Amp It Up! Engineering/Technology and Industry Lesson Extension



Teacher Name(s):	Dan Hayden
School and District:	Hamilton Wenham Regional High School
Course:	Statistics

Abstract: In 200 words or less, please provide a summary of the goal for the lesson extension and its relationship between industry and academic topic.
The goal for this lesson is to have the Statistics students practice creating sampling distribution models and confidence intervals based upon the processes and procedures used at Microline Surgical. The students will be given a quick introduction to the company and then they will use the actual data from Microline to describe the behavior of the sample proportions and create a model based upon the data and make statements and suggestions as for further testing or use of the products.

Engineering/Technology Link:

1. How did you *introduce* engineering/ technology concepts or the company/industry focus in your course? Check the appropriate box(es) or choose Other.

   ☐ Defined terms (science, engineering, technology)

   ☐ Described the engineering design process

   ☐ Engineering design challenge related to industry

   ⃠ Overview of the company

   ⃠ Challenge based on 'industry specific' area of focus (manufacturing process, quality control, measurement, development, teamwork etc.)

   ☐ Other: _____

Level of Inquiry: Which of the following best describes the level of inquiry (adapted from Bell 2005) you used for this lesson/unit? Check the appropriate level.

☒ *Structured inquiry*: Instructor provides question and procedure. Students determine the results based on given procedures.

☐ *Guided inquiry*: Instructor provides question. Students design procedure and determine the results.

☐ *Open inquiry*: Students investigate their own research question. Students design procedures and implement the procedure on their own.

Lesson Extension Plan:

Title/Topic: Sampling Distribution Models
Time (minutes): 50 minutes
Company Name and brief Description: Microline Surgical develops and manufactures precision laparoscopic reposable and electrosurgical instruments. Microline's reposable laparoscopic instruments includes disposable and reusable elements to be more cost effective.
Overview of the Lesson: Students will look at the procedures for testing materials and analyze the results of the tests and using the raw data will create models from the sample distribution. The students will use the models to make observations and conclusions about the materials.
Standard(s)/Unit Goal(s) to be addressed in this lesson: Students will use data from a sample survey to estimate a population mean or proportions. Students will understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.
Essential Question(s) addressed in this lesson: How does Microline Surgical ensure that their products are of the highest quality and can meet the various specifications/requirements required.
Objectives (academic and/or engineering/technology, career): Extend classroom understand of sampling distribution models and confidence intervals using actual data from Microline Surgical.
Link to Industry (how the lesson connects to the industry visited: Microline provided information on processes and procedures for testing materials, including images and sample data sets.
What students should know and be able to do before starting this lesson: How to calculate the mean or proportion, standard deviation, and to create a Normal Model of a given data set.
Instructional Materials/Resources/Tools: www.microlinesurgical.com, Microline Surgical data sets, pictures of jaws, brochures from Microline
Lesson Delivery
Lesson Opening: I will introduce Microline Surgical Inc. and explain what the company does. Students will explore the company's website as well as the brochures they provided and discuss the various instruments that Microline makes. I will explain how the break test works and what the data tells us. The students will pretend that they are working at Microline and they just received the results from a break test for the jaws of the disposable graspers tip.
During the Lesson (activities/labs/challenges): The students will be working in groups of 3 to analyze the set of raw data from Microline. They will calculate the mean, standard deviation, and a Normal Model of

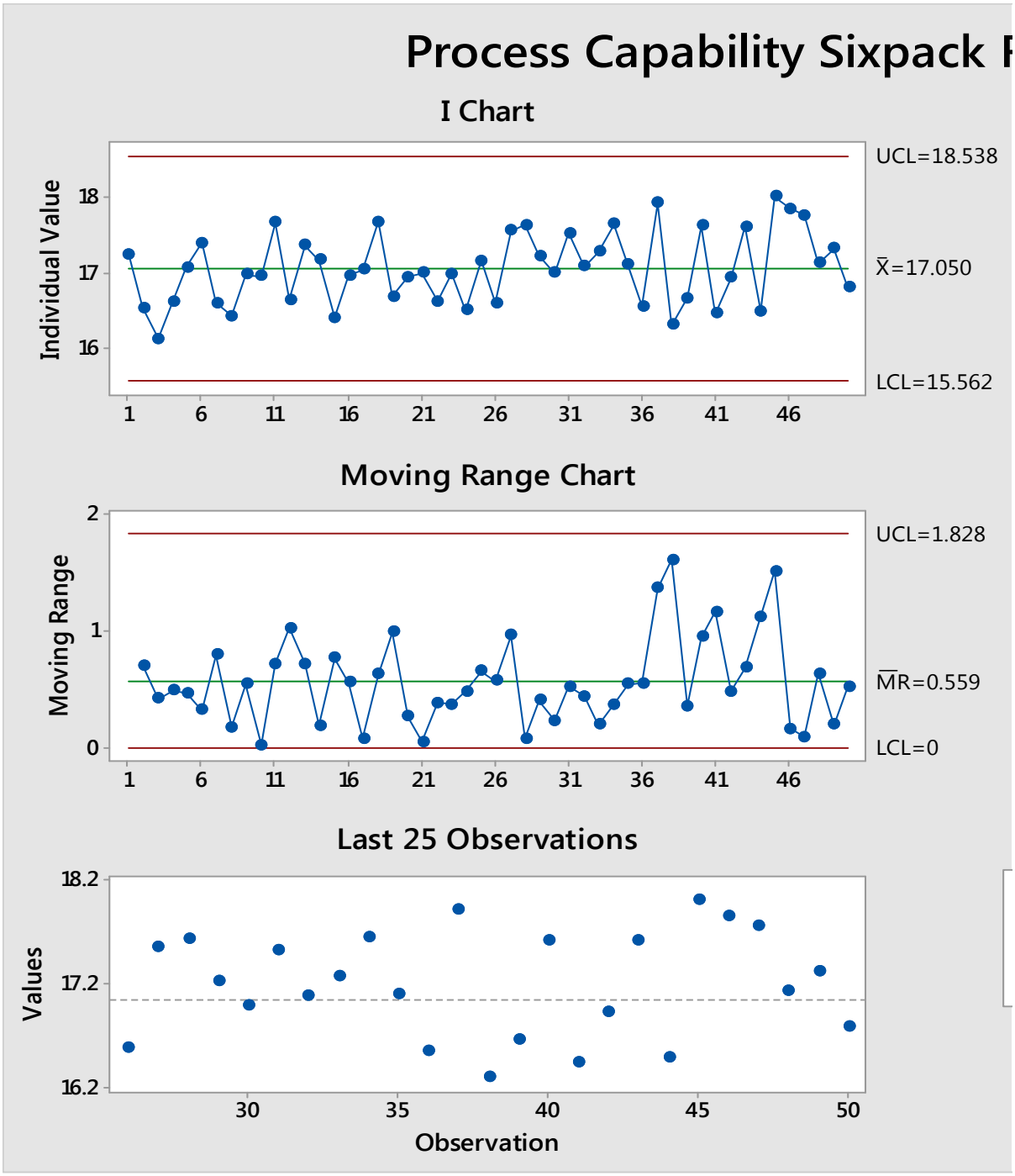
the data. They will also create a 95% confidence interval. The students will decide what the statistics tell us about the data: is it a good lot or a bad lot? They will explain what makes it a good lot or a bad lot and what the next steps would be in the process.
Lesson Closing: The students will present their findings of their analysis to the class and we as a whole class will discuss and compare the different data sets.
Assessment
Student Assessment: The students will create a report of the data, including the mean, standard deviation, normal model, and 95% confidence interval as well as their conclusion of their analysis.
Delivery Assessment: Students will be assessed on how accurate their statistics were for their given data set and if they correctly identified a good data set versus a bad data set.

Additional resources and assessments: Attachments should include handouts, readings (with references), lab write-ups, rubrics, exams/quizzes, and/or other similar materials.

1.) Microline Data sets
2.) Microline Introduction to Statistical Process
3.) Picture: the jaws before and after test
4.) Picture: the break test set up
5.) Video (hope to have it by next school year): break test in action

