

I_s -limiter

The world fastest limiting
and switching device

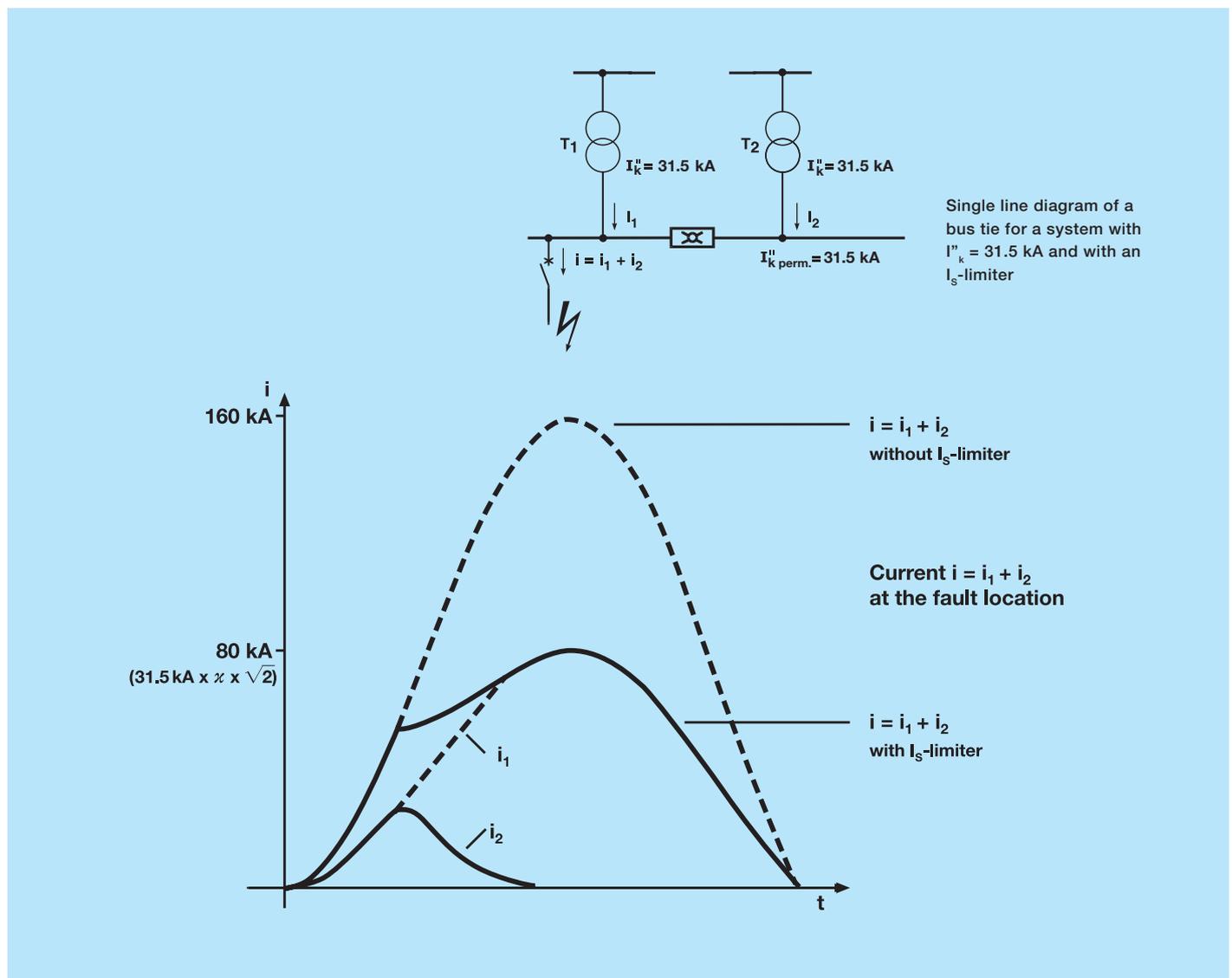
Short-circuit currents too high?

The I_S -limiter, a switching device with extremely short operation time, solves the problem.

A short-circuit downstream from an outgoing feeder breaker is assumed. The oscillogram shown below indicates the course of the short-circuit currents in the first half wave.

A short-circuit current of 31.5 kA can flow to the fault location through each transformer. This would result in a total short-circuit current of 63 kA, which is twice as much as the switchgear capability.

