Case Study Title: Oil filtration solution for cast iron honing

General Information

Business Group:	**Godrej & Boyce**
Site Location:	**Mohali**
Site Executive Officer:	**Abhishek Sharma**
Project started:	**July 2018**
Project ended:	**Oct 2019**

Purpose & Goal:

The purpose of this project was to develop a fine filtration solution for oil used during honing operation of cast iron components to:

1) Continuously supply clean oil & reduce/eliminate the need for oil disposal
2) Increase in average oil life
3) A decrease in no. of component rejects/rework
4) Increase in the life of honing tool

Abstract:

Godrej & Boyce, Mohali performs cast iron component honing as part of their overall manufacturing process.

The filtration system installed initially was not able to separate the fine honing dust from the oil. As a result, oil life, component quality, and machine life were major concerns from cost, quality & health & safety points.

Transor India took up the challenge to develop an efficient filtration for this honing oil. Multiple offline and online trials were conducted at both Pune and Mohali on dirty oil, oils of different makes and viscosities, and a range of different Transor carbon fiber and paper filter elements. After more than a year's worth of efforts from the engineering teams at both Godrej and Transor, an effective solution was finally arrived upon using a combination of prefiltration, Transor compact paper filter elements, and oil of specific make and viscosity.

The problem at hand:

After honing operation, the size of cast iron particles ranges from 0.5 microns to 5 microns. The filtration system installed initially was a combination of a magnetic prefilter plus a simple gravity-based paper filter. This filter was unable to separate the cast iron dust from the oil effectively.

Actions for finding & implementing a solution:

- Conduct a filtration trial (August 2017) on existing dirty oil using a Transor paper candle and carbon fiber candle elements- TME (Please refer figure 4 below)
- Carbon fiber candle elements delivered an excellent flow and quality of oil in the trial compared to paper candle elements. (Please refer Figure 3 below)
- A fully automatic filtration unit was installed at Mohali in July 2018. This unit contained 80 back flushable carbon fiber candle elements, with a design life of 12 months. 2 honing machines were connected to this unit.
- This unit worked satisfactorily till October 2018. The filter pressure became too high at this point, indicating the filter elements were choked and not delivering the required output flow. This early failure of filter elements meant that the cast iron dust stuck to the filters, and the backwashing was not effective.
- This issue's corrective action was; to replace filter elements in a single vessel with four filter vessels, each containing one back flushable paper Transor compact filter (TCF) element. (Please refer Figure 4 below)
- These paper candles also choked within a month.
- The cause of ineffective backflushing may be a combination of filtered material (cast iron in this case), additives in oil that reduce compressed air backflushing, the concentration of dust in the oil, and the viscosity of the oil.
- Trials were conducted in Pune using different oils and cast-iron dust from Godrej to arrive at the issue's root cause.

Oil Brand	Filter Pressure (bar)	Flow per candle (lpm)	Comments
Originally used by Godrej	3.1	19	Starting pressure is unusually high
Viscosity- 5 cst @ 40 deg C	3.5	15	Pressure after backfluch starts at 2.9 bar
	3.8	10	The pressure never comes below 2.9 bar
	4	8	
Oil brand- 1	0.9	37	Starting pressure on dirty oil- 2.2 bar
Viscosity- 3 cst @ 40 deg C	2.2	26	Pressure after backflush- 2.1 bar
	2.5	24	
	3	20	
Oil brand-2	0.5	60	Starting pressure on dirty oil- 2.1 bar
Viscosity- 5 cst @ 40 deg C	2.1	40	Pressure after back flush- 2.1 bar
	3.5	32	Clean oil pressure- 0.5 bar, which is best amongst all tested
	3.9	17	
Oil brand-3	2.3	26	Starting pressure on dirty oil- 2.3 bar

Viscosity- 4 cst @ 40 deg C	2.7	22	Pressure after backflushing- 2.2 bar
	3	20	
	3.2	19	

- Based on the above results, Transor recommended to Godrej to use lower viscosity oil.
- Trials were conducted on this oil and new compact filter elements, four different times using different filter compression pressures.
- A rare-earth magnetic separator was also added as a prefilter to increase element life. But desired life of the filter was not being achieved. (Please refer Figure 1 below)
- Finally, Transor recommended to Godrej to change the oil brand.
- Honing oil from brand-3 was filled in the unit with new filter elements in Sep 2019.
- This oil change led to a dramatic improvement in filter pressure. This configuration is now in use with excellent results, low filter pressure, and adequate flow. (Please refer Figure 3 below)

Organizational Impact

Benefits were achieved for Godrej & Boyce as desired in terms of manufacturing costs related to tool life, rework/rejects of components, and oil life. Additionally, due to the increase in oil life, the environmental impact is reduced.

