33/21/1

AVIA 7/734

8th Part of Report No.A.& A.E.E./783,a.

20 JAN 1943

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

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Kittyhawk II F.L.220
(Merlin V.1650-1)

Fuel consumption tests

DATE	STOCK
5/1/43	12

ISSUE TO	AUTHORISED
12	6.1.43.

Progress of issue DATE of report

This report deals with the aircraft (or equipment) as tested. Action to remedy defects, or decisions to accept items not in strict compliance with the specification, are matters for decision and action by the Ministry of Aircraft Production.

A.& A.E.E. ref: 4484/1-A.S.76/4.
M.A.P. ref: RA.1871/D.A.N.A.
Period of test: August-October, 1942

Report No.	Title
3rd Part of A.& A.E.E./783,a.	F.L.220 - Carbon monoxide contamination tests.
4th do.	F.L.220 - Climb and level speed performance and position error.
5th do.	F.L.220 - Engine cooling trials.
6th do.	F.L.220 - Radio trials - Communication sets.
7th do.	F.L.220 - Cabin heating tests.

1. Introduction.

Fuel consumption measurements have been made on Kittyhawk II F.L.220 fitted with a Merlin V.1650-1 engine. This engine is fitted with a Bendix-Stromberg carburettor with automatic mixture control, with rich and weak mixture positions of the control lever. In this carburettor, fuel for weak mixture operation is supplied through a single jet. On moving the lever to the rich position, the mixture is enrichened by fuel supplied from a further jet. In addition, for high engine powers, fuel is supplied through the power enrichment valve, which opens against the action of a spring at high boost pressures.

In addition to measurements made with this normal carburettor, at the request of Messrs. Rolls-Royce and with the approval of M.A.P., further tests were made with the carburettor modified to give automatic enrichment at high boost pressures when the lever was retained in the weak mixture position. The modification consisted of a weaker spring in the power enrichment valve, so that this valve came into operation at lower boost pressures, thus compensating for the absence of fuel from the rich mixture jet. These tests were made to provide information for a proposed locked mixture control system on Merlin 28 engines fitted in the Lancaster III. In this case the mixture control lever would, of course, be deleted entirely.

2. Condition of aircraft relevant to tests made.

2.1. General. The principle features of the aircraft were:-

Six 0.5" guns, three in each wing. The muzzles protruded about 3 in. from the leading edge of the wing and were tape-bound, but the ejection chutes under the wings were open.

Aerials from the fin to the wing tips and to the rear of the cockpit.

I.F.F. aerials between the side of the fuselage and the tailplane.

No aerial mast.

An external rear view mirror above the windscreen and slightly to port.

A landing lamp fitted in the port wing.

Fittings under the fuselage to take an external overload fuel tank or a bomb, but neither of these were fitted when these tests were made.

Slots in the under surface of the wings for bomb racks.

Curtiss Electric, three-bladed propeller of 11 ft. diameter with metal blades. The fine pitch setting was $26\frac{1}{2}^{o}$ and the coarse pitch setting $56\frac{1}{2}^{o}$.

A Kollsman Type D.24 V.D.C. pressure head on the leading edge of the port wing. Details of the exact position are given in 4th Part of Report No.A.& A.E.E./783,a.

2.2. Loading. The tests were made at a take-off weight of 8,910 lb. with the centre of gravity 24.7 in. aft of the datum point. Due to the expenditure of fuel, the mean weight at which the fuel consumption was measured is estimated to have been 8,490 lb.

2.3. Engine limitations obtaining at time of test.

	R.P.M.	Manifold pressure Inches of mercury
Maximum permitted for take-off	3000	48
Maximum permitted for level flight (5 min. limit)	3000	48
Maximum on climb (below 20,000 ft.)	2850	48
(above 20,000 ft.)	3000	48
Maximum for continuous cruising in rich mixture	2650	44
Maximum for continuous cruising in weak mixture	2650	38

3. Scope of tests.

Fuel consumption measurements were made using a Kent flowmeter, with the normal carburettor, under the following conditions:-

(i) At 10,000 ft. in M.S. supercharger gear, using weak mixture at various combinations of engine speed and manifold pressure. Engine speed was varied between 2650 r.p.m., the maximum permissible for use with weak mixture, down to 1600 r.p.m.; at 1600 r.p.m. it was difficult to maintain height and a steady airspeed even when using the maximum obtainable manifold pressure in weak mixture. The results given in Table I and Fig.1 have, therefore, been discontinued at 1700 r.p.m.

Manifold pressure was varied between 38 in. of mercury, the maximum permissible using weak mixture, and the minimum at which height could be maintained at a steady airspeed.

(ii) The results of test (i) showed that the engine obeyed the minimum r.p.m. - maximum boost law, i.e. maximum range at any airspeed is obtained by setting the throttle to give the maximum permissible or obtainable manifold pressure and then reducing engine speed until the required airspeed is obtained. The tests at 20,000 ft., which were made using both M.S. and F.S. supercharger gears, were confined to measurements at these minimum r.p.m. - maximum boost conditions.

(iii)At each height measurements were also made at maximum all-out level, maximum climb and maximum rich mixture cruising conditions.

All the tests at each height were made with the radiator duct gills in the neutral position.

The carburettor was then modified and the mixture control lever locked in its weak position. The tests given in (i), (ii) and (iii) were then repeated. In addition the fuel consumption was measured on a climb to 33,000 ft., using the maximum permissible engine conditions for climb and the best climbing speed as found from partial climb tests.

4. Results of tests.

In all cases the speeds and fuel flow measurements have been corrected to standard atmospheric conditions by the method of Report No.A.& A.E.E./Res/170 (incorporating A.& A.E.E. Memorandum dated 27th August, 1942). The position error correction used was that measured on this aircraft and given in the 4th Part of Report No.A.& A.E.E./783,a.

As stated in para.2.2 the mean weight at which the fuel consumption was measured was 8,490 lb. The weight of the aircraft with full day or night fighter load is 8,980 lb. Allowing for the fuel used on climb, the mean weight on a range flight at 10,000 ft. will be 8,450 lb., and at 20,000 ft., 8,420 lb. The results have, therefore, been corrected to these mean weights at each height by the method of Report No. A.& A.E.E./Res/170.

The results obtained are given in full in Tables I-VI and in Figs.1-9, as shown in the following table.

/Table

Corrigendum to 8th Part of Report No.A.& A.E.E./783/a.
Dated 20th January, 1943.

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

Kittyhawk II F.L.220
(Merlin V 1650-1)

Fuel consumption tests.

A.& A.E.E. ref:- 4484/1-A.S.76/4.
M.A.P. ref:- R.A.1871/D.A.D.A.1.

Para. 4.2.(Line 6.) (i) Delete:- " i.e. with the throttle fully open"

(ii) Change "over" to "Over".

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Date:- 2nd February 1943.

Carburettor	Height ft.	Super-charger gear		Results given in	
				Table	Figure
Normal	10,000	M.S.	Air miles per gallon	I	1
			Fuel flow	I	2
	20,000	M.S.	Air miles per gallon	II	3
			Fuel flow	II	4
	20,000	F.S.	Air miles per gallon	III	5
			Fuel flow	III	6
Modified	10,000	M.S.	Fuel flow	IV	7
	20,000	M.S.	Fuel flow	V	8
	20,000	F.S.	Fuel flow	V	9
Modified	Climb	-	Fuel flow	VI	

The following is a summary of the results:-

4.1. With the normal carburettor.

(a) At 10,000 ft. using M.S. supercharger gear under standard atmospheric conditions, the maximum air miles per gallon was 7.00. This was obtained at 170 m.p.h. A.S.I. by reducing r.p.m. to 1700 (as explained in para.3(i) this is the lowest practicable r.p.m.) and then setting the throttle to give this speed. Under standard atmospheric conditions the corresponding manifold pressure will be about 27 in. of mercury.

(b) At 20,000 ft. using M.S. supercharger gear, under standard atmospheric conditions, the maximum air miles per gallon was 7.37. This was obtained at 175 m.p.h. A.S.I. by setting the throttle fully open and then reducing r.p.m. until the required speed was obtained. Under standard atmospheric conditions, the corresponding r.p.m. will be about 2050 and the manifold pressure about $24\frac{1}{2}$ in. of mercury.

