

## CAVITY-FG PRODUCT

OPERATION PROCEDURE: 4-OP-378

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**I. Purpose**

This operation procedure is used for setting up the manufacturing processes for Cavity-FG product

**II. Application** Table II.1 Products general information

FOV code	QC flow chart	Type name	Specification No.	RV	RLS (mm)	MCS	D.S	FV	PT	IP	OP	Spectrum type	Thermal aging (heating after exposing)	Apply hot air at stripping process
CFS0002	4-QC-378	DXV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	B	Patt 2	Patt A	Uniform	Cartridge	Yes
CFS0006	4-QC-378	DUV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	B	Patt 2	Patt A	Uniform	Cartridge	Yes
CFS0054	4-QC-378	HCV	AOP82-4001-27-11	RV3	>25	No	D06	FV2	G	Patt 7	Patt C	Chirped	Hot air	No
CFS0059	4-QC-378	YUV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	E	Patt 5	Patt B	Uniform	Cartridge	Yes
CFS0063	4-QC-378	WAV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	No	No
CFS0064	4-QC-378	YXV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	E	Patt 5	Patt B	Uniform	Cartridge	Yes
CFS0066	4-QC-0154	NAV	AOP81-2122-27-01	RV1	30~55	Black	D02	FV1	A	Patt 1	Patt A	Uniform	Cartridge	No
CFS0067	4-QC-0154	NBV	AOP81-2122-27-01	RV1	30~55	Black	D02	FV1	A	Patt 1	Patt A	Uniform	Cartridge	No
CFS0068	4-QC-0154	NCV	AOP81-2122-27-01	RV1	30~55	Black	D02	FV1	A	Patt 1	Patt A	Uniform	Cartridge	No
CFS0069	4-QC-0154	NWV	AOP81-2122-27-01	RV1	30~55	Red	D07	FV1	F	Patt 6	Patt C	Uniform	Cartridge	No
CFS0070	4-QC-0154	NUV	AOP81-2122-27-01	RV1	30~55	Red	D07	FV1	F	Patt 6	Patt C	Uniform	Cartridge	No
CFS0071	4-QC-378	KEV	AOP82-4001-27-09	RV2	<50	Red	D05	FV2	D	Patt 4	Patt B	Chirped	No	Yes
CFS0073	4-QC-378	KDV	AOP82-4001-27-09	RV2	<50	Red	D05	FV2	D	Patt 4	Patt B	Chirped	No	Yes
CFS0074	4-QC-378	HDV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	Chirped	Hot air	No
CFS0075	4-QC-378	KCV	AOP82-4001-27-09	RV2	<50	Red	D05	FV2	D	Patt 4	Patt B	Chirped	No	Yes
CFS0077	4-QC-378	WBV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	No	No
CFS0078	4-QC-378	YAV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	E	Patt 5	Patt B	Uniform	Cartridge	Yes
CFS0079	4-QC-378	YEV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	E	Patt 5	Patt B	Uniform	Cartridge	Yes
CFS0080	4-QC-378	YDV	AOP82-4001-27-04	RV1	30~55	Red	D01	FV1	E	Patt 5	Patt B	Uniform	Cartridge	Yes
CFS0081	4-QC-0154	NXV	AOP81-2122-27-01	RV1	30~55	Red	D07	FV1	F	Patt 6	Patt C	Uniform	Cartridge	No
CFS0082	4-QC-0154	NYV	AOP81-2122-27-01	RV1	30~55	Red	D07	FV1	F	Patt 6	Patt C	Uniform	Cartridge	No
CFS0087	4-QC-0154	NDV	AOP81-2122-27-01	RV1	30~55	Black	D02	FV1	A	Patt 1	Patt A	Uniform	Cartridge	No
CFS0089	4-QC-378	HEV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	Uniform	Hot air	No
CFS0090	4-QC-378	KBV	AOP82-4001-27-09	RV2	<50	Red	D05	FV2	D	Patt 4	Patt B	Chirped	No	Yes
CFS0091	4-QC-378	SAV	AOP82-4001-27-14	RV1	30~55	Red	D01	FV1	B	Patt 2	Patt A	Uniform	Cartridge	No
CFS0092	4-QC-378	SCV	AOP82-4001-27-14	RV1	30~55	Red	D08	FV1	B	Patt 2	Patt A	Uniform	Cartridge	No
CFS0093	4-QC-378	CAV	AOP82-4001-27-13	RV1	<50	No	D09	FV1	H	Patt 8	Patt B	Uniform	No	Yes
CFS0097	4-QC-378	XCV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	Cartridge	No
CFS0098	4-QC-378	XDV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	Cartridge	No
CFS0099	4-QC-378	PAV	AOP82-4001-27-10	RV2	<50	Red	D05	FV2	D	Patt.4	Patt B	Chirped	No	No
CFS0100	4-QC-378	HHV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	Uniform	Hot air	No
CFS0103	4-QC-378	TAV	AOP82-4001-27-15	RV1	40~50	Red Black	D10	FV1	J	Patt 9	Patt B	Uniform	Cartridge	Yes
CFS0104	4-QC-378	TBV	AOP82-4001-27-15	RV1	40~50	Red Black	D10	FV1	J	Patt 9	Patt B	Uniform	Cartridge	Yes
CFS0105	4-QC-378	UAV	AOP82-4001-27-16	RV1	<55	Red Black	D11	FV1	J	Patt 9	Patt B	Chirped	Cartridge	No

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CFS0106	4-QC-378	UBV	AOP82-4001-27-16	RV1	<55	Red Black	D11	FV1	J	Patt 9	Patt B	Chirped	Cartridge	No
CFS0115	4-QC-378	XFV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	Cartridge	No
CFS0116	4-QC-378	XEV	AOP82-4001-27-10	RV2	<50	No	D03	FV2	C	Patt 3	Patt B	Uniform	Cartridge	No
CFS0117	4-QC-378	HLV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	Uniform	Hot air	No
#NA	4-QC-378	HJV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	N/A	Hot air	No
#NA	4-QC-378	HFV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	N/A	Hot air	No
#NA	4-QC-378	HGV	AOP82-4001-27-11	RV3	>5	No	D06	FV2	G	Patt 7	Patt C	N/A	Hot air	No
#NA	4-QC-378	SBV	AOP82-4001-27-14	RV1	30~55	Red	D08	FV1	B	Patt 2	Patt A	N/A	Cartridge	No

Noted:

D.S: Dimension specification

FV: Visual inspection criteria of Fiber section.

RV: Visual inspection criteria of Recoat section.

IP: Inner Packing.

OP: Outer Packing.

RLS: Recoating length specification.

MCS: Marking color specification.

PT: Packing type

#NA: Will be define when PLN require

The content of operation procedure is applied to Cavity-FG products manufactured in Fujikura Fiber Optics Vietnam Ltd

**Including following processes:**

Table II.2 Processes for Cavity-FG

No.	Process
1	Material preparation
2	Fiber Rewinding
3	Hydrogen Loading
4	Fiber Cutting
5	Fiber Stripping
6	Exposing & Thermal Aging
7	Thermal Aging (hot air)
8	Recoating
9	Marking and Proof test
10	Hydrogen Unloading
11	Visual Inspection (Recoat)
12	Optical measurement
13	Visual Inspection and Packing
14	Final Packing
15	Test report & Shipping

This procedure directly to Production (PRD), Production Engineering (PRE), Quality Assurance Engineering (QAE) and Planning (PLN).

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**III. Reference Documents:****1. Specification No.:**

No	Specification	Name
1	AOP82-4001-27-04(19)	Cavity-FG (SM980 for Lumentum)
2	AOP82-4001-27-09(22)	Cavity-FG (SM980 for Coherent)
3	AOP82-4001-27-11(18)	Cavity-FG (80µm PM980 for Coherent)
4	AOP82-4001-27-10(18)	Cavity-FG (PM980 for Coherent)
5	AOP81-2122-27-01(20)	Cavity-FG (PM980 for Submarine)
6	AOP82-4001-27-13(06)	Cavity-FG (SM980 for Dogain Tech)
7	AOP82-4001-27-14(06)	Cavity-FG (PM980 for Lumentum)
8	AOP82-4001-27-06(14)	Manufacturing condition of Cavity-FG
9	AOP82-4001-27-07(9)	Requirement for quality assurance of Cavity-FG
10	AOP82-4001-27-08(24)	Packing requirement of Cavity-FG
11	AOP82-4001-27-05(27)	Visual inspection of Cavity-FG
12	AOP81-2122-27-02(02)	Requirement for Submarine Cavity-FG manufacturing
13	AOP82-4001-27-12(04)	Requirement for Deliverable data and Environmental information of Cavity-FG
14	AOP82-4001-27-15(04)	Cavity-FG (SM980 for 3SP)
15	AOP82-4001-27-16(04)	Cavity-FG (PM980 for 3SP)

**2. Working Direction No.:**

No	Working direction	Name	Application process
1	PTE82-59-21-2010	Working direction about visual inspection for Submarine products	Recoat Inspection & Fiber Inspection

**IV. Term definition:**

- FG: Fiber Grating
- Recoat: a layer of acrylate material

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**V. ROHS material requirement & Traceability control:****1. ROHS material requirement**

Table V.1 List of material required RoHS compliance.

Item	Material name	Description
1	Optical Fiber	Corning-HI1060, Fujikura-SM98PSU25DH, Fujikura-RCSM98PSU17C, Fujikura-RCSM98PSU17D, Fujikura-HASM1060
2	Recoat resin	950-200 (Desolite) or 950Y200(JFC)
3	Marking pen	Artline K-50 Red (Shachihata), Artline K-50 Black (Shachihata) Artline EK-50 Red (Shachihata), Artline EK-50 Black (Shachihata)
4	Packing case	Packing Case for Cavity FG ver.2*, Antistatic Packing Case (60pcs Cavity-FG)
5	Reel Lite	SPOOL-1-ST (OPTO QUEST)*
6	Individual label	TZe-221 (Brother)
7	Packing label	TZe-251 (Brother)
8	Individual label	TZe-231 (Brother)
9	Zipper bag	GP-F-4-YOKONAGA (SEISANNIPPONSHA) or equivalent material <sup>(i)</sup>
10	Silicone spiral tube	KEPSi-2-3 (HAGITEC) or equivalent material <sup>(i)</sup>
11	Fushigi tape (white)	Fushigi tape (Nirei industry)
12	Mending tape	Magic Tape (Scotch)

(i) Need to use material approved by FJK.

**2. Traceability control:**

Type of Record	Items	Record
Quality control items	Refer to 4-QC-378 or 4-QC-0154	Manufacturing program /Checksheet
Identification and traceability record	- Material Lot#	
	- Operation date	
	- Machine/Tool-jig control number	
	- Operator code	
	- Manufacturing/ inspecting date	

**VI. Content:****1. Incoming Inspection****1.1 Process specification**

Item	Specification
Length of spiral tube	5 ~ 10mm
Length of scotch tape	~ 90mm
Length of the fold	~ 5mm
Length and quantity of air bubble sheet for an inner carton box	+ ~ 550 x 160mm, 1 sheet + ~ 450 x 200mm, 1 sheet + ~190 x 130mm , 9 sheets
Appearance	+ Aluminum board and silicon gum's groove must be not dirty, damaged... + Spiral tube & Scotch tape: Not dirty (contamination), both of end must be straight, not deviated + Air bubble: Edges must be straight, not deviated + Packing case/bag must not be dirty, damaged...

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## 1.2 Process condition

Item	Condition
Appearance	Visual
Length of spiral tube	Jig/Ruler
Length of scotch tape	Machine
Length of the fold	Visual
Quantity of air bubble	Counting and visual

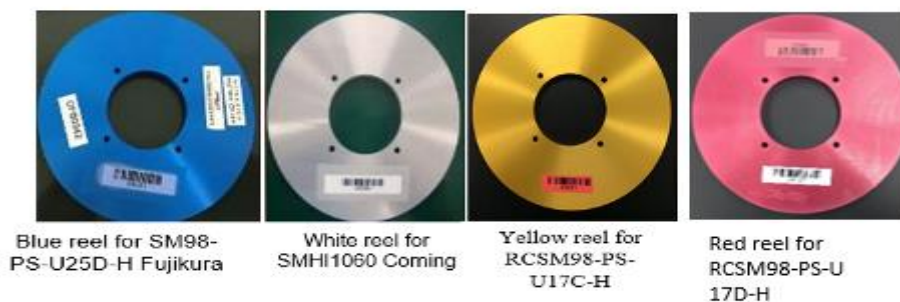
## 2. Fiber Rewinding

## 2.1 Process specification

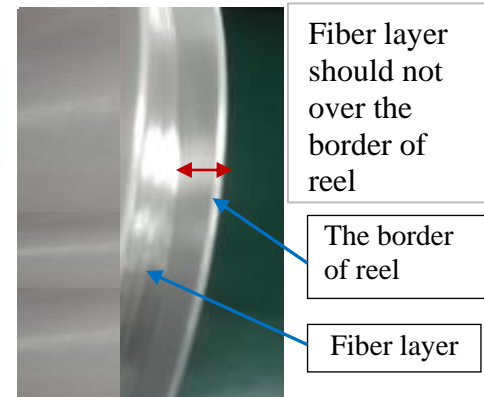
Item	Specification
Fiber rewinding length	<ul style="list-style-type: none"> <li>- Rewinding length of fiber is 250 m/reel</li> <li>- In case of end of bobbin, the rewinding length can be over 250m but less than 300m.</li> </ul>
Appearance	<ul style="list-style-type: none"> <li>- Fiber layer should not over the border of reel (See Fg 2.1.2).</li> <li>- There is no damage or deformation of fiber and reel.</li> </ul>



Fg 2.1.1: Optical Fiber Rewinding Machine



Fg 2.1.2: Optical Fiber Reel (aluminum)



## 2.2 Process condition

Item	Condition
Fiber rewinding length	Machine setting (See Fg 2.1.1).
Appearance	Visual

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### 3. Hydrogen Loading

#### 3.1 Process specification

Item	Specification
Loading pressure	Pressure is 9.0 ~ 11.0 Mpa
Loading temperature	Temperature is less than 70°C (Optimal condition: 55 ~ 65°C)
Loading time	Loading time is equal or greater than 24hrs.
Pot life of fiber (or Storage time)	<ul style="list-style-type: none"> <li>* Storage at room temperature (Storage time @RT): <ul style="list-style-type: none"> <li>- Pot life should: <math>\leq 8\text{hr}</math></li> </ul> </li> <li>* Storage time at low temperature: <ul style="list-style-type: none"> <li>- Fiber must be used less than 24 hours (Optimal condition: 22hours)</li> <li>- Storage temperature: <math>-40^{\circ}\text{C} &lt; T &lt; -20^{\circ}\text{C}</math> (Setting value)</li> <li>- Reel package: should be packaged individually in a zipper bag</li> </ul> </li> </ul>



Fg 3.1.1: Hydrogen Loading Chamber



Fg 3.1.2: Putting Optical Fiber Reel (aluminum) into Chamber



Fg 3.1.3: Pressure of Hydrogen Loading



Fg 3.1.4: Temperature of Hydrogen Loading



Fg 3.1.5: Packing reel before put into low-temperature storage

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## 3.2 Process condition

Item	Condition
Pot life of fiber	Visual (expiration date on reel)
Pressure	Hydrogen loading machine
Temperature	
Loading time	Clock, Checksheet
Storage time	- Clock, Checksheet - Visual (expiration date on reel)
Storage at low temperature	Freezer or equivalent equipment

## 4. Fiber cutting

## 4.1 Process specification

Item	Specification
Pot life of fiber	Fiber must be used less than 24 hours after taking out Hydrogen loading chamber. (Optimal condition: 22hours)
Cutting length	Prefer to table 4.1.1
Yellow port position (yellow tape)	Prefer to table 4.1.1 and Figure 4.1.1
Red port position (red plastic tape)	Prefer to table 4.1.1 and Figure 4.1.1

Table 4.1.1 Cutting length of Cavity-FG. 

Group	Type name	L1	L2	L3	Total length of cutting (mm)
1	DUV, DXV, DYV, YDV, YEV, YUV, YXV	830 ± 50	820 ± 50	1100 ± 50	~ 2750
2	NAV, NBV	860 ± 50	820 ± 50	2530 ± 50	~ 4210
3	WAV	660 ± 50	820 ± 50	2010 ± 50	~ 3490
4	XAV	660 ± 50	820 ± 50	1260 ± 50	~ 2740
5	XBV, WBV	660 ± 50	820 ± 50	510 ± 50	~ 1990
6	KBV, KCV, KYV, KXV	1505 ± 50	820 ± 50	665 ± 50	~ 2990
7	HCV, HDV, HEV, HFV, HGV, HHV, HJV, HKV, HLV	N/A	640 ± 20	945 ± 20	~ 1735
8	KDV, KEV	460 ± 50	820 ± 50	760 ± 50	~ 2040
9	YAV	1580 ± 50	820 ± 50	1100 ± 50	~ 3500
10	NCV, NDV	1480 ± 50	820 ± 50	2550 ± 50	~ 4850
11	NYV, NXV	1425 ± 50	820 ± 50	2745 ± 50	~ 4990
12	XCV, XDV	1950 ± 50	820 ± 50	1270 ± 50	~ 4040
13	NWV, NUV	765 ± 50	820 ± 50	2745 ± 50	~ 4330
14	SAV	835 ± 50	820 ± 50	1375 ± 50	~3030
15	SBV, SCV	1615 ± 50	820 ± 50	1095 ± 50	~3530
16	CAV	865 ± 50	820 ± 50	1095 ± 50	~2780
17	PAV	455 ± 50	820 ± 50	725 ± 50	~2000
18	UAV, UBV	1085 ± 50	820 ± 50	615 ± 50	~2520
19	TAV, TBV	1845 ± 50	820 ± 50	1075 ± 50	~3740
20	XEV, XFV	2755 ± 50	820 ± 50	2815 ± 50	~6390

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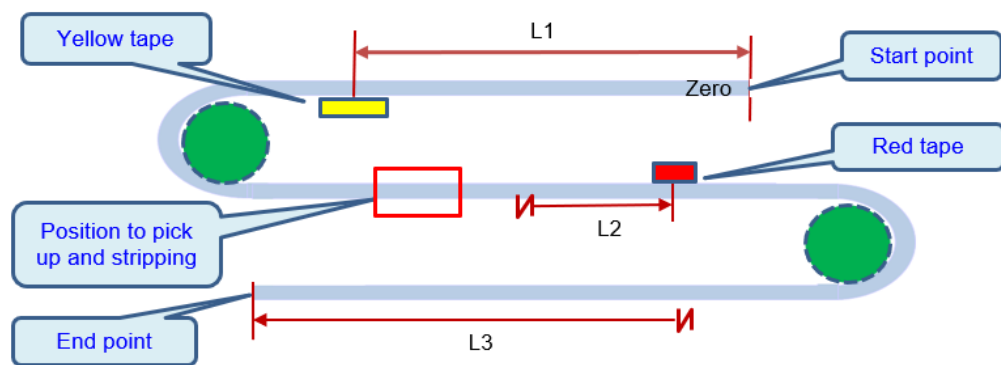


Figure 4.1.1 Diagram of cutting length - Cavity-FG

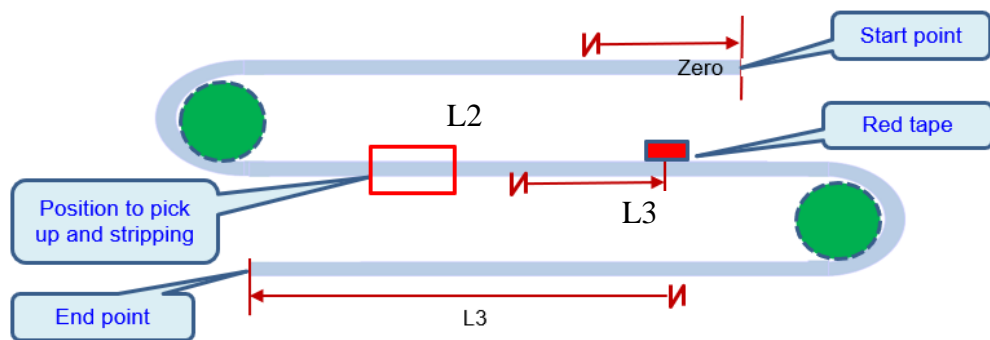


Figure 4.1.2 Diagram of cutting length - Cavity-FG (PM80um group)

## 4.2 Process condition

Item	Condition
Pot life of fiber	Program
Length of cutting	Jig
Position of starting winding fiber: Yellow port	Visual, Jig
Position of starting winding fiber: Red port	Visual, Jig
Fiber Type	Visual reel color

## 5. Fiber stripping

## 5.1 Process specification

Item	Specification
Appearance checking microscope	<ul style="list-style-type: none"> <li>- Checking bare fiber appearance by microscope. (Fg 5.1.8)</li> <li>- There are not: contamination on the glass at the middle area, contamination burned changing brown or black, peeling off the edge of primary coat, stripping sharp.</li> <li>- Stripping shape for Corning fiber and 80 um fiber as the Fg 5.1.3</li> <li>- Stripping shape for Fujikura fiber as the Fg 5.1.4.</li> </ul>
Position of stripping	At the middle of INPUT PORT (Yellow port) and OUTPUT PORT (Red port). Note: For PM80um group, position of stripping at the middle of the end fiber left port and the end of the red tape port's fiber wrap (Fg 5.1.2)
Cleaning bare fiber	<ul style="list-style-type: none"> <li>- Cleaning bare fiber by acetone right after stripping. (Fg 5.1.7)</li> <li>- Not touched bare fiber by anything.</li> </ul>
Stripping length	Daily check, 1 sample. <ul style="list-style-type: none"> <li>- Fiber 80um: &lt; 4.5 mm</li> <li>- Other fiber: 20 ~ 30mm</li> <li>- Dogain Tech (CAV type): 8 ~ 12mm</li> </ul>
Apply hot air (*)	- Hot air temperature < 650°C



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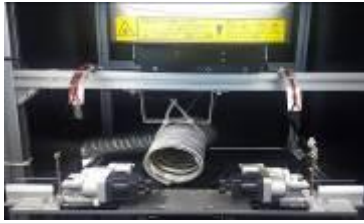
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- Hot air strip movement: 18mm (other SM types), 7mm (CAV type)
- UV remain: < 2mm from stripping end (Fig 5.1.6)

