

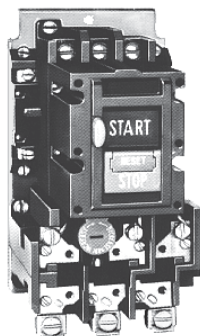
MS Series, Single-Phase Starters



3.1 Starters and Switches

Product Overview	V5-T3-2
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Type 9441, Reversing Drum Switches	V5-T3-15

Type B100, Single- and Three-Phase Starters



Types B230, B330 Switches



Revision notes

Volume 5—Motor Control and Protection, CA08100006E

Tab 3—NEMA Manual Starters

Revision date	Section	Change page(s)	Description
08/23/2018	All	All	Revision date changed to match print version date



Powering Business Worldwide

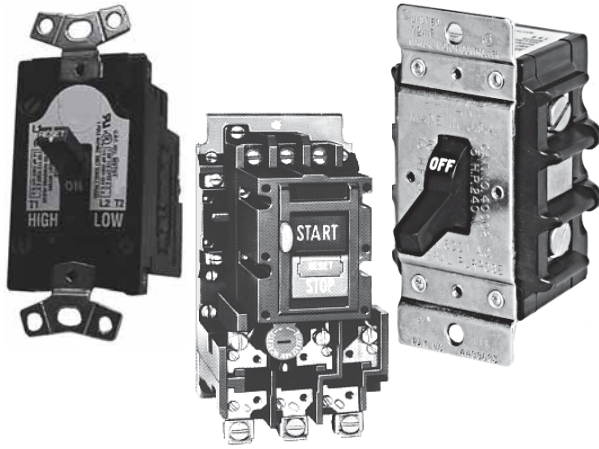
3.1

NEMA Manual Starters

Starters and Switches

Starters and Switches

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Product Overview

Eaton offers the most complete line of manual motor starters in the industry. Product offering includes manual motor starters and switches that cover single as well as three-phase motor applications.

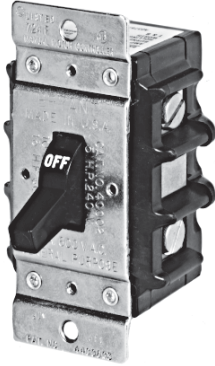
Application Description

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

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

B230 and B330 Manual Motor Switches are available in two- or three-pole configurations rated at 30A.

Types B230, B330 Switches



Types B230, B330, Switches

Product Description

Manual Motor Switches are available in two- or three-pole configurations rated at 30A.

Optional NEMA 1 aluminum enclosure is supplied with a padlock guard for locking in the OFF or STOP position.

Application Description

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

- Fans
- Blowers
- Pumps
- Wood working equipment
- Machine tools

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Features

- Compact size
- Easy installation
- Simple operation
- Padlockable NEMA 1 enclosure available

Standards and Certifications

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



Instructional Leaflet

Pub25371

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Starters and Switches




Product Selection

When Ordering Specify

- Catalog number of manual motor switch

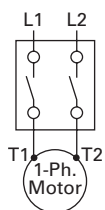
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Manual Motor Switches without Overload

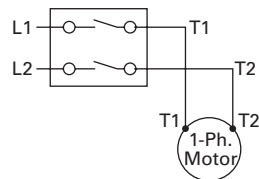
	Maximum Horsepower Ratings				Open	NEMA 1 Enclosed
	120V	240V	480V	600V		
Two-Pole B230AN	Two-Pole—Manual Motor Switches					
	2	5	—	—	B230AN	B230AG
Two-Pole NEMA 1 Enclosure B230BG	2	5	10	15	B230BND	B230BGD
						
Three-Pole B330AN	Three-Pole—Manual Motor Switches					
	3	7-1/2	15	20	B330AND	B330AGD

Wiring Diagrams

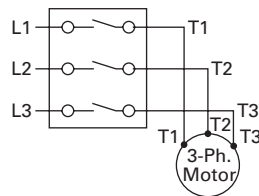
B230AN



B230BN



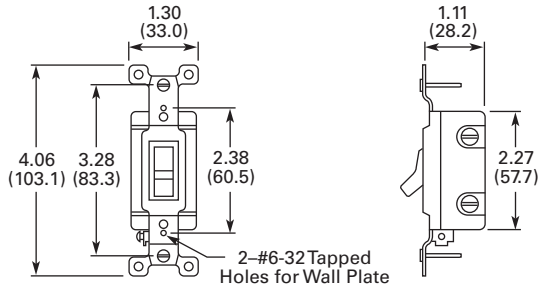
B330AN



Dimensions

Approximate Dimensions in Inches (mm)

