

July 2008

# NEMA Manual Starters

## Contents

<i>Description</i>	<i>Page</i>
<b>Starters and Switches</b>	
Type B230 Switch .....	F-2
MS Series, Single-Phase Starters .....	F-3
Type B100, Single- and Three-Phase Starters.....	F-5
Type 9441, Reversing Drum Switches .....	F-9

F

Type B230 Switch

**Product Selection**

*When Ordering Specify*

- Catalogue Number of Manual Motor Switch



2-Pole B230AN

**Product and Application Description**

Manual Motor Switch is available in two pole configuration rated at 30A.

Manual Motor Switches provide manual control of single phase motors where overload protection is not required or provided separately. Applications include:

- Fans
- Blowers
- Pumps
- Wood Working Equipment
- Machine Tools

**Features**

- Compact size
- Easy installation
- Simple operation

**Instructional Leaflet**

Pub25371

**Standards and Certifications**

- UL File No. E146654, Category NLRV
- CSA File No. LR710828, Class 3211-05



**Wiring Diagram**

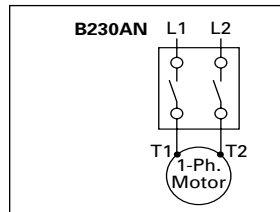


Figure F-1. Wiring Diagram

**Dimensions**

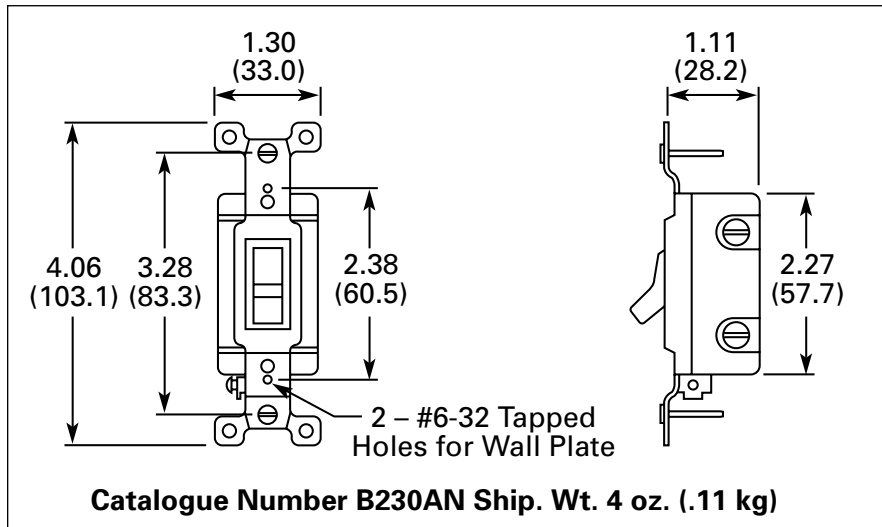


Figure F-2. Approximate Dimensions in Inches (mm) and Shipping Weight

Table F-1. Manual Motor Switch without Overload

Maximum Horsepower Ratings				Open	Price
120V	240V	480V	600V		
<b>2-Pole — Manual Motor Switch</b>					
2	5	—	—	B230AN	

Contents

Description	Page
<b>Manual Motor Starters</b>	
Product Description . . . . .	F-3
Application Description . . .	F-3
Features . . . . .	F-3
Instructional Leaflet . . . . .	F-3
Standards and Certifications . . . . .	F-3
Accessories . . . . .	F-3
Dimensions . . . . .	F-3
Product Selection . . . . .	F-4



Modular Toggle Operated Starter

Product Description

- The MS Motor Starter is a compact, versatile unit featuring heavy sliding contacts as well as “quick-make” and “quick-break” mechanism

