

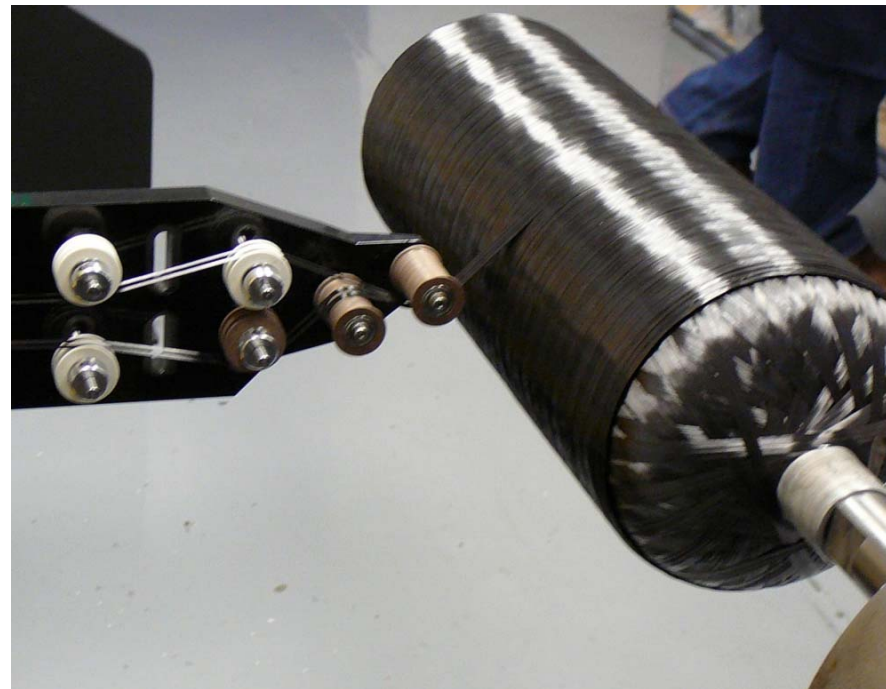
## TCR™ PREPREGS

# TCR™ Towpreg Winding Delivery System Optimization



## Winding Delivery System Optimization

***The delivery system that makes prepregs run smoothly is slightly different from a wet winding system.***



## Winding Delivery System Optimization

### Special Requirements for Towpreg Filament Winding

- **Must have higher fiber tension than wet winding (at the spool and mandrel/part)**
- **Requires rollers for the complete fiber path**
- **Should have a swiveling, or powered delivery head**
- **Does not require dust particle or fume extraction system**

## Winding Delivery System Optimization

# Towpreg Delivery System Specifications

- **Tensioners**
- **Rollers**
- **Delivery head**
- **Facilities requirements (creel box, ventilation/pressurization, freezer, etc.)**

*The following pages provide details of each specific above.*

## Winding Delivery System Optimization

### Tensioners

- **Fiber take-up capability to keep tension on the spools and part at all times**
- **Every direction change has the possibility of de-tensioning the fiber. If this occurs the fiber could...**
  - **Wrinkle and break or weaken**
  - **Become misaligned, creating a gap or lap**
  - **Become loose and not nest properly**

## Winding Delivery System Optimization

Tensioners continued...

