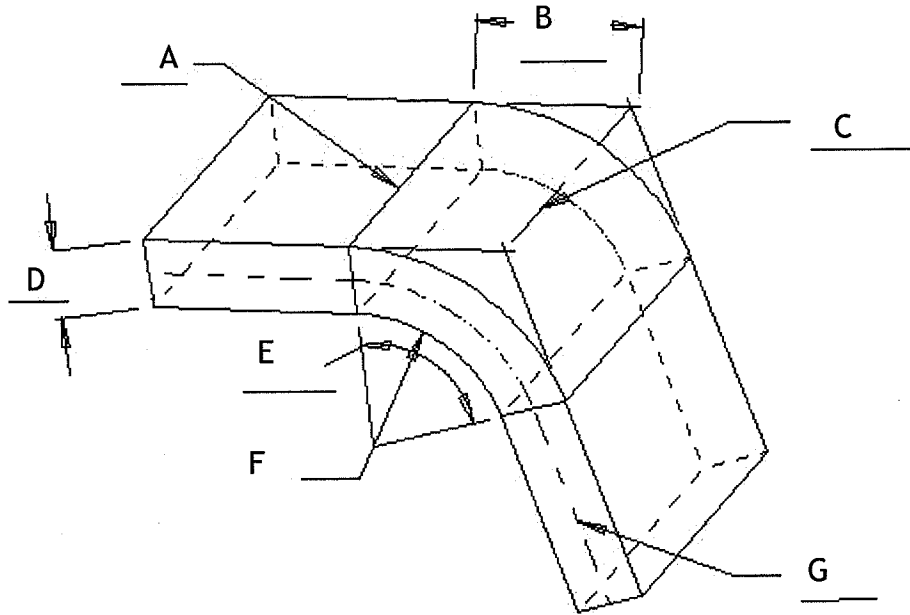


NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

## SHEET METAL ILLUSTRATION LABELING WORKSHEET

On the illustration below, write the correct term represented by the letter indicated in the space provided next to the corresponding letter.

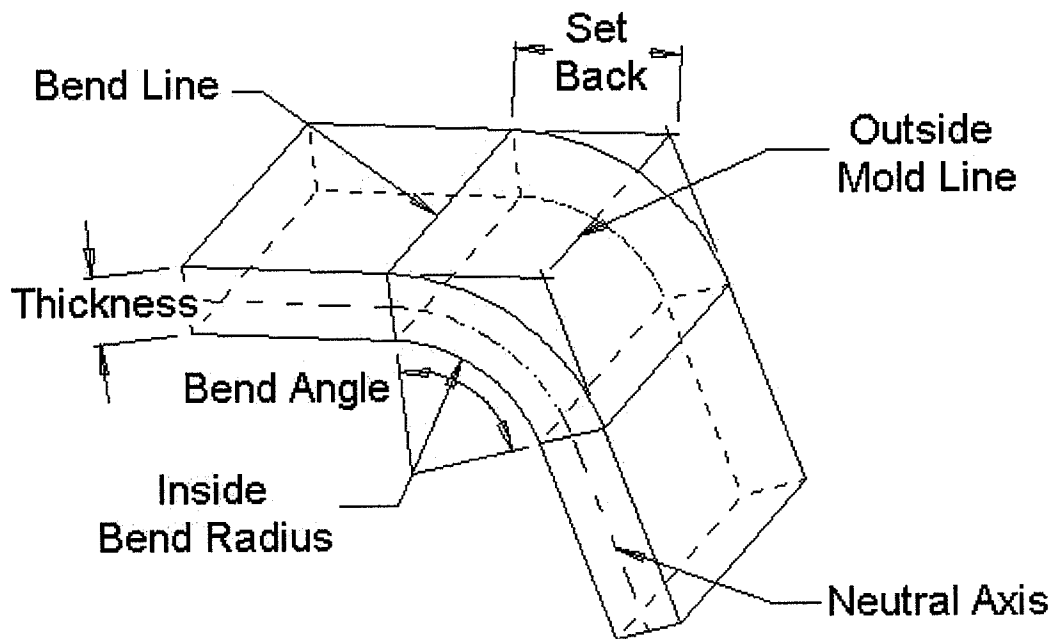


- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
- D. \_\_\_\_\_
- E. \_\_\_\_\_
- F. \_\_\_\_\_
- G. \_\_\_\_\_

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

## SHEET METAL ILLUSTRATION LABELING WORKSHEET



A.    BEND LINE \_\_\_\_\_

B.    SET BACK \_\_\_\_\_

C.    OUTSIDE MOLD LINE \_\_\_\_\_

D.    THICKNESS \_\_\_\_\_

E.    BEND ANGLE \_\_\_\_\_

F.    INSIDE BEND RADIUS \_\_\_\_\_

G.    NEUTRAL AXIS \_\_\_\_\_

## Terms Relating to Bends

**Bend Allowance** - The length of the arc through the bend area at the neutral axis.

**Bend Angle** - The included angle of the arc formed by the bending operation.

**Bend Compensation** - The amount by which the material is stretched or compressed by the bending operation. All stretch or compression is assumed to occur in the bend area.

