

### Limitation of specific let-through energy

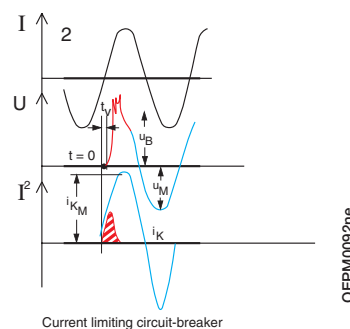
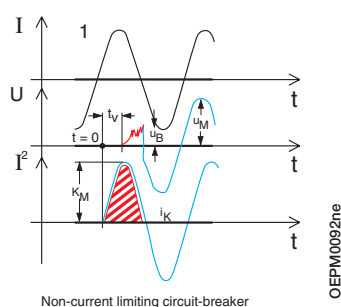
Tripping of an installation circuit by circuit-breaker when there is a short-circuit requires a certain amount of time depending on the characteristics of the circuit-breaker and the entity of the short-circuit current. During this period of time, some or all of the short-circuit current flows into the installation; the parameter  $I^2t$  defines the "specific let-through energy", ie. the specific energy that the breaker allows through when there is a short-circuit current  $I_{sc}$  during the tripping time  $t$ .

In this way, we can determine the capacity of a circuit-breaker to limit, ie. break high currents up to the rated breaking power of the device, by reducing the peak value of the above-mentioned currents to a value which is considerably lower than the estimated current.

This can be achieved using mechanisms which open very rapidly and have the following advantages:

- they limit the thermal and dynamic effects both on the circuit-breaker and on the protected circuit;
- they reduce the dimensions of the current-limiting circuit-breaker without reducing breaking capacity;
- they considerably reduce ionized gases and sparklers emitted during the short-circuit and therefore they avoid the danger of ignition and fires.

$I_{rms}$  = perspective symmetrical short-circuit current

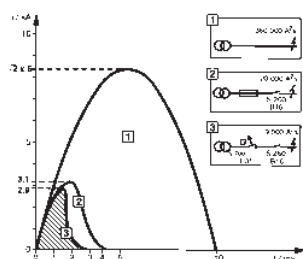


Oscillogram of short-circuit breaks on two circuit-breakers:

- 1 = traditional non-current limiting circuit-breaker  
2 = current limiting circuit-breaker  
 $u_B$  = arc voltage (red)  
 $u_M$  = rest voltage (blue)

#### Short-circuit current

- red** = effective short-circuit current squared  
**blue** = estimated short-circuit current squared (shunted circuit-breaker)  
 $iK_M$  = maximum values of symmetrical component of short-circuit current squared  
**shaded in red** = specific let-through energy in two cases



### Limiting of let-through energy

Main selective circuit breakers like S 700 support downstream mcbs in clearing short-circuit currents. They additionally reduce let-through energies without tripping. This increases the operational availability of the electrical supply and reduces drawbacks to the feeding grid and the installed equipment.

**Max. withstanding specific let-through energy of cables**

<b>Section mm<sup>2</sup></b>	<b>PVC</b>	<b>EPR</b>	<b>HEPR</b>
50	33,062,500	39,062,500	51,122,500
35	16,200,625	19,140,625	25,050,025
25	8,265,625	9,765,625	12,780,625
16	3,385,600	4,000,000	5,234,944
10	1,322,500	1,562,500	2,044,900
6	476,100	562,500	736,164
4	211,600	250,000	327,184
2.5	82,656	97,656	127,806
1.5	29,756	35,156	46,010

The selection of the cables depends both from the breakers' specific let-through energy and from carrying capacity and voltage drop of the line.

Data of the previous table are referred to the following cables:

<b>PVC</b>	<b>EPR</b>	<b>HEPR</b>
FM9	H07RN-F	N07G9-K
FM9OZ1		FTG10OM1
N07V-K		RG7OR
FROR		FG7OM1
		FG7OR

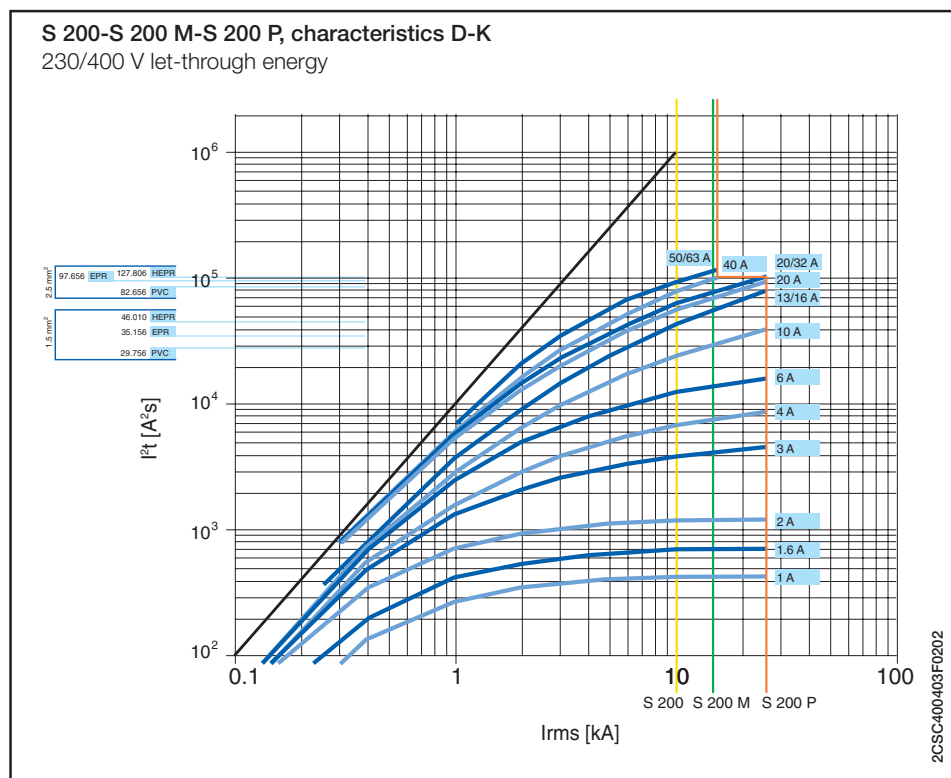
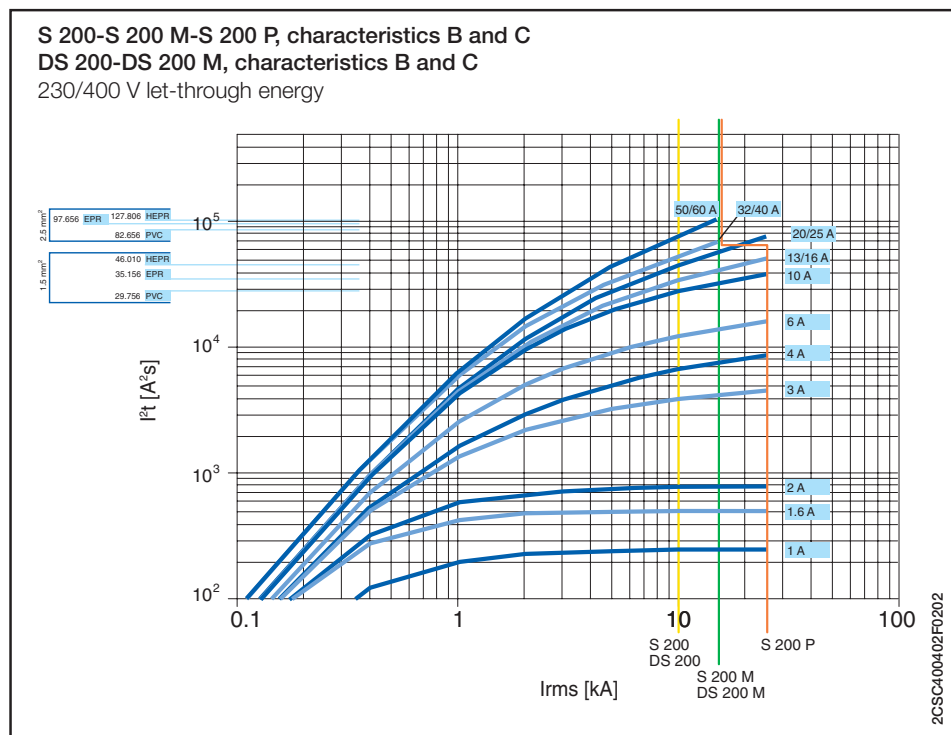
**Designation**

<b>Cable's reference to the standards</b>	harmonized	<b>H</b>
	national cable recognized by CENELC	<b>A</b>
<b>Rated voltage U<sub>o</sub>/U</b>	100/100 ≤ U <sub>o</sub> /U < 300/300	<b>01</b>
	300/300 V	<b>03</b>
	300/500 V	<b>05</b>
	450/750 V	<b>07</b>
	750/1000 V	<b>1</b>
<b>Insulating materials and non-metallic sheath</b>	ethylene-vinylacetate	<b>G</b>
	mineral	<b>M</b>
	polyvinyl chloride	<b>V</b>
<b>Conductor's shape</b>	flexible conductor of a cable for fixed installation	<b>K</b>

