11.1 Single-Phase Starters

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- Application Description ............................................... V10-T11-2
- Features ....................................................................... V10-T11-2
- Instructional Leaflet ..................................................... V10-T11-2
- Standards and Certifications ........................................... V10-T11-2
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11.2 Single- and Three-Phase Starters

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11.1 Manual Motor Control

Single-Phase Starters

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MS Series

Product Description
- Eaton’s 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 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 an G (dust)

Instructional Leaflet
IL12987G

Standards and Certifications
Note: See Tab 17 for additional information on standards and certifications that apply to all enclosed control products.
- UL File No. E1922, Category NLRV (for motor controller)
- CSA File No. LR39402-6, Class 3211-05
- ABS Type Approved
- OSHPD Certified (OSP-0015-10)
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—Open Type

<table>
<thead>
<tr>
<th>Number of Poles</th>
<th>Horsepower</th>
<th>Voltage</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>120/240V, 277 Vac</td>
<td>MST01</td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td>120/240 Vdc</td>
<td></td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td>32 Vdc</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>120/240V, 277 Vac</td>
<td>MST02</td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td>120/240 Vdc</td>
<td></td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td>32 Vdc</td>
<td></td>
</tr>
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</table>

MS Series Starters—Flush Plate Type (No Enclosure Included)

<table>
<thead>
<tr>
<th>Number of Poles</th>
<th>Flush Plate Type</th>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General purpose</td>
<td>Switch only</td>
<td>MST01FN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST01FN1P</td>
</tr>
<tr>
<td>2</td>
<td>General purpose</td>
<td>Switch only</td>
<td>MST02FN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST02FN1P</td>
</tr>
<tr>
<td>1</td>
<td>Stainless steel</td>
<td>Switch only</td>
<td>MST01DN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST01DN1P</td>
</tr>
<tr>
<td>2</td>
<td>Stainless steel</td>
<td>Switch only</td>
<td>MST02DN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST02DN1P</td>
</tr>
</tbody>
</table>

MS Series Starters—Enclosed Type

<table>
<thead>
<tr>
<th>Number of Poles</th>
<th>Enclosure Type</th>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General purpose Type 1</td>
<td>Switch only</td>
<td>MST01SN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST01SN1P</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Switch only</td>
<td>MST02SN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch with pilot light</td>
<td>MST02SN1P</td>
</tr>
<tr>
<td>1</td>
<td>Waterproof Type 3, 4 and 5</td>
<td>Through hub</td>
<td>MST01AH</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Through hub</td>
<td>MST02AH</td>
</tr>
<tr>
<td>1</td>
<td>Hazardous location Type 7D, 9E, 9F and 9G</td>
<td>Through hub</td>
<td>MST01EH</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Through hub</td>
<td>MST02EH</td>
</tr>
</tbody>
</table>

Notes
1. Does not include heater. Select heater from table on Page V10-T11-4.
2. Type 7D = Type 7, Group D; Type 9E, 9F and 9G = Type 9, Class II, Groups E, F and G.
### 11.1 Manual Motor Control

#### Single-Phase Starters

**Typical Heater**

![Image of a heater]

**Heater Element Installation**

![Image of a heater element]

**Heater Selection for MS Starters**

<table>
<thead>
<tr>
<th>Motor Full Load Current</th>
<th>Catalog Number</th>
<th>Motor Full Load Current</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 – 0.43</td>
<td>MSH-5A</td>
<td>2.72 – 2.95</td>
<td>MSH3-4A</td>
</tr>
<tr>
<td>0.44 – 0.48</td>
<td>MSH-55A</td>
<td>2.96 – 3.27</td>
<td>MSH3-7A</td>
</tr>
<tr>
<td>0.49 – 0.53</td>
<td>MSH-61A</td>
<td>3.29 – 3.59</td>
<td>MSH4-1A</td>
</tr>
<tr>
<td>0.54 – 0.58</td>
<td>MSH-67A</td>
<td>3.60 – 3.99</td>
<td>MSH4-5A</td>
</tr>
<tr>
<td>0.59 – 0.64</td>
<td>MSH-74A</td>
<td>4.00 – 4.39</td>
<td>MSH5-8A</td>
</tr>
<tr>
<td>0.65 – 0.71</td>
<td>MSH-81A</td>
<td>4.40 – 4.79</td>
<td>MSH5-8A</td>
</tr>
<tr>
<td>0.72 – 0.78</td>
<td>MSH-89A</td>
<td>4.80 – 5.26</td>
<td>MSH6-6A</td>
</tr>
<tr>
<td>0.79 – 0.87</td>
<td>MSH-98A</td>
<td>5.27 – 5.83</td>
<td>MSH6-6A</td>
</tr>
<tr>
<td>0.88 – 0.95</td>
<td>MSH1-1A</td>
<td>5.84 – 6.39</td>
<td>MSH7-3A</td>
</tr>
<tr>
<td>0.96 – 1.03</td>
<td>MSH1-2A</td>
<td>6.40 – 7.03</td>
<td>MSH8-8A</td>
</tr>
<tr>
<td>1.04 – 1.15</td>
<td>MSH1-3A</td>
<td>7.04 – 7.74</td>
<td>MSH8-8A</td>
</tr>
<tr>
<td>1.16 – 1.27</td>
<td>MSH1-45A</td>
<td>7.75 – 8.46</td>
<td>MSH9-7A</td>
</tr>
<tr>
<td>1.28 – 1.35</td>
<td>MSH1-6A</td>
<td>8.47 – 9.35</td>
<td>MSH10-6A</td>
</tr>
<tr>
<td>1.36 – 1.51</td>
<td>MSH1-7A</td>
<td>9.36 – 10.30</td>
<td>MSH11-7A</td>
</tr>
<tr>
<td>1.52 – 1.67</td>
<td>MSH1-9A</td>
<td>10.31 – 11.35</td>
<td>MSH12-9A</td>
</tr>
<tr>
<td>1.68 – 1.83</td>
<td>MSH2-1A</td>
<td>11.36 – 12.47</td>
<td>MSH14-2A</td>
</tr>
<tr>
<td>1.84 – 1.99</td>
<td>MSH2-3A</td>
<td>12.48 – 13.67</td>
<td>MSH15-6A</td>
</tr>
<tr>
<td>2.00 – 2.23</td>
<td>MSH2-5A</td>
<td>13.68 – 15.12</td>
<td>MSH17-1A</td>
</tr>
<tr>
<td>2.24 – 2.47</td>
<td>MSH2-8A</td>
<td>15.13 – 16.00</td>
<td>MSH18-6A</td>
</tr>
<tr>
<td>2.48 – 2.71</td>
<td>MSH3-1A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Accessories**

**MS Series Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot light kit (NEMA 1 enclosure and flush plates)</td>
<td>MSPT</td>
</tr>
<tr>
<td>Box, 1 unit (NEMA 1 enclosure)</td>
<td>MS1BN</td>
</tr>
<tr>
<td>Cover, 1 unit (NEMA 1 enclosure)</td>
<td>MS1CN</td>
</tr>
<tr>
<td>Flush plate, 1 unit (steel)</td>
<td>MS1FN</td>
</tr>
<tr>
<td>Flush plate, 1 unit (stainless steel)</td>
<td>MS1DN</td>
</tr>
<tr>
<td>Handle guard (padlockable for NEMA 1 enclosure and flush plates)</td>
<td>MSLG</td>
</tr>
</tbody>
</table>
Dimensions
Approximate Dimensions in Inches (mm)

MS Series Single-Phase Starters

Dimensions
Approximate Dimensions in Inches (mm)

MS Motor Starter
Toggle Operated Open Units

Type 1 Enclosures
(Boxes and covers)

Mounting Purposes
Two Holes

Indicating Light
One Unit
Flush Plates

Handle Guard

0.20 (6.1) Diameter (2) Mounting Hole

0.75 (19.1) Dia.
Lockout Hole

0.30 (7.6) Dia.
Two Mounting Holes

Hazardous Location (Cast aluminum)

0.06 (1.5)
Height of Handle

0.14-32 Tap

0.36 (9.1)
Dia.

