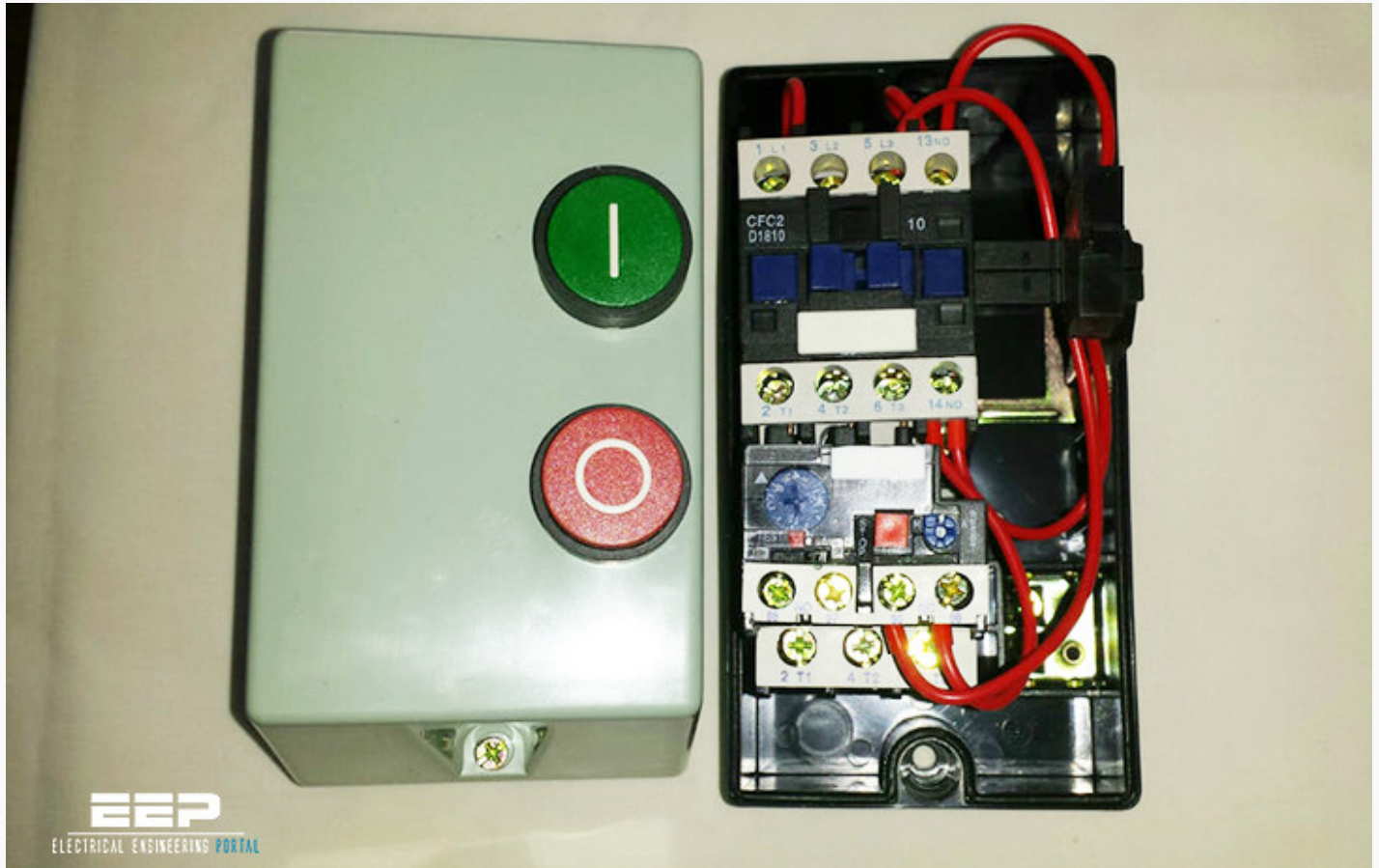


A few tips on how to select contactors for use in direct on line starters

Google+



A few tips on how to select contactor for use in direct on line starter

Contactors for DOL starters

Contactors for use in direct on line starters (DOL) are **normally selected by their AC3 rating**, that is the switching on of a cage type induction motor and switching off the supply to the motor after the motor has run up to full speed.

