LOMBARD
CHAVES ELÉTRICAS E FERRAMENTAS

Starting Star-Delta

Features

This type of starting consists of supplying the motor with a reduced voltage through the connections in the motor wires. The power is supplied through a single voltage and the key makes the connections at the motor terminals, reducing the starting current during start-up. After a time stipulated and adjusted in the switch, the nominal voltage takes effect. This switch provides a reduction in the starting current of approximately 33% of its direct starting value. It is used almost exclusively for empty (unloaded) machine starts and is suitable for machines with resistant starting torque up to 1/3 of the nominal torque.

The load resistant torque must not exceed the motor starting torque, nor must the current at the moment of switching reach very high values. The high resistant torque causes the motor to accelerate to 85% of the rated speed when the starter is switched. At this point, the current, which was approximately equal to the nominal, goes to 320%, which has no advantage, since the current was 190%.

In the star connection, the motor accelerates up to 95% of the rated speed and at that point the current is at 50%. Then switching takes place and the current rises to 170%, that is, practically equal to the star inrush current. The motor speed generally stabilizes between 75% and 85% of the rated speed. The passage from the star connection (higher voltage) to the triangle connection (operating voltage) is controlled by a timer installed on the switch, which works with a delay of 30 to 100 ms (milliseconds) in order to avoid a short circuit. between phases, since the contactors cannot be closed simultaneously.

The Star Auto Triangle Starter Switch is fitted with electromagnetic circuit breakers on the C curve (trigger curve of the standard breaker), suitable for this type of application, as they do not trip the switch during the very fast current peak. Depending on the inertia of the load, the motor can accelerate in a greater or lesser period of time, according to the following situations:

1 - Normal Load

The starting time is around 15 seconds and the starting current is relatively low. In this case the delta counters are dimensioned to 0,58 x In. The K3 counter is required to 1/3 of the nominal current. The overload relay is built between the K1 conter and the motor, and in it circulates 0,58 x In. The breakers or fuses must be dimensioned to the starting current, considering 1/3 of this value during around 10 seconds.

2 - Heavy Load

In this situation the starting time is prolonged between 10 and 40 seconds which may cause the relay disarm. In this case the relay is mounted right after the breakers or fuses and in it circulates the nominal current of the motor. The breakers or fuses must be dimensioned to the starting current, considering 1/3 of this value during around 10 seconds.

3- Extra Heavy Load

In this situation the starting time is long, around 40 seconds, in this case, so the overload relay doesn't act during the starting, it is mounted in the delta circuito that does not participates on the motor starting.

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Technical Especifications

MAX POWER - CV AC3/ 60 Hz - 4 POLOS			I (AMP)	K1 = K2	K3	OVERLOAD RELAY (A)	CIRCUIT BREAKER	SIZE H X W X D (mm)
220V	380V	440V						
-	5	-	11	NC1 0910	NC1 0910	(5,5 - 8,0)	20A	350 x 250 x 180
-	7,5	-	14	NC1 1210	NC1 0910	(7,0 - 10)	20A	
5	10	-	16	NC1 1210	NC1 0910	(9,0 - 13)	25A	
7,5	12,5	-	20,7	NC1 1810	NC1 0910	(12 - 18)	32A	
-	15	-	26	NC1 1810	NC1 1210	(12 - 18)	40A	
10	-	-	27	NC1 2510	NC1 1210	(17 - 25)	40A	
-	20	-	31,2	NC1 2510	NC1 1210	(17 - 25)	40A	400 x 300 x 200
12,5	-	-	36	NC1 2510	NC1 1810	(17 - 25)	50A	
-	25	-	39,8	NC1 3210	NC1 1810	(23 - 32)	50A	
15	-	-	43,5	NC1 3210	NC1 1810	(23 - 32)	63A	
-	30	-	54	NC1 4011	NC1 2510	(30 - 40)	63A	500 x 400 x 200
20	-	-	55	NC1 4011	NC1 2510	(30 - 40)	80A	
25	40	-	69,5	NC1 5011	NC1 3210	(37 - 50)	80A	
30	50	-	75	NC1 6511	NC1 3210	(48 - 65)	100A	
-	60	-	86	NC1 6511	NC1 4011	(48 - 65)	100A	
40	75	-	109	NC1 8011	NC1 5011	(63 - 80)	125A	
-	-	5	11	NC1 0910	NC1 0910	(5,5 - 8,0)	20A	350 x 250 x 180
-	-	7,5	11	NC1 0910	NC1 0910	(5,5 - 8,0)	20A	
-	-	10	16	NC1 1210	NC1 0910	(9,0 - 13)	25A	
-	-	12,5	20,7	NC1 1810	NC1 0910	(12 - 18)	32A	
-	-	15	23	NC1 1810	NC1 0910	(12 - 18)	32A	
-	-	20	27	NC1 2510	NC1 1210	(17 - 25)	40A	
-	-	25	36	NC1 2510	NC1 1810	(17 - 25)	50A	400 x 300 x 200
-	-	30	39,8	NC1 3210	NC1 1810	(23 - 32)	50A	
-	-	40	54	NC1 4011	NC1 2510	(30 - 40)	63A	500 x 400 x 200
-	-	50	69,5	NC1 5011	NC1 3210	(37 - 50)	80A	
-	-	60	75	NC1 6511	NC1 3210	(48 - 65)	100A	
-	-	75	96	NC1 6511	NC1 4011	(55 - 70)	125A	

