



**Aslan Nu-Tie
Sandwich Wall Connector**

AslanFRP

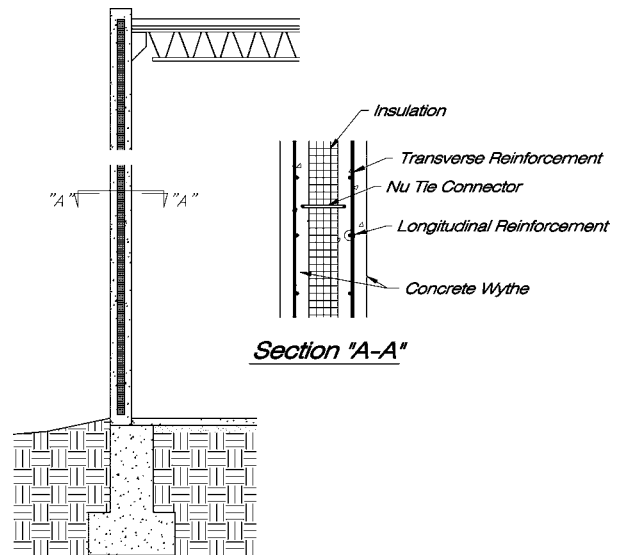

Aslan 700 Nu-Tie Sandwich Wall Connector

Typical precast concrete sandwich panel (PCSP) systems are composed of two concrete wythes with insulation placed in the center. The concrete wythes are generally connected through the insulation using metal, concrete, thermoplastic or glass fiber reinforced polymer (GFRP) connectors. PCSP systems can be designed to be composite or non-composite structural members. In non-composite walls, one wythe is counted on to resist the entire applied loading, and the second wythe is considered to be non-structural. In composite construction, the two concrete wythes share the load resistance through the connector that is capable of resisting the interface shear force resulting from composite action. Precast concrete sandwich wall panels can be classified as:



- Fully Composite wall panels
- Non-composite panels
- Partially composite panels

Full composite action is seldom achieved unless the middle wythe is penetrated with a significant amount of concrete. In this situation, the thermal efficiency is significantly compromised. It has been shown (Al-Eina et al, PCI Journal, State of the art of Precast Concrete Sandwich Panels 36(6), 78-98, 1991) that a 2% penetration of the insulation wythe with a thermally conductive material, such as steel or concrete, could result in a 40% loss in thermal efficiency. The Aslan 700 series Nu-Tie, covered by US patent 5,440,845, combines the benefits of partial structural composite action with the thermal efficiency of Aslan 100 series GFRP reinforcing bars.



ASLAN 700 NU-TIE



Benefits of Aslan 700 Nu-Tie Connector

- Composite Action Sandwich wall panels – Close to 80% composite action
- Fully Insulated wall panels with high thermal efficiency – No thermal bridges
- Use Less Concrete – Wythe thickness reduced
- Lighter weight PCSP panels allow greater transport distances
- Efficient and Economical Precast Plant production methodology
- Multiple sources of Expanded Polystyrene Foam (EPS) possible
- Straight forward wall panel design methodology
- More energy efficient buildings

Aslan 700 Nu-Tie Sandwich Wall Connector Features:

- Aslan 100 GFRP rebar connector Truss Elements
- Plane truss which is easy to place in Expanded Poly-Styrene Foam Slots
- Tested and Proven System
- Patented system available to users of the Aslan 700 Nu-Tie system
- No reason to join a “club” or pay a royalty to use the patented system as the licensure is built directly into the cost of the Aslan 700 Nu-Tie



ASLAN 700 NU-Tie

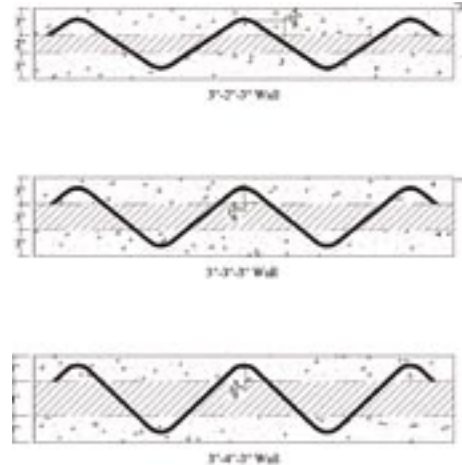
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Aslan 700 Nu-Tie System Description

The Aslan 700 series is described as a system since it involves:

- The connector truss itself
- Method for designing PCSP wall panels
- Production method for making EPS foam panels
- Casting method for PCSP panels



Available for Wall Panels with
2", 3" & 4" (50, 75, 100 mm)
EPS Insulation

Design of Wall Panels

Design Considerations

Follow Section 9.4 of the PCI Design Handbook with minor exceptions:

- Use 80% of the fully-composite Moment of Inertia (I) for P-Delta effects
- Use 80% of the fully-composite Moment of Inertia (I) for Thermal Bowing effects.
- The amount of pre-stressing strand or mild reinforcement should be determined based on the assumption that the flexural strength is 50% of a solid wall.

Special considerations must be examined for walls subject to large sustained loads.

Design Philosophy

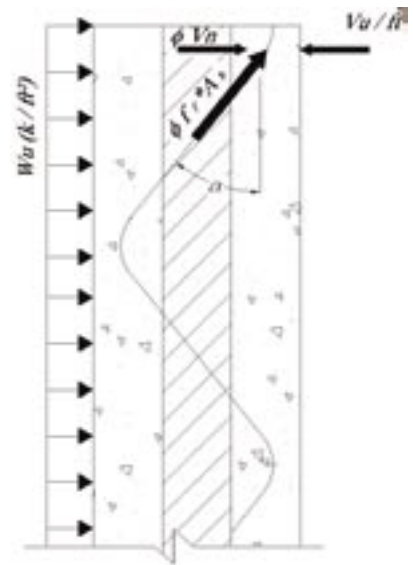
The shear force in the panel is resisted by the legs of the Nu-Tie that are in tension (every other leg). The spacing is calculated based on the legs that are located in the maximum shear section. The resisting force V_n is defined as follows

$$\phi V_n = \phi C_e f_f \frac{A_b}{S} \sin \alpha$$

ASLAN 700 NU-Tie

Where,

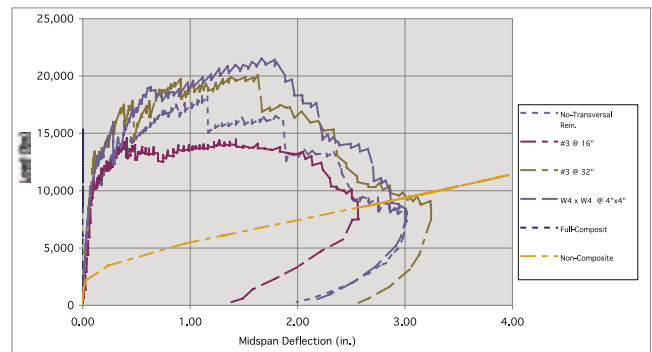
- ϕ = the strength reduction factor taken as .75
- f_f = the effective tie capacity = .5fu
- f_u = ultimate strength of the taken as 120 ksi (825 MPa), for #3 (10 mm) Nu-Tie
- C_e = the environmental exposure factor, taken as .7
- A_b = the cross sectional area for, taken as 0.11 in² for #3
- S = spacing between tie rows (ft)
- α = angle of tie leg with respect normal surface of the wall taken as 45° for #3 Nu-Tie



For a #3 (10 mm DIA) Nu-Tie

$$V_u \leq \phi V_n = .75 * .7 * .5 * 120 * \frac{.11}{S} \sin(45^\circ) \rightarrow V_u \leq \frac{2.45}{S} \quad \text{or} \quad S \leq \frac{2.45}{V_u}$$

Tests were conducted to evaluate the performance of the panels with differing amounts of transverse reinforcing. It was found that transverse reinforcement had practically no effect on the capacity of behavior of the panels, as long as a minimal amount of #3 (10 mm) reinforcing at 32" (812 mm) centers is provided.



The ultimate structural capacity of tested wall specimens using the Aslan 700 Nu-Tie is approximately 150 psf (7.2 kPa) loading on a 32ft (9.75 m) tall wall, compared to 25psf (1.2 kPa) typically assumed for design.

