

PROJECT REPORT STAGE-1

BE Project On

**IMPROVEMENT IN QUALITY PPM IN REJECTION AND REWORK
FOR CUP-MACHINING OPERATIONS ON GILDEMEISTER (AS-48).**

- College Guide-S.V.GOSAVI

➤ Project Sponsored by- CUMMINS India limited, Kothrud.

Group Members:-

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Improvement in Quality PPM in product rejection and rework for Cup-machining operations on Gildemeister (AS-48).

- **Gildemeister (AS-48)** is a cam operated- **Multi-spindle** automat machine.
- The machine was procured in **1971** by **Cummins India Limited., Kothrud**
- The machine is used for performing machining operations for diesel-generator-injector **cup**(nozzle).

NEED OF THE PROJECT:-

Since the machine has become old and rudimentary cam operated mechanism is used-

- The two AS-48 machines are giving high rejection rate and faulty machining ultimately resulting in unreasonable Quality PPM losses.
- It is a top priority in the company **to reduce PPM losses** by innovating the Gildemeister (AS-48) through technological advancement in tooling, cooling, indexing, cam motion and positioning of the tools.

Gildemeister (AS-48)



CENTRAL BLOCK

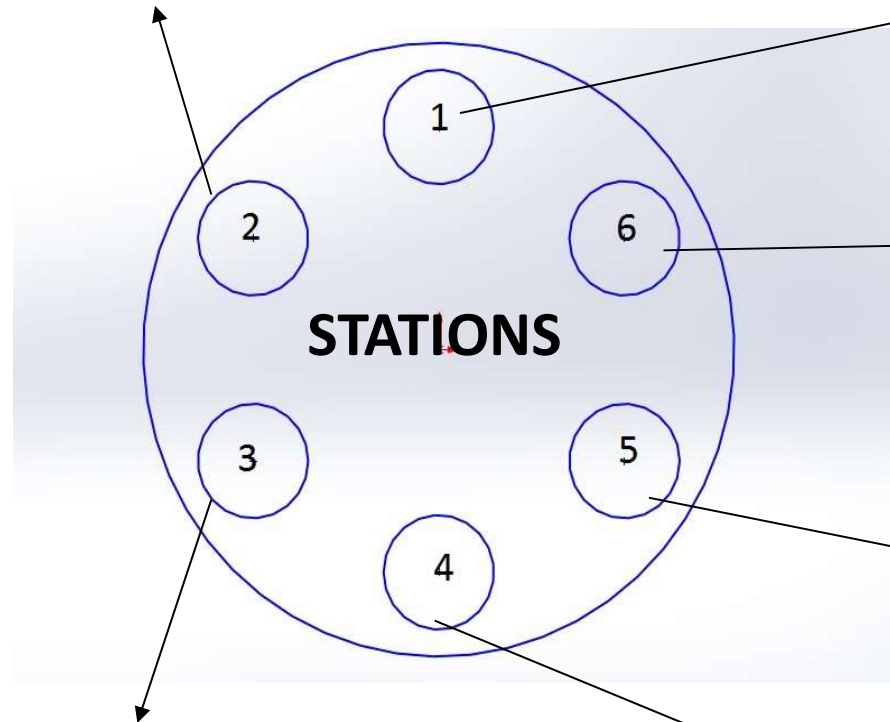


SPINDLE DRUMS OF GM-1 AND GM-2

OPERATIONS ON GILDEMEISTER

ROUGH PLUNGING O.D; FINISH FACING;
DRILLING; CHAMFER I.D;

