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WELDING academy
by voestalpine Böhler Welding

SAW solution for 40% increased productivity without significant investment in equipment

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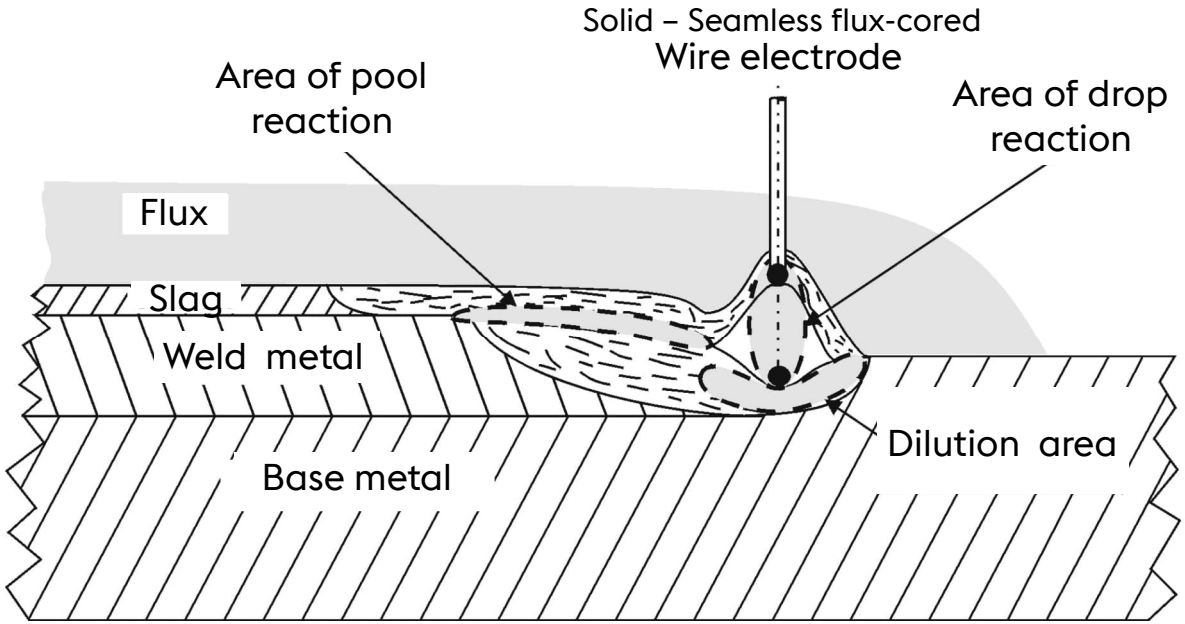
Agenda

1. Seamless SAW wire (cored)
   a. Production route
   b. Features, product advantages and customer benefits
2. diamondspark S 56 HP + UV 400
3. Application testing
   a. Penetration Y-groove
   b. Procedure optimisation : example in 20 mm plate
   c. Two-Run in thin plate (I-preparation)
4. Multi-wire
5. Product range
6. Summary


Product details :
Seamless SAW wire (cored)

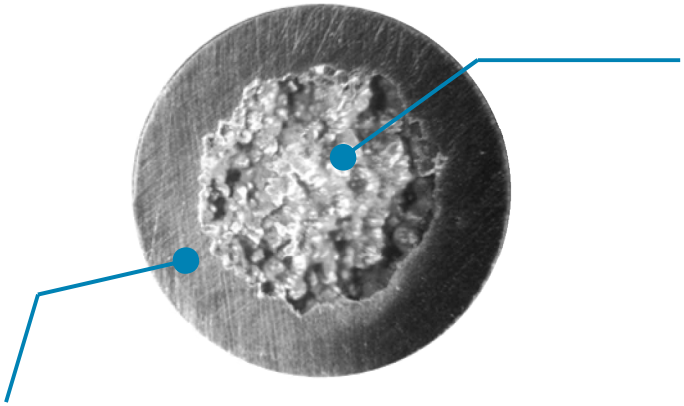
Submerged Arc Welding (SAW): Operating principle of the process



Differences with solid SAW

- Wire speed
- Metal transfer
- Flux consumption

Seamless SAW -wire



Coppered steel tube is responsible for

- Shape stability
- Electrical conduction
- > 80% of the chemical composition

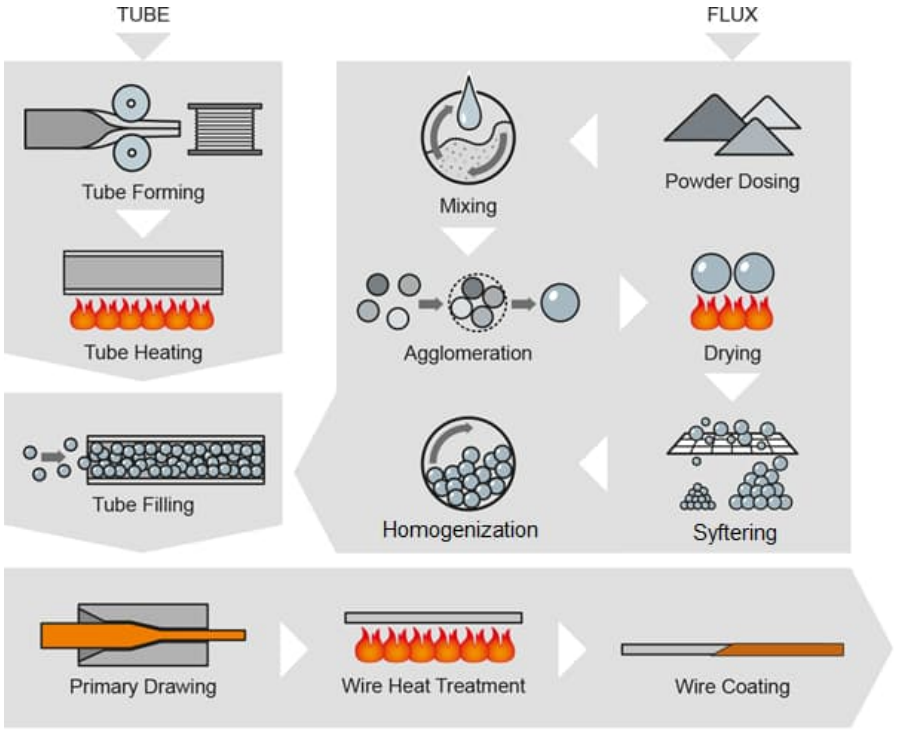
Flux filling of mineral and metallic components

Agglomerated.

