COMPOSITE MATERIALS application

Use of composites is an economic alternative for welding, surface welding, etc., in repairs related to re-shaping and protection of surfaces against unfavourable and aggressive external factors.

The Chester Molecular company offers a complete range of two-component reconditioning products that provide a solution to almost any problem related to surface protection and repair of worn metal elements.

DESCRIPTION OF TYPICAL APPLICATIONS

Damaged rolling bearing journal.
Damaged rolling bearing mounting hole.

There are two ways of reconditioning surfaces on which rolling bearings are seated.

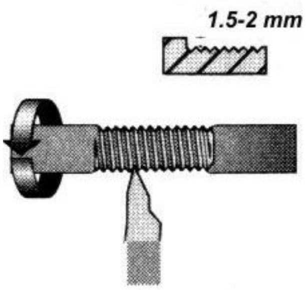
In slow-speed mechanisms where relative large deviations of an axial alignment are acceptable and high precision is not required, the „ready made" method can be used to reproduce the surface shape. In this method the surface is reproduced by an outside bearing surface or split sleeve made for a specific shaft diameter. An advantage of this method is that neither disassembly of the elements to be reconditioned nor machining is required.

In other cases the method with a final machining is used. Most often, the Chester Metal Super is used for repairs of this type. Chester Metal Super FE that features a better machinability is more suitable for a reconditioning of large elements with machining.

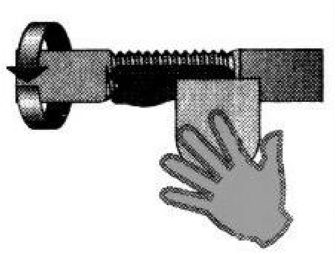
Method with machining

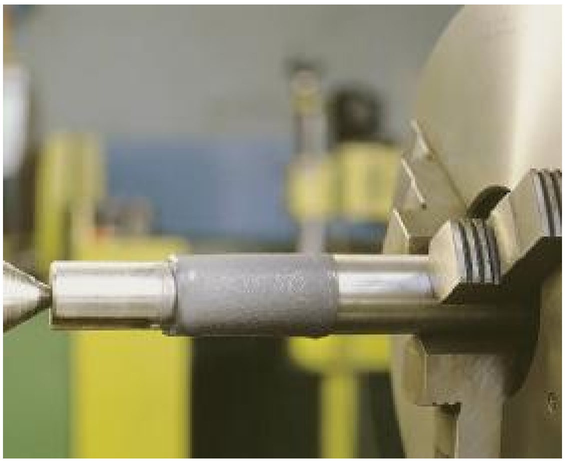
Shaft journal.

Use the Fast Cleaner F-7 cleaner/degreaser to degrease very carefully the shaft surface to be repaired. Next chuck the shaft in a lathe. Re-turn the damaged journal (remove the surficial material layer) and cut a screw line so that after the machining the layer applied was at least 1.5 to 2 mm thick.

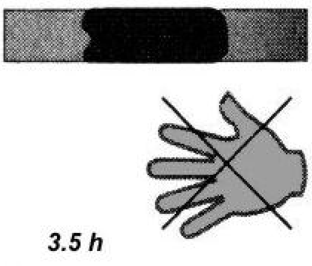


Degrease again after machining. Use the Chester Molecular spatula to apply a thin layer of thoroughly mixed Chester composite material on the dry surface of the journal prepared as above. The first layer has to be carefully rubbed into the surface. Provide some slight allowance for the final machining. The most convenient way of applying the material is when the shaft is chucked on a lathe and rotates at the tangential velocity of approximately 0.2 to 0.3 m/s.

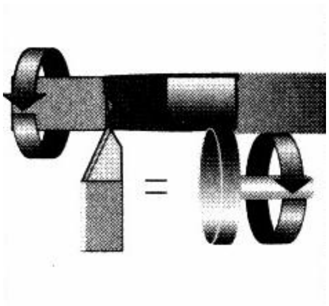




If the Chester Metal Super or Super FE is used for the repair then the final machining is possible after curing for approximately 3.5 to 4 hours at 20°C (68°F).



Once the composite is cured, machine the shaft on a lathe or grind to a required dimension.



In order to improve mechanical properties of the coating applied it can be held at a temperature of 80 to 100^{0}C (176 ^{o}F – 212 ^{o}F) for 2 up to 4 hours. Seat the bearing on the surface prepared this way. Bond the bearing in place with an anaerobic contact adhesive to prevent its rotation on the journal.

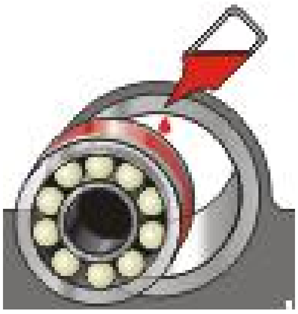
Bearing mounting hole

Use the Fast Cleaner F-7 cleaner/degreaser to degrease very carefully the hole surface to be repaired. Next chuck the element being reconditioned on a boring machine or lathe. Re-bore the damaged hole (remove the surficial material layer) and cut a screw line so that after the machining the layer applied was at least 1.5 to 2 mm thick.

Degrease again after machining. Use a spatula to apply (by rubbing) a thin layer of thoroughly mixed Chester composite material on the dry surface of the hole prepared as above. The first layer has to be carefully rubbed into the surface. Apply the composite with some slight allowance for the final machining, at the tangential velocity of approximately 0.2 to 0.3 m/s.

If the Chester Metal Super or Super FE is used for the repair then the final machining is possible after curing for approximately 3.5 to 4 hours at 20^{o}C (68^{o}F). Once the composite is cured, machine the shaft on a boring machine (lathe) or grind to a required dimension.

Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the coating applied. Install the bearing in the mounting hole prepared this way. Bond the bearing in place with an anaerobic contact adhesive to prevent its rotation in the hole.



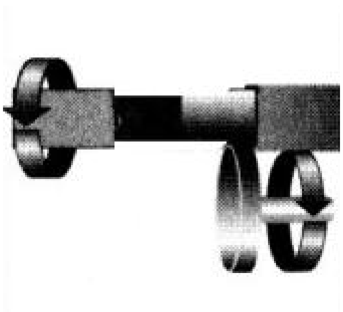
It is recommended to use the following machining data for turning of composite materials (for carbide-tip tools):

Cutting speed	1.2 to 2.5 m/s
Feed	0.1 to 0.3 mm/rev.
Cutting depth	0.4 to 0.6 mm (finishing)

Surface reproduction method.

Shaft journal

Use the Fast Cleaner F-7 cleaner/degreaser to carefully degrease the part of the shaft being repaired and next grind and mechanically roughen the worn surface using a corundum cutter or grinding disk. The diameter of the shaft part being repaired after the grinding should be smaller by at least 3 mm than that of undamaged places that will be used as the reference base. Re-grind the damaged surface so that a sharp boundary (threshold) is formed between the damaged and undamaged part of the shaft.



Having applied (with some slight excess) the Chester Metal Super or Super SL to the length of the shaft being repaired, apply the Chester Release Agent separator on split sleeves, position them on this length and clamp them with clamp hoops or bolt together with bolts (depending on the design).

The split sleeves (of a diameter equal to the rated shaft diameter) must be fabricated for a specific shaft, with an incomplete circumference contour to allow for squeezing excess material out. Undamaged parts of the shaft can be used as the reference base if their length exceeds by approximately 25% the shaft length being repaired.

As the composite material is applied with a slight excess, once the split sleeves are placed on the shaft and clamped, the excess material may penetrate into the space between the split sleeves and the shaft surfaces used as the reference base. In order to prevent this the composite material should not be applied near the reference base surfaces. Possible gaps can be filled once the split sleeves have been removed – after approximately 3 hours for the Chester Metal Super and approximately 6 hours for the Super SL (at 20°C) after application. Also after this time flashes occurring between the split sleeve edges can be removed.