ROUGH FACING;
ROUGH
PLUNGING;
CENTER DRILL



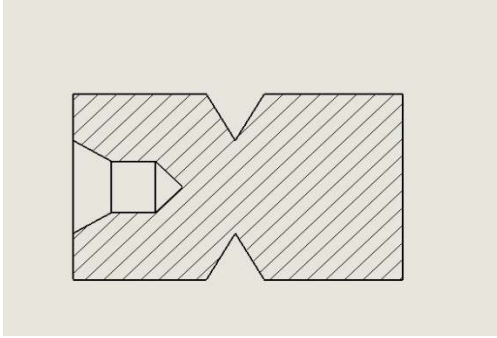
PARTING-OFF

FINISH CONE I.D 30
1/2 DEGREE;
DEBURR GROOVE

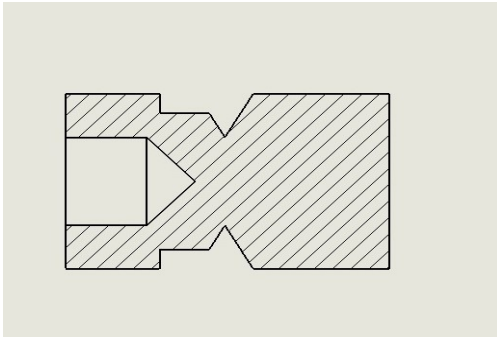
BACK CHAMFER TO COLLAR;
ROUGH CONE DRILLING (45 degree)
FINISH COLLAR O.D TURNING

PLUNGE O.D; FINISHING;
GROOVING

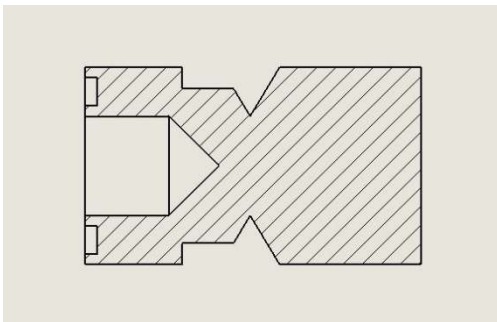
Cup evolution on different stations



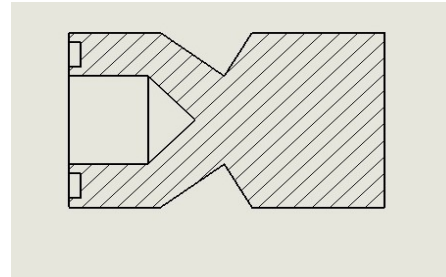
1st station



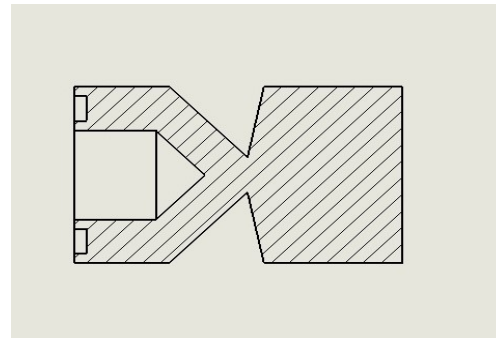
2nd station



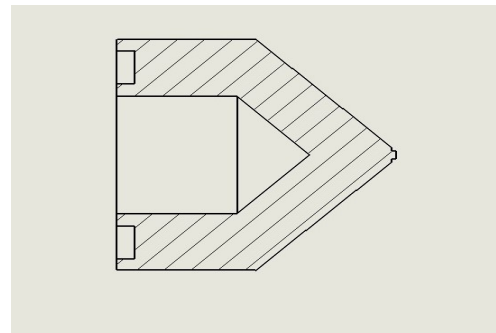
3rd station



4th station



5th station



6th station

SCOPE OF THE PROJECT:-

- Problems in the Gildemeister (AS-48) have to be studied in-depth
- Rework and installation of any techno-innovative solution within the economical feasibility of such solution.

PROBLEM DEFINITION:-

Technical problems that need to be resolved are :-

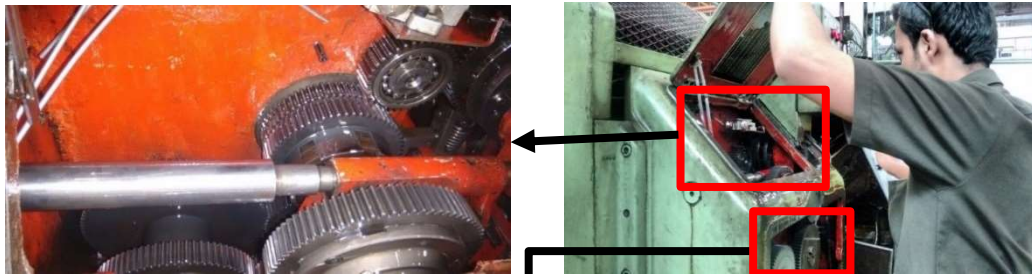
1. Tooling Quality, its rework and availability.
2. Precise tooling positioning and alignment.
3. Cam -drive mechanisms.
4. Fault-reverberations on further machines.

