# Springs

## Variable Notation

**AT:** Spring Average Tensile [constant]

**CIT:** Increase of Circumference per Turn; Change in circumference from IRS (inches)

**CL:** Spring Coil Length (inches)

**CR:** Spring Cycle Rating; Ratio of Torque to be used for calculations [constant]

**CP:** Circumference of Pipe (inches)

**HS:** Height to Stops (inches)

**HWO:** Open Hanging Weight; Weight of Unwrapped Remainder of Curtain when Door is Open (lb)

**ID:** Spring Inner Diameter (inches)

**IRS:** Increase Radius of Slat; Amount 1 individual Slat adds to the radius of the Pipe + Curtain (inches)

**L:** Spring Length Uncoiled (inches)

**LC:** Spring Length Coiled (inches)

**LR:** Spring Lift Rate [constant]

**LS:** Spring Stretch Required (for number of turns)

**MD:** Spring Mean Diameter (inches)

**MID:** Minimum OD that a Wire can accommodate [constant]

**MOD:** Max OD of Pipe; Largest OD that will fit inside of the Pipe [constant]

**MP:** Currently unknown abbreviation: is used to calculate MT.

**MP\_base:** MP\_base is the part of MP that can be pre-calculated knowing only the wire used [constant]

**MT:** Max Turns

**NC:** Number of Coils per Spring Uncoiled Length

**OD:** Spring Outer Diameter (inches)

**PT:** Pre-Turns

**RF:** Final Radius; Radius from center of shaft to outermost point of curtain (inches)

**RP:** Pipe Radius; Overall radius of the Pipe (including barrel rings) (inches)

**RMD:** Ratio of Medium Diameters for Compound Springs (Outer-over-Inner)

**RTI:** Ratio of Torque for Inner Compound Spring; used to calculate equal spring sizes

**RWD:** Ratio of Wire Diameters for Compound Springs (Inner-over-Outer)

**ST:** Spring Torque ( (inch/lb)/turn)

**T:** Torque ( (inch/lb)/turn)

**TPT:** Torque Per Turn; Target torque for spring ( (inch/lb)/turn)

**TRC:** Required Torque Closed; Torque to Lift Closed Curtain ( (inch/lb))

**TRI:** Require Torque Inner Spring ( (inch/lb))

**TRO:** Required Torque Open; Torque to Hold Curtain Open ( (inch/lb))

**TRU:** Required Torque Outer Spring (inch/lb))

**TR:** Turns to Raise

**TT:** Total Turns

**WD:** Spring Wire Diameter (inches)

## Equations

Circumference of Pipe (CP)

2π x RP

Final Radius (RF)

RP + (TR x IRS)

Increase Circumference per Turn (ICT)

π x IRS

Pre-Turns (PT)

TRO / TPT

Ratio of Mean Diameters of Compound Springs (RMD)

MDo / MDi

Ratio of Torque of Compound Springs (RTI)

RMD x RWD^5

Ratio of Wire Diameter of Compound Springs (RWD)

WDi / WDo

Required Torque Closed (TRC)

RP x HWC

Required Torque Inner (TRI)

TRU x RTI

Required Torque Open (TRO)

RF x HWO

Require Torque Outer (TRU)

TPT / (RTI + 1)

Spring Coil Length (CL)

MD x π

Spring Inner Diameter (ID)

OD – 2WD

Spring Length Coiled (LC)

NC \* WD

Spring Length Uncoiled (L)

LR / ST

Spring Lift Rate (LR)

ST x L

Spring Max Turns (MT)

MP / ST

Spring Mean Diameter (MD)

OD - WD  
Spring MP (MP)

AT x CR x WD^3 / 10.2

MP\_base x CR (Using pre-calculated MP\_base)

Spring MP\_base (MP\_base)

AT x WD^3 / 10.2

MT x ST / CR (Approximation of required MP\_base)

Spring Number Coils (NC)

L / CL

Spring Stretch (LS)

TT x WD x 2 (2 is a safety factor)

Spring Torque (ST)

LR / L (For use with Predetermined Spring)

MP / TT / 1.015 (For use with Required WD and TT, 1.015 is a safety factor)

Torque per Turn (TPT)

(TRC – TRO) / TR

Total Turns (TT)

TR + PT

Turns to Raise (TR)

Explanation and extra Equations provided for clarity (Only final equation necessary)

Length of Curtain to stops (HS) is fully wrapped by (equal to) wrapping it around the circumference of the Pipe (2π x RP) a number of Times ( x TR), including (+) the extra distance covered by the increasing radius (π x ICT) per turn ( x TR) cumulative with each previous turn ( x TR).

