IMPROVING SHIELDING GAS FLOW CONTROL IN WIRE WELDING APPLICATIONS
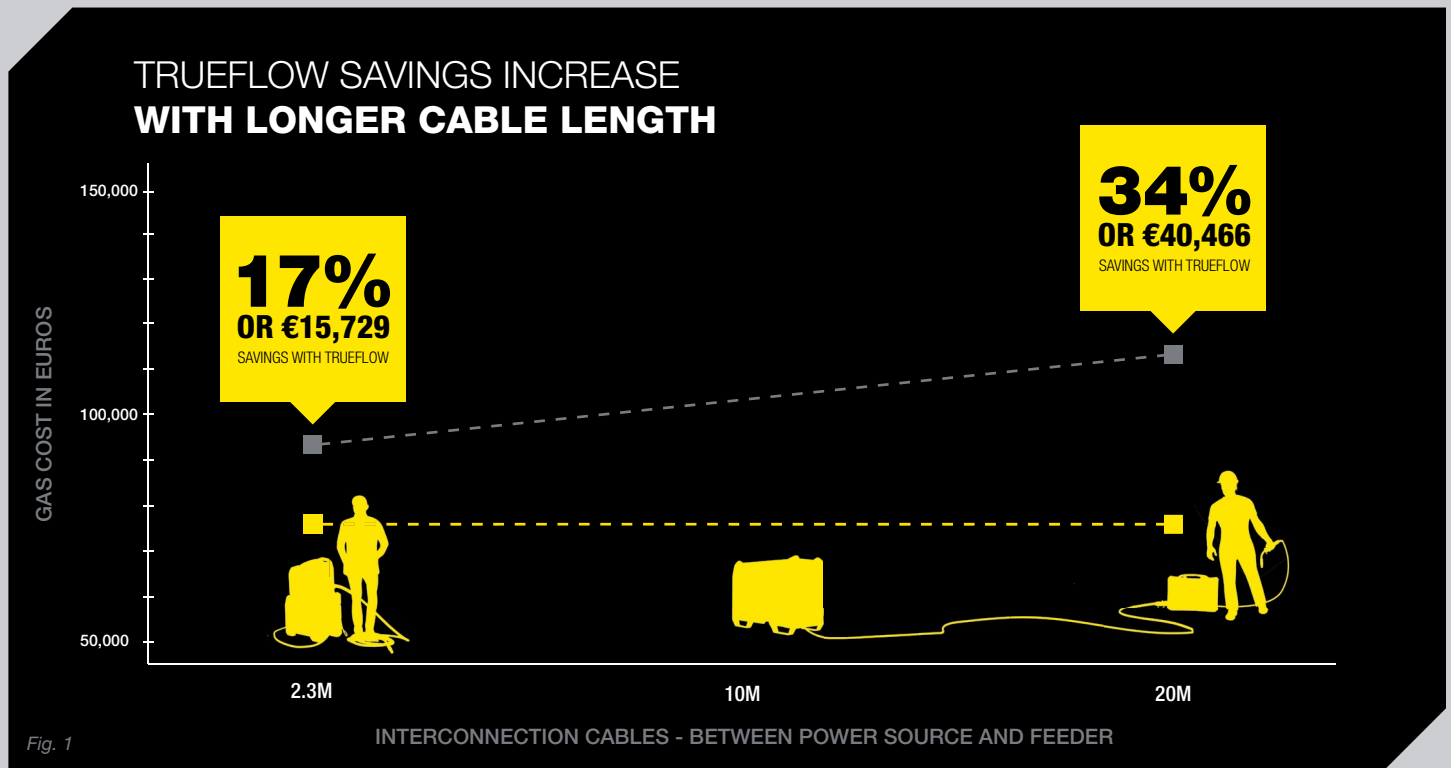
While shielding gas adds just a few cents to each meter of weld, who wouldn't want to reduce shielding gas costs by up to 20%, or about €1,000 annually per machine? Who wouldn't want to eliminate the downtime and hassle of swapping cylinders? Most importantly, who wouldn't want to eliminate a root cause of porosity and the cost associated with weld defects?

