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# HRSG MODULE WITH LIFTING EYE LUGS DEFICIENCY AND LESSON LEARNED

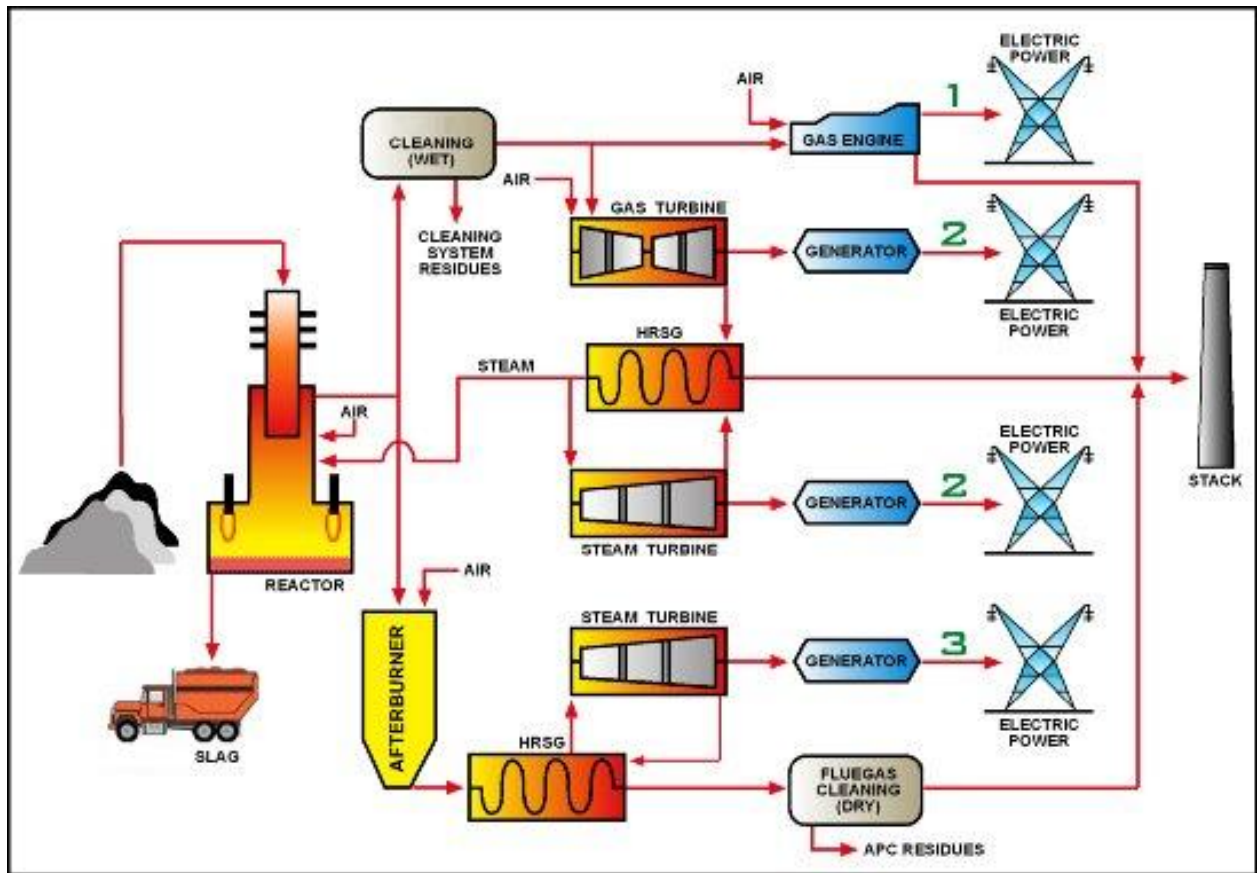
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## 1.0 HEAT RECOVERY STEAM GENERATORS



**Heat Recovery Steam Generators** also known as "**HRSG**" – are fundamentally boilers that capture or recover the exhaust of a prime mover such as a combustion turbine, natural gas or diesel engine to create steam. In another words, a HRSG module is used to recover energy from the hot exhaust gases or steam in a power generation. It is a bank of special steel tubes that is mounted in the exhaust stack. Exhaust gases as much as 800°F to 1200°F heat these special tubes.

Water is pumped and circulated through the tubes and can be held under high pressure to temperatures of 370°F or higher which can be boiled to produce steam. Furthermore, the HRSG separates the caustic compounds in the flue gases from the occupants and equipment that use the waste heat. HRSG's are found in many combined cycle power plants as shown in the diagram below.



*Schematic Flow Chart Showing Energy Recovery Configuration*

## 2.0 EXPERIENCE ENCOUNTERED / CAUSE OF EVENT

A number of HRSG modules were loaded in Thailand and bound for USA. We have seen two (2) types of lifting eyelugs on the HRSG modules namely the (a) welded and (b) bolted ones.

In this particular matter, the lifting eyelugs on the HRSG modules were bolted with four bolts and nuts. Lifting and loading operations of the said HRSG modules were safely carried out without incident. The HRSG modules were properly stowed and adequately secured under deck.

During the vessel's ocean passage, the vessel's crew had carried out a number of routine checks and tightening of the lashings that were considered slack. On one of the days of the vessel's crew routine checks, they discovered that some of the hexagon welded bolts on the shank were dislodged.

Pictures tell a thousand words and below are some pictures depicting deficiency noted on the HRSG's lifting bolted eyelugs.



*Bolts dislodged on HRSG's Lifting eyelugs*



*Bolts dislodged on HRSG's Lifting eyelugs*



*Hexagon welded bolt on the shank dislodged*



*Hexagon welded bolt on the shank dislodged*

Difficulties aroused at the port of discharge and alternative arrangements were made to discharge the subject HRSG modules units.

### 3.0 LOSS PREVENTION MEASURES

As a loss prevention measure, we recommend, *inter alia*, the following:-

- The use of such bolt connections should be purchased from the original manufacturer, or from a quality assured vendor to the original manufacturer's specification. The manufacturer may generally specify a maximum period that the bolt connection may remain in service and also provide relevant test certificates;
- Used bolts should be **avoided** unless permitted by the manufacturer. If in doubt, a 100% non-destructive testing (NDT) should be considered;
- A visual examination for any wear & tear, damage and/or corrosion should be carried out before they are installed;
- Bolt and nut threads should be free of damage and have a good tolerance fit, whilst still being free running;
- Bolt shanks should be free of defects;
- Nut and bolt heads faces should be free of damage or scuffing; and
- Bolt & nut components should be fitted in the correct sequence, location, and orientation.

### 4.0 CONCLUSION / FINALLY

The purpose of document / information is to provide the reader with our surveyor's past experiences from their investigation and hopes to contribute to the prevention of similar occurrences in the future.



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*Understanding **RISK** is knowing where to draw the line*

Thank you and Best regards,  
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P.S: We welcome any comments or suggestion with regard to the above. Kindly e-mail to the writer at [raj@cjamarine.com](mailto:raj@cjamarine.com)

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