Aalco is the UK's largest independent multi-metals stockholder. Customers from every sector of UK manufacturing and engineering industry, whether small local businesses or large multinational corporations, benefit from a cost-effective single source for all their metals requirements.

No order is too large or too small and Aalco offers a responsive and competitive service for supplying anything from single item orders to major JIT contracts, tailoring this service to the individual needs.

Whatever your requirement, in whatever quantity, your local Aalco service centre is ready and willing to satisfy your needs. For a quotation, for further information, more extensive technical information, advice on product selection or to place an order, please contact your local Aalco service centre or refer to the web site.

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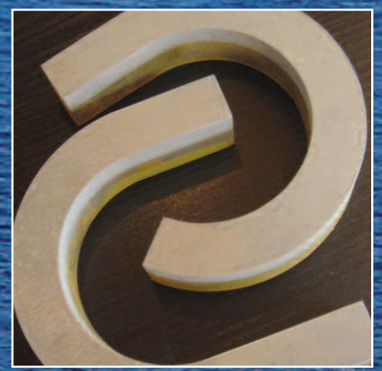
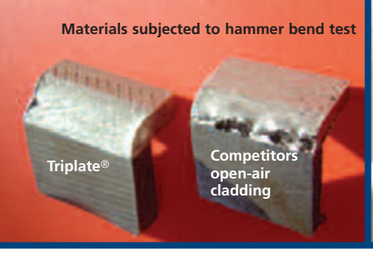
CREATE THE ULTIMATE ALLOY TO STEEL BOND



- **Explosively Bonded Transition Joint for welding aluminium to steel**
- **Vacuum technology**
- **Proven results worldwide**
- **For shipbuilding, ship & boat repairs, oil rig superstructures and many other applications**

Triplate®
Technical Booklet



aalco®

How Triplate® works

Triplate® is widely used to facilitate the on–site welding of aluminium to steel, for example ships hulls to decks and oil rig superstructures to steel supports. It consists of a steel base material and a corrosion resistant marine-grade aluminium alloy top layer with an intermediate layer of pure Aluminium to promote bonding. The three Triplate® layers are homogeneously bonded together by vacuum-explosion welding.

Other Products

The Shockwave Process is also used to bond other metal and alloy 'sandwiches' such as Titanium/Steel for use in a wide range of industries. In addition, profiled shapes can be cut according to customer's drawings using water-jet equipment. Please contact us for further details or with your specific requirements.

Unique Vacuum Explosion technology

Whilst similar products are manufactured by explosive welding in atmospheric conditions, the unique Shockwave Process produces superior results as shown in the table.

Atmospheric	Vacuum
Coarse oxide agglomerations with porosity at the steel-aluminium interface	100% dense, homogeneous joint
Oxide agglomerations & porosity initiate fracture	Does not apply
Oxide agglomerations & porosity can eventually cause corrosion, in spite of protective coatings	Does not apply
Bending of aluminium-steel strips can be difficult: Sidebend radius: 10 x stripwidth	Very good formability: Sidebend radius: 5 x stripwidth
Production control is limited by variable weather conditions	Optimal process control due to constantly reproducible vacuum conditions
Aluminium-steel joint is hard making sawing and forming difficult	Easy sawing and forming thanks to ductile aluminium-steel joint

Using Triplate®

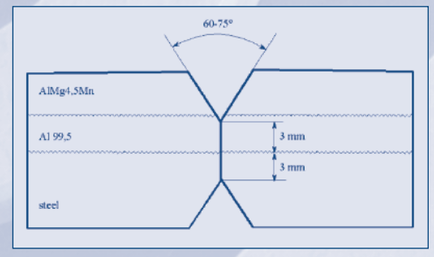
DO NOT pre-heat the transition joint before welding. It is recommended to use a heat-sensitive paint to monitor the interface temperature.

During processing the temperature of the aluminium/steel interface MUST NOT be allowed to exceed 315˚C.

Welding methods to be used are similar to those for the parent metals. Ideally the aluminium weld should be made first after removal of the aluminium oxide film by wire-brushing, followed by de-greasing. Argon shielding gas is recommended. Small diameter wires (1.2mm) are recommended. Welding methods include GTAW, GMAW, TIG, MIG and Synergic pulse MIG.

The steel weld is made using a coated electrode and GMAW, SMAW or FCAW. Small diameter electrodes are recommended (2.5mm).

When butt welding strips together the strip ends should be chamfered (see drawing) and the two strips clamped together. An area of 3mm above and below the aluminium/steel interface should NOT be welded - This unwelded area should be hammered watertight or drilled and injected with epoxy or sealant.



When bending ensure that the minimum bend radius is:
- For side bends - at least ten times the strip width or thickness
- For bends with the aluminium in tension or compression - 300mm

All conventional marine coatings can be used on Triplate® and it is recommended to apply the same coating as used on the whole construction.

