

## Endoscopy Care Solution Flexible identifying problems

### **Aeration**

This is a process where low heat, ventilation, and moisture ridding techniques are utilized to aid in the removal of internal fluid.

### **AGC**

AGC, stands for Automatic Gain Control which increases and decreases the video signal level automatically based on the average light level of the viewed object. The camera control unit utilizes AGC.

### **Air Channel**

This channel carries the flow of air through the endoscope to the surgical sight. The air channel runs from the water bottle connection on the light guide connector up to the air/water cylinder On the control body. The air/water valve operates within the air/water cylinder. When the hole On the air/water valve is covered, the airflow is directed down the air channel and out of the nozzle at the distal tip.

### **How to Identify the Repair**

If there is a reduced amount of air or water flow or if there is a leak detected the air / water channel may need repair or replacement. While leak testing the scope under water, if there is a leak in the channels it identify itself in the form of bubbles. The location where these bubbles are being emitted from will indicate which portion of the channel is leaking.

If one of the channels are clogged or kinked it can be identified by first checking the air and water flow at the cylinders. If the air or water is weak or nonexistent at the cylinders then the problem is between the universal plug to the cylinders. If at the cylinders you have strong air and water, but at the nozzle it's weak then the problem is between the cylinder and the distal tip. Channels can be kinked as a result of excessive bending. Clogged channels are the result of debris and or crystallization of disinfectant solution.

### **Air/Water (A/W) Cylinder**

Located on the front of the control body, the air/water cylinder is the stainless steel cylinder that houses the air/water valve.

### **Air/Water (A/W) Cylinder Replacement**

#### **How to Identify the Repair**

If there is a reduced amount of air or water flow from the A/W cylinder or if a leak is detected from the A/W cylinder or tube, the A/W cylinder may need to be replaced. A properly operating A/W cylinder is necessary for proper lens cleaning and water flow capacity.

## **Air/Water Connector (Water Bottle Connection)**

Located on the light guide connector, this is the port to which the water bottle is attached. There are two types of water bottle connectors, a standard plug-in type and the screw -on type. The screw -on type of water bottle is needed when using CO<sub>2</sub> gas. The CO<sub>2</sub> gas is routed through the air channel of the endoscope. The Air/Water connector connects both the air and water channels.

These two channels are separated at the connector by several O-rings. These O-rings are referred to as the separator O-rings.

## **Air/Water Separator O-Ring Replacement**

### **How to Identify the Repair**

If the air is mixed with water output during water feeding, proper water function is impaired. In order to properly remove any material blocking the lenses, correct washing capability is necessary.

If air is mixed with water, the force of the flow of water will be insufficient to clear the field of view.

This is the result of worn or damaged separator O-rings located at the bottle connection.

## **Air/Water Valve (A/W Button)**

Located on the front of the control body, the A/W valve is inserted into the A/W cylinder it is typically the bottom button and has a hole in the middle of the button that air will be exiting.

To supply air to the distal tip just cover the port hole with your finger tip; to supply water depress the button fully.

## **All Channel Irrigator**

The All Channel Irrigator is used for cleaning and disinfecting (OES) and video endoscopes. The All Channel Irrigator forces water through all channels of the endoscope at the same time. The All Channel Irrigator attaches to the endoscope covering the suction, air, water, and CO<sub>2</sub> ports. A syringe is used to force the fluid through the All Channel Irrigator and through the endoscope.

## **Angulation**

Angulation is a generic term used to describe the degree of deflection of the endoscopes bending section.

## **Angulation Adjustment**

### **How to Identify the Repair**

Over time the angulation wire can stretch. This will result in less responsive angulation movement, restricted range of and/or a "looser" feel.

### **Corrective Action**

To restore the endoscope to original specifications, Endoscopy Care Solution must adjust and tighten the

Angulation control wires to remove any slack. The range of motion will be checked for smooth movement and for correct angulation tension.

## **Caution**

Improper adjustment of the angulation control wires could lead to a failure of other components in the endoscope. Improper repair to the control wires could result in the cable breaking, causing a more extensive repair and/or complications for patient and surgeon.

### **Angulation Control Knobs**

The Angulation Control Knobs are the rotatable knobs located on the control body, which allow the user to control the articulation. When the angulation control knobs are rotated, the angulation at the distal tip of the endoscope can be manipulated to desired deflection. Both the up-down knob and the left-right knob can be turned at the same time to obtain a compound angle of the distal tip.

### **Angulation Control Knob Repair**

#### **How to Identify the Repair**

If a leak is detected in the area between the angulation control knobs, there could be physical Damage to the angulation control knobs or the O-ring seals. If there is a rough or grinding feel To the angulation control knobs, a repair is necessary.

#### **Corrective Action**

Endoscopy Techs will remove the angulation control knobs, inspect them for physical damage And replace them if necessary. The O-ring seals will be inspected and replaced if necessary. If the movement of the angulation control knobs need adjustment, the tension setting is adjusted, The tension setting is adjusted, the internal components are checked and the angulation control knobs reattached to the control body. After final assembly, the smoothness of function and brake Mechanisms are checked.

## **Caution**

If the O-rings are incorrectly seated, fluid invasion may occur, necessitating a higher level repair. If incompatible lubricants are used with the O-rings, premature deterioration may occur. This will lead to poor angulation movement and possible fluid invasion. Incorrect tension will create a tight or heavy movement and distortion of the insertion tube and bending section.

### **Angulation Control Wire**

This is a generic term used to describe the internal stainless steel cables that control the manipulation of the bending section.

### **Autoclave**

Steam autoclaving is a process using steam heat and pressure to achieve sterilization.

## **Auxiliary Water Channel**

The auxiliary water system is only found on select models of flexible endoscopes, colonoscope and therapeutic gastroscopes. The auxiliary water channel is used to supply continuous irrigation to the distal end of the endoscope. A syringe, which is attached to the auxiliary water port, is used to supply fluid to the auxiliary water channel. The auxiliary water channel is connected to the main water channel, which then carries the irrigation solution to the distal end. On select models, therapeutic gastroscopes a separate water channel may be used to direct the fluid to the distal end.

## **Auxiliary Water Port**

The auxiliary water port is located on the lower back of the control body. The auxiliary water system allows continuous flow of water, which can be used, for irrigation. Auxiliary water capability is found only on select colonoscopes and gastroscopes. A syringe connects to the auxiliary water port via an auxiliary water feeding tube, and is used to feed water to the auxiliary water channel. On older model colonoscopes, the auxiliary water channel is tied into the main water channel, which directs the water through the nozzle at distal tip. On a therapeutic gastroscope, the auxiliary water channel runs through the entire length of the insertion tube and is directed through an auxiliary water jet on the distal end of the endoscope.

## **Bending Rubber**

A common term used to describe the distal sheath. (See Distal Sheath)

## **Bending Section**

This is a generic term for the entire articulating section of the insertion tube. The bending section is located just above the distal tip.

## **Bi-Directional Hinges (Angulation Hinges)**

These hinges allow the distal tip of the endoscope to angulate. They are called bi-directional because they will angulate in all directions.

## **Biopsy Channel (Biopsy / Suction Channel)**

The biopsy channel is located inside the insertion tube. The biopsy channel provides access for passing instruments through the endoscope, out the distal tip of the endoscope and into the patient.

The biopsy channel is also utilized as a suction channel. When the suction button is depressed and the biopsy port is sealed with a biopsy port cap, suction will be applied to the channel.

## **Maintenance Tip**

To prevent biopsy channel damage, make sure that forceps and other accessories are in proper working order. *Never force an instrument into the biopsy channel.* This could result in damage to the biopsy channel. If you experience difficulty in passing instruments through the channel, withdraw the instrument slightly, reduce the amount of tension on the control mechanism and reinsert. Alternately, return the endoscope control to a neutral position and try to pass the instrument again.

## **Biopsy Channel Replacement**

### **How to Identify the Repair**

If it is difficult to pass or insert biopsy forceps or other instrument through the biopsy channel, the biopsy channel may have a kink and need replacement. In addition, if the endoscope fails the leak test in the area of the biopsy channel opening or port, the biopsy channel may have been compromised. The biopsy channels may be replaced on most model endoscopes.

### **Corrective Action**

Endoscopy Techs will disassemble the endoscope, disconnect and remove the old biopsy channel, and pull a new one into place. A special jig is used by Fiegert to ensure that the new channel is properly positioned and that the other components in the insertion tube remain in their proper position.

After the new biopsy channel is connected, it is sealed at the distal tip. Then, the control body is resealed, a new distal sheath is installed and the angulation adjusted, if necessary, leak test performed and final inspection.

### **Caution**

The use of incorrect biopsy channel material or splicing may result in a more serious problem occurring inside the endoscope. The biopsy channel must be positioned correctly inside the endoscope to avoid crossing the angulation wire or twisting, putting stress on the fiber bundle(s).

## **Biopsy Elevator Riser and Wire Replacement (JF and TJF Models Only)**

### **How to Identify the Repair**

If it is difficult to move the riser or if there is roughness in the movement of the riser, the biopsy elevator riser and wire may need to be replaced. An additional problem that may be detected is a change in the range of motion of the riser, which is caused by a stretched elevator riser wire or loose angulation.

## **Corrective Action**

Endoscopy Techs will replace the biopsy elevator riser wire with compatible Olympus replacement parts. The elevator riser will be replaced within the distal tip of the endoscope and will be properly seated and sealed. The elevator wire will be carefully connected and aligned to ensure smooth operation. The distal tip cover is also inspected for any cracks or sharp edges. The biopsy elevator riser channel is made up of three parts; from the control body to the bending section is a thin walled stainless steel tube. Then at the bending section to the distal tip there is a polymer tube reinforced by a flat stainless steel coil pipe, to allow smooth bending, but ensure no kinks.

## **Caution**

Improper alignment of the biopsy elevator riser will hinder smooth, correct movement during procedures. The length of the elevator wire is critical for proper range of motion. A very slight deviation from the original specifications will change the angulation adjustment and the range of motion of the elevator riser.

## **Biopsy Port**

The biopsy port is located on the lower front of the control body. This port is used to access the biopsy channel when instruments, e.g., forceps, snares, injector needles, etc., through a flexible endoscope.

## **Biopsy Port Cap**

The biopsy port cap is a black rubber cap that snaps over the biopsy port to prevent any reflux through the port. This cap also supplies the seal between the instruments and biopsy port, which enables the biopsy channel to be used for suction.

## **BNC Cable**

BNC refers to a type of connector. Cables using BNC connectors are usually referred to as BNC cables. See NTSC video.

## **Boot / Protector**

Located on the upper section of the insertion tube, the boot protects the joint between the control body and the insertion tube adding support to the insertion tube and helping to prevent buckling at this critical juncture. The boot works as a strain relief for the area its covers.

## **Burndy Pins (Electrical Connectors)**

Located on the electrical connector, the Burndy pins are the terminals, which provide the video signal connection between the endoscope and the video processor.

## **Camera**

A general term that refers to the group of components which create a video signal. These components include the camera head, the coupler, the camera cable and the camera control unit.

## **CCD (Charge Coupled Device) Imaging Unit**

Located at the distal tip of video endoscopes only, the CCD transforms light into electrical charges called signals. The signals are then carried through lead wires to the electrical connector of the endoscopes where they are received by the processor and translated into an image.

## **CCD Imaging Unit Replacement**

### **How to Identify the Repair**

If the video image is cloudy, appears "stained" or exhibits horizontal lines, bleeding colors, or intermittent signal, the CCD imaging unit may need to be replaced. Before assuming this unit needs to be replaced, check the lens first. If the lens is dirty or scratched, it may need to be cleaned or polished. There also could be moisture trapped in the objective lens, which will result in a cloudy image. If the lens is free of dirt, moisture and other physical damage, check all electrical contacts to make sure there is no video interference due to poor electrical contacts.

### **Corrective Action**

Currently, Fiegert Endotech does not have a replacement CCD unit for other manufacturer scopes. In the case where a CCD unit needs replacement we have a couple of options to offer they are as follows: first, Fiegert can offer a conversion where we will replace the defective CCD unit with a Fiegert CCD unit, video head and video connector plug. Secondly, we can offer you an exchange for a Fiegert flexible video scope compatible to the endoscope in question. Next, we could offer an exact recondition replacement, and lastly, advise that endoscope be sent to Olympus for service. At Olympus they will disassemble the distal tip and remove the old CCD unit and replace it with a new unit. The new CCD imaging unit (which has many cases including the external objective lens) will be placed in the uniquely shaped, internal mounting area within the distal tip, new electrical connections will be made, and a new distal sheath will be install. The proper position of the CCD unit is critical to the performance of the endoscope. Each endoscope has a unique placement of the CCD imaging unit. An angulation adjustment will be performed and the video image of the endoscope will be checked.

### **Caution**

Because of the minimal tolerances between components in the distal tip, the placement of the CCD imaging unit is critical. If the CCD unit is not seated correctly, the focusing distances will be changed, or fluid invasion may occur, compromising the function of the endoscope.

## **Camera Cable**

This cable connects the camera head to the camera control unit. It is important to remember to never connect or disconnect this cable while the camera control unit is turned on.

## **Camera Control Unit**

Also known as the CCU. This component powers the camera head and processes the information to create the video signal, which is sent to the other components. It is also used to set up the operating parameters through functions such as white balancing, memory settings, color adjustments etc...

