

Problems occurring due to oil lines on circular knitted fabrics

by Mukesh Gupta.

Oil lines on circular knitted fabric, is a common problem faced by knitters. This problem of oil stained fabric becomes intense with cotton / elastane plated fabrics, where pre-dye heat setting is essential. This article outlines a solution to eliminate this problem.

The needle of a circular knitting machine has a wet zone and a dry zone. The part of the needle which is inside the cylinder tricks and the cam boxes is the wet zone of the needle, which is in constant contact with the lubricating oil. The dry zone is the part of the needle which is protruding outside the cylinder tricks and cam boxes. This dry zone of the needle should be free of any lubricating oil. The needles make the contact with the knitted fabric and the yarn in the dry zone. The problem begins when the lubricating oil starts to migrate to the dry zone of the needles and then starts to transfer to the knitted fabric, causing oil lines.

The root cause of this problem

The question is how does the lubricating oil transfer from the wet zone of the needle to the dry zone of the needle? This oil migration to the dry zone of the needle is due to three major reasons, the wick effect of the trapped lint, surface tension properties of the lubricating oil and the reduced viscosity of the lubricating oil which enhances its flowing ability.

With time, in a running knitting machine, friction in the stitch forming elements causes the temperature of the cylinder and its associated parts to rise. This rising temperature causes the viscosity of the lubricating oil to reduce dramatically. This drop in viscosity of the oil makes the oil flow more easily.

Viscosity is a measure of the flow ability of a liquid. An example of the variation in viscosity with temperature for a famous brand of lubricating oil for circular knitting machine is highlighted below:

- ❖ At 40 °Centigrade viscosity of this oil is approximately 14.3 [mm²/s].
- ❖ At 100 °Centigrade viscosity of this very oil falls approximately to 3.6 [mm²/s].

Options available to a knitter

The knitter has only a handful of options available to solve this problem. One option is to reduce the amount of oil that is being injected into the knitting machine, but this solution is dangerous and it may cause the temperature of the knitting machine to rise excessively and may even lead to disastrous consequences including ceasing. The other option available is to stop the knitting machine and to arrange for intensive cleaning of the knitting zone by high pressure compressed air to remove oil and lint that maybe trapped in the dry zone of the needle and



Suction nozzle placed on the dry zone of the needle to extract oil and lint.

lastly to completely strip the knitting machine to remove all the lint trapped in the needle tricks and the cam boxes. All the above solutions are temporary and involve considerable cost and stop time for the knitting machine. Irrespective of what is done, the problem recurs and there seems to be no solution in sight.

Probable solution

A simpler automated solution without involving worker intervention or stopping the machine is required. The trapped lint and oil needs to be removed from the dry zone of the needles either by 'blowing-it-off' by compressed air or by 'sucking-it-off' by vacuum. Blowing-it-off is not an option since there is a danger of discharging the contaminants on the knitted fabric itself. A probable solution will lie in extracting, by vacuum suction, any oil or lint from the dry zone of the needles, as and when they are generated. Only such a solution will be successful and will not require worker intervention or stopping the machine.

Oil and lint extractors from Cleantech

Cleantech has developed an oil and lint extraction system, which consists of two purpose designed oil and lint extracting suction nozzles, which are placed on the dry zone of the needle, just above the cam boxes on the rotating cylinder. The rotating cylinder ensures that each needle is subjected to suction by a nozzle, two times in each revolution of the cylinder. High volume suction air flow is provided by a purpose designed low power vacuum generator based on maintenance and oil free side channel regenerative blower.

Any oil or lint trapped in the dry zone of the needles is sucked out and removed to the waste and oil collector in the extraction system. The filters in the extraction system are



Extractors installed for a Mayer & Cie single jersey knitting machine.

designed to separate the lint and oil. Lint is trapped in the filters and the oil is collected and discharged to an external container. The extraction nozzles are designed to act only on the exposed dry zone of the needle and not to extract any lubricating oil from the needle tricks or cam boxes of the knitting machine.

Outcome of full scale industrial trials

Full scale industrial trial was done with an aggrieved knitter, who was frequently plagued by this problem. The following observations over six months were made during the commercial trial.

- ❖ The fabric produced was devoid of oil lines and 'knitted-in-oil-stained lint'.
- ❖ There was a 25% reduction in operating temperature of the knitting machine.
- ❖ Reduced temperature meant lesser evaporation of oil, which led to reduction in lubricating oil consumption.
- ❖ Reduced machine temperature provided the opportunity to increase rpm of machine, thereby obtaining a corresponding increase in productivity.
- ❖ This increase in productivity was enough to set off all costs for this extractor over a 12 month period.
- ❖ There was marked improvement in the overall quality of fabric and a complete absence of oil soiled fabric.
- ❖ No worker intervention or machine down time was required for this oil and lint extracting solution.
- ❖ The oil that was extracted to the collector could be reused.

Inference

The trials were highly successful and also the cost of the extraction system was not prohibitive. The power consumption of the extractor at 0.5Kw was deemed affordable. This simple extraction system has a small footprint of about 300mm² and was easily accommodated on the floor without any obstruction. This is effective solution to eliminate oil lines from knitted fabric with a spin off of reduced oil consumption and reduced machine temperature. ♦