



Low Hydrogen Vertical Down Process Boosts Quality, Improves Weld Metal Deposition Rates by 15 – 50%

- ESAB Pipeweld DH electrodes address hydrogen cracking concerns.
- Guaranteed low-hydrogen, better arc starting performance.

Situation

Pipeline welding technologies continue to evolve to improve productivity and quality for circumferential girth welds on high strength steels such as X70 and X80. Mechanized welding plays an increasing role — such as the ESAB 3-run process featuring FCAW with the Pipeweld Orbiter — but the Stick (MMA) process will always play a role for welding in field applications and tight spaces.

Complication

Cellulosic (EXX10) electrodes have long been the main choice for welding pipe, as the higher hydrogen levels in the gas shield create a forceful arc and deeper penetration. However, between 30 and 45ml of diffusible hydrogen per 100 g can be found in deposited weld metal (according to TWI), which leads to concerns related to hydrogen cracking. As a result, pipeline owners are restricting the use of cellulosic electrodes to the root and hot pass.

Solution

ESAB Pipeweld DH low-hydrogen electrodes have been specifically formulated for downhill welding of fill and cap passes. Multiple North American contractors now use Pipeweld DH to:

1. Reduce defects, rework and excess grinding related to hydrogen cracking
2. Guarantee low-hydrogen content meets H4R requirements
3. Boost deposition rates by 15 to 50%
4. Improve arc starts and reduce arc-start related defects



BENEFIT #1

Reduced Weld Defects

ESAB Pipeweld DH electrodes mitigate hydrogen cracking concerns because they carry the H4R designation, which means that they produce less than 4 ml of diffusible hydrogen per 100 g of deposited weld. After the hot pass, operators can use Pipeweld DH without the deep grinding associated with other procedures.

Pipeweld DH also promotes quality because its faster travel speeds inherently protect against excess heat input. In addition, the impact toughness and tensile properties of the weld metal and heat affected zone are generally better than other options. Because the techniques for vertical down are similar to those for cellulosic electrodes, there is no need for special training.

Actual Mechanical Properties of Pipeweld DH

Pipeweld DH Electrodes	Use (Actual Application)	Yield	Tensile	Charpy V-Notch
Pipeweld 80DH (AWS E8045-P2 H4R)	X60	512 MPa (74.24 ksi)	612 MPa (88.74 ksi)	69 J (51 ft-lb) [-30 °C (-22 °F)]
Pipeweld 90 DH (AWS E9045-P2 H4R)	X70	570 MPa (82.65 ksi)	668 MPa (96.86 ksi)	86 J (64 ft-lb) [-30 °C (-22 °F)]
Pipeweld 100 DH (AWS E10018-G H4R)	X80	652 MPa (94.54 ksi)	732 MPa (106.14 ksi)	57 J (42 ft-lb) [-40 °C (-40 °F)]

BENEFIT #2

Guaranteed Fresh Electrodes

Pipeweld DH comes in VacPac, a laminated, multi-layer aluminum foil that is hermetically sealed around a strong plastic inner box. They have unlimited shelf life and do not require special warehouse conditions. The 4-lb. VacPac is sized so operators will use electrodes while they remain fresh, reducing scrap rate and eliminates the hassles of re-baking.

Designed for moisture resistance, Pipeweld DH H4R electrodes also have less than 0.4 percent moisture absorption after 12 hours of exposure at 80 °F and 80 percent relative humidity, so there is no need for special storage during the workday.



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BENEFIT #3

Increased Productivity

Pipeweld DH electrodes boost productivity because their deposition rates are 15 to 50% higher than cellulosic or low-hydrogen vertical up options.

Deposition Rates

	Pipeweld 6010 Plus	Pipeweld 7016 (low hydrogen vertical up)	Pipeweld 90 DH (low hydrogen vertical down)
2.5 x 350 mm (3/32 x 14 in.)	0.7 kg/h (1.54 lb/h)	–	1.00 kg/h (2.20 lb/h)
3.2 x 350 mm (1/8 x 14 in.)	1.0 kg/h (2.20 lb/h)	1.30 kg/h (2.87 lb/h)	1.50 kg/h (3.31 lb/h)
4.0 x 350 mm (5/32 x 14 in.)	1.2 kg/h (2.64 lb/h)	1.70 kg/h (3.75 lb/h)	2.30 kg/h (5.07 lb/h)
4.5 x 350 mm (11/64 x 14 in.)	1.9 kg/h (4.19 lb/h)	–	2.90 kg/h (6.39 lb/h)

Pipeweld DH electrodes offer 120% recovery (which means the coating contributes 20 to the weight of deposited weld metal), a 30% improvement over the recovery rate of cellulosic electrodes.

ESAB proved results in a WPQR test on a 12-in. diameter pipe. Completing the joint took 28.5 minutes with cellulosic electrodes. Switching to Pipeweld DH electrodes for the first fill and remaining fill and cap passes lowered cycle time to 19.0 minutes. Given an eight hour shift, operators could weld 24 joints instead 16 joints, or 33% more joints per day.

BENEFIT #4

Patented Tip Design

Traditional low-hydrogen arc starting technique require a complicated arc start routine to reduce risk of porosity and fusion defects. The patented tip design of Pipeweld DH overcomes this, allowing operators to start the weld at any angle with no risk of porosity. The ESAB tip design also has a stronger coating. Where competitive tapered-tip electrodes can sustain damage in transit (resulting in electrode scrap rates as high as 30 percent), Pipeweld DH all but eliminate this.



Contact your ESAB sales representative to learn more, or visit esab.com/pipelines

