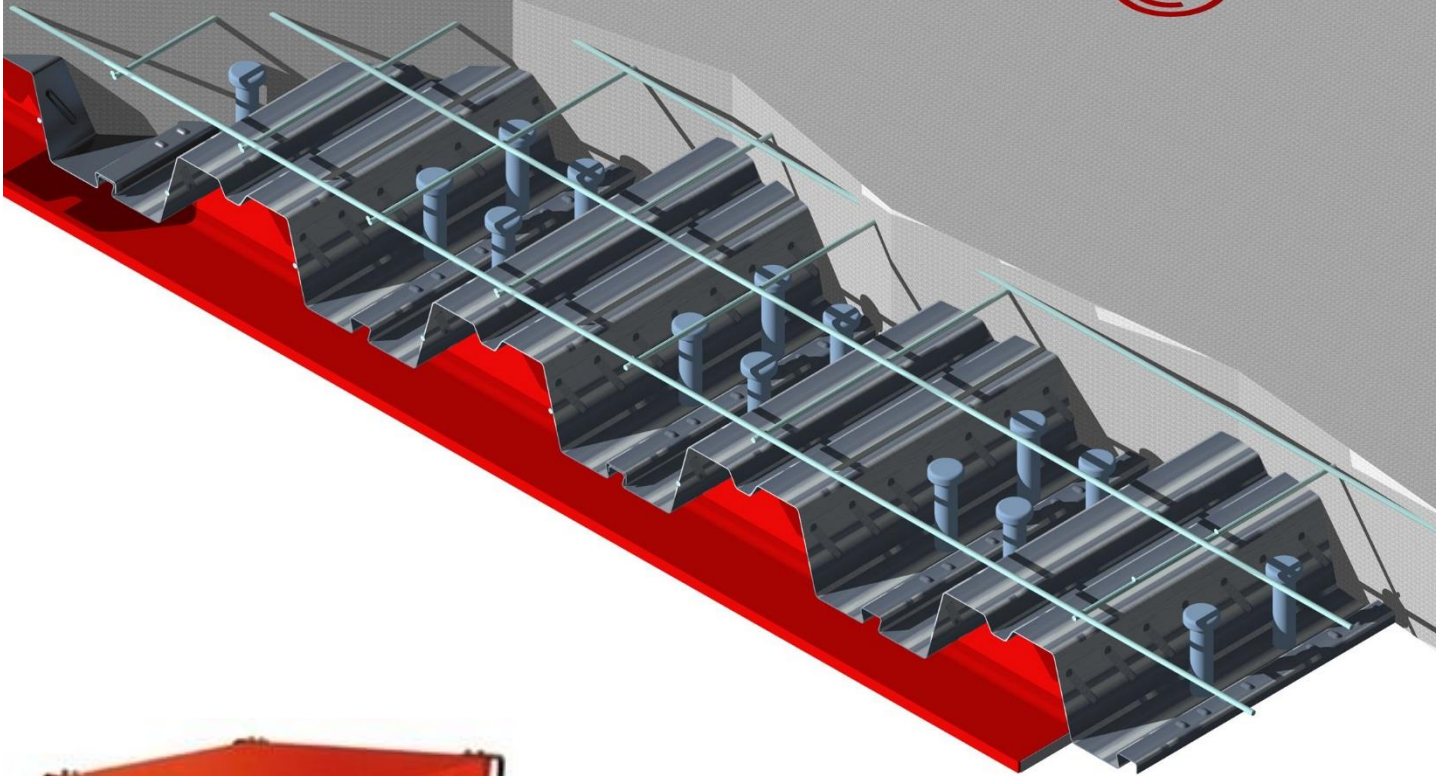


# NELSON STUD WELDING



## **Nelson Stud Welding - USA**

Nelson® Stud Welding, founded in the USA, 75 years ago, is the leading global manufacturer and distributor of weld stud fasteners and application equipment serving a broad range of markets on a worldwide basis including the automotive, construction and industrial markets. Stud welding products are suitable for the fastening needs of virtually every industry and our products include externally threaded fasteners, shear connectors, concrete anchors, punching resistor studs, and the equipment used to apply, assemble and weld these items.

Through years of design, engineering and manufacturing excellence, we have perfected the durability of our fastener products for use in high stress environments from applications such as off-road construction equipment, large expansion bridges and skyscrapers to high performance autos, nuclear power plants and equipment used in high temperature environments

## **Nelson Stud Welding - NZ**

Nelson Stud Welding has been operating in New Zealand for 40 years, with operating bases in Auckland, Wellington and Christchurch.