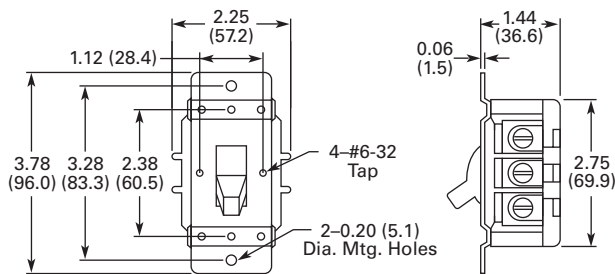
B230AN



Approximate Shipping Weight

4 oz. (0.11 kg)

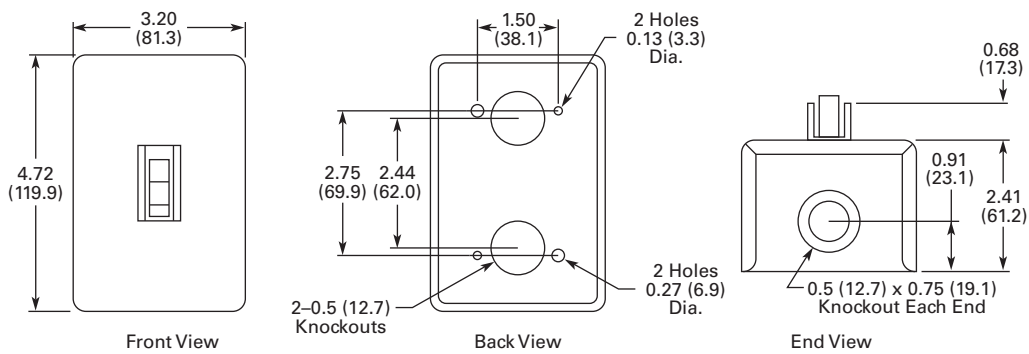
B230BN and B330AN



Approximate Shipping Weight

6 oz. (0.17 kg)

B230AG, B230BG, B330AG



Approximate Shipping Weight

14 oz. (0.40 kg)

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Starters and Switches

MS Series, Single-Phase Starters



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Type 9441, Reversing Drum Switches	V5-T3-15

MS Series, Single-Phase Starters

Product Description

- The MS Motor Starter is a compact, versatile unit featuring heavy sliding contacts as well as “quick-make” and “quick-break” mechanism
- 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 0.40A up to 16.0A. 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)

Standards and Certifications

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



Instructional Leaflet
IL12987G

Product Selection

When Ordering Specify

- Catalog number of manual motor starter
- Heater pack selection
- Any required accessories
- Heater coil selection according to the motor full load current requirements

MS Series Starters

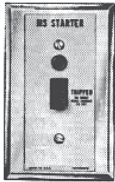
MS Series, Single-Phase Starters



Open Type

Number of Poles	Horsepower	Voltage	Catalog Number ^①
1	1	120/240V, 277 Vac	MST01
	1/4	120/240 Vdc	MST01
	1/4	32 Vdc	MST01
2	1	120/240V, 277 Vac	MST02
	1	120/240 Vdc	MST02
	1/4	32 Vdc	MST02

Switch and Pilot Light Mounted on Flush Plate



Flush Plate (No Enclosure Included)

Number of Poles	Flush Plate Type	Voltage	Catalog Number ^①
1	General purpose	Switch only	MST01FN
2		Switch with pilot light	MST02FN1P
1	Stainless steel	Switch only	MST01DN
		Switch with pilot light	MST01DN1P
2		Switch only	MST02DN
		Switch with pilot light	MST02DN1P

Note

^① Does not include heater. Select heater from tables on [Page V5-T3-8](#).

