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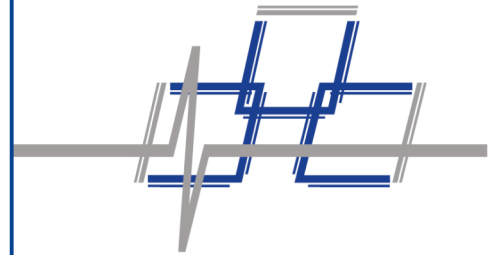
## SUMMARY

This document provides the security system designer, engineer, or fencing contractor with a comprehensive reference of Fiber SenSys® suggested fence construction specifications for high security applications. While adhering to the recommendations outlined in this document is in no way required to use the Fiber Defender™ products, constructing a chain link fence to these specifications ensures optimal performance is achieved with the fiber optic intrusion detection system.

## INTRODUCTION

While the Fiber Defender™ series fiber optic intrusion detection system can be calibrated to screen out most nuisances, the best performance can be ensured by deploying the system on a fence meeting a minimum number of construction standards. A chain link fence with a tight fabric mesh, for example, ensures the fiber optic sensor is not subjected to unwanted rattling or vibration from wind. Similarly, an aluminum oxide coated mesh is likely to last longer than an uncoated one.

# Application Note

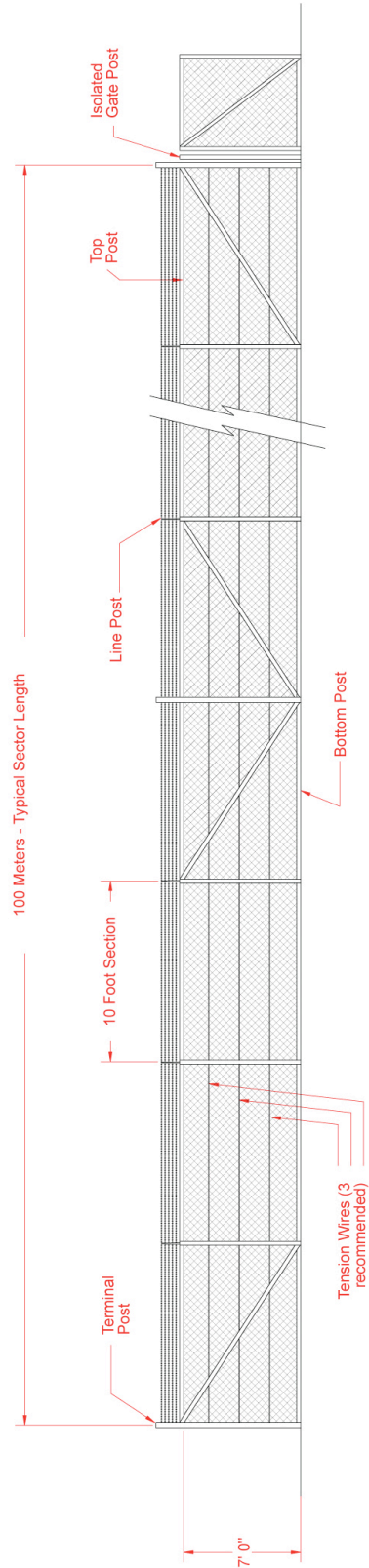


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## Security Fence Construction Recommendations

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Figure 1 - Recommended Minimum Fence Construction Guidelines



Each of these points is discussed in detail in the remainder of this document

## Material Requirements

Fences used in high security applications should meet the material recommendations outlined in this section as a minimum.

### Chain Link Fabric

The chain link fence fabric should be standard 2-inch mesh, composed of 9 gauge, galvanized steel wire. The recommended minimum height for all security fences is 7 feet. As an additional feature, the chain link fabric should be flush with the top rail and have the exposed twisted ends extruding past the bottom rail.

Because it requires little or no re-tensioning over time, the use of aluminum oxide coated wire is highly recommended for permanent security applications. Use of zinc coated (galvanized) wire is also acceptable for existing fences, however, and may be used for short-term applications.

### Fence Posts and Rails

All posts should extend to 7 feet in height (minimum) unless otherwise specified. Table 1 lists recommended diameters for fence posts and rails.

**Table 1- Recommended Fence Material Diameters**

Fence Component	Recommended Diameter
Top rail, bottom rail, or reinforcement bar	1 1/4 inch
Line Posts	2 inches
Intermediate anchor posts	2 inches
Terminal posts (corner, end, and pull posts)	2 1/2 inches
Gate posts (up to 6 foot cantilever gates)	2 1/2 inches

All fence posts and structural supports should be located on the inner side of the fence. Ideally, posts should be placed no greater than 10 feet apart. All posts should be secured in the soil with cement to prevent sagging, shifting, or collapse.

For more information on securing fence posts with cement, see *Concrete Foundations* later in this application note.

