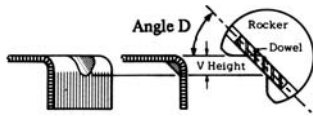


# Popular Bender Options

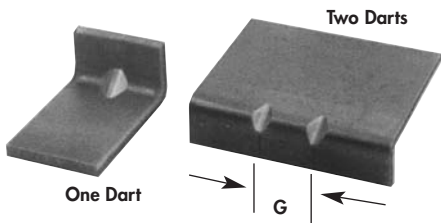
*"Wipe Tooling" darts are high maintenance - Benders make it simple.*

Eliminate:

- galling and maintenance
- unattractive parts
- secondary operations



**V Height** – The only dimension darts can hold because material thickness varies.



## 1. Dart Stiffeners ... Benders Make it Easy

Standard darts are shown below or you can specify your own angle and dowel size. Darts are rolled into the part during bending, reducing springback and stiffening the part. Darts are produced using dowels through the rocker and require relief grooves in the anvil. The side angles of the darts are a function of the angle and size of the dowel.

Vee Height	Rocker Diameters					
	5/8	1	1-1/2	2	2-1/2	3
.100"	V1	V1	--	--	--	--
.200"	V2*	V2	V2	--	--	--
.350"	--	V3*	V3	V3	--	--
.500"	--	--	V5*	V5*	V5	V5
Dowel	.093	.156	.250	.312	.375	.500

\*Dowel may be upsized to avoid a gap between the rocker and the dowel.

Darts are available as specifiable extras on all READY Benders®. Darts are central on a 45° angle unless detailed.

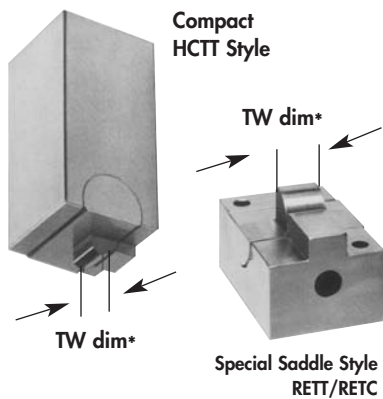
**Benders gently roll stiffening "darts" into a wide range of formed parts.**

### How to Specify

Add your selection of Dart Spec. No. after Catalog Number:

<b>2</b>	<b>REC 150</b>	<b>X = 2"</b>	<b>2 V3, Darts, G = 1"</b>
<b>Qty</b>	<b>Cat. No.</b>	<b>Length</b>	<b>Dart Callout</b>

## Tooth Benders



## 2. Tooth Benders ... Eliminate Part/Die Interferences

Tooth benders use special rockers to eliminate die/part interferences. Often the saddle needs to be made special without gibs in one piece. Send prints for a quotation.

### How to Specify

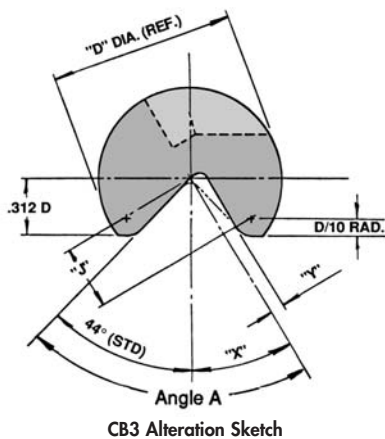
Add TW dimension after Catalog Number:

2	HCTT 62	TW .400"
1	RETT 100	TW .500"
2	RETG 100	TW .500"
Qty	Cat. No.	TW dim.

Rocker Diameter D	Min. TW Dimensions	
	Compact Style HCTT	Special Saddle Style, RETT/RETG
.625	.312	.312
1.000	.500	.438
1.500	.625	.500
2.000	.750	.625
2.500	---	.688
3.000	---	.750

\*TW central unless detailed.  
Please note: The saddle is special (gib built-in) to accept a narrow rocker tooth width. Tooth benders are available on all types of READY Benders® as specials.

