

WiseRoot+™

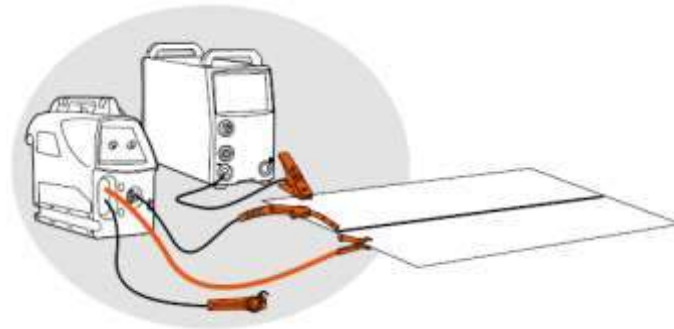


A novel and productive tailored short arc process for manual and mechanised welding of the root pass

General description of the process

Kemppi's **WiseRoot+** process involves very precise real time measurement of voltage (voltage sensing cable), which serves as the input for the current control. Once the power source has recognised a short circuit, a controlled increase in current triggers the transfer of a droplet of filler metal from the wire.

When the current measurement is exactly right, the current is dropped, before the filler-metal droplet falls and a short circuit ends. A short circuit ending at a point of low current produces smooth transfer of filler metal, with no spatter. After the short circuit is broken, a pulse is created in the current that heats the welding pool, but it does not cause transfer of filler metal.



WiseRoot+™

WiseRoot+

In the short circuit period:

- The filler wire contacts the work piece and shorts
- The welding current rises, which forces the tip of the wire in pinch mode
- Process lowers the current before droplet detachment
- The droplet detaches and softly transfers into the weld pool.

In the arc period:

- The arc reignites in low current value
- The wire and the groove faces are melted
- Controlled arc force forms a molten weld pool
- Current decreases to base current level.

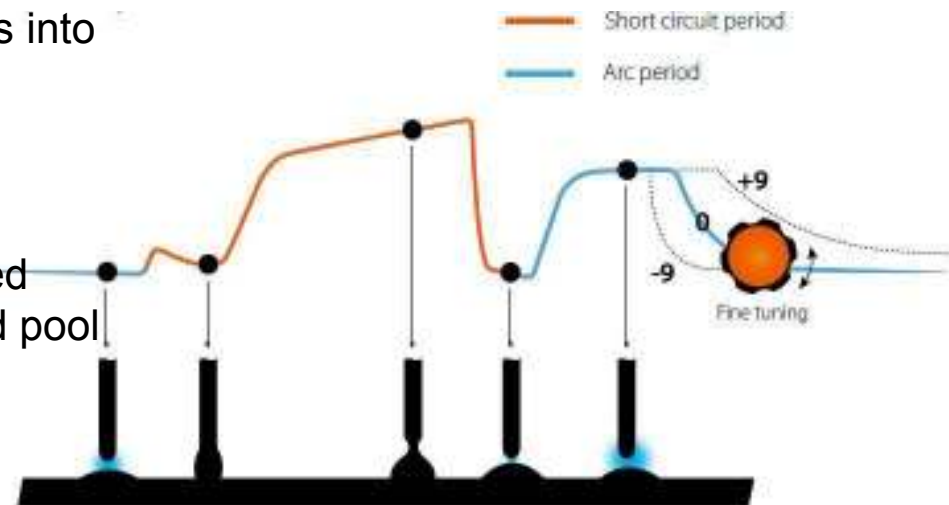


Fig. 1. WiseRoot+ welding process.



Fig. 2. WiseRoot+ welding process.

Process benefits

- **WiseRoot+** process is based on a precise voltage measurement and current control
- Root pass welding in all positions
 - Vertical downhill position
 - No need for backing ring
- Specific voltage sensing cable ensures getting actual information from the arc
- Easy to use
 - Only two parameter regulations needed
 - Wire feed speed and fine tuning
- Excellent welding characteristics also with longer cables (up to 30 m)
NOTE! Cable length regulation.

Process benefits

- **High efficient process** » 10% faster than normal MAG welding and three times faster than TIG welding
- Produces high quality welds
- Suitable for position welding
- Allows the use of a wide root gap and make possible to decrease groove volume
- **WiseRoot+** is a MIG/MAG welding process 131, 133, 135, 136 or 138 according to standard EN ISO 4063

Available welding programs

- There are **WiseRoot+** welding programs for the most common wire types, diameters and shielding gases for structural (Fe) and stainless steels.
- Availability of welding programs depends on the order (welding program packages or MatchCurve)
- Customised **WiseRoot+** welding programs can be made by order (MatchCustom)

WiseRoot+™ process parameter regulation

Very simple to adjust welding parameter:

- Wire Feed Speed
- FineTuning (-9...+9)
 - -9 cold and tight
 - +9 warm and soft
 - Stable arc and no spatter
- Only one fine tuning setting parameter
- Other functions similar to 1-MIG or Pulse
 - CreepStart
 - HotStart
 - CraterFill

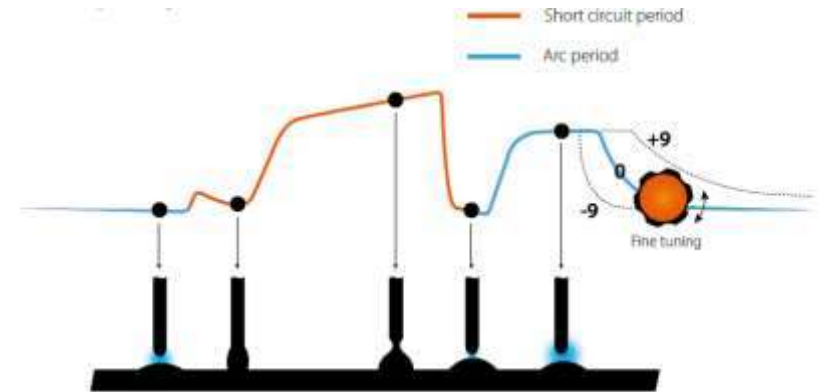
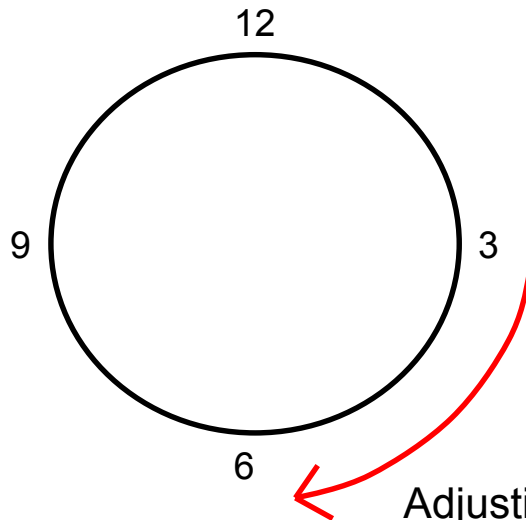


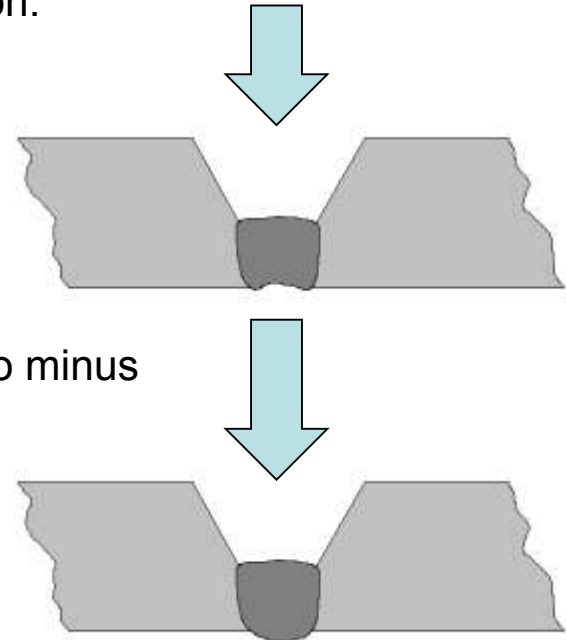
Fig. 3. Process parameter regulation.