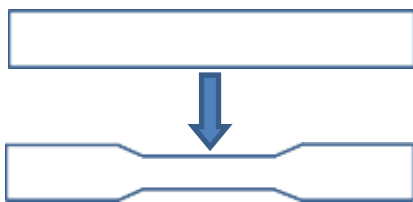
(\*) Refer to table II.1, "Apply hot air at stripping process" column



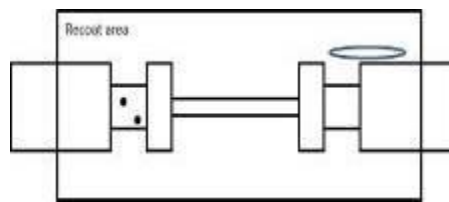
**Fig 5.1.1:** Stripping by CO2 Laser machine



**Fig 5.1.2:** Check balance of fiber before setting to machine (apply for PM80um group)



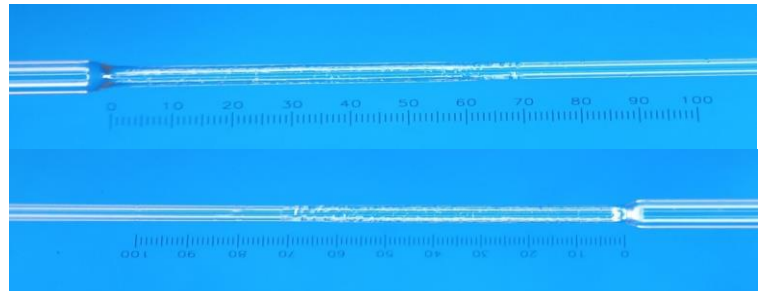
**Fig 5.1.3:** Stripping shape for Corning fiber and 80um fiber



**Fig 5.1.4:** Stripping shape for Fujikura fiber



**Fig 5.1.5:** Stripping by hot air machine (SM980)



**Fig 5.1.6:** UV remain < 2mm from stripping end → OK



**Fig 5.1.7:** Cleaning bare fiber by acetone and ultrasonic machine



**Fig 5.1.8:** Checking bare fiber by microscope.



**Fig 5.1.9:** Fiber stripping, setting and winding fiber on metal board. Yellow port is left and red port is right.

## 5.2 Process condition

Item	Condition	Remark
WIP control	Visual (Optimum condition: 5pcs)	For good yield% at Exposing, - The WIP should be controlled not over 5pcs normally to keep input to Exposing within 2 hours after cutting. - If process stopped for any reason, Leader up

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		must re-confirm WIP before input as following: + If don't use refrigerator: Don't exceeded 8hours after taking out from Hydro Loading chamber. + If use refrigerator: Don't exceeded 8 hours after taking out from refrigerator and don't exceeded 24h after taking out from Hydro Loading chamber.
Appearance of bare fiber	Visual by microscope	
Position of stripping	Visual	
<b>Equipment control:</b> + Stripping length + Proof test	Ruler (Daily checking) Proof tester (Daily checking)	
Stripping condition control	Daily Pull test (Breaking test)	Check the breaking strength before mass production usage: - Frequency: 3pcs/condition/ machine/shift - Breaking force: + $\geq 5$ kg.f, 1 sec for 125um fiber + $\geq 2$ kg.f, 1 sec for 80um fiber
	Reliability test or verification	Refer to 4-PR-006 for detail requirement
Operator skill control	Pull test (Breaking test)	Refer to 4-PR-006 for detail requirement
Hot air temperature	Visual (Machine setting)	Refer to table II.1, "Apply hot air at stripping process" column.
Hot air strip movement	Machine setting	Refer to table II.1, "Apply hot air at stripping process" column.

## 6. Exposing and Thermal aging

*Noted: Thermal aging has been applying base on requirement of product code (see the Table II. 1 Products general information).*

### 6.1 Process specification

Item	Specification
<b>Exposing result</b> Center wavelength Reflectivity Full Width Half Max Side Lobe Suppression Ratio Spectrum type	Control criteria by optical measurement result
Excimer Laser Energy Excimer Laser Density Heater Temperature Aging Time	Manufacturing: 120mJ, mode EGY-N or EGY-P, 40Hz $< 3 \text{ mJ/mm}^2$ (weekly checking) $> 380^\circ\text{C}$ $15 \pm 2$ seconds (Setting time on program)



Eg 6.1.1: Excimer Laser and Exposing

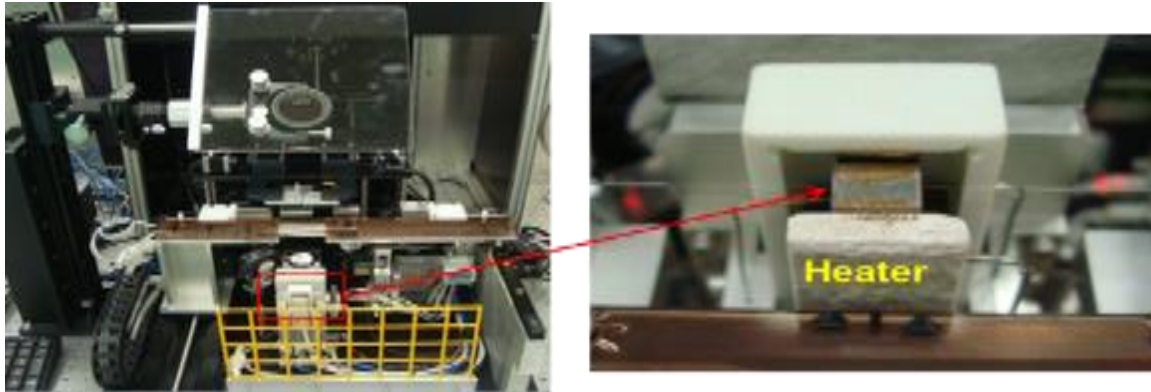
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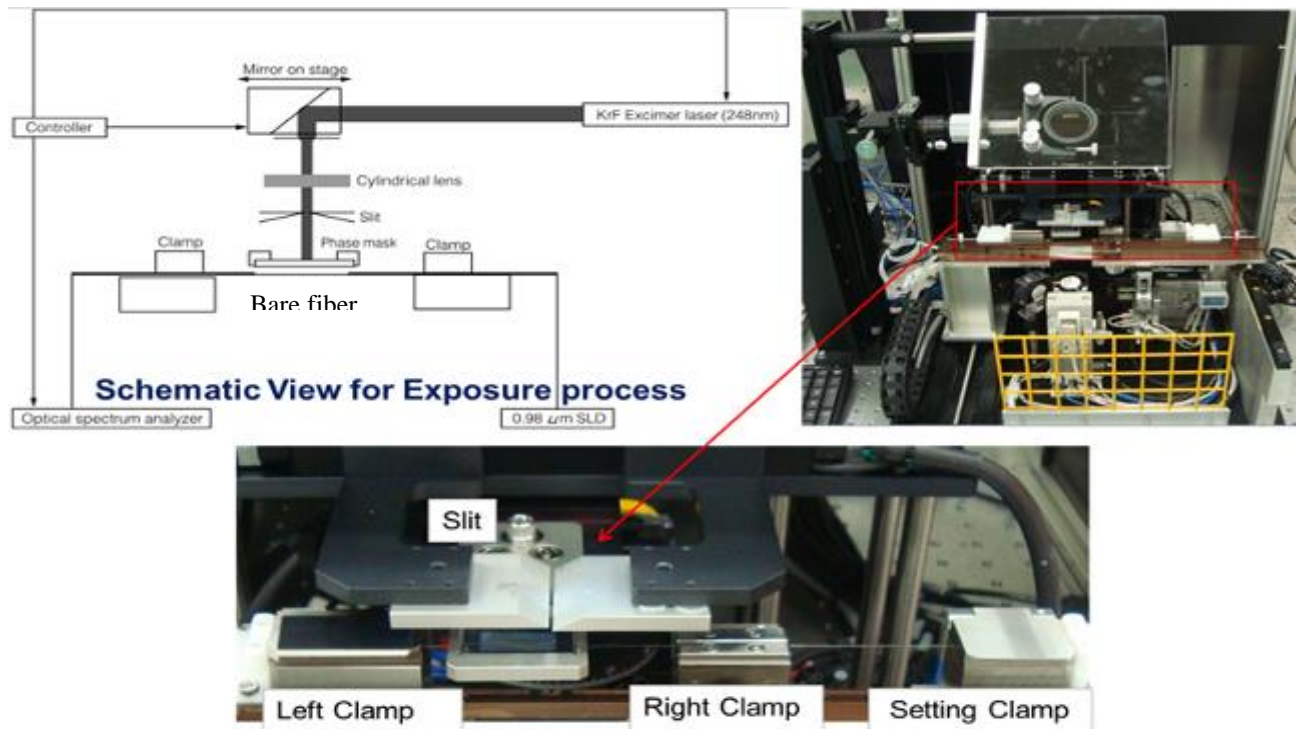
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Fg 6.1.2: Thermal Aging



Fg 6.1.3: Exposing system of Cavity FG



Fg 6.1.4: Exposing program(80um)

Fg 6.1.4: Exposing program

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## 6.2 Process condition

Item	Condition	Remark
WIP control	Visual (Optimum condition: 10pcs)	For good yield% at Exposing, - The WIP should be controlled not over 10pcs normally to keep input to Exposing within 2 hours after cutting. - If process stopped for any reason, Leader up must re-confirm WIP was not exceeded 24hours after Hydrogen loading before input.
Position of bare fiber FBG (80um)	Template	
<b>Equipment control:</b> + Excimer Laser Energy + Excimer Laser Density + Heater Temperature + Heating Time	+ Excimer laser machine (Daily checking) + Laser power meter, ruler, calculation (Weekly checking) + Exposing system (and program) (Daily checking) + Exposing system (and program) (Daily checking)	
<b>Exposing result:</b> + Center wavelength + Reflectivity + Full Width Half Max + Side Lobe Suppression Ratio + Spectrum type	Manufacturing program, measuring system Visual by checking OSA	

## 7. Thermal Aging (hot air) process

## 7.1 Process specification

Item	Specification
Hot air temperature	> 500°C
Stripping movement	2.5 mm
Pre-Heating	10 sec
Velocity	3.0mm/sec
Appearance	Check length of deformation or discoloration of fiber coating is less than 0.25mm (Fg 7.1.1) - Frequency: 3pcs/OP/day
Magnification	40X

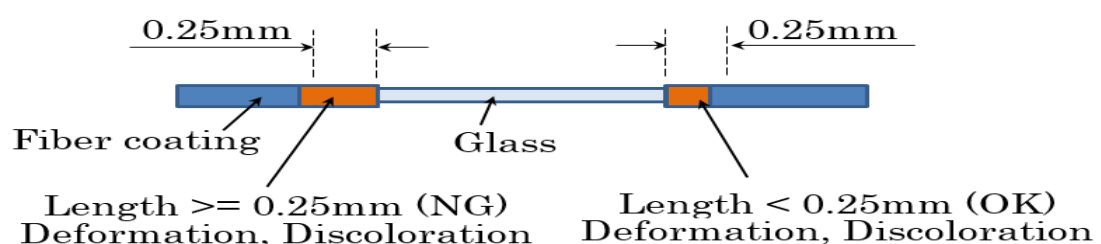


Fig. 7.1.1: Heating Area criteria at hot air



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## 7.2 Process condition

Item	Condition
Hot Air Temperature	Machine Setting
Appearance	Microscope

## 8. Recoating process

## 8.1 Process specification

Item	Specification
Appearance	Coating zone must not be overheat (change color), white, dried. Peel off: prefer to section 11. Visual inspection (recoating zone). Dent: prefer to section 11. Visual inspection (recoating zone). Dirty (contamination): prefer to section 11. Visual inspection (recoating zone).
Shape of UV resin on mold after recoating	After recoating, shape of UV resin on mold must be rhombus (see 8.1.5) but not apply for D06.
Recoating mold diameter sample.	D01, D02,D07, D08,D09,D10,D11: $300 \pm 30 \mu\text{m}$ . Refer to table II.1, DS column. D03, D05: $\leq 320 \mu\text{m}$ . Refer to table II.1, DS column. D06: $< 260\mu\text{m}$ . Refer to table II.1, DS column.
Cleaning's recoating	- Cleaning's liquid: clean alcohol (F.g 8.1.4) - Cleaning in 3~5 second.

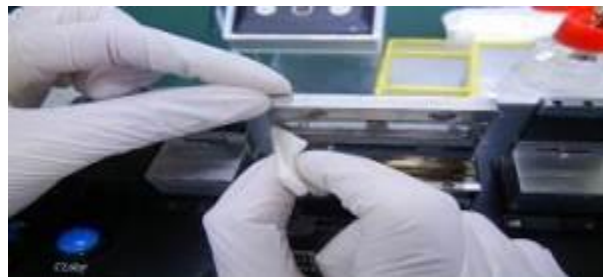


Fig 8.1.1: Mold cleaning



Fig 8.1.2: Adhesive injection and curing



Fig 8.1.3: Remove from mold



Fig 8.1.4: Cleaning by Alcohol



Fig 8.1.5: The shape of UV resin on mold must be rhombus after recoating

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## 8.2 Process condition

Item	Condition
Appearance	Visual by microscope
<b>Equipment control:</b> + Recoating diameter + Appearance + Recoating length	Microscope (Daily checking) Microscope (Checking sample) By template (Daily checking)
Shape of UV resin on mold after recoating	Visual
Recoat and UV curing	Recoater
Remove burr/cleaning	Ultrasonic machine

## 9. Marking and proof test:

## 9.1 Process specification

*Note: The marking process will be applied for product, which defined detail in table*

Item	Specification
Proof test level	+ $\geq 1.8$ kgf, 1sec (NAV,NBV,NCV,NDV,NYV,NXV,NWV,NUV type) + $\geq 1.5$ kgf, 1sec (others product) + $\geq 0.6$ kgf, 1sec (80um 980PM)
Fiber pull strain rate	$< 0.4$ mm/sec
Marking position	Mark must be located in marking area (Refer to F.g 9.1.1, 9.1.2 and 9.1.4)
Marking length	+ 5~10mm (D05, D07: Refer to table II. 1, column D.S) + 5~20mm (D01, D02, D08: Refer to table II. 1, column D.S) + 3~7mm (D10, D11: Refer to table II. 1, column D.S)
Recoating length	+ $> 5$ mm (D06: Refer to table II. 1, column RLS) + 30mm~55mm (D01, D02, D07, D08, D11: Refer to table II. 1, column RLS) + 40~50mm (D10: Refer to table II. 1, column RLS) + $< 50$ mm (others product)
Color of marking	Refer to table II.1, MCS column.

(D01)

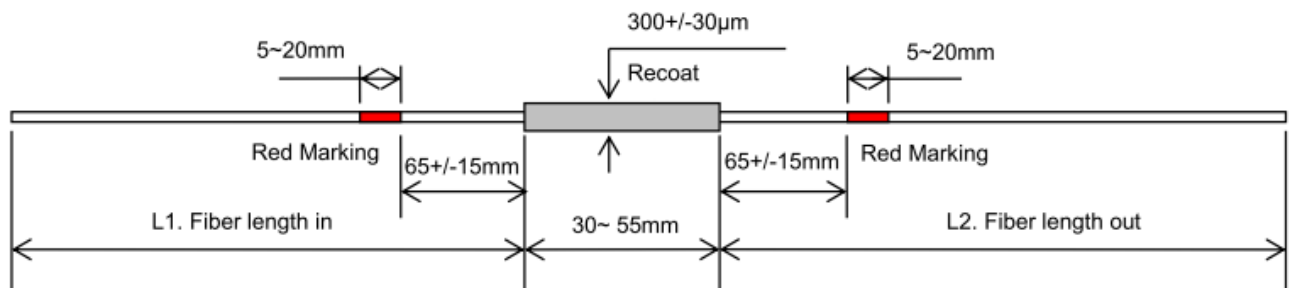


Fig 9.1.1: Product with red marking



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(D02)

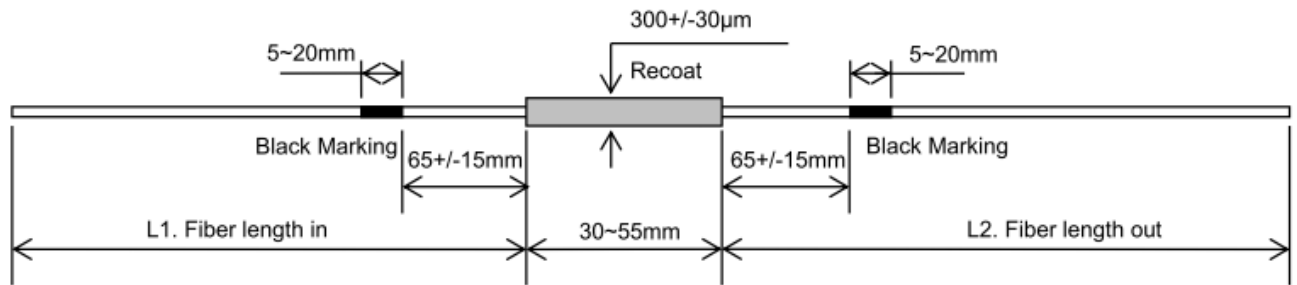


Fig 9.1.2: Products with black marking

(D03)

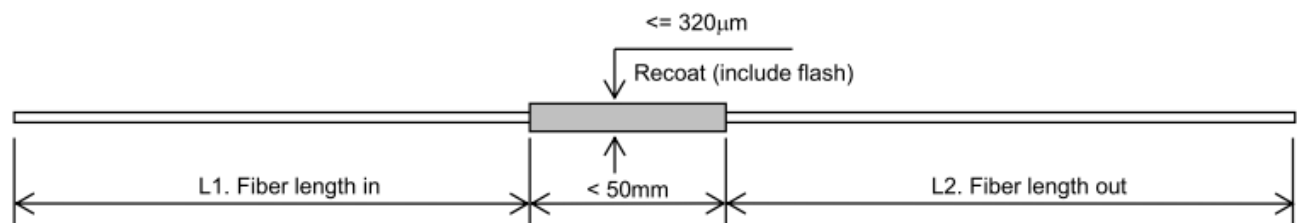


Fig 9.1.3: Products with no marking D03

\*No marking

(D05)

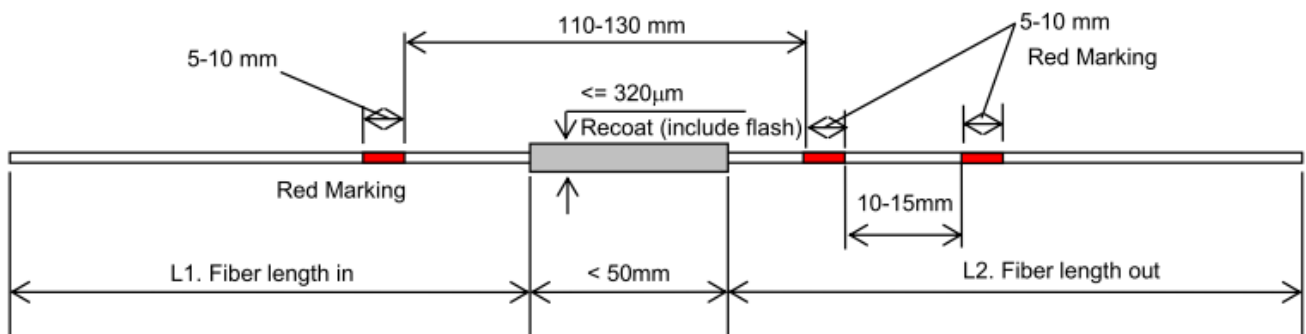
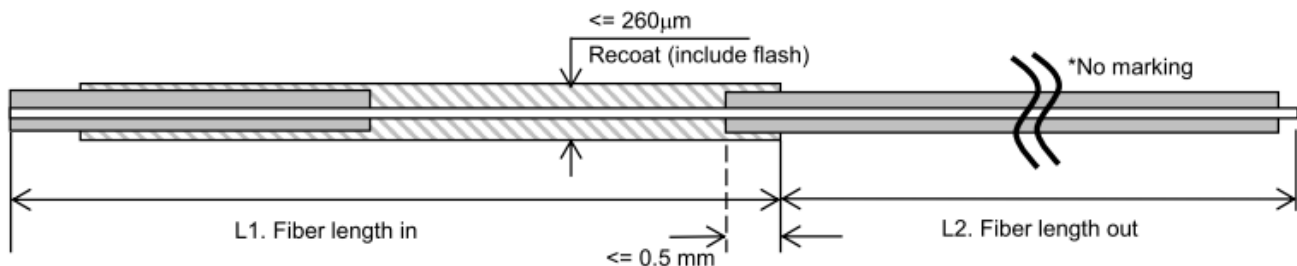


Fig 9.1.4: Products with two red marking on the right

(D06)

Fig 9.1.5: Products with no marking (fiber  $80 \mu\text{m}$ )

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(D07)

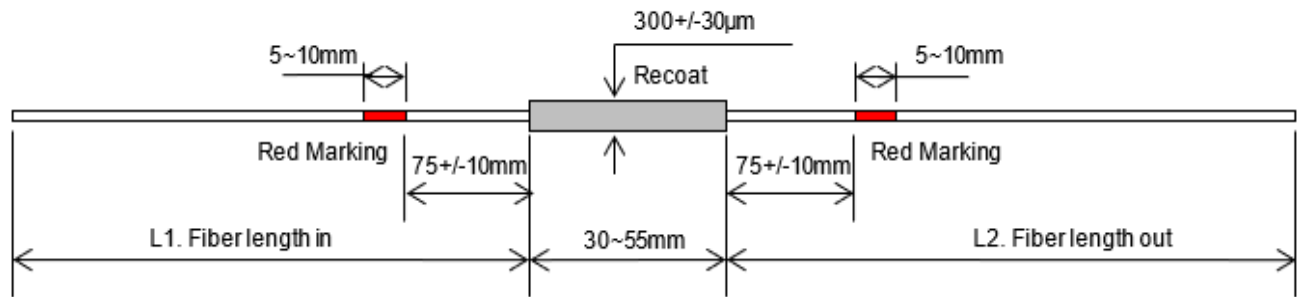


Fig 9.1.6: Products with red marking (NWV, NUV, NXV, NYV)

