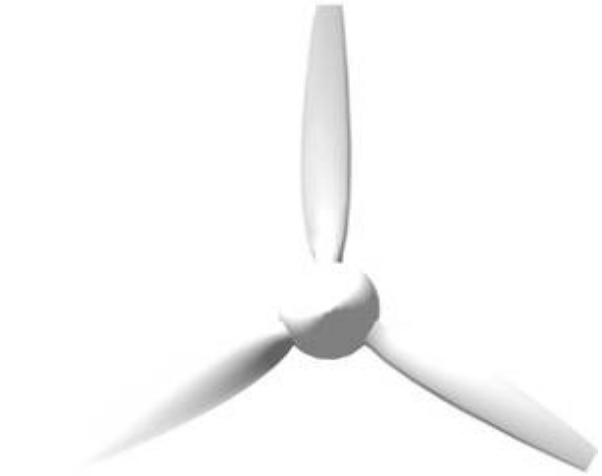


mt-propeller

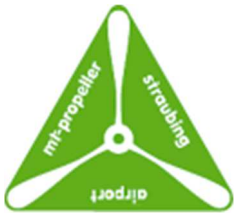
ATA 61-02-30

(E-4230)

OPERATION, INSTALLATION AND MAINTENANCE MANUAL

REVERSIBLE HYDRAULICALLY CONTROLLED
VARIABLE PITCH PROPELLER

MTV-9-( )-R(DA)



Revision 1
Release date: August 01, 2024

DE.21G.0008
EASA.21J.020

mt-propeller

Warning

People who operate an Airship should recognize that various types of risks are involved; and they should take all precautions to minimize them, since they cannot be eliminated entirely. The propeller is a vital component of the hovercraft. A mechanical failure could cause a failure in operation or create vibrations sufficiently severe to damage the Airship.

Propellers are subject to constant vibration stresses from the engine and airstream, which are added to high bending and centrifugal stresses.

Before a propeller is classified as being safe to operate, an adequate margin of safety must be demonstrated. Even though every precaution is taken in the design and manufacture of a propeller, history has revealed rare instances of failures, particularly of the fatigue type.

It is essential that the propeller be properly maintained according to the recommended service procedures and a close watch be exercised to detect impending problems before they become serious. Any grease leakage or oil leakage, unusual vibration, or unusual operation should be investigated and repaired as it could be a warning that something serious is wrong.

As a fellow pilot, I urge you to read this manual thoroughly; it contains a wealth of information about your new propeller.

The propeller is among the most reliable components of your Airship. It is also among the most critical to operation safety. It therefore deserves the care and maintenance called for in this manual. Please give it your attention, especially the section dealing with inspections and checks.

Thank you for choosing a MT-Propeller. Properly maintained it will give you many years of reliable service.

Gerd R. Mühlbauer
President
MT-Propeller Entwicklung GmbH

mt-propeller

OPERATION, INSTALLATION AND MAINTENANCE MANUAL
FOR
REVERSIBLE HYDRAULICALLY CONTROLLED VARIABLE PITCH PROPELLER
MTV-9-( )-R(DA)

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LIST OF REVISIONS

Revision No	Revision Date	Pages	Description
0	2024-02-16	All pages	Initial Revision
1	2024-08-01	13, 17, 18, 22, 23	Typos corrected, dynamic balancing marked as optional, instructions to install spinner added

MT-Propeller Important Information

Every owner should stay in close contact with his MT-Propeller dealer or distributor and authorized MT-Propeller service shop to obtain the latest information pertaining his propeller and its installation.

MT-Propeller takes a continuing interest in having the owner get the most efficient use of his propeller and keeping it in the best mechanical condition.

Consequently, MT-Propeller from time to time issues Service Bulletins, Service Letters and manuals relating to the propeller and its installation.

Service Bulletins are of special importance and should be complied promptly.

These are sent to dealers, distributors and latest registered owners. Service Letters deal with products improvements and service hints pertaining to the propeller and its installation. Occasionally they also are sent in case of need to latest registered owners.

If an owner is not having his propeller serviced by an authorized MT-Propeller service shop or MT-Propeller USA or MT-Propeller Germany, he periodically should check with a MT-Propeller dealer or distributor (see MT-Propeller`s homepage to find out the latest information) to keep his propeller up to date.

The list of valid MT-Propeller manuals, Service Bulletins, AD´s and their latest revisions can be downloaded from the MT-Propeller homepage (www.mt-propeller.com).

Hardcopies can also be obtained from MT-Propeller Germany and MT-Propeller USA.

1. GENERAL

1.1. Statement of purpose

This publication provides operation, installation and line maintenance information for the MT hydraulically variable pitch propeller with dual acting system and reverse.

In addition to the propeller assembly, the propeller governing (beta tube) system is addressed in this manual.

Installation, removal, operation and troubleshooting data is included in this publication.
Also, the airship manufacturer's manuals should be used in addition to this information.

1.2. Additional Available Publications

In addition to this manual the following applicable publications should be used for repair and overhaul:

OVERHAUL MANUAL ATA-61-16-80 / E-680

For MT-Propeller service literature contact:

MT-Propeller Entwicklung GmbH
Flugplatzstraße 1
D-94348 Atting
Germany

Tel.: +49-9429-9409-0
Fax: +49-9429-8432

E-mail: sales@mt-propeller.com
Internet: www.mt-propeller.com

1.3. Abbreviations

TBO	Time Between Overhaul
TT	Total Time
TSO	Time Since Overhaul
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers
UNF	Unified National Fine Thread Series
TCDS	Type Certificate Data Sheet
PU	Polyurethane
MAP	Manifold Pressure
AFM	Airplane Flight Manual
IPS	Inch per Second
FAA	Federal Aviation Administration
ICA	Instruction for Continued Airworthiness
TSN	Time Since New
STC	Supplement Type Certificate

NOTE: **TSN/TSO IS CONSIDERED AS THE TIME ACCUMULATED BETWEEN AIRCRAFT LIFT OFF AND AIRCRAFT TOUCHDOWN, I.E., FLIGHT TIME.**

1.4. Terms and Definitions

Blade Angle	Measurement of blade airfoil location described by propeller rotation
Constant Speed	A propeller system which employs a governing device to maintain a selected engine RPM
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface
Delamination	Internal separation of layers of a composite material
Erosion	Gradual wearing away or deterioration due to action of the elements
Feathering	A propeller with blades that may be positioned parallel to the relative wind, thus reducing aerodynamic drag
Overhaul	The periodic disassembly, inspection, repair, refinish and reassembly of a propeller assembly to maintain airworthiness
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine or propeller RPM is higher than the RPM selected by the pilot through the propeller control lever
Pitch	Same as “Blade Angle”
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power.

1.5. Definition of Component Life and Service

1.5.1. Overhaul

Overhaul is a periodic process and contains the following items:

- Disassembly
- Inspection of Parts
- Reconditioning of Parts
- Reassembly

The overhaul interval is based on hours of service (operating time) or on calendar time.

Attention:
In case of blade damage by a foreign object an overhaul is always required in case that the blade damage is beyond the limitation of an in-field repair.

A non-rotating propeller FOD does not require an overhaul; it only needs a blade repair or a blade exchange.

Blade damage with a non-rotating propeller cannot damage the propeller hub and therefore does not require an overhaul.

At such specified periods, the propeller assembly should be completely disassembled and inspected for cracks, wear, corrosion and other unusual or abnormal conditions. As specified, certain parts should be refinished, and certain other parts should be replaced.

Overhaul is to be accomplished in accordance with the latest revision of the overhaul manual ATA 61-16-80 (E-680).

The overhaul interval for the propellers (TBO) is shown in *Service Bulletin No. 1* (latest issue).

1.5.2. Repair

Repair is correction of minor damage caused during normal operation. It is done on an irregular basis, as required.
See Service Letters SL32 and SL32-2, each latest issue for additional information.

A repair does not include an overhaul.

Amount, degree and extent of damage determines whether or not a propeller can be repaired without overhaul.

Attention:
In case of blade damage by a foreign object an overhaul is always required in case that the blade damage is beyond the limitation of an in-field repair.

A non-rotating propeller FOD does not require an overhaul, it only needs a blade repair or a blade exchange.

Blade damage with a non-rotating propeller cannot damage the propeller hub and therefore does not require an overhaul.

1.5.3. Component Life

Component life is expressed in terms of total hours of service (TSN: Time Since New) and in terms of hours of service since overhaul (TSO: Time Since Overhaul).

Both references are necessary in defining the life of the component. Occasionally a part may be "life limited", which means that it must be replaced after a specified period of use. Life limited parts are listed in Overhaul Manual No. ATA 61-16-80 (E-680).

Overhaul returns the component or assembly to zero hours TSO (Time Since Overhaul), but not to zero hours TT (Total Time).

1.6. Reversible propellers

Reversible propellers with blade angle feedback are used primarily for Airship and Hovercraft Installations, but not limited to those installations.
Mechanical stops are full forward and full reverse.

Natural composite blades with fiber reinforced Epoxy cover and metal leading edge protection are used to minimize weight at the highest amount of safety against fatigue fractures due to vibrations.

mt-propeller

2. MODEL DESIGNATION

2.1. Hub-designation

MT	V	-	9	-	( )	-	R	(DA)	( )
1	**2**		**3**		**4**		**5**	**6**	**7**

1: MT – Propeller Manufacturer

2: Variable Pitch Propeller

3: Consecutive Number of Series

4: Code for Propeller Flange
AB = ARP-502 mod., ½”-20 UNF studs, 4.75” bolt circle diameter
D = ARP-502, ½”-20 UNF studs

5: R = Reversing System installed

6: (DA) = Dual Acting System

7: Capital letter = Modifications which restrict or exclude interchangeability
Small letter = Modifications which not affecting interchangeability.

2.2. **Blade Designation**

( )	RD	270	-	143	( )
1	**2**	**3**		**4**	**5**

1: Position of Actuation Pin
Blank = pin position for pitch change forces to decrease pitch

2: Sense of Rotation
Blank = right hand tractor
RD = right hand pusher
L = left hand tractor
LD = left 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.

The hub-serial number starts with the year of manufacture.
All records of the propeller are registered in respect to this number.

The propeller for the airship engine combination is always defined according the hub-, blade- and spinner combination. For the actual blade settings, the propeller- logbook must be considered.

3. TYPICAL BLADE DESIGN

Figure 1 shows the typical layout of a natural composite blade covered with glass fiber.

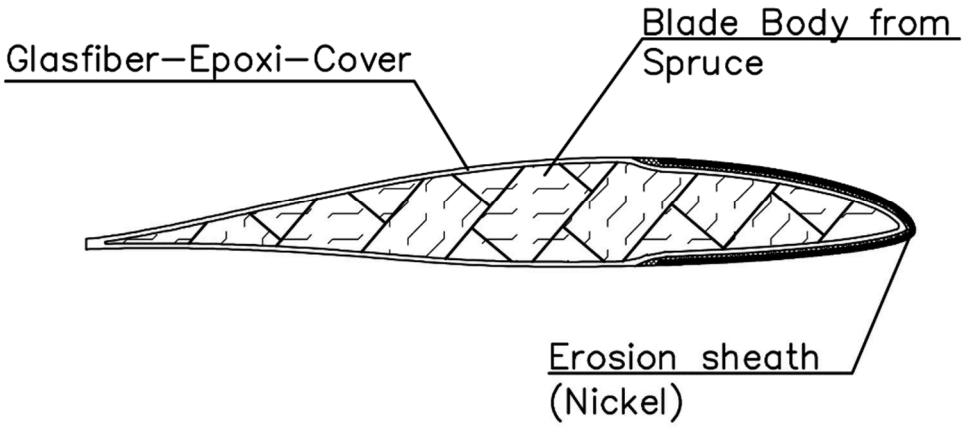


Figure 1: Typical natural composite blade

4. DESIGN AND OPERATION INFORMATION

The variable pitch propeller consists of the following main groups:

- Hub
- Pitch Change Mechanism
- Blades
- Spinner
- Beta Valve

4.1. Hub

The one-piece hub is made from forged and milled aluminum alloy with the outer surface shot-peened and anodized. The blade bearings are special designed ball bearings, whereas the balls act as split retainers in order to hold the blades in the hub, creating an increased safety factor against blade loss. The inner race is split and installed on the blade ferrule.

On the front of the hub is the dual acting cylinder mounted for the pressure oil; this arrangement allows a simple and lightweight design. The spinner front plate is used for the installation of balance weights.

4.2. Pitch Change Mechanism

The pitch change mechanism of the blades is obtained with an eccentric pin on the blade ferrule. A composite carbon fiber block connects the blade with the piston and front piece; thus, the axial movement of the piston rotates the blades.
The piston is controlled by oil pressure applied through the beta tube.
The piston's movement range from full forward to full reverse is limited by mechanical high pitch stop and low pitch stop.

High pitch stop and reverse stop can be adjusted in the manufacturing plant.

4.3. Blade

The blades are of natural composite design, using high compressed wood in the root and lightweight wood in the remaining body.
Glass fiber material covers the entire blade surface and is painted with epoxy/polyurethane lacquer.
The outer section is protected against erosion by a bonded nickel erosion sheath, the inner section of the blade is protected by a special PU boot.

The blade ferrule is installed with special lag screws to the wooden blade root and is additionally bonded with epoxy resin.

