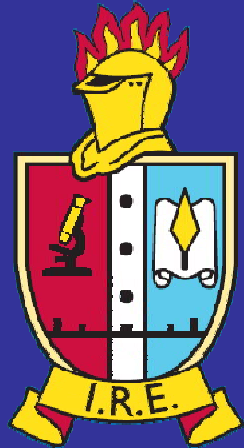


Institute Of Refractories Engineers

Some Refractory Installations

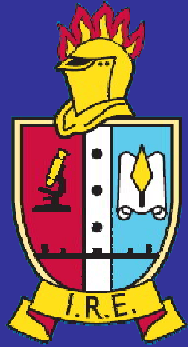
Refractories Training Day
25th September 2008

Steve Wright



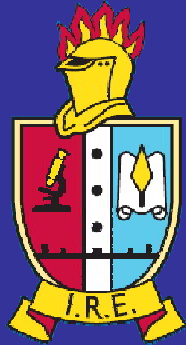
Institute Of Refractories Engineers

| | | |
|--|--|--|
| | <p>Installation Issues</p> <p>Time, Access, Safety, Material Feed</p> <p>Installation Standards & Supervision</p> <p>Shuttering, centres, stop boards,</p> <p>Gunning – rebound</p> <p>Cool down & Heat up</p> | |
|--|--|--|



Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact
- Carrying out the Installation



Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

Our Ref : 719162
Your Ref :
Date : 24/12/2007

SMART & COOK
INSURANCE BROKERS

4-6 Ripon Road
Harrogate
HG1 2HH
Tel : 01423 522431
Fax : 01423 522687
www.smartandcook.co.uk

TO WHOM IT MAY CONCERN

Commercial Combined Insurance
Our Client: TJS Holdings Ltd and/or Sheffield Refractories Ltd and/or Nushef Ltd
Business Description: Monolithic refractory manufacturer, supplier and installer of refractories.

We are Insurance Brokers to the above named and confirm that we arrange Public & Products Liability, and Employers' Liability Insurance on their behalf as follows: -

Public/Products Liability

| | |
|----------------------|---|
| Policy Number: | 42703268 |
| Insurer: | AIG UK Services Limited |
| Period of Insurance: | 12 months from 1 st December 2007 |
| Limit of Indemnity: | £10,000,000 any one occurrence (in the aggregate for Products Liability) |
| Excess: | £500 applicable to claims for Third Party Property Damage |


Employers' Liability

| | |
|----------------------|--|
| Policy Number: | 42703268 |
| Insurer: | AIG UK Services Limited |
| Period of Insurance: | 12 months from 1 st December 2007 |
| Limit of Indemnity: | £10,000,000 any one occurrence |

Please note that the above policies include an Indemnity to Principal Clause and are subject to insurers terms and conditions.

Please contact Smart & Cook Ltd if further information is required.

Yours faithfully


Karen Nicholls
Corporate Broker
Direct Tel No : 01423 700736
E-Mail : karen.nicholls@smartandcook.co.uk

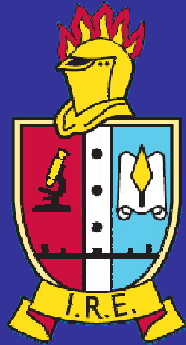
Smart & Cook Limited
Authorized and regulated by the Financial Services Authority
Registered in England No. 501954
Registered Office : Ripon Road, Harrogate, HG1 2HH
Member of the Smart and Cook Group Limited

SMART & COOK INSURANCE BROKERS

Insurance

Of an appropriate type and level for the type of installation in which you are involved

Larger company groups will often stipulate
The level of cover required to work on
Their sites



Refractory Installation

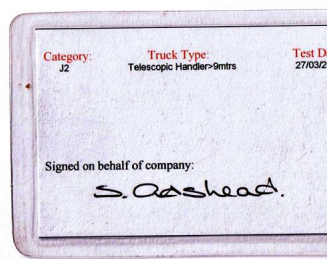
- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

PERSONAL DETAIL & TRAINING RECORD

NAME :- Harold Simpson
OCCUPATION :- Installer
DOB :-
PASSPORT TO SAFETY No :- 438361
EXPIRES :- 12-Mar-11
NI NUMBER :-



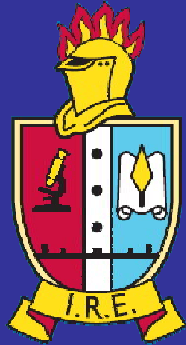
| TRAINING RECORDS - CONTRACT ACTIVITIES | | |
|--|------------|---------|
| DESCRIPTION Equipment / Activity | DATE | EXPIRES |
| Safe operation of a Boulder Gu | Ongoing | |
| Safe operation of a Reed Gu | Ongoing | |
| CITB Forklift Truck - 4, 800kg Counterbalance | 23/04/1996 | |
| CITB Forklift Truck - Telescopic All Terrain | 27/03/2007 | |
| Installation of monolithic refractories by gunning | Ongoing | |
| Installation of monolithic refractories by castin | Ongoing | |
| Installation of monolithic refractories by shotcretin | Ongoing | |
| Safe operation of an M410 shotcrete pump | Ongoing | |
| Safe methodology to erect / dismantle shotcrete pipework and hos | Ongoing | |
| Confined Space Training - Basic | 05/03/2006 | |



Competent /Qualified Responsible People and Supervision

Minimal is Passport to Safety
Additional to this is other training and certification which must Be gained and qualified to carry out certain Job tasks on site or to work in certain areas

Competencies of operating equipment, or Carrying out tasks such as
Fork truck / Telescopic truck licences
Crane operation, slinging, confined space training
First aid etc etc



Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

Method Statement for Gunning

SHEFFIELD REFRACTORIES
Health & Safety
(Revised 2007)

