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**AIMS FRP RETROFIT BRIDGE RAIL SYSTEM**  
  
**PULTRUSION PROCESS CRITICAL STEPS**

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## 1.0 PURPOSE:

Pultrusion is a portmanteau made from the words “pull” and “extrusion” because it involves pulling the composite material from a die. AIMS has created this document as a reference to help explain the pultrusion process and critical steps to be used in conjunction with the drawings referenced later in the document (6.2). With the critical steps identified to make the rail shape, AIMS knows that minor variations may exist from manufacturer to manufacturer but this document serves as an accurate description to all pultrusion processes in general for any pultruded fiberglass shape including the rail and splice.

## 2.0 SCOPE:

This document describes the critical steps that need to take place in the pultrusion process for the FRP structural members (Rail and Splice) in the AIMS FRP Retrofit Bridge Rail System.

## 3.0 RESPONSIBILITIES:

- 3.1 AIMS is responsible for the development, implementation and maintenance of this document.
- 3.2 All AIMS employees, contractors and sub-contractors are responsible to follow these work instructions during the course of work activities that are under the control of AIMS Management and Supervision; whether the work is carried out at AIMS facilities, at contractor or sub-contractor facilities, or at those of our clients.
- 3.3 End User may provide TPI as required by their requirements. **AIMS has an open-door policy which allows the end user to inspect the manufacturing of any of the parts for an order at any time throughout the duration of the order.**

## 4.0 DEFINITIONS:

- 4.1 **AIMS or AIMS International:** Trade names for **Asset Integrity Management Solutions, LLC**
- 4.2 **FRP:** Fiberglass Reinforced Plastic
- 4.3 **PPE:** Personal Protective Equipment
- 4.4 **SDS:** Safety Data Sheet

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**4.5 TPI:** Third Party Inspector

## **5.0 SAFETY:**

- 5.1** AIMS employees, contractors, sub-contractors and TPI shall read and fully understand all SDS documents of all chemicals that are used during the manufacturing process.
- 5.2** PPE appropriate to the inspection site shall be worn at all times.
- 5.2.1** Safety Glasses
  - 5.2.2** Safety Shoes (Steel Toe boots)
  - 5.2.3** Ear Protection (as required)
  - 5.2.4** Dust mask (as required)
  - 5.2.5** Gloves (as required)

## **6.0 REFERENCES:**

- 6.1** Technical Specification for AIMS FRP Retrofit Bridge Rail System Rev. 8 dated August 15, 2018
- 6.2** AIMS Drawings
- 6.2.1** 1702039-DRW COMPLETE REV H
  - 6.2.2** 1702039-DRW-2000: Pultrusion Process Overall View
  - 6.2.3** 1702039-DRW-2001: Pultrusion Process Details
  - 6.2.4** 1702039-DRW-2002: Guardrail Pultrusion Section
  - 6.2.5** 1702039-DRW-2003: Guardrail Cross Section
  - 6.2.6** 1702039-DRW-2004A: Splice Insert Cross Section
  - 6.2.7** 1702039-DRW-2005A: Splice Insert Pultrusion Section

## **7.0 GUIDE FOR SETUP BEFORE PULTRUSION PROCESS:**

Refer to AIMS Technical Specification (referenced in section 6.1) and drawings (referenced in section 6.2) for material specs and finished product tolerances.

- 7.1.** When mounting the die, configure the arrangement of roving, mat, and veil to

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enter the die efficiently.

- 7.2 Arrange the roving into the general shape of the rail to properly enter the die during the pultrusion.
- 7.3 Arrange the stainless steel tube into the die with pipe stands to support the 56' length.
- 7.4 Setup a welding station between the glass roving to weld the stainless-steel tube pieces as the pultrusion proceeds.
- 7.5 Run a quick check on the pultrusion pulling system to ensure it is functioning in operating condition.
- 7.6 Room temperature for storage shall be determined by the resin manufacturer (AIMS specified resin calls out the room temperature to be below 75°F).
- 7.7 AIMS specified resin details that the resin should be warmed to at least 65°F prior to use in order to assure proper curing and handling.
- 7.8 The temperature of the die must reach the set temperature of 270°F ( $\pm 10^\circ\text{F}$ ) and then the pultrusion process may begin.
- 7.9 A manufacturer may have a cooling water system setup to cool down the shape after it has been pultruded but it is not required.

## 8.0 CRITICAL STEPS FOR THE PULTRUSION PROCESS:

Refer to AIMS drawings (referenced in 6.2.2 - 6.2.5) to visualize the critical steps of the pultrusion process. The initial samples pulled of the rail shall be checked for visual inspection and dimensions/tolerances referenced in the drawings. Once the initial sample checks are complete and accurate, test samples shall be pultruded and tested to meet the material properties in AIMS Technical Specification (referenced in section 6.1) before the entire 56' pieces may be pultruded.

- 8.1 Arrange the single end roving in the glass feed racks based on the matrix configuration called out in AIMS Technical Specification (referenced in Section 6.1).
- 8.2 Configure the roving to allow the ends to enter into the first carding plate.

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- 8.3 The following carding plates will consolidate the roving into thicker ends which will form the shape of the rail cross section.
- 8.4 Glass mat placed on the pylons are configured to allow the fabric to enter the impregnator on the outside of the cross section and around the rectangular floating mandrel and stainless steel tube. The stainless steel tube will act like a floating mandrel as it is being inserted during the pultrusion process.
- 8.5 The rectangular floating mandrel allows the rail cross section to have the proper void area to fit the FRP splices.
- 8.6 Synthetic veil is also placed on pylons and enters the impregnator as the outermost layer and it is only used on the outer perimeter of the shape.
- 8.7 The glass roving, mat, and synthetic veil is then impregnated with the resin mix which is pumped into the impregnator with a pressure between 80 psi ( $\pm$  10 psi).
- 8.8 Some companies may recycle the excess resin that is pumped into the impregnator, if so; ensure that the excess resin is filtered for debris before being reused.
- 8.9 The glass, veil, and resin continue to move through the die which is heated to a temperature of 270°F ( $\pm$  10°F) to allow the resin to cure.
- 8.10 Pullers provide the required rate of pull based on the volume of the shape. The pullers will need to be adjusted to ensure the resin is cured before it leaves the die. The pull rate for the rail is 6" per minute ( $\pm$  1" per minute). Adjustments to the pull rate can be made to maintain product quality.
- 8.11 As the shape comes out of the die, it is now cured and it continues down the length of the pultrusion machine until it reaches 56'-0" ( $\pm$  1/8") at the cut-off saw.