Manganese:

Manufacturing Overview and Alternative Maintenance Practices

Alf Basson and Jason Babcock

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Challenges with Manganese

- As cast - hardness only 240 HB
- Difficult to weld
- Toxic fumes when cutting
- Non-magnetic

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Manganese: Manufacturing Process

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Why Are Crusher Liners Manganese?

Still the only metal that work hardens

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Manganese: Chemistry

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Grade	C	Mn	Si	P	Cr	S
14%	1.11	13.56	0.344	0.0358	1.66	0.0054
18%	1.22	18.36	0.432	0.04	1.7	0.0056
21%	1.26	21.46	0.36	0.04	1.15	0.004
24%	1.3	23.6	0.557	0.0326	1.09	0.0038

- Manganese - Impact resistant
- Carbon – Wear resistant
- 14% vs 18% vs 21% vs 24%

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Manganese: Molding Process

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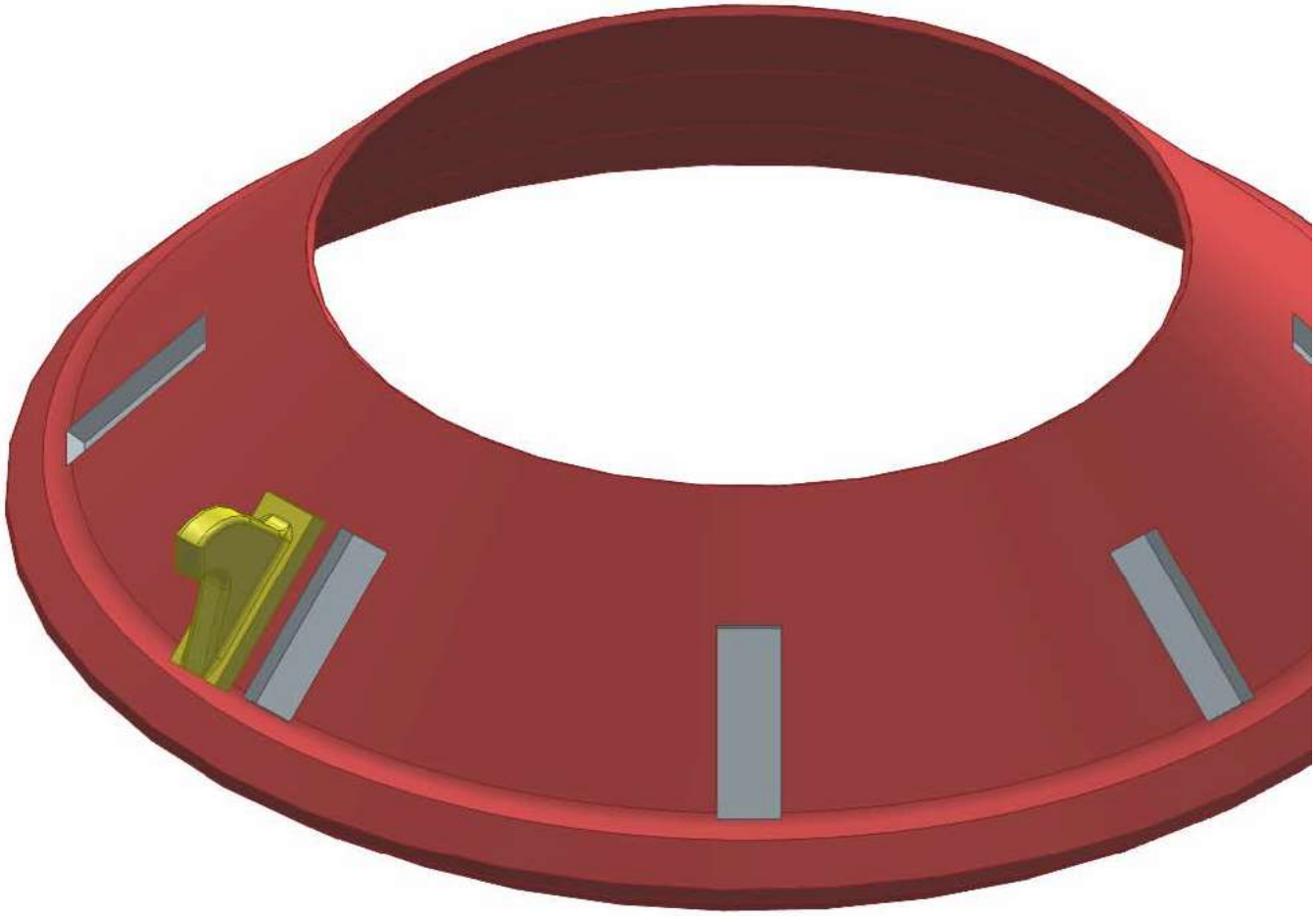
Manganese: Molding Process



