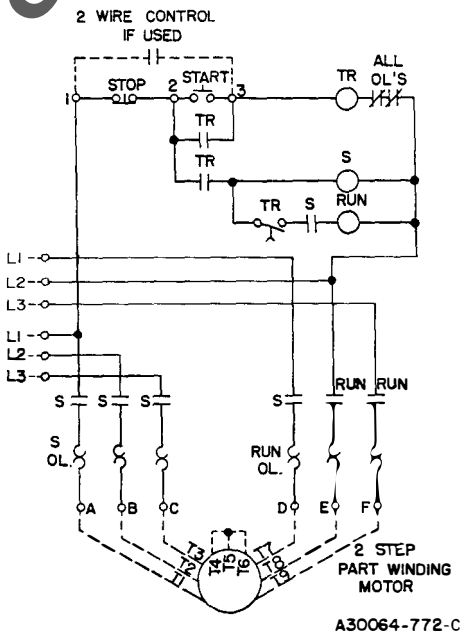
OUTLINE DIMENSIONS — See Pages 18-19.

COMBINATION STARTERS

These starters are available with circuit breaker or main disconnect. See "Modifications and Forms" for Form letter and price adder.

THERMAL UNITS

Thermal units should be ordered separately. For selection see "Overload and Short Circuit Protection."



Typical Part Winding Starter (Size 1PW-4PW)

REDUCED VOLTAGE STARTERS
WOUND ROTOR TYPE

CLASS 8650 8651

Secondary resistor starters for wound rotor (slip ring) motors are available in non-reversing (Class 8650) and reversing (Class 8651) versions. Both types are equipped with resistors connected in the ring circuit which are shorted out in one or more steps. NEMA 136 duty resistors are provided for starters with 2 accelerating points, and NEMA 135 resistors for 3 or more points. All starters have three hand reset melting alloy overload relays.

