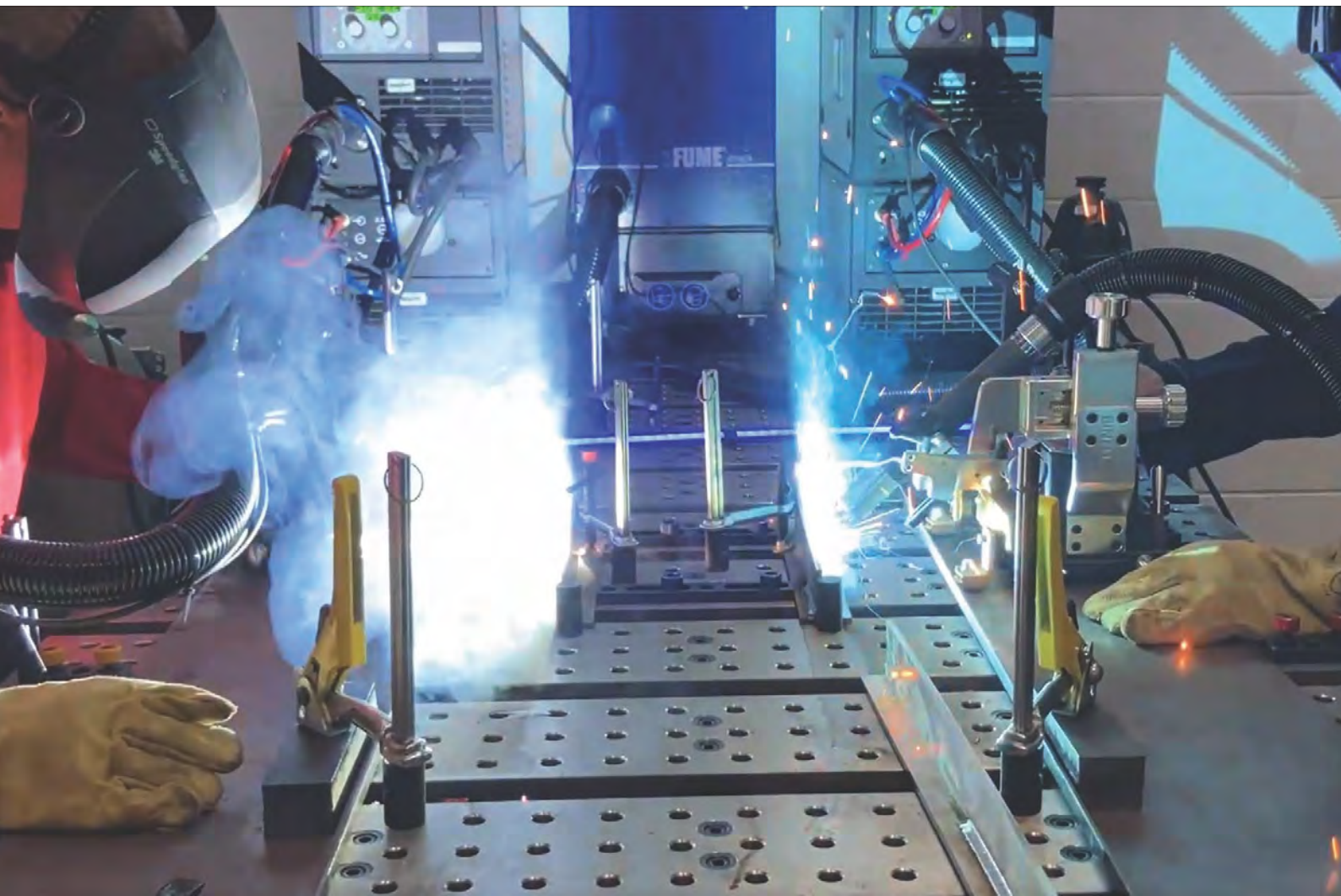
BOC
A Linde company

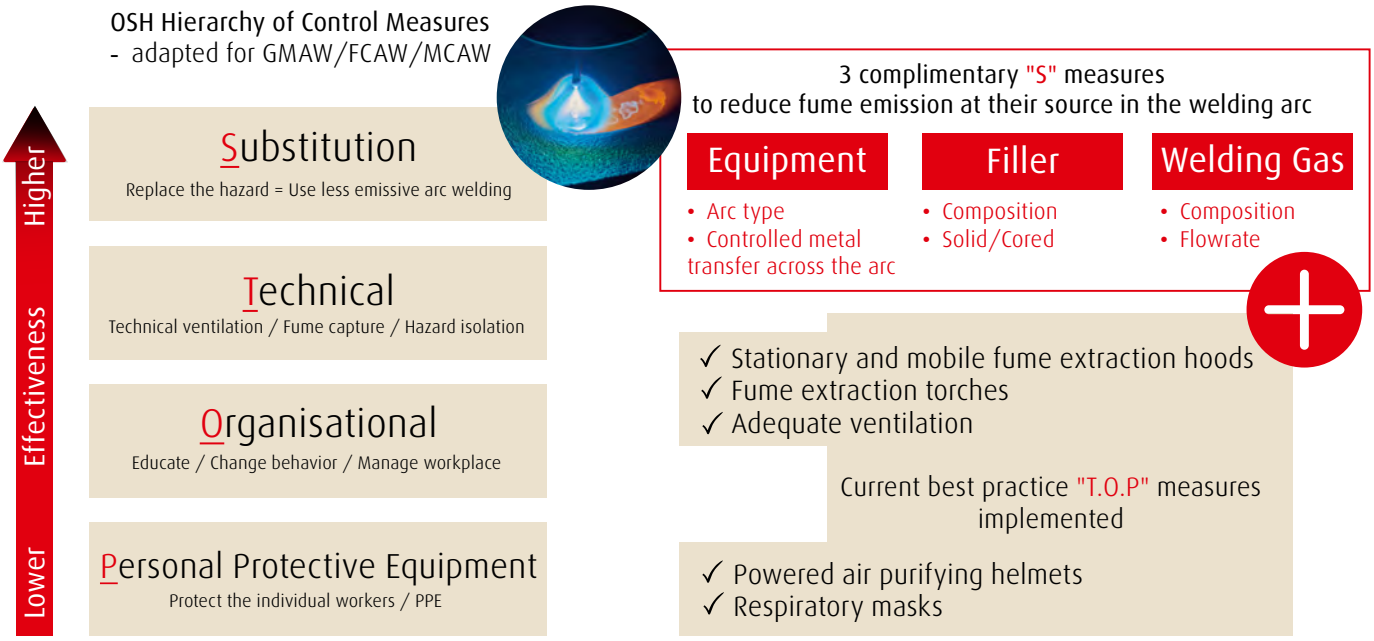
Hierarchy of Control for Welding Fume Reduction

Practical solutions for applying the Substitution, Technical, Organisational and PPE measures.




Performance,
Competence,
Prevention line shielding gases.

OSH Hierarchy of Controls – Arc Welding Fumes at source GMAW, MCAW, FCAW



Hierarchy of Controls is a regulatory Occupational Safety and Health (OSH) procedure implemented internationally, with national or hazard specific adaptations. The graphic here is proposed by BOC as an informative adaptation, particularly for gas-shielded metal arc welding processes like GMAW, MCAW, FCAW.

Gas shielded arc welding processes have unique advantages in metal fabrication, e.g.:

→ Metallurgical joining for material continuity
→ Energy efficiency > 90% in modern inverters
→ Operational flexibility for humans, robots and cobots
→ High value generation at low investment cost
→ Comprehensive standardization & industry acceptance
→ Electronic control and Industry 4.0 readiness

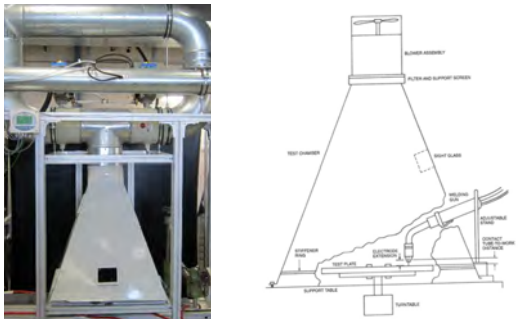
The welding arc is the efficient tool enabling all of the above, but welding fume emissions which are a complex mixture of particles, are considered an Occupational Safety and Health (OSH) hazard.

Exposure of humans to welding fumes must be avoided or minimized in compliance with local regulation.

The "Hierarchy of Controls" is an OSH method guiding companies on how to achieve this. It ranks control measures based on their general effectiveness and makes action recommendations in order of preference:

1. Elimination
2. Substitution
3. Technical / Engineering controls
4. Organizational / Administrative controls
5. Personal protective equipment (PPE)

If elimination is not an option, single measures are insufficient, different measures need to be combined for best possible protection of workers.



Fume testing booth, Linde applications technology centre - Germany

Visual reduction of FER – GMAW mild/low alloy steels

Argoshield 52 with 25% CO_2 - Balance Argon

Argoshield 10 with 10% CO_2 - Balance Argon

However, in arc welding practice the order of controls is often reversed, starting with indispensable PPE. As well, technical measures for fume capture, extraction or adequate ventilation, continuously improve and are also best practice or even mandatory.

