



Welding procedures – overview



Root welding of non-alloy and low-alloy steel

Your requirements	Our solution – rootArc® XQ	
Inconsistent, changing air gap	Perfect gap bridging	
X-ray proof results	 Good root formation and secure sidewall fusion 	
Welding in various positions	 High arc force for root welding in all positions 	
Increased productivity	 Good welding speed and melt rate compared to TIG or MMA welding Low-spatter process 	
Straightforward handling	 Rapid digital control of the process, easy to guide and to control Uses standard welding torches without additional wire movement Welding even with long hose packages without additional voltage measuring leads thanks to RCC power module (Rapid Current Control) For manual and mechanised applications 	
No grinding of intermediate passes	 Flat, smooth weld surface and virtually spatter-free process for reduced finishing work 	
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes 	

All Root welding in PC position with an air gap and without weld pool backing



Weld preparation of root welds on pipes, 60 ° included angle with 3 mm air gap



Front view



rootArc[®] XQ

3

5



Root

PC Root welding in PC position with an air gap and without weld pool backing



Front view

PC Root welding in PC position with an air gap and without weld pool backing



Front view



Root



Material thickness 10 mm, one-sided bevel 15 degrees, air gap 4 mm



Root



15 mm, included angle 60 °

Welding of filler passes and cover passes in non-alloy and low-alloy steel

Your requirements	Our solution – forceArc puls® XQ	
Straightforward handling	 Easy to learn, even for inexperienced welders, thanks to rapid digital control of the process, virtually spatter free, reduced undercuts 	
Secure penetration	 Deep penetration for excellent root and sidewall fusion 	
Minimised distortion of the components	 Modified, heat-reduced, directionally stable pulsed arc 	
Improved economy	 Enables weld seam volumes to be reduced, potential for over 50% reduction of welding times in production, manual and automated 	
Reliable welding in poorly accessible areas	Perfect welding even with very long stick-outs	
Changeable, inconsistent air gap	 Excellent gap bridging even in high power ranges 	
Undercuts, seam appearance	 Excellent wetting of the material surface, smooth weld surface even on heavily oxidised or dirty sheet metal 	
Welding procedure qualification	 Qualified by welding procedure test (process no. 135) in accordance with DIN EN ISO 15614-1 	
Straightforward handling	 EWM allin – one machine for welding all material thicknesses and using all processes 	

Welding with reduced seam volumes has been tested and confirmed multiple times by independent institutes. EWM's forceArc[®] XQ and forceArc puls[®] XQ welding processes allow welding times to be reduced by up to 50% compared to standard spray arc processes. The reduced included angle saves resources without changing the mechanical and technological properties.

Standard spray arc



11 runs

forceArc® XQ



5 runs 50% shorter welding time

Unchanged mechanical/technological properties

A complete technical report documenting all the advantages can be found online at the following link:



www.ewm-group.com/sl/professionalreport



forceArc puls® XQ





S355, 20 mm, included angle 60 ° 8 runs, standard spray arc





S355, 20 mm, included angle 30 ° 4 runs, forceArc puls®





S235, 30 mm, included angle 35 $^\circ$ 8 runs

PA Full penetration, butt joint welded on both sides





S355, 50 mm, included angle 30 $^\circ$ 15 runs

Welding fillet welds with deep penetration on non-alloy and low-alloy steel

Your requirements	Our solution – forceArc puls® XQ
Improved economy	 Reduced number of welding passes for fillet welds
Secure penetration	Deep penetration for excellent root and sidewall fusion
Minimised distortion of the components	 Modified, heat-reduced, directionally stable spray arc
Reliable welding in poorly accessible areas	 Perfect welding in narrow joints, even with very long stick-outs
	 Rapid correction of alterations to stick-out lengths, reliable processing of stick-out lengths up to 40 mm
Reduced voltage in the fillet weld area	Forces transferred to the interior of the component by deep penetration, seam volume reduced by large effective seam thickness in line with DIN EN ISO 17659:2005- 09, reduced heat input into the component
Welding procedure qualification	 Qualified by welding procedure test (process no. 135), in line with DIN EN ISO 15614-1
Simple, safe handling	 Rapid digital control of the process, easy to learn and directly applicable regardless of torch angle
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes





Reduced production time (welding, finishing work)





Reduced welding fume emissions



forceArc puls® XQ

Welding with deep penetration as per DIN EN 1090

Use the full potential of your weld seam. By taking the effective seam thickness of fillet welds into account, the forceArc puls[®] process enables single-pass welds up to throat = 8 mm to be created as opposed to throat = 5 mm in processes without deep penetration.



