

THISTLEBOND REPAIR KITS

THISTLEBOND UNIQUE POLYMER SYSTEMS.COM

# Instruction Manual

THISTLEBOND REPAIR LAMINATES  
**ThistleBond Repair Kits**

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# Table of Contents

Introduction	4	Repairs Using ThistleBond Repair Kits	8
ThistleBond Resin	4	Mixing ThistleBond Resins	9
ThistleBond Hardener	4	Application of Sealer Filler Mix	10
ThistleBond Resin Pack	4	Application of Fairing Compound	10
Glass Cloth	4	ThistleBond A & B Cement	11
Glass Tape	4	Low Pressure Pipe Repair	11
Contour Cloth	5	High Pressure Pipe Repair	12
Glass Mat	5	Plate Repair	13
Linen Scrim	5	Rapid Setting Super Metal Repair Paste	14
Cellophane	5	PlasSteel	14
Masking Tape	5	ThistleBond ThistleWrap Pipe Repair Tape	15
Sealer Filler	5	Notes	
Fairing Compound	5		
ACCESSORIES			
Instruction Manual	6	Additional Products	7
Barrier Cream	6	Brushes	6
Gloves	6	Plastic Coated Paper	6
Resin Removing Cream	6	Trowelling Tool	6
Stirring Tools	6	Scissors	7

## Introduction

### Description of ThistleBond Repair System Materials

#### **ThistleBond Resin**

A liquid epoxide resin, which, when mixed with the appropriate amount of ThistleBond Hardener produces the ThistleBond Resin Mix that will cure at normal ambient temperatures producing a strong homogeneous mass, having exceptional adhesive properties when applied to metals, wood, glass and synthetic materials.

#### **ThistleBond Hardener**

A specially developed epoxide hardener, which ensures that the ThistleBond Resin Mix not only cures at normal ambient temperatures but also attains maximum strength in a reasonable working time.

#### **ThistleBond Resin Pack**

A carton containing ten units of ThistleBond Resin and ThistleBond Hardener. Each unit consists of one container of Resin and one container of Hardener in the correct proportions for subsequent mixing. The Resin Container is apply proportioned to facilitate its use as a mixing vessel.

#### **ThistleBond A & B Cement**

A specially developed epoxide compound supplied in two separate packs marked A and B. When mixed together in equal portions by volume the Cement will cure to an extremely strong mass with a better adhesive bond than that produced by the ThistleBond Resin mix. Apart from its use as an adhesive for repairs it can be applied, prior to carrying out a ThistleBond repair, where difficult adhesion conditions exist.

#### **ThistleBond Rapid Setting Super Metal Repair Paste**

A specially developed urethane rapid repair compound supplied in two separate packs marked Resin and Hardener when mixed together in equal portions by volume the paste will cure to an extremely strong mass, having exceptional adhesive properties when applied to metals.

#### **ThistleBond PlasSteel Twist Stick**

This is a two part epoxide putty which is colour coded so that the user can see when it is thoroughly mixed. The mixed putty can be used for emergency repair of metal components, The mixed putty will also cure underwater.

#### **Glass Cloth**

A specially treated glass fibre fabric that ensures that the Resin Mix will fully permeate the fabric and give the resultant glass fibre resin laminate repair excellent mechanical properties. Glass Cloth is often used for "Plate" Repairs.

#### **Glass Tape**

The Glass Tape is also a specially treated glass fibre fabric that ensures the Resin Mix will fully permeate the fabric and give the resultant glass fibre resin laminate repair, excellent mechanical properties. Glass Tape is normally used from the roll for Pipe Repairs but can also be used in short lengths for repairs where access is difficult.

#### **Contour Cloth**

## **THISTLEBOND LAMINATES**

This is a resin reinforced fabric which can be contoured to the surface of a pipe. Its main purpose is to bridge holes in pipes so that Glass Tape can be applied evenly to ensure the original contour is maintained.

### **Glass Mat**

A fabric consisting of a random collection of glass fibres which will absorb a considerable quantity of the Resin Mix and which, when the mixture is cured, will produce a mechanically strong mass. Glass Mat is often used as a backing for repairs where Glass Cloth or Glass Tape have already been used and is normally applied using Linen Scrim as a backing.

### **Linen Scrim**

An open weave linen fabric, used as a backing for Glass Mat, to make it easier to handle when being applied to the repair. Linen Scrim Remains an integral part of the repair.

### **Cellophane**

Applied to the outside of a repair after the application of the Linen Scrim. Its purpose is to contain the Resin Mix until it has cured. Cellophane, which also ensures a smooth surface finish, is held in-situ with masking tape.

### **Masking Tape**

A self-adhesive tape used to retain the Cellophane in position.

### **Sealer Filler**

Special non-asbestos filler, in powder form, for addition to the Resin Mix after the initial mixing has taken place. The resultant Sealer Filler Resin Mix has two useful properties. (See chapter 'Preparation and Application of Sealer Filler Resin Mix').

### **Fairing Compound**

Filler, consisting of glass fibre strands, for addition to the Resin Mix after the initial mixing has taken place. Fairing Compound Resin Mix is used for filling in undulations prior to, or in conjunction with, a ThistleBond repair. (See chapter 'Preparation and Application of Sealer Filler Resin Mix').

### **ThistleBond ThistleWrap Pipe Repair Tape**

A specially treated woven glass fabric impregnated with a polyurethane resin which is activated by immersion in water.

The base unit of 'Thistlewrap' comprised 1 roll impregnated tape, 50mm wide x 1.5m long, wound on a plastic cone and vacuum packed in a foil bag.

## **Accessories**

### **Instruction Manual**

The ThistleBond Instruction Manuals gives ample information to enable you, safely to produce effective laminate repairs using the materials available from the ThistleBond range of laminate repair systems. It is essential that you familiarise yourself with the Instructions that apply to the types of repair to be carried out.

### **Barrier Cream**

A vanishing type cream compounded with mineral oils and waxes to form a protective film to the skin against resin based components in the ThistleBond Repair Kits. It is recommended that the cream be applied to hands and bare arms. It can, if necessary, be applied to the face. (See chapter 'Instructions for The Safe Handling of ThistleBond Repair Kit Materials').

### **Gloves**

Industrial gloves are supplied with all ThistleBond Repair Kits. Although the selection of materials for these kits takes account of possible skin irritation problems, it is impossible to be precise about this hazard since no two people react in the same way. E. Wood Ltd consider it prudent to recommend that when using the component materials of the ThistleBond Repair Kits, Gloves should always be worn. (See chapter 'Instructions for The Safe Handling of ThistleBond Repair Kit Materials').

### **Resin Removing Cream**

This cream is specially formulated to remove deposits of resins and adhesives easily and quickly from the skin. (See chapter 'Instructions for The Safe Handling of ThistleBond Repair Kit Materials').

### **Stirring Tools**

Wooden spatulas, those are included for mixing the ThistleBond Resin and the ThistleBond Hardener in the Resin Container.

### **Brushes**

Supplied for the easy application of the Resin Mix to surfaces and also for stippling the mix into the various fabrics supplied with the kit.

### **Plastic Coated Paper**

This paper is plastic coated on one surface and is used with the coated side uppermost. It is first of all recommended that this paper is spread out on the bench or on an area adjacent to where the ThistleBond repair is to be carried out. It will catch any drips of Resin mix which may fall and prevent the unsightly permanent disfiguration of the area involved. The Plastic Coated Paper can also be used as a working surface when stippling the Resin mix into pieces of Glass Cloth, Glass Mat or Linen Scrim before they are applied to the repair. The plastic coating permits the easy removal of the materials before final application to the repair.

### **Trowelling Tool**

This is used for applying the Resin mixes that have been filled with Fairing Compound or Sealer Filler.

### **Scissors**

The scissors included in your ThistleBond Repair Kit have been selected because of their suitability for cutting glass fibre fabrics. They can also be used for the other sheet materials included in the kit.

### **Additional Products**

Please refer to the current 'ThistleBond Price List' for full details of further Engineering, Laminate Repair, Adhesives and Accessories available.

# Repairs Using ThistleBond Repair Kits

The ThistleBond repair Kit is a maintenance tool, which as the experience of the user broadens, can resolve an increasing number of the Maintenance Engineer's problems.

The instructions in this manual describe three types of 'standard' repairs as typical examples. Ultimately, the individual engineers who use the Kits will, through experience, establish the best designs of repairs for their particular maintenance problem. The fundamental principle involved in the ThistleBond Repair Kit system is to produce a glass fibre resin laminate and to bond effectively that laminate to the sound portions of the item being repaired – the parent body.

