

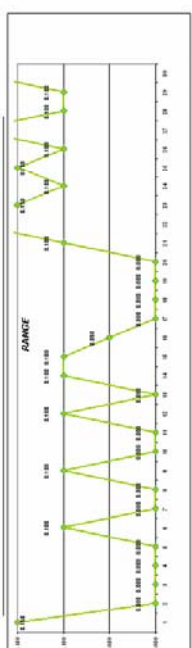
ภาคผนวก

Gage Repeatability and Reproducibility Data Sheet Collection Sheet

[illegible]

* $D_{\text{max}} = 3.27$ for 2 trials and 2.58 for 3 trials. UCL₉₅ represents the limit of individual P₉₅. Circle those that are beyond this limit. Identify the cause and correct. Repeat the readings, using the same apparatus and seal as originally used or discard values used or re-average and recompute $\bar{D}_{\text{max}}$ and the limiting value. Form the remaining observations.

Notes:

DEM NO.: F-CAM-M2-052
REV. 00

Page 2 of 2

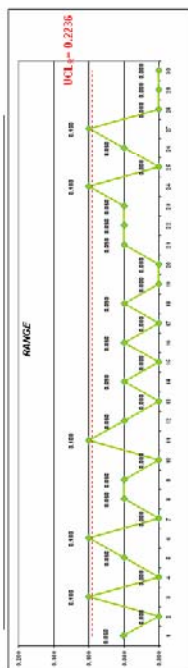
Part No. & Name :	No.655	Order Name :	Dial Thickness Gauge	Date :	17-09-20
Characteristics :	Thickness : 5mm	Order No :	D-32 (Spare ?)	Performed by :	Nashid I.
Specifications :	4.50-4.80 mm	Order Type :	0-30 mm	Approved by :	
	$\bar{R} = 0.0700$	$\bar{X}_{\text{form}} = 0.2250$		$R_p =$	1.5111
From data sheet :					
Measurement Unit Analysis					
Repeatability :	Equivalent Variations (EV)	% Total Variation (TV)			
	$EV = \bar{R} \times K_1$	Trials	K_1	% EV = 100 [EV/TV]	
	= 0.07 x 0.930	2	0.8662	= 100 [0.04136 / 0.49143]	
	= 0.0414	3	0.5903	= 8.42 %	
Reproducibility : Apparatus Variation (AV)					
	$AV = \sqrt{\frac{(\bar{X}_{\text{form}} \times K_2)^2 - (EV^2/m)}{m}}$	2	3	% AV = 100 [AV/TV]	
	= $\sqrt{\frac{(0.2500 \times 0.5231)^2 - (0.04^2 \times 10 \times 3)}{10 \times 3}}$	Apparatus	EC2	= 100 [0.11746 / 0.49143]	
	= 0.11746			= 23.94 %	
				n = number of parts	
				p = number of trials	
Repeatability & Reproducibility (R&R)					
	$R\&R = \sqrt{(EV^2 + AV^2)}$	N/A! accept % R&R < 30 %			
	= $\sqrt{(0.04^2 + 0.12^2)}$	Parts	K3	% R&R = 100 [R&R/TV]	
	= 0.12462	2	0.7071	= 100 [0.12652 / 0.49143]	
		3	0.5231	= 25.34 %	
Part Variation (PV)					
	$PV = R_p \times K3$	4	0.4407	% PV = 100 [PV/TV]	
	= 1.5111 x 0.3146	5	0.4010	= 100 [0.47540 / 0.49143]	
	= 0.47540	6	0.3742	= 94.74 %	
Total Variation (TV)					
	$TV = \sqrt{R\&R^2 + PV^2}$	7	0.3334	ndf = 1.41 (PV/0.88)	
	= $\sqrt{0.12^2 + 0.48^2}$	8	0.3755	= 1.41 (0.4754 / 0.1246)	
	= 0.49143	9	0.3249	= 5.393	
		10	0.3146		
N/A! accept % > 5					

[illegible]FORM NO.: F-2448-MS-052
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Cage Repeatability and Reproducibility Data Sheet Collection Sheet

