

# Western Instruments

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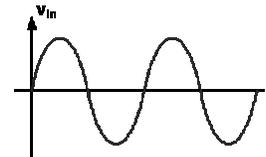
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## Inspection Fields & Particle

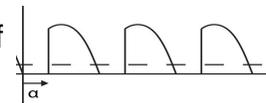
### Mobility

This article serves as an overview of the different types of Magnetic Fields that are applied to a work piece by Western Instruments Portable MPI Equipment (Yokes and Coils). Particle Mobility, are the forces that effect the movement of Magnetic Particles on the surface of the workpiece. The higher the Particle Mobility the faster, and more reliable, the particle will congregate to a defect or a change in surface profile. Let us first outline the fields produced by Yokes; 1

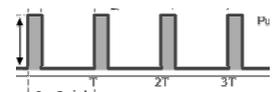
**AC Yokes:** These fields provide the greatest Particle Mobility as the frequency of the power simply causes the Particle to vibrate. The polarity at each pole (leg) alternates from positive to negative at the same frequency as the electrical input current of 50 to 60 Hertz (pulses per second).



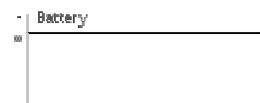
**AC / DC Yokes:** The fields provided by the AC Portion of these Yokes is identical to those outlined above. The DC Portion from these Yokes is a Phase Controlled pulse or rectified AC. The inductance of the Yoke's Coil and Iron Core is enough that the Field Induced into the material is Straight DC, with a slight 'ripple' due to the AC input frequency of 50 or 60 Hertz



**Battery Operated Yokes** take the 12 Volts DC from the Battery and Chops the current, simply turning the field on and off at 125Hz. This Chopping of the electrical supply lowers the effective draw on the battery, thus extending the useful life of a charge. As the chopped current keeps re-energizing the coil, the flat level of the DC curve is interrupted creating a ripple affect that induces some particle mobility



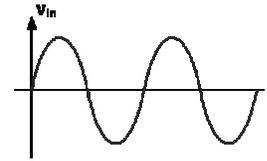
**Permanent Magnets** simply induce a Magnetic Filed into the work piece, almost the equivalent of a Full Wave DC field. As a result, there is no change in the strength or polarity (frequency) of the field .thus there is very low Particle Mobility.



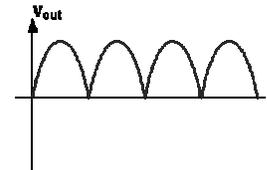
To summarize the Particle Mobility of Magnetic Fields induced by Yokes, we have noted that AC provides the best Particle Mobility, with Half Wave DC being second, third from Battery Powered with Permanent Magnet Yokes last. However, let us be mindful that a DC Field will highlight both surface and subsurface defects while AC only highlights surface indications. So in conclusion, a DC Field with a more pronounced collapse,

between pulses, would be beneficial for increased Particle Mobility. Now let us discuss the fields produced by Coils, and specifically *Multi-Turn, Low Amperage Coils*;

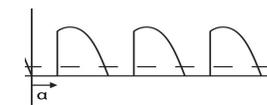
**AC Fields** produced by Coils, similarly to Yokes, provided the best Particle Mobility. However, while many think of an AC Coil as powerful, it is only testing the surface of the work piece. Producing a greater AC Field Strength provides no greater benefit to the inspection. Portable Coils that produce AC Fields are acceptable for surface inspection and not very effective in demagnetizing even the smallest parts.



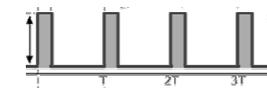
**DC Fields** produced by Coils with a higher number of Turns, such as a WD-Series Coil, produces a very strong field, due to the Wire Core absorbing any pulsing effect. Therefore, this type of DC Coil should be considered as a Full Wave device. When this type of Coil is energized, the resultant Ampere Turns is very high with the capability of magnetizing a workpiece of great mass.



**DC Fields** produced by low inductance Coils, such as the WP-Series, are again a Phase Controlled pulse or rectified. The inductance of the Coil is low enough that the Field Induced into the material is similar to a DC device, but the slight 'ripple' due to the AC input produces some



**DC Fields** similar to those high ampere turns produced by WD-Series Coils can also be produced by Coils with a Low Inductance, such as the WS-Series. This type of Coil requires a DC Pulses from circuitry referred to as Capacitive Discharge. These high intensity pulses are activated, about once per second, from these Full Wave Capacitive Discharge Power Supplies. Such Pulses are often called Capacitive Discharge, and can be found on cable wrap devices called *CD Boxes*. Such Pulse Coils induce a very Strong Residual Magnetic Field similar to the high Inductance Coils referred to above.



The primary use of Coils over yokes is a larger area can be inspected with a single activation of the tool. Furthermore, Coils are able to induce a much stronger magnetic field into a work piece.

For to many years basic AC Coils were the only portable Coils available, which were all to often miss applied. Today, with advancements in Electro-Mechanical technology, Portable Coils can be properly applied to the needed inspections. A very interesting outcome of this technology is Portable Coils can be far stronger than Wet Horizontal Coil shots. Furthermore, the ability to perform Reversing and Reducing DC Demagnetization portably at a comparatively low price.