Table of Contents

Explanation of Symbols on Product or Package Labeling  v
Indications for Use  1
MRI Conditions for Use  1
Therapy Overview  1
  Overview of the Manual  2
  Sales Package Contents  2
Implanted Component Descriptions  3
  IPG  3
  Leads  4
Contraindications  5
Adverse Effects  5
Warnings and Precautions  6
  Warnings  6
  Precautions  7
Storage and Handling  9
  IPG  9
  Leads  10
Physician Training  11
System Implant  11
  Implantable Components  11
  Procedure Overview  12
  Patient Preparation  12
  Surgical Materials  12
  Precautions for Handling Components  12
  Stimulation Lead Implant  13
  Securing the Stimulation Lead  16
  Forming the IPG Pocket  18
  Tunneling the Lead  18
  Respiratory Sensing Lead Implant  19
  Connecting the Leads and IPG  22
  Implanting the IPG  26
  System Test  27
  Completing the Implant Procedure  27
Postoperative Follow-up  28
Physician Instructions to Patient  29
Patient Registration  29
Therapy Activation  29
Explanation of Symbols on Product or Package Labeling

Refer to the appropriate product for symbols that apply.

- Open here
- Do not reuse
- Sterilized using ethylene-oxide gas
- Use by
- Serial number
- Temperature limitation
- Lead that inserts into SENSE (sensing) port of IPG
- Lead that inserts into STIM (stimulation) port of IPG
- Caution, consult accompanying documents
- Consult instructions for use
- Date of manufacture
- Manufacturer
- Reference number

The Inspire therapy system is Magnetic resonance (MR) conditional
The following is a trademark of Inspire Medical Systems, Inc.: Inspire®
Indications for Use

Inspire Upper Airway Stimulation (UAS) is used to treat a subset of patients with moderate to severe obstructive sleep apnea (OSA) (apnea-hypopnea index [AHI] of greater than or equal to 15 and less than or equal to 65). Inspire UAS is used in adult patients 22 years of age and older who have been confirmed to fail or cannot tolerate positive airway pressure (PAP) treatments (such as continuous positive airway pressure [CPAP] or bi-level positive airway pressure [BPAP] machines) and who do not have a complete concentric collapse at the soft palate level.

PAP failure is defined as an inability to eliminate OSA (AHI of greater than 15 despite PAP usage), and PAP intolerance is defined as:

1. Inability to use PAP (greater than 5 nights per week of usage; usage defined as greater than 4 hours of use per night), or
2. Unwillingness to use PAP (for example, a patient returns the PAP system after attempting to use it).

MRI Conditions for Use

The Inspire IV MR Conditional system consists of the Inspire IV model 3028 IPG, the Inspire stimulation lead model 4063 (45 cm) and the Inspire respiratory sensing lead model 4323 (45 cm). If certain criteria are met and the warnings and precautions provided by Inspire are followed, patients with an MR Conditional system are able to undergo an MRI scan. For details, refer to the “MRI Guidelines for Inspire UAS Therapy” manual at manuals.inspiresleep.com.

Therapy Overview

The implanted components of the Inspire therapy system consist of the Inspire implantable pulse generator (IPG) Model 3028, the stimulation lead model 4063, and the respiratory sensing lead model 4323 (Figure 1).
When therapy is on, the Inspire system detects the patient’s respiratory effort and maintains airway patency with mild stimulation of the hypoglossal nerve. Therapy settings are stored in the IPG and configured by the physician using an external programmer.

The patient uses their Inspire sleep remote to turn therapy on before they go to sleep and to turn therapy off when they wake up. The sleep remote also provides the ability to pause therapy and adjust stimulation amplitude within physician defined limits.

**Overview of the Manual**

This manual provides physicians with implant procedure and follow-up care information for the Inspire system. The manual includes instructions for handling, storing, and implanting the leads and IPG. Critical therapy information is provided for you to discuss with your patient, as well as instructions for follow-up care. The IPG and leads cannot be resterilized. Information on explanting the IPG and leads is included. This manual also explains how to register your patient's medical devices.

**Sales Package Contents**

The leads and IPG are provided in separate sterile packages.

**Inspire Implantable Pulse Generator (Model 3028)**

- Sterile Package Contents
  - One IPG
  - One torque limiting hex wrench (11 in-oz)
- Product Literature (patient manual, patient registration form, patient ID card, and electronic labeling insert)
Implanted Component Descriptions

The implanted components of the Inspire system consist of an IPG, a respiratory sensing lead, and a stimulation lead. All implanted Inspire system components are intended for single-use only.

**IPG**

The IPG (Figure 2) contains the battery and electronics that deliver Inspire therapy and store the therapy settings.

![Figure 2. IPG](image)

The IPG has two 3.2 mm low-profile connector ports (Figure 3), which are compatible with the connectors on the stimulation lead and the respiratory sensing lead. After inserting the lead connectors into the IPG connector ports, the lead connectors are secured using the set screws next to the connector ports.

![Figure 3. IPG connector ports](image)
Leads

The respiratory sensing lead (Figure 4) detects respiratory effort. The lead has a pressure-sensitive membrane that converts the mechanical energy of respiration into an electrical signal.

Figure 4. Respiratory sensing lead

The stimulation lead (Figure 5) delivers stimulation to the hypoglossal nerve. The lead has a flexible, self-sizing stimulation cuff. The stimulating electrodes are on the inner surface of the cuff.

Figure 5. Stimulation lead
Contraindications

Contraindications for the use of Inspire UAS therapy include the following:

- Central + mixed apneas > 25% of the total apnea–hypopnea index (AHI)
- Any anatomical finding that would compromise the performance of upper airway stimulation, such as the presence of complete concentric collapse of the soft palate
- Any condition or procedure that has compromised neurological control of the upper airway
- Patients who are unable or do not have the necessary assistance to operate the sleep remote
- Patients who are pregnant or plan to become pregnant. UAS therapy has not been evaluated for safety or efficacy during pregnancy.
- Patients with an implantable device that may be susceptible to unintended interaction with the Inspire system. Consult the device manufacturer to assess the possibility of interaction.
- Patients who require magnetic resonance imaging (MRI) other than what is specified in the MR Conditional labeling

Adverse Effects

Possible adverse effects include, but are not limited to, the following patient-related conditions:

- Damage to blood vessels in the vicinity of implant
- Excessive bleeding
- Nerve trauma or damage
- Allergic and/or rejection response to the implanted materials
- Infection
- Local irritation, seroma, hematoma, erosion, or swelling
- Persistent pain, numbness, or inflammation at the implant site
- Discomfort from the stimulation
- Tongue movement restrictions, irritation resulting from tongue abrasions on preexisting sharp or broken teeth
- Tongue soreness or weakness
- Problems with swallowing or speaking
- Tongue paresis and atrophy
- Undesirable change in stimulation over time, possibly related to tissue changes around the electrode(s), shifts in electrode position, loose electrical connections, or lead fractures
- Fibrosis to the extent that it makes it difficult to remove the system without damaging surrounding structures
- Dry mouth
- Other acute symptoms (i.e., headaches, coughing, choking, dysphasia, and speech-related events)
- Insomnia
Warnings and Precautions

Warnings

- **Training** — Physicians must be trained in the proper use and surgical procedure before implantation or operation of the device.

- **Pediatrics** — The safety of upper airway stimulation has not been evaluated in clinical studies for patients less than 22 years of age. There may be increased risk of nerve injury and stimulation-related adverse events in this population, particularly in younger children (e.g., less than 12 years of age).

- **Components** — The use of components not provided by Inspire Medical Systems may result in damaged components, improper operation, or increased risks to the patient.