### •TCR recommends Rewind Tensioners

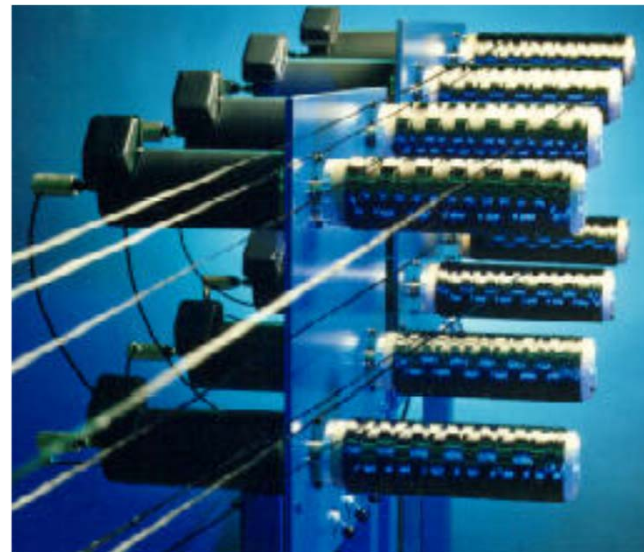
- **CTC mechanical tensioners with dancer bar take-up will also work but are NOT as consistent.**
- **Tensioners should have the capability of 10 lb tension for use with 12K carbon fiber and up to 20 lb tension if needed for larger tow (24K - 60K fiber), based on part design.**
- **Tension should be maintained to ensure proper fiber nesting and good fiber unspool.**
- **Tensioners may be housed in a cabinet that is remote or in a cabinet that travels with the delivery head.**
- **There is no need for long distance, space-wasting, remote tensioner creels.**



## Winding Delivery System Optimization

Tensioners continued...

An important characteristic necessary for repeatable products is to have **CONSTANT CONTROL** tension over the **COMPLETE** path of the fiber.



*Examples of available Rewind Tensioner Systems*

## Winding Delivery System Optimization

### Rollers

- **Each individual roller must take the fiber all the way to the final delivery roller, where the towpregs come together, onto one smooth roller.**
- **The fiber should have a straight path from roller to roller in order to keep the towpreg flat like ribbon.**
- **Shoulders should not be used on the rollers, as this will cause folding and twisting of the towpreg.**
- **Fiber path changes should be on the same plane so that the entire width of the fiber travels the same distance at equal tension**



