FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 1 OF
DATE 9.7.57		REPORT NO. E.300
WEIGHT	RESTRICTED	MODEL NO.

25-HOUR POTTED TYPE TEST AVON MK.1, UPRATED.

C.A.C. ENGINE No. 44

Report Compiled by H. R. Davis

Report Approved by W. J. McCourne

Test carried out to the requirements of R.A.A.F. Technical Requirement Specification No. BS.55, Section 5.

A.I.D. H. Johnson

R.Tech.O.at C.A.C. H. J. Neirell & Sgt LM

Date 13.8.57

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WEIGHT		MODEL No.

.25-HOUR POTTED TYPE TEST AVON MK.1, UPRATED.

Declaration

Engine Tested: Avon Mk.1 Serial No. 44

Test Conducted at: Commonwealth Aircraft Corporation Pty.Ltd.
Fishermen's Bend,
Port Melbourne, Victoria.

R.A.A.F. Test Stand
No.1 A.D.
R.A.A.F. Laverton, Victoria.

Under the supervision of a representative of the Director of Aeronautical Inspection.

Dates of Tests: Commenced 23.5.56 (Contractor's Test)
Completed 19.9.56.

R.A.A.F. Order Number 441193.

Engine testing was conducted in accordance with R.A.A.F. Technical Requirements, Specification No. BS.55 , Section 5.

This report is an accurate and complete accounting of the test and the conditions pertaining thereto.

G. Johnson
.....

Inspector in Charge.
A.I.D. at C.A.C.

Date 13.8.57..

R.A.A.F. ORDER NUMBER 441193

Test effected on Avon Mk.1 Engine, Serial No. 44

Objects of Tests

1. To conduct tests on a Mk.1 Avon Engine at the nominal uprated conditions of 8,000 r.p.m. and 7,150 lb. static thrust.

2. To carry out clearance tests on engine components which were of local origin or manufacture.

3. To prove by engine running the effectiveness of a number of salvage schemes carried out on various components.

4. To test "second life" turbine components under the previously mentioned uprated conditions.

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DATE 9.7.57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT		MODEL NO.

25-HOUR POTTED TYPE TEST, AVON MK.1, UPRATED.

Conclusions

1. The engine performed satisfactorily throughout the test period and performance figures showed no deterioration at the conclusion of engine running.

   The thrust obtained during the performance tests was slightly less than the nominal rated figure.

2. Engine condition at strip after the test period was good with the exception of compressor casings and centre bearing.

   The compressor casings suffered damage in the blade locating lands of stages 8 and 9, due to twisting of the blades and subsequent "dig in" of the locating platforms. It is thought that this condition arose from momentary stall or surge at bleed valve change while the compressor casing was hot, e.g., during slam decelerations after periods of high power running.

   This condition has not been apparent on previous Mk.1 engines but there is no evidence to suggest that the uprating of the engine was its cause.

   During test running the temperature of both the centre and rear main bearings was higher at all speeds than was expected. Subsequent metallurgical examination showed that the rear bearing, though heavily discoloured, because of endured heat, still retained its physical qualities. The centre bearing, however, exhibited signs of damage due to overheating and overloading and was not suitable for further service. The cause of the excessive bearing temperature is not known.

   Centre bearing loads in this mark of engine are high and will be decreased by the inclusion of C.A.C. modification number 136 (R.R. modifications 1039 and 1197).

3. Second life turbine assemblies (pre Mod.22 discs) were included in engine build. The rate of blade rejection was not high but both the high pressure and low pressure turbine discs were rejected. The low pressure disc was rejected because of cracks emanating from the root of the blade fixing serrations. This failure is not an uncommon one with pre Mod.22 discs. The high pressure disc was rejected because of unusual pitting in the bottom of the bucket groove. The cause of this pitting is not known and is still the subject of metallurgical examination.

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25-HOUR POTTED TYPE TEST, AVON Mk.1, UPRATED.

Conclusions (continued)

4. Excessive leakage from the rear bearing rear seal gland was apparent. This trouble may be reduced by the inclusion of C.A.C. modification number 114 (R.R.Mod.791).

5. Rejections for cracking burning and distortion of flame tubes and nozzle guide vanes was not abnormal.

6. All local forgings and castings (including locally forged compressor blades) which were included in engine build performed satisfactorily and were accepted for further service after examination on conclusion of the test run.

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25-HOUR POTTED TYPE TEST AVON MK.1, UPRATED.

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WEIGHT	GENERAL SUMMARY	MODEL NO. Section 1.

General Summary:

Performance

Throughout the 25-hour endurance portion of the type test, the engine was operated at the following figures:-

	R.P.M. (Act.)	Thrust (Act.)	J.P.T. (Act.)	C.D.P.
Max. take-off conditions	8000	7240	635	77.5
Max. Cruise conditions	7600	6400	576	69.4

Performance curves at nominal conditions conducted before and after type test produced the following results:-

Maximum take-off Conditions

Stage of Test	R.P.M. (corr.)	Thrust (lb.wt.corr.)	J.P.T. (°C.corr.)	C.D.P. (p.s.i.)	S.F.C. (lb/lb/hr.)
Acceptance Test	8000	7050	601	75.7	.893
Final Test	8000	7090	606	76.0	.910

Maximum cruise Conditions

Stage of Test	R.P.M. (corr.)	Thrust (lb.wt.corr.)	J.P.T. (°C.corr.)	C.D.P. (p.s.i.)	S.F.C. (lb/lb/hr.)
Acceptance Test	7600	6000	531	67.8	.863
Final Test	7600	6030	538	67.9	.876

This table shows a negligible change in engine performance. The increased J.P.T's are a normal expectation as engine running hours increase.

Engine handling characteristics throughout the test were satisfactory. Compressor stall occurred at some stages during the test and is elaborated later in this report.

Engine vibration throughout test running was very small.
All test running conducted without major incident.
Oil consumption averaged .472 pints/hr. over all engine running.

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Total running time of engine = 69 hours 52 minutes.

Comprising:-

Contractors Test	10 hours 28 minutes
Acceptance Test	5 hours 51 minutes
Penalty Run	4 hours 6 minutes
1st Check Run	3 hours 4 minutes
2nd Check Run	1 hour 10 minutes
25-hour Endurance	42 hours 56 minutes
Final Rating Curve	2 hours 17 minutes

Maximum Engine Operating Conditions during test running.

8240 R.P.M. 636°C. J.P.T. for 32 minutes.

Total running time at, or in excess of, 630°C. = 11 hours 25 minutes.
A total of 94 slam accelerations was carried out.
A total of 100 engine starts was completed.

Engine Build included the following modifications:-

1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 26, 27, 28, 29, 30 in part, 31, 32, 33, 34, 36, 37, 38, 39, 41, 43, 44, 46, 47, 48, 51, 53, 54, 57, 63, 69, 79, 86, 92, 106, 111 in part.

Engine was of standard Mk.1 build except for recalibration of the Fuel Control Unit to permit the higher fuel flows required. In addition all rubber seals, jointing compound etc. used in engine build were suitable for use with the EEL.3 oil employed for the test.

Faults found during engine strip after 25-hour test.

Section 1010 Spiral bevel gear external wheelcase driving. This gear together with its roller race was rejected because of slight track break up.

Section 1060 Obvious signs of heavy oil leakage past rear bearing seal gland. Rear bearing rejected because of endured high temperatures.

Section 1070 High pressure turbine disc rejected for pitting in bucket grooves.
Low pressure turbine disc rejected for cracks in bucket grooves.
Six low pressure turbine blades rejected because of cracking.
A pair of high pressure turbine blades rejected because of cracked weld.
Rear bearing sleeve rejected because of over-heating.

Section 1080 Three high pressure nozzle guide vanes were rejected because of cracking on leading and trailing edges. Two stiffener panel securing screws rejected because of failure during test running.

Section 1092 Five flame tubes were rejected for major repair of cracks, buckling and weld failures.

Section 1100 Five rubber hose assemblies were rejected for minor faults.

Section 1106 Burners 6, 7 and 8 were heavily carboned.

Section 1108 Fuel control unit rejected because of excessive leakage to atmosphere from S.O.C. spindle at rig test.

Section 1270 Tacho drive bevel gears show the usual heavy bearing below the pitch line.

Section 1371 Compressor casings arbitarily rejected because of damage to locating grooves.

Section 1372 Rotor wheel pin holes scored by faulty blade pins. Front bearing rejected because of loose cage rivets.

Section 1373 Centre bearing rejected because of over-heating and a chipped ball. Centrifugal breather seal diameter in oil gallery casing damaged.

Section 1456 Firing lead for turbo starter rejected because of burnt insulation.

Final Disposition

Engine was completely overhauled and rebuilt to current Avon Mk.1 engine standard.

Design Data

1. General

(a) Arrangement — Straight Flow Turbo-jet.

(b) Nominal Rating

	R.P.M. (Act.)	Thrust lb.	J.P.T. °C.	S.F.C. lb/hr/lb.
Idling	2750	200	475	3.500
Max.Cont.	7600	5930	525	.870
Intermediate	7800	6500	560	.880
Max. Take-off	8000	7150	600	--

(c) Limitations

	R.P.M.	Thrust	J.P.T.(°C) (corrected)	S.F.C. lb/hr/lb.
Idling	2750±100 Actual	250 Act. Max.	475 Nom.	--
Max.Take-off	8000 Corr.	6860 Min.	615 Max.	--

(d) Engine Weight. 2200 lb. Dry (without jet pipe)

(e) Direction of Rotation. Anti clockwise when viewed from rear.

2. Combustion Equipment.

(a) Type of System — Straight flow combustion chambers with pad type location at rear end.

(b) Number ofChambers — Eight, interconnected.

(c) Disposition — Radially placed with axis parallel to engine centre line.

(d) Numbering — Anti clockwise viewed from rear. Nos. 1 and 8 at top.

3. Compressor

(a) Type of Compressor — Axial flow with automatic bleed and two position inlet swirl vanes.

(b) Number of Stages — Twelve

(c) Blading

STAGE	I.S.V	1	2	3	4	5	6	7	8	9	10	11	12
ROTOR	-	43	67	73	91	89	89	89	89	97	97	97	97
STATOR	37	73	83	97	113	103	103	103	109	137	137	137	80
MATERIAL	Al.	Al.	Al.	Al.	Al.	Al.	Al.	Al.	Al.	Bz.	Bz.	Bz.	Bz. Stl.

4. Turbine

(a) Turbine Type — Shrouded blades, axial flow

(b) Number of Stages — Two

(c) Nozzle Guide Vanes — Precision cast heat resisting steel.

(d) Blading

STAGE	H.P.	L.P.
ROTOR	103	71
STATOR	73	67

5. Fuel System

(a) Fuel Specification — D.Eng.RD.2482 AVTUR (Kerosine) RAAF. Ident K1/10019.

(b) Fuel Pumps — Upper Lucas Type GB.203-5C, Lower Lucas Type GB202-4C } Multi-plunger Variable stroke.

(c) Fuel Control Unit — Combined unit incorporating B.P.C. throttle valve, pressurising valve, H.P. cock and L.P. fuel filter.

(d) Burners (Duple) — Twin Orifice emitting co-axial atomized spray.

(e) Acceleration Control Unit. — Altitude sensitive type, controlling fuel flow increase during acceleration.

6. Lubrication System

(a) Type — Self-contained wet sump with continuous circulation by one pressure and two scavenge pumps.

(b) Oil specification — DERD.2487 RAAF Ident K2/238 (OX38)

(c) Circulation — Sump, pressure pump, oil cooler, pressure filter, bearings and gears, scavenge pump or gravity drain, sump.

(d) Oil Cooling — Fuel cooled matrix type oil cooler.

(e) Sump capacity — 17 pints (approx.)

(f) System capacity — 2 pints (approx.)

(g) Oil consumption — 1.5 pints per hour (maximum)

(h) Pressure — See Schedule Limitations

(j) Temperature — See Schedule Limitations

7. Engine Cooling System

(a) Type	Pressure Air to bearings and turbine
(b) Low Pressure	Tapped from 3rd compressor stage to main bearings.
(c) Intermediate Pressure	Tapped from 10th stage to low pressure turbine and rear face of high pressure turbine disc.
(d) High Pressure	Tapped from 12th Stage to front face of high pressure turbine disc.

8. Tacho Generator — Smiths 106.RV/SB (Slave Unit used during test).

9. Oil Pressure Transmitter — Smiths 482/PG/SB (Not used during 25-hour test).

10. Starting System

(a) Starter Type	Single breech turbo starter SBS.720 Mk.2.
(b) Cartridge type	No.9 Mk.2 720 gramme cordite charge.
(c) Safety device	Pressure Shear Disc.

11. Ignition System

(a) Type of System	High energy igniter plugs located in number 3 and 6 combustion chambers and lighting spray direct from engine burners.
(b) H.E.Igniter Plugs	Lodge type 409
(c) H.E.Igniter Units	Rotax NB.25/1 (24 volt DC) (BTH Slave Units used during 25-hour endurance.

Engine Build.

General

Avon Engine Mk.1 serial number CAC.44 was built to the following requirements and submitted as a type test engine to be run at the uprated take-off speed of 8,000 r.p.m.

Details

1. The engine was built to the current standard L.O.P. for Mk.1 engines except for recalibrated fuel control unit.

2. Special parts, i.e., Australian forgings, hose assemblies etc. and time expired turbine discs and blades were included for proof during the run.

3. Accurate records of the dimensional condition of the engine components were kept by completing in all detail the check sheets included in this report and the normal "Avon Inspection and Assembly Check Sheets".

4. Rubber seals, packings etc. used, were approved for use with synthetic base lubricating oil DERD.2487.

5. Sealing compounds used during engine build were also approved for use with DERD.2487 lubricating oil.

6. Details of all balancing operations, i.e., weights added, changes in state of balance etc. were recorded and are included in this report.

7. Engine was run to Schedules PTS.57 (Contractors and Acceptance) and PTS.45A (25 hour Endurance) with approved minor alterations to suit local conditions. See ET.339, ET.336.

Modifications and Special Features

The following Modifications and special features were included in engine build.

1. Section 1010 Internal Wheelcase and Gears

   (a) In order that a thermocouple could be admitted to the internal wheelcase to check the running temperature of the centre bearing, it was necessary to replace KL.1062 "Plug - bevel gear inspection" with a specially designed part. Refer Report E.260.

   (b) The following locally forged parts were included.

   BA.22647 Assy - Spur gear and bush - Oil pump drive. S/No.94
   BA.1000 Gear - Bevel - Oil pump driving. S/No.79
   BA.20308 Gear - Bevel - Driven - Oil pump. S/No.72
   BA.22464 Spur Gear - Auxiliary drive. S/Nos. 189 and 190.
   BA.20709 Spur Gear - Centrifugal Breather. S/No.20

(c) Section build included the following modifications and engine changes.

Mod.or E.C. No.	Description
Avon 13	Introduction of centre bearing studs with stepped diameters.
Avon 41	Balancing of centrifugal breather and introduction of heavier securing studs.
Avon 111	Introduction of rubber materials suitable for use with DERD.2487 lubricating oil.
N.734	Dowels retained by spring rings instead of shoulder
N.1012	Introduction of stainless steel inserts.
N.1089	Alternative bearing manufacturer.

2. Section 1022 Single Breech turbo starter fairing

(a) A special starter fairing which was the subject of Repair Scheme RS-58 was used for proof of repair method.

This fairing was returned from RAAF after sustaining damage due to gas leaks from the starter exhaust stubs. The damage consisted of a $1\frac{1}{4}$" dia. hole burned through the skin, and it was repaired by punching the hole truly round to a maximum dia. of 2" and welding in position a flush fitting correctly contoured patch of similar material.

(b) Section build included the following modification.

Mod. No.	Description
Avon 44	Provides an additional drain hole in fairing.

3. Section 1060 Rear Bearing Housing and Intermediate Casing

(a) The rear bearing housing BA.49917 S/No.79 was re-operated to Engineering Instruction ET.324 to permit the fitting of a thermo-couple to measure rear bearing operating temperature.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 17	Increased flange diameters
Avon 29	Introduction of Stepped Studs.
N.802	Alternative bearing.
N.819	Alternative bearing.

4. Section 1070 Turbine Wheels and Shaft

(a) This section was built to include a turbine shaft, wheels and blades which had completed a minimum of 300 hours running life. These components were included in engine build by authority of L.M.C. minutes 598/56 - 2509/4/B47 - 13 April 1956. This was to prove that all Mk.1 engines in service could be similarly uprated. Therefore, the following components were fitted.

Part No.	Name	Remarks
BA.55127	Disc H.P.Turbine. S/No.AD.129	Life 300 hrs.
BA.19552	Disc L.P.Turbine. S/No.SB.437	Life 300 hrs.
SA.34458	Blade Turbine H.P.(2 blade group)	(46 off life 340 hrs. (4 off life 360 hrs.
SA.34451	Blade Turbine H.P.(3 blade group)	1 off life 360 hrs.
*SA.34481	Blade Turbine L.P.(2 blade group)	(19 off life 300 hrs. (9 off life 360 hrs.
SA.34371	Blade Turbine L.P.(2 blade group)	6 off life 360 hrs.
SA.34364	Blade Turbine L.P.(3 blade group)	1 off life 360 hrs.
BA.50776	Shaft Turbine. S/No. BA.162/MT15	1 off life 300 hrs.

Of the foregoing, the blade groups marked thus * are of pre Mod. 20 (Non co-planar) type and concession was granted to permit the mixing of these blades with the post Mod.20 type in the L.P.wheel.

The turbine shaft sleeve BA.78228 S/NO.53 used in this engine was produced from a local forging.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 16	Introduces taper bolting of turbine disc and shaft.
Avon 20	Introduces co-planar blade shrouds (see above)
Avon 92	Reduced clearance for rear bearing.
N.1200	Compliance with security requirements.

5. Section 1080 Nozzle Box and Guide Vanes

(a) Engine mount trunnion BA.20587 fitted to this engine is the subject of salvage scheme SL.586, and is fitted to the starboard location. The salvage scheme provides for chrome plating to restore the size of the spigot which locates in the nozzle box.

(b) Section build includes the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 10	Stiffened front panel
Avon 18	Increased diamater holes in air guide plate.
Avon 43	Strengthened location of L.P. N.G.V's.
N.901	Material change only
N.902	Material change only.

6. Section 1091 Exhaust Unit

(a) No special features.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 2	Extended welding lip
N.788	Alternative inner cone.

7. Section 1092 Combustion Equipment

(a) No special features.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 46	Introduces sand cast burner support rings.
Avon 47	Introduces H.E. ignition in lieu of torch igniters.
Avon 51	Various minor changes to outer casings etc.

8. Section 1100 Fuel Pipes and Fittings

(a) No special features

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 4	Re-routing of fuel pump to B.P.C. flexible hose
Avon 8	Replace fuel inlet and outlet connection studs with set screws.
Avon 27	Redesigned securing clip for main fuel manifold.
Avon 47	Introduces high energy ignition.

9. Section 1104 Acceleration Control Unit

(a) No special features.

(b) Section build includes the following modifications.

Mod.No.	Description
Avon 36	Deletion of solenoid valve adapter
Avon 39	Part "C" only. Addition of "Hours Run" plate.

10. Section 1105 Torch Igniters and Electrical Fittings

Introduction of H.E. ignition makes this section redundant.

11. Section 1106 Fuel Burner

(a) No special features.

(b) Section build includes the following modification.

Mod.No.	Description
Avon 46	Introduces sand cast burner support rings.

12. Section 1108 Combined Fuel Control Unit

(a) The fuel control unit for this engine was specially calibrated to fulfil the requirements laid down by Assistant Quality engineer's memos, HF/SL.3-4-56 and HF/SL 19-3-56 and a calibration check was carried out after the test and the results are recorded in Appendix 11.6.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 31	Provide new B.P.C. connection and an "Hours Run" plate for B.P.C.
Avon 33	Provide an "Hours Run" plate and composite sealing washers for idling adjustment.
Avon 37	Redesign of throttle stops
Avon 38	Provide new sealing ring for S.O.C. barrel
N.762	Change to facilitate production and storage.

13. Section 1110 Oil Pipes and Fittings

(a) No special features.

(b) Section build included the following modifications.

Mod.No.	Description
Avon 106	Introduction of swaged ends on rigid pipes.
Avon 111	Introduction of PE/ELR. Spec.715 seal rings.

14. Section 1113 Fuel Cooled Oil Cooler

(a) The by-pass valve assembly of this unit was replaced by a manually adjustable type SE.895 to permit the control of oil temperature. Ref. ET.326.

(b) Section build includes the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 8	Replace fuel connection studs with set screws.
Avon 57	Strengthened fuel inlet and outlet connections.
Avon 28	Redesigned pipe clip.
N.1012	Inserts in stainless steel instead of bronze or mild steel.

15. Section 1115 Oil Sump and Filter Casings

(a) The oil relief valve assembly of this unit was replaced by a manually adjustable type SE.894 to permit the control of oil Pressure. Ref. ET.326.

(b) Section build includes the following modification and engineering changes.

Mod.or E.C. No.	Description
Avon 111	Rubber seal rings to PE/ELR
N.756	Introduces a common dowel
N.991	Revised surface finish
N.1012	Introduces stainless steel inserts
N.1099	Introduces blind inserts.

16. Section 1160 Oil Pumps

(a) No special features.

(b) Section build includes the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 111	introduction of PE/ELR. Spec.715 rubber seals.
Avon 86	Introduction of blanking plug in gear shaft.
N.838	Range of plain washers added.
N.1012	Introduces stainless steel inserts.

17. Section 1175 Front Suspension

No special features.

No modifications or engineering changes.

18. Section 1180 Jet Pipe

Not applicable. Slave jet pipe used throughout test.

19. Section 1210 Fireproof Bulkhead

(a) No special features.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 47	Introduction of High Energy Ignition.
N.844	Use of longer set screws for securing fire extinguishing elbows.
N.965	Modifies outer sealing ring.

20. Section 1270 External Wheelcase and Gears

(a) The following locally forged parts were incorporated.

BA.17443	Shaft Coupling	S/No.74
BA.17686	Assy - Bevel gear and Bush - driving	S/No.56
BA.17421	Bevel gearshaft - fuel pump drive	S/No.70
BA.17425	Assy Spur gear and Bush fuel pump drive	S/No.51
BA.19097	Bevel gear - tacho driven	S/No.68
BA.17426	Spur gear - Fuel pump drive, upper	S/No.102
BA.17426	Spur gear - fuel pump drive, lower	S/No.103
BA.20548	Gear - Idler - Governor pump drive	S/No.48

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 9	Provide lubrication for A.G.B. seal
Avon 111	Introduction of PE/ELR Spec.715 seals.
N.1012	Provides stainless steel inserts
N.1089	Introduces alternative bearing supplier
N.901	Provides a range of adjusting washers
N.794	Increases the range of adjusting washers and introduces a minor drawing correction.
N.755	Introduces an alternative bearing supplier.

21. Section 1271 Auxiliary Gearbox Drive

(a) A locally forged coupling shaft BA.18013 S/No.58 was included in this section.

The coupling shaft seal BL.1023 was not previously approved for use with DERD.2487 oil, but after soak testing etc. the seals appeared satisfactory and were included in section. Ref.ET.327.

21. Section 1271 (continued)

(b) Section build included the following modification and engineering change.

Mod.or E.C. No.	Description
Avon 111	Introduction of PE/ELR.Spec 715 rubber (in part only, see above)
N.1089	Introduces alternative bearing supplier.

22. Section 1371 Compressor Casings and Stators

(a) The following special parts are included in this build.

Compressor casings top and bottom halves BA.43199/200 were the subject of a salvage scheme intended to restore these parts after the stage 4 and 5 stator blade support ribs had been machined oversize. The scheme provided for the sandblasting, metal spraying and remachining to size of the affected areas. The top half casing S/No.25 is a Rolls Royce casting and the lower half casing S/No.24 is a CAC. casting. Combined, these casings are identified as S/No.18

Locally forged stator blades were used in the following stages.

Stage 1	SA.12706 SA.12707	Made from C.1 forgings (Aluminium alloy)
Stage 9	SA.22677	Made from C.9 forgings (Aluminium bronze) Only 8 off local blades used in this stage. The remainder were imported forgings.
Stage 10	SA.22679	Made from C.9 forgings (Aluminium bronze) Only 97 off local blades used in this stage. The remainder were imported forgings.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 1	Redesigned orifice nipple for B.V.C.U.
Avon 4	Introduces new B.V.C.U. connection and clips.
Avon 14	Increases area of bleed valve ports
Avon 15	Revises brazing methods for compressor blades
Avon 79	Introduces semi-flexible 7th stage line to B.V.C.U.
N.746	Provides new hose clips and clamp blocks
N.750	Introduces new ram pipe from front bearing hsg. to B.P.C.
N.983	Re-operate imported casing castings to C.A.C.Standards
N.1012	Introduces inserts of stainless steel instead of mild steel
N.1200	Compliance with security requirements.

23. Section 1372 Compressor Shaft and Rotors

(a) The compressor shaft front half BA.68270 used in this section, was experimentally cadmium plated as an anti-corrosion measure in lieu of the normal phenolic varnish. Refer Engineering Instruction ET.323.

The following locally forged parts were included.

BA.34355	Assy Pinion and Bush - W'case driving	S/No.65
BA.12871	Assy Outer shaft and bush - starter drive	S/No.30
BA.12874	Shaft inner - Starter drive	S/No.54
BA.35404	Spacer, Rotor wheels, stages 4 and 5	S/No.18
BA.35689	Spacer, Rotor wheels, stages 8 and 9	S/No.51

Locally forged Rotor blades were used in the following locations.

Stage 1	SA.35578	Made from C.12 forgings (Aluminium alloy)
Stage 2	SA.40611	Made from C.13 forgings (Aluminium alloy)
Stage 9	SA.33295	Made from C.20 forgings (Aluminium bronze)
Stage 10	SA.33498	Made from C.20 forgings (Aluminium bronze)
Stage 11	SA.33297	Made from C.20 forgings (Aluminium bronze)

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 5	Introduces Duplex centre bearing
Avon 6	Single lug fixing for stage 3 and 4 rotor blades.
Avon 7	Taper bolt fixing for 12th stage compressor wheel halves.
Avon 19	Provides buttress type thread on rear half of shaft
Avon 23	Provides stainless steel blade retaining pins.
Avon 27	Introduces bushed rotor blades for stages 2, 3 and 4
Avon 48	Introduces Mk.20 type blades for stage 10
Avon 53	Provides increased diameter starter nut and cup washer.
N.711	Deletes the separate balancing of spacers.
N.761	Stage 4 rotor wheel bush commonised with stage 5.

24. Section 1373 Compressor Outlet Casing and Centre Bearing Housing

(a) No special features.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 5	Introduces Duplex centre bearing
Avon 12	Re-location of compressor delivery pressure tapping.
Avon 26	Fit flanged air transfer tubes and rubber seal rings.
Avon 30	Increased area balance piston vents. - (Included only in centre bearing housing. Therefore, engine is virtually to pre mod 30 standard.)

24. Section 1373 (continued)

(b)

Mod.or E.C. No.	Description
Avon 54	Introduces larger stud to prevent incorrect assembly.
Avon 69	Strengthened outlet guide vane inner shroud
N.900	Introduces new material for expansion chamber bolts.
N.1012	Provides stainless steel inserts.
N.1050	Specifies alternate material for packing rings.
N.1068	Specifies alternate material for outlet guide vanes.

25. Section 1374 Bleed Valve Control Unit

(a) No special features.

(b) Section build included the following modifications and engineering changes.

Mod.or E.C. No.	Description
Avon 1	Introduces an orifice type union nipple.
Avon 11	Increases half ball valve clearance
Avon 21	Introduces half ball valve bolts in non corrodible steel
Avon 63	Introduces high temperature sealing rings.
N.959	Local pressure test requirements.
N.1083	New material for half ball valve retaining cup.

26. Section 1375 Bleed Valves and Fittings

(a) No special features

(b) Section build included the following modification.

Mod. No.	Description
Avon 34	Introduces new type gland washers.

27. Section 1456 Wiring Connections - Single Breech Turbo Starter

(a) No special features.

(b) Section build included the following modification.

Mod.No.	Description
Avon 32	Reduced diameter firing lead nipple.

25-HOUR TYPE TEST .. AVON MK.1 UPRATED

Schedules of Engine Testing

Note: Sequence of engine testing programme was modified to suit local conditions appertaining at time of test.

Summary of Test Requirements

The test may be considered as four distinct sections.

(a) Contractor's Test
(b) Acceptance Test
(c) 25-hour Endurance Test
(d) Final rating curve and vibration survey.

The above sections involve the following running conditions.

(a) Contractor's Test

(i) 25 minute "Run In" period.
(ii) Governor, slow running and bleed valve checks.
(iii) Acceleration and fuel pump isolation checks.
(iv) 1 hour 30 minutes at maximum continuous, i.e., 7,600 r.p.m.
(v) 30 minutes at maximum take-off, i.e., 8,000 r.p.m.
(vi) Performance curve.

(b) Acceptance Test

(i) 15 minute "Run In" period.
(ii) Governor, slow running and bleed valve checks.
(iii) Acceleration and fuel pump isolation checks.
(iv) 15 minutes at maximum continuous, i.e., 7,600 r.p.m.
(v) 5 minutes at maximum take-off, i.e., 8,000 r.p.m.
(vi) Performance curve.

(c) 25-hour Endurance Test

(i) 5 hours at maximum continuous, i.e., 7,600 r.p.m. and 585°C. J.P.T.
(ii) 10 hours cylic testing, i.e., 5 minutes at maximum take-off and 5 minutes at alternatively ground idling or 4,500 r.p.m.
(iii) Overspeed test 15 minutes at 8,240 r.p.m. and 645°C. J.P.T.
(iv) 10 hours of five 2-hour periods disposed as follows:-
30 minutes at 8,000 r.p.m. and 645°C. J.P.T.
1 hour at 7,800 r.p.m. and 620°C. J.P.T.
30 minutes at 8,000 r.p.m. and 645°C. J.P.T.

(d) Final Rating Curve

(i) Carry out four point rating curve
(ii) Wash compressor and carry out full performance curve.
(iii) Carry out full vibration curve.

In addition to the above a total of 100 engine starts and 90 slam accelerations must be completed during the period of engine testing.

25 HOUR POTTED TYPE TEST - "AVON" Mk.1 UPRATED.

Date of Issue: 5/11/54.
Revised: 30/4/56.

Asst.Quality Engr.E/D.....

1. General:

1.1 This schedule specifies the test requirements and the sequence of testing during the Potted Type Test.

1.2 The test is to be carried out at the "Avon" Mk.1 uprated conditions (Ref. PTS-57).

1.3 The test comprises four basic sections:

(a) Contractor's Test.
(b) Acceptance Test.
(c) 25-Hour Endurance Test.
(d) Final Rating Curve and Vibration Survey.

1.4 Engine Build:
The engine shall be built to the current "Avon" Mk.1 L.o.P. and all variations and modifications shall be recorded on the Inspection and Assembly check sheets.

1.5 General Running, Settings, Limitations etc.

1.5.1 General requirements as regards running, settings, operating conditions, limitations and recording of results are as specified in test schedule "Avon" Mk.1 - Uprated, PTS-57 (latest issue).

1.5.2 Normally, for all running at governed speed, the throttle should be on the appropriate stop when the r.p.m. would be controlled by the governor. For all running at ground idling r.p.m., the throttle must be on the appropriate stop, when the r.p.m. should be within ± 100 r.p.m. of the nominal ground idling speed quoted.

1.6 Oil Consumption and Breather Splash:

1.6.1 Oil consumption is to be recorded accurately throughout the test and the oil sump is to be topped up at ground idling where requested. The specific gravity is to be recorded. The quantity of oil added to restore the level and the oil inlet temperature must be recorded.

1.6.2 Measurements of oil discharge are to be taken and recorded on conclusion of each stage and should be made immediately prior to topping up the oil sump.

1.7 Fuel Samples:

One 1-pint sample of fuel is to be taken at each of the following:

(a) During the performance curve in the acceptance test.
(b) During final curves.
(c) Prior to 25-hour endurance.
(d) On completion of 25-hour endurance.

Each sample bottle should be completely filled, securely sealed and labelled with the relevant test data.

1.8 Starts:

1.8.1 Definitions:

A cold start is defined as a real start after two hours or more of natural cooling with the engine at rest, and should be conveniently arranged in conjunction with the day's running.

A hot start is defined as a real start made within fifteen minutes of shutting down the engine at the conclusion of the previous period of cyclic or endurance running.

A warm start is a real start made between the limitations of the cold and hot start.

A false start is defined as any unsuccessful attempt to start. Intentional false starts will be made. Details of any unintentional false starts must be noted.

1.8.2 Readings:

When a real start is made, record time to light and to 2,650 r.p.m., peak and steady J.P.T. and steady r.p.m.

1.9 Bearing Temperatures:

The temperatures of the centre and rear bearings are to be recorded throughout the test, whenever a full set of readings is taken.

Limits: Rear 220°C. max. after 5 min. at T/O. r.p.m. + 90°C. oil temp.
Centre 165°C. max. " " " " " " " " "

2. Failure During Test:

2.1 The complete failure of any major component of the engine during the Potted Type Test will result automatically in the engine being rejected, unless it can be demonstrated that the failure was due entirely to conditions arising from the use of the test plant and would not have occurred in service.

2.2 A component will be adjudged to have failed when the engine is not considered capable of continued satisfactory operation as a result.

2.3 Each stage of the endurance test shall be run non-stop, but one involuntary interruption or stop not exceeding thirty minutes' duration will not invalidate the stage, provided it occurs after the first two hours.

2.4 All stops must be recorded in the log of the endurance test.

2.5 Servicing, including adjustments, minor repairs and replacements, will be permitted between the endurance periods, but all such repairs and replacements must be recorded in the engine running log.

2.6 If an interruption or stop occurs during the first two hours of a stage due to the failure of a proprietary accessory not essential for the functioning of the engine, the accessory may be repaired or renewed and the test continued without repetition of the stage.

3. Contractor's and Acceptance Tests:

The Contractor's and Acceptance tests comprise the complete tests as laid down in test schedule PTS-57 (latest issue).

4. Strip Inspection:

After the Contractor's test, the engine is to undergo a partial strip and dimensional inspection.

5. 25-Hour Endurance Test:

5.1 General:

5.1.1 All stages of the endurance test are to be run to the maximum J.P.T. appropriate to the conditions specified. The required maximum J.P.T's. are to be set by use of final nozzle trimmers and maintained by adjustment of r.p.m. However, no increase in the overspeed r.p.m. during stage 3 is permitted and a maximum of 25 r.p.m. increase is permitted during all running at take-off r.p.m.

5.1.2 When running at maximum take-off conditions, the limiting J.P.T. must be closely adhered to. At all times throughout the test, an accurate assessment of all running at maximum J.P.T's., together with the time, should be made and entered in the log.

5.1.3 All r.p.m. and J.P.T's. quoted in the endurance are actual.

5.2 Accelerations and Decelerations:

A total of ninety (90) accelerations and decelerations are to be carried out during the test and these are disposed as follows:

5 accelerations and decelerations prior to St.1 - All from ground idling.
60 " " " during St.2 - alternately from ground idling and 4,500 r.p.m.
25 " " " during St.4 - all from 4,500 r.p.m.

The acceleration from 4,500 r.p.m. to 7,850 r.p.m. should not exceed 5 seconds.
Accelerations may be cool or hot, as determined by the specified running conditions.
For each accel./decel. cycle, record the following:
Air intake temperature
Time to accelerate from ground idling to governed speed - 50 rpm. and from 4,500 r.p.m.to 7,850 r.p.m.
Max. J.P.T. and max. r.p.m. overshoot.
Time to decelerate from governed speed to ground idling.
Stable ground idling speed and J.P.T.

5.3 Lubrication:

5.3.1 Oil Pressure and Temperature:
The oil pressure for the 25-hour endurance test is to be set to 14.5 p.s.i. $\pm \frac{1}{2}$ at 7,600 r.p.m. and 90°C. oil inlet temperature. The oil cooler bypass is to be adjusted such that an average oil inlet temperature of 90°C. is obtained throughout the endurance test.

5.3.2 Oil Samples:
Oil samples are to be taken as follows:
One 1-pint sample of new oil prior to commencing the 25-hour endurance.
One 1-pint sample of used oil on completion of the 25 hours' endurance.

5.3.3 Min. Oil Level Test:
It is required to demonstrate satisfactory operation of the engine and oil system with a low oil supply. The test will consist of running at 7,600 r.p.m. for 15 minutes at 90°C. oil inlet temperature and with the minimum oil level (i.e., $3\frac{1}{2}$ pints). Readings of oil temperatures and pressures to be taken every five minutes. Record oil consumption, H.P. oil filter to be examined on conclusion of the 15 minutes. Careful checks should be made to ensure that bearing temperatures do not exceed limits and that no sudden rise of oil temperature occurs.

The above test is to be carried out on the conclusion of the 25-hour endurance.

5.4 Starting Requirements:

During the endurance test, at least a total of 100 starts are to be effected, all starts being counted as follows:

At least ten false starts, each followed by a real start (hot or cold), ten cold and ten hot starts are to be made (Ref. Para. 1.8). A number of starts is detailed prior to each stage as a rough guide only, to reduce the number of make up starts at the end of the test. The additional starts necessary to bring the total aggregate to 100 will generally be hot or warm starts and will be made up on conclusion of the endurance test or when it is found convenient to run off a number of starts. If more than two consecutive starts are to be made, a minimum of ten minutes must elapse between each start after the first two. The turbo starter breech should be cooled between starts, by using an air blast.

5.5 Vibration:

Throughout the whole of the endurance running, a vibration pick up is to be fitted to the compressor front flange and readings taken throughout each stage, in conjunction with the engine readings.

5.6 Warm up and Shut down:

5.6.1 Commencement of Stages - Warm up etc.

Check oil level. After starting and taking the necessary records, open up engine slowly to governed speed to check governed r.p.m. Also note B.V.C.U. operation. Throttle back to ground idling conditions.

5.6.2 Conclusion of Stages:

Close the engine throttle to the ground idling stop, noting B.V.C.U. operation when at higher r.p.m. Record steady ground idling speed and J.P.T. Close H.P. cock, timing the run down, special note being made for seal rubbing and unorthodox noises. Top up oil sump, noting temperature and quantity required. Examine engine oil filters.

5.7 Dynamometer Loading:

Each gearbox drive should be loaded throughout the 25-hour endurance by a dynamometer set to absorb 30 B.H.P. at 8,000 r.p.m. and locked in that position.

5.8 Stage 1 - 5 hours:

5.8.1 Connect up auxiliary drives.

5.8.2 Take sample of new oil.

5.8.3 Carry out one false start, allow three minutes' drain.

5.8.4 Carry out fifteen (15) cold, warm or hot starts.

5.8.5 Top up oil sump and warm up as per para. 5.6.

5.8.6 Take sample of fuel.

5.8.7 Set dynamometer.

5.8.8 Carry out one 5-hour period, as follows:
(a) 5 Accelerations and decelerations from ground idling to governed speed.
(b) 5 hours at max. continuous 7,600 r.p.m. and 585°C. J.P.T.
Record all acceleration readings. Take a full set of readings after five minutes and every twenty minutes thereafter.

5.8.9 Shut down, as per para. 5.6.2 and top up oil sump.

Endurance Total: 5 hrs. 00 min.

5.9 Stage 2 - 10 hours:

5.9.1 Carry out one false start, allow 3 minutes' drain.

5.9.2 Carry out three (3) cold, warm or hot starts.

5.9.3 Warm up.

5.9.4 Carry out one 10-hour period as follows:
Sixty 10-min. cycles, each cycle consisting of:
(a) Slam acceleration, alternately from ground idling or 4,500 r.p.m. to max. take-off (8000r.p.m.)
(b) 5 min. at 8,000 r.p.m. at 645°C. J.P.T.
(c) Slam deceleration from max. take-off to ground idling or 4,500 r.p.m.
(d) 5 min. alternately at ground idling or 4,500 r.p.m.

Take acceleration and deceleration readings every cycle. Full set of readings at max. T/O. and G/I. or 4500 r.p.m. every third cycle.

5.9.5 Shut down and top up oil sump.

Endurance Total: 15 hrs. 00 min.

5.10 Stage 3 - Overspeed:

5.10.1 Carry out one false start, allow 3 min. drain.

5.10.2 Carry out twenty-five (25) cold, warm or hot starts.

5.10.3 Warm up.

5.10.4 Carry out one 20 minute period as follows:
(a) 5 min. at r.p.m. to obtain 75% thrust.
(b) 15 min. at 8,240 r.p.m. and 645°C. J.P.T.
Take full set of readings during (a) and during last ten minutes of (b).

5.10.5 Shut down and top up oil sump.

5.11 Stage 4 - 10 hours:

5.11.1 Carry out one false start, allow three minutes' drain.

5.11.2 Carry out three (3) cold, warm or hot starts.

5.11.3 Warm up.

5.11.4 Carry out one 10-hour period, made up of five (5) identical 2-hour periods. Each 2-hour period to consist of:
(a) 5 accelerations and decelerations from 4,500 r.p.m.
(b) 30 min. at 8,000 r.p.m. and 645°C. J.P.T.
(c) 1 hour at intermediate 7,800 r.p.m. and 620°C. J.P.T.
(d) 30 min. at 8,000 r.p.m. and 645°C. J.P.T.

5.11.5 Readings:
Acceleration readings for each cycle of item (a). Full set after five minutes and during last ten minutes of item b. Full set every twenty minutes of item (c). Full set after five minutes and during last ten minutes of item d.

5.11.6 Take sample of used oil.

5.11.7 Take sample of fuel.

5.11.8 Shut down and top up oil sump.

Endurance Total: 25 hrs. 20 min.

5.12 Make up number of starts as per para. 5.4.

5.13 Carry out minimum oil level test, as per para. 5.3.3.

6. Final Rating Curve and Vibration Survey:

6.1 Disconnect aux. drives. Start and warm up to usual procedure.

6.2 Carry out 4 top points only of rating curve, as specified in para. 18 of PTS-57.

6.3 On completion of the above, wash compresor to normal procedure (if indicated by results from the short top end curve above).

6.4 Repeat full performance curve as specified in para. 18 of PTS 57

Notes: Vibration readings are to be taken at each speed of the curve (up and down). In addition, note if any peak vibration values between the curve r.p.m's. occur, recording if this occurs.

During the curve, take samples of fuel as outlined in para. 1.7.

7. Inspection:

Following inspection of the oil filters and a visual inspection of the engine, the engine is to be returned to the shop for full strip, check of clearances, examination in the dirty condition and dimensional checks and recording of the condition and wear.

This schedule is based on Rolls-Royce Schedule No. A.Exp.56/1, with necessary C.A.C. alterations for its application to the uprated "Avon" Mk.1.

PTS 1-6

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 1 OF 17
DATE 17/4/56	MELBOURNE VICTORIA	REPORT NO. PTS-57
WEIGHT	TEST SCHEDULE - "AVON" Mk.1 - UPRATED.	MODEL NO.

To be used with 25 hr Potted Type Test only

Asst.Quality Engr.E/D.....

1. General:

1.1 This schedule specifies the test requirements and sequence of testing for the above engine. Details of fuel, oil, pressures, temperatures, operating conditions, limitations etc. are given in Section 22.

1.2 The fuel pumps must circulate fuel during all running, as these pumps are fuel lubricated.

1.3 If experience indicates that the engine is not running satisfactorily, it should be shut down for investigation.

1.4 Should an engine fail to start on its own starter system, check the functioning of the drain valves, but do not blow through to clear the engine. A second cartridge may be inserted in the starter breech and fired immediately the engine has stopped turning after the first charge. Should the engine again fail to pull away, a period of ten (10) minutes after the engine has stopped turning must elapse before another start is attempted.

1.5 Leaks:
A close inspection for fuel and oil leaks is to be made during all running. On completion of the final test, the oil is to be drained from the engine, filters inspected, cleaned and carefully replaced.

1.6 Starts on Individual Igniters:
During acceptance test, at least one start is to be carried out on each igniter, with the other igniter inoperative. This may be carried out during the normal starts required during testing and noted on the test log sheet.

CONTRACTORS TEST.

2. Preliminary Checks:

2.1 Oil Priming:
Where there is any possibility of oil having completely drained away from the engine bearings, the oil system is to be primed before running. Check the sump level and top up if necessary. Remove auxiliary drive, smear ball race and seal with suitable oil and reassemble drive.

2.2 Fuel Priming:
Before the false start, bleed the fuel pumps until all air is removed from the system.

10

2.3 False Start:

Carry out a false start with the fuel turned on and check the functioning of the fuel drain system. Do not blow through to clear the engine, but ensure that sufficient fuel has drained through the valves before attempting an actual start.

3. Running In:

Start the engine from cold and watch the J.P.T. as it accelerates to idling r.p.m. If the J.P.T. rises above 500°C., the engine should be stopped immediately. Check that the oil pressure begins to rise within one minute of starting the engine and run at the conditions specified below:

r.p.m.	Time
3,000	5 minutes
4,000	5 "
5,000	5 "
6,000	5 "
7,000	5 "

Check the fuel pump metered pressure at 7,400 r.p.m. See para. 22.2 for limits.

4. *Preliminary Vibration Test:

Attach the vibration "pick-up" at the prescribed point of the compressor case and check that at maximum take-off r.p.m. (8,000 r.p.m.), the amplitude of vibration does not exceed .012". If this value is exceeded, the test must be discontinued and the engine rectified.

5. Checks prior to Endurance:

Any adjustments or servicing found necessary are permitted and must be noted on the test log.

5.1 *Governor and Slow running Setting:

The governed speed is to be controlled by the lower pump and is to be set to 8,000 $^{+25}_{-0}$ r.p.m. The setting of the two pumps is to be completed as follows:

(a) Set the bottom pump governor to control at 8,150 r.p.m. Provided the J.P.T. of 645°C. is not exceeded, this speed may be obtained by pressurising the B.P.C. capsule chamber. Pressurisation, however, must not exceed 5 p.s.i. gauge.

(b) Isolate the top pump and then set the top pump governor to control at 7,970 ± 10 r.p.m.

(c) De-isolate. Check that any increase in speed does not exceed 120 r.p.m.

(d) Set the bottom pump governor to the required governed speed.

(e) With the engine at governed speed on the lower pump, isolate the upper pump and check the change of r.p.m. If a drop in r.p.m. of more than 75 r.p.m. is recorded, the pumps should be rectified.

Set the engine slow running or idling speed to 2,750 ± 100 rpm.

5.2 *Bleed and Swirl Setting:

5.2.1 Deceleration Surge Speed Check:
With the engine speed above 6,100 r.p.m., either blank off the bleed valve venturi orifice or loosen the 7th stage air pipe to the bleed valve control unit, so that leakage to atmosphere occurs. This will keep the bleed valves closed during the subsequent deceleration. After running the engine for one (1) minute at 8,000 r.p.m. (actual), determine the surge r.p.m. during a slow deceleration from 8,000 r.p.m. Check the surge r.p.m. again. If the corrected surge speed exceeds 6,040 r.p.m., the engine must be rectified.

5.2.2 Limits of Operation:
The bleed and swirl control unit is to be adjusted so that no surge is encountered during normal acceleration and deceleration. However, the unit must operate within the following limits:

(a) Hot: After "soaking" the engine at 8,000 r.p.m., set the unit so that

Speed Decreasing: After soaking for one (1) minute at 8,000 r.p.m., the unit must operate at least 100 r.p.m. in excess of the corrected deceleration surge speed.

Speed Increasing: After soaking for two(2) minutes at 8,000 r.p.m., the unit must operate before 6,650 r.p.m. (corr.)

The difference between the change points (increasing and decreasing speed) of the bleed valves should not be less than 450 r.p.m.

(b) Cool: On decreasing engine speed, the unit must operate above 6,000 r.p.m. (corr.) For this test, the engine speed is increased to 8,000 r.p.m. and immediately decreased.

Note: Cycling of the swirl vanes (i.e., moving backwards and forwards with no change of throttle setting) is not permitted in any run up of the engine from idle unless the engine has just been started from cold. In this case, only one such swirl vane cycle is permitted when the engine is opened from idle and no cycling is permitted on any subsequent run up from idle without shut down of the engine.

5.3 *Accelerations:

5.3.1 Setting:
The A.C.U. is to be set within the limits specified below, so that surge free slam accelerations can be carried out from any engine speed to 8,000 r.p.m.

5.3.2 Limits:

(a) The slam acceleration time (cool) from ground idling speed (2,750 r.p.m.) to within 50 r.p.m. of maximum take-off speed (8,000 r.p.m.) with six bleed valves in operation, is to be set between 12 and 14 seconds on days when the test cell temperature is standard at 15°C. On off-standard days, the acceleration time is to be corrected in the proportion of one second reduction in acceleration time for each four degrees centigrade rise of cell temperature above 15°C. The corrected acceleration time must be within the above limits of 12-14 seconds. The acceleration times will be similarly increased on days when the cell temperature is below 15°C. It is permissible to alter the acceleration time within the limits of 12 to 14 seconds if this is necessary to meet the subsequent acceleration requirements.

(b) Then run the engine for three (3) minutes at maximum take-off speed and carry out a slam deceleration to ground idling. After 45 seconds from the commencement of the slam deceleration, attempt a slam acceleration. The engine must run up smoothly and the time for the "hot" acceleration must not be greater than the time for the "cool" acceleration by more than one (1) second.

(c) With the acceleration time as set above, again run the engine at 8,000 r.p.m. for three (3) minutes and carry out a slam deceleration of 4,000 r.p.m. (This throttle setting may be pre-determined). Attempt a slam acceleration from this speed twenty-five (25) seconds after the commencement of the deceleration and the engine must be free from stall or surge and open up without hesitation.

Note: During a slam acceleration, the time taken to move the throttle from the idling position to the maximum take-off position must be less than two seconds. During a slam deceleration, the time taken to move the throttle lever from the maximum take-off position to the idling position must be less than one second.

5.4 Fuel Pump Isolation:

At 7,400 r.p.m. engine speed, the upper pump is to be isolated and the lower pump "failed". Open the throttle to the maximum stop and record r.p.m., thrust, fuel pump pressure, burner pressure and fuel flow in gal./hr. Repeat this check with the upper pump "failed". Under standard atmospheric conditions (30" Hg., 15°C. air temperature), a speed of about 7,000 r.p.m. and a thrust of about 4,000 lb. should be obtained. As these values will alter with atmospheric conditions, the only test for satisfactory isolation is a measurement of the fuel flow and the actual r.p.m. The values of fuel flow to be used in checking the fuel pump isolation are given below:

Actual r.p.m.	Actual g.p.h. Post Mod.22 pumps (Slipper pad pumps)		Actual g.p.h. Pre-mod.22 pumps (non-slipper pad pumps)	
	Maximum	Minimum	Maximum	Minimum.
6,600	538	495	495	470
6,800	552	510	510	485
7,000	567	524	524	501
7,200	582	539	539	516
7,400	595	553	553	530

During isolation checks, the pump stall pressures must be 1,750 p.s.i. or greater. This pressure is to be measured at the fuel pump.

5.5 *Run down from Idling r.p.m.

Check that the time for the engine to run down from idling to rest is not less than 77 seconds. The H.P. cock and throttle must be shut during the run down.

5.6 Oil Level:

Check oil level and top up if necessary.

5.7 Oil Consumption:

The engine oil consumption is to be measured over the period from commencement of endurance running to the end of the performance run in both contractor's and acceptance tests. The measurement may be made by shutting down the engine and noting the quantity of oil required to fill the oil tank to the appropriate level, or alternatively, by other means which do not require stopping of the engine. In either case, the measurement should be taken at similar oil temperatures and engine speed.

6. Endurance (Two Hours):

6.1 Loading of Auxiliary Drives:
The port and starboard auxiliary gearbox drives should be loaded during this endurance test, with suitable dynamometers. This loading should be disconnected for performance curves and running in.

Dynamometer Loading
Load each gearbox drive to 30 H.P. at 8,000 r.p.m. and lock the dynamometer in this position, except for running in and performance curves.

6.2 Running:

6.2.1 Maximum Continuous: (7,600 r.p.m. actual). for 1 hr. 30 min. Take readings after five minutes, twenty minutes, sixty minutes and during the last three minutes.

6.2.2 Maximum Take-off: (8,000 r.p.m. actual) for 30 minutes. Take one complete set of readings in the last three (3) minutes.

6.2.3 Any break in the continuity of the endurance test, unless agreed to by the A.I.D., will necessitate a repeat endurance run.

7. Accelerations and Decelerations:

7.1 Accelerations:
Carry out two slam accelerations (cool) from idling to max. take-off r.p.m. These two accelerations must be surge free and within the limits specified in para. 5.3.2(a). Carry out twofurther accelerations from 4,000 r.p.m., as specified in para. 5.3.2(c).

7.2 Decelerations:
Complete three slam decelerations (cool) from maximum take-off r.p.m. to idling. These decelerations must be surge free. The above accelerations and decelerations may be done in conjunction with each other, if desired.

8. *Vibration Checks:

Fit the vibration pick-up to the compressor case front flange and measure the amplitude of vibration at the following speeds, both increasing and decreasing r.p.m.

(Cont'd.)

Vibration Checks (Cont'd.)

4000, 4500, 5000, 5500, 6000, 6600, 7000, 7400, 7600, 7800 and 8000 r.p.m.

The amplitude at top speed should be measured after one minute and three minutes at that speed.

Limits:

The following limits apply to the vibration readings taken during decreasing speed and to the reading taken after three (3) minutes at top speed.

Compressor Case Front Flange	Max. Amplitude.
2750 to 8000	.0035 pre-mod.91 (R.R.Avon)
2750 to 8000	.0055 post-Mod.91 "

9. Performance Curve:

9.1 Curves:

Check the oil level, start the engine and open up slowly to ensure that maximum take-off r.p.m. is obtainable. When the air temperature exceeds 15°C. (59°F.), the maximum speed should not be less than

$$\text{Actual maximum r.p.m.} \times \sqrt{\frac{\text{Air temp. °K.}}{288}}$$

i.e., $8000 \times \sqrt{\frac{\text{Air temp. °K.}}{288}}$

However, neither of the upper limits of 8240 r.p.m. and 645°C. J.P.T. may be exceeded under any circumstances. When the engine is warm, take a full set of readings at each of the following speeds in the order given:
6600, 7400, 7600, 7800, 8000, 7500 and 7000 r.p.m.
Running at intermediate r.p.m's. during the performance curve is permitted to enable vibration readings to be taken.

9.2 Checks after Performance Curve:

9.2.1 Governed Speed:

Check that the governed speed is $8000 \begin{smallmatrix}+25\\-00\end{smallmatrix}$ r.p.m. If not within these limits, reset as specified in para. 5.1.

9.2.2 *Throttle Lever Angle:

Check that the throttle lever angle of travel is 80° ± 1° from idling to the fully open stop screw.

9.2.3 Idling Speed:

Check that the idling speed is 2750 ± 100 r.p.m.

9.2.4 Oil Consumption:
Note the oil consumption over the period from the beginning of the endurance run to the end of the performance running.

10. Strip Examination:

10.1 At the completion of the endurance test, the engine is to be stripped for inspection. Extent of stripping, as agreed with A.I.D.

10.2 If any vital component of the engine needs replacement, the engine is to be given a further test, as agreed with A.I.D.

ACCEPTANCE TEST.

11. Preliminary Checks:

11.1 Oil Priming:
Where there is any possibility of oil having completely drained away from the engine bearings, the oil system is to be primed before running. Check the sump level and top up if necessary. Remove auxiliary drive, smear ball race and seal with 120 sec. oil and reassemble drive.

11.2 Fuel Priming:
Before the false start, bleed the fuel pumps until all air is removed from the system.

11.3 False Start:
Carry out a false start with the fuel turned on and check the functioning of the fuel drain system. Do not blow through to clear the engine, but ensure that sufficient fuel has drained through the valves before attempting an actual start.

12. Running In:

Start the engine from cold and run for the times specified below:

r.p.m.	Time (minutes)
3000	5
5000	5
7000	5

Open up slowly to maximum speed, to ensure actual maximum speed can be obtained. Check the fuel pump metered pressure at 7400 r.p.m.

13. *Preliminary Vibration Test:

Attach the vibration "pick-up" at the prescribed point of the com-

pressor case and check that at maximum take-off r.p.m. (8000 r.p.m.), the amplitude of vibration does not exceed .012". If this value is exceeded, the test must be discontinued and the engine rectified.

14. Checks Prior to Final Endurance:

Necessary adjustments and servicing may be made, provided they are noted in the test log.

14.1 *Governor and Slow Running Setting:

The governed speed is to be controlled by the lower pump and is to be set to 8000 $^{+25}_{-0}$ r.p.m. The setting of the two pumps is to be completed as follows:

(a) Set the bottom pump governor to control at 8150 r.p.m. Provided the J.P.T. of 645°C. is not exceeded, this speed may be obtained by pressurising the B.P.C. capsule chamber. Pressurisation, however, must not exceed 5 p.s.i. gauge.

(b) Isolate the top pump and then set the top pump governor to control at 7970 ± 10 r.p.m.

(c) De-isolate. Check that any increase in speed does not exceed 120 r.p.m.

(d) Set the bottom pump governor to the required governed speed.

(e) With the engine at governed speed on the lower pump, isolate the upper pump and check the change of r.p.m. If a drop in r.p.m. of more than 75 r.p.m. is recorded, the pumps should be rectified. Set the slow running speed to 2750 ± 100 r.p.m.

14.2 *Bleed and Swirl Setting:

14.2.1 Deceleration Surge Speed Check:

With the engine speed above 6100 r.p.m., either blank off the bleed valve venturi orifice or loosen the 7th stage air pipe to the bleed valve control unit, so that leakage to atmosphere occurs. This will keep the bleed valves closed during the subsequent deceleration. After running the engine for one minute at 8000 r.p.m. (actual), determine the surge r.p.m. during a slow deceleration from 8000 r.p.m. Check the surge r.p.m. again. If the corrected surge speed exceeds 6040 r.p.m., the engine must be rectified.

14.2.2 Limits of Operation:

The bleed and swirl control unit is to be adjusted so that no surge is encountered during normal acceleration and deceleration. However, the unit must operate within the following limits:

(a) Hot: After "soaking" the engine at 8000 r.p.m., set the unit so that

Speed Decreasing: After soaking for one minute at 8000 r.p.m., the unit must operate at least 100 r.p.m. in excess of the corrected deceleration surge speed.

Speed Increasing: After soaking for two minutes at 8000 r.p.m., the unit must operate before 6650 r.p.m. (corr.)

The difference between the change points (increasing and decreasing speed) of the bleed valves should not be less than 450 r.p.m.

(b) Cool: On decreasing engine speed, the unit must operate above 6000 r.p.m. (corr.) For this test, the engine speed is increased to 8000 r.p.m. and immediately decreased.

Note: Cycling of the swirl vanes (i.e., moving backwards and forwards with no change of throttle setting) is not permitted in any run up of the engine from idle, unless the engine has just been started from cold. In this case, only one such swirl vane cycle is permitted when the engine is opened up from idle and no cycling is permitted on any subsequent run up from idle without shut down of engine.

14.3 *Accelerations:

14.3.1 Setting:

The A.C.U. is to be set within the limits specified below, so that surge free slam accelerations can be carried out from any engine speed to 8000 r.p.m.

14.3.2 Limits:

(a) The slam acceleration time (cool) from ground idling speed (2750 r.p.m.) to within 50 r.p.m. of max. take-off speed (8000 r.p.m.) with six bleed valves in operation, is to be set between 12 and 14 seconds on days when the test cell temperature is standard at 15°C. On off standard days, the acceleration time is to be corrected in the proportion of one second reduction in acceleration time for each four degrees centigrade rise in cell temperature above 15°C. The corrected acceleration time must be within the above limits of 12-14 seconds. The acceleration times will be similarly increased on days when the cell temperature is below 15°C. It is permissible to alter the acceleration time within the limits of 12-14 seconds, if this is necessary to meet subsequent acceleration requirements.

(b) Then run the engine for three minutes at maximum take-off speed and carry out a slam deceleration to ground idling. After 45 seconds from the commencement of the slam deceleration, attempt a slam acceleration. The engine must run up smoothly and the time for the "hot" acceleration must not be greater than the time for the "cool" acceleration by more than one second.

(c) With the acceleration time as set above, again run the engine at 8000 r.p.m. for three minutes and carry out a slam deceleration to 4000 r.p.m. (This throttle setting may be pre-determined). Attempt a slam acceleration from this speed twenty-five seconds after the commencement of the deceleration and the engine must be free from stall or surge and open upwithout hesitation.

Note: During a slam acceleration, the time taken to move the throttle from the idling position to the maximum take-off position must be less than two seconds. During a slam deceleration, the time taken to move the throttle lever from the maximum take-off position to the idling position must be less than one second.

14.4 Fuel Pump Isolation:

At 7400 r.p.m. engine speed, the upper pump is to be isolated and the lower pump "failed". Open the throttle to the maximum stop and record r.p.m., thrust, fuel pump pressure, burner pressure and fuel flow in gal./hr. Repeat this check with the upper pump "failed". Under standard atmospheric conditions (30" Hg., 15°C. air temperature), a speed of about 7000 r.p.m. and a thrust of about 4000 lb. should be obtained. As these values will alter with atmospheric conditions, the only test for satisfactory isolation is a measurement of the fuel flow and the actual r.p.m. The values of fuel flow to be used in checking the fuel pump isolation are given below:

Actual r.p.m.	Actual g.p.h. Post-Mod.22 pumps (Slipper pad pumps)		Actual g.p.h. Pre-Mod.22 pumps (Non-slipper pad pumps)	
	Maximum	Minimum	Maximum	Minimum
6,600	538	495	495	470
6,800	552	510	510	485
7,000	567	524	524	501
7,200	582	539	539	516
7,400	595	553	553	530

During isolation checks, the pump stall pressure must be 1750 p.s.i. or greater.

14.5 *Run down from Idling:
Check that the run down time from idle to rest with the H.P. cock and throttle shut is more than 77 seconds.

14.6 Oil Level:
Check oil level and replenish if necessary.

15. Final Endurance (20 minutes):

15.1 Maximum Continuous: (7600 r.p.m. actual) for 15 minutes:
Take readings after five minutes and during the last three minutes.

15.2 Maximum Take-off (8000 r.p.m. actual) for five minutes:
Take one complete set of readings.

16. Accelerations and Decelerations:

16.1 Accelerations:
Carry out one slam acceleration (cool) from idling (2750 r.p.m.) to maximum take-off r.p.m. This acceleration must be within the limits specified in para. 14.3.2 (a). Carry out one acceleration from 4000 r.p.m., as specified in para. 14.3.2 (c).

16.2 Decelerations:
Complete two slam decelerations (hot) from maximum take-off r.p.m. to idling. These decelerations must be surge free.

The above accelerations and decelerations may be done in conjunction with each other, if desired.

17. *Vibration Checks:

Fit the vibration pick-up tothe compressor case front flange and measure the amplitude of vibration at the following speeds, both increasing and decreasing r.p.m.
4000, 4500, 5000, 5500, 6000, 6600, 7000, 7400, 7600, 7800 and 8000 rpm.

The amplitude at top speed should be measured after one minute and three minutes at that speed.

Limits: (During decreasing speed and after 3 minutes at top speed).

Compressor Case Front Flange	Max. Amplitude.
2750 to 8000	.0035 pre-Mod.91(RR.Avon)
2750 to 8000	.0055 Post-Mod.91 "

18. Performance Curve:

18.1 Curve:

Open the engine up slowly, to ensure that maximum r.p.m. is obtainable. When the air temperature is above 15°C., the maximum speed point should be greater than $8000 \sqrt{\frac{\text{air temp. °K.}}{288}}$ However, the limiting conditions of 8240 r.p.m. or 645°C. actual J.P.T. should not be exceeded.

With the engine warmed up, take a complete set of readings at the following speeds, in the order given:
2750, 4000, 5600 r.p.m., before bleed and swirl change over, r.p.m. after bleed and swirl change over, 7000, 7400, 7600, 7800, 8000, 7500, 6600, 4800 and 3200.

The fourth and fifth points, i.e., before and after swirl change over are to be taken at approximately the same fuel flow. The throttle settings will, therefore, be very similar, but the fifth point should be approximately 300 r.p.m. lower than the fourth point.

18.2 Checks after Performance Curve:

18.2.1 Governed Speed:

Check that the governed speed is $8000 \begin{smallmatrix}+25\\-00\end{smallmatrix}$ r.p.m. If not within these limits, reset as specified in para. 14.1.

*18.2.2 Throttle Lever Angle:

Check that the throttle lever angle from idle to the fully open stop screw is 80° ± 1°. Also note the throttle lever position when the engine is running at 7600 r.p.m.

18.2.3 Idle Speed:

Check that the idling speed is 2750 ± 100 r.p.m.

18.2.4 Oil Consumption:

Note the oil consumption over the period from the beginning of the endurance run to the end of the performance running.

19. Penalty Run Engines:

Engines which are given a penalty run after acceptance are to complete at least the performance curve specified in para. 18.1 and this will be taken as the final engine performance rating for acceptance purposes.

20. Inhibiting:

Run the engine at 3000 - 4000 r.p.m. on normal fuel and change over to DEF.2001 oil (previousl DTD.44D) as fuel, and run for three minutes after the change over.

21. Storage:

When the above testing has been satisfactorily completed, prepare the engine for transport and storage in accordance with Turbine Engineering Bulletin No.5.

22. Operating Conditions, Limitations etc.

22.1 General:

The following points are relevant to the data given in this section.

22.1.1 Limits stated in the Engine Contract Specification are prefixed 'X'. If the engine is not within these limits but the inspector is certain that this will not affect the performance of the engine in the aircraft, he may submit the engine to A.I.D. for acceptance.

22.1.2 Additional limits specified by C.A.C. are s pecified '*'. These limits may be altered by C.A.C., if considered necessary, with R.Tech.O's. approval.

22.1.3 Other limits or nominal figures given are for guidance only.

22.1.4 The engine is to be tested with a slave jet pipe of 19.65" final nozzle diameter.

22.1.5 A slave test bed flare is to be used as an intake and a suitable gauze screen is to surround the engine intake during all testing, including performance curves.

22.2 Fuel:

'X' type aviation turbine fuel to Spec. D.Eng.RD.2482.

*Pressure:

Inlet to pump, 10-15 p.s.i.

Metered fuel pressure at 7400 r.p.m.

Barometer "Hg.	Pressure p.s.i. Max.	Min.
28.0	1265	1225
28.5	1280	1240
29.0	1293	1253
29.5	1307	1267
30.0	1320	1280
30.5	1334	1294
31.0	1348	1308

Burner pressure Idling r.p.m. - pilot burner 230 psi.min.

22.3 Oil:

X Type - D.Eng.RD.2487.

X Temperature at max. continuous (7600 r.p.m.) measured at outlet from oil cooler - 70°C. actual maximum.

X Pressure at max. continuous r.p.m. and higher - 20 p.s.i. min. at 3500 r.p.m. - 10 p.s.i. min.

X Consumption at all conditions - 1½ pt./hr. max.

22.4 X Cooling Air Outlet Temperature:

After five minutes at maximum take-off speed (8000 r.p.m.), 275°C. (corr.) maximum.

22.5 Exhaust Cone Temperature:

22.5.1 Maximum Temperature:

The average of the four thermocouple readings must not exceed 615°C. (corr.) at 8000 r.p.m. (corr.)

22.5.2 X Spread at Max. Take-off (8000 r.p.m.)

Each of the four observed readings must be within ± 10°C. of observed mean J.P.T.

22.5.3 Max. Temperature at Idle:

The average of the four thermocouple readings must not exceed 500°C. actual.

22.6 Nominal Engine Rating:

Condition	R.P.M. Actual	Thrust lb. nominal	J.P.T. °C. nominal	Spec.Fuel Cons. lb./hr./lb.nom.
Idling	2750	200	475	3.500
Max.Continuous	7600	5930	525	.870
Intermediate	7800	6500	560	.880
Max.Take-off	8000	7150	600	-

22.7 Limitations:

Condition	R.P.M.	Thrust lb. corrected	J.P.T. °C. corrected.	Spec.Fuel Cons. lb./hr./lb.
Idling	2750 ± 100 actual	X 250 act. max.	475 nominal	--
Max.Take-off	8000 corr.	X 6860 min.	X 615 max.	--

The acceptance limits for thrust and jet pipe temperature given above are to be checked from a graph of corrected thrust and corrected J.P.T. plotted against corrected r.p.m.

22.8 Definitions:

Cold: The engine has been stationary for two hours or more.

Cool: The engine has been running at the idle condition for three minutes or more.

Hot: The engine has been run at 8000 r.p.m. for three minutes or more.

23. Test Log Readings:

23.1 A complete set of readings consists of the following:

Time of observation
r.p.m.
Thrust in pounds
Fuel flow
Exhaust Cone Temperature (4 readings)
Fuel pump pressure
Burner pressure (both main and pilot)
Exhaust cone pitot pressure
Exhaust cone static pressure
Oil pressure
Oil inlet temperature
Compressor delivery pressure and temperature
Turbine cooling air outlet temperature
Test House air temperature
Barometer
Fuel S.G.

Note: Where test house is sealed, the depression adjacent to the engine must be noted.

23.2 Correction of Observed Results:

23.2.1 All results are corrected to either of the following standards:

Barometer	30.00 in. Hg. abs.
Temperature	288°C. abs. or 288°K.

Note: °K = day's temperature (°C.) + 273.

23.2.2 Correction of Actual Thrust:

$$\text{Thrust (corr.)} = \frac{30.00}{P_o} \times \text{Thrust actual}$$

23.2.3 Correction of Actual r.p.m.

$$\text{r.p.m. (corr.)} = \sqrt{\left(\frac{288}{T_o}\right)} \times \text{r.p.m. actual.}$$

23.2.4 Correction of Actual Pressures:

$$\text{Pressure (corr.)} = \frac{30.00}{P_o} \times \text{pressure actual.}$$

23.2.5 Correction of Actual Exhaust Cone Temperature:

$$\text{Temp. °K. (corr.)} = \frac{288}{T_o} \times \text{Temp. °K. actual.}$$

23.2.6 Correction of Actual Specific Fuel Consumption:

$$\text{Sp. Cons.} = \sqrt{\left(\frac{288}{T_o}\right)} \times \text{Spec.Cons. actual.}$$

Note: Obtain actual Sp. Cons. from observed fuel flow and actual thrust.

23.2.7 Correction of Cooling Air Temperatures:
For air temperatures below 15°C., add the difference from 15°C. to the observed temperature and vice versa.

23.2.8 In the above formulae -

T_o = Observed temperature °K.

P_o = Observed barometer in "Hg.

23.2.9 All actual results given above should have been corrected for instrument error etc.

23.2.10 Correction charts are available to carry out the above corrections.

This schedule is based on Rolls-Royce master schedule J.123 (issue 2) and Appendix A3/1 (Issue 4), with necessary C.A.C. alterations.

Inspector in Charge,
A.I.D. at C.A.C.

R.Tech.O. at C.A.C.

1. Contractor's Test

Test commenced at 2042 hours on 23.5.56 and was run to schedule PTS.57.

Preliminary vibration checks indicated a vibration of .0015" after soaking for one minute at 8,000 r.p.m.

Governor and slow running adjustments were made without incident.

Deceleration surge speed was determined at 6020 - 6000 r.p.m. corrected.

Bleed valve control unit, S/No.CAC.26 proved unsuitable and it was replaced by S/No.CAC.23. Later S/No.CAC.23 was replaced by S/No.A.660 which remained with the engine until the completion of the contractor's test.

On three occasions during the bleed valve setting procedure deceleration surges were experienced, one of which was intentional.

Adjustments to the A.C.U. were carried out wit out incident.
Fuel pump isolation checks were complied with.
The two hour endurance period and the hot and cold accelerations were carried out without incident.

A full vibration curve was plotted, the maximum amplitude being .0027" at 6,875 r.p.m. See vibration curve, No. 1.

The standard performance curve was concluded.

After the conclusion of the contractor's test, total running time 9.07 hours, a number of checks was conducted to determine the suitability of trimmer tabs as a means of controlling J.P.T.

During these checks a brief period of apparent engine roughness was experienced but a subsequent vibration curve failed to show any appreciable increase. See vibration curve No. 2.

The completion of PTS.57 contractor's test and the functional checks with trimmers attached occupied a total running time of 10 hours 28 minutes after which the engine was inhibited and returned to assembly shop for bulk strip and inspection on 25.5.56.

High bearing temperatures were indicated throughout the contractor's test but a careful examination of the centre and rear bearings revealed no signs of deterioration. See Appendix 8 for details.

2. Acceptance Test

During the rebuild the only replacement to the engine, apart from the routine items was the Bleed Valve Control Unit. B.V.C.U. S/No.CAC.26 was overhauled, rig tested and re-fitted to the engine.

It was also noted during rebuild that the spacer between stages 10 and 11 compressor wheels had a run-out in excess of the maximum allowable (vide .009") and it was agreed with A.I.D. that the engine could be run in this condition provided the compressor casing top half was removed after the test to determine whether the run-out had increased.

Acceptance test running commenced 1325 hours on 8.6.56 and was conducted in accordance with test schedule PTS.57.

Preliminary vibration figures were obtained and the maximum amplitude recorded was .0016" at 7,750 r.p.m.

Idling and governed speed settings were checked.

During bleed valve checks it was again found necessary to replace B.V.C.U. S/No.CAC.26 and B.V.C.U. S/No.664 was fitted to the engine, correctly adjusted and remained with the engine for all subsequent test running. Two deceleration surges were experienced, one of which occurred during the determination of the engine surge speed.

The endurance period and acceleration checks were conducted without incident.

A final vibration curve was plotted, the maximum amplitude of which was .0024" at 5,500 r.p.m. See vibration curve numbers 3 and 4.

The normal performance curve was then plotted and the engine inhibited.

During this run the indicated bearing temperatures were again high.

The test was completed on 9.6.56 after having occupied running time of 5 hours 51 minutes bringing the total hours logged on this engine to 16 hours 19 minutes.

The engine was then de-rigged and returned to the assembly shop where the top half of the compressor casing was removed to check the concentricity of the spacers. No change in the run out of the spacers was indicated, but it was decided that a penalty run should be carried out to check the performance of the engine after re-assembly.

3. Penalty Run:

This test commenced on 12/6/56 at 1356 hours and it included the final performance curve and vibration survey, the results of which are shown on vibration curves 3 and 4.

In addition, further work was done to set the propelling nozzle trimmer tabs and the manually adjustable oil cooler by-pass valve and oil pressure relief valve were fitted and adjusted.

The 19.850" dia. propelling nozzle was then fitted and the engine was run at the over-speed condition of 8,240 r.p.m., while the trimmers were set to achieve the limiting J.P.T. of 645°C. Bearing temperatures recorded during this run were again high. Time recorded during this run was 4 hours 6 minutes, bringing the total time to 20 hours 25 minutes.

The engine was again returned to the assembly shop, where it was prepared for despatch to Laverton, where the 25-hour endurance section of the type test was to be carried out.

4. 1st and 2nd Check Runs, 16/8/56.

In the meantime, further consideration had been given to the high rear bearing temperature obtained. It was then decided to remove the turbine and shaft from the engine and check the condition of the rear bearing. The bearing condition proved to be satisfactory and the engine was reassembled. A check run was then performed, to ensure correct functioning of the engine.

During this run, the rear bearing temperature decreased and the centre bearing temperature increased. It was thought that the thermocouple wires may have been incorrectly connected, and Nos. 6 and 7 combustion chambers were removed to check the connections. No wiring faults were found and the combustion chambers were replaced. A further check run confirmed the temperature trend obtained in the previous run.

The run was completed on 17/8/56, after occupying 3 hours 4 minutes, which brought the total hours logged to 23 hours 29 minutes.

5. 3rd Check Run, 18/8/56.

When the engine was returned to the assembly shop, Nos. 6 & 7 combustion chambers were again removed in order that asbestos packing and ceramic heat insulation could be applied to the bearing thermocouple leads. After reassembly, the engine was again subjected to a short check run, but no great change in indicated bearing temperatures was apparent.

The compressor was then washed with water for 5 minutes at 6,500 r.p.m and the engine was de-rigged and prepared for despatch to No.1 A.D., R.A.A.F. Station, Laverton.

This test logged a further 1 hour 10 minutes, bringing the total time to 24 hours 39 minutes.

6. 25-Hour Endurance

General

The engine was rigged in a Curran type test stand at the R.A.A.F. test bed at No. 1 A.D. Laverton and the preliminary check running was commenced on 31.8.56 at 1525 hours.

Wheelcase loading was applied by using 2 C.A.C. type Fan Brake dynamometers, serial No. 2 being coupled to the port driveshaft and serial No. 3 to the starboard driveshaft.

Bleed valve settings, governed speed oil temperature and pressure settings etc. were carried out without incident and the type test to schedule PTS.45A commenced on 3.9.56 at 1113 hours. The preliminary vibration curve was carried out and the results are shown in vibration curve No. 5.

Stage 1

Commenced and concluded 4.9.56.
Five hours at maximum continuous, i.e., 7,600 r.p.m.

During this stage, 4 hours 22 minutes after commencement, an increase in thrust was noted and it was found to be caused by the detuner creeping forward and pressing on the cooling air discharge pipes attached to the engine cradle.

Due to high day barometer, pilot burner pressure was in excess of 1000 p.s.i. and the gauge line was disconnected to prevent damage to the instrument.

Schedule hours completed	5.0 hours
Total engine running time	35 hours 45 minutes.
Oil consumption for stage	1.76 pints (.3 pints/hr)
Breather spill for stage	330 cc's (66 cc's/hr.)

Stage 2

Commenced 5.9.56. Concluded 6.9.56.
Ten (10) hours disposed of as follows.
Sixty (60) ten minute cycles consisting of:-

(a) Slam acceleration alternately from G.I and 4,500 r.p.m. to M.T.O.
(b) 5 minutes at M.T.O. and 645°C. J.P.T.
(c) Slam deceleration to G.I. or 4,500 r.p.m. as applicable.
(d) 5 minutes at G.I. or 4,500 r.p.m. as applicable.

Stage 2 (continued)

During the preliminary running prior to the commencement of this stage a failure of the test house fuel supply occurred and it was necessary to stop the engine whilst repairs were effected.

The stage commenced at 1147 hours and continued until 1249 hours, when a voluntary stop of 50 minutes was made. The stage was then continued without incident until 1615 hours when the engine was shut down for the day.

Prior to resuming on 6.9.56 the long slave balance piston vent pipes were removed from the engine and were replaced by the engine parts in an endeavour to eliminate back pressure and thus reduce the apparently high centre bearing temperature. No substantial reduction was achieved and the stage was resumed at 1017 hours and continued until 1234 hours, when a voluntary stop of 41 minutes was made. The engine was re-started at 1315 hours and the stage continued without incident until 1442 hours when the test house fuel supply again failed, dropping the inlet fuel pressure to 3 p.s.i. The trouble was rectified without shutting down and the stage was concluded at 1727 hours.

Schedule hours completed	15 hours
Total engine running time	47 hours 58 minutes
Oil consumption for stage	1.63 pints (.138 pints/hr.)
Breather spill for stage	460 cc's (39 cc's/hr.)

Stage 3

Commenced 7.9.56. Concluded 12.9.56
Carried out one 20 minute period as follows.

(a) 5 minutes at r.p.m. to obtain 75% thrust.
(b) 15 minutes at 8,240 r.p.m. and 645°C. J.P.T.

The 19.850" diameter propelling nozzle with trimmers was fitted and prior to start up the jet pipe was removed for a visual inspection of the low pressure turbine blades.

The engine failed to start at the first attempt and the trouble was traced to a faulty high energy ignition unit on the starboard side and a faulty igniter plug on the port side. The port igniter plug was changed and a successful start made on the single igniter.

During the warm up period it was noted that the centre bearing thermocouple was not operating and a decision was made to remove combustion chambers 6 and 7 to inspect the connections at the hand hole cover. On 10.9.56 the combustion chambers were removed and no fault could be found with the connections.

Stage 3 (continued)

While thermocouple wiring checks were being made opportunity was taken to overhaul and grease the slave turbo-starter. Also a thermocouple was inserted in the outlet orifice of the balance piston vent in order that an alternate check could be made for changes in centre bearing temperature.

After restarting thermocouple indications were received for a short period only and again an open circuit was suspected and Nos. 6 and 7 combustion chambers were removed for the second time. Again no fault was found and after replacing the combustion chambers and the faulty starboard high energy ignition unit, the engine was restarted. Erratic readings were received for the centre bearing temperatures. It was then decided to conclude the test without an indication of centre bearing temperature.

The following day a period prior to overspeed check was allotted for 'make-up' starts. Seven starts had been accomplished when it was noticed that an increase in engine vibration had occurred. On engine run down an unusual howling noise was emanating from the port dynamometer. The dynamometer was uncoupled and a vibration curve was plotted.

This curve corresponded very closely with the previous curve plotted on 31.8.56 as shown on vibration curve number 6.

Examination of the dynamometer, Serial No. 2, revealed a failed bearing and while this was being repaired further 'make-up' starts were carried out, making a total of 19 starts for the day.

On 11.9.56 the dynamometer was recoupled and the overspeed checks were complied with without further incident.

Schedule hours completed	15 hours 20 minutes
Total engine running time	52 hours 33 minutes
Oil consumption for stage	Nil
Breather spill for stage	Nil

Stage 4.

Carried out one 10 hour period consisting of five identical two hour periods disposed as follows.

30 minutes at 8,000 r.p.m., & 645°C. J.P.T.
1 hour at 7,800 r.p.m. and 620°C. J.P.T.
30 minutes at 8,000 r.p.m. and 645°C. J.P.T.

Prior to commencement of this stage the jet pipe was removed to permit the visual inspection of the turbine blading. No defects were found and the jet pipe with the 19.654" diameter propelling nozzle and trimmers was refitted.

Stage 4 (continued)

Immediately after starting up while running at approximately 7,600 r.p.m. engine vibration momentarily increased to .010" but when the engine warmed up further the vibration decreased to the normal .0017".

Governor settings were made to control R.P.M. at 8,000 and during bleed valve checks a minor deceleration surge was experienced.

Trim tabs were adjusted to give 645°C. J.P.T. at 8,000 r.p.m. but this combination could not be achieved. Maximum J.P.T. obtainable while holding 8,000 r.p.m. was 634°C.

Two 2-hour cycles were completed before shutting down for the night. Inspection of the engine after shut down revealed that the head of a BA.44189 set screw securing the stiffener between combustion chambers 6 and 7 on the nozzle box front panel had sheared off.

Stage 4 was continued on 14.9.56 and the remaining 3-hour cycles were completed without incident.

Inspection of the engine after shut down revealed another sheared set screw on the nozzle box stiffener, this time between combustion chambers 5 and 6. Both broken setscrews were at the inner station.

A slight deceleration surge was experienced during bleed valve checks after completion of the 5th cycle.

Schedule hours completed	25 hours 20 minutes
Total engine running time	66 hours 25 minutes
Oil consumption for stage	10.85 pints (.782 pts/hr.)
Breather spill for stage	1306 cc's (1 00 cc's/hr.)

Minimum oil level Check

Commenced and concluded 17.9.56

15 minutes at 7,600 r.p.m. with oil inlet temperature of 90°C. and an oil pressure of 14.5 p.s.i. with minimum quantity of oil (i.e.3.5 pints) in the sump.

This stage was completed satisfactorily and after the dynamometers were disconnected a 4 point performance curve was conducted. The engine was then de-rigged and returned to C.A.C. for final performance curve and vibration survey.

7. Final Performance Test

The engine was rigged in C.A.C. test house under identical conditions with those for the acceptance test of 8.6.56.

The test running was commenced at 1617 hours on 18.9.56 and concluded on 19.9.56.

Bleed valve and governed speed settings were checked and needed no adjustment.

A preliminary vibration and 4 point performance curve was then conducted and the compressor was washed for five minutes at 6,500 r.p.m. prior to the final performance curve.

The final performance curve was successfully concluded and the engine was returned to the assembly department for general strip and inspection

Vibration characteristics of the engine at this stage are plotted on curve number 7.

Details of Strip Inspection

1. Section 1010 Internal Wheelcase and Gears

All components including locally forged parts were found to be in good condition.

All parts with the exception of the roller bearing on the spiral bevel gear which drives the external wheelcase were accepted for further service.

The track of the outer race of this bearing was showing slight signs of break up and together with the gear, rollers and cage, was rejected.

The wires to the centre bearing thermocouple ('test only' parts) were found to be broken thus accounting for the failure of centre bearing temperature indications during the endurance run.

All steel parts open to contact with oil mist were discolored to a manganese bronze color.

Spiral bevel gears showed good tooth marking and photograph number 1 is indicative of their condition. The abnormal tooth marking sometimes shown on these gears in other engines was not present.

2. Section 1022 Single Breech Turbo-Starter Fairing

This fairing, the subject of Repair Scheme RS.58 was thoroughly examined after the completion of the test and its condition was found to be satisfactory. See Appendix 12.4

3. Section 1060 Rear Bearing Housing and Intermediate Casing

Dimensional and physical checks proved this section to be in good condition.

An oil leak emanating from the rear gland of the rear bearing oil seal was obvious and the oil leakage carried by the cooling air and high pressure air bleeding from the face of the turbine disc caused heavy 'varnish' and coke deposits to be formed on the rear bearing housing. Varnish deposited on the rear bearing itself and within the rear bearing seals was commensurate with the high temperatures indicated during engine running. The bearing appeared to have suffered no damage but it was rejected because of the apparent overheating. A full laboratory check has been made and a copy of the appropriate report is included as Appendix 10.1.

Photographs 2, 3 and 4 show the heavy 'coking' and 'varnishing' on the rear bearing housing.

4. Section 1070 Turbine Wheels and Shaft

The rear bearing sleeve (inner race) exhibited tempering colors of a higher order than has previously been seen on an Avon engine at C.A.C., but subsequent hardness checks have shown that the material has retained its properties within drawing limits. The sleeve, however, has been rejected with the rear bearing. See (3) above.

Light galling was found in two local areas on the turbine shaft coupling locking ring.

The low pressure turbine disc was rejected because of cracks in 4 blade retaining grooves.

The high pressure turbine disc was rejected because of unusual pitting in the bottom of the blade locating grooves.

Six low pressure turbine blades were rejected, two for cracking in the fir tree serrations, three for cracking in the blade neck and one blade for a cracked locating tab.

A pair of high pressure blades was rejected because of cracking in the shroud weld. Appendix 10.3 reports on the condition of these components.

5. Section 1080 Nozzle Box and Guide Vanes

On the nozzle box front panel the heads of the securing set screws for the stiffeners between combustion chambers 5 and 6 and 6 and 7 (inner stations) had come off during engine running and the screws were rejected. See Photograph No. 5.

Carbon and varnish from burnt oil, carried by the cooling air into the nozzle box spider was heavily encrusted on the inside diameter of the spider and on the diaphragm plate. Photograph number 6 shows these deposits on the nozzle box diaphragm plate.

Fretting of the locating tabs on the nozzle bends was very slight and is considered normal.

The starboard engine mount trunnion previously chrome plated to salvage scheme SL.586, showed no signs of deterioration.

Burnt oil deposits were noted on both the inside and outside surfaces of the cooling air manifold.

A slight rub was evident on the sealing sleeve of the H.P. turbine labyrinth seal. See photograph number 7.

5. Section 1080 (continued)

The inter-stage turbine labyrinth seal was also very slightly rubbed.

All low pressure nozzle guide vanes were Zyglo inspected and a number exhibited cracks on the leading or trailing edges. All vanes were accepted for further service.

Cracks were also detected in the high pressure nozzle guide vanes and 3 of these were cracked beyond overhaul acceptance standards.

6. Section 1091, Exhaust Unit

Examination of this unit showed very slight fretting between the fairings and the inner and outer cones and the "Alfol" insulation was slightly chaffed. General condition was excellent.

7. Section 1092, Combustion Equipment

All flame tubes exhibited some local buckling and cracking, mainly on the engine inner position and confined to the cylindrical section. All inner flares exhibited distortion, cracking and burning to some degree. Photographs 8 to 15 show the buckling on the cylindrical sections and 16 to 23 show the condition of the inner flares.

Inspection of the flame tubes revealed the following faults.

No. 1

(a)	Inner Flare.	General distortion and cracking in two places. Acceptable.
(b)	Front Section	Slight distortion and cracking from three air holes, edge crack in seam from downstream end. Acceptable after direct welding
(c)	Centre Section	Minute cracks in five downstream stitch welds. Acceptable after direct welding.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.

Disposition: Return to pool after minor repair.

7. Section 1092 (continued)

No. 2

(a)	Inner Flare	General Distortion and cracking which is unacceptable because in two cases two cracks appear in the same segment. Reject.
(b)	Front Section	Pronounced distortion with minor cracking and burning round edges of five air holes.
(c)	Centre Section	Slight distortion.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition:		Reject for Major Repair.

No.3

(a)	Inner Flare	Slight distortion and one edge crack. Acceptable.
(b)	Front Section	General distortion and cracking from air holes, edge crack from downstream end of longtitudinal seam weld. Acceptable after direct welding.
(c)	Centre Section	Acceptable.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition:		Return to pool after minor repairs.

No. 4

(a)	Inner Flare	Slight distortion and unacceptable cracking in two segments. Reject.
(b)	Front Section	General distortion and unacceptable cracking from air holes. Reject.
(c)	Centre Section	Minute cracks developing in downstream end of several flute welds.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition:		Reject for Major Repair.

7. Section 1092. (continued)

No. 5

(a)	Inner Flare	Slight distortion but no cracking. Acceptable.
(b)	Front Section	Numerous small cracks emanating from 2 air holes accompanied by severe distortion over a small area. Crack in downstream end of longtitudinal seam weld. Reject.
(c)	Centre Section	Distortion and lifting in centre of flutes resulting in cracks developing in flute welds at downstream end. Reject.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition		Reject for Major Repair.

No. 6

(a)	Inner Flare	Distortion and slight edge cracking. Acceptable
(b)	Front Section	General distortion and slight cracking from air holes. Crack in downstream end of longtitudinal seam weld. Four longtitudinal cracks starting from the downstream edge between flutes of centre section. Ballooning of front section has caused circumferential cracks to develop in the stitch welding along the flutes adjacent to the centre section. Acceptable for direct welding.
(c)	Centre Section	Approximately 60% of centre to rear section welds have failed without visible cracking, i.e., insufficient penetration of welds. Reject.
(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition:		Reject for major repair.

No. 7

(a)	Inner Flare	Slight distortion but no cracking or burning. Acceptable.
(b)	Front Section	General distortion and unacceptable cracking from air holes. Crack in downstream end of longitudinal seam weld.
(c)	Centre Section	Circumferential cracking in downstream end of longitudinal stitch welds (flute welds)

7. Section 1092 (continued)

No. 7

(d)	Rear Section	Fretting on locating pads but wall thickness within acceptable limits.
Disposition		Reject for major repair.

No. 8

(a)	Inner Flare	General distortion and cracking from edges. Acceptable.
(b)	Front Section	Distortion and cracks around 2 air holes. Circumferential cracks in upstream ends of 3 flute welds (front to centre section) due to ballooning of front section. Acceptable.
(c)	Centre Section	Cracks developing in downstream ends of flute welds (front to centre section)
(d)	Rear Section	Fretting on locating pads but material within acceptable limits.
Disposition		Return to pool after minor repair.

General — Distortion and cracking in these flame tubes is more moderate than that found in most overhaul engines and follows the expected pattern. All tubes were able to be fitted to the welding assembly fixture.

The only unusual feature is the presence of some surface corrosion which is evident to some degree inside all combustion chambers.

8. Section 1100 Fuel Pipes and Fittings

This section functioned satisfactorily throughout the test but five hose assemblies were rejected for minor faults located during strip inspection.

8. Section 1100 Fuel Pipes and Fittings (continued)

Part No.	Name	Reason for rejection
BA.21759	Hose Assy.MV.to ACU	Outer covering slightly burned by contact with compressor casing. See Photograph 24
BA.22549	Hose Assy.No.8 Pilot burner	Outer covering slightly burned by contact with compressor outlet casing. See Photograph No. 25
BA.22550	Hose Assy.Nos. 1 & 7 Pilot Burner	Permitted fuel flow, but would not pass ball check.
BA.29635	Hose Assy. Fuel Spill o'board	Permitted fuel flow but would not pass ball check.
BA.21774	Hose Assy. Main burner manifold	Sealing nipples damaged due to faulty assembly.

9. Section 1104 Acceleration Control Unit.

Unit functioned satisfactorily throughout test and all components were satisfactory at final inspection.

10. Section 1106, Fuel Burners

No rejections from this section. Heavy carbon deposits were noted on burners 6, 7 and 8 and the main burner connection on No. 1 burner and its thread damaged during installation of engine in test bed. Photographs 26 to 33 show the condition of all burners.

11. Section 1108 Combined Fuel Control Unit

Unit operated satisfactorily throughout test and vibration checks after endurance running showed no change in calibration, but the unit was rejected because of excessive leakage to atmosphere from the S.O.C. shaft.

12. Section 1110 Oil pipes and fittings

All components satisfactory.

13. Section 1113 Fuel cooled oil cooler

Unit satisfactory

14. Section 1115 Oil sump and Filter Casings

All components satisfactory.

15. Section 1160 Oil pumps

All components satisfactory.

16. Section 1175 Front Suspension

All components satisfactory.

17. Section 1210 Fireproof Bulkhead

All components satisfactory.

18. Section 1270 External Wheelcase and Gears

All components were in a satisfactory condition with the exception of BA.17686 Bevel gear and bush assembly, the teeth of which exhibited the usual heavy marking below the pitch line, both from the driven bevel gear and the tachometer driving gear. Photograph No. 24 shows the condition of these components. All components were accepted for further service.

19. Section 1271 Auxiliary Gearbox Drive

All components including seal BL.1023 were in a satisfactory condition after the test. No oil leaks from the seal were evident during running.

20. Section 1371 Compressor Casings and Stators

Locally forged compressor blades were carefully inspected after test run and are quite satisfactory.

The metal sprayed stator blade support ribs in the compressor casings were satisfactory.

Inspection of the compressor casings revealed that the stator blades which were not ganged had been fidgetting in their locating grooves and the metal of the casing at the edge of the grooves had been deformed, raising 'pimples' corresponding to the diagonal corners of the blade locating platforms. This deformation was most pronounced in stages 8 and 9 and was confined in these stages to the areas between the bleed valve ports on both halves.

The pimples raised by the blades had in many instances subjected the material of the cases to such intense local stressing that minute cracks were evident in the immediate area. These cracks were so small that they could not be seen after chalk test, but were apparent when observed through a x 10 objective binocular microscope.

By their excessively dark color the 11th stage stator blades had evidently been operating at compressor delivery temperatures in excess of other Avon engines. Photographs 35 and 36 show the condition of the compressor cases.

21. Section 1372 Compressor Shaft and Rotors

This section included locally forged compressor blades in stages 1,2,9, 10 and 11 and careful inspection after test running proved these components to be in excellent condition.

The experimentally cadmium plated compressor shaft exhibited no deterioration during the period of the test.

In all rotor wheels the blade retaining pin holes experienced some scoring but this scoring has been attributed to small surface defects on the retaining pins. These defects were caused by the arcing of electric current from the locating diameter to earth when the part number etc. was being etched on the head at final inspection.

The front bearing sealing gland (rotating member) suffered a very slight rub during the contractor's test but during subsequent running, clearance was maintained. Front main bearing was rejected because of a number of loose rivets.

22. Section 1373, Compressor Outlet Casing and Centre Bearing Housing

Apart from the fact that some peeling and flaking of the external paint work had occurred the outlet casing was in excellent condition.

The centre bearing was rejected because of a chipped ball and because of apparent overheating.

The centrifugal breather seals had worn grooves in the locating bore in the centre bearing oil gallery but as this is a common fault the application of repair scheme RS.50 (ARS.12) will restore this part.

23. Section 1374 Bleed Valve Control Unit

Functioning of this unit throughout the test was excellent and subsequent rig test and inspection proved the components to be in good condition.

24. Section 1375 Bleed Valves and Fittings

This Section operated satisfactorily throughout the test and all components were found to be in good condition at subsequent inspection.

25. Section 1456 Wiring Connections, Single Breech Turbo Starter

The firing lead BA.32311 was rejected at inspection because the insulation was burned from the wire at the starter end where a leak from the starter exhaust impinged upon it. See photograph No. 37.

Details of Balancing Operations

1. Compressor

Condition	Balance	
	R.H. end	L.H. end
As received	9.0 units at blade No.19	10.0 units at blade No. 10
At green build	0.8 units at blade No.28	0.5 units at blade No. 4
After green run	3.0 units at blade No. 3	1.0 units at blade No. 10
At final build	0.1 units at blade No.13	0.2 units at blade No. 33
After 25-hr.test	3.5 units at blade No.16	1.0 units at blade No. 20

2. Turbine

Condition	Balance	
	R.H.end	L.H. end
As received	12.0 units at blade No.84	65.0 units at blade No.62
At Green build	.8 units at blade No.54	0.8 units at blade No.39
After green run	1.0 units at blade No.17	14.0 units at blade No.36
At final build	0.9 units at blade No.17	0.8 units at blade No.38
After 25-hr.test	1.7 units at blade No.32	14.0 units at blade No.45

Units referred to in this table are as used on Gisholt Dynetric Balancing Machine, i.e., 1 unit = 0.1 oz.inches unbalance at the machine operating speed of 600 r.p.m.

Notes: The engine was very smooth throughout all test running, the maximum amplitudes recorded being .0032" at 7,000 r.p.m. during green run, .0025" at 5000 r.p.m. during acceptance run, .0014" at 5500 r.p.m. during first penalty run and .0022" at 5500 during 25-hour endurance run.

During the final performance run at C.A.C. the maximum amplitude recorded was .0015 at 7,400 r.p.m.

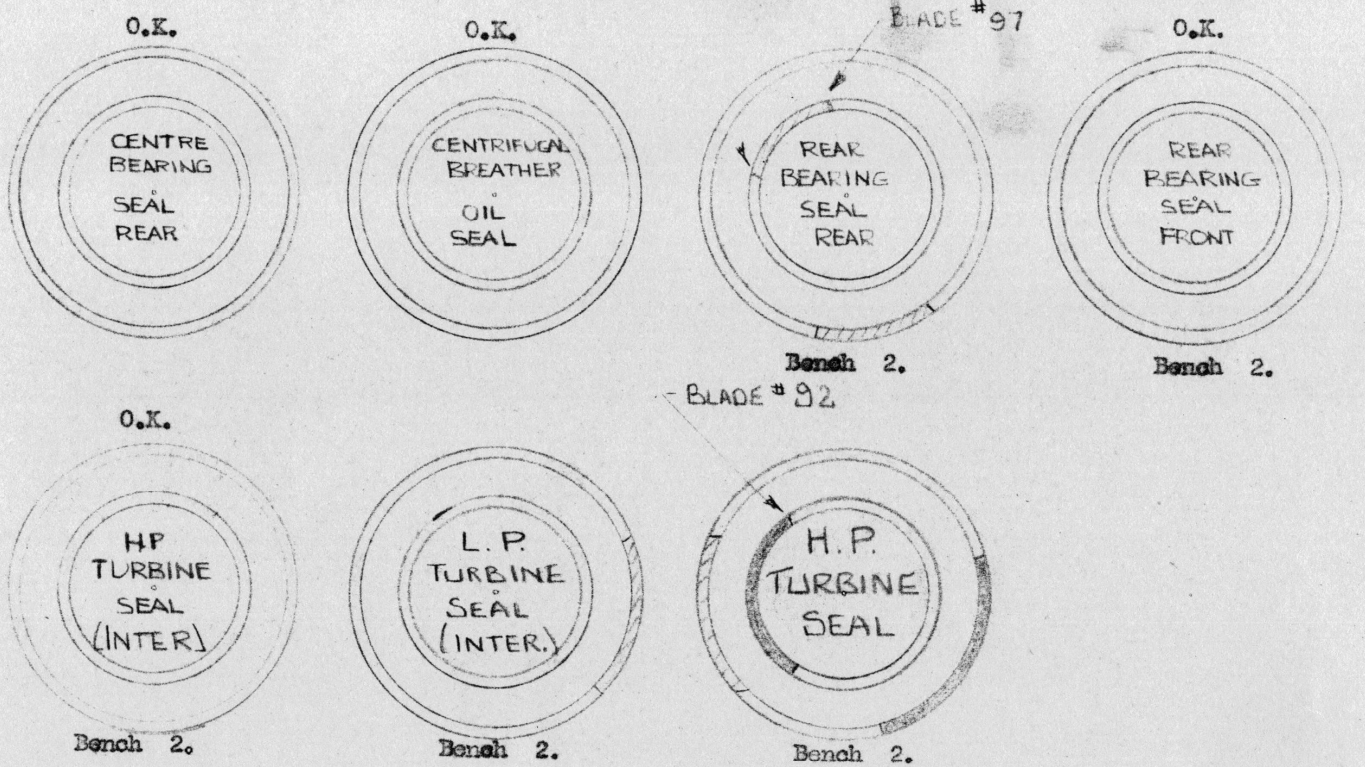
The pick-up was mounted in a vertical plane on the compressor casing for all readings.

Vibration increased momentarily during a short period of running when opening up after a warm start. The amplitude of vibration varied from .006" to .010" but settled back to normal after the engine warmed up.

POSITION OF FOULING IN ALL ENGINE SEALS

HEAVY RUB

LIGHT RUB



AFTER GREEN RUN

NO SEAL RUBS AFTER 2.5 HR TEST

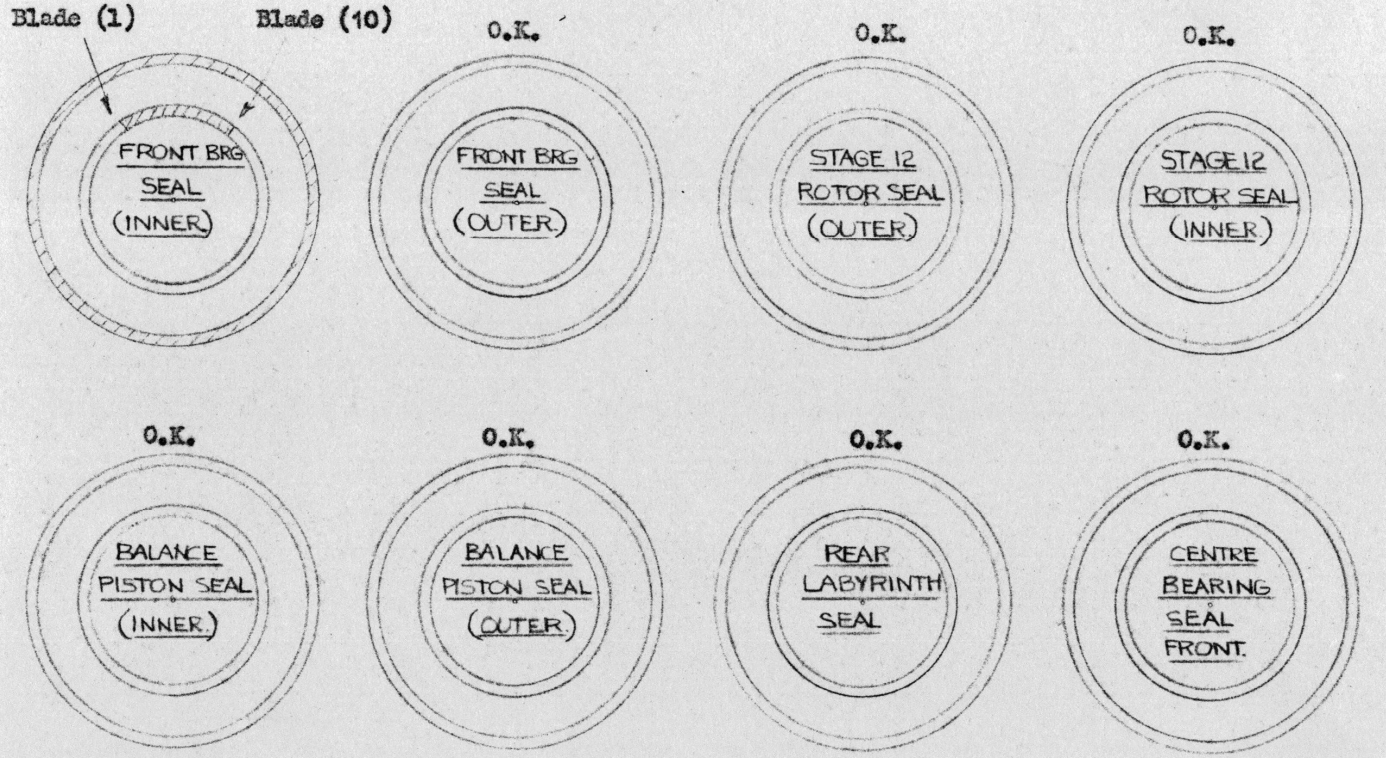
SHT 2 OF 2

WEIGHT	DATE 17-4-56	PREPARED BY: LLB.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA
MODEL NO. Section 6	REPORT NO. F.300	PAGE NO. 1 OF 57	

FORM M317-1/40.

POSITION OF FOULING ON ALL ENGINE SEALS

HEAVY RUB
LIGHT RUB



AFTER GREEN. RUN

NO SEAL RUBS AFTER 25HR TEST

NOTE: OUTER RING REPRESENTS STATIC MEMBER, INNER RING ROTATING MEMBER. ALL SEAL RUBS AND O'CLOCK POSITIONS TO BE RECORDED AS VIEWED FROM THE REAR OF THE ENGINE.

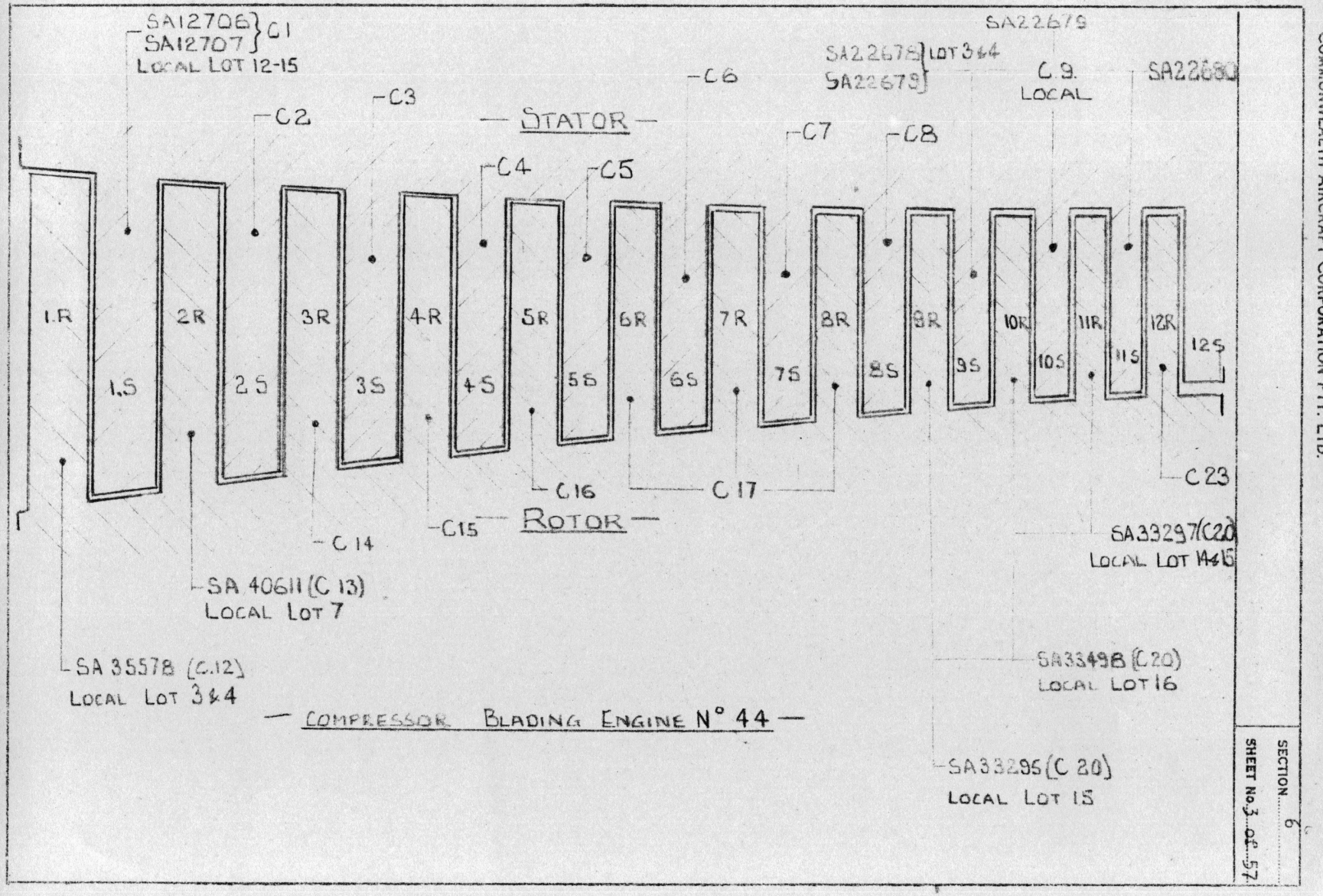
SHT. 1 OF 2

FORM M317—1/60.

PREPARED BY: I.L.B.
DATE: 17-4-56
WEIGHT:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

MODEL NO. Section 6
REPORT NO. E.300
PAGE NO. 2 OF 57



COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION 6

SHEET No. 3 of 57

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 4 OF 57
DATE 17-4-58		REPORT NO. E.300
WEIGHT	EXHAUST UNIT.	MODEL NO. Section 6

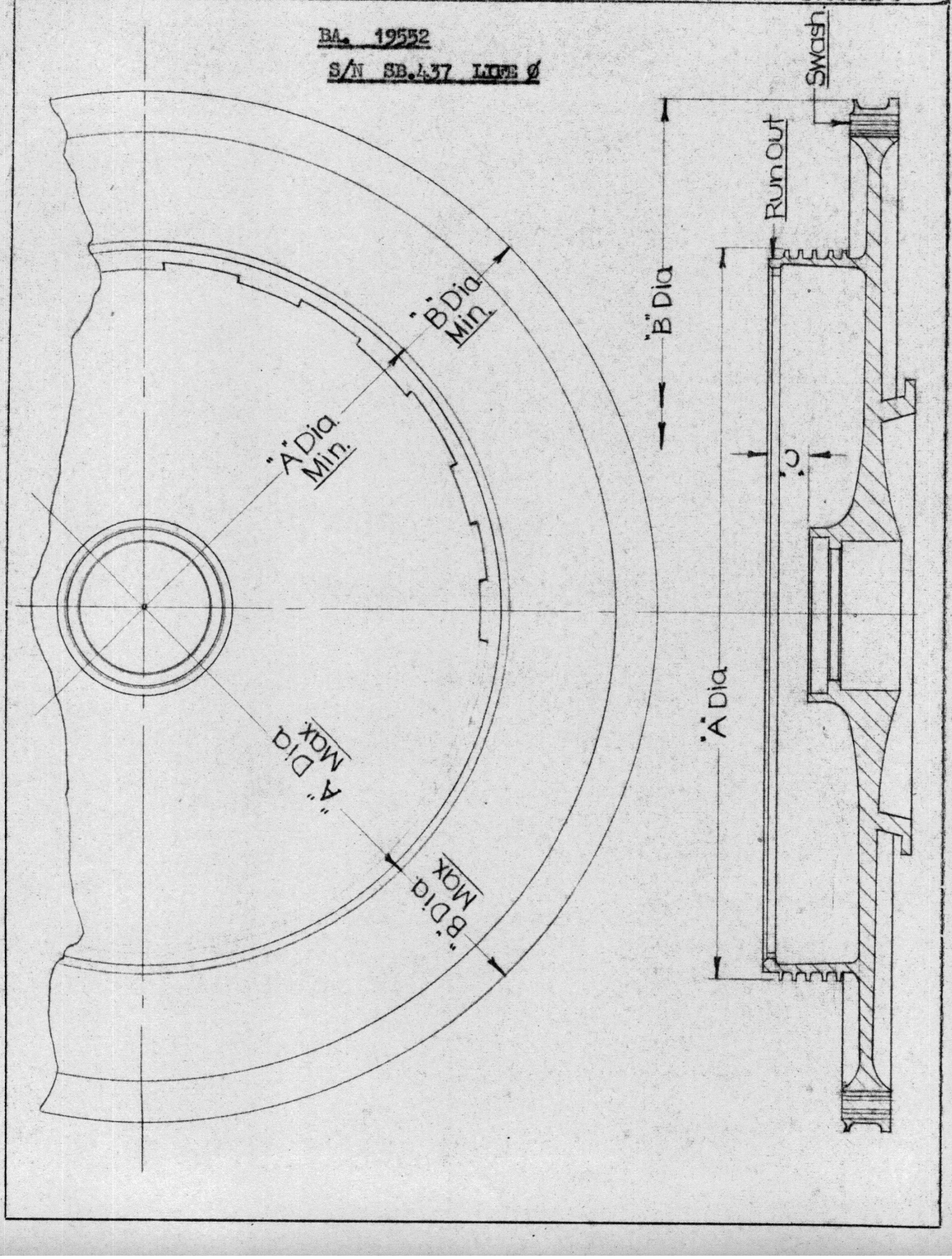
POS'N.		NEW	AFTER GREEN	AFTER 25 HR
DIA "A"	Max	25.124"		25.148"
	MIN	25.071"		25.074"
DIA "B"	MAX	32.246"		32.245"
	MIN	32.240"		32.238"
DIM "C"	MAX	19.429"		19.414"
	MIN	19.415"		19.407"

FORM M317—1/40.

PREPARED BY: I.L.B. 3-4-56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 5 OF 57
DATE	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	Turbine Wheel L.P.	MODEL NO. Section 6

BA. 19552

S/N SB.437 LIFE Ø



FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 6 OF 57
DATE 3-4-58		REPORT NO. E.300
WEIGHT	Turbine Wheel L.P.	MODEL NO. Section 6

BA. 19552

S/N. SB. 437

DESCRIPTION		DRG SIZE	NEW	AFTER GREEN	AFTER 25H.
DIA. "A"	Max.	14.595"	14.5948"	14.5945"	14.595"
	Min.	14.593"	14.5942"	14.594"	14.5945"
	Ovality.		.0006"	.0005"	.0005"
DIA "B"	Max.	20.675"	20.663"		20.663"
	Min.	20.672"	20.663"		20.663"
	Ovality		.000"		.000"
"C"	Max.	.85025"	.860"	.860"	.860"
	Min.	.84975"	.860"	.860"	.860"
	Dish.				
Swash.		———	.0015" @ #12		.002" @ #68
Run Out.		———	.0005 @ #17		.0011 @ #12

DIM "B"

Dimension taken between Blade No. 1 & 2 - 37 & 38 :- 20.663"
" " 10 & 11 - 46 & 47 :- 20.663"
" " 20 & 21 - 56 & 57 :- 20.663"
" " 30 & 31 - 66 & 67 :- 20.663"

DIM "A"

Max DIM @ Blade No. 44
Min " " " No. 71

DIM "B" After 25 hours. between Blade No. 1 & 2 - 37 & 38 :- 20.663"
10 & 11 - 46 & 47 :- 20.663"
20 & 21 - 56 & 57 :- 20.663"
30 & 31 - 66 & 67 :- 20.663"

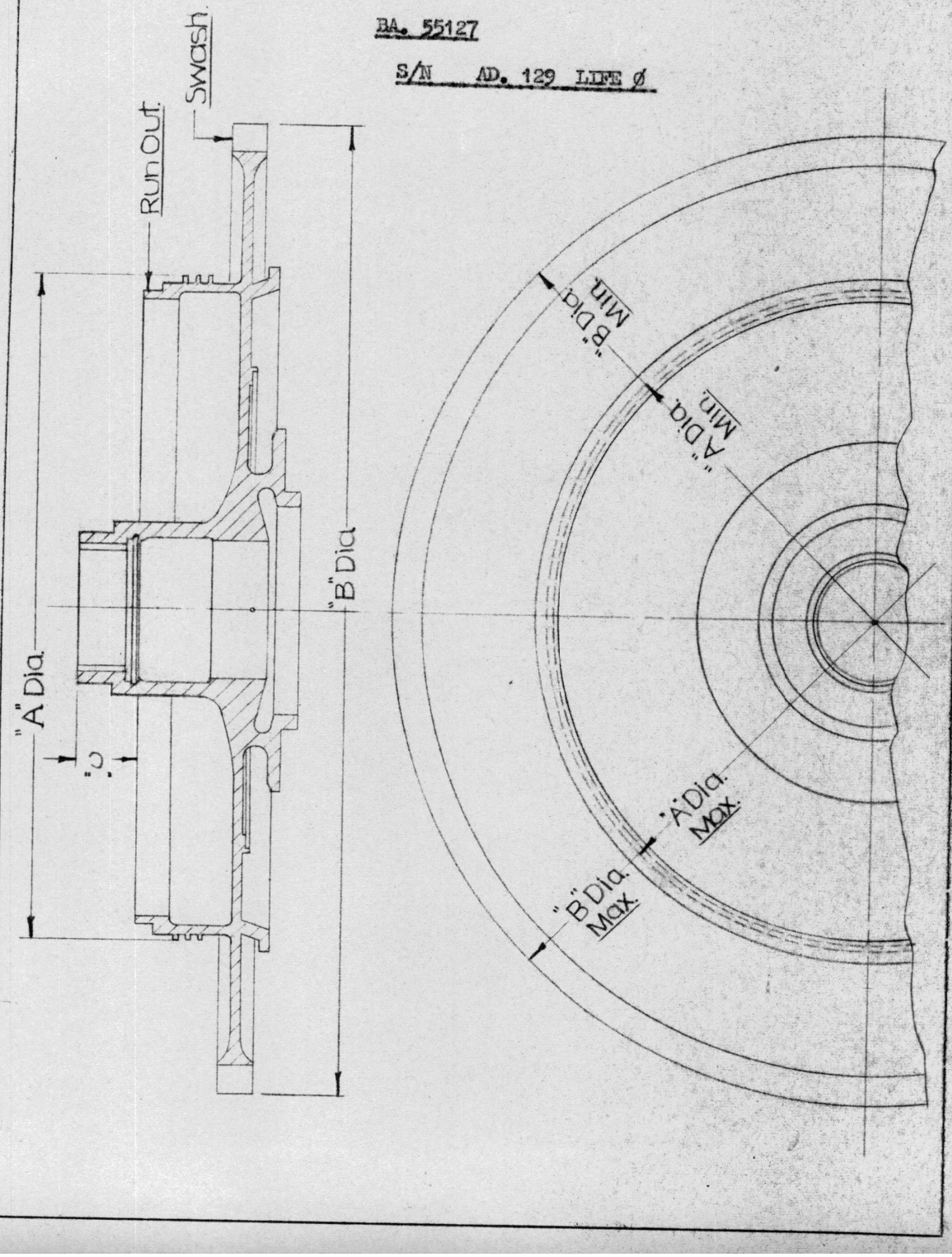
DIM "A" After 25 hours, @ Blade No. 44. 14.595" Max.
No. 71. 14.5945" Min.

FORM M311—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 7 OF 57
DATE 3-4-56	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	Turbine Wheel H.P.	MODEL NO. Section 6

BA. 55127

S/N AD. 129 LIFE Ø



FORM M317—11/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 8 OF 57
DATE 5-4-56		REPORT NO. E.300
WEIGHT	Turbine Wheel. H.P.	MODEL NO. Section 6

Sht. 2 of 2

DESCRIPTION.		DRG. SIZE.	NEW	AFTER GREEN.	AFTER 25H
DIA. "A"	Max.	14·595"	14.598"	14.5975"	14.596"
	Min.	14·593"	14.594"	14.596"	14.596"
	Ovality.		.004"	.0015"	.000"
DIA. "B"	Max.	21·700"	21.700"		21.703"
	Min.	21·697"	21.698"		21.701"
	Ovality.		.002"		.002"
"C"	Max.	·893"	.889"	.889"	.888"
	Min.	·886"	.889"	.889"	.888"
	Dish.		Nil	Nil	
Swash.		——	·0035" @ #20		·003" @ #90
Run Out.		——	·002" @ #11		·0015" @ #11

DIM "B"

Dimension taken between Blade 1 & 2 - 53 & 54 :- 21.700 (Max)
" " " " 40 & 41 - 92 & 93 :- 21.698 (Min)

DIM "A"

Max DIM @ Blade No. 80 14.598
Min " " " 1 14.594

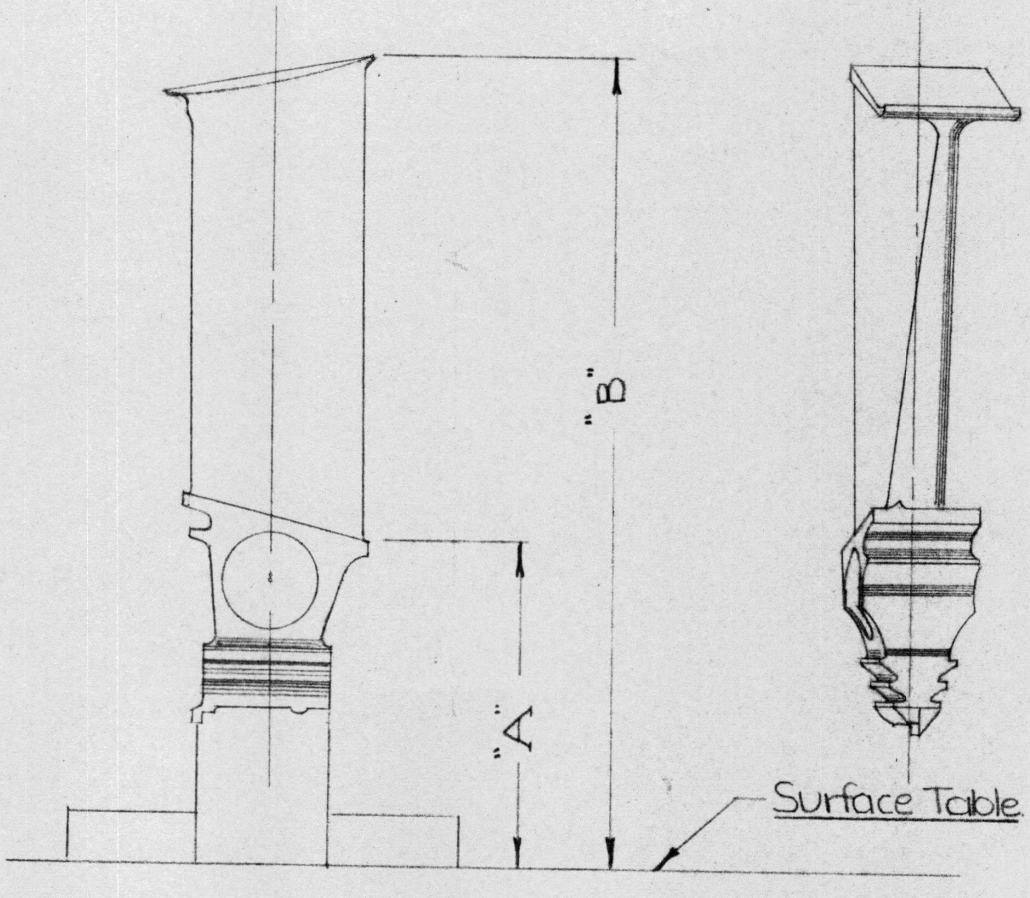
---

25. Hours

DIM "B" between Blade No. 1 & 2 - 53 & 54 :- 21.703
" " 40 & 41 - 92 & 93 :- 21.701

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 9 OF 57
DATE 6-4-56	MELBOURNE VICTORIA	REPORT No. E.300
WEIGHT	Blade Turbine H.P.	MODEL No. Section 6

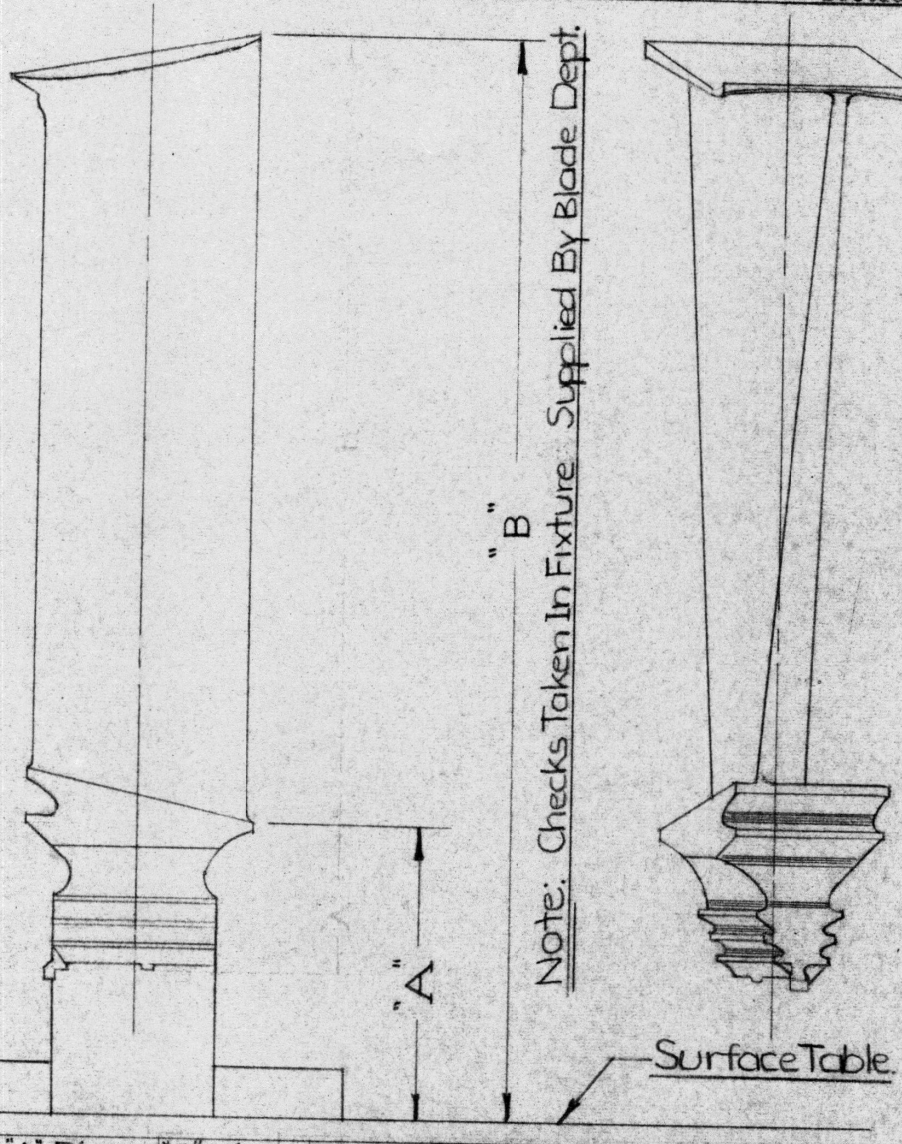


Blade No	"A" Dim New.	"B" Dim New	"A" Dim. After Green	"B" Dim. After Green	"A" Dim. After 25 Hr.	"B" Dim. After 25 Hr.
1	3.212"	6.569"			3.212"	6.572"
2	3.212"	6.569"			3.213"	6.570"
25	3.213"	6.569"			3.213"	6.570"
26	3.219"	6.572"			3.218"	6.571"
51	3.212"	6.568"			3.210"	6.567"
52	3.210"	6.572"			3.211"	6.571"
75	3.210"	6.568"			3.208"	6.570"
76	3.219"	6.570"			3.218"	6.570"

Note:- Checks Taken In Fixture Supplied By Blade Dept.

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 10 OF 57
DATE 6-4-56		REPORT NO. E.300
WEIGHT	Blade Turbine L.P.	MODEL NO. Section 6

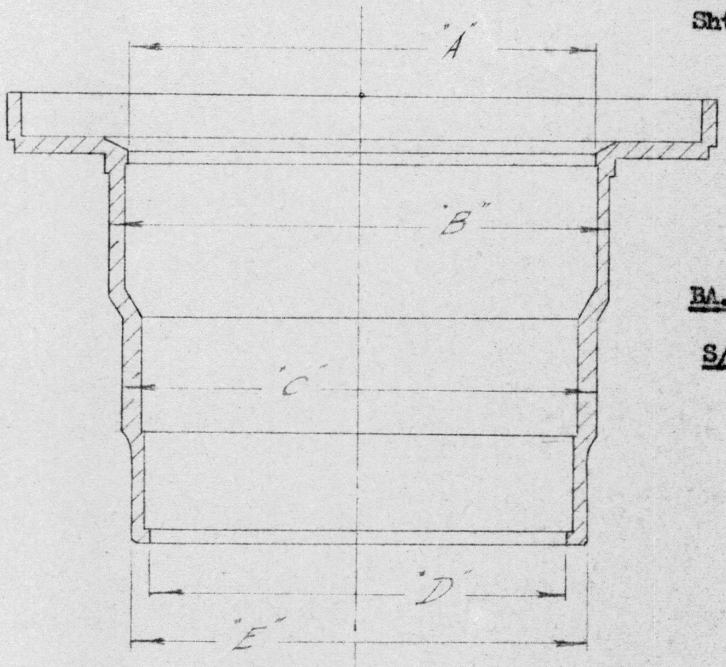


Blade Nº	"A" Dim. New.	"B" Dim. New.	"A" Dim. After Green	"B" Dim. After Green	"A" Dim. After 25 Hr.	"B" Dim. After 25 Hr.
1	2.964"	7.840"			2.964"	7.840"
2	2.963"	7.830"			2.963"	7.830"
17	2.959"	7.831"			2.961"	7.833"
18	2.955"	7.832"			2.956"	7.832"
35	2.964"	7.830"			2.964"	7.830"
36	2.963"	7.834"			2.963"	7.834"
53	2.964"	7.832"			2.960"	7.831"
54	2.969"	7.832"			2.968"	7.832"

FORM M317—1/40.

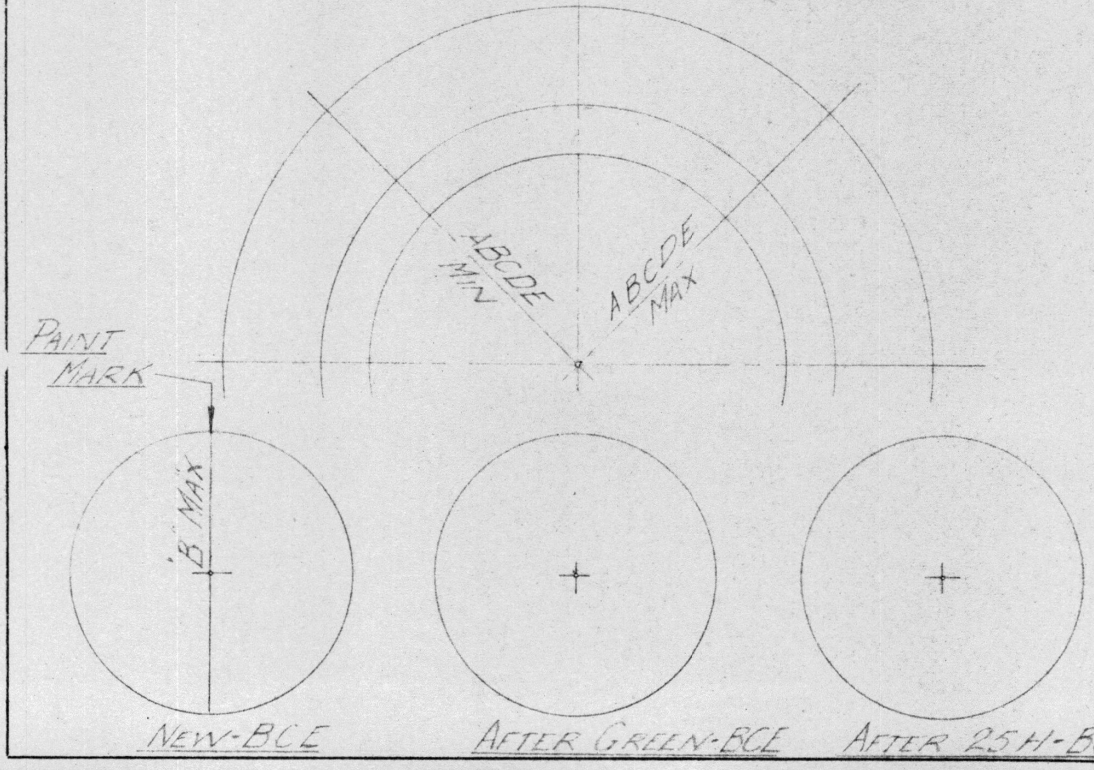
PREPARED BY: JFH 9-3-50	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 11 OF 57
DATE		REPORT NO. E.300
WEIGHT	SLEEVE TURRET MOUNT BA 78228	MODEL NO. Section 6

Sht. 1 of 2



BA. 78228

S/N . 33



FORM M317—1/40.

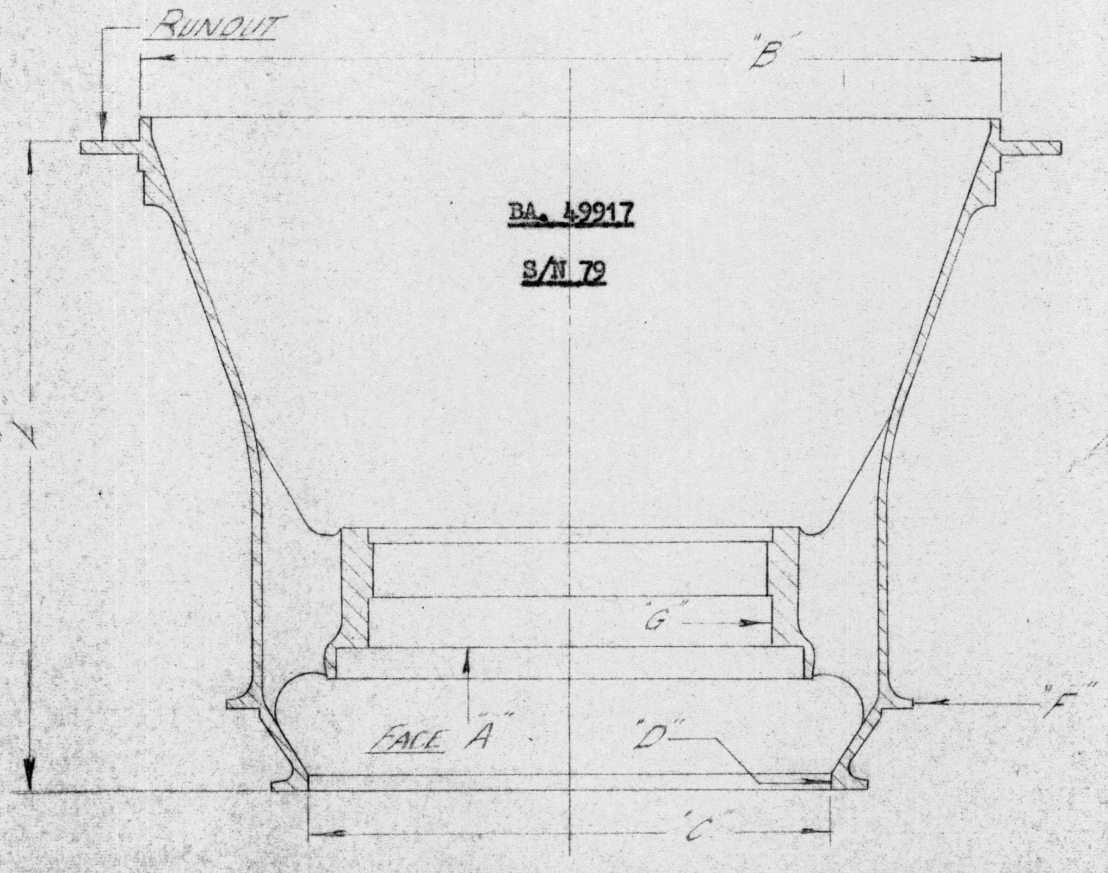
PREPARED BY: JPH 12-3-56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 12 OF 57
DATE:		REPORT NO. E.300
WEIGHT	SLEEVE TURBINE SHAFT BA78228	MODEL NO. Section 6

Sht. 2 of 2

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25H
SPIGOT DIA "A"	MAX	5·77525"	5.7758"		5.7772"
	MIN	5 775"	5.7756"		5.7768"
	OVALITY		.0002"		.0004"
REAR GLAND DIA "B"	MAX	6 150"	6.149"		6.1495"
	MIN	6·149"	6.149"		6.1495"
	OVALITY		Nil		.000"
BEARING DIA "C"	MAX	5·876"	5.8757"		5.877"
	MIN	5·8755"	5.8753"		5.8765"
	OVALITY		.0004"		.0005"
FRONT SEAL DIA "E"	MAX	5 575"	5.574"		5.5745"
	MIN	5 574"	5.5735"		5.5735"
	OVALITY		.0005"		.001"
SPIGOT DIA "D"	MAX	5·25025"	5.2507"		5.2515"
	MIN	5 250"	5.2501"		5.2505"
	OVALITY		.0006"		.001"

FORM M817—1/40.

PREPARED BY: JFH 1-2-60	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 13 OF 57
DATE		REPORT NO. E.300
WEIGHT	SECTION 1060	MODEL NO. Section 6



DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
DIA "B"	MAX	15·800"	15.795"		15.803" Side
	MIN	15·795"	15.795"		15.797" Top
	OVALITY		.000"		.006"
DIA "C"	MAX	9·5505"	9.550"		9.552" Top
	MIN	9.550"	9.549"		9.546" Side
	OVALITY		001"		.006"
"L"	MAX	11·900"	11.903"		11.900"
	MIN	11·890"	11.903"		11.900"
RUNOUT WITH RESPECT TO FACE "A"		·001"	.0014"		.0035"
"D" CONCENTRISITY WITH "G"		·002"	.0012"		.0045"
"F" CONCENTRISITY WITH "G"		001"	.0014"		.0025"

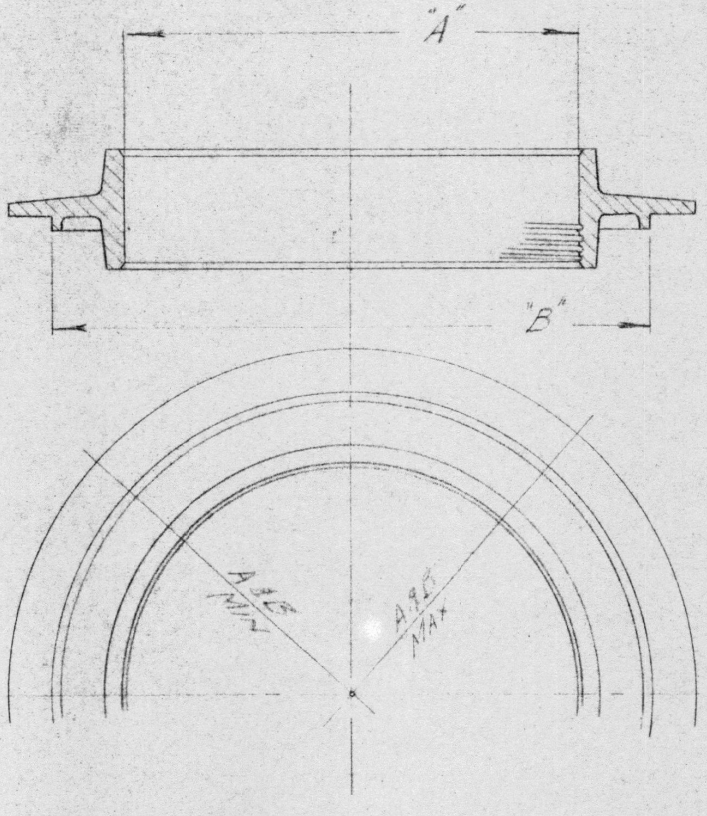
REAR BEARING HOUSING

FORM M317—1/40.

PREPARED BY: JRH 2 3 56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 14 OF 57
DATE		REPORT NO. E.300
WEIGHT	SECTION 1060	MODEL NO. Section 6

BA. 2075

S/N 159

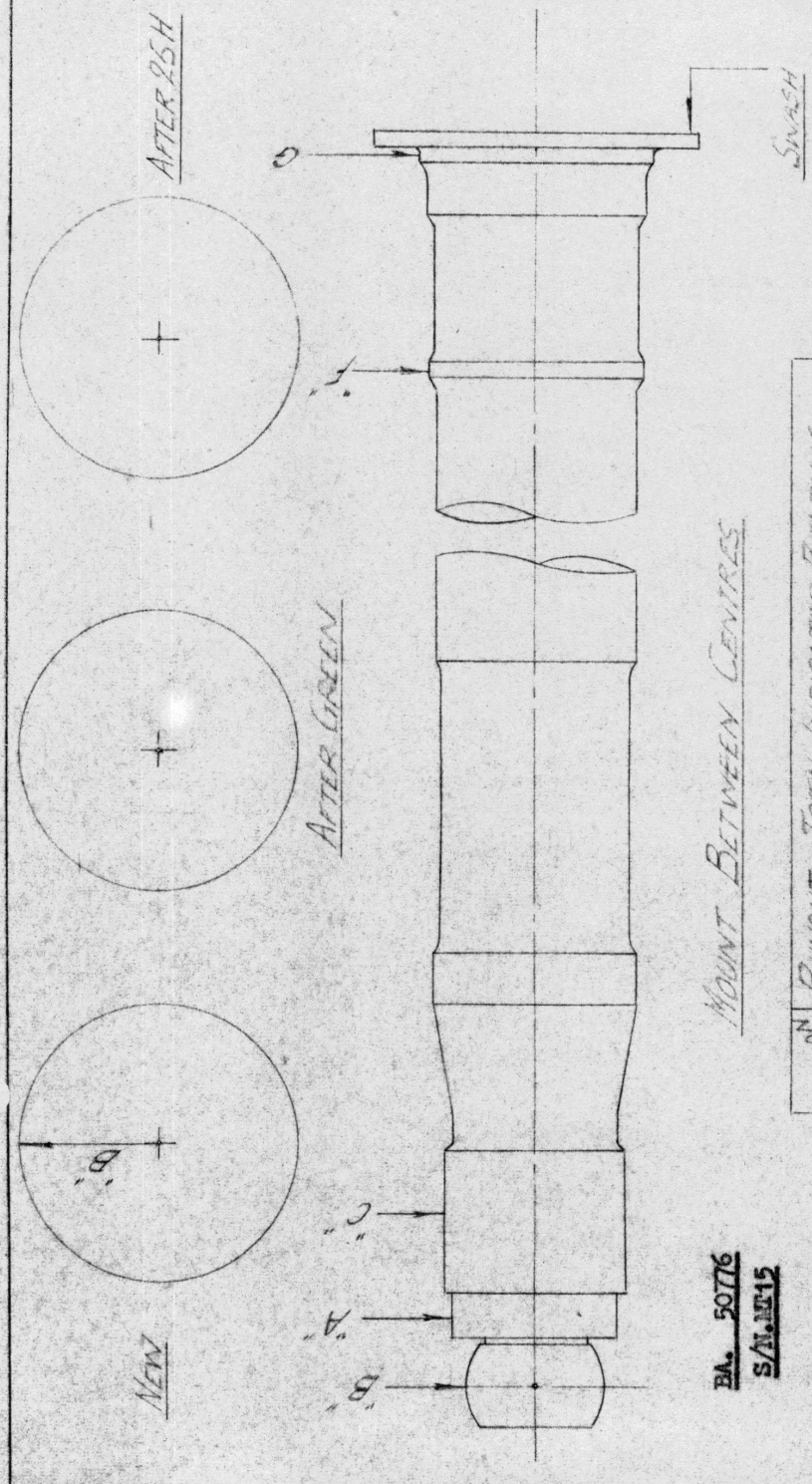


FRONT GLAND - REAR BEARING HOUSING

DESCRIPTION		TRG SIZE	NEW SIZE	AFTER GRIND	AFTER 25H
SEAL DIA "A"	MAX	5.592"	5.5925"		5.5925"
	MIN	5.591"	5.592 "		5.5925"
	OVALITY		.0005"		.000 "
SPIGOT DIA "B"	MAX	7.3495"	7.3495"		7.350 "
	MIN	7.3485"	7.349 "		7.3495"
	OVALITY		.0005"		.0005"

FORM M317-1/40.

PREPARED BY: JPH 9-3-56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 15 OF 57
DATE		REPORT NO. E.300
WEIGHT BA50776	ASSY - TURBINE SHAFT & BALL PEG	MODEL NO. Section 6



POSITION	RUNOUT - TOTAL INDICATOR READING			
	DRG ALLOW	NEW	AFTER GREEN	AFTER 25H
B	.00025"	.0004"		.0006"
A	.00025"	.0002"		.0006"
C	.00025"	.001"		.0007"
F	.00025"	.0005"		.0008"
G	.00025"	.001"		.001"
SWASH	.00025"	.0003"		.0004"

BA. 50776
S/N. MT15

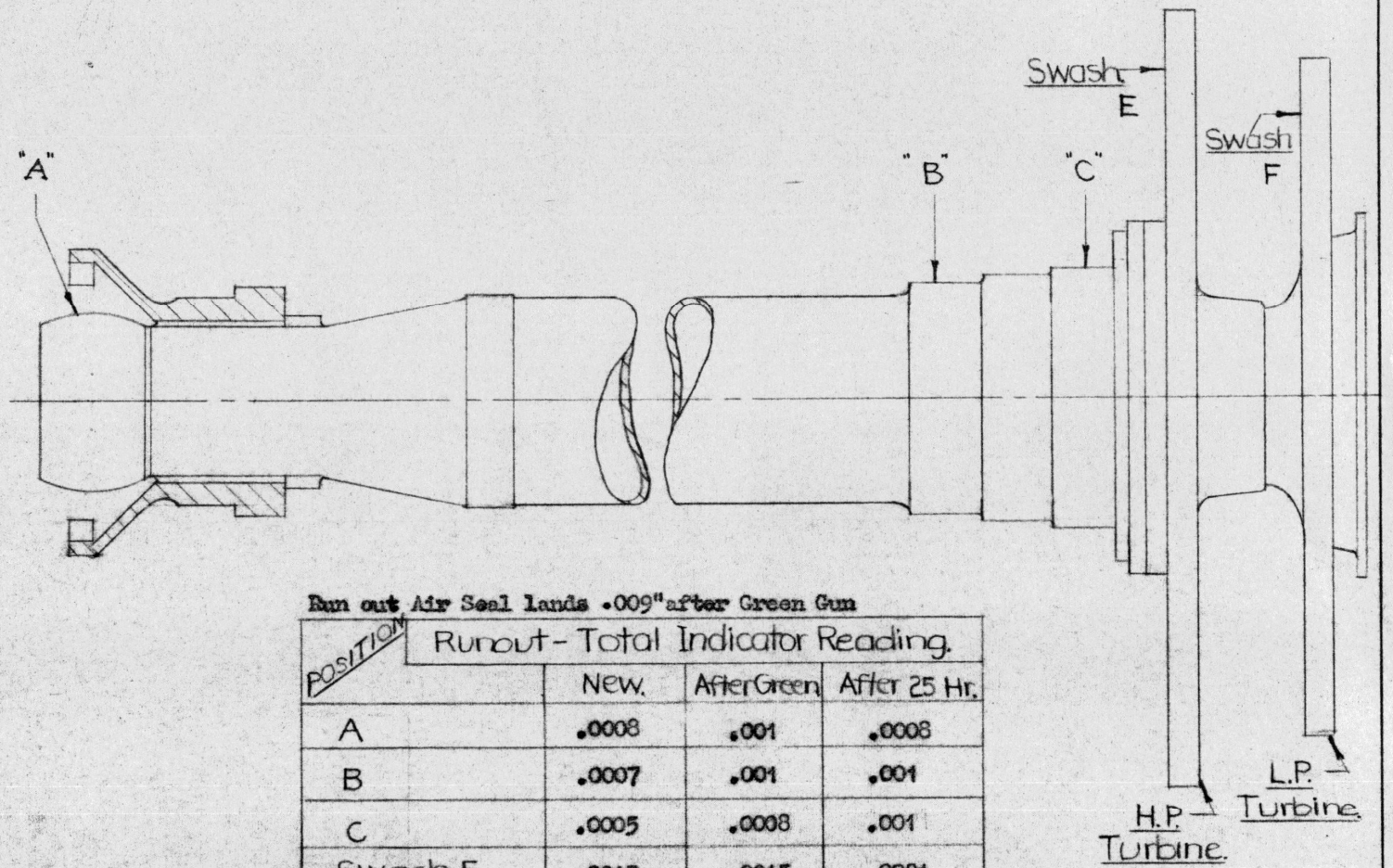
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

PAGE NO. 16 OF 57
REPORT NO. E.300
MODEL NO. Section 6

PREPARED BY: I.L.B.
DATE: 6-4-56
WEIGHT:

Turbine Wheels And Shaft

Set Up On Slave Bearings.

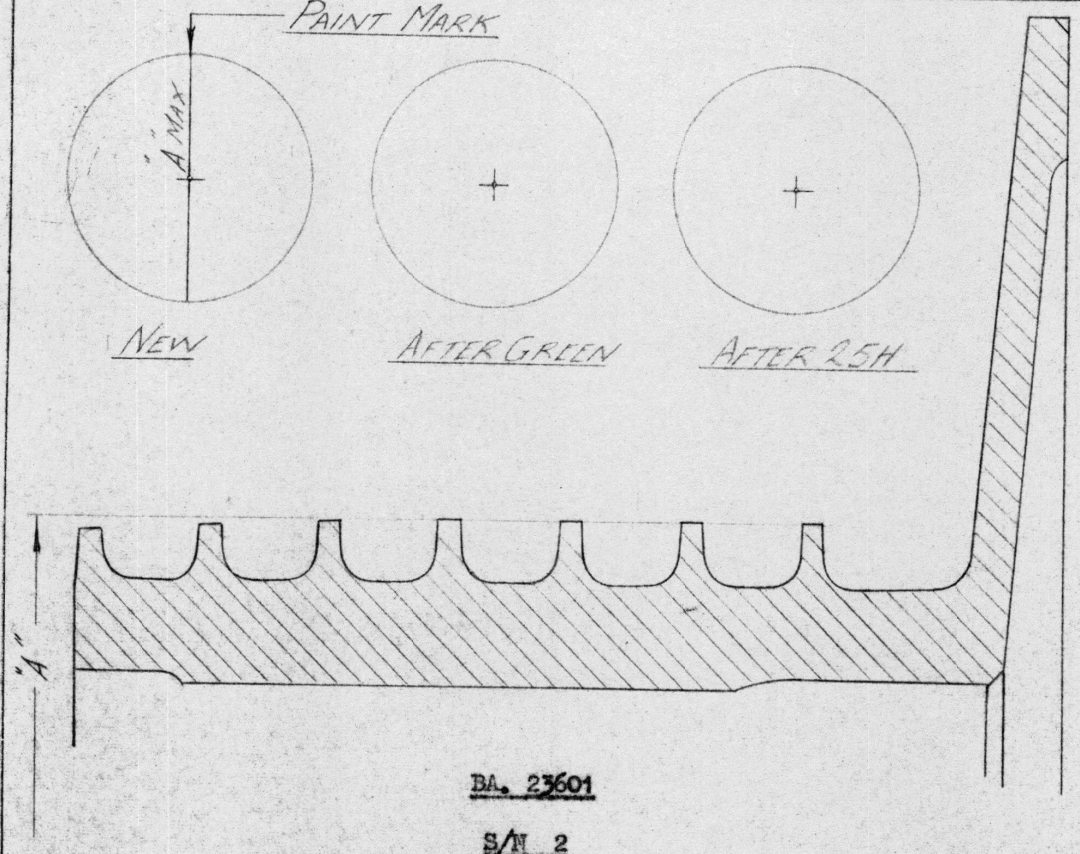


Run out Air Seal lands .009" after Green Gun

POSITION	Runout - Total Indicator Reading.		
	New.	After Green	After 25 Hr.
A	.0008	.001	.0008
B	.0007	.001	.001
C	.0005	.0008	.001
Swash E.	.0015	.0015	.0021
Swash F.	.001	.0025	.0025

FORM M317—1/40.

PREPARED BY: JPH 13.3.56.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 17 OF 57
DATE		REPORT No. E.300
WEIGHT	LABRINTH SEAL BA 23601	MODEL No. Section 6



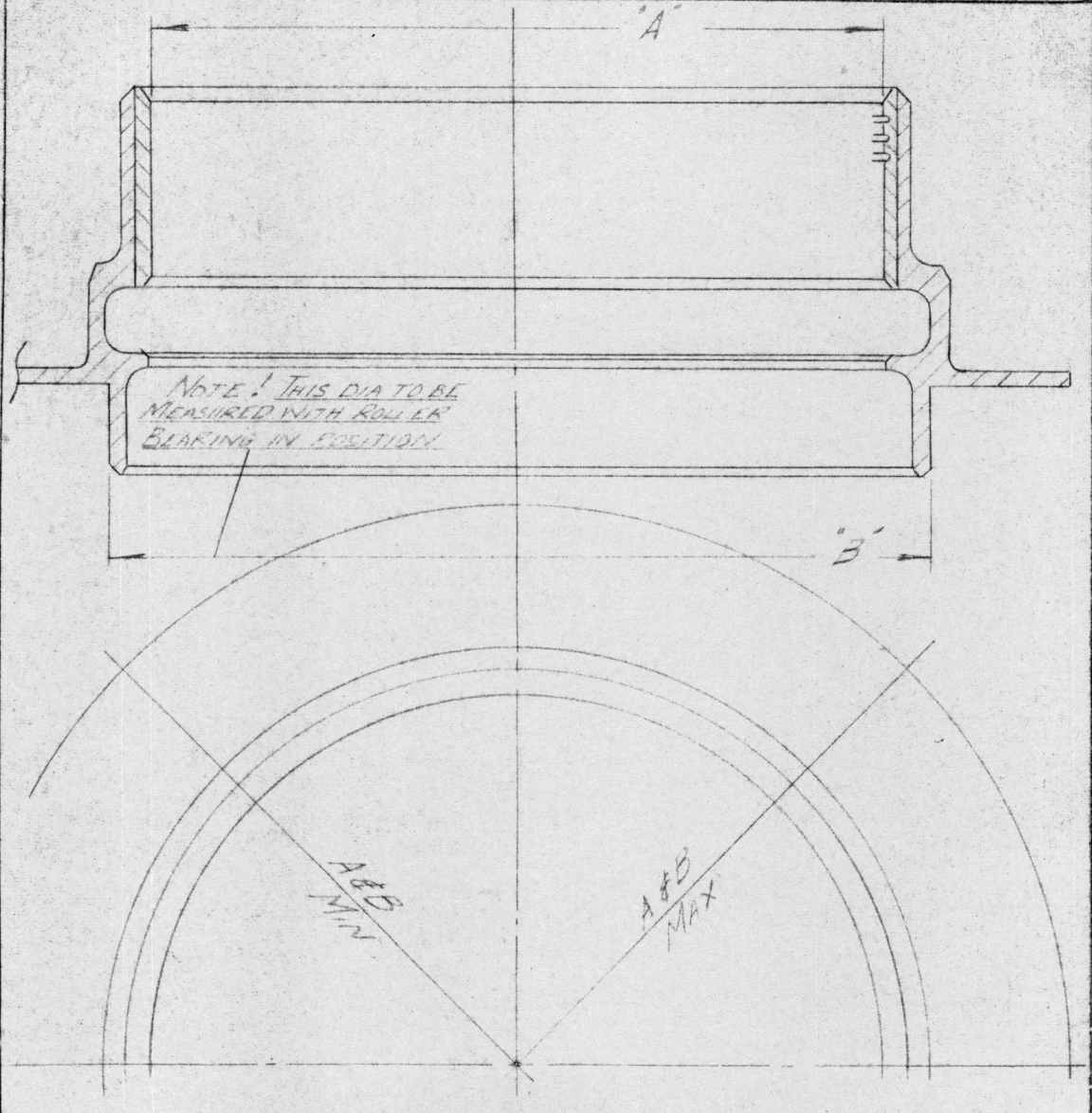
BA. 23601

S/N 2

DESCRIPTION		DRG SIZE	NEW	AFTER GREEN	AFTER 25H
SEAL DIA "A"	MAX	9.190"	9.1885"		9.189"
	MIN	9.188"	9.1872"		9.186"
	OVALITY		.0013"		.003"

FORM M317—1/40.

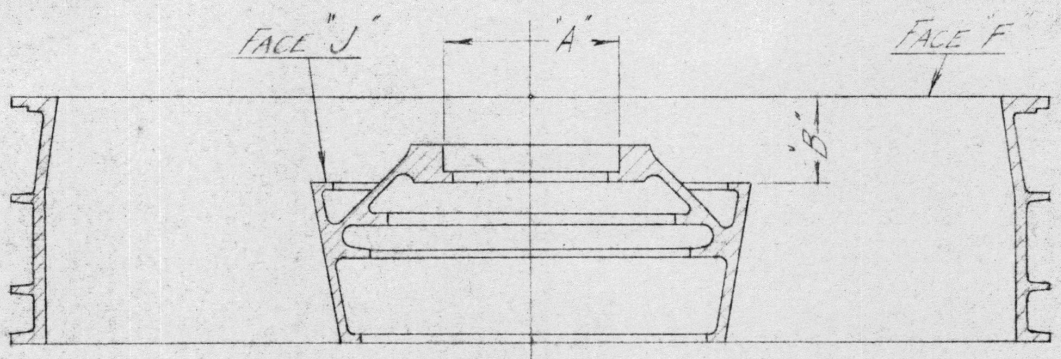
PREPARED BY: JPH 6-3-56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 18 OF 57
DATE		REPORT No. B.300
WEIGHT	LINER & OIL SEAL BA18035.	MODEL No. Section 6



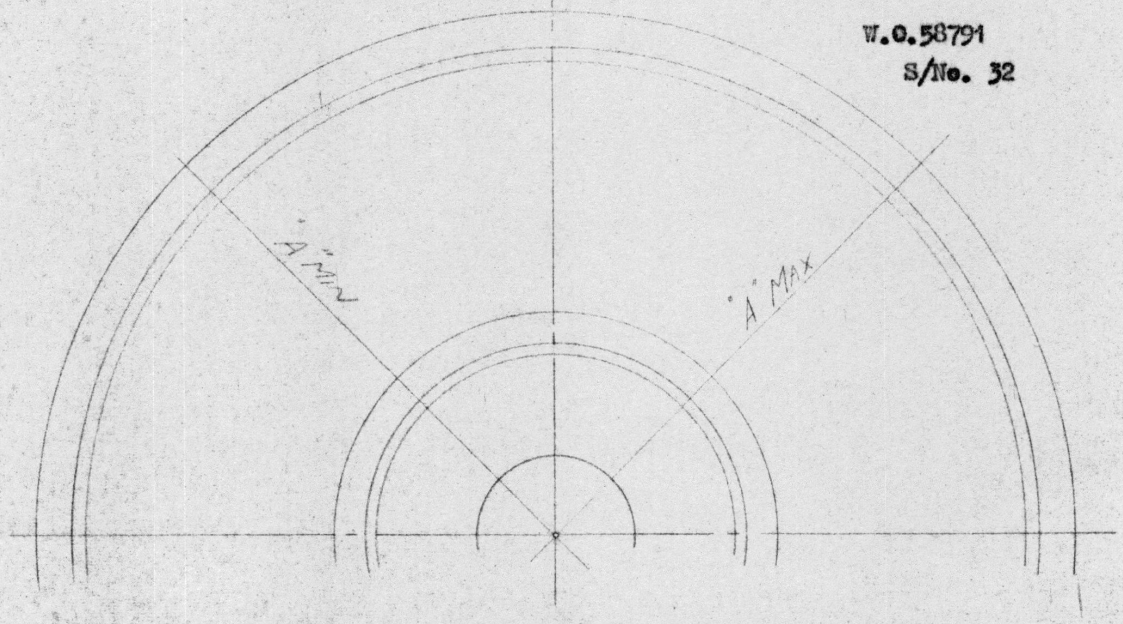
DESCRIPTION		DRG SIZE	NEW	AFTER GRIND	AFTER 25H
BORE DIA A	MAX	4.964"	4.9635"		4.9665"
	MIN	4.963"	4.9630"		4.9653"
	QUALITY		.0005"		.0012"
SPIGOT DIA B	MAX	5.4492"	5.449"		5.4491"
	MIN	5.4487"	5.4483"		5.4487"
	QUALITY		.0007"		.0004"

FORM M317–1/40.

