

Screw connection and screw connection filler

The present invention relates to a screw connection.

The invention is further related to a filler and use of said filler for secure screw
5 connections as well as a method of applying or providing a screw connection.

A prior art screw connection may comprise: a female member having a recess with
an inner screw thread; a male member having an outer screw thread that is configured to be
arranged in mating arrangement with the inner screw thread of the female member; a thread
tolerance between the outer screw thread of the male member and the inner screw thread of the
10 female member; and a filler that is configured to fill the thread tolerance.

Every screw connection comprises a thread tolerance, because some play in
between the male member and the female member is required to allow the outer screw thread to be
inserted into the inner screw thread. This play, although required to allow the screw connection to
be made, may also result in negative side effects for particular applications.

15 For example, the play provided by the thread tolerance may on the one hand result
in a screw connection that becomes loose over time, i.e. unscrews. In order to prevent this, prior art
thread locks such as the commercially available Loctite® Threadlocker have been developed as
filler. Loctite® has been developed to permanent lock of all relatively small metal threaded
connections. The thread locker permanently secures and seals bolts, nuts and studs to prevent
20 loosening due to vibration. It is a methacrylate-based locking agent, that permanently locks
threaded connections into one piece, by which it prevents loosening of nuts and bolts due to
vibration. The Loctite® distributes evenly in a thread gap defining the thread tolerance, and hardens
or cures over time. Once cured, the Loctite® defines a tough solid medium, and in order to unscrew
the screw connection, this solid medium has to be broken, thereby providing a threshold against
25 unwanted loosening, i.e., unscrewing of the screw connection. Once a torque is applied that is high
enough to break the solid medium, it shatters into small pieces. Once broken, new Loctite® needs
to be applied in order to reinstate a secured screw connection. Breaking or degrading of the
securing properties of the Loctite® however is vulnerable to remain unnoticed, because it is
impossible to visually inspect the medium in the thread tolerance. Dynamic load situations, such as
30 in a bolted flange of a wind turbine construction, or due to earthquakes, may cause the solid
medium of the thread lock to fail, and possibly result in failure over time if the security is
inadequate to withstand future loads.

The publication US 10 214 668 B2 discloses an adhesive composition comprising
an epoxy resin, a binder and curing agent. This composition is useful for nuts and bolts, where it is
35 typically disposed on a threaded surface. As with Loctite® discussed above, this composition is
cured after application and suffers from similar disadvantages.

On the other hand, the play provided by the thread tolerance may also result in gas leaking through the thread tolerance. In order to prevent such a leakage of gas, gas tapes may be applied as a filler. The gas tape fills the thread gap defining the thread tolerance, and is also for a single use. After all, the thread will cut through the tape during the screwing motion, and consequently new gas tape has to be arranged after unscrewing the screw connection. Gas tape not only prevents against leakage, but also improves the screw connection in the sense that it

A further disadvantage of thread locks and gas tape is that they are in particular suited for relatively small screw connections. However, the above-mentioned bolted flanges of a wind turbine construction may apply bolt connections having a nut size of M72 or even larger. Consequently, also the thread gap that has to be filled by the filler increases in size, and traditional fillers such as the above-mentioned curing thread locks and gas tape are less suitable for these applications.

An objective of the present invention is to provide a screw connection, a filler and use of a filler for secure screw connections that are improved relative to the prior art and wherein at least one of the above stated problems is obviated or alleviated. In particular, there is a need for secure screw connections, that are suitable for relatively large connections and able to securely withstand dynamic load conditions.

Said objective is achieved with the screw connection according to claim 1 of the present invention, comprising:

- a female member having a recess with an inner screw thread;
- a male member having an outer screw thread that is configured to be arranged in mating arrangement with the inner screw thread of the female member;
- a thread tolerance between the outer screw thread of the male member and the inner screw thread of the female member;
- a filler that is configured to fill the thread tolerance; and
- wherein the filler is a non-curable heterogeneous composition comprising a fluid carrier and solid particles suspended therein.