### **Enquires:**

**Auckland**

**Tel: 09 820 9133**

**Fax: 09 820 9131**

**Wellington**

**Tel: 04 233 9421 or 04 233 8131**

**Fax: 04 233 1072**

**Email:**

**[sales@nelsonstud.co.nz](mailto:sales@nelsonstud.co.nz)**

## The Nelson System

Nelson Stud Welding is the world's leading producer of stud welding fasteners and equipment. We invented the stud welding process and have spread its acceptance to a wide variety of end users.

Fastening with the Nelson System is quick, reliable and economical. It is a proven and tested method that successfully meets stringent fastening, material and welding codes. It has received approvals from recognised design agencies, code bodies and industrial standard organisations.

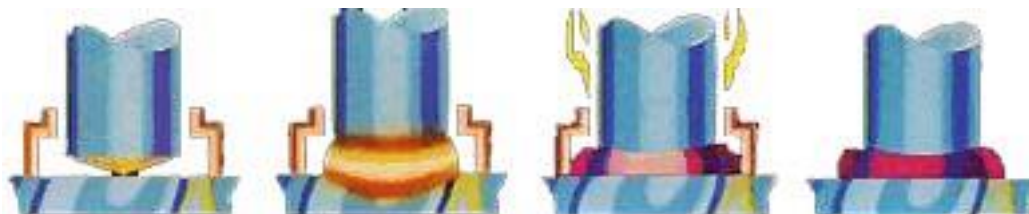
In the construction industry, Nelson pioneered the use of stud welded shear connectors and Punching Shear Resistor Studs.

## The Process

Electric-Arc stud welding is the most common process and is utilized whenever metal is fabricated. It is used to best advantage when the base plate is heavy enough to support the full strength of the welded studs, but is sometimes used with lighter gauge material.

The Stud is held in the welding gun with the end of the stud placed against the work. The cycle is started by depressing the trigger button start switch. The stud is then automatically retracted from the work piece to establish an arc. The arc continues for predetermined period of time until portions of the stud and the base plate have been melted. Then, the welding gun automatically plunges the stud into the molten pool of metal and holds it there under spring pressure. At the same time, the welding current is stopped and, when the molten metal solidifies, the weld is completed and the welding gun is removed from the stud.

The molten metal is held in place by a ceramic ferrule which also serves to shield the arc. The weld metal is deoxidised by a flux in the weld end of the stud. This results in a dense, strong weld which will develop the full strength of the stud and base plate. The weld cycle depends on the diameter of the fastener and materials being joined and varies in time from 1/10 to 1-1/2 seconds. Welding currents range from 250 to 3000 amps.



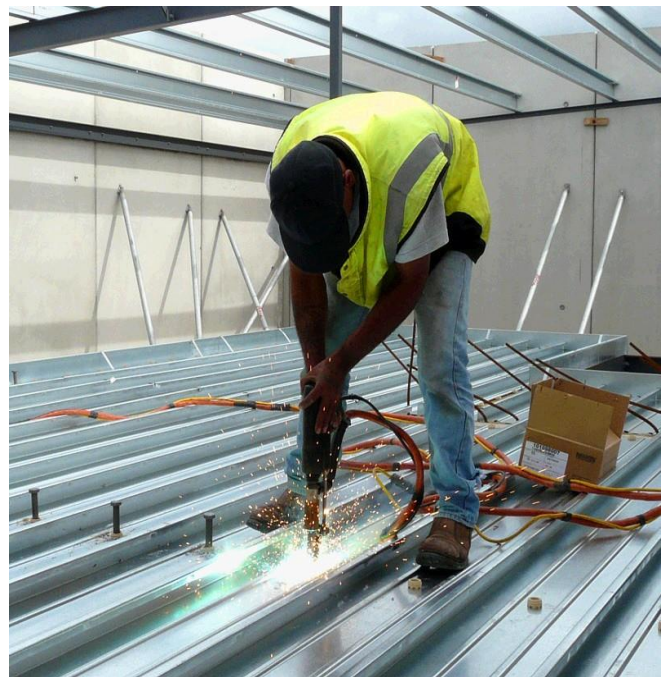
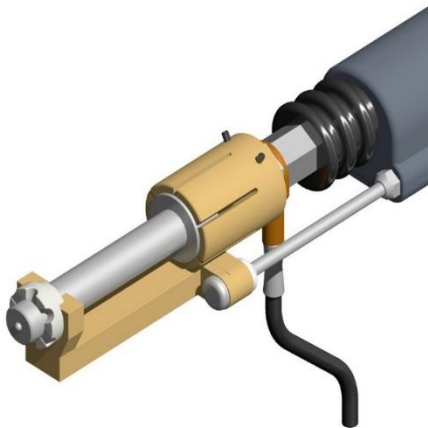
## Welding Thru deck

The best welding results are achieved through adherence to recommended job-site procedures and conditions. Factors such as painted beam flanges, water, deck fit-up to the beam, and inadequate power can seriously hamper satisfactory welding.

