LUXFER
MEL TECHNOLOGIES

DATASHEET • 1080†

Melmag® Battery Plate and Strip

Luxfer Mel Technologies produce a range of magnesium alloys to meet all seawater battery applications. These include the traditional commercial materials AZ31 and AZ61, as well as the high power speciality magnesium alloys developed by Luxfer Mel Technologies such as MELMAG® AP65, MELMAG® 75 and MELMAG® AT61. AZ31 and AZ61 are the industry standard alloys which are more economical to produce, available in a more extensive range of sizes and offer good all round properties. MELMAG® AP65, 75, and AT61 are high performance alloys which are more electrochemically reactive and generate much higher cell voltages. This results in rapid activation and short voltage transience on switching between loads, making them more suitable for the high demands required for military applications.

The chemical and metallurgical conditions of all these alloys are carefully controlled to provide optimum properties.

Condition

MELMAG® AP65, 75, and AT61 sheet is normally supplied solution treated and weight flattened, while AZ31 and AZ61 sheet is annealed and weight flattened.

AZ31 and AZ61 coiled strip is available as-fabricated or annealed at the user's option.

Packing

MELMAG® AP65, 75, and AT61 sheet is packed flat in convenient lots, sealed in polythene envelopes with silica gel dessicant bags to B.S. 2540. The envelopes are packed in waterproofed wooden cases with wooden spacers to maintain flatness when required.

AZ31 and AZ61 coils are packed horizontally (eye to the sky) in sealed steel drums with silica gel dessicant bags. Drums are palletised for ease in handling.

Product availability

MELMAG® AP65, 75, and AT61 are available only as flat sheet. AZ31 and AZ61 are available as flat sheet or coiled strip. Special shapes may be blanked in sheet form in accordance with customers' requirements.

Minimum sheet thickness	
AZ31 and AZ61	0.25 mm
MELMAG® AP65 and 75	0.25 mm
MELMAG® AT61	0.25 mm
Maximum sheet width	
AZ31 and AZ61	380 mm
MELMAG® AP65 and 75	305 mm
MELMAG® AT61	305 mm
Maximum sheet length	
AZ31 and AZ61	2790 mm
MELMAG® AP65 and 75	800 mm
MELMAG® AT61	800 mm
Minimum coil gauge	
AZ31 and AZ61	0.15 mm
Maximum coil width	
AZ31 and AZ61	380 mm

Chemical composition limits

AZ31

Aluminium	2.5 - 3.5%
Zinc	0.6 - 1.4%
Manganese	0.20 - 1.0%

AZ61

Aluminium	5.8 - 7.2%
Zinc	0.4 - 1.5%
Manganese	0.15 - 0.5%

MELMAG® AP65

Aluminium	6.0 - 7.0%
Lead	4.4 - 5.0%
Zinc	0.4 - 1.5%
Manganese	0.15 - 0.3%

MELMAG® 75

Thallium	6.6 - 7.6%
Aluminium	4.6 - 5.6%
Manganese	0.25% maximum

MELMAG® AT61

Aluminium	5.7 - 6.5%
Tin	0.8 - 1.2%

Standard tolerances

For MELMAG® AP65, 75, and AT61

Gauge	0.25 - 0.5 mm	±0.05 mm
	over 0.5 mm	±10% of nominal
Width	up to 305 mm	±0.3 mm
Length	up to 800 mm	±1 mm

For AZ31 and AZ61

Gauge	0.25 - 0.35 mm	±0.025 mm
	0.36 - 0.70 mm	±0.038 mm
	0.71 - 1.14 mm	±0.051 mm
	1.15 - 1.60 mm	±0.064 mm
	1.61 - 2.00 mm	±0.076 mm
Width	up to 150 mm	±0.25 mm
	151 - 305 mm	±0.41 mm
Length	up to 800 mm	±1 mm
	1000 - 1219 mm	±2.4 mm
	1220 - 2540 mm	±3.2 mm
Lateral Bow or Camber	Maximum in any 1 metre 8.3 mm	

Surface finish

Sheet or strip is normally supplied scratchbrushed on both sides with a surface finish in the range 500 - 3125 nanometres C.L.A.

Contact resistance immediately after brushing is not more than 100 micro ohms/cm2 with a contact pressure of 17 N/mm^2.

Electrochemical performance

MELMAG® AP65 and 75 were developed for use in high rate primary seawater activated batteries with flowing electrolyte such as torpedo batteries and will operate satisfactorily up to 500 mA/cm². Under most conditions voltage increase per cell of 20% and 30% respectively can be obtained compared to AZ61. These alloys have also been successfully used in lower rate applications such as sonobuoys or life-jackets. Higher reactivity compared to AZ61 gives shorter activation times and shorter voltage transients when switching between high and low loads.

MELMAG® AT61 also gives shorter activation times compared to AZ61. This alloy is designed to offer reduced switching transients where short periods of high discharge are needed.