2π x RP x TR + π x ICT x TR^2 = HS (Full Equation)

CIT x TR^2 + CP x TR -HS (Simplified and Reordered)

(Solved for TR and Further Simplified)

## Calculating Spring Sizes

### Requirements:

TPT, TT, CR, MOD

### Single Spring Assembly

For each WD which can accommodate MOD, calculate MT for that Wire (ST = TPT). Use smallest WD with MT greater than TT. To get LC, calculate: L -> MD -> CL -> NC -> LC.

### Compound Assembly

There are several ways to go about determining what pair of springs to use for a Compound Assembly.

For all Compound Assemblies, each WD (OUTER) which can accommodate MOD can be paired with wires (INNER) whose MID can fit within OUTER’s ID; typically, OUTER/INNER OD’s will be 3.75/2.75 respectively for 4-inch pipes and 5.652/3.75 for 6-inch pipes.

General Method

This method generates the maximum amount of torque from the OUTER and uses INNER to make up the difference.

Use the largest WD with can accommodate MOD as OUTER. Calculate the ST of OUTER using the second ST formula. Use this to calculate L -> MD -> CL -> NC -> LC -> LS.

Use the difference between TPT and OUTER ST as INNER ST. Calculate the approximate MP\_base (MT = TT). Try the Largest INNER with closest MP\_base. Calculate L -> MD ->CL ->NC -> LC -> LS.

Verify the following: OUTER ST + INNER ST ≈ TPT (±5%); INNER MT < TT \* 1.015; OUTER LS + OUTER LC > INNER LS + INNER LC + 6

If INNER doesn’t pass the above tests, calculate progressively smaller Wires.

Springs of Closest Lengths

For each pair, calculate: RMD -> RWD -> RTI -> TRU -> TRI. For each Spring in pair, calculate MT (TRU/TRI = TPT for OUTER/INNER, respectively): discard pair if either result is less than TT.

### Tandem Springs Assembly

Tandem Springs are simply multiple Assemblies chained together with a cumulative torque. Due to the additional Costs associated with the increased Shaft and Castings requirement, and the decreasing free space inside the Pipe Shell when more Assemblies are added, these Assemblies should only be a last resort!

Since Tandem Assemblies double, triple, etc. potential Torque as more Assemblies are chained together, the most straightforward way to construct a Tandem Assembly is to divide the TPT by the number of Tandem Assemblies and use the previously listed methods to create those Assemblies based on that quantity.

## Mathematics Notes

For reference and edification the following is provided to aide in the understanding of some equations.

### Quadratic Equations

Used in:

Turns to Raise (TR)

Explanation:

Given an equation of form:

x can be calculated using the formula:

This equation can potentially have no answers, one answer, or two answers. In our case, the only answer that we can use is a positive result: any other results indicate that our numbers are invalid.

For Turns to Raise (TR), a = CIT, b = CP, and c = -HS. When these numbers are plugged into the equation, they result in the equation given in the “Equations” section.

Note that will never result in a negative and will always result in a positive number as neither CIT nor HS should ever be negative numbers; due to this, the Quadratic Equation will never result in “No Answer” since “No Answer” only ever arises from a negative result in the radical (the square root of a negative number is an imaginary number).

Furthermore, since we will never use a Negative number of Turns (which is why we can only ever have one answer), and it is impossible for CIT to be negative, we will only ever be adding (+) –CP with : using subtraction would always result in a negative number of turns.

