

MINOR STOPPAGES IN MACHINES DURING PROCESSING ON CYLINDER BLOCK & HEAD COMPONENTS OF DIESEL ENGINE

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ABSTRACTS

Diesel engines used in cars, trucks have the two components named as block component & head component. At the time of assembly of components, this head component placed on block component, then assembly of other components are done on entire component. Before assembly, block component & head component is processed. Processing is done in terms of micrometers, millimeters. So Precise & accurate processing is required. But minor stoppages in the machine cause error in terms of diameter, lengths, straightness, finishing, roughness, and unwanted marks, scratches on the block & head component. The minor mistake can cause rejection of components by quality department. In an industry, production is in large quantity & quality should be maintained, in order to meet international standards for export of engines, minor stoppages plays vital role. In this paper, minor stoppages are mentioned for each machine, the repeatability for each stoppage is shown in the graphs. With the help of graphs of repeatability, we come to know that which problem is occurring frequently. So we can put preventive solutions on them. Solutions for all minor stoppages are given. These solutions will help the operator & Engineer to identify the problems. Downtime is the time required to solve problem. If downtime is reduced, then production will increase. Our focus is to reduce down time & increase the cycle time. If cycle time is improved, then we can have more production. By taking action on minor stoppage, we can reduce downtime time. There are some novel solutions are given to reduce downtime. These novel solutions will increase the productivity, reduce power consumption.

KEYWORDS: MAGNUS, DURR, BAYER, NAGEL machines, PLC

I. INTRODUCTION

In an industry dedicated working lines are present to work on block component & head component. In these two lines number of operations is carried out on components. It includes Reaming, semi finishing, finishing, roughing, boring, brushing etc. There are number of machines are installed in these two lines for processing. In block line we use MAGNUS 800 machines, NAGEL machine, DURR machine & BAYER machine. In Head line we use MAGNUS 600 machines, DURR machine, and BAYER machine. In block line MAGNUS 800 machine processes on dowel, cam, crank, NAGEL machine works on cam, crank, cylinder finishing. After that, it is washed & dried by DURR machine. Loctite application is applied for cup plug placement on block component. In head line, we use MAGNUS 600 machine, it processes on head component. It is washed & dried in DURR machine. Then loctite application is done for cup plug placement on head component. After the bayer operation from two lines, we get fully finished & precisely processed block component & head component. After that these two components go to assembly section to assemble parts to it

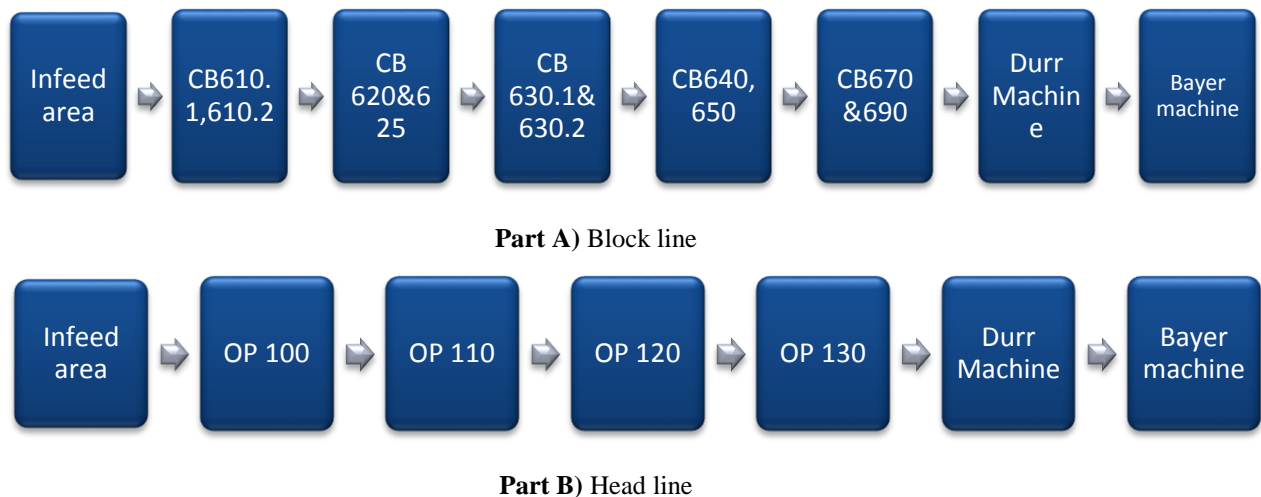


Figure 1: Block line & Head line processing

The MAGNUS machines used for block component processing are denoted as CB610, CB620, CB625, CB630, CB650, CB670. The MAGNUS machines used for head component processing are denoted as OP100, OP110, OP120, OP130. There are two gantries are used.

First gantry is used for block line. Second gantry is used for head line. Gantry picks the component by using gripper from one machine & carries it to the next machine. In figure 1, the entire block line & head line system is shown. At the output we get processed component. At the in feed area the raw block component & head component is placed. As shown in figure 1, the processing is done sequentially. There are three checkpoints in block line & head line. Checkpoint checks whether all machines working correctly or not. If it is not performing well, then we have to correct it.

II. OPERATIONS OF MACHINES

Block line

The numbers shown in the bracket indicate cycle time of machine. Cycle time is nothing but time required to complete operation of machine. The each graph indicates repeatability of that stoppage in three months.

