

# 锰锌铁氧体有效参数

一、 $L_e$   $A_e$   $V_e$  规定为:

有效磁路长度  $L_e = C12/C2$  (mm)

有效横截面积  $A_e = C1/C2$  (mm<sup>2</sup>)

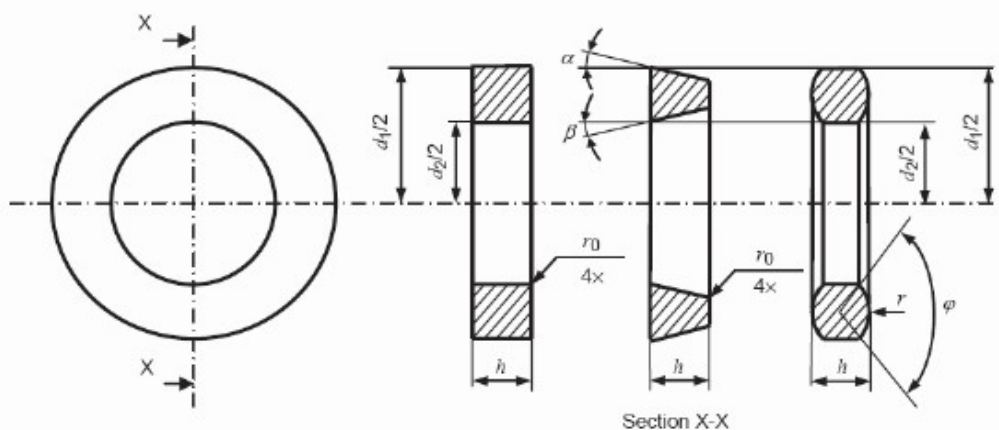
有效体积  $V_e = A_e * L_e = C13/C22$  (mm<sup>3</sup>)

$C1$  是磁芯常数 (mm<sup>-1</sup>)

$C2$  是磁芯常数 (mm<sup>-3</sup>)

二、各形状磁芯的计算

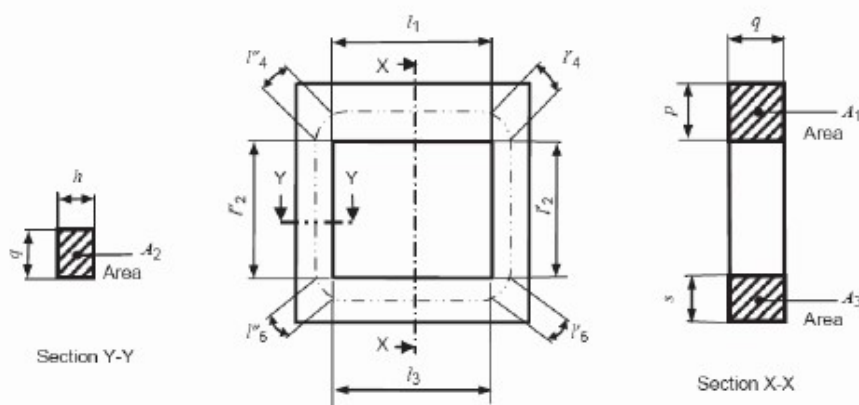
1、环形磁芯



$$C_1 = \frac{2\pi}{h_e \ln(d_1/d_2)}$$

$$C_2 = \frac{4\pi(1/d_2 - 1/d_1)}{h_e^2 \ln^3(d_1/d_2)}$$

2、矩形截面的 U 型磁芯



与面积  $A_2$  相关的磁路长度

$$l_2 = l_2' + l_2''$$

拐角处的平均磁路长度

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(p + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(s + h)$$

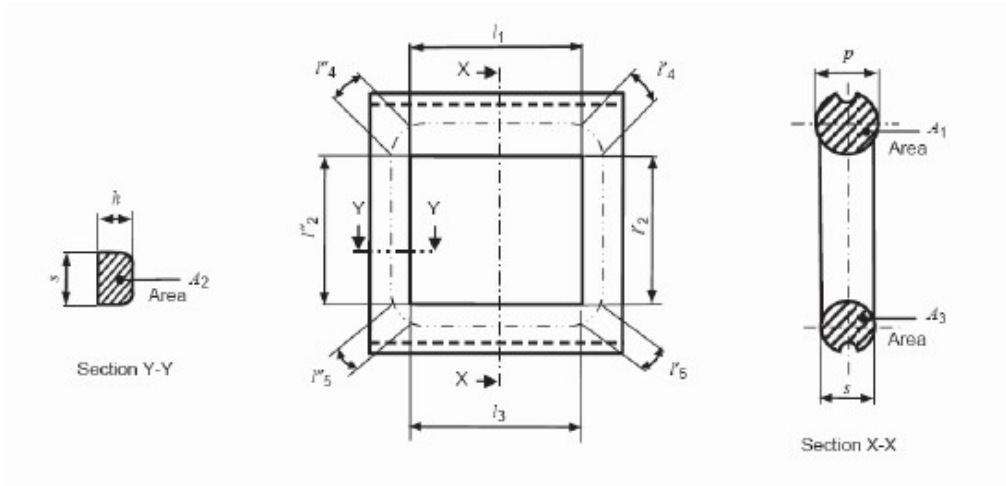
与 14 15 相关的平均面积

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i}{A_i^2}$$

### 3、圆形截面的 U 型磁芯



与面积 A2 相关的磁路长度

$$l_2 = l'_2 + l''_2$$

拐角处的平均磁路长度

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(p + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(s + h)$$

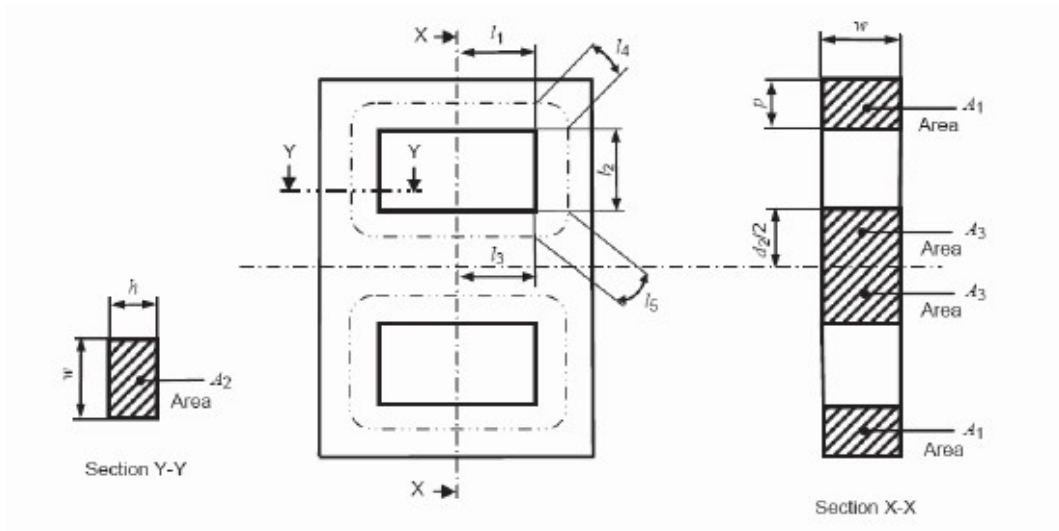
与 14 15 相关的平均面积

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i}{A_i^2}$$

### 4、矩形截面的 E 型磁芯 (EE EF EI )



拐角处的平均磁路长度

$$l_4 = \frac{\pi}{8}(p + h)$$

$$l_5 = \frac{\pi}{8}\left(\frac{d_2}{2} + h\right)$$

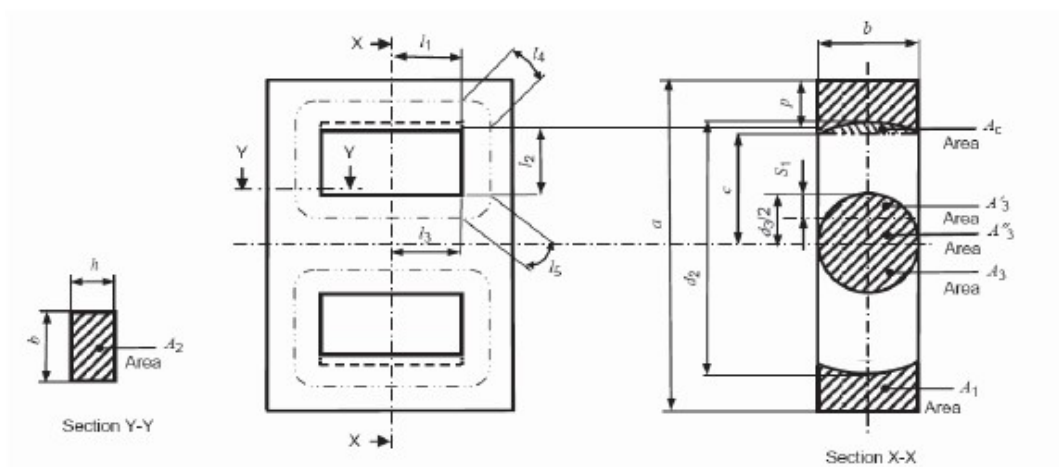
与 14 15 相关的平均面积

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i}{2A_i^2}$$

5、ER 磁芯 (EC ETD EQ)



$A_1$  是等于矩形  $b\left(\frac{1}{2}a - c\right)$  减去帽形  $A_c$

$$A_c = \frac{1}{4}d_2^2 \arcsin\left(\frac{b}{d_2}\right) - \frac{1}{4}b\sqrt{d_2^2 - b^2}$$

$$A_1 = \frac{1}{2}ab - \frac{1}{4}b\sqrt{d_2^2 - b^2} - \frac{1}{4}d_2^2 \arcsin\left(\frac{b}{d_2}\right)$$

背部的平均磁路长度

$$l_2 = \frac{1}{4}\left(d_2 + \sqrt{d_2^2 - b^2}\right) - \frac{d_3}{2}$$

半个中心柱的面积:

$$A_3 = A_3' + A_3''$$

获得  $A_3' = A_3''$  的条件为:

$$S_1 = 0.2980d_3$$

拐角处的平均磁路长度:

$$l_4 = \frac{\pi}{8}(p + h)$$

式中  $p = \frac{a}{2} - l_2 - \frac{d_3}{2}$

$$l_5 = \frac{\pi}{8}(2S_1 + h)$$

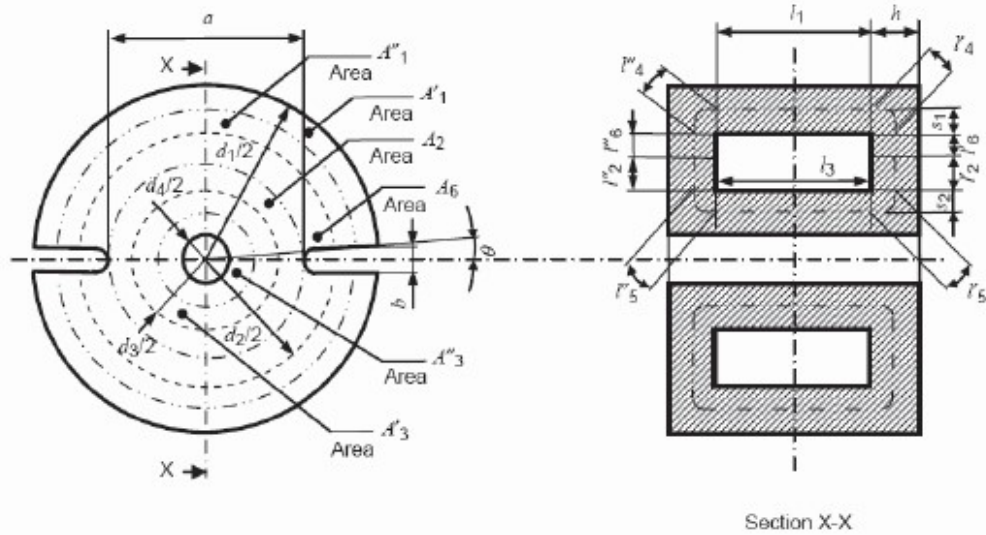
与 14 15 相关的平均面积

$$A_4 = \frac{A_1 + A_2}{2}$$

$$A_5 = \frac{A_2 + A_3}{2}$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i}{2A_i}$$

## 6、罐型磁芯



外环的面积

$$A_1 = A'_1 + A''_1$$

中心柱的面积

$$A_3 = A'_3 + A''_3$$

环的面积

$$A_1 = \frac{1}{4}(\pi - n\theta)(d_1^2 - d_2^2)$$

$$\theta = \arcsin \frac{2b}{d_1 + d_2}$$

中心柱的面积

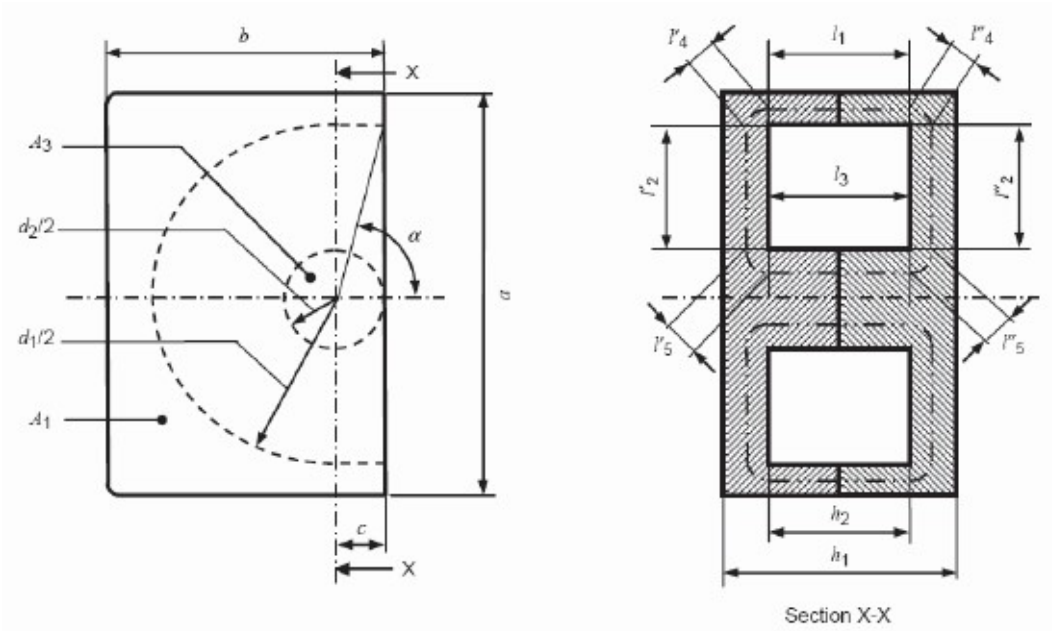
$$A_3 = \frac{\pi}{4}(d_3^2 - d_4^2)$$

拐角处的平均磁路长度

$$l_4 = l'_4 + l''_4 = \frac{\pi}{4}(2S_1 + h)$$

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4}(2S_2 + h)$$

7、EP 型磁芯



$$\frac{l_1}{A_1} = \frac{h_2}{ab - \pi d_1^2 / 8 - d_1 d_2 / 2}$$

$$\frac{l_1}{A_1^2} = \frac{h_2}{(ab - \pi d_1^2 / 8 - d_1 d_2 / 2)^2}$$

$$\frac{l_2}{A_2} = \frac{2}{(\pi - \alpha)(h_1 - h_2)} \ln \frac{d_1}{d_2}$$

$$\frac{l_2}{A_2^2} = \frac{4(d_1 - d_2)}{(\pi - \alpha)^2 (h_1 - h_2)^2 d_1 d_2}$$

$$\frac{l_3}{A_3} = \frac{h_2}{\pi \left(\frac{d_2}{2}\right)^2} = \frac{4h_2}{\pi d_2^2}$$

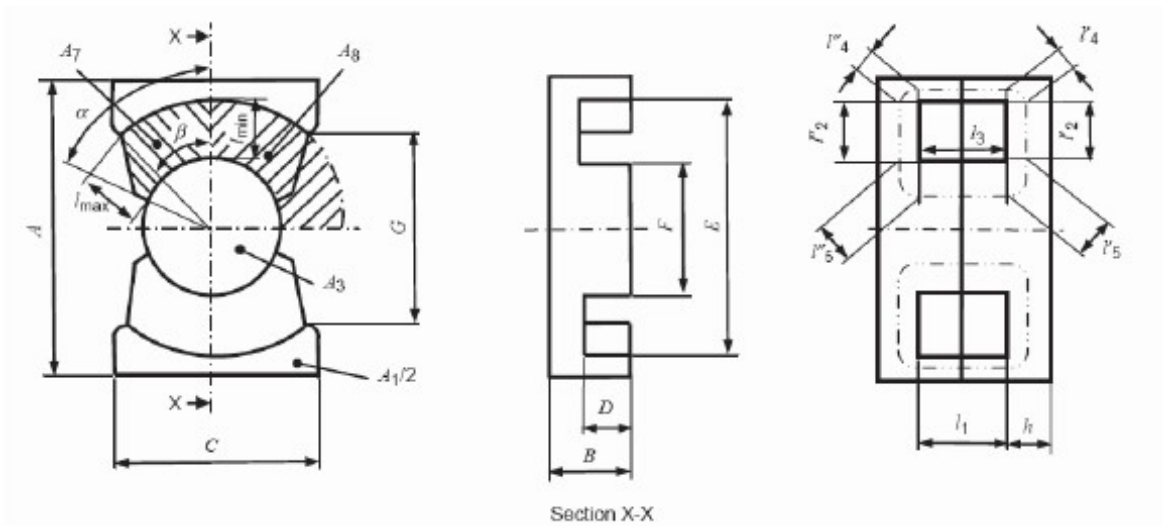
$$\frac{l_3}{A_3^2} = \frac{h_2}{\pi^2 \left(\frac{d_2}{2}\right)^4} = \frac{16h_2}{\pi^2 d_2^4}$$

与 14 15 相关的平均面积

$$l_4 = l_4' + l_4'' = \frac{\pi}{2} \left( \gamma - \frac{d_1}{2} + \frac{h_1 - h_2}{4} \right)$$

$$\gamma = \sqrt{\frac{(\pi - \alpha)d_1^2 + 2(ab - \pi d_1^2 / 8 - d_1 d_2 / 2)}{4(\pi - \alpha)}}$$

8、PQ 型磁芯



边腿的面积

$$A_1 = C(A - G) - \frac{\beta E^2}{2} + \frac{EG}{2} \sin \beta$$

边腿的平均磁路长度

$$l_1 = 2D$$

中心柱的面积

$$A_3 = \frac{1}{4} \pi F^2$$

中心柱的平均磁路长度

$$l_3 = 2D$$

外侧拐角的面积

$$A_4 = \frac{1}{2} \{A_1 + 2E(B - D)\beta\}$$

外侧拐角的平均磁路长度

$$l_4 = l_4' + l_4'' = \frac{\pi}{4} \left( B - D + \frac{1}{2} A - \frac{1}{2} E \right)$$

