HARTZELL
HYDRO-SELECTIVE PROPELLER
MANUAL

for

MODEL HC-12X20

INCLUDING
★ Description
★ Installation
★ Pilot Operation
★ Inspection and Maintenance
★ Parts List

C O N T E N T S

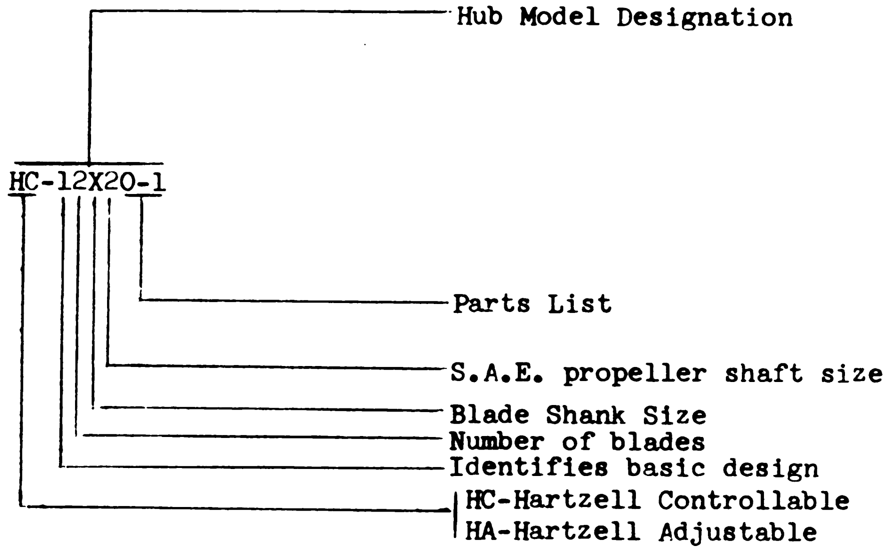
MODEL HC-12X20

MODEL HC-12X20-7 and 8

SECTION 1
MODEL DESIGNATION

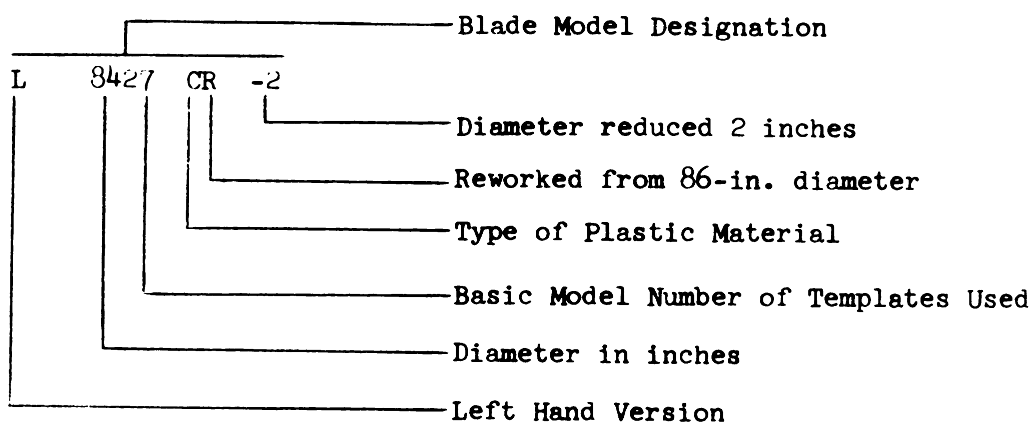
A—HUB MODEL DESIGNATION

The diagrammatic description is self explanatory. A dash and a number added to the hub model designation indicates a minor change which does not affect the eligibility.



B—BLADE MODEL DESIGNATION

The blade model designation consists of four numbers. The first group of two numbers denotes the diameter of the propeller in inches. The second group of two numbers denotes the basic model number or templates used. The left hand version is designated by an "L" preceding the blade model designation. For example:



SECTION II

DESCRIPTION

A - CONTROL

The Hartzell Hydro-Selective Propeller is a hydraulic controllable propeller. The pitch of the blades can be set to any predetermined value within the normal operating range by moving the cockpit control to the proper position corresponding to the engine speed desired. For example, the push-pull control is pushed all the way in for take-off, and is pulled out for high speed and cruise. An intermediate position will provide an intermediate pitch setting or rpm value.

B - BLADES

The blades are of a special plastic composition known as "Hartzite". The material has unusually good properties for propellers, such as high strength, good vibration qualities, and is impervious to the effects of weather and salt water. The blades are made as thin as metal blades, consequently the efficiency is equally high. As "Hartzite" absorbs vibrations, it results in smoother operation then most propeller materials.

C - HUB

The hub assembly is unusually simple and inexpensive, consisting essentially of a steel hub element, blade clamps to which are fastened counterweights, blade bearings and the hydraulic jack unit. The hydraulic unit consists of a cylinder bolted to the engine crank case, a movable piston, a ball bearing which translates the motion from the non-rotating piston to the rotating hub assembly by means of two links, and the hydraulic servo valve. Engine oil pressure is used to actuate the mechanism.

D - MODELS HC-12x2C-1, 2, 3, 4, 5, and 6 (See Section X for dash 7 and 8).

The HC-12x2C-1 model has approximately 10 to 14 degrees pitch range, which is sufficient for normal low and high speed control. The cylinder is designed specifically to mount on the Continental E-185 engine, either directly with studs or indirectly with brackets.

The -2model is similar to the -1 except the pitch range is 33 degrees which enables the pitch to be reversed for ground or water handling. Also, the cylinder mounts directly to any engine having a standard SAE 20 spline thrust plate.

The -3 model is the same as the -2 except the cylinder is larger, therefore will operate on lower engine oil pressures. (8-7/8 O.D. for -3 as compared to 7-5/8 O.D. for -2 model.)

The -3 propeller was assembled with three counterweight configurations, as follows:

Model HC-12X20-3 has counterweights that measure 4.65 inches between the extreme points of the long corner or edge.

Model HC-12X20-3A has counterweights that measure 4.5 inches long and do not have a large notch milled along the inside corner to provide clearance for the propeller hub nut. This model requires the 1/8" increase in length which is accomplished by attaching 1/8" or two 1/16" plates on the end of the counterweight using two 10-32 cap screws one inch apart centrally located.

Model HC-12X20-3C has counterweights 4.5 inches long; however, there is a large notch milled along the inside corner to provide clearance for the hub nut.

The -4 model is essentially the same as the -1 model except for the cylinder mounting provision. Whereas the -1 model is designed specifically to mount on the Continental E-185 engine, either with brackets or directly with studs, the -4 model utilizes the -2 cylinder which mounts on the standard S.A.E. thrust plate.

The -5 model is an improved version of the -1. The links which transmit the motion from the hydraulic element to the blades have been replaced in the -5 model by push rods and forks.

The -6 model is essentially the same as the -5 model except for the cylinder mounting provision. It utilizes the -2 cylinder which mounts on the standard SAE thrust plate.

SECTION III

INSTALLATION INSTRUCTIONS

When the propeller leaves the factory it is completely assembled and partly filled with grease. The pitch of the blades is set for its particular application and the clamp and blades are marked with matching lines.

A - INSTALLING PROPELLER

1. Clean crankshaft and crankcase nose section. Install bronze rear cone against the thrust nut. In Ranger engine installations, the thrust nut (Ranger Part No. 7815) must be removed and turned down in a lathe to 3.210+ .005 over all diameter.

2. The hydraulic cylinders for model HC-12X20-1, used on North American built Navions, were mounted on the Continental E-185 engine with sheet metal brackets. This was necessitated because at the first part of the program the engine had no provisions for bolting the cylinder directly on to the engine crankcase. Later the D series engines came through with four tapped holes for this purpose. Therefore, two cylinder mounting instructions are necessary:

   a. For Continental engines requiring brackets:

      Locate the valve near the top of the engine, remove cylinder from propeller assembly and secure it to the mounting brackets, which presumably are already bolted to the engine, with Allen head screws making sure the assembly is seated fully on the pilot flange of the engine crankcase. Be sure that the brackets pull the cylinder up tight against the engine crankcase; otherwise failures of the brackets and propeller components will result. Loosen through-bolts on engine to push the assembly back against the crankcase, if necessary. Safety Allen head screws and torque through-bolts.

   b. For engines having provisions to bolt the cylinder directly to crankcase: Locate valve near top of engine and remove piston from cylinder. Install a 1/64" hard paper gasket between the cylinder and the crankcase. (It is also recommended that gasket compound be used.) Use elastic stop nuts and aluminum washers on the studs inside the cylinder. Studs or nuts MUST NOT extend out more than 5/8 inches from the surface of the cylinder, else the piston will be prevented from receeding fully.

3. Check the inner and outer "O" Rings, also the "O" ring grooves, of the piston for cuts or other defects that may cause oil leaks, and install "O" rings and felt seal on piston.