## **Camera Head**

This is the part of the camera that has the light sensing device, CCD's, known as "chips". These chips measure light and color levels. The camera control unit translates this information into the image we see on the monitor. (See Camera)

## **CO<sub>2</sub> Connection**

Found on the light guide connector, the CO<sub>2</sub> is the twist-on connection, which attaches to the CO<sub>2</sub> Gas supply. This connector utilizes a luer lock type fitting.

## **CO<sub>2</sub> Valve**

The CO<sub>2</sub> valve is a stainless steel valve that is located just above the suction cylinder on the front of the control body. The CO<sub>2</sub> valve is used to control the flow of CO<sub>2</sub> gas used to insufflate the colon. The CO<sub>2</sub> valve cap is used on certain colonoscopes.

## **Composite Video**

See NTSC Video.

## **Contact Ring**

The black plastic ring on the top of an OES style eyepiece. The contact ring contains electrical contacts, which may be used to attach video converters to endoscopes.

## **Control Body**

A general term that describes the main body of the endoscope. The control body houses all of the control components necessary to control the various functions of the endoscope.

## **Coupler**

The coupler is the component, which connects a camera head to a telescope.

## **Diopter Ring**

The diopter ring is located in the center of the eyepiece. When the diopter ring is turned, the focus of the eyepiece is matched to the viewer's eyesight.

## **Distal Braid**

Located directly under the distal sheath, the distal braid is a stainless steel mesh that protects the distal sheath from being pinched between the bi-directional hinges.

## **Distal Hoods**

There are two types of distal hoods: 1. on the older model colonoscopes, the hood is made of black plastics and screwed onto the distal tip; 2. On older gastroscopes, the hood is made of rubber and snaps over the distal tip and into a groove. Some hoods extend out past the distal tip to help prevent the objective lens from touching the mucosa, thereby helping to keep the lens clean.



## **Distal Sheath (Bending Rubber)**

The distal sheath, also known as a "bending rubber", is the flexible rubber sheath that covers all of the bending section components.

## **Distal Sheath (Bending Rubber) Replacement**

### **How to Identify the Repair**

If a tear, puncture or other physical damage is detected in the distal sheath, it will need to be replaced. A distal sheath that is compromised will result in a failed leak test, where bubbles will be emitted from the sheath. It is important to maintain a watertight barrier to avoid fluid invasion. This will prevent any fluid damage to the internal elements of the endoscope, which could result in a major repair; also, loss of the insulation properties of the distal sheath due to punctures poses a safety hazard during electrosurgery.

### **Corrective Action**

Endoscopy Techs will carefully remove the damaged distal sheath and fully inspect the underlying wire mesh. All internal elements of the endoscope are inspected to ensure that there is no damage due to fluid invasion. A model-specific distal sheath is then installed using special jigs designed to install sheath easily without harm to the endoscope or sheath. The distal sheath is sealed at both ends with a specially developed adhesive, which has been tested to ensure bio-compatibility. Following sealant application, a Fiebert technician will inspect the endoscope to ensure that the endoscope has been restored to original specifications.

### **Caution**

The condition of the wire mesh is critical. A frayed piece of mesh can puncture the distal sheath and misdirect electricity during electrosurgery. Each distal sheath is specific to the model endoscope being repaired. There is no such thing as a "universal bending rubber." An incorrectly fitted distal sheath could "bunch" or wrinkle, causing wear and snags. A distal sheath that is too short can increase the tension on the angulation cables necessitating more force to angulate the endoscope. This can result in undue wear to the cables as well as the other internal components. The adhesive used to seal the distal sheath must be correct consistency and type to ensure biocompatibility and a smooth seal. Air bubbles in the adhesive could create crevices, which can attract contaminating bio-material. A smooth glue surface is necessary for both the uniform operations of the endoscope and the patient safety.

## **Distal Sheath Sealant Joint**

These sealant "glue" joints seal the distal sheath to the insertion tube at one end and the distal sheath to the c-cover at the other end.

## **Distal Tip**

This is a generic term for the lower portion of the insertion tube, specifically the tip of the endoscope. This is the portion where the c-cover is mounted, and where the light guide lenses, objective lens, and air/water nozzle are located.

## **Distal Tip Cover (C-Cover)**

Located at the distal tip of the endoscope, the c-cover encloses the entire distal tip and encases the lenses and nozzle. On most large body endoscopes, the c-cover is made of black plastic, except for the therapeutic, which are made of white plastic. On most of the small body endoscopes, the c-cover is made of stainless steel.

## **Distal Tip Cover (C-Cover) Laser**

Several models of gastroscopes utilize a white C-cover. This type of C-cover is found on gastroscopes, which are used in conjunction with lasers. The white tip is used to reflect the lasers light stabilizing the temperature of the distal end., as well as seal the endoscope to prevent fluid invasion.

## **Distal Tip Cover (C-Cover) Replacement**

### **How to Identify the Repair**

If the C-Cover exhibits cracks or a melted appearance, it needs to be replaced. Physical damage to the c-cover area may also be observed during a leak test. The integrity of the C-cover is critical to insure proper electrical insulating properties as well as seal the endoscope to prevent fluid invasion.

### **Corrective Action**

Endoscopy techs will remove the nozzle from the distal end, clear any sealant residue from the light guide and imaging unit lenses and remove the damaged C-cover. After cleaning, a new C-cover is mounted to the distal end. Then, the nozzle is replaced and a special sealant is used to glue the nozzle, and lenses to the C-cover. The endoscope is leak tested and a full functional test performed.

### **Caution**

The correct sealant must be used to provide proper insulating characteristics, as well as promote the ease of cleaning. Nozzle position is critical for proper air and water flow and all lenses must be free of obstructions to prevent any light or image degradation.

## **Electrical Connector**

Located on the light guide connector of the video endoscopes only, the electrical connector provides the electrical connections between the endoscope and the video processor. The electrical connector utilizes Burndy pins to accomplish the physical electrical connection.

### **Maintenance Tip**

Always cover the electrical connector of a videoscope with the water-resistant cap prior to immersion for cleaning and disinfecting.

## **Electrical Connector Replacement/Repair**

### **Corrective Action**

If there is fluid invasion or physical damage to the electrical connector, the video image may be compromised. The automatic brightness adjustment may be affected due to electrical pin damage.

## **Corrective Action**

If there is physical damage to the electrical connector, it will be replaced by separating it from the universal cord. A new electrical connector will be re-soldered. If there is minor fluid invasion, the endoscope will be aerated to remove excess humidity. Any residue will be carefully removed and the electrical contacts will be cleaned and tested. In all repair cases involving the electrical connector, the endoscope will undergo a leak test and an electrical leak test.

