

COLD METAL TRANSFER

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**WE HAVE THREE DIVISIONS
AND ONE PASSION:
SHIFTING THE LIMITS.**

A „COLD“ WELDING PROCESS WAS LONG CONSIDERED A COMPLETE IMPOSSIBILITY. WE WEREN'T PREPARED TO LEAVE IT AT THAT.

/ Since 1950

we've been developing innovative comprehensive solutions for arc welding and resistance spot-welding

/ Since 2002

there is the revolutionary welding process „Cold Metal Transfer“ (CMT)

/ Aluminium and steel

can now be welded together

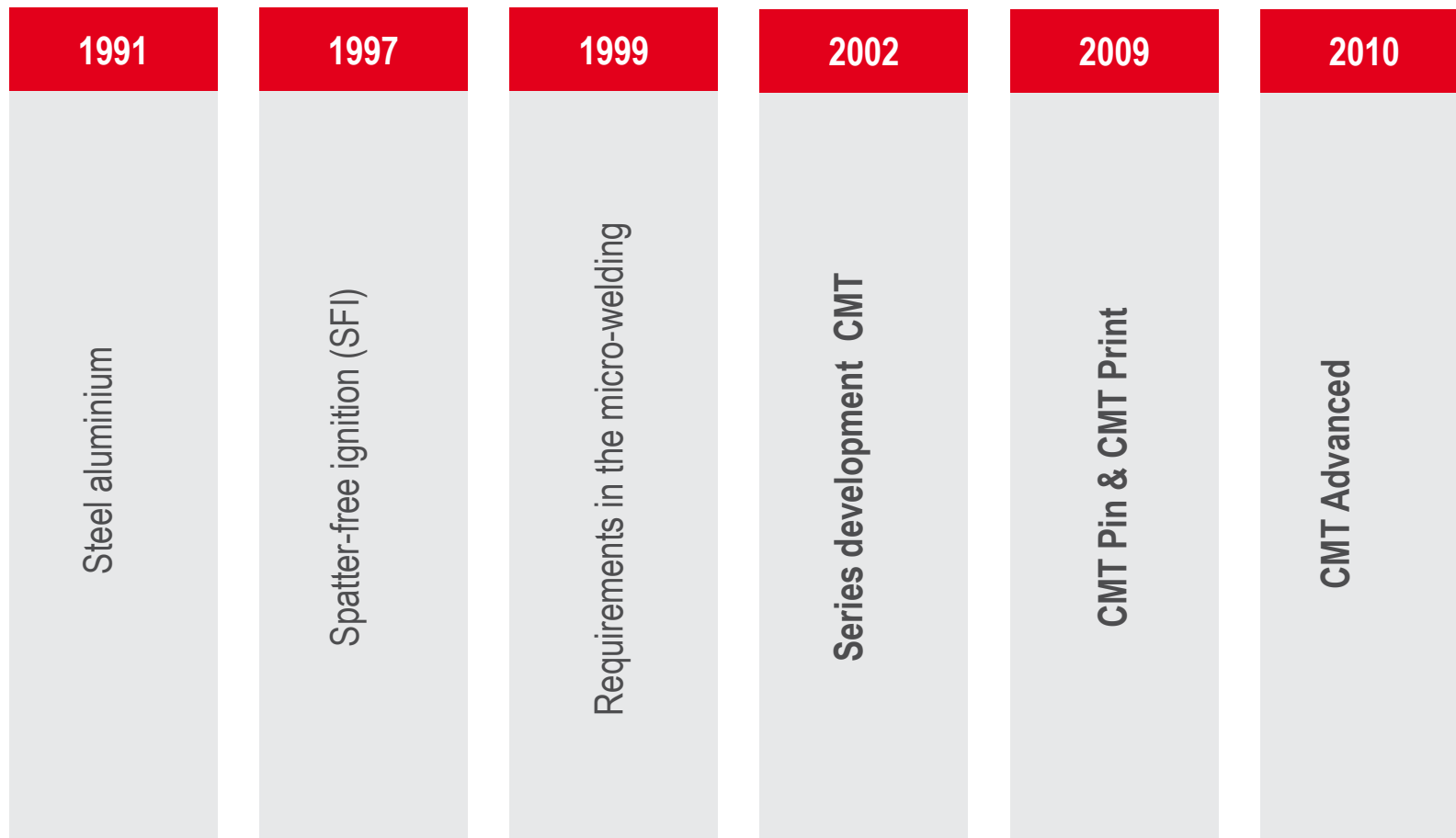
/ Our Vision

to decode the „DNA of the arc“

THE CMT PROCESS



GENESIS

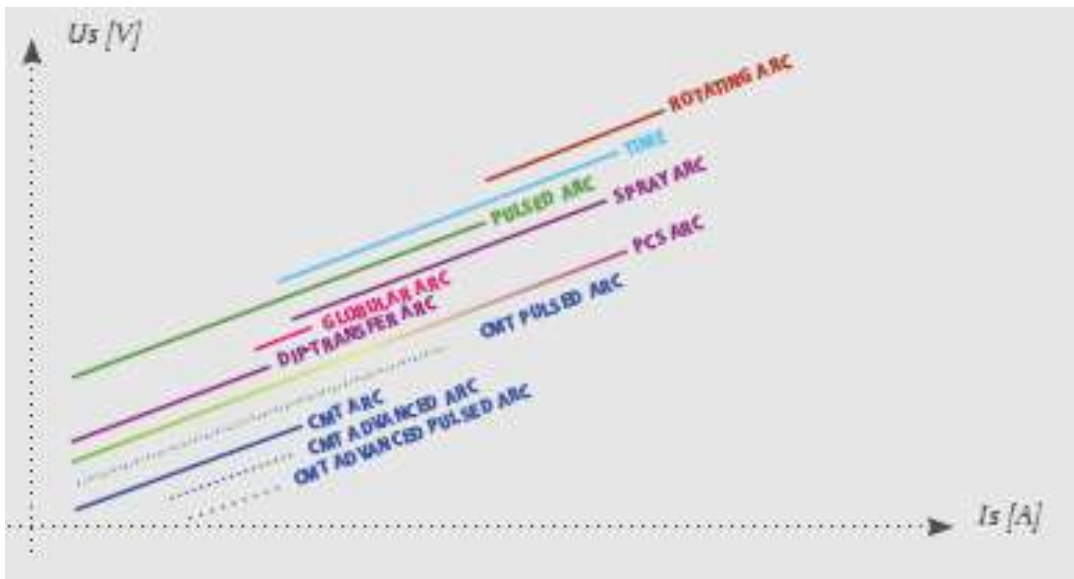


CMT: Three letters that stand for the stablest weld process anywhere in the world

