

## JAW FORCE

The Perfect Heatseal is achieved with absolute control over time, temperature, and pressure. Whereas the perfect repeatable temperature cycle is the most difficult to achieve, perfection cannot be achieved without a controlled pressure that is uniform over the full length of the sealed area.

Most heat-sealing machines used for sealing plastic films and fittings use air pressure for activating the sealing jaws and applying the pressure that is needed to consistently achieve a predictable seal.

The use of air pressure to close the heatseal jaws allows the machine designer to vary the closing speed, apply a modest interim pressure if needed for final positioning or the application of a vacuum cycle prior to executing the final full pressure seal.

The sealing pressure applied when making a seal is a function of the:

- Air Supply Pressure
- Regulated Pressure supplied to the air cylinders
- Effective Area of the air cylinders
- Number of cylinders employed
- Leverage gained or lost if leverage is employed
- Surface Area of the heatseal band the comes in contact with the work piece

The Air Supply Pressure should be as high as possible, within safety limits, to assure adequate airflow through the air regulator, usually 80 – 85 pounds per square inch (psi).

The Regulated Pressure “P” that is used is depends upon the calculated forced required at the jaw bar. The total force applied to the jaw bar is, in turn, calculated based upon the area of the contact surface between the jaw bars. More information about contact surface follows.

The Effective Area of the cylinders can be obtained from catalog specifications or calculated.

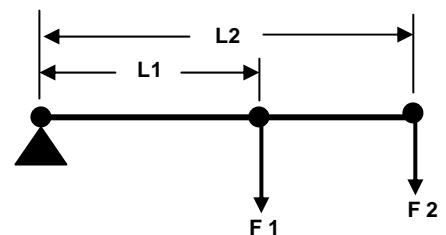
The Effective Area when extending the piston rod is equal to – Cylinder Diameter<sup>2</sup> X 0.785

The Effective Area when retracting the cylinder is the same less the area of the piston rod, that is:  
(Cylinder Diameter<sup>2</sup> X 0.785) – (Rod Dia.<sup>2</sup> X 0.785)

The Leverage is calculated as:

$$\frac{F1 \times L1}{L2} = F2$$

Where **L1** and **L2** are distances from the fulcrum and **F1** is the Cylinder Force and **F2** is the force exerted on the jaw bar.



The Cylinder Force “F1” is calculated by multiplying the Regulated Pressure “P” times the total Effective Area of the cylinder(s).

The Surface Area of the heatseal bar is its length multiplied by its effective width. The unit force or pressure is equal to the total force applied to the jaw bar divided by the effective area of the heatseal bar.

NOTE:- When sealing thicker materials the heatseal band or bar may not make significant contact with the opposing jaw because it is held away by the thickness of the work piece material(s). In this case the Surface Area calculation should be based upon the width of the actual seal multiplied by the length of the actual seal rather than the length of the seal band. Please contact Applications Engineering at Toss Machine Components, Inc. 610-759-8883.

### Optimum Jaw Force

In most cases the optimum jaw force is determined by actual testing with the work piece that is to be sealed. The ideal jaw force is influenced by the nature and thickness of the materials being sealed, the sealing temperature and the length and width of the desired seal or cut. In every case the optimum sealing parameters are a trade off amongst time, temperature and pressure. Sealing time will be reduced by increasing temperature and pressure, but excessive temperature and pressure may cause thinning or deformation of the materials and reduce the integrity of the bond.

Nonetheless, one must establish a starting point from which to fine-tune the time, temperature, and pressure relationship. For sealing applications a jaw pressure of 50 # / sq. inch is a good starting point. A higher pressure may be required for clean cutting.

### Jaw Bar Assembly

The materials used in the jaw bar assembly can have a significant effect on the quality of the seal. The Jaw Bars provided by Toss Machine Components (TMC) are designed to use a self adhesive Silicone Jaw Form Strip either beneath the Heatseal Band or on the opposing jaw. This 60-durometer strip will conform around the Heatseal Band so that the effect width of contact between the jaws is approximately 0.59" With the exception of very thick bands or special cutting bands the effective contact Surface Area for jaw pressure calculations is therefore 0.59" times the length of the jaw in inches.

### Pressure Charts

The Instruction Manuals included with PackworldUSA machines include a chart of the Jaw Bar Pressure –vs- the Air Pressure setting that is required. For copies, call PackworldUSA at 610-746-2765.

### Simple Calculation for Standard PackworldUSA machines.

A simple calculation can be made by multiplying the unit pressure desired by the length of the Jaw Bar and the Design Factor, (  $f$  ). This takes into account the design features of the machine. Each series of PackworldUSA machine has a specific Design Factor.

PackworldUSA Series	Design Factor	PackworldUSA Series	Design Factor
PW 3000	.0644	PW5036	0.0280
PW 3100	.0863	PW5052	0.0280
PW4025	.0526	PW5060	0.0210
PW4040	.0351	PW5072	0.0210

$$P_J \times f \times L = P_R$$

Where:  $P_J$  = unit pressure on the Jaw Bar  
 $L$  = Jaw Bar Length  
 $f$  = Design Factor  
 $P_R$  = Regulated Air Pressure