

GAGE REPEATABILITY AND REPRODUCIBILITY WORKSHEET

Trials:
Operators:
Parts:

Characteristic/Measurement:
Performed by:

Min. Spec.:

Operator Sample #	A-		
	1st Trial	2nd Trial	3rd Trial
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

[illegible]

GAGE REPEATABILITY AND REPRODUCIBILITY REPORT
LONG FORM - TEN PARTS, THREE TRIALS, THREE APPRAISERS

	# Trials
	# Operators
	# Parts

Operator
Sample #
1
2
3
4
5
6
7
8
9
10
Totals

R-bar [A]
R-bar [B]
R-bar [C]
Sum
R-2bar

Part Name
Characteristic
Min. Spec.:

Measurement Unit Analysis
Repeatability - Equipment Variation (EV)
EV = =

Characteristic:
Measurement:
Min. Spec.:
4.5

3
3
10

A-		3rd shift- Scott McClure	
1st Trial	2nd Trial	3rd Trial	Avg
5.5	5.375	5.75	5.541666667
7.125	6.125	6.75	6.666666667
6.25	6.5	5.875	6.208333333
6.375	6.625	6.25	6.416666667
6	5.375	4.75	5.375
5.625	5.75	5.25	5.541666667
6.5	5.125	5.5	5.708333333
6	4.75	5.625	5.458333333
5.25	4.375	4.25	4.625
5.125	5	4.875	5
59.75	55	54.875	
	59.75		
	54.875		
	169.625		
	5.654166667		
Sum			
X-bar [A]			

# Trials	
2	
3	

0.8
0.9
0.85
2.55
0.85

Model 710
Pounds of force required for the trigger to engage the sear
4.5
Max. Spec.:

(R-2bar) x (K1)
(0.85) x (3.05)

# Trials	
2	
3	

Trigger Pull	
Pounds of force required for the trigger to engage the sear	
Max. Spec.:	
6	

	2nd shift- Lori			
Range	1st Trial	2nd Trial	3rd Trial	Avg
0.375	5.25	5.5	6.25	5.66666667
1	7	8	7.5	7.5
0.625	7	8	7.5	7.5
0.375	5.25	6.5	6.75	6.16666667
1.25	5.5	6.25	6.25	6
0.5	6	6.5	6	6.16666667
1.375	4.5	5.5	5	5
1.25	5.25	4.75	6.25	5.41666667
1	4.5	4.5	4.5	4.5
0.25	4.75	4.25	4	4.33333333
8	55	59.75	60	
0.8		55		
		60		
		174.75		
		5.825		
	Sum			
	X-bar [B]			
				R-bar [E]

D4
3.27
2.57

(R-2bar) x (D4) = UCL(R)

(0.85) x (2.57) =

Gage Name	Chatillon
Calib. Date	10/3/2006
Performed by	D. Boyles

% Manufacturing Process Variation	
K1	% EV = 100 [EV /TV]
4.56	
3.05	= 48.88 %

Gage Name:	Chatillion
Calib. Date:	10/3/2006
Performed by:	D. Boyles
Date of Study:	10/3/2006

1st Shift- Todd Riley					
Range	C- 1st Trial	2nd Trial	3rd Trial	Avg	Range
1	5.25	5	5	5.083333333	0.25
1	6.75	7	6.75	5.583333333	0.25
1	5.25	6.5	5.75	5.833333333	1.25
1.5	5	5	5.75	5.25	0.75
0.75	4.5	5	6	5.166666667	1.5
0.5	5.75	5.25	4.75	5.25	1
1	4.5	4.5	4.25	4.416666667	0.25
1.5	6.25	4.75	6	5.666666667	1.5
0	4	3.5	4.25	3.916666667	0.75
0.75	4.25	4.75	3.75	4.25	1
9	51.5	51.25	52.25		8.5
0.9		51.5			0.85
		52.25			
		155			
		5.166666667			
	Sum X-bar [C]		R-bar [C]		

Initially:
2 and 3 were high
9 and 10 were low
according to J. Stairs
and DB
ALL REMAING WERE OK

X-Bar A Check: 5.65
X-Bar B Check: 5.83
X-Bar C Check: 5.17

2.1845	Max. X-bar	5.825
	Min. X-bar	5.166666667
	X-bar Diff.	0.658333333
Rp		2.652777778

	Date of Study	10/3/2006
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% Tolerance Analysis	
	% EV = 100 [EV /Tol.] = 172.83 %

Reproducibility - Appraiser Variation (AV)	AV =	=
Repeatability & Reproducibility (R & R)	R & R =	=
Part Variation (PV)	PV =	=
Total Variation (TV)	TV =	=

2.5925

$$[(\bar{X} - \text{Diff.} \times K^2)^2 - (EV / nr)]^{0.5}$$

1.71332164

Operators	2	
K2	3.65	

$$[(EV)^2 + (AV)^2]^{0.5}$$

3.107495341

$$R_p \times K3$$

4.2975

# Parts	
2	
3	
4	
5	
6	
7	
8	
9	
10	

$$[(R \& R)^2 + (PV)^2]^{0.5}$$

5.303304021

= 32.31 %

K3

= 58.60 %

Cp =

- Gage System being measured is UNACCEPTABLE. (%GRR < 10%)

- Gage System being measured is UNACCEPTABLE. (%GRR < 10%)

3.65
2.70
2.30
2.08
1.93
1.82
1.74
1.67
1.62

	$\% \text{ AV} = 100 [\text{AV} / \text{Tol.}]$ $= 114.22 \%$	
	$\% \text{ R \& R} = 100 [\text{R\&R} / \text{Tol.}]$ $= 207.17 \%$	0.21

- Gage System being measured is ACCEPTABLE. (%GRR < 10%)
- Gage System may be acceptable based upon application. (10 < %GRR < 30)
- Gage System being measured is UNACCEPTABLE. (%GRR > 10%)

Avg. Trial 1	Avg. Trial 2	Avg. Trial 3	
5.54E+00	5.67E+00	5.08E+00	
6.67E+00	7.50E+00	6.83E+00	
6.21E+00	7.50E+00	5.83E+00	
6.42E+00	6.17E+00	5.25E+00	
5.38E+00	6.00E+00	5.17E+00	
5.54E+00	6.17E+00	5.25E+00	
5.71E+00	5.00E+00	4.42E+00	
5.46E+00	5.42E+00	5.67E+00	
4.63E+00	4.50E+00	3.92E+00	
5.00E+00	4.33E+00	4.25E+00	

Rp =

$$Cp = [| USL - LSL |] / [6 \times ((Sr^2 + SR^2)^{0.5})]$$

Sr = standard deviation of trial one population
SR = standard deviation of all trials (population)

Operators
3

3

Trials

Avg. Part (X-bar)
5.43E+00
7.00E+00
6.51E+00
5.94E+00
5.51E+00
5.65E+00
5.04E+00
5.51E+00
4.35E+00
4.53E+00
2.65278

Parts
10