mt-propeller

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OPERATION- AND INSTALLATION MANUAL

HYDRAULICALLY CONTROLLED VARIABLE PITCH PROPELLER

MTV-28- ( )

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Original Issue	01-07-2012	1 to 37	Original Issue
R1	26-02-2019	2, 3, 26;	Remedy of possible Damage along Erosion Sheath;
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1.0 Scope of Manual

This publication provides operation, installation and maintenance information for the MTV-28-() variable pitch propeller. In addition to the propeller assembly, a description of the control unit is also included in this manual. Installation, removal, operation and troubleshooting data is included in this publication.

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2.0 ENTIRE MODEL DESIGNATION

The entire propeller designation consists of hub and blade designations.

Example:

MTV-28-1-I / L410-127d
H U B **B L A D E**

2.1 Model Designation of Hub

MTV - 28 - 1 - I
1 2 3 4 5

1 MT-Propeller (manufacturer)

2 Variable Pitch Propeller

3 Consecutive Number of Basic Type (i.e. "28" as 5-blade constant speed)

3 Consecutive Number of Series

5 Code for Propeller Flange
I = Special flange; 9/16” UNF bolts

2.2 Model Designation of Blade

( ) L 410 - 127 d
1 2 3 4 5

1 Position of Actuating Pin
Blank = Pitch Change Pin for Pitching Moment Towards Low Pitch
Pitch Change Pin for Pitching Moment Towards High Pitch

2 Sense of rotation
Blank = Right Hand Tractor
L = Left Hand Tractor
LD = Left Hand Pusher
RD = Right Hand Pusher

3 Diameter in cm

4 Consecutive number of basic type (including aerodynamic design)

5 Small Letter: = Modifications which do not affect interchangeability of blade sets.
Capital Letter: = Modifications which restrict or exclude interchangeability of blade sets.

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2.3 Additional Information on Hub and Blade Designation of Propeller

The serial number of the hub is the serial number of the complete propeller assembly.

Model designation and serial number of the hub have been stamped into the hub body.

The complete propeller designation (hub and blade), the serial number of the hub, data sheet number as well as date of manufacture or latest overhaul are indicated on the nameplate being bonded onto blade 1.

2.4 Code of Serial Number of Hub

Example: 86 008

- 008 → consecutive number
- 86 → year of manufacture

Note:
Any propeller documentation has been listed and kept under the serial number of the hub.

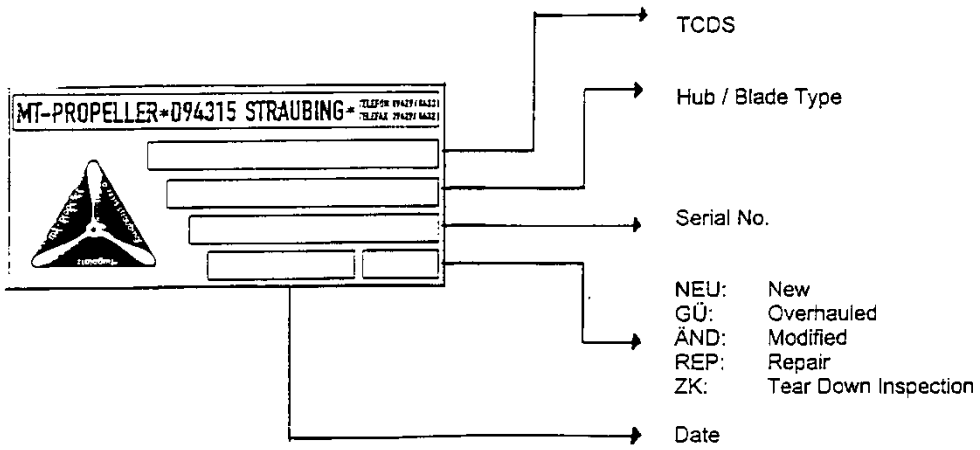
2.5 Code of Serial Number of Blade

Example C B - 157

- 157 → consecutive number
- B → month of manufacture (A = January, B = February etc.)
- C → year of manufacture (A = 1983, B = 1984 etc.)

The serial number of the blade has been stamped into the corresponding blade ferrule (topview blade root).

2.6 Instruction to complete the Type Plate



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3.0 MAINTENANCE AND OPERATING HOURS

3.1 Overhaul

Variable pitch propellers require overhauls at specified times. Defined as time between overhaul (TBO).

The time between overhaul (TBO) is based on operating and calendar time since manufacture or since the last overhaul. For the MTV-28-I a **TBO of 3500 hours or 6 years** is established.

During overhaul the propeller will be entirely disassembled and checked for wear, damage, cracks and corrosion.

Damaged parts will be subjected to replacement or repair.

Then the propeller will be assembled again, lubricated an balanced. Modifications or inspections required by the Service Bulletin have to be executed.

3.2 Repair

If damage occurs between two overhauls, the propeller has to be repaired. Kind and seriousness of damage determine the necessity of an overhaul or a repair.

If the blades are heavily damaged (e.g. mechanical contact), repair will be extensive in any case and the propeller has to be overhauled.

3.3 Life

Life is defined as total operating time, i.e. operating hours since new (TT = total time or TSN = time since new).

The total operating time since manufacture is abbreviated (time since new) TSN.

The operating time since the last overhaul is abbreviated TSO (time since overhaul).

The maximum life of a propeller or certain parts of it will be specified later and be published in a Service Bulletin. This section also comprises a list of the parts concerned.

An overhaul does not reduce the total operating time of the propeller (TT or TSN) to zero. Only the time since overhaul (TSO) will be set to zero. Any operating time has to be recorded under the hub serial number (= propeller serial number) file.

3.4 List of parts subject to life limitation

Consec. Number	Part Number	Part Designation	Hours

No specified limitation by now.

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4.0 OVERSPEED

4.1 If a propeller had been subject to overspeed the following record has to be drawn up and be attached to the propeller.

4.2 Record on propeller subject to overspeed

Owner: .....
Type of engine: ..... S/No.: .....
Reduction gear: .....
Type of propeller governor: ..... S/No.: .....
Type of propeller hub: ..... S/No.: .....
Type of propeller blade: ..... S/No. of blade 1: .....
2: .....
3: .....
4: .....
5: ……..
Max. overspeed (note whether being indicated or estimated):
.....
Propeller position (e.g. take off, cruise): .....
Pre-selected speed: .....
Overspeed time: .....
Flight attitude during overspeed: .....
Flight weight during overspeed: .....
Supposed cause of overspeed (if known): .....
.....

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5.0 DESCRIPTION OF PROPELLER TYPE AND FUNCTIONING

5.1 Type description

The milled hub is made of aluminum alloy. The servo piston is mounted on the hub front, which has been designed as a cylinder. The blade bearings are detachable ball journal bearings with a split inner ring. The blades are designed in natural-composite (wood-composite) construction using wood and epoxy fiberglass with a metal edge protection. The colored acrylic finish serves as an excellent surface protection.

5.2 Functioning

The MTV-28 is a hydraulically controlled variable pitch propeller. It is special developed for wind tunnels and bodyfly applications. The propeller is horizontally installed and gets its oil pressure from an external hydraulic control. The dual acting piston allows an adjusting of the blade pitch from 0° (low pitch) to 32° (high pitch). The hub itself is filled with 10 liters of HLP 100 oil. No preload springs are installed.

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6.0 Control Unit

The oil transfer unit is a static part of the propeller. It is connected with two terminals to a hydraulic aggregate. The terminal at the side of the unit is responsible for the low pitch control. The terminal at the front side of the unit controls the high pitch position of the blades.