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NEMA Manual Starters

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Enclosed Types

Starter and Pilot Light Mounted in Type 1 Enclosure



Number of Poles	Enclosure Type	Product Feature	Catalog Number ①
1	General purpose Type 1	Starter only	MST01SN
		Starter with pilot light	MST01SN1P
2		Starter only	MST02SN
		Starter with pilot light	MST02SN1P

Starter, Hand/Auto and Pilot Light—Type 1 Enclosure



2	General purpose NEMA 1	Starter with Hand/Auto switch and pilot light	MST02RN1PH ②
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Waterproof Type 3, 4 and 5



1	Waterproof Type 3, 4 and 5	Through hub	MST01AH
2		Through hub	MST02AH

Hazardous Location Type 7D, 9E, 9F and 9G



1	Hazardous location ③ Types 7D, 9E, 9F and 9G	Through hub	MST01EH
2		Through hub	MST02EH

Typical Heater



Heater Element Installation



Heater Selection for MS Starters

Motor Full Load Current	Catalog Number	Motor Full Load Current	Catalog Number	Motor Full Load Current	Catalog Number	Motor Full Load Current	Catalog Number
0.4–0.43	MSH-5A	1.04–1.15	MSH1-3A	2.72–2.95	MSH3-4A	7.04–7.74	MSH8-8A
0.44–0.48	MSH-55A	1.16–1.27	MSH1-45A	2.96–3.27	MSH3-7A	7.75–8.46	MSH9-7A
0.49–0.53	MSH-61A	1.28–1.35	MSH1-6A	3.28–3.59	MSH4-1A	8.47–9.35	MSH10-6A
0.54–0.58	MSH-67A	1.36–1.51	MSH1-7A	3.60–3.99	MSH4-5A	9.36–10.30	MSH11-7A
0.59–0.64	MSH-74A	1.52–1.67	MSH1-9A	4.00–4.39	MSH5-0A	10.31–11.35	MSH12-9A
0.65–0.71	MSH-81A	1.68–1.83	MSH2-1A	4.40–4.79	MSH5-5A	11.36–12.47	MSH14-2A
0.72–0.78	MSH-89A	1.84–1.99	MSH2-3A	4.80–5.26	MSH6-0A	12.48–13.67	MSH15-6A
0.79–0.87	MSH-98A	2.00–2.23	MSH2-5A	5.27–5.83	MSH6-6A	13.68–15.12	MSH17-1A
0.88–0.95	MSH1-1A	2.24–2.47	MSH2-8A	5.84–6.39	MSH7-3A	15.13–16.00	MSH18-6A
0.96–1.03	MSH1-2A	2.48–2.71	MSH3-1A	6.40–7.03	MSH8-0A	—	—

Notes

- ① Does not include heater. Select heater from table above.
- ② For OFF function, use OFF position on starter toggle switch.
- ③ Type 7D = Type 7, Class I, Group D; Type 9E, 9F and 9G = Type 9, Class II, Groups E, F and G.

Accessories

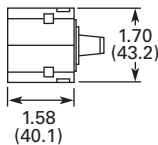
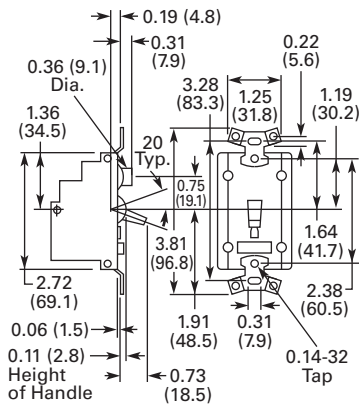
MS Accessories

Description	Catalog Number
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

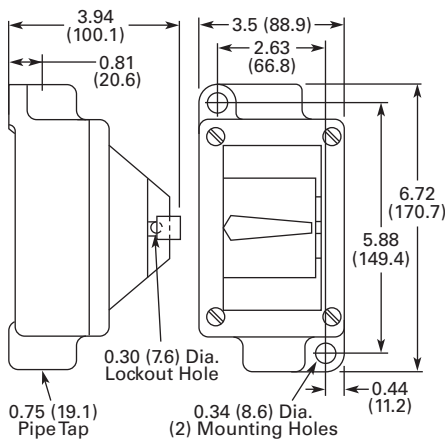
Dimensions

Approximate Dimensions in Inches (mm)

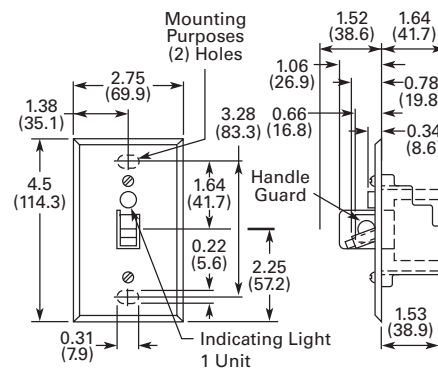
MS Motor Starter Toggle Operated Open Units



