Electrolux

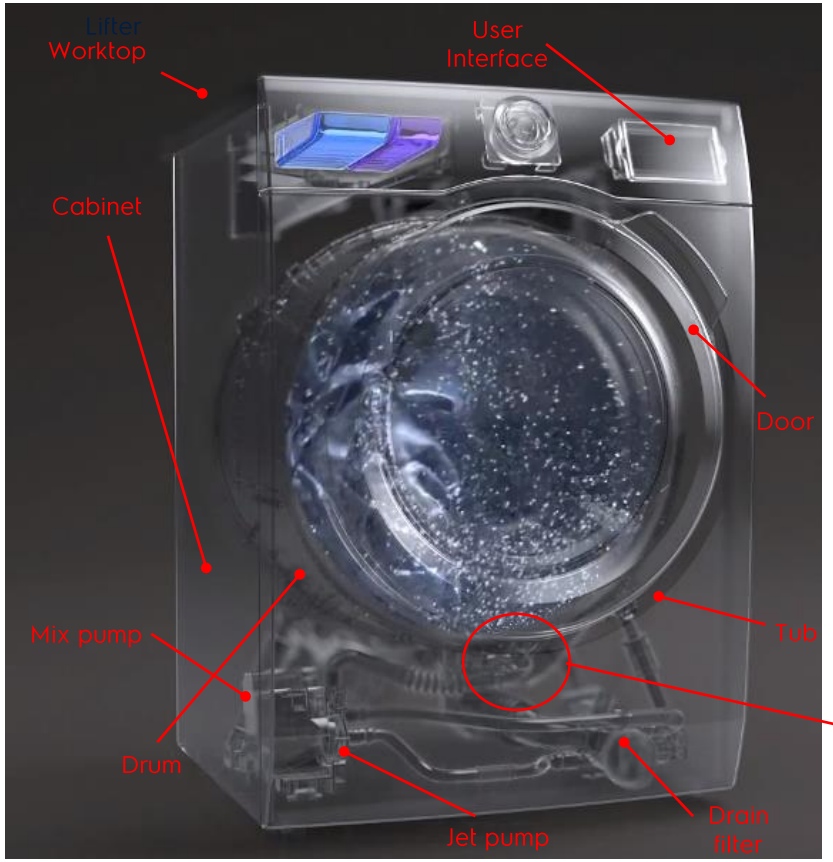
Horizontal axis washing machine

Contents

- Architecture overview
- Laundry process insights
- Standard washing cycle overview
- Water re-using & quality

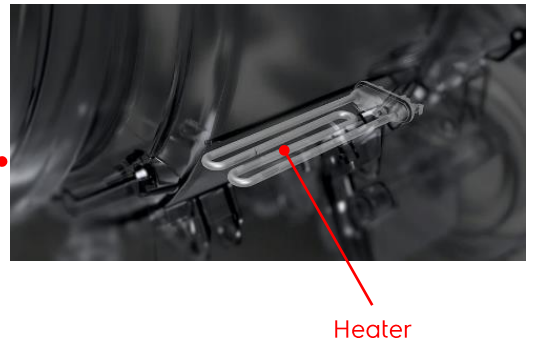
Architecture overview

Cabinet: holding structure, including worktop
Tub: it is an immovable tank that holds the wash or rinse liquor, fitted with a door through which machine can be loaded and unloaded.
Drum: it is a perforated cylindrical cage that rotates on a horizontal axis within the tub, holding the fabric load to wash. The inside of the drum is fitted with lifters and these, as the drum rotates, raise the load and then let it fall back into the wash or rinse liquor. Several revolutions in one direction followed by others in the opposite direction are used to avoid the load becoming tangled and knotted, to exert an effective mechanical action and to improve load mixing.
Hydraulic circuit: inlet and outlet valves to supply water, pumps to recirculate water through the tub and drum or to drain water out, drain filter, etc …
Electric drive, heating element, electronic boards, control system, etc …



Main sensors

- Pressure switch: its's used to monitor water level inside the tub and therefore water quantity.
- NTC (negative temperature coefficient) thermistor: it's used for monitoring water temperature in the tub.