The heterogenous composition of the filler comprises a fluid carrier, such as a grease, that distributes and thereby fills the thread tolerance. Contrary to prior art thread locks such as the commercially available Loctite® discussed above, the fluid carrier of the filler remains fluid, i.e. it doesn't cure or harden, and consequently the screw connection may be screwed (i.e. tightened) and unscrewed (i.e. untightened) over and over again without the need to replace the filler. The fluid carrier defines a carrier for solid particles that are suspended in the fluid carrier, and consequently also these suspended solid particles are distributed throughout the thread gap defining the thread tolerance. If the screw connection is tightened, and a pre-tensioning torque is applied, the outer screw thread of the male member and the inner screw thread of the female

member will move relative to each other in a longitudinal direction of the male member. As a result, the thread tolerance will be non-symmetrical relative to the thread. More in particular, the pre-tensioning force will press the inner screw thread and the outer screw thread towards each other and thereby locally reduce the thread tolerance between the inner screw thread and the outer screw thread. Consequently, at other locations, the thread tolerance will have to increase. The locally reduced thread tolerance will prevent the solid particles suspended in the filler to easily pass through these narrow thread gaps, and consequently the pre-tensioned screw connection will be able to withstand high and repeating dynamic loads. However, due to the fluid nature of the fluid carrier in the filler, the screw connection may still be unscrewed and reused over and over again.

Summarizing, by applying a filler that is a non-curable heterogeneous composition comprising a fluid carrier and solid particles suspended therein, the present invention provides a screw connection that may be easily applied, also in relatively large screw connections, that is able to withstand high dynamic loads, and moreover may be re-used over and over again.

In contrast, curable compositions cure or harden after being applied and then degrade over time, especially under dynamic load conditions. Compression/decompression cycles of dynamic load conditions cause fracturing, grinding, breaking up of the filler in the thread tolerance while its particles are moreover prevented from rearranging in the thread tolerance during or after exposure to such dynamic conditions. The purpose of the particles to reduce play may therefore be compromised. Further, curable compositions require more complex formulations. In contrast, the non-curable heterogeneous composition of the present invention may even contain only the fluid carrier and the solid particles.

Further benefits or inventive effects, are attained according to the present disclosure by the assembly of features in the appended independent claims. Preferred embodiments are the subject of the dependent claims.

In the following description preferred embodiments of the present invention are further elucidated with reference to the drawing, in which:

Figures 1 to 4 are successive schematic views of applying a connection according to a first preferred embodiment; and

Figures 5 to 7 are successive schematic views of applying a connection according to a second preferred embodiment of the invention.

The following reference signs are used throughout.

- | | |
|---|--------------------|
| 1 | screw connection |
| 2 | female member |
| 3 | recess |
| 4 | inner screw thread |

	5, 5a, 5b	male member
	6	outer screw thread
	7	filler
	8	fluid carrier
5	9	solid particles
	10, 11	opposing faces
	12	bottom
	13, 13a, 13b	end face
	14	coupler
10	15	threaded through hole
	G	thread gap
	G _c	compressed thread gap
	ØF	outer diameter of female member
	ØM	outer diameter of male member
15	R	screwing motion
	T	thread tolerance

In both embodiments the screw connection 1 comprises a female member 2 having a recess 3 with an inner screw thread 4, as well as a male member 5 having an outer screw thread 6 that is configured to be arranged in mating arrangement with the inner screw thread 4 of the female member 2. It further exhibits a thread tolerance T between the outer screw thread 6 of the male member 5 and the inner screw thread 4 of the female member 2. The screw connection 1 further comprises a filler 7 that is configured to fill the thread tolerance T, wherein the filler 7 is a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein.

The thread tolerance T is defined as the difference in diameter between the outer diameter of the female member ØF and the outer diameter of the male member ØM, i.e. $T = \text{ØF} - \text{ØM}$. As the thread tolerance T is calculated by the difference in diameters, the size thereof will be distributed between the opposing sides, resulting in a distance T/2 for each side.

