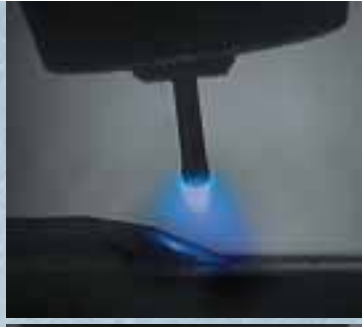
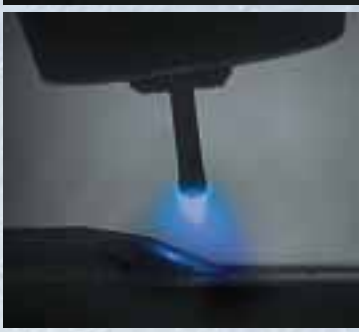




CMT: Cold Metal Transfer

MIG/MAG dip-transfer arc process

DIGITAL REVOLUTION

Fronius

PERFECT WELDING

A hot & cold process makes the impossible possible

GENERAL REMARKS

Some like it cold

There are some materials and applications where having only a low thermal input is extremely beneficial: By making it possible to weld seams without root-side drop-through, for example, or perform spatter-free brazing, or even make certain types of joins which used to be either problematical or right out of the question. With CMT, all this is now perfectly feasible. CMT stands for Cold Metal Transfer. Of course, the term “cold” has to be understood in terms of a welding process. But when set against the conventional MIG/MAG process, CMT is indeed a cold process. Its characteristic feature: hot, cold, hot, cold, hot, cold. This alternating hot & cold treatment has been made possible by a new technological development from Fronius. And above all, by incorporating the wire motions into the process-control. The result: Spatter-free MIG/MAG robot welding and brazing for ultra-light gauge sheets from 0.3 mm (0.012"). In either automated or manual applications. But let’s take one thing at a time.

THE PROCESS

Wire motions incorporated into process-control

For the first time ever, the motion of the wire is directly incorporated into the process-control. The digital process-control detects a short circuit, then retracts the wire so as to help detach the droplet. All digitally controlled. This is the first essential difference from conventional dip-transfer welding.

Reduced thermal input

The second difference is the virtually current-free, off-circuit metal transfer. The wire moves forward, and as soon as the short circuit happens, it is pulled back again. Automatically. In this way, the arc itself only inputs heat very briefly in the arcing period, after which the thermal input is immediately reduced. Hot, cold, hot, cold, hot, cold.

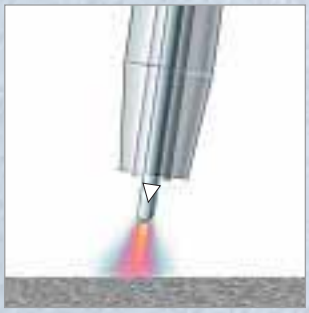
Spatter-free metal transfer

And it is precisely this which leads to the third big difference: The rearward movement of the wire assists droplet detachment during the short circuit. The short circuit is controlled, and the short-circuit current is kept small. The result: spatter-free metal transfer. The precision droplet-detachment ensures that after every short circuit, a near-identical quantity of filler metal is melted off. And it is these crucial differences that make possible all those applications which used to call for a huge expenditure of time and effort: Spatter-free welding and brazing seams; welded joins between steel and aluminium; welding of ultra-light gauge sheets from 0.3 mm (0.012"), also in butt-weld configurations without weld-pool backing support, etc.

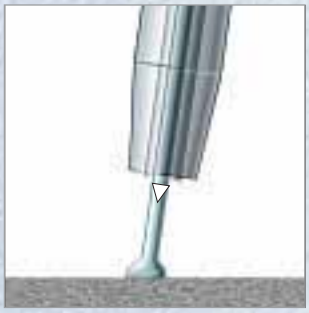
Stable arc

The CMT technology not only gives you a welding and brazing solution that works with less thermal input, it also boasts one truly compelling advantage: a stable arc that refuses to “lose its cool”, in any situation. In conventional GMA welding, the surface of the workpiece and the welding speed can both have a very marked effect on the stability of the arc. In CMT, the arc length is acquired and adjusted mechanically. This means that the arc remains stable, no matter what the surface of your workpiece is like or how fast you want to weld. In this way, you’ll be able to use this welding process anywhere, and in any position. After all, it only makes sense to have a great new system if it’s one you’re actually able to use properly. This goes for everything from Fronius, in fact. But then you’re used to that already!