Sheffield Refractories Ltd

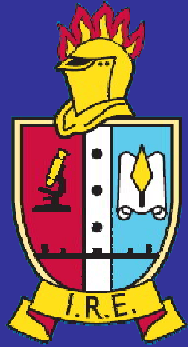
Installation of Refractories

113 Langdon Rd, Greenhithe, Chatham, Kent, ME16 9PP
Phone +44 (0)1909 566444 Fax +44 (0)1909 566525
Email: sales@sheffield-refractories.co.uk

| Hazard Identification/Risk Assessment | |
|---|---|
| Assessor: Julian Gray | Review: 2007 Location: All Sites Date: May 2007 |
| Risk Assessment: Casting of Monolithic Refractory Materials | |
| Hazards: | |
| 1. Contact, Traps, Entanglement etc. with moving parts of machinery (See risk assessment for use of Stirring mixers). | |
| 2. Dust Inhalation / Skin contact | |
| 3. Slips, Trips & Falls | |
| 4. Noise / permanent hearing damage | |
| 5. Musculoskeletal Disorders / Manual Handling | |
| 6. Skin contact with castable / possible dermatitis | |
| 7. Electrocution | |
| 8. Falls from Height | |
| 9. Use of Hand Tools | |
| 10. Stuck on / Struck by / Trapped by | |
| 11. Vibration / HAVs | |
| 12. Use of Compressed Air / High Pressure Systems | |
| 13. Workplace Transport / Collision / Trapping | |
| 14. Entry into Confined Spaces | |
| People at risk: All Personnel on external installation contracts | |
| Initial Risk Rating: Severity (4) x Probability (4) = (16) - Very High Risk | |
| Existing Safety Precautions: | |
| 1. Planned maintenance / inspection of all associated equipment. | |
| 2. Careful selection of suitable plant / equipment in relation to the work being carried out. | |
| 3. External examination and approval of pressure vessels and portable electrical equipment. | |
| 4. All employees are informed of potential hazards associated with materials and equipment used | |
| 5. All employees are authorised/instructed/trained on use of appropriate working methods and the appropriate control measures. | |
| 6. All employees are authorised/instructed/trained on use of appropriate working methods and PPE. | |
| 7. Inspection of equipment by employees / supervision. | |
| 8. Method statements for casting available. | |
| 9. Health & Safety Data sheets available for all materials being used. | |
| Action / Recommendations: | |
| 1. When purchasing / hiring plant / equipment specific hazard information / certification must be obtained | |
| 2. Supervisors should regularly inspect all equipment prior to and whilst in use on site. Ensure all appropriate safety information (method statements, risk assessments/summaries, materials safety data, etc.) are available and that appropriate PPE is issued and used at all times | |
| 3. Ensure all site personnel have safety passport, completed any required site safety inductions and are trained / authorised on plant and equipment to be used. | |
| Revised Risk Rating following action/recommendations: | |
| Severity (4) x Probability (1) = (4) Low Risk | |

H&S Policy, Risk Assessments, Safe Working Procedures /Method Statements

On –site, people involved in site activities, have a duty of care to those around them and themselves



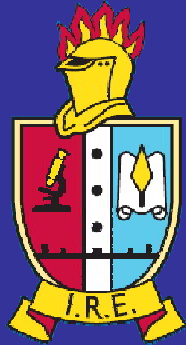
Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

Site Inductions and Procedures on Site

Specific to each site as it imparts important site specific information
And procedures including such as

- Emergency Procedure
- Evacuation /muster
- Raising Alarms
- Systems of Work- Site Permits and how they operate , Isolation Procedures
- Eg Locking On / Off
- Specific Hazards
- Safety and Welfare of Personnel



Refractory Installation

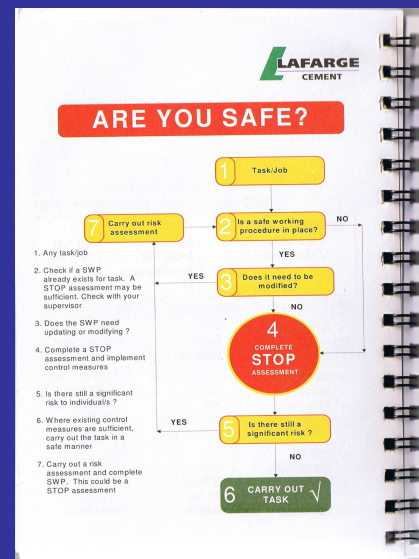
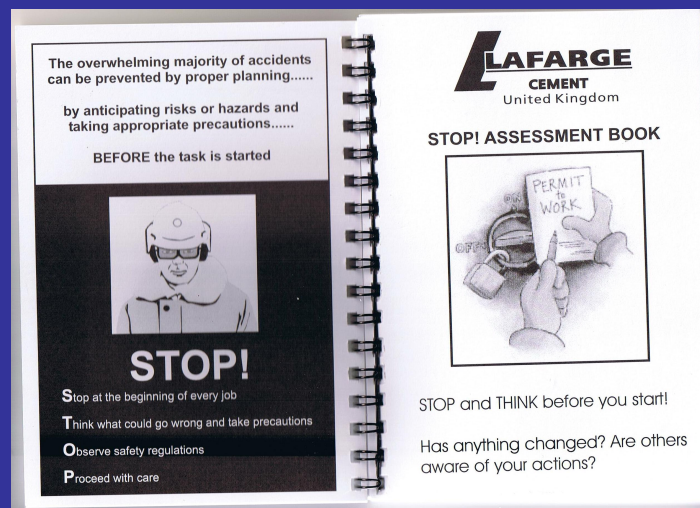
- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

On Site Risk Assessments –Prior to Job start (daily)

