Institute of Refractories Engineers

DESIGN ISSUES

IRE Training Day
25 September 2008

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Batching

- Loading
- Expansion Allowance
- Integrity & Stability
- Design for Installation
- Fail-Safe Design

Loading

- Shipping Loads – Truck and Container Weights
- Installation Loads – Crane Weights, Scaffold loads
- Structural and Foundation Loads

- How Much Does a Refractory Weigh?

Expansion Allowance

The Golden Rule of Refractory Design

If you do not put in the correct expansion allowance SOMETHING will get broken

Typical FREE Expansion Movement.

Steel Ladle Working Lining
Diameter 3m, Temp 1500°C, Material – MgO-C
140mm

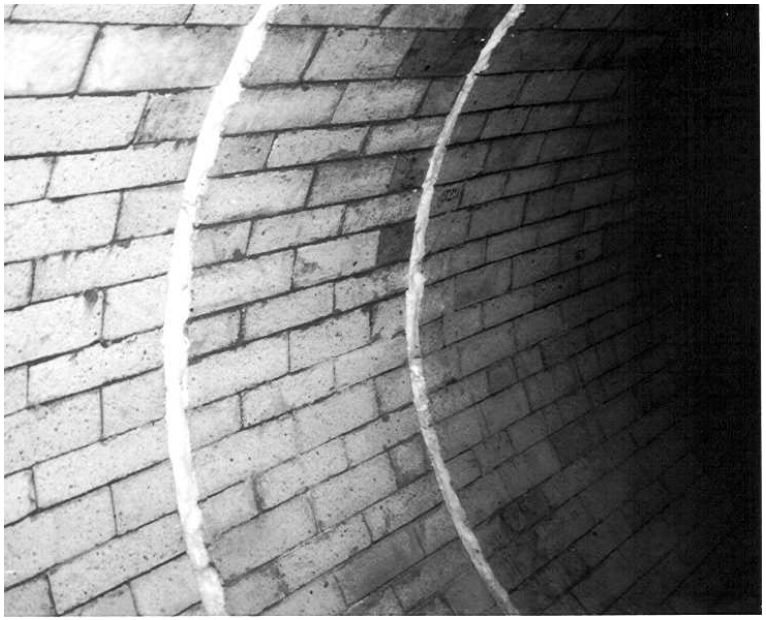
This is a equivalent to a strain of 1.5%

Expansion Allowance

- Types of allowance
  - Compressible Layer
  - Combustible Layer
  - Allow Shell deformation
  - Free Expansion
- Anchor Expansion