The course of the current through the I_S -limiter in such an event is shown below as current i_2 . It can be seen that the I_S -limiter is operating so rapidly, that there is **no** contribution via the transformer T_2 to the total peak short-circuit current ($i_1 + i_2$). Therefore, a switchgear with rating of 31.5 kA is suitable for this application.



Current $i = i_1 + i_2$ at the fault location

Technical data

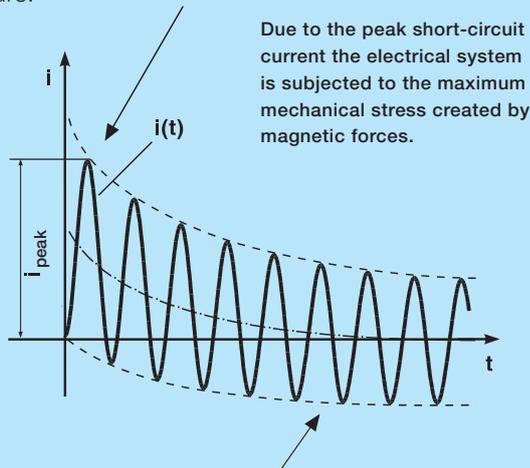
Rated voltage	kV	0.69	12.0	17.5	24.0	36.0 / 40.5
Rated current	A	1250 / 2000 / 3000/4000 ¹⁾ / 5000 ¹⁾	1250 / 2000 / 2500 / 3000 / 4000 ¹⁾	1250 / 2000 / 2500 / 3000 / 4000 ¹⁾	1250 / 1600 / 2000 / 3000 ¹⁾	1250 / 2000 / 2500 ¹⁾
Interrupting current	kA _{RMS}	up to 140	up to 210	up to 210	up to 140	up to 140

¹⁾ With cooling fan

Questions and answers regarding the I_S -limiter

1. What is the peak short-circuit current?

The peak short-circuit current i_{peak} is the maximum instantaneous value of the current after the short-circuit occurs.

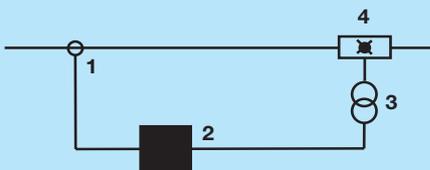


2. How does the I_S -limiter work?

The I_S -limiter consists of two parallel conductors. The main conductor carries the high rated current (up to 5.000 A). After tripping, the parallel fuse limits the short-circuit current during the first current rise (in less than 1 ms).

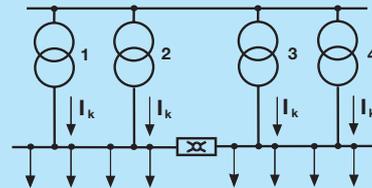
3. How is the main conductor opened in less than a thousandth of a second?

Switching devices with mechanical mechanisms and this high rating are not able to open the main conductor in such a short time. For this reason we use an electronically triggered charge as switching mechanism.



1. Current transformer (detects the short-circuit current)
2. Measuring and tripping device (measures the current and current rise and provides the triggering energy)
3. Pulse transformer (converts the tripping pulse to the busbar potential)
4. Insert holder with insert (carries the rated current and limits the short-circuit current)

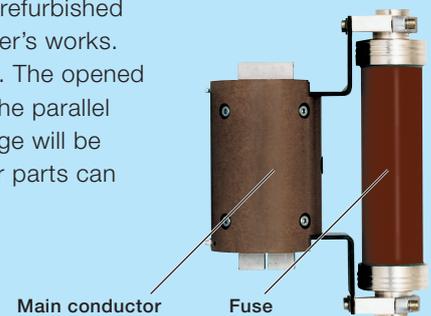
4. How can switchboards which are only dimensioned for $2 \times I_K$ be operated with four transformer infeeds and a total short-circuit current of $4 \times I_K$ without any risk of overload and without losses?



By installing an I_S -limiter between the busbar sections 1 - 2 and 3 - 4. (This is only one of the many possibilities for the use of an I_S -limiter).

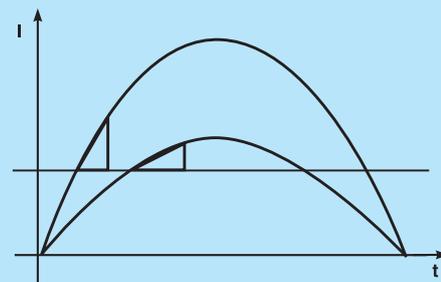
5. Can I_S -limiter inserts be refurbished after interruption of a short-circuit?

Yes! They can be refurbished at the manufacturer's works. The costs are low. The opened main conductor, the parallel fuse and the charge will be replaced. All other parts can be re-used.



6. How does the I_S -limiter distinguish between minor and serious short-circuits?

The measuring and tripping device of the I_S -limiter detects the instantaneous current level **and** the rate of current rise permanently. The I_S -limiter only trips when both set response values are reached.



- The rate of current rise ($\frac{di}{dt}$)
- is high with high short-circuit currents
 - is low with low short-circuit currents

Potential Applications

Such a fast switching device caters for a variety of applications which cannot be fulfilled by conventional switches. The most important of these are presented below.

Advantages of all I_S -limiter applications:

- Reduction of short-circuit currents at the fault location.
- No upgrading of the existing switchgears.
- Limiting of currents with delayed current zero.

Option A, figure 1:

Coupling-parallel operation of two systems

Advantages:

- Improving power quality
- Increasing the reliability of the system
- Reduction of the network-impedance
- Optimal load flow

Option B, figure 1:

I_S -limiter in the generator feeder to protect the high voltage system

Advantages:

- Generator can be connected independent on the short-circuit capability of the system
- Existing busbar system has not to be changed
- No need of expensive generator breaker

Option C, figure 1:

I_S -limiter and reactor connected in parallel

Advantages:

- Avoid copper losses of the reactor
- Avoid voltage drop over the reactor
- No electro-magnetical field of the reactor

Option D, figure 2:

Station service supply and public network

Advantages:

- Private/industrial generator feeder can be connected to the (fully loaded) grid
- Selective tripping of the I_S -limiter (I_S -limiter will operate only for short-circuit faults in the grid)

Do you need any further information, than contact

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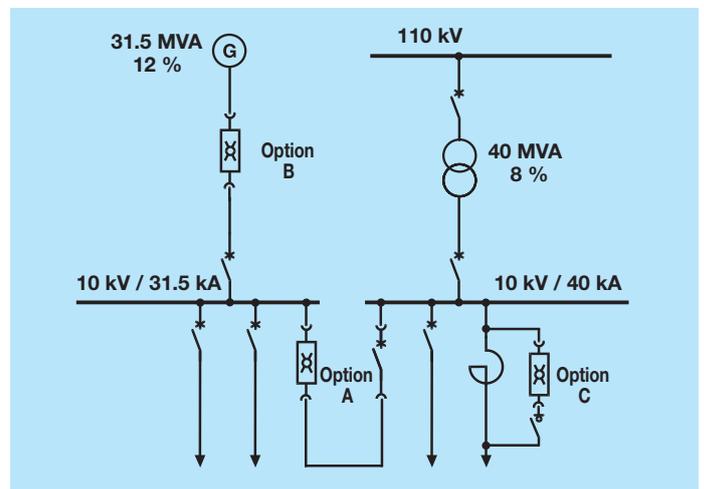


Figure 1: Application of I_S -limiters (Option A, B, C)

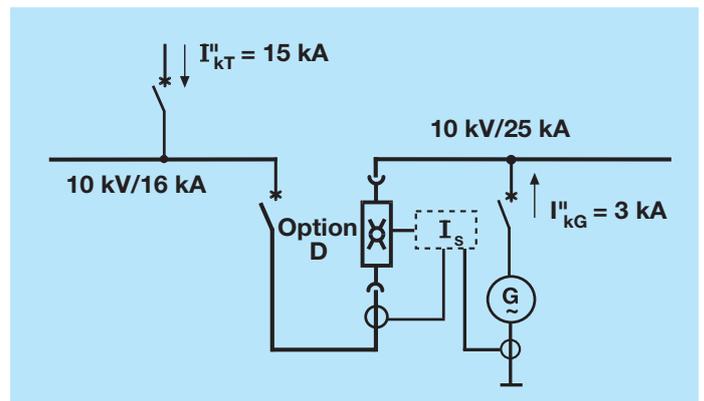


Figure 2: I_S -limiter in connection point with a public supply network (Option D)

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