BENSEN

8-10

ALL-ALUMINUM ROTOR BLADES

Packing List & MANUAL

The Bensen Team, celebrating production of the 11,000th Rotor Blade in June, 1982. Not one single in-flight failure, and with more Rotors produced than any other company manufacturing related size aircraft!

THANK YOU FOR BUYING THE BEST!

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You have purchased the finest Gyro Blades made in the world today! Properly cared for, they will give you endless years of satisfying service. DO NOT entrust your life to lower quality imitations. Use only the design test-PROVEN for over 30 years!

Item No. 8-10

All-Aluminum Rotor Blades

INSTALLATION and OPERATIONAL MANUAL

The 8-10 All-Aluminum Rotor Blades described in this Manual are designed to be used with Model B8 Gyroglider, B8M and B-80 Gyrocopters, built in accordance with current Bensen Construction Manuals. This Manual is an integral part of the Plans, and should be attached to your copy thereof as a permanent addition to it.

DESCRIPTION: Model G-4, "Bird-proof" Rotor Blades, manufactured in factory-finished pairs, and sold only by Bensen Aircraft Corporation and its Dealers.

AIRFOIL: Bensen G-4; LENGTH: 118 inches; THICKNESS RATIO: 9.7%; WEIGHT: 16 lbs.

CURRENT PRODUCTION MODEL: 3" Grip Attachment Blocks, serial numbers 7000 and up. *(As of July '82, over 11,000 produced.)

USE: The 8-10 Rotors are designed to be used only with a Bensen factory-finished Rotor Hub, 8-20B and on a standard constructed Gyro. The 8-10 and 8-20B will directly mount on a Bensen factory-finished 8-20A Gimbal Control Head, or on the 8M-20P "Kit-Built" Gimbal Head when constructed in accordance with Plans.

OPTION: 8-20B34 Extended Rotor Hub

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The Extended Rotor Hub is used by experienced pilots to lower the rotor disc-loading, on heavier machines, flying at higher altitudes, and for increased performance and a reduced descent glide rate.

WARNING: The 8-20B34 is not recommended for use without the installation of: (1) a prerotational device to pre-spin the rotor in excess of 120 rpm; (2) Replacement of the Gimbal Control Head rearward longitudinal pivot block with the Bensen "reduced travel" pivot block, and; (3) used by experienced pilots.

ADVANTAGES: Better lifting performance at higher altitudes and temperatures, slower descent glide rate, better lift for heavier machines, and the option of increasing blade pitch for increased lifting capacity.

Complete installation and use instructions are enclosed with the 8-20B and 8-20B34 Packing List and Instruction Manual.

* There has never been one-single in-flight failure of a Bensen Rotor Blade!

OPERATING LIMITATIONS: Maximum operating gross weight, with standard pitch; scribed lines on blade and hub grip aligned, rotor hand-startable .....550 lbs.

Maximum operating gross weight, with scribed lines offset positively 1/32", center-to-center, rotor startable with Pre-rotator only .....600 lbs.

Rotor operating speed limits at steady state and normal gross weight: Maximum RPM ... 425; Minimum RPM ... 375.

UNDER NO CIRCUMSTANCES SHOULD THE TRAILING EDGES BE BENT UP OR DOWN. THEY ARE PRE-SET FOR THE CORRECT AERODYNAMIC MOMENT IN FLIGHT FOR ALL OPERATING SPEEDS.

If you attempt to paint the rotor blades, the close tolerance balance will be disturbed unless you get the exact same amount of paint on each rotor.

INSTALLATION INSTRUCTIONS: The enclosed 8-10 Rotor Blades and the 8-20B or 8-20B34 Rotor Hub have attaching grip blocks with a ground-adjustable pitch setting. This permits fine adjustment of each blade pitch in the field to obtain perfect track, or a higher tip pitch setting for improved flight efficiency when a pre-rotator is available for blade starting.

The scribed line on the lower surface of the hub grip blocks is located in our fixture by referring to the teeter bolt axis, thereby eliminating any effect of twist in the hub bar.

