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Lab Scale Bicomponent Extruder Fed Spinning Machine Model LBS

Equipment Description November 2024



LBS-100 w/ quench & surface driven winder

Machine Description

These machines are designed for laboratory use to make small amounts of bicomponent fiber using only small amounts of polymer. It requires as little as 40 grams of polymer to make 100 meters of fiber. It's simplified design also makes it easy to operate and maintain. The system consists of 2 single screw extruders connected to a spinneret block. The extruder speeds are set to deliver the desired flow rates. Torque limiters are provided to prevent over pressure. It is easily disassembled for cleaning. In addition to the pack, there are only 5 wetted parts to be cleaned with no blind passages. Note that the simplified design means the tolerances of fiber properties (denier & bico ratio) are limited to +/- 10%. Meter pumps can be added as an option to get production fiber tolerances of +/- 0.5%, however the minimum polymer requirements and maintenance are increased.

Equipment specifications

The machine is very versatile and with optional parts can be converted to run spunbond material, meltblown materials, monofilaments, and more in almost any cross section desired.

There are two sizes available offering different capacities, spinneret hole counts, and nonwoven widths.

1. **Model LBS – 100** - Lab Scale Bicomponent Melt Extrusion Unit – 2kg/hr total (1kg/hr/extruder) (PP 35 MFI)
2. **Model LBS – 330** - Lab Scale Bicomponent Melt Extrusion Unit – 6kg/hr total (3kg/hr/extruder) (PP 35 MFI)

Model LBS – 100 - Lab Scale Bicomponent Melt Extrusion Unit

Complete unit ready to run

1. Extruder unit, with drive mechanisms
(Variable speed D.C. electric motor driven)
 - Throughput range: 0.2 to 2 kg/hr total [0.1 to 1 kg / hour for each extruder] (PP 35 MFI).
 - Extruder Barrel Pressure rating of 7,500 psi (500 bar)
 - Screw size 5/8" dia – 24:1 l/d (16mm)
 - Can deliver polymer pressure of 2500 psi (166 bar)
 - Temperature capability of up to 350 °C with control of ± 3 °C.
 - Electrically heated, 5 zones: 2 / extruder; 1 spinneret
 - Pack block - 17-4 ph stainless steel
 - Torque limitation on extruder screw for barrel over pressure protection
 - Control of extruder screw speed $\pm 5\%$ via KBIC dc motor controller (pressure controls optional)
 - Hoppers with N2 Purge port and shutoff valve, 11.3 L (0.4 ft3)

- Analog gauge type pack pressure indicators
- Quantity of unused polymer in each system less than 10 cc

2. Spin Pack – qty 1

- Spinneret: 19 round holes, 0.35mm dia, shaped holes available
- Screen sandwich type filters
- Two (2) sets - Distribution plates for homo, side-by-side, sheath/core, 16 segment pie and 36 islands-in-the-sea. Others available such as: nanofiber islands-in-the-sea, 10 stripes, trilobal core, hollow fiber, etc.
- Screens and seals for 100 pack builds

**Note: The standard packs will make good cross sections when using fiber grade melt spinnable polymers between 600 and 2000 poise. Bicomponent ratios and flow rates will vary depending on the polymer combination used. Custom packs can be designed and built to make almost any cross section desired.*

3. Filament Winder, surface driven type

- 50 – 1000 meter / minute
- 75 mm id x 150 mm cardboard bobbins (100 each)
- Groove roll traverse

4. Special tools and expendables

- 10 spare extruder seals (5 tear downs)
- Anti-seize for bolts
- Brass spinneret scraper
- Fiber scissors
- Pack installation handle
- Doff stick
- Extruder barrel brush
- Copper gauze for wiping spinnerets
- Fiber cross section microtome
- Hand held string up aspirator

