AMERICAN PIPING PRODUCTS

CARBON FITTINGS & FLANGES

SPECIFICATION GUIDE

CARBON FITTINGS & FLANGES

CHEMICAL

SPECIFICATION AND GRADE	A/SA350LF2 CL1/CL2	A/SA350LF3 CL1	A105	SA105	A234-WPB	SA234-WPB	A234-WPC	SA234-WPC	A/SA450-WPL6
ADDENDUM	2011	2011	2013	2013	2013		2013		2013
PRODUCTS ALLOWED	seamless/forgings	seamless/forgings	seamless/forgings	seamless/forgings	Welded pipe fittings	Welded pipe fittings	Welded pipe fittings	Welded pipe fittings	Welded & SMLS pipe fittings Low Temp

Ladle/Product Analysis

CHEMISTRY	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Carbon (C)		0.300		0.200		0.350		0.350		0.30**		0.30**		0.350		0.350		0.300
Manganese (MN)	0.600	1.350		0.900	0.600	1.05 *	0.600	1.05 *	0.290	1.06*	0.290	1.06*	0.290	1.06*	0.290	1.06*	0.290	1.350
Phosphorus (P)		0.035		0.035		0.035		0.035		0.050		0.050		0.050		0.050		0.035
Sulfur (S)		0.040		0.040		0.040		0.040		0.058		0.058		0.058		0.058		0.040
Silicon (SI)	0.150	0.300	0.200	0.350	0.100	0.350	0.100	0.350	0.100	0.350	0.100	0.350	0.100	0.350	0.100	0.350	0.150	0.400
Copper (CU)		0.400		0.400		0.400		0.400		0.400		0.400		0.400		0.400		0.400
Nickel (NI)		0.400	3.300	3.700		0.400		0.400		0.400		0.400		0.400		0.400		0.400
Chrome (CR)		0.300		0.300		0.300		0.300		0.400		0.400		0.400		0.400		0.300
Molybdenum (MO)		0.120		0.120		0.120		0.120		0.150		0.150		0.150		0.150		0.120
Vanadium (V)		0.080		0.030		0.080		0.080		0.080		0.080		0.080		0.080		0.080
Columbium (CB)		0.02*		0.020														0.02*
Titanium (Ti)																		
Boron (B)																		
Aluminum (AL)																		
Calcium (CA)																		
Nitrogen (N)																		
Tin (Sn)																		
Zirconium(Zi)																		
Cu+ Cr+Ni+Mo+V		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000		
Cu+ Cr+Ni+Mo										1.000		1.000		1.000		1.000		
CB+V+TI																		
CB+V																		
V+Ti																		
Cr+Mo		0.320		0.320		0.320		0.320										
Notes *	* by agreement .05 max				* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.65%.		* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.35%.		* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.65%. Note** Fittings made from plate mat have .35% C		* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.35%. Note** Fittings made from plate mat have .35% C		* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.65%.		* For each reduction of .01% C below the max(.35).,an increase of .06% Mn above the specified max(1.05%) will br permitted up to max of 1.35%.		* by agreement .05 max	
Melt, BOP, OH, VDG, EF, VARM	ALL		ALL		ALL		ALL		ALL		ALL		ALL		ALL		ALL	
Fully Killed, Fine Grain	Yes		Yes		Yes		Yes											

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SPECIAL TOLERANCES

Specification and Grade	A/SA350LF2 CL1/CL2		A/SA350LF3 CL1		A105		SA105		A234-WPB		SA234-WPB		A234-WPC		SA234-WPC		A/SA450-WPL6	
Addendum	2011		2011		2013		2013		2013				2013				2013	
Carbon Equivalent (CE)*	0.47				0.47		0.47		0.5		0.5		0.5		0.5		0.5	
	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.	MIN	AVG.
CHARPY 10x10 mm	Class 1		Class 1															
Temperature °F (°C)	-50° (-46)		-150° (-101)														-50° (-46)	
FT/#'S-Long	12	15	12	15													10	13
FT/#'S-Trn																		
LAT/EXP (min.MLS)	report	S3.1	report	S3.1														
Sheer %																		
CHARPY 10x10 mm	Class 2		Class 2															
Temperature °F (°C)	-0° (-18)		-150° (-101)															
FT/#'S-Long	12	15	15	20														
FT/#'S-Trn																		
LAT/EXP (min.MLS)	report	S3.1	report	S3.1														
Sheer %																		
Hydro Test	Capable		Capable															
NDE																		
No repair by welding	Yes																	
No mercury contamination	Yes																	
Flattening Test																		
Heat Treat Options																		
As Rolled	No		No		Yes	Depends on product	Yes	Depends on product									No	
Normalizing	Yes		Yes		Yes		Yes		1150°F	1800°F	1150°F	1800°F	1150°F	1800°F	1150°F	1800°F	Yes	T1100°F-1200°F
Normalized and Tempered	Yes		Yes		Yes		Yes		1100°F	1275°F	1100°F	1275°F	1100°F	1275°F	1100°F	1275°F	Yes	
Isothermal-annealed																	No	
Full-annealed																	Yes	
Quenched & Tempering	Yes		Yes		Yes		Yes										Yes	
Tempering Temp restriction	1100°F		1100°F						1150°F		1150°F		1150°F		1150°F			

* **Carbon Equivalent:** CE = C = Mn/6 + (Cr + Mo = V)/5 + (Ni + Cu)/15

Cabon under .12: CEPcm = C + (Si/30) + (Mn/20) + (Cu/20) + (Ni/60) + (Cr/20) + (Mo/15) + (V/10) + 5B

CARBON FITTINGS & FLANGES

MECHANICAL

SPECIFICATION AND GRADE	A/SA350LF2 CL1/CL2		A/SA350LF3 CL1		A105		SA105		A234-WPB		SA234-WPB		A234-WPC		SA234-WPC		A/SA450-WPL6	
ADDENDUM	2011		2011		2013		2013		2013				2013				2013	
Product Test	Buyer option		Buyer option		Buyer option		Buyer option		Buyer option		Buyer option		Buyer option		Buyer option		Buyer option	
Nunber of samples																		
TENSILE psi	70,000	95,000	70,000	95,000	70,000		70,000		60,000		60,000		70,000		70,000		60,000	
YIELD psi	36,000		37,500		36,000		36,000		35,000		35,000		40,000		40,000		35,000	
Y/T Ratio																		
ELOG. (2"std. round) Long.	22%		22%		22%		22%		22%		22%		22%		22%		22%	
ELOG. (2"std. round)Trans.									14%		14%		14%		14%		12%	
ELOG. (2"std. Strip 5/16">) Long.	30%		30%		30%		30%		30%		30%		30%		30%		30%	
ELOG. (2"std. Strip 5/16">) Trans.									20%		20%		20%		20%		17%	
Reduction of Area	30%		35%		30%		30%											
Hardness(BHN)		197		197		187		187		197		197		197		197		197
Hardness # of test	2		2															

MTR INFORMATION

Specification, Grade, Addendum	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type heat treatment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chemical analysis results	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Product analysis results	Yes	Yes	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option
Tensile property results	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Impact test results	Yes	Yes	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Purchaser Option	Yes
Hardness results	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Any supplementary testing required by the purchase order	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No repaired by welding	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes