



In all industries, the evaporative cooling towers have huge importance for the reliability and performances of the entire production process. Low spray quality, if not promptly detected and resolved, can quickly result in wet bottom, and, even worse, clogging of the tower hopper. This is a critical issue in terms of both production loss, high maintenance cost and danger for personnel.

Many industries approach the problem of monitoring spray system with the following solutions:

1. installing some devices like thermocouples in the lower portions of the tower or in the hopper, hopper pressure transmitters, discharged dust analysis, etc.
2. planning and carrying out frequent comprehensive lance maintenance and inspecting programs to visually check possible changes in flow rate and spray pressure, as well as of the spray quality.

Unfortunately, all these approaches, although of some help, are either unreliable (option 1), because too often the problem is discovered when it's too late and/or false alarms are provided during transient conditions, or (option 2), the operations are too expensive and provide merely a qualitative analysis on the spray system status.

### BoldEco Lance control box **SpraySentinel ES™**

To find a more reliable and less expensive solution to the aforementioned problems, BoldEco has recently developed a new dedicated control box commercially named **SpraySentinel ES™** that can be installed in both new and existing plants, regardless of the supplier or type of spray cooling system. Immediately after installation of the boxes,

**SpraySentinel ES™** controller carries out a 'self learning period' to record how the installed lances and nozzles are responding to the normal varying operating conditions. Then, after the learning period, the controller starts to detect all critical deviations of the working parameters of the cooling system and, when appropriate, to provide the operators with an alarm.

### **SpraySentinel ES™** operation

For both worn or clogged dual fluid and spill return nozzles, all performance variables show strong variations; see fig.1. BoldEco's new control system rapidly detects any early signs of performance variations and advises the operators that the nozzle should be immediately checked. During normal operation, the plant regulation system controls the quantity of water sprayed in the tower to maintain the temperature set point. It achieves this by changing the position of the regulating valve according to the PID loop output. As consequence, water and/or air pressures are normally not stable, but are constantly changing according to the gas flow and temperature fluctuations.

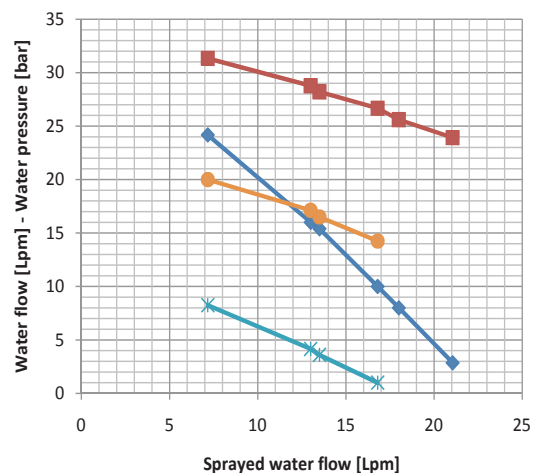
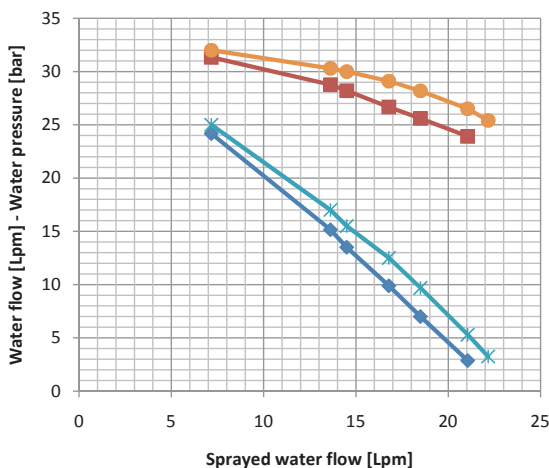
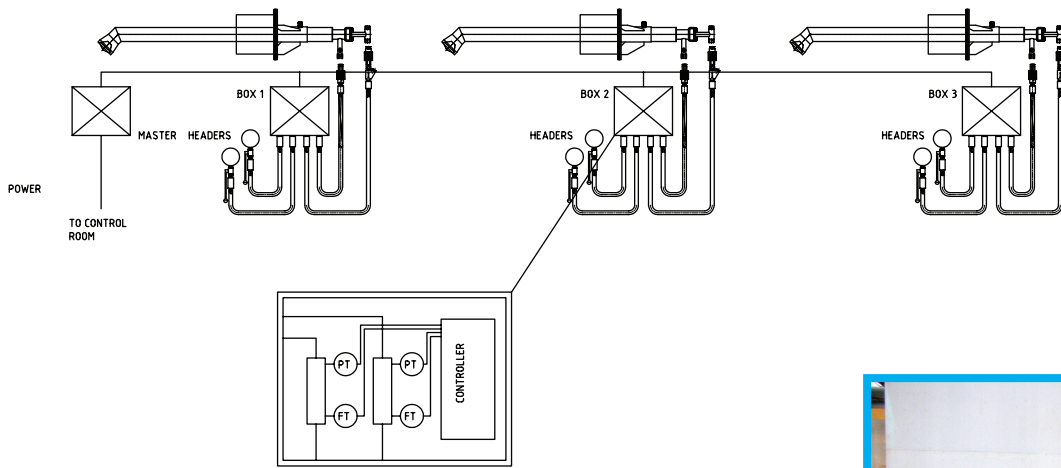


fig 1



By means of the several algorithms implemented in the **SpraySentinel ES™** software under the most stable conditions, the process variables of each lance are continuously stored in a process data matrix. These vectors of variables are statistically analysed to evaluate trends, average values and statistical data like variance etc. According to these analyses, the nozzle status is estimated for any operational instance. This allows the generation of predictive alarms even with limited data and under adverse conditions, by supplying an additional status weighted coefficient based on statistical reliability/error module calculations. In addition to these alarms, through the Master Box Controller **SpraySentinel ES™** also analyses all the differences among all lances in order to find any anomaly in their combined operation. These two operating modes are redundant. To create maximum accuracy, all differences between the lances are re-calibrated during the self-learning period in order to determine a baseline and provide the system with the highest predictability, repeatability and accuracy of all controls.

To confirm the effectiveness and reliability of **SpraySentinel ES™** already verified in several BoldEco lab tests, a complete system was installed in the evaporative cooling tower at a major cement producer in early 2010 (see Figures 3 and 4).

After almost a year, **SpraySentinel ES™** has been operating and providing continuous on-line monitoring of operational parameters of the cooling tower, confirming the major advantages offered by this system. Above all, this inexpensive control device represents a great opportunity to reduce maintenance and troubleshooting requirements, drastically reducing costs and freeing up personnel to attend to more important tasks, and reducing the possibility of lost production time. BoldEco's **SpraySentinel ES™** provides an extremely simple control output because its primary purpose is, and should be, to inform the user with the maximum speed and accuracy on the state of nozzle. Of course, all other in-depth information on the variables detected are made available in the subsequent screen pages. Besides the proven rapidity and accuracy of the Control Box outputs, the results of the first applications fully confirm the great improvement potential that **SpraySentinel ES™** offers for the maintenance optimization and problems prevention of any spraying system. A solution which immediately brings great benefit for increasing the reliability of the entire production process.

The final design of each **SpraySentinel ES™** control box is shown in Figure 5.

The control box is provided with simple led indicators for an immediate view of the nozzle status and with a small graphic screen where it's possible for the user to see all details of the measured variables.



fig 3: lance box installed at the Calusco (ITA) cement plant



fig 4: master box installed at the Calusco (ITA) cement plant



fig 5: final **Spray Sentinel ES™** design