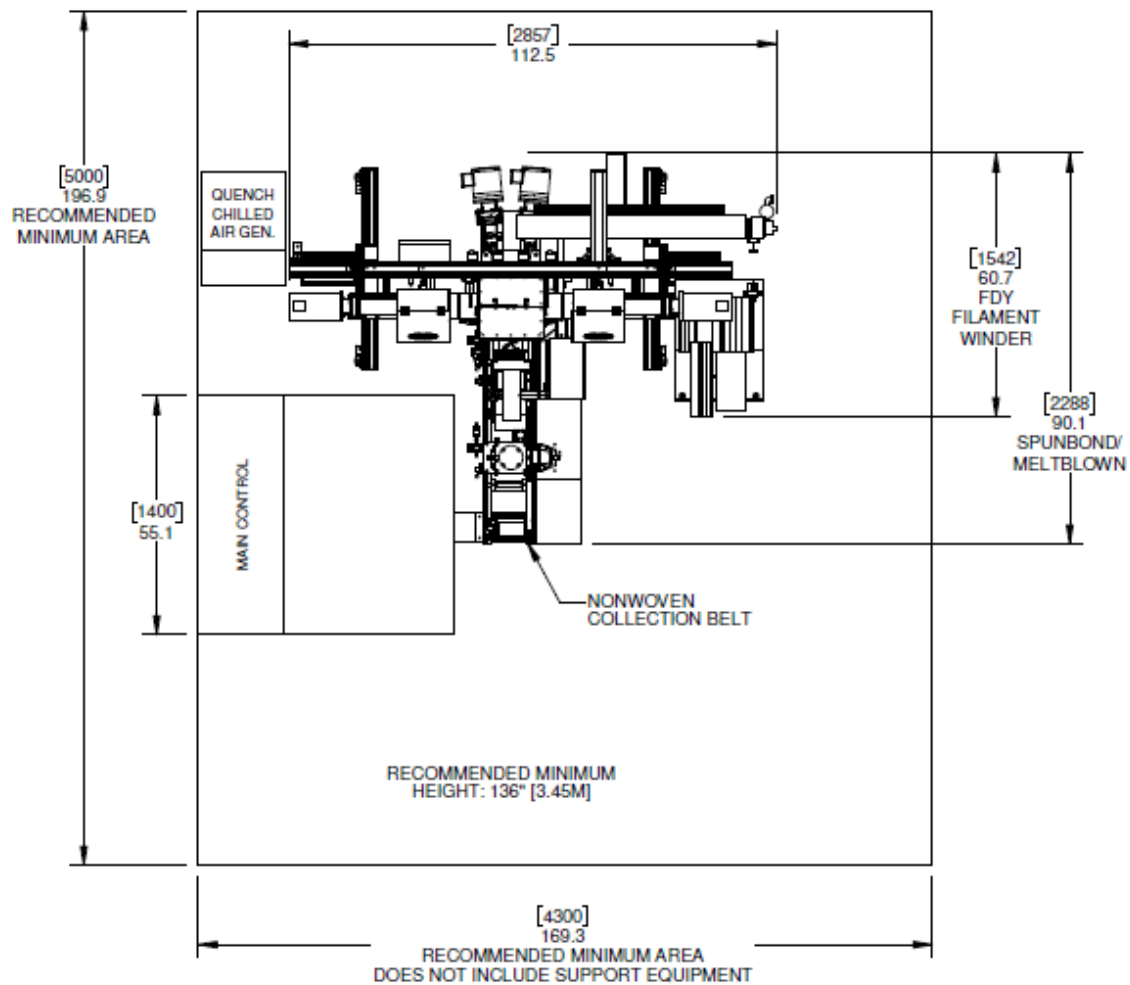
The Base unit as described above includes all the special tools needed to run the machine. Machine operation will also require some standard tools and support equipment that is usually found in industrial shops. These accessories can be purchased from Hills as options.