The scribed line on the lower surface of the rotor blade grip blocks are likewise located in our fixture, thereby compensating for any twist in the rotor blades. When your scribed lines are correctly aligned, the outer surfaces of grip blocks on the hub and the blades need not be either parallel, nor aligned.

To set blade and hub to a pitch setting that represents the best compromise between efficient rotor RPM and ease of hand-starting, the scribed lines should be exactly aligned. For maximum efficiency of rotor, if you have a pre-rotator for starting, the scribe lines may be offset approximately 1/32", center-to-center of line to pitch the blade to a greater positive pitch.

INSTALLATION TORQUE:

6-24 Tension Bolts (Supplied with Hub) ... 21 to 25 ft. lbs.
6-32 Vertical Retention..... 21 to 25 ft. lbs.
6-45 Teeter Bolt (Supplied with 8-20A) ... 15 ft. lbs.

For the correct mounting position of hub-to-rotor, and rotor-to-head, refer to the attached pictures and/or sketches.

The Rotor Blade is attached to the Hub with four 3/8" Tension Bolts in the following manner.

INSTALLATION:

1. Provide padded supports or a flat surface to lay the rotor blades on, with the bottom-flat surface facing up.

2. Carefully seat the 3/16" pin in the butt end of hub in the mating socket in the blade butt, which acts as a feathering pivot. Install the four 6-24 tension bolts in the pre-machined holes in the hub and blade grip blocks.

Place a MS20002-6 special high-strength washer under the head of each bolt, and on the threaded end of each bolt. Secure with a 310-6 castellated nut.

Carefully align the scribed lines on the hub and blade grip blocks. TORQUE the castellated nuts to 21 to 25 ft lbs. SAFETY the nuts with cotter pins provided, or safety wire if you prefer. (Note: the MS20002-6 washers are a special high-strength type which are to be used on the (8) 6-24 bolts ONLY! Do not substitute any other type of washer! If you need replacements, they are available from Bensen Aircraft at $2.25 per set of 16.)

3. Install the hub/blade assembly on your Gimbal Control ead by lifting the assembled unit by the hub, and place hub between fork blocks. Rest ssembly on the Teeter stop plate, rock hub as necessary on stop plate to insert the 6-45 bolt supplied with the head, through shoulder bushings and hub teeter block. Secure with a 310-6 castellated nut and TORQUE to 15 ft lbs.

Check for a free teetering action. MINIMUM LATERAL CLEARANCE IS .002" to a MAXIMUM OF .015". If you have insufficient clearance for free teetering action, place a shim between the shoulder of bushing on Gimbal Head, and the Hub teeter block. FREE TEETER ACTION IS A MUST. SAFETY the nut with a cotter pin. Extra 3/8 washers are provided with Gimbal Head to properly align castellated nut slot to bolt hole. 3

IF YOU HAVE EXCESSIVE CLEARANCE, FACE OFF PIVOT BUSHING, OR PLACE A SHIM BETWEEN NYLON WASHER AND HEAD OF BUSHING ON GIMBAL HEAD.

FINE TRACKING: In 99 cases out of 100, your rotor will be "In-Track" within a half-inch as assembled, which is acceptable for normal flying. To fine track your Rotor Blades further, should you seek perfection, loosen the (4) tension bolts, lift up tip of rotor to remove droop load, and rotate blade on its eathering pivot. A .006" movement of a scribed line, produces about 1/2" track change the rotor tip.

o maintain fine track, index-mark mating blade, and hub with paint. If the rotor and hub are to be disassembled, remove the (2) vertical bolts from the hub retaining grip blocks, and slide assembly off the hub blank. Replace the rotor on the same marked end of hub blank in a like manner.

If the vertical bolts in blade or hub are removed, they should be recoated with a general purpose grease, or marine preservative as they have an unprotected ground finish.

SERVICE LIFE:

The 8-10 Rotor Blades are designed to have infinite service life when used in the exact manner, and in exact accordance with the instructions provided in this Manual, and the FLIGHT OPERATIONAL PROCEDURE MANUAL which is enclosed.