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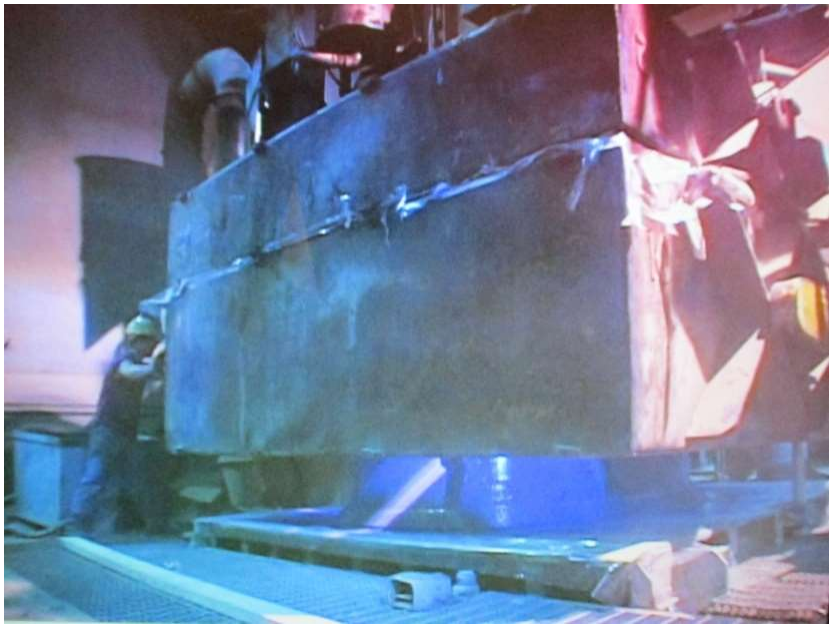

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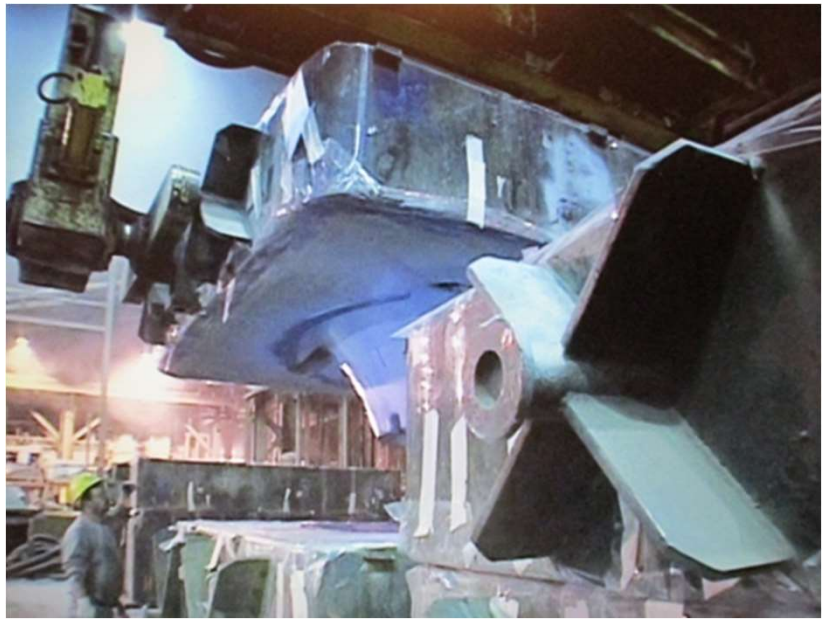

