

## 鑄造品の丸み

## Roundness of Castings

1. **適用範囲** この規格は、砂型（シェル型その他の精密砂型を除く。）による鑄造品の肉厚変化部及び交差部の隅（すみ）の丸み並びに角（かど）の丸みについて規定する。

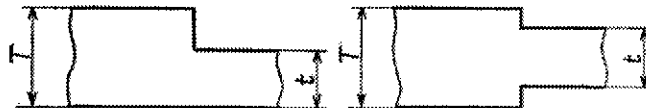
引用規格：

JIS B 8601 標準数

2. **用語の説明** この規格に用いる用語の意味は、次による。

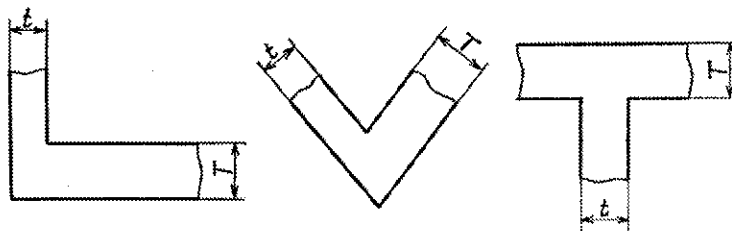
(1) **肉厚変化部** 鑄造品の厚さが変化する部分（図 1 参照）。

図 1



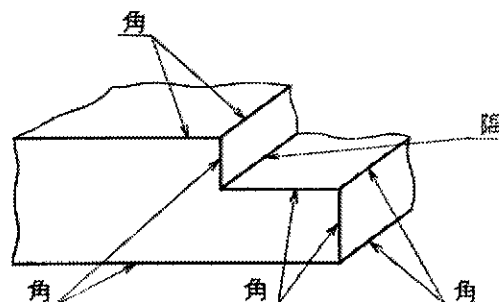
(2) **交差部** 鑄造品の L 字形、V 字形及び T 字形に交差する部分（図 2 参照）。

図 2



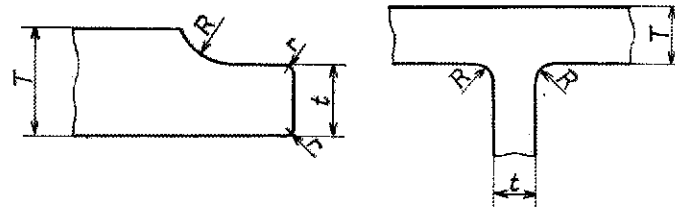
(3) **角及び隅** 鑄造品を形成する面の突き出した部分を角、内側に屈曲した部分を隅という（図 3 参照）。

図 3



(4) **丸みの値** 鑄造品の肉厚変化部及び交差部の隅の丸み並びに角の丸みを表す半径の大きさ（図 4 参照）。

図 4



$R$  : 肉厚変化部 及び 交差部の隅の丸みの値

$r$  : 角の丸みの値

$T$  : 厚肉部の肉厚

$t$  : 薄肉部の肉厚

3. 肉厚変化部及び交差部の隅の丸みの値 肉厚変化部及び交差部の隅の丸みの値は、表 1 による。

表 1 肉厚変化部及び交差部の隅の丸み

単位 mm

| 材料         | 丸みの値 $R^{(1)}$ |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
|------------|----------------|---|---|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|-----|
| ねずみ鉄品      | (2)            | 3 | 4 | 5   | 6   | 8   | 10 | 12 | 16 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 |
| 可鍛鉄品       |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 球状黒鉛鉄品     |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 黄銅铸件       |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 青銅铸件       |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 高力黄銅铸件     |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| アルミニウム合金铸件 | —              | — | — | (5) | (6) | (8) | 10 | 12 | 16 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 |
| マグネシウム合金铸件 |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 炭素鋼铸件      |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |
| 低合金鋼铸件     | —              | — | — | (5) | (6) | (8) | 10 | 12 | 16 | 20 | 25 | 30 | 40 | 50 | 60 | 80 | 100 |
| ステンレス鋼铸件   |                |   |   |     |     |     |    |    |    |    |    |    |    |    |    |    |     |

