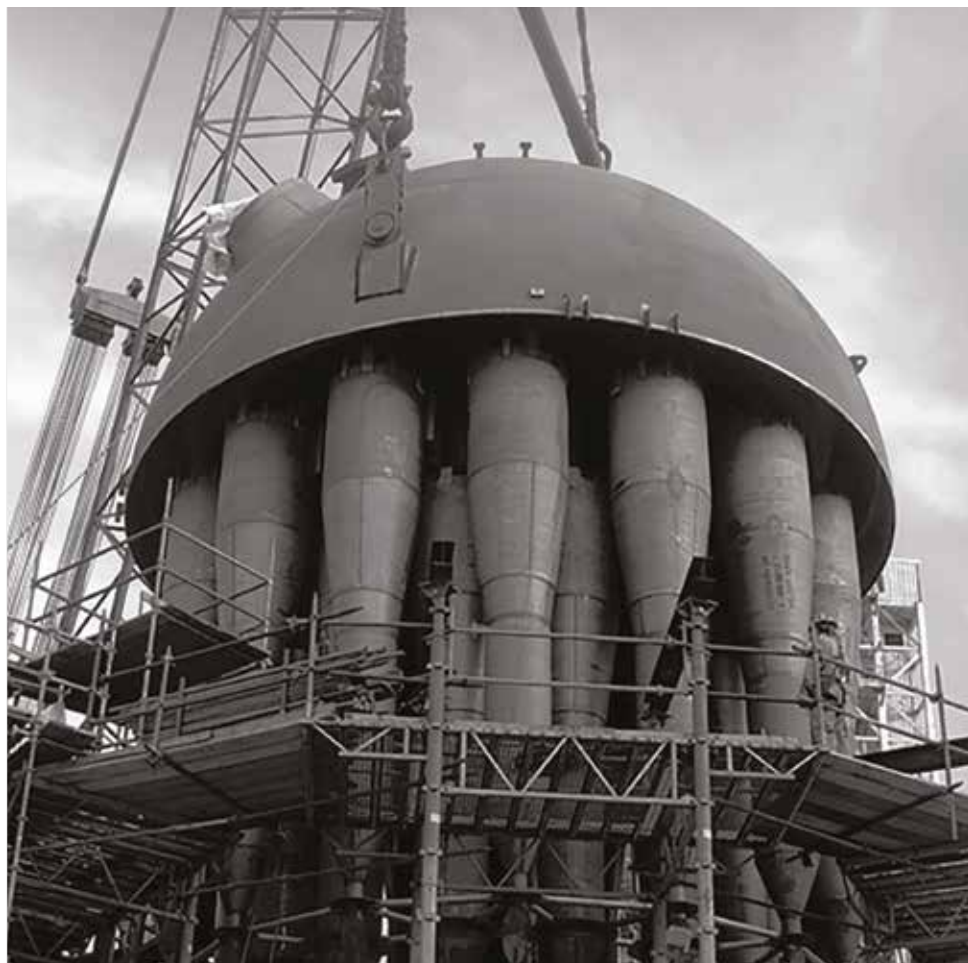


SILICON



Your partner for all refractory anchoring solutions



FCC Refractory Anchoring Solutions

**Full Service Solutions Provider:
Engineering - Production - Installation**



Patents

Closed Hex Solutions

SpeedHex® 3 (For Coking and Non-Coking)

The natural evolution to hex metal.

The following patents have been submitted and granted to SILICON in relation to the SpeedHex® system:

- EP2985106
- EP19156466.5
- US9,279,245
- US10,190,314
- US10,961,712
- US16/221,869
- US17/185,297
- US29/743,355
- NL2013327
- IN2471/DEL/2015
- CA 2,820,548
- CA2900025
- AU2015213304
- JP6533121
- JP20190096558

SpeedHex® 6 (For Non-Coking)

Fewer welds, works like SpeedHex.

The following patents have been submitted, SILICON SpeedHex® 6 system:

- NL2023011
- PCT/EP2020/060992

Open Hex Solutions

SpeedBar® 2 & 4

For end-users that still use flow-specific anchoring specifications.

