

# MANDREL BENDING TROUBLESHOOTING

Problem	Probable Cause	Solution
Hump at the end of outside bend	Mandrel too far forward	Relocate mandrel back
Excessive vibration during bend	Mandrel too far forward	Relocate mandrel back
Mandrel advances, former will not rotate to bend	Mandrel limit switches out of adjustment. Switches are located at the top rear of mandrel table, underneath removable blue cover	Position switches correctly Display should read as follows: Mandrel retracted 100mm Mandrel advanced 0mm Mandrel Between switches 50mm
Mandrel will not retract prior to end of bend cycle (Machine program light is light red)	Need to retract mandrel prior to end of bend cycle	Depress and hold return foot pedal switch for five seconds. Program light should go out and allow mandrel function button to retract manual.
Oval tube	Mandrel too far back	Relocate mandrel back
Wrinkles on inside	Mandrel too far back	Relocate mandrel back
Wrinkles on inside	Mandrel too small	Correct size
Wrinkles on inside	Low pressure die pressure	Increase pressure
Wrinkles on inside	Wrong mandrel end	Adjust to suite material
Wrinkles on inside bend, scratches on tube surface	Low clamping pressure	Increase pressure
Tool marks tube	Oversize tubing	Correct size
Wrinkles on inside of bend with thin wall tubes	Wiper die not positioned well or worn	Adjust or replace wiper die

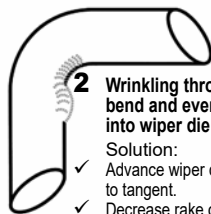
## Common Rotary Draw Bending Issues and their Solutions

When it comes to making a perfect bend, several factors come into play:

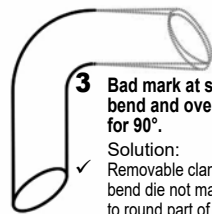
- Determine that the bender you will be using is operating properly.
- Make sure clamping and unclamping of dies, rotation of swing arm, and extracting of mandrel are all occurring in the proper sequence.
- Make sure the tube you will be using is clean, both inside and outside.
- Check the tooling, making sure it is clean, burr free and compatible with the tube to be bent.
- Confirm that the mandrel is the required distance past the tangent.



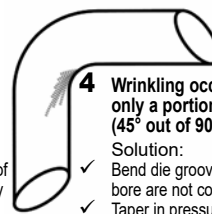
- 1 Hump at end of bend.**  
Solution:  
✓ Relocate mandrel back from tangent until bump is barely visible (this is a good system to find the best location for a mandrel.)



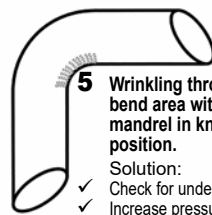
- 2 Wrinkling throughout bend and even extending into wiper die areas.**  
Solution:  
✓ Advance wiper die closer to tangent.  
✓ Decrease rake of wiper die.  
✓ Wiper worn out - have replaced.



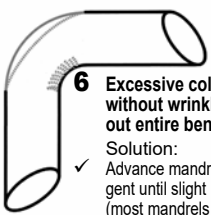
- 3 Bad mark at start of bend and over bend for 90°.**  
Solution:  
✓ Removable clamping portion of bend die not matched properly to round part of bend die.  
✓ Clamping portion of bend die not parallel to key way.



- 4 Wrinkling occurring for only a portion of the bend (45° out of 90°.)**  
Solution:  
✓ Bend die groove and counter-bore are not concentric.  
✓ Taper in pressure die (from bottom of tube groove to back of die.)



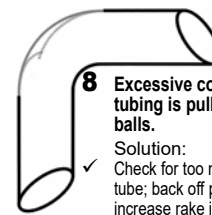
- 5 Wrinkling throughout bend area with wiper and mandrel in known proper position.**  
Solution:  
✓ Check for undersized mandrel.  
✓ Increase pressure die force only after checking wiper fit and mandrel location.



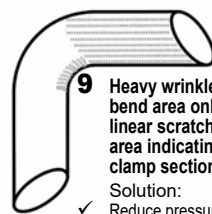
- 6 Excessive collapse with or without wrinkling throughout entire bend.**  
Solution:  
✓ Advance mandrel toward tangent until slight hump occurs (most mandrels must project somewhat past tangent.)