注(1)  $R$  の実際の適用の目安を参考1に示す。

備考1. 括弧内の丸みの値は、なるべく使用しないものとする。

2. 丸みの値が 100mm を超える場合は、JIS Z 8601 (標準数) の R 10 による。

4. 角の丸みの値 角の丸みの値は、表 2 による。

表 2 角の丸み

| 単位 mm      |                    |       |     |     |       |   |   |   |   |   |    |
|------------|--------------------|-------|-----|-----|-------|---|---|---|---|---|----|
| 材料         | 丸みの値 $r(^{\circ})$ |       |     |     |       |   |   |   |   |   |    |
| ねずみ鋳鉄品     | (1)                | (1.2) | 1.6 | 2   | 2.5   | 3 | 4 | 5 | 6 | 8 | 10 |
| 可鍛鋳鉄品      |                    |       |     |     |       |   |   |   |   |   |    |
| 黄銅鋳物       |                    |       |     |     |       |   |   |   |   |   |    |
| 青銅鋳物       |                    |       |     |     |       |   |   |   |   |   |    |
| アルミニウム合金鋳物 |                    |       |     |     |       |   |   |   |   |   |    |
| マグネシウム合金鋳物 |                    |       |     |     |       |   |   |   |   |   |    |
| 球状黒鉛鋳鉄品    | —                  | —     | —   |     |       |   |   |   |   |   |    |
| 高力黄銅鋳物     |                    |       |     |     |       |   |   |   |   |   |    |
| 炭素鋼鋳鋼品     | —                  | —     | —   | (2) | (2.5) |   |   |   |   |   |    |
| 低合金鋼鋳鋼品    |                    |       |     |     |       |   |   |   |   |   |    |
| ステンレス鋼鋳鋼品  |                    |       |     |     |       |   |   |   |   |   |    |

注(°)  $r$  の実際の適用の目安を参考 2 に示す。

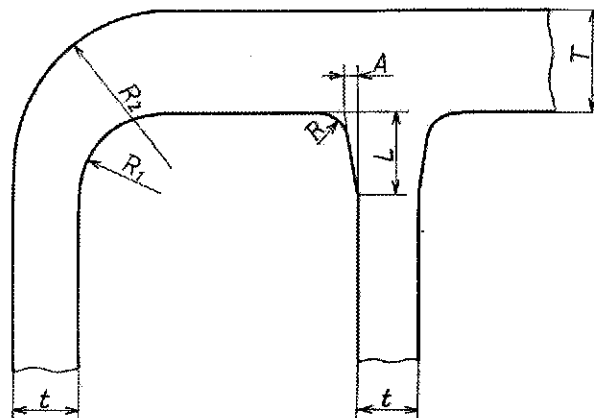
備考 1. 括弧内の丸みの値は、なるべく使用しないものとする。

2. 丸みの値が 10mm を超える場合は、表 1 の数値を用いる。

参考 1 肉厚変化部及び交差部における隅の丸みの値の適用 肉厚変化部及び交差部における隅の丸みの値の適用に際してのよりどころを、参考として次に示す。

1. 記号 参考 1 に用いる記号は、次のとおりとする (参考図 1)。

参考図 1



$T$  : 厚肉部の厚さ

$t$  : 薄肉部の厚さ

$L$  : こう配部の長さ

$A$  : こう配部の高さ

$R$  : 隅の丸みの値

$R_1, R_2$  : 隅の丸み (内側 及び 外側) の値

$T/t$  : 肉厚比

**2. 肉厚変化部** 肉厚比が 1.5 以下の場合には、薄肉側に接する丸みを付ける。肉厚比が 1.5 を超え 3 以下の場合にはこう配部を設ける。

こう配部が十分とれない場合は、こう配部に接する丸みを厚肉部側に付ける（参考図 2 参照）。

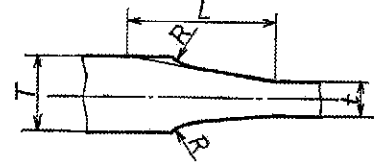
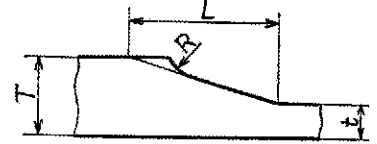
参考図 2