- Weldability and weld appearance
- Mechanical properties (weld metal composition)
- Slag formation (~5 wt%)
- 95 wt% total weld metal recovery

Production route – Seamless SAW wire

- Strip, tube forming & welding
- Annealing, cleaning, calibrating
- Flux production (dry mix & agglomeration & grain size filtering)
- Filling process
- Draw from a “filled tube” to “wire”
- Annealing & Dehydrogenation
- Coppering
- Final drawing
- Spooling
- Many production steps



Benefits
seamless SAW cored wires

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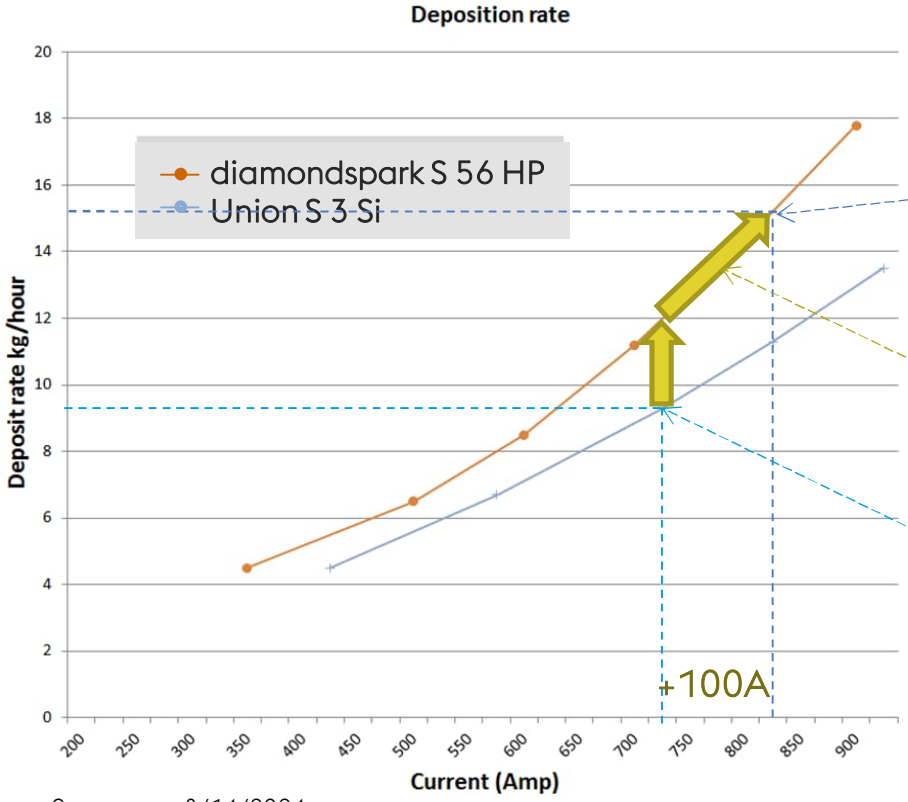
Product feature	Benefit
Higher wire speed (versus solid SAW)	Higher deposition rates => arc time saving => cost saving
Better bead appearance and better slag detachability	Less time for slag removal, low risk for slag inclusions
Possibility for higher current and /or welding speed	Reduced arc time / reduced number of passes time saving => lower costs
Lower heat input / colder process (relative low cooling rate t8/5)	Reduced restraint / distortion Good mechanical properties
Lower flux consumption (-20/-30 %)	Lower costs
Basic flux-cored wire with optimized chemistry => High toughness level	Low risk of failing mechanical properties Ability to use flux with lower basicity index (=better welding characteristics)
Different penetration profile (wider)	Lower risk of burn-through and misalignment (root passes, thin materials, poor fit-up)
Seamless (form stable and coppered)	High process reliability Good current transfer No moisture pick up and extended shelf life (compared to folded wires)

Deposition rate
diamondspark S 56 HP – 4,0 mm

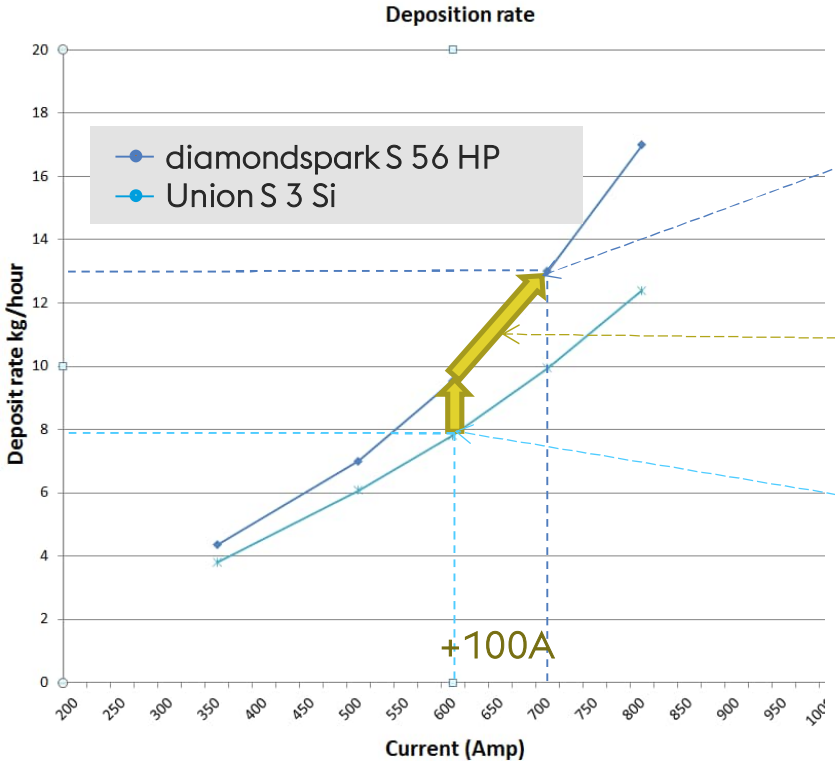


15,1 kg/hr at 825 Amp
Dep.rate => +66%
Arc time saving (= 1-1/1,66) = 40%

Due to smoother arc : mostly possible to apply higher current vs solid wire (better welding characteristics).

9,2 kg/hr at 725 Amp

Deposition rate diamondspark S 56 HP – 3,2 mm

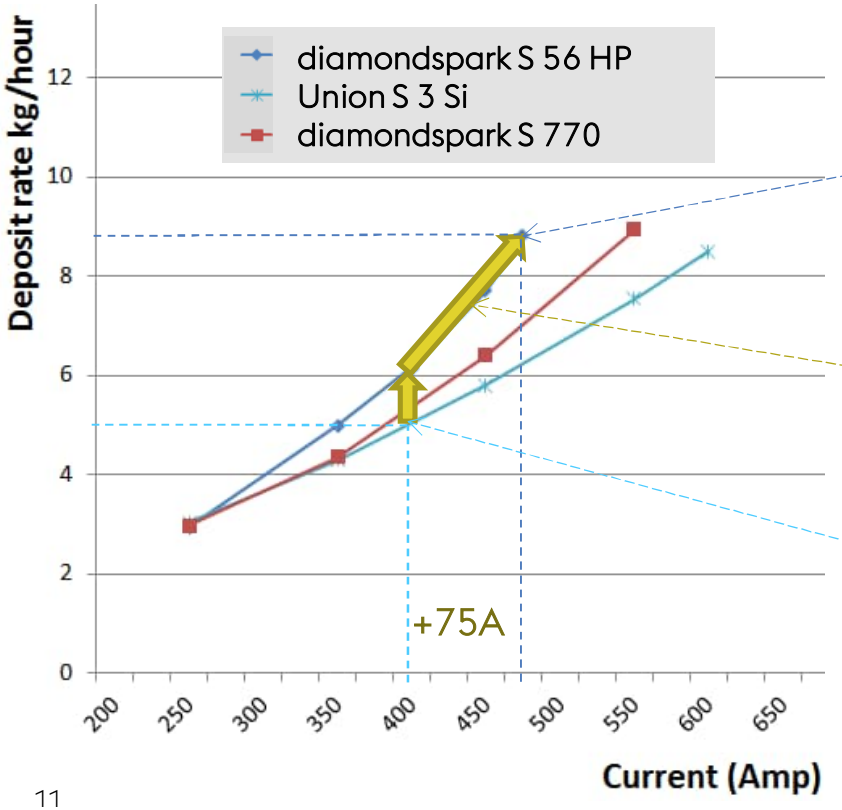


13 kg/hr at 700 Amp
Dep.rate => +66%
Arc time saving (= 1-1/1,66) = 40%

Due to smoother arc : mostly possible to apply higher current vs solid wire (better welding characteristics).