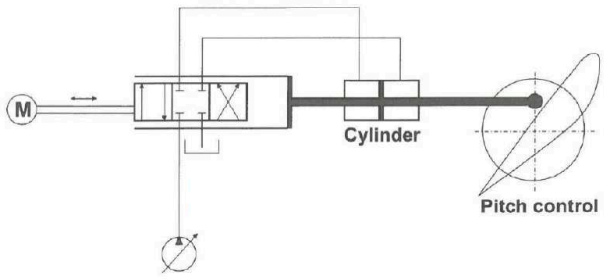
4.4. Spinner

The spinner dome is a one-piece part made from fiber reinforced composite. The spinner frontplate and spinner bulkhead is spinformed or truncated aluminium alloy.
The spinner frontplate and spinner bulkhead are parts of the hub. Filler plates increase the stiffness of the dome on the cutouts for the blades. The dome is mounted on the supports by means of screws.

4.5. Propeller pitch actuator

The electric pitch actuator offers the possibility of a direct blade angle feedback from full forward to full reverse blade pitch.

WARNING:
MAX 0.2 BACK PRESSURE IS ALLOWED IN THE DRAIN LINE. IN CASE OF QUESTION MEASURE THE BACK PRESSURE IN THE RETURN LINE!



Interface requirements:	
- Operating pressure	18 bar
- Max. design pressure	30 bar
- Min. required oil flow	2.5 ltr/min

Figure 2: Hydraulic unit schematic drawing

The pressure line is on the beta rod P-1587-( )-L/R.
An electrical push/pull actuator is connected to the beta tube, which provides a direct blade angle feedback in operation.

4.6. Beta rod

The beta rod is made out of 3 single elements and needs to have a full concentric run, no wobble is allowed.

The angular tolerance between the two interfaces (rotor side, hydraulic actuator side) must be 0.05°.

The alignments tolerances must be 0.2 mm (0.008 in)

4.7. Oil system to be used

For a good dynamic response of the propeller it is recommended to supply the adjusting unit and the beta tube with the following mineral oil based hydraulic oil:

MIL-H-5606 Aeroshell Fluid 41
HLP-10 according to DIN 51 519 and DIN 51 524 Part 2
EXXON Univis HVI 13
or individually approved oils by MT-Propeller.

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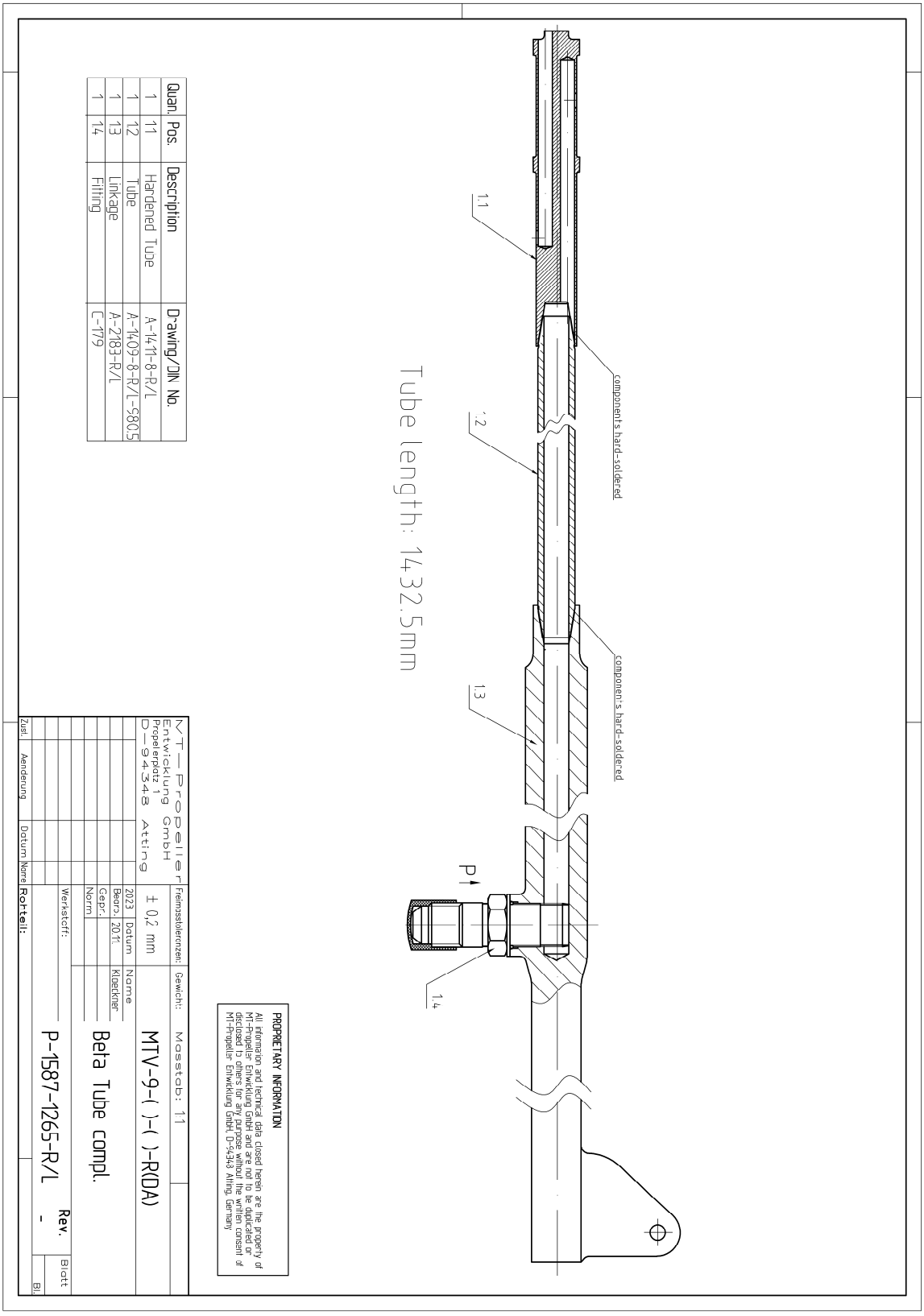
Drawing Beta Rod P-1587-1265-R/L



Quan.	Pos.	Description	Drawing/DIN No.
1	11	Hardened Tube	A-1411-8-R/L
1	12	Tube	A-1409-8-R/L-5805
1	13	Linkage	A-2183-R/L
1	14	Fitting	C-179

PROPRIETARY INFORMATION

All information and technical data closed herein are the property of MT-Propeller Entwicklung GmbH and are not to be duplicated or disclosed to others for any purpose without the written consent of MT-Propeller Entwicklung GmbH. D-94348 Atting, Germany

MT-Propeller Entwicklung GmbH
Propellerplatz 1
D-94348 Atting

Freimasstoleranzen: ± 0.2 mm
Gewicht: Masstab: 1:1

	Name	Datum
Bearb.	Kloecknet	2023
Gepr.		2011
Norm		

Werkstoff:

MTV-9-( )-( )-R(DA)

Beta Tube compl.

