Gage Repeatability and Reproducibility (ANOVA)

Method:	Crimpeado Ferrul
Trainer:	Rubicel Coria
Area:	Prensa-Ferrul

Equipment:	Micrometro
ID Equipment:	EEMI-252
Sample Code:	10
Plant:	Plant 5

Elaborated Date:
August 5, 2019
STANDARD RECORDS
2019-1277

	Number	Name
Operator A:	23199	Martha Leon
Operator B:	83656	Adilene Meraz
Operator C:	96853	Luis Sombra

Eng. Quality:	**68271**	**Victor Peralta**

According Results: **Accepted**

GR&R - %Study Variation: **0.29%**

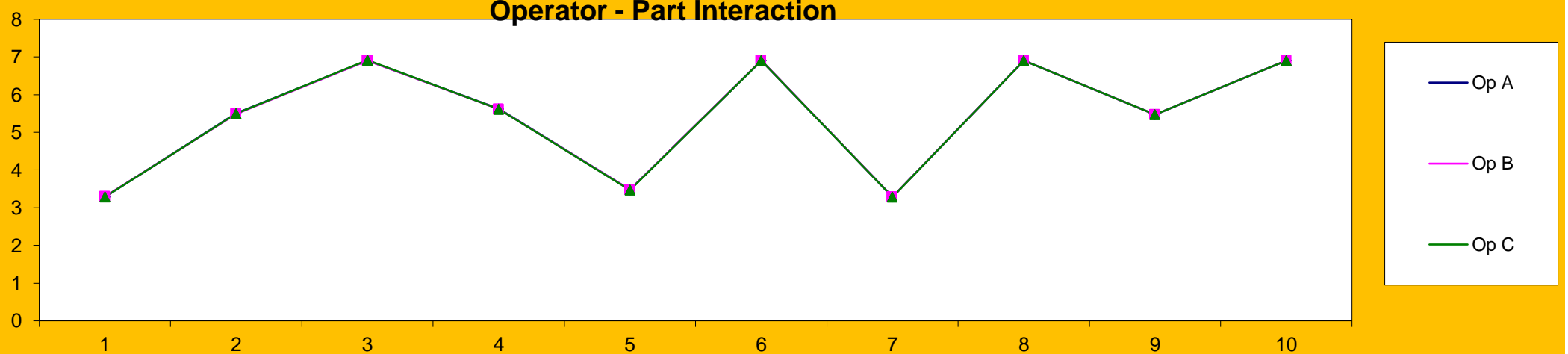**Number of Distinct Categories:** 484
All points under line UCL R: OK
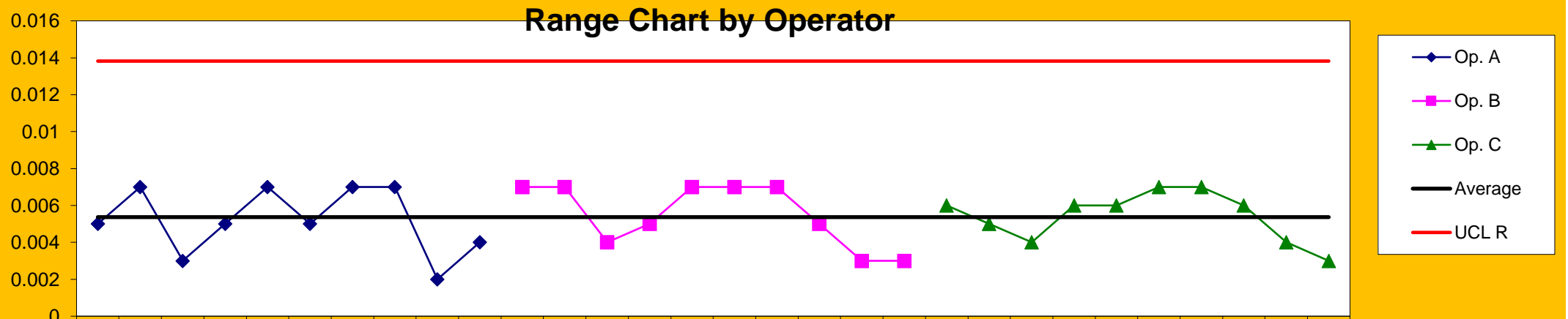
Reason of the Study
Entrenamiento

# of Trials =	3	K_1 =	0.5908	Xbar diff =	0.001433	D_4 =	2.58
# of appraisers =	3	K_2 =	0.5231	Rbarbar =	0.005367	R_p =	3.623666667
# of parts =	10	K_3 =	0.3146	UCL R =	0.0138		

