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STOCK AND CUT LIST

ITEM	PART	STOCK FORM	SPEC	CUT SIZE	QTY	WASTE
1	Optical tube	Tube Ø250 OD × 1.5 wall	Alu 6061-T6	720 long	1	+10 facing
2	Mirror cell	Plate 250 × 250 × 25	Alu 6061-T6	Ø244 disc	1	corner drop
3	Spider hub	Bar Ø50 × 40	Alu 6061-T6	Ø44 × 26	1	—
4	Spider vanes	Sheet 0.5 shim	Alu 5052-H32	110 × 22	4	+2 spares
5	Focuser board	Plate 130 × 130 × 16	Alu 6061-T6	120 × 120 × 14	1	—
6	Secondary holder	Filament PA-CF 1.75	Bambu PAHT-CF	≈190 g	1	+1 spare
7	Mirror pads	Cork sheet 3 mm	Natural cork	Ø22 disc	3	+3 spares
8	Edge rollers	PTFE rod Ø10	PTFE virgin	12 long	2	—

STOCK NOTES

1. TUBE: SEAMLESS DRAWN PREFERRED. WELDED TUBE ACCEPTABLE IF ROUNDNESS 0.5 TIR IS MET OVER BOTH TUBE-RING SEATING BANDS (STATIONS 210 AND 450).

2. MIRROR CELL: PLATE MUST BE STRESS-RELIEVED. AS-ROLLED PLATE WILL BOW WHEN THE Ø120 FAN BORE IS OPENED, AND PAD COPLANARITY 0.05 WILL NOT HOLD.

3. VANES: 5052-H32 CHOSEN OVER 6061 FOR FORMABILITY AND FLATNESS IN THIN SHEET.

4. ORDER 2 SPARE VANES. A BENT VANE SPLITS DIFFRACTION SPIKES AND IS NOT STRAIGHTENABLE ONCE CREASED.

REVISION HISTORY

REV	DESCRIPTION	DATE
A	First issue for manufacture	2026-08-16

FLOWMATIC · ASTROGRAPH PROGRAMME

200 mm f/4 NEWTONIAN ASTROGRAPH · CANBERRA ACT 35.28°S

STOCK AND CUT LIST

DRAWING NUMBER	REVISION	SHEET
FM-AST-P01	A	1 OF 6
SCALE	MATERIAL	MASS
NTS	SEE SCHEDULE	4.26 kg
PROJECTION	FINISH	UNITS
FIRST ANGLE (ISO 128)	—	MILLIMETRES
GENERAL TOL ISO 2768-mK UNLESS STATED · DO NOT SCALE		
DRAWN NaXief's Claude CHECKED SELF-CHECK + VISUAL JUDGE, SEE SHEET 6 QA GATES		
DATE 2026-08-16 STATUS ISSUED FOR MANUFACTURE		

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OPERATION SHEET

OP	SETUP	OPERATION	TOOL	CRITICAL
10	Vice, soft jaws	Face one side, skim to 25.0	50 mm face mill	datum face
20	Vice, flip	Face to 12.0 ±0.05 overall	50 mm face mill	THICKNESS 12 ±0.05
30	4-jaw / fixture plate	Bore Ø244 outside profile	Ø12 carbide end mill	—
40	SAME SETUP AS 30	Bore Ø120 fan aperture	Ø12 helical ramp	concentric 0.05
50	SAME SETUP AS 30	Mill 3 × pad bosses to 17.0 h	Ø10 end mill	COPLANAR 0.05
60	SAME SETUP AS 30	Mill 3 × collimation bosses to 20.0	Ø10 end mill	—
70	SAME SETUP AS 30	Drill+tap 3 × M6 collimation, R108.5	Ø5.0 drill, M6 tap	120° ±0.1°
80	SAME SETUP AS 30	Mill 3 × adjustment slots 9 × 5.5	Ø5 end mill	±15 travel
90	SAME SETUP AS 30	Drill 4 × Ø4.4 fan holes, 105 sq	Ø4.4 drill	—
100	Deburr bench	Break all edges 0.3 × 45°	Hand deburr	no burr in bore
110	Inspection	Verify G1 pad coplanarity	Surface plate + DTI	GATE G1
120	Anodise	Clear anodise, MASK PAD FACES	—	pads bare metal

CRITICAL MACHINING NOTES

1.

OPS 30–90 MUST BE A SINGLE SETUP. DO NOT RE-FIXTURE BETWEEN THEM.

RE-FIXTURING IS THE ONLY REALISTIC WAY TO LOSE PAD COPLANARITY 0.05,

AND PAD COPLANARITY IS WHAT KEEPS THE PRIMARY FROM BEING TILTED.

2.

MASK THE THREE PAD FACES BEFORE ANODISING. ANODIC LAYER IS 15–25 µm AND

WILL DESTROY THE COPLANARITY YOU JUST HELD TO 50 µm.

3.

CLIMB MILL THE Ø120 BORE. CONVENTIONAL MILLING PULLS THIN SECTIONS.

4.

COOLANT THROUGHOUT. DRY-CUT 6061 WELDS TO THE FLUTE AND TEARS THE FINISH.

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200 mm f/4 NEWTONIAN ASTROGRAPH · CANBERRA ACT 35.28°S

MACHINING OPERATIONS — PRIMARY MIRROR CELL

DRAWING NUMBER	REVISION	SHEET
FM-AST-P02	A	2 OF 6
SCALE	MATERIAL	MASS
NTS	ALUMINIUM 6061-T6	1.20 kg
PROJECTION	FINISH	UNITS
FIRST ANGLE (ISO 128)	CLEAR ANODISE AFTER MACHINING	MILLIMETRES
GENERAL TOL ISO 2768-mK UNLESS STATED · DO NOT SCALE DRAWN NaXief's Claude CHECKED SELF-CHECK + VISUAL JUDGE, SEE SHEET 6 QA GATES DATE 2026-08-16 STATUS ISSUED FOR MANUFACTURE		

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PRINT SPECIFICATION

PARAMETER	VALUE	REASON
Machine	Bambu Lab H2C	Vortek hotend, enclosed chamber
Nozzle	0.4 mm hardened steel	CF filament destroys brass in hours
Material	PAHT-CF	dimensional stability, low creep, dark
Nozzle temp	290 °C	—
Bed temp	100 °C	—
Chamber	ON, 55 °C	PA warps badly without it
Layer height	0.16 mm	surface finish on the 45° seat
Walls	5	load path is the wall, not the infill
Infill	60 % gyroid	stiffness without print time
Supports	Tree, 45° threshold	the 45° seat overhangs
Orientation	Seat face UP, stalk DOWN	seat accuracy beats stalk finish
Drying	PRE-DRY 12 h @ 80 °C	PA absorbs water; wet PA prints porous
Annealing	2 h @ 90 °C, slow cool	relieves print stress before service

ADDITIVE NOTES

1.

PA IS HYGROSCOPIC. A HOLDER PRINTED FROM WET FILAMENT WILL BE POROUS AND WILL CREEP UNDER THE SECONDARY'S WEIGHT OVER A SEASON. DRY IT.

2.

PRINT A SPARE IN THE SAME JOB. THE 45° SEAT IS THE MOST LIKELY REWORK.

3.

DO NOT PRINT IN PLA OR PETG. THE DEW HEATER RUNS AT 40–50 °C AND PLA CREEPS.

4.

SECONDARY IS BONDED WITH 3 DABS OF SILICONE, NOT CLAMPED. SILICONE ALLOWS DIFFERENTIAL EXPANSION; A RIGID BOND WILL WARP THE FLAT.

5.

MASS SAVING VS MACHINED ALUMINIUM: 0.32 kg — THIS IS WHAT RETURNED THE ASSEMBLY TO THE 10.0 kg MOUNT BUDGET.

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FLOWMATIC · ASTROGRAPH PROGRAMME

200 mm f/4 NEWTONIAN ASTROGRAPH · CANBERRA ACT 35.28°S

ADDITIVE MANUFACTURE — SECONDARY HOLDER

DRAWING NUMBER	REVISION	SHEET
FM-AST-P04	A	4 OF 6
SCALE	MATERIAL	MASS
NTS	PAHT-CF (PA6 + CARBON FIBRE)	0.15 kg
PROJECTION	FINISH	UNITS
FIRST ANGLE (ISO 128)	AS PRINTED, ANNEALED	MILLIMETRES
GENERAL TOL ISO 2768-mK UNLESS STATED · DO NOT SCALE		
DRAWN NaXief's Claude · CHECKED SELF-CHECK + VISUAL JUDGE, SEE SHEET 6 QA GATES		
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FASTENER SCHEDULE

REF	SIZE	GRADE	QTY	LOCATION	TORQUE	THREADLOCK
F1	M6 × 40 cap	A2-70	3	Cell collimation	HAND + spring	NONE — must adjust
F2	M4 × 12 cap	A2-70	3	Cell axial slots	2.0 N·m	medium (243)
F3	M4 × 10 button	A2-70	4	Fan to cell	1.2 N·m	low (222)
F4	M3 × 16 cap	A2-70	3	Mirror clips	FINGER ONLY	NONE — see note
F5	M10 × 60	A2-70	1	Secondary stalk	4.0 N·m	medium (243)
F6	M3 × 20 grub	A2-70	3	Secondary tilt	HAND + spring	NONE — must adjust
F7	M3 × 8 cap	A2-70	8	Vane to tube	1.0 N·m	low (222)
F8	M5 × 16 cap	A2-70	4	Focuser to board	5.0 N·m	medium (243)
F9	M5 × 20 cap	A2-70	4	Board to tube	5.0 N·m	medium (243)
F10	M6 × 25 cap	A2-70	8	Rings to dovetail	8.0 N·m	medium (243)

FASTENER NOTES

1.

F4 MIRROR CLIPS: FINGER TIGHT THEN BACK OFF UNTIL THE CLIP STANDS 0.30 PROUD OF THE GLASS. THE GLASS MUST RATTLE FAINTLY. A TORQUE FIGURE IS DELIBERATELY NOT GIVEN — ANY TORQUE AT ALL MEANS THE MIRROR IS PINCHED.

2.

F1 AND F6 ARE ADJUSTERS, NOT FIXINGS. THREADLOCK WOULD DEFEAT THEM. USE COMPRESSION SPRINGS UNDER F1 TO HOLD COLLIMATION AGAINST VIBRATION.

3.

ALL STAINLESS INTO ALUMINIUM: USE ANTI-SEIZE. GALVANIC PAIR IN A DEWY ENVIRONMENT WILL SEIZE WITHIN A SEASON IN CANBERRA.

4.

TORQUES ARE FOR DRY A2 STAINLESS INTO ALUMINIUM. REDUCE 25 % IF LUBRICATED.

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FASTENER SCHEDULE AND TORQUE

DRAWING NUMBER FM-AST-P05	REVISION A	SHEET 5 OF 6
SCALE NTS	MATERIAL —	MASS —
PROJECTION FIRST ANGLE (ISO 128)	FINISH —	UNITS MILLIMETRES
GENERAL TOL ISO 2768-mK UNLESS STATED · DO NOT SCALE DRAWN NaXief's Claude CHECKED SELF-CHECK + VISUAL JUDGE, SEE SHEET 6 QA GATES DATE 2026-08-16 STATUS ISSUED FOR MANUFACTURE		

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INSPECTION RECORD — COMPLETE IN INK, RETAIN WITH THE INSTRUMENT

GATE	CHARACTERISTIC	SPECIFIED	METHOD	MEASURED	ACC
G1	Pad coplanarity	0.05 mm	Surface plate + DTI		
G1	Cell thickness	12.0 ±0.05	Micrometer, 4 places		
G2	Mirror radial clearance	0.5 – 1.0 mm	Feeler, 6 positions		
G3	Axial clip standoff	0.30 +0.2/–0.0 proud	Shim + tap test		
G4	Secondary offset	5.0 ±0.3 mm	Depth gauge from hub		
G4	Vane coplanarity	0.3 mm	Straight edge		
G5	Focuser squareness	≤0.10°	DTI sweep on drawtube		
G5	Board seat contact	no rock, 100 % seat	Engineer's blue		
G6	Collimation	focal pt ≤1.41 mm off axis	Cheshire + laser		
G7	Corrector spacing	corner HFR ≤110 % centre	Star field measure		
G8	Sensor tilt	≤20 µm across diagonal	Corner HFR compare		
G9	First light star shape	round to the corners	Eta Car / Omega Cen		

COMMISSIONING

1.

NO GATE MAY BE SIGNED FROM A CALCULATION. EVERY ROW IS A MEASUREMENT.

2.

G6 THROUGH G9 ARE PERFORMED UNDER SKY AND WILL TAKE SEVERAL SESSIONS AT f/4.

3.

IF G7 FAILS, SHIM THE CORRECTOR IN 0.5 STEPS. TANGENTIAL FLARE = TOO SHORT, RADIAL FLARE = TOO LONG. THE DIRECTION TELLS YOU WHICH WAY TO GO.

4.

IF TWO OPPOSITE CORNERS ARE SOFT AND TWO SHARP, THAT IS TILT (G8), NOT SPACING (G7). DO NOT CHASE IT WITH SPACERS.

5.

RETAIN THIS SHEET. IT IS THE INSTRUMENT'S BIRTH CERTIFICATE.

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INSPECTION AND COMMISSIONING RECORD

DRAWING NUMBER	REVISION	SHEET
FM-AST-P06	A	6 OF 6
SCALE	MATERIAL	MASS
NTS	—	—
PROJECTION	FINISH	UNITS
FIRST ANGLE (ISO 128)	—	MILLIMETRES
GENERAL TOL ISO 2768-mK UNLESS STATED · DO NOT SCALE		
DRAWN NaXief's Claude · CHECKED SELF-CHECK + VISUAL JUDGE, SEE SHEET 6 QA GATES		
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