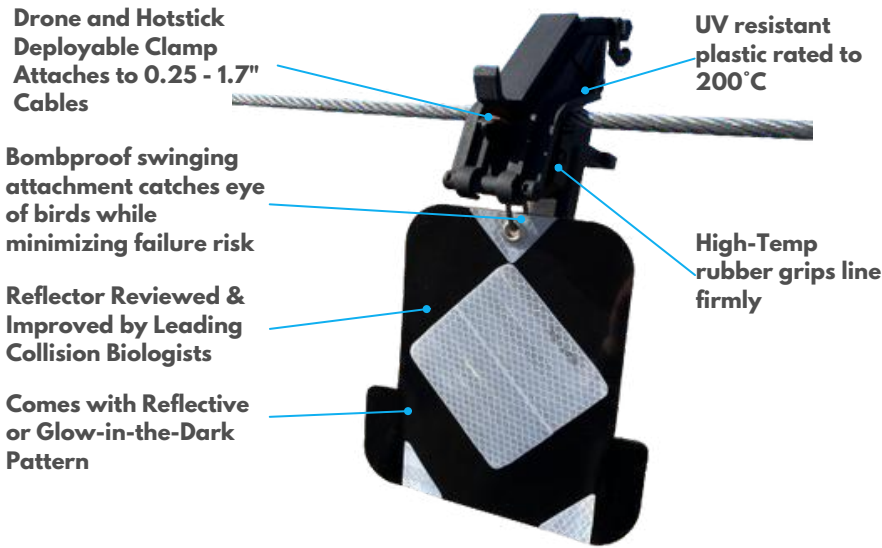


Pitch Aeronautics has developed the FeatherFender bird diverter to minimize power line collisions with the guidance of avian biologists and the latest available scientific research. FeatherFenders can be installed via a hotstick or up to 15 at a time with Pitch Aeronautics' unique drone, Astria. FeatherFenders also make lines more visible for people and could help truck drivers, crane operators, and airplane/helicopter pilots identify lines. FeatherFenders provide an inexpensive way to protect wildlife and increase safety. They provide a means to reduce inadvertant take under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA).



Drone and Hotstick Deployable Clamp Attaches to 0.25 - 1.7" Cables

UV resistant plastic rated to 200°C

Bombproof swinging attachment catches eye of birds while minimizing failure risk

High-Temp rubber grips line firmly

Reflector Reviewed & Improved by Leading Collision Biologists

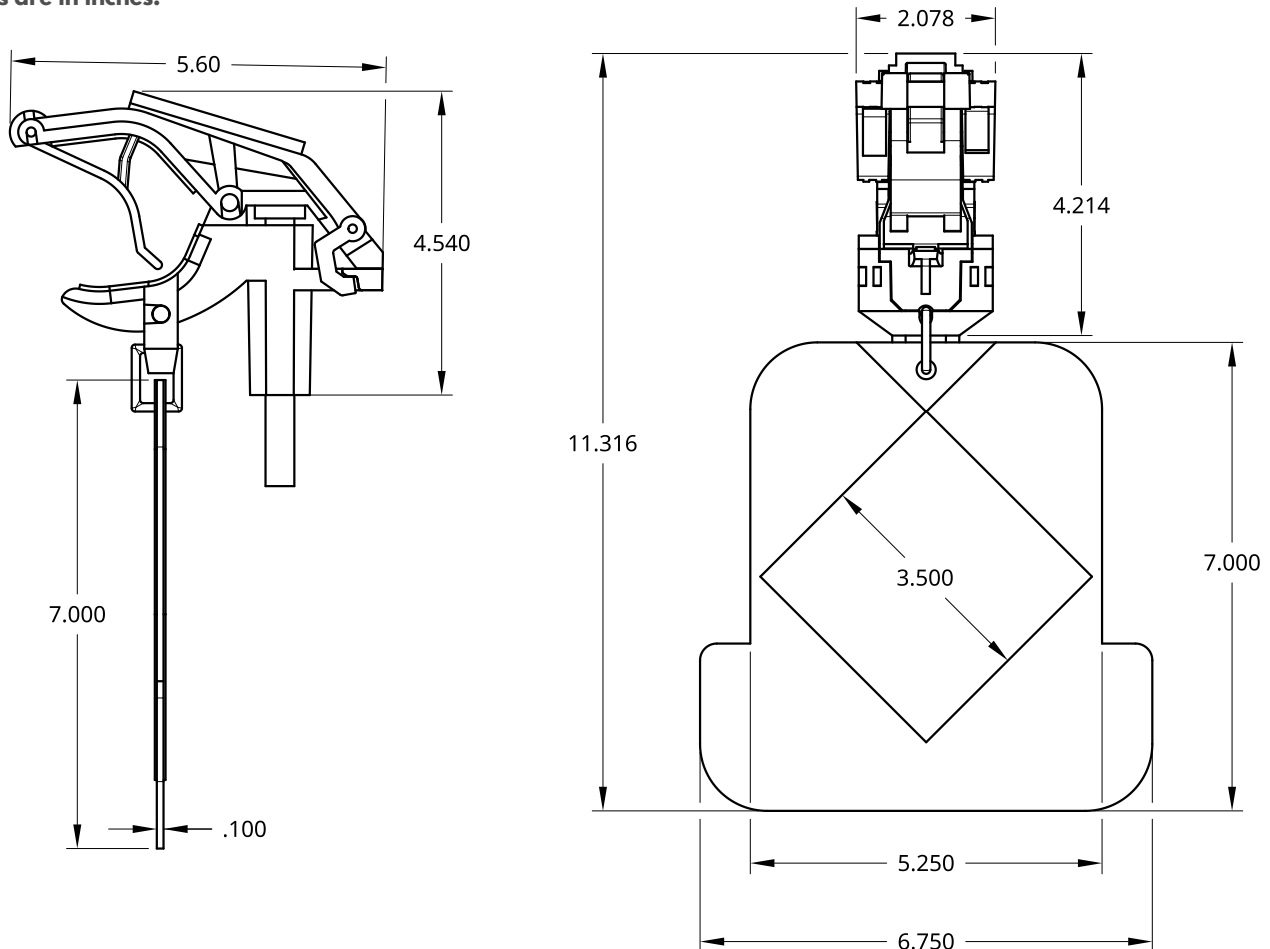
Comes with Reflective or Glow-in-the-Dark Pattern