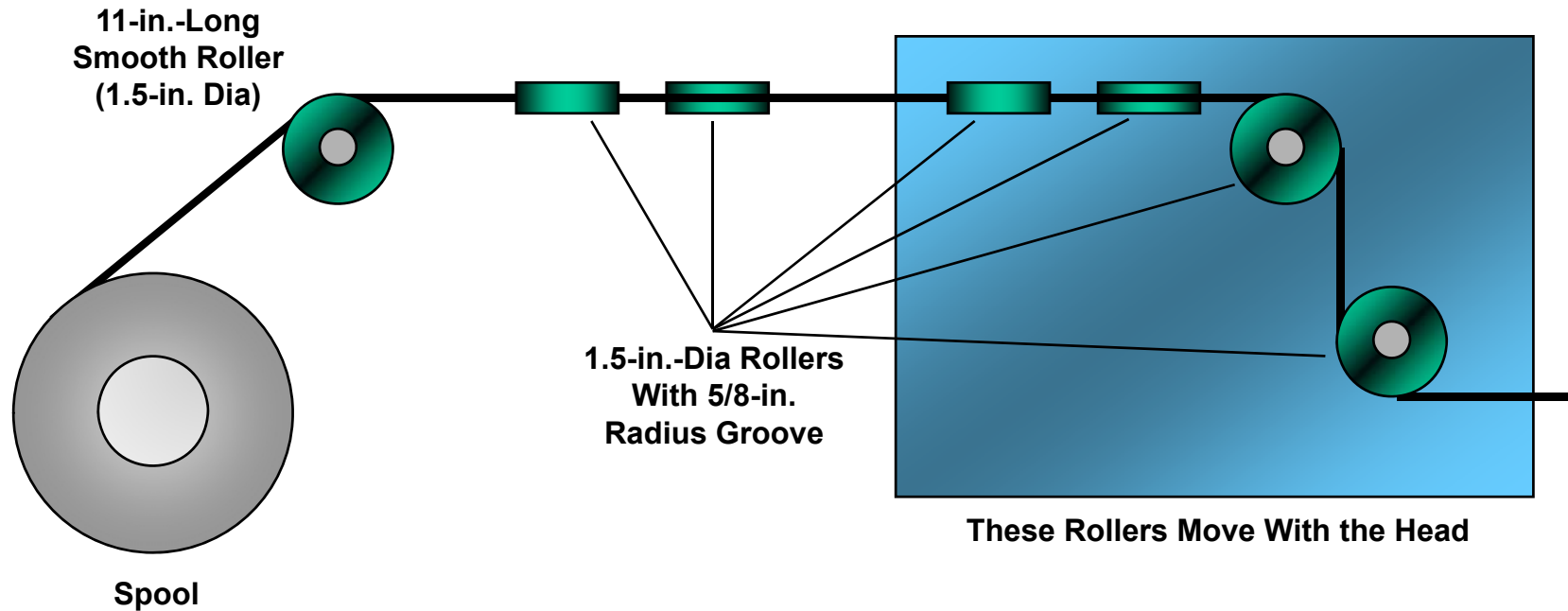
## Winding Delivery System Optimization

### Rollers continued...

- **Each individual roller must take the fiber all the way to the final delivery roller, where the towpregs come together, onto one smooth roller.**
- **Made from non-stick materials:**
  - Teflon
  - Glass- or bronze-filled Teflon (more durable than Teflon)
  - Teflon-coated aluminum or Teflon-coated steel, etc. (uncoated stainless steel or aluminum will also work, but not as well)
- **Need bearings**
  - Ball or roller bearings work best
  - Bushings will also work, but tend to wear out more quickly

## Winding Delivery System Optimization

### DELIVERY SYSTEM USING A FIXED CREEL AND REWIND OR TAKE-UP TENSIONERS

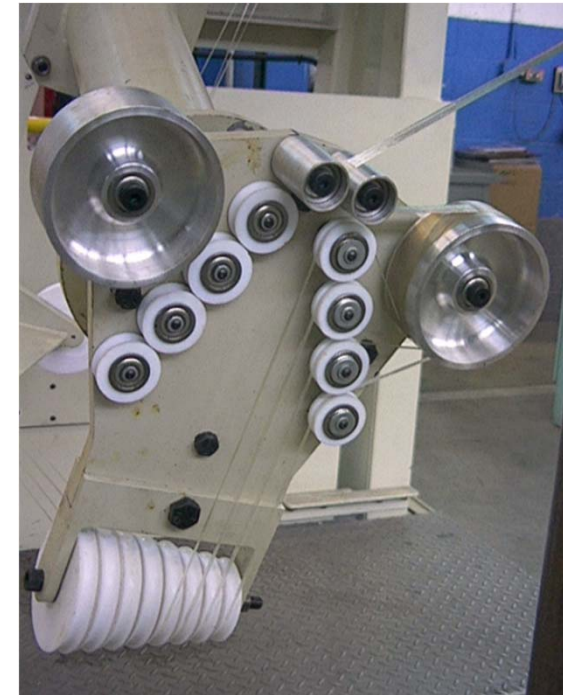


## Winding Delivery System Optimization

### Rollers continued...



**Glass- and Bronze-filled Teflon Rollers**



**Teflon and Non-coated Stainless Steel Rollers**

## Winding Delivery System Optimization

### Rollers continued...

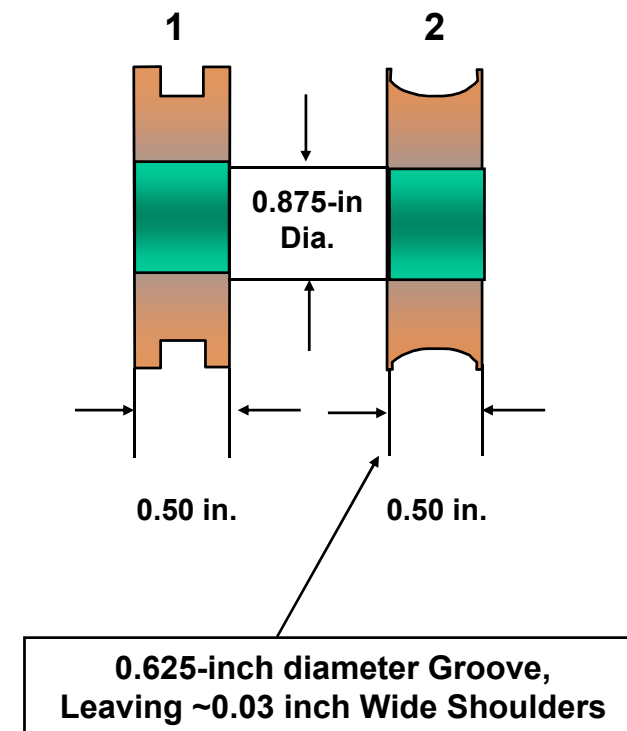
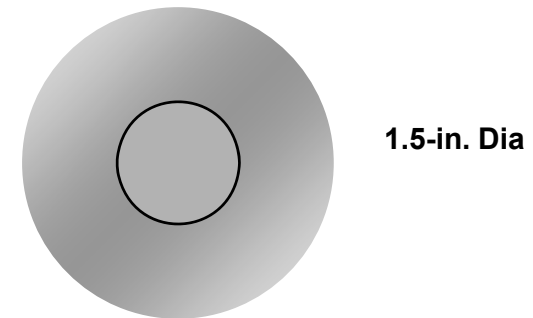
### Examples of roller types