WiseRoot+ process parameter regulation



Adjusting FineTuning to minus increases penetration.

With high wire feed speed it is hard to get enough penetration in 3 - 6 o'clock position.



Fine tuning adjustment affects the heat of the arc

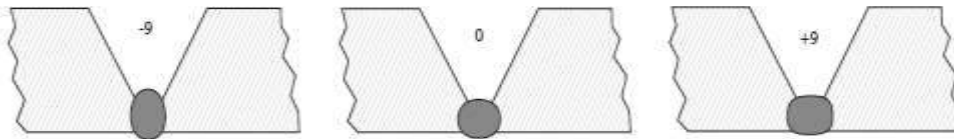
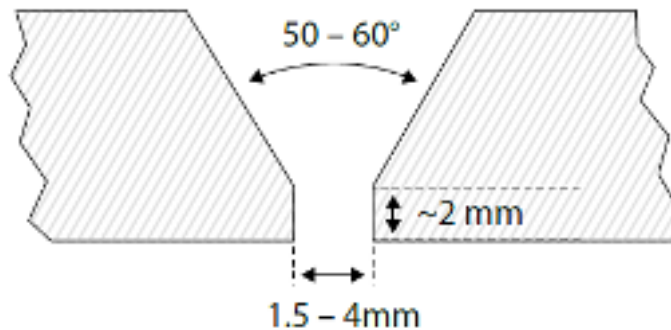


Fig. 4. Fine tuning adjustment

Joint preparation for ferrous steels

Groove types for WiseRoot+ welding (V-joint and base material thickness 10..12 mm)



Groove angle depends on the material thickness, pipe Ø etc

Groove types for WiseRoot+ welding (> 20 mm thick)

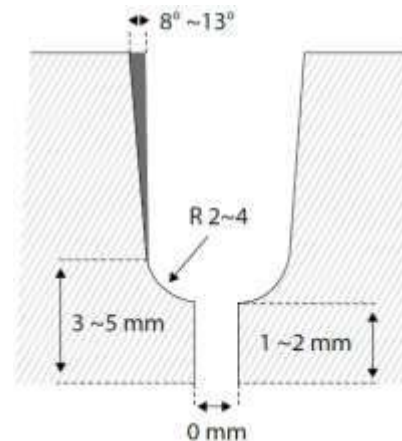
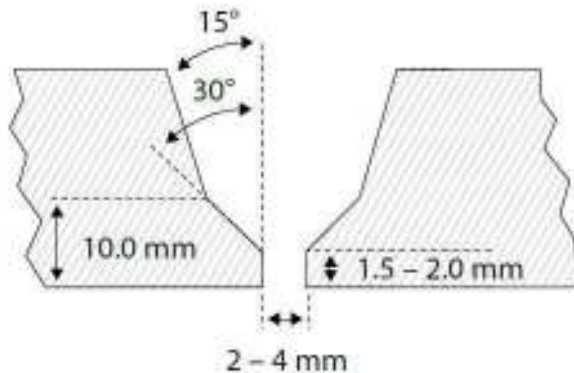
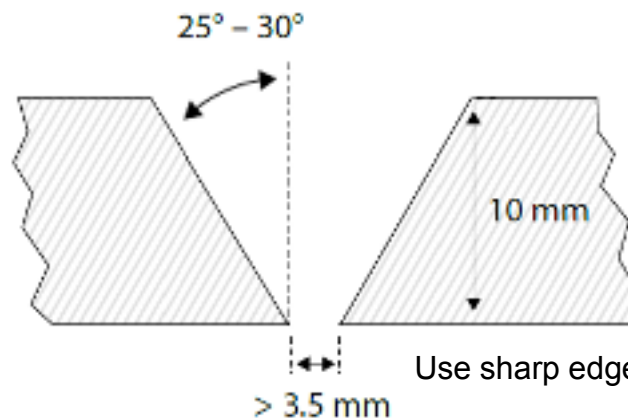


Fig. 5. Joint preparation recommendations.