600 VOLTS MAX.				THREE MELTING ALLOY OVERLOAD RELAYS									50 or 60 HERTZ
				Class 8650, Non-Reversing				Class 8651, Reversing					
				General Purpose Enclosure NEMA Type 1		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12		General Purpose Enclosure NEMA Type 1		Dusttight and Driptight Industrial Use Enclosure NEMA Type 12		Additional Accelerating Contactor — Each	Deductions
H.P. Rating	NEMA Size of Primary Contactor	Volts	Points of Acceleration	Type	Price*	Type	Price*	Type	Price*	Type	Price*		Separately Mounted Resistors / Omit NEMA 1 Enclosure
3	1	200-230 380-575	2	SCG-1	**$1720.**	SCA-1	**$2320.**	SCG-1	**$2184.**	SCA-1	**$2784.**	**$840.**	.... / ....
5	1	200-230 380-575	2	SCG-1	**1752.**	SCA-1	**2352.**	SCG-1	**2216.**	SCA-1	**2816.**	**840.**	.... / ....
7½	1	200-230 380-575	2	SCG-1	**1752.**	SCA-1	**2352.**	SCG-1	**2216.**	SCA-1	**2816.**	**840.**	.... / ....
10	2 1	200-230 380-575	2	SDG-1 SCG-1	**1956.** **1788.**	SDA-1 SCA-1	**2676.** **2388.**	SDG-1 SCG-1	**2796.** **2252.**	SDA-1 SCA-1	**3516.** **2852.**	**840.** **840.**	.... / ....
15	3 2 2	200 230 380-575	2	SEG-2 SDG-1 SDG-1	**2740.** **1956.** **1956.**	SEA-2 SDA-1 SDA-1	**3500.** **2676.** **2676.**	SEG-2 SDG-1 SDG-1	**4076.** **2796.** **2796.**	SEA-2 SDA-1 SDA-1	**4836.** **3516.** **3516.**	**840.** **840.** **840.**	.... / ....
20	3 2	200-230 380-575	3	SEG-1 SDG-2	**3652.** **2796.**	SEA-1 SDA-2	**4412.** **3516.**	SEG-1 SDG-2	**4988.** **3636.**	SEA-1 SDA-2	**5748.** **4356.**	**912.** **912.**	.... / .... / ....
25	3 2	200-230 380-575	3	SEG-1 SDG-2	**3684.** **2796.**	SEA-1 SDA-2	**4444.** **3516.**	SEG-1 SDG-2	**5020.** **3636.**	SEA-1 SDA-2	**5780.** **4356.**	**912.** **912.**	.... / .... / ....
30	4 3 3	200 230 380-575	3	SFG-1 SEG-1 SEG-1	**5552.** **3684.** **3684.**	SFA-1 SEA-1 SEA-1	**6512.** **4444.** **4444.**	SFG-1 SEG-1 SEG-1	**7440.** **5020.** **5020.**	SFA-1 SEA-1 SEA-1	**8400.** **5780.** **5780.**	**912.** **912.** **912.**	.... / .... / .... / ....
40	4 3	200-230 380-575	3	SFG-1 SEG-1	**5552.** **4036.**	SFA-1 SEA-1	**6512.** **4796.**	SFG-1 SEG-1	**7440.** **5372.**	SFA-1 SEA-1	**8400.** **6132.**	**912.** **912.**	.... / **$1232.** .... / **1232.**
50	5 4 3	200 230 380-575	3	SGG-1 SFG-1 SEG-1	**7806.** **5632.** **4036.**	SGA-1 SFA-1 SEA-1	**8886.** **6592.** **4796.**	SGG-1 SFG-1 SEG-1	**11274.** **7520.** **5372.**	SGA-1 SFA-1 SEA-1	**12354.** **8480.** **6132.**	**912.** **912.** **912.**	.... / **1232.** .... / **1232.** .... / **1232.**
60	5 4	200-230 380-575	3	SGG-1 SFG-1	**7806.** **6660.**	SGA-1 SFA-1	**8886.** **7620.**	SGG-1 SFG-1	**11274.** **8548.**	SGA-1 SFA-1	**12354.** **9508.**	**912.** **912.**	.... / **1232.** .... / **1232.**
75	5 4	200-230 380-575	3	SGG-1 SFG-1	**7806.** **6660.**	SGA-1 SFA-1	**8886.** **7620.**	SGG-1 SFG-1	**11274.** **8548.**	SGA-1 SFA-1	**12354.** **9508.**	**912.** **912.**	.... / **1232.** .... / **1232.**
100	6 5 5 4	200 230 380 460-575	4	SHG-1 SGG-2 SGG-2 SFG-2	**14174.** **10398.** **10398.** **7872.**	SHA-1 SGA-2 SGA-2 SFA-2	**15674.** **11478.** **11478.** **8832.**	SHG-1 SGG-2 SGG-2 SFG-2	**20198.** **13866.** **13666.** **9760.**	SHA-1 SGA-2 SGA-2 SFA-2	**21698.** **14946.** **14946.** **10720.**	**1200.** **1200.** **1200.** **1200.**	△ / **1232.** **$960.** / **1232.** **960.** / **1232.** **960.** / **1232.**
125	6 5	200-230 380-575	4	SHG-1 SGG-2	**14174.** **10486.**	SHA-1 SGA-2	**15674.** **11566.**	SHG-1 SGG-2	**20198.** **13954.**	SHA-1 SGA-2	**21698.** **15034.**	**1200.** **1200.**	△ / **1488.** **960.** / **1232.**
150	6 5	200-230 380-575	4	SHG-1 SGG-2	**14214.** **11014.**	SHA-1 SGA-2	**15714.** **12094.**	SHG-1 SGG-2	**20238.** **14482.**	SHA-1 SGA-2	**21738.** **15562.**	**1200.** **1200.**	△ / **1488.** **960.** / **1232.**
200	6 6 5	230 380 460-575	5	SHG-2 SHG-2 SGG-3	**16086.** **16086.** **12694.**	SHA-2 SHA-2 SGA-3	**17586.** **17586.** **13774.**	SHG-2 SHG-2 SGG-3	**22110.** **22110.** **16162.**	SHA-2 SHA-2 SGA-3	**23610.** **23610.** **17242.**	**2292.** **1200.** **1552.**	△ / **1640.** △ / **1488.** **1032.** / **1488.**
250	7 6	230 380-575	5	SJG-1 SHG-2	**27038.** **17086.**	SJA-1 SHA-2	**28538.** **18586.**	SJG-1 SHG-2	**35462.** **23110.**	SJA-1 SHA-2	**36962.** **24610.**	**2292.** **2292.**	△ / **2128.** △ / **1640.**
300	7 6	230 380-575	5	SJG-1 SHG-2	**27574.** **17302.**	SJA-1 SHA-2	**29074.** **18802.**	SJG-1 SHG-2	**35998.** **23326.**	SJA-1 SHA-2	**37498.** **24826.**	**2292.** **2292.**	△ / **2128.** △ / **1640.**
350	8 6	230 460-575	6	KG-1 SHA-3	**33754.** **19350.**	KA-1 SHA-3	**35254.** **20850.**	KG-1 SHG-3	**46090.** **25374.**	KA-1 SHA-3	**47590.** **26874.**	**2292.** **2292.**	△ / **2128.** △ / **1640.**
400	8 6	230 460-575	6	KG-1 SHG-3	**34138.** **19446.**	KA-1 SHA-3	**35638.** **20946.**	KG-1 SHG-3	**46474.** **26970.**	KA-1 SHA-3	**47974.** **26970.**	**2292.** **2292.**	△ / **2128.** △ / **1640.**
450	8 7	230 460-575	6	KG-1 SJG-2	**39410.** **35102.**	KA-1 JA-2	**40910.** **36602.**	KG-1 SJG-2	**51746.** **43526.**	KA-1 JA-2	**53246.** **45026.**	**5912.** **5912.**	△ / **4248.** △ / **2128.**
500	7	460-575	6	SJG-2	**35694.**	SJA-2	**37094.**	SJG-2	**44118.**	SJA-2	**45618.**	**5912.**	△ / **2128.**
600	7	460-575	6	SJG-2	**37262.**	SJA-2	**38762.**	SJG-2	**45686.**	SJA-2	**47186.**	**5912.**	△ / **2128.**
700	8	460-575	6	KG-1	**46846.**	KA-1	**48346.**	KG-1	**59182.**	KA-1	**60682.**	**5912.**	△ / **2128.**
800	8	460-575	6	KG-1	**47686.**	KA-1	**49186.**	KG-1	**60022.**	KA-1	**61522.**	**5912.**	△ / **2128.**
900	8	460-575	6	KA-1	**48686.**	KA-1	**50186.**	KG-1	**61022.**	KA-1	**62522.**	**5912.**	△ / **4248.**

*** Prices do not include thermal units. For selection, see below.**
△ Separately mounted resistors furnished as standard.

