

**1. GENERAL**  
This non-heat treatable magnesium alloy containing zinc and rare earth is a recent development for room temperature service. It is available in the form of sheet and plate. In either the 0 or H24 Condition, this alloy possesses the best ductility of all magnesium sheet alloys. It also exhibits good weldability and needs no postweld stress relief anneal.

- 1.01 **Commercial Designation.** ZE 10 A.
- 1.02 **Alternate Designations.** None.
- 1.03 **Specifications.** AMS specification pending.
- 1.04 **Composition.** Table 1.04.

TABLE 1.04

Source	Percent	
	Min	Max
Zinc	1.0	1.5
Rare Earths	0.12	0.22
Impurities, Total	-	0.30
Magnesium	Balance	

- 1.05 **Heat Treatment**
- 1.051 **Anneal to 0 Condition** for maximum formability. 500 F, 1 hr.
- 1.052 **Hot roll and partial anneal** to H24 Condition by supplier.
- 1.06 **Hardenability.** This alloy can be hardened only by cold work.
- 1.07 **Forms and Conditions Available.** Sheet and plate are available in thicknesses from 0.016 to 0.500 in in 0 Condition, and from 0.016 to 0.250 in in H24 Condition.
- 1.08 **Melting and Casting Practice.** See AZ 31 B.
- 1.09 **Special Considerations**
- 1.091 **When welding sheet and plate** of this alloy to magnesium alloy extrusions, an extrusion alloy which does not require post weld stress relief is recommended.

**2. PHYSICAL AND CHEMICAL PROPERTIES**

- 2.01 **Thermal Properties**
- 2.011 **Melting range.** 1100 to 1195 F.
- 2.012 **Phase changes.** None.
- 2.013 **Thermal conductivity.** 0 Condition, 79.7 Btu ft (hr sq ft F). H24 Condition, 76.7 Btu ft (hr sq ft F).
- 2.014 **Thermal expansion.** See AZ 31 B.
- 2.015 **Specific heat.** 0.25 Btu per (lb F).
- 2.016 **Diffusivity.** 0 Condition, 3.04 sq ft per hr. H24 Condition, 2.95 sq ft per hr.
- 2.02 **Other Physical Properties**
- 2.021 **Density.** 0.0634 lb per cu in. 1.758 gr per cu cm.
- 2.022 **Electrical resistivity.** 0 Condition, 1.97 microhm-in. H24 Condition, 2.05 microhm-in.
- 2.023 **Magnetic properties.** Alloy is nonmagnetic.
- 2.03 **Chemical Properties**
- 2.031 **Corrosion resistance.** General corrosion resistance of the alloy is similar to AZ 31 B.
- 2.0311 **Alloy is more susceptible to pitting** than AZ 31 B.
- 2.0312 **Alloy is free from stress corrosion cracking.**
- 2.032 **Oxidation resistance.** See AZ 31 B.
- 2.04 **Nuclear Properties.** See EZ 33 A.

**3. MECHANICAL PROPERTIES**

**3.01 Specified Mechanical Properties**

**3.011 Producers' specified mechanical properties, Table 3.011.**

TABLE 3.011

Source	(1)					
	Form Sheet, Plate					
Condition	0			H24		
	Thickness - in	0.016 to 0.060	0.061 to 0.250	0.016 to 0.125	0.126 to 0.188	0.189 to 0.250
$F_{tu}$ , min - ksi	30	30	29	36	34	31
$F_{ty}$ , min - ksi	-	-	-	-	-	-
$F_{cy}$ , min - ksi	-	-	-	-	-	-
$e(2 in)$ min - percent	15	15	12	4	4	4

Mg
1 Zn
0.2 RE
ZE 10 A

**3.02 Mechanical Properties at Room Temperature**

**3.021 Typical mechanical properties, Table 3.021.**

TABLE 3.021

Source	(1)					
	Form Sheet, Plate					
Condition	0			H24		
	Thickness - in	0.016 to 0.060	0.061 to 0.250	0.016 to 0.125	0.126 to 0.188	0.189 to 0.250
$F_{tu}$ - ksi	33	33	31	38	37	34
$F_{ty}$ - ksi	23	20	16	28	25	19
$F_{cy}$ - ksi	16	16	12	26	24	16
$e(2 in)$ - percent	23	23	18	12	12	8

**3.022 Stress strain curves in tension** for sheet in 0 and H24 Conditions, Fig. 3.022.

**3.023 Stress strain curves in compression** for sheet in 0 and H24 Conditions, Fig. 3.023.

**3.03 Mechanical Properties at Various Temperatures**

**3.04 Creep and Creep Rupture Properties**

**3.05 Fatigue Properties.** Table 3.05.

TABLE 3.05

Source	(1)							
	Form	0.064 to 0.190 in Sheet					Fatigue Strength -ksi at Cycles	
		Condition	Method	Stress Ratio		Stress Concentration		
A	B			$10^5$	$10^6$		$10^7$	
RT	Direct Stress	1	0	0.5	Smooth	19	16	15
			0.33			25	23	22

**3.06 Elastic Properties**

**3.061 Modulus of elasticity** at room and elevated temperatures, Fig. 3.061.

**3.062 Modulus of rigidity.** 2,400 ksi.

**3.063 Poisson's ratio.** 0.34.

**4. FABRICATION.** Similar to AZ 31 B. Complementary and different information is listed below.

**4.01 Forming**

**4.011 Hot forming of 0 Condition** is performed at 500 F maximum, with the maximum time at temperature being limited to 1 hr.

