

1. GENERAL

This alloy combines the heat treatment advantages and low work hardening characteristics of 18 Ni maraging steels with a corrosion resistance approaching that of the stainless steels. Maximum strength levels available approach 200 Ksi. However the highest strength condition have only limited crack propagation resistance in heavy sections. The strength and toughness are strongly dependent on the titanium content, and welding of heavy sections, requires close attention to both process and wire titanium content. At the present time the highest strength conditions are used primarily in thin sections (e.g.) cold drawn pressure vessels for aircraft application). (24)

1.01 Commercial Designation
AM 362, Almar 362

1.02 Alternate Designation
None

1.03 Specifications
None

1.04 Composition
Table 1.04

TABLE 1.04

| Source | (1) | |
|------------|---------|-------|
| | Percent | |
| | Min | Max |
| Carbon | | 0.05 |
| Chromium | 14.00 | 15.00 |
| Nickel | 6.00 | 7.00 |
| Manganese | — | 0.50 |
| Silicon | — | 0.30 |
| Phosphorus | — | 0.30 |
| Sulfur | — | 0.30 |
| Titanium | 0.55 | 0.90 |

1.05 Heat Treatment

1.051 General - As in the case of the 18 Ni maraging steels this alloy is annealed (solution treated) and aged. Hardenability is not a function of section size, tensile strength and yield strength increase with annealing temperature, however, high annealing temperatures reduce the toughness. (see Figures 3.0231 and 3.02711). Material annealed at a high temperature will increase its impact strength if reannealed at a lower temperature (see Table 3.0232). Full aging is obtained at 900 F, in about 4 hours and aging times of 2 hours or longer at 1000 F, produce overaged conditions (see Figure 3.0218). Toughness as measured by impact strength and sharp notch strength increase rapidly as overaging progresses. (see Table 3.0212 and Figures 3.0233 and 3.02712). Aging produces only very small dimensional changes, approximately 0.05 percent. (14)

1.052 Anneal - 1500 F, 1 hour AC. Strip is continuously annealed.

1.053 Age - 900 F, to 1150 F, AC depending on strength level (see Figures 3.0215 and 3.0218). For maximum strength age 900 F, three to four hour AC.

1.06 Hardness

1.061 Effect of titanium content on hardness of sheet aged at several temperatures. Figure 1.061.

1.07 Forms and Conditions Available

Sheet, strip, bar, wire, tubing and forging billets.

1.08 Melting and Casting Practice
Electric furnace air melt and consumable electrode vacuum melt.

1.09 Special Considerations
This alloy like the conventional 12 Cr steels is subject to an embrittlement when held for long times at temperatures between 700 and 1000 F, (see Table 3.0234). This is also reflected in low impact strength for tempering temperatures below about 1000F, (see Figure 3.0233). The toughness of the alloy is strongly influenced by the titanium content and decreases with increasing titanium. (see Figure 3.03711).

2. PHYSICAL AND CHEMICAL PROPERTIES

2.01 Thermal Properties

2.011 Melting range.

2.012 Phase changes. (22)

A₁ - 1166F A₃ - 1490F
M_S - 510F M_F - 320F

2.0121 Time-temperature transformation diagrams.

2.013 Thermal conductivity.

2.014 Thermal expansion. Figure 2.014

2.015 Specific heat.

2.016 Thermal diffusivity.

2.02 Physical Properties

2.021 Density. 0.281 lbs per cu in, 7.78 gm per cu cm (16)

2.022 Electrical properties.

2.0221 Resistivity.

2.02211 Resistivity of aged alloy. Table 2.02211.

TABLE 2.02211

| Source | (16) | | | |
|--------------------------------------|----------------|-----------|------------|-------------|
| | Fe-15Cr-7Ni-Ti | | | |
| Alloy | Sheet | | | |
| Form | Sheet | | | |
| Anneal | 1500F, 1 hr AC | | | |
| Age | None | 900F, 4hr | 1000F, 3hr | 1125F, 2hrs |
| Electrical Resistivity μ - ohm-in | 35.4 | 30.4 | 30.2 | 28.1 |

2.023 Magnetic properties.

2.0231 Permeability of aged alloy. Table 2.0231

2.024 Emissivity.

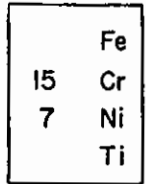
2.025 Damping capacity.

2.03 Chemical Properties

2.031 General - On the basis of limited data available thus far, the general corrosion resistance of this alloy is superior to that of Type 410 and in normal atmospheres equal to Type 430. Strip tempered at 900 F, and stressed in the transverse direction to 75% of the yield strengths showed no cracks, rust or pits following 250 days exposure to a 5% salt spray. (22)

TABLE 2.0231

| Source | (16) | | | |
|----------------------------------|----------------|------------|-------------|-------------|
| | 15Cr-7Ni-Ti | | | |
| Alloy | 3/4 in dia Bar | | | |
| Form | 1500F, 1 hr AC | | | |
| Anneal | 1500F, 1 hr AC | | | |
| Age | None | 900F, 4 hr | 1025F, 3 hr | 1125F, 2 hr |
| Max μ (H=25 oersteds) | 180 | 280 | 298 | 180 |
| Saturation μ (H=200 oersteds) | 67 | 76 | 75 | 62 |



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Fe
15 Cr
7 Ni
Ti

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- 2.04 Nuclear Properties
- 3. MECHANICAL PROPERTIES
- 3.01 Specified Mechanical Properties
- 3.011 Producers minimum mechanical properties for bar, Table 3.011.

TABLE 3.011

| Source (24) | | | |
|----------------------------------|-----------|------------|------------|
| Alloy Fe-15 Cr-7Ni-Ti | | | |
| Form Bar | | | |
| Condition 1500F, Anneal AC + Age | | | |
| Age | 900F, 4hr | 1000F, 2hr | 1125F, 1hr |
| F _{tu} -min ksi | 180 | 155 | 135 |
| F _{ty} -min ksi | 175 | 145 | 105 |
| e (4D) min Percent | 10 | 12 | 15 |
| RA min Percent | 40 | 45 | 50 |

- 3.02 Mechanical Properties at Room Temperature
- 3.021 Typical mechanical properties. Table 3.021.

- 3.0213 Tensile properties of bar as influenced by specimen location. Table 3.0213.

TABLE 3.0213

| Source (4) | | | |
|-----------------------|--------------------------------------|-----|------------------------|
| Alloy Fe-15 Cr-7Ni-Ti | | | |
| Condition | 1500F, 1hr AC + 900F, 8hr | | As Hot Rolled |
| | Form 2 to 2 3/4 in dia Bar (0.82 Ti) | | 1 in dia Bar (0.82 Ti) |
| Location | Mid Radius | | Center |
| | L | T | L |
| F _{tu} -ksi | 184 | 188 | 185 |
| F _{ty} -ksi | 178 | 180 | 179 |
| e(2in) percent | 17 | 9 | 10 |
| R. A. percent | 55 | 28 | 28 |

- 3.0214 Effect of annealing temperature on tensile properties of bar, Figure 3.0214.
- 3.0215 Effect of aging temperature on tensile properties of bar. Figure 3.0215.
- 3.0216 Effect of cold reduction on tensile properties. Figure 3.0216.

