Document No. 583040027

Date of creation 21th Jul 2020

Date of revision

MODEL

NF-103V

Electrospinning Setup
(NF-103)

OPERATION MANUAL

- Be sure to read this manual before operating the equipment.
  Please read the safety instructions thoroughly before operation.
- Please keep this manual to review anytime.

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NOTICE

HISTORY OF REVISION

The last number of the document number on the cover sheet represents the revision number of the document.

Revision number	Date of revision	Revised page / Description
0	21th Jul 2020	1st edition ※New number acquisition （Old drawing number：583040027）

Table of Contents NF Operation Manual

For Safety Operation

(1) Symbols for safety operations in this document

In this document warns dangerous operations to protect human bodies and properties from hazards and damages with the following symbols. Read through all the contents for full understanding.

WARNING

Death or serious injuries may result if mishandling of the equipment is made by ignoring this symbol.

CAUTION

Injuries or damage on properties may result mishandling of the equipment is made by ignoring this symbol.

(2) Descriptions of symbols

	⃠ represents “Prohibition”. This symbol means “Don’t disassemble”.
	△ represents “Caution” (including warning) . Contents to be pay attention to is shown in the triangle. This symbol means “Be careful of electric shock.”
	△ represents “Caution” (including warning) . This symbol means “(general) Caution.”
	The symbol represents a protective ground terminal. Be sure to connect it to the ground (earth) before operations.
I	This symbol means “POWER ON”.
O	This symbol means “POWER OFF”.

Safety Precautions

Safety Precautions

 **WARNING**	
Stop operations if the equipment generates smoke, odd smell or strange noise. It may cause electric shock and/or fire. Shut off the power immediately and disconnect the AC power plug. Contact our sales representative shown at the end of this manual. Note: Don't try to disassemble and repair the equipment by yourself. It is very dangerous!	 **ELECTRIC SHOCK**
Don't touch any terminals while power is on. It may cause electric shock.	 **ELECTRIC SHOCK**
Don't disassemble the equipment or touch the inside of the equipment while power is on. It may cause electric shock.	 **ELECTRIC SHOCK**
Don't disassemble or modify the equipment except as mentioned in this manual. It may cause injuries, electric shock and/or fire.	 **ELECTRIC SHOCK**
Do not use the power source out of the rated range. It may cause electric shock and/or fire. Secure rated voltage inputs in unstable power-supplying environments.	 **ELECTRIC SHOCK**
This equipment employs a three-prong plug with a ground terminal. Be sure to connect the plug to a receptacle with a protective ground terminal. If a two-prong plug has to be used, be sure to ground the protective ground terminal of the equipment to avoid electric shock and/or fire by leakage.	 **ELECTRIC SHOCK**

Safety Precautions

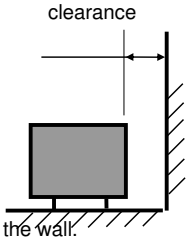
WARNING

Do not block the ventilator when an exhaust hose is not fixed to the NF103.
Blocking of the ventilator may hinder smooth exhaust inside of the spinning chamber.

Do not put an article, especially flammable materials such as paper and plastics, on the intake duct.

Do not turn the equipment upside down or over sideways.

Have a certain clearance for ventilations when the equipment is installed along the wall.



Do not insert or drop any metal or flammable articles in the rear of the main unit/ inside of mounting boards unit. It may cause electric shock and/or fire.
If any articles enter the equipment, shut off the power immediately and disconnect a power plug from the receptacle.
Then, contact our sales representative shown at the end of this manual.

ELECTRIC SHOCK

Spilling water or chemical over in the rear of the main unit/ in side of mounting boards unit may cause electric shock and/or fire. If some liquid is spilled, shut off the power immediately and disconnect a power plug from the receptacle.
Then, contact our sales representative shown at the end of this manual.

ELECTRIC SHOCK

Do not use a damaged power cord to avoid electric shock and/or fire.
Follow the instructions below.
- Do not modify the power cord.
- Do not put heavy objects on the power cord.
- Do not strain or bend the cord forcedly.

If the cord is damaged, please contact our sales representative shown at the end of this manual.

ELECTRIC SHOCK

Don't connect too many power cords to one receptacle.
It may cause fire.

FIRE

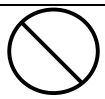
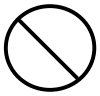
Mishandling of an AC power plug may cause fire.
Follow the instructions below.
- Don't insert a plug with dust to a receptacle.
- Insert a plug to a receptacle until the end securely.

FIRE

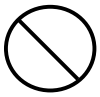
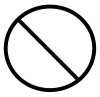
Please do not place combustibles, such as an organic solvents on a collector when electro spinning.
Electric discharge may cause ignition.
We at MECC cannot owe any responsibility for damage and injury occurred in the above usage.

FIRE

Safety Precautions

CAUTION	
Do not install the equipment on unstable places such as on unstable tables or inclined locations. It may cause rollover of the equipment and injuries.	 **INJURY**
Do not put heavy articles on the equipment. Do not ride or stand on the equipment. It may cause rollover of the equipment and injuries.	 **INJURY**
Do not operate in the area of high humidity or with much dust. It may cause electric shock and/or fire.	 **INJURY**
Be sure to use original power cords and connection cables. Use of substitutes may cause short circuits, discharge, electric shock, fire and/or malfunctions.	 **ELECTRIC SHOCK**
Each connection cable has a part of high voltage output. Be sure to turn off the power before connecting/disconnecting cables. It may cause electric shock. Be sure to confirm that cables are locked before connecting/disconnecting cables.	 **ELECTRIC SHOCK**
Don't handle power plugs with a wet hand. It may cause electric shock.	 **ELECTRIC SHOCK**
Don't strain the AC cord forcedly to disconnect. Damage on the cord may cause fire and/or electric shock. Grab the plug to disconnect the cord.	 **ELECTRIC SHOCK**
Be sure to shut off the power, pull out the AC plug and disconnect all the cables before moving the equipment. Otherwise, it may damage cables and cause electric shock and/or fire due to damages on cables.	 **ELECTRIC SHOCK**

Safety Precautions

 **CAUTION**	
Install the equipment on the floor with no vibrations from other machines. It may cause injuries by moving or fall of the equipment.	 **INJURY**
Unpack and/or carry the equipment by more than two persons as it is heavy. Otherwise, it may cause injury due to fall or rollover of the equipment.	 **INJURY**
Be careful so as not to involve something with a rotating collector when the collector is used. Otherwise, involved things flew apart. It may cause break of parts or injury.	 **INJURY**
Do not open the door of spinning chamber during spinning. Otherwise, it may cause leakage gas ,which is inside of the spinning chamber, in the laboratory.	 **INJURY**
Be careful to not be wedged between wall and an equipment duringe carrying an equipment. .	 **INJURY**
Surely hold collectors when the collectors are exchanged. Or the collector drop on your legs or something else.	 **INJURY**
Use the AC receptacle close to the equipment to prevent fire.	 **FIRE**
Connect or mount optional units or cables properly following directions in this manual. Incorrect connections or mounting may cause malfunctions of the equipment and/or electric shock.	 **MALFUNCTION**

Safety Precautions

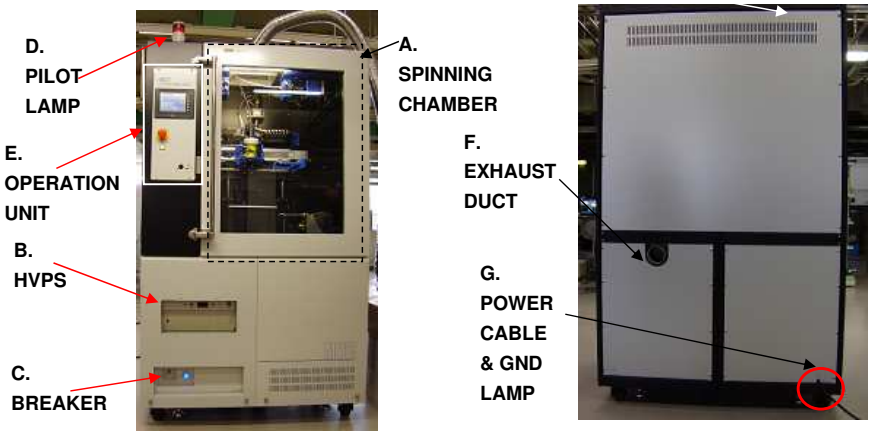
When an equipment is mounted or dismounted on / from cargo, truck, etc, arms of fork lift should be inseted in A as shown in the picture.

Chapter1: Before Operation

1-1. Confirmation of main unit and accessories

Check the NF-103 and accessories external and internal damages.
Refer to 1-1-2. accessories about accessories.