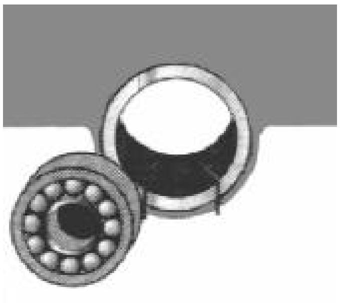
Holding at a temperature of 80 to 100°C (176°F – 212°F) for 2 up to 4 hours can be used to improve mechanical properties of the coating applied.

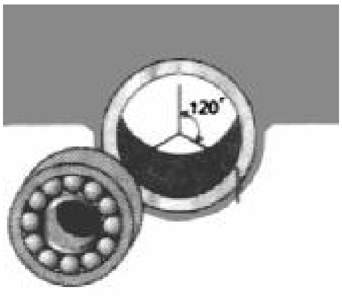
Bearing mounting hole

Use the Fast Cleaner F-7 cleaner/degreaser to carefully degrease the hole surface being repaired.

The next action is a throughout roughening of the surface, preferably mechanically - using a corundum cutter or grinding disk. Also abrasive paper can be used. Remove the dust, degrease again and dry, then apply the carefully mixed Chester Metal Super composite by rubbing it and install the bearing.

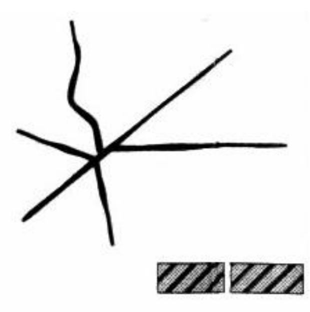
If the hole is worn out so much that the bearing rotates freely, then after applying the composite, two copper (aluminium) wires should be placed in it when it is still soft; these wires should be spaced and bent outside, to the side from which the bearing will be pressed in. These wires should have a diameter slightly exceeding a play of the hole. Upon pressing the bearing in its upper part is the reference base while the wires get flattened in the lower part. If the hole wear is large and uniform (e.g. shafts operating in a vertical position), three wires spaced every 120^{o} should be used.





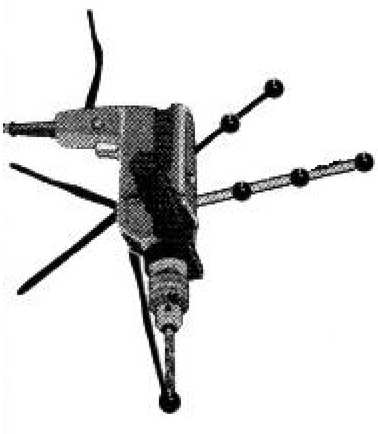
Cracked casing

The Chester Molecular composite materials can be used to repair cracks in metal housings, blocks, casings and tanks of any type. Typical examples are: blocks of internal combustion engines, electric motor housings, pump, valve and gate valve casings, gearbox housings, storage tanks for chemicals, oil, etc.



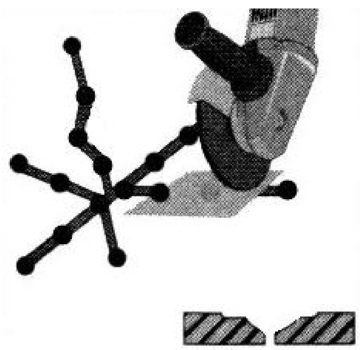
The first operation is a throughout degreasing of the area being repaired using the Chester Fast Cleaner F-7 cleaner/degreaser. Both the crack itself and its vicinity area should be degreased. Any leaks must be stopped. Whenever possible cast iron casings operating in oil should be burned using a heat gun

or oxy-acetylene blowpipe in order to remove oil particles from micropores; these particles could cause a secondary contamination of the surface.
Drill crack stop holes of a diameter exceeding the crack width by approximately 5 mm at both ends of the crack. Use indicative penetrants if it is difficult to localize the crack ends. Drill holes of the 5 mm diameter at hair cracks. These holes should stop the crack propagation. Drill the holes with approximately 50 mm spacing over the whole length of the crack.