Invariably the problem area is the bond between the resin laminate and the parent body. E. Wood Ltd has achieved pressures of 56 – 112 kg/cm<sup>2</sup> (800 – 1600 ibf/in<sup>2</sup>) before failure of the resin laminate bond when testing High Pressure Pipe Repairs. 28 – 35 kg/cm<sup>2</sup> (400 – 500 ibf/in<sup>2</sup>) when testing Low Pressure Pipe Repairs.

The following primary points should be considered during or prior to carrying out a repair.

## **IS THE APPLIATION SUITABLE?**

Before commencing a repair using a ThistleBond Repair Kit, ensure that the Repair Systems Materials are suitable for the intended application. Reference to the chemical resistance charts in this manual should be of assistance.

The physical demands on the repair when it is returned to operating conditions must also be taken into account. The hydraulic test pressures detailed above give a good indication of mechanical strengths achievable with a ThistleBond Repair. The question of operating temperatures must also be considered. This glass fibre reinforced resin laminate can give effective results up to a maximum of 170 degrees Celsius. It must be stressed however that the ultimate strength and performance of a ThistleBond Repair is very much dependent on the operating conditions and the correct repair procedure being adopted as indicated in this manual. The THISTLEBOND Technical Department are pleased at any time to comment on particular applications that you may have in mind and to advise if similar repairs have been satisfactorily been undertaken by other users. Ultimately, the individual Maintenance Engineer must use his/her own 'engineering judgement' as to the suitability of the application. It should also be stressed that ThistleBond Repair Kits have been marketed and sold for over 20 years and their success as a maintenance tool is well proven and established.

## **INITIAL PREPARATION**

Before starting a repair, always ensure that all the required contents of the Kit are at the site of the repair, clean and serviceable. Once the Resin and Hardener have been mixed, there will be no time to look for the scissors, etc. The repair once started will have to be completed in one smooth continuous operation.

To ensure that the best possible repair can be achieved, it is recommended that the areas of repair be isolated and/or pressure reduced as much as possible.

## **CLEANING THE REPAIR SURFACE**

The surface to which the repair is to be applied must be clean since, as has already been stated. It is the bond between the repair and the parent body, which dictates the ultimate strength of the repair. The resin will adhere best to a clean, grease-free surface. It is essential that before applying a repair to a surface it should be clean, free from paint, rust, scale and grease. It is also essential that the surface areas being repaired are solvent wiped with ThistleBond Cleaner/Degreaser before the repair commences.

## **APPLICATION OF THE THISTLEBOND RESIN MIX**

To maximise the strength of the repair, it is essential that a complete coating of the Resin Mix is applied prior to the laying up of each layer of Glass Fabric.

By doing so, a homogeneous glass fibre resin laminate will be achieved.

The principle strength of the glass fibre resin laminate lies in the Tape or Glass Cloth layers which are either wound or laid on the surface of the repair.

When using Tape, this should be wound on with a half overlap and care must be taken to ensure that it is applied evenly and flat. This will eliminate a possible cause of weakness in the laminate. When applying multiple layers of Tape, each subsequent layer should be applied in the reverse direction and the Tape should not be found difficult to keep the winding smooth. When the repair is on a pipe bend, it is better to cut short lengths of Tape and lap them one on the other.

The purpose of Glass Mat is to provide a rigid backing layer to a repair that has been effected using Glass Tape. To achieve this result, it is essential that the Glass Mat be thoroughly saturated with the Resin Mix. This can best be achieved by working the Resin Mix into the Mat, by stippling with the brush supplied before applying it to the repair.

## **MIXING THISTLEBOND RESIN AND THISTLEBOND HARDENER**

Each unit consists of one container of ThistleBond Resin and one container of ThistleBond Hardener. The Resin Container is slack filled to permit the addition of the complete contents of the Hardener Container. The quantities supplied in each container of the unit are exactly those required to produce the correct Resin Mix and should not be altered in any way. Immediately after the addition of the Hardener, the contents of the Resin Container should be thoroughly mixed using the Stirring Tool supplied. The resultant Resin Mix has a usable life of approximately 12 minutes at an ambient temperature of 24 degrees Celsius before it starts to 'gel'. The gel time is approximate and can be affected by a variety of conditions. It should be noted that the reaction between the Resin and the Hardener produces heat and this in turn can reduce the time to gel. When the ambient temperature is high or when it is desired to increase the time to gel, then the Resin Mix should be transferred into a shallow tray prior to use. By this means, gel time will be slightly extended.

