EWM AG
WE ARE WELDING

Unbelievable cost savings – we provide clear proof!

forceArc puls®

The patented* revolution in welding technology

✔ Steel ✔ Stainless steel

- Extremely simple handling, even for inexperienced welders – forehand, backhand or neutral position
- Low heat input, yet deep, concentrated penetration
- Greatly reduced discolouration, low distortion
- Reliable root fusion
- No undercuts, optimum wetting on edges
- Pleasant, quiet arc
- Reduction in welding fume emissions

Please note our forceArc puls® events
www.forcearcpuls.com/info

forceArc puls® Video:

*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

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*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

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forceArc puls®

The patented* revolution in welding technology

✓ Up to 30% total cost savings**	▪ Savings in wage, welding consumables, shielding gas and energy costs ▪ Reduced manufacturing times
✓ Up to 15 % less heat input**	▪ Less rework (grinding, cleaning) thanks to reduced distortion, discolouration and stress ▪ Minimised non-productive times for multi-pass welding
✓ Up to 20 % higher throat thickness**	▪ Symmetric seam formation thanks to deep, concentrated penetration with secure root fusion
✓ Virtually spatter-free	▪ Rework minimised, even for plates with scaling or very impure surfaces

**Comparison with pulsed arc

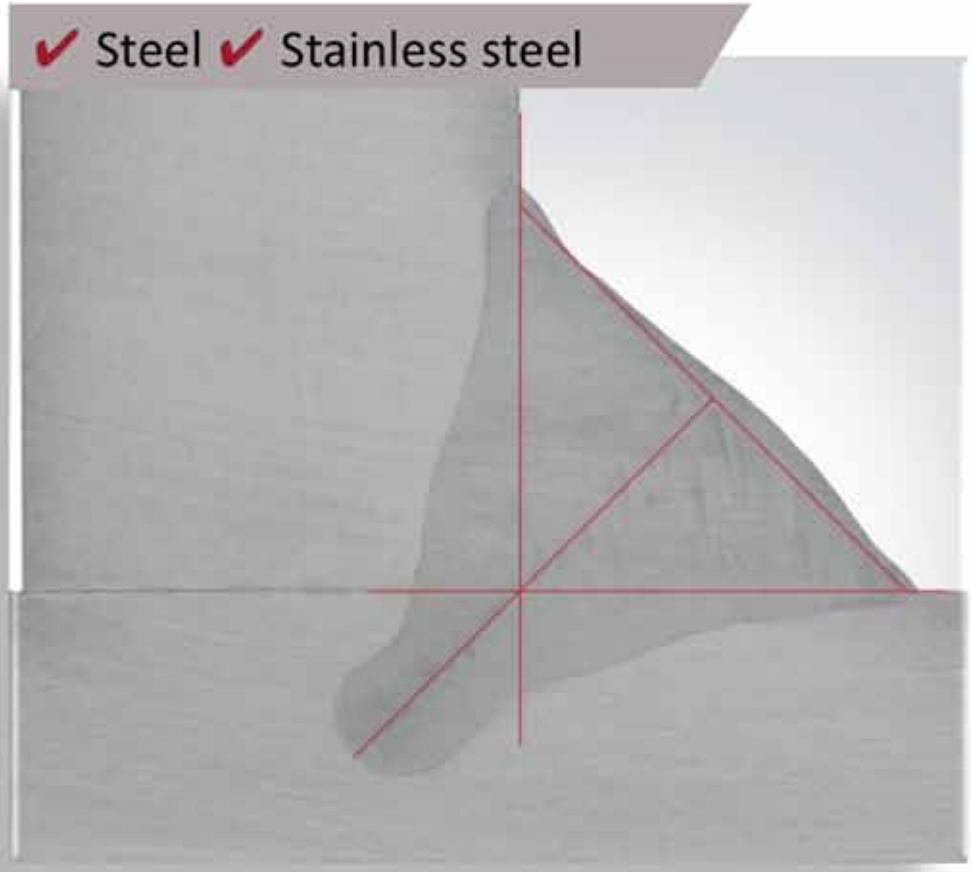
*Patent No.: EP 1 640 100 B1, EP 1 726 395 B1

More information on the savings potential can be found in the CustomerStory starting on page 42

MESA Metall-Stahlbau GmbH

Contents

- General description of forceArc puls®
- forceArc puls® for welding high-alloy (CrNi) steels
- forceArc puls® for welding low-alloy steels
- Welding with deep penetration as per EN 1090
- Putting into practice

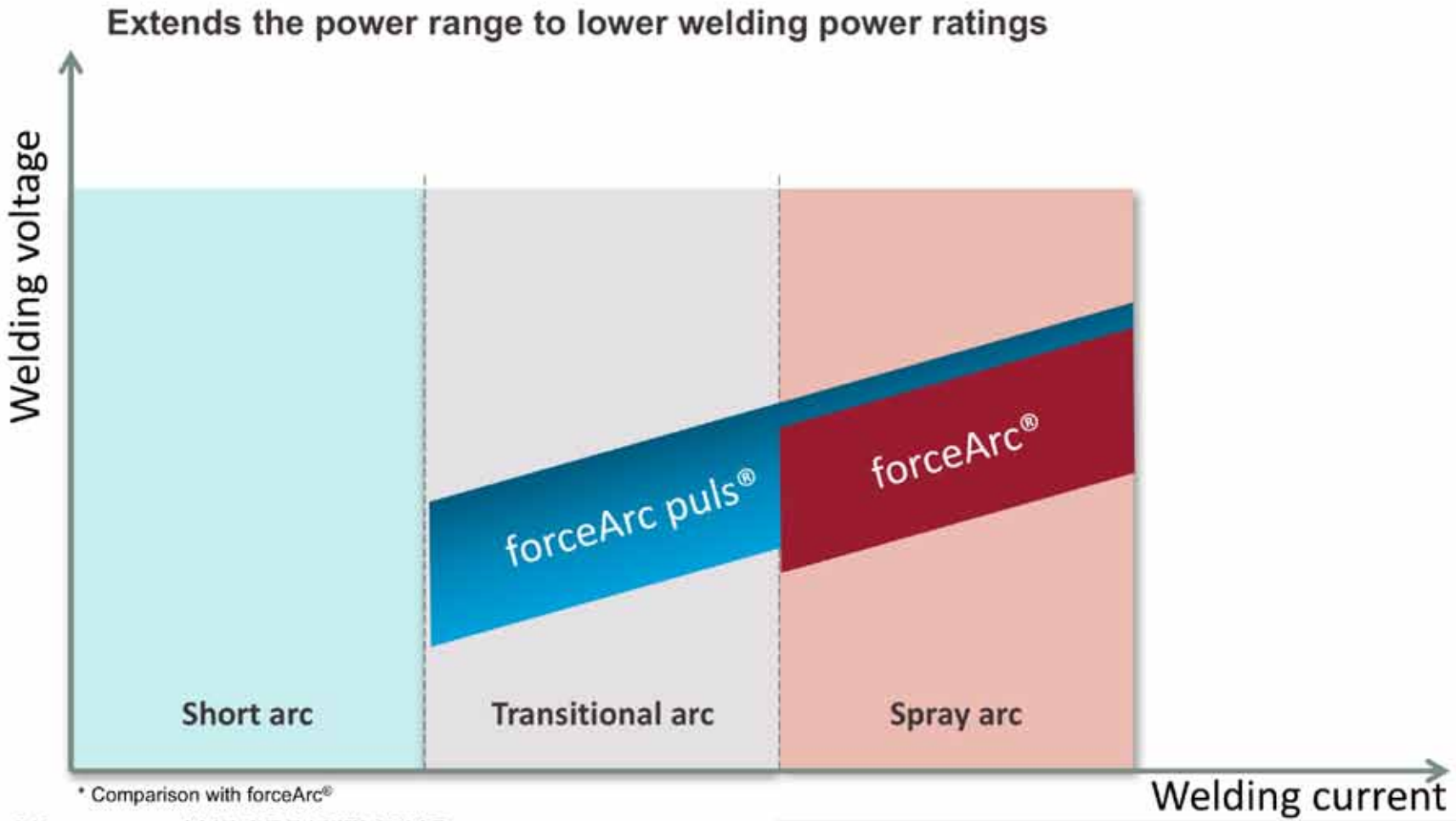


forceArc puls® – the process and its application

- MIG/MAG welding process
- Welding of non-alloy, low-alloy and high-alloy steels
- Root welding – full penetrations welded on one side and both sides
- Root welding on backing bar with up to 4 mm air gap
- Excellent gap bridging* even in a high power range
- Controlled welding for changeable air gap up to 4 mm (depending on the welding position)
- Highly suitable for multi-pass welds

* Comparison with forceArc®

forceArc puls® – output range



forceArc puls® – you can't get much easier

How you benefit

High acceptance among welders

- / Pleasant, quiet arc sound
- / Fewer welding fumes*
- / Easy to guide (excellent wetting)
- / Stress-free welding
- / Easy to learn and ready for immediate use

Quickly learnt, minimum training

- / Easy to change over from standard GMAW welding
- / For forehand and backhand welding
- / Perfect for changes in personnel
  (short-term increase in production capacities, external employees)

* Comparison with pulsed arc

forceArc puls® delivers excellent weld appearance

How you benefit

Virtually spatter-free

/ Rework minimised
/ Even for plates with scaling or very impure surfaces

Optimum quality

/ Excellent weld appearance
/ Less discolouration
/ Few undercuts, optimum wetting on edges

S355, d =10 mm, T-joint, fillet weld without weld preparation, I = 316 A, U = 28,8 V, WF = 10,5 m/min., Vs = 50 cm/min.

1,4301(304), d =10 mm, T-joint, fillet weld without weld preparation, I = 324 A, U = 25,6 V, WF = 11,5 m/min., Vs = 35 cm/min.

The patented* revolution in welding

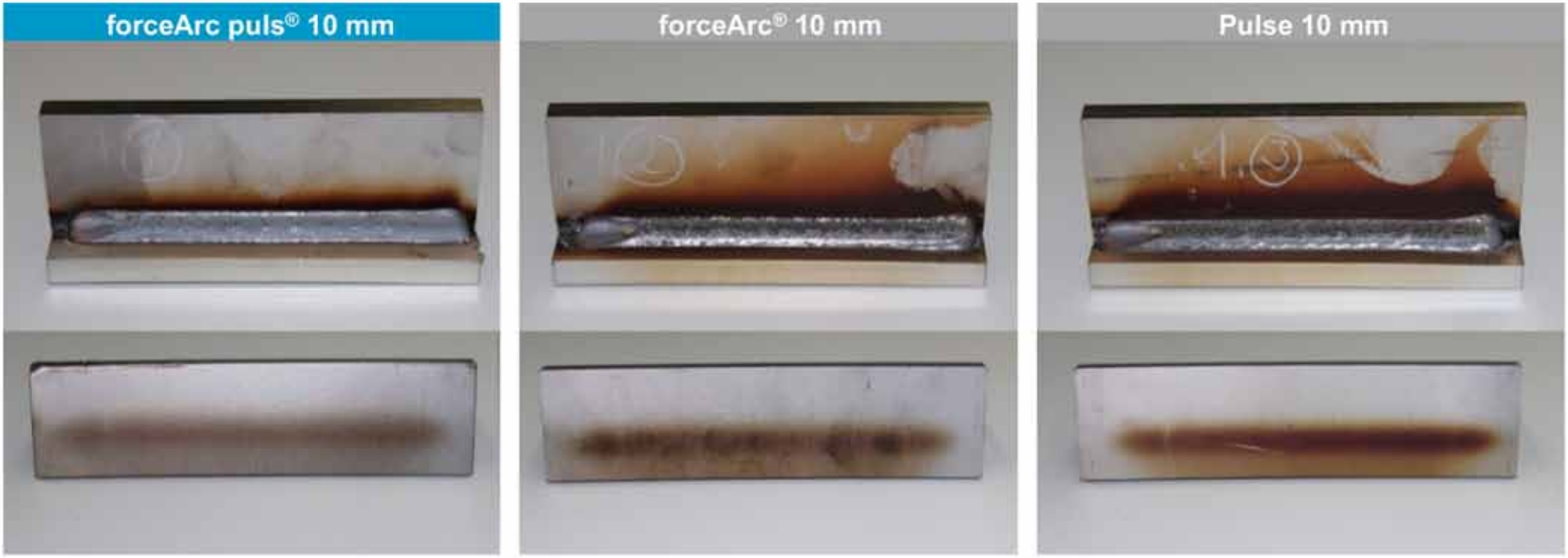
forceArc puls®

Welding high-alloy (CrNi) steels

*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

forceArc puls® – welding high-alloy (CrNi) steels

The lower heat input with forceArc puls® results in reduced discolouration and burn marks.