### Ratios

Used in:

Compound Assembly: Springs of Closets Lengths

Explanation:

Ratios are the idea that for every X items in a Unit-Size, there should be a number of Y items. A pair of examples: a display with a 16:9 ratio indicates that for every 16 pixels horizontally there are 9 pixels vertically; if a single batch of a recipe requires 4 eggs and 2 tablespoons of butter, the egg-to-butter ratio is 4:2; this results in 2:1 if using half a batch (half a Unit-Size) and 8:4 for two batches (2 Unit-Size).

Thus, the total of a Unit-Size of the ratio X-to-Y is equal to their sum:

Resolving a ratio to a decimal amount can be done by dividing X by Y. As seen above, the sum of these decimals will always be 1. The following identities can be resolved:

Given R, Y can be solved for a single Unit-Size in the following manner:

Which then can be used to solve for X:

In the case of Compound Assemblies, the Unit-Size is the Torque per Turn (TPT). We use the Ratio of Torque of Compound Springs (RTI) equation to determine the ratio of the two springs’ Torque-per-Inch. Given the results above, Required Torque Outer (TRU) is equal to and Required Torque Inner is.

## Additional Notes

### Ratio of Torque of Compound Springs (RTI)

It is important to note that this equation was developed by this company and is based on an Excel-generated Power Trendline along a graph of the Ratio of Torque between Pairs of Springs. While the equation follows the original graph a rate of nearly 1:1, there is no inherent guarantee that it would continue to be as accurate for any pairings not tested, as it is not rigorously proven.

Accordingly, when using the RTI to generate Springs, the resulting assembly should always be validated for safety’s sake.

# Tracks

## Track Design

Tracks consist of three pieces: the Wall Guide, Inner Guide, and Outer Guide. Each of these pieces is mirrored so that a set is available for each side of the door (left/right); the holes are mirrored specifically because the two tracks will be facing towards the center (thus facing opposite directions).

The Inner and Outer Guides have Stops attached to them (to prevent the Curtain from continuing to rise).

The Holes of the Tracks have an orientation: this is given relative to the ground when the Track is stood straight up. Relative to the Angle itself, “Horizontal” signifies a Punch whose long edge is parallel with the top/bottom of the track and perpendicular to the edge; “Vertical” has the reverse orientation (is at a right angle to Horizontal).

The Tracks often have a hole punched a specific distance from the bottom: in every case, no other hole on the same side should be below this hole and any hole within 8 inches of this hole does not need to be punched.

Wall Guide

The Wall Guide is a 3x3x1/8 piece of Steel Angle. It is 20-1/4 inches longer than the Opening Height. This is 18 inches for the End Plate, 2 Inches for the Stops, and a Quarter inch extra space between the End Plate and the Stops for adjustment; if the End Plate or Stops size changes, adjust this height and all hole punch measurements accordingly.

The Wall Side of the guide has 1/2 inch Hole Punches horizontally (to the ground) set between 5/8 and 3/4 inches from the edge. These holes are to anchor the Guide to the Wall; the first hole is 2 inches from the top of the Guide, the next is 16, and additional punches are made as needed every 30 inches. The final hole of the wall Guide should be 6 inches from the bottom of the Guide.

The Guide Side has 3 sets of punches: (3) 1/2 inch Holes (one Horizontal and two Vertical) to secure the End Plate and a number of 7/16 Holes for securing Inner and Outer Guides to the Wall Angle.

The first Hole for the End Plate is 1 Inch from the top of the Guide, centered on the guide, and is Horizontal. The next two are Vertical, also centered on the guide, and are placed 3-1/4 and 17 Inches from the top, respectively.

The remaining Holes on the Guide Side are vertical, again- using the 7/16 Punch, and start at 25 Inches and repeat every 30 Inches; the last hole should be 5 Inches from the bottom of the guide. These Holes should be between 1/2 and 5/8 Inch from the edge.

Stops

The current Stops being used are Bellmouth Stops. They come in two pieces: the Stop itself which is the curved piece, and the Block that the Stop attaches to, which is a rectangle piece of steel. Disassemble the pair if necessary and include the Stop and Bolt in the Hardware for the Tracks.

