Volume of cast casting = 2331450 mm$^3$

Surface area of casting = 124344 mm$^2$

Density of cast metal = 7820 kg/m$^3$

Weight of casting = volume $\times$ density

= $2.331450 \times 7.82$

= 18.32 kg

Weight of molten metal = 31 kg

Pouring time, $t = (2.4335 - 0.3953 \log_{10} W) \sqrt{W}$ s

= 11 seconds
Pouring rate of molten metal (R)

\[ R = \frac{W}{t} \]

= 2.81 kg/sec

Adjusted pouring rate (Ra)

\[ Ra = \frac{R}{k \cdot c} \]

= 2.81 ÷ (1 × 0.85)

= 3.3 kg/sec

Effective sprue height (H) = \( h - \frac{a^2}{2c} \)

= 90 mm.

Choke at Sprue exit

Choke area \( A_c \)

\[ A = \frac{W}{dtc(2gH)^{0.5}} \]

= \( \frac{31 \times 10^6}{7.82 \times 11 \times 0.85 (2 \times 9810 \times 90)^{0.5}} \)

= 318 mm²
Total runner area must be greater than sprue exit area; in general ratio 1:2 is taken.

Runner area = 318×2

= 636 mm²

Runner dimensions is selected as 25×25×350 mm³

Total in gate area must be greater than sprue exit area, in general ratio 1:2.5 is taken

Ingate area = 318×2.5

= 795 mm²

Ingate dimension is selected as 20×20 mm

Number of Ingates = 2.

**Risering of Casting:**

Modulus of casting:

\[
Modulus\ of\ casting = \frac{volume\ of\ casting}{surface\ area\ of\ casting}
\]

\[
= \frac{2331450}{124344}
\]

= 18.75
Diameter of feeder  \( D_f \)

Height of feeder  \( H_f = 1.5 \times D_f \)

Volume of the feeder ( \( V_f \) )

\[
V_f = \frac{(\pi D_f^2 \times H_f)}{4}
\]

\[
= 0.375\pi D_f^3
\]

Diameter of feeder  \( D_f = 112.50 \text{ mm} \)

Height of feeder  \( H_f = 168.75 \text{ mm} \)

**Calculations of Gating and Risering System of flanged bar**

Volume of cast casting  \( = 3901745 \text{ mm}^3 \)

Surface area of casting  \( = 174195 \text{ mm}^2 \)
Density of cast metal \( = 7820 \text{kg/m}^3 \)

Weight of casting = volume \( \times \) density

\[ = 3.901745 \times 7.82 \]

\[ = 30.51 \text{kg} \]

Weight of molten metal = 51kg

Pouring time,\( t = (2.4335 - 0.3953 \log_{10} W)\sqrt{W} \) s

\[ = 13 \text{seconds} \]

Pouring rate of molten metal \((R)\)

\[ R = W + t \]

\[ = 4.061 \text{kg/sec} \]

Adjusted pouring rate \((Ra)\)

\[ Ra = \frac{R}{k \cdot c} \]

\[ = 2.81 \div (1 \times 0.85) \]

\[ = 4.77 \text{ kg/sec} \]

Effective sprue height \((H)\) = \( h \cdot a^2 / 2c \)

\[ = 90 \text{ mm.} \]
Choke at Sprue exit

Choke area  \( A_c \)

\[
A = \frac{W}{dtc(2gH)^{0.5}}
\]

\[
\frac{51 \times 10^6}{7.82 \times 13 \times 0.85(2 \times 9810 \times 90)^{0.5}}
\]

\[
= 444 \text{ mm}^2
\]

Total runner area must be greater than sprue exit area, in general ratio 1:2 is taken. 

Runner area = 444×2

\[
= 888 \text{ mm}^2
\]

Runner dimensions is selected as 30×30×350 mm³

Total ingate area must be greater than sprue exit area, in general ration 1:2.5 is taken

Ingate area = 444×2.5

\[
= 1110 \text{ mm}^2
\]

Ingate dimension is selected as 20×25 mm

Number of Ingates = 2.
Risering of Casting:

Modulus of casting:

\[
Modulus \ of \ casting = \frac{\text{volume of casting}}{\text{surface area of casting}}
\]

\[
= \frac{3901745}{174194}
\]

\[
= 22.3
\]

Diameter of feeder \( D_f \)

Height of feeder \( H_f = 1.5 \times D_f \)

Volume of the feeder (\( V_f \))

\[
V_f = \frac{(\pi D_f^2 \times H_f)}{4}
\]

\[
= 0.375\pi D_f^3
\]

Diameter of feeder \( D_f = 133.80 \) mm

Height of feeder \( H_f = 200.70 \) mm