- / Integrated wire motions**
- / No spattering**
- / Extremely low thermal input**
- / Extremely stable arc**

YOU CAN ALWAYS MAKE A BETTER THING EVEN BETTER: CMT PROCESS AND IST IMPROVEMENTS

- / CMT
- / CMT Pulse
- / CMT Advanced
- / CMT Advanced Pulse

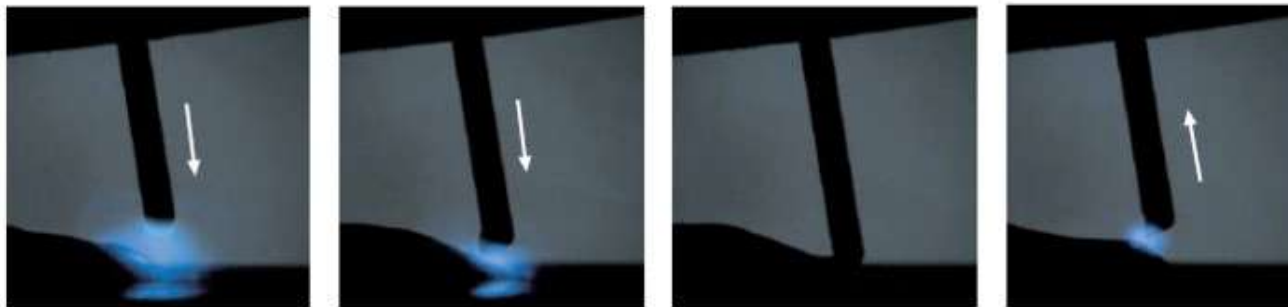


Comparison of arc technologies

CMT PROCESS

- / Wire movement integrated in process control
- / Controlled, low heat input
- / Stable arc
- / Economically due to higher welding speed

/ Integrated wire movement



/ Droplet detachment in the short circuit

CMT PULSE PROCESS

- / Combination of pulsing cycles with CMT cycles**
- / More heat input**
- / Higher welding speed**
- / Specific and variable addition of pulses**
- / Huge breadth of performance and flexibility**

