

SD-235-4-3A

DETAIL SPECIFICATIONFORMODEL F4F-4 AIRPLANE

(CLASS VF)

(SINGLE ENGINE)

(SINGLE-SEAT. LANDPLANE)

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INTRODUCTION

1a. This specification covers the requirements for the design of a single-engine single-seat landplane fighter for use aboard aircraft carrier, to be known as Model F4F-4 Airplane, which airplane shall be similar to Model F4F-4 Airplane manufactured under Contract 75736.

1b. As a landplane it shall take off from the deck of an aircraft carrier with or without the aid of a catapult and land on the carrier deck in an arresting gear or on an ordinary landing field.

1c. The airplane shall not be designed for float type alighting gear.

1d. The airplane shall be designed for catapulting as a landplane.

2a. General Specification for the Design and Construction of Airplanes for the United States Navy, No. SD-24-D, dated 1 September 1935, and changes to date of invitation to bid, form a part of this specification and shall be followed except as modified herein. The numbers of the paragraphs of this specification correspond to the numbers of the paragraphs of the General Specification.

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\*\* 12a. This specification includes the following contract changes, issued to date of 5 February 1942, for the Model F4F-3 and F4F-4 airplanes on Contract 75736: A, B, C, D, F(b)(c)(d)(e)(g)(h), H(a)(d), I, L, N, N-1, N-2, N-3, N-4, N-5(a), N-6, N-8, N-9, N-10, N-11, N-12, N-13, and N-15; on Contract 99340: A, B, D, F, H, I and Pending Changes noted in Appendix XXXIV.

12b. Trial Board and other recommendations resulting from trials of Model F4F-4 Airplane on Contract 75736, that are applicable to this airplane, shall be considered a part of this specification. The guaranteed weight empty shall be adjusted by any increase or decrease in weight due to Trial Board changes.

17a. No deviation from this specification shall be permitted unless approved by the Bureau of Aeronautics.

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PART ICHARACTERISTICS

101a. The following characteristics are considered reasonable for this airplane and shall be equaled or, if possible, bettered.

10/21/42 \*\* 102a. The gross weights are estimated to be as follows: (with armor plate and fuel and oil protection)

Fighter	(110 gals.)	7426#
Bomber	(2-100# class bombs)(110 gals.)	7424
Fighter	(144 gals. maximum)	7972

10/21/42 \*\* 104a. The normal useful load as a fighter shall be as follows:

USEFUL LOAD		1647.1#
CREW		200
GASOLINE (110 gals.)		660
OIL (9 gals.)		68
ARMAMENT		554.2
Fixed gun installation (4-.50 cal. guns)		
	(800 rds.)	528.7
Provision for bombs		0
Pyrotechnics		11.8
Gun camera		13.7
EQUIPMENT		164.9
Communicating		113.2
Navigating		4.5
Miscellaneous		47.2

NOTE: For detail distribution of weights see Appendix II-A.

10/21/42 \*\* 104b. The useful load as a bomber with 2-100# class bombs, 2-.50 cal. guns (400 rounds) and 110 gallons of fuel shall be 1644.6 pounds.

10/21/42 \*\* 104c. The useful load as a fighter with 144 gallons of fuel (maximum), 11 gallons oil (maximum) and six .50 cal. guns (1440 rounds) shall be 2193.6 pounds.

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\*\* 105a. The weight empty as a carrier landplane in the combat condition is estimated to be as follows:

WEIGHT EMPTY

5778.9#

<u>Wing Group</u>		1181
Wings	1030	
Ailerons	38	
Flaps	43	
Fuselage carry-through structure	70	
<u>Tail Group</u>		148
Stabilizer	65	
Elevator	47	
Fin	13	
Rudder	23	
<u>Body Group</u>		868
Fuselage, less engine section	517	
Lighting gear - land type	351	
Main lighting gear	286	
Retracting mechanism	33	
Auxiliary lighting gear	32	
<u>Engine Section Group</u>		335
<u>Power Plant</u>		2493
Engine (as installed)	1568	
Engine accessories	242	
Power plant controls	25	
Propeller	315.5	
Starting system	43	
Lubricating system	35	
Tanks (11 gals.)	10	
Piping, etc.	25	
Fuel system	264.5	
Tanks (144 gals.) (with full tank protection)	200	
Piping, fittings, electric pump, etc.	64.5	
<u>Fixed Equipment</u>		753.9
Instruments	61	
Surface controls	161.5	
Furnishings	195.9	
Electrical equipment	143	
Hoisting gear (provision only)	1	
Arresting hook installation	29	
Armor plate	162.5	

