

Furnace structure visual audit - a pro-active tool

MICHAEL HORSFIELD EXPLAINS HOW A FURNACE REFRACTORY STRUCTURE VISUAL AUDIT HELPS TO SCHEDULE MAINTENANCE AND EXTEND FURNACE CAMPAIGN LIFE

It is well known that after a glass melting furnace has been designed to given parameters and installed, certain initial design parameters and criteria change.

These changes may be due to several factors including product range, market share, market environment, competition and customer requirements. Any changes lead towards production planning fluctuations of varying rates, eliminating the comfort zone of constant production for set periods of time.

Experiencing such changes can have a significant effect on the internal wear of the furnace refractory structure over the furnace designed campaign life period. It is also not uncommon to find that the furnace designed campaign life is required to be extended for varying reasons.

Because of the possible criteria changes – both known and unknown – and the possibility of a refractory structure failing in operation, it is increasingly important to observe the condition of the furnace refractory structure on a regular basis.

AUDIT FREQUENCY

Over the period of the actual furnace campaign life, an audit frequency should be identified for each year and extended years. It is recommended that one audit is conducted during the first year of the furnace being in operation. This will set the norm condition of each refractory structure area of the furnace and become a reference for future audits.

A typical recommended furnace audit schedule is illustrated in figure 1; the schedule may be changed to suit the age and condition of the furnace throughout the actual campaign life.

WHO PERFORMS THE AUDIT?

Day-to-day observations of the furnace refractory structure can be

carried out by 'in-house' staff who have a reasonable understanding of furnace refractory structures. However, it is an advantage to have audits carried out by an experienced external source.

To achieve the maximum benefits from an audit, it is essential that the people assigned to conduct it are experienced in the fields of refractories and furnace refractory structure design and construction, together with an understanding of hot repairs and maintenance techniques.

Such experience and knowledge helps to obtain a correct assessment of the furnace refractory structure condition, together with realistic and practical recommendations for required maintenance.

WHEN IS THE AUDIT EXECUTED?

A comprehensive and detailed audit is normally undertaken during the day period, when all the relevant plant staff are available for consultation and furnace operation changes, if required.

A less detailed and parallel audit may be carried out under 'lights-out' conditions, that is, during darkness hours with no factory lighting around the furnace. This audit helps to identify and further assess selected 'hot' areas around the furnace that may have been difficult to observe during the day period audit.

THE AUDIT REPORT

After each audit, a comprehensive and standard format report is written. This includes, for each area of the furnace refractory structure to be sectioned, a record of the observations made during the audit for each section and advice of relevant action points for each section.

Other data, including the outside face temperature of selected areas of the furnace refractory structure taken by an infra-red thermometer, sketches of the condition of

a particular structure, experienced views made by the Auditor and furnace operational information, may also be recorded as endorsement information to the main report.

SCHEDULED MAINTENANCE

From the action points identified on the audit report, a scheduled maintenance programme can be identified. This allows for 'pro-active' maintenance on a selected area of the furnace refractory structure and eliminates the need for 'fire-fighting' maintenance.

It is recommended that maintenance work identified after each audit is carried out immediately after the audit, by qualified and competent personnel, so that a problem area is made good as soon as possible and that a reported adverse condition does not become severe.

In order to achieve optimum results from maintenance work, it is recommended that the Auditor who has prepared the audit report is present during the execution of any identified maintenance work. This will help to ensure that the work is carried out to requirement and that optimum standards of workmanship are achieved.

MAINTENANCE CATEGORIES

Throughout the furnace campaign period, refractory structure maintenance work can be divided into two main categories to assist with efficient scheduling:

1. General maintenance, including:
 - Cleaning crowns and adjacent areas of any batch carryover deposit
 - Investigating hot-spot areas of the superstructure refractory areas and sealing any rat-holes
 - Removing insulation materials at identified 'hot' areas of the furnace to allow for natural or forced air cooling