PREPARED BY: 6-3-56 JFH	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 19 OF 57
DATE		REPORT No. E.300
WEIGHT	FRONT BEARING HOUSING EA.59567	MODEL No. Section 6



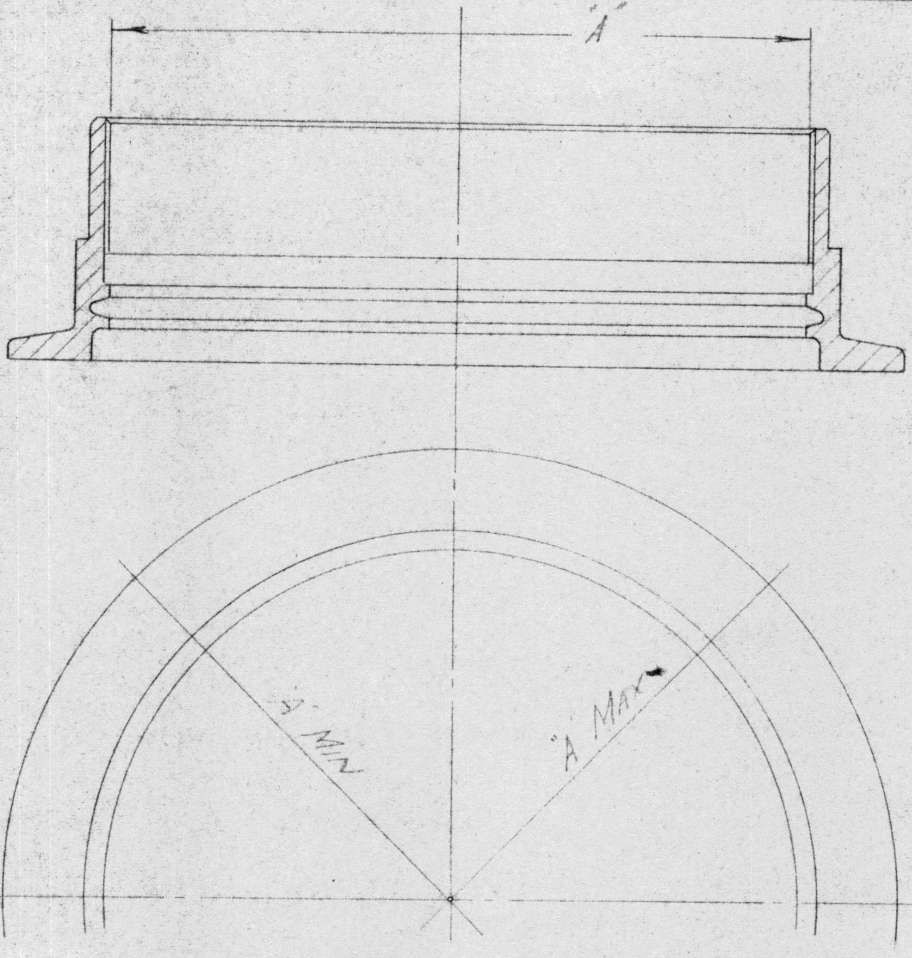
W.O.58791
S/No. 32



DESCRIPTION		DRG SIZE	NEW	AFTER GRIND	AFTER 25H.
BORE DIA "A"	MAX	5.4505"	5.4514"		5.4515"
	MIN	5.450"	5.4512"		5.4515"
OVALITY			.0002"		NIL.
"B"	MAX	2.633"	2.636"		2.630"
	MIN	2.630"	2.633"		2.627"
RUNOUT OF "F" WITH RESPECT TO "J"		.002"	.004"		.004"

FORM M317–1/40.

PREPARED BY: JPH 6-3-56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 20 OF 57
DATE		REPORT NO. E.300
WEIGHT	SEALING GLAND BA2414	MODEL NO. Section 6



DESCRIPTION		DRG SIZE	NEW	AFTER GRIND	AFTER 25H
SEAL DIA A	MAX	5.767"	5.7688"		5.7677"
	MIN	5.766"	5.7665"		5.7660"
	OVALITY		.0023"		.0017"

FORM M317-1/40.

PREPARED BY: JPH	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 21	OF 57
DATE: 5-3-56	MELBOURNE VICTORIA	REPORT No.	E.300
WEIGHT	SWIRL VANES BA22039-BA23208	MODEL No.	Section 6

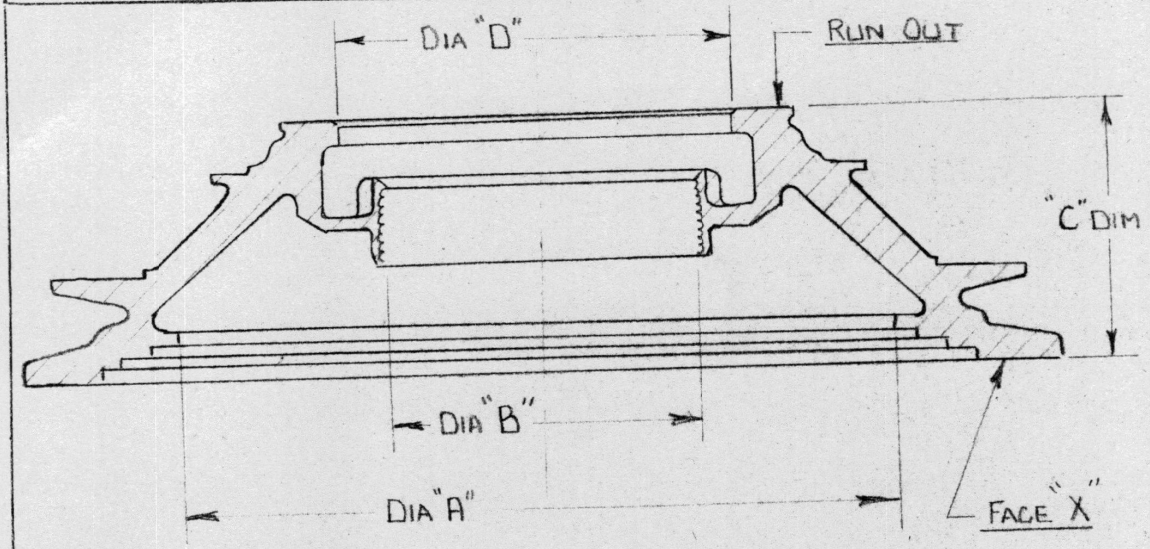
MASTER VANE No 1. NUMBER VANES 2-37 CLOCKWISE LOOKING FROM FRONT OF ENGINE

SWIRL VANE ANGLES

VANE No	Open (NEW)	Closed (NEW)	Open (AFTER GREEN)	Closed (AFTER GREEN)	Open (AFTER 25H)	Closed (AFTER 25H)	VANE No	Open (NEW)	Closed (NEW)	Open (AFTER GREEN)	Closed (AFTER GREEN)	Open (AFTER 25H)	Closed (AFTER 25H)
1	1½°	41½°	2½°	41½°	2¼°	41½°	20	0°	40°	¾°	39¾°	1°	39½°
2	-	-	-	-	-	-	21	-	-	-	-	-	-
3	-	-	-	-	-	-	22	-	-	-	-	-	-
4	-	-	-	-	-	-	23	-	-	-	-	-	-
5	½°	40½°	1°	40°	¾°	40°	24	¾°	40¾°	1¼°	40¼°	1°	40¼°
6	¼°	40¼°	1°	40°	¾°	40°	25	¼°	40¼°	¾°	39¾°	½°	39¾°
7	0°	40°	¾°	39¾°	1°	39½°	26	½°	40½°	1¼°	40°	1°	40°
8	¾°	40½°	1¼°	40¼°	1°	40¼°	27	-	-	-	-	-	-
9	-	-	-	-	-	-	28	-	-	-	-	-	-
10	-	-	-	-	-	-	29	-	-	-	-	-	-
11	0°	40°	½°	39½°	0°	39½°	30	¼°	40½°	¾°	39¾°	½°	39¾°
12	½°	40½°	1¼°	40°	1°	40°	31	0°	40°	¾°	39¾°	½°	39¾°
13	½°	40½°	1°	40¼°	1°	40°	32	¼°	40¾°	¾°	39¼°	¾°	39¾°
14	½°	40½°	1¼°	40¼°	1°	40°	33	-	-	-	-	-	-
15	-	-	-	-	-	-	34	-	-	-	-	-	-
16	-	-	-	-	-	-	35	-	-	-	-	-	-
17	-	-	-	-	-	-	36	1¼°	41½°	1¾°	40¾°	1¾°	40¾°
18	¾°	40½°	1¼°	41¼°	1½°	40°	37	¾°	41°	1¼°	40¼°	1°	40°
19	¼°	40¼°	¾°	39¾°	1°	39¾°							
						AVERAGE:-		47°	40.5°	1.08°	40.12	.962°	40°

FORM M317—1/40.

PREPARED BY: DAVIS	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 22 OF 57
DATE 18-9-56		REPORT NO. E.300
WEIGHT	CENTRE BEARING HSG	MODEL NO. Section 6



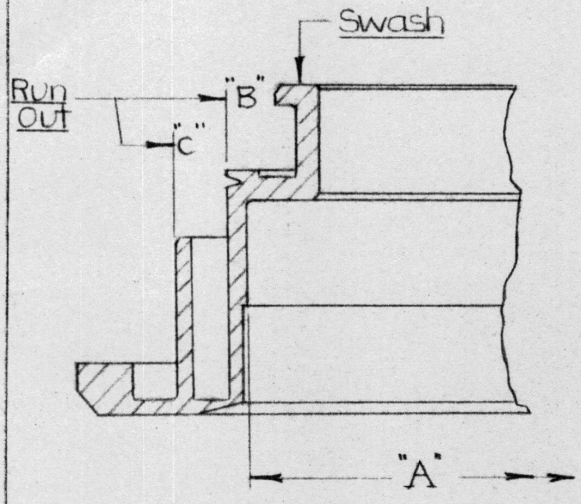
CA.20675 S/No. 1.

W/O 56935

POSITION		NEW	AFTER GREEN	AFTER 2.5 HR
DIA "A"	MAX	13.608"		13.604"
	MIN	13.608"		13.604"
DIA "B"	MAX	6.3674"		6.368"
	MIN	6.3674"		6.367"
"C" DIM				
DIA "D"	MAX	7.6201		
	MIN	7.6201		
RUN OUT WRT FACE 'X'		.003"		

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 23 OF 57
DATE 11-4-56		REPORT NO. F.300
WEIGHT	SEALING LAND FRONT BEARING. BA2901	MODEL NO. Section 6



POSITION		New	Green Run	25 HR Test.
"A"	Max	4.7755"		4.776"
	Min.	4.7755"		4.776"
Swash.		Nil		Nil
Runout "B"		.001"		.0015"
Runout "C"		.0015"		.002"

BA2901 S/N.59

X1551 SL515

FORM M317-1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 24 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6

COMPRESSOR SHAFTS & 12TH STAGE ROTOR WHEELS

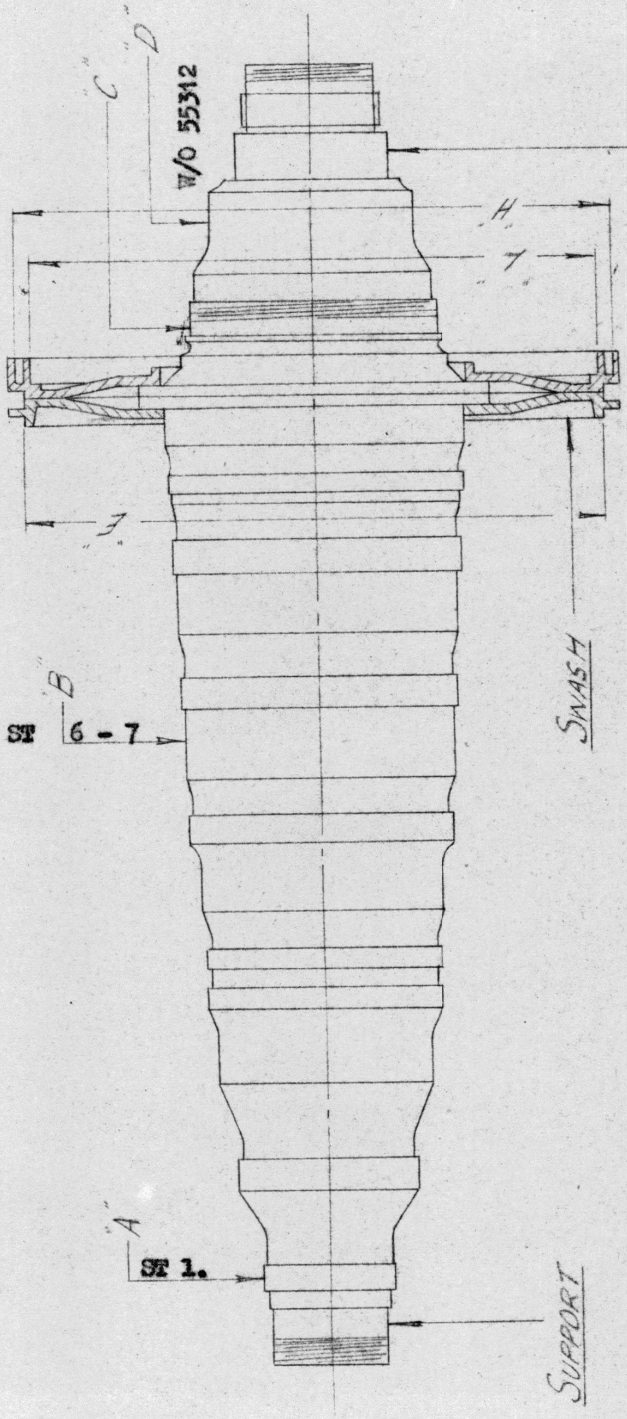
DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25H
SPIGOT DIA "E"	MAX	18.390"	18.390"		18.390"
	MIN	18.389"	18.390"		18.390"
	OVALITY		Nil		Nil
DIA. "L"	MAX	18.302"	18.304"		18.304"
	MIN	18.300"	18.304"		18.304"
	OVALITY		Nil		Nil
DIA "H"	MAX	19.202"	19.205"		19.205"
	MIN	19.200"	19.205"		19.205"
	OVALITY		Nil		Nil
SWASH			.0032"		.0025"

RUN OUT WHEN SUPPORTED AS SHOWN			
POSITION	NEW	AFTER GREEN	AFTER 25H
A	.0004"		.0005"
B	.0007"		.0006"
C	.0004"		.0005"
D	.0005"		.0005"

GROWTH CHECKS			
DIAMETER	NEW	AFTER GREEN	AFTER 25HR
A	4.1490		4.1490
B	8.5297		8.5296
C	7.774"		7.774"
D	6.3495		6.3497"

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 25 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6

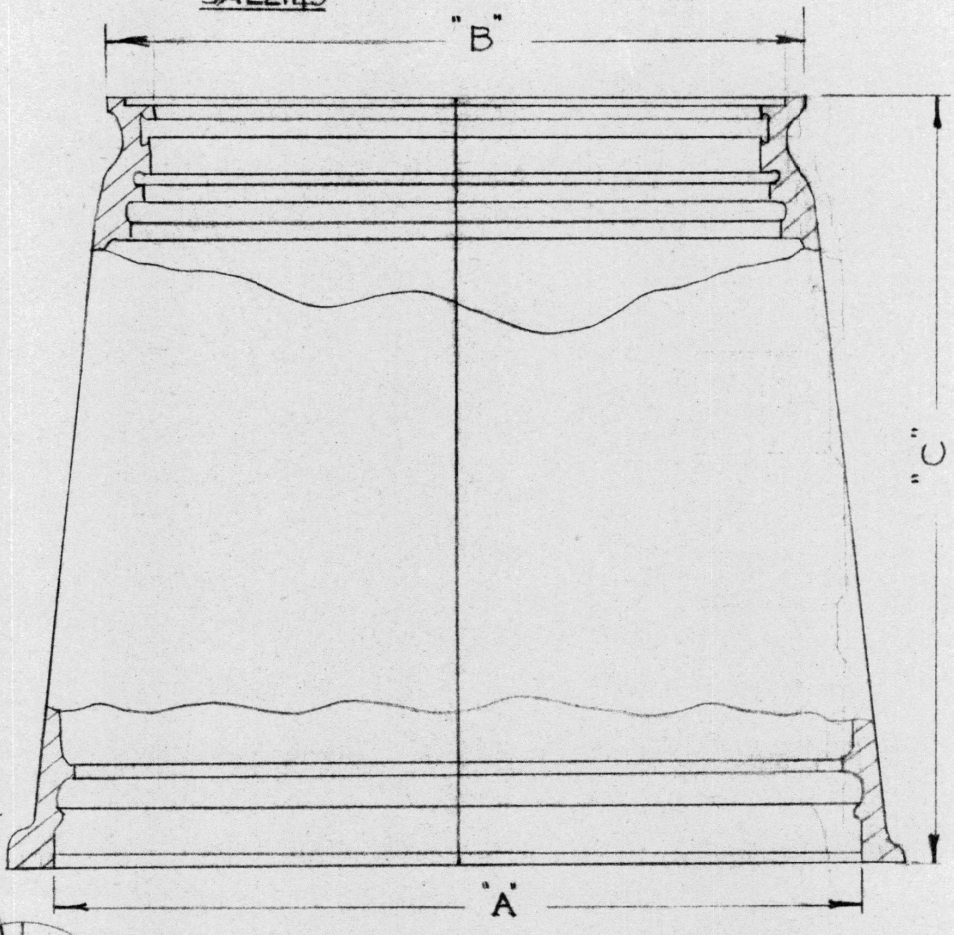


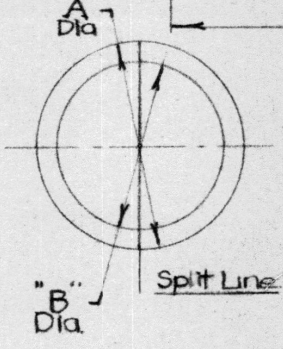
COMPRESSOR SHAFTS & 12TH STAGE ROTOR WHEELS

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 26 OF 57
DATE 13-4-56	MELBOURNE VICTORIA	REPORT NO. R.300
WEIGHT	COMPRESSOR CASING	MODEL NO. Section 6

SA22143





POSITION	NEW		GREEN RUN	25 HR TEST
"A"	Max.	28.9485"		28.9415"
	Min.	28.9485"		28.9415"
"B"	Max.	23.790"		23.7795"
	Min.	23.790"		23.7785"
"C"	Max	28.456"		28.460"
	Min.	28.456"		28.455"

NEW.			
STAGE	SHAFT SIZE	BORE SIZE	FIT
1	4·1490	4·1505	·0015L
2	6·625	6·6251	·0001L
3	6·625	6·6254	·0004L
4	7·5498	7·550	·0002L
5	7·5498	7·4999	·0011L
6	8·5297	8·5305	·0005L
7	8·5297	8·5305	·0008L
8	8·8645	8·8653	·0008L
9	8·8645	8·8653	·0008L
10	9·1500	9·1502	·0002L
11	9·4744	9·4756	·0012L

AFTER 25HR TEST			
1	4·1490	4·1506	·0016L
2	6·6253	6·6254	·0001L
3	6·6253	6·6257	·0004L
4	7·5497	7·5505	·0008L
5	7·5497	7·5505	·0008L
6	8·5296	8·5303	·0007L
7	8·5296	8·5315	·0019L
8	8·8641	8·8658	·0017L
9	8·8641	8·8657	·0016L
10	9·1499	9·1508	·0009L
11	9·4737	9·4757	·002L

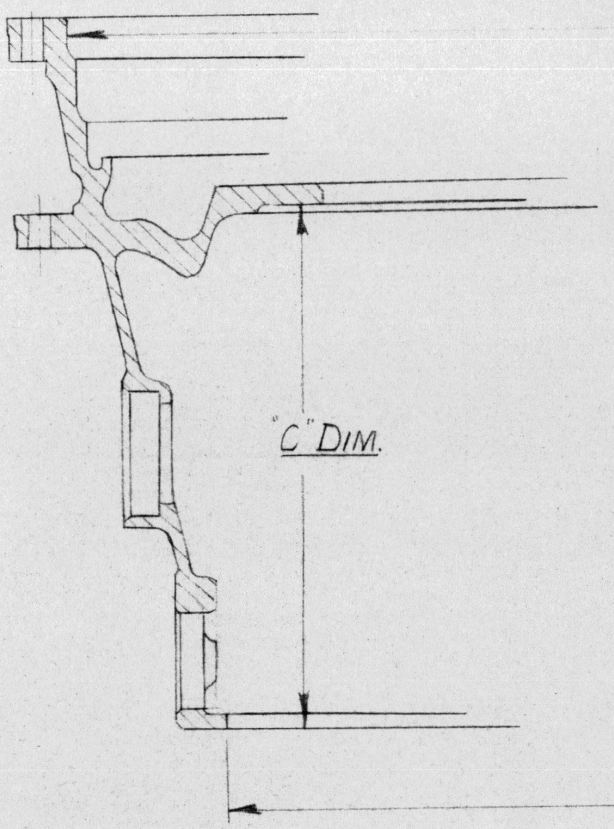
PREPARED BY: I.L.B.
DATE: 11-4-56
WEIGHT:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

Compressor-Discs Shaft Fits.

MODEL NO. Section 6
REPORT NO. E.300
PAGE NO. 27 OF 57

FORM M317—1/40.



COMPRESSOR OUTLET CASING

POSITION		NEW	AFTER GREEN	AFTER 25 HR
"A" DIA	MAX	24.882"		24.883"
	MIN	24.880"		24.881"
"B" DIA	MAX	19.857"		19.861"
	MIN	19.856"		19.858"
"C" DIM	MAX	8.501"		8.503"
	MIN	8.500"		8.501"

SECTION 1.373

BA.29111 S/N 40.

P.P.10168 P.P.10128

WEIGHT

DATE

PREPARED BY:

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

MODEL NO. Section 6

REPORT NO. E.300

PAGE NO. 28 OF 57

FORM M317-1/40.

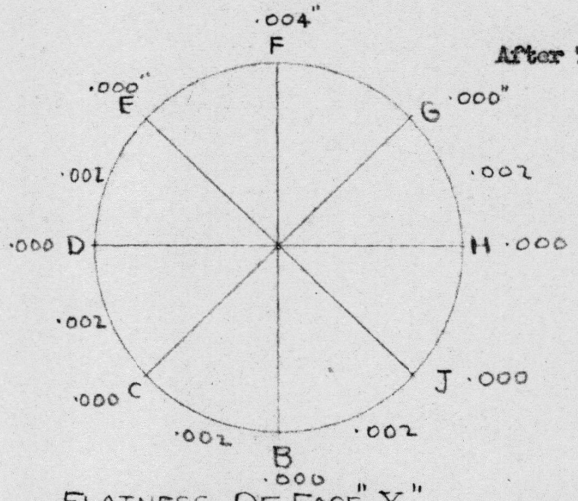
FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 29 OF 57
DATE 18-4-56		REPORT NO. E.300
WEIGHT	EXPANSION CHAMBER.	MODEL NO. Section 6

TYPICAL

BA.65630

Nº EXPANSION CHAMBER.				
POSN.	NEW		AFTER GREEN	AFTER 25 HR.
"A"	MAX.	11.005"		11.010"
	MIN.	11.000"		10.995"

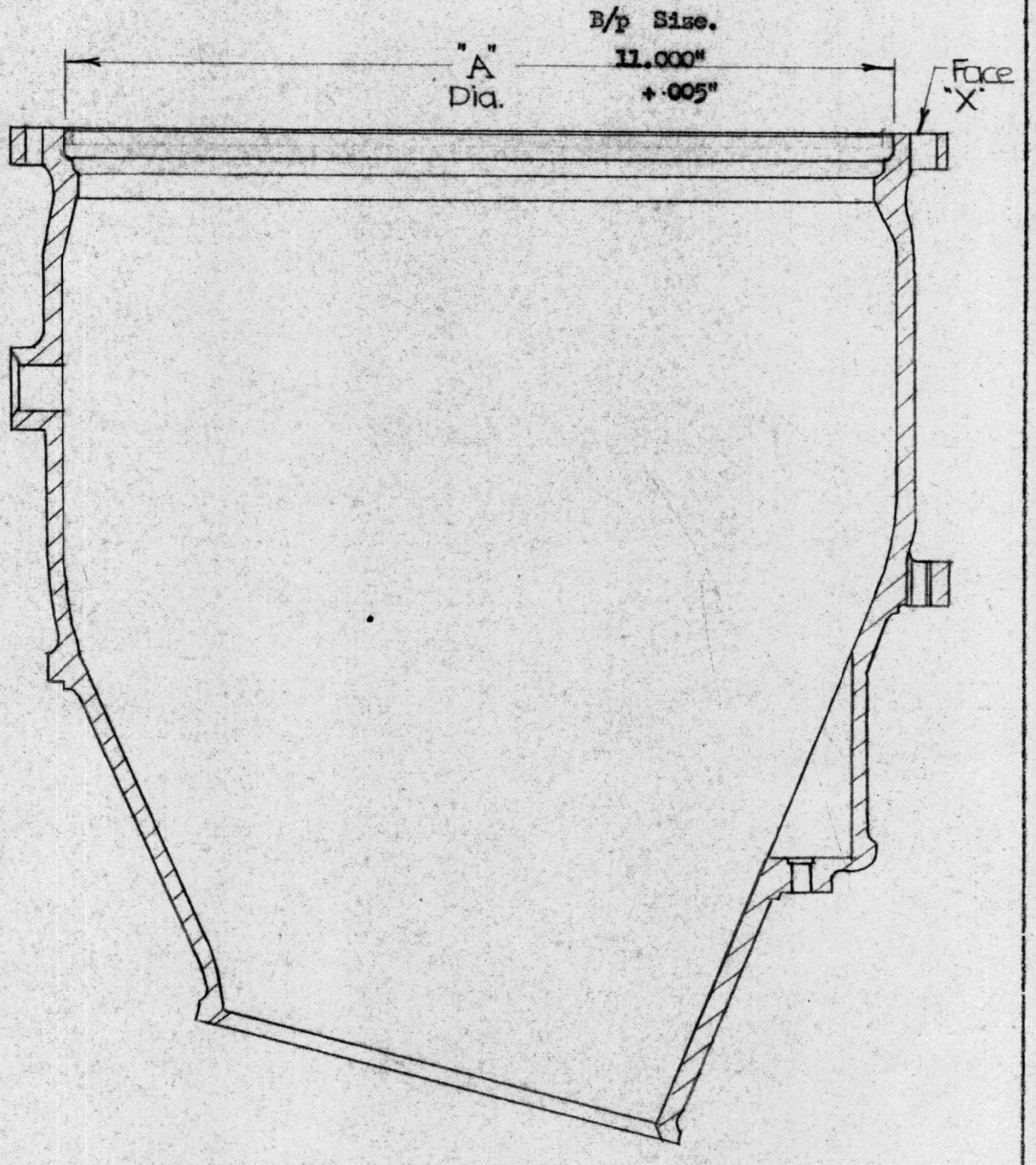


FLATNESS OF FACE "X"
AT THESE POINTS.

Sheet 2 of 2

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 30 OF 57
DATE 18-4-56		REPORT NO. E.300
WEIGHT	EXPANSION CHAMBER.	MODEL NO. Section 6

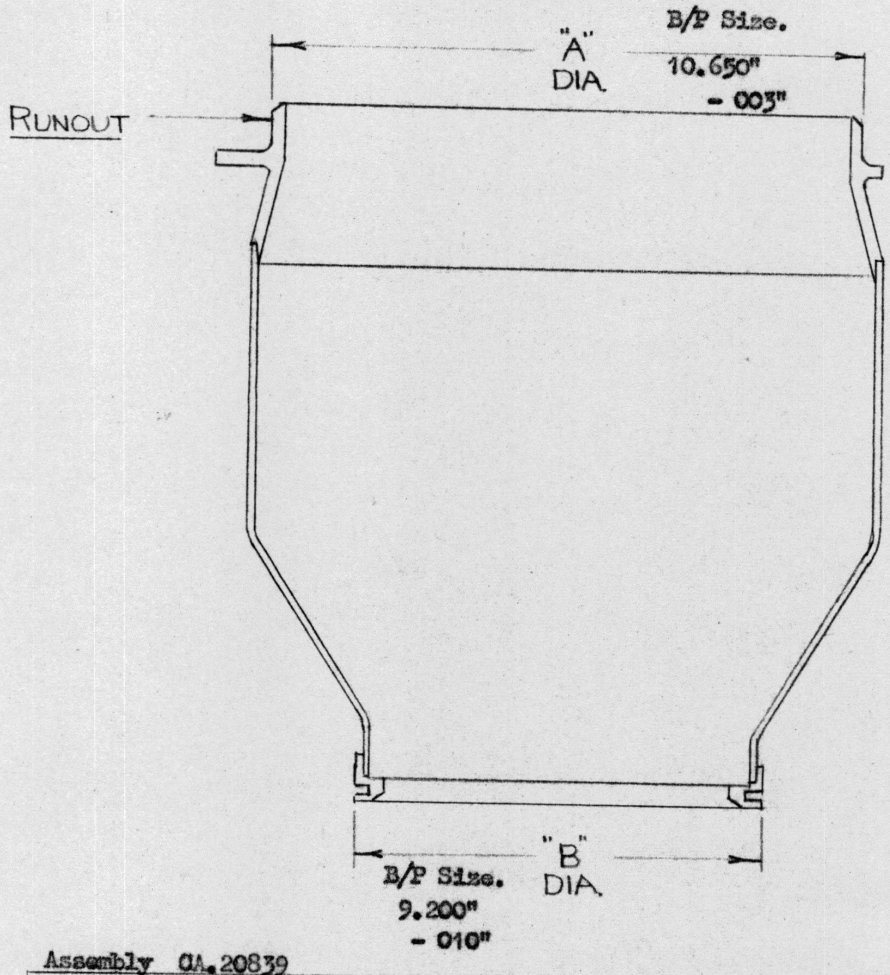


Sheet 1 Of 2

FORM M317—1/40.

Assembly BA.21945

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 31 OF 57
DATE 18-4-56	MELBOURNE VICTORIA	REPORT No. E.300
WEIGHT	OUTER CASING	MODEL No. Section 6



Assembly CA.20839

TYP. OUTER CASING

POSN		NEW	AFTER GREEN	AFTER 25 HR.
"A" DIA.	Max.	10.655"		10.652"
	Min.	10.640"		10.642"
"B" DIA	Max.	9.200"		9.201"
	Min.	9.199"		9.199"
Runout.		.013"		.011"

DIA.		POSITION	NEW	AFTER GREEN	25 HR.TEST.
"A"	MAX.	@ Vane No. 45 L.P. Turbine Lab Seal (Inner)	20.766"	20.758"	20.753"
	MIN.	@ Vane No. 28	20.750"	20.762"	20.758"
"B"	MAX.	@ Vane No. 45 " " " " (Outer)	21.254"	21.248"	21.253"
	MIN.	@ Vane No. 28	21.240"	21.252"	21.258"
"C"	MAX.	L.P. N.G.V. Outer Platform Seal.	29.886"	29.886"	29.876"
	MIN.		29.876"	29.875"	29.862"
"D"	MAX.	@ Vane No. 1 & 37 H.P. Turbine Lab Seal (Inner)	22.313"	22.309"	22.294"
	MIN.	@ Vane No. 18 & 54	22.311"	22.286"	22.263"
"E"	MAX.	@ Vane No. 1 & 37 " " " " (Outer)	22.750"	22.741"	22.731"
	MIN	@ Vane No. 18 & 54	22.746"	22.722"	22.697"
"F"	MAX.	@ Vane No. 1 & 37 H.P. N.G.V. Outer Platform Seal.	28.561"	28.555"	28.558"
	MIN.	@ Vane No. 18 & 54	28.544"	28.528"	28.530"
DIM "C"		Measurement taken @ Blade No. 30 & 63	29.881"	29.880"	29.876"
" "		" " " " No. 13 & 47	29.885"	29.884"	29.870"
" "		" " " " No. 22 & 56	29.876"	29.875"	29.862"
" "		" " " " No. 38 & 4	29.886"	29.886"	29.876"

L/P Dimensions 3' Vernier.
H/P " Inside Micrometer (Special)

Sheet 2 Of 2

PREPARED BY: I.L.B.
DATE 17-4-56
WEIGHT

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA

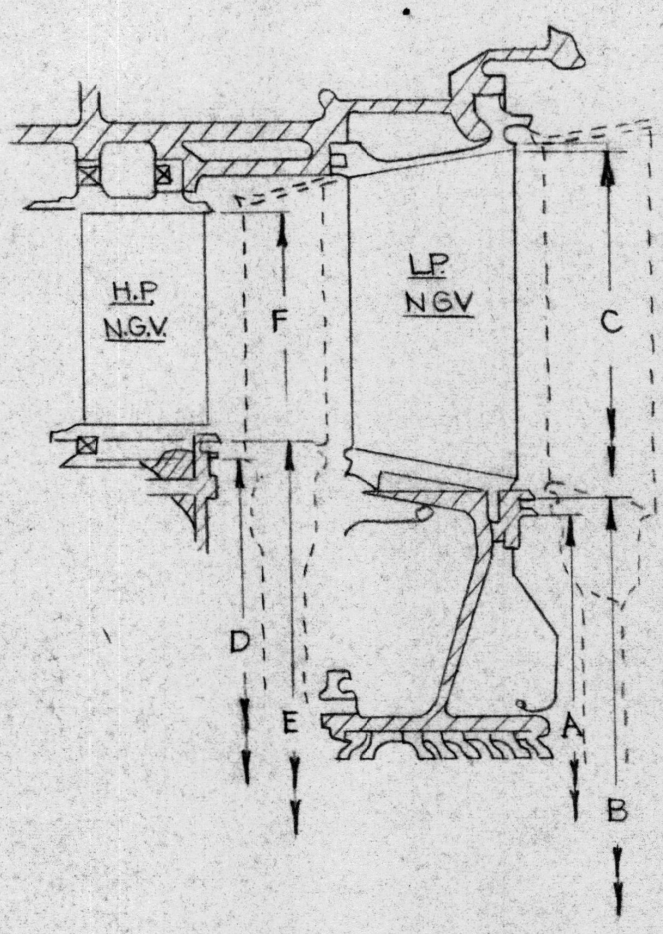
NOZZLE BOX LABYRINTH SEALS AND N.G.V. OUTER PLATFORM SEALS.

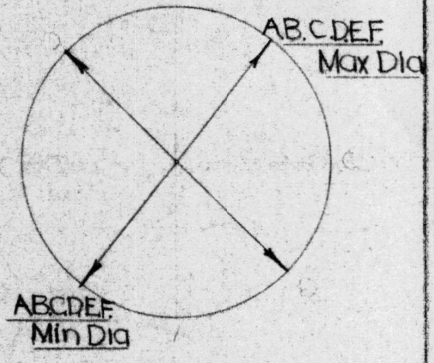
MODEL NO. Section 6
REPORT NO. E.306
PAGE NO. 32 OF 57

FORM M317-1/40.

FORM M317-1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 33 OF 57
DATE 16-4-56	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	NOZZLE BOX LABYRINTH SEALS AND N.G.V. OUTER PLATFORM SEALS.	MODEL NO. Section 6





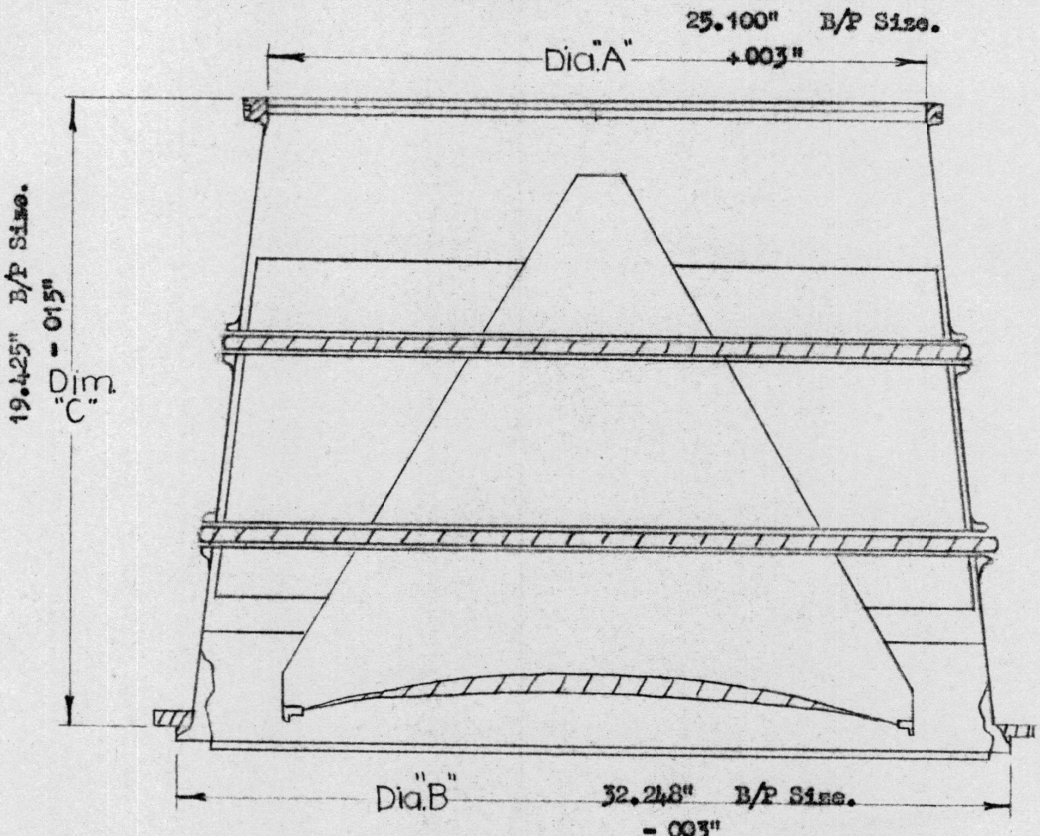
AS VIEWED FROM REAR OF ENGINE.

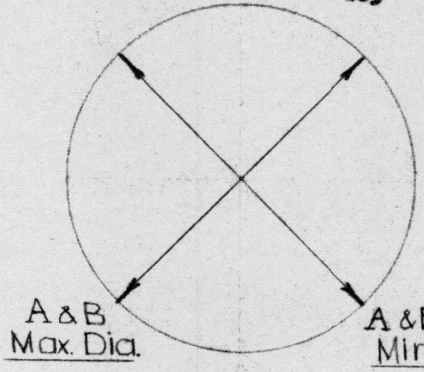
Sheet 1 of 2

FORM M317—1/40.

QA.21220

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 34 OF 57
DATE 16-4-56	MELBOURNE VICTORIA	REPORT No. E.300
WEIGHT	EXHAUST UNIT.	MODEL No. Section 6

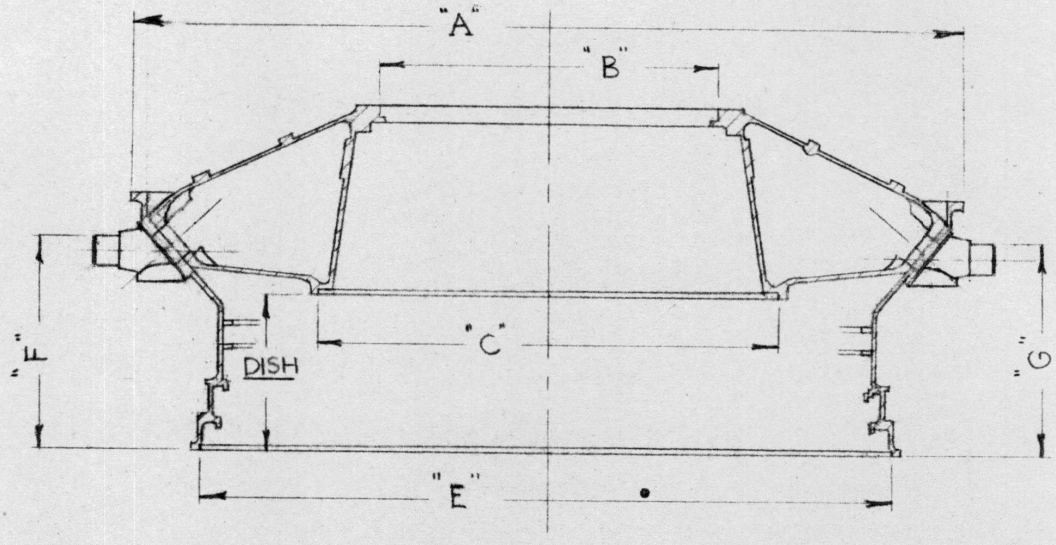




FORM M317—1/40.

PREPARED BY: I.L.B	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 35 OF 57
DATE 13-4-56		REPORT NO. E.300
WEIGHT	NOZZLE BOX	MODEL NO. Section 6

BA22142



POSITION		NEW	GREEN RUN	AFTER 2.5 HR
"A"	Max.	39.036" Top	39.041"	39.045" Top
	Min.	39.035" Side	39.036"	39.035" Side
"B"	Max.	15.880"		15.885"
	Min.	15.880"		15.880"
"C"	Max.	21.732"		21.730"
	Min.	21.730"		21.724"
"E"	Max.	32.262" Top	32.256"	32.262" Top
	Min.	32.256" Side	32.252"	32.248" Side
"G"		10.558" Port		10.553" Port
"F"		10.564" Std.		10.560" Std.
DISH		7.409- 7.413	7.418- 7.424	

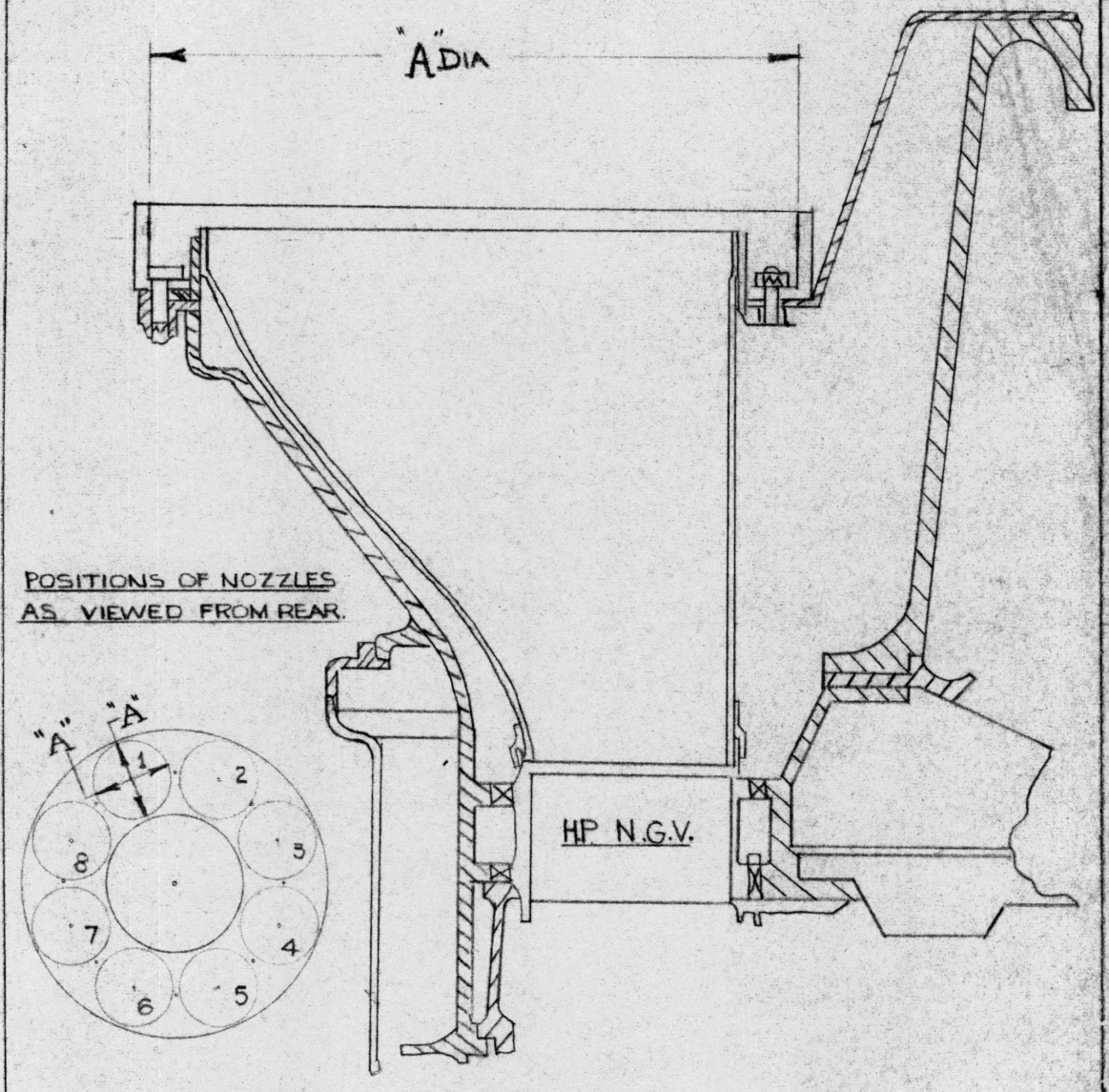
FORM M317—1/40.

PREPARED BY: ILB	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 36 OF 57
DATE 17-4-56		REPORT NO. M.300
WEIGHT	NOZZLE BOX AIR CASING LOCATING SLEEVES	MODEL NO. Section 6

		NEW.							
		NOZZLE Nos.							
		1	2	3	4	5	6	7	8
"A"	Max.	9.371"	9.369"	9.370"	9.372"	9.366"	9.371"	9.370"	9.372"
	Min.	9.351"	9.353"	9.347"	9.352"	9.348"	9.349"	9.355"	9.348"
		AFTER GREEN.							
"A"	Max.								
	Min.								
		AFTER 25 HR.							
"A"	Max.	9.363"	9.365"	9.367"	9.366"	9.367"	9.377"	9.366"	9.365"
	Min.	9.351"	9.352"	9.347"	9.349"	9.343"	9.334"	9.350"	9.350"

FORM M317—1/40.

PREPARED BY: ILB	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 37 OF 57
DATE 16-4-56	MELBOURNE VICTORIA	REPORT No. B.300
WEIGHT	NOZZLE BOX AIR CASING LOCATING SLEEVES	MODEL No. Section 6



POSITIONS OF NOZZLES AS VIEWED FROM REAR.

Sheet 1 of 2

FORM M317—1/40.

PREPARED BY: JAH 13 3 56	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. 38 OF 57
DATE	MELBOURNE VICTORIA	REPORT No. E.300
WEIGHT	BOLT BA36227	MODEL No. Section 6

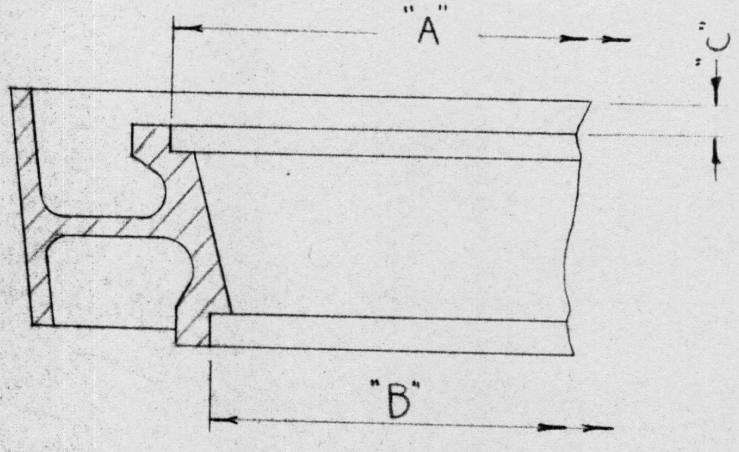
BOLT AND HOLE NOS	DRAWN BOLTS		TORQUE			
	1ST BUILD	AFTER GREEN BUILD	1ST BUILD	AFTER GREEN UNDO	AFTER GREEN BUILD	AFTER 25 H UNDO
	DRG SIZE .020" - .036"		DRG SIZE 450 - 540 IN/LBS			
1	.043"		456			
2	.035"		528			
3	.050"		480			
4	.041"		456			
5	.042"		456			
6	.042"		456			
7	.035"		480			
8	.048"		456			
9	.040"		456			
10	.045"		480			
11	.043"		468			
12	.043"		456			
13	.043"		528			
14	.043"		480			
15	.047"		528			
16	.049"		480			

FORM M317—1/40.

PREPARED BY: I.L.B	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 39 OF 57
DATE 10-4-56		REPORT No. S.300
WEIGHT		MODEL No. Section 6

- SPACER-ROTOR WHEELS - STAGE 11 - 12 COMPRESSOR -

BA 35691 S/N16 ST. STEEL



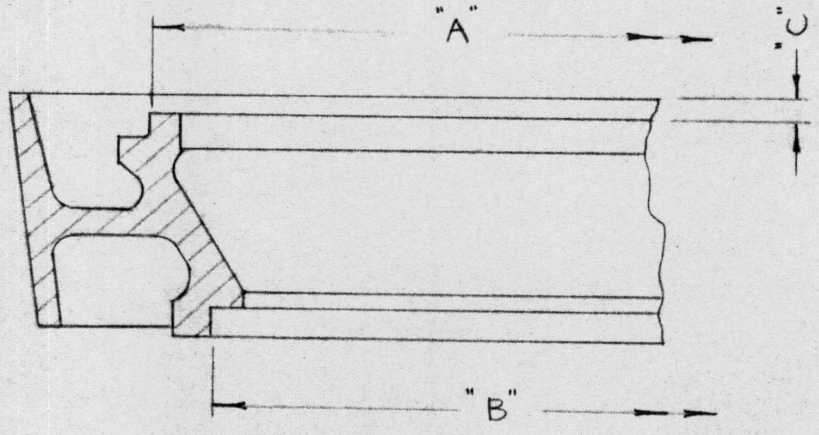
POSITION		New.	Green Run.	25 Hr Test
"A"	Max.	18.399"		18.398"
	Min	18.396"		18.394"
"B"	Max.	18.225"		18.221"
	Min	18.224"		18.219"
"C"	Max	.082"		.082"
	Min	.082"		.082"
	Dish.	-		-

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 40 OF 57
DATE 10-4-56		REPORT NO. B.300
WEIGHT		MODEL NO. Section 6

SPACER COMPRESSOR ROTOR STAGES 8-9 ALUMINIUM.

BA35689. S/N 51



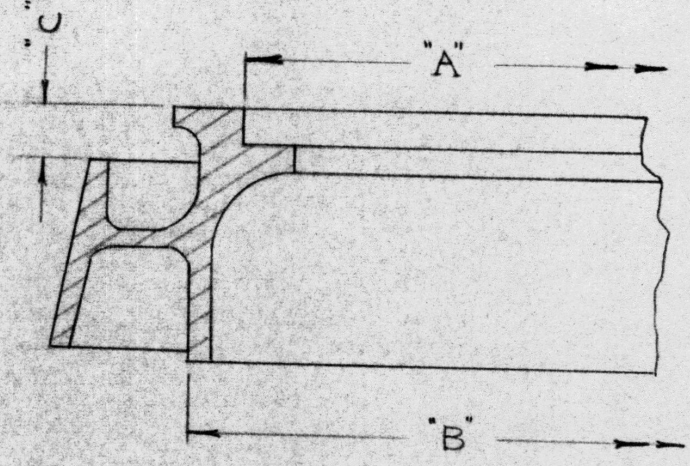
POSITION		New	Green Run	25 Hr Test.
"A"	Max.	17.889"		17.890"
	Min.	17.889"		17.890"
"B"	Max	17.523"		17.522"
	Min.	17.523"		17.522"
"C"	Max.	.086"		.085"
	Min.	.086"		.085"
	Dish.	-		-

FORM M317-1/40.