The reaction product from MELMAG® AP65 is in a fine black flaky form. In batteries with flowing electrolyte this is washed out of the cell; in static cells it may settle to the bottom of the cell.

The reaction product from MELMAG® 75 is in a fine black flaky form that washes out of cells with flowing electrolyte. In static cells, a thicker but porous brown black film may accummulate. This does not affect electrode performance, but may require special design considerations.

Under low current density discharge conditions, the relationship between voltage and current density is approximately:

V = 1.50 - 0.00144 I	**for MELMAG®AZ61**
V = 1.70 - 0.00144 I	**for MELMAG®AP65**
V = 1.80 - 0.00144 I	**for MELMAG® 75**

where V is cell voltage and I is current density in mA/cm².

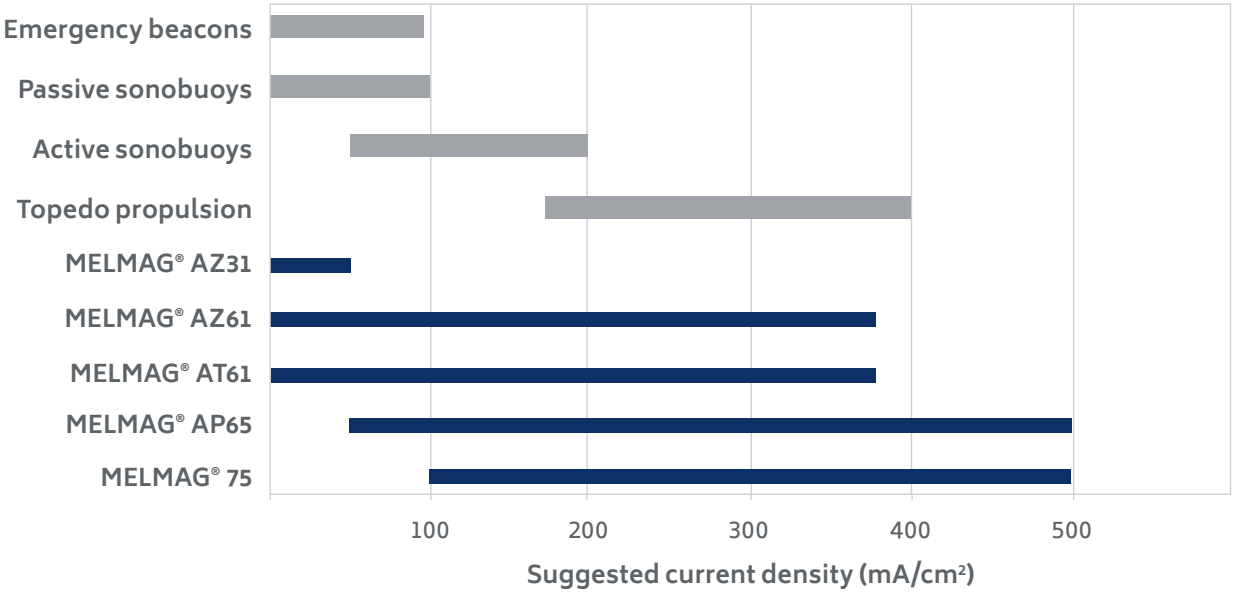
Toxicity

As MELMAG® AP65 contains a small quantity of lead, clean gloves should always be worn when handling this material. Local health authorities should be consulted for any additional precautions thought necessary.

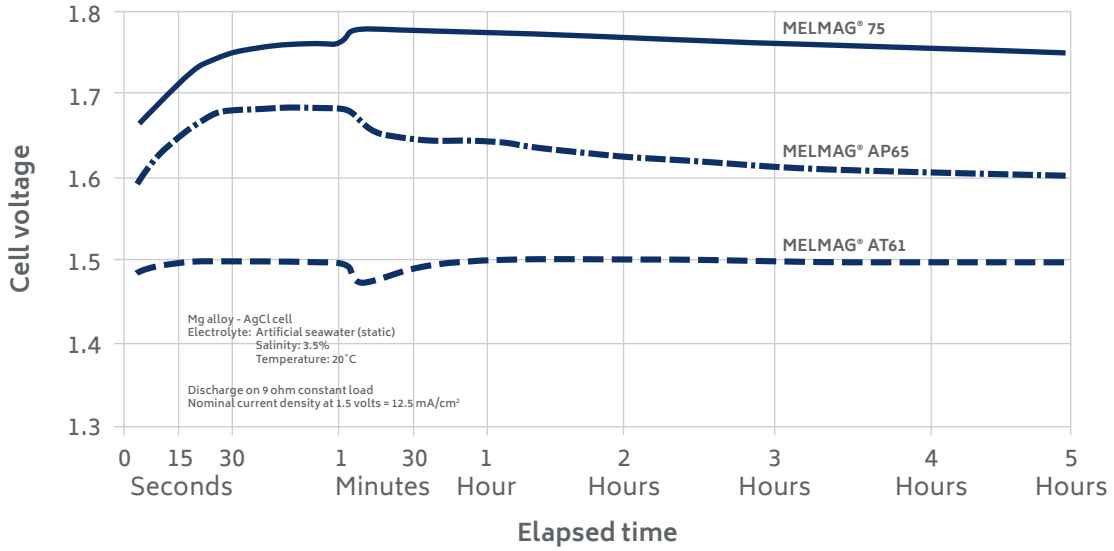
MELMAG® 75 contains a low percentage of thallium. Thallium is a cumulative poison in the same manner as lead. However, as the thallium decomposition products (oxide, hydroxide, and chloride) likely to occur in battery plate reactions have some solubility, there exists the possibility of accumulation of thallium in the body by skin absorption from continuous unprotected handling. All handling should therefore be carried out using non-absorbent type gloves (e.g. PVC or latex). Local health authorities should be informed of the presence of this material so they can take appropriate action.