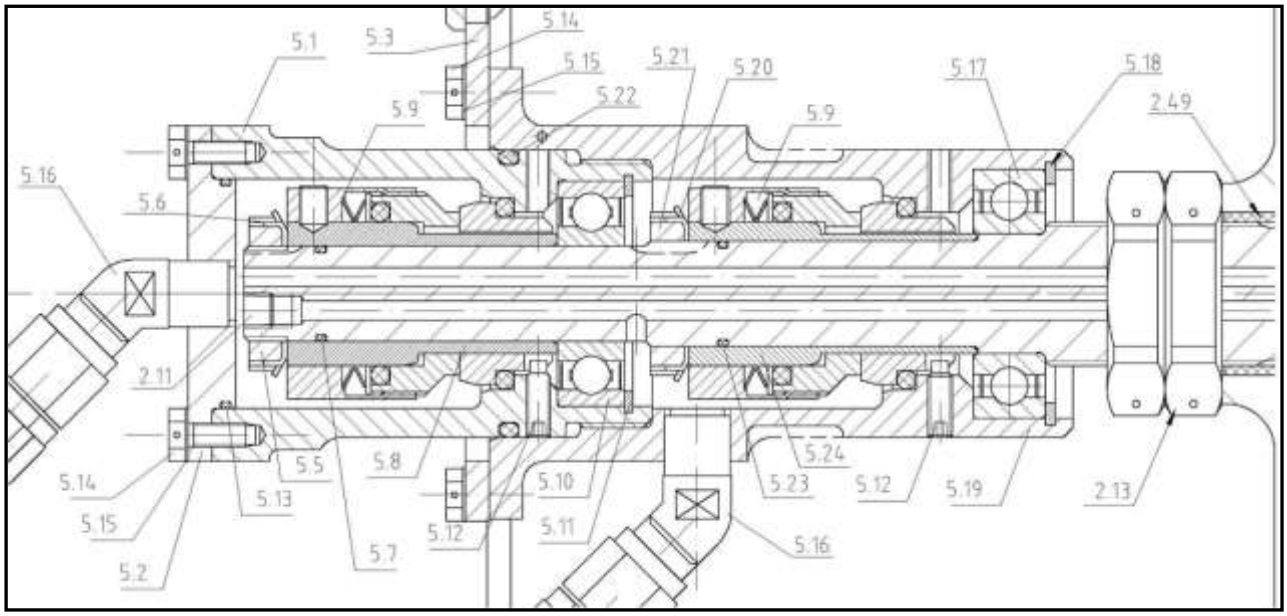

Fig. 1: Oil control unit

6.1 Assembly

Press the two bearings C-257 and C-135 into the housing A-813-2-A and A-813-1 and safe the front bearing with the retaining spring J47, and the aft bearing with the retaining spring C-136. Please note that the front bearing is an open type (5.10) and the aft one is a closed type (5.17).

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Prepare the guide rod for the installation of the control unit. Screw on the two nuts A-817-A (low pitch setting) and install the o-rings C-051-20 and C-051-22 to the guide rod. Take care that the guide rod is well lubricated (use HLP 100) before the installation of the control unit. A dry installation could damage the o-rings and the sensitive duo cone seal.

Push the aft housing of the control unit over the guide rod. Do not damage the o-rings.

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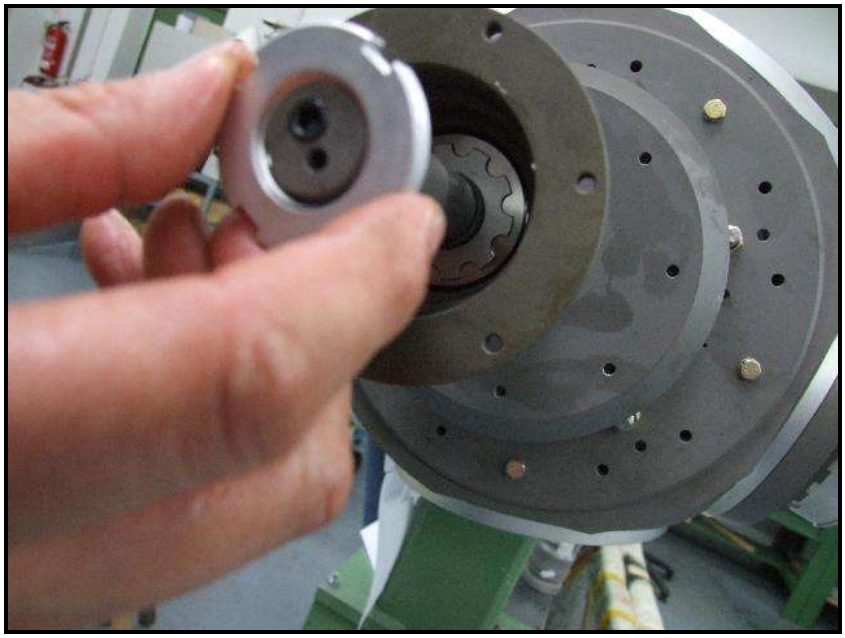
Assemble the duo cone seal C-138 to the collar A-815-1-A and safe it against rotation with the set screw. Push the assembly over the guide rod into the aft housing. Make sure that the anti rotation screw (Fig. 1; 5.12) slides into the seal cut out. If not the screw will damage the ceramic seal (Fig. 1; 5.8).
Optionally the seal is installed in the housing and then the housing is pushed over the guide rod with the seal installed.

Install the safety plate C-128 and the nut C-127 to safe the aft duo cone seal. Use grease to stick the safety plate to the bushing 5.24 and then install the nut, use the tool T-635-1 to torque the nut tight by hand.



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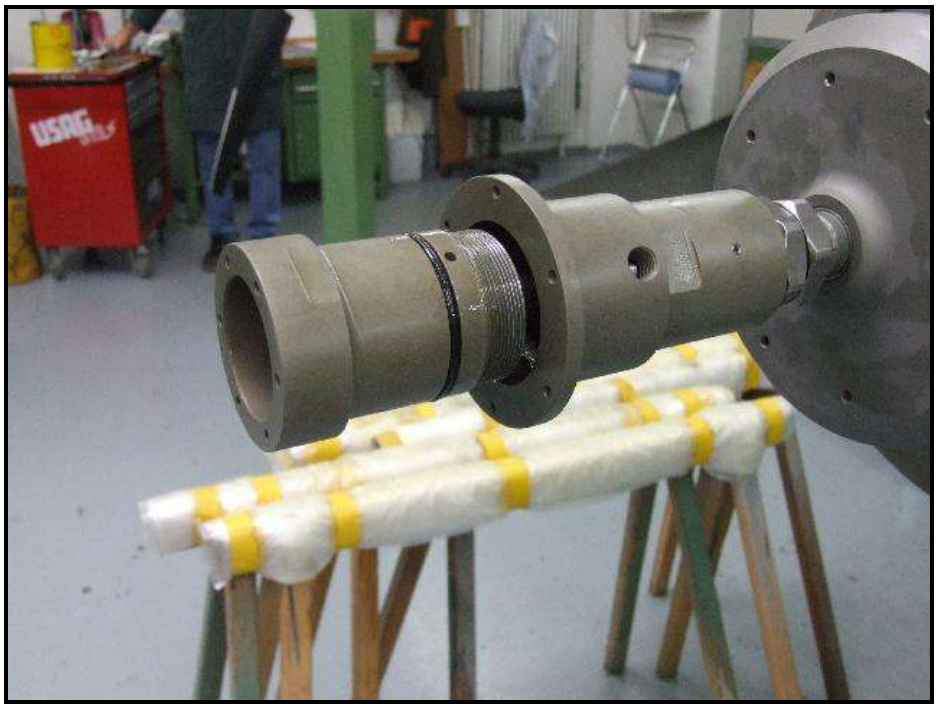
Install the front housing A-813-2-A with the o-ring C-049-55, push it over the guide rod and screw it into the aft housing, torque it only with hands. Check that an open bearing (Fig. 1; 5.10) is installed in the front housing.



Use the screws C-300-5 to install the tappet A-816-1-A with the bushing A-844-A.
Install the front duo cone seal C-138 in the same way like the aft one, use the collar A-815. Check again that the anti rotation screw slides in the seal cut out.