The thread tolerance T results in a thread gap G that is defined as a distance perpendicular to opposing faces 10, 11 of the inner screw thread 4 of the female member 2 and the outer screw thread 6 of the male member 5, respectively (Figure 7). The size of the thread gap G may differ in dependence of a pre-tensioning force applied to the screw connection, as will be explained in more detail below with reference to the detailed view in Figure 7.

In the first preferred embodiment shown in Figures 1-4, the screw connection 1 comprises a single male member 5 that is screwed into a recess 3 having a bottom 12 that contains the filler 7. Figure 2 shows a situation wherein the male member 5 is already partly screwed into

the female member 2. In Figure 3, the male member 5 is screwed even further into the female member 2, and now the end face 13 of the male member 5 has come into contact with the filler 7 on the bottom 12. Due to the screwing motion (indicated by arrow R) of the male member 5, the filler 7 is being forced to distribute in the decreasing volume between the bottom 12 of the female member 2 and the end face 13 of the male member, thereby also forcing the filler 7 into the thread gap G resulting from the thread tolerance T. Figure 4 shows the final situation, wherein the end face 13 of the male member 5 is in tight contact with the bottom 12 of the female member 2, resulting in a pre-tensioned screw connection 1 that allows the filler 7 to reach its desired functionality. This functionality of the filler 7 will be explained in more detail with reference to the second preferred embodiment.

The second preferred embodiment, that is shown in Figures 5-7, is closely related to the first preferred embodiment. Similar reference numbers apply to the similar features. The main difference relative to the first preferred embodiment is that the female member 2 is now a coupler 14 with a recess 3 that is a threaded through hole 15. This embodiment lacks a bottom 12, but is instead designed to receive and couple two male members 5a, 5b, that each comprise a respective end face 13a, 13b. When the end faces 13a, 13b of the male members 5a, 5b are screwed towards each other, the filler 7 that is arranged between these end faces 13a, 13b is – similar to the first preferred embodiment – being forced to distribute in the decreasing volume between the end faces 13a, 13b of the male members 5a, 5b, thereby also forcing the filler 7 into the thread gap G resulting from the thread tolerance T.

As indicated above, the filler 7 is a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein. The detailed view of Figure 7 shows how the pre-tensioned screw connection 1 causes the thread gap G to be compressed on one side (indicated with the suffix “c” of “compressed”). The compressed thread gap G_c creates a resistance to the solid particles 9 of the filler 7 to be forced into a through this narrow space between the opposing faces 10, 11, thereby securing the screw connection 1 to effectively withstand dynamic load conditions, such a load conditions caused by earthquakes. For example, the female member 2 may be a coupler 14 that couples mechanical rebars that define the male members 5a, 5b in extremely critical buildings, such as a nuclear power plant. Of course, the invention may be applied to other load critical applications as well, such as in particular in the oil and gas industry. Other dynamic loads may be found in wind turbines.

However, due to the filler 7 being a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein, the screw connection 1 may also be easily disassembled. After all, once the pre-tensioning force is removed by unscrewing the screw connection 1, the thread gap G will not be compressed anymore. This results in the thread gap G to more evenly distribute, thereby providing sufficient space for the solid particles 9 that are

suspended in the fluid carrier 8 to move in the thread gap G. The filler 7 being a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 doesn't require any curing, and consequently it can be disassembled, and – more importantly for safety critical applications – it is able to withstand dynamic loads over and over again. This is contrast to conventional thread lockers (such as Loctite®) that harden and cure and may break under load, wherein this breaking is vulnerable to remain unnoticed, while the resistance to future dynamic loads may be inadequate.

The size of the solid particles 9 is preferably selected in dependency of the thread tolerance T. Particle size may be measured by scattering techniques, such as light scattering. It was found that very small solid particles 9 compared to the thread tolerance T only reduce play to a modest extent, while very large solid particles 9 compared to the thread tolerance T impede flow of the filler 7 into the thread gap G. The solid particles 9 are preferably smaller than the thread tolerance T, though a fraction (e.g. 10 – 20 %) may be larger. Solid particles 9 with a median particle size in the range of 20 – 80 % of the thread tolerance T provide an adequate balance. A particle size distribution of the solid particles 9 is preferably such that most of the solid particles 9 fall in this range. A fraction of smaller and/or larger solid particles 9 outside of this range is acceptable and does not negatively affect the function of the filler 7 or the screw connection 1. Appropriate particle sizes and particle size distributions can be achieved by known technologies such as sizing or sieving.

