

THE COMPACT CLAMP

(The FUTURE of CLAMPING)

COMPACT CLAMP



CLAMP MODELS

17-5XXX-XX

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Vektek, LLC reserves the right to change specifications without notice as a part of our ongoing product improvement process. Product designed by Brent D. Coats.

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1.0 An Overview of the Compact Clamp and its Accessories

Product Line Overview: The Vektek Compact Clamp Lineup consists of four different sizes of clamps ranging from 750Lbs to 2,750Lbs. Each clamp size can be ordered in both standard and Pneumatic Clamp Monitoring versions. In addition to these options, Vektek also sells both short and long clamping arms for every clamp in the lineup.

Initial Planning: Before purchasing a compact clamp there are a few key factors to consider:

1. **Clamping Force:** To start the planning process, an approximate clamping force requirement for the application is needed. This force requirement determines both the appropriate clamp size and the number of clamps required. In general, assembly operations usually do not require high amounts of clamping forces and smaller clamps are easier to work around. Conversely, machining operations with high side loads will require large amounts of force to stabilize the workpiece. Once a general concept of clamping force desired is determined, a clamp must now be found to hold it.
2. **Arm Length and Shape:** Because of the general design of the Compact Clamp the arm being used tremendously changes the clamps holding capabilities. Clamping close to the base with a short arm installed will generally give the best clamping force. Please see section 5.4 for more information on ideal arm geometry.
3. **Area Available:** Another consideration which must be made when designing a fixture with compact clamps is the area available. If space is not of the essence, using larger clamps is a safe way to ensure adequate clamping force.

Self-Produced Arms: If the standard arms offered do not meet the application requirements, several options are available for producing a custom arm:

1. **Machining down a long arm:** Vektek offers a long clamping lever for every size of Compact Clamp. These levers are standard catalog items and can easily be machined down to fit the application. (Note: This machining is not done by Vektek.)
2. **Make from scratch:** Due to the simplicity of the design, it is not difficult to reproduce the design. For custom made arms follow the hole, slot, and groove dimensions as shown below. NOTE: Exact dimensions can be found in the online catalog (ILS175202). All dimensions should be $\pm .010$ unless otherwise noted.

Dim AA	Can be as large as needed but longer means less force.	Dim AX	Must be in tolerance past front edge of clamp. Then dimension can vary.
Dim AK	Top of groove not used in actuation. Can be as big as desired.	Dim AAA	Can not be smaller. May be larger if not using -PS but NOT recommended.
Dim AN	Needs to clear Mohawk on "Flipback". Can be smaller if "AP" radius made equally smaller.	Dim AAB	No maximum if not using -PS clamp or if overtravel sensing not important.
Dim AS	Can be as wide or narrow as desired except at pin hole and slot.	Dim AAC & AAD	This groove can be excluded but vertical clamping stroke may be limited and risk of binding increases.
Dim AV	Larger equals better clamping force. Can be any dim.		

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Model No.	For Clamp Model	DIMENSIONS																			
		AA	AF	AG	AH	AK	AL	AM	AN	AP	AR	AS	AT	AV	AW	AX	AY	AAA	AAB	AAC	AAD
SHORT ARM																					
91-7217-00	17-5217-XX	1.25	30°	.310	.549	.364	.061	.390	.900	.188	.193	.682	.200	.827	.199	.175	.163	.486	.622	.199	.080
91-7220-00	17-5220-XX	1.50	25°	.399	.685	.529	.082	.515	1.125	.188	.257	.909	.300	1.188	.278	.239	.204	.691	.855	.280	.100
91-7225-00	17-5225-XX	2.00	25°	.499	.942	.596	.102	.640	1.500	.250	.321	1.136	.333	1.472	.314	.302	.257	.855	1.088	.349	.100
91-7232-00	17-5232-XX	2.25	25°	.598	1.070	.758	.123	.765	1.700	.281	.385	1.250	.353	1.816	.356	.394	.283	1.017	1.320	.420	.150
LONG ARM																					
91-7217-05	17-5217-XX	2.50	N/A	.310	.549	.364	.061	.390	.900	.188	.193	.682	N/A	.797	.199	.175	.163	.486	.622	.199	.080
91-7220-05	17-5220-XX	3.00	N/A	.399	.685	.529	.082	.515	1.125	.188	.257	.909	N/A	1.094	.278	.239	.204	.691	.855	.280	.100
91-7225-05	17-5225-XX	3.50	N/A	.499	.942	.596	.102	.640	1.500	.250	.321	1.136	N/A	1.390	.314	.302	.257	.855	1.088	.349	.100
91-7232-05	17-5232-XX	4.00	N/A	.598	1.070	.758	.123	.765	1.700	.281	.385	1.250	N/A	1.714	.356	.394	.283	1.017	1.320	.420	.150