- **Diathermy** — Do not use shortwave diathermy, microwave diathermy or therapeutic ultrasound diathermy (all now referred to as diathermy) on patients implanted with the Inspire system. Energy from diathermy can be transferred through the implanted system and can cause tissue damage at the location of the implanted electrodes, resulting in severe injury or death.

  Diathermy can also damage the implanted system components, resulting in loss of therapy and requiring additional surgery for system explantation and replacement. Advise your patient to inform all their health care professionals that they should not be exposed to diathermy treatment.

  Injury to the patient or damage to the device can occur during diathermy treatment when:

  - The generator is turned on or off
  - Diathermy is used anywhere on the body—not just at the location of the implanted Inspire system
  - Diathermy delivers heat or no heat
  - Any component of the Inspire system (leads or IPG) remains in the body

- **Magnetic resonance imaging (MRI)** — An MRI is a type of medical imaging that uses magnetic fields to create an internal view of the body. If certain criteria are met and the warnings and precautions provided by Inspire are followed, patients with an MR Conditional device are able to undergo an MRI scan. For details, refer to the “MRI Guidelines for Inspire UAS Therapy” manual at manuals.inspiresleep.com.

  Do not bring the sleep remote into the MRI environment. Bringing the remote into the MRI scanner room could cause damage to the remote and make it unable to function.

  The patient is only eligible for certain MRI scans. If the precautions provided by Inspire are not followed, exposure to MRI can damage your stimulator or leads, cause serious injury, or result in unintended stimulation.

- **Sleep remote use** — When operating their Inspire sleep remote, patients should use special care near flammable or explosive atmospheres. The consequences of using the battery-powered sleep remote near flammable or explosive atmospheres are unknown.

- **Body Mass Index (BMI)** — BMI greater than 32 was not studied as part of the pivotal trial. Based on data from the feasibility study, it may be associated with decreased likelihood of response to treatment. Use of Inspire UAS in higher BMI patients is not recommended due to unknown effectiveness and safety.
Precautions

General
- **Expiration date** — Do not use any Inspire system product after its expiration date.
- **Component handling** — Precautions related to component handling during the implant procedure are located on page 12.
- **Storage temperature ranges**
  - Do not expose the IPG to temperatures above 58°C (136°F) or below -35°C (-31°F).
  - Do not expose the leads to temperatures above 55°C (131°F) or below -10°C (14°F).

Electromagnetic compatibility and medical procedures
For information on MRI, reference "Warnings" on page 6 and the "MRI Guidelines for Inspire UAS Therapy" manual at manuals.inspiresleep.com
For information on diathermy, see "Warnings" on page 6.
The IPG is designed to ensure immunity from most common sources of electromagnetic disturbance. In most cases, turning off the electromagnetic disturbance source, or moving away from the electromagnetic disturbance source will return the IPG to normal operation. Extremely strong sources of electromagnetic disturbance could interfere with normal IPG operation, causing the IPG to reset and requiring the IPG to be reconfigured. To reduce the possibility of electromagnetic interference (EMI), patients are recommended to use therapy only while asleep.

Medical environment
Electrocautery, irradiation, lithotripsy, RF-ablation, X-ray, and fluoroscopy are typical electromagnetic disturbance sources in hospital and clinical environments. Medical treatments that use ultrasonics, defibrillation, or radiation can adversely affect the Inspire system.
- **Electrocautery** — Electrocautery tools used near or in contact with the stimulator or leads can cause tissue damage, uncomfortable stimulation, or damage to the generator. Bipolar electrocautery should be used if alternatives are not available. Unipolar electrocautery can be transmitted along the lead body and could cause nerve damage. If electrocautery must be used in the vicinity of the IPG, therapy should be turned off.
- **Radiation therapy** — The IPG should not be directly irradiated by therapeutic levels of ionizing radiation (such as produced by cobalt machines or linear accelerators used for cancer treatment) because of the risk of permanent damage to the IPG circuitry. If such therapy is required in the vicinity of the IPG, shield the device and confirm its function after treatment.
- **RF-ablation** — RF-ablation should not be used directly over the implant sites.
- **X-ray and fluoroscopy** — Exposure to diagnostic X-ray or fluoroscopic radiation should not affect the IPG or leads.
- **Therapeutic ultrasound** — Exposure to high ultrasonic frequencies may result in damage to the IPG or leads. It is not recommended to use high-output ultrasonic devices, such as an electrohydraulic lithotriptor or bone growth stimulator on patients with an implanted IPG.
• **Ultrasonic scanning** — While there is no danger to the patient, ultrasonic scanning equipment could cause mechanical damage to an IPG or leads if used directly over the implant sites.

• **Defibrillation** — Following defibrillation, confirm normal system operation.

**Home or work environment**

Based on laboratory tests of the IPG, the device should not be affected by the normal operation of electrical equipment, household appliances, electric machine shop tools, microwave ovens, internal combustion engines, low-powered radio, and microwave frequency transmitters. All such equipment should be kept in good repair and properly grounded to avoid the possibility of electrical shock or interference with the proper operation of the IPG.

Inspire therapy is intended for use during sleep only and should be turned off otherwise.

• **Equipment operation** — Patients should not operate potentially dangerous equipment, such as power tools, while therapy is on.

• **Theft detectors** — Theft detectors have been known to cause inadvertent and potentially uncomfortable stimulation in implanted stimulation systems. Patients should use care to avoid prolonged exposure to theft detectors and be aware in the presence of such systems.

• **High-powered electric fields** — Consult Inspire Medical Systems when the patient will be in an area where contact with current carrying conductors is possible or near high-powered electromagnetic fields radiated by arc welding units, induction furnaces, induction stoves, resistance welders, radio or microwave frequency transmitters, etc.

• **Mobile and cellular phones** — Maintain a separation of at least 15 cm (6 in) between a phone and the IPG.
Storage and Handling

Recommendations for storage and handling of the IPG and leads are provided in this section. Inspire Medical Systems sterilizes the IPG and leads with ethylene oxide (EtO) prior to shipment.

Information about precautions for handling components is located on page 12.

IPG

Inspect the IPG sterile package prior to opening. If the IPG package is damaged, the IPG may be damaged as well. Return a damaged package to Inspire Medical Systems; see the back cover of this manual for addresses.

The IPG box includes a sterilization indicator. This indicator is green after the device has been sterilized. **Do not use the IPG if the indicator is red.**

<table>
<thead>
<tr>
<th>Handling and Storage: Acceptable</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store and transport IPG within the following environmental temperature limits: -35°C (-31°F) to +58°C (+136°F). A full or partial electrical reset condition may occur at temperatures below -18°C (0°F).</td>
<td>Do not implant the IPG if it has been dropped on a hard surface from a height of 30 cm (12 in) or greater.</td>
</tr>
</tbody>
</table>

**Restериลization**

The IPG cannot be restерилиzed.

- IPGs cannot be restерилиzed. If the sterile package seal is broken, or if the packages are otherwise damaged, do not use.
- Return the package to your local Inspire Medical Systems representative, see back cover for address.
Leads

If the lead sterile package seal is broken or the package is otherwise damaged, return the package to Inspire Medical Systems. Leads cannot be resterilized.

Table 2. Lead Storage, Handling, and Resterilization

<table>
<thead>
<tr>
<th>Handling and Storage: Acceptable</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store and transport leads within the following environmental temperature limits: -10°C (14°F) to +55°C (131°F). Only use sterile-gloved hands to handle the lead; rinse sterile surgical gloves in sterile water before handling the lead. Protect leads from materials that shed lint and dust. Exercise care and appropriate instrument selection when handling the stimulation lead cuff with a surgical instrument.</td>
<td>Do not implant a lead that was dropped. Avoid excessive traction or sharp instruments. Avoid severe bending, kinking, stretching, or handling with surgical instruments. Do not immerse a lead in mineral oil or silicone oil.</td>
</tr>
</tbody>
</table>

Resterilization

Leads cannot be resterilized.