Tap the holes and screw into them bolts covered with the Chester Molecular anaerobic contact adhesive. Remove the bolt heads. The bolts can be previously notched to facilitate breaking them once they have been tightened.

Use grinding disks or profile cutters to chamfer lengths of the crack between the tightened bolts and roughen the surface over a width of approximately 25 mm on both sides. The chamfer should have a V-shaped cross section and its depth should be approximately a half of the thickness of the wall being repaired.



If the above-mentioned operations resulted in a contamination with fat, repeat the degreasing operation. Once the part under repair has been degreased again and dried, the thoroughly mixed composite should be applied. The thixotropic products are used for repairs of this type. Most often this is the Chester Metal Super or Super SL. Elements exposed to erosive wear are repaired using the Chester Metal Ceramic T product.

Use the Chester Molecular to apply a layer of the product so that both the crack and chamfer are completely filled while the roughened surfaces are covered with approximately 1 mm thick layer. Next put the Chester reinforcing tape (net) of dimensions slightly smaller than the roughened surface and rub carefully the composite material into it. The composite can be previously rubbed into a cut piece of tape put on a flat and smooth surface, e.g. a hard plastic film. Cover the tape placed on the crack with a composite layer approximately 5 mm thick. The layer thickness should decline towards its edges and amount to about 1.5 mm at a distance of 5 mm from the edge.

If the repair refers to a hair crack width of which does not exceed 0.05 mm then the Chester Molecular B-00 capillary anaerobic contact adhesive should be applied into the crack before spreading of the composite.

If a tensile stress occurs in the crack or the housing stability has been impaired then, instead of drilling the holes and screwing bolts into them, a strengthening and stabilisation should be provided by means of sheet metal clamps of a thickness equal approximately to a half of that of the wall but not less than 2 mm. The clamps are placed on a thin layer of the composite material and fixed with bolts. Surfaces of the clamps should be degreased and roughened. The reinforcing tape is put on the clamps according to the recommendations presented above.

Repaired subassemblies may be put back in operation after approximately 24 hours (at 20^{o}C = 68^{o}F). Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the repaired areas.

Damage of a cylinder piston rod surface

The most often occurring types of a piston rod surface damage are mechanical scratches of various width and depth. The repair is conducted by means of Chester Metal Slide product.

An enormous care should be given to degreasing of the surface. Whenever possible, after degreasing with the Chester Fast Cleaner F-7 cleaner/degreaser, warm the damaged area with a gas or electric heat gun. Repeat these operations to make sure completely there is no oil in micropores and recesses.

These comments refer also to pneumatic cylinder piston rods.

Next deepen the damage by drilling along the scratch a series of holes with a spacing smaller than their diameter. Diameter of the holes must exceed the scratch width. To make this operation easier first drill a series of guiding holes of a diameter of approximately 2 to 3 mm and depth of 2 to 3 mm.

Another method is deepening of the scratch using a disk grinder or a profile cutter and drilling holes of a diameter exceeding the scratch width at its both ends. This is a faster but not recommended method as it is very difficult to obtain a sharp clean boundary (edge) between the deepening and undamaged surface.

Having removed metal particles and other solid loose material (and possible degreasing) fill the deepened and treated damage area with the thoroughly mixed Chester Metal Slide composite with a slight allowance for machining.

For larger damage of a large width it is useful to fabricate a spatula with an edge that reproduces the surface of the piston rod.

After pre-curing for approximately 4 hours (at 20^{o}C = 68^{o}F) smoothen the composite applied with a very fine abrasive paper (first # 200 and then gradually up to # 800).