## Over Square Bends

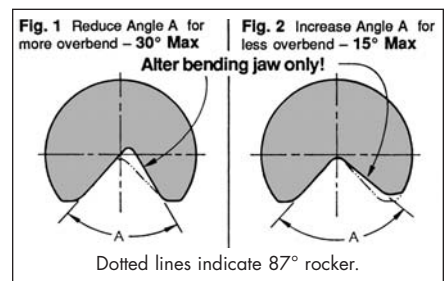


## 3. Over Square Bends ... up to 135° in one press stroke

The READY Bender's® ability to bend 45° beyond ninety (135° PA) is one of its greatest features. Customers buy standards and do this simple alteration themselves, adding a degree or two of overbend to the rocker. This easy alteration is done by grinding the bending jaw of the rocker, while not disturbing the working radius of the bending lobe (grind past centerline).

**For assistance, call READY Technology and we will give you the necessary dimensions to make this alteration.**

**Note:** Severe overbend (over 109° PA) with a small radius (less than PT) can create a situation where the rocker may catch on the anvil.



READY will check your application and advise if a pad or special rocker design is needed.

It's easy to alter rockers for more or less overbend. Example shows standard 87° rocker. Check to make sure the Anvil has more relief angle than the rocker angle A. Rockers are easy to alter.

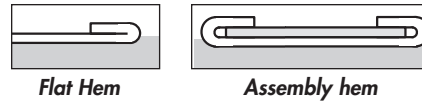
# The "Hemmer"

- Eliminate Die Stations and Operations;
- Use in Progressive Dies, Automated Machines

This patented tool can form a slightly open bend completely flat in one vertical press stroke. Use it to form UP or DOWN in high production stamping dies and automated machines. Eliminate the cam action "pre-hem" operation and do hems in two stations instead of three.

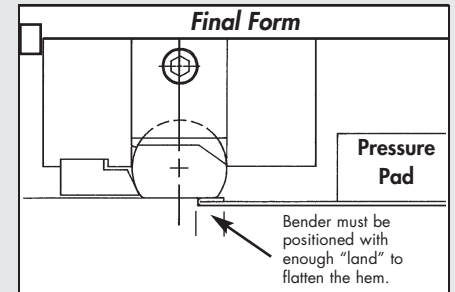
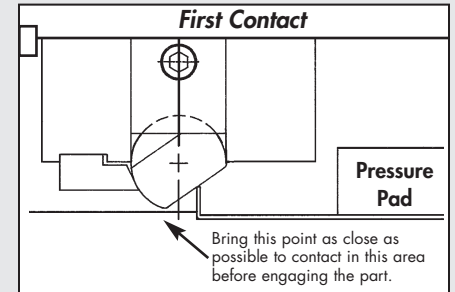
We use full hard D-2 rockers and special READY High Production style saddles. This is a special bender, yet attractively priced.

All hem applications should be quoted by READY. Fax prints and the worksheet on the back cover. We usually suggest a test-bend using your material to accurately predict results and select the right hemmer design. We charge a modest fee for this service, based upon the application.



### Important Hemmer Functions

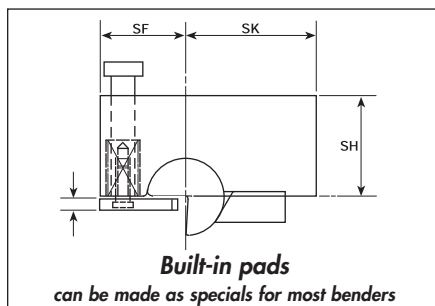
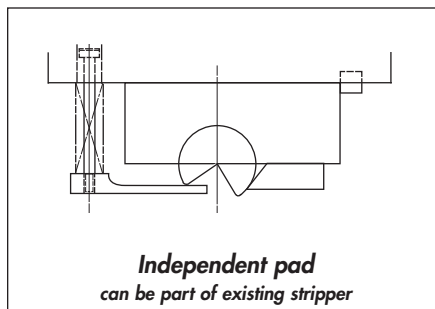
1. Diameter may be chosen more by leg height than material thickness.
2. Testing is highly recommended on all hem applications to help determine proper positioning.
3. Pressure pad needed to avoid sliding as hemmer contacts and flattens.
4. Maximum hemmer length is 12". For longer lengths, butt end-to-end with .010" gap between saddles.