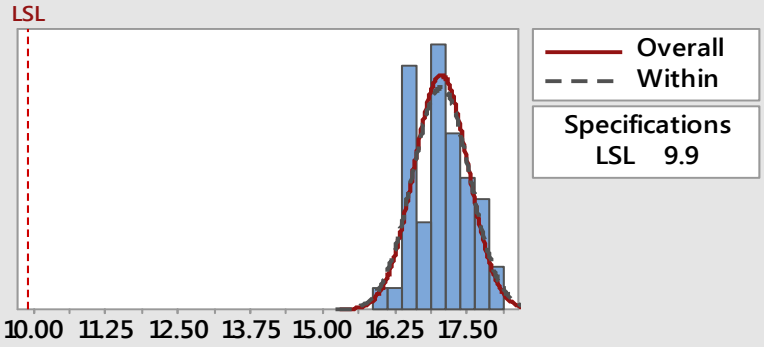
Good Data Sets		Bad Data Sets	
Spec Limit: 9.9 Minimum	Spec Limit: 13.1 Minimum	Spec Limit: 9.9 Minimum	Spec Limit: 13.1 Minimum
17.235	25.557	7.235	12.557
16.532	25.068	6.532	12.068
16.115	26.140	6.115	13.140
16.601	24.175	6.601	11.175
17.064	25.158	7.064	12.158
17.384	24.529	7.384	11.529
16.595	23.452	6.595	10.452
16.423	24.665	6.423	11.665
16.965	26.098	6.965	13.098
16.944	25.952	6.944	12.952
17.659	24.227	7.659	11.227
16.638	25.899	6.638	12.899
17.353	26.340	7.353	13.340
17.165	24.400	7.165	11.400
16.402	25.020	6.402	12.020
16.959	24.819	6.959	11.819
17.036	22.985	7.036	9.985
17.664	22.274	7.664	9.274
16.677	25.861	6.677	12.861
16.942	22.232	6.942	9.232
16.991	26.622	6.991	13.622
16.611	22.756	6.611	9.756
16.975	23.086	6.975	10.086
16.499	23.228	6.499	10.228
17.156	22.916	7.156	9.916
16.588	23.445	6.588	10.445
17.548	23.260	7.548	10.260
17.625	23.682	7.625	10.682
17.222	22.784	7.222	9.784
16.992	23.228	6.992	10.228
17.513	23.261	7.513	10.261
17.076	23.220	7.076	10.220
17.266	23.427	7.266	10.427
17.637	22.525	7.637	9.525
17.096	22.890	7.096	9.890
16.549	22.155	6.549	9.155
17.912	23.485	7.912	10.485
16.306	24.271	6.306	11.271
16.662	23.246	6.662	10.246
17.611	23.772	7.611	10.772
16.448	24.107	6.448	11.107
16.925	23.249	6.925	10.249
17.608		7.608	

16.490	6.490
17.999	7.999
17.843	7.843
17.757	7.757
17.125	7.125
17.318	7.318
16.794	6.794


Process Capability Sixpack F
I Chart
Individual Value
18
17
16
UCL=18.538
X̄=17.050
LCL=15.562
1
6
11
16
21
26
31
36
41
46
Moving Range Chart
Moving Range
2
1
0
UCL=1.828
MR=0.559
LCL=0
Last 25 Observations
Values
18.2
17.2
16.2
30
35
40
45
50
Observation