7,8 kg/hr at 615 Amp

Deposition rate diamondspark S 56 HP – 2,4 mm



8,85 kg/hr at 475 Amp
Dep.rate > +77%
Arc time saving (= 1-1/1,77) = 43%

Due to smoother arc : mostly possible to apply higher current vs solid wire (better welding characteristics).

5,0 kg/hr at 400 Amp

diamondspark S 56 HP + UV 400 Datasheet

diamondspark S 56 HP – UV 400
Mechanical properties

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High tensile and charpy toughness :
» Even with very high heat input

böhler welding
by voestalpine

diamondspark S 56 HP - UV 400

Seamless basic flux cored SAW wire/flux combination, mild steel

Typical analysis

wt.-%	C	Si	Mn
all-weld metal	0.06	0.3	1.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact energy ISO-V KV J		
	MPa	MPa	%	-60°C	-40°C	-50°
u, DC+, 1,8 kJ/mm	490(≥ 460)	560 (530-680)	28 (≥ 22)	110 (≥ 47)	160 (≥ 47)	
u, DC+, 3,2 kJ/mm	460	540	26		120	100
a, DC+, 1,8 kJ/mm	460 (≥ 420)	540 (500-650)	28	175 (≥47)	190 (≥47)	

u untreated, as welded ; a annealed 1 hr 620°C

Operating data

Polarity	DC + / AC

Dimension mm
2.4
3.2
4.0

Approvals

TUV (19505), DB (51.052.02, 52.052.02), CE , ABS (5YQ460M H5; 4Y400T H5), BV (4Y40TH5 ; 5Y46MH5), DNV (IV Y40T H5 and V Y46M H5), LR

Classifications

EN ISO 14171-A	EN ISO 14171-A	AWS A5.17 / SFA-5.17	AWS A5.23 / SFA-5.23
S 46 6 AB TZ3 H5	S 4T 5 AB TZ3 H5	F7A8-ECG / F7P8-ECG	F7TA6G-ECG
Multi-run	Two-run	Multi-run	Two-run

Characteristics and typical fields of application

diamondspark S 56 HP - UV 400 is a wire-flux combination for submerged arc welding of unalloyed structural steels and fine-grained structural steels up to MSYS = 67 ksi. diamondspark S 56 HP is a coppered seamless basic flux cored wire with a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with a low contact tip consumption. The wire is not sensitive to moisture pick up.
The weld metal demonstrates good toughness properties at low temperatures, which gives the fabricator the possibility to weld with high heat-input at high welding speed resulting in very high productivity: e.g: single wire 1/8", 800 Amps (~37 lbs/hour) with a good bead appearance, nice fusion and good slag detachability.
Also suitable for 2-run technology where the combination shows an improved welding behavior (nicer bead appearance and higher welding speed) with good charpy toughness.
UV 400 is an agglomerated, aluminate-basic flux. Its characteristic is a low Silicon and a middle Manganese pickup. It can be used on AC and DC. The good weld ability and the good mechanical properties offer a universal application. For information regarding UV 400 flux see our detailed data sheet.

» Also high toughness in two-run application

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UV 400 – Aluminate-Basic

böhler welding by voestalpine

UV 400

aluminate-basic type

Classifications				
EN ISO 14174				
S A AB 1 67 AC H5				
Characteristics and typical fields of application				
UV 400 is an agglomerated flux of aluminate basic type designed for joining and surfacing applications with general-purpose structural steels, fine grained structural steels, boiler and pipe steels. The flux is characterized by its low silicon and moderate manganese pickup. It can be used on DC and AC. Its good welding characteristics and the technological properties of the weld metal produced with different wires permit universal use. This flux has also been available on the market as "BÖHLER BB 400".				
Flux properties				
Polarity	DC / AC			
Basicity index (Boniszewski)	1.8 (wt%)			
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)			
Flux consumption	1.0 lbs per lbs wire			
Redrying	570 - 700°F. 2 hrs min.			
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)			
Composition of sub-arc welding flux				
	CaO+MgO	CaF_2	Al_2O_3	
wt. %	53	17	21	
Typical wires to combine				
Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 2	14171-A	S2	A5.17 / -5.17	EM12
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 2 NiMo 1	14171-A	SZ2Ni1Mo0,3	A5.23 / -5.23	ENi1
diamondspark S NiCu1	14171-A	T2Ni1Cu	A5.23 / -5.23	ECG
diamondspark S 56 HP	14171-A	TZ3	A5.17 / -5.17	EC1
diamondspark S 550 HP	14171-A	TZ3Ni1Mo	A5.23 / -5.23	ECNi5
Packaging				
Type	**Weight**			
BIGBAG DRY SYSTEM	2200 lbs			
DRY SYSTEM	55 lbs			

Why UV 400 ?

UV 400 versus fluoride basic flux UV 418 TT:

» Better operational characteristics (slag release and bead appearance)
» Higher current carrying capacity
» Higher welding speed

UV 400 versus rutile flux UV 306:

» Better toughness
» Lower maximum welding speed (mono-pass)

Main SAW combinations

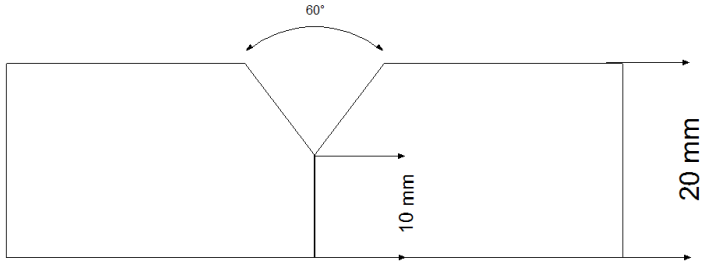
Wire grade	SAW wire name	Flux name	Flux Type	Min YS [MPa]	Charpy Multi Run [J]	Charpy 2-Run [J]	Main Application	Joint prep
EM12K/S2Si	Union S 2 Si	UV 408 TT	AB	420	-50	-30 / -50	Multi-run and 2 run	I, Y, X
EH12K/S3Si	Union S 3 Si	UV 418 TT	FB	460	-60	-30 / -50	Especially multi-run	(I), X, Y
EC1/T3	diamondspark S 55 HP	UV 418 TT	FB	460	-60	-30 / -50	especially multi-run; high deposition rate	(I), X, Y
ECG/TZ3	**diamondspark S 56 HP**	**UV 400**	**AB**	**460**	**-60**	**-60**	**2 run and multi-run High deposition rate**	**I, Y, X**

