

# Emissions reduction of a HRSG in AISCONDEL (SP) by using PILLARD GRC-INDUCT burners and Fluent® simulation

By JA. Tejuca, General Manager, PILLARD ESPANA S.A., Madrid (SP)  
FJ. Berdejo, Technical Manager, PILLARD ESPANA S.A., Madrid (SP)

## 1 - THE NECESSARY IMPROVEMENTS OF THE H-102 HRSG (Vila-Seca Aiscondel factory)

The Aragonesas Industria y Energia H-102 boiler at Vila-Seca (Tarragona) factory was fired by 2 natural gas Rodenhuis & Verloop burners. The performance of such type of burners was leading to high CO emission.

Aragonesas Industrias y Energia Group ("AISCONDEL"), taking into account their good and large experience with PILLARD burners, asked to reduce such CO emissions using PILLARD technology in order to comply with the new European regulations that will be in application in the future.

The decision consisted in changing the former burners to PILLARD GRC-INDUCT ones, and to optimize their installation thanks to the use of the FLUENT® flow simulation software.

After making such a simulation by fluid mechanics computational calculation, the new GRC-INDUCT burners (x 2) were designed and built.

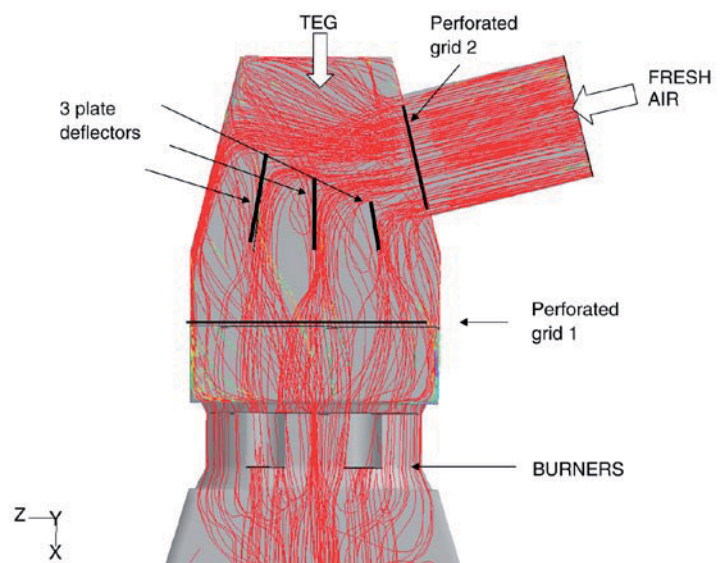
PILLARD ESPANA S.A. made the commissioning in November 2004 of the (2) GRC-INDUCT burners of 4 MW each, using natural gas which replaced the 2 x Rodenhuis & Verloop burners of the same heat release and using the same fuel.

### Boiler and burner technical data :

|                        |  |
|------------------------|--|
| Type                   | HRSG                                   |
| Designation            | H-102                                  |
| Steam type             | Superheated                            |
| Operating modes        | Fresh air or TEG                       |
| TEG temperature        | 525°C                                  |
| TEG flow               | 23.6 kg/s                              |
| % O <sub>2</sub>       | 15.8 %                                 |
| Fuel                   | Natural gas                            |
| Burner heat release    | 7.4 MW (total, i.e. 3.7 MW per burner) |
| Nb of burners          | 2                                      |
| Burner turn-down ratio | 1 to 10                                |
| Flame dimensions       | Length = 1600 mm, diameter = 1000 mm   |

## 2 - RESULTS OF THE FLUENT® SIMULATION BY PILLARD

The simulation when firing on fresh air mode allowed to prove that several deflectors and 2 grids were absolutely indispensable to balance correctly the air flow to the 2 x burners. The final simulation result (fig.1) confirms the smooth distribution of the current lines.



Path Lines Colored by Velocity Magnitude (m/s)

Feb 28, 2005  
FLUENT 6.1 (3d, segregated, ske)

Fig.1 : Final distribution of flow lines with grids and deflectors

### 3 - FINAL POSITIONING OF THE 2 PILLARD GRC INDUCT BURNERS INSIDE THE TEG DUCT

The simplified drawing and photos herebelow show the position of the 2 PILLARD GRC-INDUCT burners inside the TEG duct.

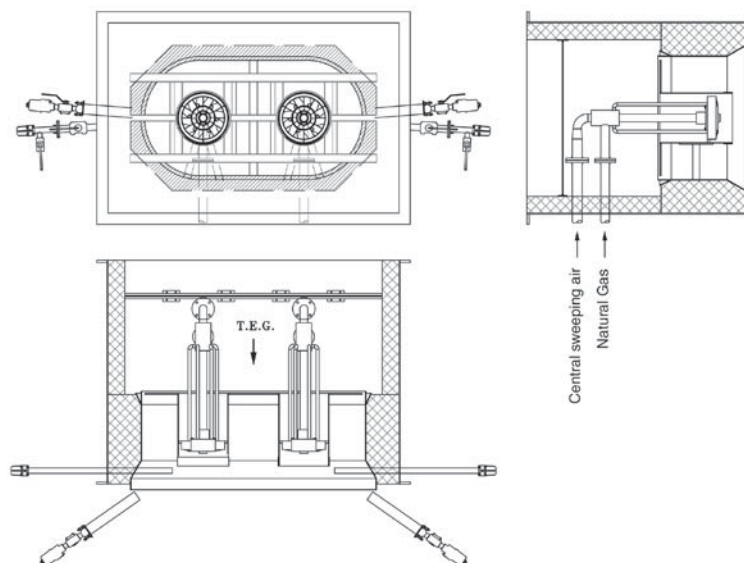


Fig.2 : Drawing of the TEG duct



Fig.3 : Photo of the 2 x PILLARD GRC-INDUCT burners



Fig.4 : Detail of the perforated grid located upstream the burners

### 4 - EMISSION MEASUREMENTS

| OPERATING MODE | BOILER PRODUCTION<br>tons/hr steam | O <sub>2</sub> % | Former RODENHUIS & VERLOOP burners |          | New PILLARD GRC-INDUCT burners |            |
|----------------|------------------------------------|------------------|------------------------------------|----------|--------------------------------|------------|
|                |                                    |                  | NOx (ppm)                          | CO (ppm) | NOx (*) ppm                    | CO (*) ppm |
| TEG mode       | 20                                 | 3                | 142                                | 177      | 41                             | 48         |
| FRESH AIR mode | 7                                  | 3                | 41                                 | 2393     | 23                             | 82         |

(\*) Average values at end commissioning in November 2004.

### 5 - CONCLUSION

- Further to the replacement of the former burners by PILLARD GRC-INDUCT ones, associated to a flow simulation by FLUENT® and adjustments during the commissioning time, huge CO emission reductions have been obtained : reduction of CO from 2400 to 82 ppm in fresh air mode.  
Other improvements reached by GRC INDUCT burners have been : HRSG's operation secured, strong flame stability, further reduction of NOx emissions, exhaust gases temperature reduction (efficiency increase).
- The capacity to obtain large emission reductions thanks to the use of simple and reliable methods constitute a step forward for which concerns steam production with HRSG and their good adaptation to the new environmental regulations.
- Finally, the decisive results allowed PILLARD to be awarded another purchase order for also replacing the existing burners (by new PILLARD GRC INDUCT ones) for the other H-103 HRSG of the same factory.