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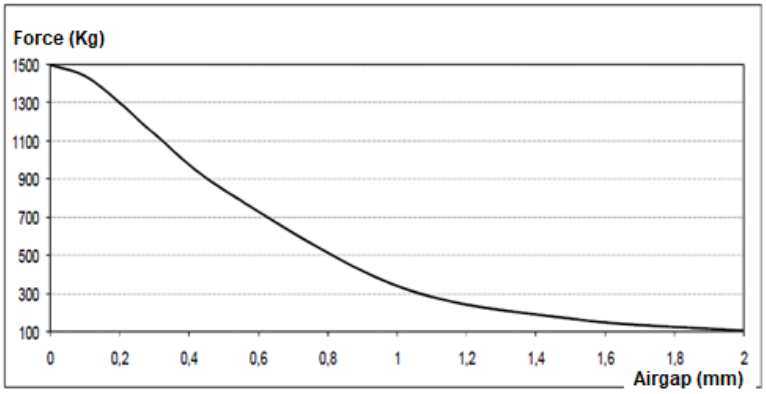
Selter
Magnetic Systems

ATRACTION FORCE OF ELECTROMAGNETS

To determine the values of the detachment force a test is performed on the SELTER test bench according to the method described below:

> *The electromagnet is placed on a steel plate (ST-37), a thickness of 30 mm, the surface of which is rectified and in a horizontal position. The electroimant is liked and stretched with constant speed from the anchors of the device and perpendicularly to the surface of the steel plate. The value of the force required to detach the electromagnet from the plate is measured directly with a dynamometric cell coupled to the traction system.*

Example of detachment force of an electromagnet 500x100x70 mm according to the airgap.
(Airgap = Separation between the contact surfaces)



IMPORTANT, when used to lift pieces, apply a safety factor 3. The weight of the load must be less than 3 times the force of detachment.

ATTENTION, According to the composition of the material, it is possible that after disconnecting the electromagnet, the piece retains some residual magnetism (with the risk that the piece doesn't detach completely and move or fall accidentally.) In this case you need to make a demagnetizing cycle to remove the remanent magnetism. The force of detachment depends on various factors such as: the conditions of the contact surface, the thickness of the workpiece, the contact area, material quality, etc. Described below.

Factors influencing the magnetic force:

There are features of the workpiece to be considered to understand the capacity of magnetic attraction. The magnetic force is represented by lines of force (magnetic flux) that go from the North Pole to the South Pole. Any circumstance that prevents or restricts the passage of magnetic flux, obviously reduces the efficiency of the electromagnet. There are four major factors that limit the magnetic flux:

1. The contact surface: the magnetic flux of the magnet passes easily through the iron, but not through air neither non-magnetic materials. If a separation (airgap) between the magnet and the workpiece is roduced, the passage of magnetic flux is hindered and the lifting force reduced. Rust, paint, dirt, paper, or rough surface produces airgap, therefore a decrease in the strength of the electromagnet.

2. The thickness of the piece: The magnetic flux of the magnet piece needs to have a minimum thickness to act (iron saturates from a certain amount of magnetic flux). If the piece doesn't have this minimum thickness, the attractive force is reduced.

3. The length and width of the piece: by increasing the length or width of the piece, the ends curve and the flatness gives up, causing airgap between the magnet and the piece, especially for thin thickness. When this ccurs, the efficiency of the electromagnet is reduced.

4. The material of the piece: steels with low carbon content are good conductors of magnetic flux, such as an F-1110 or ST-37 (0.1 to 0.3% C). However, steels with high percentages of carbon or other alloyed materials, lose magnetic properties that reduce the strength of the electromagnet. The thermal treatments that affect the structure of the steel, also reduce the lifting force. By increasing the hardness of steels, a worse magnetic behavior is got, and they tend to preserve a remanent magnetism. The given nominal strength of these electromagnets is for a non-alloy steel with low carbon content (0.1 to 0.3% C).