PREPARED BY: ILB	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 41 OF 57
DATE 10-4-56		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6

SPACER - COMPRESSOR WHEELS - STAGE 4 AND 5. - Aluminium

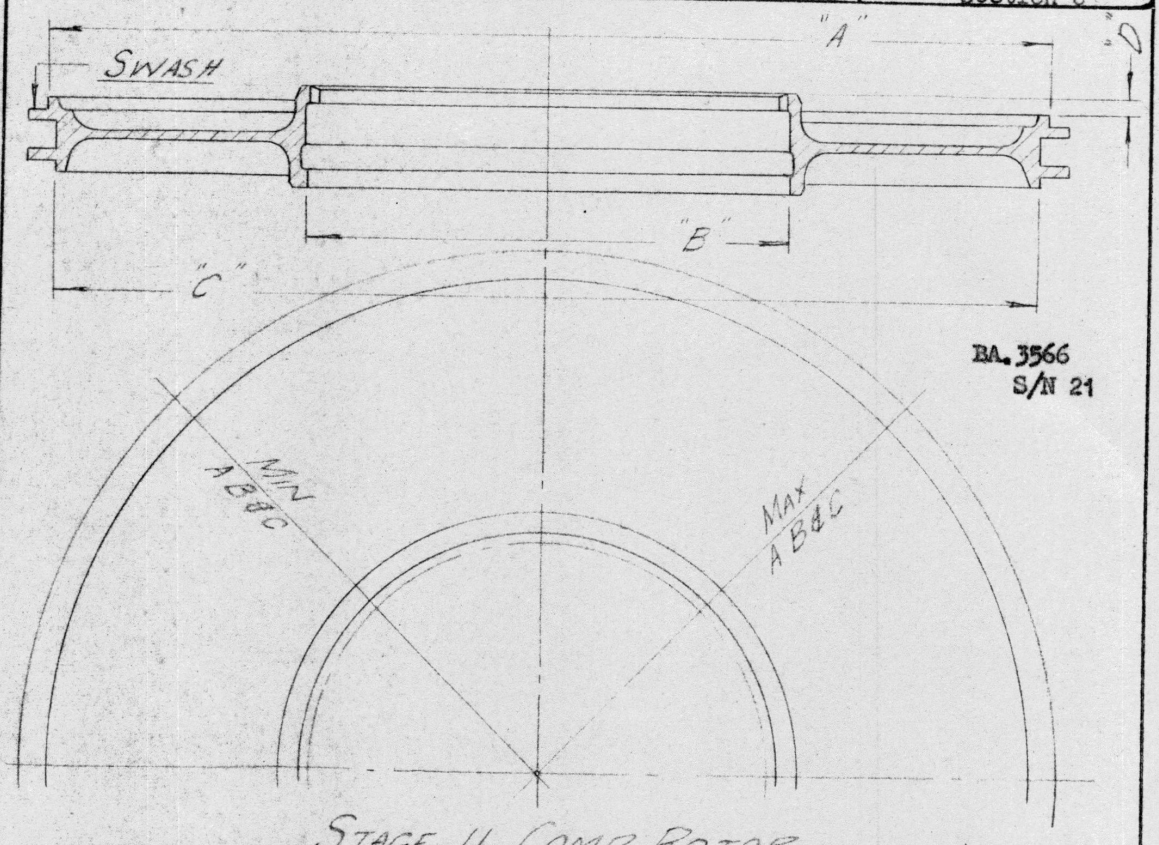
BA35404 S/N. 18



Position		New	Green Run.	25 Hr Test
"A"	Max.	15.693"		15.690"
	Min.	15.691"		15.687"
"B"	Max.	16.044"		16.046"
	Min.	16.041"		16.045"
"C"	Max	.201"		.201"
	Min.	.201"		.201"
	Dish.	-		-

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 42 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6



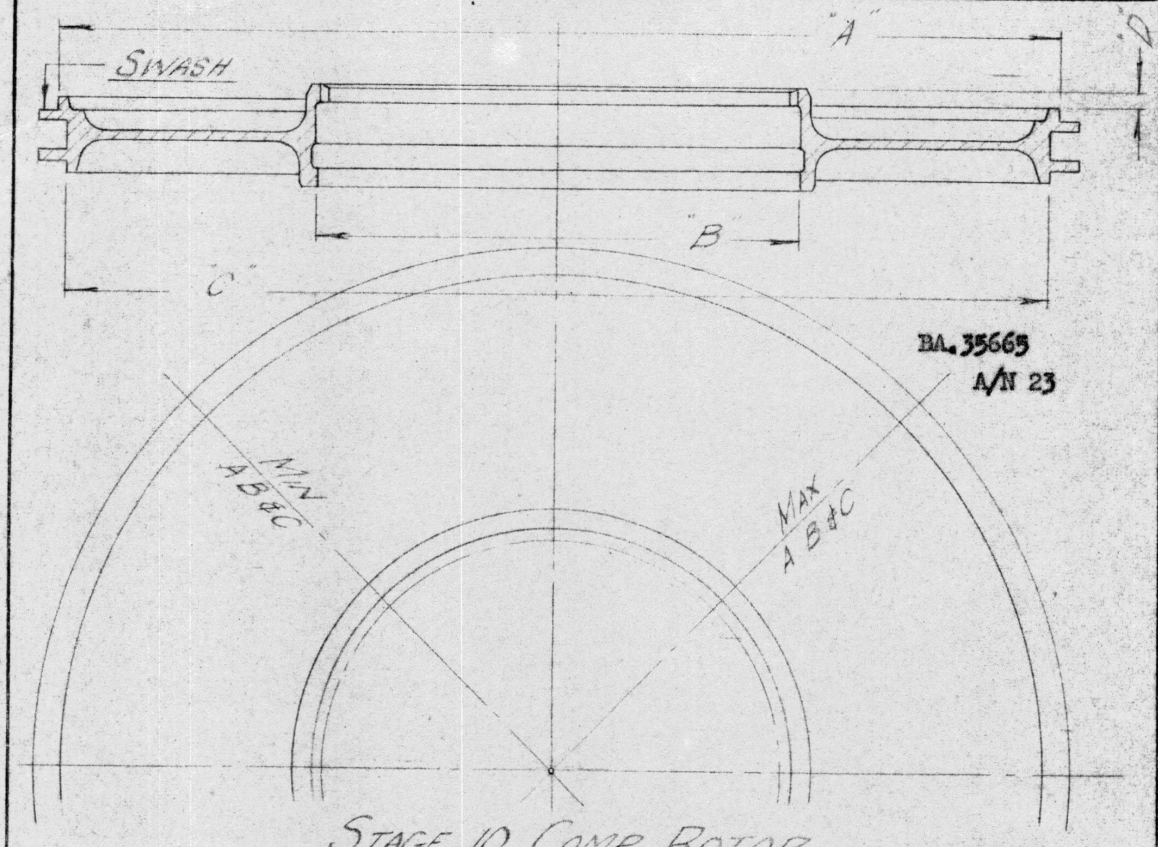
BA. 3566
S/N 21

STAGE 11 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
SPIGOT DIA "A"	MAX	18.474"	18.474"		18.475"
	MIN	18.473"	18.474"		18.475"
	OVALITY		Nil		Nil
BORE DIA "B"	MAX	9.4755"	9.4759"		9.4761"
	MIN	9.475"	9.4753"		9.4753"
	OVALITY		.0006"		.0008"
SPIGOT DIA "C"	MAX	18.220"	18.220"		18.222"
	MIN	18.219"	18.220"		18.222"
	OVALITY		Nil		Nil
"D"	MAX	.288"	.280"		.280"
	MIN	.278"	.280"		.280"
	DISH				
SWASH		.001"	.001"		.003"

FORM M317—1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 43 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6

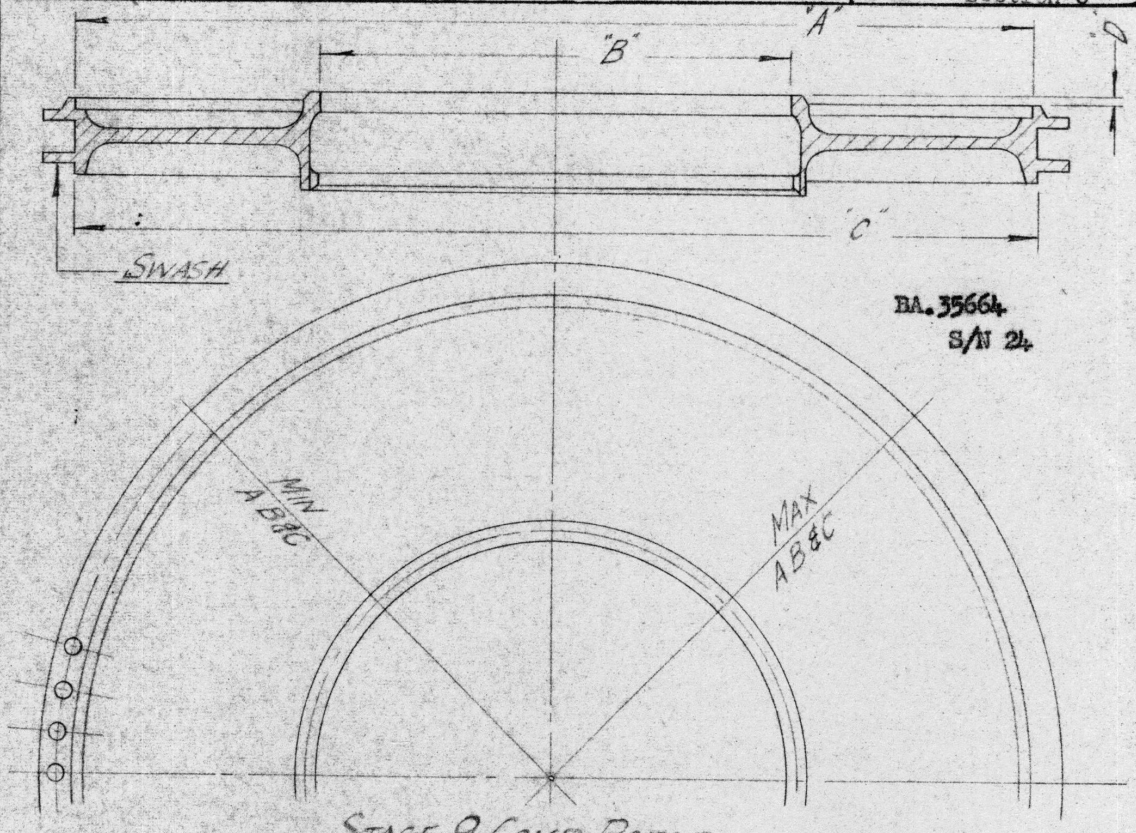


STAGE 10 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
SPIGOT DIA "A"	MAX	18·270"	18.270"		18.271"
	MIN	18·269"	18.270"		18.271"
	OVALITY		N11		N11
BORE DIA "B"	MAX	9·1505"	9.1503"		9.1509"
	MIN	9·150"	9.1501"		9.1506"
	OVALITY		.0002"		.0003"
SPIGOT DIA "C"	MAX	18·055"	18.054"		18.056"
	MIN	18·054"	18.054"		18.056"
	OVALITY		N11		N11
"D"	MAX	·276"	.266"		.266"
	MIN	·266"	.266"		.266"
	DISH				
SWASH		·001"	.0015"		.003"

FORM M317—1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 44 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6

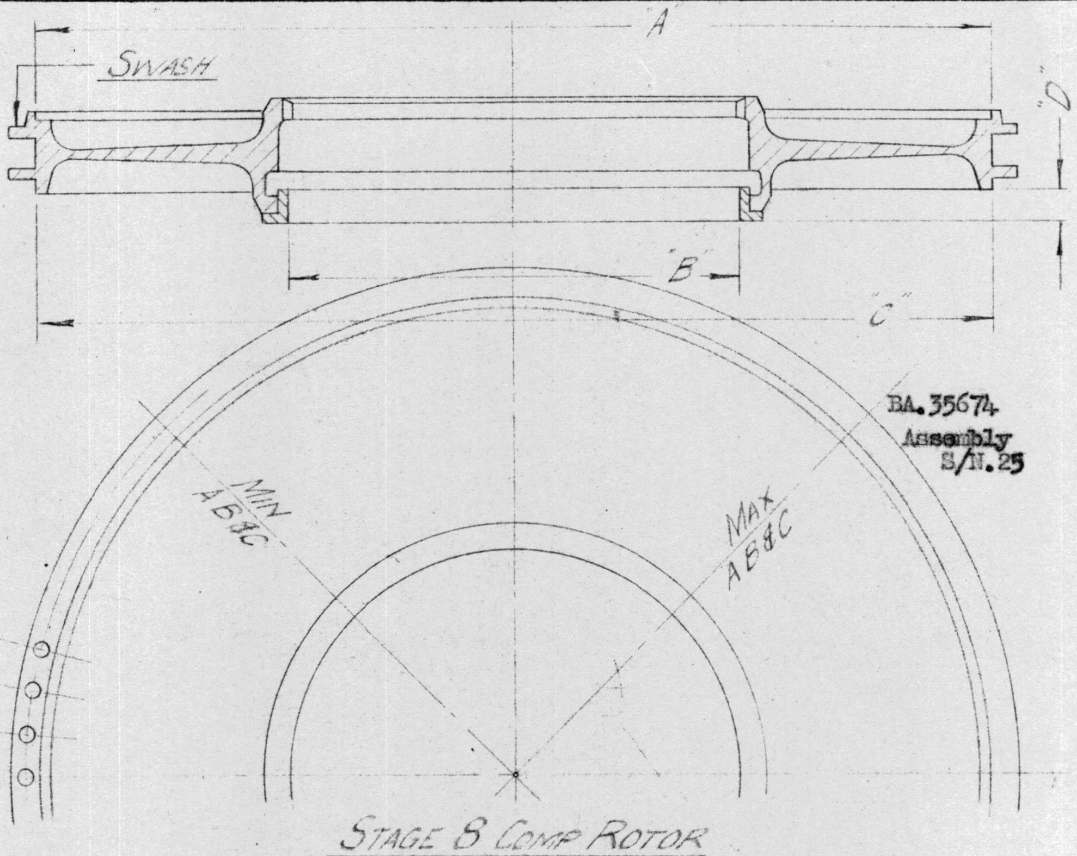


STAGE 9 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
SPIGOT BORE DIA "A"	MAX	17.896"	17.899"		17.898"
	MIN	17.895"	17.899"		17.898"
	OVALITY		Nil		Nil
BORE DIA "B"	MAX	8.8655"	8.8654"		8.8660"
	MIN	8.865"	8.8652"		8.8654"
	OVALITY		.0002"		.0006"
SPIGOT DIA "C"	MAX	17.890"	17.890"		17.893"
	MIN	17.889"	17.890"		17.893"
	OVALITY		Nil		Nil
"D"	MAX	.150"	.144"		.145"
	MIN	.140"	.144"		.145"
	DISH				
SWASH		.001"	.003"		.0035"

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 45 OF 57
DATE		REPORT NO. F.300
WEIGHT		MODEL NO. Section 6



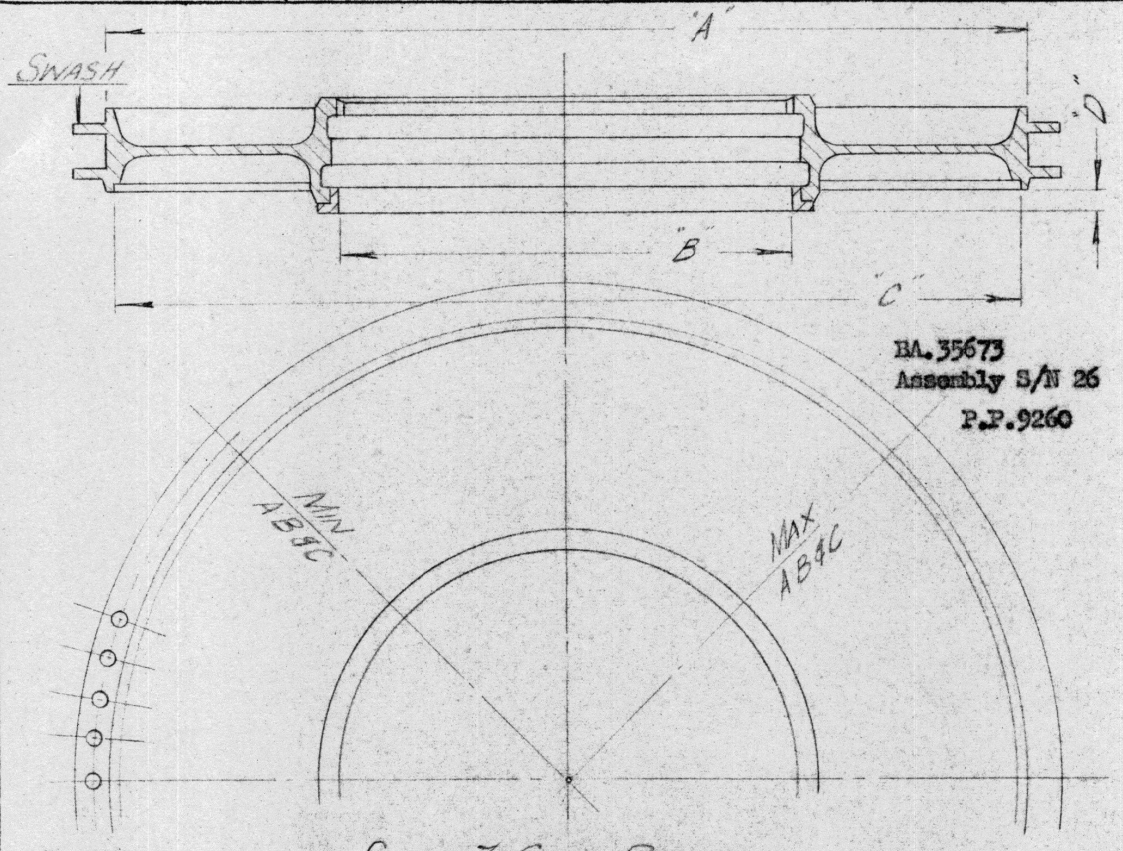
BA.35674
Assembly
S/N.25

STAGE 8 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25H
SPIGOT BORE DIA "A"	MAX	17·526"	17.528"		17.527"
	MIN	17·525"	17.528"		17.527"
	OVALITY		NIL		NIL
BORE DIA "B"	MAX	8·8655"	8.8655"		8.8622"
	MIN	8·865"	8.8651"		8.8624"
	OVALITY		.0004"		.0008"
SPIGOT DIA "C"	MAX	17·520"	17.520"		17.522"
	MIN	17·519"	17.520"		17.522"
	OVALITY		NIL		NIL
"D"	MAX	.437"	.433"		.435"
	MIN	.397"	.433"		.435"
	DISH				
SWASH		.001"	.001"		.0015"

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 46 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6



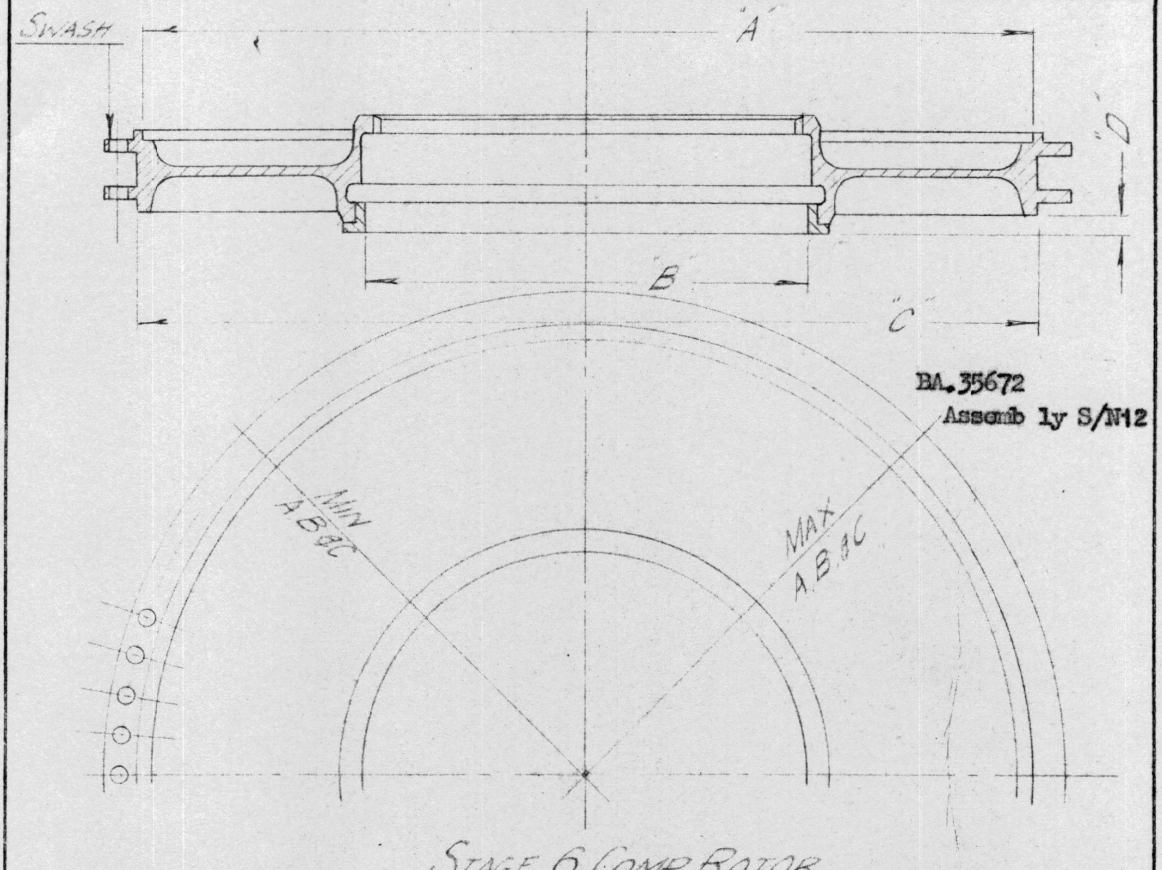
BA.35673
Assembly S/N 26
P.P.9260

STAGE 7 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
SPIGOT DIA "A"	MAX	17·155"	17.153"		17.154"
	MIN	17·154"	17.153"		17.154"
	OVALITY		Nil		Nil
BORE DIA "B"	MAX	8·5305"	8.5305"		8.5318"
	MIN	8·530"	8.5305"		8.5311"
	OVALITY		Nil		.0007"
SPIGOT BORE DIA "C"	MAX	17·151"	17.153"		17.152"
	MIN	17·150"	17.153"		17.152"
	OVALITY		Nil		Nil
"D"	MAX	·3055"	.298"		.300"
	MIN	·2655"	.298"		.300"
	DISH				
SWASH		·001"	.002"		.003"

FORM M317—1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 47 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO.. Section 6



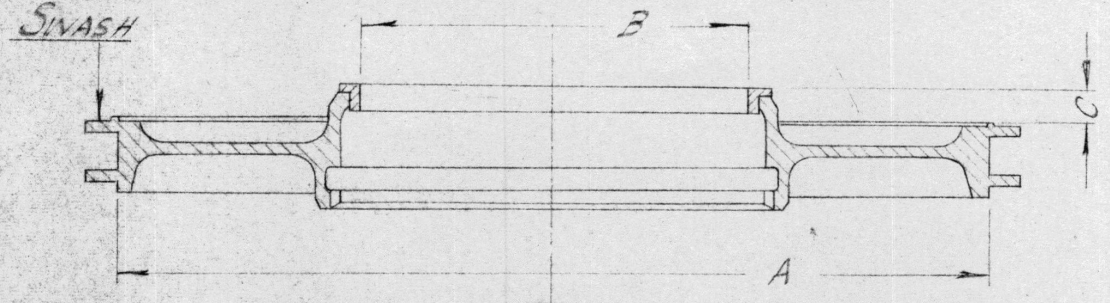
BA.35672
Assemb ly S/N12

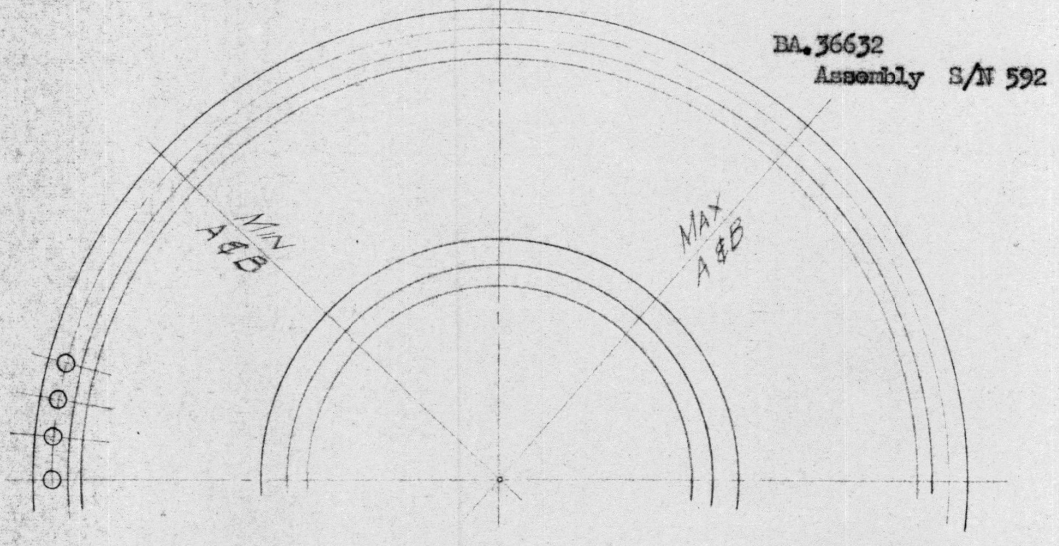
STAGE 6 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GRIND	AFTER 25 H
SPIGOT BORE DIA A"	MAX	16·801"	16.804"		16.801"
	MIN	16·800"	16.804"		16.801"
	OVALITY		Nil.		Nil.
BORE DIA B"	MAX	8·5305"	8.5303"		8.531"
	MIN	8·530"	8.5301"		8.5306"
	OVALITY		.0002"		.0004"
SPIGOT DIA C"	MAX	16·795"	16.793"		16.793"
	MIN	16·794"	16.793"		16.793"
	OVALITY		Nil.		Nil.
"D"	MAX	·270"	.266"		.266"
	MIN	·230"	.266"		.266"
	DISH				
SWASH		·001"	.002"		.002"

FORM M217—1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 48 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6





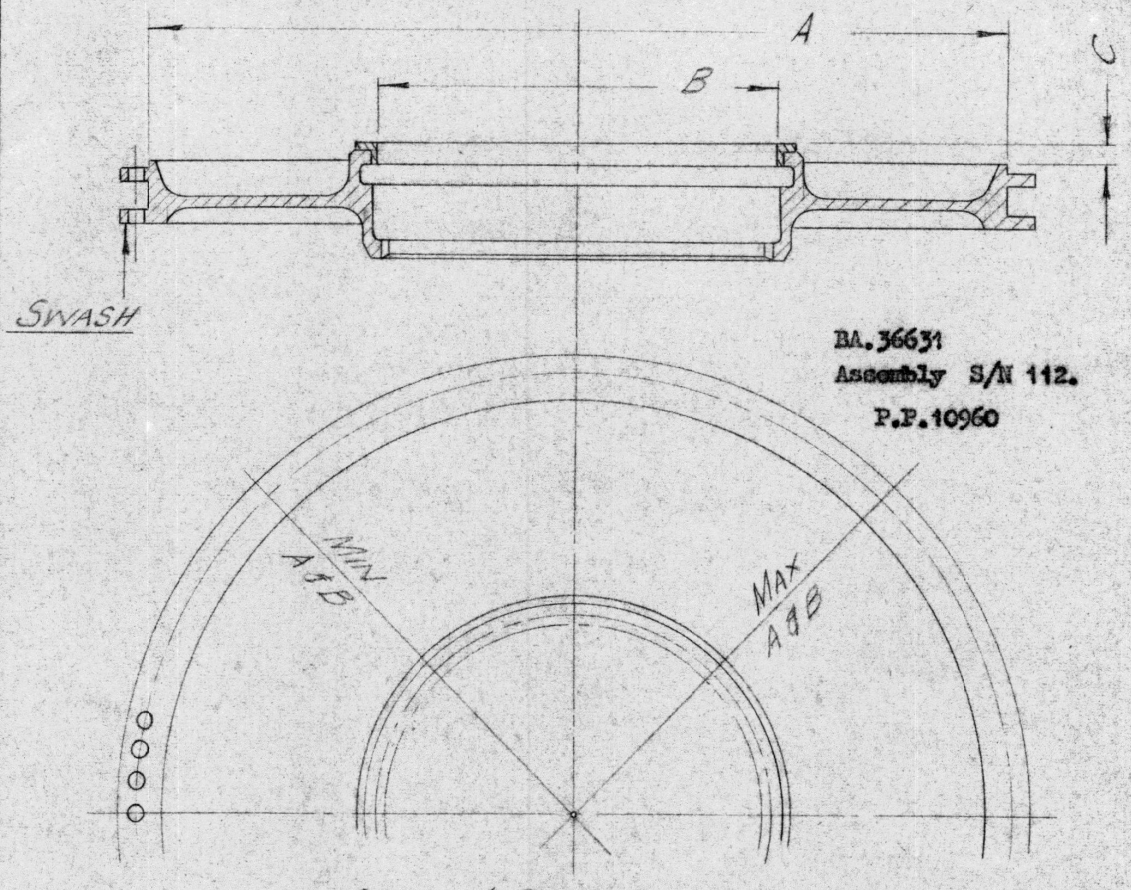
BA.36632
Assembly S/N 592

STAGE 5 COMP. ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER 1ST RUN	AFTER 25H
SPIGOT DIA "A"	MAX	16.300"	16.299"		16.301"
	MIN	16.299"	16.297"		16.300"
	OVALITY		.002"		.001"
BORE DIA "B"	MAX	7.5505"	7.5500"		7.5506"
	MIN	7.550"	7.5498"		7.5503"
	OVALITY		.0002"		.0003"
C	MAX	.540"	.529"		.532"
	MIN	.500"	.529"		.532"
	DISH				
SWASH		.001"	.0015"		.0025"

FORM 4317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 49 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6



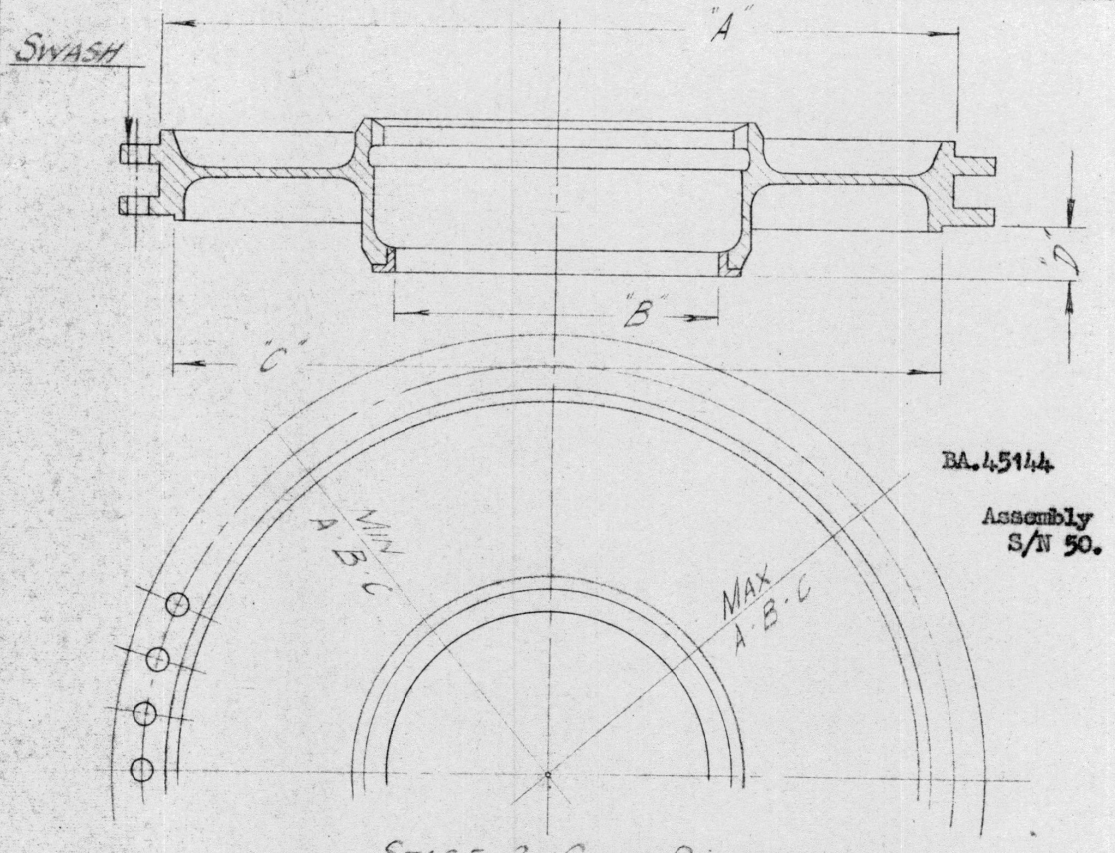
BA.36631
Assembly S/N 112.
P.F.10960

STAGE A COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25H
SPIGOT DIA "A"	MAX	15.690"	15.689"		15.690"
	MIN	15.689"	15.689"		15.690"
	OVALITY		Nil.		Nil.
BORE DIA "B"	MAX	7.5505"	7.5500"		7.5508"
	MIN	7.550"	7.5500"		7.5502"
	OVALITY		Nil.		.0006"
C	MAX	.272"	.269"		.271"
	MIN	.242"	.269"		.271
	DISH				
SWASH		.001	.002"		.003"

FORM M317—1/60.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 50 OF 57
DATE		REPORT No. E.300
WEIGHT		MODEL No. Section 6



BA.45144

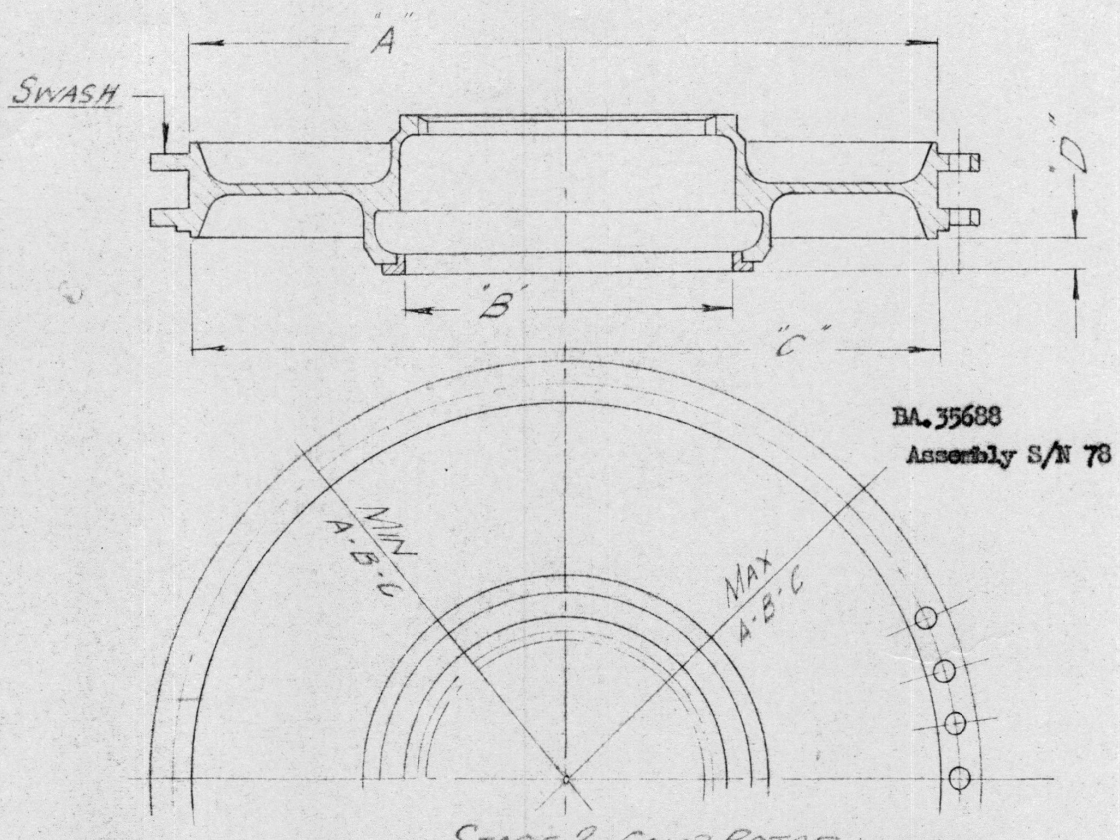
Assembly S/N 50.

STAGE 3 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER 1 RUN	AFTER 25 H
SPIGOT DIA "A"	MAX	14·738"	14.737"		14.738"
	MIN	14·737"	14.737"		14.738"
	OVALITY		Nil		Nil
BORE DIA "B"	MAX	6·6255"	6.6255"		6.6258"
	MIN	6·625"	6.6253"		6.6256"
	OVALITY		.0002"		.0002"
SPIGOT DIA "C"	MAX	14·296"	14.295"		14.295"
	MIN	14·295"	14.295"		14.295"
	OVALITY		Nil		Nil
"D"	MAX	·930"	.916"		.918"
	MIN	·890"	.916"		.918"
	DISH				
SWASH		·001"	.0015"		.002"

FORM B317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 51 OF 57
DATE		REPORT NO. E.300
WEIGHT		MODEL NO. Section 6



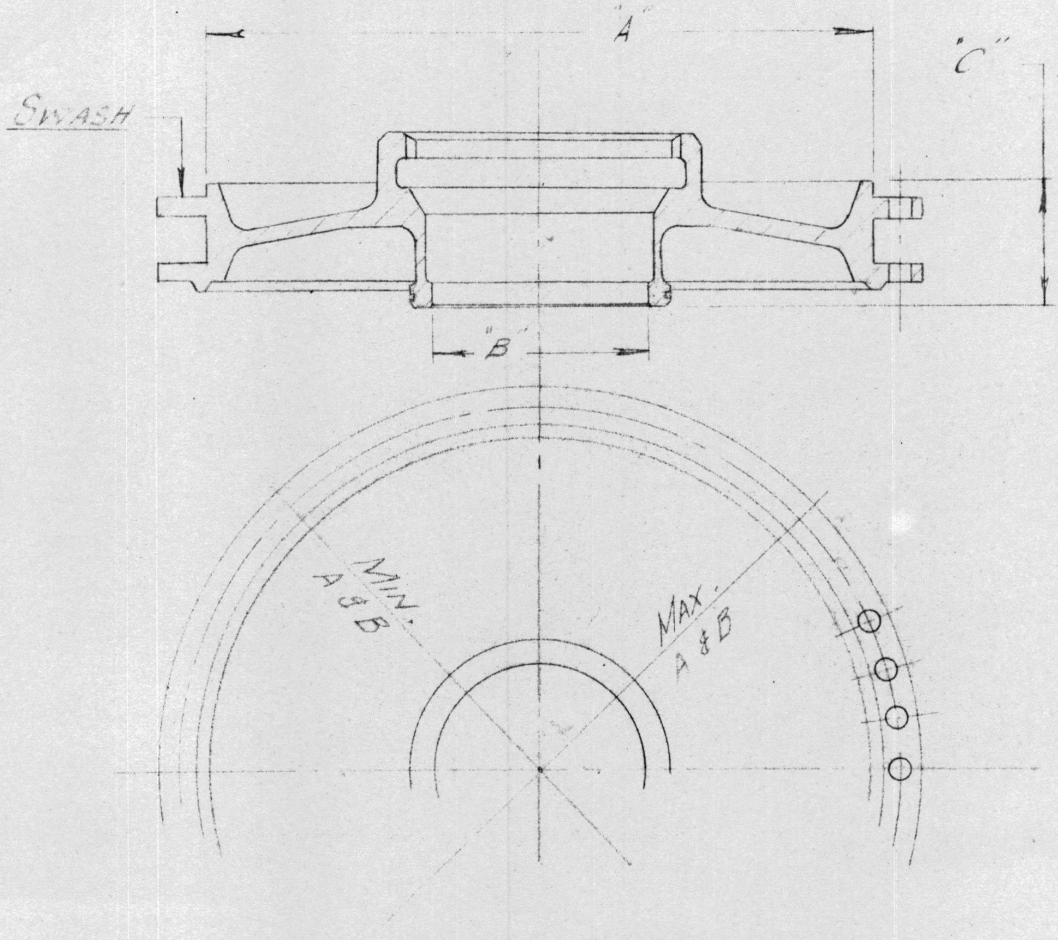
BA.35688
Assembly S/N 78

STAGE 2 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFTER 25 H
SPIGOT DIA "A"	MAX	13·810"	13.810"		13.810"
	MIN	13·809"	13.810"		13.810"
	OVALITY		Nil		Nil
BORE DIA "B"	MAX	6·6255"	6.6253"		6.6255"
	MIN	6·625"	6.6249"		6.6252"
	OVALITY		.0004"		.0003"
SPIGOT DIA "C"	MAX	13·810"	13.808"		13.808"
	MIN	13·809	13.807"		13.808"
	OVALITY		.001"		Nil
"D"	MAX	616"	.601"		.603"
	MIN	·576"	.601"		.603"
	DISH				
SWASH		·001"	.001"		.0015"

FORM M817—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 52 OF 57
DATE		REPORT No. R.300
WEIGHT		MODEL No. Section 6

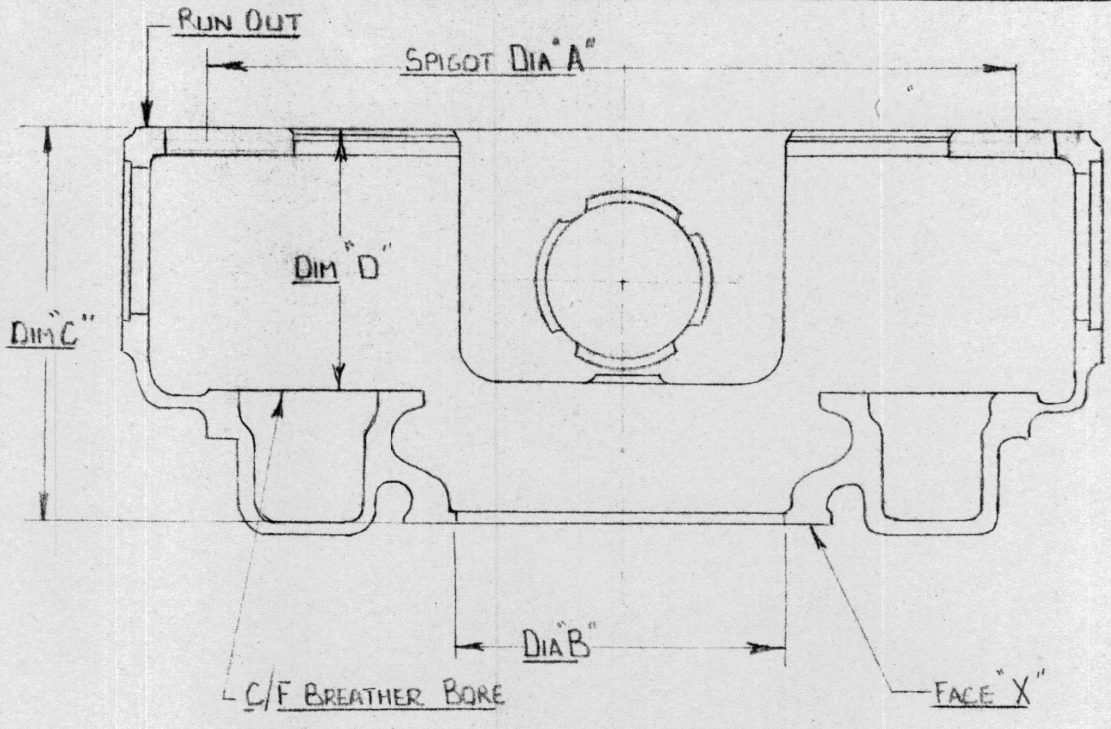


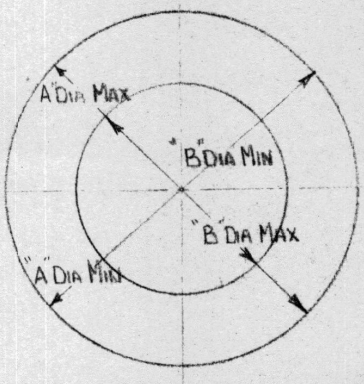
STAGE 1 COMP ROTOR

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GRIEN	AFTER 25 HR
SPIGOT DIA "A"	MAX	12.300"	12.299"		12.300"
	MIN	12.299"	12.299"		12.300"
	OVALITY		Nil.		Nil.
BORE DIA "B"	MAX	4.1505"	4.1506		4.1508"
	MIN	4.150"	4.1504"		4.1504"
	OVALITY		.0002"		.0004"
"C"	MAX	2.349"	2.423"		2.422"
	MIN	2.344"	2.423"		2.422"
	DISH				
SWASH		.001"	.0015"		.0025"

FORM M317—1/40.

PREPARED BY: DAVIS	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE No. 53 \ OF 57
DATE 18-4-56		REPORT No. E.300
WEIGHT	INTERNAL WHEEL CASE	MODEL No. Section 6





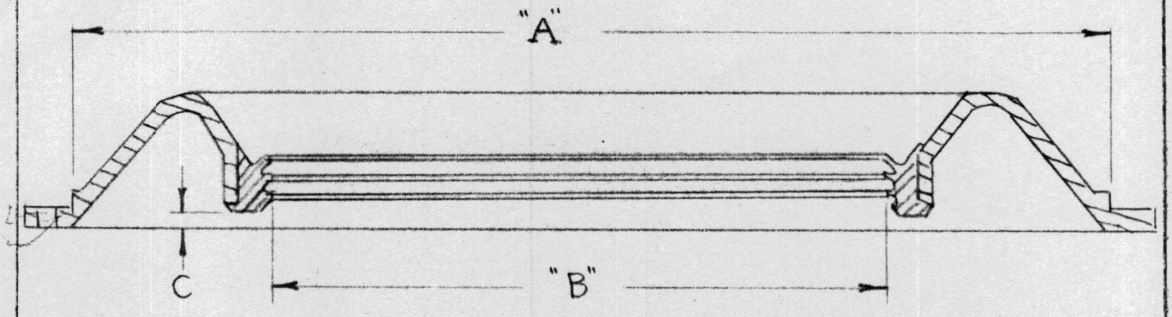
BA.4384.6 Assembly S/N64.

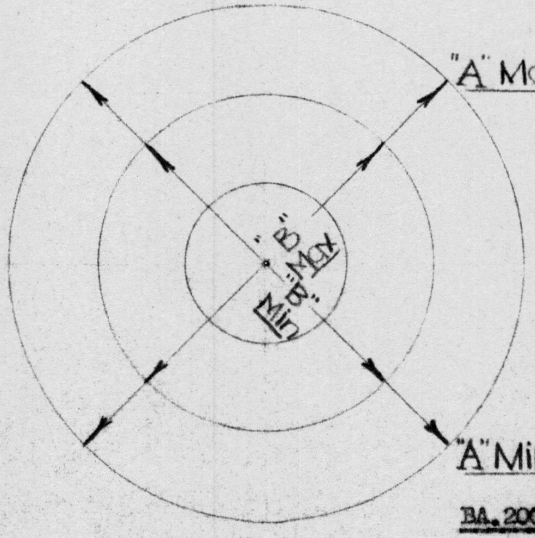
P.P.10051 X.1768

POSITION		NEW	AFTER GREEN	AFTER 2.5 HR
SPIGOT DIA "A"	MAX.	13.9773"		13.977"
	MIN.	13.9773"		13.977"
DIA "B"	MAX.	6.7501"		6.7522"
	MIN.	6.7501"		6.7510"
"C" DIM				
"D" DIM		5.050"		5.050"
RUN OUT W.R.T. FACE "X"	——	.002"		.0005"

FORM M317-1740.

PREPARED BY: ILB	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 54 OF 57
DATE 16-4-56		REPORT NO. E.300
WEIGHT	HOUSING & SEAL REAR COMPR. SHAFT.	MODEL NO. Section 6





BA.20092 S/N 31

P.P.10718

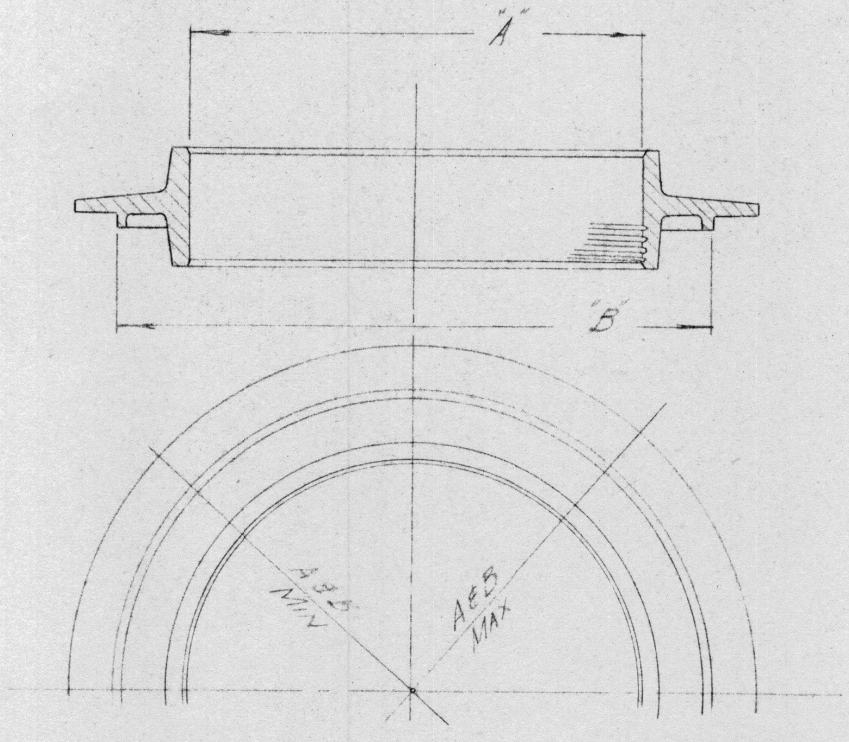
SEAL BA.20091 . S.I.T.48741

POSITION.		NEW	GREEN RUN	25 HR TEST.
"A"	Max.	13.599"	13.599"	13.599"
	Min.	13.598"	13.598"	13.598"
"B"	Max.	7.5035"	7.504"	7.504"
	Min.	7.5018"	7.502"	7.502"
"C"	Max.	.193"	.193"	.193"
	Min.	.193"	.193"	.193"

FORM M317—1/40.

