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Process control within an SME to increase output and achieve consistent manufacture of components

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University of HUDDERSFIELD

Introduction - Process control is a key aspect to any company looking to increase machining output and availability, and also those who strive to achieve automation. The dangers associated with this philosophy can be seen when producing batch's automatically. With no operator intervention, any weakness in the process control chain can result in high levels of scrap being produced. To achieve consistent manufacturing it is necessary to look at the processes which make up the whole operation. The majority of the components manufactured within the case-study SME can be single or batches of very few parts.

On machine collision causes crash within machine damaging work piece, smashing probe and possibly causing machine error

Ballbar graph showing the machine error relating to the large crash of probe body into the side of the work piece

Tooling file created for standardisation across machining centres. Standard tools are kept within the machine for common jobs and includes the Touch Probe. Pockets are left blank for job specific tooling and are changed as necessary. All tool information is recorded including grades, speeds, feeds lengths and manufacturer



CRAFTSMAN TOOLS

Inspector Name: _____
Inspector sign off: _____

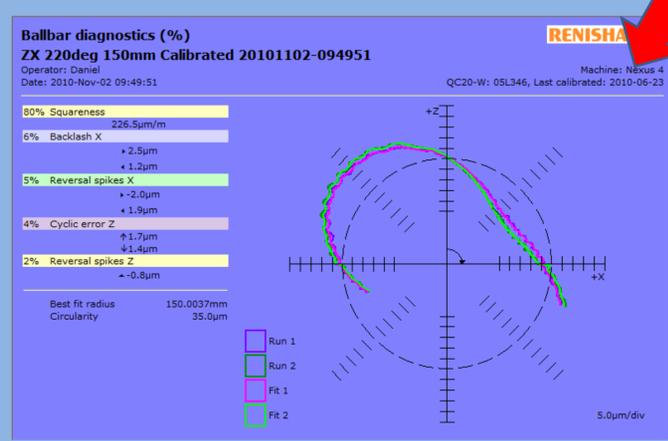
Printed on: 10/32/26

SERIAL NUMBER: ABC123 **PART NUMBER:** G6537.MHI

DIMENSION REPORT

Point No.	Position			Tolerance			Position measured			Error in Position			Vector	Standard L. Actual Distance/Angle (°)	Error	
	X	Y	Z	min	max	X	Y	Z	X	Y	Z					
38	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	40.000	39.861	-0.139
39	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
40	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
41	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
42	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000

Component measured on the machine tool highlighting large errors. First checks are made with a quick ballbar test



Machine checked using ballbar test equipment to evaluate machine alignment post incident

Component re-checked after machine alignment and showing a realistic dimension report which is comparable to manual inspection

CRAFTSMAN TOOLS

Inspector Name: _____
Inspector sign off: _____

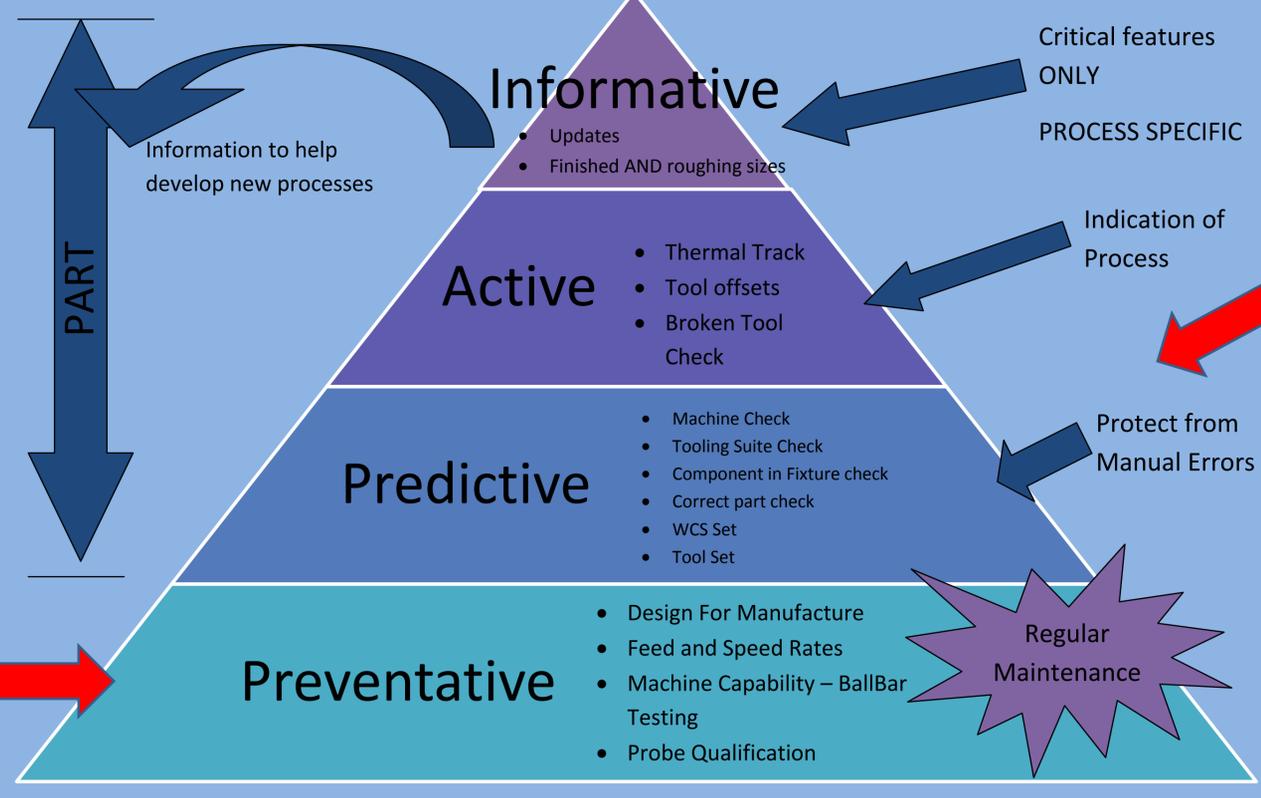
Printed on: 10/30/26

SERIAL NUMBER: ABC123 **PART NUMBER:** G6537.MHI

DIMENSION REPORT

Point No.	Position			Tolerance			Position measured			Error in Position			Vector	Standard L. Actual Distance/Angle (°)	Error	
	X	Y	Z	min	max	X	Y	Z	X	Y	Z					
38	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	40.000	40.014	0.014
39	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
40	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
41	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
42	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000

Outcomes - On-machine probing of a component has been used as a first-line diagnostic tool when comparison with manual inspection identified errors in the production machine. Collisions on the machine tool give need for testing with the ballbar as a damage indicator and allow for maintenance to take place if necessary. Processes within manufacture have been standardised and allow for greater control of the components produced across a number of Machine Tools.



Tooling file table with columns for Tool No, Tool Description, Tool Length, Tool Diameter, etc.

Tool No	Tool Description	Tool Length	Tool Diameter	Tool Material	Tool Grade	Tool Manufacturer	Tool Status	Tool Location	Tool Date
1
2
3
4
5
6
7
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11
12
13
14
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28
29
30
31
32

Component correctly secured to correct fixture check. Modification taken place within this example to allow for measurement to occur using touch probe