In cold weather conditions the Resin and Hardener may be found to be viscous and if this is the case, it is advisable to warm the containers prior to attempting mixing. Warming the containers can be achieved by placing them into hot water for a few minutes. Do not allow the materials to become too hot and always remove from water before opening the tins and mixing. Under no circumstances should water be allowed to contaminate the materials since steam can be generated in the Resin Mix and will cause foaming.

## **THISTLEBOND LAMINATES**

It should be noted that the time for the mixed resin to gel is not the time taken for it to cure. The time to cure is dependent on many factors but is mainly affected by temperature. The higher the temperature, the quicker the cure. As a general guide, over 50% repair strength is developed in approximately 4 hours at 18 – 20 degrees Celsius. Full mechanical cure is achieved under the above conditions in approximately 24 hours.

### **PREPARATION AND APPLICATION OF SEALER FILLER RESIN MIX**

Sealer Filler is a special, non-asbestos powder. It is supplied in a polythene bag containing sufficient material to add to the quantity of Resin Mix resulting from one unit of ThistleBond Resin and Hardener. It should be added to the Resin Mix, which should already have been transferred to a suitable sized container. The Sealer Filler and Resin Mix should be stirred with a Stirring Tool in order to disperse the Filler uniformly through the Mix. The resultant Sealer Filler Resin Mix should be applied to the repair areas as required using the Trowelling Tool. The Sealer Filler Resin Mix has the following distinct properties which are of great assistance in certain types of repairs:

The mix is thixotropic and can therefore be applied to vertical surfaces for filling in surface irregularities prior to or in conjunction with the ThistleBond repair.

The mix can be applied to operate at temperatures up to approximately 180 degrees Celsius. When it is applied as a pre-coat, prior to carrying out a ThistleBond repair. It will help to insulate the resin laminate from the operating temperature of the parent body.

The Sealer Filler Resin Mix can also be used on its own for certain types of repair.

### **PREPARATION AND APPLICATION OF FAIRING COMPOUND RESIN MIX**

Fairing Compound is a filler which consists of glass fibre strands. This is also supplied in a polythene bag containing sufficient materials to add to the quantity of Resin Mix resulting from one unit of ThistleBond Resin and Hardener. The methods of mixing and application are similar to those for the Sealer Filler Resin Mix.

The main purpose of the Fairing Compound Resin Mix is to fill in undulations prior to the application of a ThistleBond repair

*WARNING: The application of the Fairing Compound Resin Mix must always be followed by a further Resin Mix application incorporating Glass fabric or Linen Scrim. This will eliminate the possible hazard of single glass filaments reinforced with cured Resin Mix protruding from the surface of the finished repair and causing subsequent injury to personnel.*

### **METHOD OF MIXING AND APPLICATION OF THISTLEBOND A & B CEMENT**

Equal quantities by volume of the resin and hardener of this epoxide resin based cement are taken from the separate containers that are marked A and B. The resin and hardener should be thoroughly mixed. The different colours of the two constituent parts assist in showing when the cement is fully mixed as these will blend together to a uniform colour. Pre-warming the two containers in cold weather facilitates mixing. The use of a warm mixing container will also assist but the container must be clean and dry. The application of gentle heat during the curing process will reduce the time taken to cure.

Apart from its use as an adhesive for repairs (it should be noted that its bond strength is greater than that of the ThistleBond Resin Mix), ThistleBond A & B Cement can also be used in the following applications.

Where it proves impossible to clean thoroughly the surface to which a ThistleBond repair is to be applied, then pre-coating this surface with ThistleBond A & B Cement to overlap the areas of the repair by 50mm (2") all round will greatly assist in obtaining the required bond strength between the resin laminate and the parent body. Once this pre-coating operation has been completed, then a conventional ThistleBond repair as previously described can be carried out.