(c) At 20,000 ft. using F.S. supercharger gear, under standard atmospheric conditions the maximum air miles per gallon is 7.30. This was obtained at 175 m.p.h. A.S.I. by setting the throttle fully open and then reducing r.p.m. until the required speed was obtained. Under standard atmospheric conditions the corresponding r.p.m. will be about 1950 and the manifold pressure 27 in. of mercury.

From (b) and (c) it will be seen that at 20,000 ft. greater fuel economy is obtained by flying in M.S. supercharger gear than in F.S. supercharger gear.

The minimum speed for comfortable continuous control was found to be 155 m.p.h. A.S.I.; no difficulty should, therefore, be experienced at either height in flying at the speed for maximum range.

4.2. With the modified carburettor. A comparison of the tables and figures shows that with the modified carburettor fitted, the fuel consumption at 10,000 ft. and 20,000 ft., using M.S. supercharger gear, is within experimental limits the same as with the normal carburettor. At 20,000 ft. using F.S. supercharger gear, the fuel consumption is slightly higher over most of the weak mixture range under the condition tested, i.e. with the throttle fully open over the rich mixture range the results are almost identical.

On the whole, it appears, therefore, that the modified carburettor satisfactorily replaced the two position mixture control arrangement.

5. Determination of range.

The range of the aircraft has been determined for both 10,000 ft. and 20,000 ft. from the results obtained with the normal carburettor fitted and given in Tables I-III and Figs.1-6. The range has been determined for both the normal fuel capacity (131 gallons) and also for the long range fighter load (174 gallons), which includes 43 gallons carried in the under-fuselage tank which can be released in flight.

With the latter loading, the take-off weight is 9,375 lb.; the mean weight on a range flight at 10,000 ft. is estimated to be 8,680 lb. and at 20,000 ft., 8650 lb.

/Tests

Tests made on Kittyhawk I A.L.229 (reported in 9th Part of Report No.A.& A.E.E./785) showed that a similar tank fitted on the Kittyhawk I had little effect on the air miles per gallon obtained at the speed for maximum range and that there was little advantage in releasing the tank after it had been drained. The range of the aircraft has, therefore, been determined on these assumptions, the air miles per gallon being assumed proportional to (weight)$^{-2/3}$.

At both weights an allowance has been made for the fuel used in running up the engine on the ground and for take-off. This was taken as equivalent to that used during 5 minutes at maximum take-off power conditions which is about 9 gallons. An allowance has been made for the fuel used on climb to height and the corresponding distance covered on climb has been included in the range of the aircraft. These figures were estimated from the fuel consumption measurements at 10,000 and 20,000 ft. at maximum climb conditions, combined with the consumption measurements taken on the climb with the modified carburettor. The distance covered on climb has been obtained from the climb performance of the aircraft.

5.1. Determination of range at 10,000 ft. using M.S. supercharger gear.

(a) Normal fighter load. Starting weight 8,980 lb.
Fuel - 131 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used in running up on ground and take-off	9	NIL	NIL
Climb to 10,000 ft. at maximum climb conditions	8	15	0.1
Cruising level flight at 10,000 ft. Mean air miles per gallon 7.00. Mean weight 8,450 lb., mean speed 170 m.p.h. A.S.I. r.p.m. set at 1700 and engine throttled back to give this speed. Mean manifold pressure under standard atmospheric conditions about 27 in. of mercury.	114	800	3.9
	131	815	4.0

(b) Long range fighter load. Starting weight 9,375 lb.
Fuel 174 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used in running up on ground and take-off	9	NIL	NIL
Climb to 10,000 ft. at maximum climb conditions	10	20	0.1
Cruising flight at 10,000 ft. Mean weight 8,680 lb. Estimated mean air miles per gallon 6.87. Mean speed 175 m.p.h. A.S.I. Engine r.p.m. set to 1700 and then throttle adjusted to give required speed. Manifold pressure under standard atmospheric conditions about 28 in. of Hg.	155	1065	5.2
Total	174	1085	5.3

/5.2(a)

5.2. At 20,000 ft. using M.S. supercharger gear.

(a) Normal fighter load starting weight 8,980 lb. Fuel 131 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used in running up on ground and take-off	9	NIL	NIL
Climb to 20,000 ft. at maximum climb conditions	19	35	0.2
Cruising flight at 20,000 ft. Mean weight 8,420 lb. Mean air miles per gallon 7.37. Mean speed 175 m.p.h. A.S.I. Throttle set fully open and r.p.m. reduced to give speed. Mean r.p.m. under standard atmospheric conditions about 2050 and manifold pressure about 24 in. of mercury.	103	760	3.1
Total	131	795	3.3

(b) Long range fighter load. Starting weight 9,375 lb. Fuel 174 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used in running up on ground and take-off	9	NIL	NIL
Climb to 20,000 ft. at maximum climb conditions	23	40	0.2
Cruising flight at 20,000 ft. Mean weight 8,650 lb. Estimated mean air miles per gallon 7.24. Mean speed 180 m.p.h. A.S.I. Throttle set fully open and r.p.m. reduced to give speed. Mean r.p.m. under standard atmospheric conditions about 2075 and manifold pressure about 24½ in. of mercury.	142	1030	4.2
Total	174	1070	4.4

5.3. At 20,000 ft. using F.S. supercharger gear.

(a) Normal fighter load. Starting weight 8,980 lb. Fuel 131 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used in running up on ground and take-off	9	NIL	NIL
Climb to 20,000 ft. at maximum climb conditions	19	35	0.2
Cruising flight at 20,000 ft. Mean weight 8,420 lb. Mean air miles per gallon 7.30. Mean speed 175 m.p.h. A.S.I. Throttle set fully open and r.p.m. reduced to give speed. Mean r.p.m. under standard atmospheric conditions about 1950 and manifold pressure about 27 in. of mercury.	103	750	3.05
Total	131	785	3.25

/5.3(b)

(b) Long range fighter load. Starting weight 9,375 lb. Fuel 174 gallons.

	Fuel used gallons	Distance covered air miles	Duration hours
Fuel used running up on ground and take-off	9	NIL	NIL
Climb to 20,000 ft. at maximum climb conditions	23	40	0.2
Cruising flight at 20,000 ft. Mean weight 8,650 lb. Estimated mean air miles per gallon 7.17. Mean speed 180 m.p.h. A.S.I. Throttle set fully open and r.p.m. reduced to give speed. Mean r.p.m. under standard atmospheric conditions about 2000. and manifold pressure about $27\frac{1}{2}$ in. of mercury.	142	1020	4.1
Total	174	1060	4.3

In all cases the ranges given are the maximum possible still air ranges. No allowance has been made for any period of combat using all-out level engine conditions. For each five minutes of combat under such conditions the range will be reduced by about 60 miles, assuming that no headway is made in the required direction during this period.

6. Conclusions.

The maximum still air ranges of the aircraft with the normal carburettor are:-

Height ft.	Supercharger gear	Range - air miles	
		Normal fuel load 131 gallons	With overload tank fitted and filled 174 gallons
10,000	M.S.	815	1085
20,000	M.S.	795	1070
20,000	F.S.	785	1060

With the modified carburettor fitted and with the mixture control locked, the fuel consumption using M.S. supercharger gear at both 10,000 ft. and 20,000 ft. was within experimental errors the same as with the unmodified carburettor. At 20,000 ft. using F.S. supercharger gear, the fuel consumption is slightly higher than with the unmodified carburettor.

Thus the modified carburettor with locked mixture control appears satisfactorily to replace the two position mixture control arrangement.

The results in this report are in good general agreement with those given in the 2nd Part of Report No.A.& A.E.E./689,h, which dealt with fuel consumption tests on a Hurricane X, B.W.803, fitted with a Merlin 28 engine.

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Table I

Fuel consumption tests in level flight at 10,000 ft. in M.S. supercharger gear

Radiator duct gills in neutral position
Normal carburettor

Corrected to mean weight of 8,450 lb.

