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**Subject: Routine Service Bulletin: SB27122007**

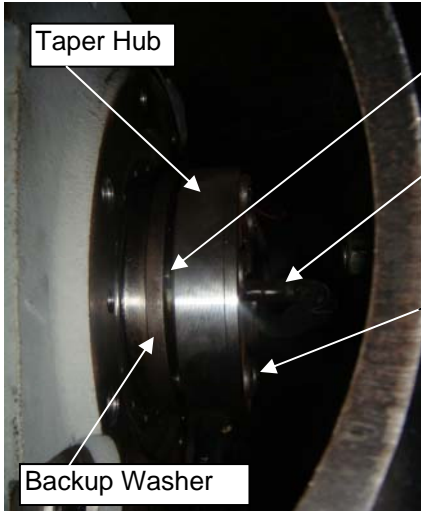
**To:**

**All owner/operators of MaxFlight manufactured virtual reality electric machines models FS2000 and VR2002.**

**Machines affected are EM-81 to present and any refurbished units that have the non keyed, new style taper grip bushing pitch and roll Sumitomo motor/gearbox combinations. See attached documents for specific details.**

**It has come to our attention that owner/operators have not complied with manufacturer recommended re-torque check of the roll and pitch motor/gear box combination taper bushing bolts. If these bolts come loose the taper bushing fails to grip its respective drive shaft, thereby preventing normal operation of either the roll or pitch axis.**

**After receiving notice of this service bulletin, comply with its contents during your next weekly preventative maintenance/ inspection of your machine. Re-check the torque on the roll and pitch taper bushing bolts per attached detail instructions.**



Gap between taper hub and backup washer  
Maximum 1/16"

Roll Slip Ring

Check torque on the six allen cap bolts  
Use the star pattern method as shown in  
attached document.

**Max Torque 90 ftlbs.**

**These are 10mm allen cap bolts**



Top of center weldment.  
These are the four hex bolts holding  
the roll gear box to the center  
weldment.  
Verify/re-tighten these four bolts  
as needed.



Pitch motor/gear box combination.  
Check torque on these six bolts at interval  
as shown on service card.

Pitch signal ring

**Max Torque is 120 ftlbs.**

**These are 14mm allen cap bolts**

**Check the allen cap bolts on the taper hubs after 30 hours initial operation and then every six months thereafter. Use torque sequence in attached document.**

# Taper-Grip® Bushing Installation Guide

## Unit Installation

**Step 6** – Position unit with the bushing flange located on the outboard side of the unit. Align the bushing with the driven shaft. Slide the unit onto the driven shaft as close to the driven shaft support bearing as possible. The driven shaft must extend into the bushing beyond the split in the bushing barrel for minimum engagement. Ideally, the driven shaft should extend beyond the bushing flange face (see Fig. 4). Refer to the table below for minimum shaft to bushing engagement:

**Table 2 – Minimum Shaft to Bushing Engagement**

HSM Size	BB Size	HBB BBB Size	Minimum Shaft Engagement	
			mm	inches
107C		AA	82	3.23
115D	AA		88	3.47
203E	A	A	95	3.74
207F	B	B	100	3.94
215G	C	C	130	5.12
307H	D	D	146	5.75
315J	E	E	145	5.71
407S			160	6.30
415K			178	7.01
507L			213	8.39
608M			258	10.16

**Step 7** – With a torque wrench, gradually tighten the capscrews to engage the bushing system. Use the appropriate tightening pattern (“star-pattern” see Fig. 5) to assure complete bushing engagement. Tighten each capscrew to the torque values shown in this table:

**Table 3 – Capscrew Tightening Torques**

HSM Size	BB Size	HBB BBB Size	Capscrews (JIS Grade 12.9)		Capscrew Torque	
			Qty.	Size	Nm	Lb.Ft.
107C		AA	6	M10x14	50	37
115D	AA		6	M10x14	55	41
203E	A	A	6	M12x16	75	56
207F	B	B	6	M12x16	140	104
215G	C	C	6	M16x20	250	185
307H	D	D	6	M16x20	250	185
315J	E	E	8	M16x20	250	185
407S			10	M16x20	250	185
415K			10	M16x35	300	223
507L			12	M16x35	300	223
608M			16	M16x35	300	223

If the shaft is recessed in the bushing, fill the void with grease to prevent corrosion and fouling.

**Step 8** – Please read, understand and follow the instructions shown in the reducer/gearmotor installation and operating manual to complete the unit installation and attach the



Fig. 4 Shaft Engagement

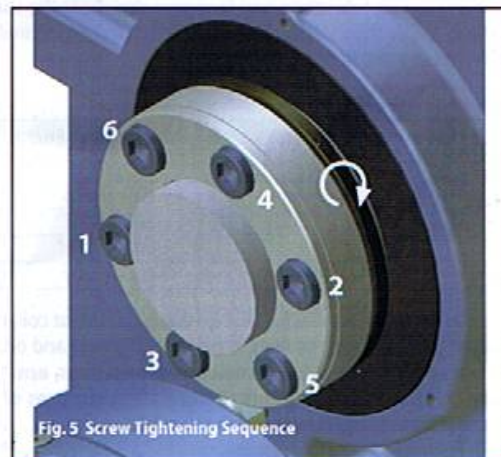


Fig. 5 Screw Tightening Sequence

## Removal Procedure

**Step 1** – Support the unit prior to beginning the removal procedure. Loosen all capscrews in the bushing until they are free from contact with the thrust collar.