S T O P System as utilised in the Lafarge Group

Small booklets easily carried and used in a work area before the start

Of each shift to see if something has changed which may represent a Hazard

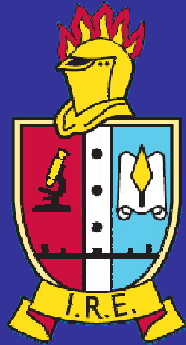


| Hazard | |
|--|--|
| Could You be injured by? | |
| 1 - MACHINERY - Can the machine start unexpectedly or can you be trapped or become entangled? | |
| 2 - STRUCK BY FALLING OR FLYING OBJECT - Can something fall onto you or fly out at you? | |
| 3 - STRUCK BY VEHICLE - Do vehicles operate in this area? | |
| 4 - STRUCK AGAINST - Is there sufficient headroom or space? | |
| 5 - HANDLING, LIFTING OR CARRYING - Is the load too big or awkward or are there any sharp edges? | |
| 6 - SLIP, TRIP OR FALL ON LEVEL - | |
| 7 - FALL FROM A HEIGHT - | |
| 8 - TRAPPED BY SOMETHING COLLAPSING - Is the structure above you stable? | |
| 9 - DROWNING OR ASPHYXIATION - Can you fall into water or be engulfed by material such as powder or is there a good air supply? | |
| 10 - CONTACT WITH HARMFUL SUBSTANCES - Could you come into contact with hot materials, hot or pressurized gases, harmful chemicals, noise? | |
| 11 - FIRE OR EXPLOSION - | |
| 12 - ELECTRICITY - | |
| 13 - OTHER - | |

| Precautions | |
|--------------------|--|
| Date..... | |
| Your name..... | |
| Task..... | |
| Task location..... | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |

Who could be injured.....If in doubt - ask !

Courtesy of Lafarge



Refractory Installation

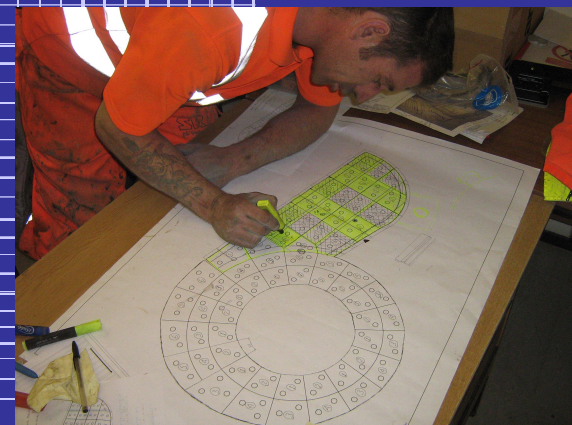
- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

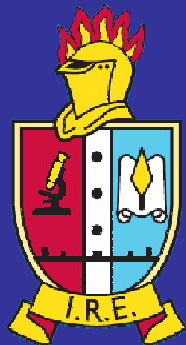
Scope and Plan of Work

Time eg Shifts

Disciplines / Activities

| | Area | Supplier | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|-------------|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Kiln Stop | Kiln | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kiln cool down period | Kiln | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bridge in kiln coating, brick, hearth, rest and steel nosing wrecking and clearing | Kiln | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gravolite kiln lumina | Kiln | Graydon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Install steel nosering castings Kiln bricking 0-27m with 2 mortared sections | Kiln | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gravolite kiln lumina | Kiln | Graydon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cast nosering Kiln bricking 27-54m with 1 mortared sections | Kiln | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bridge out & firing pipe in Permit off | Kiln | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FDS electrical test | Kiln | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Warm up to feed on | Kiln | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cut beam down on hearth | Riser | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drop scaffold | Riser | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Break scaffold in bottom riser | Riser | High peak | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wreck low kiln hearth area | Riser | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Use break to upper kiln hearth area | Riser | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wreck upper kiln hearth area | Riser | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Blaster positioning | Riser | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Anchoring in rise and panels | Riser | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shotcreting in hearth & bottom riser | Riser | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scaffolding | C3 to C2 | High peak | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wrecking from C3 to C2 | C3 to C2 | Asbestos wrecker | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shotcreting from C3 to C2 | C3 to C4 | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C4 barrel wrecking and clearing (big brick) | C4 | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Weld bricking ledge C4 bricking including setting bricks and bringing them | C4 | ?? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shotcrete/Gunning of side doors and dip tube surrounds | C4 | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler cooling off and clearing | Cooler | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Place scaffold for brick 90 in cooler | Cooler | LCUK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lifting anvil plates | Cooler | High peak | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler throat scaffold matrices | Cooler | ?? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wreck cooler refractory (side wall, arch) | Cooler | High peak | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler mechanical | Cooler | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler arch bricking & scaffold alterations | Cooler | Graydon | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler arch shotcreting | Cooler | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler sidewall casting & joinery input | Cooler | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler throat scaffolding | Cooler | SR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Move semi break from cooler to drag | Cooler | High peak | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooler drag sidewall | Cooler | Simpsons | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |





Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

SHEFFIELD REFRACTORIES LTD
113 Loughton Rd. Dinnington, Sheffield, S25 2PP, UK
Phone +44 (0)1909 568444 Fax +44 (0)1909 568525
E-mail: sales@sheffieldrefractories.co.uk

PRODUCT: JONGUN 1200AR

DESCRIPTION:
BONDING:
MATERIAL SUPP:
MAXIMUM SERV:
MAXIMUM GRAIT:
CHEMICAL ANAL:

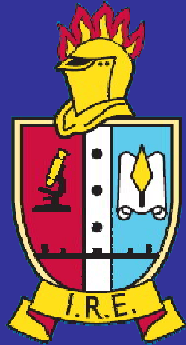
Al₂O₃
SiO₂
Fe₂O₃

PHYSICAL PROPERTIES:
Bulk Density (kg/m³)
Cold Crushing Strength (N/cm²)
Permanent Linear Change (%)
Thermal Conductivity (W/mK)
Installation by: Cast
Quantity Required (kg/m³)
Approximate Mixing Ratio
Storage Life in Cool (months)
01/06

NOTE: The information, findings and recommendations are based on the information, research and general experience of the company. It is not intended to be used as a substitute for professional advice. We make no liability for any loss or damage resulting from the use of this information.

