PARIS-Autonomous cleaning system for Parabolic Troughs

PARABOLIC TROUGHS’ CLEANING

Parabolic trough (PT) solar fields are comprised of thousands of structures that support parabolic shaped mirrors that concentrate the solar radiation in an absorber tube located in the focus of the parabola through which the heat transfer fluid flows. The solar field is composed of hundreds of collectors squarely arranged.

The reflectivity of the mirrors and the absorbance degree of the tube are key factors that directly affect the energy production of the plant. This reflectivity is very much affected by the soiling degree of the mirrors and the tube, thus being the cleaning an indispensable maintenance activity for guaranteeing the production of the plant and for maximizing its efficiency.

The cleaning system by wet brushing ensures, in comparison with water jet cleaning, a high cleaning efficiency in one pass while minimizing the water and fuel consumption, being the most effective cleaning method to maintain the average reflectivity factor of the field in an optimum level.

Brushing cleaning requires a high level of accuracy in the operation in order to ensure the cleaning without any damage.

The well-defined homogeneous distribution of the collectors along miles of road, and the accuracy requirements of the cleaning performance make the application of an unmanaged and autonomous cleaning system perfectly suitable to carry out a repetitive activity as the solar field’s cleaning.

PARIS SYSTEM

PARIS is a cleaning system designed, patented, manufactured and commercialized by SENER that performs an autonomous and distributed cleaning of the PT plants, optimizing the cleaning with the minimum operation costs.

The vehicles PARIS are characterized for being autonomous, performing an unmanaged cleaning thanks to its GNC software.

PARIS performs a wet mechanical cleaning using rotary brushes able to significantly raise the reflectivity factor of the mirrors in just one passing. This efficiency allows reducing the cleaning frequency as well as minimizing the water and fuel consumption.

PARIS is a 4x4 low weight vehicle which minimizes the impacts on the roads while improves its maneuverability. Its small size allows it’s on field parking, minimizing downtime deployment and collection of vehicles.

Its water and fuel capacity allow long cleaning autonomy. The PARIS’ independence of driver allows it to operate without scheduling time limitations.
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PARIS’ OPERATIVE

PARIS is positioned at the entrance of one loop in front of the collector at the beginning of the operative. Automatically, PARIS calibrates its position and starts the operative cleaning one line of collectors, then autonomously crosses the distance between the two parallels lines and closes the loop cleaning the frontal line of collectors. Once one loop is finished, PARIS covers the distance between loops to repeat the operative in the contiguous loop.

PARIS is the only vehicle that cleans the mirrors vertically, from the top to bottom. One brush cleans the upper semi parabola while a second identical brush cleans the lower semi parabola. The absorber tube is cleaned by pressure water. Another novelty is the fact that PARIS cleans while stopped, thus minimizing the risk of mirrors or tube’s damage. Once the vertical cleaning is performed, PARIS advances and starts again the cleaning.

One vehicle or a set of PARIS vehicles distributed on field perform an autonomous and simultaneously cleaning of the plant with the only participation of an operator for support tasks (start up and shut down, water and fuel refueling, daily maintenance and parking). In this way, the cleaning capacity is maximized per operator thus minimizing the costs.

Additionally, the independence of the human intervention in skilled cleaning procedures avoids human errors and allows the support tasks to be performed by the own O&M personnel of the plant as they are not specialized tasks.

MAIN FEATURES

- Autonomous unmanned vehicle. No driver is required.
- The operator performs punctual non-specialized support tasks.
- The own O&M personnel can carry out the operation.
- Minimization of the damages by human errors.
- High availability, not limited by the shifts timetable.
- Minimize the risk of damage due to its stopped cleaning.
- Its low weight minimizes the roads’ impact and fuel consumption.
- Its dimensions improves its maneuverability and minimizes the singular areas
- High quality of mechanical cleaning with minimum water consumption.
- High cleaning capacity and autonomy.
- Easy scalable solution and robustness to single failure.
- PARIS is designed for night cleaning, not affecting the daily plant production.

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