REPAIR SERVICE MANUAL

FOR

COLOR VIDEO GI SCOPE

90K SERIES

PENTAX

MODEL

EC-3890MK, EC-3890MK2

EC-3890FK, EC-3890FK2

EC-3890LK

EG-2990K

LIFE CARE HEADQUATERS
MEDICAL INSTRUMENT DIVISION
CUSTOMER SERVICE SECTION

PENTAX Corporation

2007.07.13
MNL-044-00

§ Notes for using this Repair Service Manual : §

1) Up-date of Repair Service Manual will be notified by such information as Notice of Modification, Service Note and so on.

2) When you start repair servicing, be sure to leave service record.

3) This Repair Service Manual voids preceding "New Product Repair Guide" for the same model, if any.

4) Upon request, Pentax will provide qualified service personnel with further information to service this product provided that the requested information needed within the range of servicing described in this Service manual.

CONTENTS

1-1 GENERAL FEATURES & SPECIFICATION

1. Outline
   1) These models are compatible with EPK-700, EPK-1000 and EPK-i.
   2) Newly designed PCB is used so that the digital image transfers with EPK-i in order to improve the image.
   3) Improved objective lens and light distribution system in order to expand the observation area and the light distribution area.
   4) Improved multi stage stiffness insertion flexible tube is used for the better maneuverability.
   5) The Insertion Tube Attaching Nut can be turned by special tool without removing the Root Brace Rubber.

1. Distal area
   1) The improved K2-CCD module CCD with new CCD drive PCB (DSP7) is used.
   2) Newly designed LCB cover glasses are equipped.
   3) Newly designed Objective lens is equipped.

2. Control Body
   1) Control Body is newly designed in order to improve the operation of the scope.
   2) Angulation Knob mechanism and Angulation adjustment are different from 70K/80K series.
   3) Newly designed A/W valve “OF-B188” is equipped.

3. Light Guide Cable and Connector Assy
   1) The structure is the same as 70K/80K scopes, except that the size of supply tubes and cylinders.

4. Specifications :

Model Name		EC3890LK	EC3890FK/FK2	EC3890MK/MK2	EG2990K
Filed of View		140˚			140˚
Depth of Filed		3~100mm			4~100mm
Rigid distal Diameter		ϕ 13.2mm			ϕ 10.2mm
Insertion Tube Diameter		ϕ 13.2mm			ϕ 9.8mm
Tip deflection	U/D	180˚ / 180˚			210˚ / 120˚
	R/L	160˚ / 160˚			120˚ / 120˚
Channel diameter		ϕ 4.2			ϕ 2.8
Working Length		1,700mm	1,500mm	1,300mm	1,050mm
Total Length		2,023mm	1,823mm	1,623mm	1,373mm

1.2 GENERAL PRECAUTIONS FOR REPAIR

1. Insertion Tube
   1) Make sure that there is no projection, which may injure internal organ walls of the patient. For this, use the palm of your hand for lightly grasping and sliding over the insertion tube along entire length.
   2) The material of flexible tube sheath may react with solvents to any degree. Principle method to scrub the surface is to use a soft detergent.
   3) Methanol or ethanol can be also used for scrubbing, but bear in mind to avoid unnecessary, extensive use.

2. Segment and Angle wires
   These are key parts for deflecting function of the distal end portion. Always make sure that nothing is wrong with them. Even slight damage can be the cause of " stuck " during the procedure.
   Make sure to rub MK-Powder (CMC/RM3203) well on the angle wire surface to reduce the torque on control.

3. CCD (Charge Coupled Device):
   CCD chip is fragile with static electricity and expensive in cost. Handle it using discharging-desk-mat with a wrist strap. Low-leakage soldering iron designed for use with C-MOSs must be used for soldering.
   Basically, replacement of CCD chip should be made in a unit as CCD Module with Drive PCB.

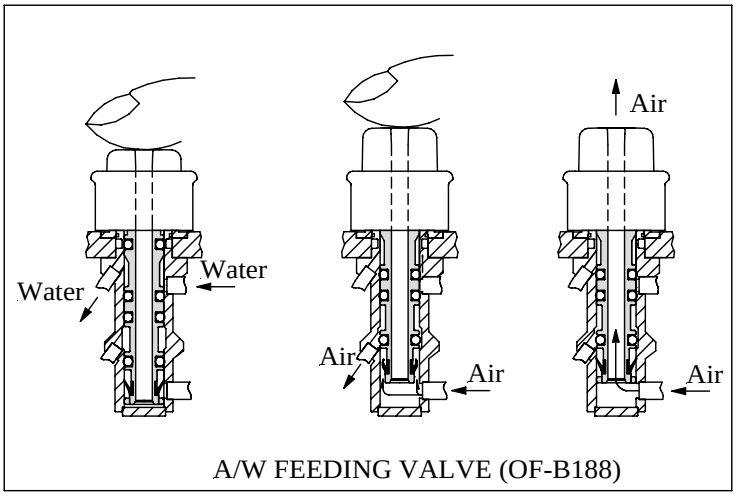
4. Stainless steel Soldering Flux (SS-FLUX/RM4110)
   This is widely used in the flexible endoscope repair but is a highly corrosive chemical containing strong acid.
   When using it, follow the rule of thumb shown below:
   a) Strictly distinguish from the general/electrical purpose soldering paste and flux.
   b) Fully gasify by applying plenty heat when soldering not to leave the corrosive liquid inside.
   c) While soldering, if necessary, protect other near-by parts from dispersing flux by covering them with a paper sheet.
   d) After soldering, clean residues of the flux with lukewarm water to prevent corrosion of the parts afterward caused by the remaining acid.

5. O-Ring to seal Control body and Light Guide Connector
   a) Each mating face appearing externally has an O-Ring for Airtight seal. Before assembly, make sure that O-Ring is free from cut, scratch, deformation, and foreign matters on its surface.
   b) Be sure to lubricate O-Ring with specified grease or silicone oil.

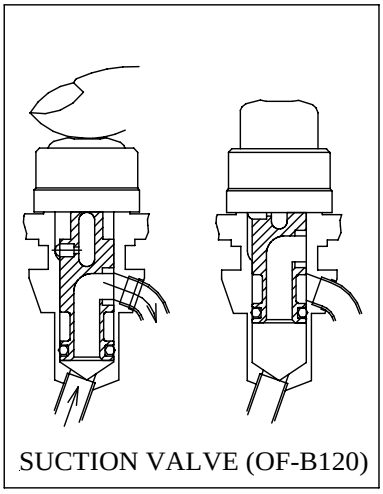
6. Set-screw
   a) Any setscrew appearing externally is made of stainless steel having each part number. Do not use standard setscrew as an alternative.
   b) Seal each setscrew appearing externally with Silicone Sealant (SS-6/RM2006) as corrosion protection.

1.3 CHANNEL AND TUBES SCHEMATICS

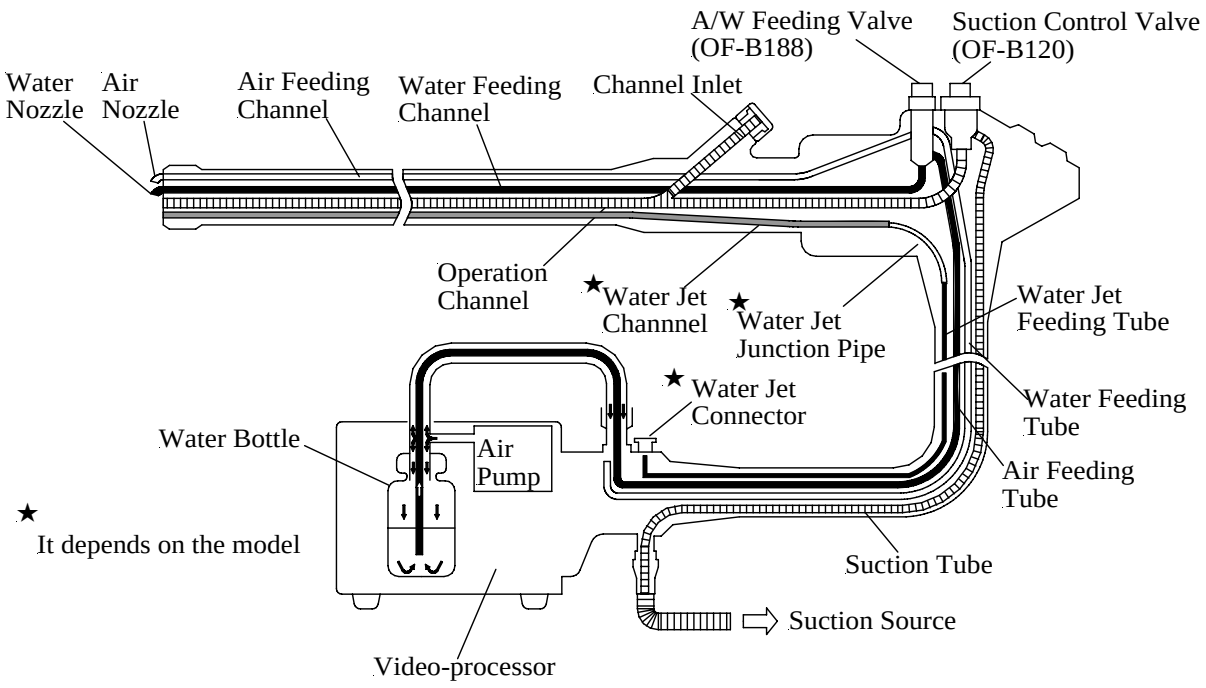
This Illustration shows the actual routes taken by air, water and suction through a PENTAX Ultrasound scope.



A/W FEEDING VALVE (OF-B188)



SUCTION VALVE (OF-B120)



1.4 STANDARD SCREWS AND OTHER MATERIALS

1. E/M Solution:
   A solution made of 7-8 part Ether [$(C_2H_5)_2O$] and 3-2 part Methanol [CH_3OH] thoroughly mixed.
   Widely used for cleaning optics, Bending Rubber, metal parts and as general purpose cleaning solution.

2. Methanol [CH_3OH] / Ethanol [C_2H_5OH] / Isopropyl alcohol (IPA)[$(CH_3)_2CHOH$]:
   Alcohol is used for cleaning the plastic materials such as the outer sheath of Insertion Tube/LG Cable, Body Cover Grip and etc.

3. Standard Screws :
   Standard screws are expressed as follows,

E x. (TW-) C N M 2 × 4
6) 1). 2). 3). 4). 5).

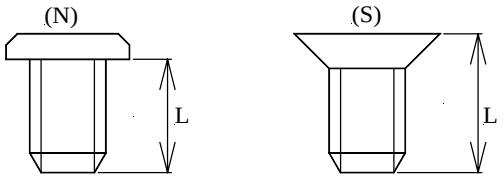


Fig.1-4-1

1). C : Cross or Phillips head
2). N : Pan head
S : Saucer head
RS : Oval-headed saucer
3). S : Head size small
M : 〃 medium
H : 〃 High head
*There are a few variations in this "H" and "L" families.
4). : Nominal size in "mm"
5). : Length in "mm"
6) TW : Tapping Screw

E x. S T 2 × 4
1). 2). 3). 4).

Fig.1-4-2

1). S : Set screw
2). T : Pointed end
F : Flat end
3). : Nominal size in "mm"
4). : Length from head to end in "mm"

* Surface treatment : Unless otherwise specified, screws less than 2mm in nominal size are treated by black nickel.
* Screws of which nominal size is equal or over 3mm may have a prefix " P " like " PCSM3×6 ". But it is actually the same as CSM3×6.

4. Solder Alloy :
   For soldering, use Sn. 60% - Pb. 40% type unless otherwise noticed.

5. Introduction of lubricant:
   1) G-M17 Grease White, featuring strong oil film
      Application : O-Ring lubricant (almost non-reactive with cover plastic material)
      : Eyepiece Diopter cam torque setting.
      : General metal parts and mechanical parts lubricant.
   2) G-M18 Grease White
      Application : Attaching Side Body Cover. Lubricant for the Control Knob mechanism
   3) SLOH Silicone oil high viscosity
      Use for O-Ring on the Air/Water Feeding piston, Suction Valve and Biopsy Inlet section.

2 GUIDE FOR DISASSEMBLY

The process below shows the major overhaul such as the replacement of Distal End Assy, Segment Staycoil Assy and Insertion Flex.Tube.

Exploded Views : DW42A005 / DW42A006 / DW42A007 / DW42A008 / DW42B003 / DW42B005 / DW42B006 / DW42B007 / DW42B009 / DW42B0010 / DW42C001 / DW42C003 / DW42C004

Special Tools : ST-2311 / ST-2320 / ST-2372 / ST-2375 / ST-3126 / ST-3133/ ST-3161/ ST-3163 / ST-3165-1 / ST-3206 / ST-3207 / ST-3209 / ST-4211 / ST-4212

Materials :

Procedures :

1. Body Cover Grip disconnection:
   1) Using ST-3126, unscrew the Biopsy Inlet Piece Attaching Nut (A-B0441).
   2) Using ST-3165, unscrew the Biopsy Inlet Barrel (A-B0251).
   3) Unscrew the Rubber Trim Collar (B0305) by hand.
   4) Using ST-3207, unscrew the FWD Body Trim Cover Attaching Nut (B0297).
   5) Remove the FWD Body Trim Cover Attaching Nut (B0297) and Spacer (B0303).
   6) Disconnect the FWD Body Trim Collar (B0302) and Colored Ring (B0301) from the Body Cover Grip.
   7) Disconnect the Joint Seal Ring (A-B0299).
   8) Remove the O-Ring (B0173) on the FWD Body Frame(2) (B0172).
   9) Depressing the Biopsy Inlet T-piece (A-B0241), disconnect the Body Cover Grip (B0298).

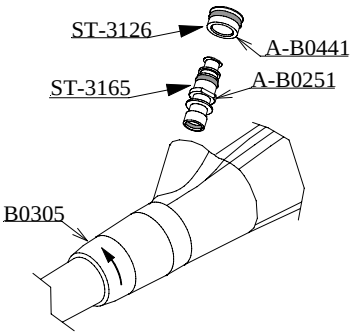


Fig.2-1

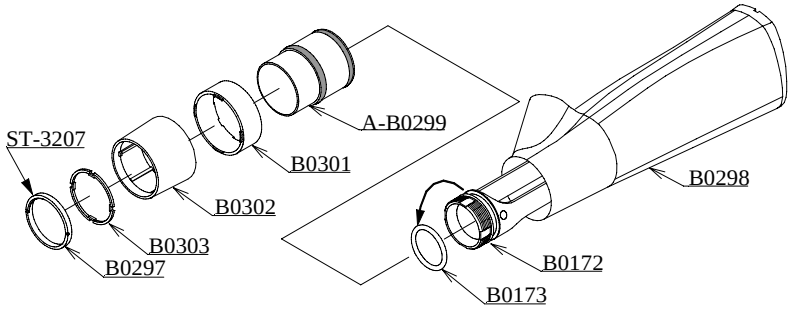


Fig.2-2

2. Angle wire and Staycoil disconnection:
   1) Remove screw (CNS2x3), disconnect the Screw Retaining Plate (B0042).
   2) Remove 3-screws (CNM2x4 w/Washer), disconnect the Guide Cover Plate (B0295).
   3) Disconnect the U-stopper Assy and D-stopper Assy.
   4) While holding the Adjusting screw (A0044) of the Angle wire, unscrew the Connecting receptacle of the Pulley wire so that the Angle wire is disconnected from the Pulley wire.

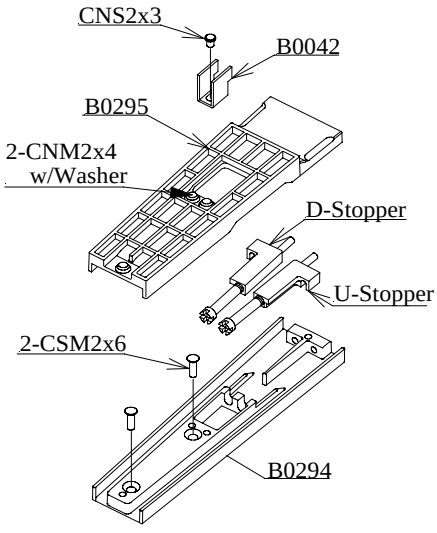


Fig.2-3

5) Remove 2-screws (CSM2x6), disconnect the Intermediate Plate (B0294).
6) Disconnect the L-stopper Assy and D-stopper Assy.
7) Disconnect the Right and Left angle wires from the Pulley wire.
8) Remove 4-screws (CNS2x2), disconnect the Staycoil Bracket Cover (B0292).
9) Remove 2-screws (CNS2x4), disconnect the Staycoil Holder Bracket (B0291).

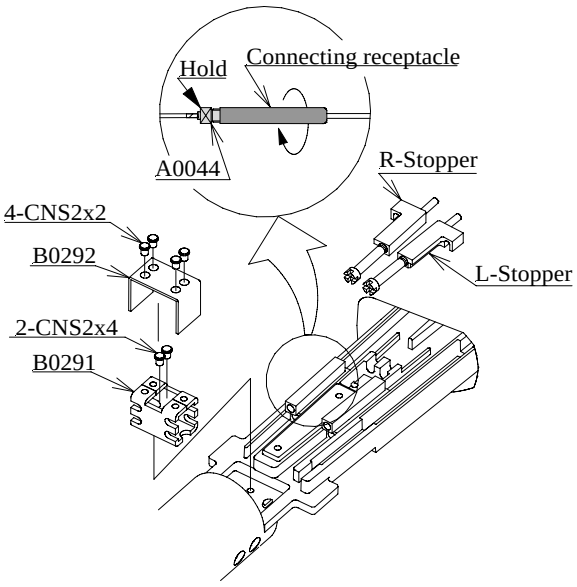


Fig.2-4

3. Side Body Cover disconnection:
   1) Unscrew the Root Brace Rubber LG Body (B0308).
   2) Using ST-3206, unscrew the Side Cover Retaining Nut (A-B0181).
   3) Pull up the Side Body Cover (A-B0211) at the Light Guide Cable side and disconnect A-B0211 from the Control Body.

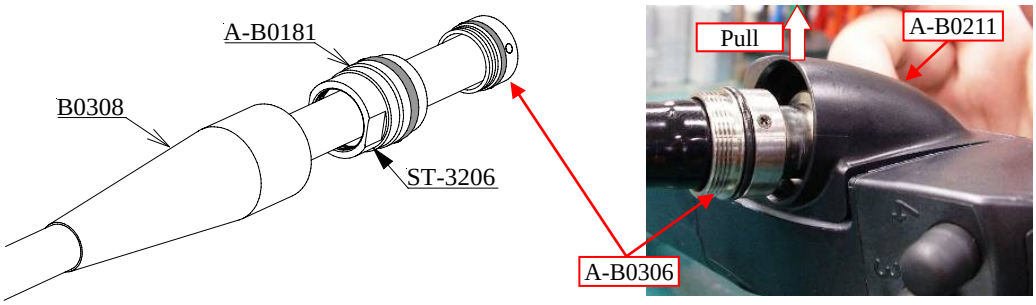


Fig.2-5

4. LG Cable Connector Housing disconnection: (Fig.2-6)
   1) Unscrew the LG Root Brace Rubber (C0131).
   2) Remove 3-ETO Valve Tightenning Screws (C0114).
   3) Using ST-2372, disconnet the ETO Valve Assy (A-C0244).
   4) Remove the EOG Valve Attaching Nut (C0113).
   5) Using ST-3133, unscrew the Jet Socket (A-C0081)
   6) Using ST-3133, unscrew the Suction Nipple Attaching Nut (A-C0041) and disconnect the Suction Nipple (A-C0031).
   7) Using ST-3163, unscrew the Air/Water Socket (A-C0061).
   8) Remove X-Ring (C0014) from the attaching collar to the Light Guide Cable in order to prevent cutting it.

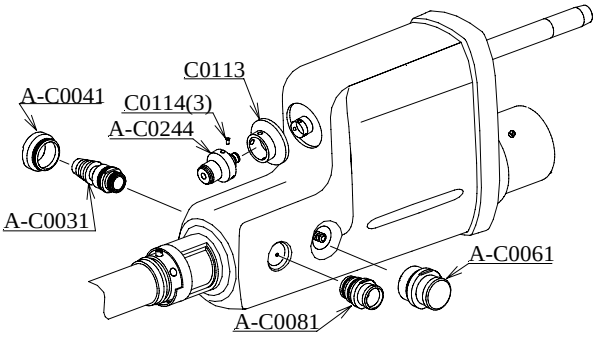


Fig.2-6

9) Using ST-3161, unscrew the LG Connector Housing Attaching Nut (C0111).
10) Move the LG Connector Housing (A-C0001) on the Light Guide Cable.
11) Unsolder or cut GND (green) wire at the soldered joint.
12) Place X-Ring on the groove of the attaching collar again.

5. PCB and LG Cover Glass Set disconnection: (Fig.2-7)
   1) Remove 8 screws (CNL-D1.7x2.2), disconnect the Shield Cover (C0115).
   2) Remove the Cover Glass/G-Rod Holding Screw (C0104), disconnect the LG Cove Glass Set (A-C0272).
   3) Loosen C0104, pull out the LCB together with the Glass Rod Assy (A-F0020) from the LG prong.
   4) Loosen LCB Set Screw (F0023), remove the LCB from A-F0020.
   5) Loosen 4 set-screws (ST1.7x2) and remove 2 screws (CNM2x2.8), disconnect Core Holding Plate (C0116).
   6) Remove 2 Core(1) (P0032) from the CCD signal wire.
   7) Disconnect the connectors of the Electrical connector Assy (A-P0023) from the PCB.

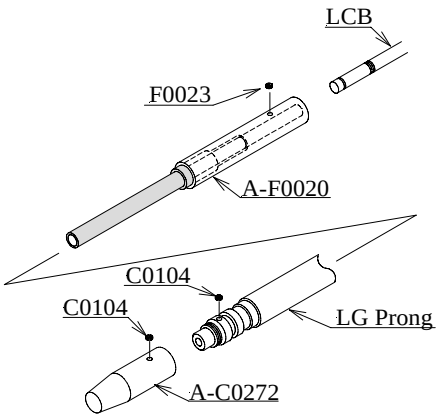


Fig.2-7

   8) Remove 4 screws (CNM2x2.8), disconnect the PCB from the LG Cable Connector.

Caution: Handle the CCD module unit and PCB on a discharging –desk-mat and wearing a wrist band to prevent them from static electricity damage.

: Use low-leakage soldering iron with non-corrosive type soldering paste for soldering wires. And thoroughly clean the paste residue with E/M solution damped tissue paper after soldering.

   9) Unsolder the CCD Signal wire and Remote Control wire from the PCB.
   10) Bind the end of the wires with an aluminium foil in order to prevent static electricity damage.

6. LG Cable Connector Assy and Light Guide Cable disconnection:
   1) Cut the Nylon tie and remove the Core(2) (P0033) from the CCD Signal wire.
   2) Using ST-2320, turn and remove the Suction Channel retaining Coil (C0026).
   3) Disconnect Suction Channel LG (A-C0027) from the LG Suction J-piece (A-C0021) and remove C0026.
   4) Free 2 Air/Water Supply Tube Retaining Collars (C0058) by moving toward the Air/Water Socket Cylinder (A-C0051).
   5) Disconnect 2 Air/Water Supply Tube LG (A-C0141) from A-C0051 and remove C0058.
   6) Free J Supply Tube Retaining Collar (C0075) by moving toward the Jet Socket Cylinder (A-C0071).
   7) Disconnect the Water Jet Supply Tube (A-C0161) from A-C0071 and remove C0075.
   8) Remove 3 screws (CSM1.7x3.5), disconnect the LG Cable Connector Assy (A-C0091) from the Light Guide Cable (A-C0121).

