

Sargent & Greenleaf  
Model 0881 Environmental Padlock  
By Bosnianbill

## Background

Years ago I commanded a unit located on Seneca Army Depot, in Upstate New York in the Finger Lakes area. The base was closed under the Base Realignment and Closing Act (BRAC) in the 1992, but I still have a few of the obsolete locks that we used to secure the nuclear and conventional storage bunkers. The Army, in its infinite wisdom, did not want to collect and destroy the locks, but was interested in accounting for every last key. When we ultimately emptied the magazines and transferred the munitions to other depots, the Army discarded the locks but insisted on recovering and destroying the keys – documenting and videotaping the entire destruction process, key-by-key. At the time I remember think that was a little crazy, but have since realized what they were doing, and why. That is the subject of this article.



Figure 1: Sargent & Greenleaf Environmental Padlock, Model 0881.

## Current Uses

Oddly, there are hundreds of these S&G locks with manufacture dates stamped into their bodies dating back to the 1940s, but it was not finally patented until the late 1980s, and again in 1991. The Sargent and Greenleaf Environmental Padlocks are still in use today, mostly on bonded warehouses (U.S. Customs), various railroads, government storage buildings, and civilian companies needing a reliable, durable and extremely tough padlock for use in environmentally challenging locations (Antarctica, Alaska, Corrosive or Salty environments, etc). The 0881 is still available, and can be bought on eBay for around \$100, but has been replaced by the updated (and more secure) 0883.

## External Design

Externally, these are some of the toughest padlocks ever manufactured. The early bodies are hardened steel and later versions are made from stainless steel and measure 4.50 inches high, 2.75 inches wide, and are 1.50 inches thick – massive locks. They weigh over two pounds (three with the security chain) and the hardened steel shackles measure 0.56 inches in diameter. In experiments I smashed the lock with a 4-pound sledge hammer repeatedly. The lock was disfigured, but the locking mechanism remained intact and fully functional. In follow-on experiments I shot them with several pistol calibers (9mm Parabellum, .40 Smith and Wesson, and .45 ACP) as well as 12 Gauge shotguns, with no serious damage on the body or shackle. I ultimately shot them with high powered rifles (5.56mm & 7.62mm NATO). The locks had penetration of the bodies but no apparent effect on function of the locking mechanism. The 0881 did not fail until I hit it with a 7.62 NATO armor piercing cartridge. (See these tests at: [http://www.youtube.com/watch?v=kvYhA9c\\_F\\_g](http://www.youtube.com/watch?v=kvYhA9c_F_g))  
**These are the TRUE “Tough Under Fire” locks!**

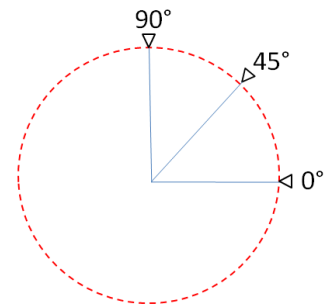
## Internal Design

Internally, the design of the 0881 is very similar to Abloy’s with one important exception: *it only has three discs!* S&G’s logic was that they wanted to provide an acceptable level of security, yet have a minimum

number of internal components, thus reducing the potential points of failure. Fewer parts = higher reliability. In effect, S&G sacrificed security for reliability. So, why did they make this choice? At the time the lock was designed, the Abloy design was virtually unknown in the United States, the target market for the lock. Given that few Americans had ever seen a lock with this mechanism, it was not likely that anyone would have any idea on how to defeat it, other than physical, destructive attacks. Knowing this, they constructed a massive, hardened steel lock and incorporated an obscure (at the time), little understood locking mechanism – the disc detainer. In effect, S&G depended on “Security through Obscurity” as a defensive measure – and it worked.

### **How to Pick the 0881**

If you disassemble the 0881 you will notice that the three discs have notches located every 45°, far fewer than the Abloy design which has notches every 15°-18°. Given that the lock only rotates through a 90° arc, there are only three possible positions (0°, 45°, and 90°) for the gate that the security bar can fall into. With that information, it becomes pretty easy to calculate the possible combinations of these three elements: 3 discs with three possible positions:  $3^3 = 27$  possible combinations, or keys.



**Figure 2: Angle of Disc Gates**

Using logic, we can further reduce the possibilities:

For example, it is very unlikely that S&G would bit a key that could be accidentally found by rotating all the discs. This removes three (0°-0°-0°, 45°-45°-45°, and 90°-90°-90°).

