

PLEASE SPECIFY THE FOLLOWING PARAMETERS AND COMPLETE THE FORM ACCORDINGLY

PARAMETERS ARE:

K₁	Number of Trials	Must be either 2 or 3	3	OK
K₂	Number of Operators	Must be either 2 or 3	2	OK
K₃	Number of Parts	Can be any value between 2 and 10	10	OK

				GAGE APPROVED, USE IT	
Part number	33385010	Part name	Terminal	Plant	11
Characteristic	Body Width	Gage number	E520011	Coord by	Randy Stitt
USL	2.590	LSL	2.470	Phone #	330-373-3499
Tolerance (ToI) / 6	0.02000	Gage name	Starrett KMR-200	Date	4/13/2021
		Gage ECL/revision			

OPERATOR		P		A		R		T		RESULTS			
TRIAL #		1	2	3	4	5	6	7	8	9	10	AVG	
A	1	2.541	2.54	2.532	2.533	2.525	2.526	2.533	2.53	2.532	2.524	A ₁	2.53160
	2	2.542	2.535	2.531	2.532	2.522	2.522	2.533	2.533	2.531	2.521	A ₂	2.53020
	3	2.541	2.541	2.532	2.534	2.522	2.523	2.53	2.535	2.533	2.523	A ₃	2.53140
Average		2.54133	2.53867	2.53167	2.533	2.523	2.52367	2.532	2.53267	2.532	2.52267	$\bar{X}_A$	2.53107
Range		0.001	0.006	0.001	0.002	0.003	0.004	0.003	0.005	0.002	0.003	$\bar{R}_A$	0.00300
B	1	2.541	2.532	2.534	2.533	2.527	2.531	2.531	2.539	2.526	2.53	B ₁	2.53240
	2	2.54	2.53	2.535	2.534	2.524	2.532	2.533	2.534	2.527	2.528	B ₂	2.53170
	3	2.542	2.532	2.536	2.532	2.525	2.532	2.534	2.534	2.527	2.531	B ₃	2.53250
Average		2.541	2.53133	2.535	2.533	2.52533	2.53167	2.53267	2.53567	2.52667	2.52967	$\bar{X}_B$	2.53220
Range		0.002	0.002	0.002	0.002	0.003	0.001	0.003	0.005	0.001	0.003	$\bar{R}_B$	0.00240
C	1											C ₁	
	2											C ₂	
	3											C ₃	
Average												$\bar{X}_C$	
Range												$\bar{R}_C$	
Part Avg		2.54117	2.535	2.53333	2.533	2.52417	2.52767	2.53233	2.53417	2.52933	2.52617	$\bar{\bar{X}}_{PART}$	2.53163
Part Range												$\bar{\bar{R}}_{PART}$	0.01700
$\bar{\bar{R}} = R_A + R_B + R_C / \text{No of operators} = 0.00300 + 0.00240 / 2$												$\bar{\bar{R}} = 0.00270$	
$\bar{\bar{X}}_{DIFF} = [\text{Max}(\bar{X})_{ABC}] - [\text{Min}(\bar{X})_{ABC}] = 2.53220 - 2.53107$												$\bar{\bar{X}}_{DIFF} = 0.00113$	
$UCL_R = \bar{\bar{R}} * D_4 = 0.00270 * 2.580$												$UCL_R = 0.00697$	
$LCL_R = \bar{\bar{R}} * D_3 = 0.00270 * 0.000$												$LCL_R = 0.00000$	
OPERATOR		NAME				NOTE: The Total Tolerance Method should be used when the gage is used for product release. When out of control conditions exist, analyze the data for Gage acceptability. The total variation method is generally used for variation reduction activities.							
A													
B													
C													
GOOD UNTIL GAGE ECL/revision CHANGE													
FROM DATA SHEET:						$\bar{\bar{R}} = 0.00270$	$\bar{\bar{X}}_{DIFF} = 0.00113$	$R_{PART} = 0.01700$					
Measurement Unit Analysis								Based on the TOLERANCE Method					
Repeatability - Equipment Variation (EV)								% EV = 100[EV/ToI] % EV = 7.98					
EV = $\bar{\bar{R}} * K_1$				Trials		K ₁							
EV = 0.00160				3		0.5908							
Reproducibility - Appraiser Variation (AV)								% AV = 100[AV/ToI] % AV = 3.73					
(n parts, r trials)				Oper		K ₂							
AV = $\sqrt{[(\bar{\bar{X}}_{DIFF} * K_2)^2 - (EV^2 / nr)]}$				2		0.71							
Repeatability & Reproducibility (GRR)								%GRR = 100[GRR/ToI] % GRR = 8.81					
GRR = $\sqrt{(EV^2 + AV^2)}$													
GRR = 0.00176													
Part Variation (PV)								% PV = 100[PV/ToI] % PV = 99.61					
PV = SQRT(TV ² -GRR ²)				Parts		K ₃							
PV = 0.01992				10		0.31							
Total Variation (TV)								Number of Distinct Categories					
TV = (USL-LSL)/6								ndc = 1.41[PV/GRR]					
TV = 0.02000								ndc = 15.949 ~ 16 should be greater than or equal to 5					
								Conclusion: GAGE IS ACCEPTED All ranges OK					