

# **INNOVASIVE™**

## **DUALX™ LLIF expanding IBFD**

### **Product Information and Instructions for Use**

#### **Description**

The **INNOVASIVE DUALX™ LLIF Expanding Titanium Lateral Lumbar Interbody Fusion System** (DualX™ LLIF) is a comprehensive interbody cage system that provides structural stability of the anterior vertebral column. It is comprised of expanding titanium interbody cages of various sizes. The instruments provided with the system include implant trials, a bone graft tamp and graft funnel, a torque limiting lockout screw driver, and an inserter to facilitate placement and expansion of the interbody device.

#### **Material**

The device is made of Ti 6AL-4V ELI per ASTM F136. The instrumentation is made from various grades of stainless steel, Radel 5500 PPSU, nitinol, medical grade adhesive, and medical grade silicone.

#### **Clinical Indications**

The **INNOVASIVE DUALX™ LLIF** is indicated for intervertebral body fusion of the lumbar spine, from L2 to S1, in skeletally mature patients. The device is intended for use at either one or two contiguous levels for the treatment of degenerative disc disease (DDD) with up to Grade I spondylolisthesis or retrolisthesis. DDD is defined as back pain of discogenic origin with degeneration of the disc confirmed by history and radiographic studies. The device is intended for use with supplemental fixation.

The **DualX™ LLIF** implants are intended for single use only.

#### **Contraindications**

Contraindications may be relative or absolute. The choice to implant the **DualX™ LLIF** must be carefully weighed against the patient's overall evaluation. Circumstances listed below may reduce the likelihood of a successful outcome. Contraindications include, but are not limited to:

1. Allergy or sensitivity to implant material or foreign body allergic reaction
2. Active or suspected infection
3. Patients who are immune compromised
4. Any condition that may affect the process of normal bone remodeling, including, but not limited to, osteoporosis, bone absorption, osteopenia, or certain metabolic disorders affecting osteogenesis
5. Morbid obesity
6. Signs of local infection or inflammation
7. Fracture of vertebrae
8. Spondylolisthesis > grade 1
9. Alcoholism
10. Heavy smoking
11. Pregnancy
12. Any patients exhibiting disorders which would cause the patient to ignore the limitations of fixation implants
13. Prior fusion at the level(s) to be treated
14. Any condition not described in the Indications for Use

#### **Possible Complications**

Possible complications specific to the device may include:

1. Implant breakage, failure, loosening, or migration
2. Bone fracture or fracture to a lumbar vertebra
3. Allergic reaction to the implant material
4. Delayed or non-union

#### **Other general complications associated with any spinal surgery may include:**

1. Pseudoarthrosis
2. Pain
3. Revision surgery
4. Bleeding
5. Infection, early or late
6. Tissue or nerve damage
7. Spinal fluid leakage
8. Spinal cord impingement or damage resulting in potential paresthesia or paralysis
9. Scar formation
10. Complications due to the use of bone grafting, including donor site complications.

#### **Warnings**

1. Use of an inappropriately sized device in an area of high functional stresses may lead to implant fracture and failure.
2. The **DualX™** has not been evaluated for safety and compatibility in the MR environment nor has it been tested for heating or migration in the MR environment.
3. Evaluating the safety and compatibility of the device in the MR environment, the following concerns were determined: magnetically induced displacement force and torque, radio frequency (RF) heating and image artifacts.
4. When more than two involved spinal levels are treated, longer operative times and greater blood loss are likely to occur.
5. As the number of previous surgeries at the involved spinal level(s) increases, the potential for intra-operative tears of the dura increases.
6. Based on fatigue testing results, the physician/surgeon should consider the levels of implantation, patient weight, patient activity level, and other patient conditions which may impact the performance of the system.
7. The **DualX™ LLIF** is intended to fill the disk space, only. Using the implant to distract the disk space may cause damage to the lumbar vertebra, or to the implant.
8. If the user wants to adjust the **DualX™ LLIF** implant after the first placement, the implant must be collapsed to allow repositioning and re-expansion of the implant.  
**NOTE:** These devices are single use only. Do not reuse an implant that has been previously removed.
9. Using instruments that have not been properly maintained may lead to inadequate performance and damage to the implant, or to the lumbar vertebra.
10. Components of this system should not be used with components of any other system or manufacturer.