**4.012 Hot forming of H24 Condition** is performed at 275 F maximum, with the time at temperature being limited to 1 hr.

**4.013 Bending.** Suggested bend factors, Fig. 4.013.

**4.03 Welding.** This alloy possesses good weldability. For fusion welding, AZ 92 A, AZ 61 A or EZ 33 A welding rod can be used. It may be necessary to provide back up plates if AZ 92 A or AZ 61 A rod is used. No corrosion cracking

Mg  
1 Zn  
0.2 RE

ZE 10 A

4.031 will occur with these welding rod materials if the alloy is welded to itself, and no stress relief is required. Tensile properties of 0.063 in welded sheet, Table 4.031.

TABLE 4.031

Source	(1)							
	Sheet 0.063 in							
Form	Sheet 0.063 in							
	O				H24			
Condition	Base Metal	Welded with Rod			Base Metal	Welded with Rod		
		AZ 61A	AZ 92A	EZ 33A		AZ 61A	AZ 92A	EZ 33A
$F_{tu}$ - ksi	34	31	30	29	39	32	32	31
$F_{ty}$ - ksi	26	17	16	17	30	16	18	18
$e_1$ (in) - percent	29	8	6	6	12	4	4	4
Weld Efficiency, Percent	-	91	88	85	-	82	82	80

4.032 Fatigue properties of welded sheet, Table 4.032.

TABLE 4.032

Source	(1)							
	0.064 to 0.190 in Sheet							
Form	Welded with AZ92A Rod							
	Temp F	Method	Stress Ratio		Stress Concentration	Fatigue Strength - ksi at Cycles		
A			R	$10^5$		$10^6$	$10^7$	
RT	Direct Stress	0.33	0.50	K = 1	13	9	8	5.5

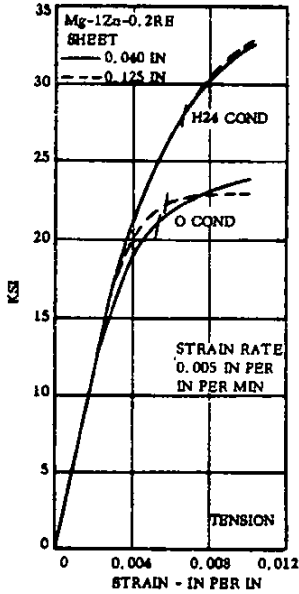


FIG. 3.022 STRESS STRAIN CURVES IN TENSION FOR SHEET IN O AND H24 CONDITIONS (2)

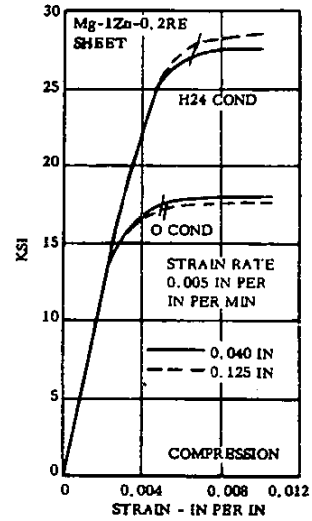


FIG. 3.023 STRESS STRAIN CURVES IN COMPRESSION FOR SHEET IN O AND H24 CONDITIONS (2)

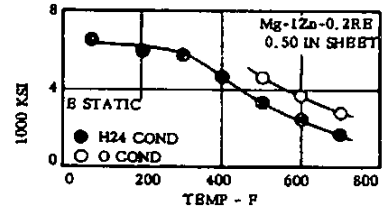


FIG. 3.061 MODULUS OF ELASTICITY AT ROOM AND ELEVATED TEMPERATURES (3)

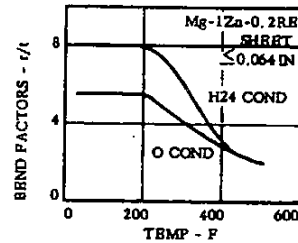


FIG. 4.013 SUGGESTED BEND FACTORS (1)

REFERENCES

- 1 The Dow Chemical Co., "ZE 10 A Magnesium Alloy Sheet and Plate", (1958)
- 2 The Dow Chemical Co., "Stress-Strain Curves for ZE 10 A (Sheet)", (Feb. 16, 1959)
- 3 Fenn, R. W., Jr., "Young's Modulus of Magnesium Alloys as a Function of Temperature and Metallurgical Variables", The Dow Chemical Co., (June 22-27, 1959)