- If the sterile package seal is broken, or if the packages are otherwise damaged, do not use.
- Return the package to Inspire Medical Systems; see the back cover of this manual for addresses.
Physician Training

Prior to implanting an Inspire system, surgeons will receive classroom instruction on Inspire implant techniques as well as cadaver training. Sleep physicians and sleep technicians will receive classroom instruction on how to titrate the device including hands-on operation of the programmer.

System Implant

This section describes a general implant procedure for the Inspire system.

Implantable Components

The Inspire system includes the following implantable components:

- Inspire implantable pulse generator (Model 3028)
- Inspire respiratory sensing lead (Model 4323)
- Inspire stimulation lead (Model 4063)

The IPG has two lead connector ports (Figure 6). The connector port for the respiratory sensing lead is marked \textbf{SENSE}. The connector port for the stimulation lead is marked \textbf{STIM}.

![Image of IPG and connector ports](image-url)

\textit{Figure 6. IPG and connector ports}
Procedure Overview

The implant procedure begins with preoperative planning. It is recommended that the stimulation lead be the first Inspire component to be implanted. Secondly, a subcutaneous pocket is created for the IPG. The connector end of the leads will be tunneled to this pocket. After the stimulation lead is implanted, the respiratory sensing lead is implanted. After tunneling the connector end of the leads to the IPG pocket, the leads are connected to the IPG and the IPG is secured in the subcutaneous pocket.

Patient Preparation

• Ensure the tongue is visible during the surgical procedure in order to observe the response to intraoperative test stimulation.
• The recommended body side for system implantation is the right side.
• Elevate the patient’s right thorax and loosely tuck the patient’s right arm to allow suitable approach for sensor implantation. If other active implanted devices are present, plan incision and tunneling locations to keep the Inspire system at least 15cm (6 inches) away from the other devices.
• The patient’s head and neck should be positioned to provide optimal access to the hypoglossal nerve.
• Iodine-impregnated adhesive drape over entire surgical area is recommended.
• Use only short-acting paralytic agent to preserve tongue response.
• A nerve monitoring system is recommended to locate the hypoglossal nerve and confirm nerve recruitment.
• The patient should be given antibiotics preoperatively as well as postoperatively.

Surgical Materials

An Inspire system implant requires typical surgical equipment used during neck surgeries. The following is a list of additional materials typically used during the system implant procedure:
• Sterile sleeve, bag or equivalent (to bring the telemetry cable into the sterile field)
• Right angled forceps or hemostat (for cuff electrode placement)
• A nerve monitoring and stimulation system (to locate the hypoglossal nerve and confirm nerve recruitment)

Precautions for Handling Components

• The implanted components of this system should be carefully handled to avoid damage by excessive traction or sharp instruments. Any component showing signs of damage should not be used.
Caution: No instrument of any type should touch the sensor membrane, the flat recessed surface near the tip of the respiratory sensing lead. Touching the sensor membrane may result in damage to the sensor. When handling the sensor, grip the device on the tapered titanium section adjacent to the lead body. Handle the sensor gently. Excessive force can cause deformation or damage to the insulation.

Do not handle the lead body with instruments, instead grip the lead at the anchors. When suturing the sensor lead in place, do not tie directly on the lead body and do not damage the insulation.

Figure 7. Sensor membrane

- IPG drop — If the IPG is dropped more than 30 cm (12 in) onto a hard surface, it should not be used.
- Setscrew cautions — Counterclockwise rotation of a set screw beyond one or two revolutions while retracting it from the connector port may disengage the set screw from the connector block. Do not use any hex wrench other than the one packaged with the IPG.
- Set Screw Seals — Use care when inserting the hex wrench to avoid damage to the seals.
- Leads should be handled with great care at all times. Any severe bending, kinking, stretching, or handling with surgical instruments may cause permanent damage to the lead body or the cuff. Do not implant a lead that has been dropped.
- Leads attract small particles, such as lint and dust; to minimize contamination, protect the lead from materials shedding these substances. Handle the lead with sterile surgical gloves that have been rinsed in sterile water.
- Do not immerse leads in mineral oil or silicone oil.

**Stimulation Lead Implant**

The stimulation lead is designed with a cuff that is placed around the hypoglossal nerve after the nerve is exposed.

The following is an overview of the recommended process for implanting the stimulation lead:

- Expose the hypoglossal nerve (see “Exposing the hypoglossal nerve” below).
- Place the cuff around the nerve and irrigate the cuff and nerve with sterile saline.
- Test the electrode placement using the IPG or an external nerve stimulator.
- Secure the stimulation lead anchor to the digastric muscle or tendon with permanent sutures.
- Form the IPG pocket and tunnel the lead connector to the pocket.
Exposing the hypoglossal nerve
1. Make a 4–6 cm (1.6–2.5 in) incision midline between the hyoid and mandible.
2. Retract the submandibular gland posterosuperior and the mylohyoid anteriorly.
3. Ligate and divide segment of vena comitans to expose distal hypoglossal neuroanatomy in a segment of 1.5 - 2.0 cm.
4. Once the nerve is identified, it may be stimulated at a low setting (typically 0.2 - 0.5 mA) using an external nerve stimulator to confirm nerve function. Do not over stimulate the nerve with the external device.

⚠️ Cautions:
- Do not apply tension to the nerve and supporting tissue while exposing the nerve and placing the cuff.
- Preserve the small nutrient blood vessels along the nerve fibers.
- Maintain hemostasis. Fluid residuals increase the chances of hematoma formation and infection.

Placing the stimulation lead
To place the stimulation lead cuff, the cuff’s short inner and long outer flaps (Figure 8) are wrapped around the hypoglossal nerve.

![Figure 8. Stimulation lead cuff flaps](image)
Refer to Figure 9 while completing cuff placement steps 1 through 4.

1. Using a right-angled forceps positioned under the nerve, grasp the long outer flap.

   Caution: Do not force the cuff into position. Be sure that a sufficient opening has been cleared. Forcing the cuff into position may result in nerve damage.

2. Carefully bring the outer flap underneath and around the nerve and then unfurl so it lies flat.

3. Ensure the short flap covers the nerve, then release the outer flap to close around the inner flap.

   Cautions:
   - Be sure that the cuff flaps are properly placed.
   - Do not suture the cuff around the nerve. The cuff is designed to expand and contract with the nerve. Suturing the cuff in place may result in nerve damage.

4. Ensure all target nerve branches are enclosed within both flaps, and without undue tension or filmy adhesions interfering with flap closure and settling.

5. Irrigate between the nerve and cuff (e.g. use 18 - 20 gauge Angiocloth) with sterile saline to facilitate adequate electrical contact between the electrodes and the nerve.

   Figure 9. Placing the cuff around the hypoglossal nerve
Securing the Stimulation Lead

The stimulation lead is anchored to the tissues surrounding the hypoglossal nerve. The suggested method for anchoring the lead body is to anchor it to the digastric tendon using permanent sutures (Figure 10).

1. Position the cuff and stimulation lead:
   • Maintain the cuff and stimulation lead body parallel to the nerve to avoid placing torque or tension on the nerve.
   • It is recommended that the spine of the cuff is positioned inferior to the nerve.

2. Secure the stimulation lead with adequate strain relief by creating a lead loop in between the stimulation lead cuff and the anchoring site (e.g. digastric tendon or muscle).

3. Using both anchor recesses, tie permanent sutures to the anchor, then secure the anchor to the digastric tendon or muscle using the sutures.

4. It is recommended that the physician not close the neck incision until all system components are implanted and tested. Consider gently packing the neck incision with 4x4 gauze soaked in a saline/antibiotic solution. Remove such packing with care prior to closing the incision so as not to dislodge or disrupt the cuff placement.