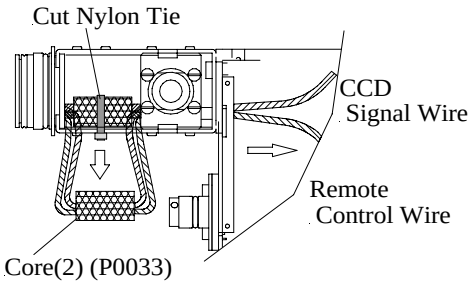


Fig.2-8

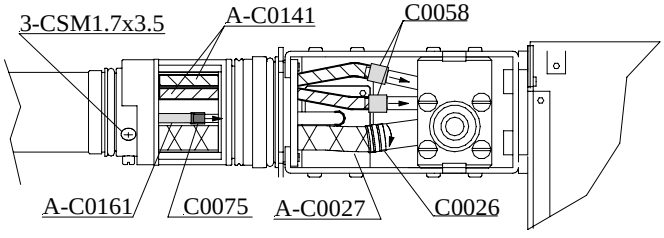


Fig.2-9

9) Remove 3 screws (CSS1.7x3.5), disconnect A-C0121 from the Control Body.
10) Remove 6 screws (CSM2x2.8), disconnect Light Guide Column (A-B0306).

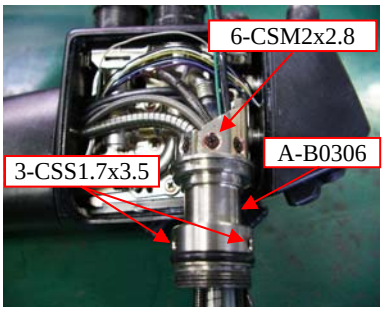


Fig.2-10

7. Control Body and FWD Body Frame disconnection:
1) Using ST-2320, turn and remove the Channel Retaining Coil (B0246).
2) Disconnect the AFT Suction Channel (B0245) from the Suction Cylinder.
3) Move the Retaining Collars toward the A/W Cylinder and disconnect the Air and Water tubes and Retaining Coils.
4) Move the Retaining Collar toward the Water-Jet Junction Pipe (A-B0281) and disconnect the Watere Jet Tube.

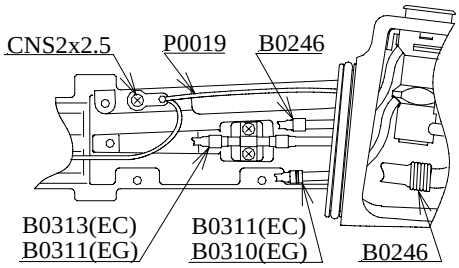


Fig.2-11

5) Remove screw (CNS2x2.5), remove the GND Lug Pltae (P0018) from the Control Body.
6) Remove the GND wires from P0018.
7) Attach the Body Cover Grip (B0298) and set the Control Body to ST-2375 as shown in Fig.2-12.
8) While holding B0298, loosen the Insertion Tube Attaching Nut (A0058).
9) Remove ST-2375 from the scope and detach B0298 form the Control Body.
10) Put the O-Ring (B0173) back to the FWD Body Frame(2) (B0172).
11) Using ST-3209, unscrew A0058 and separate the IFT from the FWD Boby Frame.

Note: It is not necessary to remove the Root Brace Rubber.

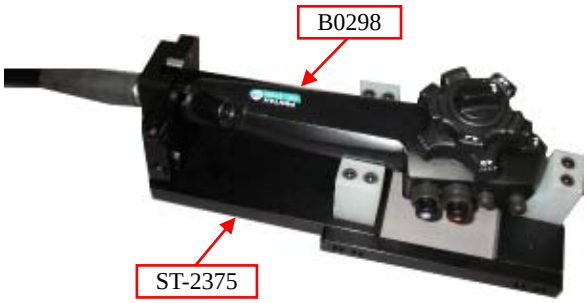


Fig.2-12

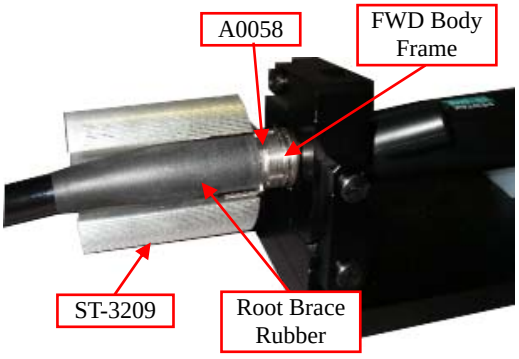


Fig.2-13

12) Biopsy Inlet T-piece disconnection:

For EC3890Ks

a) Using ST-2311, turn and remove the Channel Retaining Coil (B0309).
b) Disconnect the Biopsy Inlet T-piece (A-B0241) from the Operation Channel.
c) Remove A-B0241 form the Control Body and remove B0309 form the Operation Channel.

For EG2990K

a) Using ST-2311, turn and remove the Op Channel Retaining Nut (B0312) and disconnect Op Channel Retaining Collar (B0309).
b) Disconnect the Biopsy Inlet T-piece (A-B0241) from the Operation Channel.
c) Remove A-B0241 from the Control Body and remove B0309 and B0312 from the Operation Channel.

13) Pull out the LCB and CCD Signal wire from the Control Body and remove the Control Body from the IFT.

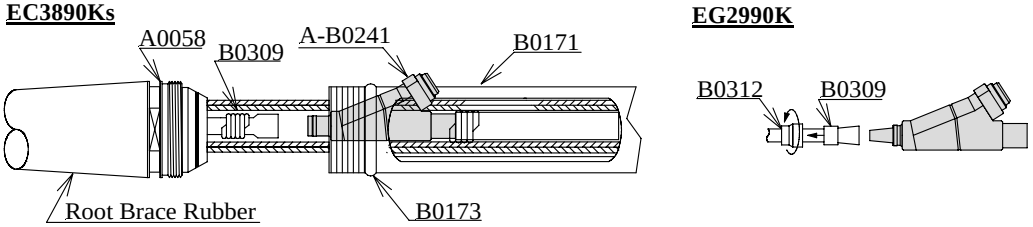


Fig.2-14

8. Separation of Distal End Assy from Insertion Tube with Segment :

Perform the process below if Insertion Flex.Tube can be reused.

1) Install an adequate sheath on Insertion Flex.Tube and Root Brace Rubber and fix it with tape at the both ends to protect from smearing with MK-Powder(MLY/RM3203).

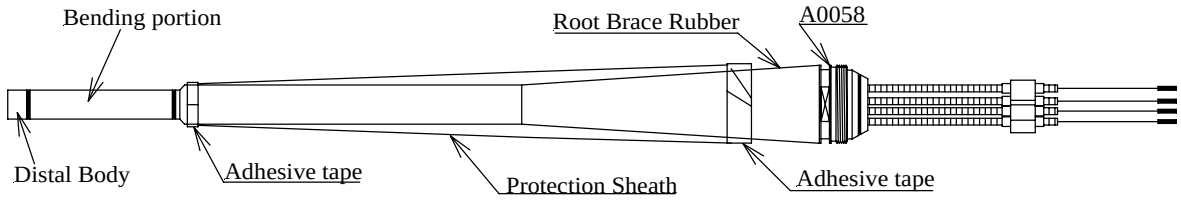


Fig.2-15

2) Removing of Bending Rubber at the bending portion :

Note: When cutting Bending Rubber binding thread with razor blade, take care not to cut external sheath of Insertion Tube under the Bending Rubber.

: Take care not to cut Steel Braid on Segment.

a) Protect Distal Body from smearing with MK-Powder (MLY/RM3203) by covering with adhesive tape.
b) Using razor blade, cut off black glue and binding threads on the end of Bending Rubber.

Note: Take cares not to cut Insertion Flex.Tube surface and/or Steel Braid on the segment area, both are just underneath the rubber.

c) Using scissors, cut-open Bending Rubber.

Note: Do not cut Steel Braid just underneath.

3) Separation of Distal End Assy from Insertion Flex.Tube with Segment :

Caution: Handle the Distal End Body with the utmost care so as not to drop the Distal End Body.

Note: Take care not to damage LCB and kink Operation Channel & A/W/J Tubes.

a) Remove three Distal Attaching Screws [3-A0040(EC)/2-A0040(EG)] with a screw driver.
b) Disconnect Distal Body from Segment.
c) Pull out inside-elements slowly.

3-1 PREPARATION OF INSERTION FLEXIBLE TUBE

Exploded View : DW42A006 / DW42A008
Special Tools : ST-2212 / ST-2214 / ST-2241 / ST-2246
Materials : RM1204 / RM1102 / RM3203 / RM4110

Procedures :

1. Preparation for Insertion Flex.Tube.

Note: If original Insertion Flex.Tube can be reused, install an adequate sheath on Insertion Flex.Tube and Root Brace Rubber, and fix it with adhesive tape at the both ends to protect from smearing with MK-Powder(MLY/RM3203).

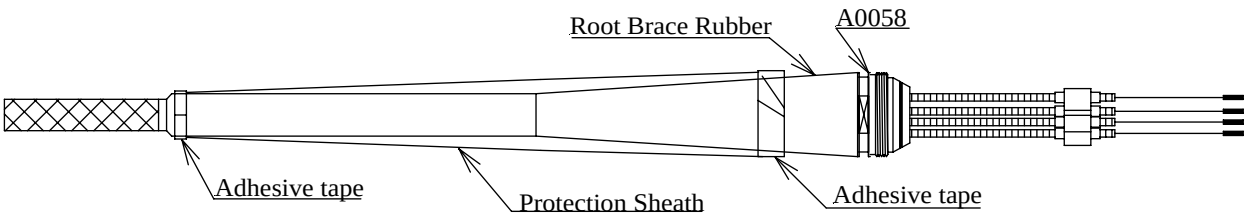


Fig.3-1-1

Perform the process below if Insertion Flexible Tube (A-A0501) is replaced with the new one.

1) Place O-Ring (A0056), Insertion Tube Attaching Nut (A0058) and Root Brace Rubber(A0057) onto Insertion Flexible Tube.
2) Protect Insertion Flex. Tube and Root Brace Rubber from smearing with MK-Powder (MLY/RM3203) as shown in above Fig.3-1-1.
3) Connect Segment Staycoil Assy (A-A0028) to IFT accordingly

EC3890Ks: Tighten 3-Segment Assy Attaching Screws (A0051) applying screw-lock (SLK-R/RM1204) on the thread of screw.
Tighten A0051 and apply instant glue (CMT-5/RM1102) around the head of the screw.

EG2990K: Tighten 3-Segment Assy Attaching Screws (A0053) and apply CMT-5 around the head of the screws.

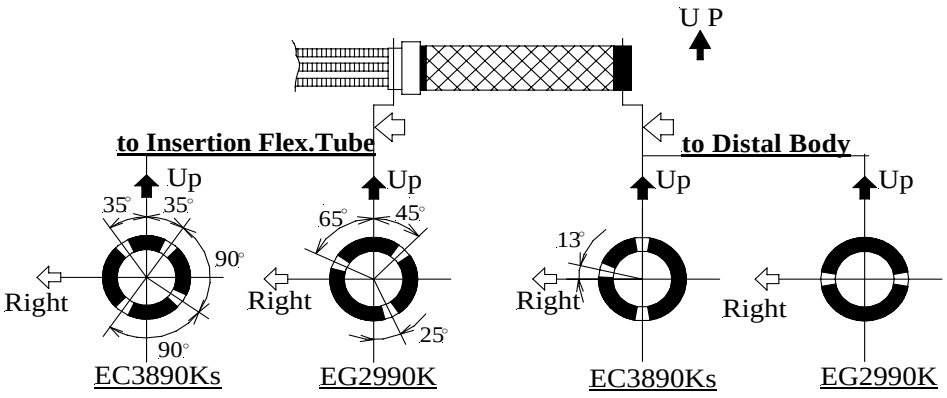


Fig.3-1-2

Perform the process below if Segment Staycoil Assy (A-A0028) is replaced with the new one.

1) Connect Segment Staycoil Assy to Insertion Flex.Tube with Segment Assy Attaching Screws (3-A0051). Refer to "Replacement of Insertion Flex.Tube-3)".

	L
EC3890Ks	97mm($^{+2}_{-0}$)
EG2990K	95mm($^{+2}_{-0}$)

2) Staycoil Cutting :
   a) Set the bending section to the neutral, and straighten Insertion Flex.Tube.
   b) Pull out four angle wires enough to clear working area.
   c) Cut the staycoil to the specified length with sharp nippers, and remove burrs inside and outside of the coil with a precision file.
   Note: Lightly pull four staycoils before cutting the coils.

3) Temporary attachment of Staycoil Collars :
   a) Apply a thin coat of solder using a small amount of SS-Flux (SS-FLX/RM4110) on the staycoil with a soldering iron.
   Caution: While applying heat, do not bend Staycoil otherwise solder will flow into the coil and ruin the parts.
   Note: Keep Insertion Flex.Tube straight and neutral.
   b) Place Staycoil Collars(A0046) on the staycoil.
   c) Flow a little solder using a small amount of SS-FLX at the shown point with a soldering iron.
   Caution: While applying heat, do not bend Staycoil as in above "3)-a)".
   : Apply heat enough to fully gasify the liquid flux.
   d) Using warm water or E/M solution damped tissue paper, clean the residual SS-FLX on the soldered area and all places around to prevent corrosion.

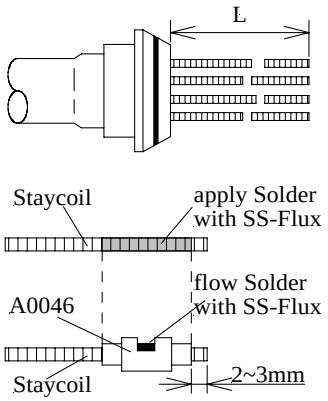


Fig.3-1-3

2. Setting of staycoil position :
   1) Attach Staycoil Holder on the exit of Insertion Flex.Tube.
   2) Insert the Staycoil separator into Insertion Flex.Tube aligning its grooves with the staycoils.
   Note: Do not twist and handle forcibly on the way.
   : If its position is once lost, advance until it appears from the other end. Then, disconnect Head and perform again.
   : If any hardness is felt, stop and check the cause.

	Holder	Separator
EC3890Ks	ST-2246	ST-2214
EG2990K	ST-2241	ST-2212

   3) Stop the separator when it has half-way-outed, and retain Staycoils with Staycoil Holder.
   Caution: If the separator head has fully outed by mistake and its position was lost, do not attempt to pull it backward. At which time, disconnect head and perform again.
   4) Tie a string or thin electrical wire(≒ ϕ 0.5～1.0 mm) to the head of Separator (to be utilized as a puller subsequently), and pull back Separator. Then remove leaving the string or wire in Insertion Flex.Tube.

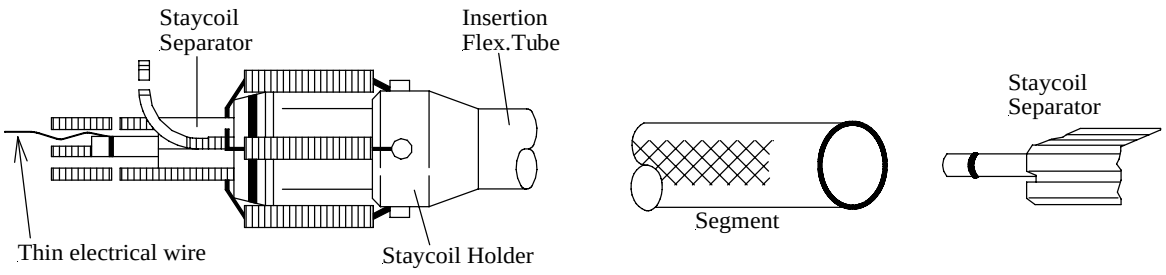


Fig.3-1-4

3-2 STUFFING OF INSERTION FLEXIBLE TUBE

Exploded View : DW42A006 / DW42A008
Special Tools :
Materials : RM2006 / RM3203

Procedures :

1. Preparation :
   1) Fully dried MK-powder (MLY/RM3203) has to be prepared as lubricant. Leave the container at 80℃ with its lid opened at least 30 min.

Perform the process below if original Distal End Assy and/or Segment Staycoil Assy is used again.

2) Remove residual sealant from Distal Body and top-ring of Segment Staycoil Assy.
3) To ease the insertion, straighten Operation Channel by hand applying a light counter-curvature.

Perform the process below if CCD Signal Wire is soldered to CCD Process/Drive PCB Assy.

Caution: Handle CCD Module Unit on a discharging-desk-mat and wearing a wrist band to prevent CCD chip from static electricity damage.

: Use low-leakage soldering iron with non-corrosive type soldering paste for soldering wires. And thoroughly clean the paste residue with E/M solution damped tissue paper after soldering.

4) Unsolder CCD Signal Wire from PCB Assy.
5) Temporally solder all CCD signal wire ends together to secure against static electricity damage.
6) Cover the soldered CCD signal wire ends with a plastic tube for insulation.

2. Insert the Distal End Assy with CCD Module into IFT in the following steps.

   Note: Do not handle the inside elements forcibly. LCB is extremely fragile.

   : Cover Distal End with adhesive tape to prevent its smearing with MK-Powder(MLY/RM3203).

   1) Fully dried MLY has to be prepared as lubricant. Leave the container at 80℃ with its lid opened at least 30 min.
   2) Find and mark Up-direction on "Distal Body(protection tape)", "Segment and Insertion Flex.Tube" respectively.
   3) Hold Distal Body on the working-bench and set each AFT end of the inside-elements using thin adhesive tape so that they are not slack and in the correct location with respect to the distal end arrangement through out entire length.

   Ex. :Taping Op. Channel to CCD Signal Wire → (Jet Tube to A/W Tubes[ES/EC only]) → / A/W Tubes to CCD Signal Wire → LCB to CCD Signal Wire

   Length of elements : Op. Channel < (Jet Tube[EC only]) < AW Tubes < LCB < CCD Signal Wire

   Note: Inside-elements should be kept straight and not be entangled.

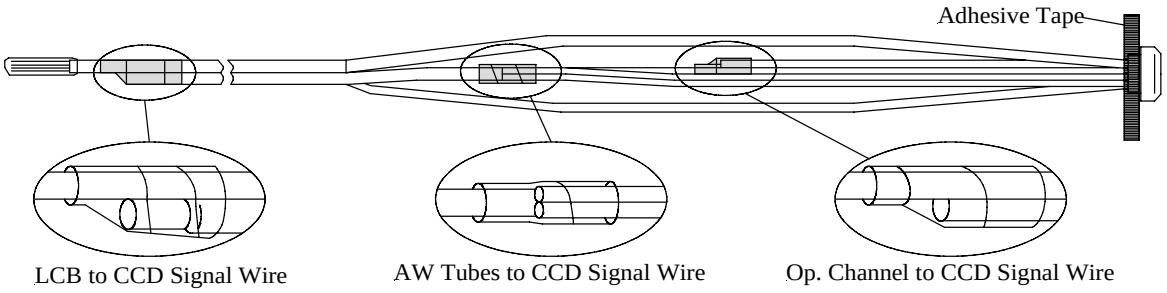


Fig.3-2-1

4) Using a thin plastic tube or the like, attach LCB end to the guide wire at the entrance of Segment, and pull it into Insertion Flex.Tube slowly until connecting plastic tube out from the other side of Insertion Flex.Tube.

Note: Inside-element & Staycoil should not be entangled in Insertion Flex.Tube.

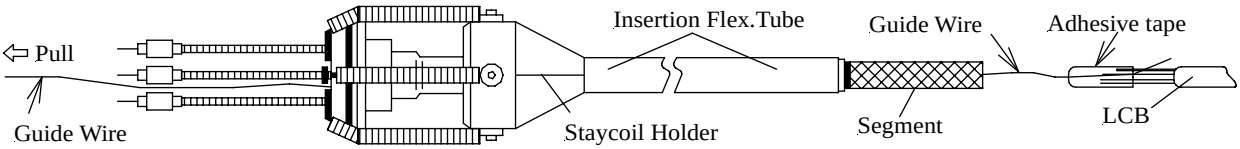


Fig.3-2-2

5) Feed the inside-elements into Segment watching correct location shown below, until the distance in the table is left between Distal Body and the entrance of Segment.

	EG2990K	EC3890LK	EC3890FK/FK2	EC3890MK/MK2
L(mm)	≒1150	≒1800	≒1600	≒1400

6) Lay the inside-elements straight on the working-bench keeping a correct relative location. Using a tea strainer, sprinkle the inside-elements with sufficient amount of MLY.

Note: Use the dried MLY and take care not to get the foreign matters such as hard dust particles into MLY.

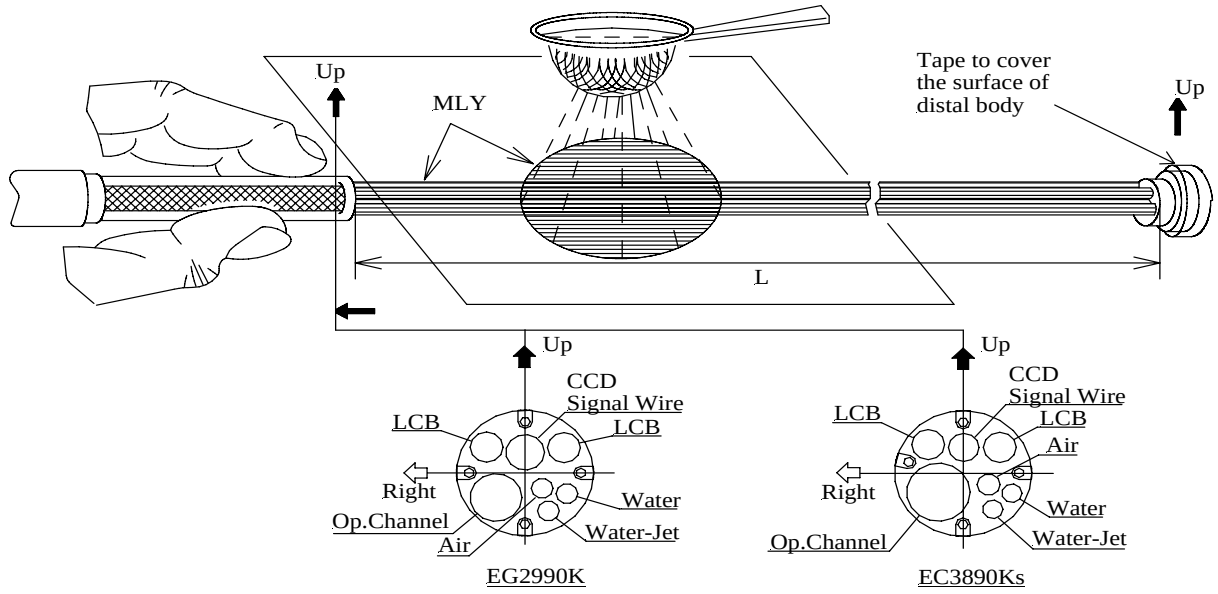


Fig.3-2-3

7) Thoroughly smear the inside-elements with MLY and sprinkle with MLY again. Then insert the inside-elements together with applied MLY, moving back and forth.

8) Adding MLY, repeat the same procedure, and advance further until rear end of Distal Body has reached the entrance of Segment.

Note: The inside-elements should smoothly come out of the other side. Lightly pull the each element one by one after LCB, Signal Wire and channels came out.

: If inside-elements seem stuck, recede the operation and check the inside elements' location.

3. Engage Distal Body with Segment :
   1) Using a brush, clean the attaching surface on Distal Body.
   2) Using a brush, clean two(EG) or three(EC) holes for Distal Attaching Plates(A0023), and wipe the surface with Methanol damped tissue paper.
   3) Apply Silicone Sealant (SS-6/RM2006) in the holes of Distal Body, and set Distal Attaching Plate on it.
   4) Apply a thin coat of SS-6 on the entire attaching surface of Distal Body, and engage Distal Body to Segment.

   Note: Sealant is used to prevent cement which is subsequently used for Bending Rubber from flowing into the gap.

