

**DE NOVO CLASSIFICATION REQUEST FOR
IOGYN SYSTEM**

REGULATORY INFORMATION

FDA identifies this generic type of device as:

Closed Loop Hysteroscopic Insufflator with Cutter-coagulator: A closed loop hysteroscopic insufflator with cutter-coagulator is a prescription device configured for hysteroscopic insufflation, resection and coagulation. It is used to perform diagnostic and surgical procedures (i.e., resection and coagulation). This device type contains a closed loop recirculating fluid management system for the controlled delivery of filtered distension fluid. This device type also contains a bipolar radiofrequency device used in conjunction with a hysteroscope for resection and coagulation of intrauterine tissues.

NEW REGULATION NUMBER: 21 CFR 884.1710

CLASSIFICATION: CLASS II

PRODUCT CODE: PGT

BACKGROUND

DEVICE NAME: IOGYN SYSTEM

SUBMISSION NUMBER: K132695

DATE OF DE NOVO: SEPTEMBER 5, 2013

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REQUESTER'S RECOMMENDED CLASSIFICATION: II

INDICATIONS FOR USE

The IOGYN System is intended to distend the uterus by filling it with saline to facilitate viewing with a hysteroscope during diagnostic and operative hysteroscopy and provide fluid management through the closed loop recirculation of filtered distension fluid. It is also intended for cutting and coagulation of uterine tissue such as intrauterine polyps and myomas using a bipolar resecting device.

LIMITATIONS

The sale, distribution, and use of the device are restricted to prescription use in accordance with 21 CFR 801.109.

The IOGYN System is to be used in conjunction with:

- IOGYN Endoscope
- 3 Liter Irrigation USP Saline Bag (sodium chloride (0.9% w/v; 150mmol/l)) Irrigation Solution (such as Baxter part#2B7477 or Hospira part#0409-7972-08)
- Light Sources and Flexible Light Cables
- Endoscopic Accessories (light cable adapters, brushes)

Contraindications:

Pregnancy, genital tract infections, and known uterine cancer are contraindications to hysteroscopy.

Use of this device for intrauterine distension is contraindicated whenever hysteroscopy is contraindicated. See the operator's manual of your hysteroscope for absolute and relative contraindications.

The IOGYN System contains a large amount of metal components. Therefore it is MRI unsafe. Do not use the IOGYN System in conjunction with MRI, CT or RFID.

Warnings:

The IOGYN System should only be used by physicians trained in hysteroscopy and hysteroscopic surgery using powered instruments. Healthy tissue can be injured, e.g., perforation by improper use of the Resecting Device. Use every available means to avoid such injury.

The IOGYN closed loop system permits the operator to elect intrauterine pressure up to 125mm Hg. Clinicians using the IOGYN System should be aware of the 2013 AAGL practice guidelines regarding uterine cavity distension pressure (i.e. lowest pressure necessary to distend the uterine cavity and ideally should be maintained below the mean arterial pressure) when setting distension pressure on the IOGYN System.

Gas bubbles are a normal by-product of electrosurgical procedures performed in liquids. When bubbles occur in the uterus, care should be taken to manage the removal of air/gas bubbles to minimize the inherent risk of emboli. Bubbles produced during tissue vaporization may interrupt surgery by temporarily interfering with field of view and may also result in electrode overheating, causing damage to the electrode tip.

Surgeon should avoid entry of air into uterus by:

- Carefully purging air from fluid inflow lines and hysteroscopic devices prior to use
- Following cervical dilation, care should be taken to minimize the exposure of the open cervix to room air
- Keeping an effective cervical seal during surgery as much as possible once the cervix is dilated
- Using active fluid outflow to effectively flush the uterus of bubbles and debris
- Minimizing the frequency of removal and reinsertion of hysteroscopic devices

If room air or gas embolism is suspected, surgeon should consider interrupting surgery, deflating the uterus, and removing sources of fluid and gas until the diagnosis and a management plan are clarified.

Do not use the IOGYN System with another fluid management system, endoscope, or controller. Use with another fluid management system, endoscope or controller may result in failure of the device to operate or lead to patient or physician injury.

Testing of the IOGYN System has not been confirmed in patients with hemoglobinopathies (e.g., Sickle Cell Disease, Beta Thalassemia) and therefore, the possible effects are unknown.

Hemolysis may occur during recirculation. If significant hemolysis occurs, this may result in electrolyte (e.g., increased serum potassium) changes or decrease in hemoglobin. Hemolysis may reveal red-tinged coloring of the recirculated fluid, but may not be visually apparent. Therefore, assessment of serum electrolytes and hemoglobin level after completion of the procedure is recommended.

Precautions:

USE ONE 3 LITER IRRIGATION USP SALINE BAG ONLY. DO NOT USE MULTIPLE SALINE BAGS. Use of multiple saline bags increases the chance of fluid overload.

Do not use the IOGYN System in patients where anatomy does not support an endoscopic procedure (i.e. cervical stenosis, existence of an IUD, or in conditions that limit access to the target tissue).

Use Resection and COAG with caution in the presence of any active implantable or body worn medical devices such as internal or external pacemakers or neurostimulators. Interference produced by the use of electrosurgical devices can cause a pacemaker to enter an asynchronous mode or can block the pacemaker effect entirely. The output of the IOGYN device might also affect other types of active devices such as implanted neurostimulator devices. Consult the active implantable device manufacturer (for implanted pacemakers and ICDs the hospital cardiology department might also be helpful) for further information when use of myomectomy or tissue coagulation is planned in patients with active implantable devices such as cardiac pacemakers.

If the patient has an implantable cardioverter defibrillator (ICD), contact the ICD manufacturer for instructions before performing myomectomy or tissue coagulation. Electrosurgery or tissue coagulation may cause multiple activations of ICDs.

PLEASE REFER TO THE LABELING FOR A MORE COMPLETE LIST OF WARNINGS, PRECAUTIONS AND CONTRAINDICATIONS.

