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INSTALLATION, OPERATING AND MAINTENANCE MANUAL

ORIGINAL INSTRUCTIONS

TURBOFLEX PLUS, MS10-50 COUPLING

C1944088-010M01

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GENERAL NOTES

- It is essential that a competent person carry out all the instructions contained in the following documents. Should any problems be anticipated or encountered then **Bibby Turboflex** personnel are available for site visits or, alternatively, repairs and overhauls can be undertaken in our works.

- Prior to performing any maintenance work (including inspection) it is essential that the power supply is isolated and that no accidental movement of rotating machinery is possible.

- This product is designed for a specific purpose. It is vital that it is not used for any purpose other than that for which it is designed and supplied, and that the limits of its capacities, as detailed here or in any other document, are not exceeded.

- No liability will be accepted and any other warranty, either expressed or implied, will be null and void should any component of whatever kind, including nuts, bolts and washers, be used in the assembly, or modifications be made to all or part of the product which are not supplied, specified or agreed by **Bibby Turboflex**.

Do's

- The following instructions should be read and understood prior to starting any assembly or maintenance work on the disc coupling.

- Prior to fitting any component, care should be taken to ensure that it is clean and free from any dirt.

- Where hub/shaft connections require a standard interference fit the hubs may be heated in oil at 200-250° Celsius and rapidly positioned on the shaft. It is essential that this heat is evenly applied over the whole hub and that spot heating is avoided.

Don'ts

- Do not use any component that is not supplied or approved by **Bibby Turboflex** in the assembly of this product.

- Do not attempt, where the weight of the unit is excessive, to lift the coupling without the use of lifting equipment.

- Do not attempt to run any equipment with any installation tooling in the area of or attached to the coupling. This includes items such as jacking screws, compression / installation / transit screws, compression plates and caps, etc. These parts will be painted yellow. If in doubt contact Bibby Turboflex.

The inherent balance of these couplings could be disturbed if they are allowed to be knocked either by striking or rolling. Care should be taken when transporting and fitting to avoid such knocks. This is particularly when a coupling is specifically balanced.

DESCRIPTION OF COUPLING

The coupling is of the dry laminated diaphragm or disc type. Flexibility is obtained by the deformation of the disc packs, within defined limits, which are separated by tubular spacers.

Individual laminations are of regular polygonal profiles, which are assembled into a stack of previously designated thickness. Flexibility is accomplished by connecting through holes on a common pitch circle diameter, by means of bolts, alternately, to driving and driven components.

The bolts and associated holes are machined to close limits associated with “fitted bolts”. Due to the need for reasonable ease of assembly, interference fits are undesirable and, consequently, tolerances are such as to allow for a close slide or slight transition fit. To compensate for these clearances and to ensure the best possible concentricity between components, the pitch circle diameter of the bolt holes in the flexible element is made smaller than that of the mating holes in the adjacent components. On assembly, all inherent clearances are, therefore, eliminated. Coupling bolts are sized such that they are capable of inducing a load equivalent to 4 times the tensile load in the flexible element laminations, between driving and driven bolt, when transmitting the full rated continuous torque of the coupling. This assumes a coefficient of friction between the various components of 0.25 but experience has shown that, due to the high loads induced, minute compressive deformation is sufficient to raise this to about 0.3.

The reason for adopting this principle of using large, highly loaded, bolts is two-fold a) to prevent interface slip, as already mentioned, and b) to eliminate any chance of bolt bending due to the overhung radial loading imposed by the flexible element. Avoiding either slip or bending helps to avoid fretting which occurs when bolts are designed only to drive in shear.

In general, the design is identical to a large number of units already in operation.

OPERATING CONDITIONS

In operation the flexible elements are subjected to both tensile and bending stresses, each having an influence on the allowable magnitude of the other. It is important, therefore, that the operating limits of the various deflections for which the coupling is designed to accommodate, are kept, as far as practicable, within those indicated on the allowable misalignment curve, or “Operating Curves”.

In practice, the initial alignment of the coupling should be as close as possible and within the alignment limits given in the “Installation Instructions”. This will allow for changes during operation to remain within allowable limits.

As the Bibby Turboflex units are designed to transmit the torque in friction between the driving and driven bolts and the flexible elements, it is essential that, should the need arise, these bolts should be correctly tightened to the torque indicated on the assembly drawing or in the “Installation and Maintenance Instructions”.

Torque and speed must remain within the originally specified conditions.

MAINTENANCE INSTRUCTIONS

General maintenance of the coupling consists of a check of the following during normal machinery maintenance schedules:

- Axial, Angular & Parallel misalignment to ensure that these are still within the acceptable limits and that no major movements have occurred.