Laundry Process insights

Main purposes of washing:

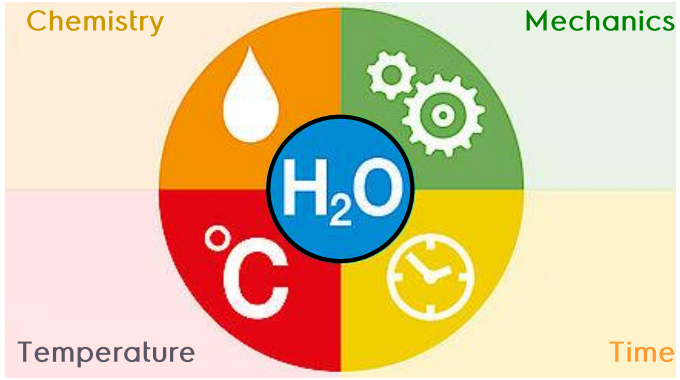
- Assure soil removal from textile fibers, soil transportation minimizing redeposition on textile fibers and soil discharge.
- Prevent fabrics from whiteness and brightness degradation, chemical/physical damages, loss of physical characteristics like softness and fluffiness.

Sinner's Circle states that four independent factors influence the performances of the washing process. These are the chemical, thermal and mechanical actions and time. If the role of one factor is reduced, the loss must be compensated for by increasing one or more of the other factors to maintain the same level of washing performance.

In the current household laundry appliances the **water** is the cleaning medium that enables the functions of these four factors. The water is used to transport and dissolve the detergent, to transport heat, to apply an hydrodynamic pressure on the textile fibers and to remove the soiling and detergent from textile fibers.

Surfactants: decrease surface tension allowing water to spread over textile surface; help dissolution of non water soluble soil such as oil and grease (hydrophobic tails stick inside fat particles; hydrophilic heads stay on surface of fat particles and have strong affinity with water; so fat particles are made water soluble)
Builders: e.g. phosphates, zeolites and sodium carbonate; help soften hard water by removing calcium and magnesium ions; this enhances action of surfactants and helps remove soil molecules, as they are often bound to fabrics by calcium ion bridging
Bleaching agents: e.g. compounds of chlorine or oxygen; help removal of soils like blood and rust; destroy microorganisms like bacteria
Special additives: e.g. enzymes break down organic compounds like fats, sugars and proteins
Detergent concentration
Water: agent for dissolving and transporting detergent ingredients

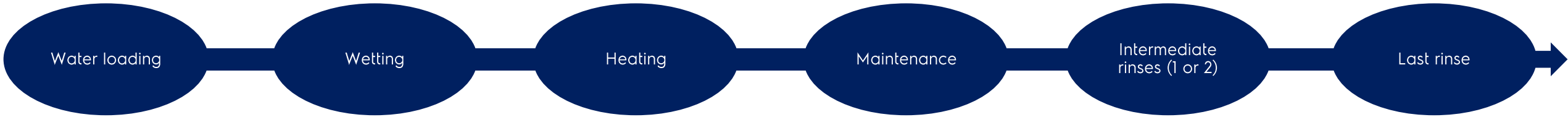
Drum rotation: makes fabrics rub against one another and fall to strike against drum wrapper, generating rubbing & pressure on fibers; falling angle of load depends on drum speed & diameter
Drum construction: higher diameter and lifters increase mechanical action; scoops increase water movement
Load ratio: drum volume/dry load; over loading reduces mechanical action because load has less space in which to move within drum
Liquor ratio: water volume in drum/dry load; low water level in drum leads to high amount of rubbing
Water: agent for providing hydrodynamic force on water soluble soil (e.g. sugar, inorganic compounds, food), for transporting released soil away from fibers and for diluting detergent solution during rinse



Soil solubility: increases with temperature for greasy soil; temperature weakens binding forces of soil on fabric; some soils (e.g. protein soils like blood) solidify on fibers if quickly heated over ~30°C; higher temperatures cause redeposition of particle soil (greying) during rinse
Kinetic action: chemical reaction speed doubles with each 10°C rise in temperature
Disinfecting action: for temperatures >65°C
Water: agent for transporting heat to the laundry

Contact time: washing process duration must be controlled so that on one hand proper interactions among textile, soil and chemical agents are allowed, but on the other is not unduly prolonged causing higher redeposition of particle soil (greying), colour fading and mechanical damage of textiles (wearing)

Standard washing cycle overview



Water is loaded by electro valves connected to water network, it enters the drawer where detergent has been placed by the user.