SHORT ARM

LONG ARM

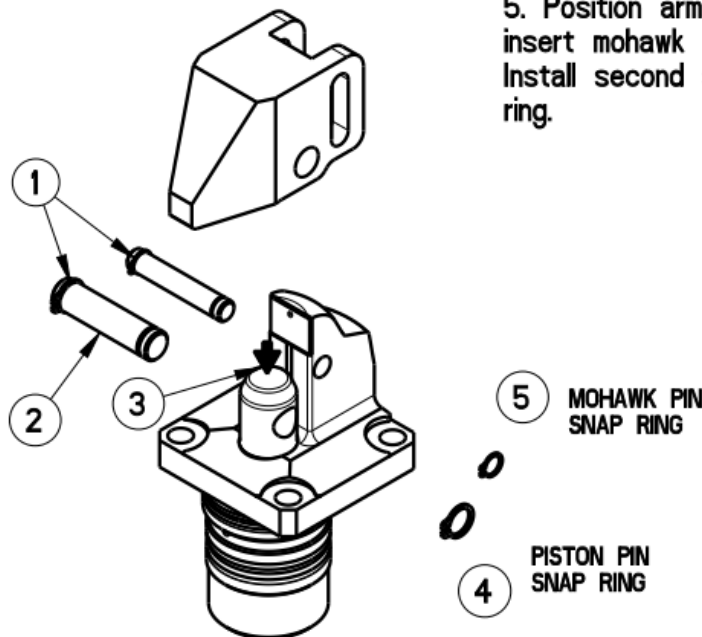
2.0 Initial Installation

The setup and installation of the compact clamp is relatively simple and can be broken down into three major steps:

1. **Installation of the arm:** Begin the setup process by installing the arm onto the compact clamp. First, locate the accessories bag that came with the clamp and remove both pins and all four snap rings. Second, install one snap ring on the end of each pin. Be careful in this step as the snap rings are different sizes. (The big snap ring goes with the big pin etc.). Third, lightly grease the two pins before sliding them into position. (The larger pin goes through the hole in the arm, into the hole in the plunger, and back out the other hole in the arm. The smaller pin goes through the slot in the arm, through the small hole in the mohawk and back out through the other slot in the arm.) After the pins are installed, push them all the way through and install the second snap ring. Make sure it seats in the groove on the pin. To complete the installation of the arm, carefully walk the clamp through its full clamping motion to ensure there is no substantial binding. (This is especially important to do with any custom-made arms). These steps can also be found on the card included with every unit.

Arm Installation Instructions

1. Install one snap ring on one end of both pins.
2. Lightly grease all pins using grease provided.
3. Position plunger near bottom of stroke.
4. Position arm and insert piston pin. Install second snap ring.
5. Position arm and insert mohawk pin. Install second snap ring.



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2. **Installing the Clamp into the Fixture.** The first step of final clamp installation is the installation of the Pneumatic Clamp Sensing O-Ring on the bottom of the unit. If the clamp was not ordered with this option or it will not be used, this step can be skipped.

As the groove for the O-ring is not round and it has a small shoulder, sometimes getting these O-rings in can be challenging. To assist in this process Vektek Engineering recommends the use of a light layer of grease on the O-ring to help it stick in the groove.