ORDERING INFORMATION REQUIRED

1. Class and Type Number
2. Horsepower, voltage, phase and hertz
3. Control voltage and hertz — if different than line voltage
4. Voltage between motor rings at standstill, and full load rotor current
5. Special features or modifications

THERMAL UNITS

Three thermal units are required, and should be ordered separately. For selection see "Overload and Short Circuit Protection."

FACTORY INSTALLED SPECIAL FEATURES

— See "Modifications and Forms."

REDUCED VOLTAGE STARTERS

Revised Oct., 1983

APPLICATION DATA
APPROXIMATE DIMENSIONS

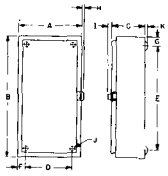


Figure 1

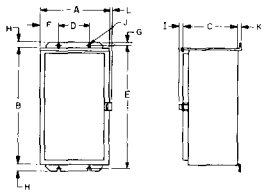


Figure 2

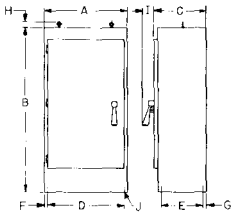


Figure 3

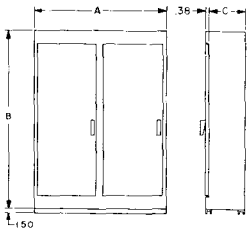


Figure 4

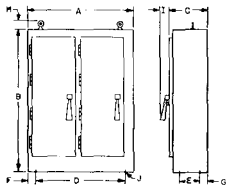


Figure 5

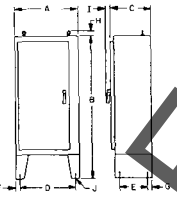


Figure 7

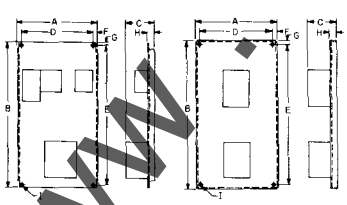


Figure 8

Figure 9

CLASS 8606 AUTOTRANSFORMER STARTERS (NON-COMB.)

Dimension Symbol	Type													
	SDO-1	SDG-1	SDA-1 SDW-1	SEO-1	SFO-1	SEG-1 SFG-1	SEA-1 SFA-1 SEW-1 SFW-1	SGO-1	SGG-1 SGA-1	SGW-1	SHG-1 SHA-1	SHW-1	SJG-1 SJA-1	KG-1 KA-1 KW-1
	Fig. 8	Fig. 1	Fig. 2	Fig. 8	Fig. 8	Fig. 2	Fig. 2	Fig. 8	Fig. 3	Fig. 7	Fig. 3	Fig. 7	Fig. 5	Fig. 4
A	16.25 413	20.25 514	18.25 464	23.00 584	23.00 584	26.00 660	26.00 660	24.50 622	28.25 718	28.25 718	34.25 870	34.25 870	64.25 1632	60.00 1524
B	34.00 864	36.25 921	35.25 921	36.50 927	36.50 927	39.75 1010	39.75 1010	49.00 1245	56.25 1429	61.13 1553	90.25 2292	98.13 2493	90.25 2292	90.00 2286
C	7.88 200	9.63 245	9.63 245	9.00 229	10.38 264	11.75 298	11.75 298	12.25 311	16.25 413	16.25 413	20.25 514	20.25 514	24.25 616	20.00 508
D	15.00 381	17.50 445	12.00 305	21.75 552	21.75 552	15.00 381	17.75 451	23.25 591	25.75 654	26.00 660	31.75 806	32.00 813	61.75 1568	—
E	33.00 838	33.50 851	37.50 953	35.50 902	35.50 902	41.50 1054	41.50 1054	48.00 1219	12.88 327	9.00 229	15.50 419	13.00 330	17.25 438	—
F	.63 16	1.38 35	3.13 80	.63 16	.63 16	5.50 140	4.13 105	.63 16	1.25 32	1.13 29	1.25 32	1.13 29	1.25 32	—
G	.50 13	1.38 35	.50 13	.50 13	.50 13	.50 13	.50 13	.50 13	1.25 32	3.00 75	1.25 32	3.13 80	4.50 114	—
H	1.00 25	.25 6	1.18 30	1.00 25	1.00 25	1.38 35	1.40 36	2.00 51	2.50 64	2.50 64	3.38 86	3.38 86	3.38 86	—
I	.63 16	.88 22	.88 22	.63 16	.63 16	.88 22	.88 22	.63 16	2.50 64	3.25 83	3.25 83	3.25 83	3.25 83	—
J	—	.44 11	.44 11	—	—	.56 14	.56 14	—	.69 18	.69 18	.69 18	.69 18	.81 21	—
K	—	.31 8	.25 6	—	—	.25 6	.25 6	—	—	—	—	—	—	—
L	—	—	.25 6	—	—	.25 6	.25 6	—	—	—	—	—	—	—

CLASS 8630 WYE DELTA STARTERS (NON-COMB.)