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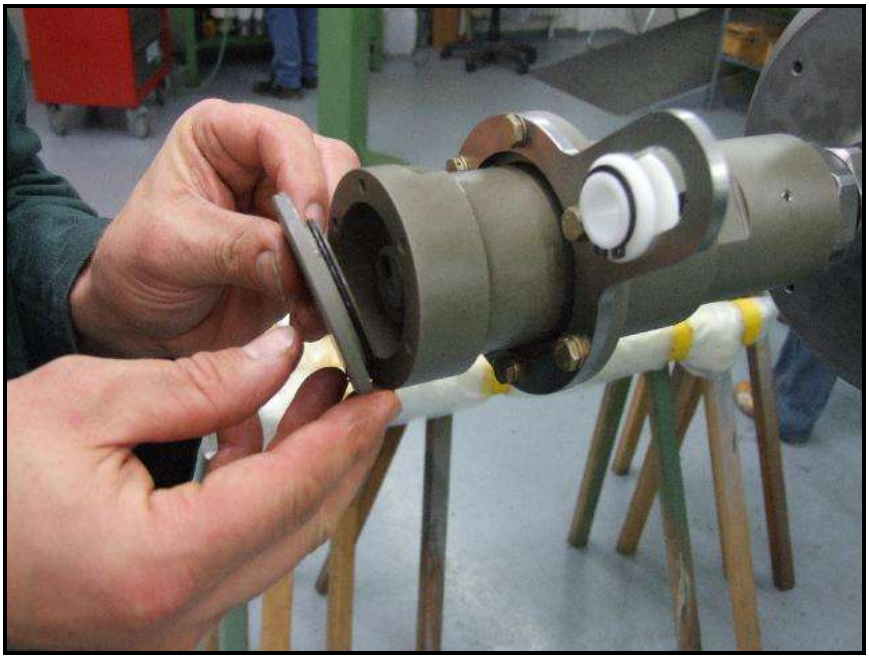
Safe the duo cone seal with the nut KM4 and the safety plate MB4, use therefore the tool T-635 to torque the nut (Fig. 1; 5.5) tight by hand and loosen it a 1/8 turn and secure it with the safety plate (Fig 1; 5.6). Take the cover plate A-814 with the o-ring C-051-20 to close the control unit. Use the screws C-300-5 with the washers C-341-10 to fix the cover plate.



Install the two 45° fittings to the control unit housing. Take care that the fittings show in the opposite direction. See the picture below.

Check for easy turning of the hydraulic assembly on the guide rod.

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7. Pitch Change Mechanism

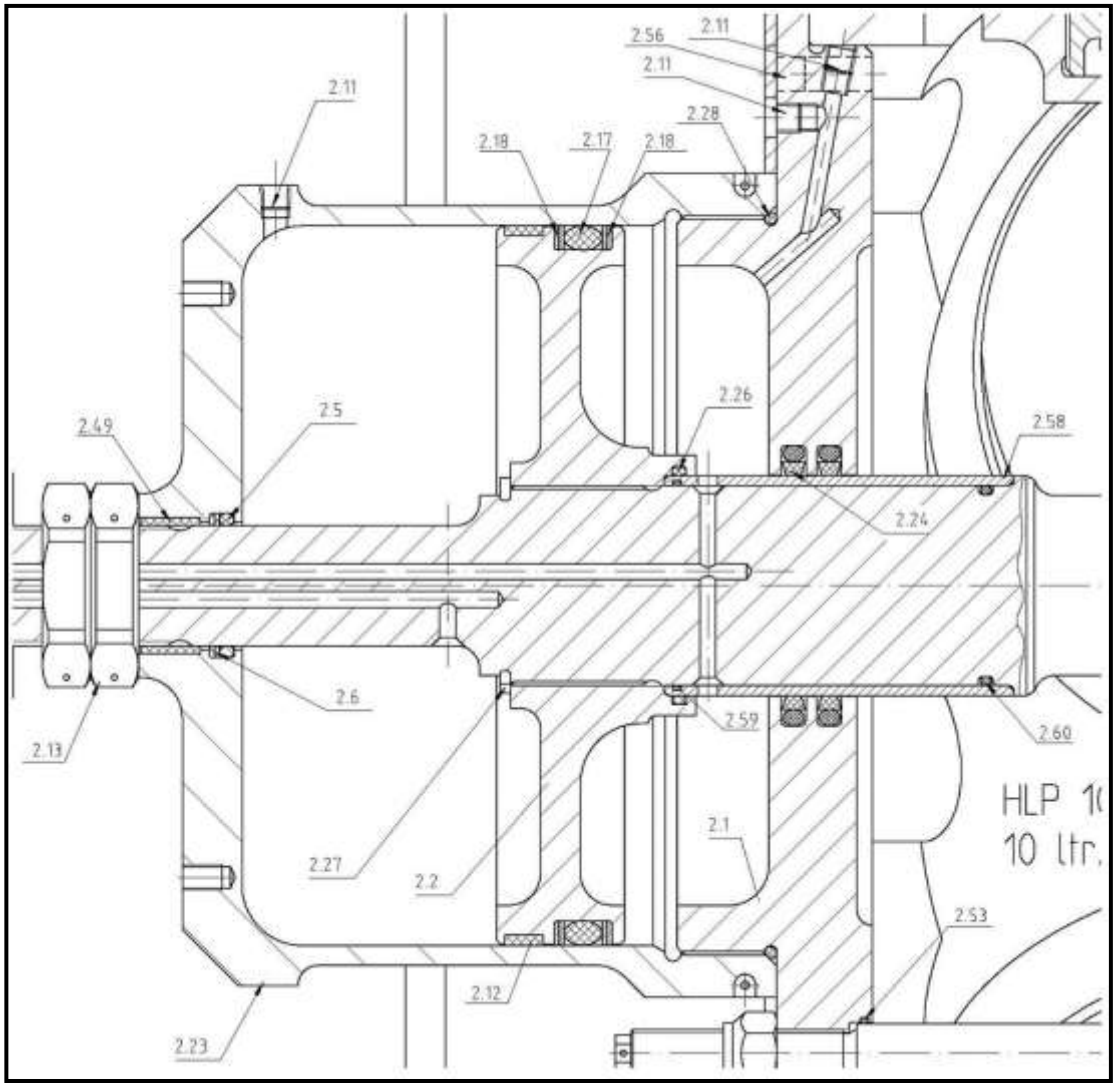

Fig. 2: Pitch change mechanism

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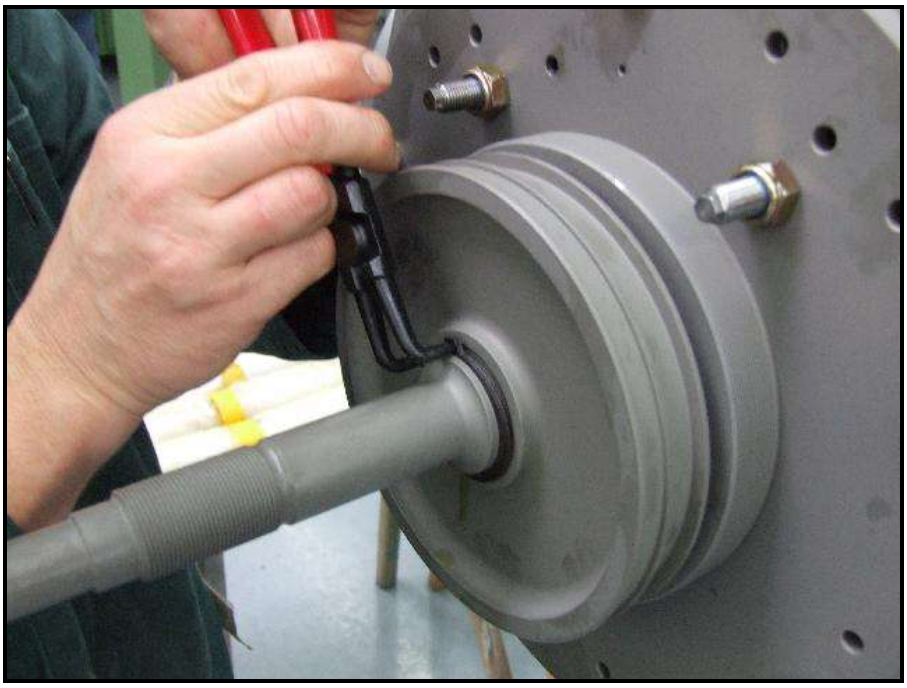
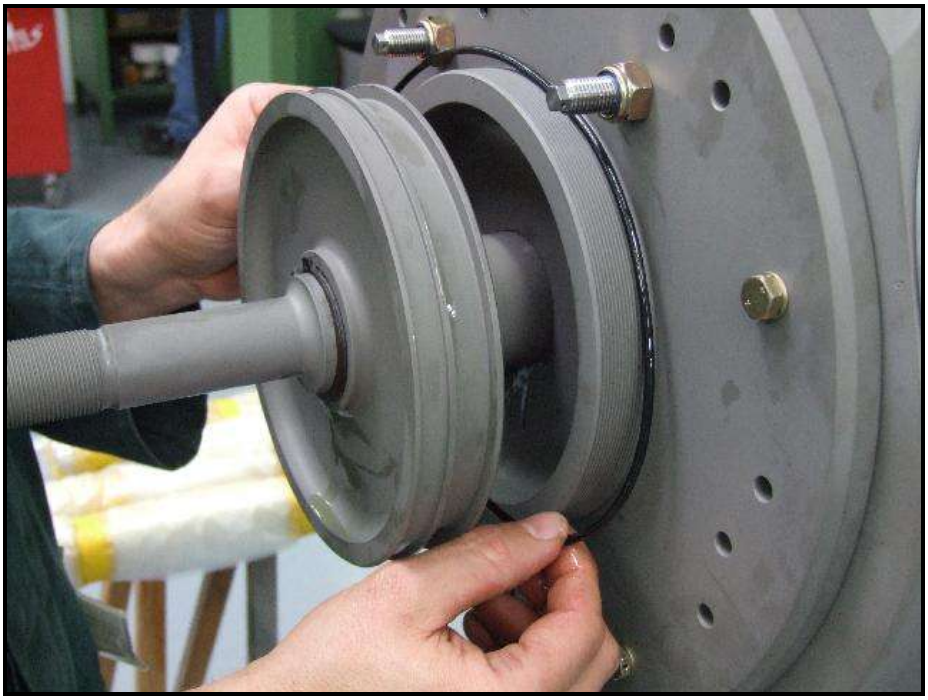
7.1 Assembly