0.19 (4.8) Dia.

1.36 (34.5)

1.06 (26.9) Handle Guard

0.22 (5.6) One Unit

3.28 (83.3)

0.66 (16.8) Pipe Top

2.83 (71.9) Indicating Light

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.31 (7.9)

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.

0.06 (1.5) Height of Handle

0.19 (4.8)

0.36 (9.1)

0.38 (9.7)

1.91 (48.6)

0.14-32 Tap

1.19 (30.2)

0.22 (5.6)

0.66 (16.8) Pipe Top

0.22 (5.6)

0.75 (19.1) Flush Plates

1.25 (31.8)

0.31 (7.9)

1.91 (48.6)

0.55 (14.0)

4.5 (114.3)

0.75 (19.1) Flush Plates

1.52 (38.6) Handle Guard

1.64 (41.7) Handle Guard

1.53 (38.9) Handle Guard

1.38 (35.1) Handle Guard

0.31 (7.9) Dia.
11.2 Manual Motor Control

Single- and Three-Phase Starters

Contents

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Accessories V10-T11-9
Options V10-T11-9
Technical Data V10-T11-9
Dimensions V10-T11-10

Type B100

Product Description
Eaton’s 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 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 Tab 17 for additional information on standards and certifications that apply to all 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
- OSHPD Certified (OSP-0015-10)
## Manual Motor Control

### Single- and Three-Phase Starters

#### 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 and Pushbutton Operated Starters

<table>
<thead>
<tr>
<th>NEMA Size</th>
<th>NEMA Size</th>
<th>Open Type Handle Catalog Number</th>
<th>General Purpose Catalog Number</th>
<th>Watertight, Stainless Steel Catalog Number</th>
<th>Type 7D, 9E, 9F and 9G for Hazardous Locations Catalog Number</th>
<th>Dust-Tight Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B100 Non-Reversing Two-Pole (For Single-Phase Motors and DC)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>M-0</td>
<td>B100M0B</td>
<td>B100S0B</td>
<td>B100W0B</td>
<td>B100U0B</td>
<td>B100J0B</td>
<td>B100L0B</td>
</tr>
<tr>
<td>M-1</td>
<td>B100M1B</td>
<td>B100S1B</td>
<td>B100W1B</td>
<td>B100U1B</td>
<td>B100J1B</td>
<td>B100L1B</td>
</tr>
<tr>
<td>Type B100 Non-Reversing Three-Pole (For Polyphase Motors)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-0</td>
<td>B100M0C</td>
<td>B100S0C</td>
<td>B100W0C</td>
<td>B100U0C</td>
<td>B100J0C</td>
<td>B100L0C</td>
</tr>
<tr>
<td>M-1</td>
<td>B100M1C</td>
<td>B100S1C</td>
<td>B100W1C</td>
<td>B100U1C</td>
<td>B100J1C</td>
<td>B100L1C</td>
</tr>
</tbody>
</table>

#### Notes

1. Does not include heaters. Select catalog numbers of heaters from table on Page V10-T11-8.
2. One 1-inch chrome hub supplied on each end.
3. Type 7D = Type 7, Class I, Group D. Type 9E, 9F and 9G = Type 9, Class II, Groups E, F and G.
4. Tapped for 1-inch conduit on each end.
### Heater Selection