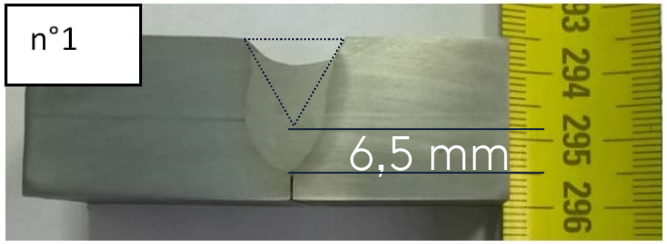

Application testing

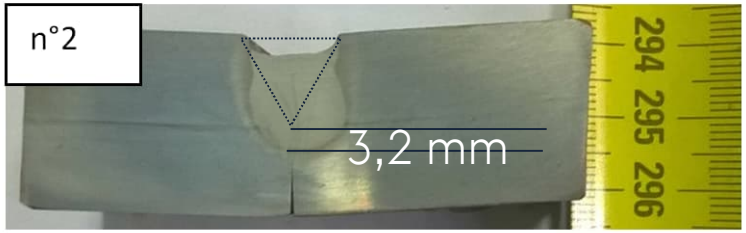
1 - Penetration in Y-groove 60°

Test	SAW Wire	Diam	Amp	Volt	Speed	Penatration
n°	type	mm	A	V	cpm	mm
1	Union S 3 Si	3.2	600	29	45	
2	S 56 HP	3.2	600	29	45	

Flux UV 418 TT







2 aspects for less penetration depth with diamondspark S 56 HP (compared to solid SAW wire):

- Wider arc (= less concentrated)
- ~30% more filler metal = especially in narrow weld preparation / small angle

=> Increasing the welding speed will decrease the difference

2 - Application test 20 mm plate
Existing WPS based on solid SAW

Wire	Diam	Flux
Union S 2 Si (EM12K)	4 mm	UV 400
Diamondspark S 56 HP	4 mm	UV 400

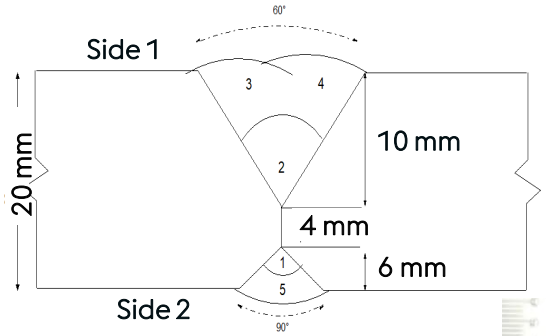
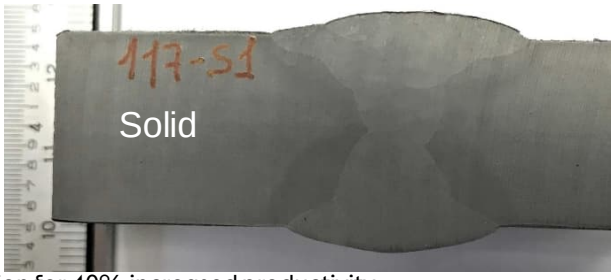
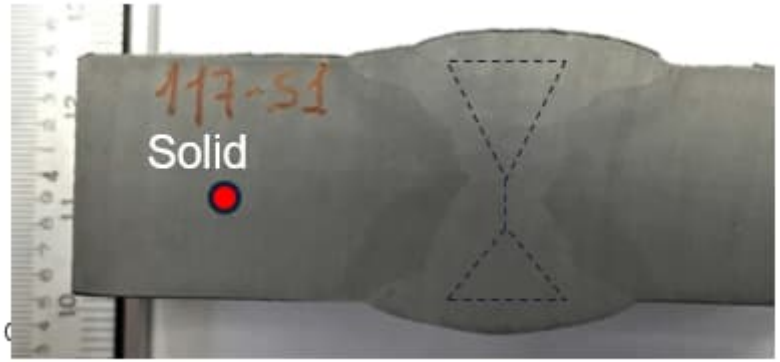


Plate side	Bead number	Electrode size (mm)	Type of current	Current	Voltage	Welding speed cpm	Heat input kJ/mm
1	2	4,0 SAW	DC+	650	28,0	45	2,4
1	3-4	4,0 SAW	DC+	550	32,0	45	2,3
2	1	1,2 GMAW	DC+	260	28,5	39	1,1
2	5	4,0 SAW	DC+	730	31,0	45	3,0



2 - Application test 20 mm plate
Charpy toughness, same parameters



Little over-thickness

Charpy toughness (-50°C)
- Side 1 : 69 J
- Side 2 : 22 J

Too much over-thickness

Charpy toughness (-50°C)
- Side 1 : 123 J
- Side 2 : 48 J

2 - Application test 20 mm plate

Optimisation (welding parameters) with diamondspark S 56 HP – UV 400.

Question :

» Do you think it is possible to achieve arc-time saving > 40% ? yes / no

» Also with same or better charpy toughness? yes / no

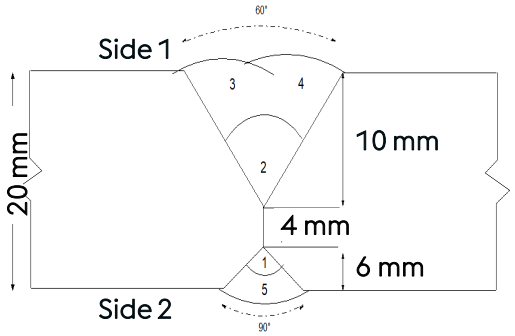


Plate side	Bead number	Electrode size (mm)	Type of current	Current	Voltage	Welding speed cpm	Heat input kJ/mm
1	2	4,0 SAW	DC+	650	28,0	45	2,4
1	3-4	4,0 SAW	DC+	550	32,0	45	2,3
2	1	1,2 GMAW	DC+	260	28,5	39	1,1
2	5	4,0 SAW	DC+	730	31,0	45	3,0

2 - Application test 20 mm plate
Optimisation of the WPS

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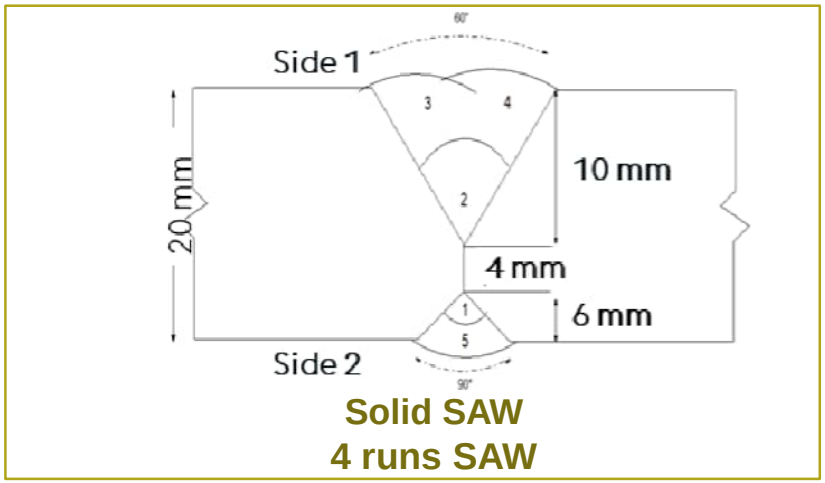
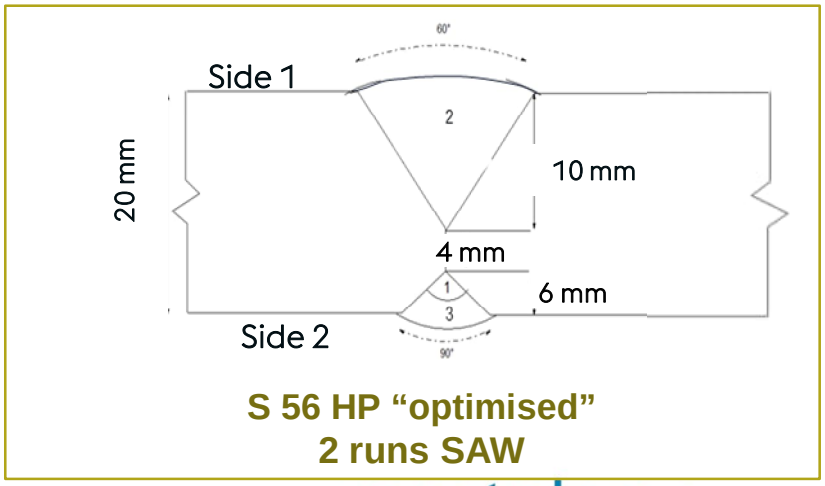
Optimise parameters for S 56 HP for