During the arcing period, the filler metal is moved towards the weld-pool.

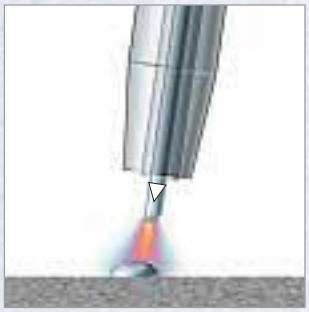


When the filler metal dips into the weld-pool, the arc is extinguished. The welding current is lowered.



The rearward movement of the wire assists droplet detachment during the short circuit. The short-circuit current is kept small.

The wire motion is reversed and the process begins all over again.



The wire buffer decouples the front and rear wire-drives from one another and ensures smooth wire travel.

The new tension-lever system in the welding torch ensures constant and reproducible contact pressure.

Entire system adapted to process

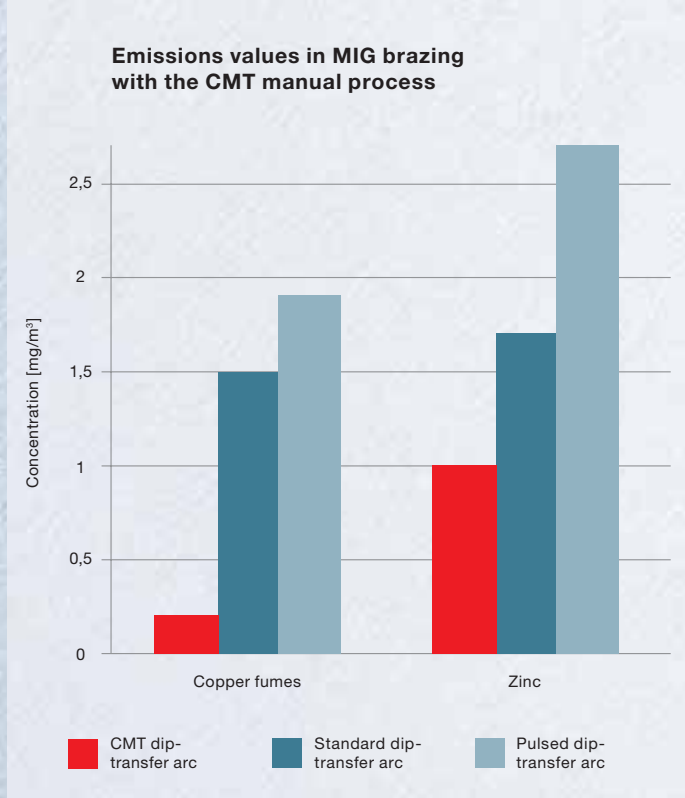
Before this innovative process could be realised in practice, new system components had to be developed. For the wirefeed, too, technologically novel approaches had to be taken.

To begin with, there are two separate wire-drives: The front one moves the wire back and forward up to 90 times per second (as against only up to 5 times on the SyncroPuls), while the rear drive pushes the wire from behind. Both drives are digitally controlled. The front one is gearless and is fitted with a highly dynamic AC servo motor. It ensures accurate wirefeed and constant contact pressure. What is new is that the torch hosepack can be uncoupled from the drive unit, permitting rapid changeovers in robot applications, with no need to reset the TCP (Tool Centre Point).

Moreover, a “wire buffer” is interposed between the two drives, to decouple them from one another and to provide additional storage capacity for the wire. In this way, the motion of the wire is achieved with practically no force being applied. And changing the inner liner in the wire buffer couldn’t be easier, either: Open the lid, old inner liner out, new one in, close the lid – that’s it.