A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Manifold pressure in. of Hg.	Mixture control	Fuel consumption lb/hr. (Sp.gr.0.72)	Fuel consumption galls/hr.	Air miles per gallon
279½	332	3000	47.7	Rich	765	106.2	3.12
278	331	2850	47.6	Rich	717	99.6	3.32
268½	319½	2650	44.	Rich	580	80.5	3.97
247	294	2650	38	Weak	402	55.8	5.27
240½	286½		36		381	52.9	5.42
233½	278		34		359	49.9	5.57
226½	270		32		340	47.2	5.71
219	260½		30		319	44.3	5.88
210½	250		28		300	41.7	6.00
200½	238½		26		280	38.9	6.13
190	225½		24		259	36.0	6.27
177½	211½		22		239	33.2	6.37
162½	193		20		218	30.3	6.36
143	169½		18		199	27.6	6.15
245	291½	2500	38		384	53.3	5.47
242½	289	2400	38		372	51.7	5.58
236	281½		36		353	49.1	5.73
229½	273½		34		335	46.6	5.87
222½	265		32		317	44.0	6.02
214½	255		30		297	41.3	6.17
205½	244		28		281	39.0	6.26
196	232½		26		263	36.5	6.37
184½	220		24		243	33.8	6.50
171½	203½		22		224	31.1	6.55
240	286	2300	38		359	49.8	5.74
236½	281½	2200	37.7		344	47.8	5.89
232	276		36		331	46.0	6.00
225	268		34		315	43.7	6.14
218	259½		32		297	41.3	6.28
210	249½		30		281	39.0	6.40
201½	239½		28		264	36.7	6.52
191½	227½		26		246	34.2	6.65
180	214		24		228	31.7	6.75
165½	196½		22		210	29.1	6.75
225½	268½	2100	35.8		358	43.7	6.15
215½	256	2000	34.2		291	40.4	6.34
208	247½		32		276	38.3	6.46
200½	238½		30		261	36.3	6.57
192½	228½		28		245	34.0	6.72
183	217½		26		229	31.8	6.84
172	204		24		212	29.4	6.93
156½	185½		22		194	27.0	6.88
136	161		20		177	24.6	6.53
206½	245½	1900	33		271	37.7	6.51
196	232½	1800	31.4		248	34.5	6.73
190	225½		30		239	33.2	6.79
181½	215½		28		225	31.2	6.91
171½	203½		26		210	29.2	6.97
158½	188½		24		195	27.1	6.94
140	166		22		180	25.0	6.64
185½	220½	1700	30		229	31.8	6.93
176	209½		28		216	30.0	6.98
164½	195		26		202	28.0	6.97
149½	177½		24		187	26.0	6.83

Table II

Fuel consumption tests in level flight at 20,000 ft.
in M.S. supercharger gear
Radiator duct gills in neutral position
Normal carburettor
Corrected to mean weight of 8,420 lb.

A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Manifold pressure in. of Hg	Mixture control	Fuel consumption lb/hr. (Sp.gr. 0.72)	Fuel consumption Galls/ hour	Air miles per gallon
253½	351½	3000	38.9	Rich	605	84.0	4.18
246	341	2850	36.0	Rich	498	69.2	4.93
234	325	2650	33.0	Rich	432	60.0	5.41
230½	320½	2650	32.9	Weak	378	52.5	6.10
218½	304	2500	30.4	↓	338	46.9	6.48
210	292½	2400	28.8	↓	313	43.5	6.72
201½	280½	2300	27.4	↓	289	40.1	6.99
191½	266½	2200	26.0	↓	266	37.0	7.20
180½	252	2100	24.8	↓	246	34.2	7.36
168½	234½	2000	23.6	↓	230	31.9	7.35
154	214½	1900	22.6	↓	216	30.0	7.14
134½	187	1800	21.6	↓	207	28.7	6.51

Table III

Fuel consumption tests in level flight at 20,000 ft.
in M.S. supercharger gear
Radiator duct gills in neutral position
Normal carburettor

Corrected to mean weight of 8,420 lb.

A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Manifold pressure in. of Hg	Mixture control	Fuel consumption lb/hr. (Sp.gr. 0.72)	Fuel consumption Galls/ hour	Air miles per gallon
260	360	3000	47.0	Rich	826	114.8	3.14
257½	357	2850	46.5	Rich	712	98.9	3.61
248½	344½	2650	41.4	Rich	544	75.6	4.56
240	333	2650	37.9	Weak	411	57.1	5.83
237½	330	2500	37.9	↓	384	53.4	6.17
227½	316½	2400	35.6	↓	359	49.8	6.35
218	303½	2300	33.3	↓	329	45.7	6.64
207	288	2200	31.2	↓	300	41.7	6.91
195	271½	2100	29.3	↓	274	38.1	7.13
182	254	2000	27.6	↓	251	34.9	7.28
166½	232	1900	26.0	↓	230	32.0	7.26
148	205½	1800	24.7	↓	214	29.7	6.92

Table IV

Fuel consumption tests at 10,000 ft.
M.S. supercharger gear

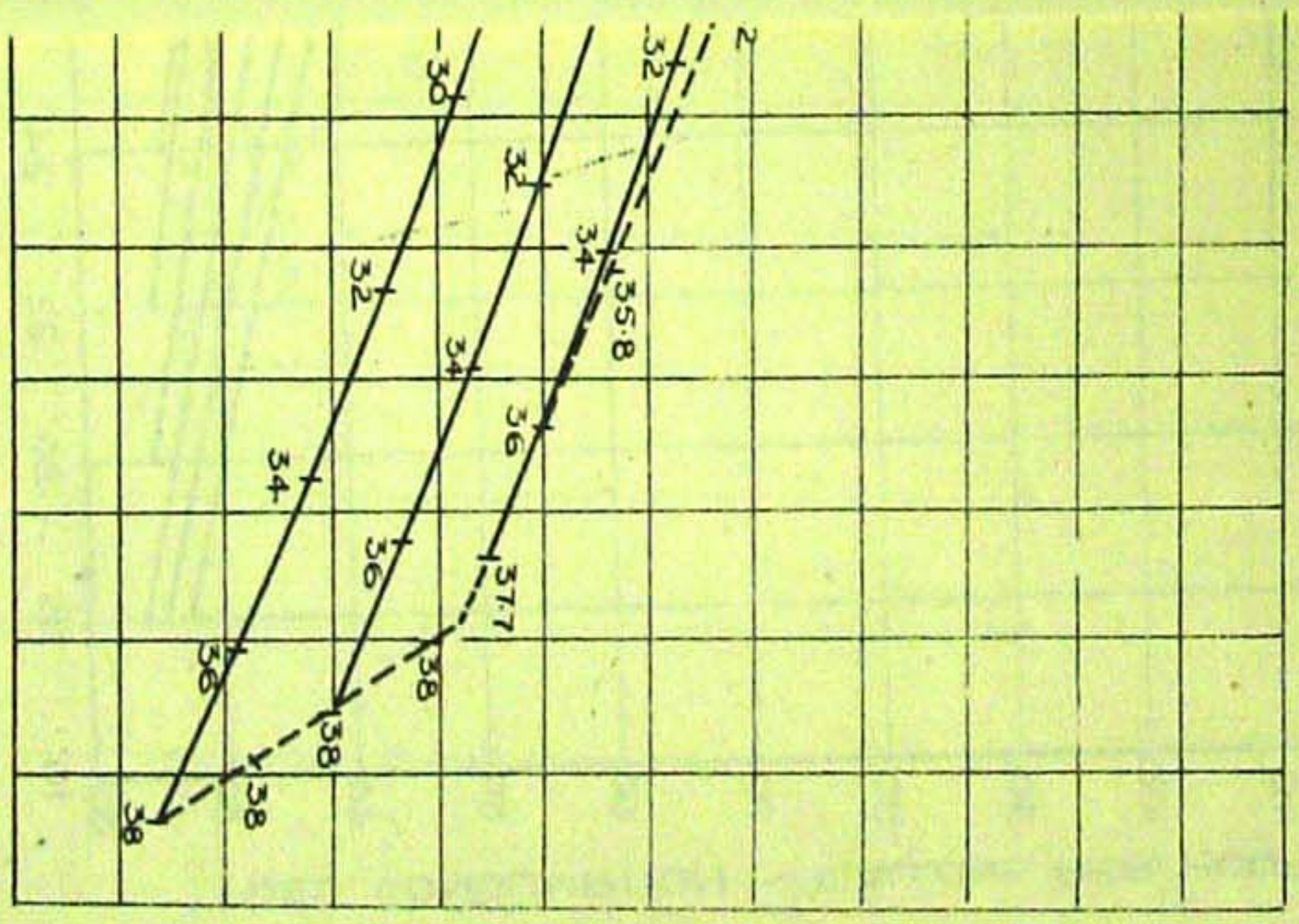
Locked mixture control. Modified carburettor.