**Step 2** – With a soft mallet, sharply strike the flange of the Taper-Grip® bushing to release the taper engagement with the unit.

**Step 3** – Hand-tighten at least two (2) capscrews until they contact the thrust collar. This will prevent accidental taper engagement between the bushing and the hub during removal of the unit from the shaft.

**Step 4** – Slide the unit from the shaft. If unit removal is difficult due to corrosion or fouling, employ a puller on the bushing to remove the unit from the shaft.

# Taper-Grip® Bushing Installation Guide

## Introduction

The keyless Taper-Grip® bushing system provides simple and reliable shaft attachment for Sumitomo Speed reducers and gearmotors. This system allows bi-directional shaft rotation and stop-start operation with a powerful, slip-free grip. To assure peak performance of your equipment, please read, understand and follow these installation instructions.

## Safety

Disconnect all power sources from the equipment before beginning this installation procedure. Handle the components with care and avoid all sharp or machined edges to prevent personal injury or damage to the components.

## Before Installing Unit on Driven Shaft (Steps 1–5)

Carefully inspect the driven equipment shaft. Remove all burrs, corrosion, lubricants, and foreign matter from the shaft surface. Verify the shaft diameter is within the dimensional tolerances shown in this table:

**Table 1 Driven Shaft Tolerances**

Shaft Diameter (inches)	Shaft Tolerance (inches)
$\frac{3}{4}'' - 1\frac{1}{8}''$	+0" -0.005"
$1\frac{3}{16}'' - 2''$	+0" -0.006"
$2\frac{1}{16}'' - 3\frac{1}{8}''$	+0" -0.007"
$3\frac{3}{16}'' - 4\frac{3}{4}''$	+0" -0.008"
$4\frac{13}{16}'' - 6\frac{1}{2}''$	+0" -0.009"

Clean all surfaces of the shaft, the bushing, the thrust collar and the unit bore with solvent to remove all grease and oil.

**Do not apply lubricants, corrosion preventatives, anti-seize compounds or coatings to the mating surfaces of the shaft, bushing, thrust collar or unit bore.**

**Step 1** - Remove the capscrews from the bushing. Lightly oil the threads of the capscrews and partially re-insert them into the threaded holes in the bushing flange. The ends of the capscrews should not extend beyond the rear face of the bushing flange.

**Step 2** - Slide the thrust collar onto the Taper-Grip® bushing (see Fig. 2).

**Step 3** - Carefully thread the Taper-Grip® bushing into the hub of the speed reducer or gearmotor until the thrust collar solidly engages the unit hub surface and the bushing flange (see Fig. 3). **Caution: Do not cross-thread. Bushing should thread easily into hub.**

**Step 4** - Unscrew the Taper-Grip® bushing to create a 1mm (0.04") gap between the thrust collar and the bushing flange.

**Step 5** - Hand-tighten the cap screws until they firmly press the thrust collar against the unit hub surface. The unit is ready for installation on the driven shaft.



Fig. 1 Taper-Grip® Bushing Parts



Fig. 2 Slide Thrust Collar on Bushing



Fig. 3 Thread Bushing into Hub

# ATTENTION

## TAPER GRIP BUSHING INSTALLATION

This unit is equipped with a tapered friction type bushing shaft locking device. Before unit start-up, read the following precautions.

To ensure proper operation of the tapered bushing device, all surfaces in engagement (i.e., hub, taper bushing, solid shaft) must be completely free from rust, grease, oil and any other contaminants and/or surface agents.

1. **CLEAN** ALL HUB, TAPER BUSHING AND SOLID SHAFT SURFACES IN CONTACT WITH SOLVENT.
2. **TIGHTEN** THE TAPER BUSHING SCREWS TO THE SPECIFIED TORQUE.

MODEL	TORQUE (LB.FT.)	TORQUE (NM)
AA	37	50
A	56	75
B	104	140
C	185	250
D	223	300
E	223	300

(B) Roll Taper  
Torque Max Value

(C) Pitch Taper  
Torque Max Value

Recheck Torque  
At Intervals  
Specified

3. **RECHECK** THE TAPER BUSHING SCREWS FOR PROPER TORQUE AFTER THE INITIAL 30 HOURS OF OPERATION.
4. **CHECK** TAPER BUSHING SCREW TORQUE AT NORMAL SERVICE INTERVALS OF SIX (6) MONTHS.
5. **READ** THE OPERATING & MAINTENANCE MANUAL FOR COMPLETE MOUNTING INSTRUCTIONS.



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