DEVICE DESCRIPTION

Device Model(s): FG-0200 (IOGYN Controller with Integrated Fluid Management), FG-0201 (Resecting Device), FG-0202 (Fluid Management Accessories)

The IOGYN System is comprised of the following:

- IOGYN Controller with Integrated Fluid Management
 - Footswitch
 - Fluid Management Accessories
- IOGYN Resecting Device

The IOGYN System provides an integrated control system with bipolar radiofrequency outputs (cut and coagulation) and fluid management through the use of two integrated peristaltic pumps. The Resecting Device is a bipolar radiofrequency device configured for the resection and aspiration of uterine pathology. Fluid infusion and aspiration of the uterine cavity are controlled by the IOGYN Controller's peristaltic pumps, in conjunction with the Fluid Management Accessories; these components form a closed loop recirculating system. These integrated peristaltic pumps are operated by a software pressure control algorithm that measures and controls intrauterine cavity pressure by varying saline infusion and aspiration rates in response to pressure changes during aspiration and tissue resection using the Resecting Device. The IOGYN Controller Graphical User Interface (GUI) has fluid control settings which allow the user to toggle infusion ON/OFF and to set the cavity pressure from 30-125mmHg.

The IOGYN System uses a closed loop fluid management system with a single 3-liter saline bag that continuously recirculates filtered distension fluid throughout the procedure. The fluid absorption is limited by the volume within the 3-liter saline bag minus the dead volume within the system, which limits the deliverable volume to less than 2.5L. The 2.5L of recirculated fluid is passed through a tissue catch and then a molecular filter to generate optically clear, sterile, filtered distension fluid which is returned to the 3 liter saline bag and recirculated.

Components Description

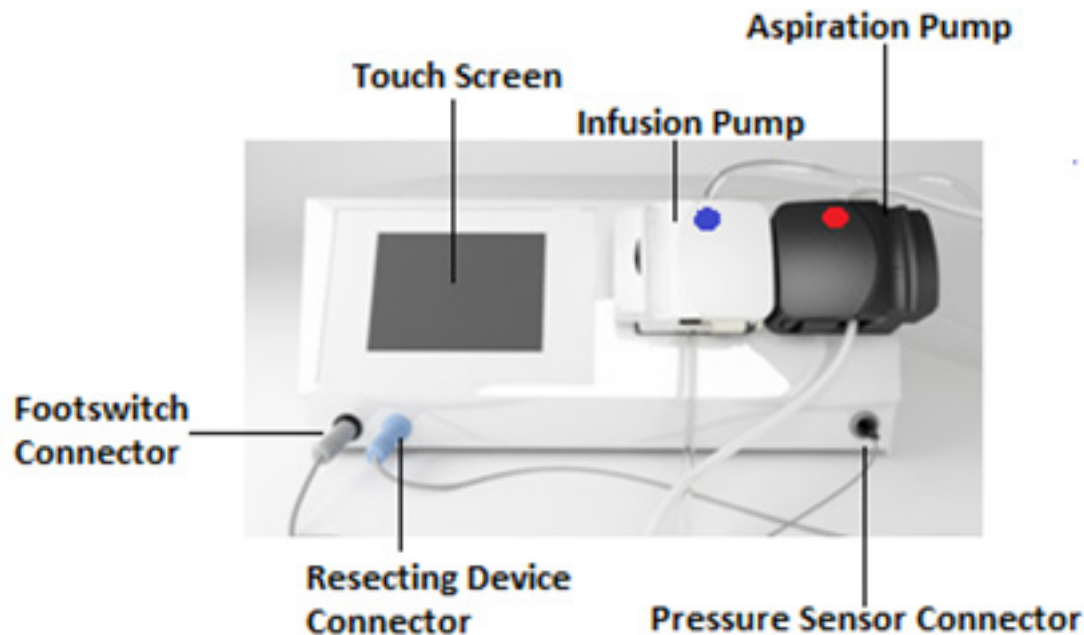
The IOGYN System consists of the following components:

- IOGYN Controller (Figure 1) with Integrated Fluid Management
- Footswitch
- Fluid Management Accessories
- Resecting Device

The IOGYN Controller includes:

- A touch screen with an Graphical User Interface (GUI) including user-adjustable cavity pressure control;
- Radiofrequency (RF) cut and coagulation output for the IOGYN Resecting Device;
- Two pumps for the controlled infusion and aspiration of fluids and tissue;
- Accessories including a footswitch and Fluid Management Accessories
- An electrical connection for pressure sensor monitoring of the uterine cavity pressure;
- A footswitch connection with the IOGYN Controller for user activation of RF energy and aspiration; and

Figure 1: IOGYN Controller



The **IOGYN Controller** is provided non-sterile and is intended to be cleaned prior to use pursuant to provided instructions. (Figure 1).

Accessories to the IOGYN Controller consist of the (1) footswitch and (2) the Fluid Management Accessories.

The **footswitch** has a three button arrangement with individual pedals for cut, coagulation, and aspiration. When acted upon by the user, it communicates with the IOGYN Controller to perform the designated function. The footswitch connects to the foot switch connector on the front of the IOGYN Controller.

The **Fluid Management Accessories** to the IOGYN Controller consist of infusion and aspiration tubing sets. (Figures 2 and 3). The infusion tubing set consists of a pressure sensor, infusion tubing and a disposable introducer seal for the endoscope. The infusion tubing has a saline bag spike integrated with a float valve on the proximal end. The float valve prevents ingress of air into the infusion tubing and the uterine cavity when the bag

is empty. The infusion tubing in conjunction with the infusion pump is responsible for insufflation of the uterine cavity via pressure feedback control from the pressure sensor to the IOGYN Controller. The aspiration tubing set consists of an aspiration tube, a container to collect tissue, a molecular filter and filter tubing. The molecular filter is a (b)(4) Trade Secret/CCI

The pore size is configured for the removal of most cellular materials including plasma proteins, cytokines, coagulation factors, and bacteria, viruses and endotoxins. The tube has a float valve to prevent back flow from the filter. The aspiration tubing set in conjunction with the aspiration pump is responsible for the aspiration and filtration of uterine outflow and the subsequent recirculation into the 3-liter saline bag. The Fluid Management Accessories are provided sterile, as a single-use disposable device.

