Determining the rated short-time withstand current (I_{cw}) of a circuit of an assembly

A switchgear assembly must be designed such that it withstands the thermal and dynamic stresses resulting from the short-circuit current. The maximum short circuit current at the connection point of an assembly must be determined on site.

The **panel builder** must specify the **rated short-time withstand current I_{cw}** of the connection point in his documentation, e.g. in the circuit diagram or technical document.

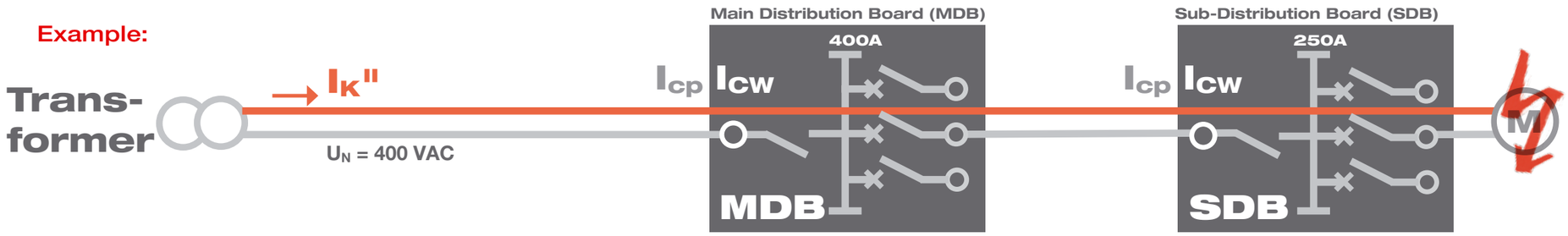
The **original manufacturer of the switchgear system,** e.g. HENSEL, is responsible for the verification of the short circuit withstand capacity of the system components, e.g. the I_{cw} value of the busbars.

Rated short-circuit withstand current is determined by the values I_K", I_{cw}, I_{cp}, I_{cu}.

HV = Main Distribution board
UV = Sub-distribution board

Example:

Path of the short-circuit current from the transformer to the short-circuit



Step 1:

Determining the transformer power and determining the value I_K"

The I_K" can be determined by reading table 1.

Transformer	
S_r = 250 kVA	see identifier plate
U_N = 400 VAC	see identifier plate
I_N = 360A	see table 1
I_K" = 9.025kA	see table 1

Alternatively, the I_K" is calculated using the formula:

$$I_K'' = \frac{S_r \cdot 100}{\sqrt{3} \cdot U_N \cdot u_K}$$

I_K" in kA
S_r in kVA
U_N in V
u_K in %

Step 2:

Determining the rated short-time withstand current I_{CW} of the main distribution board (MDB)

Determining the lowest rated short-time withstand current I_{CW} of the device installed in the main distribution board.

MDB installed devices	I_{CW} or I_{CU}
Circuit breaker 400A	I_{CU} = 50kA *
Busbars 400A	**I_{cw} = 15kA / 1s ***
MCCB 250A	$I_{cs} = I_{cu}$ = 8 kA / 690 V a.c. $I_{cs} = I_{cu}$ = 36 kA / 415 V a.c.*

Lowest value of the devices: I_{CC} / I_{CU} = 50kA
Lowest value of the busbars: I_{CW} = 15kA
⇒ I_{CW}(MDB) = 15kA
I_{CW}(MDB) ≥ I_K"
15kA ≥ 9.025kA ✓

*see table 2

Step 3:

Determining the rated short-time withstand current I_{CW} of the sub-distribution board (SDB)

Determining the lowest rated short-time withstand current I_{CW} of the device installed in the in the sub-distribution board.

SDB installed devices	I_{CW}
Circuit breaker 250A	I_{CU} = 50kA *
Busbar 250A	**I_{cw} = 15kA / 1s ***
MCCB 160A	$I_{cs} = I_{cu}$ = 8 kA / 690 V a.c. $I_{cs} = I_{cu}$ = 36 kA / 415 V a.c.*

Lowest value of the devices: I_{CC} / I_{CU} = 50kA
Lowest value of the busbars: I_{CW} = 15kA
it follows: I_{CW}(SDB) = 15kA
⇒ I_{CW}(SDB) ≥ I_K"
15kA ≥ 9.025kA ✓

*see table 2

Table 1:
Excerpt from HENSEL main catalogue

Rated power of the transformer S_r in kVA	Rated current at rated voltage U_n=400 V a.c. I_N in A	Initial short-circuit current at u_k = 4% I_K" in kA	Initial short-circuit current at u_k = 6% I_K" in kA
100	144	3.610	2.406
160	230	5.776	3.850
250	**360**	**9.025**	6.015
315	455	11.375	7.583
400	578	14.450	9.630

Table 2: Rated short-circuit withstand current of installation device in HENSEL distribution boards

Installation device in HENSEL distribution boards	Short-circuit withstand capacity
Busbar 250A / 400A	I_{CW} =15kA / 1s
NH fuse switch disconnector 250A	I_{CC} = 50kA
Circuit breaker 250A / 400A	I_{CU} = 50kA
Switch disconnector 160A	I_{CC} = 50kA
MCCB 160 A / 250 A	$I_{CS} = I_{CU}$ = 8 kA / 690 V a.c. $I_{CS} = I_{CU}$ = 36 kA / 415 V a.c.
Other values can be obtained from the device manufacturers or in the HENSEL main catalogue!	

MDB Determining the rated short-time withstand current I_{CW}

The rated short-time withstand current I_{CW} of the MDB must be equal to or greater than the short-circuit current I_K" of the transformer:

I_{cw} (MDB) ≥ I_K" (transformer)

In this analysis, the cable attenuation between the transformer and MDB is not considered. The cable attenuation can mean a reduction of the short-circuit current I_K". The prospective short-circuit current I_{cp} at the installation site of the MDB is smaller because of the cable attenuation than I_K" of the transformer.

The rated short-time withstand current of the assembly results from the rated short-time withstand current of the installed equipment and busbars.
The original manufacturer, such as HENSEL, specifies these values in the technical data.

The respective lowest value determines the maximum rated short-time withstand current I_{CW} of the main distribution board.

The panel builder must specify this value in the documentation of the assembly!

SDB Determining the rated short-time withstand current I_{CW}

I_{cp} is the prospective short-circuit current at the installation site of the assembly at the incoming terminals. It (I_{cp}) is calculated from transformer and cable data (length, cross section). Here, the cable attenuation due to distance and associated cable length between the transformer and sub-distribution board (SDB) is considered. The cable attenuation reduces the I_K" of the transformer.

I_{cw}(UV) ≥ I_{cw}(HV) > I_{cp} ≥ I_K" (transformer)

If a calculation is not possible, I_{cp} = I_K" can be assumed.

The rated short-time withstand current (I_{CW}) must satisfy the following requirements:

I_{CW}(UV) ≥ I_{cp}(UV)

The rated short-time withstand current (I_{CW}) of the sub-distribution board is determined the same way as for the main distribution board. **The respectively lowest value of the devices also determines the maximum rated short-circuit withstand current I_{CW} of the sub-distribution board.** The panel builder must specify this value in the documentation of the assembly!