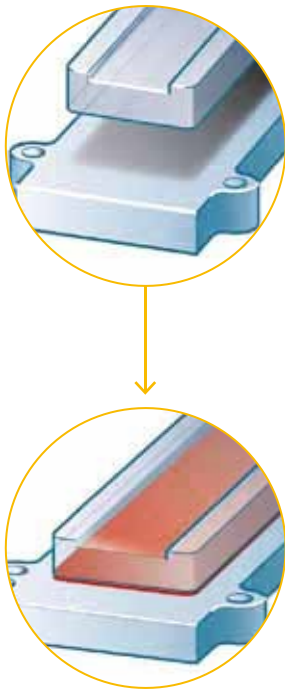


Structural Bonding

For Demanding Requirements



Why use a Henkel adhesive for structural bonding?

The Henkel range of structural bonding products offers a wide choice of solutions to meet the different requirements and conditions that apply to industrial design and construction.

Bonding

Adhesive bonding is a process in which two similar or dissimilar materials are solidly and permanently assembled using an adhesive.

Adhesives build "bridges" between the surfaces of substrates to be joined.

To achieve the optimal bonding result, the following prerequisites must be met:

- Compatibility of the adhesive with the materials to be bonded
- Compatibility of the adhesive with the specified requirements
- Correct application of the adhesive

Advantages of bonding compared to conventional joining methods

More uniform stress distribution over the entire bond face

This has a very positive effect on the static and dynamic strength achieved. Where welding and riveting result in localised stress peaks, adhesive bonding achieves uniform distribution and absorption of stress loads.

No change in surface and structure of the joined materials

Welding temperatures may change the structure and therefore the mechanical properties of materials. In addition, welding, riveting and bolting all affect the visual appearance of the parts.

Weight saving

Adhesives are particularly popular for light-weight constructions, where thin-walled parts (wall thickness < 0.5mm) must be joined.

Sealed joints

Adhesives also act as sealants, preventing loss of pressure or liquids, blocking the penetration of condensation water and protecting against corrosion.

Joining dissimilar materials and reducing the risk of corrosion

The adhesive forms an insulating film to prevent contact corrosion when different types of metals are joined. It also acts as an electrical and thermal insulator.

Surface preparation

The following key points should be observed for the design of bonded joints:

- The surfaces to be joined should be as large as possible for maximum load transmission capability
- Forces acting on the joint should be distributed across the entire bond line

Joint designs suitable for adhesive bonding

All designs involving a shear, tensile or compressive load e.g. single and double lap joint, single and double cover plate, tapered overlap and double overlapping.

Joint designs unfavourable for adhesive bonding

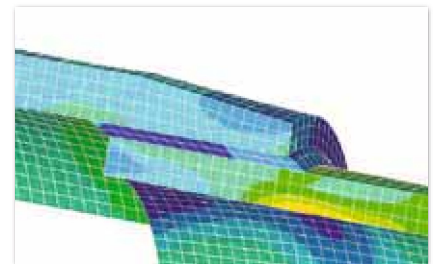
Butt joint, cleavage loading and peel loading.

Rigid bonding

Rigid adhesives are mainly used for high load transmission to replace common mechanical joining methods. Two parts bonded with such an adhesive could be considered as structurally linked. Mechanical characteristics like high strength, high modulus and high adhesion have proven to be effective for customer applications, particularly in demanding industries like aerospace and automotive.

Rigid bonding offers significant benefits for users:

- Simplifies construction by increasing strength/rigidity for load transmission
- Prevents material fatigue and failure by achieving uniform transmission of loads (stress distribution) and by maintaining structural integrity (no thermal or mechanical weakening of parts)
- Saves production costs by replacing conventional mechanical fasteners (screws, rivets or welding)
- Saves material cost and saves weight by reducing material thickness while maintaining load transmission characteristics
- Allows the most varied substrate combinations, e.g. metal/plastics, metal/glass, metal/wood etc



Stress analysis of bonded pipe joint

Available technologies

Epoxies

- Rigid bonding
- 1K or 2K solutions
- Capability to fill large gap
- Very high strength
- For small to medium surface areas
- Very good chemical resistance

Acrylics


- Rigid to slightly flexible bonding
- 1K or 2K solutions
- For small surface areas
- Very high strength
- Good chemical resistance

Polyurethanes

- Slightly flexible bonding
- 2K solution
- Capability to fill large gaps
- High strength
- For medium to large surface areas
- Good chemical resistance