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 com with starting joint of around 1/3 of the nominal joint;
- The starting current of the motor is reduced to 1/3;
- The system voltage must coincide with the delta tension of the motor;
- The motor does not achieve at least 90% of its normal nominal speed, the current peak in swithcing status from star to delta will be almost as in a direct starting, which becomes harmful to the moters contacts and it doesn't result in any advantage for the electric network;
- Generally the star-delta swicht can only be used in-empty machines starting, which means, unladen. Only after reached the nominal speed, the load can be applied.

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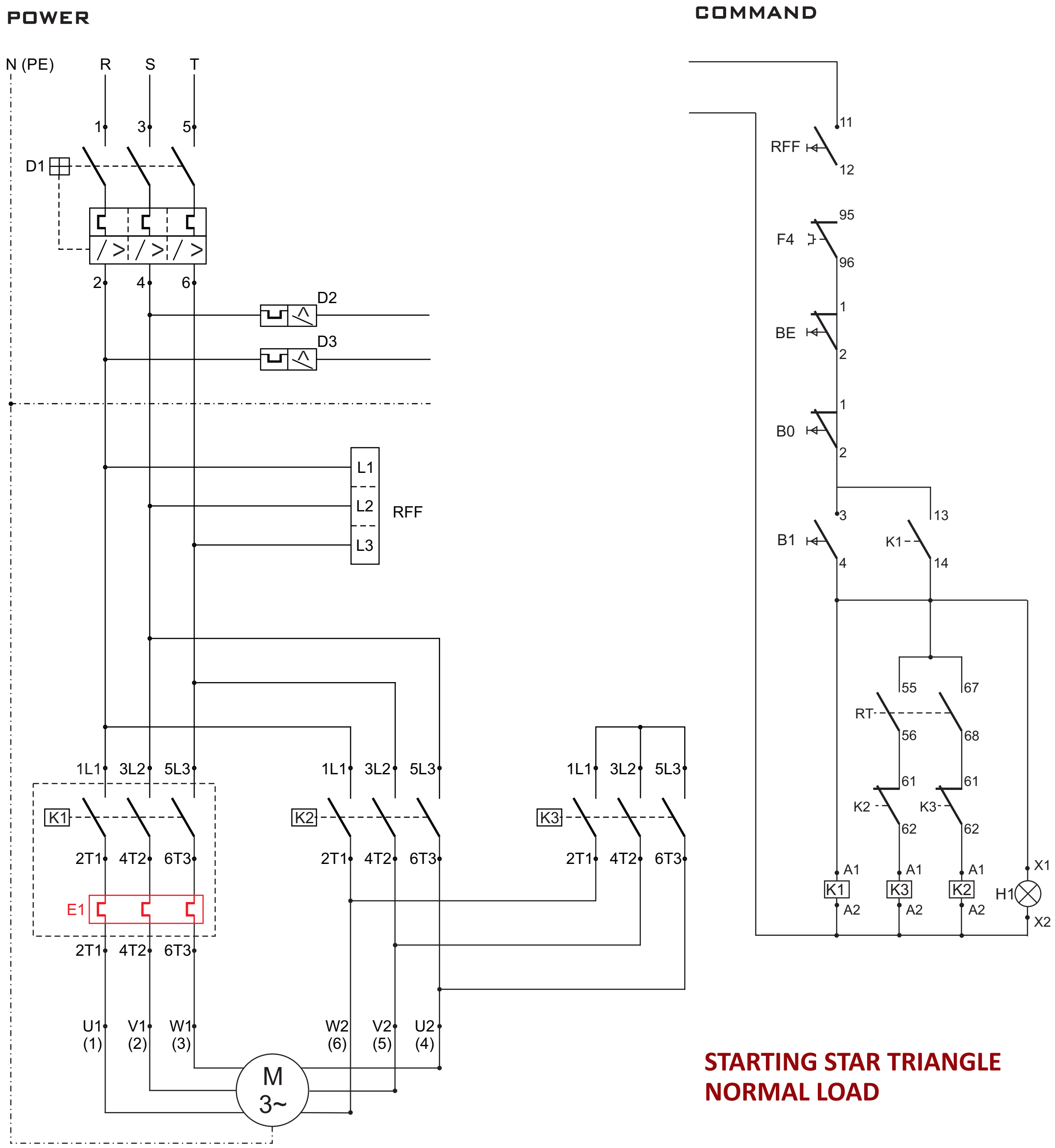
Connection Procedure