P-1587-1265-R/L

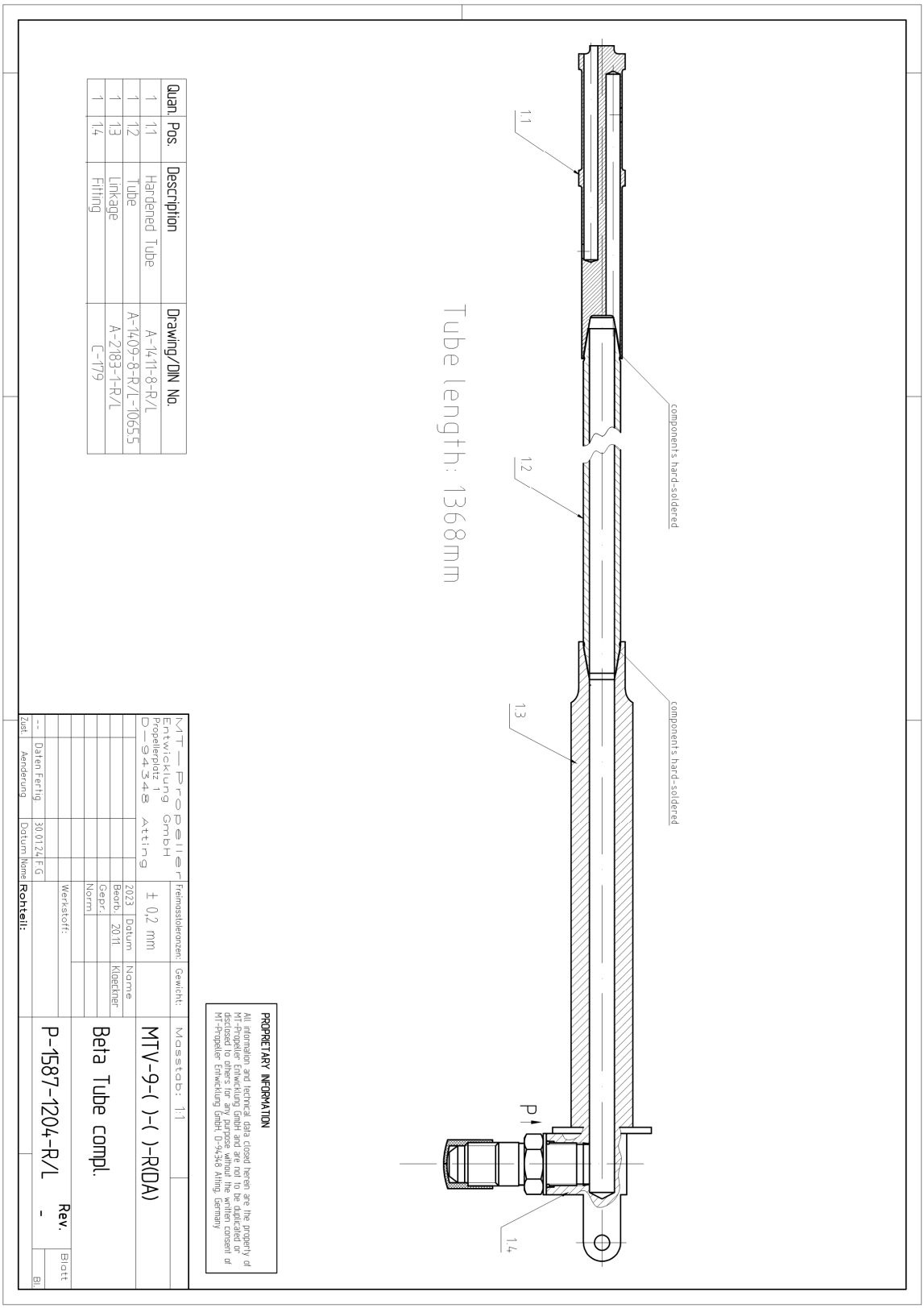
Rev. -

Blatt Bl.

Zust.	Aenderung	Datum	Name
			Rottelli:

mt-propeller

Drawing Beta Rod P-1587-1204-R/L



Quan.	Pos.	Description	Drawing/DIN No.
1	11	Hardened Tube	A-1411-8-R/L
1	12	Tube	A-1409-8-R/L-10655
1	13	Linkage	A-2183-1-R/L
1	14	Fitting	C-179

MT-Propeller Entwicklung GmbH
Propellerplatz 1
D-94348 Atting

Freimasstoleranzen: ± 0,2 mm
Gewicht:
Massstab: 1:1

	Name	Datum
Bearb.	2011	2023
Gepr.	Klopeckner	
Norm		
Werkstoff:		

MTV-9-( )-( )-R(DA)

Beta Tube compl.

P-1587-1204-R/L

Rev. -

Blatt Bl.

Zust.	Aenderung	Datum	Name
--	Daten Fertig	30.01.24	F.G.

Rohteil:

5. INSTALLATION AND OPERATION INSTRUCTION

5.1. General

The code for the flange type and size can be seen from the model designation (see chapter 2).

5.2. Clean propeller and engine flange with solvent or gasoline. Both surfaces must be dry and clean before installation. Remove all surface defects.

WARNING:
DO NOT INSTALL AN ADDITIONAL O-RING ON ENGINE FLANGE.

5.3. Grease on blade surface

The first run-up of a new or overhauled propeller may leave grease on the blades and inner surface of the spinner dome.
This is normal and does not imply a continuing grease leakage.
Remove any grease on the blades or inner surface of the spinner dome by using a mild solvent.
Minor grease leak which can be seen on one or all blade root(s) and spinner should be monitored if the situation gets worse.
If the grease leak does not spray more than 180 mm (7 in) on the blade surface measured from the blade root outside the blade ferrule in 5 hours of operation, it is defined as minor and should only be monitored.
Continued grease leakage after 20 hours of operation from first leakage requires repair at an authorized service repair facility within 5 operating hours.

In case of doubt contact manufacturer.

5.4. Installation of the propeller and the beta tube

The Airship manufacturer's documentation for the installation of the propeller on the drive shaft should be followed.

MT-Propeller will give a general guidance for the installation based on similar installations.

The propeller is fixed on slings with a crane and controlled by minimum 2 people that during installation it can be correctly aligned with the sub shaft bores.

WARNING:
CHECK FOR O-RING 2.36 TO BE IN POSITION ON THE PROPELLER. DO NOT DAMAGE THE O-RING. BEFORE INSTALLATION, MAKE SURE THE FLANGE CONTACT SURFACES ARE CLEANED FROM ANY OIL OR GREASE. BY THIS IT IS ENSURED, THAT THE LOADS ARE TRANSFERRED BY FRICTION.