<table>
<thead>
<tr>
<th>Single-Phase Enclosed Starters</th>
<th>Motor Full Load Current</th>
<th>Maximum Fuse Amps</th>
<th>Catalog Number</th>
<th>Maximum Fuse Amps</th>
<th>Catalog Number</th>
<th>Maximum Fuse Amps</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.29–0.29</td>
<td>1 FH03</td>
<td>1.90–2.10</td>
<td>7 FH22</td>
<td>9.59–10.40</td>
<td>35 FH40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.30–0.33</td>
<td>1 FH04</td>
<td>2.11–2.32</td>
<td>8 FH23</td>
<td>10.41–11.30</td>
<td>35 FH41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.34–0.36</td>
<td>1 FH05</td>
<td>2.33–2.54</td>
<td>8 FH24</td>
<td>11.40–12.20</td>
<td>40 FH42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.37–0.40</td>
<td>1 FH06</td>
<td>2.55–2.79</td>
<td>9 FH25</td>
<td>12.30–13.50</td>
<td>45 FH43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.41–0.45</td>
<td>1 FH07</td>
<td>2.80–3.07</td>
<td>10 FH26</td>
<td>13.60–14.90</td>
<td>50 FH44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.46–0.50</td>
<td>1 FH08</td>
<td>3.08–3.36</td>
<td>10 FH27</td>
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<th>Maximum Fuse Amps</th>
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<td>2.04–2.23</td>
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### Notes

2. Three-phase starters require three overload heaters.
3. FH series heaters are for type B100 manual motor starters. Heater element selection is based on motor nameplate’s listed full load amperes.
4. Trip rating of this series of elements is 125% of minimum motor full load amperes listed for the element.
5. 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.
6. 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.
## Accessories

### Field Mounting Kits

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
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<tr>
<td>Auxiliary contact 1NO</td>
<td>B1A</td>
</tr>
<tr>
<td>1NC</td>
<td>B1B</td>
</tr>
<tr>
<td>Red pilot light 120/60 (Type 1 enclosed only)</td>
<td>LK-21</td>
</tr>
<tr>
<td>208-240/6 (Type 1 enclosed only)</td>
<td>LK-22</td>
</tr>
<tr>
<td>480-600/60 (Type 1 enclosed only)</td>
<td>LK-26</td>
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</table>

**For Type 4 and 12 Enclosures Only**

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
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<tbody>
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<td>LK-41</td>
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<td>240V</td>
<td>LK-42</td>
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## Options

### Factory Modifications

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<td>Pushbutton operator (open and Type 1 only)</td>
<td>A</td>
</tr>
<tr>
<td>Without lockoff (open only)</td>
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## Technical Data

### Specifications

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<tr>
<th>NEMA Size</th>
<th>Maximum hp for AC Ratings ¹</th>
<th>Maximum hp for DC Ratings</th>
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<tr>
<td></td>
<td>120 Vac 208–240 Vac 480–600 Vac 115 Vdc 230 Vdc</td>
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<td>Two-Pole, Single-Phase</td>
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<td>1</td>
<td>1</td>
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<tr>
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<td>2</td>
<td>1-1/2</td>
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<td>Three-Pole, Three-Phase</td>
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<tr>
<td>M-0</td>
<td>2</td>
<td>—</td>
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<td>3</td>
<td>—</td>
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<tr>
<td>M-1</td>
<td>3</td>
<td>7-1/2</td>
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**Notes**

¹ Add suffix letter to starter catalog number. Example: B100MOC.

² Ratings up to 3 hp, three-phase are suitable for group fusing.
# Manual Motor Control

## Single- and Three-Phase Starters

### Dimensions

Approximate Dimensions in Inches (mm)

#### Type B100 Single-and Three-Phase Starters

<table>
<thead>
<tr>
<th>Type</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Type 1 Enclosed</td>
<td>5.13 (130.3)</td>
<td>4.59 (116.6)</td>
<td>3.19 (81.0)</td>
<td>3/16-32 Mounting Screw</td>
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<tr>
<td>Type 4 Enclosed</td>
<td>5.00 (127.0)</td>
<td>2.05 (52.1)</td>
<td>0.17 (4.3)</td>
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#### Dimensions Diagrams

- Type 1 Enclosed
- Type 4 Enclosed
- Type 12 Enclosed