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Manganese: Melting to Ladle

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Manganese: Pouring into flasks

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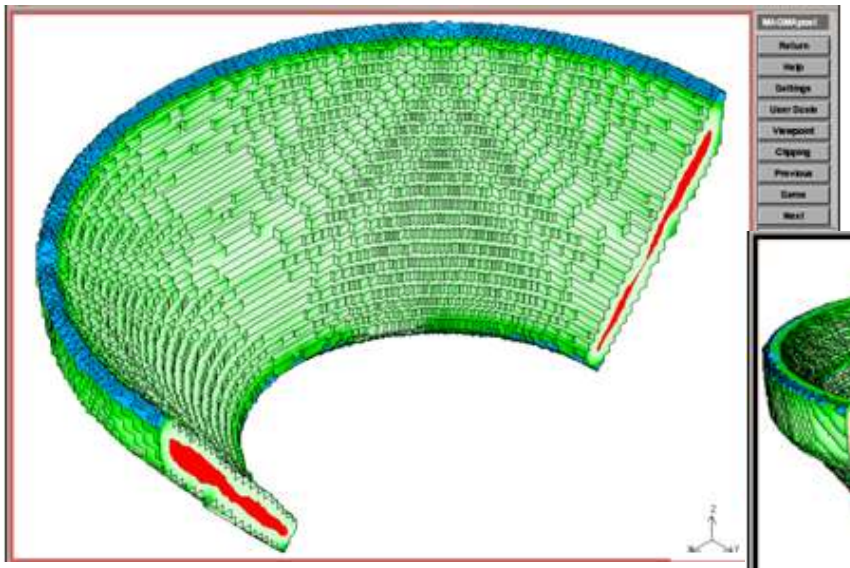
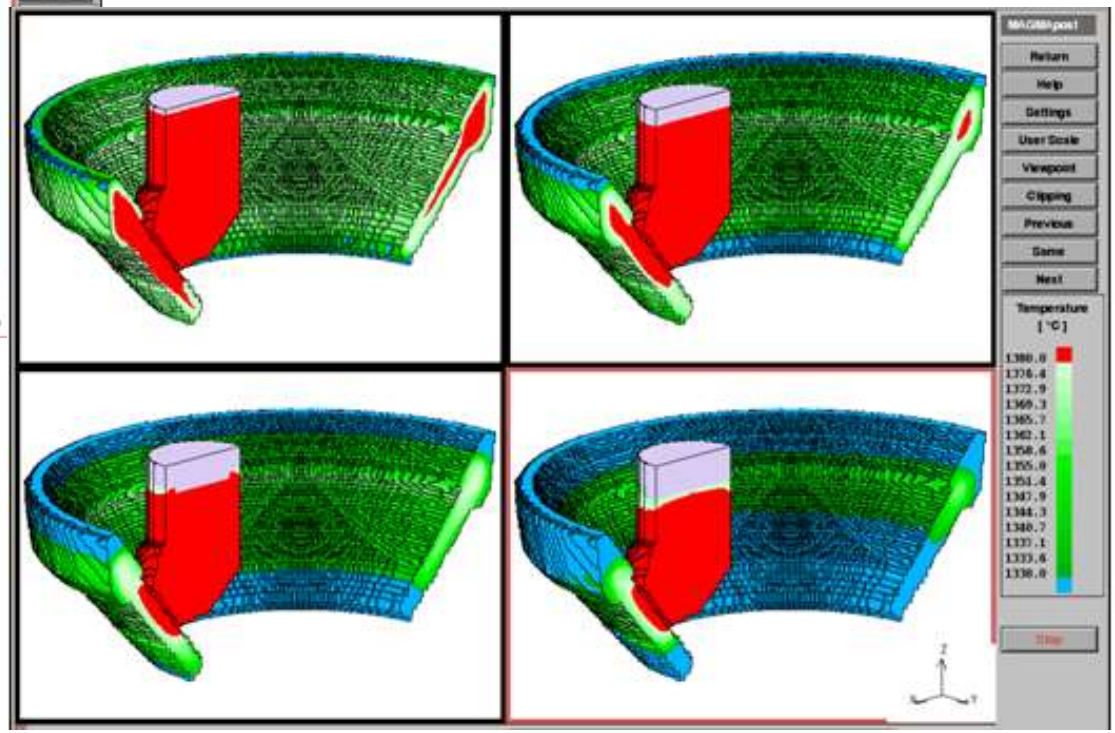
Manganese: Solidification Process



