

Kiln Workshop Guide 3: Bricking Rigs

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1. Background

Workshops were held on “*Planned and unplanned maintenance on kilns and pre-heaters*” and a number of priorities were addressed by experts drawn from the cement, contracting and refractory industries. Recommendations relating to these priorities have been published in 4 Kiln Workshop Guides. These are Maintenance, Monolithic Linings, Bricking Rigs and PPE.

This document concentrates on a relatively narrow set of health and safety priorities specific to RHI Refractories DAT System Bricking Rigs in the United Kingdom, that may be applicable to other systems that are in use. The recommendations should be considered as part of an overall risk assessment.

Site specific operating procedures should be developed according to the type of bricking rig used. This should address assembly, inspection, operation, positioning of personnel, moving, height adjustment and dismantling. Compliance with any guidance set out in this document does not absolve the user from his legal duties under the Health and Safety at Work etc Act 1974 to form his own site specific assessment of his workplaces and operations and to provide accordingly for such matters.

2. PUWER Regulations 1998

In general terms, the Regulations require that equipment provided for use at work is:

- suitable for the intended use;
- safe for use, maintained in a safe condition and, inspected to ensure this remains the case;
- used only by people who have received adequate information, instruction and training; and
- accompanied by suitable safety measures, e.g. protective devices, markings, warnings.

In addition to these general requirements which apply to all work equipment, Part III of PUWER contains specific duties regarding mobile work equipment. In particular where mobile work equipment is used for carrying people it should be suitable for purpose and measures should be taken to reduce the risks (e.g. from it rolling over) to the safety of the people being carried and anyone else.

3. Operating Procedures

Operating manuals, technical guidance notes and maintenance procedures (etc) should be obtained and the manufacturers' recommendations for safe use of bricking rigs should be followed.

All personnel must be properly trained and risk assessments should be completed prior to each use of the bricking rig apparatus (pre-shift). Risks should be reassessed if conditions change.

Cement company procedures for the use of bricking rigs should address the following key points:

- Assembly
- Inspection
- Operation
- Positioning of Personnel during all operations
- Moving
- Height adjustment
- Dismantling

4. Centre of Gravity

The rig has, or should have its Centre of Gravity on the kiln centre line, or below. Extending the legs can create severe problems. In an incident investigated by RHI the rig had overturned in the kiln. The causes were found to be:

- The legs had been extended to allow forklift access beneath.
- The rig was left in the kiln whilst the kiln was to be turned.
- The rig head was laid down for safety during the turn.
- The head was laid on a hop-up and aligned with its length along the kiln.
- The rig head weight was therefore too high, and off centre.
- The installation crew lifted the rig manually and turned the wheels to face around the kiln.
- The installation foreman then released the brakes.
- As the last one was released the rig flipped over!!

Recommendations

- don't modify rig.
- ensure weight is balanced on rig.
- use spirit level provided.
- the rig centre of gravity must be on or below the kiln centre line.

5. Ram maintenance/safety

The pneumatic rams are "fail safe"- that is double acting power open power close rams. If the air fails the rams will hold their position for up to 30 minutes. However, if there is air leakage on the rams, the weight of the bricks being supported will force the rams down.

Recommendations

- if air fails, support back ring as soon as possible using manual jack.

- remove part ring manually.
- check system for leaks and repair before shutdown.
- ensure that oiler and water trap are in use (to prolong ram life)

6. Rig Structure Inspection

The original manufacturer can examine and repair RHI rigs. However the structure can be inspected by a mechanical engineer. In particular the horizontal expanding arms should be checked for cracks and distortion. Certification and assessment can be carried out by lifting specialists.

7. Rig Head Stability

With all rams withdrawn the rig head will tend to run downhill on its wheels.

Recommendations

- The head should be supported manually when rams are withdrawn until the rams are again extended (it may be necessary to fit a temporary brick at top dead centre to stabilise the rig).
- Any running maintenance to the head (e.g. spacer adjustment) should be done with the rig head laid down.

8. Rig Head Installation

The rig head is extremely heavy, which is why the manufacturers supply a tirfor and 'A' frame.

Recommendations

- The rig head should be installed as per the manufacturers instructions.

9. Rig Loading

Bricking Rigs have been distorted through overloading. Amongst other things, PUWER requires that the risks created by the use of equipment are eliminated where possible, or adequately controlled.

Recommendations

- Bricking rigs must not be overloaded by men and/or materials. This might be achieved through warnings on maximum loading, safe systems of work, information, instruction, training and supervision.

10. Rig Repair/Modification

Bricking rigs have been found to have been modified by kiln operators using incompatible materials e.g. steel strengtheners added to a light alloy rig. Poorly made weld repairs have also been discovered.

Recommendations

- Ideally no modifications should be made to the rig. If modifications are necessary then they must be subject to a full design validation.
- Where the rig is aluminium/light alloy, repairs should only be made by a company certificated and equipped for light alloy welding.

11. Moving the Rig

Manufacturers instructions must be followed.

Where possible the move, should be co-ordinated with the brick supply. The lighter the load of bricks, the easier it will be to move the bricking rig up the kiln.

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The floor of the kiln should be cleaned and any debris removed before moving the bricking rig.

Personnel should be excluded from the area underneath the rig when it is being moved up the kiln.

- Oiler/ water traps should be fitted.
- It is strongly recommended that the rig is subject to a six monthly insurance check.
- Daily pre-work checks should be carried out on the rig and a checklist should be developed.

12. Other Issues

If a forklift travelling beneath the rig, hits the rig; all personnel on it are at risk.

Other Kiln Workshop Guides contain issues that should be considered when Bricking Rigs are operated for example interaction between different persons/groups, control and supervision, emergency procedures, condition of equipment (fit for purpose and in compliance with LOLER and PUWER; PAT Tested where appropriate), the transport of materials and waste to and from site, PPE and housekeeping.

Recommendations

- Ensure safe systems of working and procedures are in place to control vehicle and pedestrian movements in and around the rig.
- Ensure all safety rails and ladders are fitted AND USED.
- Ideally the kiln should not be turned with the rig in it; if this is necessary, then it should not be undertaken with the arm in position
- Fail safe rams should be used.
- A twin air supply should be provided with non-return valves.
- Air and hydraulic rams should be available.
- Rigs should be subject to pre-work maintenance and inspection.

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Issue: Bricking Rigs are subjected to high stresses as the many pneumatic rams are operated and released throughout the lining rebuild. It is normal for 8 men, and maybe one tonne of bricks to be situated on the bricking deck. Before a kiln repair starts the rig parts should be inspected, tested and remedial work undertaken.

1 Adhere to risk assessment

2 Transport rig to MRD and power wash

3 Check all parts are ok for use

Safety handrails, gates, access ladder and other accessories:

- 3.1 Check condition of all safety handrails, gates & access ladder.
- 3.2 Check working platform is in good working order.
- 3.3 Check side boards are available and in good working order.
- 3.4 Check shim driver and hydraulic spreader are available and in good working order.
- 3.5 Ensure that all parts are available and in good condition.

Main Wheels

- 3.6 Check main wheels are free running.
- 3.7 Check condition of rubber tyre.
- 3.8 Check brake screw operates .
- 3.9 Lubricate wheel and braking mechanism.

‘A’ frame end support:

- 3.10 Check for damage, and particularly for cracking around the welds.

Issue: If fatigue damage (many small cracks) is found the part MUST be replaced, localised welding will not resolve the problem.

- 3.11 Ensure that the spirit level is fitted and operational.

Steel support struts:

- 3.12 Check for damage, particularly around location pins.

Issue: This part is steel and an assessment will need to be made as whether it can be repaired by welding or whether the part needs replacing.

Telescoping legs and arms of ‘A’ frame (these parts are made from aluminium)

- 3.13 Check for roundness and that the parts are not cracked.

Riding rails

- 3.14 Check for straightness.

Rig head undercarriage (this part runs on the rails and supports the rig head)

- 3.15 Check condition and operation of wheels.
- 3.16 Check condition and operation of hand operated brake screw.
- 3.17 Lubricate at appropriate points.

4 Connect Rig Head together and supply air (use an air line with a whip check fitted)

Segments

- 4.1 Check body for cracking.

Pneumatic rams and valves

- 4.2 Test operate and check for leakage, replace as necessary.

Issue: Leaking rams can endanger operators.

Pneumatic ram guide bolts

- 4.3 Check for straightness.

Pneumatic cylinder rubber pressure plate

- 4.4 Check condition, replace as necessary.

Non-Return Valve

4.5 Test operate.

5. Closing hydraulic ram and pump

5.1 Check operation of air operated and manually operated hydraulic pump.

5.2 Ensure oil reservoir is full.

5.3 Check operation of pressure gauge.

6. Air treatment battery

Issue: This unit removes particles and water; and lubricates the air. It's fitted with a non-return valve for operator safety.

6.1 Check operation of air treatment battery.

6.2 Check for leakage and replace as necessary.

7. Connecting air hoses

7.1 Check the condition of hoses.

7.2 Check for leakage.

7.3 Repair as necessary.

8. Test operate checking all air cylinders are operating correctly

Filter and Lubricator Assembly

8.1 Check for air leaks from filter & lubricator assembly.

Air Cylinders

8.2 Check for air leaks from air cylinders.

8.3 Check for valve blocks and all couplings.

8.4 Check for wear and condition of cylinder bumpers & cylinder anti-turn u-clips.

9. Other

Scissor Jack and Multi-o-ring Spacer Assembly.

9.1 Check scissor jack and multi-o-ring spacer assembly.

Lock Plungers

9.2 Check lock plungers for wear and condition.

10. After inspection completely dismantle and store away ready for major kiln repair

Follow Up

10.1 Ensure a system is in place to record findings from the inspection and that any necessary action is logged and followed up.

10.2 Ensure that all parts and an adequate supply of spares is available.

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	Pass	Fail
Safety Rails:		
- Ensure that all safety rails and gates are fitted and secured.	<input type="checkbox"/>	<input type="checkbox"/>
Main Wheels		
- Brakes must be operated.	<input type="checkbox"/>	<input type="checkbox"/>
Undercarriage wheels		
- Brake must be operable.	<input type="checkbox"/>	<input type="checkbox"/>
Pneumatics		
- Incoming air line must be fitted with whip check.	<input type="checkbox"/>	<input type="checkbox"/>
- Check for leakage.	<input type="checkbox"/>	<input type="checkbox"/>
- Ensure oiler has supply of oil.	<input type="checkbox"/>	<input type="checkbox"/>
- Drain water trap.	<input type="checkbox"/>	<input type="checkbox"/>
Hydraulic		
- Ensure that hand operated hydraulic ram and pump are available (for manual closing of ring in case of air failure)	<input type="checkbox"/>	<input type="checkbox"/>
Set Up		
- The rig MUST be erected as per the manufacturers design; increasing height can move Centre of Gravity above kiln centre line, creating overturning risk.	<input type="checkbox"/>	<input type="checkbox"/>
- Ensure that brick storage is balanced – see above.	<input type="checkbox"/>	<input type="checkbox"/>
Lighting		
- Ensure lighting is adequate (ideally provide power from two sources).	<input type="checkbox"/>	<input type="checkbox"/>
Access		
- Ensure that correct access ladder is fitted and secure	<input type="checkbox"/>	<input type="checkbox"/>

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