Where a ThistleBond repair is to be carried out on a cracked pipe or plate then ThistleBond A & B Cement should be trowelled into the crack before proceeding with the repair. Where the crack is still leaking a little, it is recommended that the ThistleBond A & B Cement should be left partially to cure before being trowelled into the crack. It is emphasized that in many instances, the problem of sealing off a crack prior to carrying out a ThistleBond repair can be solved by the application of the ThistleBond PlasSteel Twist Stick which is included with each ThistleBond Repair Kit

### **METHOD OF APPLICATION OF A THISTLEBOND LOW PRESSURE, PIPE REPAIR**

This repair method represents the standard approach, which should be adopted when repairing a damaged section of pipe. This type of repair has been tested and achieved pressures in excess of 35kg/cm<sup>2</sup> (500lb/in<sup>2</sup>) before failure. The following is the sequence of steps to be taken in the repair procedure.

1. Read through the whole of this procedure and ensure that all the Kit Contents required are available at the location of the repair and are clean and serviceable.
2. Read through the section of this manual entitled 'Instructions for the Safe Handling of ThistleBond Repair System Materials'.
3. The area beneath the repair and also that area where the ThistleBond Resin Mix, etc., is to be prepared should be covered with the Plastic Coated Paper supplied. This will ensure ease of cleaning these areas on completion of the repair.
4. The overall size of the repair should extend at least 50mm (2") onto sound parent material on either end of the repair.
5. Thoroughly clean the surface to which the ThistleBond repair is to be applied.
6. If the contours of the surface to which the repair is to be applied are irregular or cracked, then apply ThistleBond A & B Cement, Sealer Filler Resin Mix, Fairing Compound Resin Mix or ThistleBond Rapid Setting Super Metal Repair Paste as appropriate.
7. If the repair is to bridge a hole in a pipe, then a piece of Contour Cloth of a suitable size should be prepared to retain the original contour.
8. Mix sufficient ThistleBond A & B Cement to coat the area to which the Contour cloth is to be applied. Once coated, the Contour Cloth should be positioned over the hole. In most applications ThistleBond Resin Mix can be used instead of ThistleBond A & B Cement and some users prefer to apply the Contour Cloth in this manner. The main requirement is to ensure that the Contour Cloth remains in contact with and therefore bonds to the surface of the repair whilst the Glass Tape is applied.
9. At this stage, the ThistleBond Resin Mix for the repair should be prepared. See the section entitled 'Mixing Instructions for ThistleBond Resin and ThistleBond Hardener'.
10. Thoroughly coat the surface of the repair area with the ThistleBond Resin Mix.
11. When Glass Tape is being used for the repair, then this should be wound round the pipe directly from the roll. The Tape should be wound reasonably tight on to the Resin Mix coated surface of the repair area to ensure that the Mix permeates through the

## **THISTLEBOND LAMINATES**

interstices of the Tape. The Tape should be wound to overlap by half its width. When applying multiple layers of Tape, do not cut the Tape at the end of each pass.

12. When Glass Cloth or pieces of Glass Tape are being used, then each piece of materials should overlap the adjacent pieces by approximately 12mm ( $\frac{1}{2}$ " ). Resin Mix should be then stippled into the interstices of the Cloth or Tape.
13. A further coat of the ThistleBond Resin Mix should now be applied to the first layer of Glass Cloth or Tape.
14. Two additional layers of Glass Cloth or Tape should now be placed or wound on to the first layer. When Tape is used, the winding of the second and third layers should each be in the reverse direction to that of the previous layer. A coating of Resin Mix is applied between each layer of Cloth or Tape.
15. Cut a piece of Cellophane a little larger than the length of the repair and at least 100mm (4") longer than the circumference.
16. This is applied to the surface of the repair and should be retained in position by means of Masking Tape. Masking Tape is applied to each end of the repair and also in an open spiral along its length.
17. The repair is now complete and the Resin Mix must be left to cure before returning the repaired item back into service. Curing times generally depend upon ambient temperature. For a general guide, in excess of 50% strength is developed in approximately 4 hours at 18 – 20 degrees Celsius. Full mechanical cure is achieved under these conditions in approximately 24 hours from time of application.
18. Gloves, Trowelling Tools, etc., used during the repair should be cleaned thoroughly immediately after use.

### **METHOD OF APPLICATION OF A THISTLEBOND HIGH PRESSURE, PIPE REPAIR**

This repair method represents the standard approach which should be adopted when repairing a damaged section of pipe which is going to be subject to pressure. This type of repair has been tested and achieved pressures of up to 112 kg/cm<sup>2</sup> (1600 lbf/in<sup>2</sup>) before failure.