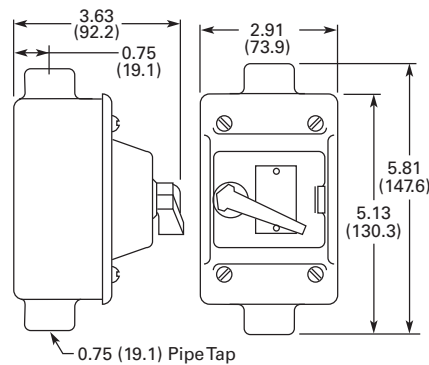
Hazardous Location (Cast Aluminum)



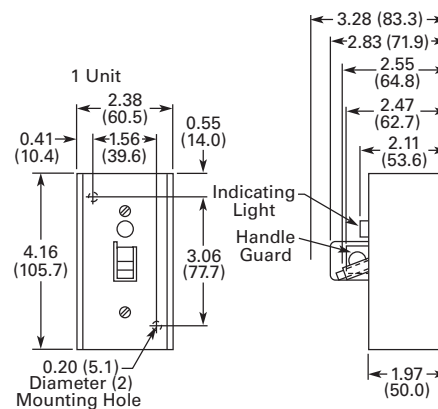
Flush Plates



Watertight (Cast Aluminum)



Type 1 Enclosure (Boxes and Covers)



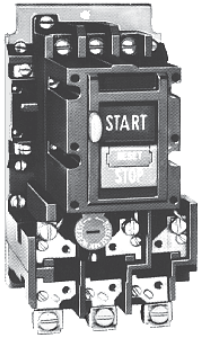
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NEMA Manual Starters

Starters and Switches

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Type B100, Single- and Three-Phase Starters



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Type B100, Single- and Three-Phase Starters

Product Description

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

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 38.9A single-phase and 26.8A 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

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)



Instructional Leaflet
IL14890

Product Selection

When Ordering Specify

- Catalog 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



Toggle and Pushbutton Operated Starters

NEMA Size	Enclosed				
	Open Type Toggle Handle Catalog Number ④	NEMA 1 General Purpose Catalog Number ④	NEMA 4 Watertight, Stainless Steel ① Catalog Number ④	NEMA 7D, 9E, 9F and 9G for Hazardous Locations ②③ Catalog Number ④	NEMA 12 Dust-Tight Catalog Number ④
Type B100 Non-Reversing Two-Pole (For Single-Phase Motors and DC)					
M-0	B100M0B	B100S0B	B100W0B	B100U0B	B100J0B
M-1	B100M1B	B100S1B	B100W1B	B100U1B	B100J1B
Type B100 Non-Reversing Three-Pole (For Polyphase Motors) ④					
M-0	B100M0C	B100S0C	B100W0C	B100U0C	B100J0C
M-1	B100M1C	B100S1C	B100W1C	B100U1C	B100J1C

Heater Selection—Single-Phase Enclosed Starters ⑤

Motor Full Load Current	Maximum Fuse Amps	Catalog Number	Motor Full Load Current	Maximum Fuse Amps	Catalog Number	Motor Full Load Current	Maximum Fuse Amps	Catalog Number
0.28–0.29	1	FH03	1.90–2.10	7	FH22	9.59–10.40	35	FH40
0.30–0.33	1	FH04	2.11–2.32	8	FH23	10.41–11.30	35	FH41
0.34–0.36	1	FH05	2.33–2.54	8	FH24	11.40–12.20	40	FH42
0.37–0.40	1	FH06	2.55–2.79	9	FH25	12.30–13.50	45	FH43
0.41–0.45	1	FH07	2.80–3.07	10	FH26	13.60–14.90	50	FH44
0.46–0.50	1	FH08	3.08–3.36	10	FH27	15.00–16.00	50	FH45
0.51–0.56	1	FH09	3.37–3.68	10	FH28	16.10–17.10	60	FH46
0.57–0.63	2	FH10	3.69–4.03	10	FH29	17.20–18.30	60	FH47
0.64–0.70	2	FH11	4.04–4.40	15	FH30	18.40–19.70	70	FH48
0.71–0.78	2	FH12	4.41–4.81	15	FH31	19.80–21.20	70	FH49
0.79–0.86	2	FH13	4.82–5.26	15	FH32	21.30–22.80	80	FH50
0.87–0.95	3	FH14	5.27–5.74	15	FH33	22.90–24.50	88	FH51
0.96–1.04	3	FH15	5.75–6.26	20	FH34	24.60–26.40	90	FH52
1.05–1.14	3	FH16	6.27–6.83	20	FH35	26.50–28.50	90	FH53
1.15–1.25	4	FH17	6.84–7.45	25	FH36	28.60–30.80	100	FH54
1.26–1.39	4	FH18	7.46–8.11	25	FH37	30.90–33.30	110	FH55
1.40–1.54	5	FH19	8.12–8.81	30	FH38	33.40–36.00	125	FH56
1.55–1.71	5	FH20	8.82–9.58	30	FH39	36.10–38.90	125	FH57
1.72–1.89	6	FH21	—	—	—	—	—	—