Comparison of results with forceArc® and pulsed arc

forceArc puls® – welding high-alloy (CrNi) steels

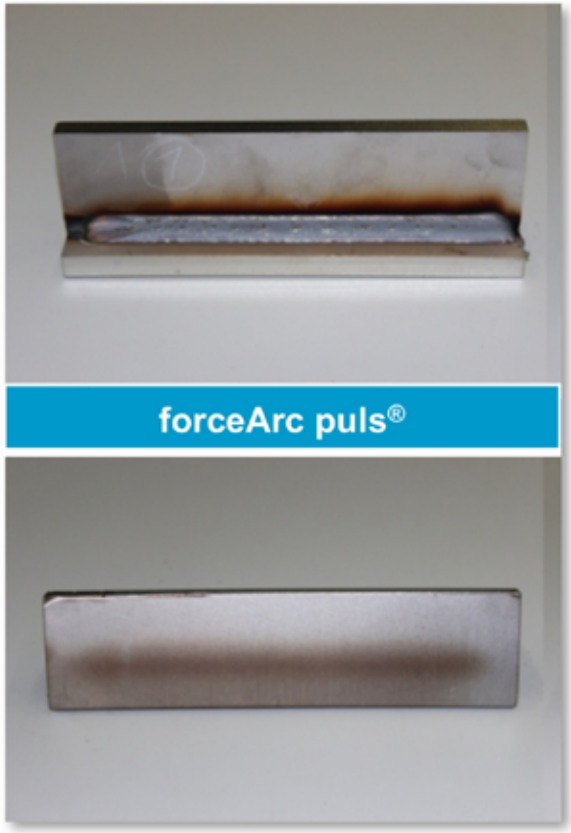
	forceArc puls®	forceArc®	Pulse
			
Process	forceArc puls®	forceArc®	Pulse
WF in m/min	13	13	13
Output in kW	9,1	11	10,8
Current in A	338	375	370
Voltage in V	26,8	29,4	28,9
Vs in m/min.	0,45	0,45	0,45
Throat thickness in mm	5,7	5,1	4,8

Comparison of results with forceArc® and pulsed arc

forceArc puls® – welding high-alloy (CrNi) steels

The comparison reveals the following:

forceArc puls® boasts up to **15% lower heat input** in the upper power range in comparison to pulse. This results in less discolouration and less distortion in the component.

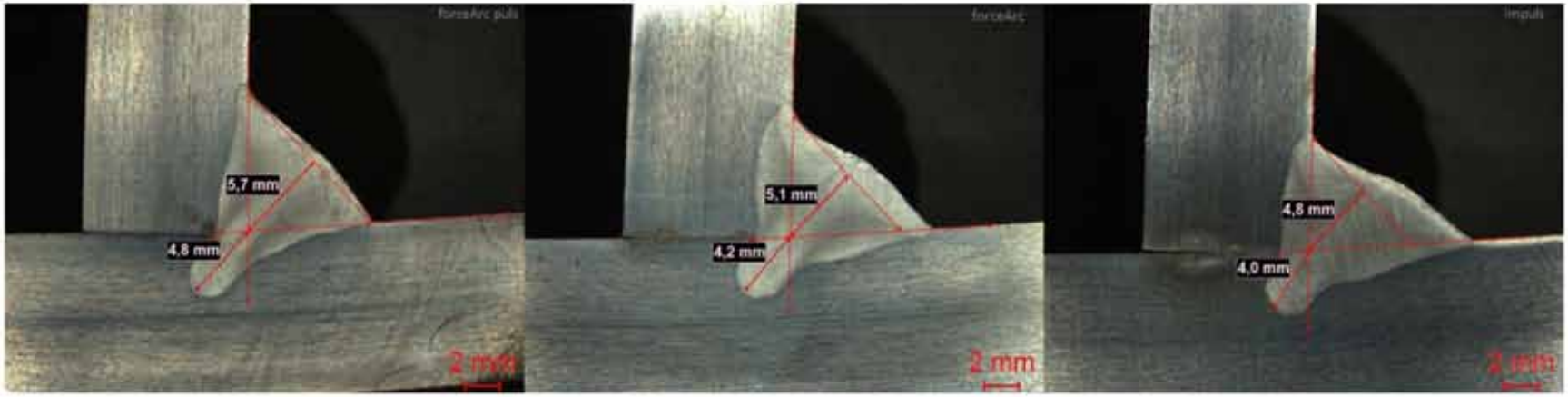


How you benefit

Less heat input

- Minimised energy per unit length
- Reduces distortion, discolouration and stress
- Less rework (straightening, grinding, cleaning)
- Less melting loss of alloy elements, producing greater corrosion resistance

forceArc puls® – welding high-alloy (CrNi) steels



Process	forceArc puls®	forceArc®	Pulse
WF in m/min	13	13	13
Energy per unit length in kj/mm	1,21 (-15%)	1,47	1,44
Vs in m/min.	0,45	0,45	0,45
Throat thickness in mm	5,7 (+15%)	5,1	4,8

Comparison of results with forceArc® and pulsed arc

forceArc puls® – welding high-alloy (CrNi) steels

The comparison reveals the following:

forceArc puls® forms a symmetrical fillet weld.

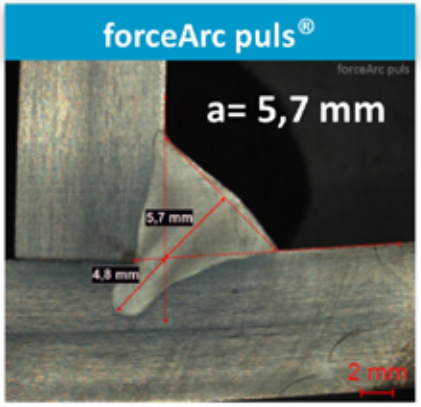
This is the requirement for achieving the maximum throat thickness for a given deposition rate.

How you benefit

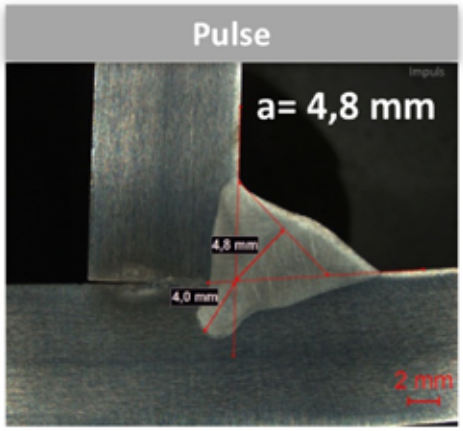
Throat thickness up to 20% greater in comparison to pulsed arc.

Looking at things from a different perspective, this means welding speeds up to 20% faster can be achieved compared to a pulsed arc process with an identical throat thickness.

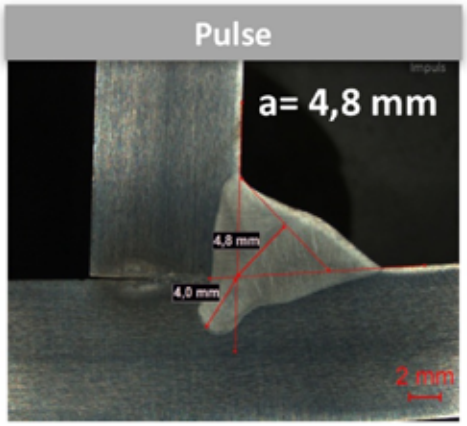
Vs = 45 cm/min



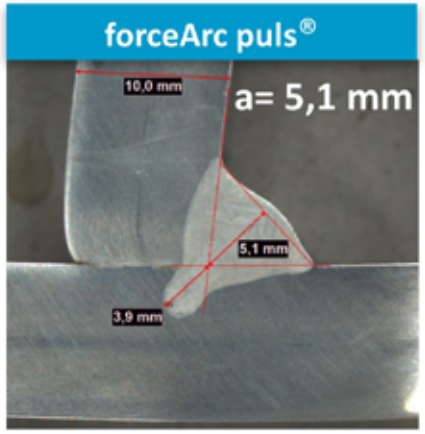
Vs = 45 cm/min



Vs = 45 cm/min



Vs = 60 cm/min



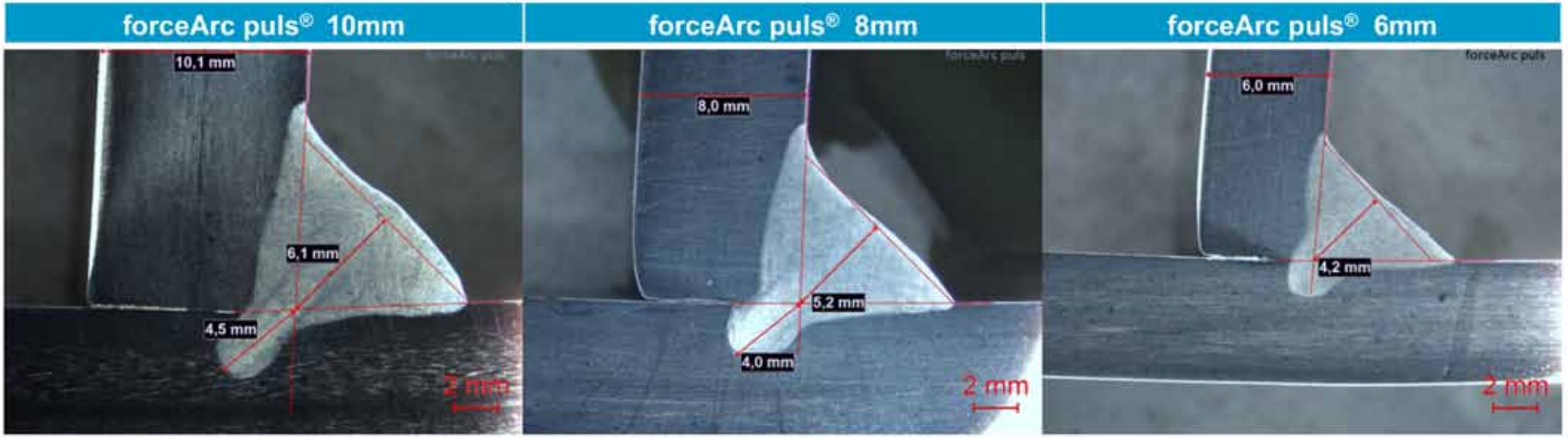
forceArc puls® – welding high-alloy (CrNi) steels