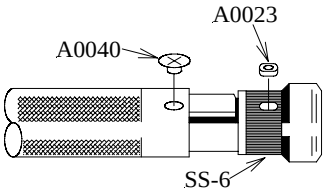


Fig.3-2-4

   5) Apply SS-6 in the holes for Distal Attaching Screws (2-A0051[EG]/3-A0040[EC]), and attach those screws.
   6) Wipe the excessive SS-6 with Methanol damped tissue paper.

3-3 BENDING RUBBER INSTALLATION

Exploded View : DW42A006 / DW42A008
Special Tools : ST-2275 / ST-2285 / ST-4024 / ST-4027
Materials : RM1003 / RM3203 / RM4201 / RM8101

Use an operation microscope for the process below.

Procedures :

1. Installation :
   1) Rub MK-Powder(MLY/RM3203) into Steel Braid.
   2) Set Bending Rubber(A0038) in Expander pulling it by 2 ~ 4 mm for tensioning.
   3) Using a vacuum pump, expand Bending Rubber and move it onto Segments.
   4) Release the vacuum and remove Expander, and clean the shown surface with Methanol or Ethanol damped tissue paper.
      Note: Locate two lines on the inner surface of Bending Rubber to R/L direction.
   5) Apply a thinnest possible coat of 1:1 Cement (CMT-2/RM1003) on the cementing area of Distal Body.
      Note: CMT-2 is not used on Insertion Flex.Tube side.
   6) Insert Work Shaft(see the table below) into Operation channel.

	Expander	W. Shaft
EG2990i	ST-2275	ST-4027
EC3890is	ST-2285	ST-4024

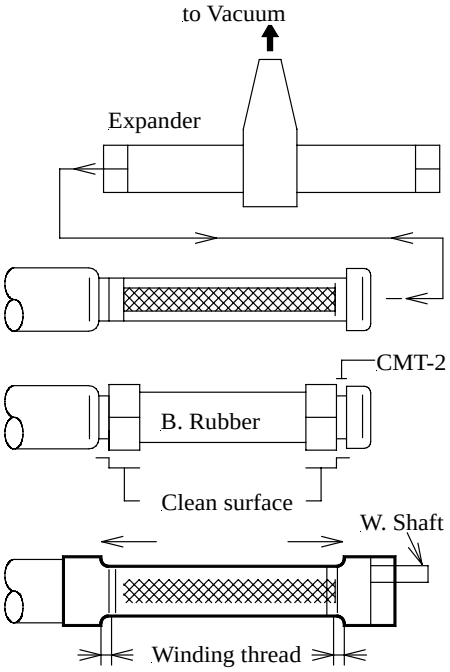


Fig.3-3-1

2. Binding with Nylon Thread(Thread-N/RM8101) ; Figs. below show area and direction of winding.
   1) The side of the Insertion Flex.Tube.
      Recommended thread length for convenience ;
      a = about 8 cm
      b = about 40 cm

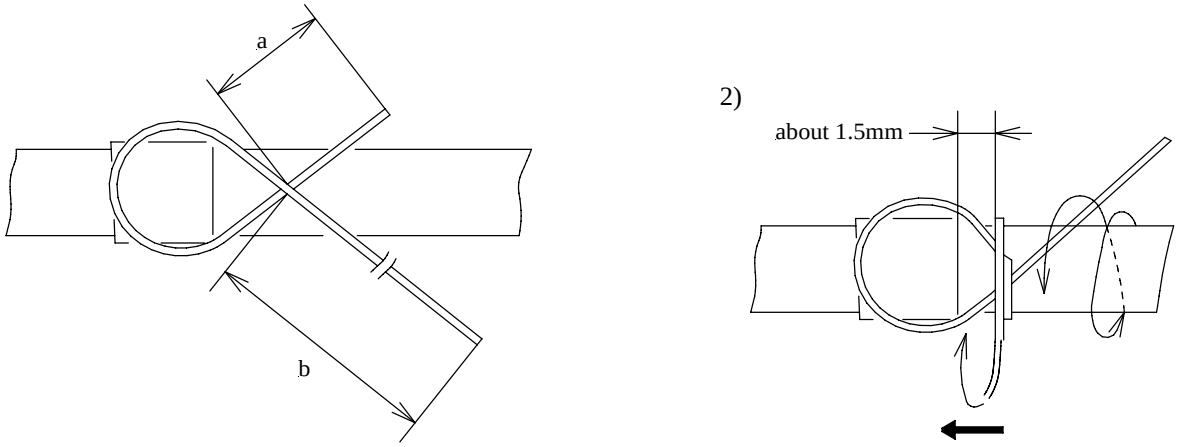
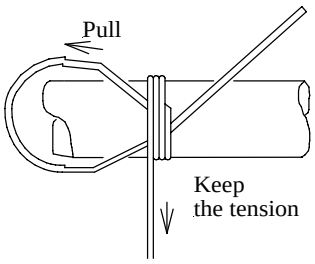


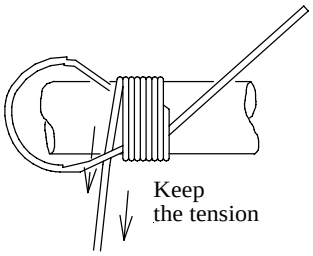
Fig.3-3-2

3)



After winding a few times, pull line as shown to settle and lower initial windings.

4)



5)

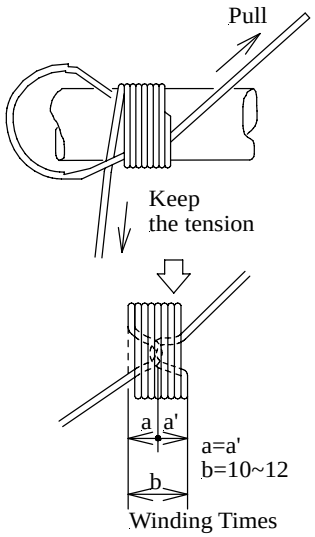


Fig.3-3-3

6) Cutting of thread : Do not cut rubber underneath.

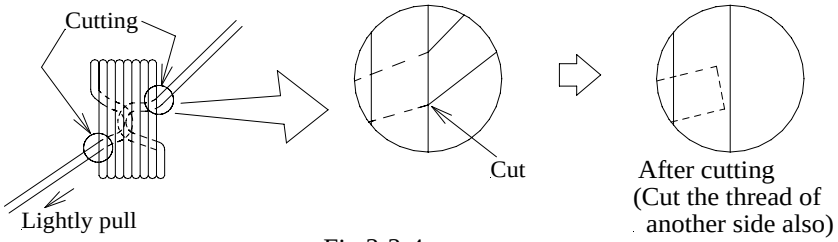


Fig.3-3-4

7) Side of Distal End.

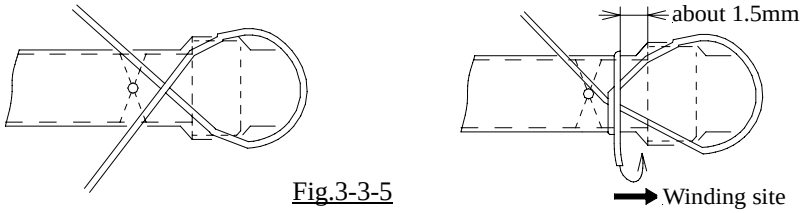


Fig.3-3-5

8) For the following steps, refer to step 3) to 6)

3. Cutting of Bending Rubber :

Note: Use an operation microscope for the process below.

1) Cut the excess rubber with a razor blade.

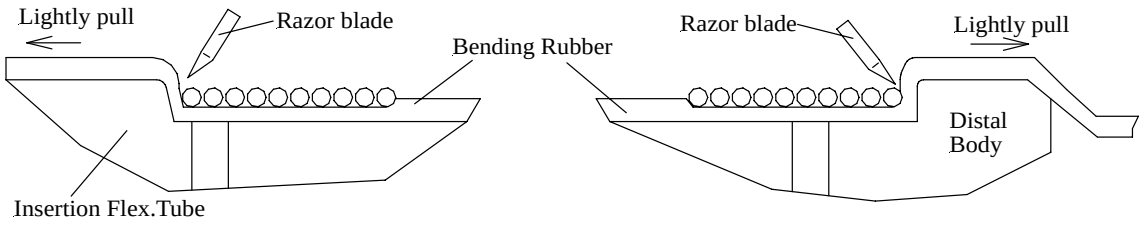


Fig.3-3-6

2) Cleaning of Bending Rubber and Insertion Tube.

Remove cement smearing on the surfaces with Methanol or Ethanol. When Methanol is used, do not forcibly wipe the surface of Insertion Flex.Tube.

Note: E/M solution is also applicable if very sparingly used.

3) Quality check

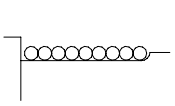
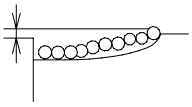
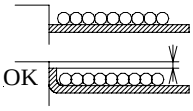
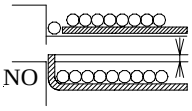
Judgment / Items	Good	No-good
Nylon Thread		
Bending Rubber	 OK	 NO

Fig.3-3-7

4. Black Coating on the thread :

1) Prepare Black coat cementing-glue (Black glue).

[1:1 Cement(CMT-2/RM1003) : Black Additive(BLK/RM4201) = 10 : 1]

2) Apply with a needlepoint to form a thin coat on the threads.

Note: Outer diameter should not increase too much.

3) Using a hair drier, heat Black glue to smooth out the surface and remove air bubbles.

Note: Take care not to heat too much and too long. Temperature should be less than 60℃.

4) Cool down the Black glue and check that it does not migrate by gravity. Then keep Distal End Upright for curing.

5) Cure at room temperature more than 6 hours.

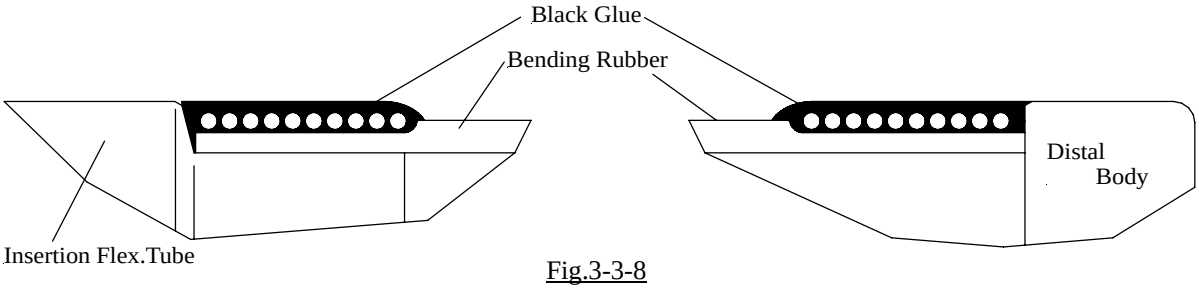


Fig.3-3-8

3-4 SPIRAL COIL ATTACHMENT

Exploded View : DW42A005 / DW42A007
Special Tools :
Materials : RM8007

Procedures:

1. Spiral Coil (P0080) attachment:
   1) Move Spiral Coil (P0080) and 2-Heat Shrink Tube (RM8007/ l=30mm) which are on the CCD signal wire toward the end of IFT.
   2) Straighten the CCD Signal Wire and P0080.
   3) Place P0080 so that the distance between P0080 and IFT become 40mm as shown in Fig.3-4-1.
   4) Place the Heat Shrink Tubes (RM8007) on both ends of P0080 so that the end of P0080 come to the middle of RM8007, and shrink them by heat.

   Note: Take care not to melt the outer seath of the CCD Signal Wire.

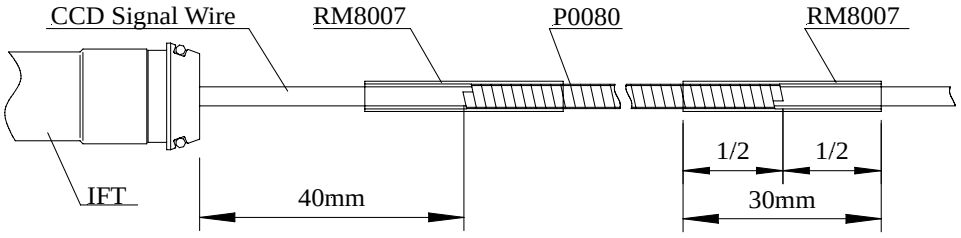


Fig. 3-4-1

4-1 CONTROL BODY CONNECTING

Exploded View : DW42B007 / DW42B010
Special Tools : ST-2311 / ST-3209 / ST-4830 / ST-4832
Materials : RM2001

Procedures :

1. Preparation of IFT for Control Body connection:
   1) Ensure the correct Up-direction of IFT, and lay it on the working bench with its Right side up.
   2) Remove the Staycoil Holder from IFT taking care not to lose the relative position of LCB, Channels, CCD signal wire from the Distal end and 4-staycoils.
      Note: If smearing of MK-powder (MLK) remains on each inside-elements, clean them with E/M solution damped tissue paper.
   3) Shift Right-Staycoil to Down-direction and Left-Staycoil to Up-direction along the inner wall of IFT.
   4) Tape R & D-staycoils and L & U-staycoils together.
   5) Remove the tape on the each AFT end of inside-elements.
      Note: Take care not to lose the relative position of each elements. If smearing of MLY is present on the elements, clean it with E/M solution damped tissue paper.

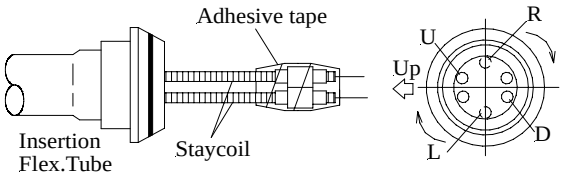


Fig.4-1-1

2. Cutting and forming Operation Channel:
   1) Set the bending section to the neutral, and straighten Insertion Flex.Tube.
   2) Cut Operation Channel from the end of Insertion Flex.Tube as shown in below table.
      Note: Lightly pull the channel before cutting.
   3) Place Channel Retaining Coil (B0246) for EC3890Ks or OP Channel Retaining Nut (B0312) and OP Channel Retaining Collar (B0309) for EG2990K onto Operation Channel as shown in Fig.4-1-2.
   4) Heat straight end of Tube Forming Rod shown in the table, with an alcohol lamp and push it into Operation Channel to the depth as shown.
   5) Cool down both Operation Channel and Forming Rod with E/M solution damped tissue paper, and pull the rod out.

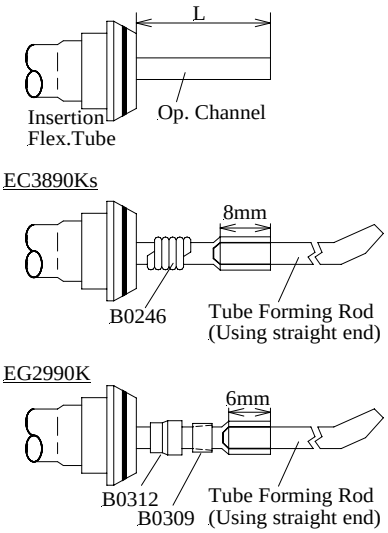


Fig.4-1-2

	Tube Forming Rod	Op.Channel Cutting length (L)
EC3890Ks	ST-4830	18mm
EG2990K	ST-4832	18mm

3. Biopsy Inlet T-piece and FWD Body Frame connection :

Note: Keep the bending section & Insertion Flex.Tube neutral and straight.

1) Wipe the pipe of the Biopsy Inlet T-piece (A-B0241) with E/M solution damped tissue paper and place it into the FWD Body Frame (B0171) as shown in Fig.4-1-3.
2) Connect and push A-B0241 into Operation Channel until the face of it touches the end of the Operation Channel keeping 45º between Up and Right-direction of Insertion Flex.Tube.
3) Make a mark on Operation Channel to monitor unexpected rotation.

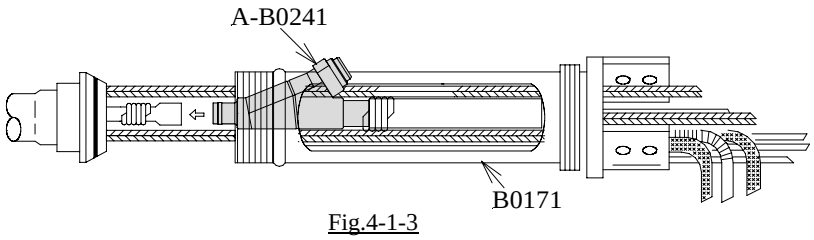


Fig.4-1-3

For EC3890Ks only

4) Apply Silicone Sealant (SS-1/RM2001) on Operation Channel. Using Special Tool (ST-2311), attach Channel Retaining Coil (B0246) pushing and turning it until about 1pitch(turn) of Channel Retaining Coil remains out of the attaching pipe of Biopsy Inlet T-piece.

Note: Biopsy Inlet T-piece should be kept 45º between Up and Right-direction.

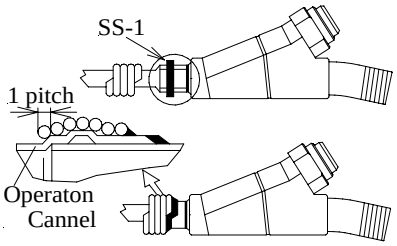


Fig.4-1-4

For EG2990K only

5) Connect B0309 to A-B0241
6) Apply silicone sealant (SS-1/RM2001) on the thread of A-B0241 and attach B0312 by using ST-2311.

Note: Do NOT apply SS-1 on the metal pipe of A-B0241 because the Operation Channel may be turned together with B0312.

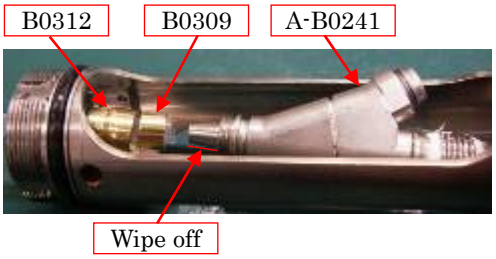


Fig.4-1-5

Fig.4-1-6

7) Wipe off the excessive SS-1.

8) Using ST-3209, tighten Insertion Tube Attaching Nut (A0058) temporarily so that the IFT become relative direction.

Note: Do not rotate IFT.

9) Pass the Sstaycoils toward the Control Body so that the position of the Staycoils become as shown in Fig.4-1-6

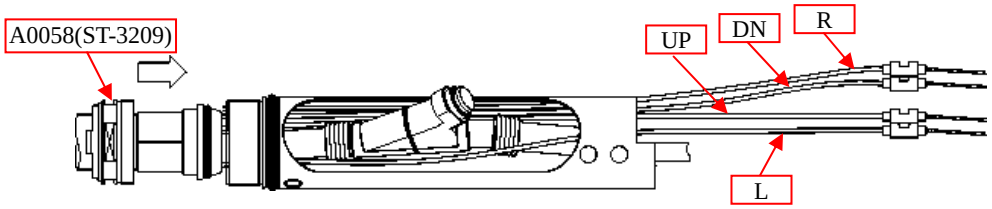


Fig.4-1-7

4. AFT Suction Channel (B0245) of Biopsy Inlet T-Piece connection :

Note: Check that the Insertion Flex.Tube is in neutral and straight status.

1) Bring AFT Suction Channel beside the metal pipe of Suction Cylinder, and cut the channel at 5 mm from the end of metal pipe.
2) Place Channel Retaining Coil (B0246) onto AFT Suction Channel.
3) Enlarge the diameter of AFT Suction Channel's end with tweezers.
4) Wipe the pipe of the Suction Cylinder with E/M solution dampped tissue paper and apply SS-1 on the metal pipe, and push AFT Suction Channel onto metal pipe by 5mm.

Note: AFT Suction Channel & Operation Channel should rest in neutral shape.

5) Mark a dot or line on Channel to monitor unexpected rotation.

Note: Avoid sealant application area.

6) Apply SS-1 on Channel, using Special Tool(ST-2320) and connect Channel Retaining Coil by pushing and turning it about 1 pitch (turn) of Channel retaining Coil remains out of the pipe of Suction Cylinder.

Note: Do not rotate Channel while turning the coil.

7) Wipe off the excessive SS-1.

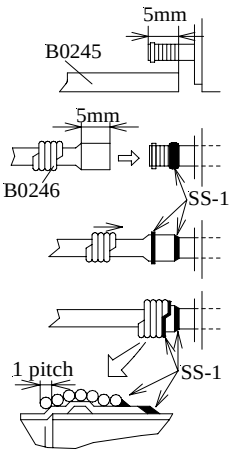


Fig.4-1-8

4-2 ANGLE WIRE / ANGULATION ADJUSTMENT

Exploded View : DW42B003 / DW42B009
Special Tools :
Materials : RM1204 / RM4104

Procedures :

1. Staycoil Attachment :
   1) Remove tapes on U/D/R/L staycoils and lightly pull each angle wire a few times to settle position of the staycoil within Insertion Flex.Tube.
      Note: Hold the staycoil with other hand when pulling the angle wire.
   2) Staycoil compression : [**3~3.5mm(EC3890Ks) / 2~2.5mm(EG2990K)]**
      a) Set the bending portion to the neutral, and straighten Insertion Flex.Tube.
      b) Flow solder using Soldering paste (SPT/RM4104) at the shown point with a soldering iron. Then, determine the position where the specified Pre-compression is attained after Staycoil Collar (A0046) was set in Staycoil Holder Bracket (B0291).
      Caution: While applying heat, do not bend Staycoil, otherwise the solder will flow into the coil and ruin the parts
      : Apply heat enough to fully gasify the liquid flux.
      Note: When Staycoil Collar and/or Staycoil Assy are replaced with new, use SS-FLX to soldering the Staycoil Collar onto the Staycoil Assy.
      c) Using warm water damped tissue paper, clean the residual SPT (SS-FLX) on the soldered area and all places around to prevent corrosion.
   3) Attach B0291 with 2-screws (CNS2x4) applying Screw-Lock (SLK-R/RM1204) on the screw thread.
   4) Place 4-Staycoils in their respective position of Staycoil Holder Bracket.
   5) Attach Staycoil Bracket Cover (B0292) with 4-screws (CNS2x2) applying SLK-R on the screw thread.

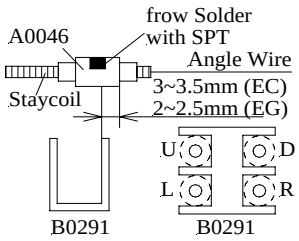


Fig.4-2-1

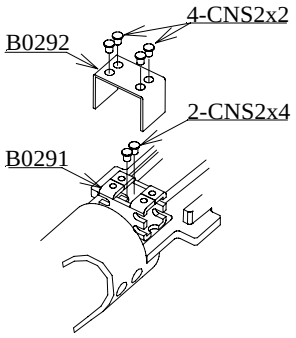


Fig.4-2-2

2. Angle Wire Connection : **Pre-tension of Angle Wire(Up/Down/Right/Left) = 0 mm (Common among GI scopes)**
   1) R/L Angle wire connection:
      a) Straighten the IFT and the bending section.
      b) Set the RL Knob to the neutral and lock with the RL Lock Knob as shown in Fig.4-2-3.
      c) Wipe off the Angle wires with E/M solution damped tissue paper.
      d) Place 2-Adjusting screw (A0044) on the Right/Left angle wires.
      e) Pull the connecting receptacles of the R/L pully assy (A-B0481) toward the Distal end in order to remove the slack in the pulley wires.
      Note: Make sure that each of pulley wires has not tangled.

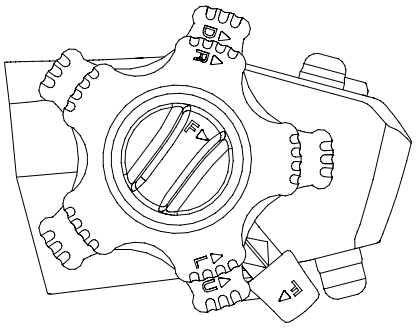


Fig.4-2-3

f) Holding 2-connecting receptacles, mark two lines on the Control Body as shown in Fig.4-2-4.
g) Pull Right and Left angle wires in order to remove the slack in the angle wires.
h) Apply thin coat of solder using small amount of SS-FLX on the wire position as shown in Fig.4-2-4.
i) Place the Adjusting screws (A0044) at the marked line as shown in Fig.4-2-5.
j) Flow solder from the end of the Adjusting screws (Distal body side) with soldering iron. And heat the angle wire and A0044 until molten solder appears from the other side taking care to keep its position on the wire.
Note: Take care not to apply solder on flatten and screw part of A0044.
k) Using warm water damped tissue paper, clean the residual SS-FLX on the solodered area and the Control Body in order to prevent corrosion.
l) Cut the angle wires at the end of A0044.
m) Turn the connecting receptacles so that they are connected to A0044.
Note: Do NOT turn A0044 for connecting.

