



PVC Extrusion Quality Control

WBS 2.4.2,2.4.3

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Quality Control At Extruder

- Quality Control

- NOvA extrusions will be produced with a well defined set of acceptance criteria. Quality control begins with a comprehensive manufacturing plan.
- This plan would include a detailed description of the tooling and manufacturing parameters and quality control procedures during extruding.



Visual Inspection

- Visual Inspection
 - **Outside profile** visually inspect surface quality for any irregularities. This would include voids or bubbles, chatter marks and discoloration from burning.
 - **Inside profile** (end) visually inspect for any irregularities including the above. Also, the quality of web and cell knitting.



Extrusion Visual Inspection





Dimensional Measurements

- **Dimensional Measurements**
 - Confirm the extrusion meets the technical drawing specifications
 - Establish written procedures for extrusion inspection (Quality control inspection sheets)
- **Measuring Equipment**
 - Ultra Sound
 - Calipers / Verniers
 - Micrometers
 - Go/No Go Gauges
 - Optics (measure bow)
 - Flatness Measuring Device



Ultrasonic Thickness Gauge

- Krautkramer Branson CL3
 - Hand held micro processor with data logger
 - Operates on the pulse-echo principle, similar to sonar
- A short ultrasonic pulse is transmitted into the part by the probe, reaching the back surface, where it is reflected back, recording the thickness measurement.
- This device has been proven to be an effective thickness measurement tool and is “operator friendly”.
- Thickness gauge measurements are cross-checked and verified with micrometer measurements.
- **Advantage**- Much faster measurement than calipers





Quality Control-Extrusion Retainer

- Two types of extrusions will be tested
 - Each full length extrusion will be “two inches longer” than required
 - The module factory will cut-off the two inch piece leaving the bar code attached for tracking purposes.
 - This part will be measured for physical properties.
 - (Refer to the breakout talk of Jim Grudzinski)
- Extrusion sample “ thirty-six inches long”
 - This sample is taken from the extrusion line once per shift for future pressure testing to 30 psi



Reflectivity Measurements

- **Portable Spectrophotometer**
- Confirm the extrusion meets the minimal reflectivity requirement.
- This measurement is taken on the outer surface and is specified to be within 400 and 470nm.
- (Refer to the breakout talk of Anna Pla-Dalmau)



Quality Control Inspection Sheet- Prototype / IPND

Extrutech/Fermi

Q.C. Check List For 16 Cell Horizontal Profile Fermilab # 9219.000-MC-435388

Extrusion Number: _____

Inspected by: _____

Date Extruded: _____

PVC Batch No.: _____

Time Extruded: _____

Extrusion Length: _____

Dimension	Min. Value	Max. Value	Measured Leading Edge	Measured Trailing Edge	Out of Tolereance	Date	Time	Comments
Straightness	.049/3.28'							
Flatness	0.039							
Overall Length								
Overall Width	25.677	25.913						
Overall Height	2.574	2.653						
Overall Height	2.574	2.653						
Cell #1 Outside Side Wall	0.118	0.158						
Cell #16 Outside Side Wall	0.118	0.158						
Cell #1 Outside Bottom Wall	0.118	0.158						
Cell #2 Outside Bottom Wall	0.118	0.158						
Cell #3 Outside Bottom Wall	0.118	0.158						
Cell #4 Outside Bottom Wall	0.118	0.158						
Cell #5 Outside Bottom Wall	0.118	0.158						
Cell #6 Outside Bottom Wall	0.118	0.158						
Cell #7 Outside Bottom Wall	0.118	0.158						
Cell #8 Outside Bottom Wall	0.118	0.158						
Cell #9 Outside Bottom Wall	0.118	0.158						
Cell #10 Outside Bottom Wall	0.118	0.158						
Cell #11 Outside Bottom Wall	0.118	0.158						
Cell #12 Outside Bottom Wall	0.118	0.158						
Cell #13 Outside Bottom Wall	0.118	0.158						
Cell #14 Outside Bottom Wall	0.118	0.158						
Cell #15 Outside Bottom Wall	0.118	0.158						
Cell #16 Outside Bottom Wall	0.118	0.158						
Cell #1 Outside Top Wall	0.118	0.158						