Figure 2- Infusion Tubing Set

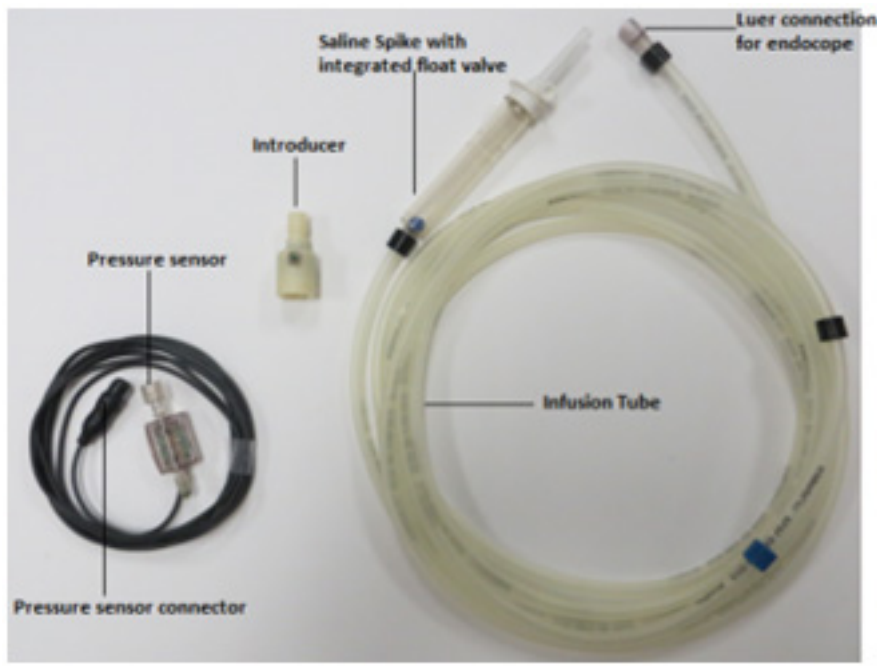
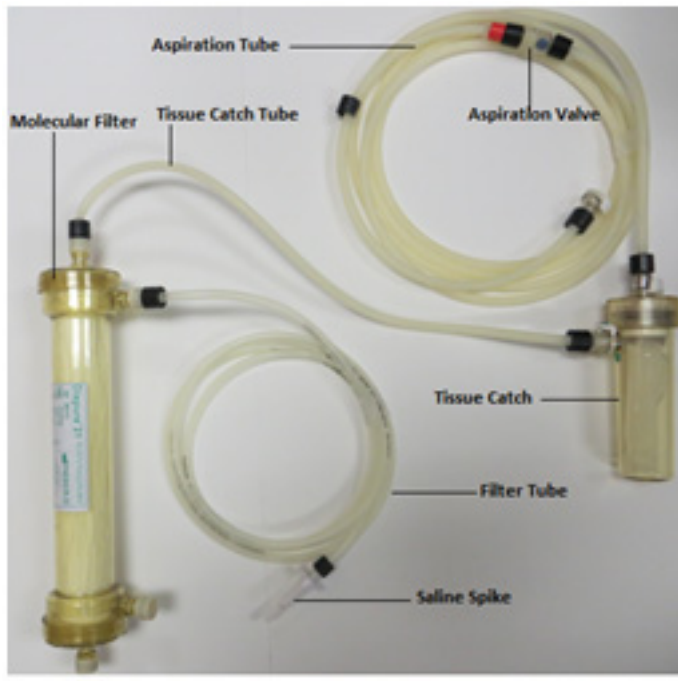


Figure 3- Aspiration Tubing Set

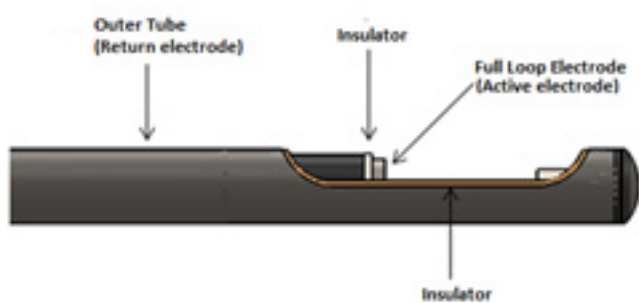


The **Resecting Device** is a sterile, single use disposable bipolar radiofrequency device for the resection and coagulation of tissue in a saline-insufflated environment. (Figures 4 and 5). The Resecting Device features an outer tube and an internal reciprocating electrode. The IOGYN Controller provides bipolar radiofrequency output to the Resecting Device sufficient for the cutting and coagulation of tissue within the endoscopic environment. An internal full loop electrode reciprocates within the outer tube window, which is positioned at the distal tip of the device. When the RF Cut pedal is activated, the bipolar RF full-loop electrode moves distally to electrosurgically cut the tissue in the outer tube window. The resected tissue is simultaneously aspirated from the treatment site through the inner diameter of the full loop electrode, through the shaft and device handle area, and through the aspiration tube of the Fluid Management Accessories via the aspiration pump on the IOGYN Controller. When the RF Coagulation is activated, the bipolar RF full-loop electrode electro-surgically coagulates the tissue adjacent to the full loop electrode.