Very extensive damage usually requires dismounting the piston rod and grinding it on a grinding machine.

Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the repaired areas.

Damaged keyways

Most often the damage has the form of a wear of the sidewalls of the keyway. Use the Fast Cleaner F-7 cleaner/degreaser to carefully degrease the damaged area and next trim the damaged side surfaces of the keyway using profile cutters or a disk grinder. Maintain sharp keyway edges.

Having carefully removed metal particles and other solid loose material, degrease again and apply a layer of the thoroughly mixed Chester Metal Super composite to the side surfaces of the keyway. Do not apply the composite to the keyway bottom. Insert undamaged (new) key, covered with a very thin layer of the Chester Release Agent separator, into the keyway prepared as above. The separator does not need to be used – without it a durability of the coupling being repaired is even better as the key is bonded into the keyway. Prior to curing of the composite applied a mating element – coupling sleeve, pulley, etc., protected with the separator, is assembled to set the right position of both the key and the keyway. Remove the squeezed out excess composite before it is completely cured.

This method allows for a complete rebuilding of a keyway without dismounting the shaft and machining it.

Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the repaired areas.

Rebuilding and reconditioning of pump casings and impellers

Liquid flow in pumps results in a wear due to cavitation, erosion and chemical effects of the liquid. This leads to a growth of working clearances between the impeller and the casing, and a clear loss of an original shape of both the impeller and the casing, translated into a decrease of the pump capacity. The wear can be so much that a housing perforation occurs.

Composites with ceramic filler, very resistant to erosive effects of liquid flow are used to repair damage of this type. They are: Chester Ceramic T, F, FSL, FHT and Chester Surface Protector B, C, CK.

First, use the Fast Cleaner F-7 cleaner/degreaser to carefully degrease the parts to be reconditioned. Next, clean the surfaces and provide an appropriate profile to it. The most preferable method to achieve this is abrasive blasting. Having degreased the surface again with the Fast Cleaner F-7 and drying it the basic operations may begin.

Shape losses are repaired with a thixotropic material, usually Chester Metal Ceramic T product. Use reinforcement with the reinforcing tape or a fine wire mesh with previously rubbed-in reconditioning material to repair large casing losses. This reinforcement can be additionally fixed by means of bolts or rivets.

The method of repair for a perforation damage of the housing is similar. Degrease and roughen the external surface in the perforation area using abrasive blasting or power tools. Apply a thin layer (approximately 1 mm thick) of the composite material on the surface prepared this way. Next, put a reinforcement made of the reinforcement tape into which the composite material was thoroughly rubbed. The reinforcement should be larger by approximately 40 mm than the damaged area. Spread a composite layer, about 4 mm thick, on the tape. The layer thickness should decline towards its edges and amount to about 1.5 mm at a distance of 5 mm from the edge. After pre-curing, adjust the shape in the repair area by applying the composite material to the tape from inside so that to rebuild the original surface contour and fill other material losses according to the guidelines presented above. An adequately contoured piece of sheet metal that must have a ceramic coating on its inside surface can be used instead of the reinforcement tape.

Most often, the liquid Chester Ceramic F or FSL material is used for surface finish and filling of small material losses. These products, besides increasing a wear resistance, provide also a smooth finish to the surface. Please keep in mind the liquid material that constitutes the external layer can be applied only to an incompletely cured thixotropic material. In critical reconditioning repairs two layer of this material are applied according to this rule. In order to facilitate a check of correctness of the double layer application the Chester Ceramic F and FSL products are manufactured in two colours. The liquid (fluid) materials are applied by means of stiff brushes with short-cut hair.

Often, a type of the pumped liquid makes it necessary to use the Chester Surface Protector B, C or CK thixotropic products. The liquid Chester Ceramic (F, FSL, FHT) product is not used as the finish layer applied on these materials. Because of that, after pre-curing, once they are no longer sticky, smoothen them with hand in a wet rubber glove. After the material is completely cured, smoothening by means of machining is actually not possible.

