

# Installation, Operation and Maintenance Instructions



**WET HIGH  
INTENSITY  
MAGNETIC  
SEPARATOR  
CF-5-MM-WHIMS**

**ERIEZ MAGNETICS** HEADQUARTERS: 2200 ASBURY ROAD, P.O. BOX 10608, ERIE, PA 16514-0608 U.S.A.  
*WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY and METAL DETECTION APPLICATIONS*

# Introduction

This manual details the proper steps for installing, operating and maintaining the Eriez Wet High Intensity Magnetic Separator (WHIMS).

Careful attention to these requirements will assure the most efficient and dependable performance of this equipment.

If there are any questions or comments about the manual, please call Eriez at 814/835-6000 for Magnetic Separator assistance.

## CAUTION

Safety labels must be affixed to this product. Should the safety label(s) be damaged, dislodged or removed, contact Eriez for replacement.

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# General Description

The CF-5-MM HIW is a small continuous type wet separator with a new Multiple Matrix feature. It is a completely assembled unit designed to give continuous trouble free separation of weakly magnetic materials. Its size and portability lend itself as an ideal unit for laboratory or pilot plant operations.

The separator consists of three (3) main components which are:

## ELECTROMAGNETIC COIL

The strong magnetic field is generated by an oil-cooled coil, with expansion tank and relief valve, space wound with Class H wire. The coil is completely enclosed to protect it from moisture, chemicals or other elements which might cause deterioration.

## ANNULAR RING

A unique feature of the annular ring is a Multiple Matrix design which permits easy interchangeability of the wide variety of matrices available to produce the necessary high-intensity, high-gradient magnetic fields. The ring is made of stainless steel machined to provide 36 rectangular compartments with individual cover plates. Matrices can be quickly removed for inspection, cleaning or changing, without damage to either the matrix or the ring. The variable speed drive system is located under the ring to allow full visibility of the separating area.

## DISCHARGE TRAY

The fully adjustable stainless steel discharge tray collects the separated materials below the annular ring. To provide maximum variability in splitting the product, the tray has six sections for middling fractions as well as sections for magnetic and non-magnetic fractions.

# Application

The CF-5-MM is used for the separation of paramagnetic materials such as:

- A. Hematite and goethite in the beneficiation of iron ore.
- B. Iron oxide and ferrosilicates from quartz and clays used for manufacturing glass ceramics and glazes.
- C. Ilmenite, wolframite and columbite from gangue during concentration.

- D. Ferro-oxides and ferro titanium oxide from cassiterite, zircon and rutile concentrates.

The separator has a capacity of approximately 500 lb/hr (225 kg/hr) to 1500 lb/hr (680 kg/hr) of solids in the feed. The capacity will vary with the type of material and the separation requirements. It is completely controllable so that all factors are independently variable for maximum flexibility of operation. It is designed to test material and predict operation and performance data on larger models.

# Installation

Upon receipt of the unit, a visual inspection should be made to insure that no damage has resulted during shipping and handling.

This machine has been run at the factory to insure proper alignment of all drive and supporting com-

ponents. The drive motor and all bearings have been lubricated at the factory. During the first month of operation, all lubrication points should be checked frequently to determine the correct lubrication schedule for your particular installation.

# Operation

- A. All connections must be made to the feed inlet, float rinse, spray rinse and discharges. All inlets require valving to adjust the flow as required.
- B. Turn on the drive motor to rotate the tray. (Refer to Motor Section).
- C. Energize the coil and check for any malfunction or binding.
- D. Turn off the coil and introduce the product at the rate of approximately 500 lb/hr (225 kg/hr) to 1500 lb/hr (680 kg/hr).
- E. Adjust the splitter in the discharge tray in the area or the pole face so that all of the feed discharges behind it rather than over it.
- F. Energize the coil and turn on the float and spray rinse.

The separator is now in operation and adjustments may be made to the feed, rinse, speed or splitter location to optimize the separation.

## ADJUSTMENTS

The following is a guide to use of the variables built into the unit.

### Magnetic Field Strength

Controlled by the power supply, used to increase the removal of magnetic minerals or to select a desired grade of the minerals.

### Float Rinse

The position of the float rinse is adjustable within the magnetic area. Float rinse used to increase

the removal of entrapped non-magnetic particles from the magnetics, to remove middlings from the magnetics or to make washings similar to the non-magnetics.

### Percent Solids or Feed

This is controlled by water to solids ratio. It is used to increase feed or to reduce water consumption.