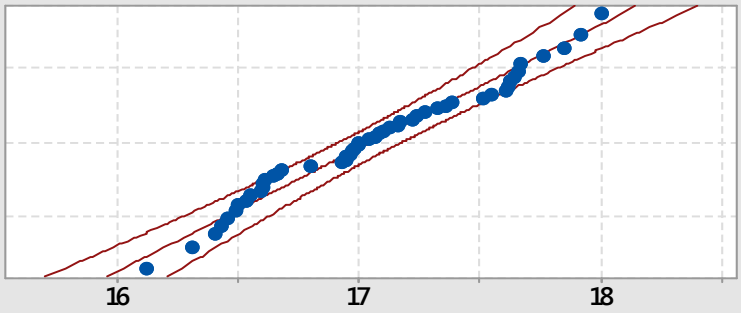
Report for A

Capability Histogram



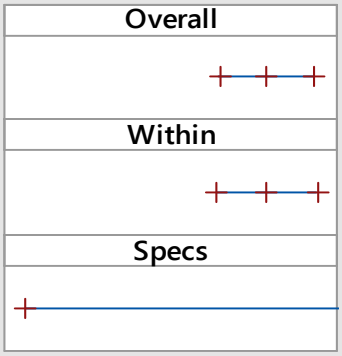
Normal Prob Plot

AD: 0.500, P: 0.200

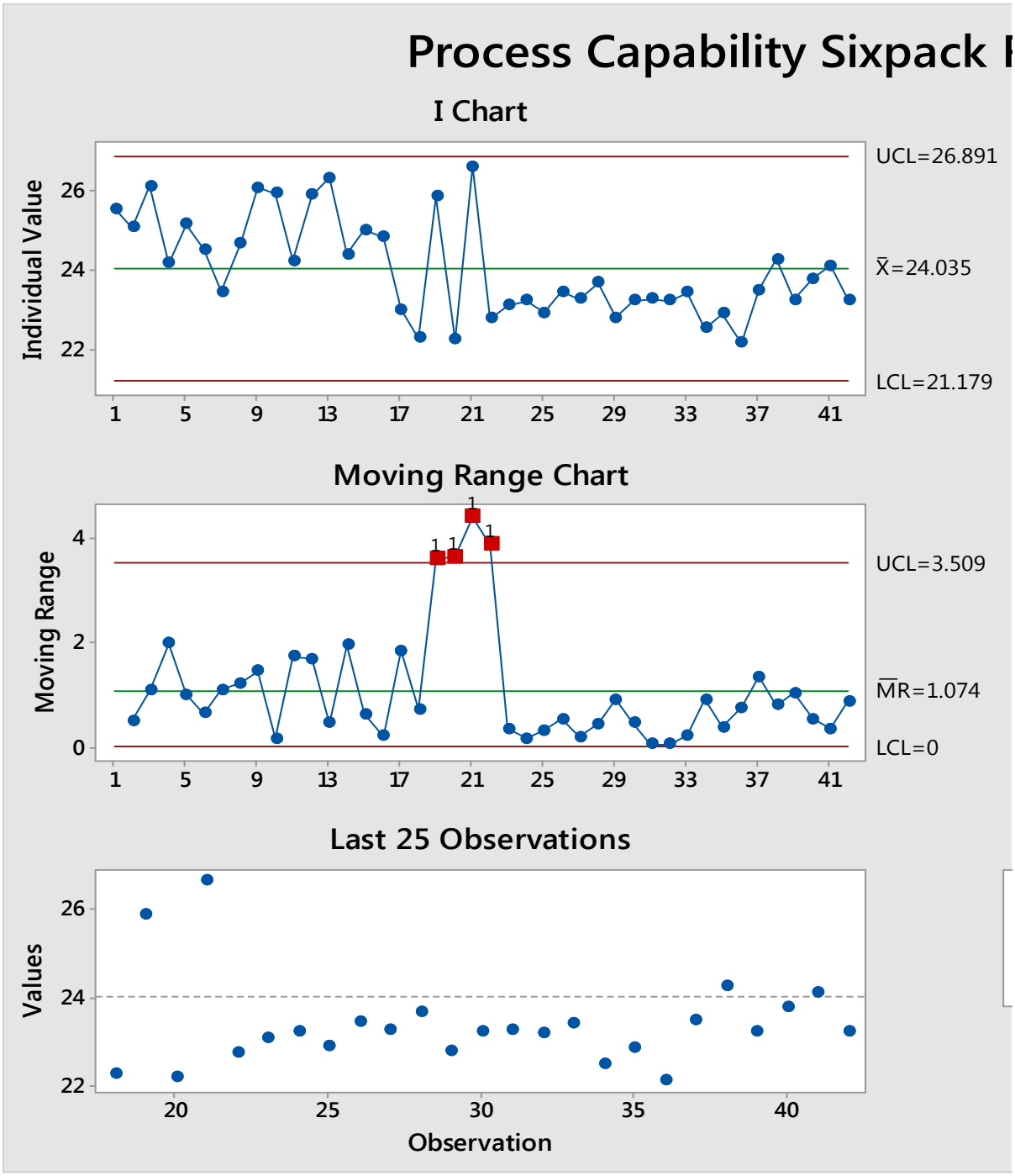


Capability Plot

Within	
StDev	0.4959
Cp	*
Cpk	4.81
PPM	0.00

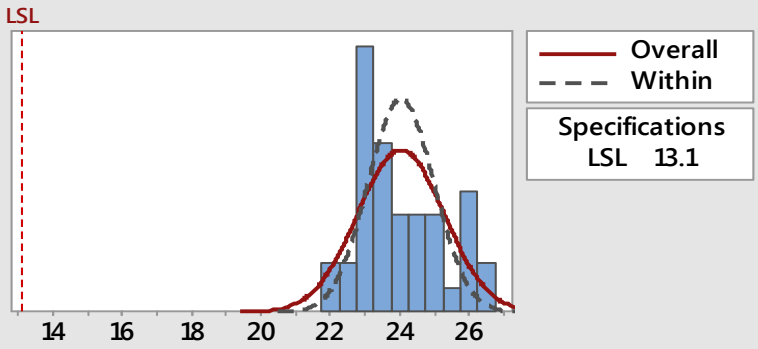


Overall	
StDev	0.4705
Pp	*
Ppk	5.07
Cpm	*
PPM	0.00


Process Capability Sixpack I
I Chart
Individual Value
26
24
22
UCL=26.891
X̄=24.035
LCL=21.179
1
5
9
13
17
21
25
29
33
37
41
Moving Range Chart
Moving Range
4
2
0
UCL=3.509
MR̄=1.074
LCL=0
Last 25 Observations
Values
26
24
22
20
25
30
35
40
Observation

