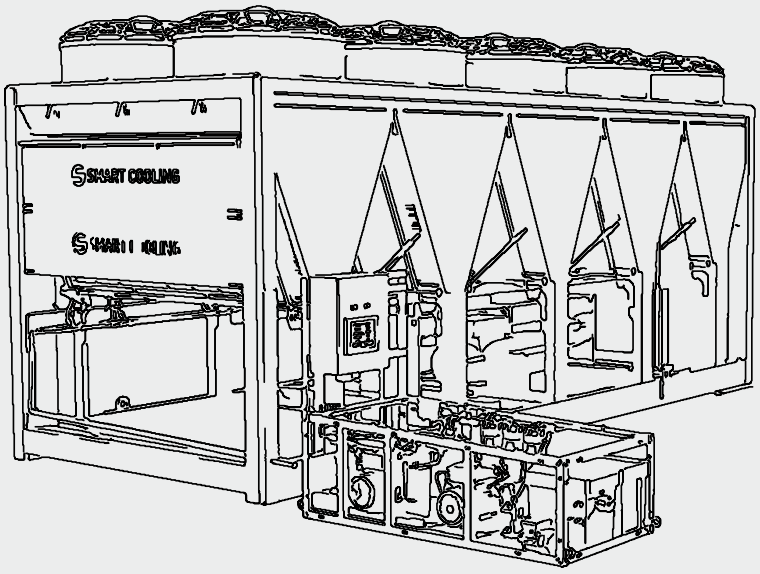
12 June 2019

TEST REPORT

009



SMART COOLING™ PRO10 SYSTEM

Fiat Factory

Test Participants:
Project name: **FPT INDUSTRIAL PLANT** Location: **Fiat Plant, Foggia, Italy**
Customer: **FENICE S.P.A.**
Installer: **CMA – Mr. Colangelo**
Swiss Integrated Energy Technologies: **Luca Gallarate**

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Introduction:

Type of structure: FPT Industrial Engine Test Room, Fiat Plant, Foggia, Italy.
Cooling units: Air cooled water chiller **RC Group Glider 920 V2 F10.**
Chiller booster: *Smart Cooling™ PRO 10*, adiabatic technology with condenser protection.

In September 2018, the intelligent adiabatic pre-cooling system *Smart Cooling™* was installed on the *RC Group* chiller used for engine test room cooling.

The *Smart Cooling™* system enhances chiller performance through an **adiabatic pre-cooling process** and **intelligent condenser protection**. The technology lowers condenser air temperature before it reaches the coils, reducing compressor load and improving efficiency.

Its main functions include:

- Control and elimination of calcium carbonate in water.
- Complete water sanitation, eliminating bacteria including Legionella.
- Regulation of water spray quantity for optimal adiabatic efficiency.
- Protection of condenser coils using special membranes that:

1. prevent water contact;
2. filter incoming air to stop dust and debris;
3. ensure even air distribution to prevent hot spots.

- Filtration and recirculation of unevaporated water to minimize consumption.

As soon as ambient conditions allowed, the system was activated for the summer season.
A performance test was then conducted to verify the actual improvement in EER (Energy Efficiency Ratio).

Main components:

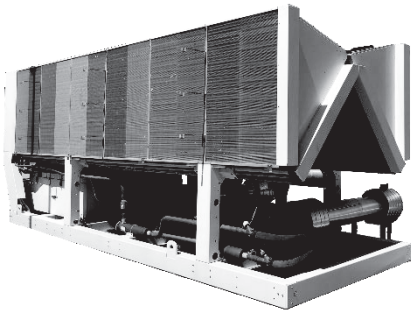
Smart Cooling™ comprises the following key components: protective membranes, water treatment and recirculation systems, high-pressure water pump, control unit, high-pressure nozzle panels, fasteners, and fixings.

- **Protective membranes** cover the condenser surface, preventing direct water contact.
- **Water system** purifies and sterilizes water to prevent mineral buildup and bacteria.
- **Pump** provides 70 bar pressure.
- **Control unit** regulates operation via real-time data (temperature, humidity, chiller parameters).
- **Nozzles** spray 5–40 µm droplets.
- A set of **fasteners and fixings** ensure the compatibility of the equipment with the chiller.

