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CAPABILITY AND CONTROL CHART

Company Name ACME S.r.l.

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Brief data description: Assessment of process capability of packaging machines

Document approval

The signatures below certify that the data and statistical analysis have been analyzed and verified by competent personnel in statistical analysis and according to the internal procedures of Agile Quality Support S. r. l.

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Document versions

This section records the versions of the document and any updates

Revision	Update	Source	Month/Year
022022	First version	Order number XX	02/2022

1 Contents

1 Capability & Control Charts

1.1 Description of the problem

A manufacturer uses two machines to package its product. A quality engineer wants to assess the process capability of each machine. The engineer randomly samples 50 packages from each machine and records the weight of each package. The specification range is 31 oz ± 4 oz. The engineer knows that the distribution of weights follows the largest extreme value distribution.

1.2 Data Overview

Worksheet column	Description
Packaging Weight	The weight of each package
Machine	The machine identifier: *Current* or *New*

The data sheet is available in the "Data" section.

1.3 Capability Output interpretation

1.3.1 Capability

Machine	Factor	Output	Results
Before	Actual Performance (PpK)	0.89	was below the target (1.33)
	Potential Performance (CpK)	0.81	Was below the target (1.33)
	Probability of OOS	0.41%	To compare with internal procedure
After	Actual Performance (PpK)	0.93	was below the target (1.33)
	Potential Performance (CpK)	1.03	Was below the target (1.33)
	Probability of OOS	0.27%	To compare with internal procedure Reduced compared to before

1.3.2 Control chart

Machine	Test Failed OOT/OOS	Suggested hypothesis
Before	None	Process In control
After	None	Process In control

1.4 Performance of the Process before and after

Before/After Capability Comparison for current vs new
Report Card

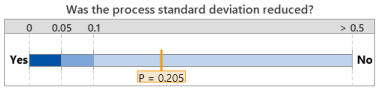
Check	Status	Description
Stability	✓	For both the Before and After data, the process mean and variation are stable. No points are out of control.
Number of Subgroups	i	Both the Before and After data have at least 25 subgroups. For a capability analysis, this is usually enough to capture the different sources of process variation when collected over a long enough period of time.
Normality	✓	Both the Before and After data passed the normality test. As long as you have enough data, the capability estimates should be reasonably accurate.
Amount of Data	!	For both the Before and After data, the total number of observations is less than 100. You may not have enough data to obtain reasonably precise capability estimates. The precision of the estimates decreases as the number of observations becomes smaller.

Before/After Capability Comparison for current vs new
Summary Report

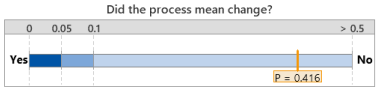
35%

Reduction in % Out of Spec
% Out of spec was reduced by 35% from 0.41% to 0.27%.

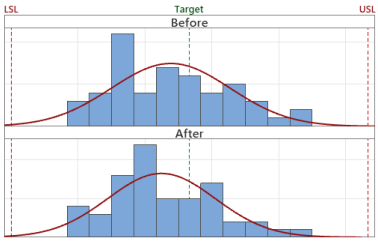
Was the process standard deviation reduced?



Did the process mean change?



Actual (Overall) Capability
Are the data inside the limits and close to the target?



Customer Requirements

Lower Spec	Target	Upper Spec
27	31	35

Process Characterization

Statistics	Before	After	Change
Mean	30.577	30.369	-0.20802
StDev(overall)	1.3345	1.2062	-0.12832
Actual (overall) capability			
Pp	1.00	1.11	0.11
Ppk	0.89	0.93	0.04
Z.Bench	2.64	2.79	0.14
% Out of spec	0.41	0.27	-0.15
PPM (DPMO)	4138	2674	-1464

Comments

Before: current After: new

- The process standard deviation was not reduced significantly (p > 0.05).
- The process mean did not change significantly (p > 0.05).