Dimensions

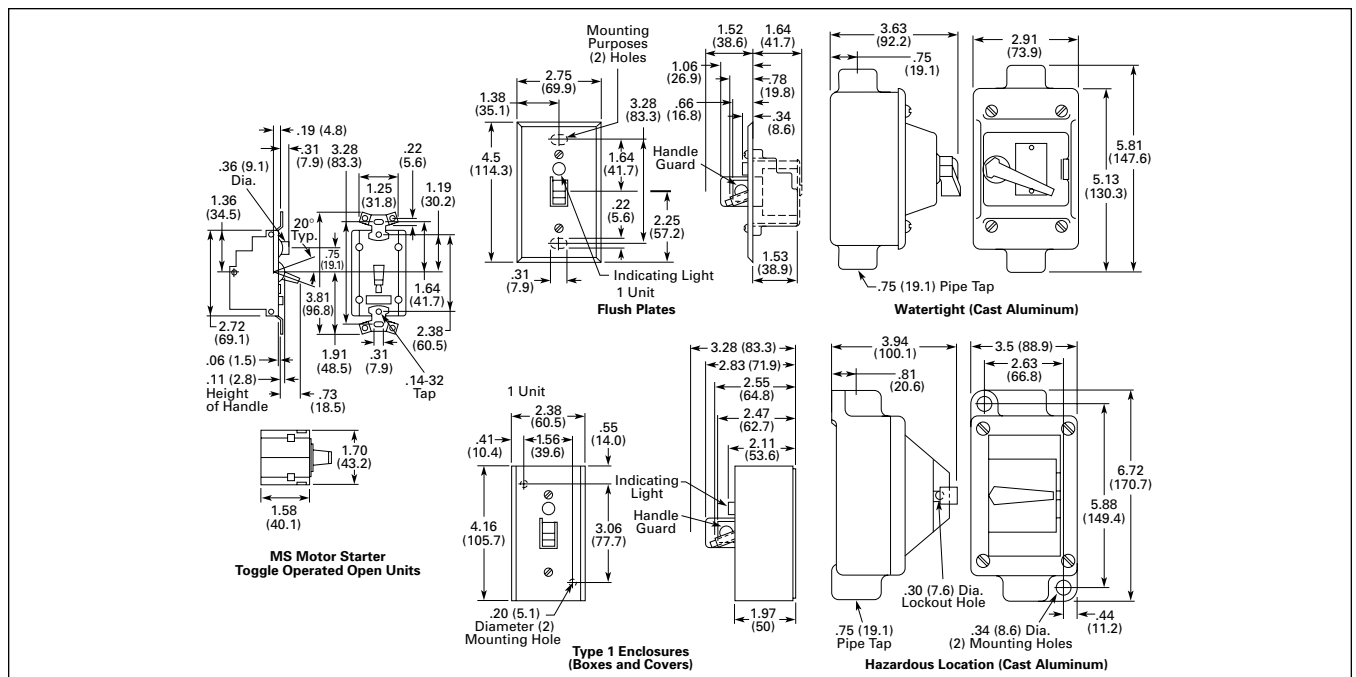


Figure F-3. Approximate Dimensions in Inches (mm)

- Standard with large pressure type terminals, straight-through wiring and a trip-free handle mechanism
- The “plug-in” heater element is keyed to ensure proper positioning and an adjustable knob allows a setting of plus or minus ten percent of the nominal heater rating

Application Description

The MS Manual Motor Starter provides manual control and overload protection to single-phase motors. By utilizing the interchangeable heater elements, the starter can protect motors ranging from .40 amps up to 16.0 amps. Ideal for HVAC applications.

Features

- Compact size
- Trip-free handle mechanism
- Keyed heater elements to ensure proper installation
- Starters available with red pilot light
- The operating handle of the enclosed units can be locked in the OFF position
- Enclosures are offered in NEMA 1, 3, 4 and 5
- Hazardous locations cast aluminum enclosures are available rated for Type 7, Class I, Group D (vapors) and Type 9, Class II, Groups E, F and G (dust).

Instructional Leaflet

IL12987G

Standards and Certifications

- UL File No. E19222, Category NLRV
- CSA File No. LR39402-6, Class 3211-05



Accessories

Table F-2. MS Accessories

Description	Catalogue Number	Price
Pilot Light Kit (NEMA 1 Enclosure and Flush Plates)	MSPT	
Box, 1 Unit (NEMA 1 Enclosure)	MS1BN	
Cover, 1 Unit (NEMA 1 Enclosure)	MS1CN	
Flush Plate, 1 Unit (Steel)	MS1FN	
Flush Plate, 1 Unit (Stainless Steel)	MS1DN	
Handle Guard (Padlockable for NEMA 1 Enclosure and Flush Plates)	MSLG	

F

Discount Symbol . . . . . MC7

**MS Series, Single-Phase Starters**

**Product Selection**

**When Ordering Specify**

- Catalogue Number of Manual Motor Starter
- Heater Pack selection
- Any required Accessories
- Heater Coil selection according to the motor full load current requirements

**Table F-3. Product Selection — MS Series Starters**

Number of Poles	Horsepower	Voltage	Catalogue Number ①	Price
<b>Open Type</b>				
1	1 1/4 1/4	120/240V, 277V AC 120/240V DC 32V DC	<b>MST01</b>	
2	1 1 1/4	120/240V, 277V AC 120/240V DC 32V DC	<b>MST02</b>	