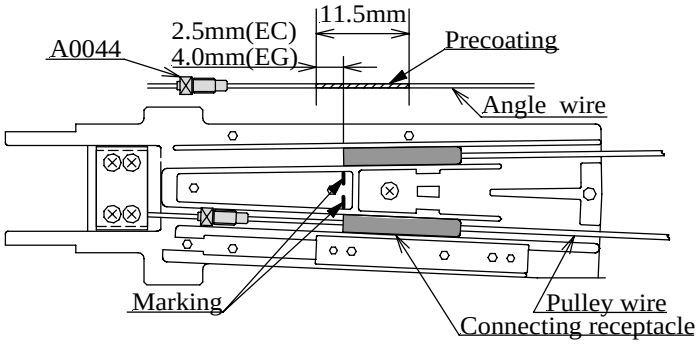


Fig.4-2-4

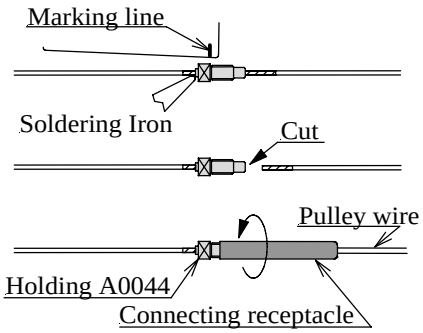


Fig.4-2-5

2) Release the RL Lock Knob, and turn the RL Knob to deflect bending portion for check.
3) Turn the RL knob 20 times to deflect bending portion.
4) R/L angulation adjustment:

Model	Right / Left
EC3890Ks	160° / 160°
EG2990K	120° / 120°

For EC3890Ks:

a) Place a UL-Stopper Assy (A-B0221) and DR-Stopper Assy (A-B0231) on the Control Body.
b) Turn the Stopper Adjusting Screw (B0222) of A-B0221 and A-B0231 so that the RL deflection become properly.

For EG2990K:

a) Place an L-Stopper Assy (A-B0223) and DR-Stopper Assy (A-B0232) on the Control Body.
b) Turn the Stopper Adjusting Screw (B0222) of A-B0223 and A-B0232 so that the RL deflection become properly.

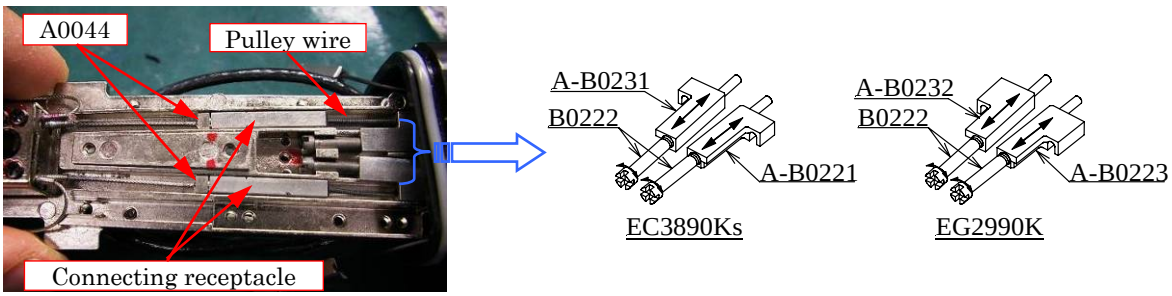


Fig-4-2-6

5) Attach an Intermediate Plate (B0294) with 2-screws (CSM2x6) applying SLK-R on the screw head.
6) UD Angle wire connection:
   a) Solder A0044 to U/D angle wire and connect it to the Connecting receptacle of the U/D Pulley wire according to the procedures section “1) R/L Angle wire connection”
7) Turn the UD knob 20 times to deflect bending portion.
8) U/D angulation adjustment: (Fig.4-2-8)

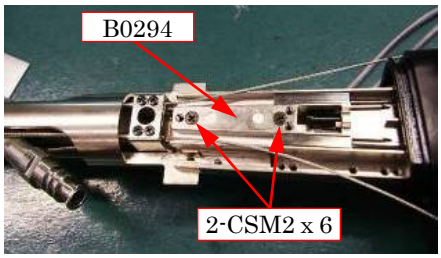


Fig.4-2-7

EC3890Ks:

Model	Up / Down
EC3890Ks	180° / 180°
EG2990K	210° / 120°

   a) Place a UL-Stopper Assy (A-B0221) and DR-Stopper Assy (A-B0231) on B0294.
   b) Turn the Stopper Adjusting Screw (B0222) of A-B0221 and A-B0231 so that the UD deflection become properly.

EG2990K:

   a) Place a U-Stopper Assy (A-B0221) and DR-Stopper Assy (A-B0232) on B0294.
   b) Turn the Stopper Adjusting Screw (B0222) of A-B0221 and A-B0232 so that the UD deflection become properly。
9) Attach a Guide Cover Plate (B0295) with 3-screw (CNM2.0x4.0 W/Washer/SS-WCNM2040) applying SLK-R on the thread of the screws. (Fig.4-2-9)
10) Align the slit of B0222 vertically and attach a Screw Retaining Plate (B0042) with a screw (CNS2x3) applying SLK-R on the head of screw in order to prevent turning of B0222.

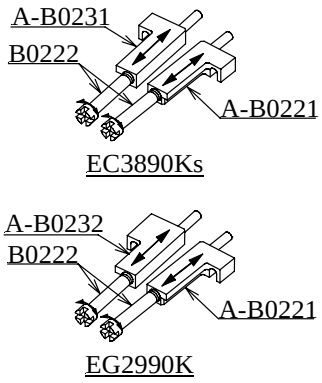


Fig.4-2-8

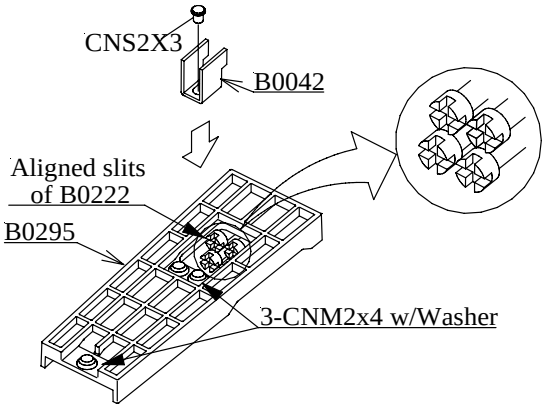


Fig.4-2-9

4-3 AIR & WATER TUBES CONNECTING

Exploded View : DW42B005 / DW42B006 / DW42B008
Special Tools : ST-2315 / ST-4812 / ST-4833
Materials : RM1003 / RM1024 / RM2001

Procedures :

1. Air and Water Tube connection :

Note: For the following procedures, keep IFT neutral and straight.

1) Bring Air and Water tubes beside the metal pipe of A/W Cylinder, and cut them at the length as shown in Fig4-3-1.
2) Heat the straight end of drill bit (ϕ 1.8mm) with an alcohol lamp and push it into Tubes to the depth of about 5.0 mm.
3) Cool down both Tubes and drill bit with E/M solution damped tissue paper, and pull drill bit out of the tube.
4) Place the appropriate Retaining Collar in the correct direction to the metal pipe of A/W Cylinder.
5) Apply 1:1 Epoxy Cement (CMT-2/RM1003) on metal pipes and push Tubes onto the pipe.

Caution: Push the tube until the metal pipe bottoms the enlarged section of the tube. This is important to prevent disconnection /slipping of the tube afterward.

6) Apply CMT-2 on Tubes. Holding the tube, attach Retaining Collar onto the tube using of pliers.
7) Apply CMT-2 on the both side of the Retaining collars.

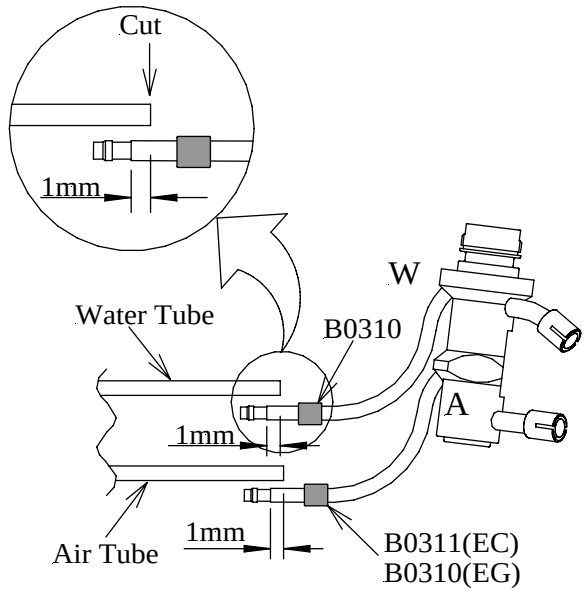


Fig.4-3-1

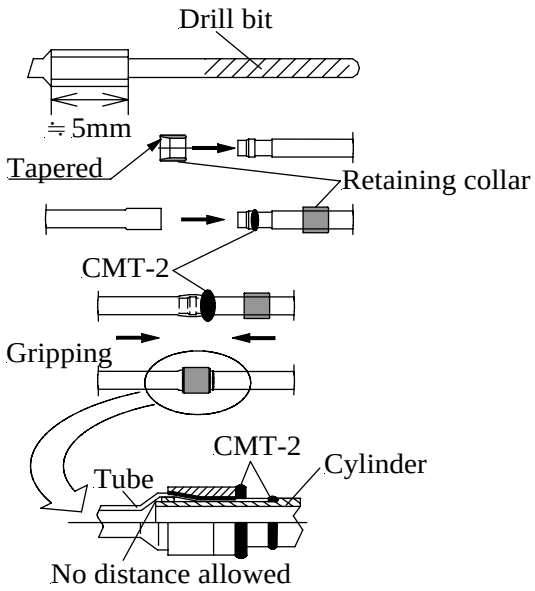


Fig.4-3-2

2. Jet Supply tube LG (A-C0161) and Water tube connection:
   1) Pass the coiled side of A-C0161 into the Control Body as shown in Fig.4-3-3.
   2) Place WJ Supply Tube Retaining Collar [B0313(EC), B0311(EG)] on the Water-Jet Junction Pipe (A-B0281).
   3) Heat the straight end of drill bit (ϕ 1.8mm) with an alcohol lamp and push it into the tube to the depth of about 7.0mm.
   4) Connect A-C0161 to A-B0281 like the Air/Water tubes connection.
   5) Attach A-B0281 to the Control Body with 2-screws (CNS2x2.5) temporarily.

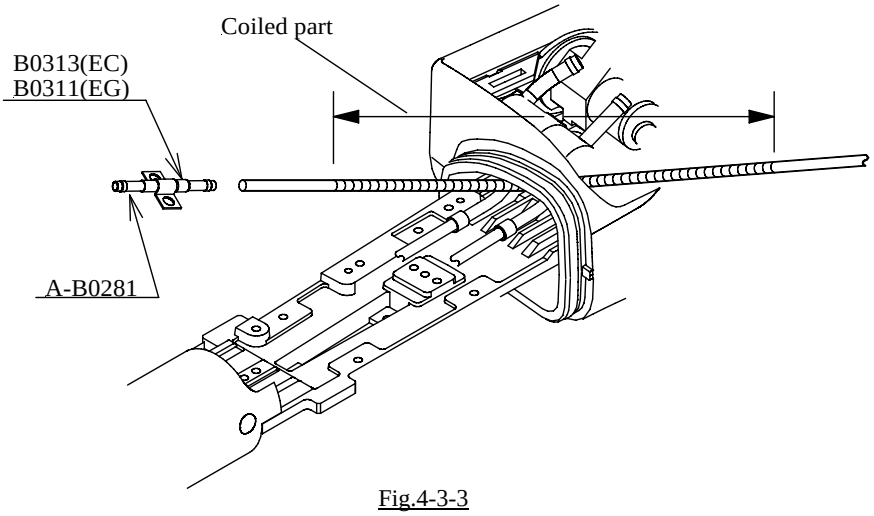


Fig.4-3-3

   6) Cut the Water Jet Tube at the length as shown in Fig.4-3-4.
   7) Detach A-B0281 and connect the water tube to other side of A-B0281 with a Retaining Collar [B0311(EC), B0310(EG)] like the Air/Water tubes connection.
   8) Attach A-B0281 to the Control Body with CNS2x2.5 applying screw-lock (SLK-R/RM1204) on the thread.

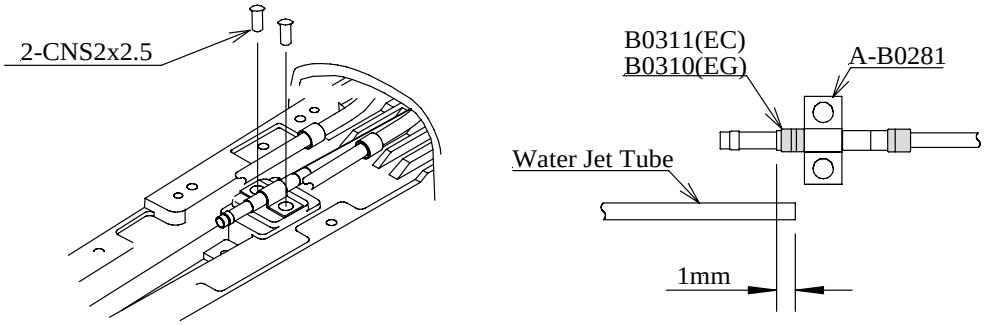


Fig.4-3-4

3. A/W Supply Tubes and Suction Channel connection:
   1) Place a Suction Channel Retaining Coil [B0309(EC), B0315(EG)] on the Suction Channel LG (A-C0027).
   2) Clean the metal pipe of the Suction Cylinder with E/M Solution damped tissue paper and apply silicone sealant (SS-1/RM2001) to it.
   3) Form the end of A-C0027 by Tube Forming Rod 5.8 (ST-4833).
   4) Attach A-C0027 to the metal pipe of the Suction Cylinder and apply SS-1 to it.
   5) Using ST-2315, connect the Suction Channel Retaining coil by pushing and turning it until 1 pitch of the coil remains out of the pipe of the Suction Cylinder.
   6) Wipe off the excessive SS-1.
   7) Clean the pipe of the A/W Cylinder with E/M solution damped tissue paper.
   8) Place the A/W Supply Tube Retaining Collar [B0312(EC), B0314(EG)] on the pipe of the A/W Cylinder so that the slit side of it is toward the outside of the Cylinder.
   9) Apply SS-1 on the pipe of the Cylinder.

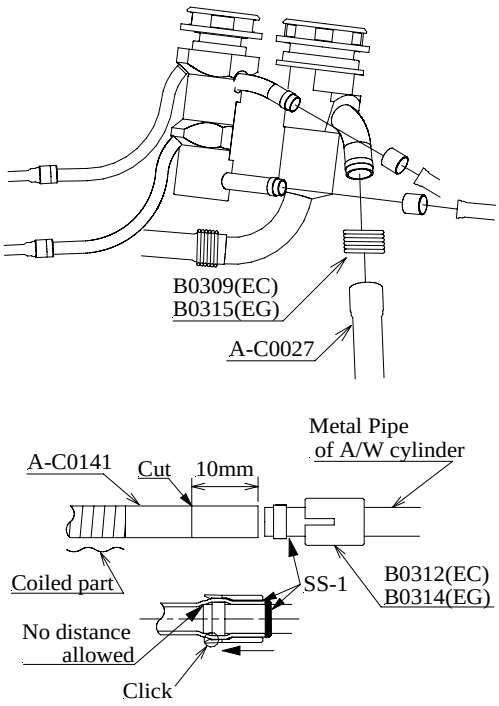


Fig.4-3-4

   10) Cut off A/W Supply Tube LG (A-C0141) 10mm from the end of the coiled side.
   11) Form the end of A-C0141 by Tube Forming Rod 3.1 (ST-4812).
   12) Connect A-C0141 to the pipe of A/W Cylinder.
   13) Apply SS-1 to the end of A-C0141 and attach the Retaining Collar by using pliers.
   14) Apply SS-1 to the both side of the Retaining Collar.

4. Placing CCD Signal Wire and LCB:
   1) Pass the CCD Signal Wire and LCB into the LG Cable Attaching Frame.
      Note: Make a loop with the CCD Signal Wire at the Control Body as shown in Fig.4-3-5.
   2) Pass the LCB into the LG Cable Attaching Frame.
      Note: Slacken the LCB at the Control Body adequately.

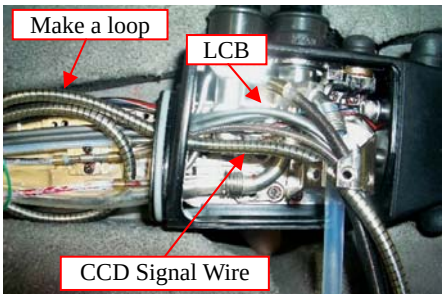


Fig.4-3-5

5-1 LIGHT GUIDE CABLE & LG CONNECTOR ATTACHMENT

Exploded View : DW42B006 / DW42C001 / DW42C003 / DW42C004
Special Tools : ST-2320 / ST-4812 / ST-4833
Materials : RM1003 / RM1204 / RM2001 / RM3115

Procedures :

1. Pass GND wire (P0019) and Remote Control Wire (P0009) into the LG Cable Attaching Frame if they are replaced with new one. (Fig.5-1-1)
2. Insertion of elements into Light Guide Cable (A-C0121):
   1) Place the Light Guide Column (A-B0306) on the elements so that the position of the element become as shown in Fig.5-1-2.

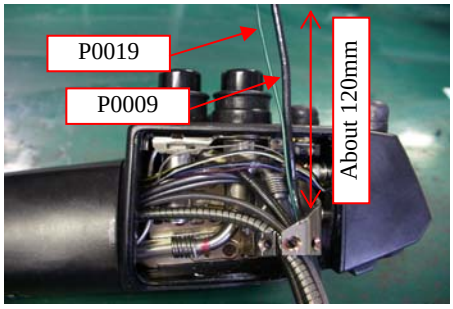


Fig.5-1-1

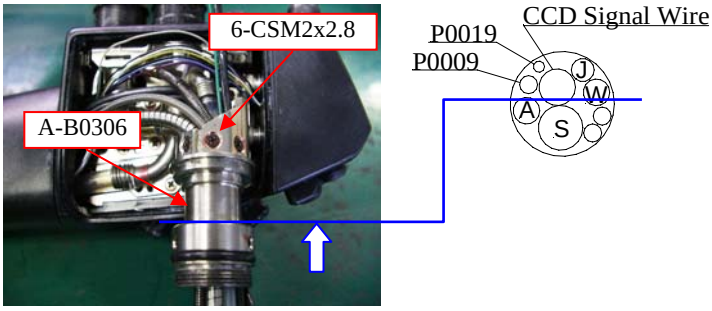


Fig.5-1-2

   2) Place the Side Cover Retaining Nut (A-B0181) and Side Body Cover (A-B0211) on the Light Guide Cable.
   3) Put a mark on Air Supply Tube (A-C0141) with a red marker in order to distinguish the tubes.
   4) Lay the elements straight on the working bench keeping a correct relative position.
   5) Holding elements all together and keeping their relative position, insert them into Light Guide Cable.
   6) Apply grease (G-M17/RM3115) to the O-Ring (C0132) on the Light Guide Cable.
   7) Attach the Light Guide Cable to the LG Cable Attaching Frame with 3-CSS1.7x3.5 applying Screw-Lock (SLK-R/RM1204) on the thread.

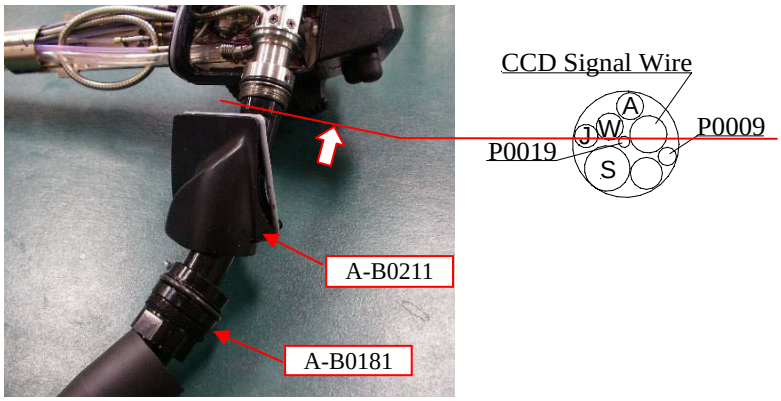


Fig.5-1-3

3. Preparation of connecting LG Cable Connector Assy (A-C0091)
   1) Set LG Connector Housing Attaching Nut (C0111) and LG Cable Connector Housing (A-C0001) onto the Light Guide Cable before installing the LG Connector Assy.
   2) Cut the Jet Supply Tube LG (A-C0161), A/W Supply Tube LG (A-C0141) and Suction Channel LG (A-C0027) with a sharp razor blade at the length as shown in Fig.5-1-4.
   3) Heat straight end of Tube forming rod 3.1 (ST-4812) with an alcohol lamp and push it into Supply Tube to the depth of 5mm.

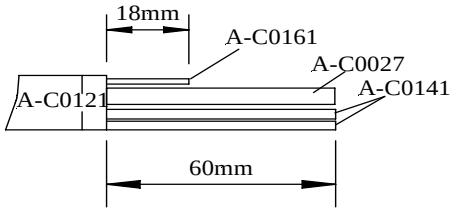


Fig.5-1-4

   4) Cool down both Supply Tubes and forming Rod with E/M solution damped tissue paper, and pull the Rod out.
   5) Place the LG Connector Housing Attaching Nut (C0111) and LG Cable Connector Housing (A-C0001) on the Light Guide Cable.

4. Jet Supply Tube LG (A-C0161) connection:
   1) Heat the Straight end of drill bit (ϕ 2.1) with an alcohol lamp and push it into Water Jet Supply Tube to the depth of about 4.0 mm.
   2) Cool down both Jet Tube and drill bit with E/M solution damped tissue paper.
   3) Place J Supply Tube Retaining Collar (C0075) onto metal pipe of Jet Socket Cylinder (A-C0071).
   4) Apply 1:1 Epoxy Cement (CMT-2/RM1003) on metal pipe and push Tube onto the pipe.
   5) Apply CMT-2 on Tube. Holding the tube, attach C0075 onto the Tube by using of pliers.
   6) Wipe off the excessive CMT-2.

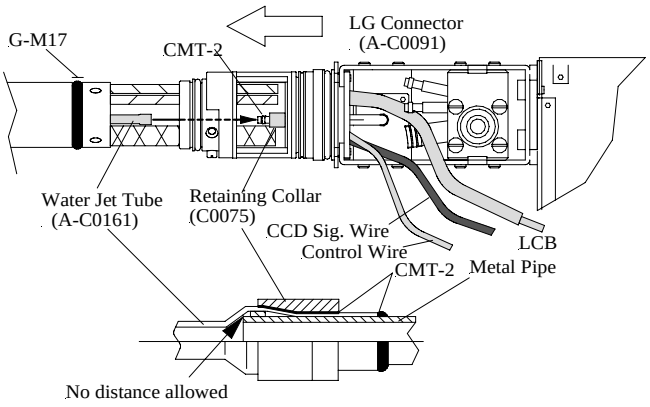


Fig.5-1-5

5. Air/Water Supply Tubes (2 x A-C0141) connection:
   1) Pass CCD Signal Wire, Remote Control Wire and GND Wire into the attaching collar of LG Cable Connector.
   2) Take those elements out from the opening of the attaching collar.