#### **Maintaining Device Effectiveness**

1. The surgeon should have specific training, experience, and thorough familiarity with the use of expandable fixation products and techniques.
2. The surgeon must exercise reasonable judgment when deciding which implant sizes to use for specific indications.
3. The **DualX™ LLIF** is not intended to endure excessive abnormal functional stresses.
4. Failure to use dedicated, unique **INNOVASIVE DUALX™** instruments for every step of the implantation technique may compromise the integrity of the implanted device, leading to premature device failure and subsequent patient injury. Failed devices may require re-operation and removal.
5. Carefully inspect **INNOVASIVE DUALX™** instruments before and after each procedure to ensure they are in proper operating condition. Instruments which are faulty, damaged, or suspect should not be used. They should be replaced or sent to **INNOVASIVE INC.** for disposition and repair.
6. **INNOVASIVE** recommends the use of **INNOVASIVE** products in a sterile environment.



**Attention: Instructions for Use are in the Surgical Technique Guide (1283-9010)**

#### **Instructions for Use, DualX™ LLIF Expandable Lateral Lumbar Interbody Fusion System**

1. With the patient in a direct lateral decubitus position and secured in place, identify the location of the disc space with AP and lateral fluoroscopic images.
2. Repeat fluoroscopy using two guide wires to determine initial skin incision location.  
**NOTE:** If multiple levels will be fused, the initial incision may be biased in the direction of the vertebral body between the two spine fusion levels.
3. Identify landmarks and mark the position of a second posterolateral incision.
4. Make a posterolateral incision and palpate using a finger and blunt instruments to find the psoas muscle.
5. Once the psoas muscle is identified, ensure the abdominal wall is palpated out of the path of the lateral incision using the index finger.
6. Make the lateral incision using the index finger as a guide.
7. Use a probe or hospital neuromonitoring probe to palpate through the lateral incision.
8. Verify the positioning of the probe using both A-P and lateral fluoroscopy images.
9. Palpate through the psoas muscle using a probe or hospital neuromonitoring probe.
10. Place an appropriate retractor and retract the musculature and soft tissue to allow for proper visualization and placement of the **DualX™ LLIF** implant.

11. Verify positioning and determine preliminary implant size using fluoroscopy.
12. Excise annulus according to the estimated size of the collapsed implant required for the patient. Remove freed annular tissues.  
**NOTE:** Maintain distraction during implant placement  
**NOTE:** Distraction of the intervertebral space is only intended to provide just enough space to slip the collapsed **DualX™ LLIF** implant into position.
13. Perform standard discectomy using preferred instrumentation/technique.
14. Prepare end plate surfaces for Interbody Fusion Device implantation.
15. Use **DualX™ LLIF** trials to determine the correct implant size. Begin trialing with a conservatively smaller sized trial to avoid over stressing soft tissues.
16. Place implant trial through retractor with the collapsed height orientation against the vertebral bodies. Ensure the orientation and initial location of the trial is correct. Rotate the trial 90° clockwise to simulate expanded height of the implant. Rotate the trial counterclockwise to return to the collapsed height prior to removal.  
**WARNING:** do not continue to rotate the trial clockwise from the expanded height position. Rotating the trial more than 90° could cause overexpansion of the disk space and/or damage to the vertebrae or soft tissues.
17. Determine implant length using grooves in the trial. Each groove in the trial represents a 5mm increase in implant length the proximal end of the trial head represents the 60mm implant length.
18. Repeat step 18-19 using sequentially larger trials until the appropriate implant size has been determined.
19. Attach the appropriately sized implant to the **DualX™** inserter.
  - a. Push the implant into the pocket at the tip of the inserter
  - b. Turn the inserter thumb wheel clockwise until wheel is finger tight.
  - c. Install the draw bar
  - d. Turn the drawbar knob clockwise until it is finger tight.
20. Engage the expansion lever by rotating / pushing it flat against the inserter handle.
21. Insert the implant into the disk space  
**NOTE:** Care must be taken to avoid over insertion of the implant.
  - a. Confirm initial position using fluoroscopy
22. Lateral expansion
  - a. Turn inserter handle (grey region) clockwise until the "LATERAL" etch is visible.
23. Vertical expansion
  - a. Continue to turn inserter handle (grey region) clockwise until the "VERTICAL" etch is visible.
  - b. Confirm position and expansion using fluoroscopy
  - c. **NOTE:** Audible clicks or pops may be heard as the implant provisional locks are engaged.
24. Determine placement via fluoroscopy to verify placement within the disc space.
25. Draw bar and handle removal
  - a. Disengage the draw bar by lifting and pulling the expansion lever to the disengaged position.
  - b. **NOTE:** The lever may initially be easy to lift, but the if the internal mechanism is under load, additional force may be necessary to fully disengage the draw bar. Rotating the inserter handle slightly counterclockwise will relieve the internal forces on the inserter mechanism.
  - c. Unthread (counter clockwise) and remove the draw bar
  - d. Press the handle removal tabs and remove the inserter handle
26. Bone Graft Insertion
  - a. Install the funnel onto the inner hex shaped shaft
  - b. Insert bone graft material into the disk space using the tamp
27. Install the **DualX™ LLIF** lockout Screw (provided in the implant packaging)
  - a. Install the lockout screw into the TORX screw driver and insert through the funnel into the implant.
  - b. Apply a lockout torque of 14 in-lbs. using the TORX driver and torque-limiting driver handle.
28. Remove Inserter Shaft and Funnel.
  - a. Remove TORX screw driver and torque limiting handle
  - b. Remove inserter shaft and funnel by using the funnel as a knob and turning it counter-clockwise to unthread the inner shaft until the inner and outer inserter shafts are free to be removed.