肉厚比が 1.5 を超え 3 以下の場合

肉厚比が 1.5 以下の場合

こう配部が十分とれる場合

こう配部が十分とれない場合



参考表 1 肉厚変化部における丸み及びこう配部の値

単位 mm

| T   | 3   |    | 4 |    | 5 |    | 6 |    | 8  |    | 10 |    | 12 |    | 16 |     | 20 |     | 25 |     | 30 |     | 40 |     | 50 |     | 60 |     | 80 |   |
|-----|-----|----|---|----|---|----|---|----|----|----|----|----|----|----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|---|
|     | R   | L  | R | L  | R | L  | R | L  | R  | L  | R  | L  | R  | L  | R  | L   | R  | L   | R  | L   | R  | L   | R  | L   | R  | L   | R  | L   | R  | L |
| 4   | (2) | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 5   | 3   | 8  | 3 | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 6   | 3   | 12 | 3 | —  | 3 | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 8   | 4   | 20 | 4 | 16 | 4 | 12 | 4 | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 10  | —   | —  | 5 | 25 | 5 | 20 | 5 | 16 | 5  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 12  | —   | —  | — | —  | 6 | 30 | 6 | 25 | 6  | 16 | 6  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 16  | —   | —  | — | —  | — | —  | 8 | 40 | 8  | 30 | 8  | 25 | 8  | —  | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 20  | —   | —  | — | —  | — | —  | — | —  | 10 | 50 | 10 | 40 | 10 | 30 | 10 | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 25  | —   | —  | — | —  | — | —  | — | —  | —  | —  | 12 | 60 | 12 | 50 | 12 | 40  | 12 | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 30  | —   | —  | — | —  | — | —  | — | —  | —  | —  | 16 | 80 | 16 | 80 | 16 | 60  | 16 | —   | 16 | —   | —  | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 40  | —   | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | 20 | 100 | 20 | 80  | 20 | 60  | 20 | —   | —  | —   | —  | —   | —  | —   | —  | — |
| 50  | —   | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | 25 | 125 | 25 | 100 | 25 | 80  | 25 | —   | —  | —   | —  | —   | —  | — |
| 60  | —   | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | 30 | 160 | 30 | 125 | 30 | 125 | 30 | —   | 30 | —   | —  | —   | —  | — |
| 80  | —   | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | 40 | 200 | 40 | 200 | 40 | 160 | 40 | 125 | 40 | —   | —  | — |
| 100 | —   | —  | — | —  | — | —  | — | —  | —  | —  | —  | —  | —  | —  | —  | —   | —  | —   | —  | —   | —  | —   | 50 | 250 | 50 | 200 | 50 | 160 | 50 | — |

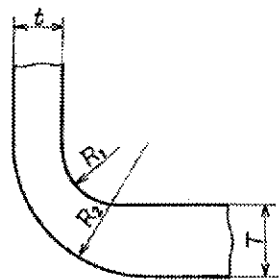
備考1. 丸みの値が鋳造品の材料により規格本体の値以下になっている部分は、規格本体の最小値を採用する。

2. 括弧内の丸みの値は、なるべく使用しない。

**3. L 字形交差部及び V 字形交差部** L 字形交差部（交差角 90°）及び V 字形交差部（交差角 90° 未満）は、次の(1)のようにその交差部の内側及び外側を原則として丸めるが、交差部が 60° 以上の場合には、次の(2)のように内側だけを丸めて、外側は丸めなくてもよい。