| | |
|---|---|
| 1 Identification of the substance / preparation & company name | Jongun 1200AR Hydraulically bonded castable supplied dry in plastic or paper sacks Suppliers Sheffield Refractories Ltd address at top of sheet. |
| 2 Composition / information on the ingredients | Aggregate, High Alumina Cement, clay |
| 3 Hazard identification | Fine particles can be dispensed into the atmosphere during handling, Free silica 11.4% |
| 4 First aid measures | <p>Skin Contact - Wash off any material with warm soapy water</p> <p>Eye Contact - Wash out thoroughly with clean water and seek medical advice</p> <p>Ingestion - Do not induce vomiting, remove material from mouth, drink plenty of water. If symptoms persist seek medical advice</p> <p>Inhalation - May cause irritation to the mucous membranes, remove to fresh air and allow to recover then put on respiratory protection before again exposing to the dust. Lung damage may occur to long term exposure to dust.</p> |
| 5 Fire fighting measures | Not flammable use fire fighting measures suitable for surrounding environment. |
| 6 Accidental release measures | Contain the spillage, wearing dust mask, goggles, gloves and protective clothing. Re-pack into suitable container. |
| 7 Handling and storage | Keep dry, cool and frost free. Use in rotation |
| 8 Exposure controls and personal protection | Ensure dust is kept to a minimum, by use of Local Exhaust Ventilation wherever possible. Wear respiratory and eye protection, gloves and protective clothing. |
| 9 Physical and chemical properties | Dark grey mix of aggregate and dust, alkaline when mixed with water, bulk density 1.4 |

Product Data
H&S Data- MSDS



Refractory Installation

- Documentation, Legislation and Procedure and the Health Safety and Welfare of those installing and with whom they interact

QA - Sign Off

Quality and Scope of Work
Carried out April-08

For Refractory repair and replacement work carried out in the following areas

Preheater Tower
Kiln- Inlet
Cooler
Cooler Project Extension

We confirm that we are satisfied with the quality and scope of work carried out in the above areas during our April- 08 shutdown

For

For Sheffield Refractories Ltd

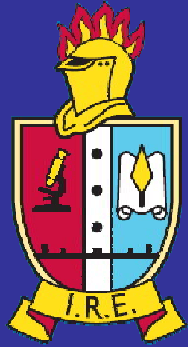
Steve Wright
Mob 07854 912207

Julian Gray
Mob 07854 911925

Quality Assurance Sign-Off On installation

A document whereby both parties
Agree that the scope of work has been completed
In a timely manner and to standard that is
Acceptable to all parties

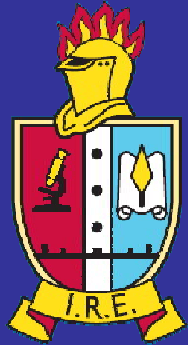
This document effectively hands over the
Finished installation to the client



Refractory Installation

Installation Of Refractories

- Carrying out the Installation



Refractory Installation

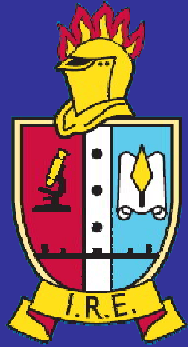
Installation Of Refractories

Personal Protective Equipment

A minimal level of PPE must be worn on all sites, dependant on site Activity

In dust environments appropriate Filter masks should also be worn Which may be the personal silicone type With interchangeable filters for prolonged Exposure to dust / airborne particle environments





Refractory Installation

Brick or Monolithic

Castable

Planning /Preparation

Anchoring

Shuttering

Homogenisation

Dosing

Mixing

Transport

Pouring

Vibration

Setting /Hardening

Curing

Drying

Heating-Up

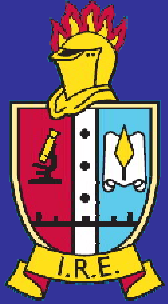
Brick

Planning /Preparation

Transport

Laying

Heating-Up



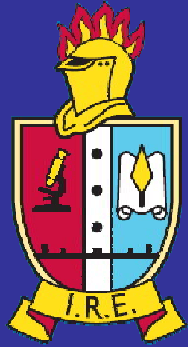
Refractory Installation

Brick Installations

Preformed quality assured shapes supplied on pallets direct from the factory
Fed to application area by forklift or conveyor
Laid by skilled masons
Supervision essential
No moisture to remove (unless combined with monos)
Quicker heat –up

Long lead times
Basic shapes – Squares / End Arch /Side Arch
Unusual emerging applications difficult





Refractory Installation

What is a monolithic and why is it used ?