The following patents have been submitted, SILICON SpeedBar® system:

- NL2023010
- NL2023011
- PCT/EP2020/060992
- EU20170355.0
- US16/855,423
- CA3,077,949

Closed vs. Open Hex Philosophy

SILICON recommends using a Closed Hex solution. Because it does not have to align with the vessel's flow, the full hexagonal shape is extremely versatile. Open Hex solutions are based on older single-point anchors (such as the K-Bar). While these lining types are still commonly specified, there is a greater risk of cracking not being properly contained, as seen with the SpeedHex and hex metal options. SpeedHex is a natural evolution to hex metal, but we can offer SpeedBars if your specifications require it.

SpeedTab® (For Edges and Corners)

Increasing refractory retention on corners.

The following patents have been submitted, SILICON SpeedTab® system:

- NL2023012
- PCT/EP2020/060994
- EP20718689.1
- US17/605,361

SpeedStrip™ (For Terminations)

Solving termination strip inefficiencies.

The following patents have been submitted, SILICON SpeedStrip system:

- NL2023014
- US16/855,454
- CA3,077,964

SpeedTab® Mega (Castable Bullnoses)

Replacement for designed-to-fail Monster Tabs.

The following patents have been submitted, SILICON SpeedTab® Mega system:

- NL2025862
- PCT/NL2021/050380

We are always working on new and better solutions. That is how we continue to evolve.