/ combination of CMT cycles and pulsing cycles

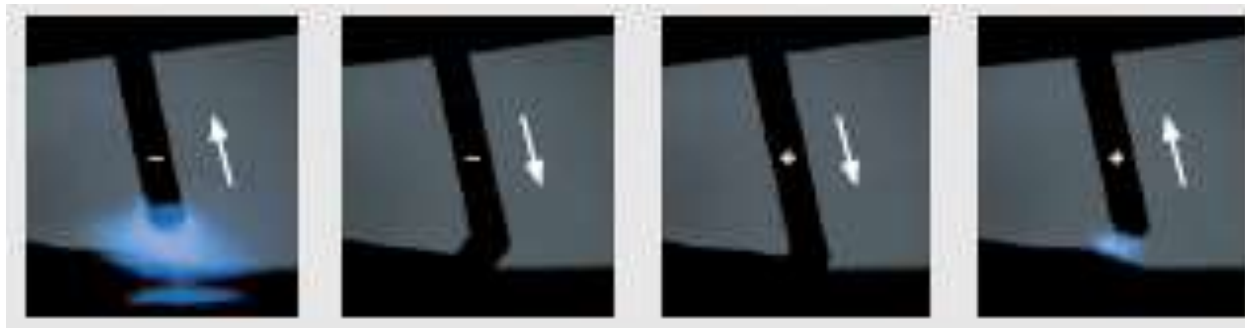


/ Pulsed-arc positive

CMT ADVANCED PROCESS

- / Polarity of the welding current integrated in process control
- / Polarity reversal takes place in the short-circuit phase
- / Tightly controlled heat input
- / Extremely high gap bridge-ability due to a bigger deposition rate

/ Combination of CMT negative and CMT positive



/ CMT negative

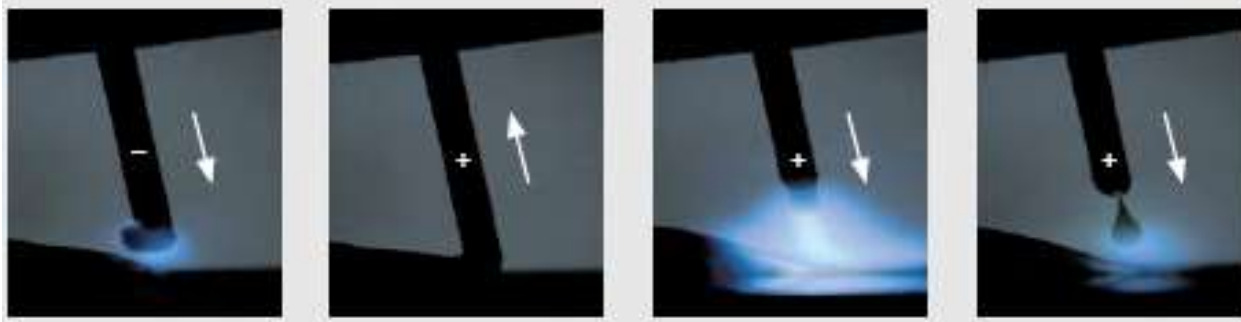
/ Initialisation

/ CMT positive

CMT ADVANCED PULSE PROCESS

- / Combination of negatively poled CMT cycles and positively poled pulsing cycles
- / Absolute precision
- / Very greatest mastery of the arc

/ Combination of CMT negative and pulsing cycles



/ CMT negative

/ Initialisation

/ Pulsed-arc positive

Benefits

EXTREMELY LOW SPATTERING

.....
up to 99 % less spatter

EXCELLENT GAP BRIDGEABILITY

.....
up to 60 % more deposition

MINIMAL DISTORTION

.....
by lower thermal input

LESS DILUTION OF BASE AND FILLER METAL

.....
up to 50 % lower

EXTREMELY LOW THERMAL INPUT

.....
up to 90 % less heat input

ULTRA-HIGH-PRECISION WELD PROCESS

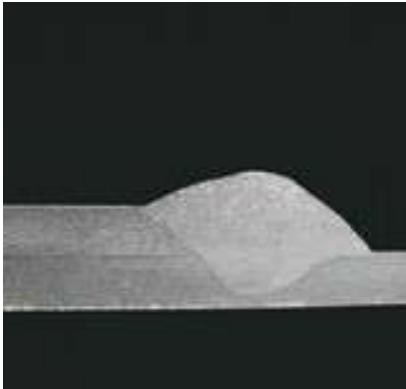
.....
100 % reproducibility and the best process-control
new fields of application like CMT Pin and CMT Print

HIGHER WELDING SPEEDS

.....
up to 10 times faster

CMT on steel
Higher welding speeds
Extremely low spattering
Extremely low thermal input

