

Induction Pipe Bending

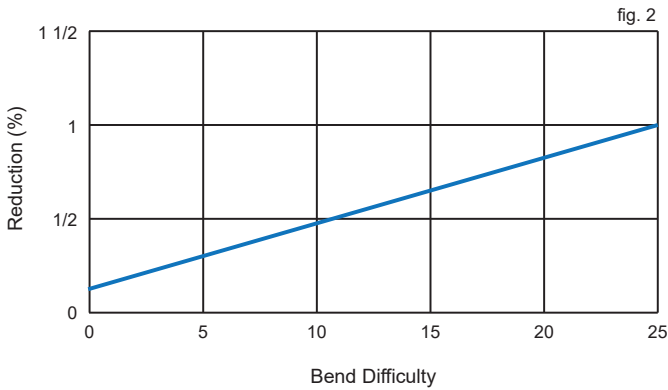
Carbon Steel & High Strength for Pipeline Use

BendTec

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Circumferential Reduction vs. Bend Difficulty



Standard Bend Tolerances

- Bend Angle ± 1 degree
- Bend Radius ± 1%
- Plane of Bend ± 1 degree
- Flat Plane of Bend ± 1% of center-line radius
measured at pipe center-line

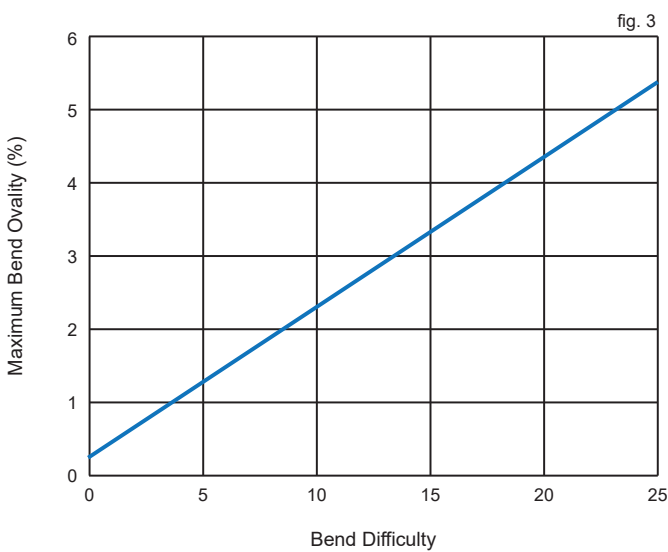
Linear Dimensions

- sizes 10" and under ± 1/8 in. (3.0mm)
- sizes 12" through 24" ± 3/16 in. (5.0 mm)
- sizes over 24" through 36" ± 1/4 in. (6.5 mm)
- sizes over 36" through 48" ± 5/16 in. (8.00 mm)
- sizes over 48" through 60" ± 3/8 in. (9.5 mm)

- Thinning See Fig. 1
- Ovality at Ends ± 1% of outside diameter
- Ovality throughout Bend See Fig. 3
- Circumferential Reduction See Fig. 2

Where closer tolerances than those given above are necessary, they shall be subject to agreement between the purchaser and BendTec.

Bend Ovality vs. Bend Difficulty

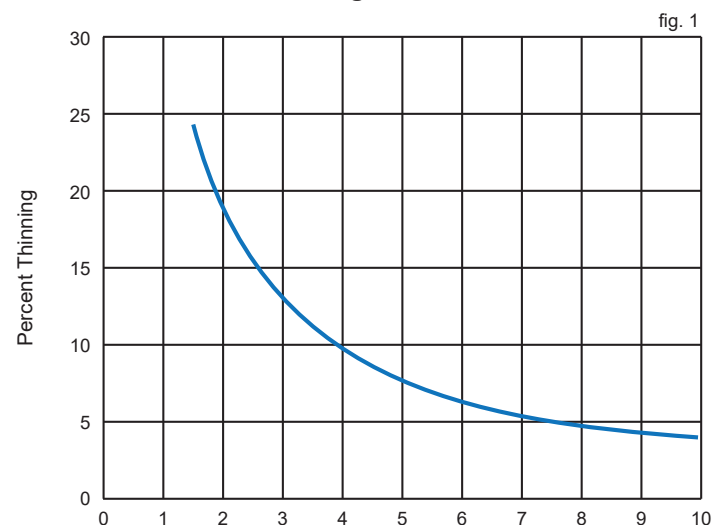


Where

$$\text{Percent Ovality} = \frac{\text{OD}_{\text{max}} - \text{OD}_{\text{min}}}{\text{OD}_{\text{nom}}} \times 100$$

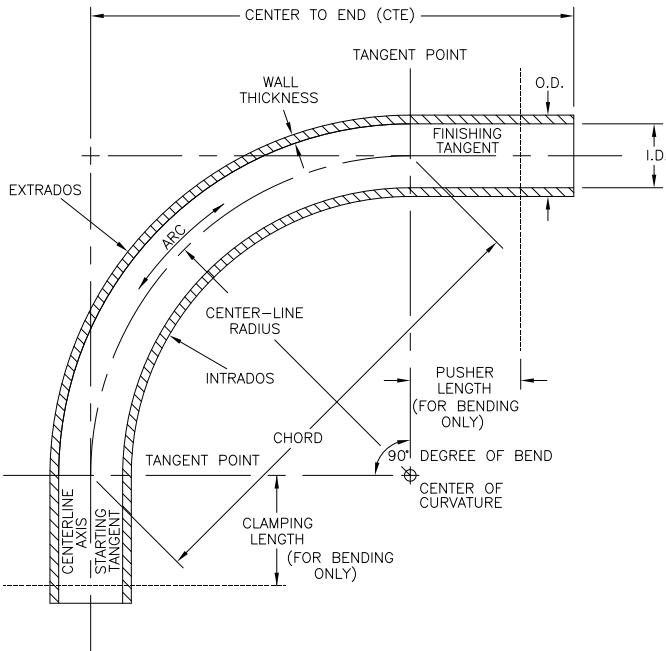
$$\text{Difficulty} = \frac{\text{OD}/t}{R/\text{OD}}$$