Measurability

Transor achieved the following project goals:

1) Continuously supply clean oil & reduce the frequency of oil disposal – Achieved.
2) Increase the average oil life from 4 months to >12 months - > 200% increase
3) A decrease in no. of rejects from 100 per month to <5 per month - 2000% decrease
4) Increase in the life of honing tool from 1000 hours to 5000 hours - 400% increase

Conclusion:

Transor's honing oil filtration system for cast iron is working very well at Godrej & Boyce, Mohali, and the configuration is highly recommended for this application.

Photos

Figure 1Rare-earth high Gauss magnetic separator for prefiltration to reduce dirt load on main filter elements.

Figure 2 Filtration result on original oi (5 cSt viscosity oil) (l - clean oil, r - dirty oil)

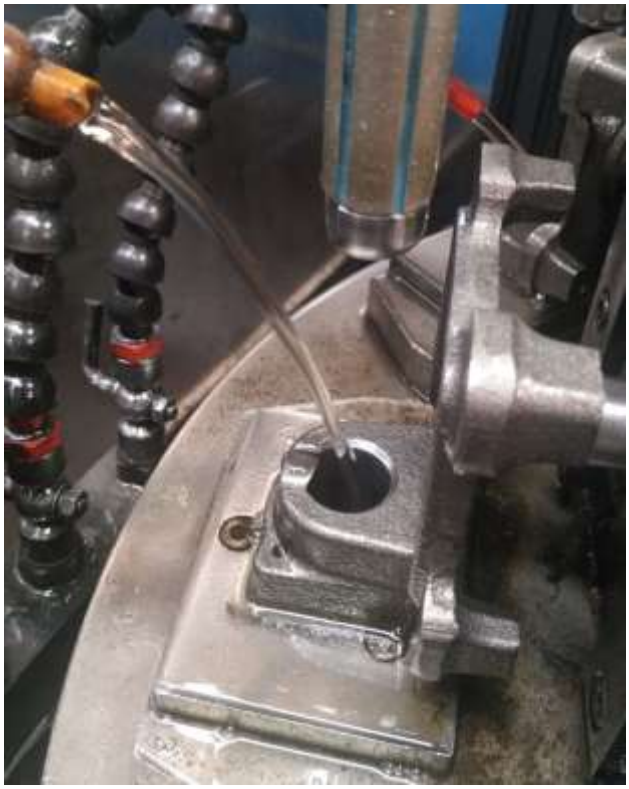

Figure 3 Final filtration result on Transor recommended oil

Figure 4 L- Transor Compact Filter (TCF), R- Transor filter element (TME)

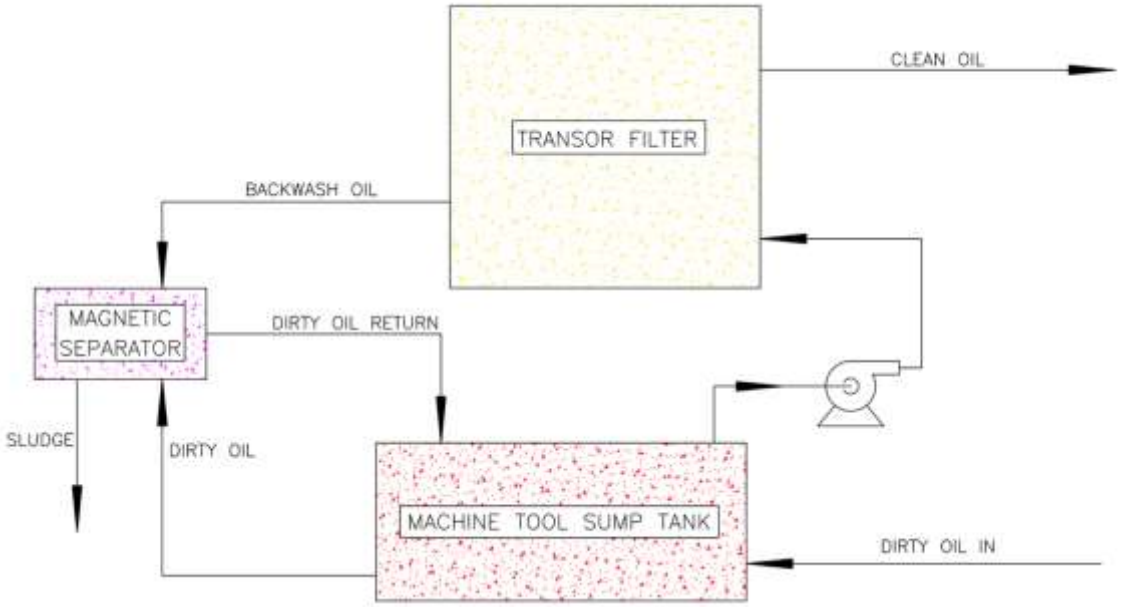

Figure 5 Schematic diagram of final filter configuration