Monolithics - Can give exceptional performance in difficult to install areas

Advantages of monolithic

High strength

Tailored to meet specific requirements –eg chemical, strength, light weight, etc

Dry / minimal joints

Easy to repair

Large high quality and relatively fast installations with such as shotcrete

Special requirements eg Precast shapes, blasters , shrouds etc

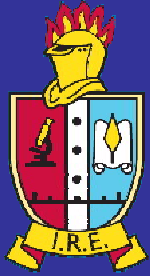
Disadvantages

Difficult to

Setup / install

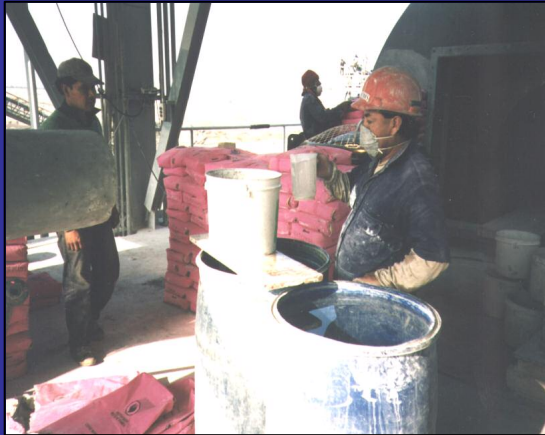
Dry

Demolish



Refractory Installation

Example; Low Cement Castable



1. Accurate water measurement



2 Timing mix in "Hi-Shear" mixer



3. Castable "stiff" as applied



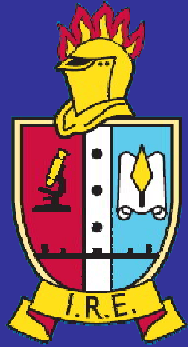
4. Apply high frequency poker



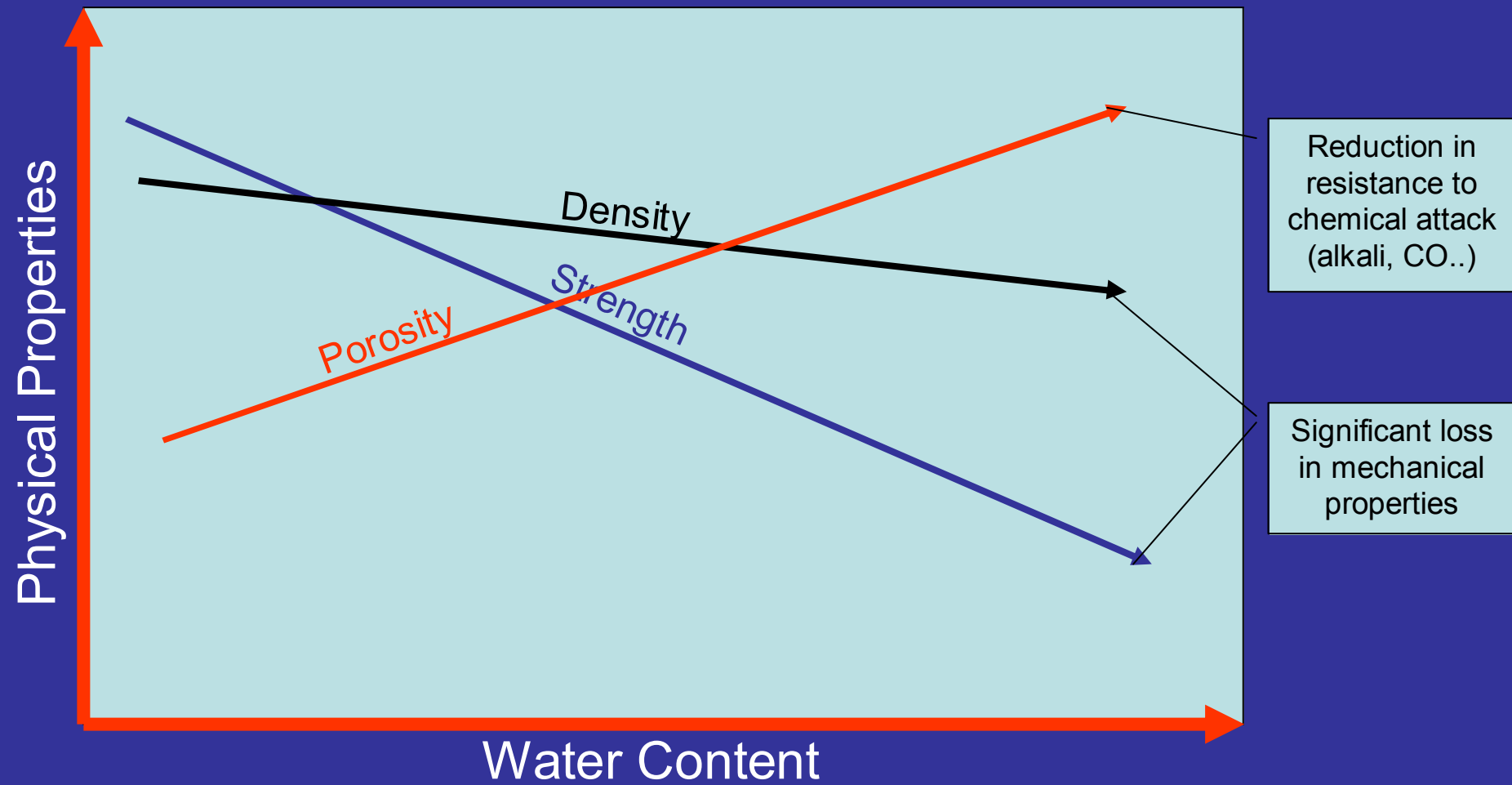
5. Material flows with vibration

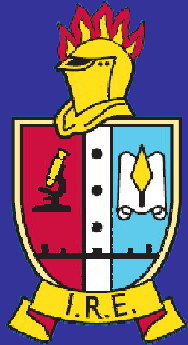


6. Partially completed lining



Castable Properties





Refractory Installation

- Technical Castables such as Low Cement, Freeflow Pumpable etc

These type of products are quite complex and have several fine additive Additions which are crucial to the optimal performance

Increased water additions have a dramatic effect by decreasing properties

On –site installation is therefore very important to get the best properties and Performance in services.

Mixing must be with the use of a high shear mixer with a positive mixing action

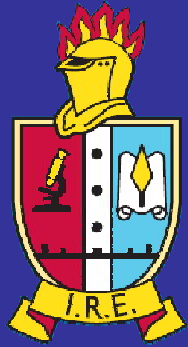
Mixing time with this kind of equipment is generally

4 -6 minutes per batch

At the recommended water content (usually 5-7% for LC types)