Bend Thinning vs. Bend Radius

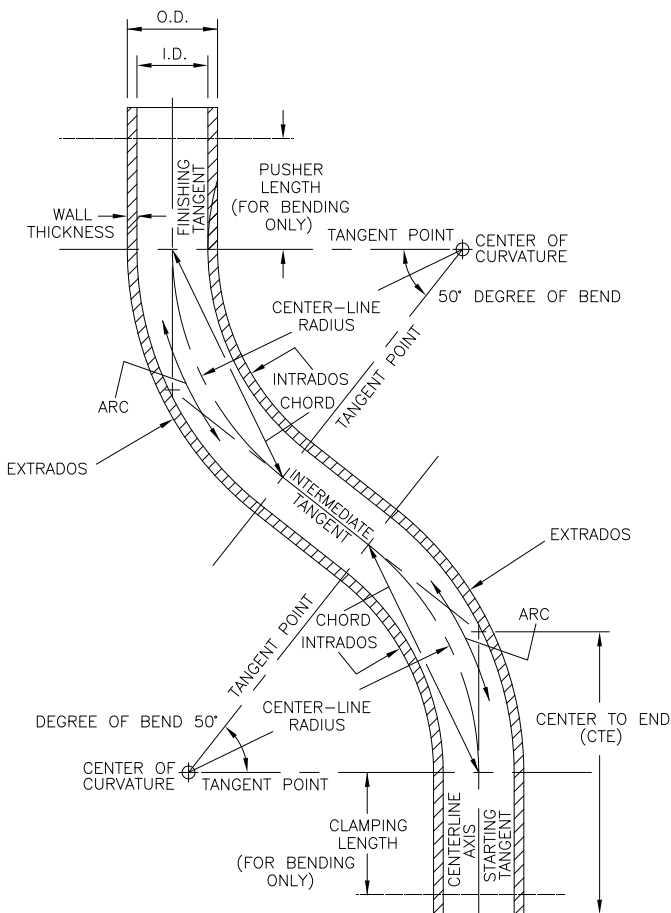


$$\frac{\text{Bend Radius}}{\text{Outside Diameter}} \left(\frac{R}{D} \right)$$

Plain Bend



Offset Bend



Nomenclature

Terms and Definitions

Arc The curved portion of a bend

Bend Radius The distance from the center of curvature to the center-line (axis) of the pipe.

Center to Center The distance between the theoretical or calculated centers of two adjoining bends on the same plane. Also used for diametric measurement between the center lines of two tangent points of a bend, (i.e., 180 degree bend, for which the Center-to-Center distance will be equal to twice the Center-line radius).

Center-line diameter The distance from the center-line axis of the pipe across to the other center-line of a 180 degree return bend.

Center-line radius (CLR) The distance from the center of curvature to the center-line (axis) of the pipe (same as Bend radius).

Chord The straight distance measured between the center-line points of any two points of a bend.

Cold bending The bending of pipe or shapes by cold working methods.

Degree of Bend (DOB) The angle, expressed in number of degrees, to which the bend is formed, (i.e., 45 degrees, 90 degrees, 180 degrees, etc.).

Distance between bends (Mid-tangent) The actual length of the straight section between the tangent points of two adjoining bends (i.e. common tangent).

Flat Plane The deviation of the horizontal plane of a single bend between its tangent points, based on the theoretical center-line of the bend.

Flattening The distortion of the cross section of pipe or tube from its normal (round) shape.

Hot bending The bending of pipe or shapes through hot working methods.

I.D. Inside diameter of the pipe or tube.

Induction bending A method or process of bending which utilizes an induction heating coil to create a narrow, circumferential, heated band around the material to be bent. When the appropriate temperature is reached the material is moved forward through the coil at a predetermined speed while a bending moment is applied. After the material passes through the coil it may be cooled (quenched) by air or water spray.

Intrados The inside arc of the bend (also called Inner radius)

Minimum design wall thickness The wall thickness specified on the fabrication drawing or computed in accordance with the applicable specification as the minimum acceptable for the temperature and pressure application

Neutral axis That portion of the pipe or tube that is neither in compression nor tension

Nominal Usually refers to pipe sizes up to and including 12-inch I.P.S. Also used in reference to wall thickness, generally as a "mean" or average measurement

Ovality The distortion of the cross-section of pipe or tube from its normal (round) shape, usually expressed as a percentage of the difference between the major and minor axes

Plane of bend (POB) The plane of a bend in relation to the axis of the straight section preceding it. Used specifically for change of plane in successive bends

Tangent The straight section of material on either side of the arc of a bend

Tangent point The point at which the bend is started or ended

Transition zone The area, at the tangent points of a bend, that covers the change (transition) from unheated to heated material

Wall thickness The thickness of the material, usually stated in "Schedule" for pipe or "guage" for tube

Wall thinning The amount of reduction from original wall thickness of pipe or tube to the amount of wall thickness remaining in the extrados of a bend after forming

Wrinkles Definite folds, creases, or crinkles formed on the surface of the pipe during bending operation