MAGNET SIEB SYSTEMS
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ELECTRO-LIFTING MAGNET

OPERATOR'S MANUAL
AND
SAFETY INSTRUCTIONS

WITH INSPECTION AND MAINTENANCE INSTRUCTIONS

⚠ DANGER ⚠

- **Always stay clear of the load**
- **Never lift loads over people or in close proximity to people**
- **Never attempt to operate until you have read and understand the Operator's Manual & Safety Instructions**

Sieb Sales & Engineering, Inc.
10001 Express Dr.
Highland, IN 46322

www.siebsales.com

219.924.3616 TEL

219.924.3617 FAX

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INTRODUCTION

SIEB has been in the magnetic material handling business since 1967. We specialize in magnet systems for the scrap, steel and railroad industries. What has made us successful is our service to the customer and the well thought out design and quality of our systems.

Read this manual carefully to learn how to operate and maintain your magnet. Failure to do so could result in serious injury, or even death, to yourself and others in the area. This manual should be considered a permanent part of your magnet and should always be available to all operators and remain with the magnet if it is re-sold.

PRODUCT DESCRIPTION

SIEB SE30C Electro-lifting Magnet

- 75% duty cycle copper coil with Class H insulation
- Heavy duty fabricated housing designed for wear and long life
- 5' lead with quick disconnects
- Rolled manganese bottom plate
- Double ears with chain pins for greater safety
- High strength tested alloy steel chains
- Replaceable coil
- Hard surfacing available

SAFETY INSTRUCTIONS

GENERAL SAFETY RULES

Danger always exists when loads are transported by lifting devices, especially when the equipment is not being used properly or is poorly maintained. Because accidents and severe bodily injury or death can result, special safety precautions apply to the operation, inspection and maintenance of all lift magnets.

Following these simple rules can help to avoid lifting accidents:

DANGER

- Always stay clear of the load.
- Never lift loads over people or in close proximity to people.
- Never attempt to operate this magnet until you read and understand the Operator's Manual & Safety Instructions.
- Never use this magnet to lift, support or transport people.
- Never leave any lifted load unattended.
- Always position the magnet so the load remains level.
- Never exceed rated load capacity of the magnet or crane.
- Always make sure that the supporting structure and attaching devices (i.e. crane, chains and hook) are rated to support the weight of the magnet and load.
- Never disconnect a magnet from its power source while it is energized! Electrical arcing will occur and may cause serious injury or death.
- Always let those near you know that a lift is to begin.

Remember, proper lifting knowledge and techniques are the responsibility of the operator. Be sure to read and understand the instructions and safety warnings contained in this manual before using your lift magnet(s).

If you do not understand everything in this manual contact **SIEB** for assistance before using the magnet(s).

OPERATING INSTRUCTIONS & TROUBLE SHOOTING

SAFETY RULES FOR OPERATION

1. Never attempt to operate this lift magnet until you read and understand this Operator's Manual & Safety Instructions.
2. Check the condition of your entire magnet(s) by visually inspecting it prior to use each day. Especially check the chains and pins for any defects and wear. Also, inspect the physical condition all electrical cables and leads.
3. Check that the weight and size of the load to be lifted does not exceed the rated lift capacity of the magnet, magnet lifting system, or the crane.
4. Position the magnet(s) on the load so that it will remain level when lifted.
5. For maximum lift performance:

   a) The full surface of the magnet must be in contact with the load before being energized. Energize the magnet(s) by placing the control actuator in the “ON” or “LIFT” position. Never energize the magnet before full contact is made and always keep the magnet power off between lifts!