4. Oil the crankshaft, rear cone, "O" rings and the inner surface of the

cylinder. A thin film of antiseize compound (Specification AN-C-53) or an equivalent mixture of 70 per cent white lead and 30 per cent engine oil by volume is advisable on the threads of the engine shaft.

5. Attach the proper hydraulic fittings onto the valve body.

6. Place propeller on crankshaft and align wide hub spline with shaft blind spline (if used). In the case of the -2 and -3 models, turn the nut about two threads on the shaft making sure the threads have engaged properly. Never use force to start the nut.

7. Turn the piston so the number stamped on the flange matches with the same number stamped on the front edge of the cylinder and so that the three pins in the cylinder will line up with the holes in the piston.

8. By hitting the inboard portion of the blades with the palm of the hands, enter the piston into the cylinder taking precautions not to cut the "O" rings in the process. The valve body should be at either extreme of its stroke in order to allow air to escape from the cylinder.

   As soon as possible start the nut on the threads of the shaft and then push the piston into the cylinder by applying hand pressure on the counter-weights.

9. Tighten the nut on the crankshaft using a bar about 3 or 4 feet long with a force of 50 lbs. - maximum effort of a man pulling with one hand.

10. With piston bottomed in the cylinder, check travel of piston by measuring between jack plate (5) and shoulder of hub. The travel should be .413 to .375 on models -1 and -5, .507 to .469 on model -4, and 1.062 to 1.094 on models -2 and -3. Shim behind cone (6) if distance insufficient. Safety nut to engine shaft.

11. Install 3/8" to 1/2" I.D. flexible hose from pressure side of the engine to the lever side of the valve and from the engine crankcase to valve. This hose must be sufficiently long and arranged so that the valve can be moved in and out freely. Locate the drain fitting in the crankcase as close to the valve as possible - not over 18 inches.

12. With the cockpit reverse control line forward (in the case of the reversible propeller) just off the locked position, attach this control line at the propeller to the short end of the lever (42) on the valve (41) making sure that the clamping bolt is tight against the bracket on the cylinder. When moving the cockpit reverse control lever into the locked position, there should be an increase in tension due to the slack being taken up in the lines.

13. With the piston bottomed in the cylinder, the cockpit propeller control handle pulled out approximately 2-1/4" from the instrument panel, and the valve body located midway between the cotter pin and the base of the guide pin; attach the propeller pitch control line to the valve lever. (Valve body shown in mid-position on parts diagram.)

14. With the piston bottomed in the cylinder, check the emergency stop screws on the inboard end of clamps for clearance with the hub. If necessary, file the head on screws to paper clearance between the screw and hub.

B - ADJUSTING PROPELLER CONTROL FOR PROPER GROUND OR STATIC RPM

1. Start and warm up engine and check propeller action. The full throttle maximum static rpm, with cockpit propeller control full forward, should be held to limits listed in CAA Aircraft Specification. (Rpm for best rate of climb should not exceed max. engine speed.)

2. If static rpm is too high pull back on propeller control until correct rpm is obtained. Stop engine and adjust propeller low pitch stop screw which limits the valve travel. On -1 and -5 models this stop screw is located in a bracket carried by the valve lever. The end of the screw bumps against the back of the cylinder when the propeller is pulled into low pitch. For the -2 and -3 models this screw is held by a bracket that is bolted to the cylinder. It is adjusted to limit the movement of the valve lever. For the -4 and -6 models the screw adjusts directly against the valve body.

3. If static rpm is too low, stop engine and back off enough on low pitch stop screw and run up engine again as in paragraph 2.

4. If the correct rpm cannot be reached because the jack plate is against the shoulder on the hub, reset the blade pitch about one degree, or 1/32 inch measured at the scribe marks, for each 100 rpm desired.

   The propeller should never operate with the jack plate against the shoulder because the cylinder oil pressure is then equal to the engine oil pressure. This pressure, which may be considerably higher than normal cylinder operating pressure, loads up both the propeller thrust bearing and the engine thrust bearing needlessly. The minimum clearance should be about .010".

5. After run-up fill propeller blade bearings with grease recommended in Parts List using zerk fittings on clamps. Stop when grease appears between clamp and hub. Care must be taken that the pressure does not blow out gaskets in clamps.

6. Check pitch control in flight for proper operating range.

SECTION IV

PILOT OPERATING INSTRUCTIONS

A - HIGH-LOW PITCH

The Hartzell-Hydro-Selective Propeller operates with engine oil pressure to reduce pitch, and centrifugal force created by the counterweights to increase pitch. A servo valve regulates the oil flow to provide any desired pitch setting within limits of pitch range. The pilot regulates the valve with a push pull control in the same manner that he regulates the throttle. He pushes the control IN TO INCREASE RPM and pulls it OUT TO DECREASE RPM. The blade follows the control precisely, the rpm will reflect this movement immediately.

a. WARM-UP

During warm-up the pitch control should be IN or in low pitch. Then set rpm at 1500 with the throttle and check pitch change once or twice. This will also fill cylinder with warm oil.

b. TAKE-OFF

No pitch control is necessary. The rpm should increase to nearly the desired climbing value by the time the airplane leaves the gound without changing the pitch control.

c. CLIMB

If rpm exceeds the limit allowed it may be decreased by pulling back on the pitch control until the desired value is reached.

d. CRUISE

Pull pitch control out to cruise position. If manifold pressure gauge is available the rpm and manifold pressure can be correlated with pitch control and throttle as recommended by engine manufacturer for best fuel consumption or best engine performance.

e. LONG RANGE CRUISE

Maximum cruise economy dictates low airspeed, low rpm and fairly high manifold pressure. For these conditions the pitch must be high. This can be obtained with pitch control pulled OUT to desired value of rpm and manifold pressure.

f. LANDING

Push control in before landing in order to be in a position to take-off again if necessary. Taxi in low pitch.

B - REVERSE PITCH

Model HC-12X20-2 and -3, reversible propellers, go into reverse pitch with engine oil pressure and comes out of reverse by centrifugal force created by the counterweights.

Before attempting to reverse the pitch the rpm must be reduced to 1200 or less for engines having oil pressure less than 50 lbs. Generally, the lower rpm the less is the time for the pitch to go completely into reverse, depending on the oil pressure available at idling speeds.

For the Sea-bee installation, unscrew and push up the reversing control and slowly push towards the rear. DO NOT FORCE. The pilot can feel the control yield to his pressure indicating that the pitch is changing. When the control is all the way back the pitch is in reverse and the pilot can then apply throttle. UNDER NO CONDITIONS SHOULD ONE OPEN THE THROTTLE WHILE THE REVERSE CONTROL IS IN AN INTERMEDIATE POSITION. If there is any doubt whether the pitch is completely in reverse open the throttle slowly to avoid the possibility of the engine racing. Never let the engine exceed 2500 in reverse in the case of the Franklin Engine 6AL500.

In order to come out of reverse the rpm should be set AT LEAST 1200. The higher the rpm without exceeding the limitation of approximately 2500, the faster the pitch changes out of reverse.

Apply forward pressure to the reverse control until it slips into the lock position. LOCK. Any monetary rpm increase up to the limitation of the engine is not to be a cause of concern as some speed up is inevitable when the pitch goes through zero.

C - PROPELLER CARE

It is advisable to turn the propeller into a horizontal position on preparing the ship for tie-down or hangering. In this position it will not permit water to drain between the clamp and hub into the blade bearing, and in this position the propeller cannot be damaged by hitting the overhead portion of the hanger.

Since the blades are solid "Hartzite" through and through with good weathering characteristics, covers for them are not a necessity. It is advisable, however, to cover the hub and hydraulic elements with a waterproof hood when storing in the open. In cleaning the propeller, use grease-cutting soap and water to wash the blades and carbon tetrachloride or naptha to clean the hub. Most automobile waxes used on the blades will give them lustre and protection. A waxed surface is also of some advantage aerodynamically.

In order to minimize water erosion in the case of the "Sea-bee", all water taxying should be done in low pitch and with wing flaps down.

The pilot should perform the daily visual inspection as listed in Section V, Part A.

SECTION V

SERVICE INSTRUCTIONS

A - DAILY VISUAL INSPECTION

The propeller should be regularly and carefully inspected visually for the following:

1. Excessive oil leaks in the hydraulic element and valve. Replace "O" rings when necessary. A true source of leaks can best be discovered by standing off to a side clear of the propeller and watching the valve and cylinder, or by wiping all visible oil from the engine, propeller and cowling and then starting the engine for a very short period of time.

2. Grease leaks through the clamp gaskets. Replace gaskets if necessary as described in Section VII, Part D. Use non-hardening gasket compound.

3. Cracks in the hub or clamps, and particularly the links in linkplate (5). Never hesitate performing a magnetic check at the first sign of a crack.