1-1-1. Functions of the NF-103



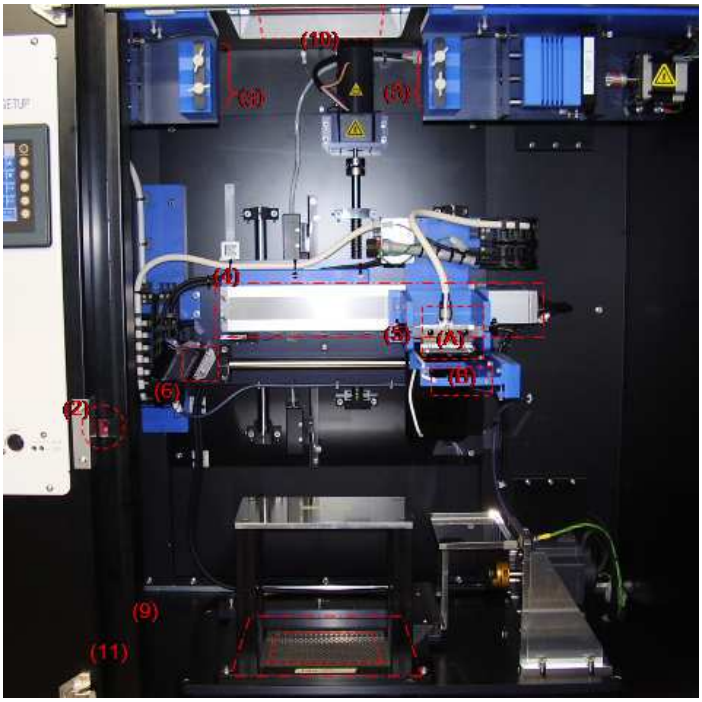
(a) (b)

(c) (d)

Figure1-1 NF-103 outline picture
(a)FRONT
(b)REAR
(c)LEFT SIDE
(d)RIGHT SIDE

A. SPINNING CHAMBER

(a)



(b)

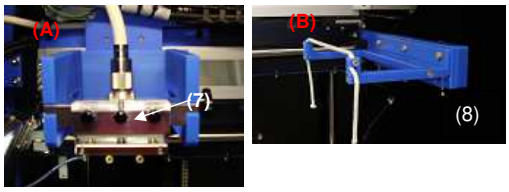


Figure1-3. SPINNING CHAMBER:
(a) External view
(b) Internal view

(1) Door :Doors of the spinning chamber. Open/Close the right side door by the grip. Remove the up and down screws to open/close the left side one. It has hardened glass in the center of the door.
(2) Safety Lock :Detect opening/closing doors. Voltage is not applied when the doors open.
(3) Syringe pump :A pump to place syringes. It supplies the injection with the spinning solution.
(4) Slider :A slider to move a spinneret are in X and Y directions.
(5) Slider arm :An arm to place a spinneret.
(6) Light for confirming initial jet
:The light for an nozzle tip.
(7) Spinneret :A block to connect a nozzle and a tube from the syringe. The voltage is applied to the block.
(8) Jig for cleaning :A jig to set a string for cleaning of an nozzle tip.
(9) Space for collector:The space to place a collector.
(10) Intake duct :A duct to get external air into the spinning chamber.
(11) Ventilator :A ventilator with a cleanup filter and a cover for the filter to exhaust gas in the spinning chamber.

B. HVPS (High Voltage Power Supplier)

Operate the touch panel in the operation unit to turn ON/OFF of applying voltage and adjust voltage. The panel displays current value during voltage applying/spinning.

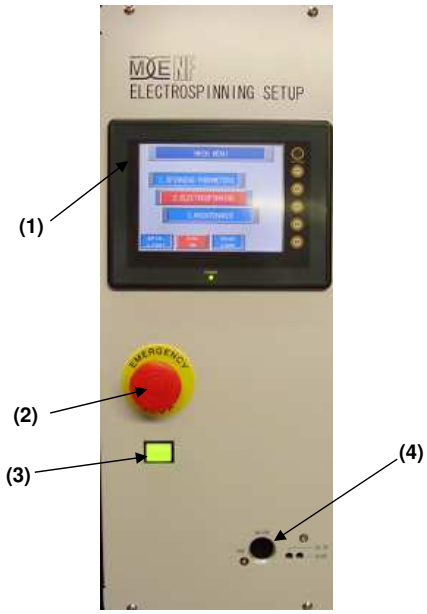
C. BREAKER

A breaker for power supply.

D. PILOT LAMP

Lighting:High voltage is outputted.
Blinking:Error

E. OPERATION UNIT



(1) TOUCH PANEL
Input the parameter about spinning and program operation settings for the NF-103.

(2) EMERGENCY STOP BUTTON
All functions of the system except control system by depressing the button.

(3) POWER SWITCH
The system works when the button is pressed. The power button will illuminates during ON.

(4) RELEASE KEY & INDICATORS
The release key is used to unlock the Switch in case of emergency or if the power supply to the Switch stops.
If the release key setting is changed from LOCK to UNLOCK, the lock will be released and the safety door can be opened.
It unlocks at the time of SOL ON indicator lighting.
It is door opening at the time of OPEN indicator lighting.

F. EXHAUST DUCT

A duct to exhaust gas in the chamber. The exhaust hose is connected to the duct.

G. POWER CABLE & GND

An AC Power cable and an earth terminal. Be sure to connect with the earth to prevent electric shock.

1-1-2 Accessories

Please see the attached entitled “Table1. Accessories/attachment parts”.

Chapter2: Operation

2-1. Preparation for spinning

FIRE

Please do not place combustibles, such as an organic solvents on a collector when electro spinning.
Electric discharge may cause ignition.
We at MECC cannot owe any responsibility for damage and injury occurred in the above usage.

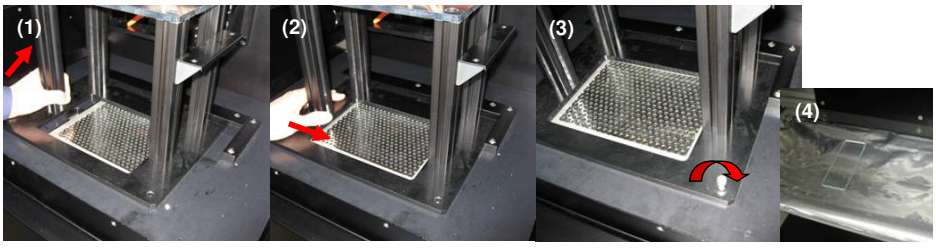
2-1-1. Setup the collector

(0) Turn on the breaker.

【Plate collector】

(1) to (3) Press the collector base to the metal blocks which identify the location of collectors at the bottom plate of the spinning chamber. Slide the base to right and fix it to the spinning chamber with bolts. After attaching a collector, the collector surface is covered with base materials, such as aluminum foil.

(4) Put glass board on the plate and collect samples on the board. The sample can be observed by an optical microscope.



【Drum collector】

(1) Set a coupling to the collector rotary shaft.

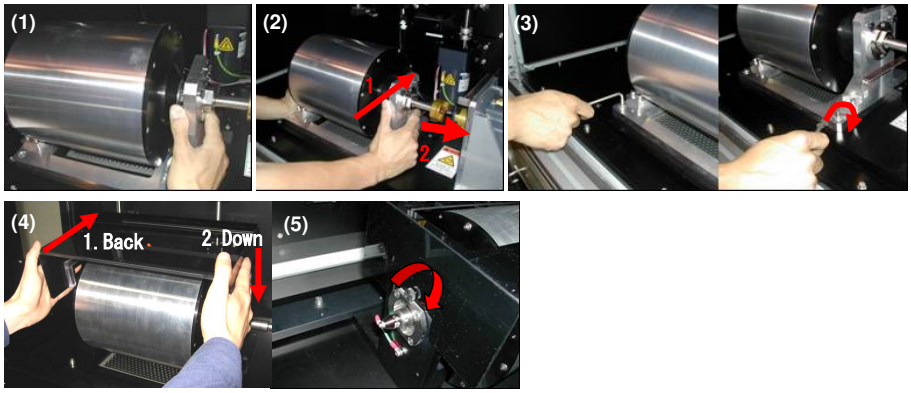
(2) Press a collector base to metal blocks which identify the location of collectors at the bottom plate of the spinning chamber. Slide the base to right and engage a motor shaft and a coupling of collector shaft. Fix each coupling by screw bolts.

(3) Fix a collector base to the spinning chamber with bolts.

(4) A collector hood is attached (when a drum collector's rotation is not less than 1000 rpm).

(5) Please fix to a collector main part with the screw in both the sides.

*A disc collector setup is the same as the drum collector.



【Roll to roll collector】

(1) Set the paper cylinder in the Wind-up roll side.Press a collector base to metal blocks which identify the location of collectors at the bottom plate of the spinning chamber. Slide the base to right .Fix a collector base to the spinning chamber with bolts.

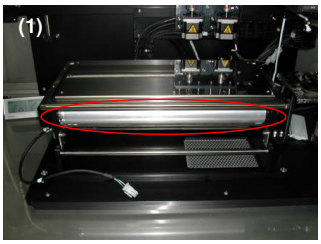
(2) Connect Collector's power cable.

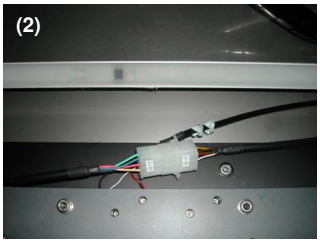
(3) The upper part of the collector is knocked down forward while drawing out the knobs on the collector both sides right and left.