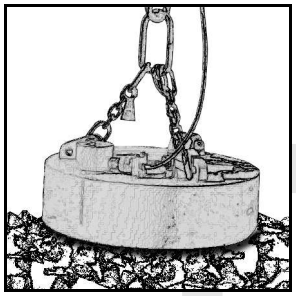
   b) Allow a few seconds for the magnet(s) to reach full power before lifting the load.
6. Check to be sure no one is near the load to be lifted. FOR CLOSE PROXIMITY OPERATIONS: Inform others in the area that a lift is to begin. Lift the load 2 to 3 inches (50 to 77 mm) and then jar the load to ensure that adequate holding power is available. Always stay clear of the load.
7. Lift and move the load SMOOTHLY. Avoid jarring and swinging the load. KEEP THE LOAD LEVEL. NEVER let the load come in contact with any obstruction.
8. FOR CLOSE PROXIMITY OPERATIONS: ALWAYS STAY CLEAR OF THE LOAD. IF YOU MUST GUIDE THE LOAD, use a tag line. As a last resort, push or pull the edges of the load while keeping your entire body clear of the suspended load at all times. DO NOT guide the load by pushing or pulling the magnet(s). NEVER get in a position where you could get hit with the load if it dropped.
9. Carefully set the load down and de-energize the magnet(s) or release scrap as required. Apply reverse current as required for a clean release. Lift the magnet(s) slightly to be sure the load has been released.

CAUTION

Never re-energize the magnet(s) until it has been placed in contact with the next load to be lifted. Prematurely energizing the magnet could cause damage to the magnet(s), as well as cause unwanted materials to be accidentally attracted to the magnet. This could cause personal injury to people in the vicinity.

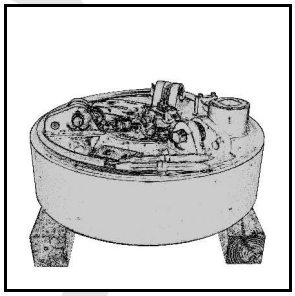
When working in an area using lifting magnets, wear safety glasses, work gloves, steel toed boots and a safety hard hat.

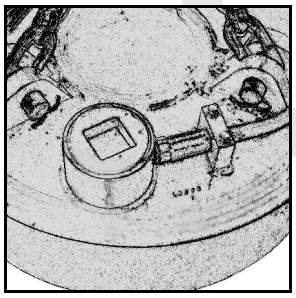
LIFTING PROCEDURES
DO's



Do **ease the magnet onto the pile!**

Do **keep the magnet dry!**





Do **keep the terminal box closed!**

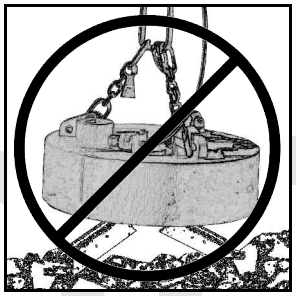
DO set the magnet down easy! You will save money on repairs, parts and time. Keep the bolts tight (if applicable) and check them periodically. Bolts can become stretched and allow the center pole shoe to come away from the face of the magnet core. Not only is this dangerous but it will also reduce your lift. The bolts can snap and allow the center pole shoe to fall off.

DO **keep the power "OFF" until the magnet is in contact with the material. This also helps to prevent the magnet from overheating.** Remember, a hot magnet will not lift as much and won't last as long! Let the magnet settle on the deepest part of the pile. Then, switch the magnet "ON" and leave the magnet in position for a few seconds. This lets magnetism build to a peak level and will help to maximize the lifting capacity.

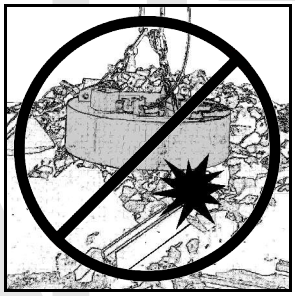
DO keep the magnet dry! Always store the magnet off of the ground and keep the terminal box closed. Keeping the terminal box closed keeps moisture away from the terminals and out of the magnet coil. Never cool the magnet with water. Rapid cooling may cause the steel section or welds to crack. Moisture can cause short circuits!