PREPARED BY:	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 55 OF 57
DATE		REPORT NO. E.300
WEIGHT	SECTION 1010	MODEL NO. Section 6

BA. 30304
S/N 98



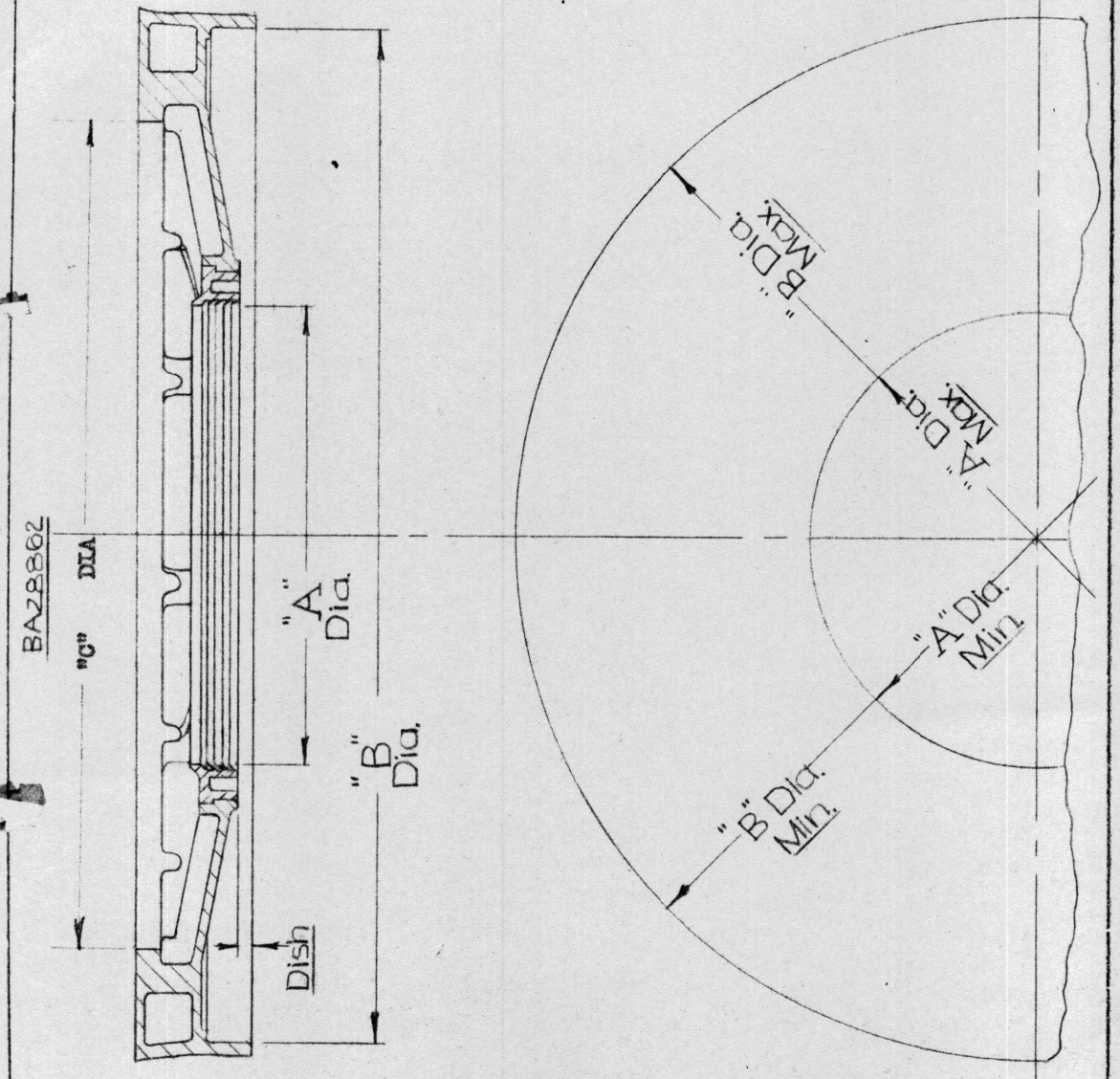
REAR GLAND - CENTRE BEARING

DESCRIPTION		DRG SIZE	NEW SIZE	AFTER GREEN	AFT. R25H
SEAL DIA "A"	MAX	5.017"	5.017"		5.020"
	MIN	5.016"	5.017"		5.020"
	OVALITY		.000"		.000"
SPIGOT DIA "B"	MAX	6.7495"	6.749"		6.750"
	MIN	6.7495"	6.749"		6.750"
	OVALITY		.000"		.000"

FORM M317—1/40.

PREPARED BY: I.L.B.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 56 OF 57
DATE 4-5-56		REPORT No. E.300
WEIGHT	SEAL HOUSING AND SEAL.	MODEL No. Section 6

CA. 20953 WO. 54868 S/No. 79



Sht. 1 Of 2

FORM M317—11/40.

PREPARED BY: ILB	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 57 OF 57
DATE 4-5-56		REPORT NO. E.300
WEIGHT	SEAL Housing And Seal.	MODEL NO. Section 6

BA28862

POSITION		NEW	* GREEN RUN	25 HR TEST.
"A" Dia.	Max.	8.671" 8.678"	8.6645" 8.674"	8.6685" 8.676"
	Min.	8.670" 8.676"	8.6640" 8.673"	8.6680" 8.675"
"B" Dia.	Max.			
	Min.			
Dish.		* * .387"	.380"	.373"
"C" Dia	Max	15.803"	15.803"	15.795"
	Min	15.803"	15.803"	15.795"

* "A" Dia. Re-operated back to B/P before 25 Hr. Test

(B/P 8.668" + .003" - .000") (B/P 8.675" + .002" -.000")

Size after re-operation :- 8.671" & 8.676"

* * The "Dish" varied .007" between New & Green Run and a further .007" between Green & 25 Hr. Test.

Sht. 2 of 2

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FORM M317—1/40.

PREPARED BY H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 1 OF 3
DATE 9/7/57		REPORT NO. E.300
WEIGHT	HISTORY OF MAJOR COMPONENTS	MODEL NO. Section 7

Section	Part Name	Part No.	Material	Source Manufacture
1010	Wheelcase, Internal S/No.64	BA.43846	Local	Local
	Gear Driven, Auxiliary Gearbox drive	BA.22464	Local	Local
	Gear Spiral bevel, Aux. Gearbox driving	BA.22461	O'seas	Local
	Gear Spiral bevel, Aux.Gearbox driven	BA.22462	O'seas	Local
	Housing Bearings, Cent. breather	BA.23131	O'seas	Local
	Shaft, Breather, Rear half	CA.20710	Local	Local
	Gear, spur, driven, breather	CA.20709	Local	Local
	Spur gear, oil pump drive	BA.22466	Local	Local
	Bevel gear, oil pump driving	BA.1000	Local	Local
	Bevel gear, oil pump drive	BA.20308	Local	Local
1020	Housing front bearing and intake csg.	BA.59567	Local	Local
	Swirl vane, inlet guide	SA.22039	O'seas	Local
	Swirl vane, inlet guide, master	SA.23208	O'seas	Local
	Bearing, roller, main front	BA.1384	Fischer	
1060	Casing, intermediate	BA.21703	Local	Local
	Housing, rear bearing	BA.49917	Local	Local
	Bearing, roller, rear	BA.46074	O'seas	O'seas
1070	Shaft, turbine	BA.50776	O'seas	O'seas
	Flange, coupling, turbine shaft	BA.53296	Local	Local
	Sleeve, rear bearing	BA.78228	Local	Local
	Turbine wheel, high pressure	BA.55127	O'seas	O'seas
	Turbine wheel, low pressure	BA.19552	O'seas	O'seas
1080	Casing, outer, nozzle box	BA.20526	O'seas	Local
	Support, nozzle box	BA.43641	O'seas	Local
	Ring, inner, H.P. nozzle guide vanes	BA.22401	O'seas	Local
	Nozzle Guide Vane - low pressure	SA.56371	Local	Local
	Nozzle Guide Vane - High Pressure	SA.20462	Local	Local
1091	Inner Cone, exhaust unit	BA.55415	O'seas	Local
	Outer cone, exhaust unit	BA.44445	O'seas	Local
1092	Assy. flame tubes	Various	O'seas	Local
	Assy. expansion chambers	Various	Local	Local
	Assy, outer casings	Various	Local	Local
1113	Body, oil cooler	BA.29255	Local	Local
	Header, oil cooler	BA.30399	O'seas	O'seas

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 2 OF 3
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	HISTORY OF MAJOR COMPONENTS	MODEL NO. Section 7

Section	Part Name	Part No.	Material	Source Manufacture
1372	Shaft, compressor front assy.	BA.40841	O'seas	O'seas
	Shaft, compressor rear	BA.68269	O'seas	O'seas
	Wheel Rotor stage 1	BA.35656	O'seas	Local
	Blade, rotor, stage 1	SA.35578	Local	Local
	Wheel, rotor stage 2	BA.35657	O'seas	Local
	Blade, rotor, stage 2	SA.40611	Local	Local
	Spacer, rotor 1-2	BA.22491	O'seas	Local
	Wheel rotor stage 3	BA.45142	O'seas	Local
	Blade, rotor, stage 3	SA.40616	O'seas	Local
	Spacer, rotor 2-3	BA.45141	O'seas	Local
	Wheel rotor, stage 4	BA.35389	O'seas	Local
	Blade, rotor, stage 4	SA.40621	O'seas	Local
	Spacer, rotor, 3-4	BA.35400	O'seas	Local
	Wheel, rotor, stage 5	BA.35390	O'seas	Local
	Blade rotor, stage 5	SA.33291	O'seas	Local
	Spacer, rotor, 4-5	BA.35404	Local	Local
	Wheel, rotor, stage 6	BA.35661	O'seas	Local
	Blade, rotor, stage 6	SA.33292	O'seas	Local
	Spacer, rotor 5-6	BA.35686	O'seas	Local
	Wheel, rotor stage 7	BA.35662	O'seas	Local
	Blade, rotor, stage 7	SA.33293	O'seas	Local
	Spacer, rotor, 6-7	BA.35687	O'seas	Local
	Wheel, rotor, stage 8	BA.35663	O'seas	Local
	Blade, rotor, stage 8	SA.33294	O'seas	Local
	Spacer, rotor, 7-8	BA.35688	O'seas	Local
	Wheel rotor, stage 9	BA.35664	O'seas	Local
	Blade rotor, stage 9	SA.33295	Local	Local
	Spacer, rotor, 8-9	BA.35689	Local	Local
	Wheel, rotor, stage 10	BA.35665	O'seas	Local
	Blade, rotor, stage 10	BA.33498	Local	Local
	Spacer, rotor, 9-10	BA.34090	O'seas	Local
	Wheel rotor, stage 11	BA.35666	O'seas	Local
	Blade, rotor, stage 11	SA.33297	Local	Local
	Spacer, rotor, stage 10-11	BA.35911	O'seas	Local
	Wheel, front half, stage 12	BA.68280	O'seas	Local
	Wheel, rear half, stage 12	BA.68281	O'seas	Local
	Blade, rotor, stage 12	SA.33298	Local	Local
	Spacer, rotor, 11-12	BA.35691	O'seas	Local
	Balance Piston	BA.30306	O'seas	Local
	Pinion w'case driving	BA.34356	Local	Local
	Starter, shaft outer spring drive	BA.12872	Local	Local
	Starter, shaft, inner spring drive	BA.12874	Local	Local

FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 3 OF 3
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	HISTORY OF MAJOR COMPONENTS	MODEL NO. Section 7

Section	Part Name	Part No.	Material	Source Manufacture
1373	Casing outlet compressor	BA.29111	Local	Local
	Vane, guide, compressor outlet	SA.12338	Local	Local
	Seal housing	CA.20956	Local	Local
	Seal housing, rear compressor shaft Assembly Centre bearing	BA.20092	Local	Fischer
	Oil Gallery	BA.43747	Local	Local
	Housing centre bearing	CA.20675	Local	Local
1115	Casing, oil sump	BA.30384	Local	Local
	Casing, filters	BA.31868	Local	Local
1160	Casing, oil pump, pressure	BA.19525	Local	Local
	Casing, scavenge, intermediate	BA.10574	Local	Local
	Casing, scavenge, oil pump	BA.10576	Local	Local
	Gear, driving, pressure pump	BA.19531	O'seas	Local
	Gear, pumping, driving	CA.21119	O'seas	Local
	Gear, driving scavenge	BA.11833	O'sea	Local
	Gear, driven, scavenge pump	BA.11836	O'seas	Local
1270	Casing, front half, external w'case	BA.22642	O'seas	Local
	Casing, rear half, external w'case	BA.22098	Local	Local
	Coupling shaft	BA.17433	Local	Local
	Bevel gear, fuel pump & tacho driving	BA.17444	Local	Local
	Bevel gearshaft - fuel pump drive	BA.17421	Local	Local
	Spur gear, fuel pump drive	BA.17422	Local	Local
	Bevel gear, driven, tacho.	BA.19097	Local	Local
	Spur gear, fuel, pump drive	BA.17426	Local	Local
	Gear, Idler	BA.20548	Local	Local
1271	Coupling shaft Aux. Gearbox drive	BA.18013	Local	Local
1371	Casing, compressor, top half	BA.43199	O'seas	Local
	Casing, compressor, lower half	BA.43200	Local	O'seas
	Stator Blade, Stage 1	SA.12706-7	Local	Local
	Stator Blade, Stage 2	SA.12708	O'seas	Local
	Stator Blade, Stage 3	SA.12709	O'seas	Local
	Stator Blade, Stage 4	SA.10870) SA. 2559)	O'seas	Local
	Stator Blade, Stage 5	SA.11082) SA.11197)	O'seas	Local
	Stator Blade, Stage 6	SA.11083) SA.2560)	O'seas	Local
	Stator Blade, Stage 7	SA.755) SA.11171)	O'seas	Local
	Stator Blade, Stage 8	SA.756) SA.2561)	O'seas	Local
	Stator Blade, Stage 9	SA.22677-8	Local	Local
	Stator Blade, Stage 10	SA.22679	O'seas	Local
	Stator Blade, Stage 11	SA.22680	O'seas	Local

.TEST PERFORMANCE FIGURES AND VIBRATION CURVES

1. Test figures obtained before and after 25-hour Endurance test. Tests conducted with slave jet pipe and nozzle of 19.654" diameter.

Take-off Condition

	R.P.M.	Thrust	J.P.T.	S.F.C.	C.D.P.
Before 25-hour endurance	8,000	7,050	601°C.	.893	75.7
After 25-hour endurance	8,000	7,090	606°C.	.910	76.0

Maximum Continuous Condition

	R.P.M.	Thrust	J.P.T.	S.F.C.	C.D.P.
Before 25-hour endurance	7,600	6,000	531°C.	.863	67.8
After 25-hour endurance	7,600	6,030	538°C.	.873	67.9

2. Running time at maximum J.P.T. i.e., 630°C. or higher.

Contractor's test, 25.5.56	0 hours 13 minutes
Penalty Run, 13.6.56	0 hours 24 minutes
25-hour Endurance	
Stage 1	
5 hours at 7,600 r.p.m.	0 hours 33 minutes
Stage 2	
10 hours of cyclic running	5 hours 0 minutes
Stage 3	
Overspeed test	0 hours 15 minutes
Stage 4	
5 hours at 7,800 r.p.m. and 5 hours at 8,000 r.p.m.	5 hours 0 minutes
Total running time at 630° or higher.	11 hours 25 minutes.

3. Total engine running time.

The total running time logged on the engine was 69 hours 52 minutes disposed as follows.

Contractor's test	10 hours 28 minutes
Acceptance Test	5 hours 51 minutes
Penalty test	4 hours 6 minutes
First check run	3 hours 4 minutes
Second check run	1 hour 10 minutes
25-hour endurance	42 hours 56 minutes
Final Rating Curve	2 hours 17 minutes
TOTAL:	69 hours 52 minutes

TEST PERFORMANCE FIGURES AND VIBRATION CURVES

4. Maximum engine operating conditions

The maximum conditions under which the engine was operated during this series of tests were 8,240 r.p.m. and 636°C. J.P.T. for a period of 15 minutes.

During this period the recorded thrust was 7,290 lb.

5. Oil consumption

Oil consumption during the 25-hour endurance test was as follows.

Stage	Oil consumed Pints	Running time hours - minutes	Consumption Pints per hour
1	1.76	5.52	.300
2	1.63	11.48	.138
3	2.5	5.00	.500
4	10.85	13.52	.783
TOTAL	16.74	35.52	.472

During this period 1,300 cc. of oil was collected as centrifugal breather spill

6. Dynamometer loadings

Throughout the 25-hour endurance test both auxiliary drives were loaded with fan brake type dynamometers to a minimum value of 30 h.p. at 8,000 r.p.m.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

LOG OF STARTS

SECTION 8
SHEET No. 3 of 9

THE VARIOUS STARTS ARE DEFINED AS FOLLOWS

COLD — MADE AFTER AT LEAST 2 HOURS NATURAL COOLING THE ENGINE NOT BEING TURNED

HOT — MADE NOT MORE THAN 15 MINUTES AFTER SHUTTING DOWN FOLLOWING PREVIOUS RUNNING

WARM — STARTS MADE BETWEEN 15 MINUTES AND 2 HOURS AFTER THE PREVIOUS SHUT DOWN

FALSE — AN UNSUCCESSFUL ATTEMPT TO START THE ENGINE. SOME FALSE STARTS ARE MADE INTENTIONALLY WITH THE IGNITION SWITCH IN THE OFF POSITION

CONDITION		TYPE OF START	TIME TO LIGHT (SEC)	TIME TO S/R (SEC)	MAX JPT C°	A.I.T. C°	OIL PRESS PSI	TIME TO RUN DOWN (SEC)
		1 FALSE		INTENTIONAL				
+ PORT IGNITOR ONLY		2 COLD				12·9		88·6
⊙ STBD IGNITOR ONLY		3 COLD				12·8		85·9
		4 HOT +				13·5		86·5
		5 HOT ⊙				14·9		85·2
CONTRACTOR'S TEST		6 WARM				13·7		85·8
		7 WARM				15·2		87·4
		8 WARM				15·0		80·5
		9 WARM				14·2		85·7
		10 COLD						90·2
		11 WARM						89·2
		12 WARM				14·6		97·2
		13 FALSE		INTENTIONAL				
		14 COLD				12·2		85·3
ACCEPTANCE TEST		15 WARM +						86·8
+ PORT IGNITOR ONLY		16 WARM ⊙						85·6
⊙ STBD IGNITOR ONLY		17 WARM						82·8
		18 COLD				11·6		95·8
		19 FALSE		INTENTIONAL		12·5		
		20 COLD				12·9		91·8

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

LOG OF STARTS

SECTION 8
SHEET No. 4 OF 9

CONDITION	TYPE OF START	TIME TO LIGHT (SEC)	TIME TO S.I.R. (SEC)	MAX J.T. C°	A.I.T. C°	OIL PRESS PSI	TIME TO RUN DOWN (SEC)
†PORT IGNITOR ONLY ⊙STBD IGNITOR ONLY	21 FAIL	TEST HOUSE CIRCUIT FAULTY					
	22 WARM						89·6
	23 WARM						89·5
PENALTY RUN.	24 HOT						88·1
	25 WARM						90·6
	26 WARM†						91·0
	27 WARM⊙						91·3
	28 WARM						87·6
	29 HOT						88·4
	30 WARM						88·0
	31 COLD						96·0
	32 FALSE		INTENTIONAL		13·0		
1ST CHECK RUN	33 COLD				13·0		94·4
	34 WARM				12·6		89·4
	35 COLD				13·4		100·6
2ND CHECK RUN	36 COLD				12·0		91·2
	37 WARM				12·8		102·0
	38 FALSE		INTENTIONAL				
	39 FAIL	TEST HOUSE CIRCUIT FAULTY					
	40 COLD						
	41 FALSE		INTENTIONAL				
	42 COLD	2·8					
	43 WARM	3·6	40·0		15·5		81·7
	44 WARM						80·0
	45 COLD	3·4	26·0	415			79·3
	46 WARM	3·0	41·6	465			80·7
	47 FALSE		INTENTIONAL				
	48 COLD	3·8	37·0	410			
	49 COLD	3·6	40·0		19·6		80·0
	50 WARM	2·8	39·4	480			
	51 WARM	2·9	33·0	450	18·0		
	52 COLD	3·7	34·0	410			80·4
	53 WARM	6·4	36·7				
	54 FALSE		INTENTIONAL				
	55 FAIL	TEST HOUSE CIRCUIT FAULTY					

M 304

LOG OF STARTS

SECTION 8
SHEET No. 5 OF 9

CONDITION		TYPE OF START	TIME TO LIGHT (SEC)	TIME TO S/R (SEC)	MAX JPT °C	AIT °C	OIL PRESS PSI	TIME TO RUN DOWN (SEC)
STARTER SERVICED	→	56 COLD						
		57 COLD						
		58 COLD						
		59 COLD	4	57·0	380	11	8	83
		60 HOT	3·5	32·0	465	12·2	7	84·8
		61 HOT	3·1	30·0	500	13·2	6	86·2
		62 WARM	3·6	36·2	480	12·8	7	86·8
		63 WARM	3·9	30·0	420	13·0	7	86·0
		64 WARM	3·6	26·4	460	14·1	6	87·3
		65 WARM	2·8	27·7	435	14·4	5	83·6
		66 WARM	3·6	23·0	390	14·0	6	89·6
		67 WARM	3·1	25·0	420	13·6	5	89·7
		68 WARM	2·8	24·8	415	14·4	5	85·0
		69 WARM	3·2	25·6	425	15·0	6	89·2
		70 WARM	2·6	24·0	428	14·4	4	89·2
25 HOUR ENDURANCE		71 WARM	2·6	23·1	442	12·2	4	89·5
		72 WARM	2·9	27·0	418	12·8	5	89·4
		73 WARM	2·9	23·3	430	11·8	5	90·2
		74 WARM	2·8	23·3	435	12·2	4	89·4
		75 WARM	2·5	23·0	435	12·8		90·0
		76 WARM	2·5	23·0	435	12·6	4	89·2
		77 WARM	2·8	25·0	435	12·1	4	88·4
		78 COLD	2·6	32·4	380	12·7		86·7
		79 WARM	2·3	27·1	420			88·6
		80 COLD	2·3	34·0	400	13·6		91·1
		81 WARM	2·2	35·2	450	12·0	7	88·7
		82 HOT	2·8	35·0	450	14·3	7	89·3
		83 HOT						90·1
		84 COLD	3·8	36·0	380	11·1	4	86·3
		85 COLD	2·7	30·2	380	18·0		83·0
		86 HOT	2·8	27·2	420	17·0		92·9
		87 WARM	2·8	34·2	440	18·8		98·4
		88 WARM	3·2	30·2	390	19·0		111·5
		89 FALSE		INTENTIONAL				

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

SECTION 8

SHEET No. 6 OF 9

LOG OF STARTS

CONDITION	TYPE OF START	TIME TO LIGHT (SEC.)	TIME TO S/R (SEC.)	MAX JPT °C	AIT °C	OIL PRESS PSI	TIME TO RUN DOWN (SEC)
FINAL RATING	90 COLD	3·0	48·0	390	18·0		98·0
	91 HOT	2·9	46·0	530	18·0		95·6
	92 HOT	3·2	34·7	515	18·0		95·2
	93 HOT	3·6	35·4	540	18·0		95·0
	94 HOT +	3·9	34·8	540	18·0		93·7
	95 COLD ⊙	3·8	30·8	440	17·3		92·6
	96 HOT	3·2	35·0	520	16·5		95·6
	97 HOT	2·8	28·0	510	19·0		92·1
	98 HOT	3·2	26·7	515	16·0		92·1
	99 HOT	3·3	23·5	525	15·9		91·8
	100 HOT	3·4	24·8	530	16·5		99·2

+ PORT IGNITOR ONLY

⊙ STBD IGNITOR ONLY

TEST PERFORMANCE FIGURES AND VIBRATION CURVES

Log of Accelerations

A total of 94 slam accelerations was carried out during the 25-hour endurance test.

	Accel. No.	Accel. time secs. Corr.	J.P.T. °C. at M.T.O.	R.P.M. at M.T.O.	R.P.M. at G.I. or 4500.	J.P.T. °C. at G.I. or 4500	A.I.T. °C.	Remarks
Stage 1	1	12	-	-	-	-	-	Cool slam
	2	12.6	-	-	-	-	-	Hot slam from G.I.
	3	-	-	-	-	-	-	Hot slam from 4,500
	4	14.5	-	-	-	-	-	Cool slam
	5	12.7	-	-	-	-	-	"
	6	12.6	-	-	-	-	-	"
	7	12.8	-	-	-	-	18.3	
	8	12.9	-	-	-	-	18.5	"
	9	12.8	-	-	-	-	18.3	"
Stage 2	10	13.5	637	8000			18.0	Cool Slam
	11	13.3	637	7980	2720	479	18.1	"
	12	4.0	638	7990	4520	419	18.2	"
	13	13.8	640	7980	2720	483	18.2	"
	14	4.1	641	8000	4500	417	19.0	"
	15	14.0	638	8000	2720	485	19.4	"
	16	3.3	638	7995	4500	409	18.0	"
	17	13.0	638	7990	2720	481	20.0	"
	18	4.1	638	7995	4505	412	20.5	"
	19	12.4	639	7990	2725	485	20.2	"
	20	4.0	639	7990	4500	413	19.0	"
	21	13.0	638	7990	2720	483	20.2	"
	22	4.1	638	7990	4490	411	20.0	"
	23	13.0	636	7985	2720	488	23.0	"
	24	3.8	639	7990	4510	412	20.1	"
	25	13.0	638	7990	2730	480	19.2	"
	26	3.9	637	7985	4510	410	18.6	"
	27	13.0	640	7990	2725	485	19.0	"
	28	4.0	639	7980	4510	411	18.0	"
	29	13.6	639	7985	2730	478	18.4	"
	30	4.1	639	7985	4490	411	18.0	"
	31	13.2	640	7980	-	-	18.4	"
	32	4.0	636	7945	4510	408	18.4	"
	33	13.0	637	7960	2750	481	17.8	"
	34	4.4	637	7945	4500	404	14.3	"
	35	14.8	630	7920	2760	471	17.6	"
	36	4.4	636	7935	4490	408	17.8	"

TEST PERFORMANCE FIGURES AND VIBRATION CURVES

Log of Accelerations

Accel. No.	Accel. time Secs. Corr.	J.P.T. °C. at M.T.O.	R.P.M. at M.T.O.	R.P.M. at G.I. or 4500	J.P.T. °C. at G.I. or 4500.	A.I.T. °C.	Remarks
80	3.8			4500	11.2		Cool Slam
81	3.8			4500	11.2		"
82	3.8			4500	11.8		"
83	3.7			4500	11.4		"
84	3.7			4500	11.3		"
85	3.9			4500	12.0		"
86	4.0			4500	12.0		"
87	3.6			4500	12.0		"
88	3.6			4500	12.0		"
89	3.9			4500	12.2		"
90	3.7			4500	12.4		"
91	3.8			4500	12.4		"
92	3.9			4500	12.2		"
93	3.9			4500	12.2		"
94	3.9			4500	12.4		"

Stage 3 (continued)

Average acceleration conditions during 25-hour endurance run.

Accelerations from Ground Idling Stage 2

31	13.0	636	7952	2732	482	19.8

Accelerations from 4500 r.p.m. Stage 2

29	4.1	637	7952	4502	413	20.5

Accelerations from 4500 r.p.m. Stage 2

25	3.8	-	-	4500	-	12.4

TEST PERFORMANCE FIGURES AND VIBRATION CURVES.

Log of Accelerations

Accel. No.	Accel. time Secs. Corr.	J.P.T. °C. at M.T.O.	R.P.M. at M.T.O.	R.P.M. at G.I. or 4500	J.P.T. °C. at G.I. or 4500	A.I.T. °C.	Remarks
37	13.0	636	7940	2755	482	20.8	Cool Slam
38	3.6	636	7940	4500	411	21.6	"
39	13.1	635	7920	2745	486	21.5	"
40	4.3	635	7925	4490	415	20.0	"
41	12.9	635	7925	2740	486	21.2	"
42	3.6	635	7925	4495	414	20.0	"
43	13.3	636	7940	2750	482	21.2	"
44	4.3	635	7925	4510	413	22.0	"
45	13.5	635	7925	-	-	18.4	"
46	4.4	635	7930	4475	412	20.2	"
47	12.6	632	7910	2745	479	19.8	"
48	4.4	636	7930	4510	411	20.4	"
49	12.2	634	7910	2740	474	19.8	"
50	4.2	634	7915	4505	412	21.7	"
51	12.8	636	7925	2730	483	20.8	"
52	3.7	635	7915	4510	418	23.2	"
53	13.1	634	7920	2735	486	21.3	"
54	3.5	637	7925	4490	414	23.8	"
55	12.2	637	7930	2730	479	20.2	"
56	4.3	636	7930	4505	416	22.2	"
57	12.0	636	7935	2725	484	21.0	"
58	4.0	634	7930	4520	412	24.0	"
59	12.2	635	7930	2710	482	20.0	"
60	4.0	635	7940	4505	416	22.8	"
61	12.9	736	7930	2725	486	21.6	"
62	4.6	637	7940	4490	414	21.0	"
63	12.8	635	7925	2725	485	21.5	"
64	5.0	636	7940	4475	415	21.6	"
65	13.0	637	7940	2740	482	21.0	"
66	4.3	633	7930	4520	412	24.0	"
67	12.8	636	7940	2740	482	20.2	"
68	4.6	635	7935	4510	413	23.6	"
69	12.8	634	7920	2740	478	20.8	"
70	4.0			4500		13.2	Cool Slam
71	3.9			4500		13.2	"
72	3.9			4500		13.2	"
73	3.6			4500		13.2	"
74	3.7			4500		13.2	"
75	4.0			4500		13.2	"
76	4.0			4500		13.2	"
77	3.8			4500		13.2	"
78	4.0			4500		13.2	"
79	4.0			4500		13.2	"

Stage 2 (continued)

Stage 3

30

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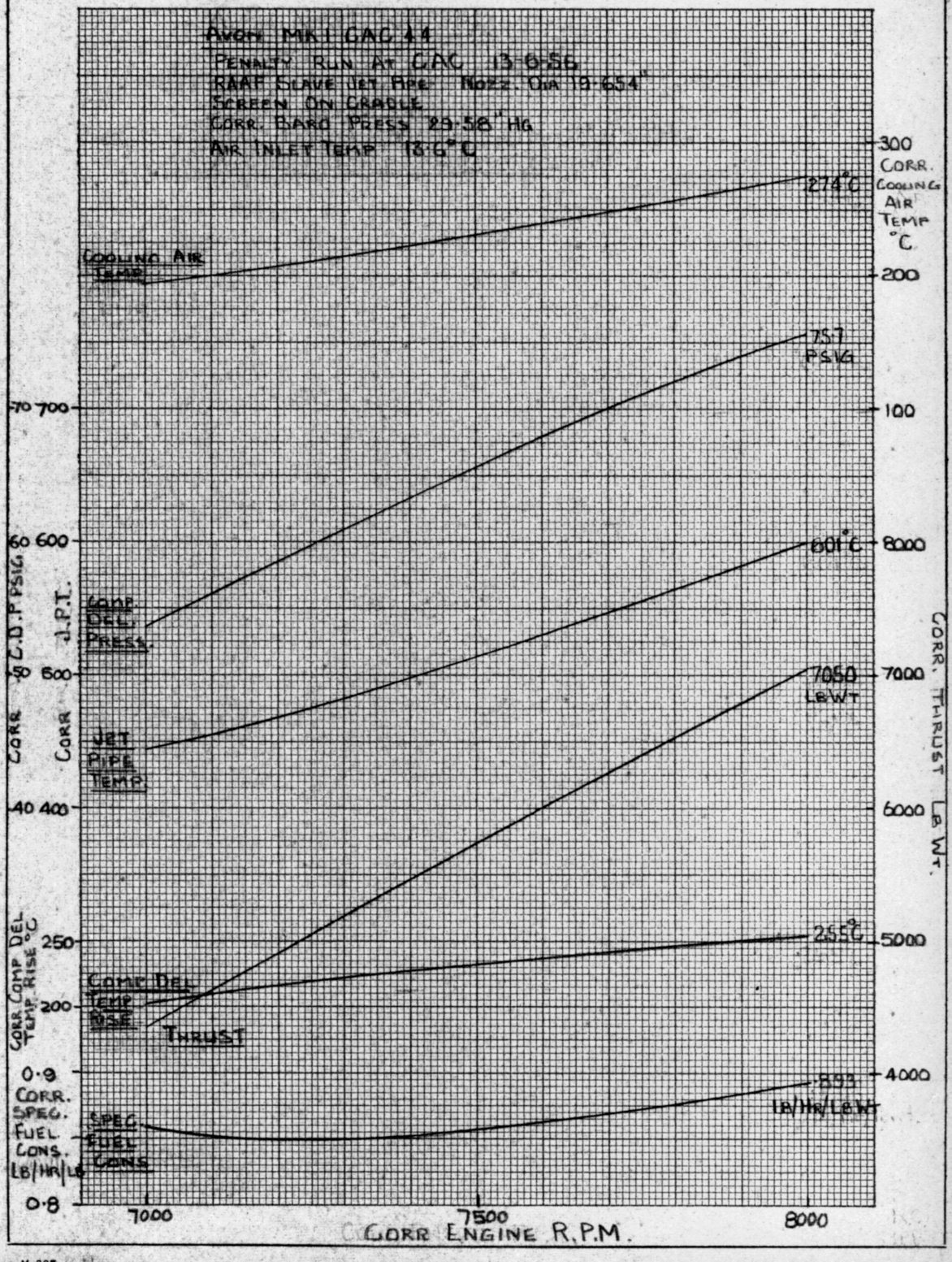
MELBOURNE, VICTORIA

FIG 1

SECTION 8

DATE:



M 325

31

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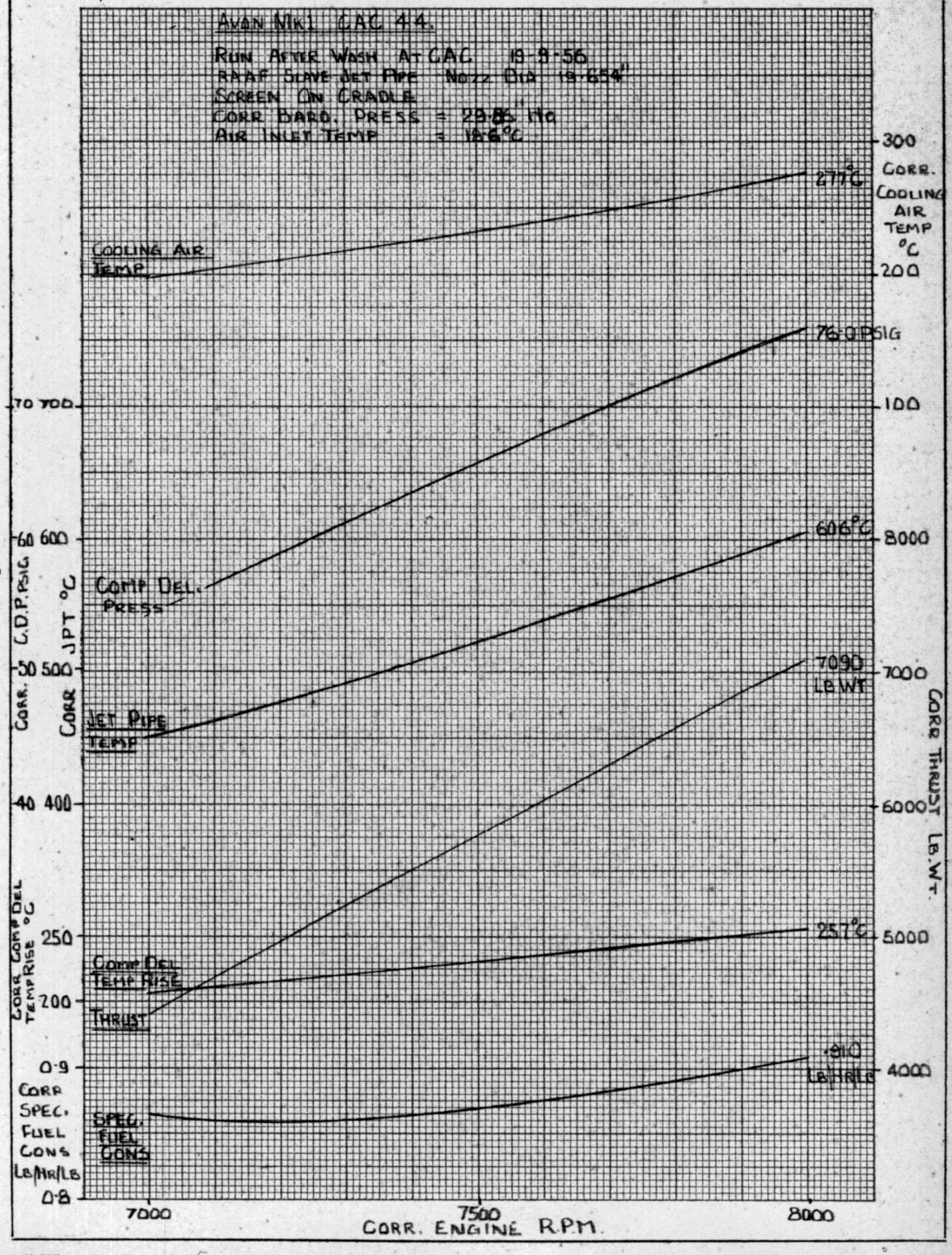
MELBOURNE, VICTORIA

FIG 2

SECTION 8

DATE:



M 325

32

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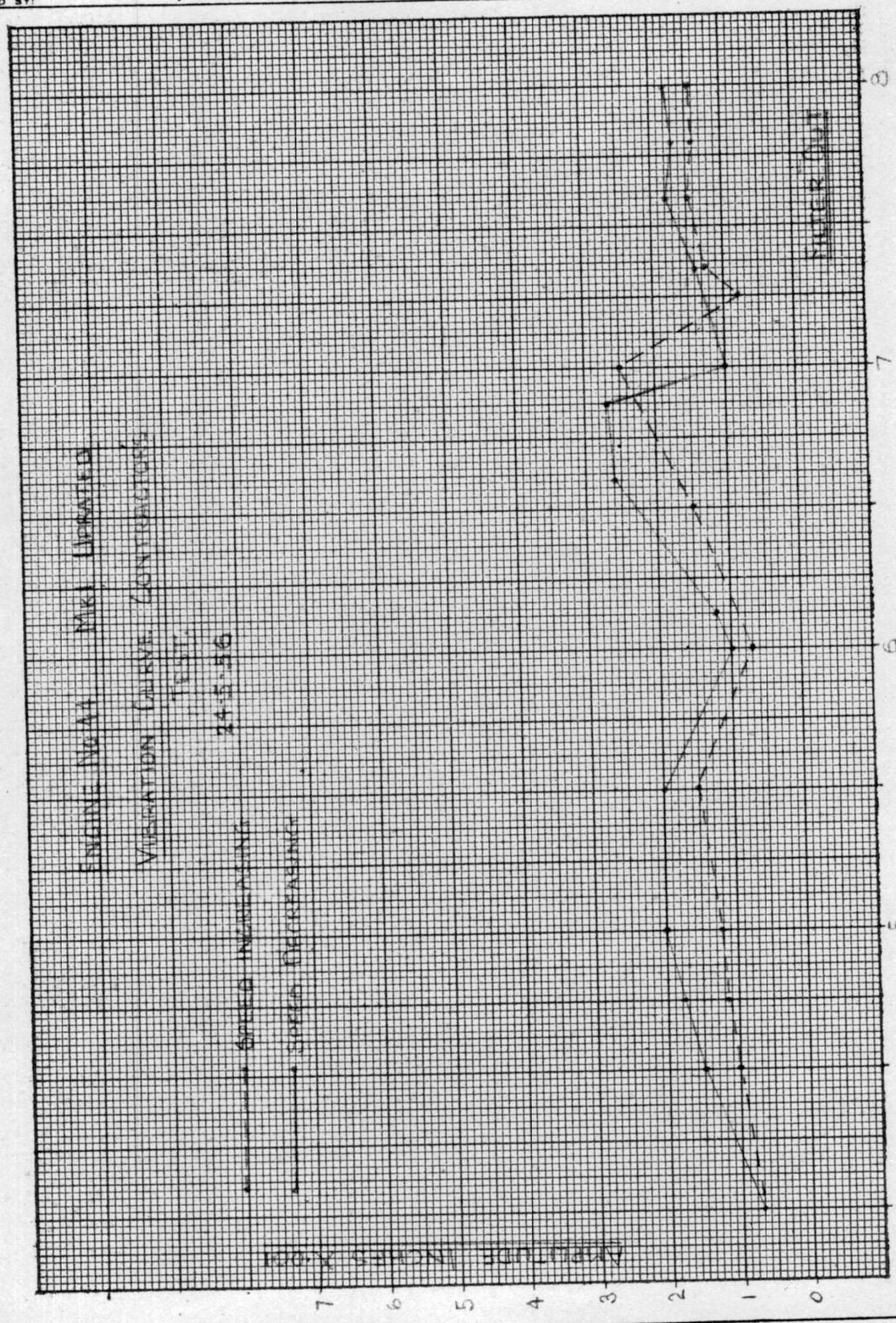
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA FIG 3

SECTION No 8

DATE: 14-1-57.



VIBRATION CURVE No1

M 325

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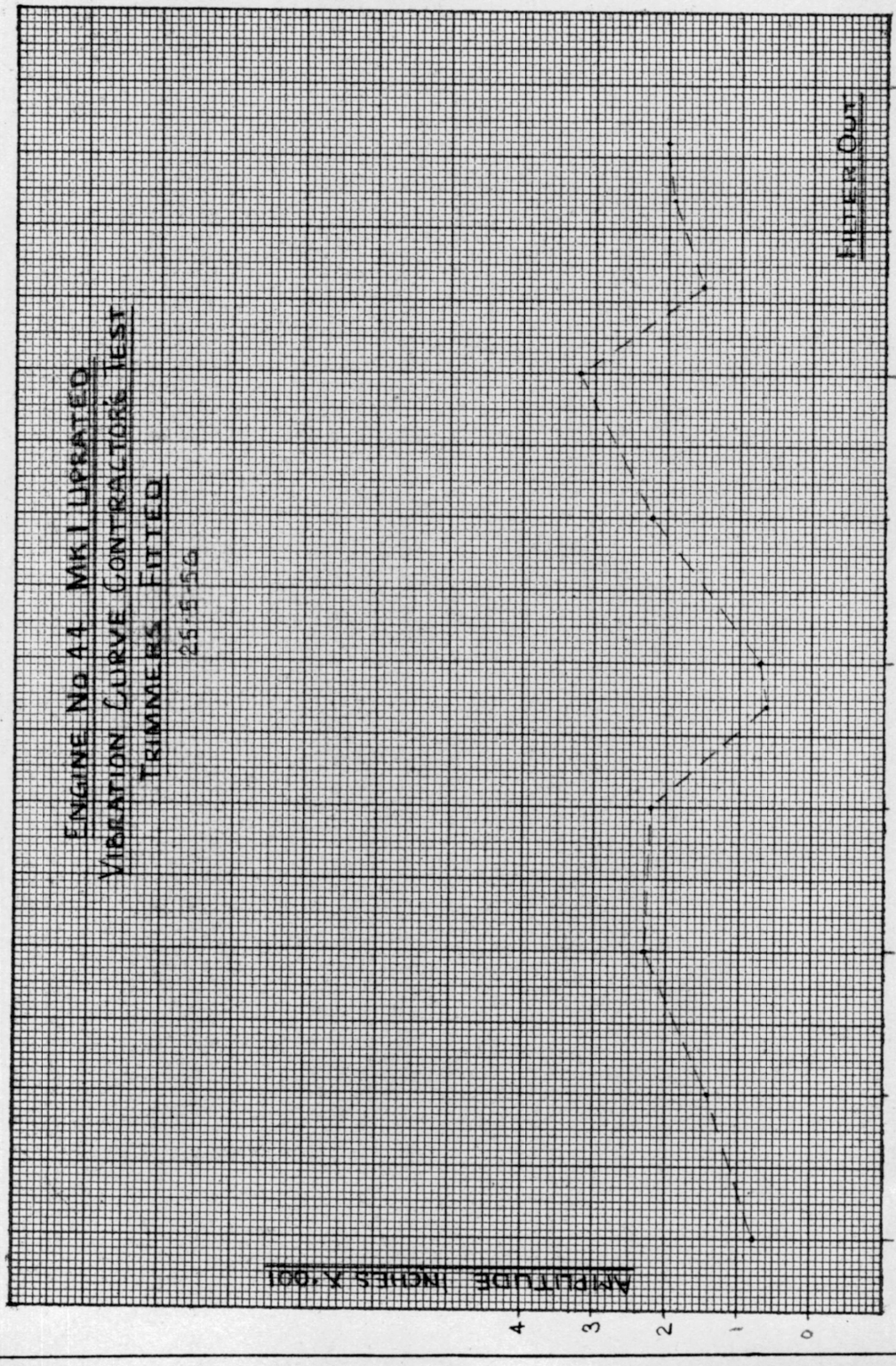
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA FIG 4

SECTION NO 8

DATE: 15-1-57



VIBRATION CURVE No 2

M 325

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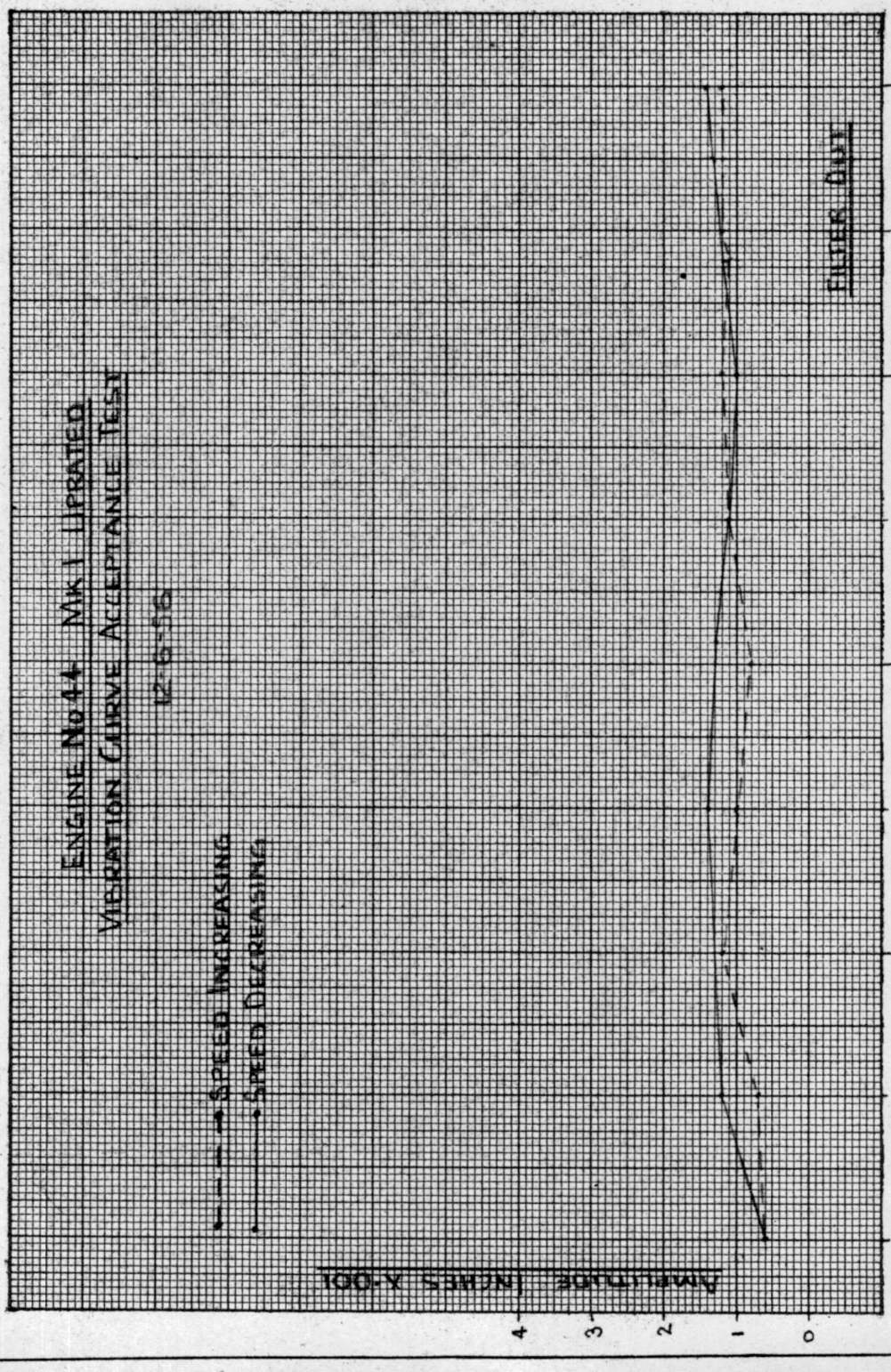
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA FIG 5

SECTION No 8

DATE: 15-1-57



VIBRATION CURVE No 3

M 325

35

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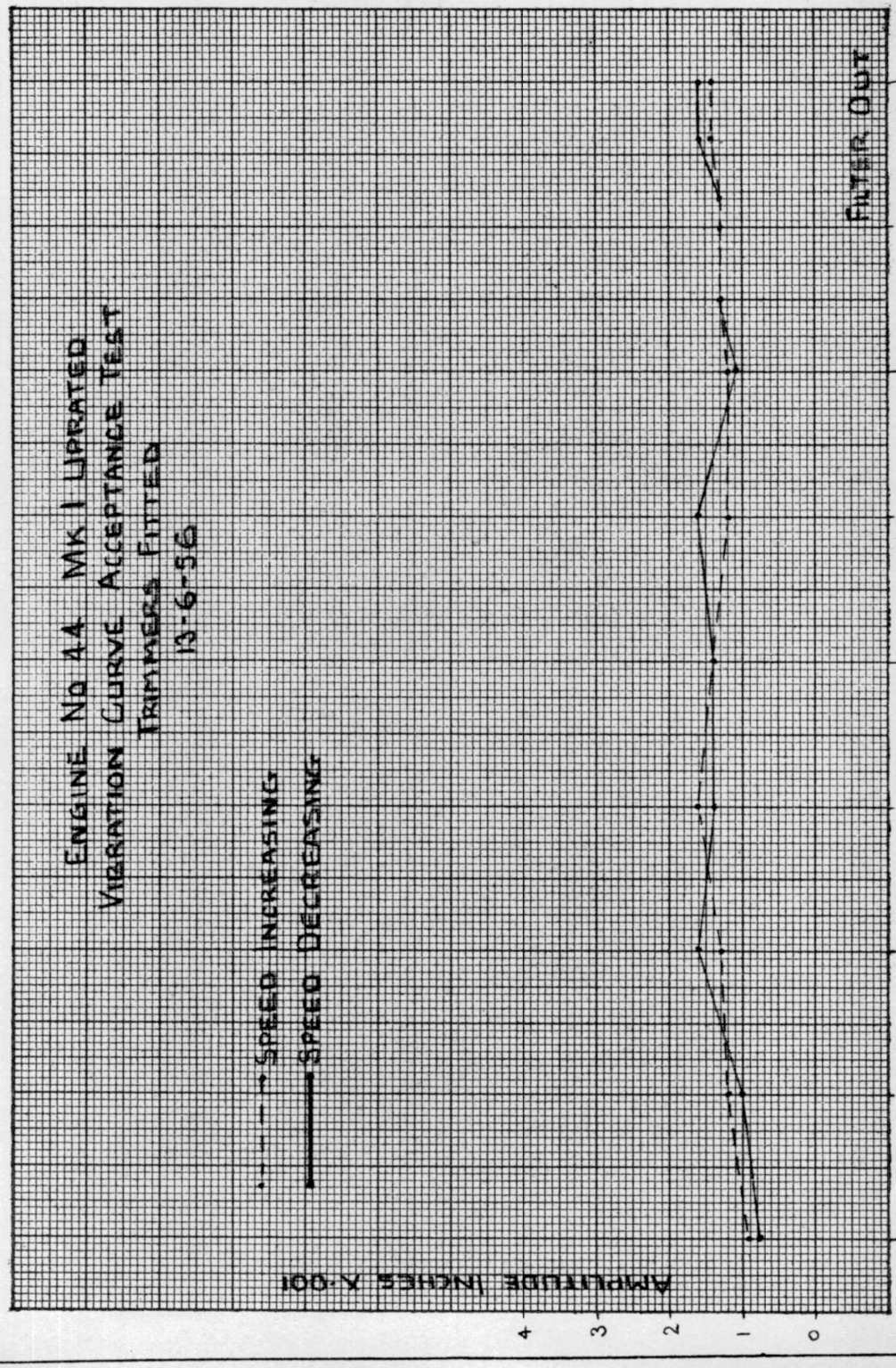
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE VICTORIA FIG 6

