P U B L I C A T I O N T R A N S M I T T A L

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V2500-A1/A5/D5 PROPULSION SYSTEMS SERVICE BULLETIN

This document transmits the Revision 1 of Service Bulletin V2500-ENG-80-0015 and the Revision 1 of Sumitomo Precision Products Service Bulletin 80-2515.

Document History

Service Bulletin Revision Status

Initial Issue. Dec.10/00.

Service Bulletin Revision 1

Remove	Incorporate	Reason for change
All pages of the Service Bulletin.	Pages 1 to 7 of the IAE Service Bulletin.	To update the attached Sumitomo Precision Products Service Bulletin 80-2515. Minor editorial and style changes.
All pages of the Service Bulletin.	Pages 1 to 20 of the Sumitomo Precision Products Service Bulletin 80-2515.	Revision 1.

V2500-ENG-80-0015

CHECK THAT ALL PREVIOUS TRANSMITTALS HAVE BEEN INCORPORATED
If any have not been received please advise IAE International Aero Engines AG

SERVICE BULLETIN

STARTING – PNEUMATIC STARTER – INTRODUCTION OF A REVISED PNEUMATIC STARTER WITH A MODIFIED SYNCHRONOUS ENGAGEMENT CLUTCH ASSEMBLY

1. Planning Information

A. Effectivity

(1) Airbus A319

R V2522-A5, V2524-A5, V2527M-A5 Engines prior to Serial No. V10870 (A5
R Standard and A5 SelectOne™ Retrofit Standard).

(2) Airbus A320

R (a) V2500-A1 Engines prior to Serial No. V0362.

R (b) V2527-A5, V2527E-A5 Engines prior to Serial No. V10870 (A5 Standard
R and A5 SelectOne™ Retrofit Standard).

(3) Airbus A321

R V2530-A5, V2533-A5 Engines prior to Serial No. V10870 (A5 Standard and A5
R SelectOne™ Retrofit Standard).

R (4) Boeing MD-90

R V2525-D5, V2528-D5 Engines prior to Serial No. V20286.

B. Concurrent Requirements

R None.

C. Reason

(1) Condition

Output shaft shear may occur on pneumatic starters that incorporate the Synchronous Engagement Clutch Assembly (SEC). This condition prevents N2 system rotation and subsequent engine start.

R This has been attributed to excessive torque transmission caused by relaxation of the wave springs within the SEC assembly.

(2) Background

R This condition has been observed on units in service.

(3) Objective

Incorporation of the changes introduced by this Service Bulletin (Modification) is designed to maintain unit reliability.

(4) Substantiation

The changes introduced by this Service Bulletin have been the subject of satisfactory engineering assessment, successful vendor testing including high speed re-engagement testing and a 1000 cycle rig endurance test on a
R representative unit.

(5) Effect of Bulletin on:

(a) Operation

R Not affected.

(b) Maintenance

R Not affected.

(c) Overhaul

R Not affected.

(d) Repair Schemes

Not affected.

(e) Interchangeability

Not affected.

(f) Fits and Clearances

Not affected.

D. Description

(1) This Service Bulletin covers the fitment to engines of a pneumatic starter, supplied by Sumitomo Precision Products Co., incorporating design changes to prevent shock load transmission through the output shaft.

(2) The changes introduced are:

(a) A revised pneumatic starter is introduced similar to the existing unit except for the changes that follow:

(i) Both the clutch and tail wave springs have been revised and now consist of two springs nested together, as opposed to the replaced single leaf springs.

(ii) The ring spacer has been revised to consist of a selection of seven spacers of varying thickness, as opposed to the replaced single size spacer.

(b) The opportunity has been taken to introduce a number of minor changes to optimise the design of the SEC assembly, into the new production standard of SEC assembly only.

(3) Existing pneumatic starters may be reworked. Refer to Sumitomo Service Bulletin 80-2515.

(4) Units incorporating this Service Bulletin will be identified by a new type number (see 2.A. Material Information).

E. Compliance

Category Code 6

Accomplish when the sub assembly (i.e. modules, accessories, components, build groups) is disassembled sufficiently to afford access to the affected part and to all affected spare parts.

F. Approval

R The part number changes and/or part modifications described in sections 2 and 3
R of this Service Bulletin have been shown to comply with the applicable Federal
R Aviation Regulations and are FAA-APPROVED for the engine models listed.

R The technical content of this Service Bulletin has been approved under the
R authority of the EASA Design Organization Approval N° EASA.21J.031.

G. Manpower

R (1) In Service

R For the removal/installation of the pneumatic starter: 4 hours.

R (2) At Overhaul

R Applicable (hours not affected).

H. Material Price and Availability

R For price and availability of future spares, refer to the attached Sumitomo
R Precision Products Service Bulletin 80-2515.

I. Tooling Price and Availability

R For price and availability, refer to the attached Sumitomo Precision Products
R Service Bulletin 80-2515.

J. Industry Support Information

R Not applicable.

K. Weight and Balance

(1) Weight Change

R None.

(2) Moment Arm

R No effect.

(3) Datum

R Engine Front Mount Centerline (Power Plant Station (PPS) 100).

L. Electrical Load Data

R The aircraft electrical load is not affected by this Service Bulletin.

M. Software Accomplishment Summary

R Not applicable.

N. References

R (1) This Service Bulletin is subject to Aircraft Modification No. 21820.

R Under no circumstances shall the modified equipment, resulting from the
R application of this SB, be installed on the aircraft type unless the
R corresponding modification, and if applicable, its aircraft SB are
R approved.

R (2) Internal Reference No.

R Engineering Change No. 00VI002 and 00VI002A.

R (3) Sumitomo Precision Products Service Bulletin 80-2515.

(4) Engine Manual:

R (a) 71-00-02, Pneumatic starter, Removal and Installation.

R 72-00-60, Pneumatic starter, Removal and Installation 13.

R (b) 72-00-60, External gearbox, Removal and Installation Method 1.

(5) Aircraft Maintenance Manual:

R (a) 80-13-41, Removal/Installation (A1/A5).

R (b) 80-11-01, Removal/Installation (D5).

O. Other Publications Affected

(1) Illustrated Parts Catalogue, 80-13-41, will be revised.

P. Interchangeability of Parts

Not affected.

2. Material Information.

A. Material Price and Availability

R Refer to the attached Sumitomo Precision Products Service Bulletin 80-2515 for
R parts and availability.

Applicability: For each V2500 engine to incorporate this Bulletin.

B. Vendor units affected by this bulletin:

The type of equipment affected by this Service Bulletin is listed below for information only:

R A1 and A5 Models:

80-13-41

	FIG ITEM NO.	NEW PART NO.	QTY	PART TITLE	MAT	OLD PART NO.	INSTR DISP
R	01-200	790425A6	1	Starter, pneumatic (VKO680)	-	790425A4	(A)(S1) (1D)
R	01-200	790425A5	1	Starter, pneumatic (VKO680) (Customer Option)	-	790425A3	(A)(S1) (1D)

R D5 Models:

	FIG ITEM NO.	NEW PART NO.	QTY	PART TITLE	MAT	OLD PART NO.	INSTR DISP
R	01-200	790425A5	1	Starter, pneumatic (VKO680)	-	790425A3	(A)(S1) (1D)
R	01-200	790425A6	1	Starter, pneumatic (VKO680) (Customer Option)	-	790425A4	(A)(S1) (1D)

C. Instruction disposition codes:

R (A) New standard of unit will be made available from October 2000.

R (S1) Old and new units are freely and fully interchangeable.

R (1D) Old standard of unit may be reworked.

3. Accomplish Instructions

A. Rework Instructions

R Refer to the attached Sumitomo Precision Products Service Bulletin 80-2515.

B. Assembly Instructions

The revised pneumatic starter introduced by this Service Bulletin is interchangeable with existing. Remove and install in accordance with current
R overhaul procedures and maintenance practices (Engine Manual, 72-00-60
R (71-00-02), Removal and Installation and Aircraft Maintenance Manual, 80-13-41, Removal/Installation (A1/A5), 80-11-01, Removal/Installation (D5)).

C. Recording Instructions

R A record of accomplishment is required (Refer to the attached Sumitomo Precision
R Products Service Bulletin 80-2515).

SUMITOMO PRECISION PRODUCTS CO., LTD.

SERVICE BULLETIN

HAMILTON SUNDSTRAND 80-2515 STARTING - PNEUMATIC STARTER - INSPECTION OF THE SYNCHRONOUS ENGAGEMENT CLUTCH AND REPLACEMENT OF THE WAVE SPRINGS

Revision	Date	Pages Affected
1	Mar 28/02	1 through 20

1. Planning Information

A. Effectivity

All Pneumatic Starters with the part numbers: 790425A3 or 790425A4

NOTE: The part number of the starter is changed after you do this service bulletin. The new part number is 790425A5 or 790425A6 depending on the incoming starter part number. The serial number of the first production starter with the new part number is A11284.

NOTE: The Pneumatic Starters are installed in Airbus A319, A320, A321 and Boeing/ Douglas MD90 aircraft that use IAE/V2500 engines.

B. Reason

(1) Problem - There have been removals of the PS400-1D Pneumatic Starter because the drive shaft has sheared. The synchronous engagement clutch that was designed to prevent crash re-engagements and drive shaft shearing is exhibiting wear.

(2) Cause - The two wave springs, one small and one large, in the clutch assembly are relaxing and loosing their force. The lower spring force does not position the clutch parts properly and allows the clutch parts to contact one another when the engine is running. This causes wear on the back side of the output shaft. The wear increases the gap between the clutch jaw teeth, that are shimmed to a tolerance during assembly of the starter. The increased gap delays the engagement of the clutch jaw allowing the jaw teeth to skip one or two teeth during the synchronized re-engagement of the starter to the engine. The problem only occurs during a running re-engagement of the starter. This delay in engagement of the clutch jaw allows the starter to develop high torque and results in the drive shaft shearing at the shear section and usually allows the starter free run.

(3) Solution - The two wave springs, one large and one small, are replace with 4 new wave springs, two large and two small, that each have higher forces than the original springs. The clutch parts are reworked to make the wave spring pockets deeper to accommodate the new springs. The higher total force created in each wave spring location by the two wave spring packs will minimize the wear on the output shaft and will allow the clutch jaws to engage within one jaw tooth of rotation when the starter is accelerating and becomes synchronized with the decelerating engine speed.

(4) Substantiation - Test starters were run through running re-engagements on a test stand using field returned clutch hardware that had caused drive shafts to shear on aircraft. We consistently could shear the drive shaft with the relaxed springs and worn shafts. The new springs were installed and we could occasionally shear the shaft. The worn parts were replaced and the clutch assembled with the new springs. Running re-engagements were conducted at speeds up to 6000 RPM with no failures.

C. Description

(1) The 790425A3 and 790425A4 Pneumatic Starters are disassembled to gain access to the Synchronous Clutch assembly. The Synchronous Engagement Clutch is disassembled and inspected and the parts are reworked or replaced based on the inspection results. The two wave springs located within the clutch are replaced by four new wave springs.

D. Compliance

(1) Do when the starter is at a maintenance facility capable of performing the modification.

E. Approval

(1) This Service Bulletin 80-2515 (IAE SB V2500-ENG-80-0015) has been technically approved by IAE. The part number changes shown in paragraph 3 of this Service Bulletin have been sanctioned under a product development/control system that has been approved by the D.G.A.C. (Direction Generale de L'Aviation Civile) - Paris.

F. Manpower - Approximately 5 man-hours are necessary to do these Service Bulletin procedures when you do component maintenance (or overhaul). The estimate does not include any time for a test. This time is divided as shown here:

(1) Approximately 4 man-hours are necessary to inspect and rework the clutch parts per the SK rework in the accomplishment instructions.

(2) Approximately 1 man-hours are necessary to assemble the synchronous engagement clutch, part number 803188-3 SK1000027 and install it in the Pneumatic Starter.

G. Weight and Balance

(1) None

H. Electrical Load Data

(1) Not Affected

I. References

(1) Component Maintenance Manual (CMM) 80-13-41

J. Other Publications Affected

(1) CMM 80-13-41

2. Material Information

A. Material - Price and Availability

(1) Refer to Table 1.

B. Industry Support Information

(1) None

C. Material Necessary for Each Component

(1) Material to be Purchased

(a) This Service Bulletin change will use the parts in the list for each Pneumatic Starter that is changed.

(b) Any parts that usually are discarded when you disassemble the Pneumatic Starter are not in the list.

(c) In the list of parts for this change, MSQ is the “Minimum Sales Quantity”. the parts that have an entry in this area of the list are supplied only in this quantity, or a multiplication of this quantity.

(d) In the list of parts for this change, the “key word” is a one-word name for the part.

(e) In the list of parts for this change, the “instruction codes” tell you what to do with the parts. A short list under the list of parts tells you about the instruction codes that are used in the list.

(f) The prices that are shown are estimates for one part. When you buy the parts, the prices may be different. If more data is necessary, ask your account representative. Send requests to:

Mail: Hamilton Sundstrand
United Technologies Corporation
Attention:Sales Order Administration
1 Hamilton Road
Windsor Locks, CT 06096-1010

Telephone: (860) 654-6863
FAX (General Communication): (860) 654-6905
Main Switchboard: (860) 654-6000
SITA Communications: (HFDHT7X
SITA SPEC 2000 Address: RKHHS7X

(2) Material Supplied by the Operator

(a) None

SERVICE BULLETIN

NOTE: If the Synchronous Engagement Clutch, part number 803188-1 needs to be replaced because it does not meet the inspection requirements, it has been superseded to PN 803188-3.

Table 1. Material Information

New PN	Qty	MSQ	Estimated Price	Key Word	PN Before this SB	Instruction Code
803188-3	1	001	10,460.00	Synchronous Engagement Clutch	803188-1	A
1000664-1	2	001	240.00	Wave Spring Washer	813590-1	B,E
813396-1	1	001	520.00	Starter Ball Guide	813396-1	CE
813428-1 through -7	AR	001	65.00	Spacer Ring	813428-1	E
1000685-1	AR	001	30.00	Spacer ring	new part	F
1000663-1	2	001	210.00	Wave Spring Washer	813558-1	B,E
813389-1 REV SK1000027	1			Carrier Support	813389-1	CE
813390-1	1	001	1,790.00	Ring Gear Carrier	813390-1	CE
813393-1	1	001	1,520.00	Clutch Jaw	813393-1	CE
813398-1 REV SK1000027	1		-	Output Shaft	813398-1	CE
797671-3	1	001	3.60	Identification Plate	797671-3	B,D

Instruction Code A.	The Service Bulletin change adds the “New PN” to the Pneumatic Starter if the clutch is replaced in it’s entirety.
Instruction Code B.	The Service Bulletin change removes the “PN before the SB” from the Pneumatic Starter. Discard the old part and use the new part number.
Instruction Code C.	The “PN before the SB” is reworked or inspected per this service bulletin.
Instruction Code D.	The “PN before the SB” has the same fit and function as the “New PN”.
Instruction Code E.	These parts make up the synchronous engagement clutch assembly PN 803188-3 SK1000027. If you purchase a new clutch assembly it will be part number 803188-3 and you do not need these parts separately.
Instruction Code F.	The Service Bulletin change adds the “New PN” to the Pneumatic Starter if the clutch measurements require that a shim must be added.

D. Material Necessary for Spare

(1) Material to be Purchased

(a) Refer to Table 1.

(2) Material Supplied by the Operator

(a) None

E. Reidentified Parts

(1) None

F. Tooling - Price and Availability

(1) Shimming Ring - 63001001-3

(2) Shimming Fixture - 63001009-1

(3) Locknut Torque Tool - 63001002-3

(4) Shimming Dummy Washer - 63001006-3

(5) Shimming Spacer - 63001007-3

(6) Shimming Dummy Washer - 63001003-3

(7) Shimming Spacer - 63001004-3

(8) Shimming Spacer - 63001005-3

(9) Clutch Inspection Fixture 1 - 63001010

(10) Clutch Inspection Fixture 2 - 63001011

(11) Clutch Measurement Spacer - 63001012

NOTE: Sumitomo can quote tooling price and availability upon request. Some of the tools can be manufactured locally.

3. Accomplishment Instructions

A. To modify the clutch assembly PN 803188-1 per the rework procedure SK 1000027 and reidentify it as PN 803188-3 Rev (SK1000027), use the steps that follow:

NOTE: The reworked clutch assembly PN "803188 -3 Rev.(SK1000027)" is functionally equivalent to a new production clutch PN 803188-3, but the internal clutch parts are slightly different and are not interchangeable. If the clutch parts fail these inspections, the entire clutch assembly must be replaced with a new clutch assembly PN 803188-3 or another acceptable PN 803188-3 Rev. (SK1000027).

(1) Remove the transmission housing from the Pneumatic Starter. Use the procedure in DISASSEMBLY of the CMM to do this.

(2) Remove the synchronous engagement clutch assembly PN 803188-1 from the gear cage.

(3) Disassemble the clutch using the procedure in DISASSEMBLY of the CMM to do this.

(4) Remove and discard these parts:

(a) Wave Spring PN 813558-1

(b) Wave Spring PN 813590-1.

(5) Remove these parts and keep them. You will inspect and or change them and use them to rebuild the Pneumatic Starter:

(a) Support, Carrier, part number 813389-1

(b) Jaw, Clutch, part number 813393-1

(c) Guide, Ball-Starter, part number 813396-1

(d) Output Shaft, part number 813398-1

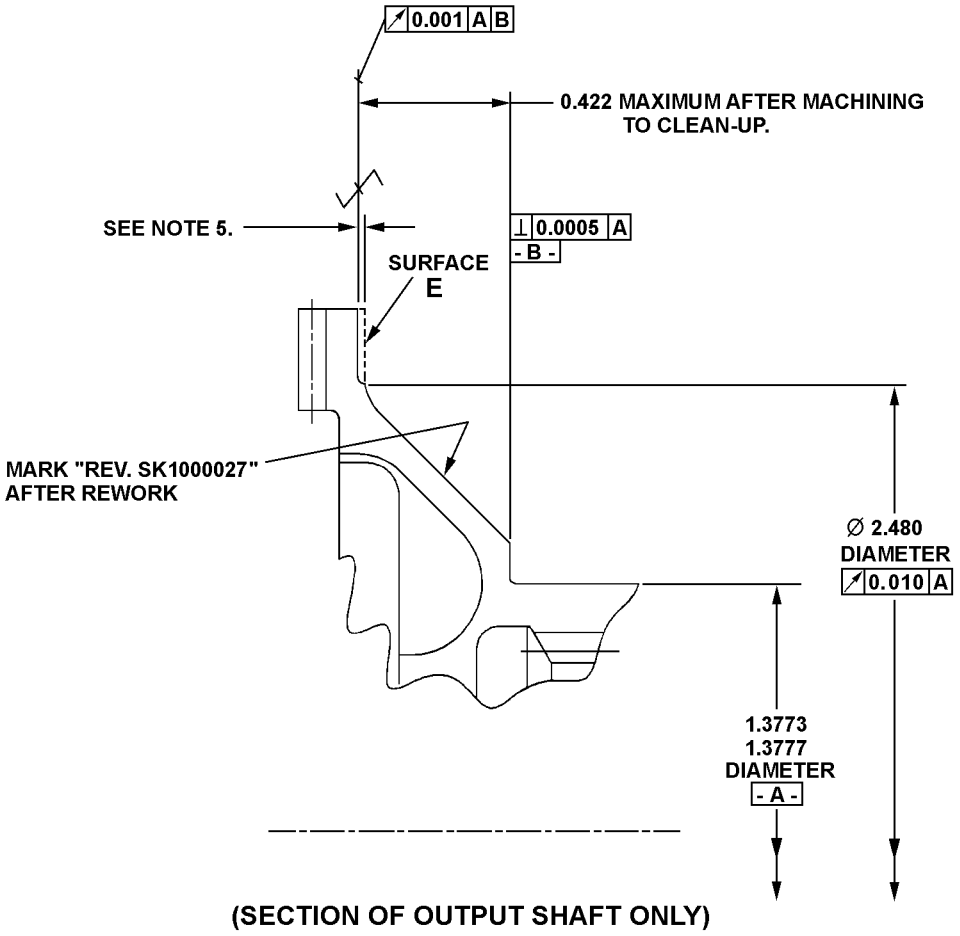
(e) Ring Spacer PN 813428-1.

SERVICE BULLETIN

(6) Inspect output shaft for wear on surface E per Figure 1. If worn, machine to clean up within limits shown in Figure 1.

NOTE: If the wear can not be removed by machining within the limits shown in figure one the shaft must be replaced.

(a) If the part is reworked, vibrapeen SK1000027 following PN 813398-1.



NOTES:
1. SYMBOLS AGREE WITH ANSI Y14.5.
2. DIMENSIONS IN INCHES.
3. MATERIAL PER ASTM A535
4. HARDNESS 34 - 44 RC
5. MINIMIZE STOCK REMOVAL WHEN YOU MACHINE TO CLEAN-UP. DO NOT REMOVE MORE THAN 0.010 INCH MAXIMUM.

Figure 1. Output Shaft inspection and Rework

SERVICE BULLETIN

(7) Rework and Inspect Support Carrier PN 813389-1 as shown in Figure 2.

(a) Rework the wave spring and bearing bore to 0.404 +/- 0.003.

(b) Measure dimension H from the top of each of the three balls to surface -A- and record the average result of the three measurements.

(c) Measure dimension J from surface -A- to the bottom of the large wave spring bore and record.

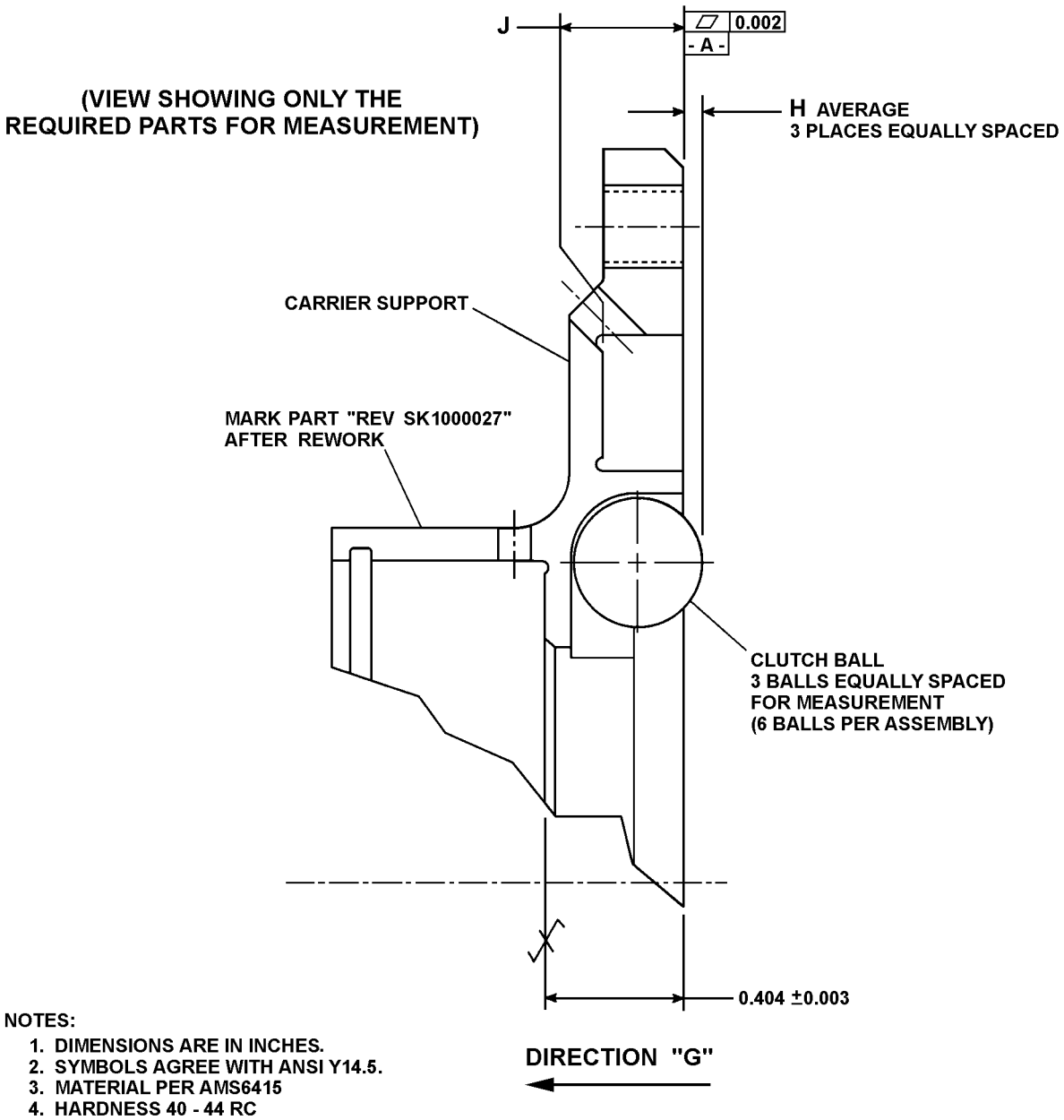


Figure 2. Rework and Measurement of Support Carrier

(8) Inspect and record dimensions M and N per Figure 3.

(a) Put the output shaft in ring gear carrier.

(b) Put clutch jaw PN 813393-1 in ring gear carrier. Load the output shaft and jaw against the ring gear carrier in direction F.

(c) Measure and record dimension M.

(d) Take the clutch jaw PN 813393-1 out of the ring gear carrier.

(e) Put measurement spacer tool PN 63001012 shown in Figure 10 on the output shaft over the three ball pockets.

NOTE: You can locally manufacture the tool shown in Figure 10.

(f) Put two small wave springs PN 728851-2 (same part that is used in the turbine bearing stack) on the measurement spacer tool PN 63001012.

NOTE: The two wave springs that are used for inspection of the clutch can not be reused in the turbine assembly. You should paint the inspection spring red and use it only for inspection of clutch assemblies.

(g) Put the ball guide PN 813396-1 on the wave spring and spacer tool.

(h) Put clutch jaw PN 813393-1 in ring gear carrier.

(i) Place the large wave spring PN 813558-1on the back of the clutch jaw PN 813393-1.

NOTE: The wave spring that is used for inspection of the clutch can not be reused in the clutch assembly for flight use. You should paint the inspection spring red and use it only for inspection of clutch assemblies.

(j) Install clutch inspection Fixture 1, PN 63001010, shown in Figure 8 on ring gear carrier and secure with bolts PN 69274-253. This will hold the assembly together and the wave springs provide the force to hold the parts in directions F and G.

CAUTION: MAKE SURE THE PARTS ARE ALIGNED PROPERLY WHEN YOU TIGHTEN THE BOLTS. THE WAVE SPRING CAN BE DAMAGED IF IT IS OUT OF PLACE.

NOTE: You can locally manufacture the tool shown in Figure 8.

(k) Put three balls PN 813425-1 in to three of the six pockets equally spaced apart.

(l) Place Clutch Inspection Fixture 2, PN 63001011, shown in Figure 9 on top of the three balls to take dimension N. Measure from the top of fixture 2 to the top of fixture 1 in three equally spaced locations. The average if the three measurements is dimension N.

NOTE: You can locally manufacture the tool shown in Figure 9.

(m) Add dimension H average from step 7 to dimension N average. If the sum of H plus N is equal to or greater than 0.185 inch, proceed with the following steps. If it is less than 0.185 inch, the clutch assembly must be replaced.

SERVICE BULLETIN

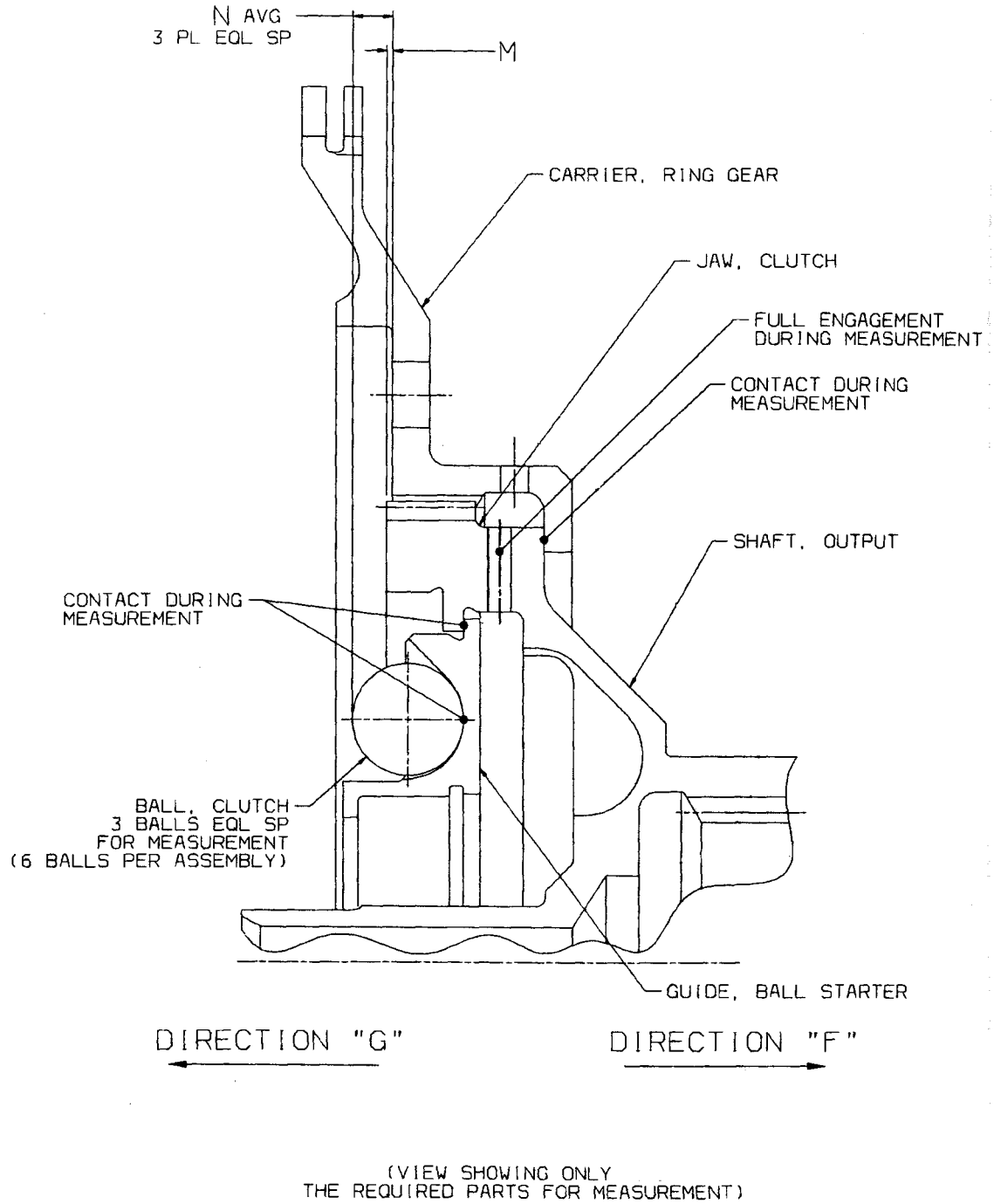


Figure 3. Measurement of Dimensions M and N

B. If dimensional condition in step 3.A.8.(m) is acceptable and the parts were not previous marked during the inspection process, mark the clutch parts as follows using any shallow method impression marking of less than .003 inches. This includes electrolytic etching and vibrapeen:

(1) Mark the support carrier with “(Rev. SK1000027)” following the existing part number 813389-1.

(2) Mark the output shaft with “(Rev. SK1000027)” following the existing part number 813398-1.

(3) Mark the inspected and reworked clutch assembly part number “803188-1” as follows:

(a) Using vibrapeen put “PN 803188-3 (Rev. SK1000027)” on the carrier support as shown in Figure 4.

NOTE: The clutch assembly part number, “PN 803188-1” will not be marked on the clutch assembly that you removed from the starter. You are adding it to identify that the part was reworked to this service bulletin. It is very important to include “Rev. SK1000027” in the part identification. This is part of the part number for a reworked clutch.

SERVICE BULLETIN

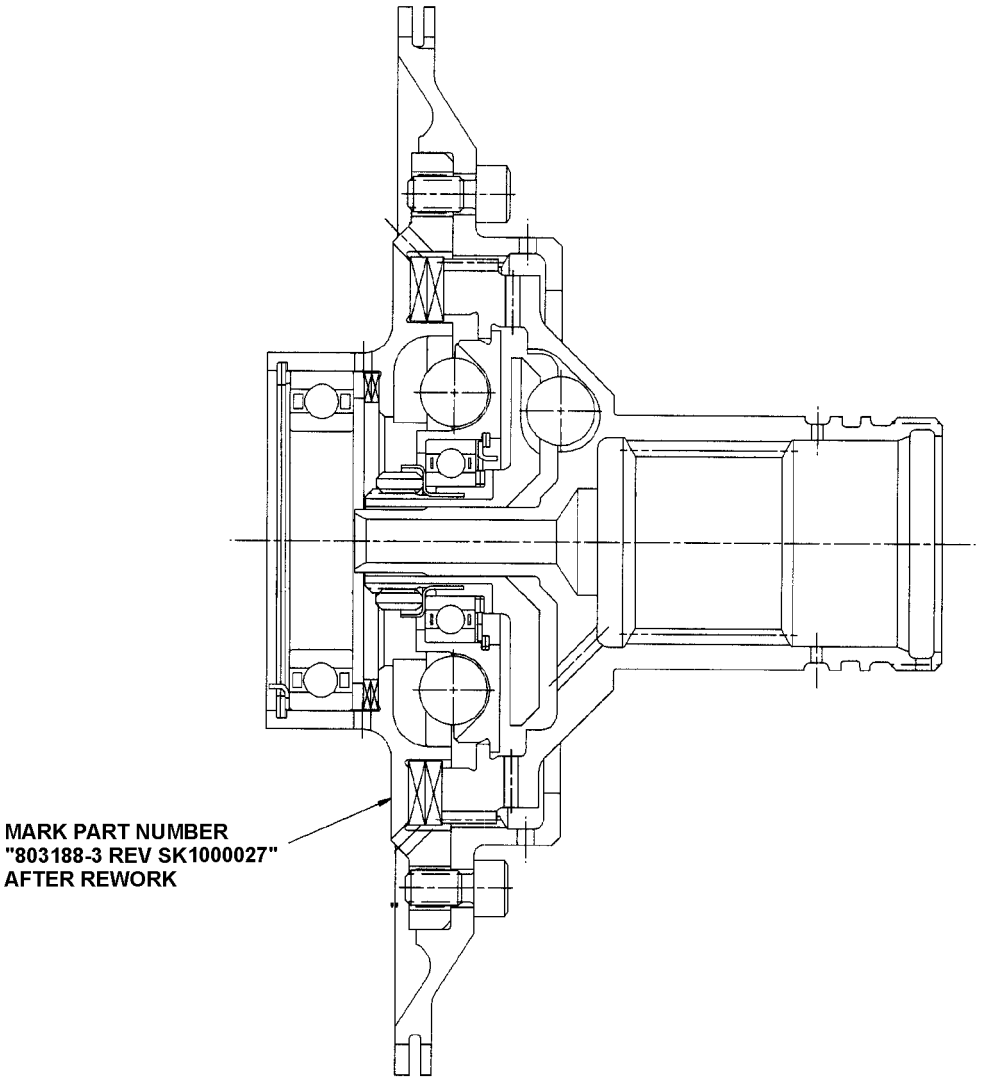


Figure 4. Marking the SK Inspected and Reworked Parts

C. If the clutch is acceptable per step (8), proceed as follows to determine if a spacer is needed in the carrier support and assemble the clutch:

(a) Subtract dimension M from dimension J, recorded in step (7). If the result is equal to or greater than .220 install one spacer ring PN 1000685-1 under the two large wave springs part number 1000663-1 when they are installed in the carrier support.

(b) If the result is less than .220 do not install the spacer under the two large wave springs.

(1) Select a spacer ring PN 813428-1 through -7 to be installed under the carrier support ball bearing as follows:

(a) Install spacer ring, bearing, and lock ring and retaining ring in carrier support as shown in Figure 5.

NOTE: Do not bend lock ring at this time.

NOTE: Do not install wave springs.

(b) Load spacer ring, bearing, and lock ring and retaining ring DIRECTION “G”.

(c) Measure the gap for the wave spring and select Spacer Ring PN 813428-1 through -7 to obtain à gap of .0805 +/- .0025 inches.

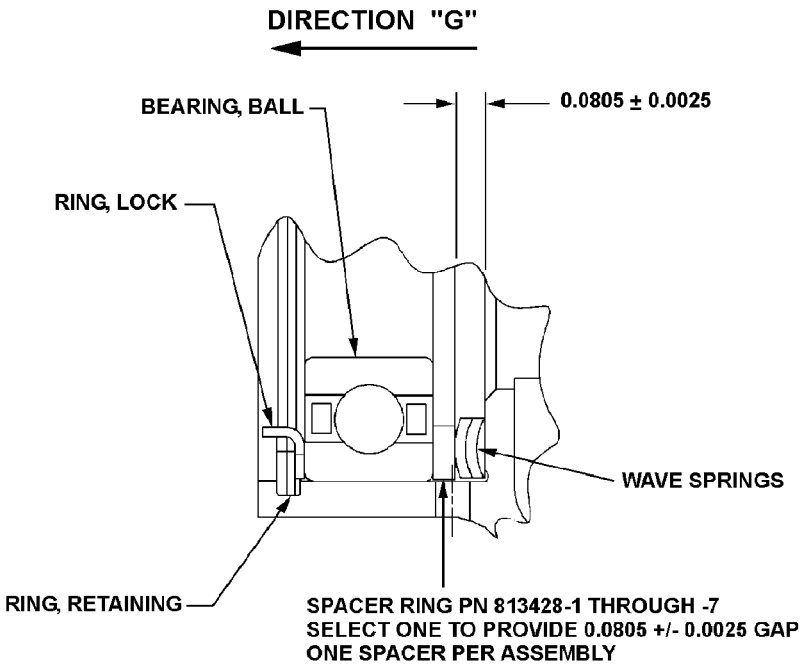


Figure 5. Ring Spacer Selection

SERVICE BULLETIN

(2) Assemble the clutch using the CMM assembly procedure except shim the clutch jaw as follows:

(a) Use the instructions in the CMM Assembly section to assemble the clutch except shim the clutch jaw gap to 0.015 +/- 0.002 inch as shown in Figure 6 and install the new wave springs part number 1000663-1 (2 required) and PN 1000664-1 (2 required) as shown in Figure 7.

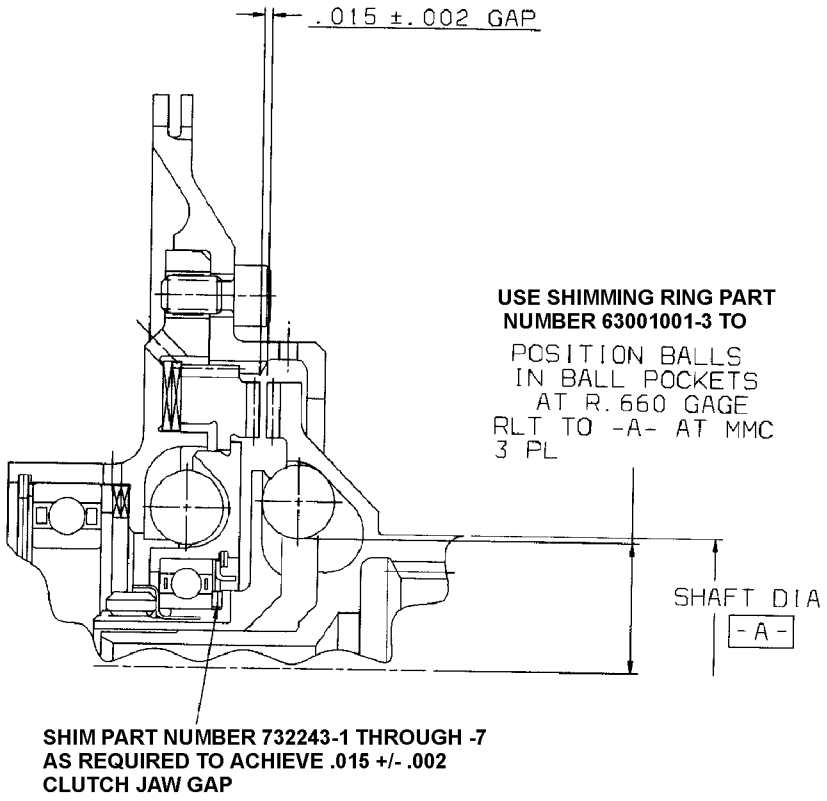


Figure 6. Jaw Shimming

SERVICE BULLETIN

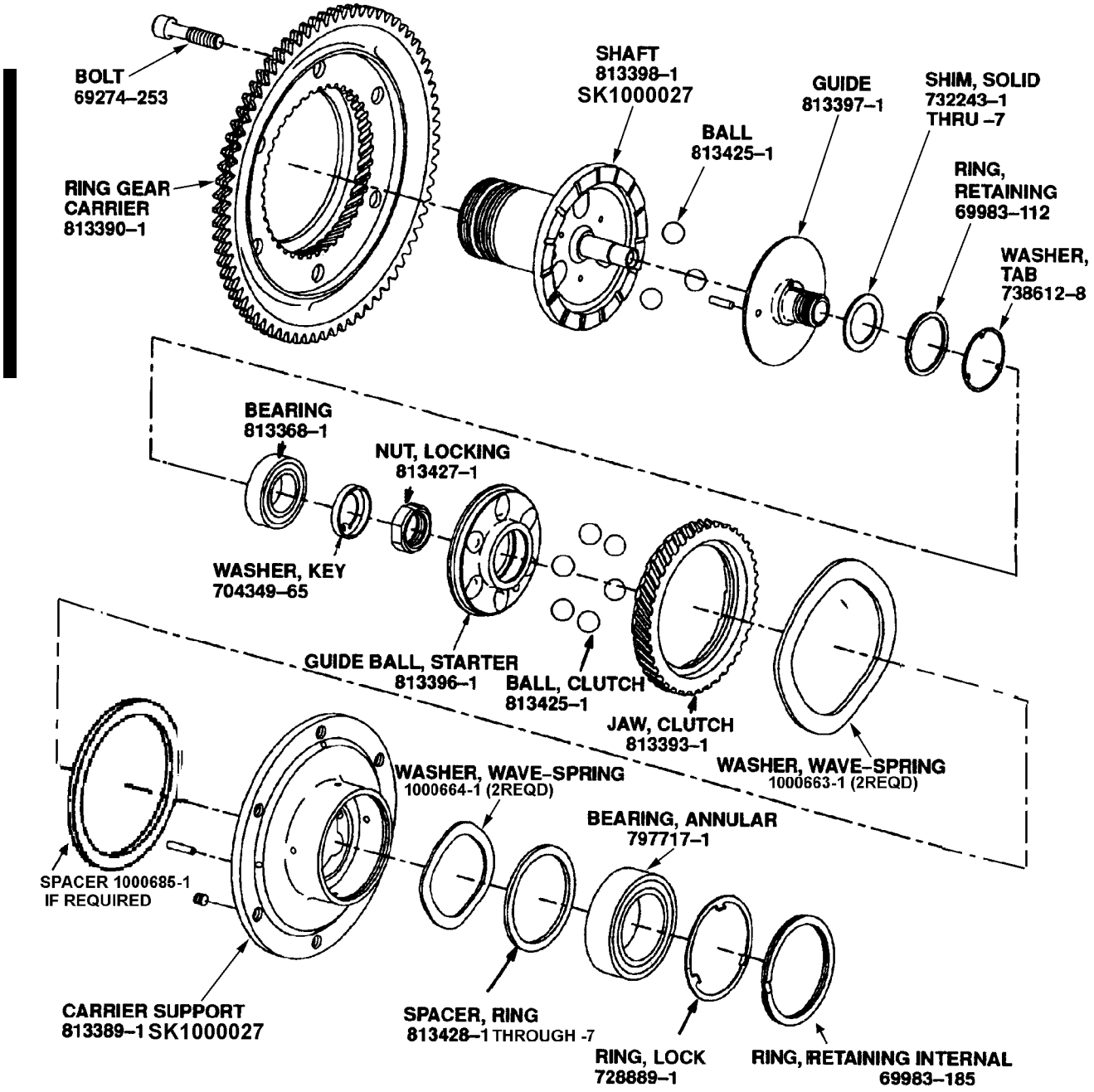


Figure 7. Synchronous Engagement Clutch Assembly

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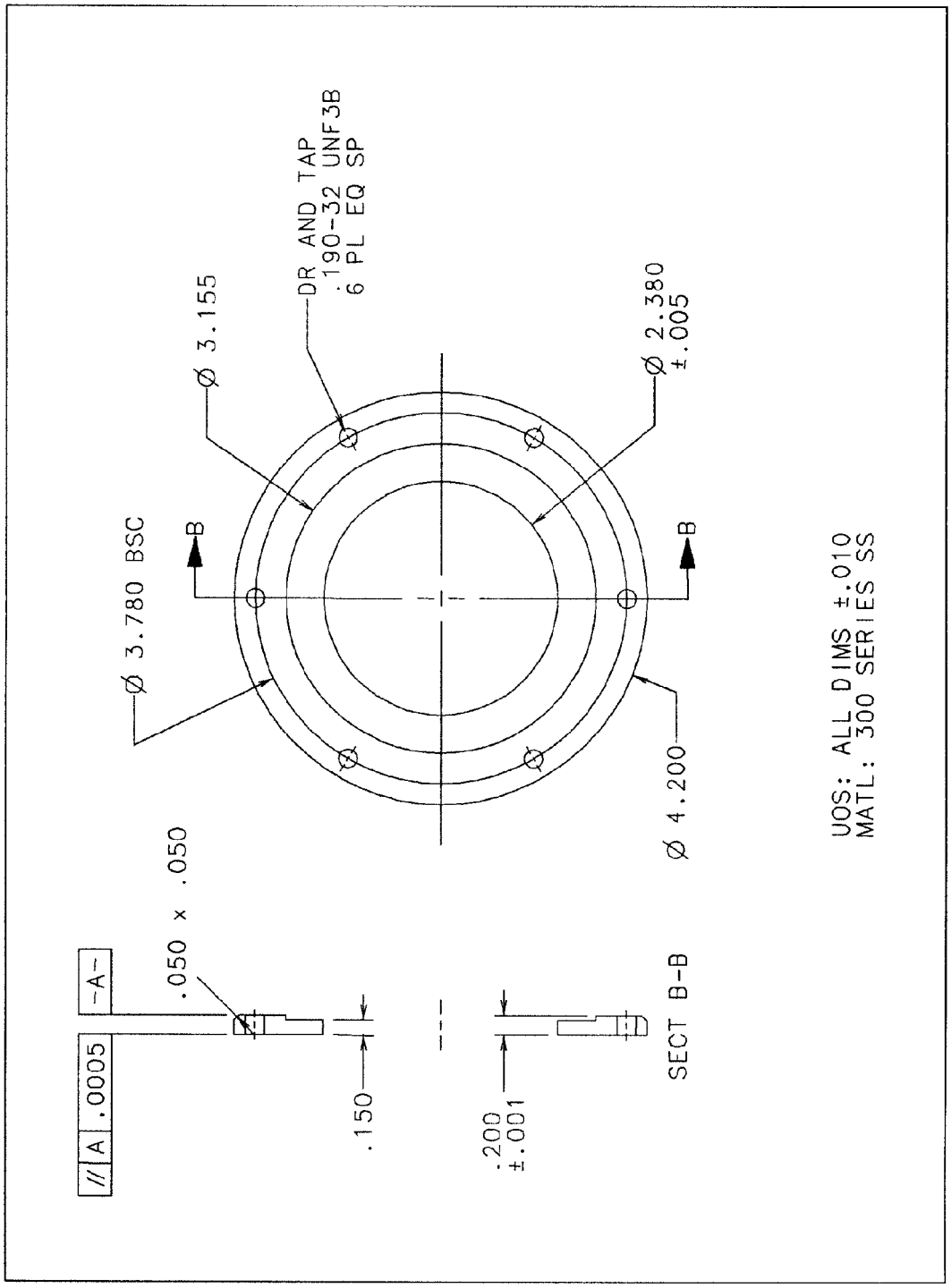

Figure 8. Clutch Inspection Fixture 1 (PN 63001010)