CB610 : (256 sec)

- 1) Oil cooler face milling, with the help of 1202 tool, this operation is done. In entire block line oil cooler is only processed in CB610 machine
- 2) Oil pumps pocket milling.
- 3) Front dowel semi finish reaming (903,904)
- 4) Cam bore 7,6,1,2 rough boring.
- 5) Cam bore 3,4,5 rough boring (2)
- 6) All crank bore rough boring.
- 7) Rear face dowel semi finish reaming (806,810)
- 8) Thrust face circular s/f reamer.

CB620: (130 sec)

- 1) Rear end dowel finish reaming
- 2) Crank bore finish boring 2-7 & 1.
- 3) Cam bore s/f boring 1 & 2-7.
- 4) Width of thrust journal.
- 5) Depth of dowel hole & dowel diameter (903,904).

CB630: (264 sec)

- 1) Cam bore oil groove finish boring.
- 2) Dowel diameter & depth (905 s/F)
- 3) Front end dowel s/f reaming (911,912)
- 4) Water pump s/f boring.
- 5) Water pump oil groove milling.

- 6) Water pump bore & cone finishing
- 7) Oil pump finish bore (908)
- 8) Front end dowel finish reaming (911,912)
- 9) Front end dowel finish reaming (905)
- 10) Dowel diameter s/f (407,412)
- 11) Distance from head face to crank bore (head face s/f milling)
- 12) Dowel diameter finish (407, 412)

CB640 :(154 sec)

- 1) Head face finish milling
- 2) Rear face finish milling
- 3) Front face finish milling

CB650 :(246 sec)

- 1) Tappet bore semi finish boring
- Semis finishing of all tappets are done here.

- 2) Tappet bore finish boring

Finishing of all tappets are done here.

CB670: (126 sec)

- 1) Rough bore diameter
- 2) Finish bore diameter

Durr machine(134sec)

- 1) Injection wash
- 2) Spray wash

Spray washing eliminates metal chips, dust on the component. This is most effective washing.

- 3) Blow off

- 4) Vacuum drying

After washing the component. That get component is dried, by using pressurized air in Durr2

Bayer: (164)

- 1)2A cup plug on oil face=58.18
- 2)2B cup plug on PRC side=25.74
- 3)3A cup plug on front &rear oil gallery=58.18
- 4) Cup plug on front & Rear oil gallery=17.73
- 5) Cup plug on PRC oil gallery=17.73
- 6) Leak test

HEAD LINE:

OP 100 :(164 sec)

- 1) Reaming of dowel hole on combustion face
- 2) s/f milling of combustion face
- 3) Finish milling of combustion face

OP110:

- 1) Valve guide pilot drilling
- 2) Valve guide drilling
- 3) Spring seat finishing
Valve guide finishing
- 4) Valve seat roughing
Pilot reaming
- 5) Valve seat boring
Valve guide reaming

OP 120 :(240 sec)

- 1) Counter bore of diameter hp line
- 2) Fuel hole pilot drilling
- 3) HP fuel line deep hole drilling
- 4) Fuel hole reaming
- 5) Fuel hole tapping

OP130:

- 1) Injector hole 7.8 mm from combustion face

- 2) Injector hole 16/20 mm from cover face
- 3) Injector hole rough step drilling(8.2, 16.9, 20.5, 25.6) mm
- 4) Injector hole finish reaming

Durr:

- 1) Injection wash
- 2) Spray wash
- 3) Blow off
- 4) Rewash
- 5) Vacuum drying

Bayer:

- 1) 2B insert ring inlet=28
- 2) 3B insert ring exhaust=28
- 3) 3A cup plug on cover face:22.5
- 4) 4A cup plug on Exhaust face=25.74,9.86
- 5) 4B cup plug on intake face=38.28
- 6) 5A cup plug on exhaust face=12.98
- 7) Cup plug on front face=25.74
- 8) Cup plug on front face=25.74
- 9) Cup plug on rear face=25.74
- 10) Leak test

