

# Build Tensile Test System for Twine Product 建置合股線拉伸強度檢驗方法

-DMADV

6-Sigma成果報告

WINTEX 穩益實業股份有限公司

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2017/5/20

# Comparison of DMADV and DMAIC

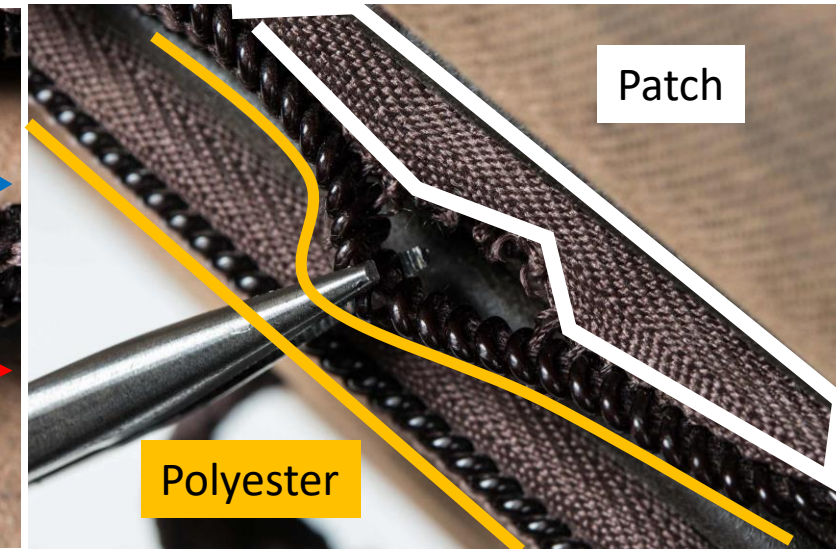
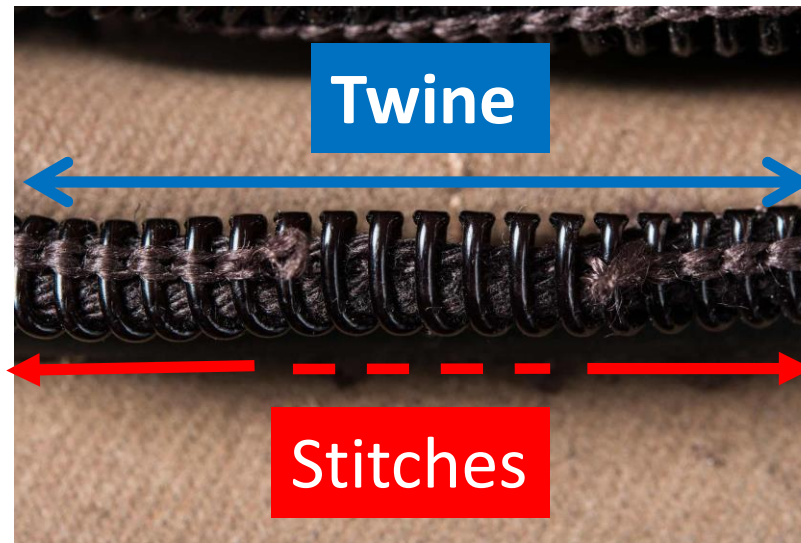
Define	Define the project goals and customer (internal and external) deliverables	Define	Define the project goals and customer (internal and external) deliverables
Measure	Measure and determine <b>customer needs and specifications</b> , CTQ, Risks, Capabilities	Measure	Measure the process to determine <b>current performance</b>
Analyze	Analyze and select <b>the process options</b> to meet the <b>customer needs</b>	Analyze	Analyze and determine <b>the root cause(s) of the defects</b>
Design	Design the process details and optimize to meet the <b>customer needs</b>	Improve	Improve the process based on data analysis to eliminate defects (DOE)
Verify	Verify the design performance (pilot test/monitor) capability to meet <b>customer needs</b>	Control	Control future process performance (SPC)

iSixSigma: <https://www.isixsigma.com/new-to-six-sigma/design-for-six-sigma-dfss/dmaic-versus-dmadv/>

Minitab Blog: <http://blog.minitab.com/blog/real-world-quality-improvement/dmaic-vs-dmadv-vs-dfss>

# Introduction to Twine(中心線/合股線) and Definition of Key Terms

- A zip is consist of Polyester/Stitches/Side Patch/Twine.
- The weight of twine is up to 8%
- Twine provides toughness, and increases the reliability of zipper.