RPM	Manifold pressure in. of Hg	Fuel consⁿ Galls/ hr.	Fuel consⁿ lb/hr. (Sp.gr. 0.72)	RPM	Manifold pressure in. of Hg	Fuel consⁿ Galls/ hr.	Fuel consⁿ lb/hr. (Sp.gr. 0.72)
3000	48	108.2	780	2200	32	41.7	300
↓	46	100.6	725	↓	30	39.3	283
	44	92.7	668		28	37.0	266
2850	48	101.0	727		26	34.6	249
↓	46	95.2	686		24	32.0	230
	44	88.8	639		22	29.6	213
2650	44	78.5	565		20	26.9	194
↓	42	71.7	516	↓	18	24.1	174
	38	57.1	411	2100	35.6	43.4	313
	36	53.9	388	↓	34	41.7	300
	34	50.9	366		32	39.6	285
	32	47.9	345		30	37.2	268
	30	44.8	322		28	35.0	252
	28	41.7	300		26	32.6	235
	26	38.8	279		24	30.2	218
	24	35.7	257		22	27.8	200
	22	32.6	235	1900	32.6	37.3	269
	20	29.6	213	↓	32	36.7	264
	18	26.5	191		30	34.7	250
2500	38	54.2	390		28	32.6	235
2400	38	52.1	375		26	30.4	219
↓	36	49.7	358		24	28.3	204
	34	47.0	338		22	26.0	187
	32	44.3	319	1800	31.3	34.7	250
	30	41.7	300	↓	30	33.3	240
	28	39.2	282		28	31.3	225
	26	36.4	262		26	29.3	211
	24	33.7	243		24	27.2	196
	22	31.0	223		22	25.1	181
	20	28.1	202	1700	29.9	31.7	228
	18	25.0	180	↓	28	29.9	215
2300	38	50.6	364		26	28.0	202
2200	38	48.8	351		24	26.0	187
↓	36	46.5	335		22	24.0	173
	34	44.1	317				

KITTYHAWK II FL-220
(MERLIN 1650-1)

CARBURETTOR.

RE IS INDICATED IN INS: OF MERCURY.
D TO STANDARD ATMOSPHERIC CONDITIONS.
AINED AT CONSTANT R.P.M. BY REDUCING MANIFOLD PRESSURE
INED AT FULL THROTTLE BY REDUCING R.P.M.



8 PART OF REPORT N° A&AEE/783.

Table V

Fuel consumption tests at 20,000 ft.

Locked mixture control. Modified carburettor.

M.S. supercharger gear				F.S. supercharger gear			
RPM	Manifold pressure in. of Hg	Fuel consⁿ Galls/hr.	Fuel consⁿ lb/hr.	RPM	Manifold pressure in. of Hg	Fuel consⁿ Galls/hr.	Fuel consⁿ lb/hr.
3000	38.1	79.6	573	3000	47.3	114.5	825
2850	36.0	67.4	485	2850	46.9	105	755
2650	32.9	52.6	379	2650	42.0	95.2	686
2500	30.4	46.6	336	2650	37.9	61.8	445
2400	28.8	43.4	313	2500	37.9	58.8	423
2300	27.4	40.0	288	2400	35.6	52.6	379
2200	26.0	36.7	264	2300	33.3	47.7	343
2100	24.7	34.0	245	2200	31.2	43.5	313
2000	23.6	31.4	226	2100	29.3	39.7	286
1900	22.6	28.8	207	2000	27.6	36.2	261
				1900	26.0	32.8	236
				1800	24.7	30.4	219

Table VI

Fuel consumption on climb with modified carburettor

Height ft.	Supercharger gear	R.P.M.	Boost in. of Hg	Fuel consumption Galls/hr	Fuel consumption lb/hr
2,000	M.S.	2850	48	100	720
4,000	↓	↓	48	100	720
6,000	↓	↓	48	100	720
8,000	↓	↓	48	97½	702
10,000	↓	↓	47	97	698
12,000	↓	↓	44	84½	608
14,000	F.S.	↓	48	98½	709
16,000	↓	↓	48	98½	709
18,000	↓	↓	45½	93½	673
20,000	↓	↓	42½	82	590
22,000	↓	↓	40	72½	522
24,000	↓	2950	37	69	497
26,000	↓	↓	35½	69½	500
28,000	↓	↓	33	64	461
30,000	↓	↓	30	54	389
31,000	↓	↓	28¼	52	374
32,000	↓	↓	27	51½	371
33,000	↓	↓	25½	52	374

FIG 1

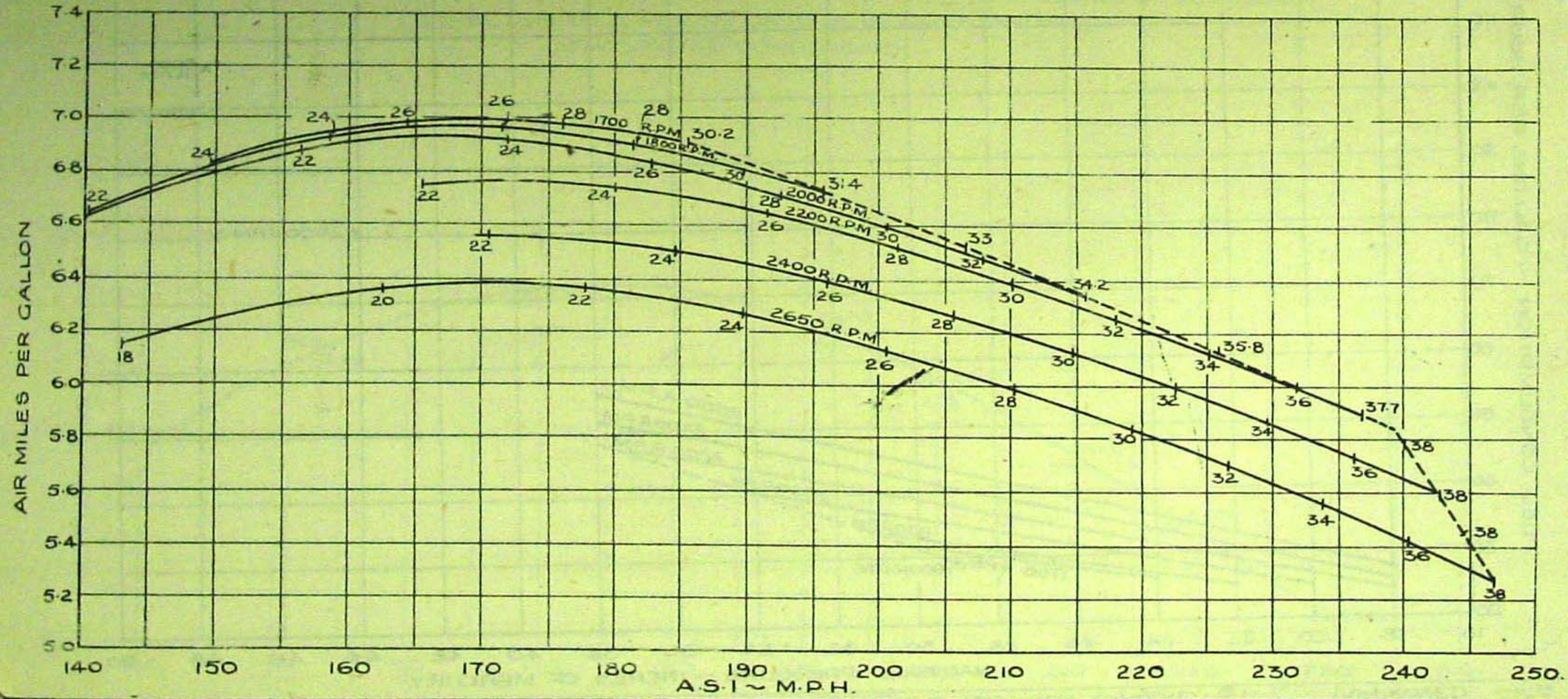
KITTYHAWK II FL-220

(MERLIN V1650-1)

AIR MILES PER GALLON NORMAL CARBURETTOR.