## **Caution**

If the electrical connections are not properly soldered, the video image will be compromised. For proper electrical connection and clear video image, all traces of fluid invasion must be removed.

### **Electrical Contact Pins**

Located on the outer edges of the light guide connector, these stainless steel pins provide the electrical contacts needed between the endoscope and the light source.

### **Elevator Control Lever**

The elevator control lever is found only on side viewing (JF and TJF) duodenoscopes. The elevator control lever is located on the back of the control body and controls the forceps elevator at the distal tip of the endoscope.

### **Elevator Cleaning Channel (Elevator Wire Channel)**

Located inside the insertion tube of the side viewing duodenoscopes, the cleaning channel runs from the top of the control body down through the insertion tube to the distal tip. The elevator control cable also runs through this channel. This channel may be cleaned by attaching a feeding tube/syringe to the cleaning port on the front of the control body and flushing the channel with disinfectant.

### **Elevator Mechanism Repair**

#### **How to Identify the Repair**

If the elevator knob movement is not smooth or feels "heavy," or the elevator does not attain full range of movement, the elevator mechanism needs to be repaired.

#### **Corrective Action**

Endoscopy Techs will open the control body of the endoscope to expose the elevator mechanism. In most cases, adjusting and tightening the elevator cable will correct the problem. This involves detaching the elevator cable from the elevator mechanism, repositioning the stopper and checking the elevator riser position. After re-soldering the connection, extreme care is taken to ensure that no future damage occurs as a result of solder flux or other residue. The mechanism is then reassembled and the control body is resealed. The endoscope undergoes a leak test and the Elevator mechanism function is checked.

## **Caution**

If the elevator mechanism is not set to the correct specifications, full function cannot be attained when passing forceps through the elevator riser. The elevator mechanism must be fully cleaned of all solder and flux residue to ensure there is no deterioration or breakage due to corrosion.

### **Elevator Wire**

The elevator wire is the cable that controls the elevator movement. One end is attached to the elevator control level and the other end is attached to the elevator riser. Movement of the elevator control lever is transferred to the elevator riser by the elevator wire.

### **ETO Cap**

This cap is used universally on OES-style endoscopes. ETO caps can be made of stainless steel, aluminum, or plastic. When the cap is properly attached to the endoscope, the ETO valve is opened allowing pressure to be vented during ETO sterilization.

**Never immerse a fiberscope with the ETO cap in place. The ETO cap must be removed prior to immersion in fluids to avoid fluid invasion.**

### **ETO Gas Sterilization**

Ethylene oxide gas sterilization is a process used to sterilize many types of instruments prior to patient examination. This process uses a combination of ETO gas, heat, pressure and humidity. After the ETO sterilization process, the instrument must undergo a cycle of aeration to evacuate any remaining gas residue prior to patient examination.

### **ETO Valve**

Found on the light guide connector of OES-style endoscopes only; the ETO valve provides the Connection needed to vent the endoscope during ethylene oxide gas sterilization. The ETO valve also provides the connection needed for leakage testing the endoscope.

### **Eyepiece**

On all endoscopes incorporating an image guide fiber bundle, the eyepiece provides magnification and focuses the image to the viewer's eyesight.

## **Maintenance Tip**

If a fiberscope is out of focus, check the focus ring on the ocular and align the pin with the yellow dot for correct focus.

### **Eyepiece Cover Glass**

The flat glass window that provides exterior protection to the internal eyepiece lens, only found on OES fiberscopes.

### **Eyepiece Replacement/Repair**

## **How to Identify the Repair**

If the viewed image is clouded or physical damage has occurred such as chips, cracked or scratched glass, damaged ocular housing or damaged contact pins, the eyepiece needs to be replaced.

## **Corrective Action**

Fiebert will remove the eyepiece, access the extent of the damage and either replace the entire eyepiece or certain components of the eyepiece. Indicator marks can also be re-applied to the housing if needed.

## **Caution**

If the eyepiece is replaced or repaired improperly, the visual acuity may be affected. Improper assembly may cause damage to the fiber bundle, shortening the useful life of the endoscope. Damage may also occur to the electrical wiring, which may contribute to an electrical short in the fiberscope.

## **Fiber Bundle**

A fiber bundle is simply a bundle of flexible glass fibers. The fiber bundle can be used to carry light for illumination purposes or to carry an image for viewing purposes.

## **Fluid Invasion**

If the physical integrity of an endoscope is compromised, fluid invasion may occur. Any fluid, e.g., water, cleaning solution, body fluids etc., can cause damage to the interior of the endoscope. This damage can be in the form of rust, corrosion, image staining, electrical damage, a tightening of the angulation wires, etc. To prolong the life expectancy of the endoscope, a leak test should be performed prior to immersion.

## **Maintenance Tip**

If a small amount of fluid invades the endoscope, aerating the endoscope at 122 to 135 degrees Fahrenheit for a period of 24 hours may remove the moisture from the endoscope. *However, residue that may have been left behind needs to be cleaned and the cause of the fluid invasion must be identified and corrected.*

## **Forceps Elevator (Elevator Mechanism)**

Located at the distal tip of side viewing duodenoscopes, the forceps elevator is recessed in the distal end. When an instrument is passed through the biopsy channel and out of the distal tip, the forceps elevator is used to manipulate the instrument into position.

## **Free Engage (F/E) Knob, R-L (Right-Left)**

The R-L free engage knob is located on the extreme outside of the main shaft. When engaged, the R-L free engage lever will act as a "brake" to hold the distal tip in position.

## **Free Engage (F/E) Lever, U-D (Up-Down)**

The U-D free engage lever is located behind the U-D angulation control knob. When engaged, the U-D free engage lever will act as a "brake" to hold the distal tip in position.

## **Free Engage (F-E) Mechanism Repair/Adjustment**

### **How to Identify the Repair**

If the engage mechanism does not hold or there is too much drag on the angulation mechanism when engaged, the free engage mechanism may need to be repaired. It is important that the F/E mechanism maintain the desired angulation position during the procedures.

### **Corrective Action**

Fiebert will remove the control knobs to gain access to the F/E mechanism. The tension is reset in both the free and engage modes. O-ring seals are inspected and, if necessary, replaced and the control knobs are re-attached to the control body. A specified tension setting is used to ensure the movement is smooth and the full range of motion is complete.

### **Caution**

If the O-rings are incorrectly seated, fluid invasion may occur necessitating a higher level repair. If incompatible lubricants are used with the O-rings, deterioration may occur. This will lead to poor angulation movement and possible fluid invasion.

## **Gas/Water Valve**

The gas/water valve is found only on Series 100 and 130 Colonoscopes. The gas/water valve takes the place of the air/water valve when CO<sub>2</sub> gas is being used for insufflation.

