

Safe handling of linear motors

Safety notes are required due to the permanent magnets installed in the secondary parts of the linear motors. They shall be observed strictly. As a result of the high-energy magnetic fields as well as the associated high ferromagnetic forces of attraction, there can be a direct danger to health (e.g. to persons with pacemakers) or indirect danger (e.g. through fast motor movements and high trusts).

According to medical findings, magnetic fields with less than 5 mT have no effect on the human organism. Already at a distance of approx. 100 mm, the flux density of the existing secondary parts is less than 5 mT (at 150 mm => approx. 0.5 mT). As the field intensity in synchronous motors solely comes from the magnetic fields of the secondary parts, this value is not depending on the operating condition of the motor.

Because of the high attraction forces special caution is required in the direct vicinity of the secondary part (i.e. under 50 mm). Therefore heavy (> 1 kg) or wide (> 100 cm²) objects made of steel or iron are not allowed to be raised in the direct vicinity of the secondary part by free unsupported hand. Because magnetic forces are invisible, their effects often are underestimated - within the direct vicinity of the secondary part the magnetic attraction forces start immediately and can increase up to several 100 kg, already at ferromagnetic objects (steel or iron) of medium size.

General precautionary measures

- Assembly, operation and maintenance are only to be carried out by trained personnel
- Persons with pacemakers or magnetic implants should never carry out the work.
- Generally we recommend for all people that may be affected by the influence of strong magnetic fields, a minimum distance of 1 m to the secondary parts and to the active (energized) primary parts (coil).
- Always wear working gloves for assembly and maintenance work
- Provision of warning information on the machine which is clearly visible (e.g. permanent adhesive signs) („Caution: the linear drives of this machine are fitted with powerful magnets – POWERFUL MAGNETIC FIELDS + HIGH MAGNETIC FORCES OF ATTRACTION!")
- For event of emergency, while carrying out jobs on synchronous linear motors: Always have at hand at least two wedges of solid, non-magnetic material - e.g. stainless steel (wedge angle approx. 10°-15°) as well as a hammer (approx. 6 pounds) for separating parts magnetically attached to the synchronous secondary to free caught limbs [hand, finger, foot, toes] (see also section 'Behavior and immediate action in the event of accidents')
- Keep away watches and data carriers which are susceptible to magnetism (e.g. credit cards, hard disks etc.) from the strong magnetic area (< 500mm)
- Do not bring heavy metal objects near to the secondary part

Regulations for storage and transport

- Identification in the storage places („Caution! Powerful magnets!")
- Never store without the packaging, always use non-magnetic packaging measuring of at least approx. 1 inch in thickness
- Observe warning information on the packaging
- Keep storage places dry and protected against heat
- When transporting machines or parts of machines with already assembled primary and secondary parts, secure these parts to prevent unintentional movement (no self-locking mechanism)

Regulations for assembly

- Do not remove packing from secondary part until just before assembly
- There must always be two persons carrying out the assembly work
- For event of emergency, while carrying out jobs on synchronous linear motors: Always have at hand at least two wedges of solid, non-magnetic material - e.g. stainless steel (wedge angle approx. 10°-15°) as well as a hammer (approx. 6 pounds) for separating parts magnetically attached to the secondary to free caught limbs [hand, finger, foot, toes] (see also section 'Behavior and immediate action in the event of accidents')
- Never place secondary parts with magnetically active surface on metal
- Never place a primary part directly on a secondary part
- Always hold on tight to steel tools and slowly approach secondary part from the side
- For assembly work on machines with already installed secondary parts, cover the secondary parts with non-magnetic material measuring at least approx. 1 inch in thickness (e.g. wood)
- Avoid any unintentional movement of a primary or secondary part which has not yet been mounted
- Avoid unintentional movement in direction of travel of a primary or secondary part already assembled on the linear guideways
- Use specially prepared assembly tools, if necessary

Regulations for setup

- Never carry out operations in the area of travel when the machine is switched on
- Make sure that the path of travel is clear
- Check commutation prior to switching on
- Limit the motor currents, set speed limit to low values
- Supervise end positions (limit switches)

Regulations for operation

- Keep motor compartment free from chips
- Pay attention to noise development
- In event of problems on the workpiece regarding accuracy, check ease of operation of the traverse path and the current input of the machine

Regulations for maintenance and repair

- Always switch machine off prior to carrying out work in the traversing area (switch dead)
- Regularly check ease of operation of the traversing paths
- Regularly check current input
- Regularly clean the motor area to remove chips
- Regularly check condition of surfaces of primary and secondary parts on the air gap side

Behavior and immediate action in the event of ACCIDENTS

1. If the machine is connected to the mains, press EMERGENCY STOP immediately
2. Call for First Aid immediately
3. If limbs are caught between two synchronous secondary parts or one synchronous secondary part and a ferromagnetic part due to strong magnetic attraction forces:
Separate parts adhering together by driving the available wedges of solid non-magnetic material between the adhering parts with the available hammer. Free the caught limbs.
4. Store the secondary parts safely to avoid new accidents.