### Fittings

All post caps, barbed wire outriggers, stretcher bars, and other fittings should be composed of galvanized pressed steel. Aluminum fittings should not be used.

### Tension Wire

Fence Fabric Material

Fence Post Sizes

### Minimum Number of Tension Wires

At least 3 tension wires should be used in the standard fence design. The wires should be evenly spaced to aid in support of the fence fabric tension. The top tension wire should be placed 8 inches below the top of the fence fabric. All tension wires should consist of 7 gauge, hardened, galvanized steel spring wire.

### Fasteners

Fence fabric should be secured firmly to posts and rails with 9 gauge, galvanized steel tie wire so that:

- The fence fabric is attached to the top and bottom rails with the ties every 12 inches.
- The fence fabric is attached to the posts in at least 5 equidistant locations to include the top and bottom of the fabric.
- The fabric is secured firmly to tension wires with 12-gauge steel tie wire (as opposed to 9 gauge), incorporating at least a 540 degree tightened loop.

**Note:** The use of “hog rings” and aluminum wire is not recommended

### Concrete Foundations

All concrete foundations should be sized to sustain estimated lateral forces and point loads (from wind, potential intruders, etc.). Table 2 provides industry standard recommended foundation sizes. As with all Fiber SenSys® security fence construction recommendations, these foundation sizes may be modified as necessary depending on individual site conditions and requirements.

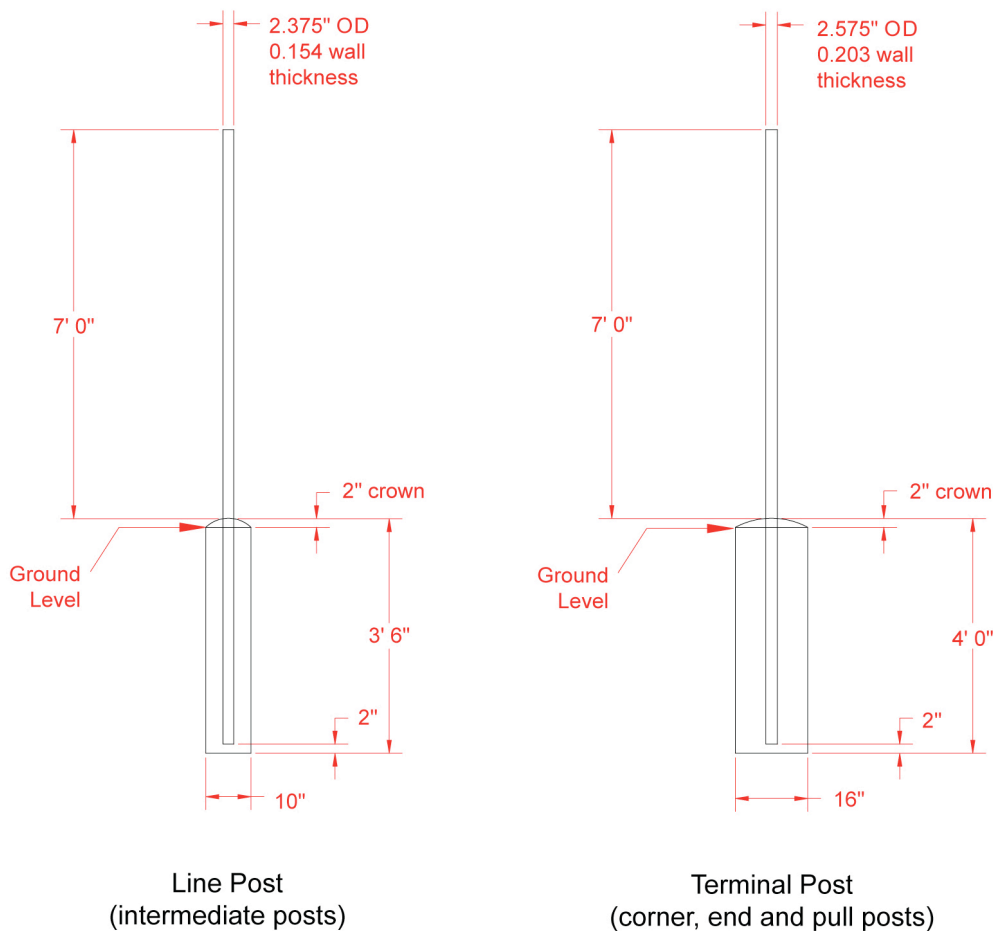
**Table 2 - Concrete Foundation Recommendations**

Post Type	Recommended Foundation
Line Post	10 " OD, 3'6" depth
Terminal Post	16 " OD, 4'0" depth
Gate posts (6' gate)	16 " OD, 4'0" depth

### Securing Fence Posts With Concrete

Application Note

**Figure 2 - Recommended Fence Post Foundation Specifications**



**Fence Post Drawing**

When creating a concrete foundation, ensure the concrete extends below the frost line.