The other most common utilisation categories are **AC4**, the switching on and off of a cage type induction motor before it has run up to full speed, sometimes termed 'inching' or 'jogging' the drive, and category **AC2**, the switching of the stator supply to a [wound rotor motor](#) where the starter circuit automatically inserts resistance into the rotor circuit for each start.

Figure 1 shows a star-delta starter.

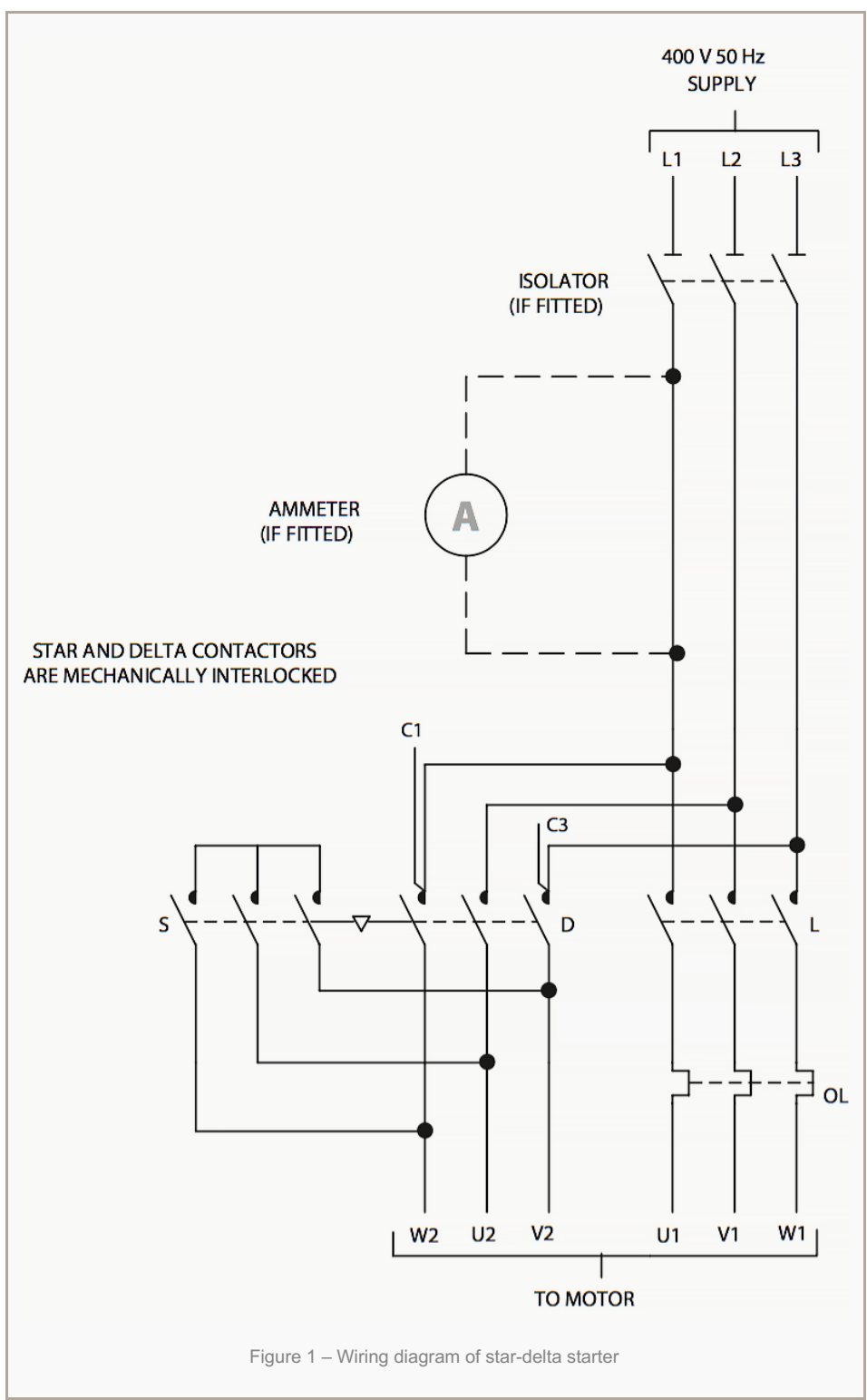
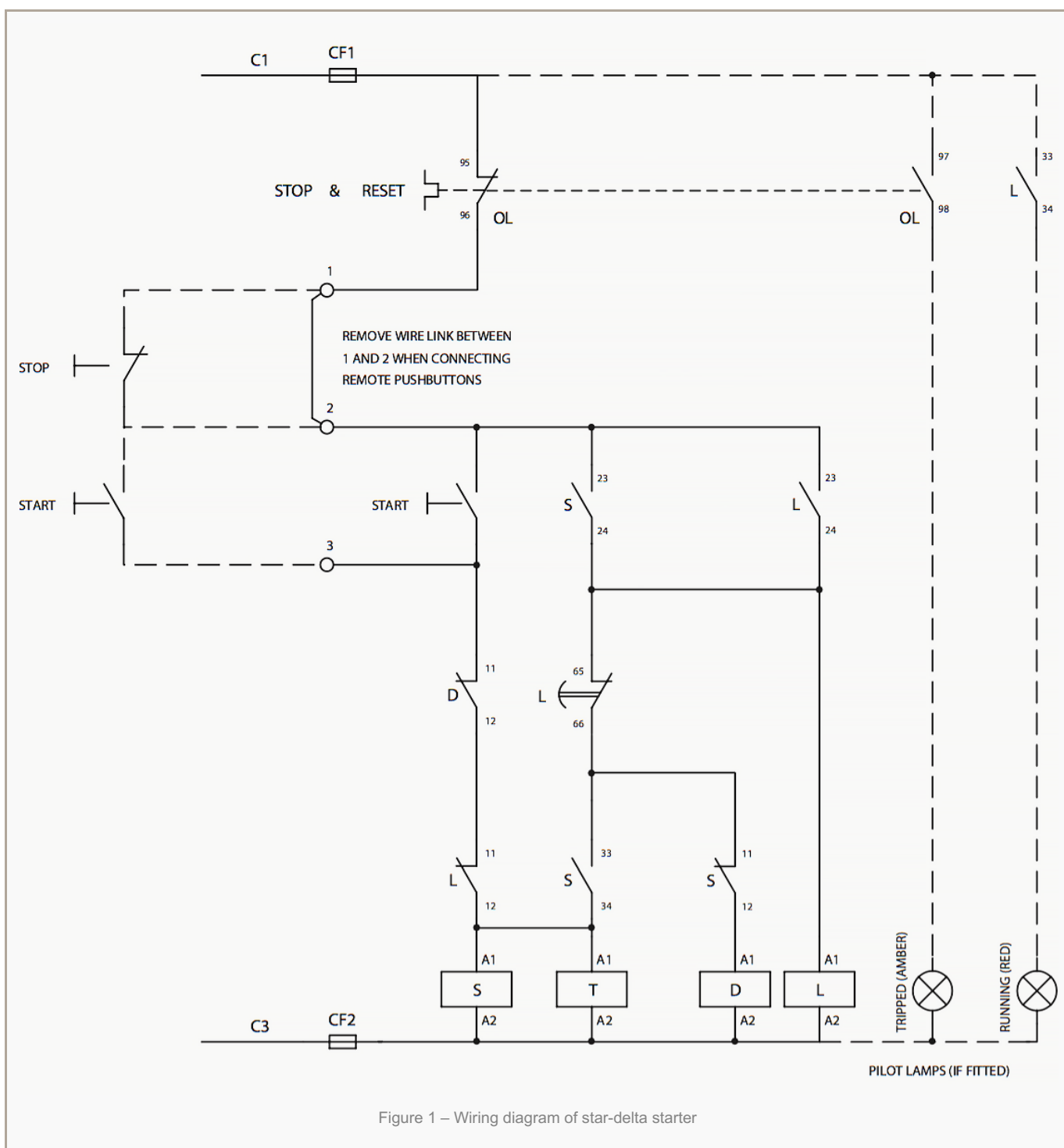