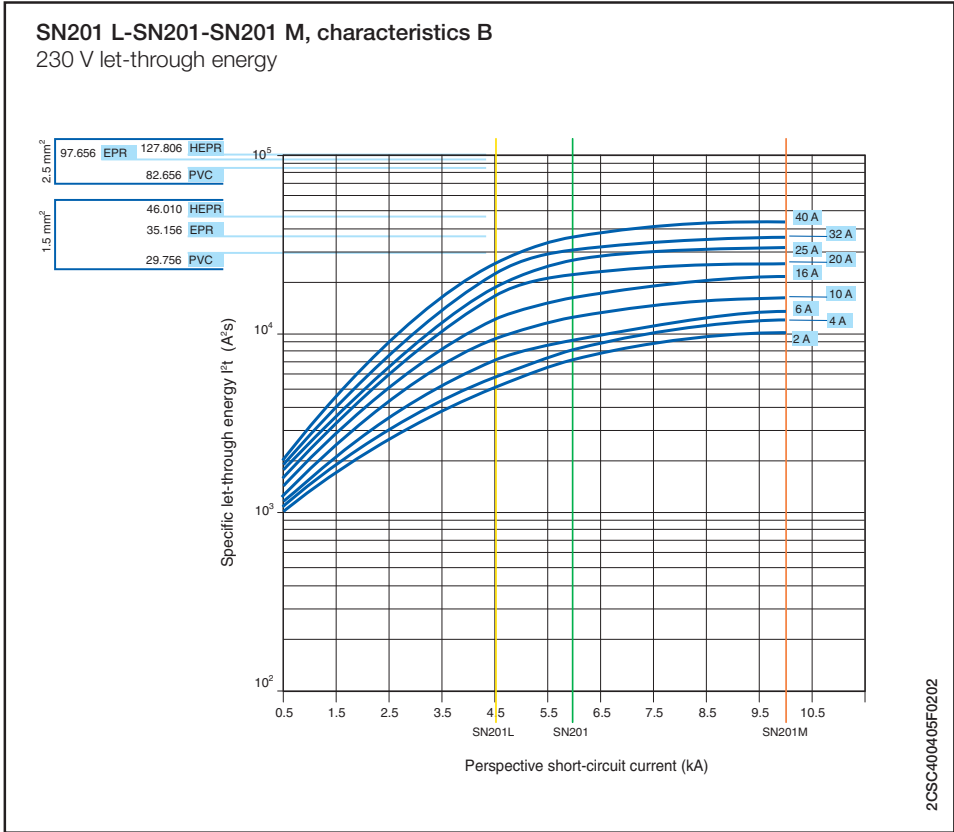
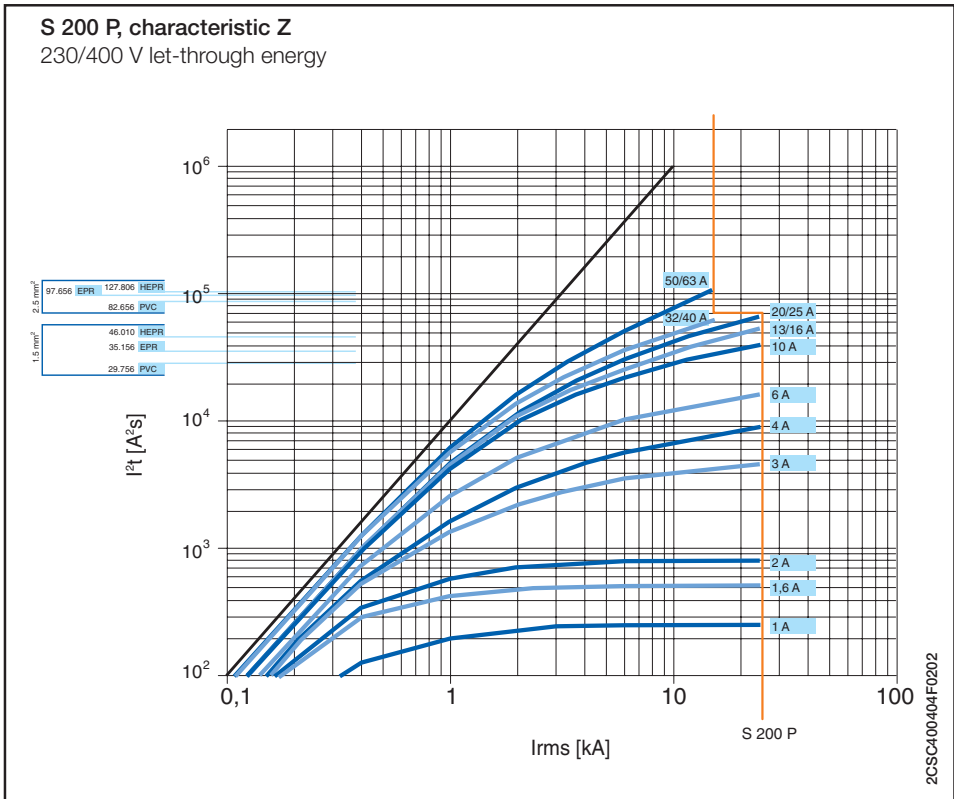
Some cables on the market are identified with different names according with the designation UNEL 35011.

### $I^2t$ diagrams - Specific let-through energy value $I^2t$

The  $I^2t$  curves give the values of the specific let-through energy expressed in  $A^2s$  (A=amps; s=seconds) in relation to the perspective short-circuit current ( $I_{rms}$ ) in kA.

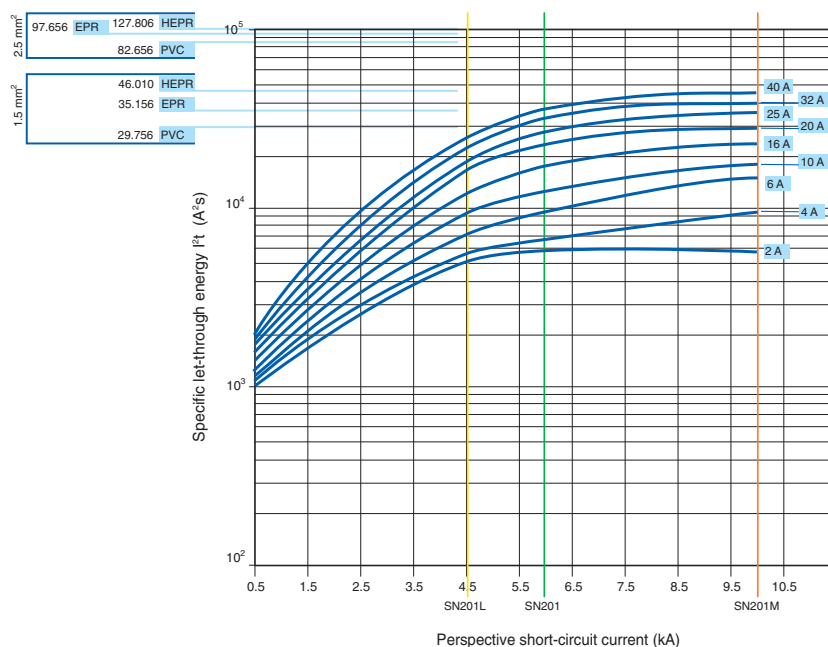


For further information about the selection of the cable, please look at the table in page 10/3



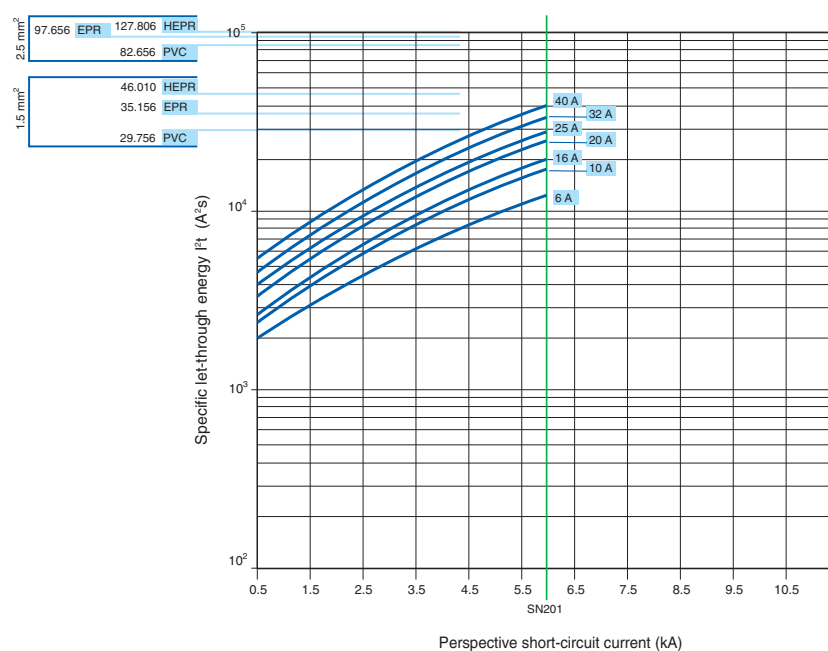
For further information about the selection of the cable, please look at the table in page 10/3