- All bolts to ensure that they are correctly tightened.

- The flexible elements, by visual inspection, for signs of fatigue cracking local to the washer anchoring points or general signs of fretting corrosion. Slight bowing or “S” like distortion is not detrimental to the operation of the unit. Note that any cracking will begin at the outermost edge of the outside blade. This means that this inspection is still possible without disturbing the element bolting. The element packs should be replaced at the earliest opportunity should cracking / damage be detected.

- Bibby Turboflex use self locking nuts containing a stainless steel spring insert. This gives a high level of performance over many reinstallations. It is recommended by Bibby Turboflex that these be replaced after being re-torqued 10-12 times.

Note: Any requirement for spare parts should be made quoting the original purchasers original purchase order number and the coupling serial number. (This will be etched on the major coupling flanges) and will appear on all documentation.

ATEX COMPLIANCE

If this coupling is marked with the ATEX symbol,  then it is supplied in accordance with Directive 2014/34/EU (ATEX) & BS EN ISO 80079-36:2016 as non-electrical equipment for use in explosive atmospheres by providing protection through constructional safety “c” and control of ignition sources “b” in compliance with BS EN ISO 80079-36:2016.

For this coupling to meet ATEX requirements, these installation and maintenance instructions must be followed. If these instructions are not adhered to, the coupling will be immediately considered non-conforming to ATEX.

IF IN DOUBT – CONTACT THE SUPPLIER

PRODUCT IDENTIFICATION / MARKING

Applies to disc coupling assemblies. Excludes component spare parts.

MARKING

The equipment shall be legibly and indelibly marked, in a variety of ways, on the main part on the exterior of the equipment and shall be visible prior to the installation of the equipment. (subject to contractual obligations permitting),

- Name and telephone number of manufacturers.
- Designation of the series or type and size (Part Number)
- Contract/ Order Number and/or Batch or serial number, if any

If applicable and in addition to the above, for equipment intended for use in potentially explosive atmospheres, the following will be marked on the equipment in accordance with Directive 2014/34/EU (ATEX) and BS EN ISO 80079-36:2016.

- Year of construction
- Identification number of the notified body
- CE Symbol.
- The specific symbol of explosion protection Ex followed by the equipment group and category.
- For equipment group II,
    - the letter 'G' (concerning explosive atmospheres caused by gas, vapours or mist), and/or
    - The Letter 'D' (Concerning explosive atmospheres caused by dust)
- Symbol "Ex" indicating explosion prevention and protection
- Letter "h" indicating non-electrical equipment.
- Where appropriate Equipment Group including the subdivision
- For group II the symbol indicating temperature class or maximum surface temperature in °C. (e.g.T4 or T4… T2) (see notes below)
- For group III the letter "T" followed by the maximum surface temperature in degrees Celsius followed by the units "°C" (e.g. T135°C… T300°C) (see notes below)
- The EPL (Equipment Protective Level).
- The ambient temperature range when different to Standard.

Note:

Where a temperature class or surface temperature range is specified (e.g. "T4… T2"), then further assessment must be performed to ascertain an accurate surface temperature based on application. (see "Adjustments for Temperature Classification" below)

Standard ambient temperature (Ta) is between -20°C to 40°C.

ADJUSTMENTS FOR TEMPERATURE CLASSIFICATION

If a Temperature Class Range is stated as part of the product marking, the coupling must be reviewed to account for influencing factors on the surface temperature of the coupling. It is the responsibility of the purchaser / installer to ensure the correct temperature class is applied.

The list below isn't exhaustive but highlights some of the main factors to include when making this assessment. The temperature class can then be read from the following table taking account of EPL.

Temperature Class (1)	Maximum Surface Temperature °C (2)	The Highest Surface Temperature Measured / Calculated shall not exceed °C for specified EPL		
		EPL Ga (3)	EPL Gb & Gc (4)	EPL Da, Db & Dc (5)
T1	≤ 450	360	440	450
T2	≤ 300	240	290	300
T3	≤ 200	160	195	200
T4	≤ 135	108	130	135
T5	≤ 100	80	95	100
T6	≤ 85	68	80	85

Heat Generated by the Coupling

Heat generated by the coupling alone is considered negligible. There are no moving parts to generate friction and any heat generated by the flexing of the discs is very low when the coupling is installed correctly. The surface temperature of a coupling is due to heating from other sources in the environment and installation of the coupling as listed below.