Technical problems analyzed:-

1. Jamming of slides.
2. Tool holder broken.
3. Worn out Cam profile.
4. Pick-off Dysfunctions.
5. Turning tool positioning problem.

1.Jamming of slides

- **Causes:-** Slide lubrication is inadequate and the gear tooth were a bit worn out leading to lag in gear timing.
- **Rejection Frequency :-** Twelve jobs every month.



Gear adjustment lever mechanism



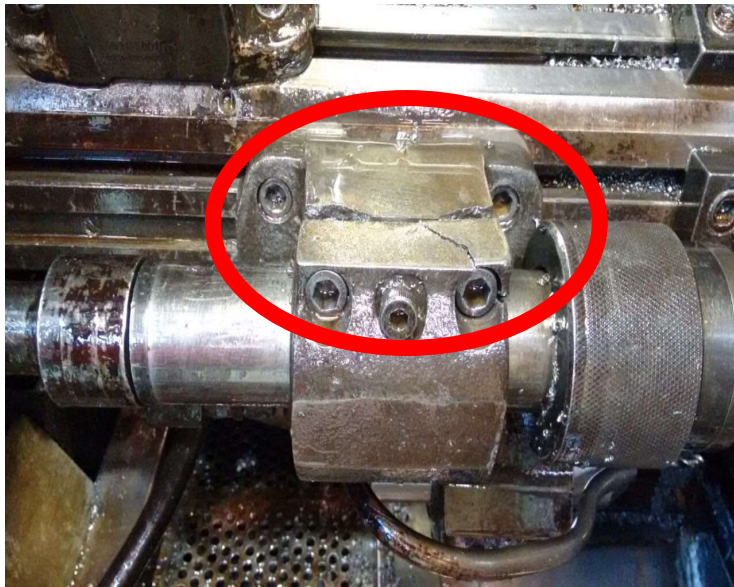
Gear train mechanism

- There is frequent activation of safety-clutch due to jamming of slides.
- The safety clutch in gear adjustment level disengages if the slides are jammed.

❖ All six jobs on six spindles are rejected.

2.Tool holder broken

- **Causes:-** Vibrations and stress loading.
- **Rejection Frequency:-** 4-5 jobs were rejected daily for almost a week.