SERVICE BULLETIN

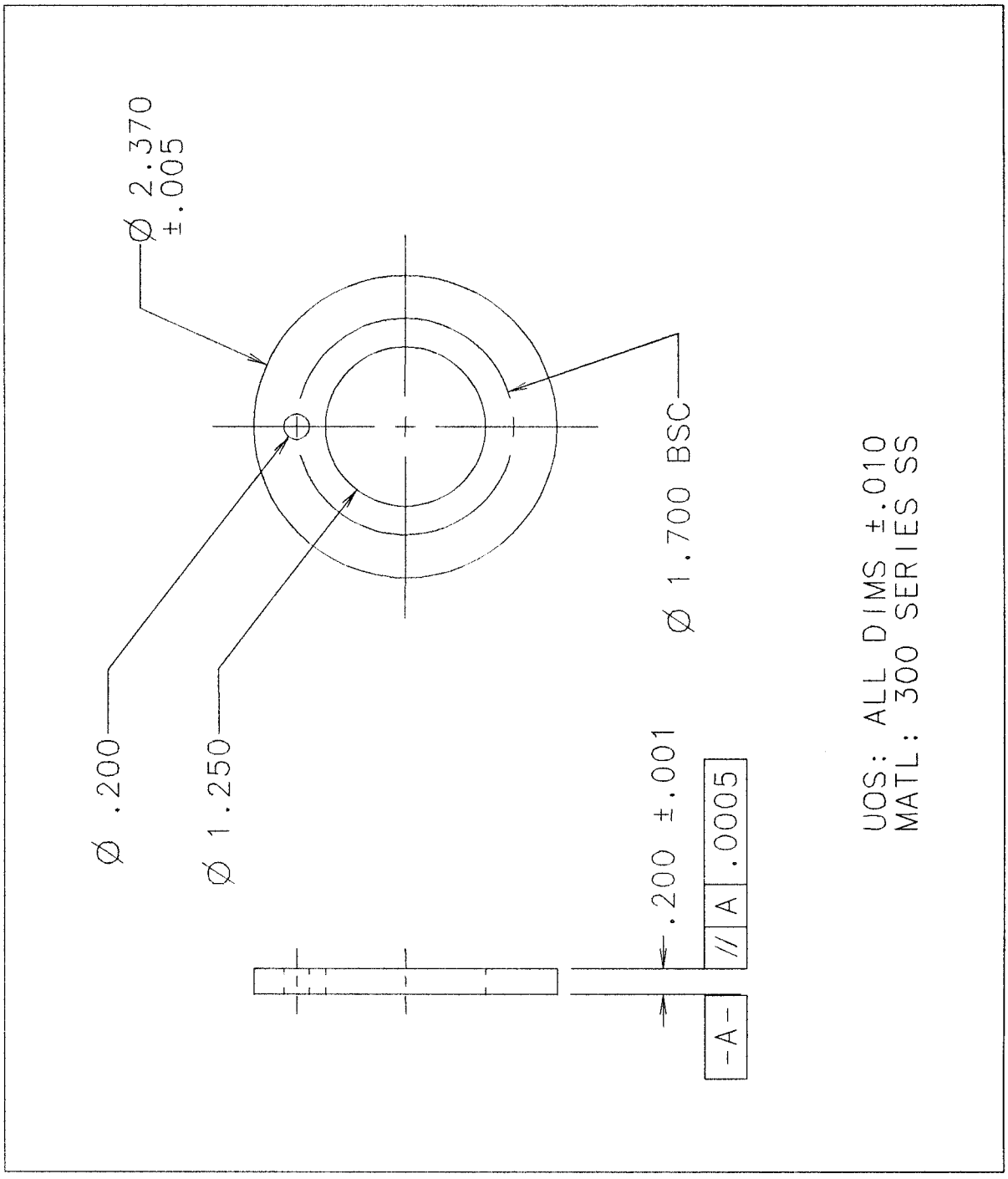

Figure 9. Clutch Inspection Fixture 2 (PN 63001011)

SERVICE BULLETIN

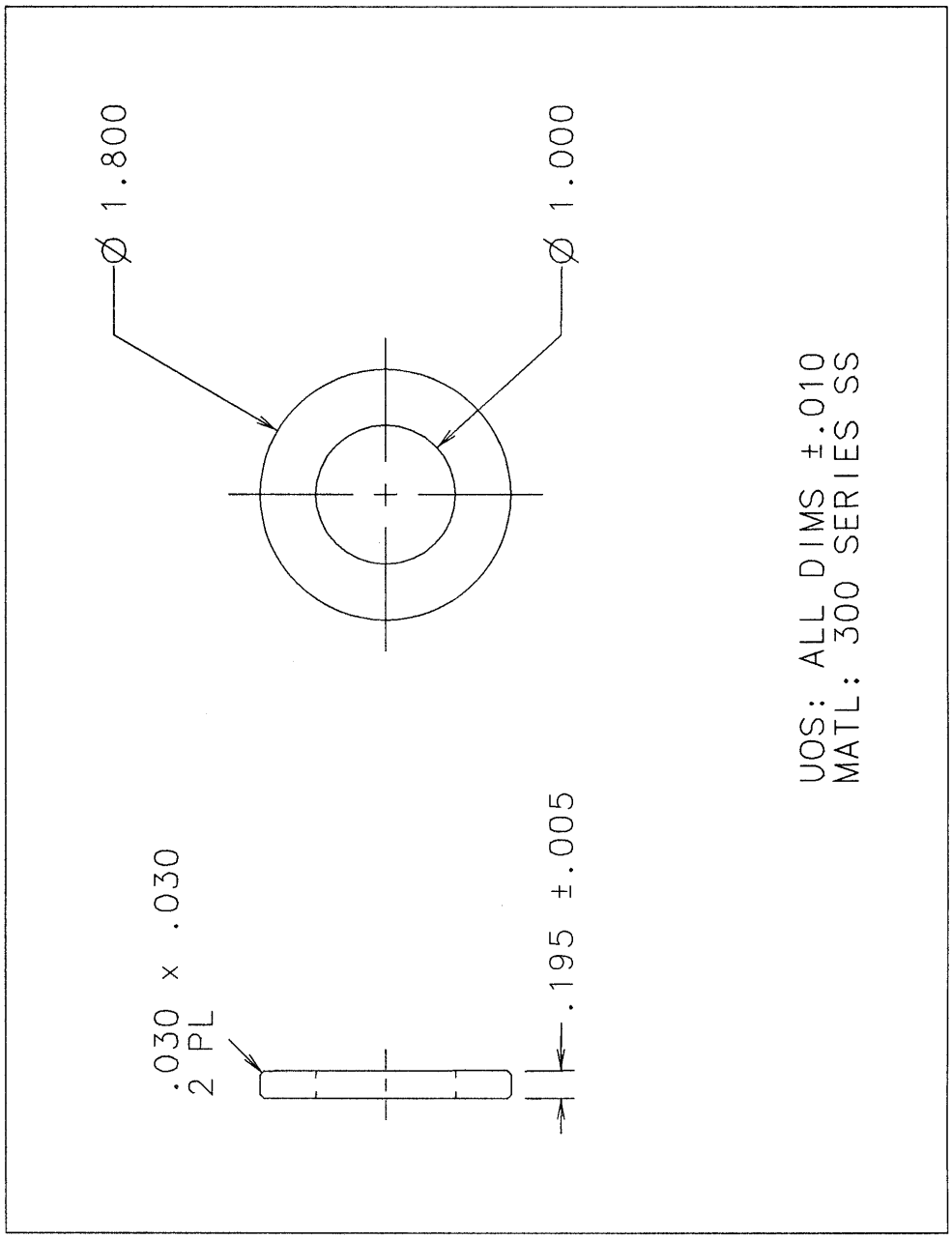

Figure 10. Measurement Spacer Tool (PN 63001012)

D. Reidentification

(1) To show that this service bulletin was done the starter part number is changed. If the starter being modified is part number 790425A3 change the part number to 790425A5. If the starter being modified is part number 790425A4 change the part number to 790425A6.

NOTE: If you replace the identification plate, make sure the unit serial number is marked on the new identification plate.

Hamilton Sundstrand Internal Reference Number 273447
Hamilton Sundstrand Internal Identification Number 80-2515

SERVICE BULLETIN

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