4. Bruises, dents or cracks in the blades. See CAA Manual 18 for the allowable damage to be airworthy. (Major repairs should be made only by a certified agency or the factory.) The metal leading edge is stainless steel and is expected to crack around the leading edge only along the scribed lines put in the metal for this purpose. Missing metal or loose rivets should be repaired. See Section VIII, Part E instructions for replacing rivets. HAVE THE TIPPING REPAIRED WHEN SMALL PITS APPEAR ON THE TIPS. This is especially true on the propellers used on amphibians. If the water penetrates the stainless steel tipping, the plastic beneath it can be damaged beyond repair in a very short period of time if the punishment is severe. Armor tipping should be refiled to a sharp edge at the first sign of pits on the leading edge.

5. Check the scribed lines on the clamps and blades to see if they are matching. The reason for this precaution is to detect blades that may slowly be twisting to flat pitch because the clamps are not tight enough on the shanks of the blades. These matching lines must be present originately and can be scribed in with a scale and scriber. See Section VIII, Part F.

6. Check blades for free movement in the hub. Grab counterweights and move both forward and then backward making sure at the time that the valve is against the cotter pin of the guide pin. In this position, oil can bleed out of the cylinder.

7. Check pitch control connections to valve lever. This is especially true in the case of the reverse control connection on the HC-12X20-2 and -3 propellers. The head of the bolt attaching this control line to the valve lever should be hard against the stop bracket on the cylinder. Check by pulling on the valve body. See Section III Part A-12 for attaching this

control line to the valve lever should be hard against the stop bracket on the cylinder. Check by pulling on the valve body. See Section III Part A-12 for attaching this control to the lever.

B - 50 HOUR INSPECTION

1. Follow the regular inspection procedures as listed under Part A.

2. Check wear in valve lever linkage. Replace pins or lever if excessively worn. The valve lever is extremely sensative, and for correct operation the valve should respond immediately with the movements of the cockpit control. Replace worn parts if pitch control is not precise.

3. Grease the thrust bearing located in the hydraulic element by any of the three methods. Too much grease will cause it to overheat. Use only the recommended greases listed in Section IX.

   a. Take the screws out of the cover plate on the piston and drop about two teaspoonful of grease between the cover plate and piston.

   b. If a zerk fitting is in the piston, pump about one-half cubic inch of grease into the bearing.

   c. Remove the propeller from the engine as a unit including the piston. Work grease in the 1/16 crack between the I.D. of bearing using ones fingers.

4. Grease blade bearing with zerk gun. Care should be exercised when pumping grease into the zerk fitting, else excessive pressure will blow out the gaskets. Grease should be added until it starts coming out around joint between the clamp and hub. Unless the bearings are kept flooded with grease they will become rough and eventually cause the propeller to stick. See list of recommended greases in Section IX.

5. Check tightness of linkscrew (25) and also wear between screw and link of (5). Linkscrew (25) must be tight in clamp (24) else it will work and possibly break. Torque to approximately 30 foot pounds. Safety with wirelock (28) in such a way that wire tends to tighten screw. Replace screw if badly worn.

6. Check clamp gaskets for leakage of grease. For remedy see Section VII Part D.

C - 250 HOUR INSPECTION (or coincide with engine overhaul).

1. Remove propeller and disassemble.

2. Magniflux steel parts.

3. Replace worn parts.

4. Assemble.

SECTION VI

DISASSEMBLY INSTRUCTIONS

The parts will be referred to by name and number as listed in the Parts List Section IX which refers to the exploded view and general drawing shown on the cover.

A - REMOVAL OF HUB AND BLADE ASSEMBLY FROM ENGINE

A. Without piston and cylinder

1. Remove wirelocks (28) and linkscrews (25).

2. Replace linkscrews in the same clamps from which they were removed.

3. Remove safety screw (16) in nut (15) and turn nut off of engine shaft.

4. Remove hub from engine shaft and place away from possible damage.

B. With piston and cylinder.

1. Remove cotter pin (38) from valve guide on valve bracket (40).

2. Grab counterweights and pull piston as far out of cylinder as possible. Valve must be in high pitch position in order to bleed air into cylinder.

3. Remove safety screw (16) in nut (15) and turn nut off engine shaft.

4. Repeat instruction 2 above until piston is entirely out of cylinder. Provide a pan to catch the oil draining from cylinder.

5. Remove hub from engine shaft and place on stub shaft of a work bench.

6. Remove cylinder and valve parts from engine.

B - REMOVAL OF PROPELLER BLADES

1. Remove piston from propeller assembly replacing the linkscrews in the clamps from which they were removed.

2. Scribe matching lines on blades and clamps.

3. Take nuts (13) off of bolts (12) and remove Allen screws (14) using Allen wrench (5/16" across the flats).

4. Record blade serial number with the clamp number for each side of the propeller.

5. Remove clamp halves (8) and (24) from assembly. The blade is then free to be pulled off of pilot tube in hub.

C - REMOVAL OF BLADE BEARING

1. Pull "O" ring (26) out of the groove in hub and roll it back on the hub.

2. Spring snap ring (27) and move back into the "O" ring groove. NOTE: Hold the bearing together or use two small C clamps, for this operation will permit the two races of the bearings to part allowing the balls to come out.

3. Tap the bearing (22) back toward the snap ring and off of the split ring (23).

4. Remove split ring and the bearing, snap ring and "O" ring will then be free to come off the hub.

D - REMOVAL OF JACK ASSEMBLY FROM PISTON ASSEMBLY

1. Back wire retainer (34) out of slot using pliers. A sharp 1/16" dia. piano wire bent 90 degrees will aid in prying the wire retainer (34) out to where it can be reached with plyers.

2. Push or tap the jack plate out of the bearing using preferably a cylinder of steel whose O.D. is slightly less the I.D. of the bearing.

E - REMOVAL OF BEARING FROM PISTON

1. Remove screws (35) holding on cover plate (4).

2. Push or tap bearing (3) out of piston (2). Support the piston on the front rim. Use a drift punch applied to the inner edge of the bearing.

F - DO NOT remove counterweights from clamps as they are pinned at the factory and should not be loosened.

DO NOT remove links from jack assembly (5). If links should be replaced return assembly to factory.

DO NOT interchange cylinders and pistons for they are paired by stamped numbers on the outer edges of both.

DO NOT interchange the valve body and valve plate on the "C" series valve assemblies.

SECTION VII

ASSEMBLY INSTRUCTIONS

The parts will be referred to by name and number as listed in the Parts List Section IX which refers to the exploded view and general drawing shown on the cover.

A - INSTALLATION OF JACK IN BEARING

1. Push or tap jack plate (5) in bearing (3) with the cover plate (4) and gasket (32) between the two. The groove just inside the inner race of the bearing must match the groove in the jack plate.

2. Install wire retainer (34) through slot in jack plate. (5). Use plyers to work wire around groove.

B - INSTALLATION OF BEARING IN PISTON

1. Grease bearing (3) with 1/2 cubic inch of grease. (See greases recommended listed in Section IX).

2. Press bearing (3) in piston (2). Slight press fit is required. Use gasket compound between bearing and piston to insure tight fit if necessary.

3. Use gasket compound on gasket (32).

4. Insert lock washers (33) and screws (35) in cover plate (4) and piston(2).

C - INSTALLATION OF BLADE BEARING

1. Install "O" ring (26) over tube in hub (7) past the "O" ring groove.

2. Install snap ring (27) in "O" ring groove.

3. Install bearing (22) over tube with the NARROW RACE PLACED ON FIRST.

4. Move bearing against snap ring and install like numbered split ring (23) just back of the thrust shoulder on hub.

5. Tap bearing over split ring until against shoulder.

6. Slip snap ring from "O" ring groove and place between bearing and shoulder of hub.

7. Roll "O" ring into groove.

D - INSTALLATION OF PROPELLER BLADES

1. Fill propeller blade shank pilot tube hole with grease, conforming to Grease Specifications listed in Parts List. Be sure air is not trapped below grease as this will affect balance of propeller. (For -2 and -3 propellers install staking lug over heads of tow screws at base of blade. Lug must match up with hole in clamp when pitch is set properly).

2. Place propeller blade on tube of hub.

3. Put hardening gasket compound around the blade shank in the inboard groove.

4. Install MATCHING pair of clamps (8) and (24).

5. Place gaskets (10) in place with non-hardening gasket compound on both sides of gaskets.

6. Insert screws (14) and bolts (12) in the same direction to avoid interference with valve.

7. Tighten screws (14) and nuts (13) evenly, torque approximately 20 foot lbs.

8. Check freedom of blades on pilot tube of hub. If tight, correct cause of tightness by loosening outer nuts slightly. If this is sufficient without permitting the blade to turn in the clamps, then refer to the causes of friction listed in Section VIII, Part A.