**Flush Plate (No Enclosure Included)**

1	<b>Flush Plate Type</b>	Switch Only	<b>MST01FN</b>	
	General Purpose	Switch with Pilot Light	<b>MST01FN1P</b>	
2	General Purpose	Switch Only	<b>MST02FN</b>	
		Switch with Pilot Light	<b>MST02FN1P</b>	
1	Stainless Steel	Switch Only	<b>MST01DN</b>	
		Switch with Pilot Light	<b>MST01DN1P</b>	
2		Switch Only	<b>MST02DN</b>	
		Switch with Pilot Light	<b>MST02DN1P</b>	

**Enclosed Types**

1	<b>Enclosure Type</b>	Switch Only	<b>MST01SN</b>	
	General Purpose	Switch with Pilot Light	<b>MST01SN1P</b>	
2	Type 1	Switch Only	<b>MST02SN</b>	
		Switch with Pilot Light	<b>MST02SN1P</b>	
1	Waterproof Type 3, 4 & 5	Through Hub	<b>MST01AH</b>	
2		Through Hub	<b>MST02AH</b>	
1	Hazardous Location ②	Through Hub	<b>MST01EH</b>	
2		Through Hub	<b>MST02EH</b>	

① Does not include heater. Select heater from **Table F-4**.

② Type 7D = Type 7, Class I, Group D; Type 9E, 9F and 9G = Type 9, Class II, Groups E, F and G.



**Typical Heater**



**Heater Element Installation**

**Table F-4. Heater Selection for MS Starters**

Motor Full Load Current	Catalogue Number	Price	Motor Full Load Current	Catalogue Number	Price	Motor Full Load Current	Catalogue Number	Price	Motor Full Load Current	Catalogue Number	Price
.4 – .43	<b>MSH-5A</b>		1.04 – 1.15	<b>MSH1-3A</b>		2.72 – 2.95	<b>MSH3-4A</b>		7.04 – 7.74	<b>MSH8-8A</b>	
.44 – .48	<b>MSH-55A</b>		1.16 – 1.27	<b>MSH1-45A</b>		2.96 – 3.27	<b>MSH3-7A</b>		7.75 – 8.46	<b>MSH9-7A</b>	
.49 – .53	<b>MSH-61A</b>		1.28 – 1.35	<b>MSH1-6A</b>		3.28 – 3.59	<b>MSH4-1A</b>		8.47 – 9.35	<b>MSH10-6A</b>	
.54 – .58	<b>MSH-67A</b>		1.36 – 1.51	<b>MSH1-7A</b>		3.60 – 3.99	<b>MSH4-5A</b>		9.36 – 10.30	<b>MSH11-7A</b>	
.59 – .64	<b>MSH-74A</b>		1.52 – 1.67	<b>MSH1-9A</b>		4.00 – 4.39	<b>MSH5-0A</b>		10.31 – 11.35	<b>MSH12-9A</b>	
.65 – .71	<b>MSH-81A</b>		1.68 – 1.83	<b>MSH2-1A</b>		4.40 – 4.79	<b>MSH5-5A</b>		11.36 – 12.47	<b>MSH14-2A</b>	
.72 – .78	<b>MSH-89A</b>		1.84 – 1.99	<b>MSH2-3A</b>		4.80 – 5.26	<b>MSH6-0A</b>		12.48 – 13.67	<b>MSH15-6A</b>	
.79 – .87	<b>MSH-98A</b>		2.00 – 2.23	<b>MSH2-5A</b>		5.27 – 5.83	<b>MSH6-6A</b>		13.68 – 15.12	<b>MSH17-1A</b>	
.88 – .95	<b>MSH1-1A</b>		2.24 – 2.47	<b>MSH2-8A</b>		5.84 – 6.39	<b>MSH7-3A</b>		15.13 – 16.00	<b>MSH18-6A</b>	
.96 – 1.03	<b>MSH1-2A</b>		2.48 – 2.71	<b>MSH3-1A</b>		6.40 – 7.03	<b>MSH8-0A</b>				



**Switch and Pilot Light Mounted on Flush Plate**



**Switch and Pilot Light Mounted in Type 1 Enclosure**



**Waterproof Type 3, 4 & 5**

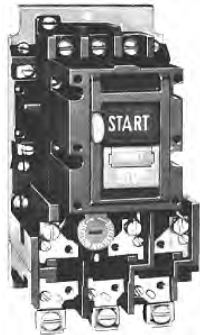


**Hazardous Location Type 7D, 9E, 9F & 9G**

Discount Symbol ..... **MC7**

**Contents**

<i>Description</i>	<i>Page</i>
<b>Manual Motor Starters</b>	
Product Description . . . . .	F-5
Application Description . . .	F-5
Features . . . . .	F-5
Instructional Leaflet . . . . .	F-5
Standards and Certifications . . . . .	F-5
Technical Data . . . . .	F-5
Options . . . . .	F-5
Accessories . . . . .	F-5
Dimensions . . . . .	F-6
Product Selection . . . . .	F-7