Cautions:
- Make sure that the anchor points are located in tissue that moves with the hypoglossal nerve.
- Do not loop the lead such that the lead body crosses and touches itself. Crossing the lead bodies can result in fibrosis at the intersection point and reduce the strain relief provided by the lead body.
- Place sutures only around the lead anchor.
- Surgical instruments should not be used to handle the lead body directly. The lead and lead insulation is easily damaged. Care should be used when handling the lead. Surgical instruments may be used for handling the lead anchor.
Figure 10. Anchoring the stimulation lead

- Lead anchor (attached to digastric tendon)
- Hypoglossal nerve
- Digastric tendon
- Strain relief loop
- Cuff
- Lead passes under digastric tendon and does not touch itself when crossing
Forming the IPG Pocket

When selecting the location for the IPG pocket, consider patient lifestyle factors, such as the use of firearms, carrying backpacks, and other work or recreation-related activities. The following instructions reflect the typical IPG pocket location.

1. Make a 5–6 cm (1.9–2.4 in) incision mid-line 4–5 cm (1.6–2.0 in) below the right clavicle, taking precautions to ensure that the patient’s typical arm movements with activities of daily living will not cause the IPG to ride up onto the clavicle.

2. Make a subcutaneous pocket of sufficient size to contain the IPG and any excess lead wrap, which can typically be expected. The pocket should be created no deeper than 2.5 cm (1.0 inch) below the skin to allow for reliable communication between the IPG and external devices.

3. Place two anchoring sutures, permanent braided 2.0 silk or equivalent, in the medial-most pectoralis major fascia and 1.0 — 1.5 cm lateral of the first, forming a V-shaped sling for securing the IPG’s rear anchor point.

Tunneling the Lead

These instructions apply to both the stimulation lead and the respiratory sensing lead. Use the tunneling tool to pass the lead connector from the point of lead implantation to the subcutaneous pocket, avoiding sharp angle bends of the lead body.

1. Locate the sterile tunneling tool (Figure 11) provided with the stimulation lead packaging.
   • Prior to assembly, the rod may be bent into a bow shape to aide tunneling. Generally, it is better to make multiple gentle bends than a single sharp bend.
   • The tool is assembled by threading the tip and the collet assembly to the stainless steel rod. Attach the tip first and the collet only after the tunnel is established.

2. Simulate the final positioning by identifying where the lead connector will exit the eventual tunnel.

3. Subcutaneously advance the tunneling tool from the lead incision to the IPG until the tip is exposed in the IPG pocket. Complete the tunnel before attaching the collet.

Figure 11. Tunneling tool components
4. For the respiratory sensing lead, remove the shorting bar from the connector; for the stimulation lead, proceed to step 5.

5. Insert the lead connector into the tunneling tool collet as follows:
   a. Slide the collet sleeve down toward the tunneling tool tip to allow the lead connector to be inserted into the collet.
   b. Insert the pin of the lead connector into the collet of the tunneling tool (Figure 12 A)
   c. Slide the sleeve over the collet to lock the connector pin in place (Figure 12 B).
   d. It is not necessary to exert excessive force to secure the sleeve over the collet.

![Figure 12. Inserting lead connector into tunneling tool collet](image.png)

6. Gently pull the lead out through the exit site in the IPG pocket.
   
   ![Caution: Be sure the lead is routed so as to avoid sharp bends or kinks in the lead body.](image.png)

7. Remove the lead from the tunneling tool by sliding back the sleeve from the collet.
   
   ![Caution: Leave a small amount of excess lead length at both sides of the subcutaneous tunnel so that normal body motions do not stretch the leads' body. The patient may be able to feel this stretching and it may cause damage to the lead.](image.png)

---

**Respiratory Sensing Lead Implant**

**Cautions:**

- Do not touch the recessed sensing membrane of the sensor with surgical tools as this will damage the sensor.
- Do not touch the lead body with surgical tools, as this may damage the lead.
- Handle the lead at the anchor or proximal tapered portion of the sensor housing.
The respiratory sensing lead is placed between the intercostal muscle layers in the extrapleural space (Figure 13). The potential complications can be avoided by positioning the incision as outlined in the following steps:

1. Using the inferolateral margin of the pectoralis major as the main landmark, select the target intercostal space immediately at or superior to this margin. Make a 4–6 cm (1.6–2.4 in) incision starting near the mid-axillary line, parallel to the ribs, and toward midline on the right side of the chest.
   
   **Note:** The respiratory sensing lead will be tunneled approximately 3–5 cm (1–2 in) in length between the intercostal muscle layers, and therefore the incision should be approximately 3–5 cm (1–2 in) from the desired sensor location. The desired sensor location is in line with the nipple.

   **Note:** A neurovascular bundle is located inferior to each rib. Therefore, implantation of the sensor should be as close as possible to the superior surface of the inferior rib within the target space.

2. Use sharp and blunt dissection to expose the intercostal muscle layers.

*Figure 13. Respiratory sensing lead extrapleural placement*
• Dissection is required to reach and identify the internal intercostal muscle.
• The sensor will be inserted between the internal intercostal muscle and the external intercostal muscle layers.

**Note:** Enter the intercostal space toward the medial side of the incision in order to provide lateral space for lead anchoring within the incision.

3. Create a 6cm tunnel between the internal and external intercostal muscle layers with the use of a narrow malleable retractor or other similar tool.

4. Insert the tip of the respiratory sensing lead between the internal and external intercostal muscle layers at a shallow angle along the superior edge of the inferior rib forming the intercostal space.

5. Insert approximately 3–5 cm (1–2 in) of the length of the distal lead between the internal and external intercostal muscle layers.
   • The sensor membrane (flat surface) is required to face toward the pleura.
   • Raised ridges on the distal anchor are to face up, which confirms that the sensor membrane is facing toward the thoracic cavity.

6. Secure the respiratory sensing lead with permanent sutures using the two winglet features and two grooves on the anchors.
   • Ensure that the sensor membrane orientation is maintained during suturing of the anchors.

**Note:** The distal anchor is adhered to the lead body, and the second anchor may be slid along the lead body to the desired position. If the second anchor does not slide, use saline to moisten the lead body, which may improve the ability to slide the anchor. Position the sliding anchor to direct the lead toward the IPG pocket. Leave about 8 cm of excess lead length between the two anchors to allow the anchors to move with the body without placing tension on the lead. The excess lead should form an omega shape between the two lead anchors. Make the omega-shaped strain relief as generous as possible, bluntly dissecting laterally from the incision site to allow the strain relief segment to lie deep to the subcutaneous fat.

7. Suture the movable anchor into place on robust tissues, such as the fascia of inferolateral pectoralis major.

8. Check that the lead body exiting the intercostal muscles transitions smoothly before tunneling to the IPG pocket, forming the recommended omega-shaped strain relief between the two anchors.

**Caution:** Do not loop the lead such that the lead body crosses and touches itself. Crossing the lead bodies can result in fibrosis at the intersection point and reduce strain relief in the lead body.

9. Tunnel the connector end of the respiratory sensing lead to the IPG pocket using the tunneling tool. Refer to "Tunneling the Lead" on page 18 for instructions.
Connecting the Leads and IPG

**Caution:** Saline or bodily fluids in the IPG connector may reduce battery longevity.
- Do not allow saline or bodily fluids to enter the IPG connector ports.
- Confirm that lead connectors are dry prior to inserting them into the IPG ports.
- Use care when inserting the hex wrench to avoid damaging the seals.
- Confirm that setscrew seals fully close after securing the lead in place.