#### Roller No. 1

- 1.5-in.-diameter shoulder**
- 1.25-in. diameter at bottom of groove**
- Width of roller: 0.50 in.**
- Width of groove: 0.125 in.**
- Standard bearing: 0.875-in. diameter**  
(Used in delivery head for final fiber alignment. Groove width should match fiber bandwidth. If used before delivery head, groove width should be slightly wider than fiber bandwidth.)

#### Roller No. 2

- 1.5-in.-diameter shoulder**
- 1.25-in.-diameter at bottom of groove**
- Width of roller: 0.50 in.**
- Width of groove: See sketch**
- Standard bearing: 0.875-in. diameter**  
(“Universal” roller which can be used anywhere before delivery head.)



## Winding Delivery System Optimization

### Delivery Head

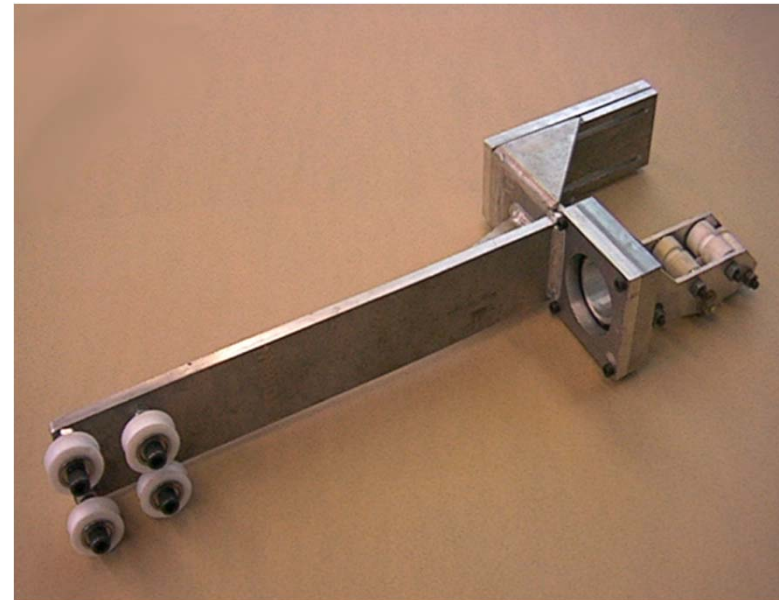
- **Powered or free-castoring**
- **Towpreg will make constant twist when changing from horizontal to vertical, etc., but *fiber direction changes should be accomplished by moving in and out of roller set of “S” rollers on same plane***
- **Multiple towpregs may be combined at the last roller or on the mandrel itself**

## Winding Delivery System Optimization

### Delivery Head continued...



**Powered Delivery Head**



**Simple Castoring Delivery Head**



## Winding Delivery System Optimization

# Delivery System Review

• **Towpreg winding is simple and efficient when the basics are followed:**

- **Tensioners with take-up capability**
- **Tension is ~10 lbs (4.5 kgs)**
- **Rollers are used throughout**
- **Towpreg fiber path is carefully aligned**
- **Castoring or powered delivery head is used**
- **Use TCR™ Towpreg**

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