In a further preferred embodiment, the solid particles 9 have a powder size of $P_s \leq T / 4$. The size of the solid particles 9, in particular the median particle size, may be in the range of from 0.01 – 50 % of the thread tolerance T, preferably in the range of from 0.1 – 30% of the thread tolerance T. This size gives the flexibility for the filler 7 to be transported through the thread gap G between the inner screw thread 4 and the outer screw thread 6, for example under pressure, and to fix these threads 4, 6 by reducing play.

The solid particles 9 may have a size in the range of from 1 nm – 1000 µm, preferably in the range of from 10 nm – 100 µm, more preferably in the range of from 0.1 – 50 µm. A mix of sizes of the solid particles 9 may be present in the filler 7, for example by providing solid particles 9 in a distribution of particle sizes or by combining multiple particle sizes each having a relatively narrow size distribution. This may suit local and/or temporal variation in the thread tolerance T in the screw connection 1 when screwed or unscrewed. Advantageously, a particle size in a wider range is used, as this may allow a broader application of the filler 7. It is especially advantageous when large screws are being used for wind turbines or as mechanical rebar (i.e. reinforcement bar) screw connections, for example. Preferably, the solid particles 9 are more or less spherically shaped.

In a further embodiment, the screw connection 1 comprises a filler 7 wherein the filler 7 comprises solid particles 9 that are made of an inorganic material.

In a further embodiment, the screw connection 1 comprises a filler 7 wherein the filler 7 comprises solid particles 9 that are made of a non-corroding material. This is advantageous as non-corroding solid particles 9 maintain their particle size better than corroding particles would and that non-corroding material generally does not cause corrosion of the female and male members 2, 5 of the screw connection 1.

In a further embodiment the solid particles 9 are oxides, carbides and/or sulphides of the group of alkali metals, alkaline earth metals, transition metals, basic metals and semi metals, preferably oxides or carbides of the group of alkali metals, alkaline earth metals, transition metals, basic metals and semi metals.

In a further embodiment the solid particles 9 are selected from a group of materials comprising at least CaO, SiO₂, TiO₂, Al₂O₃, MgO, or graphene. It is preferred to use SiO₂ (i.e. silica). Further, cement powder can be used as solid material in the filler. Cement may comprise calcium silicates or at least CaO and SiO₂. Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Concrete is the most widely used material in existence and is behind only water as the planet's most-consumed resource. Cements used in construction are usually inorganic, often lime or calcium silicate based. A type of cement, Portland cement, is by far the most common type of cement in general use around the world. This cement is usually made by heating limestone (calcium carbonate) with other materials (such as clay) to 1,450 °C (2,640 °F) in a kiln, in a process known as calcination that liberates a molecule of carbon dioxide from the calcium carbonate to form calcium oxide, or quicklime, which then chemically combines with the other materials in the mix to form calcium silicates and other cementitious compounds. The resulting hard substance, called 'clinker', is then ground with a small amount of gypsum into a powder to make ordinary Portland cement, the most commonly used type of cement. Portland cement is a basic ingredient of concrete, mortar, and most non-specialty grout. The most common use for Portland cement is to make concrete. Concrete is a composite material made of aggregate (gravel and sand), cement, and water. As a construction material, concrete can be cast in almost any shape, and once it hardens, can be a structural (load bearing) element.

In a further embodiment it is preferred to use cement as source of particles in the filler 7 comprising a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein.

The filler 7 is preferably formulated as a paste in order to stay in the female member 2 of the screw connection prior to screwing the one or two male parts 5, 5a, 5b therein. In

a further embodiment the fluid carrier 8 comprises a viscosity, in particular the kinematic viscosity, preferably at 20 °C, in the range of 100 to 4000 centistokes, preferably 150 to 400 centistokes. This viscosity range is preferably maintained over a temperature range of -40 °C to +60 °C, which covers most practical applications of the invention.