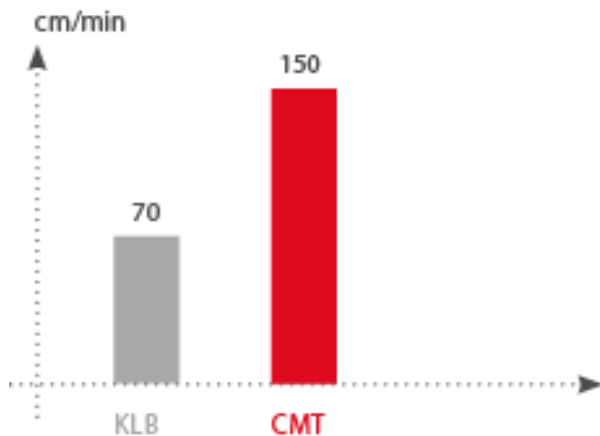
CMT ON STEEL



Dip-transfer arc



CMT



Higher welding speeds

- / Dip-transfer arc I: 185 A, U: 17.6 V
- / CMT I: 200 A, U: 16.2 V

50 % faster

- / Dip-transfer arc Vs = 70 cm/min
Vs = 27 in/min
- / CMT Vs = 150 cm/min
Vs = 59 in/min

CMT ON STEEL



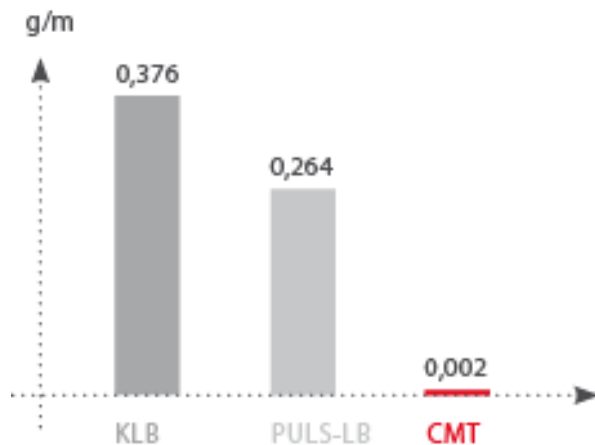
Dip-transfer arc

Pulsed

CMT

Extremely low spattering

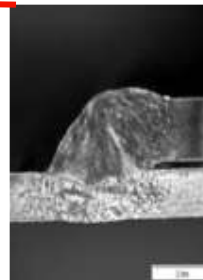
- / Steel, measured over 1 m (3.2 ft) length of weld-seam



- 99,5 % less spatter

- / Dip-transfer arc 0,376 g/m
- / Pulsed 0,264 g/m
- / CMT 0,002 g/m

CMT ON STEEL: PRACTICAL EXAMPLE VOLVO



Volvo / Automotive

- / Volvo XC 60 car body (BIW)
- / Steel, Usibor
- / Following advantages result from the use of CMT
- / Joining of Usibor is possible
- / 20 % higher welding speed
- / less spatter

CMT ON STEEL



Dip-transfer arc



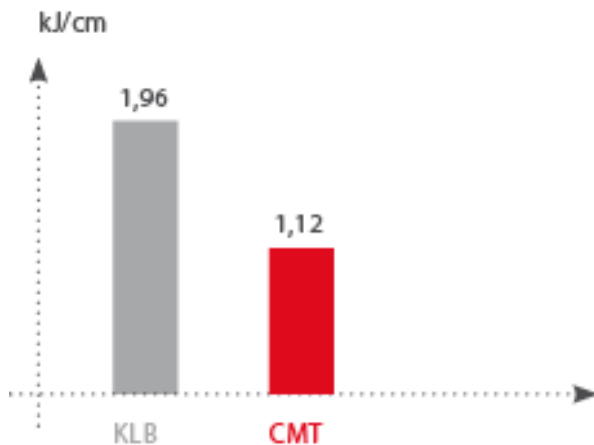
CMT

Extremely low thermal input

- / Mixed gas M21
- / Material: steel 1 mm (0.04 in)
- / Dip-transfer arc I: 97 A, U: 18,1 V
- / CMT I: 98 A, U: 11,8 V

- 50 % less thermal input

- / Dip-transfer arc 1,96 kJ/cm
- / CMT 1,12 kJ/cm



CMT ON STEEL: PRACTICAL EXAMPLE BMW



BMW / Automotive

- / BMW 1
car body (BIW)
- / steel
- / Plug welding
- / Following advantages result from the
use of CMT
- / 20 % higher welding speed
- / 70 % less spatter
- / Better gap bridgeability
(up to 1,2 mm)
- / **Less thermal input**

