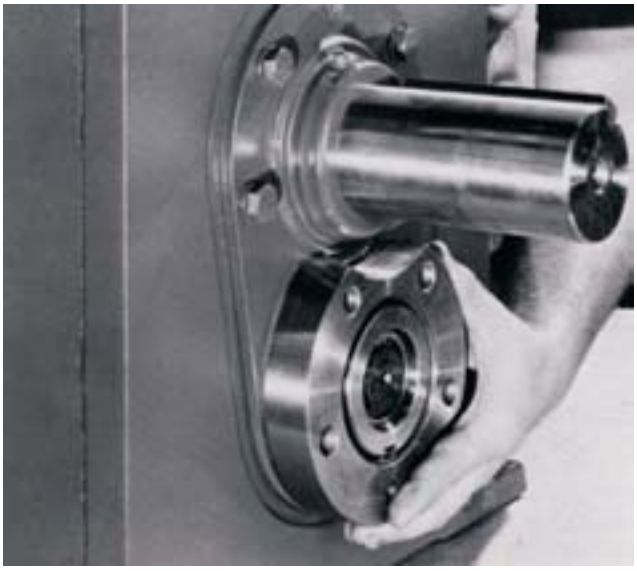
INTRODUCTION

Over the years there sprag type backstops have experienced a variety of different malfunction modes. The information that has been accumulated is presented in this paper as an aid in analyzing future problems. The analysis begins with the following investigative work before the backstop is uncovered.



MOTOREDUCERS
TYPES FEZ, EZ, EZB

SPEED REDUCERS
TYPES FC, C, CB

GET THE FACTS!

(CHECK LIST)

Before removing the backstop from the drive get the following facts.

- O Motor size and RPM.
- O Drive size and input RPM.
- O If backstop is on H.S. shaft, sheave size and axial position of sheave.
- O Number of stops per 8 hour day.
- O Is drive stopped loaded or unloaded?
- O Minimum and average running time between holdbacks. Jogging can cause the backstop sprags to "bunch up" and, thereby cause excessive wear.
- O Viscosity, grade ,and trade name of oil used.
- O Ambient temperature when backstop problem occurred.
- O Does oil contain any EP additives? EP additives may cause backstop to slip during holdback.
- O Low oil levels can starve the backstop of oil and cause it to overheat and wear during overrunning.
- O When was drive and backstop put in service by customer?
- O When was drive last serviced to replace any worn parts in drive? What parts were replaced? Incorrect assembly or disassembly could have damaged the backstop.

When removing the backstop from the drive check the following.

- O Measure axial float of backstop shaft if shaft contains taper roller bearings, Figure 1. Improperly adjusted taper roller bearings can cause excessive runout of the backstop. The following drives have taper roller bearings on the backstop shaft.

7 & 75C2	7 & 75CB3
75 & 8C3 & 4	7 & 75EB3
7E2	90F
75 & 8E3 & 4	1070, 1080, 1090F

- O Measure face runout of backstop if possible per Figure 1. This can indicate if backstop was square to shaft axis.
- O If possible before backstop removal from shaft, check sprag position through radial clearance between shaft and backstop end washer. This can show if backstop was assembled to shaft correctly, Figure 3, and if sprags were manufactured or assembled in backstop correctly, Figure 4.

Remove backstop from drive and examine all parts on backstop shaft assembly.

- O What is condition of both bearings? Do bearings show excessive clearance as compared to a new bearing? Did bearings spin in the housing bore? All of these conditions could produce excessive runout on backstop.
- O Does wear on gearing indicate overload for length of service? Overload during overrunning could produce excessive runout on backstop due to shaft deflection.
- O During disassembly of backstop note if energizing springs were kinked. If so, are they kinked as shown in Figures 5 or 6?

SPRAG TYPE BACKSTOPS ARE CATALOG STANDARD ACCESSORIES WHICH CAN BE FURNISHED WITH THESE FALK GEAR DRIVES

SHAFT MOUNTED DRIVES
TYPES J, JF, JSC

Figure 1

Check Axial Float Of Backstop Shaft With Dial Indicator

Check Face Runout of Backstop with Dial Indicator

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108-020
April 2007
Supersedes 10-79

TYPES AND CAUSES OF BACKSTOP PROBLEMS

Overrunning Wear Most Often the Cause of Apparent Failure During Holdback!

Most conclusions are that the backstop failed during holdback when actually 95% of the time the backstop was worn during overrunning. The overrunning wear alters the cam surfaces on the sprags and as a result the sprags cannot engage during holdback.

NORMAL WEAR

Normally a backstop, if properly installed and applied and the drive properly maintained, will look like Figure 2 after many years of service.

Figure 2 below illustrates normal wear. Figures 3 through 8 illustrate other types of wear which will help you evaluate the cause of a given malfunction.

