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SERIAL NO. AEL-753

COPY No. 8

NAVY DEPARTMENT
BUREAU OF AERONAUTICS

WASHINGTON, D. C.



CALIBRATION OF
PRATT & WHITNEY R-1400-65 ENGINE

NAVAL AERONAUTIC FACTORY

WASHINGTON, D. C.

DATE OF REPORT

6 February 1943.

SERIAL NO. AEL-753

COPY No. 8

NAVY DEPARTMENT
BUREAU OF AERONAUTICS

REPORT ON

CALIBRATION OF PRATT & WHITNEY R-1830-26 ENGINE

BY

AERONAUTICAL ENGINE LABORATORY
NAVAL AIRCRAFT FACTORY
PHILADELPHIA, PA.

NUMBER OF PAGES - Text, 11; Plates, 24

AUTHORIZATION - Bureau of Aeronautics Letter Aer-E-442 - ERM/2-13
F21(Project 4077) F21(R-1830-26) 009912 of 30 January 1942.
BU. AER. PROJECT NO. 4077.

DATE OF TEST. FROM 6 March 1942 TO 21 April 1942

REPORTED BY

G. L. SANWALD
G. L. SANWALD, Sr. Aero. Engineer.

Project Engineer.

A. J. SEMOLA
A. J. SEMOLA, Asst. Aero. Engineer.

Test Engineer.

APPROVED BY

J. E. PIXTON
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Superintendent.

AL

SERIAL NO. AEL-753

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OBJECT

1. The object of this test was to determine the performance characteristics of the Pratt and Whitney R-1830-86 engine equipped with a PDL2E2-2 carburetor. It was also desired that sufficient data be obtained to evaluate operation when using fuel having an aromatic content of approximately 20 percent.

CONCLUSIONS

2. Calibration results indicate that the engine is capable of the following ratings with zero main scoop and auxiliary stage scoop ram, with main stage inlet valve losses of approximately .70 In. Hg, and with auxiliary stage duct and intercooler losses of approximately .65 In. Hg:

Neutral (Std. alt. CAT)	- take-off	- 1200 BHP at 46 In. Hg abs.
	- military	- 1200 BHP at 1800 feet alt.
	- normal	- 1100 BHP at 3300 feet alt.
Auxiliary low (90°F CAT)	- military	- 1150 BHP at 11,500 feet alt.
	- normal	- 1050 BHP at 12,500 feet alt.
Auxiliary high (90°F CAT)	- military	- 1100 BHP at 18,500 feet alt.
	- normal	- 1000 BHP at 19,500 feet alt.

NOTE: Ratings are with automatic rich carburetor mixture approximately 2.5 percent leaner than Pratt and Whitney Aircraft guarantee for continuous operation.

Take-off and military speed	- 2700 RPM.
Normal speed	- 2550 RPM.

When the normal rated results are corrected to zero pressure losses and to best power mixture, the basis used for the contract guarantees, the altitude ratings are increased by approximately 1500 feet. When the military results are corrected to zero pressure losses only, the basis used for the contract guarantees, the altitude ratings are increased by approximately 700 feet. The corrected results all comply with the guaranteed values of Pratt and Whitney Specification No. N-5121 (Revision 1) of 11 October 1940. The engine ratings in neutral, low, and high gears are comparable when based on air flow.

3. All the normal altitude ratings are approximately 500 feet higher than those obtained with an experimental 1830-76 engine calibrated

at the Naval Aircraft Factory and reported in reference (c). The differences are probably due to the changes in distribution effected by the location of the fuel injection, diffuser modifications, and by the differences in the fuel-air mixture ratios.

4. It is impossible to obtain both the normal and military ratings with one setting of the supercharger regulator (See Plate 2). It is suggested that the regulator be set to obtain military conditions and the throttle be used to limit the normal speed BHP to normal.

5. In compliance with reference (b), comparative mixture control runs extending over the complete cruise range and including normal and take-off conditions made with regular Specification AN-VV-F-781-4 and approximately 16 percent aromatic 100 octane fuels indicated the following:

- (a) No appreciable consistent difference in power was noted.
- (b) In the cruise range, best economy mixture results averaged one percent richer when using aromatic fuel.
- (c) When using the aromatic type fuel, the Bendix PD12F2 carburetor metered approximately 2-1/2 percent richer at the air flows near and above rated but a negligible amount at air flows in the cruising range.
- (d) The mixture temperatures, when using the aromatic type fuel, were found to be slightly less than those obtained with regular 100 octane fuel.
- (e) No consistent differences in cylinder temperatures were indicated.
- (f) Generally, no difference in engine operation, including smoothness and acceleration, was noticeable. No signs of detonation were present when using either fuel.

In view of the unimportant differences resulting when using the two fuels, it was believed unnecessary to make the basic calibration with both fuels.

6. In view of the fact that the leanest practicable cruising characteristics are desired for present service P4F airplanes, the standard -2 carburetor setting is considered unsuitable. An investigation should be made to determine the possibility of using a "one position" best economy setting similar to that pictured on Plate 20. As a temporary measure it is suggested that the present automatic lean setting be used for all operating conditions. The suitability of this measure has proven satisfactory on flight tests conducted under Project 4225 (See reference (e)).

7. The general performance of the engine was satisfactory.

8. The operation of the Bendix 6S9 spark plugs was satisfactory.

RECOMMENDATIONS

9. The engine ratings tabulated in paragraph 2 are recommended as satisfactory.

10. It is recommended that a 28.5 In. Hg absolute supercharger regulator setting be used and that the throttle be employed to restrict the BHP at speeds less than military.

11. One hundred octane regular (Amendment-4) and aromatic (16%) type fuels are recommended as being satisfactory for use with the subject type engine and carburetor.

12. To increase the range of the F4F service airplanes, it is recommended that the automatic lean control position be used throughout the operating range.

DESCRIPTION OF SUBJECT

13. The characteristics of the subject type engine are as follows:

(a) Manufacturer:

Name - Pratt and Whitney Aircraft.
 Location - East Hartford, Connecticut.

(b) Model, Numbers, and Ratings:

Model - R-1830-86.
 Type - Air-cooled, 14-cylinder, double-row radial, two-stage, two-speed auxiliary supercharger.
 Engine numbers - Bureau No. 14228.
 Ratings - Manufacturer's No. 9309.
 - Overspeed dive - 3050 RPM.
 For power ratings see paragraph 2.

(c) General Data:

Bore and stroke - 5.5 x 5.5 inches.
 Cylinder arrangement - Two radial banks of seven cylinders each.
 Master rod locations - Nos. 5 and 12.
 Total displacement - 1830 cubic inches.
 Compression volume ratio - 6.7 to 1.

Reduction gear ratio	- .667 to 1.
Reduction gear propeller shaft	- SAE No. 50.
Crankshaft dampers	- Two 3-1/2 order.
Overall dimensions	- 48-1/2 inches diameter. 67-1/2 inches long.
Dry weight of engine - including carburetor, spark plugs, and supercharger; regulator	- 1560 pounds.
Maximum specific outputs	- .66 BHP per cubic inch. - .77 BHP per pound.
Grade fuel required	- 100 octane.
Grade oil required	- Symbol 1100.

(d) Superchargers:

Number of stages and speeds	- Two-stage, two-speed auxiliary supercharger.
Type	- Gear-driven centrifugal with vaned diffusers.
Impeller gear ratios	- Main stage: 8.08 to 1. - Auxiliary stage low: 6.43 to 1. - Auxiliary stage high: 8.48 to 1.
Impeller diameters	- Main: 9-1/2 inches. - Auxiliary: 11 inches.

(e) Carburetor:

Make and Serial Number	- Bendix, No. 29135.
Model and Setting	- PD12E2-2
Parts List Number	- 392006-4.
Injector Location	- Crab bar nozzle in adapter.
Fuel pressure required	- 15 pounds per square inch.

(f) Ignition:

Magnetos (two)	- Bendix Scintilla SFLARN-8.
Mounting	- Front (nose)
Ignition timing (No. 1 cylinder)	- 25° BTC, fixed, both.
Spark plug type	- Bendix 6S9.
Firing order	- 1, 10, 5, 14, 9, 4, 13, 8, 3, 12, 7, 2, 11, 6.
Harness	- Bendix cast manifold type.

(g) Valve Timing:

The tappet clearances and valve timing are as follows:

Clearances (hot), timing - .060 inch, both.

Clearances (cold), running - .010 inch, both.

I.C., • ABC - 76
 E.O., • BBC - 76
 I.O., • BTC - 20
 E.C., • ATC - 20

(h) Accessory Drives:

	Permissible Torque:		Direction of Rotation *	Ratio to Crankshaft:
	Inch	Pounds		
Starter (starting torque) 2500 at 70° F.	-	24,600	C	1.000: 1
Generator	600	6,000	C	1.400: 1
Vacuum Pump	250	850	C	1.400: 1
Fuel Pump	150	450	CC	0.875: 1
Tachometer	20	60	R.H.-C.L.H.- CC	0.500: 1
Magneto	125	600	C	0.875: 1
Governor	100	600	C	0.964: 1
Gun Synchronizer	125	600	C	0.667: 1
Auxiliary Drive	125	500	C	1.000: 1

* Direction of rotation indicated by C - Clockwise
 CC - Counterclockwise
 when looking at the accessory drive shaft in the engine.

(i) Auxiliary Stage Two-Speed Operation:

For a general description of this system, see Aeronautical Engine Laboratory Report, Serial No. AEL-744, paragraph 9(j). A diagrammatic sketch of the ducts, intercoolers, etc., used during the calibration appears on Plate 24.

(j) Important Basic Improvements:

The two magnetos are now mounted on the reduction gear nose of the engine thus allowing a more compact ignition installation. A cast type ignition manifold is installed forward of the cylinder banks.

Fuel is injected from a "crab" bar at the carburetor adaptor. The 1830-76 engine previously calibrated and reported under Report AEL-744 employed spinner type injection at the main stage impeller. The cylinders have been strengthened and the cooling fin area increased measurably.

METHOD OF TEST

14. For all the calibration running, the engine was installed in No. 9 dynamometer room with a U. S. Rubber Company type flexible coupling and a flywheel mounted on the engine propeller shaft. The engine carburetor air supply, exhaust, and fuel systems were maintained at the required altitudes. The oil and breathing systems were operated at or near sea-level conditions. A standard complement of instruments as is normally used at this laboratory was connected to the engine to measure air, fuel and oil flows, temperatures, and pressures. A carburetor scoop and intercoolers, as used on the F4F airplanes, were adapted to the dynamometer stand by a special duct system.

15. Fuels of 100 octane rating, regular (Specification AN-VV-F-781-4) or 16 percent aromatic (made with "Two-pass" Houdry and Alkylate Blending Agent - Requisition No. Aero 3873-Bu-42), and grade 1100 oil were used during all tests. The oil-in temperature and oil-out pressures were maintained at approximately 165°F and 10 pounds per square inch, respectively.

RESULTS AND DISCUSSION

16. The location of the various calibration curves and charts in this report is as follows:

	<u>Plate Numbers</u>
Optimum performance at rated and take-off speeds	1
Performance at rated and T.O. as limited by supercharger regulator	2
Operating charts	3 to 8
Sea level and altitude basic characteristics	9 to 17
Mixture control characteristics	18
Minimum Specific Fuel Cons. characteristics	19
Average F/A characteristics	20
Corrections	
HP vs. carburetor air and mixture temp.	21
HP vs. carburetor scoop ram	22
HP vs. exhaust back pressure	23
Diagrammatic arrangement of ducts, intercoolers, fittings, etc.	24

17. A curve of optimum performance is shown on Plate 1. These results were obtained with mixtures guaranteed for continuous operation and with valve, intercooler, and duct losses comparable to F4F airplane installation but without carburetor scoop pressure regulation. These results comply essentially with the contract guarantees when they are corrected to conditions under which the guarantees were made in Pratt and Whitney Specification No. W-5121 (Revision 1) of 11 October 1940.

18. The curves shown on Plate 2 give results for two different settings of the supercharger regulator - one restricting the low-high rated speed power to normal and the other restricting the low-high military speed power to military. The second setting of 28.5 In. Hg absolute is recommended (reference (d)) in order to attain the military power conditions of which the engine is capable. The excessive powers then obtainable at rated speed have to be restricted by the carburetor throttle. Carburetor entrance pressure, transmitted through an external line to the regulator, is used for the supercharger regulator setting, thus the setting is not affected by the intercooler and duct loss.

19. Plates 3 to 8, inclusive, show the basic calibration in an operating chart form. These curves show the operating power and manifold pressure limits and the specific fuel consumption values representative of what is expected when using a PDL2E2-2 carburetor setting. Assuming that the supercharger regulator will be set to obtain military powers as suggested in paragraph 18, the limiting power-pressure line normally drawn through the speed range is omitted as the powers resulting in each case would be greater than the present maximum BMEP and propeller load limiting power curves. Therefore, the primary purpose of the regulator is to limit the manifold pressure to that required at military speed - at any lower speed the resulting regulator pressures would allow excessive powers which must be restricted by carburetor throttle.

20. Plates 9 to 17, inclusive, show the basic calibration plotted in a more comprehensive form to include several part-throttle sea-level and altitude runs, air and fuel flows, and mixture temperatures. A representative 27 In. Hg absolute supercharger regulator setting line is shown drawn through rated conditions.

21. The mixture control characteristics shown on Plates 18 and 19 indicate little choice between the regular and 16 percent aromatic fuels other than slight differences in best economy, carburetor metering, and mixture temperatures. These differences have been found to be generally true with other type engines and injection carburetors. The difference in the "lower heat value" of the two fuels (300 Btu per pound) justifies the differences in best economy. Approximately 2.5 percent richer metering of the carburetor itself was noticeable at the higher air flows when using aromatic fuel. This condition is apparently due to stiffening of the fuel diaphragm and consequent basic change in adjustment. Apparently the diaphragm returns to its original set when regular fuel is again used as is evidenced by similar results using regular fuel before and after conduct of a complete neutral calibration using 16 percent aromatic fuel. No detrimental effect on the carburetor mechanism was noted as a result of using 16 percent aromatic fuel.

22. Plate 19 shows lines of minimum specific fuel consumption within the allowable cruise range in neutral and high gears. These values were obtained without making actual mixture control runs but by leaning to a point just slightly richer than cut-out or rough running. Therefore, the curve values in some instances may be somewhat richer than optimum best economy. However, the curves are generally representative of what may be expected by manually leaning for maximum economy.

23. Plate 20 gives average engine fuel-air results supplied by the standard PDL2E2-2 setting. It is apparent that the automatic lean curve shown is relatively rich in comparison to the best economy of .060 possible with this type engine. For present service F4F airplanes it is desired that the longest practicable cruising range be incorporated. An investigation is now being made under Project 4312 to determine the feasibility of using a "one position" best economy setting similar to that pictured on Plate 20. As a temporary measure it is suggested that the present automatic lean setting be used for all operating conditions. The suitability of this measure has proven satisfactory on flight tests conducted under Project 4225. (See reference (e)).

24. The engine operated satisfactorily in regard to starting, acceleration, and smoothness. Operation of the Bendix 6S9 spark plugs was also satisfactory. When the engine was received at the Naval Aircraft Factory, after overhaul at Quantico, it required considerable additional running-in to properly seat the piston rings and the auxiliary stage impeller shaft oil seal rings. The excessive amount of oil pulled through by the auxiliary stage indicated that the auxiliary shaft seal rings had not been lapped-in. This condition also indicated that the engine operation had not been properly inspected during its run after overhaul. It is urged that particular care be exercised to insure that during overhaul, all auxiliary shaft oil seal rings be lapped-in and that during the operation runs after overhaul, checks in low and high gears be made to determine the effectiveness of the seal. When the engine was received, the attached supercharger regulator was found to be set at approximately 25.5 in. Hg absolute (instead of 28) thus indicating that a bench check at overhaul had not been made or had been made improperly.

25. The exhaust back pressure characteristics as plotted on Plate 23 are average for the conditions shown and can be used as a general correction for this engine. Data are being compiled and analyzed relative to all the back pressure runs obtained on various engine calibrations made at the Naval Aircraft Factory during the past several years. A general correction based on intake and exhaust pressure ratio is being investigated.

REFERENCES

- (a) Project Authorization - Bureau of Aeronautics Letter
Aer-F-442-FRM/2-13 F21(Project 4077) F21(R1830-86)
009912 of 30 January 1942.