Each Inner and Outer Track should have a Block welded centered horizontally and flush with the top edge of the Angle. The Block typically has an edge with a slight curve on it: this curve should be at the bottom of the Block. The Block is welded on the Inside (interior angle side) of the 3 Inch side on the Inner Track. It should be welded on the Outside (exterior angle side) of the Outer Track, on the side that is not punched.

Inner Guide

The Inner Guide is a 3x2x1/8 piece of Steel Angle. It should be 2 Inches longer than the Opening Height (to accommodate the Stops). As with the Wall Guide, if the Stops are changed, this height may need to be adjusted.

The Inner Guide has Horizontal, 7/16 Holes centered on the 2 Inch side. For the placement of these Holes, align the guide with the bottom of the Wall Track of the same side with the Wall Track’s Guide Side against the Inner Guide’s 2 Inch side; the marks on the Wall Track’s Guide Side can then be transferred directly across to the Inner Guide to ensure they are aligned.

Outer Guide

The Outer Guide is a 3x3x1/8 piece of Steel Angle. It is the same length- and follows the same procedure as- the Inner Guide with the exception that it only has 3-inch sides (punch just one of the two) and that the Punch should be Vertically-oriented and placed 1/4 inch from the Edge (this Hole should ***never*** be less than 1/4 for safety reasons, and should be as close to 1/4 as possible to provide for the most amount of space within the Tracks when assembled).

Standard Assembly

We do not assemble the Tracks ourselves; they should be stacked atop each other with Wall Angles at the bottom, followed by Outer, then Inner Tracks.

The standard method for assembling the Tracks is referred to as “E-Guides.” To do so, Bolt together the Wall Angle’s Guide Side to the Inner and Outer Guides so that the unbolted sides are all facing the same direction. In this manner the Tracks form the eponymous “E” shape, with the Inner Guide sandwiched between the Wall and Outer Guides. (As reference here, for Masonry “Z-Guides” should be used and simply involves reversing the orientation of the Wall Angle so that the Wall Side is pointing the opposite direction as the Inner and Outer Guides).

Hardware

For every Hole on the Outer Guides include Two 3/8by 1-1/2 Bolt and a Washer and Nut of the same inner diameter (One set for each Track Set- left and right). Also be sure to include the leftover pieces from the Stops so that they can be reassembled by the Installers.

## Hole Punch Machine

The Hole Punch Machine has the following parts: the Machine itself, the Motor, the Punch Holder, the Punch, Spring, and the Die. The Bench is also described here as an extension of the machine.

Hole Punch Machine

The Hole Punch Machine connects the Motor to a drive shaft via three belts. A foot petal is used to releases the drive shaft which then cycles the Press Plate up and down. The Press Plate impacts the Punch, which is held in place by the Punch Holder, which simultaneously aligns it with the Die: the Die sheers against the Punch in order to penetrate the steel being punched.

Motor

The Motor sits atop the Hole Punch Machine on an adjustable plate. The plate can be moved up and down in order to adjust the slack on the belts that drive the machine.

The following are the key statistics of the motor:

Punch Holder

The Punch Holder is an elongated “C”-shaped, single piece of Steel which sits below the Hole Punch Machine’s Press Plate.

It has a round hole in the front of the Holder through the top and bottom portion of the “C.” The top hole has a Collar on it which is wrapped by a thin wire. The Collar is slotted to assist in aligning the Punch. The bottom hole has a slope to it for discharging punched steel debris away from the Punch. It has a nub which- like the collar- is used to align the Die. The nub can be adjusted by using a hammer to lightly shift it in or out using a long punch.

The Punch Holder also has a slotted hole through the center-bottom of the “C” which can be used to secure the Punch Holder to the Machine’s table. This uses a 1/2 by 5 Inch Hex Bolt. The Bolt is screwed up through the Table from underneath. If this becomes difficult to do, the threads can be cleaned using the Tap Set. The Punch Holder is then clamped in place by tightening it down with a serrated nut on the Bolt.

Punch

The Punch comes in two sizes: 1/2 [.5] Inch and 7/16 [.4375] inch. They are “Double D”-type punches.