DO monitor the magnet temperature and voltage. When handling hot slabs or ingots, watch the temperature carefully. ***If your magnet(s) gets too hot, switch to a spare magnet to finish the job!***

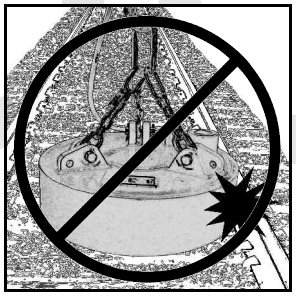
LIFTING PROCEDURES
DON'Ts



Don't **turn the magnet on before settling on the pile!**



Don't **drop the magnet onto the pile!**



Don't **strike or rub the magnet against the rails or use it as a battering ram!**

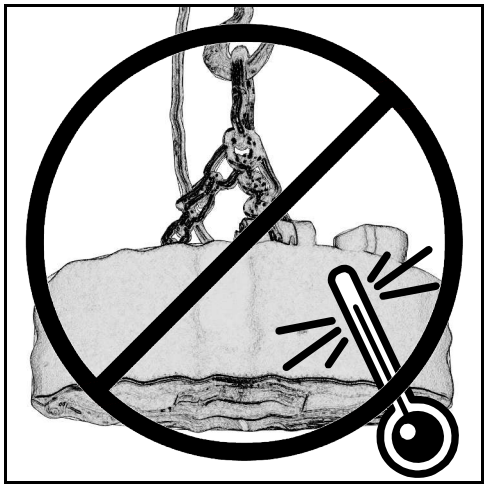
When track sweeping maintain a minimum of 1 to 2 inches clearance from the rail. Keep the magnet as close to the ground as possible!

DON'T **turn the magnet on early!** This may cause smaller pieces to jump up and reduce the lifting capacity. This also helps to prevent the magnet from overheating. ***A hot magnet will not lift as much and won't last as long!***

DON'T drop the magnet onto the material, use it as a battering ram, or strike or rub it between the rails. When track sweeping refer to **DUTY CYCLE LIMITATIONS**. Improper use, such as dropping a magnet to break up or compact material, may cause damage to the pole shoe, terminal box or damage the coil. ***Use the magnet only for lifting!***

DON'T grease the chain! If there are any abrasive particles in the air, such as foundry sand or slag dust, the grease will cause the particles to adhere to the chain. This dust will then act like a grinding compound and soon wear away at the chain material.

DUTY CYCLE LIMITATIONS



DON'T exceed the duty cycle of the magnet! Exceeding the duty cycle will result in reduced lifting capacity because of the excessive heat that will be built up in the magnet. Excessive heat can cause the magnet coil to short or ground out.

Duty cycle rating (D.C.%) is defined as:

(Time On x 100)/(Time Off + Time On) = D.C.%

Examples:

3 min. ON, 1 min. OFF = (3 x 100)/(3 + 1) = 75%
5 min. ON, 5 min. OFF = (5 x 100)/(5 +5) = 50%

The duty cycle rating of your magnet(s) is marked on the magnet nameplate. Always maintain minimum time off! ***Monitor your magnet temperature!*** If your magnet(s) gets too hot, switch to a spare magnet to finish the job!

DO NOT LEAVE THE POWER ON WHEN THE MAGNET IS NOT IN USE!

$$$
REWINDING OR REPLACING A MAGNET COIL CAN COST THOUSANDS OF DOLLARS!
$$$

Magnets often suffer from terrific mechanical abuse. The result can be cracked casting; outer pole, center pole or even the case; broken or loose bolts, worn chain or ears; completely worn center or outer pole; dented bottom plate; and broken center pole weld.

Under these conditions the coil will eventually fail and appear as a grounded, shorted or open coil; or a combination thereof. A grounded coil usually happens because the magnet seal has broken, permitting water to enter and causing the trouble. Coils can also become grounded because mechanical shock breaks or cracks the insulation. Broken insulation can also permit adjacent coil layers to arc across, causing a shorted coil. Continued pounding on the bottom plate can loosen the layer insulation and permit individual coil layers to shift, usually resulting in an open coil.

Moisture is the greatest single factor in coil failure. Water will reduce the ground reading at elevated temperature; and, if it is not removed in time and dried out, a complete short to ground will result, requiring a rewind.

A defective magnet coil will cause malfunction of the controller and usually results in poor load drop characteristics. Other problems external of the magnet will also have the same effect; these are grounded magnet terminals, leads or cable reel. When this occurs on a system having a ground also on the generator side of the controller, the reverse current resistors on the controller will overheat and eventually burn out.