*Pushbutton Operated*

**Product Description**

The B100 Manual Motor Starters can be used in single-phase applications rated 3 hp at 240V AC or 2 hp at 230V DC. The starter can also be rated for three-phase applications up to 10 hp at 600V AC.

There are two methods of operation for the B100 Manual Starter. It can be ordered with a toggle switch operator or a START/STOP pushbutton operator.

**Application Description**

The B100 family of Manual Motor Starters provides manual control, as well as overload protection, to both single-phase and three-phase motors. The starter protects motors up to 38.9 amp single-phase and 26.8 amp three-phase with the appropriate heater selection.

**Features**

- Includes three-pole bimetallic overload relay
- Straight-through wiring
- Field mounted auxiliary contacts
- Available in NEMA 1, 4, 7, 9 and 12 enclosures with toggle operation (NEMA 1 enclosure for pushbutton operator)
- Standard with a lockout device to lock motor in the OFF position

**Technical Data**

**Table F-5. Specifications**

NEMA Size	Maximum hp for AC Ratings ①			Maximum hp for DC Ratings	
	120V AC	208 – 240V AC	480 – 600V AC	115V DC	230V DC
<b>2-Pole, Single-Phase</b>					
M-0	1	2	—	1	1-1/2
M-1	2	3	—	1-1/2	2
<b>3-Pole, Three-Phase</b>					
M-0	2	3	5	—	—
M-1	3	7-1/2	10	—	—

① Ratings up to 3 hp, 3-phase are suitable for group fusing.

**Options**

**Table F-6. Factory Modifications**

Description	Catalogue Number ② Suffix	Adder
Pushbutton operator (open and NEMA 1 only)	A	
Without lockoff (open only)	X	

② Add Suffix letter to starter Catalogue Number Ex: B100MOCA.

**Instructional Leaflet**

IL14890

**Standards and Certifications**

- UL File No. E19222, Category NLRV
- CSA File No. LR39402-6, Class 3211-05 (Open Starters)
- CSA File No. LR54517-1, Class 3211-05 (Closed Starters)



**F**

**Accessories**

**Table F-7. Accessories**

Description	Catalogue Number	Price
<b>Field Mounting Kits</b>		
1NO elect. auxiliary	<b>B1A</b>	
1NC elect. auxiliary		
Red pilot light 120/60 (NEMA 1 Enc. Only)	<b>B1B</b>	
Red pilot light 208-240/6 (NEMA 1 Enc. Only)	<b>LK-22</b>	
Red pilot light 480-600/60 (NEMA 1 Enc. Only)	<b>LK-26</b>	