SERIAL NO. AEL-753

- (b) Request for Calibration With Aromatic Fuel - Bureau of Aeronautics RESTRICTED Letter Aer-E-442-SAG F21(Project 4077) F21(R-1830-86) 021669 of 2 March 1942.
- (c) Calibration, Type, Dive and Torsional Vibration Tests of Pratt and Whitney XR-1830-76 Engine - Aeronautical Engine Laboratory RESTRICTED Report, Serial No. AEL-714.
- (d) Projects 4077 and 3911 - Supercharger Regulator Setting - Naval Aircraft Factory Letter to Bureau of Aeronautics F21-1(2)(1830) F21-1(2)(2800) (E-5) (43451) of 18 December 1942.
- (e) Operation in Automatic Lean Recommended Satisfactory - Project 4225, Naval Aircraft Factory Letter to Bureau of Aeronautics VF4F3/VF4F4/F21-1 (E-5) (43445) of 12 December 1942.

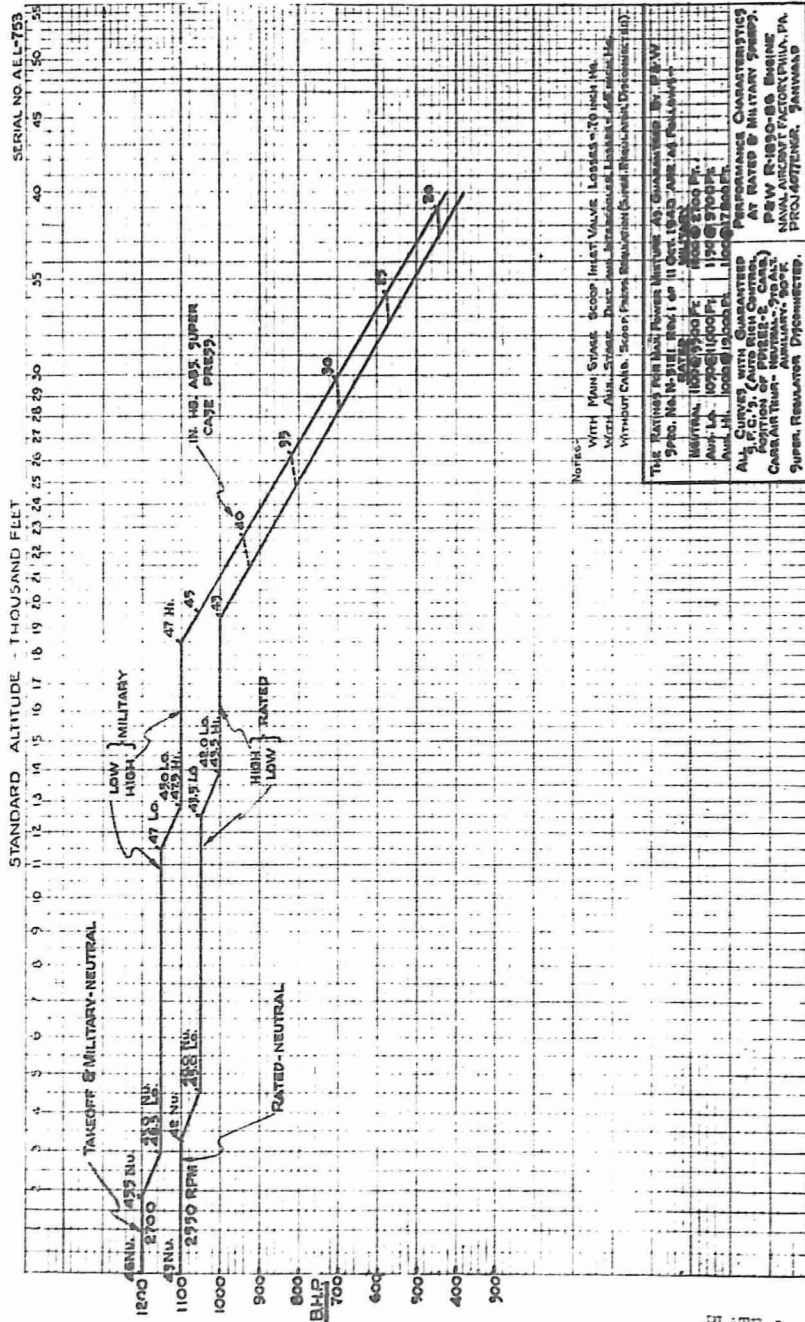


PLATE 1

PLATE 1

Notes:
 WITH MAIN SWAYE SCOP INLET VALVE. LOSSES TO INCH Hg.
 WITH 1/2" ALU. SWAYE. DUCT - 1/2" DIA. METAL. LOSS TO INCH Hg.
 WITH BUR. CATH. "SUPER" PAINT. EQUIPMENT (CURRENT THROUGH DUCTING 110):

This chart is for the Pratt & Whitney R-1550-38 engine. The chart is for the engine with the main swaye scope inlet valve. The chart is for the engine with the main swaye scope inlet valve. The chart is for the engine with the main swaye scope inlet valve.

PERFORMANCE CHARACTERISTICS AT RATED & MILITARY SPEEDS.
 PW R-1550-38 ENGINE
 CATERPILLAR DIVISION - CHICAGO, ILL.
 PRODUCTIONS - 1947

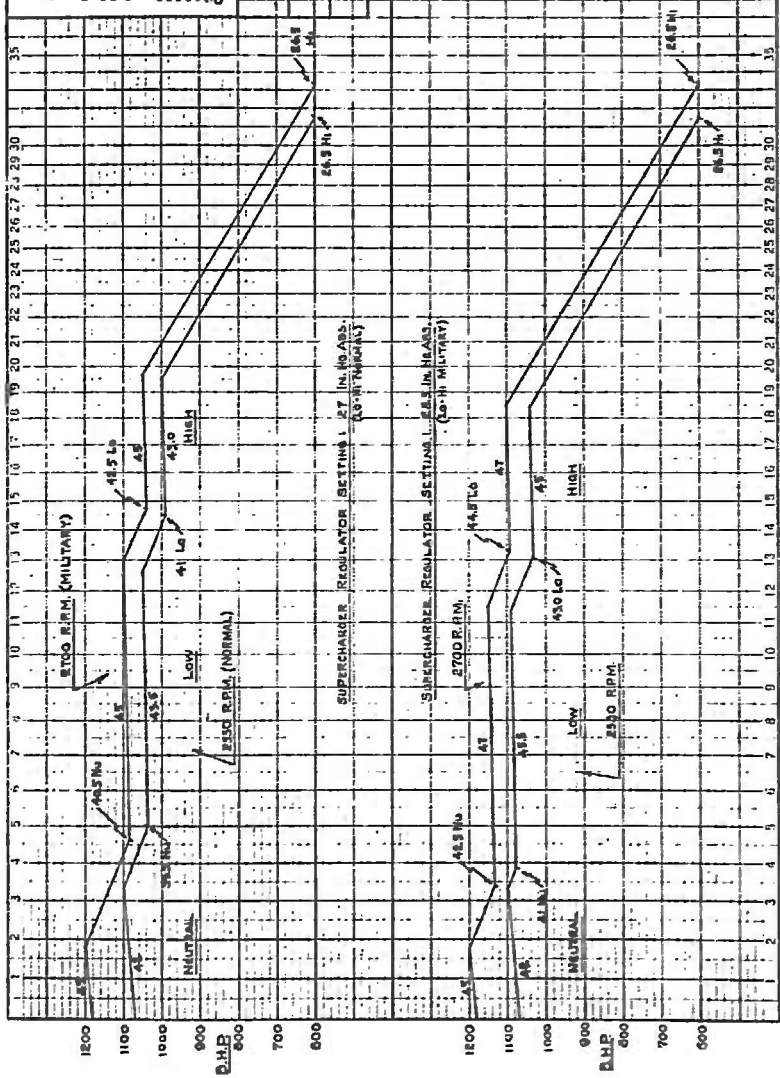
SERIAL NO. 71-278

NORMAL AND MILITARY PERFORMANCE LIMITED BY SUPER-REGULATOR P&W R-1830-66 ENGINE
ENGINE NO. 10428880, NO. 8303
PROBATIONAL PRODUCTION PLANT, PRODUCTIONS DIVISION, GEORGE EASTMAN CO., MILWAUKEE, WIS.
MOTOR CODE: 67 PROP. 312
IMPELLER: 686, 687, 648

CONDITION
FUEL METERS:
CUT

575. Super-Regulator without the
Clear Air Filter - No. 376, to 8/11/1972

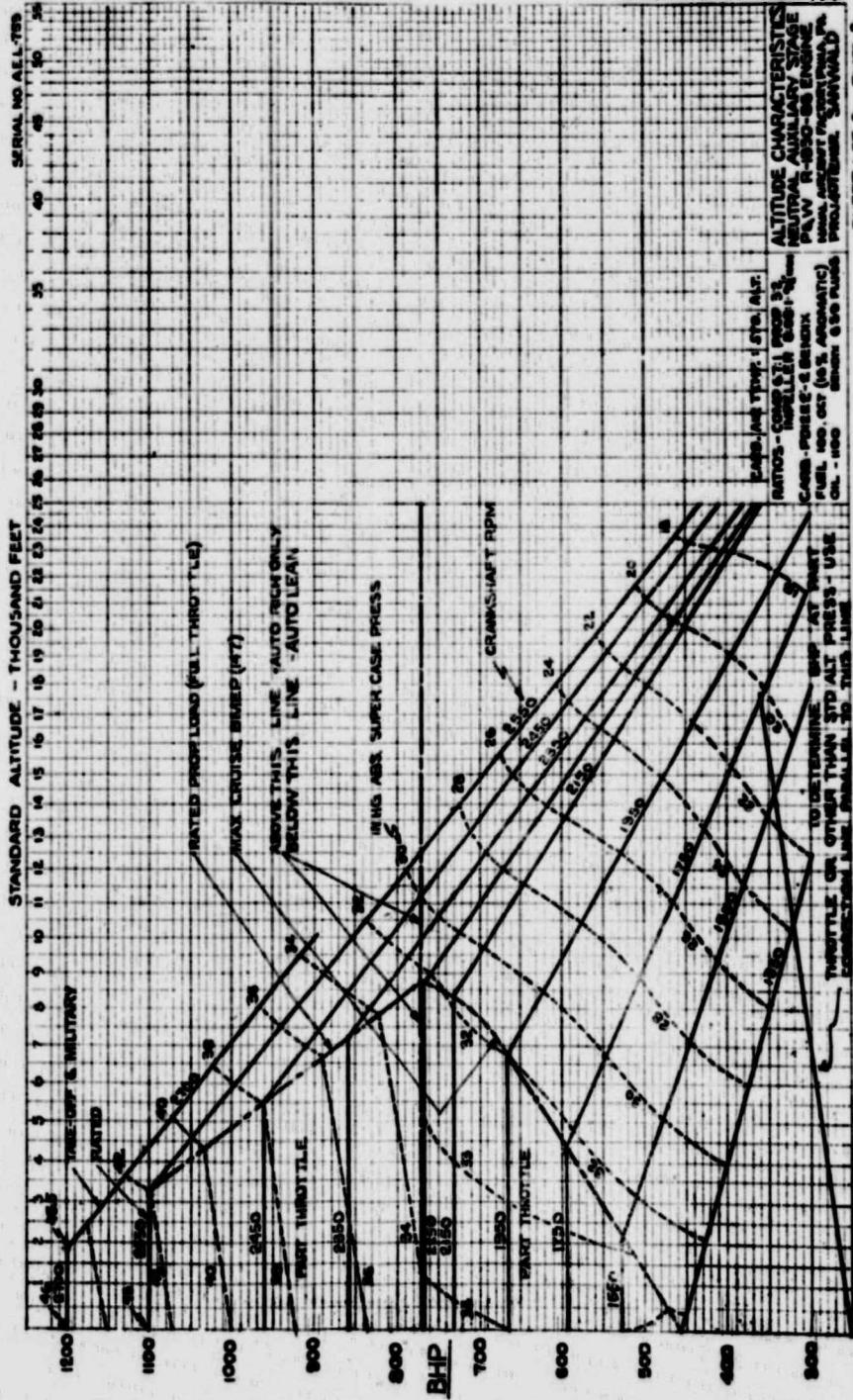
Engine	10428880
Impeller	686, 687, 648
Motor Code	67
Prop.	312
Condition	Normal
Altitude	0
Pressure	44.5
Temperature	43.0
Speed	2700
Power	1100
Flow	4.5
Efficiency	86.5
Remarks	Super-Regulator without the Clear Air Filter