Quality Control Inspection Sheet- Prototype / IPND

Extrutech/Fermi

Q.C. Check List For 16 Cell Horizontal Profile Fermilab # 9219.000-MC-435388

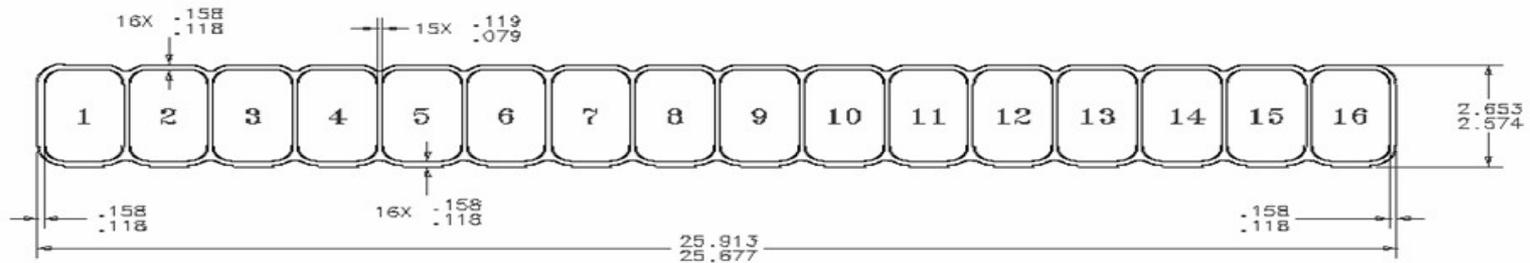
Dimension	Min. Value	Max. Value	Measured Leading Edge	Measured Trailing Edge	Out of Tolereance	Date	Time	Comments
Cell #2 Outside Top Wall	0.118	0.158						
Cell #3 Outside Top Wall	0.118	0.158						
Cell #4 Outside Top Wall	0.118	0.158						
Cell #5 Outside Top Wall	0.118	0.158						
Cell #6 Outside Top Wall	0.118	0.158						
Cell #7 Outside Top Wall	0.118	0.158						
Cell #8 Outside Top Wall	0.118	0.158						
Cell #9 Outside Top Wall	0.118	0.158						
Cell #10 Outside Top Wall	0.118	0.158						
Cell #11 Outside Top Wall	0.118	0.158						
Cell #12 Outside Top Wall	0.118	0.158						
Cell #13 Outside Top Wall	0.118	0.158						
Cell #14 Outside Top Wall	0.118	0.158						
Cell #15 Outside Top Wall	0.118	0.158						
Cell #16 Outside Top Wall	0.118	0.158						
Cell #1 Inside Wall	0.079	0.119						
Cell #2 Inside Wall	0.079	0.119						
Cell #3 Inside Wall	0.079	0.119						
Cell #4 Inside Wall	0.079	0.119						
Cell #5 Inside Wall	0.079	0.119						
Cell #6 Inside Wall	0.079	0.119						
Cell #7 Inside Wall	0.079	0.119						
Cell #8 Inside Wall	0.079	0.119						
Cell #9 Inside Wall	0.079	0.119						
Cell #10 Inside Wall	0.079	0.119						
Cell #11 Inside Wall	0.079	0.119						
Cell #12 Inside Wall	0.079	0.119						
Cell #13 Inside Wall	0.079	0.119						
Cell #14 Inside Wall	0.079	0.119						
Cell #15 Inside Wall	0.079	0.119						



Quality Control Inspection Sheet- Prototype / IPND

Extrutech/Fermi
Q.C. Check List For 16 Cell Horizontal Profile Fermilab # 9219.000-MC-435388

EXTRUSION TOP



On the above sketch show the locations of all the out of tolerance dimensions.

