

PRODUCT SPECIFICATION

TITLE	DATE	REV
Product Requirements	9/18/2018	0

TDRC Tubing Insulation  
Tooling for more Efficient and  
Ergonomic Insulation Installation on  
Hydraulic Tubing Sets

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## Document History

Rev Number	Date	Modified By	Reason
0	9/18/18	Group	Initial Release

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# 1 Objective

The objective of the Boeing Insulation-Installation Group (BIG) is to design and develop tooling or establish novel manufacturing techniques to improve the process of installing insulation on hydraulic tubing for Boeing commercial aircraft.

BIG is tasked with the objective of improving the overall ergonomics and efficiency of the manufacturing process currently orchestrated by the Boeing Tubing Ducting and Reservoir Center (TDRC). It is necessary for the tubing installation to be defect-free, consistent, user-friendly and reduce current manufacturing times. The proposed method/tooling developed by BIG must be reviewed by an engineering team at TDRC.

# 2 Scope

Propose a defect free solution to reduce assembly time and eliminate ergonomic exposure.

# 3 Functional Requirements

## 3.1 User Interface Requirements

The device should be a user friendly mechanism that simplifies the installation process and increases productivity. Ideally the device should be able to meet the following requirements:

- Device shall insulate a tube in under three minutes
- Device shall be multipurpose and be compatible with various bends
- Device shall be compatible with tubes of various lengths
- Device shall reduce input from user
- Device shall maintain a consistent and uniform appearance
- Device shall appropriately set insulation within tolerances for end conditions
- Device shall be compatible with tube diameters ranging from:
  - $\frac{3}{8}$ "
  - $\frac{1}{2}$ "
  - $\frac{5}{8}$ "
  - $\frac{3}{4}$ "
  - $\frac{7}{8}$ "
  - 1"
- Device shall not permanently warp tubing
- Device shall not destroy insulation

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### **3.2** *What it should do*

Insulate tubing without damage to the insulation or the tube.

Reduce assembly time and eliminate ergonomic issues

## **4 Mechanical Requirements**

### **4.1** *Spatial Requirements*

This device should be user driven, staying in the constraints of the current working area.

### **4.2** *Durability Requirements*

The mechanism should be able to handle 50-100 a day, easily keeping up with the 5000 items a year.

### **4.3** *Reliability Requirements*

All components shall have 95% reliability

## **5 Electrical Requirements**

### **5.1** *Operational Voltage*

The system should be able to operate off a standard 120V wall outlet, or air.

## **6 Software Requirements**

### **6.1** *Possible*

Possible use of an Arduino to control the prototype.

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## 7 Environmental Requirements

### 7.1 N/A

This project will be designed to operate in a controlled, indoor, and air conditioned environment.

## 8 Cost Requirements

### 8.1 *Prototype Cost*

Cost of the first prototype shall not exceed \$500.

### 8.2 *Production Requirements*

Projected cost for production units shall be < \$1500.

## 9 Schedule Requirements

The following are the major Project Milestones:

- Approval of Requirements Sept. 30, 2018
- Concept Design Review Nov. 30, 2018
- Detailed Design Review Feb. 9, 2019
- ER of drawing package March 2, 2019
- Complete Prototype build April 5, 2019
- UI Design EXPO April 26, 2019
- Final Report / Drawings May 4, 2019