

# Improvement in Delivery Fulfillment of Single Cylinder Pump Variants using Lean Concepts



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**Keywords:** PF Pumps, OEE, Non-value Added Activity, Drum Buffer Rope, Leveling

**Abstract:**

This project was carried out in an automotive industry, PF-33 Monoblock pump manufacturing line. The Diesel Fuel Injection Pumps which is having an external drive are called PF pumps. PF means “pump with foreign drive” i.e. the cam which drives the pump is a separate part and is not part of the pump. PF-33 Pump is used for farm equipment. The pump Element is made up of two parts Element Plunger and Element Barrel. The Plunger and barrel are match ground with a clearance of 2 to 4.5 µm. Later the elements are moved to pump assembly line where the remaining parts are assembled and then moved calibration where the delivery is measured at different rpm and finally to dry tightness, visual inspection and packing.

Here in PF pump there are around 13 different variants which needs to produced in a month and supplied to the customer based on different customer order quantity given for each variant. Since there was no proper information flow to assembly line and also to down stream process, all the variants are manufactured as and when the materials are available resulting in 96% delivery fulfillment.

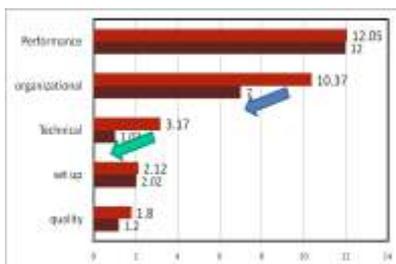
This project was mainly focused on improvement of type wise fulfillment of PF-33 pump by eliminating NVA, reducing technical losses in honing machine there by improving OEE of bottle neck machine i.e. Honing from 70% to 77%. And finally implementing leveling in PF-33 pump assembly with a leveling compliance of 58% along with Pull for up stream process has helped in meeting overall delivery fulfillment with type wise from 96% to 97.34%. By VSM we came to know where we are and where we need to be, Takt time chart reveled the bottle neck process and how to de-bottle neck the same, also it has reveled the need for OEE improvement in Honing machine, VSM helped us to visualize NVA and also need for leveling and consumption based pull system in upstream.



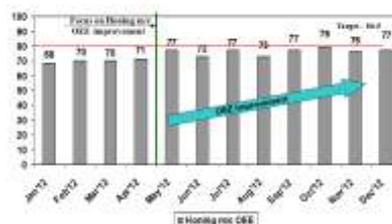
**PF-33 Pump**

Problem	Non Value Added activities	Technical losses	OEE improvement	Down Buffer Rope	Leveling	Consumption pull
Through VSM identified non-value added activities in Final and Element generating area	Low OEE due to High Technical losses in both main machine in Honing	Low OEE in both main machine in Honing resulting in low OEE due to high technical losses for the main honing	Both Honing and DV unit leveling resulting in high OEE due to high technical losses for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing
<b>Solution:</b> 1. Elimination of Phosphating step 2. Elimination of left and right side honing 3. Elimination of Element 4. Elimination of Element 5. Elimination of Element 6. Elimination of Element 7. Elimination of Element 8. Elimination of Element 9. Elimination of Element 10. Elimination of Element 11. Elimination of Element 12. Elimination of Element 13. Elimination of Element	Reduced technical losses by taking following action: 1. Eliminated part gripper problem by increasing gripping width and in 2. Eliminated Part Kitting in the conveyor by guiding and stopper 3. Replacing proximity sensor with steel roller to avoid false detection 4. Shorten conveyor time	Reduced technical losses by taking following action: 1. Eliminated part gripper problem by increasing gripping width and in 2. Eliminated Part Kitting in the conveyor by guiding and stopper 3. Replacing proximity sensor with steel roller to avoid false detection 4. Shorten conveyor time	Both Honing and DV unit leveling resulting in high OEE due to high technical losses for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing	Regular information flow and supporting process under process i.e. Strong compliance for the main honing

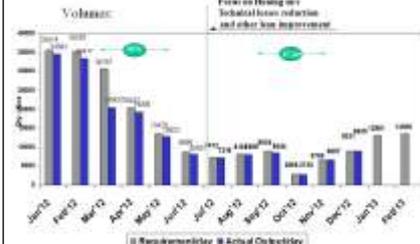
**Overall summary**



**Technical losses reduction**



**OEE from 70% to 77%**



**PF-33 Pump fulfillment**