

## CLAMPING FORCE

### PURPOSE OF TEST

Card-Lok retainers offer the highest clamping force available for cold wall applications. In a typical application two Card-Loks will be mounted either directly to the PCB or to a heat frame assembly via screws or rivets, and are then inserted into a machined cold wall channel within a rugged enclosure. When expanded, the Card-Lok will clamp the PCB in place. The amount of clamping force needed will depend on the application, specifically the amount of shock and vibration the board will be exposed to; too little clamping force may result in insufficient board retention and poor thermal performance and too great clamping force may result in damage to the Card-Lok, cold wall or printed circuit board.

### EQUIPMENT

Since there is currently no industry standard for testing clamp force performance, our Engineers developed a test fixture. The fixture consisting of two stainless steel bars, one fixed and one floating, to simulate the cold wall channel. The floating bar pushes against two calibrated load cells that measure the normal force applied by the Card-Lok when actuated. The new fixture is equipped with an automated screw driver that can quickly and accurately apply a specified torque. This allows us to test, measure, and accurately record clamp force data in seconds, allowing for more extensive cycle testing and continuous validation of product performance.

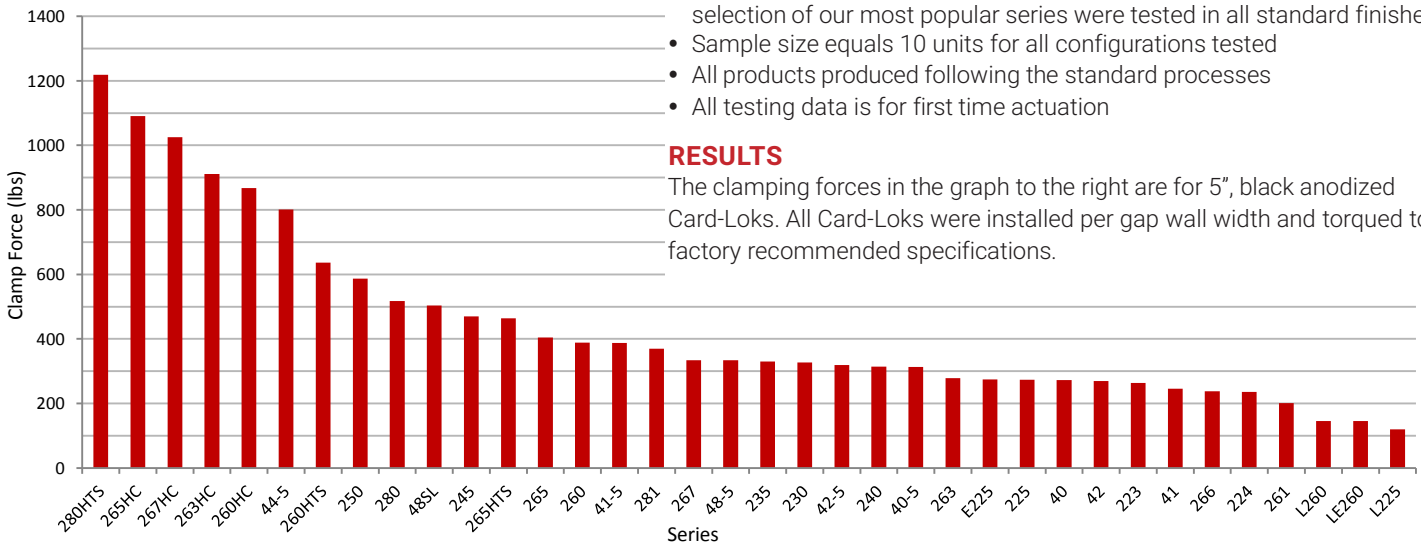


### TEST PROCEDURE

- All standard products were tested with black anodized finish and a selection of our most popular series were tested in all standard finishes
- Sample size equals 10 units for all configurations tested
- All products produced following the standard processes
- All testing data is for first time actuation

### RESULTS

The clamping forces in the graph to the right are for 5", black anodized Card-Loks. All Card-Loks were installed per gap wall width and torqued to factory recommended specifications.



Testing has shown the wedge angle has the greatest impact on clamp force, with the HC series having 2-3x the clamp force of their traditional counterparts. Following the wedge angle, the number of wedge segments has the next greatest impact on clamp force performance; in general a five segment Card Lok will provide higher clamp force as compared to a similar profile three segment Card Lok. The High Thermal Sawtooth design provides similar clamp force as the HC series.

As compared to the wedge angle, and number of wedges, the surface finish has a lesser impact on clamping force. The chart to the right shows the percentage change in clamping force among various plating finishes. Of the four plating finishes tested, black anodized provided the highest clamping force, followed closely by hard black anodized and electroless nickel. Card Loks with chem film yielded less than half the clamping force compared to comparable Card Loks that were anodized.

		Benchmark plating (previously used / tested)			
		Black Anodized	Hard Black Anodized	Electroless Nickel	Chem Film
New plating considered for application	Black Anodized	0.0%	10.4%	15.4%	105.8%
	Hard Black Anodized	-9.5%	0.0%	4.5%	86.4%
	Electroless Nickel	-13.4%	-4.3%	0.0%	78.3%
	Chem Film	-51.4%	-46.3%	-43.9%	0.0%