Structural Bonding – Polyurethanes

Product Table

Solution	Large surface bonding		
	Gap variation tolerance		
	1K		2K
	General purpose	Fast curing	General purpose
	LOCTITE UR 7221 	LOCTITE UR 7228 	LOCTITE UK 8103 
Technology	1K PU	1K PU	2K PU
Viscosity	5,500 – 10,500 mPa·s	5,500 – 10,500 mPa·s	8,000 – 10,000 mPa·s
Initial strength	2 – 4 hr	10 – 15 min.	5 – 8 hr
Working life at 20°C	–	–	40 – 70 min.
Tensile shear strength	> 6 N/mm ²	> 6 N/mm ²	> 6 N/mm ²
Service temperature range (short exposure)	-40°C to +80 (+100)°C	-40°C to +80 (+100)°C	-40°C to +80 (+120)°C
Pack sizes	11lb kit	1kg, 30kg	250kg
Handy Hints <ul style="list-style-type: none"> • LOCTITE SF 8040 is used for cleaning tanks, pumps, hoses and mixing heads of metering equipment • LOCTITE SF 7515 can be used to increase ageing resistant of polyurethane adhesives on metals in humid conditions. For further information please refer to the TDS. • Refill working packs into new buckets to prevent applying unmixed adhesive from the bottom of the working pack 	LOCTITE UR 7221 <ul style="list-style-type: none"> • Long open time • Multi-purpose • Foaming • IMO approval <p>A 1K PU adhesive which cures with humidity from the air or fine water spray to bond PVC and PU rigid foams to lacquered or (epoxy primer) coated metal sheets. Good ratio of open time to press time.</p>	LOCTITE UR 7228 <ul style="list-style-type: none"> • Short fixture time • Foaming • IMO approval <p>A 1K PU adhesive which cures with humidity from the air or fine water spray to bond PVC and PU rigid foams to lacquered or (epoxy primer) coated metal sheets. Very fast application for panel bonding.</p>	LOCTITE UK 8103 <ul style="list-style-type: none"> • Multi-purpose • Different acceleration levels available • Good flow properties • IMO approval <p>A general purpose 2K PU adhesive, easy to spread over large surface areas for bonding coated metals and PU foams, especially in the shipbuilding industry.</p>

Structural bonding

Gap filling

1K

2K

Low temperature resistance

Elastic bonding

Primerless adhesion

Good adhesion to plastics

High strength

LOCTITE UK 8202



TEROSON PU 8597 HMLC



LOCTITE UK 8326 B30



LOCTITE UK 1366 B10



LOCTITE UK 1351 B25



2K PU

1K PU

2K PU

2K PU

2K PU

8,000 – 10,000 mPa·s

Pasty

250,000 – 310,000 mPa·s

400,000 – 500,000 mPa·s

400,000 – 500,000 mPa·s

8 – 10 hr

1 h/4 hr*

3 – 4 hr

40 – 60 min.

1 – 2 hr

80 – 120 min.

–

25 – 35 min.

7 – 13 min.

20 – 30 min.

> 12 N/mm²

> 5 N/mm² at 5 mm layer

> 12 N/mm²

> 10 N/mm²

> 20 N/mm²

-190°C to +80 (+150)°C

-40°C to +90 (+120)°C

-40°C to +80 (+150)°C

-40°C to +80 (+100)°C

-40°C to +120 (+150)°C

24kg pail

310ml cartridge, 400ml foil, 570ml foil, set

3.6kg combi pack

415ml twin cartridge, 25kg

400ml twin cartridge

LOCTITE UK 8202

- Good flexibility at low temperatures
- High strength

A low viscous 2K PU adhesive suitable for the construction of panels for LNG/LPG tankers complying with the regulations of American Bureau of Shipping (ABS).

TEROSON PU 8597 HMLC

- High modulus
- Low conductivity
- Elastic
- Stress compensation

An elastic 1K PU adhesive which cures by moisture from the air. Used for direct glazing in automotive industry and in joints where tension should be leveraged by the adhesive (elastic bonding).

LOCTITE UK 8326 B30

- Primerless metal adhesion
- Good ageing stability
- Sag resistant

A sag resistant 2K PU adhesive which is suitable for vertical application combining primerless metal adhesion with good elastic and shock absorption properties for use in trailer production.

LOCTITE UK 1366 B10

- Short fixture time
- Good adhesion to plastics and metal
- Shock absorbent

A multi purpose, sag resistant cartridge grade 2K PU adhesive with a very good extrusion rate and outstanding adhesion to metals and plastics. Slightly elastic for good shock absorption.

LOCTITE UK 1351 B25

- GL approved
- High strength
- No tempering required

A cartridge grade 2K PU adhesive with high strength and stiffness and good compressive strength. It is certified by Germanischer Lloyd for bonding in wind power applications.