## **Ground Lug (S-Cord Connector Mount)**

Located on the light guide connector, this is a screw-on connection that the patient's grounding plate is attached to during electro-surgical procedures.

## **Identification Ring-Blue**

The blue identification ring around the eyepiece indicates that the endoscope can be immersed. On an OES fiberoptic endoscope the ETO cap must be removed prior to immersion. On a video endoscope, the water-resistant cap must be securely in place prior to immersion.

## **Insertion Tube**

The insertion tube is the lower portion of the endoscope that is actually inserted into the patient. In the video endoscope, the lower section of the insertion tube contains the distal tip, which houses the CCD unit and related components. The insertion tube also has graduated markings, which act as reference points during procedures.

## **Maintenance Tip**

Be sure to use bite blocks during all upper GI procedures. Visually inspect each endoscope for physical damage before and after each procedure. Pay particular attention to the bending section, distal sheath, and connection to the control body and distal tip lenses. Do not allow the insertion tube to buckle at the control body. Do not bend any endoscope into a radius tighter than that at which it was originally packed in the shipping case. A sharp bend may cause internal damage to the endoscope, which may not be immediately apparent.

## **Leakage Test**

This is a generic description of a leak test. During a leak test, the endoscope or camera cable is pressurized using a leakage tester and an air supply. During the pressurization period, the endoscope is totally immersed in water. Any residual air trapped in the channels of the endoscope should be removed while the endoscope is immersed. This is achieved by using a syringe to force water through the channels while pushing the air out. After the trapped air is removed, any sign of continuous bubbles indicates the presence of a leak. During the leakage test, the scope should be angulated in all directions while observing the control knobs, biopsy channels, insertion tube and the bending section for bubbles. Each scope switch must also be manipulated while observing them for small bubbles, as well. This procedure helps to expose any small holes or insufficient seals which may be present.

## **Maintenance Tip**

After each procedure, the endoscope or camera cable should undergo a leak test to identify any damage to the endoscope that may have occurred during the procedure. Check the leak tester regularly to ensure that it is functioning properly. Never immerse a videoscope longer than one hour in any liquid.

## **Leakage Tester**

The leakage tester is a mechanical device that regulates the flow of air to the endoscope during the leakage testing. It consists of an air source or hand pump to pressurize the endoscope, a hose with the appropriate ETO fitting, and a pressure gauge for reading the pressure or loss of pressure.

## **Lens Setter Pin**

Found on the OES style of eyepiece, the normal position for the lens setter pin is to be rotated to the extreme left. This is also indicated by the alignment of the pin with a yellow dot on the eyepiece mount. When any camera or camera adapter is attached to the endoscope, the pin is automatically rotated to the right. This will put the eyepiece lens in the neutral position, allowing you to back focus using the attached component, e.g., camera or video adapter.

## **Light Guide Fiber Bundle**

The light guide fiber bundle carries the light from the light source to the distal tip of the endoscope. All flexible endoscopes incorporate a light guide fiber bundle.

## **Light Guide Connector**

The light guide connector is the scope component that plugs into the light source. The light guide connector is sometimes called the universal plug because it incorporates connections for the suction, CO<sub>2</sub>, air/water bottle, S-cord, electrical contacts and the ETO venting valve (fiberscopes only). The light guide connector also houses the electrical connector on the video endoscopes.

## **Light Guide Connector Replacement/Repair**

### **How to Identify the Repair**

If a leak is detected from the contact pins, suction port, or air/water port, during the leak test, the light guide connector may need to be replaced or serviced. Physical damage may also be present on the light guide connector, which would prevent the proper attachment of the endoscope to the light source.

### **Corrective Action**

Endoscopy Techs will disassemble all of the operating elements of the light guide connector from the universal cord. The appropriate damaged components will be replaced and all electrical connections in the light guide connector will be re-soldered to the contact pins. The endoscope will then undergo a leakage test for water tightness and proper insulation. On the video endoscopes, the video image will be checked to ensure that all wire connections have been made correctly.

### **Caution**

It is critical that the suction, air, water and gas tubes be reattached correctly to ensure there are no twists, kinks or potential areas for a collapse to occur.

## **Light Guide Cover Glass Replacement (L.G. Connector Side)**

### **How to Identify the Repair**

If the image is dark and can not be improved by increasing the brightness controls on the light source, the light guide cover glass may be cracked, damaged or dirty. If the light guide cover glass is physically damaged, fluid invasion becomes a potential problem.

### **Corrective Action**

Endoscopy Techs will remove the light guide cover glass from the mounting unit. The glass will be inspected, the end of the light guide fiber bundle will be polished and the light guide cover glass is replaced, if necessary. The O-rings on the mounting unit are inspected to ensure a watertight seal. The new light guide cover glass unit is tightened to a specific torque to ensure a fluid tight seal.

### **Caution**

The light guide cover glass and light guide fiber bundle must be handled carefully to avoid compromising light transmission. The light guide cover glass unit must be tightened properly to avoid fluid invasion due to a poor seal.



## **Light Guide Lens**

Located on the distal tip, the light guide lens is the clear/white lens that helps you focus the light transmitted by the fiber bundle from the light source onto the surgical sight. The light guide lens also acts as a waterproof seal to protect the light guide fiber bundle from fluid invasion.

### **Maintenance Tip**

If the light being transmitted is compromised, check it to be sure that the light source is on and that the lamp has been ignited. Check the endoscope to ensure that it is securely plugged into the light source and make sure the lenses are not severely cracked or blocked by dried disinfectant or debris.

## **Light Guide Lens Unit Repair/Replacement**

### **How to Identify the Repair**

If the light being transmitted from the distal tip of the endoscope appear dark or in any way distorted, there may be a problem with the light guide lens. Physical damage to the light guide lens may impair the image quality and compromise the watertight seal of the endoscope.

### **Corrective Action**

If there is physical damage to the light guide lens, the old lens will be repaired or replaced. The amount of lens damage and the amount of light transmission will determine whether a repair or replacement is performed. In the case of a repair, the old lens will be removed and a new lens installed. If there is minor damage to the lens, a special non-yellowing epoxy will be used to repair the lens. This special epoxy will allow the maximum amount of light to be transmitted.

### **Caution**

It is important that the light guide lens be correctly seated and sealed. If the lens is not properly sealed, fluid invasion through the lens opening may occur. Maximum light transmission is critical, Especially on narrow diameter, single lens endoscopes.

## **Light Guide Mount**

Located on the end of the light guide connector, the light guide mount is the silver colored stainless steel component that is inserted into the light source. *Also known as the light guide probe.*

## **Light Guide Mount Repair/Adjustment**

### **How to Identify the Repair**

If the light guide mount does not fit into the light source, the connection is loose or a water leak is detected, the light guide mount needs to be repaired. The light guide mount must be properly attached to the light guide connector to ensure a watertight seal. If there is a poor mechanical connection between the light guide mount and the light source, damage may occur to the fiber bundle and /or the light source. The autobrightness function may also be impaired, causing a fluctuation in the light transmission.