» Better penetration

» Reduced arc time



Solid SAW
4 runs SAW



S 56 HP "optimised"
2 runs SAW

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2 - Application test 20 mm plate
Optimised parameters

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Plate side	Bead number	Electrode size (mm)	Type of current	Current Amp	Voltage Volt	Welding speed cpm	Heat input kJ/mm
1	2	4,0 SAW	DC+	650	28.0	45	2,4
1	3-4	4,0 SAW	DC+	550	32.0	45	2,3
2	1	1,2 GMAW	DC+	260	28.5	39	1,1
2	5	4,0 SAW	DC+	730	31.0	45	3,0

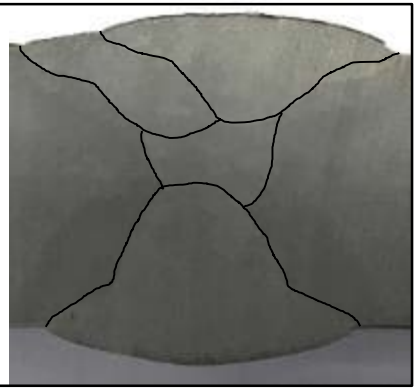
Plate side	Bead number	Electrode size (mm)	Type of current	Current Amp	Voltage Volt	Welding speed cpm	Heat input kJ/mm
1	2	4,0 SAW	DC+	**800**	**29.5**	**50**	**2,8**
2	1	1,2 GMAW	DC+	260	28.5	39	1,1
2	3	4,0 SAW	DC+	730	**32.0**	**65**	**2,2**

60% time saving

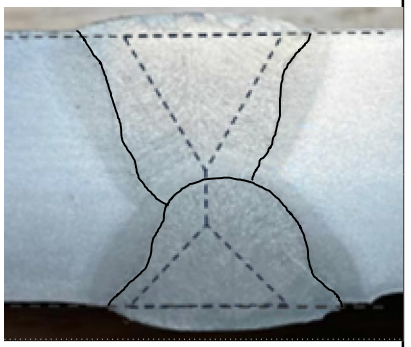
2 - Application test 20 mm plate

Resume : 60% time saving and increased toughness

Solid SAW
4 runs
(45 cpm ; 18 ipm)
1 mtr weld :
= 8,9 mins arc time



S 56 HP “optimised”
2 runs
(50&65 cpm ; 20&26 ipm)
1 mtr weld :
= 3,5 min arc time
= 5,4 minutes less
60% arc time saving



Charpy toughness (-50°C)
- Side 1 : 69 J
- Side 2 : 22 J

Charpy toughness (-50°C)
- Side 1 : 89 J
- Side 2 : 71 J

Approvals :
Two-run and multi-run

WELDING academy by voestalpine Böhler Welding

Approvals

TUV (19505), DB (51.052.02, 52.052.02), CE , ABS (5YQ460M H5; 4Y400T H5), BV (4Y40TH5 ; 5Y46MH5), DNV (IV Y40T H5 and V Y46M H5), LR

Page 1 / 1

Certificate number : WM 99406/29/A.0

File number : 99406 N 2021

TYPE APPROVAL CERTIFI

as per Bureau Veritas Marine & Offshore Classificatio

This certificate is issued to

VOESTALPINE BOHLER WELDING

CITTADELLA - PD - ITALY

for the product

Wire / Flux Combination for Submerged

Designation	:	diamondspark S 56 HP - UV 400
Grade	:	4Y40TH5 (Two-run) & 5Y46MH5 (Multi-run)
Description	:	Flux-Cored Wire / Flux
Diameter	:	2,4mm - 3,2mm - 4,0mm
Welding current	:	DC +
Welding position	:	Flat butt weld (PA bw)
Remark	:	Two-run technique: thickness <= 20 mm

This certificate is issued to attest that Bureau Veritas Marine & Offshore did undertake the rele above which was found to comply with the relevant requirements of Bureau Veritas Marine & Classification of Marine Units.

This certificate will expire on: 04 Mar 2

For Bureau Veritas Marine & Offshore,

Local office: BV VENEZIA

Issued on 17 Mar 2021

Surveyor: S. BRUSEGAN

This certificate remains valid until the date stated above, unless cancelled or revoked, provided the conditio have not been notified to, and agreed in writing with Bureau Veritas Marine & Offshore. Should the specifie of this certificate, the product(s) is/are to be re-approved prior to it/they being placed on board vessels to whic This certificate is issued within the scope of the General Conditions of Bureau Veritas Marine & Offshore. An document is delivered may not assert a claim against Bureau Veritas Marine & Offshore for any liability ari said document, or for errors of judgement, fault or negligence committed by personnel of the Society or of t and in connection with any activities for which it may provide.

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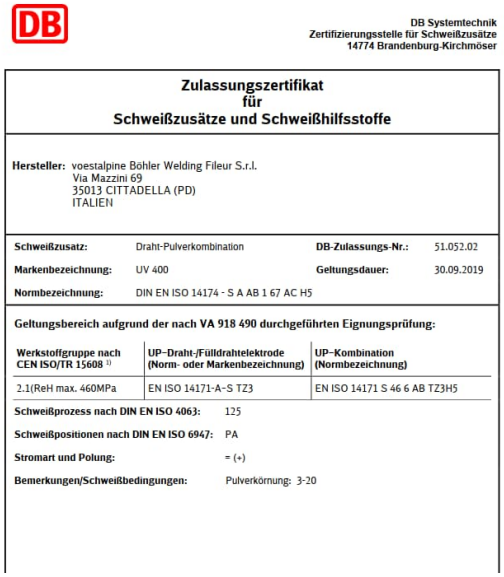
BV-DE ES7 June 2017



DB

DB Systemtechnik
Zertifizierungsstelle für Schweißzusätze
14774 Brandenburg-Kirchmöser

Zulassungszertifikat für Schweißzusätze und Schweißhilfsstoffe

Hersteller: voestalpine Böhler Welding Fileur S.r.l.
Via Mazzini 69
35013 CITTADELLA (PD)
ITALIEN

Schweißzusatz:	Draht-Pulverkombination	**DB-Zulassungs-Nr.:**	51.052.02
Markenbezeichnung:	UV 400	**Geltungsdauer:**	30.09.2019
Normbezeichnung:	DIN EN ISO 14174 - S A AB 1 67 AC H5		

