Extrusion Process Improvement

Raumedic

Western Carolina University

PROBLEM STATEMENT

Raumedic Inc. is a manufacturer of medical equipment, specializing in injection molded components and extruded tubing. One of the main products manufactured by Raumedic is dual layered tubing with a thermoplastic urethane (TPU) touter layer. The manufacturing process for these tubes leaves their exterior surfaces tacky. Due to the post -uring process common with TPU, the individual tubes end up in bundles, are left for 48 hours on a rack for post-curing and are then manually separated by workers.

OBJECTIVES

- Developing an automated (in-line) process to separate tubing OR
- Develop a mechanical process to prevent the tubes from sticking together that fits the confines of the extrusion production area OR
- Reducing or eliminating the tendency of tubes to stick together through mechanical or other process changes

REQUIREMENTS

Req #	Requirement Description	Motivation
1	Tubes must not be damaged	Prevention of defect product
2	Mechanical and chemical properties of tubing cannot be permanently affected	Prevention of defect product
3	The solution must be compatible with the standards set for an ISO Class 7 Clean Room	The solution must be able to be used in the room where the tubes are extruded
4	Any solution must be made of stainless steel or anodized aluminum	Prevention of contamination of product
5	Distilled water and isopropyl alcohol	Prevention of contamination of product
6	Fit within the confines of the assembly line	The solution must be able to be used in the room where the tubes are extruded

Photo caption:Tubing bundles resulting from original manufacturing process

FINAL DESIGN, APPROACH, PLAN

The final plan for improving Raumedic's extrusion process involves both physical components and a control scheme for the conveyor table already in use by Raumedic, specifically:

- Guide Chutes to direct the tubing as they transfer from the primary belt to the secondary belt
- A control scheme that advances the secondary belt each time a tube is dropped to prevent contact.

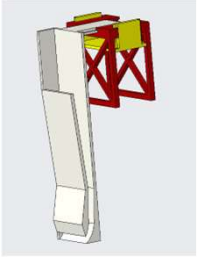
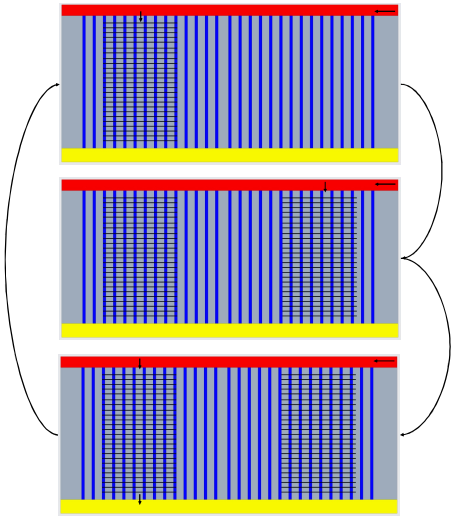


Photo Caption: 3D model of final design for tubing guides.

Tube Drying Cycle



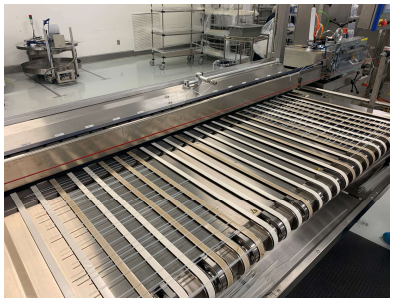
PROCESS DESCRIPTION

- Red block represents the long conveyor that the tubes are dropped onto immediately after being cut
- Gray represents the machinery that holds the secondary conveyor belts which are in blue
- Black represents the tubes themselves and the
- Yellow represents the trough that the tubes fall into at the end

1. The cycle begins with the conveyor belts running and 25 tubes being placed on the left side.
2. The left conveyor belt stops running and the tubes are dropped on the right side and fill that side of the conveyor belt.
3. Lastly, the right conveyor belt starts back and the tubes that were lined up from the beginning of the cycle are dropped into the trough.

RESULTS

After testing both the guides and controls for the conveyor table, the tubing was noted to be much less tacky and easier to separate. Allowing the tubes more time to cure before contacting other tubes was demonstrated promising results for the continuation of the project following this process.



Tubing one table with new process, tubing enters table from cutting equipment to the right

Tubing on the table with new process and guides

SUMMARY AND CONCLUSIONS

One of the best aspects of the new process we are proposing is the elimination of an entire manual step from Raumedic's current manufacturing process. Currently when batches of tubing are made at least 1 day is given for the tubes to cure in bundles, and employees must manually separate the tubes before shipping. With the process we have developed, Raumedic hopes to be able to package tubing for shipping as soon as it leaves the conveyor.

FUTURE WORK

Conversations with Raumedic about the future of the project focused on a few concepts:

- Refining the design of the guides to more accurately drop tubes in 1 location.
- Sourcing secondary belts with cleats to hold tubes.
- Manufacturing the final guide design from aluminum or stainless steel to comply with the manufacturing standards used by Raumedic.

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