Joint preparation for stainless steels

**Groove types for WiseRoot+ welding
(V-joint and base material thickness > 6 mm)**



Groove angle depends on the material thickness, pipe \varnothing etc

Use always backing gas to avoid root side weld oxidation.

Welding techniques for pipe welding

WiseRoot+

- Pulling gun angle 10° - 15°
- Overhead 5 to 6 straight angle
- Arc carries the weld pool
- Vertical down welding technique
- Oscillation:
 - Flat / 12 / 2 Yes
 - Vertical / 3 / 9 No
 - Overhead / 6 No
- In oscillation no delays on sides

For filling passes use synergic MAG with solid or flux cored wire

- Straight 90° MIG gun angle
- Vertical up welding technique
- Gun points to the centre of the pipe
- Oscillation: Yes
- Oscillation delays on sides

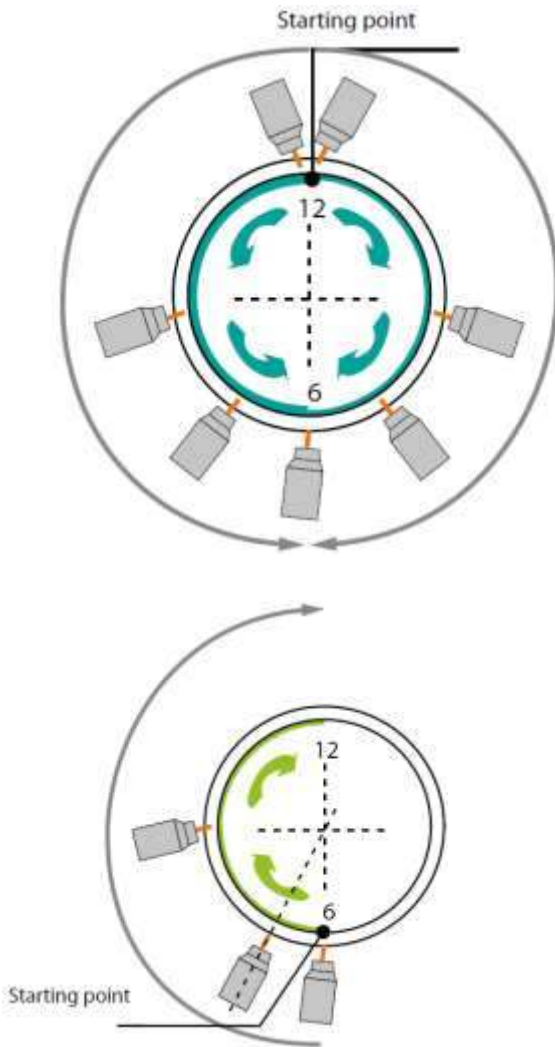
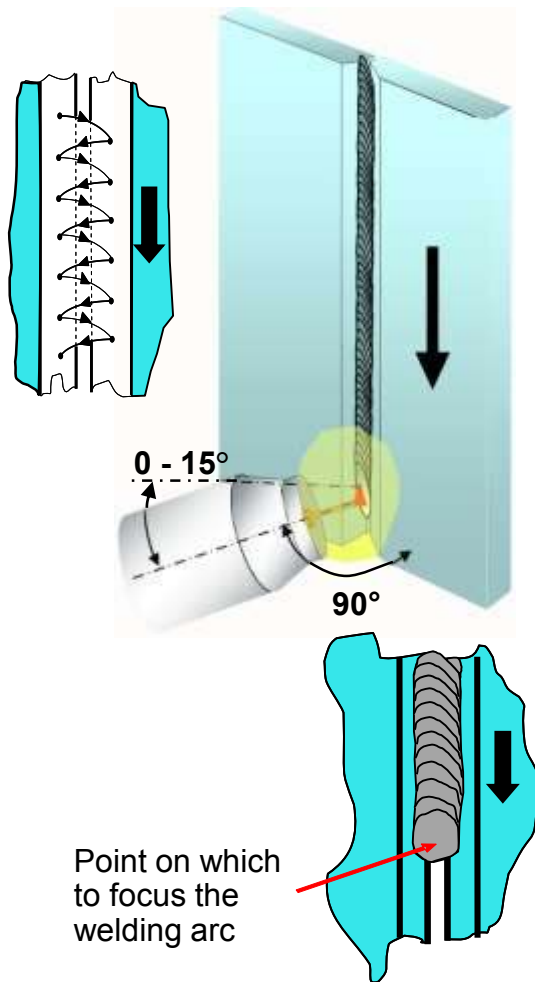