[illegible]

$D_{\text{max}} = 2.27$ for 2 trials and 2.58 for 3 trials. Circle those that are beyond this limit. Identify the cause and correct. Repeat these readings using the same apparatus and unit as originally used or discard value and recompute the mean and standard deviation. Repeat the entire experiment with a different apparatus and unit. ¹⁰

Notes:

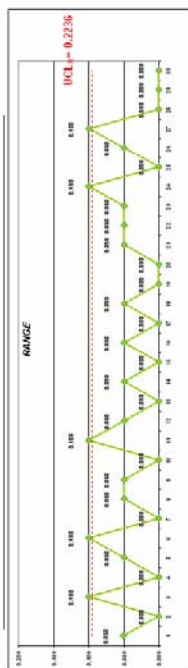
FORM NO.: FQM-MT-002

D-32 Group 2 (Re-test)

Cage Repeatability and Reproducibility Data Sheet Collection Sheet

[illegible]

$D_{\text{max}} = 2.27$ for 2 trials and 2.58 for 3 trials. Circle those that are beyond this limit. Identify the cause and correct. Repeat these readings using the same apparatus and unit as originally used or discard value and recompute the mean and standard deviation. Repeat the entire experiment with a different apparatus and unit. ¹⁰

Notes:

FORM NO.: FQM-MT-002

Case Repeatability and Reproducibility Report

Part No. & Name :	No.625	Cap Name :	Dad Thickness Gauge	Date :	17-09-2023
Characteristics :	Thickness 5 mm	Cap No. :	D-32 (Spec 7)	Performed by :	Shakeel
Specifications :	4.50-6.30 mm	Cap Type :	0.10 mm	Approvers :	
From data sheet :	$\bar{R} = 0.0367$	$\bar{X}_{\text{part}}$	0.0783	R_p	1.4667
Measurement Uncertainty					
Repeatability :	Equipment Variation (EV)	% Total Variation (TV)			
	$EV = \bar{R} \times K_1$				
	= 0.04	Trials	K_1	% EV = 100 [EV/TV]	
		2	0.3862	= 100 [0.0216 / 0.6372]	
		3	0.5908	= 4.67 %	
Reproducibility :	Apprision Variation (AV)	% AV = 100 [AV/TV]			
	$AV = \sqrt{(\bar{X}_{\text{part}} \times K_2)^2 - (EV)^2/m}$				
	$= \sqrt{(0.0783 \times 0.5231)^2 - (0.02)^2 / 10 \times 3}$				
	= 0.0472	Assessment	2	n = number of parts	
		K2	0.7071	m = number of trials	
Repeatability & Reproducibility (R&R)					
	$R\&R = \sqrt{(\bar{R}^2 + AV^2)}$				
	$= \sqrt{(0.02^2 + 0.04^2)}$	Parts	K3	% R&R = 100 [R&R/TV]	
	= 0.04615	3	0.5231	= 100 [0.0461 / 0.6372]	
		4	0.4472	= 9.96 %	
Part Variation (PV)	$PV = R_p \times K3$	5	0.4310		
	= 1.4667 $\times$ 0.3146	6	0.3742		
	= 0.45144	7	0.3334		
Total Variation (TV)	$TV = \sqrt{R\&R^2 + PV^2}$	8	0.3395	$n_{\text{def}} = 1.41$ [PV/0.882]	
	$= \sqrt{0.05^2 + 0.46^2}$	9	0.3365	= 1.41 (0.46 / 0.6372)	
	= 0.4372	10	0.3146	= 1.409	