### Feed Rate

The feed rate should be controlled by valves or pumps. Feed should be introduced to the unit in such a manner as to prevent surges.

### Annular Ring Speed

The annular ring speed is controlled by an SCR drive unit permitting adjustment between .15 and 4.5 RPM. The speed should be adjusted to control the time that the magnetics are held in the high intensity zone. Adjustment of speed varies the grade and recovery.

### Feed Splitter

The feed splitter in the discharge tray may be moved closer to or further from the magnetic zone and determines the split between the non-magnetics and middlings.

### Rinse Spray

The rinse spray is used to remove the magnetics from the elements.

### Flexible Piping

To provide for the proper adjustments required at the inlets, the connecting piping should be flexible.

# Operation (cont.)

## Pole Nose Adjustment

Some units in the CF-5-MM series were designed with the capability of running various filter elements. These units are easily recognized by the adjustment feature on the pole itself. (See Figure 1).

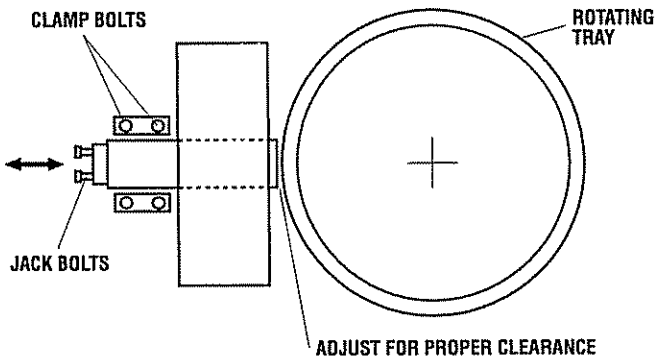


FIGURE 1

If the unit is to be run with a filter element other than Eriez standard expanded metal or expanded metal and steel wool combination, a slight binding in the rotating tray may occur at high input voltages. To alleviate this condition, loosen the clamp bolts and retract the pole from the rotating tray by using the jack bolts provided. After proper clearance is obtained, retighten the clamp bolts on the sides of the pole.

NOTE: The strongest possible field will be realized when the pole is as close as possible to the rotating tray, so in the event that the elements are changed, always reset the pole for optimum performance.

## **⚠ CAUTION**

**NEVER RUN A MIXTURE OF ELEMENTS IN THE ROTATING TRAY.**

## STOPPING THE SEPARATOR

1. Stop the feed.
2. De-energize the coil.
3. Allow the machine to run for five (5) minutes with the rinse stations running to clean the elements.
4. Stop the rinse water.
5. Stop the tray rotation. (Refer to Motor Section)
6. Rinse the discharge tray clean with an available water source.

# Maintenance

## COIL

No maintenance is normally required on the coil, but care should be taken to prevent any scratching or gouging of the coil surface. The coil is air cooled and is coated to prevent moisture from entering, but as a matter of normal maintenance, the coil should be wiped dry when the machine is not in use.

## ROTATING TRAY

The rotating tray is supported by a pair of tapered roller bearings. There is a lube fitting up under the

rotating tray and these bearings should be lubed on a cycle suitable for your environment.

## DRIVE CHAIN

The drive chain should be kept well lubricated and a maximum of 5/8 inch (16 mm) slack side chain sag is permissible. The motor is mounted in slotted holes to permit nominal adjustment.

# Test Program

## GUIDELINES FOR A WHIMS TEST PROGRAM

The objectives for a test program should be to determine the matrix and field intensity necessary to provide the desired separation.

First, determine whether any ferromagnetics exist in the sample. Use low intensity magnetic separation prior to WHIMS if more than a few percent of ferromagnetics are found. If only a small amount is found, scalping may be done at 1000 gauss with any matrix. High pressure rinse may be required to flush out the magnetics.

The amount of sample used per charge will vary depending on the percentage of magnetics. Less than 20% magnetics would allow a 100 gram batch to be processed. With higher percentage magnetics, 25-50 grams per batch is recommended. Keep the weight per batch constant to remove the loading as a factor in the test results.

Select the type of matrix expected to be best for the material at hand. The first pass should be at 1000 gauss applied field intensity. (Field intensity should always be considered as that available in the open air gap) The sample should be adequately slurried and rinsed through the separation process. Light rinsing should continue until no material can be seen discharging from the matrix. Turn the magnet off and vigorously rinse the magnetics from the matrix. It may be necessary to remove the canister from the separator to completely flush the magnetics.