9. Install jackplate (5) on the propeller assembly using link screws (25).

10. With the jackplate against the shoulder on the hub, set the angles of the blades at the 30-in. station by loosening clamps and rotating blades in clamps. Set pitch as indicated in table below.

Engine Installation	-1	-2	-3	-4	-5
Continental E-185	12°				12°
Ranger 6-440C-2 6 440C-5		* 20°		10°	
Franklin 6AL500		* 18°	* 18°		

*NOTE: A 1-1/16 to 1-3/32 spacer must be used between jack plate and hub.

11. Scribe matching lines on the blades and clamp.

12. Tighten the nuts (13) until snug or not over 20 foot lb. torque. Check tightness of blades in clamp in the case of -1, -4, -5 and -6 models. A torque of 2000 inch lb. should be applied to the blade near the root to determine whether it might slip in flight. If the blades slip in metal to metal clamps, remove the clamps and file the two pads on the ears of the one clamp-half. Remove only .005 at a time.

13. Carefully check the angles making sure the jackplate is against the shoulder on the hub or against spacer as noted for -2 and -3 models. The angles of the blades should be within 1/2 degree of each other and 1/2 degree of the correct angle setting.

14. For -2 and -3 propellers drill staking lug through hole in clamp using .154 dia. drill. Hole should be only 5.16 deep. Drive staking pin in hole flush with surface of clamp. Staking pin is necessary to prevent blade from turning in clamp.

E - BALANCE

1. Remove hydraulic element from blade hub assembly.

2. Install balancing jackplate assembly (These may be obtained from factory). Jackplate should rest against hub shoulder. Wedge blades out, using small wedges between hub and clamps.

3. Install balancing mandrel using the cone seats for centering. Do not use the I.D. of the hub.

4. Check horizontal balance by laying weight slugs (47) in the corner of the blade and clamp. Record no. of slugs on clamp.

5. Apply a vertical force of about 50-100 lb. near tip of each blade and check vertical balance having the heavy blade up. Lay slugs on the hub end of the clamp. Record no. of slugs on the side of hub.

6. Repeat item 5 above with propeller rotated 180 degrees and check vertical balance having the heavy blade up and record slugs.

7. If the two recorded number of slugs for vertical balance have occurred on the same side of the hub, correct amount of slugs to use is one half of the sum.

   If the two recorded number of slugs for vertical balance have occured on opposite sides of the hub, the correct amount of slugs to use is one-half of the difference and placed on the side with the greater number.

   Divide the vertical balance slugs to maintain the horizontal balance within one slug. Vertical balance should be held within four slugs at the worst condition. Do not attach more than eight slugs on two fillister head screws.

8. Install slugs on clamps temporarily and again check balance.

9. Grease blades with zerk gun equally on both sides. See Section V Part B-4.

10. Check horizontal and vertical balance. Add grease until in balance.

11. Safety fillister head screws.

F - INSTALLATION OF LINKSCREWS

1. Attach hydraulic element with linkscrews.

2. Tighten linkscrews with allen wrench using 30 ft. lbs. torque. The tapered shoulder on the screw must be seated on the tapered countersink in the clamp.

3. If the hole in the head of the linkscrew does not line up so that when the wirelock is in place, the spring or stress should tend to tighten the linkscrew: then center punch the proper location and drill a hole with a No. 41 drill.

SECTION VIII

TROUBLE SHOOTING AND RECENT IMPROVEMENTS

Following is a list of the possible ailments and the remedy.

A - FAILURE FOR PITCH TO CHANGE

1. If the pitch changes to high pitch but will not change to low pitch properly, the cause is generally low engine oil pressure. For proper functioning with a 7-1/4 inch diameter cylinder the pressure should not be below 45 psi. and with an 8-7/8 in. dia. cylinder, not below 30 psi. If it is no pressure, refer to the causes of friction as listed below.

2. If the pitch changes to low pitch but will not change to high pitch properly, the cause is usually a drain line that is either too small or too long. The drain line should never be less than a 3/8" line, and if possible it should return directly to the crankcase through a distance of not over 18 inches. Also refer to the causes of friction as listed below.

3. If the pitch does not change properly toward both high and low pitch, the cause is usually due to an excessive amount of friction which minimizes the hydraulic and counterweight forces or a combination of low oil pressure and a drain line that is too small or too long.

   The causes of friction are:

   a. Improper grease which, due to centrifugal force or the presence of a small amount of water, solidifies and causes a tight fit of the blade on the pilot tube. Use recommended greases as listed in Section IX.

   b. The snap ring (27) wedged beneath the inboard race of the blade bearing. This condition can be detected by carefully removing one of the clamp halves and noting the position of the ring. By removing this snap ring as described in Section VI, Part C, and springing it apart slightly, the ring will not jam between the bearing and hub.

   c. Insufficient clearance between the blade bore and the pilot tube. See Part I of this section for the amount of clearance necessary.

   d. Over squeezing of the blade by the clamps: For early clamps that do not have metal to metal contacting surfaces on each corner, it is possible to tighten bolts (12) to the point where the blade is deformed and tightens upon the pilot tube. This overtightness can be detected by backing off the castellated nuts (13). If this frees the rotation of the blades on the tube of the hub, then disassemble and assemble the blades as described in Section VI, Part B, and Section VII, Part D, using new clamp gaskets. If the blade has taken a permanent set, it should be reamed with a clamp installed and properly tightened. The hole size should be 1.502 - 1.504 with the clamp mounted on blade alone and properly tightened.

e. Pilot tubes that slip out of the hub due to vibration and centrifugal force: Some tubes which had improper press fits, might work loose and slide outwardly until they press hard against the bottom of the hole in the blade shank.

   This condition can be detected by removing the wirelock and linkscrew and then backing off the castellated nuts on the clamp. If the blade does not rotate freely even upon removing the nuts from the bolts, the indications point to the condition of a loose tube. In order to check further, remove the blade as outlined in Section VI, Part B, and measure the length of the pilot tube extending beyond the hub. This dimension should be 3-3/4" + 1/32".

   If the tube has slipped slightly, it should be replaced by one which is .002 greater in diameter for the portion which fits into the hub. Tube pullers are available for service establishments as are oversize tubes. New tubes may be pressed in using an arbor press. (In emergencies where no press is available, the tube may be driven in with a wooden mall.) Check replaced tubes for fit by attempting to pull it with a puller by putting a torque of 30 ft. lbs. on the tube-puller screw, having the threads well greased, or by applying the maximum force of one man with his hands ten inches apart. If the tube does not slip in the hub it is sufficiently tight. If the tube slips, install one of greater oversize.

f. Insufficient clearance between the end of the hub and the end of the blade: This can be checked by moving the blade by hand in and out, radially. There should be a slight end movement. If there is no clearance, the end of the blades should be scraped a few thousands of an inch at a time until clearance is produced. Clearances should be at least .005.

B - IMPROPER RPM SETTINGS

1. Static rpm too low:

   The limits for full throttle maximum static rpm are listed in the CAA Aircraft Specification. (It is the rpm that will permit the rated engine speed during the best rate of climb.) Adjust stop that controls the valve lever travel so that the proper rpm is obtained. The correct procedure is given in Section III, Part B.

   If the valve lever stop is not controlling the travel of the push pull control because it is limited in the cockpit, then loosen the control housing clamp next to the valve and move the control housing toward the propeller until the stop on the lever limits the lever movement. Then adjust stop to give proper static rpm.

If the piston travel is limited by the hub low pitch stop (when jack plate touches hub) then the pitch of the blades must be reduced. See Section III, Part B4.

2. Static rpm too high:

   This condition can readily be corrected by running the engine at full throttle and pulling back on the cockpit propeller control until the correct static rpm is obtained. Then stop engine and adjust propeller low pitch stop screw until it bears against the controlling surface.

3. Cruise rpm too high with respect to manifold pressure: The high pitch position is not correct and is due to:

   a. Improper travel of the piston in relation to the hub. This stroke can be checked and compared with recommended strokes as listed in Section III, Part A10. Check to see if the piston is actually bottoming in cylinder. The piston should extend out from the cylinder about 1/32" for the -2, -3, -4 models or about 1/16" - 1/32" for the -1 and -5 models. If the piston does not bottom, remove piston and eliminate cause. If piston is bottoming correctly and stroke insufficient, then add shim behind rear cone sufficiently thick to provide correct stroke.

   b. Insufficient movement of the cockpit control lines: The push-pull control lines must have sufficient travel to actuate the piston through the full stroke. This can be determined by running the engine up on the ground and observing whether the piston moves through its stroke in response to moving the push-pull controll. If the control limits the travel of the piston, except for low pitch stop, then rework the control until sufficient travel is obtained. See Section III, Part A13.

   c. Reverse control not tight: If the reversing control does not pull the short end of the valve lever (pivot point) up tight against the bracket it will be impossible to adjust the high-low pitch control satisfactorily and may be impossible to obtain full high pitch. To pull the lever pivot back against the bracket, loosen the clamp holding the push-pull control housing and slide housing away from propeller until pivot is hard against bracket. Tighten Clamp. See Section III, Part A12.