(1) 内側及び外側に丸みを付ける場合 交差部の両側に接するように丸みを付ける（参考図 3 参照）。

参考図 3



参考表 2 L 字形交差部, V 字形交差部の内側及び外側に丸みを付ける場合の丸みの値

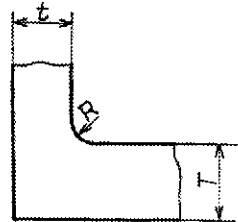
単位 mm

| $T \backslash t$ | 3     |       | 4     |       | 5     |       | 6     |       | 8     |       | 10    |       | 12    |       | 16    |       | 20    |       | 25    |       | 30    |       | 40    |       | 50    |       | 60    |       | 80    |       | 100 |     |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|
|                  | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ | $R_1$ | $R_2$ |     |     |
| 3                | 3     | 6     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 4                | 4     | 8     | 4     | 8     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 5                | 4     | 8     | 5     | 10    | 5     | 10    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 6                | 5     | 10    | 5     | 10    | 5     | 10    | 6     | 12    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 8                | 5     | 10    | 6     | 12    | 6     | 12    | 6     | 12    | 8     | 16    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 10               |       |       | 6     | 12    | 8     | 16    | 8     | 16    | 10    | 20    | 10    | 20    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 12               |       |       |       |       | 8     | 16    | 10    | 20    | 10    | 20    | 10    | 20    | 12    | (24)  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 16               |       |       |       |       |       |       | 10    | 20    | 12    | 25    | 12    | 25    | 16    | 30    | 16    | (32)  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 20               |       |       |       |       |       |       |       |       | 16    | 30    | 16    | 30    | 16    | 30    | 20    | 40    | 20    | 40    |       |       |       |       |       |       |       |       |       |       |       |       |     |     |
| 25               |       |       |       |       |       |       |       |       |       |       | 20    | 40    | 20    | 40    | 20    | 40    | 25    | 50    | 25    | 50    |       |       |       |       |       |       |       |       |       |       |     |     |
| 30               |       |       |       |       |       |       |       |       |       |       | 20    | 40    | 20    | 40    | 25    | 50    | 25    | 50    | 30    | 60    | 30    | 60    |       |       |       |       |       |       |       |       |     |     |
| 40               |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 30    | 60    | 30    | 60    | 30    | 60    | 40    | 80    | 40    | 80    |       |       |       |       |       |       |     |     |
| 50               |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 40    | 80    | 40    | 80    | 40    | 80    | 50    | 100   | 50    | 100   |       |       |       |       |     |     |
| 60               |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 40    | 80    | 40    | 80    | 50    | 100   | 50    | 100   | 50    | 100   | 60    | 120   |       |       |     |     |
| 80               |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 50    | 100   | 60    | 120   | 60    | 120   | 60    | 120   | 80    | 160   |     |     |
| 100              |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 60    | 120   | 80    | 160   | 80    | 160   | 100   | 200   | 100 | 200 |

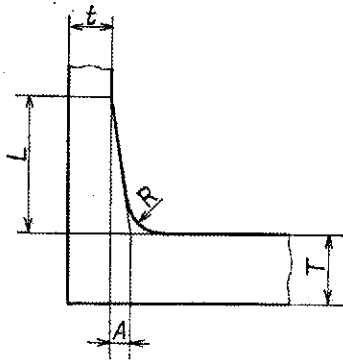
- 備考1. 括弧内の値は、規格値ではないが、この場合に限りに丸みの値として使用する。
2. 丸みの値が鋳造品の材料によって規格本体の値以下になっている部分は、規格本体の最小値を採用する。
- (2) 外側に丸みを付けない場合 肉厚比が 1.5 以下の場合には、内側の接続部に丸みを付け、肉厚比が 1.5 を超え 3 以下の場合には、内側にこう配部を設けて厚肉側に丸みを付ける (参考図 4 参照)。

