Productivity- Alloy Steel Machining- Energy Saving

“Sovereign Kombo DV30”
On
Alloy Steel Machining
@
Fuel Injection Equipment Manufacturer, Chennai.

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Pure Machining Experience

Winning Team

FUEL INJECTION EQUIPMENT MANUFACTURER, CHENNAI.

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Machine Details

VMC Make : Makino Slim 3 (NHB Soft Transfer Line)
(4 Axis – 3 Nos & 5 Axis – 4 Nos)

Spindle Power : 11 Kw/15Kw

Spindle Taper : HSK A50

Coolant through spindle : Yes

Through spindle pressure capability: 30 bar

Maximum spindle rpm : 15000

No. of components per set-up : 1 No

No. of tools: 8 Nos

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Component Details

NOZZLE HOLDER BODY SOFT MACHINING TRANSFER LINE:

Critical Transfer Line for Fuel Injection Pump Assembly

Component	: Nozzle Holder Body Soft (NHB)
Component material	: Alloy Steel
Type of Machining	: Finish
Critical operations	: Drilling, Finish Reaming
Other operations	: End Milling
Tool Diameters	: 1.8 mm to 12 mm
NHB Soft parts per day on 3 Shift basis	: 700 Nos

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Background

Fuel Pump Manufacturer procured 7 Makino Slim 3 VMCs (4 Axis–4Nos & 5 Axis–3Nos)
for producing 'Nozzle Holder Body' parts.

1) Initial scope of supply was as under;

- Entire transfer line commissioning with committed cycle time.
- Proving of Fixture/Tooling (Cp/CpK)
- Quality, Surface Finish, Dimensional accuracy, stability & reliability.

2) Machines : Makino Slim 3 VMC (4 Axis–4Nos & 5 Axis–3Nos)

3) **Concerns :**

- **Frequent downtime of the machines due to improper Chip handling & Coolant Management.**
- **Poor housekeeping due to frequent cutting oil overflow.**
- **Excessive heating of cutting oil due to unnecessary churning.**
- **Component rejection due to unstable dimensional accuracy.**
- **As a result of which 'NHB' parts line became bottleneck in meeting the Assembly line demands.**

Background

After deliberation & "Root Cause Analysis" both End Customer & Makino narrowed down to 'COOLANT FILTRATION,FLOW,PRESSURE & LUBRICITY' to be the main causes of frequent down time of the Machines in the line.

The Makino VMC was inadequately equipped with 'Screw Pump'.

This Screw Pump was churning the coolant which was elevating the temperature of the coolant at unacceptable levels.

End Customer in discussion with Makino referred this case to Sovereign Tech.

After detailed pre-study of the problem & the subsequent brainstorming sessions along with the End Customer & Makino Team Members.

Team Sovereign offered 'Sovereign Kombo DV30' – An unique combination of Kompact Band Filter & ChipBLASTER.

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SovereignTech's Recommendation

Based on the root cause analysis & inputs of Makino:

SovereignTech recommended -

- "Sovereign Kombo DV30" - An Intelligent High Performance Coolant Delivery System.
- Total involvement of SovereignTech Core Team for the total prove out.
- "On dot" committed delivery of DV30 for trials.
- Efficient interfacing of DV30 with Makino Slim 3.
- 'First shot prove out'.

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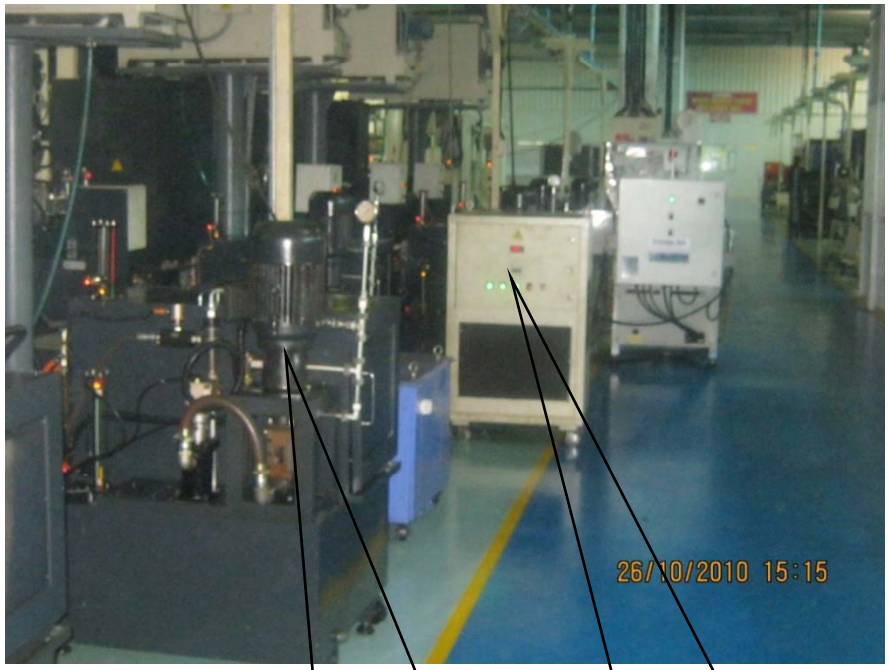
Objective