      Caution: If the elements are taken out from wrong opening, they will be crushed when Connector rotates.

   3) Apply G-M17 to O-Ring (C0132) on Light Guide Cable and attach LG Connector to LG Cable.
   4) Place A/W Supply Tube Retaining Collar (C0058) onto the metal pipe of Air/Water Socket Cylinder (A-C0051).

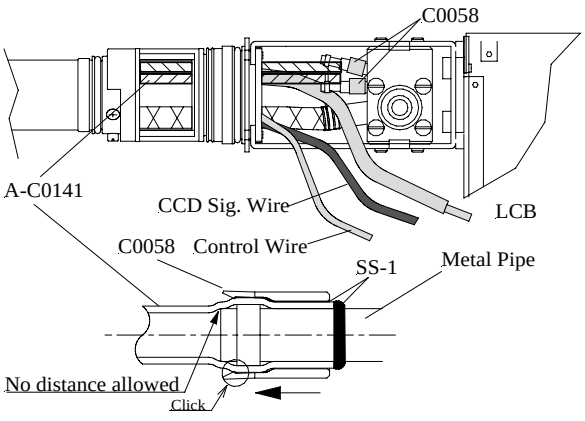


Fig.5-1-6

5) Apply silicone sealant (SS-1/RM2001) on metal pipe and push Supply Tubes onto metal pipe.

Caution: The bottom of enlarged portion of the tube must touch to the end of metal pipe to prevent the moving/disconnection of the retaining collar and tubes during field use.

6) Apply SS-1 onto Supply Tubes, holding it, and attach Retaining Collars onto Supply Tubes by using pliers.

7) Wind adhesive tape around Retaining Collars.

6. Suction Channel LG Connection:

1) Place Suction Channel Retaining Coil (C0026) onto the suction Channel LG (A-C0027).
2) Heat Straight end of Tube forming Rod 5.8 (ST-4833) with an alcohol lamp and push it into Suction Channel LG to the depth of 6mm.
3) Cool down both Suction Channel LG and Forming Rod with E/M Solution damped tissue paper, and pull it out.
4) Attach A-C0027 to the LG Suction J-piece (A-C0021).
5) Apply SS-1 on A-C0027.
6) Using ST-2320, connect C0026 by pushing and turning it until 1 pitch of Channel Retaining Coil remains out of the pipe of Suction Cylinder.
7) Wipe off the excessive SS-1

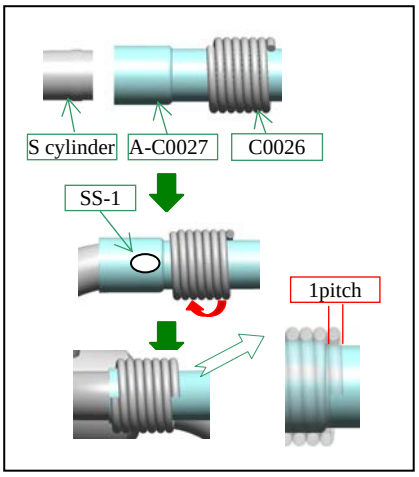


Fig 5-1-7

7. LG Cable Connector Assy (A-C0091) connection:

1) Set LG connector Assy in the middle as shown in Fig.5-1-8.
2) Attach LG Connector to Light Guide Cable (A-C0121) with 3-CSM1.7x3.5 applying SLK-R on screw threads.
3) Pass LCB through the bore of LG Cable Connector and attach to the Light Guide Prong temporarily.

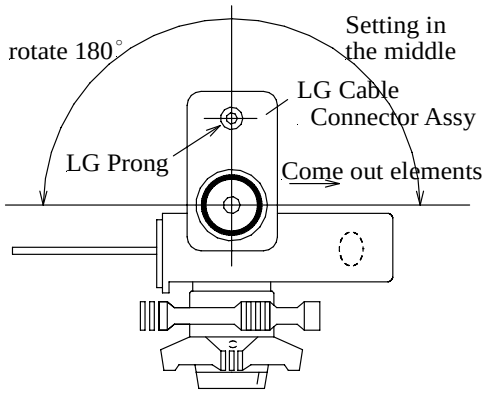


Fig.5-1-8

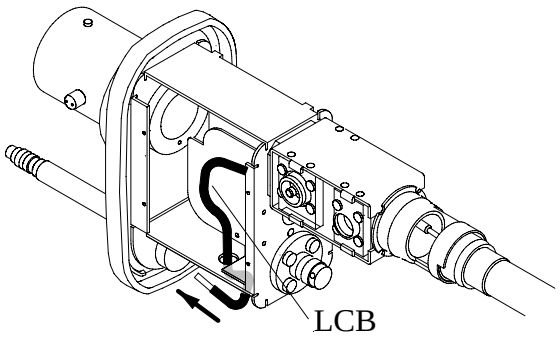


Fig.5-1-9

5-2 PCB WIRING AND ATTACHMENT

Exploded View : DW42B006 / DW42C004
Special Tools :
Materials : RM1204 / RM8006 / RM8007 / RM8022

Procedures:

1. GNDWires connection :
   1) Remove the outer sheath of GND wire (P0019) and green wire of the Biopsy Inlet T-piece about 2mm.
   2) Bind core wires and apply solder to them.
   3) Solder the end of Grounding Wires to GND Lug Plate (P0018).
      Note: If soldering paste(non-corrosive type) is used, thoroughly clean the paste residue with E/M solution damped tissue paper immediately after soldering.
   4) Attach the GND Lug Plate onto the main plate of control body with CNS2x2.5 and apply SLK-R to the head of screw.

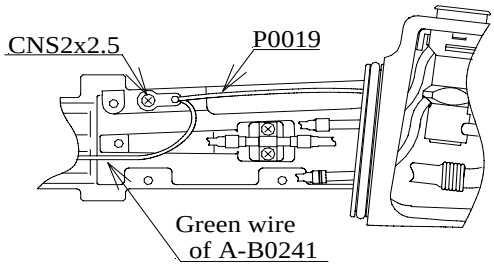


Fig.5-2-1

2. Remote Control Wire (A-P0009) connection:
   Note: Perform if Remote Control Wire was replaced with the new.
   1) Cut 8 wires of the Remote Control Switch according to the shortest wire.
      Note: Perform if any Remote Control Switch was replaced.
   2) Remove outer sheath of each wires. (Black--7mm / Others—5mm)
   3) Twist the end of black wires.
   4) Pass Remote Control Wire into Control Body through Light Guide Base Column
   5) Twist the end of wires in the same colors (Gray, Purple, Blue, White and Yellow) and then solder it.
   6) Twist the end of black wires and sheild wires (Twisted Red, black and Sheild Braid) and then solder it.
   7) Cover the solder point with Heat-shrink Tube.
      For Black wires—HT-OC (RM8006)
      For Other wires—HT-SC (RM8022)
   8) Place a Heat-shrink Tube (HT-HP/RM8007) in order to bundle the all wires.

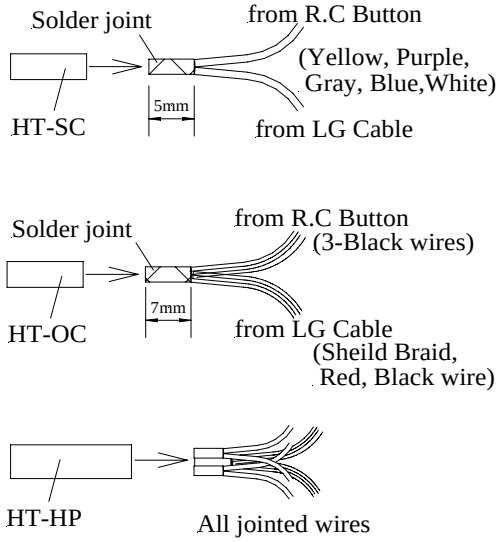


Fig.5-2-2

3. EMI Core (P0033) attachment:
   1) Pass CCD Signal Wire and Remote Control wire through the EMI Core refer to showing Fig.5-2-3.
   2) Attach EMI Core to LG Cable Connector with the Nylon Tie.

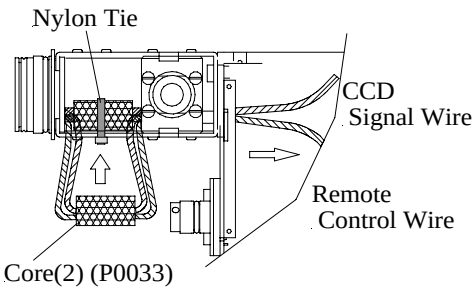


Fig.5-2-3

4. Wiring :

Caution: Handle CCD Module Unit on a discharging-desk-mat and wearing a wrist band to prevent CCD chip from static electricity damage.

: Use low-leakage soldering iron with non-corrosive type soldering paste for soldering wires. And thoroughly clean the paste residue with E/M solution damped tissue paper after soldering.

1) Unsolder each CCD Signal Wire to separate for wiring.
2) Solder CCD Signal Wire and Remote Control Wire to CCD Drive PCB Assy (A-S701) as shown in Fig.5-2-4.

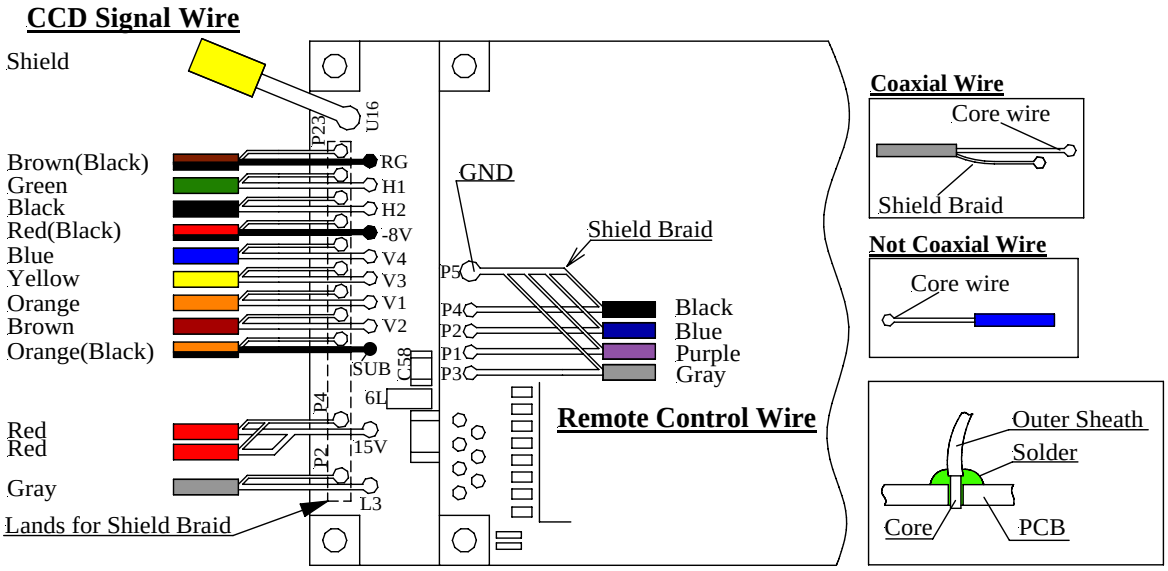


Fig.5-2-4

5. EMI Core(P0032) and CCD Process/Drive PCB Assy (A-S0704) attaching:

1) Attach CCD Process/Drive PCB Assy to LG Cable Connector Assy with 4 Screws (CNM2x2.8) applying Screw-Lock (SLK-R/RM1204) on the head of Screw.
2) Remove LCB from Light Guide Prong.
3) Attach Ring Core (P0054) to the Electrical Connector Assy (A-P0023). (Fig.5-2-6)
4) Connect 2-connectors of A-P0023 to the PCB.
5) Bind CCD Signal Cable and Remote Control Wire around 2-P0032 2 turns (winding 1 times).
6) Place the EMI Cores on the LG Connector and attach Core Holding Plate (C0116) with 2 Screws (CNM2x2.8) applying SLK-R on the head of screws.
7) Fasten 2 EMI Cores with 4 Screws (ST1.7x2) and apply SLK-R on the head of Screws.
8) Fix P0054 to the Electrical Connector Assy by a Nylon tie band. (Fig.5-2-6)

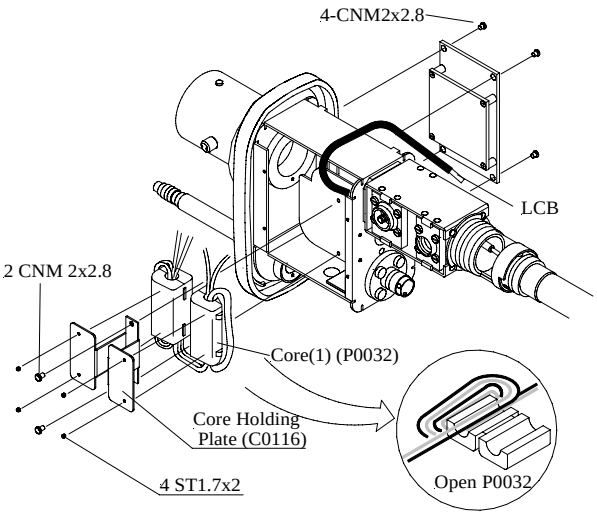


Fig.5-2-5

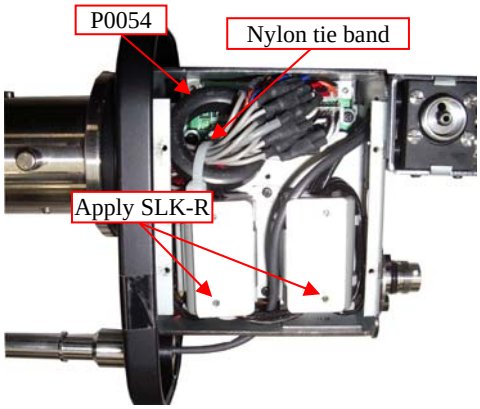


Fig.5-2-6

5-3 LCB & LG COVER GLASS ATTACHMENT

Exploded View : DW42C003
Special Tools :
Materials : RM2005 / RM2006 / RM3115

Procedures:

1. LCB attaching to LG Cable Connector:
   1) Clean the Inside metal pipe of Glass Rod Assy(A-F0020), Around of metal pipe of the LCB and Surface of the LCB
   2) Apply small amount of silicone sealant (SS-6/RM2006) on the around of metal pipe of the LCB as shown in Fig.5-3-1.
   3) Install LCB into the pipe of Glass Rod Assy until it touches a glass rod.
   4) Fasten LCB by LCB Set Screw (F0023) and apply Silicone Sealant SS-6 on the head of screw. Then, remove excess sealant.
   5) Clean the surface of Glass Rod Assy.
   6) Install LCB with Glass Rod Assy into the Light Guide Prong until its end face has become flush with the end of the prong.
   7) Turn the Cover Glass/G-Rod Holding Screw (C0104) until it just touches the Glass rod Assy. And then, turn C0104 clockwise about 30 degree (±10°).

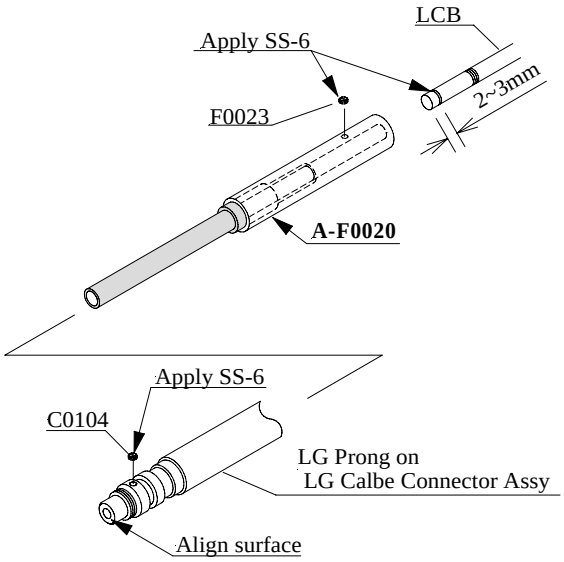


Fig.5-3-1

   Caution: Do not tighten G0104 more than 40degree because the Glass Rod Assy may be broken.
   8) Pulling the LCB, ensure that the Glass Rod Assy is fastened by screw.

2. LG Cover Glass Set (A-C0272) connection:
   1) Clean the surface of A-F0020 and the inner surface of LG Cover Glass in LG Cover Glass Set (A-C0272) with E/M solution damped tissue paper or cotton tip applicator.
   2) Apply Grease White (G-M17/RM3115) on O-Ring (C0103).
   3) Apply Silicone Sealant (SS-5/RM2005) on the screw threads of LG Prong.
   4) Attach A-C0272 and wipe off excess SS-5.
   5) Tighten attaching screw (C0104) but not too tight, and apply SS-6 on the head of Screw.

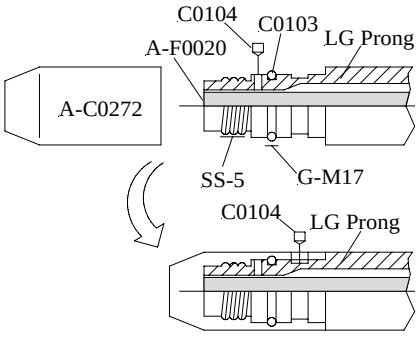


Fig.5-3-2

5-4 LG CABLE CONNECTOR ASSEMBLY

Exploded View : DW42C001 / DW42C003 / DW42C004
Special Tools : ST-3133 / ST-3161 / ST-3163
Materials : RM1003 / RM1204 / RM2005 / RM2006 / RM3003 / RM3115 / RM8006

Procedures:

1. Shield Cover connection:
   1) Attach Shield Cover (C0115) with 8-screws (CNL-D1.7x2.2), and apply Screw-Lock (SLK-R/RM1204) on the screw heads.
      Note: Take care not to damage Light Guide Cable by the edge of Shield Cover.
   2) Pass GND Wire (P0019) from Control Body into attaching collar of LG Cable Connector Assy.
   3) Solder the end of two GND wires to connect and clean the paste residue with E/M solution damped tissue paper.
   4) Cover the connecting areas with Heat-Shrink Tube (HT-OC/RM8006) and heat it to shrink it.
   5) Apply Grease (G-M17/RM3115) on O-Rings as shown Fig.5-4-1.

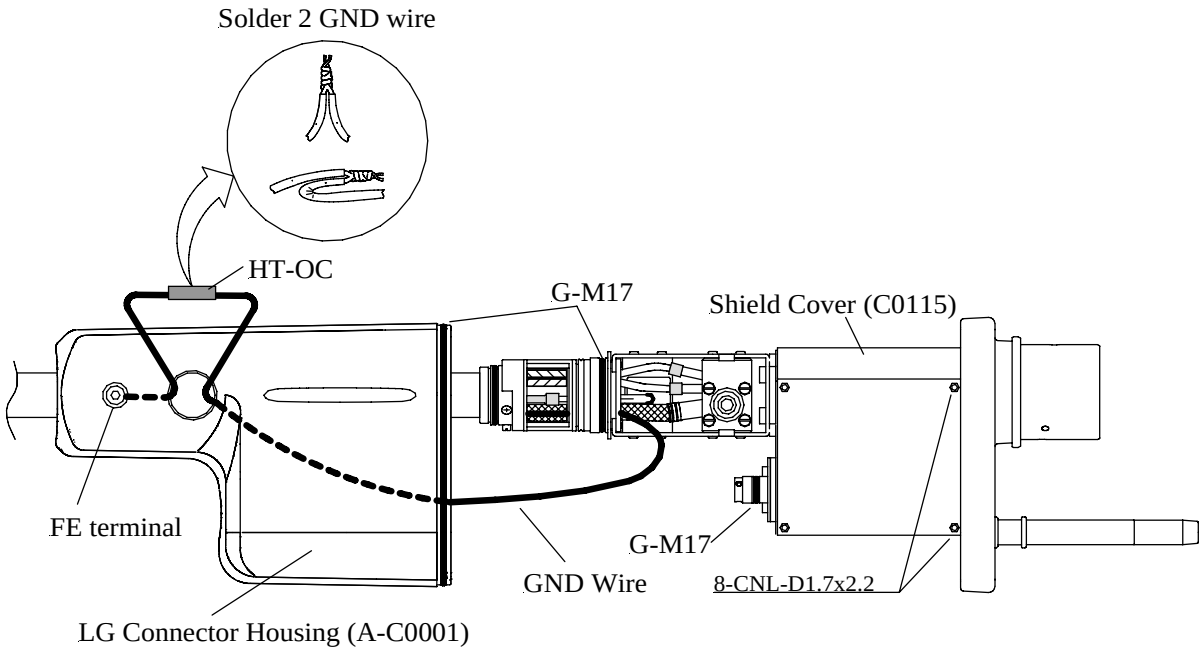


Fig.5-4-1

   6) Put GND wire into the bore of LG Connector Housing while attaching LG Connector Housing onto LG Cable Connector.
   7) Attach the LG connector Housing to the LG Cable Connector.
   8) Remove X-Ring (C0014) from attaching collar to prevent cutting by ST-3161 to be used in the next step.
   9) Using ST-3161, tighten the LG Connector Housing Attaching Nut (C0111) temporary.

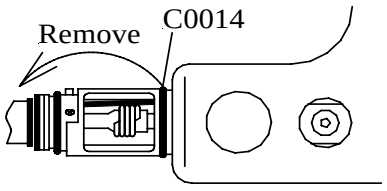


Fig.5-4-2

2. LG Cable Connector Assembly:

1) Using ST-3161, tighten LG Connector Housing Attaching Nut (C0111) temporary while positioning the holes for the AW receptacle and AW Cylinder to share the proper spacing.

2) Suction Nipple (A-C0031) Installation :

a) Wipe all dust and residual silicone sealant from the relevant parts.

b) Apply Silicone Oil (SLOH/RM3003) to O-Rings (C0032, C0033, C0034) on the Suction Nipple.

c) Place the Suction Nipple into the LG Suction J-piece its key-way and put a mark on the Suction Nipple to monitor unexpected rotation.

d) Apply G-M17 to O-Ring (C0054) on Suction Nipple Attaching Nut (A-C0041).

Fig.5-4-3

e) Apply thin coat of silicone sealant (SS-6/RM2006) to the screw threads of A-C0041.

f) Using Special Tool (ST-3133), tighten A-C0041 adequately.

g) Check the mark and height of A-C0041.

h) Remove the mark and wipe off the excessive SS-6.

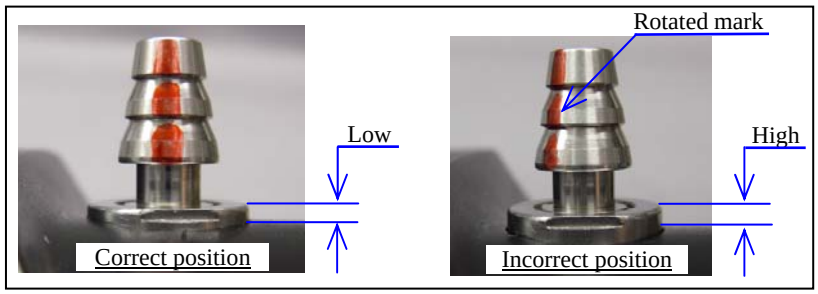


Fig.5-4-4

3) Air/Water Socket (A-C0061) installation :

a) Apply G-M17 on O-Ring (C0062).

b) Apply thin coat of SS-6 to the screw threads of Air/Water Socket.

c) Using Special Tool (ST-3163), tighten Air/Water Socket adequately.

d) Wipe off the excessive SS-6.

2) Jet Socket (A-C0081) installation:

a) Apply SLOH to O-Ring (C0082, C0083) of A-C0081.

b) Apply thin coat of SS-6 to the screw threads of A-C0081.

c) Using ST-3133, tighten A-C0081 adequately.

d) Wipe off the excessive SS-6.

