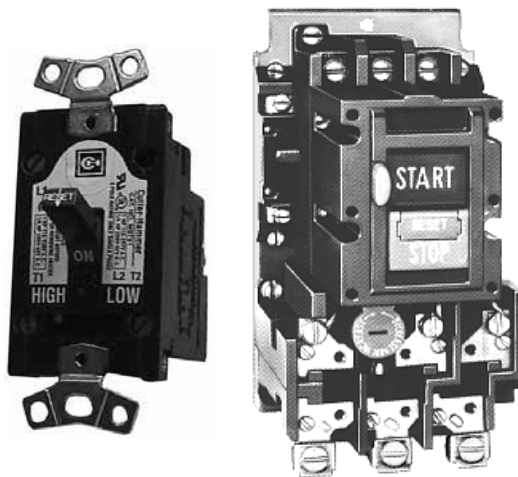


# Manual Motor Control

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*Manual Motor Control*



Modular Toggle Operated Starter

## Product Description

- Eaton's Cutler-Hammer® 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 .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 Type 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

**Note:** See Page 18-2 for additional information on Standards and Certifications that apply to all Cutler-Hammer Enclosed Control products.

- UL File No. E1922, Category NLRV (for motor controller)
- CSA File No. LR39402-6, Class 3211-05
- ABS Type Approved



## Accessories

Table 13-1. 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

**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

**Table 13-2. Product Selection — MS Series Starters**

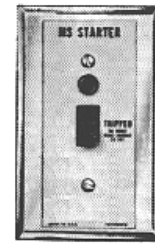
Number of Poles	Horsepower	Voltage	Catalog Number ①
<b>Open Type</b>			
1	1 1/4 1/4	120/240V, 277V AC 120/240V DC 32V DC	<b>MST01</b>
2	1 1 1/4	120/240V, 277V AC 120/240V DC 32V DC	<b>MST02</b>
<b>Flush Plate (No Enclosure Included)</b>			
1	<b>Flush Plate Type</b>	Switch Only Switch with Pilot Light	<b>MST01FN</b> <b>MST01FN1P</b>
2	General Purpose	Switch Only Switch with Pilot Light	<b>MST02FN</b> <b>MST02FN1P</b>
1	Stainless Steel	Switch Only Switch with Pilot Light	<b>MST01DN</b> <b>MST01DN1P</b>
2		Switch Only Switch with Pilot Light	<b>MST02DN</b> <b>MST02DN1P</b>
<b>Enclosed Types</b>			
1	<b>Enclosure Type</b>	Switch Only Switch with Pilot Light	<b>MST01SN</b> <b>MST01SN1P</b>
2	General Purpose Type 1	Switch Only Switch with Pilot Light	<b>MST02SN</b> <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	Types 7D, 9E, 9F & 9G	Through Hub	<b>MST02EH</b>

① Does not include heater. Select heater from **Table 13-3**.

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

**Table 13-3. 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
.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*