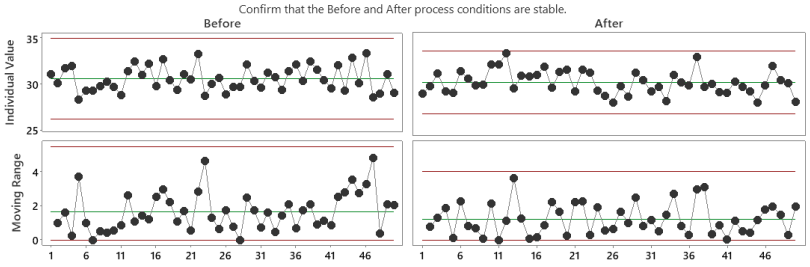
Actual (overall) capability is what the customer experiences.

Potential (within) capability is what could be achieved if process shifts and drifts were eliminated.

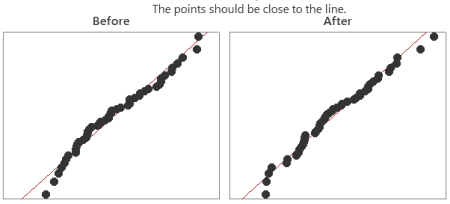
Before/After Capability Comparison for current vs new
Diagnostic Report

Before: current
After: new

I-MR Charts
Confirm that the Before and After process conditions are stable.

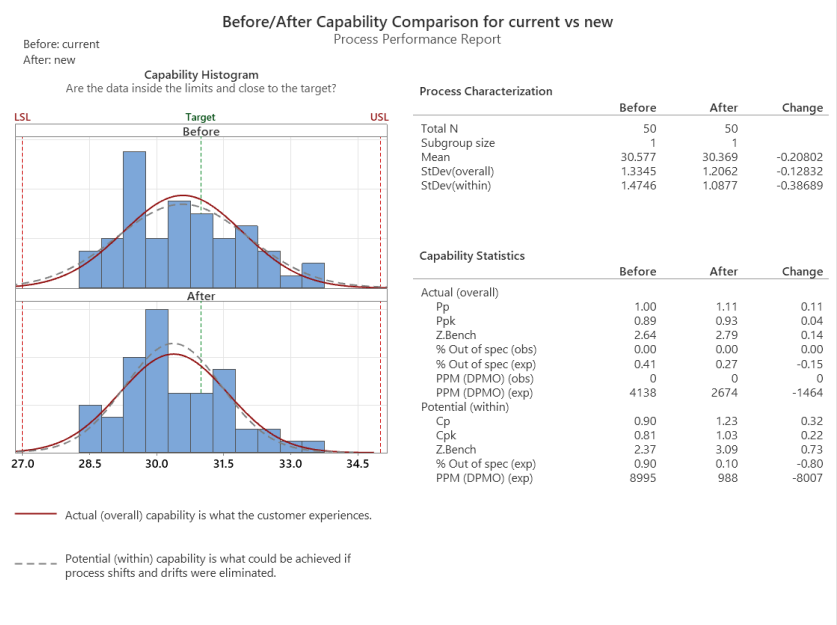


Normality Plots
The points should be close to the line.



Normality Test (Anderson-Darling)

	Before	After
Results	Pass	Pass
P-value	0.158	0.349



1.5 Definitions

Term	Definition
OOT	Out of Trend
OOS	Out of Specification
Cpk	Process capability – it indicates whether the process potentially can meet specifications
Ppk	Process performance – it indicates how the actual process performed over a period of time

1.6 Data

Values are recorded in oz

Machine	
current	new
31.08	29.22
30.09	29.98
31.71	31.30
31.97	29.44
28.29	29.29
29.28	31.56
29.29	30.75
29.81	30.08
30.26	30.15
29.69	32.27

Machine	
current	new
28.80	32.25
31.39	33.39
32.49	29.79
31.03	31.04
32.24	30.97
29.73	31.15
32.68	32.03
30.46	29.80
29.38	31.45
31.07	31.70
30.48	29.47
33.32	31.71
28.71	31.39
30.01	29.49
30.65	28.94
28.91	28.28
29.68	29.95
29.67	28.93
32.13	31.40
30.37	30.58
29.62	29.42
31.25	29.93
30.78	28.46
29.33	31.15
31.43	30.34
32.11	30.03
30.38	32.99
32.47	29.89
31.57	30.22
30.42	29.37
29.54	29.32
32.07	30.43
29.31	29.91
32.84	29.46
30.09	28.31
33.36	30.10
28.57	32.07
28.96	30.60
31.06	30.31
29.02	28.37