Zipper Secure: <https://zipperrescue.com/faq/>

Samsonite: [http://www.samsonite.com.tw/products\\_detail\\_1091.htm](http://www.samsonite.com.tw/products_detail_1091.htm)

# DMADV (Design for Six Sigma:DFSS)Road Map

Define

Measure

Analyze

Design

Verify

## Project Initiation:

# Build Tensile Test System for Twine Product

- Problem Statement:

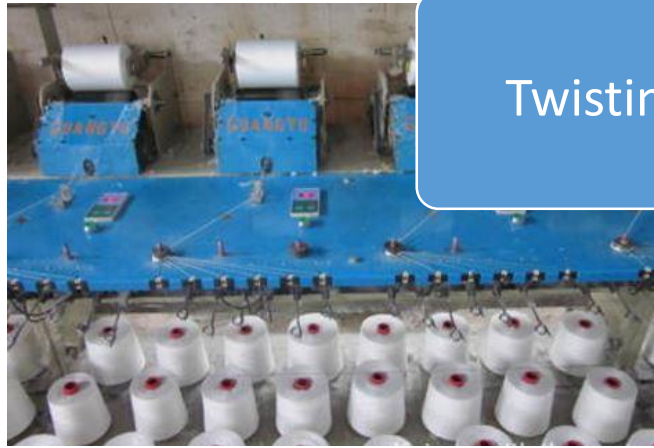
Customer has reported the failure of twine, which increases their downtime and quality issues. The main issues are: Disconnection, Diameter of Reconnection.

- Goal/Objective:

To build a reliable measurement method to meet customer's specification. To understand current performance of our process.

- In Scope: Equipment Survey/Determine the measurement method
- Out Scope: Process Change/Weighting/Packing
- Target: Implement new measurement into process by Q3 2017
- Sponsor: General Manager

