B-87 1.) $P = 15\,kW$ $\quad n = 1000\,\frac{1}{min} = 16{,}67\,\frac{1}{s}$

$$\frac{1}{\omega} \cdot P = M_t \Leftrightarrow M_t = \frac{P}{2\pi n} = 143{,}211\ Nm$$

b) $\tau_{t\,zul} = 60\,\frac{N}{mm^2}$

$$\tau_{t\,zul} \overset{!}{\geq} \frac{M_t}{W_t} \Leftrightarrow W_t = \frac{M_t}{\tau_{t\,zul}}$$

Berücksichtigung von α_{kt}:

$$W_t = \alpha_{kt} \cdot \frac{M_t}{\tau_{t\,zul}} = \frac{\pi d^3}{16}$$

$$\Rightarrow d_w = \sqrt[3]{\alpha_{kt} \cdot \frac{16\,M_t}{\pi \cdot \tau_{t\,zul}}}$$

$$\Rightarrow d_{w_1} = 27{,}97\,mm$$

$$d_{w_2} = 26{,}893\,mm$$

$$d_{w_3} = 28{,}97\,mm$$

c) $d_{w_1} = 27{,}97\,mm \Rightarrow b \times h = 8 \times 5$

$$t_1 = 3{,}1\ ,\ t_2 = 2$$

1) $$l_1 = \frac{2\,M_t}{d_{w_1} \cdot (h - t_1) \cdot p_{zul,w}} = 56{,}733\,mm$$

2) $l_1 = 37{,}927\,mm$ für $p_{zul,N}$ und t_2

3) $$l_1 = \frac{F_u}{b \cdot \tau_{a\,zul}} = \frac{2\,M_t}{d_{w_1} \cdot b \cdot \tau_{a\,zul}} = 18{,}286\,mm$$

d) $l = l_1 = 56,733\,mm$, $d_{w_2} = 26,893\,mm$

1) $\Rightarrow p_{zul} \geq \frac{4 M_t}{l \cdot d \cdot d_{w_2}}$

$\Leftrightarrow d = \frac{4 M_t}{l \cdot p_{zul,N} \cdot d_{w_2}} = 4,172\,mm$

2) $\tau_{azul} = \frac{F_u}{d \cdot l}$ mit $F_u = \frac{2 M_t}{d_{w_2}}$

$\Rightarrow d = \frac{2 M_t}{d_{w_2} \cdot \tau_{azul} \cdot l} = 2,682\,mm$

e) $d_{w_3} = 28,97\,mm$, $D_A = 1,5 \cdot d_{w_3} = 43,455\,mm$

$\hat{=} D_i$

1) $p_{zul,N} \geq \frac{4 M_t}{d (D_a^2 - D_i^2)}$ $\Rightarrow d \overset{!}{\geq} \frac{4 M_t}{p_{zul,N} (D_a^2 - D_i^2)}$

$\Rightarrow d_I \overset{!}{\geq} 6,067\,mm$

$p_{zul,w} \overset{!}{\geq} \frac{6 M_t}{d \cdot (D_i^2)}$ $\Leftrightarrow d_{II}^2 = \frac{6 M_t}{p_{zul,w} \cdot (D_i^2)} = 10,777\,mm$

2) $\tau_{azul} = \frac{2 F_u}{\pi d^2} = \frac{4 M_t}{\pi d^2 \cdot d_{w_3}}$

$\Leftrightarrow d = \sqrt{\frac{4 M_t}{\pi \cdot \tau_{azul} \cdot d_{w_3}}} = 9,48\,mm$

f) Die Passfederverbindung, da sie zur Übertragung von Drehmomenten durch ihre Geometrie besonders geeignet ist.