Install the propeller on the engine flange with washer and stop nuts 2.38 and 2.39. Observe the position of the 2 index pins 2.40 for the drive shaft.

Attention
Never use the stop nuts 2.39 to pull the propeller onto the flange!
Manual pushing only!
Disrespecting this can damage the hub and / or sheared off metal chips can cause oil leakage through the O-ring!

Before installation, make sure the flange contact surfaces are cleaned from any oil or grease.

Stop nuts with washers should be tightened crosswise with equal moment.

Torque the 1/2''-20 UNF stop nuts ungreased with 85 - 90 Nm (63 – 66 ft lbs)

Note:
Torque values are valid for dry, free-moving threads only.

Install spinner filler plates, observe mating marks. Afterwards, install spinner dome, again observe mating marks. Torque screws with plastic washers 4 - 5 Nm (35 - 44 inlb). Check runout of the dome. Max. 2 mm (0.08 inch) permissible.

Figure 3: Marking of blade 1 on spinner front plate

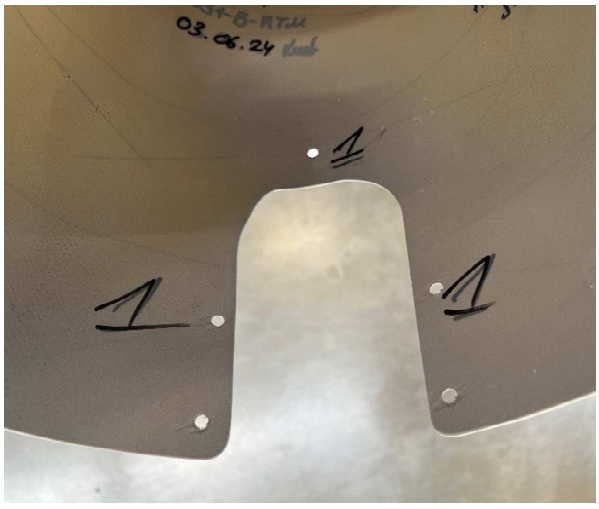


Figure 4: Marking of blade 1 inside spinner dome

For short ground tests it is allowed to run the propeller without spinner dome. In this case the spinner filler plates must be removed prior to engine start up.

5.5. Adjusting

Mechanical high pitch stops and reverse stops are adjusted during manufacturing, according to the requirement of the engine / application.

5.5.1. Setting the Low Pitch

Set the low pitch blade angle with the electric actuator and due to moving the beta rod in or out as well as fine adjusting with the threaded beta rod end

Moving out:	Higher pitch
Moving in:	Lower pitch

5.5.2. **Setting to ensure that the complete travel of the blade angle is given:**

- Use the electric actuator to bring the blades to full reverse position until the blades stop moving.
- Check blade angle acc. to Table 1.
- Then use the electric actuator to bring the blades to the high pitch stop until the blades stop moving and again check blade angle acc. to Table 1.

	P-1795-1		P-1795-2	
Throttle position	**Pitch °**	**Beta rod travel**	**Pitch °**	**Beta rod travel**
Full Forward (beta rod all the way out of hub)	+34°	-21.3 mm	+29°	-18.4 mm
Full Reverse (beta rod all the way in hub)	-34°	+21.2 mm	-19°	+12.4 mm

Table 1: Blade pitch in comparison to beta rod travel

5.6. **After first runs, check for oil leaks and blade shake.**

5.7. **Perform test run in accordance with the description in the airship operation manual.**

5.8. **Operation**

Propeller, beta tube and electric actuator are selected as a result of tests.
The beta tube allows a direct blade angle feedback but no constant speed operation. Overspeed protection must be provided by the engine control.
In case of failure of oil pressure, the propeller automatically goes to zero thrust position.

6. INSPECTIONS

6.1. Pre-operation inspection

Before each operation of the propeller inspect the condition of the blades and spinner visually from ground using appropriate tools. In case any abnormalities can be found a more detailed inspection is necessary.

NOTE: POSSIBLE GREASE LEAK ON BLADE SURFACE:

The first run-up of a new or overhauled propeller may leave grease on the blades and inner surface of the spinner dome.
This is normal and does not imply a continuing grease leakage.
Remove any grease on the blades or inner surface of the spinner dome by using a mild solvent.
Minor grease leak which can be seen on one or all blade root(s) and spinner should be monitored if it gets worse.
If the grease leak does not spray more than 180 mm (7 in) on the blade surface from the blade root outside the blade ferrule in 5 hours of operation, it is defined as minor and should be only monitored!
Continued grease leakage after 20 hours of operation from first leakage requires repair at an authorized service repair facility within 5 operating hours

In case of doubt, contact manufacturer.

6.2. 100 Hours Inspection

Remove spinner and check for cracks. Check blade shake, max. 1/8 inch.

The blade shake must be checked in and opposite the direction of rotation. Measure blade shake 4 inch from blade tip at the trailing edge.

Figure 5: Blade shake check direction

Note: DO NOT measure in flight direction, as the blade bending will also be measured.

Check blade angle play, max. 2°. If the check shows values above these tolerances, contact the service department of MT-Propeller. Inspect outside condition of the hub and parts for cracks, corrosion, deterioration. Inspect check nut for low pitch stop for tightness. Check all safety means to be intact. Check flange bolts or stopnuts for tightness. No check of torque is required if safety paint is still intact in place. Check front and rear spinner plate for cracks and fixing.

6.3. Adjusting unit and beta rod

Check for corrosion on adjusting unit and beta rod.
In case corrosion is found, remove corrosion by polishing with abrasive paper and apply sticky grease every 100 operating hours to avoid further corrosion.

6.3.1. Check the blades for cracks in the carbon fiber cover and blade 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 blade core. Blisters or delaminations up to 645 mm² (1 in²) are permissible.
In case of questionable conditions please contact the service department of MT-Propeller.
Also see Service Letter SL-32 and SL-32-2.

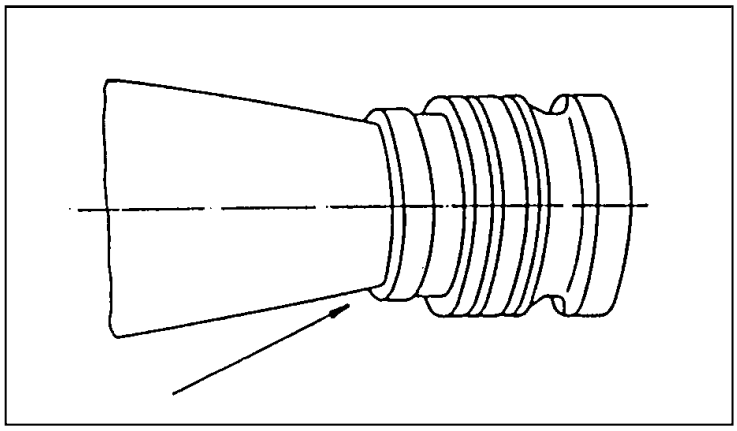


Figure 6: black sealer between the blade and ferrule

Check that the black sealer which is sealing the blade with the ferrule is not damaged, see Figure 6. If a damaged seal is obvious it has to be repaired acc. to Service Letter SL-32
in order no moisture can intrude the blade body and ferrule.
Perform a visual inspection in case notches, dents, nicks or other damages are present on the blade body, e.g. stone nicks.