CORRECTED TO A WEIGHT OF 8450lb.
HEIGHT ~10,000 FT.
M.S. SUPERCHARGER GEAR.
WEAK MIXTURE USED THROUGHOUT
RADIATOR DUCT GILLS IN NEUTRAL POSITION

MANIFOLD PRESSURE IS INDICATED IN INS: OF MERCURY.
RESULTS CORRECTED TO STANDARD ATMOSPHERIC CONDITIONS.
——— LINES OBTAINED AT CONSTANT R.P.M. BY REDUCING MANIFOLD PRESSURE
- - - - - - - - LINE OBTAINED AT FULL THROTTLE BY REDUCING R.P.M.



8 PART OF REPORT No A&AEE/783a.	CURVE No. 4652	TRACED.	DATE OF TEST ~ AUG-OCT/42	CHECKED.	APPROVED.

KITTYHAWK II. FL-220.

(MERLIN V1650-1)

FUEL CONSUMPTION AT 10,000 FT IN M.S SUPERCHARGER GEAR.

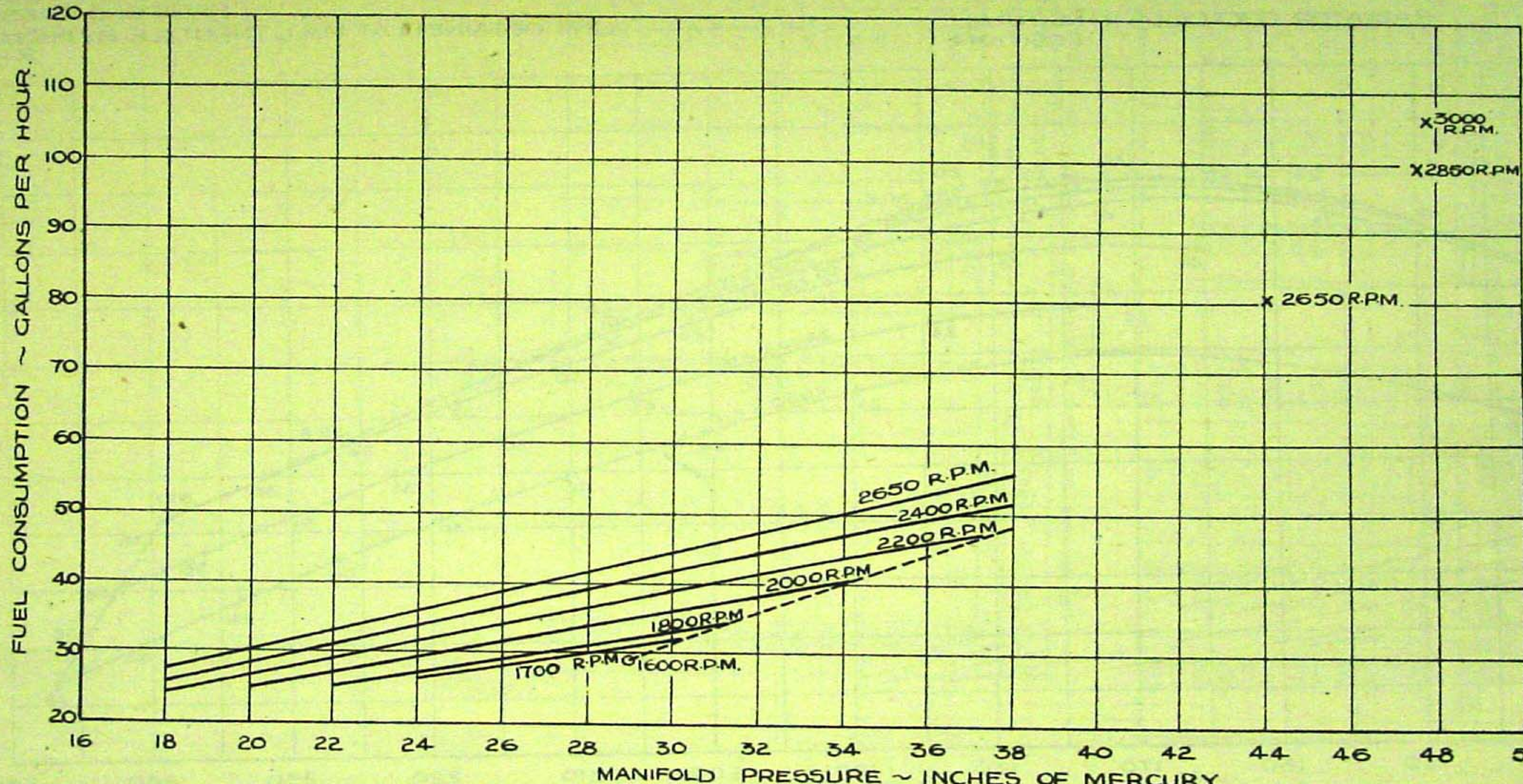
NORMAL CARBURETTOR.

FIG 2

——— LINES OBTAINED AT CONSTANT R.P.M BY REDUCING MANIFOLD PRESSURE } WEAK MIXTURE
- - - - - - LINE " " FULL THROTTLE BY REDUCING R.P.M. } WEAK MIXTURE

X RICH MIXTURE

CORRECTED TO STANDARD ATMOSPHERIC CONDITIONS.



...OF REPORT No A&AEE/783a	CURVE No. 4653.	TRACED. [illegible]	DATE OF TEST ~ AUG-OCT/42	CKD. [illegible]	APPROVED. [illegible]	20

FIG 3

KITTYHAWK II FL-220.

(MERLIN V 1650 -1)

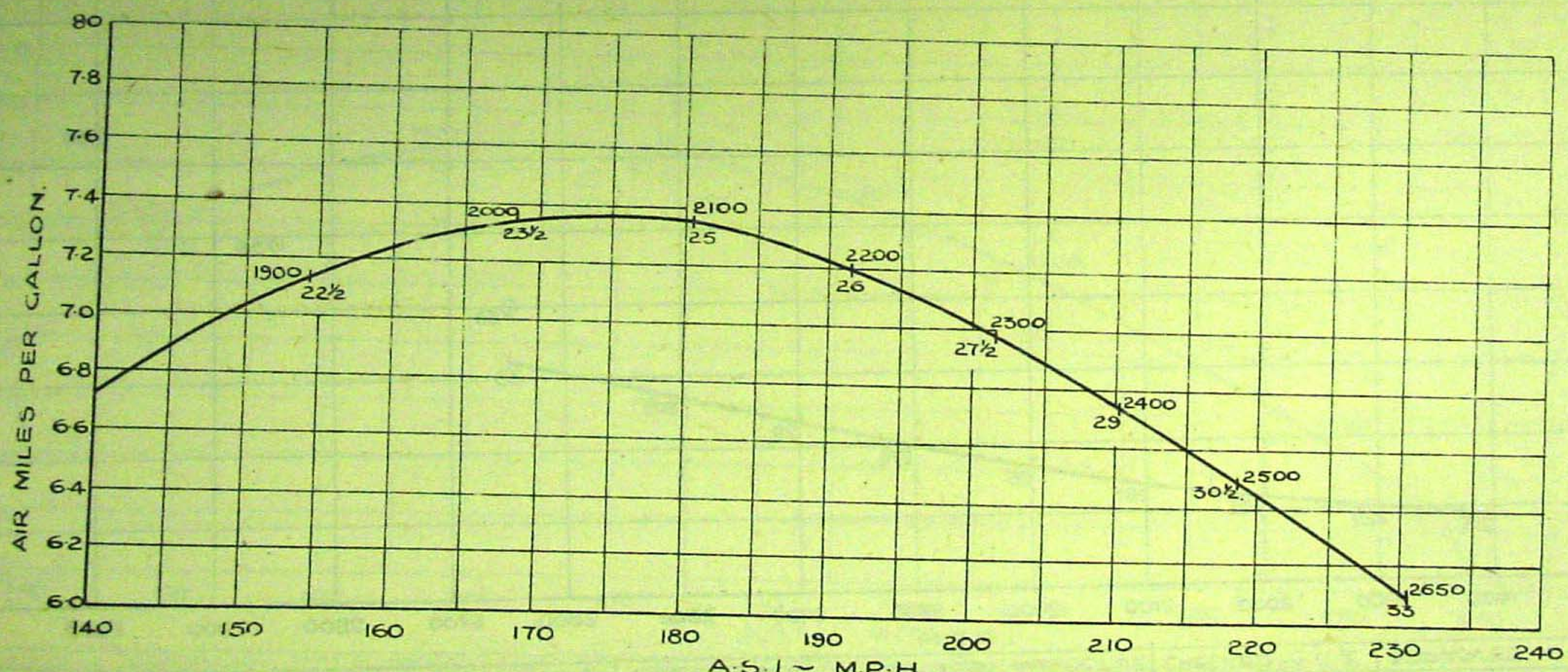
AIR MILES PER GALLON.