TABLE 3.021

| Alloy Fe-15 Cr-7Ni-Ti | | | | | | | | | | |
|-----------------------|----------------------|-----|----------------------|-----|----------------------------|-----|---------------------------|-----|---------|----------------|
| Source (3)(4)(6)(7) | | | | | | | | | | |
| Form (1) | Strip | | | | Plate | | | | Bar (2) | |
| | 1600 F, + 900F, 4hr | | 1600 F, + 1000F, 4hr | | 1500 F, 1hr AC + 900F, 4hr | | 1500 F, 1hr AC 1050F, 3hr | | HR | 1500 F, 1hr AC |
| Direction | L | T | L | T | L | T | L | T | L | L |
| | F _{tu} -ksi | 200 | 210 | 168 | 175 | 188 | 190 | 157 | 157 | 135 |
| F _{ty} -ksi | 199 | 208 | 160 | 168 | 184 | 184 | 148 | 153 | 104 | 108 |
| e(2in) percent | 5 | 2 | 9 | 8 | | | | | | |
| e(4D) percent | | | | | 14 | 12 | 18 | 16 | 12 | 16 |
| R. A. percent | | | | | 51 | 46 | 65 | 54 | 45 | 68 |

- (1) All forms from same 0.82 Ti heat
- (2) See also Table 3.011

- 3.0212 Tensile and impact properties of plate aged at two temperatures. Table 3.0212.

TABLE 3.0212

| Source (4) | | | | |
|--|---------------------------|-----|----------------------------|-----|
| Alloy Fe-15 Cr-7Ni-Ti | | | | |
| Form 1/2in Plate (specimen dia=0.375 in) (0.82 Ti) | | | | |
| Condition | 1500F, 1hr AC + 900F, 4hr | | 1500F, 1hr AC + 1050F, 2hr | |
| | L | T | L | T |
| F _{tu} -ksi | 188 | 190 | 157 | 157 |
| F _{ty} -ksi | 184 | 184 | 148 | 153 |
| e(4D) percent | 14 | 12 | 18 | 16 |
| R. A. percent | 51 | 46 | 65 | 54 |
| Charpy V ft-lb | 6 | 4 | 40 | 23 |

- 3.0217 Effect of titanium on tensile properties of sheet aged at several temperatures. Figure 3.0216.
- 3.0218 Effect of aging time and temperature on tensile properties of continuously annealed strip. Figure 3.0217.
- 3.0219 Effect of aging temperature on tensile properties of continuously annealed strip. Figure 3.0219.
- 3.02110 Effect of sheet thickness on the tensile properties of annealed and aged alloy. Figure 3.02110.
- 3.02111 Effect of cold rolling and aging on tensile properties of sheet. Figure 3.02111.
- 3.02112 Effect of cold drawing on tensile properties of extruded tubing. Figure 3.02112.
- 3.02113 Effect of annealing and aging on tensile properties of extruded tubing. Table 3.02113.

TABLE 3.02113

| Source | | | | |
|--|-------------|-----|------------------------------------|-----|
| Alloy Fe-15 Cr-7Ni-Ti | | | | |
| Form 3.226 OD x 2.500 ID Tubing (0.82Ti) | | | | |
| Condition | As Extruded | | 1500F, 1hr AC | |
| | | | 1500F, 1hr AC 900F, 8hr 1000F, 8hr | |
| F _{tu} -ksi | 130 | 112 | 176 | 150 |
| F _{ty} -ksi | 111 | 98 | 171 | 141 |
| e(2in) percent | 11 | 16 | 16 | 18 |

- 3.022 Compression.
- 3.0221 Effect of aging on compressive yield strength of bar, Figure 3.0221.

TABLE 3.0221

| | | | |
|----------------------|-----------------------------|-----------|------------|
| Source | (4) | | |
| Alloy | Fe-15Cr-7Ni-Ti | | |
| Form | 1 in dia Bar (0.82Ti) | | |
| Condition | Anneal 1500F, 1 hr AC + Age | | |
| Age | 900F, 8hr | 975F, 4hr | 1050F, 2hr |
| F _{cy} -ksi | 187 | 168 | 145 |

- 3.023 Impact
- 3.0231 Effect of annealing temperature on impact strength of bar, Figure 3.023.
- 3.0232 Effect of double annealing on impact strength of aged bar, Table 3.0232.

- 3.026 Bearing.
- 3.027 Stress concentration.
- 3.0271 Notch properties.
- 3.02711 Effect of annealing temperature on notch properties of bar, Figure 3.02711.

| |
|-------|
| Fe |
| 15 Cr |
| 7 Ni |
| Ti |

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- 3.02712 Effect of aging temperature on sharp notch strength of strip, Figure 3.02712.
- 3.02713 Effect of cold reduction on sharp notch strength of cold rolled and aged sheet, Table 3.02713.

TABLE 3.0232

| | | | | |
|-----------------------|----------------------------------|-----------------------------------|--|---|
| Source | (20) | | | |
| Alloy | Fe-15Cr-7Ni-Ti | | | |
| Form | 2 1/2 in Bar (0.76 Ti) T | | | |
| Condition | 1400 F, 1 hr AC +1000 F, 3 hr | 1500 F, 1 hr AC + 1000 F, 3 hr | 1500 F, 1 hr AC + 1400 F, 1 hr AC + 1000 F, 3 hr | 1650 F, 1 hr AC + 1400 F, AC + 1000 F, 3 hr |
| F _{tu} - ksi | 159 (1) | 158 (1) | - | 154 |
| F _{ty} - ksi | 150 | 152 | - | 148 |
| e (4 D) percent | - | - | - | 11 |
| R. A. percent | - | - | - | 50 |
| Charpy V | - | - | - | - |
| ft - lbs | 7 | 6 | 10 | 14 |

(1) Longitudinal values

- 3.0233 Effect of aging on impact properties of bar from two heats, Figure 3.0233.
- 3.0234 Effect of exposure to elevated temperatures on impact strength of bar, Table 3.0234.