Figure 4- Resecting Device

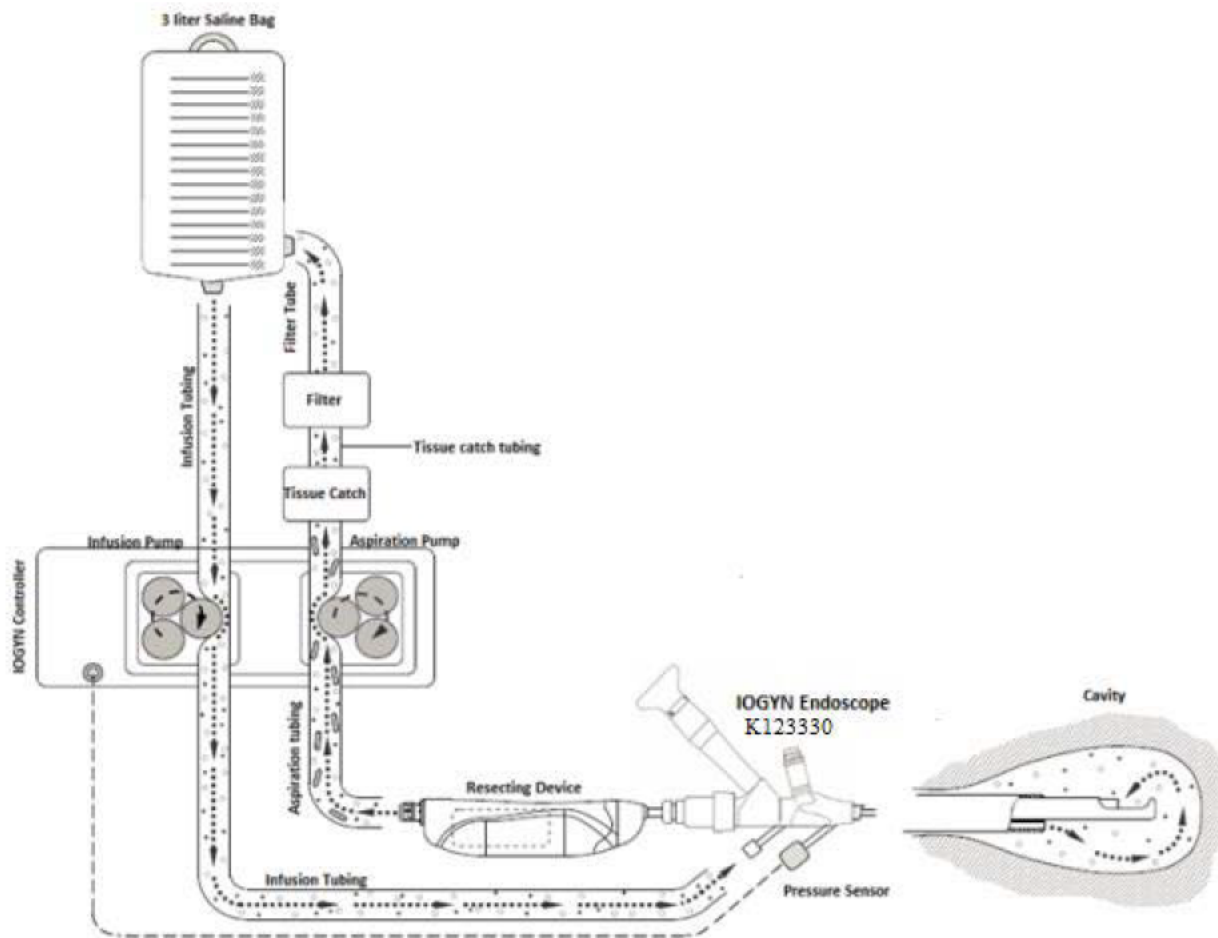


Figure 5- Resecting Device Distal Tip



A depiction of the IOGYN System set-up when used with the currently cleared IOGYN Endoscope is shown in Figure 6.

Figure 6- IOGYN Closed Loop System



The IOGYN System operates under two modes: Diagnostic mode and Resection mode. In diagnostic mode, the infusion pump, aspiration pump and pressure monitoring are active. The Controller graphical user interface (GUI) touch screen has fluid control settings that can be adjusted by the user. The infusion pump can be toggled ON/OFF by pressing the infusion pump button on the GUI touch screen. The cavity pressure can be set by touching the up and/or down arrows on the touch screen. The pressure can be set from 30-125mmHg in 5 mmHg increments and can be adjusted at any time during the procedure. The user must first set a desired pressure in order for the system to start. Once the procedure starts, the rotational speed of the infusion pump is (b)(4) Trade Secret/CCI based on feedback from the pressure sensor which monitors the uterine pressure. The pressure control algorithm creates a (b)(4) Trade Secret/CCI from the (b)(4) Trade Secret/CCI. Therefore, if the user selects (b)(4) Trade Secret/CCI the (b)(4) Trade Secret/CCI will (b)(4) Trade Secret/CCI

During diagnostic mode, fluid can also be aspirated from the cavity using the center button on the foot switch; this causes the aspiration pump to operate at a flow rate preset and fixed by the Controller. This results in a constant outflow from the cavity in which the pressure algorithm adjusts by increasing the flow rate of the infusion pump to maintain the pressure in the cavity. When aspirating from the cavity, the aspiration icon appears on the GUI. The user display includes information on the set pressure and the actual pressure.

In Resection mode, bipolar radiofrequency outputs for the IOGYN Resecting Device are active as well as the fluid management functions described in diagnostic mode. When switching from diagnostic mode to resection mode, the user detaches the aspiration tube from the introducer (attached to the endoscope) and connects the tube to the proximal end of the Resecting Device.

SUMMARY OF NONCLINICAL/BENCH STUDIES

BIOCOMPATIBILITY/MATERIALS

There are two components of the IOGYN System that are patient contacting: Fluid Management Accessories (FMA) and Resection Device. Unique to this system is the recirculation of the hysteroscopic fluid. As a result, the biocompatibility of the filtrate also needs to be considered.

FMA and filtrate:

The patient contacting materials including colorants were identified for the following components of the FMA: aspiration tubing assembly; pressure sensor assembly; filter tubing assembly; tissue catch assembly; tissue catch tubing assembly; vacuum tubing assembly; introducer assembly; and filter assembly.