(D08)

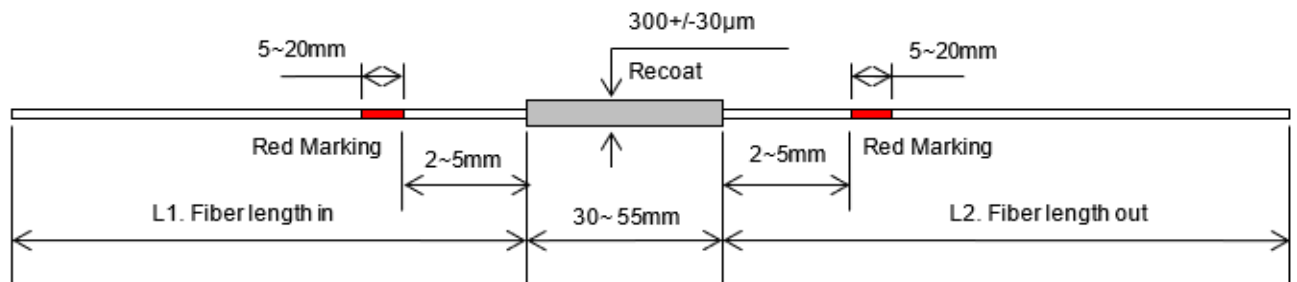


Fig 9.1.7: Products with red marking (SBV, SCV)

(D09)

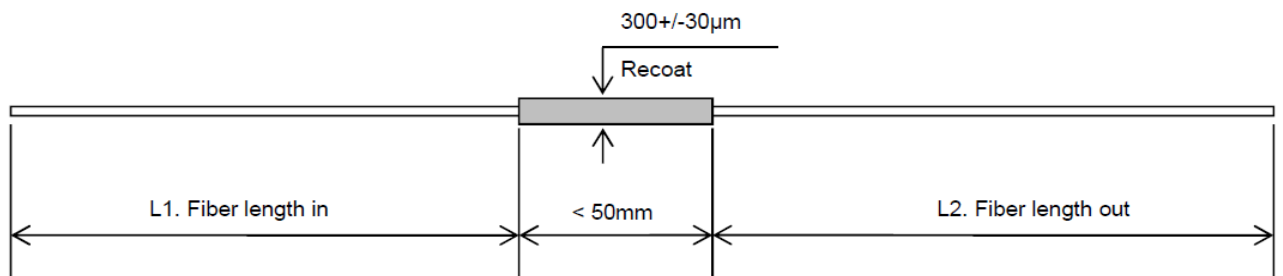


Fig 9.1.8 Products with no marking (CAV)

(D10)

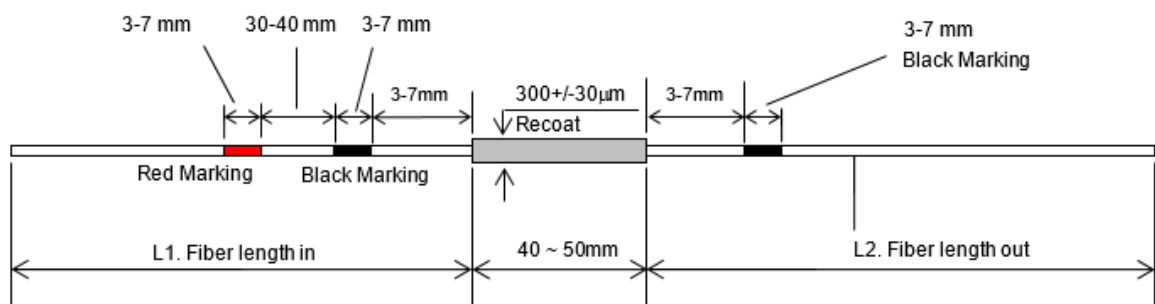


Fig 9.1.9 Products with Red &amp; Black marking (TAV &amp; TBV)

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(D11)

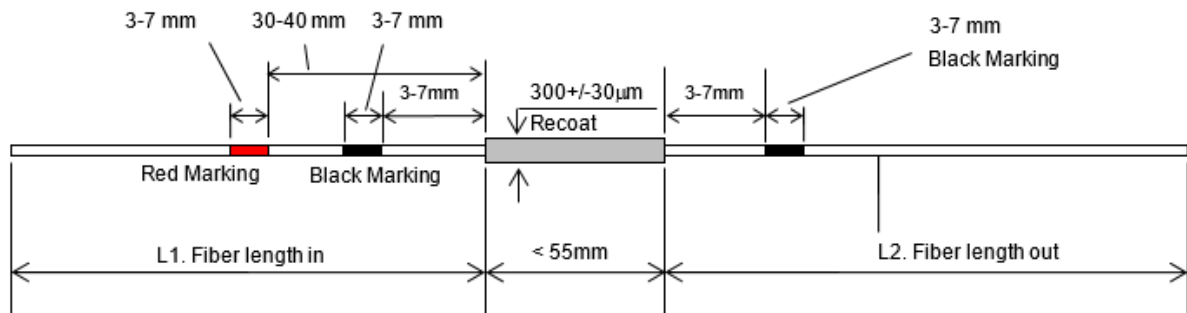


Fig 9.1.10 Products with Red &amp; Black marking (UAV &amp; UBV)



Fig 9.1.11: Proof test by machine

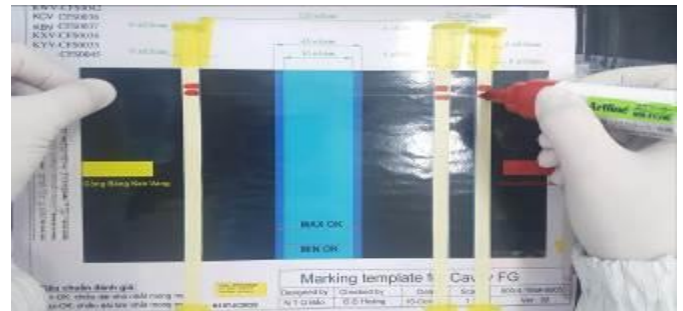
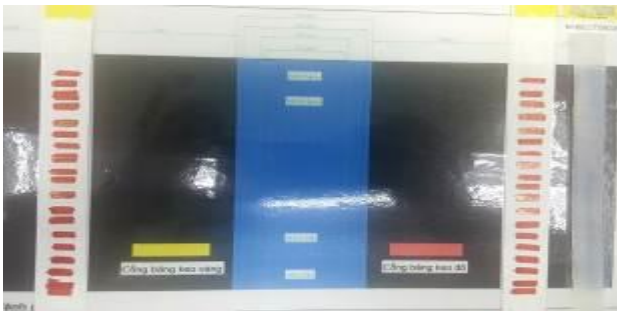


Fig 9.1.12: Marking by template

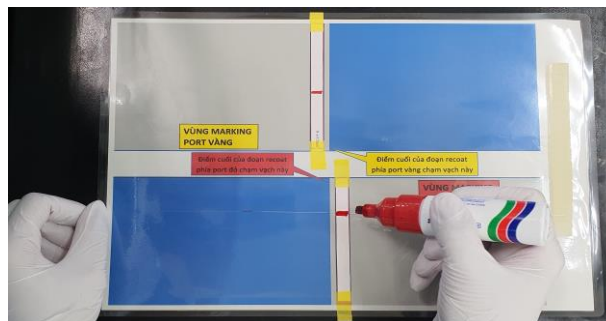


Fig 9.1.13: Marking by template for SBV, SCV

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## 9.2 Process condition

Item	Condition
Appearance	Visual
Proof test level	Proof tester (see Fg 9.1.11)
Marking position	Template
Marking length	
Recoating length	
Color of marking	Art-line pen

## 10. Hydrogen Unloading

## 10.1 Process specification

Item	Specification
Temperature	+ 120°C ± 5°C <i>Noted: Allowed temperature over 125°C but less than 130°C within first hour from when temperature goes up 115°C.</i>
Unloading Time	+11.5~13 hours (690~ 780 min)

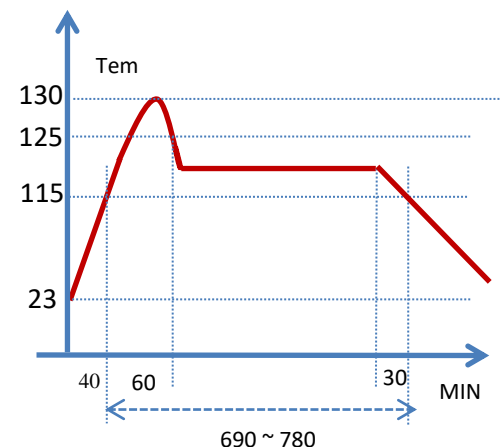


Fig 10.1: Unloading diagram

## 10.2 Process condition

Item	Condition
Unloading Temperature	Oven & Thermal recorder
Unloading Time	

## 11. Visual inspection (Recoating zone)

## 11.1 Process specification (Refer to table II.1, column RV)

- + Recoat region should be continuous
- + The recoat region must be fully cured and not tacky to the touch.
- + Within the critical recoat zone, recoat must be continuous around the fiber circumference with no exposed glass or original acrylate coating

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## 11.1.1 Apply for all products belong RV1

Item	Specification
Appearance	<ul style="list-style-type: none"> <li>- Table 11.1.1.1: Defect Size and Frequency Criteria within Critical Recoat Zone</li> <li>- Table 11.1.1.2: Defect Size and Frequency Criteria within Outside Critical Recoat Zone</li> </ul>

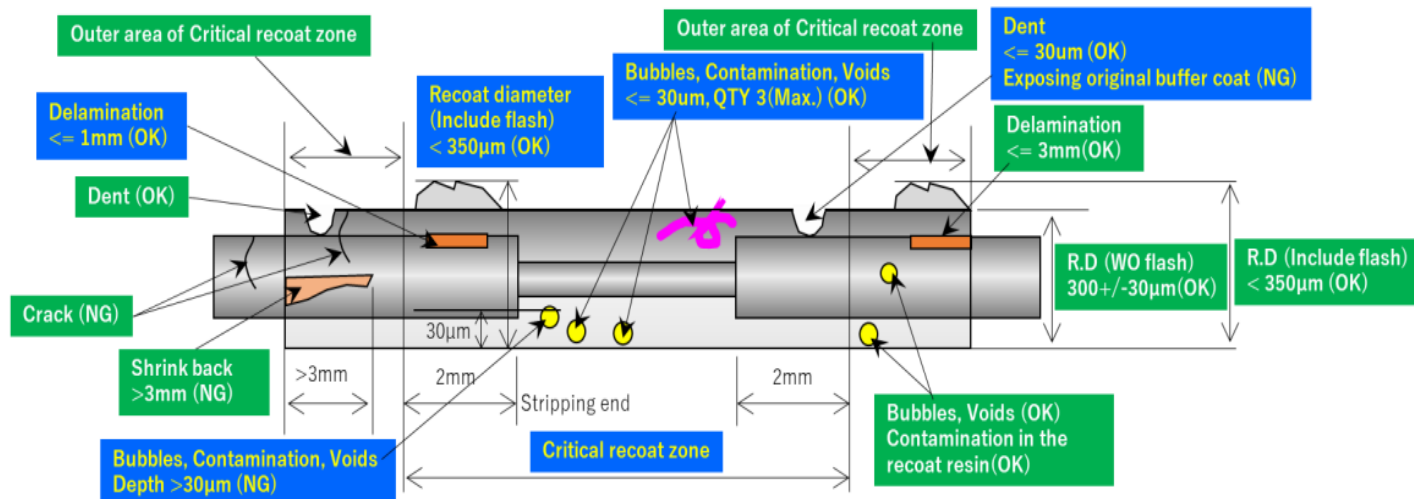


Table 11.1.1.1: Defect Size and Frequency Criteria within Critical Recoat Zone (RV1)

Defect Type	Defect Size/Condition	Acceptance level	Instrument and Method
Crack	Any	Not accept	Microscope: Magnification x40
Voids, Bubbles, contamination, Dent	Maximum depth $\leq 30\mu\text{m}$	Accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
	Max. dimension $\leq 30\mu\text{m}$	Accept	
Surface irregularities (not overlapped)	Maximum dimension or depth or height $\leq 30\mu\text{m}$ , Max: 3 pcs	Accept	
	Maximum dimension or depth or height $> 30\mu\text{m}$	Not accept	
	Exposing original buffer coating	Not accept	
Recoat diameter (wo flash)	D01, D02, D07, D08, D09, D10, D11 $< = 270\mu\text{m}$ or $> = 330\mu\text{m}$	Not accept	
Recoat diameter (including flash)	D01, D02, D07, D08, D09, $\geq 350\mu\text{m}$ D10, D11 $> = 330\mu\text{m}$	Not accept	
Discoloration (From marking ink)	Easy to find by naked eyes	Not accept	
Brown ring	At buffer/glass interface	Not accept	
Discoloration (yellowing)	Dark yellow	Not accept	
Delamination	A bright reflection between the glass and the recoating layer $> 1\text{mm}$	Not accept	

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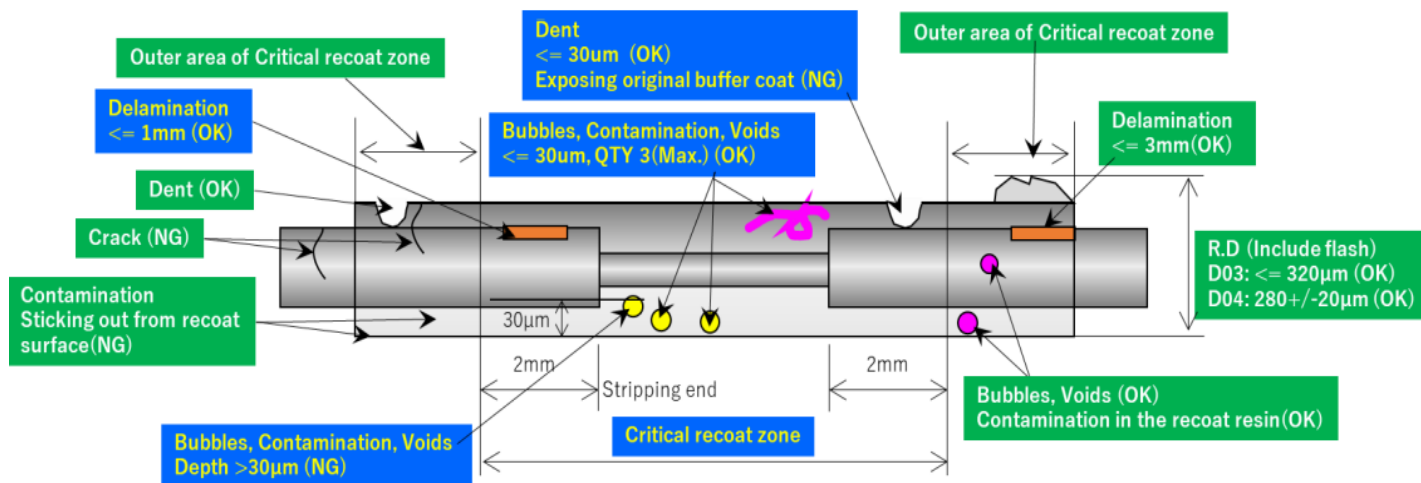
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Table 11.1.1.2: Defect Size and Frequency Criteria within Outside Critical Recoat Zone RV1

Defect Type	Defect Size/Condition	Acceptance level	Instrument and Method
Crack	Any	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
Contaminations	Sticking out from recoat surface	Not accept	
Voids, Bubbles, Dent	Any	Accept	
Surface irregularities (not overlapped)	Not expose original buffer coating over 3mm	Not accept	
Recoat diameter (wo flash)	D01, D02, D07, D08, D09 $\leq 270\mu\text{m}$ or $\geq 330\mu\text{m}$	Not accept	
Recoat diameter (including flash)	D01, D02, D07, D08, D09 $\geq 350\mu\text{m}$ D10, D11 $\geq 330\mu\text{m}$	Not accept	
Discoloration (From marking ink)	Easy to find by naked eyes	Not accept	
Brown ring	At buffer/glass interface	Not accept	
Discoloration (yellowing)	Dark yellow	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x20
Delamination	A bright reflection between the buffer coating (original) and the recoating layer is more than 3 mm from the end of recoating (both side)	Not accept	

## 11.1.2 Apply for all products belong RV2

Item	Specification
Appearance	<ul style="list-style-type: none"> <li>- Table 11.1.2.1: Defect Size and Frequency Criteria within Critical Recoat Zone</li> <li>- Table 11.1.2.2: Defect Size and Frequency Criteria within Outside Critical Recoat Zone</li> </ul>





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Table 11.1.2.1 Defect Size and Frequency Criteria within Critical Recoat Zone (RV2)

Defect Type	Defect Size/Condition	Acceptance level	Instrument and Method
Crack	Any	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
Contamination	Maximum depth > 30μm Max. dimension > 30μm	Not accept	
	Max. dimension ≤ 30μm Max: 3 pcs	Accept	
Voids, Bubbles	Maximum depth > 30μm Max. dimension > 30μm	Not accept	
	Max. dimension ≤ 30μm Max: 3 pcs	Accept	
Dent	Maximum depth > 30μm	Not accept	
	Exposing original buffer coating		
Recoat diameter	(D03, D05) > 320um	Not accept	
Brown ring	At buffer/glass interface	Not accept	
Discoloration (yellowing)	Dark yellow	Not accept	
Delamination	A bright reflection between the glass and the recoating layer>1mm	Not accept	
Surface irregularities (not overlapped)	Maximum dimension or depth or height ≤ 30μm, Max: 3 pcs	Accept	
	Maximum dimension or depth or height > 30μm	Not accept	
	Exposing original buffer coating	Not accept	

Table 11.1.2.2 Defect Size and Frequency Criteria within Outside Critical Recoat Zone (RV2)

Defect Type	Defect Size/Condition	Acceptance level	Instrument and Method
Crack	Any	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
Contamination	Sticking out from recoat surface	Not accept	
Bubbles, Voids	Any Void, Bubble	Accept	
Recoat diameter	(D03, D05) > 320um	Not accept	
Surface irregularities (not overlapped)	Not expose original buffer coating over 3mm.	Not accept	
Discoloration (yellowing)	Dark yellow	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x20
Delamination	A bright reflection between the glass and the recoating layer > 3mm	Not accept	

Note: D03, D04, D05: Refer to table II.1, column D.S

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11.1.3. Apply for all products belong RV3:

Item	Specification
Appearance	- Table 11.1.3.1: Defect Size and Frequency Criteria within Recoat Zone

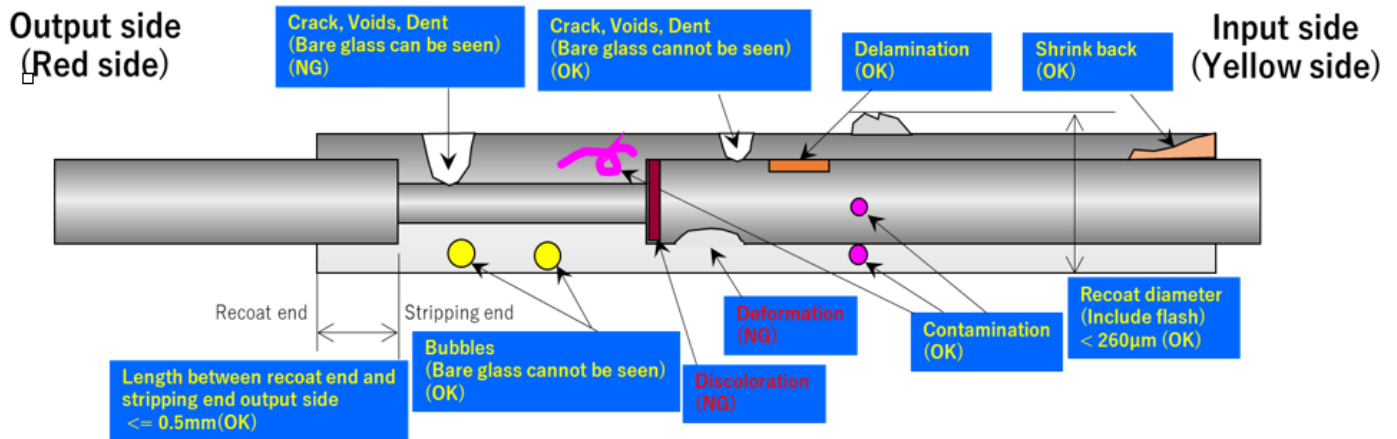


Table 11.1.3.1 Defect Size and Frequency Criteria within Recoat Zone (RV3)

Defect Type	Defect Size/ Condition	Acceptance level	Instrument and Method
Dent, air bubble, delamination, shrink back	- Can be seen bare glass - Recoat resin does not overlap rounded corners of fiber coating even if only for a part	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
Recoating diameter (include flash)	> 260µm	Not accept	Microscope: inspect by Magnification x40 and measure by Magnification x40
Length between recoat edge and stripping end at the output (red port)	> 0.5 mm	Not accept	Ruler in microscope with Magnification x40
Glass exposure at the recoat overlap	Bare glass can be seen	Not accept	Microscope: inspect by Magnification x40
Deformation, discoloration	At buffer/glass interface	Not accept	Microscope: inspect by Magnification x40