Reference should be made to Local Authority regulations on the disposal of toxic materials when disposing of battery plate, scrap or reaction products from MELMAG® AP65, 75, and AT61.

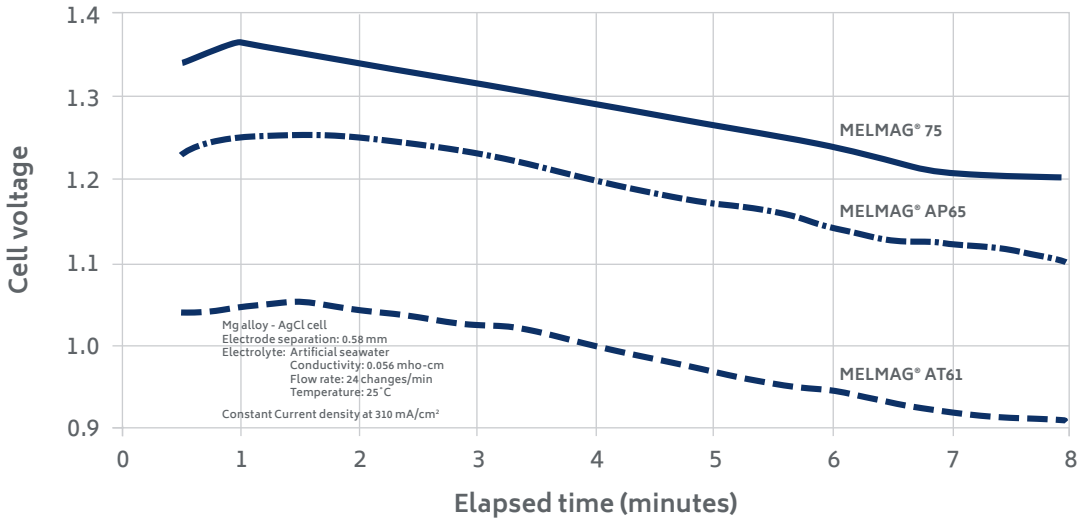
Typical applications of seawater batteries



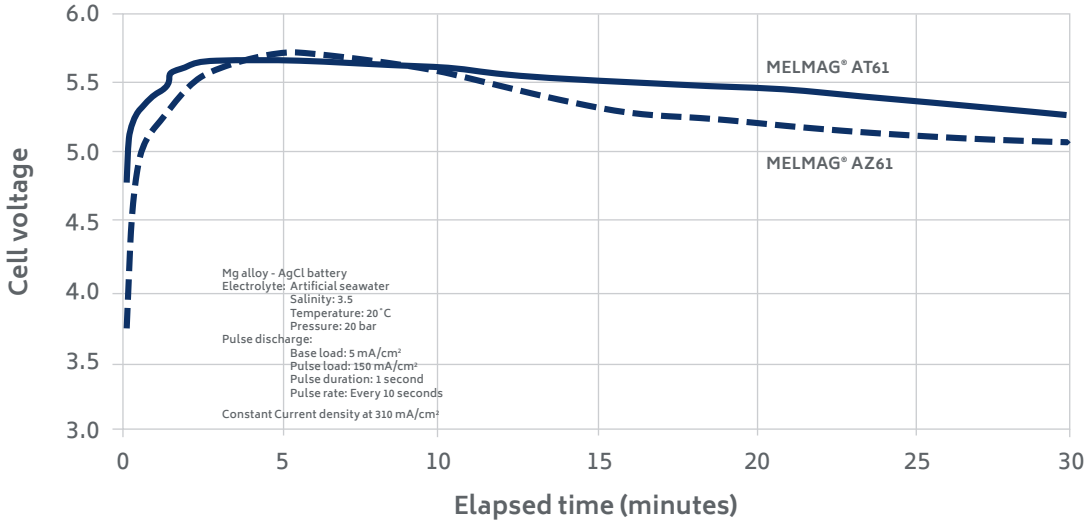
Discharge of life jacket batteries at low current density



Typical single cell discharge at high current density



Typical pulsed load battery discharge



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† The information contained within is meant as a guideline only

Certificate No. FM12677

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