Structural Bonding – Polyurethanes

Product List (2K)

Product	Technology	Viscosity	Mix ratio by weight	Working life at 20°C	Initial strength	Tensile strength
LOCTITE UK 1351 B25	2K PU	400,000 – 500,000 mPa·s	2:1 vol.	20 – 30 min.	1 – 2 hr	> 20 N/mm ²
LOCTITE UK 1366 B10		400,000 – 500,000 mPa·s	4:1 vol.	7 – 13 min.	40 – 60 min.	> 10 N/mm ²
LOCTITE UK 8101*		Liquid	4:1	50 – 70 min.	5 – 8 hr	> 9 N/mm ²
LOCTITE UK 8103*		8,000 – 10,000 mPa·s	5:1	40 – 70 min.	5 – 8 hr	> 6 N/mm ²
LOCTITE UK 8126*		300 – 900 mPa·s	100:65	45 – 70 min.	–	> 15 N/mm ²
LOCTITE UK 8160*		Pasty	5:1	60 – 90 min.	5 – 8 hr	> 7 N/mm ²
LOCTITE UK 8202*		8,000 – 10,000 mPa·s	4:1	80 – 120 min.	8 – 10 hr	> 12 N/mm ²
LOCTITE UK 8303 B60*		200,000 – 300,000 mPa·s	6:1	60 – 75 min.	4 – 5 hr	> 12 N/mm ²
LOCTITE UK 8306 B60*		250,000 – 310,000 mPa·s	5:1	55 – 65 min.	4 – 5 hr	> 12 N/mm ²
LOCTITE UK 8309*		850,000 mPa·s	5:1	40 – 60 min.	3.5 – 4 hr	> 9 N/mm ²
LOCTITE UK 8326 B30*		250,000 – 310,000 mPa·s	5:1	25 – 35 min.	3 – 4 hr	> 12 N/mm ²
LOCTITE UK 8436*		500 – 900 mPa·s	2:1	90 – 130 sec	50 – 60 min.	–
LOCTITE UK 8445 B1 W*		Liquid	100:22	70 – 74 sec	–	> 6 N/mm ²
TEROSON PU 6700		Pasty	1:1 vol.	10 min.	30 min.	> 12 N/mm ²
TEROSON PU 8630 2K HMLC		Pasty	100:0.3 vol.	25 min.	2 hr***	> 4 N/mm ² at 5 mm layer
TEROSON PU 9225 SF ME		Pasty	1:1 vol.	~150 sec	6 min	13 N/mm ²

Consumption per m ²	Service temperature range (short exposure)	Pack sizes	Comments
–	-40°C to +120 (+150)°C	400ml twin cartridge	Pasty/sag resistant, high strength, high compressive strength, no tempering necessary, GL approved as Duromeric Adhesive according to Rules for Classification and Construction, II, Part 2
–	-40°C to +80 (+100)°C	415ml twin cartridge, 25kg	Pasty/sag resistant, short fixture time, cartridge grade, good adhesion to plastics and metal, shock absorbent
200 – 400g	-40°C to +80 (+120)°C	Not available in the U.K.	Low viscosity
200 – 400g	-40°C to +80 (+120)°C	250kg drum	Low viscosity, multi-purpose, different acceleration levels available, good flow properties, IMO approval for shipbuilding (wheel mark, low spread of flame)
–	-40°C to +80 (+150)°C	Not available in the U.K.	Low viscosity, good penetration properties for laminates e.g. in the ski and snowboard industry
200 – 500g	-190°C to +80 (+150)°C	3.6kg combi pack**,	Very pasty, IMO approval for shipbuilding (wheel mark, low spread of flame)
200 – 400g	-190°C to +80 (+150)°C	24kg pail	Liquid, good flexibility at low temperatures, high strength, ABS type approval (shipbuilding), Bureau Veritas (type approval liquefied Gas Tanks)
200 – 500g	-40°C to +80 (+150)°C	24kg pail, 300kg drum	Multi purpose, pasty/sag resistant, DIN 4102 B1, IMO approval for shipbuilding (wheel mark, low spread of flame)
200 – 500g	-40°C to +80 (+150)°C	Not available in the U.K.	Pasty/sag resistant, high strength and good elasticity, different working life versions available
200 – 500g	-40°C to +80 (+150)°C	30kg pail	Pasty/sag resistant, good workability, used for truck body assembly
200 – 500g	-40°C to +80 (+150)°C	3.6kg combi pack**	Pasty/sag resistant, primerless metal adhesion, good ageing stability
–	-40°C to +80 (+120)°C	Not available in the U.K.	Good adhesion properties and excellent flowability
–	-40°C to +80 (+150)°C	Not available in the U.K.	Liquid, fast setting for top lid bonding
–	-40°C to +80 (+140)°C	50ml (2 x 25ml) cartridge, 250ml (2 x 125ml) cartridge, 620ml (2 x 310ml) cartridge	Easy to use
–	-40°C to +90 (+120)°C	310ml cartridge	Warm applied, high modulus, low conductivity, 2K material, 2 hours drive away time acc. to European standard
–	-40°C to +80 (+140)°C	50ml (2 x 25ml) cartridge	Developed for plastic repairs