5 The fluid carrier 8 may comprises a grease. Examples include synthetic or mineral greases. Other examples include bearing grease or ball bearing lubricants, such as commercially available under the names of Super HT or Arpol 9901. Though these are intended as lubricants for bearings and exhibit low viscosity at elevated temperatures, their viscoelastic properties at ambient temperatures (e.g. a temperature range of -40 °C to +60 °C) have been found to be highly suitable
10 for application with the present invention.

 As a practical example, the filler 7 may be composed of such grease as the fluid carrier 8 and cement powder as the solid particles 9. When grease and cement powder are combined, a 1:2 ratio by weight has proven effective, even without further additional components in such a filler 7. A fluid carrier 8 being or comprising grease may also be combined with other
15 solid particles 9 disclosed herein, or a combination of solid particles 9 may employed. The ratio by weight of the fluid carrier 8 to the solid particles 9 may still be 1:2 in that case. More in general, this ratio may be in a range of from 1:0.5 to 1:5, preferably 1:1 to 1:3, more preferably 1:2. More coarse screw threads (i.e. larger thread tolerance T, usually the case with screw threads having a larger pitch) may require relatively more solid particles 9 to fluid carrier 8, while for finer screw
20 threads, a lower amount of solid particles 9 may suffice.

 The screw connection 1 may be a mechanical rebar screw connection, for example as part of a mechanical rebar splicing system.

 The female member 2 of the screw connection 1 may be a rebar coupler configured to couple at least one mechanical rebar defined by the male member 5, for example as
25 explained in relation to Figures 1 – 4. Additionally or alternatively, the female member 2 may be a rebar coupler configured to connect two mechanical rebars, each defined by a like male member 5, for example as explained in relation to Figures 5-7 with the two male members 5a, 5b.

 The present invention is also directed to a filler 7, in particular a screw connection filler, comprising a non-curable heterogeneous composition comprising a fluid carrier 8 and solid
30 particles 9 suspended therein. Preferably, the filler 7 comprises a grease with a viscosity of 100 to 4000 centistokes, more preferably 150 to 400 centistokes, and/or particles comprising at least CaO and SiO₂. Any of the features disclosed above in relation to the filler 7 can also be employed with the filler 7 separately from the screw connection 1. The filler 7 may be provided in a container, such as a squeeze tube with a nozzle, for easy application to components of a screw connection 1.

35 The present invention is also directed to the use of a filler 7 comprising a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended

therein for securing screw connections against dynamic load conditions. The filler 7 may in particular be used in screw connections that are suitable for relatively large connections and able to securely withstand dynamic load conditions and/or in a mechanical rebar splicing system. Existing mechanical rebar splicing systems may be improved in their capacity to withstand dynamic load conditions by applying the filler 7 in one or more than one thread tolerance T present in screw connections 1 of such a system.

It is contemplated to provide the female member 2 with the filler 7 arranged in the recess as a separate product, which can be used to mechanically connect one or two rebars (e.g. male members 5a, 5b) during construction work. That is, the female member 2 in combination with the filler 7 in any of the disclosed embodiments of the screw connection 1, but without the male member 5, is also disclosed.

Provided is a coupler, in particular a rebar coupler, for a screw connection 1, in particular a mechanical rebar splicing system, comprising:

- a female member 2 having a recess 3 with an inner screw thread 4 configured to be in mating arrangement with an outer screw thread 6 of a male member 5, in particular a rebar, exhibiting a thread tolerance T between the outer screw thread 6 of the male member 5 and the inner screw thread 4 of the female member 2; and

- a filler 7 arranged inside the recess 3 and configured to fill the thread tolerance T, wherein the filler 7 is a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein.

Provided is also a method of applying or providing a screw connection 1 that is preferably secured against dynamic load conditions. This method comprises:

- providing a female member 2 having a recess 3 with an inner screw thread 4;
- providing a male member 5 having an outer screw thread 6 that is configured to be arranged in mating arrangement with the inner screw thread 4 of the female member 2;
- providing a filler 7 configured to fill a thread tolerance T between the outer screw thread 6 of the male member 5 and the inner screw thread 4 of the female member 2, wherein the filler 7 is a non-curable heterogeneous composition comprising a fluid carrier 8 and solid particles 9 suspended therein; and
- arranging the outer screw thread 6 of the male member 5 in mating arrangement with the inner screw thread 4 of the female member 2 and the filler 7 therebetween to obtain the screw connection 1.

