THE “REPAIR OR REPLACE” DECISION OF BOILER FEED PUMP IMPELLERS

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Problem Statement

• Current boiler feed pumps are reliably running 5 to as many as 20 years before being overhauled.

• When an overhaul is required, the inner assembly of a high pressure pump can be removed and replaced by a refurbished inner assembly.

• The removed inner assembly should be disassembled, inspected and refurbished.

• The inner assembly contains impellers that, depending on the inspection data, will either need repair or replacement (if not reusable “as is”).

• The decision of whether to repair or replace an impeller is a difficult decision and is the subject of this case study.
Pump Type

• The type of pump for this case study is a high pressure double case type pump. It is usually a high speed, turbine driven boiler feed pump in power plants of 500 to 800 megawatts.
Case Study Outline

• Pump Description
• Background
• Impeller description
• Examples of impeller inspection data
• Making the decision to “repair or replace”
• Conclusions
Background - Pump Assembly
(high speed, multistage, turbine driven)
Pump Stage Component Terminology
Recommended Impeller Inspection

• Visual
• Dimensional
• Magnetic Particle or Dye Penetrant
Impeller Materials

- 17-4PH
- CA6NM

Both materials can be welded, but require pre-heat and post-heat treatment during the welding process.

Because the post-heat treatment is at a high temperature, all critical dimensions will require welding.
Impeller With Shroud and Hub Seal Wear
Impeller With Shroud and Hub Seal Wear
Impeller With Vane Cavitation Damage
Impeller With Cracks
Failed Impeller With Catastrophic Damage
The Repair or Replace Decision

Cost Equation Components

**REPLACE WITH NEW IMPELLER**

- Cost of Casting
- Cost of Machining
- Cost of NDE
- Cost of Balancing
- Probability of Porosity in Casting
- Probability of Machining Error
- Probability of Casting Dimensional Problems if the Impeller Geometry is Recreated
- Experience of Involved Personnel

**REPAIR EXISTING IMPELLER**

- Cost of Welding
- Cost of Pre-Machining
- Cost of NDE
- Cost of Skimming Seal Areas
- Cost of Final Machining
- Probability of Porosity in Casting
- Probability of Machining Error
- Probability of Inclusions or Lack of Fusion in Welds
- Experience of Involved Personnel
- Vintage of Impeller
- Profit

\[ \text{Overhead} \]

\[ \text{Profit} \]

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Conclusions

• There are many factors that influence whether and impeller is repaired or replaced:
  – Extent of damage
  – Impeller history
  – Impeller vintage
  – Material costs
  – Machining costs
  – In-process inspection costs
  – Experience of personnel

• The probability and cost of non-conformance must be evaluated before a proper decision can be made.