Geltungsbereich aufgrund der nach VA 918 490 durchgeführten Eignungsprüfung:

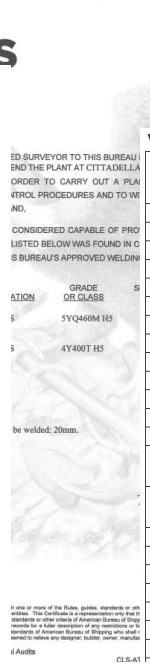
Werkstoffgruppe nach CEN ISO/TR 15608 1)	UP–Draht-/Fülldrahtelektrode (Norm- oder Markenbezeichnung)	UP–Kombination (Normbezeichnung)
2.1(ReH max. 460MPa	EN ISO 14171-A-S TZ3	EN ISO 14171 S 46 6 AB TZ3H5

Schweißprozess nach DIN EN ISO 4063: 125

Schweißpositionen nach DIN EN ISO 6947: PA

Stromart und Polung: = (+)

Bemerkungen/Schweißbedingungen: Pulverkörnung: 3-20



ABS

ED SURVEYOR TO THIS BUREAU
END THE PLANT AT CITTADELLA
ORDER TO CARRY OUT A PLA
NTROL PROCEDURES AND TO W
ND.
CONSIDERED CAPABLE OF PRO
LISTED BELOW WAS FOUND IN C
S BUREAU'S APPROVED WELDIN

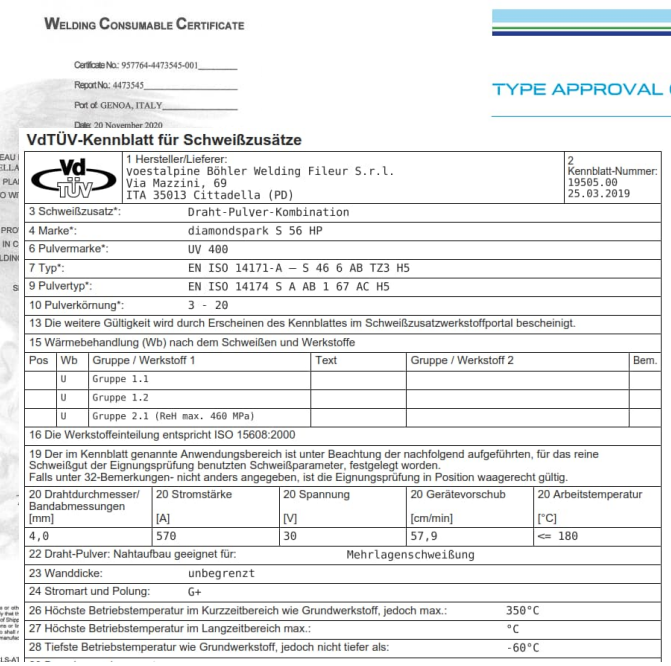
ATION	GRADE OR CLASS	S
S	5YQ460M H5	
S	4Y400T H5	

be welded: 20mm.

In one or more of the Rules, guides, standards or oth entities. This Certificate is a representation only that it standards or other criteria of American Bureau of Shipp records for a fuller description of any restrictions or li standards of American Bureau of Shipping who shall r eemed to relieve any designer, builder, owner, manufac

il Audits

CLS-A1



WELDING CONSUMABLE CERTIFICATE

Certificate No.: 957764-4473545-001

Report No.: 4473545

Port of: GENOA, ITALY

Date: 20 November 2020

VdTÜV-Kennblatt für Schweißzusätze

VdTÜV	1 Hersteller/Lieferer: voestalpine Böhler Welding Fileur S.r.l. Via Mazzini, 69 ITA 35013 Cittadella (PD)	2 Kennblatt-Nummer: 19505.00 25.03.2019

3 Schweißzusatz*:	Draht-Pulver-Kombination
4 Marke*:	diamondspark S 56 HP
6 Pulvermarke*:	UV 400
7 Typ*:	EN ISO 14171-A – S 46 6 AB TZ3 H5
9 Pulvertyp*:	EN ISO 14174 S A AB 1 67 AC H5
10 Pulverkörnung*:	3 - 20

13 Die weitere Gültigkeit wird durch Erscheinen des Kennblattes im Schweißzusatzwerkstoffportal bescheinigt.

15 Wärmebehandlung (Wb) nach dem Schweißen und Werkstoffe

Pos	Wb	Gruppe / Werkstoff 1	Text	Gruppe / Werkstoff 2	Bem.
	U	Gruppe 1.1			
	U	Gruppe 1.2			
	U	Gruppe 2.1 (ReH max. 460 MPa)			

16 Die Werkstoffeinteilung entspricht ISO 15608:2000

19 Der im Kennblatt genannte Anwendungsbereich ist unter Beachtung der nachfolgend aufgeführten, für das reine Schweißgut der Eignungsprüfung benutzten Schweißparameter, festgelegt worden.
Falls unter 32-Bemerkungen- nicht anders angegeben, ist die Eignungsprüfung in Position waagerecht gültig.

20 Drahtdurchmesser/ Bandabmessungen [mm]	20 Stromstärke [A]	20 Spannung [V]	20 Gerätevorschub [cm/min]	20 Arbeitstemperatur [°C]
4,0	570	30	57,9	<= 180

22 Draht-Pulver: Nahtaufbau geeignet für:	Mehrlagenschweißung	
23 Wanddicke:	unbegrenzt	
24 Stromart und Polung:	G+	
26 Höchste Betriebstemperatur im Kurzzeitbereich wie Grundwerkstoff, jedoch max.:		350°C
27 Höchste Betriebstemperatur im Langzeitbereich max.:		°C
28 Tiefste Betriebstemperatur wie Grundwerkstoff, jedoch nicht tiefer als:		-60°C

DNV·GL

Certificate No: TAW00004UW

TYPE APPROVAL CERTIFICATE

g Fileur S.r.l.

9 – Type approval – Welding consumables

M(H5)

thickness <= 25 mm

/are accepted for installation on all vessels classed

for DNV GL

Digitally Signed By: Widhagen, Christian
Location: DNV GL Hamburg, Germany
Signing Date: 21.01.2021, on behalf of

Thorsten Lohmann
Head of Section

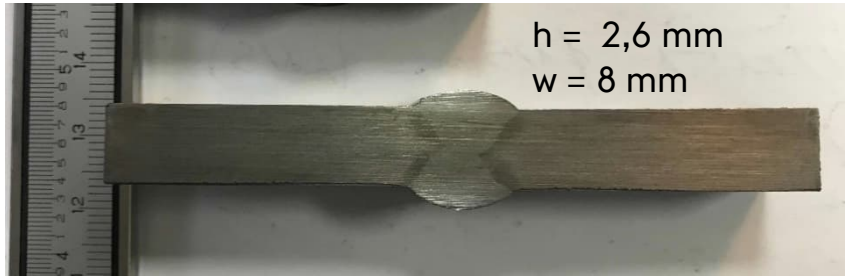
is Certificate invalid.
contract with the holder of this document, or following from mandatory law, the
well as their officers, directors and employees ("DNV GL") arising from or in
suance of this document or reliance thereon, whether in contract or in tort
er any circumstance be limited to 300,000 USD.