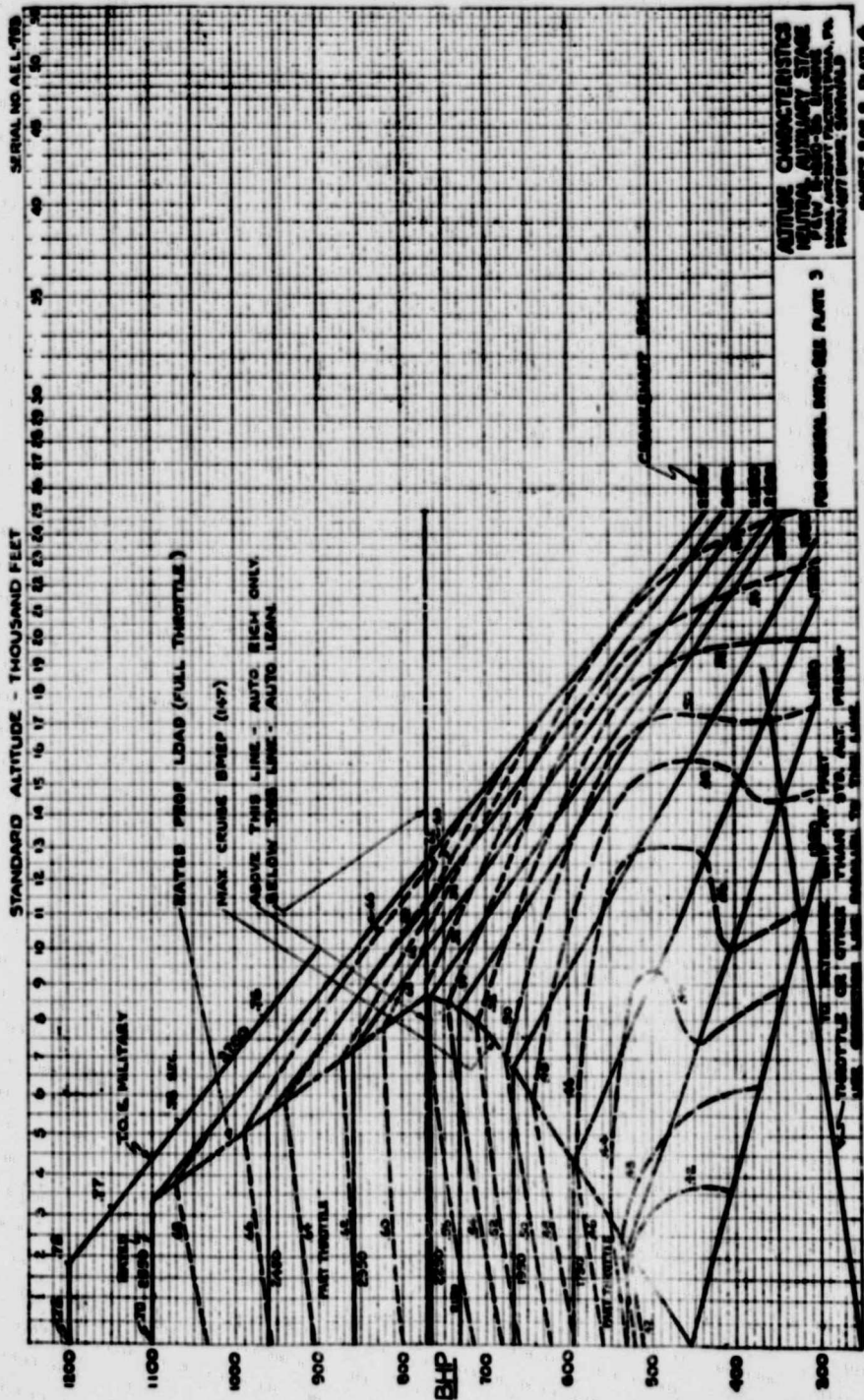
SERIAL NO. AIR-753

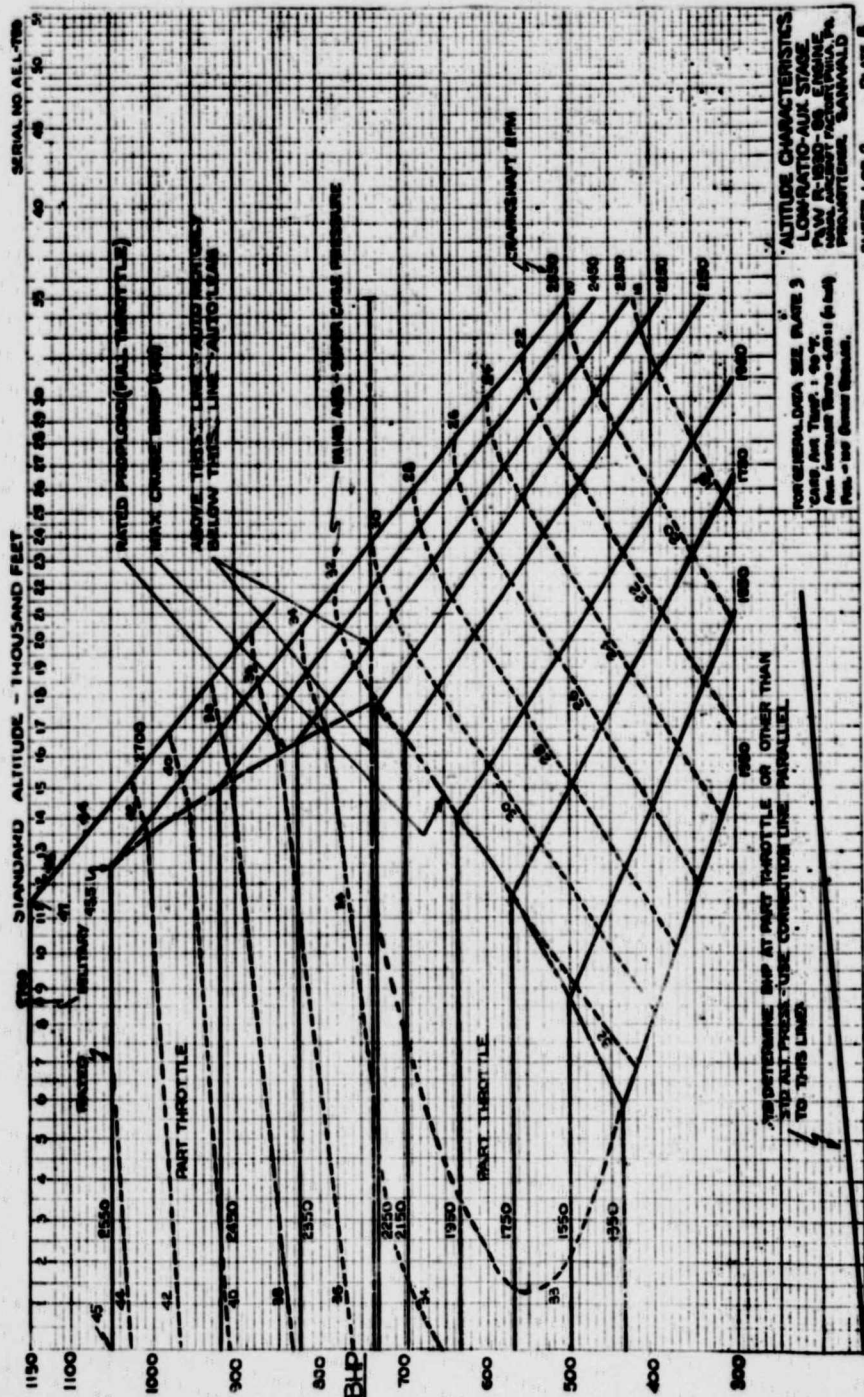
SHEET ... OF ... PLATE 1

PLATE 2



Pratt & Whitney R-950-8B
 PARTS - COMP. SET 33
 HOLLER 608 1-1
 CASE - PRESS. & BENCH
 FUEL. 100.0% (10% AUTOMATIC)
 OIL - 100.0% (10% AUTOMATIC)
 ALTITUDE CHARACTERISTICS
 NEUTRAL AUXILIARY STAGE
 P/W R-950-8B ENGINE
 MANUFACTURED BY PRATT & WHITNEY
 PROUDLY PRINTED IN THE U.S.A.

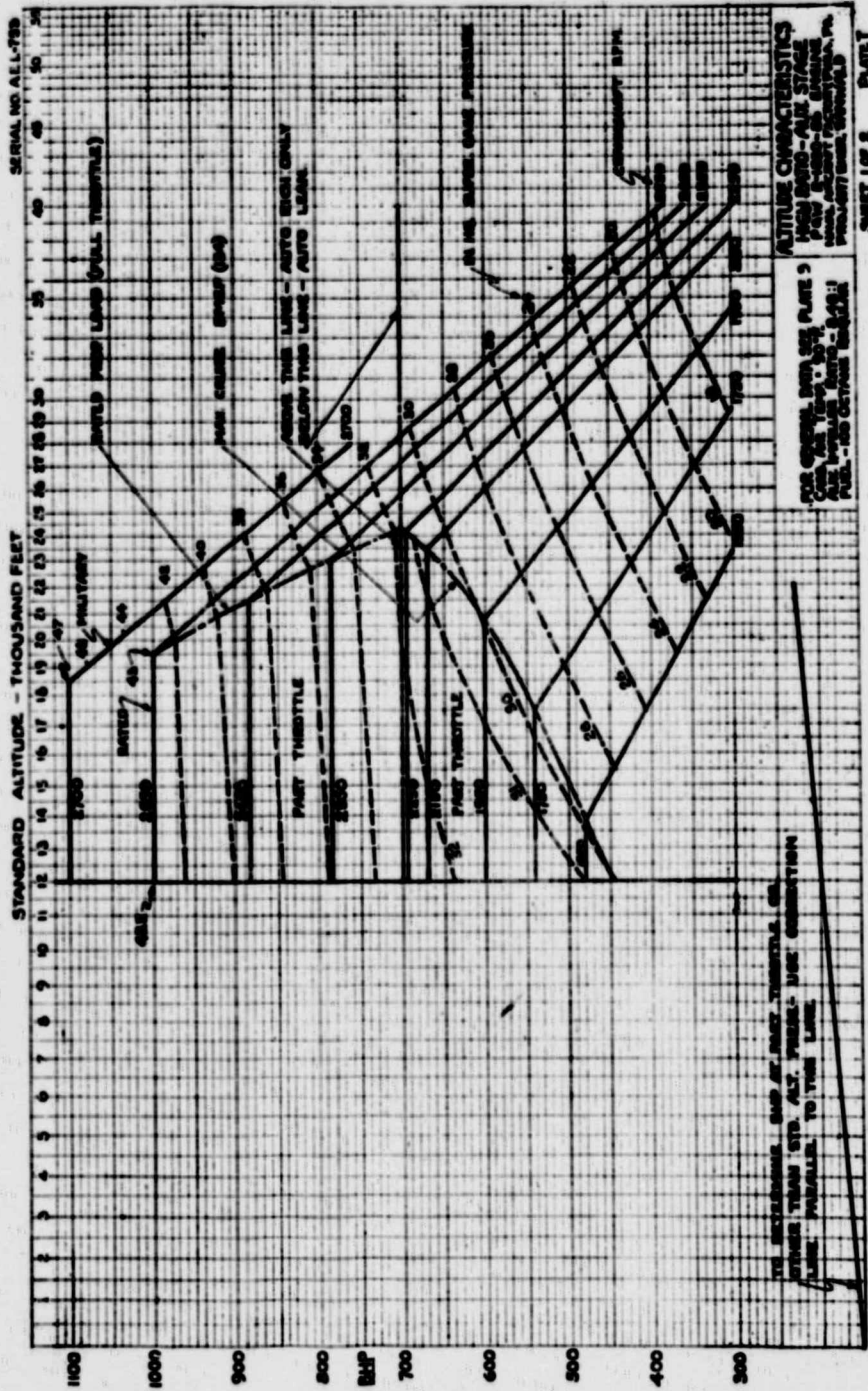




FOR GENERAL DATA SEE PLATE 3
 CASE AIR TEMP. 100° F.
 AIR LEANNESS WIND - 400 ft (400)
 PLOT - 1000 RPM (1000)

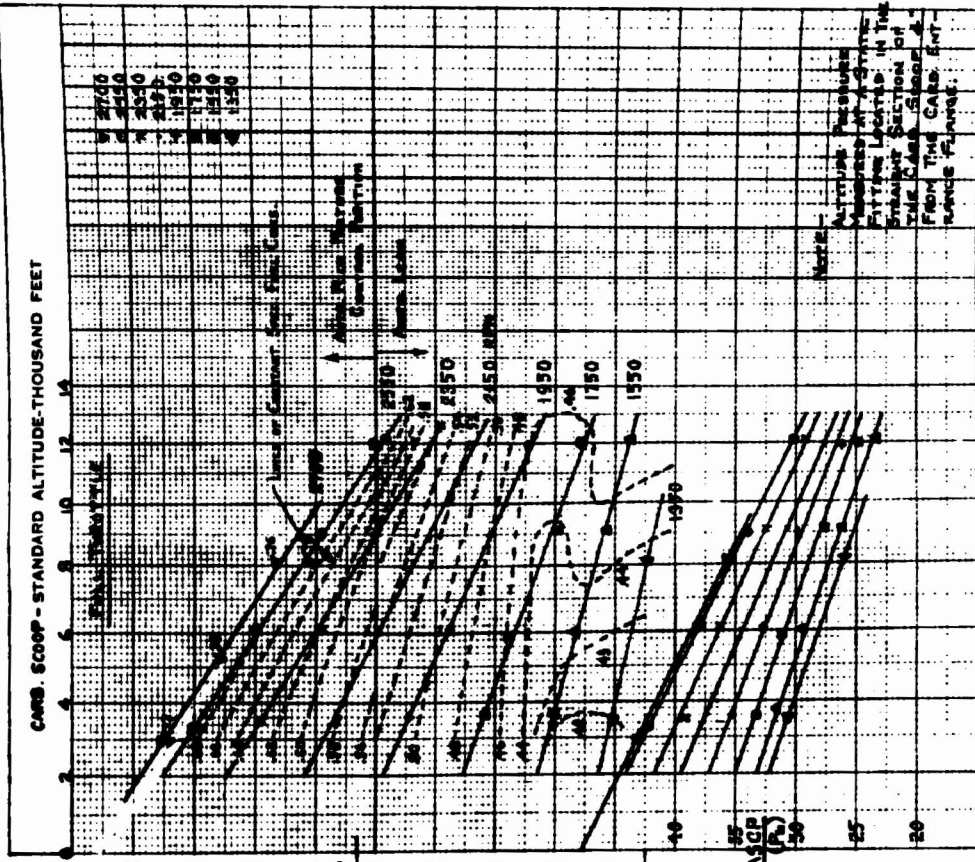
ALTITUDE CHARACTERISTICS
 LOW RATIO-AUX STAGE
 PLW 8-1000-00 ENGINE
 MODEL A-1000-00 (1000)
 PRODUCED BY BAWWALD

PLATE 5



ALTITUDE CHARACTERISTICS
 HIGH SPEED - AIR STAGE
 FOR GENERAL USE AT ALT. BETWEEN 1000 FT. AND 1100 FT.
 FOR GENERAL USE AT ALT. ABOVE 1000 FT.
 FOR GENERAL USE AT ALT. BELOW 1000 FT.

SHEET 1 OF 2 PLATE 7



PROP 3:2
 OIL 1100
 FUEL 100 OCTANE (20% AROMATIC)

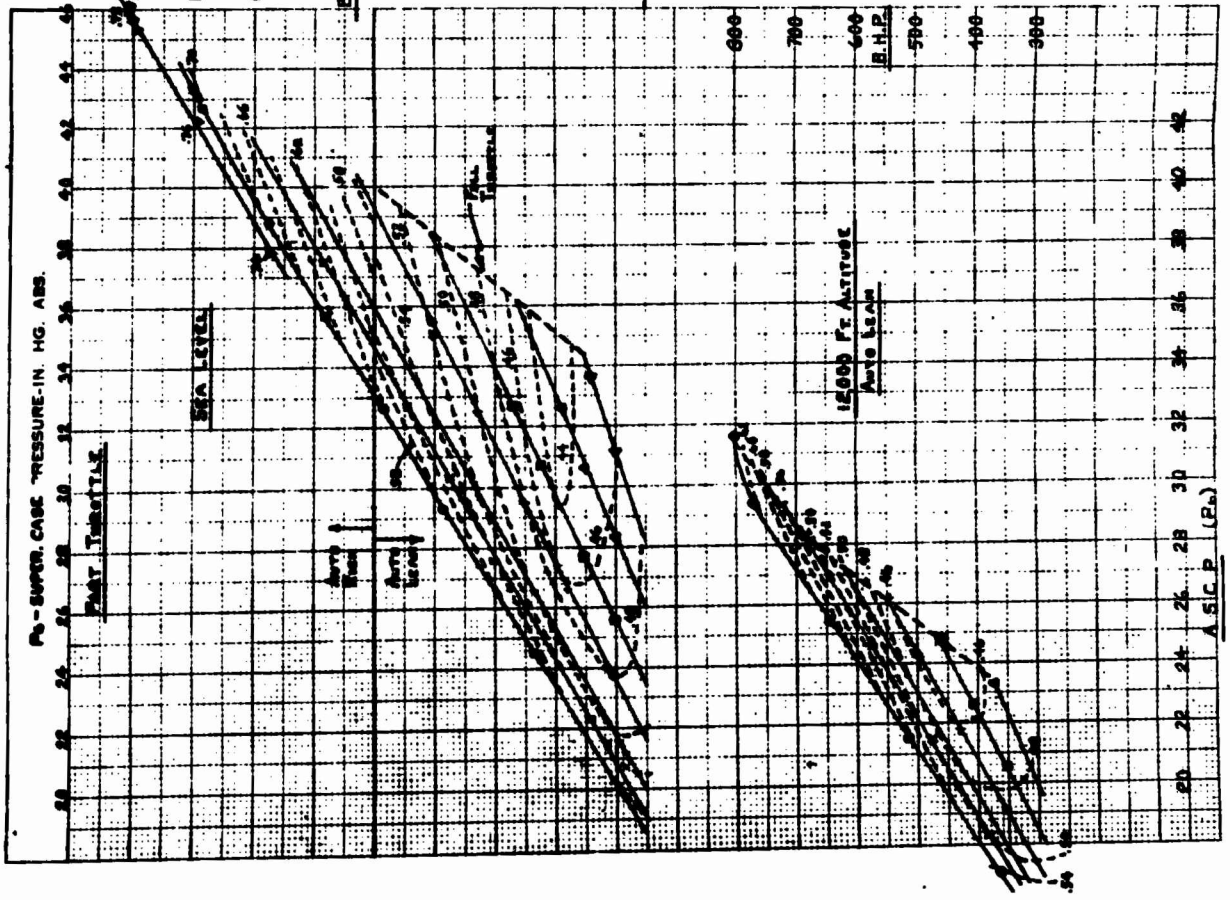
NEUTRAL - AUX. STAGE
SL-5 ALT. CHARACTERISTICS
P4W R-1830-86 ENGINE
 ENGINE BU NO. 14228 MFG. NO. 9309
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY PHILA., PA.