Broken tool holder

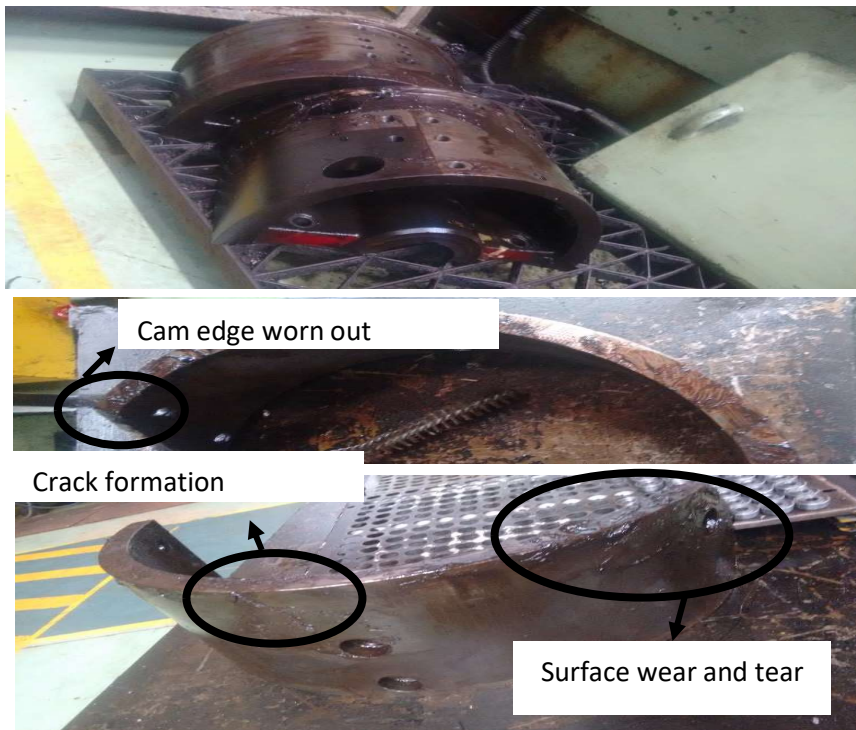


New tool holder deployed

3.Worn out Cam profile

➤ Causes:-

1. Inaccurate cam profile
2. Cam edge worn-out
3. Crack formation
4. Surface wear and tear.



Cam profile

➤ Effects:-

1. Inaccurate central-block motion
2. Wear and tear of gears



Operator removing Cams

4. Pick-off Dysfunctions

➤ Causes:-

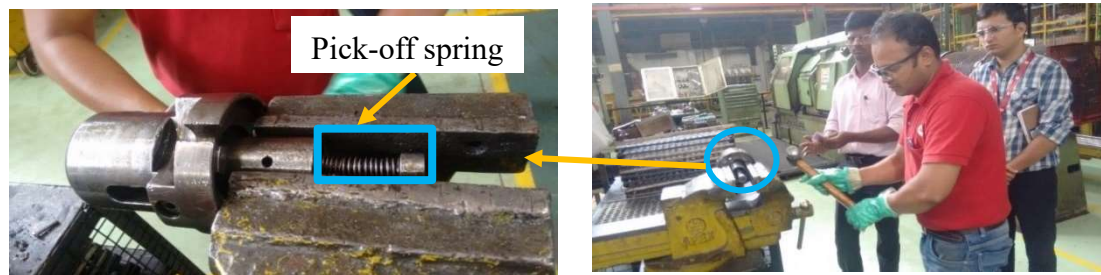
1. Pick-off sleeve is worn out.
2. Mandrill bar of pick-off is slightly bend.
3. Cup O.D reduced beyond tolerance.
4. Pick-off spring malfunctioned

➤ Effects:-

1. Cup breakage
2. Surface indentation and scratches on cup.



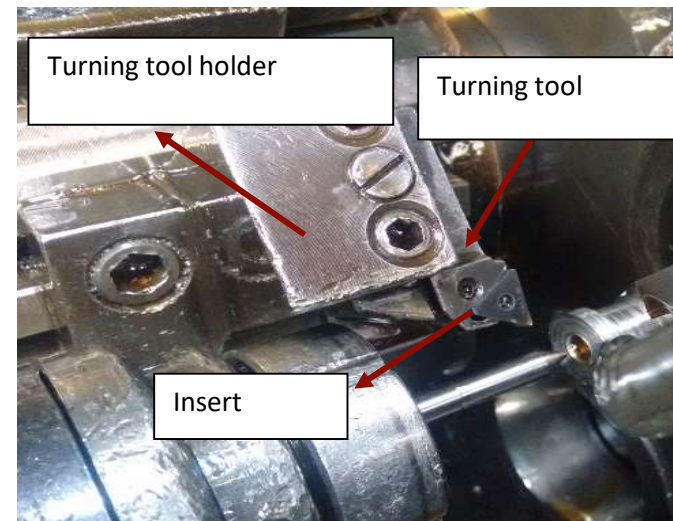
Pick-off collet



Operator repairing Pick-off spring

5. Turning tool positioning problem.

- The Turning tool has to be set for three different cups- K, STC, STD.
- **Causes:-** Turning tool setting done on trial and error method using dial gauges.
- **Rejection Frequency:-** 3 parts per day
- **Effects:-** Faulty plunge profile on cup.