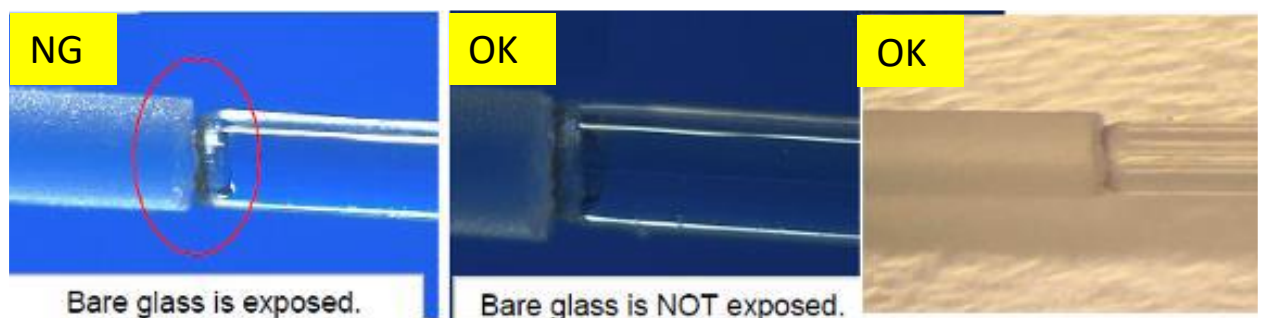


Fig 11.1.3.1: Glass exposure at the recoat overlap samples

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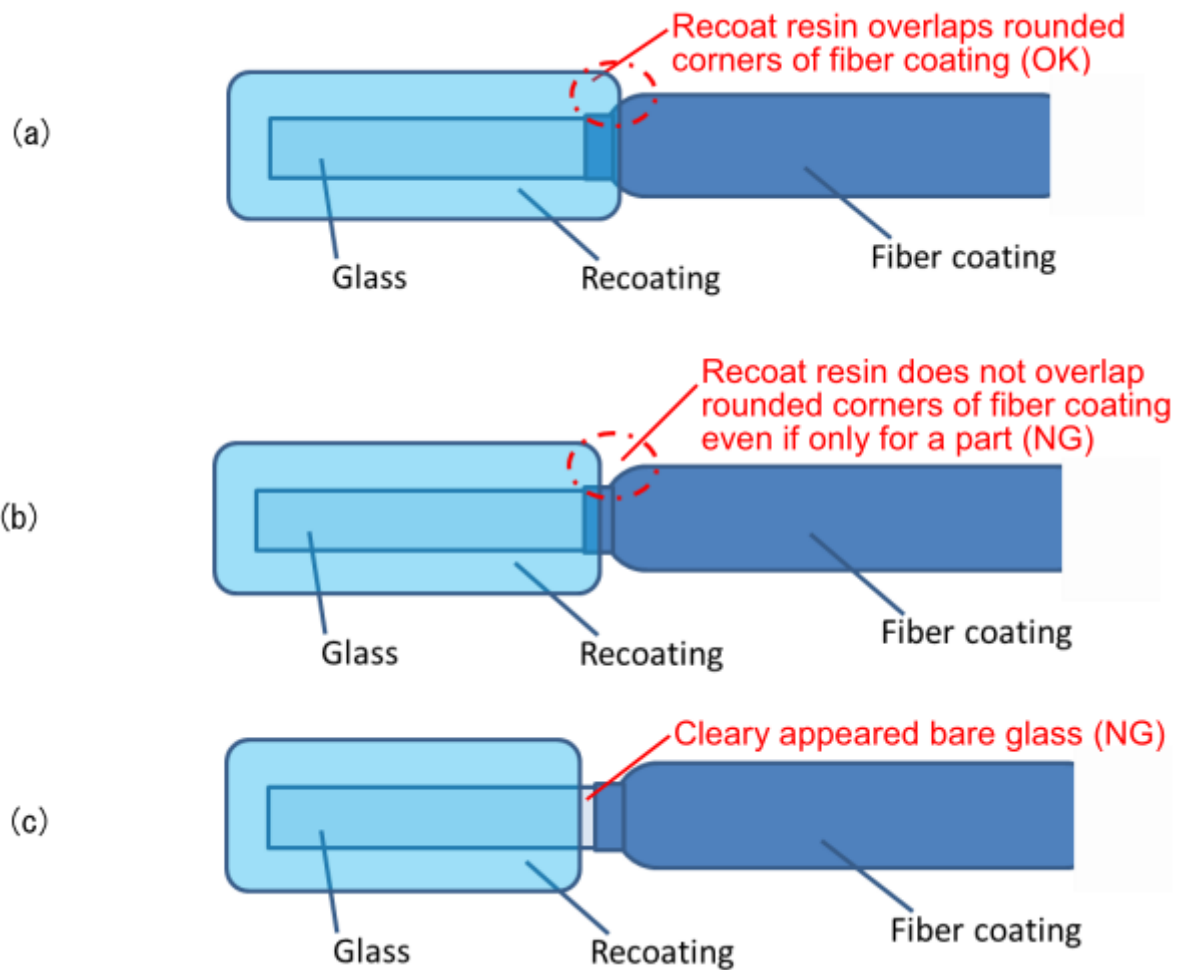


Fig 11.1.3.2: Schematics of Glass exposure at the recoat overlap

Defect example of RV3

Discoloration

Criteria: At buffer/glass interface is NG



Fig. 11.1.3.3. Discoloration sample

Deformation

Criteria: At buffer/glass interface is NG



Fig. 11.1.3.4. Deformation sample

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## 11.2 Process condition

Item	Condition
Appearance	Microscope
Inspection method (procedure)	<ul style="list-style-type: none"> <li>- Step 1: set and adjust product in horizontal direction to see burr line (molding line) clearly.</li> <li>- Step 2: do burr removing along the recoating zone</li> <li>- Step 3: measure &amp; check recoating diameter</li> <li>- Step 4: check the appearance of recoat area (contamination, void, air bubble,...)</li> <li>- Step 5: rotate product (recoat area) next 180 degree and repeat step 4.</li> <li>- Step 6: rotate product (recoat area) next 90 degree and repeat step 4.</li> <li>- Step 7: rotate product (recoat area) next 180 degree and repeat step 4.</li> </ul> <p>* Note: keep one direction of rotation under checking to complete all sides of recoating surface.</p>

## 12. Optical Measurement



## 12.1 Process specification

Table 12.1.1: Optical parameter for each product

		Type	Specification
Optical measurement configuration	Splice Loss	All product types	-0.1dB ~ 0.3 dB
	Center wavelength	YDV, NDV, NXV, SCV	975.7 ~ 976.3 nm
		YEV	976.7 ~ 977.3 nm
		DUV, YUV	973.9 ~ 974.5 nm
		DXV, DYV, YXV, YAV, SAV, SBV	973.3 ~ 973.9 nm
		NAV, NWV	973.5 ~ 974.5 nm
		NBV, NUV	975.5 ~ 976.5 nm
		WAV, XAV, XBV, WBV	973.75 ~ 974.25 nm
		XCV, TAV, XEV	973.45 ~ 973.95 nm
		XDV, TBV, XFV	975.45 ~ 975.95 nm
		KBV, KYV, KDV, PAV	973.25 ~ 973.75 nm
		KCV, KXV, KEV	975.25 ~ 975.75 nm
		HCV, HEV, HGV, HHV, HJV, HKV, HLV	973.7 ~ 974.6 nm
		HDV, HFV	975.7 ~ 976.6 nm
		NCV, NYV	973.2 ~ 973.8 nm
		CAV	973.7 ~ 974.3 nm
		UAV	974.05 ~ 974.55 nm
		UBV	975.55 ~ 976.05 nm
	Reflectivity	DUV, DFV, DXV, YDV, YEV, YUV, YXV, YAV, CAV, SBV, SCV	1.8 ~ 2.4%
		DYV, NAV, NBV, NWV, NUV	3.5 ~ 4.5%
		NCV, NXV, NYV, NDV	1.7 ~ 2.3%
		HCV, HDV	3.5 ~ 5.2%
		WAV	1.5 ~ 2.5%
		XAV, XBV	4.0 ~ 5.0%

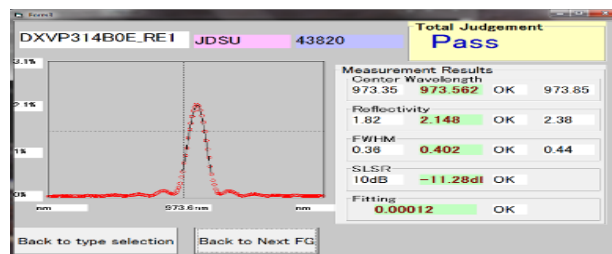
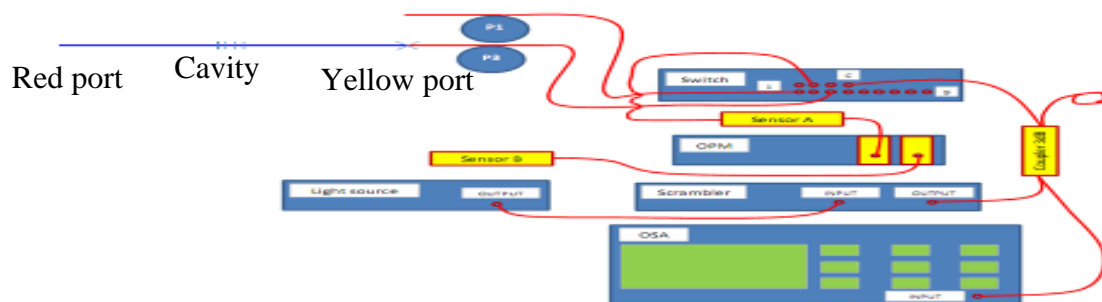
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		XCV, XDV, XEV, XFV	2.5 ~ 3.5%
		KBV, KCV, KYV, KXV, KDV, KEV, PAV, TAV, TBV	1.75 ~ 2.25%
		WBV	5.0 ~ 6.0%
		HEV, HFV, HGV, HHV, HJV, HKV, HLV	5.4 ~ 7.2%
		SAV	1.8 ~ 2.2%
		UAV, UBV	7.5 ~ 8.5%
	Full Width Half Max	DUV, DFV, DXV, DYV, YDV, YEV, YUV, YXV, NAV, NBV, NWV, NUV, CAV, SAV	0.35 nm ~ 0.45 nm
		WAV, WBV	0.4 nm ~ 0.6 nm
		XAV, XBV	1.2 nm ~ 1.4 nm
		KBV, KCV, KYV, KXV, KDV, KEV	1.1 nm ~ 1.4 nm
		HAV, HBV, HCV, HDV, HGV, HKV	1.1 nm ~ 1.5 nm
		YAV, SBV, SCV, HLV	0.8 nm ~ 1.2 nm
		NCV, NDV, NYV, NXV	0.9 nm ~ 1.1 nm
		HEV, HFV, HHV, HJV	0.5 nm ~ 1.0 nm
		XCV, XDV, XEV, XFV	0.7 nm ~ 0.9 nm
		PAV	1.1nm ~ 1.4 nm
		TAV, TBV, UAV, UBV	0.55nm ~ 0.75 nm
	Side Lobe Suppression Ratio	DUV, DFV, DXV, DYV, NAV, NBV, WAV, YDV, YEV, YUV, YXV, YAV, NCV, NDV, NYV, NXV, NWV, NUV, WBV, CAV, SAV, SBV, SCV, TAV, TBV, UAV, UBV	≤ -10dB
		XAV, XBV, HEV, HFV, HGV, HHV, HJV, HKV, HLV	≤ -15dB
		KBV, KCV, KYV, KXV, KDV, HCV, HDV, KEV, XCV, XDV, PAV, XEV, XFV	≤ -20dB



Measurement program

Fig 12.1.1: Optical measurement configuration

## 12.2 Process condition

Item	Condition
Environment temperature	Thermometer (Monitoring system)
Thermometer position	Fixed position and near to the product are measuring
Splice Loss	Manufacturing program, measuring system

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**Optical Measurement result:**

- + Center wavelength
- + Reflectivity
- + Full Width Half Max
- + Side Lobe Suppression Ratio

**13. Visual Inspection and Packing**

a. Process specification (Refer to table II.1, column FV1, FV2)

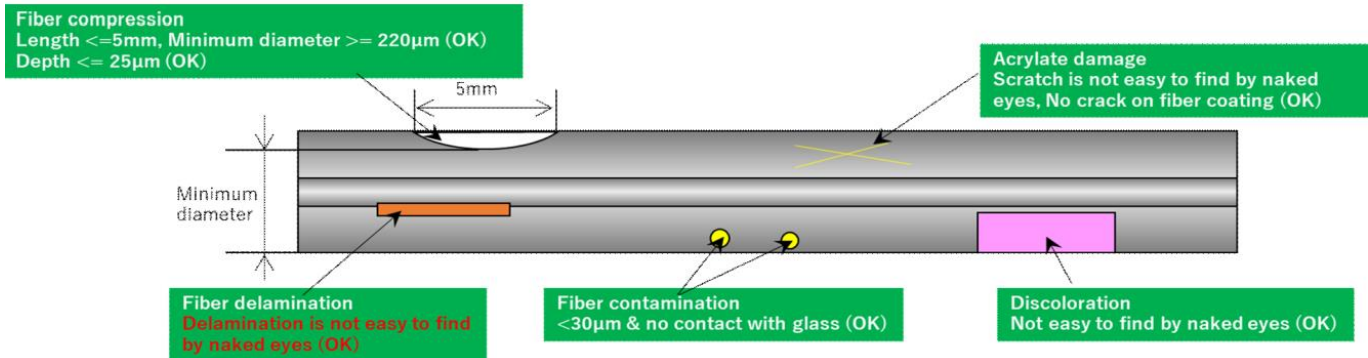
**13.1.1 Visual Inspection**

Fig 13.1.1.1: Defect mode on fiber (FV1)

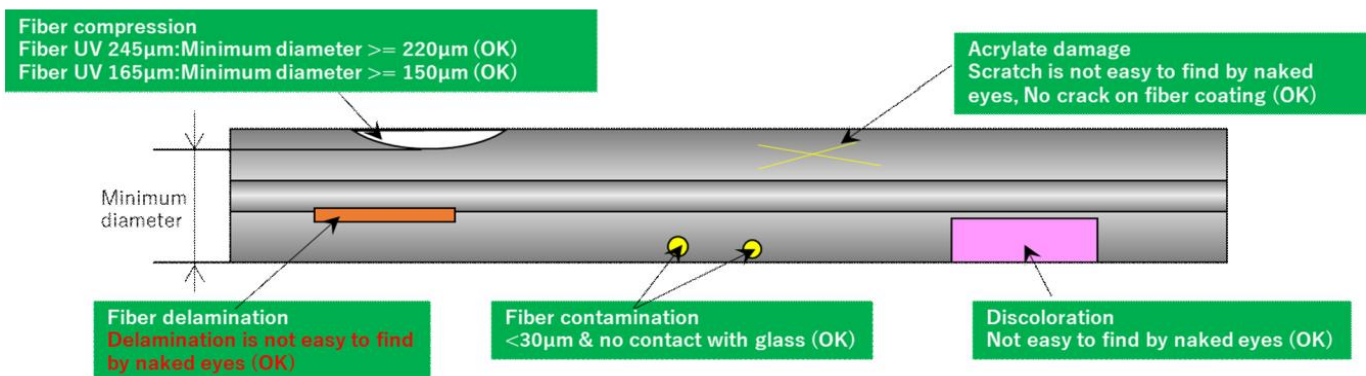


Fig 13.1.1.2: Defect mode on fiber (FV2)

Table 13.1.1.1 Fiber Defect Size and Frequency Criteria

Defect Type	Defect Size/Condition	Acceptance level
Discoloration	Easy to find by naked eyes	Not accept
Contamination	$> 30\mu\text{m}$	Not accept
	Contacting the glass	
Delamination	Easy to find by naked eyes	Not accept
Fiber compression (criteria of FV1)	Minimum diameter $< 220\mu\text{m}$ OR Depth $> 25\mu\text{m}$	Not accept
	Length in longitudinal direction $> 5\text{mm}$	Not accept
Fiber compression (criteria of FV2)	Fiber UV 245 $\mu\text{m}$ : minimum diameter $< 220\mu\text{m}$	Not accept
	Fiber UV 165 $\mu\text{m}$ : minimum diameter $< 150\mu\text{m}$	Not accept
Acrylate damage without exposed glass	Crack on fiber coating Scratch (easy to find by naked eyes)	Not accept
Acrylate damage with exposed glass	Exposed glass	Not accept



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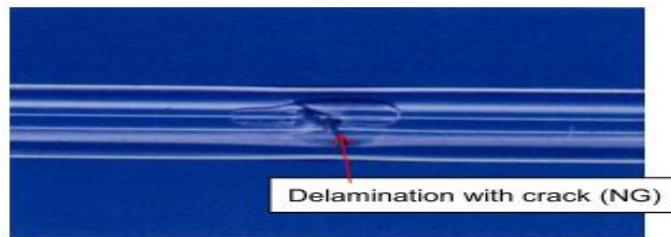
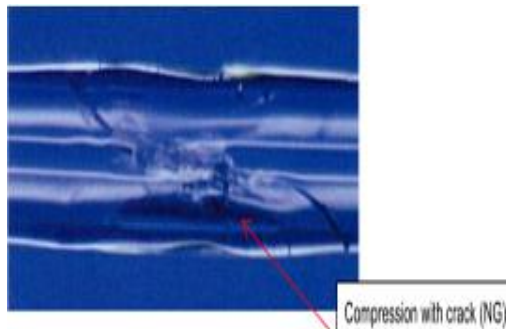
Figure 13.1.1.3: Fiber delamination with crack sample → **NG**

Figure 13.1.1.4: Compression with crack

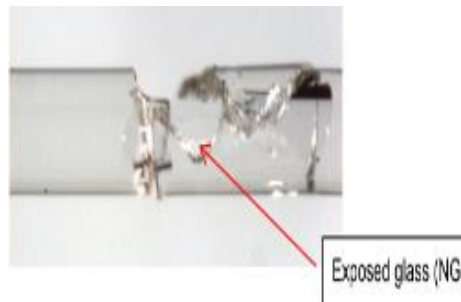


Figure 13.1.1.5: Exposed glass sample

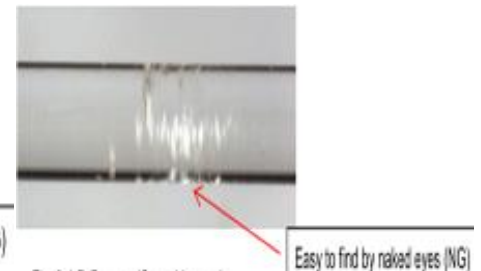


Figure 13.1.1.6: Damage (Scratch) sample

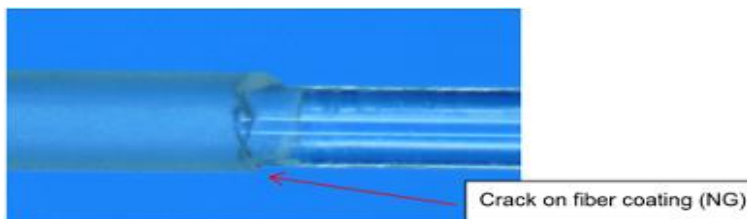


Figure 13.1.1.7: Compression with crack

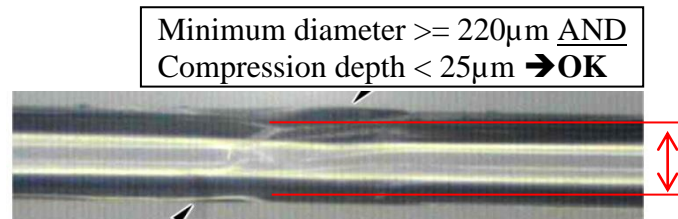


Figure 13.1.1.8: Fiber compression with diameter (FV1)

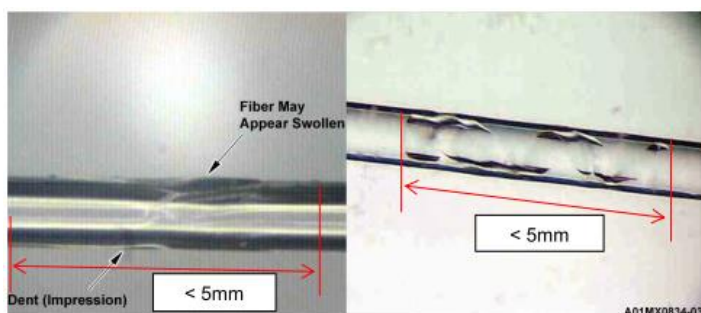


Figure 13.1.1.9: Fiber compression with length in longitudinal direction &lt; 5mm, diameter &gt;= 220μm → OK (FV1)

Fiber UV 245μm: minimum diameter >= 220μm is OK  
Fiber UV 165μm: minimum diameter >= 150μm is OK

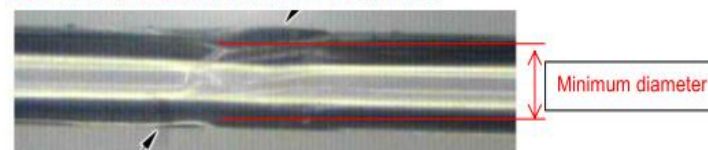


Figure 13.1.1.10: Fiber compression with diameter (FV2)

Table 13.1.1.2 Length of Cavity product



Group	Type name	L1(mm)	L2(mm)	Remark
1	DDV, DEV, DFV, DUV, DXV, DYV, YDV, YEV, YUV, YXV	1075 ± 25	1275 ± 25	Refer to figure 13.1.1.11
2	NAV, NBV	1105 ± 25	2705 ± 25	
3	WAV	895 ± 25	2195 ± 25	
4	XAV	895 ± 25	1445 ± 25	
5	JAV, JBV, JYV, JXV, XBV, WBV	895 ± 25	695 ± 25	
6	KBV, KCV, KYV, KXV	1745 ± 25	845 ± 25	

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7	HAV, HBV, HCV, HDV, HEV, HFV, HGV, HHV, HJV, HKV, HLV	$30 \pm 10$	$>1050$	Refer to figure 13.1.1.12
8	KDV, KEV	$695 \pm 25$	$945 \pm 25$	Refer to figure 13.1.1.11
9	YAV	$1825 \pm 25$	$1275 \pm 25$	
10	NCV, NDV	$1725 \pm 25$	$2725 \pm 25$	
11	NYV, NXV	$1670 \pm 20$	$2925 \pm 25$	
12	XCV, XDV	$2195 \pm 25$	$1445 \pm 25$	
13	NWV, NUV	$1005 \pm 25$	$2925 \pm 25$	
14	SAV	$1075 \pm 25$	$1555 \pm 25$	
15	SBV, SCV	$1855 \pm 25$	$1275 \pm 25$	
16	CAV	$1105 \pm 25$	$1275 \pm 25$	
17	PAV	$695 \pm 25$	$905 \pm 25$	
18	TAV, TBV	$2085 \pm 25$	$1255 \pm 25$	
19	UAV, UBV	$1325 \pm 25$	$800 \pm 20$	
20	XEV, XFV	$2995 \pm 25$	$2995 \pm 25$	