TEST DATE _____
 AV ROOM BAR IN. HG. _____
 AV CARB AIR TEMP. °F _____
 AV OIL INLET TEMP. °F _____
 AV COOL AIR TEMP. °F _____

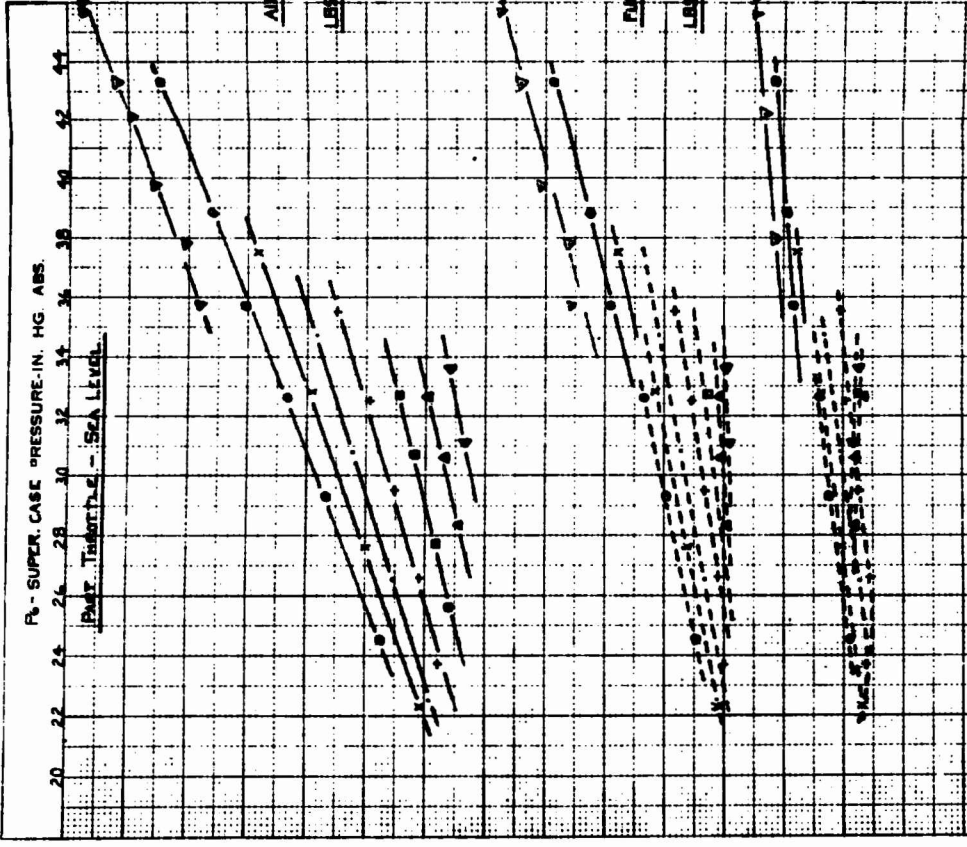
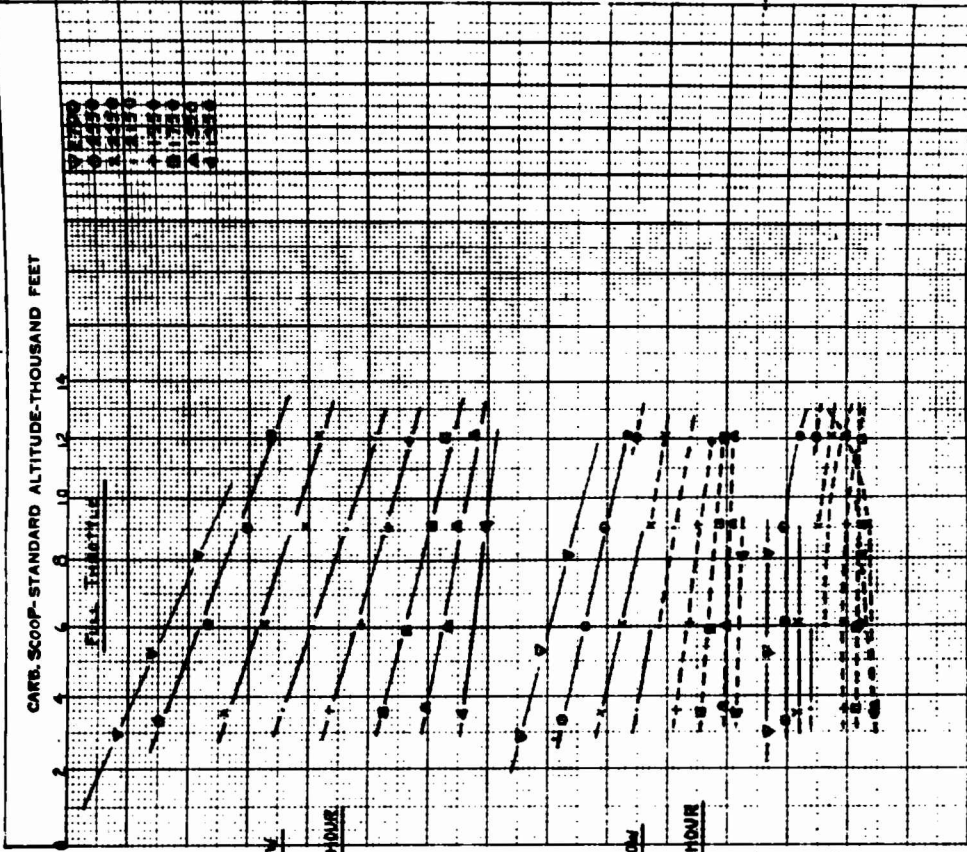
RATIOS COMP 6.7:1 IMPELLER B08:1 MAIN
 CARB PD12E2-2 PLUGS BENDIS 6S9
 SPARK ADV _____
 IMPELLER DIAM. 9 1/2 IN. MAIN

TEST EQUIPMENT No. 9 DYMA (RAYMUEL RUBBER COND)

PROJ. 4077 ENGR. SANNALD



SERIAL NO. A.E.L. 789

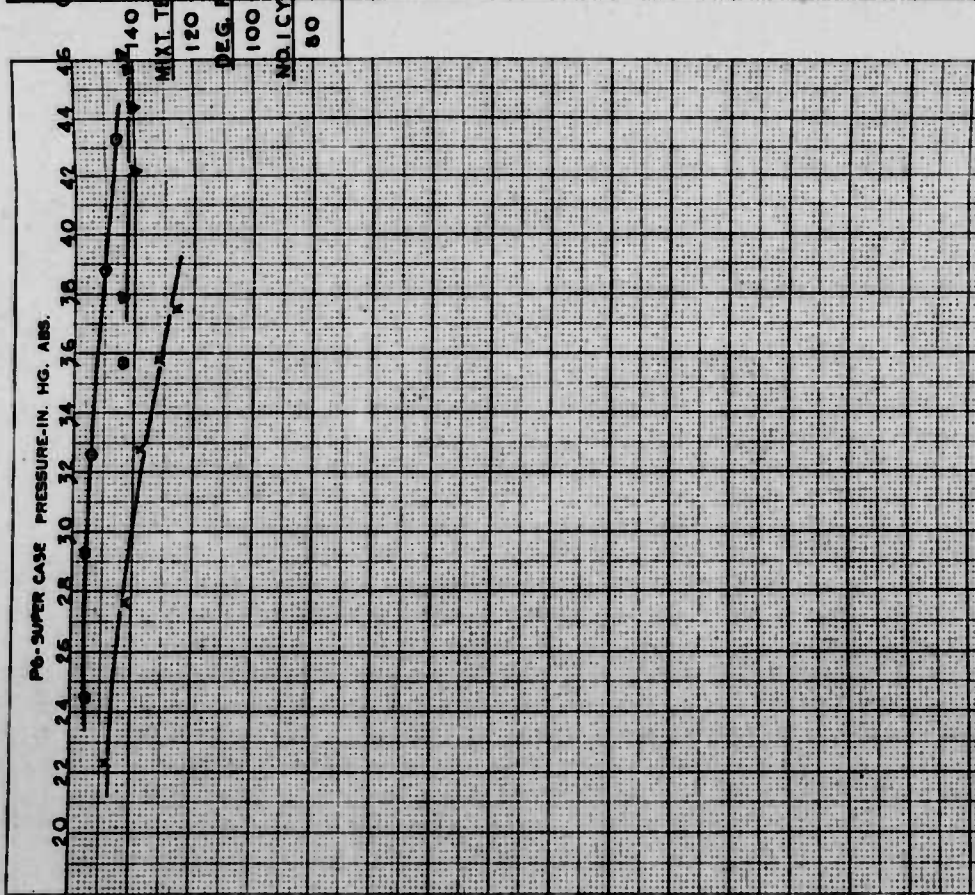
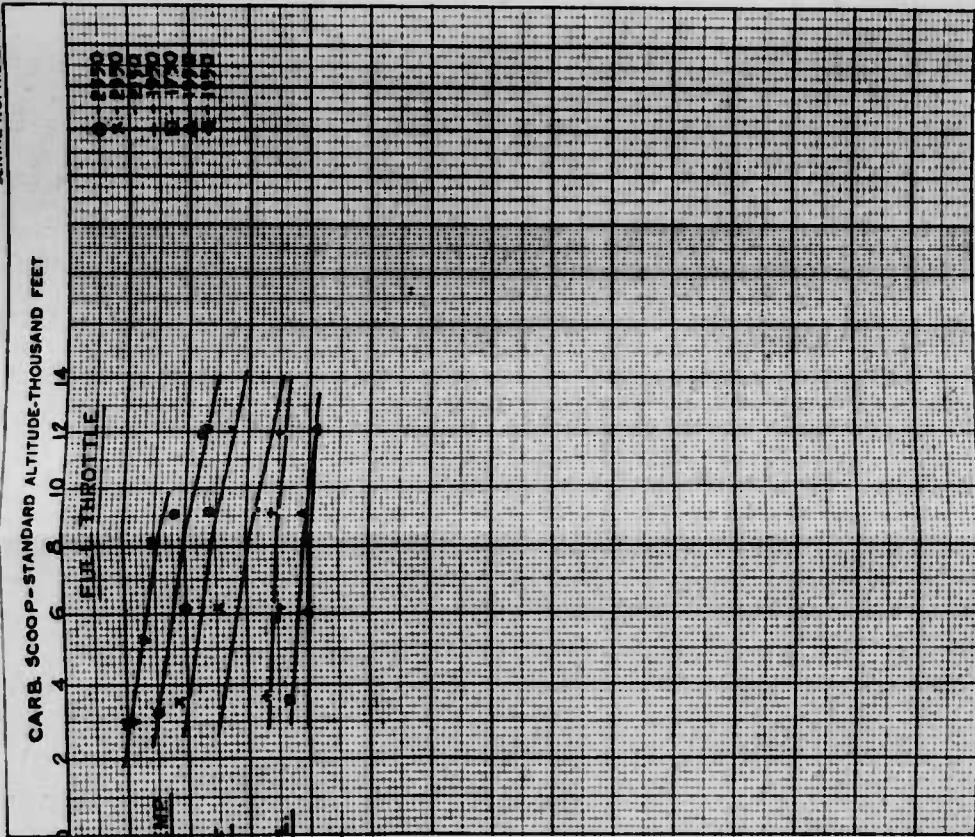


PROP OIL FUEL
 RATIOS COMP IMPELLER
 CARB SPARK ADV IMPELLER DIAM PLUGS
 IMPELLER DIAM

FOR GENERAL DATA SEE PLATE No. 9

TEST DATE
 AV ROOM BAR. IN HG.
 AV CARB AIR TEMP. °F.
 AV OIL INLET TEMP. °F.
 AV COOL AIR TEMP. °F.

NEUTRAL - AUX. STAGE
 S.L. 4 ALT. CHARACTERISTICS
 P4 W R-1830-86 ENGINE
 ENGINE BU NO 14288 MFG. NO. 9999
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ. 4077 ENGR. SANWALD



RATIOS COMP. IMPELLER
 CARB. SPARK-ADV. IMPELLER PLUGS
 IMPELLER DIAM.

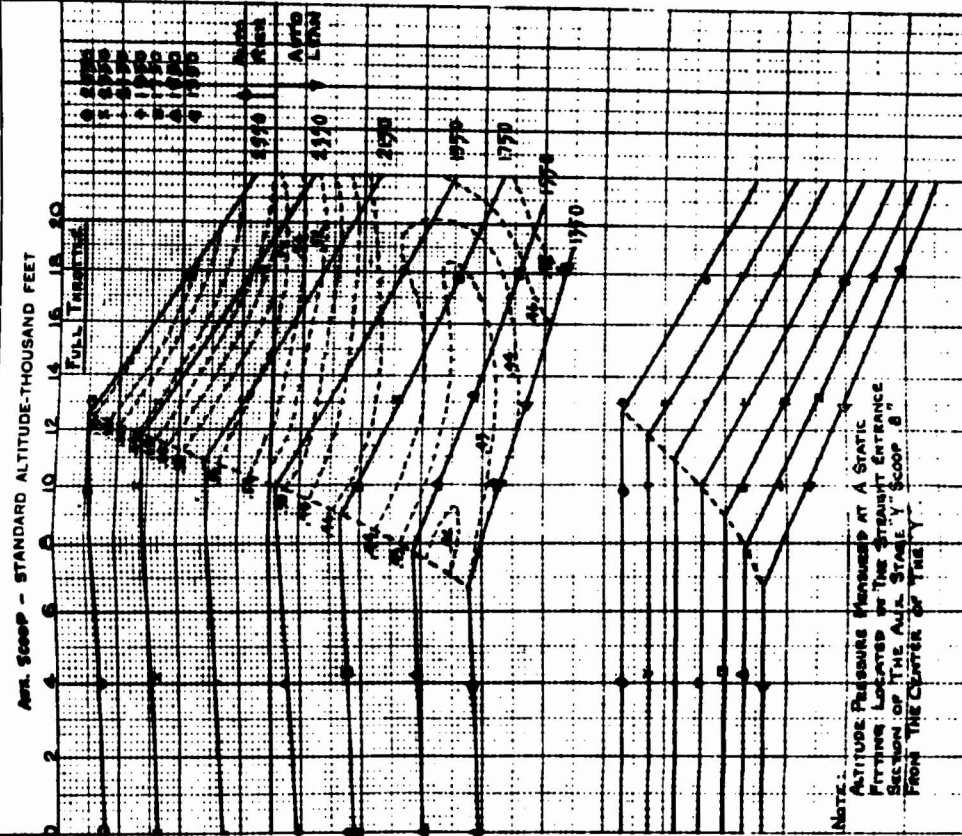
PROP. OIL FUEL

NEUTRAL-AUX. STAGE
S.L. & ALT. CHARACTERISTICS
P&W. R-1830-86 ENGINE
 ENGINE BU. NO. 14228 MFG. NO. 9309
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ. 4077 ENGR. SANWALD

FOR GENERAL DATA SEE PLATE No. 9

TEST DATE
 AV. ROOM BAR. IN. HG.
 AV. CARB. AIR TEMP. °F.
 AV. OIL INLET TEMP. °F.
 AV. COOL. AIR TEMP. °F.

TEST EQUIPMENT



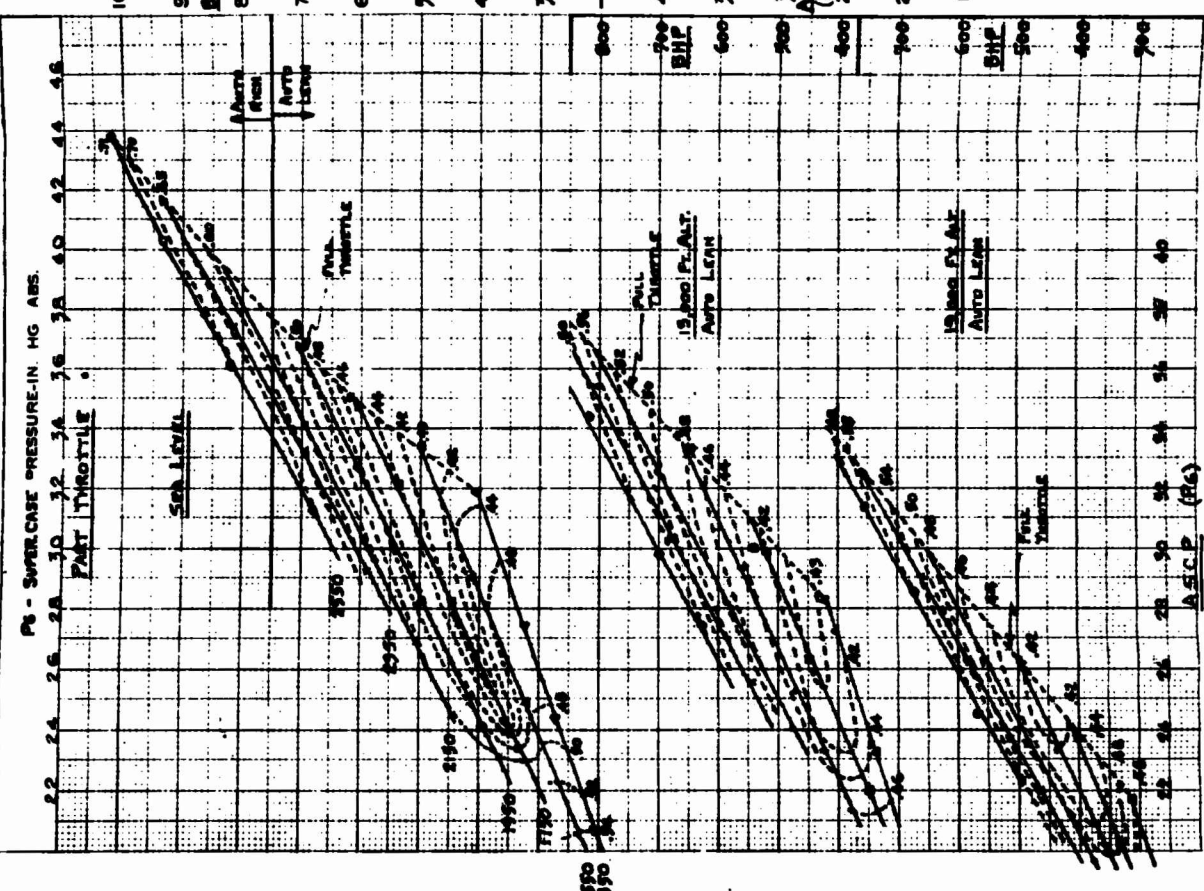
NOTE: ALTITUDE PRESSURE MEASURED AT A STATIC PRESSURE LOCATED IN THE STRAIGHT ENTRANCE SECTION OF THE ALT. STAGE 'Y' SCOOP, 8" FROM THE CENTER OF THE Y.