Next, begin inserting the clamp into the fixture by honing out the receiving bore. This step is crucial to prevent O-ring tearing from burrs on the cross holes and shoulders.

Afterwards lightly oil the external O-rings on the clamp and carefully push the clamp into the fixture using the top of the mohawk. A couple of light hammer whacks with a rubber mallet may be necessary to get the clamp to seat. DO NOT push down or hammer on the compact clamp arm. This will cause the piston to bottom out and break.

Last but not least, bolt the clamp down to the fixture using four Grade 12.9 socket head cap screws. Recommended screws and torques can be found below:

MODEL No.	Recommended Bolt Size	Torque
17-5X17-XX	8-32 x ½" long	5 Ft-Lbs
17-5X20-XX	12-24 x ¾" long	9 Ft-Lbs
17-5X25-XX	1/4-28 x ¾" long	16 Ft-Lbs
17-5X32-XX	5/16-24 x 1" long	30 Ft-Lbs

3. Once the clamp is installed there may be the final challenge of setting the clamping height. If the fixture was premade with a hard datum, (clamp point on fixture), this step is not necessary. In other cases where an adjustable datum is used, adjust the height so that the top of the compact clamp arm is level with the top of the compact clamp mohawk with part being clamped under pressure. This is the center of the clamps vertical stroke and is the optimum placement for maximum clamping force.

3.0 General Use Guidelines

Best Practices for Long Service Life:

1. **Clamp in the center of the stroke.** This will produce the greatest amount of clamping force with the least amount of reaction force on the clamp. Longer clamp and seal life will be obtained by following this guideline, but it is not critical to the clamps functioning. See Figure below to find the center of the stroke.

THE CLAMP HERE IS SHOWN IN THE CENTER OF THE CLAMPING STROKE. NOTE HOW THE TOP OF THE MOHAWK (BLUE) IS LEVEL WITH THE TOP OF THE ARM. THIS IS ALSO THE CENTER OF THE SENSING STROKE.