Repaired pumps that pump non-aggressive liquids can be put back in operation after approximately 24 hours (at 20^{o}C = 68^{o}F). The Chester materials achieve full chemical resistance in 7 days. Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the repaired areas. If the Chester Ceramic FHT product is used, the process of additional curing at elevated temperatures, described in the corresponding Technical Data Sheet, must be conducted.

A correctly accomplished reconditioning by means of ceramic materials provides a total restoration of the pump's operational performance.

Application of ceramic composite materials to working surfaces of pumps is also used for brand new pumps. This provides a durability increase and improvement of total pump efficiency. New pumps are protected by means of liquid materials.

Repair of cracked pipelines

The most often occurring damage in piping and connectors/couplings used in pipelines and transmission installations is cracks and holes caused by cavitation as well as erosive and corrosive wear. Usually the Chester Metal Super product is used for these repairs.

Stop all leaks before beginning the repair. It is preferable to empty the pipeline. Sometime, with small cracks it is sufficient to reduce pressure in the installation for the time of repair, without emptying it. If this is not possible, stop leaks by means of wooden plugs, metal screws, etc. All repair stages are accomplished from outside without usually time consuming dismounting of damaged elements.

The first operation is a throughout cleaning and degreasing of the damaged area using the Chester Fast Cleaner F-7 cleaner/degreaser. Also adjacent areas should be carefully cleaned.

If the damage is of a crack type, drill crack stop holes of a diameter exceeding the crack width by approximately 5 mm at both ends of the crack. Cracks in pipes of a diameter exceeding 70 mm (2.75”) should be chamfered. The chamfer should have a V-shaped cross section and its depth should be approximately a half of the of the pipe wall thickness. Obviously, this can be done only if a contamination of the liquid carried by the pipe with metal chips and swarf generated by drilling and grinding is acceptable.

Use abrasive disks to roughen the area around the damage – crack or pipe wall perforation. Size of the roughened area depends on further procedures. The composite must not be applied to an unprepared surface (without degreasing and roughening).

Further procedures depend on the pipe diameter, internal pressure and size of the material loss (hole).

Small damage to low-pressure piping (pressure up to 0.7 MPa = 100 psi) is repaired by means of a patch made of the Chester reinforcement tape. Use abrasive disks or profile cutters to roughen the surface in the damage area. The roughened surface should extend to approximately 25 mm on either side of the damage. Having degreased again and dried the repair area, apply an approximately 1 mm thick layer of the thoroughly mixed composite **only** to the roughened surface.

Next put the Chester reinforcing tape (mesh) of dimensions larger by approximately 40 mm than the damage size and rub carefully the composite material into it. If need arises, 2 to 3 layers of the tape, each one offset by a half division (or angular-wise by 45^{o}), can be applied. The composite can be previously rubbed into a cut piece of tape put on a flat and smooth surface, e.g. a hard plastic film. Cover the tape placed on the crack with a composite layer approximately 5 mm thick. The layer thickness should decline towards its edges and amount to about 1.5 mm at a distance of 5 mm from the edge.

Also a piece of a fine wire mesh can be used or an adequately contoured piece of steel sheet (degreased and roughened), with a composite layer applied to it can be placed on the already applied composite layer and attached until the full adhesion is achieved (approx. 24 hours at w 20^{o}C).

With a more extensive (larger) damage the tape is wrapped around the pipe to form a wrap band. In this method the pipe surface is roughened along its whole circumference over an appropriate length and a 1mm thick layer of composite is applied. Wrap the length of the pipe prepared this way with the Chester reinforcement tape into which the composite has been rubbed before so that everywhere there are at least 2 tape layers. Apply an approximately 5 mm thick composite layer to the tape.

Damage of thick-walled large-diameter pipes (over 70 mm), exposed to external stresses (not resulting from internal pressure) is repaired by means of pipe sections (split sleeves) of a similar wall thickness and inside diameter equal to or slightly larger than an outside diameter of the pipe being repaired. The procedure is similar to the use of appropriately contoured steel sheet described above.

Prepare a split sleeve of dimensions exceeding the damage size by approximately 80 mm and degrease as well as roughen its inside surface.

Degrease and roughen the surface around the damage area; this surface must be larger than the split sleeve prepared. Once both the pipe under repair and the split sleeve have been degreased again and dried, apply an approximately 1 mm thick composite layer to both surfaces prepared.

Next, place the split sleeve on the pipe, press it carefully to the surface and fasten with clamp hoops until the composite is cured. During the final hardening, remove the excess material that was squeezed out as a result of pressure and fastening of the hoops.

The clamp hoops can be removed and the pipeline put back in operation after approximately 24 hours (at 20°C = 68°F).

Small diameter piping, working with a high internal pressure (over 0.7 Mpa = 100 psi) is repaired by means of previously prepared pipe sections as described above. The only difference is that the split-sleeves of a larger area comparing to that of the damage must be used.

Internal thread damage

Damage of this type has the form of so-called broken thread or a more extensive failure, often covering the whole threaded area. The repair consists in a rebuilding of the connection by a reproduction of the external thread.

The first operation is a throughout degreasing of the hole surface using the Chester Fast Cleaner F-7 cleaner/degreaser. Next, use a power drill or grinding machine to increase the hole.
Make incision or just roughen the hole surface. Alternatively, the damaged hole can be re-bored and an auxiliary large-pitch thread cut.

Having removed swarf, degrease again and rub thoroughly the mixed Chester Metal Super in the surface. Apply the Chester Release Agent to a brand new or non-damaged bolt (or element with external thread) and next spread the Chester Metal Super on it. Insert the bolt prepared this way into the hole while rotating it gently so that the free space between the bolt and the hole is completely filled with the composite material.

Once the composite material has been completely cured (after 24 hours at 20°C), the bolt can be removed. It will leave in the hole a thread formed by reproducing the undamaged (full-profile) external thread of the bolt.

If the joint can be of an inseparable type then degrease the bolt (and do not apply the separator to it) before applying the composite material. Such a joint will be stronger and it can be dismounted after heating it up.

Repair of castings

The subject of repair are external casting defects and those that are found upon machining (voids, pores, etc.). Having prepared the repair area, i.e. a thorough degreasing, roughening and degreasing again, apply a mixed quantity of the Chester material. Chester Fast Cleaner F-7 provides the best degreasing effect. Use an angle grinder to prepare the surface. Mix carefully the selected composite material according to the proportions shown on the packaging. Type of the reconditioning material used depends on the casting type:

Cast iron and cast steel castings - Chester Metal Super or Super Fe
Aluminium alloy castings - Chester Metal Super Al
Bronze castings - Chester Metal Super Br
Brass castings - Chester Metal Super Ms

The above recommendations are based on such a selection of the reconditioning material that minimizes a colour difference between the repaired area and the parent material. Whenever appearance considerations are not important the Chester Metal Super product can be used.
Once the material has been cured the repaired areas can be machined – turned, milled and drilled.

Heat exchangers

Damage of heat exchanger results from a chemical aggression as well as from cavitation and erosion. Both covers and tubeplates can be reconditioned. Type of material used for repair depends on the exchanger's operating conditions.

Use the Chester Fast Cleaner F-7 cleaner/degreaser to degrease the elements qualified for repair. Due to complex shapes the next operation, i.e. cleaning and roughening, can be accomplished correctly only by means of abrasive blasting. Remove very carefully corrosion products and old protective coatings and next degrease the repair areas with the Fast Cleaner F-7 product.