内侧拐角的面积

$$A_5 = \frac{\pi}{2} \left( \frac{F}{2} \right)^2 + F(B - D)\alpha$$

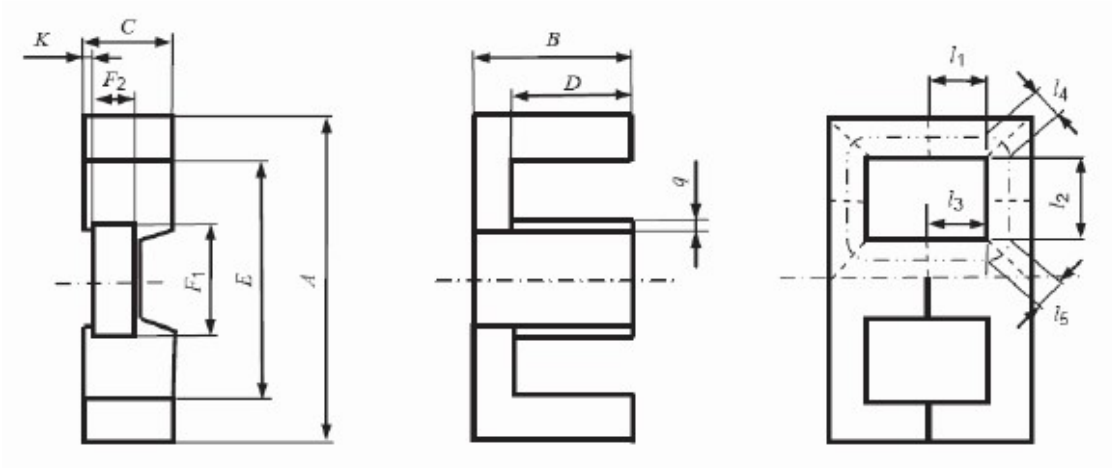
内侧拐角的平均磁路长度

$$l_5 = l'_5 + l''_5 = \frac{\pi}{4} \left\{ (B-D) + \left( 1 - \frac{1}{\sqrt{2}} \right) F \right\}$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i^2}{A_i^2}$$

$$l_e = C_1^2 / C_2 \quad A_e = C_1 / C_2 V_e = C_1^3 / C_2^2$$

## 9、EFD 磁芯



边腿的面积

$$A_1 = \frac{C(A-E)}{2}$$

边腿的平均磁路长度

$$l_1 = D$$

背部面积

$$A_2 = C(B-D)$$

背部平均磁路长度

$$l_2 = \frac{E-F_1}{2}$$

中心柱面积

$$A_3 = \frac{F_1 F_2 - 2q^2}{2}$$

中心柱的平均磁路长度

$$l_3 = D$$

外侧拐角的面积

$$A_4 = \frac{A_1 + A_2}{2}$$

外侧拐角的平均磁路长度



$$l_4 = \frac{\pi}{8} \left( \frac{A-E}{2} + (B-D) \right)$$

内侧拐角的面积

$$A_5 = \frac{A_2 + A_3}{2}$$

内侧拐角的平均磁路长度

$$l_5 = \frac{\pi}{4} \left( \frac{F_1}{4} + \sqrt{\left( \frac{C - F_2 - 2K}{2} \right)^2 + \left( \frac{B - D}{2} \right)^2} \right)$$

$$C_1 = \sum_{i=1}^5 \frac{l_i}{A_i} \quad C_2 = \sum_{i=1}^5 \frac{l_i}{2A_i^2}$$

$$l_e = \frac{C_1^2}{C_2} \quad A_e = \frac{C_1}{C_2} \quad V_e = \frac{C_1^3}{C_2^2}$$