Dimension Symbol	Open Transition Type										
	SCO-1	SDO-1	SCG-1 SDG-1	SCA-1 SDA-1 SCW-11 SDW-11	SEO-1 SFO-1	SEG-1 SFG-1	SEA-1 SEW-11 SFA-1 SFW-11	SGO-1 SHO-1	SGG-1 SGA-1 SHG-1 SHA-1	SGW-1 SHW-1	KG-1 KA-1 KW-1
	Fig. 9	Fig. 9	Fig. 1	Fig. 2	Fig. 9	Fig. 2	Fig. 2	Fig. 8	Fig. 3	Fig. 7	Fig. 4
A	21.25 540	21.25 540	23.25 591	23.25 591	25.50 648	28.50 724	28.50 724	29.25 743	33.25 845	33.25 845	60.00 1524
B	21.25 540	21.25 540	24.75 629	23.25 591	41.75 1060	45.75 1162	45.75 1162	62.00 1575	70.25 1784	78.13 1985	90.00 2286
C	5.81 148	6.53 166	8.50 216	8.50 216	7.00 178	8.25 210	8.25 210	11.13 283	16.25 413	16.25 413	20.00 508
D	20.00 508	20.00 508	20.50 521	17.00 432	24.25 616	15.00 381	20.25 514	28.00 711	30.75 781	31.00 787	—
E	20.00 508	20.00 508	22.00 559	24.50 622	40.50 1029	47.50 1207	47.50 1207	61.00 1549	12.50 318	9.00 229	—
F	.63 16	.63 16	1.38 35	3.13 80	.63 16	6.75 171	4.13 105	.63 16	1.25 32	1.13 29	—
G	.63 16	.63 16	1.38 35	.50 13	.63 16	.50 13	.50 13	.50 13	1.25 32	3.00 75	—
H	.50 13	.50 13	.25 6	1.18 30	.50 13	1.38 35	1.40 36	2.00 51	2.50 64	2.50 64	—
I	.31 8	.31 8	.88 22	.88 22	.38 10	.88 22	.88 22	.63 16	3.25 83	3.25 83	—
J	—	—	.44 11	.44 11	—	.56 14	.56 14	—	.69 18	.69 18	—
K	—	—	.31 8	.25 6	—	.25 6	.25 6	—	—	—	—
L	—	—	—	.25 6	—	.25 6	.25 6	—	—	—	—

CLASS 8640 PART WINDING STARTERS (NON-COMB.)

Dimension Symbol	Type													
	SCO-1	SDO-1	SCG-1 SDG-1	SCA-1 SDA-1 SCW-11 SDW-11	SEO-1 SFO-1	SEG-1 SFG-1	SEA-1 SEW-11 SFA-1 SFW-11	SGO-1	SGG-1	SGA-1 SGW-1	SHO-1	SHG-1 SHA-1	SHW-1	KG-1 KA-1 KW-1
	Fig. 9	Fig. 9	Fig. 1	Fig. 2	Fig. 9	Fig. 2	Fig. 2	Fig. 9	Fig. 1	Fig. 2	Fig. 8	Fig. 3	Fig. 7	Fig. 4
A	21.25 540	21.25 540	23.25 591	23.25 591	25.50 648	28.50 724	28.50 724	22.25 565	24.25 616	24.25 616	24.50 622	28.25 718	28.25 718	60.00 1524
B	21.25 540	21.25 540	24.75 629	23.25 591	41.75 1060	45.75 1162	45.75 1162	35.25 895	42.25 1073	42.25 1073	49.00 1245	56.25 1429	64.13 1629	90.00 2286
C	4.72 120	5.44 138	8.50 216	8.50 216	7.00 178	8.25 210	8.25 210	9.75 248	12.25 311	12.25 311	11.13 282	16.25 413	16.25 413	20.00 508
D	20.00 508	20.00 508	20.50 521	17.00 432	24.25 616	15.00 381	20.25 514	20.00 508	21.50 546	18.00 457	23.25 591	25.75 654	26.00 660	—
E	20.00 508	20.00 508	22.00 559	24.50 622	40.50 1029	47.50 1207	47.50 1207	33.00 838	39.50 1003	43.50 1105	48.00 1219	12.88 327	9.00 229	—
F	.63 16	.63 16	1.38 35	3.13 80	.63 16	6.75 171	4.13 105	1.13 29	1.38 35	3.13 80	.63 16	1.25 32	1.13 29	—
G	.63 16	.63 16	1.38 35	.50 13	.63 16	.50 13	.50 13	1.13 29	1.38 35	.50 13	.50 13	1.25 32	3.00 76	—
H	.50 13	.50 13	.25 6	1.18 30	.50 13	1.38 35	1.40 36	1.00 25	.25 6	1.18 30	2.00 51	2.50 64	2.50 64	—
I	.31 8	.31 8	.88 22	.88 22	.38 10	.88 22	.88 22	.63 16	.88 22	.88 22	.63 16	2.50 64	3.25 83	—
J	—	—	.44 11	.44 11	—	.56 14	.56 14	—	.44 11	.44 11	—	.69 18	.69 18	—
K	—	—	.31 8	.25 6	—	.25 6	.25 6	—	.31 8	.25 6	—	—	—	—
L	—	—	—	.25 6	—	.25 6	.25 6	—	—	.25 6	—	—	—	—

Dual Dimensions: **INCHES** / Millimeters

REDUCED VOLTAGE STARTERS

APPLICATION DATA
APPROXIMATE DIMENSIONS

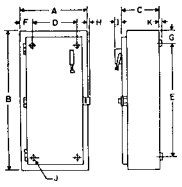


Figure 1

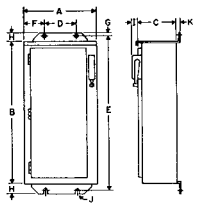


Figure 2

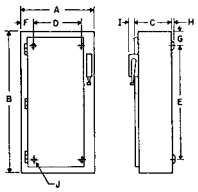


Figure 3

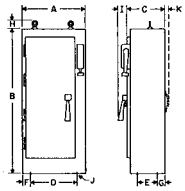


Figure 4

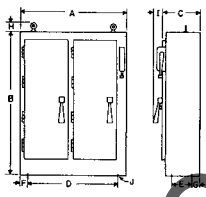


Figure 5

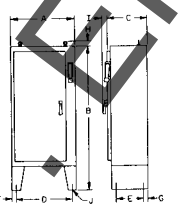


Figure 7

CLASS 8606 AUTOTRANSFORMER STARTERS (COMB.)

Dimension Symbol	Type									
	SDG-1 w/Form Y79-1, 2 3 & 4	SDA-1 w/Form Y79-1, 2 3 & 4	SDW-1 w/Form Y79-1, 2 3 & 4	SEG-1 SEA-1 SFG-1 SFA-1 SGG-1 SGA-1 w/Form Y79-1, 2 5 & 6	SEW-1 SFW-1 SGW-1 w/Form Y79-1, 2 5 & 6	SGG-1 SGA-1 w/Form Y79-7	SGW-1 w/Form Y79-7	SHG-1 SHA-1 w/Form Y79-1, 10	SHW-1 w/Form Y79-1, 10	SHG-1 SHA-1 SJG-1 SJA-1 w/Form Y79-1, 8, 9, 10, 19, 20
	Fig. 1	Fig. 2	Fig. 2	Fig. 4	Fig. 7	Fig. 4	Fig. 7	Fig. 4	Fig. 7	Fig. 5
A	20.25 / 514	18.25 / 464	19.25 / 489	28.25 / 718	28.25 / 718	36.25 / 921	36.25 / 921	34.25 / 870	34.25 / 870	64.25 / 1632
B	36.25 / 921	36.25 / 921	42.25 / 1073	70.25 / 1784	75.13 / 1908	90.25 / 2292	98.13 / 2493	90.25 / 2292	98.13 / 2493	90.25 / 2292
C	9.63 / 245	9.63 / 245	9.63 / 245	16.25 / 413	16.25 / 413	16.25 / 413	16.25 / 413	20.25 / 514	20.25 / 514	24.25 / 616
D	17.50 / 445	12.00 / 305	13.00 / 330	25.75 / 654	26.00 / 660	33.75 / 857	34.00 / 864	31.75 / 806	32.00 / 813	61.75 / 1568
E	33.50 / 851	37.50 / 953	43.50 / 1105	12.50 / 318	9.00 / 229	12.50 / 318	9.00 / 229	16.50 / 419	13.00 / 330	17.25 / 438
F	1.38 / 35	3.13 / 80	3.13 / 80	1.25 / 32	1.13 / 29	1.25 / 32	1.13 / 29	1.25 / 32	1.13 / 29	1.25 / 32
G	1.38 / 35	.50 / 13	.50 / 13	1.25 / 32	3.00 / 76	1.25 / 32	3.00 / 76	1.25 / 32	3.13 / 80	4.50 / 114
H	.25 / 6	1.18 / 30	1.18 / 30	2.50 / 64	2.50 / 64	2.50 / 64	2.50 / 64	3.38 / 86	3.38 / 86	3.38 / 86
I	2.00 / 51	2.00 / 51	1.25 / 32	3.25 / 83	3.25 / 83	3.25 / 83	3.25 / 83	3.25 / 83	3.25 / 83	3.25 / 83
J	.44 / 11	.44 / 11	.44 / 11	.69 / 18	.69 / 18	.69 / 18	.69 / 18	.69 / 18	.69 / 18	.81 / 21
K	.31 / 8	.25 / 6	.25 / 6	—	—	—	—	—	—	—

CLASS 8630 WYE-DELTA STARTERS (COMB.)

