by ken richendollar

Need A Lift?

When selecting a magnet for scrap handling applications, recyclers should consider a number of questions.

Scrap handling applications for magnets in today's marketplace are almost as wide as the materials that arrive daily in the recycling yard. Magnets are used to lift, sort, sweep, separate, load and unload ferrous metals all day long.

RISING TO THE MATTER

Electric lifting magnets have been in use since the early 1900s. The first electric magnets were heavy, bulky units designed to handle anything they could pick up. Magnets were available in small (29 inches), medium (40 inches and 45 inches) and large (55 inches and 65 inches) diameter units. Slow-moving overhead and cable cranes were typically used to handle the magnets and their loads. Lifting magnets are cycled on to pick up steel products and cycled off to release them.

Applications eventually evolved to become more specific in the materials magnets were required to handle. Aluminum wound magnet coils replaced the much heavier copper wound designs in scrap magnets to reduce the cost, the overall weight and subsequent maintenance on the cranes that moved them.

When auto shredders came into existence, they created a whole new grade of ferrous scrap in light of the size and density of the end product produced. Scrap magnets became more pancake shaped in design to handle this shredded material, leaving the much thicker models for steel mill product applications. As a rule of thumb, the thicker or

deeper a magnet is, the denser the material it is designed to handle.

Today's typical scrap handling magnets are available in sizes ranging from 20 inches up to 93 inches in diameter. The limiting factor for the size of the magnet is normally the crane capacity.

Magnets that are rectangular in shape are available to unload rail cars, barges and oceangoing vessels because they are adept at reaching into the squared-off corners of these containers, which is something circular magnets cannot do.

Lifting magnets can be specially manufactured to fit a specific application; however, most scrap magnets are produced in standard-field, deep-field or extra-deep-field configurations. Standard and deep field scrap magnets are the designs typically used in scrap processing and recycling yards. Extra-deep field models are used to load electric arc furnaces in mini-mills and transportation vessels such as ships and rail cars.

BEYOND THE BASICS

When selecting a magnet for an application, today's scrap yard managers have much to consider beyond the normal questions of what materials will be lifted with the magnet and what its operating cycle will be.

General scrap iron can be handled by either a standard- or deep-field magnet. Shredded or bundled scrap iron is best handled by a deep-field magnet with a heavy-duty case construction. As a rule of thumb, most magnets are designed to operate at a 50 percent duty cycle for continuous around-the-clock operation or that cycle can be prorated to 75 percent over a shorter time, such as a single shift of eight hours.

A 50 percent duty cycle is defined as having the magnet energized in the on position for 50 percent of the time and off for at least 50 percent for each minute of operation. Operators need to keep the magnet off when a load has been dropped and while the crane is swinging back to pick up the next pile of scrap. Magnets that are energized immediately after dropping a load of steel tend to overheat and lift less on an average day. The continuous overheating of a magnet will cause premature failure and expensive magnet repairs.

Lifting magnets require several seconds once turned on before they reach their full lifting potential; therefore, they should be energized once they are placed on the scrap pile and allowed to settle for three to five seconds before moving the next load of scrap. This ensures that the magnet is lifting a full load of steel on each movement of the crane and prolongs the magnets life.

For new applications, we like to ask two questions in addition to those mentioned above:

1. What is the maximum weight your material handler can lift with the boom fully extended to the side of the machine? We ask this because do not want to tip the material handler over when the magnet handles a full load. Always remember to add the potential magnet's weight plus its maximum lifting capacity for the grade of scrap to be handled when determining whether your scrap handler will be able to accommodate the magnet.

2. What sizes are the power supply and magnet controller on your material handler? Many new mobile crane manufacturers now include a magnet power supply and a controller on their scrap handling machines, so they are offered as "magnet ready" to the marketplace.

Most domestic manufactured magnets are designed to operate on 230 volts DC. To make sure that your magnet falls under the maximum capacity rating of your power supply, you must first know the cold operating amps of the magnet and multiply that number by the rated magnet voltage (230).

For example a typical 58-inch diameter magnet draws 60 amps in the cold condition, therefore 60 amps times 230 volts equals 13,800 watts. Your power supply must be greater than 13,800 watts DC to use a 58-inch magnet on the material handler in question.

At the same time, you must check the operating range (in amps) of your magnet controller. Magnet controllers are offered in many size ranges: 5-to-20-amp, 20-to-100-amp, 65-to-135-amp and 100-to-150-amp models are the most common. For the same 58-inch diameter (60-cold-amp) magnet in our example above, a 20-to-100-amp magnet controller would be required. The purpose of a magnet controller is not only to turn the magnet on and off but also to contain the discharged energy produced by the magnet when it is turned off safely, allowing the load of scrap iron to be dropped.

Once you have purchased your magnet, you'll want to ensure that you maintain it properly.

MAINTAINING YOUR INVESTMENT

Magnet maintenance should be part of the operator's everyday routine to prevent an unexpected failure and to ensure long life. The inspection should be done before beginning your daily operation.

Scrap magnets are air-cooled electrical devices. As they are operated, the magnet produces heat that is transferred from the inside coil to the outside edges of the magnet case. The temperature on a hot magnet can exceed 212 degrees Fahrenheit, the boiling point of water; therefore; we recommend that you never touch or inspect a magnet at the end of a day's operation.

Daily/weekly inspections should include checking the magnet lead connections to ensure they are tight. You should also look for exposed or frayed wires and worn out insulation. The magnet chain should be inspected for worn links and pins.

On a monthly basis, be sure to do the following:

- Measure and record the magnet's coil resistance. The coil resistance can be obtained by directly calling the magnet manufacturer or looking at the magnet nameplate. It also can be calculated by dividing the magnet's cold amps into the design voltage. Referring back to our earlier example, a 58-inch magnet that has 60 cold amps and operates on 230 volts DC would have a coil resistance of 3.8 ohms (230 divided by 60).
- You should also measure and record the magnet's resistance to ground. This measurement requires a meter that can measure in the millions of ohms range. A reading above 1 million ohms is considered acceptable as a minimum; however, the higher the number, the better the magnet's insulation.
- Inspect the magnet bottom plate for cracks in the welds around the center and outer pole shoes. Cracks in the weld can be re-welded to prevent moisture from entering the coil cavity and permanently damaging the coil. In situations when the magnet's ground resistance has fallen below 1 million ohms, the magnet will require a bake out to drive out trapped moisture inside the coil. Contact your magnet manufacturer for this service.
- Inspect both the magnet center and outer pole shoes for wear. These poles can be hard faced to build up the wear depth and prolong the magnet's life. Hard facing is a "Z" stitched weld that goes around the working surface of the pole shoes. Worn out pole shoes will reduce the magnet's lifting performance.

By considering this advice when shopping for and operating your next lifting magnet, you're likely to be rewarded with efficiency when handling ferrous scrap. rt

Ken Richendollar is a sales manager with Ohio & Stearns Magnetics Inc., Maple Heights, Ohio. He can be contacted at kenr@ohiomagnetics.com.