Laundry saturates with water, refills might be needed in order to load the right amount of water (pressure switch is used for controlling).

Heating element is active in case the user doesn't select a cold programme. Heater is on until the target temperature (e.g. 60°) set by the user is reached, check is made on the NTC signal.

Only drum tumbling is performed, at the end of this phase, drain pump is activated and washing liquor is drained and the first spin is performed for extracting water from laundry.

Fresh water is loaded for removing detergent & soil residuals from clothes while drum tumbles; at the end an intermediate spin is performed and water is drained outside the machine.

Fresh water is loaded by passing through softener compartment, a short maintenance phase is performed before final spinning and draining.

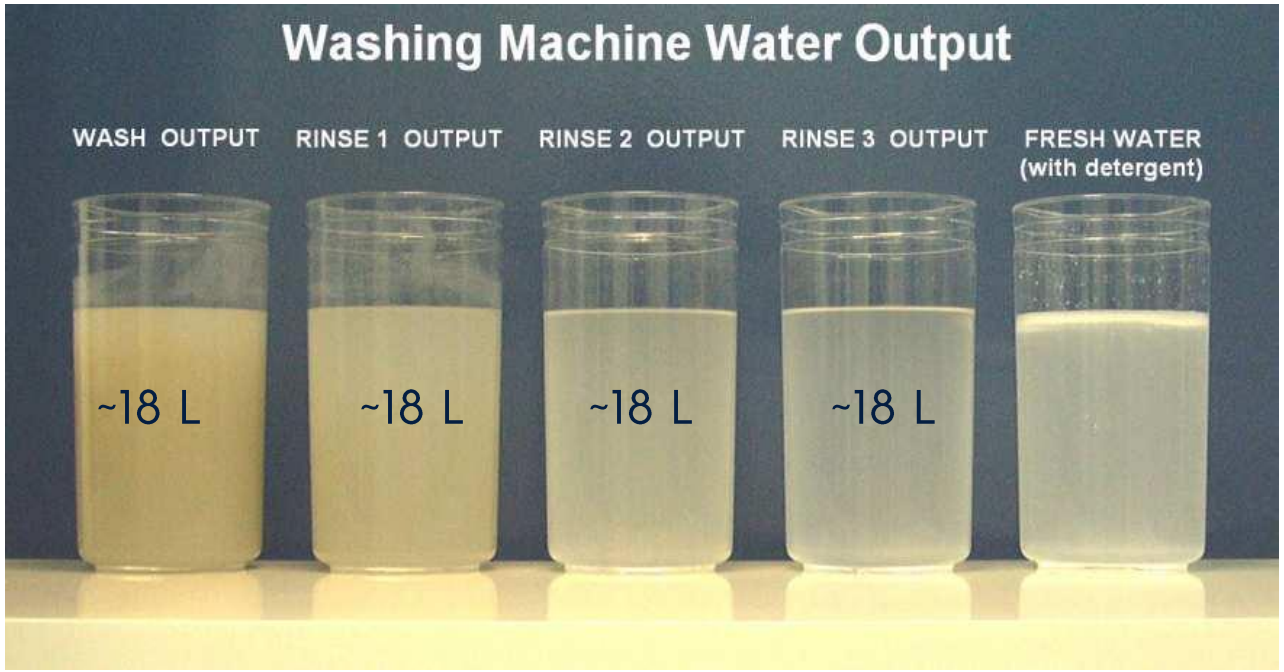
Water re-using & quality

Theoretically drained water can be stored in a tank and reused in subsequent washing cycles, however its quality needs to be taken into account.

Water colour/turbidity is an indication of quality and it depends on how dirty laundry is.

Stagnant water in a tank can generate bad odours and bacteria growth if stored for long time.

Regular laundry



Very dirty laundry

Wash output Rinse 3 output


Electrolux