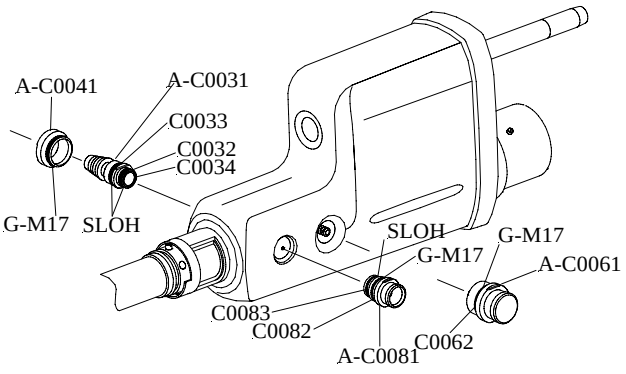


Fig.5-4-5

4) Using ST-3161, tighten up LG Connector Housing Attaching Nut (C0111).

5) ETO Valve Assy (A-C0244) installation:
   a) Apply G-M17 to the O-Ring (C0245) of the ETO Valve Assy.
   b) Apply small amount of silicone sealant (SS-5/RM2005) into three screwed holes of A-C0244. (This is to prevent cement migration into the thread which makes disassembly difficult.)
   c) Apply cement (CMT-2/RM1003) to the ETO Valve Assy and EOG Valve Attaching Nut (C0113) as shown in Fig.5-4-6.

      Caution: Cement on the surface of C0113 should be minimum just enough to smear surface.
   d) Install C0113 onto the Attaching Base with aligning the screw holes.
   e) Keeping the position of lock pin of A-C0244 for EOG Cap inward as shown in figures below, install it into the Attaching Base.

      Caution: Do not turn EOG Valve after it has entered the bore.
   f) Tighten 3-EOG Valve Tightening Screws (C0114) and apply a good amount of SS-5 onto the screw head and flatten the surface.

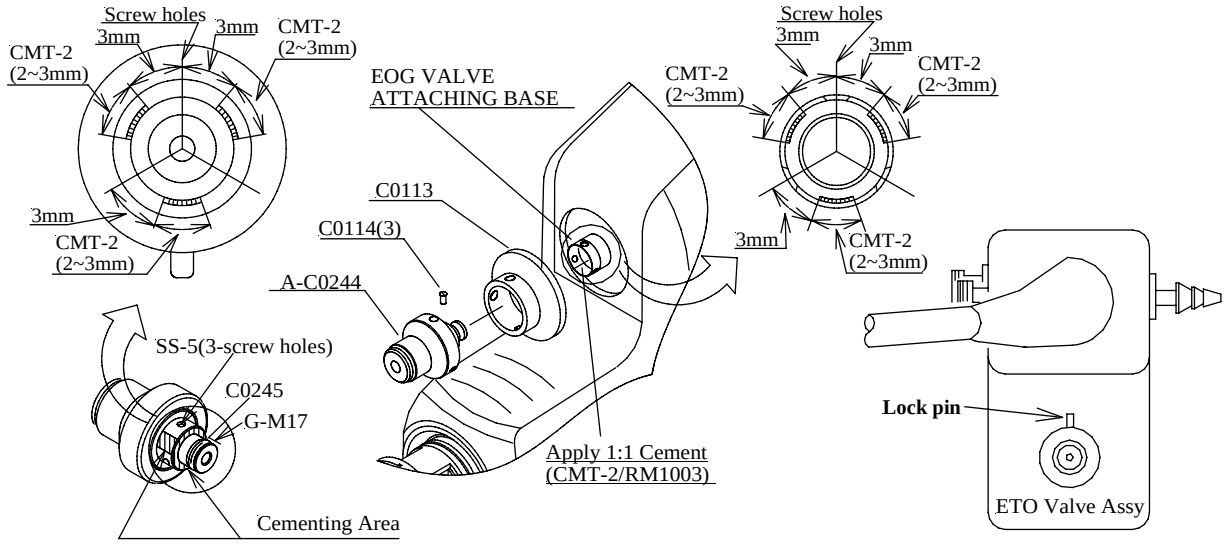


Fig.5-4-6

3. LG Root Brace Rubber (C0131) attachment:
   1) Place X-Ring (C0014) on the groove of attaching collar.
   2) Apply G-M17 on O-Ring (C0015) and X-Ring (C0014).
   3) Apply thin coat of SS-6 to the screw threads for LG Root Brace Rubber, witch will be acting as corrosion protection.
   4) Attach Root Brace Rubber to LG Cable Connector Assy.

4. Cure LG Cable Connector Assembly at room temperature for 6 hours or cure it at 60℃ for 1 hour under the Infra-Red lamp.

6-1 SIDE COVER AND JUNCTION CASE ATTACHMENT

Exploded View : DW42B006
Special Tools : ST-3206
Materials : RM2005 / RM2006 / RM3115 / RM3116

Procedures:

1. Side Body Cover (A-B0211) connection:
   1) Apply grease (G-M16/RM3116) to the Control body and O-Ring Special for Side Cover (B0212) of the Side Body Cover (A-B0211). (Fig.6-1-1)
   2) Apply Silicone sealant (SS-6/RM2006) to A-B0211 as shown in Fig.6-1-2 and Fig.6-1-3.

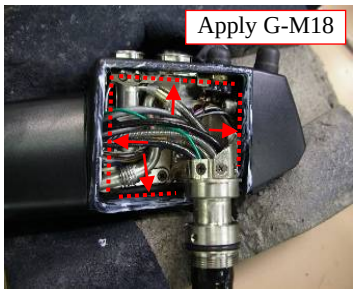


Fig.6-1-1

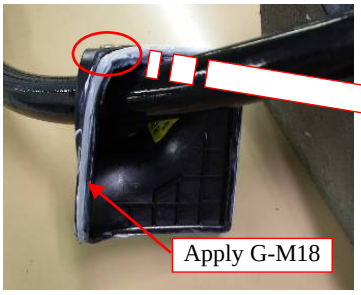


Fig.6-1-2

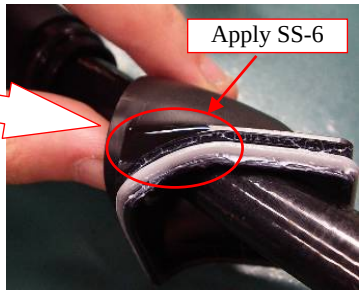


Fig.6-1-3

   3) Hook A-B0211 at the Light Guide Cable side to the Control Body. (Fig.6-1-4)
   4) Push A-B0211 at the A/W Valve side until a click is felt. (Fig.6-1-5)
      Note: Do NOT push A-B0211 forcibly.
   5) While pulling up A-B0211at the Light Guide Cable side, push A-B0211 at the A/W Valve side in the Control Body. (Fig. 6-1-6)
   6) Push A-B0211at the Light Guide side again so that A-B0211 fitted into the Control Body.

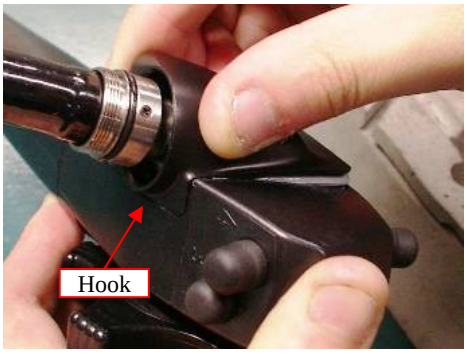


Fig.6-1-4

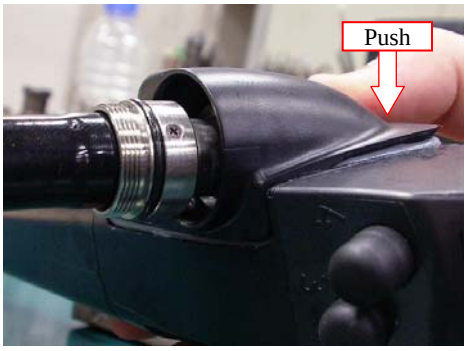


Fig.6-1-5

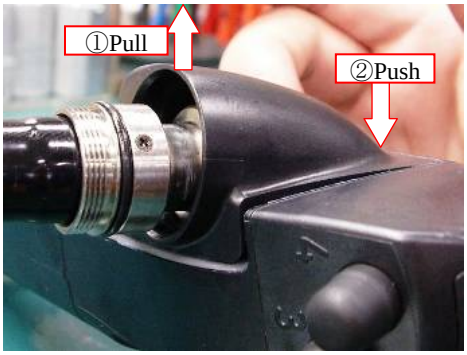


Fig.6-1-6

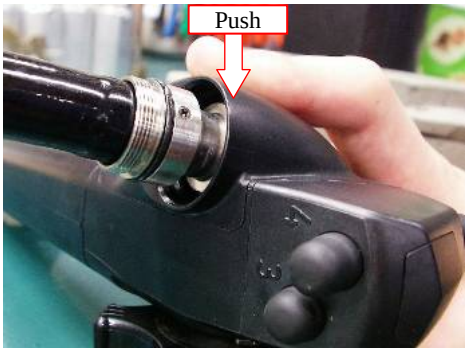


Fig.6-1-7

7) Apply G-M17 to the O-Ring (B0307) and apply SS-6 to the thread of the Light Guide Column (A-B0306).
8) Apply G-M17 to the O-Ring (B0182) of the Side Cover Retaining Nut (A-B0181).
9) Using ST-3206, tighten A-B0181 to A-B0211.
10) Apply SS-6 to the thread of A-B0181 and attach the Root Brace Rubber LG Body (B0308).
11) Wipe off excessive SS-6 and G-M17 with IPA damped tissue paper.

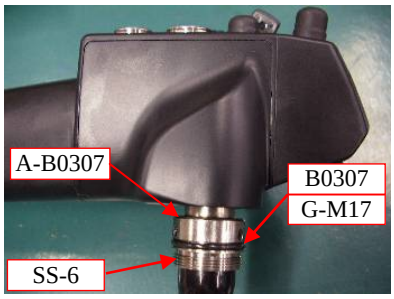


Fig.6-1-8

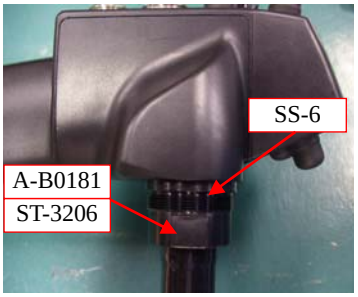


Fig.6-1-9

Fig.6-1-10

6-2 BODY COVER GRIP ATTACHMENT

Exploded View : DW42B001 / DW42B007
Special Tools : ST-2375 / ST-3126 / ST-3165 / ST-3207 / ST-3209
Materials : RM2005 / RM2006 / RM3003 / RM3115

Procedures :

1. Body Cover Grip (B0298) Installation :
   1) Apply Grease (G-M17/RM3115) to O-Ring Special for Grip (B0026) of the Control Body.
   2) Install Body Cover Grip (B0298) to the Control Body.
   Note: Detach the O-Ring (B0173) from the FWD Body Frame when attaching or detaching B0298 in order to prevent the O-Ring from cutting.

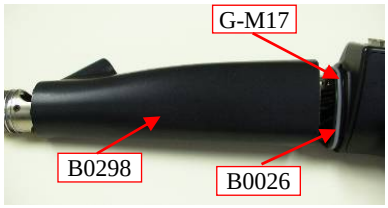


Fig.6-2-1

2. Adjustment of the IFT alignment:
   1) Set the Control Body on ST-2375 as shown in Fig.6-2-2.
   2) Using ST-3209, loosen the Insertion Tube Attaching Nut (A0058) slightly.
   3) Turning the Insertion Flexible Tube, adjust to attain a correct relative position against theControl Body.
   4) Using ST-3209, tighten A0058 firmly after alignment was adjusted.

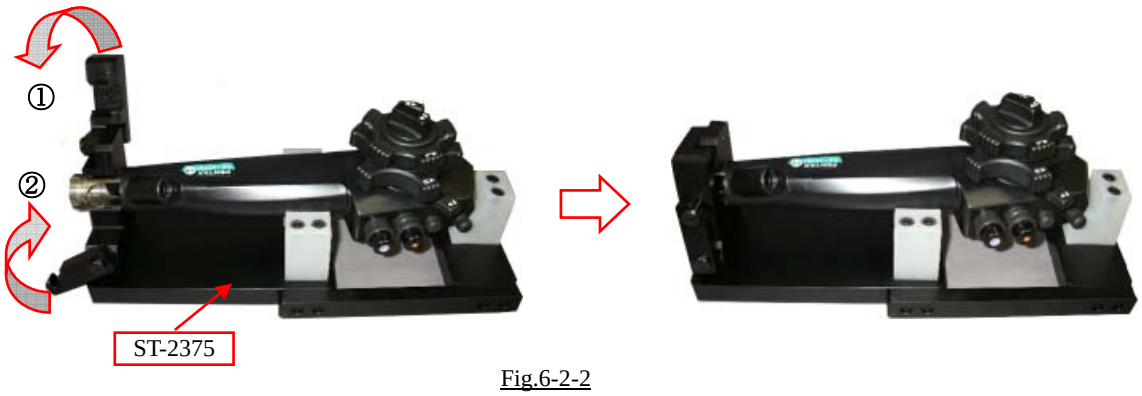


Fig.6-2-2

3. Biopsy Inlet Piece (A-B0231) Installation:
   1) Apply Silicone Oil (SLOH/RM3003) to O-Rings (B0252, B0253) of the Biopsy Inlet Barrel (A-B0251) and O-Ring (B0442) of the Biopsy Inlet Piece Attaching Nut (B0441).
   2) Using ST-3165, attach A-B0251 to the Biopsy Inlet T-piece (A-B0241) through the bore of B0298.
   3) Apply plenty of silicone sealant (SS-6/RM2006) to the thread of B0441 and attach B0411 to B0298 with ST-3126.
   4) Wipe off the excessive SS-6 with IPA damped tissue paper.

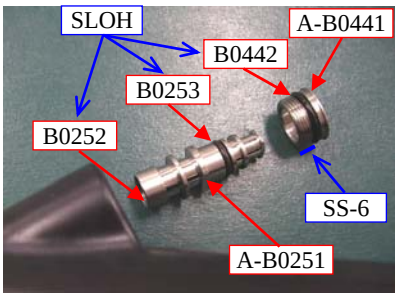


Fig. 6-2-3

4. FWD Body Cover attachment:
   1) Apply G-M17 to 2-O-Ring (B0300) of the Joint Seal Ring (A-B0299) and install A-B0299 to B0298 as shown in Fig.6-2-4.
   2) Attach the Colored Ring (B0301) to B0298 so that one of the pawl of B0301 become up position as shown in Fig.6-2-5.

Series	Color
90K-series	Black
90i-seires	White

Color of B0301

Note : The color of B0301 for 90K-seriese is different from the color of B0301 for 90i-series.

: Do NOT attach B0301 to B0298 in the incorrect position as shown in Fig.6-2-6 because the Spacer (B0303) can not place on the FWD Body Frame correctly.

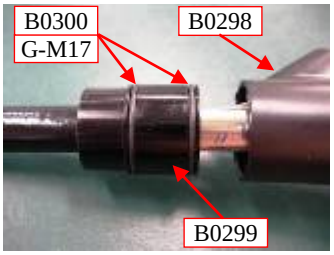


Fig.6-2-4

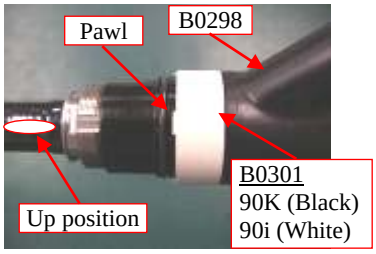


Fig.6-2-5

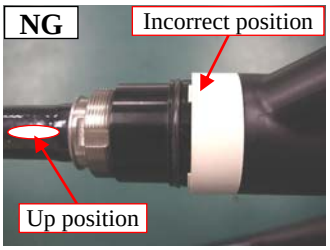


Fig.6-2-6

   3) Attach the FWD Body Trim Collar (B0302) to B0301.
   4) Place the Spacer (B0303) on the FWD Body Frame so that the groove of B0303 is fitted to pawl of B0302.
   5) Using ST-3207, tighten the FWD Body Trim Cover Attaching Nut (B0297).

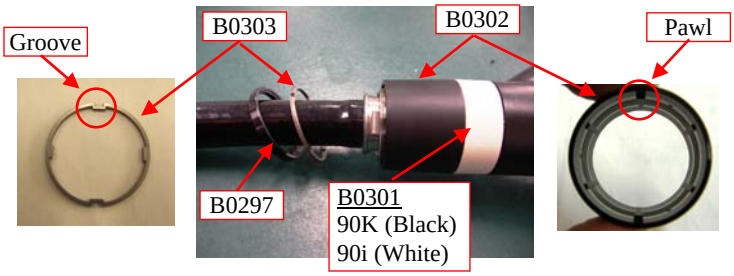


Fig.6-2-7

5. Root Brace Rubber attachment:

Note: If the Insertion Flexible tube was replaced with new, attach the Root Brace Rubber according to procedure below.

   1) Place the Root Brace Rubber (A-A0057) to the Insertion Tube Attaching Nut (A0058) so that their slit and pawl are fitted. And then, turn the A-A0057 90 degree in order to hook it to A0058. (Fig.6-2-8)
   2) Apply SS-6 to the thread of A0058 about 1/3 of circumference and attach the Rubber Trim Collar (B0305) by hand.
   3) Apply silicone sealant (SS-5/RM2005) into the whole of A-A0057 end and wipe off the excessive SS-5 with Isopropyl alcohol dumped tissue paper.
   4) Leave the scope about 6hrs to cure silicone sealant. And then, perform the inspection.

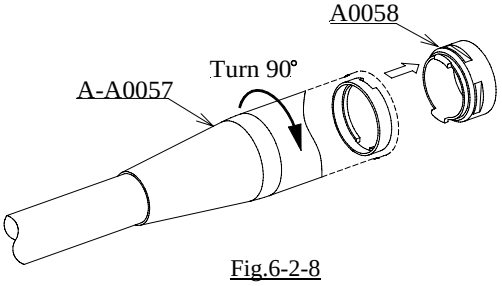


Fig.6-2-8

Fig.6-2-9

7-1 ANGULATION KNOB MECHANISM OVERHAUL

Exploded View : DW42B002
Special Tools : ST-3192-1 / ST-3205 / ST-3210
Materials : RM1204 / RM2006 / RM3115 / RM3116

Disassembling procedures :

Note: Refer to the Exploded view for following procedures.

1. Pull out the RL Lock Knob Retaining Nut Cover (B0140)
2. Using ST-3192-1, unscrew the RL Lock Knob Retaining Nut (B0139).
3. Pull out the RL Lock knob (B0138).
4. Remove the Lock-Washer (LW-28).
5. Pull out the RL Lock Knob Plate (A-B0135) with O-Ring (B0136 and B0137)
6. Pull out the RL Knob (B0134).
7. Loosen 3-screws (ST1.7x3) on the RL Lock Adjusting Ring (B0131).
8. Turn B0131 counter-clockwise until the RL Lock rotating Disk (A-B0132) is disconnected.
9. Loosen 3-screw (2-SF1.7x6, SF1.7x3) on the RL Lock Base Unit (A-B0126) through the hole of B0131.
10. Pull out A-B0126, RL Friction Disk (B0129), RL Lock Friction Drum (B0130) and B0131.
11. Disconnect the RL Knob Shaft (A-B0123) and UD Knob assembly (B0120, A-B0118).
12. Loosen 3-screws (ST1.7x3) on the UD Lock Adjusting Ring (B0116).
13. Turn B0116 counter-clockwise unit B0116 is disconnected.
14. Pull out the UD Friction Drum (B0117) and UD Friction Dist(B0115).
15. Loosen 3-screws (2-ST1.7x6, ST1.7x3) on the UD Lock Base Unit (A-B0112) and pull out A-B0112.
16. Pull out the UD Lock Rotating Disk (A-B0110), UD Knob Bottom Lid (A-B0108) and UD Lock Lever (A-B0103).
17. Using ST-3205, unscrew the Control Body Lid (A-B0101).
18. Remove 3-screws (CSS1.7x3.5) and disconnect Pulley Housing Unit from the Control Body.
19. Remove 2-screws (CSS1.7x2.2) and separate UD/RL Pulleys and Pulley Housing.

Assembling procedure:

1. Pulley and bearing assembly: (Fig.7-1-1)
   1) Apply thin coat of Grease White (G-M17/RM3115) to inner wall of the Pulley Housing (B0071).
   2) Apply thin coat of G-M17 to two wires, two grooves, upper and lower working surface of UD Pulley Assy (A-B0091).
   3) Wind each wire by 1 & 1/4 times in the respective grooves and hold it.
   4) Holding wires of UD Pulley Assy, install it into B0071.
   5) Apply thin coat of G-M17 to both surfaces of Polyslider (B0073) and place it on UD Pulley Assy in B0071.
   6) Apply thin coat of G-M17 to the bottom face and shaft of the Pivot For Control Knob (B0072).
   7) Applying G-M17 to RL Pulley Assy (A-B0081) as above “2)”, wind the wires as above “3)” and hold it.
   8) Holding wires of RL Pulley Assy, install it in B0071.
   9) Attach Pulley Housing with 2 Pulley to B0072 and fix with 2-screws (CSS1.7x2.2) applying Screw-Lock (SLK-R/RM1204) to the thread.

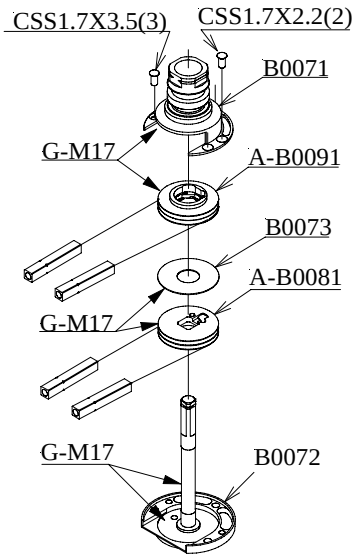


Fig.7-1-1

2. Pulley assembly installation : (Fig.7-1-2)
   1) Apply G-M17 to 2 groove of B0071 for O-Rings and attach O-Rings (B0074, B0075) to B0071.
   2) Positioning the assembled Pulley housing on the Control Body Frame, attach them with 3-screw (CSS1.7x3.5) applying SLK-R to the thread.

3. Control Body Lid (B0004) Connection: (Fig.7-1-2)
   1) Apply G-M17 to O-Ring (B0075) on B0071 and O-Ring (B0102) on Control Body Lid (A-B0101).
   2) Using ST-3205, attach A-B0101 to Control Body turning clock-wise.

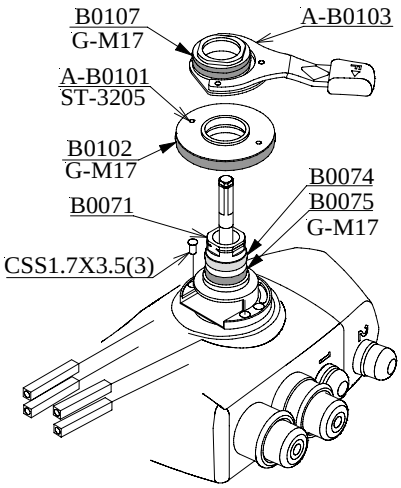


Fig.7-1-2

4. UD Lock Lever Installation
   1) Apply G-M17 to O-Ring (B0074) on B0071.
   2) Attach UD Lock Lever (A-B0103) to B0071.
   3) Apply G-M17 to X-Ring (B0107) on A-B0103.
   4) Attach the UD Knob Bottom Lid (A-B0108) to A-B0103.
   5) Apply grease (G-M18/RM3116) to the pins and groove of the UD Lock Rotating Disk (A-B0110) and place A-B0110 to B0071. (Fig.7-1-3)
   6) Apply G-M18 to the pin and springs of the UD Lock Base Unit (A-B0112) and attach A-B0112 to B0071 so that the pin of A-B0112 goes into the groove of A-B0110.
   7) While pressing A-B0112, tighten 3-screws (2-ST1.7x6, ST1.7x3) of A-B0112 through the hole of B0116 and apply SLK-R to the head of screws. (Fig.7-1-4)

   Note: Do not apply SLK-R too much in order to prevent flowing over to other part.