With the growing attention on OSH and the working environment for all employees, we believe it's time to add the next level of measures: **Substitution.**

These measures are not only ranked more effective in the hierarchy, but they can also improve the effectiveness of PPE and technical fume capture.

Substitution type measures aim at reducing the Fume Emission Rate (FER) directly at the source, in the welding arc. Welding fumes are formed when metals are heated above their boiling point and the vapours condense subsequently into very fine particles (solid particulates). Technically, reducing FER rates means reducing the generation of metal vapours.

So far, 3 substitution measures have been identified to target this:

→ optimised shielding gases
→ lower fume emitting fillers
→ optimal welding equipment settings and digitally controlled metal transfer across the arc.

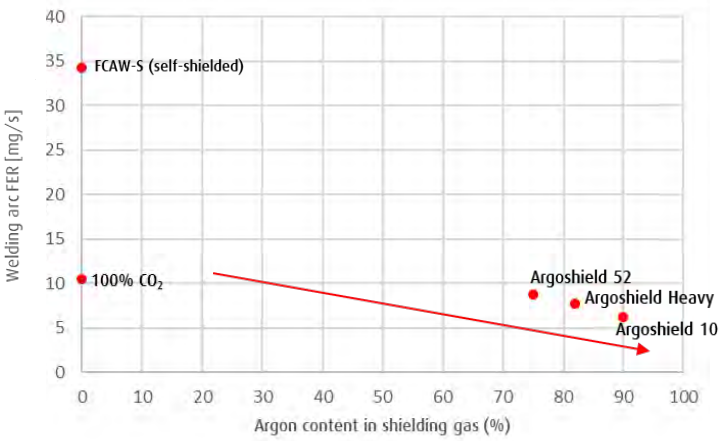
Each of them individually can already reduce welding FER, but combining them leverages their individual effectiveness in combination with each other for an improved outcome..

In fact, this is valid for all S.T.O.P. type measures from the hierarchy of control: in collaboration with OSH institutions and welding industry experts we have learnt that combinations of measures are more powerful than single measures.

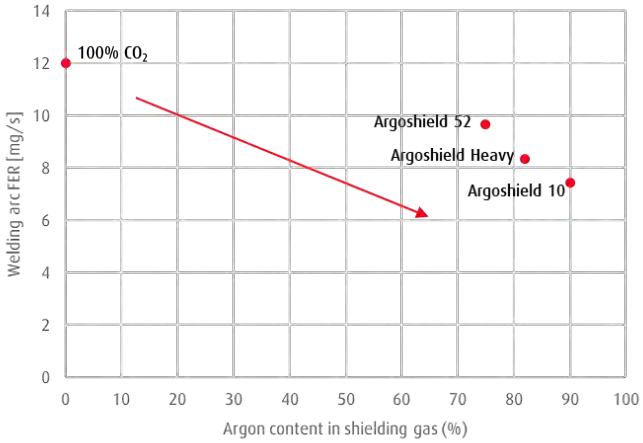
Beyond optimised welding gases, BOC offers complimentary solutions on different levels of the hierarchy, as well as consultancy for an application considering your specific welding tasks.

See further important information on the back cover.

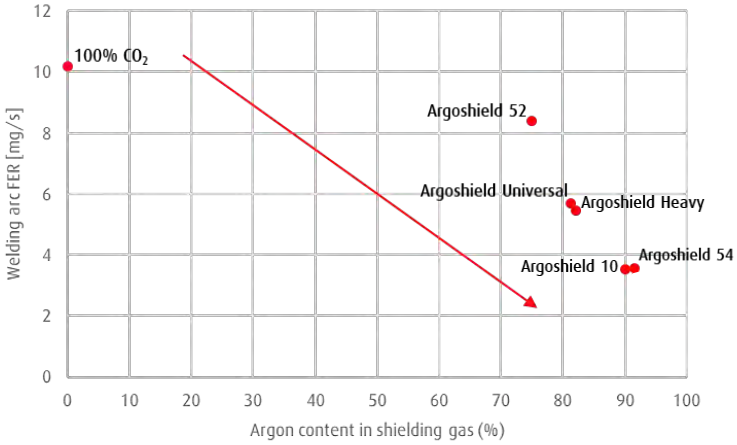
Measured reduction of FER – GMAW/ FCAW / MCAW mild/low alloy steels



Example graphic for FCAW welding carbon steel 12m/min, using 1.2 mm FCAW wire. Data source: Linde Technology Arc Welding Laboratory Fume emission measurement according to EN ISO 15011-1



Example graphic for MCAW welding carbon steel 12m/min, using 1.2 mm MCAW wire. Data source: Linde Technology Arc Welding Laboratory Fume emission measurement according to EN ISO 15011-1



Example graphic for GMAW/MAG welding carbon steel 10m/min, using 1.2 mm GMAW/MAG wire. Data source: Linde Technology Arc Welding Laboratory Fume emission measurement according to EN ISO 15011-1.

>90% of welding fume amount in GMAW originates from overheating and vapourising the solid filler in the arc, therefore, substitution measures must address heat input to the melting wire. As a leading welding gas company, our research focuses on the gas impact, but always considering the interdependence with all variables and the expectations on productivity and quality.

Arc physics revealed that higher CO_2 content in the welding gas focuses the heat input at the melting tip, leading to overheat. In contrast, higher argon content spreads the arc heat input to larger areas of the melting wire, generating less metal vapours. The resulting reduction in FER is visible and measurable under laboratory conditions defined by industry standards.

Are you considering welding gas optimisation with Argoshield 10, Argoshield 54 or another PREVENTION Line welding gas? Here are some helpful hints:

Optimising both arc transfer mode and gas may increase the benefit
→ Check if spray arc can be substituted by pulsed arc or lower energy arc types.

At a set wire feed rate, the arc length will change if the gas composition changes
→ Adjust arc parameters , e.g. voltage.

Modern synergic power sources use proprietary arc control software and hardware, which can react differently to a shielding gas change

→ Check if your welding equipment offers optimized parameters for BOC gases listed here.

Weld quality control and documentation depends on industry branch, applied standards and company procedures
→ Check your weld job specification for what needs to be re-evaluated when implementing a gas optimisation.

See important information on the back cover.
Still have questions?

→ Contact BOC
Australia - 131 262
New Zealand - 0800 111 333

ARGOSHIELD 10® – the PREVENTION LINE welding gas for carbon steels

Argoshield 10 is a precise blend of argon and carbon dioxide for high productivity mild steel welding. It is designed to provide fast, clean, high-quality welds over a wide range of applications.

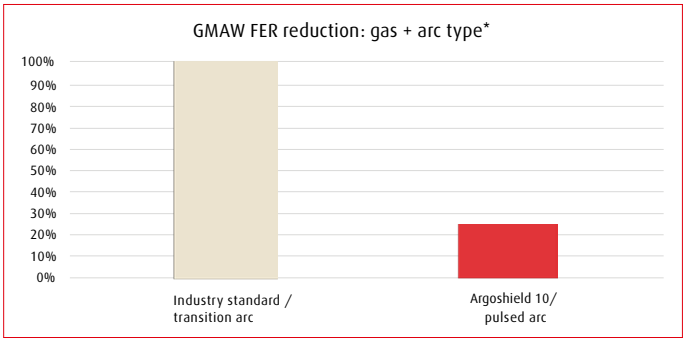
It offers significant improvements over many other general purpose MAG welding gases because of its lower, controlled oxidation potential.

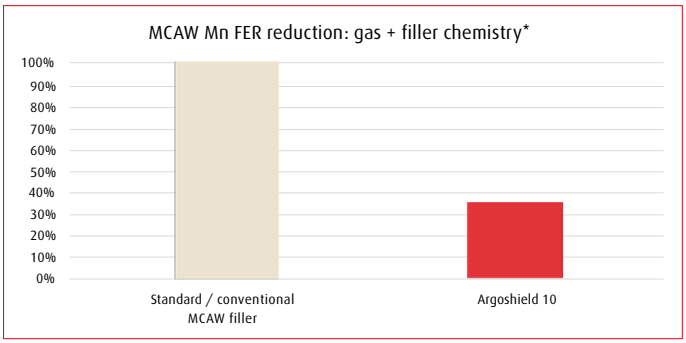
Bead shape and puddle control are excellent; spatter and fume levels can be reduced also. Mechanical properties of the weld metal deposited meet or exceed normal requirements.

