Fe
0.04 C
11.5 Cr
4 Ni
0.3 Ti

AM-363

1. GENERAL

AM-363 is a recently developed low cost, medium strength stainless steel alloy for structural applications. Its strength levels can be compared to low alloy structural steels and 1/4 to 1/2 hard Type 201 Stainless Steel. Its corrosion resistance in the atmosphere can be compared to Type 430 Stainless Steel. This alloy is an outgrowth of an attempt to produce a maraging stainless steel. At best it may be considered a lean maraging steel. The alloy, when aged at 900 to 950F for 2 to 8 hours, will not increase in tensile strength and will increase in yield strength only slightly. This suggests that the alloy be considered as a low alloy structural steel rather than as a maraging steel. The alloy is obtainable as sheet or strip with a guaranteed yield strength of 100 ksi and a tensile strength of 120 ksi. It can be formed and joined by welding. At room temperature, the alloy's structure consists of low carbon martensite. At the annealing temperature, the structure is austenitic, (1)(2)(3)(4).

1.01 Commercial Designation
AM-363

1.02 Alternate Designations

1.03 Specifications

1.04 Composition
Table 1.04.

TABLE 1.04

Source	(5)	
	Percent	
	Min	Max
Carbon	-	0.05
Chromium	11.00	12.00
Manganese	-	0.30
Nickel	4.00	5.00
Silicon	-	0.15
Titanium	0.30	0.60
Iron	Balance	

1.05 Heat Treatment

1.051 All necessary heat treating is done in the mill. For a majority of applications subsequent heat treating is not required, (1)(2).

1.052 Solution temperature. 1600F, (1).

1.053 Annealing temperature range. 1500 to 1700F, (1).

1.054 Age at 900 to 950F for 2 to 8 hours. Aging will not increase the tensile strength but will increase the yield strength slightly to its maximum value, (2).

1.06 Hardness

1.061 At room temperature and at -50F the hardness is 26 RC.

1.07 Forms and Conditions Available

1.071 Available as sheet or strip heat treated at the mill.

1.08 Melting and Casting Practice

1.09 Special Considerations

2. PHYSICAL AND CHEMICAL PROPERTIES

2.01 Thermal Properties

2.011 Melting range. 2550 to 2650F.

2.012 Phase changes. A_3 - 1375F, A_1 - 1250F, M_s - 770F, M_f - 500F,

2.0121 Time-temperature transformation diagrams

2.013 Thermal conductivity

2.014 Thermal expansion Fig. 2.014.

2.015 Specific heat

2.016 Thermal diffusivity

2.02 Other Physical Properties

2.021 Density. 0.281 lb per cu in; 7.77 gr per cu cm, (1).

2.022 Electrical properties

2.023 Magnetic properties. The alloy is ferromagnetic, (1)

2.024 Emissivity

2.025 Damping capacity

2.026 Crystal structure:
Face centered cubic, at annealing temperature,
Body centered cubic, at room temperature, (1)

2.03 Chemical Properties

2.031 The resistance of this alloy to atmospheric corrosion is excellent. The alloy does not develop a visible oxide film or stain in the atmosphere, (1).

2.032 Exposure time for rusting to develop in the 5% neutral salt spray test for the alloy is from 72 to 100 hours, (1).

2.033 The effect of various chemical environments on the oxidizing activity of the alloy, Table 2.033.

TABLE 2.033

Source	(1)		
Alloy	Fe(0.04C)-11.5Cr-4Ni-0.3Ti		
Test medium	Boiling solution		
	25% Nitric acid	20% Phosphoric acid	60% Acetic acid
Time	5-48 hr	24 hr	24 hr
Penetration, in per Month	0.0125	0.0009	0.034

2.034 Alloy exhibits good resistance to stress corrosion cracking. Tests on two heats stressed almost to Fty showed complete resistance to stress corrosion cracking after 155 days exposure to 5% neutral salt spray, (1).