参考図 4

肉厚比が 1.5 以下の場合



肉厚比が 1.5 を超え 3 以下の場合



参考表 3 L 字形交差部, V 字形交差部の外側を丸みを付けない場合の丸み及びこう配部の値

単位 mm

| <div><div></div><div><math>T</math></div></div> | 3   |     | 4   |     | 5   |     | 6   |     | 8   |     | 10  |     | 12  |     | 16  |     | 20  |     | 25  |     | 30  |     | 40  |     | 50  |     | 60  |     | 80  |     | 100 |     |     |     |     |    |     |    |    |    |   |    |   |   |
|-------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|----|----|----|---|----|---|---|
|                                                 | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ |     |     |    |     |    |    |    |   |    |   |   |
| 3                                               | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 4                                               | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 5                                               | 3   | 8   | 2   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 6                                               | 3   | 12  | 3   | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 8                                               | 3   | 20  | 5   | 3   | 16  | 4   | 3   | 12  | 3   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 10                                              |     |     |     | 3   | 25  | 6   | 3   | 20  | 5   | 3   | 16  | 4   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 12                                              |     |     |     |     |     |     | 4   | 34  | 8   | 4   | 25  | 6   | 4   | 16  | 4   | 4   | —   | —   | 4   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 16                                              |     |     |     |     |     |     |     |     |     | 5   | 40  | 10  | 5   | 30  | 8   | 5   | 25  | 6   | 5   | —   | —   | 5   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 20                                              |     |     |     |     |     |     |     |     |     |     |     |     | 6   | 50  | 12  | 6   | 40  | 10  | 6   | 30  | 8   | 6   | —   | —   | 6   | —   | —   |     |     |     |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 25                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 8   | 60  | 16  | 8   | 50  | 12  | 8   | 40  | 10  | 8   | —   | —   | 8   | —   | —   |     |     |     |     |     |    |     |    |    |    |   |    |   |   |
| 30                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 10  | 80  | 20  | 10  | 80  | 20  | 10  | 60  | 16  | 10  | —   | —   | 10  | —   | —   |     |     |    |     |    |    |    |   |    |   |   |
| 40                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 12  | 100 | 25  | 12  | 80  | 20  | 12  | 60  | 16  | 12  | —   | —   | 12  | —   | —  |     |    |    |    |   |    |   |   |
| 50                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 16  | 125 | 30  | 16  | 100 | 25  | 16  | 80  | 20  | 16  | —   | —   | 16 | —   | —  |    |    |   |    |   |   |
| 60                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 20  | 160 | 40  | 20  | 125 | 30  | 20  | 125 | 30  | 20  | —   | —  | 20  | —  | —  |    |   |    |   |   |
| 80                                              |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 25  | 200 | 50  | 25  | 160 | 40  | 25  | 125 | 30 | 25  | —  | —  | 25 | — | —  |   |   |
| 100                                             |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  | 250 | 60  | 30  | 200 | 50  | 30 | 160 | 40 | 30 | —  | — | 30 | — | — |

備考1. 丸みの値が鋳造品の材料によって規格本体の値以下になっている部分は, 規格本体の最小値を採用する。

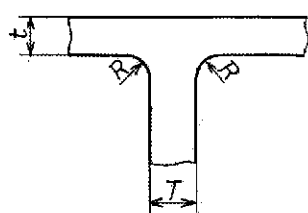
2. 括弧内の丸みの値は, なるべく使用しない。

4. T 字交差部 T 字交差部には, 次の(1)及び(2)の場合のように, その隅に丸み及びこう配部を設ける。

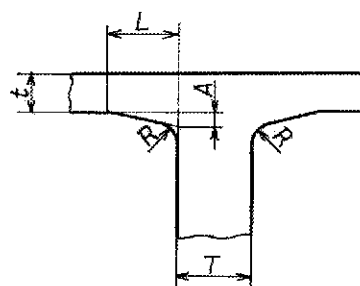
(1) 薄肉部に厚肉部が交差する場合 肉厚比が 1.5 以下の場合には, 隅に丸みを付け, 肉厚比が 1.5 を超え 3 以下の場合には, こう配部を設けて, 厚肉側に丸みを付ける (参考図 5 参照)。

