

For welding steel such as:

Outokumpu	EN	ASTM	SS*	BS*	NF*
2205	1.4462	S32205	2377	318S13	Z3 CND 22-05 Az

\* Obsolete national standards, replaced by EN 10088.

### CHARACTERISTICS

AVESTA 2209 is primarily designed for welding the duplex grade Outokumpu 2205 and similar steel grades.

AVESTA 2209 provides a ferritic-austenitic weldment that combines many of the good properties of both ferritic and austenitic stainless steels. Due to the high content of both Cr and Mo a very good resistance to general and pitting corrosion is obtained. The duplex microstructure gives a high tensile strength and hereby also an excellent resistance to stress corrosion cracking.

AVESTA 2209 is over-alloyed with respect to nickel, to ensure the right ferrite balance in the weld metal.

### WELDING DIRECTIONS

The weldability of 2209 is excellent and welding can be performed using short, spray or pulsed arc. Welding using pulsed arc provides good results in both horizontal and vertical-up positions. The best flexibility is achieved by using pulsed arc and Ø0.045" (1.14 mm) wire.

However, duplex steels are somewhat more difficult to weld compared to austenitic steels such as 316L, mainly with respect to fluidity and penetration into the parent metals.

To utilise the good properties of a duplex steel it is of the utmost importance to obtain a good ferrite content in the weld. This is best achieved by welding with sufficient root gap 0.08-0.1" (2-2.5 mm), which also ensures good penetration, by using the right amount of filler metal and by welding with a controlled heat input 12.7-63.5 kJ/in (0.5-2.5 kJ/mm).

Duplex steels have remarkably lower thermal expansion than for example 304 and 316 type steels. The deformation and extension during welding is therefore somewhat lower.

### WELDING DATA

For further recommendations, please contact Avesta Welding.

	Ø (inch)	Ø (mm)	Current (A)	Voltage (V)
Short arc	0.035"	0.89	90-120	19-21
Spray arc	0.035"	0.89	108-220	27-30
	0.045"	1.14	200-240	28-31
	1/16"	1.60	250-330	29-32
Pulsed arc	0.045"	1.14	I <sub>peak</sub> = 450-550 A I <sub>bg</sub> = 150-200 A Freq = 120-150 Hz	

### Standard designations

EN 12072      22 9 3 L N  
AWS A5.9      ER2209

### Shielding gas recommendations

Ar + 2% O<sub>2</sub> or Ar + 2-3% CO<sub>2</sub>

The addition of O<sub>2</sub> or CO<sub>2</sub> provides good arc stability. Welding can also be performed using an addition of 30% helium (He), which will increase the energy of the arc. The fluidity is hereby improved and the weld is generally wider. The welding speed can therefore be increased. Addition of He will increase the blackening slightly.

Gas flow rate: 25-34 ft<sup>3</sup>/hour (12-16 l/min)

### Chemical composition - Typical values, %

C	0.02	Cr	23.0
Si	0.5	Ni	8.5
Mn	1.6	Mo	3.1
N	0.17		

Ferrite: 50 FN (WRC-92)

### Mechanical properties – Typical values, IIW

	Typ. values	Typ. values
Yield strength, R <sub>p0.2</sub>	550 N/mm <sup>2</sup>	80 ksi
Tensile strength, R <sub>m</sub>	770 N/mm <sup>2</sup>	112 ksi
Elongation, A <sub>5</sub>	30 %	30 %
Impact strength, KV	+20°C	150 J
	-40°C	110 J
		111 ft·lb
		81 ft·lb

**Interpass temperature:** Max. 300°F (150°C)

**Heat input:** 12.7-63.5 kJ/in (0.5-2.5 kJ/mm)

**Heat treatment:** Generally none. If requested, quench annealing at 2012-2102°F (1100-1150°C).

**Structure:** Austenite with 45-55 % ferrite.

**Scaling temperature:** Approx. 1562°F (850°C) (air).

**Corrosion resistance:** Very good resistance to pitting and stress corrosion cracking in chloride containing environments.

**Approvals:** CWB