How you benefit

Symmetric seam formation

- Maximum possible throat thickness is achieved
- For all welding power ratings and plate thicknesses

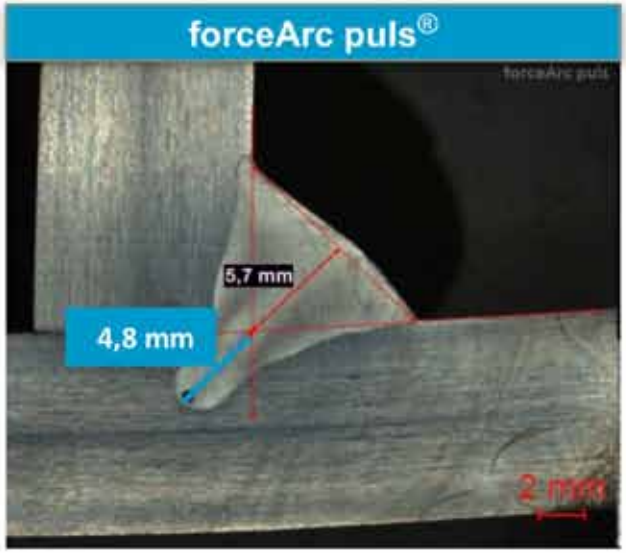
Seam formation and penetration profile for different plate thicknesses

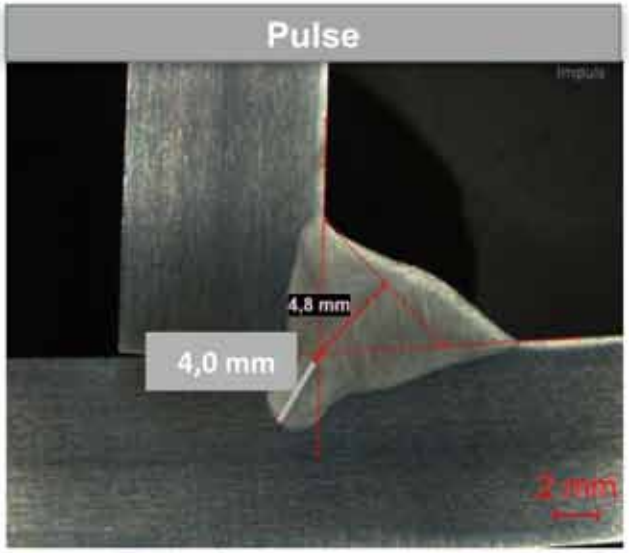


forceArc puls® – welding high-alloy (CrNi) steels
Penetration profile

The comparison reveals the following:

forceArc puls® offers very deep penetration and thus greater safety during welding.





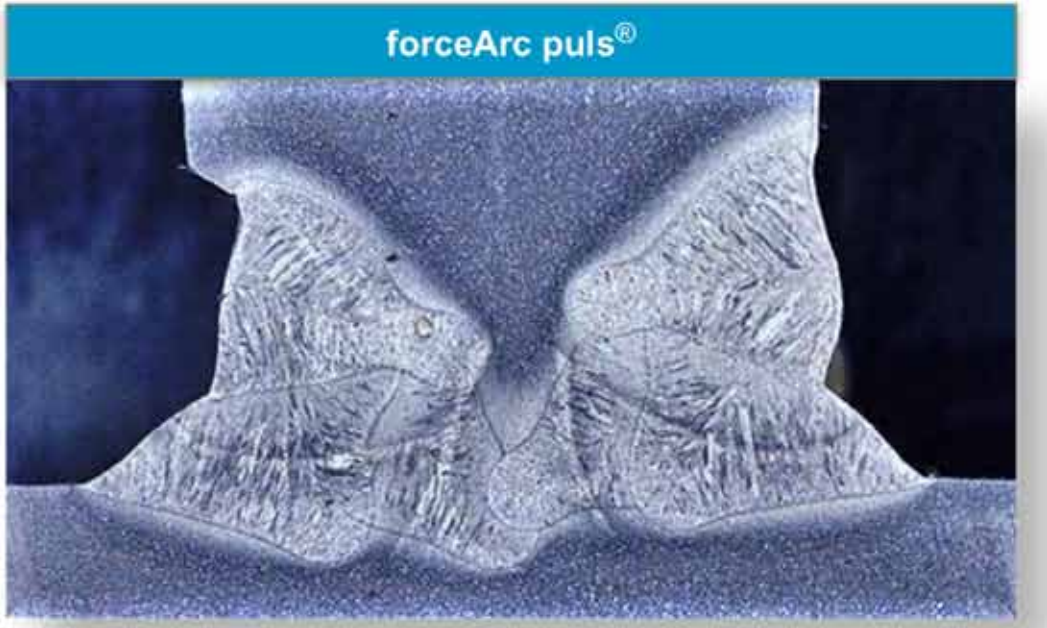
forceArc puls® – welding high-alloy (CrNi) steels
Multi-pass welding

How you benefit

Combination

Less heat input and deeper penetration:

- Highly suitable for multi-pass welding
- Heat-reduced compared with standard pulse welding
- Several passes can be welded until the maximum intermediate pass temperature is reached
- Less distortion in the component thanks to lower heat input



The patented* revolution in welding

forceArc puls®

Welding of non-alloy and low-alloy steels

*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

forceArc puls® – welding non-alloy and low-alloy steels

Reference client

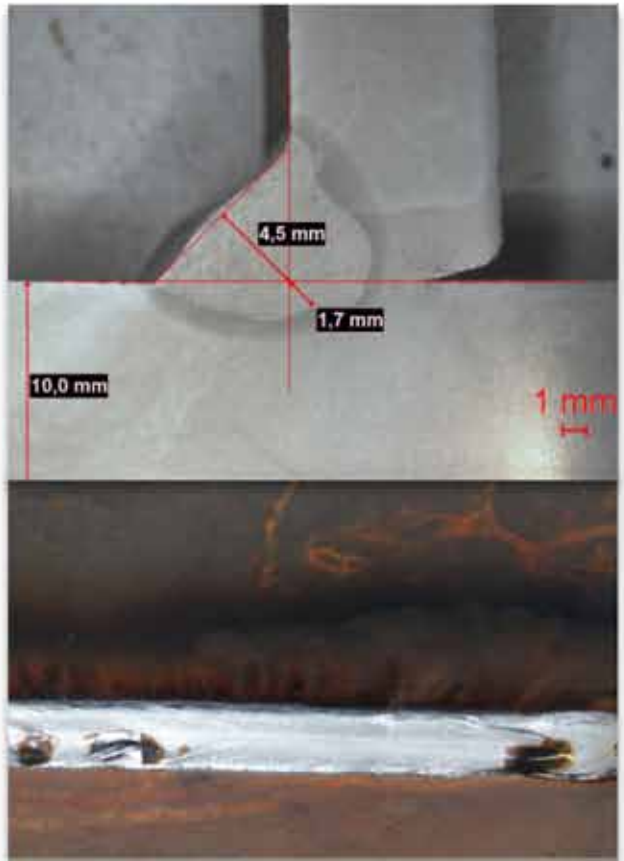
MESA

"Mesa cuts working hours by 57 per cent and makes substantial savings thanks to EWM and forceArc puls."

forceArc puls® – welding non-alloy and low-alloy steels

How you benefit

- Virtually spatter-free
- Excellent seam appearance
- Few undercuts, optimum wetting on edges
- Insensitive to contaminated and scaling surfaces
- Symmetric weld seam

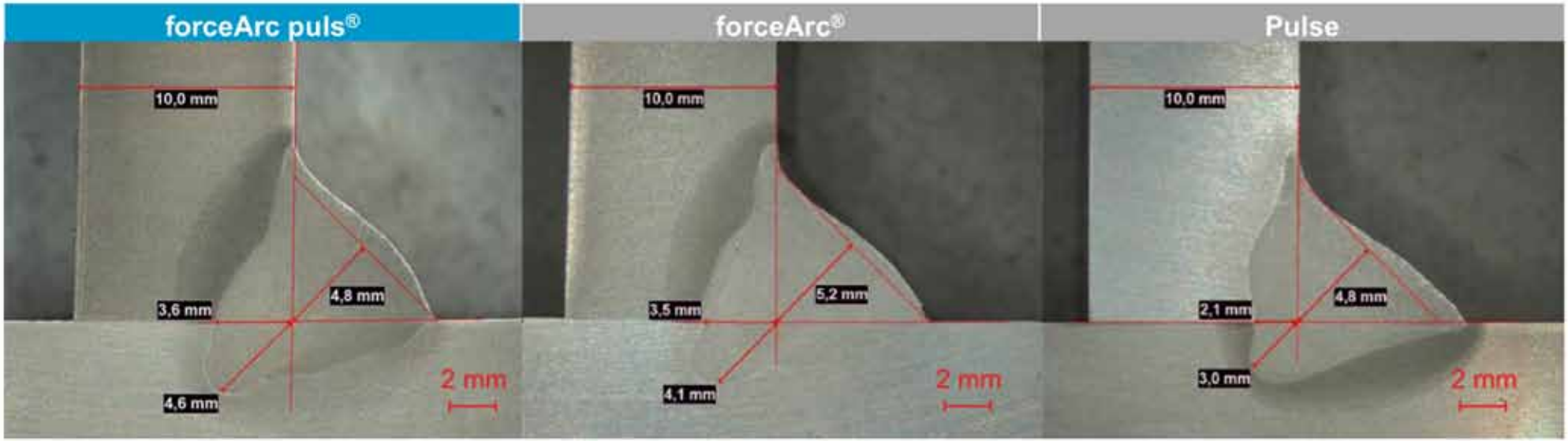


S355, d =10 mm, T-joint, fillet weld without weld preparation, I = 316 A, U = 28,8 V, WF = 10,5 m/min., Vs = 50 cm/min.

forceArc puls® – welding non-alloy and low-alloy steels

How you benefit

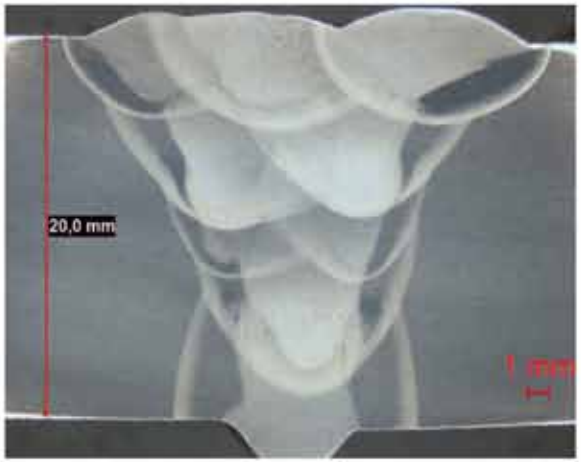
- Symmetric fillet weld
- Deep penetration



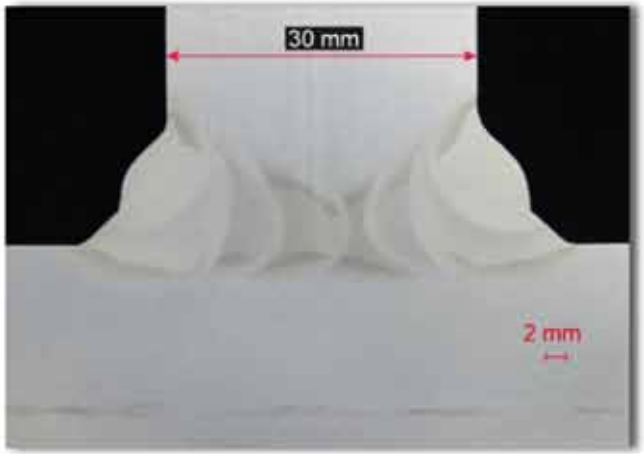
Comparison with forceArc® and pulsed arc

forceArc puls® – perfect for full penetration

- Full penetrations on both sides
- No need for grinding or gouging on the root side
- With or without air gap
- T- and butt joints
- Root passes with backing bar
- Filler and final passes