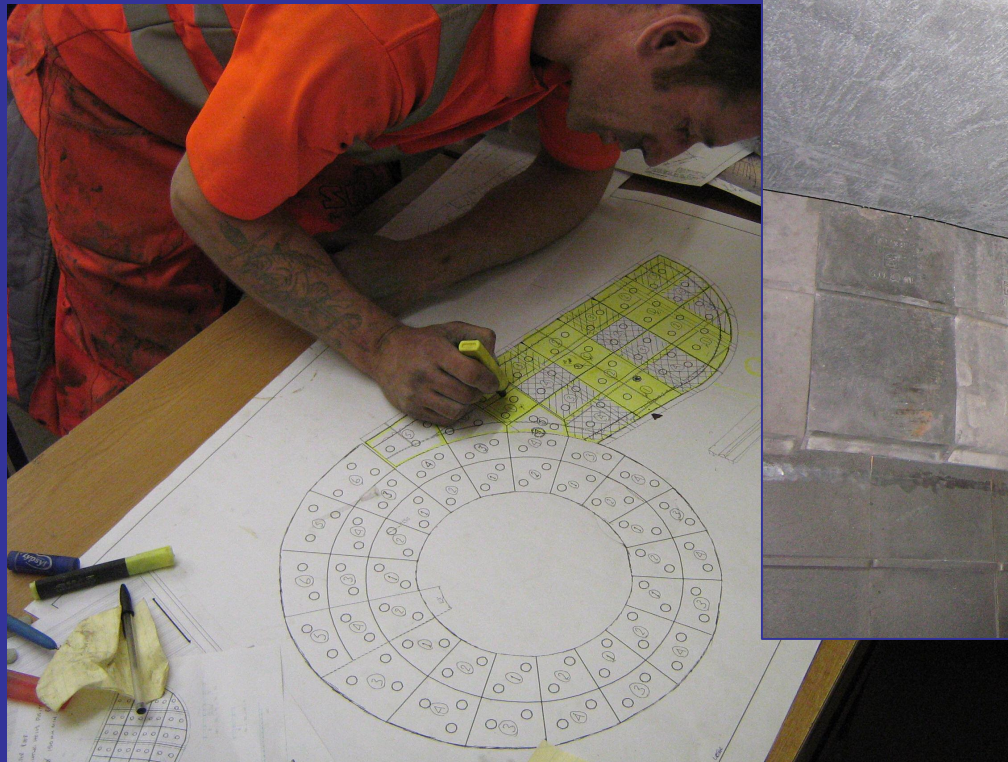


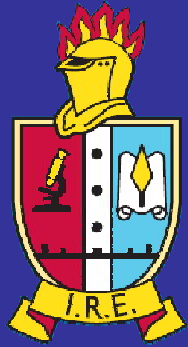
Large High Shear Mixer
with measured water being added



Refractory Installation

- Installing Low Cement Castables In a roof

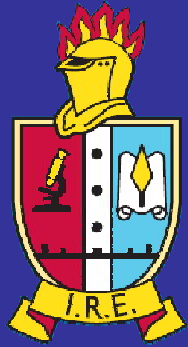




Refractory Installation

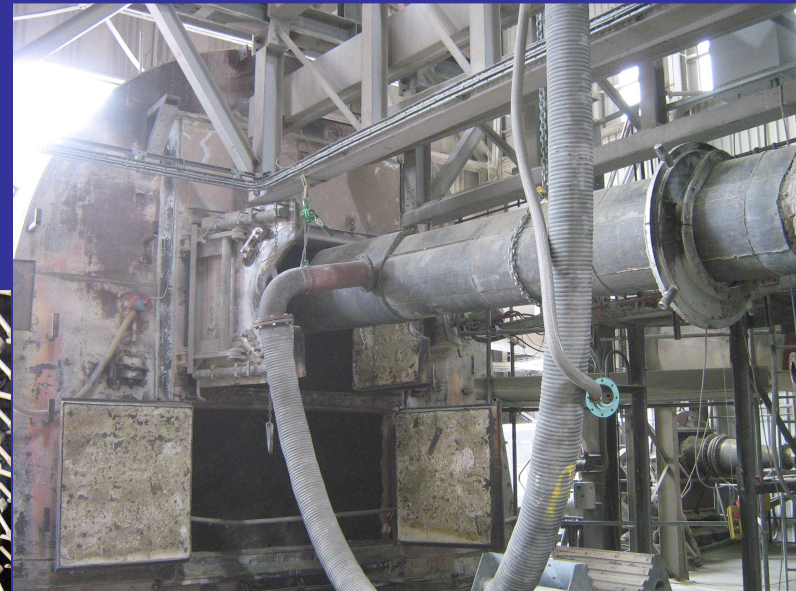
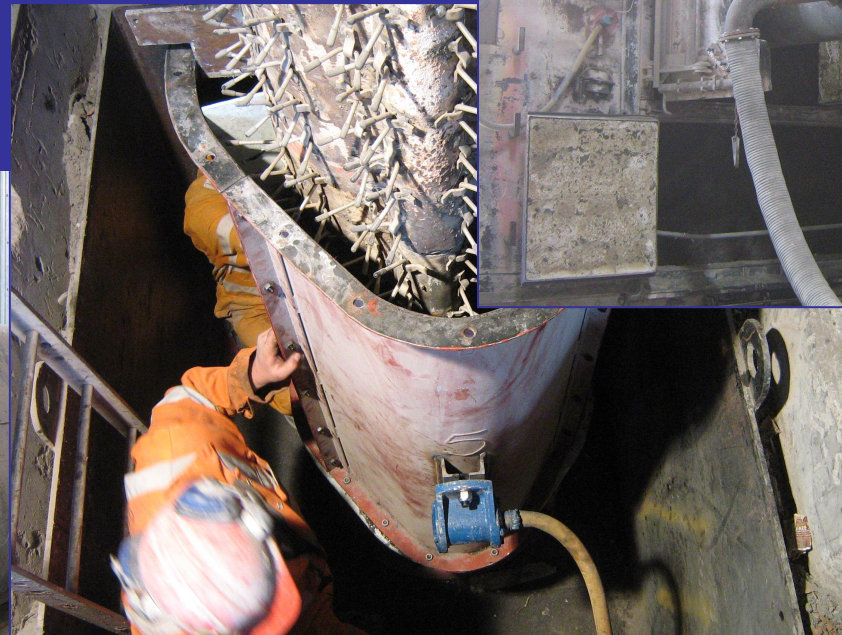
- Prest Shapes
- Can be small or large

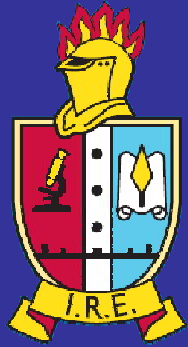




Refractory Installation

- Installing Low Cement Castables
Thin section using limpet vibrators





Refractory Installation

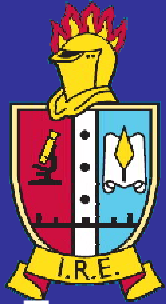
What is a monolithic and why is it used ?

