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Metal Detectable Plastic & Rubber Considerations

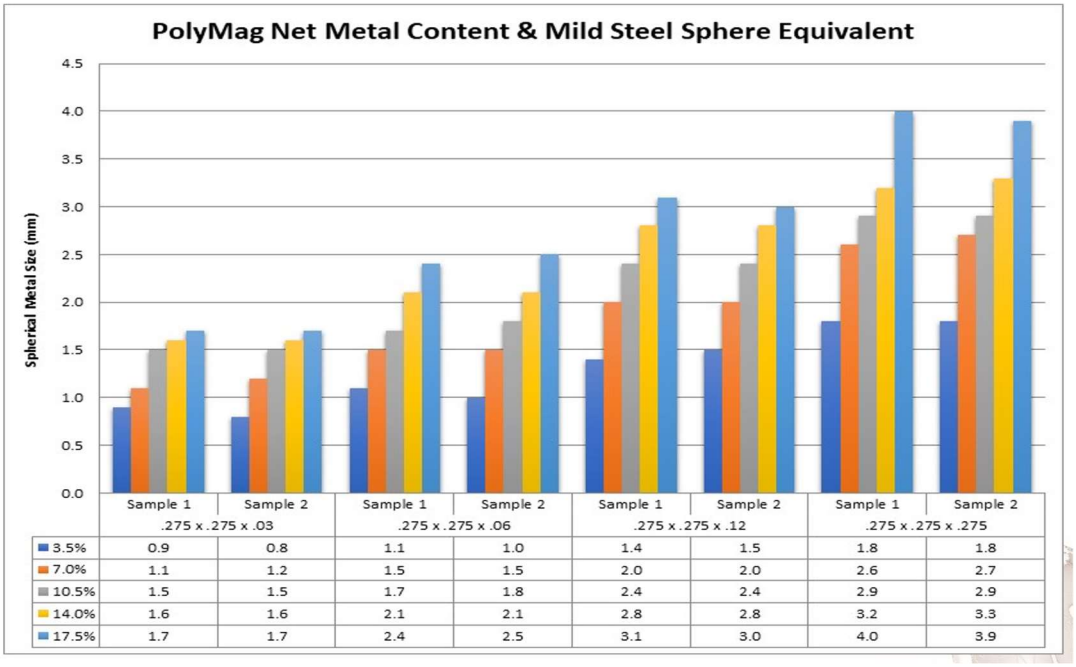
The Food Safety Modernization Act (**FSMA**) requires agricultural producers, packers, and food processors to implement Hazard Analysis & Risk-Based Preventative Controls (**HARPC**) to prevent physical contaminates like glass, metal, and plastic from entering the market. The FDA considers contaminates greater than .275" (7mm) in length to present a hazard. Growers, packers, and food processors are using their existing metal detector inspection systems and metal detectable plastics to prevent plastic and rubber contaminated foods from reaching the consumer.

Metal detectors are sensitive instruments that create an electromagnetic field. When metal passes through this field, "detection" occurs, and the offending product is isolated & rejected. The sensitivity and reject settings of a metal detector are set up and verified by using a ferrous steel, brass, or 316 series stainless steel sphere of different diameters. For instance, a high sensitivity metal detector may be set up to detect a 0.75 mm ferrous steel sphere and larger.

Two methods are used to identify metal and detectable plastic contaminates: ***length & phase angle*** detection.

The amount of metal additive included in a plastic or rubber part and the size of the plastic piece determine how "detectable" the piece is based upon the ***length*** of the signal. Shown below are typical plastic piece sizes, PolyMag® net metal loadings, and the size of the detectable plastic signal ***alone*** compared to a ferrous steel sphere in conductive food products. When evaluating plastic detectability, the plastic piece should be scanned ***with*** the normal food product and quantity. The detectable plastic plus the food produces a longer signal.