TABLE 3.0234

| | | | | | | |
|-------------|---------------------------------|-----------------|-----------------|---------------------------------|-----------------|--|
| Source | (10) | | | | | |
| Alloy | Fe-15Cr-7Ni-Ti | | | | | |
| Form | 1 in dia Bar (0.76 Ti) | | | | | |
| Condition | 1500F, 1 hr AC + 1000F, 3 hr | | | 1500F, 1 hr AC + 1150F, 1 hr | | |
| Exposure | None | 700F 1000 hr | 800F 1000 hr | None | 800F 1000 hr | |
| IE Charpy V | | | | | | |
| ft-lbs | 32 | 5 | 3 | 96 | 11 | |

- 3.0235 Drop weight (NDT). NDT = 20F for 3/4 hot rolled plate annealed 1500 F, 1 hour AC and aged at 900 F, 8 hour or 1050 F, 2 hour. (4)
- 3.025 Torsion and shear.
- 3.0251 Torsion and shear strength of aged bar, Table 3.0251

TABLE 3.0251

| | | |
|----------------------|---|---------|
| Source | (23) | |
| Alloy | Fe-15Cr-7Ni-Ti | |
| Form | 1/4 in dia Bar (0.88 Ti) | |
| Condition | 1500F, 1 hr AC + 1000F, 3 hr (F _m =160 ksi, F _{ty} =155 ksi) | |
| Test Type | Double Shear | Torsion |
| F _{su} -ksi | 104 | 133 |

TABLE 3.02713

| | | | | | | |
|------------------------|--------------------------|------|------|------|-----|------|
| Source | (17) | | | | | |
| Alloy | Fe-15Cr-7Ni-Ti | | | | | |
| Form | 0.130 in Sheet (0.76 Ti) | | | | | |
| Condition | CR + 900F, 72 hr | | | | | |
| CR percent | 62 | | 75 | | 90 | |
| Direction | L | T | L | T | L | T |
| F _{ty} | 206 | 214 | 212 | 227 | 220 | 242 |
| Notch strength-ksi (2) | 225 | 195 | 209 | 174 | - | 137 |
| Notch strength (1) | 1.09 | 0.91 | 0.98 | 0.77 | - | 0.57 |
| Ratio | | | | | | |

- (1) Ratio of notch strength to yield strength
- (2) For specimen see Figure 3.02712

- 3.0272 Fracture toughness.
- 3.028 Combined properties.
- 3.03 Mechanical Properties at Various Temperatures
- 3.031 Stress strain diagrams.
- 3.0311 Stress strain curves at room and elevated temperatures for aged bar, Figure 3.0311.
- 3.0312 Effect of test temperature on tensile properties of aged bar, Figure 3.0312.
- 3.032 Compression.
- 3.033 Impact.
- 3.034 Bending.
- 3.035 Torsion and shear.
- 3.036 Bearing.
- 3.037 Stress concentration.
- 3.0371 Notch properties.
- 3.03711 Effect of titanium content on room and low temperature sharp notch properties of sheet, Figure 3.03711.
- 3.0372 Fracture toughness.
- 3.038 Combined properties.

| |
|-------|
| Fe |
| 15 Cr |
| 7 Ni |
| Ti |

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- 3.04 Creep and Creep Rupture Properties
- 3.05 Fatigue Properties
- 3.051 Fatigue strength of aged bar, Table 3.051.

4. FABRICATION

- 4.01 Formability
- 4.011 General - Readily hot and cold worked by practices and equipment normally used for processing austenitic stainless steels. Because of an extremely low work hardening rate (see Figure 3.0216) this alloy has excellent cold workability. In this respect it is superior to the austenitic steels and the quenched and tempered steels in all cold forming operations with the exception of stretch forming which is not possible because of the alloy's low uniform elongation. (24)
- 4.012 Hot working. Initial forging and hot rolling temperatures between 2000 F and 2200 F. At these temperatures hot workability is similar to Type 304. Finishing temperatures can be as low as 1400 to 1500F. (22)
- 4.0121 Effect of forge upset temperature on tensile properties, Figure 4.0121.
- 4.0122 Effect of forge upset temperature on impact strength, Figure 4.0122.
- 4.02 Machining and Grinding
- 4.021 General-Machinability in hardened condition is good. In general, at speeds and feeds approximating those for Type 410, tool life is increased (22)
- 4.03 Welding
- 4.031 General - Welding can be accomplished by processes used for austenitic stainless steels. Precautions similar to those for the maraging steels should be observed. The TIG process is preferred for maximum weld toughness.
- 4.0311 Thin sections - Experience is available for thicknesses between 0.020 and 0.060 inch. Filler wire if required can have parent metal composition. When the weld metal and parent metal titanium contents are approximately equal, aging after welding will produce comparable smooth and sharp notch tensile strengths in the parent metal and in the weld joint. (compare Table 4.032 with Figure 3.02717 and 3.02712).
- 4.0312 Heavy sections - Problems here are similar to those encountered in welding the 18 Ni maraging steels. In order to minimize segregations in the weld deposit and consequent loss in toughness the titanium content of the weld wire should be reduced as low as is consistent with obtaining the required weld joint strength. (see Table 4.033) A weld wire with 0.42% Ti is recommended for MIG and TIG welding of plate (see Table 4.033). (15)(22)(24)
- 4.032 Smooth and sharp notch tensile strength characteristics of TIG welded strip given several postweld treatments, Table 4.032.

TABLE 3.051

| Source | | (12) | | | | | | |
|---------------|--------------|--|------------------------------|--------------------------------|-----------------|-----------------|-----------------|--|
| Alloy | | Fe-15Cr-7Ni-Ti | | | | | | |
| Form | | 1 in. dia. bar stock (1) (F _{TU} = 163 ksi) | | | | | | |
| Condition | | 1500F, 1 hr AC + 1000F, 3 hr | | | | | | |
| Method | Stress Ratio | | Stress Concentration | Fatigue Strength-ksi at cycles | | | | |
| | A | R | | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁸ | |
| Rotating Beam | 00 | -1 | Smooth K _t = 1 | 135 | 114 | 100 | 95 | |

(1) Results from 0.69 and 0.88 Ti heats are essentially identical

- 3.06 Elastic Properties
- 3.061 Poisson's ratio.
- 3.062 Modulus of elasticity. 28,500 to 30,500 ksi.
- 3.063 Modulus of rigidity. 12,200 ksi.