Notes

- ① One 1 in 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 Tapped for 1 in conduit on each end.
- ④ Starter does not include heaters. Select catalog numbers of heaters from table on Page V5-T3-12.
- ⑤ Single-phase starters require two overload heaters.

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NEMA Manual Starters

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Heater Selection—Three-Phase Enclosed Starters ^②

Motor Full Load Current	Maximum Fuse Amps	Catalog Number	Motor Full Load Current	Maximum Fuse Amps	Catalog Number	Motor Full Load Current	Maximum Fuse Amps	Catalog Number
0.25–0.26	1	FH03	1.51–1.66	5	FH21	7.12–7.73	25	FH38
0.27–0.29	1	FH04	1.67–1.84	6	FH22	7.74–8.40	25	FH39
0.30–0.32	1	FH05	1.85–2.03	7	FH23	8.41–9.12	30	FH40
0.33–0.35	1	FH06	2.04–2.23	7	FH24	9.13–9.89	35	FH41
0.36–0.39	1	FH07	2.24–2.45	8	FH25	9.90–10.70	35	FH42
0.40–0.44	1	FH08	2.46–2.69	9	FH26	10.80–11.80	40	FH43
0.45–0.49	1	FH09	2.70–2.95	10	FH27	11.90–13.00	45	FH44
0.50–0.55	1	FH10	2.96–3.23	10	FH28	13.10–14.00	50	FH45
0.56–0.61	2	FH11	3.24–3.53	10	FH29	14.10–15.00	50	FH46
0.62–0.68	2	FH12	3.54–3.85	10	FH30	15.10–16.10	50	FH47
0.69–0.75	2	FH13	3.86–4.22	10	FH31	16.20–17.30	60	FH48
0.78–0.83	2	FH14	4.23–4.61	15	FH32	17.40–18.60	60	FH49
0.84–0.91	3	FH15	4.62–5.03	15	FH33	18.70–20.00	70	FH50
0.92–1.00	3	FH16	5.04–5.49	15	FH34	20.10–21.50	70	FH51
1.01–1.10	3	FH17	5.50–5.99	20	FH35	21.60–23.20	80	FH52
1.11–1.22	4	FH18	6.00–6.53	20	FH36	23.30–25.00	80	FH53
1.23–1.3	4	FH19	6.54–7.11	25	FH37	25.10–26.80	90	FH54
1.36–1.50	5	FH20	—	—	—	—	—	—

Accessories

Type B100 Starters

Description	Catalog Number
Field Mounting Kits	
1NO elect. auxiliary	B1A
1NC elect. auxiliary	B1B
Red pilot light 120/60 (NEMA 1 enclosure only)	LK-21
Red pilot light 208-240/6 (NEMA 1 enclosure only)	LK-22
Red pilot light 480/60 (NEMA 1 enclosure only)	LK-26

Options

Modifications

Description	Catalog Number Suffix ^③
Pushbutton operator (open and NEMA 1 only)	A
Without lockoff (open only)	X

Notes

- ① Single-phase starters require two overload heaters.
- ② Three-phase starters require three overload heaters.
- ③ Add suffix letter to starter catalog number Example: B100MOCA.

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.