NMT accepted Article 15

For information on the theory and constant used in the form see *MGZ reference Manual*. Third edition. The repeatability or a treatment variation ($\text{CV} \propto \sigma_{\text{TE}}$) is determined by multiplying the average range ($\bar{r}$) by a constant (K_1). K_1 depends up on the number of trials used in the gage study and is equal to the inverse of d_2 which is obtained from *Appendix C*. K_1 is dependent on the number of trials (m) and the number of gages (g) tests the number of operators (o) and the number of parts (p) which is calculated as follows: $\text{CV} = \frac{\bar{r}}{d_2} \times \frac{1}{\sqrt{m \times o \times p}}$. The repeatability or appraiser variation ($\text{AV} \propto \sigma_{\text{A}}$) is determined by multiplying the maximum average difference (MX_{max}) by a constant (K_2). K_2 depends upon the number of appraisers used in the gage study and the inverse of d_4 which is obtained from *Appendix C*. K_2 is dependent on the number of appraisers (m) and gages used there is only one calculation. The part to part variation ($\text{PV} \propto \sigma_{\text{P}}$) is determined by multiplying the range of part averaging ($\bar{R}_p$) by a constant (K_3). K_3 depends upon the number of part used in the gage study and the inverse of d_3 which is obtained from *Appendix C*. K_3 is dependent on the number of part (m) and (a) in this situation $\bar{R}_p$ can be three, is only one case: calculation.

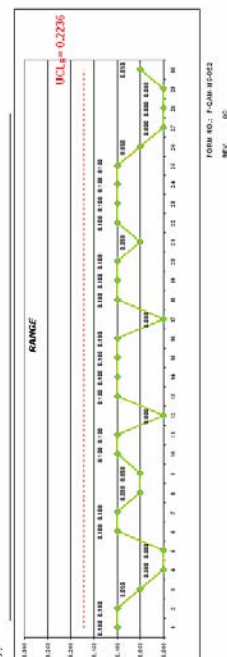
FORM NO.: P-QAM-01-052

Cage Repeatability and Reproducibility Data Sheet Collection Sheet

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$\bar{D}_{0.5} = 3.27$ for 3 trials and 2.58 for 3 trials. $QCL_{0.5}$ represents the limit of individual P^* . Certain those that are beyond the limit. Identify the cause and correct. Repeat this readings using the same apparatus and unit is originally used or record value and re-average and recalculate $\bar{D}_{0.5}$ and the limiting value from the remaining observations.

Notes:

FORM NO.: F-CAM-MS-012
REV. 02

Cage Repeatability and Reproducibility Report

Part No. & Name :	No.855	Qty Name :	Dial Thickness Gauge	Date :
Characteristics :	Thickness 5 mm	Qty No. :	D-53 (Exceeding 3)	Performed by :
Specifications :	4.56-6.00 mm	Qty Type :	0-30 mm	Approved by :
Form data test :	$\bar{R} = 0.0657$	$\bar{X}_{\text{sum}} = 0.1033$	$R_p =$	1.5289
Measurement Unit Analysis				
Repeatability -	Equipment: Variation (EV)			
	$EV = \bar{R} \times K_1$			
	$= 0.07$			
	$= 0.0394$			
Reproducibility -	Apprentice Variation (AV)			
	$AV = \sqrt{\frac{(\bar{X}_{\text{sum}} \times K_2)^2 - (\bar{R}^2 \times \text{sum})}{n}}$			
	$= \sqrt{\frac{(0.1033 \times 0.221)^2 - (0.06 \times 106.3)}{2}}$			
	$= 0.0357$			
	$EC2$			
Repeatability & Reproducibility (E&R)				
	$E\&R = \sqrt{(\bar{R}^2 + AV^2)}$			
	$= \sqrt{(0.06^2 + 0.03^2)}$			
	$= 0.0649$			
Part Variation (PV)				
	$PV = R_p \times K_3$			
	$= 1.5289 \times 0.3146$			
	$= 0.4841$			
Total Variation (TV)				
	$TV = \sqrt{R\&R^2 + PV^2}$			
	$= \sqrt{0.07^2 + 0.48^2}$			
	$= 0.4868$			

[illegible][illegible]

for performance on any of the tasks. The most common variations (DSZ and T) are discussed below in relation to the evidence of task outcomes (D). This is a point that *Fig. 1*

of α is dependent on the number of rad^+ (m) and rad^- (n). In this situation $\alpha \approx 1$ since there is only one cause calculation.

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REV. 00