Utilities - LBS-100

- Main Control Enclosure
 - o (MCE): 220VAC \pm 10%/1PH/50-60HZ/110A/ BREAKER 130A
 - o (MCE3): 220VAC \pm 10%/3PH/50-60HZ/70A/ BREAKER 80A
 - o (MCE380): 380,400VAC \pm 10%/3PH WITH FULL SIZE NEUTRAL/50-60HZ/60A/ BREAKER 70A

- (MCE460): 460VAC±10%/3PH/60HZ/40A/ BREAKER 50A
 - Melt Blown
 - (MBCE): 220VAC±10%/1PH/60HZ/30A/ BREAKER 40A
 - (MBCE3): 220VAC±10%/3PH/50-60HZ/20A/ BREAKER 30A
 - (MBCE380): 380,400VAC±10%/3PH/50-60HZ/10A/ BREAKER 30A
 - (MBCE460): 460VAC±10%/3PH/50-60HZ/10A/ BREAKER 30A
 - Human-Machine Interface
 - (HMICE): 120VAC±10%/1PH/50-60HZ/5A/ BREAKER 10A
 - (HMICE240): 240VAC±10%/1PH/50-60HZ/5A/ BREAKER 10A
 - Denier Stand
 - 460VAC±10%/3PH/50-60HZ/8A
 - Draw Stand
 - (DSCE): 380,400VAC±10%/3PH/50-60HZ/60A/ BREAKER 70A
 - (DSCE460): 460VAC±10%/3PH/50-60HZ/50A/ BREAKER 60A
 - Chilled Air Generator for air quench
 - 120VAC±10%/1PH/50-60HZ/11A
 - Cleaning Oven
 - 460VAC±10%/3PH/50-60HZ/27A
 - Cooling Water for extruder:
 - 0.2 GAL/MIN 70°F [0.9 L/m 20°C]; IN & OUT per extruder
 - Compressed Air:
 - String-up Aspirator: 158 CFM@ 100 PSI [270 NM3/H @ 6.9 BAR]
 - Winder Standard: <1 CFM @ 80 PSI [2 NM3/H @ 5.5 BAR]
 - Spunbond Gun: 45 CFM@ 100 PSI [76 NM3/H @ 6.9 BAR]
 - Meltblown: 40 CFM@ 50 PSI [68 NM3/H @ 3.5 BAR]
 - Spunbond Slot Asp: 70 CFM@ 100 PSI [120 NM3/H @ 6.9 BAR]
 - Web former Compaction Roll 2 CFM@ 90 PSI [130 NM3/H @ 6 BAR]
 - Draw stand separator rolls 7.5 CFM@ 100 PSI [13 NM3/H @ 6.9 BAR]
 - Tension Controlled Winder <1 CFM @ 60-80 PSI [2 NM3/H @ 4.1-5.5 BAR]
 - Nitrogen: 5 CFH (3 L/m)
- *Utilities are subject to change

Recommended Minimum Room Layout – LBS-100



Floor Plan LBS-100 machine w/ forming table & chiller. The layout shown is the minimum required to run the machine. More room is advised for more comfortable operations.

Note: Additional space needed for a pack assembly work bench and pack cleaning equipment. These items should be located in a different room.



LBS-100 FDY fiber arrangement with 3 roll draw stand, metered spin finish, quench, self-contained air chiller, and 2000 m/m production winder



LBS-100 Spunbond arrangement with quench (air chiller & blower connection not shown), slot aspirator, web former w/ 2 sheet un-winds and, calender



LBS-100 Meltblown arrangement with forming drum

Model LBS – 330 - Lab Scale Bicomponent Melt Extrusion Unit

Complete unit ready to run

The LBS-330 is our latest design at 6 kg/hr total (when configured as a bicomponent system) offering wider nonwoven capabilities. The height adjustment of the spin head is a powered jack-screw system allowing the user to change spinning and collecting distances.

1. Extruder unit, with drive mechanisms
(Variable speed D.C. electric motor driven)
 - Throughput range: 0.6 to 6 kg/hr total [0.3 to 3 kg / hour for each extruder] (PP 35 MFI).
 - Extruder Barrel Pressure rating of 7,500 psi (500 bar)
 - Screw size 3/4" dia – 30:1 l/d (19mm)
 - Can deliver polymer pressure of 2500 psi (166 bar)
 - Temperature capability of up to 350 °C with control of $< \pm 3$ °C.
 - Electrically heated, 7 zones: 3 / extruder; 1 spinneret
 - Pack block - 17-4 ph stainless steel
 - Torque limitation on extruder screw for barrel over pressure protection
 - Control of extruder screw speed $\pm 5\%$ via KBIC dc motor controller (pressure controls optional)
 - Hoppers with N2 Purge port and shutoff valve, 11.3 L (0.4 ft³)
 - Quantity of unused polymer in each system less than 50 cc
2. Spin Pack, Filament – qty 1
 - Spinneret: 72 round holes, 0.35mm dia
 - other diameters and shaped holes available – additional costs may apply.
 - Pack top – 17-4 ph SS
 - Screen support plate – 17-4 ph SS
 - Screen sandwich type filters
 - Two (2) sets - Distribution plates for homo, side-by-side, sheath/core, 16 segment pie and 36 islands-in-the-sea. Others available such as: nanofiber islands-in-the-sea, 10 stripes, trilobal core, hollow fiber, etc.
 - Screens and seals for 100 pack builds

