LOMBARD
CHAVES ELÉTRICAS E FERRAMENTAS

# Compensating Starter

## Features

This starter reduces the voltage in the motor coils during starting, through an autotransformer connected in series with the coils. After starting, the motor coils are rated voltage. In this type of switch the opposite of the Star Triangle starter occurs, because the motor connection is always the same and the input voltage varies.

The starting autotransformer is formed by 3 coils and its lower terminals are connected in Y, forming a center that is suspended along the winding of the autotransformer. Operational TAP'S (intermediate outputs) are made at the height of the voltages of 65% and 80% of the voltage applied in the phase.

The current, during the motor starting process, is reduced due to the application of a voltage lower than the nominal working through the autotransformer. Sensors (thermal probes) are installed to monitor the temperature of the autotransformer windings and prevent activation if the temperature exceeds the safety value for the autotransformer coils. This type of starter is used for engines above 15 hp that start with up to 50% of the load. The reduction of voltages applied to the motor occurs according to the derivation of the transformer (TAP) to which it is connected.

The main contactor K1 must be dimensioned for the rated motor current, as it starts operating after reaching the rated speed. The contactor K2, located between the mains and the autotransformer, must be dimensioned for a current of $K^2$ x In (K is the Tap value of the autotransformer). The K3 contactor, which short-circuits the secondary of the autotransformer during start-up, must be dimensioned for a current equivalent to ($k-k^2$) x In.

The overload relay must be dimensioned by the rated motor current. The fuses must be rated by the starting current F1, F2, F3 = 0.64 x Ip (approximately 15s). The autotransformer must be dimensioned considering the following parameters:

- Rated voltage;
- Motor power;
- Estimated number of departures per hour (usually 10);
- Approximate time for each game (usually 15 seconds).

| TAP (%) | FACTOR (K) | CORRENTE | | |
|---|---|---|---|---|
| | | PRIMÁRIO (TR) | TAPS | SECUNDÁRIO (TR) |
| 85 | 0,85 | 0,72 X In | 0,85 X In | 0,13 X In |
| 80 | 0,80 | 0,64 X In | 0,80 X In | 0,16 X In |
| 65 | 0,65 | 0,42 X In | 0,65 X In | 0,23 X In |
| 50 | 0,50 | 0,25 X In | 0,50 X In | 0,25 X In |

## Dimensions criterias

### Contactors

As the most used TAP'S are 65% and 80% the switch componentes are defined for those, using the worst scenario (highest voltage in the path)

- K1 = IN
- K2 = 0,64 . IN
- K3 = 0,23 . IN

### Relé Térmico

- FT1 = In

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**Escritório:** Rua Catão, 1040 • Vila Romana • CEP: 05049-000 • Telefone: 11 3674-1544 • Fax: 11 3862-8568
**www.lombard.com.br** **vendas@lombard.com.br**

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## Technical Especifications

| POWER MAX - CV AC3/ 60 Hz - 4 POLES | | | I (AMP) | K1 | K2 | K3 | OVERLOAD RELAY (A) | CIRCUIT BREAKER | SIZE H X W X D ( mm ) |
|---|---|---|---|---|---|---|---|---|---|
| 220V | 380V | 440V | | | | | | | |
| - | - | 15 | 20 | NC1 2510 | NC1 1810 | NC1 0910 | (17 - 25) | 50A | 600 x 400 x 250 |
| - | 15 | - | 23 | NC1 2510 | NC1 1810 | NC1 0910 | (23 - 32) | 50A | |
| - | 20 | - | 30,5 | NC1 4011 | NC1 2510 | NC1 0910 | (28 - 36) | 50A | |
| 12,5 | - | - | 32 | NC1 4011 | NC1 2510 | NC1 0910 | (30 - 40) | 50A | |
| - | 25 | - | 38 | NC1 4011 | NC1 2510 | NC1 0910 | (37 - 50) | 63A | |
| 15 | - | - | 39,5 | NC1 4011 | NC1 3210 | NC1 1210 | (37 - 50) | 63A | |
| - | 30 | - | 43,5 | NC1 5011 | NC1 3210 | NC1 1210 | (37 - 50) | 63A | 700 x 500 x 250 |
| 20 | - | - | 53 | NC1 6511 | NC1 4011 | NC1 1810 | (48 - 65) | 80A | |
| - | 40 | - | 59 | NC1 6511 | NC1 4011 | NC1 1810 | (48 - 65) | 80A | |
| 25 | - | - | 64 | NC1 6511 | NC1 5011 | NC1 1810 | (55 - 70) | 80A | |
| - | 50 | - | 73 | NC1 8011 | NC1 5011 | NC1 1810 | (63 - 80) | 100A | |
| 30 | - | - | 75,5 | NC1 8011 | NC1 5011 | NC1 1810 | (63 - 80) | 125A | |
| - | 60 | - | 88 | NC1 9511 | NC1 6511 | NC1 2510 | (80 - 93) | 125A | 800 x 600 x 250 |
| - | - | 20 | 26,5 | NC1 3210 | NC1 1810 | NC1 0910 | (23 - 32) | 50A | 600 x 400 x 250 |
| - | - | 25 | 32 | NC1 4011 | NC1 2510 | NC1 0910 | (30 - 40) | 50A | |
| - | - | 30 | 38 | NC1 4011 | NC1 3210 | NC1 1210 | (37 - 50) | 63A | |
| - | - | 40 | 50,5 | NC1 6511 | NC1 4011 | NC1 1810 | (48 - 65) | 80A | 700 x 500 x 250 |
| - | - | 50 | 61 | NC1 6511 | NC1 4011 | NC1 1810 | (55 - 70) | 80A | |
| - | - | 60 | 73 | NC1 8011 | NC1 5011 | NC1 1810 | (63 - 80) | 100A | |
| - | - | 75 | 88 | NC1 9511 | NC1 6511 | NC1 2510 | (80 - 93) | 125A | 800 x 600 x 250 |