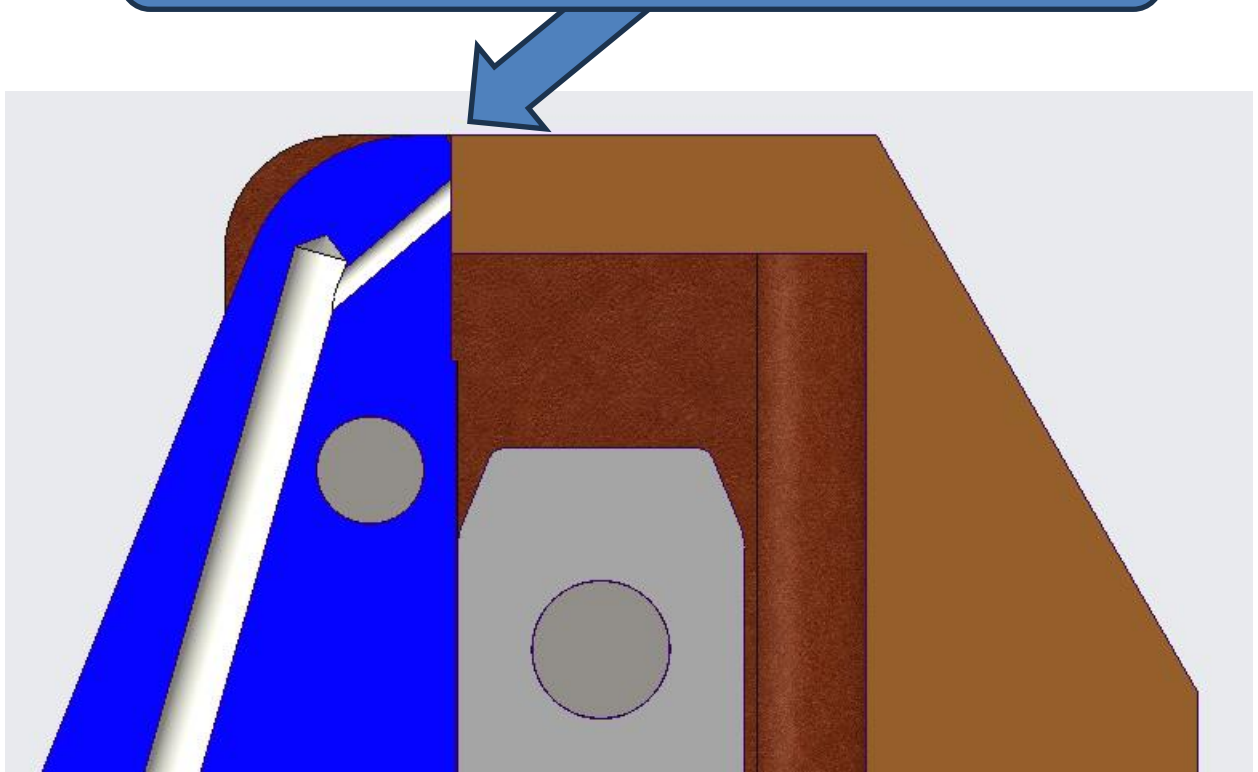


FIGURE 7

2. **Frequently remove chips and debris from surface.** Chips and debris which pile up on the surface of the clamp may get forced down into the rod wiper. This is not common but cleaning these chips off on occasion can help avoid this risk.
3. **Use the coolant stream to keep the clamp clean.** If coolant is present in the machine where the compact clamp is to be installed, purposely setting up the coolant system to help flush chips away from the clamp is a great way to avoid chip ingress and frequent seal replacement!
4. **Use the pneumatic sensing.** While not designed or rated for this purpose, it was found in testing that the use of the pneumatic clamp confirmation circuit helped blow

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chips and coolant out of the crevices in the arm. If this is easy to do on the machine it certainly won't hurt!

5. **Limit the size of the clamp arm.** In general, shorter arms are better on the clamp. They provide more clamping force with less reaction force on the mohawk, and the inertia is reduced. All of these factors help protect the clamp from damage.
6. **Inspect regularly.** The compact clamp was designed with maintenance in mind, so use it. If possible, regularly check that the bolts are well torqued and remove and repack grease in the pins and arm. This simple step will help detect problems early, preventing downtime, and keeping the clamp in a well serviceable state with the full rated clamping force for its entire life.

4.0 Repair and Service

Step By Step Instructions for Replacement of Seals:

1. **Order the appropriate seal kit:**

CLAMP MODEL No.	SEAL KIT No.
17-5217-00	60-1752-10
17-5217-00-PS	60-1752-11
17-5220-00	60-1752-20
17-5220-00-PS	60-1752-21
17-5225-00	60-1752-30
17-5225-00-PS	60-1752-31
17-5232-00	60-1752-40
17-5232-00-PS	60-1752-41

2. **Remove clamping arm.** Remove both snap rings on one side of the clamp and pull out mohawk and piston pins. After pins are removed pull arm off of compact clamp. (Note: If clamp placement prevents removing the pins or arm in place proceed to step 3 and come back to this.)
3. **Uninstall Clamp.** Carefully remove the compact clamp from the fixture. If clamp will not easily pull out try placing an allen wrench through the Mohawk Pin hole and pull upwards with a twisting motion.
4. **Remove plunger.** Press downward on the plunger and push it through the bottom of the unit. Be careful of potentially sharp edges from wear on the inside of the clamp.
5. **Remove all seals.** Remove the plunger seal, the 2 external SSA seals, the rod seal, and the quad ring-wiper. If equipped the Position Sensing o-ring should also be removed.
6. **Install the new plunger seal.** Put a light amount of grease on the new crown seal and slowly install it onto the plunger being careful not to stretch it more than necessary.

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7. **Install the new rod seal.** This is the hardest seal to install and may be difficult to do. With patience it can be done with a pick and seal tool but specialty AT tools can be purchased if necessary. Make sure the lips are facing the bottom of the clamp!
8. **Install the wiper.** Lightly grease the quad ring and slip it into the top internal groove. Orientation not important.
9. **Install the external seals.** Lightly grease the SSA seals and slide them into their corresponding grooves.
10. **Reinstall the clamp into the fixture.** Repeat all of the procedures described in section 2.

Service Recommendations:

1. **Grease regularly.** While not required Vektek engineering would recommend removing and re-greasing both the mohawk and plunger pin about every 50,000 cycles.
2. **Clean and inspect.** Use a rag or a jet of coolant to clean off the clamp and inspect it for any issues at the start of every workday.
3. **Retorque mounting bolts.** The precise torque of the mounting bolts is important for the proper functioning of the compact clamp. Vektek Engineering would recommend checking the torque of the clamping bolts every month or during preemptive maintenance routines.

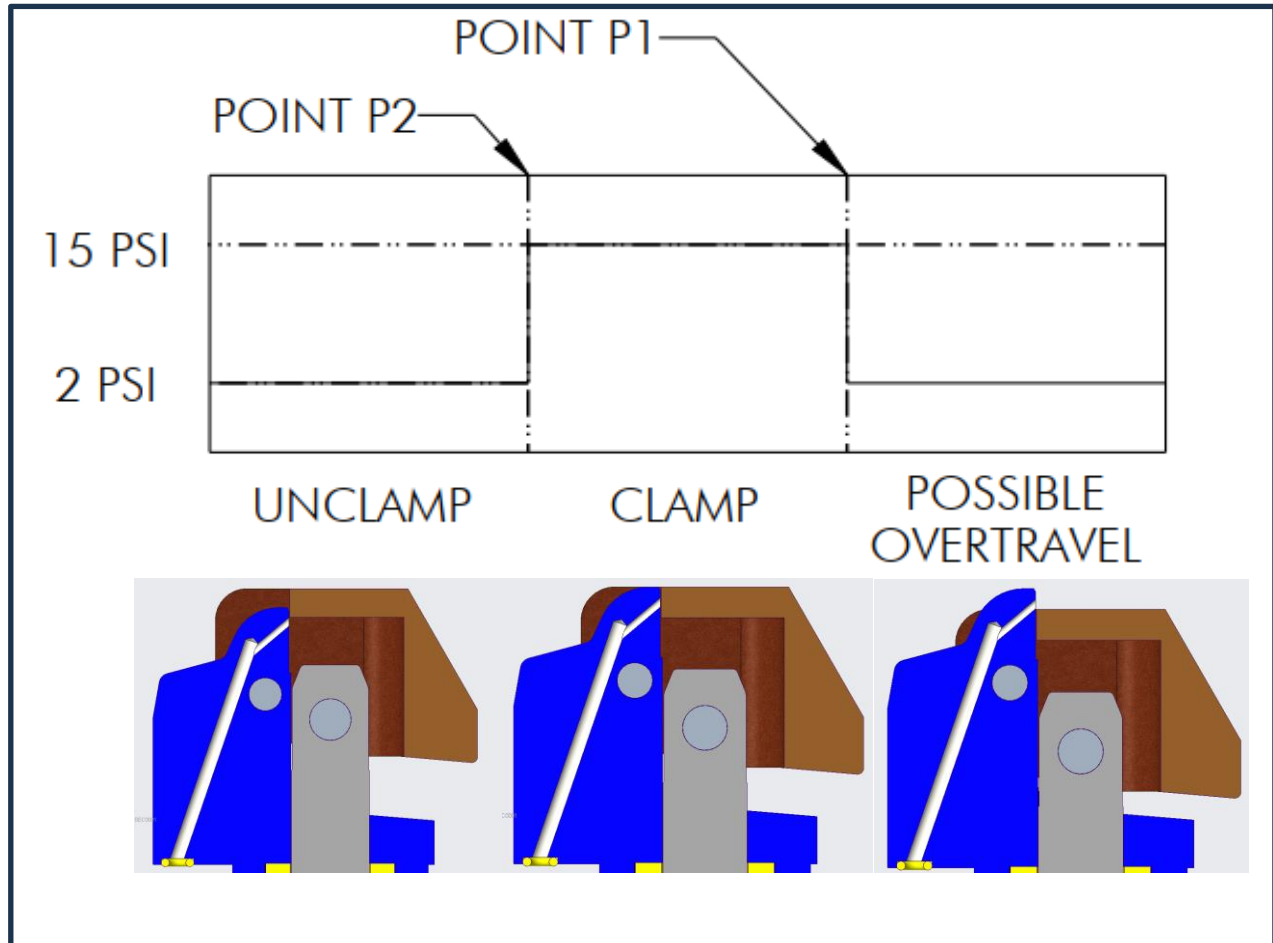
MODEL #	TORQUE
17-5X17-XX	5 Ft-Lbs
17-5X20-XX	9 Ft-Lbs
17-5X25-XX	16 Ft-Lbs
17-5X32-XX	30 Ft-Lbs