New digital gas control (DGC) technology is being incorporated in some of today's premium wire feeders, such as ESAB's RobustFeed Edge. DGC delivers the peace of mind that comes from using each liter of gas in accordance with weld procedure specifications. DGC provides a level of precision, confidence and savings not previously possible with flowmeters and standard wire feed units.

THE SURGE AT ARC STARTS

To appreciate the benefits of DGC, start with one of the biggest problems it solves: gas surges. That "whooshing" sound at arc start is the sound of losing money! A standard regulator and wire feeder can waste 1.8 liters per arc start. Conversely, DGC virtually eliminates waste. Further the volume of over-pressurized gas is proportional to length of gas hose, so the DGC savings will be greater with longer interconnect cables (see Fig. 1, which shows the savings possible for a company operating 10 welding machines over two shifts).

TRUEFLOW SAVINGS INCREASE
WITH LONGER CABLE LENGTH

17%
OR €15,729
SAVINGS WITH TRUEFLOW

34%
OR €40,466
SAVINGS WITH TRUEFLOW

GAS COST IN EUROS

150,000

100,000

50,000

2.3M   10M   20M

Fig. 1   INTERCONNECTION CABLES - BETWEEN POWER SOURCE AND FEEDER

HIDDEN QUALITY ISSUES

While wasting gas is annoying, gas surges may also have a hidden cost: porosity at the start of the weld.

A gas surge during arc starts creates turbulence that pulls air into the shielding gas flow (Fig. 2).

Unfortunately, some operators mistakenly believe insufficient gas flow caused the porosity, so they increase flow rates to a point where they compound contamination problems. In addition to porosity at the beginning of the weld, excess gas flow may cause random porosity along the weld seam.
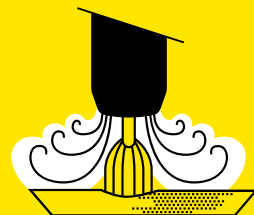
Fig. 2

The cost of repairing weld defects adds up quickly:
· Moving parts around workshop
· Rework
· Inspection
· Delivery delays
· WPS compliance

A BETTER DESIGN

Instead of a standard On/Off solenoid valve with Open/Closed positions, feeders with DGC uses a proportional flow valve that provides variable control. The proportional control mechanism also incorporates two sensors, a differential pressure sensor and an absolute pressure sensor. The differential pressure sensor regulates gas flow rate in liters per minute, and the absolute pressure sensor determines the mass flow rate. Combined, they can precisely and rapidly control gas flow no matter which gas is used. Even better, fabricators can achieve huge savings by programming the RobustFeed Edge Quick Jobs buttons and setting limits. This prevents operators from using too much or too little gas.

As shown in Fig. 3, digital gas control reaches the set flow rate quickly and ensures an accurate flow rate. Conversely, standard technology systems greatly overshoot, then take more time to reach set value. With short cables, it can take 2 to 3 seconds; with a 40 m cable, it can 10 seconds or more to reach the set value.

Additional benefits include of DGC include the ability to:
· Regulate flow to the correct rate independent of cylinder pressure or gas flow restrictions,which preserve weld integrity as cylinders run low.
· Eliminate the need to calibrate the system upon first use.
· Eliminate the need to recalibrate the system when switching torches or changing gas mixes, increasing uptime.