**Note: The standard packs will make good cross sections when using fiber grade melt spinnable polymers between 600 and 2000 poise. Bicomponent ratios and flow rates will vary depending on the polymer combination used. Custom packs can be designed and built to make almost any cross section desired*

3. Filament Winder, surface driven type
 - 100 – 1000 meter / minute
 - 75 mm id x 150 mm cardboard bobbins (100 each)
 - Groove roll traverse

4. Special tools and expendables
 - 10 spare extruder seals (5 tear downs)
 - Anti-seize for bolts
 - Brass spinneret scraper
 - Fiber scissors
 - Pack installation handle
 - Doff stick
 - Extruder brush
 - Copper gauze for wiping spinnerets
 - Fiber cross section microtome
 - Hand held string up aspirator

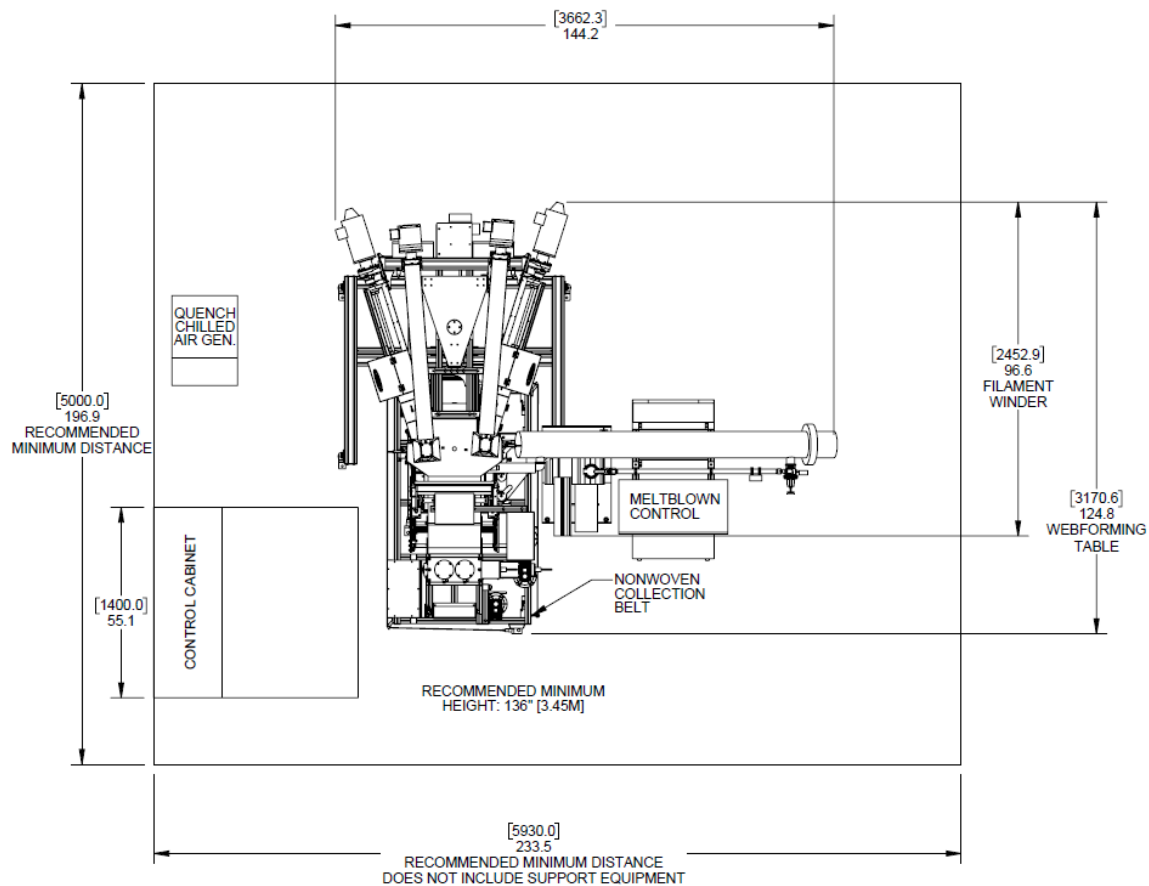
The Base unit as described above includes all the special tools needed to run the machine. Machine operation will also require some standard tools and support equipment that is usually found in industrial shops. These accessories can be purchased from Hills as options.