**13**



*Typical Heater*



*Heater Element Installation*

Dimensions

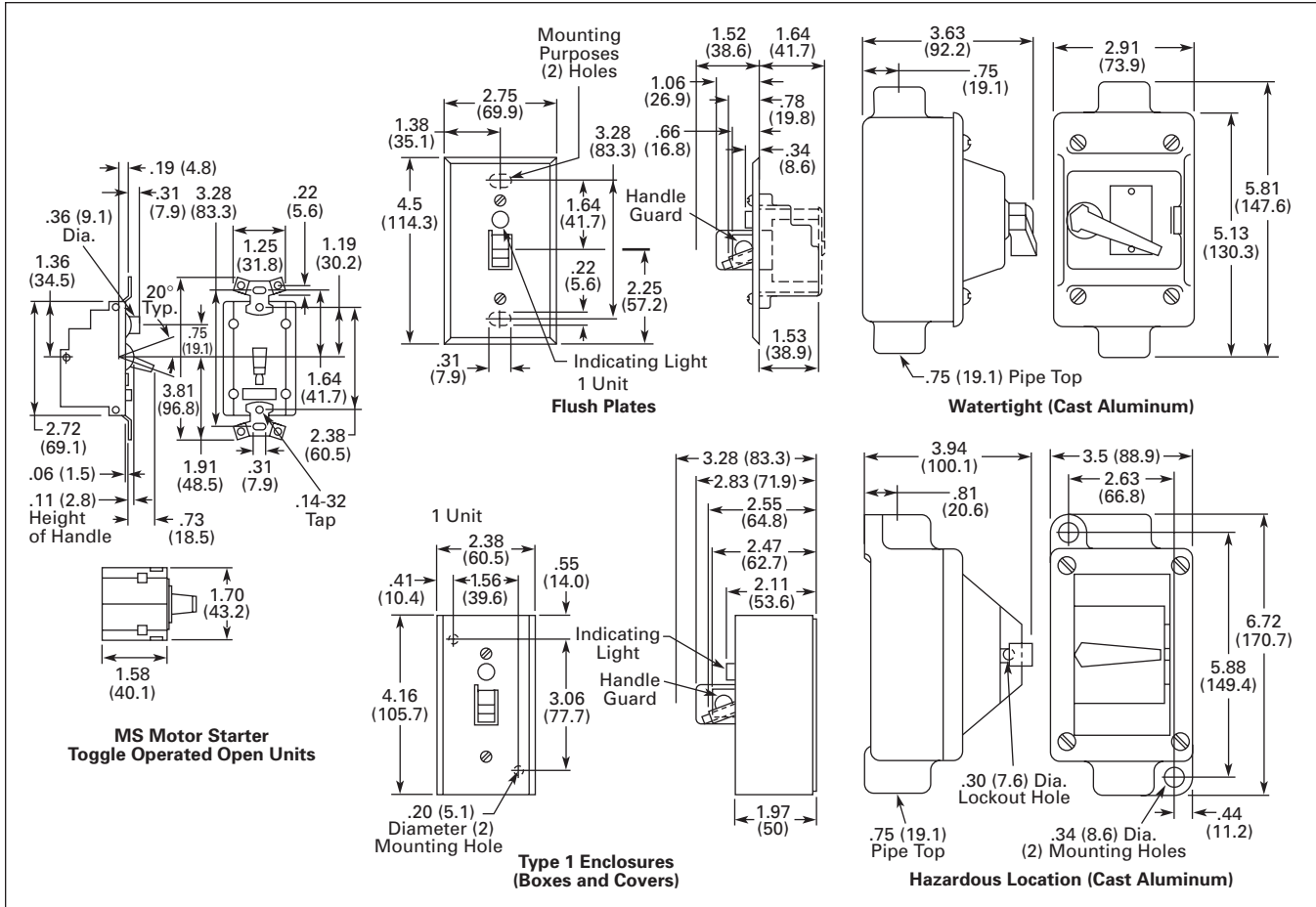
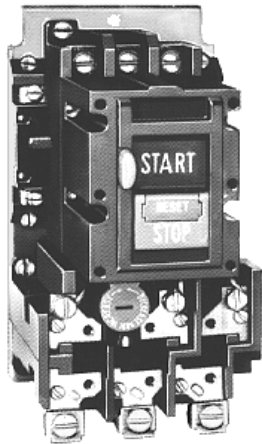


Figure 13-1. Approximate Dimensions in Inches (mm)

**Type B100**



*Pushbutton Operated*

**Product Description**

Eaton's Cutler-Hammer® 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 Type 1, 4, 7, 9 and 12 enclosures with toggle operation (Type 1 enclosure for pushbutton operator)
- Standard with a lockout device to lock motor in the OFF position

**Instructional Leaflet**

IL14890

**Standards and Certifications**

**Note:** See **Page 18-2** for additional information on Standards and Certifications that apply to all Cutler-Hammer Enclosed Control products.

- UL File No. E19222, Category NLRV (for motor controller)
- CSA File No. LR39402-6, Class 3211-05 (Open Starters)
- CSA File No. LR54517-1, Class 3211-05 (Closed Starters)
- ABS Type Approved



**Technical Data**

**Table 13-4. 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 13-5. Factory Modifications**

Description	Catalog Number Suffix ②
Pushbutton operator (open and Type 1 only)	A
Without lockoff (open only)	X

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

**Accessories**

**Table 13-6. Accessories**

Description	Catalog Number
<b>Field Mounting Kits</b>	
Auxiliary Contact — 1NO 1NC	<b>B1A B1B</b>
Red Pilot Light — 120/60 (Type 1 Enc. Only) 208-240/6 (Type 1 Enc. Only) 480-600/60 (Type 1 Enc. Only)	<b>LK-21 LK-22 LK-26</b>
<b>For Type 4 and 12 Enclosures Only</b>	
Red Pilot Light — 120V 240V	<b>LK-41 LK-42</b>

## Type B100

## 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

**Table 13-7. Product Selection — Toggle and Pushbutton Operated Starters**

NEMA Size	Open Type Toggle Handle	Enclosed			
		Type 1 General Purpose	Type 4 Watertight, Stainless Steel <sup>①</sup>	Type 7D, 9E, 9F & 9G for Hazardous Locations <sup>②④</sup>	Type 12 Dust-Tight
	Catalog Number <sup>③</sup>	Catalog Number <sup>③</sup>	Catalog Number <sup>③</sup>	Catalog Number <sup>③</sup>	Catalog Number <sup>③</sup>

**Type B100 Non-reversing 2-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 3-Pole (For Polyphase Motors)<sup>④</sup>**

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

③ Does not include heaters. Select Catalog Numbers of heaters from **Table 13-8**.