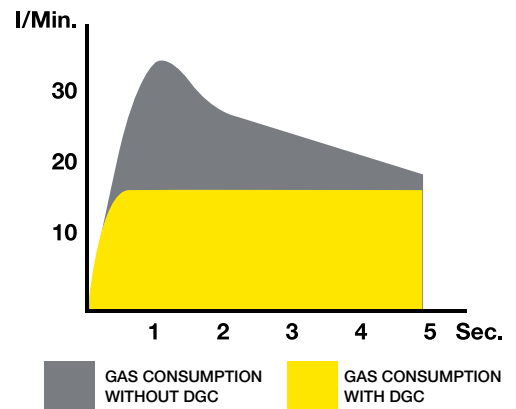| | GAS CONSUMPTION WITHOUT DGC | | GAS CONSUMPTION WITH DGC |

Fig. 3

Digital gas control reaches the set flow rate faster and ensure an accurate flow rate. Conversely, standard technology systems greatly overshoot, then take more than 5 seconds to reach the set value.
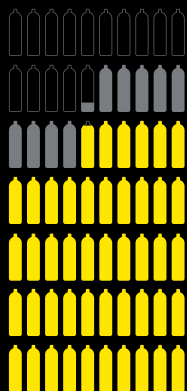
ACCURACY MADE EASY

Some systems with DGC set gas flow as part of a synergic line. To begin welding, the operator follows a few simple steps to weld with accuracy: select the wire type, diameter and gas blend, then set gas flow on digital controls.

Fig. 4: In this welding system with DGC, users set gas flow rate as a part of a synergic line.

INHERENT GAS COST SAVINGS

DGC technology inherently provides savings. Users need to do nothing special or extra to save money. In addition to eliminating gas waste, DGC can eliminate 20 cylinder changes per station, per year in a typical shop.

To help fabricators calculate potential savings, ESAB created an online Gas Savings Calculator tool. In an example at a facility with 10 welding systems working for 16 hours per day, annual gas consumption with a standard system would be 552 cylinders (50 l cylinders) with 2.3 m cables and rising to 697 cylinders with 20 m cables. Conversely, consumption with DGC holds steady at 459 cylinders regardless of cable length, yielding an annual savings that ranges from 93 to 238 cylinders (Fig. 5).

Reducing the number of cylinders used also reduces downtime associated with cylinder swap-outs, the possibility of a weld defect when gas runs out in the middle of a seam, spare cylinders in stock and rental charges and delivery frequency.
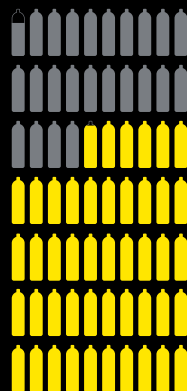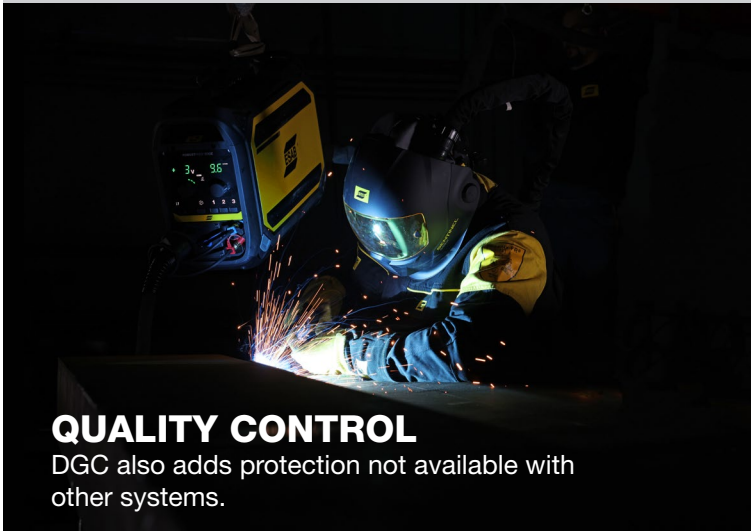
93 CYLINDERS SAVINGS WITH TRUEFLOW

2.3 METER INTERCONNECT CABLE

238 CYLINDERS SAVINGS WITH TRUEFLOW

20 METER INTERCONNECT CABLE

1 EQUALS 10 CYLINDERS   WITH STANDARD FLOWMETER   WITH ESAB TRUEFLOW

Fig. 5

QUALITY CONTROL

DGC also adds protection not available with other systems.