III. METHODOLOGY**Part A: Minor Stoppages In Head Line**

OP100=OP110=OP120=OP130

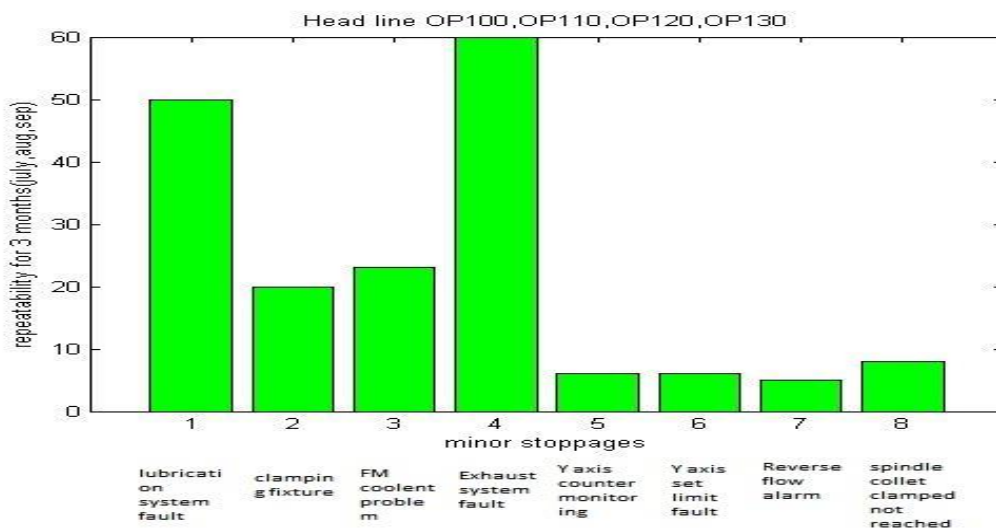


Figure 2: Head line OP100, OP110, OP120, OP130

A) OP100=OP110=OP120=OP130**1) Lubrication system fault**

Causes: The pressure for lubrication material at SKF is set to 1.5 bars. When pressure goes beyond 1.5 bars. It shows this alarm. There is one cartridge in which spring is incorporated. That spring makes to & fro motion.

Actions: Press acknowledge alarm, if not solved go to hydac section, loose relief valve, remove it & again connect it. Press stop after end of cycle, Initial state & then starts it.

Down time: 05 minutes

2) Clamping fixture problem

Causes: Metal chips get accumulated at clamping area, Metal chips/burr is at seat check area, Rarely casting problem comes

Actions: Open the door & apply coolant on it. Press ack , stop after end of cycle, initial, menu, HMI, manual, part handle, it shows blank, EB, STOP, Initial, press move to in position, clamping fixture, clamped, unclamped, clamped, stop end of cycle, initial, stop end of cycle, start

Down time: 5 to 10 minutes

3) FM coolant problem

Causes: It is related to set limit pressure. The coolant filter is present at the hydac section. This is 05 micron filter. If metal burr greater than 05 micron in that filter. Then it shows alarm. The coolant from this then goes to spindle

Actions: Cancel the alarm, and then press reset, machine on .if problem is not solved. Then clean the filter, and then press reset on the machine

Down time: 20 to 30 minutes

4) Exhaust system fault(machine is not stopped by this alarm)

Causes: It comes when we start the machine. Exhaust system filter is present in each machine. The congested air in machine is sucked & it is given to this filter. When this filter get choked. It shows this alarm

Actions: Press stop after end of cycle, initial state, ER, menu select, HMI, prepare, page down, exhaust, make it switch off, off ack light by pressing it, VK, machine on, stop after end of cycle, initial state, start

Down time: 05 minutes

5) Y axis counter monitoring fault (rpm related)

Causes: For Y axis there is set limit given. Within that set limit, spindle is moving; if spindle rpm vary with standard rpm then it stops in Y axis. Then it shows this alarm. This alarm is related to Hydraulic & electronic break.

Actions: Press EB mode, change the tool in slow feed. Increase the feed slowly

Down time: 10 minutes

6) Y axis set limitation fault:

Causes: For Y axis movement there is set limit is given. But at certain instances, this movement goes beyond the limit then it shows this alarm.

Actions: Cancel the alarm, press reset, move y axis manually + or – with respect to fault. Then press initial & start

Down time: 05 minutes

7) Reverse flow alarm/filter fault:

Causes: There are four bags present in filter.& it is connected to drain line. Following reasons may cause reverse flow alarm

- 1) Filter choke problem
- 2) Differential pressure switch faulty.
- 3) Orifice thread damage problem

Actions: Press menu, prepare, power up, LP &HP coolant, switch off, switch on, menu, HMI, manual, coolant, reverse flow meter, make it running, Press manual, HMI, make reverse flow filter on, press filter orientation valve

Down Time: 10 minutes

8) spindle collet clamped not reached

Causes: The tool is clamped at spindle collet. If metal chips or burr is present at there, then clamping is not done properly then it shows this problem, it may be due to tool problem

Actions: Apply coolant pressure by coolant gun on it. Press manual, tool management, spindle collet, tool spindle, press tool spindle 1,unclamp,clamp