The FeatherFender bird diverter uses a **high-contrast pattern optimized for bird vision in low-light conditions** when collisions generally occur. The FeatherFender is aerodynamically tuned to rock back and forth in the wind. This motion **increases visibility with a simple, robust mechanism**. There is no gimbal that can fail.

The diverter only requires 1/2 lb of force to actuate, making it **easy to install** on all types of cables.

Dimensions

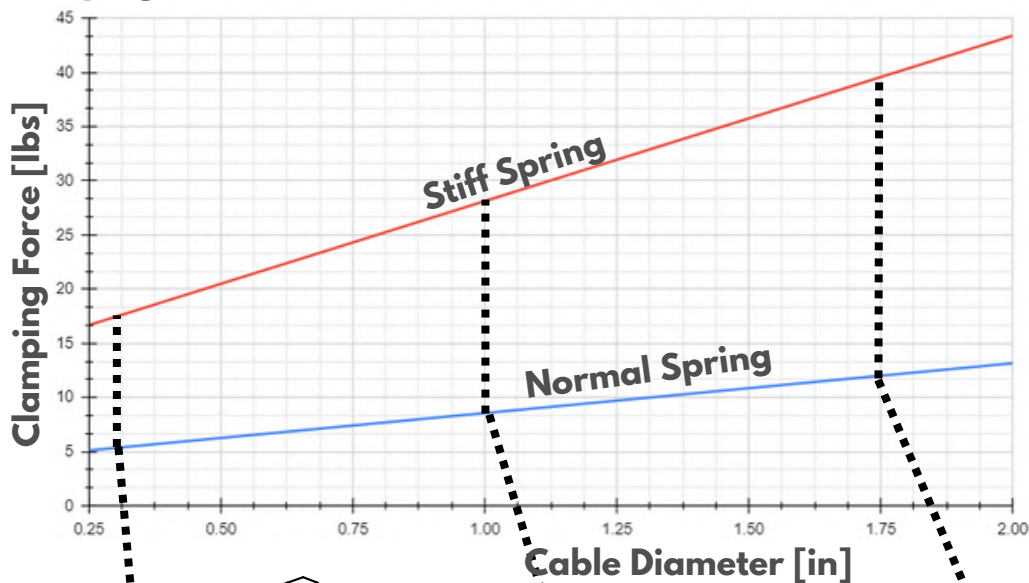
All values are in inches.