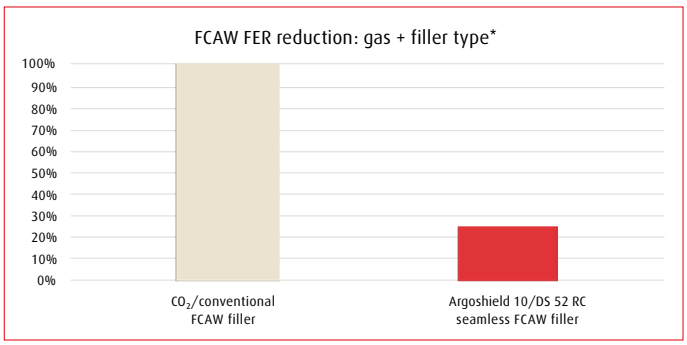
Product Features	Benefits
→ Industry proven **quality and productivity benefits** of the controlled CO_2 content	→ Reduced spatters, oxides, slags, cleaning work → Better impact energy values for deposited material → Suitable for multi arc use (e.g. spray, pulsed) and tandem GMAW
→ NEW **OSH (Occupational Safety and Health) benefits** expected from increased Argon content.	→ Reducing Fume Emission rate FER* at the source: in the arc → Substitution measure recommended by international OSH institutions → Excellent combination possible with other substitution measures like pulsed or low energy arcs and low Mn fillers

→ 1 aim: reducing welding fume emissions
→ 3 processes: GMAW / MCAW / FCAW
→ 1 welding gas: Argoshield 10

Powerful combination of substitution measures to leverage effectiveness of single optimisations shown here:







Specifications

AS/NZS ISO 14175 M20-ArC-10

Cylinder size	F3VIPR	G	MCP4	MCP15
Material code	066F3VIPR	066G	066MCP4	066MCP15
Cylinder assembly	Individual	Individual	4-Pack	15-Pack
Volume 1 (m3)	10.2	8.9	63.3	237.4
Pressure 2 (bar)	3005	169	3006	3006
Valve type	AS4267 5/8-18UNF RH	AS2473.2 Type 10	AS2473.2 Type 10	AS2473.2 Type 10
Net weight (kg)	17.43	15.2	108.14	405.57
Gross weight 3 (kg)	69.14	70.0	510	1745
Dimensions 4 (mm)	1275H × 229∅	1510H × 232∅	700L x 550W x 2014H	1230L x 800W x 2025H

Shielding Gases Selection Chart

BOC offers a wide range of shielding gases to cater for all metals, welding processes and applications.
The following selection chart provides recommendations for optimum gas/es to suit each application.
The gases are listed in 3 classes:

- Competence Line standard shielding gases
- Performance Line high performance gases for improved quality and productivity
- Prevention Line low fume emission shielding gases

MATERIAL	PROCESS	COMPETENCE LINE	PERFORMANCE LINE	PREVENTION LINE
Aluminium alloys	GMAW	Argon (061)	Alushield Light (079)	Alushield Heavy (069)***
			Alushield Universal (133)	
			Alushield Heavy (069)	
	GTAW	Argon (061)	Alushield Light (079)	Alushield Heavy (069)***
	Laser welding	Argon (061)		
Nickel alloys	GMAW	Argon (061)	Alushield Universal (133)	
			Alushield Heavy (069)	
			Alushield Light (079)	
	GTAW	Argon (061)	Argoplas 5 (143)	Alushield Heavy (069)***
			Alushield Light (079)	
	****Laser welding	Argon (061)		
		Nitrogen (032)		
Copper alloys	GMAW	Specshield Copper (077)	Helium (124)	
		Alushield Light (079)	Alushield Heavy (069)	
			Alushield Universal (133)	
	GTAW	Argon (061)	Alushield Universal (133)	
			Alushield Light (079)	
	****Laser welding	Argon (061)		
Titanium, Tantalum	GMAW	Argon UHP (262)	Argon UHP (262)	
alloys	GTAW	Argon UHP (262)	Argon UHP (262)	
Mild steels	GMAW/MCAW	Argoshield 10 (066)	Argoshield 100 (095)	Argoshield 54 (071)
		Argoshield Light (060)		Argoshield 10 (066)
		Argoshield Universal (065)		
		Argoshield Heavy (122)		
	FCAW	CO2 (081)	Argoshield 52 (070)	Argoshield Heavy (122)
			Argoshield Heavy (122)	Argoshield 10 (066)*
	GTAW	Argon (061)		
	Laser welding	Argon (061)		
		Nitrogen (032)		
Stainless steels	GMAW/MCAW	Stainshield Light (119)	Stainshield Heavy (092)	
		Stainshield (075)	Stainshield Pipeline (399)	
	GTAW	Argon (061)	Argoplas 5 (143)	Alushield Heavy (069)***
		Stainshield Duplex (114)	Alushield Light (079)	Argoplas 5 (143)**
	FCAW	CO2 (081)	Argoshield 52 (070)	
			Argoshield Heavy (122)	
	Laser welding	Nitrogen (032)		
		Argon (061)		
*Only suitable for certain wires.	**Austenitic stainless only.	***Alushield Heavy reduces ozone emissions.	****Refer operating manual.	

Substitution

Recommended filler metals suitable for Argoshield 10

GMAW:

706B08-1	WIRE MIG MAGMATE 70S6	0.8MM	15KG
706B09-1	WIRE MIG MAGMATE 70S6	0.9MM	15KG
706B12-1	WIRE MIG MAGMATE 70S6	1.2MM	15KG
706B16-1	WIRE MIG MAGMATE 70S6	1.6MM	15KG
706B06-1	WIRE MIG MAGMATE 70S6	0.6MM	15KG
706B09250	WIRE MIG MAGMATE 70S6	0.9MM	250KG
706B0509	WIRE MIG MAGMATE 70S6	0.9MM	5KG
706B0506	WIRE MIG MAGMATE 70S6	0.6MM	5KG
706B12250	WIRE MIG MAGMATE 70S6	1.2MM	250KG
706B0508	WIRE MIG MAGMATE 70S6	0.8MM	15KG
1091150	WIRE MIG BOC 70S6	0.9MM	5KG
1081155	WIRE MIG BOC 70S6	0.8MM	15KG
1091155	WIRE MIG BOC 70S6	0.9MM	15KG
1101155	WIRE MIG BOC 70S6	1.0MM	15KG
1121250	WIRE MIG BOC 70S6	1.2MM	250KG
1061155	WIRE MIG BOC 70S6	0.6MM	15KG
1091250	WIRE MIG BOC 70S6	0.9MM	250KG
1081150	WIRE MIG BOC 70S6	0.8MM	5KG
1061150	WIRE MIG BOC 70S6	0.6MM	5KG
1081108	WIRE MIG BOC S6	0.8MM	1KG
1121155	WIRE MIG BOC 70S6	1.2MM	15KG

MCAW:

DS420MC12	DIAMOND SPARK GUARDIAN 420 MC	1.2MM	15KG
DS420MC16	DIAMOND SPARK GUARDIAN 420 MC	1.6MM	15KG
HSC70ML16	SC70ML METAL CORED	1.6MM	15KG
HSC70ML12	SC70ML METAL CORED	1.2MM	15KG
HSC70ML12BP	SC70ML METAL CORED WIRE	1.2MM	250KG
HSC70NS12BP	SC70ML METAL CORED WIRE	1.2MM	250KG
HSC70NS12	SC70NS METAL CORED	1.2MM	15KG
HSC70NS16	SC70NS METAL CORED	1.6MM	15KG
HSC70NS16BP	70NS METAL CORED WIRE	1.6MM	250KG

FCAW:

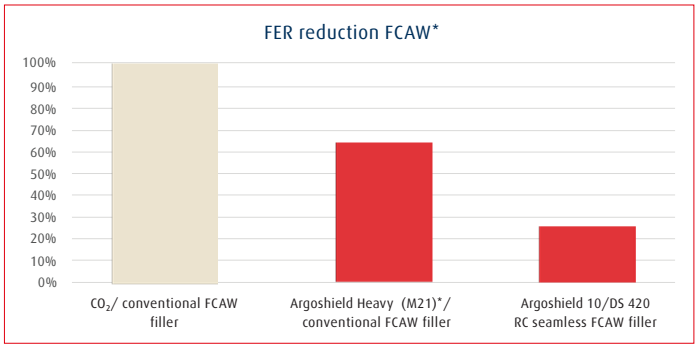
DS420RC12	DIAMOND SPARK GUARDIAN 420 RC	1.2MM	15KG
DS420RC16	DIAMOND SPARK GUARDIAN 420 RC	1.6MM	15KG
E35PP12247V	DUALSHIELD 70 U/ PLUS E71T-9M	1.2MM	15KG

Recommended Filler Metals

FCAW Diamond Spark 420 RC

BOC recommends Bohler's seamless cored wire – Diamondspark 420 RC for FCAW on carbon steels with BOC's Argoshield 10.