Prepare the piston A-1328-2 for installation. Lubricate the piston thread and screw it on the guide rod. Secure the piston with the retaining ring C-271.



Lubricate the o-ring C-049-180 and bring it in position on the front plate.



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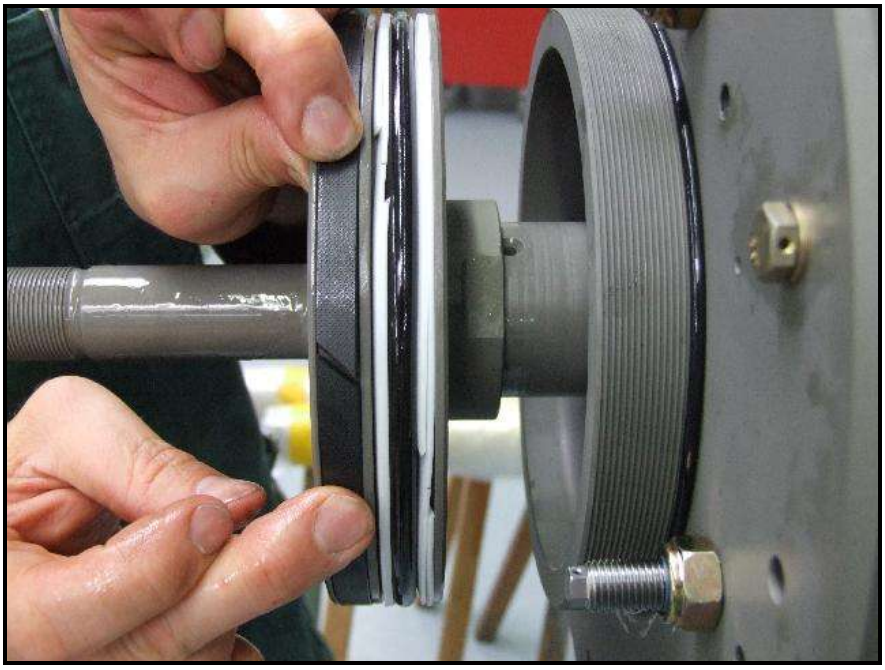
Install the guide ring C-240-X, the o-ring C-047-180 and the PTFE backup ring C-378 on both sides of the piston. All parts must be well lubricated. It is important to cut the edges at the two ends of the PTFE backup ring, otherwise the ring could be damage during assembly.



Prepare the cylinder A-1320-2 for installation. Insert the o-ring C-049-30 with the PTFE backup ring C-383-300 and the permaglide bushing in the front of the cylinder. Lubricate the inside thread of the cylinder and the thread of the front plate for the installation. Protect the thread of the guide rod with a tape to avoid the damage of the o-ring (Fig. 2; 2.5) during pushing on the cylinder. After installation of the o-ring remove protection tape from the thread of the guide rod.
Use the tool T-640-A for screwing the cylinder to the front plate.

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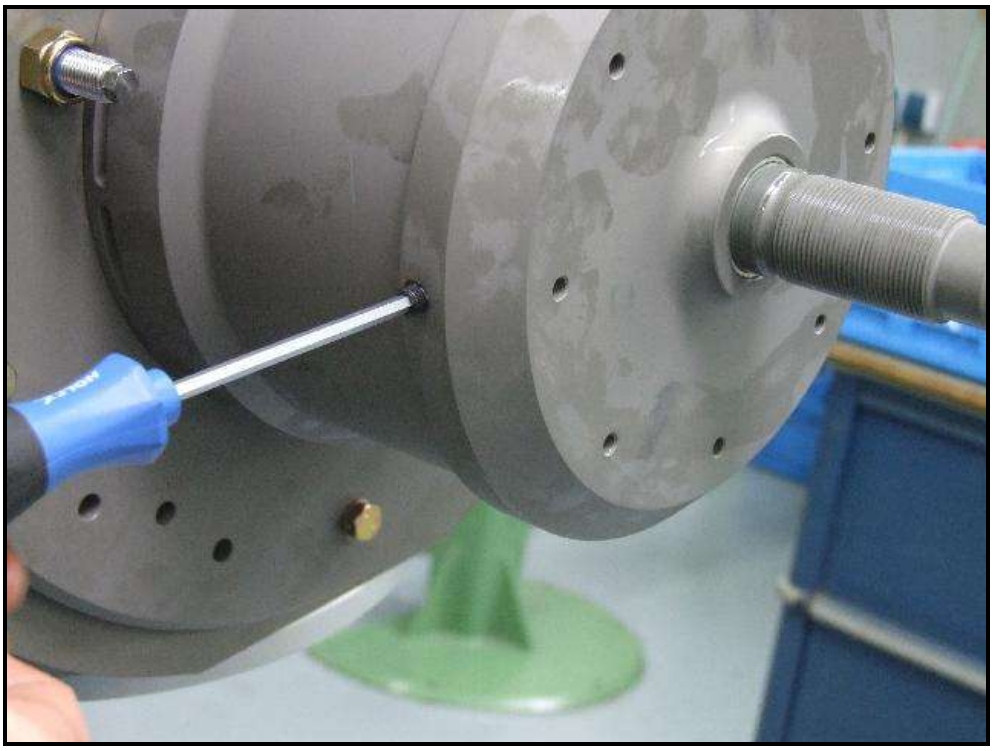
Finally install the screw plug C-107 at the side of the cylinder with HLP 100 oil or similar – it is also an air vent. Make sure that all other screw plugs are installed.