TABLE 4.032

| Source | | (13) | | | | | | | |
|--------------------------|-------------|---------------------------------------|--------------|-----|-------------------------------|------|--------------------------------|------|--|
| Alloy | | Fe-15Cr-7Ni-Ti | | | | | | | |
| Condition | | Annealed Strip + TIG Weld (no filler) | | | | | | | |
| Post Weld Treatment | 900 F, 8 hr | | 1000 F, 3 hr | | 1500 F, 1 hr AC + 900 F, 8 hr | | 1500 F, 1 hr AC + 1000 F, 3 hr | | |
| | A (1) | B | A | B | A | B | A | B | |
| Thickness | | | | | | | | | |
| F _{TU} -ksi | 193 | 238 | 172 | 200 | 189 | 224 | 161 | 192 | |
| F _{ty} -ksi | 192 | 237 | 171 | 192 | 188 | 222 | 159 | 184 | |
| e (2 in) percent | 2.5 | 1 | 4.5 | 5.0 | 8 | 1.5 | 5.5 | 4.5 | |
| Notch strength ratio (2) | 0.81 | | 1.07 | | 0.97 | 0.72 | 1.06 | 0.90 | |

- (1) A - 0.031 in strip (0.70 Ti) B - 0.060 in strip.(0.99 Ti)
- (2) Edge notch specimen, notch radius < 0.001 in



4.033 Effect of titanium content on tensile and impact strength of MIG welded plate, Table 4.033.

TABLE 4.033

| Source | (15) | | | | | | | | | | | |
|---------------------------|---|-----|-----|------------------|-----|-----|----------------------------|-----|-----|-----------------------------|-----|-----|
| Alloy | Fe-15Cr-7Ni-Ti | | | | | | | | | | | |
| Form | 1/2 in Plate (0.85 Ti)($F_{tu} = 202$ ksi, $F_{ty} = 196$ ksi) MIG welded | | | | | | | | | | | |
| Post Weld Treatment | As welded | | | Age 900 F, -8 hr | | | 1500 F, 1 hr AC +900F, 8hr | | | 1500 F, 1 hr AC +1000F, 8hr | | |
| | | | | | | | | | | | | |
| Weld Deposit Ti content % | .43 | .52 | .73 | .43 | .52 | .73 | .43 | .52 | .73 | .43 | .52 | .73 |
| F_{tu} - ksi (2) | 126 | 128 | 126 | 154 | 169 | 169 | - | - | 168 | - | - | 148 |
| F_{ty} - ksi | 115 | 111 | 116 | 150 | 161 | 166 | - | - | 164 | - | - | 142 |
| Impact (1) | 34 | 54 | 60 | 32 | 8 | 4 | 51 | 22 | 4 | 45 | 28 | 13 |
| Charpy Vif-lb | | | | | | | | | | | | |

- (1) Notch at weld center, in weld direction and perpendicular to plate surface
- (2) Smooth specimens transverse to weld

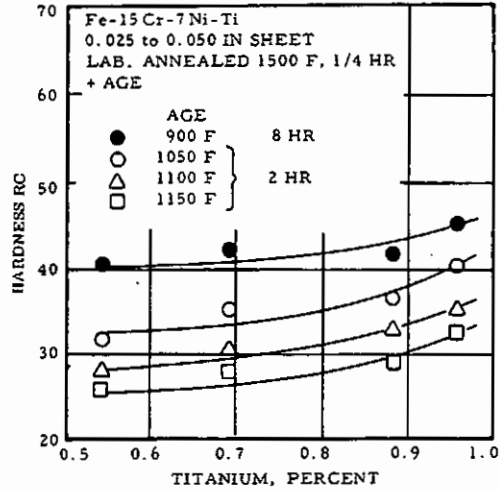


FIG. 1.061 EFFECT OF TITANIUM CONTENT ON HARDNESS OF SHEET AGED AT SEVERAL TEMPERATURES (2)

| |
|-------|
| Fe |
| 15 Cr |
| 7 Ni |
| Ti |

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TABLE 4.034

| Source | (15) | | | |
|-------------------|----------------------------------|-------------|--------------------|-------------|
| Alloy | Fe-15Cr-7Ni-Ti | | | |
| Form | 1/2 in Plate (0.42 Ti) | | | |
| Condition | TIG Welded (AM 362 wire 0.40 Ti) | | | |
| Specimen Location | All Weld Metal | | Transverse to Weld | |
| | As Welded | 900 F, 8 hr | As Welded | 900 F, 8 hr |
| F_{tu} - ksi | 122 | 134 | 113 | 136 |
| F_{ty} - ksi | 102 | 132 | 102 | 128 |
| e (4 D) percent | 18 | 18 | 15 | 15 |
| R. A. percent | 67 | 56 | 66 | 69 |

4.034 Tensile properties of TIG welded plate, Table 4.034

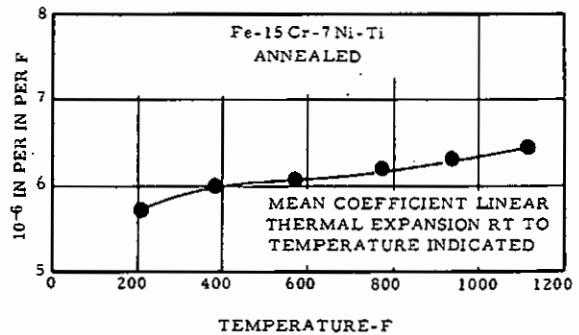


FIG. 2.014 COEFFICIENT OF EXPANSION (4)

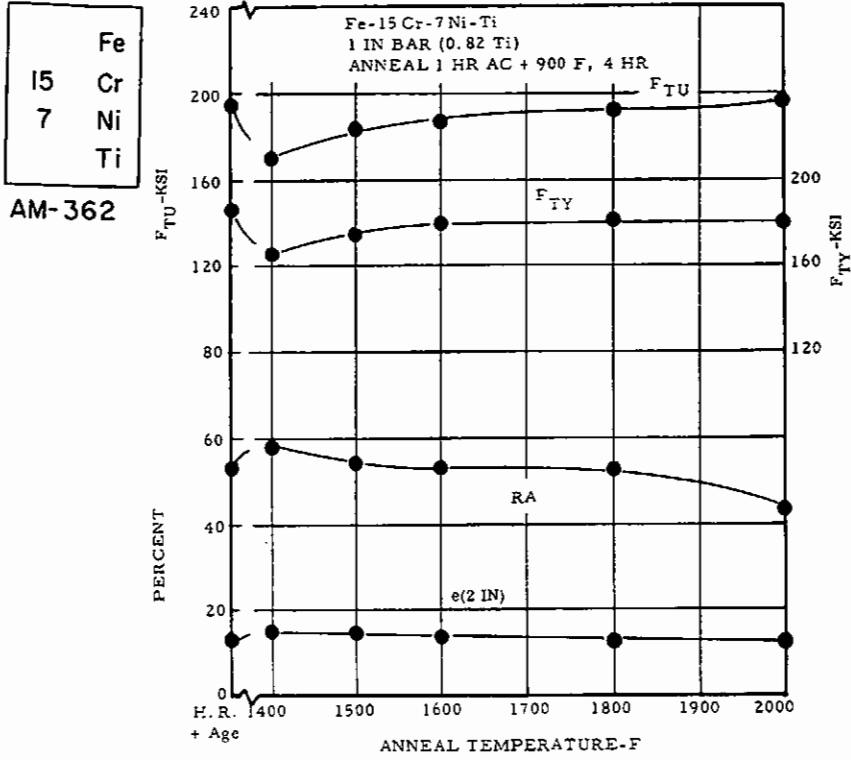


FIG. 3.0214 EFFECT OF ANNEALING TEMPERATURE ON TENSILE PROPERTIES OF BAR (4)