Turning tool mechanism

OPERATIONAL PROBLEM ANALYSIS

OPERATIONS	PROBLEMS	REASONS	SOLUTION
FACING	INSERT WORN OUT	-	-
PARTING	. TOOL BREAKAGE	ASYNCHRONOUS MOTION BETWEEN FEED AND HOLDING MECHANISM	-
		HIGHER CLAMPING FORCE IN CLAMPING MECHANISM	-
CONE-DRILLING	TOOL HOLDER BROKEN	VIBRATION AND STRESS LOADING	CASTING NEW TOOL HOLDER.
	FAULTY TOOL SETTING	MANUAL SETTING	DESIGNING ACCURATE GAUGE FOR BETTER TOOL SETTING (STD,STC AND K TYPE)
TURNING	POCKET-FORMATION	UNREASONABLE SLIDE – MOTION VARIATION	-
	O.D TOOL SETTING SIZE VARIATION	MANUAL SETTING	-
PICK-OFF OPERATIONS	FAULTY PICK-OFF OPERATION	SLEEVE OF PICK-OFF WAS WORN-OUT	REGRINDING OF SLEEVE
		CUP O.D REDUCED BEYOND TOLERANCE	-
		MANDRILL BAR OF PICK-OFF IS SLIGHTLY BEND.	-

MISCELLANEOUS PROBLEMS

PROBLEMS	REASONS	SOLUTION
CAM PROFILE FAULTY	FRICTION; WEAR AND TEAR	
TOOL HOLDER SHIFTS FROM TOOL POST.	WEAK TIGHTENING MECHANISM	
SPRING OF FEED DAMAGED.	WEAR AND TEAR; UNBALANCED LOADING.	
GEAR ADJUSTMENT LEVER STOPPED	FREQUENT ACTIVATION OF SLIP-CLUTCH DUE JAMMING OF SLIDES	
VARIATION IN CENTRAL BLOCK-SLIDES.	GEAR MOTION PROBLEM	
BURR SEDIMENTATION-SATURATION IN TOOL-HOLDER LEADING TO FAULTY MOTION	SMALL CHIP SIZE.	USING BETTER INSERTS WHICH PRODUCE LONG CHIPS.
BAR ENDING SIGNAL NOT WORKING.	ELECTRICAL WIRING CORRUPTED	REPLACE THE BAR ENDING SIGNAL

Problem Statement – Error in measurement of cone drill length on station 2

➤ Solution –

- We have designed measuring gauge to tackle the arbitrary measurement taken on cone drill .
- The cone drill is 30 degree and the length of the cone drill outside the tool holder is not fixed.
- Thus C- clamp has been designed to accurately measure the length of the tool length outside the tool holder.
- The L shaped scale fabricated on the C – clamp perfectly aligns the tip of the cone drill at accurate length .
- This is an offline operation