参考図 5

肉厚比が 1.5 以下の場合



肉厚比が 1.5 を超え 3 以下の場合



参考表 4 薄肉部に厚肉部が T 字形に交差する場合の丸み及びこう配部の値

単位 mm

| $T$ | $t$ | 3   |     |     | 4   |     |     | 5   |     |     | 6   |     |     | 8   |     |     | 10  |     |     | 12  |     |     | 16  |     |     | 20  |     |     | 25  |     |     | 30  |     |     | 40  |     |     | 50  |     |     | 60  |     |     | 80  |     |     | 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|     |     | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4   | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5   | (2) | —   | —   | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6   | (2) | 6   | 2   | (2) | —   | —   | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8   | 3   | 10  | 2.5 | 3   | 8   | 2   | 3   | 6   | 2   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10  |     |     |     | 3   | 12  | 3   | 3   | 10  | 2.5 | 3   | 8   | 2   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12  |     |     |     |     |     |     | 4   | 16  | 4   | 4   | 12  | 3   | 4   | 8   | 2   | 4   | —   | —   | 4   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16  |     |     |     |     |     |     |     |     |     | 5   | 20  | 5   | 5   | 16  | 4   | 5   | 12  | 3   | 5   | —   | —   | 5   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20  |     |     |     |     |     |     |     |     |     |     |     |     | 6   | 25  | 6   | 6   | 20  | 5   | 6   | 16  | 4   | 6   | —   | —   | 6   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 8   | 30  | 8   | 8   | 25  | 6   | 8   | 20  | 5   | 8   | —   | —   | 8   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 10  | 40  | 10  | 10  | 30  | 8   | 10  | 30  | 8   | 10  | —   | —   | 10  | —   | —   | 10  | —   | —   |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 12  | 50  | 12  | 12  | 40  | 10  | 12  | 30  | 8   | 12  | —   | —   | 12  | —   | —   |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 16  | 60  | 16  | 16  | 50  | 12  | 16  | 40  | 10  | 16  | —   | —   | 16  | —   | —   |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 20  | 80  | 20  | 20  | 60  | 16  | 20  | 60  | 16  | 20  | —   | —   | 20  | —   | —   | 20  | —   | —   |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

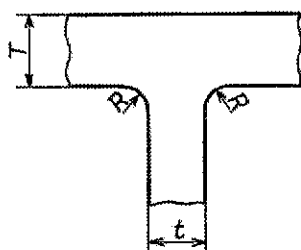
備考1. 丸みの値が鋳造品の材料によって規格本体の値以下になっている部分は、規格本体の最小値を採用する。

2. 括弧内の丸みの値は、なるべく使用しない。

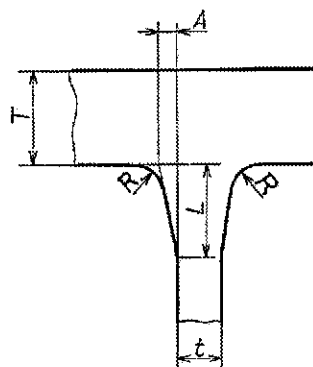
(2) 厚肉部に薄肉部が交差する場合 肉厚比が 1.5 以下の場合は隅に丸みを付け、肉厚比が 1.5 を超え 3 以下の場合には、こう配部を設けて、厚肉部に丸みを付ける (参考図 6 参照)。