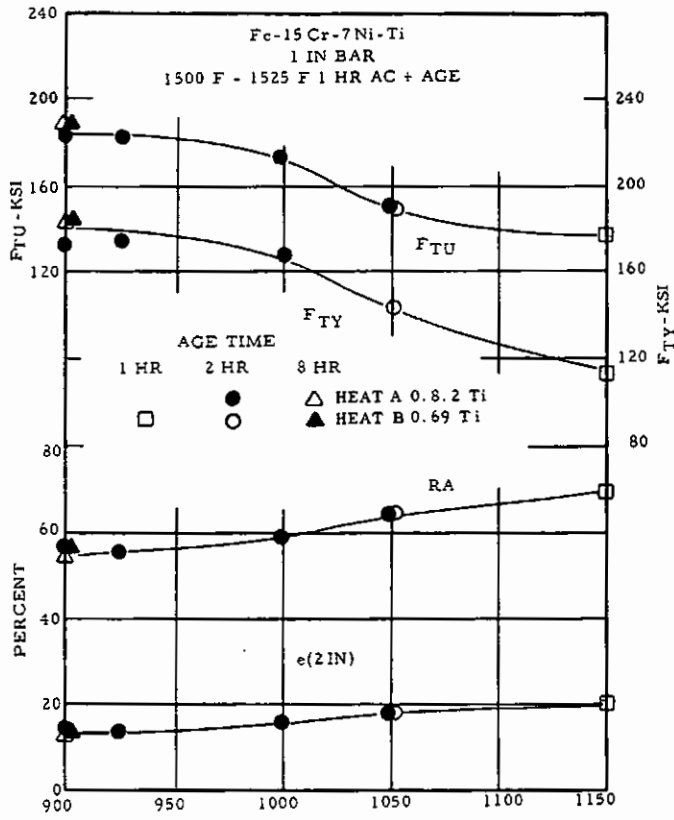


FIG. 3.0215 EFFECT OF AGING TEMPERATURE ON TENSILE PROPERTIES OF BAR (3)(4)

Fe
15 Cr
7 Ni
Ti
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Fe
15 Cr
7 Ni
Ti
AM-362

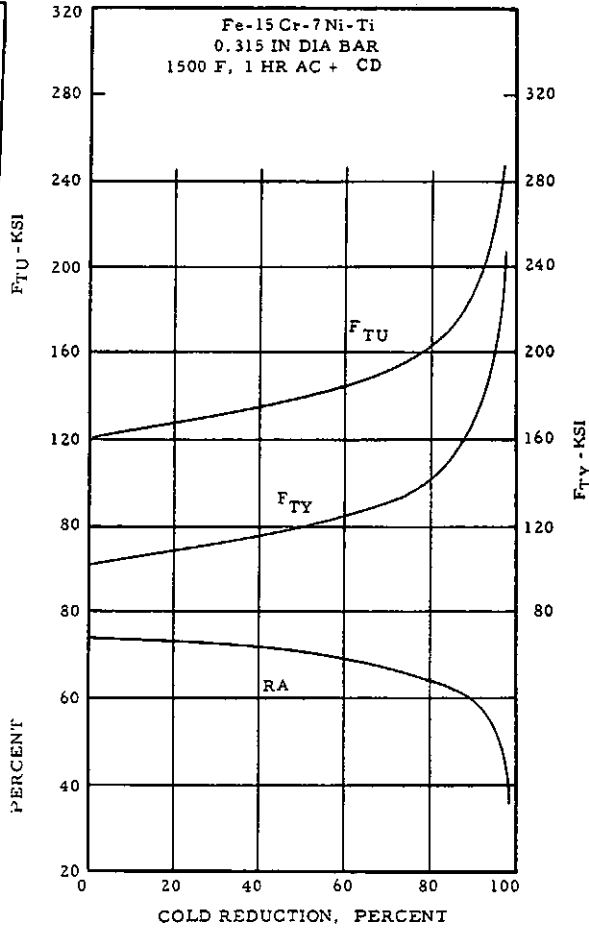


FIG. 3.0216 EFFECT OF COLD REDUCTION ON TENSILE PROPERTIES (21)

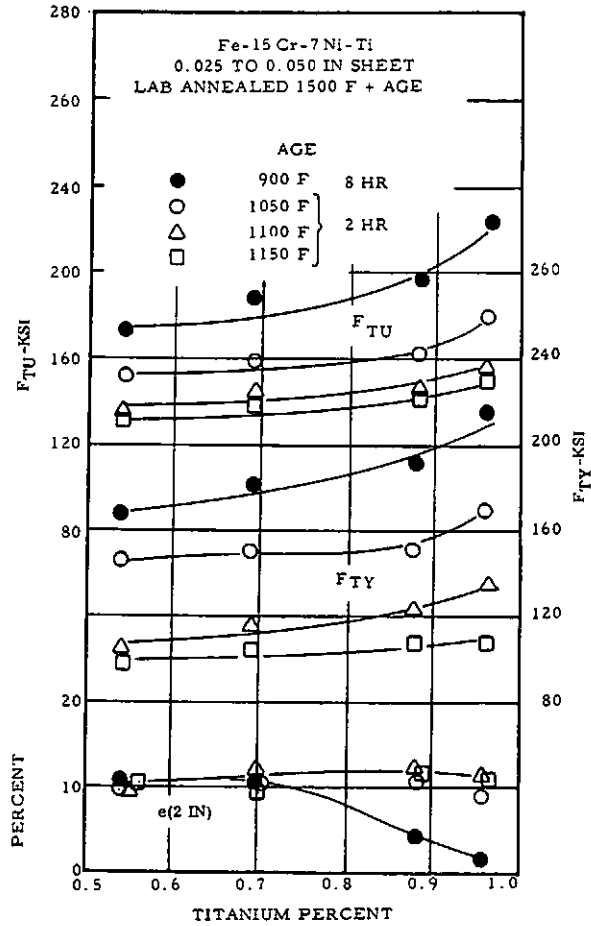


FIG. 3.0217 EFFECT OF TITANIUM ON TENSILE PROPERTIES OF SHEET AGED AT SEVERAL TEMPERATURES (2)

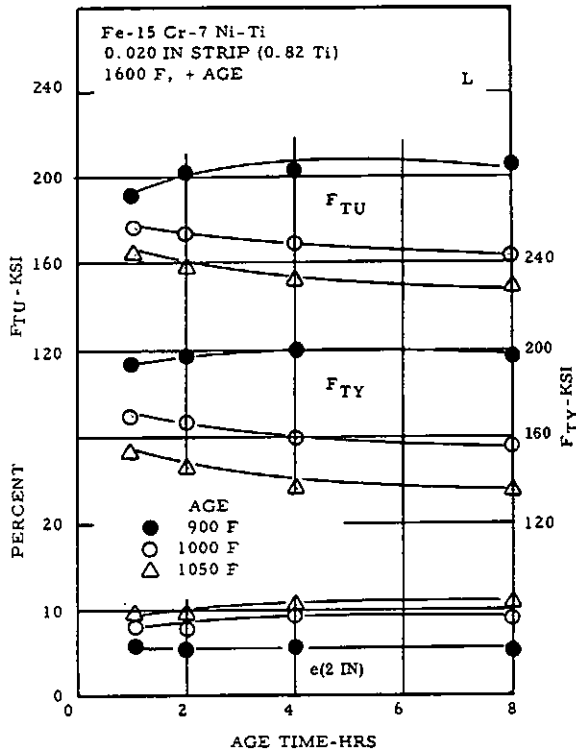


FIG. 3.0218 EFFECT OF AGING TIME AND TEMPERATURE ON TENSILE PROPERTIES OF CONTINUOUS ANNEALED STRIP

(6)

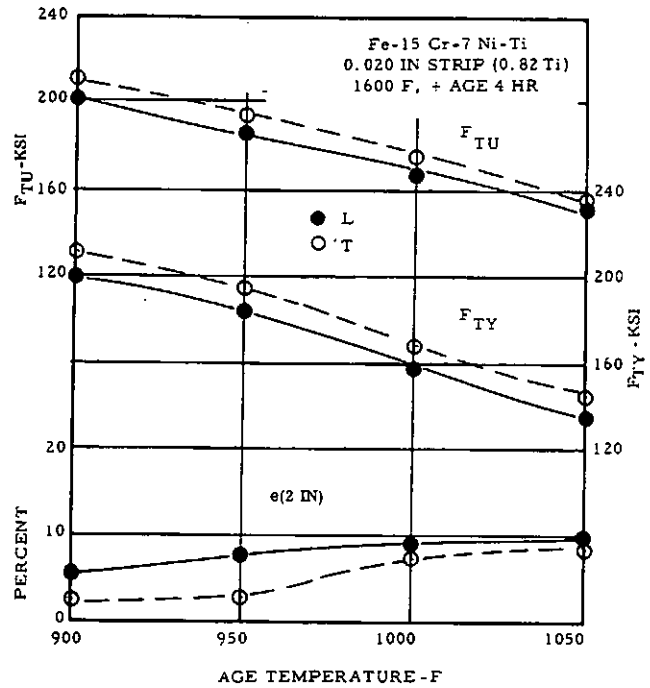


FIG. 3.0219 EFFECT OF AGING TEMPERATURE ON TENSILE PROPERTIES OF CONTINUOUS ANNEALED STRIP

(6)

Fe
15 Cr
7 Ni
Ti
AM-362

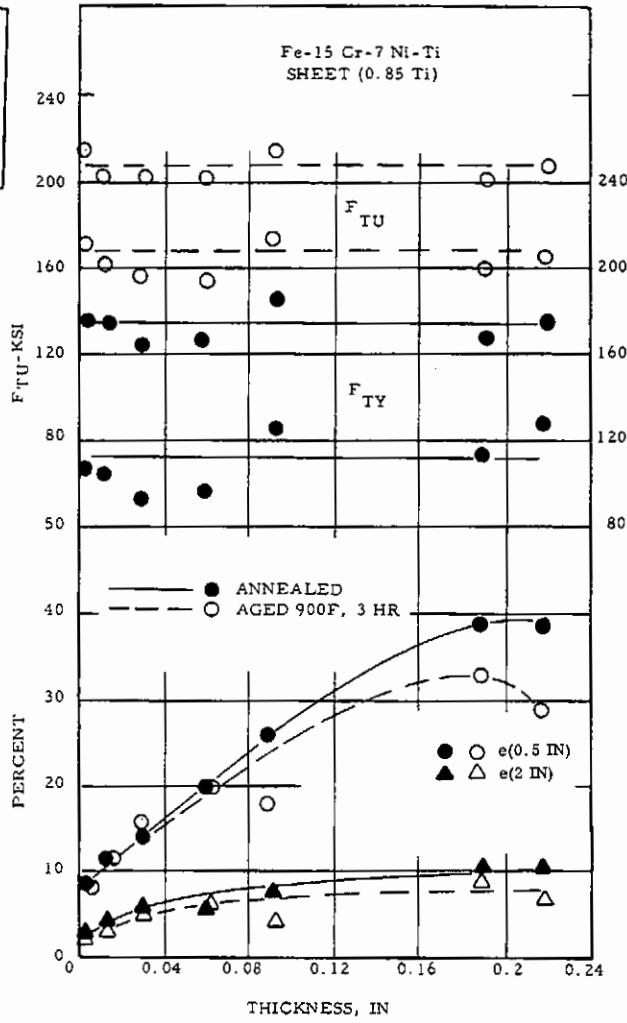


FIG. 3.02110 EFFECT OF SHEET THICKNESS ON THE TENSILE PROPERTIES OF ANNEALED & AGED ALLOY (8)

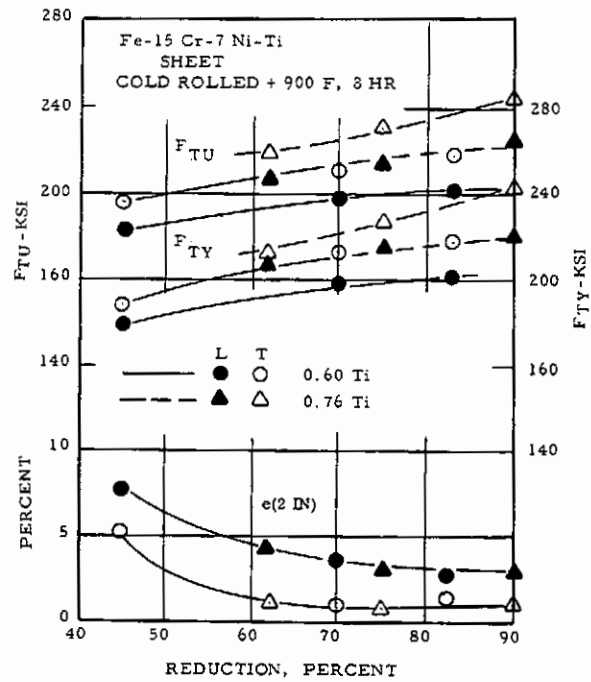


FIG. 3.02111 EFFECT OF COLD ROLLING AND AGING ON TENSILE PROPERTIES OF SHEET (9) (17)

