

Factors Influencing Campaign Life of PGM Furnace Hearths

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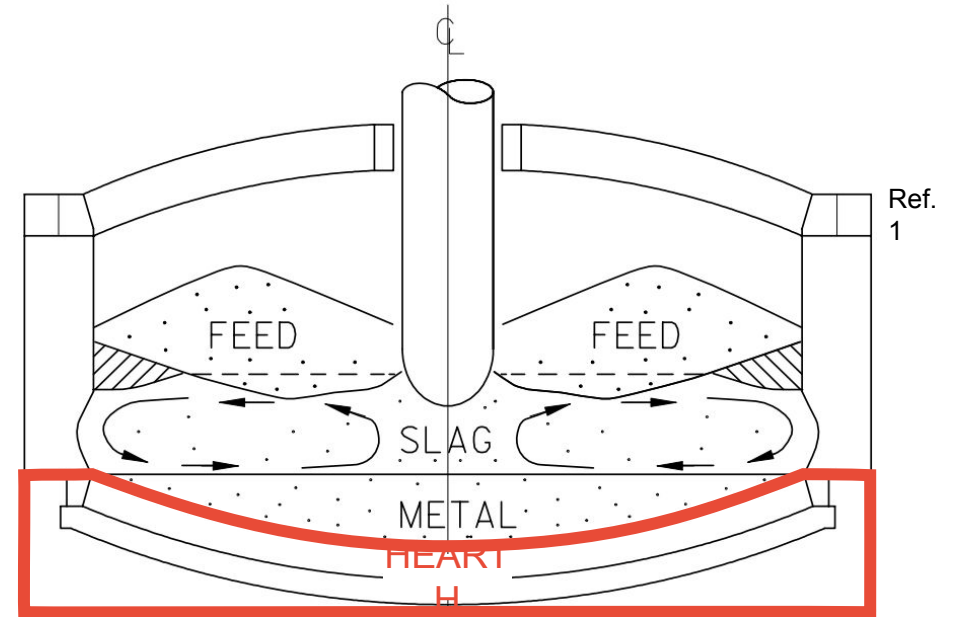
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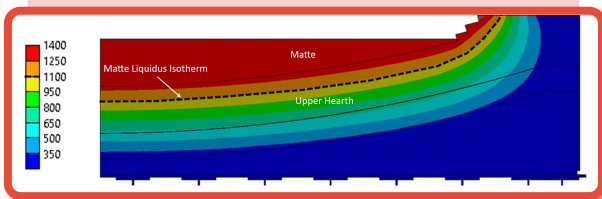
Factors Influencing Campaign Life of PGM Furnace Hearths

- The end of a hearth campaign is typically driven by:
 - growth □ inverted arch instability and/or expansion limits
 - wear □ reduced lining thickness and/or crucible instability
- A furnace hearth reline and recommissioning takes 3-5 months
 1. Affects cash flow of the operation
 2. May lead to increased concentrate stockpiles
 3. Can lead to safety risks to the operating team
 4. Contributes significantly to sustaining capital cost



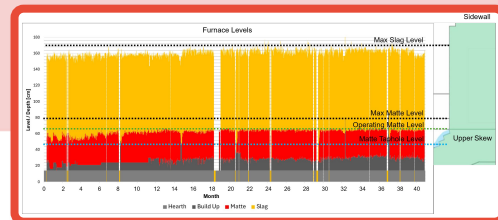
Design

- Process design
- Hearth geometry
- Hearth materials
- Binding



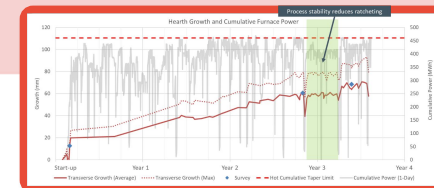
Process Stability

- Feed blending
- Bath levels and electrode immersion
- Feed-to-power ratios



Monitoring

- Start-up growth
- Ratcheting
- Hearth lifting
- NDT and thermal analysis



Maintenance

- Binding spring adjustment
- Thermal cycle management
- Maintenance synchronization

