Min shaft diameter:

$M_{ICE} = 350$ Nm

$M_{EM} = 245$ Nm

$S = 1,5$

$$d = \sqrt[3]{\frac{M \cdot 16 \cdot S}{\pi \cdot \tau_{perm}}}$$

1) Pure ICE: (fixed ring gear)

$M = 350.000$ Nmm

$\sigma_{UTS} = 720$ MPa $\Rightarrow$ $\tau_{max} = 0,5 \cdot \sigma_{UTS} = 360$ MPa

$\downarrow$ alloying approximation

From 3.4.1.1.1: $\frac{1}{4}\tau_{max} < \tau_{perm} < \frac{4}{9}\tau_{max} \Rightarrow \tau_{perm} = 90$ MPa

$$d = \sqrt[3]{\frac{16 \cdot 1,5 \cdot 350}{\pi \cdot 90}} = 30,97 \text{ mm} \Rightarrow \text{ONLY COMBUSTION ENGINE}$$

2) Pure electric: (fixed carrier)

$M_{EM} = 245$ Nm $\Rightarrow$ chain gear ratio = 2 $\Rightarrow$ $M_{EM, shaft} = 490$ Nm

$$d = \sqrt[3]{\frac{1,5 \cdot 16 \cdot 490000}{\pi \cdot 90}} = 34,65 \text{ mm} \Rightarrow \text{ONLY EM}$$

3.) Combined:

M_{total} = 1785 Nm = 1785000 Nmm

$$d = \sqrt[3]{\frac{16 \cdot 1,5 \cdot 1785000}{\pi \cdot 90}} = 53,31 \text{ mm}$$