S355, butt joint,
single-V butt weld with 30° included angle, on ceramic backing bar



S355, d = 30 mm,
double bevel seam with 35° included angle, welded on both sides
no air gap,
no need for grinding or gouging on the root side

The patented* revolution in welding technology

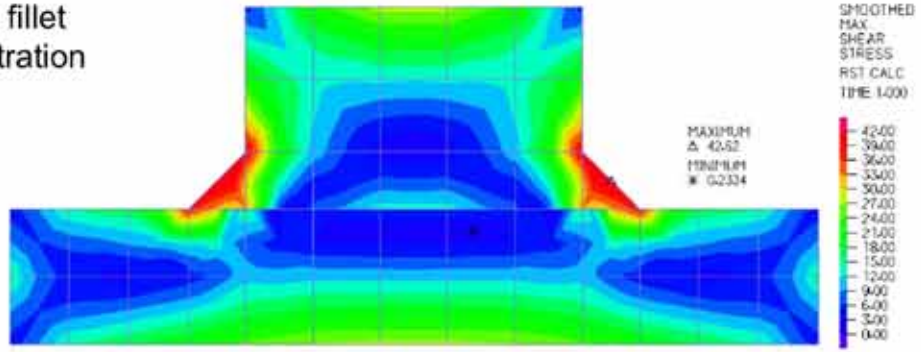
forceArc puls®

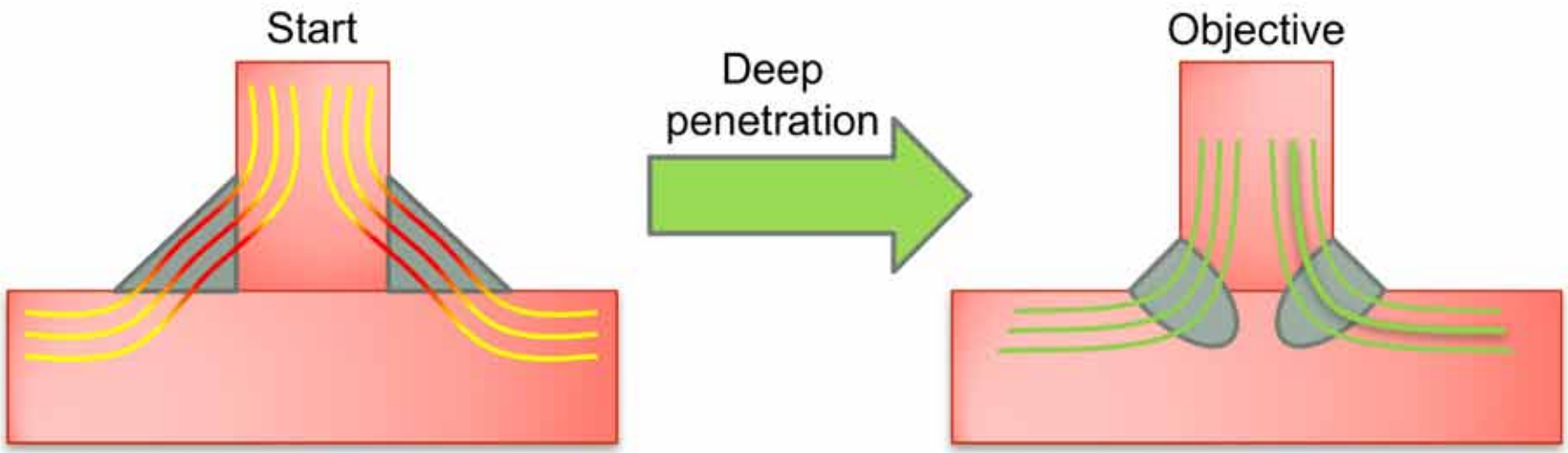
Welding with deep penetration as per EN 1090

*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

forceArc puls® – welding with deep penetration

How to prevent shear stress in the fillet weld area by means of deep penetration welding

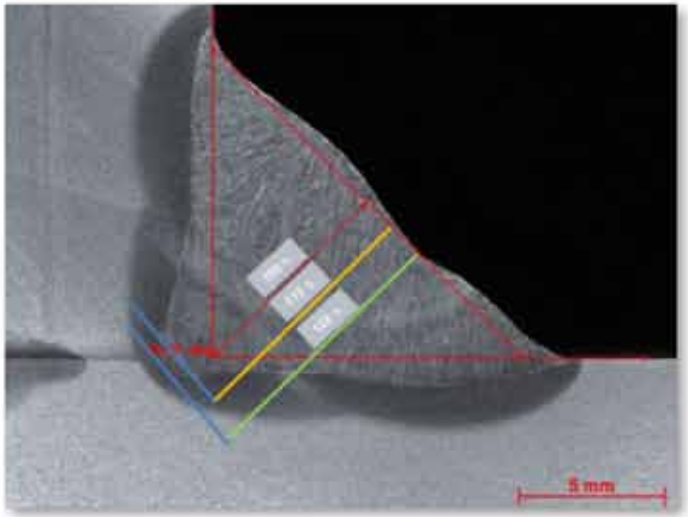




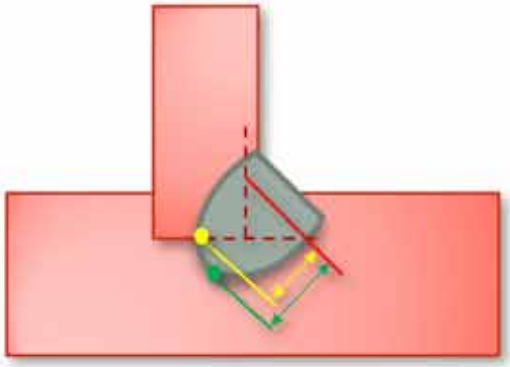
Improved flow of force thanks to deep penetration

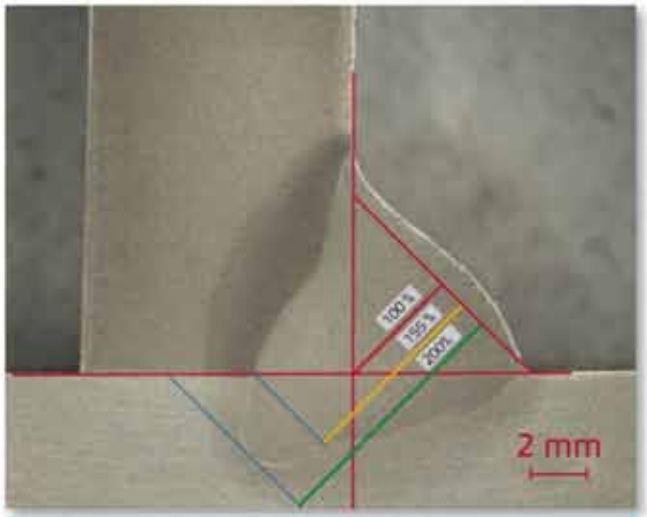
forceArc puls® – welding non-alloy and low-alloy steels

forceArc puls® achieves a very high penetration depth, which enhances the strength of the joint.



"Normal" fillet weld

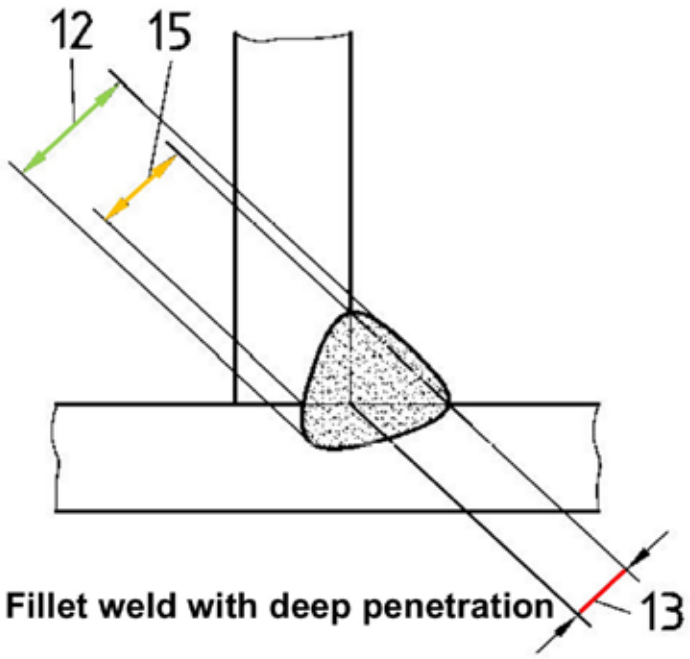




Fillet weld with deep penetration

forceArc puls® – welding with deep penetration

EN ISO 17659:2005-09
Definition of "effective" seam thickness for fillet welds with deep penetration



Fillet weld with deep penetration

12 "**Overall** seam thickness"

13 "**Target** seam thickness"
("throat thickness")

15 "**Effective** seam thickness"

forceArc puls® – welding with deep penetration

Extract from standard

4.5.2 Effective seam thickness (as per Eurocode 3 [EN 1993-1-8:2010-12])

- *The effective seam thickness a of a fillet weld should be taken as the height of the largest triangle (with equal or unequal legs) that can be inscribed within the theoretical root base, see Figure 4.3.*
- *The effective seam thickness of a fillet weld should not be less than 3 mm.*
- ***In determining the design resistance of a deep penetration fillet weld, account may be taken of its additional seam thickness – see Figure 4.4 – provided that welding procedure tests show that the required penetration beyond the theoretical root base can be achieved.***

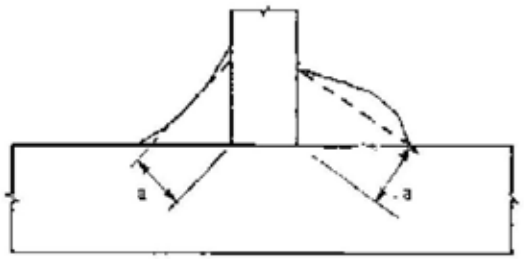
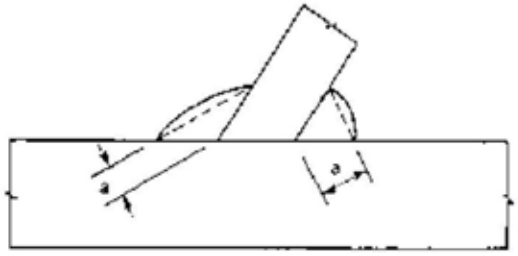