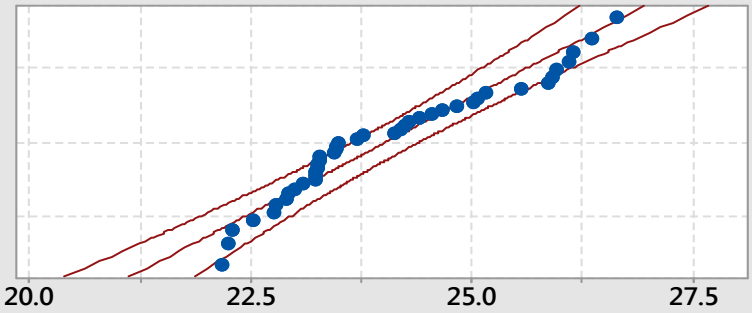
Report for B

Capability Histogram



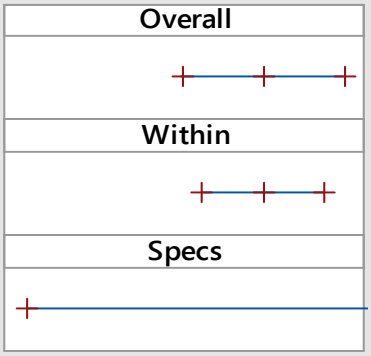
Normal Prob Plot

AD: 1.050, P: 0.008

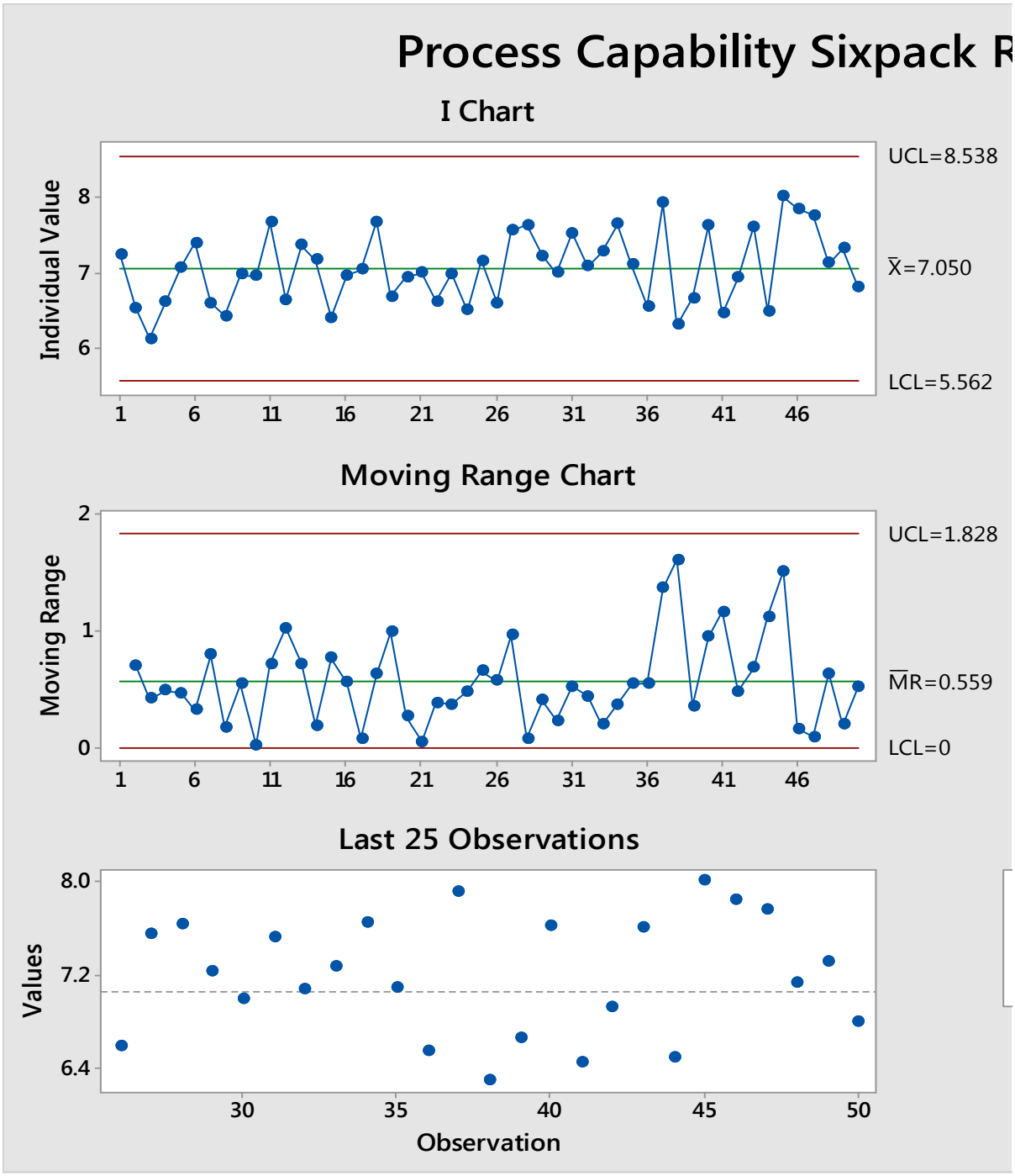


Capability Plot

Within	
StDev	0.9521
Cp	*
Cpk	3.83
PPM	0.00

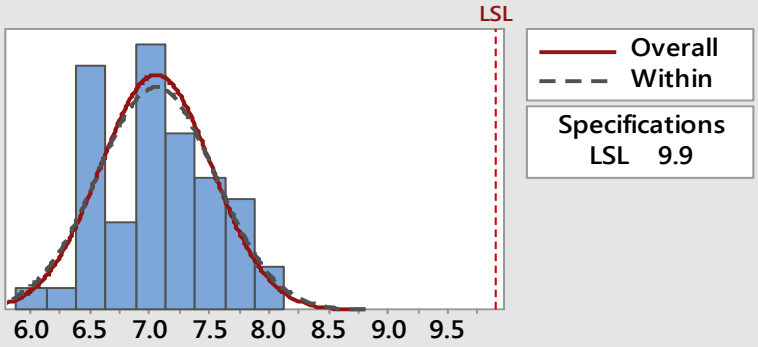


Overall	
StDev	1.251
Pp	*
Ppk	2.91
Cpm	*
PPM	0.00


Process Capability Sixpack R
I Chart
Individual Value
UCL=8.538
X̄=7.050
LCL=5.562
Moving Range Chart
Moving Range
UCL=1.828
MR=0.559
LCL=0
Last 25 Observations
Values
Observation