For repair see Service Letters SL-32 and SL-32-2.

Attention:
The aerodynamic properties of the airfoil must not be disturbed when performing a repair.

Apply a layer of lacquer to protect the repaired spot against moisture.
Check this particular area carefully for possible cracks in each inspection prior to propeller operation.
The area will be inspected and repaired by propeller specialists during next repair or overhaul at the manufacturer or service station.
Damages on erosion protection sheaths are not allowed beyond the restrictions of Service Letters SL-32 and SL-32-2.

6.4. Special Inspections

Type and extent of a special inspection are shown in the propeller log book. In case of questions consult MT-Propeller.

6.5. Overhaul

The time between overhauls is expressed in hours flown and calendar months since manufacture or overhaul. The figures are presented in Service Bulletin No. 1( ), latest revision. They are also shown in the propeller log book. In any case, a calendar time inspection must be performed after a maximum of 60 months from installation, if no more than 24 months have passed since manufacturing overhaul when properly stored. This means that calendar TBO can be max. 84 months. The extent of the overhaul and the replacement of life-limited parts is defined in the applicable service manual.

6.6. Overspeed / Overtorque

When a propeller has an overspeed event refer to the engine overspeed limits (see Figure 5) to determine the corrective action to be taken.

In case an overspeed inspection or overhaul due to overspeed is required also engine mounted accessories manufactured by MT-Propeller (e.g. governor, pump, propeller control unit) need to be disassembled in order to be inspected in accordance with the applicable maintenance manual.

Regardless of the degree of damage a log book entry is required to document the overspeed incident.

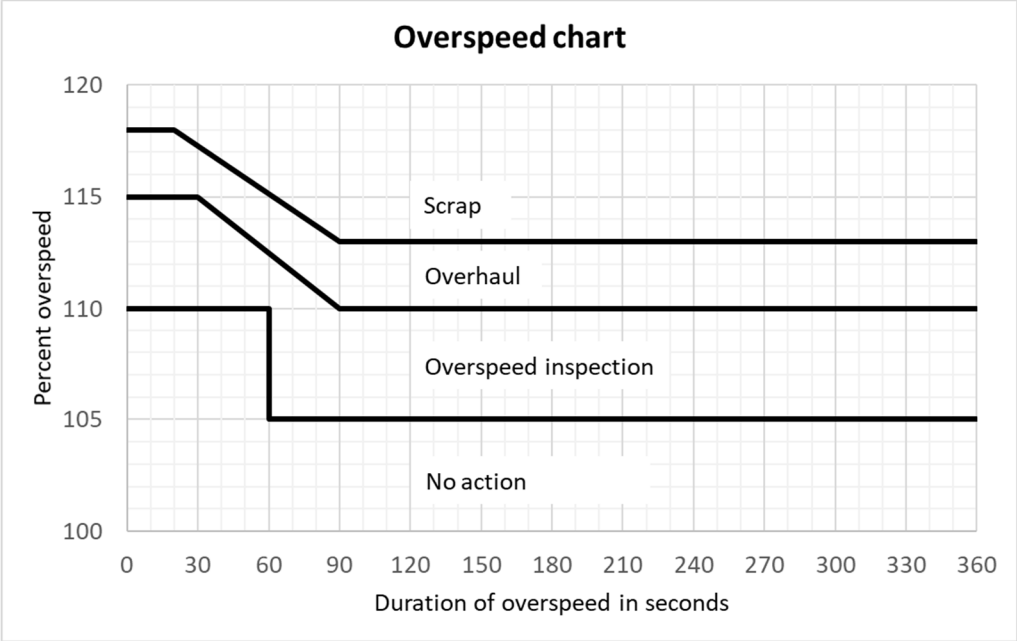


Figure 7: Overspeed chart

The corrective action is based on the severity and the duration of an overspeed for a single event.

6.6.1. No Action Necessary

In case no action due to overspeed is necessary also no maintenance is required.
However, it has to be verified that the overspeed incident is not caused by a mechanical issue of the propeller.

6.6.2. Overspeed Inspection

An overspeed inspection requires the disassembly of the propeller in accordance with the appropriate propeller overhaul manual and performance of the following inspections:

General
Visually inspect for signs of abnormal wear and/or damage.
Evidence of wear and/or damage should be further evaluated using the inspection criteria from the appropriate propeller or blade overhaul manual.
Special attention must be given to blade retention components.

Aluminum Hub
Visually inspect the blade retention area of the blade socket.

Composite Blades

Perform a thorough visual and coin tap inspection (see Figure 8) of the exposed portion of each blade including the stainless-steel leading edge.

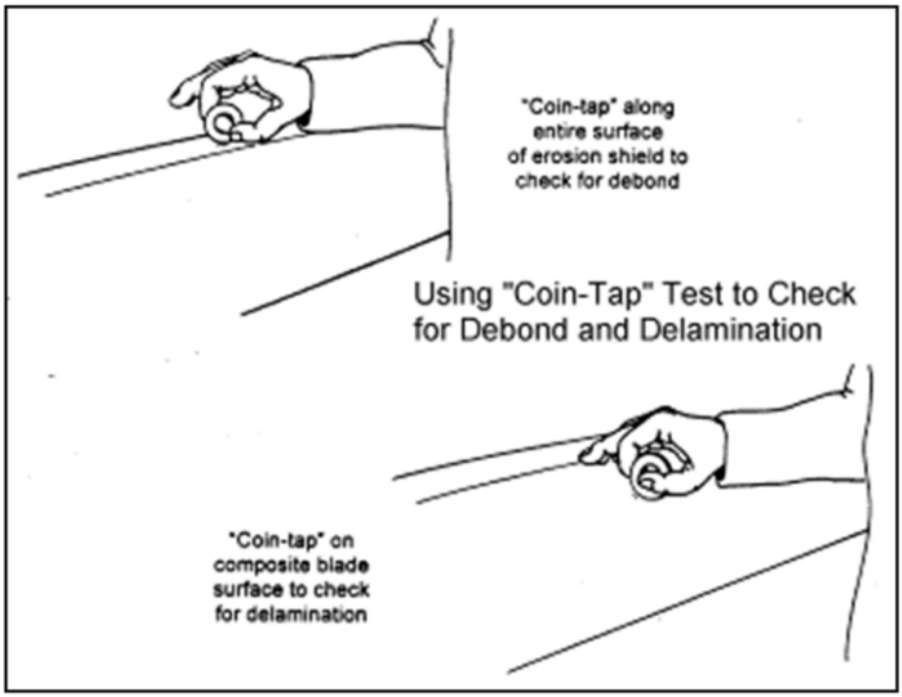


Figure 8 Coin tab test for composite blades

6.6.3. Overhaul

In case an overhaul inspection is required as corrective action for an overspeed the propeller needs to be overhauled in accordance with the appropriate overhaul manual.

