

Firbimatic Sealed Perchlorethlyne Cycle

The Firbimatic washer allows manufacturers to use solvent cleaning in their plants while still adhering to environmental regulations in place to limit solvent use. The Firbimatic is designed with these specifications in mind, and controls the environmental impact of the solvent used.

The machine is hermetically sealed. Parts are loaded manually or by an automatic pusher into the process area, where solvent spray is applied as a pre-wash/gross cleaning cycle. Solvent for this first step is obtained from a storage tank, known as Tank #1.

The solvent spray removes up to 70% of the soil from the parts, and then is pumped into the still for the distillation process that separates oil from solvent. The still is heated via plate and frame steam heat coils, which warm the solvent until it becomes a clean solvent vapor. In the first still, the oil is reduced to a level with 15% solvent. The vapor is clean due to the fact that the oil (or lubricant) cleaned off the parts boils at a higher temperature than the solvent. The solvent is sent to a second still, where the remaining oil is boiled. In industrial applications, virtually all of the solvent is boiled out of the oil using this dual still system. When the still is not cleaning solvent from the pre-wash cycle, it is still running. The still is operating continuously, drawing from Tank #1 and boiling the solvent to vapor, and then directing it to the condenser.

The soil not boiled in the still travels via closed plumbing system into a storage drum, where it waits to be hauled away by a licensed hauler. Using a qualified hauler keeps the soil (with less than 5% solvent content) from contaminating the surrounding environment.

The clean, vaporized solvent moves to a chiller, where a plate and frame exchanger uses chilled water to condense the clean solvent vapor back to liquid form. The liquid solvent is then stored in a second, smaller tank, where it is kept until the final fluid rinsing stage.

In the immersion stage, after the pre-wash stage, new solvent is drawn from tank #1 and pumped into the process area for submersion of the parts. The parts are covered completely in solvent, and at this point different mechanical actions can assist in the cleaning process. The basket can remain still, it can oscillate back and forth to move parts in the basket, or the entire load can be completely rotated on a constant basis to provide a more aggressive action. Also, a vacuum can be used to remove air bubbles in the process house so that ultrasonic action can be more effective.

The process development team determines the appropriate mechanical action after evaluating the design of the part to be washed. Once the submersion is complete, the used solvent is returned to the holding tank #1, where it is eventually drawn into the distillation process.

In the next stage, the parts receive a final solvent fluid rinse. The solvent that has been cleaned, vaporized, re-chilled and directed to tank #2 is used to rinse the parts before being pumped back into storage tank #1.

Following this fluid rinse, the parts are then subjected to a clean solvent vapor rinse with that vapor which is generated from the still. The vapor becomes fluid again when it comes into contact with the parts and removes the remaining soil. The vapor also warms the parts to prepare them for drying, and the condensed vapor returns to tank #1.

Once this cycle is complete, the parts are ready for the drying cycles. Using an electric fan, airflow is generated across the heated steam coils and into the process area to facilitate drying. The air is driven out of the process house and moves along the chilling coils to cool back down before it passes through the fan again. This cycle of air continues for a pre-determined duration to assure adequate drying is accomplished.

The heated drying cycle is followed by the vacuum drying cycle. A vacuum pump lowers treatment chamber pressure, which allows for the solvent to boil at a lower temperature. Therefore, the remaining solution is evaporated from the parts at the lowest possible temperature.

Charcoal absorption is the next phase in the process. This process assures that no solvent fumes are able to exit from the process area to the operator area. A fan directs air circulation through a Coalperc activated carbon recovery unit, which filters the air to remove solvent fumes. Once the concentration in the chamber is below 1g/m³, or 150 PPM, the process area door can be opened and the parts are removed.