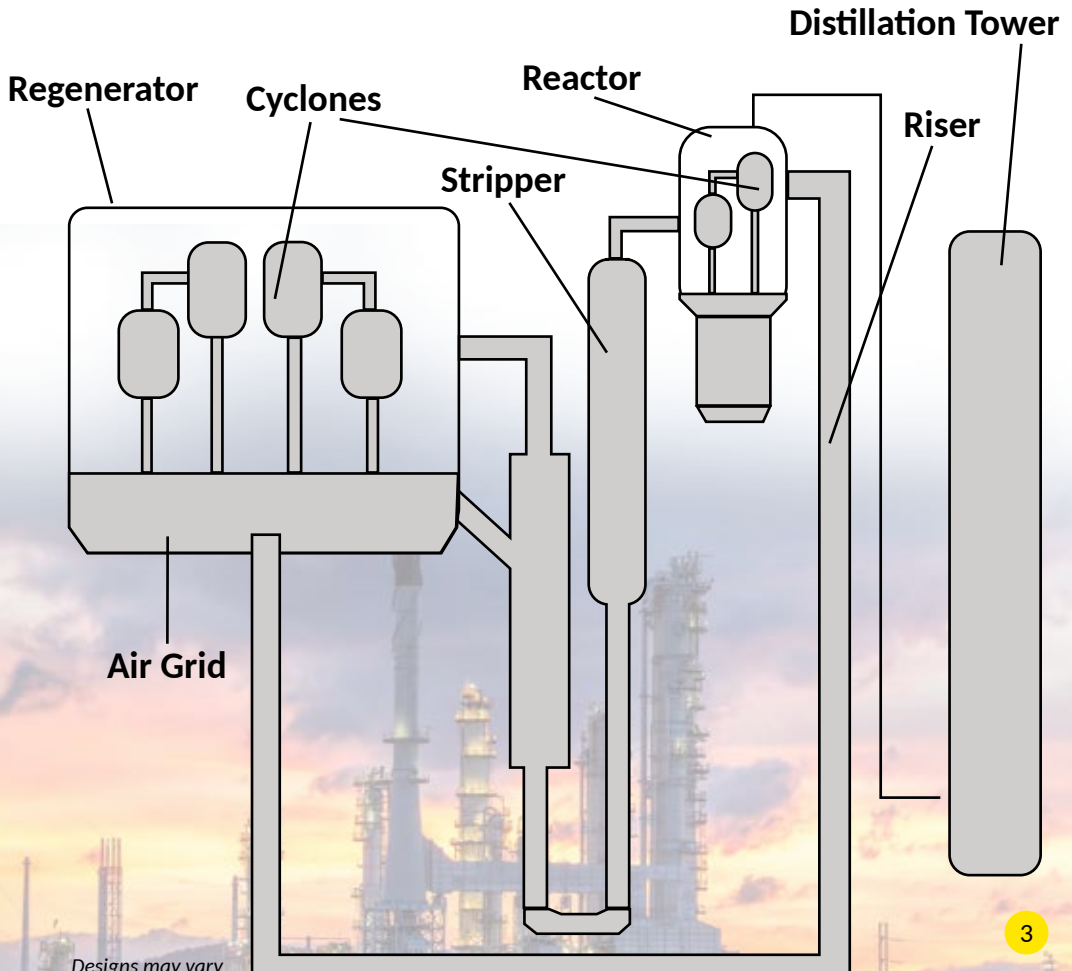
Fields of Application

SILICON is a Full Service Solutions Provider:

1. Engineering – SILICON provides custom and proprietary products and solutions.
2. Production – SILICON has a state-of-the-art Refractory Anchoring & Rapid Arc Welding production facility.
3. Installation – SILICON has a dedicated crew that supervises and/or installs Refractory Anchoring Systems with our own Rapid Arc Welding technology worldwide.

We have products for each component of an FCC, because we know each part has its own unique problems.

There is a solution for every problem. An anchor for every lining.



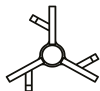
CYCLONES

(Reactor, Regenerator and Late-Stage Separators)

Problem: Hex metal — A ticking-time bomb

- Currently, the steel clasp between two metal plates allows a bypass of gases and catalyst/product to go behind the protective lining and abrasion resistant material.
- **The welds have many potential failure points:**
 - due to stresses when installing (rolling and hammering) the hex metal into position
 - due to attacks on the welds by the gases that bypass through the cracks
- The failure rate is heightened by the recurring expansion of hex metal resulting in the potential domino effect of sheets detaching from the shell.
- These failures can lead to process disruptions, and may cause catastrophic damage, like clogged-up dip legs, that will often require an **emergency shutdown**.

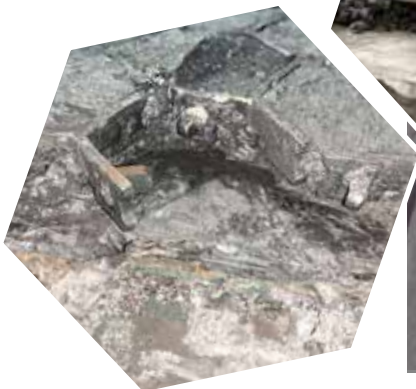
Our Solution: SpeedHex® 3



The SpeedHex® 3 is designed to remove the direct path to the shell for gases and enable continuous refractory protection across the surface of the shell, rather than only cookies/small pockets of protection and allows for more refractory material to flow through, over, under AND in between each cell.

Less steel, more refractory - a better balance for hex linings with more protection. This design also allows for multiple alloys to be used, to ensure superior welds can be achieved.

Multiple service cycles have shown excellent retention of refractory to the shell without observing any detachment from the shell.



$\frac{3}{4}$ to 2" (19mm to 50mm) Abrasion Linings

Problem: Edges and Corners

Standard variable standard corner tabs fail on a regular basis. The corners see the **heaviest abrasion** due to changes of pressure. The long exposed steel path on the corner causes anchors to be eaten up and refractory to fail.

Our Solution: SpeedTab®

These facilitate greater refractory protection and a better hold on the corners, where the thermal cycling is especially heavy and commonly "pushes away" the steel and lining over a given period.

The SpeedTab® is incredibly versatile and also resolves some of the termination bar issues on corners where the complexity of the shape of the junction reduces the effectiveness of other anchorage options.