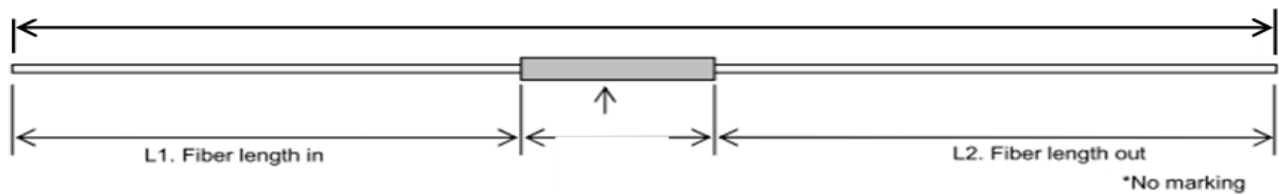


Fig 13.1.1.11: Length of fiber 250μm

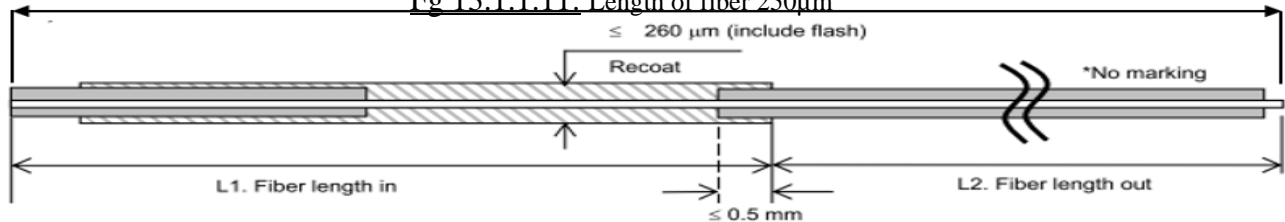


Fig 13.1.1.12: Length of fiber 80μm

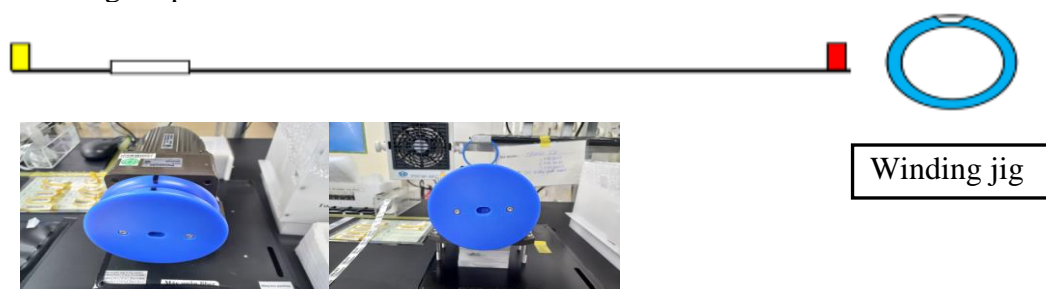
Table 13.1.1.3 Marking specification of Cavity product

Note: The marking process will be applied for product, which defined detail in table II.1

Item	Specification
Marking position	Mark must be located in marking area (following F.g 9.1.1, 9.1.2 and 9.1.4)
Marking length	+ 5~10mm (D05, D07: Refer to table II. 1, column D.S) + 5~20mm (D01, D02, D08: Refer to table II. 1, column D.S) + 3~7mm (D10, D11: Refer to table II. 1, column D.S)
Color of marking	Refer to table II.1, MCS column.

## 13.1.2. Inner Packing

## 13.1.2.1 Inner Packing for patt 1



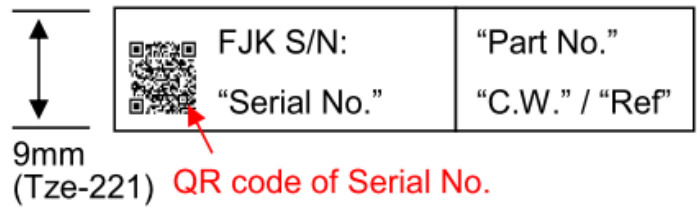
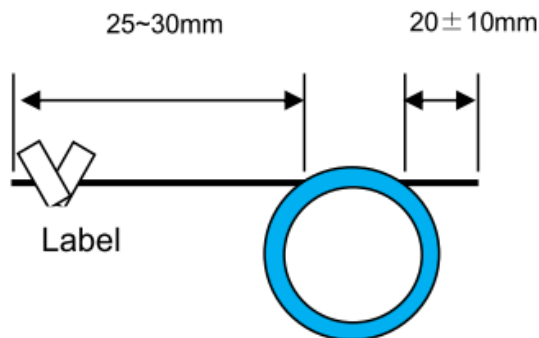
Step 1: Winding fiber to reel by machine from red side

## CAVITY-FG PRODUCT

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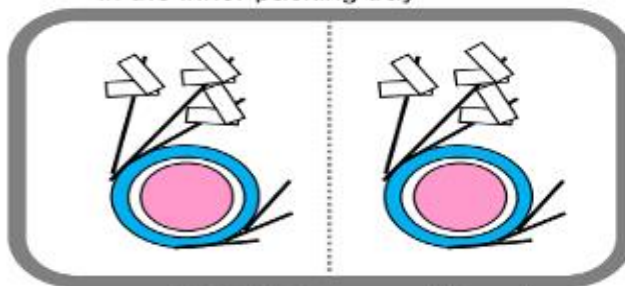


Step 2: The serial label is taped at the end of fiber



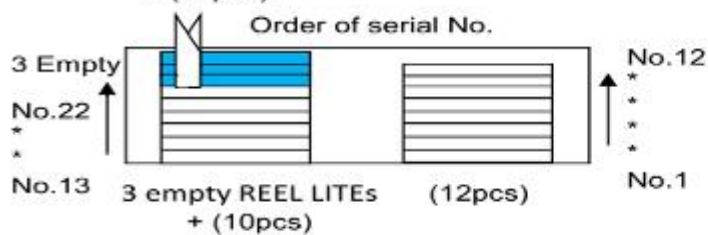
Step 3: After rewinding and labeling, there is no protrusion of fiber from REEL LITE

22 FGs and 3 empty REEL LITEs in the inner packing tray



3 empty REEL LITEs + (10pcs) (12pcs)

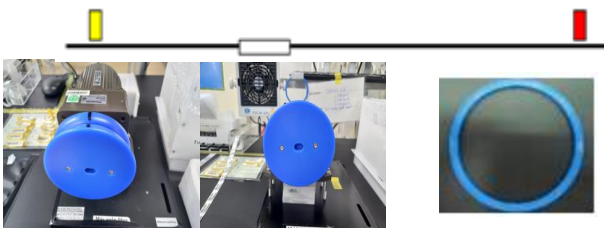
Sample of inner tray



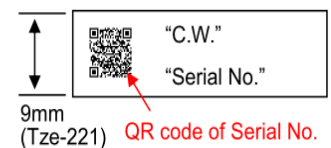
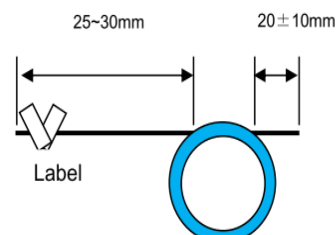
3 empty REEL LITEs (without FG)  
3 empty REEL LITEs are fixed by angled cut fushigi tape

Step 4: Put 22 products in packing tray and cover 3 empty reels lite fixed by fushigi tape

## 13.1.2.2 Inner Packing for patt 2



Step 1: Winding fiber to reel by machine from red side



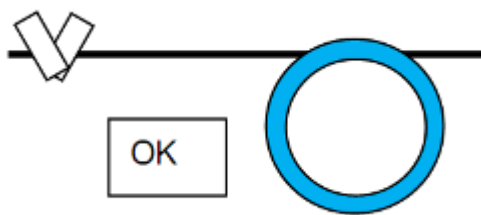
Step 2: The serial label is taped at the end of fiber

## CAVITY-FG PRODUCT

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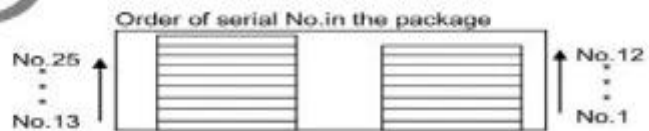
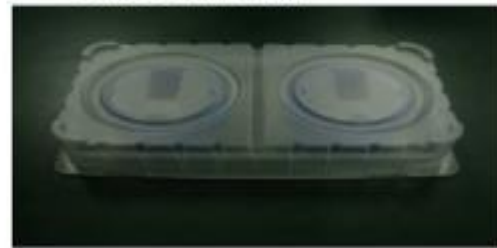
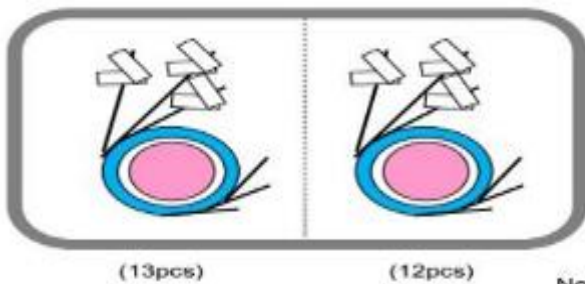
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Step 3: After rewinding and labeling, there must be no protrusion of fiber out of REEL LITE

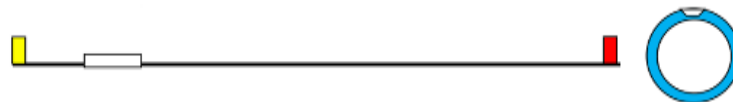
25 FGs in the inner packing tray

Sample of inner tray



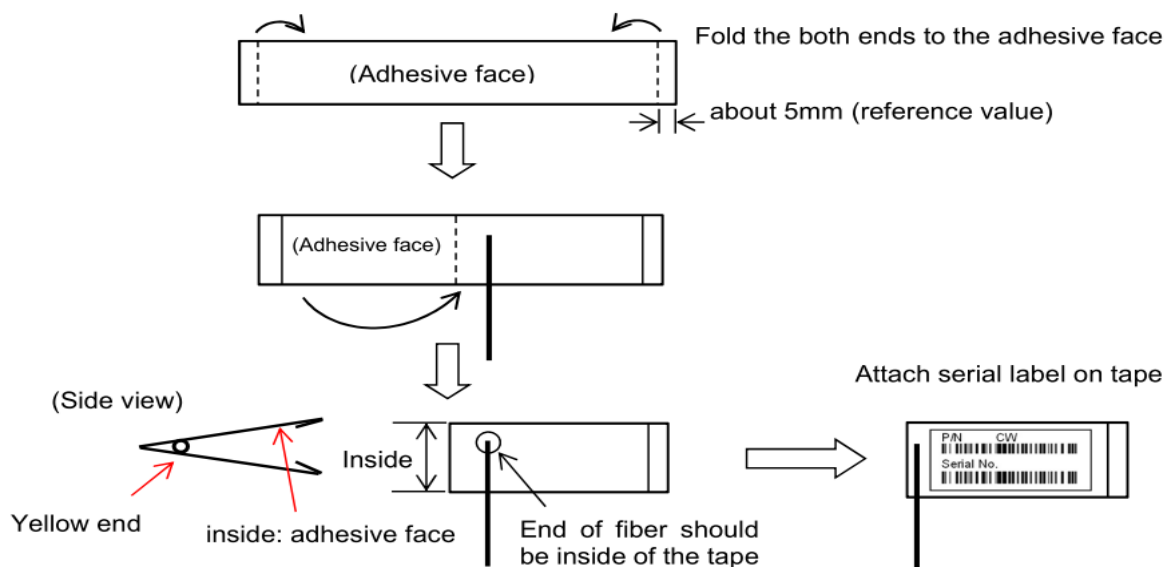
Step 4: Plastic tray packing

### 13.1.2.3 Inner Packing for patt 3



Step 1: Winding fiber to reel by machine from red side.

(Detail of transparent tape)

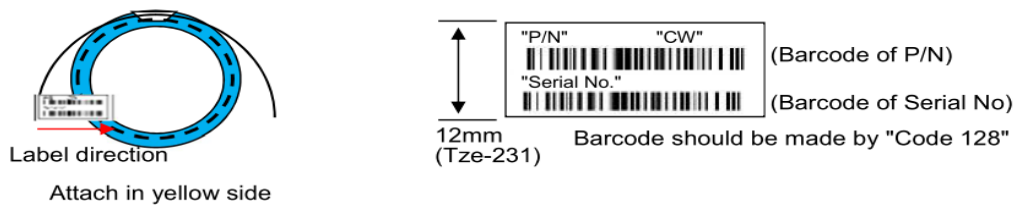


## CAVITY-FG PRODUCT

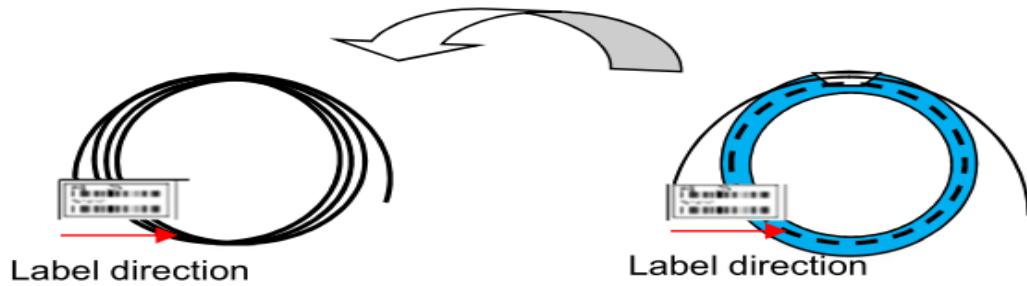
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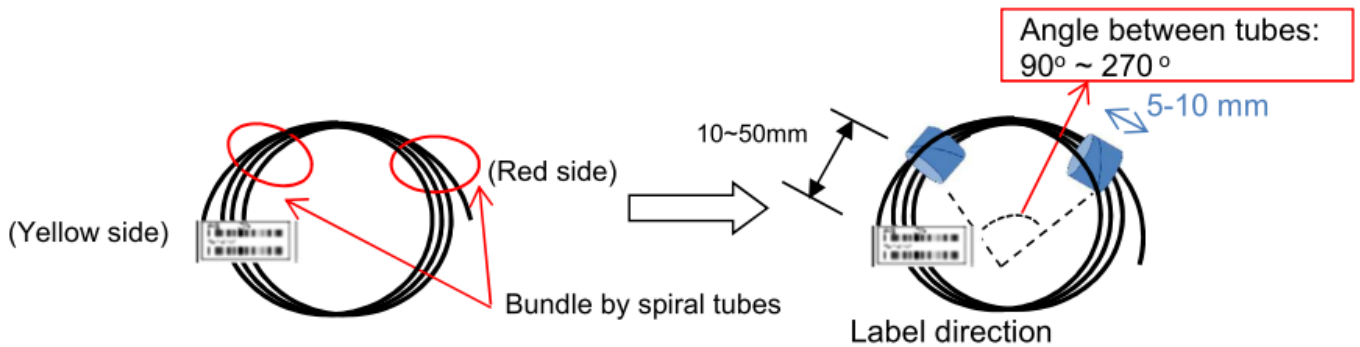
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Step 2: Attach transparent tape to fiber end and attach serial label on it



Step 3: Remove bundled fiber from winding jig



Step 4: Bundle each fiber end keeping off recoating area by spiral tubes



Step 5: Put the individual fiber bundle into zipper bag and close the zipper.



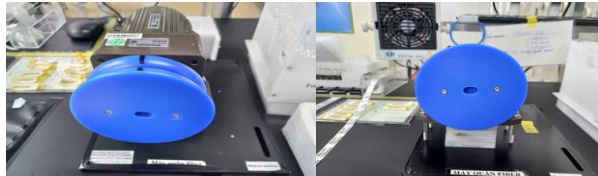
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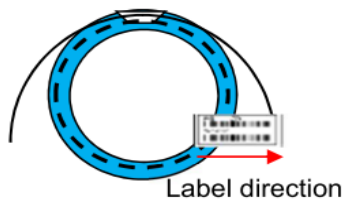
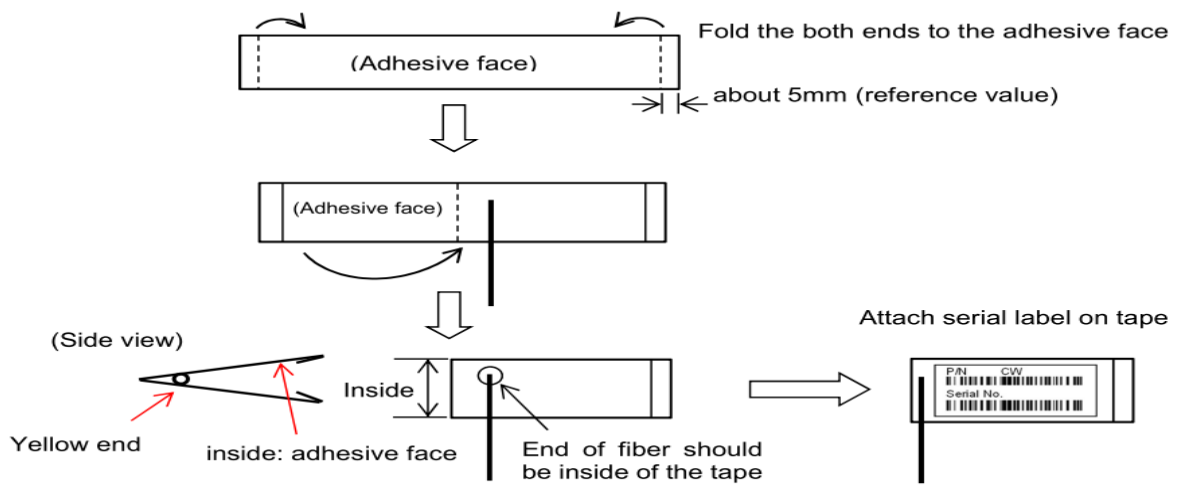
## 13.1.2.4 Inner packing for patt 4



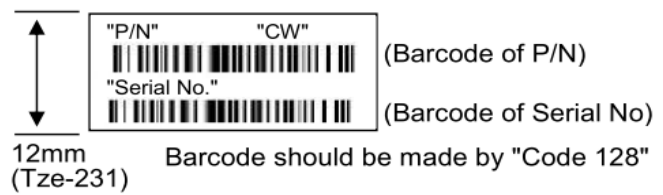
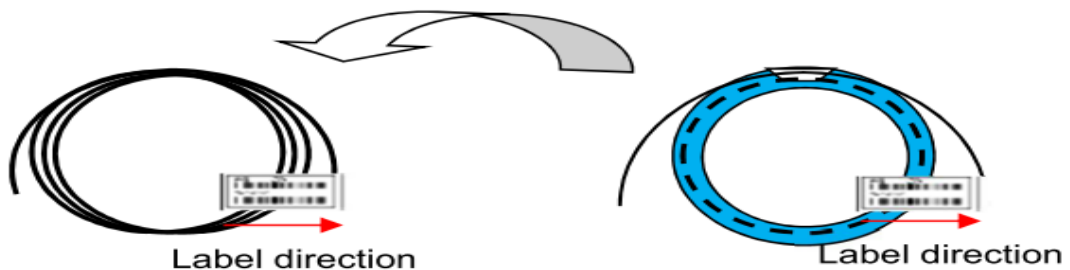
Winding jig

*Step 1: Rewind to the winding jig from red side*

(Detail of transparent tape)



Attach in red side

*Step 2: Attach transparent tape to fiber end and attach serial label on it**Step 3: Remove bundled fiber from winding jig*

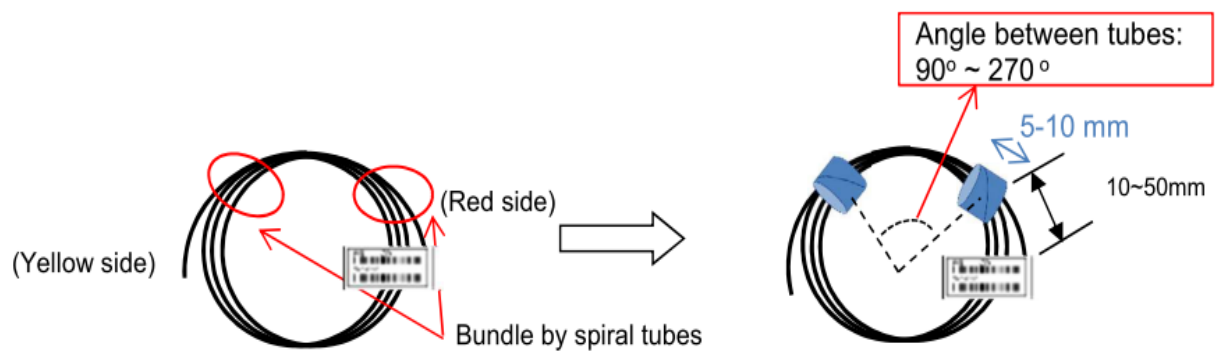


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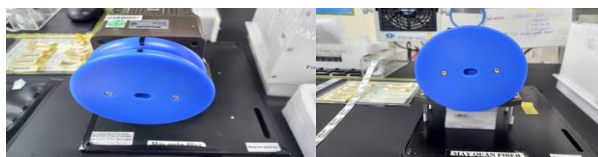
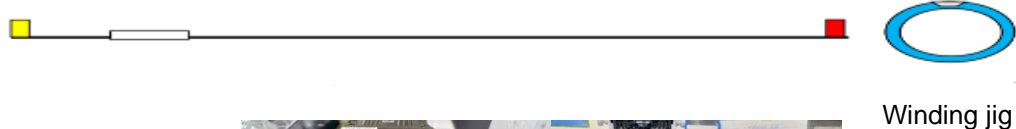


