PRODUCT GUIDE

Chapter 7
Installation and maintenance guidelines for TeraSpin spindles

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Research and Development is a continuous process. Hence, some of the information provided in this PRODUCT GUIDE may have become obsolete with TeraSpin's new developments in technology.

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TeraSpin is a business unit of A.T.E. Enterprises Private Limited, a company engaged in the service of the textile industry since 1939. TeraSpin came into existence in 2012 after A.T.E.'s takeover of SKF India's textile spinning component business. Since then it has been innovating and making continual improvements in quality and reliability in the service of spinning mills and machinery manufacturers around the world.

TeraSpin's product range consists of weighting arms, top rollers & cradles for roving frame and ring frame, spindle bearing units and complete spindles for ring frames and doubling frames. TeraSpin also offers customized upgrades for existing ring spinning and roving frames.

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Chapter 7

Installation and maintenance guidelines for TeraSpin spindles.

Recommendations for the best performance of TeraSpin spindles

TeraSpin spindle bearing units for spinning and twisting spindles

TeraSpin supplies the appropriate spindle bearing units for a wide range of applications in modern spinning and twisting machines. The world-famous TeraSpin HF series spindle bearing units are proven in millions of instances.

Advantages of TeraSpin spindle bearing units

Outstanding running properties

All TeraSpin spindle bearing units feature metal-elastic spring elements that give the bearing points radial resilience. This ensures that top part of the spindle can rotate together with the unbalanced bobbin mostly about their common axis through the center of gravity, thereby minimizing the bearing forces and spindle vibrations. In addition, the spring elements ensure that the top part is always returned to the initial position centered on the spinning ring after being moved.

Another important feature of TeraSpin spindle bearing units is the damping system with wear-free operation. This involves metal strip spirals filled with oil. Very precisely matched spring and damping qualities of TeraSpin spindle bearings ensures outstanding running properties of the spindles.

Top spindle speed

TeraSpin spindle bearing units of HF series are of single-elastic type. In these bearing units, the footstep bearing is kept radially movable by a metal spring. Damping in the form of an oil-filled metal spiral is an integral part of the spiral system. The single elastic bearings are of robust design, and as such are standard for the majority of the applications in spinning and twisting. They can be used in conjunction with high-quality upper parts and tubes right up into the high-speed range.

Quiet running

The high precision of the of the TeraSpin spindle bearings and the system-inherent low bearing forces ensure low-noise spindle operation over the full speed range.

Minimised energy requirement

The oil-lubricated neck bearing and footstep bearing of a TeraSpin spindle bearing units are precisely matched to the blade of the spindle upper part for good bearing performance in that they ensure minimum bearing friction in all speed ranges. Furthermore, the low dynamic bearing forces mean that roller bearings and wharves can be made smaller and in turn permit low belt speeds and tension roller speeds. The result is considerable energy savings at the machine.

TeraSpin HF series of spindle bearing units are designed specifically for high-speed spinning spindles with their low head diameters allowing very small wharve diameters of as small as 18.5 mm, and an even bigger drop in energy consumption.

High centering precision

Centering of the spindle with respect to ring is a crucial factor in minimizing ends down rates and maximizing cop filling. The TeraSpin spindle bearing units offer ideal conditions here:

- The spring elements of the spindle bearing counteract every movement of the spindle upper part with sufficiently high resetting forces to restore it quickly to its initial centered position
- The bolster flange and the centering collar of the spindle bearings are made with high precision and are fully aligned with the axis of the upper part

Long life

Minimized bearing forces and high manufacturing precision of the TeraSpin spindle bearing units are the basis for their proverbially long life. In addition, the sturdy design of elements of the spindle bearings ensure that the bearing can withstand the stresses encountered in practical operation, e.g. during deceleration and doffing.

In addition, the spindle oil inside the bolster ensures continuous lubrication of the bearing points that results in long maintenance intervals.

Installation of spindles:

To achieve maximum spindle speed, smooth running and trouble free long life of spindles, we recommend that you follow the guidelines below:

1. Clean the steel bolster externally with a soft and clean cloth.
2. Clean the spindle rail before fixing the bolster.
3. Please do not forget to use a washer between the spindle rail and the nut. This prevents damage to the threading provided on the bolster casting, if over tightened.
4. It is advisable to use a torque wrench for tightening the bolster nut. This prevents over tightening of the nut and hence ensures no damage to threading. **While using torque wrench, set max. torque at 5 kg-m.**
5. Remove the bolster cap and clean the bolster from inside and rinse it with an appropriate spindle lubrication machine with the recommended spindle oil **(please refer running-in procedure on page no. VII-8 to VII-9).**
6. Fill the bolster with the recommended spindle oil up to the maximum recommended level **(please refer running-in procedure on page no. VII-8 to VII-9).**

   Note: TeraSpin complete spindles are supplied without oil filling and hence, correct quantity of oil must be filled-in as specified in running-in procedure before putting the spindles into operation. Operation of spindles without oil, even for a short period, will damage the spindle bearing unit.
7. Wipe the spindle upper part, blade and steel wharve with a soft and clean cloth.
8. Insert spindle upper part gently into the bolster assembly.

