



GE Energy

**WATER WASH SKID  
DESIGN MANUAL**

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## WATER WASH SKID DESIGN MANUAL

### 1 PURPOSE:

This specification concerns the Gas Turbine water wash skid.

The purpose of the system is to wash the gas turbine compressor during OFF & ON line phases.

The system is also used to injected water into compressor during Grid Frequency event.

The water is injected into compressor using the water wash system to reduce the net over firing of the gas turbine and to increase mass flow through the turbine in an attempt to restore grid frequency.

One skid per GT is required.

### 2 DESCRIPTION:

This specification applies to the description of use of an ON&OFF line pulsed mode washing module for a 6C or 6FA+e Turbine

#### 2.1 Constitution:

The compressor ON&OFF line washing skid is mainly composed of:

- ❑ A common base frame. , with a delimited area to collect potential detergent leakage. There are two solutions to drain this detergent leakage area :
  - Drain to a dedicated tank
  - Drain to the gutter around the WWS
- ❑ Tanks for demineralised water and detergent
- ❑ A water pump.
- ❑ Piping, tubing's and fittings
- ❑ Instrumentation
- ❑ Electrical cabinet

#### 2.2 Water wash skid:

##### 2.2.1 Mechanical equipment

- ❑ A 4 m<sup>3</sup> stainless steel water tank (**TK 111**) with a automatic stop filling valve **HV111**
- ❑ A pump inlet water strainer (**FLT 121**)
- ❑ A water pump (**P 121**)
- ❑ A 230 liters detergent tank (**TK 101**) with a automatic stop valve (**HV101**) when the tank is empty
- ❑ A venturi used to mix water and detergent (**EJR 121**)
- ❑ Manual isolation valves (**HV121/123**)

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### 2.2.2 Electrical equipment

- ❑ One heater to heat up the water (**EHTR 111**)
- ❑ A water pump motor (**MO 121**)
- ❑ A water solenoid valve (**FV175**) opened during OFF LINE rinsing
- ❑ A detergent motorized valves (**FV153**) open for the cycle with detergent during OFF LINE washing.
- ❑ A limit switch (**ZSL153**) on motorized valves (**FV153**) is used to verify closed position of the motorized valve (**FV153**) during on line washing and off line rinsing.
- ❑ An electric cabinet (**CAB 001**) for the interface with the operator (heating and pump starting, defect...) and the interaction with the speedtronic.

### 2.2.3 Instrumentation

- ❑ Two thermostats to regulate water temperature(**TSLH 164 / TSLH 163**). The **TSLH 163** is used to regulate the temperature between 10°C and 14°C for ON LINE washing and antifreezing situation. The **TSLH 164** is used to regulate the temperature between 78°C and 85°C for OFF LINE washing situation.

A water level gauge (**LG 161**) with a low water level switch (**LSL 162**) and hight water level switch (**LSH 166**). The **LSL 162** stops the pump or the heaters if the water level is to low (just above the heater).The **LSH 166** will be actuated when the water tank is full, and the information "water full tank" is send to the Speedtronic. A indicator light is added on electric cabinet (CAB 001).

- ❑ A temperature indicator on the water tank (**TI 165**)
- ❑ A pump inlet water pressure switch (**PSH 171**), to stop the pump if the pressure is not correct.
- ❑ A pump outlet water pressure switch (**PSL 173**) , to stop the pump if the pressure is not correct.
- ❑ A pump outlet water pressure indicator (**PI 172**)
- ❑ A pump outlet water flow switch (**FS 174**), to stop the pump if there is no flow.
- ❑ A detergent level gauge (**LG 151**)
- ❑ A detergent flow indicator **FI152**

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## 3 FUNCTION:

### 3.1 Washing general rules:

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Before to use the washing skid, make sure that the turbine is ready for a washing cycle ( inter-wheel temperature, air inlet temperature, valves on the turbine in the good position...) see the operation and maintenance guide of the turbine. Starting authorization for the washing skid (ON/OFF sequence) are given from the Speedtronic.

### 3.2 Off-line procedure:

#### 3.2.1 General

The Off Line washing cycle is controlled only by the local electrical panel.

The control (by relays) is made by the local electrical cubicle (**CAB 001**).

Off line washing pulse mode is controlled by the speedtronic.

In addition, a manual operating is necessary to prepare the WWS for off line washing.

A signal is transmitted by the module to the speedtronic to make sure that the water temperature is correct. f all permissives (gaz turbine, WWS) are given, the speedtronic starts the pulse mode sequences. The water heaters and water motor pump can not be energized in the same time. There are two phases , the first is the washing cycle with detergent and the second is the rising just with water. Washing with water or detergent should be done at crank speed or slower.

#### 3.2.2 Skid Preparation

1. The washing module assembly (piping, pump...) and the interconnecting pipes are heat tracing to maintain water at 10°C., **to avoid Turbine wheels thermal shock.(See GEK 107 122)**
2. Fill the detergent tank (TK 101) if necessary with the detergent quality required (see appendix table 3). Check the detergent level with the gauge (LG151) provided on the detergent tank. The draining valves HV102 must be closed
3. Make sure the electric cabinet (CAB 001) is energized.
4. Start heating up the water with the EHTR 111 heater. This heating procedure and the operations on the turbine can be executed simultaneously. The duration of the heating operation depends on the quantity of water involved , the ambient temperature and initial cold water temperature.

We need around 15 hours for heating water. So, it is better to anticipate this phase.

5. Control the water temperature with the thermometer (TI165) fixed on the tank (80°C mean value)

#### 3.2.3 Off line washing procedure

See table 4.

If the ambient temperature is higher than 4 °C, the washing operation is authorized.

The washing skid should be ready:

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