Castings solidify from the outside towards the center



Manganese: Risers and their function

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Manganese: Riser removal

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Manganese: Transition - Heat Treatment to Quench

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Manganese: Machining

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Manganese: Work Hardness

234
191
252
286
300

185
164
223
240
298

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Manganese: Work Hardness

230
174
238
221
296

357
545
505
566
506

248
216
205
244
205

286
525
605
485
542

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Manganese: Work Hardness

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How Can We Reduce Risk In Crusher Related Maintenance Activities?

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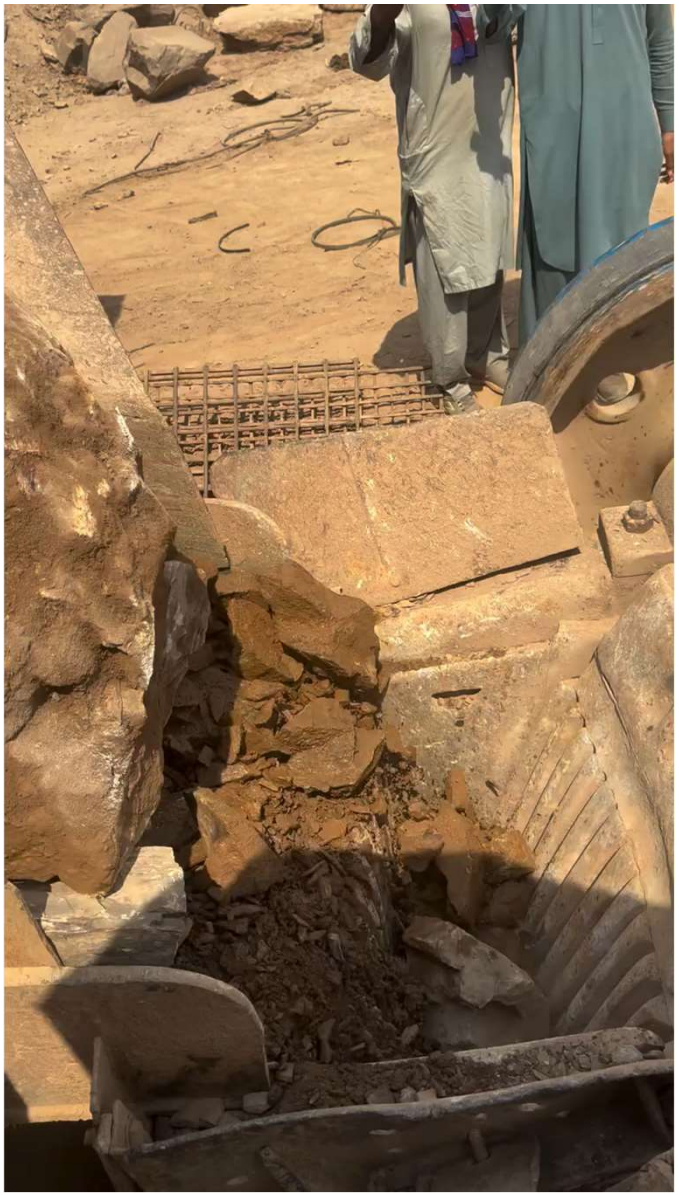

Can we reduce or eliminate HAZARDS associated with hot work?