SECTION B

DATE: 15-1-57



VIBRATION CURVE No 4

M 325

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MELBOURNE VICTORIA

SECTION 8
DATE: 15-1-57
Fig 7

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VIBRATION CURVE No 5

R.P.M. x 1000

4 5 6 7 8

0 1 2 3 4 5

AMPLITUDE INCHES x .001

Speed Increasing
Speed Decreasing

Filter Out

ENGINE No 44 Mk I UPRATED
PRELIMINARY VIBRATION CURVE 31-8-56
RAAF Test Stand LAVERTON

M 325

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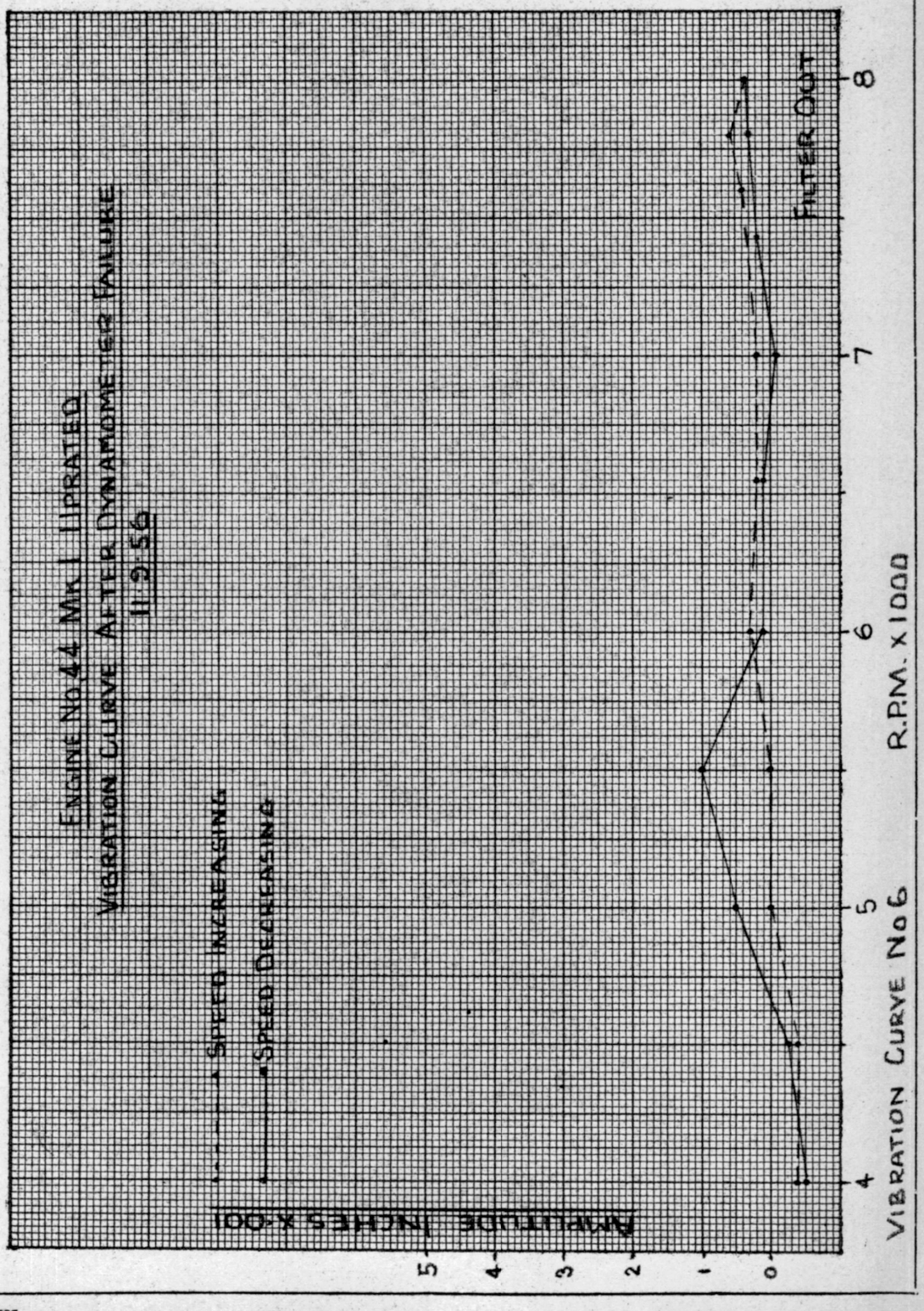
MELBOURNE VICTORIA FIG 8

SECTION No. 8

DATE: 15-1-57



M 325

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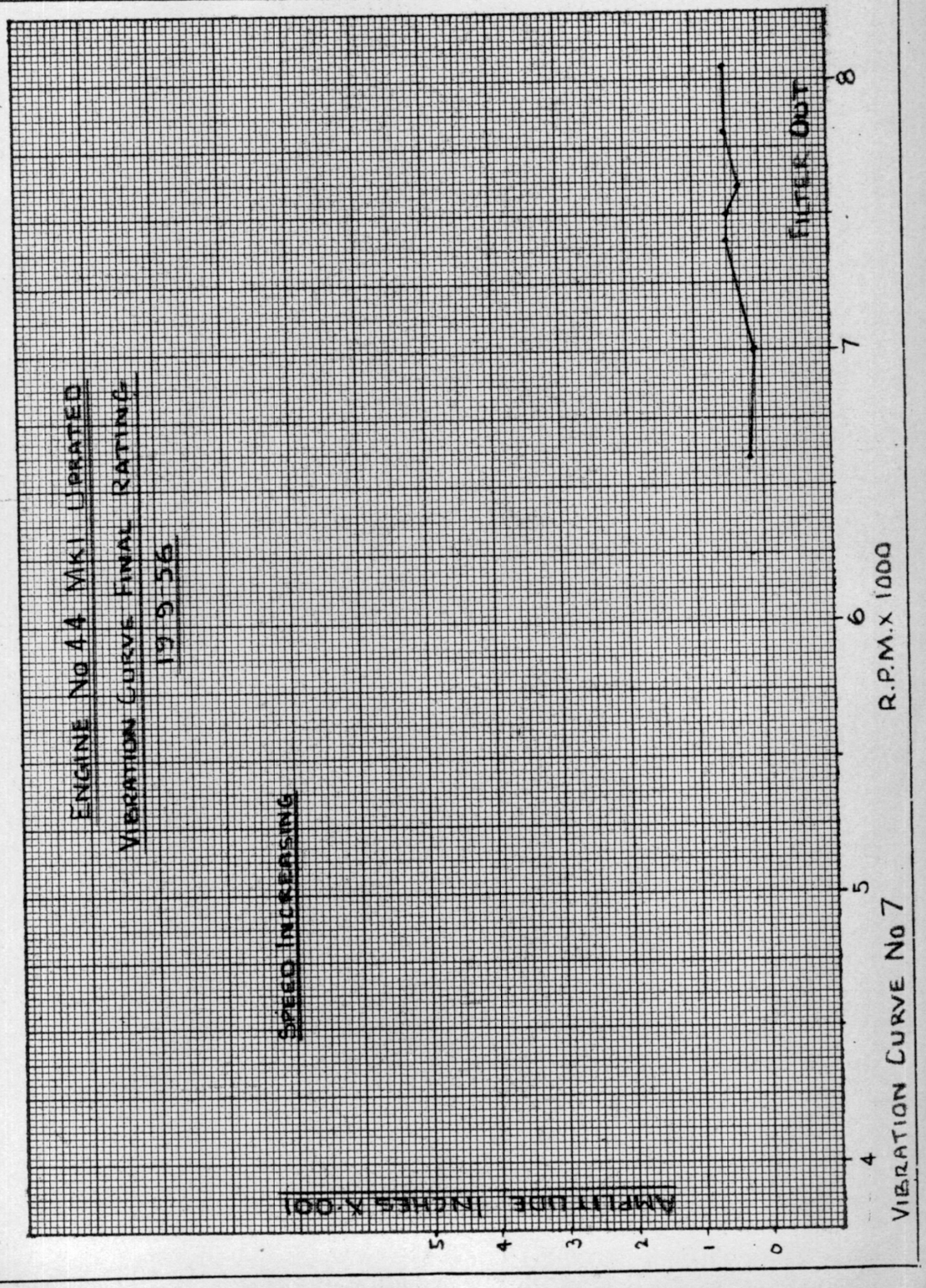
MELBOURNE VICTORIA FIG 9

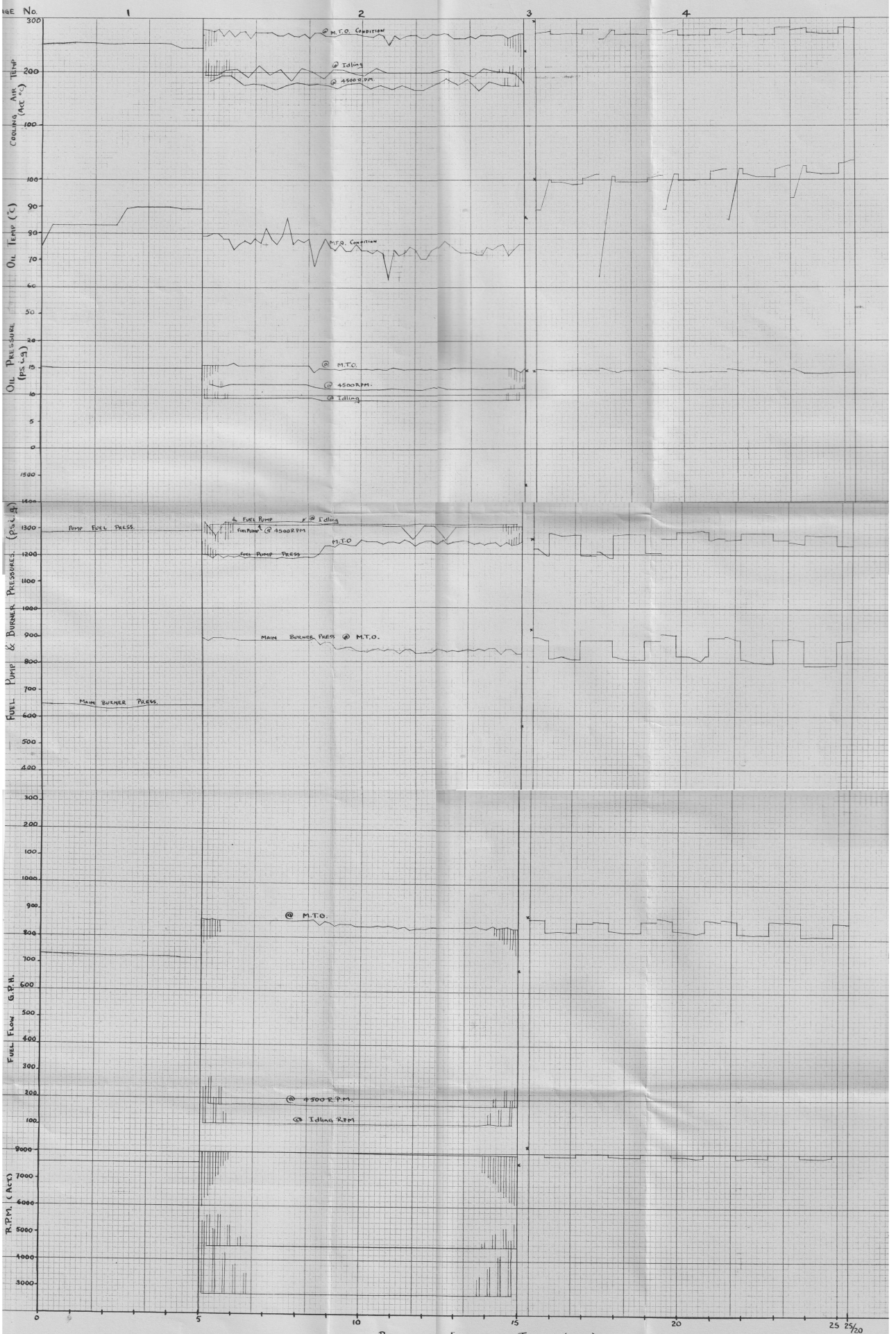
SECTION No 8

DATE: 15-1-57



VIBRATION CURVE No 7

AVON MK 1 ENGINE No. 44 25HR. POTTED TYPE TEST. SHEET No. 2.



R.C.

AVON MK.1 ENGINE Nº 44 25 HOUR POTTED TYPE TEST

STAGE No.	1.	2	3	4
DATE	4-9-56	5-9-56 to 6-9-56	12-9-56	13-9-56
BARO. "Hg.	30.36	30.25 (Av.)	30.00 "(Av.)	3020	30.25 "Hg
FUEL S.G.	.792	.792	.792	.792	.792
OIL CONS Pts	1.76	1.63	2.5	10.85

A.I.T. °C

CENTRE & REAR BEARING TEMP °C (Act.)

COMP DEL. TEMP °C (Act.)

COMP DEL. PRESS. P.S.I.G (Act.)

JET PIPE TEMP °C (Act.)

THRUST lbs/st (Act.)

R.P.M. (Act.)

@ M.T.O. Condition

CENTRE BEARING TEMP

REAR BEARING TEMP

CENTRE BEARING TEMP PEAK VALUES

REAR BEARING TEMP PEAK VALUES

REAR BEARING TEMP.

M.T.O.

@ 4500 R.P.M

@ Idling

M.T.O.

@ 4500 R.P.M

@ Idling R.P.M

M.T.O.

@ Idling R.P.M.

@ 4500 R.P.M.

M.T.O.

@ 4500 R.P.M

@ Idling R.P.M

M.T.O.

Idling R.P.M.

PROGRESSIVE ENDURANCE TIME (HOURS).

FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 1 OF 20
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	LIST OF PHOTOGRAPHS	MODEL NO. Section 9

Fig. No.	Title
1	Condition of Wheelcase Drive Gears
2	Coking and varnishing of oil within the rear bearing housing
3	Burnt oil deposit within rear bearing housing
4	Burnt oil deposit within rear bearing housing
5	Typical location of failed nozzle box stiffener and screws
6	Burnt oil deposit on diaphragm plate
7	High pressure air seal gland rub
8	Distortion No. 1 Combustion Chamber
9	Distortion No. 2 Combustion Chamber
10	Distortion No. 3 Combustion Chamber
11	Distortion No. 4 Combustion Chamber
12	Distortion No. 5 Combustion Chamber
13	Distortion No. 6 Combustion Chamber
14	Distortion No. 7 Combustion Chamber
15	Distortion No. 8 Combustion Chamber
16	Inner Flare No. 1 flame tube
17	Inner Flare No. 2 flame tube
18	Inner Flare No. 3 flame tube
19	Inner Flare No. 4 flame tube
20	Inner Flare No. 5 flame tube
21	Inner Flare No. 6 flame tube
22	Inner Flare No. 7 flame tube
23	Inner Flare No. 8 flame tube
24	Reject Rubber Hose Assembly
25	Reject Rubber Hose Assembly
26	No. 1 Burner
27	No. 2 Burner
28	No. 3 Burner
29	No. 4 Burner
30	No. 5 Burner
31	No. 6 Burner
32	No. 7 Burner
33	No. 8 Burner
34	Tooth marking on Tacho drive gear
35	Damaged compressor case, upper half
36	Damaged compressor case, lower half
37	Reject starter firing lead



Fig. 1. Showing good condition of Wheelcase Drive Gears.

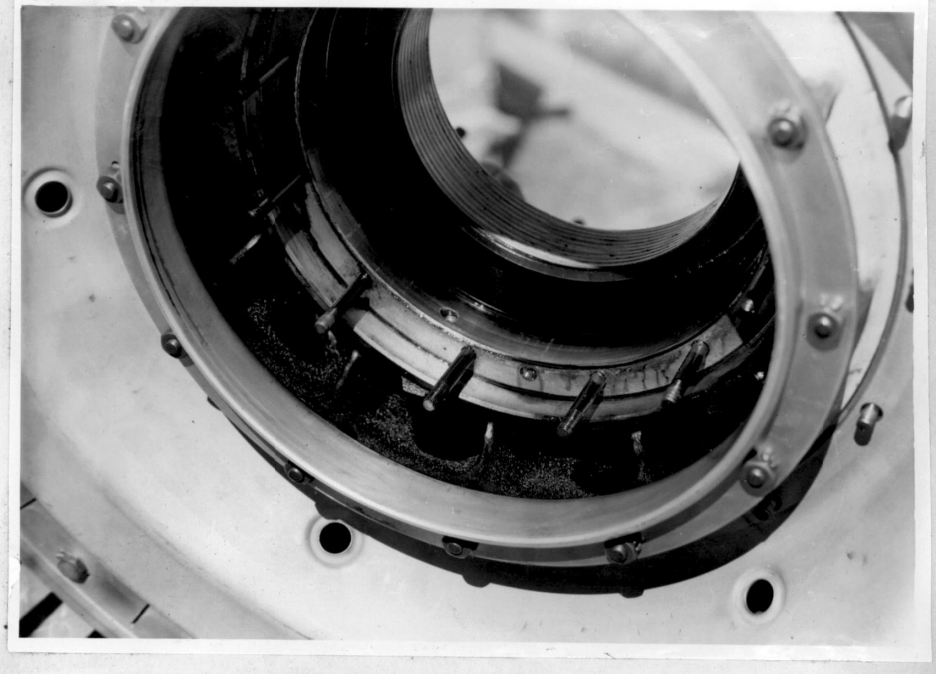


Fig. 2. Showing coking and varnishing of oil within rear bearing housing.



Fig. 3. Showing burnt oil deposit within rear bearing housing



Fig. 4. Showing burnt oil deposit within rear bearing housing.



Fig. 5. Typical location of failed nozzle box stiffener screws.



Fig. 6. Showing burnt oil deposit on Diaphragm Plate



Fig. 7. Showing H.P. Air Seal Gland Rub

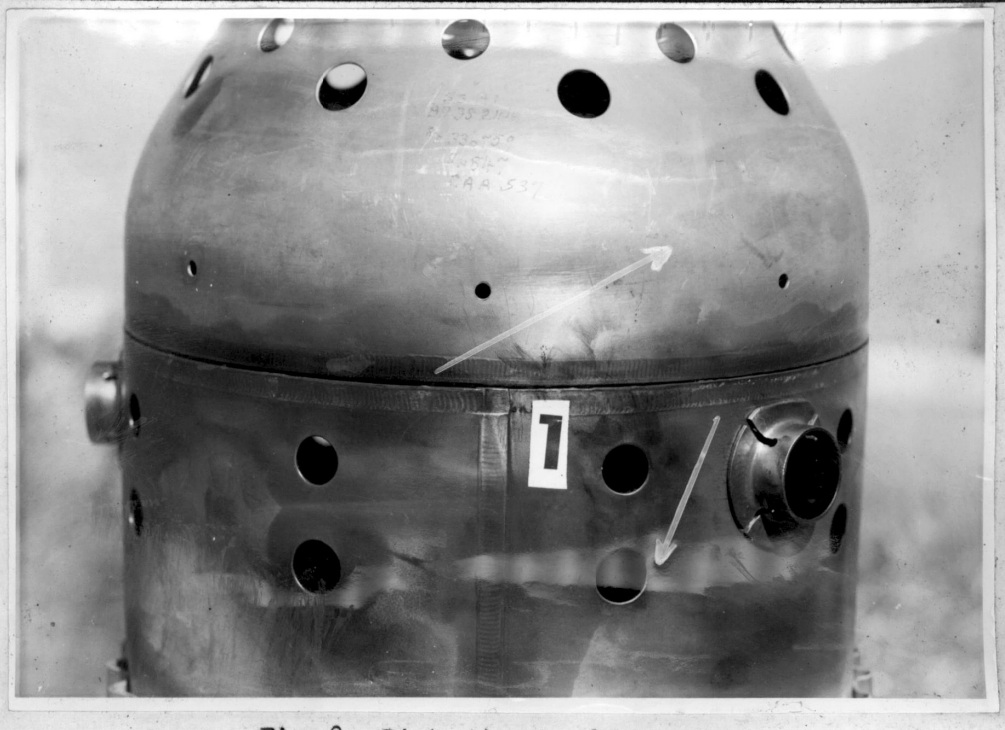


Fig. 8 Distortion No. 1 Flame Tube



Fig. 9. Distortion No. 2 Flame Tube

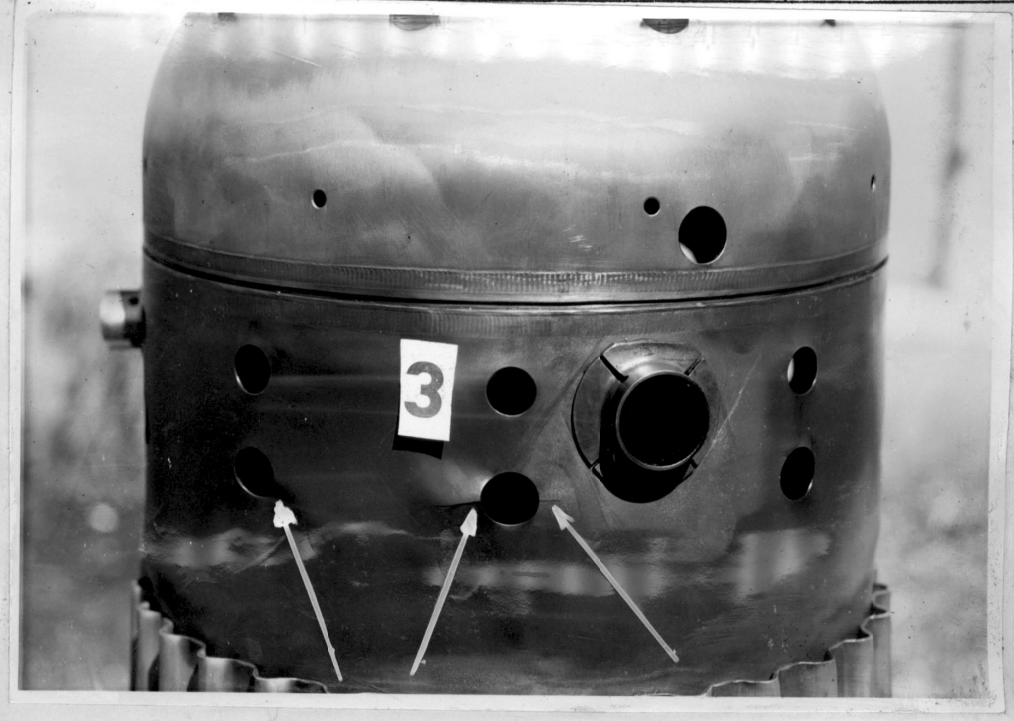


Fig. 10 Distortion No. 3 Flame Tube

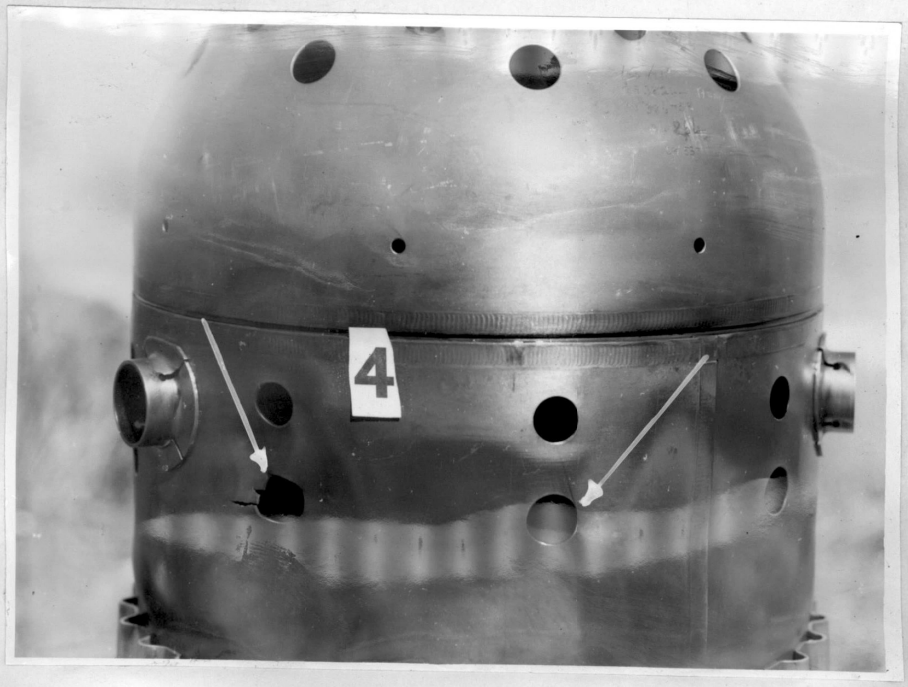


Fig. 11. Distortion No. 4 Flame Tube



Fig. 12. Distortion No. 5 Flame Tube

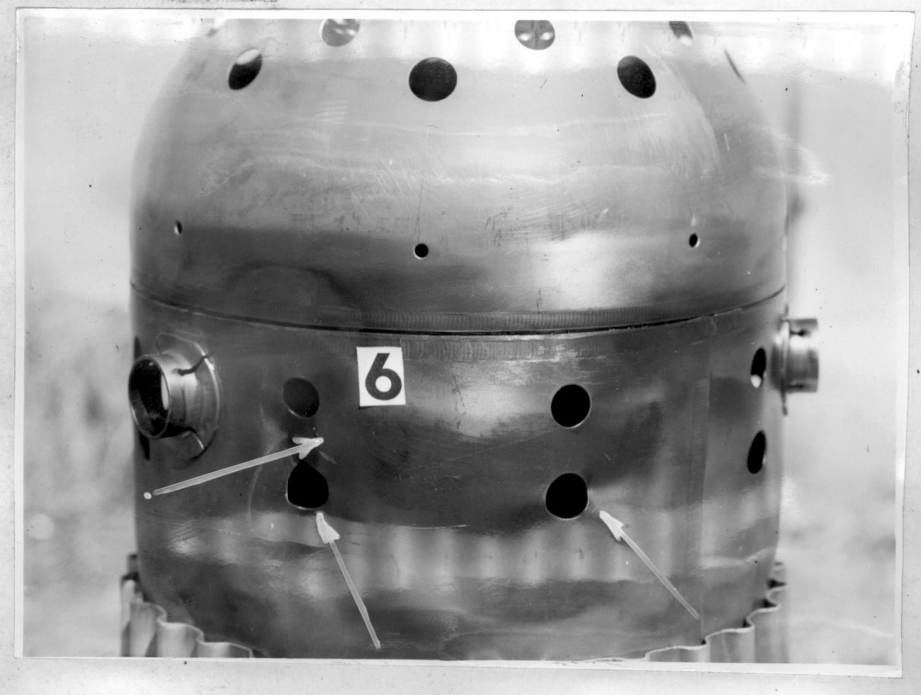


Fig. 13. Distortion No. 6 Flame Tube

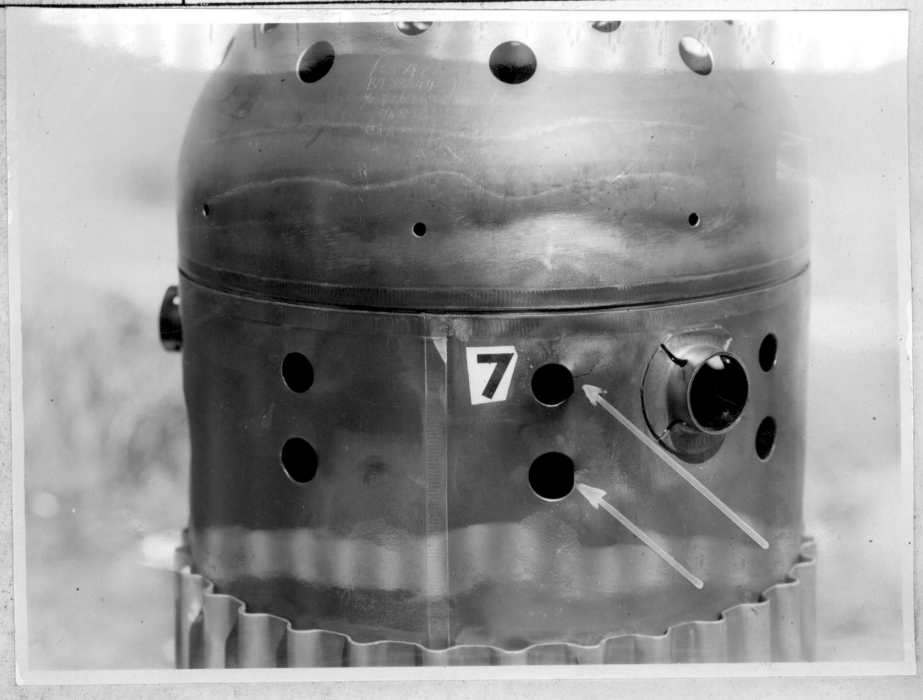


Fig. 14. Distortion No. 7 Flame Tube

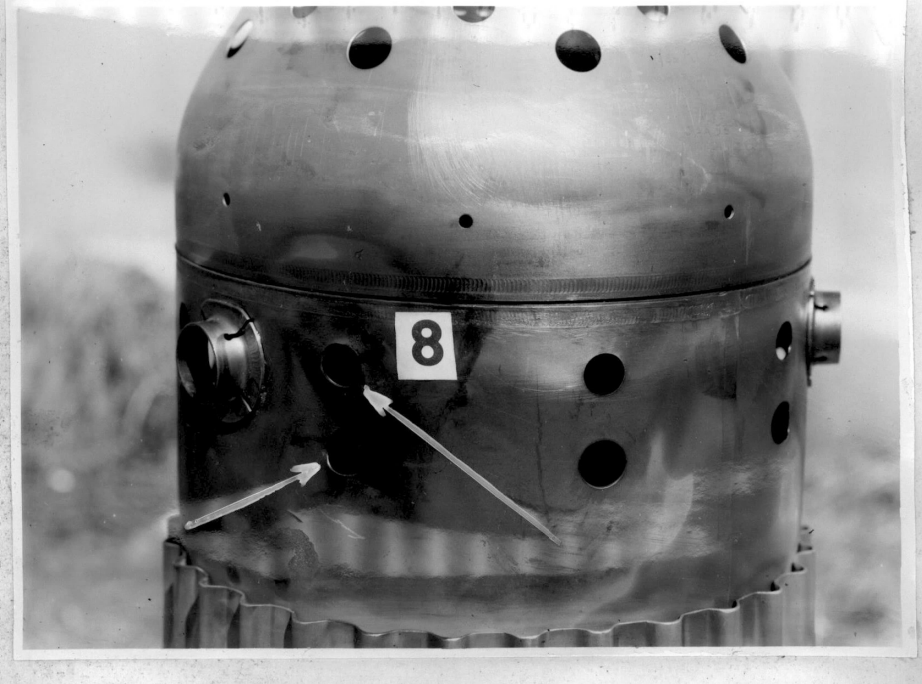


Fig. 15. Distortion No. 8 Flame Tube



Fig. 16. Inner Flare No. 1 Flame Tube

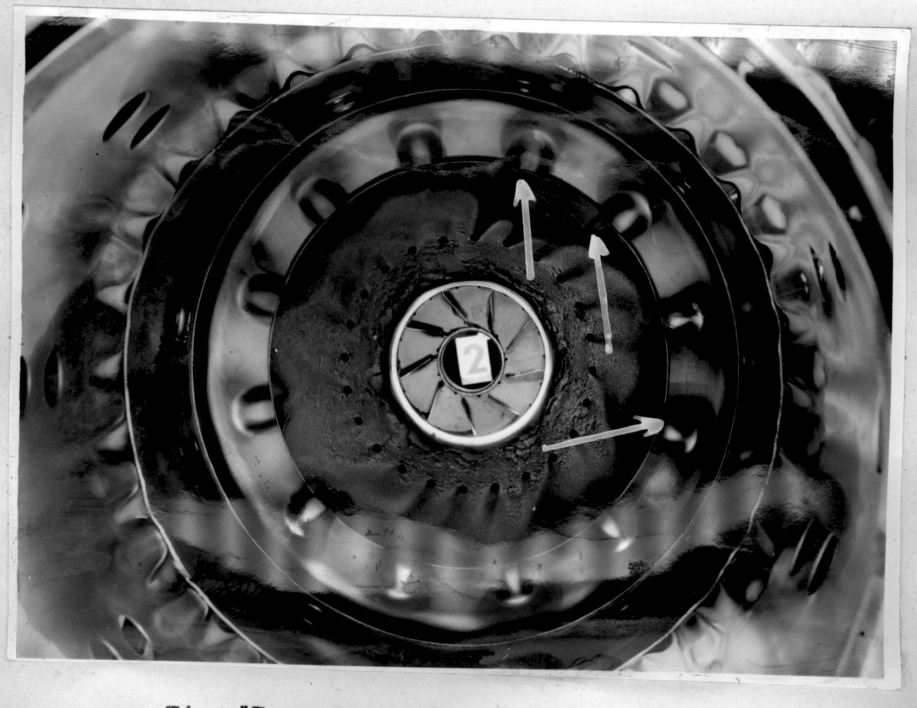


Fig. 17. Inner Flare No. 2 Flame Tube



Fig. 18. Inner Flare No. 3 Flame Tube

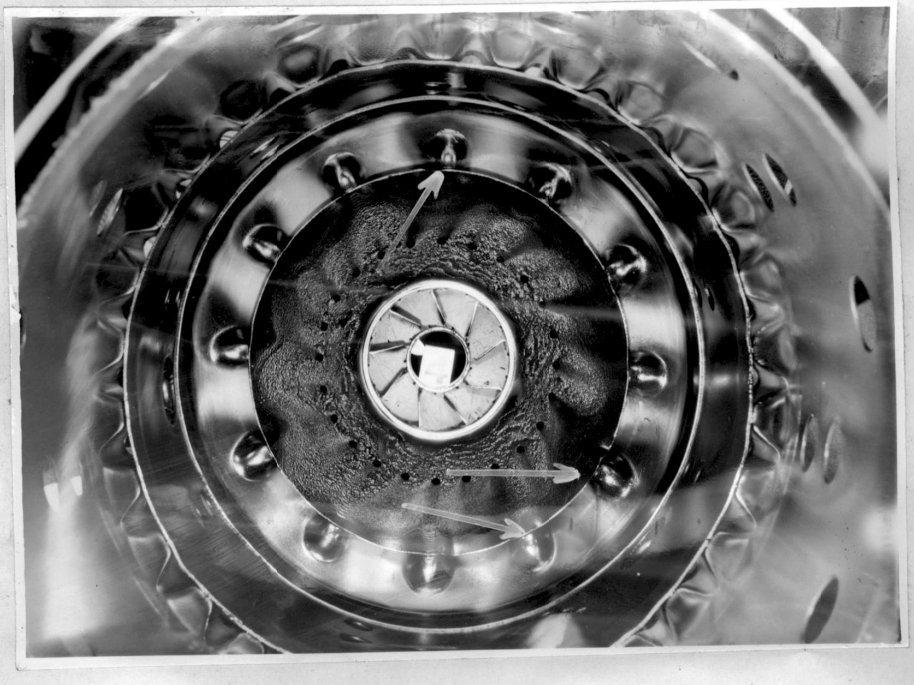


Fig. 19. Inner Flare No. 4 Flame Tube

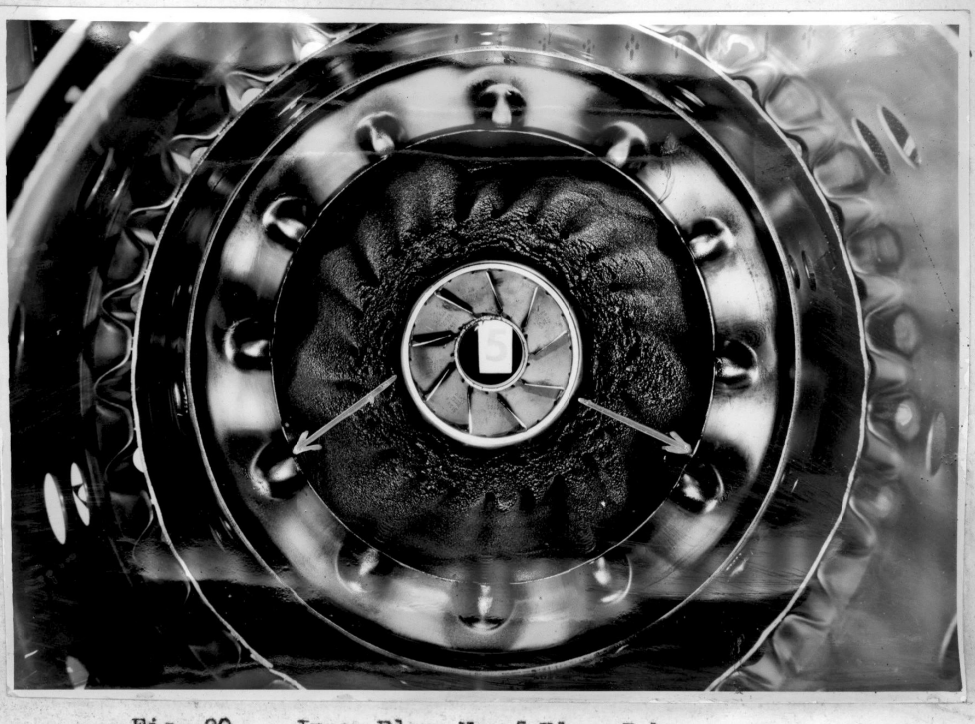


Fig. 20 Inner Flare No. 5 Flame Tube

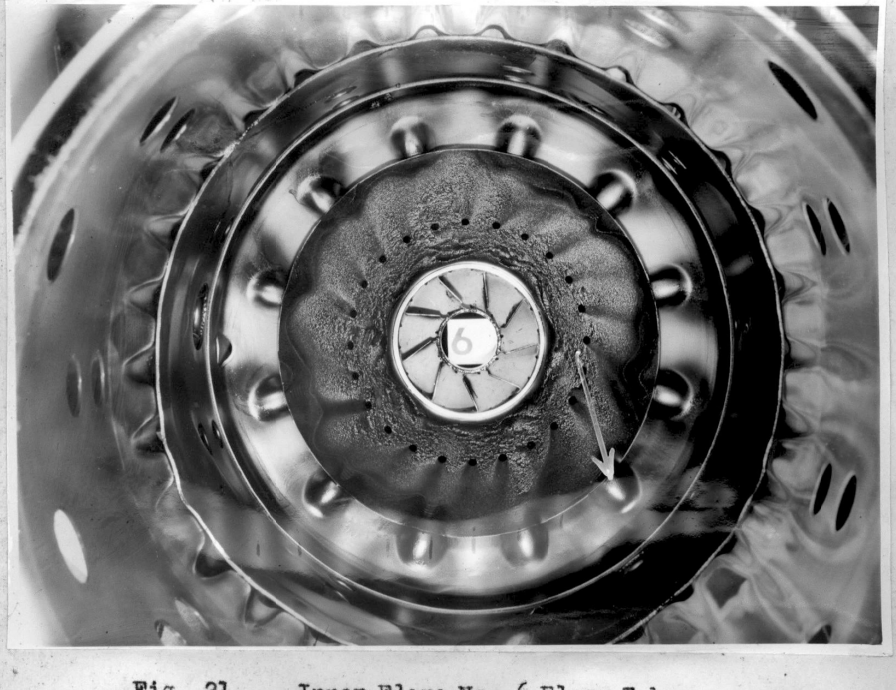


Fig. 21. Inner Flare No. 6 Flame Tube

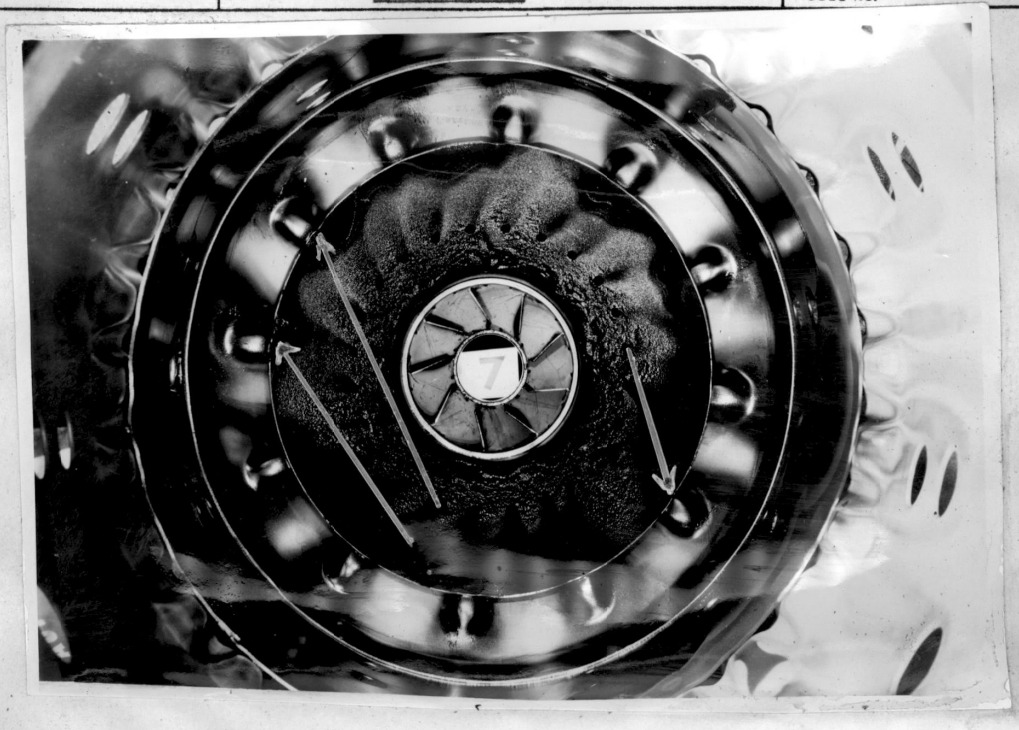


Fig. 22 Inner Flare No. 7 Flame Tube

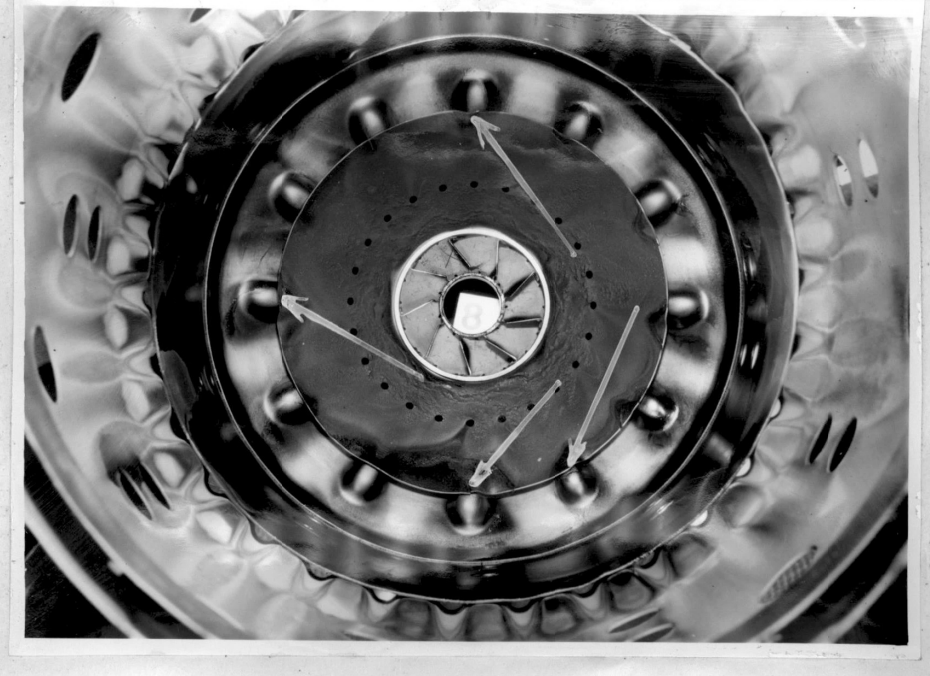


Fig. 23. Inner Flare No. 8 Flame Tube



Fig. 24 Reject Rubber Hose Assembly



Fig. 25. Reject Rubber Hose Assembly



Fig. 26 No. 1 Burner

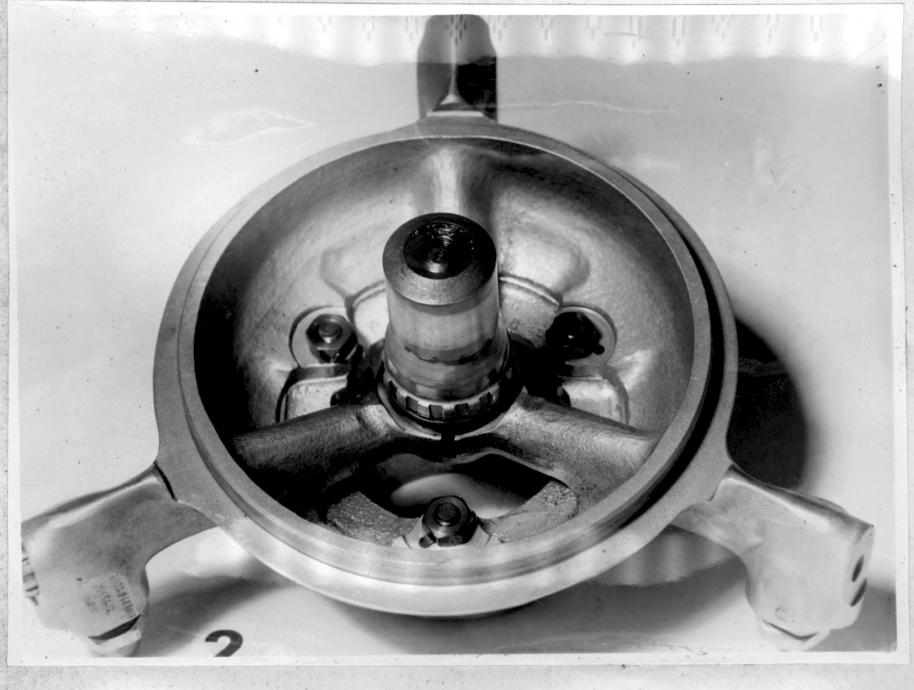


Fig. 27. No. 2 Burner.

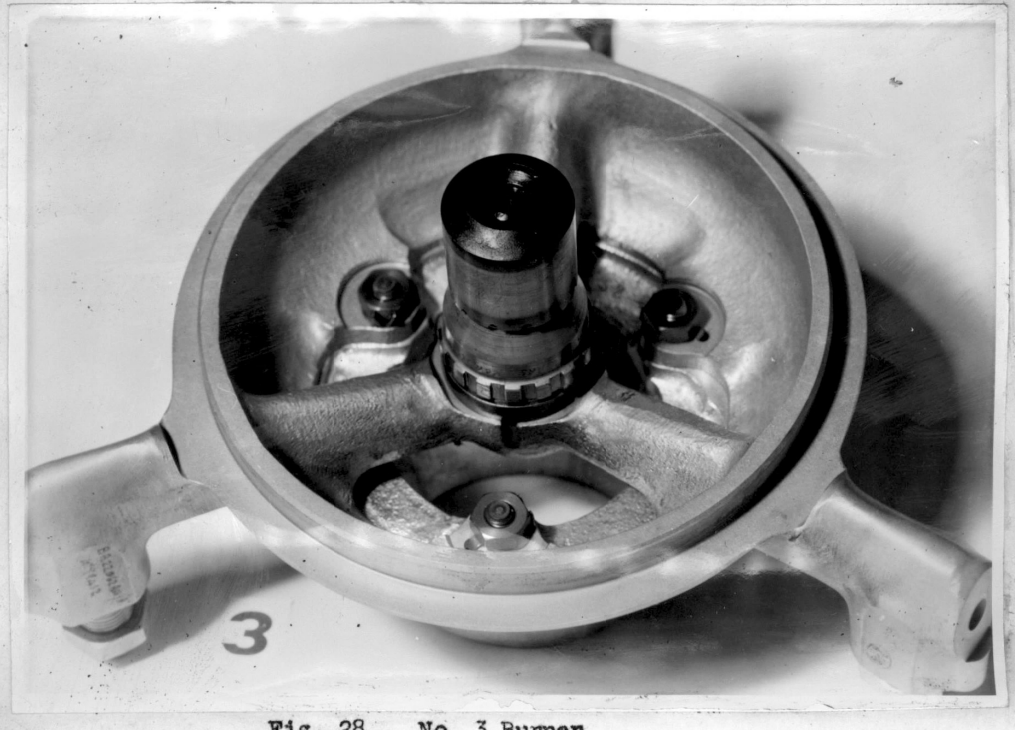


Fig. 28. No. 3 Burner



Fig. 29 No. 4 Burner



Fig. 30 No. 5 Burner

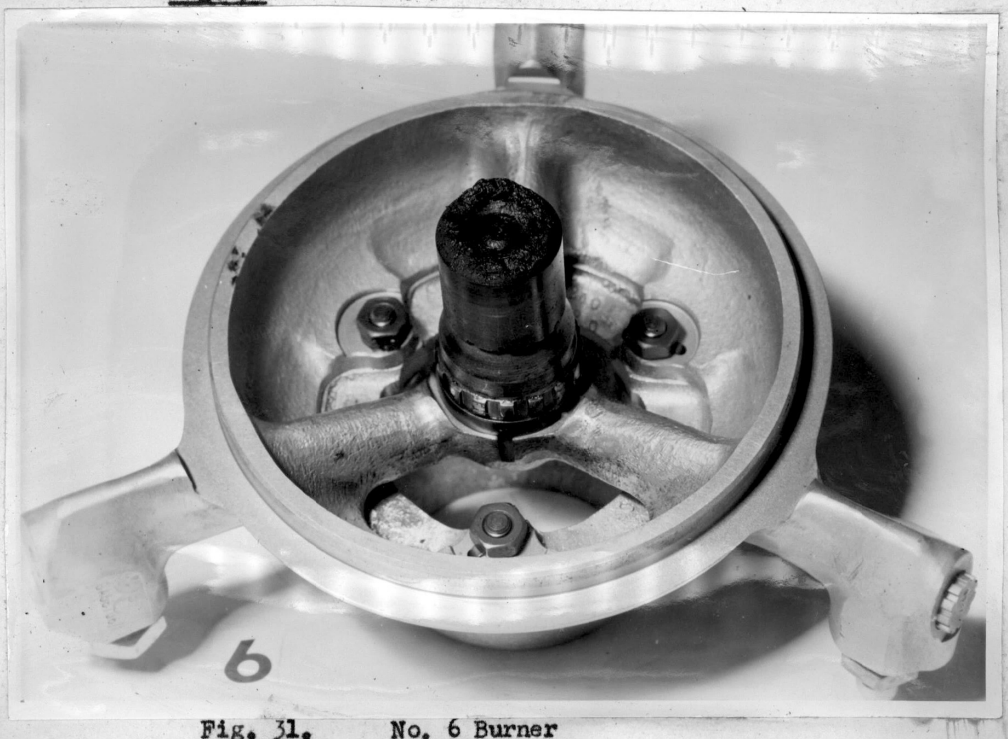


Fig. 31. No. 6 Burner



Fig. 32. No. 7 Burner



Fig. 33 No. 8 Burner

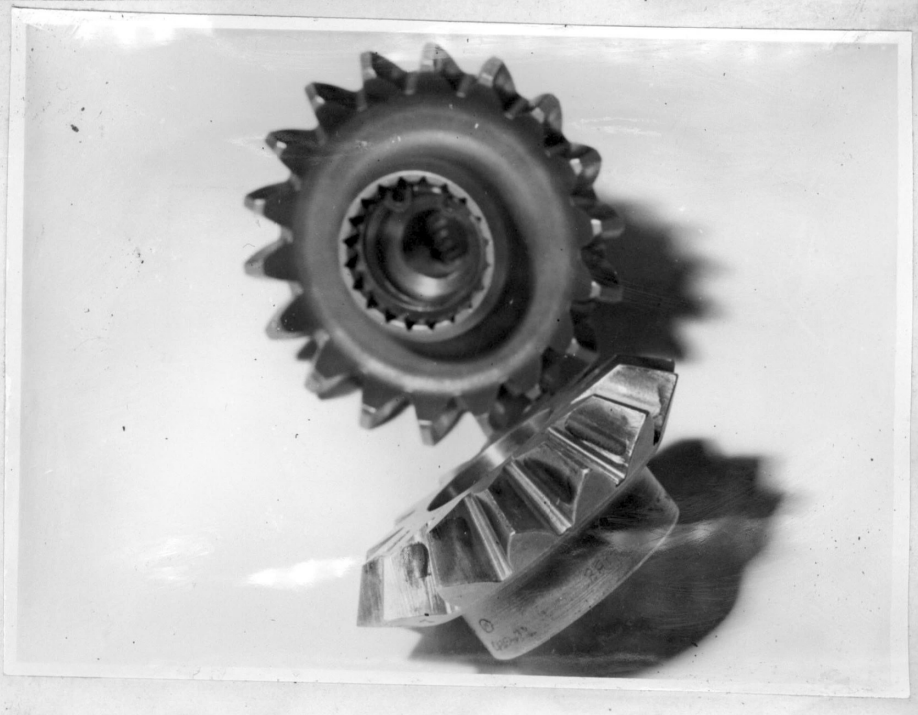


Fig. 34 Tooth Marking on Tacho Drive Gear



Fig. 35 Damaged Compressor Case. Upper Half

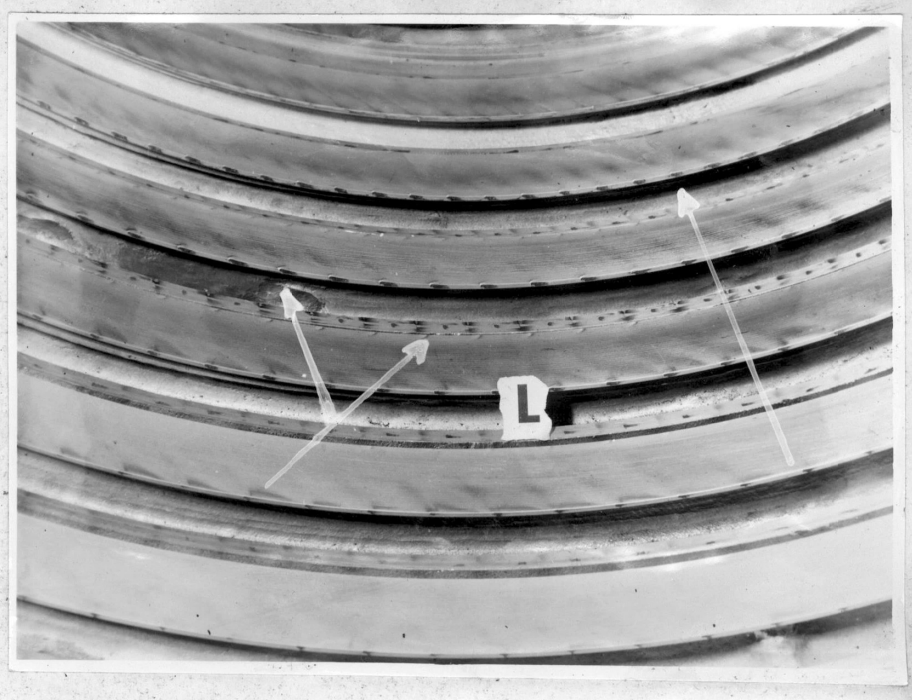


Fig. 36 Damaged Compressor Case, Lower Half



Fig. 37 Reject Starter Firing Lead

/2

FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 1 OF 2
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	APPENDIX I	MODEL NO. Section 10.1

19.11.56

INSPECTION REPORT ON BEARING EX "AVON" No. 44

After Potted Type Test

Centre Bearing BA.3488A/1 Duplex Type. Spec. 2 S/N.AA-96

Inner Races — Ball tracks in good order except for flight flecking and/or indentation. Also some minute bright spots on rear half (possible initial stage of spalling).
Balls tracking normally.
Both components heat or oil stained dark straw to dark brown; the rear half being the darker stained.
Galling at mating faces more than normal, also bright narrow band of fretting at I/D of rear half (coincides with end of O/D of rear shaft assembled).

