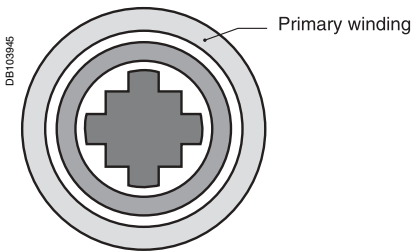


## Inrush currents

When LV/LV transformers are switched on, very high inrush currents are produced which must be taken into account when choosing overcurrent protection devices. The peak value of the first current wave often reaches 10 to 15 times the rated rms current of the transformer and may reach values of 20 to 25 times the rated current even for transformers rated less than 50 kVA.



## Selecting the protection

Merlin Gerin has conducted an extensive test programme to optimise the protection of LV/LV transformers.

The Compact and Masterpact circuit breakers detailed in the following tables offer the following advantages:

- protection of the transformer in the event of abnormal overloads
- no nuisance tripping when the primary winding is energised
- unimpaired electrical endurance of the circuit breaker.

The transformers used for the tests are standard. The values in the tables have been calculated for a crest factor of 25. These tables indicate the circuit breaker and trip unit to be used depending on:

- the primary supply voltage (230 V or 400 V)
- the type of transformer (single-phase or three-phase).

They correspond to the most frequent case in which the primary is wound externally <sup>(1)</sup>. The type of circuit breaker to be used (i.e. N, H or L) depends on the breaking capacity required at the point of installation.

## Protection using a Compact circuit breaker (1<sup>st</sup> peak ≤ 25 In)

| Compact NS100 to NS250 equipped with TM-D thermal-magnetic trip unit |   |                    | Protective device |           |                |
|--|---|--------------------|-------------------|-----------|----------------|
| Transformer rating (kVA)   |   |                    | Circuit breakers  | Trip unit | Ir max setting |
| 230/240 V 1 phase  | 230/240 V 3 phases<br>400/415 V 1 phase | 400/415 V 3 phases |                   |           |                |
| 3  | 5 to 6                                  | 9 to 12            | NS100N/H/L        | TM16D     | 1              |
| 5  | 8 to 9                                  | 14 to 16           | NS100N/H/L        | TM25D     | 1              |
| 7 to 9   | 13 to 16                                | 22 to 28           | NS100N/H/L        | TM40D     | 1              |
| 12 to 15   | 20 to 25                                | 35 to 44           | NS100N/H/L        | TM63D     | 1              |
| 16 to 19   | 26 to 32                                | 45 to 56           | NS100N/H/L        | TM80D     | 1              |
| 18 to 23   | 32 to 40                                | 55 to 69           | NS160N/H/L        | TM100D    | 1              |
| 23 to 29   | 40 to 50                                | 69 to 87           | NS160N/H/L        | TM125D    | 1              |
| 29 to 37   | 51 to 64                                | 89 to 111          | NS250N/H/L        | TM160D    | 1              |
| 37 to 46   | 64 to 80                                | 111 to 139         | NS250N/H/L        | TM200D    | 1              |

| Compact NS100 to NS1600 / Masterpact equipped with STR and Micrologic trip unit |   |                    |                            |                        |                |
|---|---|--------------------|----------------------------|------------------------|----------------|
| Transformer rating (kVA)  |   |                    | Protective device          |                        |                |
| 230/240 V 1-phase   | 230/240 V 3-phases<br>400/415 V 1-phase | 400/415 V 3-phases | Circuit breakers           | Trip unit              | Ir max setting |
| 4 to 7  | 6 to 13                                 | 11 to 22           | NS100N/H/L                 | STR22SE 40             | 0.8            |
| 9 to 19   | 16 to 30                                | 27 to 56           | NS100N/H/L                 | STR22SE 100            | 0.8            |
| 15 to 30  | 05 to 50                                | 44 to 90           | NS160N/H/L                 | STR22SE 160            | 0.8            |
| 23 to 46  | 40 to 80                                | 70 to 139          | NS250N/H/L                 | STR22SE 250            | 0.8            |
| 37 to 65  | 64 to 112                               | 111 to 195         | NS400N/H                   | STR23SE/53UE 400       | 0.7            |
| 37 to 55  | 64 to 95                                | 111 to 166         | NS400L                     | STR23SE/53UE 400       | 0.6            |
| 58 to 83  | 100 to 144                              | 175 to 250         | NS630N/H/L                 | STR23SE/53UE 630       | 0.6            |
| 58 to 150   | 100 to 250                              | 175 to 436         | NS630bN/bH-NT06H1          | Micrologic 5.0/6.0/7.0 | 1              |
| 74 to 184   | 107 to 319                              | 222 to 554         | NS800N/H-NT08H1-NW08N1/H1  | Micrologic 5.0/6.0/7.0 | 1              |
| 90 to 230   | 159 to 398                              | 277 to 693         | NS1000N/H-NT10H1-NW10N1/H1 | Micrologic 5.0/6.0/7.0 | 1              |
| 115 to 288  | 200 to 498                              | 346 to 866         | NS1250N/H-NT12H1-NW12N1/H1 | Micrologic 5.0/6.0/7.0 | 1              |
| 147 to 368  | 256 to 640                              | 443 to 1108        | NS1600N/H-NT16H1-NW16N1/H1 | Micrologic 5.0/6.0/7.0 | 1              |
| 184 to 460  | 320 to 800                              | 554 to 1385        | NW20N1/H1                  | Micrologic 5.0/6.0/7.0 | 1              |
| 230 to 575  | 400 to 1000                             | 690 to 1730        | NW25H2/H3                  | Micrologic 5.0/6.0/7.0 | 1              |
| 294 to 736  | 510 to 1280                             | 886 to 2217        | NW32H2/H3                  | Micrologic 5.0/6.0/7.0 | 1              |

<sup>(1)</sup> For other windings, please consult us.

If a circuit breaker upstream of a transformer with a transformation ratio of 1 and a rated power of less than 5 kVA is subject to nuisance tripping, before choosing a circuit breaker with a higher rating, invert the input and the output of the transformer (the inrush current may be doubled if the primary is wound internally rather than externally).