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8. Blade Installation

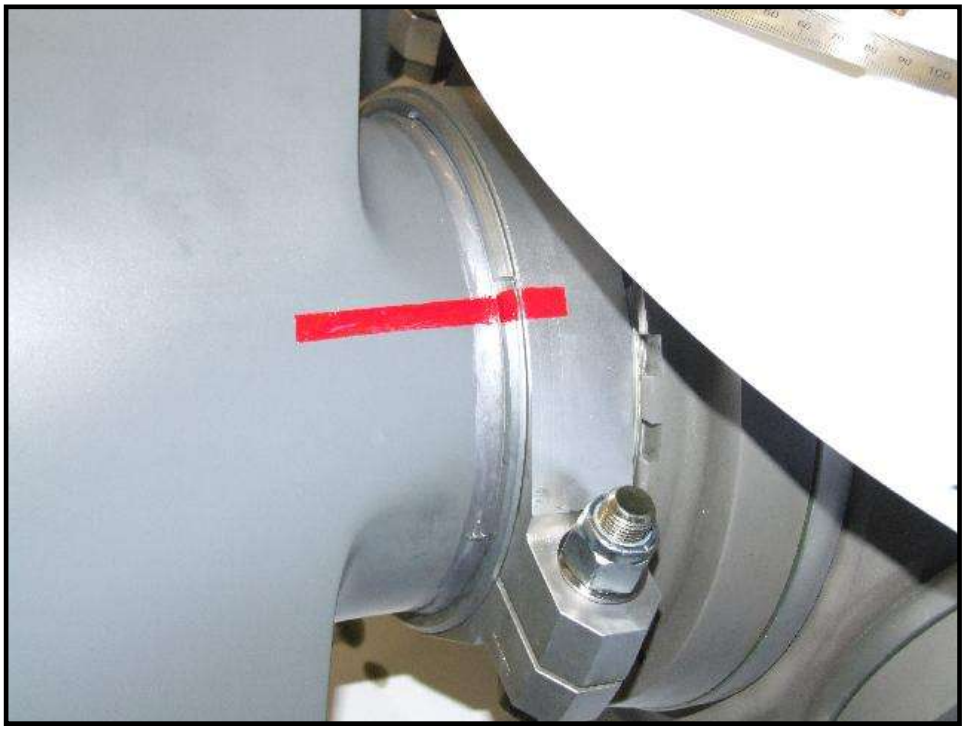
8.1 Blade installation of new blades

The hub comes with already installed and adjusted blade clamps and counterweights. Two holes are already pre drilled in each outer blade ferrule.
Screw the blade into the outer blade ferrule until the end of the thread is reached. Make sure that the hydraulic control unit is in the low pitch position. Screw the blade counter clockwise (max. 1 turn) until the blade angle of 0° at the 75% (154cm; 60.63”)radius station is reached.

Use therefore an air level and lay it on the thrust side of the blade.

When the blade angles for the low pitch position is adjusted use the drill template tool T-800. Insert the T-800 into the predrilled hole in the blade clamp and the outer blade ferrule and use a 6mm drill bit to drill a center hole with a depth of 20mm from the blade clamp surface. Remove the T-800 and enlarge the hole with a 11,80mm drill bit. Finish the hole with a 11,95mm reamer.

Insert a pin C-166 in each hole. Mark the blade, blade ferrule and the blade clamp with a red stripe.



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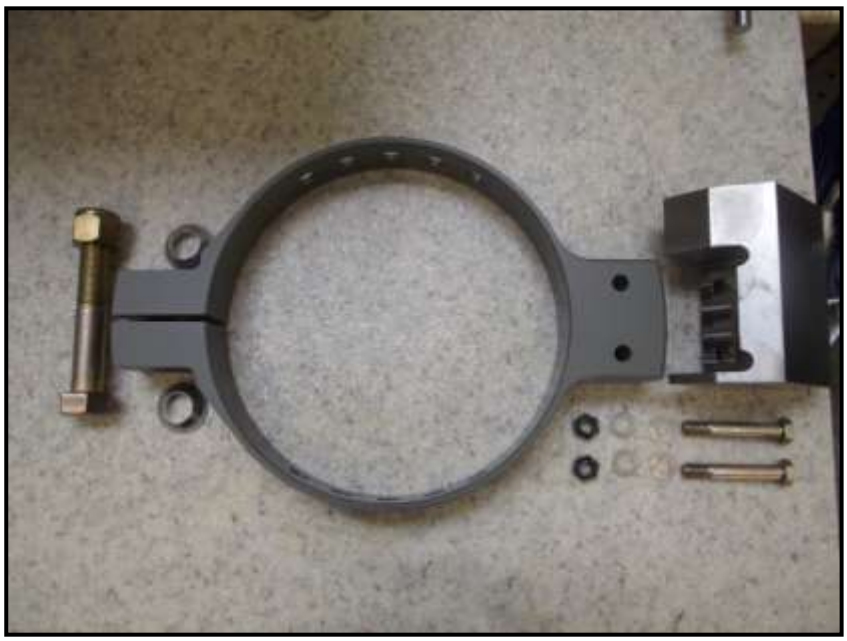
8.2 Blade installation of used blades

Prepare the blade clamps A-1344-B for the installation; they come with 5 holes on each side.



Bring the blade clamp assembly in position, but do not install the screw yet so that it is possible to adjust blade clamp angle.

Bring the hydraulic control unit in the low pitch position. Install the o-ring (2.50) at the blade ferrule and screw the blade into the outer blade ferrule until the end of the thread is reached. Screw the blade counter clockwise (max. 1 turn) until the blade angle of 0° at the 75% (154cm; 60.63”)radius station is reached.
Use therefore an air level and lay it on the thrust side of the blade.

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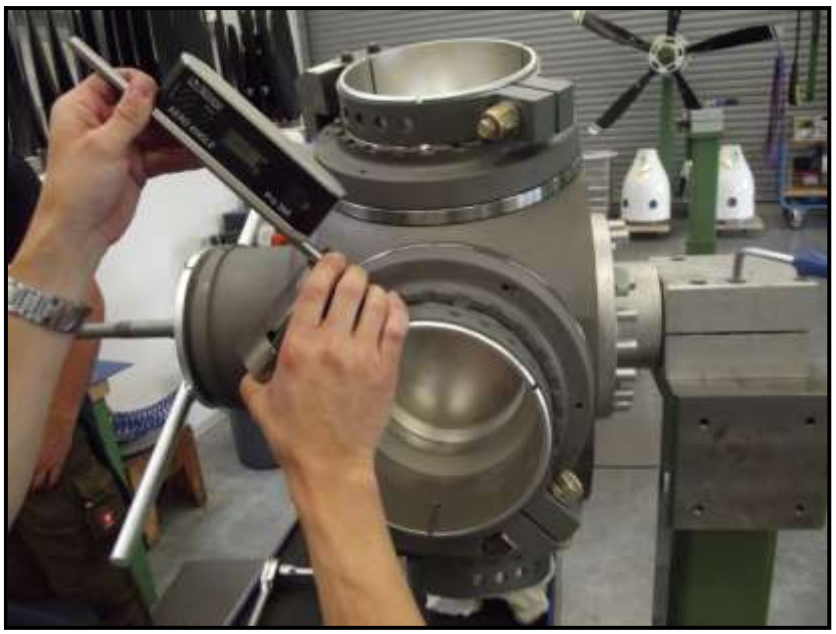
Use a digital air level to turn the counterweight assembly in the right position (45° ±0,5°). Torque the screw of the blade clamp to fix the position.

The holes in the blade clamp are marked with letters from A to E. Use one of the holes which has enough distance to the cut outs in the outer blade ferrule. Use the hole in the clamp as a drill guide and use the tool T-800 as a drill template and drill a center hole with a 6mm drill bit, remove the tool and enlarge the hole with a 11,80 mm drill bit, 25mm deep from the surface of the blade clamp. Use a 11,95mm Reamer and finish the hole. Insert a Pin C-166. Repeat this step for the second hole in the blade and for all the other blades.



Compile a list which shows the blade, blade clamp and letter of the blade clamp combination. Mark the blade, blade ferrule and the blade clamp with a red stripe.

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9. Ventilation

The MTV-28-() has two air vent plugs. One plug is installed on the front of the front plate A-1321-F. The second air vent plug is installed laterally on the cylinder. Both plugs are numbered with 2.11 in the drawing.

9.1 Ventilation Procedure

Use the hydraulic aggregate to turn the blades to high pitch position.
After reaching high pitch stop loosen the bleed air plug C-104 on the front plate and let it drain for about 5-10 seconds.
With the propeller in high pitch pressurize the lower pitch pressure area and drain the low pitch system by loosen the plug C-104 on the cylinder for 5-10 seconds.
Propeller is still in the high pitch position.

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10. INSPECTION

Inspect the condition of the blades and spinner before use. No blade tip play is tolerable, an angular play of 2° is acceptable. Cracks as defined in 6.2 are considered to be non critical cracks. These cracks are allowed and are cosmetic only, except a cracked erosion sheath as shown in 6.2.2. Allowable cracks are not need to be repaired before flight. Metal erosion sheath must not be loose. PU-strip existing and in proper condition. If not, replace within the next 10 hours after the last inspection.

10.1 Oil level

The hub is filled with 10 liters of HLP 100 oil. Check the oil level in the hub in case of oil leak. Unscrew the plug C-107-1 on the backside of the hub (Fig 3; 2.56). Use a piece of wire to check the oil-level. The oil-level should be 66mm under the aft level of the hub (see the drawing below).