## Pad Benders

Not Just for Elimination of Tool Marks

Pads can help in many bender applications. By activating the bender on top of a pad, you isolate the rocker from the part on the critical holddown surface. NO CONTACT = NO MARK.



### Important Pad Functions

1. Pads can be designed to match a part's "irregular" shape on one side yet be flat and parallel on the surface that the bender contacts.
2. Eliminates rocker contact and impact on part holddown surface.
3. To protect a part cutout or hole from distortion due to its proximity to the bend line.
4. To eliminate humping of the material when the application dictates upsizing the rocker diameter. The pad provides holddown pressure close to the bend radius.
5. To match a standard rocker diameter to the Zee bend or offset vertical height. Allows use of standard rockers versus making specials.

### When Using Pads, READY Technology Recommends:

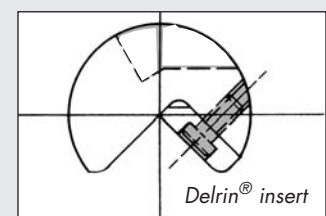
1. Locate the pad and its shoulder screws/ spools as close as possible to the tangency point of the radius. This location and bushings or guides will prevent the pad from tipping.
2. Springs to lift the pad should work separately from the spring return of the bender.
3. Additional part holddown may be required in some applications (pilots, die springs or nitrogen cylinders).

## Bending Without Tool Marks

READY Benders® normally leave a slight burnish or shine mark on both part surfaces. This is a big improvement over wipe tool scrapes and gouges.

Elimination of tool marks is not just for prepainted metal - one of our big success areas. Use of pads (bottom, left) and highly polished steel rockers are very successful on prepaint and other decorative surfaces.

Depending on acceptable tool mark criteria, we have the solution to most situations. Test-bending (page 19) is the safe approach. For a modest fee, we will form your material using our benders and send you a report with your sample for evaluation.

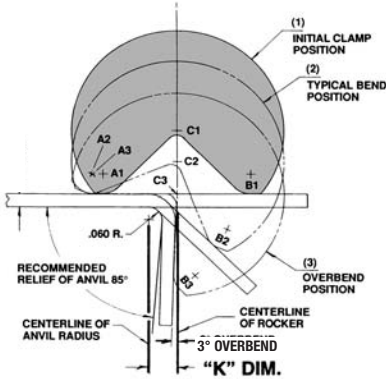


Solid Delrin® Rockers or Delrin® Inserted Rockers are used without pads on low to medium production applications.

Delrin® is a registered trademark of E.I. DuPont.

# Bender Location and Design Formulas:

## Bender Location ... "K" Dim.



The formula for the "K" dimension of a 87° standard rocker is:

Formula for 'A' = 87°, rocker  

$$K = \frac{PT + PR}{\tan(A/2)}$$

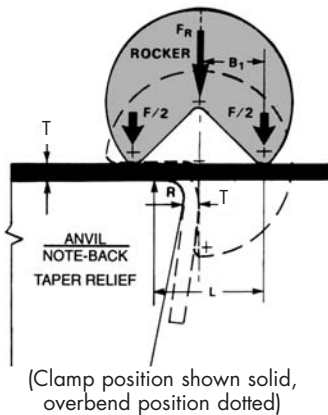
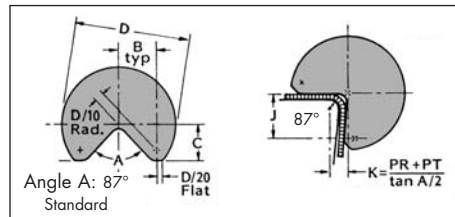
## 1. Bender location ... CAD compatible "K" Dimension

The "K" Dimension is the distance between the centerline of the anvil radius and the centerline of a fully closed bending lobe. Its purpose is to aid the designer in dimensioning the key slots needed to locate the READY Bender® easily.