C - OIL LEAKAGE

There are several sources of oil leakage in the propeller and adjacent parts, listed as follows:

1. "O" Rings in hydraulic element. These rings may leak if:

   a. They become flat and hard. It has been determined that AN-6227 rings originally specified will not stand up at engine temperatures. After a few hours they become hard and flatten out and leak oil. Remedy -- Use only Plastic and Rubber Specification H222-70 rings.

   b. They are cut or nicked during assembly. Remedy -- replace.

   c. "O" ring grooves in piston becomes nicked or rough. Remedy -- Polish out nick with fine emery cloth.

   d. Surface of cylinder becomes rough or scratched. Remedy -- Polish out nicks with fine emery cloth.

2. "O" rings in servo valve. This ring may leak for the same reasons as noted above under Item C1. Remedy -- replace valve with chrome plated valve having double "O" rings. This type of valve is a recent improvement over the original valves and may be obtained from the factory by exchanging old valve. Incidentally, the original valves were the principle source of oil leakage. The new chrome valves have eliminated this source.

3. Valve gasket. Early assemblies were put together with soft paper gasket between valve and piston. It was found that vibration loosened the valve and allowed oil to leak past the gasket. Remedy -- use hard paper gasket 1/64" thick. Also use thin gasket compound.

4. Hydraulic lines leak, particularly near the valve. Remedy -- replace.

5. Piston guide pins. Early models of the -1 propeller mounted on the Continental engine have three guide pins pressed into the cylinder from the rear to guide the piston. As these pins were not backed up by the engine they sometimes worked loose, thereby allowing oil to leak. Remedy -- return cylinder and piston to factory for late model pins which are pressed in from the front and riveted over at the rear.

6. Engine crankshaft seal. Oil leaking from this source is thrown by centrifugal force into the propeller hydraulic element and works out through the thrust bearing. Consequently, the oil appears to come from the smaller "O" rings. As this source is quite common but difficult to recognize, it is recommended that the engine seal be replaced if oil persists in coming from the hydraulic element after the above remedies have been put into effect.

D - GREASE LEAKAGE

There are two sources of grease leaks. The bearing (3) and blade bearings (22). The grease leaking from bearing (3) is seen coming from between the jackplate (5) and the cover plate (4). This leak is caused by over-greasing the bearings and stops when the excess grease is thrown off. Grease leaking from bearing (22) is seen coming through the clamp gaskets and around the blade and clamp. By the use of sealing compounds as described in Section VII, Part D-3 and 5, and new gaskets this leak can be eliminated.

E - REPLACEMENT OF RIVETS

Rivets which break off or come out of the tipping should be replaced immediately. This can be done without removing the propeller from the airplane. All broken rivets, whether they be 3/32" or 1/8" diameter brass or copper, should be replaced with 1/8" annealed copper having a 7/32" diameter flat head.

Replacing a 1/8" rivet.

1. If both heads of the broken rivet are still in place, center punch on the center of the head and drill 1/8" deep with 1/16" drill.

2. Cut out the head with a 90 degree countersink but do not cut the steel tipping.

3. Punch out the old rivet with a 1/8" drift punch.

4. Redimple the metal tipping with 90 degree dimple.

5. Insert rivet from flat side of blade.

6. Cut rivet off leaving 3/16" or 1/4" extending beyond the metal.

7. Head rivet with bucking iron and hammer using very light tapping strokes.

8. For a smooth surface the vacant cavities around the rivet can be filled in with solder and acid flux and then filed. Replacing a 3/32" rivet is similar to a 1/8" rivet except tools must conform to the smaller size. The rivet hole should then be enlarged for a 1/8" rivet.

F - BLADES TURNING IN CLAMPS (-1, -4 and -5 propellers only.)

Matched lines on the blade and clamp halves are provided for determining whether the blades are turning in the clamps. If slippage occurs remove the lock wire (28) and linkscrew (25). Then tighten nuts (13) and bolt (12) checking the freedom of the blades on the hub to avoid over tightening. Then check tightness of the blades in the clamp by applying 2000 inch pound moment near the root of the blade by means of a lever having a cut out to fit the blade section.

If the blade freezes on the hub pilot tube and will not withstand a 2000 inch pound twisting force, remove the blade. File .005 off the metal contacting surfaces at the corners of the clamps (metal to metal clamps) and put clamps on the blades alone. Tighten bolts so that metal contacting surfaces pull up tight. Ream hole in blade to 1.502 - 1.504. Reassemble blade and clamp on hub and check for tightness of blade in clamp and also freedom of blade to rotate on pilot tube. (Use grease to fill pilot hole for assembly.) See Section VII, Part D.

If the clamps do not have the metal contacting surfaces at the corners of the parting line (early models), the tightness of the clamps on the blade is determined solely by the tightness of bolts (12). If the blades freeze on the tubes after the clamps are drawn up tight enough to pass the torque test, then the pilot tube hole in the blade must be reamed as noted above.

G - END PLAY IN BLADES.

The propeller was designed for the tube to take the bending load on the blade and the ballbearing to take the centrifugal force. Preloading on the bearing was then not necessary; thus, a very small amount of end play is as effective as a large amount; therefore, an end play of any amount will not affect the airworthiness of the propeller. It is considered, however, in balancing at which time it is taken up by a wedge placed between the hub and clamp.

H - BLADE TRACK.

A tolerance of 1.4 inch in track is provided. A few thousandths clearance between the hole in the blade and the tube in the hub may result in as much as 3/16" freedom at the tip of the propeller when the propeller is dry. With grease in the pilot tube hole the play at the blade tip should be largely eliminated. It is sometimes necessary to whirl the propeller to force the grease in the space between the tube and hole.

Recently, the blade serial numbers include a dash number and letter. The number refers to balance as described in Part K and the letter refers to track.

Due to variations of warpage which occurs during the manufacture of the propeller, three track dimensions were necessary, "H" designates a track above the blueprint dimension. "C" on the blueprint dimension and "L" below the blueprint dimension. Two "H", two "C" and two "L" blades can be assembled in a hub without checking the track. An "H" and "C" combination and "C" and "L" may be possible but must be checked and maintained within 1/4" tolerance. An "H" and "L" combination should never be used. This check should be made on the tip just back of the metal tipping.

I - WEAR IN BLADE BORE AND HUB TUBES

The blades bore should be 1.502 +inches in diameter, as measured with clamp in place and pulled tight.

If this hole is worn or oversize it should be re-reamed for an oversize pilot tube, 1.507 - 1.509 inches with clamp in place. New oversize tubes designated as the -5 tubes should replace the standard tubes. A -5 should then be stamped behind the serial number of the blades and hub for identification purposes.

J - WEAR IN THE BLADE BEARING

The ball bearings which hold the blades will last almost indefinitely if they are kept in grease. If, however, they are allowed to run dry for any long period of time they will oxidize at points of contact of bails and race. This is evidenced by the presence of red rust. The result is that the bearings will become pitted, which may prevent the pitch from changing. Minor roughness will not affect propeller operation. Replace bearings only if roughness is pronounced.

K - BLADE IMPROVEMENTS

The propeller blade Design L8427 as used on the Sea-bee installation is subjected to severe operating conditions due to the water spray and large waves. The outer 6" of the tip may wear through in a relatively short period of time. To offset this problem the armored tip was developed. This tip adds about .090 more metal on 8" of the tips and brings the leading edge to a very sharp point. The life of the blade is extended considerably by this improvement, however, pilot care such as holding the rpm as low as possible with flaps down while taxiing on water will aid a great deal in extending the life of the blades. By filing the armored tipping to a sharp edge at the first sign of pits will also aid in extending the life of the blades.

This improvement necessitated two balance masters. They are designated as -1 and -2 which are stamped after the serial number of the blades. These balance masters have also been used for repair purposes. Do not assemble a -1 blade with a -2 blade and an unarmored blade with an armored blade. This blanace system was only started at the time of armored tipping and all blades without a dash number are usually -1 balance.

Propeller Blade Design 8428 was previously an 8628 as used on Continental E-185 engine installations. This change in the propeller necessitated two masters for this design, designated by a -1 and -2 following the serial number of the blade. A -1 propeller must not be assembled with a -2 propeller.

L - HYDRAULIC ELEMENT IMPROVEMENTS

The guide pins have been increased in size to 7/16" in diameter and are installed through the inside of the cylinder with the end extending out the back and headed over a steel washer. In this manner pins cannot be pushed out inadvertently on assembly and the added strength will alleviate possibility of failure.

M - NEW CYLINDER MOUNTING PROVISION FOR CONTINENTAL E-185 "D" SERIES ENGINE.