Utilities - LBS-330

- Main Control Enclosure
 - o (MCE): 220VAC \pm 10%/1PH/50-60HZ/209A/ BREAKER 210A
 - o (MCE3): 220VAC \pm 10%/3PH/50-60HZ/83A/ BREAKER 90A
 - o (MCE380): 380,400VAC \pm 10%/3PH WITH FULL SIZED NEUTRAL/50-60HZ/70A/ BREAKER 70A
 - o (MCE460): 460VAC \pm 10%/3PH/60HZ/58A/ BREAKER 60A
- Melt Blown
 - o (MBCE3): 220VAC \pm 10%/3PH/50-60HZ/165A/ BREAKER 170A
 - o (MBCE380): 380,400VAC \pm 10%/3PH/50-60HZ/96A/ BREAKER 100A
 - o (MBCE460): 460VAC \pm 10%/3PH/50-60HZ/57A/ BREAKER 70A
- Denier Stand
 - o 380,400VAC \pm 10%/3PH WITH FULL SIZED NEUTRAL/50-60HZ/5A/ BREAKER 10A
 - o 460VAC \pm 10%/3PH/50-60HZ/5A/ BREAKER 10A
- Draw Stand
 - o (DSCE): 380,400VAC \pm 10%/3PH/50-60HZ/45A/ BREAKER 50A
 - o (DSCE460): 460VAC \pm 10%/3PH/50-60HZ/37A/ BREAKER 40A
- Chilled Air Generator for air quench
 - o 110VAC \pm 10%/1PH/50-60HZ/12.5A
 - o 240VAC \pm 10%/1PH/50-60HZ/6.4A
- Cleaning Oven
 - o 460VAC \pm 10%/3PH/50-60HZ/31A/ BREAKER 40A
 - o Cooling Water: 150 GAL/HR @ 15 PSI
- Extruders:
 - o Cooling Water: 24 GAL/HR 65°F [1.5 L/m 16.5°C]; IN & OUT per extruder
- Compressed Air:
 - o Base Machine: 69 CFM @ 80 PSI [112 NM³/H @ 5.5 BAR]
 - o String-up Aspirator: 1122 CFM @ 90 PSI [1806 NM³/H @ 6.2 BAR]