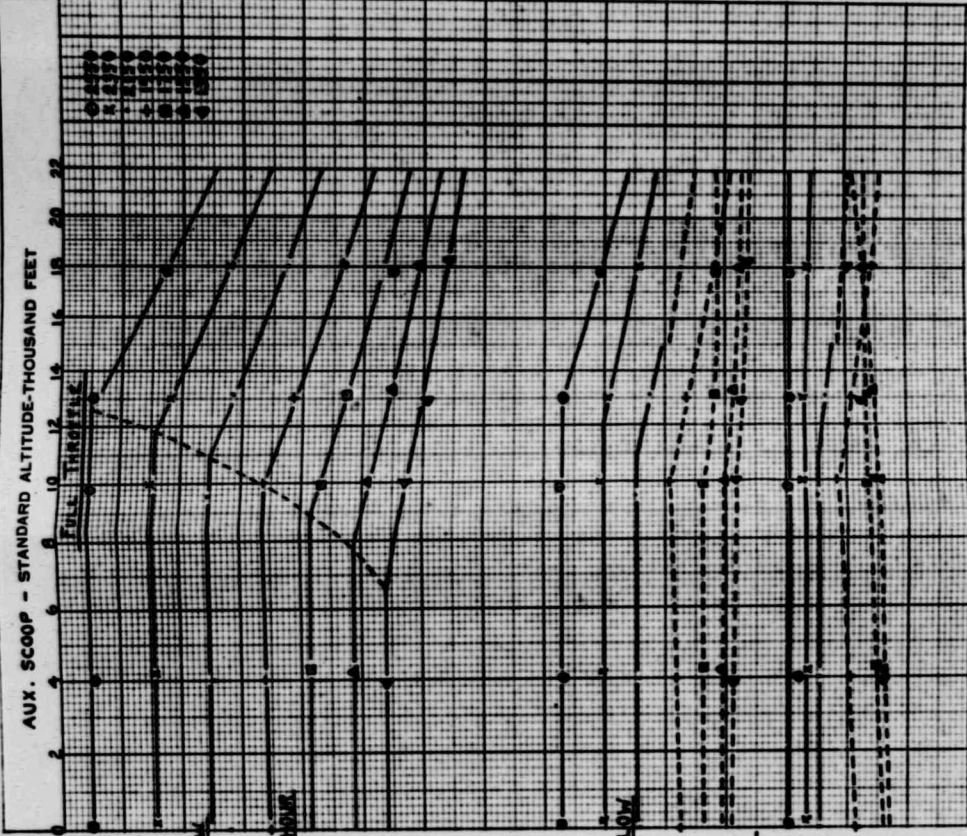
RATIOS COMP. 67.1 | IMPELLER 808.1 | MAIR PROP 3:2
 CARB. PD12E2-2 | PLUGS Bendix 659 | OIL 100
 SPARK ADV 9 1/2 IN. MAIR, 11 IN. AUX | FUEL 100 OCTANE

SUPER. REGULATOR SETTINGS: 27 IN. Hg ABS.

TEST DATA:
 AV ROOM BAR IN HG
 AV CARB AIR TEMP F
 AV OIL INLET TEMP F
 AV COOL AIR TEMP F

LOW RATIO - AVG. STAGE
 S.L. & ALT. CHARACTERISTICS
 P2W R-1890-86 ENGINE
 ENGINE BU NO 14228 MFG NO 9809
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY PHILA. PA.
 PROJ. 4077 ENG. R. SAMWALD





RATIOS COMP. CARB. ADV. IMPELLER PLUGS

PROP. OIL FUEL

TEST DATE

AV. ROOM BAR. IN. HG.

AV. CARB. AIR TEMP. °F.

AV. OIL INLET TEMP. °F.

AV. COOL. AIR TEMP. °F.

TEST EQUIPMENT

FOR GENERAL DATA SEE PLATE No. 12

LOW RATIO - AUX. STAGE

S.L. 4 ALT. CHARACTERISTICS

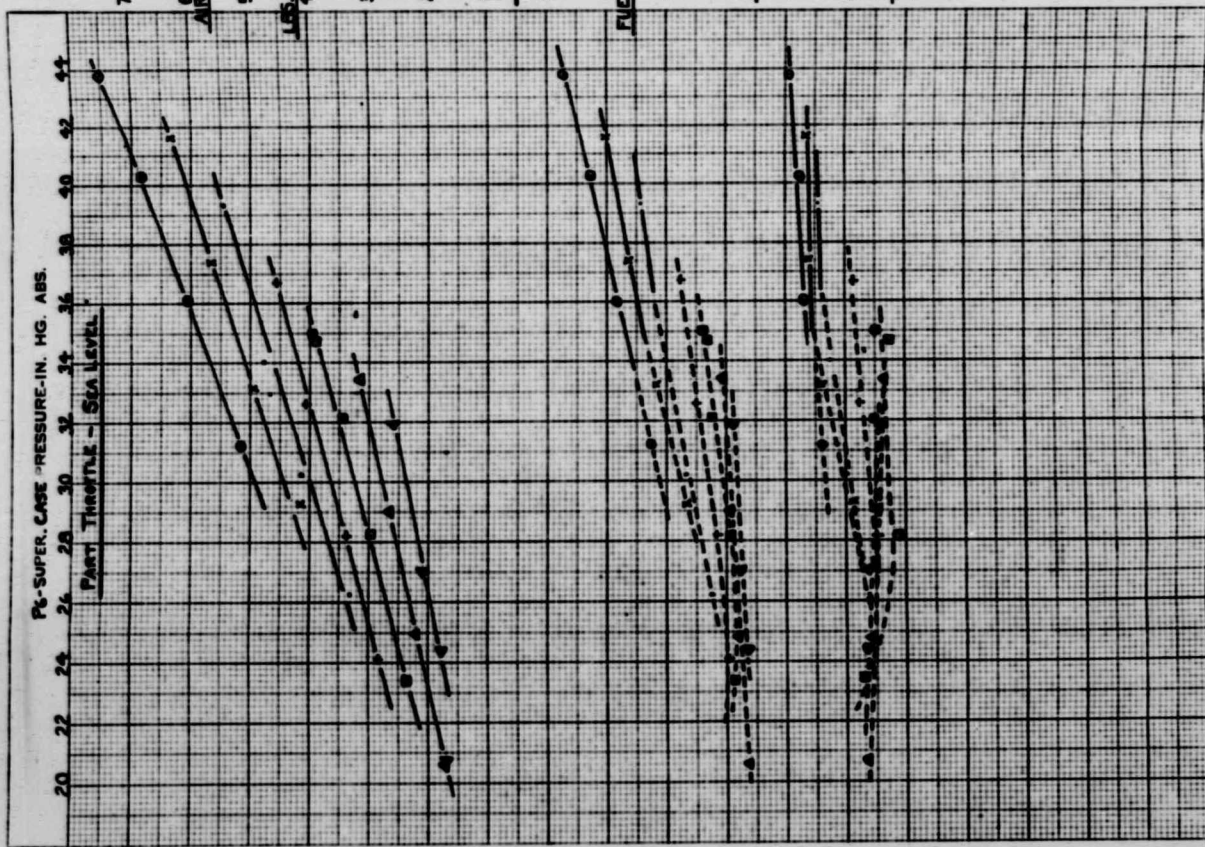
P4W R-1830-86 ENGINE

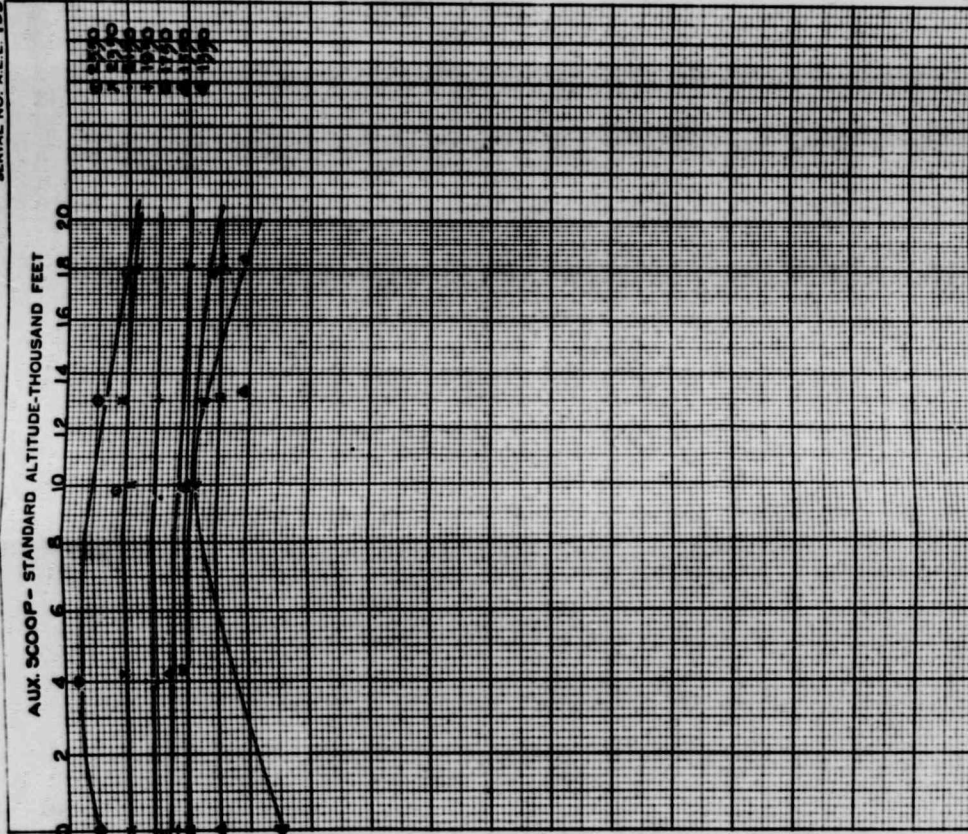
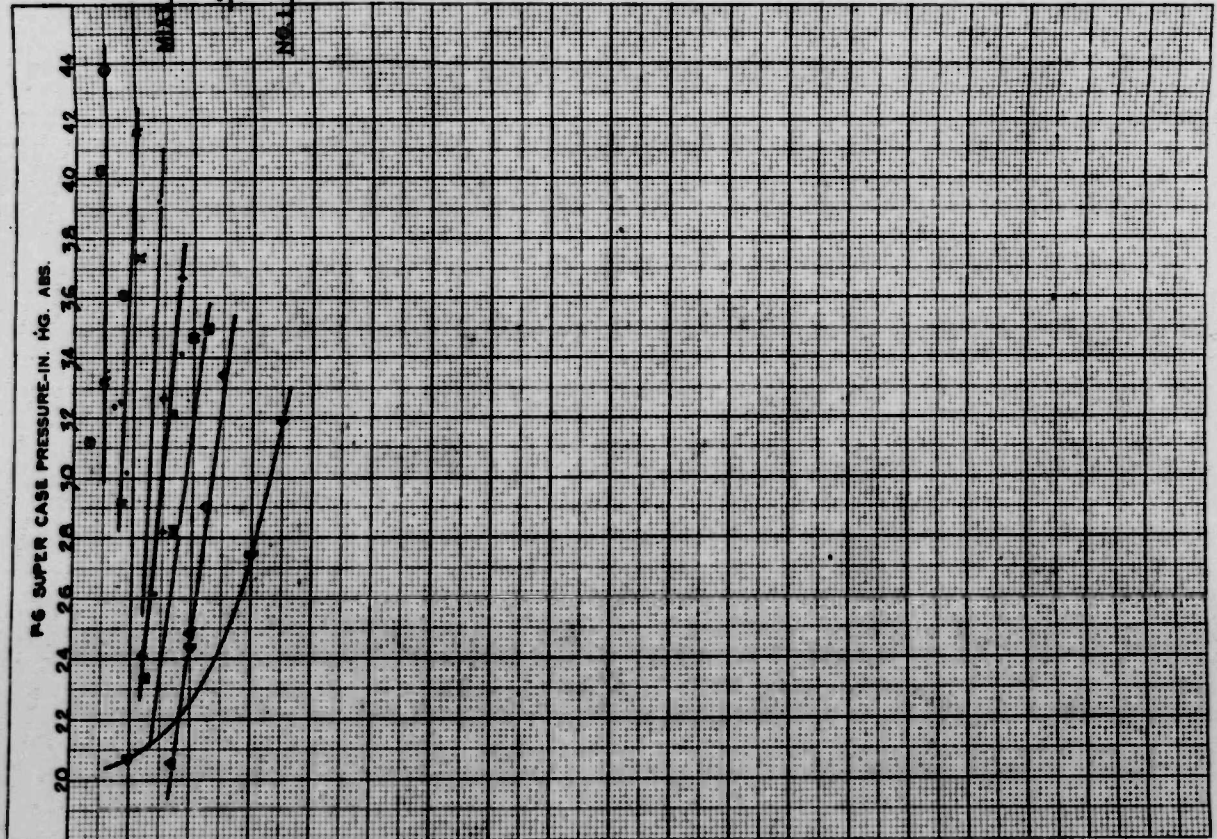
ENGINE BU NO. 14528 MFG. NO. 9309

AERONAUTICAL ENGINE LABORATORY

NAVAL AIRCRAFT FACTORY, PHILA., PA.

PROJ. 4077 ENGR. SANWALD



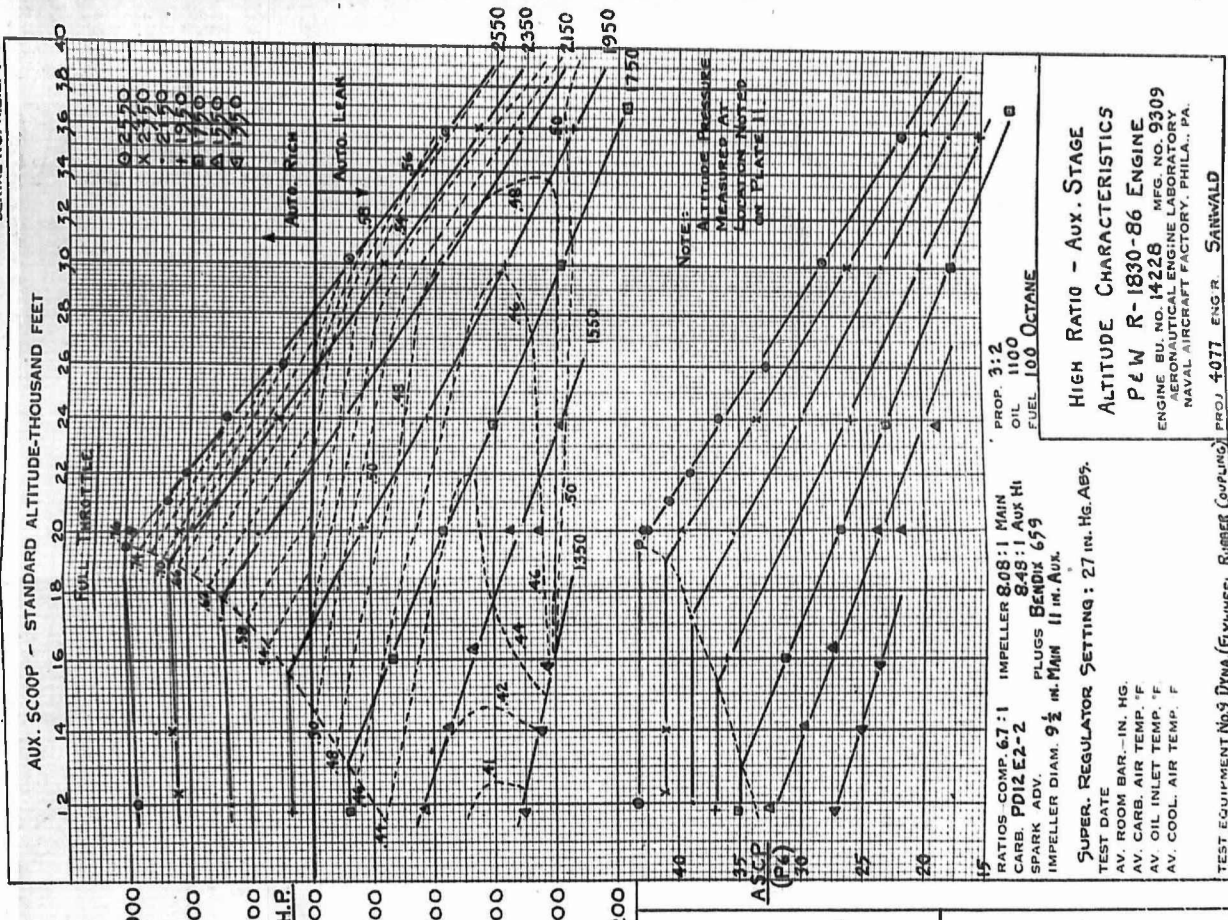
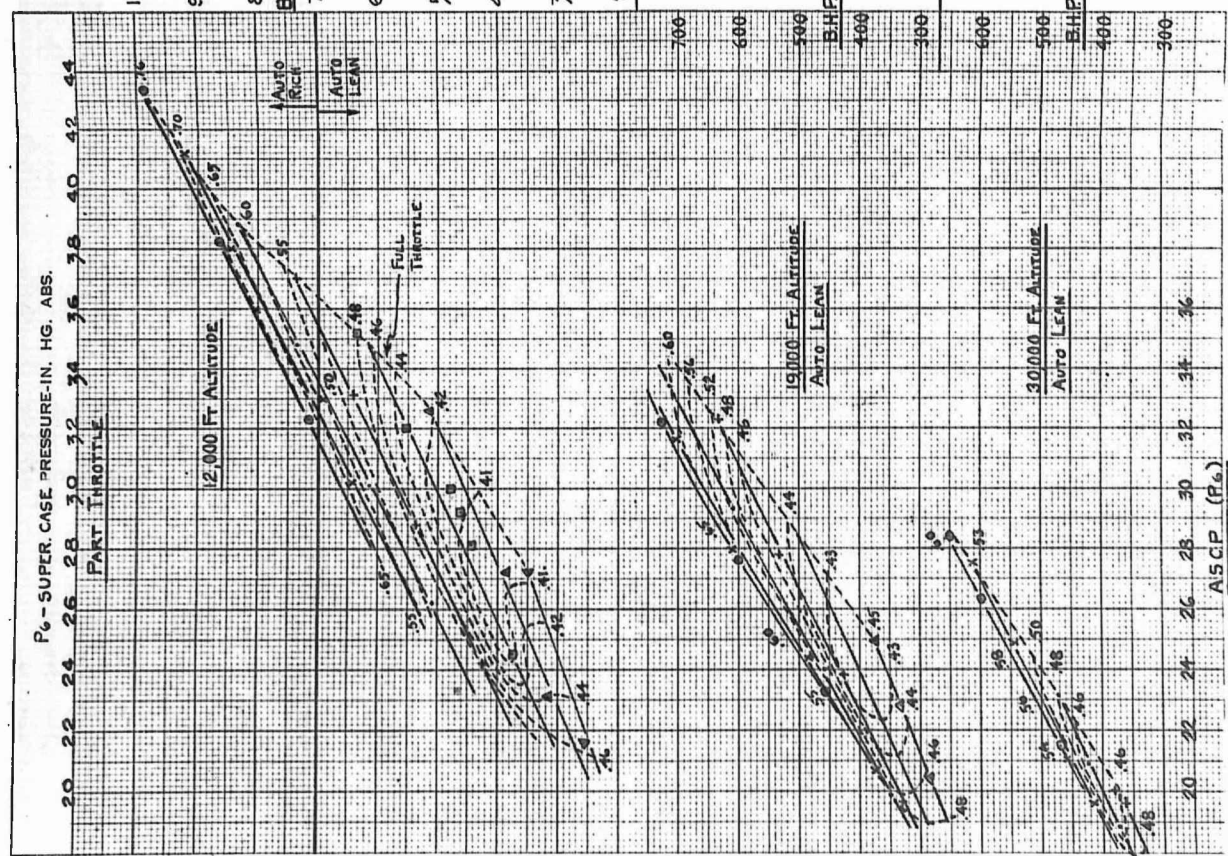