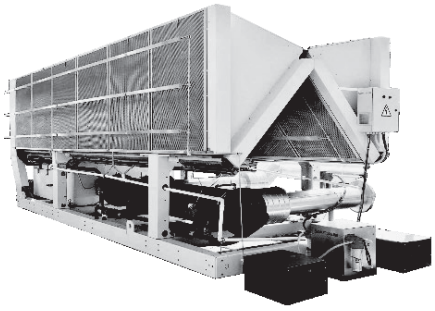
Measuring instruments:

Measurements used a **RIELS RIF 600 W** ultrasonic flow meter.
It measures flow based on **ultrasound time difference** across the pipe.
Connected to chiller pipes to verify efficiency with *Smart Cooling*™ ON and OFF
Energy data was taken from the **electrical substation**.

- **Formula:**
  COP = Cooling (kW) ÷ Electrical (kW)



Chiller **with** *Smart Cooling*™ *system*



Chiller **without** *Smart Cooling*™ *system*

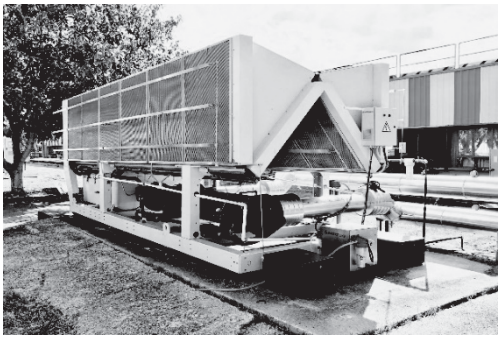
- **Equipment tested:** Air-cooled water chillers, **RC GROUP GLIDER 920 V2 F1**.

- Shown in **picture No.2** are the chiller's condensers fully enveloped by *Smart Cooling's*™ protective membranes, which prevent water mist infiltration and damage.

- In the foreground is the *Smart Cooling*™ pump station, pumping meticulously treated water at 70-bar pressure.

- The system is equipped with an automated Siemens controller.

- The system also includes a water drain line to re-filter and safely reuse water.



Picture No.2
Chiller equipped with chiller
equipped with **Smart Cooling™**

Testing *Smart Cooling*™

During the test, the *Smart Cooling*™ system demonstrated a **significant improvement in cooling efficiency.**

However, several operational characteristics of the existing chiller influenced the results:

- Fan control modification:
- The fan speed control had been changed from variable-speed (based on condensing pressure) to simple **ON** / **OFF** operation.
- This limited optimization of water use and reduced overall savings at low load conditions.

- Chiller oversizing:
- The chiller operated at 100% capacity for one hour, then decreased to 50%, later stabilizing between **30%–50%**, indicating oversizing relative to actual demand.

Despite these constraints, the *Smart Cooling*™ system produced measurable improvements in energy efficiency and cooling capacity.

Testing Data:

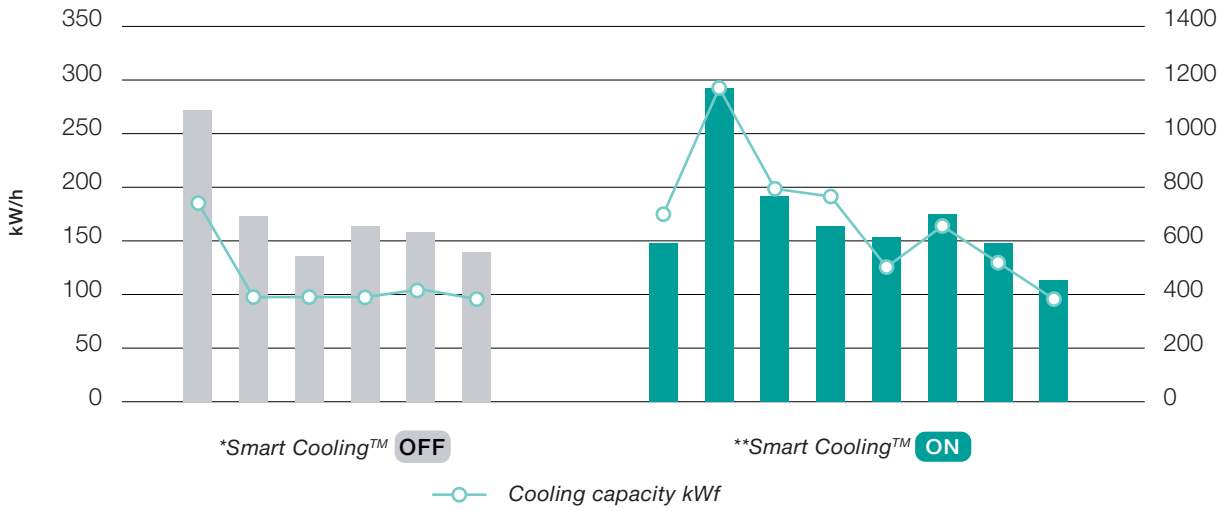
The comparative test was performed on **June 12, 2019**.
Energy readings were collected simultaneously with flow and temperature data to determine COP, cooling capacity, and energy savings with *Smart Cooling*™ OFF and ON

