Agenda

Exhaust Systems PG Meeting

29 June 2011, Total, Paris, France

09:00 - 10:40	1. Review of the March Budapest PG meeting minutes and actions 2. Failure Analysis - Review of the received operational feedback WHRU. - Review of operational feedback from HRSG.
10:40 – 11:00	Coffee Break
11:00-12:30	3. Cross reference with existing standards. 4. Design: Theoretical Analysis - Presentation of necessary boundary conditions to optimize the design of the exhaust systems - Presentation from Exhaust System OEM by ○ AAF ○ ALSTOM ○ BIH with GE O&G - Discussion to define the required boundary conditions 5. Presentation of the draft datasheet. - Cross-reference the results of discussion with the first draft of exhaust systems datasheet
12:30 – 13:15	Lunch
13:15 – 14:30	6. Discussion concerning steps ahead. 7. Project design and timeline: - work packages - roadmap
14:30 – 14:40	Coffee Break
14:40 – 16:00	8. Summary of meeting results and upcoming actions 9. Meetings in 2011-2012 - Discussion on preliminary agenda for upcoming meeting 10. Closing of the Exhaust Systems PG Meeting

List of Participants

Exhaust Systems PG Meeting

29 June 2011, Total, Paris, France

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1. Summary

During the workshop in Budapest it was decided to move ahead with the project group, cutting up the activities to be looked into, in to two parts: the operational approach and the theoretical approach.

This first meeting went as planned and the expected participants shared their feedback with the rest of the ETN project group members:

- The first part of the meeting was based on operational feedback and the crosschecking with the current available standards within ETN (thanks to SHELL and to STATOIL). (2,3)
- The second part of the meeting was based on presentations from different Exhaust systems designers and the necessary criteria to assure a proper design. (4)
- The last part of this meeting was the presentation of a draft data sheet to develop in parallel to the common standard that will be developed with ETN. (5)

2. Failure Analysis

a. Review of the received operational feedback WHRU by Total

b. Review of operational feedback HRSG by Alstom

The review of the operational feedback highlighted all areas that could be worked on in the standard and the points that would require modeling to be solved.

3. Cross reference with existing standards.

TOTAL reported on the cross checking of the operational feedback with the available standards.
It was agreed that the current standards are a good base to use in order to develop a common standard.
It was decided that, for the moment, the cross checking of the operational feedback with the available standards should only be done for the common part of the exhaust stack of the HRSG and WHRU. The bundle part would need to be reviewed separately, as well as the auxiliary firing burners.

4. Design: Theoretical Analysis

a. Presentation of necessary boundary conditions to optimize the design of the exhaust systems

b. Presentation from Exhaust System OEM by

i. **AAF** presented the design requirements for exhaust ducts, silencers, and stacks
ii. **ALSTOM** presented HRSG design process.
iii. **BIH with GE O&G** presented the joint datasheet and steady flow modeling they use for the design of the exhaust for the CLOV FPSO in Angola.

MJORUD agreed to share their listing of requirements that they have already established.
The combination of the design requirements will be made available on the wiki by 21 July 2011.

c. Discussion to define the required boundary conditions

Suggestions for additional design criteria were made by other participants and will be included in the combination of all the design requirements.

The last presentation raised the topic of adding turbulence to the flow modeling in order to complete the design assessment of an exhaust system. The opinion of the group was divided on this point:

- BIH stated that they don't have the time or the financial means to respond to a client's request including systematically this type of calculation.
- GE O& G validated that approach stating that their internal standard has up to now given a positive operational feedback and do not see the need to use turbulence modeling.
- MJORUD stated that they did not perform turbulence modeling in the past but do include it systematically at present.
- CAMFIL FARR & AARDING agreed that turbulence modeling is necessary to completely validate a new design but also confirmed that this time consuming, cost consuming and not always included in the project scope.
- FRAZER- NASH and RWTH AACHEN stated that according to the level of modeling done it should not be that time consuming nor expensive.

For the modeling of the turbulent flow, it is also necessary to know the thermodynamic and flow boundary condition of the turbine exhaust. These models or boundary conditions aren't provided by the OEM. STATOIL raised this point and asked GE O&G directly to see why these conditions cannot be provided. CAMFIL FARR commented that this is most likely proprietary data and is therefore not shared by the gas turbine OEM.