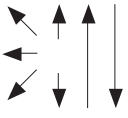
→ Can help reduce total welding FER (Fume Emission Rate) by 65-75% versus comparable wires used with CO_2
→ Will also reduce the calculated emission of Mn fume emission rates
→ Is approved by the Lloyds Register of Shipping for this gas/wire combination



*New Zealand: Argoshield Heavy Oxygen Free (M21)

Product Features	Product Benefits	User Benefits
→ Seamless design → Extremely clean manufacturing process	→ Ultra-low-hydrogen weld metal (H4) → Total resistance against moisture absorption during storage and use	→ Optimal protection against hydrogen cracking → No porosities observed → Easier stock conditions
→ Fast freezing rutile slag system	→ Enhancing travel speed and arc stability in all position welding → Easy slag removal	→ Productive positional welding → Automatic slag detachability
→ Wide parameter window	→ More spray arc welding	→ Easy arc setting → Easy welding in overhead position
→ Excellent feedability	→ Low contact tip wear due to seamless design → Trustable performance with long welding cable	→ Less down-time for maintenance → No wire breaks
→ Stable arc → Sharp arc	→ Low spatter → Good weldability → Good wetting	→ Less post-weld cleaning → Very flat root pass → No undercut
→ Copper coated	→ Excellent current transfer → Rust resistance	→ Easy handling → Safer storage
→ Designed chemistry	→ Excellent CVN impact toughness down to –46°C mix gas and to -20°C in pure CO_2 → Highest welding performance in welding travel speed in particular in 3 G/F position → Low fume emission	→ Wide margin to cover both strength and CVN impact requirements → Faster weld execution → Healthy working place

Part number	Description	Wire Dia. inch (mm)	Spool Size
DS420RC12	DIAMOND SPARK GUARDIAN 420 RC	1.2mm	15 kg
DS420RC16	DIAMOND SPARK GUARDIAN 420 RC	1.6mm	15 kg

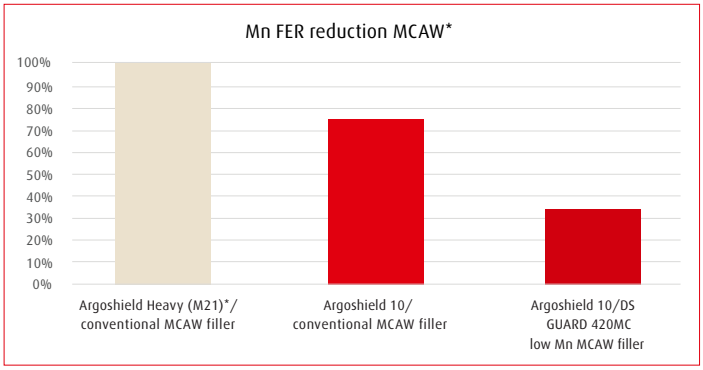
AWS A5.20 / ASME SFA-5.20	Welding Positions	Polarity
E71T1M/T-9M/T-12M JDH4		DC+

*All FER data measured under laboratory conditions according to industry standard.

MCAW diamondspark GUARD 420 MC

Linde recommends Bohler's metal-cored wire – Diamondspark GUARD 420 MC for MCAW on carbon steels with Argoshield 10 as it;

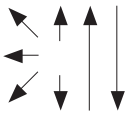
→ Can leverage the impact from both products to reduce Manganese Fume Emission Rates (Mn-FER)
→ Electrochemical effect of Argoshield 10 in the arc can reduce general FER compared to welding with higher reactive gases
→ Optimised chemistry of DS GUARD 420 MC filler can reduce concentration of Mn in the arc generated welding fumes
→ Is approved by the Lloyds register of Shipping (LRS) for this gas/wire combination



*New Zealand: Argoshield Heavy Oxygen Free (M21)

Product Features	Product Benefits	User Benefits
→ Low Mn Fume emission → Low FER (Fume Emission Rate) diamondspark MCAW	→ Lower Mn emission in welding fume → Reduction of hazardous particles at source	→ Provide highest level of protection in combination with existing safety tools → Supporting to achieve the most stringent safety limits in term of Mn emission
→ Designed chemistry	→ Good CVN impact toughness down to -50°C → High travel speed in vertical up	→ Good margin to cover both strength and impact requirements → Productive positional welding → Reduced harmful elements
→ Stable arc	→ Welder-friendly → Smooth wetting → Low spatter	→ Low defect rate → Good fatigue resistance → Less post weld cleaning
→ Excellent feedability	→ Dependable feed-ability → Low contact tip wear due to seamless design	→ No starting defects → Less down-time for maintenance
→ Seamless design	→ Copper-coated seamless cored wire → Low-hydrogen weld metal (H4) → Resistance against moisture pick-up	→ High rust surface resistance → Low risk of HAC (Hydrogen-Assisted Cracking) → No porosity observed

Part number	Wire Type	Wire Dia. inch (mm)	Spool Size
DS420MC12	DIAMOND SPARK GUARDIAN 420	1.2mm	15 kg
BOH87784KG	DIAMOND SPARK GUARDIAN 420	1.6mm	15 kg

AWS A5.18 / SFA-5.18	Welding Positions	Polarity
E70C-6M H4		DC+

*All FER data measured under laboratory conditions according to industry standard. See further important information on the back cover.

SC-70ML HYUNDAI

BOC recommends HYUNDAI Welding SC-70ML Metal-cored wire for mild steel.

SC-70ML is a gas-shielded metal-cored wire designed for manual and semiautomatic applications. Designed for use with M20 and M21 mixed gases in compliance with EN ISO 14175, it offers high deposition rates, a stable arc, minimal splatter, and superior resistance to porosity, ensuring clean and dependable welds.

Shielding gas	Welding Position	Register of shipping & Size mm(in)								
		JIS	ABS	LR	BV	DNV-GL	TUV	CWB	DB	EN
M21 (80%Ar + 20% CO_2)	F, HF V-up	Z3313 T49 4 T15-1 M A-U H5	4Y400S AH5 1.2-1.6 (0.045-1/16)	4Y40S H5 1.2-1.6 (0.045-1/16)	SA4Y40 M HHH 1.2-16 (0.045-1/16)	IVY40M S H5 1.2-1.6 (0.045-1/16)	EN ISO 17362-A -T46 4 M M 2 H 5	CSA W48 E491C-6MJ-H4	DIN EN ISO 17632-A-T 46 4 M M212 H5	ISO 17632-A-T46 4 M M21 2 H5
M20 (90%Ar + 10% CO_2)	F, HF V-up	Approval certificates are currently pending, with the certification process in progress as of December 2024.								

Item	Tensile Test			Impact Test (CVN -Joule)				
	YS (MPa)	TS (MPa)	EL (%)	Temp °C (°F)	X1	X2	X3	Avg.(J)
M21 (80%Ar + 20% CO_2)	503	582	29.5	-30(-22)	102	105	106	104
				-40(-40)	85	80	88	84
M20 (90%Ar + 10% CO_2)	510	594	28.7	-30(-22)	98	95	94	96
				-40(-40)	79	74	82	78
AWS A5.18 E70C-6M	≥400	≥480	≥22	-30(-22)	≥27			

Consumable: SC-70ML Diameter: 7.2mm Spool: 15kg

Item	Chemical Composition (wt%)					
	C	Si	Mn	P	S	Ni
M21 (80%Ar + 20% CO_2)	0.031	0.65	1.53	0.010	0.021	0.35
M20 (90%Ar + 70% CO_2)	0.033	0.69	1.58	0.010	0.022	0.37
AWS AS.78 E70C-6M	≤0.12	≤0.90	≤1.75	≤0.03	≤0.03	≤0.50

Consumable: SC-70ML Diameter: 1.2mm Spool: 15kg

Diameter mm (in)	Spool kg (lbs)	Pac kg (lbs)
1.2 (0.045)	5 (11) 15 (33) 20 (44)	250 (551) 300 (661) 350 (771)
1.4 (0.052)		
1.6 (1/16)		

Shielding Gas	Welding Position	Wire diameter		
		1.2mm (0.045in)	1.4mm (0.052in)	1.6mm (1/16in)
M21 (80%Ar + 20%CO_2) M20 (90%Ar + 10%CO_2)	F&HF	200-300A	260-320A	290-340A

Substitution

Supercored 70NS HYUNDAI

HYUNDAI WELDING

BOC recommends HYUNDAI Welding Supercored 70NS for mild steel.

Supercored 70NS is a gas-shielded metal-cored wire designed to combine the high deposition rates characteristic of flux-cored wires with superior efficiency of solid wires. Utilising M20 and M21 mixed gases in accordance with EN ISO 14175, it provides an exceptionally smooth and stable arc, while ensuring minimal spatter and reduced slag coverage.

Shielding gas	Welding Position	Register of shipping & Size mm(in)								
		JIS	ABS	LR	BV	DNV·GL	TUV	CWB	DB	EN
M21 (80%Ar+ 20%CO_2)	PA, PB	Z3313 T49 3 TIS0M A H 5	3SAH5, 3YSA 0.9-1.6 (0.035-1 /16)	3S, 3YSHS 0.9-l.6 (0.035-l /16)	SA3M, SA3YM HHH 0.9-1.6 (0.035-l/1 6)	IIIYMS (HS) 0.9-l.6 (0.035-l/ 16)	ENISO 17632-A-T 42 3 M M 3	CSA W48 E492C-6M -H4	DIN EN ISO 17632-A -T 42 2 MM3	3YS H5
M20 (90%Ar+ l0%CO_2)	PA,PB	Approval certificates are currently pending , with the certification process in progress as of December 2024.								