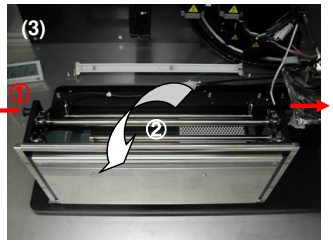
(4) Set the paper cylinder of the substrate and after draws it out at a constant amount.Return the upper part of the collector to former position (You can set 2 pieces of the paper cylinder)

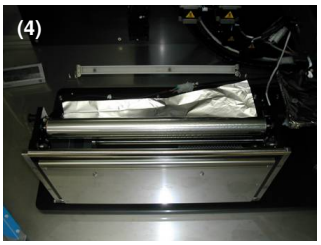
(5) Drawn out the substrate to the paper cylinder on the Wind-up roll side and fix the edge of the substrate to the he Wind-up rolll with the tape etc.

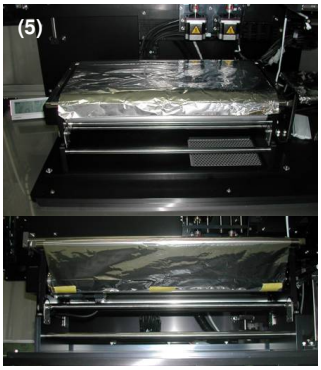
(6) A tray for solution and cleaning unit → p.2-7











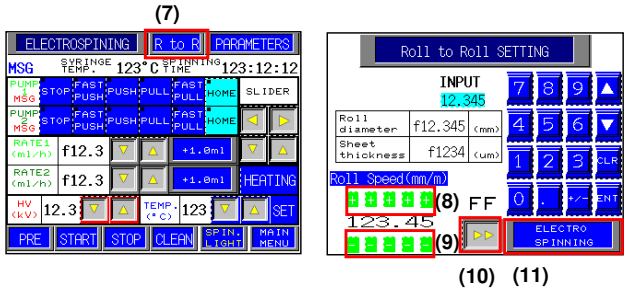
(7) How to change Roll to roll collectors speed during Electrospining. After push R to R switch, Open below multi screen.

(8) Push + switch
Increase value (+1)

(9) Push - switch
Decrease value (-1)

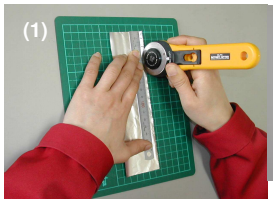
(10) Fast- forwarding switch
Fast- forwarding of substrate

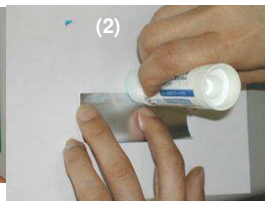
(11) Return to ELECTROSPINING-screen

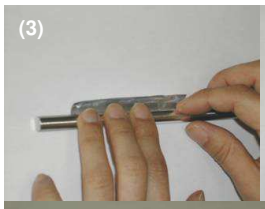


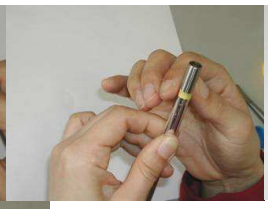
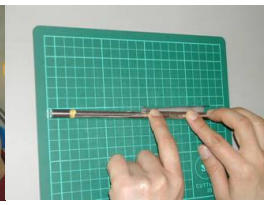
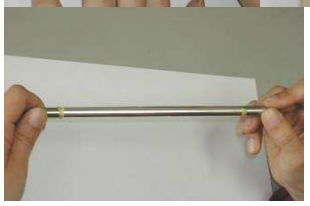
【Mandrel collector】

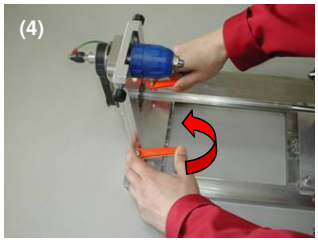
(1) Two base materials are small cut down according to the diameter of a mandrel.
(2) From the center of a mandrel, it twists one base material around a right half and a left half at a time. An end is pasted after twisting.
(3) The both ends of a base material are stuck on a mandrel on a tape etc., and it fixes.
(4) An orange handle is turned counterclockwise and a lock is canceled.
(5) A left-hand side block is made to slide and the interval of chucking is extended.
(6) A chuck is turned clockwise, the interval of the nail of a chuck is extended, and a mandrel is inserted.
(7) Make the block of a left-hand side side slide, and return to the original position. Chuck is turned counterclockwise and a mandrel is firmly held by chuck. If a mandrel is fixed, an orange handle is turned clockwise and locked.
(8) Finally attach the cover of resin.
(9) Attach to the main part of equipment like a drum collector.
(10) A right-hand side cover top is covered with a paper towel, aluminum foil, etc.
(11) A tray for solution and cleaning unit → p.2-7



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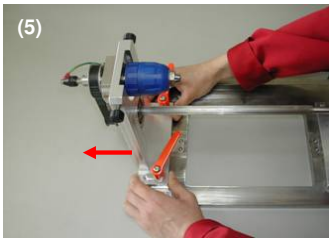
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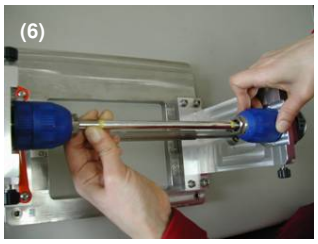
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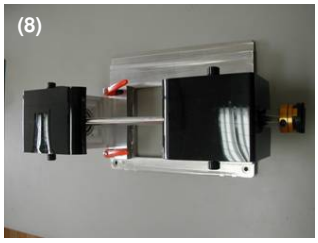
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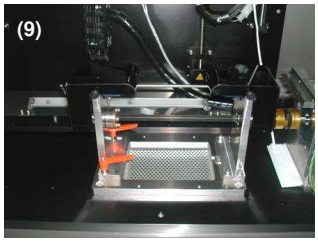
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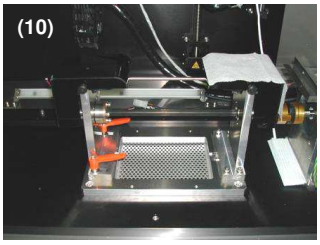

(10)

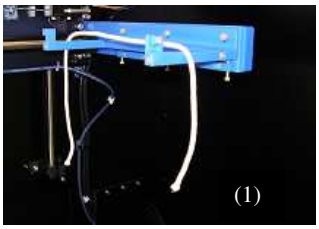
A tray for solution and cleaning unit

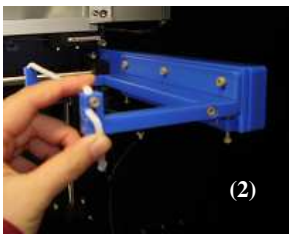
(1) A string is attached to a cleaning unit. First, a string is pulled from the back to this side.

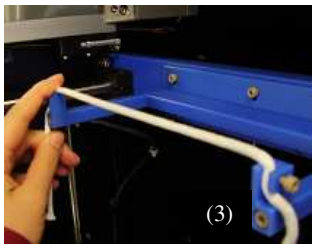
(2) It lets a string through the slit of a front arm. And it presses down and fixes with a screw. (Even if it turns a screw by hand, it does not interfere)

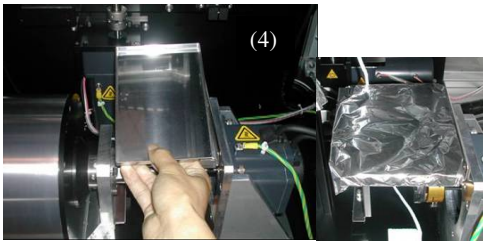
(3) It lets a string through the slit of the arm by the side of the back. And it fixes like this side side. At this time, a string is fixed so that there may not be Rumi who had stretched tightly.

(4) A solution receptacle tray is installed between a collector and a motor. Maintenance will become easy if it covers with aluminum foil etc. beforehand.



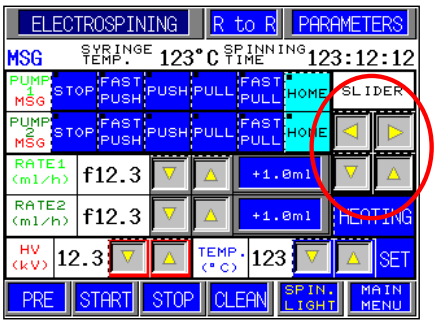






2-1-2. Setup the spinneret

(0) Turn ON "Spinning Light", "FAN", and "Room Light" by "Main Menu" on an operation panel. Moreover, the item "2. ELECTROSPINNIG" is chosen and desorption of spinneret moves a slider arm to an easy position with the cursor button of the SLIDER column.

