成都莫仕连接器有限公司
MOLEX INTERCONNECT (CHENGDU) CO.,LTD

TITLE MEASUREMENT SYSTEM EVALUATION PROCEDURE

GAUGE REPEATABILITY AND REPRODUCIBILITY STUDY

EVALUATED BY:	Liu Tao	Date:	2019/03/11	DECISION:

Gauge Type/Name:	Equipment No.:	Characteristics Measured:
QV	Q1488	206523-2121 dim3

Spec:		
USL	20.00	TV=SQRT(R&R²+ PV²)
LSL	19.40	TV=PROCESS 6 SIGMA
		√ TV=PART'S TOLERANCE

Number of Operator = 3

		1	2	3	4	5	6	7	8	9	10	Average	Average
Chen Lifen	1	19.578	19.620	19.602	19.713	19.611	19.603	19.594	19.599	19.661	19.582	19.6163	
	2	19.575	19.618	19.599	19.712	19.612	19.602	19.594	19.598	19.660	19.583	19.6153	$\bar{X}a$= 19.6158
	3	19.576	19.618	19.599	19.712	19.612	19.602	19.593	19.603	19.659	19.584	19.6158	
	Range	0.003	0.002	0.003	0.001	0.001	0.001	0.001	0.005	0.002	0.002	$\bar{R}a$=	0.0021
Luo jingchun	1	19.574	19.618	19.598	19.715	19.612	19.601	19.582	19.598	19.658	19.583	19.6139	
	2	19.574	19.618	19.598	19.715	19.612	19.602	19.582	19.598	19.658	19.584	19.6141	$\bar{X}b$= 19.6139
	3	19.573	19.618	19.598	19.715	19.612	19.601	19.582	19.597	19.658	19.584	19.6138	
	Range	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.001	$\bar{R}b$=	0.0004
Wang Ze	1	19.580	19.617	19.598	19.711	19.611	19.603	19.583	19.598	19.656	19.586	19.6143	
	2	19.580	19.618	19.598	19.711	19.611	19.603	19.583	19.598	19.656	19.586	19.6144	$\bar{X}c$= 19.6143
	3	19.579	19.617	19.598	19.711	19.611	19.603	19.583	19.598	19.656	19.586	19.6142	
	Range	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	$\bar{R}c$=	0.0002
TTL Reading		176.1890	176.5620	176.3880	177.4150	176.5040	176.4200	176.2760	176.3870	176.9220	176.2580	Process Stdev=	0.3721
Part Ave(Xp		19.5766	19.6180	19.5987	19.7128	19.6116	19.6022	19.5862	19.5986	19.6580	19.5842	$\bar{\bar{X}}$ =	19.6147
												Average Rp=	0.1362

$\bar{X}_{DIFF} = \bar{X}_{MAX} - \bar{X}_{MIN}$

$\bar{X}_{DIFF}$ = 0.00187

$\bar{R} = \frac{\bar{R}_a + \bar{R}_b + \bar{R}_c}{\text{operators}}$ = 0.0009

$UCL_R = \bar{R} * D_4$ = 0.0023

UCL Represents the limit of individual R's circle those ranges that are beyond this limit. Identify the cause and correct. Repeat those readings using the same operators and units originally used or discard the reading and reaverage and recompile ranges and UCL from the remaining readings.

Parts	2	3	4	5	6	7	8	9	10
K3	0.7071	0.5231	0.4467	0.403	0.3742	0.3534	0.3375	0.3249	0.3146

# of Trials	D4	K1	Operator	K2
2	3.27	0.8862	2	0.7071
3	2.58	0.5908	3	0.5231

n = Number of Parts = 10 r = Number of Trials = 3

AV defaults to zero if a negative is calculated the square root sign

ANALYSIS	Repeatability (EV)	Reproducibility (AV)	Combined R&R	Part Variation (PV)	Total Variation (TV)	Precision / Tolerance
	$EV = \bar{R} * K1$	$AV = \sqrt{(X_{DIFF} * K2)^2 - \frac{EV^2}{nr}}$	$R\&R = \sqrt{(EV^2 + AV^2)}$	PV = Rp * K3	TV process = SQRT (R&R*R&R + PV*PV) 0.04287	Tolerance = 0.6000
	EV = 0.00053	AV = 0.00097	RR = 0.00111	PV = 0.04286	TV process = 6 *Process Std Dev.= N/A	
% PROCESS VARIATION	% EV = 100 * (EV / TV)	% AV = 100 * (AV / TV)	% R&R = 100 * (R&R / TV)	% PV = 100 * (PV / TV)	TV spec = Part's Tolerance = 0.60	P/T = Tolerance / EV
	% EV process = NA	% AV process = NA	% R&R process = NA	% PV process = NA	TV process = N/A	P/T = NA
	% EV spec = 0.53	% AV spec = 0.97	% R&R spec = 1.11	% PV spec = 99.97	TV spec = 0.6	NDC = 55

Note: 1. Use %R&R spec for production line control and %R&R spec for Customer Acceptance application

2. TV process shall be the minimum value of SQRT(R&R²+ PV²) or 6 * Process Std Dev.

3. Enter raw data in the highlighted field and Sepc value when applicable. The rest will be calculated automatically.

4. Process Std Dev shall be "one-sixth of UCL less LCL" from SPC chart or GR&R sample if it is representative of the population

5. For One-sided Sepc, the unknown limit = 2 * Average - the known list. Ex, if LSL = 10 and Average = 30, then USL = 50. These limits shall be keyed in the highlighted Spec field.

REMARK: