



# Structural Transition Joints

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## ABOUT STRUCTURAL TRANSITION JOINTS

DetaCouple™ structural transition joints are composite inserts that make it possible to permanently join dissimilar metals by standard welding techniques. These transition joints are formed by the patented\* NobelClad explosion bonding process, and are available in a variety of metal combinations for use in structural and electrical\*\* applications.

The principal use is in shipbuilding, where DetaCouple™ structural joints have become the standard method of welding Aluminum superstructures and bulkheads to Steel hulls, framing and decks. This Aluminum-to-Steel weldability has given naval architects and shipbuilders the freedom to maximize the benefits of materials: the strength and economy of Steel, plus the lightweight and corrosion resistance of Aluminum. These benefits have been proven by extensive testing, as well as by long-term performance in actual service on thousands of ships. This construction has become the standard of the industry, and is approved by maritime authorities throughout the world.

For more information on properties, applications, specifications or fabricating techniques, contact us.

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## BENEFITS OF DETACUPLE™

- Low cost
  - Low maintenance
  - Easy installation
  - Reduced vessel weight
  - Superior corrosion control
  - Lower center of gravity
  - Large inventory assures rapid delivery
  - Universally approved by maritime authorities
  - Increased vessel speed or cargo capacity
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## INSTALLATION

Cutting by mechanical methods (sawing) is recommended, rather than cutting by thermal methods.

Joining procedures for DetaCouple™ should follow standard welding methods and parameters, except that care must be taken to avoid heating the aluminum/steel interface above 600° F.

General guidelines for welding DetaCouple™ transition joints are available from NobelClad. A review of product capabilities and evaluations is presented in “Explosion- Bonded Metals for Marine Structural Applications,” published in the July 1971 issue of Marine Technology (Society of Naval Architects and Marine Engineers, New York, N.Y.). Copies are available upon request.

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## TECHNICAL DATA

**DetaCouple™ 9009** has an overall thickness of 0.750”, consisting of 0.125” 5086 Al, plus 0.250” 1100 Al, plus 0.375” SA516-55 Low Carbon-Manganese Steel, all joined by explosion welding.

**DetaCouple™ 9008** has an overall thickness of 1.375”, consisting of 0.250” 5456 Al, plus 0.375” 1100 Al, plus 0.750” SA516-55 Low Carbon-Manganese Steel, all joined by explosion welding.

**Mechanical Properties** are summarized in *Table I*. Any properties not listed should be considered equal to those established for 1100-H12 Aluminum when the transition joint is in the as-welded condition.

The impact resistance of the DetaCouple™ bond zone, as demonstrated by Izod tests, exceeds that of the 1100 Al. Testing has demonstrated that the fatigue resistance of DetaCouple™ transition joints is superior to that of the aluminum welds joining them to adjacent Aluminum structures. The fatigueresistance also greatly exceeds that of mechanical connections used for the same purpose (*Table II*).

**Table I: Mechanical Properties**

PROPERTY	CONDITION	VALUE (PSI) TYPICAL	VALUE (PSI) MIN.
Ultimate Tensile Strength	As clad	20,000	11,000
	As welded	14,000*	
Ultimate Shear Strength (Shear Test per ASME SA-263)	As clad	13,000	8,000
	As welded	11,500*	
	Thermal cycled**	13,000	
Impact Resistance	Test Temp.	45-75 ft-lb	
Charpy "Keyhole"	-50° F	60-130 ft-lb	
Charpy "V-Notch"	+15° F	-15° F NDT	
Dropweight (ASTM E-208)			

\* Peak welding temperatures above 600° F may lower this value

\*\* Cycled 2500 times between 500° F and 80° F before testing

**Table II: Fatigue Resistance (Krouse Double Direct Stress Testing Machine)**

SPECIMEN TYPE	STRESS IN WEB* (PSI) COMPRESSION	STRESS IN WEB* (PSI) TENSION	CYCLES TO FAILURE	COMMENTS
Suggested Design Ratio (Transition joint 4x as thick as Al welded to it)	15,000	5,000	395,000	All failed in heat affected zone of 5456 Al weld
	15,000	1,000	721,500	
	10,000	3,000	1,267,400	
Typical Mechanical Connection (14 CRES 3/8" welded to it)	15,000	5,000	31,600	Rivet fractured
	15,000	5,000	63,300	

\*In all cases , web consist of 5456-H321 Al & HY-80 Steel, 1/4" thick

Note: Samples fabricated by commercial shipyard using standard production techniques

**Corrosion Resistance** of Aluminum/Steel transition joints has been demonstrated widely in actual service, as well as by numerous controlled tests in marine environments. These tests have shown that accelerated galvanic corrosion at the Al/Steel interface is inhibited by the sealing effect of Aluminum corrosion products. Painting completely eliminates initial corrosion penetration, and localized paint defects do not lead to significant corrosion.

Specifically, in seaside splash-spray tests and in shipboard exposure tests, unpainted transition joints showed penetration at the interface of only 0.033" after 12 months. In accelerated testing by continuous 5% salt-spray (ASTM B-117-57T), unpainted samples showed only 0.060" penetration after 1,000 hours (equivalent of 62 years exposure). In all tests, painted samples showed no corrosion.

DetaCouple™ structural transition joints have been tested and approved by maritime authorities throughout the world, including the United Kingdom (Lloyd's Register), France, Japan, Russia, Canada, Australia, Korea, Norway, and Finland, as well as the U.S. Navy and Coast Guard.

Table III: Corrosion Testing

SPECIMEN CONDITION		EXPOSURE DURATION	DEPTH OF PENETRATION
Seaside Splash Spray Test	Unpainted	3 months	0.027"
		12 months	0.033"
		27 months	0.042"
	Completely Painted	12 months	None
		34 months	None
		12 months	None
Aluminum Panel Unpainted; Steel Panel & Transition Joint Painted	12 months	None	
	34 months	None	
	12 months	None	
Seaside Splash Spray Test	Unpainted	12 months	0.033"
	Unpainted	12 months	None
	Painted	12 months	None

**STANDARDS INCLUDE:**

- Military Specification MIL-J-24445A (SHIPS), 25 July 1977
- NobelClad Product Specification DETA-604M
- American Bureau of Shipping (ABS) type approved