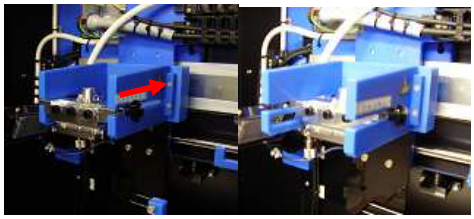


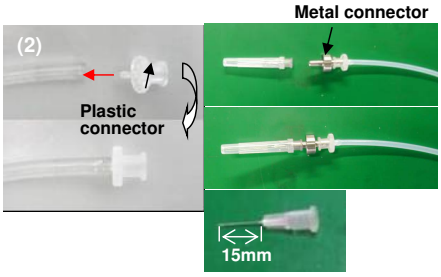
- Clip spinneret → (1)
- Coaxial spinneret → (9)
- Tubeless spinneret → (16)
- Solution heating spinneret → (21)
- Multi Jet spinneret → (32)

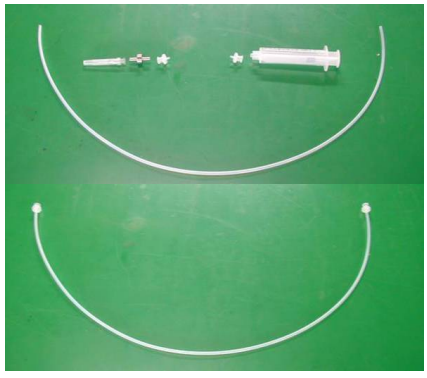
[Clip spinneret]

(1) Set the spinneret to the slider and fix a high voltage cable to the spinneret.

(2) Prepare a tube and around nozzles. First, insert plastic female connectors into both ends of a tubing. (NOTE: In case of PTFE tubing, you may wear lubber globe to make inserting plastic connector into a tubing easier. Be sure to use a longer tube. Confirm that high force is not applied at the connecting point. High force at the connection causes dropping out of connector from a tubing. (*Reference tube length: 550 to 830mm.*) Next, insert metal connector into one of luer connector, and insert another end of metal connector into a nozzle. A nozzle whose length is 15mm and tip is grinded flat could be used as a nozzle.







(3) Setup a set of the nozzle/metal connector/tube to the clip spinneret. Confirm the position in the Y axis by scale. Fasten bolts at side of the spinneret. Please adjust an absolute location, when not spun by a collector's center.

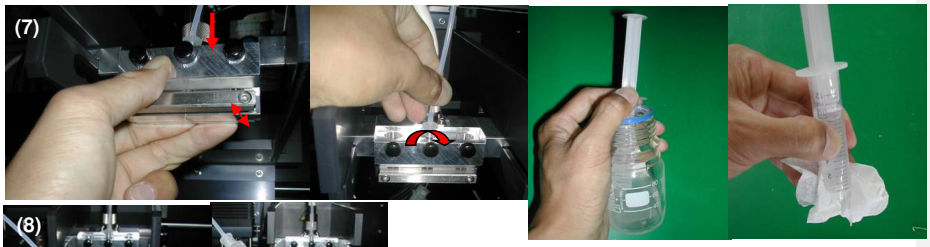
(4) See(34)

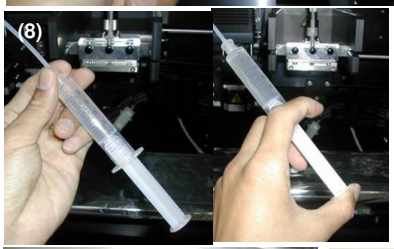
(5) Insert the nozzle to the spinneret spreading space between blocks underneath of spinneret. Fix a metal connector by screwing bolts. Fix the spinneret to the slider arm with a bolt on the side. Spun solution is sucked up into syringe.

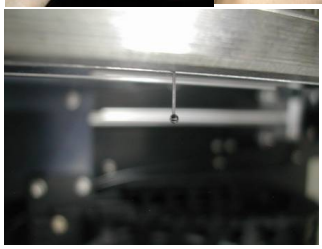
(6) The solution which arrived at the syringe outer wall is wiped off carefully.

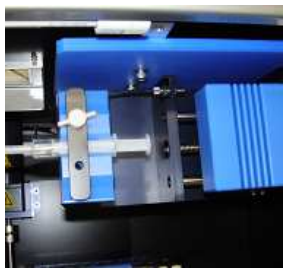
(7) A lure lock connector ties syringe and a Infusion tube firmly. The solution in syringe is pushed out by hand to a nozzle tip.

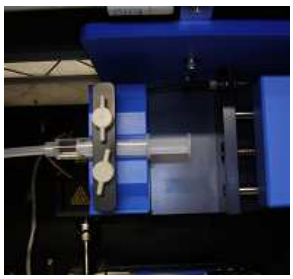
(8) A syringe is attached to a syringe pump if it checks that solution comes out from a nozzle tip.There are two gray screws in one syringe pump. Unscrew the lower screw and set a syringe.Syringe is pressed down, fixes. And then screw the lower screw.











[Co-axial spinneret]

(9) Core joint and metal connector via resin washer

Connect the terminal and needle to the tip of the metal connector.

Install. This is the core side nozzle.

(Needle Recommendations: 18G Cylinder Length: 24 mm)

(Needle Recommendations: 22G Cylinder Length: 24 mm)

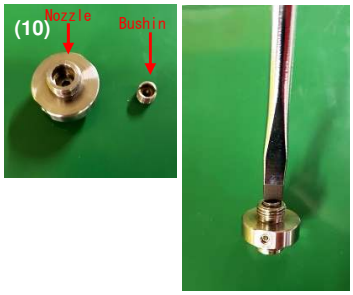
(Needle Recommendations: 27G Cylinder Length: 22 mm)

コメントの追加 [E1]: At the end of (1), adding a sentence such as "This is the core side nozzle" would make the flow of (7) easier to image.

(10) Mount the bush to the nozzle base A. Takeoff

Rotate the watch with a minus screwdriver to the back of the watch.

You can.

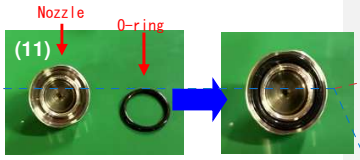


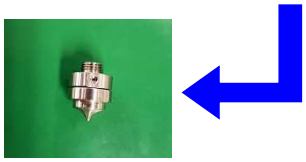
(11) Place an O-ring in the groove of Nozzle B and manually insert it into Nozzle A.

Mount. At this time, tighten until there is no clearance.

Let's put it in.

You do not need to use tools.





コメントの追加 [E2]: 「Insert the O-ring into the groove of nozzle B and attach nozzle A by hand. Tighten until clearance is cleared.I thought that the flow would be easier to understand."

コメントの追加 [m3]: Is there a tightening, e.g. hand tightening until clearance is cleared?

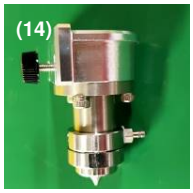
(12) Attach (11) to the nozzle holder.

(13) Attach (12) to the nozzle base. With a sheath-side joint
Assemble so that the part to be attached is located on the back

※ With the core tube when the tube is installed
On the sheath side to prevent touching and when used in a NANON
Device with a tube passing through the back of the spinneret
This is to get out to the top.

コメントの追加 [m4]: Set the character size

(14) Mount the sheath side fitting with a resin washer.

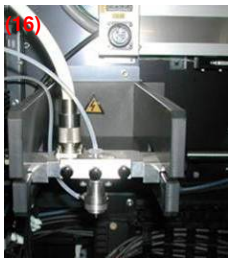


(15) Connect the tube to the joint on both the core side and the sheath side.
The length of the rib depends on the equipment used and the spinning distance.
For the appropriate tube with reference to the recommended length of the tube shown below
Use in length.

Insert the core-side nozzle into the center of the spinneret, and use Metalco.
Tighten the necker fixing screw to fix the metal connector.
Projection of the nozzle by changing the fixing position of the core-side nozzle
You can vary the amount.
(Recommended nozzle protrusion amount: about 0.5mm)

(Recommended tube length)
Core side:approximately 990mm/sheath side: approximately 665mm

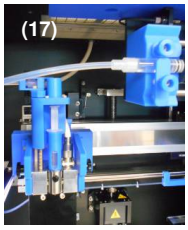
(16) The nozzle was attached to the slider arm beforehand.
Secure to the spinneret holder.
Plastic at the tip of the tube on the side opposite to the joint side for both the core side and the sheath side.
With a stick connector and a syringe containing the solution
Connect and set to the syringe pump.



[Tubeless spinneret]

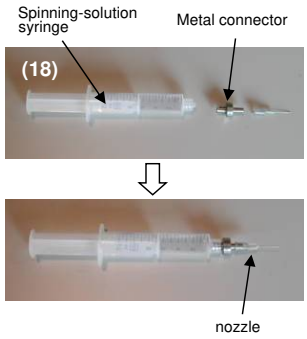
※ There are 2mL specifications and 5mL specifications.
In this volume, 2mL specifications will be used for explanation.

(17) Insert the spinneret to the slider arm unit and connect the high voltage cable to the high voltage connector.
Set the hydraulic syringe to the syringe pump.



Hydraulic syringe

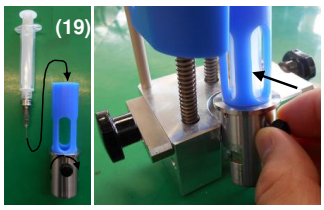
(18) Connect the metal connector to the spinning-solution syringe and suck up solutions to the syringe.
Remove bubbles inside the syringe and connect the nozzle to the metal connector.
Note: Solutions to be less than 2ml.