Step 4: Bundle each fiber end keeping off recoating area by spiral tubes

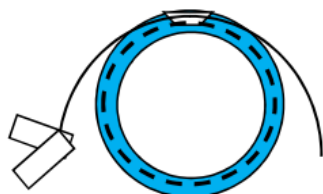


Step 5: Put the individual fiber bundle into zipper bag and close the zipper

#### 13.1.2.5. Inner packing for patt 5



Step 1: Rewind to the winding jig from red side



Attach in yellow side



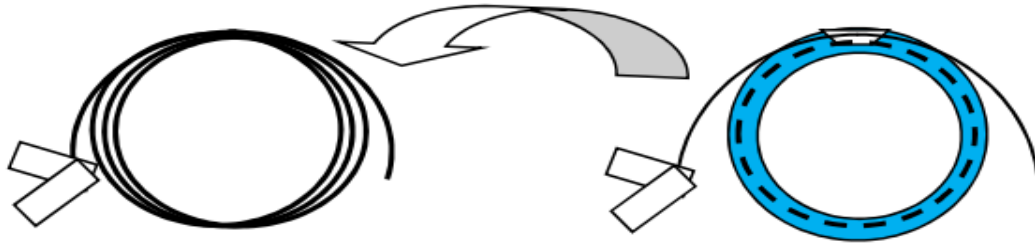
Step 2: Attach serial label to yellow end

## CAVITY-FG PRODUCT

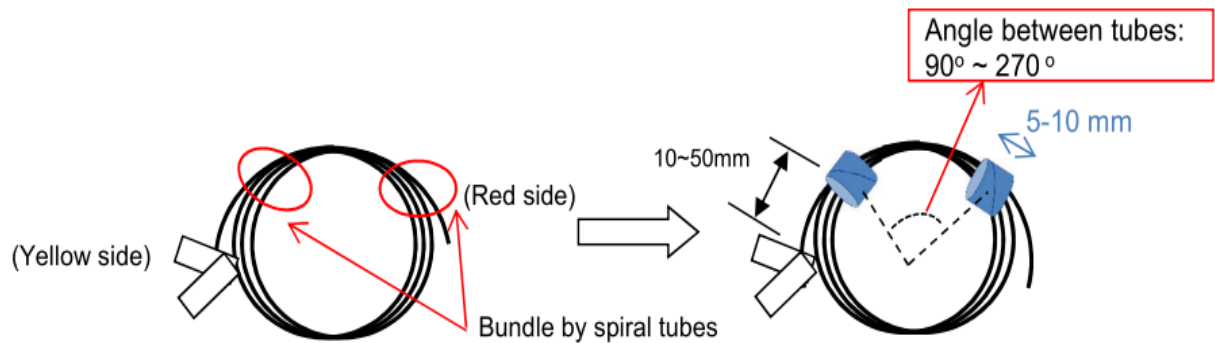
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Step 3: Remove bundled fiber from winding jig

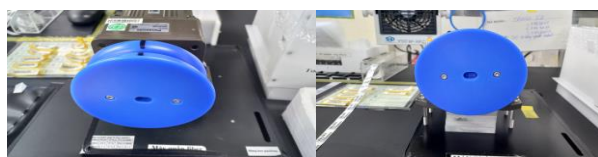
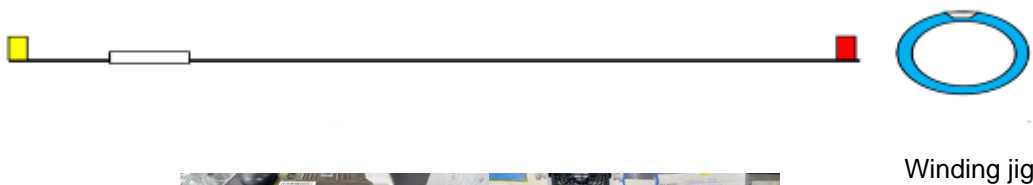


Step 4: Bundle each fiber end keeping off recoating area by spiral tubes



Step 5: Put the individual fiber bundle into zipper bag and close the zipper

### 13.1.2.6 Inner packing for patt 6



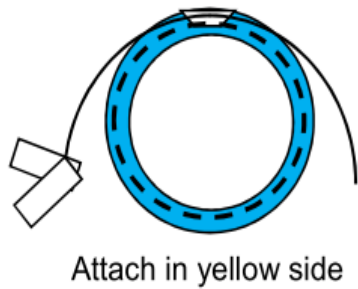
Step 1: Rewind to the winding jig from red side

## CAVITY-FG PRODUCT

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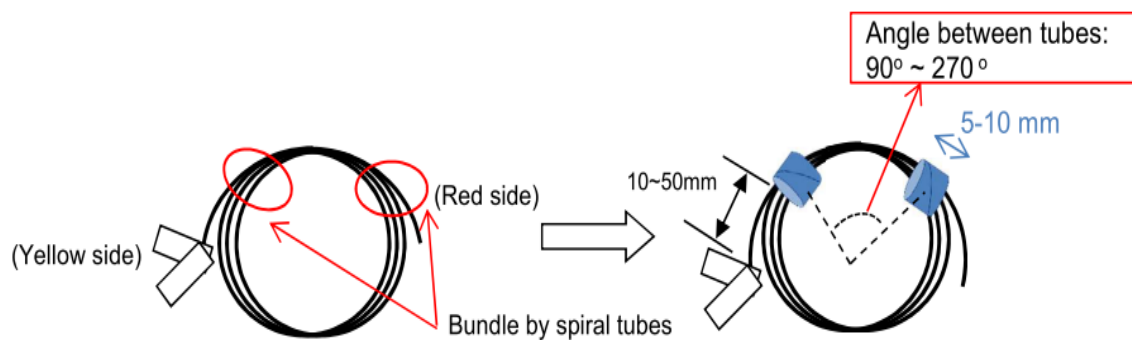
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Step 2: Attach serial label to yellow end



Step 3: Remove bundled fiber from winding jig

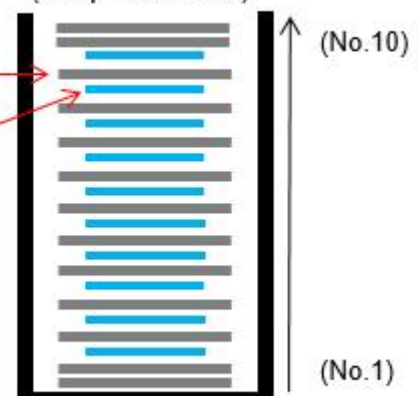


Step 4: Bundle each fiber end keeping off recoating area by spiral tubes

(6 separated area in a package)

Sponge sheet  
(Total 13pcs)Winded fiber  
(Total 10pcs)Keep same direction of  
winded fiber

(1 separated area)



Step 5: Prepare separated area and put products into case

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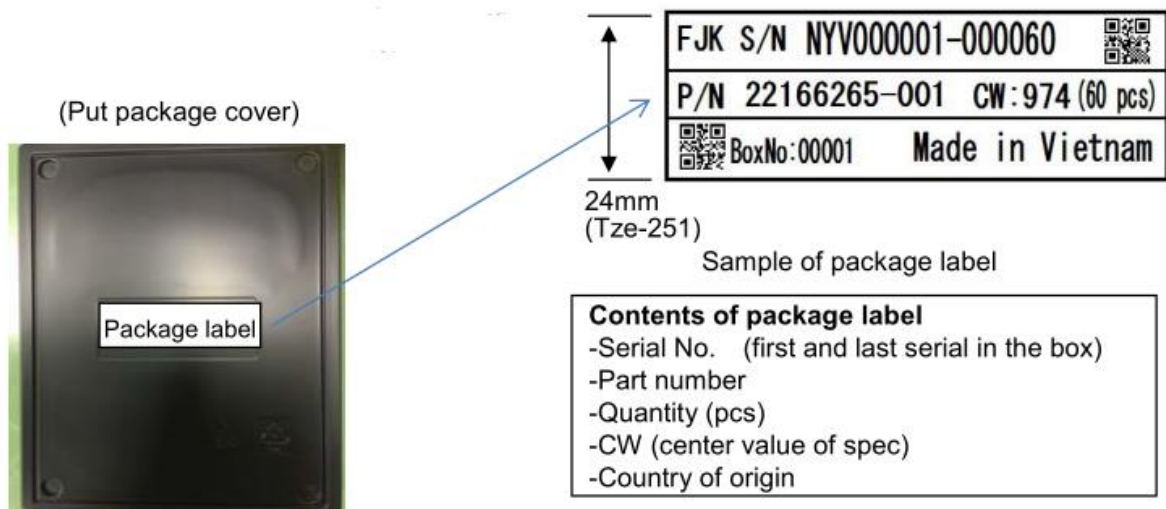


Keep same direction of all sponge sheets  
(cut corner must be located in the upper  
right side of the compartment)

(Put sponge cover)

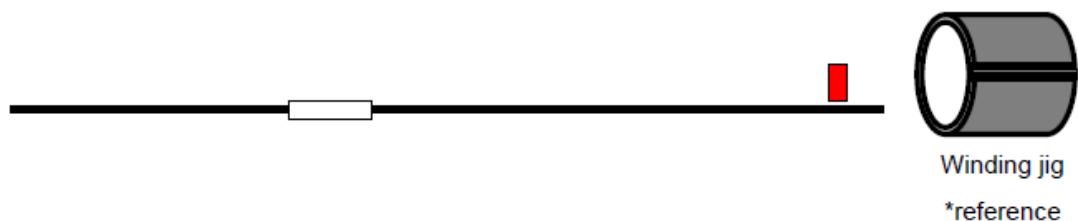


Step 6: Put 60 products in case and cover by sponge.



Step 7: Cover tray and paste label

## 13.1.2.7 Inner packing for patt 7



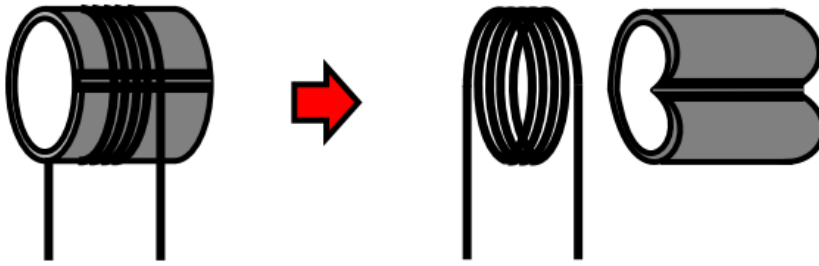
Step 1: Rewind to the winding jig from red side

## CAVITY-FG PRODUCT

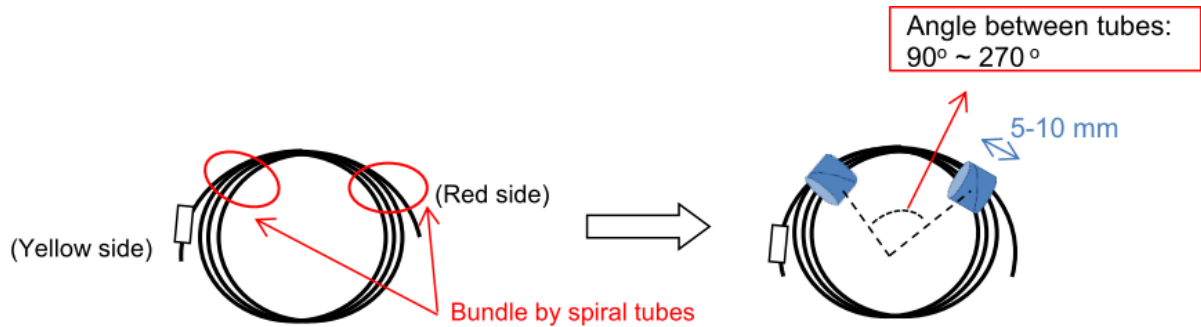
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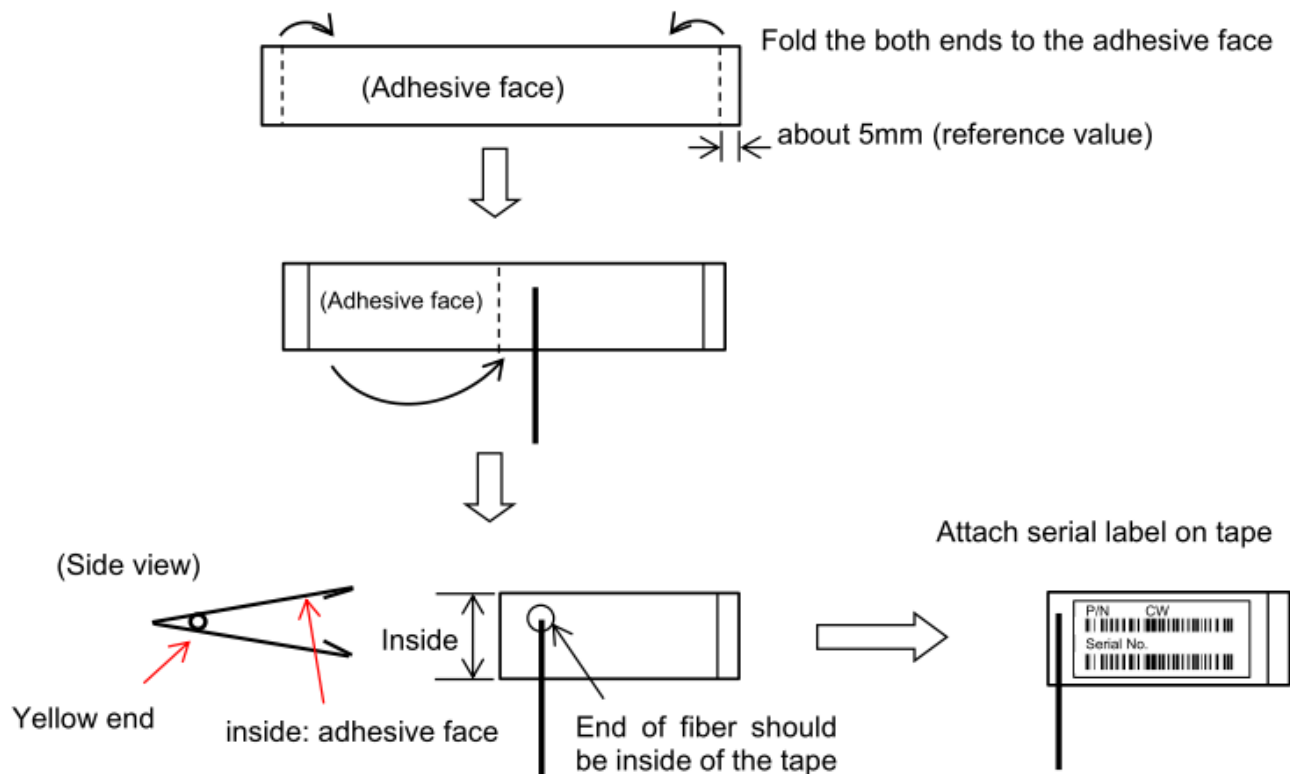


Step 2: Remove bundled fiber from winding jig



Step 3: Bundle each fiber end keeping off recoating area by spiral tubes

(Detail of transparent tape)



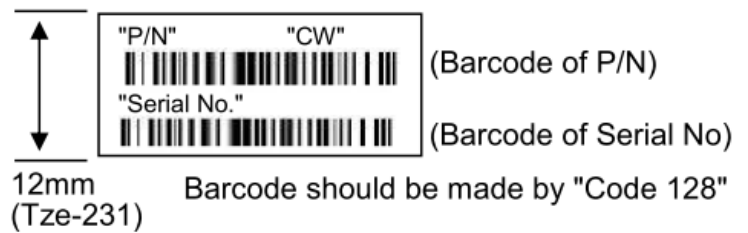
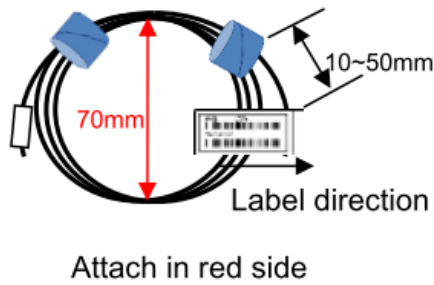


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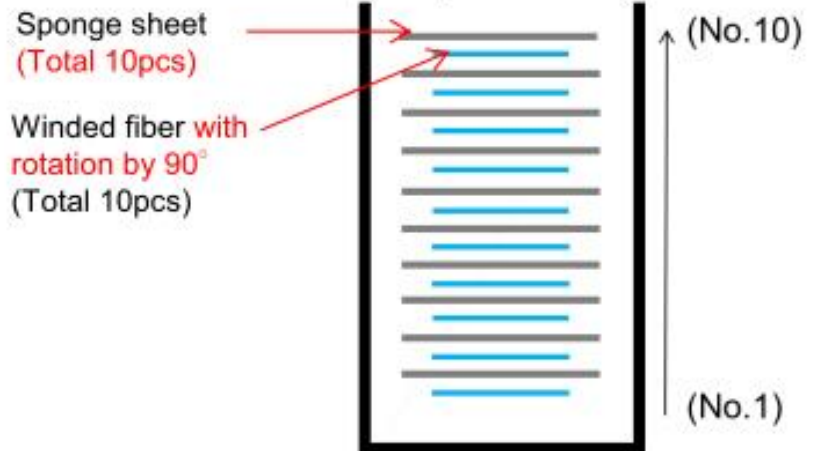


Step 4: Attach transparent tape to fiber end and attach serial label on it.  
(Transparent tape and serial label can be attached before bundling each fiber end)

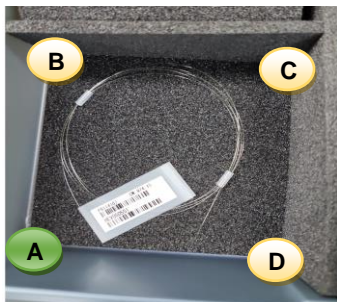
(6 separated area in a package)



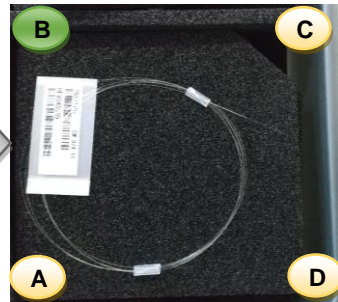
(1 separated area)



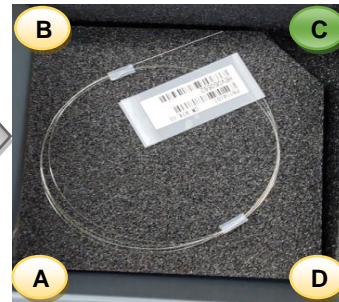
## Rotation method of winded fiber



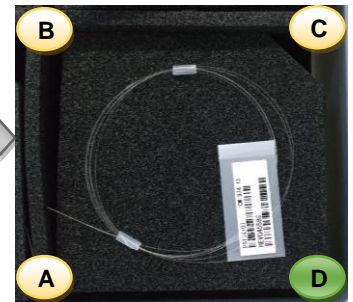
Label of 1<sup>st</sup> product in separated area will direct to corner A



Label of 2<sup>nd</sup> product will direct to corner B.



Label of 3<sup>rd</sup> product will direct to corner C.



Label of 4<sup>th</sup> product will direct to corner D.

Label of 5<sup>th</sup> product will direct to corner A same with 1<sup>st</sup> product.

Step 5: Prepare separated area and put products into case with right direction.

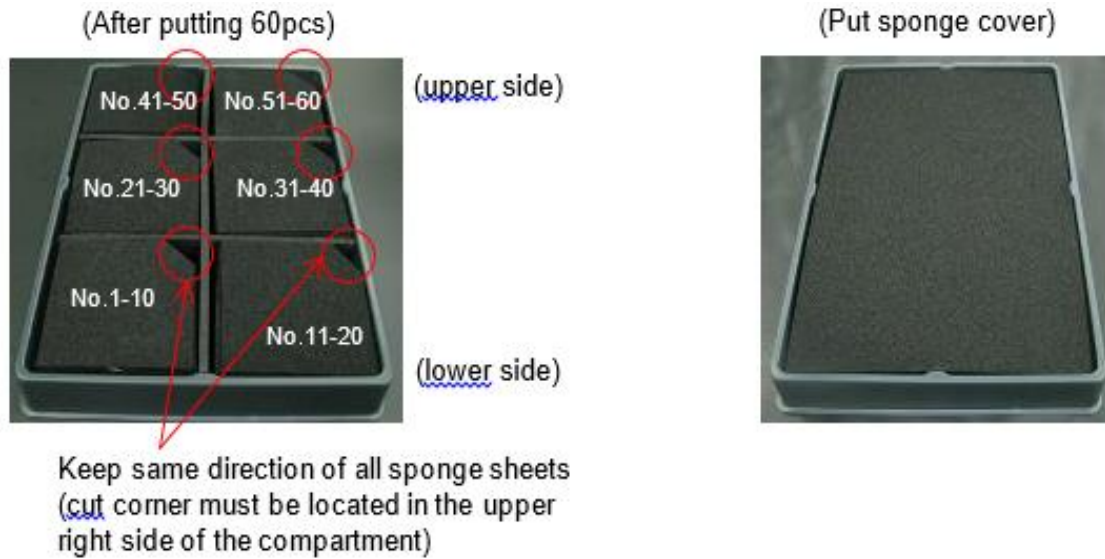


## CAVITY-FG PRODUCT

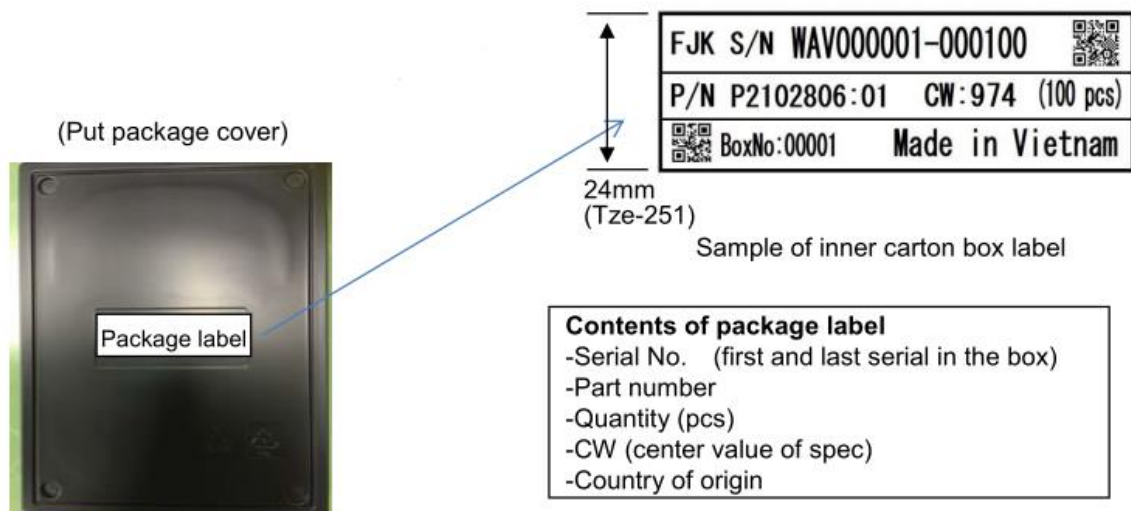
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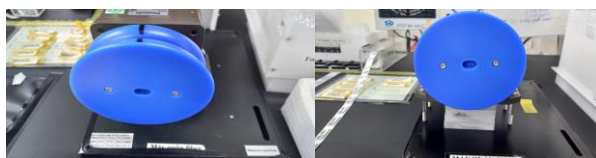
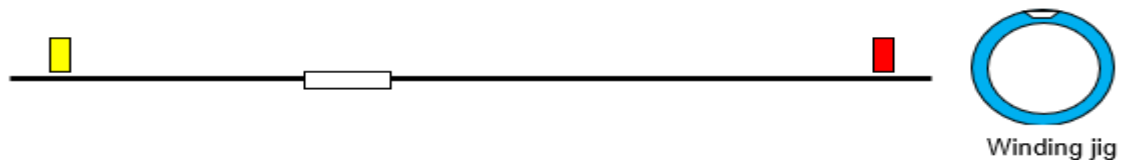


Step 6: Put 60 products in case and cover by sponge.



