



date:
19.08.2011

Measurement Capability Gage Repeatability and Reproducibility Report (GRR)

SP 06-FS 013

Part-Nr. 000-100097410-01

Article: Tube

Attribute: Outside Dimension

Tolerance: 0.2 6

Measurement: ID-Nr.: RO B16243607

Evaluation Measurement: Caliper

Date: 14.09.2022

Adapter: Anita Jakab Niczas

Appraiser Name - Dep.

Checker a Chira Nicoleta

Checker b Molnar Sabina

Checker c Bereczki Eva

Parts of 1-10	Checker a			Checker b			Checker c			Parts of 1-10	x across Part
	1st check	2nd check	Range a	1st check	2nd check	Range b	1st check	2nd check	Range c		
1	5.920	5.930	0.010	5.920	5.930	0.010	5.920	5.920	0.000	1	5.923
2	5.940	5.940	0.000	5.930	5.940	0.010	5.930	5.940	0.010	2	5.937
3	6.100	6.110	0.010	6.110	6.100	0.010	6.110	6.110	0.000	3	6.107
4	5.990	5.990	0.000	5.990	5.990	0.000	5.980	5.990	0.010	4	5.988
5	5.970	5.980	0.010	5.970	5.980	0.010	5.970	5.970	0.000	5	5.973
6	5.960	5.960	0.000	5.950	5.960	0.010	5.960	5.950	0.010	6	5.957
7	6.010	6.020	0.010	6.020	6.010	0.010	6.010	6.020	0.010	7	6.015
8	5.890	5.900	0.010	5.900	5.890	0.010	5.900	5.900	0.000	8	5.897
9	5.980	5.980	0.000	5.990	5.980	0.010	5.980	5.980	0.000	9	5.982
10	5.980	5.980	0.000	5.980	5.990	0.010	5.990	5.980	0.010	10	5.983
Summe	59.740	59.790	0.050	59.760	59.770	0.090	59.750	59.760	0.050	Summe	59.762
	Ra across		0.0050	Rb across		0.0090	Rc across		0.0050	Rp across	0.2100
	Xa across		5.9765	Xb across		5.9765	Xc across		5.9755		
	Sum of check's a		119.5300	Sum of check's b		119.5300	Sum of check's c		119.5100		

Ra across	0.0050
Rb across	0.0090
Rc across	0.0050
Sum	0.0190
R across	0.0063

max x across	5.977
min x across	5.976
X across diff.	0.0010

Amount of done checks	D4
2	3.27

UCLr* = R across x D4

D4 = 3.27

UCLr* = 0.0207

decision* = All R's within von UCLr

The examiners a b and c register their results of measurement on 3 separate test sheets.

* Limit for separate R's. Mark all R's, which exceed that value. Correction of encircled R's by repetition of measurement for related single values at origin conditions. If UCLr is again exceeded, eliminate the related spot tests and recalculate the average of x-, R across and UCLr newly.