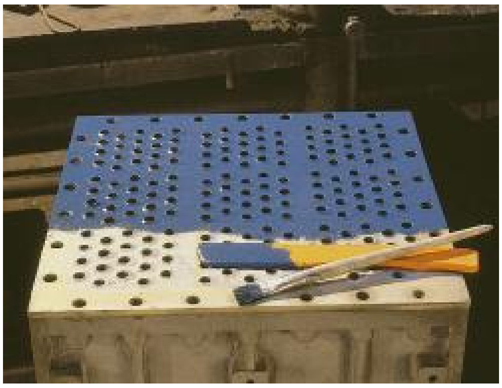
Usually, a thixotropic material is used for repairs of material losses in cover partitions and flange damage. Rebuilding of large material losses requires a fabrication of a reinforcement made of the Chester reinforcement mesh, fine metal mesh or plugging. Also an appropriate boarding can be fabricated and missing cover parts can be rebuild by casting a liquid (fluid) material. A surface prepared for an application of the composite materials must be clean, degreased and dry. Once the reconditioning material has been cured, grinding pins can be used for shape adjustments.

Tubeplates, once their surface has been prepared, are reconditioned using liquid materials. Major material losses can be rebuilt with a thixotropic material. If it is possible to position the tubeplate horizontally, then, after possible fabrication of a boarding and plugging the holes with previously prepared wooden plugs, a liquid material, e.g. Chester Ceramic F or FHT can be used for pouring into the whole tubeplate.

Use a brush with a stiff short-cut hair to apply the liquid material to vertically positioned tubeplates. Usually, several layers of this material have to be applied in order to obtain the right protection. Please adhere to the principle the next layers are applied to non-cured previous ones.

Reconditioned exchangers operating with a non-aggressive working fluid can be put back in operation after approximately 24 hours (at 20^{o}C). The Chester materials achieve full chemical resistance after 7 days. Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the reconditioned areas. If the Chester Ceramic FHT product is used, the process of additional curing at elevated temperatures, described in the corresponding Technical Data Sheet, must be conducted.

Application of ceramic composite materials to working surfaces of heat exchangers is also used for brand new exchangers. This provides a significant extension of the durability period. New exchangers are protected by means of liquid materials.



Reconditioning of screw conveyors

Wear of the screw working surfaces results primarily from erosive effect of the transported material. Often a chemical aggression occurs. The material losses and wear may be so extensive that a visible reduction of the total screw diameter and a significant thickening of the helical walls (working band) occurs.

Use the Chester Fast Cleaner F-7 cleaner/degreaser to degrease the surfaces to be repaired. The preferable method of providing the right surface profile is abrasive blasting. Angle grinders can be also used for minor repairs. Once dust and swarf has been removed from the surface, the right work, i.e. reconditioning material application may begin.

Material losses are rebuilt with a thixotropic material. This can be, e.g. the Chester Metal Ceramic T product.

Often it is necessary to strengthen the rebuilt surfaces with the Chester reinforcement tape or fine wire mesh. Completely destroyed parts of the helical band are rebuilt by inserting their replicas made of a metal sheet of an appropriate thickness and connecting then by welding. Once the right screw contour has been reproduced, a ceramic liquid reconditioning material is applied to the surface exposed to an abrasive wear (the active part). If aggressive effects of the material carried by the conveyor occurs then the whole screw area and also the conveyor trough should be protected.

It is reasonable to apply the protective coating to an incompletely worn conveyor (when no visible material losses occur) or a brand new one. This provides a significant extension of the durability period.

Protected conveyors carrying non-aggressive materials can be put back in operation after approximately 24 hours (at 20^{o}C). The Chester materials achieve full chemical resistance after 7 days. Holding at a temperature of 80 to 100^{0}C (176^{o}F – 212^{o}F) for 2 up to 4 hours can be used to improve mechanical properties of the reconditioned areas. If the Chester Ceramic FHT product is used, the process of additional curing at elevated temperatures, described in the corresponding Technical Data Sheet, must be conducted.