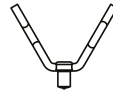
CASTABLE LININGS (Any Refractory-Light to Dense)

Problem: Standard Wavy V Anchors

Commonly welded by hand with an electrode, V anchors are unreliable, inefficient and have serious health hazards due to the presence of hexavalent chromium. These problems often lead execution planners to miss out critical preventative maintenance repairs during turnarounds.

From a reliability point of view, V anchors fail over long periods of time due to sensitizing of the steel and ripping that occurs at the unwelded portion of the upwards bend at the footed base.

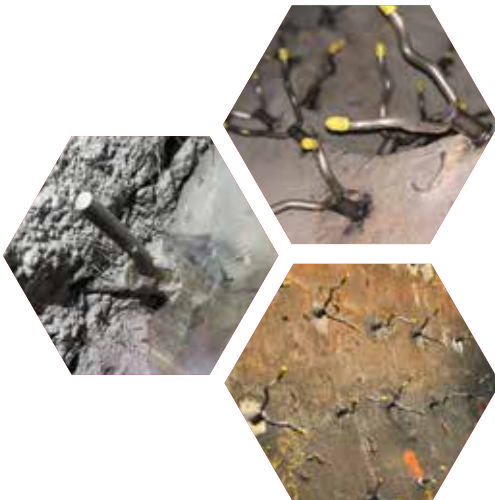
Our Solution: SpeedVee®



SpeedVee® anchors have outperformed conventional V anchors in every vessel they have been installed in. They're safer, more reliable and more cost-effective by having huge positive schedule impacts.

With these full fusion welds, V anchors are no longer just little refractory attachments.

They have become **mechanical upgrades,**
with **refractory features.**



1.5" to +16" (38 to + 400mm) Thermally Insulating Linings

Problem: Bullnose Transition

Thermal cycles on bullnose transitions cause frequent cracking and chunks of refractory to fall off. Variable monster tabs have been used as a controlled cracking mechanism, but **they are designed to fail and be replaced every turnaround.**

Our Solution: SpeedTab® Mega

The SpeedTab Mega uses the same successful design philosophies as many other SILICON anchors.

By reducing the exposed steel, more refractory can flow over, under and through the anchor - keeping the refractory where it belongs - **on the shell.**



FIBER LININGS

(Exterior of the Cyclones, Air Grids, Interior of the Burners and Other Internal Components)

Problem: Insultwist

Refineries have lived with failing fiber pins for years. The conventional insultwist/twist-lock anchors snap off, fail at the weld or lose their not-so-locking clips.

Its rectangular cut-out shape was not meant for longevity. Once fiber inevitably comes loose, temperature differentials can be detrimental to thermal expansion in certain key areas, leading to cracks and/or shifting of steel.



Insultwist

Our Solution: FiberFix™



The design of our FiberFix™ is rounded and does not have any cut material to make "grooves". It has shaped notches that help **lock** the washer into place, preventing undesired shifting of material during service.

Fiber pins are commonly bent over due by walking on or near them, the FiberFix is designed to withstand such forces without snapping off. This makes the anchor re-usable with long-term reliability in mind.

Our mounting clips fit snugly around the anchor, ensuring multiple layers are fixed securely in their place.



1" to 8" (25 to 150mm)
All Fiber Types



FiberFix



TRANSITIONS

Castables into Abrasion Resistance

Problem: Non-standard Applications

Dual-lined transitions on flared sections on vessels have been plagued by makeshift options that are inefficient and unreliable. S-bars, stand-offs with hex mesh, chamfered hex cells, protruding plates and so on - all have their issues. Prior to starting turnarounds, these key areas are often overlooked and, if found during inspection, **can become a critical path problem**.