SN201 L-SN201-SN201 M, characteristics C  
230 V let-through energy

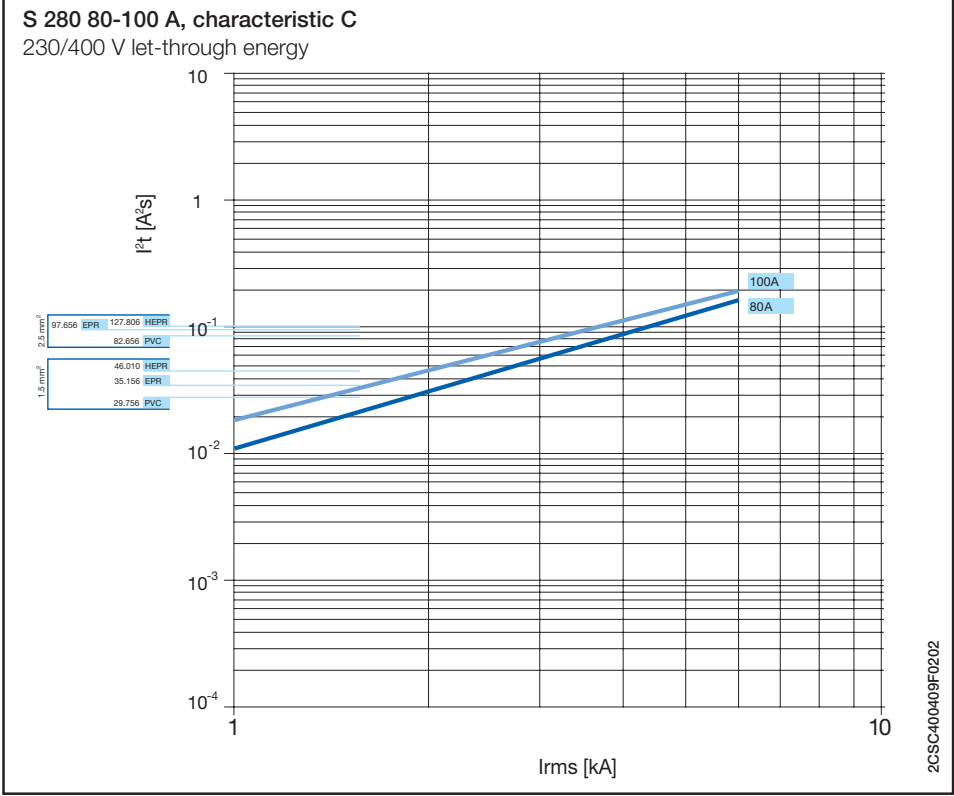
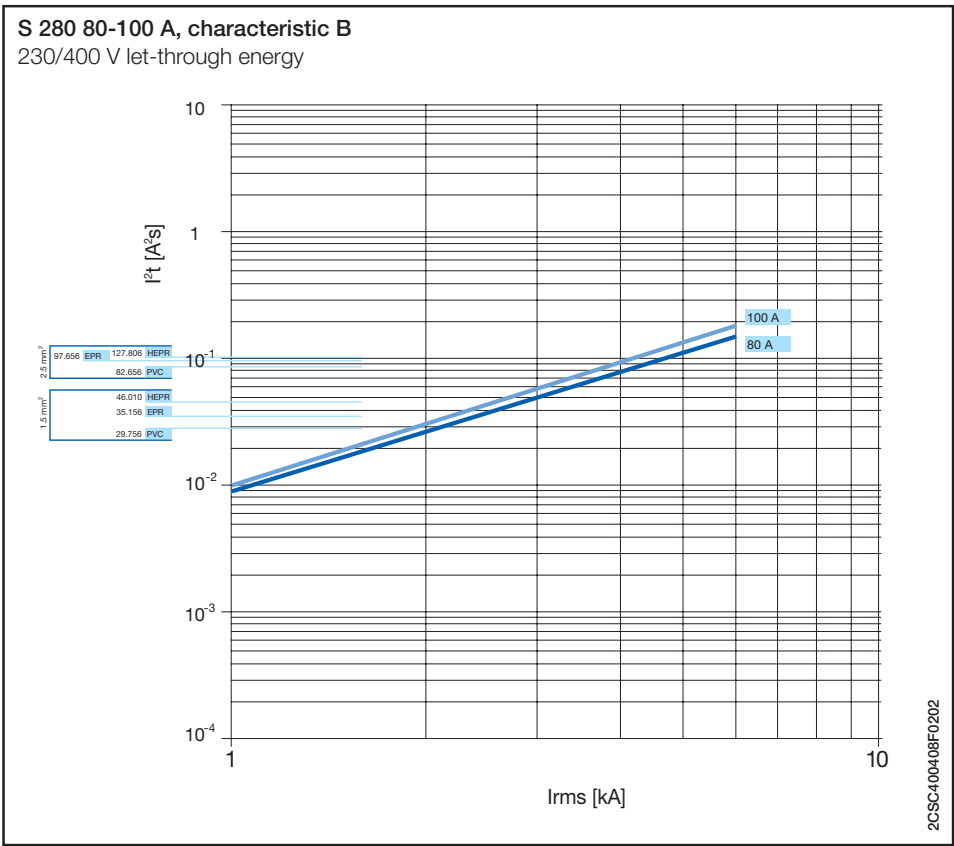


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SN201, characteristics D  
230 V let-through energy



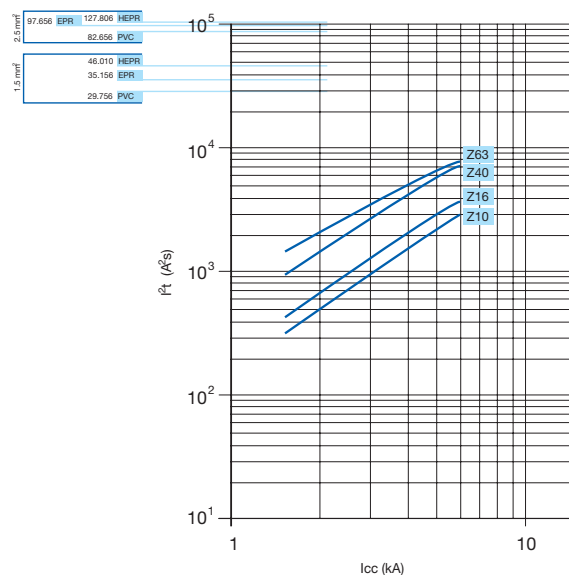
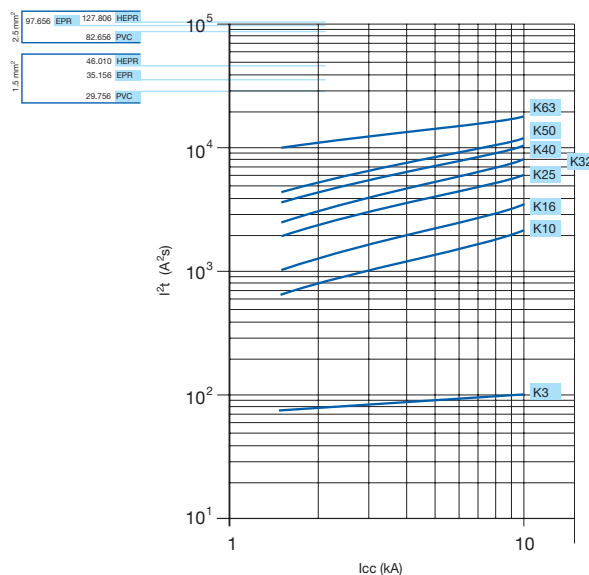
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For further information about the selection of the cable, please look at the table in page 10/3

**S 280 characteristics K, Z**

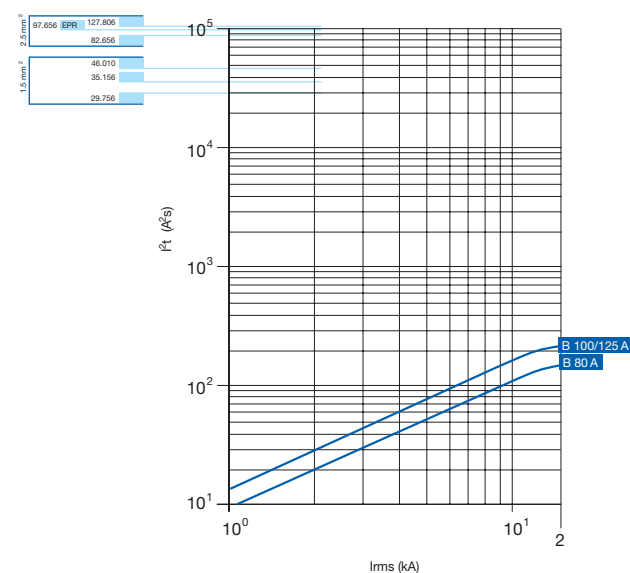
230/400 V let-through energy



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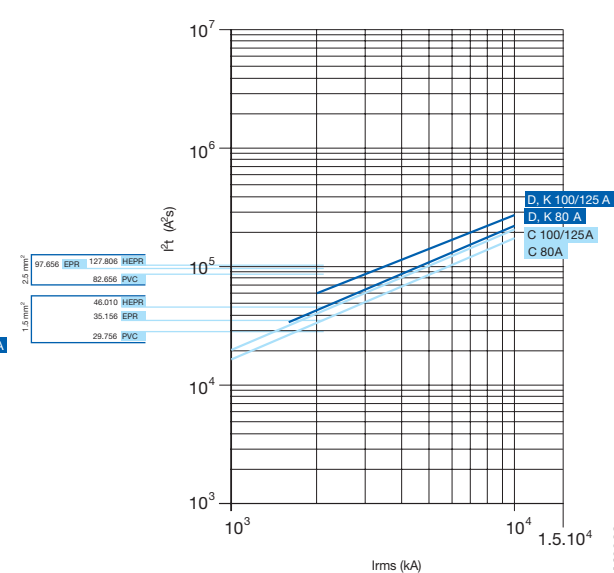
**S 290 characteristics B**

230/400 V let-through energy



**S 290 characteristics C, D, K**

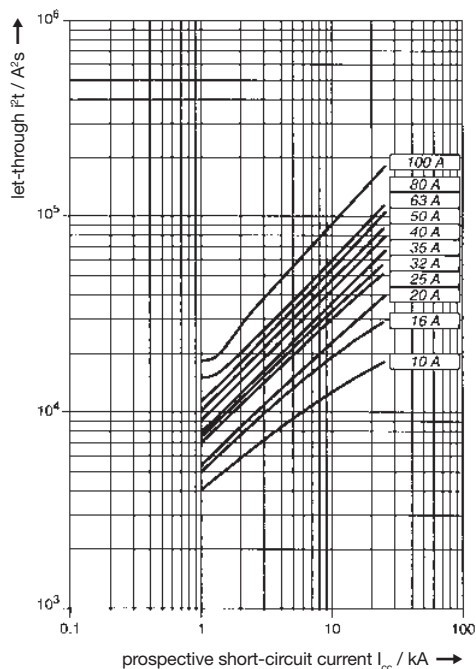
230/400 V let-through energy



OEPM00098

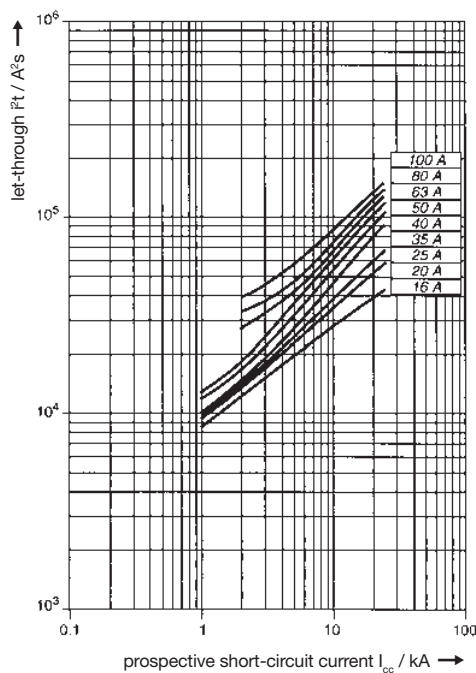
For further information about the selection of the cable, please look at the table in page 10/3

