CARE AND OPERATION OF TWIN DISC POWER TAKE-OFFS

MODEL
SP-111-HP-x*

Assembly Drawings SP111Pxxx* and X-9582

Manual #1015591

TWIN DISC, INCORPORATED
Administrative Offices – Racine, Wisconsin

* The numbers designated by "x" will vary.

TWIN DISC, INCORPORATED
EXCLUSIVE LIMITED WARRANTY
GENERAL UNITS

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of twenty-four (24) months from the date of original shipment by Twin Disc, Incorporated to the original customer, but not to exceed twelve (12) months of service, whichever occurs first.* This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.

The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc ,Incorporated's application engineering.

B. The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective and the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages. The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in warranty repair.

2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.

3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.

4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.

5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.

6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or properly, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no-charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

POWER TAKE-OFF SERVICE MANUAL

MODEL
SP-111-HP-x*

Assembly Drawings SP111Pxxx* and X-9582

Manual #1015591

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Twin Disc, Incorporated

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Racine, Wisconsin, U.S.A.

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* The numbers designated by "x" will vary.

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Revision G Page Changes; Cover, Title Page, 5, 7 and 14

GENERAL INFORMATION.

Scope.

This publication provides the information necessary for the operation and maintenance of the Twin Disc, Incorporated equipment specified on the cover of this manual. Specific engineering details and performance characteristics can be obtained from the Service Engineering Department of Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

Operation and maintenance personnel responsible for this equipment should have this manual at their disposal and be familiar with its contents. Applying the information in the manual will result in consistent performance from the unit and help reduce downtime.

Special Tools.

Engineering drawings are included for the fabrication of special tools that should be used during disassembly and assembly of a unit. Repair of this equipment should not be attempted without special tools. Twin Disc does not manufacture these tools for general use.

RENEWAL PARTS AND KITS.

Parts Lists.

Illustrations with complete parts listings are provided in appropriate sections of the manual to facilitate ordering spare or renewal parts and kits.

Ordering Parts.

Renewal Parts and Service Parts Kits, may be obtained from an authorized Twin Disc distributor or service dealer. They are listed under POWER TRANSMISSION EQUIPMENT in the Yellow Pages of most metropolitan telephone directories.

NOTE

Do NOT use planographs included in this manual for ordering parts. Parts must be ordered from the bill of material (formally specifications). Bill of material numbers are stamped on the unit's nameplate.

If the bill of material sheet from which part numbers are obtained is unavailable, proceed as follows:

1. Provide the figure number of the illustration containing the part, the item number of the part, the description of the part, and the quantity required.

2. Do not use the word "complete", but state exactly each item wanted.

3. Do not designate the quantity by "sets", but specify the part required.

4. Specify the model, bill of material (formally specifications), and serial number of the unit involved. These numbers are stamped on the unit's nameplate.

Parts Shipment.

Furnish the complete shipping destination and postal address. All parts shipments made from the factory will be F.O.B. factory location, U.S.A. State specifically whether the parts are to be shipped by freight, express, etc. If shipping instructions are not specified on the order, the equipment will be shipped the best way, considering time and expense. Twin Disc, Incorporated will not be responsible for any charges incurred by this procedure.

Twin Disc, Incorporated, having stipulated the bill of materials (formally specifications) number on the unit's nameplate, absolves itself of any responsibility resulting from any external, internal, or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, emanating from any of the above stated changes will not be accepted for credit. Furthermore, any equipment which has been subjected to such changes will not be covered by a Twin Disc Warranty.

PREVENTIVE MAINTENANCE-TROUBLE SHOOTING.

Frequent reference to the information provided in this manual regarding daily operation and limitations of this equipment will assist in obtaining trouble free operation. Schedules are provided for the recommended maintenance of the equipment, and if observed, minimum repairs, aside from normal wear, will result.

In the event a malfunction does occur, a trouble shooting table is provided to help identify the problem area, and list information that will help determine the extent of the repairs necessary to get a unit back into operation.

LIFTING BOLT HOLES.

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product.

CAUTION

These lifting points must not be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

CAUTION

Select lifting eyebolts to obtain maximum thread engagement with bolt shoulder tight against housing. Bolts should be near but should not contact bottom of bolt hole.

SAFETY.

General.

Safe operating practices should be employed by all personnel servicing this unit. Twin Disc, Incorporated will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unaccepted maintenance/working practices.

Important Safety Notice.

Because of the possible danger to person(s) or property from accidents which may result from the use of manufactured products, it is important that correct procedures be followed. Products must be used in accordance with the engineering information specified. Proper installation, maintenance, and operation procedures must be observed. Inspection should be made as necessary to assure safe operations under prevailing conditions. Proper guards and other suitable safety devices or procedures that may be desirable or specified in safety codes should be provided. These devices are neither provided by Twin Disc, Incorporated nor are they the responsibility of Twin Disc, Incorporated.

SOURCE OF SERVICE INFORMATION.

Each series of maintenance manuals issued by Twin Disc, Incorporated is current at the time of printing. When required, changes are made to reflect advancing technology and improvements in state of the art.

Individual product service bulletins are issued to provide the field with immediate notice of new service information. These service bulletins are distributed to all the Twin Disc distributorships throughout the United States and in many foreign countries.

For the latest service information on Twin Disc products, contact a Twin Disc Distributor, or write to the Service Engineering Department, Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

WARRANTY

Equipment for which this manual was written has a limited warranty. For details of the warranty, contact any Twin Disc distributor, service dealer, or the Warranty Administration Department, Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

ADJUSTMENT

CLUTCH – If the clutch does not pull, heats, or operating lever jumps out, the clutch must be adjusted. To adjust the clutch, remove the hand hole plate from the housing and turn the clutch shaft assembly until the adjusting lock pin can be reached. Disengage the adjusting lock pin and turn the adjusting yoke or ring to the right or clockwise, until the operating lever shaft requires 1,540 lbs.-inches of torque to engage, or divide 1,540 by lever length to obtain pounds pull at end of lever.See pages 13 and 14.

BEARINGS

The only approved method for the field adjustment of tapered roller bearings in Twin Disc Power-Take-Off Units is by use of a dial indicator to read actual end play. See pages 15-21.

Adjust tapered roller bearings as follows:

1. Tighten adjusting nut. Roll bearings by rotating shaft to align and seat bearing rollers. Re-check adjusting nut for a tightness which would require 60 lbs.-in. to rotate the shaft in addition to seal drag. This step applies before greasing. Mark notch to use.

2. Back-off bearing retainer the number of notches as shown.

3. Strike output end of shaft with a soft hammer to seat bearing cup (outer race) against bearing retainer. This should give approximately the end play shown.

4. Measure end play with a dial indicator. Place the PTO in a vertical position with input end up. Mount indicator to end of shaft to measure end play. Use a hoist, or other suitable means, and attach to shaft. With a 200 lbs. force, lift the shaft to end of its free travel. This is done to seat bearing cup. Rotate shaft several times to seat and align bearing rollers. Set indicator to zero and release shaft. Use 200 lbs. force and press on end of shaft while rotating it to seat and align bearing rollers in opposite direction. If indicator shows end play out of limits, shim retainer, or adjust bearing nut to give correct end play. End play specified is 0.004-0.007 inches.

5. After obtaining correct bearing end play adjustment, lock or secure bearing retainer.

NOTE

It is recommended after a new Power Take-off has been assembled to an engine or the bearings have been adjusted, to rap the shaft on the end to relieve any preloading that may result due to the resistence of the pilot bearing when being pressed into the flywheel.

LUBRICATION

THROWOUT COLLAR – Apply a small amount of lubricant once a day, before starting, through the fitting on the tapered part of the housing. Lubricate the bronze type collar design daily or after every 10 hours of operation. Lubricate the ball bearing type (periodic lubricated) every 100 hours of operation. Sealed-for-life ball bearing collar needs no further lubrication.

ANTI-FRICTION BEARINGS – Apply a small amount of lubricant to the pilot bearing through hole in the clutch shaft and to shaft bearings through fitting located at the housing hub approximately every 100 hours of operation.

CAUTION

The sealed-for-life pilot bearing should not be lubricated during service, damage to engine crankshaft could result from trapped grease pressure. Clutch shaft, normally, will not be drilled. If drilled, a plug should be installed to prevent inadvertent greasing.

NOTE

When a Power Take-off is being used with a direct drive through a flexible coupling, or any other means, thereby making it impossible to get at the fitting in the end of the shaft, provision should be made for cross drilling of the shaft and installing a fitting between the housing and the hub of the driven member.

LUBRICANT – Use any high grade, high temperature, lithium base gun lubricant for anti-friction bearings, having operating temperatures of 200° F.

DRIVING PLATE REPLACEMENT – Common symptoms indicating the driving plate is worn out. The adjusting yoke cannot be screwed up any tighter and, in the case of riveted-on friction discs, that the rivet heads are flush with the face of the disc. In the case of moulded driving plates, the entire plate must be replaced. In the case of driving plates with riveted-on friction disc, the latter may be replaced. Wherever split driving plates are used, these may be replaced by unbolting Power Take-off housing from engine in order to permit getting at the clutch. With solid driving plates, it is necessary to further remove the clutch from the Power Take-off shaft.

CHECKING FLYWHEEL HOUSING FACE

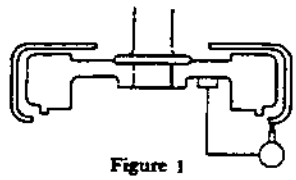


Figure 1

Bolt the indicator to the flywheel so that the indicator is vertical to the housing face and the indicator stem rides on the housing face. (See Fig. 1). Runout should not exceed tolerance listed in table No. 1.

CHECKING FLYWHEEL HOUSING BORE

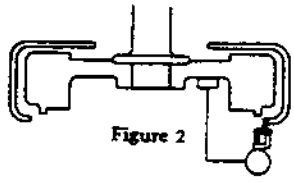


Figure 2

Readjust indicator so that the stem rides on the bore of the flywheel housing. (See Fig. 2). Runout should not exceed tolerances listed in table No. 1.

CHECKING DRIVING RING SURFACE OF FLYWHEEL

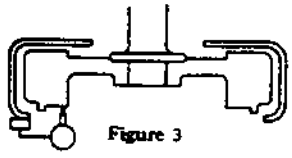


Figure 3

Remove indicator base from flywheel, and bolt indicator to flywheel housing proper, and check flywheel (See Fig. 3).

The variation of the face runout of the surface to which the driving ring or clutch plate is bolted, should not exceed .0005 maximum total indicator reading per inch of diameter.

CHECKING DRIVING RING PILOT BORE OF FLYWHEEL

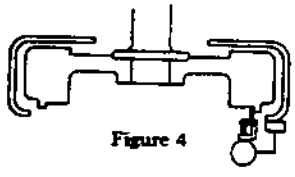


Figure 4

Readjust indicator so that the stem will ride on the driving ring pilot bore. The eccentricity of the driving ring pilot bore should not exceed .005 maximum total indicator reading. Eccentricity between driving ring pilot bore and pilot bearing bore should not exceed .008 total indicator reading.

CHECKING PILOT BEARING BORE OF FLYWHEEL

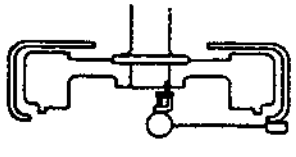


Figure 5

Readjust the indicator so stem rides on the pilot bearing bore cavity. The eccentricity of the pilot bearing bore should not exceed .005 maximum total indicator reading.

REPAIR PARTS – In order to properly identify parts when ordering, always refer to unit and specification number stamped on the pad or plate on the top center of the Power Take-off housing flange.

See page 7.