CAUTION

Metal components are made of SUS304.
Avoid using solutions that may corrode such components.

(19) Push solutions to the tip of the nozzle manually and set the syringe to the tubeless spinneret.

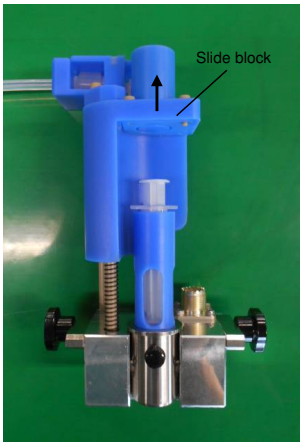


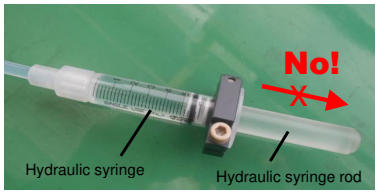
CAUTION

Check no clogging of solutions on the tip of the nozzle and start spinning.
Use a nozzle without bend, collapse or clogging.
Use solutions that will not cause clogging, or it will generate too much pressures on the actuation oil and cause leakage and breakage of the spinneret.

CAUTION

The slide block will not return to the home position with a spring. Rest the block manually by pushing up the slide block.
NEVER pull the hydraulic syringe rod, or bubbles will generate and the spinneret will be unusable.





CAUTION

Avoid overbending the tube, or the tube be collapsed and may cause leakage of oil and breakage of the spinneret.
The bend radius to be more than 50mm.

CAUTION

The actuation oil may leak from the O ring of the hydraulic syring on the side of the syringe pump or the spinneret. Fill up the actuation oil in that case.

CAUTION

The Maximum pushing force of the syringe is 80N (8kgf). In the event viscosity or flow rate of solutions is high, use a bigger nozzle referring to the table below. Otherwise, it will create too high pressure on the actuation oil and cause its leakage and breakage of the spinneret.

Viscosity and allowed flow rate for nozzle size (index)

	Flow rate [ml/hr] (Maximum)		
Viscosity [mPa･s]	27G	22G	18G
50	20	20	20
100	12.8	20	20
200	6.4	20	20
400	3.2	20	20
800	1.6	20	20
1600	0.8	12.8	20
3200	0.4	6.4	20
6400	0.2	3.2	20
12800	0.1	1.6	20

*Internal diameter of syringe: φ12.5mm

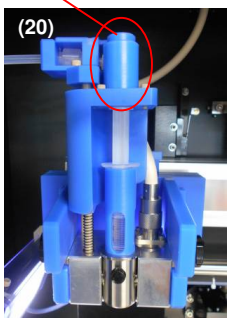
CAUTION

The depressurization ball holder has an O ring to release pressure.
When the O ring deteriorates, releasing of pressure will not work and cause leakage of the actuation oil and breakage of the spinneret. Replace the O ring when necessary.

(20) Come-off of the depressurization ball shaft

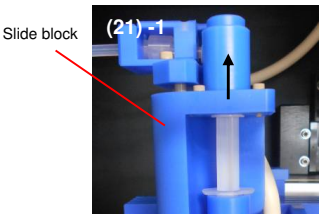
When too high pressure is applied on the actuation oil, the ball shaft will come off to realease the pressure as shown in the right photo.
Check clogging of a nozzle, too high flow rate or viscosity. (Refer to the table on the previous page.)
Replace a nozzle, remove clogging or reset a flow rate when necessary.

Depressurization ball shaft

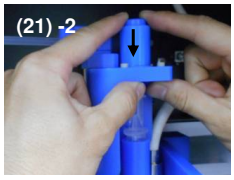


(21) Resetting the ball shaft

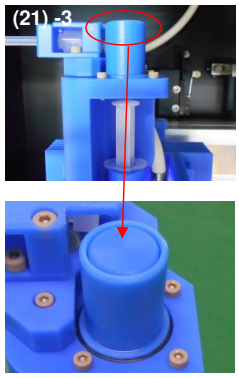
1. Push the slide block up to the top end.



2. Push the ball shaft down to the ball holder while holding the slide block firmly.



3. When the height of both surfaces of the ball shaft and the ball holder be the same as shown in the right photos, it is done.



[Solution heating spinneret]

(22) A high-frequency-induction-heating unit is attached to a slider arm.

(23) The connector for temperature sensors, a high-pressure cable, and an output connector are connected, respectively.

(24) An oil pressure cylinder is attached to a syringe pump.

(25) Wind the white heat-resistant tape for temperature surveies (recommendation: Teraoka Seisakusho Co., Ltd nomex (R) No.561S (#2)) around a syringe (tape 120 mm in length).

(26) A syringe pipe, a plunger, and silk-thread-spun solution are warmed in oven to silk-thread-spun temperature. If it reaches to silk-thread-spun temperature, a heat-resistant glove will be stuck and the syringe pipe furnished with the jig made from Teflon will be filled with solution.

(27) A syringe pipe is inserted.

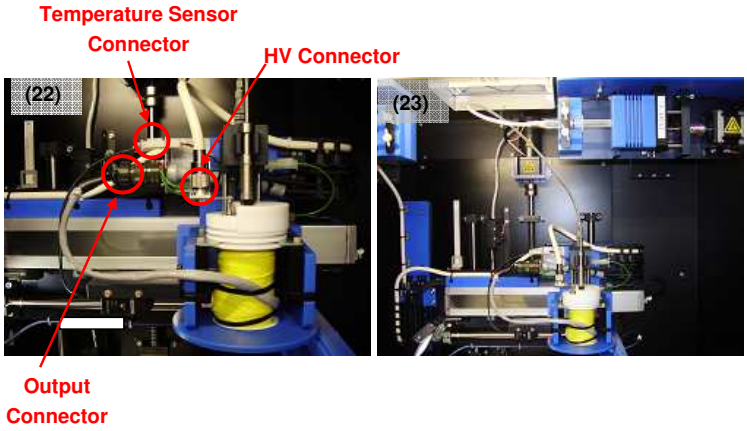
(28) A plunger is inserted

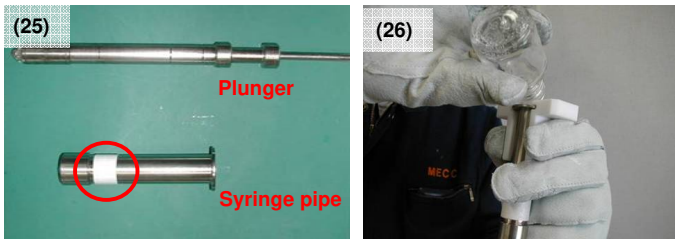
(29) A hydraulic pump is moved with a syringe pump, the height of the "plunger holding part" shown in a figure is united, and a plunger and a bobbin are made to slide to the back, and

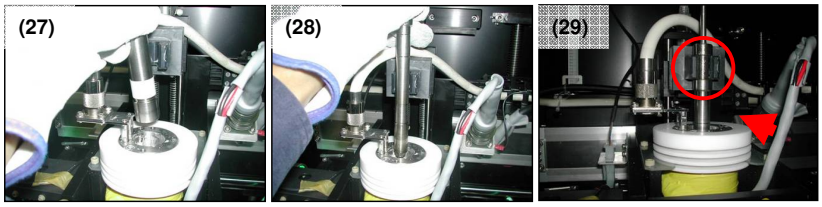
are attached.

(30) As shown in a photograph, a syringe is fixed to a coil with the jig.

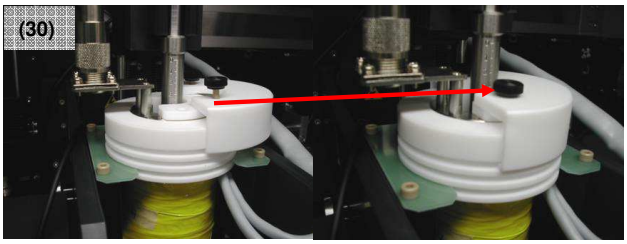
(31) The "HEATING" button of a touch panel is pushed and it heats to preset temperature. If measurement/display temperature reaches preset temperature, the "PRE" and "START" button of a touch panel will be pushed, and silk thread spun will be started.

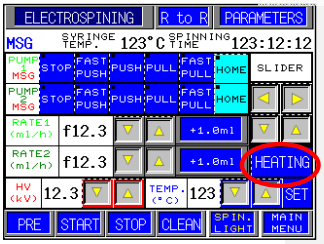






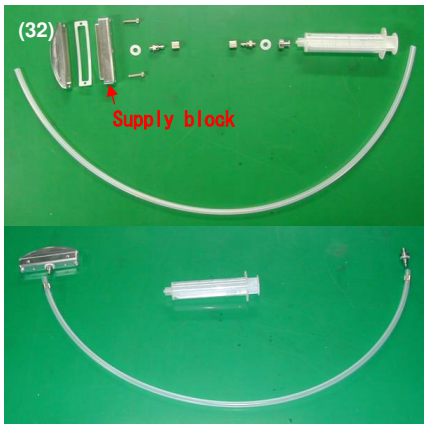
(31)





[Multi Jet spinneret]

(32) Assemble tip section of spinneret in right picture in sequence.Use sealing material on joint part and screw tightly.
（*Recommended tube Length：630mm*）



※ *note*

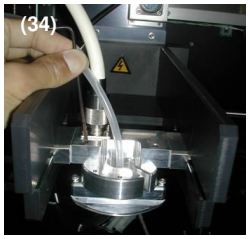
It needs to use different inner diameter tube depending on solution viscosity.
It takes on different supply block, connector between tube and syringe depending on diameter of tube.
Metal connector for thick polyethylen tube and Luer lock connector for thin Teflon BT tube are used between tube and syringe.
Before assembling, confirm each diameter.