Figure 4.3 - Fillet weld thickness



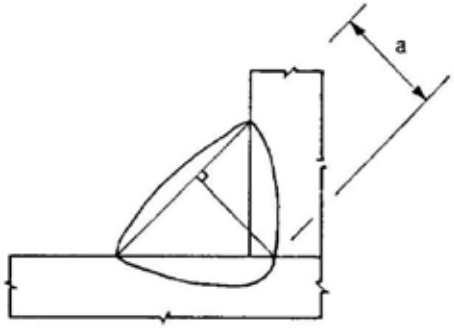


Figure 4.4 - Fillet weld thickness with deep penetration

forceArc puls® – welding with deep penetration as per EN 1090

Extract from standard

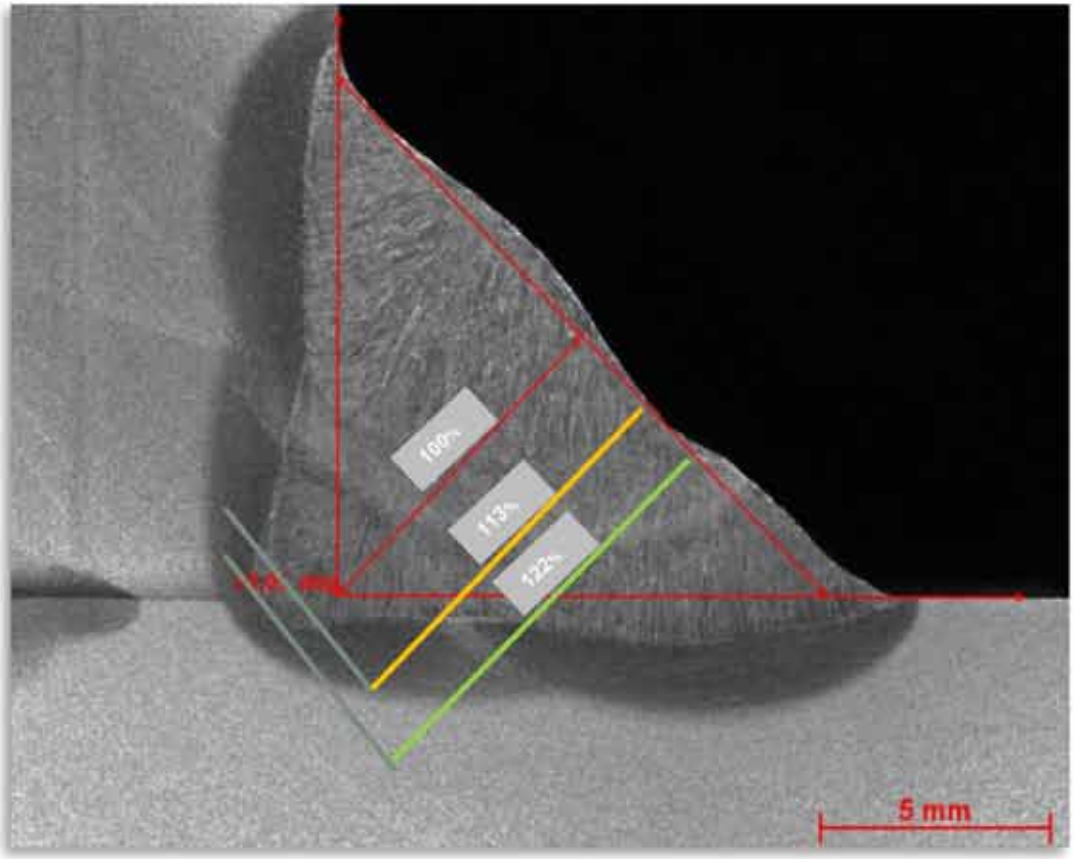
EN 1090-2:2011-10

7.5.8.1 General

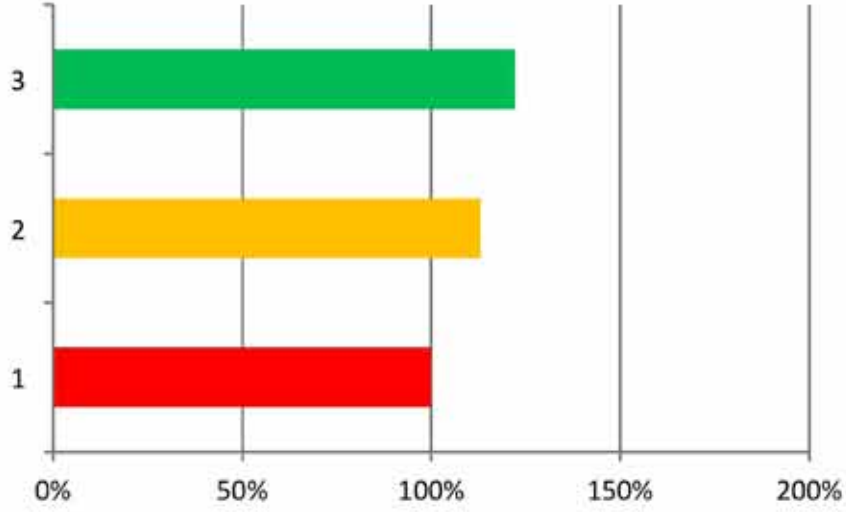
A fillet weld must not be less than the established width for the fillet weld thickness and/or leg length while taking into account the following:

a) the full seam thickness which has proven to be practicable when the WPS is applied for welding processes with deep penetration or partial penetration.

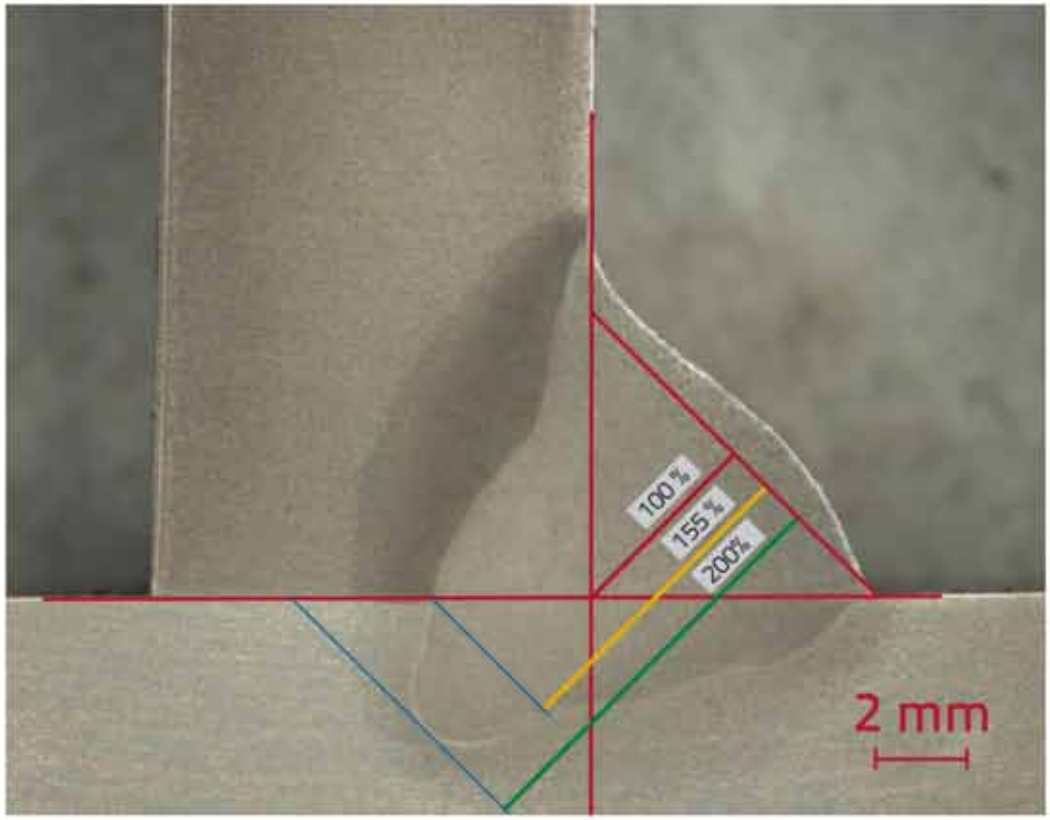
forceArc puls® – welding with deep penetration as per EN 1090



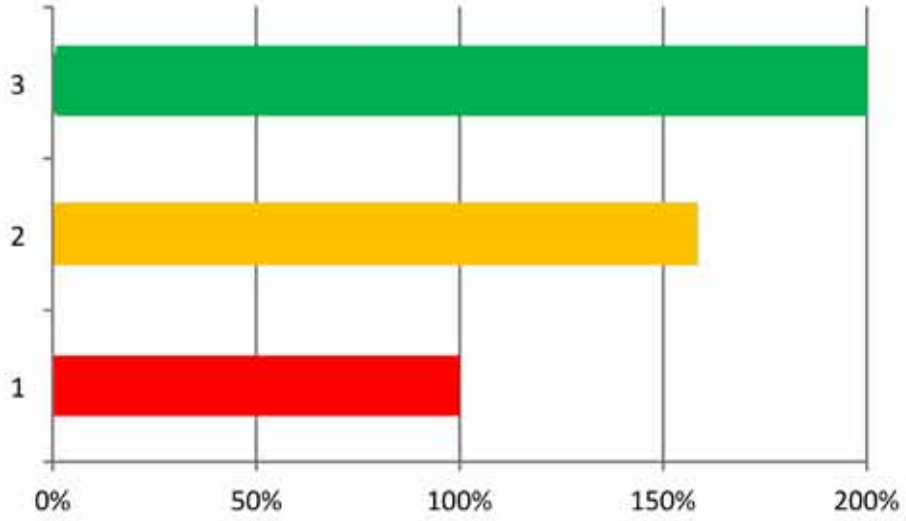
Effective seam thickness, target seam thickness and overall seam thickness are almost identical for other standard MIG/MAG welding procedures, that is why multi-pass welding is required



forceArc puls® – welding with deep penetration as per DIN EN 1090



Effective seam thickness and overall seam thickness with **forceArc puls®** are significantly greater than target seam thickness, **therefore welding with just one pass is possible**

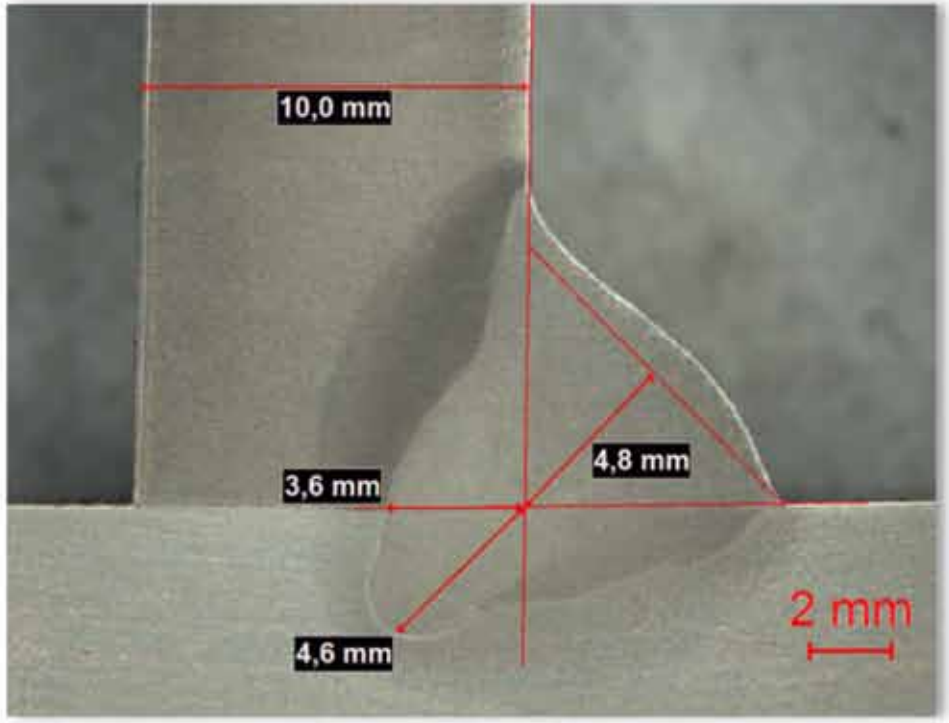


forceArc puls® – welding with deep penetration as per EN 1090

How you benefit

/ **Technologically superior**
- Less heat input
- Better flow of force
- More favourable state of stress

/ **More cost-effective**
- Faster welding speed
- Less gas and welding wire
- Single-pass welds up to a = 8 mm possible, a = 5 mm for processes without deep penetration



forceArc puls® – putting into practice

- Fillet welds predominant welded joint in steel construction

forceArc puls® – putting into practice

/ Extensive variety of seam types

forceArc puls® – putting into practice

1st step – suitable welding technology

forceArc puls® – putting into practice

2nd step – qualify welding procedure

3rd step – qualify welder

REMARKS: The area of application for the welding consumable must be observed. Welding was performed using the forceArc process with deep penetration. Effective seam thickness as per DIN EN ISO 17659 = 8 mm

TÜV Rheinland Industrie Service GmbH
Notifizierte Stelle für Druckgeräte 0035
Prüfstelle für Verfahrensprüfungen

TÜVRheinland
Genau. Richtig.