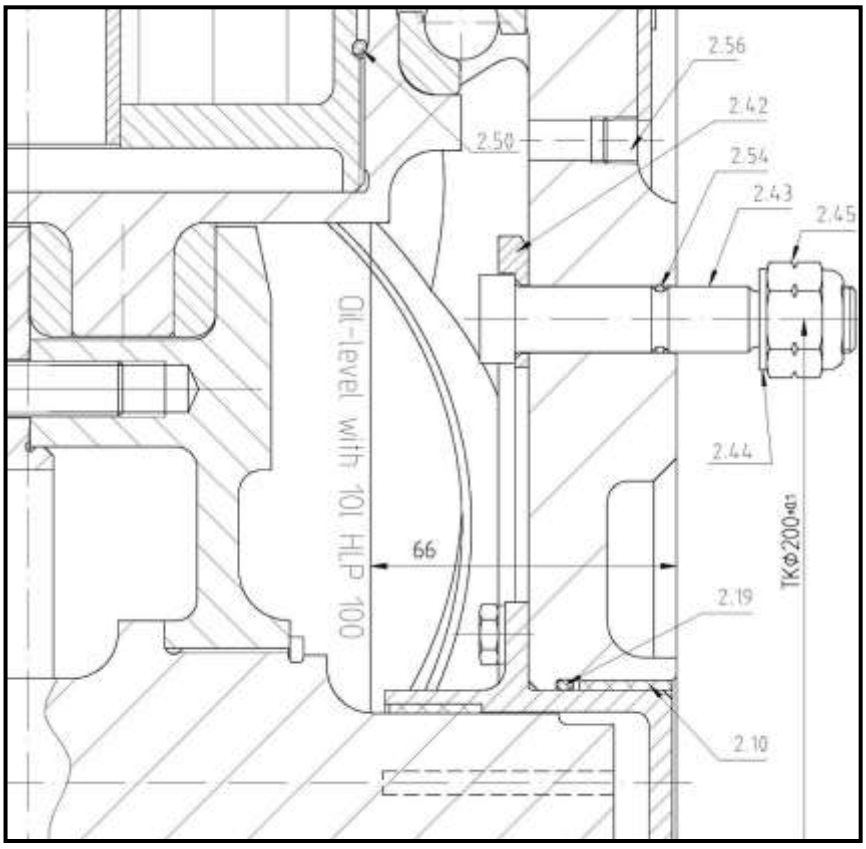

Fig. 3: Correct oil-level in the hub.

In case of to less oil, please refill and check the oil level.
After the check fix the plug C-107-1.

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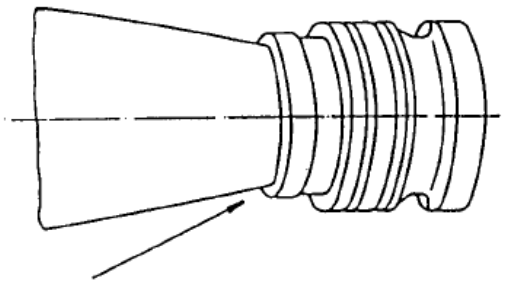
10.2 200 hrs Inspection

10.2.1 Visually inspect the entire blade (leading edge, trailing edge, face and camber side) for nicks and cracks. If any damage is discovered, refer to chapter 6.1 and 6.2.2 to identify if it is an allowable crack or a non critical crack. Remove spinner dome. Check all visible hub parts for cracks, deformation, position and safety. A cracked hub is not allowed. Check backplate and spinner for cracks and loose screws. Repair of spinner parts is not permissible. Cracked spinner domes and backplates have to be replaced by airworthy parts. Missing screws have to be replaced.Check all locks and safety wires for function. If any damage, exchange it before next use. Check torque of flange bolts and stop nuts (for torque values see chapter 12). Install spinner dome. If one or more of the checks shows any noticeable problem contact the service department of MT-Propeller. No Blade tip play is allowed, angular play max. 2°. If the check shows values beyond these tolerances, contact the service department of MT-Propeller. The blade shake must be checked IN and OPPOSITE the direction of rotation.

Note:

DO NOT measure in wind direction, as the blade bending will also be measured.

10.2.2 Check blades (see 9.2.3) for cracks in the fiberglass cover and erosion sheath.
Only certain cracks are allowed. Cracks along the leading edge and on the beginning of the erosion sheath area are allowed as long as the erosion sheath is not loose. Cracks in the painted surface are allowed as long as no moisture can enter the wooden body. Blisters or delaminations up to 1 square inch are permissible. In case of questionable conditions please contact the service department of MT-Propeller.



Illustrations of Possible Cracks in the Blade

Check that the silicone, sealing the blade to the blade ferrule, is not damaged. If a damage is obvious, repair that no moisture can enter into blade body and blade ferrule. Perform visual inspection in case of nicks, dents, notches or other damages to the blade body (for example stone nicks). If no cracks exist, fill gap with an appropriate epoxy resin. The aerodynamics of the airfoil must not be destroyed. Afterwards sand the filled spot with sandpaper. Apply a layer of paint to protect the repaired spot against moisture. Whenever performing a pre-flight inspection, check this area carefully for possible cracks. During the next repair or overhaul at the manufacturer or service station this area will be inspected and repaired by a trained expert.

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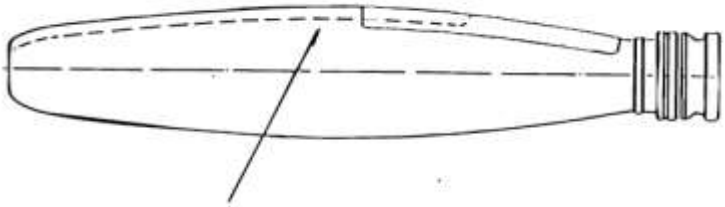
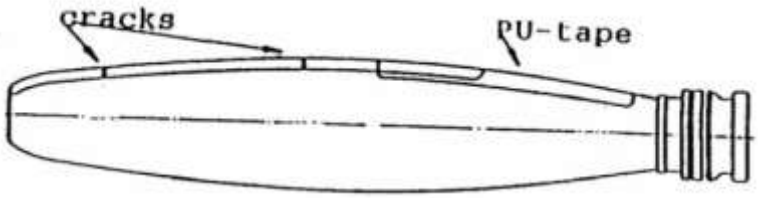
Possible cracks along the metal erosion sheath.
If loose, replacement required.



Cracked erosion sheath requires immediate repair. If chordwise cracks appear, return propeller to manufacturer. Replace PU-tape as soon as possible, if loose or damaged.



10.2.3 Possible Damage along Erosion Sheath

10.2.3.1 Circular dents (more than 0,24 inch x 0,24 inch):
Do not repair !Change erosion sheath!

10.2.3.2 Pointed dents (more than 0,24 inch x 0,24 inch):
Do not repair ! Change erosion sheath!

10.2.3.3 Cracks:
No cracks allowed in the erosion sheath, otherwise - change erosion sheath!

10.2.3.4 Hollow and debonded spots:
Max. 0,39 square inch, no two spots may occur within 5,5 inch of each other, otherwise blade must be repaired.