1. To resolve excessive heating of Neat cutting oil.
2. To maintain neat cutting oil temperature close to ambient temperature.
3. To resolve coolant overflow problem.
4. To avoid excess churning of coolant.
5. To improve filtration efficiency.
6. To improve house keeping.
7. To make energy efficient process.

Objective



Existing cutting oil filter system on Makino Slim 3

Existing cutting oil filter system on Makino Slim 3 with Chiller Unit.

Sovereign Kombo DV30 on Makino Slim 3 VMC.

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Temperature Observation Sheet

-Temperature Observation Sheet.

Date - 20 -10 -10.

Time	Room Temp	With Chip Blaster		Temp diff	Without Chiller		Temp diff	With Chiller		Temp diff	Remarks
		Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	
9.45	37.5	38	39	1.5	-	-		-			
11	39.7	41.2	41.5	1.8	45	45.8	6.1	35	30	-9.7	
12	38	38.2	38	0	42.5	46	8	34.4	25.6	-12.4	Machine idle for 30 minutes.
13	37.6	39.7	39.8	2.2	45.2	46.2	8.6	38	30	-7.6	
14	38	40.7	41	3	46.8	49.1	11.1	41.2	41.6	3.6	Here on chiller stopped working.
15	38.1	41.8	42.2	4.1	47	49.2	11.1	42.6	46.3	8.2	
16	38.2	42	42.8	4.6	43.2	48.6	10.4	43.2	47.5	9.3	
17	38.7	43	42.8	4.1	46.8	48.8	10.1	44.6	48.9	10.2	

Temperature observation.

Date - 21 -10 -10

Time	Room Temp	With Chip Blaster		Temp diff	Without Chiller		Temp diff	With Chiller		Temp diff	Remarks
		Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	
10	36	39.6	39.2	3.2	46.6	48.6	12.6	36.9	27.7	-8.3	
11	36.5	39.1	39.2	2.7	44.1	47.5	11	36.5	28.5	-8	
12	36.8	39.2	39.2	2.4	44.2	46.7	9.9	36.6	29.2	-7.6	
13	36	38.2	38.6	2.6	44.9	42.3	6.3	35	27.6	-8.4	
14	36.5	38.7	38.6	2.1	44.3	44.5	8	36.1	29.5	-7	
15	37.3	40.2	40.1	2.8	44.5	47.5	10.2	37.5	29	-8.3	
16	37.2	40.4	39.2	2	46.1	47.1	9.9	37.6	26.5	-10.7	
17	37.1	39.7	39.2	2.1	46.1	47.8	10.7	37	27.1	-10	

Note :
Pri.Tank refers to Primary tank, i.e, conveyor Tank
Sec.Tank refers to secondary tank, i.e, CCT.

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Temperature Observation Sheet

Temperature observation.

Date - 22 -10 -10.

Time	Room Temp	With Chip Blaster		Temp diff	Without Chiller		Temp diff	With Chiller		Temp diff	Remarks
		Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	
10	35.6	37.6	36.8	1.2	43.4	45.4	9.8	35.5	28	-7.6	
11	35.6	37.8	37.6	2	43.2	44.4	8.8	36	36.8	1.2	chiller brakedown.
12	35.5	38.1	37.9	2.4	43.6	45.3	9.8	37.1	41.2	5.7	
13	36.3	39	39	2.7	46.1	48	11.7	39.1	43.7	7.4	
14	36.9	39.2	39.4	2.5	45.3	47	10.1	39.8	44.7	7.8	
15	37.5	40.5	40.1	2.6	46.4	47.7	10.2	41.1	45	7.5	
16	37.1	39.8	39.6	2.5	45.4	46.6	9.5	40	45.1	8	
17	37.1	39.5	39.3	2.2	43.3	44.5	7.4	49.4	45.7	8.6	

Temperature observation.

Date - 23 -10 -10.

Time	Room Temp	With Chip Blaster		Temp diff	Without Chiller		Temp diff	With Chiller		Temp diff	Remarks
		Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	
12	36.1	39.1	39	2.9	43.4	45.1	9	36	26.1	-10	
13	37.2	40	40.2	3	44.5	46	8.8	37.1	29.2	-8	
14	36.5	39.2	39.1	2.6	44.5	46.7	10.2	36.6	28	-8.5	
15	37.3	40	40.5	3.2	46	48.2	10.9	38	29	-8.3	
16	36.6	39.4	39.5	2.9	45.7	47	10.4	37.2	24.3	-12.3	

Note :
Pri.Tank refers to Primary tank, i.e, conveyor Tank
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Temperature Observation Sheet

Temperature observation.