INSTALLATION – Avoid excessive wear or scrubbing of parts due to misalignment between the engine and the Power Take-off. If wear is experienced check the following:

1. Excessive loads tend to deflect parts to which Power Take-offs are mounted. To determine deflection under actual operating conditions, a dial indicator may be mounted on a rigid part of the engine, such as the crankcase, or independently on the foundation. Readings taken before the drive is installed, with the engine standing still and when under actual operating conditions, will indicate the extent of such deflection. In no case should the indicated deflection exceed .010-inch at the bearing in the Power Take-off housing.

2. To determine the concentricity of the flywheel housing bore and the alignment of the flywheel housing face, a dial indicator should be used in the manner shown. All measurements should be taken with the assembled engine mounted on its supports after the flywheel and housing has been thoroughly cleaned.

MODEL SP-111-HP-1 (X9582) POWER TAKE-OFF DISASSEMBLY AND ASSEMBLY

REMOVAL AND DISASSEMBLY

1. Remove all attached parts from the output end of the clutch shaft (27). Remove the key (28) and grease fitting (29) from the output end of the clutch shaft.

2. Remove the hex-head cap screws that secure the clutch housing (34) to the engine flywheel housing. Use two 7/16-14 thread pusher screws in the tapped holes of the clutch housing flange, and remove the power take-off from the engine.

3. Remove the hex-head cap screws that secure the driving ring (1) to the engine flywheel. Remove the driving ring.

4. Support the clutch housing with wooden blocks on a work bench with the clutch end up.

5. Use a standard bearing puller, and remove the pilot bearing (2) from the clutch shaft.

6. Remove the jam nut (19) and the lock washer (18) from the hose fitting (17a) located in the clutch housing. Push the grease fitting (20) with the hose fitting (17a) into the clutch housing.

7. Straighten the bent portion of the hub nut lock washer (4) from the hub nut (3). Remove the hub nut and lock washer from the clutch shaft. Discard the hub nut lock washer.

8. Fit a protective cap (hardwood, bronze, brass or the like) over the pilot bearing end of the clutch shaft (27). Pry or pull on the hub-and-back plate with force while you apply a sharp rap to the pilot end of the clutch shaft. The shock will free the hub-and-back plate taper from the shaft taper. Remove the hub-and-back plate with attached parts from the clutch shaft. Remove the key (26) along with the hub-and-back plate.

9. Straighten and remove the three cotter pins (7) from the lever headed pins (9). Remove the lever headed pins (9) and spring washers (8). Remove the levers, sliding sleeve, and collar groups as an assembly from the floating plate (11).

10. Use a screw driver to depress the adjusting ring lock pin (13) and remove the adjusting ring (14) from the hub-and-back plate. Remove the adjusting ring lock pin (13) and spring (12) from the floating plate (11). Remove the floating plate (11) and driving plate (6) from the hub-and-back plate.

11. Remove the hose (17c) from the fitting (17b) in the collar assembly (16b). Remove the fitting (17a) from the hose (17c). Remove the fitting (17b) from the collar. Remove the hydraulic fitting (20) from the hose fitting (17a).

12. Remove the two hex nuts (16a) and hex-head cap screw (16d) which secure the collar to the sliding sleeve. Remove the collar (16b) and two shims (16c) from the sliding sleeve (15d).

13. Straighten and remove the six cotter pins (15c) from the six headed pins (15a). Remove the headed pins (15a) lever links (15b), and levers (10) from the sliding sleeve.

14. Remove the hex-head cap screw (21), lock washer (22), and lock (23) from the housing (34), securing the bearing retainer (24) to the housing. Remove the bearing retainer (24) from the housing.

15. Press the clutch shaft (27) out of the clutch housing and tapered roller bearings (25) and (30). Press on the output end moving the shaft from the rear toward front out of the housing opening. The forward bearing cup (25) will remove with the shaft and bearing cones. If removal of the rear bearing cup is required, a punch can be used through the two holes provided at the rear of the housing. The holes have small plastic dust seals which have to be pried from the housing to expose the punch access holes.

16. Remove the bearing cones (25) and (30) from the clutch shaft (27) with a puller or arbor press. The cones are mounted back-to-back, and remove in opposite directions from the shoulder machined on the clutch shaft.

17. Remove the headless setscrew (31) from the clutch housing only if replacement of the part is necessary or cleaning of the grease passage is required.

18. Remove the lubrication fitting (32) from the clutch housing (34). Remove the lubrication fittings (33) only if the repalcement of parts is necessary.

19. Remove the two round head machine screws (39) which secure the instruction cover plate to the housing. Remove the plate (38) and gasket (37).

20. Remove the lever cap screw (35) from the hand lever (36), and remove the hand lever from the operating shaft. Remove the two hex-head cap screws (42) and lock washers (43) from the throwout yoke (44). Remove the operating shaft (41), throwout yoke (44), and Woodruff keys (40) from the clutch housing (34).

ASSEMBLY AND INSTALLATION

1. Install the lubrication fittings (33) if removed previously. Install the lubrication fitting (32) into the housing (34).

2. Install the operating shaft (41) halfway into the clutch housing. Slip the throwout yoke (44) onto the operating shaft and push the shaft through the opening on the other side of the housing. Install one Woodruff key (40) in the operating shaft. Slightly move the throwout yoke on the operating shaft and install the other key. Install the two 3/8-16 x 1-1/2 hex-head cap screws (42) and lock washers (43) to secure the throwout yoke to the operating shaft. Tighten the cap screws (42) to 38-42 lbs.-ft. torque.

3. Secure the hand lever (36) to the operating shaft with the 1/2-13 x 1-3/4 hex-head cap screw (35). Tighten the cap screw (35) to 86-95 lbs.-ft. torque.

4. Use an arbor press, and press the clutch shaft (27) into new clutch shaft tapered roller bearing cones (25) and (30). The cones are positioned back-to-back against the shoulder on the shaft. The shaft must be turned around for the second cone installation, as the cones mount from opposite ends of the clutch shaft.

5. Use a piece of steel tubing approximately 10 inches long and slightly less in diameter than the outside diameter of the bearing (30) and drive or press the rear bearing cup into the bearing bore of the clutch housing, until it bottoms.

6. Use wooden blocks on a work bench and support the clutch housing (34) with the clutch end facing upward.

7. Install the clutch shaft (27) with attached parts into the clutch housing from the clutch end toward the output end.

8. Install the tapered roller bearing cup (25) into the bearing bore over the clutch shaft. Again, use the steel tubing to tap the bearing cup into position in the bearing bore.

9. Install the bearing retainer (24). Adjust the bearing end play by following the instructions outlined on the first page under **"ADJUSTMENT"**. Be sure to rotate the clutch shaft after adjustment, and before taking a reading, to align and seat the bearing rollers. Install the headless setscrew (31) if removed previously.

10. Install the bearing retainer lock (23), lock washer (22) and cap screw (21). Tighten the cap screw (21) to 21-24 lbs.-ft.

11. Place the hub-and-back plate (5) on the bench with the threaded hub up. Install the driving plate (6) onto the hub-and-back plate. Install the floating plate onto the spline of the hub-and-back plate against the driving plate (6).

12. Install the adjusting lock pin spring (12) into the bore provided in the floating plate (11). Install the adjusting lock pin (13), on top of the spring, and depress the pin while installing the adjusting ring (14) onto the threaded hub of the hub-and-back plate. Turn the adjusting ring halfway down the thread.

13. Install six headed pins (15a), six lever links (15b) and three clutch levers (8) to the sliding sleeve (15d). Retain the headed pins with six cotter pins (15c). Spread the ends of the cotter pins so their radius is 0.390 inches for operating clearance.

14. Install the collar halves (16b) and two shims (16c) onto the sliding sleeve (15d). Secure the collar to the sleeve with two hex-nuts (16a) and two hex-head cap screws (16d) 3/8-24 x 2-1/4. Tighten the cap screws and nuts to 38-42 lbs.-ft. torque.

15. Install the levers, sliding sleeve, and collar groups as an assembly to the adjusting ring and floating plate. Hook the levers onto the adjusting ring and position them in the mounting lugs. Place a spring washer (8) on each side of each lever. Retain the levers and washers to the floating plate with three headed pins (9). Retain the headed pins with three cotter pins (7). Spread the ends of the cotter pins.

16. Install the hose fittings (17a) and (17b) on the hose (17c). Install the hose assembly (17) onto the collar by installing the fitting end (17b) into the collar.

17. Partially install the clutch assembly (5-17) onto the clutch shaft (27). Align hub and shaft keyways. Install key (26) into hub and shaft about two-thirds of key length. Lower clutch assembly further, engaging the throwout yoke with trunnions of collar. Tap key home.

18. Secure the clutch assembly to the clutch shaft by installing a new hub nut lock washer (4) and the hub nut (3). Tighten the hub nut against the lock washer to remove clearances and seat tapers. Use 30 lbs.-ft. torque for this. Then tighten the nut to final position by turning it 60° to 90° in tightening direction. Bend a section of the lock washer (4) against a flat on the hub nut.

19. Install the pilot bearing (2) on the clutch shaft (27). Press or drive the bearing to a position where the inner race overhangs the shaft by 0.110 inch (see sketch). Install the grease fitting (29) in the output end of the clutch shaft.

20. Insert the grease fitting and hose fitting (17a) through the clutch housing. Secure the fitting in place with a lock washer (18) and a jam nut (19).

21. Adjust the clutch assembly by the following procedure:

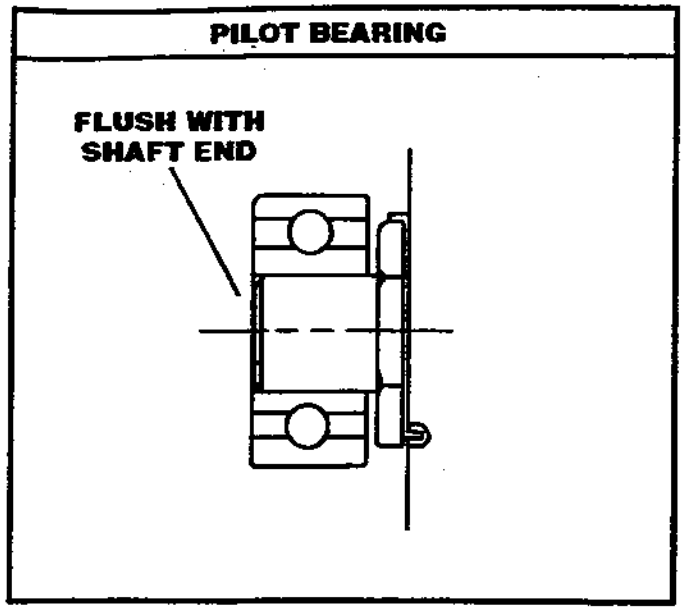
(a) With the clutch disengaged, turn the clutch until the adjusting lock pin (13) can be reached through the hand-hole. Depress the adjusting pin.

(b) Turn the adjusting ring (14) in a clockwise direction one or two notches, or until the hand lever requires distinct pressure. Specifically, 1540 lbs. inches torque on lever shaft or the lever length divided into 1540 to obtain pounds pull at end of lever.

(c) Release the adjusting lock pin and engage it in the nearest locking notch of the adjusting ring.

(d) Engage and disengage the clutch a number of times to make certain the clutch is functioning properly. If proper adjustment has not been accomplished, repeat step (a) through (c) until proper engagement and disengagement is obtained.

22. Place a new hand-hole and instruction plate cover gasket (37) and plate (38) in position on the clutch housing (34). Secure the plate and gasket to the housing with two round-head cap screws (39). Tighten the screws to 21-24 lbs.-ft. torque.



23. Position the driving ring (1) against the engine flywheel and secure it with eight hex-head capscrews. Torque capscrews. Refer to torque chart Page 11 for proper torque.