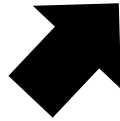
# Process Flow



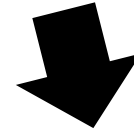
Twisting



Winding on  
paper tube



Weighting  
Fine-Tuning



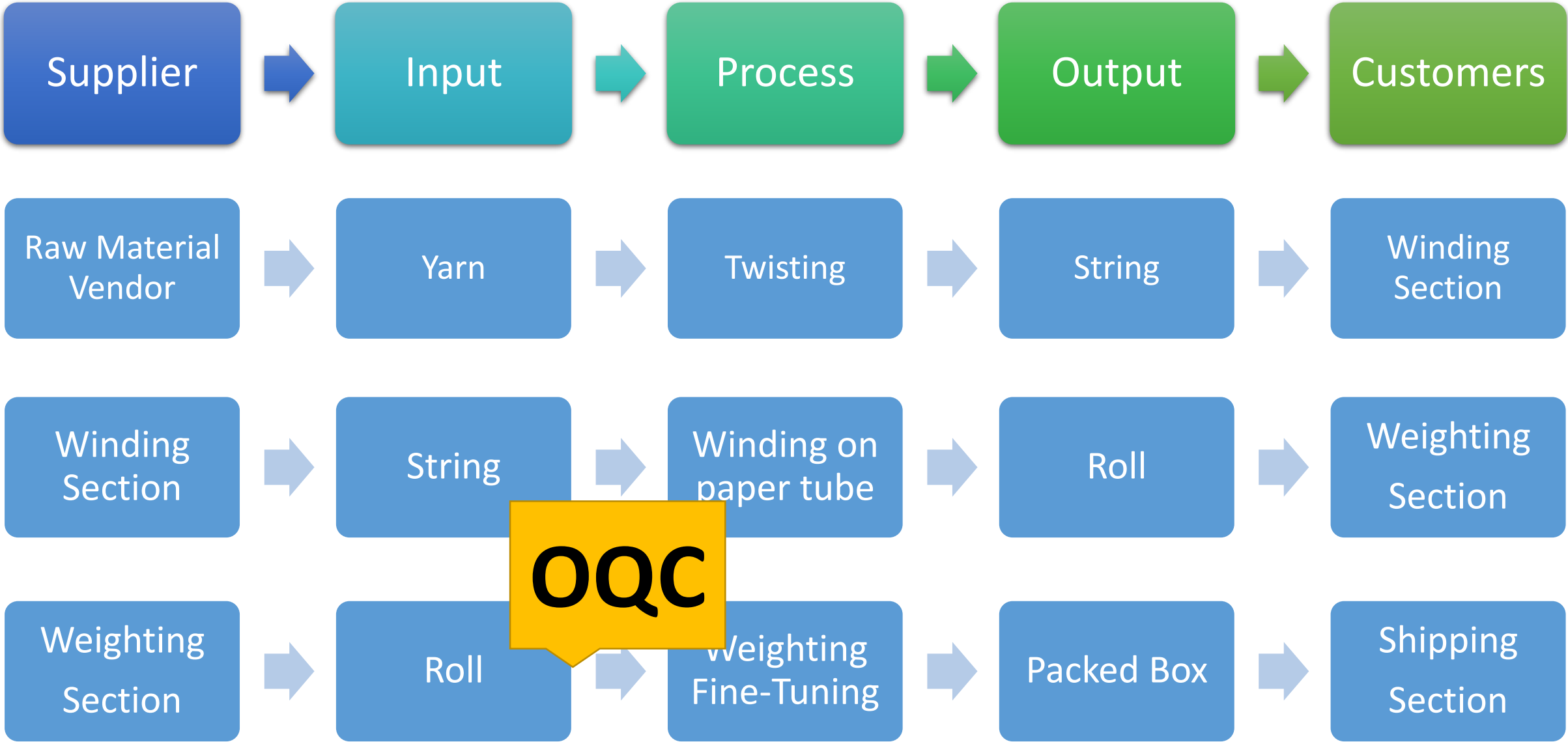
OQC

Customer





# SIPOC



# DMADV (Design for Six Sigma:DFSS)Road Map

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# Voice of Customers and its solutions:

## Source of VOC:

- Up to 40 Customers from last 10 years and complaints from Disconnection issues.

## Items:

- Zero Disconnection
- Less than 1 reconnection point in every 10,000 yard.

### ➤ New Process A: Sorting

每一捲多做一公尺, 檢查有無斷線, 附上資料, 打OK標籤(9000meters=200m\*45Rolls)

- Diameter of Reconnection Point should not larger than 25%

### ➤ New Process B: Measure Diameter of Reconnection有重接的拿出來量直徑, 附上接線直徑資料, 另外包裝

- Tensile Test Cpk will be another topic

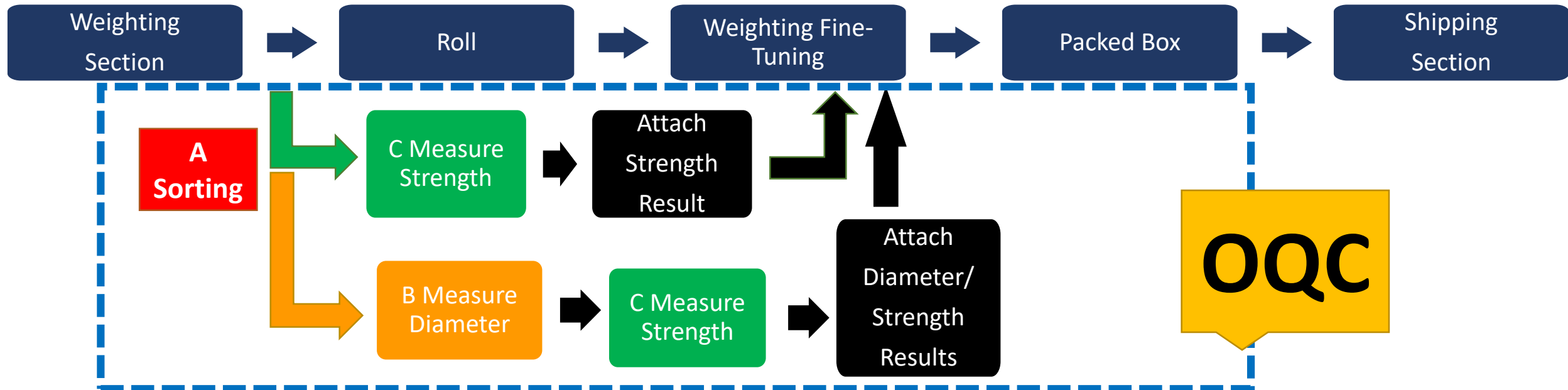
### ➤ New Process C: Measure Strength量測成品的Tensile Stress, 出貨時附上Cpk檢測數據