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\*\* 106a. Unit weights:

Weight of wing group per sq. ft. net wing area (222 sq. ft.)	5.32
Weight of tail group per sq. ft. net tail area ( 70 sq. ft.)	2.11
Weight of lubricating system per gallon capacity (11 gals. oil)	3.18
Weight of fuel system per gallon capacity (144 gals.) (maximum)	1.84

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107a. The horsepower ratings for the Pratt and Whitney R-1830-86 engine shall be as specified in paragraph 503a.

108a. Areas: (in accordance with Appendix XXII)

Total wing area including 37.6 sq. ft. of fuselage and stub and ailerons	260
Control surface areas:	
Ailerons (2 at 6.63)	13.26
Total stabilizer area (including 1.8 sq.ft. fuselage and 4.96 sq.ft. elevator balance)	30.43
Total elevator area aft of hinge (including 2.32 sq.ft. of tabs)	18.62
Total fin area (including 2.36 sq.ft. rudder balance)	13.2
Total rudder area aft of hinge (including 0.56 sq.ft. of tab)	9.38
Total vertical tail area	22.58
Total horizontal tail area	49.05
Total flap area (2 at 14.85 sq.ft.)	29.70

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\*\* 111a. The unit loadings shall be as follows:

	Wing Load Lbs./sq.ft.(260)	Power Load Lbs./BHP(1000)
Fighter (110 gals.)	28.56	7.43
Bomber (110 gals. & 2-100# class bombs)	28.55	7.42
Fighter (144 gals. maximum)	30.66	7.97

112a. The airfoil section for the wings shall be NACA 23015 at fuselage tapered to NACA 23009 at tips.



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\*\* 113a. The performance is estimated to be as follows: (to be submitted by the contractor and to be consistent with guarantees)

	(Normal) FIGHTER	BOMBER	(Overload) FIGHTER
Fuel (gals.)	110	110	144
Gross weight (lbs.)	7426	7424	7972
High speed at sea level (MPH)	275.0	265.1	274.4
High speed at 2500 ft. (MPH)*	281.8	271.8	281.1
High speed at 4600 ft. (MPH)*	283.1	273.0	282.7
High speed at 12,000 ft. (MPH)*	303.2	293.2	302.4
High speed at 14,000 ft. (MPH)*	304.5	294.3	303.8
High speed at max. engine rated alt. 19,000 ft. (MPH)	317.0	307.1	315.0
High speed at airplane critical alt. 19,400 ft. (MPH)	318.0	308.2	316.1
Stalling speed at sea level with full load and without power (MPH)	78.7	78.5	81.3
Stalling speed at sea level with full load less fuel (MPH) without power	75.0	74.9	76.8
Stalling speed at sea level less 1/2 fuel without power	76.7	76.6	79.1
Initial rate of climb at sea level (ft./min.)	1920	1810	1690
Time of climb to 10,000 ft. (min.)	5.7	6.0	6.5
Time of climb to 20,000 ft. (min.)	12.7	13.1	14.7
Service ceiling (ft.)	34800	34600	33600
Endurance at high speed (hr.)	.9	.9	1.2
Endurance at 90% high speed (hr.)	1.4	1.4	1.8
Endurance at 75% high speed (hr.) (at	2.7	2.7	3.5
Endurance at 60% high speed (hr.) (19,000	3.9	3.8	5.0
Maximum endurance (hr.) (feet	4.2	4.1	5.3
Maximum range (mi.) (alt.	765	705	925
Average speed for maximum range (MPH)	190.5	186.0	192.0
Average speed for maximum endurance (MPH)	162.5	164.0	163.7
Take-off distance in calm (ft.)	605	605	710
Take-off distance in 15-knot wind (ft.)	378	378	450
Take-off distance in 25-knot wind (ft.)	256	256	310

