



date:
19.08.2011

Measurement Capability Gage Repeatability and Reproducibility Report (GRR)

SP 06-FS 013

Part-Nr. 000-100097410-01

Article: Tube

Attribute: Inside Dimension

Tolerance: 0.3 4.2

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	4.110	4.110	0.000	4.120	4.110	0.010	4.110	4.110	0.000	1	4.112
2	4.190	4.180	0.010	4.180	4.190	0.010	4.180	4.180	0.000	2	4.183
3	4.380	4.370	0.010	4.380	4.370	0.010	4.370	4.380	0.010	3	4.375
4	4.150	4.160	0.010	4.150	4.150	0.000	4.160	4.160	0.000	4	4.155
5	4.170	4.150	0.020	4.170	4.160	0.010	4.170	4.170	0.000	5	4.165
6	4.120	4.110	0.010	4.120	4.120	0.000	4.100	4.120	0.020	6	4.115
7	4.160	4.160	0.000	4.160	4.150	0.010	4.150	4.140	0.010	7	4.153
8	4.110	4.120	0.010	4.120	4.120	0.000	4.120	4.110	0.010	8	4.117
9	4.140	4.150	0.010	4.150	4.160	0.010	4.150	4.140	0.010	9	4.148
10	4.290	4.280	0.010	4.260	4.270	0.010	4.270	4.270	0.000	10	4.273
Summe	41.820	41.790	0.090	41.810	41.800	0.070	41.780	41.780	0.060	Summe	41.797
	Ra across		0.0090	Rb across		0.0070	Rc across		0.0060	Rp across	0.2633
	Xa across		4.1805	Xb across		4.1805	Xc across		4.1780		
	Sum of check's a		83.6100	Sum of check's b		83.6100	Sum of check's c		83.5600		

Ra across	0.0090
Rb across	0.0070
Rc across	0.0060
Sum	0.0220
R across	0.0073

max x across	4.181
min x across	4.178
X across diff.	0.0025

Amount of done checks	D4
2	3.27

UCLr* = R across x D4

D4 = 3.27

UCLr* = 0.0240

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 quer x K1 E.V.= 0.0065				Number	K1	Test courses	K1	2	0.8862	3	0.5908	Total dispersion (ndc≥5) Repeatability - Equipment Variation (EV) % EV= 100 (EV/TV) %EV= 7.82%							
Number	K1																		
Test courses	K1																		
2	0.8862																		
3	0.5908																		
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.= $\sqrt{X \text{ quer Diff. x K2}^2 - (E.V.^2/nr)^2}$ A.V.= 0.0013 <table border="1"> <thead> <tr> <th colspan="2">Number of Parts</th> <th colspan="2">Number of examinations</th> </tr> <tr> <th>n</th> <th>10</th> <th>r</th> <th>2</th> </tr> </thead></table>				Operator	K2	2	0.7071	3	0.5231	Number of Parts		Number of examinations		n	10	r	2	Reproducibility - Appraiser Variation (AV) % AV= 100 (AV/TV) %EV= 1.57%	
Operator	K2																		
2	0.7071																		
3	0.5231																		
Number of Parts		Number of examinations																	
n	10	r	2																
Repeatability & Reproducibility (GRR) GRR= $\sqrt{(E.V.)^2 + (A.V.)^2}$ GRR= 0.0066				Repeatability & Reproducibility (GRR) % GRR= 100 (GRR/TV) % GRR= 7.98%															
Part Variation (PV) PV= Rp quer x K3 PV= 0.0828				Part Variation (PV) % PV= 100 (PV/TV) % PV= 99.68%															
Total Variation (TV) TV (wenn ndc ≥5)= $\sqrt{(GRR)^2 + (PV)^2}$ TV (wenn ndc ≥5)= 0.0831 TV (wenn ndc <5)= Toleranz / 6 TV (wenn ndc <5)= 0.0500				Number of different categories (ndc) ndc= 1,41 (PV/GRR) ndc= 17.622 ndc geround.= 18 (Soll ≥5)															
Decision		Reasons		Measures															
GRR <10% = Measur. System capable 10% < GRR < 30% = Measur. Conditionally capable GRR > 30% = Measur. Not capable		/ economic efficiency /		none none yes															
				%GRR (ndc relevant)= 7.98% Decsision= Measur. System capable Signature QS / QM:															
Remarks: All variables/ factors according to MSA issue June 2010 Fourth Edition																			

