SRU Reaction Furnace Refractories

Solutions for Reliable Lining Service

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REFCOMM GALVESTON MAY 2-6 2016

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Itinerary

Operating Temperature

Variety of Vessel Sizes

Expansion Joints

Inspection Checklists

Future Improvements

Operating Temperature

Higher Operating Temperature

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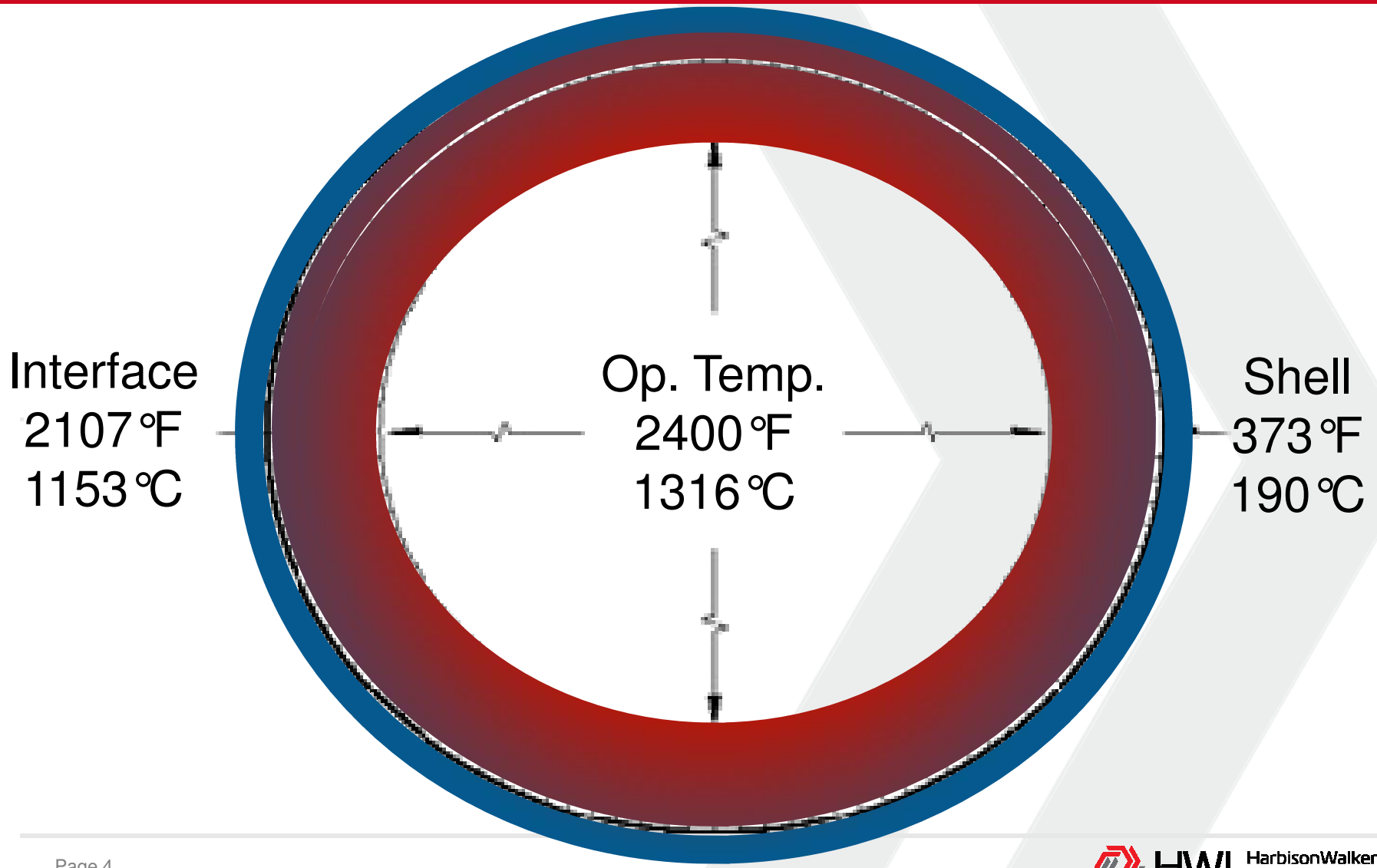
Higher Acid Gas Processing Capacity