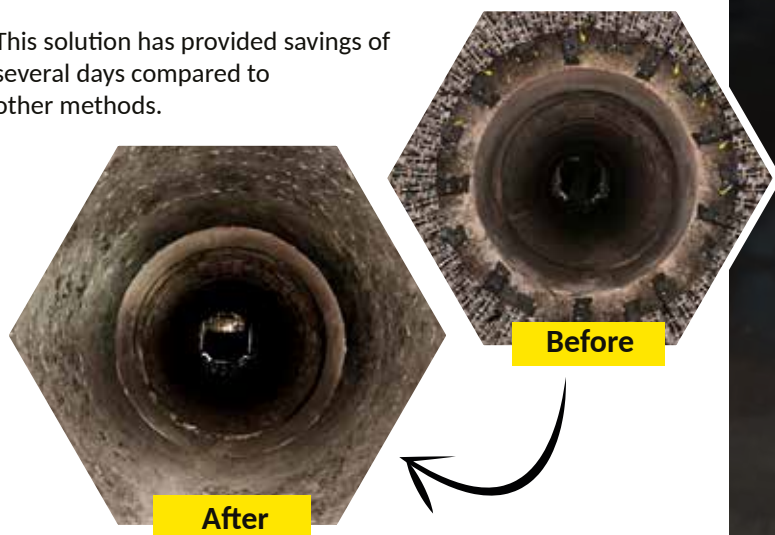
Our Solution: SpeedHextensions™

By taking a few dimensions of your transition, we automatically map out the pattern needed to transition smoothly from an abrasion resistant lining to a castable/monolithic lining.

Incorporating successful design characteristics of the SpeedHex®, we are able to provide similar benefits on the front-facing portion with additional thermal properties on the backup layer. Each anchor is made flush to avoid disruption of your process flow.

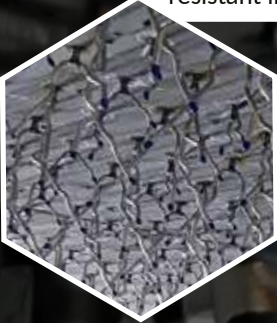
Refractory selection could require some additional vertical support to avoid sagging, and SILICON has various anchoring solutions for this as well.

This solution has provided savings of several days compared to other methods.



HYBRID AND DUAL LININGS

The increasing emphasis on energy conservation and higher operating temperatures has meant that refractory concrete linings are frequently employing multi component configurations like high-density hot face abrasion resistant linings backed by lower density linings for thermal protection.



SpeedVee® Dual

The SpeedVee® Dual incorporates the successful design philosophy of the SpeedVee® and has been specifically developed for dual linings.

The lower portion of the anchor is vertical until the separation point of the backup layer. From that point, the 'V' anchor flares into a standard Vee anchor design. This helps in gauging where to stop the backup layer. The lower and upper portions of the anchor also have different angles. Corrugations may be included in the upper and/or lower anchor portions based on preference.



Hybrid Solutions

If there is a desire to stay closer to existing specifying documents, we can optimize some of the components to still provide some time-savings.

Any existing method can be optimized while still adhering to specifications.



RAW - Rapid Arc Welding

Developed by SILICON, Rapid Arc Welding (RAW) is an innovative method of attaching refractory anchors inside high-temperature vessels and furnaces. It is recognized industry-wide for its ability to optimize the quality, speed and safety of the anchor installation process.

When it comes to designing, manufacturing and installing refractory anchors, we are the experts. We recognize that it is crucial for our customers to minimize downtime on their plants and projects. That's why we make every effort to ensure our service delivery is geared to achieve that goal, while complying with COVID-19 safe work procedures.

Your benefits

- 60 - 70% fewer staff required in one space
- 10 times faster
- Fast response and mobilization
- Countless more benefits