S 700 characteristic E  
let-through energy



2CDC 022 160 F0103

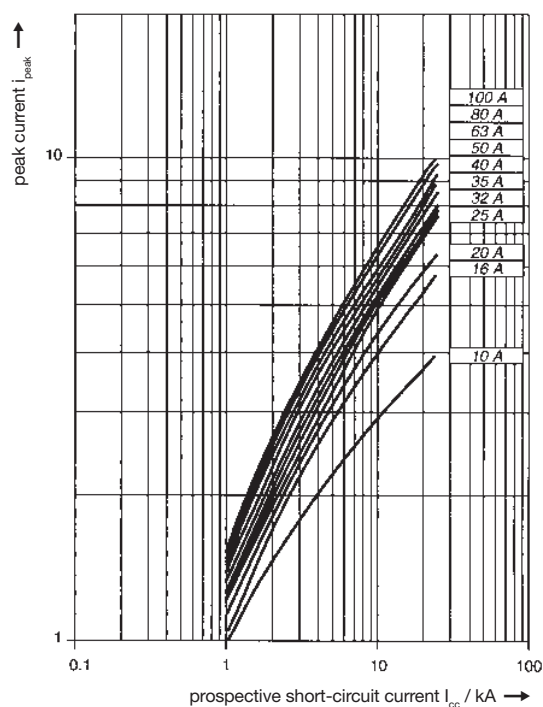
S 700 characteristic K  
let-through energy



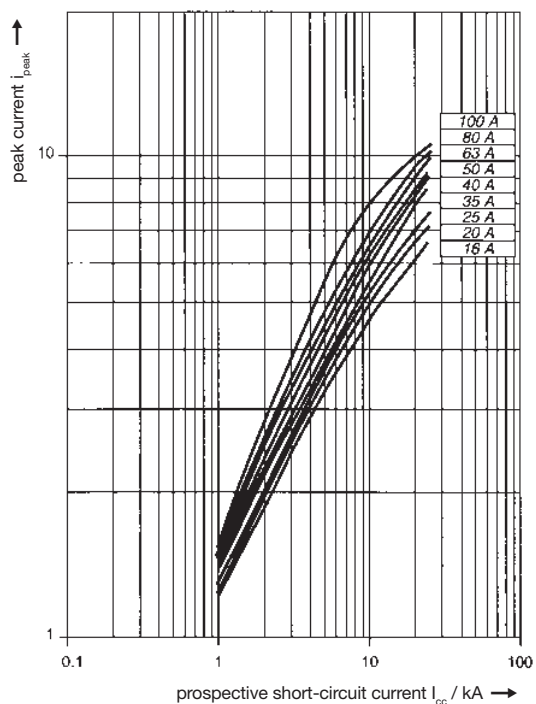
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S 700 characteristic E  
let-through peak current ( $I_{peak}$ )

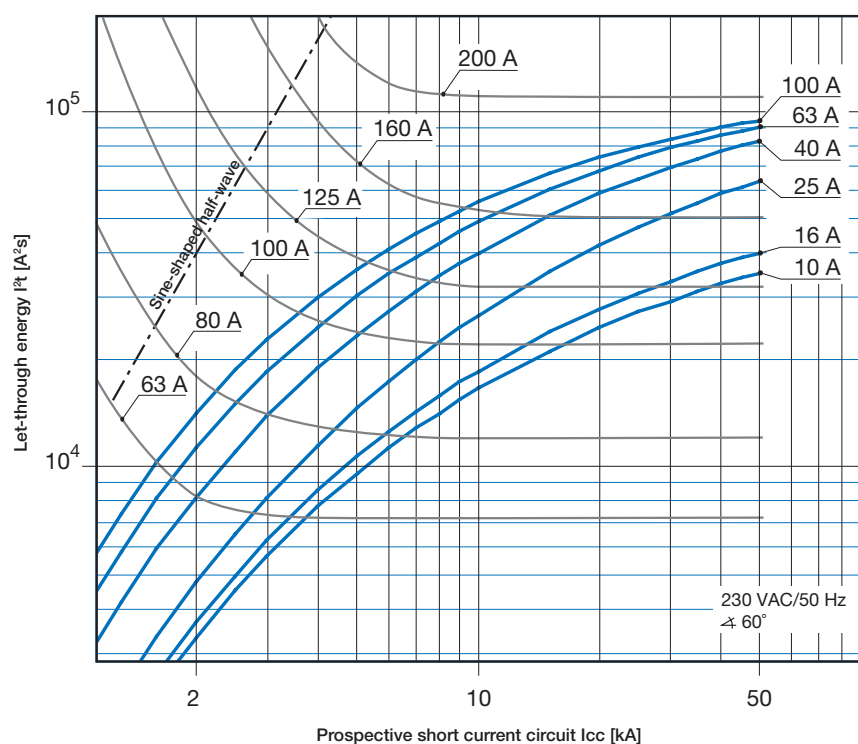
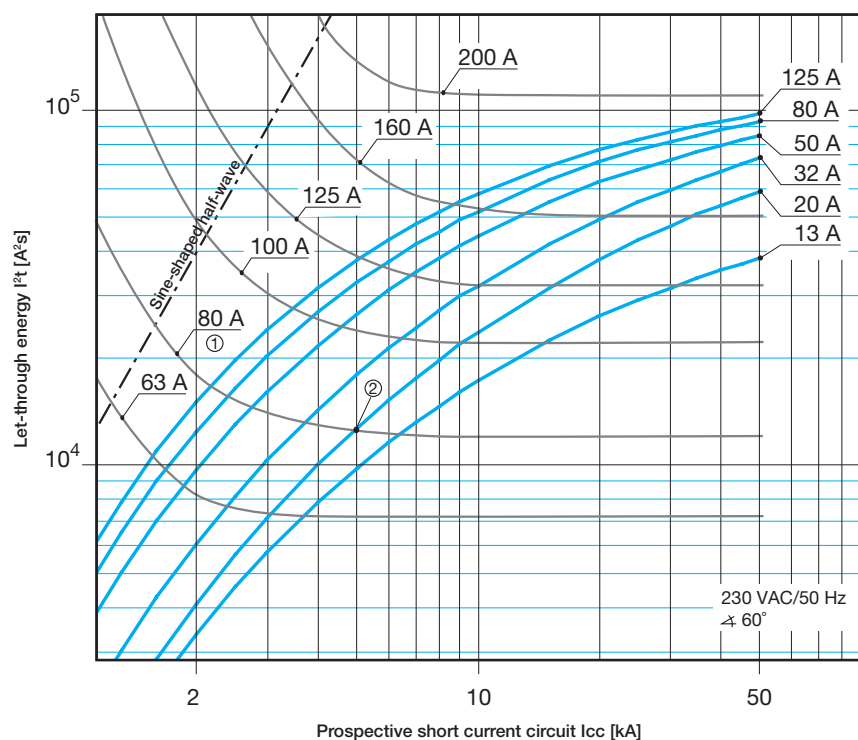


S 700 characteristic K  
let-through peak current ( $I_{peak}$ )



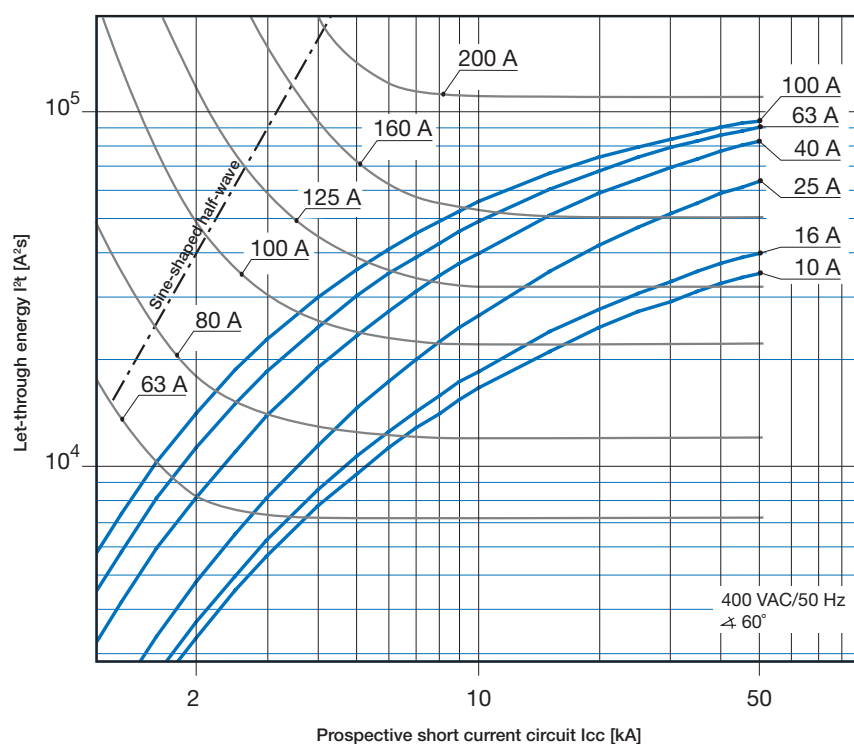
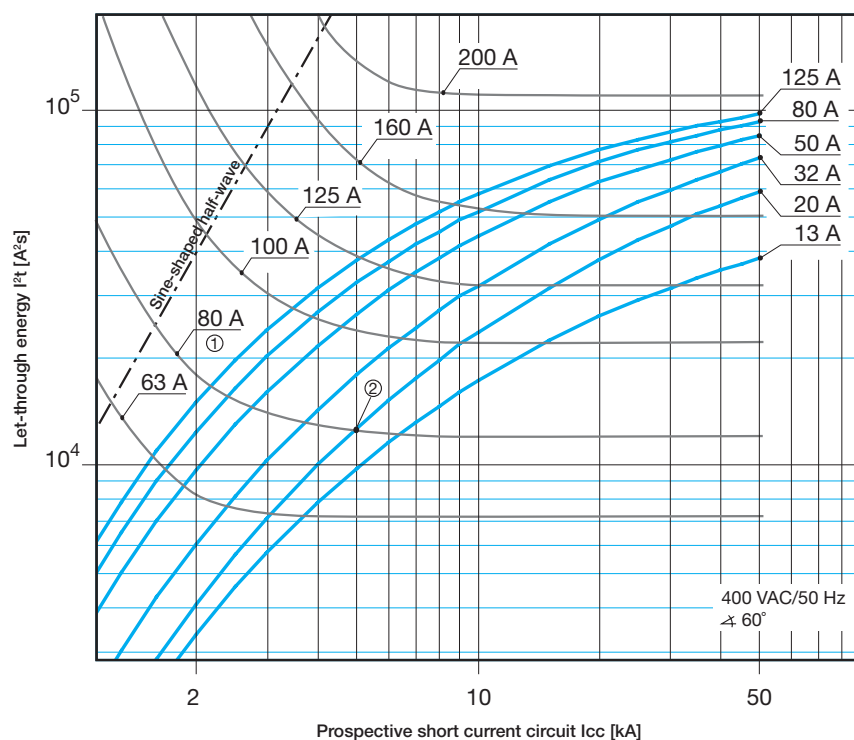
S800 S characteristics B, C, K and D