Flow of force in standard fillet welds



Improved flow of force thanks to deep penetration



Definition of effective seam thickness as per DIN EN ISO 17659;2005-09



S355, 10 mm, effective seam thickness of 8 mm as per DIN EN ISO 17659:2005-09

All Welding with deep penetration and long stick-out





Web plate material thickness 10 mm, included angle 35 °



Additional information

Welding with consistent penetration and consistent power on non-alloy, low-alloy and high-alloy steel

wiredArc XQ / wiredArc puls XQ

Your requirements	Our solution – wiredArc puls XQ
Secure penetration, root and sidewall fusion	 Welding process with consistently high penetration depth regardless of alterations to the stick-out
Reduced or no weld spatter	 Virtually spatter-free welding results thanks to rapid digital control of the welding process
Controlled heat input	 Digital process control supplies a consistent welding current The energy per unit length and heat input remain virtually consistent despite changes to the stick-out
Increased productivity	Ability to reduce the seam's included angle and therefore the weld seam volume
Visually pleasing weld surface	 Flat, even weld surface and virtually spatter-free process for reduced finishing work
Straightforward handling	 Easy to learn and to control
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes

12 mm stick-out







30 mm stick-out

Standard

Alteration of the stick-out causes the penetration depth to change in standard welding processes. In particular, welding with an increasing stick-out length can cause the weld root to be insufficiently fused (lack of fusion).



wiredArc XQ

With EWM wiredArc XQ, the penetration remains consistent when the stick-out is altered. The innovative control keeps the welding current and the heat input virtually consistent.



100% CO₂

Welding using 100% CO₂ on non-alloy and low-alloy steel

Your requirements		
Minimised spatter similar to mixed gas	 Digital process control for low-spatter droplet transfer thanks to the RCC power module (Rapid Current Control) 	
Process stability	 Rapid process control thanks to the use of the latest microelectronics 	
Increased productivity	 Minimised weld spatter similar to mixed gas Welding even with long hose packages without additional voltage measuring leads thanks to RCC power module (Rapid Current Control) 	
Straightforward handling	Easy to guide and control	
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes 	

PC Root welding in PC position with an air gap and without weld pool backing







S355, material thickness 3 mm, using G3Si1 1.2 mm diameter at 100% CO₂

PA Root welding in PC position with an air gap and without weld pool backing





S355, material thickness 3 mm, using G3Si1 1.2 mm diameter at 100% $\text{CO}_{_2}$





Welding full penetration fillet welds on non-alloy, low-alloy and high-alloy steel

Your requirements	Our solution – forceArc puls® XQ
Simple, safe handling	 Good gap bridging even in high power ranges, easy to learn and directly applicable Considerably reduced welding fume emissions compared to pulsed arc welding
Improved economy	 Secure full penetration even without an air gap, therefore good for fitting work Enables included angles to be reduced thereby reducing weld seam volumes, lowering the number of runs and significantly lowering costs
No gouging or grinding of the transverse root side	 Double-sided full penetration welds on butt joints or T-joints without grinding or gouging the transverse root side
Secure penetration	 Deep penetration for excellent root and sidewall fusion
Stable arc	 Good process stability when welding on the weld pool even at small included angles
Reliable welding in poorly accessible areas	 Perfect welding, even with very long stick-outs Even in tight and narrow gaps with very long stick-outs Rapid correction of alterations to stick-out lengths, reliable processing of stick-out lengths up to 40 mm
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes





www.ewm-group.com/sl/savings



forceArc puls® XQ





PB Full penetration, welded on both sides





S355, 15 mm, included angle 35 $^\circ$

S355, 5 mm on 10 mm

PB Full penetration, welded on both sides









1.4301, 10 mm, included angle 40 $^{\circ}$



1.4301, 10 mm, double-sided full penetration on a butt joint with an included angle of 35 $^\circ$

Positional welding without using the "Christmas tree" technique on non-alloy, low-alloy and high-alloy steel

Your requirements	Our solution – Positionweld
Increased productivity	 High welding speeds compared to the traditional "Christmas tree" technique
Secure penetration, root and sidewall fusion	 Concentrated, digitally modified pulsed arc
Reduced or no weld spatter	 Virtually spatter-free welding results thanks to rapid digital control of the welding process
Controlled heat input	 Optimum, factory-configured switching between low and high welding power Heat-reduced process with low arc power and energy per unit length
Visually pleasing weld surface	 Flat, evenly spaced bead ripples and virtually spatter-free process for reduced finishing work
Straightforward handling	Easy to set and easy to guide
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes





Positionweld



Welding and brazing of thin sheet metal made from nonalloy, low-alloy, high-alloy steel and galvanised sheet metal

Your requirements	Our solution – coldArc®XQ/coldArc® puls XQ
Less distortion, minimal discolouration	 Lower heat input due to digital control of droplet transfer in short-circuit welding thanks to RCC power module (Rapid Current Control)
Visually pleasing, smooth weld surface, less or no weld spatter	 Flat, smooth weld surface and virtually spatter-free process, less discolouration and distortion reduces finishing work, excellent wetting of surfaces when brazing
Changeable, inconsistent air gap	 No sagging of the molten metal, secure sidewall fusion even with misaligned edges
Secure penetration	 Optimum process performance configuration, steady and stable welding process
	 Rapid digital control of the process, easy to guide and control
Straightforward handling	 Welding even with long hose packages without additional voltage measuring leads thanks to RCC power module
Welding and brazing of coated (galvanised) sheet metal	 Minimal spatter formation, minimal impact on corrosion resistance
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes





coldArc[®] XQ / coldArc[®] puls XQ



Welding unalloyed sheet metal



Welding high-alloy sheet metal



Welding galvanised sheet metal



Brazing galvanised sheet metal



Brazing high tensile sheet metal, e.g. Usibor®



Brazing high-alloy (CrNi) sheet metal

Filler pass and cover pass welding of high-alloy steel

Your requirements	Our solution – forceArc puls® XQ
Secure deep penetration	 Concentrated, digitally modified pulsed arc
Reduced or no weld spatter	 Virtually spatter-free welding results thanks to rapid digital control of the welding process Lower welding fume emissions compared to pulse arc welding
Minimal distortion	 Heat-reduced process with low arc power and energy per unit length reduced by up to 20% compared to pulsed arc
	 Ability to reduce the seam volume thanks to the smaller included angle in multipass welding
Increased productivity	 Symmetrical fillet welds with maximum attainable seam thickness (throat thickness)
	 Low interpass temperature/reduced non-productive time
Visually pleasing, smooth weld surface	 Flat, smooth weld surface and virtually spatter-free process for reduced finishing work, minimal discolouration
	 Rapid digital control of the process, easy to guide and control
Straightforward handling	 Consistent weld surface from various torch positions
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes

Your benefits

Up to 30% total cost savings

- Reduced costs for wages, welding consumables, shielding gas and power
- Reduced production time

Up to 15% lower heat input

- Less finishing work (straightening, sanding, cleaning) due to reduced distortion, discolouration and stress
- Minimised non-productive time due to shorter waiting times in multipass welding

Up to 20% greater throat thickness**

• Symmetrical seams due to deep, concentrated penetration with reliable root fusion

Virtually spatter free

 Minimised finishing work, even on panels with scaling or very dirty surfaces



forceArc puls® XQ



Front view: Lower heat input using forceArc puls[®] XQ, less surface oxidation resulting in a better finish



Back view: Low heat input using forceArc puls[®] XQ, less surface oxidation

Compared to pulsed arc welding, forceArc puls[®] XQ inputs up to 15% less heat in the upper power ranges. This results in less discolouration and less distortion in the component. Your benefits

- Lower heat input
- Minimised energy per unit length
- Reduces distortion, discolouration and stress in the workpiece
- Less finishing work (straightening, sanding, cleaning)
- Less melting loss of alloy elements resulting in greater corrosion resistance





Process	forceArc puls® XQ	Pulse
Wire feed in m/min	13	13
Energy per unit length in kJ/mm	1.21 (-15%)	1.44
Weld speed in m/min	0.45	0.45
Throat thickness	5.7 (+15%)	4.8

For welding aluminium and aluminium alloys

Pulsed arc XQ

Your requirements	Our solution – pulsed arc XQ
Secure penetration, root and sidewall fusion	 Rapid and stable process control thanks to the use of the latest microprocessor technology
Visually pleasing weld surface	 Steady, stable droplet transfer, less smoke residue on surface Individual weld appearance thanks to freely adjustable superPuls function
Minimised spatter	 Wire feed reverse for spatter-free ignition
For welding any material thickness	Reliable process starting from 1 mm
Straightforward handling	 Rapid digital control of the process, easy to guide and control
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes

PC Welding on both sides of aluminium in shipbuilding





Welding of aluminium and aluminium alloys in positional welding without using the "Christmas tree" technique

Positionweld

Your requirements	Our solution – Positionweld	
Secure penetration, root and sidewall fusion	 Concentrated, digitally controlled pulsed arc 	
Controlled heat input	 Optimum, factory configured switching between low and high welding power 	
Increased productivity	 High welding speeds compared to the traditional weaving techniques 	
Visually pleasing weld surface	 Flat, evenly spaced bead ripples and virtually spatter-free process for reduced finishing work 	
Straightforward handling	Rapid digital control of the process, easy to guide and to control	
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes 	

PF Vertical-up welding, easy handling







AlMg5, material thickness 4 mm









Surfacing, cladding/hardfacing

Your requirements	Our solution – cladding/hardfacing
Deposit with good corrosion resistance	 Low dilution due to optimum process configuration for surfacing
Little material removal after welding	 Even deposit structure, minimal machining work
Stable arc	 High process stability thanks to digitally controlled arc, minimised spatter formation
Straightforward handling	Easy to operate and set
Flexibility in production	 EWM allin – one machine for welding all material thicknesses and using all processes
	 Surfacing processes at no extra cost for Co-based and Ni-based alloys and high-alloy CrNi alloys





Cladding/hardfacing

PA Surfacing of finned tube walls





Corrosion-resistant surfacing of Alloy 625 Ni-based materials

PA MAG + hot wire surfacing for increased deposition rate



New process variant combines a MAG welding process supplemented with an additional hot wire.

- Up to 13.8 kg deposition rate for significantly increased productivity
- Minimal dilution
- Further improved properties of deposited layers
- Process easy to set up and configure
- Suitable for cladding and hardfacing



Additional information



www.ewm-group.com/sl/cladding

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The content of this document has been prepared and reviewed with all reasonable care. The information provided is subject to change; errors excepted.