The Punch goes in the top of the top section of the Punch Holder above the collar. The Punch has two nubs on it at right-angles to each other for aligning the Punch inside of collar (which is slotted to accept the Punch’s nub).

The Punch can be purchased from UnitPunch.

Spring

The Spring is a “Green” spring for an A2 set. “Blue” (weaker) and “Yellow” (stronger) can be used, but are not recommended.

The Punch goes through the Spring before being placed into the Punch Holder; the Spring retracts the Punch and separates it from the Collar.

The Spring can be purchased from UnitPunch.

Die

The Die should match the Specifications and Orientation of the punch being used; failure to do so will destroy the Punch and possibly the Die itself. The Die goes in the top of the bottom section of the Punch Holder, directly below the Punch. The Die has two slots for aligning it inside of the Punch Holder (which has a nub to guide them).

It should be purchased from the same company as the Punch in order to ensure that it matches. Generally, it is sized slightly larger (.543 for the 1/2 inch and .475 for the 7/16 inch) in order to not impact the Punch.

Bench

The Bench holds the track that is being punched. The track should overhang the edge of the Bench with the opposite side facing down and flush against the bench (in other words, the angle should have the same orientation as the Bench. It can be adjusted in and out by loosening the top bolts which holds the steel rods connecting the table. Adjusting the Bench inwards (towards the back of the Hole Punch Machine) will cause the holes to be punched closer to the angle’s bend; adjusting the Bench outwards will move the punch towards the angle’s edge.

The Bench is custom-built, so any repairs need to be done in-house.

# Roll Former

The Roll Former is the machine used to “roll” the Slats- that is, to bend and cut the steel into Slats of the appropriate shape and length. It consists of a Tracking Wheel, three sets of three cylindrical Shaping Wheels (inside the plexiglass Case), three Straightening Wheels, and a Die Cutter. An Uncoiler is used in conjunction with the Roll Former to feed the steel into it.

Our Roll Former has 3 lanes which form specific types of Slats. From back-to-front they are: New York, BRD, and Crown. 5.28-Wide Steel should be fed into the New York and BRD lanes and 5.34 into Crown.

## Preparation

Before loading the Steel it should be coated with a lubricant to improve performance of the Roll Former. We currently use CRC 3-36 Multi-purpose Lubricant & Corrosion Inhibitor. Previously, the Blue Lubrication Roller at the left end of the machine was used for this purpose, however it is broken and lubricant must be applied manually (the Forklift and can be used to turn the steel over to lubricate the other side). The lubricant should be applied directly prior to initially loading the Uncoiler; lubricating steel earlier may potentially result in the lubricant drying and needing to be reapplied. Generally, loading a previously lubricated coil does not require another application as coils do not sit for long once they are used on the Roll Former.

## Handling Steel Coils

To move steel coils, place the chain found behind the Roll Former through the coil. Make sure the Slide Guard (a welded shaft) is secure at the end of the Forklift’s fork and then loop the chain over the fork and secure it onto itself using the hook. It is very important that the Slide Guard is in place and the forks are angled backwards to ensure that the chain does not slide off the end of the fork while transporting steel.

If there is not space to loop the chain through the coil, use the forklift to lift the edge of the coil enough to throw the chain through. Once the chain is through, make sure enough of it is through to fasten itself and then lower and remove the fork from the coil.

***NEVER*** place any body part under the coil and do not attempt to move coils by hand. While coils are standing vertically, only manipulate them when they are securely attached to the forklift with all precautions in place and with the weight of the coil supported by the forklift so that it cannot fall.

If the coil needs to be turned around, place it standing vertically in an area with plenty of horizontal clearance and lower the forks so that they are only a few inches from the coil. Unhook the chain, cross the ends underneath the fork, and reattach it; at this point the chain should form a figure-8 shape (remember to be cautious around the coil while it is not attached to the forklift). Lift the coil: as it comes off the ground it should spin. The spinning will be rapid at first, but once it slows down you can gently lower the forks to use the ground to completely stop the oscillations.

## Uncoiler

To load a new coil on the Uncoiler, first remove the Steel Guards from the front (there is no need to ever remove the Rear Guards). The Steel Guards are removed by loosening the locking bolt and then sliding them off of the front.