NORMAL CARBURETTOR.

HEIGHT ~ 20,000 F.T.
M.S. SUPERCHARGER GEAR.
WEAK MIXTURE USED THROUGHOUT
RADIATOR DUCT GILLS IN NEUTRAL POSITION

——— LINE OBTAINED AT FULL THROTTLE BY REDUCING R.P.M.
READINGS OF R.P.M. & MANIFOLD PRESSURE ARE INDICATED ON CURVE. MANIFOLD PRESSURE IS IN INCHES OF MERCURY.

CORRECTED TO A WEIGHT OF 8420 lb AND STANDARD ATMOSPHERIC CONDITIONS.



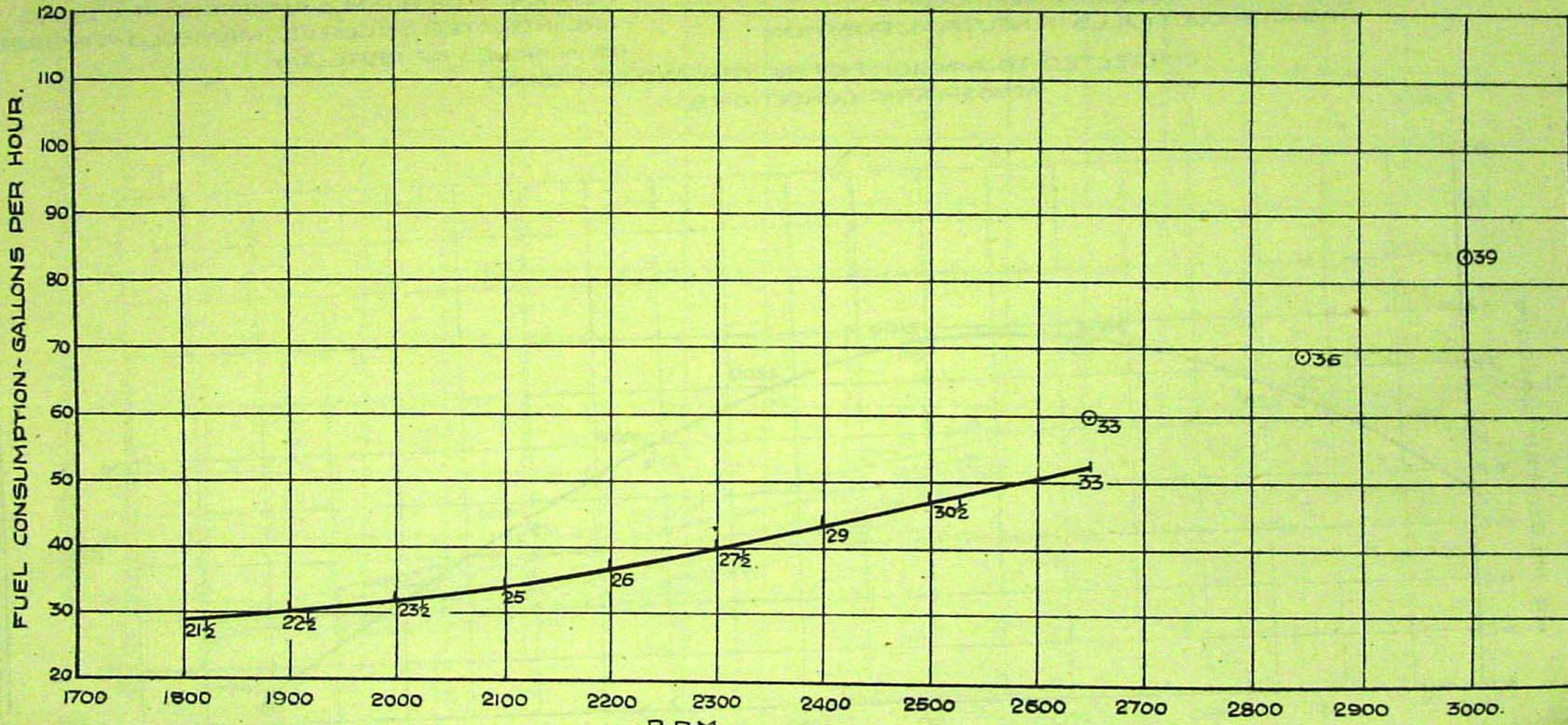
8" P.O.R. Nº A&AEE/783a | CURVE No. 4654 | TCD. | D.O.T.~AUG-OCT/42 | CKD. | APP. | 20

FIG. 4

KITTYHAWK. II F.L. 220. (MERLIN V. 1650-1)

FUEL CONSUMPTION AT 20,000 FT. IN M.S. SUPERCHARGER GEAR

NORMAL CARURETTOR
——— LINE OBTAINED AT FULL THROTTLE BY REDUCING R.P.M. ~ WEAK. MIXTURE
MANIFOLD PRESSURE INDICATED IN INCHES OF MERCURY
CORRECTED TO STANDARD ATMOSPERIC CONDITIONS
⊙ RICH MIXTURE



PART OF REPORT Nº. A&A.EE/783a	CURVE Nº 4655	TRACED. E.A.A.	DATE OF TEST. AUG.OCT.42	CHECKED	APPROVED.	D.O.

FIG. 5

KITTYHAWK II FL 220

(MERLIN V-1650-1)

AIR MILES PER GALLON.

