

Line Reactors

- ✓ Purpose
- ✓ Harmonics Reduction
- ✓ Ratings Considerations

Line Reactors Increase Drive Reliability

- Minimize catastrophic drive failures due to transient over-voltages
- Minimize nuisance over-voltage trips due to line transients:
 - Utility power factor correction
 - Switching large AC motor loads
 - Switching large transformers
 - High AC line conditions

Line Reactors Increase Drive Reliability (cont)

- Minimize line-side fuse operation during unsymmetrical voltage sags:
 - Utility system line-to-ground faults
 - Unbalanced phase currents
- Reduce harmonics
- Improve effective power factor

Drive/Line Reactor Economics (480 VAC User Prices)

10 HP AC Inverter	\$ 1838
10 HP Motor	\$ 552
Circuit Breaker	\$ 362
Safety Switch	\$ 105
Operator Control Station	\$ 307
Input Reactor—NEMA I	\$ 218
Installation	\$ 1500
Total	\$ 4882

Cost of Catastrophic Failure

10 HP Inverter	\$ 1838
Labor	\$ 200
Total	\$ 2038

+
Down Time

How Much Reactor Do I Need?

3% reactor eliminates 95%
of nuisance trips

5% reactor eliminates 99+%
of nuisance trips

Reactors Reduce Harmonic Distortion

Harmonic Number	INPUT IMPEDANCE						
	0.50%	1%	1.5%	2%	2.5%	3%	5%
5th	0.8	0.6	0.5	0.46	0.42	0.4	0.32
7th	0.6	0.37	0.3	0.22	0.2	0.16	0.12
11th	0.18	0.12	0.1	0.09	0.08	0.073	0.058
13th	0.1	0.075	0.06	0.058	0.05	0.049	0.039
17th	0.073	0.052	0.04	0.036	0.032	0.03	0.022
19th	0.06	0.042	0.03	0.028	0.025	0.022	0.008
% THD - I	102.5	72.2	59.6	52.3	47.6	44.13	34.96
Amps Increase	43%	23%	17%	13%	11%	9%	6%

Input harmonic current distortion depends on total input line impedance. (Data is for 6-pulse diode bridge).

Line Reactor Ratings

- Maximum voltage rating
- Thermal current rating — I_{RMS}
 - Must be \geq VFD Input Current Rating
- Fundamental current rating — I_{FUND}
- Percent impedance =

$$\left(\frac{(100) \sqrt{3} 2\pi f L}{V_L^L} \right) I_{\text{FUND}}$$

Line Reactor Ratings

- Maximum ambient temperature
- Maximum altitude without derating
- Temperature rise
- Maximum switching frequency
- dv/dt rating
- Dielectric strength
- Agency approvals

MTE Line Reactors

- Harmonic Compensated
- Impedance based on Fundamental amps
- TRMS Amp rating sufficient for VFD input current
- $\geq 16,000$ volt/usec dv/dt rating
- CE, UL, cUL, CSA (1-1200 amps)

MTE Gives You...

- ➔ The lowest cost
- ➔ The lowest installed cost
- ➔ The full measure of impedance
- ➔ The most durable product
- ➔ Delivery from stock
- ➔ A global delivery system

Input Reactor Spec

Each variable frequency drive must be equipped with an input reactor offering no less than 4.5% effective impedance at rated motor amps (the fundamental current). They must be harmonic compensated and be UL-506 and UL-508 approved. Nema 1 enclosed units must be UL Listed. The continuous current rating of the reactor must be equal to or greater than the rms input current rating of the drive. Reactors must be copper wound with a UL class H (180 C) insulation system. They must be suitable for an ambient temperature of 45 C and a have a maximum temperature rise of 115 C. Their watts loss must be less than 1% of the rated load. Box lug type terminals must be provided on all reactors rated from 2 amps thru 400 amps. Higher current reactors may be supplied with copper tab type terminals. Reactor must be MTE Corporation type "RL" series.

Power Factor Correction Capacitor De-Tuning Reactor Specification

Each Power Factor Correction Capacitor Bank must be equipped with a series connected de-tuning reactor to prevent importation of harmonics. They must be UL-506 and UL-508 approved. Nema 1 enclosed units must be UL Listed. The reactor must be rated to handle 110% of the capacitor fundamental current continuously to compensate for capacitor tolerance and aging. It must also be rated to handle fifth harmonic current of a magnitude equal to 15% of the capacitor fundamental current rating. The nameplate must indicate the rated fundamental and harmonic currents and frequencies. Reactors must be copper wound with a UL class H (180 C) insulation system. They must be suitable for an ambient temperature of 40 C and have a maximum temperature rise of 100C. When applied in an ambient of 25C their temperature rise must be only 80C. Their watts loss must be less than 1% of the capacitor KVAR rating. Box lug type terminals are acceptable on all reactors rated up to 50 amps. Reactors rated higher than 50 Amps must be supplied with copper tab type terminals. Reactor must be MTE Corporation type "RL" series.

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