General Comments:

- 1) EXTRUSION TO BE LABELED "TOP"
- 2) EXTRUSION TO BE LABELED "OP" (OPERATOR SIDE)
- 3) EXTRUSION TO BE LABELED WITH EXTRUSION # ON "OP" SIDE



Poor Knitting Of Webs



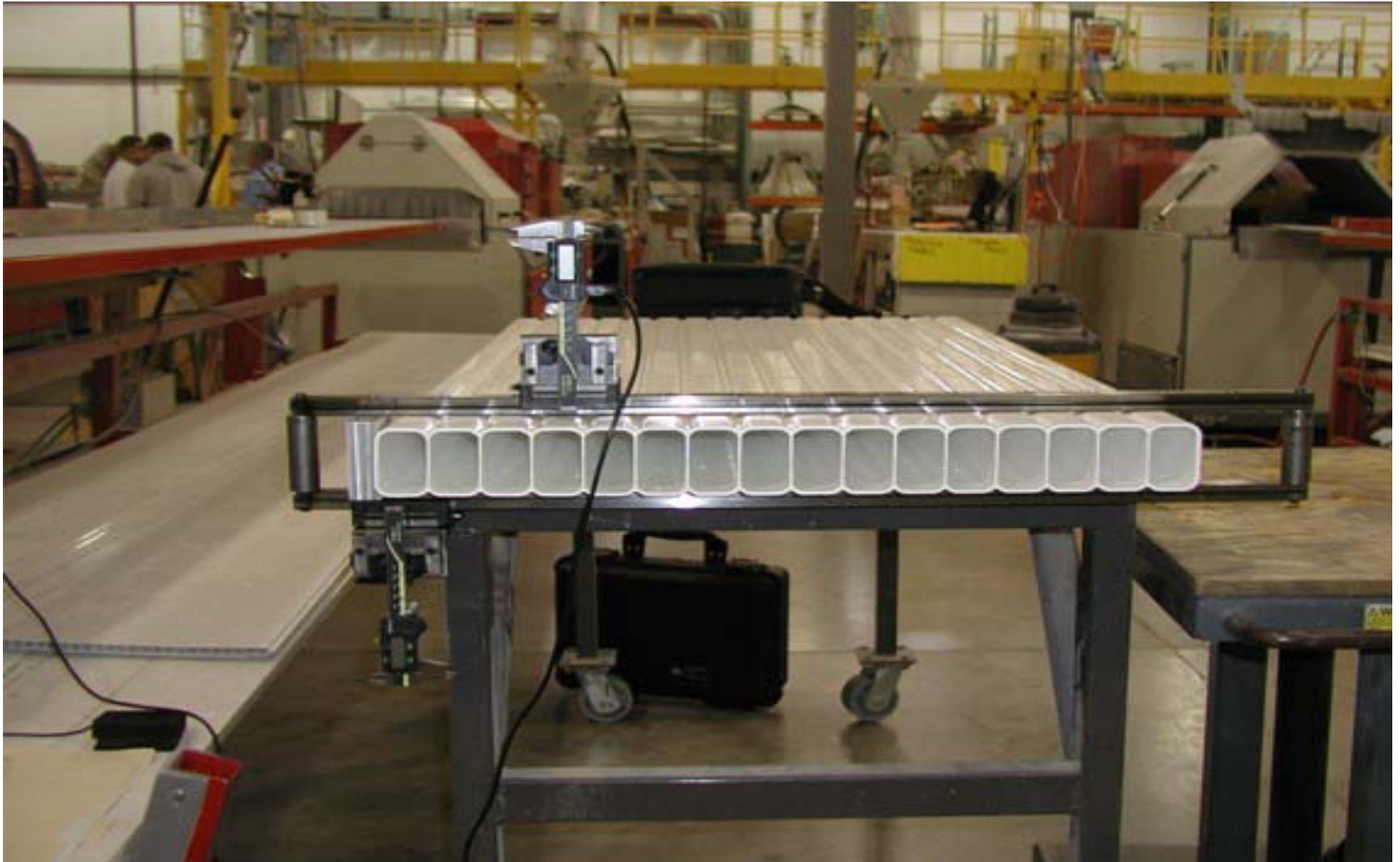


Inspecting With Ultra Sound





Flatness Measuring Device





Inspecting Flatness

