DELFINGEN

date: 19.08.2011	Measurement Capability Gage Repeatability and Reproduciblity Report (GRR)	SP 06-FS 013

Part-Nr.	**1200016**	**Measurement: ID-Nr.:**	**WF 1601488**	**Appraiser**	**Name - Dep.**
Article:	**Tube NW 17**	**Evaluation Measurement:**	Cantar	**Checker a**	Eva Bereczki
Attribute.	Weight	**Date:**	**04.01.2023**	**Checker b**	Lucica Pintye
Tolerance:	1.5 **56**	**Adapter:**	**Anita Jakab N.**	**Checker c**	Erika Danea

	Checker a			Checker b			Checker c				
Parts of 1-10	1st check	2nd check	Range a	1st check	2nd check	Range b	1st check	2nd check	Range c	Parts of 1-10	x across Part
1	55.94	55.95	0.010	55.93	55.92	0.010	55.99	55.97	0.020	1	55.950
2	56.08	56.05	0.030	56.01	56.06	0.050	56.03	56.05	0.020	2	56.047
3	55.91	55.93	0.020	55.98	55.95	0.030	55.96	55.93	0.030	3	55.943
4	56.01	56.03	0.020	56.00	56.04	0.040	56.07	56.09	0.020	4	56.040
5	55.26	55.21	0.050	55.26	55.28	0.020	55.21	55.23	0.020	5	55.242
6	55.91	55.96	0.050	55.94	55.91	0.030	55.90	55.93	0.030	6	55.925
7	56.07	56.05	0.020	56.03	56.05	0.020	56.04	56.02	0.020	7	56.043
8	55.93	55.97	0.040	56.00	55.98	0.020	55.91	55.95	0.040	8	55.957
9	56.03	56.01	0.020	56.01	56.02	0.010	56.02	56.00	0.020	9	56.015
10	56.05	56.04	0.010	56.03	56.05	0.020	56.08	56.06	0.020	10	56.052
Summe	559.190	559.200	0.270	559.190	559.260	0.250	559.210	559.230	0.240	**Summe**	559.213
		Ra across	**0.0270**		Rb across	**0.0250**		Rc across	**0.0240**	Rp across	**0.8100**
		Xa across	**55.9195**		Xb across	**55.9225**		Xc across	**55.9220**		
		Sum of check's a	1118.3900		Sum of check's b	1118.4500		Sum of check's c	1118.4400		

Ra across	0.0270
Rb across	0.0250
Rc across	0.0240
Sum	**0.0760**
R across	**0.0253**

max x across	55.923
min x across	55.920
X across diff.	**0.0030**

Amount of done checks	**D4**
2	3.27

UCLr*= R across x D4

D4= **3.27**

UCLr*= **0.0828**

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 repeation 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

Repeatability - Equipment Variation (EV)

Number Test courses	K1
2	**0.8862**
3	0.5908

E.V.= R quer x K1

E.V.= 0.0225

Reproducibility - Appraiser Variation (AV)

Operator	K2
2	0.7071
3	**0.5231**

Number of Parts		Number of examinations	
n	10	**r**	2

A.V.= $\sqrt{(\text{X quer Diff. x K2})^2 - (\text{E.V.}^2/nr)^2}$

A.V.= 0.0015

Repeatability & Reproducibility (GRR)

GRR= $\sqrt{(\text{E.V.})^2 + (\text{A.V.})^2}$

GRR= 0.0225

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**

Part Variation (PV)

PV= Rp quer x K3

PV= 0.2548

Total Variation (TV)

TV (wenn ndc ≥5)= $\sqrt{(\text{GRR})^2 + (\text{PV})^2}$

TV (wenn ndc ≥5)= 0.2558

TV (wenn ndc <5)= Toleranze / 6

TV (wenn ndc <5)= 0.2500

Number of different categories (ndc)

ndc= 1,41 (PV/GRR)

ndc= 15.967

ndc geround.= 16 **(Soll ≥5)**

% Total Variation (TV)

Total dispersion (ndc≥5)	Toleranz (ndc <5)

Repeatability - Equipment Variation (EV)

% EV= 100 (EV/TV)	% EV= 100 (EV/TV)
%EV= 8.78%	**%EV= 8.98%**

Reproducibility - Appraiser Variation (AV)