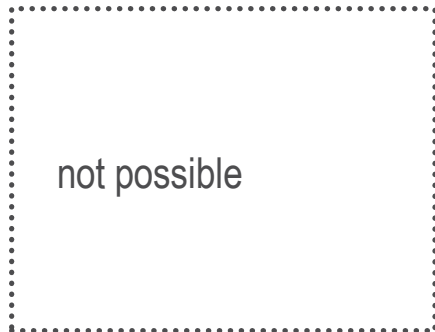
CMT on aluminium

Ultra-light-gauge joints

Higher welding speeds

Excellent gap bridgeability

CMT ON ALUMINIUM



Pulsed arc



CMT

Ultra-light-gauge joints, Higher welding speeds

- / Material aluminium 0,3 mm (0.01 in)
- / Pulsed arc not possible
- / CMT
Vs = 6,4 m / min
Vs = 21 ft/min



Pulsed arc



CMT

+ 50 % faster

- / Material aluminium 3 mm (0.12 in)
- / Pulsed arc
Vs = 1,1 m/min
Vs = 3.6 ft/min
- / CMT
Vs = 1,7 m / min
Vs = 5.6 ft/min

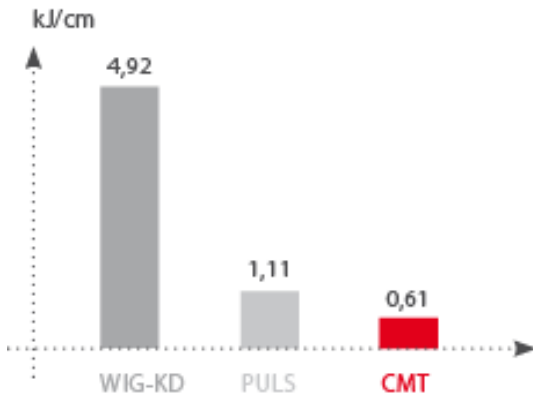
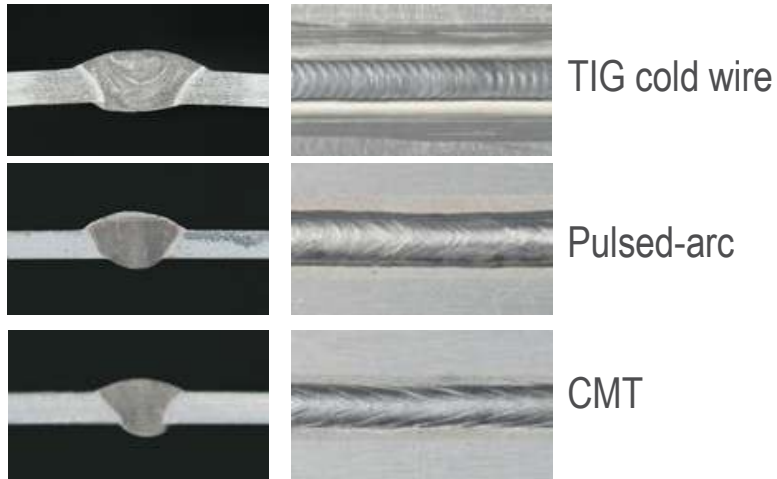
CMT ON ALU: PRACTICAL EXAMPLE PLZ MIELEC



PLZ Mielec / Aircraft

- / Helicopter outer skin
- / Aluminium 6xxx
- / **Light-gauge sheet 0,8 mm**
overhead butt weld
no weld pool backing
- / **Welding speed 1,8 m / min**
- / Minimal distortion

CMT ON ALUMINIUM



Higher welding speeds

10 times faster

- / Material aluminium 1,6 mm (0.06 in)
- / TIG cold wire I: 84 A, U: 17.4 V
Vs = 24 cm/min (9.45 in/min)
- / Pulsed-arc I: 88 A, U: 18.6 V
Vs = 100 cm/min (40 in/min)
- / CMT I: 99 A, U: 16.7 V
Vs = 200 cm/min (80 in/min)

- 90 % Thermal input

- / Material aluminium 1,6 mm (0.06 in)
- / TIG cold wire 4,92 kJ/cm
- / Puls 1,11 kJ/cm
- / CMT 0,61 kJ/cm