Design

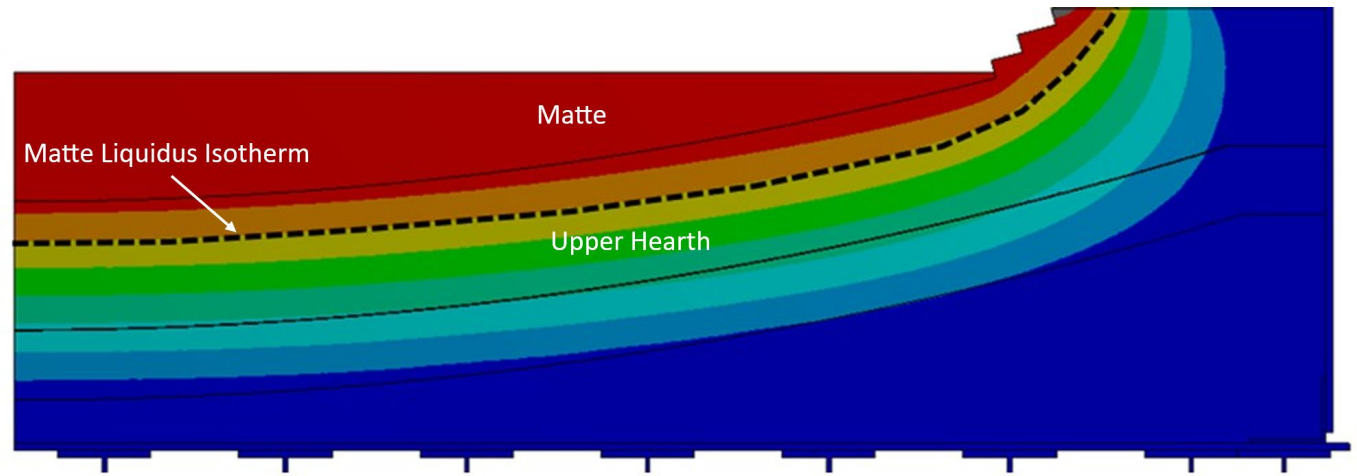
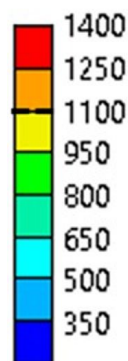
Process design

- Feed composition
- Bath levels
- Feed-to-power ratios

Hearth geometry

- Cumulative taper
- Matte taphole elevation
- Tongue and groove
- Skew position

Reference



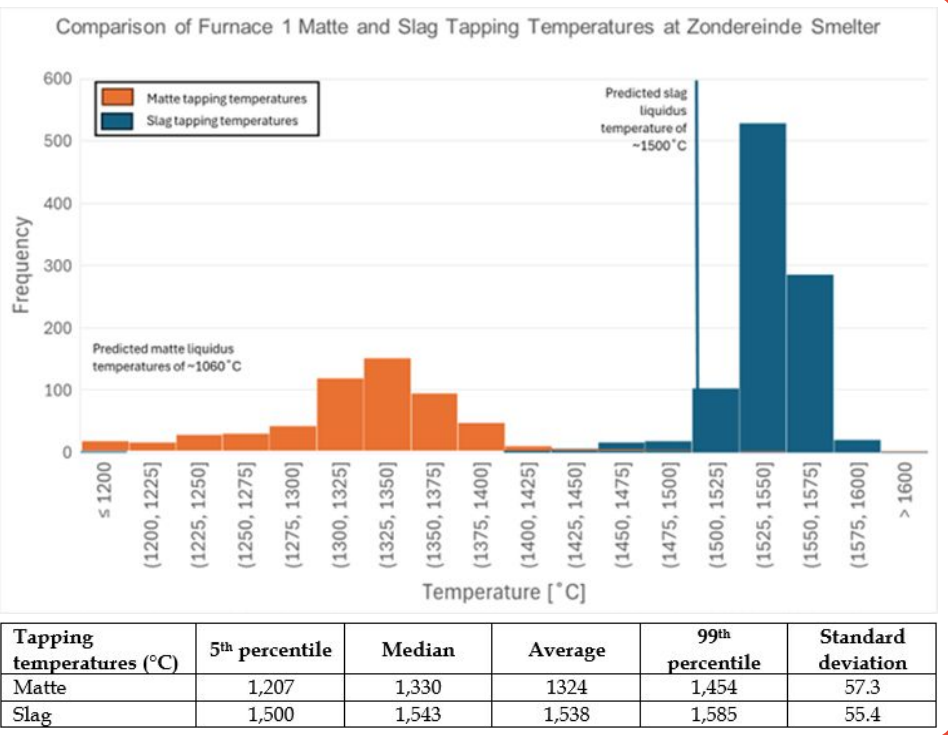
Binding

- Spring-tie rod systems (rectangular furnaces)
- Shell hoop stress (circular furnaces)