This method may comprise providing the screw connection 1 according to any of the embodiments disclosed herein and/or the filler 7 according to any of the embodiments disclosed here. The screw connection 1 obtainable by the method may be secured against dynamic load conditions.

Various screw connections in the form a mechanical rebar coupling (a female member with two male members according to the second preferred embodiment described above) were subjected to a slip test according to ISO norm 15835-2:2009. Slip was evaluated according to Option 2 of ISO norm 15835-1:2009. Table 1 shows test results for samples with a filler according to the present invention. Table 2 shows test results for comparative samples without filler.

The filler in this particular test was a grease mixed with cement powder at 1:2 weight ratio. The slip test involved subjecting the sample to a tensile force cycling from 0 MPa to 300 MPa, conforming to 60% of the specified characteristic (or nominal) yield strength value of the reinforcement bar, back to 10 MPa at which slip was evaluated. The slip test was performed in three subsequent cycles on sample 2a – 2f of Table 1 to further assess repeated exposure to tensile forces. Samples 1a – 1f were also subjected to

Screw connections with a filler according to the invention exhibit lower slip, which even meets the strict requirements of the above norms of no more than 0.10 mm slip. The larger the nominal diameter of the reinforcement bar (male member), the larger the slip in conventional couplings which therefore generally do not meet the norm. The present invention provides a filler which can be employed to reduce slip in mechanical rebar couplings so that even couplings of bars of larger diameter (e.g. above 25 mm nominal diameter) comply with the ISO norm. Further, even when repeating the slip test three times, slip complies with the norm when the filler is used, indicating that such couplings can cope with cycling exposure or dynamic loads.

Sample no.	Nominal size, ØM [mm]	Slip [mm] cycle 1	Slip [mm] cycle 2	Slip [mm] cycle 3
1a	32	0.03		
1b	32	0.07		
1c	32	0.03		
1d	32	0.07		
1e	32	0.04		
1f	32	0.03		
2a	40	0.02	0.01	0.01
2b	40	0.05	0.05	0.05
2c	40	0.10	0.10	0.10
2d	40	0.09	0.09	0.10
2e	40	0.08	0.09	0.09
2f	40	0.07	0.08	0.09
ISO norm		≤ 0.10	≤ 0.10	≤ 0.10

TABLE 1 – Test results of screw connections with filler according to the invention

Sample no.	Nominal size, ØM [mm]	Slip [mm]
3a	25	0.08
3b	25	0.09
4a	32	0.20
4b	32	0.17
5a	16	0.04
5b	20	0.09
5c	25	0.13
5d	32	0.15
5e	40	0.11
ISO norm		≤ 0.10

TABLE 2 – Test results of screw connections without filler

Although they show preferred embodiments of the invention, the above- described
5 embodiments are intended only to illustrate the invention and not to limit in any way the scope of
the invention. Accordingly, it should be understood that where features mentioned in the appended
claims are followed by reference signs, such signs are included solely for the purpose of enhancing
the intelligibility of the claims and are in no way limiting on the scope of the claims. Furthermore,
it is particularly noted that the skilled person can combine technical measures of the different
10 embodiments. The scope of protection is defined solely by the following claims.

Claims

1. A mechanical rebar screw connection, comprising:

- a rebar coupler configured to couple at least one mechanical rebar and having a recess with an inner screw thread;

5 - a mechanical rebar having an outer screw thread that is configured to be arranged in mating arrangement with the inner screw thread of the rebar coupler;

- a thread tolerance between the outer screw thread of the mechanical rebar and the inner screw thread of the rebar coupler; and

10 - a filler that is configured to fill the thread tolerance, wherein the filler is a non-curable heterogeneous composition comprising a fluid carrier and solid particles suspended therein, wherein the fluid carrier comprises a grease.