ZERTIFIKAT – CERTIFICATE
BERICHT ÜBER DIE QUALIFIZIERUNG DES SCHWEISSVERFAHRENS (WPQR)
WELDING PROCEDURE QUALIFICATION RECORD FORM (WPQR)

Schweißverfahrensprüfung - Metall / Welding Procedure Qualification - Metal (WPQR)

Zertifikat-Nr. / Certificate No.: 01 202 640/V-13-0103

Company address

Company address

PRÜFGRUNDLAGEN / SPECIFICATIONS:

PRÜFSTÜCK / TEST PIECE

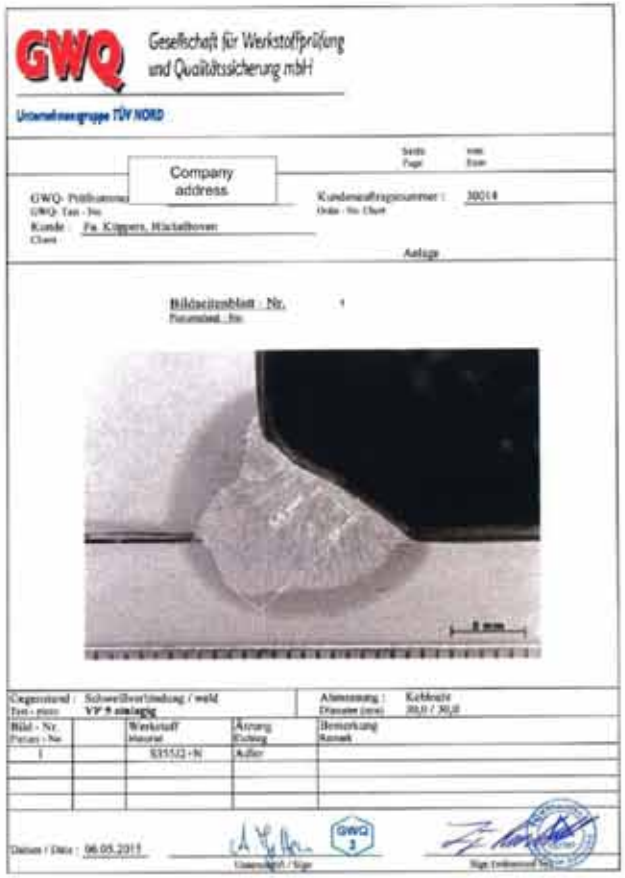
GELTUNGSBEREICH / RANGE OF APPROVAL

BEMERKUNGEN / REMARKS:

ERGEBNIS / RESULT:

Ort: Düsseldorf Datum: 10.06.2015

Anlagen: 1. Protokoll des Schweißens 2. Prüfergebnisse



GWQ Gesellschaft für Werkstoffprüfung und Qualitätssicherung mbH

Company address

Kunde: Fa. Kippers, Rückelhoven

Anlage

Bildarchivblatt : Nr. 1

Datum / Date: 06.05.2015

forceArc puls® – putting into practice

4th step - regular work samples and process monitoring with quality management software ewm Xnet

ewm Xnet – quality management software for the whole welding process

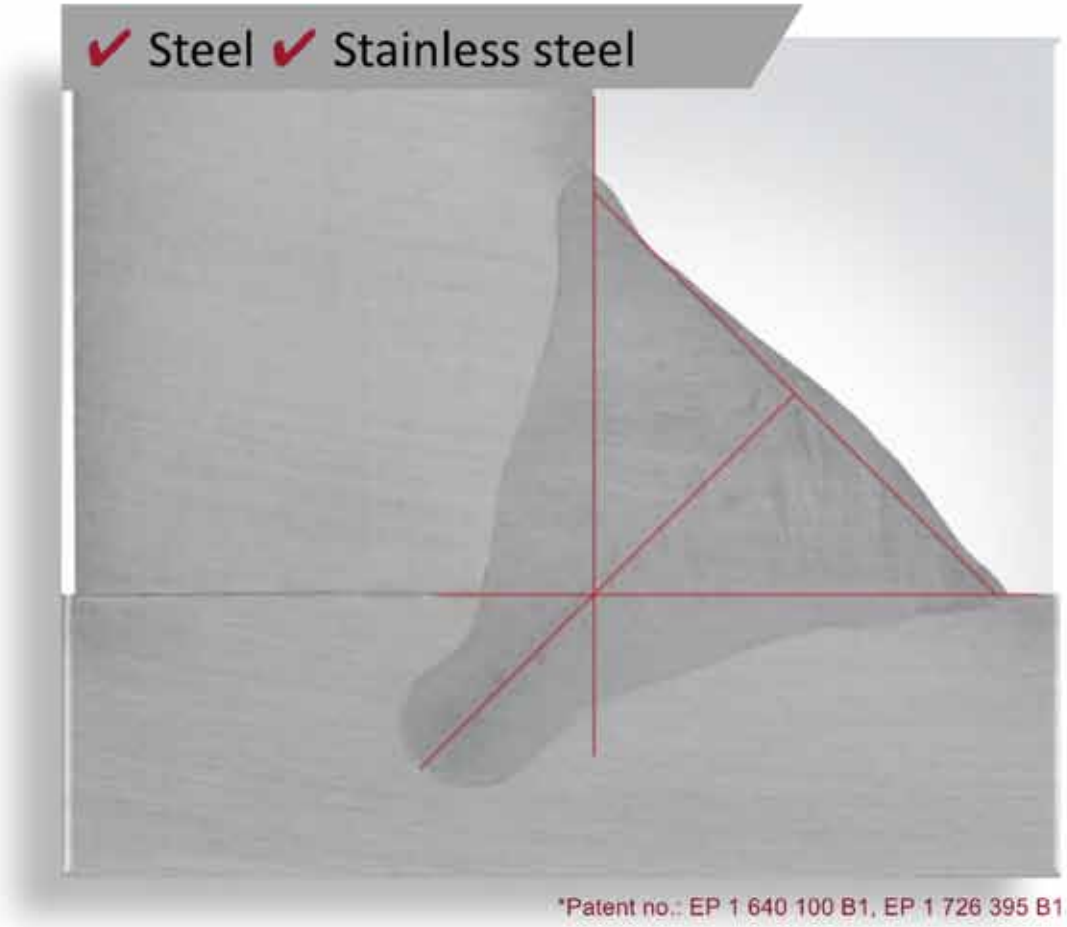
EWM AG
WE ARE WELDING

Unbelievable cost savings

forceArc puls®

The patented* revolution in welding technology

- Extremely simple handling, even for inexperienced welders – forehand, backhand or neutral position
- Low heat input, yet deep, concentrated penetration
- Greatly reduced discolouration, low distortion
- Reliable root fusion
- No undercuts, optimum wetting on edges
- Pleasant, quiet arc
- Reduction in welding fume emissions



*Patent no.: EP 1 640 100 B1, EP 1 726 395 B1

From construction steel to Duplex – The revolutionary forceArc puls GMAW process variant

A. Burt, B. Ivanov
EWM AG, Mündersbach, Germany

This article highlights the clear advantages of the new EWM *forceArc puls* process variant using simple, yet meaningful, analyses and comprehensible explanations. The patented* MSG process variant has succeeded in combining the advantages of a powerful heat-minimised and economical forceArc process with the advantages of a pulse process, ensuring top-quality and economical results. Conscious, efficient handling of available resources is a cost-effective, sustainable approach to work practices. Sustainability in welding technology not only entails saving energy and raw materials and cutting emissions, but also reducing welding times and, consequently, cutting costs. Such savings can be achieved with highly dynamic, energy-saving power sources and innovative welding processes. This is where the idea of the new *forceArc puls* process variant comes in. *forceArc puls* has been available in all power sources of the Phoenix and alpha Q machine series for unalloyed, low-alloy, medium-alloy and high-alloy stainless steels (CrNi) since January 2016.

1 Modern process variants

With the introduction of digitally controlled inverter power sources from EWM came the possibility of generating any number of welding process sequences. Concerning the control and regulation of welding processes, analogue electrical components used in the past have been replaced with microprocessor technology, which offers nearly unlimited possibilities for process sequences and process signal handling. Thanks to these technical advancements, the market is full of a variety of welding processes with special attributes for different power levels (short, transition, spray and pulsed arcs). A user-friendly overview can be found in DVS information sheet 0973, "Overview of the process control variants of GMAW welding" [1], and the associated data sheet with a tabular overview of the process variants [2].

2 The forceArc puls process variant

As the development of software and hardware continues unabated, new welding process variants shown to be especially ideal for specific materials and areas of use arise again and again. This is also how the forceArc puls arc was developed. During its development, great value was placed on broad capabilities for handling a variety of different materials. The advantages can be seen from simple, unalloyed construction steel to high tensile fine-grained steels to corrosion- and heat-resistant high-alloy materials. forceArc puls is the logical development of the long well-known and successfully used forceArc in conjunction with the advantages of a pulsed arc. The following features and advantages are especially noteworthy:

- Extremely easy handling and fast to learn for welders
- Very good, clean and even weld seam surfaces
- The welding speed can be increased by considerably improved wetting characteristics.
- The risk of a lack of side wall fusion drops thanks to the arc width being set in a targeted way.
- Reduced heat input and a considerable reduction in discolouration
- Lower heat input leads to less component distortion
- Spatter-free, absolutely consistent arc, regardless of the stick-out
- forceArc puls creates a very symmetrical fillet weld, which is required for achieving the greatest possible throat thickness for a given deposition rate. This enables a 20% greater throat thickness in comparison to a standard pulse process. Conversely, this means that a higher welding speed is possible with an identical throat thickness.
- forceArc puls achieves a greater penetration depth than a pulse process, which is structurally favourable for the strength of a connection and ensures safety during the procedure.
- All the advantages of the forceArc puls increase as the deposition rate increases.
- Even with longer stick-outs, a required minimum penetration (fusion of the root base) is ensured.
- Overall, considerable cost savings in the form of labour costs, working time and material, shielding gas and energy consumption are possible thanks to the addition of the above advantages.