Biocompatibility testing was performed in accordance with ISO 10993-1-2009: Biological evaluation of medical devices, Part 1: Evaluation and Testing. The Fluid Management Accessories have indirect tissue and blood contact through the filtrate and can be generally classified as an external communicating device with mucosal tissue and indirect blood path contact of limited duration (<24 h). The following tests are recommended:

- Cytotoxicity
- Sensitization
- Irritation/Intracutaneous Reactivity
- Acute System Toxicity
- Hemocompatibility (e.g., Hemolysis, complement activation, coagulation)
- Reproductive Toxicity (due to contact of the filtrate with the uterus and the potential for absorption of the chemicals leaching from the FMA)

Testing was conducted separately on the filter and the aspiration/infusion tubing. Cytotoxicity, sensitization, acute systemic toxicity and pyrogen testing were conducted on the final, finished FMA filter and the FMA Aspiration and Infusion tubing set. Irritation/Intracutaneous Reactivity testing was provided on a “dummy

device” that included both the filter and tubing. Although there are some differences in material(s) in the final, finished device when compared to the test material, since there was a negative finding in the sensitization test of the filter and tubing components, a positive finding in the irritation test of the same article was considered unlikely and testing on the “dummy device” was considered acceptable.

Since the filtrate passes through the filter and tubing, hemocompatibility of the filtrate was determined to be sufficient for addressing any hemocompatibility concerns with the filter and tubing. Similarly, a toxicological risk assessment of the filtrate was also provided to address the systemic toxicity and reproductive toxicity concerns with the finished device.

A complete characterization of the filtrate which addressed the likelihood that bacteria, endotoxin, virus and certain cellular constituents would pass through the filter incorporated into the device design was provided. This included testing demonstrating that the (b)(4) Trade Secret/CCI filter are able to remove bacteria, endotoxins, and viruses with at (b)(4) Trade Secret/CCI

This met the applicable test standards for the removal of these biologics.

A hematology/toxicology report that identified the coagulation and anti-coagulation proteins as well as cytokines was provided. The filter will return any substance that is less than (b)(4) Trade Secret/CCI

The return of this cytokine to the patient’s uterus was not determined to pose any safety concern. The filter has a 100% filtration rate (b)(4) Trade Secret/CCI This filtration rate is greater than that used for pharmaceutical grade plasma injection.

The following tests were conducted to evaluate the filtrate of the IOGYN System:

- Hemolysis
- Hemocompatibility
- Complement Activation
- The Prothrombin Time Assay (PT)
- The Unactivated Partial Thromboplastic Time Assay (UPTT)
- Platelet Aggregation
- Acute Systemic Toxicity
- Electrolyte Testing

The filtrate that was prepared via filtration through the IOGYN System included filtered human tissue, blood, saline, and any of the components remaining after filtration through the IOGYN filter. The results all passed and/or were assessed to be equivalent to normal saline.

Reproductive toxicity concerns are raised by this device due to the recirculation of the filtrate through the tubing and filters and into the uterus. In particular, (b)(4) Trade Secret/CCI

which is used in the filter, (b)(4) Trade Secret/CCI A toxicologic risk assessment was provided in which both saline and 20% EtOH solution, as an exhaustive extraction media, were used to extract the potential leachables. The sponsor evaluated the risks associated with the chemicals detected in the extract. A literature review was conducted on these chemicals. The conclusion was that the filtrate did not pose a significant reproductive toxicity risk.

Resection Device:

The Resection Device includes patient contacting materials in the following components: outer tube; heat sink; and inner tube/cutting tube. It also includes a colorant that is patient contacting.

The Resecting Device is generally classified as an external communicating device with mucosal tissue contact of limited duration (<24 h). The following tests are recommended:

- Cytotoxicity
- Sensitization
- Irritation/Intracutaneous Reactivity
- Acute System Toxicity

Subassemblies were tested rather than the final device because the inner tube/cutting tube assembly is exposed to higher temperatures during use and therefore was tested at a higher extraction temperature for all tests but cytotoxicity. The test samples used, however, had differences in three materials when compared to the Resection Device included in the *de novo*. Rather than repeating the tests, the sponsor provided a risk-based assessment of the biocompatibility of these materials, including supporting data and test results of the raw materials. The information provided was sufficient to address the biocompatibility of the materials.

SHELF LIFE/STERILITY

The IOGYN Resecting Device and the IOGYN Fluid Management Accessories are supplied sterile, as single use only components to the system. The IOGYN Controller unit is a non-sterile component and is to be cleaned according to the Instructions after each use.

The device components provided sterile are not intended for reuse or re-sterilization by the user. The radiation sterilization process was validated in accordance with method VDmax outlined in ANSI/AAMI/ISO 11137-2:2006 and AAMI TIR33:2005. The VDmax validation substantiates that the specified minimum sterilization dose will provide a Sterility Assurance Level (SAL) of 10^{-6} . A sterilization validation was completed for the IOGYN Resecting Device and IOGYN Fluid Management Accessories. Results were evaluated against the criteria outlined in ANSI/AAMI/ISO 11137-2, AAMI TIR 33.

Shelf life validation for the disposables (IOGYN Fluid Management Accessories and IOGYN Resection Device) includes the following:

- Visual inspection testing of the device and packaging per ASTM F1886/F1886M-09
- Dye penetration sterile barrier testing of the device per ASTM F1929-12
- Seal peel strength testing of the pouch seals per ASTM F88/F88M-09
- Device performance testing including the following:
 - verification of RF connector on Resection Device cable and quick connect on aspiration tube to Resection Device handle
 - vapor formation on cutting electrode when CUT pedal depressed
 - bubble formation on cutting electrode when COAG pedal depressed
 - target number of oscillations of inner tube is reached (b)(4) Trade Secret/CCI
 - pressure sensor reading achieves target specification (b)(4) Trade Secret/CCI
 - Resecting Device resects and aspirates tissue without clogging
 - visual discoloration noted on tissue model when Resecting Device is in COAG mode (b)(4) Trade Secret/CCI

Samples of the resection device (n=30) and the fluid management accessories (n=30) were tested at baseline following storage, shipping and handling and following real-time aging for 7 months.