Discount Symbol . . . . . **MC7**

Type B100, Single- and Three-Phase Starters

Dimensions

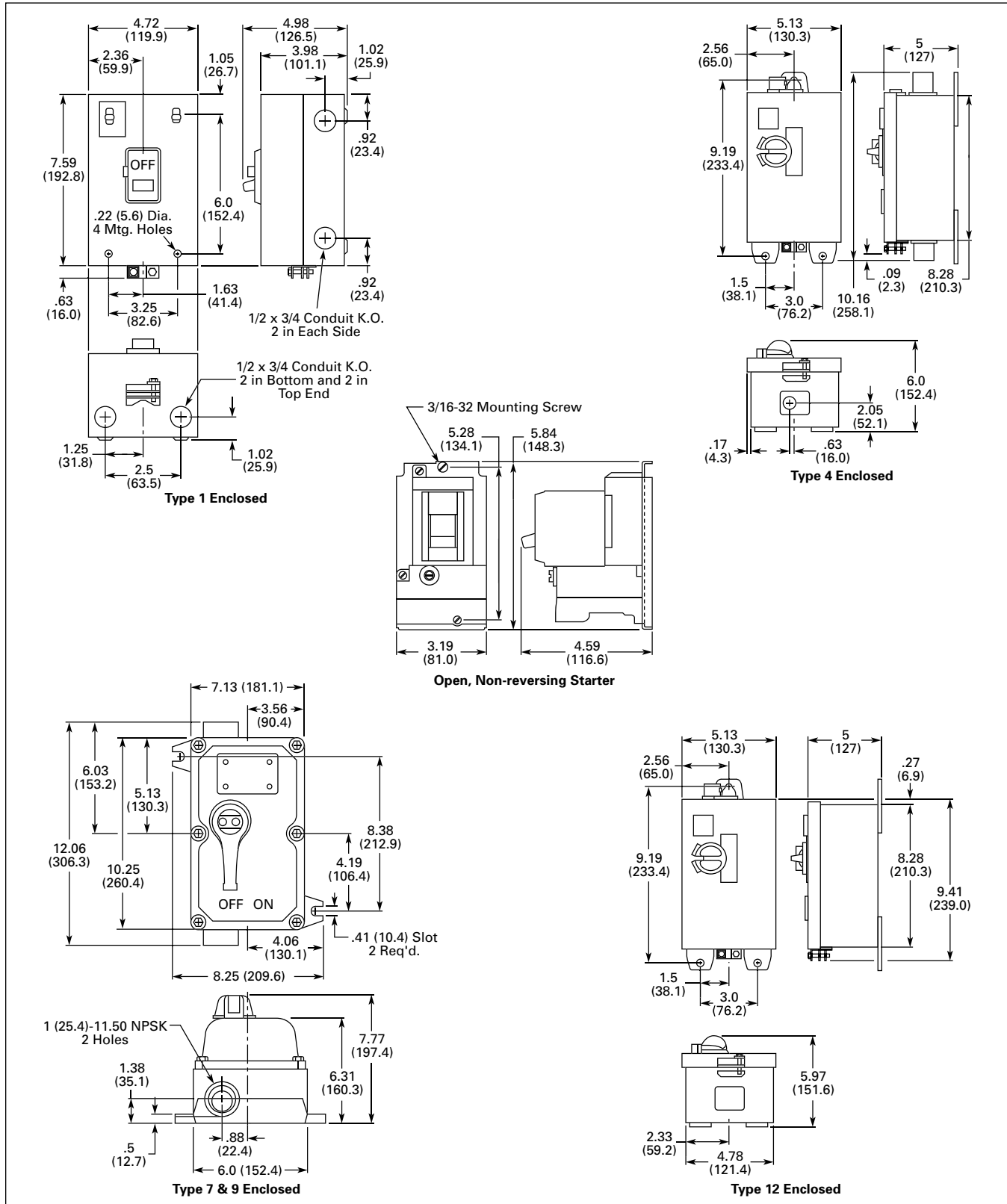


Figure F-4. Approximate Dimensions in Inches (mm)

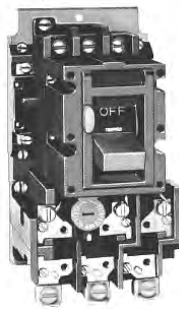
July 2008

**Type B100, Single- and Three-Phase Starters**

**Product Selection**

**When Ordering Specify**

- Catalogue Number of Starter with application modifications
- Heater Pack selection — A three-phase starter requires three heaters, and a single-phase starter requires two heaters
- Any required Accessories



*Toggle Operated*



*Type 1 Enclosure*

**Table F-8. Product Selection — Toggle and Pushbutton Operated Starters**

NEMA Size	Open Type Toggle Handle		Enclosed							
	Catalogue Number ③	Price	NEMA 1 General Purpose		NEMA 4 Watertight, Stainless Steel ①		NEMA 7D, 9E, 9F & 9G for Hazardous Locations ②④		NEMA 12 Dust-Tight	
			Catalogue Number ③	Price	Catalogue Number ③	Price	Catalogue Number ③	Price	Catalogue Number ③	Price
<b>Type B100 Non-reversing 2-Pole (For Single-Phase Motors and DC)</b>										
M-0	B100M0B		B100S0B		B100W0B		B100U0B		B100J0B	
M-1	B100M1B		B100S1B		B100W1B		B100U1B		B100J1B	
<b>Type B100 Non-reversing 3-Pole (For Polyphase Motors) ④</b>										
M-0	B100M0C		B100S0C		B100W0C		B100U0C		B100J0C	
M-1	B100M1C		B100S1C		B100W1C		B100U1C		B100J1C	

① One 1-inch chrome hub supplied on each end.  
 ② NEMA 7D = NEMA 7, Class I, Group D. NEMA 9E, 9F and 9G = NEMA 9, Class II, Groups E, F and G.  
 ③ Starter does not include heaters. Select Catalogue Numbers of heaters from **Table F-9**.  
 ④ Tapped for 1-inch conduit on each end.