1. Wipe off any body fluids from the respiratory sensing lead connector.
2. Grasping the lead approximately 3 cm (1.2 in) from the connector end, insert the lead connector into the IPG connector port marked **SENSE** (Figure 14).
   - Make sure the lead connector is fully inserted into the IPG connector port by verifying that the lead connector pin is visible past the set screw block.
   - If the lead tip is hard to visualize, verify the large seals on the lead are past the insertion indicator on the connector block.

![Figure 14. Insert the respiratory sensing lead connector into IPG connector port marked SENSE.](image)

3. Use the white-handled torque limiting hex wrench provided with the IPG to tightened the set screw on the **SENSE** port. Tighten until resistance is felt, and then continue until audible clicking is heard from the wrench. After the set screw is tightened, pull firmly on the lead.
strain relief section immediately adjacent to the IPG – NOT the lead body – to confirm that the set screw has secured the lead in place. Verify the lead tip is visible past the set screw connector block. After removing the hex wrench, confirm the seal covering the set screw is fully closed and undamaged.

Figure 15. Tighten the lower setscrew
Connect the stimulation lead to the IPG

1. Wipe off any body fluids from the stimulation lead connector.

2. Grasping the lead approximately 3 cm (1.2 in) from the connector end, insert the lead connector into the IPG connector port marked STIM (Figure 16).
   • Make sure the lead connector is fully inserted into the IPG connector port by verifying that the lead connector pin is visible past the set screw block.
   • If the lead tip is hard to visualize, verify the large seals on the lead are past the insertion indicator on the connector block.

3. Use the white-handled torque limiting hex wrench to tighten the set screw on the STIM port. Tighten until resistance is felt, and then continue until audible clicking is heard from the wrench. After the set screw is tightened, pull firmly on the lead strain relief segment immediately adjacent to the IPG — NOT the lead body — to confirm that the set screw has secured the lead in place. Verify the lead tip is visible past the set screw connector block. After removing the hex wrench, confirm the seal covering the setscrew is fully closed and undamaged.

Figure 16. Insert stimulation lead connector into IPG connector port marked STIM

2 Seal Rings

Insertion indicator on header
Figure 17. Tighten the upper setscrew
Implanting the IPG

When implanting the IPG, consider patient lifestyle factors, such as the use of firearms, carrying backpacks, and other work or recreation-related activities.

1. Wrap the excess lead body behind the IPG (Figure 18) and position the IPG and wrapped excess lead body in the pocket. Implant the IPG with the logo facing up toward the skin.

**Figure 18. Wrap excess lead length**

<table>
<thead>
<tr>
<th>Caution: When placing the IPG and leads into the subcutaneous pocket:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do not coil the leads. Coiling the leads (Figure 19) can twist the lead bodies and may result in lead dislodgement.</td>
</tr>
<tr>
<td>• Do not grip the leads or IPG with surgical instruments.</td>
</tr>
<tr>
<td>• Do not place the leads under tension. Ensure there is a small amount of excess lead length in each pocket to prevent body motions from stretching the leads.</td>
</tr>
<tr>
<td>• Ensure that the IPG logo is facing up toward the skin.</td>
</tr>
</tbody>
</table>

**Figure 19. Do not coil excess lead length**
System Test
Perform intraoperative testing prior to closing to confirm proper lead placement and lead-IPG connections.
1. Test the stimulation function as follows:
   • Place the telemetry cable into a sterile sleeve and hold the telemetry head centered over the IPG.
   • Test stimulation thresholds using the Inspire programmer Record Thresholds screen (see the programming manual for instructions). It is recommended to start at 0.5 volts and increase stimulation in 0.2 volt increments. Conduct intraoperative test stimulation while observing the tongue and neck area for signs of patient muscle response to stimulation.
   • Verify that bipolar stimulation gives the appropriate response.
   • Reposition the stimulation lead cuff if necessary. During and after repositioning of the cuff, apply saline to the cuff to facilitate electrical contact of the cuff electrodes with the nerve. Continue to reposition the cuff if a stimulation response does not occur.
   • Record the functional threshold using the Inspire programmer.
2. Test the sensor function as follows:
   • Start waveform from the Adjust Sensing screen.
   • Verify sensor function by observing the sensor waveform using the programmer. Gently and firmly tap on the patient's chest directly over the location of the sensor membrane. Confirm that these taps are clearly visible on the displayed sensor waveform.
   • Once sensor function has been verified, turn the therapy off.
3. Following the system functional check, verify that the therapy is off and the stimulation amplitude is programmed to 0 volts. It is recommended to keep the therapy off for the first month after the implant surgery to allow for healing and encapsulation of the stimulation lead.
4. If it is necessary to disconnect a lead from the IPG, use care to insert the torque limiting wrench through the set screw seals. Carefully disconnect the stimulation lead connector from the IPG.

Cautions:
• Use care to not loosen the IPG set screws too far, which can result in the set screws unseating from the connector.

Completing the Implant Procedure
After testing, complete the implant procedure:
1. Secure both permanent sutures through one of the IPG suture holes, forming a V-shaped sling. Place a clamp or other tool within loose loops as the knots are secured for each so that there is a tight knot forming a loose loop that will not cause undue tension on the anchoring sutures that could cause patient pain or lead to the anchoring sutures tearing loose from their underlying anchor points.
2. Irrigate all incision sites with a generous amount of bacitracin and saline solution or equivalent before closing.
3. Close the surgical incisions.
4. At the discretion of the physician, antibiotics may also be administered postoperatively.
5. Take at least one anterior-posterior and one lateral x-ray to document the location of all system components. Both head/neck and chest x-rays may be needed to fully capture the implanted system.
6. Place pressure dressings on all three incision sites (e.g. fluffs with Hypafix™ or Medipore™).

Postoperative Follow-up

Follow up with normal postoperative care. A 7–14 day check of surgical incision healing is recommended.

To allow for healing after surgery, the system should not be activated for about 1 month following implant. Refer to the Inspire programmer manual for additional information.

Regular patient follow-up should be scheduled to monitor system status and therapy effectiveness.
Physician Instructions to Patient

Give the patient information concerning the Inspire system. This should include information on the IPG, the sleep remote, the stimulation lead, and the respiratory sensing lead.

Patients should be instructed as follows:

- It is normal to feel some discomfort from the incisions and to have some pain at the implant sites for 2–6 weeks.
- It is best to avoid bending, twisting, and large arm movements for several weeks after the implant procedure, as such movements could impair the healing process. This time period allows the leads and IPG to fix themselves more securely in place.
- Avoid physical activities that could damage the implant site or implanted device.
- Inform personal physicians, consulting physicians, or dentists that they have an implanted stimulation system.
- Carry their Inspire Medical Systems ID card at all times.

The “Precautions” section on page 7, which includes information about cellular phones and electromagnetic interference in the home or work environment, should also be conveyed to the patient.

Patient Registration

The implanted components of the Inspire system (IPG and leads) are subject to the Food and Drug Administration’s Medical Device Tracking Requirements (21 CFR 821). A device registration form must be completed by the implanting (or explanting) clinician and returned to Inspire Medical Systems. The information provided on this form is required for Inspire to meet government obligations for device tracking, product safety, effectiveness, performance and government event reporting and is a public health disclosure under Section 164.512(b)(1)(iii).

Therapy Activation

Inspire therapy should be activated approximately 4 weeks after the implant procedure to allow for healing.

Therapy Titration

At least one sleep study will be needed approximately 4–8 weeks after therapy activation to titrate stimulation settings. Additional titration sleep studies may be needed to improve therapy effectiveness and patient comfort.
Surgical Revision and Explant

Lead Repositioning
• If the stimulation or respiratory sensing lead becomes displaced, any repositioning should be attempted as soon as possible, before scar tissue builds up.
• If the lead must be repositioned (or removed) proceed with caution to avoid damage to surrounding tissue.
• Extreme forces used during removal can damage leads or result in dismantling of the leads.
• If removal is unavoidable, return the removed lead, or portion thereof, to Inspire Medical Systems.

