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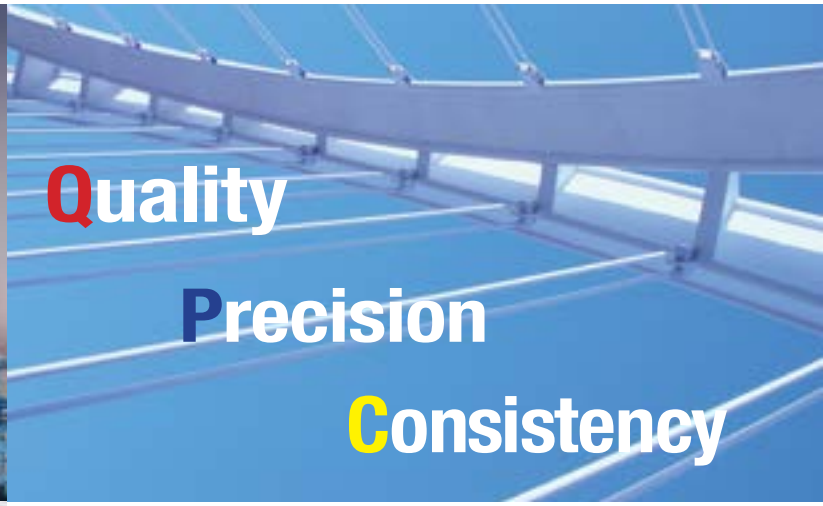

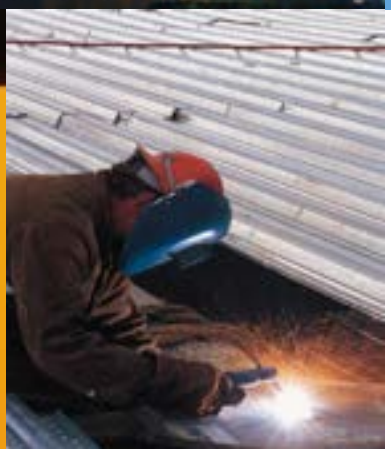

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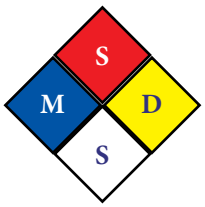

Material
Safety
Data
Sheet

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Guide to the Choice of Filler Metal for General Purpose Welding

Base Metal	AM100A	AZ10A	AZ31B AZ31C	AZ61A	AZ63A	AZ80A	AZ81A	AZ91C	AZ92A	EK41A	EZ33A
AM100A	AZ101A AZ92A										
AZ10A	AZ92A	AZ61A AZ92A									
AZ31B AZ31C	AZ92A	AZ61A AZ92A	AZ61A AZ92A								
AZ61A	AZ92A	AZ61A AZ92A	AZ61A AZ92A	AZ61A AZ92A							
AZ63A	C	C	C	C	AZ61A AZ92A						
AZ80A	AZ92A	AZ61A AZ92A	AZ61A AZ92A	AZ61A AZ92A	C	AZ61A AZ92A					
AZ81A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ61A AZ92A				
AZ91C	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ61A AZ92A			
AZ92A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ101A		
EK41A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	
EZ33A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
HK31A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
HM21A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
HM31A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
HZ32A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
K1A	AZ92A	AZ92A	AZ92A	AZ92A	C	AZ92A	AZ92A	AZ92A	AZ92A	EZ33A	EZ33A
LA141A	D	D	EZ33A	C	C	C	C	C	C	D	D
M1A MG1	AZ92A	AZ61A AZ92A	AZ61A AZ92A	AZ61A AZ92A	C	AZ61A AZ92A	AZ92A	AZ92A	AZ92A	AZ92A	AZ92A
QE22A	D	D	EZ33A	D	C	D	D	D	D	EZ33A	EZ33A
ZE10A	AZ92A	AZ61A AZ92A	AZ61A AZ92A	AZ61A AZ92A	C	AZ61A AZ92A	AZ92A	AZ92A	AZ92A	EZ33A AZ92A	EZ33A AZ92A
ZE41A	D	D	D	D	C	D	D	D	D	EZ33A	EZ33A
ZK21A	AZ92A	AZ61A AZ92A	AZ61A AZ92A	AZ61A AZ92A	C	AZ61A AZ92A	AZ92A	AZ92A	AZ92A	AZ92A	AZ92A