#### **Repositioning / removal of the DualX™ LLIF**

- NOTE:** An implant can be removed or repositioned only after initial placement, not after fusion has taken place.
1. Reattach screw driver to lockout screw.  
**NOTE:** The screw driver acts as a guide to allow for easy alignment and attachment of the inner and outer inserter shafts.
  2. Reattach the Outer Shaft by sliding it over the screw driver shaft and then rotating slowly until the shaft pocket drops over the attachment boss of the implant.  
**NOTE:** Installing the outer and inner shafts simultaneously over the screw driver shaft will improve alignment and ease of attachment onto the implant.
  3. Thread the inner shaft into the back of the implant using the funnel as a knob.
  4. Reattach the torque-limiting screw driver handle and remove the lockout screw.
  5. Remove the funnel and reattach the inserter handle.
  6. Reattach the drawbar and engage the expansion lever as done previously in steps 21-22
  7. Collapse the implant by rotating the inserter handle counterclockwise until the "COLLAPSED" etch is aligned with the top of the inserter handle.
  8. Reposition or remove the implant as necessary. Re-expand and lockout the implant again in desired location by following steps 23-30

#### **Cleaning**

- Instruments must be carefully cleaned prior to sterilization. Trained personnel must perform cleaning and mechanical inspection prior to sterilization.
- Compliance is required with the equipment manufacturer's user instructions (manual and/or machine cleaning, ultrasound treatment, etc.) and recommendations for chemical detergents.
- It is the responsibility of the facility/user to qualify any deviations from the recommended method of processing.
- **INNOVASIVE** recommends the following cleaning and sterilization instructions for Instrumentation:
  1. Disassemble the inserter into separate components, including:
    - a. Draw Bar
    - b. Inserter Handle
    - c. Inner Shaft
    - d. Outer Shaft
  2. Disassemble the Screw driver into separate components, including:
    - a. Screw Driver Shaft
    - b. Screw Retaining Sleeve
    - c. Torque Limiting Handle
  3. Rinse instruments in cool tap water for a minimum of 2 minutes for each disassembled component. Actuate all buttons and levers while rinsing to facilitate debris removal.
  4. Brush (with a soft-bristled nylon brush) and flush (with a 60mL syringe) instruments during rinsing until they are free of visible debris.
  5. Enzymatic Soak/Brush/Flush
    - a. Completely submerge instruments in pH Neutral enzymatic cleaner (US: e.g. Steris Prolystica 2X) prepared according to the manufacturer's instructions, using warm (110° F Min) tap water.
    - b. Rotate the instruments below the surface of the cleaner and actuate all buttons and levers while submerged to facilitate debris removal and to eliminate any trapped air bubbles.
    - c. Ensure there is no contact between the instruments, and allow instruments to soak in enzymatic cleaner for a minimum of 20 Minutes
    - d. Following the soak, and while still submerged, brush each disassembled component of the instruments for a minimum of 2 minutes. Pay special attention to orifices, cracks, crevices, and all lumens of the instruments. Use soft nylon (e.g. See Below) bristle brushes while flushing with enzymatic cleaner. Actuate all buttons and levers a minimum of 4 times while submerged.
  6. Fresh Enzymatic Cleaner Flush
    - a. Prepare a fresh cleaning solution per Step 5a. Use a 60ML syringe to jet flush all joints/cracks and gaps in the instruments with the cleaning solution a minimum of 5 times. Actuate all buttons and levers while flushing.
  7. Ultrasonic Clean
    - a. Place instruments in ultrasonic cleaner, ensuring that all instruments are disassembled and submerged with a freshly prepared solution of pH Neutral enzymatic cleaner (prepared per step 5a). Ensure there is no contact between the instruments and rotate the instruments below the surface of the cleaner and actuate all buttons and levers while submerged to facilitate debris removal and to eliminate any trapped air bubbles.
    - b. Allow instruments to soak in the solution while sonicating for a minimum of 20 Minutes.