Operating Temperature



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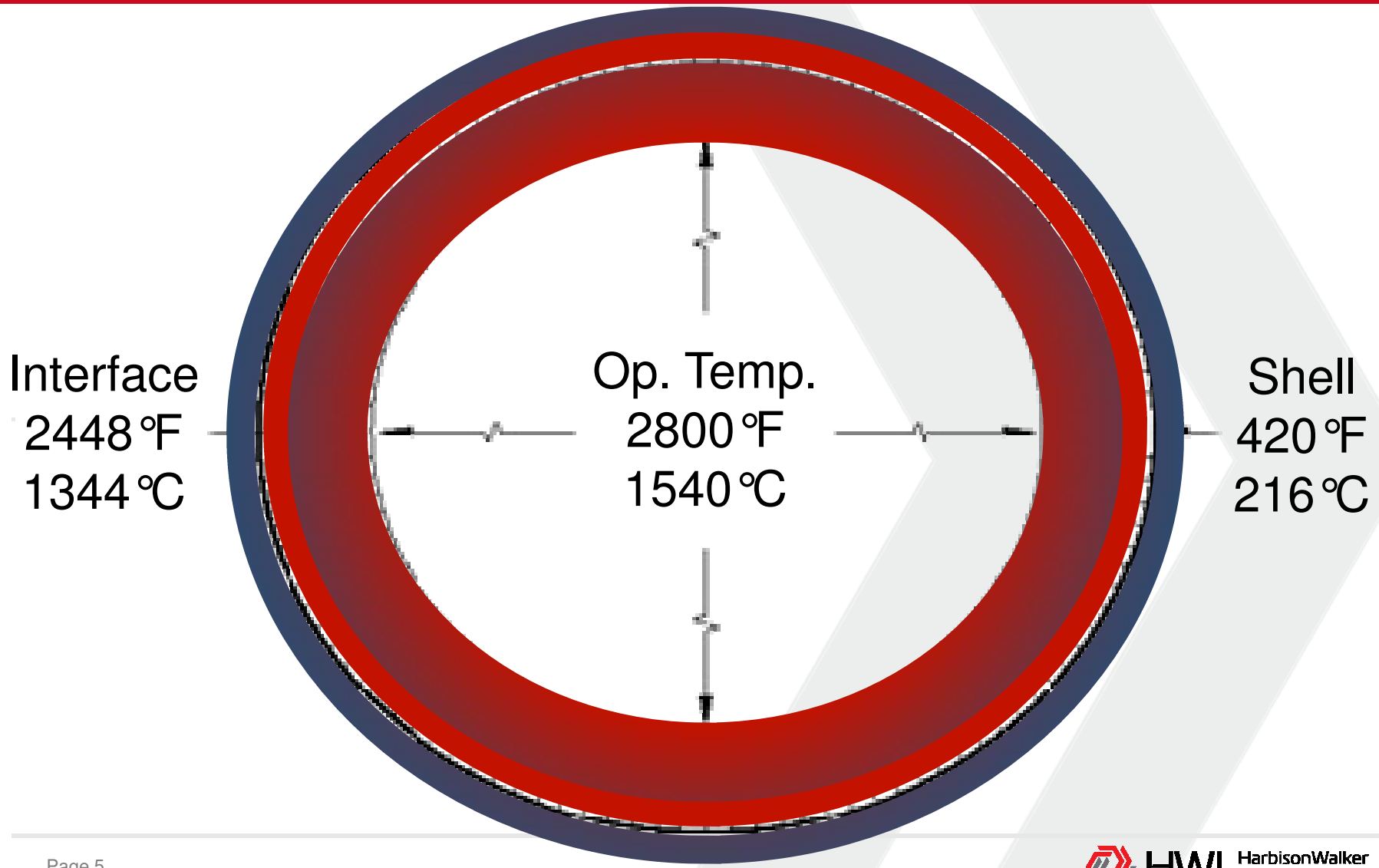
Operating Temperature