2. The mechanical rebar screw connection according to claim 1, wherein the thread tolerance is defined as the difference in diameter between the outer diameter of the rebar coupler (ØF) and the outer diameter of the mechanical rebar (ØM).

3. The mechanical rebar screw connection according to claim 1 or 2, wherein the size of most of the solid particles is smaller than the thread tolerance and the median particle size of the solid particles is in the range of from 0.01 – 50 % of the thread tolerance, preferably in the range of from 0.1 – 30% of the thread tolerance.

4. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles have a size in the range of from 1 nm – 1000 µm, preferably in the range of from 10 nm – 100 µm, more preferably in the range of 0.1 – 50 µm.

5. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles are spherical.

6. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles are made of an inorganic material.

7. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles are made of a non-corroding material.

8. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles are oxides, carbides and/or sulphides of the group of alkali metals, alkaline earth metals, transition metals, basic metals and semi metals, preferably oxides or carbides of the group of alkali metals, alkaline earth metals, transition metals, basic metals and semi metals.

9. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the solid particles are selected from a group of materials comprising at least CaO, SiO₂, TiO₂, Al₂O₃, MgO, or graphene.

10. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the fluid carrier comprises a viscosity in the range of 150 to 400 centistokes.

11. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the rebar coupler is configured to couple two mechanical rebars.

12. The mechanical rebar screw connection according to one or more than one of the foregoing claims, exhibiting a slip of no more than 0.10 mm as tested in a slip test according to ISO norm 15835-2:2009 and evaluating the slip according to Option 2 of ISO norm 15835-1:2009.

13. The mechanical rebar screw connection according to one or more than one of the foregoing claims, wherein the mechanical rebar has a nominal diameter above 25 mm.

14. A rebar coupler for a mechanical rebar screw connection, the rebar coupler having a recess with an inner screw thread configured to couple at least one mechanical rebar, with a filler arranged inside the recess, wherein the filler is a non-curable heterogeneous composition comprising a fluid carrier and solid particles suspended therein, wherein fluid carrier comprises a grease.

15. The rebar coupler according to claim 14, wherein the solid particles are spherical.

16. A filler configured to fill a thread tolerance of a mechanical rebar screw connection to secure the mechanical rebar screw connection against dynamic load conditions, wherein the filler is a non-curable heterogeneous composition comprising a fluid carrier and solid

particles suspended therein, wherein the fluid carrier comprises a grease and the solid particles are at least one of:

- oxides and/or sulphides of the group of alkali metals, alkaline earth metals, transition metals, basic metals and semi metals;
- 5 - selected from a group of materials comprising at least CaO, SiO₂, TiO₂, Al₂O₃, MgO, or graphene; and
- spherical.

10 17. The filler according to claim 16, wherein the solid particles comprise cement powder.

18. The filler according to claim 16 or 17, wherein the fluid carrier comprises grease with a viscosity of 100 to 4000 centistokes, preferably 150 to 400 centistokes.

15 19. Use of a filler according to any of the claims 16 to 18, for securing a mechanical rebar screw connection against dynamic load conditions.

20 20. A method of applying or providing a mechanical rebar screw connection that is preferably secured against dynamic load conditions, the method comprising:

- providing a rebar coupler configured to couple at least one mechanical rebar and having a recess with an inner screw thread;
- providing a mechanical rebar having an outer screw thread that is configured to be arranged in mating arrangement with the inner screw thread of the rebar coupler;
- providing a filler configured to fill a thread tolerance between the outer screw thread of the mechanical rebar and the inner screw thread of the rebar coupler, wherein the filler is a non-curable heterogeneous composition comprising a fluid carrier and solid particles suspended therein, wherein the fluid carrier comprises a grease; and
- arranging the outer screw thread of the mechanical rebar in mating arrangement with the inner screw thread of the rebar coupler and the filler therebetween to obtain the screw connection.

21. The method of claim 20, comprising providing the mechanical rebar screw connection according to any of the claims 1 – 13 and/or the filler according to any of the claims 16 – 18.