Fig. 6. Technique for pipe welding.

Welding techniques



- In oscillation no delays on groove edges
- Oscillation frequency is faster than in vertical up welding
- Welding power regulation according to:
 - Opening
 - Root face
- Travel speed / Oscillation wideness
- Penetration increases when the gun is in steeper pulling angle
- **NOTICE:** Avoid too great an oscillation - try to use max. travel speed.

Fig. 7. Detailed information on the travel technique.



WiseRoot+ case

- WiseRoot+ in fixed pipe welding application
- Position PG (vertical downhill)
- 1.2 mm Fe solid wire
- CO2 shielding gas
- MatchChannel function in use to get more heat in the following cases:
 - on position from 12 o'clock to 02 o'clock (weaving)
 - when arc ignited on a grinded tack weld
 - when arc extinguished on a grinded tack weld.



Fig. 8. Fixed pipe welding.

WiseRoot+ case

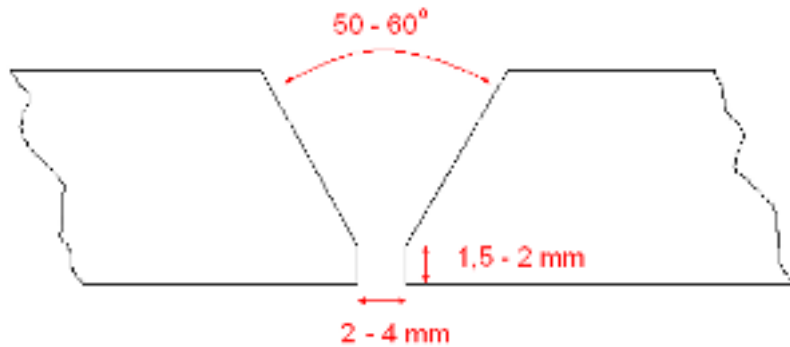


Fig. 9. Groove preparation.



Position	Welding process	Shielding gas	Filler wire	WFS (m/min)	Fine tuning	I (A)	U (V)	v (mm/min)
From 12 o'clock to 2 o'clock (weaved)	WiseRoot+	CO ₂	1.2 mm solid	3.0	+3	150...160	15...16	180...220
From 2 o'clock to 6 o'clock (straight down)	WiseRoot+/MatchChannel	CO ₂	1.2 mm solid	4.0	-4	140...150	14...15	250...350



Welding test with WiseRoot+

- X60 Ø600 mm wall thickness 12 mm, 60° V-groove, 2-3 mm root gap, 2 mm root face
- G3Si1 Ø 1,2 mm mild steel solid wire / CO2 shielding gas
- Same parameter setting in all positions from 12 to 6
- Wfs 4 m/min (150-180 A), FineTuning 0
- Travel speed 20-30 cm/min



Fig. 10. Welding test.

Summary

- WiseRoot+ is world's best root pass solution for manual MAG welding
- Advanced power source technology makes possible to control arc fast and accurately
- Spatter free and stable arc with high productivity
- Excellent arc characteristic also with CO₂
- Wide selection of wire diameter (0,8 – 1,2)
- Easy to adjust parameter
- Possible to change welding power during welding to match welding application
- Possible to weld a fixed pipe in same wire feed speed parameter from 6 o'clock to 12 o'clock.