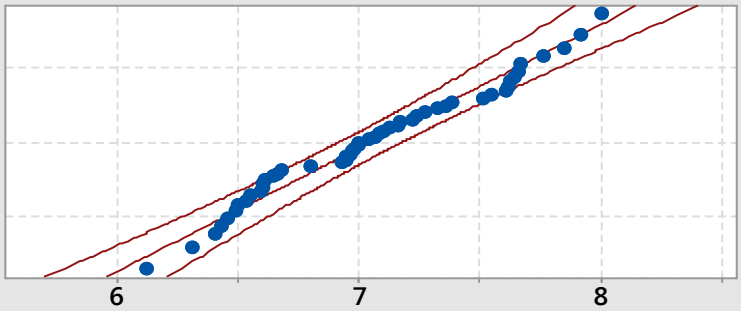
Report for C1

Capability Histogram

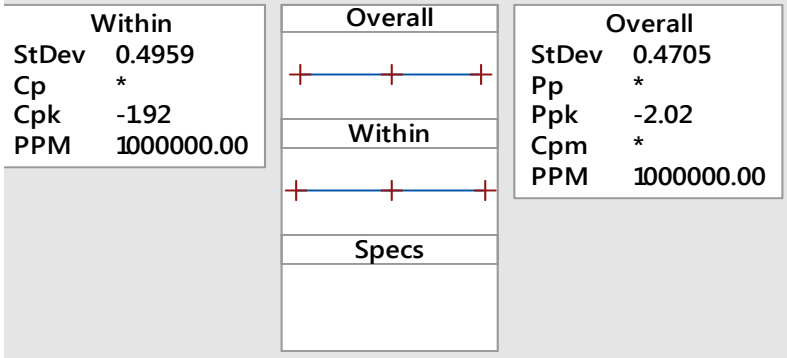


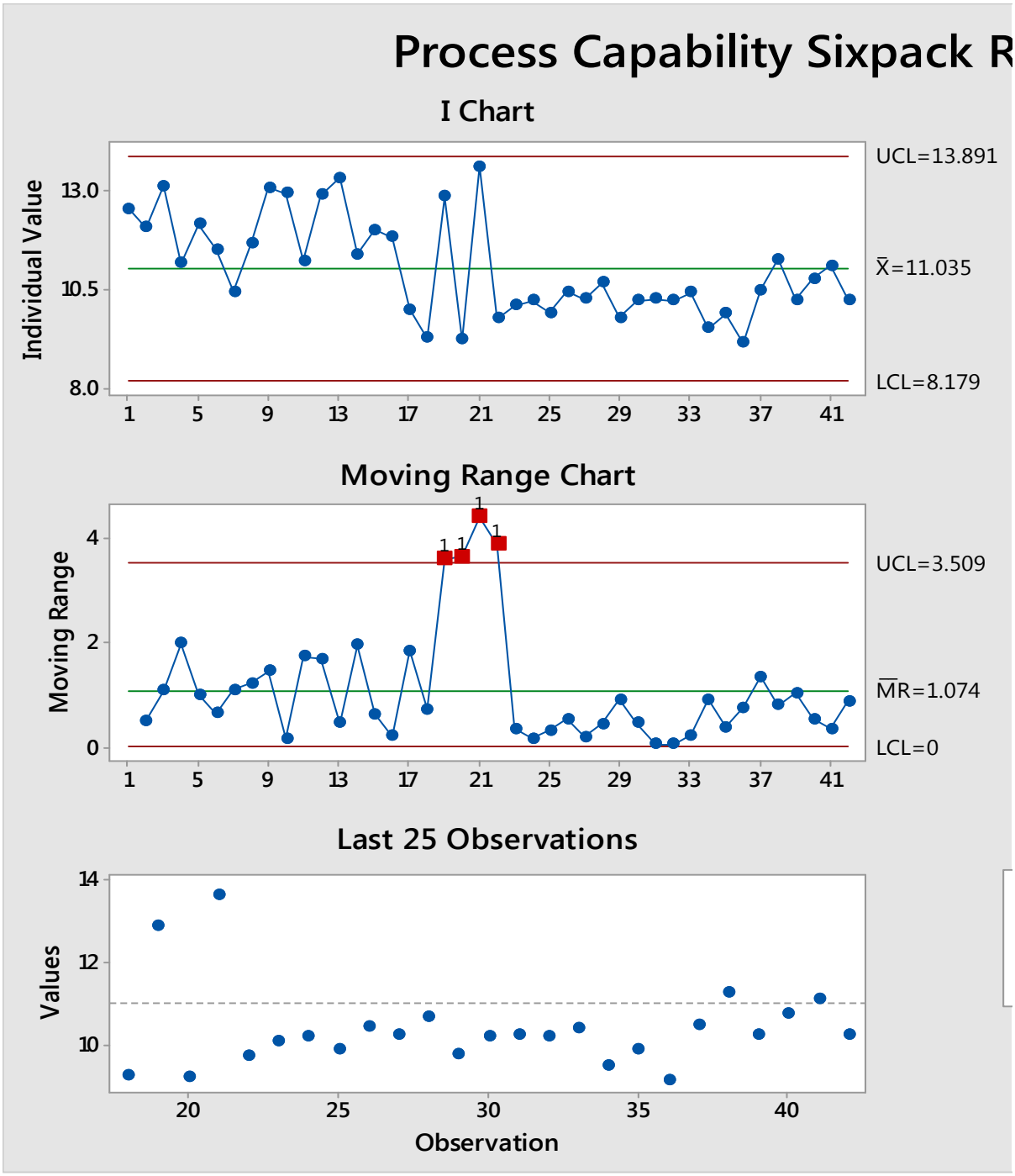
Normal Prob Plot

AD: 0.500, P: 0.200



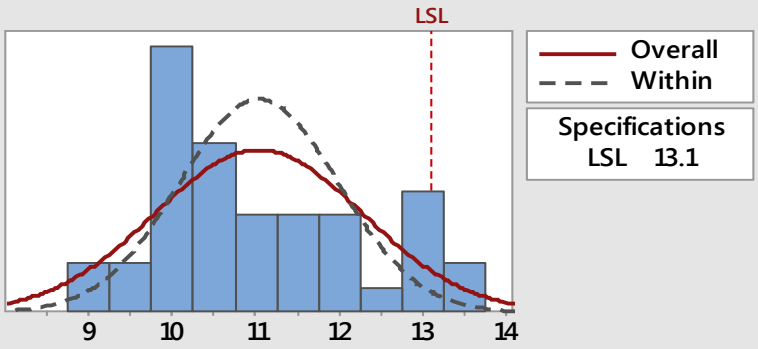
Capability Plot




Process Capability Sixpack R
I Chart
Individual Value
13.0
10.5
8.0
UCL=13.891
X̄=11.035
LCL=8.179
1
5
9
13
17
21
25
29
33
37
41
Moving Range Chart
Moving Range
4
2
0
UCL=3.509
MR̄=1.074
LCL=0
Last 25 Observations
Values
14
12
10
20
25
30
35
40
Observation