Down Time: 05 minutes

B) Durr& Bayer machine

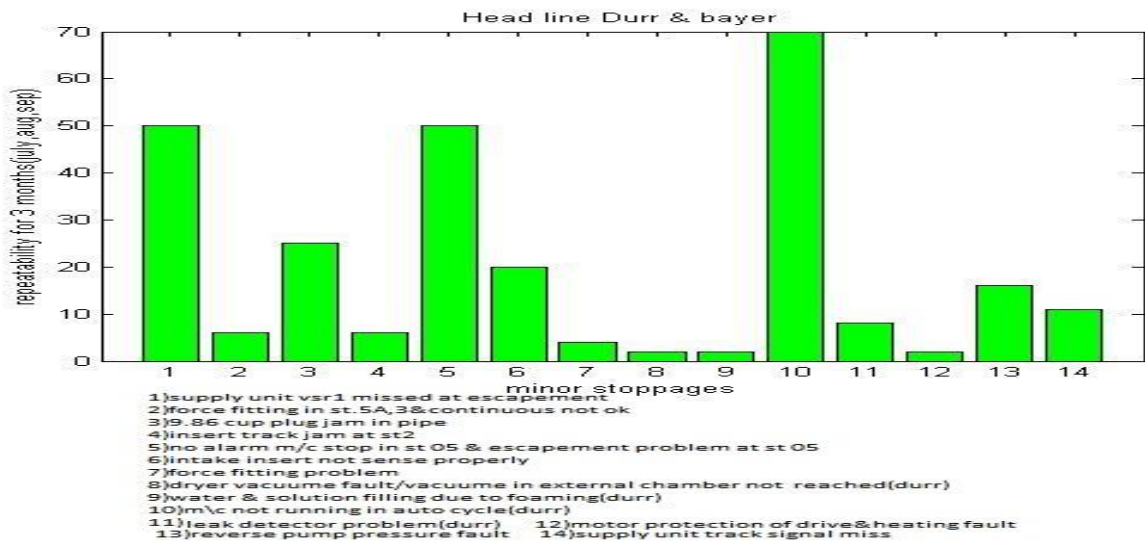


Figure 3:Durr& Bayer of Head line

1) Supply unit VSR1 missed at escapement:

Causes: When valve seat rings don't go in bayer machine in time, then it shows this alarm. this problem comes when track is not clean

Actions: Cancel the alarm. This problem is eliminated in preventive maintenance, by cleaning the target.

2) Force fitting in st 5A, st3& continuous not ok 25D13

Causes: Cup plug under size, oversize, Depth is not adjusted, Dust on the spindle

Actions: Press Alarm cancel, by using WPA monitor, height is adjusted

Down time: 15 minutes

3)9.86 cup plug jam in pipe

Causes: If cup plug is oversize or undersize. It is jammed at push up section of cup plug feeder

Actions taken: Remove that cup plug from feeder section

Time taken: 10 to 15 minutes

4) Insert track jam at st 02

Causes: If valve seat rings are oily then it gives this problem

Actions: Remove that jam & make it clean

5) No alarm m/c stop in station 5 or escapement problem at st 05

Causes: At 9.86 escapements, on the backside of escapement, there is one bolt. If it is loose then it shows this problem

Actions: If we tight escapement bolt then alarm disappears.

Down Time: 05 to 10 minutes

6)9.86 cup plug missing

Causes: Sensor cable may be faulty, cup plug is not present at feeder

Actions: Check for sensor cable, add the cup plugs in to feeder section

Down Time: 5 to 10 minutes

7) Intake inserts not sense properly

Causes: Sensor problem, Insert may be oily. Due to this dust is get accumulated. Sensor can't sense it.

Actions: Check for sensor cable, clean the inserts

Down time: 10 to 15 minutes

8) Force fitting problem:

Causes: If metal chips or metal burr on holes in centre of spindle then this problem arises, Cup plug outer diameter finishing is not ok, or it may be due to casting problem

Actions: Clean the center of spindle, Check whole load of feeder section & change it.

Down time: 5 to 10 minutes

9) Vacuum fault/ vacuum in external vacuum chamber not being reached

Causes: Oil level is low. oil level sensed by the sensor

Actions: Fill the oil

Down time: 10 minutes

10) Water & solution filling due to foaming

Causes: When foam reached above sensor .it shows this problem

Actions: Add liquid in to it

Down time: 05 to 10 minutes

11) Machine not running in Auto cycle

Causes: When component is not in home position. Then it shows this problem, if initial temperature not reached to 40 degree

Actions: take machine in home machine

Down time: 05 minutes

12) Filter change due to cycle time increase

Causes: There is filter bag in durr. In this bag metal chips & metal burr present. These chips results in to jamming problem. It is responsible for cycle time increase.

Actions: Filter is changed

Down time: 15 to 20 minutes

13) Leak detector problem:

Causes: When cycle is running & someone stops it. At that time water filling switch is on. Then coolant comes down due to overflow. At the downside sensor sense it & it gives alarm.

Actions: Remove all coolant by vacuum cleaner.

Down time: 15 to 20 minutes

14) Motor protection of drive & heating fault

Causes: When temperature goes above 55 degree. Then this alarm comes.

Actions: Switch off the machine for some time

15) Reverse pump pressure fault/gyro wheel position fault continuously

Causes: After washing coolant reverse flow is done. While doing so if pipe is leaked then it shows above problem.

Actions: Change the pipe (after checking)

Down time: 15 to 20 minutes

16) Supply unit track signal miss

Causes: When opposite side of cup plug is inserted. Then it shows this alarm

Actions: Remove that cup plug

Down time: 10 minutes

17) At TOD it is identified that valve seat ring is not fitted properly

Causes: Stepping of spindle is not done properly or Fixture problem, tool problem or component problem

Actions: In operating panel do stepping, If it is not OK then open the door, take Allen key & tight the spindle

IV. METHODOLOGY

Part b: minor stoppages in head line

Block line

A) CB620 & CB625

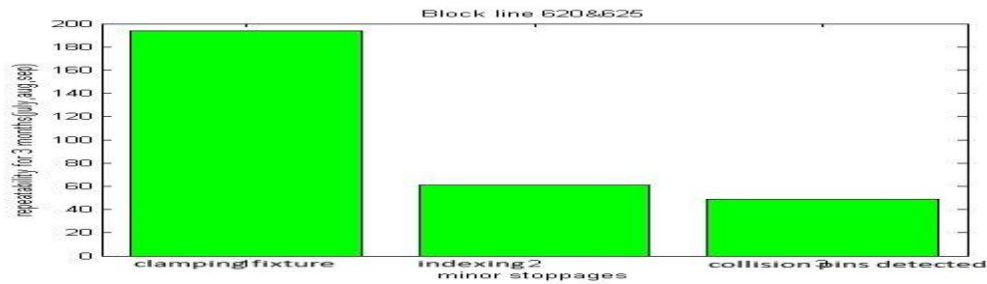


Figure 4: Block line 620 & 625

1) Clamping fixture switch 8 pressure fault:

Causes: Metal chips get accumulated at clamping area, Metal burr/chips are at seat check area, May be casting problem

Actions: After completing 625 operations. press clear fault+reset, home position, set up mode, operating, units 2.1,2.1 lifting device advanced & returned, fixture, unclamp, clamp, auto, start

Down time: 05 minutes

2) Indexing problem:

Causes: Inserts life complete or due to friction with component get damaged

Actions: Measure the diameter from the screen of 625.if it is exceeding set limit. Then reduce the height of inserts (respected) & vice versa. Height measuring is done by dial gauge. Height adjustment done by allen key. This principle applied to cam & crank. If it doesn't work, change the inserts

Down Time: 15 to 20 minutes

3) Collision pins 1 & 2 detected:

Causes: When metal chips & metal burr on brush of gauge then it shows this error

Actions: Apply coolant on it, make it clean with clothe & place clothe on cam/crank & apply small force of hammer

Down time: 05 minutes

B) CB640, CB650, CB670

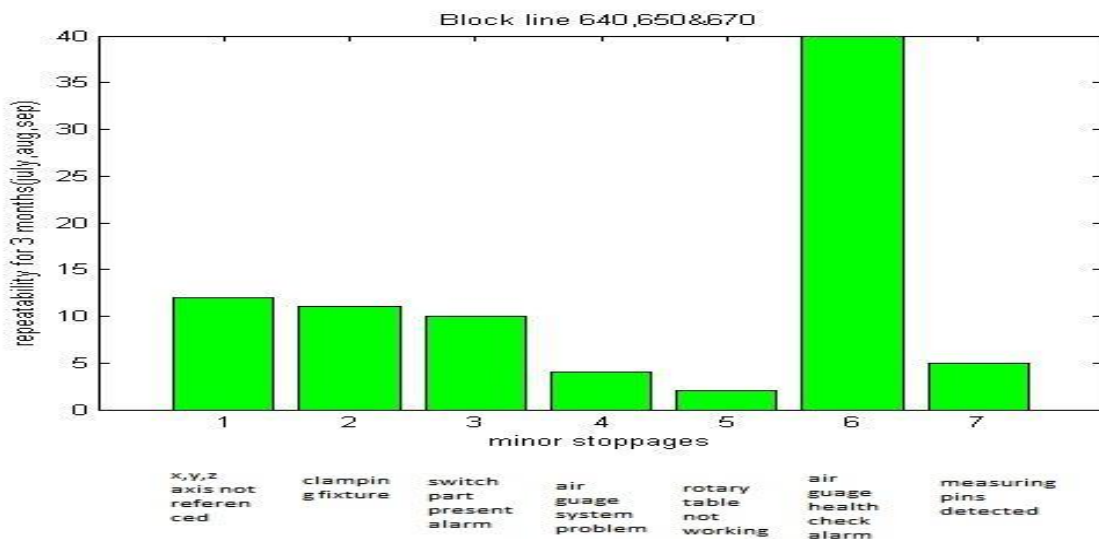


Figure 5: Block line 640,650 & 670

1) LP/HP coolant problem:

Causes: This problem comes because of coolant department. if pressure from coolant department is not sufficient then it shows this problem

Actions: Make machine reset then start it, then alarm disappears

Down time: 05 minutes

2) X, Y, Z axis not referenced:

Causes: This problem comes when we start machine in early morning. The lubrication for X, Y, Z axis gets dry. Therefore it shows this alarm

Actions: When alarm comes, we have to make machine in home position, then problem get solved

Down time: 05 minutes

3) Clamping fixture:

Causes: Metal chips get accumulated at clamping area, Metal burr/chips is at seat check area ,May be casting problem

Actions: Open the door. Apply coolant by coolant gun. Press clear fault+reset, Home, setup, menu, HMI, fixture, clamp, unclamp, clamp, auto start

Down time: 05 minutes

4) Spindle lubrication Head fault:

Causes: Lubrication pipe may leak, Lubrication material missing, Jam in pipes

Actions: Press reset, start

Down time: 10 to 15 minutes

5) Switch Part present alarm:

Causes: If metal chips present at part present sensor then it gives this alarm

Actions: Press set up, operating, guard, front loading door, door open & close, clear fault/reset, auto, home, start. If not solved then open the door, apply coolant on it, make it up down.

Down time: 05 minutes

6) B axis not turns in auto mode:

Causes: B axis is rotating & it stops.

Actions: Setup mode, Press B, press +, - with respect to fault, auto, start

Down time: 05 minutes

7) Air gauge system problem:

Causes: If diameter & length of tool inserts are vary then it gives this alarm. This problem is related to tool.

Actions: Press set up mode, operating, tool handle, tool change enable, push emergency return, tool change, press yes, auto, Home, start. Check diameter & length of tool, if it is faulty adjust it.

Down time: 10 to 15 minutes

8) Rotary table not working:

Causes: Motor is tripped. This problem comes because reed switch under malfunction

Actions: Reed switch is changed to eliminate this problem

Down time: 15 minutes

9) Air gauge health check alarm (related to gauge):

Causes: When metal burr or chips present on air gauge. It shows this alarm.

Actions: Clean the gauge with clothe

Down time: 10 minutes

C) CB630 machine

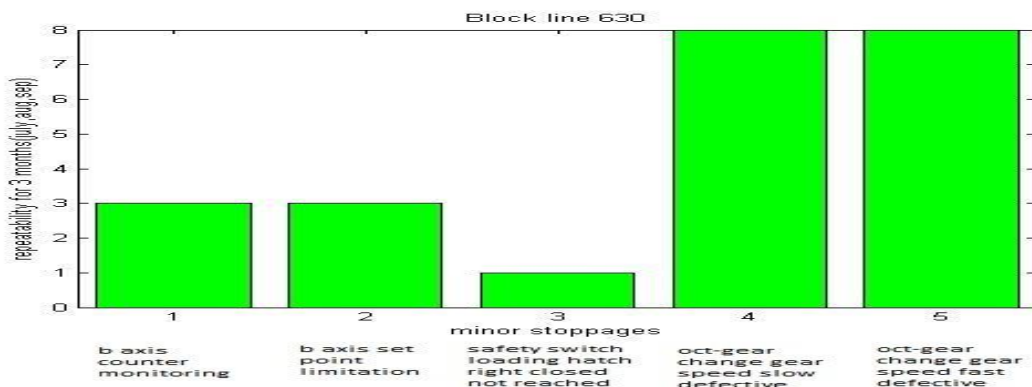


Figure 6: Block line 630

1) B axis Counter monitoring alarm

Causes: It is related to hydraulic break. Enough torque is not getting for B-axis movement. Then it stops at certain position.

Actions: Press set up mode, B, press +, - with respect to fault, reset+clear fault, auto, start

Down time: 05 minutes

2) B-axis set point limitation alarm:

It is related to velocity. Insufficient torque movement is done & it goes beyond the set limit.

Actions: Press set up mode, B, press +, - with respect to fault, reset+clear fault, auto, start

Down time: 05 minutes

3) Clamping fixture:

Causes: Metal chips get accumulated at clamping area, Metal burr/chips is at seat check area ,May be casting problem

Actions: Open the door. Apply coolant by coolant gun. Press clear fault+reset, Home, setup, menu, HMI, fixture, clamp, unclamp, clamp, auto, start

Down time: 05 minutes

4) Safety switch loading hatch right closed not reached mac-ws8

Causes: If obstacle comes in between plates, Metal burr comes on PPS (part present sensor) of gantry then it shows this alarm

Actions: Press menu select, HMI, part handle, hatch, clean the sensor & adjust, close & open by manual, auto mode & cycle start.

Down time: 15 minutes

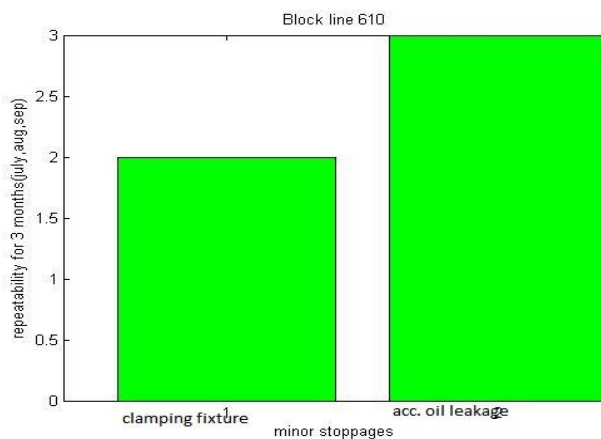
D) CB610 machine

Figure 7: Block line 610

1) Clamping fixture:

Causes: Metal chips get accumulated at clamping area, Metal burr/chips is at seat check area, May be casting problem

Actions: Open the door. Apply coolant by coolant gun.

Press clear fault+reset, Home, setup, menu, HMI, fixture, clamp, unclamp, clamp, auto, start

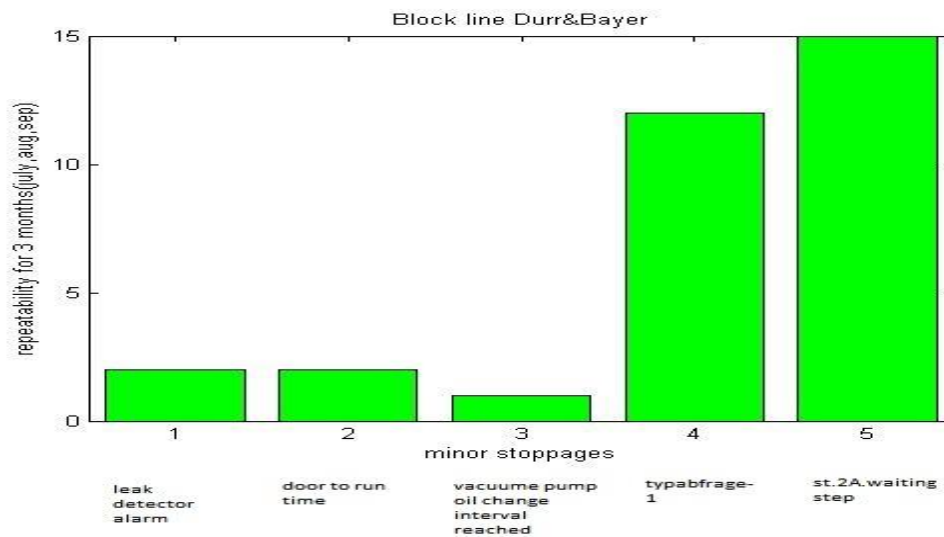
Down time: 05 minutes

2) Accumulator Oil leakage:

Causes: If accumulator oil pipe damaged. Then oil leakage is done & it is sensed by the sensors.