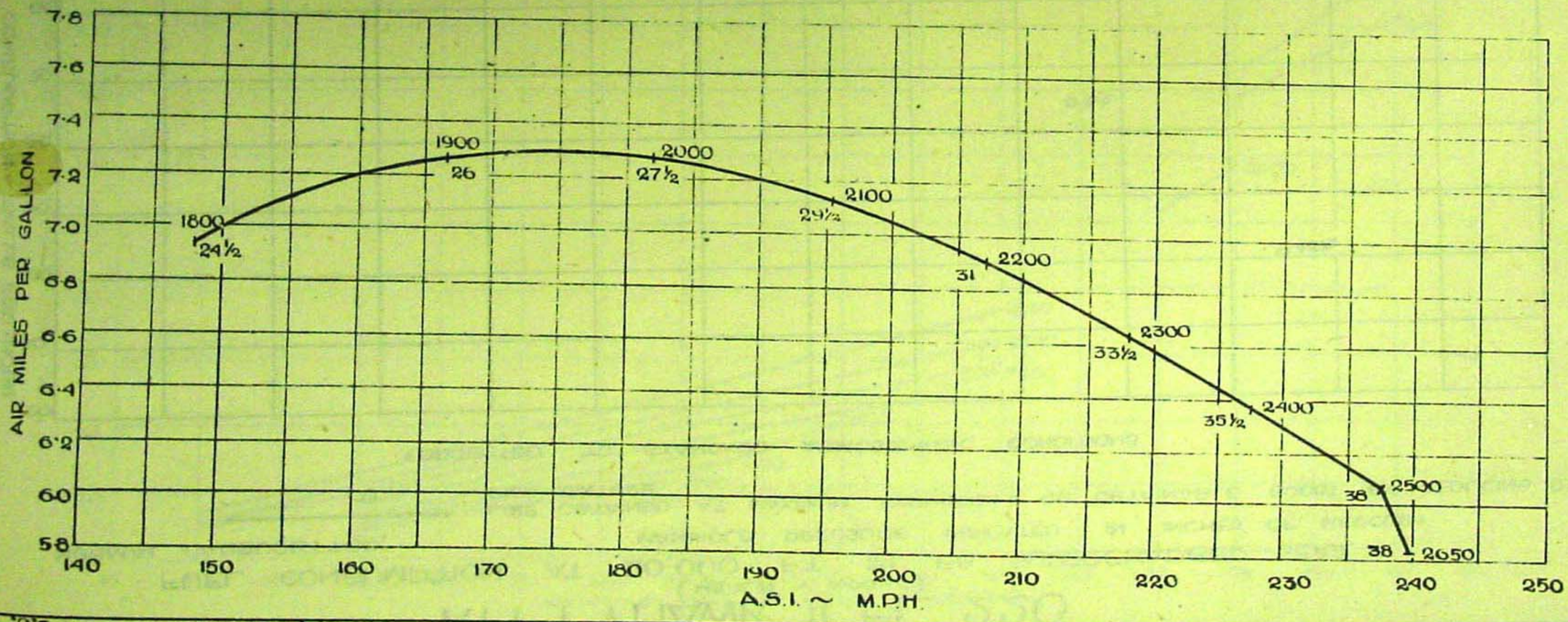
F.S. SUPERCHARGER GEAR. HEIGHT ~ 20,000 FT. WEAK MIXTURE USED THROUGHOUT.

RADIATOR DUCT GILLS IN NEUTRAL POSITION.

CORRECTED TO A WEIGHT OF 8420 LB AND STANDARD ATMOSPHERIC CONDITIONS.

———— LINE OBTAINED AT MAXIMUM PERMISSIBLE, OR OBTAINABLE BOOST BY REDUCING R.P.M.

READINGS OF RPM AND MANIFOLD PRESSURE ARE INDICATED ON CURVE. MANIFOLD PRESSURE IS IN INCHES OF MERCURY.



G.T. PART OF REPORT No. AEAEE/783	CURVE No. 4656	TRACED I.M.P.	DATE OF TEST AUG ~ OCT '42	CHECKED	APPROVED

OF REPORT Nº AEAE.E	783	CURVE Nº 4657	TRACED IM.P	DATE OF TEST AUG ~ OCT. '42	CHECKED A.E.R.	APPROVED A.G.D.O

KITTYHAWK II FL 220

(MERLIN V 1650 ~ 1)

FUEL CONSUMPTION AT 20,000 FT. IN F.S. SUPERCHARGER GEAR.

NORMAL CARBURETTOR,

MANIFOLD PRESSURE INDICATED IN INCHES OF MERCURY

⊙ LINE OBTAINED AT MAXIMUM PERMISSIBLE OR OBTAINABLE BOOST BY REDUCING R.P.M. RICH MIXTURE

CORRECTED TO STANDARD ATMOSPHERIC CONDITIONS.

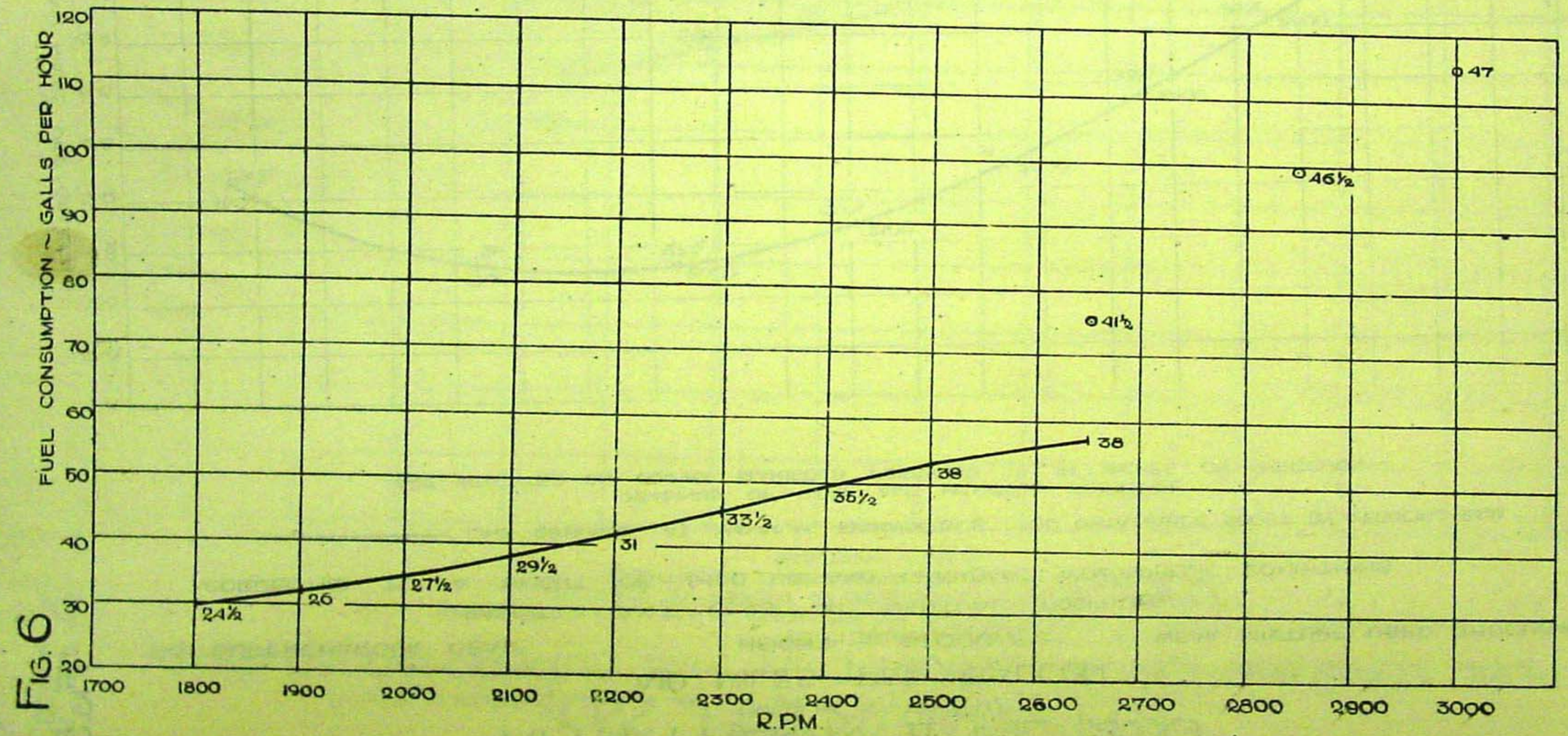


FIG. 6

FIG 7

KITTYHAWK FL~220

(MERLIN V 1650-1)

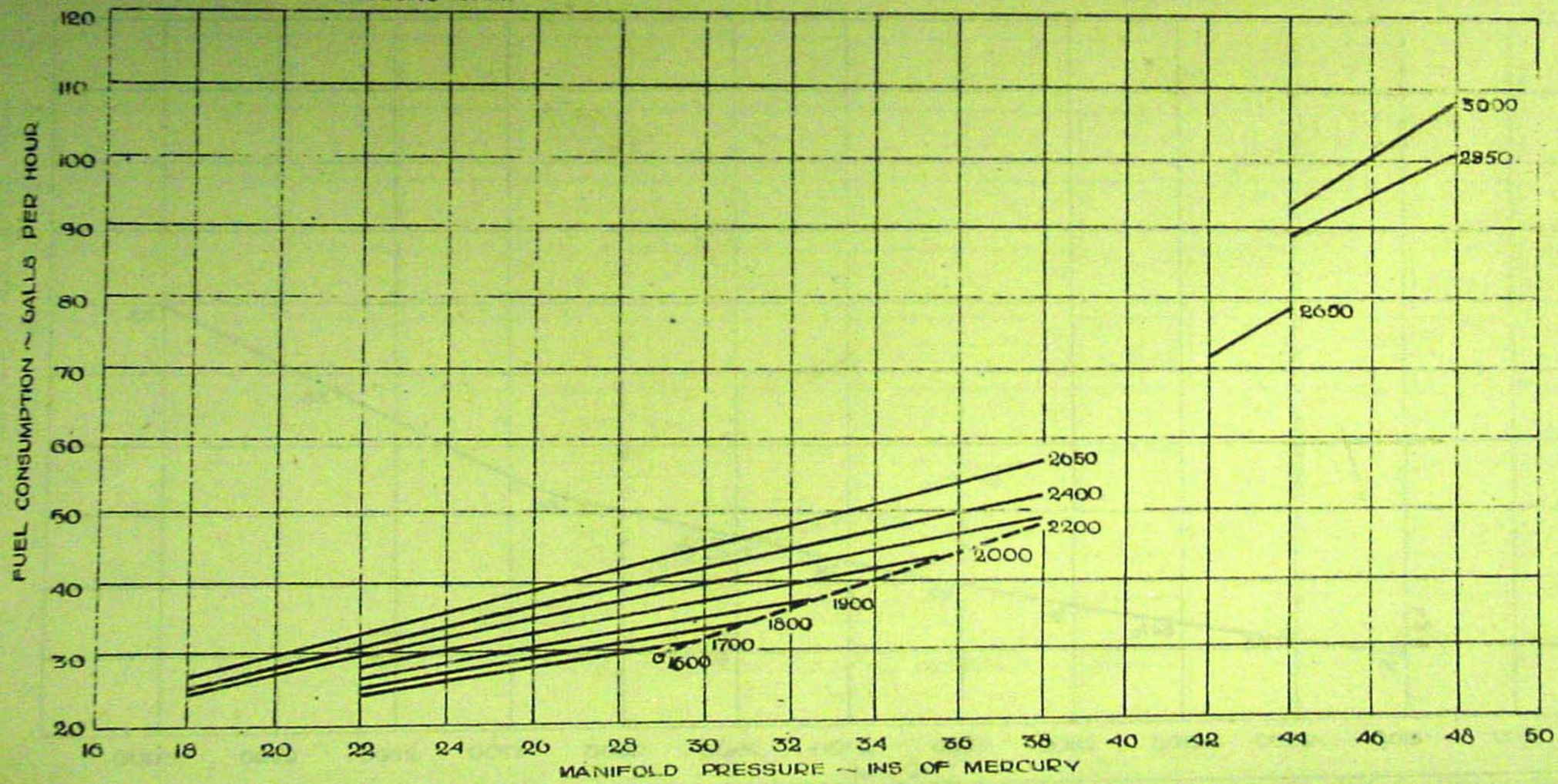
FUEL CONSUMPTION AT 10,000 FT. IN M.S. SUPERCHARGER GEAR.

LOCKED MIXTURE CONTROL, ~ MODIFIED CARBURETTOR

——— LINES OBTAINED AT CONSTANT R.P.M. BY REDUCING MANIFOLD PRESSURE

- - - - - - - - LINE OBTAINED AT FULL THROTTLE BY REDUCING R.P.M.

CORRECTED TO STANDARD ATMOSPHERIC CONDITIONS



~ PART OF REPORT No AEAE/783	CURVE No 4656	TRACED IMP	DATE OF TEST AUG-OCT '42	CHECKED	APPROVED

KITTYHAWK II FL~220

(MERLIN V~1650~1)

FUEL CONSUMPTION AT 20,000 FT. IN M.S. SUPERCHARGER GEAR

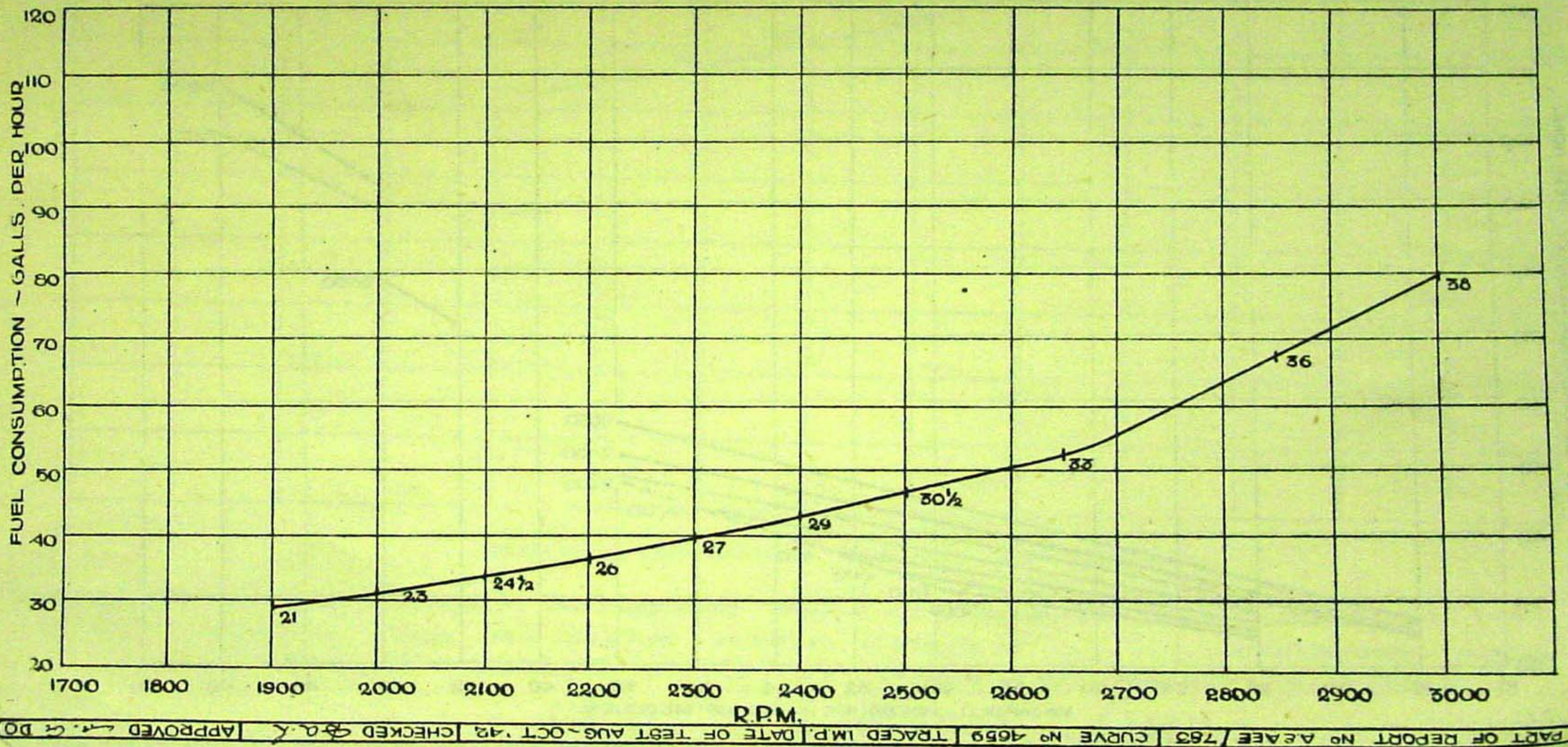
LOCKED MIXTURE CONTROL ~ MODIFIED CARBURETTOR

——— LINE OBTAINED AT FULL THROTTLE BY REDUCING R.P.M.

MANIFOLD PRESSURE INDICATED IN INCHES OF MERCURY

CORRECTED TO STANDARD ATMOSPHERIC CONDITIONS.

Fig. 8



PART OF REPORT No A.E.A.E.E/783	CURVE No 4659	TRACED I.M.P.	DATE OF TEST AUG~OCT '42	CHECKED	APPROVED