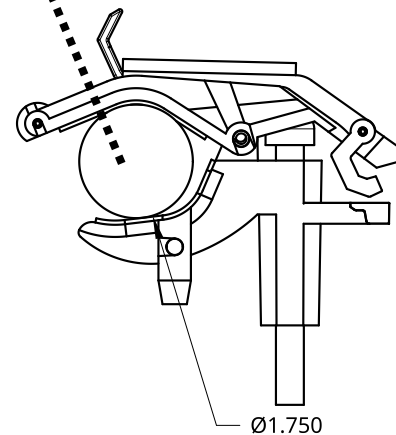
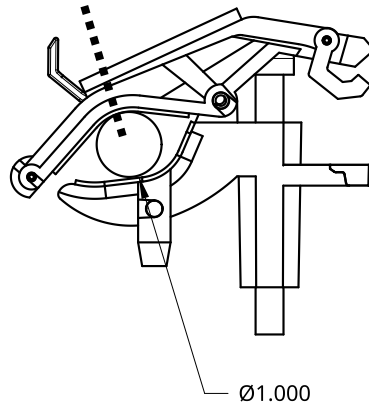
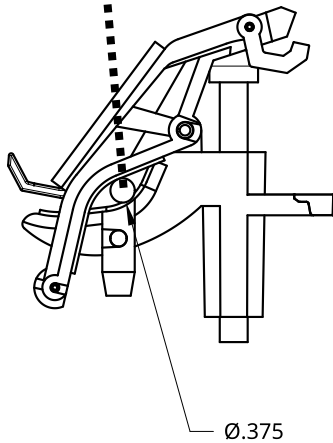
Key Parameters

Category	Value
Reflector Dimensions [in (cm)]	7 / 6.75 / 0.1 in (17.8 / 17.1 / .25 cm)
Overall Dimensions [in (cm)]	11.3/ 6.8 / 5.3 in (28.7 / 17.1 / 13.5 cm)
Overall Weight [lbs (g)]	0.8 lbs (363 g)
Cable Diameters [in (mm)]	0.25 - 1.7 in (6.3 - 43.2 mm)
High-Contrast Tape Options	Reflective or Glow-In-The-Dark
Trigger Force [lbs (N)], Normal/Stiff Spring	0.51 / 1.67 lb (2.27 / 7.43 N)
Removal Force [lbs (N)], Normal/Stiff Spring	9 / 30 lb (40 / 133 N)
Maximum Cable Temperature	200°C
Plastic Characteristics	UV & Chemically Resistant, Glass Fiber Reinforced
Motion	Swings Back and Forth in Wind

Clamping Force and Cable Diameters

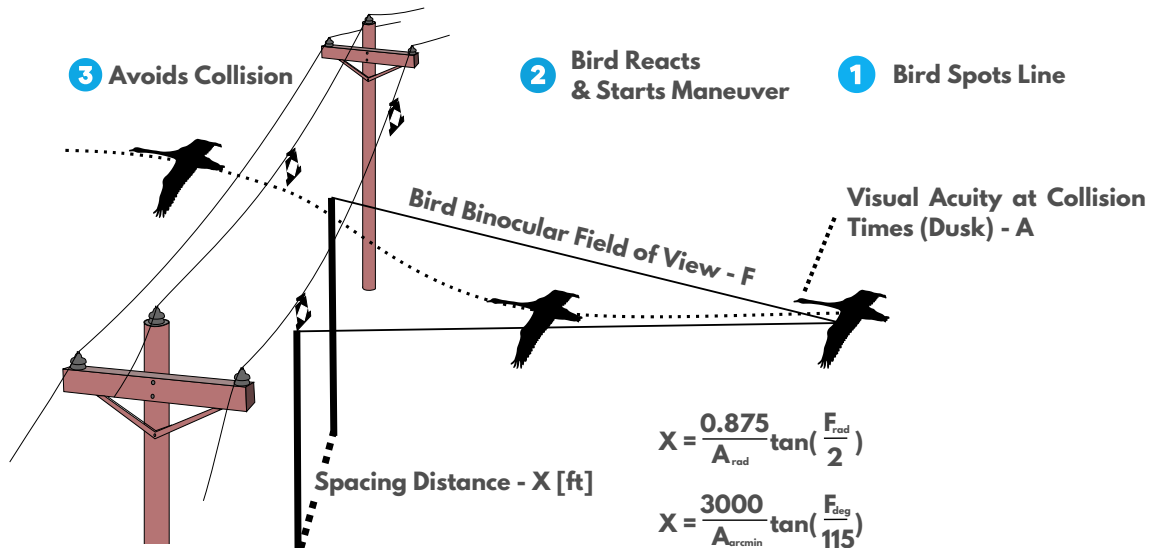


The FeatherFender is designed to attach to cables from 0.25 to 1.75 in in diameter. The static clamping force decreases as the spring extends and the clamp exerts less force on smaller cables. In all cases the high-temperature rubber firmly attaches to the cable and prevents rotation or translation of the clamp on the line.



Field Spacing

Pitch Aeronautics designed the FeatherFender to be visible at a sufficient distance so that poor-sighted birds with heavy wing loading and high flight speeds can see the diverter (in low light conditions) and have 1.5s to react and maneuver to avoid the line. The diverters should be spaced so that at the maximum sighted distance, there is always a FeatherFender in the bird's field-of-view. This maximum distance depends on the bird's visual acuity, which decreases with ambient light level.