Item	Tensile Test			Impact Test (CVN -Joule)				
	vs (MPa)	TS (MPa)	EL (%)	Temp °C (°F)	X1	X2	X3	Avg.(J)
M21 (80%Ar +20% CO_2)	482	563	30.2	-30(-22)	78	75	76	76
M20 (90% Ar+ 10% CO_2)	495	578	29.4	-30(-22)	65	67	62	65
AWS A5.18 E70C-6M	≥400	≥480	≥22	-30(-22)	≥27			

Consumable: Supercored 70NS Diameter: 1.2mm Spool : 15kg

Item	Chemical Composition of All-Weld Metal (wt%)					
	C	Si	Mn	P	S	Ni
M21 (80%Ar + 20% CO_2)	0.042	0.59	1.53	0.009	0.006	0.018
M20 (90% Ar+ 10% CO_2)	0.044	0.65	1.56	0.010	0.006	0.019
AWS AS.18 E70C-6M	≤0.12	≤0.90	≤1.75	≤0.03	≤0.03	≤0.50

Consumable: Supercored 70NS Diameter: 1.2mm Spool : 15kg

Diameter mm (in)	Spool kg (lbs)	Pac kg (lbs)
1.2 (0.045)	5 (11) 15 (33) 20 (44)	250 (551) 300 (661) 350 (771)
1.4 (0.052)		
1.6 (1/16)		

Shielding Gas	Welding Position	Wire diameter		
		1.2mm (0.045in)	1.4mm (0.052in)	1.6mm (1/16in)
M21 (80%Ar + 20%CO_2) M20 (90%Ar + 10%CO_2)	F & HF	200-300A	260-320A	290-340A

Dual Shield 70 ULTRA PLUS

Dual Shield 70 Ultra Plus is an all-position wire that is uniquely designed to provide high deposition, outstanding all position performance and a fume emission rate approaching that of solid wires.

Dual Shield 70 Ultra Plus may be used in a variety of applications including railcar, automotive, heavy equipment, and general structural steel fabrication. It is especially recommended in applications where reduction of welding fume is a priority

Specifications	
Classifications	ISO : 173632-B T493T1-1MA- U ASME SFA 5.36 ASME SFA 5.20 AWS A5.36 : E71T1-M20A2-CS1 AWS A5.36 : E71T1-M21A4-CS1 AWS A5.20 : E71T-1M/T-9M
Approvals	CWB CSA W48 : E491T-1M-H16 ABS
Industry	Bridge Construction Civil Construction Railcars Mobile Equipment Ship/Barge Building Industrial and General Fabrication Steel Industry Process Automotive

Typical Tensile Properties				
Condition	Yield Strength	Tensile Strength	Elongation	Reduction in Area
100% CO_2				
As Welded	550 MPa	605 MPa	27 %	-
75% Ar - 25% CO_2				
As Welded	525 MPa	595 MPa	29 %	-
As Welded	570 MPa	605 MPa	25 %	56 %

Typical Charpy V-Notch Properties		
Condition	Testing Temperature	Impact Value
75% Ar / 25% CO_2		
As Welded	-18 °C	72 J
As Welded	-29 °C	54 J
90% Ar / 10% CO_2		
As Welded	-18 °C	92 J
As Welded	-29 °C	58 J

Typical Weld Metal Analysis %				
C	Mn	Si	S	P
100% CO_2				
0.04	1.2	0.7	0.012	0.015
75% Ar - 25% CO_2				
0.04	1.2	0.6	0.012	0.016

Deposition Data					
Diameter	Current	Voltage	Wire Feed Speed	Efficiency (%)	Deposition Rate
92% Ar - 8% CO2					
1.4 mm	157 A	24 V	381 cm/min	86 %	1.8 kg/h
1.6 mm	210 A	24.5 V	381 cm/min	86 %	2.5 kg/h
1.6 mm	545 A	30 V	1270 cm/min	87 %	8.3 kg/h
1.4 mm	205 A	24.5 V	508 cm/min	86 %	2.5 kg/h
1.4 mm	465 A	31.5 V	1524 cm/min	87 %	7.5 kg/h
1.6 mm	410 A	27.5 V	889 cm/min	86 %	5.7 kg/h
1.2 mm	335 A	30.5 V	1524 cm/min	87 %	5.5 kg/h
1.4 mm	365 A	29 V	1270 cm/min	87 %	6.3 kg/h
1.2 mm	200 A	26.5 V	762 cm/min	86 %	2.7 kg/h
1.6 mm	432 A	28.5 V	1016 cm/min	87 %	6.7 kg/h
1.2 mm	293 A	29 V	1270 cm/min	87 %	4.6 kg/h
1.4 mm	335 A	27.5 V	1016 cm/min	87 %	5.0 kg/h
1.6 mm	360 A	26.5 V	762 cm/min	86 %	4.9 kg/h
1.4 mm	265 A	26 V	762 cm/min	86 %	3.7 kg/h
1.6 mm	315 A	25.5 V	635 cm/min	86 %	4.2 kg/h
1.2 mm	150 A	25.5 V	508 cm/min	84 %	1.8 kg/h
1.2 mm	245 A	27.5 V	1016 cm/min	86 %	3.7 kg/h

Recommended Welding Parameters			
Wire Diameter	Current	Voltage	Wire Feed Speed
75% Ar - 25% CO2			
1.2 mm	150-200 A	25.5-26.5 V	508-762 cm/min
1.2 mm	245-293 A	27.5-29 V	1016-1270 cm/min
1.2 mm	335 A	30.5 V	1524 cm/min
1.4 mm	157-205 A	24-24.5 V	381-508 cm/min
1.4 mm	265-335 A	26-27.5 V	762-1016 cm/min
1.4 mm	365-465 A	29-31.5 V	1270-1524 cm/min
1.6 mm	210-315 A	24.5-25.5 V	381-635 cm/min
1.6 mm	360-410 A	26.5-27.5 V	762-889 cm/min
1.6 mm	432-545 A	28.5-30 V	1016-1270 cm/min

EWM Digital Processes

ForceArc Puls XQ

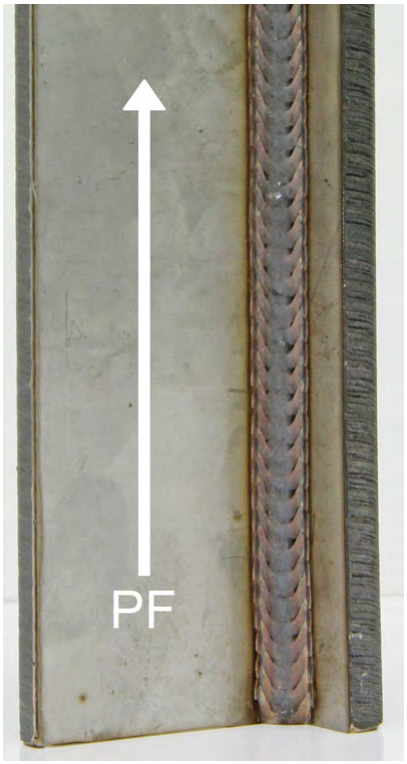
forceArc puls® is a MIG/MAG welding process with a heat-minimised pulsed arc. Easy to handle and suitable for welding non-, low- and high-alloy materials throughout the entire power range.

Key Features :
→ Symmetrical seam formation and the greatest possible seam thickness (throat thickness) on fillet welds
→ Outstanding wetting
→ Deeper, more concentrated penetration with reliable root fusion
→ Fewer welding fumes

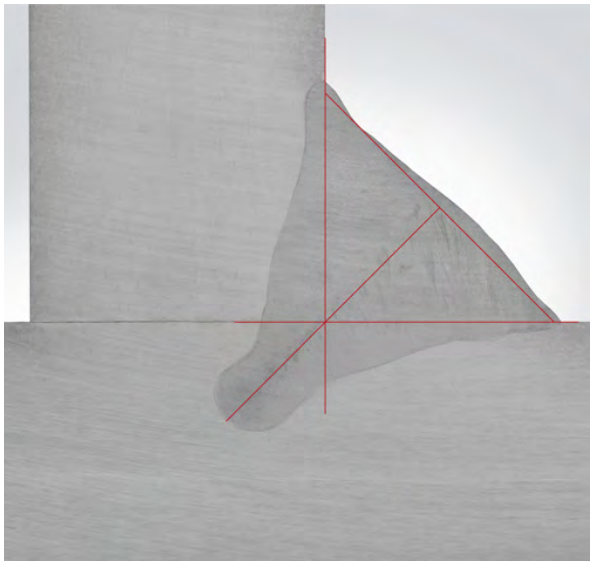
ForceArc XQ

forceArc ® is an efficient and cost-effective welding heat-reduced, directionally stable arc with deep penetration for the higher performance range. Unalloyed, low-alloy and high-alloy steels as well as high tensile fine-grained steels.

Key Features:
→ Smaller included angle due to deep penetration and directionally stable arc
→ Less distortion thanks to heat-reduced, concentrated arc
→ Excellent root and sidewall fusion
→ Unalloyed, low-alloy and high-alloy steels and high-tensile fine-grained steels
→ Manual and automated applications
→ Welded fillet welds exhibit deeper penetration



rootArc / rootArc puls
Vertical-up weld with PF



forceArc puls

RootArc XQ / RootArc puls XQ

rootArc:
Short arc with perfect weld modelling capabilities for effortless gap bridging and positional welding.