Appraiser/Trial #		1	2	3	4	5	6	7	8	9	10	Average
23199 Martha Leon	S-1	3.293	5.509	6.908	5.624	3.473	6.902	3.284	6.909	5.472	6.901	5.4275
	S-2	3.288	5.506	6.905	5.624	3.479	6.907	3.286	6.902	5.472	6.905	5.4274
	S-3	3.290	5.502	6.905	5.619	3.480	6.906	3.291	6.905	5.474	6.902	5.4274
Average		3.2903	5.5057	6.9060	5.6223	3.4773	6.9050	3.2870	6.9053	5.4727	6.9027	Xbar $_a$ = 5.4274
Range		0.0050	0.0070	0.0030	0.0050	0.0070	0.0050	0.0070	0.0070	0.0020	0.0040	Rbar $_a$ = 0.0052
83656 Adilene Meraz	S-1	3.296	5.496	6.909	5.617	3.477	6.905	3.288	6.906	5.474	6.904	5.4272
	S-2	3.293	5.497	6.908	5.615	3.470	6.912	3.284	6.907	5.475	6.904	5.4265
	S-3	3.300	5.490	6.905	5.612	3.476	6.912	3.291	6.911	5.477	6.901	5.4275
Average		3.2963	5.4943	6.9073	5.6147	3.4743	6.9097	3.2877	6.9080	5.4753	6.9030	Xbar $_b$ = 5.4271
Range		0.0070	0.0070	0.0040	0.0050	0.0070	0.0070	0.0070	0.0050	0.0030	0.0030	Rbar $_b$ = 0.0055
96853 Luis Sombra	S-1	3.290	5.498	6.915	5.616	3.467	6.902	3.285	6.897	5.474	6.908	5.4252
	S-2	3.288	5.498	6.915	5.617	3.472	6.909	3.280	6.901	5.478	6.905	5.4263
	S-3	3.284	5.503	6.919	5.611	3.473	6.906	3.287	6.903	5.474	6.905	5.4265
Average		3.2873	5.4997	6.9163	5.6147	3.4707	6.9057	3.2840	6.9003	5.4753	6.9060	Xbar $_c$ = 5.4260
Range		0.0060	0.0050	0.0040	0.0060	0.0060	0.0070	0.0070	0.0060	0.0040	0.0030	Rbar $_c$ = 0.0054

Operator - Part Interaction

Range Chart by Operator

Gage Repeatability and Reproducibility (Crossed)

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According Results:		**Accepted**

General Comments - Special Event

Gage R&R Study - ANOVA Method

Variance and Standard Deviation Components

Source	St. Dev.	Variance	% of Variance
Total Gage R&R	0.004524	2.047E-05	0.00%
Repeatability	0.002953	8.7222E-06	0.00%
Reproducibility	0.003428	1.1748E-05	0.00%
Operator	0	0	0.00%
Operator*Part	0.003572	1.276E-05	0.00%
Part to Part	1.554726	2.41717228	100.00%
Total Variation	1.554732	2.41719275	100.00%

Process Tolerance = 0

Gage R&R Using 5.15 Standard Deviations (99%)

Source	Study Variation	% Study Variation
Total Gage R&R	0.023301	**0.29%**
Repeatability	0.01521	0.19%
Reproducibility	0.017652	0.22%
Operator	0	0.00%
Operator*Part	0.018397	0.23%
Part to Part	8.006838	100.00%
Total Variation	8.006872	100.00%

Gage R&R Using 6.0 Standard Deviations (99.7%)

Source	Study Variation	% Study Variation
Total Gage R&R	0.027147	**0.29%**
Repeatability	0.01772	0.19%
Reproducibility	0.020565	0.22%
Operator	0	0.00%
Operator*Part	0.021433	0.23%
Part to Part	9.328355	100.00%
Total Variation	9.328394	100.00%

Number of Distinct Categories = **484**

Analysis of Variance (ANOVA) Table

Source	DF	SS	MS	F	p
Part	9	195.7913778	21.7545975	462827.306	0.000
Operator	2	3.32667E-05	1.6633E-05	0.354	0.707
Op.x Part Interaction	18	0.000846067	4.7004E-05	5.389	0.000
Gage (error)	60	0.000523333	8.7222E-06		
Total	89	195.7927805			

p value for Op. x Part Interaction as error term = 0.25

Part

Components of Variation, ANOVA

Legend: ■ % Contribution ■ % Study Variation □ % Tol (5.15 SD) □ % Tol (6.0 SD)