10.2.3.5 Erosion

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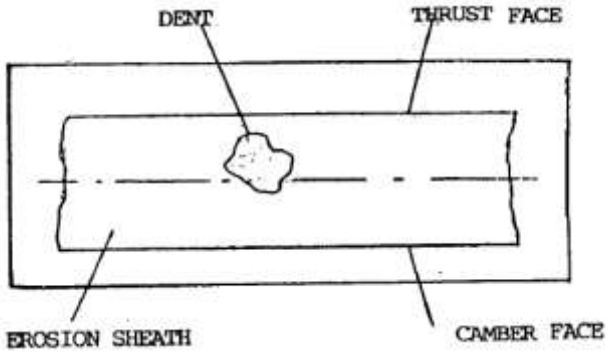
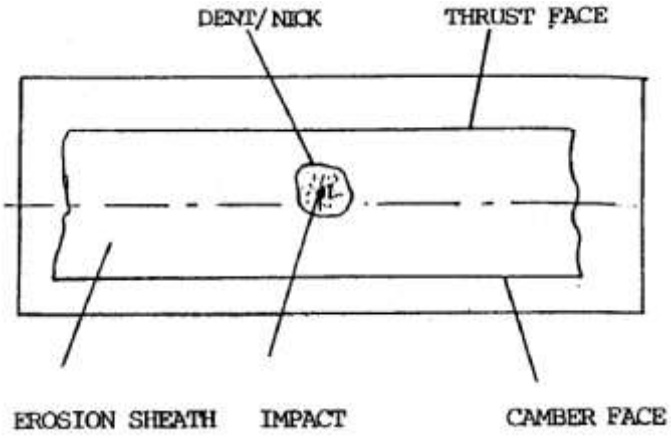
10.3 In case of any impact as mentioned under item **6.2.3.1 (Circular Dents**), check whether it penetrates through the erosion sheath. If not, fill dent with Epoxy and grind off until there is a smooth surface.
Note: Epoxy may be applied for cosmetic reasons but not “must be done”.
Check this area carefully for possible cracks whenever performing pre-flight inspection. Erosion sheath may remain until next repair/overhaul will be done.



10.4 In case of impacts in the erosion sheath (as mentioned under item 6.2.3.2 the sheath may possibly be penetrated. If not, proceed as described under item 6.3. If yes, check erosion sheath for possible cracks. If there are no cracks, the dent must be filled with Epoxy so that no moisture can enter into the blade body. Check this area carefully for possible cracks whenever performing pre-flight inspection.
The erosion sheath must be replaced as soon as possible.



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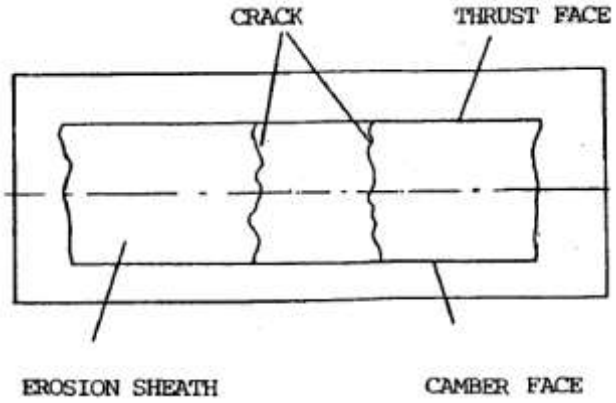
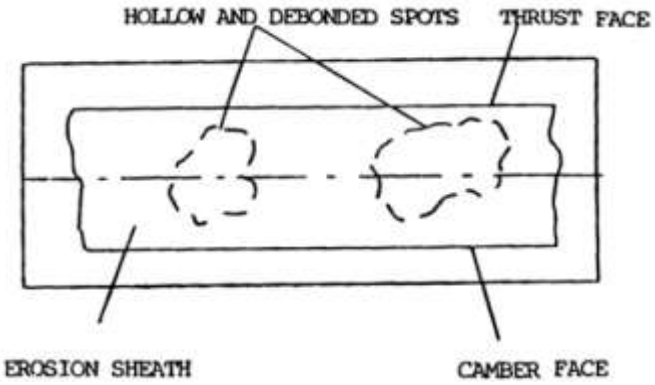
10.5 If there are any cracks (as mentioned under item 6.2.3.3), the erosion sheath must be replaced as soon as possible.
The propeller is to be returned to the manufacturer or to an authorized service station.



10.6 If any hollow and debonded spots exist (as mentioned under item 6.2.3.4), mark them. Whenever performing pre-flight inspection, monitor whether there are further delamination and/or whether the already existing delamination becomes worse. The inspection can be executed by using an appropriate coin (Tab-Test). The hollow and debonded spots must not exceed 30 % of the surface of the erosion sheath at all (lengthwise only 1 inch allowed). Otherwise the blade is to be sent to the manufacturer or to an authorized service station for repair as soon as possible. Check secure fixing of the erosion sheath in any case every time before flight.



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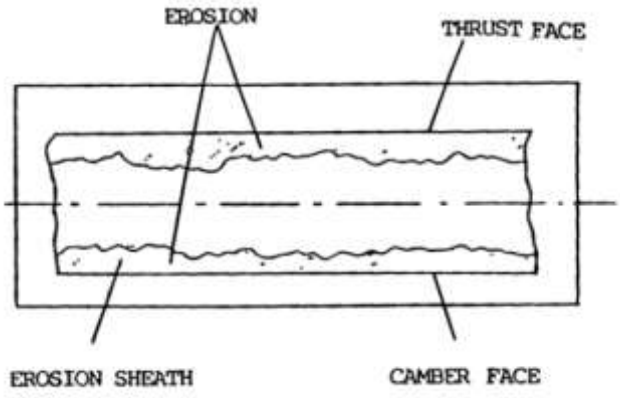
10.7 The erosion mentioned under item 6.2.3.5, which erodes the lacquer layer from the erosion sheath, occurs due to the peripheral speed of the blade and is normal. However, always take care that the erosion never becomes so deep that the FRP-coat is damaged an there is a possibility that moisture may enter into the blade body. In this case the blade must be repaired/overhauled immediately. Return the blades also, if the erosion sheath is eroded through. If the PU-protection tape is damaged, replace it immediately.



10.8 Blisters and delaminations

Are blisters or delaminations visible, mark them and check them periodically. Blisters from sap (resin) shall be opened to release the material. Fill void with 5-min Epoxy and sand. Larger delaminations shall be opened and the material be removed. Such areas must be covered with new fiber glass laminate. Damage on the trailing edge can be repaired the same way.

10.8.1 Crunched Trailing Edges

Crunched trailing edges can be repaired by using 5 minute Epoxy if the damage is not deeper than 5 mm (0,20 inches) and not wider than 15 mm (0,60 inches). Most important is, that no moisture can enter into the load carrying blade body. If damage is bigger contact manufacturer.

10.9 PU-Erosion Protection Tape

If the PU-tape at the inner portion of the blade is damaged or does not exist any more, replace it as soon as possible (max. 10 hours). This can be done by a qualified person.

10.10 Overhaul

The time between overhauls is expressed in hours and calendarmonths since manufacture or overhaul. Overhaul for the MTV-28 is recommended every 3500 hours or 6 years, whatever comes first.

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11.0 MAINTENANCE

11.1 There is no special maintenance schedule for this propellers beyond the usual inspections as per item 9. For the repair of minor damages in the blade surface and edges, automotive material such as PU or acryl paint and Epoxy resin can be used.

11.2 The surface finish is made with PU lacquer or acryl lacquer. This material is resistant against nearly all solvents. The blades can be cleaned with normal car cleaners and polish. It is important to avoid moisture penetrating into the wooden core. If necessary, please consult an aircraft inspector for final decision concerning repair. If the repair is made locally, please observe the curing time of resin and paint systems.

11.3 There are no frequent maintenance works required on the hub because all moving parts are inside the hub and not exposed to the environment. The hub itself is filled with 10 liter HLP100.

11.4 Repair of spinner parts is not permissible. Cracked spinner domes, filler plates and backplates are to be replaced by airworthy parts.

11.5 DYNAMIC BALANCE

11.5.1 Overview

11.5.1.1 Dynamic balance is accomplished by using an accurate means of measuring the amount and location of the dynamic imbalance. After such a undertake the remaining imbalance should be below 0,1 ips.

11.5.1.2 The amount of balance weights added cannot exceed the number installed for static balance.

11.5.1.3 Follow the instructions from the equipment manufacturers for dynamic balance.

11.5.1.4 If the dynamic imbalance is bigger than 0,6 ips, the propeller must be removed and statically rebalanced.

11.5.2 INSPECTION PROCEDURES PRIOR TO BALANCING

11.5.2.1 Visually inspect the propeller assembly after it has been reinstalled on the aircraft prior to dynamic balancing.

11.5.2.2 Prior to dynamic balance record the number and location of all balance weights from the static balance.

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11.5.2.3 It is recommended that placement of balance weights on aluminum spinner bulkheads with the pre-installed self securing nuts.

11.5.3 PLACEMENT OF BALANCE WEIGHTS FOR DYNAMIC BALANCE

11.5.3.1 The preferred method of attachment of dynamic balance weights is to add the weights to the spinner bulkhead. The static balancing weights are installed on the spinner front plate, if applicable.