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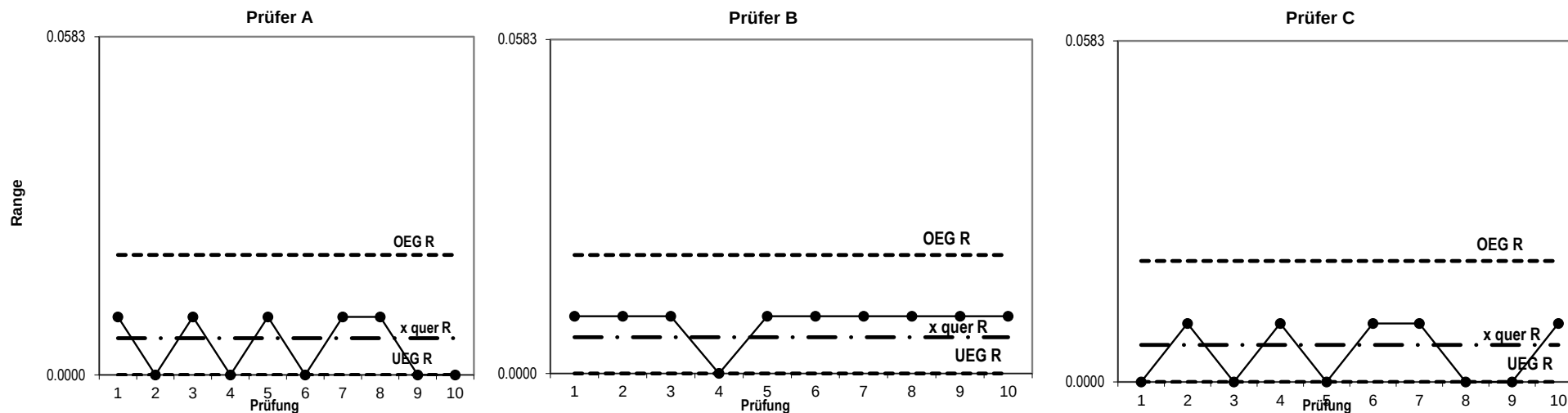
Analysis of measurement module				% Total Variation (TV)																					
Repeatability - Equipment Variation (EV) <table border="1"> <thead> <tr> <th>Number</th> <th>K1</th> </tr> </thead> <tbody> <tr> <td>Test courses</td> <td>K1</td> </tr> <tr> <td>2</td> <td>0.8862</td> </tr> <tr> <td>3</td> <td>0.5908</td> </tr> </tbody> </table> $E.V. = R_{\text{quer}} \times K1$ $E.V. = 0.0056$				Number	K1	Test courses	K1	2	0.8862	3	0.5908	Total dispersion (ndc≥5)													
Number	K1																								
Test courses	K1																								
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Reproducibility - Appraiser Variation (AV) <table border="1"> <thead> <tr> <th>Operator</th> <th>K2</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>0.7071</td> </tr> <tr> <td>3</td> <td>0.5231</td> </tr> </tbody> </table> $A.V. = \sqrt{(X_{\text{quer Diff.}} \times K2)^2 - (E.V.^2 / nr)^2}$ $A.V. = 0.0005$				Operator	K2	2	0.7071	3	0.5231	Toleranz (ndc <5)															
Operator	K2																								
2	0.7071																								
3	0.5231																								
Repeatability & Reproducibility (GRR) $GRR = \sqrt{(E.V.)^2 + (A.V.)^2}$ $GRR = 0.0056$				Repeatability - Equipment Variation (EV) $\% EV = 100 (EV/TV)$ $\% EV = 8.46\%$																					
Part Variation (PV) $PV = R_{p \text{ quer}} \times K3$ $PV = 0.0661$				Reproducibility - Appraiser Variation (AV) $\% AV = 100 (AV/TV)$ $\% AV = 0.79\%$																					
Total Variation (TV) $TV (\text{wenn } ndc \geq 5) = \sqrt{(GRR)^2 + (PV)^2}$ $TV (\text{wenn } ndc \geq 5) = 0.0663$ $TV (\text{wenn } ndc < 5) = \text{Toleranz} / 6$ $TV (\text{wenn } ndc < 5) = 0.0333$				Repeatability & Reproducibility (GRR) $\% GRR = 100 (GRR/TV)$ $\% GRR = 8.50\%$																					
Number of different categories (ndc) $ndc = 1,41 (PV/GRR)$ $ndc = 16.526$ $ndc \text{ geround.} = 17 \quad (\text{Soll } \geq 5)$				Part Variation (PV) $\% PV = 100 (PV/TV)$ $\% PV = 99.64\%$																					
<table border="1"> <thead> <tr> <th>Number of Parts</th> <th>K3</th> </tr> </thead> <tbody> <tr><td>2</td><td>0.71</td></tr> <tr><td>3</td><td>0.52</td></tr> <tr><td>4</td><td>0.45</td></tr> <tr><td>5</td><td>0.40</td></tr> <tr><td>6</td><td>0.37</td></tr> <tr><td>7</td><td>0.35</td></tr> <tr><td>8</td><td>0.34</td></tr> <tr><td>9</td><td>0.32</td></tr> <tr><td>10</td><td>0.31</td></tr> </tbody> </table>				Number of Parts	K3	2	0.71	3	0.52	4	0.45	5	0.40	6	0.37	7	0.35	8	0.34	9	0.32	10	0.31	Signature QS / QM:	
Number of Parts	K3																								
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6	0.37																								
7	0.35																								
8	0.34																								
9	0.32																								
10	0.31																								
Decision		Reasons		Measures																					
GRR < 10% = Measur. System capable		/		none																					
10% < GRR < 30% = Measur. Conditionally capable		economic efficiency		none																					
GRR > 30% = Measur. Not capable		/		yes																					
Remarks: All variables/ factors according to MSA issue June 2010 Fourth Edition																									
All calculations based on prediction 5,15 F (99% of the range are below normal curve)																									

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Graphical evaluation of repeatability of the measurment system Comparison of measurement system between different checkers



Result

1) All ranges of all checkers under statistic control

2) Range of one checker out of statistic control

3) Ranges of all 3 checkers out of statistic control

Remarks

Measurement system can be used by all checkers

one checker uses system in different way as other checkers

Measurement system sensitive against checkers and method

Rating

ok

cond. ok

not ok

Measures

none

analyse root cause and repeat analysis with that checker

start measures for improvement of measurement system



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Rating of statistic control for measurement system according to MSA - Reference Manual issue June 2010 Fourth Edition

Checker a		Checker b		Checker c		x across (a,b,c)	OEG x across	UEG x across	R across (a,b,c)	OEG R across	UEG R across
<i>x quer</i>	Range	<i>x quer</i>	Range	<i>x quer</i>	Range						
5.925	0.010	5.925	0.010	5.920	0.000	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.940	0.000	5.935	0.010	5.935	0.010	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
6.105	0.010	6.105	0.010	6.110	0.000	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.990	0.000	5.990	0.000	5.985	0.010	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.975	0.010	5.975	0.010	5.970	0.000	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.960	0.000	5.955	0.010	5.955	0.010	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
6.015	0.010	6.015	0.010	6.015	0.010	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.895	0.010	5.895	0.010	5.900	0.000	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.980	0.000	5.985	0.010	5.980	0.000	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000
5.980	0.000	5.985	0.010	5.985	0.010	5.9762	5.9881	5.9643	0.0063	0.0207	0.0000