参考図 6

肉厚比が 1.5 以下の場合



肉厚比が 1.5 を超え 3 以下の場合



参考表 5 厚肉部に薄肉部が T 字形に交差する場合の丸みとこう配部の値

単位 mm

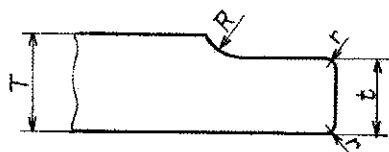
| $T$ | $t$ | 3   |     |     | 4   |     |     | 5   |     |     | 6   |     |     | 8   |     |     | 10  |     |     | 12  |     |     | 16  |     |     | 20  |     |     | 25  |     |     | 30  |     |     | 40  |     |     | 50  |     |     | 60  |     |     | 80  |     |     | 100 |    |   |   |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|---|---|--|--|
|     |     | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ | $R$ | $L$ | $A$ |     |    |   |   |  |  |
| 3   |     | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 4   |     | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 5   |     | (2) | —   | —   | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 6   |     | (2) | —   | —   | (2) | —   | —   | (2) | —   | —   | (2) | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 8   |     | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 10  |     |     |     | 3   | 12  | 2   | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   | 3   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 12  |     |     |     |     |     | 4   | 16  | 2   | 4   | 12  | 2   | 4   | —   | —   | 4   | —   | —   | 4   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 16  |     |     |     |     |     |     |     |     |     | 5   | 20  | 2.5 | 5   | 16  | 2   | 5   | 12  | 2   | 5   | —   | —   | 5   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 20  |     |     |     |     |     |     |     |     |     |     |     |     | 6   | 25  | 3   | 6   | 20  | 2.5 | 6   | 16  | 2   | 6   | —   | —   | 6   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 25  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 8   | 30  | 4   | 8   | 25  | 3   | 8   | 20  | 2.5 | 8   | —   | —   | 8   | —   | —   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 30  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 10  | 40  | 5   | 10  | 40  | 5   | 10  | 30  | 4   | 10  | —   | —   | 10  | —   | —   | 10  | —   | —   |     |     |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 40  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 12  | 50  | 6   | 12  | 40  | 5   | 12  | 30  | 4   | 12  | —   | —   | 12  | —   | —   |     |     |     |     |     |     |     |     |     |    |   |   |  |  |
| 50  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 16  | 60  | 8   | 16  | 50  | 6   | 16  | 40  | 5   | 16  | —   | —   | 16  | —   | —   |     |     |     |     |     |     |     |    |   |   |  |  |
| 60  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 20  | 80  | 10  | 20  | 60  | 8   | 20  | 60  | 8   | 20  | —   | —   | 20  | —   | —   | 20  | —   | —   |     |     |     |    |   |   |  |  |
| 80  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 25  | 100 | 12  | 25  | 80  | 10  | 25  | 60  | 8   | 25  | —   | —   | 25  | —   | —   |    |   |   |  |  |
| 100 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 30  | 125 | 16  | 30  | 100 | 12  | 30  | 80  | 10  | 30  | 40  | 5   | 30 | — | — |  |  |

- 備考1. 丸みの値が鋳造品の材料によって規格本体の値以下になっている部分は、規格本体の最小値を採用する。  
2. 括弧内の丸みの値は、なるべく使用しない。

参考 2 角の丸みの値の適用 角の丸みの値の適用に際してのよりどころを参考として次に示す。

1. 記号 参考 2 に用いる記号は、次のとおりとする (参考図 7)。

参考図 7



$T$  : 厚肉部の肉厚  
 $t$  : 薄肉部の肉厚  
 $r$  : 角の丸みの値

2. 角の丸みの目安 角の丸みの値の適用の目安は参考表 6 による。

参考表 6

|                                                             |                          | 単位 mm |      |       |       |        |
|-------------------------------------------------------------|--------------------------|-------|------|-------|-------|--------|
| 材料                                                          | 鑄造品の肉厚<br>( $T$ 又は $t$ ) | 3～5   | 6～10 | 12～20 | 25～40 | 50～100 |
|                                                             |                          |       |      |       |       |        |
| ねずみ鑄鉄品<br>可鍛鑄鉄品<br>黄銅鑄物<br>青銅鑄物<br>アルミニウム合金鑄物<br>マグネシウム合金鑄物 |                          | 1     | 2    | 2     | 3     | 4      |
| 球状黒鉛鑄鉄品<br>高力黄銅鑄物                                           |                          | —     | 2    | 3     | 4     | 5      |
| 炭素鋼鑄鋼品<br>低合金鋼鑄鋼品<br>ステンレス鋼鑄鋼品                              |                          | —     | 3    | 4     | 5     | 6      |