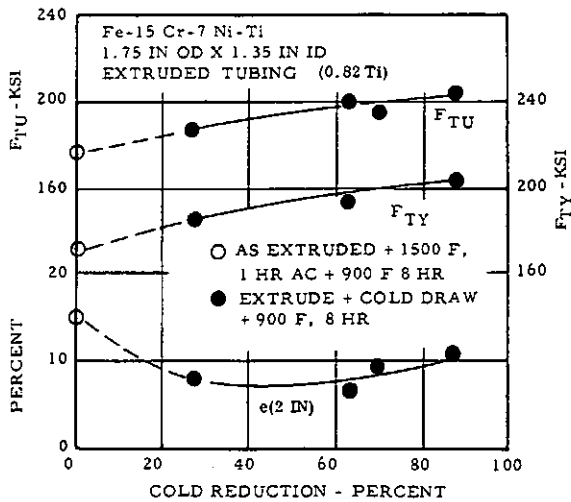


FIG. 3.02112 EFFECT OF COLD DRAWING ON TENSILE PROPERTIES OF EXTRUDED TUBING (4)

| |
|--------|
| Fe |
| 15 Cr |
| 7 Ni |
| Ti |
| AM-362 |

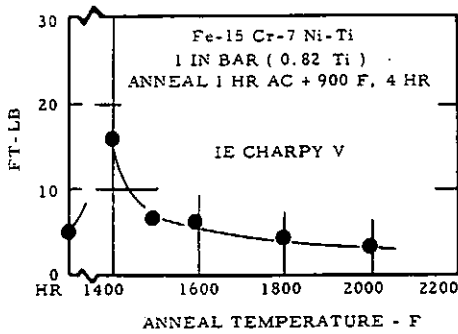


FIG. 3.0231 EFFECT OF ANNEALING TEMPERATURE ON IMPACT STRENGTH OF BAR (4)

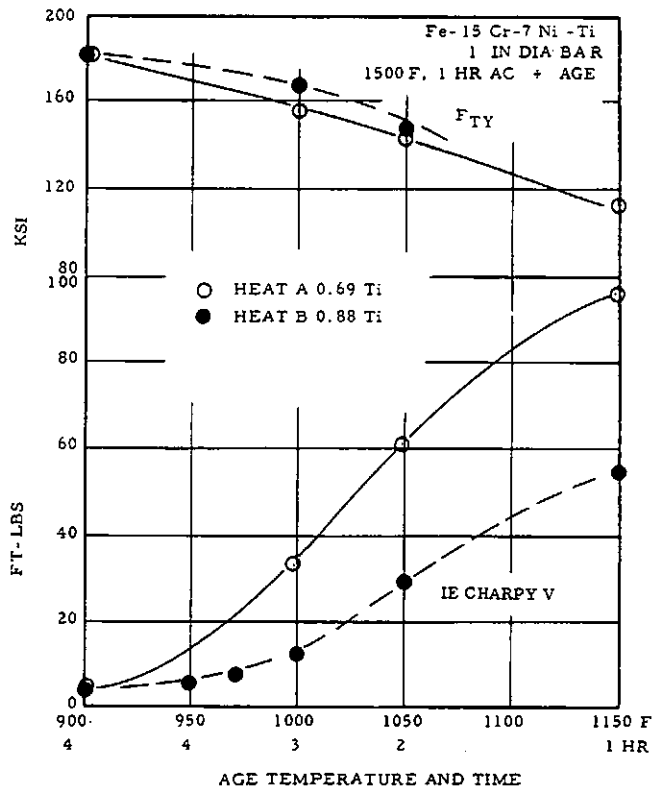


FIG. 3.0233 EFFECT OF AGING ON IMPACT PROPERTIES OF BAR FROM TWO HEATS (5) (7)

Fe
15 Cr
7 Ni
Ti
AM-362

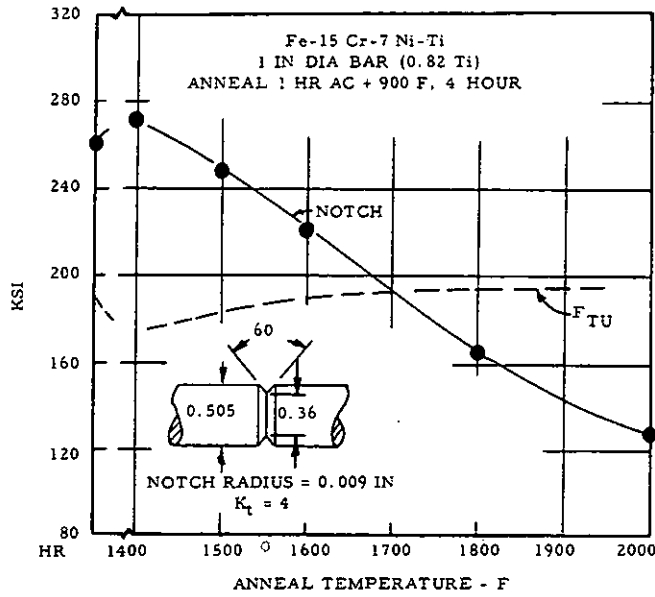


FIG. 3.02711 EFFECT OF ANNEALING TEMPERATURE ON NOTCH TENSILE PROPERTIES OF BAR (4)

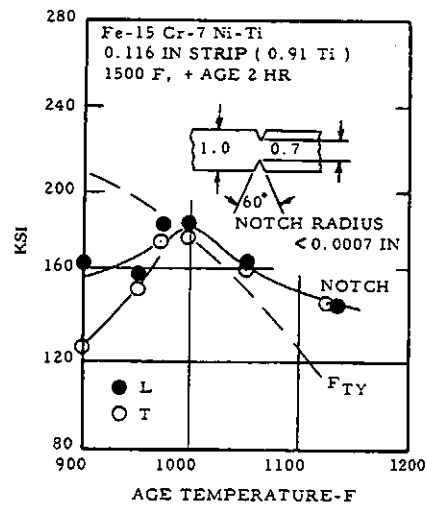


FIG. 3.02712 EFFECT OF AGING TEMPERATURE ON SHARP NOTCH STRENGTH OF STRIP

(18)