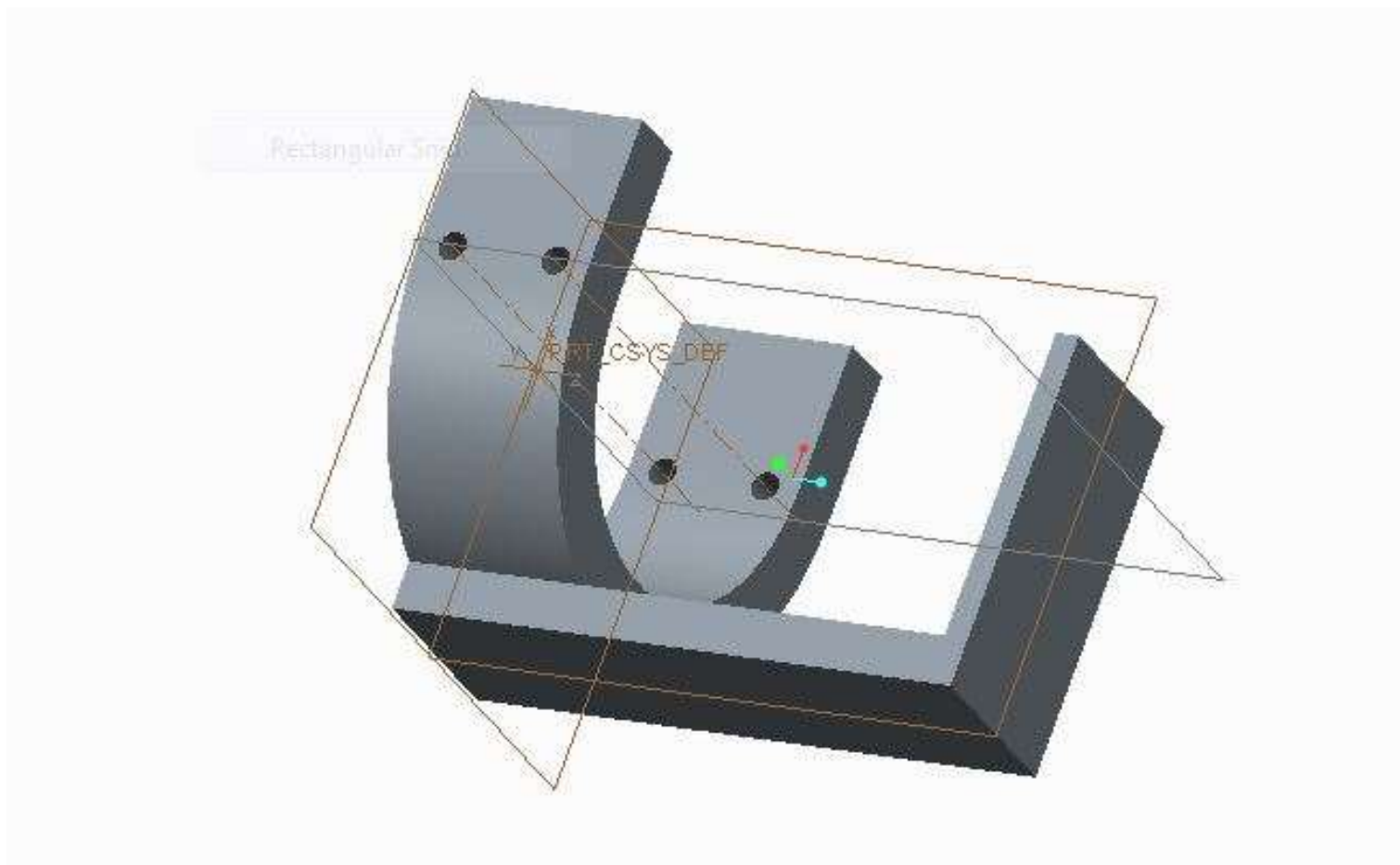
PROCEDURE – 1) The C- clamp is fixed on the holder with the help of nuts .

2) The tip of cone drill is aligned as per the L shaped .

3) Once the tool length is fixed the C –clamp is removed .

4) The procedure is completed .