24. Position the clutch housing (34) against the flywheel housing, carefully aligning the pilot bearing (2) with the flywheel pilot and the driving clutch plate (6) with the driving ring. Secure the clutch housing to the flywheel housing with twelve hex-head cap screws. Rap the output end of the shaft with a soft hammer to relieve any preloading of bearings.

25. Install the key (28) 5/8 x 5/8 x 5-3/8 into the keyway on the output end of the clutch shaft (27), and install all parts, previously removed, to the output end of the clutch shaft.

CAUTION

Most Twin Disc products are made to be mounted directly on the flywheel of the engine. It is possible, due to mismatch of components or many other reasons, to have flywheel to driven component interference. As a result, it is necessary that engine crankshaft end play be measured before the driven component is installed.

After installation of the driven component, crankshaft end play should again be measured. The second measurement should be the same as the first end play measurement. If it is not the same, it could be an indication of interference. Consequently, the driven component should be removed, the source of interference found and corrected.

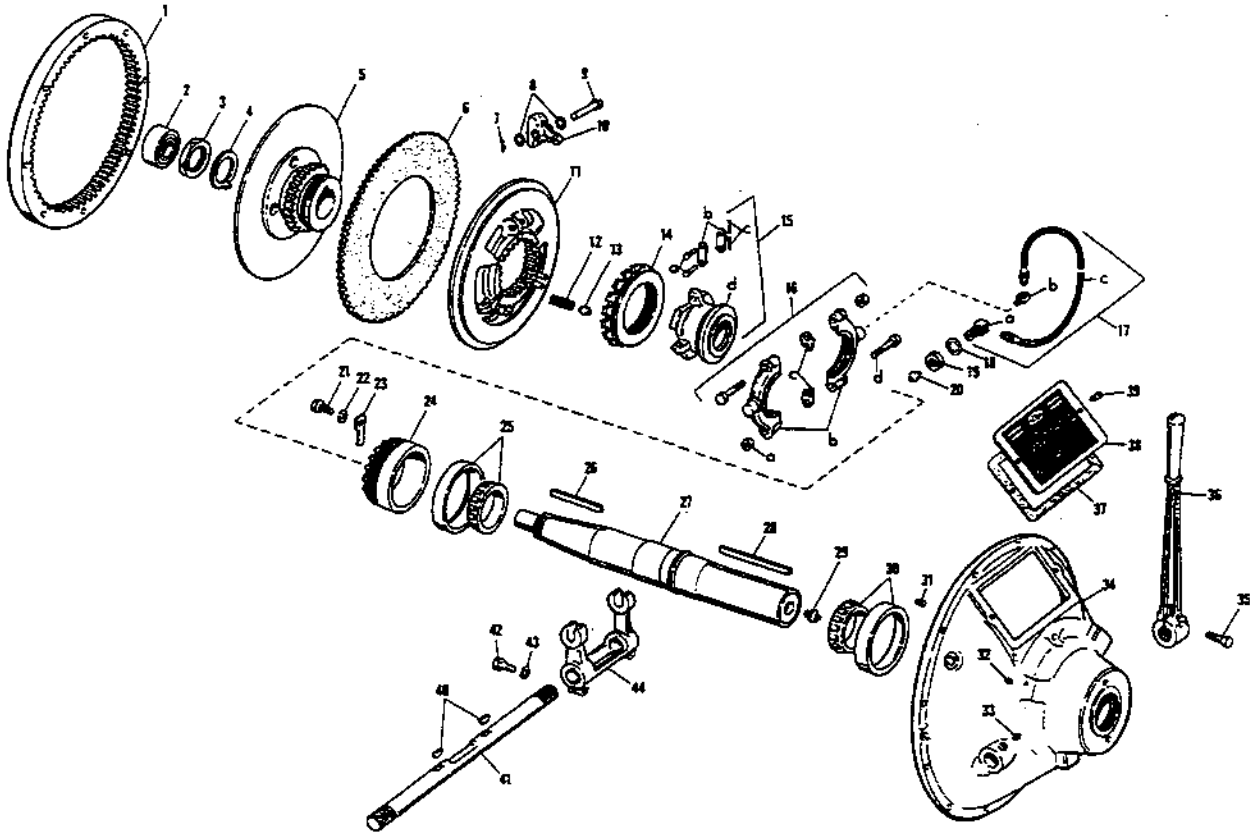
Twin Disc will not be responsible for system damage caused by engine to Twin Disc component interference regardless of the cause of interference. This engine crankshaft end play check is considered mandatory.

LIMITING OPERATING CONDITIONS

Maximum Allowable RPM *

	Cast Iron Driving Ring		Steel or Nodular Iron Driving Ring			
Model	Solid Drive Plates	Split Drive Plates	Solid Drive Plates	Split Drive Plates	Cast Iron Drive Ring	Nodular Drive Ring
SP-111	2850	2200	3600	3200	Part No. 6625-A	Part No. 6625-D

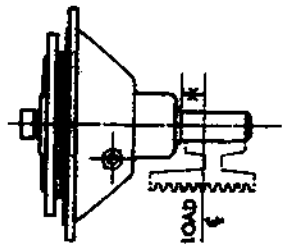
* Maximum RPM should not exceed tabulated speed by more than 8% including governor over run.



Item	Description	Quantity
1	RING, driving	1
2	BEARING, pilot	1
3	NUT, hub	1
4	WASHER, lock (hub nut)	1
5	PLATE, hub and back	1
6	PLATE, driving	1
7	PIN, cotter	3
8	WASHER, spring	6
9	PIN, lever	3
10	LEVER	3
11	PLATE, floating	1
12	SPRING, adjusting lock pin	1
13	PIN, adjusting lock	1
14	RING, adjusting	1
15	SLIDING SLEEVE ASSEMBLY	1
a	PIN, lever link	6
b	LINK, lever	6
c	PIN, cotter	6
d	SLEEVE, sliding	1
16	COLLAR ASSEMBLY	1
a	NUT, hex	2
b	collar	1
c	SHIM	2
d	SCREW, cap, hex-head 3/8-24 x 2-1/4	2
17	HOSE ASSEMBLY	1
a	FITTING	1
b	FITTING	1
c	HOSE, flexible	1

Item	Description	Quantity
18	WASHER, lock	1
19	NUT, jam	1
20	FITTING, hydraulic	1
21	SCREW, cap, hex-head (5/16-18 x 5/8)	1
22	WASHER, lock	1
23	LOCK, bearing retainer	1
24	RETAINER, bearing	1
25	ROLLER BEARING	1
26	KEY	1
27	SHAFT, clutch	1
28	KEY	1
29	FITTING, hydraulic	1
30	ROLLER BEARING	1
31	SCREW, headless set	1
32	FITTING, hydraulic	1
33	FITTING, (oper. shaft)	1
34	HOUSING	1
35	SCREW, cap, hex-head 1/2-13 x 1-3/4	1
36	LEVER, hand	1
37	GASKET	1
38	PLATE, instruction cover	1
39	SCREW, cap, round head 1/4-20 x 1/2)	2
40	KEY, woodruff	2
41	SHAFT, operating	1
42	SCREW, cap, hex-head 3/8-16 x 1-1/2	2
43	WASHER, lock	2
44	YOKE, throwout	1

ALLOWABLE SIDE-PULL LOADS – FOR STANDARD POWER TAKE OFFS



THE FOLLOWING GENERAL FORMULA SHOULD BE USED FOR DETERMINING THE ACTUAL APPLIED LOAD:

$$L = \frac{126{,}000 \times H.P.}{N \times D} \times F$$

WHERE L=ACTUAL APPLIED LOAD (LBS.)
N=SHAFT SPEED, (REV./MIN.)
D=PITCH DIA. OF SHEAVE, ETC.
* F=LOAD FACTOR
"X" DISTANCE, INCHES (SEE SKETCH)

1.0 FOR CHAIN OR GEAR DRIVE
2.5 FOR ALL V-BELT DRIVES
3.5 FOR FLAT BELT
*NOTE: FOR RECIPROCATING COMPRESSORS AND OTHER SEVERE SHOCK DRIVES, MULTIPLY ABOVE FACTORS BY 2.1

PTO	RPM	1	2	3	4	5	6	7	8	9
SP-111-HP-1	1000	2790	2600	2240	1840	1570				
	1200	2630	2450	2240	1840	1570				
	1800	2330	2170	2030	1840	1570				
	2400	2140	1990	1865	1750	1570				

TABLE No. 1 – FLYWHEEL HOUSING TOLERANCES

SAE Housing No.	Face Deviations	Bore Eccentricity
00	.019	.019
0	.016	.016
½	.014	.014
1	.012	.012
2	.011	.011
3	.010	.010
4	.009	.009
5	.008	.008
6	.007	.007

All Figures are Total Indicator Readings Tolerances

POWER TAKE-OFF CHART

Model No.	Drawing No.	Main Bearing T.D. No.	Recommended End Play	Notches Backed-Off From Tight
SP-111-HP-1	X9582	M 207	0.004-0.007	3¼ - 4¼

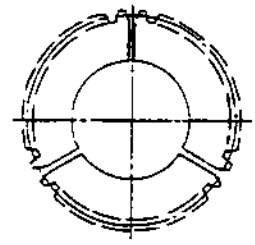
MAXIMUM SPEED

For proper release of clutches with split plates

NOTE: THESE SPEEDS ARE FOR USE WITH INTERNAL COMBUSTION ENGINE DRIVE; FOR ELECTRIC MOTOR DRIVE AND OTHER SMOOTH DRIVES DIVIDE THESE VALUES BY 1.75.

FORMULA: $$n = \frac{2.5}{\sqrt{\frac{8{,}400{,}000 \quad D^2}{N \; W \; \mu_T \; \mu_{PL} \; r_m \sqrt{PD^2 + d^2}}}}$$

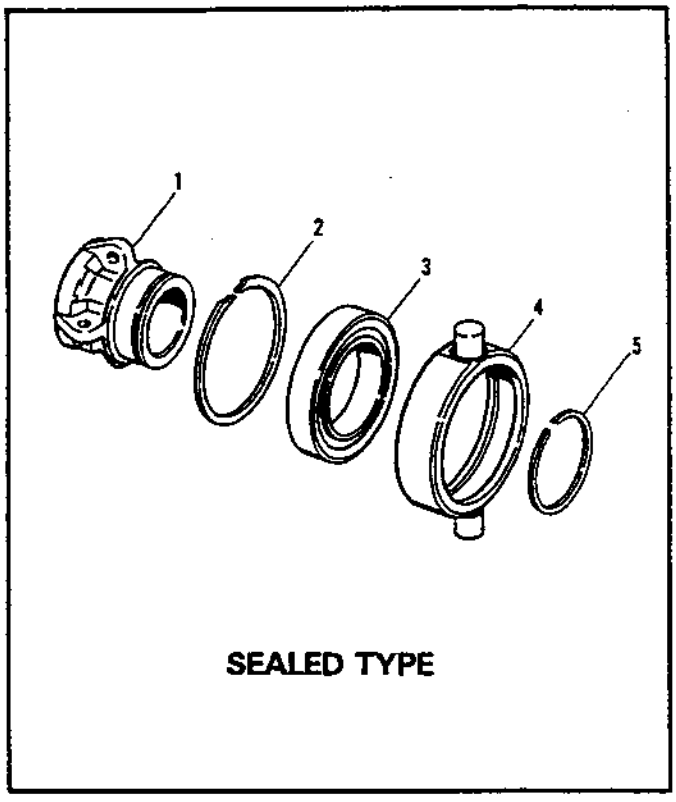
n = Max. speed in RPM for proper release
D = Hub & Backplate O.D. (in.)
N = Number of split plates per clutch
W = Weight of 1 complete split plate (lbs.)
μ_T = .24 for metallic and TD530 molded gear teeth
.18 for TD526 molded gear teeth
μ_{PL} = .18 for friction faces for TD526 and .24 for TD530
$r_m = \frac{D + d}{4}$
PD = Gear teeth pitch dia. (in.)
d = I.D. split plate (in.)



CLUTCH SIZE	PLATE PART NO.	POUNDS PER PLATE	NO. OF SEGMENTS	MATERIAL	MAXIMUM SPEEDS – RPM		
					1 PLATE	2 PLATE	3 PLATE
11½	A5579A	2.67	3	TD 526	2147	1628	1383
11½	A5579E	2.67	3	TD 530	1707	1293	1100
11½	6310K	3.11	3	TD 501	1605	1216	1034

ORDERING PARTS

Renewal Parts and repairs may be obtained from your Authorized Twin Disc Distributor or Service Dealer. You can find him listed under POWER TRANSMISSION EQUIPMENT in the Yellow Pages of most metropolitan telephone directories.



SEALED TYPE

ALTERNATE BALL BEARING THROWOUT COLLAR ASSEMBLY

A ball bearing throwout collar feature is obtainable for this model, PTO. The parts which differ from the standard bronze collar type are: sliding sleeve and throwout collar. New additional parts are; ball bearing (sealed-for-life, or periodic-lubricated) and two snap rings. A lubricating hose, two fittings, a jam nut, washer (shakeproof), and grease fittings go with the periodically lubricated bearing.

OPTIONAL SEALED TYPE BEARING

During disassembly, remove the external snap ring (5), and with a bearing puller remove the collar (4) and bearing (3) form the sleeve (1). Remove the internal snap ring (2), and remove the ball bearing (3) from the collar (4). To assemble, press the ball bearing (3) from the collar (4). To assemble, press the ball bearing (3) into the collar (4). Install the internal snap ring (2) into the collar (4) to retain the bearing. Press the collar and ball bearing onto the sleeve (1) using force on the bearing inner race only. Install the external snap ring to retain the bearing and the collar on the sleeve.

STEPS TO BE TAKEN IN SETTING UP AIR ENGAGEMENT ON TWIN DISC POWER TAKE OFFS

1. The cylinder should be located so that the piston travels in the same plane as the arc of the engagement lever.
2. Air cylinder must be of sufficient size to operate the required torque to engage the clutch. It must have some means to make adjustment to the piston stroke.
3. Air pressure must be constant. Low pressures could give only partial engagement which will cause failures to the clutch plates and throwout collar.
4. Piston travel must be within limits established to engage and disengage the clutch. Failure to adhere to this will cause failure and possible breakage of the clutch.
5. The engaging cylinder must unload itself at the engaged and disengaged position.*

*To further qualify this statement, the engaging collar must float free after engagement or disengagement. Short life on the collar and sleeve will result if proper adjustment is not made.

When adjustments are made to the clutch to take up plate wear the power cylinder rod length must be re-adjusted to assure proper stroke length.

TO DETERMINE THE LENGTH OF TRAVEL FOR THE ENGAGING CYLINDER

*Multiply the length of the engaging arm by the figure given in the engaging stroke column. This will give you the length of stroke in inches, required for the force cylinder.

TABLE I

ENGAGING EFFORTS AND TRAVEL

Model No.	Drawing Number	† Torque on Operating Shaft Required to Engage Clutch Lbs.-in.	* Engaging Stroke Travel at One Inch
C106-SP	X8317 - Nos. 4, 6 Hsg.	940	.238
C106-SP	X8317 - No. 5 Hsg.	940	.218
C107-SP	X8317 - Nos. 4, 6 Hsg.	940	.238
C107-SP	X8317 - No. 5 Hsg.	940	.218
C108-HP	X8419-E	1030	.270
C110-HP	X8249 - Nos. 1, 2, 3 Hsg.	1270	.270
C110-HP	X8249 - Nos. 4 Hsg.	1270	.270
SP111-OP	X9818	1540	.325
SP111-HP	X9582	1540	.325
SP211-HP	X9681	1930	.267
SP211-OP	X9894	1930	.267
SP114-P	X9643	3150	.312
SP214-P	X9803	3150	.312
SP314-P	X9585 & A	3150	.313
IBF214-OP	X9745-C & D	3465	.312
8118-P	X7243-A	3540	.352
8218-P	X7189-8	3540	.352
SP318-P	X9671	7370	.350
IBF318-OP	X9918 & A	7370	.375
EH121-P	X9235	9950	.272
EH221-P	X9236	9950	.280
IBF321-OP	X9919	7370	.375
SP321	X9691-A	7370	.352
EH224-P	X9635	10530	.303

*Multiply engaging stroke travel at one inch by length of engaging lever to obtain piston travel.

TO DETERMINE THE ENGAGING FORCE IN POUNDS REQUIRED AT THE ENGAGING CYLINDER

Use the following formula to determine the engaging piston force in lbs.

† $\frac{\text{Torque on operating shaft}}{\text{Lever Length}}$ = Force in lbs. at piston

Example: C108-HP $\frac{1030 \text{ lbs.-in.}}{10 \text{ in.}} = 103 \text{ lbs.}$

CAUTION NOTES:

1. When using a power engager there is no feel to the adjustment of the clutch.
2. The power engager should be disconnected periodically and required force physically checked with a scale. The use of 66.7% of maximum force for minimum effort to engage is acceptable before readjusting.

ASSEMBLY INSTRUCTIONS FOR PILOT ROLLER BEARINGS

Twin Disc has available roller type pilot bearings in several sizes for use with PTO's and single stage torque converters. Many specifications have been written to include this type of bearing. All of the roller pilot bearings available from Twin Disc are the separate race type i.e. the inner race is removable from the outer race roller and seal assembly. Due to this construction axial alignment of the inner and outer races is most important. Data is given here in general terms which will assure proper bearing mounting for any unit using this type pilot bearing. In most cases installation drawings are also available for specific units using this bearing.

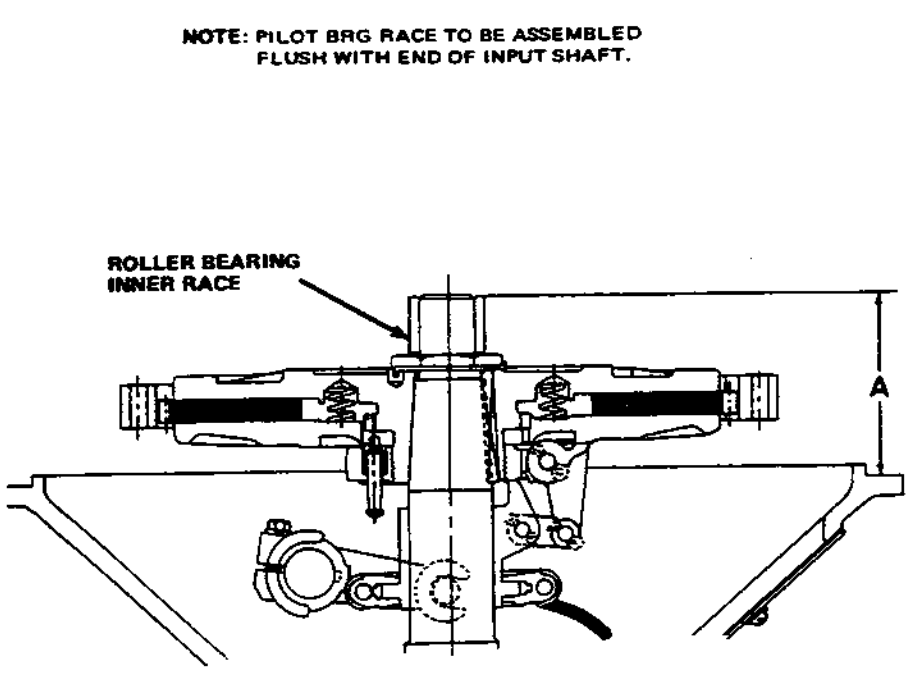


FIGURE 1.

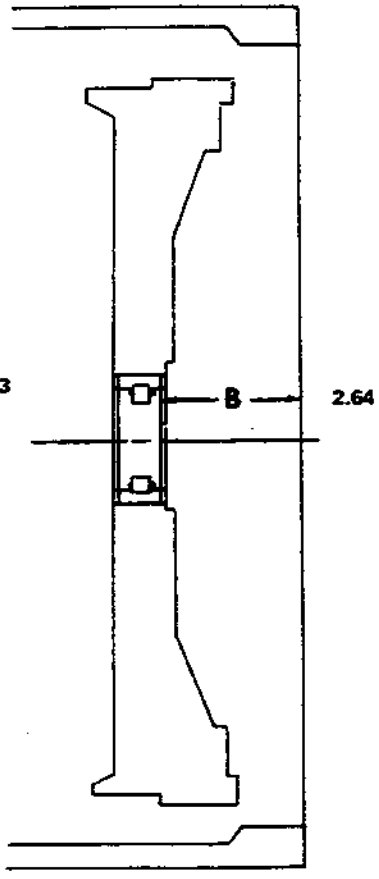


FIGURE 2.

Figure 3. Roller Bearing Data.

Roller Brg. Part No.	Brg. O.D.	Recommended Flywheel Bore	Brg. I.D.	Roller Brg. Width Nominal
M2680	3.1506	3.1500	1.1807	1.1850
	3.1501	3.1494	1.1802	
M2467	2.8356	2.8350	1.1806	1.1850
	2.8351	2.8344	1.1802	
M2529	3.1506	3.1500	1.3775	1.3725
	3.1501	3.1494	1.3770	
M2713	3.9384	3.9377	1.7707	1.5600
	3.9378	3.9367	1.7712	

INSTRUCTIONS FOR ASSEMBLY:

1. Press inner race of roller bearing on clutch shaft flush with end of shaft.
2. Place unit on bench with clutch shaft vertical as shown.
3. Measure dimension A as shown in fig. 1.
4. Installation dimension B for bearing outer race is determined by subtracting the bearing width shown in fig. 3 from dimension A. (B=A—brg. width)
5. Install bearing outer race and roller assembly into flywheel cavity to dimension B.

TORQUE VALUES

FOR TIGHTENING CAPSCREWS, BOLTS, NUTS, TUBE FITTINGS AND PLUGS.

CAP SCREWS, BOLTS & NUTS

TORQUE (LB. FT.) FOR COURSE AND FINE THREADS (1)

NOMINAL THREAD DIAMETER	SAE GRADE 5		SAE GRADE 8		Screws for Universal Joint Bearing Caps
	AS (2) RECEIVED	LUBRI- (3) CATED	AS (2) RECEIVED	LUBRI- (3) CATED	LUBRI- (3) CATED
1/4	9 ± 1	7 ± 1	14 ± 1	11 ± 1	----
5/16	19 ± 2	15 ± 2	27 ± 2	22 ± 2	----
3/8	33 ± 3	27 ± 2	46 ± 4	38 ± 3	----
7/16	52 ± 4	40 ± 3	73 ± 6	60 ± 5	64 ± 4
1/2	80 ± 6	65 ± 5	112 ± 8	90 ± 7	100 ± 7
9/16	112 ± 8	90 ± 8	158 ± 12	130 ± 10	----
5/8	158 ±12	130 ± 10	224 ± 16	180 ± 15	190 ± 10
3/4	280 ±20	225 ± 20	390 ± 30	320 ± 25	330 ± 17
7/8	448 ±32	360 ± 30	630 ± 50	510 ± 40	510 ± 25
1	680 ±50	540 ± 45	960 ± 70	775 ± 60	----
1 1/8	850 ±60	675 ± 60	1360 ±100	1100 ± 85	----
1 1/4	1175 ±85	925 ± 75	1850 ±150	1500 ±125	----

(4)

SAE STANDARD HEX BOLT HEAD MARKINGS

12 Pt. Head and Undercut Body

TAPERED PIPE PLUGS

RECOMMENDED TORQUE (LB. FT.)

NPTF SIZE	LUBRICATED (a)	
	In Cast Iron or Steel	In Aluminum
1/16-27	8.5 ± 1.0	5.5 ± 0.7
1/8-27	10.5 ± 1.3	6.5 ± 0.8
1/4-18	25 ± 3	16 ± 2
3/8-18	27 ± 3	17 ± 2
1/2-14	50 ± 6	30 ± 4
3/4-14	54 ± 7	34 ± 4
1 -11 1/2	80 ± 10	50 ± 6
1 1/4-11 1/2	85 ± 10	55 ± 7
1 1/2-11 1/2	85 ± 10	55 ± 7

(a) THE LUBRICANT IS TO BE JOHN CRANE INSOLUBLE PLASTIC LEAD SEAL NO. 2 OR EQUIVALENT OR LOCTITE NO. 92 OR EQUIVALENT AND PLUGS ARE TO BE CAPABLE OF REMOVAL WITHOUT DAMAGE. OVERTIGHTENING MAY CAUSE INITIAL LEAKAGE PLUS POTENTIAL REMOVAL DAMAGE. AN OPTION OF A MAX. OF TWO FULL TURNS AFTER FINGER TIGHTENING THE PLUG MAY BE USED IF REQUIRED AND IF REMOVAL CONDITIONS ARE MET.

(1) THESE TORQUE VALUES APPLY TO USE OF IRONS, STEELS AND ALUMINUM TAPPED HOLES.
THE THREAD ENGAGEMENT LENGTH IN ALUMINUM IS TO BE TWICE THE NOMINAL THREAD DIAMETER AND ENGAGEMENT LENGTH RATIO IS TO BE 1.5 FOR IRONS AND SOFT STEEL. WHEN ZINC PLATING IS USED, LUBRICATE THE ZINC PLATED SURFACES OF THE SCREWS AND/ OR NUTS AND USE SPECIAL TORQUE VALUES.

(2) USE FOR ALL CAPSCREWS, BOLTS AND NUTS COATED ONLY WITH THE FASTENER MANUFACTURER'S RUST PREVENTATIVE OIL AND USE FOR PARTS WIPED OR WASHED NEARLY FREE OF OIL. DO NOT USE FOR PLATED PARTS.

(3) USE FOR ALL CAPSCREWS AND NUTS WHOSE THREADS AND WASHER FACE ARE LUBRICATED, ALSO FOR SCREWS OR NUTS WHOSE WASHER FACE IS ASSEMBLED AGAINST A HARDENED WASHER OR SMOOTH FINISHED HARD PART. (R_c40 OR ABOVE AND 40AA MAX.). ALSO USE FOR PLATED SCREWS (EXCEPT ZINC PLATED). LUBRICATING THE THREADS AND SCREW OR NUT FACE WITH SAE 20 OR 30 OIL IS RECOMMENDED FOR BEST RESULTS FOR ALL THE GRADE 8 SCREWS AND IS REQUIRED FOR ALL THE UNIVERSAL JOINT BEARING CAPSCREWS.

DO NOT USE MOLY-DISULFIDE, WHITE LEAD, COPPER FILLED OR OTHER SUCH FILLED LUBRICANTS WITH THESE TORQUE VALUES. SUCH LUBRICANTS REQUIRE SPECIAL TORQUE VALUES.

(4) SOCKET HEAD SCREWS AND 12 POINT HEAD SCREWS WITH FULL BODY ARE GRADE 8 OR BETTER QUALITY AND ARE TO BE ASSEMBLED WITH THE ABOVE TORQUE VALUES.

BEARING LOCKNUT TORQUE

Size	M-2012	M-2281	(1) Torque Lb. Ft.	M2012	(1) Torque Lb. Ft.	M-2037	(1) Torque Lb. Ft.
01	BC		15± 2				
03	A		34 ± 5				
04	B		46 ± 6				
05	C	C	75 ± 10				
06	D		92 ± 12				
07	E		125 ± 16			E	150 ± 20
08	F	F	160 ± 20	AF	230 ± 30	(3) F	190 ± 25
09	G	G	200 ± 25	(2) AG	300 ± 40	G	240 ± 30
10	H	H	240 ± 30	AH	370 ± 50	H	290 ± 40
11	J	J	290 ± 40	AJ	440 ± 55	J	350 ± 45
12	K	K	350 ± 45	AK	530 ± 70	K	430 ± 55
13	L		400 ± 50	AL	600 ± 75	L	490 ± 65
14	M	M	460 ± 60	AM	710 ± 90	M	580 ± 75
15	N	AJ	550 ± 70	AN	830 ±110	N & AN	680 ± 85
16	P	P	660 ± 85	AP	1000 ±130	P	800 ±100
17	Q		770 ± 100	AQ	1200 ±150	Q	950 ±120
18	R	–	900 ± 120	AR	1350 ±170	R	1100 ±140
19	S	S & AH	1000 ± 130	AS	1500 ±190	S	1300 ±170
20	T		1150 ± 150	AT	1700 ±225	T	1400 ±180
21	U		1300 ± 170	AU	2000 ±250	U	1600 ±200
22	V	V	1400 ± 180	AV	2200 ±275	V	1800 ±225
24	W		1800 ± 225	AW	2700 ±350	W	2200 ±275
26	X	X	2200 ± 275	AX	3300 ±425	X	2700 ±350
28	Y		2600 ± 325	AY	4000 ±500	Y	3300 ±425
30	Z		3100 ± 400	AZ	4800 ±600	Z	4000 ±500

C

(1) TORQUE VALUES APPLY TO SOLID SHAFTS.
TORQUE VALUES MAY OR MAY NOT BE SATISFACTORY ON THIN-WALLED SHAFTS.
TORQUE VALUES APPLY TO THREADS LUBRICATED WITH SAE 20 OR 30 OIL.

(2) M-2281-AG IS TO HAVE SAME ASSEMBLY TORQUE AS M-2012-AG.

(3) M-2037-AA IS TO HAVE 120 ±15 LB. FT. ASSEMBLY TORQUE.

LIFTING BOLT HOLES PROVIDED ON TWIN DISC PRODUCTS

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product.

These lifting points should not be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

WARNING

This clutch requires checking of adjustment after installation and prior to operation. Be sure to disconnect the input power to the clutch before adjusting.

CLUTCH ADJUSTMENT OF POWER TAKE-OFFS

NEW POWER TAKE-OFFS SHOULD HAVE CLUTCH ADJUSTMENT CHECKED BEFORE BEING PLACED IN SERVICE. A newly placed in service power take-off should have its clutch adjustment checked again after the first ten (10) hours of operation. New clutch plates have a "wear in" period and the clutch may require several adjustments until the new plates are "worn in".

After wear in, clutch adjustment should be checked regularly. Heavy duty applications (rock crushers, etc.) which have frequent engagements and relatively long periods of clutch slip, will require more frequent re-adjustment than light duty (power shovel master clutch) applications.

In order to determine if clutch adjustment is required, operating shaft torque should be measured.

A method of measuring this is shown in Figure 1, page 14.

If this force is found to be at or below the "MINIMUM" shown, the clutch should be adjusted until the "MAXIMUM" force for your model is required to engage the clutch.

NOTE: Do Not adjust the clutch too tight. Forces above maximum can cause clutch component failure.

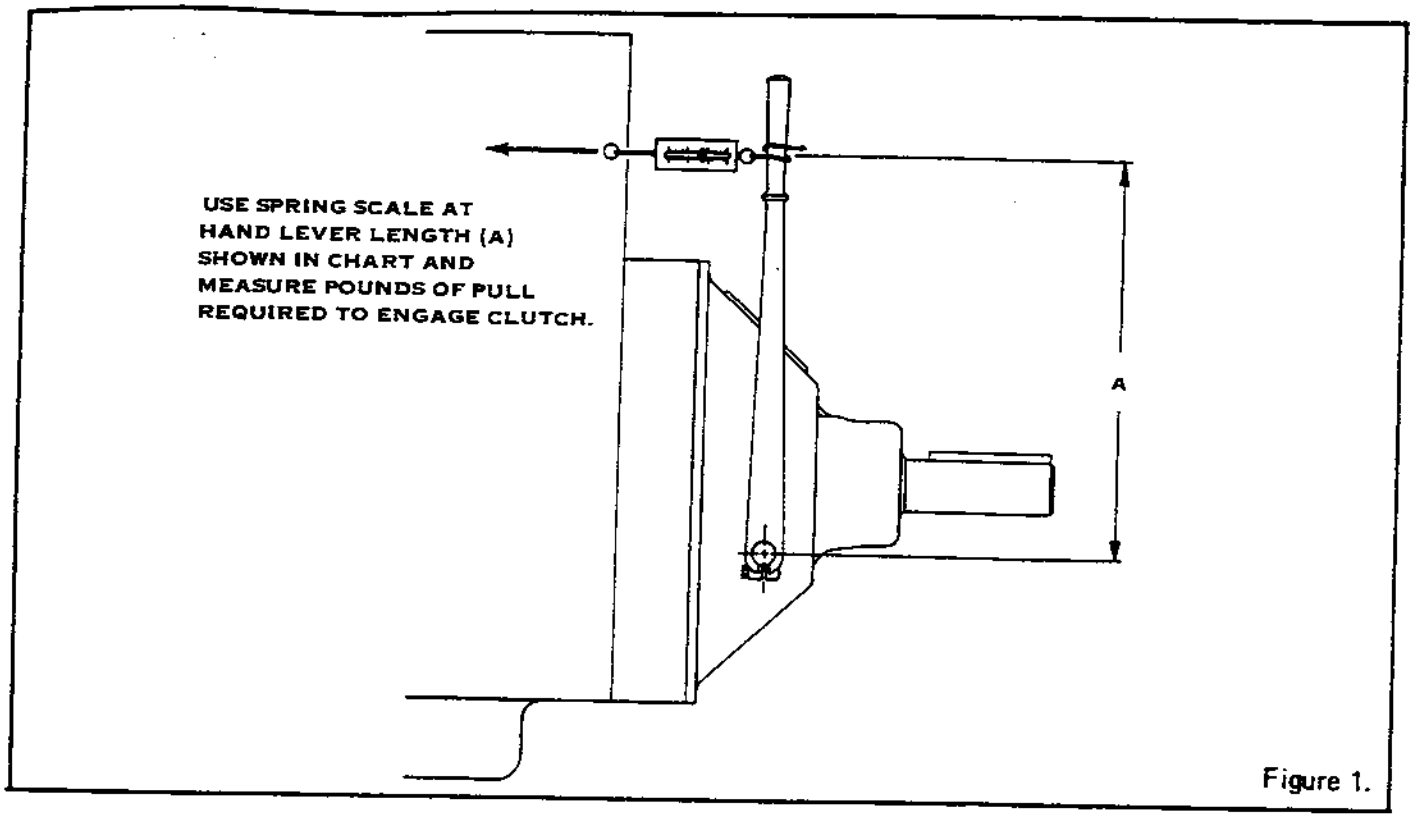


Figure 1.

The chart shows the "MINIMUM" and "MAXIMUM" values for clutch adjustment checking.

CLUTCH MODEL	OPERATING SHAFT TORQUE (POUNDS/FEET) MIN	MAX	HAND LEVER EFFORT (POUNDS) MIN	MAX	HAND LEVER LENGTH (A) (INCHES)
C-106	66	86	58	76	13.6
C-107	66	86	58	76	13.6
C-108	71	94	63	83	13.6
C-110	88	117	78	103	13.6
SP-111	108	142	95	125	13.6
SP-211	134	177	118	156	13.6
SP-114	218	289	123	163	21.3
SP-214	218	289	123	163	21.3
SP-314	218	289	123	163	21.3
IBF-214	218	289	123	163	21.3
IBF-314	218	289	123	163	21.3
*B-118	247	325	139	183	21.3
*B-218	247	325	139	183	21.3
SP-218	514	676	226	297	27.3
SP-318	514	676	226	297	27.3
IBF-318	569	751	172	227	39.7
*EH-121	695	913	210	276	39.7
*EH-221	695	913	210	276	39.7
SP-321	513	675	155	204	39.7
IBF-321	513	675	155	204	39.7
*EH-224	731	966	221	292	39.7

* — These clutch models no longer in production.

This information applies to power take-offs, reduction gears and pump drive units built by Twin Disc, Incorporated.

FIELD ADJUSTMENT – TAPERED ROLLER BEARINGS (SIDE LOADED PTO APPLICATIONS)

The only approved method for field setting (adjusting) tapered roller bearings in Twin Disc Power Take-off units, is by the use of a dial indicator to read actual end play.

Twin Disc PTO design will have one of two means provided for adjustment of the tapered roller bearings; either a bearing retainer nut (figure 1) page 16, or a bearing retainer plate and shim pack (figure 2) page 17.

To reach a starting point for bearing adjustment, assemble PTO clutch shaft, bearings and retainer nut or shim retainer plate into the housing and carrier (if used).

1. Tighten the retainer nut or capscrews on retainer plate until the shaft requires a 60 lbs. in. force to turn.

2. Back off the retainer nut (figure 1) the number of notches shown on page 7. Measure the shim pack space on (figure 2) for selecting shims. Select shims equal to space plus additional shims for endplay specified in table.

3. Dial indicate resulting end play as follows:

a. Set PTO on supporting blocks with the clutch shaft in a vertical position with the input end down.

b. Attach an eyebolt in the 1/4 PTF thread at the output end of the shaft. (Models which do not have this hole will have to be inverted with the input end up, and clearance at the output end below, for dial indicator mounting. An extra hub nut with a loop shaped strap welded to it can be used to apply the pushing and pulling forces required during end play check). See p.17 for tool.

c. Attach a hoist with a thrust bearing equipped swivel hook to the eyebolt or strap.

d. Attach a dial indicator to the housing and locate the stem or plunger, from the indicator, on the outer machined area of the end of the clutch shaft. Mark a spot next to the indicator stem.

e. Apply a pushing force of two hundred pounds while turning the shaft two complete revolutions in each direction (the weight of the shaft can be counted as part of the two hundred pounds). With the pushing force applied, stop the plunger or stem next to the mark and zero the dial indicator.

f. Apply a pulling force of two hundred pounds (compensate for shaft weight), to the shaft and rotate, with force applied, two complete revolutions in each direction. Stop with force applied and mark next to plunger or stem of the dial indicator. The indicator reads the actual end play.

g. Adjust nut or add or subtract shims as model requires, to obtain the desired end play. Recheck final end play with the dial indicator as described. Lock nut when end play adjustment is satisfactory.

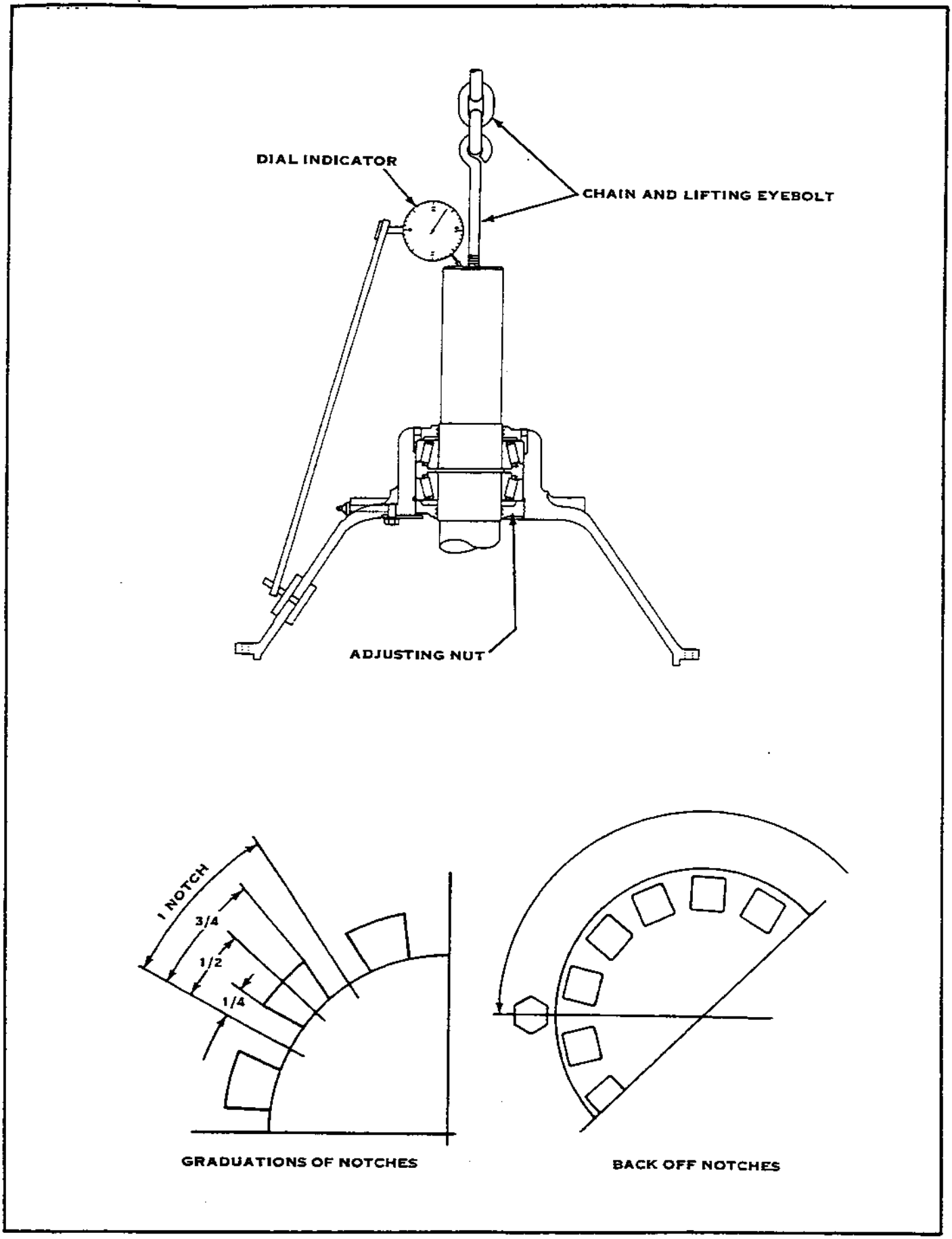
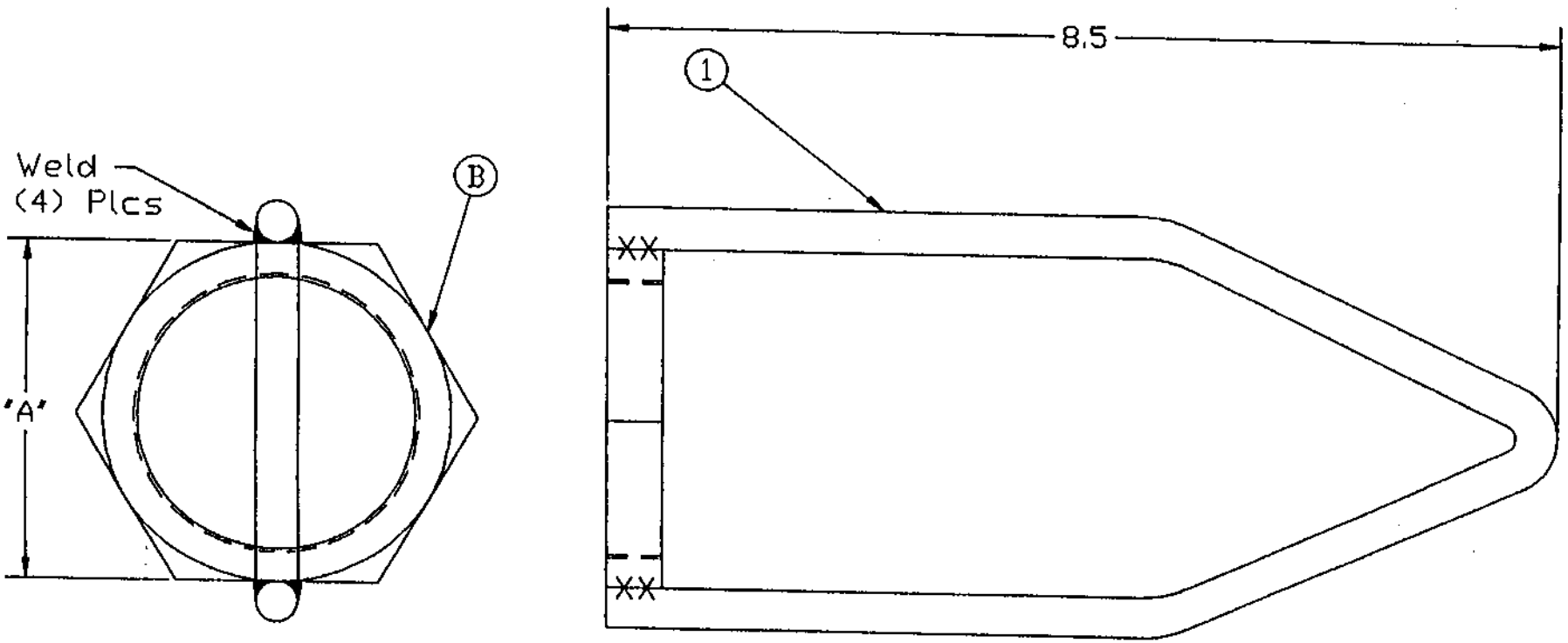

DIAL INDICATOR
CHAIN AND LIFTING EYEBOLT
ADJUSTING NUT
1 NOTCH
3/4
1/2
1/4
GRADUATIONS OF NOTCHES
BACK OFF NOTCHES

Figure 1.

CHANGE	DESCRIPTION	DATE	BY



T.D. Tool No.	"A" Dim.	"B" T.D. Part No.	Thread.	Units
T-21275-1	3.125	1442	2.5-16N	
T-21275-2	2.000	1092	1.375-12NF	
T-21275-3	2.375	B1509B	1.75-16N	

DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE
1	1	C.R.S.	.38 Dia. 1018 C.R.S. Round Stock	

DATE 10-4-94 BY M. WADE

LIFTING BAIL

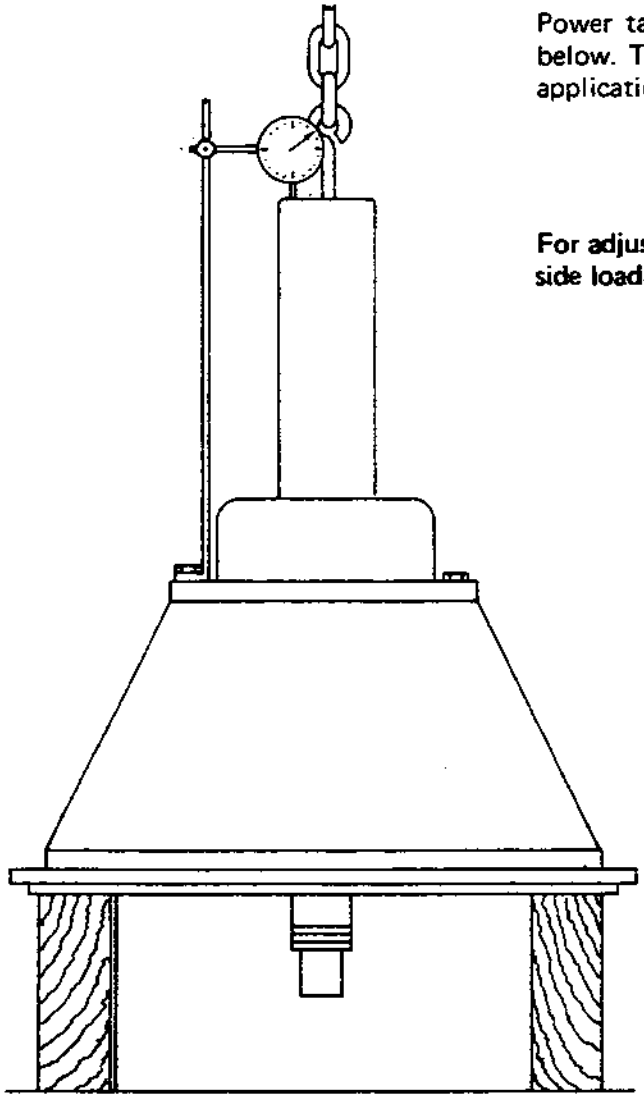
FOR MISCELLANEOUS PARTS

TWIN DISC, INCORPORATED RACINE, WI

SHEET OF

T-21275

ADJUSTMENT TAPERED ROLLER BEARINGS HIGH SPEED. "U" JOINT TYPE OR FLEXIBLE COUPLING. IN-LINE DRIVE APPLICATIONS



Field experience with high speed, "U" joint type, irrigation pump or other in-line drive installations indicates that extra care must be taken when adjusting the power take-off tapered roller bearings.

Power take-off shaft end play should be within the limits tabulated below. The end play shown on this chart is special for the above type applications. The sketch shows the method of checking this end play.

NOTE

For adjustment of tapered roller bearings in PTO applications where side loading is a factor, refer to Service Letter 71-26.

Twin Disc Number	Recommended End Play	Used in Model	Drawing Number
M-1590	.007-.009	C-108	X8419-A
M207	.007-.009	C110HP	X8249
		C111HP	X8249
M-207	.007-.009	SP-111HP	X 9582
M-282	.009-.012	B-114	X8409-A
		SP114P	X9643
M-215	.009-.012	B-118	X7243-A
M-215	.009-.012	B-218-P	X7189-B
M-215	.009-.012	SP314-P	X9585
M-215	.009-.012	SP314-P	X9585-A
M-214	.009-.012	B214-P	X8295-A
M-214	.009-.012	SP214-P	X9803
M2169	.007-.009	SP211HP	X9681
MA-181	.007-.009	SP211OP	X9894-B
M-2780	.009-.012	SP218OP	XA7190
M-2780	.009-.012	SP218OP	XA7190-A
M-2780	.009-.012	IBF214OP	X9745-E
M-2780	.009-.012	IBF214OP	X9745-F
M-2780	.009-.012	IBF314OP	XA7149-A
M-2780	.009-.012	IBF314OP	XA7149-B
M-2962	.013-.016	IBF318OP	X9918
M-2962	.013-.016	IBF321OP	X9919

Procedure for checking clutch shaft end play.

1. Tighten bearing adjusting nut, until output shaft requires 60 in. lbs. to rotate.

2. Back off adjusting nut 2-3 notches. Note: If shims are used refer to appropriate PTO manual for procedure.

3. Strike output end of shaft with soft hammer or block of wood to set bearing cup (outer race) against adjusting nut.

4. Place housing and shaft assembly on firm blocking, output end up (see sketch).

5. Install dial indicator as shown in sketch.

6. Mark a spot adjacent to the indicator stem or plunger and apply a two hundred pound force (weight of shaft counts toward 200 lbs. force), while rotating the shaft two complete revolutions in each direction. While applying this force stop with the stem or plunger of the dial indicator next to the spot marked and zero the indicator. Apply a pulling force of two hundred pounds and rotate the shaft two complete revolutions in each direction. With force applied, stop so the stem or plunger of the indicator is next to the mark as before, and read the actual shaft end play on the indicator. The pulling and pushing forces can be applied with an eyebolt as illustrated, or by inverting the PTO and using an extra hub nut with a loop strap welded to it on the input end of the shaft. With the latter design the dial indicator will have to be mounted below the unit on the output end of the shaft.

7. If end play reading obtained in step 6 is below the minimum shown in the table, back off adjusting nut and follow steps 3 through 6 until proper end play is obtained.

8. If end play reading obtained in step 6 is above the maximum shown in the table, tighten the adjusting nut and follow steps 3 through 6 until proper end play is obtained.

*9. When proper end play is obtained, lock adjusting nut and complete assembly of the power take-off.

* This check must be made WITHOUT grease in the bearings.

BE SURE TO PACK BEARINGS AND BEARING CAVITY WITH GREASE BEFORE STARTING UNIT.

ALIGNMENT – "U" JOINT AND IN LINE DRIVE TYPE INSTALLATION

To realize the longest possible life of the power take off bearings, the best possible alignment must be maintained between the center line of the power take off shaft and the center line of the driven member shaft.

This may be accomplished as follows:

First, and very important, the forks of the drive shaft, between the PTO and the driven member, must lie in the same plane. This will prevent severe vibrations from occurring in the drive shaft.

Second, the center lines of the PTO shaft and driven member input shaft must be offset within the limits recommended by the universal joint manufacturer to prolong the life of the universal joint needle bearings.

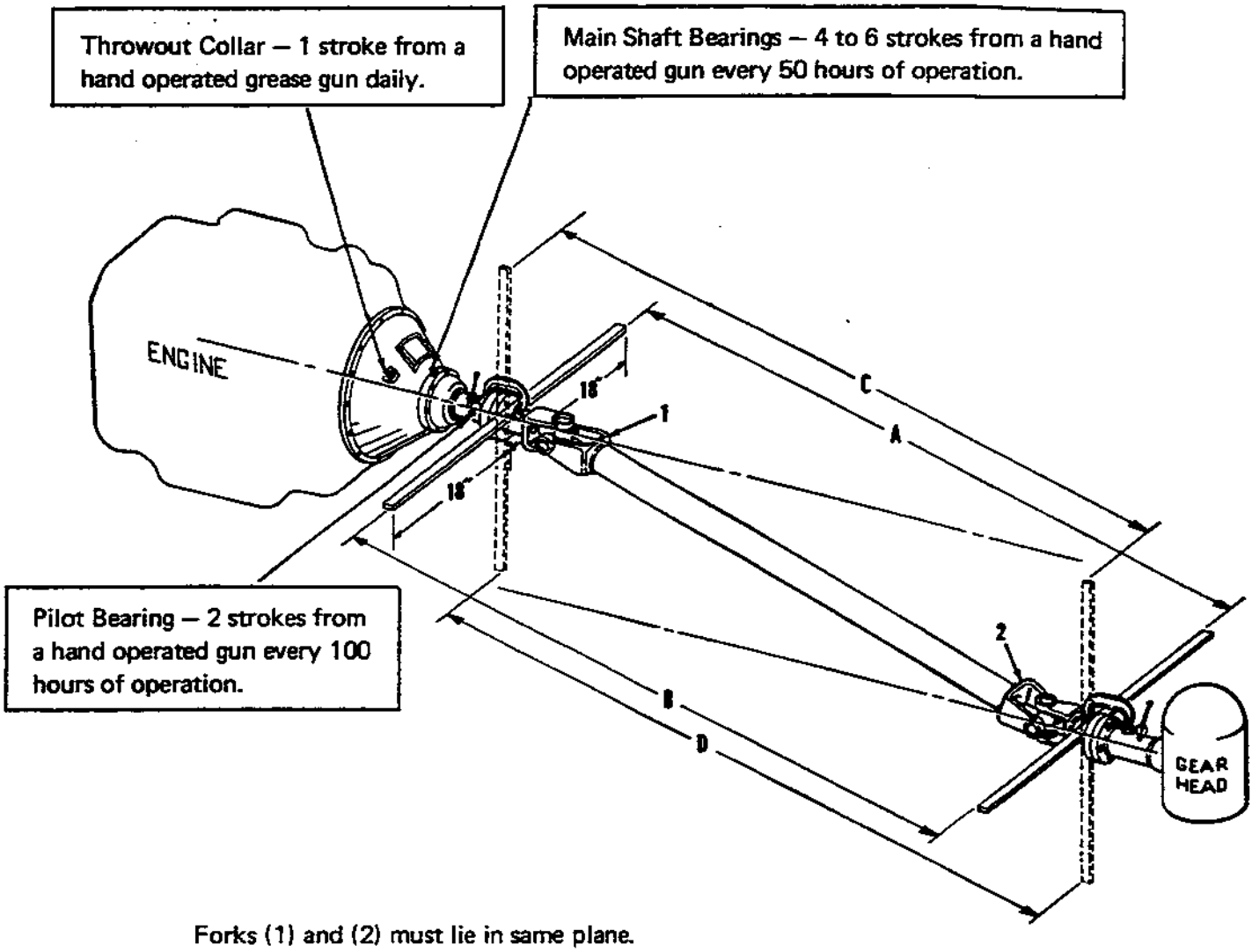
Third, and very important, the center lines of the PTO shaft and driven member input shaft must be parallel. This will further prevent vibrations which cause premature PTO bearing failure.

Proper lubrication of the power take off is also very important for satisfactory performance.

A high grade grease gun lubricant should be used. The grease selected should be recommended for anti-friction bearings and have a minimum melting point of 300° F.

A list of approved lubricants is available upon request.

Refer to sketch on reverse side.



Forks (1) and (2) must lie in same plane.

The centerlines of the power take off shaft and input shaft of the gear head must be parallel. One method of accomplishing this is shown on this sheet. To align engine and gear head by this method two accurate straight edges of at least 36 inches and a tape measure are required.

Place the straight edges horizontally along the face of the PTO and gear head hubs. Measure distances A and B. A and B should be equal within 1/8 inch measured 18 inches out fom the centerlines of the shaft. If a difference in A and B of more than 1/8 inch is found the engine should be moved to bring these distances within 1/8 inch. After A and B have been set the straight edges should be rotated to the vertical position as shown by the dotted lines in the sketch. Distance C should be equal to distance D within 1/8 inch measured 18 inches out from the center of the shaft. If C and D vary more than 1/8 inch measured 18 inches from the shaft center the engine should be moved until the difference is brought within 1/8 inch. After setting C and D, A and B should be rechecked and reset if required. Repeat this procedure until distances A and B and C and D are equal to each other within 1/8 inch measured 18 inches from shaft centers.

After setting as described above the engine should be securely anchored. The PTO shaft centerline and gear head input shaft centerline will now be within 1 degree of parallel.