2.04 Nuclear Properties

3. MECHANICAL PROPERTIES

3.01 Specified Mechanical Properties

3.02 Mechanical Properties at Room Temperature

3.021 Tension

3.0211 Stress-strain diagrams

3.02111 Stress-strain curve at room temperature for strip, Fig. 3.02111.

3.0212 Room temperature tensile properties of sheet in various conditions, Table 3.0212.

TABLE 3.0212

Source	(5)				(1)	
Alloy	Fe(0.04C)-11.5Cr-4Ni-0.3Ti					
Form	Sheet					
Condition	As HR	Ann 1600F	Ann + age 1050F, 5Min	Ann + age 900F, 8 hr	Mill ann L	Mill ann T
F_{tu}, -ksi	138	124	123	124	123	125
F_{ty}, -ksi	131	105	117	118	106.5	112
e(2 in)-percent	11.0	8.0	11.0	11.5	12.5	11.5

3.022 Compression

3.0221 Stress-strain diagrams

3.0222 F_{cy} at room temperature, transverse direction, 122 ksi, (2).

3.023 Impact

3.024 Bending

3.025 Torsion and shear

3.026 Bearing

3.027 Stress concentration

3.0271 Notch properties

3.0272 Fracture toughness

3.028 Combined properties

3.03 Mechanical Properties at Various Temperatures

3.031 Tension

3.0311 Stress-strain diagrams

3.0312 Effect of test temperatures on tensile properties of sheet, Fig. 3.0312.

3.032 Compression

3.0321 Stress-strain diagrams

Fe
0.04 C
11.5 Cr
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AM-363

3.033 Impact

3.0331 Effect of test temperature on impact energy of bar, Fig. 3.0331.

3.034 Bending

3.035 Torsion and shear

3.036 Bearing

3.037 Stress concentration

3.0371 Notch properties

3.03711 Effect of test temperature on notch strength of strip, Fig. 3.03711.

3.0372 Fracture toughness

3.038 Combined properties

3.04 Creep and Creep Rupture Properties

3.05 Fatigue Properties

3.051 S-N curves for smooth and notched specimens in tension, Fig. 3.051.

3.06 Elastic Properties

3.061 Poisson's ratio
Longitudinal 0.320,
Transverse 0.330, (1).

3.062 Modulus of elasticity
Longitudinal 27.9×10^3 ksi,
Transverse 27.5×10^3 ksi, (1).

3.063 Modulus of rigidity
Longitudinal 10.6×10^3 ksi,
Transverse 10.3×10^3 ksi, (1).

4. FABRICATION

4.01 Formability

4.011 Can be formed by all conventional methods. The alloy has very good deep drawing characteristics but is only limited in stretching operations, (3).

4.012 The alloy can be bent in the transverse direction 135° around a pin whose radius is 1.0 to 1.5 times the thickness of the sheet, (1).

4.02 Machining and Grinding

4.021 Alloy was tested with 1/4 inch M-1 drill using Gulf cutting oil 43A with a constant feed of 0.005 in per revolution giving a tool speed for constant wear of 135 sfpm, (1).

4.03 Welding

4.031 The alloy has been successfully butt-welded by the automatic gas tungsten-arc process to itself and to austenitic and ferritic stainless steels without the use of filler material, (1). Preparation for welding, welding parameters and welding performance are similar to the austenitic stainless steels, (2). Welded tensile tests indicate that both the welded and welded plus aged strength compare favorably with the unwelded aged material, (2).

4.032 Manual gas tungsten-arc welding with 0.035 inch diameter AM-363 welding wire produced a 1/2 inch butt-weld which compared in tensile properties to the mill-aged unwelded material, (2).

4.033 The alloy has excellent electrical resistance spot welding characteristics similar to austenitic stainless steel. Approximately the same welding conditions as used for austenitic stainless steels will produce tension-shear tests results greater than the required minimum values, (1).

4.04 Heat Treatment

4.05 Surface Treatment

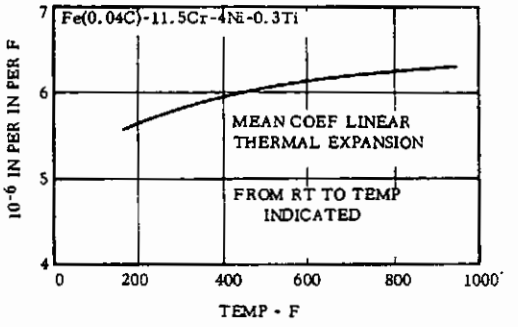


FIG. 2.014 THERMAL EXPANSION (5)

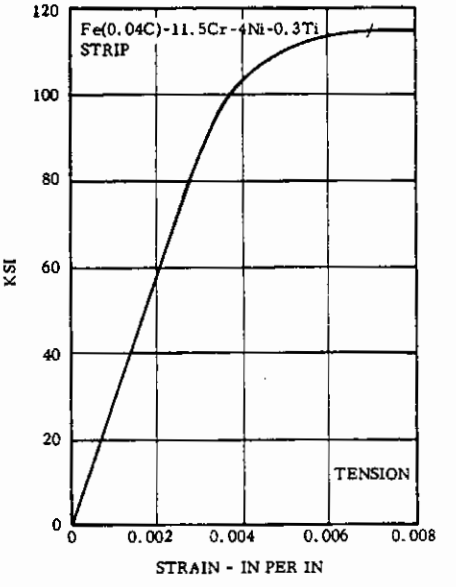


FIG. 3.02111 STRESS-STRAIN CURVE AT ROOM TEMPERATURE FOR STRIP (2)