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Jaw Die Design

G-210/S-210

G-210 Screw pin anchor shackles meet the performance requirements of Federal Specification RR-C-271F Type IVB, Grade A, Class 2, except for those provisions required of the contractor. For additional information, see page 452.

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Jaw Die Design

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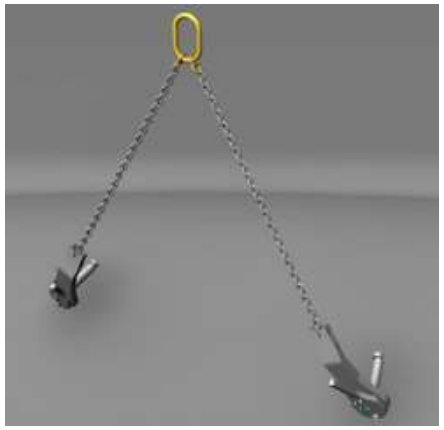
Specialized Tool Design



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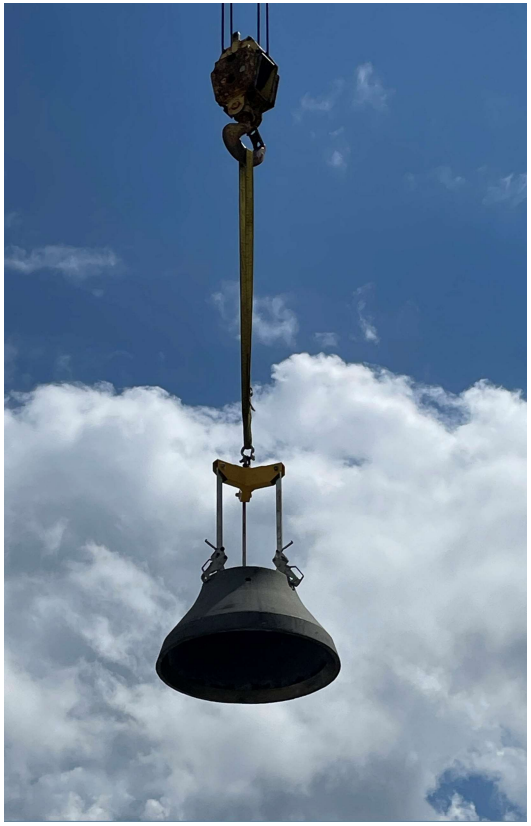
Specialized Tool Design



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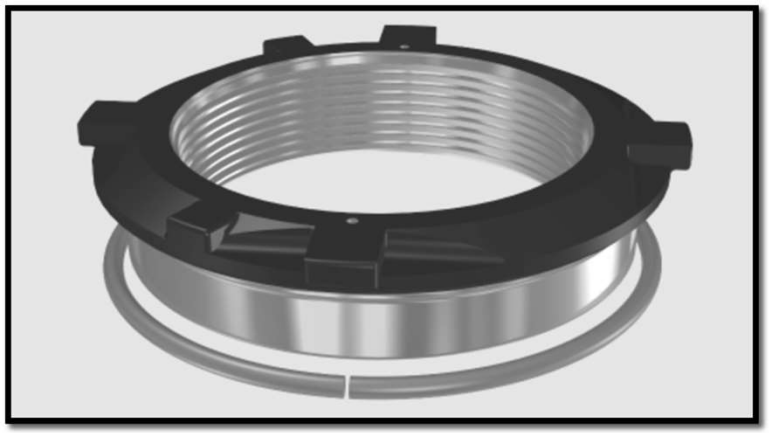
Can we reduce or eliminate HAZARDS associated with sledgehammers?