※*Recommended tube*

1. *Name of product： polyethylen tube hose 4x6mm 50m*
2. *Name of product：Teflon BT tube 1/8B 10m*

(33) Attach ring-shaped block on top of spinneret. On the ring there are a few screw holes and depending on position of spinneret attachment, it can change the angle of position of attachment spinneret on the main body.

(34) Attach spinneret holder on slider arm and connect High Voltage Power Supply cable.
Attach Multi Jet Nozzle to the spinneret holder.



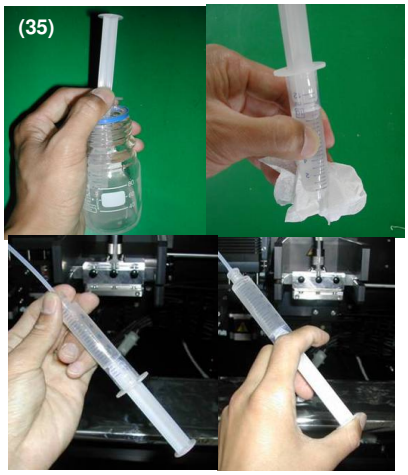
(35) Attach syringe following below procedure.

A) Spun solution is sucked up into syringe.

B) The solution which arrived at the syringe outer wall is wiped off carefully.

C) A lure lock connector ties syringe and a Infusion tube firmly. The solution in syringe is pushed out by hand to a nozzle tip.

D) A syringe is attached to a syringe pump if it checks that solution comes out from a nozzle tip.There are two gray screws in one syringe pump. Unscrew the lower screw and set a syringe.Syringe is pressed down, fixes. And then screw the lower screw.

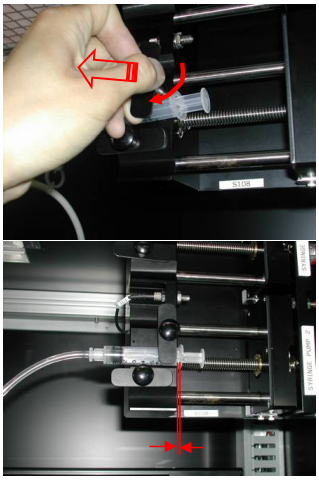


Before attaching syringe to syringe pump, push solution by hand to reach solution to the spinneret from syringe on the below value for reference.

In case, polyethylen tube : 3.5ml
In case, Teflon tube : 11ml

When solution in syringe getting low, exchange syringe which refill solution.

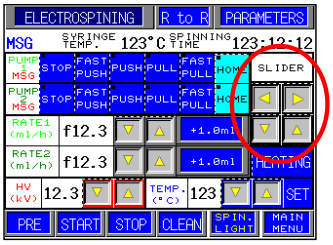
※*Recommended syringe*
Name of product : NORM JECT® 20ml Luer Lock Syringe、LOT : 0B22048、REF : 4200.X00V0

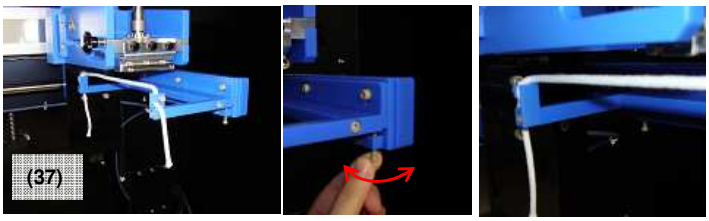


(36) Move the slider arm widely (right and left) by operation panel. Be sure that any items like tubings, string, etc. does not prevent movements of slider arm. Confirm tube and connectors are fixed tightly.

(37) Adjust height of a cleaning string so that the tip of nozzle touches the string. The cleaning string can make it fluctuate with the screw currently attached to the jig lower part for cleaning. Move the slider arm right and left on the string to confirm its position. The desirable position is that the tip of nozzle can flick the string for cleaning. After setting of cleanig, move the slider arm to the far right (tray for solution).

(36)





2-2. Creation of fiber samples

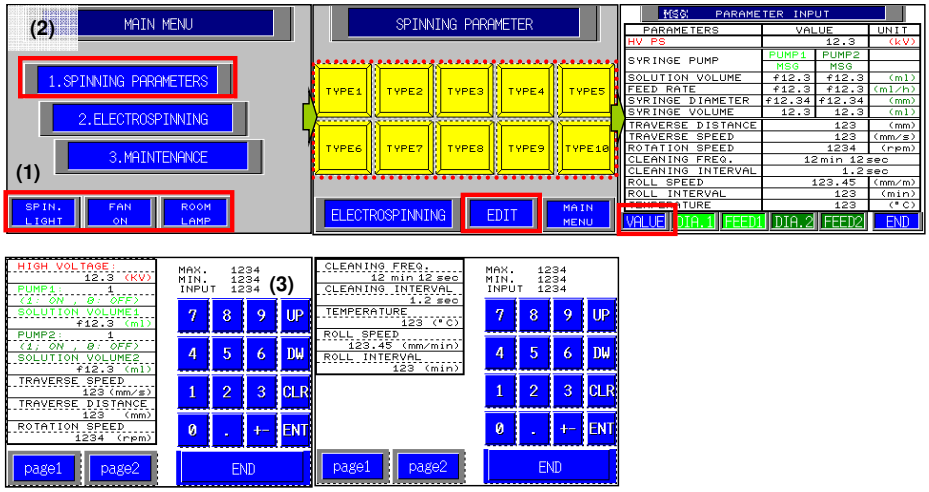
(1) Press “SPIN.LIGHT”, “FAN ON” and “ROOM LAMP” in the main menu to turn on the light for confirming initial jet, exhaust fan and room light in the chamber.

(2) Press “1. SPINNING PARAMETERS” and select a TYPE from “TYPE 1” to “TYPE 10”. Proceed to “PARAMETER INPUT” screen. With a press of “VALUE”, the screen proceeds to a screen to program applying voltage (HV PS or HV), Solution Volume, Traverse Speed and Distance of Spinneret, Collector Rotation Speed, Nozzle Cleaning Frequency and turning ON/OFF syringe pump1 and 2. (Option: Temperature, Roll Speed, Roll Interval)

(3) Creation of samples will finish automatically when programmed Solution Volume is pushed out. Operator can input each value by numeric keypad and decide by “Enter”. Close the programming screen by pressing “END” when all parameters are input.

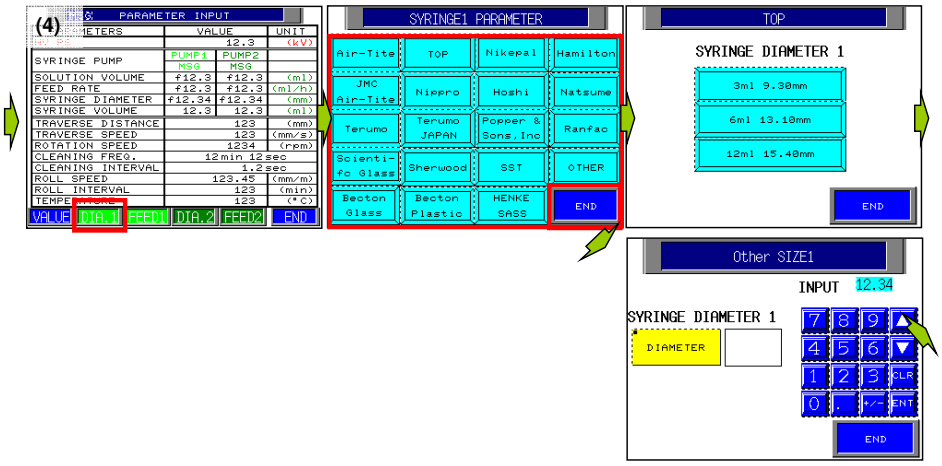
[Reference]

We recomand that you should program applied voltage 0kv when materials are used for the first time.



(4) Program the diameter of syringes and feed rate.

Select “Dia.1” to enter the diameter of a syringe which is used in syringe pump1. Select a manufacturer and capacity after pressing “Dia.1” when you know them. Then, the NF-103 will program diameter of the syringe automatically. Press “OTHER” key, and enter a diameter with numeric keypad when an operator doesn’t know manufacturer or the syringe except list is used.



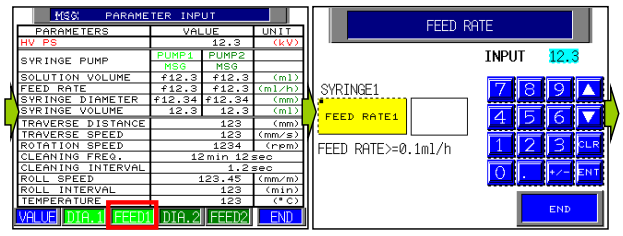
Press “Feed Rate1” to program feed rate after entering a diameter of the syringe and enter the feed rate of solution.

