

MSA Gage R&R Studies

How to Conduct a Gage R&R Study

Before You Begin

A Gage R&R study evaluates your measurement system and NOT your products. In fact, you need bad parts to do a good Gage R&R Study.

What You Will Need

1. Five to ten parts (number them) that span the distance between the upper and lower spec limits. The parts should represent the actual or expected range of process variation.
2. Two appraisers (people who measure the parts).
3. One measurement tool or gage.
4. Two to five measurement trials, on each part, by each appraiser.
5. The QI Macros Gage R&R Template for Excel.

Three Types of Variation

Type	Explanation	Corrective Action
Part	Differences between individual pieces manufactured.	
Appraiser Reproducibility	Can two appraisers measuring the same thing, using the same gage, get the same answer consistently?	If $AV > EV$ Operator may need to be better trained or gage is hard to read.
Equipment Repeatability	Can the same person using the same gage measure the same thing consistently?	If $EV > AV$ Gage may need maintenance, redesign, or better clamping.

Gage System Acceptability: You want most of the variation to be between the parts, and less than 10% to be caused by the appraisers and equipment.

- % R&R < 10% - Gage System Okay (most variation caused by parts)
- % R&R < 30% - May be acceptable
- % R&R > 30% - Gage system needs improvement (appraisers and equipment > 1/3 of the variation)

QI Macros Gage R&R Template for Excel

QI Macros Contains these Gage R&R Studies:

Gage R&R Study - Using Average & Range Method, along with the ANOVA Method.

Type 1 Gage R&R - 1 part x 1 appraiser x 50 measurements.

Range Method - Provides quick approximation of overall measurement variability.

Bias - Calculates the “bias” of your gage, using a “target” or “reference” value that you input.

Linearity - Calculates whether a gage over reads or under reads across a range of different sized parts.

Attribute Gage Worksheet - for Pass/Fail gages.

Analytic Attribute Method - to assess the amount of repeatability and bias of a measurement system.

Advantages of Using the QI Macros Gage R&R Template

- Just drop data into yellow shaded input cells.
- Performs calculations and interprets results for you.
- Red alarm if $NDC < 5$. Number of Distinct Categories < 5 means your test parts don't vary enough.
- Validated using AIAG MSA 4th Ed & Ford Data.
- Works in Excel 2000-2013
- Saves time and reduces risk vs. manual calculations or your own Excel formulas.

	A	B	C	D	E	F	
1	Gage R&R	Part Number					
2	Average & Range Method	1	2	3	4	5	
3	Appraiser 1	Trial 1	3.64	3.94	3.84	4.17	4.2
4	Enter your data here->	Trial2	3.575	3.93	3.88	4.22	4.3
5		Trial3	3.617	3.9	3.79	4.18	4.2
6		Trial4					
7		Trial 5					
8		Total	10.83	11.8	11.5	12.6	12
9		Average	3.611	3.92	3.84	4.19	4.2
10		Range1	0.064	0.04	0.09	0.06	0.0
11	Appraiser 2	Trial 1	3.588	3.92	3.85	4.16	4.2
12	Enter your data here->	Trial2	3.629	3.91	3.85	4.21	4.2
13		Trial3	3.631	3.95	3.85	4.23	4.2
14		Trial4					
15		Trial 5					
16		Total	10.85	11.8	11.6	12.6	12
17		Average	3.616	3.92	3.85	4.2	4.2
18		Range2	0.043	0.04	0	0.07	0.0
19	Appraiser 3	Trial 1	3.577	3.88	3.85	4.18	4.2
20	Enter your data here->	Trial2	3.583	3.87	3.78	4.16	4.2

Learn More and Watch Gage R&R Video Series at:
www.qimacros.com/gage-r-and-r-study/gage-r-and-r/