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Frequently Asked Question

Topic:	**How to calculate a DC Choke?**	Author	Yaskawa
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I. Generally

A DC choke between the input rectifier and the bus capacitor affects the DC bus voltage waveform and the AC input current waveform. It reduces the amount of AC ripple on the DC bus voltage and the AC input line harmonics. Additionally it offers protection against nuisance tripping due to voltage spikes, such as those caused by phase advancing capacitor switching.
DC link chokes offer the advantage of maximizing the circuit inductance for power quality reasons, but without causing an AC input line voltage drop. DC link chokes can be used individually, typically on the positive DC bus, or in pairs with one in the positive and one in the negative DC bus branch. When two DC reactors are used on the bus, the inductance is additive.

II. Calculation of the Inductance

Generally, you will need twice as much inductance on the DC bus as used on the AC input (per phase) to accomplish the same performance like with AC input reactors. Consequently when the voltage drop of an AC reactor is 3% the voltage drop has to be 6% on a DC choke to get the same effect.
To calculate the DC choke inductance, the following formula can be used:

$$L = \Delta v_{\%} \cdot \frac{U}{\sqrt{3} \cdot 2 \cdot \Pi \cdot f \cdot I_{Inv}}$$

So when using for example a 55kW inverter at a voltage of 400V the DC choke inductance is:

$$L = 0.06 \cdot \frac{575V}{\sqrt{3} \cdot 2 \cdot \Pi \cdot 50Hz \cdot 77A} = 0.686mH$$

The inductance of the DC choke is 0.686mH.

III. Calculation of the Rated Current

The rated current of the DC choke must be the same as the output current of diode rectifier ($I_{rec(rms)}$).

$$I_{rec_{rms}} = \frac{I_{DC_{av}}}{\phi}$$

$$I_{DC_{av}} = \frac{P_M}{V_{PN} \cdot \eta_M \cdot \eta_{inv}}$$

I_{Dcav}	average value of DC bus current
ϕ	power factor of power source: 0.9
P_M	maximum motor power: 15 kW
η_M	motor efficiency: 0.9
η_{inv}	inverter efficiency: 0.96 *(For inverter efficiency reed inverter efficiency FAQ)*

$$I_{DC_{av}} = \frac{15kW}{1{,}35 \cdot 400V \cdot 0.9 \cdot 0.96} = 32{,}15A$$

$$I_{rec_{rms}} = \frac{32{,}5A}{0.9} = 35{,}72A$$

The rated current of the DC choke is 35,72 Amps.