- Refractoriness, chemical stability
- Matte solidus isotherm

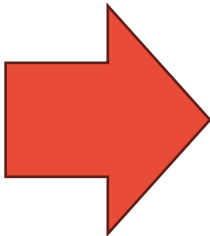
Hearth materials

Northam



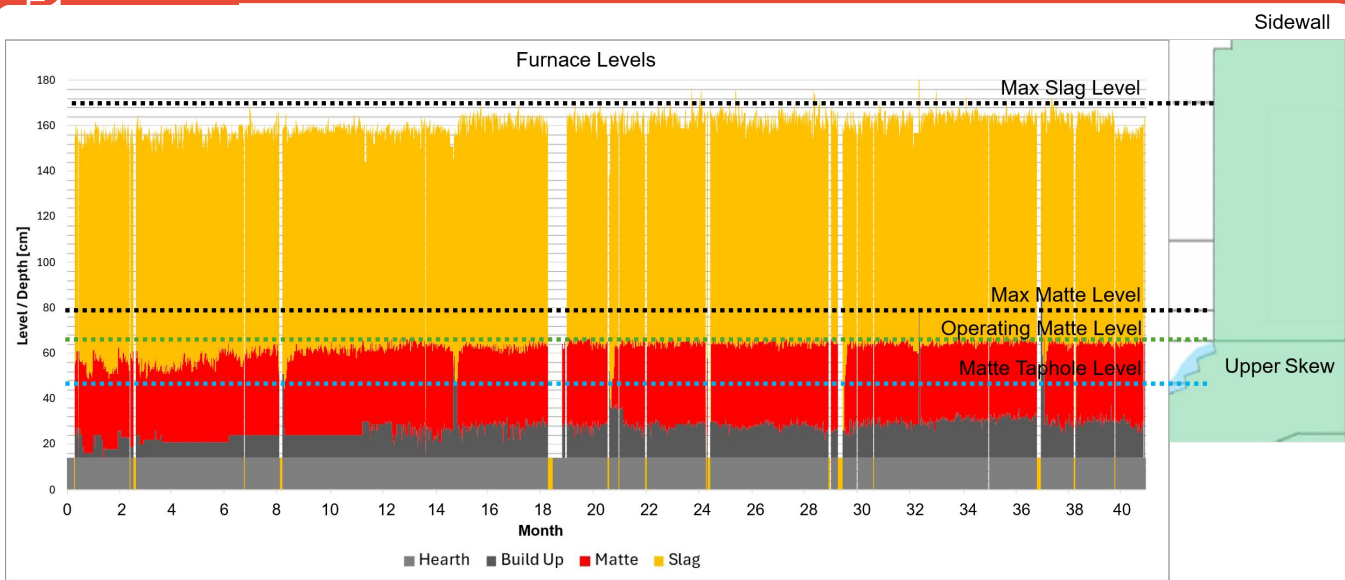
Process Stability

Consistent furnace feed
Bath levels and electrode immersion
Feed-to-power ratios



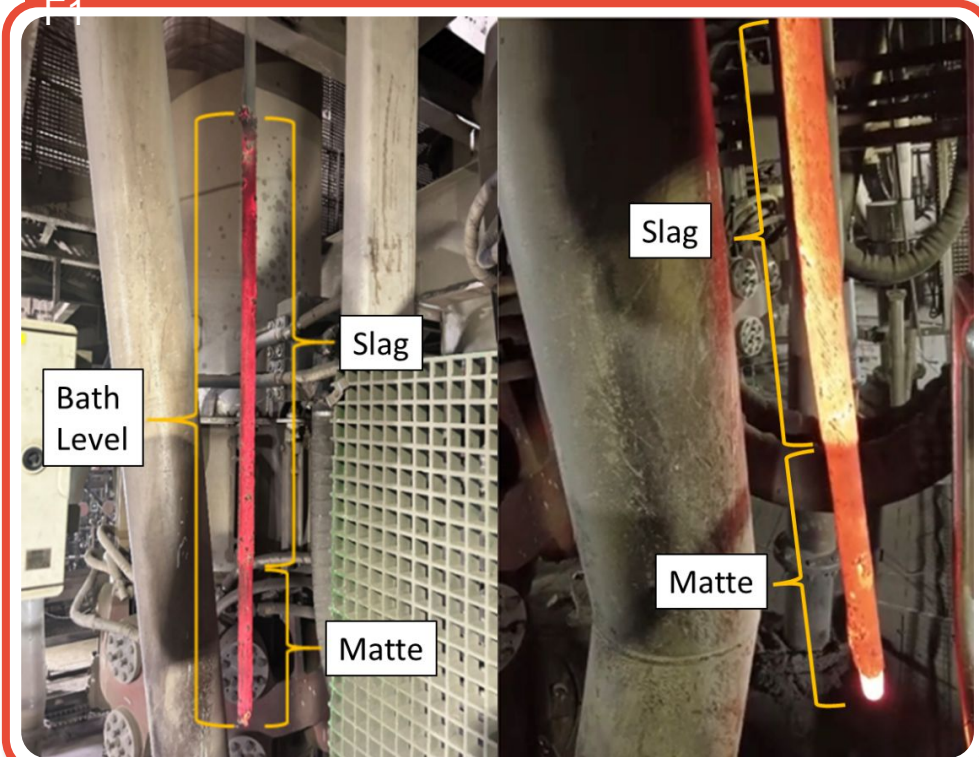
Consistent slag and matte temperatures, slag viscosity and slag electrical properties
Stable freeze lining that protects refractory
Fewer thermal cycles