Outer Race — Generally indentedtrack (by broken ball material).
Heat or oil stained, light straw color.

Balls — 1 off spalled. Area approx. .070/.080^2
Also a number lightly indented by broken ball material.

Cage — Both ends and one side of one pocket commencement of gouging by spalled ball. Front I/D only shows rubbing on inner race shoulder but not abnormal.
Inner Race shoulder O/D's and Cage mating I/D's were checked for size and ovality with the following results.
Variation between Inner race O/D's .0002 ovality of Cage I/D .0025 (considered normal.)

BA.46074 Rear Main Roller Bearing and Turbine Sleeve BA.78228

All components have very dark discoloration, either by heat or oil staining and rejection for Met. Lab. investigation has been recommended. Four rivets were loose. No abnormal running defects were noted.

Front Main Roller Bearing BA.108/1 S/N. 857

No abnormal running defects were noted, but race has been rejected due to a few loose rivets.

Outer Race BA.11158 for Starboard spiral bevel gear drive (BA.22462)

Edge of roller track breaking up and both edges of track burnished.
Rollers of Roller and Cage Assembly BA.27659 in good order.
Rejected on principle.

BA.22462 (Starboard Side) Spiral bevel gear

Track shows burnished lines in centre and majority of the component is very discoloured (dark). Rejected on principle of mating outer race, track break up.

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 2 OF 2
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WEIGHT	APPENDIX I	MODEL NO. Section 10.1

BA.22462 (Starboard Side) Spiral bevel gear (continued)

All other races Internal Wheelcase had dark discolouration either through heat and/or oil stain.

External Wheelcase Bearings were all in good order and showed no discolouration.

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 1 OF —
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	APPENDIX 2	MODEL NO. Section 10.2

L a b o r a t o r y

27th September, 1956.

Examination of N.F. Compressor Blades after Engine Proof Test

A number of N.F. Compressor blades as set out below were included in Engine No. 44 for 25-hour potted type test. Including green, acceptance and penalty runs associated with this test, the engine ran a total of approximately 70 hours.

After disassembly and visual examination for condition, the aluminium alloy blades were anodic stripped, vapour blasted and re-anodised, and the aluminium bronze blades were re-electropolished.

All the blades were subjected to a critical examination at 10 to 15 magnifications for defects.

Apart from some erosion and corrosion mainly on the L.E. of the aluminium alloy blades, all blades were found to be in a satisfactory condition.

The N.F. blades included in this engine were as follows:-

Aluminium Alloy Blades

Stage 1 Rotor (C12) SA.35578 (Blade and bush assy. SA.35577)
43 off comprising 27 Lot 3 and 16 Lot 4.
All satisfactory.

Stage 1 Rotor (C1) (SA.12706, SA.12707)
73 off consisting of 1 off 4 blade assy. SA.12719
23 off 3 blade assy. SA.12716, SA.12717.
comprising 17 Lot 12
19 Lot 13
22 Lot 14
15 Lot 15
All satisfactory.

Stage 2 Rotor (C13) SA.40611 (Blade and bush assy. SA.40613)
67 off All from Lot. 7.
All satisfactory.

Aluminium Bronze Blades

Stage 9 Rotor (C20) SA.33295
97 off comprising 62 off N.F. all from Lot 15
22 off H.D.A.
13 off Omes.
All satisfactory.

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 2 OF 2
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	APPENDIX 2	MODEL NO. Section 10.2

Stage 9 Stator (C9) SA.22677 (2 blade assy. SA.46092)
8 off N.F. comprising 3 off Lot 3
5 off Lot 4.
All satisfactory.

The remaining blades in this stage were of overseas manufacture.

Stage 10 Rotor (C20) SA.33498
97 off All from Lot 16
All satisfactory.

Stage 10 Stator (C9) SA.22679
4 blade assy. SA.23571
5 blade assy. SA.30374

23 off 4 blade ex N.F.
6 off 4 blade ex. Omes
4 off 4 blade ex. H.D.A.
1 off 5 blade ex. N.F.

N.F.Blades consist of 23 lot 7
18 Lot 18
7 Lot 20
49 Lot 21.
All satisfactory.

Stage 11 Rotor (C20) SA.33297
97 off comprising 72 Lot 14
25 Lot 16
All satisfactory.

(sgd) R. R. BROOKS.

Metallurgical Superintendent

RRB/IE.

16

FORM MS17-1/46.

PREPARED BY: E.Holloway	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 1 OF 2
DATE 9-11-56		REPORT NO. 212
WEIGHT	LABORATORY	MODEL NO. APPENDIX 3

REPORT OF THE EXAMINATION OF THE TURBINE WHEELS AND TURBINE BLADES EX. ENGINE No.44.

The turbine wheels and blades ex. the MK1. potted type test engine No.44 were submitted for examination after completion of test running.

After the normal preparation given these components on overhaul, inspection was carried out and the following summarises the results of examination.

H.P. Turbine Wheel.

S/No. AD127. Wheel originally ex. Engine No. AR1-12 life "0" i.e. 300 hours.

No cracking was found in the serrations.

Heavy pitting was found in the bucket grooves towards the front edge of the wheel.

This was particularly apparent in bucket groove No's. 13 - 16, 22 - 35, 65 - 78 and 93 - 98.

This condition is puzzling in view of the following

1. No evidence at 300 hours.
2. No previous occurance in "Avon" O/H discs inspected at C.A.C.
3. Pitting was evident only on bucket groove surfaces.
4. The rim material is normally well worked in forging and therefore free from porosity.

In view of the unknown character of this defect the disc must be regarded as reject.

L.P. Turbine Wheel.

S/No. SB437. Wheel originally ex. engine No. ARI-12. Life "0".

1st Serration cracking progressing from the serration over the front edge of the wheel was apparent in four (4) positions i.e. positions 5, 52, 56 and 60. See fig. (1).

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FORM 8317-1/46.

PREPARED BY: E. Holloway	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 2 OF 2
DATE 9-11-56		REPORT NO. 212
WEIGHT	LABORATORY	MODEL NO. APPENDIX 3

There was no cracking in the bucket grooves.

The wheel is reject due to cracking in the serrations.

H.P. Turbine Blades:-

All H.P. turbine blades had completed life "O" i.e. 300 hours prior to type test running.

All blades were satisfactory with the exception of one 2 blade assembly which showed unusual cracking in the weld on the underside.

The assembly had been hand welded using filler rod and the penetration was rather excessive.

This condition was not noted when originally inspected at previous O/H however it has probably become more apparent because of repeated ferric chloride etching.

L.P. Turbine Blades:-

All L.P. turbine blades had completed between 300 and 360 hours prior to type test running.

Two (2) blades showed cracking in the 1st serration life O.C. and R.C.

Three (3) blades showed cracking in the neck of the blade below the labyrinth seal groove life O.C.

One (1) cracked tab (centre blade of a three blade assembly). Life R.C.

The remaining blades were satisfactory.

METALLURGICAL SUPERINTENDENT.

FORM M317—1/40.

PREPARED BY: E.Holloway	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE No. OF
DATE 9.11.56	MELBOURNE VICTORIA	REPORT No. 212
WEIGHT	LABORATORY	MODEL No APPENDIX 3

REPORT OF THE EXAMINATION OF THE TURBINE WHEELS AND TURBINE BLADES EX. ENGINE No. 44.

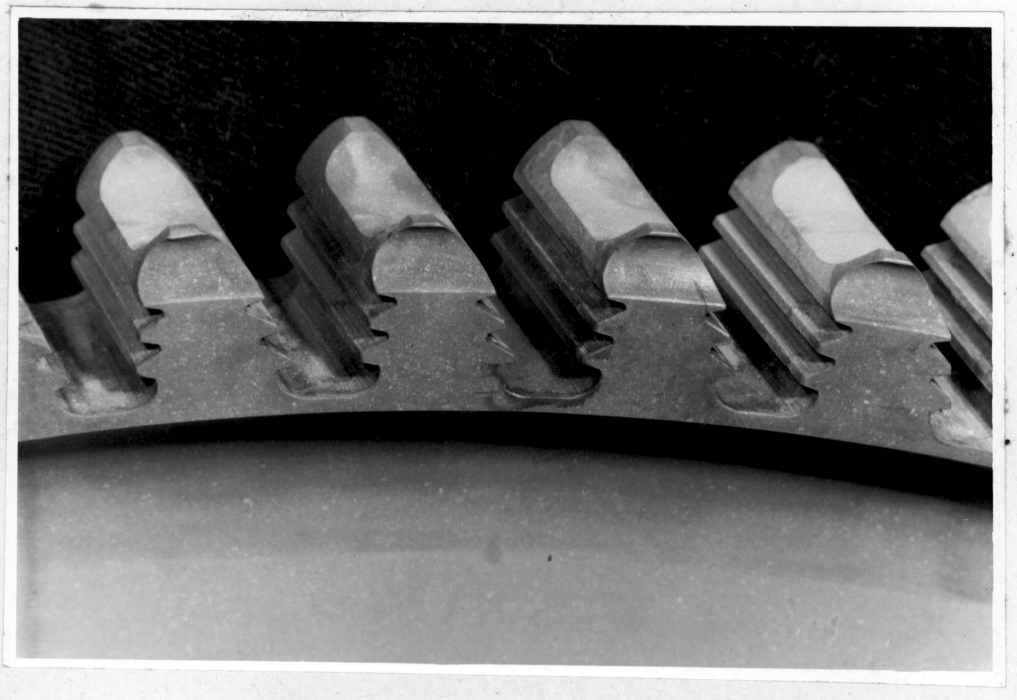

Fig. 1.

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.	PAGE NO. 1 OF 1
DATE 9/7/57	MELBOURNE VICTORIA	REPORT NO. E.300
WEIGHT	APPENDIX 4.	MODEL NO. Section 10.4

Copy:

5th October, 1956

MEMORANDUM:

From: Quality Department, E/D

To: Mr. H. R. Davis

Report on Fairing - Turbo Starter Assembly BA.59570
Fitted to Type Test Engine "Avon" Mk.1, CAC-44.

This fairing is one of four returned by the R.A.A.F. to C.A.C. for repair. A hole had been burnt in the side of each fairing by a gas leak from the Starter Exhaust System. These fairings were repaired to TS-58 by oxy welding in a flush patch.

After the type test, this fairing was Zyglo inspected for cracking and found to be satisfactory for further service.

(sgd) John R. Martin

JRM/SL.

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FORM M317—1/40.

PREPARED BY: H.R.D.	COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD. MELBOURNE VICTORIA	PAGE NO. 1 OF 1
DATE 9/7/57		REPORT NO. E.300
WEIGHT	APPENDIX 5	MODEL NO. Section 10.5

Condition Report on Rotor Wheel for Holes - CAC.44

Stage 1	Every pin hole shows light galling in stress area. Some holes have scoring - radially on flange adjacent to face E.
Stage 2	Every pin hole shows light galling in stress area. Some holes have radial scoring on flange adjacent to face 'B'.
Stage 3	Light galling in pin holes in stress area. Light galling on face 'G'.
Stage 4	Light galling and scoring in pin holes. Light galling on face 'B'.
Stage 5	Heavy galling in pin holes. Scoring in pin holes on flange adjacent to face 'E'. Light galling on face 'K'.
Stage 6	Light galling in pin holes. Scoring in pin holes on flange adjacent to face 'E'.
Stage 7	Light galling in pin holes. Scoring in pin holes on flange adjacent to face 'H'.
Stage 8	Light galling in pin holes. Scoring in pin holes on flange adjacent to face 'E'.
Stage 9	Light galling in pin holes. Scoring in pin holes on flange adjacent to face 'E'
Stage 10	Light galling in pin holes. Scoring in pin holes on flange adjacent to face 'E'
Stage 11	Light galling in pin holes. Light galling on face 'E'
Stage 12	Heavy galling in pin holes. Very heavy galling on pin hole faces.

Copy:

19th March, 1956.

MEMORANDUM:

From ASST. QUALITY ENGR., E/D
To ASSEMBLY & TEST SUPT., E/D

Subject: 25-Hour Potted Type Test.

Will you please arrange the calibration of the F.C.U. which is to be fitted to "Avon" Mk.1 No.44, for the potted type test, to the attached graph. This calibration is a requirement for the uprated "Avon" Mk.1 (8,000 r.p.m., 7,150 lb. thrust).

For the purpose of the unit to be fitted to engine No.44, the attached calibration graph replaces the one given in PTS-31, Page 8. The unit thus calibrated should be clearly tagged and set aside for the type test engine.

C.c. R.Tech.O. (2)
Inspr.in Charge, A.I.D. (2)
Mr. Bellward
Mr. Finch (2)
Mr. Melbourne
Mr. Dalton

HF/SL
Attach.

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.

APPENDIX 6 Section 10.6

SECTION.....
SHEET No.....

Report E.300

3rd April, 1956.

MEMORANDUM:

From ASST. QUALITY ENGR., E/D
To ASSEMBLY & TEST SUPT., E/D (2)

Subject: 25-Hour Potted Type Test - "Avon" Mk.1.

Further to my memo. dated 19th March 1956, will you please add the following requirement to the F.C.U. calibration for engine No.44. This is based on Rolls-Royce specifications for the uprated engine.

Prior to calibration of the pressurising valve and throttle valve to the curve attached to the above memo., the following preliminary settings must be effected:

(a) Set the B.P.C. controlling pressure between 1290 and 1310 p.s.i. at 30" Hg., by means of the fuel side pressure adjusting screw.

(b) Set the main burner pressure to give 875 p.s.i. and 800 g.p.h., by means of a variable main burner restrictor.

After the P.V. and T.V. calibration, the altitude curve is to be carried out as specified in PTS-31 (i.e., with the B.P.C. controlling pressure reduced to 1060-1100 p.s.i. at 30" Hg.)

Following completion of the altitude curve, reset the B.P.C. controlling pressure to 1290-1310 p.s.i.

C.c. R.Tech.O. (2)
Inspr.in Charge, A.I.D. (2)
Mr. Bellward
Mr. Finch
Mr. Answerth
Mr.Melbourne
Mr. Dalton

HF/SL

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PREPARED BY: H. F.

CHECKED BY:

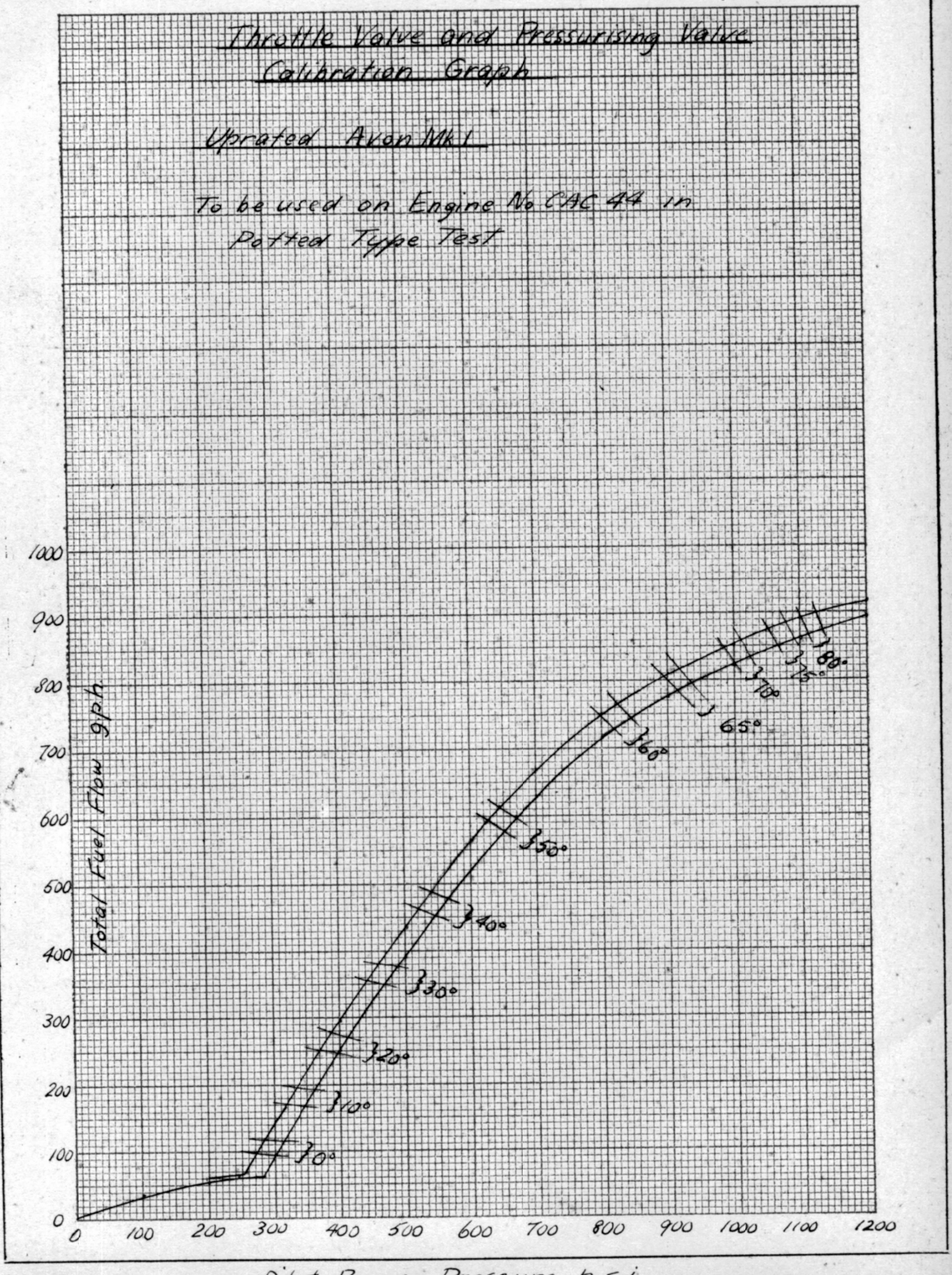
COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
MELBOURNE, VICTORIA

DATE: 19-3-56

Throttle Valve and Pressurising Valve Calibration Graph

Uprated Avon Mk I

To be used on Engine No CAC 44 in Pattea Type Test



M 325

COPY

APPENDIX 7 .. Section 10.7

PLT-56/558.

(a) Oil, OX-38, Synthetic Turbine (2 Samples).
(b) AVTUR. (3 Samples).

Reference: Your Examination Notes, VIC. 3015/3016, dated 8/10/56.
Location: C.A.C., Fishermen's Bend, Melbourne.

Specification No. (a) D.Eng.RD.2487.
(b) D.Eng.RD.2482.

Laboratory No. PLT-56/558.

Results of Examination:

(a) Oil OX-38.

Test	Spec'n. Requires	Used Oil	Unused Oil
5. General:	Shall be homogeneous, free from dirt, water and other impurities.	Trace sediment - mainly carbon.	Trace sediment.
5.2 Acidity (Total) mgsKON/gm.	0.2	0.36	0.20
5.8 Viscosity. cS. @ 100°F.	39.0 max.	40.4	35.6
(Petroleum ether) Insolubles %	Not defined.	0.11	0.06

(b) AVTUR.

Test	Sample No. 2291	2327	2525
Specific Gravity: 60/60°F.	0.792	0.786	0.789
(not limited)	*(0.788)	*(0.787)	*(0.796)

*Results reported by the contractor on the original deliveries of fuel.

(SL)

1. Centre Bearing Temperatures:

1.1 The temperature of the centre bearing was measured by means of a chromel alumel thermocouple attached to a setscrewlocated in the flange of the outer race. (Refer Fig's. 1 & 2).

1.2 At the initial build of the type test engine, no information was available as to the Rolls-Royce method of measuring the centre bearing temperature. Advice was subsequently received that the Rolls-Royce thermocouple is located in the centre bearing housing, as shown in Fig. 3. It was not possible to fit a Rolls-Royce type thermocouple as the engine was already under test when the information was received.

1.3 It was considered that the C.A.C. 'couple would give a higher reading, as it was not subject to the influence of the jet of cooling oil, nor the effects of differential expansion. This was subsequently confirmed in tests on other engines. The variation was 12°C. on a Mark 1 engine and 50°C. on a Mark 20 engine.

1.4 It was therefore necessary to fix an allowable maximum temperature for the C.A.C. type 'couple. The maximum temperature obtained at 8,000 r.p.m. during the contractor's run was 222°C. At engine strip, the bearing was found to be in good condition. Hardness checks were made with bearings soaked at temperatures between 300°C. and 330°C. After consideration, it was decided to permit a maximum temperature of 270°C. at 8,000 r.p.m., with this type of 'couple fitted to the centre bearing. A maximum of 245°C. for 7,800 r.p.m. and 230°C. for 7,600 r.p.m. was also laid down.

1.5 Comparison of Temperatures at 8,000 r.p.m.

Test Condition	Temperature	Remarks
Contractor's Run	222°C.	After 30 min., soak at 8,000 r.p.m. Bearing in good condition at strip.
Acceptance Test	201.5°C.	
Penalty Run	207°C.	After compressor run out check.
Check Run	260°C.	After rear bearing check.
Check Run	286°C.	After thermocouple wiring check.
Check Run	265°C.	After thermocouple insulation check.
Type Test Performance	265°C.	
Type Test Accelerations	275°C.	
Type Test Endurance	Nil	Thermocouple broke down during test.

Centre bearing was subsequently rejected at strip, after type test. See appendix 1 for condition.

2. Rear Bearing Temperatures:

2.1 The temperature of the rear bearing was measured by means of a chromel alumel thermocouple inserted through the rear bearing housing, as shown in Fig. 4. This is similar to the Rolls-Royce method of measurement, as far as can be determined.

2.2 After the contractor's run, the colour of the turbine shaft sleeve of the rear bearing (i.e., the rear bearing inner race) indicated that the temperature was higher than normal for a Mark 1 engine, but was approximately equivalent to a Mark 20 engine. This run was conducted with normal oil temperatures and pressures, using EEL-3 synthetic oil. No hardness checks were conducted on the actual engine parts at this stage.

2.3 Laboratory tests were made to determine the effect of high temperatures on the hardness value of the turbine sleeve. A reject sleeve was immersed in EEL-3 oil, placed in a furnace and held at a temperature of 325° for forty-five minutes. Subsequent hardness checks indicated that the hardness value had decreased very slightly, i.e., $\frac{1}{2}$ to $1\frac{1}{2}$ points Rockwell 'C' scale, but was still within the minimum drawing requirement of 53 Rockwell 'C' scale. The colour change was not so marked on this test sleeve as on the engine part and it is thought that oil varnishing and time of soak have a significant effect on this phenomenon.

2.4 On completion of the penalty run, the rear bearing temperature was still reading high. It was therefore decided to further inspect the condition of the rear bearing. Visual inspection was satisfactory, there being no signs of distress. A hardness check on the turbine shaft sleeve gave the satisfactory figure of 58 Rockwell 'C', which is in excess of the 53 Rockwell 'C' minimum requirement. A check was also made to establish that there was a free flow of oil from the rear bearing lubricating jet.

2.5 A further series of hardness checks was made on the unused outer race of the rear bearing, together with a number of rollers. Results are tabulated as follows:

Condition	Hardness Track	Rock. 'C' Rollers
As received	57-58	61-62
1 hr. at 300°C.	55-56	56-57
1 hr. at 315°C.	54.5-55.5	56.5-57
1 hr. at 325°C.	54-55	56-57
1 hr. at 330°C.	54.5-55	56-57

2.6 Comparison of Temperatures at 8,000 r.p.m.

Test Condition	Temp.	Remarks
Contractor's Run	322°C.	Rear bearing in acceptable condition after strip.
Acceptance Test	283.5°C.	
**Penalty Run	291°C.	After compressor run out check. Rear bearing again inspected and found to be serviceable. Instrumentation suspect.

2.6 (Cont'd.)

Check Run	215°C.	After rear bearing check.
Check Run	210°C.	After thermocouple wiring check.
Check Run	218°C.	After thermocouple insulation check.
**Type Test Endurance	250°C.*	R.R. maximum limit, 220°C.

See appendix 1 for condition after test.

* By way of comparison, the rear bearing temperature of Mark 20 engine No.135 was 230°C. at 7,950 r.p.m. and normal oil temperature and pressures.

** J.P.T. controlled to 645°C. Oil temperature set at 90°C. and oil pressure at 14.5 p.s.i.

3. Bearing Temperatures at Rebuild after Type Test:

3.1 General:

"Avon" Mk.1 engine Serial No. CAC-44 was subject to a 25-hour potted type test and throughout the period of test running, centre and rear main bearing temperatures were somewhat higher than anticipated. Examination of the bearings during engine strip after the test, verified these high indicated temperatures and it was decided to replace these components when the engine was rebuilt. During engine rebuild, thermocouples were again attached to the centre and rear main bearing outer faces, so that comparative temperatures could be obtained.

3.2 Attachment of Thermocouples:

(a) Centre Bearing:

Two thermocouples were attached to the centre bearing, one of a type similar to that used by Rolls-Royce Ltd. and the other a washer or tab type evolved at C.A.C. and used throughout the type test.

(b) Rear Bearing:

The thermocouple used on the rear bearing was similar to that used by Rolls-Royce Ltd. and was also used during the type test period on this engine.

3.3 Instrumentation:

Temperatures from all three thermocouples were continuously recorded on a Honeywell Brown 12-point potentiometric recorder.

3.4 Test Running:

The test being conducted while this temperature survey was being made was the normal Contractor's test for Mk.1 engines and was carried out on 29-30 March 1957, in the "Avon" test bed at C.A.C.

3.5 Differences in Running Conditions:

Synthetic oil EEL-3 was used for the type test, while DTD.44D oil was used for the subsequent run.

3.6 Results:

During this test, both centre and rear bearing temperatures were lower than those indicated at corresponding engine speeds during the "green" run prior to the type test. Tabulations of the results obtained are given below:

(a) Rear Bearing Temperatures, °C.

R.P.M.	Green run before Type Test.	Green run after Rebuild.
3000	32	49
4000	42	62
5000	77	76
6000	135	95
7000	210	126
7600	262	145
7800	283	155

(b) Centre Bearing Temperatures, °C.

R.P.M.	Green run before Type Test	Green run after Rebuild	
	CAC. Type	CAC. type	R.R.Type
3000	44	42	38
4000	58	50	45
5000	80	60	55
6000	119	75	62
7000	158	97	86
7600	200	137	125
7800	202	144	132

Visual inspection of the bearings after "green" run showed them to be in good condition.

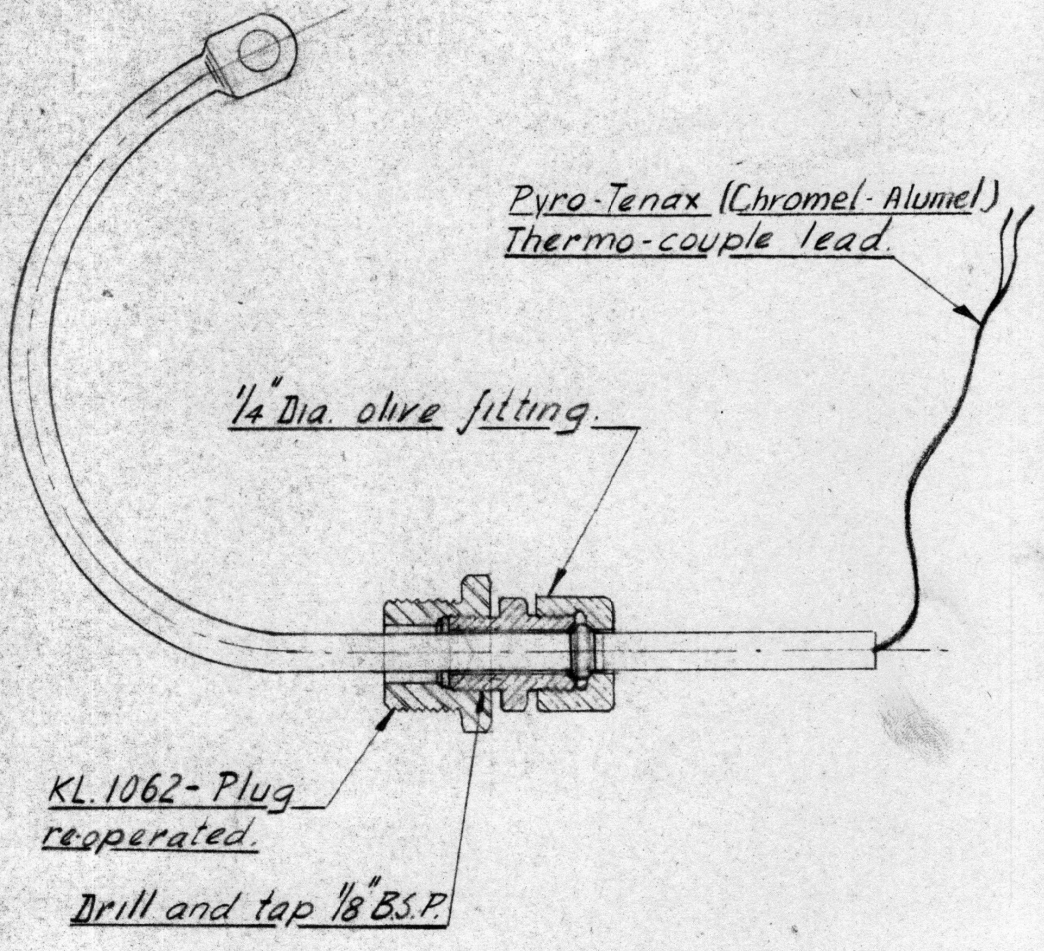
The engine has now been rebuilt and after an uneventful acceptance test, was delivered to the R.A.A.F.

3.7 Modifications etc. Complied with During Rebuild after Type Test:

ET.342	Reoperation of centre bearing housing to accept R.R. type thermocouple.
N.1278	Fibre brushing of gear teeth.
N.1628	Fibre brushing of gear teeth.
N.1761	Increase clearance of balance piston seal lips.
RS.50	Reoperation of centre bearing oil gallery - centrifugal breather oil seal ring locating bore.
Mod.22	Introduces modified turbine wheels and blades.
Mod.92	Reduces rear bearing clearance.
Mod.106	Introduces rigid oil and air pipes with swaged ends.
Mod.133	Introduces cad. plating of centre brg. retaining nut.

THERMO-COUPLE – CENTRE BEARING TEMPERATURE. Fig. 1

Appendix B.

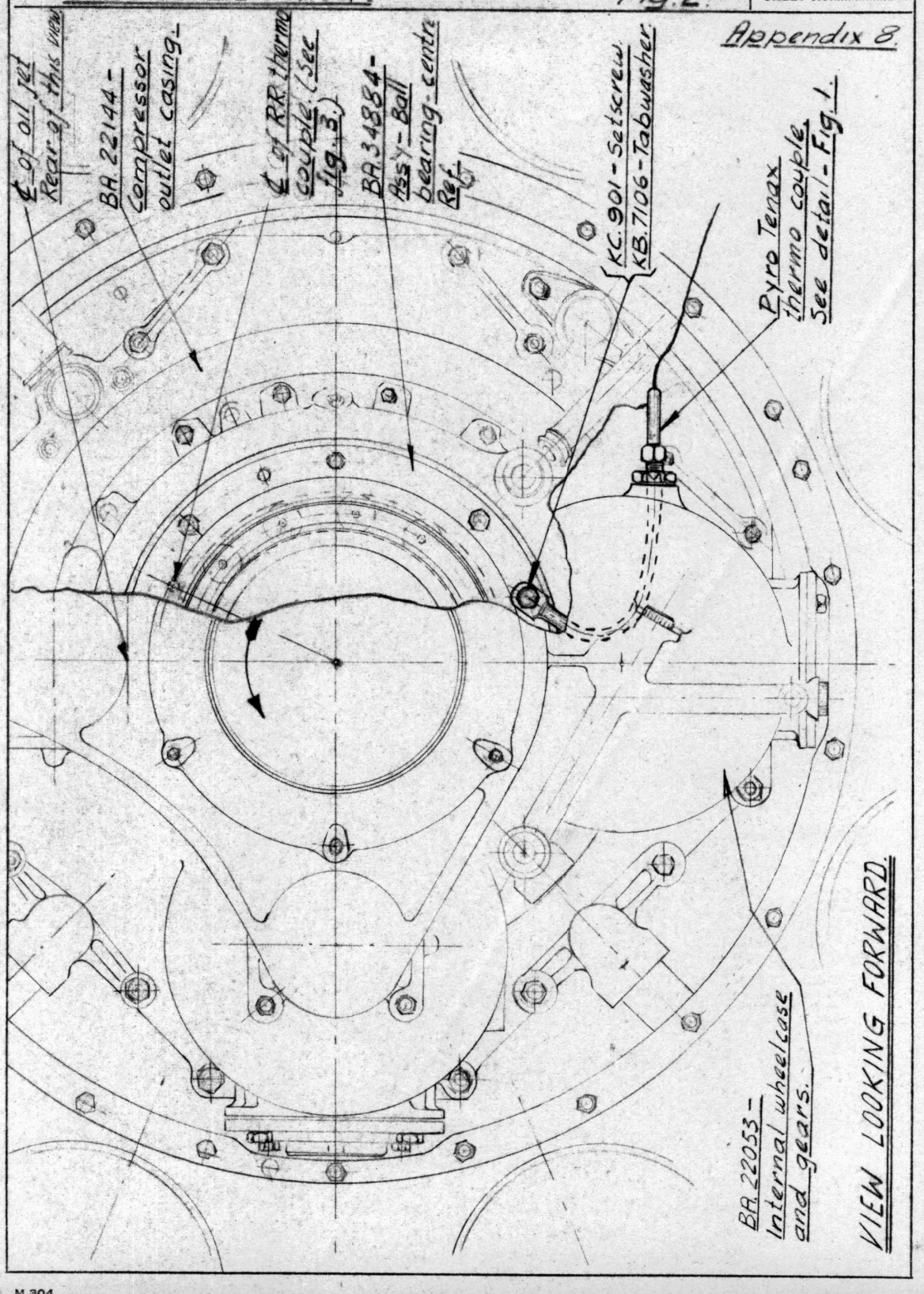


PYRO TENAX THERMO-COUPLE

LOCATION OF THERMO COUPLES - CENTRE BEARING. Fig.2.

SECTION E.300
SHEET No. 6 of 8

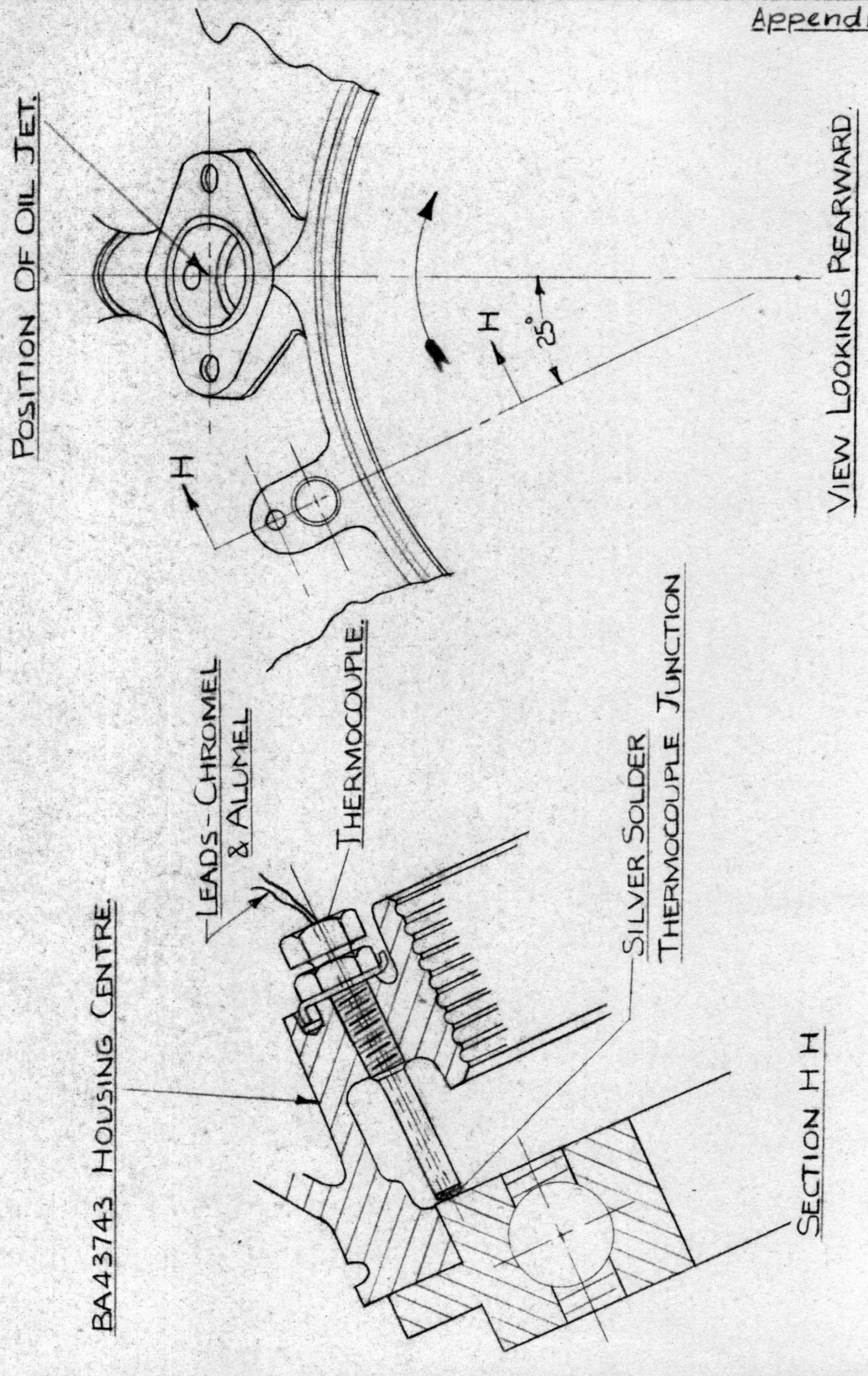
Appendix 8.



THERMOCOUPLE - R.R. TYPE - CENTRE BEARING - TEMPERATURE.

Fig. 3

Appendix 8.

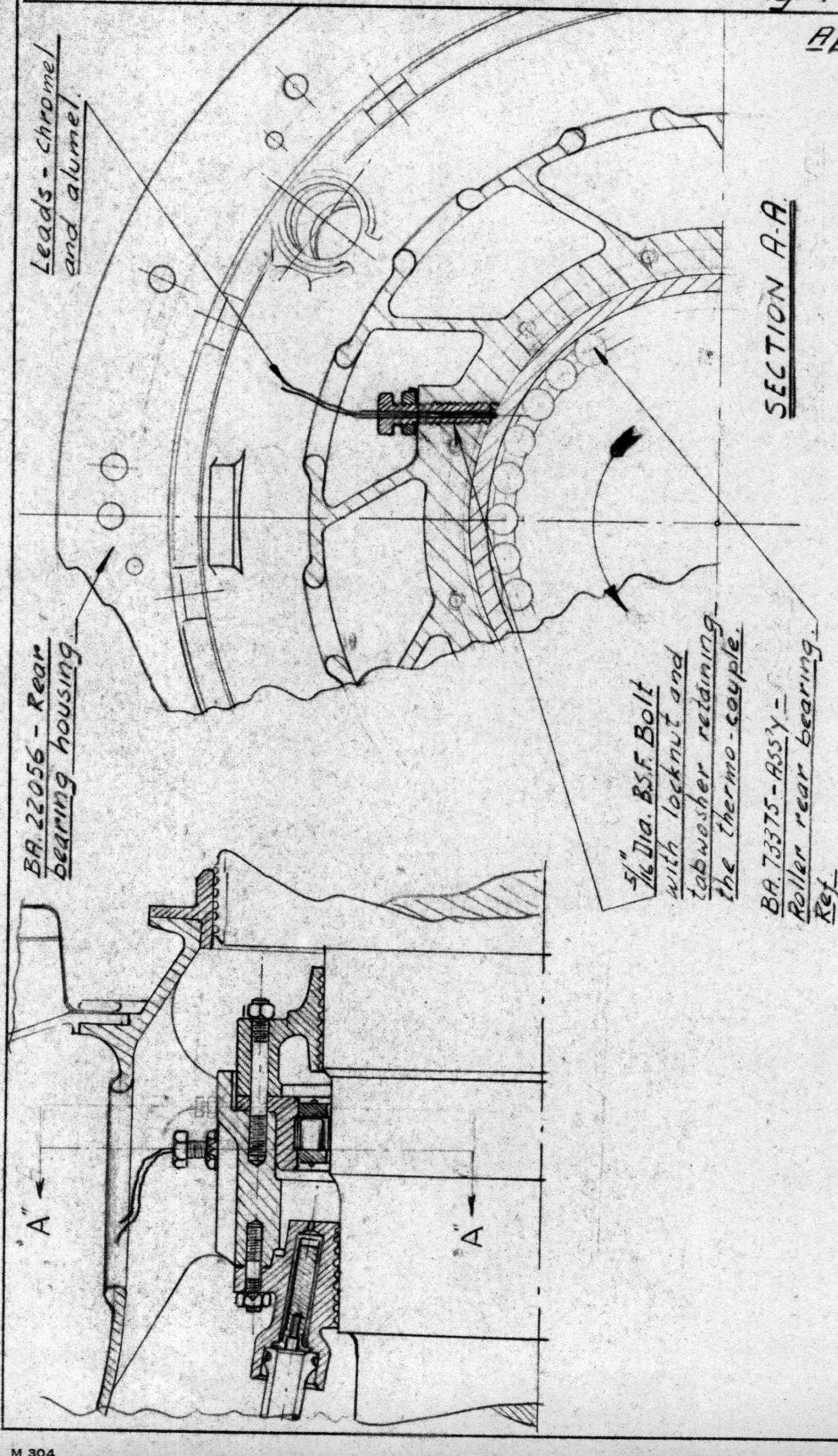


THERMO-COUPLE — REAR BEARING TEMPERATURE.

Fig. 4

SECTION E.300
SHEET No. 8 of 8

Appendix 8.



CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS.

Copy:

C.A.C. Liaison Office,
Rolls Royce Limited,
Derby, England.

Our ref. N/5441 JRK/PMB.

20th December, 1956

Commonwealth Aircraft Corporation Pty. Ltd.,
Box 779 H. P.O.,
Elizabeth Street,
MELBOURNE, Australia

For the attention of Mr. H. H. Knight

Dear Sir,

Subject: Avon Mark I Potted Type Test

Previous Correspondence N/5412, your J.2742

The subject of the potted type test was again discussed at East Kilbride last week. It is hoped that the test will be completed before Christmas and that the results will be available before the end of January 1957.

I inspected the compressor casing which has been built up and the clearance of the worst condition will be 0.006" which is 0.001" above the maximum allowable assembly clearances. Six blades have been assembled with this clearance at the split line of the casing and six others have been assembled at the Bleed Valve Port. Three of each of these two lots of six have had the sharp edges removed by barrelling and three have been left "as machined". The type test will be run at 8,100 r.p.m. It is interesting to note that the Turbine Blades are Nimonic 100.

The engine layout after strip should be available for inspection when I move to East Kilbride, early in January. A full report will be forwarded to you as soon as possible.

Yours faithfully,

(sgd) J. R. KELLY

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

Copy/PMB

E.K./G.Rd. H/FW 2/LR. 29.11.56

To: C.A.C. Representative

c. EJV/Hld
c. Cal/Bdy.

Avon Mark 1 Potted Type Test

In reply to your memo JRK. J.2742 5/PMB 18.11.56, concerning the "digging in" of stator blade platforms, we have never seen any engine, either Service or Development, exhibiting anything of this nature. Since receiving your memo several engines subjected to 25-hour Potted Type Tests were examined, but there was not the slightest evidence of "digging in".

The twisting moment on blade aerofoils will increase with incidence (the blade tends to turn away from the airstream) and stalling will occur at lower r.p.m., if the bleed valves remain closed. If the clearance in the channel was high, the twisting moment on the blade would tend to increase the blade incidence and render it more prone to stall. When stall occurred the moment would fall and blade flutter would probably result. The worst possible condition for this "digging in" tendency would be a rapid deceleration from governed speed when the compressor case was still hot and, if the bleed valves were late in opening flutter of the blades could occur. Sharp corners on the blade platform would aggravate this tendency and would eventually produce cracks.

The purpose of the bleed valves is to reduce the velocity through the rear stages of stator blades at low pressure ratios, i.e., low r.p.m., but on a rapid deceleration it is unlikely that the bleed off will be evenly distributed around the annulus particularly at the instant of opening. In this case stall and flutter will only occur on certain groups within each stage.

It should be pointed out that there must be considerable resistance to this tendency to twist as the air-load on the blades will tend to pack the blades in the direction of this load. However, the stator blades whose concave sides are nearest the split line will have the lowest circumferential load on their platforms and then have the least resistance to twisting. A low split-line clearance would of course be an advantage in this respect.

Having examined the factors which could give rise to "digging in" we have agreed to try and introduce the worst possible conditions in our next Potted Type Test engine. The build will be roughly as follows:-

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

(1) Groups of 8th and 9th stage stators to have maximum platform clearance (.005") or possible above, some with sharp corners and others with rounded corners to increase the bearing area.

(2) Above group to be placed near bleed valves and also adjacent to the split lines.

(3) Maximum split line clearances.

(4) Several deceleration surge checks to be carried out during the test.

As soon as the above tests have been carried out we will inform you of the results. Brazing of the blades in groups would be an advantage, but this was originally introduced to prevent "digging in" due to direct bending and not to prevent twisting. We would suggest in the meantime that sharp corners be avoided on blade platforms and recommend the smallest possible clearance in the blade locating channel.

With regard to the "digging in" of the Compressor stator blades into the lands on the Compressor casing, this condition has not been apparent on any engines of which we have experience in this country, although there is always a slight marking on the vertical edges of the Stator retaining land which confirms that the blades do tend to twist during running.

Because of our lack of experience of this trouble, we have no established standards of acceptance for Compressor casings which have become damaged in consequence of this "digging in". Nevertheless, we can see no objection to the re-use of Casings damaged to the extend reported on this type test.

We would recommend that the spilled metal at the points of maximum pressure between Stator blades and Casing should be removed by polishing and the Casing inspected by an approved crack detection process.

Without having run the development test which is now scheduled to reproduce this trouble, it is difficult to decide the maximum clearance which could be permitted between Blade Platform and Casing Land. We would expect the limit to be set more by handling consideration than by mechanical reliability as such; this being so, the maximum figure of .008 reported in the Tupe Test engine is probably the maximum which could be accepted without including more definite handling trouble.

It might be worth while considering the re-positioning of Stator blades on subsequent engine builds to ensure that the areas of the Casing Lands, which had become damaged during previous running, were not again coincident with the corners of the Stator Blades.

As soon as the test outlined in this memo is completed, we will communicate with you further.

(sgd). H/FW.

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

Copy

C.A.C. Liaison Office,
Rolls-Royce Limited,
Derby, England.

Our Ref. N/5412 JRK/PMB

3rd December, 1956

Commonwealth Aircraft Corporation Pty. Ltd.,
Box 779 H. P.O.,
Elizabeth Street,
MELBOURNE. Australia.

For the attention of Mr. H. H. Knight

Dear Sir,

Subject: Avon Mark 1 Potted Type Test

Receipt is acknowledged of your J.2742 on the above subject.

Cable No. 198 was despatched to you on the 12th November, 1956, of which we confirm as follows:-

"J.2742 Quality meeting Glasgow Factory stop. Dig in not previously experienced stop Answer seven days"

It is unfortunate that I have not been able to obtain a complete answer for you on this matter, but the position is that Rolls-Royce have not experienced this type of "dig in" to the extent that you have noted in J.2742 and it was necessary to consider your request as a new and untouched problem.

During my last visit to East Kilbride, a meeting was held with the Licence Office, Quality Engineer, and the Experimental and Investigational Group at East Kilbride. The enclosed memo, reference H/FW. 2/LR. 29.11.56 is a product of that discussion. It consists of comments from Rolls-Royce and a statement of the tests that they will carry out for us, in an endeavour to ascertain the cause of the "dig in"

Rolls-Royce have not experienced "dig in" of this nature previously, they have noted light bruise marks on the casing, indicating a resistance to twisting. However, this may be due to the fact that their clearance on their type test engines has not been anywhere near the top limit but has been in the vicinity of 0.002".

They have experienced gas bending with a line type "dig in" and have noted when this occurs excessively that the blades are hard to remove from the casing. Incidently, the original brazing together of the blades was to overcome "dig in" due to gas bending not twisting.

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

Ref. N/5412 - 2 - 3.12.56

It is noted also, that Rolls-Royce barrel rumble all their blades and this removes the sharp edge and will naturally reduce the unit pressure at the edge contact of the blade to the compressor casing. I have asked Rolls-Royce to give us details of this barrelling process.

In group one of their memo it is noted that a combination of maximum platform clearance and blades with sharp corners and others with "barrelled" rounded corners are to be used.

It is hoped that this test will be run in the near future as we have an assurance that our queries will be investigated at their next type test.

Mr. Marks, the Quality Engineer, at East Kilbride, has stated that the amount of "dig in" we have experienced would be acceptable and his comments are included in page two of the enclosed memo, paragraph three and four.

I trust that the above information will enable you to proceed and if any further queries result from this information an early reply will enable me to discuss further points with East Kilbride previous to their running the test.

Yours faithfully,

(sgd) J. R. KELLY

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

Copy:

C.A.C. Liaison Office,
Rolls-Royce Limited,
East Kilbride,
Lanarkshire
Scotland

8th March, 1957

Our ref. JRK/AG. N.5576

Commonwealth Aircraft Corporation Pty. Ltd.,
Box 779 H. P.O.
Elizabeth Street,
MELBOURNE Australia

For the attention of Mr. H. H. Knight

Dear Sir,

"Avon" Mark 1 Potted Type Test.

This letter is further to our N.5412 and N.5441

Subsequent to N.5441, cable 230 was despatched, on the 12th February, 1957, and read as follows:-

"J.2742 no dig in on R.R. test letter follows soon Kelly."

Subsequent to that date, the matter of "dig in" has been discussed on one or two occasions, but Rolls-Royce can offer no good reason for it. Please find enclosed, a copy of a memo reference H/FW. 1/EM. of the 6th March, 1957, from the Licence Office, East Kilbride, on the subject.

When Mr. Halstead was at East Kilbride, the subject was raised with him and he had some recollection of a letter, or a report which he had received at his Melbourne office, which gave an explanation of a clockwise and anti-clockwise "digging in". I have not been able to confirm this report or letter, either in Derby, or in the Scottish Group and I suggest that he be contacted on his return to Melbourne, and he may be able to give you some further information.

I am afraid that my efforts here have not been particularly helpful to you in discovering the reason for the "digging in", but if you have any further thoughts on the matter and any other line of investigation that you would wish me to follow up, I am sure that Rolls-Royce would be very accommodating.

Yours faithfully,

(sgd) J. R. KELLY

CORRESPONDENCE RE DAMAGED COMPRESSOR CASINGS

COPY/IH

E.K./E.K. H/FW. I/EM. 6.3.57.

To: C.A.C. Representative

Avon Mk.1 Potted Type Test

Further to your memo J.2742 11.10.56, a type test has now been carried out at Mk.121 rating on an engine fitted with Stator Blades modified as detailed below and on completion of the tests there was no evidence of "digging in" on the blade platform.

Details of the engine build and test are as follows:-

Groups of treated blades, consisting of six blades in each group, were placed adjacent to the split line and near the bleed valves in each half casing. Clearances of 0.006" (top limit .005") were introduced in each group and of the six blades three had sharp corners on the platforms and three had rounded corners. Split line clearances were in excess of Mk.1 limits. The engine Avon Mk.121 No. 4212 was then subjected to a 25-hour potted type test followed by a 15 hr. cyclic endurance test, the total running time amounting to 56 hours.

On completion of the above tests the casings were removed for examination but there was not the slightest evidence of "digging in" of the blade platforms and we can only conclude that the abnormal conditions introduced into this engine could not in themselves have been responsible for the Australian trouble. We regret that we have been unable to reproduce the "digging in" of stator blade platforms but are still of the opinion that the phenomena can only be the result of aerodynamic instability under certain conditions and I have no doubt that by paying attention to the points raised in our previous memo further trouble can be avoided.

H/FW.