MAINTENANCE:

As needed, wash rotor with water and a mild detergent. Burnish out any sharp nicks, scratches, etc. Wax surface to retard corrosion. If rotor is exposed to salt water, spray or mist, clean as above immediately after use.

INSPECTION:

Regular pre-flight and post-flight visual inspections of the entire rotor are required. Look for loose or severed rivets, buckled or bent skin sections, especially the bottom skin area next to the butt end of rotor. Check for dents or scores on the leading edges. Look closely for any cracks radiating from under rivet heads. Assure yourself that retention and teeter bolts are safetied.

Perform these inspections at the following times:

1. As part of every pre-flight inspection.

IMMEDIATELY following flapping loads resulting from improper rotor-starting or stopping in strong winds, or rough ground transporting.

3. IMMEDIATELY following a ground strike or rotor contact with any object.

4. IMMEDIATELY following a hard landing.

REPAIR INSTRUCTIONS:

ALL REPAIRS TO ROTOR BLADES: REPLACEMENT OF RIVETS, UPPER SKINS, STRAIGHTENING OF SPARS, ETC., MUST BE DONE BY THE BENSEN FACTORY ONLY! NO EXCEPTIONS! WE DO NOT SELL INDIVIDUAL PARTS FOR FACTORY-FINISHED ROTOR BLADES.

1. BOTH blades, regardless of condition, MUST be returned to the factory via prepaid conveyance. The rotors are a matched set. Therefore repairs to one rotor may change the balance and track of either or both.

2. The Rotor Hub and Gimbal Control Head must also be returned.

The description of circumstances under which blades are damaged must be indicated. Supply as much information as possible as to in-flight or non-flight conditions, such as approximate speed of rotor, type of object struck etc. This information is essential to establish possible stress level and stress pattern the rotor was exposed to.

4. Bensen WILL NOT accept rotor blades for repair, where user has attempted to repair blades himself.

5. After any rotor ground strike, we recommend that the Mast structure be removed and carefully inspected for any signs of damage, such as twist or cracks. To be absolutely safe, we recommend that the Mast be replaced with the current redundant type structure.

WARNING: NEVER allow anyone to stand or walk under or near a turning rotor! Stay in your seat with seat belt fastened until the rotor is completely stopped. Rotor tip speed at 400 RPM is 314 MPH. Always start your

own rotor from the seat. Never allow anyone else to start it, as they might be struck by the propeller, or the rotor.

Note the enclosed pictures and/or sketches and make certain that your 8-10 Rotor Blades, 8-20A Gimbal Control Head, and the 8-20B/8-20B34 Rotor Hub are assembled properly, and that you install them on your machine in the proper direction. DO NOT INSTALL THE ROTOR OR ROTOR HUB UPSIDE DOWN.

You have purchased the finest Gyro blades made in the world today! Properly cared for, they will give you endless years of satisfying service. Do not entrust your life to lower quality imitations. Use only the design test-PROVEN for over 30 years!

Be sure to read and understand the attached **FLIGHT OPERATIONAL PROCEDURE MANUAL**. It covers the entire rotor starting procedure, towed flight, landing, and rotor stopping.