④ Tapped for 1-inch conduit on each end.

**Toggle Operated****Type 1 Enclosure**

**Type B100**

**Table 13-8. Heater Selection**

Motor Full Load Current	Max. Fuse Amps	Catalog Number	Motor Full Load Current	Max. Fuse Amps	Catalog Number
<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.

Type B100

Dimensions

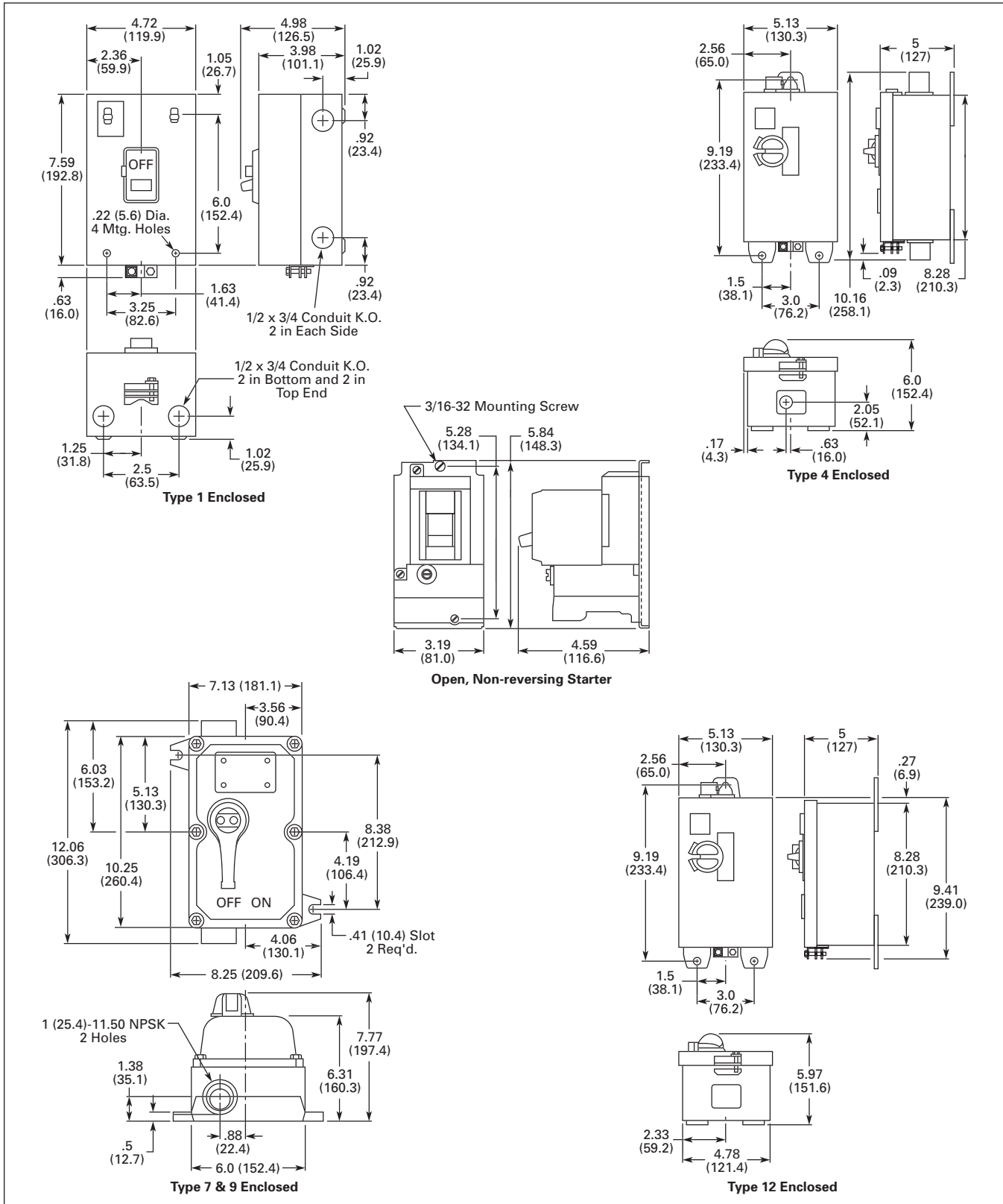


Figure 13-2. Approximate Dimensions in Inches (mm)