Here are some important site requirements:

- Top flanges of beams must be unpainted (or at least a strip where the studs are to be welded).
- Remember if fire protection coating is applied to the rest of the beam (top uncoated) prior to stud welding, that touch up may be required after the studs have been welded. (The heat from stud welding may activate the fire protection)
- The beams should be free of heavy rust and mill scale
- The beams should be free of dirt, sand and other materials
- Galvanised beams will need to be ground back to remove the galvanising
- Water on the deck, or between the beam and deck must be removed before welding

## Gun setup for weld-thru deck application



## Shear Connectors

Nelson headed shear connectors deliver code specified shear strength values as used in composite construction, securing concrete to steel structural components. Nelson shear connectors meet requirements of the following codes:



- AS/NZS 1554.2 Structural steel welding Part 2: Stud Welding (steel studs to steel)
- AWS D1.1 Structural Welding Code – Steel
- AWS D1.6 Structural Welding Code – Stainless Steel
- AWS D1.5 Structural Welding Code / AASHTO Standard Specification for Highway Bridges
- Canadian Standards Association W59 – Welded Steel Construction
- AISC Manual of Steel Construction – Allowable Stress Design
- AISC Manual of Steel Construction – Load & Resistance Factor Design

See also: ICC-ES Evaluation Report ESR-2856 Nelson Shear Connector Studs

Shear connectors are typically used in composite steel construction for holding concrete slabs to steel members to resist shear forces and increase shear loading capacity in steel buildings, bridges, columns caissons, containment liners, etc. They also act as embedment anchors on miscellaneous embedded plates, frames, angles, strip plates, attachments and connections.

### Shear Studs held in stock

	D Diameter	Nominal Length	L Length	A	H	Burn off
	M13	50	54	8	25	4
	M13	100	104			
	M13	150	154			
	M16	65	69	8	32	4
	M16	100	104			
	M16	150	154			
	M19	50	55	10	32	5
	M19	75	80			
	M19	80	85			
	M19	95	100			
	M19	100	105			
	M19	125	130			
	M19	150	155			
	M19	175	180			
	M19	200	205			
	M19	250	255			
	M22	100	105	10	35	5
	M22	125	130			
M22	150	155				
M22	200	205				
M22	250	255				
M25	100	106	13	41	6	
M25	125	131				
M25	200	206				

Please note that limited stocks are held on some sizes

Other sizes may be available, so please contact us.

## Short form specification

To ensure that certified products are used, the following specification is suggested. “Headed anchors shall be Nelson Shear Studs, flux filled welding to plates as shown on drawings. Studs shall be made from cold drawn steel Grades to I C -1010 through C – 1020 per ASTM A-108 and shall be welded per manufactures recommendation”

## Physical Properties of Shear Connectors

Diameter	A <sub>s</sub> Nominal Area mm <sup>2</sup>	A <sub>s</sub> f <sub>y</sub> Yield Kg (min)	A <sub>s</sub> f <sub>s</sub> Tensile Kg (min)
M13	126.7	4,445	5,334
M16	198.0	6,963	8,355
M19	285.0	10,024	12,029
M22	388.0	13,630	16,356

A<sub>s</sub> Area of stud shank

f<sub>s</sub> Ultimate strength (tensile):

M13, M16, M19, and M22

420 Mpa min

Cold Finished low carbon steel

C 0.23 max

f<sub>y</sub> Yield strength

345 Mpa min

Mn 0.90 max

Elongation

20%

P 0.04 Max

Reduction Area

50% min

S 0.05 max

## Tension capacity

The following data is presented as guideline as only and are based on embedded studs and adequate spacing for full capacity development. Appropriate safety factors should be applied based on actual use.