It is also likely we can remove all the combinations that allow the key to fall out when the shackle is open, making this (with one exception) a key-retaining lock. (There is one unusual exception to this, but few of these were made and they are difficult to find. Many collectors consider this single exception to be an S&G “mistake”, never intended to be released). This reduces the 24 remaining possibilities to 17.



**Figure 3: S&G 0881 Key #101**

Again, we can further reduce the possibilities by examining the known keys, which have a 3-digit number stamped onto their bow. Our suspicion that there are only three possible gate locations can be easily confirmed by examining a few of the S&G Environmental’s keys (FIGURE 3). Notice the keys are marked with a three-digit code, the key number.

Oddly, this key number (or actually the 2<sup>nd</sup> and 3<sup>rd</sup> digits of this number)



**Figure 4: Key number marking on top of lock**

matches a 2-digit stamp on the lock body or on the disc pack retainer (SEE FIGURE 4). In effect, each lock is marked to tell the user which key will open it! By scanning collector boards, YouTube videos, lock picking forums, and auction house listings we can pair the number stamped on the bow with a specific bitting in our table, so we can include the key numbers in the table as well.

Key #	Bow	Middle	Tip
101	90	0	45
102	45	0	90
103	45	0	45
104	90	0	90
105	0	45	0
106	0	90	0
107	0	90	45
109	45	90	0
112	0	45	90

Table 1: S&G 0881 Environmental Bitting Chart

With this data, it becomes very easy to pick the S&G Environmental 0881 lock. Here's how to do it:



Figure 5: You can see the three "half-moon" shaped disks in the key hole.

Step 1: Insert a Peterson pry bar (perfectly shaped and dimensioned for this task) into the keyway and rotate all three discs to their right-most (clockwise) position. For clarity, we'll call this the 0° position.

Step 2: Determine which key you need by reading it off the lock. Remember, the marking will be only two digits, representing the last two digits of the 3-digit key code. For example, "01" means key number "101" is needed to open the lock. We will use key 101 for the rest of the example. From the bitting chart, we see that the 101 key has a key bitting of 90°- 0°- 45°.

Step 3: Using a Peterson pry bar and rotate the *bottom disk first*. For the 101 key, rotate the bottom disk to the 90° position.

Step 4: The 2<sup>nd</sup> disk (the middle one) is already at 0°. Leave it alone.

Step 5: Rotate the 3<sup>rd</sup> disk (the top one) to 45°. At this point, all your disks for the lock are properly aligned but the lock will not fall open. It requires the final step.

Step 6: Begin turning the 3<sup>rd</sup> disk clockwise, as far as it will go. You should see the entire disc pack turning, not just disk 3. The disc pack will turn beyond the 0° position and the hasp will fall open.

Easy....but who wants to pick it? Why not make a key?

### **How to make a key for the S&G Environmental 0881 Padlock**

Making a key for the S&G Environmental 0881 is really pretty easy and you can do it in about 15 minutes. (You can see me make a key on YouTube at: <http://www.youtube.com/watch?v=o2TGlusJUK8>). S&G Environmental 0881s *with keys* sell for \$100 or more on eBay or auction sites. 0881s *without keys* are commonly available for less than \$30. To begin, you'll need a short piece (1-1/4" long) of 5/16" stock – aluminum, steel or brass – it really doesn't matter. You'll also need a file and a washer to use as the bow.



Figure 6: First, clamp your 5/16" stock into your vise and grab your file.



Figure 7: File it until you have a half-round profile that is 0.90" long. This is your blank key.



Figure 8: Next, refer to the bitting chart and mark off the three bits. Each bit is 0.30" wide. In this case, I am making a key for a number 103 lock I bought on eBay for \$21.



Figure 9: Here the two sections marked 45° have been filed. The center section, Marked 0° remains untouched.



Figure 10: In the top of the key use a hacksaw to cut a slot for the bow (the washer). Knock off the sharp edges on a wire wheel or with a hand file.



Figure 11: Since I have several locks, I punch the key number into my bow.



Figure 12: Next I tap the bow into the slot. You can either epoxy it in place or silver solder it. I prefer to silver solder it because it'll last longer.



Figure 13: My brand new key in my 103 lock.

Anyway, the S&G Environmental family of locks are very interesting and, until people figure out how easy it is to make their own key, are pretty inexpensive to collect.

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