230 V let-through energy

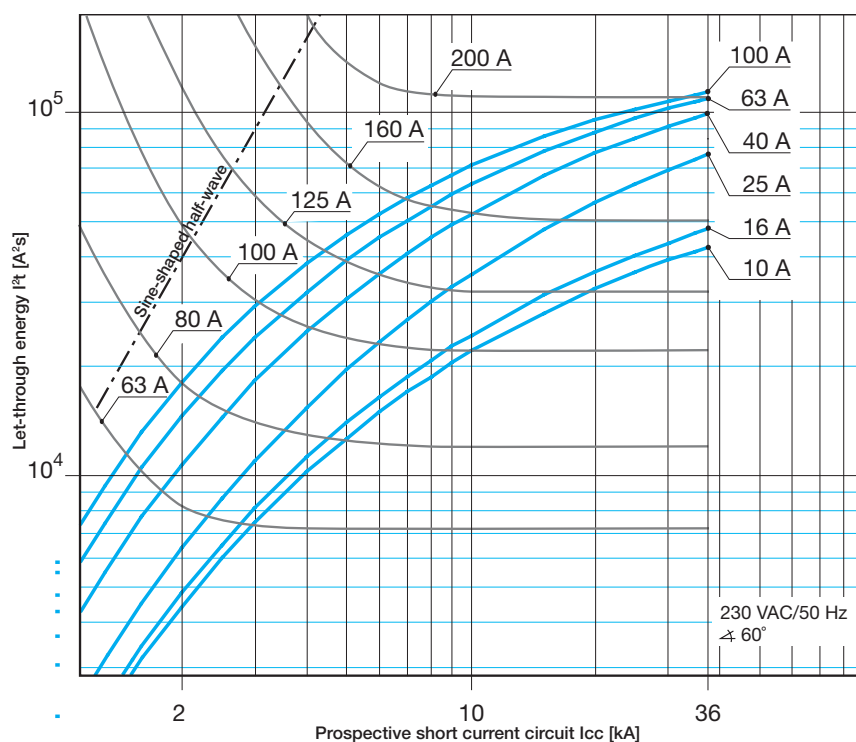
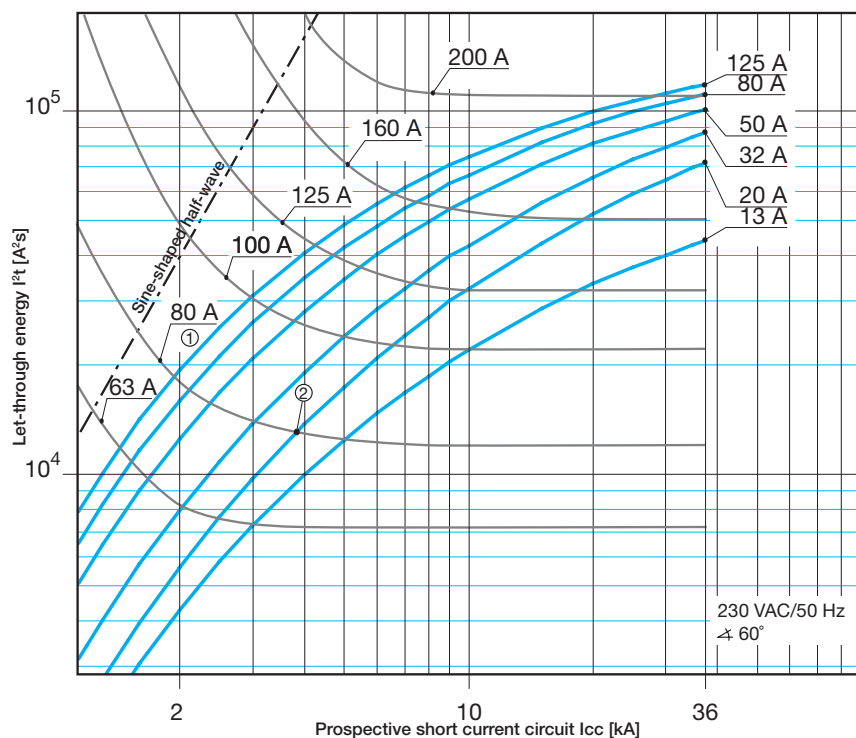


① Min. pre-arcing  $I^2t$ , e.g. NH80 A gL/gG  
② Max. let-through  $I^2t$ , e.g. S801S-C20

S800 S characteristics B, C, K and D  
400 V let-through energy

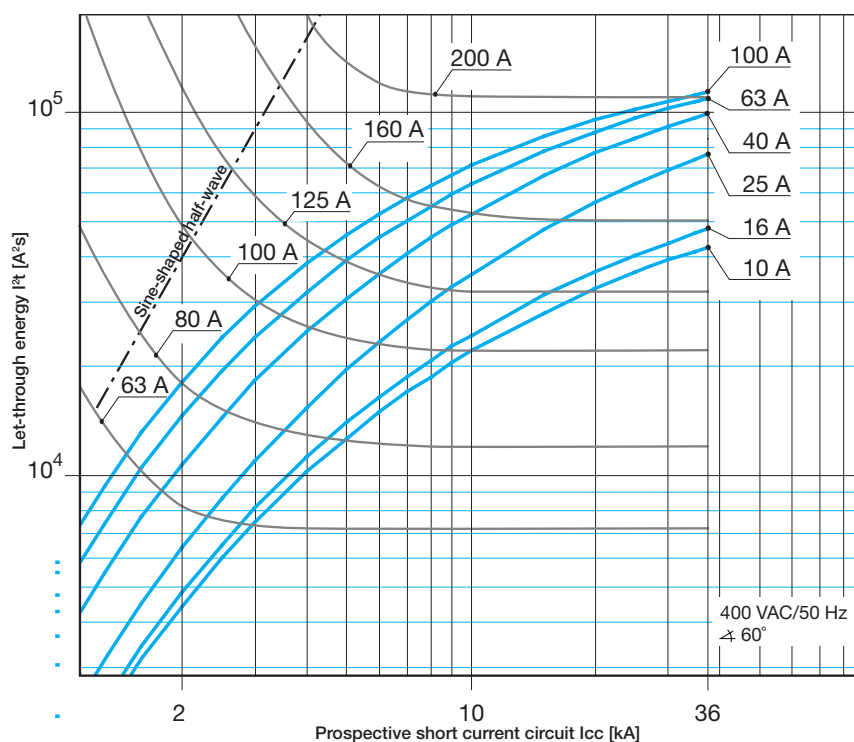
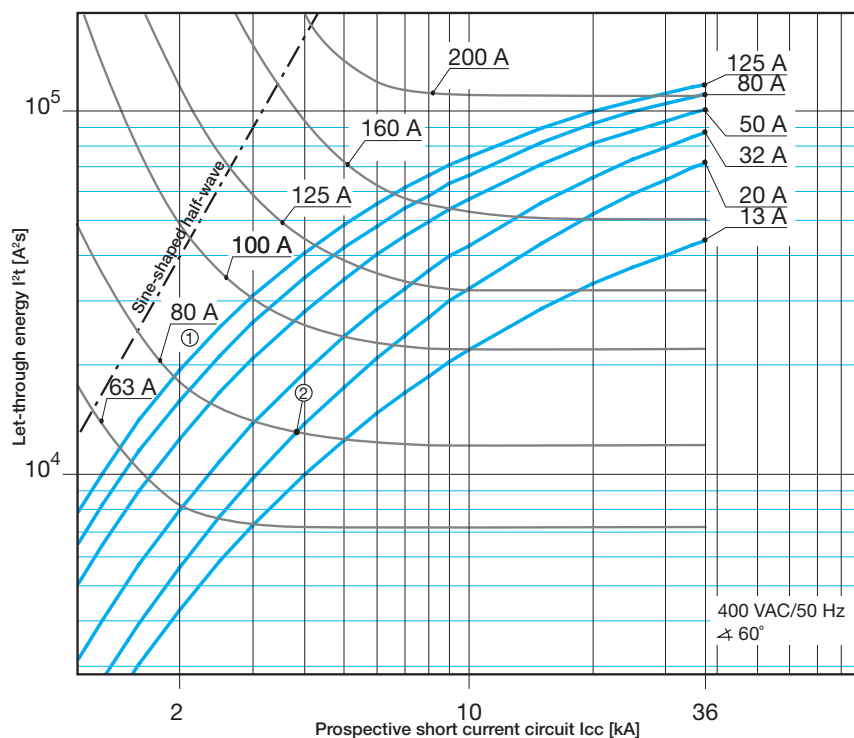