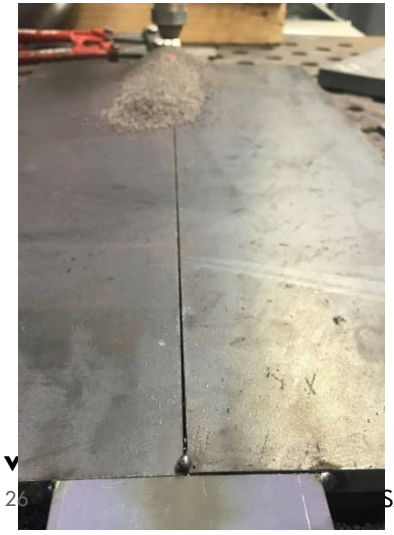

2-Run welding technique
in thin plate

Example : two–run - 10 mm plate – I-prep diamondspark S 56 HP - UV 400

Parameters both sides :

- 3,2 mm
- wire feed speed: 2,5 mtr/min
- Amp: 550
- Volt: 31-32
- Welding speed: 75 cm/min
- Heat Input : 1.4 kJ/mm



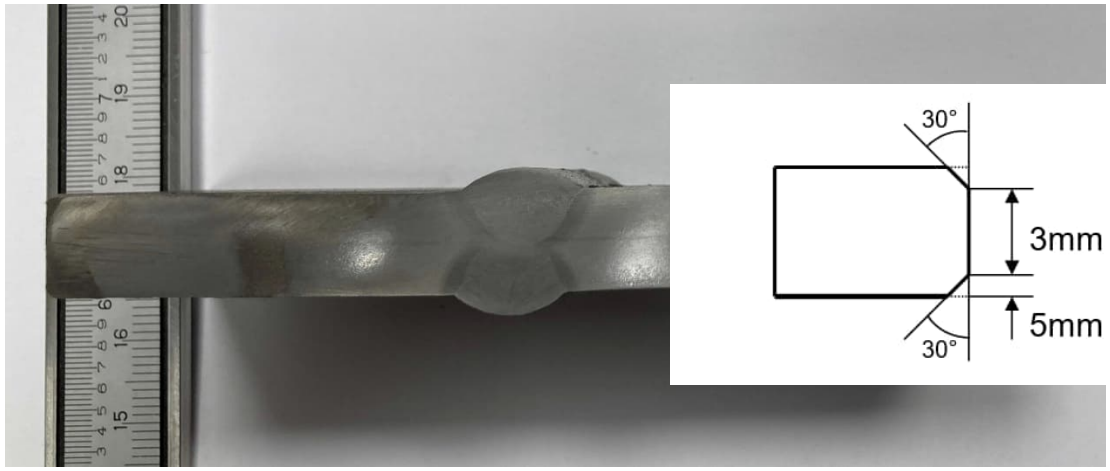


diamondspark S 56 HP –UV 400
10 mm plate – 2 run

Welding parameters:

side 1:
- wire feed speed: 3.40 mt/min
- Amp: 650
- Volt: 34
- Welding speed: 120 cm/min

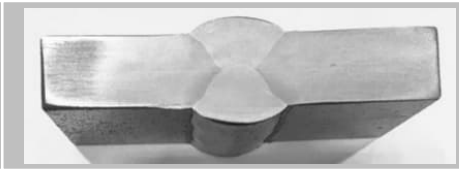
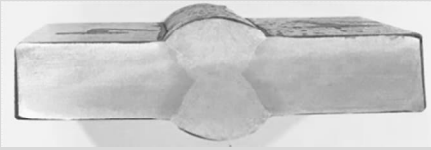
side 2:
- wire feed speed: 3.40 mt/min
- Amp: 650
- Volt: 35
- Welding speed: 120 cm/min



No defects inside and good penetration.
- Reinforcement S1: 2 mm
- Reinforcement S2: 2mm

diamondspark S 56 HP –UV 400

10 mm plate – 2 run – 4,0 mm - toughness

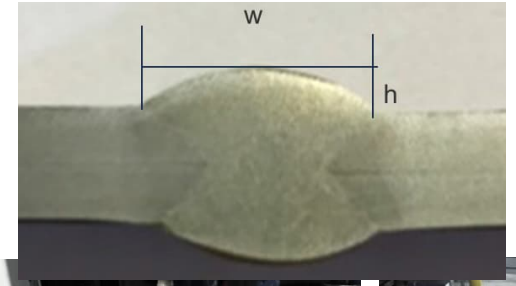
Current (amp)	Voltage (V)	Weld.speed (cm/min)	HI (kJ/mm)	t8/5 (sec)	I-preparation
600	31	80	1,40	29 sec	
700	33	90	1,54	35 sec	

Current	ISO-V (J) reduced specimen size 7,5mm		
	-20°C	-40°C	-60°C
600	123-107-115	101-81-110	67-57-27
700	118-106-114	87-92-69	39-46-43

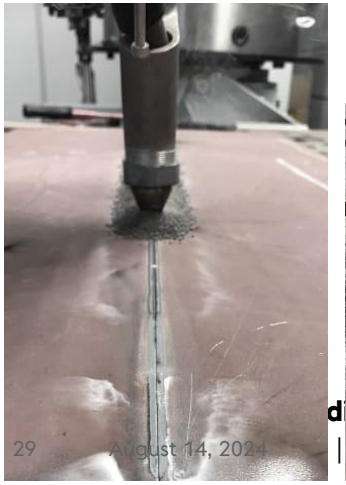
Example : two–run - 6 mm plate – I-prep diamondspark S 56 HP - UV 400

Parameters both sides :

- 3,2 mm
- wire feed speed: 2.50 mt/min
- Amp: 550
- Volt: 30-31
- Welding speed: 95 cm/min
- Heat input : 1.0 KJ/mm



h = 3 mm
w = 12 mm



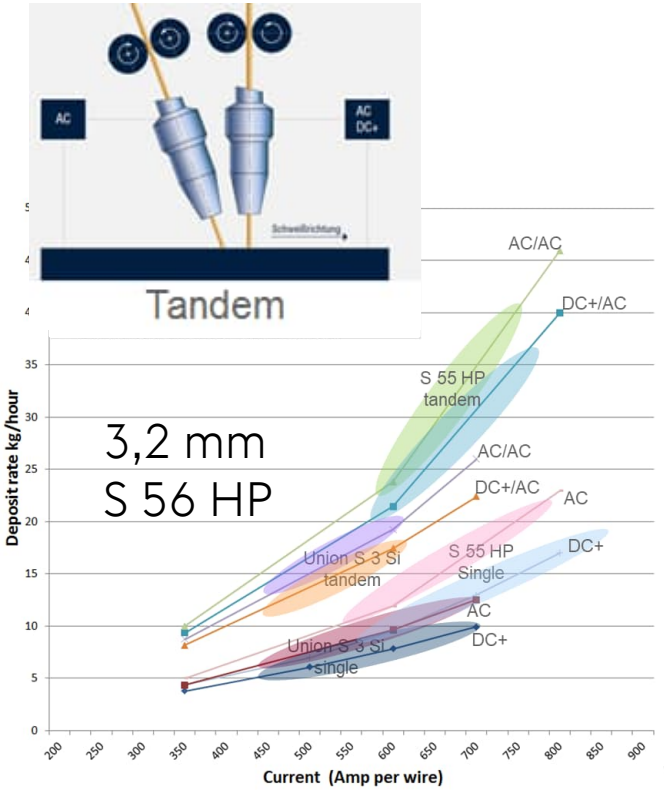

Multi-wire

Multi-wire diamondspark S 56 HP

Suitable for multi-wire configurations, like

- Twin arc (2x2,4 mm – 1 power source)
- Tandem (2 power sources)
- Triple wire (3 power sources)