**F**

Discount Symbol ..... **MC7**

**Type B100, Single- and Three-Phase Starters**

**Table F-9. Heater Selection**

Motor Full Load Current	Max. Fuse Amps	Catalogue Number	Price	Motor Full Load Current	Max. Fuse Amps	Catalogue Number	Price
<b>Single-Phase Enclosed Starters ①</b>				<b>Three-Phase Enclosed Starters ②</b>			
.28 – .29	1	FH03		.25 – .26	1	FH03	
.30 – .33	1	FH04		.27 – .29	1	FH04	
.34 – .36	1	FH05		.30 – .32	1	FH05	
.37 – .40	1	FH06		.33 – .35	1	FH06	
.41 – .45	1	FH07		.36 – .39	1	FH07	
.46 – .50	1	FH08		.40 – .44	1	FH08	
.51 – .56	1	FH09		.45 – .49	1	FH09	
.57 – .63	2	FH10		.50 – .55	1	FH10	
.64 – .70	2	FH11		.56 – .61	2	FH11	
.71 – .78	2	FH12		.62 – .68	2	FH12	
.79 – .86	2	FH13		.69 – .75	2	FH13	
.87 – .95	3	FH14		.78 – .83	2	FH14	
.96 – 1.04	3	FH15		.84 – .91	3	FH15	
1.05 – 1.14	3	FH16		.92 – 1.00	3	FH16	
1.15 – 1.25	4	FH17		1.01 – 1.10	3	FH17	
1.26 – 1.39	4	FH18		1.11 – 1.22	4	FH18	
1.40 – 1.54	5	FH19		1.23 – 1.35	4	FH19	
1.55 – 1.71	5	FH20		1.36 – 1.50	5	FH20	
1.72 – 1.89	6	FH21		1.51 – 1.66	5	FH21	
1.90 – 2.10	7	FH22		1.67 – 1.84	6	FH22	
2.11 – 2.32	8	FH23		1.85 – 2.03	7	FH23	
2.33 – 2.54	8	FH24		2.04 – 2.23	7	FH24	
2.55 – 2.79	9	FH25		2.24 – 2.45	8	FH25	
2.80 – 3.07	10	FH26		2.46 – 2.69	9	FH26	
3.08 – 3.36	10	FH27		2.70 – 2.95	10	FH27	
3.37 – 3.68	10	FH28		2.96 – 3.23	10	FH28	
3.69 – 4.03	10	FH29		3.24 – 3.53	10	FH29	
4.04 – 4.40	15	FH30		3.54 – 3.85	10	FH30	
4.41 – 4.81	15	FH31		3.86 – 4.22	10	FH31	
4.82 – 5.26	15	FH32		4.23 – 4.61	15	FH32	
5.27 – 5.74	15	FH33		4.62 – 5.03	15	FH33	
5.75 – 6.26	20	FH34		5.04 – 5.49	15	FH34	
6.27 – 6.83	20	FH35		5.50 – 5.99	20	FH35	
6.84 – 7.45	25	FH36		6.00 – 6.53	20	FH36	
7.46 – 8.11	25	FH37		6.54 – 7.11	25	FH37	
8.12 – 8.81	30	FH38		7.12 – 7.73	25	FH38	
8.82 – 9.58	30	FH39		7.74 – 8.40	25	FH39	
9.59 – 10.40	35	FH40		8.41 – 9.12	30	FH40	
10.41 – 11.30	35	FH41		9.13 – 9.89	35	FH41	
11.40 – 12.20	40	FH42		9.90 – 10.70	35	FH42	
12.30 – 13.50	45	FH43		10.80 – 11.80	40	FH43	
13.60 – 14.90	50	FH44		11.90 – 13.00	45	FH44	
15.00 – 16.00	50	FH45		13.10 – 14.00	50	FH45	
16.10 – 17.10	60	FH46		14.10 – 15.00	50	FH46	
17.20 – 18.30	60	FH47		15.10 – 16.10	50	FH47	
18.40 – 19.70	70	FH48		16.20 – 17.30	60	FH48	
19.80 – 21.20	70	FH49		17.40 – 18.60	60	FH49	
21.30 – 22.80	80	FH50		18.70 – 20.00	70	FH50	
22.90 – 24.50	88	FH51		20.10 – 21.50	70	FH51	
24.60 – 26.40	90	FH52		21.60 – 23.20	80	FH52	
26.50 – 28.50	90	FH53		23.30 – 25.00	80	FH53	
28.60 – 30.80	100	FH54		25.10 – 26.80	90	FH54	
30.90 – 33.30	110	FH55					
33.40 – 36.00	125	FH56					
36.10 – 38.90	125	FH57					

① Single-Phase Starters require two overload heaters.