S800 N characteristics B, C and D  
230 V let-through energy

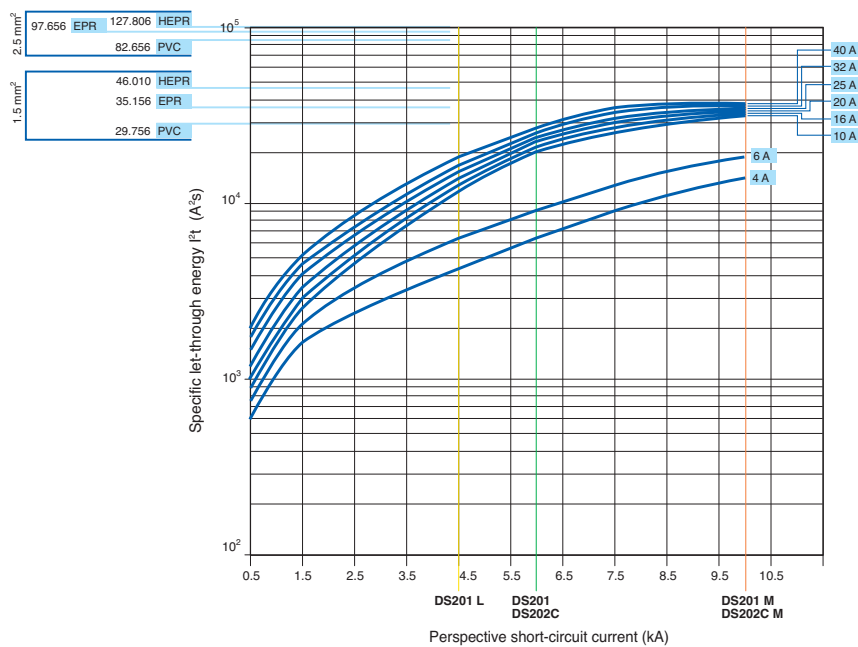


① Min. pre-arching  $I^2t$ , e.g. NH80 A gL/gG  
② Max. let-through  $I^2t$ , e.g. S801S-C20

S800 N characteristics B, C and D  
400 V let-through energy

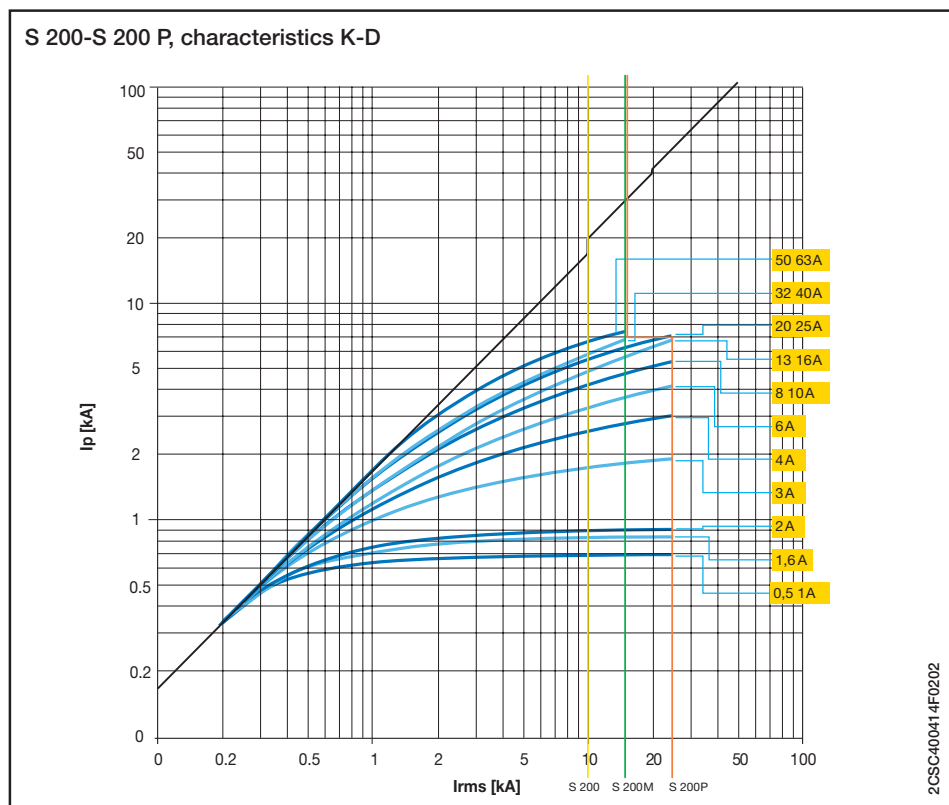
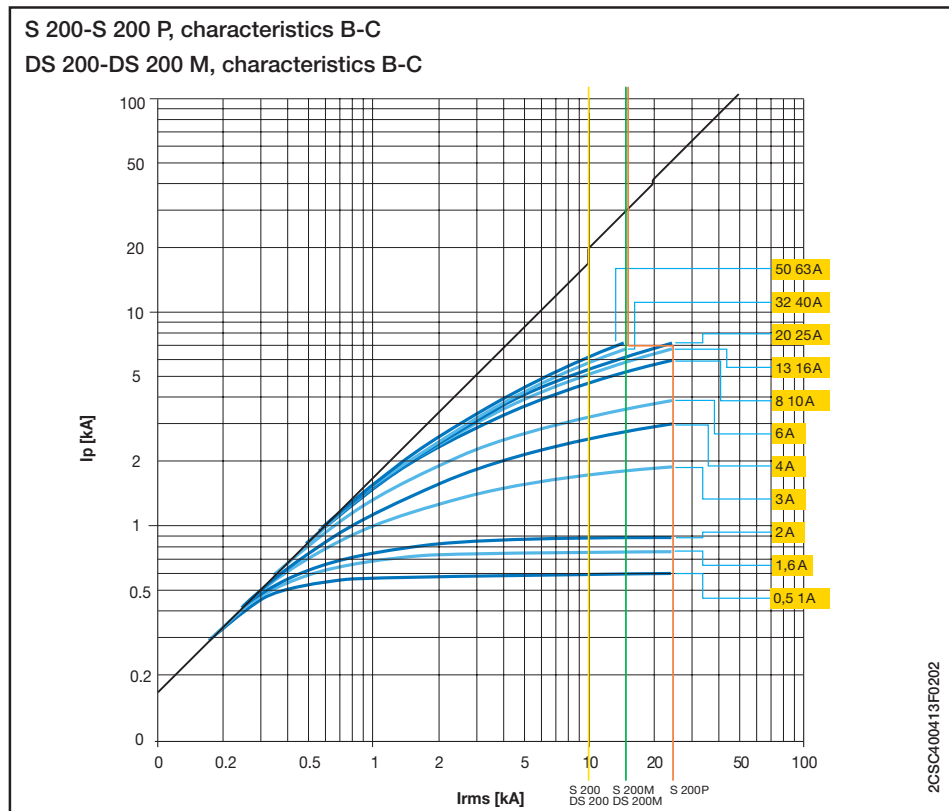


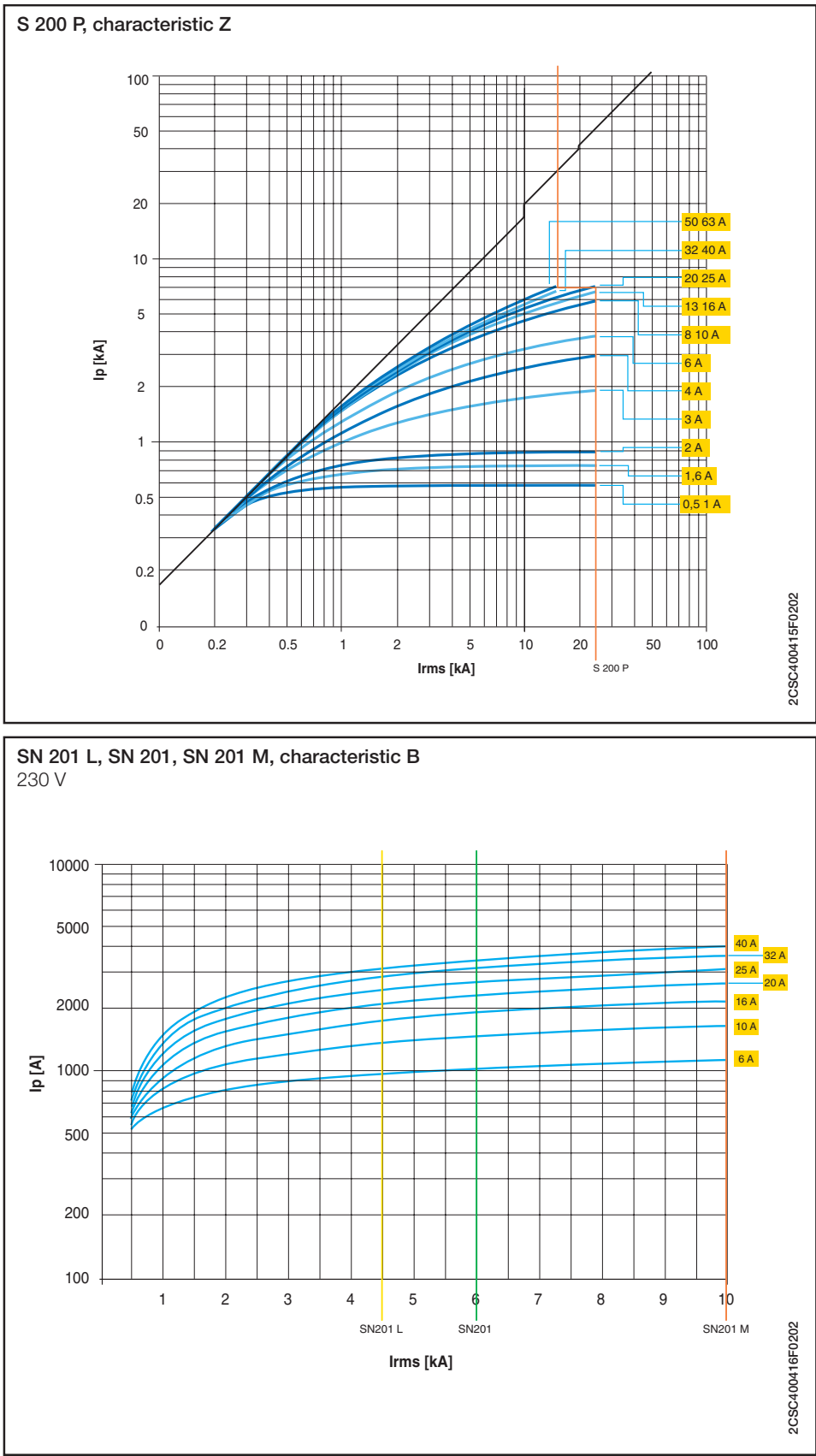
DS201 L - DS201 - DS201 M  
DS202C - DS202C M, characteristics B and C  
230 V let-through energy