# Financial Impact: COPQ Calculation

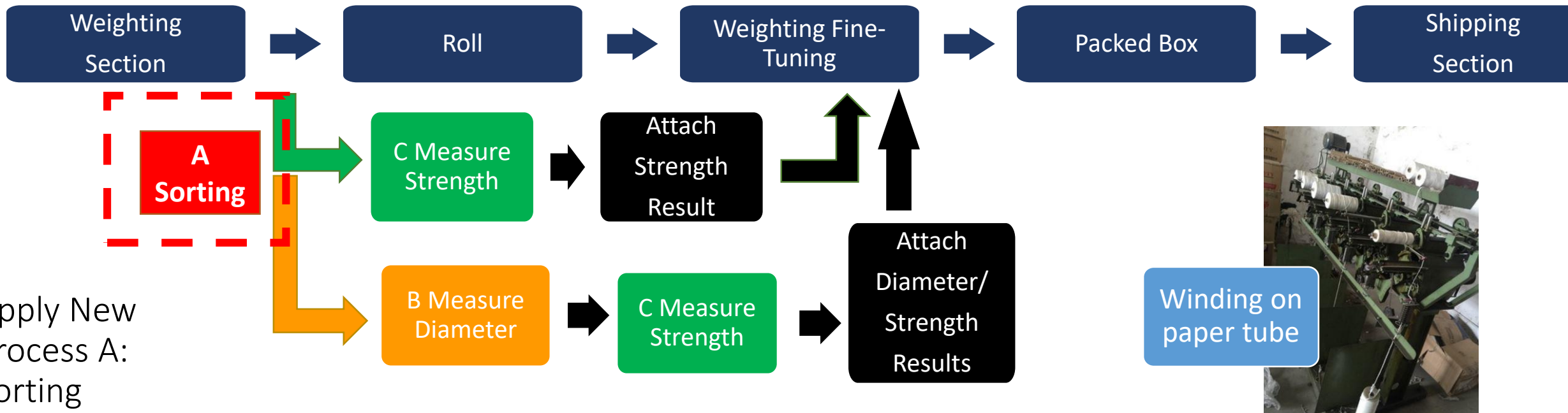
- Total Cost of **First Year**: \$1,218,000NTD( **8.12%** of income)
- Cost **from 2<sup>nd</sup> year**: \$498,000NTD (**3.32%** of income)
- Equipment Depreciation is excluded
- External error cost and indirect poor-quality cost is under estimation

Cost element			
Direct poor-quality costs	Controllable poor-quality cost	Prevention cost	Insp. Machine:720000 Sample: 150*500=75000
		Appraisal cost	Annual:396000
	Resultant poor-quality cost	Internal error cost	900*30=27000
		External error cost	NA
	Equipment poor-quality cost		NA
Indirect poor-quality costs	Customer-incurred cost		NA
	Customer-dissatisfaction cost		NA
	Loss-of-reputation cost		NA
			Total:\$1,218,000NTD

# New OQC Inspection Process:



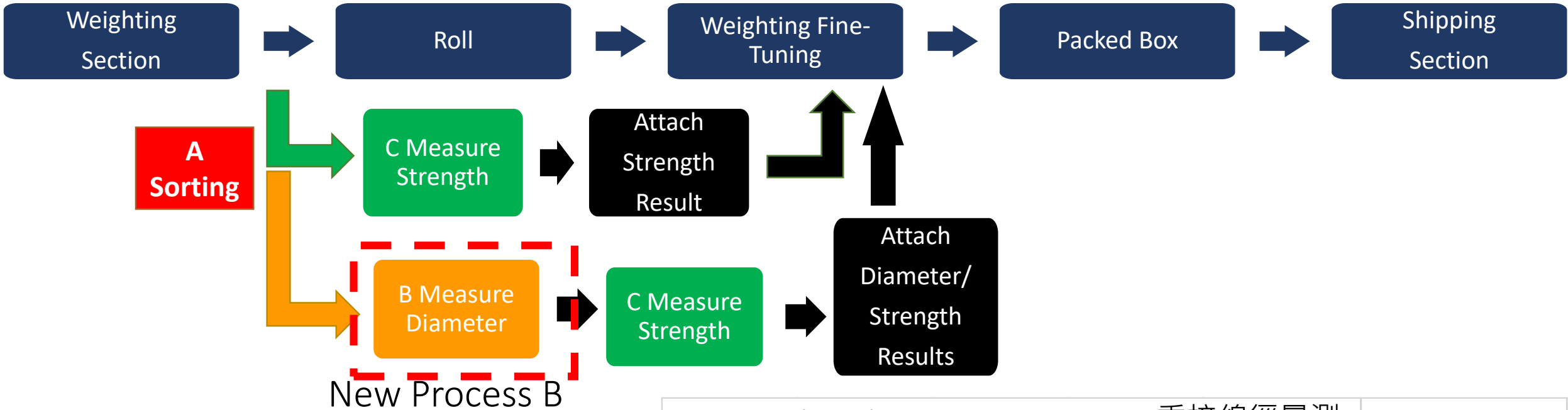
- **A: Sorting** the Rolls by Reconnection, and use different labels to identify the product. 每一捲多做一公尺, 檢查有無斷線, 附上資料, 打OK標籤 (9000meters=200m\*45Rolls)
- **B: Measure the diameter** of Reconnection if exists. 有重接的拿出來量直徑, 附上接線直徑資料, 另外包裝
- **C: Measure the Tensile Strength** of last 1M from every Roll. 量測成品的Tensile Stress, 出貨時附上Cpk