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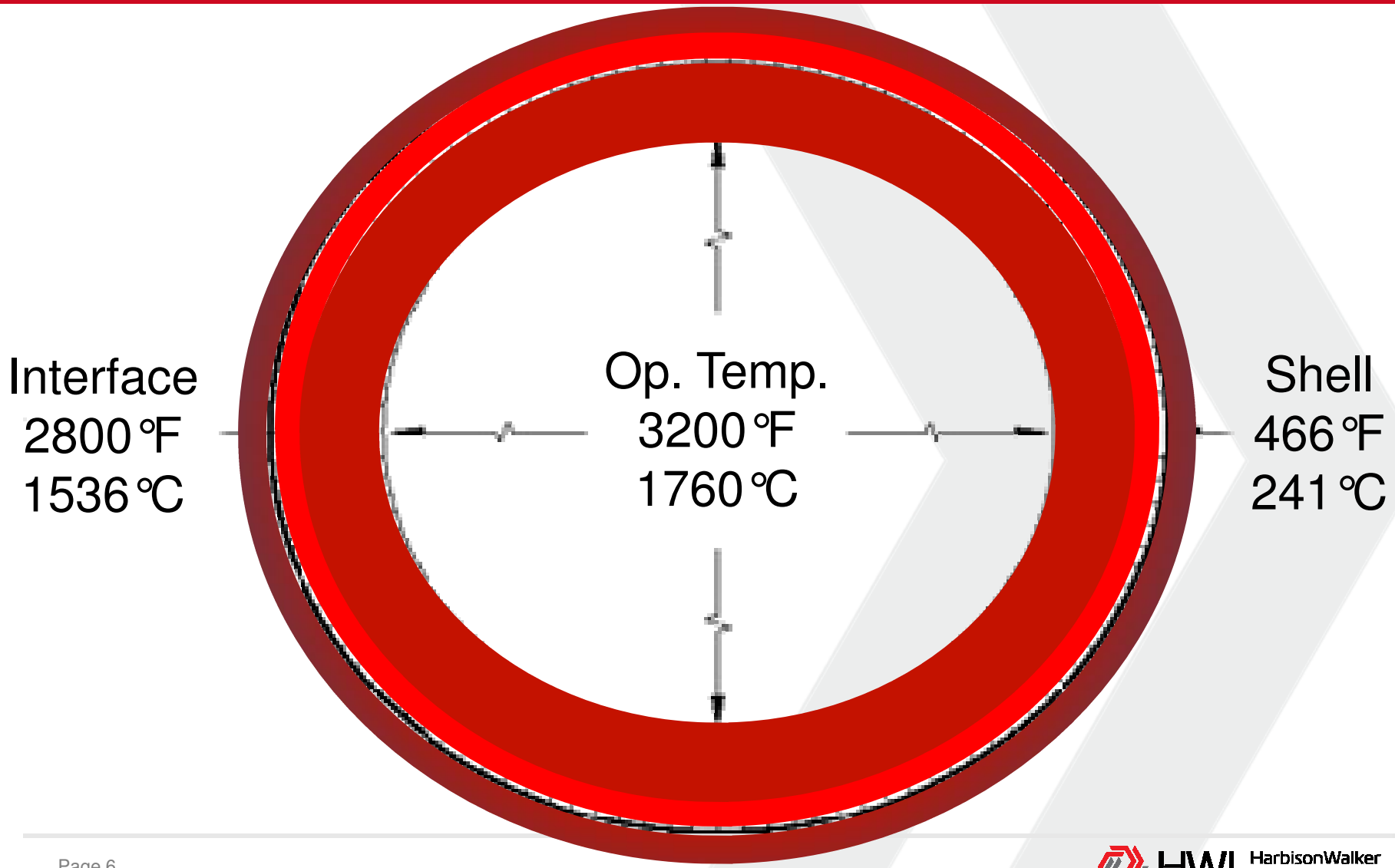
Operating Temperature



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Operating Temperature

Signs of Hotface Instability:

- Hotface brick joints seen open during operation
- Checker wall movement away from the lining
- Severe cracking of feed inlet ports or thermocouple ports due to excessive expansion or movement of hotface lining
- Hotface brick turning to glass or sagging