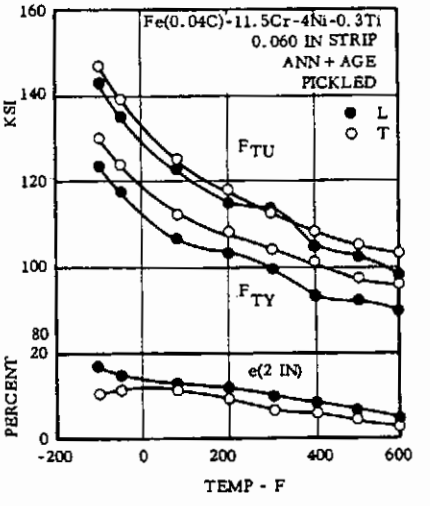


FIG. 3.0312 EFFECT OF TEST TEMPERATURE ON TENSILE PROPERTIES OF SHEET (1)

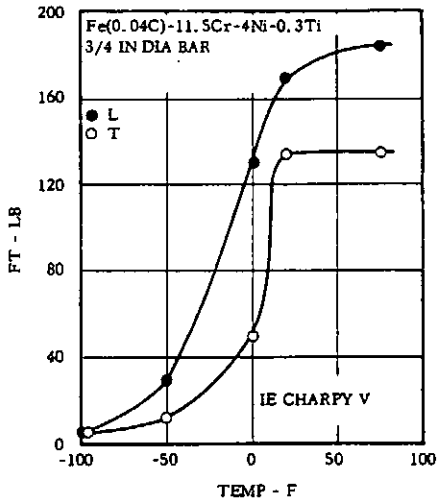
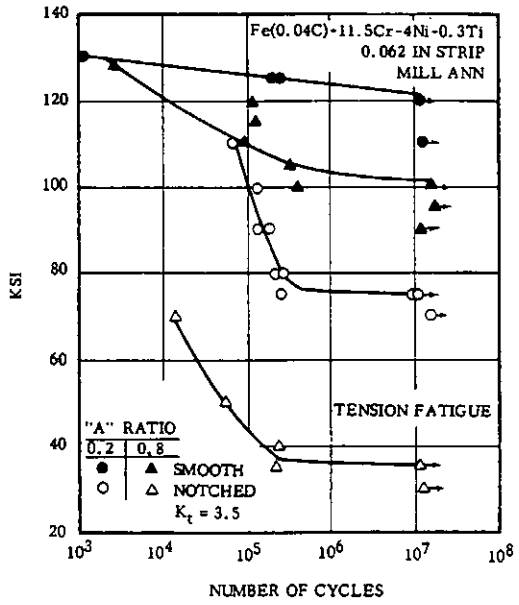


FIG. 3.0331 EFFECT OF TEST TEMPERATURE ON IMPACT ENERGY OF BAR (1)



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AM-363

FIG. 3.051 S-N CURVES FOR SMOOTH AND NOTCHED SPECIMENS IN TENSION (4)

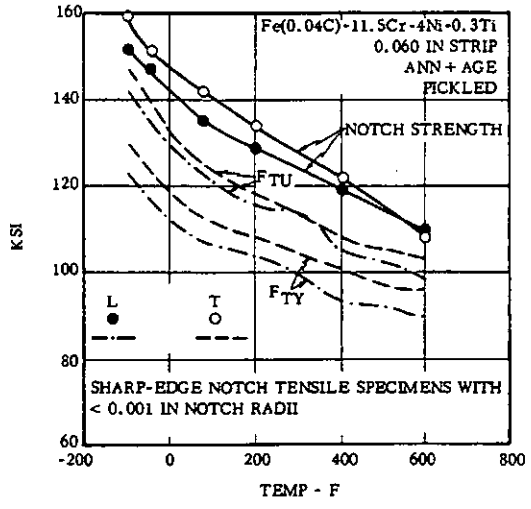

FIG. 3.03711 EFFECT OF TEST TEMPERATURE ON NOTCH STRENGTH OF STRIP (1)

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