The "D" series engines provides four lugs on the nose for 5/16" cap screws or studs. The new cylinder for the dash 1 and dash 5 model propellers now have four holes drilled through the cylinder for bolting on to the engine. In making this installation it is recommended that the following parts be used: 4 NAS183-5-7A studs, Aluminum Washers AN960D516 and AN 265-524 fibre inserted nuts.

N - VALVE IMPROVEMENTS

Oil leakage from the servo valve accounts for a large part of the leakage problem. This has been eliminated by using two "O" rings, chrome plating the stem and lapping the bore in valve body to the size of the stem. Since the two parts are hand-fitted, they are not interchangable. This new valve has a "C" stamped on it and is called the "C" series valve. Old valves may be exchanged at the factory for new ones.

O - DASH 5 PROPELLER.

The dash 5 propeller is an improved version of the dash 1 propeller, which incorporates all the improvements mentioned above plus new type of pitch control links. The links in jack plate assembly (5) are replaced with rods and forks. These rods slide in lugs which are made integral with the hub. This feature prevents cocking of the piston, which reduces the possibility of oil leakage, and possible breakage of the links and guide pins. Dash 5 propellers will be available after January 1, 1948.

SECTION IX
PARTS LIST

Key to Illus-trations	Descriptions	Part No.	No. REQ. PER PROP. Model Dash No. 1	2	3	4	5	6
	Pin, Blade Clamp	A-83						
1	Cylinder	B-35		1				
		B-68	1					
		B-68A	1				1	
		B-68B				1		1
		C-17			1			
2	Piston	C-36		1				
		C-67	1			1	1	1
		D-78			1			
3	Ball Bearing	A-38	1	1	1	1	1	1
4	Cover Plate	B-12-1	1	1		1	1	1
		B-12-3			1			
5	Jack with Link and washer	92-1 (RH)	1	1		1		
		92-2 (LH)		1	1			
		B-109					1	1
6	Rear Cone	A-50-1	1	1	1		1	
		A-50-4				1		1
7	Hub with Pilot Tubes	94-1	1			1		
		94-2		1	1			
		94-5					1	1
8	Clamp - half	C-3	See Illustration 24					
9	Propeller blade	8428	2	2		2	2	2
		L8427		2	2			
10	Clamp Gasket	A-47	4	4	4	4	4	4
11	Clamp Washer	AN960-616	4	4	4	4	4	4
12	Clamp Bolt	AN6-21	4	4	4	4	4	4
13	Nut	AN355-6	4	4	4	4	4	4
14	Socket Head Cap Screw	3/8-24x1-1/4	4	4	4	4	4	4
15	20 Spline Nut	A-63	1	1	1	1	1	1
16	Safety Screw or Pin		1	1	1	1	1	1
17	Snap Ring	A-46	1	1	1	1	1	1
18	Front Cone	A-42	1	1	1	1	1	1
19	Blade Angle Stop	A-75	2	2	2	2	2	2
20	Washer	AN960-416LX	2	2	2	2	2	2
21	Cotter Pin	AN380-3-3	11	11	11	11	11	11
22	Thrust Bearing	A-14	2	2	2	2	2	2
23	Split Ring	A-16	2	2	2	2	2	2
24	Counterweight	C-66-1	2	2		2	2	2
	Clamp Half	C-86-3			2			
25	Linkscrew	A-7	2	2	2	2		
		A-98					2	2
26	"O" Ring Seal	H222-70-33	2	2	2	2	2	2
27	Snap Ring	Eaton No. 6	2	2	2	2	2	2
28	Linkscrew Wirelock	A-64	2	2	2	2		
29	Outer "O" Ring Seal	H222-70-67	1	1		1	1	1
		H222-70-72			1			
30	Inner "O" Ring Seal	H222-70-44	2	1	1	2	2	2

Key to Illus-trations	Descriptions	Part No.	No. REQ. PER PROP. Model Dash No. 1	2	3	4	5	6
31	Felt Seal	A-74	1			1	1	1
32	Cover Plate Gasket	B-73	1	1	1	1	1	1
33	Washer	AN936A-10	12	12	12	12	12	12
34	Bearing Wire Retainer	A-43	1	1	1	1	1	1
35	Screws	AN501-A-10-6	12	12	12	12	12	12
36	Socket Head Cap Screws	1/4-28x3/4	2	2	2	2	2	2
37	Gasket	A-71-1	1				1	1
		A-71-2		1	1	1		
38	Cotter Pin	AN380-2-2	3	3	3	3	3	3
39	"O" Ring Seal	H222-70-10	1	1	1	1	2	2
40	Valve Plate	A-56-1	1				1	1
		A-56-2		1	1	1		
41	Valve Body	B-59-1	1				1	1
		B-59-2		1	1	1		
42	Valve Lever	A-44		1	1			
		A-101A				1		1
		A-108	1				1	
43	Lever Pin	AN393-13	1	1	1	1	1	1
44	Valve Lever	A-41		1	1			
	Bracket	A-102					1	
		A-105				1		1
45	Valve Spring			Discontinued				
46	Filuster Head Screw	AN501-A-10-6	2	4	4	2	2	2
47	Weight Slug	A-48	?	?	?	?	?	?
48	Filuster Head Screw	AN501-A-10-4, 5, & 6	?	?	?	?	?	?

RECOMMENDED GREASES:

1. Experience has brought to light the fact that water sometimes gets into the propeller blade clamp assembly. This water will mix with certain types of greases and cause them to become hard and chalky in consistency. This may result in poor operation of the propeller, as the blades may become tight on the pilot tubes.

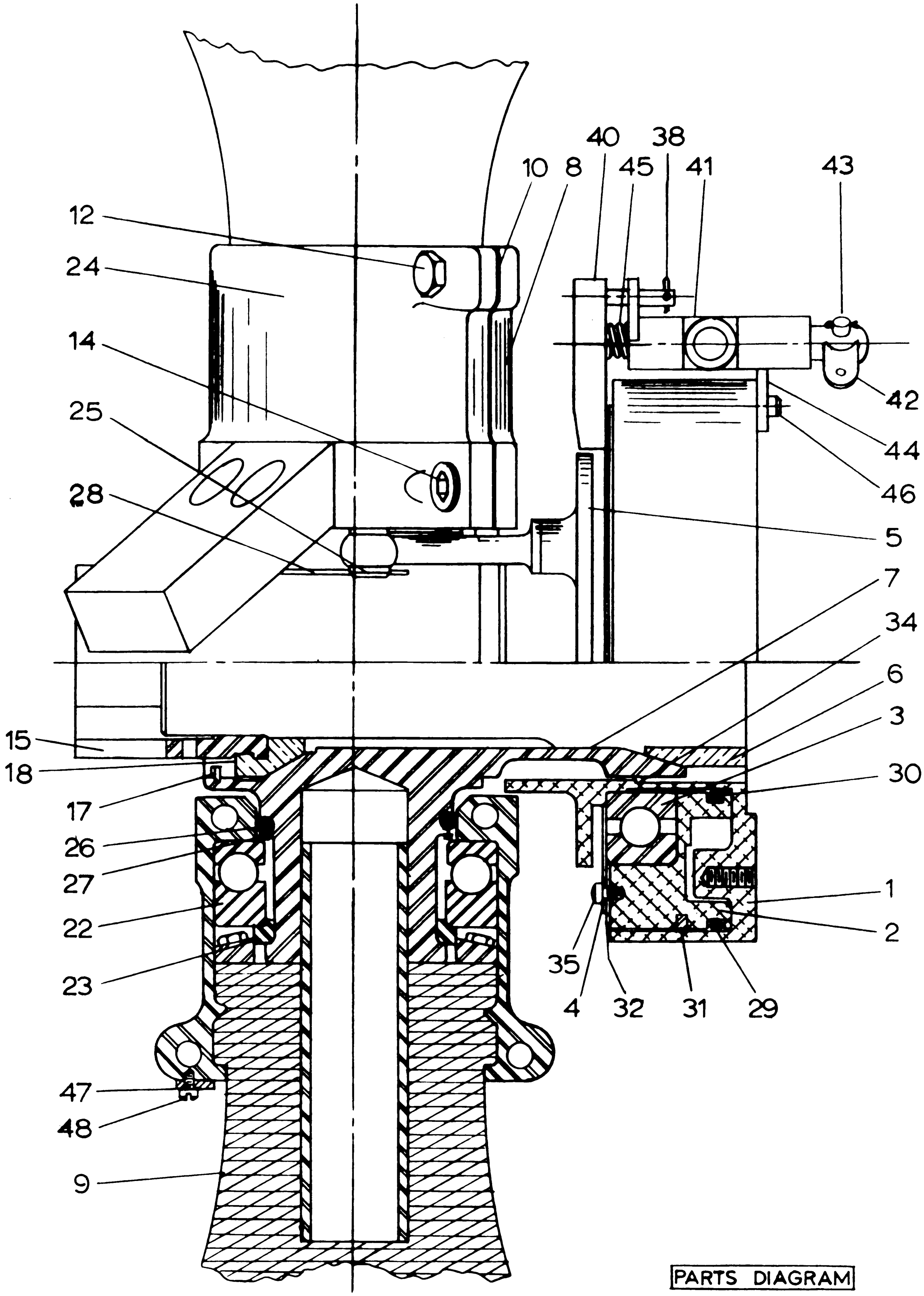
2. A number of greases have been tested for water resistance tackiness, lubricating properties when mixed with water, and viscosity under various temperatures. The following greases are recommended in the order of listing.