Sagging Checker Wall Brick


Melted/Glazed Checker Wall Brick


Widening Brick Joints from Slumping
Fractured Bricks from Pinch Spalling

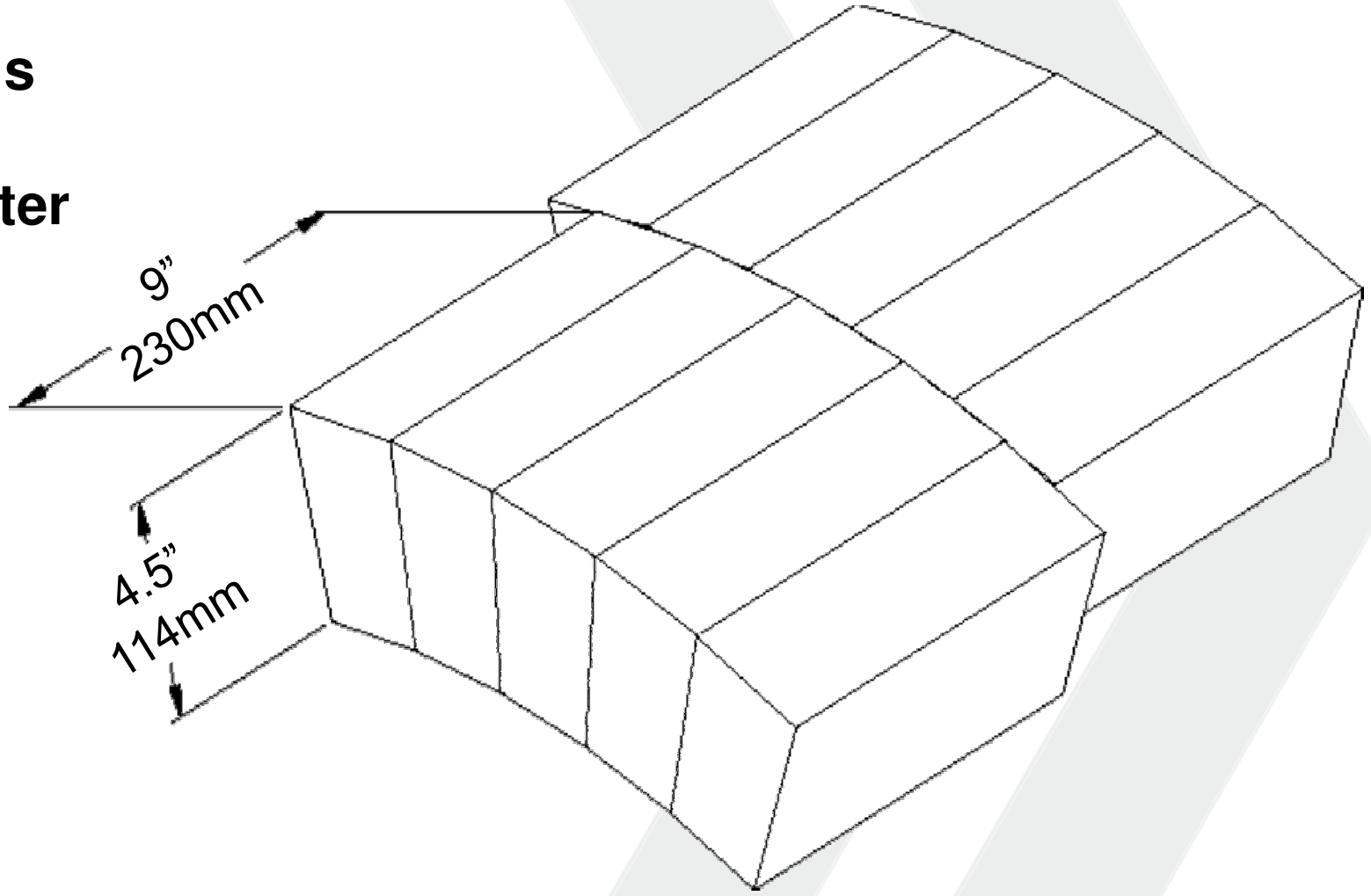
Operating Temperature

Refractory Upgrades to Prevent Hotface Instability:

- Increase the hotface lining thickness
- Increase the temperature grade of the backup lining