Technical Data and Specifications

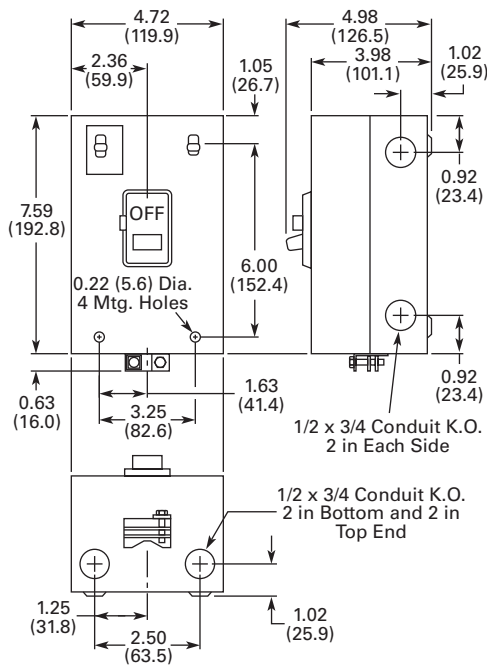
Type B100 Starters

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

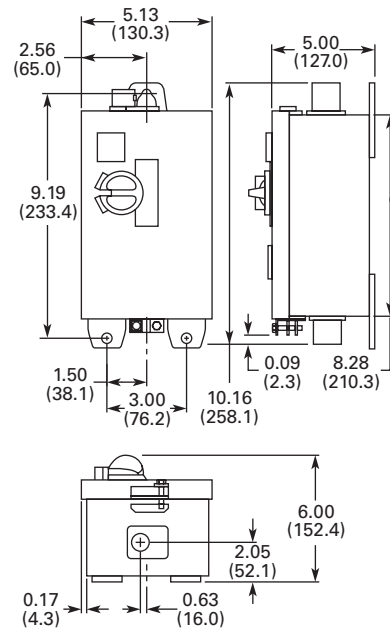
Dimensions

Approximate Dimensions in Inches (mm)

Type 1 Enclosed



Type 4 Enclosed



Note

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

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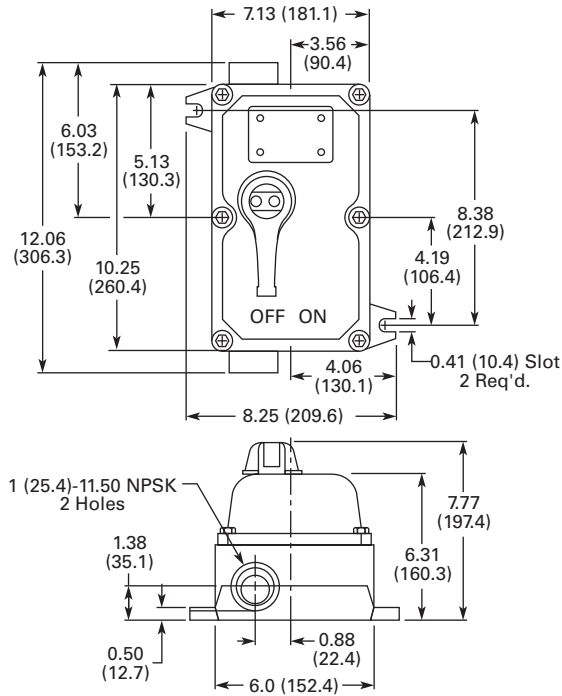
NEMA Manual Starters

Starters and Switches

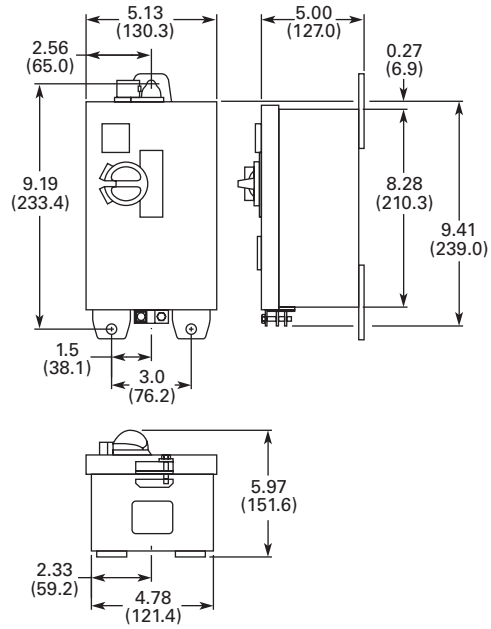
Approximate Dimensions in Inches (mm)