## Shear Stud tension capacity in concrete

D Diameter	L Length Before weld length	(1) After Weld Length	Dh Head Diameter	(2) Le (mm)	(3) Ultimate Embedded Strength of Anchor (Pue)	(4) Tension Capacity (Puc) kN								
						(5)			(6)			(7)		
						Fc=3000 kPa	Fc=4000 kPa NWT	Fc=5000 kPa NWT	Fc=3000 kPa SLWT	Fc=4000 kPa SLWT	Fc=5000 kPa SLWT	Fc=3000 kPa ALWT	Fc=4000 kPa ALWT	Fc=5000 kPa ALWT
M13	54	50	25	42	47.15	25.86	29.85	33.37	21.58	25.37	28.34	19.37	22.41	25.03
M13	104	100	25	96	47.15	73.08	73.08	73.08	73.08	73.08	73.08	73.08	73.08	73.08
M13	154	150	25	142	47.15	73.08	73.08	73.08	73.08	73.08	73.08	73.08	73.08	73.08
M16	69	65	32	57	73.66	42.89	49.50	55.16	36.47	42.06	46.88	32.13	37.16	41.37
M16	104	100	32	92	73.66	103.84	114.18	114.18	88.25	101.90	113.97	77.91	89.91	100.59
M19	80	75	32	65	106.13	57.98	66.95	74.88	49.30	56.88	63.64	43.51	50.19	56.19
M19	85	80	32	70	106.13	65.16	75.29	84.12	55.36	63.98	71.50	48.88	56.47	63.09
M19	100	95	32	85	106.13	86.18	99.56	111.28	73.29	84.60	94.80	64.67	74.67	83.70
M19	105	100	32	90	106.13	100.80	116.31	130.1	85.70	98.87	110.59	75.64	87.22	97.56
M19	130	125	32	115	106.13	164.51	164.51	164.51	131.76	152.03	164.51	116.25	134.17	164.51
M19	155	150	32	140	106.13	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51
M19	180	175	32	165	106.13	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51
M19	205	200	32	195	106.13	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51	164.51
M22	105	100	35	90	144.43	103.42	119.28	133.41	87.91	101.42	113.42	77.57	89.49	100.04
M22	155	150	35	140	144.43	223.87	223.87	223.87	190.85	220.29	223.87	168.44	194.36	217.39
M22	205	200	35	190	144.43	223.87	223.87	223.87	223.87	223.87	223.87	223.87	223.87	223.87

Notes:

- (1) A.W. – Length overall after welding to plate
- (2) Le – Length of embedment under head of stud
- (3) Pue –  $0.9A_sF_s$
- (4) Puc – Ultimate concrete tension capacity from formulae where Puc = Puc controls  

$$Puc = 0.1777C(L_e)(L_e + D_h) f^1c$$
- (5) NWT – Normal weight concrete (C = 1)
- (6) SLWT Sand Lightweight Concrete (C = 0.85)
- (7) ALWT All Lightweight Concrete (C = 0.75)

## Shear capacity

Headed shear studs embedded in concrete with an embedment length more than four times their diameter are capable of developing full shear capacity. Spacing is not as sensitive in shear as in tension. Spacing four times diameter between studs in plane perpendicular to the shear force and six times diameter in the direction of the shear force is generally adequate to develop full stud capacity. Free edges in the direction of the shear force and some spacing restrictions along a free edge apply. Use proper safety factors and edge reinforcement.

An upper bound limit for headed studs as approached at  $0.9 A_s f_s$  when concrete strength exceeds 35Mpa

Headed studs used as inserts have different values than those employed in composite design. For shear capacity of studs in composite design with or without metal deck see appropriate code and commentary.

## Stud Shear Capacity in Concrete

Diameter	(a) Length	(b) A.W. Length	H/Ds (No. of Dia)	(c) Sue	Concrete Shear Capacity (Suc) kPa					
					Normal Concrete (145 pcf)			Lightweight Concrete (110pcf)		
					Fc=3000 kPa	Fc=4000 kPa NWT	Fc=5000 kPa NWT	Fc=3000 kPa SLWT	Fc=4000 kPa SLWT	Fc=5000 kPa SLWT
M13	54	50	101.60	47.15	61.16	71.22	73.08	50.95	59.36	66.47
M13	104	100	203.20	47.15	61.16	71.22	73.08	50.95	59.36	66.47
M13	154	150	304.80	47.15	61.16	71.22	73.08	50.95	59.36	66.47
M16	69	65	101.60	73.66	95.77	111.63	114.18	79.77	93.00	104.11
M16	104	100	162.56	73.66	95.77	111.63	114.18	79.77	93.00	104.11
M19	80	75	101.60	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	85	80	114.30	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	100	95	124.97	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	105	100	135.38	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	130	125	169.42	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	155	150	203.20	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	180	175	236.98	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M19	205	200	271.00	106.13	137.83	160.65	164.51	114.94	133.90	149.82
M22	105	100	116.01	144.43	187.47	218.49	223.87	156.24	182.10	203.74
M22	155	150	172.24	144.43	187.47	218.49	223.87	156.24	182.10	203.74
M22	205	200	232.16	144.43	187.47	218.49	223.87	156.24	182.10	203.74

Notes:

- (a) Stud Length
- (b) A.W. Length – After welding length
- (c) Sue =  $9A_s f_s$  Where Sue = Sue Controls