If no other heat sources / sinks are expected on the application, then the expected temperature class will be T6 / T85°C

Ambient temperature greater than standard.

Once thermal equilibrium is achieved after installation, the surface temperature of the coupling will be equal to the ambient temperature of the environment. The maximum ambient temperature will also be the maximum surface temperature of the coupling.

Heat generated by windage power losses.

Couplings are generally guarded for health and safety reasons. These guards tend to be close fitting. When couplings rotate at high-speed, they shear the air within the guard and this shearing generates heat through friction. A coupling installed in an open guard (i.e. ventilated or constructed from mesh) is not expected to generate heat. Couplings in closed guards with very little ventilation are expected to heat up significantly. Likewise, slow speed couplings will generate less heat than a high-speed coupling.
Please refer to the guard manufacture for further advice.

Heat transfer from nearby equipment and other sources.

Heat can be transfer to the coupling through,

- Conduction via connected parts, i.e. Flanges, Hub/Shaft interface
- Heat radiated from a nearby source such as a turbine or the Sun

Heat from connected equipment can be transferred to the coupling. For example, a shaft of a pump moving a hot liquid will transfer heat from the liquid to the coupling. Or a coupling outside can absorb heat from the Sun particularly when it is stationary.

FASTENER TIGHTENING PROCEDURE

This procedure outlines the recommended method for tightening of threaded fasteners used on flanged connections.

The main Coupling Bolts/Nuts attaching the element assemblies to mating parts at both ends are tightened by **Bibby Turboflex,** and should, under normal circumstances, **NOT BE TOUCHED**.

Preparation

- Review the General Assembly Drawing.
- Any burrs or imperfections on the mating faces and pilots of flanged connections should have been removed during the manufacture of the coupling. However, a check of all mating faces for imperfections should be made to ensure correct assembly.
- Contact faces between flanges should be thoroughly cleaned, degreased and dry.
- Ensure all other parts are thoroughly cleaned before assembly.

NOTE : DO NOT MIX FASTENER SETS.
Fasteners are supplied in match balance weight sets; the difference between of the heaviest and lightest fastener is controlled.

Recommended lubricants.
Unless otherwise stated the following lubricants are suitable. Equivalents are acceptable provided consideration to their performance is made.

- BP Energrease L21M
- Rocol MTS.1000
- Molykote 321R
- Extreme pressure Molybdenum-Disulphide Grease

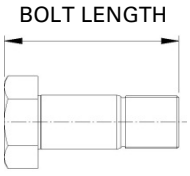
Lubrication of fasteners
Lubricate all bolts and nuts. Apply lubrication to

- Bolt threads.
- Bolt bearing face (under the head).
- Nut threads
- Nut bearing face

Measuring bolt stretch / elongation.
It is preferable to measure bolt stretch or elongation over the use of torque tightening methods.

Torque tightening is prone to many factors that result in large inaccuracies in the estimated preload of the bolt. These factors include but are not limited to torque equipment calibration, type and degree of lubrication, fastener and flange surface finishes, geometry variation etc.

Measuring of bolt elongation is recognised as a more accurate means of establishing bolt preloads.



Using a micrometre, simply measure the length of the bolt from the top face of the head to the end of the fastener before it is fitted. Then once the fastener is fitted, measure this length again. The difference between the fitted and free length of the bolt is the elongation or bolt stretch.

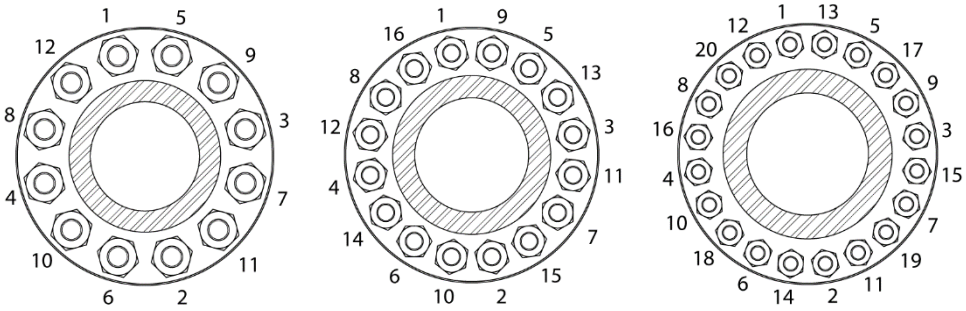
Note: Although the bolts are batch manufactured, no tight control is applied to the length of the bolt which would allow for one measurement to establish stretch once fitted. Measurement of the free unfitted length and fitted length of the bolt is required to establish stretch.