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F4



Matte levels	Difference between mean level and operating level (cm)	Standard deviation (cm)
January 2022 to June 2022	-6.9	3.4
January 2025 to June 2025	0.2	1.3

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F4



Monitoring

Start-up growth

- Confirm successful hearth heat-up
- Baseline for future hearth growth monitoring

Ratcheting

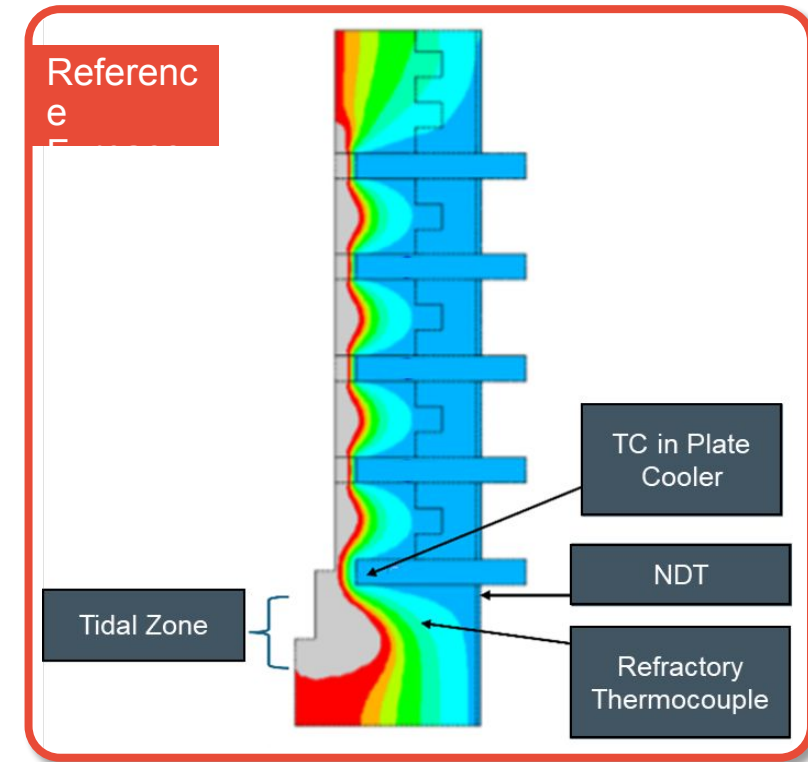
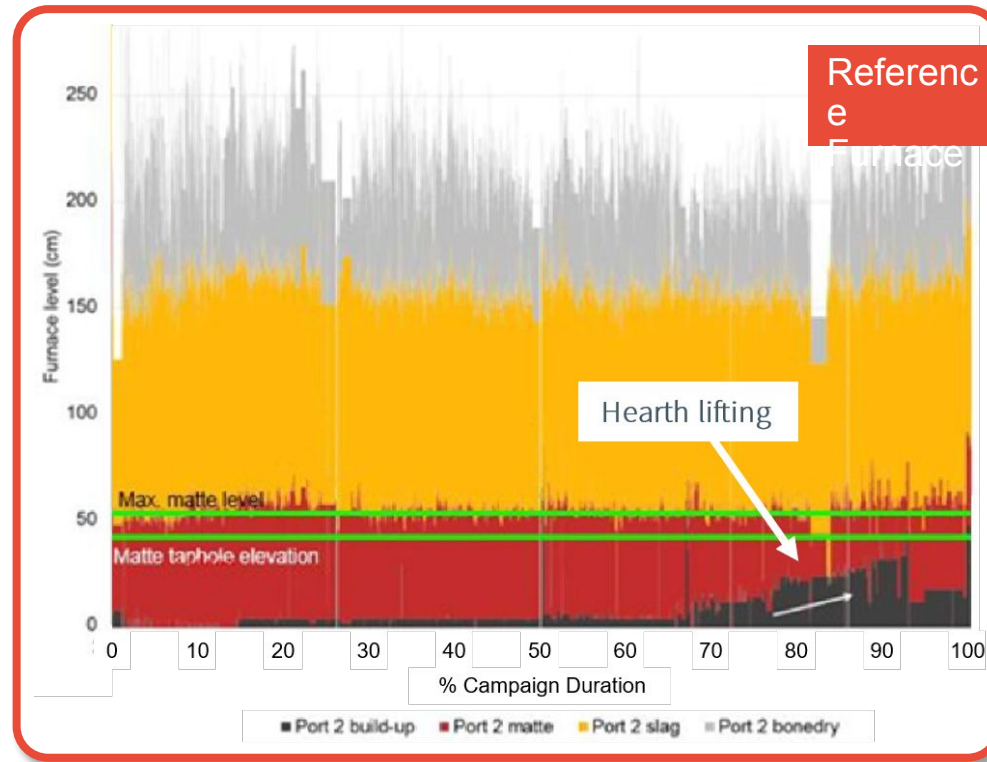
- Thermal cycles lead to molten material infiltrating gaps