Variety of Vessel Sizes

Vessels <6’ Diameter



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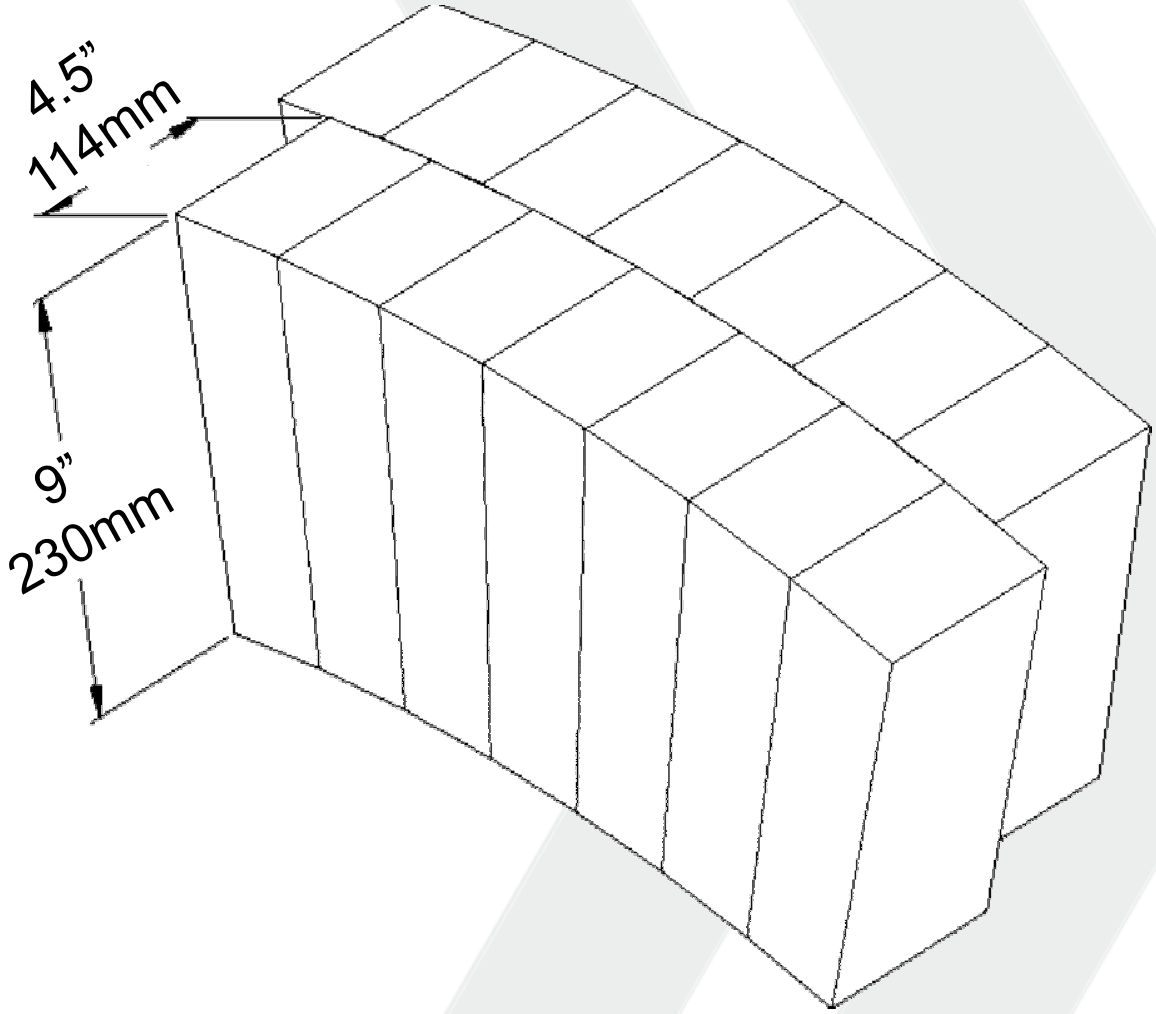
Variety of Vessel Sizes