### Limitation curves - Peak current values

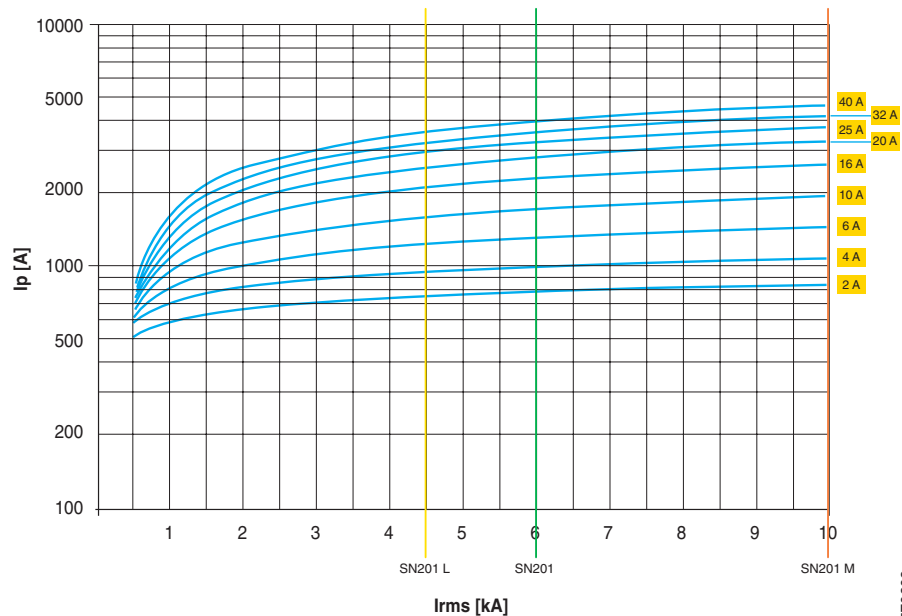
The  $I_p$  curves give the values of the peak current, expressed in kA, in relation to the prospective symmetrical short-circuit current (kA).





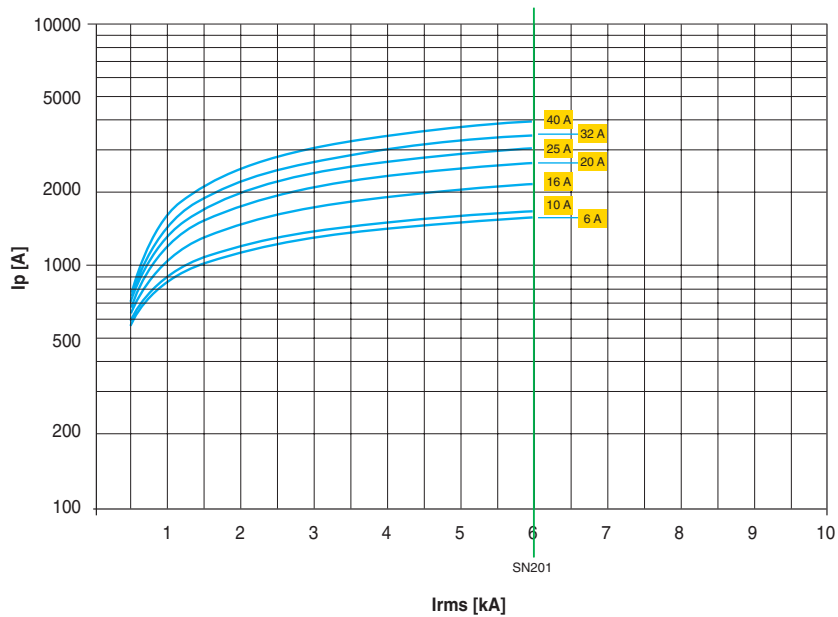


SN 201 L, SN 201, SN 201 M, characteristic C  
230 V

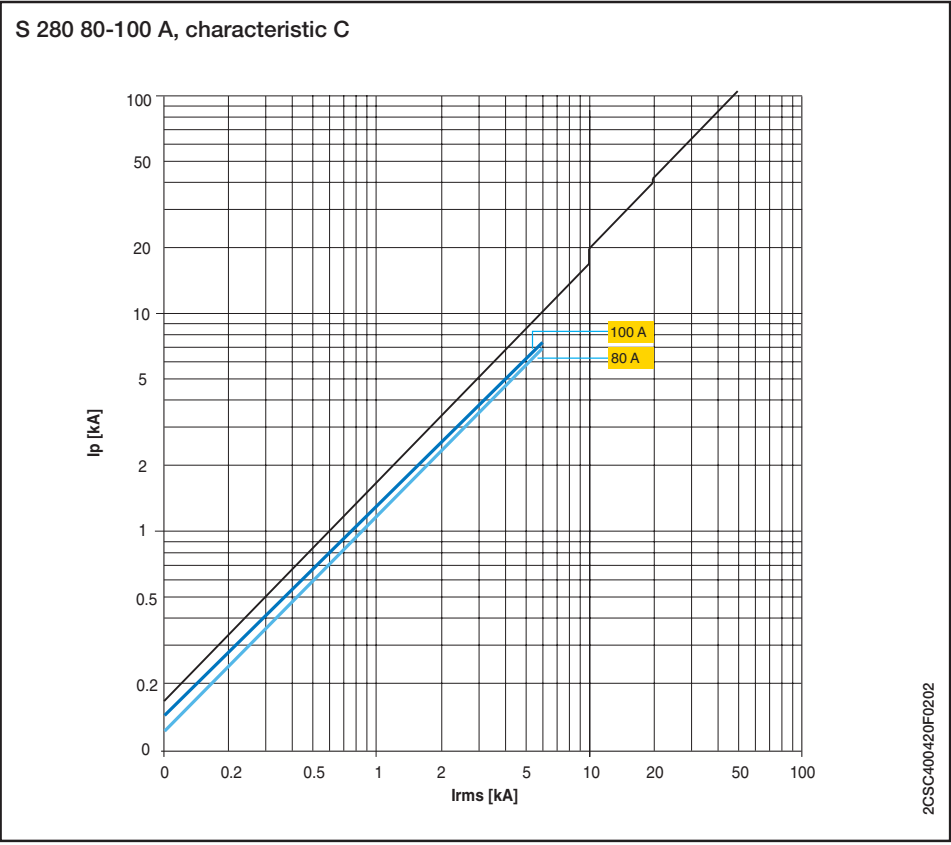
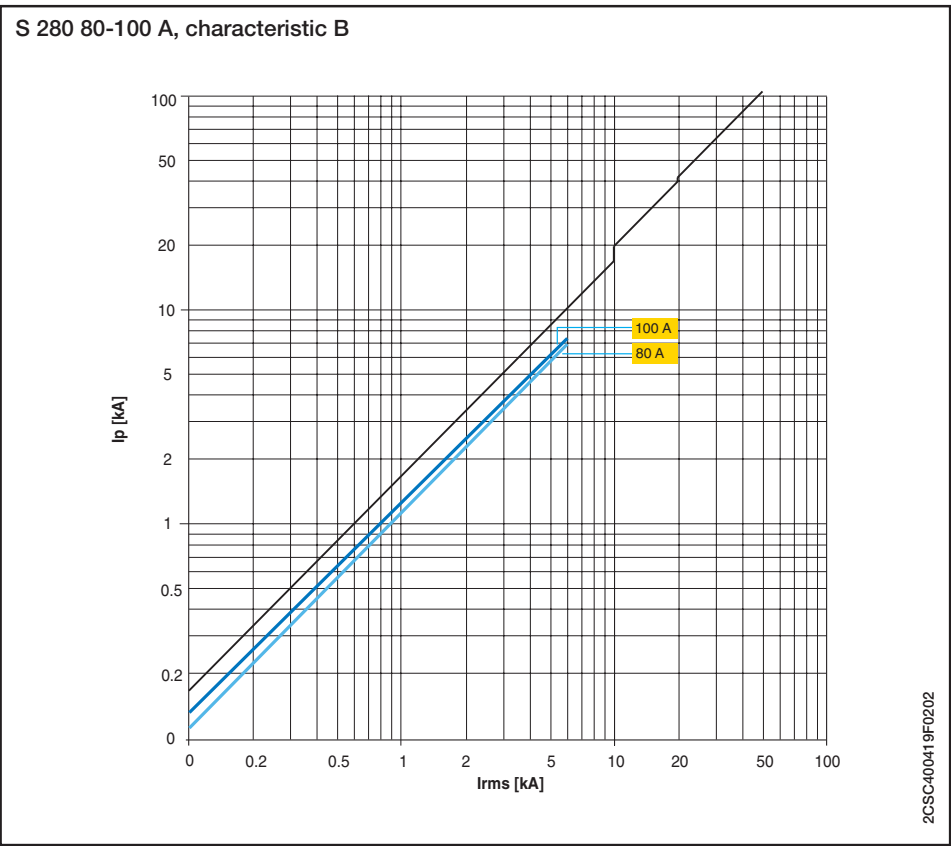