ASSEMBLY NOTES:

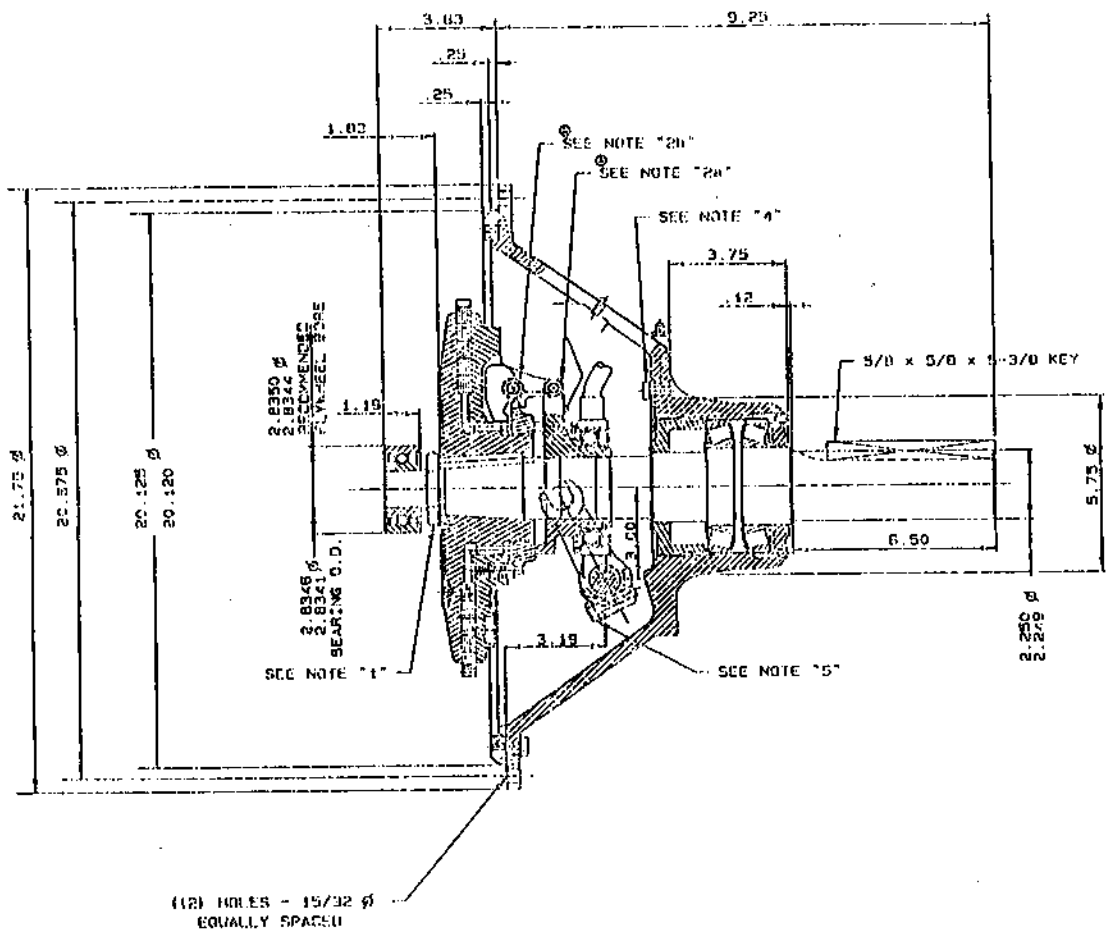
1.) SEAT HUB USING 30 LB.-FT. TORQUE ON NUT, THEN TIGHTEN NUT BY TURNING AN ADDITIONAL 150 TO 180 DEGREES.

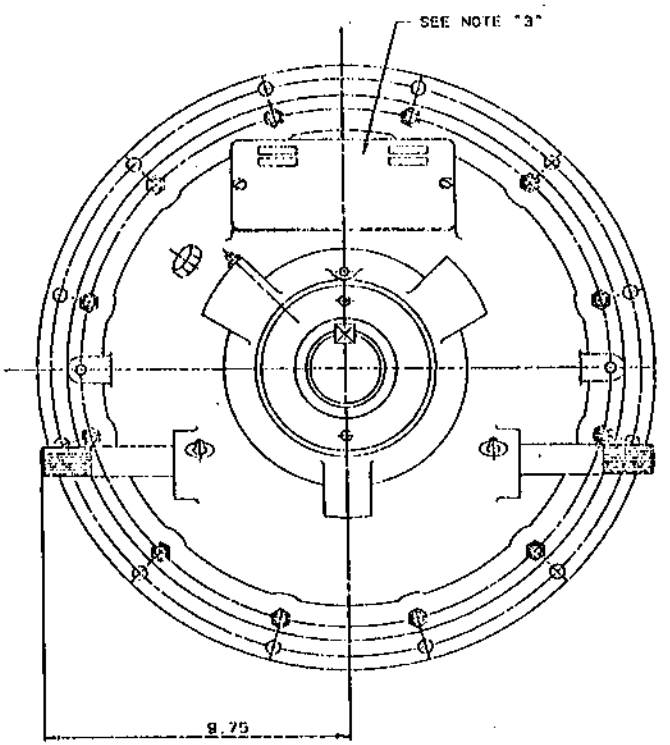
2.) A
A: R=.38 MAX. FOR COTTER PINS
B: R=.47 MAX. FOR COTTER PINS

3.) STAND 192-146 IN Nm BLOCK AND 142-108 IN LB.-FT. BLOCK FOR OPERATING SHAFT TORQUE.

4.) TORQUE TO 17 - 21 LB. FT.

5.) TORQUE TO 30 - 36 LB. FT.





GENERAL NOTES:

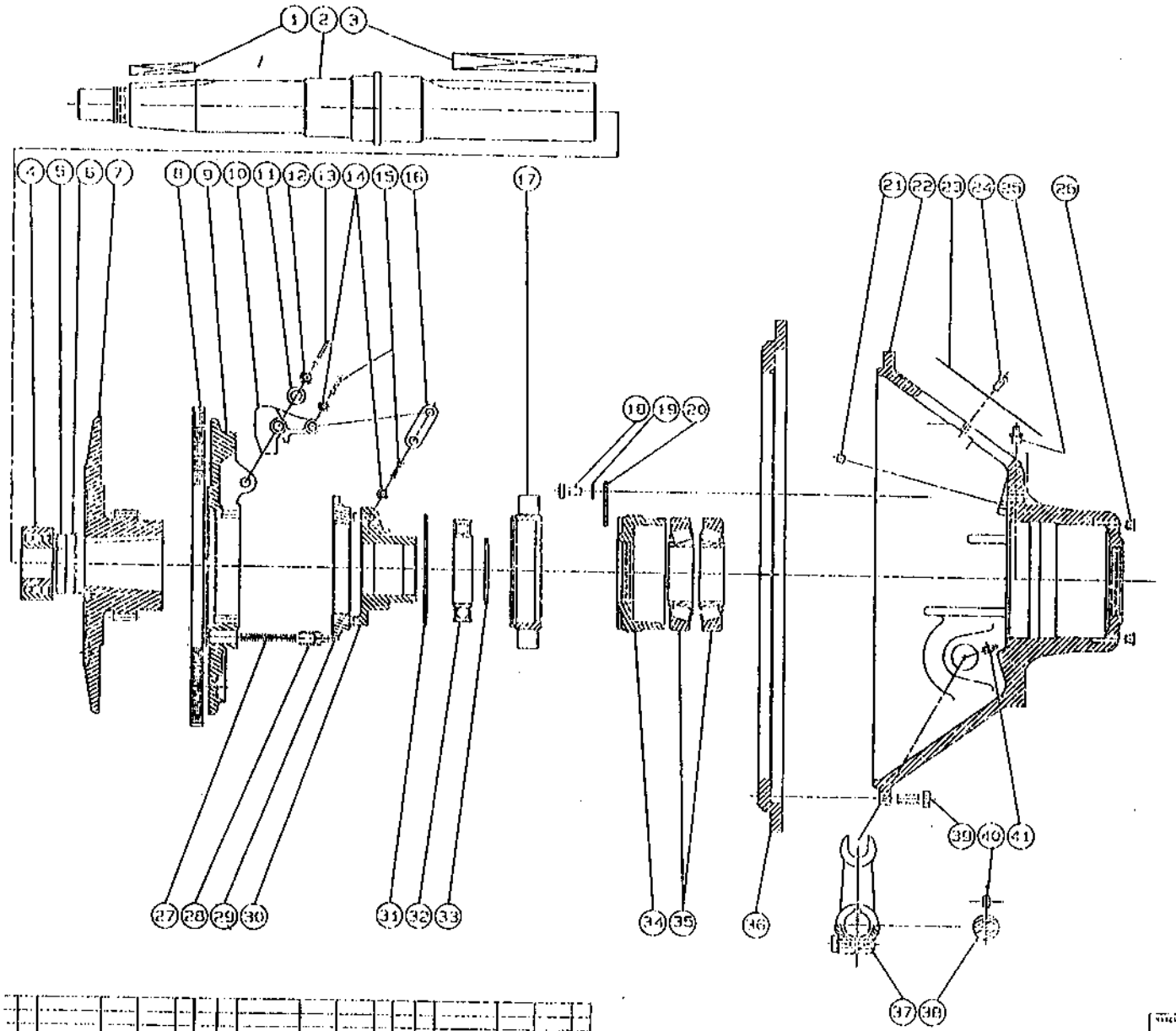
a.) REFER TO BILL OF MATERIAL LIST WHEN ORDERING PARTS.
b.) REFER TO CARE & OPERATION MANUAL FOR ADDITIONAL INFO.

TWINDISC

SP111P102

SP111 POWER TAKE-OFF

SHEET 1 OF 2



ITEM	PART NO	QTY	NAME	REMARKS
1	M20125C	1	KEY, STRAIGHT SQUARE	
2	A51904S	1	SHAFT, CLUTCH	
3	M20311J	1	KEY, STRAIGHT SQUARE	
4	M2214	1	BEARING, PILOT	
5	1002	1	NUT, HUB	
6	A1500	1	WASHER, LOCK, HUB NUT	
7	Z40031A	1	HUB AND BACKPLATE	
8	A50701	1	PLATE, FRICTION	
9	A07006	1	PLATE, FLOATING	
10	B1304	1	LEVER	
11	A01150	6	WASHER	
12	B1533A	3	PIN, CLEVIS	
13	B1535E	3	COTTER	
14	B1537D	6	PIN, CLEVIS	
15	B1539H	6	COTTER	
16	2017	6	LINK, LEVER	
17	XA4404	1	COLLAR ASSEMBLY	
18	M2001F	1	SCREW, HEX HD. (5/16 X 5/8)	
19	M2016L	1	WASHER, LOCK	
20	1218	1	LOCK, BEARING RETAINER	
21	M20413D	1	SETSCREW	
22	8927	1	HOUSING ASY	
23	2810AL	1	NAMEPLATE	
24	M2043F	2	SCREW, ROUND HD. (1/4 X 1/2)	
25	1008	2	FITTING	
26	M2087L	2	PROTECTOR	
27	A270100	1	SPRING, COMPRESSION	
28	B2349	1	PIN, ADJUSTING LOCK	
29	A1236	1	ROD, ADJUSTING	
30	A4434	1	SLEEVE, SLIDING (5.8")	
31	A2009M	1	RING, INTERNAL SNAP	
32	M2030	1	BALL, BEARING	
33	A2007C	1	RING, EXTERNAL SNAP	
34	B2147	1	RETAINER, BEARING	
35	M207	2	BEARING, TAPERED ROLLER	
36	8009	1	ADAPTER	
37	X1295A	1	YOKE, OPERATING	
38	1144E	1	SHAFT, OPERATING	
39	M2058U	1	SCREW, HEX HD. (3/8 X 1)	
40	M4022Z	2	KEY, WOODRUFF	
41	1003	2	FITTING	
NS	M2005A	1	SCREW, HEX HD. (5/8 X 1)	SHEAR
NS	HA1034A	2	WOOD, 2 x 4 x 22	
NS	HA1032B	3	WOOD, 1 x 8 x 23	
NS	HA1032C	2	WOOD, 2 x 8 x 10	
NS	HA1033D	4	WOOD, 2 x 8 x 22	
NS	HA1033A	1	CANTON	
NS	HA1033B	1	INSERT	
NS	HA1033C	1	ADAPTER	

NS = DENOTES PART NOT SHOWN ON ASSEMBLY DRAWING

PACKAGING NOTES:

1.) THESE ITEMS ARE SHIPPED LOOSE FROM P10.

YOUNG'S	12-22-99	SP111P102	
SP111 POWER TAKE-OFF	SHEET 2 OF 2		

NOTICE

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