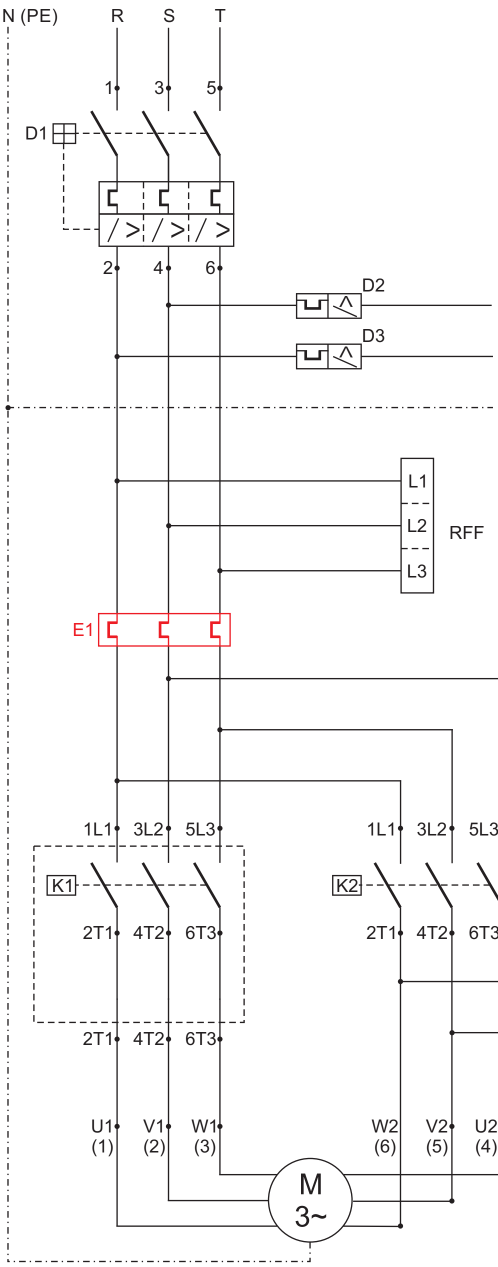
STARTING STAR TRIANGLE
NORMAL LOAD

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

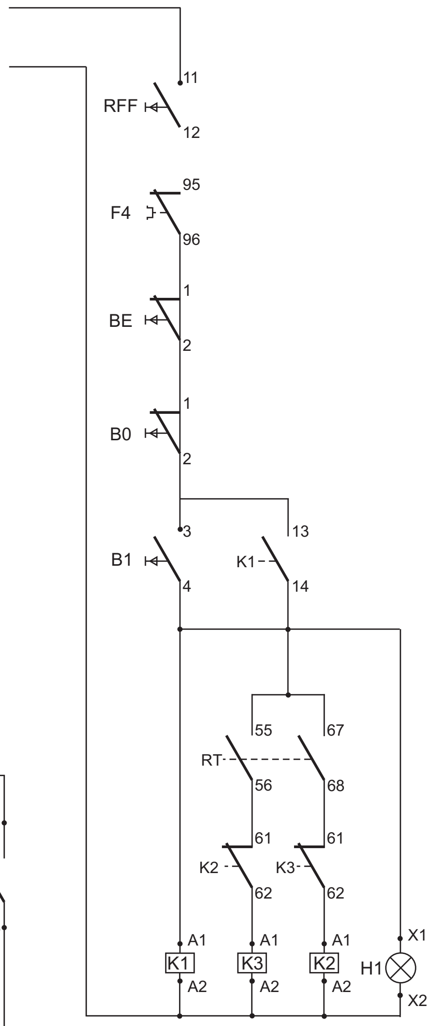
Sizing

- 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

POWER