Vessels
8’ – 13.5’
Diameter



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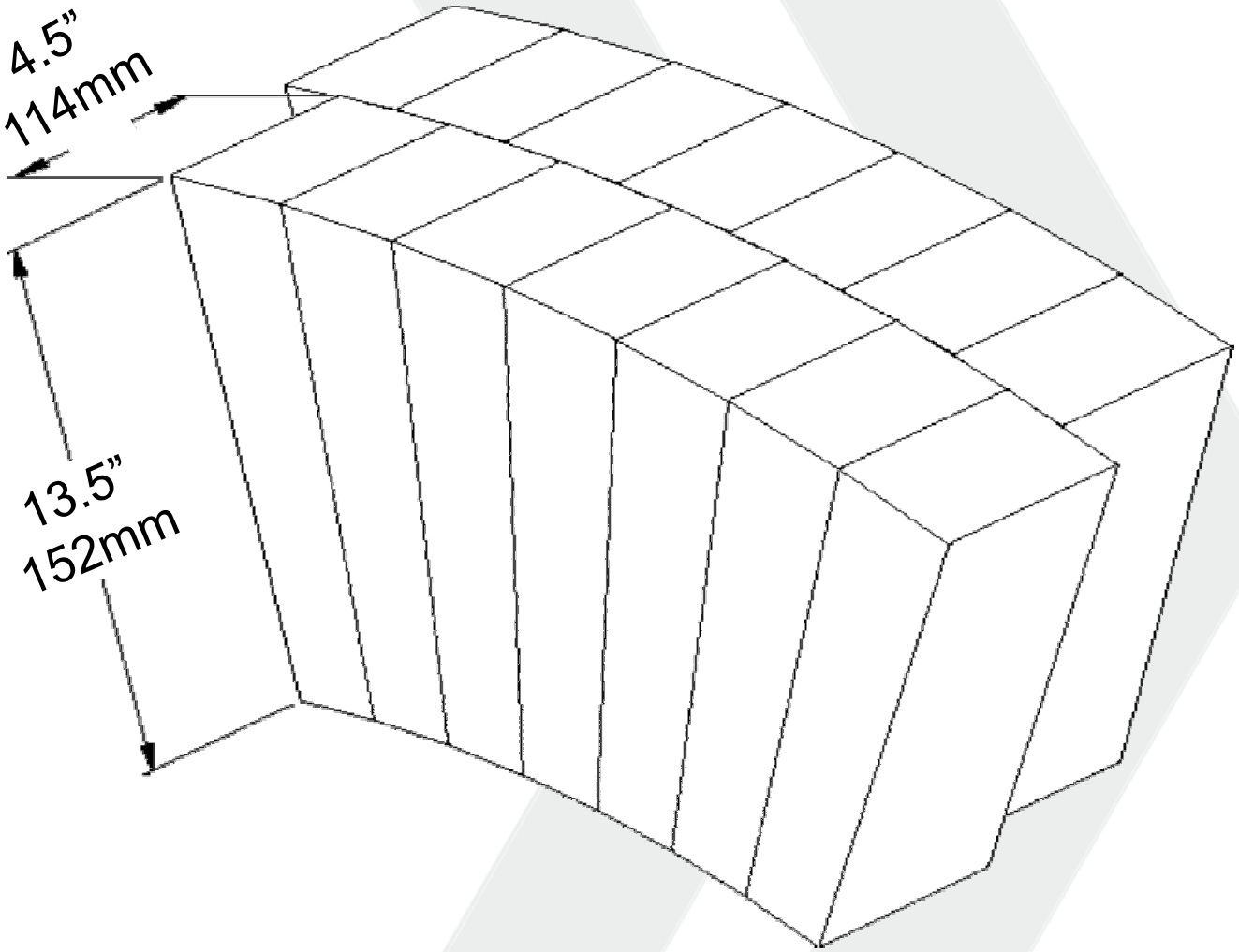
Variety of Vessel Sizes