8. Rinse in hot water
  - a. Rinse instruments under hot (110° F minimum) running water and rinse for a minimum of 3 minutes
  - b. Actuate all buttons and levers while rinsing, and ensure water penetrates all cracks, crevices, lumens, and orifices.
  - c. Jet Flush with hot water
  - d. Use a 60ML syringe filled with hot water (110° F minimum) to jet flush all joints/cracks and gaps in the instruments two (2) times. Actuate all buttons and levers while flushing
9. Final Rinse
  - e. Rinse all instruments using AAMI TIR37 compliant rinse water for 2 minutes.
10. Dry
  - f. Dry instruments with a soft, lint-free cloth
  - g. Dry the instruments with filtered pressurized air
  - h. Optional: Heated dry in a 90-120° instrument dryer
11. Rinse the articles under running reverse osmosis/deionized (RO/DI) water until all evidence of detergent is removed.
12. Steam autoclave per sterilization instructions.

**Storage**

- Sterile packaged implants should be stored at controlled room temperature out of direct sunlight.
- Product Tyvek package should be inspected prior to use for signs of damage or tampering.
- Sterile implants have a shelf life of 5 years.

**Sterilization Instructions**

1. Implants are supplied STERILE and System instruments are supplied NON-STERILE.
2. Use of the sterilizer shall comply with the manufacturer's user instructions for sterilizers.
3. The user facility must clean and disinfect devices prior to sterilization per standard hospital procedures.
4. Non-sterile devices should be sterilized by steam sterilization (autoclaving). For sterilization of **DualX™ LLIF** instruments, the following parameters should be used.

**Tray System**

Pre-Vacuum Steam Sterilization  
 Cycle: 3  
 Temperature: 270°F (132°C)  
 Time: 4 minutes  
 Dry Time: 30 minutes

Configuration: Individually wrapped in two layers of 1-ply polypropylene wrap (Kimguard KC600-510(k) K082554 or equivalent) using sequential wrapping techniques.  
 Do not exceed 275°F (135°C), to avoid compromising functions of polymeric instrumentation.

**Caution**

- **Federal (United States) law restricts this device for sale by or on the order of a medical practitioner licensed to do so.**
- **Do not attempt a surgical procedure with faulty, damaged, or suspect Innovasive instruments or implants. Inspect all components preoperatively to assure utility. Alternate fixation methods should be available intraoperatively.**



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<b>Symbols and Definitions</b>			
	Single Use Only	<b>REF</b>	Catalogue Number
	Use By (Date)		Sterile, Method of Sterilization Using Irradiation
	Batch Code (Lot Number)		Consult Instructions for Use
	Date of Manufacture (MFG DATE)		Manufacturer (MFR)
	Attention, See Instructions for Use  Caution, Consult Accompanying Documents		Authorized Representative in the European Community
	Federal Law (U.S.A.) Restricts this device to sale by or on the order of a physician.		Do not use if sterile package is damaged