# Motor cooling

## Thermal behavior of linear motors

The rated feed force of a synchronous linear motor can be achieved is mainly determined by the power loss PV that is produced during the energy conversion process. The power loss fully dissipates in form of heat. Due to the limited permissible winding temperature it must not exceed a specific value.

**Note: The maximum winding temperature rise of L-series motors is 105 K. This corresponds to insulation class F.**

The total losses of synchronous linear motors are chiefly determined by the direct load loss of the primary due to the low relative velocities between the primary and the secondary: □□=□□□= 34•□2•□□−□•□□

PV: Total loss in W

PVi: Direct load losses in W

i: Current in motor cable in A

RU-V: Electrical resistance of the motor at 20°C in Ohm (see Chapter technical_data)

fT: Factor temperature-related resistance raise

**Note: When you determine the power loss, you must take the temperature-related rise of the electrical resistance into account. At a temperature rise of 105 K (from 20°C up to 125°C), for example, the electrical resistance goes up by the factor fT = 1.45.**

## Cooling concept of L-series linear motors

Due to their aluminum structure, the L-series motor is naturally air cooled by motor surface (IC40). Water cooled versions (ICW37) are also available if necessary.

## Water cooling

When using the integrated cooling models with water as a coolant, it is necessary to use treated water without mechanical impurities. The recommended water hardness is max. 0.7 mmol/l. If necessary, water softeners shall be used. Inhibitors are recommended in order to prevent corrosion of aluminum. The ratio of the inhibitor to water should not exceed ¼ in volume, otherwise cooling performance may be reduced.

The recommended cooling water acidity is 6.5 pH to 7.5 pH. The inlet water temperature is +5°C to +25°C. The maximum water flow is 5 l/min at the pressure drop of 2 hPa. The cooling system is tested at the maximum pressure of 1 MPa. Water pressure and water flow detectors should be used in order to prevent the unlike event of an emergency shutdown of the machine due to an overheated motor.

It is recommended to use the same material for the whole water cooling circuit in order to prevent galvanic corrosion.

# Motor temperature monitoring circuit

L-series motors are equipped with built-in motor protection thermal switches (break contact) being located in end windings and reacting at the temperature of 125°C. PTC600 or equivalent thermal sensor combined with thermal-switch is available too.

# Setup elevation and ambient conditions

L-series motors are designed for being used in the environment protected against weather influences defined in EN 60721-3-3:
• Ambient temperature from +5°C to +40°C
• Relative humidity of air from 5% to 95%
• Altitude above sea up to 1000 m

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