The Impact of Magnetic Array Filtration on Particle Capture and Retention

Background

- Hydraulic systems are critical parts of most agricultural equipment
- Approximately 90% of hydraulic system failures are due to fluid contamination

Objectives

- Determine the effects of applying MAF collar on particle removal rate in hydraulic fluid
- Create a transparent filter to observe particle accumulation
- Design a linear magnetic filter with a sight glass for more magnetic coverage in future tests

Conclusion

- MAF collar produces a higher particle removal rate than a traditional hydraulic filter
- Transparent filter confirms that metallic particles are accumulating within the magnetic field applied to the filter
- Further research will determine if a linear magnetic array filter will produce a faster particle removal rate in high flow situations

Acknowledgements

- Research funded in part by Stewart Research Award
- Special thanks to Jeff Fleenor and Anthony Lo of Fleenor Manufacturing and Dennis O’Neel of Magnetic Filtration Company

Methods

MAF Collar

- A Donaldson P165335 filter was tested with and without a Magnetic Array Filtration (MAF) collar
- 1 gram of spherical <10 micron iron particles was added to the system
- Three different flow rates were tested (0.8 gpm, 2.2 gpm, and 4.6 gpm)

Transparent Filter

- A transparent polycarbonate filter casing was designed and built using the filter media from the Donaldson filter
- Tests were run and time-lapse photographs were taken using a Go-Pro camera

Linear Filter

- Linear magnetic array filter was designed for potential high-flow applications
- Linear arrangement of magnets will allow for more magnetic field coverage as the fluid flows through the filter

Results

MAF Collar

- The particle removal rate was higher with the MAF for all three flow rates than without the MAF
- The largest difference between the particle removal rate with and without the MAF occurred at the lowest flow rate, while the smallest difference occurred at the highest flow rate

Transparent Filter

- Conducted tests at 180 psi and 2.5 gpm flow
- Iron particles could be seen accumulating along edges of magnet pairs

Linear Filter

- SolidWorks model was designed
- Time and cost of construction prohibited production of a prototype