Clean working means healthy working

As the CMT process functions with less heat input, it almost incidentally has another, added advantage: Lower pollutant emissions. As shown by numerous test results, the concentrations of pollutants investigated in CMT brazing are far below those encountered in MIG brazing – nearly 90 % less copper fumes, and as much as 63 % less zinc than with conventional dip-transfer arc-technology. A clean solution that'll help keep you in good health.



CMT scores convincingly for its greatly reduced pollutant emissions.

FACTS

The CMT process sets brand-new standards in welding technology

- assists droplet detachment by means of the wire-motions incorporated in the digital process-control
- reduces the thermal input by achieving almost current-free metal transfer
- ensures spatter-free metal transfer by controlling the short circuiting
- permits spatter-free MIG/MAG robot welding and brazing of ultra-light gauge sheets from 0.3 mm (0.012"), and joining of steel to aluminium
- offers all the benefits of digital Fronius welding technology.

UTILISATION

Materials

The CMT process has a universal range of application. The specific know-how can be used for all materials.

Applications

Whether as an automated or a manual application, the CMT Process is suitable for use in all industrial sectors: from the automotive and supplier industries to industrial plant and pipeline construction, to maintenance and repair work.

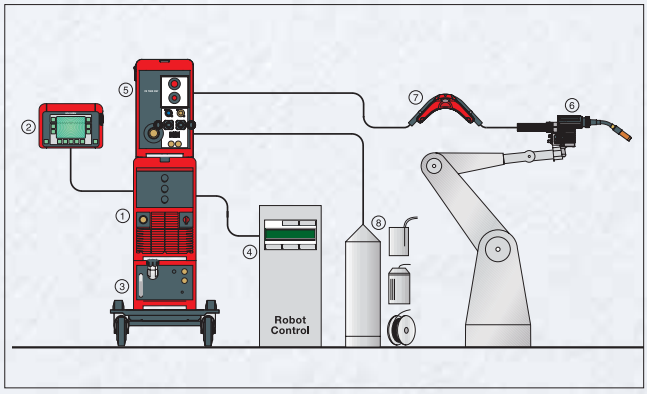
The success package

THE SYSTEM

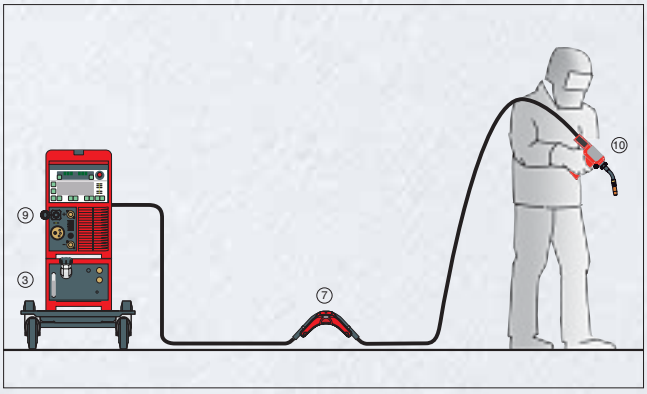
CMT system configuration

By now, Cold Metal Transfer ranks as a tried-and-tested solution for robot systems. For manual applications, however, it is wholly new. This also necessitated a number of innovations in the system itself – as compared to the other digital systems, for instance. All the components were given a rethink, adapted to the CMT process and harmonised with one another. Below you will see overviews of the system as a whole – one example of an automated configuration, and another of a manual set-up. Differing design variants are also possible, of course.

System example: CMT with robot



System example: CMT manual configuration



1. TPS 3200 / 4000 / 5000 CMT power source
Fully digitised, microprocessor-controlled and digitally regulated GMA inverter power source (320/400/500 A) with an integral functional package for the CMT process.

2. RCU 5000i remote-control unit
Remote-control unit with full-text display, weld-data monitoring with Q-Master function, easy-to-follow user guidance, systematic menu structure, user administration features.

3. FK 4000 R cooling unit
Sturdy and dependable, ensures optimum cooling of water-cooled robot welding torches.

4. Robot interface
Suitable for all customary robots, irrespective of whether these are addressed digitally, in analogue or via field-bus.

