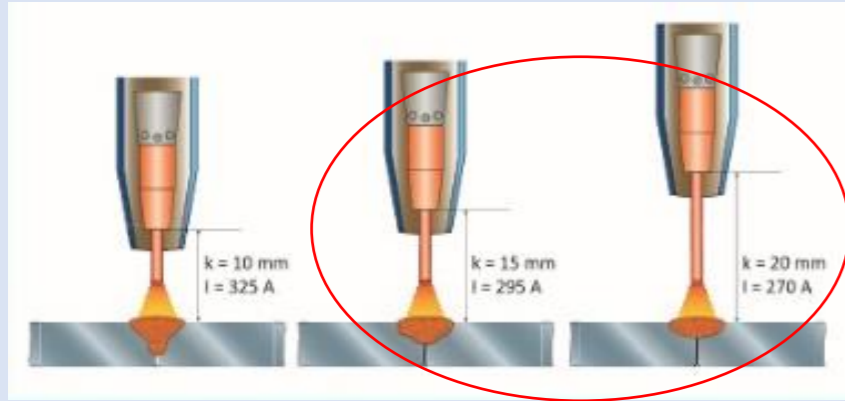


Determination of welding parameters - Wire and Arc Additive Manufacturing (WAAM) for steel – Gaz Metal Arc Welding (GMAW)

1. Determine Contact Tip to Work Distance (CTWD)



How longer the distance k:

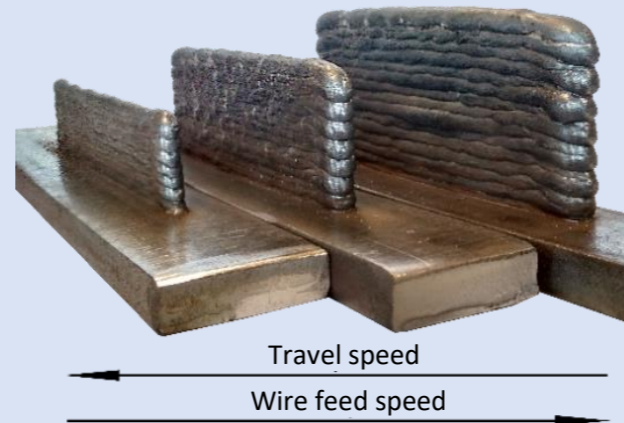
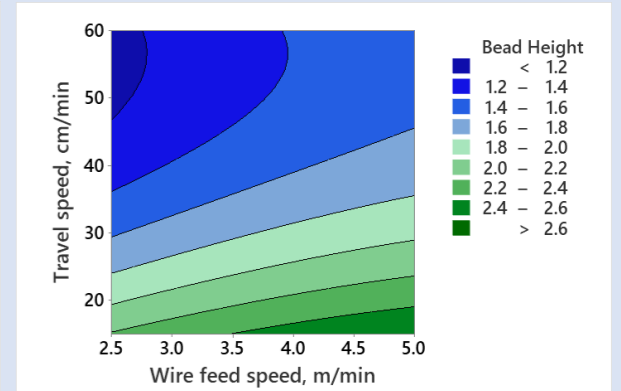
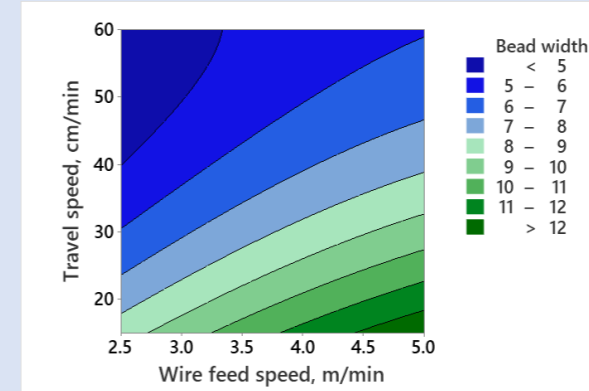
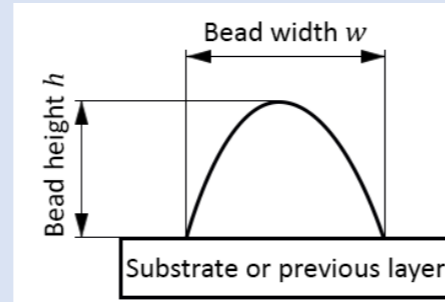
- the lower current I is
- less deep the penetration is
- the more welding spatters
- the colder the contact tip is

Rule of thumb

Short arc WAAM:
 $k = 8-15\text{mm}$

3. Determine robot Travel Speed (TS) & bead geometry

Contour plots for bead geometry determination (wire $\varnothing 1.2\text{ mm}$, G 42 3 M21 3Si1)



Rule of thumb

$WFS/TS = 8\text{ to }12$

- WFS [m/min]
- TS [m/min]



4. Interpass temperature

Rule of thumb

- Keep interpass temperature between $150^{\circ}\text{C} - 200^{\circ}\text{C}$
- Red glowing metal (behind the weld pool) $\leq 20-40\text{mm}$. If necessary, stop welding, weld another cold part or cool down!



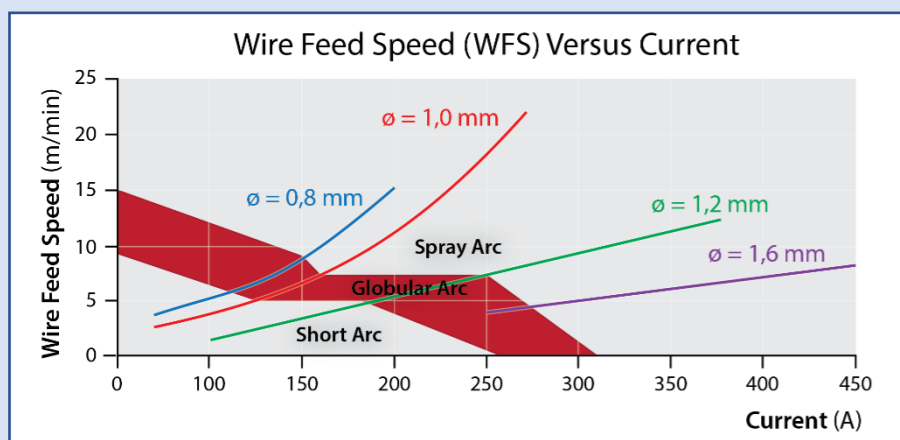
\pm first 5 beads are higher and thinner

Rule of thumb for first 5 beads

- Increase WFS on $\approx \pm 20\%$
- Decrease TS on $\approx \pm 16\%$

2. Wire Feed Speed (WFS) is determined - Metal transfer mode

(short arc only = "cold" welding)



Rule of thumb WFS short Arc

- Diameter $0,8\text{mm} \approx 4-6\text{ m/min}$
- Diameter $1,0\text{ or }1,2\text{ mm} \approx 3-5\text{ m/min}$