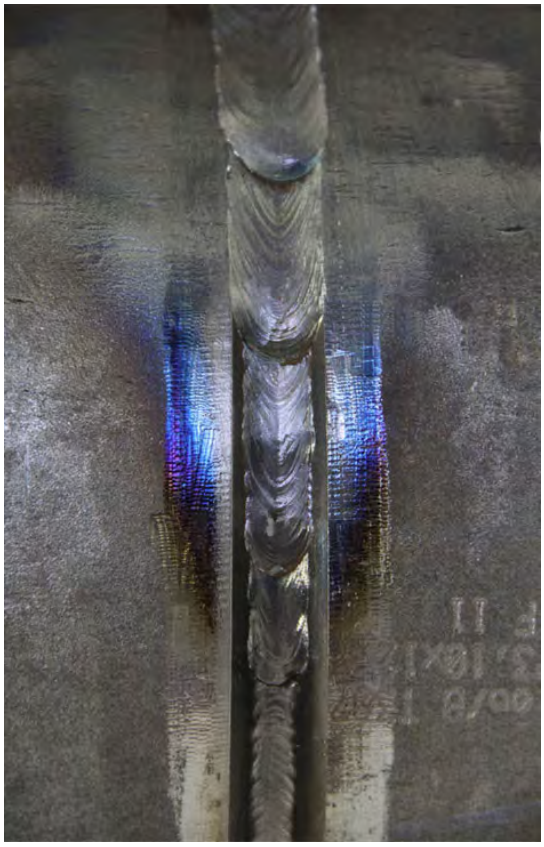
rootArc puls:
- The perfect enhancement for focused heat input for the higher performance range.
- Optimum reduction of spatter compared to standard short arc.
- Perfect for sheet metal from 1 mm and greater.
- Optimal for repair and maintenance.
- Reduced-energy short arc.
- rootArc puls for welding around transitional areas and for initial and final passes.
- Excellent, heat-reduced welding in vertical-up positions (PF) through rootArc - superPuls.
- Superb root formation and secure sidewall fusion.
- Vertical-up welds without weaving.
- Un-alloyed and low-alloy steels.
- Manual and automated applications.

Key Featues:
→ Reliable short arc welding in all positions
→ Ideal for CO_2 and mixed gas
→ Reduced-energy short arc for effortless mastery of gaps
→ Low-spatter, digitally-controlled material transfer
→ Perfect for sheet metal from 1 mm and greater
→ Excellent for butt welds and lap welds

ColdArc / ColdArc Puls

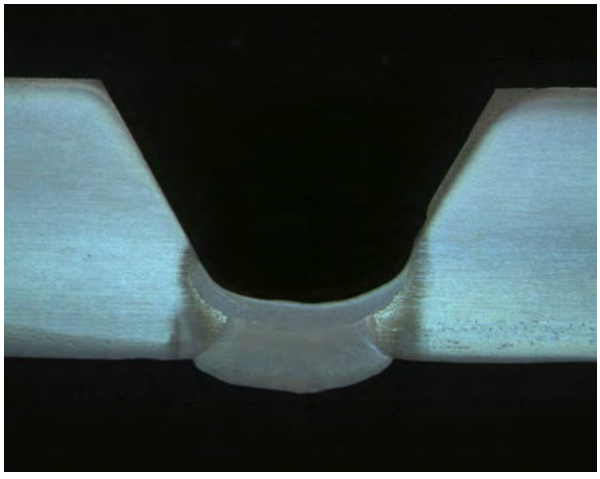
coldArc:
Heat-reduced, low-spatter short arc for high dimensional stability welding and brazing, plus root welding with excellent gap bridging capabilities.

coldArc puls:
- The optimum enhancement for the higher power range, with focused heat input exactly where the heat is required.
- Less distortion and reduced discolouration thanks to minimised heat input.
- Impressive process stability even with long hose packages without additional sensor leads.
- Commercial torch systems, as the material is transferred without drive in the torch, causing no wear and tear.
- Easy welding of root passes in all panel thicknesses and in all positions.
- Excellent wetting of surfaces when brazing thin metal sheets.
- Minimal finishing work, ideal for visible seams thanks to low-spatter process.
- Unalloyed, low-alloy and high-alloy steels and also dissimilar joints of even the thinnest metal sheets.
- Brazing of CrNi sheets with CuAl8/AlBz8.
- Brazing and welding of coated metal sheets, e.g. CuSi, AlSi and Zn.
- Root welding of non-alloyed and low-alloy steels and high-tensile fine-grained steels.
- Visible CrNi seams within the thin metal sheet range.



Sidewall fusion

coldArc / coldArc puls:
- Heat, where heat is needed, with coldArc puls.
- Root welding with coldArc: full control of droplet transfer, minimised risk of lack of fusion.
- Pass build-up and final passes with coldArc puls.
- Performance enhancement for thick metal sheets with coldArc puls.
- Perfect welding with transitional areas with coldArc puls.
- Press torch trigger to switch between coldArc and coldArc puls for secure overlaying of tack points.
- Turn on superPuls to switch between coldArc and coldArc puls automatically for straightforward modelling of the molten metal.
- When superPuls is turned on, the machine switches automatically between coldArc and coldArc puls for outstanding and straightforward welding in the vertical up position, without using the "Christmas tree technique".



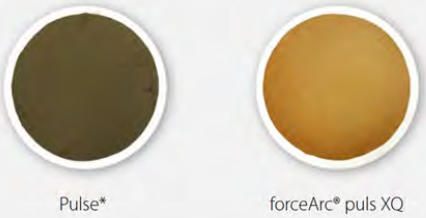
Gap bridging for root passes

Lower fume emission MIG/MAG welding processes

WE ARE WELDING

Stainless Steel

Glass fibre filter after welding

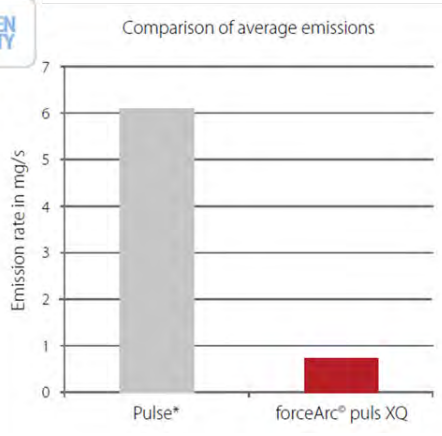


Pulse* forceArc® puls XQ

The glass fibre filter is much dirtier after welding with the pulsed arc than it is after the forceArc® puls XQ process.

* – Mean value as per German Building Trade's Employers' Liability Association information sheet 593 – Harmful substances during welding and related processes (BGI 593 – Schadstoffe beim Schweißen und bei verwandten Verfahren)

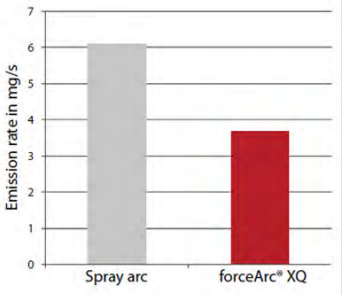
RWTH AACHEN UNIVERSITY



Carbon Steel

FORCEARC® XQ / FORCEARC® PULS XQ

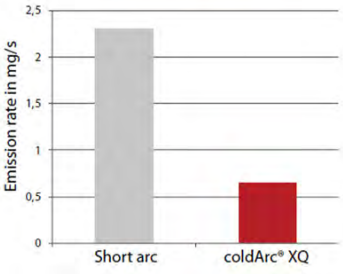
Using forceArc® XQ can reduce emissions by up to 40% thanks to the higher welding fume deposition on the workpiece surface. That means these emissions do not enter the air at all.



TECHNISCHE UNIVERSITÄT DRESDEN

COLDARC® XQ / COLDARC® PULS XQ

The coldArc® XQ process generates significantly fewer emissions than the short arc process while delivering the same deposition rate. Welding fume emissions are reduced by up to 75%.



Substitution

EWM XQ Welding Machines

WE ARE WELDING

Titan XQ puls

- rootArc® XQ / rootArc® puls XQ
- coldArc® XQ / coldArc® puls XQ
- forceArc® XQ / forceArc® puls XQ
- wiredArc XQ / wiredArc puls XQ
- Standard (MIG/MAG)
- Pulse
- Positionweld
- superPuls
- TIG
- MMA
- Gouging
- Bespoke packages available on enquiry

Phoenix XQ puls

- rootArc® XQ / rootArc® puls XQ
- forceArc® XQ / forceArc® puls XQ
- Standard (MIG/MAG)
- Pulse
- Positionweld for aluminium
- superPuls
- TIG
- MMA
- Gouging
- Stocked: Part No.: 091-005644-00001
  Description: PHOENIX XQ 400 PULS DG R1 VRD
- Bespoke Phoenix XQ models & packages available on request

Taurus XQ Synergic

- rootArc® XQ
- forceArc® XQ
- Standard (MIG/MAG)
- superPuls
- TIG
- MMA
- Gouging
- Stocked: PartNo.:091-005650-00001
  Description:TAURUS XQ 400 SYNERGIC DG VRD
- Bespoke Taurus XQ Synergic models & packages available on request

Xnet ready

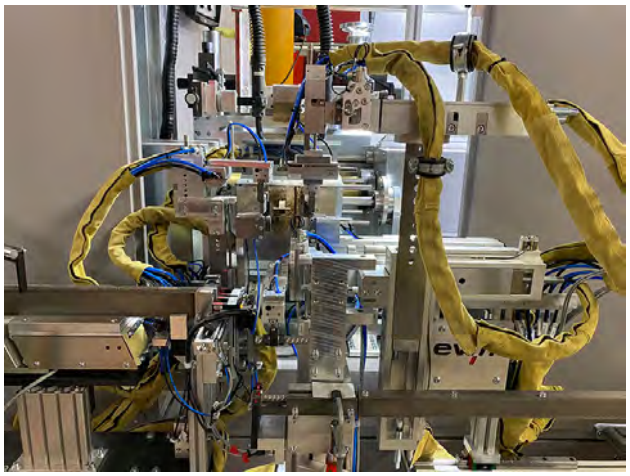
3 Years // 5 Years transformer and rectifier
ewm-warranty*
3 shifts / 24 hours / 7 days

Industry 4.0 ewm

EMW Robot / Cobot Solutions

Welding cobots and robots are gaining in popularity for their benefits in productivity and addressing welder's shortage. But as a "technical" measure in the OSH hiearchy it can also help prevent hazards from coming into close contact with workers. Since the fumes, as the hazard generated by the arc, are still there, we recommend using a cobot with an integrated fume extraction option.