Hearth lifting

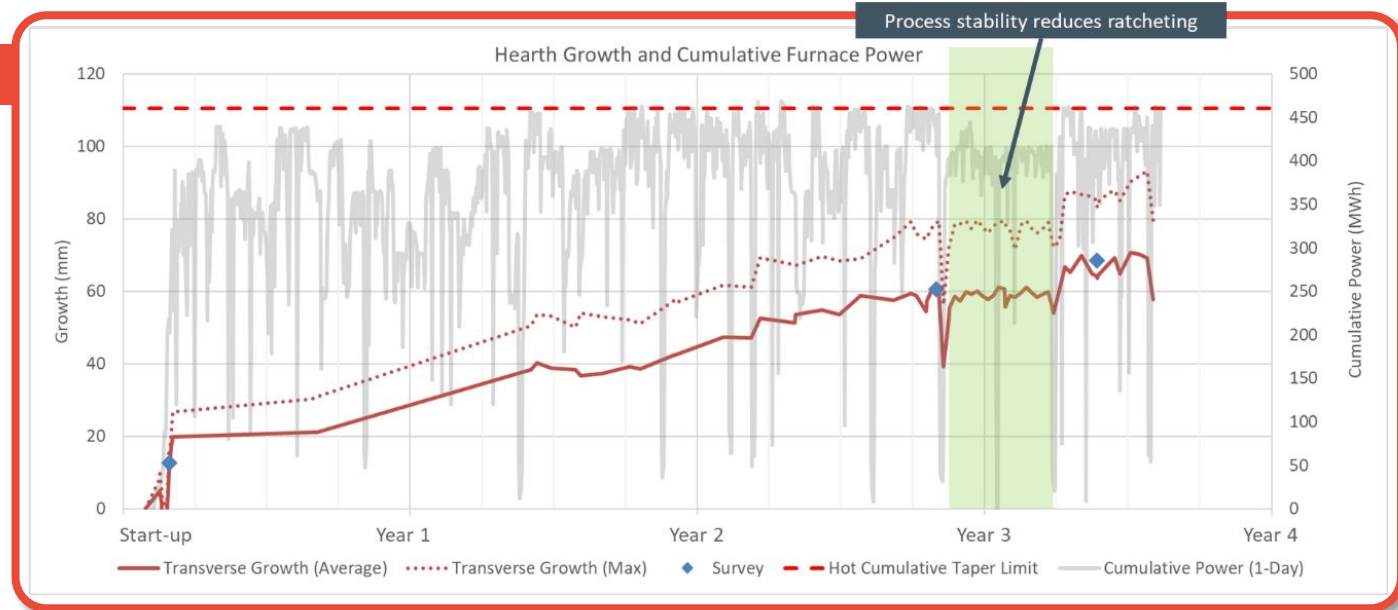
- Sounding bar measurements can be used to detect hearth failure due to brick flotation