Dimension Symbol	Open Transition Type					Closed Transition Type					
	SCG-1 SDG-1 w/Y79-1, 2, 4, & 5	SCA-1 SDA-1 w/Y79-1, 2, 4, & 5	SEG-1 SFG-1 w/Y79-1 2, 5, & 6	SEA-1 SFA-1 SEW-12 SFW-12 w/Y79-1, 2, 5, & 6	SGG-1 SGA-1 SHG-1 SHA-1 w/Y79-1	SGW-1 SHW-1 w/Y79-1	SCG-2 SDG-2 w/Y79-1, 2, 4 & 5	SCA-2 SDA-2 w/Y79-1, 2, 4 & 5	SEG-2 SFG-2 w/Y79-1, 2, 5 & 6	SEA-2 SFA-2 SEW-12 SFW-12 w/Y79-1, 2, 5 & 6	SGG-2 SGA-2 SHG-2 SHA-2 w/Y79-1	SGW-2 SHW-2 w/Y79-1
	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 4	Fig. 7	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 4	Fig. 7
A	23.25 / 591	23.25 / 591	30.25 / 768	30.25 / 768	36.25 / 921	36.25 / 921	23.50 / 597	23.50 / 597	30.25 / 768	30.25 / 768	36.25 / 921	36.25 / 921
B	24.75 / 629	23.25 / 591	47.25 / 1200	47.25 / 1200	90.25 / 2292	98.13 / 2493	23.50 / 597	23.50 / 597	47.25 / 1200	47.25 / 1200	90.25 / 2292	98.13 / 2493
C	8.50 / 216	8.50 / 216	10.63 / 270	10.63 / 270	16.25 / 413	16.25 / 413	16.25 / 413	16.25 / 413	18.38 / 467	18.38 / 467	16.25 / 413	16.25 / 413
D	20.50 / 521	17.00 / 432	15.00 / 381	22.00 / 559	33.75 / 857	34.00 / 864	9.00 / 229	17.25 / 438	15.00 / 381	22.00 / 559	33.75 / 857	34.00 / 864
E	22.00 / 559	24.50 / 622	49.00 / 1245	49.00 / 1245	12.50 / 318	9.00 / 229	24.75 / 629	24.75 / 629	49.00 / 1245	49.00 / 1245	12.50 / 318	9.00 / 229
F	1.38 / 35	3.13 / 80	7.63 / 194	4.13 / 105	1.25 / 32	1.13 / 29	7.25 / 184	3.13 / 80	7.63 / 194	4.13 / 105	1.25 / 32	1.13 / 29
G	1.38 / 35	.50 / 13	.50 / 13	.50 / 13	1.25 / 32	3.00 / 76	.50 / 13	.50 / 13	.50 / 13	.50 / 13	1.25 / 32	3.00 / 76
H	.25 / 6	1.18 / 30	1.38 / 35	1.40 / 36	2.50 / 64	2.50 / 64	1.13 / 29	1.18 / 30	1.38 / 35	1.40 / 36	2.50 / 64	2.50 / 64
I	2.00 / 51	2.00 / 51	1.75 / 44	1.75 / 44	3.25 / 83	3.25 / 83	1.75 / 44	1.75 / 44	1.75 / 44	1.75 / 44	3.25 / 83	3.25 / 83
J	.44 / 11	.44 / 11	.56 / 14	.56 / 14	.69 / 18	.69 / 18	.44 / 11	.44 / 11	.56 / 14	.56 / 14	.69 / 18	.69 / 18
K	.31 / 8	.25 / 6	.25 / 6	.25 / 6	—	—	.25 / 6	.25 / 6	.25 / 6	.25 / 6	—	—

CLASS 8640 PART WINDING STARTERS (COMB.)

Dimension Symbol	Type											
	SCG-1 SDG-1 w/Y79-2, 31, 41	SCA-1 SDA-1 w/Y79-2, 31, 41	SCG-1 SDG-1 w/Y79-11	SCA-1 SDA-1 SCW-11 SDW-11 w/Y79-11	SEG-1 SFG-1 w/Y79-11	SEA-1 SFA-1 SEW-11 SFW-11 w/Y79-11	SEG-1 w/Y79-51	SEA-1 SEW-11 w/Y79-51	SFG-1 SFA-1 w/Y79-61	SFW-11 w/Y79-61	SCG-1 SGA-1 Y79-11, 71	SHG-1 SHA-1 w/Y79-20 21, 71
	Fig. 1	Fig. 2	Fig. 3	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 2	Fig. 4	Fig. 7	Fig. 4	Fig. 5
A	23.25 / 591	23.25 / 591	19.25 / 489	19.25 / 489	30.25 / 768	30.25 / 768	25.25 / 641	25.25 / 641	32.25 / 819	32.25 / 819	36.25 / 921	64.25 / 1632
B	24.75 / 629	23.25 / 591	32.25 / 819	32.25 / 819	38.25 / 972	38.25 / 972	50.25 / 1276	50.25 / 1276	70.25 / 1784	78.13 / 1985	70.25 / 1784	90.25 / 2292
C	8.50 / 216	8.50 / 216	10.75 / 273	10.75 / 273	11.75 / 298	11.75 / 298	10.63 / 270	10.63 / 270	16.25 / 413	16.25 / 413	16.25 / 413	24.25 / 616
D	20.50 / 521	17.00 / 432	15.63 / 397	13.00 / 330	15.00 / 381	22.00 / 559	22.50 / 572	19.00 / 483	29.75 / 756	30.00 / 762	33.75 / 857	61.75 / 1568
E	22.00 / 559	24.50 / 622	29.50 / 749	33.50 / 851	40.00 / 1016	40.00 / 1016	47.50 / 1207	51.50 / 1308	12.50 / 318	9.00 / 229	12.50 / 318	17.25 / 438
F	1.38 / 35	3.13 / 80	1.81 / 46	3.13 / 80	7.63 / 194	4.13 / 105	1.38 / 35	3.13 / 80	1.25 / 32	1.13 / 29	1.25 / 32	1.25 / 32
G	1.38 / 35	.50 / 13	1.38 / 35	.50 / 13	.50 / 13	.50 / 13	1.38 / 35	.50 / 13	1.25 / 32	3.00 / 76	1.25 / 32	4.50 / 114
H	.25 / 6	1.18 / 30	.31 / 8	1.18 / 30	1.38 / 35	1.40 / 36	.31 / 8	1.18 / 30	2.50 / 64	2.50 / 64	2.50 / 64	3.38 / 86
I	2.00 / 51	2.00 / 51	1.25 / 32	1.25 / 32	1.25 / 32	1.25 / 32	1.75 / 44	1.75 / 44	3.25 / 83	3.25 / 83	3.25 / 83	3.25 / 83
J	.44 / 11	.44 / 11	.44 / 11	.44 / 11	.56 / 14	.56 / 14	.44 / 11	.44 / 11	.69 / 18	.69 / 18	.69 / 18	.81 / 21
K	.31 / 8	.25 / 6	—	.25 / 6	.25 / 6	.25 / 6	—	.25 / 6	—	—	—	—

