

**CANADIAN AERO MANUFACTURING
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS**

All CAM539800 Series and All CAM539601 Series Starter Adapter Clutch Springs
CI-06-01 Revision: C Issue Date: May 01, 2003 Print Date: 01/05/03 Page 1 of 5

This ICA is Transport Canada Accepted

RECORD OF REVISIONS

Revision	Effective date for new revision	Date of withdrawal of previous revision	Person making revision	Organization
C	May 1, 2003	N/A	Ron Newburg	CAM
B	April 5, 2001	N/A	Jim Watson	CAM
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1. INTRODUCTION:

1.1 All CAM Clutch Springs are currently manufactured as per Canadian Aero Manufacturing PDA01-11, issue # 2 or later approved revisions.

1.2 These instructions apply to all CAM539800 Series and all CAM539601 Series Starter Adapter Clutch Springs. This ICA describes the installation and required maintenance elements.

1.3 The installation of the CAM spring involves specialized repair procedures that may be beyond the scope of some repair facilities. Cylindrical Grinding, Lathe Work, NDT (MPI and LPI), Bead Blasting, and Specialized Measuring are required to complete this installation. Great care must be taken to maintain cleanliness during inspection and assembly, particularly internal oil flow passages.

1.4 The satisfactory function of the Continental Starter Adapter is very much dependent upon the dimensions and condition of these springs. Prior to installation of any of the products described herein, confirm that all of the components are within the dimensional tolerances and conditions required by both these instructions and the prevailing TCM publications.

1.5 The starter adapter must be able to disengage itself from the engine immediately after the engine starts. In order to disengage, the clutch spring must be able to unwind, releasing its grip on the starter adapter main shaft gear friction drum. It does so by turning the starter motor **backwards**. **If the starter motor is too stiff to turn freely, the starter adapter will remain partially or fully engaged to the engine.** This will result in a short starter adapter service life. Catastrophic failure may occur, with the spring winding around and destroying the main gear shaft and other expensive components.

Note:

(a) Chrome Plated Shaft gears are **not** to be used under any circumstances as they will cause premature spring wear and give an extremely short service life.

(b) Geared, permanent magnet, starter motors must **not** be used with CAM539800 Series and CAM539601 Series Starter Adapter Clutch Springs. Refer to 1.5 above.

1.6 CAM539800 Series and CAM539601 Series Starter Adapter Clutch Springs are available in standard (new size) as well as the following sizes:

(a) M15, M28 and M43 – these springs are intended for use with Shaft Gears which have been worn or damaged by use, and have been reworked for reuse, by grinding the starter adapter main shaft gear friction drum undersize.

(b) Standard (new size) springs, M15 and M28 springs are also available with a larger than original outside diameter. These P4OD springs are intended for use in adapters where the friction sleeve front end I.D. has worn beyond 2.345" diameter. **If the adapter sleeve is knurled or has worn beyond 2.350" it must be removed and replaced with a CAM633039 sleeve.** These sleeves are not knurled.

1.7 Distribution of this ICA is accomplished at the time of sale of a CAM Spring. This ICA is also available via the CAM website. Should there be a revision, the latest version will be available on the CAM website.

1.8 Revisions of this ICA are done by entire replacement only. All pages are at the same revision status, and are in effect as shown in the Header.

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2. ELIGIBILITY:

2.1 This replacement clutch spring may be installed on Continental engines as per CAM Document CA-C-01, Rev: B-2 or later approved revision.

3. INSTALLATION:

3.2 Standard Size Spring Installation:

3.2.1 Installation of the CAM Clutch Spring is to be accomplished as described in the appropriate TCM publications for that particular engine model. Installation of this spring cannot be accomplished if the knurled drum area of the Shaft Gear is worn below 1.930" diameter. Also, installation of this spring cannot be accomplished if there is any taper measured along the drum in excess of 0.0005". If it found that the knurled drum area of the Shaft Gear is worn below 1.930", or there is an excessive taper, it will be necessary to install an M15, M28 or an M43 Spring.

Note: Installation of all M15/M28/M43 CAM series Clutch Springs will require that the Starter Adapter Main Shaft Gear Friction Drum area, and the Starter Worm Wheel Clutch Drum area be reworked. Installation of an M43 spring will also require the installation of an M43 starter adapter sleeve CAM633039M43. Installation instructions are provided with the sleeve.

3.3 M15 Clutch Spring Installation:

3.3.1 Installation of the M15 spring will require that the knurled drum area of the Shaft Gear be ground down to obtain a final preferred diameter of 1.917", with an absolute minimum diameter of 1.916". Taper in excess of 0.0005" over the length of the drum is not acceptable. The newly ground corner of the knurled drum must be chamfered at an angle of 45° to prevent Worm Wheel damage, and the surface finish must be 32 micro-inches or smoother. If the knurled drum area of the Shaft Gear is below 1.916" or there is excess taper, it will be necessary to install an M28 Spring.

3.3.2 The Starter Worm Wheel clutch drum area will also have to be reworked. Machine the drum area as follows:

- A. Front Step 1.916" to 1.917" diameter, 0.155" wide **Note:** Size should be identical to the knurled drum
- B. Center Step 1.922" to 1.923" diameter, 0.155" wide
- C. Rear Step 1.940" to 1.945" diameter

On the center and rear steps, the larger size is preferred.

3.4 M28 Clutch Spring installation:

3.4.1 Installation of the M28 spring will require that the knurled drum area of the Shaft Gear be ground down to obtain a final preferred diameter of 1.904", with an absolute minimum diameter of 1.903". Taper in excess of 0.0005" over the length of the drum is not acceptable. The newly ground corner of the knurled drum must be chamfered at an angle of 45° to prevent Worm Wheel damage, and the surface finish must be 32 micro-inches or smoother. If the knurled drum area of the Shaft Gear is below 1.903", or there is an excess taper, it will be necessary to install an M43 Spring.

3.4.2 The Starter Worm Wheel clutch drum area will also have to be reworked. Machine the drum area as follows:

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- A. Front Step 1.903" to 1.904" diameter, 0.155" wide **Note:** Size should be identical to the knurled drum
 - B. Center Step 1.909" to 1.910" diameter, 0.155" wide
 - C. Rear Step 1.927" to 1.932" diameter
- On the center, and rear steps, the larger size is preferred.

3.5 M43 Clutch Spring installation:

3.5.1 Installation of the M43 spring will require that the knurled drum area of the Shaft Gear be ground down to obtain a final preferred diameter of 1.889", with an absolute minimum diameter of 1.887". Taper in excess of 0.0005" over the length of the drum is not acceptable. The newly ground corner of the knurled drum must be chamfered at an angle of 45° to prevent Worm Wheel damage, and the surface finish must be 32 micro-inches or smoother. If the knurled drum area of the Shaft Gear is below 1.887", or there is an excess taper, the gear shaft cannot be used and should be destroyed. A CAM633039M43 starter adapter sleeve must also be installed.

3.5.2 The Starter Worm Wheel clutch drum area will also have to be reworked. Machine the drum area as follows:

- A. Front Step 1.888" to 1.889" diameter, 0.155" wide **Note:** Size should be identical to the knurled drum
 - B. Center Step 1.894" to 1.895" diameter, 0.155" wide
 - C. Rear Step 1.912" to 1.917" diameter
- On the center, and rear steps, the larger size is preferred

3.6 P4OD Spring installation:

3.6.1 P4OD Springs have been manufactured so that the outside diameter of the spring is 0.004" larger than the original spring O.D. They are intended for use in adapters where the sleeve front end I.D. has worn beyond 2.345" diameter. If the adapter sleeve is knurled OR has worn beyond 2.350" it must be removed and replaced with a CAM633039 sleeve. These sleeves are not knurled.

4. CONTINUING AIRWORTHINESS INSTRUCTIONS:

4.1 The continuing airworthiness of the clutch spring, and the starting system as a whole, is unchanged from the original instructions included in the TCM publications for the Continental Engines. Once properly installed, the CAM spring will function in exactly the same way as the original Continental product. All maintenance functions required by Continental must be carried out accordingly.

4.2 Service or overhaul the starter motor every four years, as required by the TCM service manual, **OR** when installing an overhauled or repaired starter adapter. The starter motor must turn freely using only your fingers or it will not work. Refer to 1.5.

4.3 The clutch spring and starter adapter may be damaged during use, as a result of any of the following:

- Faulty Magneto components, or timing, which can cause a kickback on start up.
- Faulty or malfunctioning starter motor, where abnormal starter motor internal friction keeps the spring partially engaged after starting. Refer to 1.5.
- Use of a replacement (OEM) or "after market", light weight, geared starter motor on any starter adapter into which a CAM539800 Series or a CAM539601 Series adapter clutch spring has been installed. Geared starters will prevent the starter adapter spring from fully disengaging after start up. Refer to 1.5.

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- A faulty starting circuit, could result in the starter motor continuing to run after the engine has started, preventing the spring from disengaging. Refer to 1.5.
- Starter adapter oil passages may become clogged due to infrequent oil changes and sludge build-up.
- Overall engine maintenance and proper lubrication are very important for the best possible Spring life.

5. TROUBLESHOOTING:

The starter adapter clutch spring can be presumed not to be operating properly if engagement of the starter, and a properly operating motor, does not result in the prompt and continuous rotation of the propeller.

Observation	Possible cause	Recommended action
When the starter is engaged, no effect is observed.	Electrical circuit failure.	Safely operate starter while listening for starter motor. If no starter sound is heard, determine reason for electrical problem
Starter motor can be heard while engaged, but propeller does not turn	Drive broken or slipping moderately	Remove and inspect starter adapter, and repair as required as per this ICA
Propeller turns non-continuously while starter engaged	Starter adapter slipping, probably due to worn spring or shaft gear	Remove and inspect starter adapter, and repair as required as per this ICA
Propeller turns very slowly or non-continuously while starter engaged	Discharged battery and / or very cold engine	Discontinue start attempt. Charge battery and / or preheat engine as required
Accessory driven by starter adapter, is no longer being driven	Failed drive inside starter adapter	Confirm that the drive failure is not in the accessory. If the starter adapter internal drive is suspected. Do not operate engine. Remove and inspect starter adapter, and repair as required as per this ICA

Note: Any questions regarding the clutch spring should be addressed to Canadian Aero Manufacturing, 2648 Ego Side road, Orillia, Ontario, Canada L3V 6H3; Tel # (705) 326 1368. Residents of USA may call (800) 565 4268.

The preceding constitutes the entire ICA for Canadian Aero Manufacturing Springs.

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