Next, the non-magnetics should be rerun at 3000 gauss, following the above procedure. The non-magnetics are reprocessed at 5000 gauss, and then again at 8000 gauss. After evaluating the four magnetic fractions and one non-magnetic fraction, a curve can be made to illustrate the relationship between field intensity and recovery.

If recovery does not meet specification another matrix should be tried.

Optimum field intensity and matrix for a magnetic concentrate can be determined similarly.

NOTE: When keeping data on separator parameters, it is important to record the amperage. The amperage and not the voltage controls the magnetic field available.

After the best field intensity and matrix combination have been determined, a loading curve can be generated. This will save time when testing proceeds to pilot plant sized equipment. Loading should be expressed in terms of grams of feed per square inch of cross-sectional matrix area.

The loading curve is produced by passing increasingly larger batches through the L-4 (25, 50, 75, 100, etc.). Plugging will eventually occur and further testing should be terminated. It is expected that efficiency will drop as loading increases. From the curve, a loading factor can be obtained which will be the starting point for feed rate and carousel speed in a pilot plant unit like the Eriez CF-5-MM.

With the Eriez WHIMS units, the basic parameters affecting separation are the particle diameter and magnetic susceptibility. Since the magnetic susceptibility cannot be changed, only particle diameter can be modified. If a wide range in particle diameters is seen, consideration should be given to classification of the feed. Then different matrices more appropriate to the particle diameter can be used.

Another particle size strategy applies when making magnetic preconcentrates with such minerals as hematite. If crushing to 325 mesh is necessary for liberation, then investigation at 100 mesh for a preconcentrate can save considerable milling costs.

## MATRICES

NOTE: All comments on the applicabilities of matrices are generalizations based on experience from thousands of tests.

The matrices should be oriented so that the lines of flux are perpendicular to them. The expanded metal should be layered with the "diamonds" in opposite directions. Sufficient grids should be used to prevent the movement of the matrix when the field is applied.

# Test Program (cont.)

Magnetic field strength and matrix are independently variable for maximum flexibility of operation.

By operating at a reduced amperage the laboratory unit can also be used as a scalper for removal of more highly magnetic particles.

## ADJUSTMENTS

There are three (3) standard expanded metal elements (matrices):

Coarse Expanded Metal (CEX)	(1/2" - #13 ga.)
Medium Expanded Metal (MEX)	(1/4" - #18 ga.)
Fine Expanded Metal (FEX)	(plaster lath)

In addition to the standard matrices, special application matrices are available. Grooved plated, steel balls and stainless steel wool each have their own specialized applications. Actually, any ferromagnetic material can be used, but these have proven to be the most practical.

## Coarse and Medium Expanded Metal (CEX and MEX)

These are the standard Eriez matrices used in the majority of investigations (see Figure 2 and Figure 3 respectively). Purification of silica sands, recovery of wolframite and concentration of hematite are but a few of its applications. CEX and MEX will handle feeds with particle size as great as 30 mesh. CEX is the expanded metal matrix that will experience the least problems with plugging due to large particles and tramp material.

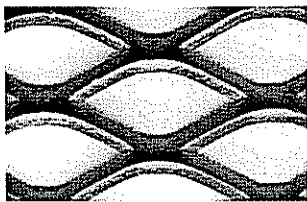


FIGURE 2

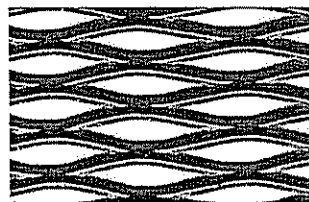


FIGURE 3

## Fine Expanded Metal (FEX)

This matrix is not often used as its efficiencies of separation are generally lower than CEX and MEX. However, if recovery has been adequate with CEX and MEX, but the grade of the magnetic concentrate is low, FEX should be tried.

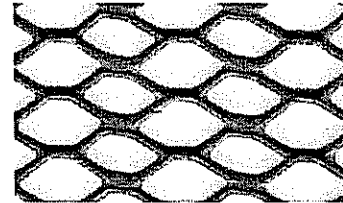


FIGURE 4

## Steel Balls

Steel balls should be used when maximum recovery of magnetics at a very fine particle size is desired. The 1/4" (6 mm) diameter ball is the best choice from the standpoint of practicality and separation. Larger diameter balls may be used, but at the expense of recovery. Particle size should not exceed 100 mesh. The major advantage to the ball matrix is its ability to be changed automatically in industrial equipment. This eliminates plugging caused by wood pulp and other deleterious substances.



FIGURE 5



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