## **Corrective Action**

Tech will remove the light guide mount from the light guide connector, and inspect it for damage. If the attachment surface is damaged on either the light guide mount or light guide connector, it must be repaired. The screws, which hold the units together will be tightened to a specified torque and sealed to prevent fluid invasion. The pin mount unit is also checked and glued with epoxy.

## **Caution**

If the light guide mount is damaged, the autobrightness function may fail causing an over exposed or underexposed video image. Incorrect torque when tightening may cause damage to the light guide connector or mount which may lead to fluid invasion.

### **Light Guide Rod End**

Located on the light guide mount, the "rod end " screws onto the mount. The rod end houses the light guide fiber bundle and clad glass rod located inside.

### **Light Guide Tube**

Also known as the umbilical or universal cord, the light guide tube runs from the control body down to the light guide connector. The light guide tube houses wiring, tubing fiber bundles and channels.

### **Line Level Video**

See NTSC Video

### **Main Shaft**

The main shaft is a stainless steel shaft on which all of the angulation control knobs rotate.

### **Mavigraph**

Component used for making a color print or transparency of the video signal. Please study your specific printer's manual for complete instructions.

### **Name Plate**

An identifier that the manufacturer has installed on the endoscope, it usually states the model and is sometimes color-coded to match like color-coded accessories.

### **Nozzle, Air/Water**

Located on the distal tip, the nozzle is the component, which directs the air and water over objective lens. The nozzle is bent at a 90-degree angle and is oriented to direct the flow of air and water across the objective lens. This air and water combination is used to clean the objective lens during a procedure, as well as insufflation of the patient.

## **Nozzle Replacement**

### **How to Identify the Repair**

If there is a decrease in the flow of air or water across the lenses from the nozzle, the nozzle maybe clogged or damaged necessitating the need for repair or replacement. On a colonoscope, the nozzle may also be used for the delivery of the CO<sub>2</sub> gas.

### **Corrective Action**

After accessing whether the nozzle needs to be repaired or replaced, Fiegert will remove the nozzle by loosening a set screw on the side of the distal tip. If the nozzle is clogged with debris, the nozzle will be placed in an ultra sonic cleaner for a specified period to loosen a possibly dislodge the debris. Then, the nozzle will be reamed out to ensure all debris is removed and replaced back in the ultra sonic cleaner. Next, air is blown through the nozzle; it is installed back on the scope and tested. If the nozzle was damaged or the debris could not be successfully removed a new nozzle will be installed. The nozzle is set into the distal tip to direct the flow of water or air over the objective lens to maximize lens cleaning. Application of a special biocompatible sealant is used to properly seal and insulate the nozzle and retaining screw.

### **Caution**

Incorrect positioning of the nozzle will compromise the flow of water over the lenses. The correct sealant must be used for proper seal and insulation, air/water flow and for chemical compatibility.

## **NTSC (National Television Standards Committee) Video**

This signal is known as line level video or composite video. This signal is usually carried by a BNC cable. NTSC video differs from component or Y/C video in that its signal is a combination of luminance and chroma.

## **Objective lens**

Located on the distal tip, the objective lens is a dark colored lens. This lens is used to focus an image of the mucosa on the distal face of the image fiber bundle (in the case of fiberscopes) or CCD image sensor (in the case of a videoscope). At the same time, the objective lens provides a seal to protect the fiber bundle or CCD chip from external fluid invasion.

## **Painting Knobs**

Controls on the camera control unit used for adjusting the color (hue) of the image. Newer models of CCUs may have buttons instead of knobs.

## **S-Cover**

Located on the upper control body, the S-cover serves as an access panel to the internal components in the upper section of the endoscope. The S-cover is located at the attachment point between the universal cord and the control body.

## **Signal Path**

This refers to the path, which the video image travels from the camera through each component, to the monitors. Though the components can be assembled on the video cart in any configuration, the signal path should always remain constant.

## **Suction Connection**

Located on the light guide connector, the suction connection is a barb type connection to which the suction supply tubing attaches. The other end is attached to a suction source.

## **Suction Cylinder**

Located on the front of the control body, the suction cylinder is a stainless steel cylinder that houses the suction valve button.

## **Suction Channel**

*See Biopsy Channel*

## **Suction Tube**

The suction tube is located inside the universal cord. One end of the suction tube is connected to the suction cylinder in the control body and the other end is connected to the suction connector, which is in the light guide connector. The suction tube is used to route suction cylinder, which is then directed to the biopsy channel by the suction valve.

## **Suction Tube Replacement**

### **How to Identify the Repair**

If it is difficult to insert the cleaning brush into the suction cylinder, the passage may be resisted due to suction tube wear or damage. If there is a sharp bend in the universal cord, the suction tube may become restricted, causing a reduction in the force of the suction, usually on an intermittent basis.

### **Corrective Action**

Endoscopy care tech's will open the control body and dismount the suction tube from the suction cylinder. The light guide connector will be disassembled and the old suction channel disconnected from the suction connector. The old suction tube will be removed and new channel will be pulled through the universal cord while ensuring that all internal components remain in proper alignment.

### **Caution**

It is critical that the connections between the suction tube, biopsy channel, suction connector and suction cylinder be seated properly. Any damage to these joints will result in a leak, which could result in fluid invasion and a costly additional repair. The suction cylinder must be inspected to ensure that the proper suction capacity is being generated. If the suction tube is not properly installed in the universal cord, a kink may develop which may compromise the suction function and make cleaning the suction tube difficult.

## **Suction Valve**

The suction valve is located on the front of the control body just above the air/water valve. The suction valve has one (1) red ring in the center of the button. When depressed, the suction valve generates suction at the distal tip through the biopsy channel.

## **S-VHS**

An S-VHS VCR is similar to a standard VCR except for one important difference: the ability to record and the passing on the video image is greatly enhanced on an S-VHS. A standard VHS machine uses a video signal that is composed of both luminance and chroma (brightness and color). An S-VHS recorder uses a signal that has separate luminance (Y) and chroma (C) signals.

This is done with a Y/C cable. This signal is referred to as both Y/C and S-video.

## **S-Video**

*See S-VHS*

## **Switch #1, Olympus**

Found on all video endoscopes, the #1 switch button utilizes a micro-switch located inside the control body. This switch is typically operates the freeze mode to "freeze" the video image.

## **Switch Cover, #1**

The #1 switch cover is an external black rubber cover that protects the #1 switch.

