

CORRECTIONS FOR POORLY BENT TUBES

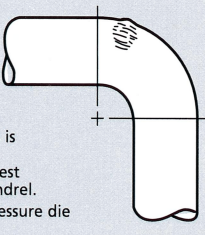
After the initial tooling set-up has been made, study the bent part to determine what tools to adjust to make a better bend. Keep in mind the basic bending principle of stretching the material on the outside radius of bend and compressing the material on the inside of bend. Make only one adjustment for each trial bend unless the second adjustment is very obviously needed. Avoid the tendency to first increase pressure die force rather than adjust the wiper die or mandrel location. Start with a clean, deburred and lubed tube with the elongation properties sufficient to produce the bend.

Note: There are certainly other corrections that could be made for the following problems. These illustrations are a few examples of how to "read" a bend and improve the tooling set-up.

1. PROBLEM
Hump at end of bend.

CORRECTION

- 1) Adjust mandrel slightly back from tangent until hump is barely visible. This is also a good system to find the best location for the mandrel.
- 2) Increase force on pressure die assist.

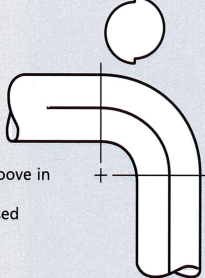


Clamp End

2. PROBLEM
Tool marks on centerline of bend.

CORRECTION

- 1) Re-adjust vertical alignment of clamp and/or pressure die.
- 2) Undersized tube groove in bend die.
- 3) Tooling not purchased from TFB.

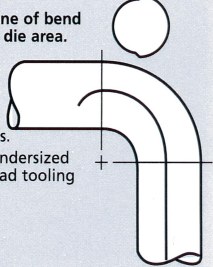


Clamp End

3. PROBLEM
Tool marks on centerline of bend in clamp and pressure die area.

CORRECTION

- 1) Reduce pressure and clamp die forces.
- 2) Oversized tube or undersized tube groove from bad tooling source.

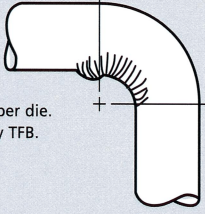


Clamp End

4. PROBLEM
Wrinkling throughout bend, even extending into wiper die area.

CORRECTION

- 1) Advance wiper die closer to tangent.
- 2) Decrease rake of wiper die.
- 3) Recut worn wiper by TFB.

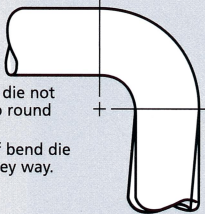


Clamp End

5. PROBLEM
Bad mark at start of bend and over bend for 90°.

CORRECTION

- 1) Removable clamping portion of bend die not matched properly to round part of bend die.
- 2) Clamping portion of bend die not parallel to the key way.

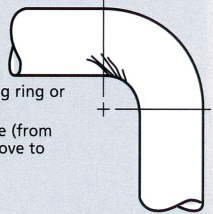


Clamp End

6. PROBLEM
Wrinkling occurring for only a portion of the bend (45° out of 90°).

CORRECTION

- 1) Bend die out of round. Bad centering ring or counter bore.
- 2) Taper in pressure die (from bottom of tube groove to back of die).

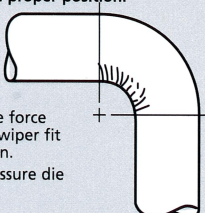


Clamp End

7. PROBLEM
Wrinkles throughout bend area with wiper and mandrel in known proper position.

CORRECTION

- 1) Check for undersized mandrel.
- 2) Increase pressure die force only after checking wiper fit and mandrel location.
- 3) Reduce force on pressure die advance.

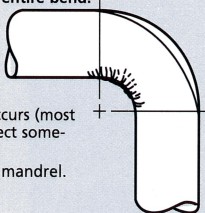


Clamp End

8. PROBLEM
Excessive collapse with or without wrinkling throughout entire bend.

CORRECTION

- 1) Advance mandrel toward tangency until slight hump occurs (most mandrels must project somewhat past tangent).
- 2) Need more balls on mandrel.

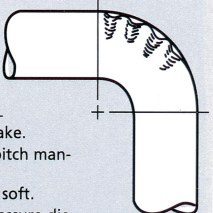


Clamp End

9. PROBLEM
Mandrel ball humps.

CORRECTION

- 1) Too much drag on tube; back off pressure die force — increase wiper die rake.
- 2) May require closer pitch mandrel ball assembly.
- 3) Tubing material too soft.
- 4) Increase force on pressure die assist.

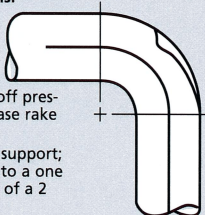


Clamp End

10. PROBLEM
Excessive collapse after tubing is pulled off mandrel balls.

CORRECTION

- 1) Check for too much drag on tube; back off pressure die force; increase rake on wiper die, etc.
- 2) Increase mandrel to support; change from a plug to a one ball; a 3 ball instead of a 2 ball mandrel, etc.

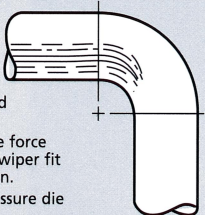


Clamp End

11. PROBLEM
Deep scratches throughout the bend and in wiper die area.

CORRECTION

- 1) Increase rake.
- 2) Check for undersized mandrel.
- 3) Increase pressure die force only after checking wiper fit and mandrel location.
- 4) Reduce force on pressure die advance.
- 5) Use more and/or a better lube.
- 6) Recut tube groove at TFB.

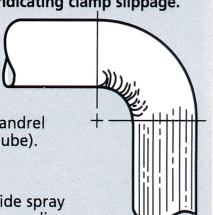


Clamp End

12. PROBLEM
Heavy wrinkles through bend area only and linear scratches in grip area indicating clamp slippage.

CORRECTION

- 1) Reduce pressure die force.
- 2) Check location of mandrel and wiper die (and lube).
- 3) Increase pressure on clamp die.
- 4) Use serrated or carbide spray in tube groove of clamp die.



Clamp End