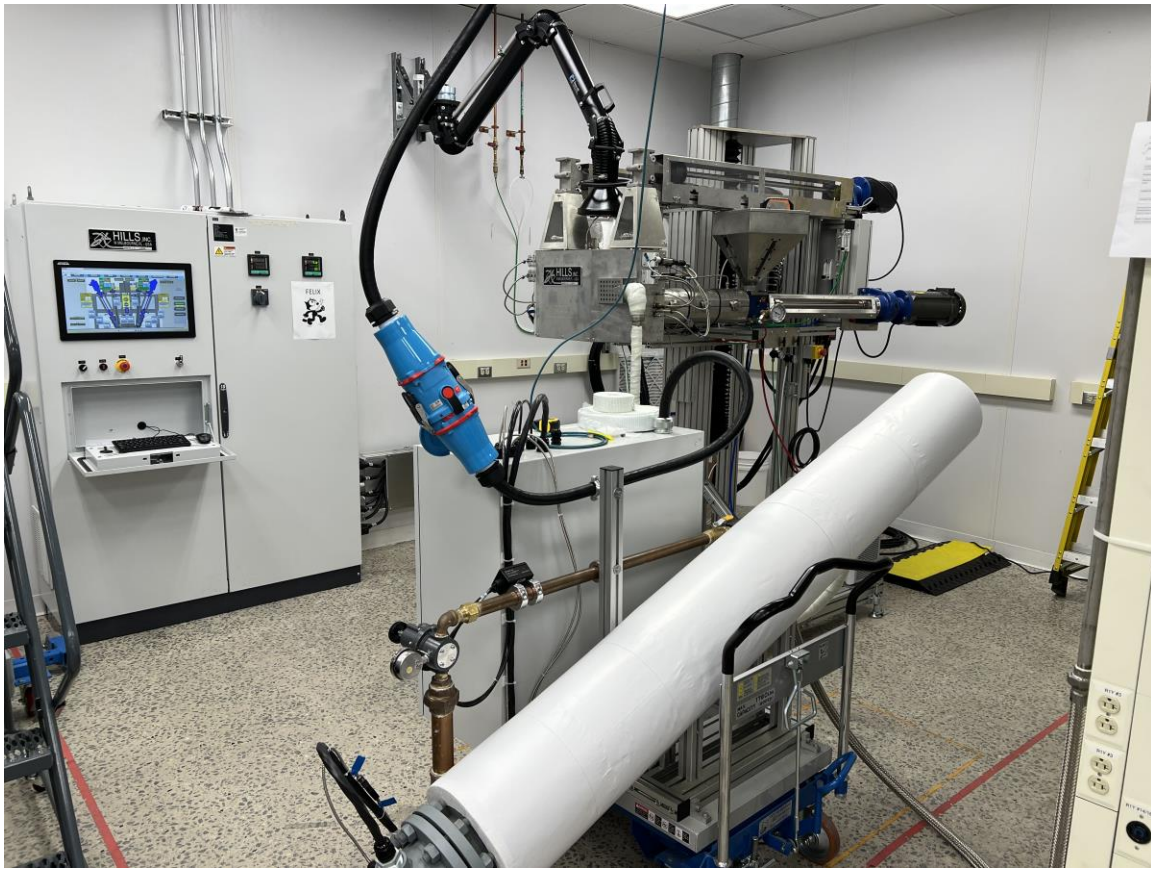
- Winder Standard: <1 CFM @ 80 PSI [2 NM3/H @ 5.5 BAR]
 - Meltblown: 200 CFM @ 14 PSI [322 NM3/H @ 1.0 BAR]
 - Spunbond Slot Asp: 275 CFM @ 90 PSI [443 NM3/H @ 6.2 BAR]
 - Web former Compaction Roll <1 CFM @ 80 PSI [<1 NM3/H @ 5.5 BAR]
 - Draw stand separator rolls 8 CFM @ 80 PSI [12 NM3/H @ 5.5 BAR]
 - Tension Controlled Winder <1 CFM @ 80 PSI [<1 NM3/H @ 5.5 BAR]
- Nitrogen: 5 CFH (3 L/m)
- Note: utilities are subject to change

Recommended Minimum Room Layout LBS-330



Floor Plan LBS-330 machine w/ forming table & chiller

Note: Additional space needed for a pack assembly work bench and pack cleaning equipment. These items should be located in a different room.