Proven in service

For a number of years now, shipbuilders have gratefully taken advantage of the availability of pre-produced transition joint assemblies to make welds between aluminium and steel. The older, more traditional methods of joining, like riveting and bolted joints have fallen from favour due to the fact that in a few years considerable corrosion can occur aided by capillary action caused mainly by the widely differing thermal expansion co-efficients of aluminium and steel. Bolting and riveting are also much more labour intensive and therefore more costly. In spite of efforts to prevent it, this phenomenon allows seawater to seep into the dissimilar metal joint, thereby resulting in severe corrosion. In many cases the only way to maintain the ship in a sea-worthy condition is to completely replace the aluminium-steel transition or, in some cases, to replace the complete wheelhouse. Extensive laboratory and in-service testing has been conducted on Triplate® and comparing Triplate® with similar products - A technical paper is available on request.

- Superior bend radii plus flexibility to produce complex profiles
- The benefits of three Triplate® layers
- Enhanced strength of joint from homogeneous bonding yet easy to saw and form
- Stronger, more secure and more durable than traditional rivets and welding
- Available in lengths up to 3800mm+ standard dimensions ex stock

Construction and composition

Triplate® is constructed in three layers - Steel, Pure Aluminium and Marine Grade Aluminium. These three layers are homogeneously bonded together in a vacuum with the aid of explosives. The explosive cladding/welding process produces a perfect metallurgical bond.

Base Material:
Steel: LRA Shipplate Gr.A or St 52-3N

Interlayer:
Pure Aluminium: Al 99.5 (Alloy 1050A)

Superlayer:
Corrosion-resistant Al: AlMg4.5Mn (Alloy 5083)

Mechanical properties

Shear Strength Base Material - Interlayer:	> 55 N/mm²
Bend Test Base Material in Compression:	acceptable
Bend Test Base Material in Tension:	acceptable
Side Bend Test:	acceptable
Tensile Strength (through thickness):	> 75 N/mm²
Processing Temperature:	max. 315° C

Stock

The standard Triplate® strips in stock are:
3800mm long - 24mm wide - 34/35mm thick
16mm & 32mm wide also available
Lengths up to 5800mm can be made to order

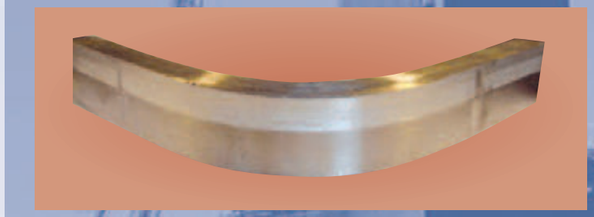
Approvals

Meets the requirements of all relevant international standards including MIL-J-24445A. Aalco operates to ISO 9000/2000.

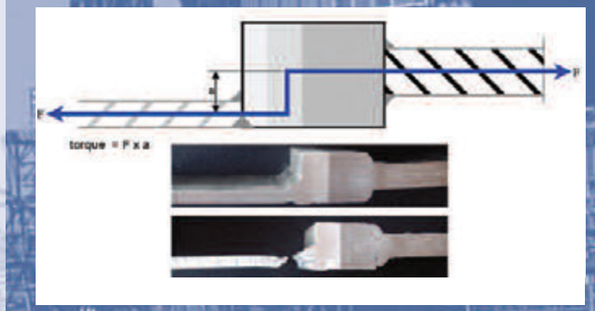
Shockwave Metalworking Technologies BV
www.smt-holland.com

Shockwave Metalworking Technologies BV is approved by Lloyds Register of Shipping and Det Norske Veritas (DNV).

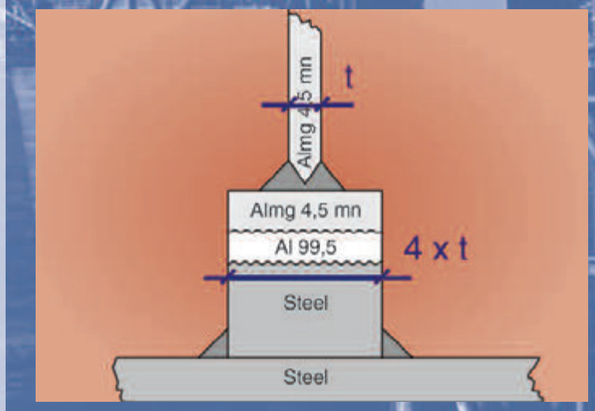
Sidebend test 90˚ open air cladding (oxide agglomerations are visible)



Sidebend test 90˚ Triplate® vacuum cladded (no oxide agglomerations)



Assymetric tensile test on Triplate®



Triplate® dimensions