- Refractory monolithics can be
- Gunning grades



Loading gun with 25Kg bags
Dry refractory transported to application

Good water injection and elongated nozzle
Ensure good mixing and minimal rebound



Refractory Installation

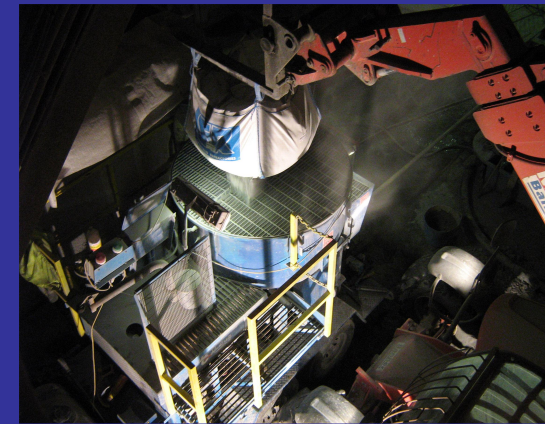
•Example –Full Wet Low Cement Shotcrete



1. Readyng materials to start



2 Specialised equipment & team



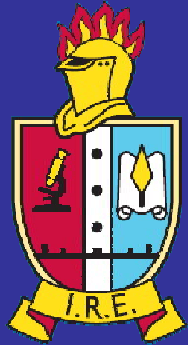
3. Lines ready, process starts



4. Special nozzle with air & accr



5. Applied in panels, quick setting (no slumping),
clean environment



Refractory Installation

What is a monolithic and why is it used ?

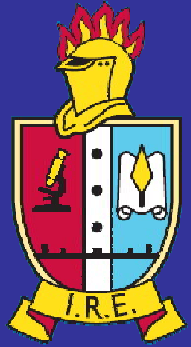
- Refractory monolithics can be
- Shotcretes



Special pumpable LC castable
Is charged in bulk bags, then mixed
and pumped to application

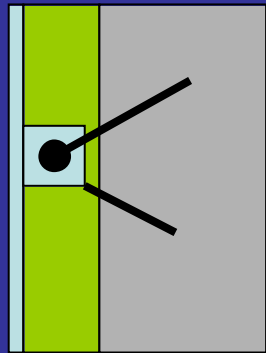
At the nozzle, material combines
With compressed air stream and
Accelerator to project and stay
On the wall





Refractory Installation

Lining Configuration, Anchorage, Panelisation and Expansion Allowance



1/3 2/3

Perceived typical

But can vary by application



Lining configuration

Determined by

Local conditions such as :

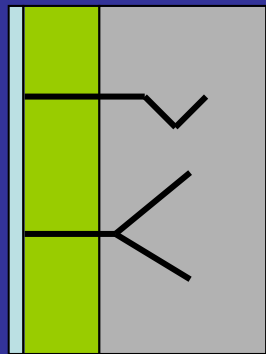
Heat Retention

Chemical and Abrasion Resistance

Anchorage and panelisation/ expansion

Determined on case by case basis

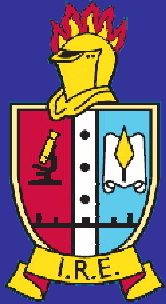
Taking into consideration, environment, history, and safety



IC9 Med Wt
Safety & Security



Metallic and Ceramic anchors

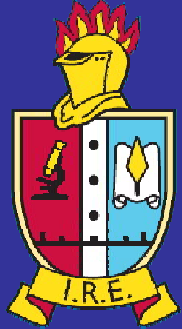


Refractory Installation

Lining Configuration, Anchorage, Panelisation and Expansion Allowance



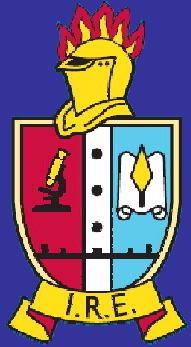
If anchors fail for whatever reason..it can be very dangerous
as refractory can fall out unexpectedly