Packaging integrity was assessed with peel strength (n=10) and dye penetration (n=10) testing. Ten samples were evaluated for device functionality as described above. The tested samples met the acceptance criteria.

The information provided was sufficient to support a 7 month labeled shelf-life.

ELECTROMAGNETIC COMPATIBILITY AND ELECTRICAL SAFETY

As summarized in Table 1, test reports and labeling provided demonstrate the device's compliance with the following standards:

- IEC 60601-1:1988+A1:1991+A2:1995: Medical electrical equipment - Part 1: General requirements for safety
- IEC 60601-2-2:2006: Medical electrical equipment - Part 2-2: Particular requirements for the basic safety and essential performance of high frequency surgical equipment and high frequency surgical accessories
- IEC 60601-1-2:2001+A1:2004: Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility – Requirements and tests

Table 1- Electromagnetic Compatibility (EMC)/Electrical Safety

System EMC and Electrical Safety Testing		
Test	Description	Results
Electrical Safety Testing	To evaluate compliance with electrical safety requirements per IEC 60601-1:1998 +A1:1991 + A2:1995 (2 nd ed.), UL 60601-1, CSA C22.2 No 601.1, and EN 60601-1	Pass
System Electromagnetic Compatibility	To evaluate the compliance with the emissions and immunity requirements to IEC 60601-1-2:2001 + A1:2004 and IEC 60601-2-2:2006	Pass
• Radiated Emissions	To evaluate compliance with CISPR 11, Section 5, Table 3	Pass
• Conducted Voltage	To evaluate compliance with CISPR 11, Section 5, Table 2A	Pass
• Current Harmonics	To evaluate compliance to IEC 61000-3-2	Pass
• Voltage Fluctuations	To evaluate compliance to IEC 61000-3-3	Pass
• Electrostatic Discharge	To evaluate compliance to IEC 61000-4-2	Pass
• Radiated Immunity	To evaluate compliance to IEC 61000-4-3	Pass
• Electrical Fast Transient/Burst	To evaluate compliance to IEC 61000-4-4	Pass
• Surge	To evaluate compliance to IEC 61000-4-5	Pass
• Conducted Immunity	To evaluate compliance to IEC 61000-4-6	Pass
• Power Frequency Magnetic Immunity	To evaluate compliance to IEC 61000-4-8	Pass
• Voltage Dips and Interrupts	To evaluate compliance to IEC 61000-4-11	Pass

Devices met the EMC requirements when tested in both the active and standby modes. The sponsor adequately identified the essential performance, test procedures, and pass/fail criteria and included appropriate EMC information as part of the labeling. Although the standards referenced are prior versions of recognized consensus standards, a rationale to support utilization of these earlier versions of these standards was provided and appropriate.

MAGNETIC RESONANCE (MR) COMPATIBILITY

The IOGYN System is identified as MR Unsafe. As such, the device labeling includes a contraindication against use of the device in a MR environment.

The IOGYN System contains a large amount of metal components. Therefore it is MRI unsafe. Do not use the IOGYN System in conjunction with MRI, CT or RFID.

SOFTWARE

The software for the IOGYN system consisted of proprietary software. Closed loop hysteroscopic insufflators with cutting-coagulation are considered to present a 'MAJOR' level of concern (LOC) because a malfunction of, or a latent design flaw in the software device could, if relied upon, lead to death or serious patient injury.

All the elements of software information corresponding to 'MAJOR' LOC devices as outlined in FDA's *Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices* (May 11, 2005) has been provided. The sponsor provided adequate documentation describing the software development program. In addition, the sponsor provided documentation that they performed a hazard analysis. The key hazards that are associated with hysteroscopic insufflators include fluid overload, overpressurization and air/gas embolism. These hazards have been adequately mitigated through software, hardware and labeling. The verification and validation testing documentation provided an acceptable description of the validation and verification activities at the unit, integration and system level(s), which included system level test protocols, including the pass/fail criteria, and the results of these activities. Overall, the software documentation included in the *de novo* request is in sufficient detail to provide reasonable assurance that the software performs as intended and all software-related risks have been adequately mitigated.

PERFORMANCE TESTING – BENCH

Tables 2 and 3 provide a summary of the bench testing conducted on the IOGYN system.

Table 2- Summary of Mechanical Testing

Mechanical Testing- conducted on 10 samples following simulated use and corrosion exposure		
Name	Description	Results
Resecting Device (RD) Shaft Compression Test	RD shaft must resist buckling under the specified compressive force.	Pass
RD Shaft Tensile Test	Tensile force necessary to pull the RD shaft out of the Resecting Device assembly must meet the device specification.	Pass
RD Cutting Window Bend Test	Bending force necessary to deflect the cutting window beyond the limit at which the RD can operate must meet the device specification.	Pass
RD Cable Tensile Test	Tensile force necessary to pull the device cable off of the RD handle must meet the device specification.	Pass
Fluid Management Accessory (FMA) Tubing to Connectors	Tensile force necessary to pull the FMA aspiration tube off of the RD handle attached by quick connects must meet the device	Pass

	specification.	
Temperature and Coagulation Testing	<p>To determine the maximum temperature generated by the Resecting Device during cut and coagulation modes and the coagulation depth generated by the Resecting Device during various time points.</p> <p>Ex vivo testing was conducted (b)(4) Trade Secret/CCI [redacted]. Each device was used only once to generate (b)(4) Trade Secret points with a coagulation duration of (b)(4) Trade Secret/CCI which is intended to represent a worse case clinical use. A target coagulation depth was pre-specified.</p>	Pass