   (a) Lubriplate 630 AA.
   Fiske Brothers, Toledo, Ohio.

   (b) Stroma HT-1 (Z-801 Grease)
   Union Oil Co. of California

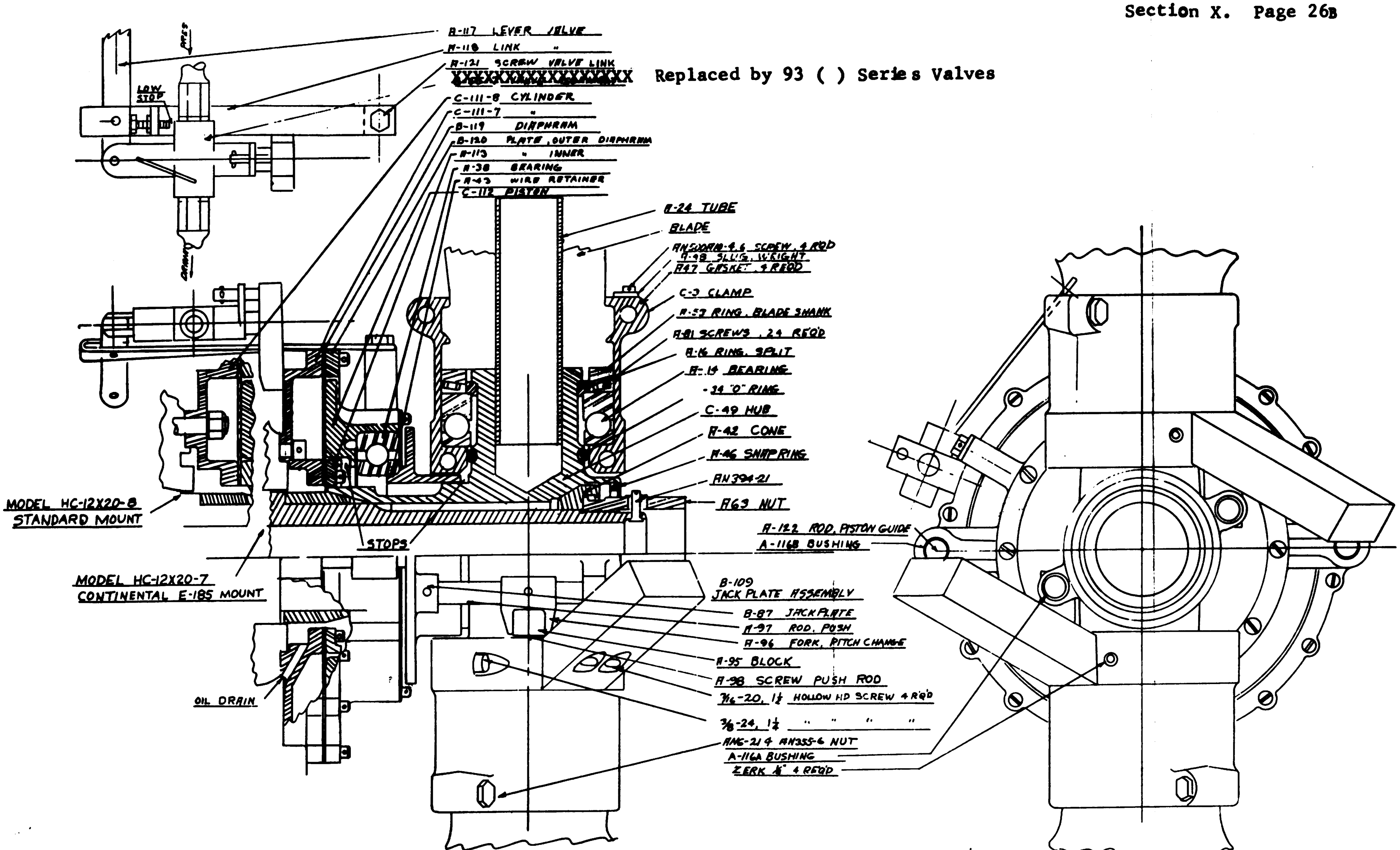
   (c) RPM Aviation Grease No. 2
   Standard Oil Co. of California

   (d) Stroma LT-1 (Z-815 Grease)
   Union Oil Co. of California



PARTS DIAGRAM

SEE CATALOG NUMBER SHEET FOR
PARTS IDENTIFICATIONS


B-117 LEVER VALVE
A-118 LINK "
A-121 SCREW VALVE LINK
XXXXXXXXXXXXXXXXXX Replaced by 93 ( ) Series Valves
C-111-8 CYLINDER
C-111-7 "
B-119 DIAPHRAM
B-120 PLATE, OUTER DIAPHRAM
A-113 " INNER
A-38 BEARING
A-43 WIRE RETAINER
C-112 PISTON
LOW STOP
A-24 TUBE
BLADE
AN500A-4-6 SCREW, 4 REQ'D
A-98 SLUG, WEIGHT
A47 GASKET, 4 REQ'D
C-3 CLAMP
A-53 RING, BLADE SHANK
A-81 SCREWS, 24 REQ'D
A-16 RING, SPLIT
A-14 BEARING
-34 "O" RING
C-49 HUB
A-42 CONE
A-46 SNAP RING
AN394-21
A63 NUT
A-122 ROD, PISTON GUIDE
A-116B BUSHING
B-109
JACK PLATE ASSEMBLY
B-87 JACK PLATE
A-97 ROD, PUSH
A-96 FORK, PITCH CHANGE
A-95 BLOCK
A-98 SCREW PUSH ROD
5/16-20, 1 1/2 HOLLOW HD SCREW 4 REQ'D
3/8-24, 1 1/2 " " " "
AN6-21 & AN355-6 NUT
A-116A BUSHING
ZERK 1/8" 4 REQ'D
STOPS
MODEL HC-12X20-8
STANDARD MOUNT
MODEL HC-12X20-7
CONTINENTAL E-185 MOUNT
OIL DRAIN

(e) RPM Aviation Grease No. 1
Standard Oil Co. of California

(f) Lubriplate 707
Fiske Brothers, Toledo, Ohio

(g) Mobilgrease Aero Lo-Hi PD-535-K
Socony Vacuum Oil Co.

(h) No. 84 Medium Grease
Keystone Lubricating Co.

(i) Texaco Regal Starfak Special

SECTION X

HC-12x20-7 and 8 models

The dash 7 and dash 8 models reflect a basic change in the design of the hydraulic element (See assembly drawing).

The "O" rings are replaced by a synthetic rubber diaphragm, the object being to eliminate all possibilities of oil leakage. The valve is moved to the rear of the cylinder in order to be located within the engine cowling. All rotating elements of the propeller are identical to the dash 5 design. There are several configurations of these models, which have interchangable parts with few exceptions as noted below:

A - MODELS

1. HC-12x20-7: This model is designed to fit Continental E-185 engine only.

2. HC-12x20-8: This model will fit any engine having S.A.E. standard 20 spline shaft and nose plate.

3. Both the dash 7 and dash 8 models have several parts configurations as listed in the following table:

Model	Hub	Clamp	Jack Assembly	Cylinder
HC-12x20-7	C-49-2A	C-3-1	B-109-2	C-111-7
HC-12x20-7A	C-49-1A	C-3-1	B-109-3	C-111-7
HC-12x20-7B	C-49-2A	C-3-3	B-109-4	C-111-7
HC-12x20-8	C-49-2A	C-3-1	B-109-2	C-111-8
HC-12x20-8A	C-49-1A	C-3-1	B-109-3	C-111-8
HC-12x20-8B	C-49-2A	C-3-3	B-109-4	C-111-8

All other parts are interchangable.

B - INSTALLATION

The installation of the dash 7 and dash 8 models is the same as for the other models described previously except for the hydraulic element, which is outlined in detail below:

1. Remove piston from cylinder by removing A-121 valve link screw and sliding piston forward off piston guide rods.

2. Remove diaphragm B-119 by removing outer and inner plates B-120 and A-113.

3. The cylinder is mounted on the engine nose with the guide pins A-122 in the horizontal plane. It may be necessary to trim the cowling to clear the guide pin brackets. After the cowling is trimmed proceed to install cylinder onto engine nose. In order to eliminate all possibilities of oil leaks it is recommended that a paper gasket be used between cylinder C-111 and the face of the engine, together with gasket compound.