- Autotransformer (TAP'S 65 and 80%) + signalpoint of motor running.
- Mounted in metallic box with removable cover for the entrance of cable press.
**- The values shown are subject to change without notice.**

• IE = Nominal Current;
• Appopriate charts to work in AC2 and AC3 categories, for other categories specific criterias must be followed.
• Service fator equal to 1,0 and addition of 10% in the currents for compensation of tension oscillations.
• Specifications for IV motors, 60Hz poles, except where is indicated otherwise.
• Overload relay with protection against lack of phase;
• Recommended circuit breaker lie inside of the shooting curve in C category.
• Command tension through power cables and in some cases a transformer can be used;
• Direct starting and star-delta allows up to 15 maneuvers na hour;
• Breakers breaking capacity (Icu) 3 kA of circuit breakers, other values on request.

## Remarks

• Recommended for actioning of machines with starting joint of around half of the nominal joint; • In the 65% TAP the energy line current is around equal to the star-delta switch, however, in passage of reduced tension to the network tension, the motor is not turned off and second peak is reduced, since the autotransformer becomes a reactance for shor period of time;
• It is possible that the TAP variation from 65 to 80% or even to 90% of the network tension so that the motor can start adequately;
• The switches are submitted in metallic boxes with a protection level IP55.

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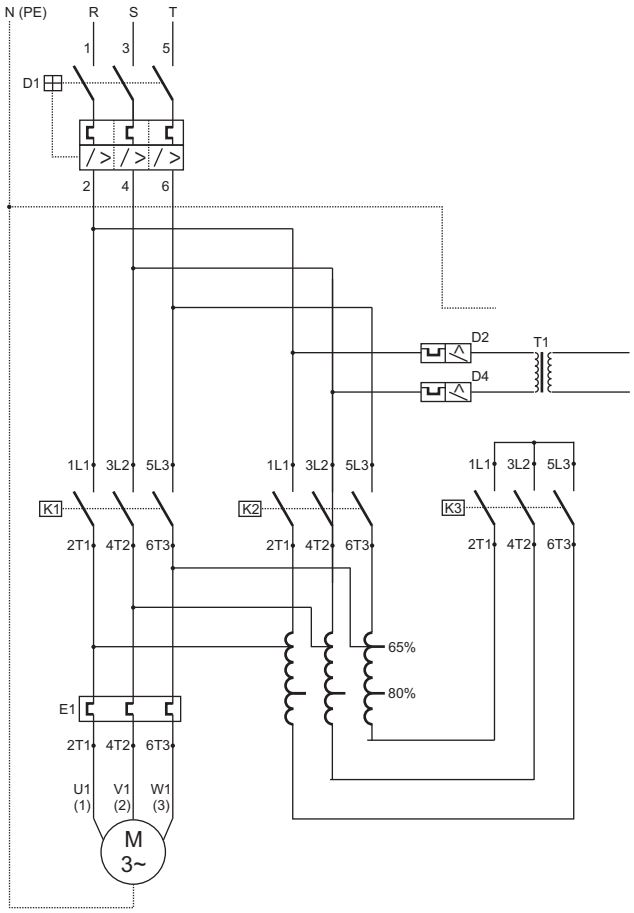
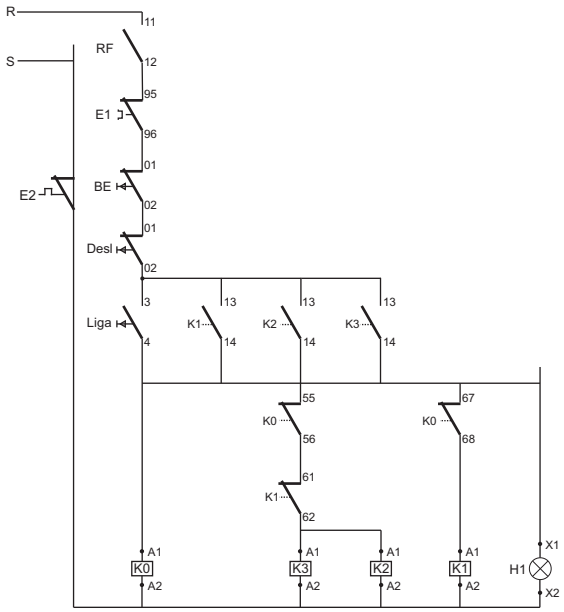
## Connection Procedure

**POWER**




**COMMAND**




## AUTOMATIC COMPENSATING STARTER

| | |
|---|---|
| **D1,D2,D3** | - Disjuntores |
| **RFF** | - Phase lack relay |
| **E1** | - Overload relay |
| **K1,K2,K3** | - Contactors |
| **BE** | - Emergency button |
| **B0** | - Off button |
| **B1** | - Power button |
| **H1** | - Flag button |

**Sizing**

| | |
|---|---|
| - Contactor: | K1 = K2 = 0,58 x In x 1,15 |
| | K3 = 0,33 x In |
| - Overload relay: | E1 = 0,58 x In |
| - Fuses: | F1, F2, F3 = 1/3 x Ip |

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