** Combi packs include hardener component LOCTITE UK 5400

*** Drive away time

Structural Bonding – Polyurethanes

Product List (1K)

Product	Technology	Viscosity	Open time at 23°C, 50% RH	Initial strength	Curing time	Tensile shear strength
LOCTITE UR 7220	1K PU	5,500 – 10,500 mPa·s	4 – 6 hr	6 – 10 hr	3 days	> 6 N/mm ²
LOCTITE UR 7221		5,500 – 10,500 mPa·s	40 – 60 min.	2 – 4 hr	2 days	> 6 N/mm ²
LOCTITE UR 7225		5,500 – 10,500 mPa·s	20 – 25 min.	50 – 70 min.	1 day	> 6 N/mm ²
LOCTITE UR 7228		5,500 – 10,500 mPa·s	7 – 9 min.	10 – 15 min.	1 day	> 6 N/mm ²
LOCTITE UR 7388		3,000 – 5,000 mPa·s	7 – 9 min.	10 – 15 min.	1 day	> 6 N/mm ²
LOCTITE UR 7396		2,000 – 4,000 mPa·s	25 – 35 min.	60 – 90 min.	1 day	> 7 N/mm ²
LOCTITE UR 7398		3,000 – 6,000 mPa·s	5 – 7 min.	7.5 – 9.5 min.	5 – 7 days	> 4 N/mm ²
TEROSON PU 8596		Pasty	25 min.	6 hr*	5 – 7 days	> 5 N/mm ² with 5 mm layer
TEROSON PU 8597 HMLC		Pasty	20 min.	1 hr / 4 hr*	5 – 7 days	> 5 N/mm ² with 5 mm layer
TEROSON PU 8599 HMLC		Pasty	15 min.	15 min.*	5 – 7 days	> 4 N/mm ² with 5 mm layer
TEROSON PU 9097 PL HMLC	Pasty	25 min.	1 hr*	5 – 7 days	> 5 N/mm ² with 5 mm layer	

Cleaner:

LOCTITE SF 8040 (viscosity – 3 mPa·s) in 30kg pack. Rinsing and cleaning agent for 1K and 2K polyurethane adhesives / high dissolving capacity / low evaporation rate.

For further information, please refer to the TDS and MSDS.

Consumption per m ²	Service temperature range (short exposure)	Pack sizes	Comments
100 – 200g	-40°C to +80 (+100)°C	Not available in the U.K.	Very long open time for large panel applications, foaming
100 – 200g	-40°C to +80 (+100)°C	11 lb	Long open time, foaming, IMO approval for shipbuilding (wheel mark, low spread of flame)
100 – 200g	-40°C to +80 (+100)°C	1,000kg container	Medium open time, foaming, IMO approval for shipbuilding (wheel mark, low spread of flame)
100 – 200g	-40°C to +80 (+100)°C	1kg, 30kg jerry can	Short fixture time, foaming, IMO approval for shipbuilding (wheel mark, low spread of flame)
100 – 200g	-40°C to +80 (+100)°C	1,000 kg container	Low viscosity, fast setting
100 – 200g	-40°C to +80 (+100)°C	Not available in the U.K.	Low viscosity, thermally accelerated, medium open time
120 – 150g	-40°C to +80 (+100)°C	Not available in the U.K.	Low viscosity, thermally accelerated, IMO approval for shipbuilding (wheel mark, low spread of flame)
–	-40°C to +90 (+120)°C	310ml cartridge, set	6 hours drive away time acc. to FMVSS
–	-40°C to +90 (+120)°C	310ml cartridge, 400ml foil, 570ml foil, set	High modulus, low conductivity, 4 hours drive away time acc. to European standard (frontal crash test at 64 km/h with 40% overlap)
–	-40°C to +90 (+120)°C	310ml cartridge, 400ml, set	Warm applied, high modulus, low conductivity, 15 minutes drive away time acc. to FMVSS
–	-40°C to +90 (+120)°C	310ml cartridge, set	Primerless adhesion, high modulus, low conductivity, 1 hour drive away time acc. to FMVSS