System or IPG Explant
• Extreme forces used during removal can damage the lead or result in dismantling of the lead.
• A lead that has been cut off should have the remaining lead end sealed. If the leads are left in place, the proximal connector ends of the leads should be capped to minimize tissue irritation and induced currents.
• Lead removal may not be possible due to the risk of damaging surrounding structures. The decision to remove the leads or leave them in place is made between the physician and the patient on a case by case basis. The implications of both options should be discussed, for example:
  – Removing the leads will extend the duration of the surgical procedure, require two additional incisions, and require the dissection of fibrotic tissue that may have formed around the leads.
  – A partially explanted system is MR Unsafe, which will prevent the patient from receiving an MRI. Furthermore, patients must be made aware that they need to notify medical personnel that they still have implanted leads even if the IPG has been removed and the lead ends have been capped.
• Return all explanted components to Inspire Medical Systems for disposal.

Explant Disposition
When replacing an IPG, (due to battery depletion or explanting the IPG at the death of a patient who is to be cremated) return the IPG to Inspire Medical Systems for analysis and disposal. See the back cover of this manual for mailing address.
Clinical Summary

Stimulation Therapy for Apnea Reduction (STAR) Clinical Trial

The Inspire Upper Airway Stimulation (UAS) system was evaluated in a multi-center trial at study centers in the United States and Europe for the indication of moderate to severe obstructive sleep apnea (OSA) in patients who were not effectively treated by continuous positive airway pressure (CPAP).

Patients Studied

The study enrolled 929 OSA patients. These patients were evaluated against patient selection criteria that included moderate to severe OSA, a BMI (body mass index) less than or equal to 32, and the absence of a complete concentric collapse at the level of the soft palate. Following the evaluation period, 126 patients met all selection criteria and proceeded to implant. All 126 implant procedures were successful, and 124 of the 126 implanted patients provided evaluable data through at least 12 months. The STAR trial was an intent to treat study. Therefore, the 2 patients who did not provide evaluable data through 12 and 18 months post-implant are assumed to be non-responders and were included in the evaluation as such. The patient demographics for the STAR trial are included in Table 3. The patients' baseline AHI showed a mean of 32.0 and a median of 29.3, and the baseline ODI showed a mean of 28.9 and a median of 25.4.

<table>
<thead>
<tr>
<th>Table 3. STAR Trial Subject Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Measures</td>
</tr>
<tr>
<td>Age, year</td>
</tr>
<tr>
<td>Body Mass Index, kg/m2</td>
</tr>
<tr>
<td>Neck Size, cm</td>
</tr>
<tr>
<td>Systolic BP, mmHg</td>
</tr>
<tr>
<td>Diastolic BP, mmHg</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Race</td>
</tr>
<tr>
<td>Caucasian</td>
</tr>
<tr>
<td>African American</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Others*</td>
</tr>
</tbody>
</table>
Study Design and Methods
The STAR trial was a multi-center, prospective trial with a 12-month single arm study and a randomized controlled therapy withdrawal study at 13 months. Following implant of the Inspire system, patients were followed at 1, 2, 3, 6, 9, 12, 13, 15, 18 months, and every 6 months thereafter. The patients’ baseline AHI and ODI (oxygen desaturation index) values were the mean results from their screening (pre-implant) and 1-month (post-implant but prior to therapy activation) sleep studies. Baseline results were compared to the 12-month results to determine the percentage of patients who experienced a clinically meaningful reduction in the severity of their OSA in terms of their AHI and ODI scores. For this study, a clinically meaningful reduction in AHI and ODI was defined as (1) a 50% reduction in the AHI compared to the pre-implant screening and 1-month visit (post-implant but prior to therapy activation) and an AHI < 20 events per hour, and (2) a 25% or greater reduction in ODI at the 12-month visit compared to baseline.

Upon completion of the overnight sleep study at the 12-month visit, a randomized controlled therapy withdrawal study was conducted. The first 46 responders were randomized 1:1 to either the therapy maintenance (ON) group or the therapy withdrawal (OFF) group, resulting in 23 subjects in each group. Patients randomized to the therapy withdrawal group had Inspire therapy turned OFF for at least five days. Patients randomized to the therapy maintenance group continued their use of the Inspire system. All randomized patients participated in a sleep study at the 13-month visit. The therapy withdrawal group had the sleep study performed with Inspire therapy OFF, and the therapy maintenance group had the sleep study performed with the Inspire therapy ON. The mean change of AHI for each arm was compared to determine the extent of treatment effect from Inspire therapy.

The percentage of sleep time a patient had an oxygen saturation (SaO2) level below 90% was recorded during the sleep studies, and two validated quality of life questionnaires were administered at follow-ups through 18 months. The quality of life questionnaire was the Epworth Sleepiness Scale (ESS), which rates a patient's daytime sleepiness, and the Functional Outcomes of Sleep Questionnaire (FOSQ), which assesses the effect of a patient's daytime sleepiness on activities of ordinary living. The hypotheses for the secondary efficacy endpoints, which included the randomized withdrawal study, FOSQ, ESS, and SaO2, were tested according to a hierarchical strategy in order to preserve an overall Type I error rate of 5%.
Study Results

Titration
All subjects underwent polysomnography (PSG) for titration of therapy settings at 2 and 6 months. Additional titration PSG studies were performed as needed. Through 18 months, patients had an average of 3.3 (range 2–6) titration studies.

Safety
Of the 126 patients implanted with the Inspire UAS system in the STAR trial, 124 were followed through 18 months. There were no unanticipated events and only 2 events required surgical intervention. Both events consisted of an IPG migrating out of position and were resolved with a surgical procedure performed under local anesthesia to reposition the IPG.

Many of the procedure-related adverse events reported are expected with a surgical procedure. The procedure-related events are described in Table 4.

<table>
<thead>
<tr>
<th>Event</th>
<th>Number of Subjects with Event</th>
<th>Percent of Subjects (n=126)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incision pain</td>
<td>35</td>
<td>28%</td>
</tr>
<tr>
<td>Post-operative discomfort</td>
<td>31</td>
<td>25%</td>
</tr>
<tr>
<td>Temporary tongue weakness</td>
<td>23</td>
<td>18%</td>
</tr>
<tr>
<td>Sore throat from intubation during implant</td>
<td>15</td>
<td>12%</td>
</tr>
<tr>
<td>Other post-operative symptoms (such as gastrointestinal (nausea, vomiting, abdominal pain, constipation), body pain (back, knee, wrist, hand), allergy to antibiotics, anxiety, ineffective airway clearance, loss of some taste, inability to void)</td>
<td>14</td>
<td>11%</td>
</tr>
<tr>
<td>Headache</td>
<td>8</td>
<td>6%</td>
</tr>
<tr>
<td>Mild infection</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>
The device-related adverse events are described in Table 5.