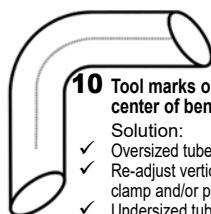
- 7 Mandrel ball humps.**  
Solution:  
✓ Too much drag on tube; back off pressure die force - increase wiper die rake.  
✓ May require closer pitch mandrel ball assembly.  
✓ Tubing material too soft.



- 8 Excessive collapse after tubing is pulled off mandrel balls.**  
Solution:  
✓ Check for too much drag on tube; back off pressure die force, increase rake in wiper die, etc.  
✓ Increase mandrel support, change from a plug to a one ball, from a 2 ball to a 3 ball mandrel, etc.



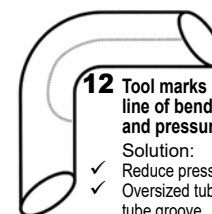
- 9 Heavy wrinkle through bend area only and linear scratches in grip area indicating slippage in clamp section.**  
Solution:  
✓ Reduce pressure die force.  
✓ Check location (and lube) of mandrel and wiper die.  
✓ Increase pressure on clamp die.  
✓ Use serration, knurling or carbide spray in clamp area.



- 10 Tool marks on center of bend.**  
Solution:  
✓ Oversized tube.  
✓ Re-adjust vertical alignment of clamp and/or pressure die.  
✓ Undersized tube groove in bend die.



- 11 Deep scratches throughout the bend and in wiper die area.**  
Solution:  
✓ Increase rake or relief in wiper die 1 to 2 degrees.  
✓ Use more and/or better lubrication.  
✓ Galled tube groove in wiper die. Recut wiper die.



- 12 Tool marks on center line of bend in clamp and pressure die area.**  
Solution:  
✓ Reduce pressure die force.  
✓ Oversized tube or undersized tube groove.



### Mandrel Nose Problems:

**Ovality (i.e., general deformation of the tube's cross-section) is excessive.** Check if the mandrel nose is undersized or not placed deep enough into the bend. If undersized, a temporary fix may be to advance it deeper into the bend. However, optimal bending will require a new mandrel made to the correct nose diameter.

**The inside radius buckles.** Check if the mandrel nose is placed behind the line of tangency.

**The outside radius collapses.** Check if the mandrel nose is placed behind the line of tangency.

**A hump or humps form on the outside radius.** This is usually not because the mandrel nose is too deep into the bend, but because there is excessive drag or insufficient assist from the pressure die. See below for details. However, if you do suspect the mandrel nose is the problem, check the depth of its placement

**Drag is excessive.** This is not a defect but an immediate cause of many defects. Too much direct pressure die pressure is usually the culprit, however, an oversized mandrel nose can be the problem.

### Direct Pressure Problems:

**Continuous wrinkling of the inside radius.** If the entire arc of the inside radius is wrinkled, this indicates that the direct pressure die pressure is too low. Note that this defect is distinct from a single hump or a small series of humps forming on the inside radius at the end of the bend. This type of wrinkling is associated with the wiper die.

**Excessive flattening of the outside radius.** A very common problem that results from too much direct pressure die pressure. In effect, the pressure die is clamping on the tube at the point of bend causing the outside radius to stretch and flattening between the pressure die and the clamp die. Reduce the pressure.

If the mandrel nose is properly placed and the direct pressure is correct and flattening is still too much, then the assist pressure should be increased.

### Wiper Tip Problems:

**A hump or humps form on the inside radius at the end of the bend.** The role of the wiper is limited. Humps are the only problem the wiper is designed to solve. Humps only occur if the wiper is not raked correctly or is worn out. Decreasing the rake will eliminate this problem.

### Assist Pressure Problems:

**Excessive flattening of the outside radius.** If excess direct pressure has been eliminated as a source of this defect

**A hump or humps on the outside radius.** Respond to this in the same way as to excessive flattening if mandrel nose placement is correct.

**Excessive wall thinning.** If ovality and flattening are under control, then increase the assist pressure.

### Other Sources of Problems:

While the set-up is most often the source of a bending problem, other factors may include:

- The machine is not applying pressure consistently.
- The machine is not lubricating the tooling properly.
- The tools are worn out.
- The working surfaces of the tools are mismatched or dimensionally incorrect for the bending application.
- The tubing material is undersized, oversized, or the wrong wall thickness.
- The tubing material is too hard or too soft.