Actions: Check for sensor who detects the oil leakage, Check for cable for oil leakage, change according to it

Down time: 10 to 15 minutes

E) Durr& Bayer machine**Figure 8:** Block line durr& Bayer**1) Leak detector alarm**

Causes: When cycle is running & someone stops it. At that time water filling switch is on. Then coolant comes down due to overflow. At the downside sensor sense it & it gives alarm.

Actions: Remove all coolant by vacuum cleaner.

Down time: 15 to 20 minutes

2) Door to run time:

Causes: Chips get accumulated near sensor

Actions: Reset & start

3) Vacuum fault/ vacuum in external vacuum chamber not being reached

Causes: Oil level is low.oil level sensed by the sensor

Actions: Fill the oil

Down time: 10 minutes

4) Part carrier outlet next machine:

Causes: After durr 2, if operator inserts a component for rework on conveyor then it shows this alarm.

Actions: Press Reset fault, ack, start.

Down time: 05 minutes

5) Station 01, SF;S15 Typabfrage-1:

Causes: This problem comes for the TML blocks. This is due to casting problem.

Actions: Press Home & start

6) Station 2A SE:S77 waiting step:

Causes: When cup plug don't come at dolly & when less than 3 cup plugs are present at dolly. Then it shows this alarm.

Actions: reset & start

Torque Plate gantry:

Causes: Tightening of torque is not done properly. Though torquing & untorquing is ok. If metal burr/chips are present in torque plate then it will show this problem. If spindles are not in one level. Bottom level should be balanced. Gas kit may be not ok. Corrosion at threads or at bolt may lead to this problem

Repeatability in 3 months: 173

Down Time: 05 to 10 minutes

F) NAGEL machine

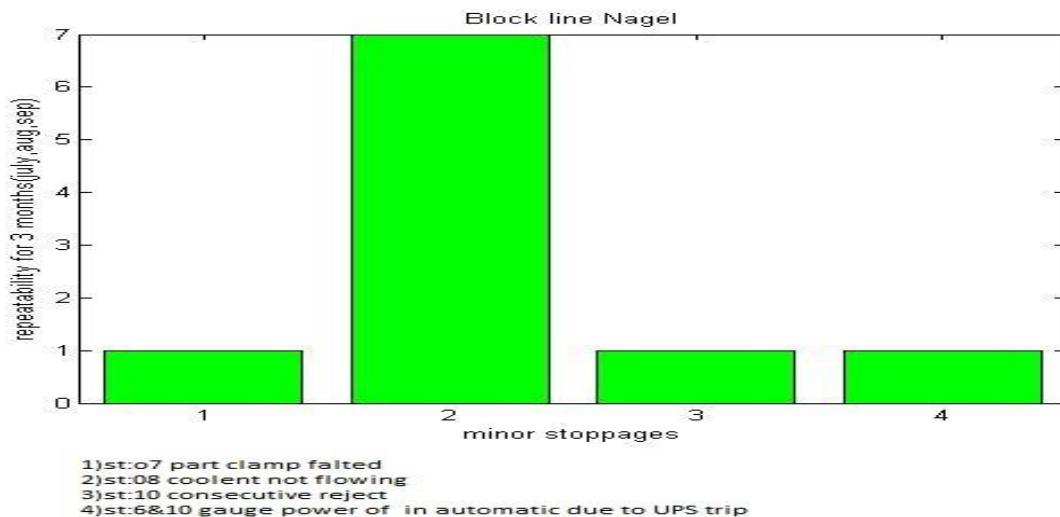


Figure 9: block line Nagel

1) Clamping problem:

Causes: If there is change in casting then it will show this problem, Metal burr or chips is at clamping or metal burr on component area where clamping is done.

Actions: Check for casting change, apply coolant by coolant gun at clamping area. Check for sensor cable & hydraulic pressure. Adjust pressure according to it.

Down time: 05 to 10 minutes

2) Station 10 consecutive rejects:

Causes: If error comes in cam, crank & cylinder measurement then consecutive reject error comes

This problem may come because of undersize or oversize of bore or it may come because of metal chips/burr. Less material (casting problem) leads to gauging problem.

Actions: Check for taper & ovality. If it is undersize then draw more material. Check for metal chips or burr at gauging area & apply coolant on it. Check for casting for less material.

3) Coolant not flowing

Causes: Coolant get jam at the base of machine, Coolant get jam because of metal burr or chips get accumulated at the base

Actions: Clean the area where jam is occurred, Remove all metal chips or burr from that area

Down time: 05 to 10 minutes

V. NOVEL SOLUTION FOR THE MINOR STOPPAGES WHO AFFECTS THE CYCLE TIME

A) CB610

Objective: To reduce cycle time, power requirement & increase the production.