| | |
|----|----|
| | Fe |
| 15 | Cr |
| 7 | Ni |
| | Ti |

AM-362

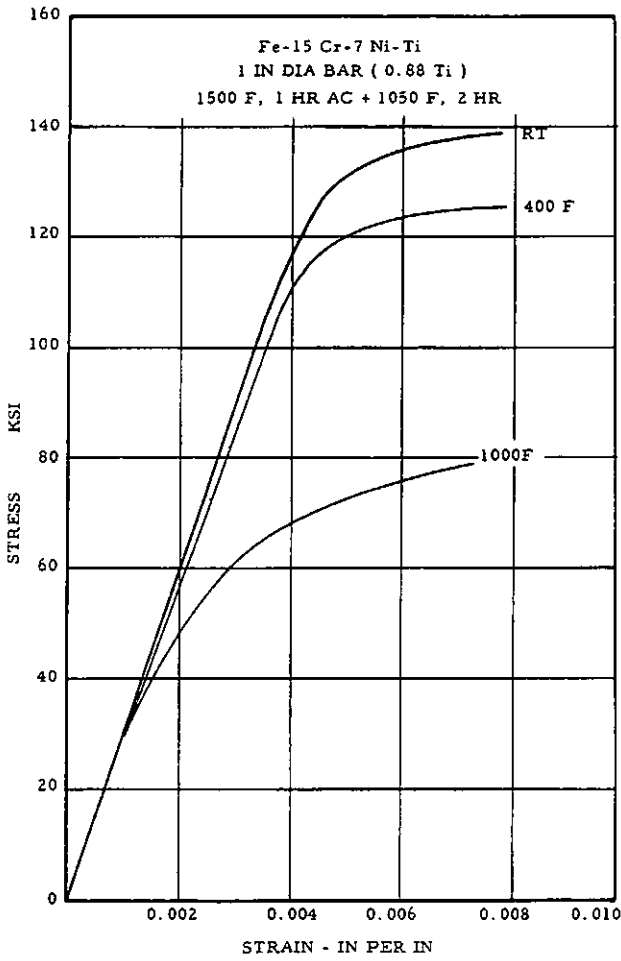


FIG. 3.0311 STRESS STRAIN CURVES AT ROOM AND ELEVATED TEMPERATURES FOR AGED BAR (11)

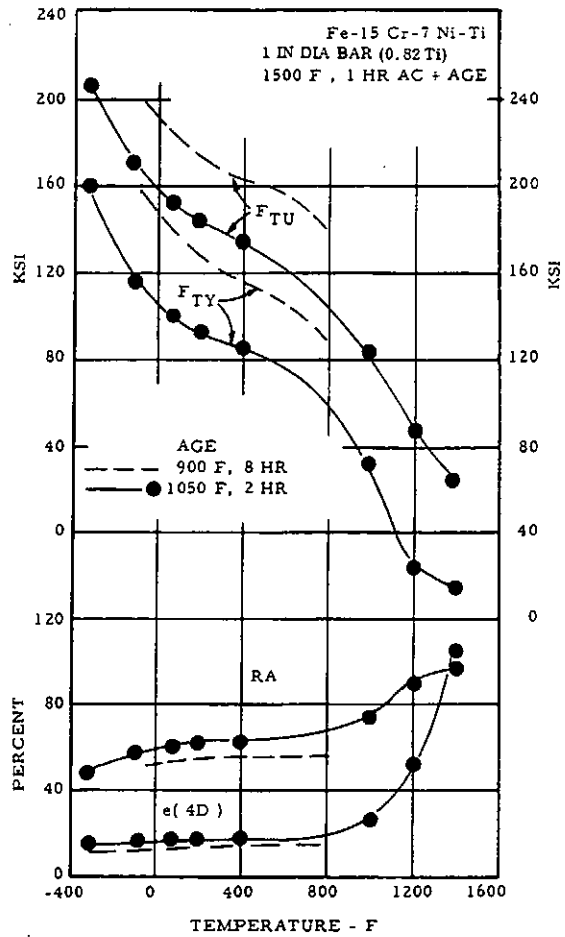


FIG. 3.0312 EFFECT OF TEST TEMPERATURE ON TENSILE PROPERTIES OF AGED BAR

(4) (11)

| | |
|----|----|
| | Fe |
| 15 | Cr |
| 7 | Ni |
| | Ti |

AM-362

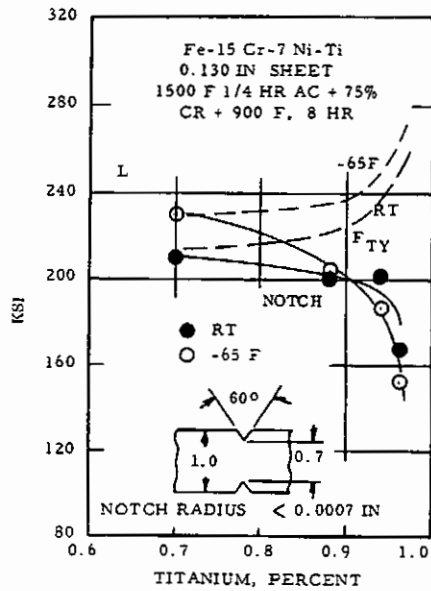


FIG. 3.03711 EFFECT OF TITANIUM CONTENT ON ROOM AND LOW TEMPERATURE SHARP NOTCH PROPERTIES OF SHEET (19)

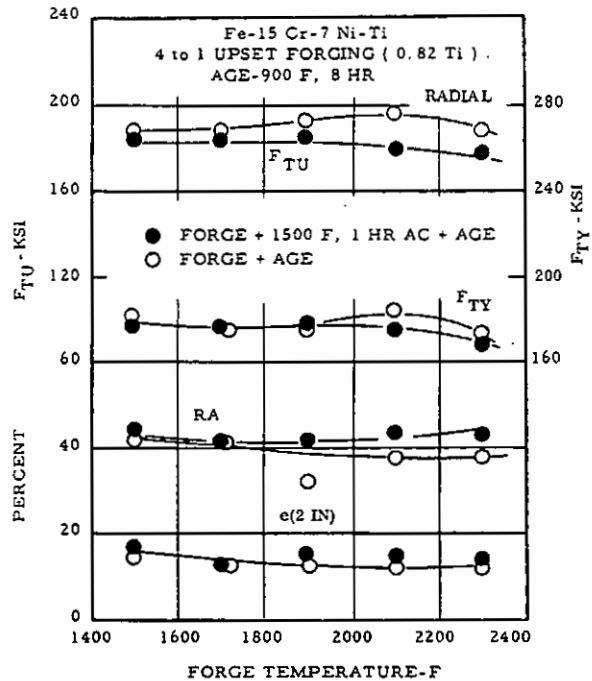


FIG. 4.0121 EFFECT OF FORGE UPSET TEMPERATURE ON TENSILE PROPERTIES (4)

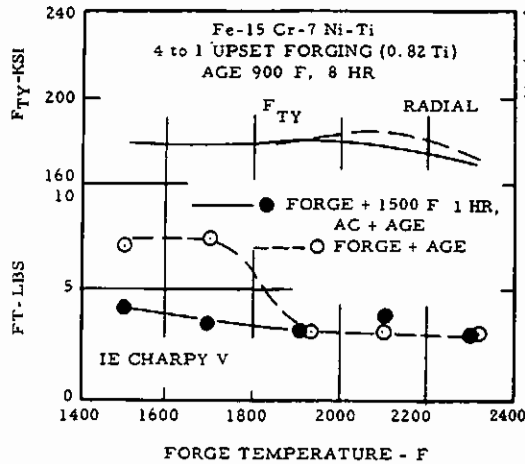
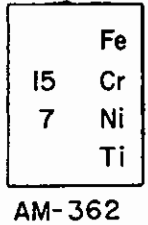


FIG. 4.0122 EFFECT OF FORGE UPSET TEMPERATURE ON IMPACT STRENGTH (4)



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