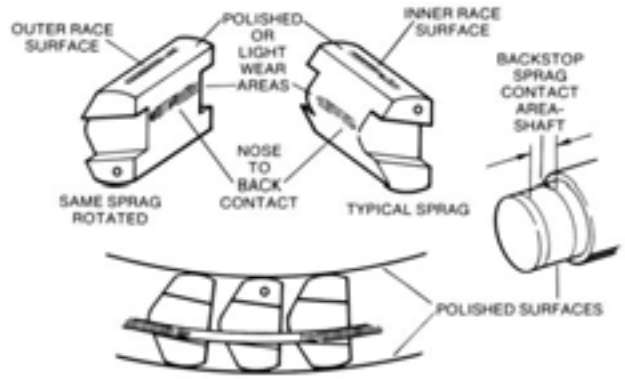

Figure 2 NORMAL OPERATING CONDITION

IMPROPER ASSEMBLY BACKSTOP-TO-DRIVE

By forcing or hammering a backstop onto the shaft, one or more of the sprags can roll over and thus cause lockup of the shaft in both directions of rotation when the shaft is rotated by hand. If the drive is allowed to be started, the rolled-over sprags could flip back to their normal operating position. The axial indentations produced by the sprags on the shaft when they rolled over on startup or during the forced assembly onto the shaft will cause the backstop assembly to appear as shown in Figure 7 due to vibration or kinked or broken spring.

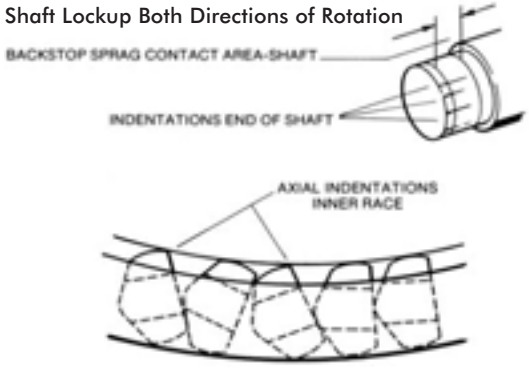

Figure 3 IMPROPER ASSEMBLY BACKSTOP TO DRIVE

IMPROPER ASSEMBLY AND SPRAG MANUFACTURE

Sprags assembled upside down or incorrectly slotted sprags will cause the shaft to lockup in both directions of rotation.

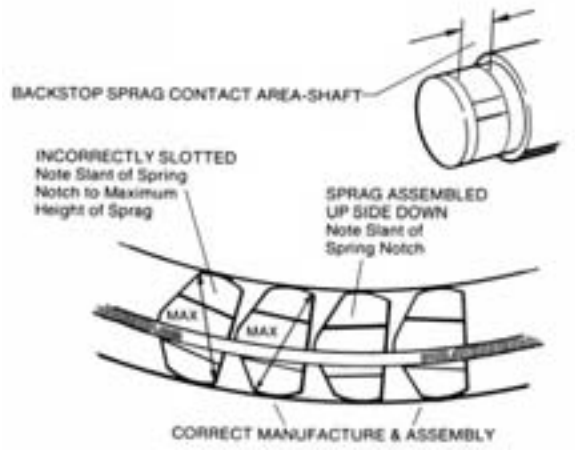

Figure 4 IMPROPER ASSEMBLY AND SPRAG MANUFACTURE

HOLDBACK OVERLOAD ROLLED-OVER SPRAGS

Sprags can roll over during holdback for one or more of the following reasons.

- Excessive holdback load in system.
- Start up of drive with wrong direction of rotation and oversize motor or high starting torque motor.
- EP oils with slipping additives will allow the sprags to slide on the races during holdback for a short period of time before engaging the races. The inertia built up in the system during the sliding produces an excessive holdback load on the backstop when the sprags finally engage.
- Abrasives in the oil could produce excessive wear on the sprags and races during overrunning. The excessive race wear reduces the load carrying capacity of the backstop

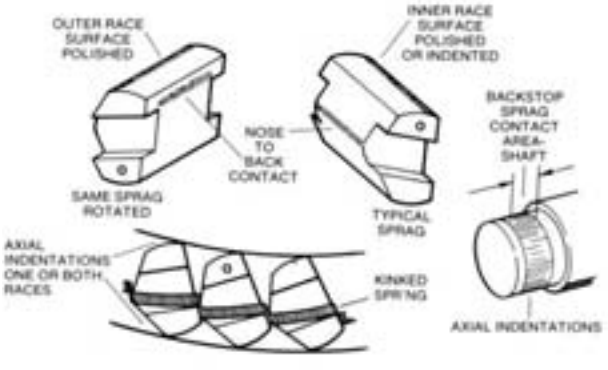

Figure 5 HOLDBACK OVERLOAD ROLLED-OVER SPRAGS

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OVERRUNNING WEAR EXCESSIVE RUNOUT

Backstops can fail during overrunning due to excessive runout for one or more of the following reasons.

- Improperly adjusted taper roller bearings on backstop shaft.
- Worn or failed bearings or bearings which have spun in housing bore on backstop shaft assembly.
- Drive overloaded during overrunning.
- Excessive belt tension (OHL) if backstop is on high speed shaft.
- Backstop installed "cocked" causing misalignment.
- Backstop mounting cage bore and register not concentric.