Similar increase in deposition rate
Mostly necessary to increase also welding speed



Increase deposition rate without investment

Possible investment in equipment to get increased deposition rate		Alternative without investment in equipment)
Single wire 1x 4 mm ; 1x 5/32”	Tandem (AC/DC+ ; 2x 4,0 mm ; 2x 5/32”) ??	Single wire diamondspark S 55(56) HP 4 mm ; 5/32” - with present equipment
Single wire 1x 4 mm ; 1x 5/32”	Long stick out + special power source (AC) ??	Single wire diamondspark S 55(56) HP 4 mm ; 5/32” - with present equipment
Tandem 2x 4 mm ; 2x 5/32”	Triple (3x4 mm ; 3x 5/32”) ??	Tandem diamondspark S 55(56) HP 4 mm ; 5/32” - with present equipment
Single wire 1x 4mm ; 1x 5/32”	Special proces (twin-arc + cold wire ; 3 x 2,5 mm ; 3x 3/32)”??	Twin –arc diamondspark S 55(56) HP (2,4 mm ; 3/32”) - with present equipment
Triple 3x 4 mm; 3x 5/32”	4x 4,0 mm ; 4x 5/32” ??	Triple diamondspark S 55(56) HP 4 mm ; 5/32” - with present equipment
Special proces (twin-arc + cold wire in between) solid	??	Apply diamondspark S 55(56) HP 3x 2,4 mm ; 3x 3/32” - with present equipment

Bead cross section (mm2)

- High(er) deposition rate ….
- Apply also increased welding speed => to avoid :
  - too large cross section (weld preparation geometry)
  - higher risk for lack of fusion


Product range seamless SAW

Seamless SAW - Product range Combinatons (high strength)

	UV 306 AR BI~0,6	UV 400 AB BI~1,5-1,8	UV 418 TT FB BI~2,7	UV 420 TTR-C FB BI~2,6	UV 422 TT-LH FB ; FB~2,5
diamondspark S 55 HP	S 50 4 / F7A5		S 46 6 / F7A8P8		
diamondspark S 56 HP		S 46 6 / F7A8			
diamondspark S NiCu1	S 46 4 / F8A5	S 46 6 / F7A8			
diamondspark S 550 HP		S 50 6 / F9A8	S 50 6 / F9A8	S 50 6 / F9AP8	S 50 6 / F9A8
diamondspark S 700 HP			S 69 6 / F11A10		S 69 6 / F11A10
diamondspark S 770			S 69 6 / F11A6		S 69 6 / F12A6
diamondspark S 900 HP					S 89 6 / F13A8
diamondspark S 960 HP					(S 96 5 / F14A8)

Resume

Resume

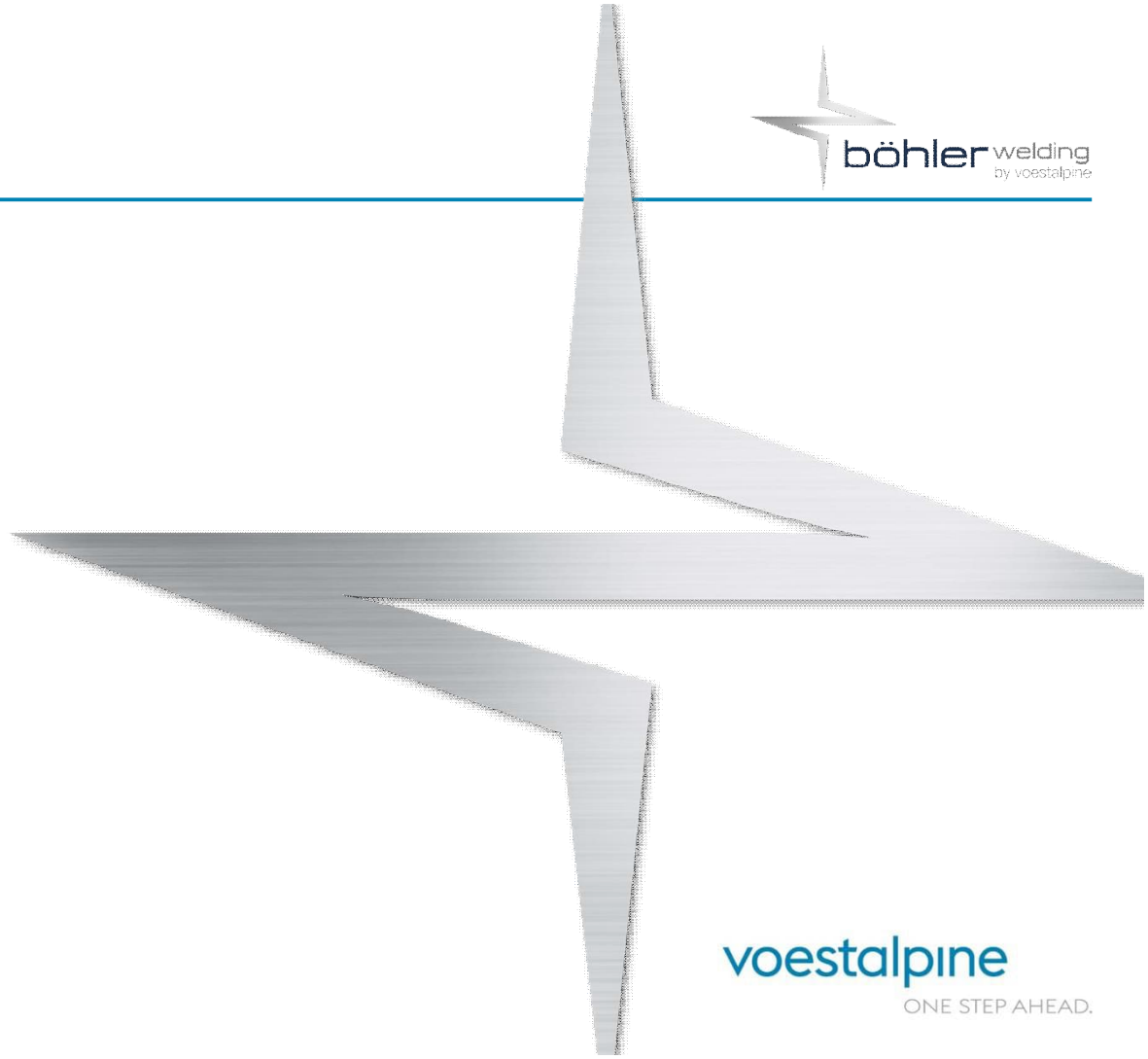
Possibility for reduction in cost and project lead time by

- Relative simple WPS and simple solution, with low / without investment
- Increased deposit rate and/or welding speed
- Low risk on failing mechanical properties
- High process reliability leading to
    - Low defect ratio
    - Low down-time

Project-lead-time-fulfillment might be key factor to

- Reduce risk for penalties
- Win projects

Thank you!



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