



How to Start and How to Stop: AC/DC Motor Control

An Online Continuing Education Course for Engineers

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1. Introduction

The industrial world uses electric motors to move solids, liquids, and gases. These electric motors could be alternating current or direct current. The motors range from fractional horsepower to thousands of horsepower. For the motors to be effective, there has to be a way to turn them off and on. The whole purpose of this course is to show how motors are turned off and on or controlled. Motors can also be speed controlled. Since this is a course about motor control, various ways to control the speed of motors will also be discussed. With that in mind, let's look at starters for AC induction motors.

2. AC Induction Motor Starters

When AC induction motors are started, there is a large current that flows as soon as the voltage is applied to the motor. It is typically 6 to 10 times the running current. This means that the device that turns power onto the motor has to be able to handle a lot of currents. Just to give some idea of the magnitude of this current, the following information was copied from the 2005 National Electric Code.

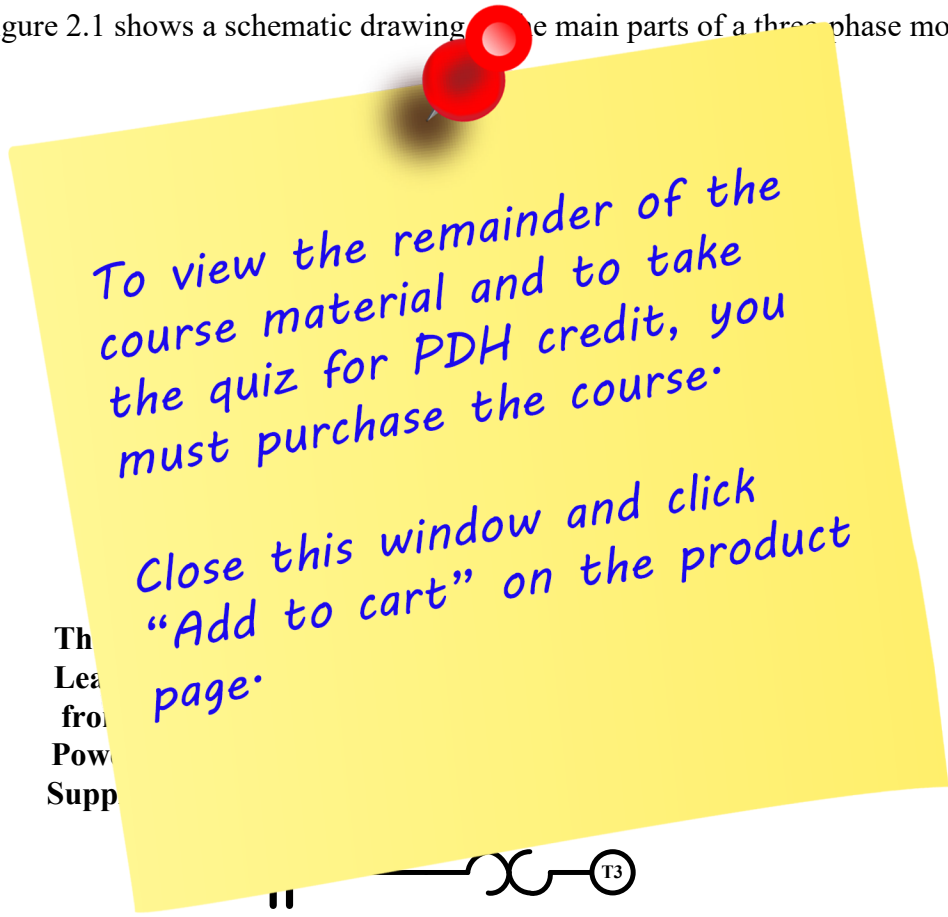
Full Load Current Three-phase AC Motors

Horsepower Current at 460 volts, 3 phase

½	1.1
¾	1.6
1	2.1
1&1/2	3
2	3.4
3	4.8
5	7.6
7½	11
10	14
15	21
20	27
25	34
30	40
40	52
50	65
60	77
75	96
100	124
125	156
150	180
200	240
250	302
300	361
350	414
400	477
450	515
500	590

At 460 volts, the full load current rating is just a little higher than the horsepower rating for 3 phase motors. Notice that a 10 horsepower motor has a current rating of 14 amps, and a 100 horsepower motor has a current rating of 124 amps.

Even for a relatively small 10 Horsepower motor, the running current is 14 amps. That would make the starting current somewhere between 84 and 140 amps. Clearly, this requires a relatively heavy-duty switch. And that is what a motor starter is, a heavy-duty electro-mechanical switch. This heavy-duty switch consists of 3 main parts. They are a coil that is energized to operate the second part, a three-pole relay or contactor. The third part is an overload relay. The overload relay consists of a current measuring device and an auxiliary contact. Usually, there are also some low current auxiliary contacts that operate at the same time as the main high current contacts. Figure 2.1 shows a schematic drawing of the main parts of a three phase motor starter.



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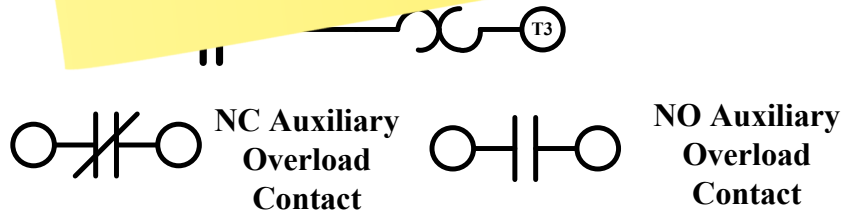


Figure 2.1 Schematic Drawing Showing the Parts of a Starter