% AV= 100 (AV/TV)	% AV= 100 (AV/TV)
%EV= 0.60%	**%EV= 0.62%**

Repeatability & Reproducibility (GRR)

% GRR= 100 (GRR/TV)	% GRR= 100 (GRR/TV)
% GRR= 8.80%	**% GRR= 9.00%**

Part Variation (PV)

% PV= 100 (PV/TV)	% PV= 100 (PV/TV)
% PV= 99.61%	**% PV= 101.93%**

	Decision	Reasons	Measures
GRR <10% =	Measurem. System capable	/	none
10% < GRR < 30% =	Measurem. Conditionally capable	economic efficiency	none
GRR > 30% =	Measurem. Not capable	/	yes

%GRR (ndc relevant)= 8.80%

Decsision= Measurem. 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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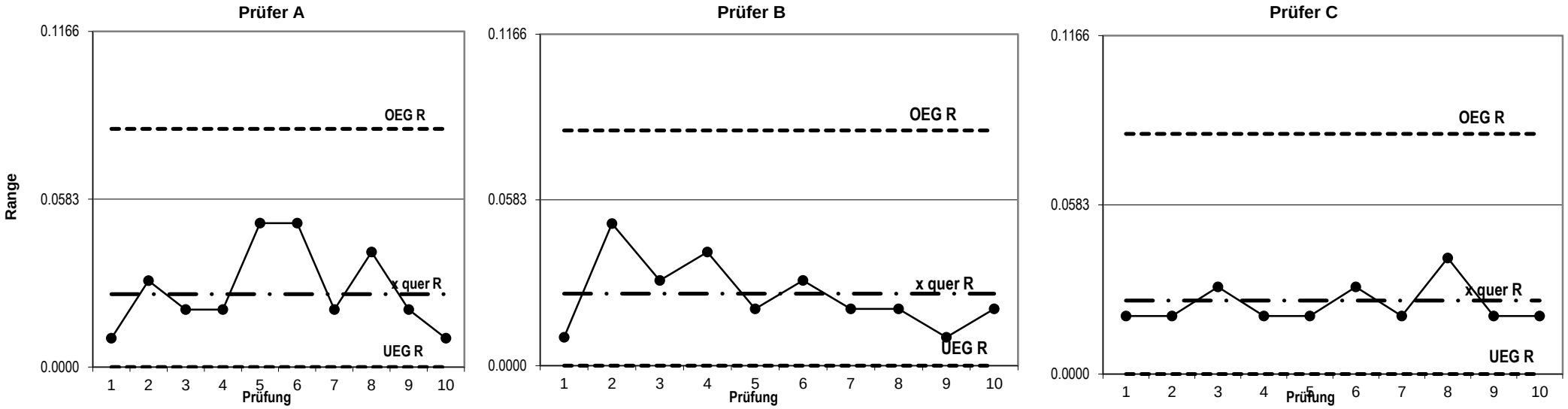
Graphical evaluation of repeatability of the measurment system

Comparison of measurement system between different checkers



Result	Remarks	Rating	Measures
1) All ranges of all checkers under statistic control	Measurement system can be used by all checkers	ok	none
2) Range of one checker out of statistic control	one checker uses system in different way as other checkers	cond. ok	analyse root cause and repeat analysis with that checker
3) Ranges of all 3 checkers out of statistic control	Measuerement system sensitive against checkers and method	not ok	start measures for improvement of measur-ment 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
x quer	Range	*x quer*	Range	*x quer*	Range						
55.945	0.010	*55.925*	0.010	*55.980*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
56.065	0.030	*56.035*	0.050	*56.040*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
55.920	0.020	*55.965*	0.030	*55.945*	0.030	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
56.020	0.020	*56.020*	0.040	*56.080*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
55.235	0.050	*55.270*	0.020	*55.220*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
55.935	0.050	*55.925*	0.030	*55.915*	0.030	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
56.060	0.020	*56.040*	0.020	*56.030*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
55.950	0.040	*55.990*	0.020	*55.930*	0.040	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
56.020	0.020	*56.015*	0.010	*56.010*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000
56.045	0.010	*56.040*	0.020	*56.070*	0.020	55.9213	55.9690	55.8737	0.0253	0.0828	0.0000