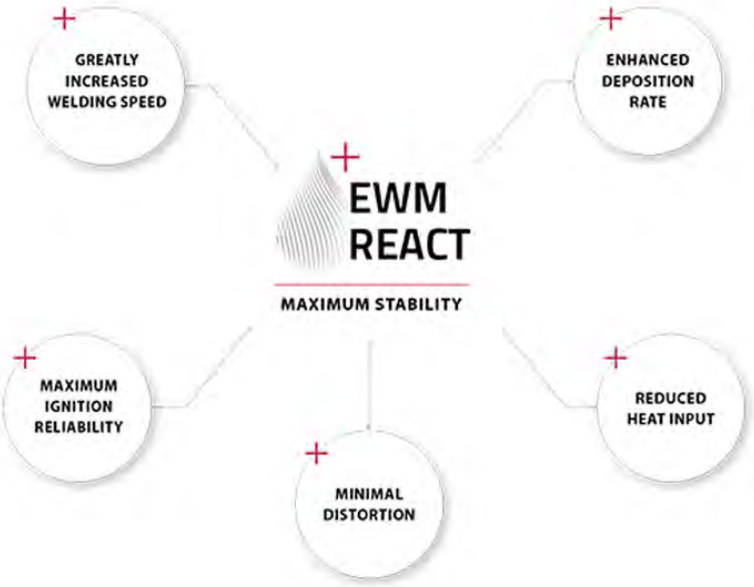
BOC collaborates with several integration partners in Australia and New Zealand who integrate dedicated EWM power sources (Titan XQ, Phoenix XQ or Taurus XQ) with various examples of cobot and industrial robot brands such as ABB, Kawasaki, Kuka, Yasakawa,Motoman, Doosan, Hans, and Universal Robots.



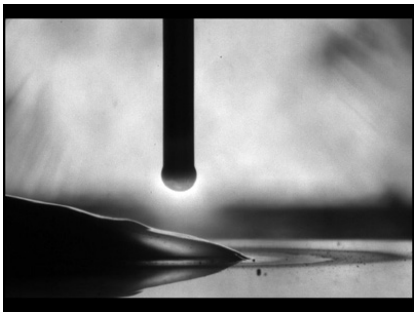
EWM REACT

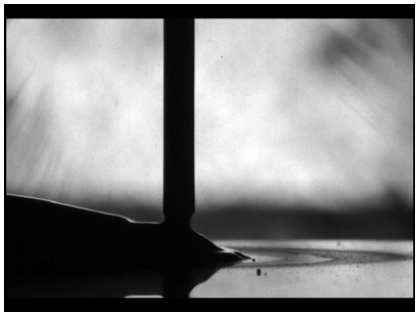
EWM React delivers what you want in a precise and stable automation welding process. With this welding process, you get full control over droplet transfer. Instead of falling off the electrode, the droplet passes safely into the weld pool despite high welding speeds. This results in perfect weld seams which you can rely on even under the heaviest loads. EWM utilise the high deposition rates of the spray arc range and combine them with all the advantages of the short arc. Just as low spatter as the pulsed arc, but cooler in every power range.

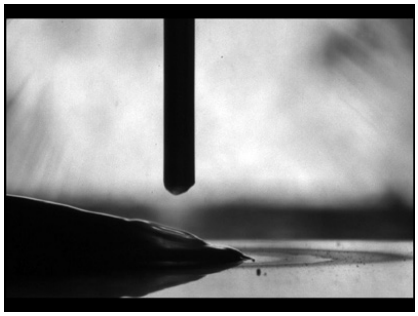
→ Weld more than 100% faster.
→ 35% less heat input.
→ 30% less welding fumes.
→ Almost 0% spatter compared to short arc.
→ Gap bridging up to 2mm.
→ Extremely stable ignition and welding process.
→ 2x higher deposition rate compared to standard short arc.



How EWM React works is by immediately recognizing short circuits and using a reversing wire movement to support droplet detachment. As the wire moves forward and a short circuit occurs, it is actively retracted in a push/pull motion. This mechanism extends the range of the short arc and enables higher deposition rates at very high welding speeds while reducing heat input.







Binzel Fume Extraction Torches and Systems

Powerful welding with integrated welding fume extraction Nowadays, health protection and occupational safety for welders are just as important as precise welding results with the most consistent quality possible. In addition to muscular strain, the risk of harmful welding fumes also comes into consideration. Anyone who employs manual welders must provide them with tools that, on the one hand, fit well in the hand and put as little strain as possible on the musculoskeletal system and, on the other hand, equipment that reliably extracts the harmful welding fumes produced during MIG welding and MAG welding. The gas cooled and liquid cooled fume extraction torches xFUME® PRO are a new generation of torches which meets the current requirements for health and safety at work even more specifically and reliably.

These extraction torches have been specially developed for spot extraction and mobile welding fume extraction – and set new standards in terms of ergonomics, efficiency and weight.

Item number	Description
601.0099.1	XFUME ADVANCED EXTRACTION UNIT 240V 15A
601.KFEC501	FEC C/W XFUME 501 4M
601.0097.1	BINZEL XFUME VAC FLEX 3M
601.0098.1	BINZEL XFUME VAC FLEX 4M
601.K2ADV501	XF ADVANCE DUAL 501 4M
601.K2ADV365	XF ADV DUAL 36 5M
601.K2ADV36	XF ADVANCE DUAL 36 4M
601.K1ADV501	XF ADVANCE SINGLE 501 4M
601.KFES	FES C/W XFUME 36 4M
601.K1ADV365	XF ADV SINGLE 36 5M
601.K1ADV5015	XF ADV SINGLE 501D 5M
601.K2ADV24	XF ADV DUAL 24 4M
601.K2ADV5015	XF ADV DUAL 501D 5M
601.KFEC24	FEC C/W XFUME 24 4M
601.KFEC5	FEC C/W XFUME 36 5M
601.KFEC5015	XF ADV DUAL 501D 5M
601.KFEC	FEC C/W XFUME 36 4M
601.0071.1	FEC EXTRACTION UNIT 240V 10A
601.K1ADV36	XF ADVANCE SINGLE 36 4M

xFUME and FEC – Fume Extraction Systems

Fume extraction torch systems are closer to the weld arc and catch higher concentrations of welding fume to limit the spread.

Capture at source keeps air from entering not just the breathing zone of the welder, but also from spreading to other parts of the plant and exposing other people on the shop floor.

→ Powerful, high-vacuum technology with more than 20 kPa (80" w.g.) negative pressure
→ Supports up to two work stations with one system
→ Automatic filter cleaning with compressed air
→ Filters out up to 99.5% of all dust >0.1µm
→ Automatic start/stop via current clamp
→ Compact & robust design with casters for mobile use and easy transport

Technical Specs.	Fume Extraction System FEC	xFUME Vac Advanced 230 V
Max. airflow:	135 CFM (230 m³/h)	360 CFM (610 m³/h)
Connections:	2	2
Connection diameter:	50mm	60 mm
Max. vacuum:	19,000 Pa	24,000 Pa
Noise level:	≤ 76 dB (A)	≤ 80 dB (A)
Voltage:	115V 50/60 Hz	230V 60 Hz
Motor power:	1.1 kW	1.6 kW
Filter efficiency:	permanent filter dust class M, 0.8 m²	≥ 99.5 %
Cleaning:	Automatic	Automatic
Adjustable air flow:	Yes	Yes
Automatic start/stop:	Yes	Yes
Weight:	25.0 kg	53.5 kg
Size:	590 × 425 × 825 mm	530 × 370 × 1000 mm

Fume Extraction Cyclone

xFUME Advanced

ALLCLEAR – Fume Extraction Systems

Weldclass ALLCLEAR MA100 Mobile Fume Extractor

- → For welding and grinding fumes.
- → Operates on ~230V 10A single phase power.
- → Single 3m arm.
- → 'In situ' filter cleaning (access via cleaning door, clean with compresses air nozzle).
- → One of the most popular ALLCLEAR mobile units.
- → Compact and mobile.

Technical Specs.	Fume Extraction System FEC
Max. airflow:	1,600m³/hr
Motor Power:	1.1kW
Main Supply:	-230V 10A
Area of Filter Cartridge:	14.5m²
Filter Cleaning:	Manual
Standard arm length:	3 metres
Body:	Galvanised Steel
Fan:	Aluminium
Noise:	74 db (A)
Sound Insulation:	Acoustic Sponge
Weight:	100kg
Size:	780 × 600 × 1000 mm

ALLCLEAR MA100
Part No:. 91100MA1

Personal Protective Equipment

Speedglas®

And finally when all other measures have been employed, the final line of defense for fume is with Personal Protection Equipment (PPE).