Bolt tightening

1. Measure and record the bolt free length of two bolts and temporarily mark the bolts as “1” and “2”

2. Lubricate all the fastener applying the lubricant to
   - Bolt threads and bearing face
   - Nut threads and bearing face

3. Number the bolt holes temporarily in a cylinder head sequence / criss cross fashion(see examples below). The order in which the bolts are tightening effectively requires the next bolt to be tightened to be midway between bolts which are already preloaded.



Examples of 12, 16 and 20 bolt pattern tightening sequence

4. Fit fasteners to flange and tighten nuts to a snug fit. Ensure measured bolts 1 and 2 are diametrically opposite to each other.

5. Measuring the bolt elongation, tighten bolts 1 and 2 to achieve approximately 25% of the stated bolt stretch and make note of the average tightening torque required.

6. Using the same tightening torque, tighten the remaining fasteners in the flange keeping to the cylinder head sequence.

7. Repeat steps 4 and 5 three more times aiming to achieve 50%, 75% then finally 100% of bolt elongation. Care should be taken at full elongation as bolt length can be difficult to measure.

8. Repeat the process until nuts do not move under the torque used to achieve 100% elongation.

9. Check final elongation on bolts 1 and 2.

If it is not possible to use bolt elongation/stretch as a method of establishing bolt preload, then use the tightening torque as stated on the general assembly drawing. Apply the same principal of cylinder head sequence at 25%, 50% 75% and 100% torque values.

Bolt Loosening

> **WARNING: DO NOT FULLY LOOSEN BOLTS SEQUENTIALLY.**
> **This may result in the final bolts being over loaded and failing.**

Bolts can be loosened in any sequence (cylinder head or otherwise) but must only initially be loosened to 70% of full stated tightening torque initially. A second sweep would further reduce the torque to approximately 50 % then a third sweep to 25% before being fully removed.

INSTALLATION INSTRUCTIONS

GENERAL

No liability will be accepted, and any warranty, either expressed or implied, will be null and void should any components of whatsoever kind, including nuts, bolts and washers, be used in the assembly or any modifications be made to all or part of the unit which are not supplied, specified or agreed by **Bibby Turboflex**.

For general Safety, Alignment and Maintenance Instructions see other sections of this manual.

IMPORTANT

All component item numbers referred to in these instructions are taken from the general assembly drawing.

Check that the parallel & and axial misalignments of the shafts are within the limits defined on the separate alignment sheet or curves. **Bibby Turboflex** does not recommend any specific alignment method as this varies due to personnel preference. However, the alignment should be within the operational envelope shown on the misalignment curve.

1. Reference any applicable drawings for sizes and dimensions. Ensure that all required tools and equipment are available.

2. The coupling is supplied in an assembled state with its misalignment capabilities locked by compression screws and transit blocks (items 18 & 19) inserted in spacer (items 2) and adaptor (item 4) drive end 'A' Motor side. Compression screws and transit blocks (items 3 &2) are also inserted in spacer (item 3) and adaptor (items 5) at driven end ' B' gearbox side.

3. For balanced couplings, note any match markings, which must be aligned when the coupling is installed.

4. Bring shaft ends of the driver and driven machinery together and check that the distance between shaft ends (DBSE/DBFF) is as near as possible to 3048 mm.

5. This Turboflex coupling has been supplied in a fully assembled and compressed state, this assembly should be separated into two sections before assembly onto associated machinery. To do this evenly remove connecting bolts and nuts (items 15 & 17) at the hub and adaptor (items 2 & 4) of coupling. remove attachment bolts and nuts (items 13 & 14) at the adaptor customer flange. Store the connecting bolts, nuts, safely for future use

6. Remove the Packing ring and shims (items 6&7) from the transmission unit assembly. Store the packing ring, and shims safely for future use.

7. Align the machine components. Bibby Turboflex do not recommend any particular method as long as the results are within the operational envelope shown on the misalignment curves.

8. Remove the transit blocks (item 19) by loosening compression screws (item 18) from both End ‘A’ and End ‘B’ assemblies. Store safely for future use.

9. Install the hub (item 1), to the motor shaft at drive 'A' side, ensuring that bore and shaft are clean and free from any dirt and oil before mounting, ensure correct fit and pull up is achieved. Refer to motor manufacturer for any installation instructions.

10. Compress the element packs by installing and tightening the compression screws (item 18) on both End ‘A’ and End ‘B’ assemblies. This will compress the element assemblies.