Step 7: Cover tray and paste label

### 13.1.2.8 Inner packing for patt 8



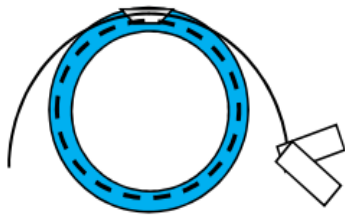
Step 1: Rewind to the winding jig from red side

## CAVITY-FG PRODUCT

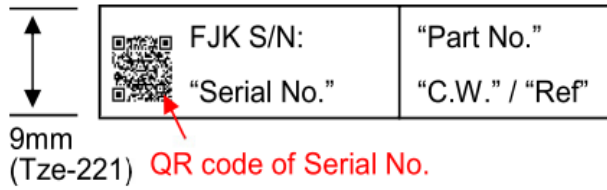
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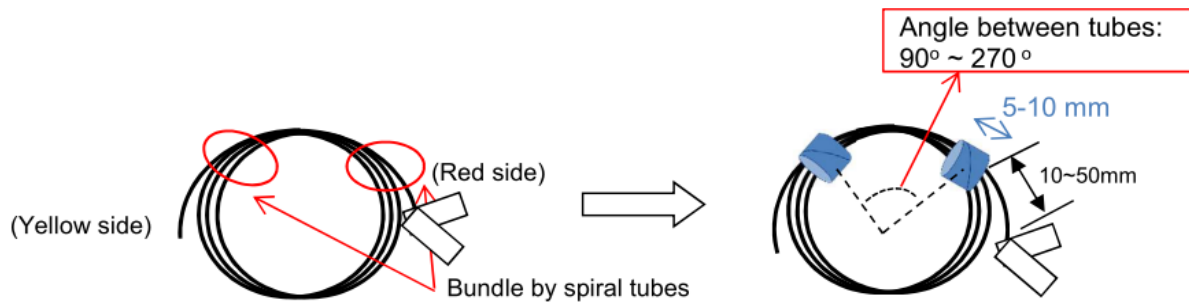
Attach in red side



Step 2: Attach serial label to red end



Step 3: Remove bundled fiber from winding jig



Step 4: Bundle each fiber end keeping  
off recoating area by spiral tubes



Step 5: Put the individual fiber bundle into zipper bag and close the zipper.

## CAVITY-FG PRODUCT

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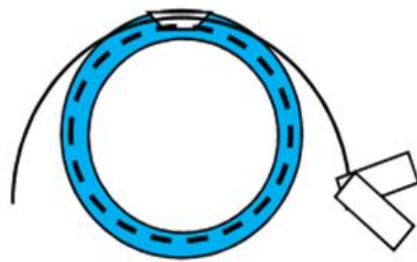
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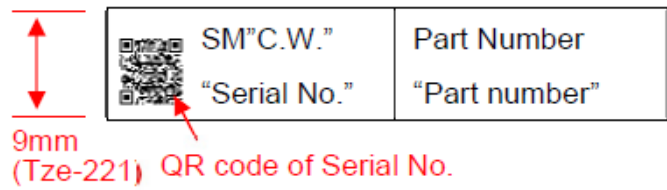
## 13.1.2.9 Inner packing for patt 9



Step 1: Rewind to the winding jig from red side



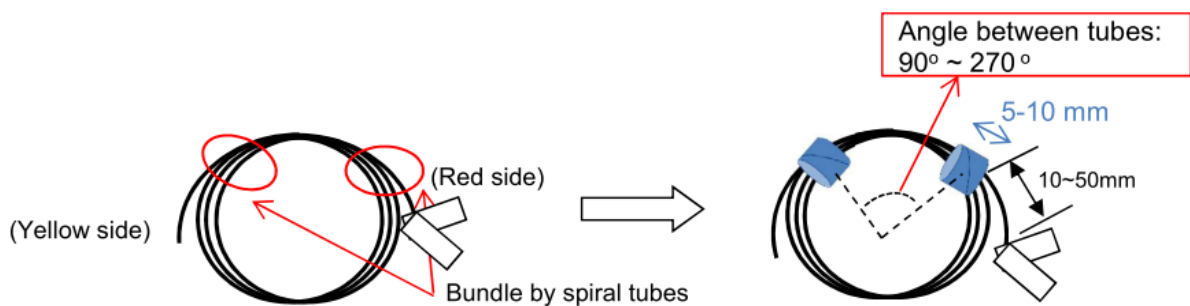
Attach in red side



Step 2: Attach serial label to red end



Step



3:

Remove bundled fiber from winding jig

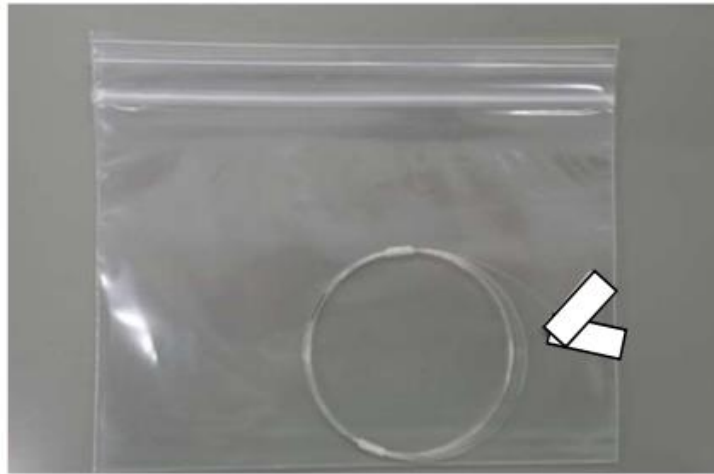
## CAVITY-FG PRODUCT

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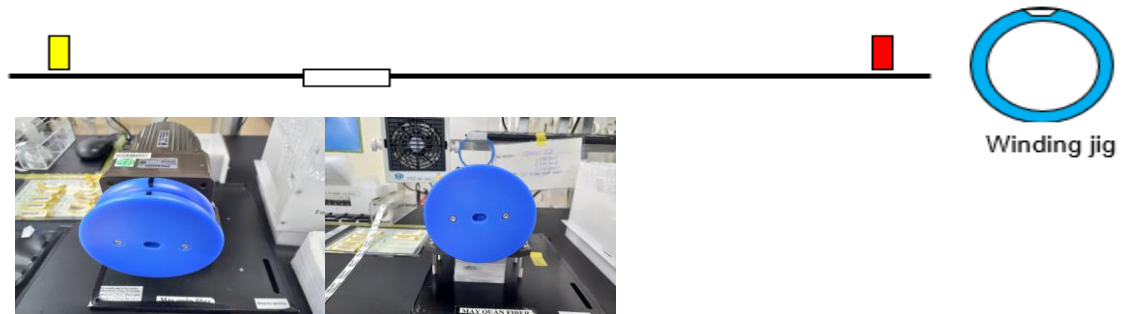
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*Step 4:* Bundle each fiber end keeping off recoating area by spiral tubes

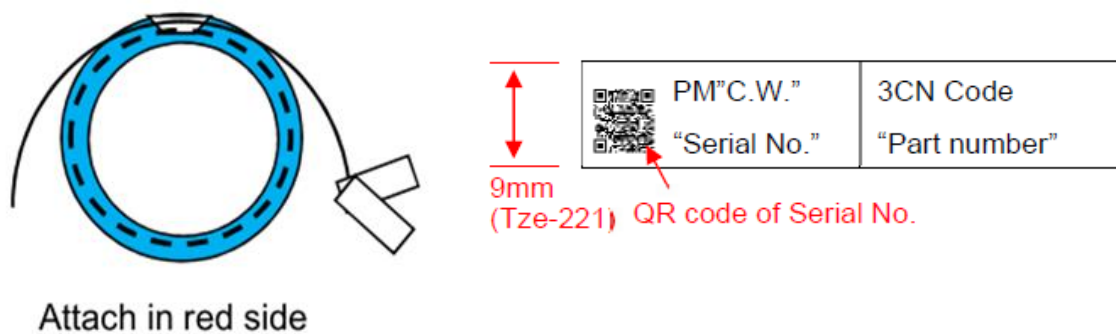


*Step 5:* Put the individual fiber bundle into zipper bag and close the zipper

## 13.1.2.10 Inner packing for patt 10



*Step 1:* Rewind to the winding jig from red side



Attach in red side

*Step 2:* Attach serial label to red end



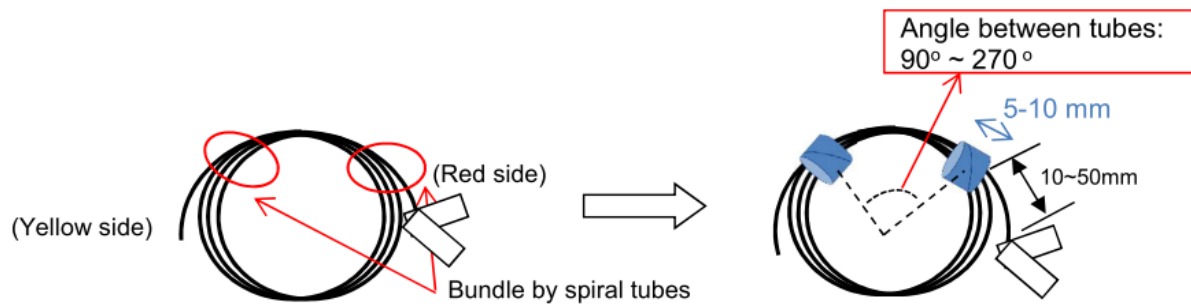
## CAVITY-FG PRODUCT

OPERATION PROCEDURE: 4-OP-378

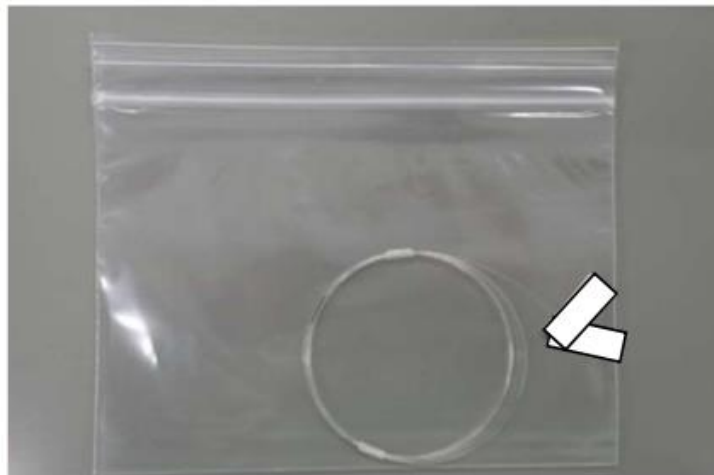
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Step 3: Remove bundled fiber from winding jig



Step 4: Bundle each fiber end keeping off recoating area by spiral tubes



Step 5: Put the individual fiber bundle into zipper bag and close the zipper

### 13.2. Process condition

Item	Condition
Appearance	Visual Microscope (To confirm NC)
Length	Template Ruler (To confirm NC)
Marking	Template Ruler (To confirm NC)
Packing quantity and serial No. order	Program and Jig
Fiber protrusion length (if required)	Template/Ruler
Contamination/hair	Ionizer Fan

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## 14 Final Packing

## 14.1.Process specification

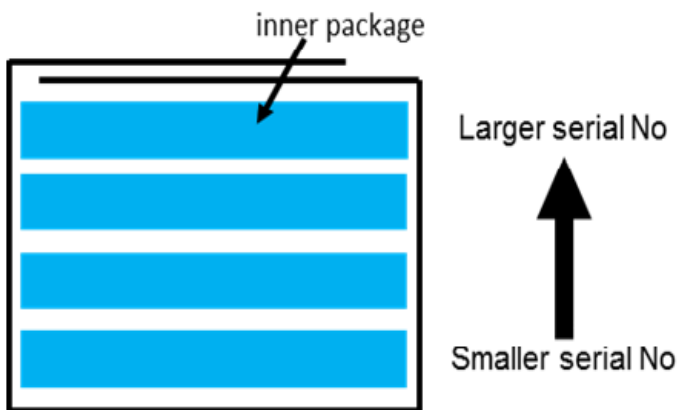
Item	Specification
Appearance	No damage for inner package, inner carton box, outer carton box
Quantity of block in the inner carton box	Max 1 blocks
Quantity of the inner carton box in an outer carton box	Refer to relative product structure
Storage condition	Thermal (0 – 30°C) (Refer 4-PR-014 Table 1 (Final Packing area & Storage area of Product which required storage conditions))

## 14.1.1 Outer packing specification patt A

&lt;Packing image&gt;

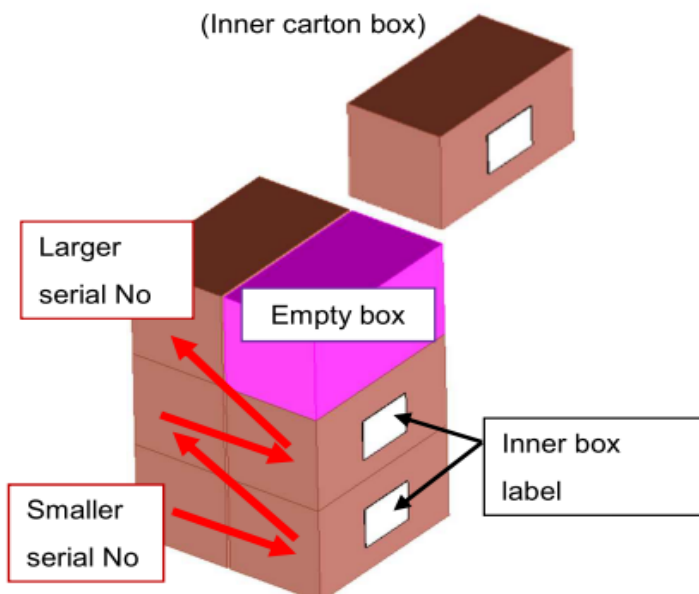
&lt;Order of serial No&gt;

&lt;Note&gt;



Wrap the inner package in the bubble sheet  
(Max 4 packages)

Step 1: Put product case with small serial No. at bottom and latest serial No at top. Max 4 cases



Put 1 block into an inner carton box

Fill up an interspace with cushioning material.  
For example (Packing form chip, Bubble wrap)  
Almost center of inner carton box  
No move the block in an inner carton box

Put 6 inner carton boxes into an outer carton box  
6 inner carton boxes are arranged in 2 rows.

1. Fill up an interspace with cushioning material.

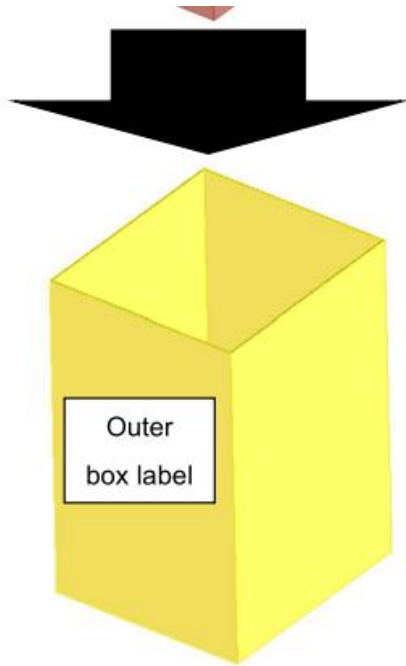


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For example (Packing form chip, Bubble wrap, Trikon, empty inner carton box)

No move the block in an outer carton box.

Can use Empty Box to fill up the outer carton box when there is not enough products to pack fill up for 6 inner carton boxes

## 2. Attach outer box label

Label example

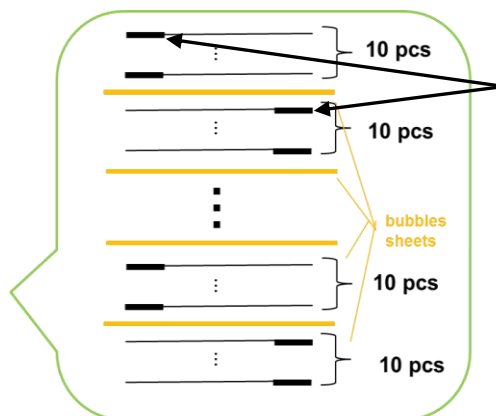


Contents of box label

- \*P/O No
- \*Product name
- \*Quantity
- \*Shipping date
- \*Box number  
(current and total number)
- \*Order number  
(informed by ODD's planner)

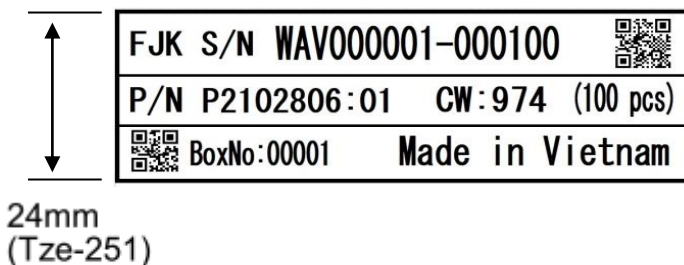
Step 2: Put inner boxes and empty box into outer box

## 14.1.2 Outer packing specification patt B



Reverse the direction of zipper of plastic bags after per 10 pcs

Step 1: Put the individual zipper bags into inner carton box and insert bubble sheet after per 10 pcs



Sample of package label

## Contents of inner carton box label

- Serial No. (first and last serial in the case)
- Part number and Version
- Quantity (pcs)
- CW (center value of spec)
- Country of origin
- Box No.
- \*Refer to outer box label

Note: Fill up an interspace with cushioning material. For example:

- + Packing form chip, Bubble wrap, Trikon, empty inner carton box.
- + No move the block in an outer carton box.
- + Can use Empty Box to fill up the outer carton box when there is not nough product to pack fill up for 6 inner carton boxes. In that case, please indicate "Empty" on the box.

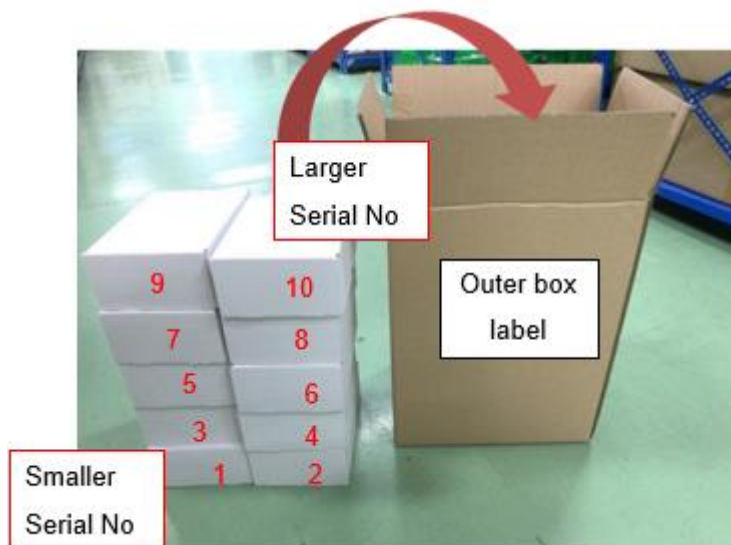
Step 2: Attach the label to the inner carton box.

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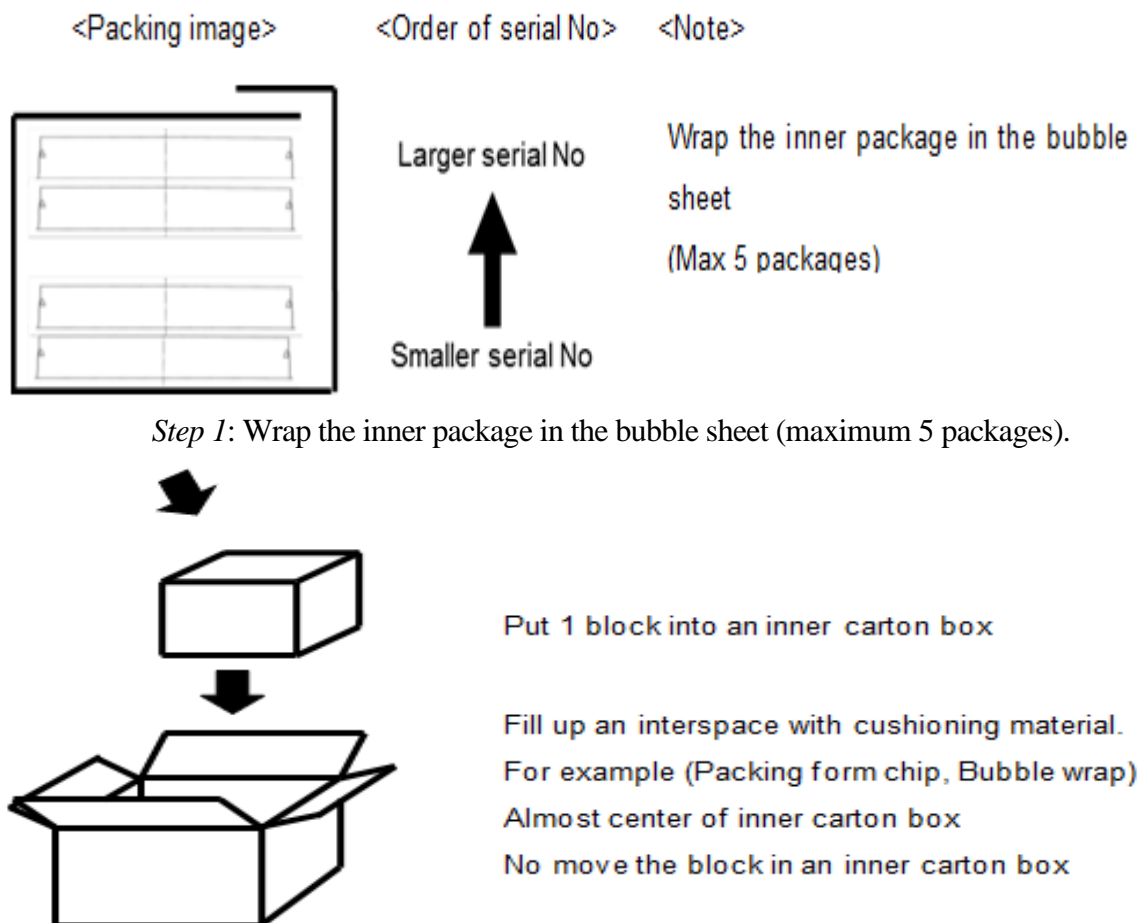
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10 inner carton boxes are arranged in 2 rows.  
Fill up an interspace with cushioning material.

Step 3: Put 10 inner carton boxes into an outer carton box and attach outer box label

## 14.1.3. Outer packing specification patt C



Step 1: Wrap the inner package in the bubble sheet (maximum 5 packages).

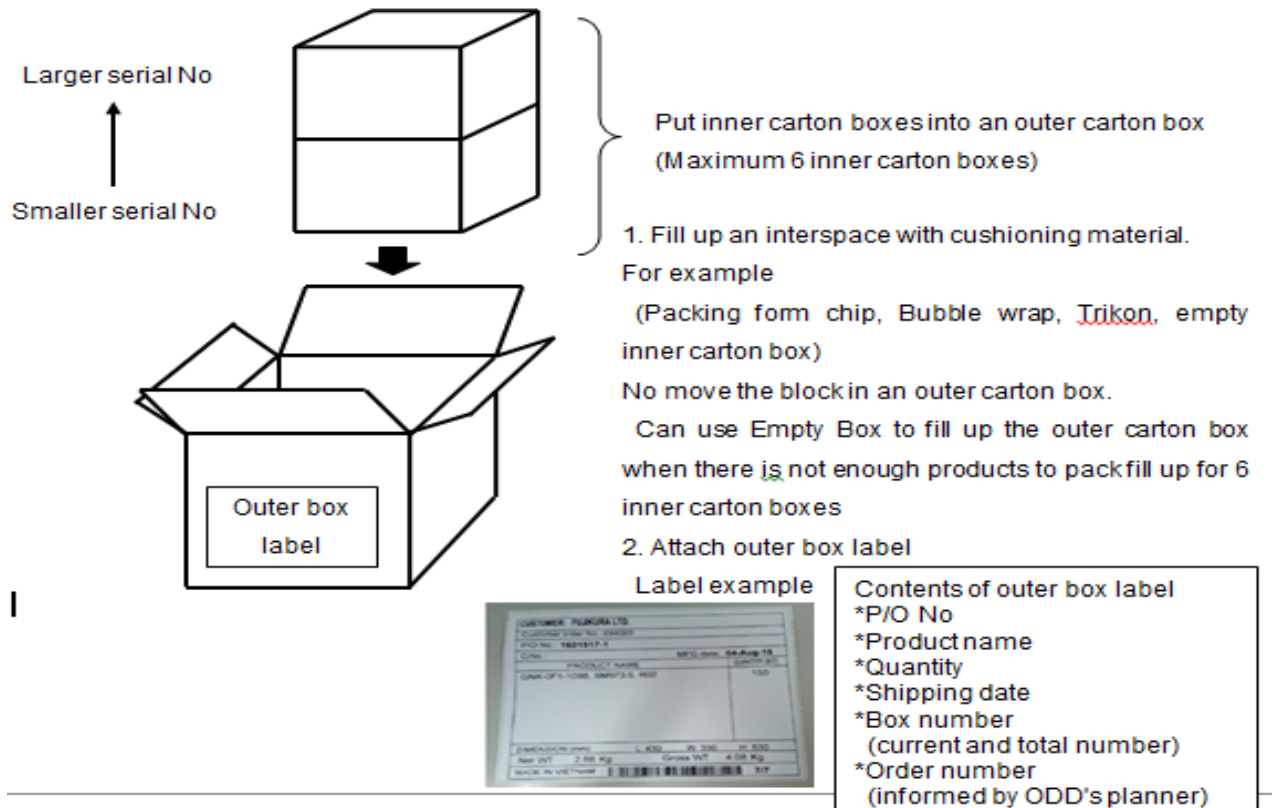
Step 2: Put 1 block into an inner carton box

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Step 3: Put inner carton boxes into an outer carton box (maximum 6 inner carton boxes) and attach outer box label

*Note: Need ODD's approval before changing carton box size or maximum capacity per box even if it meets specification.*

### **Noted for Box label format**

The formats are separated depending on packing type and the order types VMI P/O or Other. VMI P/O is indicated on PURCHASE ORDER SHEET. The contents are shown in Table 14-3. Box label formats and PURCHASE ORDER SHEET example are shown in Fig.1, Fig.2.

Table 14-3: Box label contents

Packing type	A, B, E, F, H, J, K	C, D, G	
Label format	Standard	VMI P/O	Other
Customer order No.	o	o	o
P/O No./Lot.No.	o	x	x
Product name	o	o	o
Quantity	o	o	o
Shipping date	o	o	o
Box number	*1	o	*1
VMI P/O identification	x	o	x
Vendor Name	x	o	o
Purchasing PO#	x	o *2	o *2
II-VI Part No.	x	o *2	o *2
Version	x	o	o
Batch/Lot Number	x	o *2	o *2

o: to be displayed, x: not to be displayed, \*1 may be displayed,  
\*2 to be displayed with Code 39 barcode

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CUSTOMER: II-VI Photonics(Shenzhen)Inc C/O: Top Trans Logistics Co.	
Customer order No.: 4500135748	
P/O No.: 1875080-1	
C/No.:	MFG date: 29-Mar-2018
PRODUCT NAME	QUANTITY (PCS)
SM973.70-3.0-1.2-UN (P6111808:FJK)	1
DIMENSION (mm): L 429 W 339 H 562	
Net WT 0.39 Kg	Gross WT 1.57 Kg
MADE IN VIETNAM 1/1	

(a) Format for Standard

CUSTOMER: II-VI Photonics(Shenzhen)Inc C/O: Top Trans Logistics Co.	
Customer order No.: 4500276024 VMI	
MFG date: 10-May-2022	
PRODUCT NAME	QUANTITY (PCS)
GNK-03FCA-101C(P6112614.05:KBV)	500
Vendor Name Fujikura	
Purchasing PO# 4500276024	
II-VI Part No. P6112614	
Version 05	
Batch/Lot Number FPO220003830-31	
DIMENSION (mm): L 327 W 227 H 439	
Net WT 2.13Kg	Gross WT 2.74Kg
MADE IN VIETNAM 1/1	

(b) Format for VMI P/O

CUSTOMER: II-VI Photonics(Shenzhen)Inc C/O: Top Trans Logistics Co.	
Customer order No.: 4500276024	
MFG date: 10-May-2022	
PRODUCT NAME	QUANTITY (PCS)
GNK-03FCA-101C(P6112614.05:KBV)	500
Vendor Name Fujikura	
Purchasing PO# 4500276024	
II-VI Part No. P6112614	
Version 05	
Batch/Lot Number FPO220003830-31	
DIMENSION (mm): L 327 W 227 H 439	
Net WT 2.13Kg	Gross WT 2.74Kg
MADE IN VIETNAM 1/1	

(c) Format for Other

Fig.1 Box label formats

	VMI P/O	Other
①Box number (current number / total quantity)	Current number should be consecutive number within each P/O. Total quantity should be counted as each P/O.	Current number may be consecutive number and Total quantity may be counted in particular shipping date.
②VMI P/O identification	The words “VMI” should be displayed.	The words “VMI” must not be displayed.

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## PURCHASE ORDER SHEET

Order No <b>*4</b>	Product name/Type <b>*5</b>	Remarks <b>*6</b>
1234567-1	GNK-03FUN-001F(P6111808:01:JYV)	27/Apr 1p II-VI PO#:1234567890 VMI
9876543-1	GNK-03FUN-001F(P6111808:01:JYV)	27/Apr 1p II-VI PO#:9876543210

Fig.2 PURCHASE ORDER SHEET example with VMI P/O

\*3 FOV should not change label format without ODD's approval.

\*4 Order No is Batch/Lot Number.

\*5 Product name/Type contains customer information.

GNK-03FUN-001F(P6111808:01:JYV)

└───┘
└──┘

II-VI Part No.    Version

\*6 There are the words "VMI" at the end of Remarks column only VMI P/O.

II-VI PO#:1234567890    VMI

└───┘
└──┘
└──┘

Purchasing PO#    space    "VMI" with capital letter

## 14.2 Process condition

Item	Condition
Packing quantity	Program
Appearance	Visual
Storage condition	Thermal recorder

## 15. Test report &amp; Shipping

- Shipping quantity and product name must be confirmed correct with P/O from Customer
- Attach label outside carton box to indicate: Specification of product type, Specification Number and serial No.
- Update Data (test report and E-data) to FTP server IP: 10.16.248.14
- Shipping date of deliverable data:
  - + Uploading deliverable data by 11AM of 2 days before shipping day in Vietnam time.
  - + If you cannot upload TR in time, inform QA in ODD by 11AM of 2 days before shipping day.
  - + Counting number of days is working day in Vietnam except for Saturday and Sunday.
  - + After 11AM of 2days before shipping day, DON'T replace TR on your server before informing ODD.
- In case storage period after the last measurement date over 1 year, the product has to be re-measured before shipping.
- FOV must inform to Fujikura before re-measure the stock products.
- After measurement Fujikura will review the results and judge they can be shipped or not.
- The measurement value in the test report should be the result of re-measurement.

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**Note for test report:**

1. Optical measurement data should be described to two decimal places
2. For the items as shown below, the specified value needs to be written in Spec column
  - Center Wavelength
  - Reflectivity
  - FWHM
  - SLSR
  - Fiber length in / Fiber (pigtail A)
  - Recoat length
  - Fiber length out / Fiber (pigtail B)
3. Detailed requirements for each type, refer to Spec No. AOP82-4001-27-12



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## REVISION HISTORY

Date	PIC	Ver	Description		Reason of change	Change requester
			Old contents	New contents		
04-Oct-2024	VietTA	68	II. Application Table II.1 Products general information N/A	II. Application Table II.1 Products general information Add new products HLV	Customer update Specifications Version	TrungDN
			III. Reference Documents: 1 AOP82-4001-27-04(18) 2 AOP82-4001-27-09(21) 3 AOP82-4001-27-11(17) 4 AOP82-4001-27-10(17) 5 AOP81-2122-27-01(19) 6 AOP82-4001-27-13(05) 7 AOP82-4001-27-14(05) 11 AOP82-4001-27-05(26) 14 AOP82-4001-27-15(03) 15 AOP82-4001-27-16(03)	III. Reference Documents: 1 AOP82-4001-27-04(19) 2 AOP82-4001-27-09(22) 3 AOP82-4001-27-11(18) 4 AOP82-4001-27-10(18) 5 AOP81-2122-27-01(20) 6 AOP82-4001-27-13(06) 7 AOP82-4001-27-14(06) 11 AOP82-4001-27-05(27) 14 AOP82-4001-27-15(04) 15 AOP82-4001-27-16(04)		
			Table 4.1.1 Cutting length of Cavity-FG N/A	Table 4.1.1 Cutting length of Cavity-FG Add new products HLV		
			12. Optical Measurement N/A	12. Optical Measurement Add new products HLV		
	ThuyNT D		Table 13.1.1.2 Length of Cavity product N/A	Table 13.1.1.2 Length of Cavity product Add new products HLV	- Customer update Specifications Version add new product code.	DucNTM
09-Sep-2024	VietTA	67	II. Application Table II.1 Products general information N/A	II. Application Table II.1 Products general information Add new products XEV, XFV	Customer update Specifications Version	TrungDN
			III. Reference Documents: 1 AOP82-4001-27-04(17) 2 AOP82-4001-27-09(20) 3 AOP82-4001-27-11(16) 4 AOP82-4001-27-10(16) 5 AOP81-2122-27-01(18) 6 AOP82-4001-27-13(04) 7 AOP82-4001-27-14(04) 11 AOP82-4001-27-05(25) 14 AOP82-4001-27-15(02) 15 AOP82-4001-27-16(02)	III. Reference Documents: 1 AOP82-4001-27-04(18) 2 AOP82-4001-27-09(21) 3 AOP82-4001-27-11(17) 4 AOP82-4001-27-10(17) 5 AOP81-2122-27-01(19) 6 AOP82-4001-27-13(05) 7 AOP82-4001-27-14(05) 11 AOP82-4001-27-05(26) 14 AOP82-4001-27-15(03) 15 AOP82-4001-27-16(03)		
			Table 4.1.1 Cutting length of Cavity-FG N/A	Table 4.1.1 Cutting length of Cavity-FG Add new products XEV, XFV		
			12. Optical Measurement N/A	12. Optical Measurement Add new products XEV, XFV		
	ThuyNT D		II. Application Table II.2 Processes for Cavity-FG Item 15. Shipping	II. Application Table II.2 Processes for Cavity-FG Item 15. Test report & Shipping	Correction (as internal review from audit no QLA2404)	DucNTM
			Table 13.1.1.2 Length of Cavity product - Type name: HAV, HBV, HCV, HDV, HEV, HFV, HGV, HHV, HJV, HKV: Refer to figure 13.1.1.10 - Remain of type name: Refer to figure 13.1.1.9 - N/A	Table 13.1.1.2 Length of Cavity product - Type name: HAV, HBV, HCV, HDV, HEV, HFV, HGV, HHV, HJV, HKV: Refer to figure 13.1.1.12 - Remain of type name: Refer to figure 13.1.1.11 - Add new products XEV, XFV	- Correction  - Correction  - Customer update Specifications Version add new product code.	
			VI. Content: 15. Shipping	VI. Content: 15. Test report & Shipping	Correction (as internal review from audit no QLA2404)	
14-Aug-2024	VietTA	66	1. Material preparation 2. Fiber Optical Rewinding	1.Incoming Inspection 2. Fiber Rewinding	Action for finding internal audit 8-Aug-	TrungDN

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					2024	
1-Aug-2024	VietTA ThuyNT D	65	<p>III. Reference Documents:</p> <p>1 AOP82-4001-27-04(16)</p> <p>2 AOP82-4001-27-09(19)</p> <p>3 AOP82-4001-27-11(15)</p> <p>4 AOP82-4001-27-10(15)</p> <p>5 AOP81-2122-27-01(17)</p> <p>6 AOP82-4001-27-13(03)</p> <p>7 AOP82-4001-27-14(03)</p> <p>8 AOP82-4001-27-06(13)</p> <p>9 AOP82-4001-27-07(08)</p> <p>10 AOP82-4001-27-08(23)</p> <p>11 AOP82-4001-27-05(24)</p> <p>13 AOP82-4001-27-12(03)</p> <p>14 AOP82-4001-27-15(01)</p> <p>15 AOP82-4001-27-16(01)</p>	<p>III. Reference Documents:</p> <p>1 AOP82-4001-27-04(17)</p> <p>2 AOP82-4001-27-09(20)</p> <p>3 AOP82-4001-27-11(16)</p> <p>4 AOP82-4001-27-10(16)</p> <p>5 AOP81-2122-27-01(18)</p> <p>6 AOP82-4001-27-13(04)</p> <p>7 AOP82-4001-27-14(04)</p> <p>8 AOP82-4001-27-06(14)</p> <p>9 AOP82-4001-27-07(09)</p> <p>10 AOP82-4001-27-08(24)</p> <p>11 AOP82-4001-27-05(25)</p> <p>13 AOP82-4001-27-12(04)</p> <p>14 AOP82-4001-27-15(02)</p> <p>15 AOP82-4001-27-16(02)</p>	Customer update Specifications Version	
			<p>III. Reference document.</p> <p>2. Working direction</p> <p>PTE82-59-24-2003(01)</p> <p>PTE82-59-24-2007</p> <p>PTE82-59-23-2010</p> <p>PTE82-59-23-2023</p>	<p>III. Reference document</p> <p>2. Working direction</p> <p>Remove</p>	The content of WD was updated in new specifications version	
			Table 4.1.1 Cutting length of Cavity-FG. Fiber length of KBV, KCV, KXV, KYV	Table 4.1.1 Cutting length of Cavity-FG. Change Fiber length of KBV, KCV, KXV, KYV	Update follow new specifications version	
			<p>5.1 Process specification</p> <p>Stripping length:</p> <p>- Fiber 80um: <math>\leq 5\text{mm}</math></p>	<p>5.1 Process specification</p> <p>Stripping length:</p> <p>- Fiber 80um: <math>&lt; 4.5\text{mm}</math></p>		
			<p>6. Exposing and Thermal aging</p> <p><i>Excimer Laser Energy</i></p> <p><i>Manufacturing: 120mJ, mode EGY-N</i></p>	<p>6. Exposing and Thermal aging</p> <p><i>Excimer Laser Energy</i></p> <p><i>Manufacturing: 120mJ, mode EGY-N or EGY-P</i></p>	Update follow CO :9-PR-0014-9-FO-0001-4-RC-0127	
			<p>7.Thermal Aging (hot air) process</p> <p>N/A</p>	<p>7.Thermal Aging (hot air) process</p> <p>Stripping movement</p> <p>Pre-Heating</p> <p>Velocity</p>	Update to match with control process	TrungDN
			<p>11.1.3. Apply for all products belong RV3</p> <p>Deformation and discoloration</p> <p>+ Defect Size/ Condition</p> <p>Length of deformation or discoloration of fiber coating is greater than 0.25mm</p> <p>+ N/A</p>	<p>11.1.3. Apply for all products belong RV3</p> <p>Deformation and discoloration</p> <p>+ Defect Size/ Condition</p> <p>At buffer/glass interface</p> <p>+ Add Fig. 11.1.3.3&amp;11.1.3.4</p>	Update follow new specifications version.	
			<p>Table 13.1.1.2 Length of Cavity product</p> <p>Fiber length of KBV, KCV, KXV, KYV</p> <p>+ L2: <math>1245 \pm 25\text{ mm}</math></p>	<p>Table 13.1.1.2 Length of Cavity product</p> <p>Fiber length of KBV, KCV, KXV, KYV</p> <p>+ L2: <math>845 \pm 25\text{ mm}</math></p>		
			<p>13.1.2.7 Inner packing for patt 7: Products have scotch tape at yellow port and red port.</p>	<p>13.1.2.7 Inner packing for patt 7: Delete scotch tape at yellow port.</p>		
			<p>13.1.2.9 Inner packing for patt 9: Have 2 format label:</p> <p>a. For UAV, UBV; TAV, TBV products</p> <p>b. For other products</p>	<p>13.1.2.9 Inner packing for patt 9: Update format label for patt 9, delete format label for:</p> <p>+ UAV, UBV products</p> <p>+ Other product</p>	Follow AOP82-4001-27-08(24)	
			<p>13.1.2.10 Inner packing for patt 10: N/A</p>	<p>13.1.2.10 Inner packing for patt 10: Add method packing for patt 10.</p>		
			<p>14.1. Process specification: N/A</p>	<p>14.1. Process specification: Add storage condition Thermal (0 – 30°C)</p>	-Add storage conditional from specification	
			<p>14.2 Process condition: N/A</p>	<p>14.2 Process condition: Add storage condition: thermal recorder.</p>		
			<p>15 Shipping</p> <p>+ N/A</p> <p>+ Update Data (test report and Shipping data) to FTP server</p>	<p>15 Shipping</p> <p>+ Add Re-measurement for stock products.</p> <p>+ Update Data (test report and E-data) to FTP server (Change “Shipping data” to “E-data”)</p>	Follow AOP82-4001-27-07(09)	
4-Jun-2024	NguyenV T	64	<p>III.Reference document.</p> <p>2. Working direction</p> <p>- PTE82-59-21-2005</p>	<p>III.Reference document.</p> <p>2. Working direction</p> <p>- Remove</p>	FOV didn't use resin 950Y200	ChienPH
			<p>IV. Content</p> <p>4. Fiber cutting</p> <p>Table 4.1.1 Cutting length of Cavity-FG.</p>	<p>IV. Content</p> <p>4. Fiber cutting</p> <p>Table 4.1.1 Cutting length of Cavity-FG.</p>	Following 9-PR-0014-9-FO-0001-4-RC-0105	

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L1 = 120 ± 50

5. Fiber Stripping

5.1 Process specification

- Stripping position:N/A

Remove L1

5. Fiber Stripping

5.1 Process specification

- Stripping position: Add note

III. Reference Documents

No Specification

1 AOP82-4001-27-04(15)

2 AOP82-4001-27-09(18)

5 AOP81-2122-27-01(16)

6 AOP82-4001-27-13(02)

7 AOP82-4001-27-14(02)

III. Reference Documents

No Specification

1 AOP82-4001-27-04(16)

2 AOP82-4001-27-09(19)

5 AOP81-2122-27-01(17)

6 AOP82-4001-27-13(03)

7 AOP82-4001-27-14(03)

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