Vessels >13.5' Diameter



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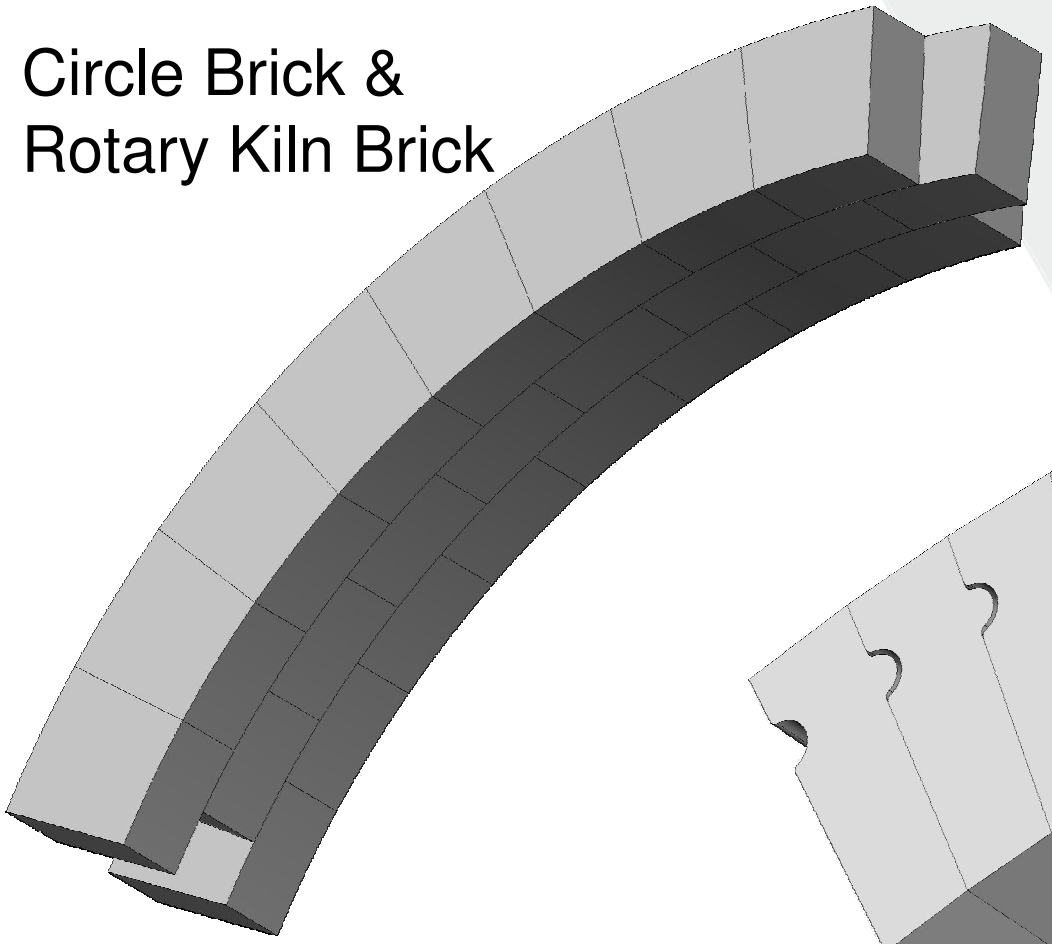
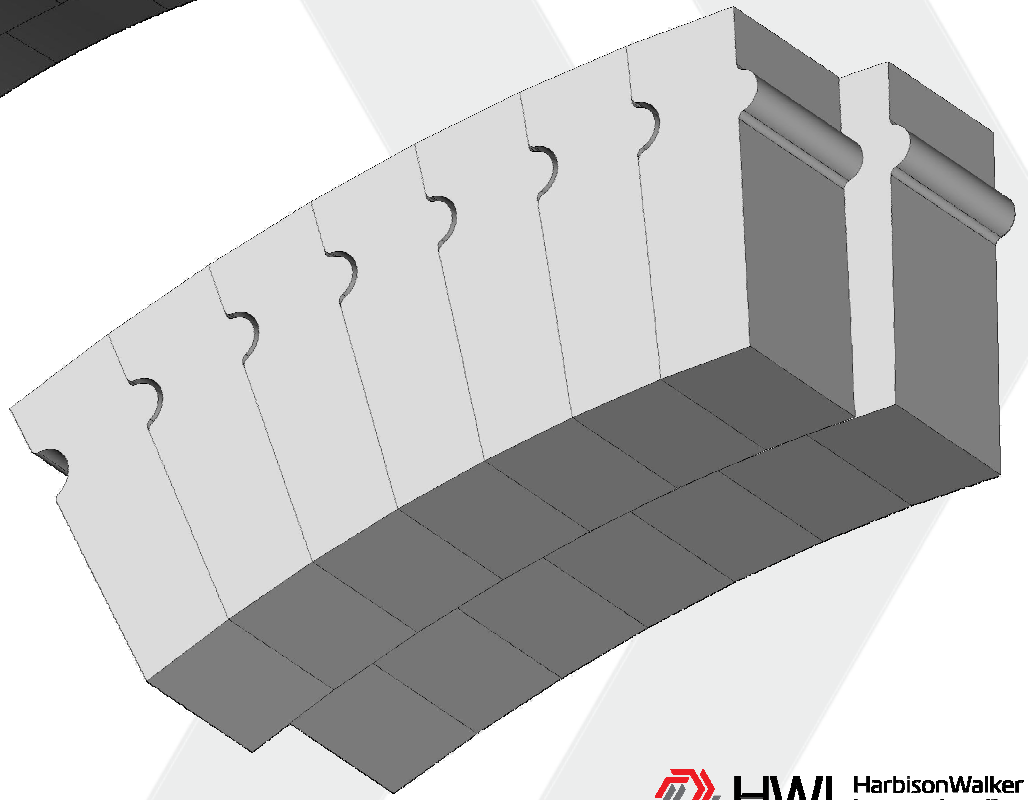
Variety of Vessel Sizes