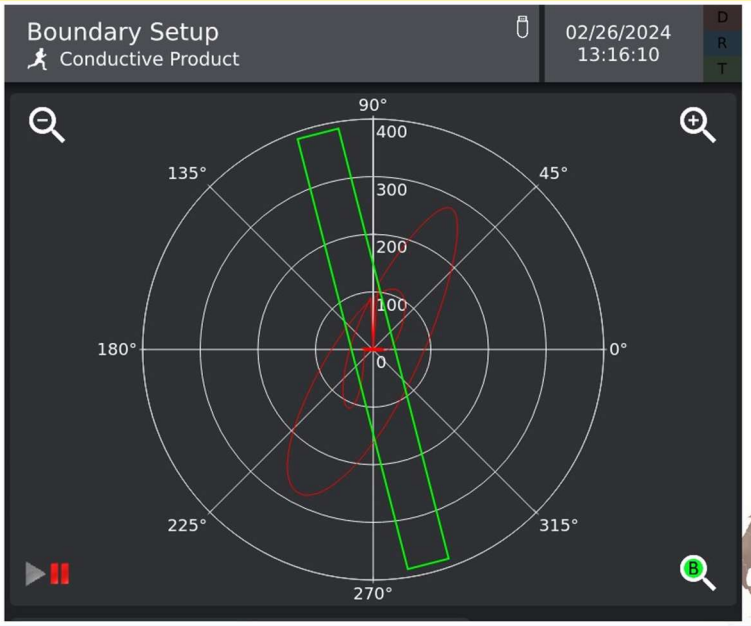
ERIEZ Metal Detectability Data



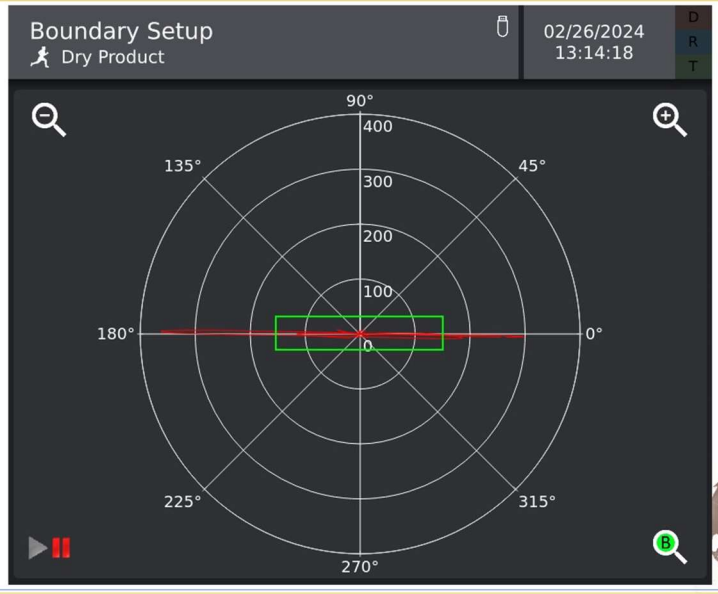
	Sample 1 .275 x .275 x .03	Sample 2 .275 x .275 x .03	Sample 1 .275 x .275 x .06	Sample 2 .275 x .275 x .06	Sample 1 .275 x .275 x .12	Sample 2 .275 x .275 x .12	Sample 1 .275 x .275 x .275	Sample 2 .275 x .275 x .275
3.5%	0.9	0.8	1.1	1.0	1.4	1.5	1.8	1.8
7.0%	1.1	1.2	1.5	1.5	2.0	2.0	2.6	2.7
10.5%	1.5	1.5	1.7	1.8	2.4	2.4	2.9	2.9
14.0%	1.6	1.6	2.1	2.1	2.8	2.8	3.2	3.3
17.5%	1.7	1.7	2.4	2.5	3.1	3.0	4.0	3.9

Another consideration is “Product Effect”. It is easier to detect Metal Detectable plastic in moist or conductive food products. Detection in dry foods like flour is more difficult because the ***phase angle*** of the dry food and the metal detectable plastic are nearly the same. Oils, margarine, dry spices, and frozen foods also have phase angles similar to metal detectable plastics and rubber. To detect metal detectable plastics in these non-conductive food products the plastic piece must have a longer signal than the food product so a larger piece of plastic or rubber with a higher metal loading may be required. The red line is a detectable plastic or rubber signal. Any signal outside the green food rejection rectangle will trigger a food rejection device.

ERIEZ **PolyMag in a Conductive Product**



ERIEZ **PolyMag in a Dry Product**



The concentration or "let down ratio" of the FDA compliant PolyMag® metal detectable additives included in plastic or rubber moldings, can be selected to suit the demands of the food processor's application and metal detector settings. The PolyMag® additives also impart ***X-Ray Contrast*** and ***Magnetic Susceptibility.***

Metal Detectable Plastic Application Questions & Comments

- What diameter metal test spheres (Ferrous, Non-ferrous, 316 SS) do your current metal detectors detect & reject? A QC detection & rejection capability with very small spheres such as 0.75 mm (.030") ferrous is a good indication of high metal detector sensitivity & rejection settings with minimal food "product effect".

- What is the food product? Is it dry or does it contain moisture or salt? Is it frozen when inspected? Does the product contain iron which produces a long signal i.e. enriched flour or red meat? Metal detectable plastic is easier to detect in foods that contain moisture and are conductive vs. non-conductive dry or fully frozen foods.

- How much product is in the metal detector aperture at one time? For instance, a 50 lb bag of iron enriched flour produces a long signal so the plastic part needs more metal additive and a larger size.

- What is the minimum size (L x W X H) of the plastic or rubber piece that you must detect? Larger pieces are easier to detect. The FDA considers a physical contaminate with a dimension of 7mm (.275") or larger to be a choking or dental hazard.

- What is the shape of the plastic or rubber fragment that is most likely to get into the food product? Wire-like shapes have more detection variability due to variations in orientation passing through the metal detector.

- What type of resin is being molded or extruded and what is the desired end use color? Blue is most popular because there are very few blue foods, so this provides a visual alert. Darker colors like purple, green, red, orange, gray and black are fine. White & yellow are generally impractical.

- The customer should test pieces of metal-detectable plastic or rubber ***with*** the food product because the food plus a piece of detectable plastic will produce the longest signal. This confirms satisfactory detectability with the customer's application and specific metal detector settings.

- The metal test spheres, or detectable plastic & rubber pieces are easier to detect close to the detector coils located on the bottom, top, or sides of the metal detector tunnel.

Inspection process variables including metal detector sensitivity, reject settings, food product effect, contaminate shape & orientation, conveyor speed, food temperature, food product volume, food conductivity, factory EMI, proper metal detecting conveyor design and installation results in customized settings that are "taught into" the detector for each food type and package size. It is important that the customer conduct trials to verify if a given size and shape of a plastic or rubber piece can be detected.

Please contact Eriez to discuss your application requirements, additive compatibility, typical additive loadings, and metal detectability or X-ray contrast testing of your samples.