Attention:
In case the blade has been damaged by a foreign object an overhaul is always required.

6.6.4. Scrap

In case the corrective action requires scrapping the propeller, the propeller is no further airworthy and must be put out of service.

7. MAINTENANCE

7.1. There is no special maintenance schedule for these propellers beyond the usual inspections as per chapter 6. 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, see service letter SL-32 and SL-32-2.

A repair of spinner parts is not permissible. Cracked spinner domes and backplates need to be replaced by airworthy parts.

Broken blade tips and damaged composite blades can be repaired by the manufacturer if a minimum of 85 % of the blade remains without cracks. For damages on the leading and trailing edges see Service Letters SL-32 and SL-32-2
In case of doubt send the affected hub as well as the broken blades to the manufacturer for evaluation.

7.2. **Dynamic balancing (optional)**

7.2.1. Overview

Dynamic balance is accomplished by measuring the amount and location of the dynamic imbalance, using accurate means of measuring.
After the balancing the remaining imbalance should be lower than 0.2 ips. Follow the instructions from the equipment manufacturers for dynamic balance.If the dynamic imbalance is larger than 1.2 ips, the propeller must be removed from the Airship and a static rebalancing needs to be performed.

7.2.2. Inspection procedures prior to balancing

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

NOTE: POSSIBLE GREASE LEAKS ON PROPELLER SURFACE:

The first run-up of a new or overhauled propeller may leave grease on the blades and inner surface of the spinner dome.
This is normal and does not imply a continuing grease leakage.
Remove any grease on the blades or inner surface of the spinner dome by using a mild solvent.
Minor grease leak which can be seen on one or all blade root(s) and spinner should be monitored if it gets worse.
If the grease leak does not spray more than 18 cm (7 in) on the blade surface from the blade root outside the blade ferrule in 5 hours of operation, it is defined as minor and should be only monitored!
Continued grease leakage after 20 hours of operation from first leakage requires repair at an authorized service repair facility within 5 operating hours.

In case of doubt, contact manufacturer.

7.2.4. Prior to dynamic balance record the number and location of all balance weights form static balancing.

NOTE: CHADWICK-HELMUTH MANUAL AW-9511-2, „THE SMOOTH PROPELLER" SPECIFIES SEVERAL GENERIC BULKHEAD REWORK PROCEDURES.

7.2.5. Ensure that the balance weights and attachment parts do not interfere with the adjacent airframe and engine or propeller components!

7.2.6. Placement of balance weights for dynamic balance.

7.2.7. The method of attachment of dynamic balance weights is to add the weights to the rear spinner bulkhead.

7.2.8. The removal of the dynamic balance weights, if they exist, will restore the propeller to its original static balance condition. A removal of the static balance weights is only allowed in exceptional cases.

7.2.9. Use only stainless or plated steel washers as dynamic balance weight on the spinner bulkhead.

7.2.10. Do not exceed maximum weight per location of 50 g. This is approx. equal to 8 pieces AN970-( ) style washers. If more weight is needed split to 2 locations.

7.2.11. Weights are to be installed using aircraft quality 10 - 32 inch screws or similar screws.

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

7.2.13. All propellers which have been dynamically balanced must be labeled with a decal on blade no. 1 to inform service station personnel that the existing balance weight configuration may not be correct for static balance.

7.2.14. Register number and location of static and dynamic balance weights in the propeller logbook if they have been reconfigured.

8. TROUBLE SHOOTING

8.1. Blade shake in FWD and AFT direction

Cause: Blade bearing loose

Remedy: If more than 3 mm, return propeller to the factory or any approved repair station to correct the pre-load of the blade retention bearing.

8.2. Sluggish RPM change

Cause:
1. Cold oil
2. Excessive friction

Remedy:
1. Run the system until a sufficient the oil temperature is reached (green arc).
2. Move blades with the electric actuator from reverse to full forward and measure the time to achieve this motion. Check whether the electric actuator is moving synchronal. If excessive friction is observed or the blades move asynchronously to the electric actuator, the blade retention system needs to be inspected.
   Contact manufacturer.

8.3. Surging RPM

Cause:
1. Residual oil
2. Abrupt movement of propeller or throttle control
3. Instrumental error

Remedy:
1. Clean oil tubes in the propeller piston and eventually in the beta valve and beta tube
2. Move the controls carefully and slowly.
3. Check tachometer and drive.

8.4. RPM increase during normal operation without change of propeller lever position

Cause:
1. Oil leakage or hot oil
2. Worn oil transfer system on the beta-tube causes an decrease in blade angle.
3. Supply pressure failure.

Remedy:
1. Check for oil leaks, replace gaskets, decrease oil temperature.
2. If the system works with cold oil and fails at high oil temperature, this is an indication for high leakage in the oil transfer system in the beta-valve.
   Replace beta tube.
3. Check pump drive on the test bench.

8.5. **Extremely slow pitch change or no pitch change on ground**

Cause:
1. Blocked oil line.
2. Residual oil in propeller piston.
3. Damaged pitch change mechanism.
4. Corrosion in the blade bearings.

Remedy:
1. Check beta tube and the electric actuator
2. Clean beta tube oil lines
   NOTE: THIS BEHAVIOR DOES NOT APPEAR AT ONCE AND GETS WORSE OVER TIME. IT SHOULD BE OBSERVED.
3. Contact manufacturer.
4. Repair propeller.

8.6. **Oil leakage (visible outside or hidden inside)**

Cause: Damaged seals

Remedy: Replace gaskets or repair propeller.

8.7. **Rough running engine / propeller, possibly in limited RPM range only**

Cause:
1. Bad static balance.
2. Bad dynamic balance.
3. Rotation of blade in blade ferrule

Remedy:
1. Rebalance statically.
2. Rebalance dynamically.
3. Check marking whether blade is rotated in blade ferrule.
   If applicable, reset according to chapter 5.

9. SHIPPING AND STORAGE

9.1. For any shipment of the propeller use original container. If this is not possible it is mandatory to fix the propeller at the blades and the hub in a way to avoid damage during transport.

Furthermore, it is recommended to return all accessories and parts together with the propeller when returning the propeller. These will also be inspected and thus not considered to be missing.

