AUTOMATC VACUUM FILTERS FOR SIDE LOOP CARBIDE GRINDING FILTRATION

AN ECONOMICAL ALTERNATIVE FOR HIGH PRODUCTIVITY

By Polytech-Filtration

Small automatic vacuum filters can provide more convenient operation than cartridge filters and lower cost than more complex filter systems used in tool and cutter grinding operations.

Many carbide tool and cutter grinding operations use simple cartridge filters to maintain their grinding oil at reasonable clarity levels. These filters operate on a side or “kidney” loop where oil is drawn from the grinder oil reservoir, pumped through a pleated cartridge filter and returned to the tank. Oil supplied to the grind zone is pumped directly from the oil reservoir. Regular filtration of the grinding oil extends the oil life, extends abrasive tooling life and reduces carbide deposits in the grinder and oil reservoir. Some reservoirs are fitted with a simple pre-filter tray where some solids can be removed before reaching the reservoir.
Typical side loop cartridge filter flow schematic (Side Loop Schematics1.pdf)

This arrangement is simple, inexpensive and a great improvement over oil reservoirs with no filtration at all. It does require regular attention for cartridge element changes, cleaning of contaminants that settle in the tank and changing the pre-filter media. As tool and cutter grinder productivity increases with improved machine design, faster stock and automated stock feeders, the need to service the tanks and filters increases.

As carbide swarf load increases and chillers are added handle the heat of pumps with higher volume and pressure, the simple cartridge system becomes inadequate. When this point is reached, the traditional response is to use much larger full flow filters where 100% of the oil is filtered before being returned to the grind zone. Historically, this filter is often a back flushing type paper disc edge filter. These filters do provide very good filtration and effective back flushing for long media life. They tend to be relatively complex, expensive and ill-suited for use with stainless or high speed steel tool grinding as the filter vessel packs with swarf.

A fundamental trade off in filter design is filter area versus the size and cost of the filter. For a given flow rate, more filter area keeps the flux (fluid velocity through the filter media) low so that more of the available pressure drop across the media can be used to build up a greater contaminant load before the media must be replaced, reducing operating cost. A full flow filter

capacity must exceed the highest oil supply ever needed, plus an additional 10-15 % to provide an oil reserve for uninterrupted supply to the grinder. The cost is increased by both the filter area required and the added complexity of providing an uninterrupted oil supply.

Polytech's development of vacuum filter technology over the past decade yielding vacuum filters suitable for use with high aerated grinding oil and our extensive testing of various filter media allow us to offer a middle path for carbide and steel tool and cutter grinding. By utilizing a smaller filter sized for, let's say, 1/3 of the maximum oil demand and foregoing the equipment required to provide an uninterrupted supply of filtered oil, a small side loop vacuum filter can provide the benefits of automatic filtration at a fraction of the cost of full flow filters.

A side loop automatic vacuum filter flow diagram is shown here: Side Loop Schematics1.pdf. In this case, all the contaminated oil discharges from the grinder into the contaminated oil section of a small vacuum filter. A portion of the oil is filtered while the rest passes through the contaminated section to the grinding oil supply pump. As the unfiltered oil passes through the filter section, larger particles can settle out to the media/swarf conveyor. The filter features a spent media/swarf conveyor that indexes the bulk roll filter media as required. The filter media is supported by a perforated plate that connects to the vacuum chamber. The filter pump draws oil through the filter media and discharges filtered oil to a small clean tank. This clean tank overflows into the main filter section adjacent to the grinding oil supply pump. The clean oil tank allows fully filtered oil to be circulated to a chiller heat exchanger to reduce maintenance associated with cleaning the heat exchanger.

For a grinding application where 60 GPM is needed in the grind zone, our side loop filter might have filter section suction characteristics as shown in the .pdf file above. Across the full operating range, the flow through the filter section would be between 25 and 15 GPM so that at least 25% of the oil delivered to the grinder is freshly filtered and entire volume is turned over several times an hour. The point at which the media is indexed is determined by an adjustable vacuum switch allowing faster filter turnover or longer filter cycles for more economical operation.

With proper media selection, we see carbide grinding applications where the oil in the clean tank is clear to the bottom and there is no visible sedimentation after months of production grinding. Filtration flow rates of 4+ GPM per square foot of filter area at up to 25 inches of mercury vacuum (0.8 bar) are common.

This type of system would be well suited for use in a grinding cell where two or more grinders can share a single filtration and temperature control system.

We think that the convenience of simple, automatic filter operation, the elimination of swarf in the grinding oil reservoir and well filtered grinding oil at very competitive cost are compelling reasons to consider this tool and cutter grinding oil filtration alternative.