Full-Scale Flexure Test Results

SPECIMEN					CONNECTOR		TEST RESULTS	
Transverse Rein.	No.	THICKNESS Con.	Ins.	f'_c (psi)	Type	Area (in ²)	Ultimate External Load (lbs)	Deflection at Ultimate Load (in)
No-Rein.	1	3	3	5000	GFRP	1.1	16,847	.63
	2	3	3	5000	GFRP	1.1	18,150	1.12
#3 @ 32"	3	3	3	5000	GFRP	1.1	19,657	0.92
	4	3	3	5000	GFRP	1.1	16,644	0.87
#3 @ 16"	5	3	3	5000	GFRP	1.1	17,496	0.72
	6	3	3	5000	GFRP	1.1	14,486	0.42
W4xW4 @ 4"x4"	7	3	3	5000	GFRP	1.1	16,826	1.96
	8	3	3	5000	GFRP	1.1	21,448	1.67
Ave.							17,694	1.04

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Aslan 700 Nu-Tie

Preparation of EPS Foam Panels

Using the Aslan 700 system allows the precaster to purchase closed cell Expanded Poly-Styrene foam insulation from their vendor of choice. In-plane slots are fabricated into the EPS foam at standard spacing in widths that accommodate the casting bed to be used.



A key part of this system is a fixture that hot melts slots into the foam blanks. Hughes Brothers will work with the precast company to supply a copy of this machine or provide drawings and detailed parts lists that would enable the precaster to fabricate their own machine. On site, the precaster will likely need to add exhaust containment hoods and adequate ventilation to deal with smoke and fumes associated with the melting of slots in the foam. Material Safety Data Sheets and EPS foam supplier information assure this smoke is non-hazardous and non-toxic, but certainly not a pleasant odor and as such should be adequately vented.



After hot melting slots in foam blanks, the appropriate Nu-Tie for the foam thickness is easily inserted into the blanks.



Remaining gaps are simply filled with canned expanding foam insulation available from several local sources. Excess foam is easily removed with a long, flat fine tooth blade. The Aslan 700 Nu-Tie ends should rest against the face of the EPS foam ensuring proper exposure and penetration into the concrete wythe on either face of the foam.

ASLAN 700 NU-Tie





Aslan 700 Nu-Tie Precast Production

Once the casting bed is prepared, the bottom wythe strands stressed and any transverse reinforcing in place, concrete is placed in the bottom wythe. Typically, SCC (self consolidating concrete) is used. Prepared EPS foam blanks with Nu-Ties now integrated into the foam blanks are simply placed on the first concrete wythe.

At this point, any block-outs, window or door openings can be accommodated in the prepared EPS foam blanks by simply cutting them to fit.

Aslan 700
SANDWICH WALL CONNECTOR



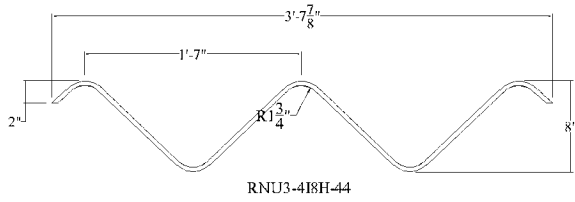
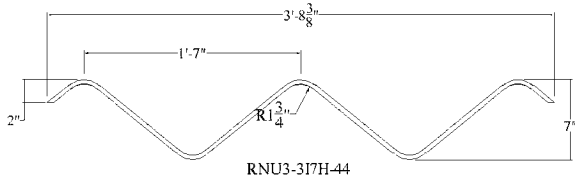
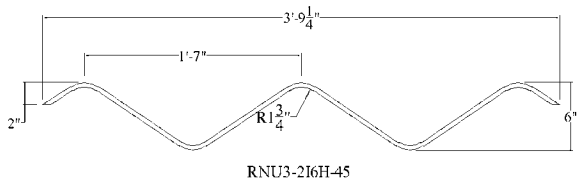
The second wythe of concrete is ready to be placed over the EPS foam once strands are stressed and transverse reinforcing put in place.

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Ordering Information

The Aslan 700 Nu-Tie is configured for 2", 3" & 4" (50, 75 & 100 mm) foam insulating panels. As such, there are only three items to order and stock:

Part Number	Insulation Thickness (inches)	(mm)
RNU3-216H-45	2"	50
RNU3-317H-44	3"	75
RNU3-418H-44	4"	100



Aslan FRP

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