COMMAND



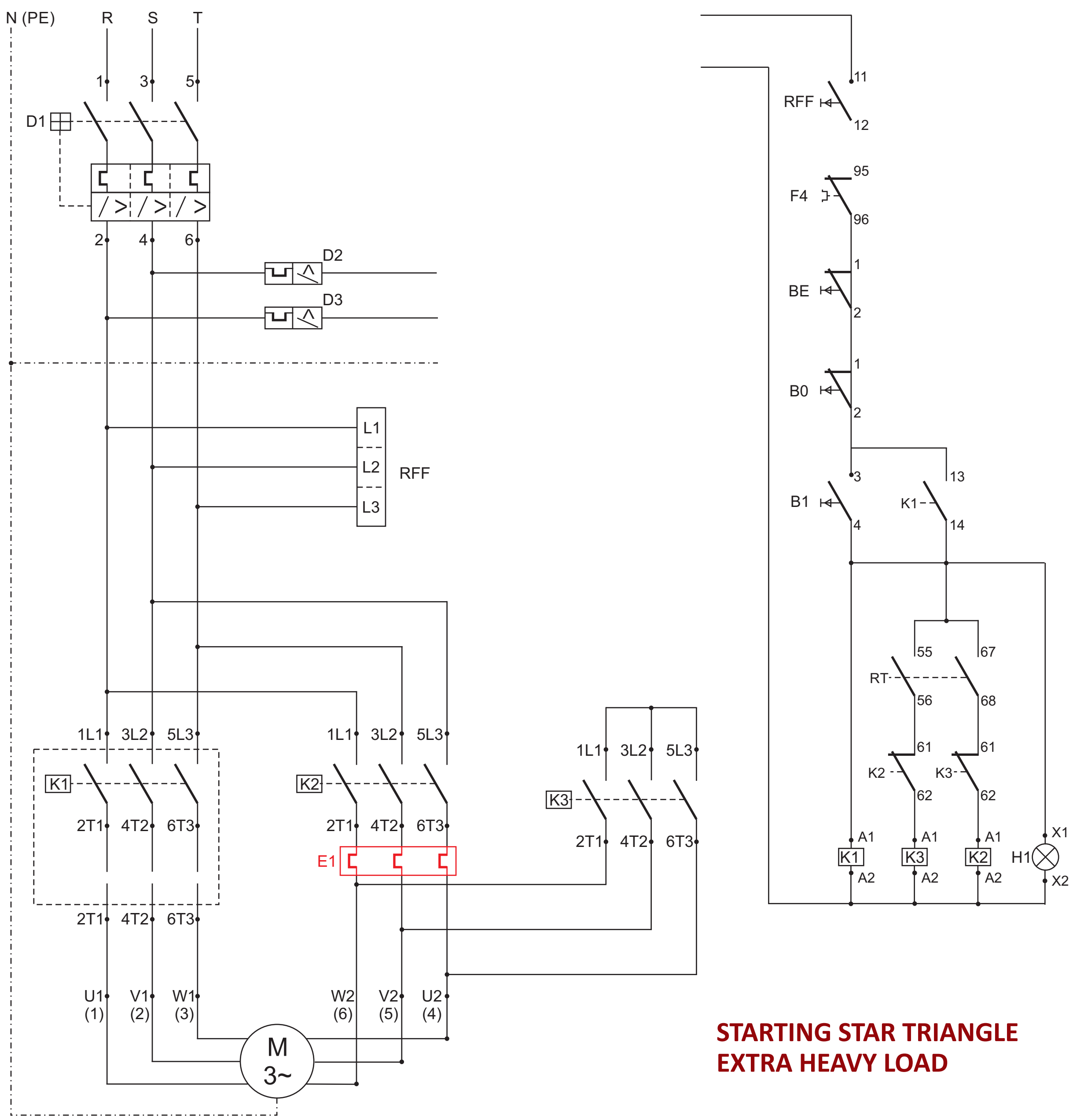
STARTING STAR TRIANGLE HEAVY LOAD

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

POWER **COMMAND**



STARTING STAR TRIANGLE EXTRA HEAVY LOAD

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