Next, attach the crank to the front shaft and spin it counter-clockwise until it stops- you will notice the steel supports converging towards the center. Remove the crank when you are done.

Use the forklift to hoist the coil per the Handling Steel Coils section. Ensure that the winding of the coil will be towards the Roll Former once in position: in other words, when in position the outside flap at the end of the coil should be wrapped over the top. Carefully move the coil over to the Uncoiler so that the coil is centered on the Wheel and Rear Guards are against the coil. If you cannot get close enough to Uncoiler, you can move the Uncoiler towards the coil and continue to center it afterwards. Once the coil is centered and pressed against the Guards, secure the Front Guards against the coil. While doing so, make sure neither the straps binding the steel together nor the chain are impacted by the Guards or Supports. When the Guards are firmly attached, reattach the crank and wind it clockwise.

As the Steel Supports expand, you may notice they are not contacting the coil evenly: use the forklift to continue to center the coil so that the Supports remain evenly spaced from the coil (err too high rather than too low). Turn the crank until it becomes difficulty to do so (do not over crank it).

If you were a little high, you’ll notice that you can pivot the Uncoiler with some effort; if you can’t, use the Forklift to relieve most of the weight of the coil. As best you can, ensure that the Uncoiler is parallel with the Roll Former by pivoting it as necessary.

Once everything is straight and secure, lower the Forklift. Remove the chain and Slide Guard (returning them to behind the Roll Former) and return the Forklift to where you found it. Use steel sheers to remove the bands on the coil and carefully remove the tape holding the outer flap in place (the flap will likely want to spring away from the coil, so either hold it firmly or keep clear of it). You can rotate the Uncoiler to make the tape on the flap more accessible.

## Forming the Steel

To begin, make sure the Roll Former is powered on and done booting up. Then, press the Green Button to power the rollers (this will also power the Uncoiler). Lower the Speed to 20 and bring the Allen key and yellow wire Remote to the end of the Roll Former closest to the Uncoiler.

If the Tracking Wheel is in the wrong lane, use the Allen key to loosen it and transfer it to the correct lane. Ensure the blue Lubricating Wheel is clear of the lane you are going to be running.

Pass the steel below the Automatic Feed Bar at the bottom of the Uncoiler which will cause the Uncoiler to unwind automatically whenever the steel becomes taught. While holding the Remote in one hand, pass the steel through the roller at the end of the Roll Former, through the slotted steel, beneath the Tracking Wheel, and right up to the first Shaping Wheel. Then, hold the Forward button (white) on the remote while pushing the steel into the Roll Former. Once passed the first Shaping Wheel, the Roll Former should pull the steel unassisted, though in some cases you may have to continue manually pushing the steel up through the second.

Once the Roll Former is pulling the steel, watch it carefully to ensure that the slat is being formed correctly. Specifically, on occasion the steel will slip on 7th Shaping Wheel, resulting on it flattening out instead of bending inwards/down. When this happens, Reverse the machine (black button) until the steel is out of the Shaping Wheel, then use some object (such as a hammer and punch) to bend the steel towards the correct direction (in the given example, the 7th Shaping Wheel is supposed to bend the steel downwards, so the edge is hammered so that it is pointing down).

Continue running the steel through the Straightening Wheels (these are adjusted later).

## Changing the Die Cutter

There is a separate Die Cutter for each type of slat: you can tell the difference by the outline of the slot on it.

To change the Die, use the Allen key and socket wrench to loosen the bolts underneath the current Die holding it in place. Make sure the rollers are not powered (press the Red button on the console), and then remove the hydraulics and sensor cable from the Die. Be careful with the sensor cable as it is necessary for running the Roll Former and is susceptible to damage.

The Dies are heavy, so be careful when handling them. Remove the current Die and use a brush to remove debris from the area. Place the new Die in the tracks with the hookups facing towards the back of the Roll Former and aligning the Die with the black marker on the tracks. Screw and tighten the bolts: do not over-tighten, and you can remove spacers from the bolt if it is not catching. Then, reattach the sensor wire and hydraulics.

