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Permanent Magnet Yokes

Permanent Magnet Yokes have been available for Magnetic Particle Testing for many years. However, most of these original products (YM5 & PM5) used Alloy Type Magnets. As Alloy Type Magnets lose their magnetism in a finite amount of time, various efforts are employed to prolong the decay. Keeper Bars are provided with these products because they aid in keeping the magnetic circuit. If the magnetic circuit is broken (no keeper bar) the magnetism in Alloy Magnets will decay even faster.

Elaborate fixtures are available to remagnetize these Alloy Magnets, costing far more than the original Yokes. Unfortunately, the more often Alloy Magnets are remagnetized, the shorter the life of the field. The original design of these products, and the limited market, do not permit the manufacturers to use more modern materials. The original YM5 lifts only 18kg (40 pounds), which no longer complies with ASTM E709 or E1444. All this being said, one can not dispute the many advantages of the total portability of Permanent Magnet Yokes.

Rare Earth Magnets (Elements) have been known for many years, and as the name implies, the elements are, in fact, rare. However in the early 1970's Rare Earth Magnets became more readily available due to lower production costs, and have become relatively inexpensive in the last 15 years. Rare Earth Magnets hold their magnetism for a very long time, and depending on the element, half life is typically over 50 years.

Western Instruments WM-Series of Permanent Magnets, all employ specially formulated Rare Earth Magnets. The Magnet Cartridges used on the WM-5 and WM-5LT are easily field replaceable, in the unlikely event of a failure or diminished magnetism. With the use of Rare Earth Magnets, WM-Series Yokes do not require remagnetization or keeper bars. The operator can expect many, many years of use from these Yokes.

All WM-Series Yokes lift more than required by industry specifications (23kg / 50 Pounds), however these same specifications reference maximum pole spacing. This pole spacing is more critical than lift for testing, as a magnetic circuit is required for testing. This circuit requires the negative field, on one pole, to travel to the opposite or positive pole. These maximum pole spacings, can not exceed 150mm (6"), the extra pole spacing on WM-Series Yokes allows convenient positioning of poles for maximum contact to the workpiece.

Many specifications discourage the use of Permanent Magnet Yokes, why? There is no particle mobility (like any DC field), so extra care must be used in applying particle, and/or to remove excess particle to see indications more clearly. If guidelines for Pole

Spacing are ignored, then there will be an absence of a Magnetic Circuit, thus no field, and therefore no test.

Finally, when these specifications were initially developed, equipment manufacturers wanted to supply capital equipment (Mobile Power Packs), and not portable hand tools (Yokes). These specifications therefore discourage the use of the *Yoke Method*, however the safest Pressure Equipment Industries in the world use only Yokes for MPI. These early specifications often approve the use of Prods, which have not been used in the last 30 years!

Western Instruments manufactures two basic types of Permanent Magnet Yokes; the Cable Type (WM-5C), and the Hinged Frame Type (WM-5 & WM-5LT);

- The Hinged Frame Yokes look very similar to the original YM5, however, the WM-5 and the WM-5LT have several advantages;
 - The flat and angled contact surfaces (Pole Pieces) provide a better ability to follow workpiece contours.
 - The Pole Pieces rotate far easier, again, making contour following easier.
 - These Permanent Magnet Yokes produce far more field (lift) than the YM5, thus performing a better inspection.
- The Cable type Yokes are preferred by industries where the *Yoke Method* has been totally accepted.
 - Cable type Yokes are lighter than the Hinged Frame units.
 - Pole Pieces are easier to remove from the workpiece.
 - The flexibility of the Cable permits the Pole Pieces to be easily positioned, making these units the most convenient to use.

Which type of Permanent Magnet Yoke is the most popular? That depends on the area of the World and the type of industry. In southeast Asia Hinged Frame units are the norm, as industry considers them proven. In North America's Pressure Equipment Industry, Cable type units are the most common as Yokes in general are more accepted. The *traditional* Marine Industry only uses the *traditional* Hinged Frame units! While on large Mobile Mining equipment Cable Type units are common, as like these Yokes, the large size of the equipment is new.

In my opinion, Cable type units have not displaced Hinged units yet, because until the WM-5C was introduced, Cable units looked shabbily made. The WM-5C's ergonomic design and Safety Orange Pole Pieces set it apart from the 'fabricated' PM5, and the several copies of it in the world. Plastic Housings (PVC Tubing) on Permanent Magnet Yokes, like their electrical counterparts, do not stand up to rough handling. The WM-5C captures the magnet both mechanically and magnetically, while operators complain of magnets falling out of the plastic units. The contact face of the WM-5C is copper, and protects the workpiece from the very hard magnet material. Plastic units are made inexpensively, so the hard magnets are in direct contact with the surface of the workpiece. Finally, due to the superior engineering and design of the WM-5C, the Magnetic Circuit is more efficient, it lifts more, and thus produces a beneficial field.

Finally the proof. Until the WM-5C was introduced in Australia, the most common Permanent Magnet Yoke in the Country were Hinged Frame units. In under 18 months the WM-5C has accounted for half of the sales in Permanent Magnet Yokes.