<table>
<thead>
<tr>
<th>Event</th>
<th>Number of Subjects with Event</th>
<th>Percent of Subjects (n=126)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort due to electrical stimulation</td>
<td>59</td>
<td>47%</td>
</tr>
<tr>
<td>Tongue abrasion</td>
<td>30</td>
<td>24%</td>
</tr>
<tr>
<td>Other acute symptoms (i.e., headaches, coughing, choking, dysphasia,</td>
<td>23</td>
<td>17%</td>
</tr>
<tr>
<td>and speech-related events)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth dryness</td>
<td>14</td>
<td>11%</td>
</tr>
<tr>
<td>Complaints related to temporary usability or functionality issues</td>
<td>13</td>
<td>11%</td>
</tr>
<tr>
<td>with an implanted device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complaints related to temporary usability or functionality issues</td>
<td>13</td>
<td>10%</td>
</tr>
<tr>
<td>with an external device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical pain associated with presence of device</td>
<td>10</td>
<td>8%</td>
</tr>
<tr>
<td>Mild infection</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

At the completion of the 18-month follow-up visits of all study patients, 75% of device-related events were fully resolved, primarily with either medication, device reprogramming, dental work to fix a jagged tooth, or with the aid of a lower tooth guard used during sleep to prevent tongue abrasions, or no intervention. Twenty-five percent (25%) of device-related events were unresolved at 18 months. Currently unresolved events include reports of discomfort due to stimulation, tongue abrasion and various stimulation related events including dry mouth, headaches, intermittent waking, isolated stimulation sensation events, audible buzzing, and intermittent fatigue. Despite these reported events, patients continued to report high (85%) compliance with the therapy at 18 months.

Two subjects had their devices removed, which required a surgical procedure. One chose to have the stimulator removed, and the leads were capped and left in the patient. The other had the entire system removed as a precaution due to proximity to an unrelated infection. Both explants were successfully completed without damage to the surrounding structures. There were 3 deaths over the course of the study, all were unrelated to Inspire therapy. There were 32 serious adverse events (SAE), 2 of which were related to Inspire therapy, both involving repositioning of the IPG.
Efficacy

The sleep studies, which were scored by an independent sleep scoring core lab, showed statistically significant and clinically relevant reductions in the patients’ AHI and ODI scores. Table 6 reports the percentage of patients who experienced a clinically meaningful reduction in their OSA severity (i.e., responders). As this is an intent to treat study, these results are based on a total of 126 patients even though only 124 patients provided evaluable data through 12 and 18 months. The other 2 patients are assumed to be non-responders and are included in the evaluation as such.

<table>
<thead>
<tr>
<th>Responder</th>
<th>Responder Rate at 12-Month Follow-Up</th>
<th>Responder Rate at 18-Month Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% Reduction in AHI from baseline and AHI &lt; 20</td>
<td>66% (83/126)</td>
<td>65% (80/124)</td>
</tr>
<tr>
<td>25% Reduction in ODI from baseline</td>
<td>75% (94/126)</td>
<td>80% (99/124)</td>
</tr>
</tbody>
</table>

The average reduction of AHI from baseline to 12 months was 68% and 70% for ODI. Baseline AHI showed a mean of 32.0. In comparison, the AHI at the 12-month PSG study showed a mean of 15.3. Baseline ODI showed a mean of 28.9. In comparison, ODI at the 12-month PSG study showed a mean of 13.9. The patients also had statistically significant improvements in terms of time with SaO₂ < 90%, ESS and FOSQ scores at 12 months relative to baseline. The mean FOSQ score at baseline was 14.3, at the 12-month visit it was 17.2, and at the 18-month visit it was 17.3. The mean ESS score at baseline was 11.6, at the 12-month visit it was 7.0, and at the 18-month visit was 7.0. The mean percentage of sleep time with SaO₂ < 90 at baseline was 8.7%, at the 12-month visit it was 5.9%, and at the 18-month visit was 5.6%. These results through 18 months show the durability of Inspire therapy’s treatment effect.

The randomized controlled therapy withdrawal study provided further evidence that improvements were attributed directly to the Inspire therapy. AHI increased significantly in the therapy withdrawal (OFF) group compared to AHI scores in the therapy maintenance (ON) group. The results from the randomized control therapy withdrawal study showing the difference between the therapy OFF arm and the therapy ON arm are provided in Table 7.

<table>
<thead>
<tr>
<th>AHI</th>
<th>Mean AHI</th>
<th>Change (13M–12M) Mean</th>
<th>95% CL for Mean Change</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapy ON</td>
<td>7.2</td>
<td>8.9</td>
<td>1.7</td>
<td>(-1.1, 4.5)</td>
</tr>
<tr>
<td>Therapy OFF</td>
<td>7.6</td>
<td>25.8</td>
<td>18.2</td>
<td>(11.4, 24.9)</td>
</tr>
</tbody>
</table>
The randomized controlled therapy withdrawal study confirmed that the significant OSA severity reduction at 12 months is attributable to the Upper Airway Stimulation therapeutic effect. An analysis of AHI responder status relative to baseline characteristics is provided in Table 8.

### Table 8. AHI Responder Analysis of Baseline Characteristics

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Responders N = 83 Mean % (N)</th>
<th>Non-responders N = 43 Mean % (N)</th>
<th>Association of AHI Response to Baseline Characteristics p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>55.9</td>
<td>51.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Gender (% Male)</td>
<td>82%</td>
<td>86% (37)</td>
<td>0.56</td>
</tr>
<tr>
<td>BMI</td>
<td>28.3</td>
<td>28.6</td>
<td>0.50</td>
</tr>
<tr>
<td>Neck Size</td>
<td>41.0</td>
<td>41.6</td>
<td>0.32</td>
</tr>
<tr>
<td>Baseline AHI</td>
<td>30.7</td>
<td>34.6</td>
<td>0.08</td>
</tr>
<tr>
<td>Baseline ODI</td>
<td>27.1</td>
<td>32.3</td>
<td>0.02</td>
</tr>
<tr>
<td>Prior UPPP (%)</td>
<td>20.5% (17)</td>
<td>11.6% (5)</td>
<td>0.22</td>
</tr>
<tr>
<td>Baseline FOSQ</td>
<td>14.7</td>
<td>13.6</td>
<td>0.059</td>
</tr>
<tr>
<td>Baseline ESS</td>
<td>11.2</td>
<td>12.3</td>
<td>0.22</td>
</tr>
</tbody>
</table>

While the percentage of patients with prior UPPP surgery is noted to be twice as high in the responder group as compared to the non-responder group, the observation was not statistically significant (p-value of 0.22).

**Conclusion**

Upper Airway Stimulation is a safe and effective treatment for patients with moderate to severe OSA who are not effectively treated by CPAP.
### IPG Specifications

#### Factory Settings

**Table 9. Inspire Implantable Pulse Generator (Model 3028) Factory Settings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>Therapy On/Off</td>
<td>Off</td>
</tr>
<tr>
<td>Usage</td>
<td>0</td>
</tr>
<tr>
<td>Start Delay</td>
<td>30 mins</td>
</tr>
<tr>
<td>Pause Time</td>
<td>15 mins</td>
</tr>
<tr>
<td>Therapy Duration</td>
<td>8 hrs</td>
</tr>
<tr>
<td><strong>Stimulation</strong></td>
<td></td>
</tr>
<tr>
<td>Amplitude</td>
<td>0 V</td>
</tr>
<tr>
<td>Rate</td>
<td>33 Hz</td>
</tr>
<tr>
<td>Pulse Width</td>
<td>90 µs</td>
</tr>
<tr>
<td>Electrode Configuration</td>
<td>Outer (+) Center (–) Case (off)</td>
</tr>
<tr>
<td>Patient Control</td>
<td>Off</td>
</tr>
<tr>
<td><strong>Sensing</strong></td>
<td></td>
</tr>
<tr>
<td>Exhalation Sensitivity Threshold</td>
<td>-4</td>
</tr>
<tr>
<td>Inhalation Sensitivity Threshold</td>
<td>0</td>
</tr>
<tr>
<td>Refractory Hard</td>
<td>Soft</td>
</tr>
<tr>
<td>Invert Signal</td>
<td>Off</td>
</tr>
<tr>
<td>Max Stim Time</td>
<td>4 secs</td>
</tr>
</tbody>
</table>
Configurable Settings

The parameters in Table 10 can be changed using an Inspire programmer. See the physician programmer manual for more information.