3M Speedglas G5-03 Pro Air Fixed Front Welding Helmets with Heavy-Duty Adflo PAPR

The Speedglas G5-03 Pro Air Welding Helmet is a slim and lightweight respiratory welding helmet featuring the latest technology from 3M Speedglas. The G5-03 Pro Air is over 10% lighter than the Speedglas G5-01 Welding Helmet and has a 30% more attractive starting price point.

- → True-View optics for improved colour and contrast
- → SideWindows for enhanced peripheral vision
- → Adjust helmet airflow with Climate Control
- → Optional extra head and neck covers available
- → Optional task light designed for welding
- → Heavy-duty Adflo PAPR for 12hrs respiratory protection (RMPF = 50)

Choose between 3 welding lens options:

Part No.: AWS631830

Speedglas G5-03VC

- → Variable colour tones in the dark state (natural, cool, warm)
- → New TAP Technology for easy switching (weld/cut/grind)
- → Extra-large welding lens viewing area (73 x 109mm)
- → Extra dark shade 14 for heavy duty welding (3/5, 8 – 14)
- → Bluetooth® connectivity

Part No.: AWS631820

Speedglas G5-03TW

- → New TAP Technology for easy switching (weld/cut/grind)
- → Extra-large welding lens viewing area (73 x 109mm)
- → Extra bright light state 2.5 (2.5/5, 8 – 13)
- → Bluetooth® connectivity

Part No.: AWS631810

Speedglas G5-03NC

- → Large 55 x 107mm welding lens viewing area
- → Shades 3/5, 8 – 12

CIGWELD ARCMASTER Welding Helmet series with the Cyclone PAPR Fume Extraction.

Experience the highest level of respiratory protection against carcinogenic welding fumes at a reasonable price. Designed for professional performance and everyday durability, these units provide clean, breathable air in the harshest work environments. Ideal for welding, cutting, grinding, and sanding applications, they combine advanced filtration technology with lightweight comfort and all-day wearability.

- → Next-gen respiratory protection for hazardous welding fumes
- → Affordable solution without compromising safety or quality
- → Advanced filtration system for cleaner, healthier air
- → Lightweight and comfortable design for extended use
- → Built for durability in tough industrial environments
- → Long battery life for all-day performance
- → Ideal for both workshops and on-site operations

Part No.: 45XC90F1AIR

CIGWELD Arcmaster XC90F AIR with Cyclone PAPR Trade Kit

- → Features a flip-lid with easy nod-down design with a massive clear grinding visor to effortlessly switch between welding and grinding.
- → Experience a panoramic view of the weldment with one of the largest viewing areas (118 x 83mm = 99mm^2) in a flip welding helmet and shade 5 passive side-windows.
- → Comes with a Bluelight outer cover lens for improve visibility and reduced eye strain.
- → 9 memory profiles can be manually set for various welding processes.
- → Supplied standard with a super comfortable 5-Point Head Harness for all-day use.

Part No.: 45XC10F1AIR

CIGWELD Arcmaster XC10 AIR with Cyclone PAPR

- → Features a Flip-N-Nod lens that makes switching between welding and grinding effortless.
- → Boasts a high impact rating for the grinding lens and for the helmet shell.
- → Experience Enhanced clarity and colour recognition with Ultra View technology.
- → The lightweight ADF offers variable shade range for cutting (4-8) and welding (9-13) with the ability to adjust sensitivity and delay.

Weldclass Mobile Fume Extractor and Welding Helmet.

Weldclass Be Outstanding

Weldclass equipment is designed with safety and performance in mind, offering effective solutions for fume reduction in welding environments, with user-friendly features, robust construction, and reliable performance that help protect welders while maintaining productivity and meeting workplace safety standards.

Part No.: WC-06700

Weldclass PROMAX 680R Welding Helmet

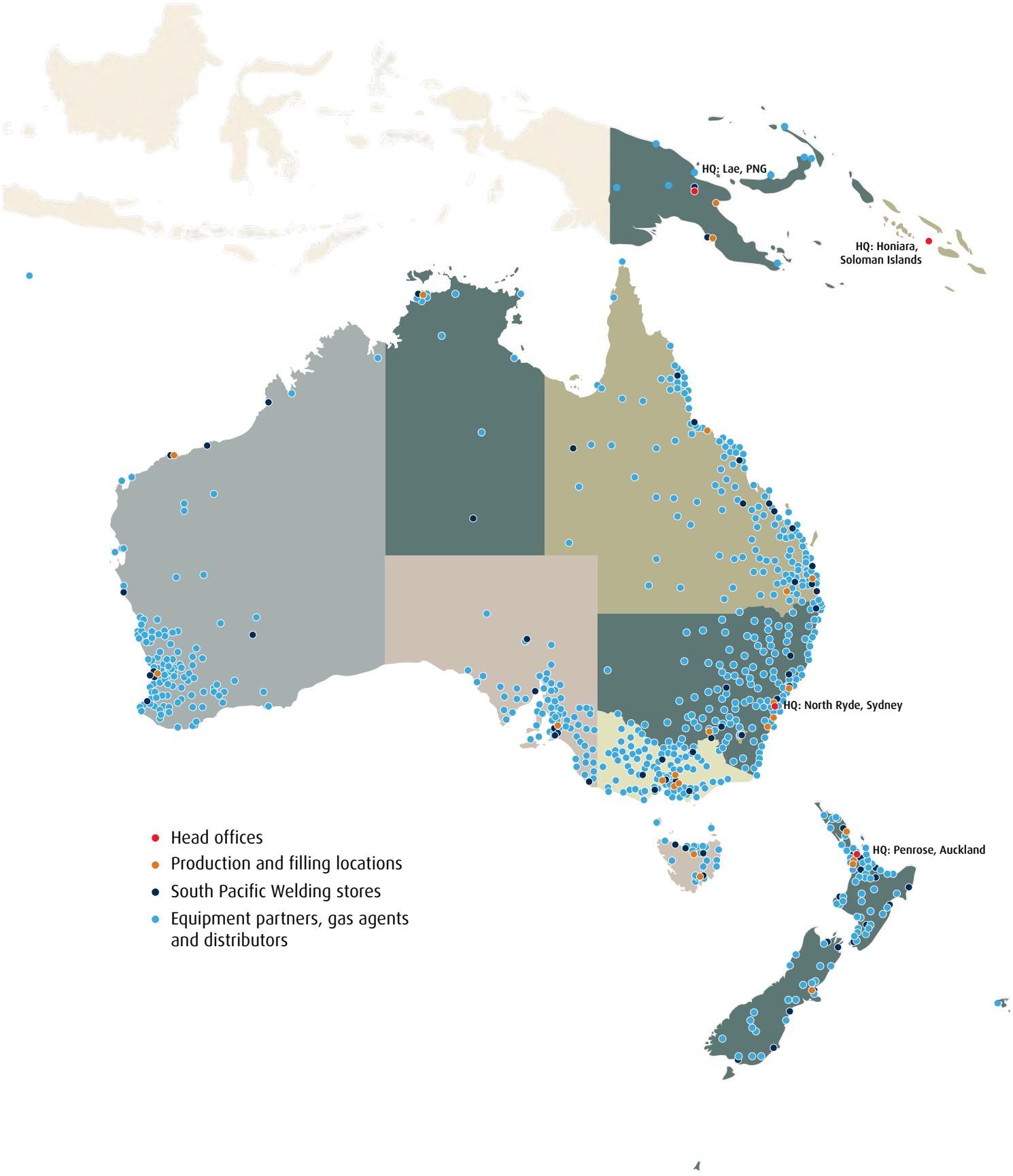
- 116 x 81mm 'landscape' format for wider & more natural field of view.
- Illuminated LCD screen.
- Choice of auto or manual shade, sensitivity & delay adjustments.
- The lightweight ADF offers variable shade range for cutting (4-8) and welding (9-13) with the ability to adjust sensitivity and delay.

Part No.: WC-06702

Weldclass PROMAX 850R Welding Helmet

- Wide view grinding visor, side view windows.
- Super-size 95cm2 viewing area.
- Illuminated LCD screen.
- Audio, visual and vibration filter alarm.
- Choice of auto or manual shade, sensitivity and delay adjustments.

Our distribution and network



DISCLAIMERS

All information presented is correct at time of printing and is subject to change without notice.

All Fume Emission Rate (FER) data were generated according to industry standards (e.g. ISO and AWS) and are provided for reference and comparison purposes only. FER is only one factor effecting workplace air quality. Your actual welding conditions, materials, processes, and methods will also affect workplace air quality and the welder's exposure levels. Users and employers have the sole responsibility for and control over workplace conditions, including the manner in which work is performed and the safety measures taken. Always read and follow all information on product labeling and safety data sheets when using BOC products. Safety data sheets for BOC products, including references to other important and helpful information specific to your location, can be found by visiting BOC Gas: Gas Safety Data Sheets.

If you have any questions about reducing or controlling welding fumes, or complying with applicable standards in your workplace, you should consult with a qualified industrial health professional who can assess your unique facts and provide customized advice about options available to you.

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