Move any Dies not in use out of the way of the lane currently being run.

Using the portable Bandsaw, cut a clean, angled edge on the steel. Use the Remote to run the steel close to the Die and then lower the speed to 4 (the minimum). Use one hand to press Forward on the Remote and the other to guide the steel into the slot on the Die. Run the steel through the other side until the cut angle is through the Die, and then press 0 on the Console to cut the end of the slat.

## Operating the Roll Former

Pressing the large Green button will power the rollers. Pressing any of the large Red Buttons will cut power to the rollers immediately.

On the Home Screen, pressing F1 will move to the Operational Screen.

Pressing F3 on the Operation Screen will enter the Standard Setup Popup.

Pressing Enter on the Standard Setup Popup confirms the current settings and loads the settings into the Operational Screen.

Once settings are implemented on the Operation Screen, pressing the Start button will begin rolling slats.

Pressing the Stop button once will stop the Roll Former after the current slat. Pressing the Stop button twice will stop the Roll Former immediately.

To exit the Operational Screen, press Stop an additional time, and then press Escape. To change settings on the Operational Screen, you will have to exit back to the Home Screen.

## Running Slats

To run normal slats, press F1 on the Console followed by F3. In the popup window, set the Cut Length and Quantity (for New York and BRD, remember to run an extra slat if your order also has a Bottom Bar). Press Enter, then press the Green button to power the rollers. If you are running a new coil, you should not run slats faster than 40 Speed. Confirm the Cut Length and Quantity are correct on the current screen, that the Roll Former is set up for the correct type of slat, and that the steel is correctly fed through the machine. You will also want to have a cart available to place finished slats onto. When you have confirmed that everything is correctly setup, press the Delete button on the Console to ensure that the current counter is reset to 0, press the Start button, and then press the Stop button.

Take the one slat you ran and measure it. If its length is off from the specifications by more than 1/8 of an inch, you will have to change the Cut Length incrementally until it is in the acceptable range. For example, if your first slat is 1/4 inch too short, increase Cut Length by 1/8, run another single slat, and check the measurement.

Once you have two slats available, you can check that the slats are straight. See *Straightening the Steel* for more information.

Continue rolling slats until you have rolled all required slats. A popup window should appear asking whether you want to continue rolling slats or stop: regardless of your answer, be sure to press the Delete button afterwards to clear the current slat total.

## Straightening the Steel

The final three Shaping Wheels (in the black, metal casing) are for straightening the slat.

The first and second wheels are preset and generally should not be touched.

The third wheel controls the up-down pitch of the slat. You can check if a slat is curved up or down by placing it on a flat surface or by standing it on an edge and look down that edge. When adjusting, tightening will tend the slat upwards while loosening will do the opposite. The two bolts- obviously- control each end of the slat (the little curl and the big curl); since they can be moved independently, this can result in the slat not just curving up and down, but twisting as well. The easiest way to straighten the slat would be to eliminate the twist first by adjusting one side only, then to adjust both sides up or down at the same time until the curve is removed.

The slat may also curve left-to-right: this is actually controlled by the Die Cutter. To check if New York or BRD Slats are curved left-to-right, flip one slat over and place the other slat inside it and try to make the sides flush. If there is a gap in the center, adjust the Die towards the back of the Roll Former; if there are gaps at the ends, pull it towards the front.

Since Crown slats cannot be nested in this manner, spin one slat around so that the small curls are touching on both slats. Since the slats are backwards, so are the adjustments: a gap in the middle means the Die should be pulled forward and gaps at the end result in the Die going back.

When making adjustments, remember that the next slat on the Roll Former is already partially through the Rollers: this means that you should skip that slat and check how you adjustments impacted the slat after it (more succinctly said, when making adjustments roll two slats and check the second).

# Curtains

A Curtain is a series of interlocked Slats with Endlocks on the ends to ensure the slats to do not slide apart and a Bottom Bar to prevent the Curtain from continuing to roll upwards out of the Guides.

## Curtain

## Endlocks

## Bottom Bars

# Bandspring Doors