The incorporation of Glass Mat into this type of repair improves the strength. It should be noted that larger volumes of Resin Mix are involved in this type of repair and with the greater mass of Mix the gel time will be reduced accordingly.

The sequence of steps to be taken in the repair procedure is as follows:

1 – 14. Proceed as steps 1 – 14 of the 'Method of Application of a ThistleBond, Low Pressure Pipe Repair'. With reference to step 4 E. Wood Ltd recommend the repair be extended at least 100 mm (4")

15. Cut a piece of Glass Mat, so that it will fully cover the repair and overlap at the joint by approximately 100 mm (4").
16. Cut a piece of Linen Scrim approximately 100 mm (4") larger all round than the piece of Glass Mat.
17. Lay out an adequately sized piece of Plastic Coated Paper.
18. The piece of Linen Scrim should be laid out on the plastic coated side of the Plastic Coated Paper.
19. The piece of Glass Mat should be laid on the Linen Scrim. The Glass Mat should be well saturated with Resin Mix.
20. The combination of Linen Scrim and Glass Mat should now be removed from the Plastic Coated Paper and the Glass Mat side applied to the Glass Tape or Cloth surface of the repair. At the joint, the Glass Mat should be overlapped on to itself by peeling back the Linen Scrim, which is then replaced, and itself overlapped. By moulding the combination to the repair with gloved hands, the Resin Mix will satisfactorily permeate through the Linen Scrim.
21. Cut a piece of Cellophane a little longer than the length of the repair and at least 100 mm (4") larger than the circumference.
22. Apply the piece of Cellophane to the Linen Scrim surface of the repair with a 50 mm (2") overlap at the join. It should be moulded onto the repair with Gloved hands to expel as much air as possible.
23. The Cellophane is held in position by Masking Tape applied to each end of the repair. Masking Tape is also applied in an open spiral along its length.
24. The repair is now complete and the Resin Mix must be left to cure before returning the pipeline, plant or equipment into service. Curing times generally depend upon ambient temperature. For a general guide, in excess of 50% strength is developed in approximately 4 hours at 18 – 20 degrees Celsius. Full mechanical cure is achieved under these conditions in approximately 24 hours from time of application. This type of repair, because of the larger volume of Resin Mix required, will gel more quickly, under given conditions because of the greater amount of heat generated during the curing process.
25. Gloves, Trowelling Tool etc., used during the repair should be cleaned thoroughly immediately after use.

### **METHOD OF APPLICATION OF A THISTLEBOND PLATE REPAIR**

In a ThistleBond Pipe Repair, the resin laminate will be in the form of a complete cylinder around the circumference of the pipe. Where a repair is required on a flat surface, a very large diameter surface or a complex surface, this will not normally be possible and the repair will require to be in the form of a patch.

The sequences of steps involved in the High or Low Pressure types of Plate Repair are the same as those required for Pipe Repairs and the reasons for the choice of type are identical.

Normally Glass Cloth will be used in the repair instead of Glass Tape and this should be read into the sequences of steps indicated previously in this manual. The use of Linen Scrim, Cellophane, etc., will not necessarily be required in all cases as this is dependent upon the nature of the repair.

### **METHOD OF MIXING AND APPLICATION OF THISTLEBOND RAPID SETTING SUPER METAL REPAIR PASTE**

This adhesive has been included in the ThistleBond Repair Kit because there has been a consistent demand from engineer for a quick curing urethane resin material for certain types of emergency repairs. Its inclusion broadens the scope of the ThistleBond Repair Kit as a maintenance tool. The adhesive can be applied, if required, prior to a standard ThistleBond repair.

The method of mixing applying ThistleBond Rapid Setting Super Metal Repair Paste is as follows:

1. The precautions to be taken prior to handling this material are set out previously in this manual.
2. All surfaces to be bonded must be clean, dry and free from grease, oil etc. Metal surfaces should be abraded. Once all surfaces to be bonded have been cleaned they should not be touched.
3. Measure out equal amounts of Resin and Hardener onto a clean mixing surface. Mix thoroughly then apply a thin film on both surfaces to be bonded and unite immediately.
4. Maintain pressure on the bonded surfaces until the adhesive sets (approximately 5 minutes at 25 degrees Celsius). Wipe off excess adhesive whilst still wet or scrape off with a razor blade before the material fully sets. Once set, the bond is permanent

## THISTLEBOND LAMINATES

and at normal ambient temperatures the strength of the bond will continue to develop for about 7 days. This can if required be accelerated by the application of a gentle heat.