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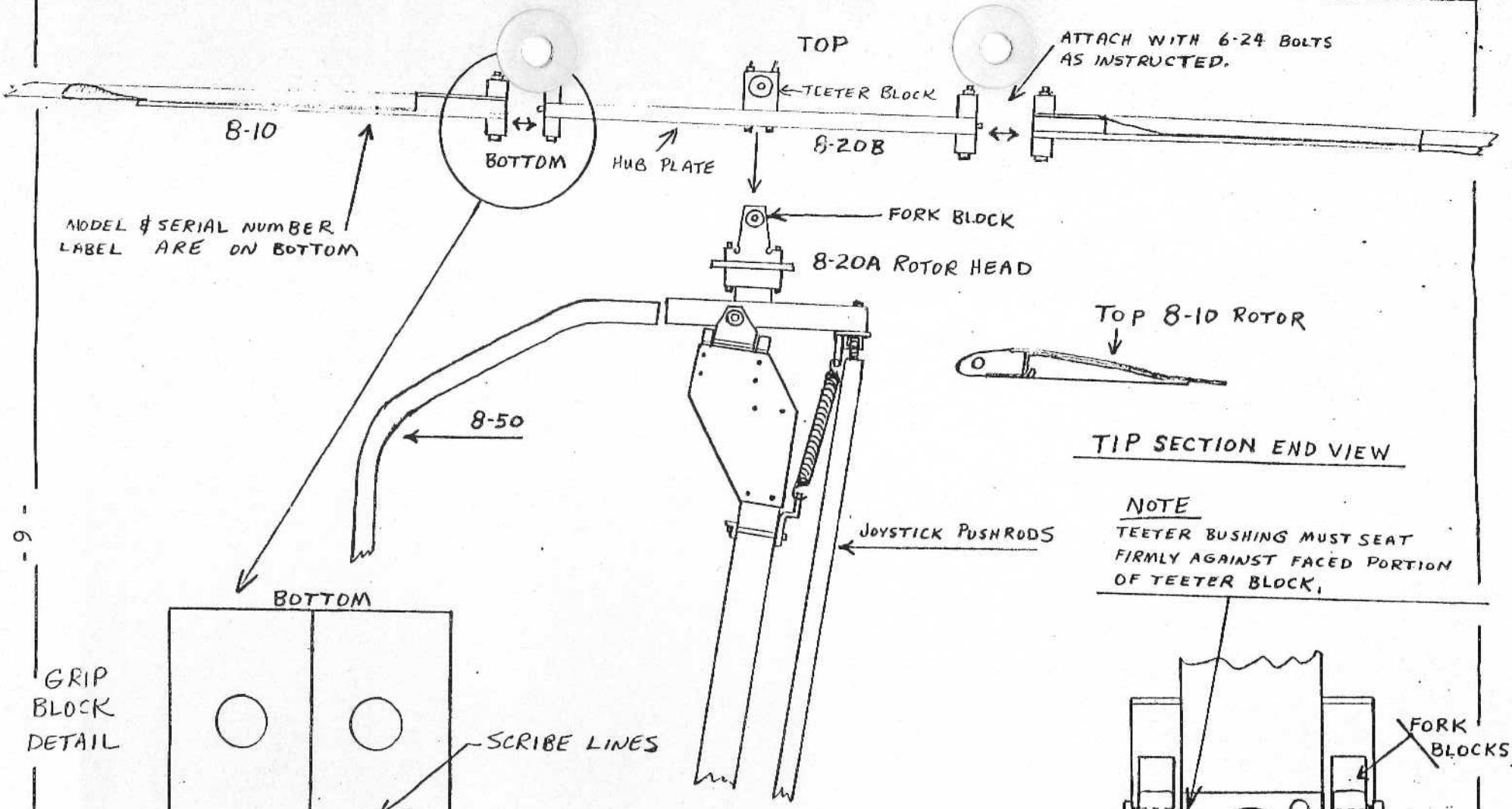
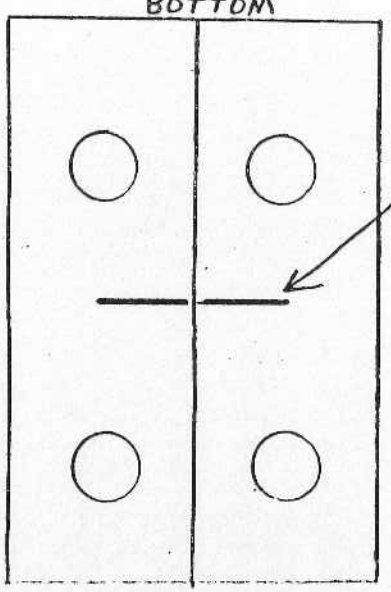
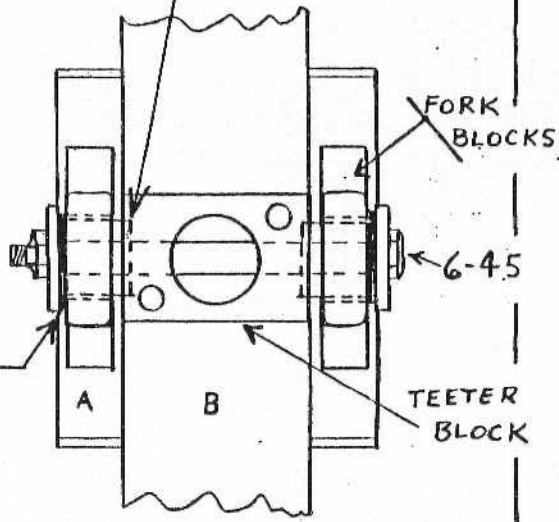