SERVICE FACTOR

Magnets are wound for 50% or 75% cycle operation which means they are suitable only for intermittent duty such as thirty seconds (30 s) on and thirty seconds (30 s) off for a 50% duty cycle magnet and ninety seconds (90 s) on and thirty seconds (30 s) off for a 75% duty cycle magnet. A poor crane operator can easily cause a magnet to become overheated by energizing it more than its rated cycle. A hot magnet loses some lifting capacity and so it is doubly important to keep it cool. Overheating a magnet may not result in a burnout, but each time this occurs the coil life will be shortened by an amount dependent on the time and temperature.

MAGNET TEMPERATURE

Overheating of magnet coils is a quick way to reduce the life of the magnet. A rule of thumb, often related by insulation manufacturers, is that for every 10° C over the temperature class rating, the insulation life will be reduced by half. It doesn't take too high of a temperature rise over rating to reduce magnet life to months or even weeks. At the cost to rewind magnets, the following methods to increase the life of magnets should pay for themselves in short order. Operator training, along with instrumentation or information, is necessary for efficient handling of magnetic material.

MONITORING MAGNET TEMPERATURE

The coil and leads are the items that must be kept cool, otherwise the magnet will fail in a short time. Average coil temperature can be monitored by monitoring magnet current. However, voltage must be fairly constant to get accurate results. A variance of ±11.5 V will give ±5% accuracy plus the accuracy of the current reading. If the accuracy of the current reading is 2% then the total accuracy is ±7%. If you wanted to ensure that the temperature rise never exceeds 180° C rise then the hot magnet resistance should never exceed 1.67 times the cold magnet resistance.

Specific operating times for particular magnets are difficult to predict due to the many variables involved. If operations are repeatable, typical times can be determined by monitoring magnet resistance over a period of time. The smaller the magnet, the shorter time period. Magnets of any size and/or shape can be monitored over an eight hour (8 h) period with resistance taken every one to two hours. Resistance and ambient temperatures must be taken when the magnet is cold, that is at ambient temperature throughout the magnet. Resistance readings can be taken by measuring voltage at the magnet lead (this eliminates voltage drop through the cable reel and long leads) and current with accurate meters. The resistance can be calculated by dividing voltage by current. Also, direct magnet resistance with an accurate meter is suitable. The following table can be used to determine when magnet temperature is up to coil rated temperature.

Temperature Class	***Resistance Ratio Max R (hot) / R (@25° C)***	***Avg. Coil Temp. Rise 25° Ambient***
B	1.41	130° C
F	1.50	155° C
H	1.60	180° C
C	1.70	+240° C

Because of some thermal overshoot, the magnet coil temperature is continuing to increase in temperature for a short time after the magnet is removed from service. It is a good idea for the magnet to be removed from service and allowed to cool before the rated temperature rise is reached. The overshoot can be minimized by not leaving the magnet on or above hot material and not setting the magnet on a solid floor or ground. Do not try to cool in water! Keep the magnet in the air as much as possible. If placed to rest, use a frame or blocks to allow air to circulate under the magnet. Provide fans to increase cooling. A moving magnet stays much cooler than a stationary magnet.

TROUBLE SHOOTING

In many cases of poor magnet performance the difficulty can be traced to the power supply, controller or cable reel assembly. If these elements are found to be in good working order the magnet can be checked with simple tests. To determine the condition of the magnet, the resistance of the coil and insulation resistance to ground must be measured. To be meaningful these readings should be compared with figures obtained from the factory for your particular magnet at the ambient temperature in which it is operating.

If a lifting magnet is suspected to be faulty, preliminary electrical tests can be made from the external leads.

1. Disconnect power to the magnet before making any electrical tests on your magnet.

2. Make electrical tests at outside leads. If tests indicate an open coil, ground or low case to coil resistance, disconnect cable and connector and make further tests at coil leads. On some magnets this will require removal of the terminal box cover. If these tests are satisfactory, trouble is then in the outside leads, connectors, controller, or power supply.