Table 3- Summary of Performance Testing on the Fluid Management Components

Performance Testing – Fluid Management- Ten samples of FMA and RDs used during testing.		
Name	Description	Results
Maximum Aspiration Flow Rate – Diagnostic Mode	<p>Determine the maximum aspiration flow rate at various set pressures while the IOGYN Controller is monitoring and controlling pressure in <i>diagnostic</i> mode (i.e., no RD used).</p> <p>Testing is conducted in a (b)(4) Trade Secret/CCI [redacted] which includes the IOGYN System and IOGYN endoscope. Specification for flow rate was met.</p>	Pass
Maximum Aspiration Flow Rate – Resection Mode	<p>Determine maximum aspiration flow rate at various set pressures while the IOGYN Controller is monitoring and controlling cavity pressure in <i>resection</i> mode while a resection device <i>is</i> in place.</p> <p>Testing is conducted in a (b)(4) Trade Secret/CCI [redacted] hich includes the IOGYN System and IOGYN endoscope. Specification for flow rate was met.</p>	Pass
Maximum Infusion Flow Rate	<p>Determine the <i>absolute</i> maximum infusion flow rate in three different situations (cavity filling, during aspiration, during resection) by (b)(4) Trade Secret/CCI [redacted].</p> <p>Specification for flow rate was met.</p>	Pass
Maximum Vacuum	Determine the maximum level of vacuum the	Pass

Testing for Fluid Management System	<p>system can provide during cutting.</p> <p>The test set-up required that the aspiration tube quick connect (b)(4) Trade Secret/CCI and cut pedal is depressed.</p> <p>Specification for vacuum was met.</p>	
Pressure Control	<p>Determine the ability for the pressure sensor algorithm to control pressure at various pressure set points (30, 50, 100 and 125 mmHg). Actual pressure in cavity model is compared to set pressure on controller GUI under the following conditions:</p> <ul style="list-style-type: none"> • Diagnostic Mode: Static Pressure Control (aspiration and resection not active) • Diagnostic Mode Aspiration Pressure Control • Resection Mode: Static Pressure Control • Resection Mode: Aspiration Pressure Control • Resection Mode: Resection Pressure Control • Resection Mode: Coagulation Pressure Control <p>Test set-up included the IOGYN System and IOGYN endoscope in a uterine cavity model.</p> <p>Actual pressure should not exceed set pressure by (b)(4) Trade Secret/CCI for more than (b)(4) Trade Secret/CCI.</p>	Pass
Over Pressure Relief Testing	<p>Evaluate the overpressure relief mechanism of the IOGYN system in a condition in which the actual pressure exceeds the set pressure for the following conditions: diagnostic mode; resection mode; and coagulation mode.</p> <p>Test set-up included the IOGYN System and IOGYN endoscope in a uterine cavity model.</p> <p>Testing was performed at 4 set pressures, including 30, 50, 100, 125 mmHg.</p> <p>Pressure relief should activate within (b)(4) Trade Secret/CCI of overpressure condition.</p>	Pass
Relief Valve	<p>Evaluation of mechanical relief valve to ensure pressure is maintained (b)(4) Trade Sec mmHg.</p>	Pass
Backflow Valve	<p>Prevents fluid from Tissue Catch or Filter from</p>	Pass

	flowing retrograde through system. Testing evaluated the pressure at which the valve activates. This pressure should be (b)(4) Trade Secret/CCI .	
Dead Volume	Amount of saline remaining in 3L saline bag after system fully primed. Volume should be less than 2.5L.	Pass
Filtration Testing- Molecular Filter	Evaluation of the minimum amount of blood that can be captured by the filter and an evaluation of the operating pressure when holding the minimum amount of blood. Test set-up requires (b)(4) Trade Secret/CCI Filter is able to capture the minimum amount of blood specified while maintaining the target pressure.	Pass
Filtration Testing- Tissue Catch Container And Tissue Catch Container Capacity	Evaluate filtration ability and maximum tissue capacity of tissue catch. The filter bag was filled with (b)(4) Trade Secret/CCI contents were weighed. The specifications were met.	Pass
Durability Testing	Evaluate durability of the IOGYN System components. Devices were operated and tissue resected for over (b)(4) Trade Secret/CCI No device issues were noted during use and no rust/corrosion following testing was recorded.	Pass
Simulated Use Testing	Test set-up to simulate use included (b)(4) Trade Secret/CCI Tissue coagulation, cutting, aspiration and visualization were evaluated.	Pass
Usability Verification	To evaluate the ability of users to appropriately follow the IFU to setup the IOGYN System under simulated use conditions and to perform a procedure using a simulated uterine cavity.	Pass

SUMMARY OF CLINICAL INFORMATION

The firm evaluated the usability of the IOGYN System within the clinical testing as well as under simulated use conditions.

Clinical Testing

Three clinical studies were conducted using the IOGYN System outside the U.S. at six sites (Mexico, Hungary and Canada) between October 2012 and May 2013. A total of 36 subjects age 25 to 65 years with endometrial polyps and/or submucosal myomas were enrolled. Two were excluded at the time of the procedure due to the location and/or size of the myoma. Thirty four were treated. The primary endpoint was the ability to resect tissue with the IOGYN system. Follow-up was scheduled for 2-4 weeks post-procedure.

The results of tissue removal were expressed as a percentage. This information is included in Table 4. Note that subjects may have had multiple myomas, multiple polyps and/or a combination of myomas/polyps. Results are provided based on the percentage of polyp/myoma resected rather than per individual patient.

Table 4- Percentage of Pathology Removed

	0-49%	50-74%	75-100%
Myoma (n=19)	3	0	16
Polyp (n=29)	0	0	29

A single intraoperative adverse event occurred when visualization of the endometrial cavity was lost. Perforation was suspected, however this was ruled out during laparoscopy. The sponsor concluded that a large intramural myoma migrated into the visual field secondary to incision of the myoma capsule. Two postoperative adverse events (uterine cramping) were reported and resolved. Fluid deficit did not exceed 2500 mL in any case. The sponsor indicates that there were no serious adverse events or unanticipated adverse device effects. The histopathology examination of the removed tissue showed a consistent zone of thermal damage and sufficient tissue viability for post-operative histopathology evaluations.

There were a total of seven device malfunctions noted during the clinical use of the device: 4 noted malfunctions with the Resecting Device; 2 with the controller; and 1 with the Fluid Management Accessories. There were no adverse events or patient injuries associated with any of these malfunctions. A failure analysis was provided as well as a discussion of the corrective actions which were implemented. The clinical information provided is sufficient to reasonably support the safe and effective use of the IOGYN System.