3 A comparison of modern arcs

Modern arcs don't spring up by chance. In today's world, arcs can be set in a targeted way using precise measuring and camera technology and the possibility of configuring digital inverter power sources, and it can be done individually for every type of shielding gas and material. This poses a question to the ambitious and pioneering user: What are the concrete dif-

* Patent no.: EP 1 640 100 B1 / EP 1 726 395 B1

ferences in comparison to other arc types, and where do the previously mentioned advantages come from? The following figures contrast three different arcs. The requirement for creating the figures is identical. All recordings were made using a linear drive unit with a welding torch firmly clamped in place. Only the welding process was adjusted.

Figure 1: forceArc puls

Figure 2: forceArc

Figure 3: Pulse

Figures 1 through 3 show a single frame of a high-speed recording. The welding torches, camera and reflected light are aligned precisely on one axis. The metal plate is clamped to a positioning table which can be moved at different welding speeds. The figures always show the stick-out and the arc at the wire end and on the plate. In comparing Figures 1 and 2, you can see that the arc at the wire end is applied somewhat higher using forceArc puls than forceArc. forceArc is defined as a short, powerful and heat-minimising arc with enormous penetration and weld pool force. As a result of the somewhat higher application point, arc formation is somewhat wider, yet still clearly defined. This combination results in both safe and fast fusion of the joint sidewalls. The risk of a lack of fusion drops considerably. The chain of droplets is centred and even, which leads to continuous wetting and a clean seam appearance. In comparison to a standard pulse process (see Figure 3), the defined forceArc puls arc ensures greater penetration and thus considerably increased reliability when fusing the root base in comparison to a standard pulse process.

The requirement had already been clearly defined during the development phase. Namely, it was to take the advantages of the forceArc process and combine them with the advantages of a pulse process in a sensible way across the entire power range, thus creating a new arc – forceArc puls!

4 Trials on high-alloy steels

Fully mechanised trials were carried out using a welding robot for qualification of the forceArc puls. Different plate thicknesses were welded in a single layer using a fillet weld in a T-joint in the PB welding position here. Each of the plate thicknesses used was welded using the pulse, forceArc and forceArc puls processes. The same maximum controllable deposition rate was set for all plate thicknesses in the three processes for the trials. The same welding speed was always maintained throughout all the processes, thus enabling the same theoretical throat thickness to be achieved. The parent metal for the trials was the material 1.4301 (X5CrNi18-10), which is used as an austenitic material for all standard applications in the field of corrosion protection under atmospheric conditions. Material 1.4316 (X1CrNi19-9) lends itself as the welding consumable for the parent metal being used and was welded in a 1.2 mm diameter under M12-ArC-2.5 here. For the comparison, the following "characteristic values" were referenced for the evaluation and comparison of the processes:

- Throat thickness
- Penetration depth
- Discolouration

The welding results for a plate thickness of t = 10 mm welded with a wire feed speed of 13 m/min are presented as an example in this article.

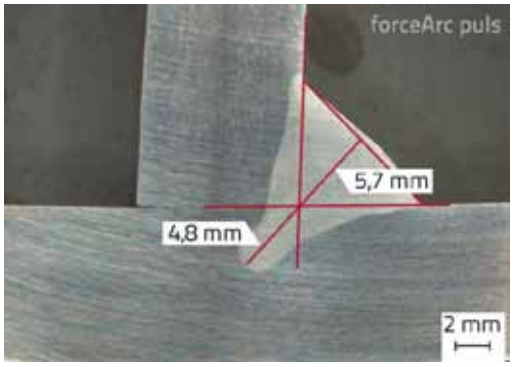


Figure 4: forceArc puls penetration characteristics

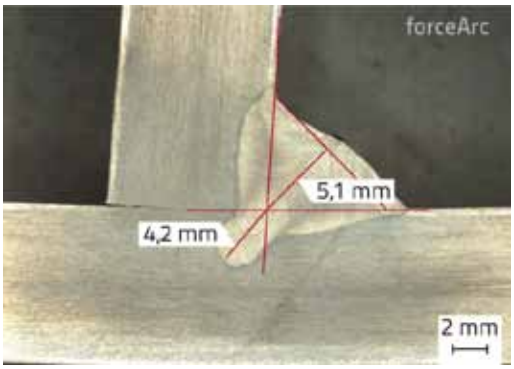


Figure 5: forceArc penetration characteristics

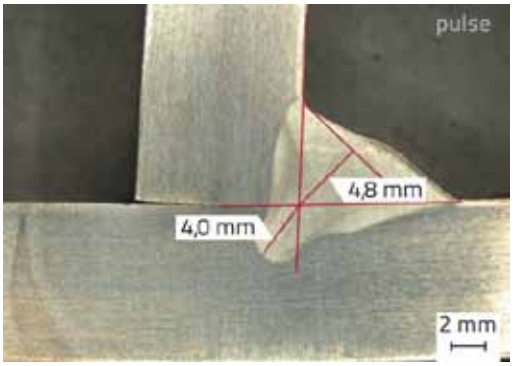


Figure 6: Pulse penetration characteristics

With identical requirements, the forceArc puls arc achieves a 0.8 mm greater penetration depth with an absolutely symmetrical throat thickness using a high-alloy steel. The arc is exceptionally easy to control in the fillet and features outstanding wetting characteristics, which together result in considerably easier handling for the welder when welding manually and for the set-up and alignment of the torch when welding fully mechanically.

The comparison of Figures 4 through 8 permits the following assertion:

- forceArc puls boasts up to 15% lower heat input in comparison to pulse in the upper power range. This leads to less discolouration, less distortion and reduced stress in the component (see Figures 7 and 8).
- forceArc puls forms a symmetrical fillet weld. This is the requirement for achieving the maximum throat thickness for a given deposition rate. A throat thickness up to 20% greater in comparison to pulse is thus achieved. Conversely, this means that a welding speed up to 20% faster could be achieved with a throat thickness identical to the pulse throat thickness (see Figure 9).
- forceArc puls achieves a greater penetration depth with symmetrical seam formation, which is structurally favourable for the strength of the connection (see Figures 4–6 and 10).
- Thanks to easy and trouble-free handling and great wetting, the welding speed can be increased. This increased speed is evidenced by considerably less distortion, smaller heat-affected zones and less discolouration in the visual test of the seam.

Figure 7: Comparison of the seam appearance and discolouration, plate t = 10 mm, wire speed = 13 m/min; forceArc puls on left, forceArc in centre, pulse on right

Figure 8: Comparison of the discolouration on the bottom; forceArc puls on left, forceArc in centre, pulse on right

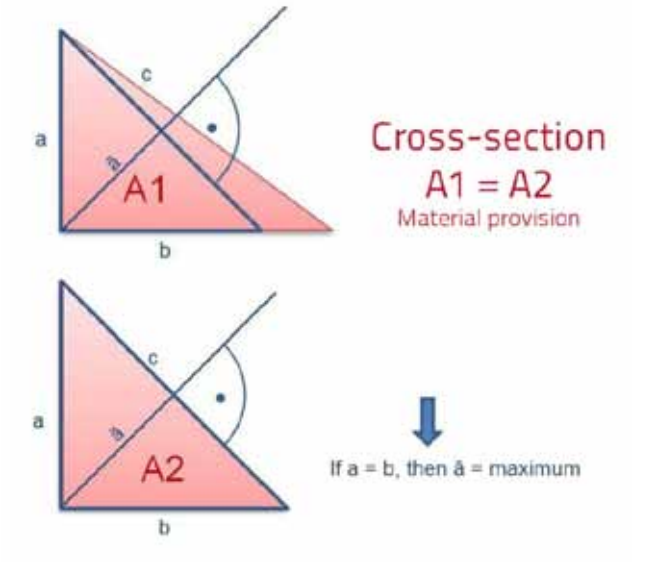


Figure 9: Comparison of the cross-sectional area and the resulting maximum throat thickness

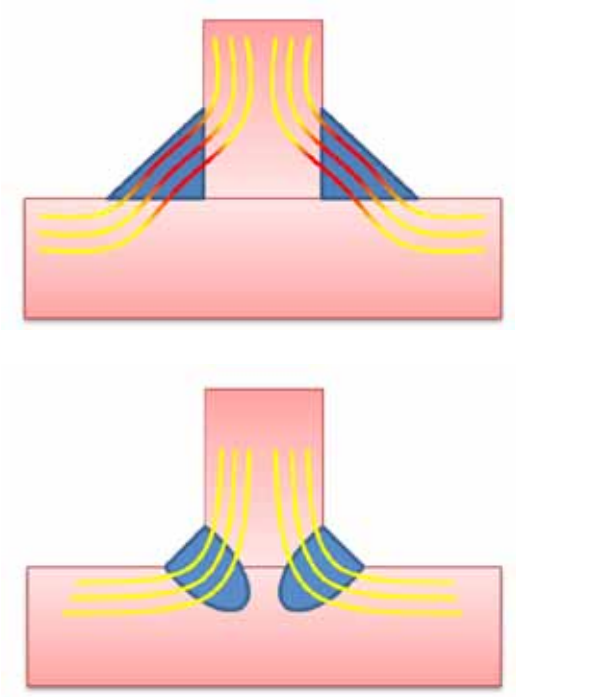


Figure 10: Flow of force over the fillet weld with "normal" penetration and flow of force over the fillet weld with "deep" penetration

5 Outlook

The forceArc puls arc variant is already being used by many companies today! The competitive edge in terms of quality, economy and expertise which is gained here serves to safeguard jobs. To be able to continue offering this quality to the global market in competitive conditions in the future, many companies in Germany, Europe and around the world are betting on modern GMAW arc variants, power sources and accessories from EWM. In addition to outstanding, unmatched hardware, our comprehensive consulting custom-tailored for each customer across the entire production process, from selecting the right welding components to consideration of the overall system structure, consultation on selection of the parent materials and welding consumables, component handling and actual operation of the power source through to production readiness, means added value for you as a customer! Merged under the name "maXsolution," EWM's consulting activities are of the same high quality as our products and are always being further developed with a practical orientation.

6 Literature

[1] DVS information sheet 0973: Overview of the process control variants of GMAW welding, 2015, DVS e.V.

[2] DVS information sheet 0973 – Data sheet 1: Tabular overview of process control variants of GMAW welding, 2015, DVS e.V.

EWM AG
WE ARE WELDING

CustomerStory

MESA
Metall-Stahlbau
GmbH

„Mesa cuts working hours by 57% and makes substantial savings thanks to EWM and forceArc puls®"

EWM provides support for entering new business areas – "We would miss out on a lot of contracts if we weren't able to weld in the required way."

"That affirms my calculations," says Pierre Mack, managing director of Mesa Metall-Stahlbau GmbH in Carlow, Mecklenburg-Western Pomerania. He is referring to the significant savings his company is making thanks to the new welding technology from EWM. "They are so spectacular that they create a real ‚aha' moment and further strengthen our competitiveness." Most mid-sized companies in the metal and steel construction industry are in a similar situation to Mack's firm. They are required to keep manufacturing costs as low as possible while simultaneously maintaining a high level of quality, and also to fill lucrative market niches wherever they can. Mesa has succeeded in doing precisely this thanks to the innovative welding technology from Germany's largest welding machine manufacturer.

Strong support for developing new business areas

Over the past 25 years, Mesa has positioned itself predominantly as a marine equipment supplier. At its headquarters near the coast, the company manufactures a wide range of products for the maritime industry. These range from manhole covers and hatches to ship stairs and handrails as well as various other metal and steel constructions. A substantial part of the company's core activities therefore involve welding metal assemblies made of steel, stainless steel and aluminium. Mesa's 56 employees generate annual sales of almost EUR 4 million. Its 25 metalworkers, two welding practitioners, two welding experts and one welding engineer work in one or two shifts, using MIG, MAG, TIG and stud welding as their welding procedures.