② Three-Phase Starters require three overload heaters.

**Note:** FH Series heaters are for Type B100 manual motor starters. Heater element selection is based on motor nameplate's listed full load amperes. Trip rating of this series of elements is 125% of minimum motor full load amperes listed for the element.

When motor and overload relay are in the same ambient and the service factor of the motor is 1.15 to 1.25, select heaters from the heater selection table. If the service factor is 1.0 or less (including zero), or a maximum of 115% protection is desired, select a heater one size smaller than indicated for the amperage range required.

Discount Symbol ..... **MC7**



**Contents**

<i>Description</i>	<i>Page</i>
<b>Reversing Drum Switches</b>	
Application Description . . .	<b>F-9</b>
Features . . . . .	<b>F-9</b>
Operation . . . . .	<b>F-9</b>
Standards and Certifications . . . . .	<b>F-9</b>
Wiring Diagrams . . . . .	<b>F-9</b>
Dimensions . . . . .	<b>F-10</b>
Product Selection . . . . .	<b>F-10</b>



**Type DB and DD**

**Application Description**

These drum switches are designed primarily for use with single-phase and squirrel cage, single-speed reversible motors which may be connected directly across-the-line. Typical applications would be hoists and machine tools.

**Features**

- Compact size
- Front mounting — easily installed
- Terminals front accessible — slanted 45° for extra convenience
- Captive pressure clamps on terminal screws back off with screw — no prying with screwdriver necessary
- Choice of operators
  - Large
  - Lever
  - Knob
- Orientation of operator independent of legend — 360° positioning in 22-1/2° increments — pointer remains oriented to legend
- Field convertible from maintained to momentary operation
- Replaceable, large volume, silver plated contacts
- Oiltight machine cavity or surface mounting types
- Modern attractive appearance

**Operation**

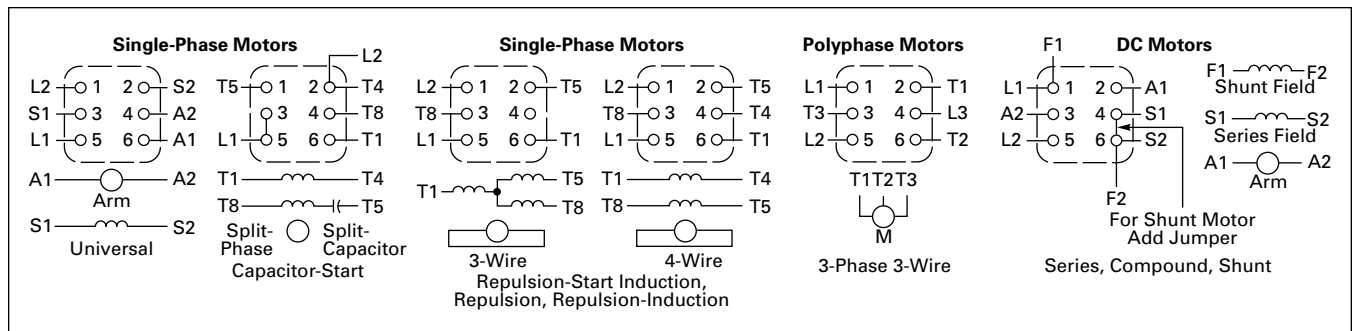
All of the operators may be rotated 360° in 22-1/2° increments without losing the indication of the drum position. A red-lined pointer is permanently orientated to the legend markings and clearly indicates the selected drum function regardless of the selected setting for the operator. This enables the user to “offset” the operator to afford the most comfortable operating position. This is accomplished simply by loosening and retightening one screw.