Circle Brick &
Rotary Kiln Brick



Tongue & Groove Arches



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Expansion Joints

The Purpose of Expansion Joints:

- To allow adequate movement of the refractory lining as it is heated and cooled°

Reversible Thermal Expansion 90% alumina, mullite-bonded brick	
Temp (℃)	Expansion (%)
1000	0.73
1100	0.82
1200	0.91
1300	1.01
1400	1.11

Expansion Joints

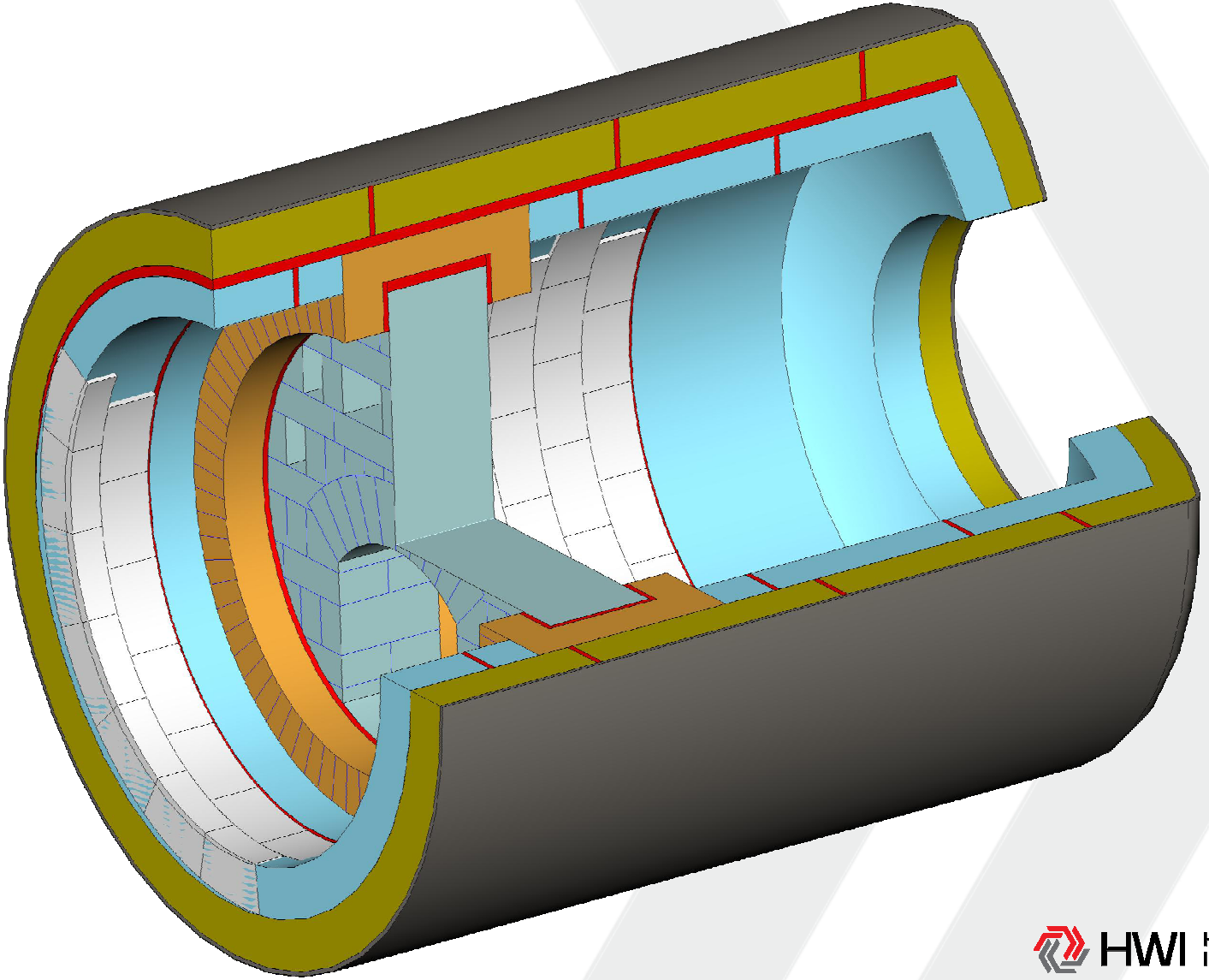
13 Variables:

1. Is there a weather shroud installed?
2. Weather highs and lows (wind and temperature)
3. Operating temperature
4. Upset temperature
5. Movement of steel shell
6. Shell Temps around then entire unit
7. Thermal expansion of refractory lining
8. Thermal conductivity of refractory lining

Expansion Joints

9. Localized flame impingement of the hotface lining
10. Speed of the refractory lining heat-up schedule
11. Width of expansion joints
12. Location of expansion joints
13. Number of expansion joints

Expansion Joints



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Inspection Checklists

Checklists are an important tool to assure that all elements of an inspection are covered every time it is performed.

2. Inspection Checklists

- ❑ Assure temperature sensors are working properly
- ❑ Check flame scanners for sulfur, soot, condensation, etc. and assure they are calibrated properly
- ❑ Fuel gas lines should be blown-down before startup/shutdown
- ❑ Check air/oxygen blowers and meters
- ❑ Glazing, deforming, sagging, shrinking, slipping of hotface and checker wall or choke ring brick
- ❑ Check interior of cracks for similar color to hotface.
- ❑ Look for movement of the checker wall or choke ring
- ❑ Check tubesheet refractory
- ❑ Take “before” and “after” photos
- ❑ Use spray-paint to mark issues
- ❑ Keep track of tube leaks or amine carryover during service
- ❑ Track vibration from the burner
- ❑ Record a history of internal temps, shell temps, and hot spots
- ❑ Record the age of the lining
- ❑ Condition of weather shroud

Future Improvements

Opportunities for Greater Capacity and Reliability

Future Improvements

Scenario 1

A reaction furnace lined with a traditional lightweight castable backup lining can use the newest light weight insulating castable designs that have nearly half the thermal conductivity.

Options for change:

1. Reduce the total refractory lining thickness and increase the volume of the vessel resulting in upgraded capacity.
2. Reduce the backup lining depth and increase the hotface lining depth to allow higher operating temps and greater capacity.

Future Improvements

Scenario 2

A reaction furnace can be completely analyzed and designed in zones according to shell temperatures. This will allow higher operating temperatures and more effective use of the wide variety of refractory products available. For example, thermal shock resistant products could be used in the top 45° of the reaction furnace to counter act the effect of tube leaks or amine carryover.

Thank You

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Solutions for Reliable Lining Design

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