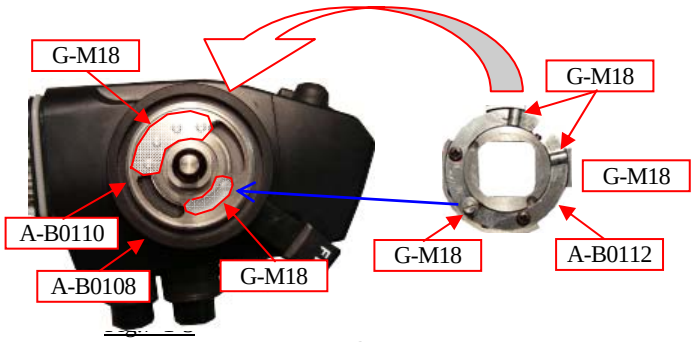


Fig.7-1-3

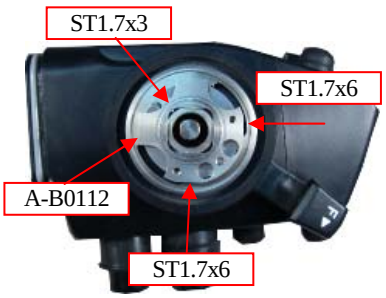


Fig.7-1-4

   8) Apply G-M18 to the UD Friction Disk (B0115) both sides and place B0115 on A-B0112 so that the burr side of B0115 become downward. (Fig.7-1-5)
   9) Apply G-M18 to inner wall of the UD Friction Drum (B0117) and place B0117 on B0115.
   10) Apply G-M18 to the thread of the UD Lock Adjusting Ring (B0116) and place B0116 on B0117.
   11) Turn B0116 clockwise so that B0116 is engaged to A-B0110.
   12) Tighten 3-screws (ST1.7x3) on B0116 temporarily.

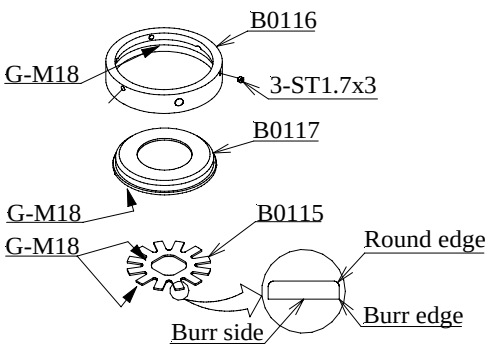


Fig.7-1-5

5. UD Knob assembling:

Note: Perform if the UD Knob (B0120) was disconnected from UD Knob shaft (A-B0118).

1) Apply G-M17 to O-Ring (B0119) on A-B0118 and engage B0120 to A-B0118 proper direction as shown in Fig.7-1-6.

Note: Take care not to cut the O-Ring (B0119) when attaching A-B0118 to B0120.

2) Apply SS-6 to the thread of the UD Knob Retaining Nut (A-B0121).
3) Using ST-3210, tighten A-B0121 to A-B0118. (Fig.7-1-7)
4) Wipe off the excessive SS-6 IPA damped tissue paper.

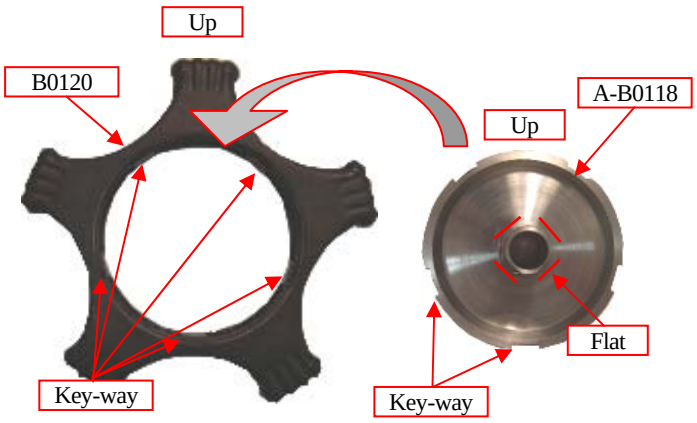


Fig.7-1-6

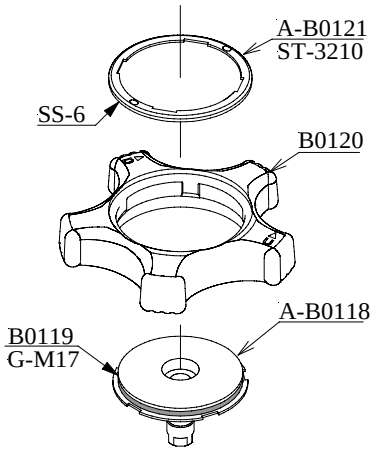


Fig.7-1-7

6. U/D Lock adjustment:

1) Pull the UD Pulley wire and set it evenly. (Fig.7-1-8)
2) Apply G-M17 to O-Ring (B0109) on the A-B0108 and engage the UD Knob assembly to the Control Body.
3) Turn A-B0103 to the lock side and check the degree of the friction by turning of the UD Knob.

if the degree of the friction is not adequate, perform following procedure.

4) Disconnect the UD Knob assembly and loose 3-screws (ST1.7x3) on B0116.
   - To increase degree of the friction: Turn B0116 **clockwise**
   - To reduce degree of the friction: Turn B0116 **counterclockwise**
5) Engage UD Knob assembly and check the degree of the friction while deflecting bending portion.
6) Repeat the above procedures until adequate degree of friction has been obtained.
7) Disconnect the UD Knob assembly from the Control Body.
8) Fasten 3-screws (ST1.7x3) on B0116 and apply SLK-R on the head of screw.
9) Engage UD Knob Assy to UD Lock lever correct direction as shown in Fig.7-1-9.

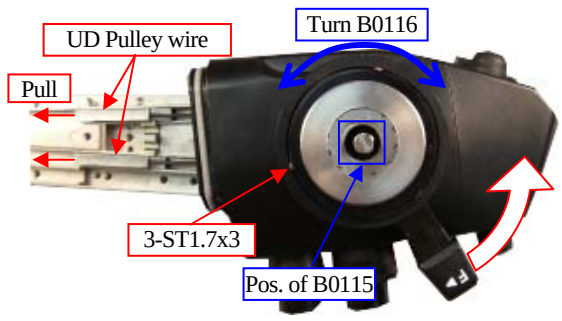


Fig.7-1-8

Fig.7-1-9

7. RL Knob Shaft installation
   1) Apply G-M17 to O-Ring (B0125) on the RL Knob Shaft (A-B0123).
   2) Pull RL Pulley wire and set it evenly.
   3) Engage A-B0123 to the Control Body in the correct position as shown in Fig.7-1-10.

Fig.7-1-10

   4) Apply G-M18 to the thread of the RL Lock Adjusting Ring (B0131) and place B0131 on the A-B0123.
   5) Apply G-M18 to the inner wall of the RL Friction Drum (B0130).
   6) Apply G-M18 to the both side of the RL Friction Disk (B0129) and place B0129 on B0130 so that the burr side of B0129 become upward.
   7) Place the RL Lock Base Unit (A-B0126) on B0129.
   8) While pressing A-B0126, tighten 3-screws (2-SF1.7x6, SF1.7x3) of A-B0126 through the hole of B0131 and apply SLK-R to the head of the screws.

      Note: Do not apply SLK-R too much in order to prevent flowing over to other part.

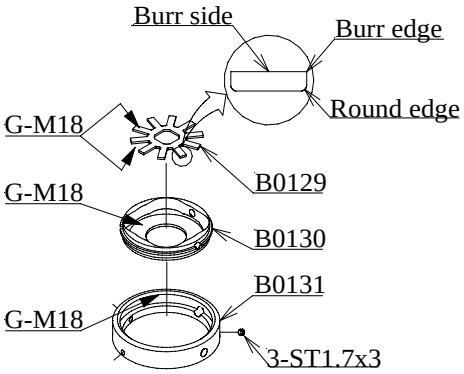


Fig.7-1-11

   9) Apply G-M18 to the groove and pins of the RL Lock Rotating Disk (A-B0132). (Fig.7-1-12)
   10) Place A-B0132 on A-B0126 so that the pin of A-B0126 goes to the groove of A-B0132.
   11) Turn B0131 in order to engage A-B0132. (Fig.7-1-13)

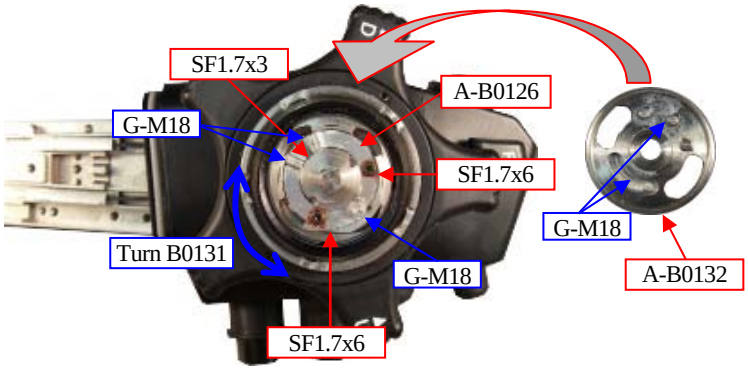


Fig.7-1-12

Fig.7-1-13

8. RL Lock adjustment:
   1) Attach the RL Lock Knob Plate (A-B0135) and RL Lock Knob (B0138) temporarily and turn B0138 toward the lock side.
   2) Turn B0131 clockwise until it stops and turn it clockwise some more.
   3) Tighten 3-screw (ST1.7x3) on B0131 temporarily.
   4) Disconnect A-B0135 and B0138.
   5) Pull the RL Pulley wire and set it evenly.
   6) Attach the RL Knob (B0134) and check the degree of the friction while deflecting bending portion.

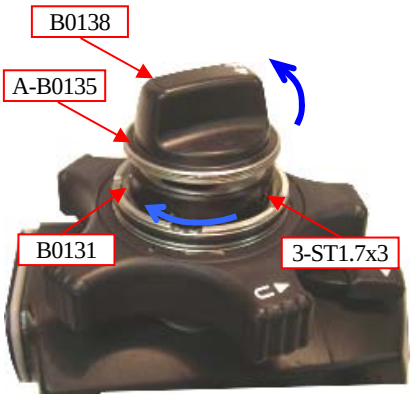


Fig.7-1-14

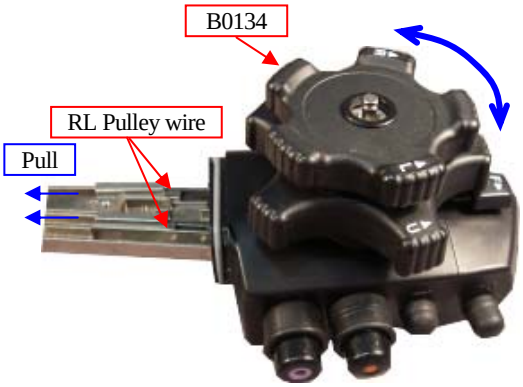


Fig.7-1-15

If the degree of the friction is not adequate, perform following procedure.

7) Disconnect RL Knob and loose 3-screws (ST1.7x3) on B0131.
   - To increase degree of the friction: Turn B0131 **clockwise**
   - To reduce degree of the friction: Turn B0131 **counterclockwise** and turn it **clockwise**

   Note: Adjustment must be finished after turning B0131 clockwise.
8) Engage B0134 and check the degree of the friction while deflecting bending portion.
9) Repeat the above procedures until adequate degree of friction has been obtained.
10) Disconnect B0134 and fasten 3-screws (ST1.7x3) on B0131 and apply SLK-R on the head of screw.

Fig.7-1-16

9. RL Knob and RL Lock Knob installation:
   1) Apply G-M17 to O-Ring (B0124) on A-B0123.
   2) Pull the RL Pulley wire and set it evenly and attach B0134 in the correct position as shown in Fig.7-1-17.
   3) Apply G-M17 to O-Rings (B0137, B0138) on A-B0135 and place A-B0135 on the B0134.
   4) Attach a Lock-washer (LW-28) to the Pivot for Control Knob (B0072).
   5) Place the RL Lock Knob (B0138) on A-B0135 in the correct position.
   6) Apply Silicone Sealant (SS-6/RM2006) to the whole thread of the RL Lock knob Retaining Nut (B0139).
   7) While holding RL Lock Knob, tighten B0139 adequately by using ST-3192-1.

      Caution: Pivot of the Control Knob may be twisted if it is tightening too much above Nut.
   8) Apply Silicone Sealant (SS-6) to the back of the RL Lock Knob Retaining Nut Cover (B0140).
   9) Attach B0140 on B0139 and wipe off the excessive SS-6 using IPA damped tissue paper.

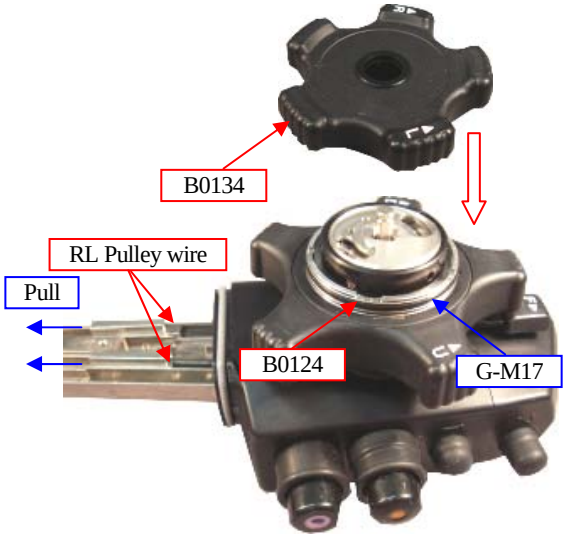


Fig.7-1-17

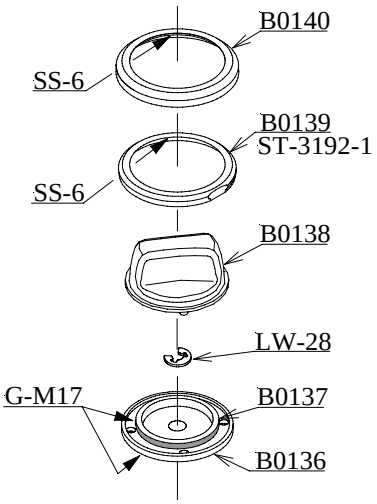


Fig.7-1-18

7-2 DISTAL END ASSY WITH TUBES REPLACEMENT

Exploded View : DW42A005 / DW42A007
Special Tools : ST-2699 / ST-2711 / ST-2718 / ST-2724
Materials : RM2005 / RM2006 / RM8200

Procedures:

1. Dismounting:
   1) Dismounting LCB:
      Note: Take utmost care not to slip off the silicone sheath and/or Flat spiral coil of the LCB. If slip them off, the LCB need to replace to new one.
      a) Remove silicone sealant on the back face of the Distal Body as much as possible.
      b) Loosen 2-LCB Attaching Screw (A0025) on the Distal Body.
      c) Turn the LCB metal pipe with small jaw pliers having a recess that fits the pipe.
      Note: Never use normal jaw pliers if LCB is going to be used again, since it will crush the metal pipe and fibers.
      d) When the pipe was freed, pull the LCB out holding the Distal Body.
   2) Dismounting CCD module:
      Caution: Do NOT dismount the CCD module before removing the LCB. Because, the LCB and/or CCD shield pipe will be damaged.
      a) Attach Ob. Lens Press Head (ST-2724) to Ob. Lens Press (ST-2699).
      b) Set the Distal Body in the appropriate Ob. Lens Press as shown in the table below.
      c) Adjust the Distal Body and Ob. Lens Press in order to align the ST-2703 to the center of the Objective Lens properly.
      d) Turning the handle bar(1) of ST-2699, press the Objective Lens Unit to break cementing with silicone sealant.
      e) When the CCD module has become free, disconnect it from the Distal Body.

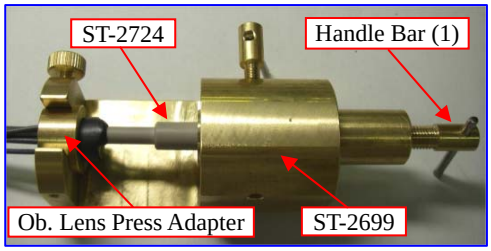


Fig.7-2-1

	Ob. Lens Press Adapter
EC3890is	ST-2718
EG2990i	ST-2711

2. Remounting CCD module:
   1) Binding Insulation Tape:

Perform the process below if original CCD Module Unit(with Objective Lens Unit) can be reused.

a) Remove Insulation Tape (RM8200) around on Objective Lens Unit.
b) Remove any residual Silicon Sealant on Objective Lens Unit and CCD Signal Cable.
c) Using E/M solution damped tissue paper, clean the surface of Shield Pipe.
d) Tape a piece of Insulation Tape(RM8200 : cutting size=13.0mm x 18.0mm) around on Shield Pipe of Objective Lens Unit about 1 & 1/4 turns starting from Right side as shown in Fig.7-2-2.
e) Fill cavities between the excess insulation tape of cable side and thread covering cement with SS-6, and fold the excess portion of the tape around the cable as shown in Fig.7-2-2.
f) Remove excess SS-6 with tissue paper, and cure more than 8 hours.

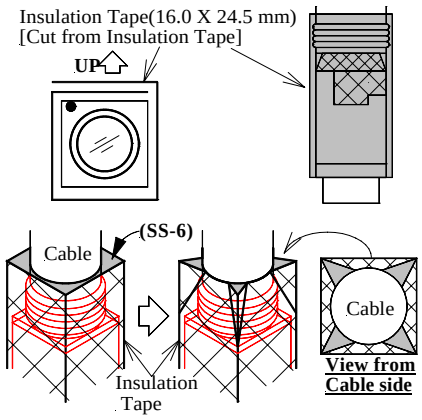


Fig.7-2-2

2) CCD Module (A-P0001) installation:

a) Check the surface of Insulation Tape (RM8200) on CCD Module unit (Objective Lens Unit). If it is damaged, replace Insulation Tape as shown by the above "2.-1)-a)~f)".

b) Wipe off inner wall of the Distal Body and the surface of the CCD module with E/M solution damped tissue paper.

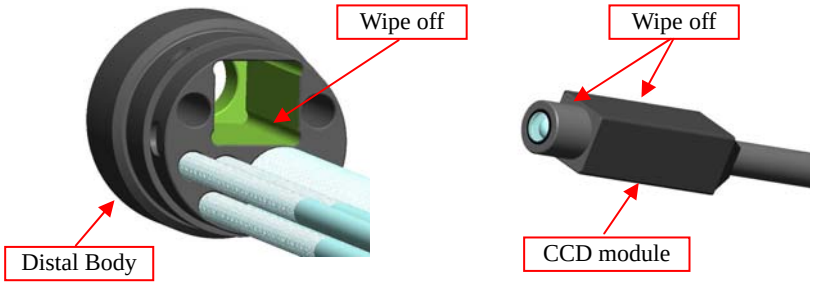


Fig.7-2-3

c) Apply thin coat of Silicone Sealant (SS-5/RM2005) to the inner wall of attaching hole of Distal Body.

d) Apply enough amount of SS-5 around on Objective Lens Unit (CCD Module Unit).

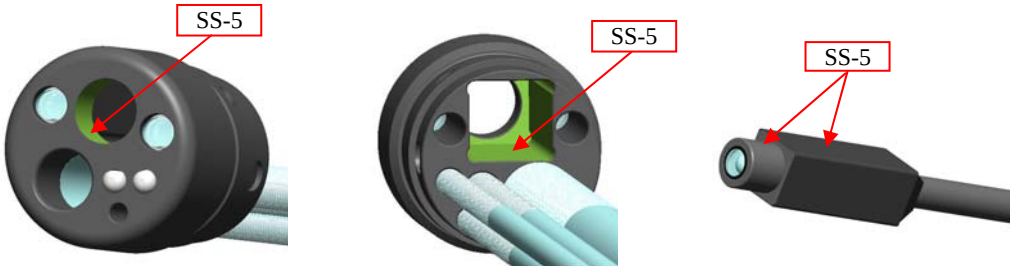


Fig.7-2-4

e) Introduce CCD Module into the Distal Body keeping the Up-direction and remove excessive SS-5. (Fig.7-2-5)

Note: Take care not to enter SS-5 into the nozzle.

f) Align the face of the Ob. lens unit to the face of the Distal Body so that the height of the Ob. lens surface from the face of the Distal Body become within 0.03mm ~ 0.1mm. (Fig.7-2-6)

g) Wipe off the excessive SS-5 with E/M solution damped tissue paper. Then, clean the surface of Distal Body and the lens.

Note: Ensure that the space between the Ob. lens and Distal Body is filled with SS-5 properly.

h) Cure the Distal Body at room temperature for 12 hours.

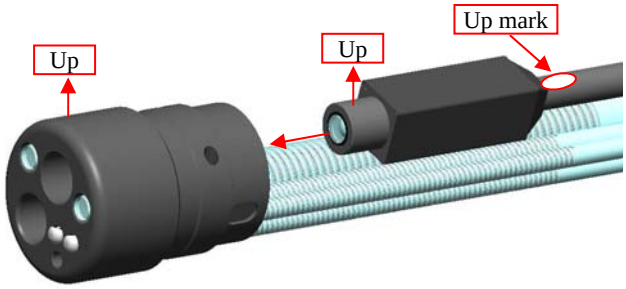


Fig.7-2-5

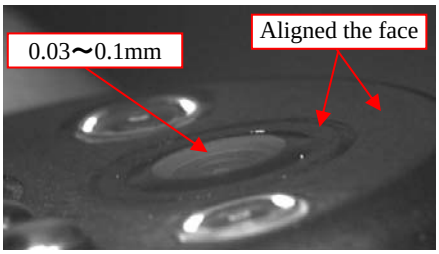


Fig.7-2-6

3. Remounting LCB:
   1) Place 2-Distal Set Screw M1.2 Special (A0025) into the Distal Body. (Fig.7-2-7)
   2) Check the bore and the back surface of LCB Lens Unit (A-A0002). If there is any particle of dust, it must be removed.
   3) Separate the LCB and make it straight.
   4) Clean the top face of LCB and the metal pipe with E/M solution damped tissue paper. (Fig.7-2-8)
   5) Apply a thin coat of SS-5 on the metal pipe of LCB as shown in Fig.7-2-9.

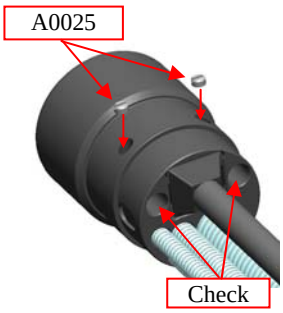


Fig.7-2-7

Fig.7-2-8

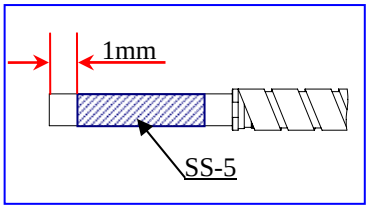


Fig.7-2-9

   6) Insert the LCB into the bore of the Distal Body until it bottoms checking from front.
   7) Turn the LCB so that the end of the flat spiral coil will be inside of the Distal Body in order to prevent hitting the flat spiral coil during stuffing of the IFT. (Fig.7-2-10)
   8) Lightly tighten 2-LCB Set Screws (A0025).
      Note: Avoid too much force.
   9) Fill the hole for A0025 with SS-5. (Fig.7-2-11)
   10) Cure the Distal Body at room temperature for 12 hours.