## **Switch, #1 Replacement**

### **How to Identify the Repair**

If the freeze function does not respond properly, the #1 switch may need to be replaced.

### **Corrective Action**

Endoscopy Care techs will replace the damaged switch, reconnect the electrical wires and reseal the switch cover to prevent fluid invasion of the endoscope. After the control body of the scope is re-assembled, the endoscope will undergo a leak test to ensure proper sealing and the switch function is checked.

### **Caution**

If the switch is not properly sealed, its function may be impaired and fluid invasion may occur. Also, if the electrical connection is incorrect it could not only cause a short in the system damaging the #1 switch, but also damage to the entire system.

## **Switch Cover, #1 Replacement**

### **How to Identify the Repair**

If the leak detected in the #1 switch cover, the switch cover may need to be replaced. If the leak is not repaired, fluid invasion may occur necessitating a #1 switch replacement or another high level repair.

## **Corrective Action**

Endoscopy Care Solution will remove the damaged switch cover, clean the switch itself to ensure proper function, and install a new switch cover. The scope is then leak tested to ensure proper sealing and switch function is checked.

## **Caution**

If the switch cover is not properly sealed, the switch function may be impaired and fluid invasion may occur.

### **Switch Head (Video Head Assembly)**

Located at the top of a video endoscope, the switch head contains three (3) micro-switches that Remotely operate ancillary components, e.g., video recorder or printer.

### **Switch Head (Video Head Assembly) Replacement**

#### **Corrective Action**

Endoscopy Care Solution will open the control body, disconnect the #2,3,4 switch head, remove it and install a new video head. All electrical connections will be resoldered and insulated. The control body will be resealed and a functional test performed as well as a leak test.

### **Sync**

An RGB output also needs a separate signal to synchronize the scan on the video monitor with the three color signals, red, green, and blue. This additional synchronization signal is referred to as a sync signal.

### **Telescope**

A common name used to describe a rigid endoscope. Its function is to enable the surgeon to view the surgical sight. This is achieved through a series of glass optical components, rod lenses, ocular, and an objective.

### **Tension Ring**

This is the silver colored metal "split ring" located on the light guide mount (connector). The tension ring provides the necessary tension to hold the endoscope in the light source.

### **Termination**

A video signal path must have a proper end point termination or the image quality will suffer. Some components will terminate automatically if there is no cable attached to an output and other will need to have a termination switch set. Please check your component manuals for proper instruction.

### **Universal Cord**

The universal cord connects the control body and the light guide connector. The universal cord houses the components that transmit the light, air, water, and the suction to the endoscope.

## **Universal Cord Replacement**

### **How to Identify the Repair**

If there is evidence of a leak from the universal cord during a leak test, the universal cord may have to be replaced. A sharp bend or kink may damage the suction tube or the light guide fiber bundle inside of the universal cord. If the bend is too severe enough, the light transmission and the suction tube capacity may be compromised. Also, extreme wear in the form of multiple buckles, which is the physical result of the black insulation material separating from the underlying wire mesh, may compromise the integrity of the universal cord and its internal components and should be replaced.

### **Corrective Action**

Endoscopy Care solution will replace the universal cord by detaching all of the operating elements of the light guide connector from the universal cord. A new universal cord will be carefully placed over the internal components of the endoscope ensuring all components are in their proper position. All electrical connections in the light guide connector are re-soldered to the contact pins, and all channels are reconnected. The endoscope then undergoes a leak test and an electrical leak test to ensure the scope is watertight and proper insulation. On the video endoscopes, the video image will be checked to ensure that all wire connections have been made correctly.

### **Caution**

It is critical that the suction, air, water and gas tubes be attached correctly to ensure that there is no twists, kinks, or potential areas for collapse to occur.

### **Video Cart**

A mobile cart that holds all the video components and other related operating room equipment.

### **Water Channel**

The water channel carries the flow of water through the endoscope. The water channel runs from the water bottle connection on the light guide connector up to the air/water cylinder on the control body. The water flow is stopped by the air/water valve. When the air/water valve is depressed, the water flow is directed down in the air/water channel and out of the nozzle at the distal tip.

### **Water Resistant Cap (Leak Test Cap)**

This is the black colored cap that is only used on the video endoscopes and is attached to the light guide connector. The water-resistant cap must be properly attached to the endoscope prior to immersing the endoscope in fluids. The water-resistant cap must be removed from the endoscope prior to aeration or ETO gas sterilization. This cap is also equipped with a stainless steel valve, which allows a leakage tester to be attached.

### **White Balance**

White balancing calibrates the camera (camera head and camera control unit) and the video processor to display a white object as "white". Once white balance is achieved, all other colors will be reproduced accurately.

## Xenon Lamp

A type of light source lamp used in endoscopy applications. A xenon type lamp is used due to its pure white illumination. This ensures that the color of the image is being reproduced accurately.

## Y/C

A type of video cable and connector that separates the luminance (brightness) Y signal, from the chroma (color) C signal. This interconnection is better than an NTSC line video signal, which combines the luminance and chroma information in one signal.