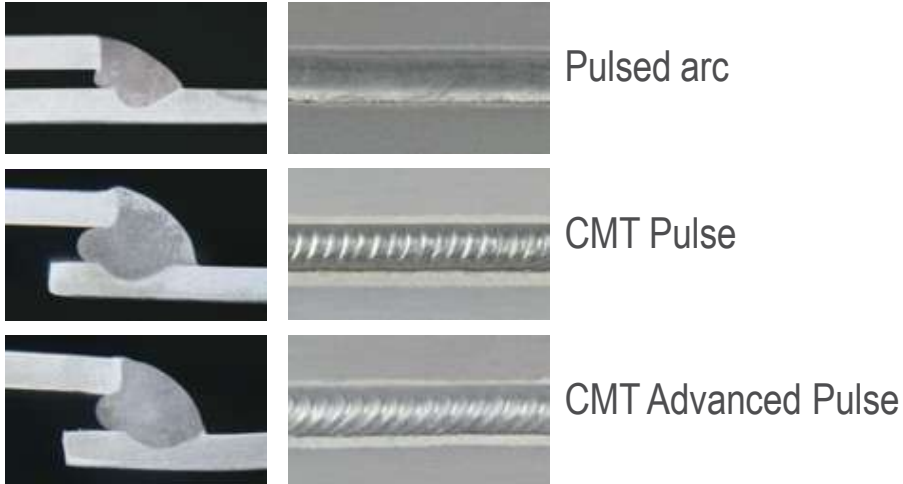
CMT ON ALU: PRACTICAL EXAMPLE CONTAC



Contac / Automotive, -supplier

- / Fuel supply line
- / AlMn1 / AlMg3
- / Three sheet joint (laminated joint)
(pipe/flange/coupling)
- / Variable thicknesses 0,8 - 3,0 mm
- / **Assured deep penetration necessary
with no through penetration**
- / Welding speed 90 cm / min
- / Only feasible with CMT

CMT ON ALUMINIUM



Excellent gap bridgeability 2,5 mm (0.1 in) gap

/ Material: aluminium 2 mm (0.08 in)

/ Pulsed arc

1 mm gap (0.04 in)

I: 100 A, U: 18.9 V, Vd = 4,5 m

Vs: 60 cm/min (23 in/min)

/ CMT Pulse

2 mm gap (0.08 in)

I: 97 A, U: 16.9 V, Vd = 5 m

VS: 60 cm/min (23 in/min)

/ CMT Advanced Pulse

2,5 mm gap (0.1 in)

I: 97 A, U: 11.9 V, Vd = 6 m

VS: 60 cm/min (23 in/min)

CMT ON ALU: PRACTICAL EXAMPLE MAGNA



Magna Steyr / Automotive and -supplier

- / Bodies of premium sedans and sport cars
- / AlMgSi-alloy 6014
- / B-pillar 1,1 mm is connected to the sheet metal roof with same thickness
- / Welding speed 40 cm /min
- / **The gap which has to be filled is several millimeters**
- / With CMT Advanced the gap bridgeability has been realised

CMT Steel/Alu, CrNi, Cladding
Steel/Aluminium Hybrid join
Higher welding speeds
Extremely low dilution - Cladding

CMT STEEL/ALUMINIUM



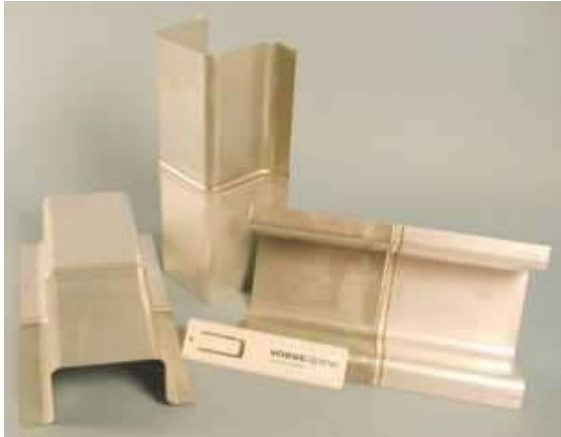
Hybrid join

/ Material: steel and aluminium

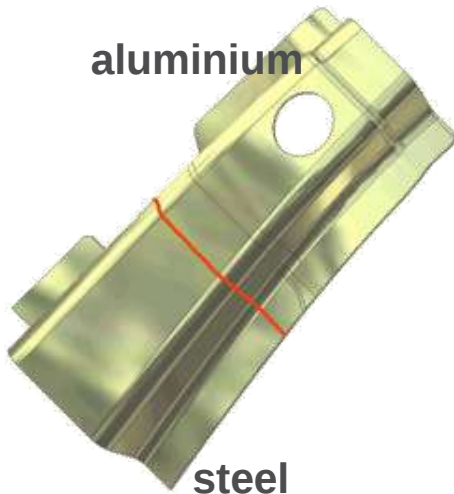


Crash-test proven

CMT STEEL/ALU: PRACITCAL EXAMPLE VOEST ALPINE



aluminium



steel

Voest Alpine / Supply industry

- / Hybrid blank
- / **Steel-aluminum**
- / Target is the weight reduction in automotive engineering
- / Several activities concerning multi-material-mix (Steel with aluminium)
- / Development of a semi-finishing production tool for Steel-aluminium blank

CMT CRNI 2,0 mm (0.08 in)