	Date	Time	Outside air temperature (°C)	Air temperature at the coil (°C)	Energy consumption (kWe)	Cooling capacity (kWf)	EER (ex COP)
SYSTEM OFF	12.06.2019	11:00	37	37	275	753	2,738181818
	12.06.2019	12:00	36	36	168	395	2,351190476
	12.06.2019	12:14	35	35	136	400	2,941176471
	12.06.2019	12:30	34	34	166	390	2,34939759
	12.06.2019	12:45	34	34	164	420	2,56097561
	12.06.2019	13:00	35	35	137	380	2,773722628
SYSTEM ON	12.06.2019	14:40	34	22,7	149	722	4,845637584
	12.06.2019	14:50	35	21,9	295	1190	4,033898305
	12.06.2019	14:57	35	22,3	196	816	4,163265306
	12.06.2019	15:21	34	21,2	165	760	4,606060606
	12.06.2019	15:53	37	25	152	485	3,190789474
	12.06.2019	16:20	36	24,9	158	586	3,708860759
	12.06.2019	16:46	37	25,8	146	478	3,273972603
	12.06.2019	17:00	35	27	129	380	2,945736434

During testing, *Smart Cooling*™ ON maintained an average condenser temperature **14 °C** lower than *Smart Cooling*™ OFF
This translated into a COP increase of **~1.9 points**, and an average energy saving of **21 %**, even with the oversized chiller operating under variable loads.

Smart Cooling™ system energy efficiency test

NOTE:
Average air temperature 35.2* **°C
*** Average air temperature 35.4* **°C (14:40-17:00)**



A. SYSTEM OFF – BOTH COMPRESSORS 100%

Time	Outside air temperature (°C)	Air temperature at the coil (°C)	Energy consumption (kWe)	Cooling capacity (kWf)	EER (ex COP)
11:00	37	37	275	753	2.738181818

B. SYSTEM OFF – ONE COMPRESSOR OFF, THE OTHER AT 100%

Time	Outside air temperature (°C)	Air temperature at the coil (°C)	Energy consumption (kWe)	Cooling capacity (kWf)	EER (ex COP)
12:14	35	35	136	400	2.941176471

A. SYSTEM ON – BOTH COMPRESSORS 100%

Time	Outside air temperature (°C)	Air temperature at the coil (°C)	Energy consumption (kWe)	Cooling capacity (kWf)	EER (ex COP)
14:50	35	21.9	295	1190	4.033898305

A. SYSTEM ON – ONE COMPRESSOR OFF, THE OTHER AT 100%

Time	Outside air temperature (°C)	Air temperature at the coil (°C)	Energy consumption (kWe)	Cooling capacity (kWf)	EER (ex COP)
15:21	34	21.2	165	760	4.606060606

Conclusion:

The increase in EER and energy saving have both been calculated keeping into account the issues previously reported. Following are the results:

Supposing:

- **5** Working days per week
- **10** Working hours per day
- **20** weeks per year with the *SMART COOLING*™ system ON
- Water average cost: **1,30 €/m³**
- Energy average cost: **0,12 €/kW**

The following results:

- Saved kW: **141.000**
- Water consumption: **183 m³**
- MONEY SAVING: **€ 16.000,00**

Installing the *Smart Cooling*™ system on the chiller proved to be a valid solution.
The system, furthermore, increases the “life” of the compressors:

- by keeping the condensation pressure uniform even when the air temperature changes,
- by keeping the coils of the chiller clean acting as an air filter.
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Undoubtedly, installing the *SMART COOLING*™ system on a chiller serving a productive or technological process (working at around 80% of its capacity) would have given much higher results in terms of SAVING (the average **saving in our climate is around 39%–40%**), but even in this installation it is possible to foresee a ROI of 8 (eight) operational months.

Luca Gallarate 
18 June 2019