MAGNET TEST PROCEDURES

It can take two days for the magnet to reach ambient temperature after the magnet has been taken out of service. Preliminary readings can be taken immediately, however, and this will indicate if the magnet is grounded, shorted or open. When readings are taken of a hot magnet, consideration must be given to the values for the heated condition.

Coil Resistance Test

1. Use an accurate ohmmeter.

2. Connect meter leads to terminal junction. If the resistance is lower than that shown on the magnet's name tag or by calculating the coil resistance by dividing 230 volts by the amps on the name tag, shorted turns are indicated. If the resistance is less than 75% of this resistance, DO NOT operate magnet as it is likely to cause extreme overheating and may cause serious damage to the coil material.

Ground Insulation Test "Megger Test" (Case to Coil Resistance)

1. Use a 500 volt Megger.

2. Connect one Megger lead to the terminal junction and the other to a clean surface of the magnet casing. If the reading is between 20 Megohms and infinity, it is typical of a brand new magnet. If the reading is between 10 and 20 Megohms the insulation is sound. If the insulation is between 1 and 10 Megohm, the insulation is still acceptable. However, the insulation has degraded and the magnet should be closely monitored for further deterioration. If the reading is less than 1 Megohm, it should be returned to the factory for further inspection. Zero Megohms indicates a dead short.

What Can Affect the Ground Insulation Test

The most common cause is moisture.

The most likely entry point is the terminal box because the box has not been properly maintained and sealed.

The second most likely entry point is the bottom plate area because the bottom plate has been damaged and the welds have fractured.

Once the moisture enters the coil cavity, the coil insulation degrades and permits the current to arc or trace through the moisture to the case wall or winding hub.

AC Current Test

A more accurate test for shorted turns can be made by checking the current that will flow through the magnet with a 220 volt 60 cycle power supply connected to the magnet leads. A good quality ammeter should be used to perform this test.

MAGNET INSPECTION (DAILY)

1. TURN OFF ELECTRIC POWER.

2. All chain links should be checked for wear. Any chain in which the minimum diameter of the worn portion of any link is less than 87% of the actual new stock diameter or thickness must be replaced. Never attempt to repair links by welding or hardfacing work areas.

3. Inspect all chain pins. Any pin in which the minimum diameter of the worn portion is less than 90% of the new stock diameter must be replaced. Be sure that cotter pins, plates, washers, etc. are in place and in good condition.

4. Check the entire magnet case for any cracks. Repair cracks immediately.

5. Check chain pin lugs and tagline lugs for wear and other damage. Make necessary repairs immediately.

6. Inspect the physical condition of all electrical cables and leads. Look for cuts, abrasion and strain damage. Replace any suspect cable or lead. Magnet leads are sometimes protected by thick hoses, steel pipes or fabricated cable channels. Check that these items have not been cut, bent or crushed and are hiding a damaged cable or lead.

7. Check the terminal box for any damage or missing components. Replace any missing covers and plugs to prevent the entry of moisture. Clean away any build-up of dirt or foreign materials in the area of the box since these materials retain moisture and can accidentally enter the box during repairs.

8. Inspect the non-magnetic bottom plate for cracks, dents and the integrity of the weld between it and the magnet case.

9. If the magnet has a center pole shoe, inspect for excessive wear, cracks and fit to the center pole. An air gap between the shoe and pole will result in reduced lifting capacity.

10. If the magnet is used for plate lifting, care should be taken to keep the unpainted magnetic pole surfaces on the bottom of the magnet flat and free from rust, nicks and burrs which reduce the lifting capacity. Burrs may be removed by filing, deep nicks may require grinding of the pole faces.

MAGNET INSPECTION (EVERY MONTH)

1. TURN OFF ELECTRIC POWER.

2. Completely inspect and record the condition of the magnet and its suspension system. Test and record the magnet's coil resistance, case to coil resistance and AC current test reading.

MAGNET INSPECTION (OUT OF SERVICE MAGNET)

Any magnet that has been out of service more than 30 days MUST be thoroughly inspected before being put back into service.