LBS-330 Base Machine with Meltblown arrangement

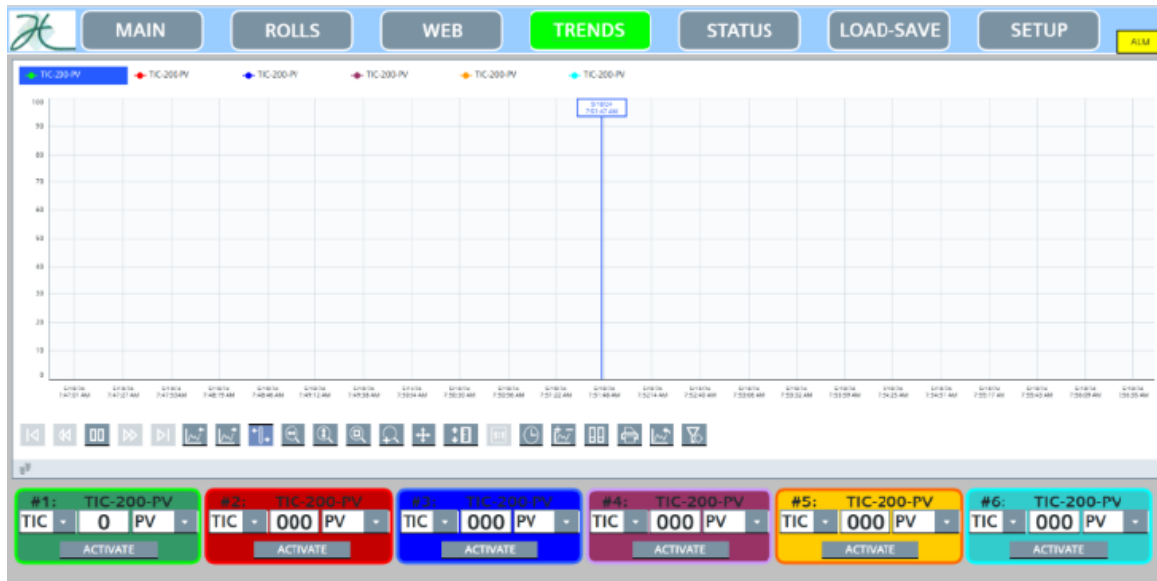
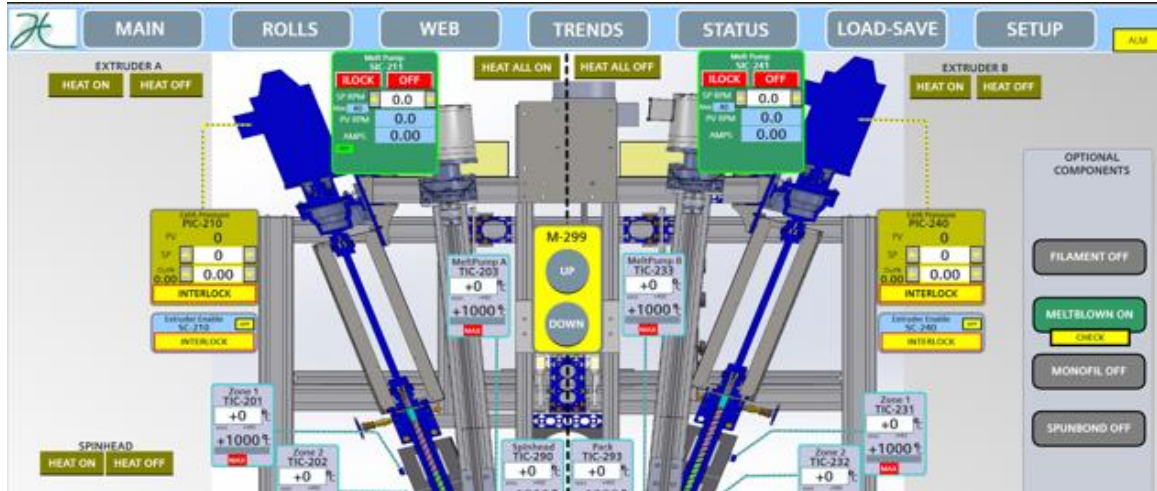


Forming Drum and Industrial Quality Control Cabinets

Options & Accessories

Base Machine Options:

- High Temperature - rating to 450°C
- Corrosion resistant wetted parts for running fluoropolymers
- Melt pumps – melt metering pumps to produce fiber tolerances of +/- 0.5%
- Computer Control Supervisor – features included: Siemens HMI software on a Windows PC, data logging, trending graphs, recipe save/load and VPN access for remote trouble shooting



Filament Accessories:

- Filament Air quench cabinet, 1.0M lg, w/ variable speed blower
- Chiller coil for quench cabinet for customer supplied chilled water
- Air chiller for quench cabinet, self-contained unit
- Melt pump upgrade, includes: melt pumps, drives and controls
- Spin finish system, kiss roll type or metered type
- Denier roll stand, 250-2000 mpm, dual canted type, unheated