Apply New  
Process A:  
Sorting

此箱產品無重接線				
日期	品項	批號	箱號	點檢者
170502	#3/9股	170430	1	王XX
上層	1	2	3	4
	X	X	X	X
	5	6	7	8
	X	X	X	X
下層	9	10	11	12
	X	X	X	X
	13	14	15	16
	X	X	X	X
請由正面俯視點檢, 並將檢查結果貼於箱子正面				

Reconnection Diameter Measurement 重接線徑量測					規格
日期	品項	批號	箱號	點檢員	
170502	#3/9股	170430	1	王XX	0.9~1.125mm
上層	1	2	3	4	
	1.00	1.10	0.95	0.95	
	5	6	7	8	
	1.10	0.95	1.00	1.00	
下層	9	10	11	12	
	1.10	0.95	0.90	1.00	
	13	14	15	16	
	NA	NA	NA	NA	
請由正面俯視點檢, 並將檢查結果貼於箱子正面					



Products has  
Reconnection



Reconnection Diameter Measurement重接線徑量測					規格
日期	品項	批號	箱號	點檢員	
170502	#3/9股	170430	1	王XX	0.9~1.125mm
上層	1	2	3	4	
	1.00	1.10	0.95	0.95	
	5	6	7	8	
	1.10	0.95	1.00	1.00	
下層	9	10	11	12	
	1.10	0.95	0.90	1.00	
	13	14	15	16	
	NA	NA	NA	NA	
請由正面俯視點檢, 並將檢查結果貼於箱子正面					