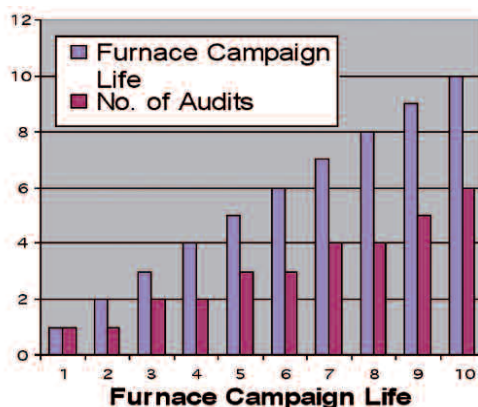


FIGURE 1: A VISUAL AUDIT SCHEDULE

- Re-positioning any loose brickwork at identified areas of the furnace refractory structure
 - Re-sealing expansion joints.
2. Major maintenance, including:
- Soldier block flux-line over-coat
 - Soldier block total overcoat
 - Electrode block over-coat
 - Throat over-coat
 - Superstructure and identified refractory structure reconstruction
 - Crown reconstruction.
- Prior to any maintenance

work being carried out, all Health & Safety and UK COSHH data for materials to be used must be prepared by the staff planning and executing the works, ensuring that all involved are fully aware of the contents of such documentation.

EXTENDING FURNACE DESIGNED CAMPAIGN LIFE

By implementing a schedule of audits over a designed furnace campaign life, a scheduled maintenance programme can be formulated which in turn leads towards extending this campaign life.

The scheduled maintenance programme allows a problem to be solved quickly and efficiently, before a possible refractory structure premature failure is experienced, which in turn may stop the furnace operation and productivity.

The audit helps to identify a potential problem at an early stage, which in turn, when rectified, maintains the strength and stability of the particular refractory structure in question, minimising premature failure and resulting in an extended furnace designed campaign life.

From the author's experience an extended furnace designed campaign life has reached up to two years and beyond, depending on the furnace type, glass being produced and furnace operation.

COMPLEMENTARY AUDIT SERVICES

To complement the furnace refractory structure visual audit, other services may be used to

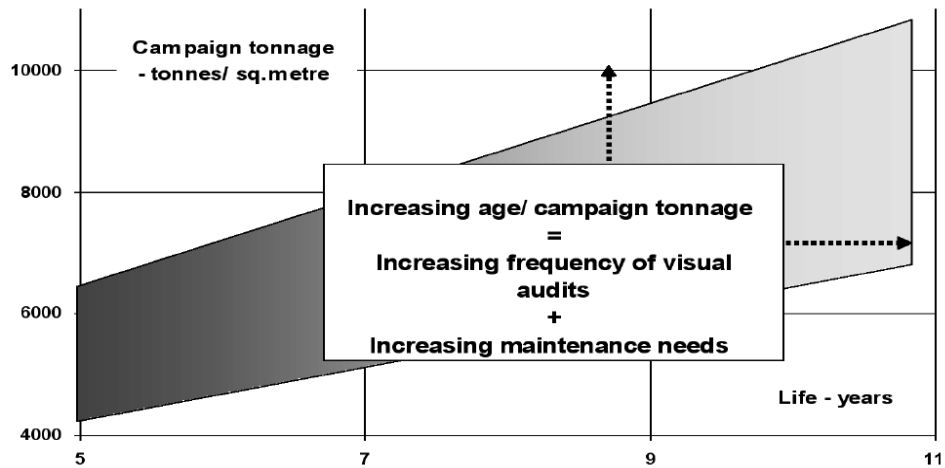


FIGURE 2: THE OLDER THE FURNACE, THE MORE AUDITS MAY BE REQUIRED

obtain further information and data, including thermographic and endoscopic audits. These services should be carried out at the same time as the visual audit and the results analysed in parallel with those of the visual audit, in order to provide comprehensive recommendations and conclusions.

CONCLUSION

The furnace refractory structure visual audit allows for detailed observations to be made, actions to be recommended and scheduled maintenance to take place, helping to identify refractory structure problems at an early stage and thereby preventing unexpected severe adverse conditions within the furnace refractory structure.

The furnace refractory visual audit is a useful 'tool' for preparing a scheduled furnace refractory structure maintenance schedule and an extended furnace designed campaign life. Planned maintenance work is a key factor in

extending the designed furnace campaign life.

The furnace refractory structure's visual audit, complementary services and recommended maintenance work should run in parallel in order to extend the designed furnace campaign life. As the age of the furnace extends and/or the campaign productivity output increases, the need for increased visual audits and maintenance work is realised. This is illustrated in figure 2.

The visual furnace refractory structure audit becomes a second 'tool' for assisting the glass producer form future business plans, adapt to change more easily, organise future furnace re-builds or up-grade more efficiently, helping to realise financial status more easily. ■

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