- Draw roll stand w/ 3 sets of heated rolls, 500-2500 mpm, 230°C max temp, with separator rolls
- Production type winder, 2000 mpm w/ bobbins

Spunbond Accessories

- Spunbond Pack
 - o LBS-100: uses 19-hole filament pack with 32mm wet width included with base machine
 - o LBS-330: 144-hole with 220mm wet width
 - Distribution plates to make homo-component, side-by-side, and sheath/core cross-sections
- Gun type Spunbond aspirator for fiber property study only. Not for study of web formation.
- Slot type Spunbond Aspirator
 - o LBS-100: 75mm wide
 - o LBS-330: 220mm wide
- Web forming table with compaction roll, calender, winder and leader sheet unwind for spunbond webs.
 - o LBS-100:
 - Belt Speed: 3-35 m/min
 - Single-zone vacuum system with interchangeable plates to control air flow in the forming and hold down areas.
 - o LBS-330:
 - Belt Speed: 5-50 m/min
 - Dual-zone vacuum system for independent control of the forming and hold down areas.
 - Pneumatic belt tensioning

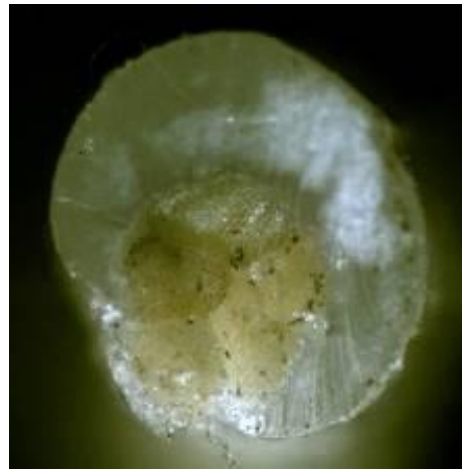
Meltblown Accessories:

- Meltblown upgrade, includes: air heater, meltblown dies, assembly fixture, hydro tester, and burnout basket
 - o 25 hpi s/c, 100 hpi s-s submicron & 100 hpi s-s nano
 - o LBS-100 die: ~22mm wet width
 - o LBS-330 die: ~150mm wet width
- Web collector drum with winder and leader sheet unwind for meltblown webs
 - o LBS-100: 10-100 m/min with 60mm active width
 - o LBS-330: 10-100 m/min with 250mm active width

Note: Width dimensions given for the non-woven components indicate the active width of the component and are not intended to suggest the equipment can produce non-woven materials of the same width.

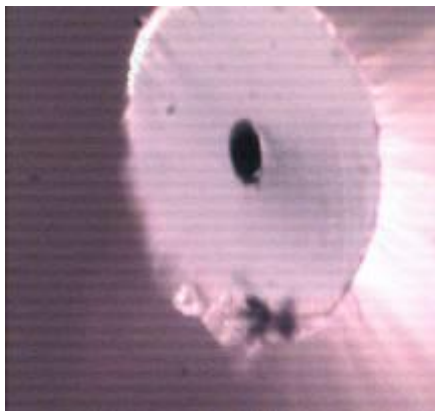
Other Accessories and Auxiliary Equipment:

- Monofilament pack and water quench
- Thread coating attachment– Coats thread with a sheath of melt processable polymer



Cross section of a Kevlar thread coated with PP

- Metal core fiber attachment – makes monofilaments with low melt temperature metal cores



- Special extruder screws
- Custom packs for any cross section
- Burn out oven for cleaning polymer from packs and parts
- Ultra-sonic tank for cleaning spinnerets
- Small lots of Polymer

Required support equipment

- Standard mechanics tool kit
- Torque wrench – 10-60 ft-lbs
- Aluminum surface work bench for assembling packs
- Inert atmosphere burn-out oven for cleaning polymer from parts
- Ultrasonic tank for cleaning spinnerets

Optional support equipment

- Preheat oven for preheating packs for quicker pack changes
- Microscope for inspecting spinnerets
- Microscope for viewing fiber cross sections