Using MIG, MAG, TIG and stud welding as their welding procedures

Supplying shipyards is a very important area of business, accounting for approximately 80 per cent of the company's activity. However, due to an increasing number of changes in the shipbuilding market worldwide, Mesa has now consciously decided to expand its range to include other industries. Rail vehicle construction is an especially interesting area with particularly high requirements in terms of welding quality. Suppliers need to be certified in accordance with DIN ISO 15085-2 and be able to weld in the highest quality class CL1 where possible. This is precisely what Mesa is aiming for in order to ensure the company stands out from the competition. It is also evident that there is a need for major investment at the rail companies.

Mesa first came into contact with Dräger Safety in 2013. The Lübeck-based company was looking for a supplier of welded assemblies, including steel water tanks for fire and rescue trains. These tanks are used in seven Deutsche Bahn fire and rescue trains to ensure safety on the tracks throughout Germany, particularly at prominent points such as tunnels and bridges. One carriage on each of the trains carries firefighting equipment, including two tanks containing 10,000 litres of water each. It is these tanks that Mesa has been manufacturing since 2014.

The metal and steel construction company produced the first four out of a total of 14 tanks using conventional welding technology and welding machines made by another manufacturer. This resulted in such a level of expenditure that managing director Mack's calculations became very tight. He decided to consult Toralf Pekrul, the head of EWM's Rathenow branch, whom he had known for three years after first coming into contact with EWM at the EuroBLECH trade fair.

At that time, he had been looking for high-quality, long-lasting welding machines with a high duty cycle that would enable him to attain lower production costs and thus greater market strength. He was also looking for a partner to provide him with technological advice and support.

During the previous two years, Mesa had already had positive experiences with a number of EWM welding machines in other production areas.

maXsolution and the complete EWM welding range

Pekrul came to Mack's aid immediately and was able to provide prompt support for the complex task of manufacturing the tanks. It took just three months from the first meeting to the development of the first possible solutions and, finally, to putting the chosen solutions into practice. In his analysis, Pekrul took a consistent approach in line with the EWM innovation and technology consulting concept maXsolution. This includes a full range of advice, all services and the provision of support for the customer throughout the entire process chain. "Not only was the consultation very competent and proactive, it also included new solutions to problems that we hadn't previously recognised ourselves," says Mack.

New solutions to problems that we hadn't previously recognised ourselves

The EWM employee from Rathenow recommended a whole range of measures to his customer, along with full conversion to EWM welding technology. This included the use of power sources from the Phoenix puls and alpha Q puls series with the new forceArc puls® arc, the use of MT welding torches and welding consumables, and partial mechanisation with the aid of a track-guided welding tractor.

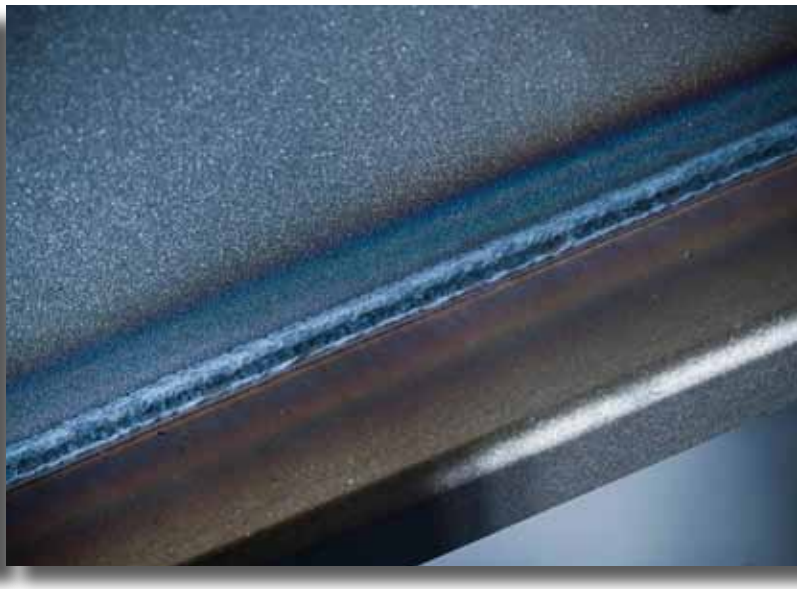
EWM also took care of all the tasks involved, beginning with laboratory experiments and essential preparations for the welding procedure test through to briefings and commissioning. The new solution was then put to the practical test during its introduction. "We differentiate ourselves from our competitors by being able to support our customers from start to finish with maXsolution and taking over as many tasks as possible on their behalf," says Pekrul, who succeeded in establishing a great deal of trust at Mesa.

forceArc puls® results in 30% lower costs

As the improvements quickly started to become noticeable, Mack and his employees soon realised that their consultant had certainly delivered on his promises. The application and effect of the new forceArc puls® arc from EWM – a combination of a forceArc arc and a pulsed arc which brings together the benefits of both – really amazed them.

> This combination creates a welding process that is extremely easy to handle and which requires virtually no familiarisation period. forceArc puls® also achieves excellent wetting on the material surface while also providing very deep penetration. Virtually spatter-free, the innovative arc excels thanks to a low heat input and also allows greater welding speeds, ultimately leading to a significant reduction in costs.

Use of the new EWM welding process forceArc puls® brings significant efficiency benefits and savings for Mesa. The arc is characterised by a much faster welding speed and is completely spatter-free.



The heat-reduced forceArc puls® arc results in far less discolouration. Distortion is also minimised thanks to the lower heat input.

This is also the case at Mesa, which is now seeing a significant 30 per cent reduction overall in working hours, wage costs, material consumption and electricity costs due to the improvements. In contrast to the welding technology used up to now, the forceArc puls® arc results in a 10 per cent reduction in straightening work thanks to less distortion. The virtually spatter-free process minimises finishing work, while excellent wetting means the welding speed can be increased.

Welding time has decreased by around 20 per cent overall, saving a significant amount of material. The consumption of shielding gas and welding consumables has dropped by 40 per cent, while the shorter welding time and the reduced-energy process of forceArc puls® contribute to lowering power consumption by 50 per cent.

The lower heat input ensures minimised distortion, thus reducing straightening work by around 50 per cent compared to the process used at Mesa in the past. This lower heat input also produces less discolouration, which reduces the time and effort required for subsequent grinding, brushing and pickling. Effective sidewall wetting also brings a decisive cost advantage. Working conditions have improved, too, as welding fume emissions have decreased. "The easy handling makes welding positively stress-free," says welding practitioner Martin Lukat. "The reduced noise levels generated by the quiet forceArc puls® arc are also very welcome."

The use of MT torches from EWM is also paying off for Mesa. The long service life of the consumables, and contact tips in particular, has allowed the company to reduce costs in this area by at least 50 per cent. The shorter amount of time required to change contact tips and gas nozzles is also having a considerable impact. In addition, errors are minimised due to interference-free wire guiding, resulting in increased quality and less time spent on finishing work.

Mesa has been able to improve quality by using a track-guided welding tractor, which ensures a high level of consistency. This mechanisation process has also halved production times and working hours for the manufactured components.

MT torches cut consumables costs by 50%

"In terms of the total welding costs, we are making significant savings just by using the EWM torches alone," emphasises Tino Volkmer, the welding coordinator at Mesa.

EWM branch manager Toralf Pekrul (far left) is an ongoing partner to Mesa welding coordinator Tino Volkmer (2nd right) and his welding team, not just for the production of the water tanks.

Mechanisation improves quality and cuts wage costs by 50%

The mechanisation of individual welding processes as recommended by the EWM branch manager is also enabling Mesa to save money while simultaneously improving quality. The use of a track-guided welding tractor improves efficiency during the manufacture of the tanks. When welding a butt weld as the T-joint of a sheet with six millimetres on a square tube of five-millimetre wall thickness (both S355), the tractor now helps to shorten the time needed for welding and weld preparation, and also reduces manual welding and finishing work.

Mechanisation has also enabled Mesa to significantly improve quality thanks to the constant high level of consistency. Minimising the finishing work results in a time saving of 60 per cent, and wear on welding torch consumables is reduced by 20 per cent due to the use of the welding tractor. Mechanisation means Mesa is also saving a significant amount of time. The process and production times and the working hours for the relevant components have reduced by half. This equates to a corresponding increase in productivity. The company is therefore able to save half the wage costs and around 20 per cent on piece costs for these tasks.

A 57% saving on time with investment paid off after the first batch

For the managing director of Mesa, using the complete range of EWM welding technology in the production of water tanks for the Deutsche Bahn fire trains has more than paid off. The results are extremely positive, from the new welding machines and welding torches to mechanisation.

His company is achieving the most significant improvements thanks to the new, powerful, heat-reduced, directionally stable forceArc puls® arc. The overall savings are impressive: "We have managed to cut down production times for welding and grinding by an incredible 57 per cent," reports Mack. The first four tanks took 781 working hours to produce, but a mere 339 hours were needed after EWM technology was introduced.

In the previous water tank production process, the preparation, pass grinding and finish-grinding of contact points accounted for more than half of the total time required. "That is now virtually gone, helping to make this enormous time saving," enthuses welding coordinator Volkmer. The welders are also very satisfied as EWM welding technology not only offers time benefits, but also helps substantially with their work. "Previously, positional welding was extremely tiring, but now it is much more straightforward in PA and PB," says metalworker Ronald Branke. "That's a significant improvement in our working conditions."

His managing director Mack adds: "It's impossible to describe the price-to-performance ratio as anything other than excellent. The investment costs for the new technology had already been paid off with the first batch – in other words, when the first two tanks had been produced." Delivery times have also been significantly reduced by two weeks. "We would have had deadline problems without EWM," admits Mack.

EWM is a key part of the corporate strategy

For Mack, EWM has become an essential part of Mesa's future corporate strategy. The welding partner has a crucial role to play as Mesa moves from being a small-scale, mid-sized industrial company

"As a welded metal and steel construction manufacturer, we want to become one of the top five metal and steel construction companies in the north"

to becoming an industrial manufacturer, albeit one who remains committed to manual skills. "As a welded metal and steel construction manufacturer, we want to become one of the top five metal and steel construction companies in the north," says the managing director confidently, adding that the clear competitive advantages provided by EWM are the strong driving force that will take them in the right direction.

He says that it is now easier than before to deliver even higher quality with a significantly reduced outlay, and thus at attractive prices. Mesa has also been able to expand the range of goods it manufactures. "We would miss out on a lot of contracts if we weren't able to weld in the required way," states Mack. "With the conventional machines, we couldn't compete at all in some cases." Mesa would have lost volumes and market share without EWM welding technology, he says, adding that the innovation and technology advice from EWM was also of crucial importance. "This differs radically from the rest of the competition and is a truly unique feature," stresses Mack. He would even go as far as to say that other manufacturers are no longer even worth considering.

Pierre Mack, managing director of Mesa, and Tino Volkmer, welding coordinator, are impressed by their welding partner. "We wouldn't have got so many of our contracts without EWM welding technology," emphasises Mack.

Kindly supported by

MESA
Metall-Stahlbau GmbH
Schmiedestraße 7
19217 Carlow, Germany

EWM AG / Dr. Günter-Henle-Straße 8 / 56271 Mündersbach, Germany
Tel: +49 2680 181-0 / info@ewm-group.com / www.ewm-group.com

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Dr. Günter-Henle-Straße 8 | D–56271 Mündersbach
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www.ewm-group.com | www.ewm-sales.com
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