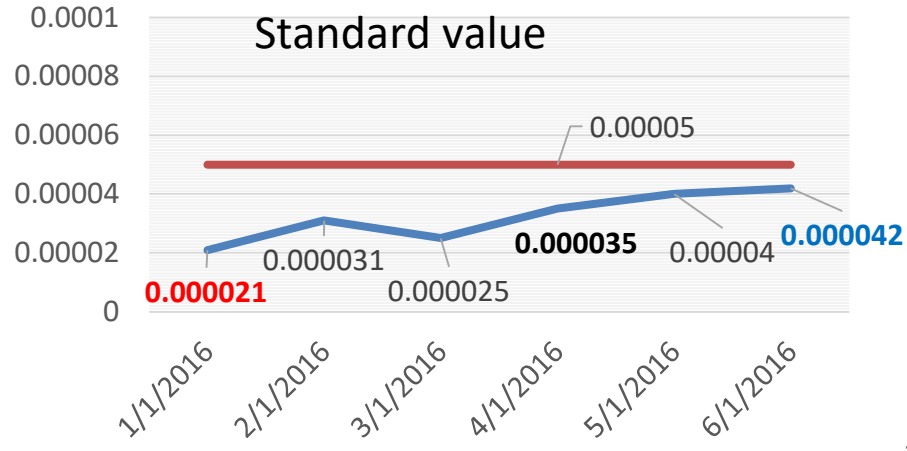
Solution for Cone-drill Problem



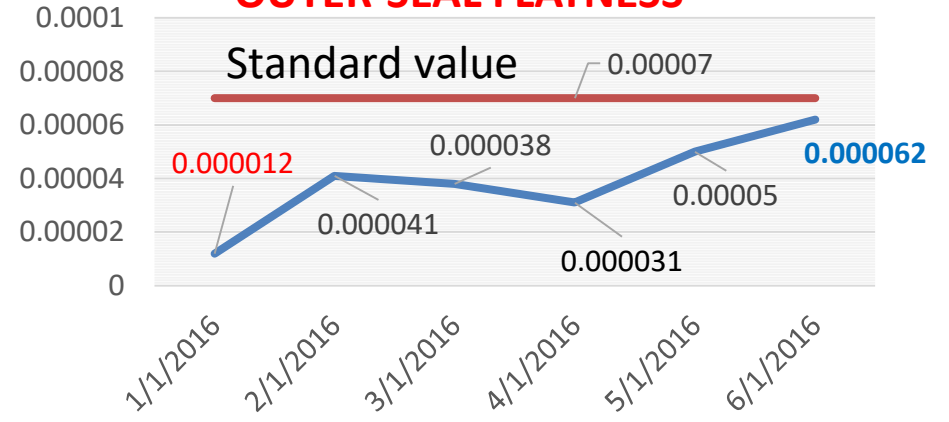
Statistical Data of Cup Parameters(STD):-

PARAMETER	SPECIFICATIONS	1 st SEPTEMBER	2 st SEPTEMBER	3 st SEPTEMBER	4 th SEPTEMBER	5 th SEPTEMBER	6 th SEPTEMBER
CONE ROUNDNESS	0.00005	0.000021	0.000031	0.000025	0.000035	0.00004	0.000042
CONE STRAIGHTNE SS	0.0001	0.000052	0.000045	0.000065	0.000061	0.00007	0.00008
INNER-SEAL FLATNESS	0.00003	0.000016	0.000011	0.000012	0.000013	0.000023	0.000028
OUTER-SEAL FLATNESS	0.00007	0.000012	0.000041	0.000038	0.000031	0.00005	0.000062
CUP FACE ROUGHNESS	10	5.12	5.45	6.19	3.97	4.5	7
CONE ANGLE	45	44.96	45.75	44	45.83	44.9	43.5