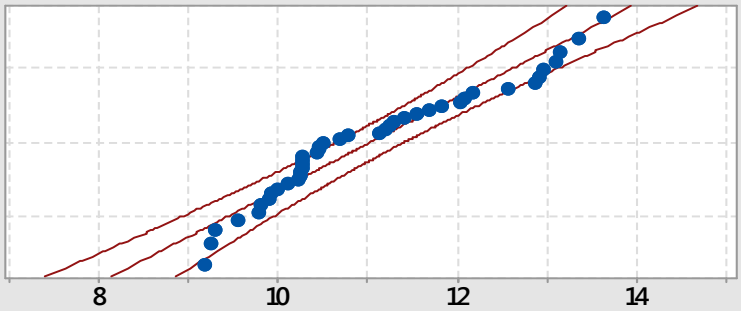
Report for C2

Capability Histogram



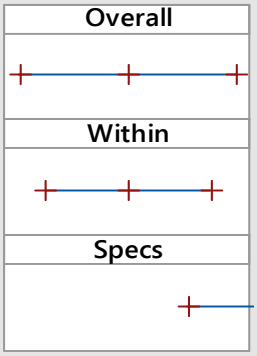
Normal Prob Plot

AD: 1.050, P: 0.008

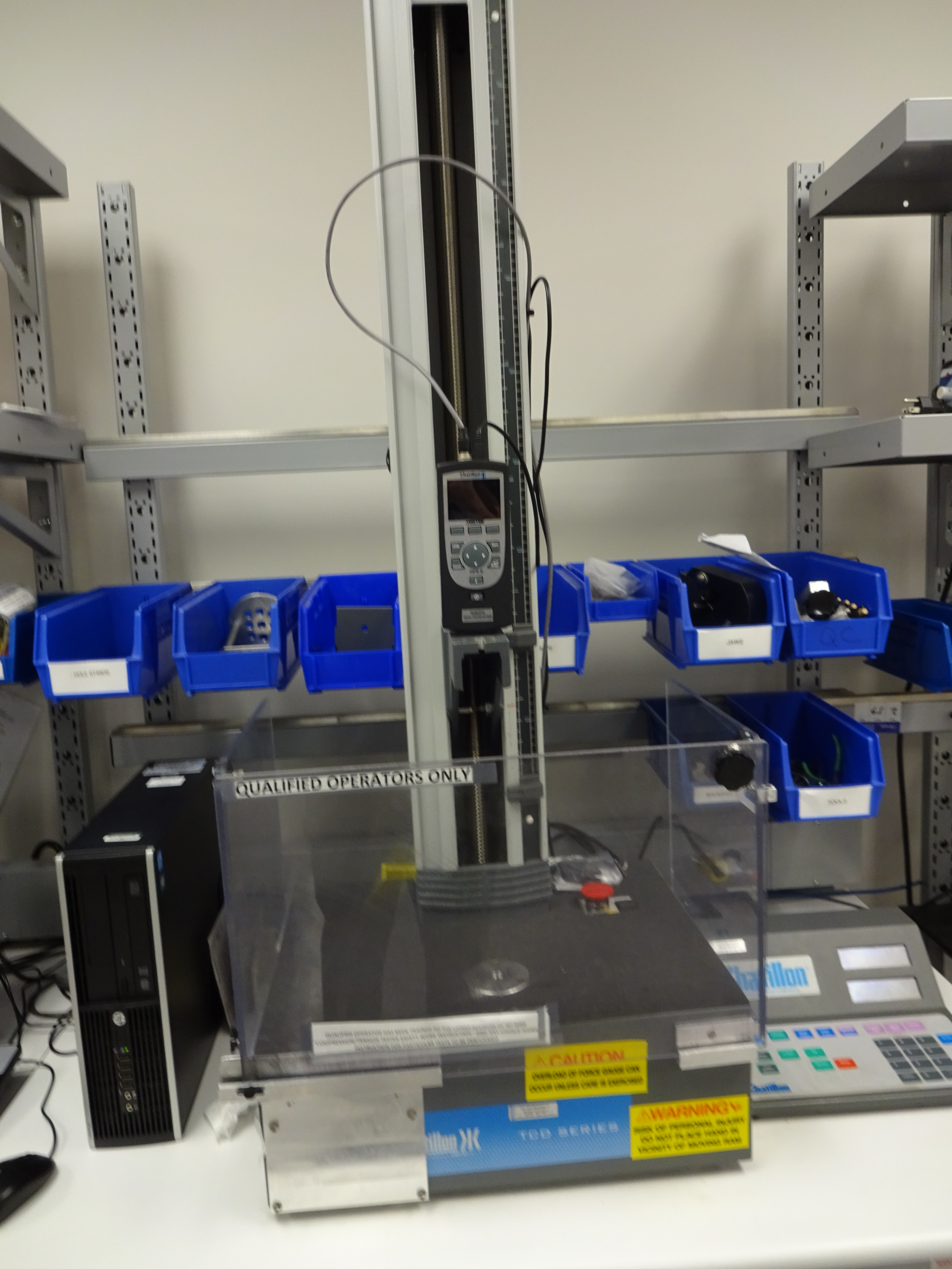


Capability Plot

Within	
StDev	0.9521
Cp	*
Cpk	-0.72
PPM	98496157



Overall	
StDev	1.251
Pp	*
Ppk	-0.55
Cpm	*
PPM	95057144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