(Continued)

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Guide to the Choice of Filler Metal for General Purpose Welding *(Continued)*

Base Metal	HK31A	HM21A	HM31A	HZ32A	K1A	LA141A	M1A MG1	QE22A	ZE10A	ZE41A	ZK21A
HK31A	EZ33A										
HM21A	EZ33A	EZ33A									
HM31A	EZ33A	EZ33A	EZ33A								
HZ32A	EZ33A	EZ33A	EZ33A								
K1A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A						
LA141A	D	EZ33A	D	D	D	EZ33A					
M1A MG1	AZ92A	AZ92A	AZ92A	AZ92A	AZ92A	D	AZ61A AZ92A				
QE22A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	C	EZ33A			
ZE10A	EZ33A AZ92A	EZ33A AZ92A	EZ33A AZ92A	EZ33A AZ92A	EZ33A AZ92A	EZ33A	AZ61A AZ92A	EZ33A AZ92A	AZ61A AZ92A		
ZE41A	EZ33A	EZ33A	EZ33A	EZ33A	EZ33A	D	D	EZ33A	D	EZ33A	
ZK21A	AZ92A	AZ92A	AZ92A	AZ92A	AZ92A	D	AZ61A AZ92A	AZ92A	AZ61A AZ92A	AZ92A	AZ61A AZ92A

Notes:
a. When more than one filler metal is given, they are listed in order of preference.
b. The letter prefix (ER or R), designating usability of the filler metal, has been deleted, to reduce clutter in the table.
c. Welding not recommended.
d. No data available.
When welding ZH62A, ZK51A, ZK60A, ZK61A; EZ33A is to be used.

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Chemical Composition Requirements

AWS Class	Mg	Al	Be	Mn	Zn	Zr	Rare Earth	Cu	Fe	Ni	Si	Total Other
AZ61A	REM	5.8 ~ 7.2	0.0002 ~ 0.0008	0.15 ~ 0.5	0.40 ~ 1.5	-	-	0.05	0.005	0.005	0.05	0.30
AZ92A	REM	8.3 ~ 9.7	0.0002 ~ 0.0008	0.15 ~ 0.5	1.7 ~ 2.3	-	-	0.05	0.005	0.005	0.05	0.30
AZ101A	REM	9.5 ~ 10.5	0.0002 ~ 0.0008	0.15 ~ 0.5	0.75 ~ 1.25	-	-	0.05	0.005	0.005	0.05	0.30
EZ33A	REM	-	0.0008	-	2.0 ~ 3.1	0.45 ~ 1.0	2.5 ~ 4.0	-	-	-	-	0.30

Welding Considerations

Gas tungsten arc and gas metal arc welding are the most commonly used processes for welding magnesium alloys.
Plasma arc welding is also suitable for magnesium alloys.
Oxyfuel gas welding should be used only for temporary repair work, when suitable arc welding equipment is not available.

Magnesium alloys are welded by the gas tungsten arc welding (GTAW) process using techniques and equipment similar to those used for aluminum.
Argon, helium, or mixtures of these gases are used for shielding.
Alternating current is preferred because of a combination of good arc cleaning action and good joint penetration, although direct current is also used.
Direct current with the electrode positive provides excellent cleaning action but is limited to thin base metal.
Direct current with the electrode negative is sometimes used for mechanized welding with helium shielding gas to provide deep joint penetration.
GTAW is generally recommended for the welding of magnesium alloy castings.
Welding is usually limited to the repair of defects in clean castings.

The basic principles for gas metal arc welding (GMAW) of magnesium alloys are the same as for other base metals.
The higher filler metal deposition rate of this process reduces the welding time, thereby reducing weld distortion and fabrication costs.
Argon is generally used as a shielding gas; occasionally mixtures of argon and helium are used.
Pulsed GMAW and short circuit GMAW are both used for magnesium alloys.
Higher welding current, to produce spray transfer of the filler metal without pulsing, is also used.
Globular transfer is not suitable.