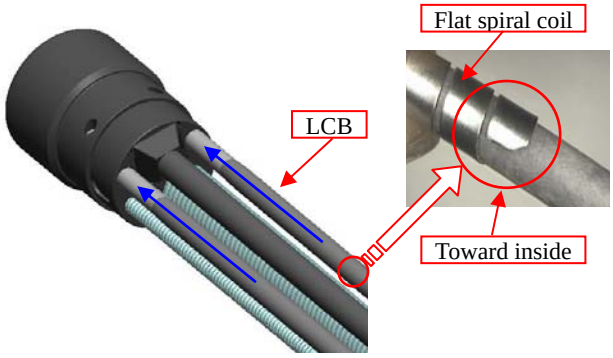


Fig.7-2-10

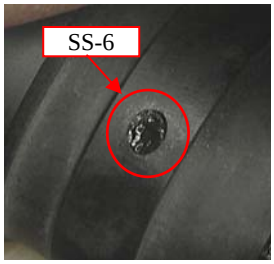


Fig.7-2-11

8-1 INSPECTION PROCEDURE

Perform inspection on repaired scope in the following sequence. Refer to Product specification for acceptable limits, if no shown.

1. Angulation

Deflection direction	Up, Down, Right, Left
Smoothness	
Maximum angulation	Refer to Product specification
Lock mechanism	Friction to retain position as Maximum angulation

2. External appearance

Insertion Flex. Tube, Light Guide Cable	Projection from surface, dents, Flexibility
Bending section	Projection, deformation, scratches
Control body	Cracks, deformation

3. Operation Channel

Passing a specified Forceps smoothly from the Biopsy Inlet to the Distal End.

4. LCB

Broken fibers of LCB	Check at the distal end while illumination at LG Plug
Distal cover glass	Reject if any crack was found

5. Water leakage test

1) Vacuum Test (Refer to “HOW TO USE WATER-LEAK TESTER”)

Prior to the test, visually check entire surface for hole/cut/pit.

Check leaks by presence of continuous bubble from the surface.

Use “A/W Suction Channel Cleaning Adapter” (OF-B153) instead of A/W Button (OF-B178) and Suction Button (OF-B177) due to using different sealing.

Apply Max. angulation to check leaks from Operating channel at ultimate condition.

Hint: Checking at the stage of “3-1) LG Connector attaching” will enable you to find problem earlier.

2) Immersion test (Refer to “AIR-TIGHTNESS CHECK OF IMMERSIBLE SCOPES”)

Prior to the test, visually check entire scope surface for hole/pit/crack.

Check leaks by presence of continuous bubble from the surface.

6. Electrical safety test

1) General

Perform “Patient leakage test” on every repaired scope to secure electrical safety of the scopes. Whereas “Dielectric strength test” should be applied only in the specified condition. See ” Condition for Dielectric strength test” in 6.3). However, when “Dielectric strength test” is performed, it should be first in order**. Do not reverse the order or sequence**.

On “Dielectric strength test”, high-voltage is present. Read “Danger” advice before starting this test.

2) Resistance test

(1) Measure D.C. resistance between the FE terminal and the Suction Cylinder by Tester.

(2) The resistance should be less than 2Ω

3) Patient leakage test

a) Devices

① A tub with water

② Leakage current tester (having a 1KΩ load resistor shunted by a 0.15 μ F capacitor),

Note: If above tester is not available, refer to an alternative method shown in " 3)." using a resistor and capacitor with DVM(Digital volt-ohm meter).

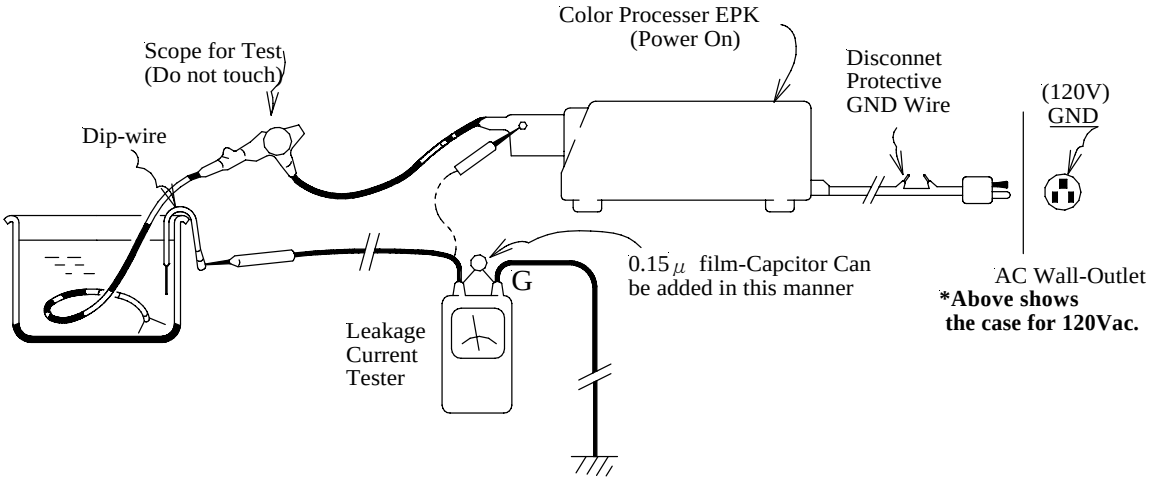
b) Measuring Steps:

① Device setting See Fig.

② Operate Processor with its GND not connected.

Caution: If AC cable is prepared for this purpose by cutting GND cable, place a conspicuous marking on it to avoid use for other purpose.

③ Connect your leakage tester leads as shown.



④ Insertion tube leakage current measurement:

Put Inserion Flex.Tube in the water. Then reading must be as follows:

Note: Keep your hands off from the scope during the test.

50 μ A or less

⑤ Metallic part leakage current :

Disconnect Probe from the dip-wire, and connect Probe to the metallic part of the scope appearing externally, such as Biopsy Inlet, FE terminal on LG plug and so on.

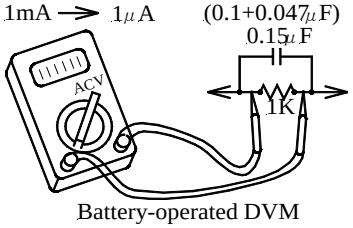
50 μ A or less

c) Alternative method to measure:

① Instead of Leakage current tester, connect a 1KΩ resistor shunted by a film capacitor 0.15 μ F.

② Connect a battery-powered DVM set at ACmV mode, across the above resister.

③ 1mV reading corresponds to 1 μ A.



4) Dielectric Strength Test

Danger	: During this test, high voltage is present. Pay utmost care to avoid fatal electric shock hazard.
	: This test procedures are intended for execution by trained personnel.
	: For handling of Test device, refer to Operating manual of your device.
	: Keep general rules for electrical safety.

Condition for performing this test:

When following parts was exchanged, perform this test.

a) Distal end Assy

b) CCD Module (In the distal body)

a) Devices:

① A tub with water.

② Dielectric strength tester(500V 50/60Hz) with a 5mA threshold detector.

③ Test connector (ST-4903)

Note :When the warning device is not available, See " 3). Alternative method ".

Testing Steps :

b) Between Internal circuit of scope and Insertion tube surface.

① Make sure that Test voltage is “Off (0V)”

② Connect Test connector (ST-4903) to the scope.

③ Place one end of Dip wire into water.

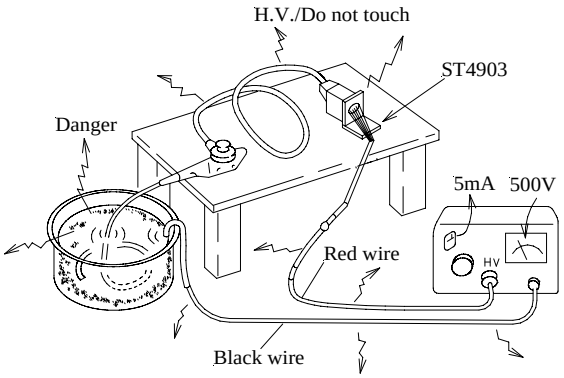
④ Connect Red wire (HV) to ST-4903, Black wire to Dip wire.

⑤ Submerge Insertion tube in the water.

⑥ Smoothly rise test voltage to 500Vac and keep for 1min.

If the leak detector does not operate, OK.

If it operated, immediately lower voltage and stop test.



Danger:

To avoid electrical shock hazard, be sure to keep hands off from Scope, Water tab, test leads and any electrically conductive material that touches the scope.

⑦ Reduce test voltage to “0V”.

c) Between FE Terminal and Insertion Tube surface:

① Make sure that test voltage is " OFF "(0V).

② Place one end of Dip wire into water.

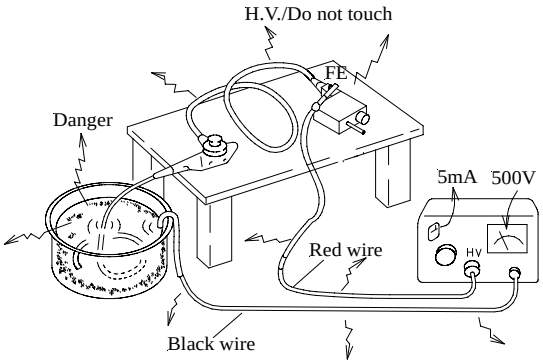
③ Connect Red wire (HV) to FE terminal and black wire to Dip wire.

④ Submerge Insertion Flex.Tube in the water.

⑤ Smoothly rise the test voltage to 500Vac and keep for 10 sec.

If the leak detector does not operate, OK

If it operated, immediately lower voltage and stop test.



Danger:
To avoid electrical shock hazard, be sure to keep hands off from Scope, Water tab, test leads and any electrically conductive material that touches the scope.

⑥ Reduce test voltage to “0V”, and turn off Test Switch.

2. Operation test with Processor

Note: Check with EPK-i.

1) Image Check Check for Color, Sharpness, noise.
2) Image orientation Check for Correct image traveling on the monitor.
3) All control buttons Check for proper function
4) Zoom lever Check zoom in and zoom out when turn the Zoom lever.
5) Air/Water feeding button Check for Normal feeding.

3. Cleaning

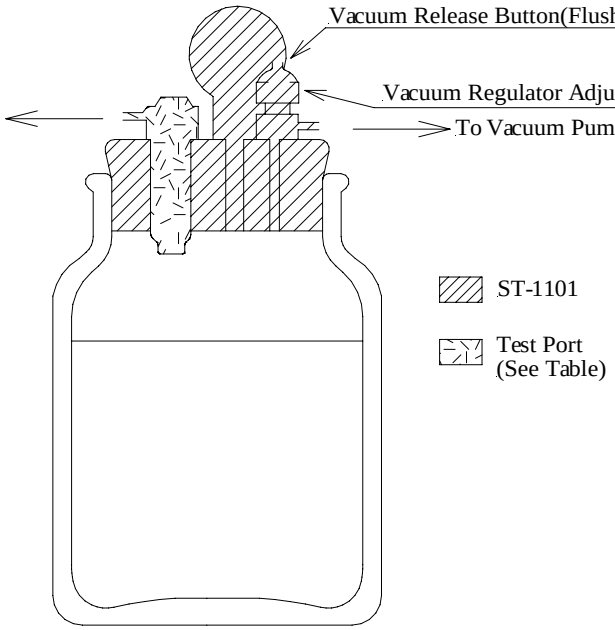
1) Drain water from all Tubes.
2) Wipe entire scope, and make sure there is no MLK, Grease etc

Note: Do not use any Solvent except Methanol (Ethanol).

4. Repair Record

Leave your records in a written form to enable repair history tracing afterward.

8-2 HOW TO USE WATER-LEAK TESTER (Vacuum Test)



Test Port	Models
ST-1102	15/17/19
ST-1103	27/28
ST-1104	29/32/34
ST-1105	38/D-34
ST-1106	23/24
ST-1107	7/9/10
ST-1108	36

1. Preparations :

   Set up the tester with Water-leak tester base(ST-1101), Test port of adequate size(ST-1102～1108, explained elsewhere), Water bottle and a vacuum pump. Also prepare tubings.

2. Test :

   Note :Test vacuum is 26.6kPa(20cmHg). Do not exceed max. of 33.25kPa(25cmHg), otherwise Bending Rubber will expand too much.

   If controllable vacuum pump is used, set regulator at 33.25kPa(25cmHg) as safety valve.

   1) Connect Vacuum pump to the suction pipe of Test port.
      (Seal rubber inside will be pulled to increase its bore)
   2) Pass the insertion tube through Test port and immerse in the water.
   3) Disconnect vacuum from Test port.
      (Seal rubber will fit around the insertion tube)
   4) Turn the adjusting knob of the regulator C.C.W. as an initial set.
   5) Connect vacuum to the regulator.
   6) Turn the adjusting knob C.W. so that a reading of “26.6kPa(20cmHg)” is attained on the vacuum meter.
      Note :Vacuum can be quickly released by pressing release-button on the regulator.
      :If reading fluctuates, press the release button a few times to let regulator valve properly seated.
      :Do not exceed max. vacuum.
   7) Check water leaks with "Up/Down/Right/Left angulation".
      Note :Take out the scope from Water-leak-tester if continuous rising air bubbles are present from the scope.

[NOTES]

*If seal-rubber is broken, any adequate Bending Rubber can be used as a seal for Test port.

*When there is no item in Test port, do not apply vacuum by plugging Test port with your palm or the like. It will cause ballooning or splitting of the seal rubber.

8-3 AIR-TIGHTNESS CHECK OF IMMERSIBLE SCOPE

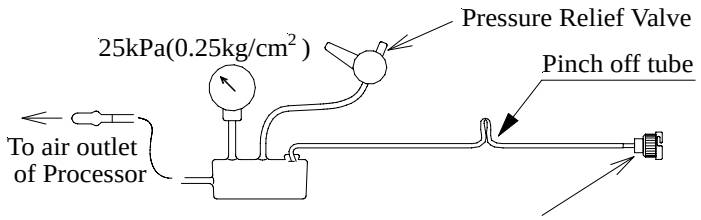
< Device >

SHA-P2 (Leakage Tester)
Processor (EPM3300, EPK700 and as such), Light source (LH150P, LX750P)
ST-1110 (Water Leak Test Unit)
Soaking Cap / ETO Cap

< Step >

1. Preparation:
   1) Detached all external accessories such as A/W Valve, Suction Valve and Rubber Inlet seal from the scope.
   2) Set a ST-1110 with a processor and turn on the air pump of the processor.
   3) Pinch off the tube of the ST-1110 to shut off air and adjust a Pressure Relies Valve of the ST-1110 so that meter shows 25Kpa (0.25Kg/cm²).

   Note: Do not pressurize beyond the 25Kpa, as it may cause serious damage to the scope.

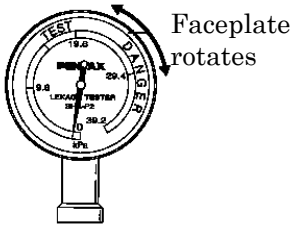


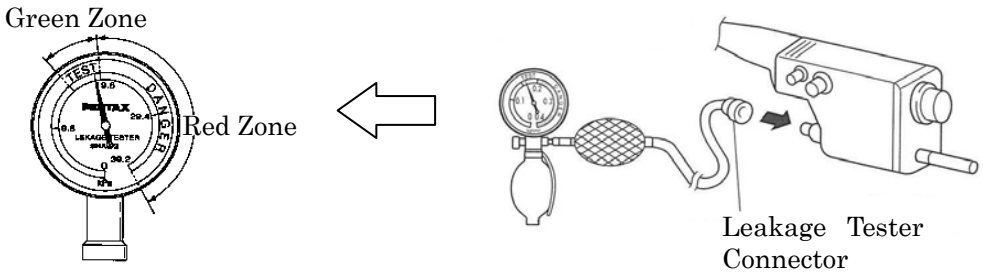
ST-1110

2. Stage-I --- Dry test ---

   Note: Before immersion, the scope should be tested at the outside of a water tub by SHA-P2 in order to prevent entering water into the scope.

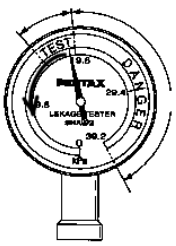
   1) Turn the gauge faceplate of the SHA-P2 to 'zero' the pressure indicator.
   2) Connect the Leakage Tester Connector of the SHA-P2 to the ETO valve of the scope properly and pressurize the scope by pumping the hand bulb until the indicator on the gauge is in the Green zone.
   3) Observe the gauge pressure to determine if the indicator remains in the GREEN zone.

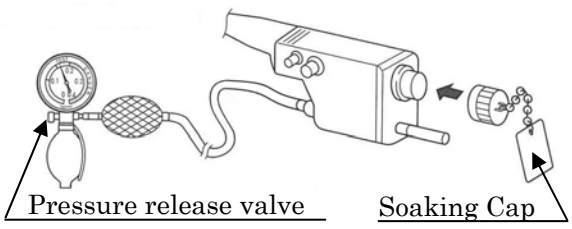




4) If the indicator drops from the GREEN zone rapidly, attach a proper SOAKING CAP to the LG Cable Connector.
5) And then, if the indicator stops dropping from the green zone, there is a possibility that the electrical connector is leaking.
6) If the indicator keeps dropping, the scope has a leakage in the place other than the electrical connector, even though the soaking cap is attached.
7) Release the air pressure from the scope by opening the pressure release valve on the handle of the SHA-P2.
8) After the gauge indicates 'zero', disconnect the SHA-P2 from the scope.

Note: Fix the scope before going to next step if any leakage is found by this test.



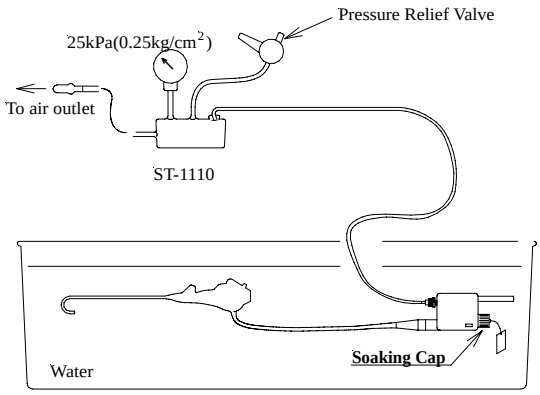


3. Stage-II --- Wet test ---

Note: After determining the absence of any major leak in Stage I testing, perform the Immersible as following step.

1) Attach the SOAKING CAP to the LG Cable Connector properly in order to prevent the electrical contacts from wetting.
2) Connect the ETO Valve connector of the ST-1110 to the ETO Valve of the Scope and ensure that the scope is pressurized.
3) Submerge the scope into the water tub.
4) Observe the instrument carefully while turning an angulation knob fully for all directions.

Note: A few bubbles may occur initially from recessed areas of the scope. This is normal. If a continuous stream of bubbles is observed from the same spot, a leak is indicated.



5) Take out the LG Cable Connector from water and detach the ETO Valve connector of the ST-1110 from the scope. And then submerge the LG Cable Connector slowly.
6) Observe the ETO Valve of the scope. If the bubbles come out from the ETO Valve continuously, remove the scope from the water immediately.
7) Note: The replacing of the ETO Valve is necessary when a leakage was found.
8) Take out the scope from the water tub and release the air pressure from the scope by attaching the ETO CAP (OF-C5).
9) Wipe off the water and blow away the water which remained in the tubes by a pressured air.

Note: if the electrical contacts of the LG Cable Connector got wet accidentally, blow away the water with pressured air so that dry it completely in order to prevent the electrical connector from damaging.

9-1 MATERIAL LIST

Major supplemental materials for repair:
For details of position of use, refer to the Exploded View and the explanation in the manual.

MATERIAL CODE	ODR CODE No.	DESCRIPTION	CONTAINER	QTY
CMT-2	RM1003	1 : 1 Epoxy Cement Tube 6H	TUBE	55g x 2 tubes
CMT-5	RM1102	Instant Glue L-Vicosity	VIAL	20g
SLK-R	RM1204	Screw Lock	CAN	200g
SS-1	RM2001	Silicone Sealant White	TUBE	100g
SS-5	RM2005	Silicone Sealant Black	TUBE	100g
SS-6	RM2006	Silicone Sealant Black / Liquid	TUBE	0.33lit
SLOH	RM3003	Silicone Oil for O-Ring	OF-Z11	
G-M17	RM3115	Grease White	CAN	350g
G-M18	RM3116	Grease White	CAN	500g
MLY	RM3203	MK-Powder	CAN	1kg
SPT	RM4104	Titory Solder Paste	CAN	40g
SS-FLX	RM4110	SUS Soldering Flux	VIAL	1lit
BLK	RM4201	Black Additive	VIAL	20g
HT-OC	RM8006	Heat-Shrink Tube for OC	—	0.5m
HT-HP	RM8007	Heat-Shrink Tub		
HT-SC	RM8022	Heat-Shrink Tube for 1x1.1	—	0.5m
THREAD-N	RM8101	Nylon Thread 0.128 mm	SPOOL	—
	RM8200	CCD Insulation Tape	SPOOL	

9-2 SPECIAL TOOL LIST:

For details of position of use, refer to the manual and exploded view.

TOOL No.	D E S C R I P T I O N	POSITION OF USE (INDEX in MANUAL)
ST-1001	Scope Work-Hanger	
ST-1004	Work-Hanger Head PVE	
ST-1101	Water-Leak Tester Base	8-2
ST-1104	W-L Test Port 34	8-2
ST-1105	W-L Test Port 36/38/D34	8-2
ST-1110	Water-Leak Test Unit H/X/PVE	8-3
ST-2212	Staycoil Separator 28	3-1
ST-2214	Staycoil Separator 38	3-1
ST-2241	Staycoil Holder28/29	3-1
ST-2246	Staycoil Holder 38	3-1
ST-2275	B. Rubber Expander 32	3-3
ST-2285	B. Rubber Expander 38	3-3
ST-2311	Channel Retainer Pliers 4.6mm DIAM.	2 / 4-1
ST-2315	Channel Retainer Pliers 3mm DIAM	4-3
ST-2320	Channel retainer Pliers GI	2 / 5-1
ST-2372	EOG Vent Plier-1	2
ST-2375	Control Body Holding Jig 90	2 / 6-2
ST-2699	Ob. Lens Press	7-2
ST-2711	Ob. Lens Press Adapter	7-2
ST-2718	Ob. Lens Press Adapter 3870ZK	7-2
ST-2824	Ob. Lens Press Head 3890K	7-2
ST-3126	Spanner Biopsy Inlet PVE-GI	2 / 6-2
ST-3133	Spanner Skt/Suc. Nple PVE-GI	2 / 5-4
ST-3161	Spanner LG Cntr Housing PVE 30/40	2 / 5-4
ST-3163	Spanner Skt/Suc. Nple PVE 30/40	2 / 5-4
ST-3165-1	Spanner B.Inlet Barrel PVE 30/40 IMP-1	2 / 6-2
ST-3192-1	Spanner RL Lock Knob Nut	7-1
ST-3204	Spanner R.C. Button Case Nut 90	
ST-3205	Spanner Control body Lid 90	7-1
ST-3206	Spanner Side Cover Retaining Nut	2 / 6-1
ST-3207	Spanner Body Cover Grip Attaching Nut 90	2 / 6-2
ST-3208	Spanner R.C. Button Attaching Nut 90	
ST-3209	Spanner IFT Attaching Nut	2 / 4-1 / 6-2
ST-3210	Spanner UD Knob Retaining Nut	7-1
ST-3900	Spanner Grip Handle	

TOOL No.	D E S C R I P T I O N	POSITION OF USE (INDEX in MANUAL)
ST-4024	B. Channel Work Shaft 3.6mm Diam	3-3
ST-4027	B. Channel Work Shaft 2.6MM	3-3
ST-4211	RBR Separater 29Fr	2
ST-4212	RBR Separater 38Fr	2
ST-4812	Tube Forming Rod 3.1	4-3 / 5-1
ST-4830	Tube Forming Rod 5.0	4-1
ST-4832	Tube Forming Rod 3.8	4-1
ST-4833	Tube Forming Rod 5.8	4-3 / 5-1
ST-4903	Test Connector K/AK/I	8-1