TIP SECTION END VIEW

NOTE
TEETER BUSHING MUST SEAT FIRMLY AGAINST FACED PORTION OF TEETER BLOCK.



GRIP BLOCK DETAIL



MINIMUM TEETER BLOCK CLEARANCE BETWEEN FORK BLOCKS .002". MAXIMUM CLEARANCE .015". SEE STEP 3. TORQUE 6-45 BOLT TO 15 FT. LBS.

VIEW SHOWING BOTTOM OF HUB AND BLADE GRIP BLOCKS.
ALIGN FACTORY SCRIBED LINES AS DESCRIBED IN STEP #2

TOP VIEW 8-20A & 8-20B

Bensen 8-10 Rotor Blades and 8-20A Gimbal Control Head Unit

Consult and read the Bensen Manuals for general procedures and practice for self-taught Gyroglider flying, towed Gyrocopter flying, and powered Gyrocopter flying. The specific instructions in the Manual refer to home-built wood rotors, home-built spindle control head, and the overhead "azimuth" control stick. The flight procedures and operating methods, however, are applicable to factory-built components. Follow these instructions to the letter!

WARNING! BE AWARE...

The 8-10 Rotors and the 8-20A Head can be severely damaged by improper rotor starting technique. If you attempt to start the rotors with insufficient RPM by simply moving faster forward, or in a strong wind, and you tilt the rotor rearward, severe flapping will occur. The blades will act as if they were two long boards in the wind. The result will be, the advancing blade will flap up severely, forcing the hub to bottom on the Gimbal Head stop-plate. The imposed structural loads imposed by such flapping are far greater than any normal flight loads. The Rotor MUST turn at a high enough RPM to produce a tip velocity necessary to give significant response to control imput. When the rotor is tilted rearward, its RPM must be high enough to produce centrifugal force large enough to prevent excessive upward movement of the advancing blade.

Rotor Blades are your "life-support" system in flight. PROTECT YOURS!

CORRECT ROTOR STARTING PROCEDURE:

1. The Rotor responds to the relative speed of the air flowing through it. A airspeed meter is a MUST. Refer to airspeed ONLY, not ground speed.

2. ALWAYS start the rotors with the machine pointing into the wind.

3. ALWAYS start the rotors, and stop the rotors with the rotor-plane level to prevent flapping. (Gyro sitting on the main wheels and nose wheel, with Joystick fully forward, or Overhead Stick fully rearward.)

4. Head into the wind, level rotor and hold in this position with your left hand on the control stick. Reach up with your right hand and push forward on the rotor hub. Each time the hub comes by, give it another push making the rotor go faster and faster. Gradually tilt the rotor back. Practice this procedure over and over until you can rotate the rotor up to 30 RPM'S, (One push on the hub per second.)

5. Accelerate to 13 mph and continue to push the rotor until the rotor accelerates to a RPM faster than you can follow by hand. NEVER exceed 23 mph airspeed when moving forward, until the rotor has obtained sufficient RPM, with rotor tilted rearward, to rotate the Gyro from the nosewheel to the tailwheel.

   If the rotor begins to "flap", it is telling you that the incoming airspeed is more than it can stand at its current RPM. SLOW DOWN AND EASE FORWARD ON THE CONTROL STICK!

   If the rotor flaps, you will begin to hear a light bumping noise as the hub bar hits the head stop plate. You will also begin feeling this "bump", transmitted from the rotor to your control stick. If it continues without correction, it can completely destroy your rotors and head. SLOW DOWN! Gradually give the rotor a chance to build up its RPM. Then and only then speed up and tilt the rotor rearward.