11. Accurately measure the gap between Hub face (item 1) and adaptor (item 5) of coupling, record this value as X. For best results measure the gap at 4 points, the average figure should then be recorded. The resultant number of shims N required can then be calculated using the calculation in section 1.
The number of the required shims should be rounded to the nearest whole number.

12. Install the required number of shims (item 7) (as calculated in step 11) on to the spigot of packing ring (item 6) on drive side end ‘A’. Ensure that the surfaces are clean from any dirt and oil before mounting. Ensure all match marks and holes are aligned.

13. Mount the packing ring and shims (item 6 & 7) onto adaptor (item 4). Ensure that the spigots are correctly seated in its recess and all match marks are aligned

14. Carefully place transmission unit between the flanges of the hub (item 1) at the drive end 'A' motor and the at driven end “B” gearbox. Ensure that the mating recess and spigots are clean and free from any dirt and oil before mounting. Ensure that the spigots are correctly seated in its recess and all match marks are aligned. Make sure transmission unit, shims and packing ring are correctly and safely supported throughout this step.

15. Install the connecting bolt and nuts (items 15 & 17) at hub and adaptor (items 1 & 4) joint at drive end 'A' side. Do not torque tighten them at this point.

16. Install the connecting bolt and nuts (items 13 & 14) at customer flange and adaptor (item 5) joint at driven end 'B' side. Do not torque tighten them at this point.

17. Evenly remove compression screws (items 18) completely at both ends and store safely for future use. Once removed the coupling has now been released from its compressed state.

18. Torque tighten all the connecting bolts and nuts (items 13, 14 & 15) as stated on page 10- bolt tightening to the torque value stated on the GA drawing. Ensure correct fit of the flanges, spigots & recesses are achieved. Note once the cap screws are tightened the coupling will be in a stretched state.

19. Ensure that all match marks are aligned, all installation/compression screws, and transit blocks are removed, all fasteners are correctly tightened, and all the coupling components are in good condition before operating the machines.

REMOVAL INSTRUCTIONS

Coupling removal is the reverse of the above installation process. Ensure that on reinstallation the process is followed in careful sequence. The use of jacking screws is recommended for separating joints/flanges.

ALIGNMENT INSTRUCTIONS

Bibby Turboflex couplings will accept substantial amounts of misalignment, the configuration of each individual unit defining the actual acceptable level. The allowable misalignment is shown graphically on a curve produced uniquely for any unit. This curve shows the maximum permitted level of misalignment for operation and is NOT intended to define set up limits.

ALIGNMENT METHOD:
Each company has its own method for aligning machinery all of which are well documented in both internal and freely available documents and books. Hence it is not our intention to describe methods for setting machines. Instead, the following gives guidelines for quick checks for alignment suitable after initial installation and for general maintenance checks.

AXIAL:
The suggested limits for axial set up distance between the machinery shafts will generally be specified in the installation instructions unique for the coupling. However, as a general rule, the following may be used:

4-bolt couplings - +/- 0.4mm
6-bolt couplings - +/- 0.3mm
8-bolt couplings - +/- 0.2mm
10-bolt couplings - +/- 0.2mm

These values may be exceeded in certain cases and, if no reference is made in the unique installation instructions, reference should be made to Bibby Turboflex.

PARALLEL / RADIAL / ANGULAR:
Having basically aligned the machinery shafts using one of the established techniques, the coupling may be installed as per the instructions. It is then worth performing a check to establish that the overall alignment is correct for the particular coupling. This may be simply performed by one of the following two methods:

Attach a dial indicator securely to the back of one of the coupling flanges, with the needle in contact with the flange face the other side of the flexible element as near the outside periphery as possible. Rotate the machinery & coupling and locate the minimum reading position. At this position, set the dial reading to zero. Rotate the machinery again and record the maximum reading over 360 degrees. Divide this maximum value by the coupling flange diameter to gain a value in mm/mm, which should be no greater than that shown in the following list. (This should be repeated at both flexible elements in a spacer coupling).

An alternative method is, where possible, to accurately measure the distance across the flanges that sandwich the flexible element to obtain a maximum and minimum value. The difference between these two values should be divided by the flange outside diameter to obtain a value in mm/mm, which should be no greater than that shown in the following list. (This should be repeated at both flexible elements in a spacer coupling).

4-bolt couplings - 0.004 mm/mm
6-bolt couplings - 0.003 mm/mm
8-bolt couplings - 0.002 mm/mm
10-bolt couplings - 0.0015 mm/mm

NOTE: These values are intended as guides only and, in certain cases, may be exceeded. **IF IN DOUBT, CONTACT BIBBY TURBOFLEX.**