RATIOS COMP. IMPELLER
 CARB. PLUGS
 SPARK ADV. IMPELLER DIAM.
 IMPPELLER DIAM.

FOR GENERAL DATA SEE PLATE No. 12
 TEST DATE
 AV. ROOM BAR - IN. HG.
 AV. CARB. AIR TEMP. °F.
 AV. OIL INLET TEMP. °F.
 AV. COOL. AIR TEMP. °F.

LOW RATIO - AUX. STAGE
S.L. & ALT. CHARACTERISTICS
P. & W. R-1630-66 ENGINE
 ENGINE BU. NO. 14828 MFG. NO. 9309
 AERONAUTICAL ENGINE DIVISION
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ. 4077 ENG'R. SANWALD

TEST EQUIPMENT



NOTE: ALTITUDE PRESSURE MEASURED AT LOCATION NOTED ON PLATE I

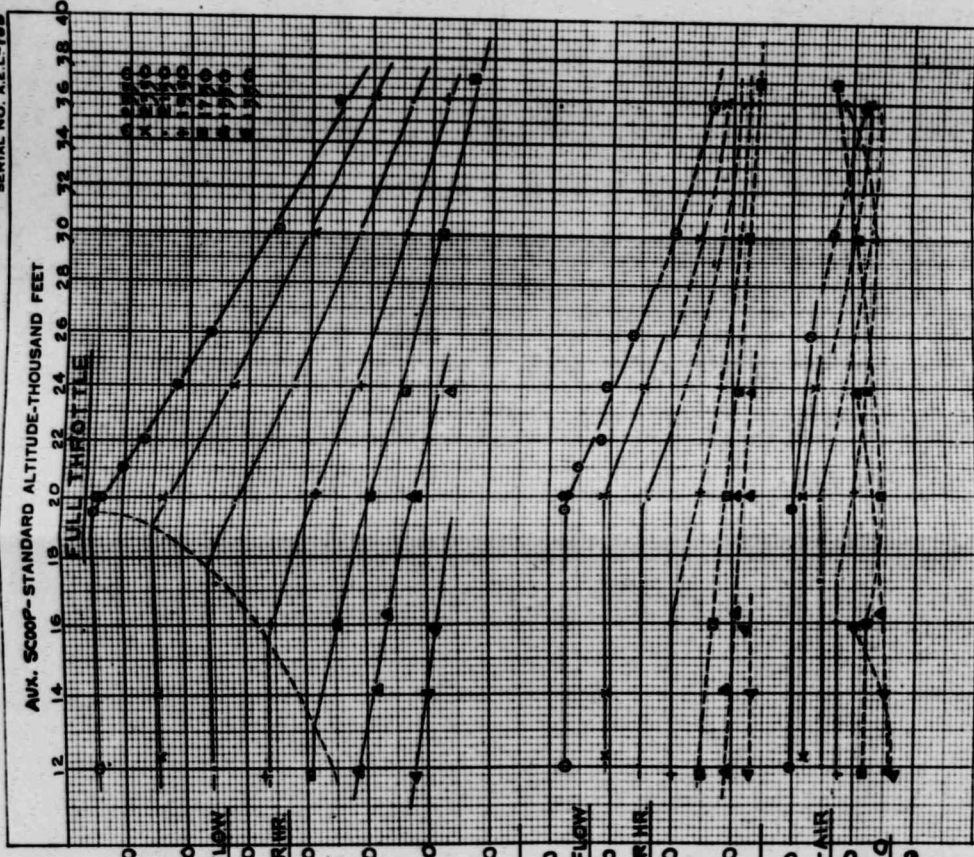
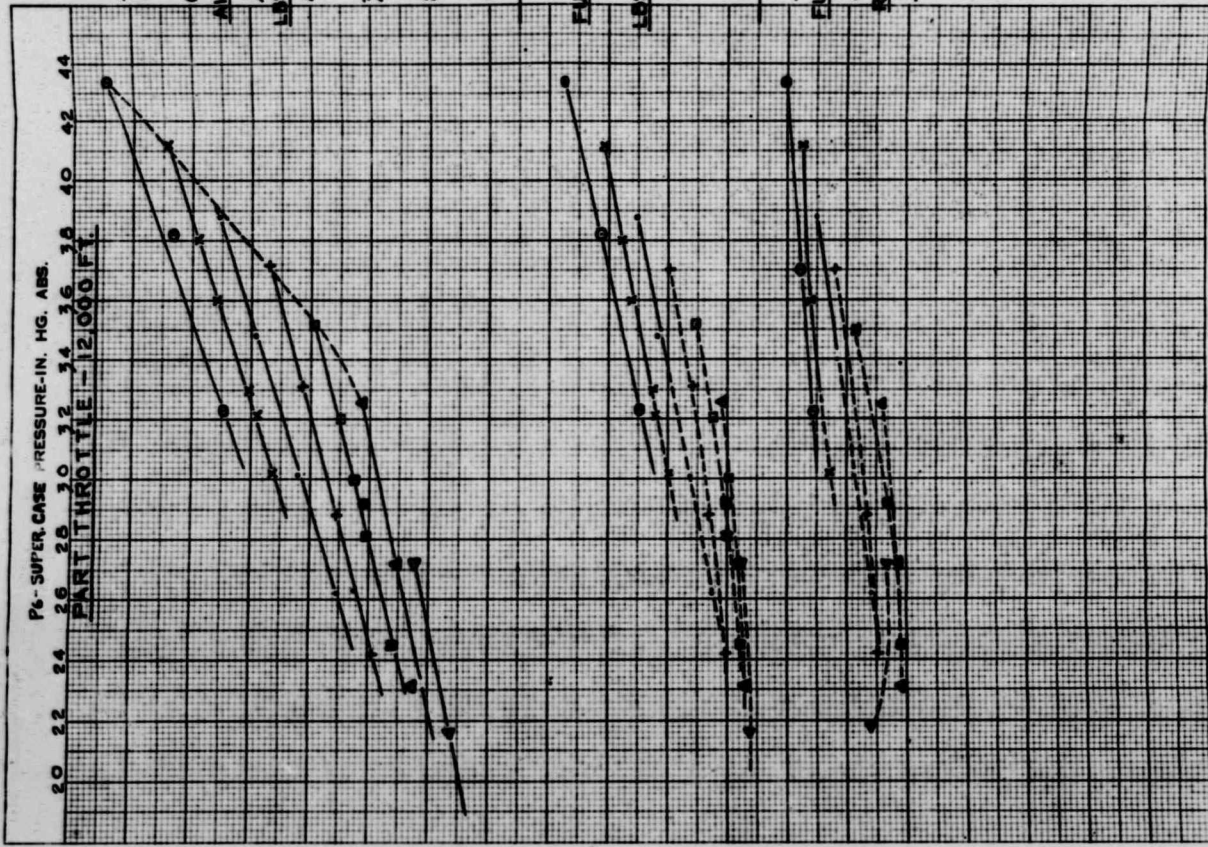
PROP. 3:2
OIL 1100
FUEL 100 OCTANE

HIGH RATIO - AUX. STAGE
ALTITUDE CHARACTERISTICS
P & W R-1830-86 ENGINE
ENGINE BU. NO. 14228 MFG. NO. 9309
AERONAUTICAL ENGINE LABORATORY
NAVAL AIRCRAFT FACTORY, PHILA., PA.

TEST DATE
SUPER. REGULATOR SETTING: 27 in. Hg. ABS.
AV. ROOM BAR-IN. HG.
AV. CARB. AIR TEMP. °F
AV. OIL INLET TEMP. °F
AV. COOL. AIR TEMP. °F

TEST EQUIPMENT No. 9 Dyna (FLYWHEEL, RUBBER COUPLING) PROJ. 4077 ENG. R. SAINWALD

SERIAL NO. A.E.L.-788



RATIOS COMP. IMPELLER
 CARB. SPARK - ADV. PLUGS
 IMPELLER DIAM.

PROP. OIL FUEL

FOR GENERAL DATA SEE PLATE No. 15

HIGH RATIO - AUX. STAGE
ALTITUDE CHARACTERISTICS
P & W R-1830-86 ENGINE
 ENGINE BU NO 14228 MFG NO 9309
 NAVAL AIRCRAFT ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.

TEST DATE
 AV. ROOM BAR - IN. HG.
 AV. CARB. AIR TEMP. °F.
 AV. OIL INLET TEMP. °F.
 AV. COOL. AIR TEMP. °F.

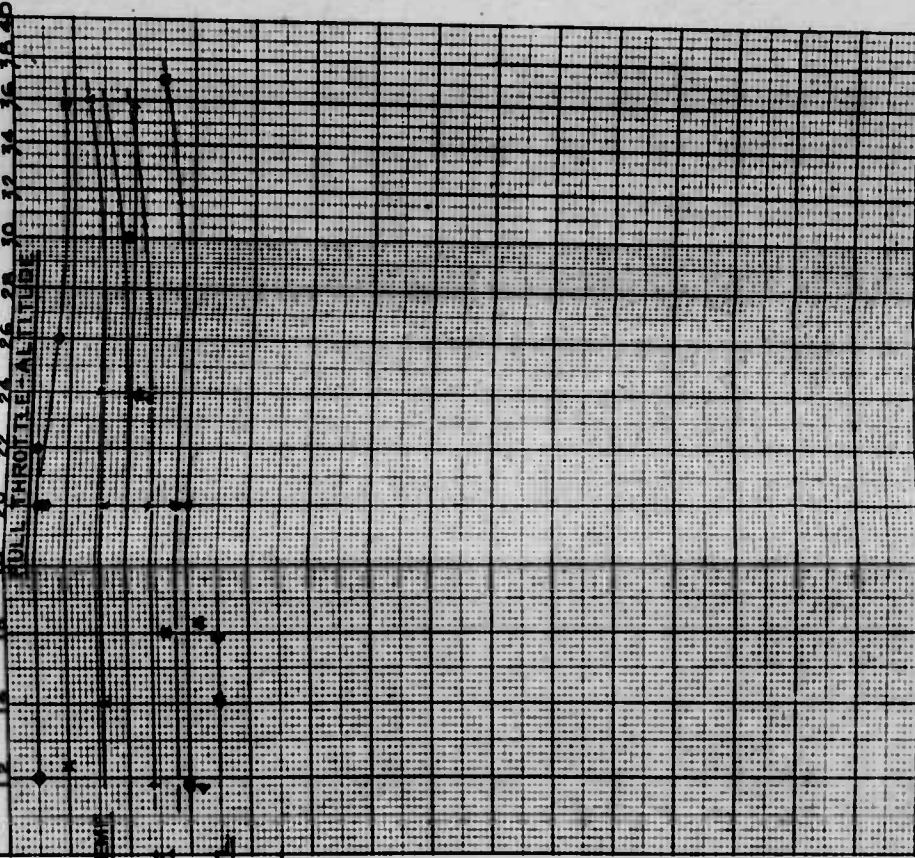
TEST EQUIPMENT

PROJ. 4077 ENGR. G. L. SANWALD

PLATE 16

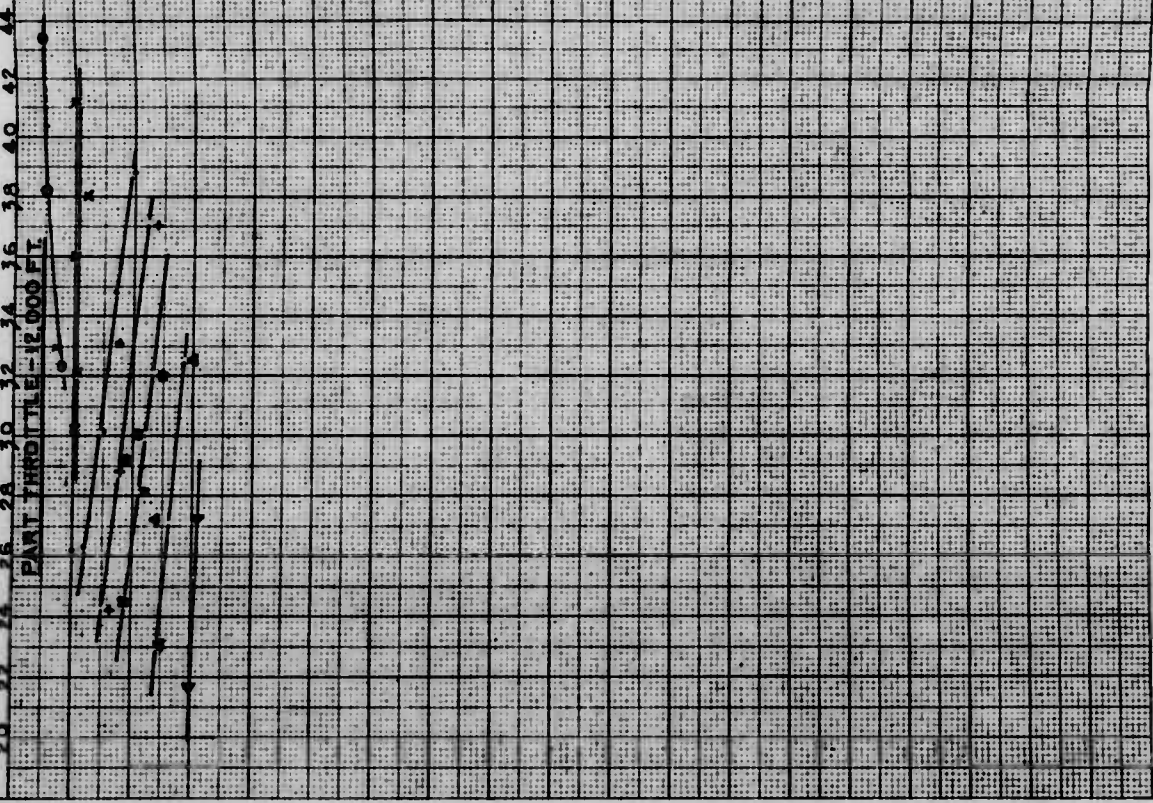
SERIAL NO. A.E.L.-789

AUX. SCOOP-STANDARD ALTITUDE-THOUSAND FEET



140
MIXT. RATIO
120
DEG. F
100
NO. I.C.Y.
80

P-6 SUPER CASE PRESSURE-IN. HG. ABS.