There are optional methods for securing the fence posts. One alternative is to install the fence post in the center of a concrete walkway measuring at least 50 inches wide and 4 inches deep (or install the post between two 36-inch walkways). A concrete crown should always be formed at the top and extended at least 2 inches above the ground level to ensure water is shed away from the post.

**Securing fence posts-  
Optional methods**

## Sensor Barrier Integrity

Because a perimeter is only as secure as the fence that protects it, the material condition and integrity of the fence itself is critical to the success of preventing intrusion. The fiber optic intrusion detection system is meant to complement the fence line.

### Using a Concrete Sill

The soil under the fence must be in stable condition (not prone to erosion) to maintain the barrier. If surface conditions make soil stability impractical (local rainfall is typically high, causing streams of running water, for example), creating a concrete “skirt” or sill below the fence may help. Such a concrete sill should measure a minimum of 6 inches wide and 1 inch deep, with the concrete poured in a continuous run along the fence line. A gap of approximately 1 inch should exist between the concrete sill and the bottom of the fence fabric. The top of the sill should come up at least to ground level to ensure water does not collect.

### Fence Fabric Tension

Ensure the fence fabric is taut and uniform throughout the fence line. A fence with tight fabric conducts high frequency vibration to the fiber optic sensor cable more readily than loose or sagging fabric and forms a tougher barrier to intrusion in general. Tight fence fabric is also less prone to be moved by the wind.

The height of the fence should be consistent throughout the fence line.

Trees and shrubs should be kept trimmed back from the fence to avoid interfering with the fabric or forming a natural fence climbing/intrusion aid.

### General Installation Recommendations

Generally, industry standard fence installation practice should be used for fence construction. This section notes some recommended exceptions.

#### Hardware Spacing

Hardware used to secure the fabric to posts/rails should be used at intervals listed in Table 3.

**Table 3 - Recommended Hardware Spacing Intervals**

Hardware Component	Recommended Foundation
All Posts	14 inches
All Rails	12 inches
All Tension Wires	15 inches

**Note:** Using tension wires exclusively to obtain fabric tension is not recommended.

- All rails should be formed using a continuous piece from post to post.
- Bottom rails are recommended with all fences.
- Post and outrigger caps should be welded to posts to prevent movement.
- The placement of signs on the fence fabric is discouraged. If signs are required, it is preferable to secure them to the post to eliminate movement in high winds.
- Brace and truss assemblies are sometimes required to counteract lateral forces. These assemblies are typically located at each terminal post. In some cases, 2 brace and truss assemblies are required in a single panel.

### Securing The Fabric

## Visual Inspection

Prior to conducting fence testing, all new and existing chain link fences should be visually inspected for:

- Loose or broken fabric
- Loose posts
- Broken, loose, or missing ties
- Broken posts or rails
- Worn points on posts, rails, and fabric
- Cracked or broken concrete at the base of posts

### Visual Inspection Guidelines

All broken or missing parts, including concrete foundations, should be repaired or replaced prior to conducting tests described following this section. Any suspect or questionable areas identified during the visual inspection process should be given particular attention during testing to receive validation.

## Fence Construction Testing

Prior to sensor cable deployment, the tests outlined in this section should be performed to determine the acceptability of the fence. While the fence does not have to meet the criteria defined by these tests for the fiber optic intrusion detection system to work, meeting the suggested test criteria will ensure optimal intrusion detection and will help reduce the possibility of nuisance alarms.

### Post Rigidity Test

Posts should be tested by applying a 50 lb. force at a height of 5 feet above the ground level. The post should not deflect more than 3/4 inches at the point the force is applied. If the post moves more than 3/4 inches, it should be removed and a new post installed in accordance with Figure 2.

### Fabric Deflection Test

Fence fabric should be tested by applying a 50 lb. force to the fabric at mid-height of the fence and at the center of each pair of posts. The force should first be applied by pulling the fabric then pushing it. Measure the movement of the fence fabric at maximum deflection. The measured deflection should not exceed 2 1/2 inches. Repeat the test using a 30 lb. force applied at the same point. If the measured deflection exceeds the maximum allowable tolerance, the connections between the fabric and posts, rails, and top guard should be checked to ensure that as a minimum:

- The fabric is attached to the top and bottom rails by the proper ties at intervals not more than 12 inches.
- The fabric is attached to the posts in at least 5 equidistant locations including the top and bottom of the fabric.

### Testing Fabric Rigidity

If these requirements are not satisfied, new ties should be installed at the proper intervals and the test performed again. If the deflection still exceeds the recommended tolerance, the fabric should be re-tensioned to 1000 lbs. and ties installed at the proper interval.

Application Note

For more information on using the Fiber Defender™ series products with a buried application, please contact Fiber SenSys® technical support team directly at +1-503-692-4430 or by email at [info@fibersensys.com](mailto:info@fibersensys.com).

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