TIG cold wire



CMT

Higher welding speeds

5 times faster

- / Material: CrNi 2mm (0.08 in)
- / TIG cold wire
I: 84 A, U: 17.4 V
Vs: 24 cm/min (9.45 in/min)
- / CMT
I: 138 A, U: 19 V
Vs: 130 cm/min (51.12 in/min)

CMT CRNI: PRACTICAL EXAMPLE ELB-FORM

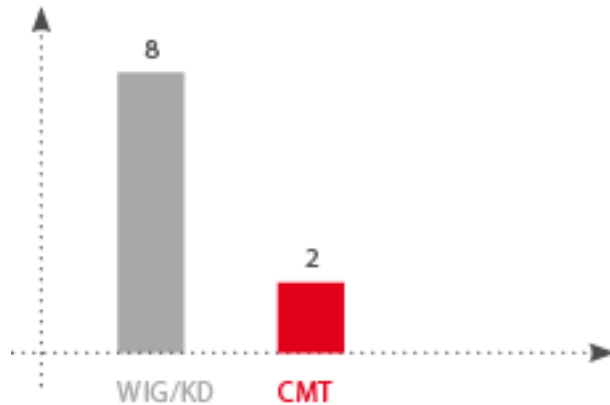


ELB-Form / Automotive and -supplier

- / CrNi hollow body produced through internal high pressure forming
- / High tensile structural and light components
- / Increased productivity, quality and reduced production costs through ...
- / reduced thermal input
- / faultfree, reproducible welds
- / **Highly increased welding speeds**

CLADDING

Fe-content in 1st pass



Extremely low dilution during Cladding: - 75 %

- / Fe-content in 1st pass
- / TIG cold wire 8 %
- / CMT 2 %



TIG cold wire



CMT

+ 50 % faster

- / TIG cold wire Vs: 40 cm/min
Vs: 15.75 in/min
- / CMT Vs: 80 cm/min
Vs: 31.5 in/min

CLADDING: PRACTICAL EXAMPLE



Uhlig / Power Plant construction

- / Cladding of tube panels
- / Cladding for use in harsh environments
- / Power Plant construction using CrNi materials
- / ST 35.8, 16 Mo3, 13crmo45, 10 Crmo9-10
- / Target is a greatly reduced dilution of the sub-straight.
- / **Dilution (Fe content)**
1st layer 3 %
2nd layer 0,6 %

**CMT Brazing, CO₂-Shielding gas
CMT Pin, CMT Print
Extremely low thermal input (brazing)
Extremely low spattering (CO₂)
Ultra-high-precision weld process
(Pin, Print)**

CMT BRAZING

Copper fume concentration mg/m^3



Zinc concentration mg/m^3



Extremely low thermal input during CMT Brazing

- / Material: hot-dip galvanised sheets
- / Fewer pollutants than with pulsed-arc and dip-transfer arc
- / 90 % less copper fume concentration
- / 63 % less zinc concentration

CMT BRAZING: PRACTICAL EXAMPLE VW MOSEL



VW Mosel / Automotive

- / Car body Bently Continental GT
- / High strength galvanized steel
- / Additional material CuSi 3
- / Different thicknesses
- / Stability and optics is very important
- / Perfect results because of **less thermal input and minimal distortion**
- / spatterfree

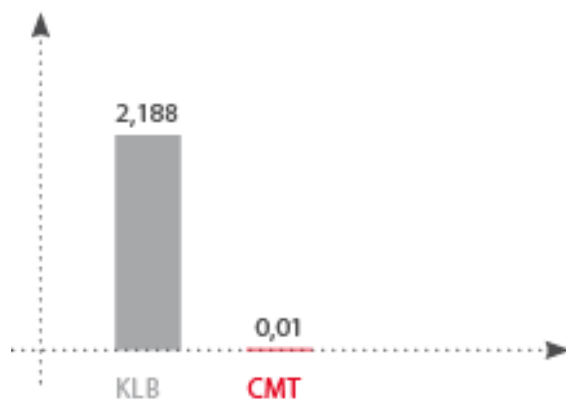
CO₂ SHIELDING GAS



Extremely low spattering with CO₂ shielding gas

- / Material: steel
- / Measured over 1 m (3.2 ft) length of weld-seam

Spattering g/m



- 99% less spatter

- / Dip-transfer arc 2,188 g/m
- / CMT 0,01 g/m

CO₂ SHIELDING GAS: PRACTICAL EXAMPLE ARBONIA



Arbonia AG / plants and container

- / Heat exchange collection pipe
 - / steel
 - / Thick and thin gage joints
 - / Variable weld types
 - / Improved weld bead penetration prevents leakage
 - / **Reduced spatter prevents re-work**
- weld bead shape is important
→ on visible welds

