G102 - 90S, Gas Metal Arc Welding (GMAW) Welding Process Emission Factors

CALCULATION METHODS

Annual Emissions: $E_a = U_a \times EF$ (lbs/lb rod) $\times (1-e)$

Hourly Emissions: $E_h = U_h \times EF$ (lbs/lb rod) $\times (1-e)$

E_a = Annual emissions of each listed toxic air contaminant per welding rod, (lbs/year)

E_h = Maximum hourly emissions of each listed toxic air contaminant per welding rod, (lbs/hour)

U_a = Annual usage of each welding rod, (lbs/year)

U_h = Maximum hourly usage of each welding rod, (lbs/hour)

EF = Emission Factor (lbs/lb rod)

Emission Factors:

(1) Complete AP-42 information from Final Section 12.19 (1/95): EF = Trace Metal EF (Table 12.19-2)

(2) Incomplete AP-42 Final Section 12.19 (1/95): EF = FGR (Table 12.19-1) x FCF x Ci (MSDS)

(3) No AP-42 information but known welding process: EF = FGR (District Default) x FCF x Ci (MSDS)

(4) District Study or AWMA information: EF = Trace Metal EF

(5) Incomplete District Study information: EF = FGR (District Study) x FCF x Ci (MSDS)

(*) Incomplete AP-42, District, or AWMA Hexavalent Chromium information: EF = Cr (Total Chromium in Fumes) EF x HCR

NOTES:

• Emission factors assume "uncontrolled" releases. Emission control methods and efficiencies reported are be applied within the emission calculations.

• Fume generation rates (FGR) are based on the following:
  o EPA AP-42 Final Section 12.19 (1/95) Table 12.19-1 (PM10 EF)
  o ARB, Richard Bode: 0.01 (GMAW, TIG, MIG), 0.02 (SMAW, FCAW), 0.00005 (SAW), 0.05 (unspecified)

• Fume Correction Factors (FCF) per District engineering discussions with Industry:
  o 0.5464 (GMAW, TIG, MIG), 0.2865 (SMAW, FCAW, SAW), 1.0 (unspecified)

• Trace metal emission factors are based on the following:
  o AWMA Volume 59, 2009, Issue 5 (Pages 619-626) Table 2 and Table 3
  o EPA AP-42 Final Section 12.19 (1/95) Table 12.19-2
  o District engineering estimates using rod compositions (Ci) from MSDS

• Hexavalent chromium conversion rates (HCR) are per District engineering reviews of studies on welding:
  o 0.05 (GMAW, TIG, MIG), 0.55 (SMAW), 0.0005 (SAW), 0.10 (FCAW, unspecified)

POLLUTANT	DISTRICT EMISSION FACTORS (lbs/lb rod)	REFERENCE DOCUMENT	FACTOR	(UNITS)	COMMENTS
NOX					
CO					
SOX					
TOG					
VOC					
TSP	1.00E-02				Assume PM10 = TSP
PM10	1.00E-02	CARB Welding Recommendations (1993)	0.01	lbs/lb rod	Assume PM10 = Fume Generation Rate (FGR)
Al					
Al2O3					
Be					
Cd					

Element		Source		Units	Procedure
Co					
Cr	1.31E-04	District Welding Study SDS - Lincoln ER90S-B3	2.4	wt%	District Procedure (3) $EF = FGR \times FCF \times C_i$
Cr(VI)	6.56E-06	AWMA Page 623	5	%	District Procedure (*) $EF = Cr\ EF \times HCR$
Cu	4.37E-06	District Welding Study SDS - Lincoln ER90S-B3	0.08	wt%	District Procedure (3) $EF = FGR \times FCF \times C_i$
Mn	3.17E-05	District Welding Study SDS - Lincoln ER90S-B3	0.58	wt%	District Procedure (3) $EF = FGR \times FCF \times C_i$
Ni	2.19E-06	District Welding Study SDS - Lincoln ER90S-B3	0.04	wt%	District Procedure (3) $EF = FGR \times FCF \times C_i$
P	2.73E-07	District Welding Study SDS - Lincoln ER90S-B3	0.005	wt%	District Procedure (3) $EF = FGR \times FCF \times C_i$
Pb					
Crystalline Silica					
V					
Zn					

REFERENCES:
EPA AP-42 Chapter 12.19: https://www.epa.gov/sites/production/files/2020-11/documents/c12s19.pdf
AWMA: https://www.tandfonline.com/doi/abs/10.3155/1047-3289.59.5.619

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