5. Most materials except thermoplastics can be bonded with ThistleBond Rapid Setting Super Metal Repair Paste. The flexibility of the cured resin permits the bonding of materials with different coefficients of thermal expansion with minimum stress in the bonded joint.

### METHOD OF MIXING AND APPLICATION OF THISTLEBOND PLASSTEEL

These unique 'twist stick' grade products are specially formulated two part epoxy repair compounds in the form of a concentric coloured stick of putty consistency (so that the user can see when the materials are thoroughly mixed). PlasSteel incorporates a metal filler.

Sticks are packaged in approximate weight/lengths of 125gm, 175mm long in clear plastic tubes, capped at the ends. They are easily applied after twisting off the required amount from the stick and mixed by kneading in a gloved hand to a uniform consistency.

PlasSteel set initially within approximately one hour and can be machined after about 30 minutes. One stick of PlasSteel is provided in the ThistleWrap Pipe Repair Kit and in each of the Thistlebond 'A' and 'C' Kits.

### METHOD OF MIXING AND APPLICATION OF THISTLEBOND THISTLEWRAP

**ThistleBond 'ThistleWrap Pipe Repair Tape'** is ideal for pipe repairs to low pressure systems. As a general guide, a repair built up to a thickness of approximately 12mm (½") will withstand a maximum service pressure of 10 bar (150 psi). Higher pressures, up to 50 bar, can be achieved by first applying over the leak, a 'plug' of **ThistleBond 'PlasSteel'** twiststick grade metal-filled epoxy putty.

Pipes up to a nominal diameter of 65mm may be repaired using **ThistleBond 'ThistleWrap Pipe Repair Tape'** with holes approximately 3mm to 6mm diameter, although slightly larger pipes and holes can be effectively repaired using a plug of putty as described herein, always at users discretion.

**Before proceeding, please read the following information carefully to ensure that the correct application procedure is fully understood.**

All pressure within the pipe should be released. For leaks where pressure cannot be removed, holes should be stopped using a pipe repair clamp.

Remove all oil, grease, loose rust scale, sealant tape and paint from the repair area. Rough score a 10 cm (4 inch) patch around the pipe centering on the leak site.

If the pipe surface is pitted by rust, surfaces must be wire brushed to remove the loose scale. If the surface is smooth, as with copper or stainless steel, surfaces should be roughened with a coarse file, rasp or saw blade.

For plastic pipe, the external mould release must be removed.

Abrade surfaces with a coarse grit sandpaper. A saw blade may also be used to create a cross hatch pattern. This is particularly useful on polypropylene and PVDF piping.

During mixing and during application, lightweight disposable gloves should be worn to protect the hands.

**ThistleBond 'ThistleWrap Pipe Repair Tape'** should be immersed in water and squeezed two or three times for about 10 to 20 seconds prior to use.

Remove roll from water and wrap quickly and tightly as follows.

Centre tape over leak site, wrap from bottom of roll, pulling firmly throughout application. After 5-7 plies, resin foam will come through the tape, which is desirable and aided by pulling tightly. Continue until entire roll is applied, building to a minimum thickness of ½ inch (12 mm), use a second roll if necessary. Firmly press and smooth end of roll into wrap in the direction of application. Wet gloves in water, smooth and firmly press the wet resin back into the wrap.

**KEEP HANDS MOVING QUICKLY AND WET GLOVES FREQUENTLY TO AVOID STICKING.**

Continue rapid hand movement pressing and polishing resin in motions around and parallel to the pipe. Continue process until resins are no longer tacky. The repair should now have a smooth, hard surface and an enamel-like appearance with no fabric protruding through the surface.

When used in conjunction with a plug of **ThistleBond 'PlasSteel' Putty** repeat the above instructions but having first plugged the hole. Knead a small bead of putty in gloved hand and flatten into a disc centrally over the hole pressing gently and feathering out the edges. Leave to semi-harden (full cure 30 minutes) before applying tape, although tape may be applied immediately if necessary.

After application dispose of gloves.

**NOTE:** If a thicker application is needed, spend a little less time finishing the first roll and immediately begin the application of the next. Finish the final roll as if a single roll application.