[Reference]

We recomend that Feed Rate to be program as 1.0ml/hr when you use material for the first time.

Program the operation environment for the syringe pump as same as above procedures when syringe pump2 or both syringe pumps are used.

Press “END” after above programming and return to MAIN MENU.



(5) Press “2. ELECTROSPINNING” to start creating fiber samples.

(6) Move a pusher block of the syringe pump with “PUSH” and “PULL” to touch a plunger.

*When the Rolle Thu roll collector is used. (option) The "R to R" key is pressed and a Roll to Roll SETTING screen is displayed.

① Roll diameter

The diameter of the core on the rolling-up side is inputted.

② Sheet thickness

The value which totaled the thickness of a base material and electrospinning is inputted.

③ Roll Speed

The speed of rolling up is set up.

The value set up with the parameter is displayed.

A preset value can be changed by the "+" and "-" key.

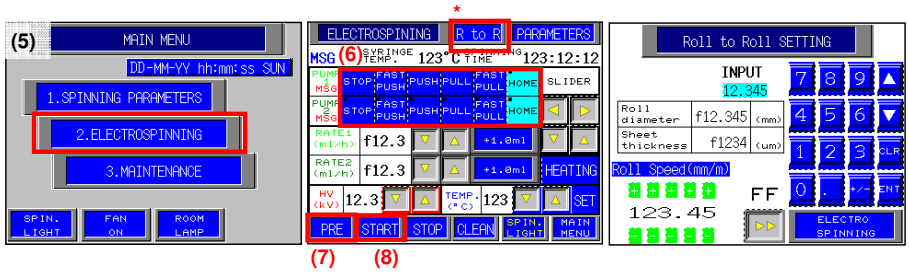
④ FF

It will wind, if a switch is pushed, and a core rotates at the rate of 600 mm/min.

If a switch is pushed once again, it will return to the original speed.

(7) With “Pre” key, the syringe pump comes into operation based on Feed Rate programmed in “1. SPINNING PARAMETERS”. Spinning time will start countdown at the same time. The pump will finish spinning automatically and high voltage power supply is turned OFF when spinning time becomes 0.

(8) Press “START” when Feed Rate from the tip of nozzle becomes steady. Press “START” to apply programmed voltage in “1. SPINNING PARAMETERS”. After starting appling voltage, the spinneret moves toward the collector.



【Reference】

When applied voltage is set as 0kV about first spinning material.

- *Up the applied voltage with “△” of ”HV (kV)” in the third line.*
- *Jets will generate from the tip of nozzle when the voltage becomes a certain value.*
- *Down the voltage with “▽” little by little and read minimum applied voltage when jets generates in steady. This minimum voltage becomes standard spinning condition.*
- *Continue spinning for a while when the stabdard voltage is decided. Up Feed Rate when jets break. Down Feed Rate when drops can be seen.*
- *Parameters when the NF-103 can get jets in steady continuously become spinning conditions.*

(9) Look samples spinned on the collector through microscope, and repeat adjustment of the spinning conditions.

【Reference】

Collect a little sample on the glass board material. It makes observation with the microscope easy.

2-3. Care after creating fiber samples

(1) Trun off the breaker and move the slider to detachable position of spinneret.

(2) Remove a set of syringe/tube/metal connector/nozzle. (Clip spinneret)
Remove a set of syringe/tube/spinneret/nozzle. (Block spinneret)

(3) Remove the nozzle and push out all solution in the syringe/tube.

(4) Wash inside of a nozzle, tube, metal connector or inner of spinneret with fine solvent which is for spinningmaterial.

(5) Vaporize organic solvent enough after cleaning. Dry each part with oven.
*Clean inside of the spinneret with fine brush after vaporize to be cleaner.

(6) Clean the inner wall of the spinning chamber, surface of a collector, a tray for solution and a string for cleaning.

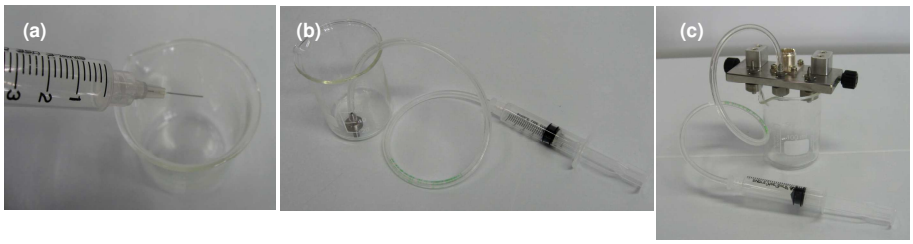


Figure2-2. Examples of cleaning nozzle and spinnerets:
(a) Cleaning nozzle.
(b) Cleaning a set of syringe/tube/metal connector
(c) Cleaning a set of syringe/tube/block spinneret.

2-4. Procedure of the filter exchange

Change cleaning filters (Activated Charcoal Filter, Neutral (HEPA or ULPA) filter) which are set at the ventilator as following procedures when counter for filters are 0 on the display. Change the pre-filter when dirt is checked with eyes.

* life time of all filters is up to half a year (it depends on frequency of equipment working).

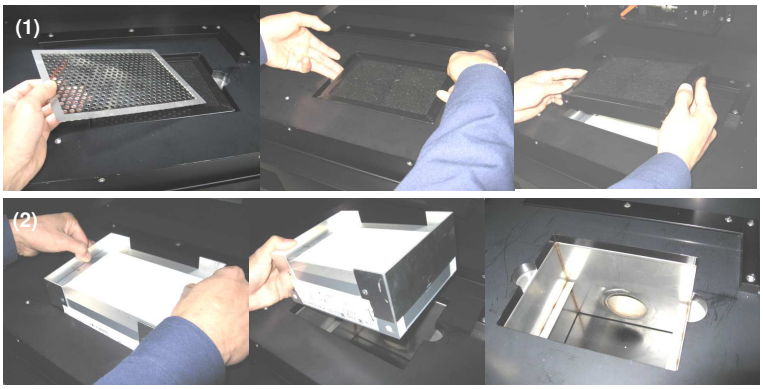
Activated Charcoal/ Neutral /HEPA/ULPA filter

(1) Take off the cover for filters. Put fingers on the flame of the activated charcoal filter with the black cover and take off the filter.

(2) Put fingers on inside of the flat plate which is fixed to the side of Neutral/HEPA/ULPA filter and pull up the filter.

(3) Outfit filter fitting space with new Neutral (HEPA or ULPA) filter, and Activated Charcoal filter, in that order.

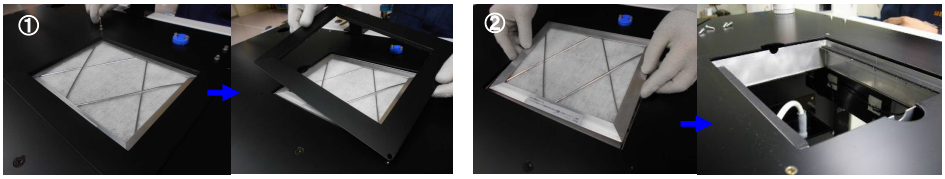
(4) Outfit the filter cover.



*Change the pre-filter when dirt is checked with eyes.

Pre-filter

(1) Loosen bolts and take off the filter cover.
(2) Put fingers on the flame of filter, and take off the filter.
(3) Outfit a new filter and fix the filter cover with bolts.



2-5. Indications at errors and counter measures

Indications of contents and counter measure at errors when the equipment is operated by mistake are as follows.

Table2. Indications at errors and counter measure

Errors	Contents of indications on the panel	
	At detecting errors	Counter measures
Open the door of spinning chamber during spinning.	Emergency Stop Door is Opened.	Press STOP Button
Errors at rotating the drum.	Emergency Stop Error is Detected. Drum Error	Turn Power Off
Errors about slider operation	Emergency Stop Error is Detected.	Turn Power Off

Chapter3: Maintenance

We recommend periodical maintenance to keep the device clean and in good condition.

3-1. Cleaning

3-1-1. Outside

(1) Clean with a soft brush after POWER OFF.
(2) Prepare washing included detergent a little. Wipe outside after dipping and squeezing a piece of soft clothes. Wipe a piece of dry clothes after that.

CAUTION

Clean not to leak moisture inside or electrical circuit is shorted and it may cause malfunction, fire and/or electric shock.

CAUTION

Do not use hard brush and/or detergent.
The coated surface may be damaged or printed letters may come off.

3-1-2. Inside

- Clean with an air gun (blower) or a soft brush.
- Clean inside at least once a year to avoid fire and /or malfunction.
  We recommend to clean before the rainy season.

CAUTION

Refrain from using any solvent or detergent of cleaning as the parts may possibly be damaged in some cases.

3-1-3. Lubrication

- All the mechanical parts such as switches or relays in this equipment require no lubrication.
- Refrain from lubricating each contact or from using any contact activator. Replace any parts which go out of order.