It was agreed that the best compromise would be to establish a boundary conditions table that would define the exhaust flow status sufficiently to use for the exhaust stack, while limited enough for the OEM to agree to share the information.

The group agreed to discuss this issue further at the next meeting.

5. Presentation of the draft datasheet.

TOTAL presented the draft of a datasheet which should accompany the drafted standard. This data sheet should list all the necessary boundary conditions for the exhaust system design.
It was agreed to pace this data sheet and the presentation on the wiki page so that everyone is able to review it together with their section of the combined standard.
BIH offered to share their existing datasheet on exhaust systems with ETN.
AAF proposed to color code the datasheet according to the parties modifying it.

6. Discussion concerning steps ahead.

It was agreed that the current structure of the existing standards would be used as a base to try to establish a common standard.

The presentations from exhaust designers illustrated the need of establishing a clear definition of what boundary conditions would be a minimum requirement for an adequate design. The presentations provided will be merged with the additional list provided by MOJURD and available on Wiki. GE O&G would see internally if it is possible to share their standard.

FRAZER-NASH stated that TULSA HEATERS has advanced quite far on this standard and should be contacted by Total for additional assistance and advice.

As a review of the combination of the two standards by each member would be a quite a time consuming activity, it was agreed to divide the standard into sections that will be reviewed and enriched by agreed parties, as detailed in the table below.

Section	Member	Date
Turbine exhaust and flue gas system	To be discussed and reviewed during next meeting	11/10/2011
Ducting (including sealing, expansion joint), silencer	Aarding and AAF	Week 39
Dampers	Mjørud, Camfil Farr	Week 39
Insulation and liners	Frazer-Nash, Camfil Farr, BIHL	Week 39
Mechanical and thermal design	To be discussed and reviewed during next meeting	11/10/2011
Tubes, fins, tube supports	Mjørud, BIH	Week 39
Instrumentation, control	Alstom, Mjørud	Week 39
Manufacturing	Statoil, Aarding	Week 39
Installation, commissioning	Total, Kanfa -Tec (to be validated with Kanfa-Tec)	Week 39

A webex meeting will be held on 1 September 2011 with the exhaust designers and turbine OEM's to establish a datasheet including boundary conditions criteria that would be acceptable by both parties. A detailed agenda will be sent out by the 15th of August.

7. Upcoming Actions

Action Owner	Description	Deadline date
TOTAL/ETN	To prepare and send the minutes of meeting	Week 28
ETN	To upload the presentations and MoM on the Wiki	Week 28
TOTAL	Too contact Kanfa-Tec about PG participation	Week 28
TOTAL	To merge the two standards into one	21/07/11
BIH	To provide their internal datasheet to ETN	27/07/11
MJORUD	To provide their internal criteria list provide to ETN	27/07/11
TOTAL	To merge the design criteria presented by exhaust designers	30/07/11
ETN	To upload the datasheet and the standard on the wiki	Week 31
TOTAL	To send the agenda for the webex meeting to ETN	10/08/11
ALL members	To review their assigned section of the standard*	Week 39
All members	To review their assigned section of the datasheet*	Week 39
All	To attend webex meeting 1 September 2011	01/09/11
GE O&G	To provide their internal standard to ETN (if possible)	27/07/11

(*) for the review of the standard and the datasheet it was specified that only comments will be made on Wiki, if modifications need to be made, it's better to provide them in a separate document and send it back to Amélie and Karen so it can be compiled.

8. Next Meetings

The need of a meeting dedicated to the means of modeling, the tools, what and how it should be modeled came out as a requirement to move forward.

It was agreed that the next meeting would be dedicated to:

- The theoretical design approach and the necessary tests.
- Tools and limits to define and establish an adequate model.
- The outcome of the WebEx meeting of the 1 September 2011

This meeting would take place on 11 October 2011 in the London area. A detailed agenda will be sent out by the 20 September 2011. ETN will assist in the logistical organization of the meeting.

Points pending to be included in the review:

- HRSG and WHRU specific bundle design criteria
- Auxiliary firing burners.
- The roadmap of the review and writing up of this ISO standard.

Minutes prepared by Amélie Pesquet