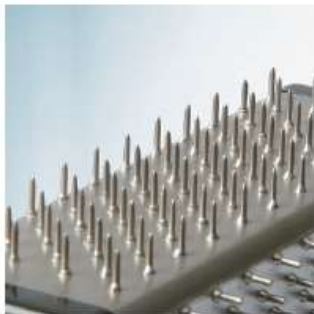
CMT PIN, CMT PRINT



CMT Print

Ultra-high-precision MIG/MAG Weld Process

- / Exceedingly high precision of CMT Pin and CMT Print
- / Extension of the applications of the process



CMT Pin Pike



CMT Pin Cylindrical



CMT Pin Ball

CMT PIN, CMT PRINT: APPLICATIONS



CMT PIN

- / Assembly aids
- / Spacers
- / Anchor pins



CMT PRINT

- / Handles
- / Anti-slip surfaces
- / Braille

SYSTEM DESCRIPTION

WIREFEEDER

For feeding the filler metal precisely and smoothly

DIGITALLY CONTROLLED MIG/MAG POWER SOURCE

unrivalled precision
exact reproducibility
superlative welding properties

COOLING UNIT

Ensures optimum water cooling of the welding torch



WIRE BUFFER

Ensures smooth wire travel

ROBACTA DRIVE CMT WELDING TORCH

Ensures accurate wirefeed and constant contact pressure

CONTEC

two moveable half-shells ensure the highest process stability in contacting

PRODUCT RANGE: CMT



/ TransPulsSynergic 2700 CMT

/ MV

/ TransPulsSynergic 3200 CMT

/ Remote

/ MV, MV Remote

/ 460V

/ TransPulsSynergic 4000 CMT

/ Remote

/ MV, MV Remote

/ 460 V

/ TransPulsSynergic 5000 CMT

/ Remote

/ MV, MV Remote

/ 460 V

TECHNICAL DATA

	TPS 2700 CMT	TPS 3200 CMT	TPS 4000 CMT	TPS 5000 CMT
Mains voltage	3x400V +/-15%	3x400V +/-15%	3x400V +/-15%	3x400V +/-15%
Mains frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Mains fuse protection	16 A	35 A	35 A	35 A
Degree of efficiency	87 %	91 %	88 %	90 %
Welding current range	3 – 270 A	3 – 320 A	3 – 300 A	3 – 500 A
DC at 10 min/40 °C (104 °F)	40 % at 270 A	40 % at 320 A	40 % at 400 A	40 % at 500 A
DC at 10 min/40 °C (104 °F)	100 % at 170 A	100 % at 220 A	100 % at 320 A	100 % at 360 A
Open circuit voltage	50 V	65 V	70 V	70 V
Working voltage	14,2 – 27,5 V	14,2 – 30 V	14,2 – 34 V	14,2 – 39 V
Protection class	IP23	IP 23	IP 23	IP 23
Dimensions l/b/h in mm	625/290/475 mm	625/290/475 mm	625/290/475 mm	625/290/475 mm
Dimensions l/b/h in in.	24.5/11.4/18.7 in	24.5/11.4/18.7 in	24.5/11.4/18.7 in	24.5/11.4/18.7 in
Weight	27 kg / 59.5 lb	35,6 kg / 78.6 lb	35,2 kg / 77.6 lb	35,6 kg / 78.6 lb

PRODUCT RANGE: CMT ADVANCED

/ CMT Advanced 4000
/ MV



TECHNICAL DATA

	CMT Advanced 4000
Mains voltage	3x400V +/-15%
Mains frequency	50/60 Hz
Mains fuse protection	35 A
Degree of efficiency	88 %
Welding current range	3 – 300 A
Duty cycle at 10 min/40 °C (104 °F)	40 % at 400 A
Duty cycle at 10 min/40 °C (104 °F)	100 % at 320 A
Open circuit voltage	70 V
Working voltage	14,2 – 34 V
Protection class	IP 23
Dimensions l/b/h in mm	625/290/475 mm
Dimensions l/b/h in in.	24.5/11.4/18.7 in
Weight	35,2 kg / 77.6 lb

CONTEC



New contacting technology recommended for the CMT Process

- / Two moveable half-shells
- / to transfer the current onto the welding wire constantly and reproducibly
- / High process stability results in
 - / Superlative welding properties
 - / Fewer welding defects
 - / Less post-weld machining by minimising spatter
- / Longer service life of the contact tip

/ Battery Charging Systems / Welding Technology / Solar Electronics



SHIFTING THE LIMITS