   Note: Please make sure that while inserting the spindle upper part into bolster assembly, you are holding it in a vertical position (as shown in fig.1). If it is inserted in a

skewed manner (as shown in fig.2) or if it is dropped into the bolster assembly (as shown in fig.3), it can damage the neck bearing of the spindle bearing unit and the spindle blade, which will directly affect the performance and life of the spindle.

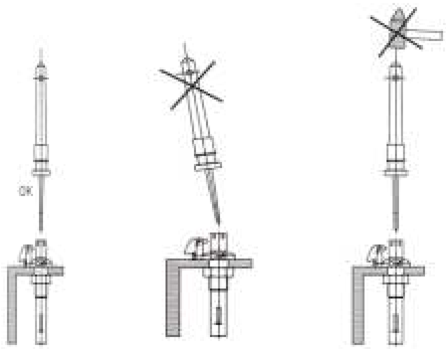
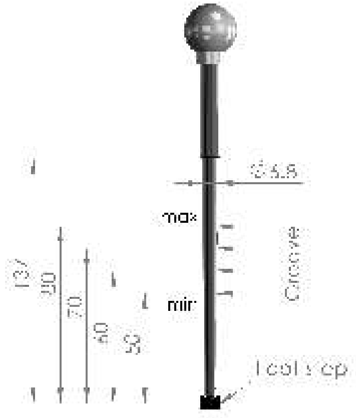


Fig. 1 *Fig. 2* *Fig. 3*

10. Wipe off any spindle oil spilling out of bolster assembly with a cloth.

    Note: Please do not use any kind of powder to soak the spindle oil overflows as it may enter into the bolster assembly and damage the neck bearing and spindle blade tip.
11. Please check the free rotation of spindles by rotating the upper part by hand before starting the machine
12. Position the spindle tape or tangential belt gently over the spindle wharve.
13. Run the machine at initial speed for 30 minutes without bobbins and check for any abnormal vibration, noise or excessive heat generation



Oil quantity

1. 1st oil change : maximum oil level 80mm for all spindle bearing units (for HF-100 : 70 mm).
2. Subsequent oil changes : Oil level at 65-70 mm for all spindle bearing units (for HF-100 : 60 mm).
3. Oil level should never fall below 50 mm.
4. This will ensure proper oil circulation up to the neck bearing even at lower spindle speeds.

Precautions:

1. Ensure no fly/fluff enter the spindle bearing unit during oiling
2. Clean and wipe the spindle blade before inserting it into the bolster assembly
3. After installation and oil filling it is recommended to perform bare running of the spindles for nearly 30-60 minutes. During this period please check each spindle carefully for any abnormal heat generation or sound or vibration.
4. Always use the dip stick provided by TeraSpin to check the oil level in the bolster
5. Ensure the neck bearing is oiled with 2-3 drops of oil during the first oiling. A good spindle bearing unit flushing and lubricating machine will ensure wetting of the neck bearing and the correct level of oil inside the bolster
6. Make sure there is no air bubble left inside the damping spring
7. Please check the oil level at least 30-40 minutes after filling oil inside the bolster as oil enters slowly between the layers of damping coil and hence, the oil level comes down.
8. In case new spindles have different wharve diametre than old spindles, make sure that correct spindle tape length is being chosen to suit wharve diametre of the new spindle.
9. Please ensure correct tension in the spindle tape.
10. Please do not use damaged or incorrect bobbins as these may lead to damage/bend of the upper part. This will further result in poor performance and even early failure of the spindles.
11. During topping/oil change, make sure that combination of bolster with respective top part should not get changed.

Running-in schedule

Sr. No.	Activity	Frequency	Remark
1	Flushing and oiling by machine	New installation / 6 monthly	80% of target speed or 15000 rpm, whichever is lower
2	**2-3 drops of oil at the neck bearing rollers (critical)**	**Every time during oil change**	
3	1st oil flushing and change by oiling machine	24 hours	After every 24 hours, increase rpm by 1000 till target speed is achieved
4	2nd oil flushing and change by oiling machine	7 days	
5	3rd oil flushing and change by oiling machine	30 days	
6	Oil quantity measuring / topping	3 months	Check 10% spindles randomly
7	Scheduled oil change (regular) based upon the spindle speed	6 months	Approximately

Lubrication of spindle bearing unit

Types of spindle bearing unit	Lubricant	Operation	Lubrication intervals Operating hours	Viscosity class to ISO
HF-1, HF-100, HF-21	Servospin EE10*	With ring and traveller spindle speed up to 18000 rpm	20000	VG 10
		With ring and traveller spindle speed exceeding 18000 rpm	12000	