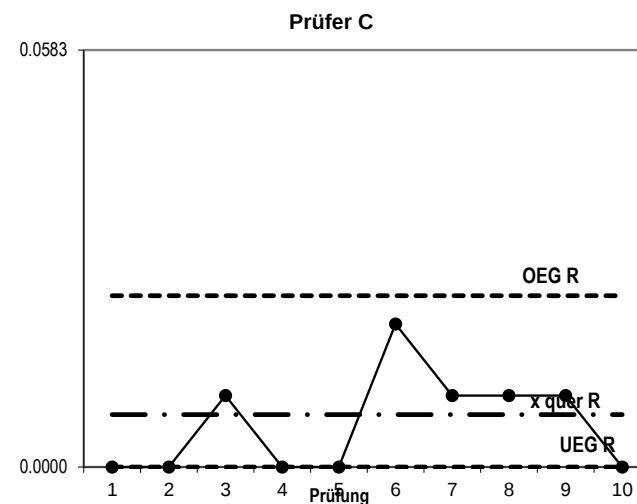
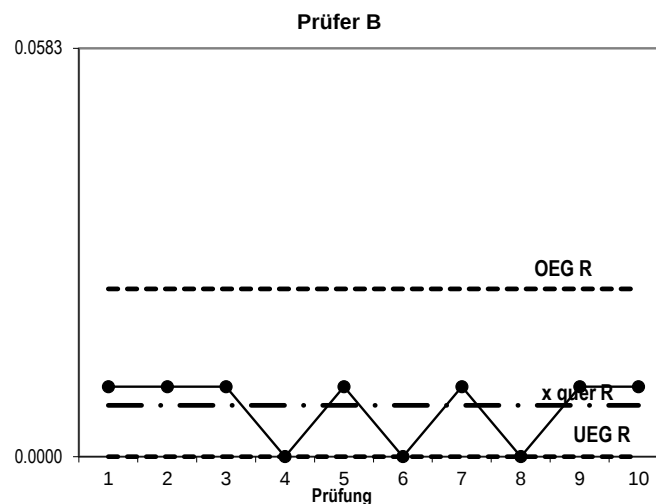
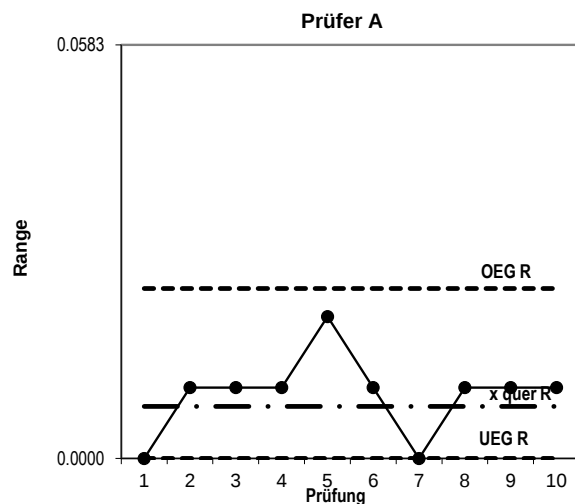
All calculations based on prediction 5,15 F (99% of the range are below normal curve)

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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						
4.110	0.000	4.115	0.010	4.110	0.000	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.185	0.010	4.185	0.010	4.180	0.000	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.375	0.010	4.375	0.010	4.375	0.010	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.155	0.010	4.150	0.000	4.160	0.000	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.160	0.020	4.165	0.010	4.170	0.000	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.115	0.010	4.120	0.000	4.110	0.020	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.160	0.000	4.155	0.010	4.145	0.010	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.115	0.010	4.120	0.000	4.115	0.010	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.145	0.010	4.155	0.010	4.145	0.010	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000
4.285	0.010	4.265	0.010	4.270	0.000	4.1797	4.1935	4.1659	0.0073	0.0240	0.0000