Non-Destructive Testing (NDT) and Thermal Analysis

- Assess remaining refractory thickness



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Maintenance

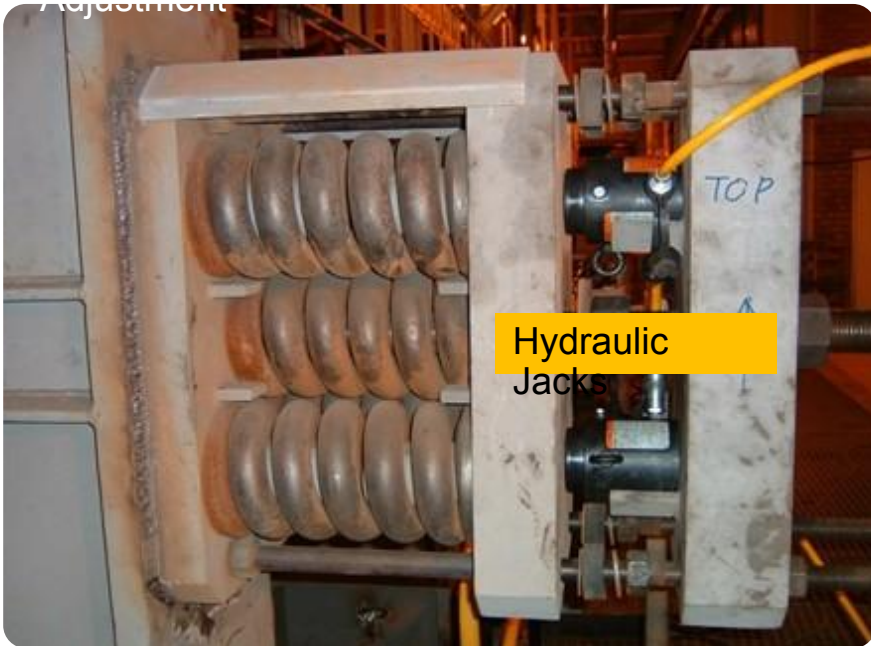
Binding spring adjustment → Maintain loads to keep brick joints tight

Magnitude of hearth temperature change → Reduce thermal contraction and ratcheting

Rate of hearth temperature change → Allow sufficient time for thermal expansion

Maintenance synchronisation → Reduce the number of thermal cycles due to shutdowns

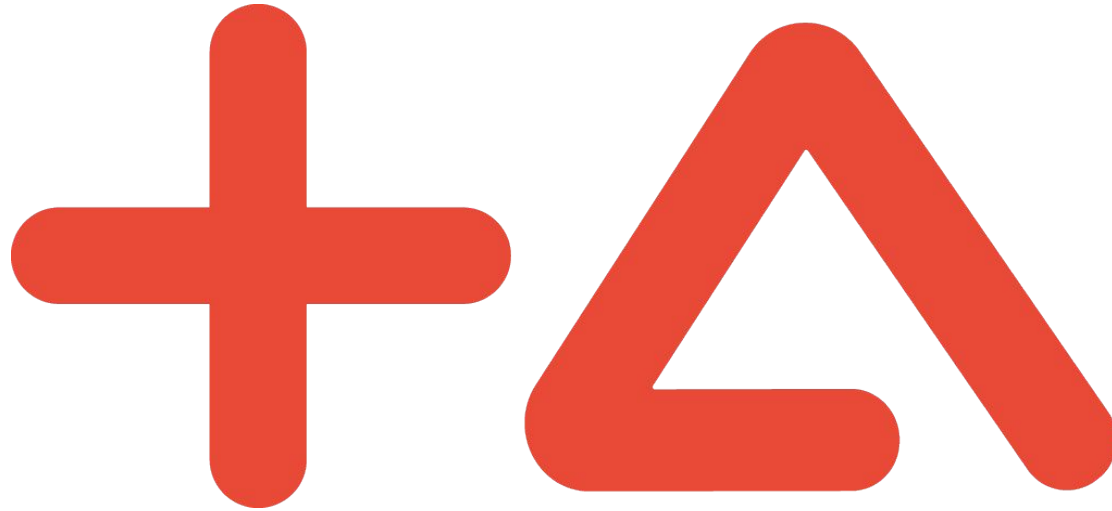
Binding Spring Set
Adjustment



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Hatch PGM
Website



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