LABELING

Labeling has been provided which includes package labels, instructions for use and a package insert. The prescription statement as required by 21 CFR 801.109(b) is included on all labels. The sponsor has also provided a copy of the physician training manual and video.

The sponsor intends to provide the IFU electronically. A Package Insert has been developed which provides the user with the website that contains the labeling. It also includes the indications, contraindications, warnings and precautions.

The IOGYN System Instructions for Use/Operator’s Manual incorporates all of the relevant contraindications, warnings and precautions for hysteroscopy and electrosurgery including warnings specific to fluid overload, over pressurization and air/gas emboli. In addition, the labeling includes the following warnings that are specific to the risks associated with the use of filtered distension fluid design:

WARNING: Testing of the IOGYN System has not been confirmed in patients with hemoglobinopathies (e.g., Sickle Cell Disease, Beta Thalassemia) and therefore, the possible effects are unknown.

WARNING: Hemolysis may occur during recirculation. If significant hemolysis occurs, this may result in electrolyte (e.g, increased serum potassium) changes or decrease in hemoglobin. Hemolysis may reveal red-tinged coloring of the recirculated fluid but may not be visually apparent. Therefore, assessment of serum electrolytes and hemoglobin level after completion of the procedure is recommended.

The labeling also includes the relevant MRI contraindications, warnings and precautions.

The IOGYN System Physician Training Manual is consistent with the IFU.

RISKS TO HEALTH

Table 5 below identifies the risks to health that may be associated with use of Closed loop Hysteroscopic Insufflators with Cutter-coagulator and the measures necessary to mitigate these risks.

Table 5 – Risk/Mitigation Measures

Identified Risk	Mitigation Measure
Adverse tissue reaction	Biocompatibility Labeling
Equipment malfunction leading to injury	Non-clinical Performance Testing Software Verification, Validation & Hazards Analysis Labeling Training
Recirculated fluid causes adverse tissue reaction	Biocompatibility Non-clinical Performance Testing
Fluid overload, embolism, perforation or other adverse events	Non-clinical Performance Testing Software Verification, Validation & Hazards Analysis Labeling

	Training
Infection	Sterility Shelf Life Testing Non-clinical Performance Testing
Electromagnetic interference/electrical safety issues	Electromagnetic Compatibility Testing Electrical Safety Testing Labeling
Operator error leading to patient injury	Labeling Training

SPECIAL CONTROLS:

In combination with the general controls of the Food, Drug & Cosmetic Act, the Closed Loop Hysteroscopic Insufflator with Cutter-coagulator is subject to the following special controls:

1. The patient-contacting components of the device must be demonstrated to be biocompatible.
2. Software validation, verification and hazard analysis must be provided.
3. Electrical equipment safety, including appropriate thermal and mechanical safety and electromagnetic compatibility (EMC) testing must be performed.
4. Device components that are labeled sterile must be validated to a sterility assurance level of 10^{-6} .
5. Shelf life testing that demonstrates the device packaging maintains sterility and the functionality of the device is maintained following simulated shipping and handling must be provided to support the proposed shelf life.
6. Non-clinical testing data must demonstrate the performance characteristics of the device. Detailed protocols and the test reports must be provided for each test.
 - a. The following tests must be performed for the resection portion of the device:
 - Mechanical testing to assess critical joint strength
 - Device electrode temperature testing
 - Coagulation depth testing
 - Simulated use testing
 - Device durability testing
 - b. The following tests must be performed for the fluid management portion of the device:
 - Mechanical testing to assess tensile strength of connections
 - Pressure testing that demonstrates the following parameters, including accuracy of the pressure displayed; appropriate detection and response to overpressure conditions; activation of a secondary overpressure relief valve at the maximum safe level; and all accessories within the fluid path meet the pressure requirements.
 - Fluid delivery volume testing that demonstrates that the maximum fluid volume delivered is below a predefined level.
 - Flow rate testing

- Simulated use testing
- Filtration testing
- Blood filtration capacity testing
- Tissue collection capacity testing
- Filtrate characterization and testing that demonstrates that the continuous reintroduction of filtrate into the uterus does not pose a safety risk.

7. Clinician labeling must include:

- Specific instructions and the clinical training needed for the safe use of the device.
- Appropriate warnings, precautions and information related to over pressurization.
- Appropriate EMC information
- An expiration date/shelf life

BENEFIT/RISK DETERMINATION

The risks of the IOGYN System are based on clinical and nonclinical laboratory studies. The risks associated with the use of the device include uterine perforation, fluid overload, embolism, infection and introduction of filtrate into that patient's circulation through venous sinuses.

The probable benefits of the IOGYN System are also based on clinical and nonclinical laboratory studies. The benefits of the device include an upper limit on the maximum volume of saline that may be absorbed by the patient due to the closed loop design of the distension fluid. This maximum is below the currently accepted clinical limits and therefore reduces the risk of fluid overload.

The IOGYN System also offers the benefit of an integrated fluid management and tissue resection device. This integration addresses visualization problems through the use of a controlled vacuum aspiration during active tissue cutting. The use of the bipolar resection device allows for coagulation and cutting which minimizes blood loss and reduces the risk of perforation from multiple device insertion/removals. It also allows for the use with saline which matches physiological sodium levels.

In conclusion, given the available information, the data support that for uterine distension and fluid management through the closed loop recirculation of filtered distension fluid during hysteroscopy and cutting and coagulation of uterine tissue using a bipolar resecting device, the probable benefits outweigh the probable risks for the IOGYN System. The device provides substantial benefits and the risks can be mitigated by the use of general and the identified special controls.

CONCLUSION

The *de novo* for the IOGYN System is granted and the device is classified under the following:

Product Code: PGT

Device Type: Closed Loop Hysteroscopic Insufflator with Cutter-coagulator Class: II
(Special Controls)

Regulation: 21 CFR 884.1710