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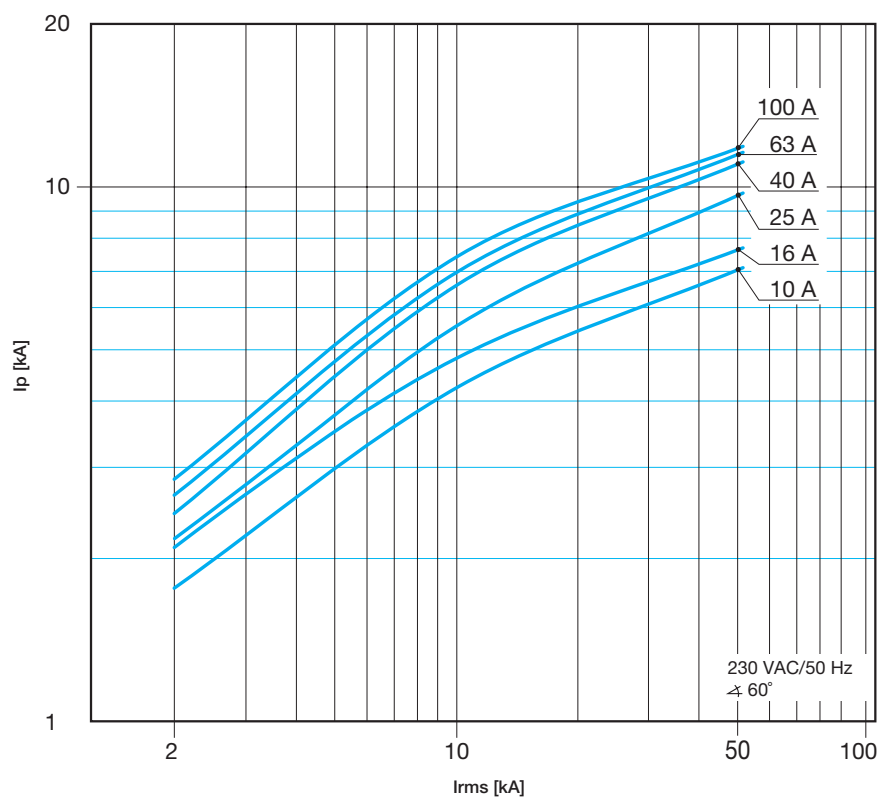
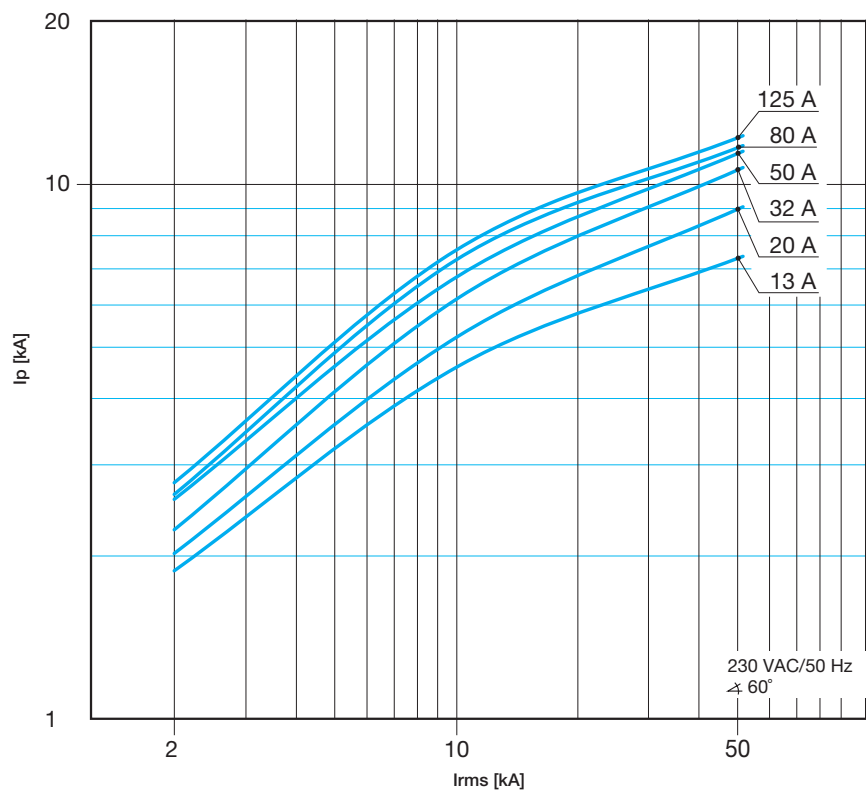
SN 201, characteristic D  
230 V



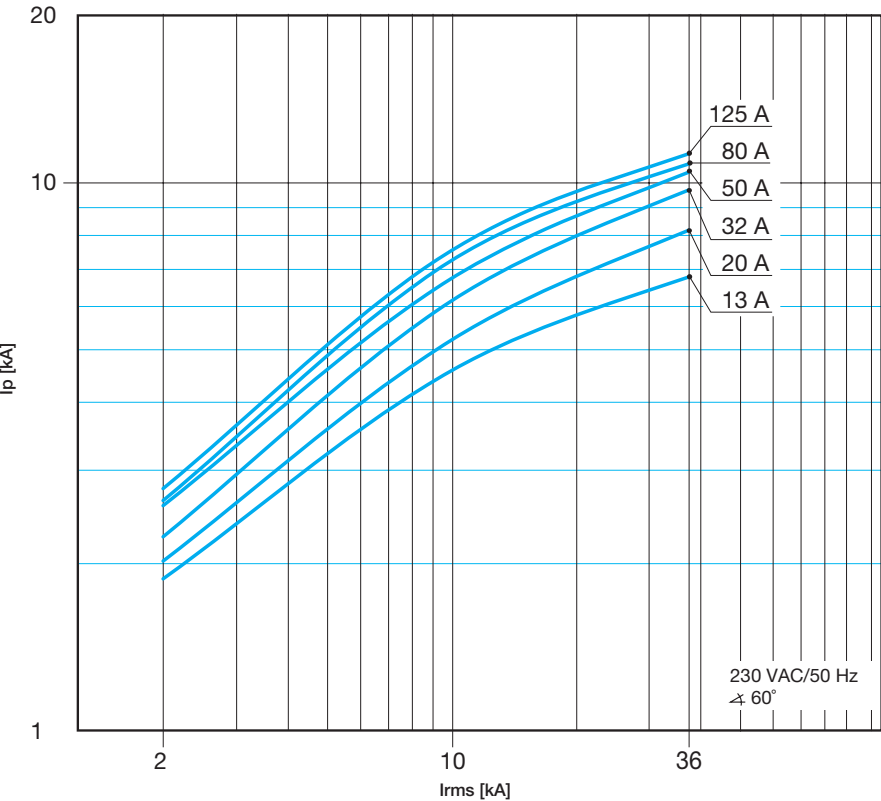
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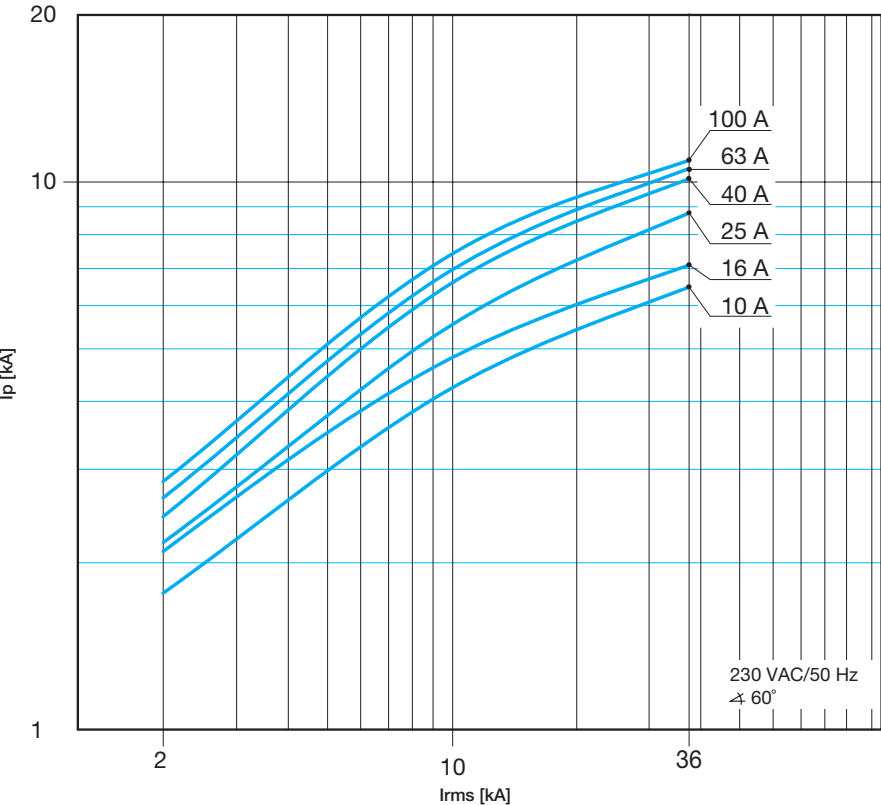
S 800 S characteristics B, C, K and D



S 800 N characteristics B, C and D

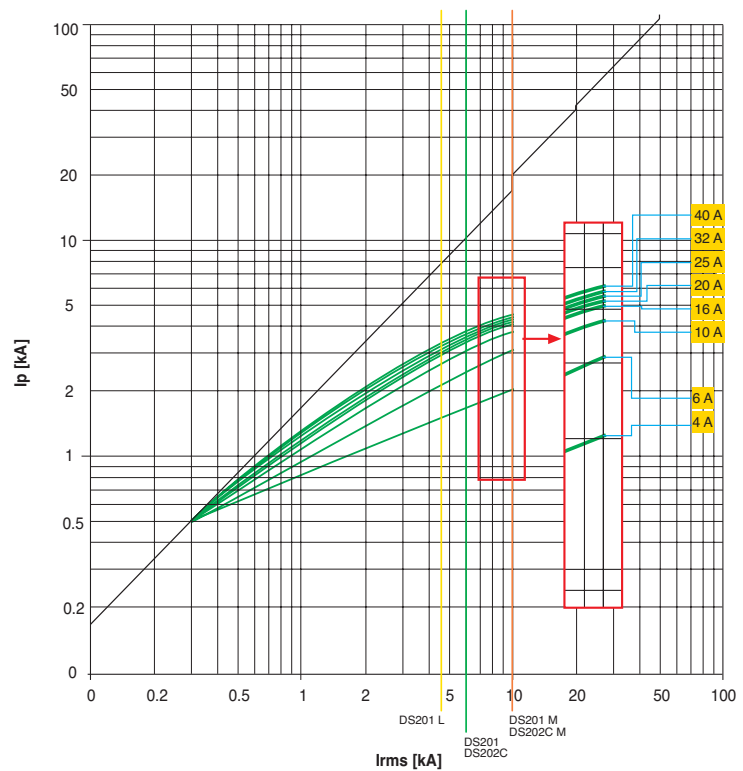


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2CCC413037Z0001

DS201 L - DS201 - DS201 M  
DS202C - DS202C M characteristics B and C  
230 V



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