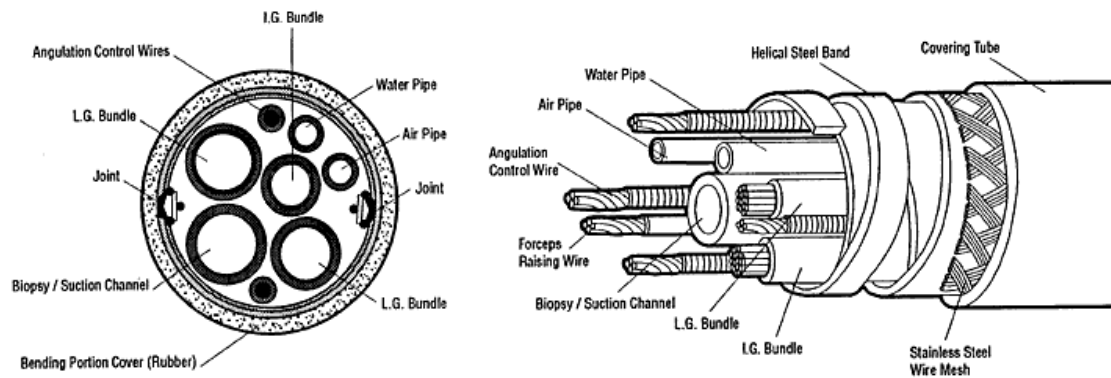
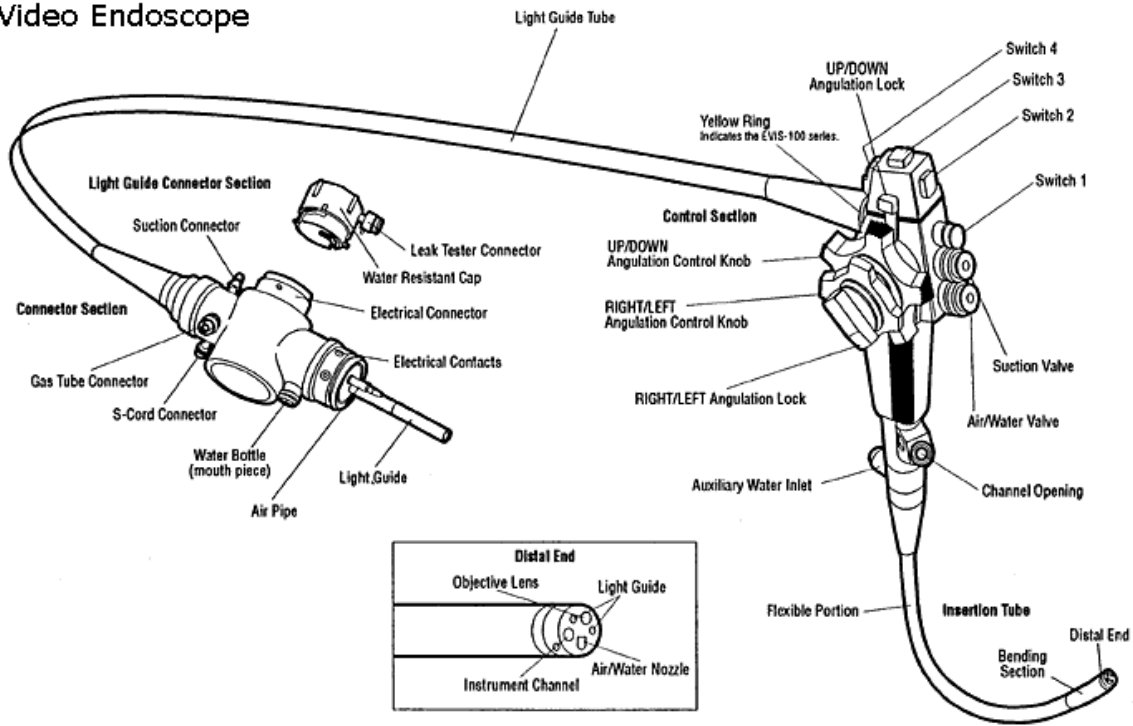


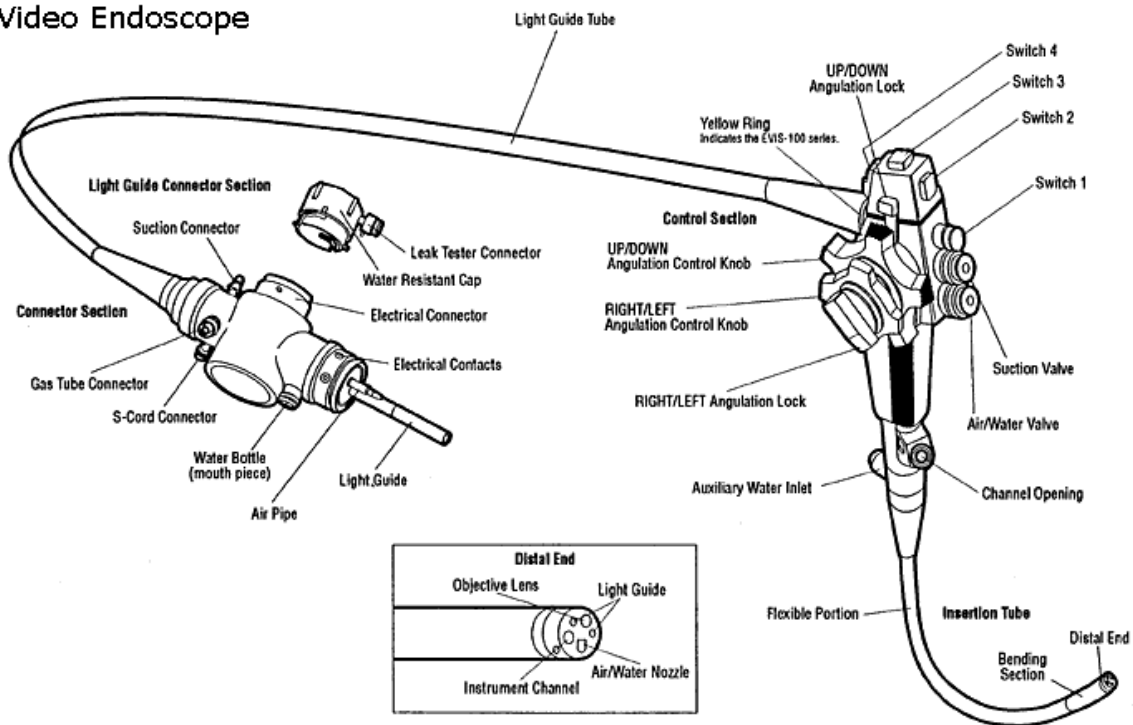
Figure 1: Distal Tip Assembly



# Video Endoscope



# Video Endoscope



# Maintenance

## Cleaning, Disinfection and Sterilization Procedures

**Clean Immediately After Procedure**



1. Wipe insertion tube with gauze.
2. Turn off air pump. Remove Air/Water Valve by slowly pulling out and place in cleaning suction.
3. Insert Air/Water Channel Cleaning Adapter (blue collar) turn on air pump.
4. Alternately feed water and air for 10 seconds each. Turn off light source.
5. Place distal tip in water and apply suction for 10 seconds. Then alternate suctioning of water and air several times. Then turn off suction pump.
6. Remove Air/Water Channel Cleaning Adapter, Suction Valve, Gas Valve, and Biopsy Valve. Place in cleaning solution.
7. Clean auxiliary water channel using a syringe and auxiliary tube.
8. **Perform Leak Test**
9. Immerse insertion tube in cleaning solution.
10. Insert channel cleaning brush through insertion tube, universal cord and channel opening to brush the entire suction/ biopsy channel.
11. Turn off suction pump and remove suction line and channel cleaning adapter.
12. Immerse entire endoscope in cleaning solution. Scrub all external surfaces. Remove endoscope, place in clean water and rinse.
13. Using a brush gently wash and rinse all valves.
14. Install Air/Water channel cleaning adapter and suction valve.
15. Connect suction line connector on the endoscope. While holding the control section out of the water, turn on the suction pump, making certain the free end of the channel cleaning adapter remains in water. Aspirate water for approximately 10 seconds.
16. Remove entire instrument from water. Continue to aspirate air for
17. Rinse and dry the instrument taking steps 1 and 9 through 12 in

**Disinfection**

**BEDSIDE**

**Cleaning  
Area**