The "K" Dimension changes as an overbend is added to or subtracted from the bending lobe. Though the centerline of the rocker is constant, it will move closer to or further from the anvil radius.

When the toolmaker actually sets the READY Bender®, he is in fact setting to the "K" Dimension. Correct setting of the bender will provide for longer tool life and better parts.

These formulas are only valid for square 90° bend angles. For overbends up to 135° or underbends down to 60°, please consult READY. Due to the trigonometric variations, the formulas are completely changed and can not be generalized.



**Benders require 50-80% less tonnage than wipe tools.**

## 2. Tonnage Formula for READY Benders®

READY Benders® require 50-80% less tonnage than wipe bending tools. The clamping lobe provides part holddown from first contact, the bending lobe has greater bending leverage. The ability to overbend up to 135° eliminates the need for coining and bottoming.

- F = force required
- S = nominal ultimate tensile strength
- W = width of bend
- T = stock thickness
- L = span (as a beam)  $L = B + R + T$
- B = designer dimension of 1" dia. rocker
- R = anvil radius

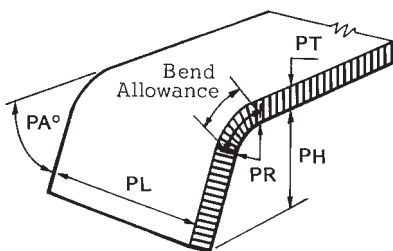
**Example:**

$$F = \frac{2.25 \times \frac{SWT^2}{L}}{L}; L = B_1 + T + R = 0.343 + 0.060 + 0.060 = 0.463$$

(1" DIAMETER ROCKER)

$$F = \frac{2.25 \times 50,000 \times 1" \times 0.060^2}{0.463} = 875 \text{ lb.} = 0.44 \text{ ton}$$

## 3. General Bend Allowance Formula



**Bend Allowance**

READY Benders® overbend to allow for springback instead of coining the part material to "set" the bend. As a result, benders leave more material within the bend radius so the bend allowance is greater than wipe bending.

**Caution.** As we all know, bend allowance may change with different materials and even within different coils of the same material. The only way to be sure of the bend allowance is to test the material and measure the BA. (See Test Bending Service, page 19).

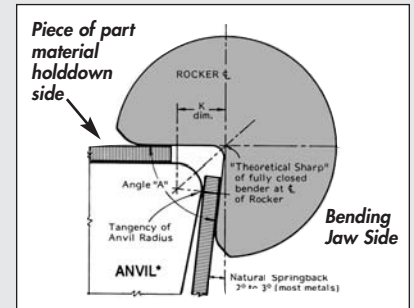
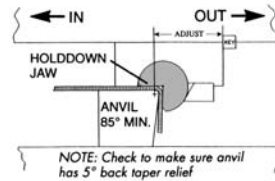
The general formula is:

$$\text{Bend Allowance (BA)} = .01745 \times PA \times [PR + (PT \times .43)]$$

# How To Install READY Benders®

1. Release the return spring(s) and plunger(s) by releasing the lube fitting or set screw so the rocker can rotate freely. Do not remove the gib from the saddle.
2. Using two pieces of the part material, place one piece on the holddown side of the anvil near to but not into the anvil radius (see drawing right). Put the bender into approximate position.
3. Keeping the second piece of material flush to the bending lobe of the rocker like a feeler gage (moving up and down minorly), set the opening between the tangency of the anvil radius and the bending jaw of the rocker. The anvil should be ground with 2° to 3° more back taper relief than the rocker's angle "A" being used.
4. Locate the bender with a key for proper location and resistance to side load.

5. Tighten the fastening screws. Lubricate the bender with light oil. Make sure no debris has lodged in spring return area, especially after machining mounting holes.
6. **Bender Adjustment.** You can vary overbend by minor shut height adjustments. Progressive dies are usually best adjusted by moving the bender slightly in (closer to anvil) for more overbend, or out (away from anvil) for less overbend. The standard 87° rocker only has 3° overbend. Anvil inserts can be shimmed or reground to avoid moving the bender.
7. For more details to properly locate READY Benders®, see page 12.