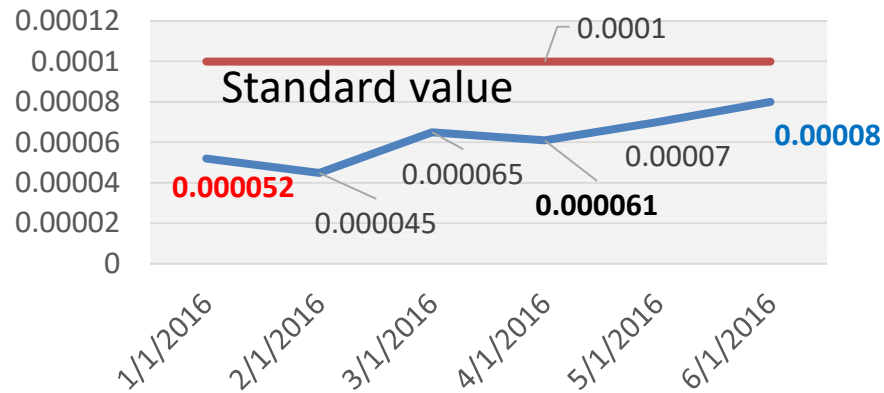
CONE ROUNDNESS



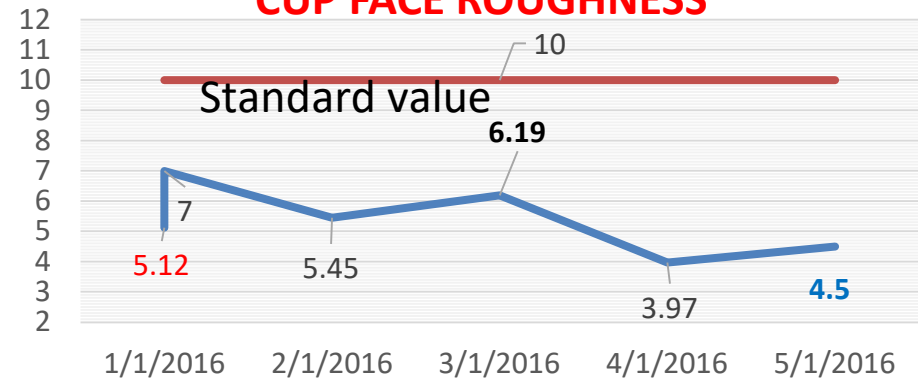
OUTER-SEAL FLATNESS



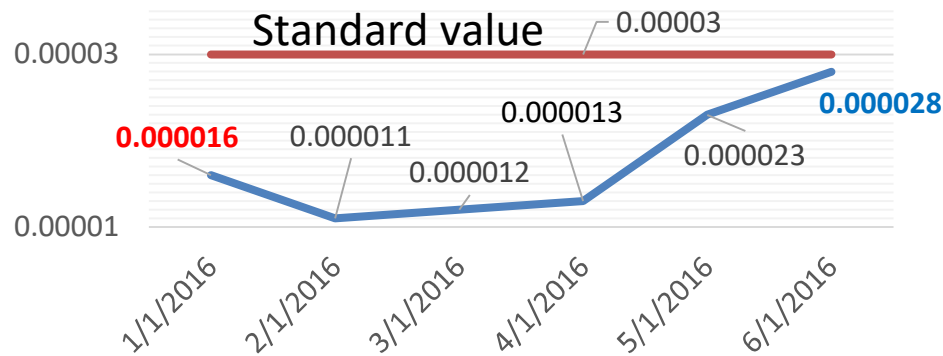
CONE STRAIGHTNESS



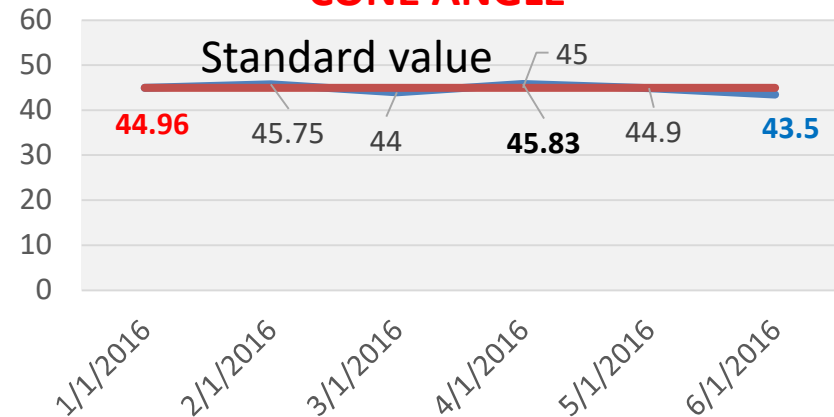
CUP FACE ROUGHNESS



INNER-SEAL FLATNESS



CONE ANGLE



Rejection and Rework Data

MONTH	REJECTION (QTY.)	REJECTION (%)	REWORK (%)	REJECTION (PPM.)	REWORK (PPM)
16-JUNE	1343	17%	11%	1,70,000	1,10,000
16-JULY	602	7%	10%	70,000	1,00,000
16-AUGUST	544	5%	9%	50,000	90,000

- **REJECTION** has been considerable reduced from **17% in JUNE** to **5% in AUGUST**.
- **REWORK** has been reduced from **11% in JUNE** to **9% in AUGUST**
- Nearly **(1,70,000 - 50,000) = 1,20,000 PPM** have been saved in **REJECTION** since **JUNE**
- Nearly **(1,10,000 - 90,000) = 20,000 PPM** have been saved in **REWORK** since **JUNE**

CONCLUSION REMARKS: -

- PPM losses are reduced since JUNE.
- Still,
50,000 PPM losses in **REJECTION** &
90,000 PPM losses in **REWORK** are unreasonable PPM losses.
- Further technological improvement and validation is essential to reduce these unreasonable **PPM losses**.

6. FUTURE SCOPE: -

- The unsolved and unrecognized problems on Gildemeister (AS-48) have to be solved to achieve lesser PPM losses in **REJECTION** and **REWORK**.
- Statistical analysis of various cup-parameters need to be further performed to find root causes of high PPM losses.