## Chemical Resistance Chart for ThistleBond Epoxy Resin Products

Chemicals	ThistleBond A&B Cement	ThistleBond Resin & Hardener	ThistleBond Plasteel
Acetic Acid (greater than 10%)	P	P	P
Acetic Acid (less than 10%)	G	G	F
Alum	E	E	G
NH <sub>4</sub> Cl (10% Solution)	E	E	G
Ammonium Sulphate (10 % solution)	E	E	G
Ammonium Bisulphate	G	F	F
Ammonium Chloride	G	G	G
Ammonium Nitrate	G	G	G
Animal Fats	G	G	G
Aviation Spirits	U	U	U
Benzene	P	P	U
Butanol	P	P	U
Carbon Tetra-chloride	U	U	U
Carbonic Acid	G	G	E
Chlorine Gas	U	U	U
Chromic Acid	U	U	U
Chrome Plating Solutions	U	U	U
Copper Sulphate	F	F	P
Creosote	U	U	U
Cyclohexanol	U	U	U
Detergent Solution (5%)	G	G	F
Ethylene Glycol	U	U	U
Ferric Chloride	F	F	P
Ferric Sulphate	G	G	G
Formic Acid (less than 10%)	P	P	U
Formaldehyde (37%)	G	G	P
Glucose	G	G	F
Glycerine	G	G	F
Hydrochloric Acid (10%)	E	E	G
Hydrochloric Acid (20%)	G	G	G
Hydrochloric Acid (30%)	F	F	F
Hydrofluoric Acid (less than 10%)	G	F	F
Chemicals	ThistleBond A&B Cement	ThistleBond Resin & Hardener	ThistleBond PlasSteel
Lactic Acid (less than 5%)	F	P	U
Lead Nitrate	G	G	F
Magnesium Chloride	G	G	G
Mineral Oil	E	G	G
Nitric Acid (10%)	G	F	P
Nitric Acid (30%)	F	P	U
North Sea Oil	F	F	F
Paraffin (low grade)	G	G	G
Petrol	F	F	F
Phenol	P	P	U
Phosphoric Acid (10%)	F	F	P
Potassium Cyanide	U	U	U
Potassium Dichromate	F	F	F
Potassium Hydroxide	E	G	G
Potassium Nitrate	G	G	G
Potassium Sulphate	G	G	G
Sea Water	E	E	E
Sewage	G	G	G
Sodium Bisulphate	G	G	F
Sodium Bisulphite	F	F	F
Sodium Dichromate	F	F	F
Sodium Cyanide	P	P	U
Sodium Hydroxide (40%)	E	E	G
Sodium Nitrate	G	G	G
Sodium Phosphate	G	G	G
Sodium Sulphite	F	F	F
Sulphuric Acid (10%)	G	G	G
Sulphuric Acid (30%)	G	G	G
Sulphuric Acid (greater than 30%)	U	U	U
Toluene	F	P	U
Triethanolamine	E	G	G
Turpentine	P	P	P
Water	E	E	E
Zinc Chloride	F	F	F
Zinc Sulphate	F	F	F

**NOTE:** E = Excellent G = Good F = Fair P=Poor U = Unsuitable

## Contents of the ThistleBond and Engineers Repair Kits

	‘A’ Kit	‘C’ Kit
Standard Resin and Hardener 225gm Unit	20	5
A & B Cement 2 x 175gm tubes	1	1
PlasSteel Twist stick 125gm	1	1
Rapid Setting Super Metal Repair Paste 2 x 175gm tubes	1	1
Roll Glass Tape 38mm x 50 metres	2	1
Glass Cloth 1m <sup>2</sup>	3	1
Glass Mat 0.5m <sup>2</sup>	2	1
Roll of Contour Cloth 250mm x 250mm	1	1
Linen Scrim 0.5m <sup>2</sup>	3	1
Plastic Coated Paper 2m <sup>2</sup>	1	0
Roll of Cellophane 250mm x 2.5 metres	1	1
Roll of Masking Tape	1	1
Unit of Fairing Compound 50g Bag	1	1
Unit of Sealer Filler 50g Bag	2	1
ThistleWrap Pipe Repair Tape 50mm x 1.5m	1	1
Disposable Gloves (pair)	10	1
Pair of Scissors	1	0
Brush	3	1
Stirring Tool	10	2
Trowelling Tool	1	1
Barrier Cream 110gm unit	1	1
Resin Removing Cream 110gm unit	1	1