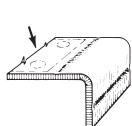
\*NOTE: The back taper relief ground on the anvil is to allow for the overbend required without pinching the material at full closure. (85° minimum anvil angle suggested for all 90° bends). Always grind 2° to 3° more back taper on anvil than the rocker's angle "A" being used.

**Critical - Once the holddown jaw is parallel to the material, ALL adjustments must be in or out. The rocker can be reground to add overbend...**

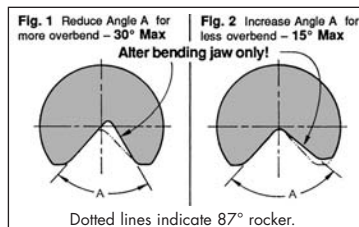
## Troubleshooting Guide

Problems	Possible Reasons	Solutions
<b>1. UNDERBENT</b> <p>DO NOT set the die deeper! See WARNING below!</p>	<p>A. Bender is set "too open".....</p> <p>B. Material is too thick.....</p> <p>C. Part radius is too large.....</p> <p>D. Material is "springy".....</p>	<p>Reset bender per instructions.</p> <p>Use the next larger bender.</p> <p>Use the next larger bender, or reduce the part radius.</p> <p>Decrease angle A per Fig. 1 below and reset bender per instructions.</p>
<b>2. OVERBENT</b> 	<p>A. The bender is set too tight....</p> <p>B. Part material is too soft.....</p> <p>C. Part radius is too small.....</p>	<p>Reset bender per instructions.</p> <p>Increase angle A per Fig. 2 below and reset bender per instructions.</p> <p>Increase angle A per Fig. 2 below. Another option is to match rocker and anvil to 90°. <b>No coining.</b></p>
<b>3. HOOK</b> 	<p>A. Material is being "trapped" at the tangency (pinch point)...</p> <p>B. Rocker is too large for the material thickness.....</p>	<p>Reset bender per instructions. Check anvil radius, it may be too small. Call READY Technology.</p> <p>Refer to catalog page for correct rocker size and set per instructions.</p>
<b>4. EXCESSIVE MARKING</b> <p>"Double Shinemark"</p>	<p>A. Bender is set too tight.....</p> <p>B. Material is too thick or too strong for rocker diameter.....</p> <p>C. Not enough relief on the anvil.</p>	<p>Reset bender per instructions.</p> <p>Refer to catalog page for correct rocker size and set per instructions.</p> <p>Increase relief angle to 2° - 3° less than angle A of rocker</p>

### 5. SADDLE IMPRINTING ONTO THE PART



**BENDER IS SET MUCH TOO DEEP! STOP!** Once the holddown jaw is parallel to the material, ALL adjustments must be in or out. The rocker can be reground to add overbend. **See bender adjustment top of page.**



## READY Can Help You

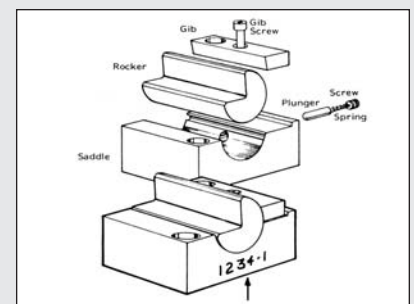
A copy of bender installation instructions are packaged with every bender shipped. We can assist you if you have technical questions or concerns.

**Please note, most problems with benders are easy to fix!**

- The #1 biggest problem is not enough back taper relief on the anvil or insert that we form material around. Do not assume - please check 85° minimum for all 90° bends (2° to 3° more relief than the rocker's angle A which is 87° standard).
- Too often the bender is improperly located either too close or too far away from the anvil. Check the "K" dimension as per the setting instructions.

## Ordering Replacements

*keep a back-up unit in the crib!*



**Bender ID No. for replacement and back-up. Reference this when ordering replacements. To order service kit, state model number or bender ID number followed by "K".**