

Project Name: Defect free deep hole drilling

Business Case: One of the primary products of the client is heat exchanger. The holes in the tubesheet, which forms the critical component of the heat exchanger, has to be produced with utmost care. Deviation in holes produced results in rework of drilling process or rejection of tubesheet. Rejection of a tubesheet led to a loss as high as Rs. 10 million

Initial condition:

- Rejection of a tubesheet led to a loss as high as Rs. 10 million
- Delay in delivery of equipment resulted in a loss of about 5-10% of equipment cost
- Repair and rework arising due to inaccurate drilling of holes required additional 20% of production time and cost

Target condition:

- To raise the quality level of the drilling process to meet global challenges and reduce the percentage of defective tube holes

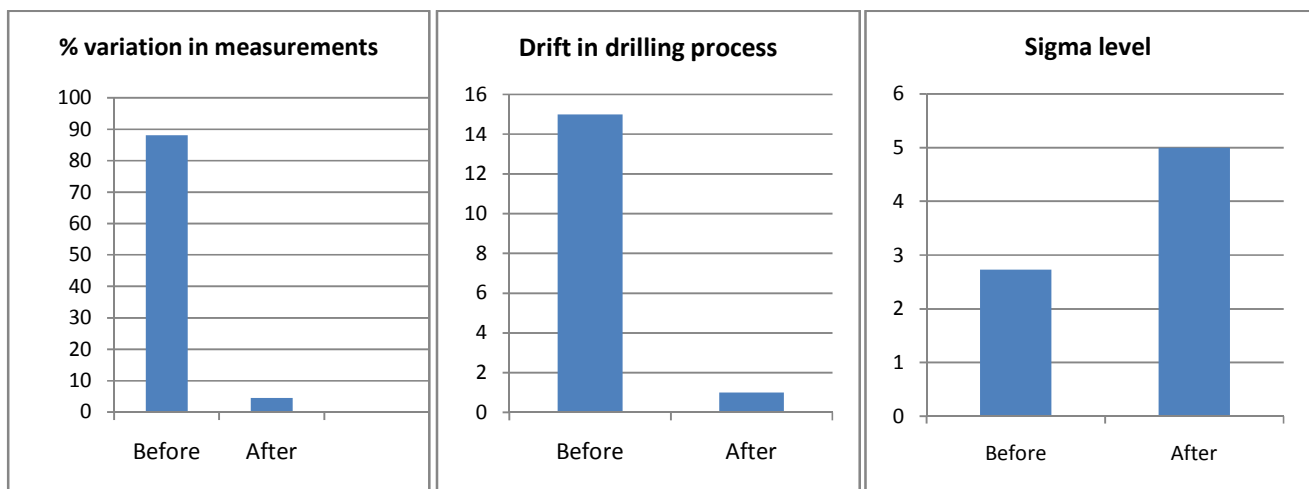
Root Causes and Solutions:

- Effect of various parameters like cutting speed, feed, tool make on the drilling process was determined using regression and testing of hypothesis
- Optimum settings of input parameters were defined by Design of Experiment
- Calibration of all tools and equipments was done to reduce variations due to measurement systems
- Trials of various input combinations were conducted to enable meeting quality standards

Results achieved:

- Reduction in variations in measurements due to measurement systems
- Improvement in drift in the drilling process
- Elimination of spiral marks and scratches due to drilling
- Breakthrough improvement in surface finish and hole locations
- Simplified process controls to achieve nuclear standards with lower emphasis on 100% inspection
- On time delivery and reduction in costs due to rework and rejection

Benefit Analysis Chart



Intangible benefits:

- Improvement in machine quality with First Time Right machines
- Greater understanding of the process