Expansion Allowance

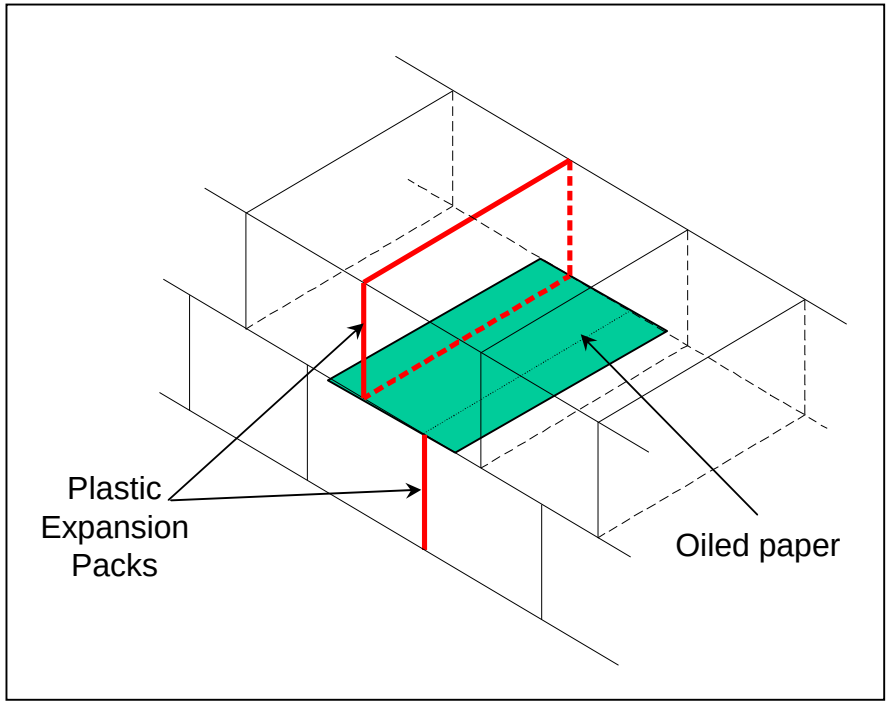
Compressible Layer



Ceramic Fibre
Ramming/Plastic Refractory
Dry Vibrateable

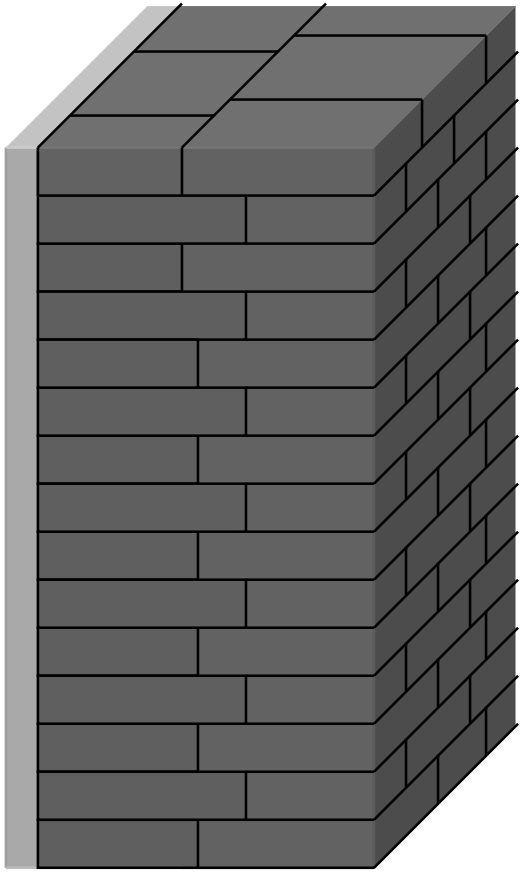
Expansion Allowance

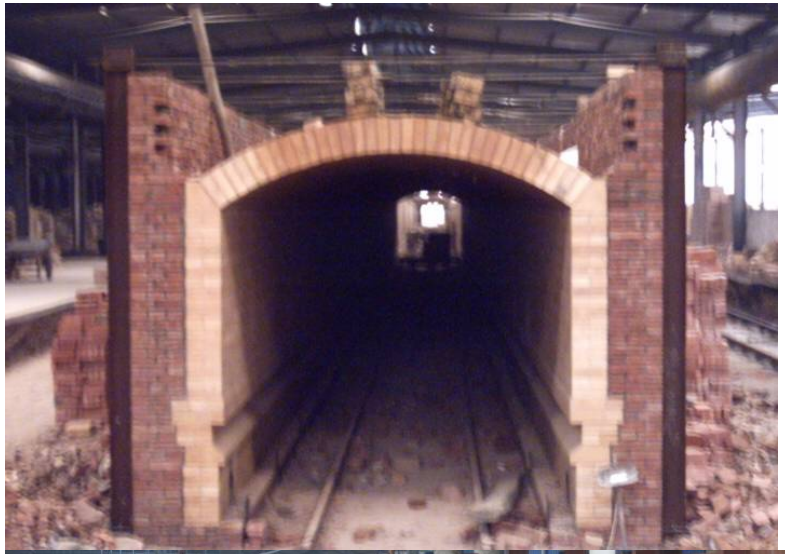
Combustible Layer



Expansion Allowance

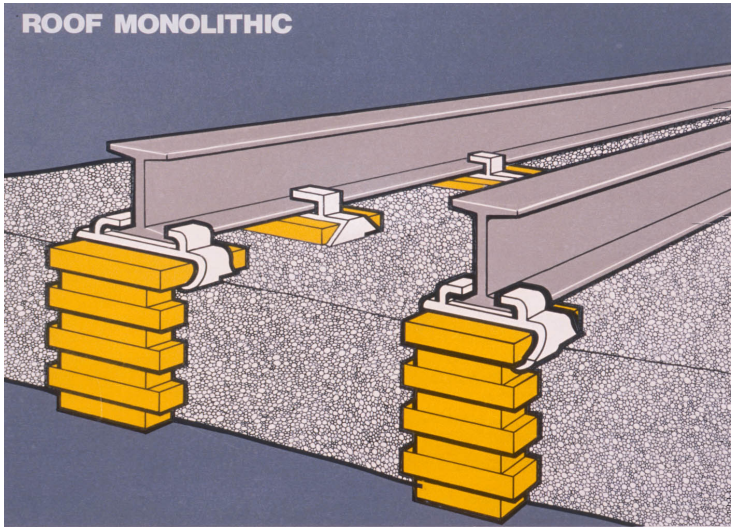
Allow Shell deformation





Expansion Allowance

Free Expansion



Expansion Allowance

Expansion of Anchors for Monolithic Linings

Expansion Allowance

What Happens when it all goes wrong?

Integrity and Stability

Castable – drying shrinkage – Crack paths

Low Tensile Strength - Arch stability

Openings – Doorways, Instruments

Anchor Spacing

Design for Installation

Installation time
- Cost
- Lost Production

Piece Size
Fitting/Cutting
Space to Work

Fail-Safe Design

What is failure mechanism?
How good should the safety lining be?
How frequent is an inspection?
Monitoring techniques

Thank You For Your Attention