140
PART THROTTLE-12,000 FT.
120
DEG. F
100
NO. I.C.Y.
80

RATIOS COMP
CARB.
SPARK ADV.
IMPELLER DIAM.

IMPELLER
PLUGS

PROP.
OIL
FUEL

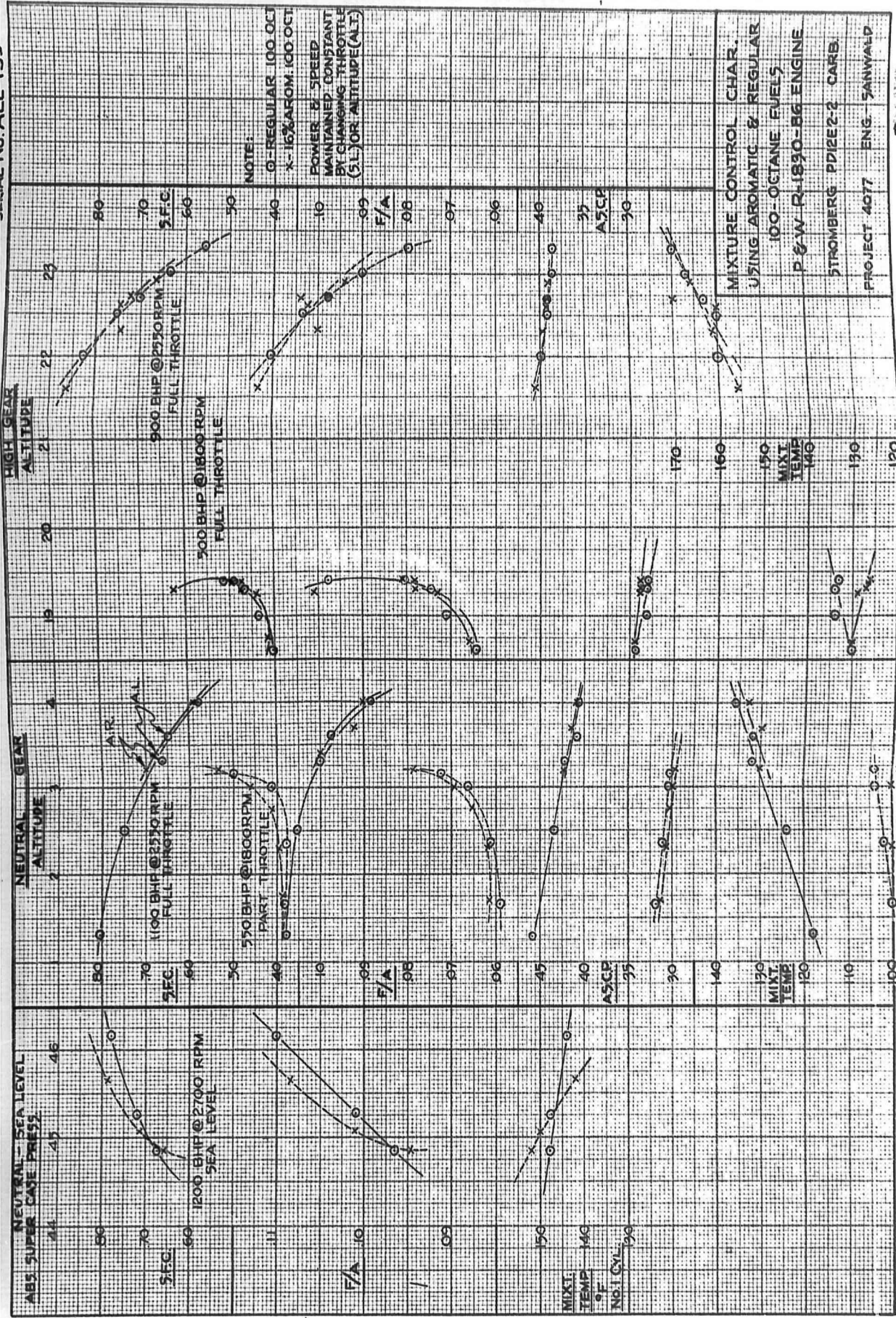
FOR GENERAL DATA SEE PLAT No 15

TEST DATE
AV. ROOM BAR. IN. HG.
AV. CARB AIR TEMP. °F.
AV. OIL INLET TEMP. °F.
AV. COOL. AIR TEMP. °F.

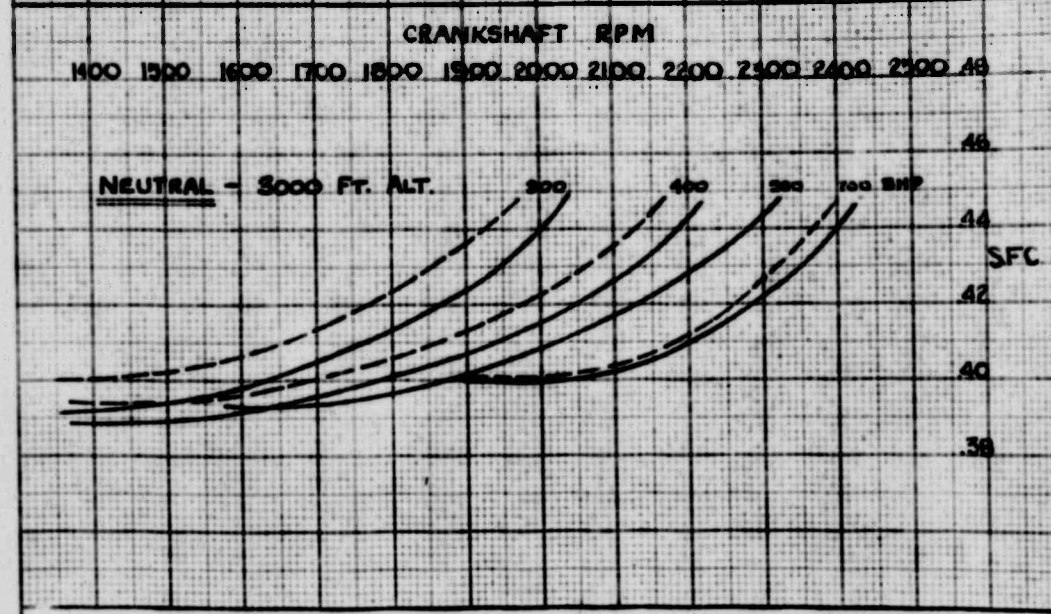
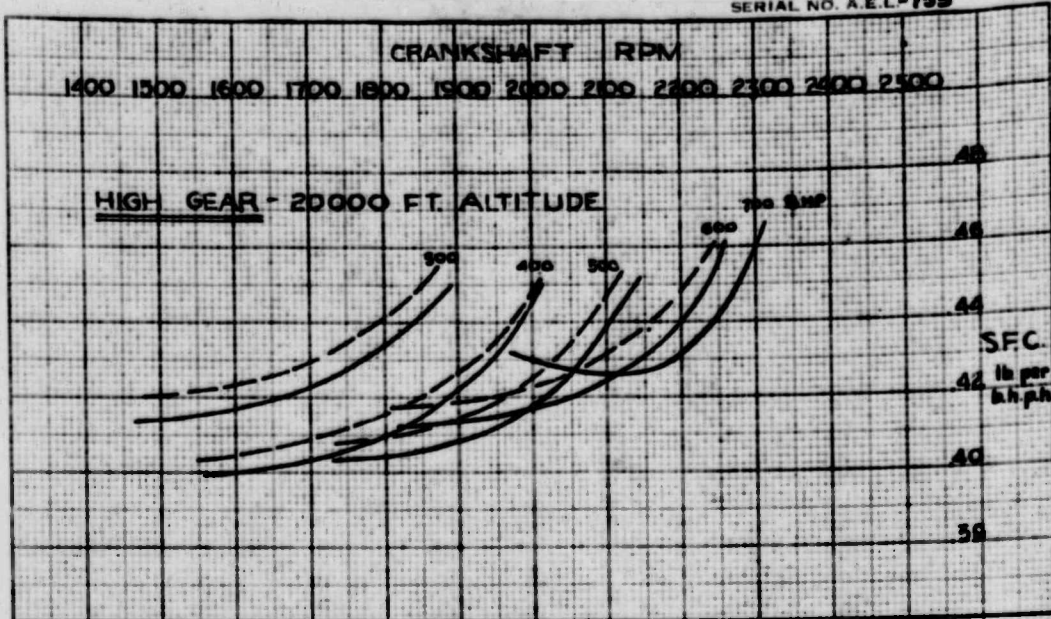
HIGH RATIO-AUX. STAGE
S.L. & ALT. CHARACTERISTICS
P & W. R-1630-66 ENGINE
ENGINE BU. NO. 14988 MFG. NO. 9709
AERONAUTICAL ENGINE LAB. PHOTO
NAVAL AIRCRAFT FACTORY, PHILA., PA.

PROJ. 4077 ENG. R. SANWALD

PLATE 17



XG 8-2 D11 AND 8-251 043330 2-2 4107 11 31 2011



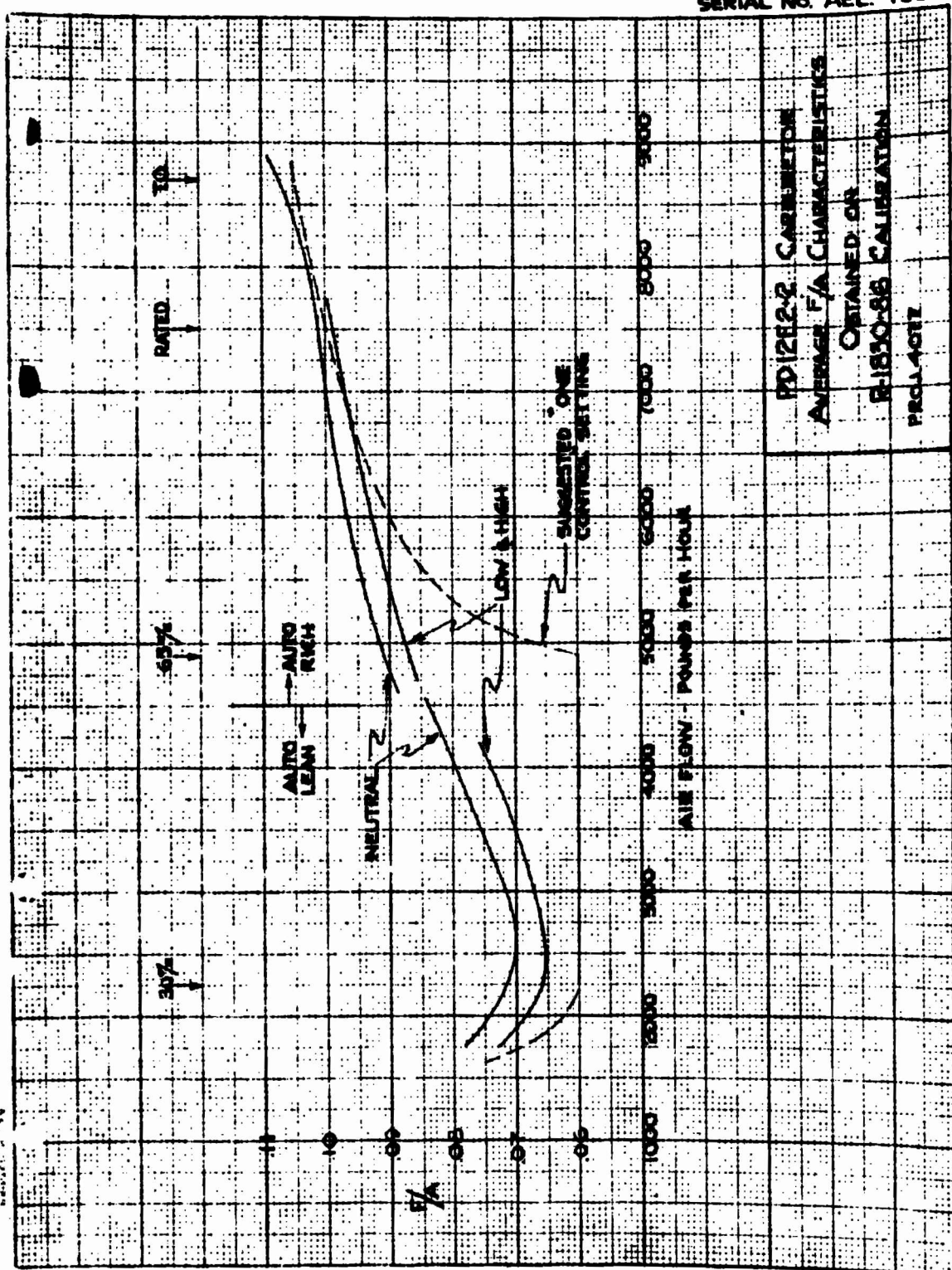
— REGULAR 100 OCTANE FUEL
 ---- AROMATIC (16%) 100 OCTANE FUEL

MINIMUM S.F.C. VALUES COMMENSURATE WITH SMOOTH RUNNING.

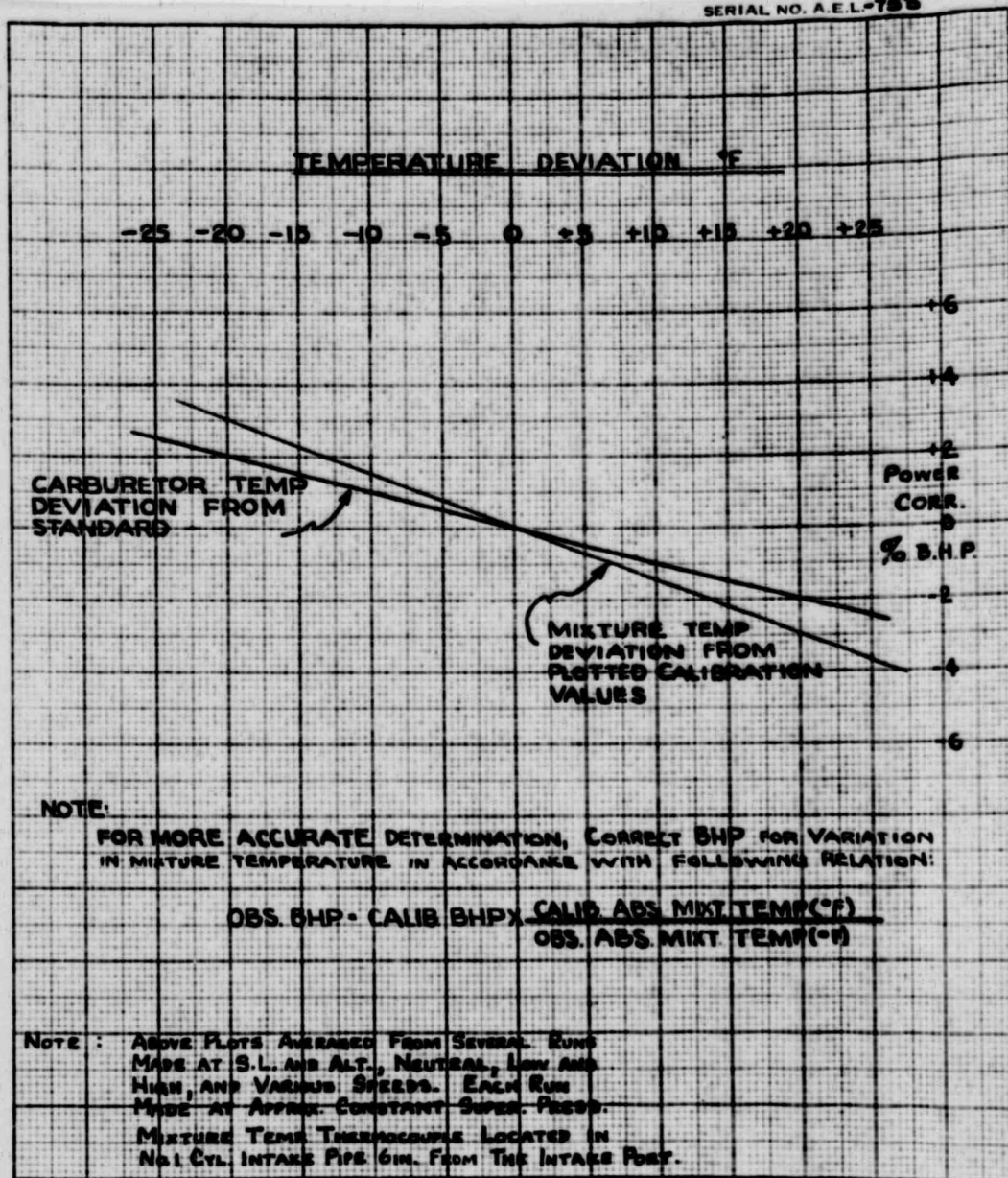
CARB. - BENDIX PD12E2-2 LEANED MANUALLY.
 COMP. RATIO - 6.7:1.
 IMPELLER RATIOS - 8.08 MAIN, 6.43 LO, 8.48 HI.
 SPARK ADVANCE - FIXED 25° (BOTH)
 CARB. AIRTEMP. - NU: STD. ALT., HI: 90°F