4. **Check for wear.** Inspect the tip of the clamping arm every 100,000 cycles or so to see if it has worn significantly.

5.0 Other Useful Information

Pneumatic Clamp Monitoring:

1. Pneumatic clamp monitoring allows the user to determine if the clamping arm is in the proper position for clamping. Please see the graph below for process:



2. Setup procedure: Connect an air supply to the clamp sensing pathway. Manually or hydraulically put every clamp into the fully clamped position and confirm that all of the pneumatic pathways at the top of the mohawk are covered by the arm. Adjust the pressure to be around 15 PSI. Unclamp each compact clamp one at a time and check for pressure drop. The pressure should drop to about 2 PSI. If the pressure does not drop this low, try reducing the pneumatic flow rate to the fixture. If one or more of the clamps does not show a drop in pressure when in the unclamp position, there may be an issue with that clamps internal passageways. Contact customer service for instructions to solve this issue.

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Troubleshooting:

- 1. The clamp is not extending/retracting completely; What is wrong?**
 - a. If the clamp is getting stuck right at the “Flip back” point, it is most likely caused from incorrect arm geometry between the slot and the hole. A new arm is likely needed.
- 2. The clamp is not achieving full clamping force?**
 - a. This depends on the arm in use. If it is a custom-made arm reference the graphs in the following section for expected clamping forces. Otherwise check to see if the clamp is leaking, or not in the proper area of its stroke when clamping.
- 3. The pneumatic sensing option is not working?**
 - a. Try decreasing the pneumatic flow to the circuit. If that fails to solve the issue a chip or manufacturing issue has blocked the internal pneumatic passageway.

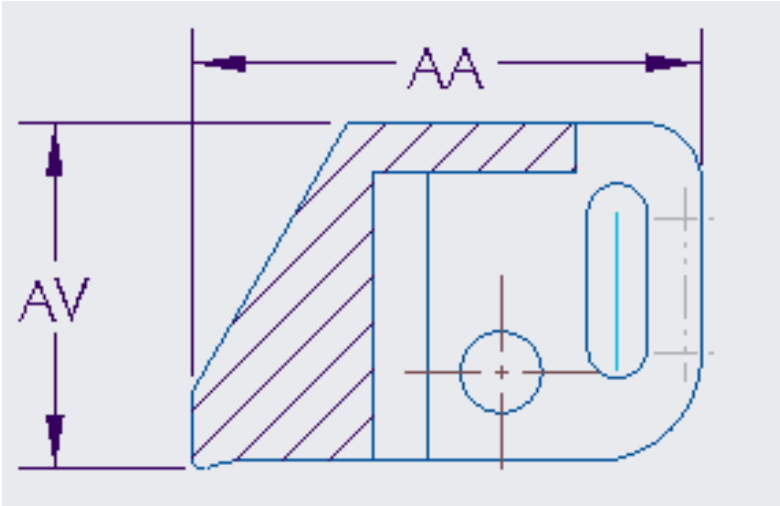
Calculations:

MAX PRESSURE					
$PF = \left\{ \frac{\alpha * AV}{AA - \Omega} \right\}$ $MP = \frac{PF}{\delta}$ <u>or</u> $MP = \frac{\left\{ \frac{\alpha * AV}{AA - \Omega} \right\}}{\delta}$	COEFICIENTS				
	SZ	Ω	α	δ	β
	1	.355	1,207	.223	.28
	2	.419	1,331	.293	.28
	3	.627	2,244	.481	.28
	4	.685	3,399	.789	.28
	VARIABLES				
	MP=	MAXIMUM PRESSURE			
	PF=	PLUNGER FORCE			
	AA=	ARM LENGTH (SEE PICTURE)			
	AV=	ARM HEIGHT FROM CLAMPING POINT TO MOHAWK (SEE PICTURE)			

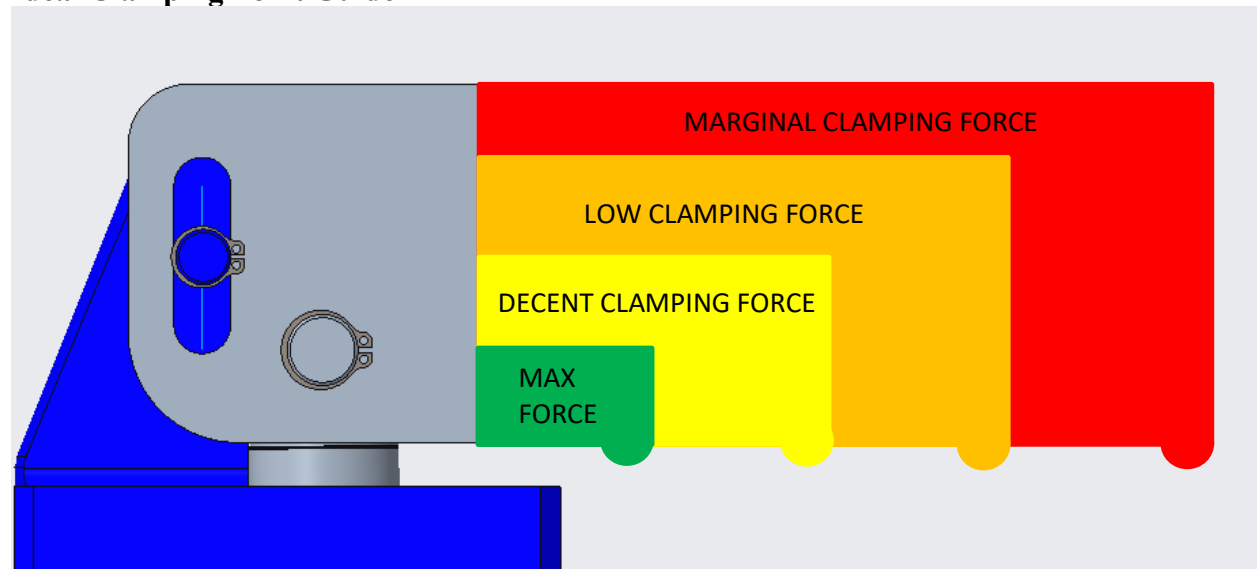
Calculations look tough?

Ask customer support for Excel Calculator IS1798 to do the work for you!

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CLAMPING FORCE					
$CF = PF - \left\{ \frac{PF * (AA - \Omega)}{AV} \right\} * \beta$ <u>or</u> $CF = \left\{ \frac{\alpha * AV}{AA - \Omega} \right\} - \alpha * \beta$		COEFFICIENTS			
		SZ	Ω	α	β
		1	.355	1,207	.28
		2	.419	1,331	.28
		3	.627	2,244	.28
		4	.685	3,399	.28
VARIABLES					
CF=		CLAMPING FORCE			
PF=		PLUNGER FORCE			
AA=		ARM LENGTH (SEE PICTURE)			
AV=		ARM HEIGHT FROM CLAMPING POINT TO MOHAWK (SEE PICTURE)			

Ideal Clamping Point Guide



NOTE: For reference only. Zones reflect the location of clamping, not exact arm geometry.