Table 10. Inspire Implantable Pulse Generator (Model 3028) Configurable Settings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start Delay</td>
<td>0–75 mins</td>
<td>5 mins</td>
</tr>
<tr>
<td>Pause Time</td>
<td>5–30 mins</td>
<td>5 mins</td>
</tr>
<tr>
<td>Therapy Duration</td>
<td>1–15 hrs</td>
<td>1 hr</td>
</tr>
<tr>
<td>Amplitude</td>
<td>0.0–5.0 V</td>
<td>0.1 V</td>
</tr>
<tr>
<td>Rate</td>
<td>20, 25, 30, 33, 40 Hz</td>
<td></td>
</tr>
<tr>
<td>Pulse Width</td>
<td>60, 90, 120, 150, 180, 210 µs</td>
<td></td>
</tr>
<tr>
<td>Electrode Configuration</td>
<td>Outer (+) Center (-)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer (-) Center (+)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case (+) Outer (-)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case (+) Center (-)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case (+) Outer (-) Center (-)</td>
<td></td>
</tr>
<tr>
<td>Patient Amplitude Control</td>
<td>On, Off</td>
<td></td>
</tr>
<tr>
<td>Sensing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhalation Sensitivity</td>
<td>-4 to +3</td>
<td>1</td>
</tr>
<tr>
<td>Exhalation Threshold</td>
<td>-1, 0, +1</td>
<td>1</td>
</tr>
<tr>
<td>Inhalation Sensitivity</td>
<td>-7 to 0</td>
<td>1</td>
</tr>
<tr>
<td>Inhalation Threshold</td>
<td>0, +1</td>
<td>1</td>
</tr>
<tr>
<td>Hard Off Period</td>
<td>38, 50, 63, 75%</td>
<td></td>
</tr>
<tr>
<td>Soft Off Period</td>
<td>13, 25%</td>
<td></td>
</tr>
<tr>
<td>Invert Signal</td>
<td>On, Off</td>
<td></td>
</tr>
<tr>
<td>Max Stim Time</td>
<td>2–5 secs</td>
<td>1.0 sec</td>
</tr>
</tbody>
</table>
### Battery Longevity

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Longevity Estimate</td>
<td>10.9 years average (0.6 years standard deviation)</td>
</tr>
<tr>
<td>End of Service</td>
<td>1 month after Recommended Replacement Time</td>
</tr>
</tbody>
</table>

(a) Longevity estimate is based on STAR trial therapy settings at the 12-month endpoint. IPG longevity will vary based on usage and therapy settings. The minimum estimated longevity from the STAR trial is 7 years.

(b) Recommended Replacement Time - The sleep remote generator light turns on to indicate that replacement of the Model 3028 is recommended within 1 month.

(c) End of Service - The Model 3028 should be replaced immediately.
Physical Description

Table 11. Inspire Implantable Pulse Generator (Model 3028)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>46mm (1.8 in)</td>
</tr>
<tr>
<td>Length</td>
<td>51mm (2.0 in)</td>
</tr>
<tr>
<td>Thickness</td>
<td>8.4mm (0.33in)</td>
</tr>
<tr>
<td>Volume</td>
<td>15cm³ (0.92in³)</td>
</tr>
<tr>
<td>Radiopaque identification</td>
<td>IMS1</td>
</tr>
<tr>
<td>Tissue contacting materials</td>
<td>Titanium, polyurethane, silicone rubber</td>
</tr>
</tbody>
</table>

Radiopaque identification

The IPG’s radiopaque identification, IMS1 (Figure 20), can be confirmed by using fluoroscopy on the IPG.

Figure 20. Radiopaque identification
Inspire Medical Systems Limited Warranty

Summary
Inspire provides a limited warranty against defects. The warranty period for implanted products is 3 years. All other products have a warranty period of 1 year. The warranty information below is intended for doctors (referred to as physicians in the warranty), but is included here for reference. Ask your doctor if you have any questions. The information below takes precedence over the information contained in this Summary.

Inspire Medical Systems’ products consist of Implantable Pulse Generators (IPG), tools to connect the IPG to implantable leads, leads, Inspire Sleep Remotes, and physician programmers.

1. EXCLUSION OF WARRANTIES, NO WARRANTIES FOR TOOLS. The implied warranties of MERCHANTABILITY and fitness for a particular purpose and all other warranties, express or implied with regard to tools are EXCLUDED from any transaction and shall not apply. Inspire Medical Systems will not be liable for any damages, whether direct, consequential, or incidental caused by tool defects, failures, or malfunctions, whether such claims are based on warranty, contract, tort or otherwise. No person has any authority to bind Inspire Medical Systems to any representation or warranty with respect to tools. You may have other rights, which vary from state to state. If one or more of the provisions of this exclusion of warranties for tools shall be deemed void or unenforceable, the remaining provisions shall continue to have full force and effect.

2. LIMITED WARRANTY FOR PRODUCTS OTHER THAN TOOLS. This limited warranty is available if products other than tools fail to function within normal tolerances due to defects in materials or workmanship that manifest during the specified warranty period.

During the operational life of an IPG, battery energy is consumed to monitor the patient’s breathing and provide therapy. On the basis of individual patient physiology, certain patients may require more frequent therapy, thus requiring replacement of the IPG in less than the warranty period shown below. This is considered normal for those patients and not a malfunction or defect in the IPG.
If the purchaser complies with the Terms and Conditions, Inspire Medical Systems will issue a limited warranty toward the purchase of a new Inspire Medical Systems IPG product. The limited warranty credit amount will be the full purchase price of either the original unit or the replacement unit, whichever is less.

- For patient products, for example, IPG, lead, Inspire Sleep Remote, Inspire Medical Systems will issue a credit to the hospital conducting replacement surgery on behalf of the original patient. Any cost reductions extended as a result of this warranty shall be fully and accurately reflected on the patients' bill and reported to that applicable payor using the appropriate methodology.
- For physician products, for example, physician programmer, Inspire Medical Systems will issue a credit to the original purchaser of the product.

A. Terms and Conditions

1. The product labeling must indicate a limited warranty exists.
2. For implantable products, this limited warranty applies only for a product replacement in the original patient.
3. All registration materials must be completed and returned to Inspire Medical Systems within 30 days of first use.
4. The product must be replaced with an Inspire Medical Systems product.
5. If the product is implantable, it must be implanted before the product expires and implanted with other Inspire Medical Systems products.
6. The product must be returned to Inspire Medical Systems, 9700 63rd Avenue North Maple Grove, MN 55369 within 30 days that the product first fails to function within normal tolerances. The product may be returned at no cost to you. Contact your Inspire Medical Systems representative for information on how to return the product.
7. Inspire Medical Systems will inspect the returned product and determine whether a limited warranty credit is due.
8. All products returned to Inspire Medical Systems become its property.

This limited warranty represents the entire obligation of Inspire Medical Systems for products other than tools and is made IN LIEU OF any other warranties, whether express or implied, including MERCHANTABILITY or fitness for a particular purpose.

Inspire Medical Systems will not be liable for any damages, whether direct, consequential, or incidental caused by product defects, failures, or malfunctions, whether such claims are based on warranty, contract, tort or otherwise.

No person has any authority to bind Inspire Medical Systems to any warranty or representation except those specifically contained herein.
This limited warranty gives specific legal rights, and you may also have other rights, which vary from state to state. If one or more of the provisions of this limited warranty shall be deemed void or unenforceable, the remaining provisions shall continue to have full force and effect.

B. Limited Warranty Period

The applicable limited warranty period for each product is listed and calculated as follows:

1. Three (3) years from date an IPG or lead is implanted in the patient.
2. One (1) year from the date a physician programmer or Inspire Sleep Remote is first used.