Fig. 6

The system has an adjustable gas pre-flow time with a default value of 0.1 seconds of gas pre-flow, which is standard for carbon steel. In a fraction of that time, the system will determine if the gas flow rate will attain the set value; if it will not, the arc will not start and the system displays an insufficient input pressure error message.

If the system detects more than a few liters of flow deviation from the set value for a few seconds, it initiates a controlled termination of the weld using the programmed weld sequence (e.g., post-flow and crater fill) and will display a warning.
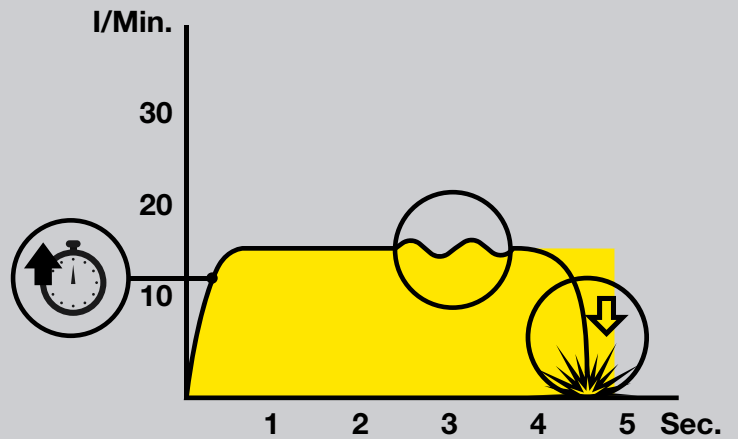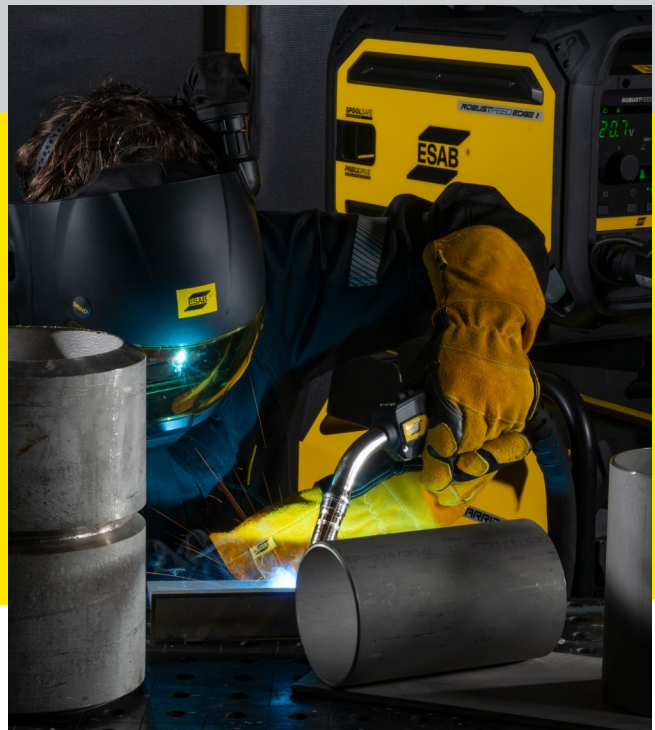
If the system detects sudden and total loss of pressure (e.g., the gas hose becomes disconnected), it terminates the weld immediately. The ability to detect pressure loss and flow deviations especially helps avoid porosity issues, as summarized in Fig. 6

Risk of leakage due to over-pressure. Most solenoid valves cannot withstand excessive pressure, which can cause leakages. If a DGC system senses a pressure exceeding 7 bar, it will not allow the arc to start and will display an over-pressure error code.

In summary, traditional gas cylinder and line regulators can experience issues with gas surges, porosity, inaccuracy and wasted gas. The digital gas control technology found in new wire feeders, such as ESAB's RobustFeed Edge, offers the most accurate gas control of any system available. DGC promotes consistent flow rates across a weld fleet to enhance consistency and quality while lowering gas costs, all without the operator needing to make any extra effort.

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