A broken or disconnected spring may also produce this type of failure.

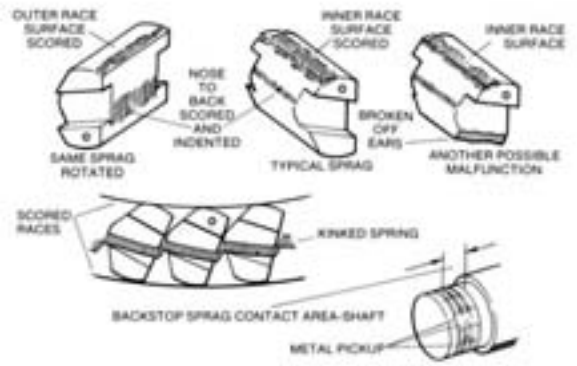

Figure 6 OVERRUNNING WEAR EXCESSIVE RUNOUT

OVERRUNNING WEAR VIBRATION

Vibration causes the sprags to "bunch up" and produce wear as shown in Figure 7. The following are some causes of vibration.

- Vibration in system.
- Inadequate running time between stops (jogging).
- Forced assembly or holdback overload put axial indentations on shaft.
- New backstop put on old shaft which was marked up by previous backstop.

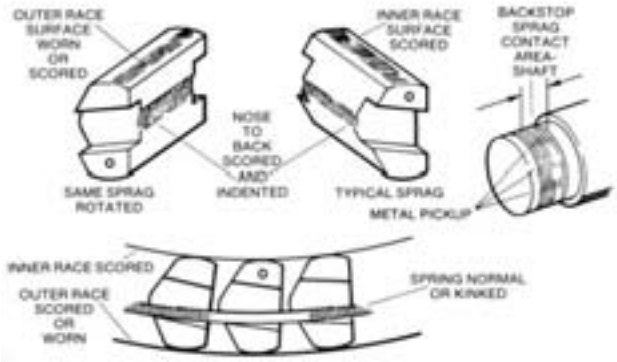

Figure 7 OVERRUNNING WEAR VIBRATION

OVERRUNNING WEAR LUBRICATION

Heat discolored spags can indicate a lack of lubrication. The following lists some causes for a lubrication failure.

- Run without oil on initial start-up or during an oil change (could be less than two minutes).
- Oil level too low.
- wrong grade of oil for season of year.
- Blocked oil passage to backstop.
- Drive not mounted in a horizontal position, (unless specifically ordered for another mounting position).

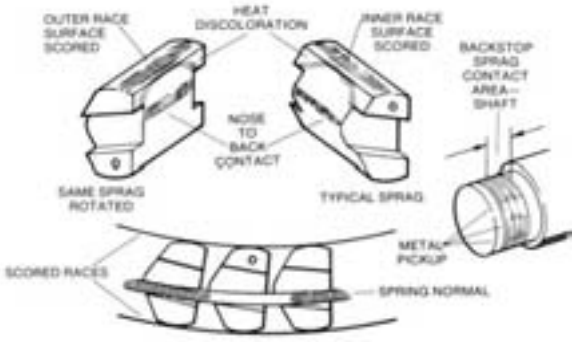

Figure 8 NORMAL OPERATING POSITION LACK OF PROPER LUBRICATION

INSTALLING A NEW BACKSTOP

In order to prevent a reoccurring problem, it is imperative that the new backstop is properly installed. The mechanics of changing the backstop is adequately described in the appropriate service manual, however, the following information is sufficiently important that it is worth repeating.

Shaft — Must be replaced if backstop failed. Axial indentations, scoring, wear, etc., can cause a new backstop to fail. Corrective action such as grinding shaft smooth will change the annular space dimension for the sprags and reduce its torque holding capacity.

Bearings — Replace any questionable bearings on backstop shaft. A worn bearing can result in excessive runout at the backstop.

Check the fit of the new bearing into its housing bore. Oversize housing bores will cause excessively runout at the backstop.

Adjust the taper roller bearings on the backstop shaft according to drive service manual specifications. Use new shim gaskets.

Backstop Cage and Drive Housing — Remove all burrs and nicks. A burr or nick can cause the backstop to be misaligned and thereby increase probability of a problem.

Backstop Installation — Use new shims and gaskets.

Oil backstop and backstop surface on shaft before installing backstop.

Rotation arrow on backstop must agree with shaft rotation. This arrow indicates free or overrunning shaft direction.

Slide backstop onto shaft. To ease assembly rotate the shaft in the correct free rotation or the backstop outer race in the opposite rotation. Forcing a backstop onto the shaft may produce axial indentations or cause a few sprags to lay over improperly as in Figure 3.

Rotate drive shaft by hand to make sure backstop is installed for the correct free rotation.

Install necessary fasteners.

Fill unit with correct grade of oil to proper oil level.

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