Figure 1 – Wiring diagram of star-delta starter



Catalogued ratings //

The catalogued ratings are published on the basis of known service conditions, typically //

Rating #1 – **Ambient temperature** outside the starter enclosure between -5° and 35°C average (with a maximum not exceeding 40°C).

Rating #2 – **Rate of operation** to be specified by the manufacturer, typically 120 starts per hour.

Rating #3 – **The duty cycle or utilisation category** – see Table 1 for typical values of current to be switched during type testing and in service, e.g. is the starter a reversing type [which must reverse a motor](#) which is already run up to

speed, or does the reversing only occur after allowing the motor to come to rest? In the latter case only AC3 rated contactors could be used.

Rating #4 – **The acceleration time of the drive**, the ability of the contactor to carry the starting current, must be considered. AC3 rated contactors are able to carry eight times rated current for a minimum of 10 s (this applies to ratings of up to 630 A. Above this the value is six times rated current).

Rating #5 – **Any special contact life** requirement.

Rating #6 – **The type of short-circuit protective device** to be installed in series with the supply to the starter, and the classification of type of protection to be obtained.

Rating #7 – **Any special coordination requirement**, e.g. are there any residual current devices, which on detecting a fault condition may attempt to open the contactor on a current in excess of its breaking capacity.

Rating #8 – **Any special requirement to attach cables** of other than copper cored, PVC or rubber insulated types to the contactor terminals, e.g. the use of some types of high temperature insulation such as XLPE allows the cable to run much hotter than the manufacture expected.

The normal practice is to design for use with 70°C cable so the possible economies of using XLPE may not be exploited as the core temperature may be as high as 250°C, consequently the cabling would act as a heat source, not a heat sink.

Table 1 – Contactor utilisation categories

Utilisation category	Current as multiples of operational current (I_e)			
	Normal operation		Proving operation	
	make	break	make	break
AC1 – Non-inductive or slightly inductive loads such as furnaces and heating loads	1	1	1.5	1.5
AC2 – Starting of slip ring motors. Plugging with rotor resistance in circuit	2.5	2.5	4	4
AC3 – Starting of cage motors, switching of motors during running	6	1*	10	8
AC4 – Starting of cage motors, plugging inching	6	6	12	10

All tests carried out at supply voltage for normal operation except as indicated below and at 105% voltage for proving operations. For full details and power factors, etc. refer to specification IEC 947/BS EN60947.

**At 17% supply voltage.*

Any of the above may need special consideration and may necessitate the selection of a contactor of a higher AC3 rating than catalogued values would initially suggest. Final or run contactors used in auto-transformer starters (Figure 2) should be selected using AC3 ratings. Star and intermediate contactors should be selected in accordance with catalogue recommendations.

For stator-rotor starters, the stator contactors should be selected using AC2 ratings. Rotor

contactor ratings are normally specified by the contactor manufacturer as enhanced ratings based on them being in circuit only during starting.

Figure 2 – Simplified wiring diagram of stator-rotor (or rotor resistance) starter

Another important consideration when selecting contactors is **to ensure that the proposed cable conductor can be accommodated by the contactor terminals**. Most manufacturers supply this information in their catalogue together with the different types of termination that are available.

A range of contactors is illustrated in Figure 3.



Figure 3 – Typical range of contactors covering three-phase AC3, AC2 and AC1 (ratings 4 – 400 kW)

Reference // *Handbook of Electrical Installation Practice* by GEOFFREY STOKES