Variable Analysis

1) Define the Problem

a) Identify the problem you are trying to solve
b) Determine the primary variable:
   i. What does failure look like?
   ii. What measurable property do you want to change?
   iii. Can you define the problem using a more specific variable?

2) Describe the problem in detail

a) Closely observe the problem
b) Understand the pattern of failure:
   i. When did the problem begin?
   ii. How often does the problem occur?
   iii. Where does the problem first occur?
   iv. When/where don't you see the problem?

3) Expand the Variable Tree

a) Develop each layer of sub-variables by understanding how the process works:
   i. How is the process designed to control the primary variable?
   ii. What else determines the value of the primary variable?
b) Can we combine any of the sub-variables?

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4) Eliminate Sub-Variables from the Tree

a) Determine the value that each sub-variable must be to prevent the problem from occurring:
   i. What is the relationship between each sub-variable and the primary variable?

b) Eliminate sub-variables that do not contribute to the problem:
   i. What is the actual value of the sub-variable during failure? During non-failure?
   ii. Can you use the pattern of failure to eliminate variables?

c) Repeat Steps 3 and 4 for the remaining sub-variables until you have found the out-of-spec sub-variable(s) that can be directly controlled:
   i. Can the pattern of failure help you prioritize which variables to expand first?
   ii. Can you explain directly how the out-of-spec sub-variable(s) contribute(s) directly to the problem?

d) If you get stuck:
   i. Have you eliminated a sub-variable that you should not have?
   ii. Have you missed a sub-variable?

5) Implement the Solution

a) Design and implement a simple solution
b) Verify the impact of the solution