5. VR 7000 CMT wirefeeder
Digitally controlled wirefeeder for all common types of wirepack.

6. Robacta Drive CMT
Compact robot welding torch with digitally controlled, gearless, highly dynamic AC servo motor. For precision wirefeed and constant contact pressure.

7. Wire buffer
Decouples the two wire-drives from one another and provides additional storage capacity for the wire. For mounting on the balancer (preferably), or on the third axis of the robot.

8. Wire supply

9. TransPuls Synergic 2700 CMT power source
Fully digitised, microprocessor-controlled and digitally regulated GMA inverter power source (270 A) with integral wirefeeder and functional package for the manual CMT process.

10. PullMig CMT
Compact, water-cooled high-performance welding torch for manual CMT applications. In conjunction with the wire buffer in the hosepack, the digitally controlled, high-dynamic AC servo motor permits rapid oscillating motions of the welding wire.

UTILISATION

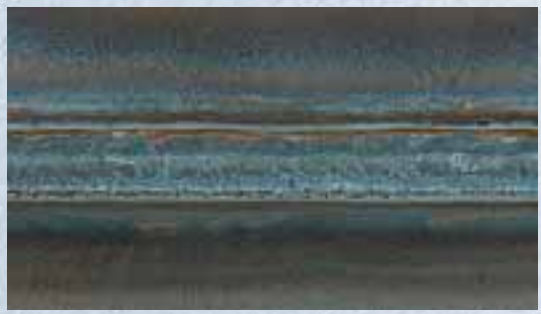
Wholly new applications open up

So what are some typical areas of application for the CMT process? Which metals and materials “prefer it cold”? All thin and ultra-light gauge sheets, from as thin as 0.3 mm (0.012"); for MIG brazing of galvanised sheets, and for joining steel to aluminium. And generally for all applications that have to meet stringent requirements in terms of weld-seam appearance. Until CMT, applications like these were only possible under difficult and labour-intensive conditions (e.g. weld-pool backing support), or users had to resort to different joining technologies altogether – which of course meant doing without all the advantages of a welded joint. With CMT, what used to seem impossible is now possible.

CMT sets brand-new standards in welding technology. The process is well-suited to just about any area of application, from the automotive and supplier industries to industrial and pipeline construction, to the repair and maintenance field. Essentially, all automated, robot-assisted or manual tasks are suitable. All customary base and filler metals can be used.

CMT-brazed join between hot-dip and electrolytically galvanised sheets; welding speed 2.0 m/min (78.74 IPM). Sheet thickness 0.8 mm (0.03"), filler metal CuSi3.

Butt-weld, without weld-pool backing support, on 0.3 mm (0.012") AlMg3 sheet.



Lap-weld on 1.0 mm (0.04") steel sheet, welded under 100 % CO_2 shielding gas. Welding speed 0.7 m/min (27.6 IPM).

CMT joint between steel and aluminium. Welded on the aluminium side; brazed on the steel side.

COST EFFECTIVENESS, SERVICE, SAFETY

Giving the costs the cold shoulder

Being a “colder” process overall, CMT makes a number of work-steps superfluous. Freedom from spatter, for instance, means no post-weld machining. Not even when 100 % CO_2 shielding gas is used in the welding of steel. Being able to butt-weld light-gauge sheets means there is no need for weld-pool backing support. High gap bridgeability means better process manageability and therefore suitability for automation.
And thanks to the multiprocess capabilities of the welding machine, you can also perform MIG/MAG standard and pulsed-arc welding as well as CMT. On top of all this, there are all the savings that result from the loss-free gas supply to the torch, the automatic cooling-unit cut-out, low open-circuit power, high efficiency, modular (and thus highly flexible) system principle, easy servicing, updates via laptop, etc. All the attributes that feature in the digital MIG/MAG systems do sterling service here as well, then.

The very highest protection – as standard

Working with Fronius systems is definitely a very safe bet indeed. They all come with: S Mark, CE Mark, IP 23, earth fault-current watchdog, temperature-controlled fan. An additional benefit with the CMT systems is that because there is no spatter, fewer welding fumes are generated, which leads to less soiling at the workplace.

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