SERVICE NOTES

Service Notes SN0040-00

Line Reactors and VFD's

Problem Description:

As AC drives have grown in popularity and application there is an increased need to better understand the effects that the power source has on the drive and what effects the drive places on the power source. Specifically, when should a line reactor be used and what size reactor should be used.

Problems experienced but not limited to are: Nuisance over voltage tripping - which causes reset and restart of the drive, up to complete failure of the drive by permanently damaging the front-end of the VFD; Noise from capacitors being switched in and out; Line notching from SCR's firing on the line - typically DC drives, welders, reduced voltage solid state starters and switch mode power supplies.

Background:

When the source connected to the drive is much greater than the drive is designed to work with, the drive is susceptible to damage. This damage will occur when the source impedance is too low or if the source KVA is substantially larger than the drive KVA. If the supply transformer impedance were two percent or less, this would be considered a low impedance source. When this occurs the front-end diodes and buss capacitors are stressed due to excessive peak input currents. If the source or supply KVA ratio is greater than ten times the drive's KVA, a line reactor should be installed (See Table I). The KVA and impedance information are typically located on the transformer nameplate or may be supplied by the local utility company.

Power quality problems affecting drives can occur in the form of noise and transients generated from power factor switching capacitors, frequent power interruptions or equipment that uses large semiconductor switching devices such as AC and DC drives, furnaces \ ovens, welders and similar devices.

Problem Symptoms:

The drive may experience overvoltage tripping which allows a reset and restart. If the front end of the drive is damaged this typically results in blown or tripped supply side circuit protection, shorted input diodes and typically a blown DC bus fuse. In some cases the drive may allow power to be applied again due to the diodes clearing after shorting, this results in a "dead" display or keypad. The drive must be repaired or replaced and a line reactor installed to prevent future reoccurrences of this failure.

Workaround/Solution:

Prior to the operation of the drive a line reactor should be installed if the source KVA is too large or impedance too low. Typically a three percent reactor is sufficient. If a failure occurs due to the above circumstances a reactor must be used prior to recommissioning of the repaired or replaced drive. Failure to adhere to these common guidelines may result in damage not covered under warranty. Please consult with the factory if assistance is needed in procuring the proper line reactor.

Line reactors in general provide other benefits as follows: harmonic attenuation which will reduce the total harmonic distortion, overvoltage and undervoltage tripping by reducing surges and sags, acts as a current limiting device in short circuit conditions, attenuates electrical noise and transients. These result in system improvements, minimize the risk of drive malfunction or damage and help to extend the service life of the drive.

If the line voltage is constantly over the operating maximum voltage of the drive and the facility cannot re-tap the transformer, a 5% reactor may be required, not for the improved impedance, but to reduce the voltage on the drive.

The % value is normally the voltage reduction that the inductor will reduce the supply voltage by.

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Table I If the source is ten times greater than the Transformer KVA listed for the Drive HP a reactor is recommended.

Drive HP	1	2	3	5	7.5	10	15
Transformer KVA	2	4	5	9	13	18	23

Drive HP	20	25	30	40	50	60	75
Transformer KVA	28	36	42	56	76	90	112

Drive HP	100	125	150	200	250	300	400
Transformer KVA	150	175	225	300	350	500	600