3-2. Replacing battery

If you get BATTERY DROP message to TROUBLE screen, please replace the PLC of the battery as soon as possible. If it is left as it is, there is that the program will disappear. PLC unit is being built in front of the lower right corner.

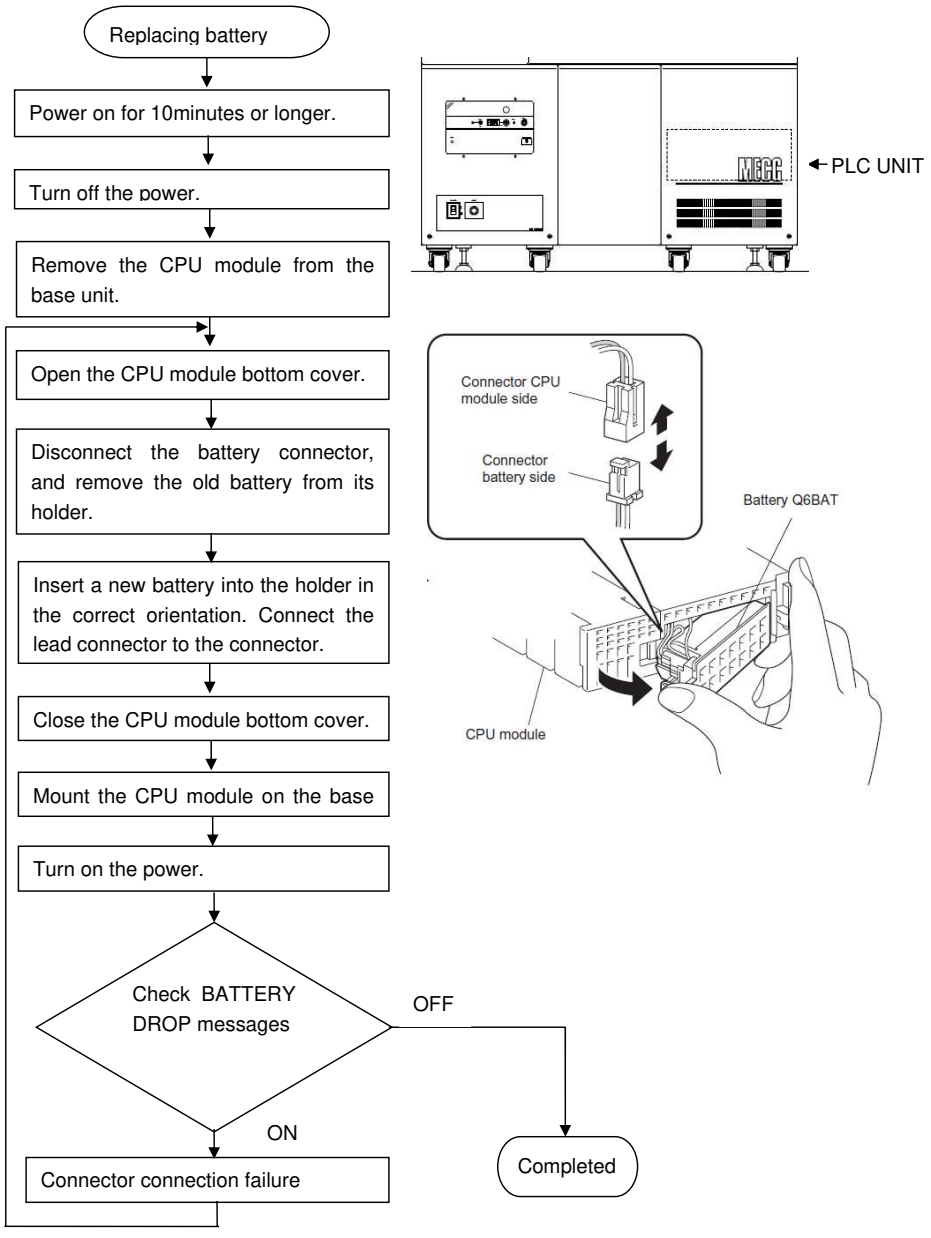
Remove the front cover on the bottom right, and then to the state to touch the PLC unit. According to the battery replacement procedure, please do the replacement of the battery.

CAUTION

Backup time is 3 minutes. It exceeds the backup time and there is that the program disappears. Please be done within 3 minutes quick battery replacement.

Replacement Procedure of the Battery

※ Turn off the power and perform the replacement within 3 minutes.
Over time, you may lose your program.



Chapter4: Trouble Shootings

Most of circuits of this equipment are mounted on printed circuit boards. Parts with high reliability is used, however, it may cause the problem. Trouble shooting method is as follow. Please operate trouble shooting after understanding the circuits enough. Please consult to our engineers for more details.

4-1.Trouble shooting method

Symptom	Cause of Problme	Counter-measure
DOOR OPEN	Isn't door opened?	Press 'RESET' key and close a door
SYRINGE1 MOTOR ERROR	a driver may be broken.	Contact to MECC.
SYRINGE2 MOTOR ERROR		
EMERGENCY SW	Isn't an emergency switch is pressed?	Press 'RESET' and release an emergency switch.
SYRINGE1 LEFT HARD LIMIT ERROR	Isn't a hard limit working?	Press 'RESET' and move slider to right.
SYRINGE1 RIGHT HARD LIMIT ERROR		Press 'RESET' and move slider to left..
BATTERY DROP	Batterty run out?	Press 'RESET' and exchange to new one.
FILTTER CHANGE	Isn't filter expired?	Press 'RESET' and exchange to new one.
QD75P2 FAULTS	Slider at incorrect position.	Contact to MECC.
SYRINGE2 LEFT HARD LIMIT ERROR	Isn't a hard limit working?	Press 'RESET' and move slider to right.
SYRINGE2 RIGHT HARD LIMIT ERROR		Press 'RESET' and move slider to left..
FEED RATE1 NO DATA	Isn't a data input?	Press 'RESET' and input a data
FEED RATE2 NO DATA		
SOLUTION VOLUME1 NO DATA		
SOLUTION VOLUME2 NO DATA		
DIAMETER1 NO DATA		
DIAMETER2 NO DATA		
SLIDER MOTOR ERROR	Maybe an electrical circuit error,	Contact to MECC.
SLIDER LEFT HARD LIMIT ERROR	Isn't a hard limit working?	Press 'RESET' and move slider to right.
SLIDER RIGHT HARD LIMIT ERROR		Press 'RESET' and move slider to left..
COLLECTOR MOTOR ERROR	Maybe an electrical circuit error,	Contact to MECC.
DOOR LOCK ERROR	Isn't a door opened?	Press 'RESET' and surely close door.

Limited Warranty and Service

Limited Warranty Policy

This product is guaranteed for 12 full months after shipping from our factory in Fukuoka, Japan. When it is malfunctioned during the period, its repair will be done at our factory or a facility of our representative free of charge.

■ This warranty policy is only to promise free repair service of a purchased product.
- We will not be responsible for any damages or accidents by troubles with the product or by the use of the product.
- This warranty policy will never limit any legal rights of a user.

■ Price and/or warranty service of this product does not include any of the following items.
1) Cost for dispatching engineers for troubleshooting including travel expense
2) Freight to send repair parts
3) On-site installation and adjustment fee
4) Operation training fee
5) Observation fee after installation of this product
6) Periodical check, adjustment and/or calibration fee
7) Technical training and/or consultation fee
8) Spinning of samples on site or at our facility in Japan

■ Exceptions of the warranty policy
Following items will not be covered by the limited warranty policy.
1) Malfunctions or damages by operations not described in the operation manual of this product.
2) Damages or loss during transportation on a user's responsibility.
3) Malfunctions or damages caused by the repair or the modification made by a user.
4) Malfunctions or damages caused by disasters such as earthquake, typhoon and flood, lightening, salt damage, fluctuation of voltage, use of out-of-range powers.
5) Physical damages or malfunctions caused by strike, falling or mechanical shock.
6) Malfunctions or damages caused by the connection with external devices not described in the operation manual.
7) Consumable parts (e.g. batteries and filters)

■ Ownership of malfunctioned parts replaced in repair work belongs to MECC.

■ We will not be responsible for any damages or loss of integrated software, memory data or firmware.
** Periodical backup to be recommended.*

■ Repair work may take a long time of period due to late delivery, shortage or discontinued production of parts and there may be a case we cannot accept a request for repair.

Limited Warranty and Service

■ Request for a repair service

Please tell the following items to our representative when repair service is needed.

- Name and contact (telephone number and e-mail address) of a user
- Product name (e.g. Electrospinning system)
- Model name (e.g. NANON-01A)
- Serial number (e.g. 27123J789)
- Symptom of the trouble (as in detail as possible)
  (e.g. No high voltage output more than 11.5kV. Programming can be made but no actual output.)
- Situation of operation when the trouble happened (as in detail as possible)
  (e.g. The trouble was found when starting the system in the morning. It worked normally yesterday.)

CAUTION

This product is designed to be operated by a personnel who has knowledges and technique safely to handle electronic equipment, attachments, consumable parts and chemicals for spinning.
We will not be responsible for any damages or accidents by an unauthorized personnel's access or use of the product.

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Outline drawing