Dual Dimensions: **INCHES** / Millimeters

REDUCED VOLTAGE STARTERS

APPLICATION DATA
APPROXIMATE DIMENSIONS

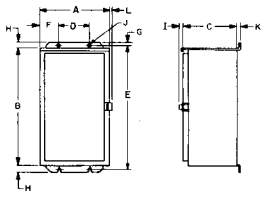


Figure 1

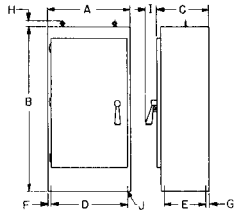


Figure 2

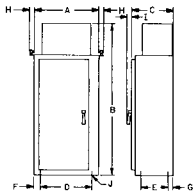


Figure 3

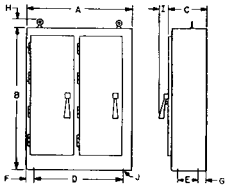


Figure 4

CLASS 8547 AND CLASS 8549 PRIMARY RESISTOR STARTERS (NON-COMB.)

Dimension Symbol	Class 8547 Type								Class 8549 Type					
	SCG-1 SCG-2 SCG-3 SDG-1 SDG-2	SCA-1 SCA-2 SCA-3 SDA-1 SDA-2	SEG-1 SEG-2 SFG-1	SEA-1 SEA-2 SFA-1	SCG-1	SGA-1	SHG-1 SHA-1	KG-1 KA-1	SCG-1 SDG-1	SCA-1 SDA-1	SEG-1 SFG-1	SEA-1 SFA-1	SGG-1	SGA-1
	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 3
A	**23.50** 597	**23.50** 597	**28.50** 724	**28.50** 724	**30.25** 768	**32.25** 819	**69.00** 1753	**56.00** 1422	**23.50** 597	**23.50** 597	**28.50** 724	**28.50** 724	**30.25** 768	**32.25** 819
B	**23.50** 597	**23.50** 597	**45.75** 1162	**45.75** 1162	**56.25** 1429	**100.44** 2551	**80.25** 2038	**90.00** 2286	**23.50** 597	**23.50** 597	**45.75** 1162	**45.75** 1162	**56.25** 1429	**100.44** 2551
C	**16.25** 413	**16.25** 413	**15.50** 394	**15.50** 394	**28.25** 718	**16.25** 413	**20.25** 514	**20.00** 508	**16.25** 413	**16.25** 413	**15.50** 394	**15.50** 394	**28.25** 718	**16.25** 413
D	**9.00** 229	**17.25** 438	**15.00** 381	**20.25** 514	**28.00** 711	**29.75** 756	**66.50** 1689	—	**9.00** 229	**17.25** 438	**15.00** 381	**20.25** 514	**28.00** 711	**29.75** 756
E	**24.75** 629	**24.75** 629	**47.50** 1207	**47.50** 1207	**24.50** 622	**12.50** 318	**16.50** 419	—	**24.75** 629	**24.75** 629	**47.50** 1207	**47.50** 1207	**24.50** 622	**12.50** 318
F	**7.25** 184	**3.13** 80	**6.75** 171	**4.13** 105	**1.13** 29	**1.25** 32	**1.25** 32	—	**7.25** 184	**3.13** 80	**6.75** 171	**4.13** 105	**1.13** 29	**1.25** 32
G	**.50** 13	**.50** 13	**.50** 13	**.50** 13	**1.31** 33	**1.25** 32	**1.25** 32	—	**.50** 13	**.50** 13	**.50** 13	**.50** 13	**1.31** 33	**1.25** 32
H	**1.13** 29	**1.18** 30	**1.38** 35	**1.40** 36	**2.50** 64	**1.50** 38	**3.38** 86	—	**1.13** 29	**1.18** 30	**1.38** 35	**1.40** 36	**2.50** 64	**1.50** 38
I	**.88** 22	**.88** 22	**.88** 22	**.88** 22	**3.25** 83	**3.25** 83	**3.25** 83	—	**.88** 22	**.88** 22	**.88** 22	**.88** 22	**3.25** 83	**3.25** 83
J	**.44** 11	**.44** 11	**.56** 14	**.56** 14	**.69** 18	**.69** 18	**.69** 18	—	**.44** 11	**.44** 11	**.56** 14	**.56** 14	**.69** 18	**.69** 18
K	**.25** 6	**.25** 6	**.25** 6	**.25** 6	—	—	—	—	**.25** 6	**.25** 6	**.25** 6	**.25** 6	—	—
L	**.25** 6	**.25** 6	**.25** 6	**.25** 6	—	—	—	—	**.25** 6	**.25** 6	**.25** 6	**.25** 6	—	—

CLASS 8547 AND CLASS 8549 PRIMARY RESISTOR STARTERS (COMB.)