Old sequence of operation:

- 1) Oil cooler face milling.
- 2) Front face: Oil pump pocket milling.
- 3) Front dowel semi finish reaming (903, 904)
- 4) Rear face: Cam bore 7, 6 rough boring. (2)
Front face: Cam bore 1, 2 rough boring.
- 5) Front face: Cam bore 3, 4, and 5 rough boring (2)
Rear face: Cam bore 5, 4 and 3 rough boring
- 6) Front face: All crank bore rough boring. (1, 2, 3, 4)
Rear face: All crank bore rough boring. (7, 6, 5, 4)
- 7) Rear face: dowel semi finish reaming (806, 810)
- 8) Rear face: Thrust face circular s/f reamer.

Novel sequence of operation:

- 1) Oil cooler face milling.
- 2) Front face: Oil pump pocket milling.
- 3) Front dowel semi finish reaming (903, 904)
- 4) Front face: Cam bore 1, 2 rough boring
Rear face: Cam bore 7, 6 rough boring.
- 5) Rear face: Cam bore 5, 4 and 3 rough boring
Front face: Cam bore 3, 4 and 5 rough boring (2)
- 6) Front face: All crank bore rough boring. (1, 2, 3, 4)
Rear face: All crank bore rough boring. (7, 6, 5, 4)
- 7) Rear face: dowel semi finish reaming (806, 810)
- 8) Rear face: Thrust face circular s/f reamer.

Benefits:

We changed the sequence of fourth & fifth operation. If we implement the novel sequence of operations. Then for each component we can reduce 5 seconds. Suppose we have production of 4000 per month. Then

Total time saved per month is:

$$4000 * 5 \text{ sec} = 20000 \text{ sec}$$

$$= 5 \text{ hour } 55 \text{ minutes}$$

Cycle time for 610 is 256 sec. We can reduce it up to 251 sec. Thus by dint of this, we can reduce the cycle time, cost reduction is done by reducing power. Ultimately we can have more production.

B) Clamping problem due to casting

Objective: To eliminate clamping problem due to casting, to reduce downtime

Need: when clamping problem comes, there are number of reasons. We can't initially understand that this problem is due to casting or not. To finalize this, it takes 20 minutes. Though this problem concerned with sourcing company (TML, Hinduja and AIW). But when it comes, it increases the precious down time.

Problem definition: In figure no.1, when height is greater than 49.82mm & height is greater than 29.63 in fig.no.2. then clamping problem will arise. At these two positions clamping is done.

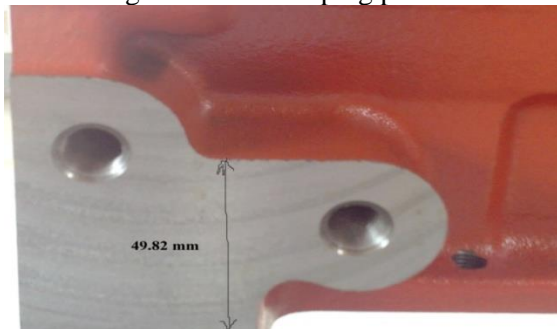


Figure 10: Height at clamping area (49.82 mm)

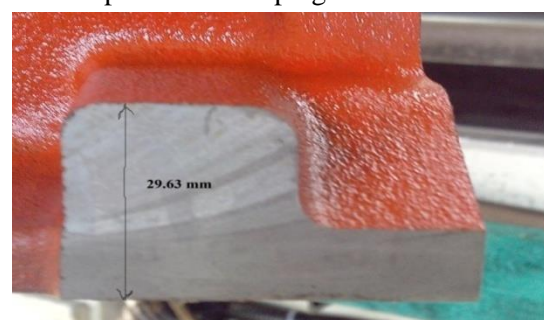


Figure no 11: Height at clamping area (29.63mm)

Solution:

At the in feed area of block line, we have to put sensor to sense the level at clamping area of component (just like cup plug feeder section, where cup plugs are sensed). These sensors will be present at the conveyor R4, where gantry picks up the component. If there is casting problem then it will give alarm. Then easily we can place that component at intra1 for checking purpose.

VI. FUTURE WORK

In this paper the number of causes for each stoppages are mentioned. Prevention is always better than cure. With the help of root causes of stoppage, we can prevent that particular stoppage. If we get the root cause for the problem, then we can proceed to develop the system or equipment to avoid such kind of problem. These kinds of system or equipment may come under kaizen or six sigma improvement methods. Six sigma method is nothing but primary process improvement.

VII. CONCLUSION

By using minor stoppages given in the paper, we can identify the stoppage & can put solution accordingly. Sometimes, if problem comes, Engineer tries to analyze the problem. After a long time he comes to know that problem was simple, wastage of time is done at there. Thus by using solutions for clamping problem of component, we can save lot of time. If down time is reduced at the machines, Then PLC programming need to be done to set the cycle time. The machines mentioned in the paper are used world over to produce diesel engines for trucks, buses, cars, military vehicles. Minor stoppages plays vital role in diesel engine production. As far as Novel solutions concerned, it will reduce power requirement. The production of diesel manufacturing company will increase. Specifically casting problem is common in all machines. If we identify it early, then it can reduce good amount of time.

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