**Standards and Certifications**

- UL File No. E37316, Category NLRV
- CSA Guide No. 184-N-13.13A, Class 3211



**Wiring Diagrams**



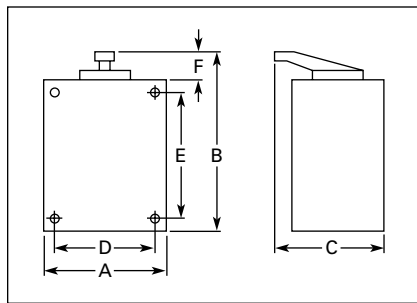
**Figure F-5. Wiring Diagrams**

**Type 9441, Reversing Drum Switches**

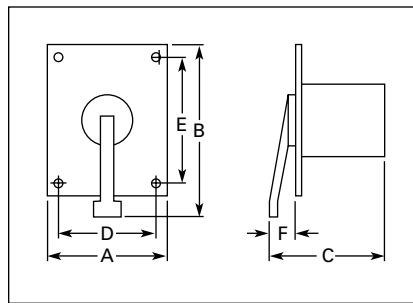
**Dimensions**

**Table F-10. Approximate Dimensions and Shipping Weights**

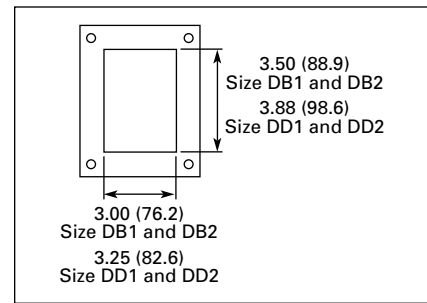
Size	Type of Operator	Dimensions in Inches (mm)					Shipping Weights	
		Wide A	High B	Deep C	Mounting		Lever F	Lbs. (kg)
					D	E		
<b>Surface Mounting</b>								
DB1 & DB2	Lever	2.50 (63.5)	5.88 (149.4)	4.38 (111.3)	2.00 (50.8)	2.25 (57.2)	1.88 (47.8)	3.0 (1.4)
	Knob	2.50 (63.5)	5.38 (136.7)	3.00 (76.2)	2.00 (50.8)	2.25 (57.2)	1.38 (35.1)	3.0 (1.4)
DD1 & DD2	Lever	3.38 (85.9)	6.88 (174.8)	4.75 (120.7)	2.63 (66.8)	2.75 (69.9)	2.00 (50.8)	4.0 (1.8)
	Knob	3.38 (85.9)	6.25 (158.8)	3.63 (92.2)	2.63 (66.8)	2.75 (69.9)	1.38 (35.1)	4.0 (1.8)
<b>Cavity Mounting</b>								
DB1 & DB2	Lever	4.00 (101.6)	4.75 (120.7)	5.00 (127.0)	3.50 (88.9)	4.00 (101.6)	1.88 (47.8)	3.0 (1.4)
	Knob	4.00 (101.6)	4.50 (114.3)	4.50 (114.3)	3.50 (88.9)	4.00 (101.6)	1.38 (35.1)	3.0 (1.4)
DD1 & DD2	Lever	4.50 (114.3)	5.75 (146.1)	5.25 (133.4)	4.00 (101.6)	4.50 (114.3)	2.00 (50.8)	4.0 (1.8)
	Knob	4.50 (114.3)	5.13 (130.3)	4.63 (117.6)	4.00 (101.6)	4.50 (114.3)	1.38 (35.1)	4.0 (1.8)



**Figure F-6. Approximate Dimensions Surface Mounting**



**Figure F-7. Approximate Dimensions Cavity Mounting**



**Figure F-8. Approximate Dimensions Panel Cutout Cavity Mount**

**Product Selection**

**When Ordering Supply**

- Catalogue Number



**Type DB1  
Flush Mount  
Standard Lever**



**Type DB and DD  
Surface Mounting  
Standard Lever**



**Type DB1  
Flush Mount  
Knob Operator**



**Type DB and DD  
Surface Mounting  
Knob Operator**

**Table F-11. Reversing Drum Type without Overload Relay**

Maximum Horsepower						Size	Type of Operation	Surface Mounting General Purpose – NEMA 1			Flush or Cavity Mounting (Oiltight Mounting on Sizes DB and DD)		
3-Phase		Single-Phase		DC				Lever Operator	Knob	Price	Lever Operator	Knob	Price
200 – 230V	380 – 575V	115V	230V	115V	230V			Catalogue Number		Catalogue Number			
<b>3-Pole</b>													
2	2	1-1/2	2	1	1	DB 1	Maintained ①	9441H268	9441H269		9441H274	9441H275	
							Maintained and Momentary ②	9441H271	9441H272		9441H276	9441H277	
3	5	1-1/2	2	1	1	DB 2	Maintained ①	9441H353	9441H354		9441H347	9441H348	
							Maintained and Momentary ②	9441H356	9441H357		9441H349	9441H350	
5	7-1/2	1-1/2	3	2	3	DD 1	Maintained ①	9441H284	9441H285		9441H388	9441H287	
7-1/2	10	2	5	2	3	DD 2	Maintained ①	9441H361	9441H363		9441H362	9441H364	

① These devices are field convertible from maintained both positions to momentary both positions.

② These devices are field convertible from maintained FORWARD and momentary REVERSE to momentary FORWARD and maintained REVERSE.

Discount Symbol ..... **MC7**