Bird Type	Visual Acuity Daytime [Min Arc]	Approximate Visual Acuity Dawn/Dusk [Min Arc]	Bird Binocular FOV [Deg]	Distance of Diverter Detection [ft]	Maximum Diverter Spacing [ft]
Geese	3.2	16	22	94	37
Ducks	3.2	16	10	94	16
Brown Tailed Falcons	0.4	2	40	752	50
Wedge-Tailed Eagles	0.2	1	40	1504	50
House Sparrows	6.3	31.5	20	48	17
Adult Humans	1	5	120	301	50

The equations above estimate the maximum spacing for diverters on the line as functions of species field of view (F) and visual acuity in reduced lighting levels (A). The table to the left provides computations for some example birds. The approximate visual acuity at dawn/dusk is assumed to be five times the normal daytime number. Diverters may need to be placed as close together as 15ft for poor-sighted waterfowl with a narrow field of view. Geese may allow spacing over 30ft. While many birds of prey have exceptional vision, they tend to hit lines while distracted at closer ranges, and 50ft is a general guide for the maximum useful spacing.

Which Lines Should be Marked?

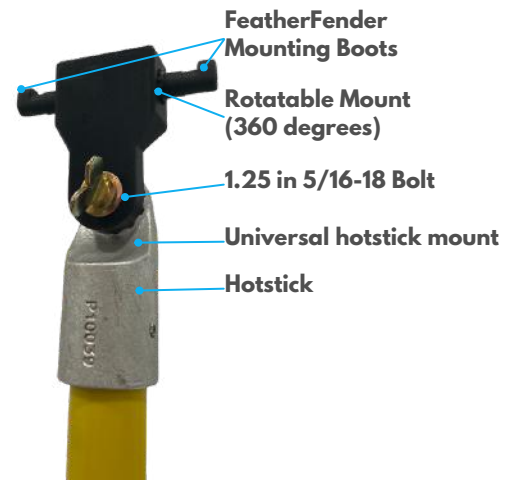
Power line configurations vary widely, and consultation with avian biologists should be leveraged to determine proper line marking at individual field sites. A few guiding principles can aid in determining which lines should be marked:

- Many bird's binocular field-of-view is substantially greater in the vertical dimension. Moreover, birds may climb over the highest obstacle. Marking the top cable is often more critical than lower cables.
- Most collisions on transmission lines are with overhead shield wires. Birds frequently see, climb above thicker phase wires, and collide with the thinner shield wire.
- The outer wires should be marked on widely spaced horizontal lines.
- Birds are less likely to see longer cables without towers in their field of view.
- Local diurnal and seasonal migratory routes should be considered. Lines that cross routes to roosting and feeding areas should be marked.
- Carcasses may be an inaccurate measure of collisions as scavengers can quickly carry them away. Many collisions occur over water where there is no ground-based evidence.
- Pitch Aeronautics can recommend third-party biologists for professional consultation.

Installation

Hotstick Installation:

Our double headed hot stick installation tool allows easy installation of two FeatherFenders on distribution lines. The tool attaches to the universal mounting adapter with a winged 1.25 in 5/16-18 bolt. The mounting boots can be rotated incrementally in any orientation to accommodate steep cable angles or when access directly below the line is not possible. Hotstick installation allows for rapid deployment of the FeatherFender in standard environments.



1 Place FeatherFenders on tool

While keeping the trigger forward, close the back of the FeatherFender around the mounting boot to attach.

2 Adjust to angle of cable

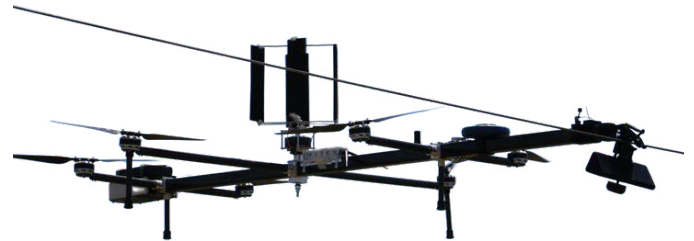
Simply pull the FeatherFender away from the hotstick and set to the desired angle.

3 Install on Cable

Install on cables with ease using a standard hotstick with a universal adapter head. Only 1/2 lbs. of trigger force required to actuate.

Drone Installation:

Our drone Astria can perform precision touch-based installations, maintenance, and inspections. This allows safer and faster installation of FeatherFender bird diverters and other components. **We have already demonstrated energized installations with Astria. Astria can install 15 FeatherFenders in a single flight.** Drone installation reduces risk, cost, and allows easy installation on transmission lines and over water. **Leave the helicopters and cranes behind.**



Pitch Aeronautics' drone Astria can install 15 FeatherFenders in a single flight!