**Bend Lines** - The straight lines on the inside and outside surfaces of the material where the flange boundary meets the bend area.

**Inside Bend Radius** - The radius of the arc on the inside surface of the bend area.

**K-factor** - Defines the location of the neutral axis. It is measured as the distance from the inside of the material to the neutral axis divided by the material thickness.

**Mold Lines** - For bends of less than 180 degrees, the mold lines are the straight lines where the surfaces of the flange bounding the bend area intersect. This occurs on both the inside and outside surfaces of the bend.

**Neutral Axis** - Looking at the cross section of the bend, the neutral axis is the theoretical location at which the material is neither compressed nor stretched.

**Set Back** - For bends of less than 180 degrees, the set back is the distance from the bend lines to the mold line.

## Terms relating to general sheet metal

**Tolerances** - Sheet metal tolerances should not be tighter than necessary to make the part functional. Tight tolerances raise the cost of manufacturing significantly. Practical tolerances vary according to the design requirements. Tolerances of +/- .010 should be considered minimum. Linear tolerances should be held as loose as possible. Recommend +/- .020 for general and tolerance functional areas as needed.

**Flatness** - Flatness specifications are applied with perfect form not required at maximum material condition. Flatness tolerance of .005" per inch is the best that can be achieved without secondary individual checking and straightening. In general the primary datum should have some type of form specified. Defining the primary datum by datum targets in a retained condition is preferred.

**Minimum Bend Radii** - The minimum bend radii data contained within charts are measured to the inside of the bend. The bend radii listed are standard minimum for manufacturing for aerospace and space applications. Commercial sheet metal radius is created with less concern for stresses created during forming and radii can approach zero (sharp internal corner) for many thin sheet metal gages.

**Grain Direction** - A "grain" is formed in metal in the direction in which the sheet is rolled at the mill. This is not a surface finish. Grain direction is usually specified on stainless steel and other hard materials when it is necessary to maintain minimum bend radius or to control spring back on parts with large radius forms. The grain can be seen by viewing off the shelf sheet and noting the direction of visible lines running end to end.

## SHEET METAL TERMS - MATCHING (ANSWER KEY)

- E - 1. Bend Allowance**      E) The length of the arc through the bend area at the neutral axis.
- F - 2. Bend Angle**         F) The included angle of the arc formed by the bending operation.
- A - 3. Bend Compensation**    A) The amount by which the material is stretched or compressed by the bending operation.
- G - 4. Bend Lines**            G) The straight lines on the inside and outside surfaces of the material where the flange boundary meets the bend area.
- B - 5. Inside Bend Radius**     B) The radius of the arc on the inside surface of the bend area.
- H - 6. K -factor**             H) Defines the location of the neutral axis.
- C - 7. Mold Lines**            C) straight lines where the surfaces of the flange bounding the bend area intersect
- J - 8. Neutral Axis**            J) at the cross section of the bend, is the theoretical location at which the material is neither compressed nor stretched
- D - 9. Set back**                D) is the distance from the bend lines to the mold line
- K - 10. Flatness**              K) applied with perfect form not required at maximum material condition

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

## SHEET METAL TERMS - MATCHING

Write the correct letter representing the definition for the term given on the line provided.  
10 points for each correct answer given.

- |                             |  |
|-----------------------------|--|
| _____ 1. Bend Allowance     | A) The amount by which the material is stretched or compressed by the bending operation.                                   |
| _____ 2. Bend Angle         | B) The radius of the arc on the inside surface of the bend area  |
| _____ 3. Bend Compensation  | C) straight lines where the surfaces of the flange bounding the bend area intersect  |
| _____ 4. Bend Lines         | D) is the distance from the bend lines to the mold line  |
| _____ 5. Inside Bend Radius | E) The length of the arc through the bend area at the neutral axis.  |
| _____ 6. K -factor          | F) The included angle of the arc formed by the bending operation.  |
| _____ 7. Mold Lines         | G) The straight lines on the inside and outside surfaces of the material where the flange boundary meets the bend area.    |
| _____ 8. Neutral Axis       | H) Defines the location of the neutral axis.   |
| _____ 9. Set back           | J) at the cross section of the bend, is the theoretical location at which the material is neither compressed nor stretched |
| _____ 10. Flatness          | K) applied with perfect form not required at maximum material condition  |