# DMADV (Design for Six Sigma:DFSS)Road Map

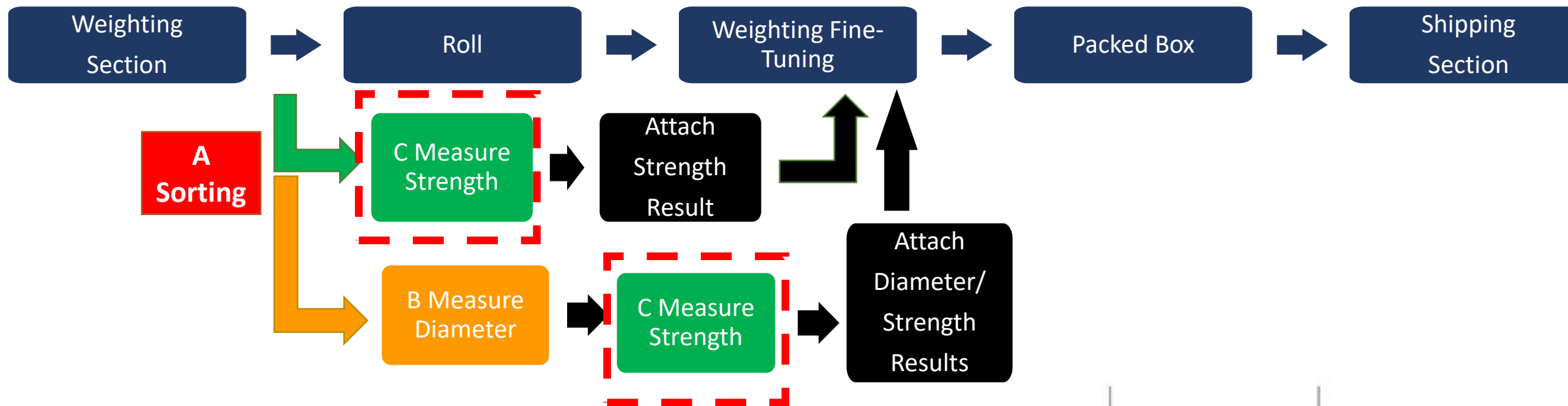
Define

Measure

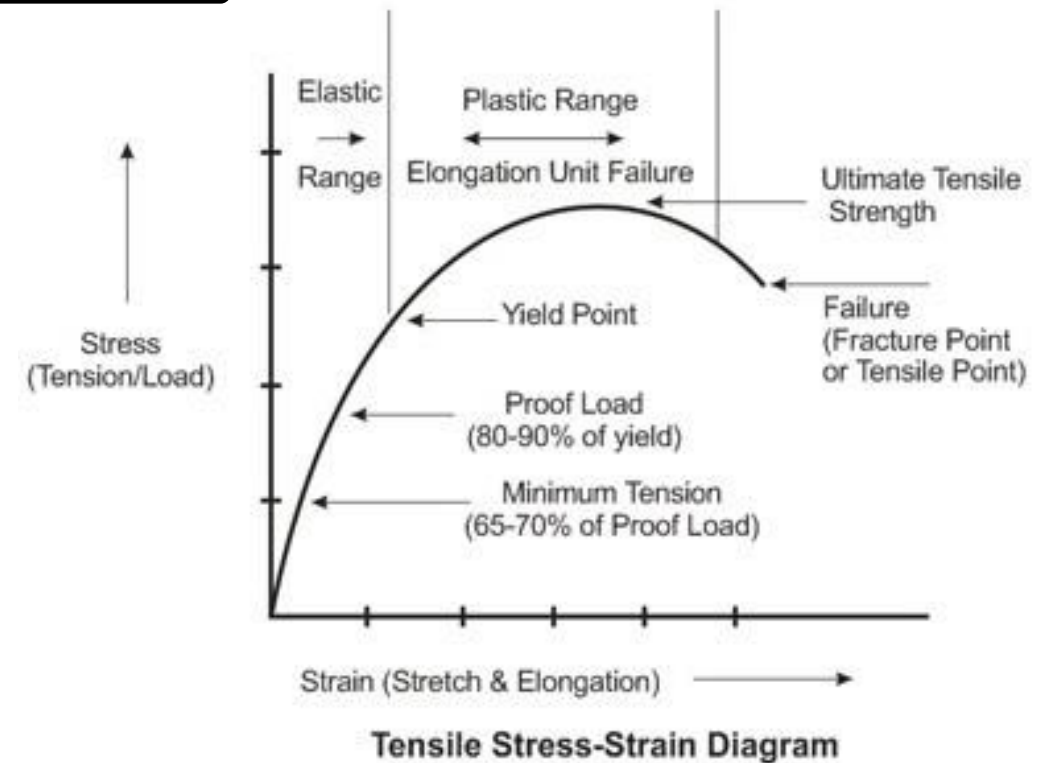
Analyze

Design

Verify



New Process C



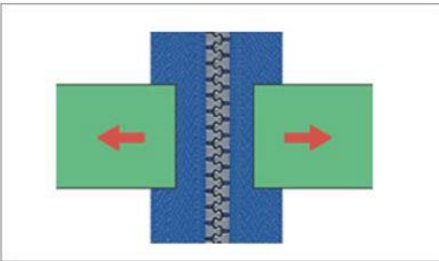


# New Measurement Technique and Customer Test Method

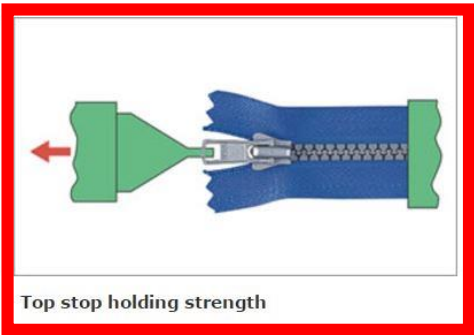


Twine mainly contributes the strength at **Top Stop Holding Test** from YKK Testing System, and Max Zipper will feedbacks further demand. Referring potential tests as below:

## YKK Test Method



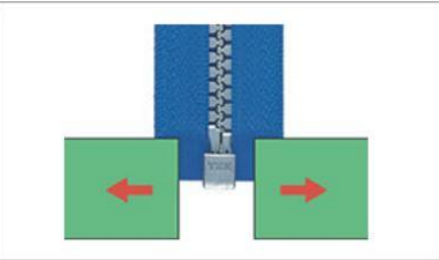
Chain crosswise strength ( per 2.5cm )