Dimension Symbol	Class 8547 Type							Class 8549 Type					
	SCG-1 SDG-2 w/Form Y79-1, 2, 3 & 4	SEG-1 SFG-1 w/Form Y79-1, 2, 5, & 6	SGG-1 w/Form Y79-1	SGG-1 w/Form Y79-2, 7	SGA-1 w/Form Y79-1	SGA-1 w/Form Y79-2, 7	SHG-1 SHA-1 w/Form Y79-1, 8, 9 & 10	SCG-1 SDG-1 w/Form Y79-1, 2, 3 & 4	SEG-1 SFG-1 w/Form Y79-1, 2, 5 & 6	SEA-1 SFA-1 w/Form Y79-1, 2, 5 & 6	SGG-1 w/Form Y79-1	SGA-1 w/Form Y79-1	SGA-1 w/Form Y79-2 & 7
	Fig. 6	Fig. 6	Fig. 7	Fig. 7	Fig. 8	Fig. 8	Fig. 9	Fig. 6	Fig. 6	Fig. 6	Fig. 7	Fig. 8	Fig. 8
A	**23.50** 597	**30.25** 768	**40.25** 1022	**32.25** 819	**30.25** 768	**32.25** 819	**69.00** 1753	**23.50** 597	**30.25** 768	**30.25** 768	**40.25** 1022	**30.25** 768	**32.25** 819
B	**23.50** 597	**47.25** 1200	**70.25** 1784	**70.25** 1784	**96.44** 2450	**110.44** 2805	**80.25** 2038	**23.50** 597	**47.25** 1200	**47.25** 1200	**70.25** 1784	**96.44** 2450	**110.44** 2805
C	**16.25** 413	**18.38** 467	**30.25** 768	**30.25** 768	**16.25** 413	**16.25** 413	**20.25** 514	**16.25** 413	**18.38** 467	**18.38** 467	**30.25** 768	**16.25** 413	**16.25** 413
D	**9.00** 229	**15.00** 381	**37.75** 959	**29.75** 756	**27.75** 705	**29.75** 756	**66.50** 1689	**9.00** 229	**15.00** 381	**22.00** 559	**37.75** 959	**27.75** 705	**29.75** 756
E	**24.75** 629	**49.00** 1245	**26.50** 673	**26.50** 673	**12.50** 318	**12.50** 318	**16.50** 419	**24.75** 629	**49.00** 1245	**49.00** 1245	**26.50** 673	**12.50** 318	**12.50** 318
F	**7.25** 184	**7.63** 194	**1.25** 32	**1.25** 32	**1.25** 32	**1.25** 32	**1.25** 32	**7.25** 184	**7.63** 194	**4.13** 105	**1.25** 32	**1.25** 32	**1.25** 32
G	**.50** 13	**.50** 13	**1.25** 32	**1.25** 32	**1.25** 32	**1.25** 32	**1.25** 32	**.50** 13	**.50** 13	**.50** 13	**1.25** 32	**1.25** 32	**1.25** 32
H	**1.13** 29	**1.38** 35	**3.38** 86	**2.50** 64	**1.50** 38	**1.50** 38	**3.38** 86	**1.13** 29	**1.38** 35	**1.40** 36	**3.38** 86	**1.50** 38	**1.50** 38
I	**1.75** 44	**1.75** 44	**3.25** 83	**3.25** 83	**3.25** 83	**3.25** 83	**3.25** 83	**1.75** 44	**1.75** 44	**1.75** 44	**3.25** 83	**3.25** 83	**3.25** 83
J	**.44** 11	**.56** 14	**.81** 21	**.69** 18	**.69** 18	**.69** 18	**.69** 18	**.44** 11	**.56** 14	**.56** 14	**.81** 21	**.69** 18	**.69** 18
K	**.25** 6	**.25** 6	**1.50** 38	**1.50** 38	—	—	—	**.25** 6	**.25** 6	**.25** 6	**1.50** 38	—	—

DUAL DIMENSIONS **INCHES** / MILLIMETERS

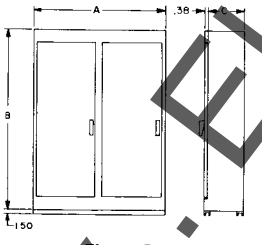


Figure 5

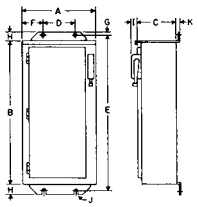


Figure 6

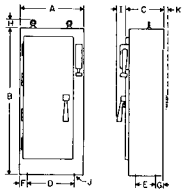


Figure 7

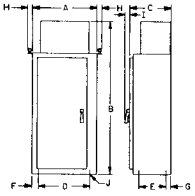


Figure 8

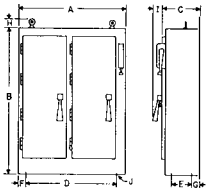


Figure 9