Solvent refined high-grade oil – with good anti-wear properties and containing anti-oxidant and anti-corrosion additives

The oil level should be checked on a random sample of spindles after half the number of operation hours shown. ***The roller bearing should be thoroughly coated with oil before putting the spindle into service and also at each lubrication operation.***

Viscosity class

Viscosity class according to ISO	Mean kinematic viscosity at 40°C mm^2/s (cSt)	Limits of kinematic viscosity at 40°C mm^2/s (cSt)	
		minimum	maximum
VG 10	10	9	11

Application of TeraSpin spindle bearing units

Spindle bearing types

Parameters	HF-100	HF-1	HF-21
Maximum spindle speed (rpm) *	25,000	22,000	20,000
Maximum bobbin length (mm)	210	210	270
Spindle	Light cotton and worsted spindles	Light cotton and worsted spindles	Light cotton and worsted spindles and light twisting spindles

** Each spindle bearing unit has been designed for the maximum spindle speed as mentioned in the above chart. However, actual operating speed depends up on various parameters as recommended by the machinery manufacturers and the raw material, environment, yarn count being spun, etc*

Factors affecting the performance and life of spindle bearing unit

The service life of spinning and twisting spindles is generally affected by imbalances in the rotating spindle elements (spindle top part and bobbin, with and without yarn). The higher the imbalances, the higher will be the reaction forces in the bearings of the spindles. These forces increase disproportionately as the spindle speed increases and cause premature wear of the bearing and hence, spindle failure. Moreover, such imbalances lead to spindle vibrations with detrimental effects on yarn quality and ends down rates, which results in higher energy consumption and noise emission. Today spindle upper parts are generally produced with extremely low run-out and suitable resistance to deformation. But in most of the cases less attention is given to the quality of tubes and bobbins e.g. bobbins used sometimes have too much clearance or inaccuracies in shape or they are made of poor material. Hence, in order to achieve max. spindle speed, high bobbin quality is a basic requirement. While selecting bobbins, following aspects should be taken into account:

Tube clearance

The clearance between bobbin and spindle upper part has to be kept as low as possible. However, the care should be taken to ensure that the bobbins can easily be fitted and removed each time and contraction through yarn winding does not cause the bobbin to stick to the spindle upper part.

The following technical measures have proved to be successful:

- ✓ Reduction of the bobbin tolerances by improved manufacturing methods and use of high-quality materials
- ✓ Partial recesses in the upper part or in the bobbin to provide more tolerance against deformation and contraction
- ✓ Use of dimensionally stable materials or metal fittings to avoid changes in tube diameter resulting from continued bobbin handling

Concentricity of bobbin

The concentricity is one of the major aspects, which should not deteriorate over the period of time. There are spinning tubes in the market, which have a good concentricity, but those lose their concentricity after a short time. This could be due to improper plastic material. Unfortunately it is not usually possible at textile mills to measure and the problems with the spindle bearings and poor yarn quality will start after 1-2 years. Generally the reasons for this are searched in quality of the bearings, about the belts, the various fibre qualities and so on.

The concentricity depend on raw material, selection and method of production, which facilitate higher spindle speed without any adverse effect on spindles and yarn like shorter life time of the spindle bearing, unequal yarn due to eccentric run of the tube with unequal yarn draw and more hairiness.

Bobbin curvature and difference in wall thickness

Bobbins with curvature or large differences in wall thickness increase imbalance. Hence, an attempt should also be made to reduce these tolerances by means of high quality manufacturing as well as the use of high-quality materials. As recommended in the ISO 368 standard, suitable tolerance for tapered tubes has to be adopted.

Bobbin stiffness

At high-speed, bobbins can bend due to dynamic forces connected with an increase in imbalances acting on the spindles. This is mainly true when the tube is not supported over its full length by the upper part or when the tube projects above the spindle plug at its upper end. For this case it is strongly recommended to use dimensionally stable tubes made of high-strength material.

Wear on tube and bobbin seats

In many cases, the spindle upper parts are not stopped by the brakes when the yarn breaks, but instead the tubes are stopped by hand. Due to this coupling buttons get rubbed against the tube and damage the tubes as well as the buttons. Hence, thereafter the coupling buttons do not have the adequate grip on the tube. This leads to early replacement of tubes as well as the complete spindle.

The use of low-wear materials for tubes and bobbins or embedding low-wear rings can reduce this problem. But it is more advisable to use a proper brake to stop the spindle.

The above points about the tube quality have been deliberately kept general; they are intended only as food for thought about the subject of tube quality and as a pointer to inter-related factors. Practical ideas, which generally have to make allowance for commercial consideration too, must be matched to the respective application. Proposals to that end are made by machinery manufacturers and authorized spindle makers.

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