Top stop holding strength



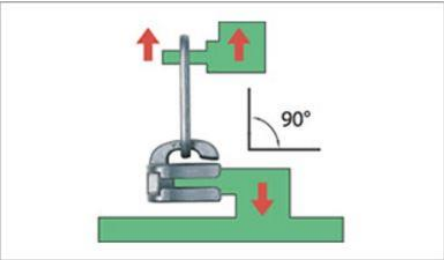
Bottom stop holding strength



Separating unit crosswise strength

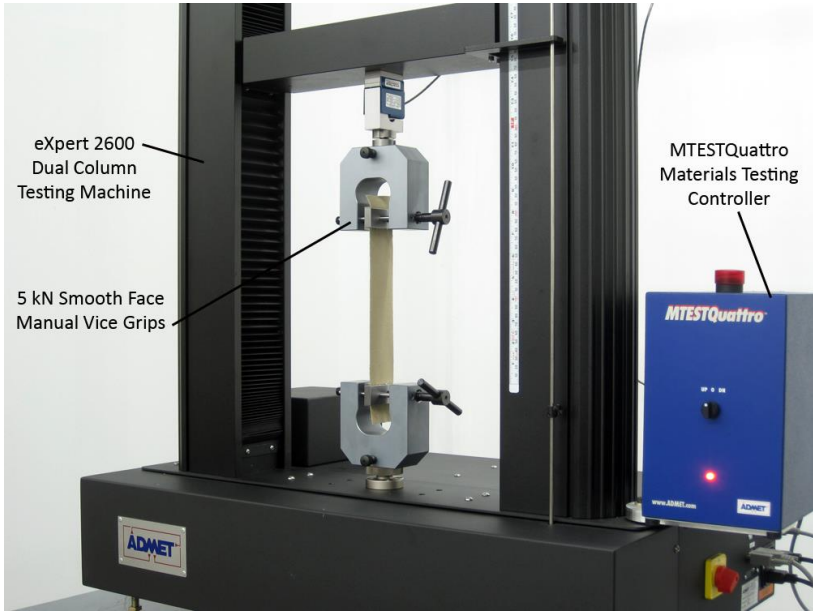


Slider lock strength



Slider tab pull off strength ( 90 degrees )

[Instron.com](http://Instron.com)



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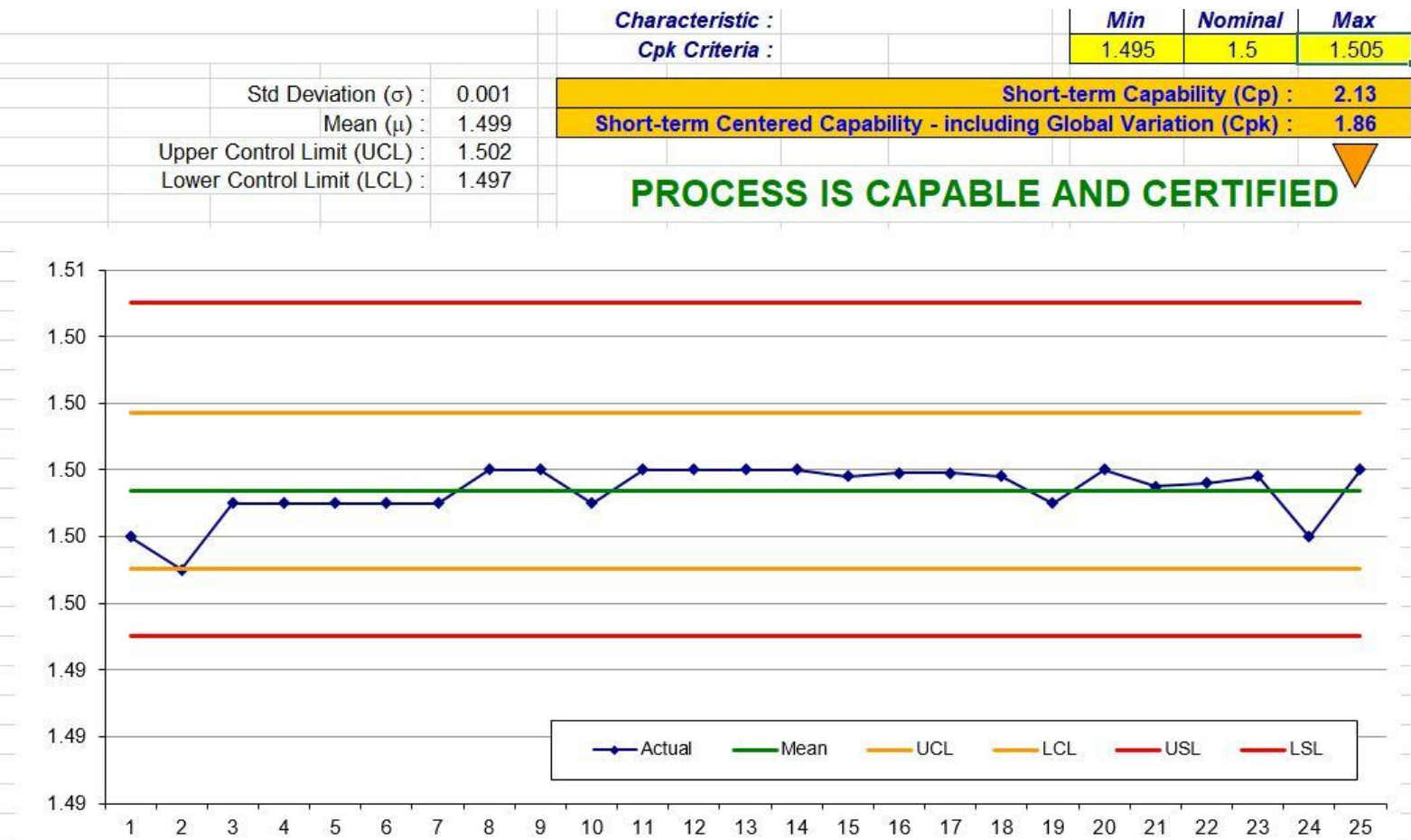
# Expecting Results of New Process C: Tensile Strength Test Results:

First Lot Test:  
Mean:1.49Kg  
Cpk: 1.86

Communicating with Max  
Zipper(宏大拉鍊) for the  
specification of  
Tensile  
Strength.

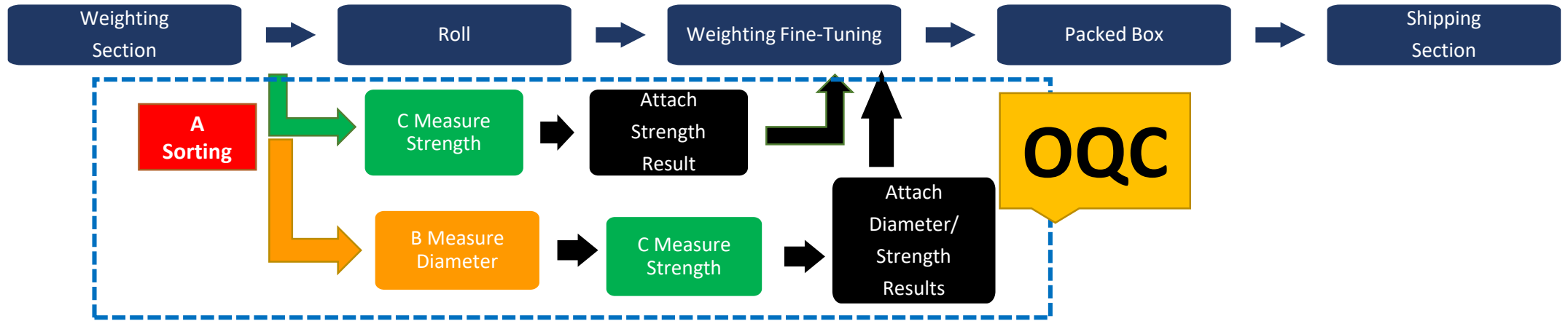


Data(kg)	
Part	Actual
1	1.4980
2	1.4970
3	1.4990
4	1.4990
5	1.4990
6	1.4990
7	1.4990
8	1.5000
9	1.5000
10	1.4990
11	1.5000
12	1.5000
13	1.5000
14	1.5000
15	1.4998
16	1.4999
17	1.4999
18	1.4998
19	1.4990
20	1.5000
21	1.4995
22	1.4996
23	1.4998
24	1.4980
25	1.5000



# Summary

- After Identify the Voice of Customers, we have applied 3 improvement action as Outgoing Quality Control.



- New Process C: Expecting Total Cost of **First Year**: \$1,218,000NTD( **8.12%** of income), and **2<sup>nd</sup> year**: \$498,000NTD (**3.32%** of income)
- Evaluating the New Tensile Strength Test with Customers.

# Next Steps

- Collect Customers' feedback from New Process A/B/C.
- Communicating with MaxZipper宏大拉鍊 for the spec of tensile strength Test
- Calculate the Internal Error Cost after New Process applied.
- Identify the vital few factors that affects tensile strength from:  
    Operator/Equipment/Material/Environmental/Process.
- Establish check points in the process.
- Apply Destructive MSA in the Process C:Tensile Test
- Reconnection Product might be downgraded.