



# Cycleclean® Engine Wash

**Lufthansa Technik's revolutionary engine washing technology, Cycleclean®, is quick and simple, proven by more than 60,000 successful washes. Cycleclean® is available all over the world and is performed in Australia by 145 Aviation Services (Permagard Group). It enables airlines to clean their engines quickly and very efficiently. By using Cycleclean® regularly optimum performance can be achieved.**



## The situation

The airflow through a jet engine is enormous. But with the air being contaminated by sand, salt, chemicals and unburned hydrocarbons, amongst others, these particles adhere to the surface of engine parts leading to a phenomenon known as compressor fouling. The contaminated engine has to work harder to compress a defined amount of air. Therefore engine temperatures rise and more fuel must be injected to achieve the same thrust. This consequentially leads to faster engine deterioration.

## The solution – Cycleclean® by Lufthansa Technik

Washing a jet or turboprop engine on a customized cycle leads to a cleaner and therefore more efficient compressor. To achieve the minimum downtime necessary to perform the washing process as an integral part of aircraft operations, Lufthansa Technik developed completely new equipment (patent technology) which makes engine washing a quick and easy process.

A dual nozzle arrangement sprays water heated to 70 °C (160° F) with up to 70 bar (1.015 psi) directly into the core engine. Contrary to conventional washing methods, a fine and evenly distributed water mist follows the gas path. The amount of water injected is optimized for each engine type. This ensures efficient cleaning of the compressor and at the same time minimizes the amount of residual water remaining within the engine. The advanced equipment ensures easy preparation, short washing times and washing results second to none.

Cleaner engines run at lower temperatures, need less fuel and therefore emit less CO<sub>2</sub> and other harmful greenhouse gases. The improved overall performance achieved saves real money on MRO expenses during the engine's life cycle. Moreover, using Cycleclean® for your engine wash creates less work, avoids costly and time consuming towing (engine wash at the gate is possible) and yields less waste water. Thanks to the significantly reduced amount of water and its high precision, pinpoint injection, run-ups become obsolete with night curfews not being an obstacle anymore.

## Optimized washing interval

Engine washes should be performed at a defined interval. This has to be individually calculated with regard to the engine type, the operating conditions and operator-specific flight profiles to assure the optimum balance of washing efforts and resulting savings. While results vary between operating conditions and engine types, experience shows that frequent washes produce an average fuel flow reduction of 0.5 percent. Lufthansa Technik supports customers with consulting services and recommendations to identify the optimum cleaning profile.

## Customer advantages

- EGT margin improvement up to 20°C (36° F)
- Fuel flow reduction up to 1%
- Maintenance costs decrease due to higher on-wing time
- Greenhouse gas emission reduction
- AMM or a faster, customized EO procedure
- Customized and flexible business models
- Quick and easy washing during stopover possible

## Services

- Customized engine washing interval
- ECM data analysis of washing results
- Global wash network
- No post wash run-up required
- Overall service time for each engine less than one hour using a faster, customized EO procedure
- Options for complete wash service or for equipment lease available

## Contact

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The continuously growing Cycleclean® network



Capability

Lufthansa Technik currently offers the Cycleclean® Engine Wash for the following engine types. Further engine types will be added.

**CFM International**

CFM56-3, CFM56-5A, CFM56-5B, CFM56-7B, CFM56-5C

**General Electric**

CF34-8, CF34-10, CF6-50, CF6-80A2, CF6-80C2, CF6-80E1, GE90-90, GE90-110, GE90-115, GENx1B, GENx2B

**Engine Alliance**

GP7200

**IAE International Aero Engines**

V2500

**Pratt & Whitney**

PT6, PW120 Series, PW150, PW4000-94“, PPW4000-100“, PW4000-112“, PW6000

**Rolls-Royce**

AE3007, BR715, RB211-535E, RB211-524, Trent 500, Trent 700, Trent 800, Trent 900, Trent 1000, Trent XWB