9.2. If the propeller is stored for a longer period of time, preferably use the original container or an equivalent container. Store it only in a controlled environment (temperature - 5° F to 95° F, rel. humidity 10 % to 75 %). Avoid extreme temperature/humidity differences or cycles. All metal surfaces should have anti-corrosion protection which is easy to remove. There is no need for additional blade protection since its lacquer is sufficient.

9.3. The TBO starts with the installation on the aircraft.
However, if the installation is later than 24 months after new assembly or overhaul and proper storage provided, the TBO automatically starts after this 24 months, up to maximal 84 months of calendar time.

9.4. In case the propeller is stored for longer than 24 months it can be disassembled before installing it onto the aircraft and all seals have to be replaced. This will bring calendar time TBO back to zero.

9.5. Long-term storage could require additional preservation. All standard anti-corrosive preservation oils may be used if they do not affect the seals. Only metal parts need to be protected. The wood-composite blades do not need special protection but mechanical damage has to be avoided in order no moisture is allowed to enter the wooden blade core.

9.6. If the propeller is stored or transported in corrosive environment such as salt water or fog, it is recommended to cover the visible outside surfaces of the metal parts with a film of thinned engine oil.

9.7. If the propeller is delivered in a wooden shipping box, the shipping box must be opened after receipt. By opening the shipping box it is ensured that the chemically treated wood of the shipping box does not create any corrosion on the metal parts of the propeller.

9.8. **Acceptance Check**

Examine the exterior of the shipping container for signs of shipping damage, especially at the box ends around each blade.
A hole, tear or crushed appearance at the end of the box (at the propeller tips) may indicate the propeller was dropped during shipment, possibly damaging the blades.
After removing the propeller from the shipping container, examine the propeller components for shipping damage.

9.9. **Uncrating:**

Place the propeller on a firm support.
Remove the banding and any external wood bracing from the cardboard shipping container.

CAUTION:
Never place the propeller onto a blade tip!

Put the propeller on a padded support that supports the entire length of the propeller.

If applicable, remove the plastic dust cover cap from the propeller mounting flange.

9.10. Lifting

To lift the propeller, pick up the propeller at the blade ferrule as close as possible towards the hub. Do not pick up the propeller on any other spot, especially not on the blade tips as well as the spinner front plate or back plate.

10. SPECIAL TOOLS

None

11. PART LIST

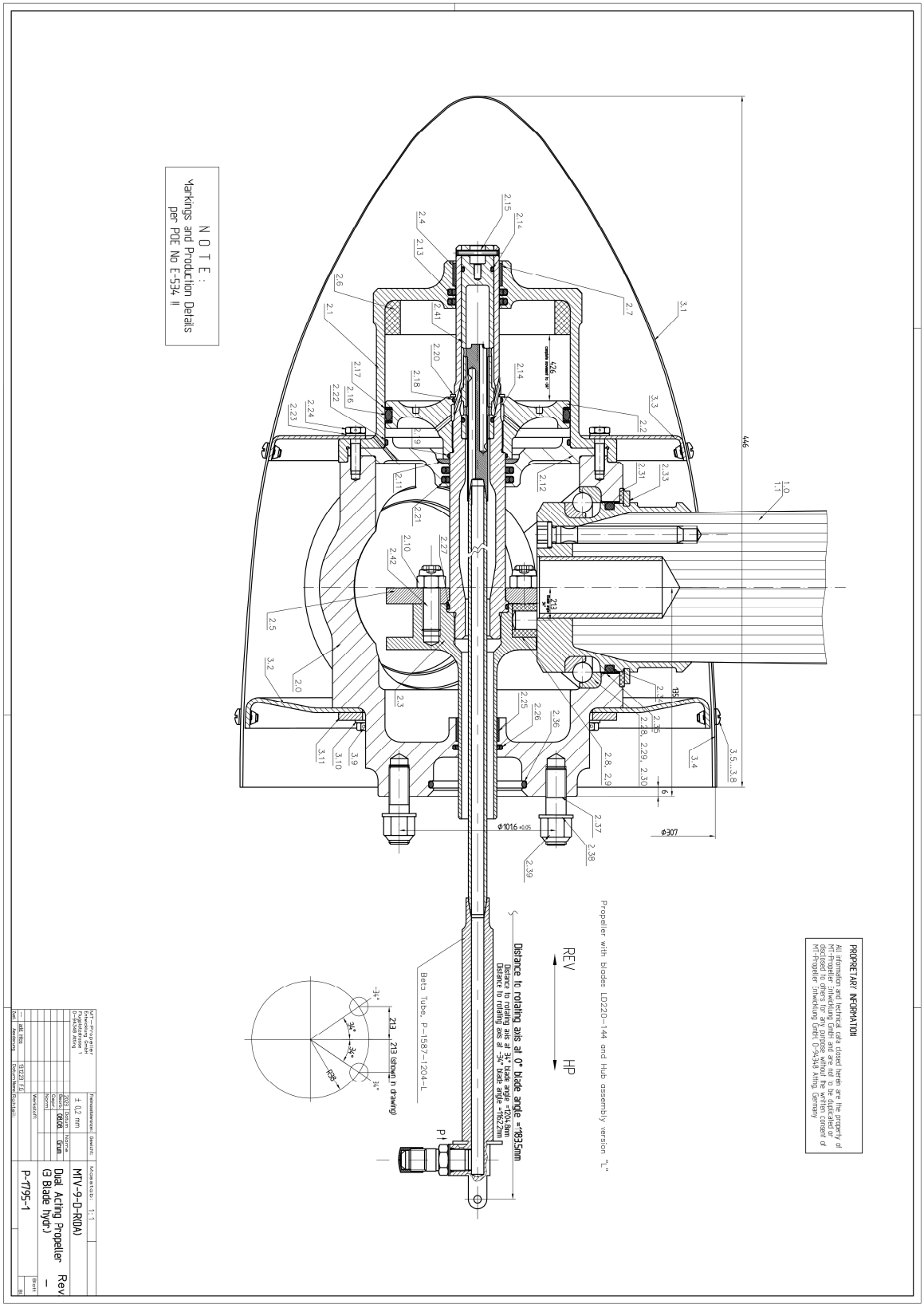
Item	QTY	Part	Part number	Item	QTY	Part	Part number
2.39	6	Stop Nut ½''	C-067-A	3.7	33	Spinner screw	C-306-8
2.38	6	Washer	C-076-A	3.8	33	Washer	C-344
2.36	1	O-Ring	C-048-B	3.9	6	Screw	C-303-6
				3.10	6	Washer	C-336-4

mt-propeller

12. PROPELLER DRAWING

MTV-9-AB-R(DA)

Drawing No. P-1795-1



mt-propeller

MTV-9-D-R(DA)

Drawing No. P-1795-2