11.5.3.2 Subsequent removal of the dynamic balance weights, if they exist, will return the propeller to its original static balance condition. The static balance weights are only allowed to remove exceptionally.

11.5.3.3 Use only stainless or plated steel washers as dynamic balance weights on the spinner bulkhead.

11.5.3.4 Do not exceed maximum weight per location of 150 g.

11.5.3.6 Balance weight screws attached to the spinner bulkheads must protrude through the self-locking nuts a minimum of one thread and a maximum of four threads.

11.5.3.7 All propellers which have been dynamically balanced must install a decal on blade no. 1. This will alert repair station personnel that the existing balance weight configuration may not be correct for static balance.

11.5.3.8 Record number and location of dynamic balance weights, and static balance weights if they have been reconfigured, in the Propeller Logbook.

Warning:

Only products and material listed in this Manual are approved for use with the prescribed propeller system.

Products and materials of manufacturers other than those listed in this Manual that the user may desire to use as replacement of approved products and material should first be referred to the MT-Propeller Service Department for evaluation.

Use of products not approved by MT-Propeller could result in improper maintenance and damage to equipment.

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12.0 TORQUE MOMENTS (all models)

The following data is valid for dry threads, free of grease.

		Nm	inlbf	ftlbf
1.	Screw, Front Plate 5/16“	35-37	310-328	25-27
2.	Screw, Piston Extension M12	45-47	398-415	33-35
3.	Screw, Bulkhead 5/16”	20 - 22	177-195	14-16
4.	Stop Nuts 9/16”	135-150	1195-1328	99-110
5.	Screw, Spinner Dome	4-5	35-45	3-4
6.	Check Nut M30x1,5	90-100	796-885	66-74
7.	Screw, Blade Ring 5/8”	210-220	1858-1947	155-162
8.	Preload Nut	1000-1400	8850-12391	737-1032

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13.0 SPECIAL TOOLS

For the installation an operation are no special tools required.

To disassemble the oil control unit and the piston unit the following tools are required:
- Use the tool **T-640-A** for screwing the cylinder to the front plate.
- Use the tool **T-635-1** to torque the safety nut for the aft duo cone seal.
- Use the tool **T-635** to torque the safety nut for the front duo cone seal.

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14.0 LIST OF SPARE PARTS AND PROPELLER DRAWINGS

14.1 List of Spare Parts

Quantity	Item	Name	Part No.
5	*1.0*	*Blade*	*P-769-2-( )*
5	*1.2*	*Inner Blade Ferrule*	*A-1331*
5	*1.3*	*Outer Blade Ferrule*	*A-1330-1-B*
1	2.0	Hub	A-1311-I
1	2.1	Front Plate	A-1321-F
1	2.2	Piston	A-1328-2
1	2.3	Fork	A-1327-1-C-R/L
1	2.4	Guide Rod	A-1329-2-C
1	2.5	O-Ring	C-049-30
1	2.6	Backup Ring	C-383-300
5	2.7	Pitch Change Block	A-1614-1-A
5	2.8	Guide Block	A-1343-2
1	2.9	Permaglide Bushing	C-232
1	2.10	Permaglide Bushing	C-265
4	2.11	Plug	C-107
1	2.12	Guide Ring	C-240-X
2	2.13	Nut	A-817-A
5	2.14	Screw	C-282-40
15	2.15	Washer	C-336-5
15	2.16	Screw	C-304-6
1	2.17	O-Ring	C-047-180
2	2.18	PTFE Backup Ring	C-378
1	2.19	O-Ring	C-050-40
5	2.20	Blade Bearing	A-1323
170	2.21	Ball 5/8``	C-393
185	2.22	Seperator	C-192
1	2.23	Cylinder	A-1320-2
2	2.24	Sealing	C-173
1	2.25	O-Ring	C-049-300
1	2.26	O-Ring	C-050-55
1	2.27	Retaining Ring	C-271
1	2.28	O-Ring	C-049-180

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Spare Parts for MTV-28-() to be continued:

Quantity	Item	Name	Part No.
3	2.29	Pitch Stop Rod	A-1313-A-X
3	2.30	Stop Nut	C-283-12
1	2.31	Front Piece	A-1326-1
1	2.32	Hub Insert	A-1324
5	2.33	Washer	B-444-1
5	2.34	Bearing	AX14190240
5	**or 2.33**	Washer	B-444-5
5	**2.34**	Washer	B-444-4
370	**2.35**	Needle roller	C-169
5	**2.36**	Seperatorring	A-1705
5	2.37	Preload Nut	A-1325-C
10	2.38	Safety Plate	A-1380
5	2.39	O-Ring	C-052-180
5	2.40	O-Ring	C-049-240
5	2.41	Blade Seal	C-057-165
1	2.42	Ring	A-1322
18	2.43	Bolt	C-098-1-A
18	2.44	Washer	C-077
18	2.45	Stop Nut	C-066
2	2.46	Pin	A-1063-1
2	2.47	Washer	C-336-4
2	2.48	Screw	C-302-5
1	2.49	Permaglide Bushing	C-232-1
5	2.50	O-Ring	C-049-140
1	2.51	Retaining Ring	C-270-55
5	2.52	Hub Insert	A-1600-B
3	2.53	O-Ring	C-051-19
18	2.54	O-Ring	C-165
5	2.55	Plate	A-1615-1
2	2.56	Plug	C-107-1
5	2.57	O-Ring	C-058-190
1	2.58	Bushing	A-1785
1	2.59	O-Ring	C-051-50
1	2.60	O-Ring	C-050-44

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Spare Parts for MTV-28-() to be continued:

Quantity	Item	Name	Part No.
1	3.0	Spinner Assy	P-932-H
1	3.1	Spinner Dome	B-477/B-477-1
1	3.2	Spinner Bulk Head	B-478
1	3.3	Spinner Front Plate	B-479-C
(5)	3.4	Cover Plate	.....
88	3.5	Rivet, countersunk hd.	C-346
20	3.6	plate nut	C-345
20	3.7	Screw	C-306-8
20	3.8	Washer	C-344
10	3.9	Washer	C-339-5
10	3.10	Screw	C-304-4
1	3.11	Spant	A-821-1-A
1	3.12	Spant	A-822-1-A
6	3.13	Washer	DIN 440 Di=10,5mm
1	3.14	Bushing	A-793-A
1	3.15	Splint	DIN 94 min 3x28-St
1	3.16	Rod	A-819-B-X
1	3.17	Spant	A-823-1-A
6	3.18	Damper	C-134
6	3.19	Stop Nut	DIN 985 M10
6	3.20	Screw	DIN601 M10x40
6	3.21	Washer	C-243-10
24	3.22	plate nut	MS21059L4

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Spare Parts for MTV-28-() to be continued:

Quantity	Item	Name	Part No.
1	5.1	Housing	A-813-2-A
1	5.2	Cover	A-814
1	5.3	Tappet	A-816-1-A
1	5.4	Bushing	A-844-A
1	5.5	Nut	KM4
1	5.6	Safety Plate	MB4
1	5.7	O-Ring	C-051-20
1	5.8	Collar	A-815
2	5.9	Duo Cone seal	C-138
1	5.10	Bearing	C-257-1
1	5.11	Retaining Ring	J47
2	5.12	Set screw	C-267-X
1	5.13	O-Ring	C-051-48
12	5.14	Screw	C-300-4
12	5.15	Washer	C-341-10
2	5.16	45°-Fitting	C-167
1	5.17	Bearing	C-135
1	5.18	Retaining Ring	C-136
1	5.19	Housing	A-813-1-A
1	5.20	Safety Plate	C-128
1	5.21	Nut	C-127
1	5.22	O-Ring	C-049-55
1	5.23	O-Ring	C-051-22
1	5.24	Collar	A-815-1-A
5	6.0	Blade clamp	A-1344-A
5	6.1	Screw	C-381-X
10	6.2	Cone	A-1530
5	6.3	Stop Nut	C-382
5	6.4	Counterweight	A-1712
10	6.5	Pin	C-166
10	6.6	Stopnut	C-335-5
20	6.7	Washer	C-204-0,2
10	6.8	Screw	C-304-17

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Spare Parts for MTV-28-( ) to be continued:

Drawing P-932-H