3a. The cylinder C-111-7 is mounted on the Continental "D" series engines with 4 Allen head cap screws (5/16-18). Use 1/16 thick aluminum or copper washers under the heads of the screws. Be sure the screws do not bottom in the engine tapped hole before pulling up tight on the cylinder; otherwise oil will leak out. Safety screws with wire through drilled holes in screw head.

3b. The cylinder C-111-7 is mounted on the early undampened engines with a sheet metal bracket which is screwed to the rear of the cylinder.

3c. The cylinder C-111-8 is bolted to the nose plate of any engine having an SAE standard nose with the six studs provided on the engine. Use a gasket and gasket compound between engine and cylinder. Also use washer and "Elastic Stop Nut" on inside of cylinder; the latter is recommended as oil will not leak past the threads.

4. Install rubber diaphragm with inner and outer diaphragm rings. Important -- tighten all screws uniformly until the rubber squeezes out past the edges of the rings 1/16 inch. Breakage of the rings may result if only a few screws are tightened up at a time.

5. Install hydraulic lines to valve. An 18 inch line is required for the pressure side for the dash 7 installation. The drain line should be as short as possible. Use 1/4 I.D. flexible hose.

6. Grease front face of rubber diaphragm and install piston. Connect A-118 link with piston, using A-121 screw. Safety screw with wire running to other screws on piston.

7. Install propeller hub and blade assembly.

8. Connect push-pull control wire to valve lever A-117. For Navions, this requires shifting the control wire from left side of engine (facing rear of engine from cockpit) to right side. The bracket supporting the wire at the front can be reworked by riveting on an angle plate to support the wire in the proper position in forward position and valve body 3/8 inch from valve plate (near mid position); also push-pull control should be pulled out from dash about 1/8 inch. (When piston is in forward position it extends out in front of B-120 Plate by 1/8 inch. When in neutral position, piston front face is 1/16 behind face of B-120 plate).

9. Check travel of piston. The total travel should be 3/8", or 3/16" on both sides of neutral position of diaphragm. If these dimensions do not exist the rear cone should be shimmed or reduced in length to provide above travel.

10. Run up engine and set pitch control to provide proper static RPM. Shut off engine and set low stop screw on link A 118 so that it touches valve body. Check engine static again to assure proper stop setting. Shut off engine and check clearance between jack plate B-87 and hub when in low pitch. This can be done with the engine running by standing to one side of propeller and observing clearance gap. A 1/16" clearance must exist; otherwise the thrust bearings in propeller and engine will be loaded up needlessly. Check high pitch travel by pulling control back to limit and forcing piston back by pushing on counterweights. The valve lever should have sufficient travel so that the

valve can be positioned at the center of its travel while the piston C 112 is at rear end of its travel of 3/8 inch. This latter check will provide assurance of obtaining full RPM range available during flight.

11. Safety feature: in the event a leak should develop in the diaphragm or cylinder, the oil supply to cylinder can be shut off during flight by pulling the prop control wire to the extreme rear, past the normal high pitch setting. The mechanical stop will limit the high pitch while the valve will shut off the oil. In order for this feature to be effective there must be provided sufficient travel in the push-pull wire and lever so as to position the valve body in front of the neutral position while the C-112 piston is in the extreme rear position. Whether the valve actually closes can also be checked with engine running full throttle by slowly reducing engine speed with prop control. If the prop control has a slight travel of say 1/2" after the RPM stops dropping, this indicates that the valve is closed.

B - SERVICE PROBLEMS

The diaphragm hydraulic element has proven to be entirely reliable and free from oil leakage when installed properly. To date all leakage troubles have been traced to the following:

(a) Mounting bolts not properly installed; either they bottomed in the crankcase or were not pulled up tight on the washers.

(b) Diaphragm screws not tight enough.

(c) Engine shaft seal leaking excessive amount.

In order to eliminate the problem of oil from a leaky engine shaft seal flooding the thrust bearing and coming out the front of the hydraulic element, a drain hole has been provided in cylinder C-111. Tests indicate that the drain will handle any normal leakage without any reaching the thrust bearing; but when the leakage reaches extreme amounts (1 qt. per hr.) it may flood the bearing, in which case a new seal should be installed.

It is desirable, in connection with the oil drain, to provide a drain tube to carry the oil outside of the engine compartment.

The service life of the diaphragm has not been determined to date. It is recommended that it be replaced during the major overhaul or at 250 hours.

Parts List

HARTZELL HYDRO-SELECTIVE PROPELLER
Model HC-12x20-7 & -8/8428
Also HC-12x20-7A, -7B, -8A, -8B/8428

August 3, 1948

(See note below)

Part No.	Change Letter	Name	Qty. Per Prop.	Model Dash No. -7	-8
8428	O	Propeller Blade	2	x	x
*C-3	GG	Clamp	2	x	x
A-14	C	Bearing, blade	2	x	x
A-16	C	Split Ring	2	x	x
B-17	Q	Counterweight	2	x	x
A-24	B	Pilot Tube	2	x	x
A-38		Ball Bearing	1	x	x
A-42	B	Cone, front	1	x	x
A-43		Retainer, Wire	1	x	x
A-46		Snap Ring	1	x	x
A-47	A	Gasket, Clamp	4	x	x
A-48	A	Weight slug		x	x
*C-49	S	Hub	1	x	x
A-50-1	C	Cone, Rear	1	x	x
A-53	D	Ring, Blade	2	x	x
B-55	B	Valve Assembly	1	x	x
A-56	E	Plate, Valve	1	x	x
A-57	B	Tube, Valve	1	x	x
A-58	D	Guide Pin	1	x	x
B-59	N	Valve Body	1	x	x
A-63	B	Nut-Prop Hub	1	x	x
A-65		Pin, Counterweight Dowel	2	x	x
C-66		Assembly Counterweight	2	x	x
A-71-1	B	Gasket	1	x	x
A-72	L	Blade Shank Details	2	x	x
B-73		Gasket, Cover Plate	1	x	x
A-81		Shank Screws	24	x	x
*B 87	B	Jack	1	x	x
C-94		Assembly, Hub & Tube	1	x	x
A-95	C	Block, Pitch Change	2	x	x
A-96	E	Fork, Pitch Change	2	x	x
A-97	F	Rod, Push	2	x	x
A-98	A	Screw, push rod	2	x	x
*B-109	D	Assembly, jack plate	1	x	x
C-111-7	C	Cylinder, diaphragm	1	x	
C-111-8	C	Cylinder, diaphragm	1		x
C-112	B	Piston, diaphragm	1	x	x
A-113		Plate, inner diaphragm	1	x	x
A-114		Pin, staking fork	2	x	x
A-115		Pin, staking push rod	2	x	x
A-116A		Bushing, push rod	2	x	x
A-116B		Bushing, push rod	2	x	x
A-117	B	Lever, Valve	1	x	x

*NOTE: Models -7 and -8 requires C-49-2A hub, C-3-1 clamp and B-109-2 Jack ass'y.
Models -7A and -8A require C-49-1A hub, C-3-1 clamp, and B-109-3 jack ass'y.
Models -7B and -8B require C-49-2A hub, C-3-3 clamp and B-109-4 jack ass'y.
All other parts are interchangable.

Model HC-12x20-7 & -8/8428

Part No.	Change Letter	Name	Qty. Per Prop.	Model Dash No. -7	-8
A-118	B	Link, Valve	1	x	x
B-119		Diaphragm	1	x	x
B-120		Plate, outer diaphragm	1	x	x
A-121		Screw, Valve Link	1	x	x
A-122		Rod, Piston Guide	2	x	x
D-125		Assembly, Model HC-12x20 -7, -8	1	x	x
AN501-A10-6		Screws	12	x	x
AN501-A10-12		Screws	26	x	x
AN380-2-2		Cotter pin	3	x	x
AN380-2-3		Cotter pin	11	x	x
Eaton No. 6		Snap Ring	2	x	x
1/4-28		Zerk Fitting	5	x	x
H222-70-10		"O" Ring (Valve)	2	x	x
PLASTIC & RUBBER SPEC.					
H222-70-33		"O" Ring (Clamp)	2	x	x
3/8-24x1-1/4		Allen Head Screw (Clamp)	4	x	x
7/16-20-1-1/4		Allen Head Screw (Ctwt.)	4	x	x
1/4-28-3/4		Allen Head Screw (Valve)	2	x	x
AN6-21		Bolt (Clamp)	4	x	x
AN355-6		Nut (Clamp)	4	x	x
AN960-616		Washer (Clamp)	4	x	x
AN960-516LX		Washer (For A-75-2)	2	x	x
AN501-A10-4		Screw (A-48)	2	x	x
AN393-13		Pin (A-44)	1	x	x
AN936A-10		Lock Washer	38	x	x

End