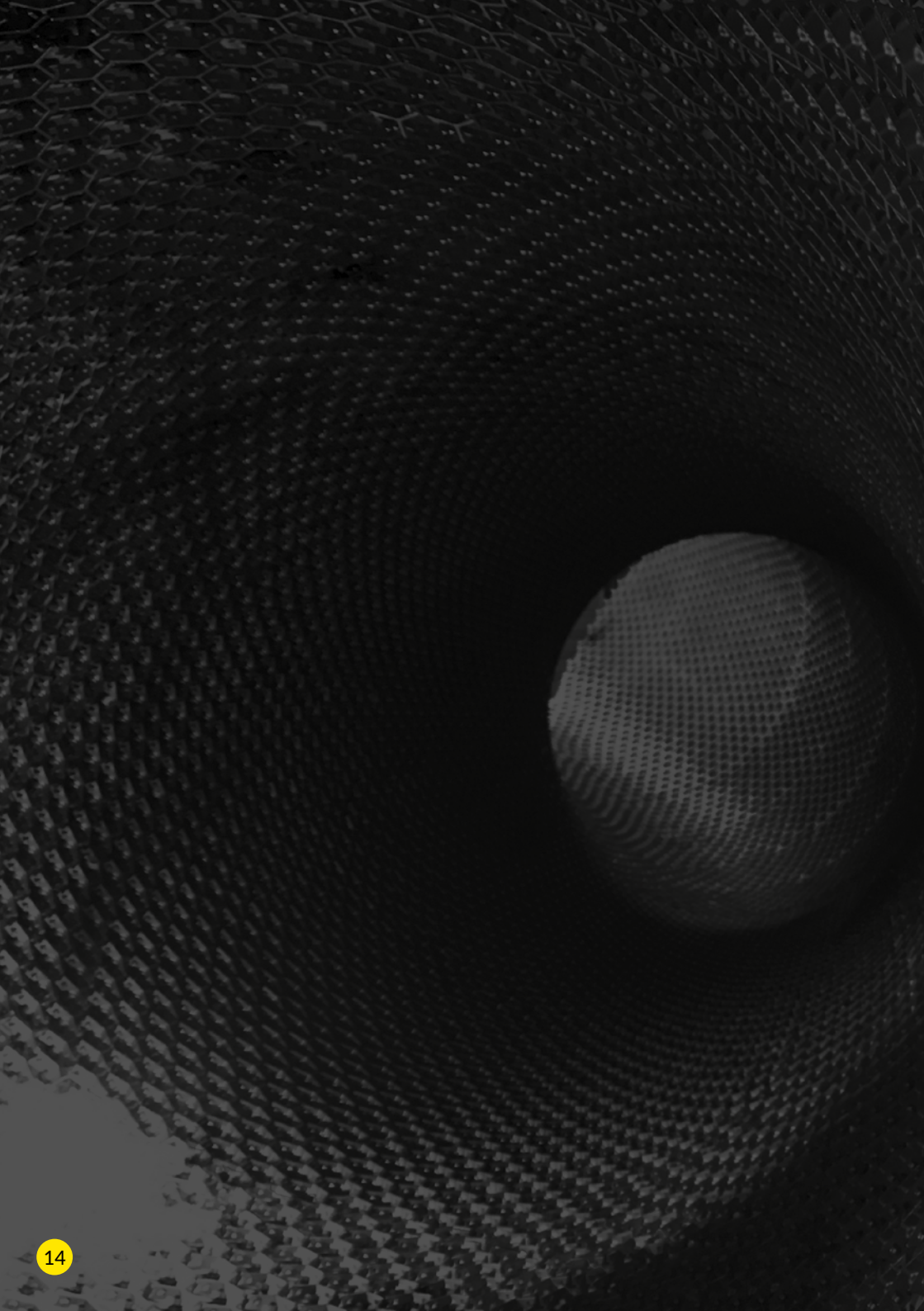


SILICON RAW Team

Using RAW technology, rather than conventional welding methods, our teams dramatically reduce installation time while achieving unparalleled efficiency. They use automatic computer-controlled technology combined with years of hands-on experience to achieve **optimum & persistent quality, countless time savings and exceptional safety performance.**

Do you face challenges beyond those listed in this brochure? Don't hesitate to inquire about our additional solutions tailored for Air Rings, Risers, Strippers, Mix Lines, and many more.

We have a solution for every anchoring problem.





*Find out how
we can help
you.*

SILICON



Your partner for all refractory anchoring solutions

Corporate Vision

To positively impact industries by providing superior anchoring systems and time saving Rapid Arc Welding services.

Corporate Mission

Our mission is to provide the technical and metallurgical expertise required to bring Refractory Anchors, and their installations, to the next level.



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