Refractory Installation

Lining Configuration, Anchorage, Panelisation and Expansion Allowance

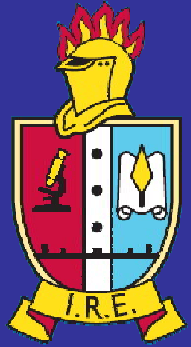




Refractory Installation

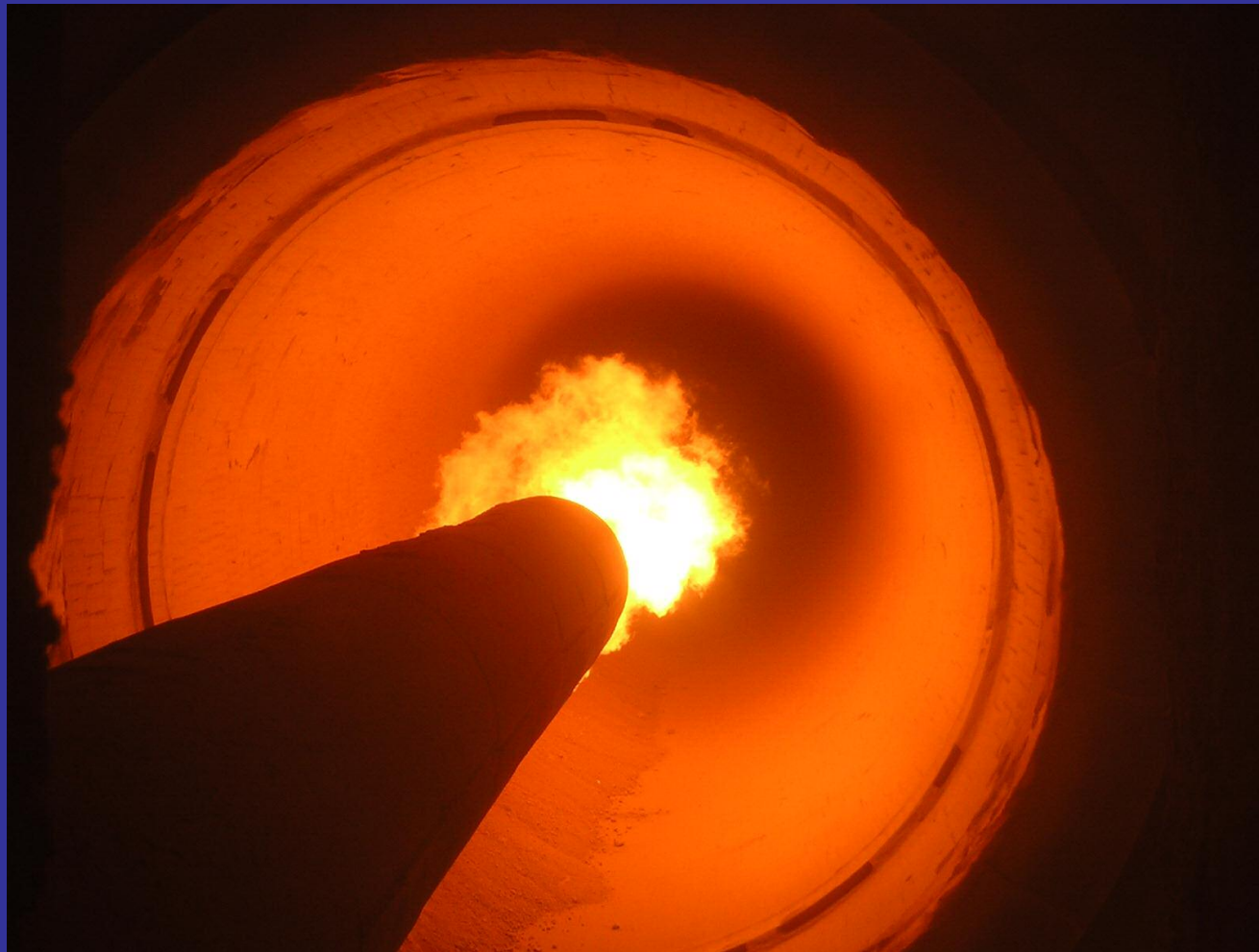
Lining Configuration, Anchorage, Panelisation and Expansion Allowance

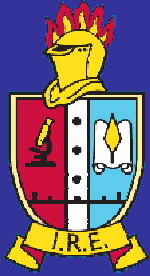




Refractory Installation

Setting, Curing and Preheating





Monolithics Manufacture and Installation

Setting, Curing and Preheating

Setting is determined by the type of product and the ambient temperatures

At a **typical 20C** an initial set would be expected in 4-6 hours

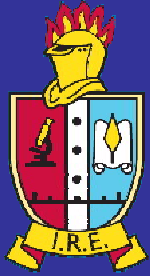
In **hotter climates** setting time can be dramatically reduced due to the heat accelerating the bond. This can have consequences for the installation and retarders should be considered to be added at the suppliers factory with a minimal fine tune on site or wholly on-site under careful supervision

Conversely in **colder climes** the opposite is true.

The more technical low cement products can exhibit very long set times, even 1 -2 shifts
Which can have serious consequences for the installation programme

In these circumstances, retarder at the factory should be cut back and consideration should be given to the supply of accelerants for site addition

With extremes of temperature, site materials should be kept in controlled temperature
Warehouses and site water temperature controlled



Monolithics Manufacture and Installation

Setting, Curing and Preheating

Curing should be at least 12 hours and air drying similar

Theoretically castables should not be allowed to prematurely dry out in the first 12 hours and the surface should be kept moist.

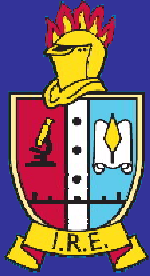
See manufacturers data sheets

This is best practice but with the exception of floors, it rarely happens on site

Thicker section jobs should be planned early in repair to allow maximum curing /air drying time

Where and when practicable, shells should be drilled and monolithic vented during installation. Organic fibres are added which also aid moisture removal.

Very dense monolithics give good performance but are the most difficult to dry out (Low porosity / permeability)



Monolithics

Manufacture and Installation

Preheating

No Preheating curve is given as generally this follows custom and practice
Or is discussed and agreed on a case by case basis

Different schools of thought exist for drying out and Preheating monolithics

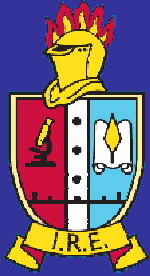
1 Traditional

Where possible, preheating should be done to an agreed regime and allowing good air movement across the face

Preheating regimes will vary but should consist of slow ramping- 20-25C/hr and holds at 110 and 350 visibly monitoring for high steam pressure and if so hold until it subsides

2 Modern

Ramping at a constant temperature from ambient, theoretically building heat up slowly at the hot face and driving moisture back through at a constant rate with no holds



Monolithics Manufacture and Installation

Preheating

In either Preheating situation it is extremely important to visually monitor the application and if excessive steaming or plumes are noted then the regime should be held until it subsides and then progressed with caution

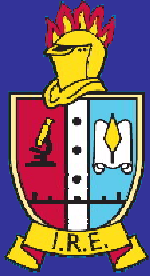
Installations can be long and costly affairs taking place over long periods of time and consequently heating up should not be rushed.

Specialised companies are available for preheating on site for small or large project applications

Generally, > 80% of moisture is removed by 400C equilibrium.

Cooling of Linings

Unless being wrecked for replacement, refractory linings should not be force cooled
And certainly water should never be used to cool down a lining



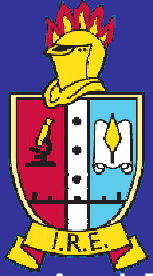
Monolithics Manufacture and Installation

Storage

See manufacturers instructions

Generally supplied products should be kept under cover in a clean, dry
Well ventilated storage area

Manufacturers can modify the packaging spec liasing with the customer, especially for international destinations, however normally, such as 25Kg valve packed bags of monolithic stored in the above, can have a life of 6-12 months duration dependant on type



Refractory Installation

And Finally.....



Thank You for your time
And consideration