**MINIMUM SPEC FUEL CONS.
 CHARACTERISTICS
 P & W R-1830-86 ENGINE**

AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ. 4077 ENG'R. SANWALD



FD12E2-2, CARBURETOR
 AVERAGE F/A CHARACTERISTICS
 OBTAINED ON
 R-1830-86 CALIBRATION
 PRCL-407Z



RATIOS COMP. _____
 CARB. _____
 SPARK ADV. _____
 IMPELLER DIAM. _____

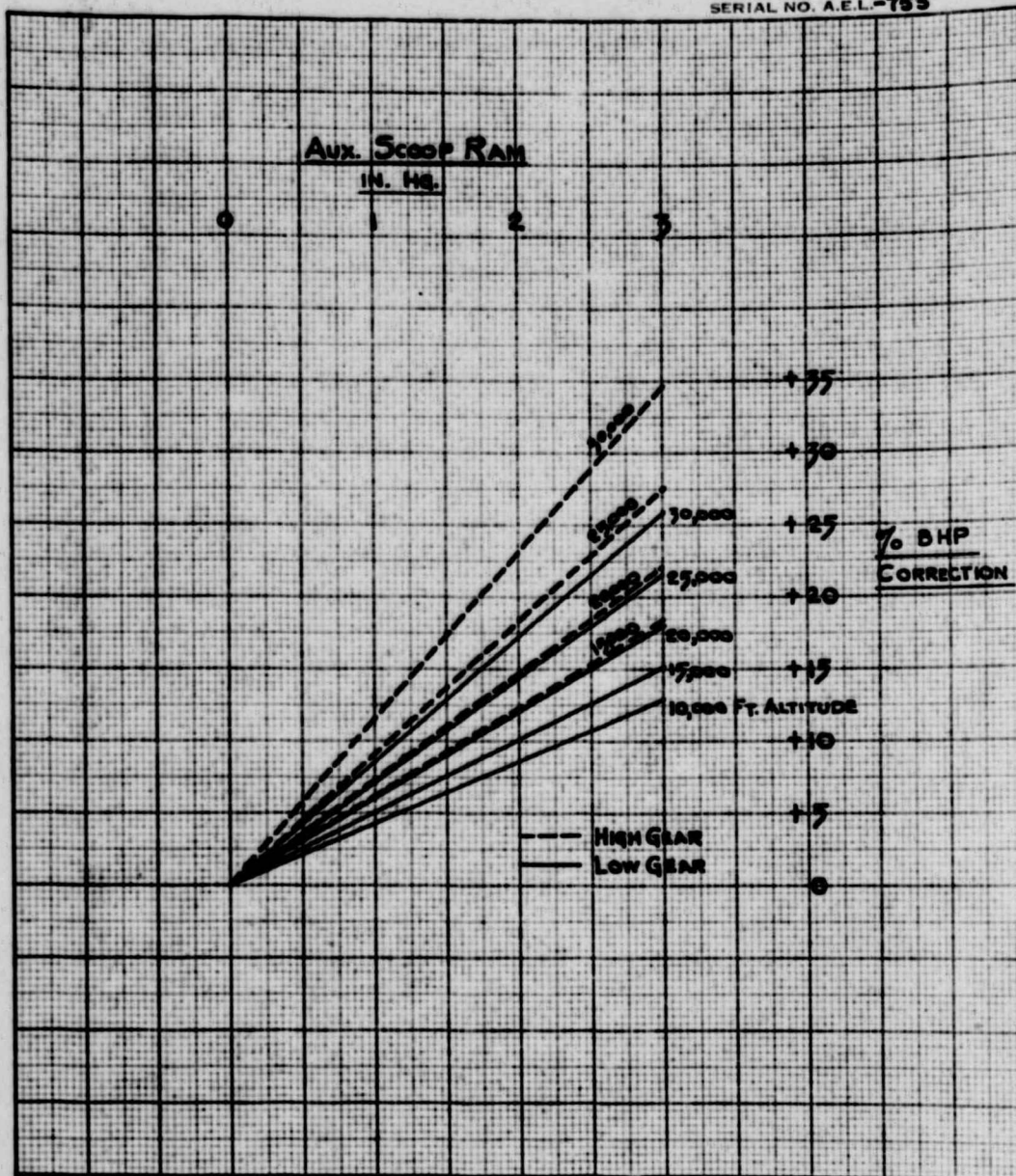
IMPELLER _____
 PLUGS _____

PROP. OIL _____
 FUEL _____

TEST DATE _____
 AV. ROOM BAR. IN. HG. _____
 AV. CARB. AIR TEMP. °F. _____
 AV. OIL INLET TEMP. °F. _____
 AV. COOL. AIR TEMP. °F. _____

TEST EQUIPMENT _____

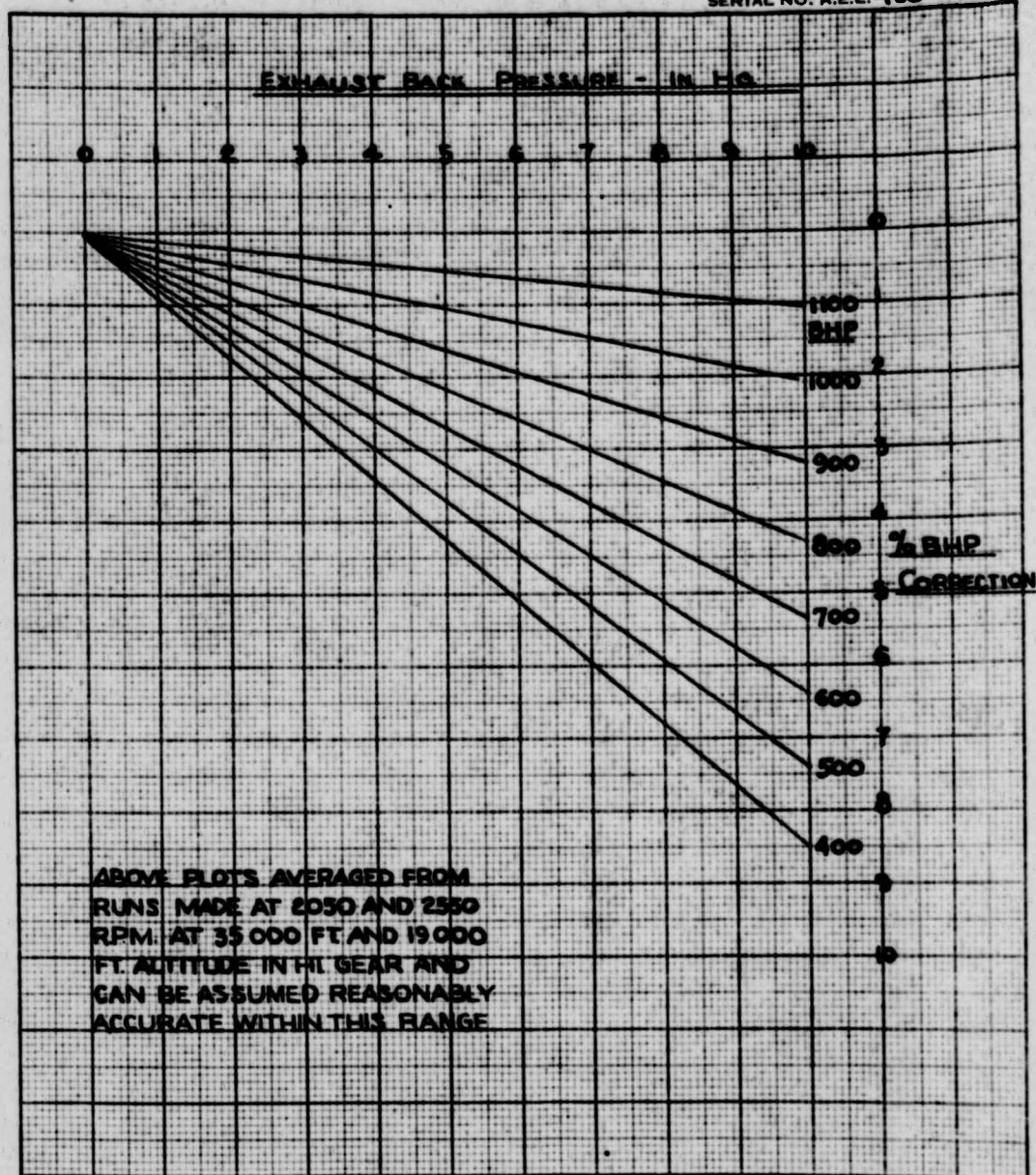
SEA LEVEL & ALTITUDE
HP CORRECTION CURVE
P & W R-1630-86 ENGINE
 ENGINE BU. NO. 14228 MFG. NO. 9309
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ 4077 ENG'R. SANWALD



ABOVE PLOTS AVERAGED FROM BASIC
CALIBRATION CURVES AT 2150, 2350
AND 2550 RPM.

Aux. STAGE SCOOP RAM
CHARACTERISTICS
P&W R-1830-36 ENGINE
Du. No. 14228 Mfg. No. 9309
AERONAUTICAL ENGINE LABORATORY
NAVAL AIRCRAFT FACTORY, PHILA., PA.
PROJ. 4077 ENG'R. SANWALD

SERIAL NO. A.E.L.-789

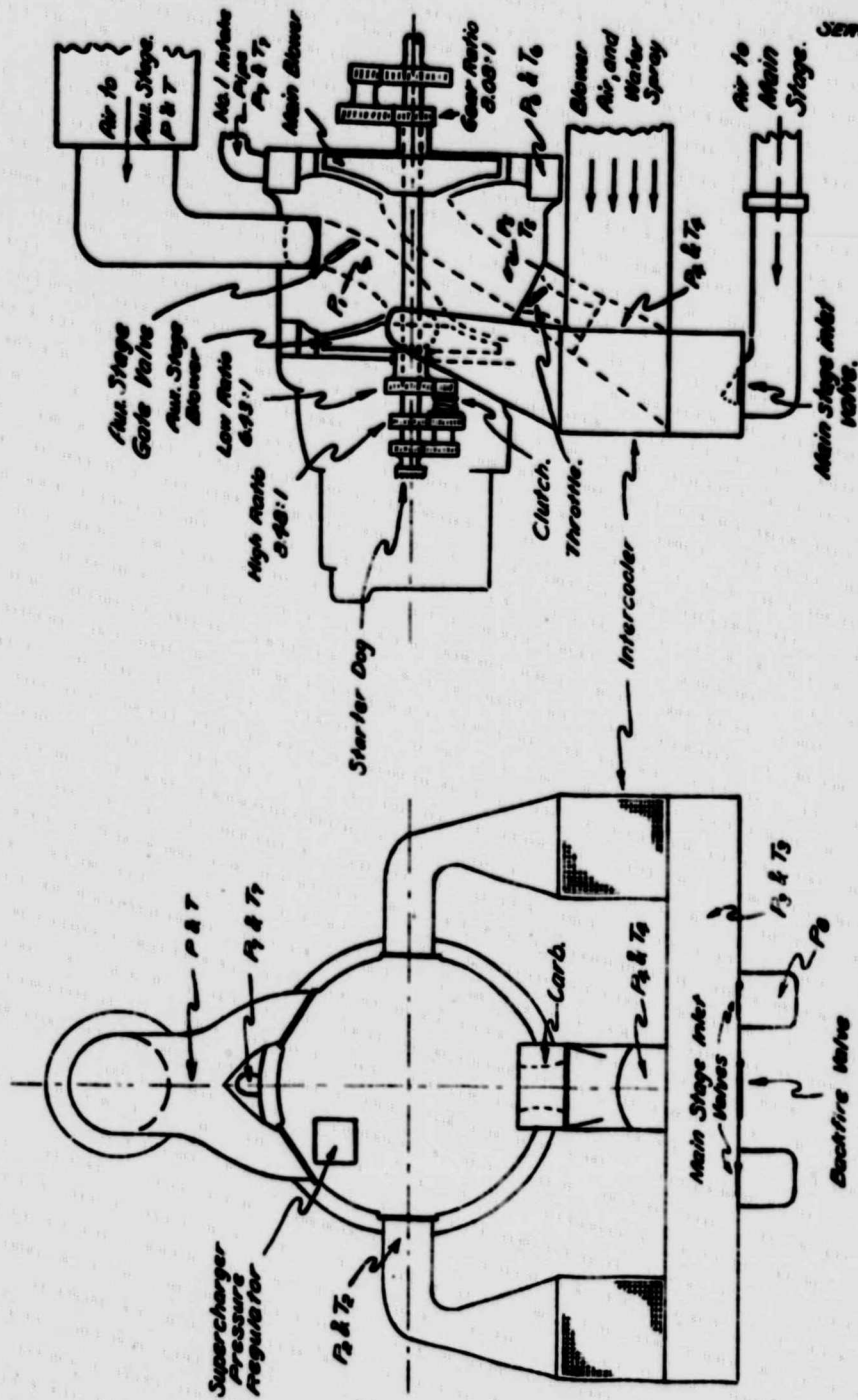


RATIOS COMP. 6.7:1 IMPELLER 8.08" MAIN. PROP 3:2
 CARB. PD12E2-2 6.43:1 AUX Lo 848 HI OIL 1100
 SPARK-ADV. 25° PLUGS BENDIX 699 FUEL 100 OCT.
 IMPELLER DIAM. 9½" MAIN 11" IN. AUX.

TEST DATE _____
 AV. ROOM BAR. IN. HG. _____
 AV. CARB. AIR TEMP. °F. _____
 AV. OIL INLET TEMP. °F. _____
 AV. COOL. AIR TEMP. °F. _____

TEST EQUIPMENT No. 9 DYNA (FLYWHEEL RUBBER COUPLING)

**ALTITUDE EXHAUST BACK
 PRESSURE CHARACTERISTICS
 P & W R-1830-86 ENGINE**
 ENGINE-BU. NO. 14228 MFG. NO. 9309
 AERONAUTICAL ENGINE LABORATORY
 NAVAL AIRCRAFT FACTORY, PHILA., PA.
 PROJ. 4077 ENG'R. GL SANWALD



DIAGRAMMATIC ARRANGEMENT OF DUCTS, INTERCOOLERS, AND TWO-SPEED TWO-STAGE SUPERCHARGER ON P & M. P-1030-B ENGINE, SHOWING LOCATION OF PRESSURE AND TEMPERATURE MEASUREMENTS.

REEL - C

16 17

A.T.I.

3 8 2 7 5

TITLE: Calibration of Pratt and Whitney R1830-36 Engine

AUTHOR(S): Sanwald, G. L.; Senola, A. J.

ORIGINATING AGENCY: Naval Aircraft Factory, Aeronautical Engine Lab., Phila., Pa.

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ABSTRACT:

Tests were conducted on a P and W R-1830-86 engine equipped with a PD12E2-2 carburetor to determine the performance characteristics and to evaluate operation when using fuel having an aromatic content of approximately 20%. Comparative mixture control runs extending over the complete cruise range and including normal and take-off conditions indicated that best economy mixture results averaged 1% richer when using aromatic fuel. The mixture temperatures, when using aromatic type fuel, were found to be slightly less, and the Bendix PD12E2 carburetor metered approximately 2-1/2% richer at the air flows near and above rated, but a negligible amount at air flows in the cruising range. Generally, no difference in engine operation, including smoothness and acceleration, was noticeable. No signs of detonation were present when using either fuel.

CFST, auth: USNAPTC etc, 13 Apr 70

over

DISTRIBUTION: Copies of this report may be obtained only by Government Agencies

DIVISION: Power Plants, Reciprocating (6) 27
SECTION: Performance (13) 1,4

SUBJECT HEADINGS: Engines, Reciprocating - Performance evaluation (34078.15); Engines, Reciprocating - Carburetion tests (34076.3); R-1830 (76694)

AD-A800 376

CHNICAL INDEX

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Dayton, Ohio