Date - 25-10 -10.

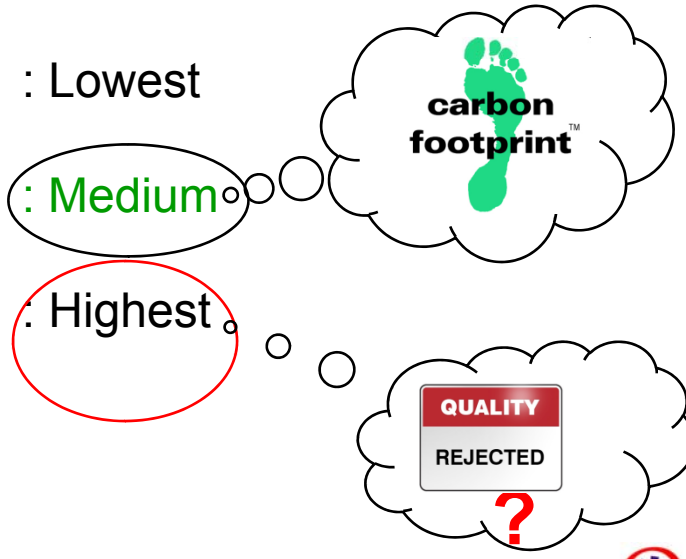
Time	Room Temp	With Chip Blaster		Temp diff	Without Chiller		Temp diff	With Chiller		Temp diff	Remarks
		Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	Pri.Tank	Sec.Tank	Vs Amb	
10	34	34.2	34.1	0.1	39	40.8	6.8	32.8	26.7	-7.3	
11	34	34.1	34	0	38.1	41.3	7.3	33.7	26.6	-7.4	
12	33.8	33.9	33.9	0.1	39.5	41.1	7.3	33.2	29.4	-4.4	Machine not in continous opn.
13											
14											
15											
16											
17											

Temperature Rise/Overheating compared to ambient temperature with respect to;

1. With Chiller : Lowest

2. With Sovereign Kombo DV30/ChipBLASTER : Medium

3. With existing Makino filter system without Chiller : Highest



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Energy Consumption

TIME	MAKINO SLIM WITH CHILLER			MAKINO SLIM WITH EXISTING FILTER SYSTEM			MAKINO SLIM WITH SOVEREIGN KOMBO DV30		
	R	Y	B	R	Y	B	R	Y	B
05.00PM	4.35	5.4	5.5	11.05	11.21	11.13	2.6	2.17	2.7
05.30PM	4.6	5.7	5.7	11.12	11.15	11.2	2.5	2.7	2.3
06.00PM	4.5	5.3	5.5	11.01	11.05	11.04	2.7	2.9	2.8
06.30PM	4.6	5.8	5.7	Filter did not function			2.4	2.3	2.9
07.00PM	4.4	5.7	5.6	11.13	11.04	11.2	2.4	2.5	2.7
7.30PM	4.6	5.7	5.8	11.1	11.25	11.17	2.2	2.4	2.65
8.00PM	4.2	5.6	5.52	11.23	11.26	11.2	2.5	2.4	2.8
8.30PM	4.5	5.6	5.7	11.11	11.2	11.17	2.3	2.7	2.4
9.00PM	4.6	5.7	5.8	11.14	11.25	11.24	2.3	2.6	2.7
9.30PM	4.5	5.8	5.9	11.01	11.05	11.11	2.45	2.6	2.8
10.00PM	4.7	5.7	5.8	11.24	11.26	11.23	2.5	2.7	2.9
10.30PM	4.4	5.6	5.5	11.15	11.24	11.28	2.5	2.6	2.8
11.00PM	4.7	5.4	5.6	11.22	11.25	11.23	2.7	2.8	2.8
11.30PM	4.5	5.7	5.8	11.19	11.21	11.2	2.6	2.7	2.9
12.00PM	4.6	5.6	5.9	11.27	11.29	11.23	2.5	2.6	2.5
12.30PM	4.7	5.5	5.7	11.12	11.18	11.17	2.5	2.7	2.95

Energy efficient process

Increased Profits

Productivity & Quality

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Mission Accomplished!!

Sovereign Kombo DV30

1. Set for 35 Bar for all thru coolant tools.
2. Delivered adequate volume flow & lubricity.
3. Effective dissipation of heat from the point of cut.
4. Effective chip evacuation.

Result:

1. **Resolved the problem of OVERHEATING.**
2. **Consistent Cp/CpK results.**
3. **Energy efficient process.**

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Sincere Thanks!

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