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Different Approaches

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Hydraulic Head Nut’s

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Hydraulic Head Nut's

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Ez Nut: Mechanical Mantle Clamps

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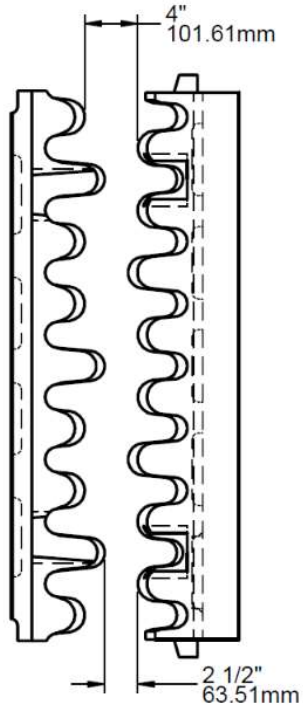
Casting Design



Documented Sets:

Standard Dies – 563 Hours

Slab Breaker – 807 Hours – still in service

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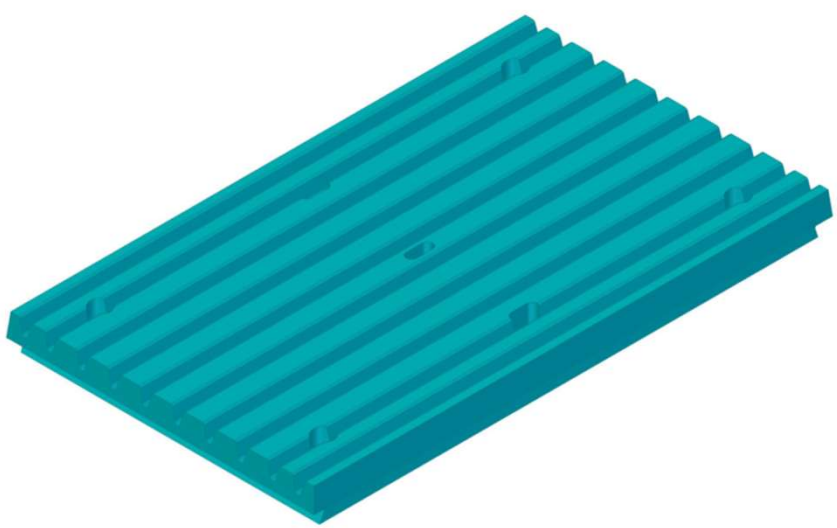
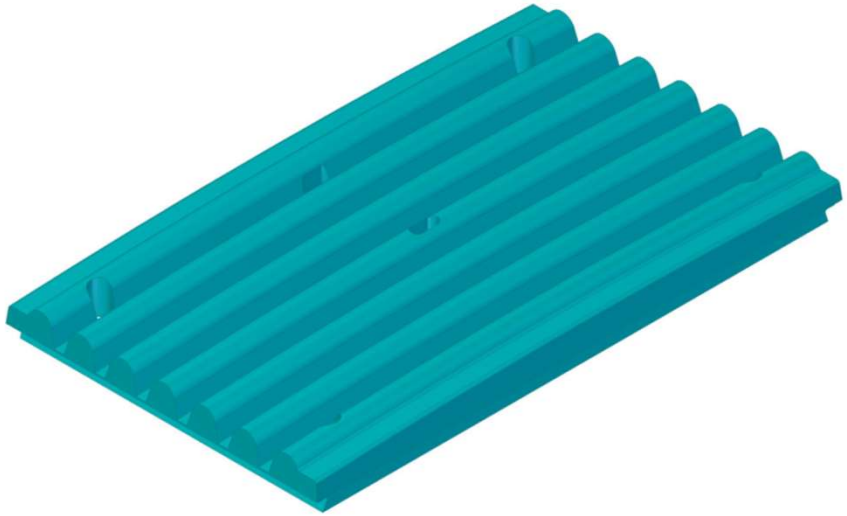
Manganese:
Design Modification





Documented Sets:

764 hours - 531,000 tons – 695 TPH

728 hours - 543,000 tons – 745 TPH

1377 hours -1,102,909 tons – 800 TPH

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Q&A

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Thank You

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