3

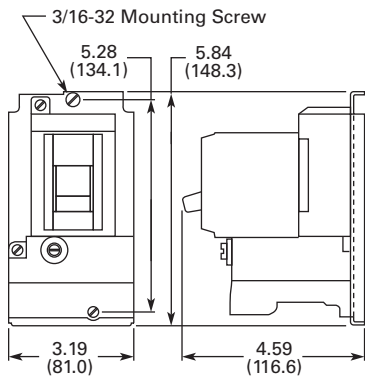
Type 7 and 9 Enclosed



Type 12 Enclosed



Open, Non-Reversing Starter



Type 9441, Reversing Drum Switches



Contents

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Type 9441, Reversing Drum Switches

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



3.1

NEMA Manual Starters

Starters and Switches

Product Selection

When Ordering Specify

- Catalog number

3

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



Reversing Drum Type without Overload Relay

Maximum Horsepower

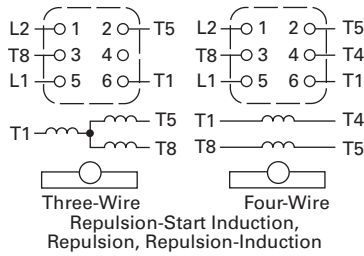
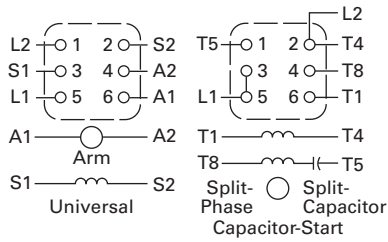
Three-Phase 200–230V		Single-Phase 380–575V 115V 230V		DC 115V 230V		Size	Type of Operation	Surface Mounting General Purpose—NEMA 1		Flush or Cavity Mounting (Oiltight Mounting on Sizes DB and DD)	
200–230V	380–575V	115V	230V	115V	230V			Lever Operator Catalog Number	Knob	Lever Operator Catalog Number	Knob
Three-Pole											
2	2	1-1/2	2	1	1	DB 1	Maintained ①	9441H268	9441H269	9441H274	9441H275
							Maintained and Momentary ②	9441H271	9441H272	9441H276	—
3	5	1-1/2	2	1	1	DB 2	Maintained ①	9441H353	9441H354	9441H347	—
							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	—
7-1/2	10	2	5	2	3	DD 2	Maintained ①	9441H361	9441H363	9441H362	—

Notes

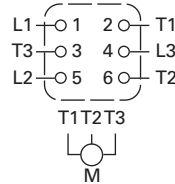
- ① These devices are field convertible from maintained both positions to momentary both positions.
- ② These devices are field convertible from maintained FORWARD and momentary REVERSE to momentary FORWARD and maintained REVERSE.

Wiring Diagrams

Single-Phase Motors

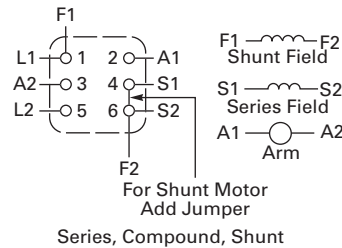


Polyphase Motors



Three-Phase Three-Wire

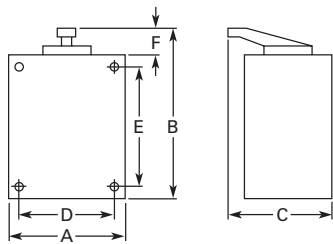
DC Motors



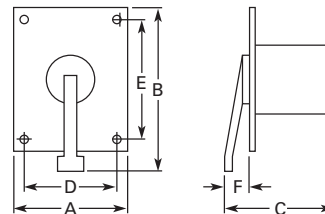
Dimensions

Approximate Dimensions in Inches (mm)

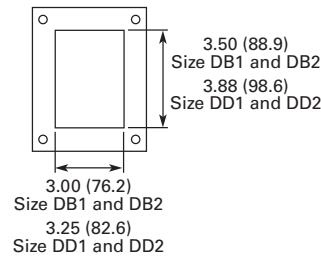
Surface Mounting



Cavity Mounting



Panel Cutout Cavity Mounting



Dimensions and Shipping Weights

Size	Type of Operator	Wide A	High B	Deep C	Mounting D	Mounting E	Lever F	Shipping Weight Lbs (kg)
Surface Mounting								
DB1 and 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 and 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)
Cavity Mounting								
DB1 and 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 and 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)