

HAYNES[®] HR-120[®] alloy

Welding

HAYNES[®] HR-120[®] alloy is readily welded by Gas Tungsten Arc Welding (GTAW), Gas Metal Arc Welding (GMAW), Shielded Metal Arc Welding (SMAW), and resistance welding techniques. Submerged Arc Welding (SAW) is not recommended as this process is characterized by high heat input to the base metal and slow cooling of the weld. These factors can increase weld restraint and promote cracking.

Base Metal Preparation

The welding surface and adjacent regions should be thoroughly cleaned with an appropriate solvent prior to any welding operation. All greases, oils, cutting oils, crayon marks, machining solutions, corrosion products, paint, scale, dye penetrant solutions, and other foreign matter should be completely removed. It is preferable, but not necessary, that the alloy be in the solution- annealed condition when welded.

Filler Metal Selection

HAYNES[®] 556[®] filler metal (AMS 5831, AWS A5.9 ER3556) and MULTIMET[®] (AMS 5794) coated electrodes are recommended for joining HR-120[®] alloy. When dissimilar base metals are to be joined, such as HR-120[®] alloy to a stainless steel, HAYNES[®] 556[®] filler metal and MULTIMET[®] coated electrodes are again recommended. Please [click here](#) or the Haynes [Welding SmartGuide](#) for more information.

Preheating, Interpass Temperatures, and Postweld Heat Treatment

Preheat is not required. Preheat is generally specified as room temperature (typical shop conditions). Interpass temperature should be maintained below 200°F (93°C). Auxiliary cooling methods may be used between weld passes, as needed, providing that such methods do not introduce contaminants. Postweld heat-treatment is not generally required for X alloy. For further information, please [click here](#).

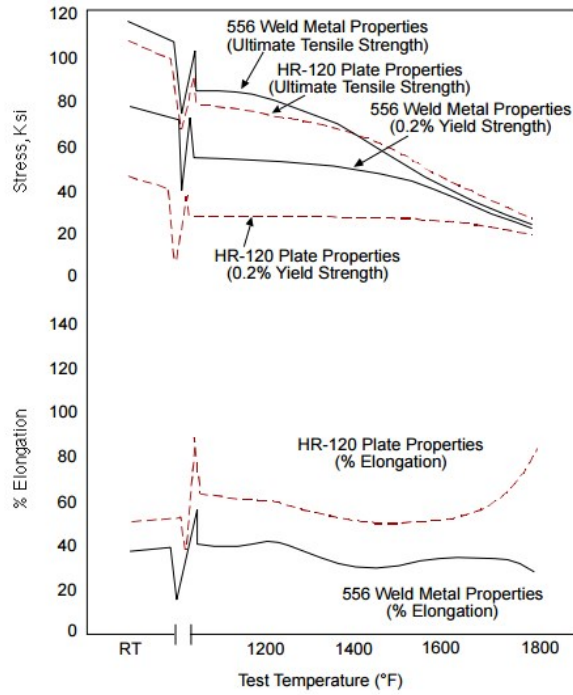
Nominal Welding Parameters

Details for GTAW, GMAW and SMAW welding are given [here](#). Nominal welding parameters are provided as a guide for performing typical operations and are based upon welding conditions used in our laboratories.

Tensile Properties of All Weld Metal (AWM)

Test Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Elongation
°F	°C	ksi	MPa	ksi	MPa	%
RT	RT	77.2	530	115.4	795	37
1200	650	53.3	380	81.0	560	39
1400	760	49.5	340	66.3	455	26
1600	870	36.8	255	40.2	270	34
1800	980	23.6	165	24.0	165	30

RT=Room Temperature



Transverse Tensile Tests, HR-120[®] Base Metal Welded with Haynes 556[®] filler

Temperature		0.5 Inch Plate		0.125 Inch Sheet	
		UTS		UTS	
°F	°C	ksi	MPa	psi	MPa
RT	RT	106	731	104	717
200	93	97	666	97	665
300	149	91	625	92	632
400	204	87	600	89	612
500	260	86	595	78	540
600	316	85	589	83	571
700	371	84	576	79	547
800	427	84	581	83	570
900	482	82	568	82	564
1000	538	79	544	80	549
1100	593	75	516	77	530
1200	649	71	490	74	507
1300	704	68	471	66	455
1400	760	60	413	55	382
1500	816	47	327	45	312
1600	871	35	241	33	226
1700	927	27	184	26	176
1800	982	20	136	25	174
1900	1038	15	102	16	110
2000	1093	12	84	9	64

Transverse Tensile Tests, HR-120[®] Plate Welded with Haynes 556[®] filler

	1 Inch Plate	0.5 Inch Plate
--	--------------	----------------

Temperature		UTS		UTS	
°F	°C	ksi	MPa	ksi	MPa
RT	RT	110	762	106	731
200	93	102	703	96	661
300	149	96	665	91	629
400	204	93	641	88	609
500	260	90	622	86	590
600	316	89	611	84	582
700	371	89	612	82	564
800	427	89	611	82	563
900	482	87	602	82	568
1000	538	78	538	78	534
1100	593	79	545	75	519
1200	649	75	515	72	497
1300	704	72	497	68	471
1400	760	64	439	60	412
1500	816	53	362	48	329
1600	871	40	279	36	247
1700	927	31	215	27	188
1800	982	24	166	20	141
1900	1038	18	123	15	106
2000	1093	12	84	11	74

**HR-120[®] Plate and Transverse Weld Room Temperature Charpy Impact Tests
0.5" Plate, Welded with Haynes 556[®]**

Condition	Energy	
	ft-lb	J
Parent Metal	182	247
GMAW SYN Mid Weld	155	211
GMAW SYN HAZ	147	199

Restrained 1/2 inch thick HR-120[®] plates have been successfully joined using 556[®] weld wire and MULTIMET[®] coated electrodes. The results below indicate an absence of hot cracking and microfissuring related weldability problems under the test conditions.

Welding Process	Welding Product	Hot Cracking	2T Radius Guided Bend Test	
			Face	Side
-	-	-	Pass	Pass
GTAW	556 [®] Filler Metal	None	Pass	Pass
GMAW	556 [®] Filler Metal	None	Pass	Pass
SMAW	MULTIMET [®] Electrodes	None	Pass	Pass

Room Temperature Tensile Strength of Transverse Welded Specimens

Welding Process	Welding Product	Tensile Strength		Fracture Location
		ksi	MPa	
-	-	-	-	-

GTAW	556 [®] Filler Metal	111.0	765	HR-120 [®] Base Metal
GMAW	556 [®] Filler Metal	109.4	755	HR-120 [®] Base Metal
SMAW	MULTIMET [®] Electrodes	109.7	755	HR-120 [®] Base Metal