\*The high speed values necessary for a plot of high speed vs. altitude up to the maximum engine rated altitude shall be given. If less than four high speed values in addition to the speed at sea level and at maximum engine rated altitude are required for such a plot, high speed values at altitudes above the airplane critical altitude shall be given. The airplane critical altitude is defined as the altitude at which the engine in the airplane delivers rated horsepower at full throttle.

**NOTE:** The above performance is based on the results of flight tests conducted on the first F4F-4 Airplane with the assumption that the engine in this first airplane developed the power rating of paragraph 503a. The above performance is with all external armament and radio equipment in place for each condition of loading.

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\*\* 116a. The principal dimensions of the airplane are as follows:

Span: Wings (monoplane)	38' 0"
Span: Wings folded	14' 6"
Height, over cabin thrust line level (approx.)	9' 10"
Height, over propeller, three-point position	11' 9"
Height, over tail thrust line level (approx.)	11' 11"
Height to top of hoisting sling (approx.)	9' 11"
Length (maximum)(approx.)	28' 10-5/8"
Length from hoisting sling to furthest aft part of tail, thrust line level, rudder neutral, elevator down	20' 7"
L.E.W. to c.g. (empty)(wheels up)	20.48"
L.E.W. to c.g. (bomber)(wheels up)	27.17"
L.E.W. to c.g. (fighter - overload)(wheels up)	28.57"
Center of gravity, normal loading condition:	
Horizontal location, % M.A.C. (wheels up)	28.87
Vertical location, above thrust line	2.03"
Horizontal distance from rudder hinge line	18' 2.2"
Horizontal distance from elevator hinge line	18' 3.3"
Angle of line through c.g. and point of contact of wheels with normal to thrust line (approx.)	17°
Angle between line joining c.g. and points of contact of wheels (front elevation)	58° 30'
Ground angle	12° 20'
Dihedral (outer panel)	5°
Sweepback (leading edge)	None
Chord at root section	98"
Chord at construction tip section	61.44"
Mean aerodynamic chord, inches	84.14"
Wing section and thickness; at root section (% chord)	NACA 23015 (15%)
at construction tip section (% chord)	NACA 23009 ( 9%)
average - (frontal area divided by wing area)	0.1073
Effective aspect ratio of the following:	
Wing cellule	5.56
Horizontal tail surfaces	3.8
Vertical tail surfaces	1.21
Aileron span (approx.)	5'-0"
Aileron chord, mean	1' 3-29/32"
Wing incidence, at root section	0°
Clearance of wing at root above ground thrust line level (approx.)	3' 10-1/2"
Tail span	13' 8"
Stabilizer, incidence	1-1/2°
Wheel tread	6' 4-31/32"
Wheel size	26" x 6"
Tail wheel tire	6" x 2-1/2"
Diameter of propeller (3 blades)	9' 9"
High lift device:	
Type of wing flap	Split
Span of wing flaps (% of wing span)	53%
Flap chord aft of hinge, average (% wing chord)	25%
Flap angle, maximum	43°
Aileron droop	0°
Propeller clearance, normal loading condition:	
Thrust line level	8-3/4"

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\*\* 117a. Angular movement for full movement of control each side of neutral: (as limited by the stops in the pilot's cockpit)

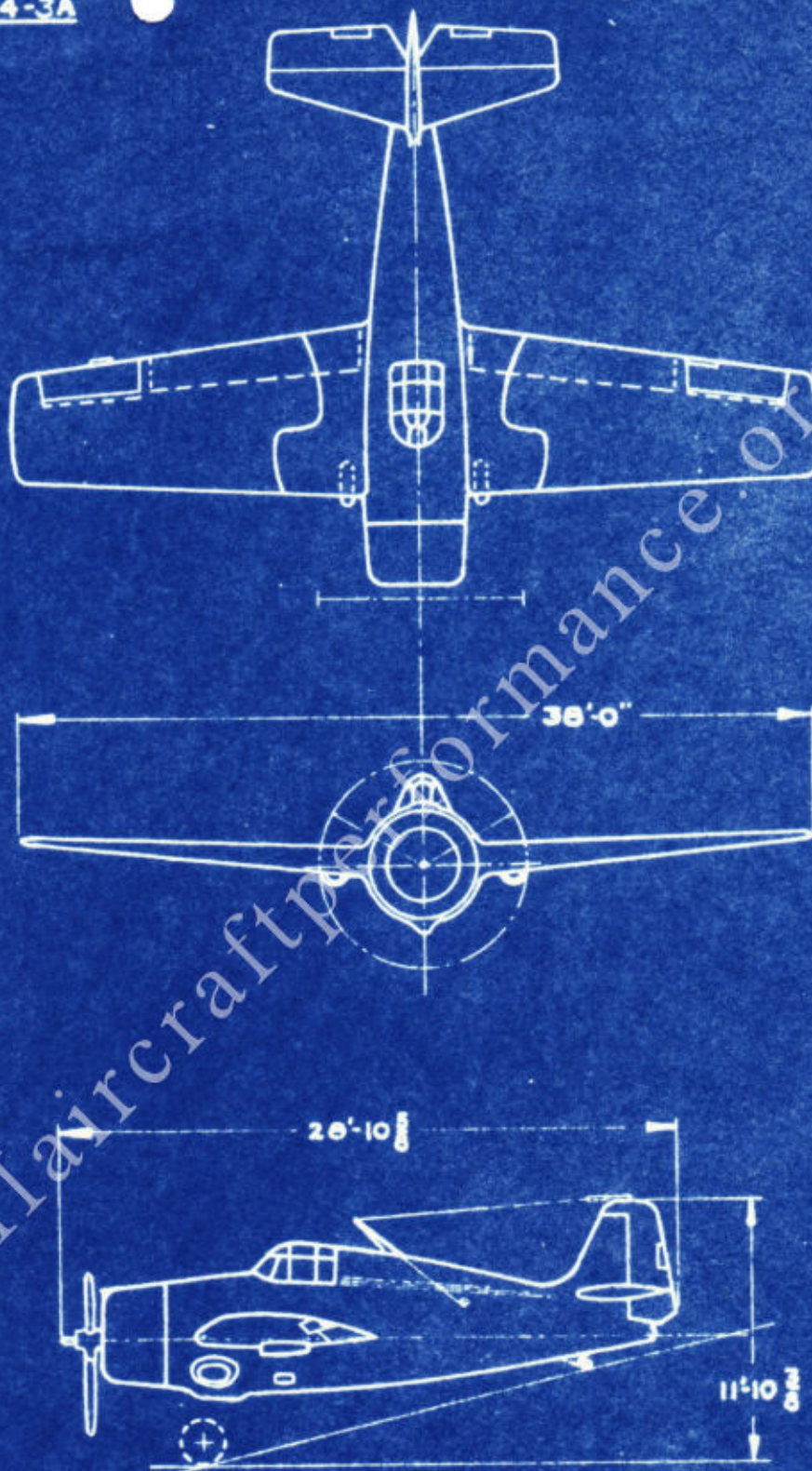
Rudder	31 degrees right, 31 degrees left
Rudder pedal	3-3/4 inches forward, 3-7/8 inches aft
Elevators	26 degrees above, 20 degrees below
Elevator control	7-7/16 inches forward, 12-3/32 inches aft
Ailerons	17 degrees above, 12 1/2 degrees below
Aileron control	8-15/16 inches right, 8-15/16 inches left
Elevator tab control	6-3/4 turns of handle for 16-3/4 degrees of tab movement
Elevator tabs	5°-54' up, 10°-51' down
Rudder tab control	8-1/2 turns of handle for 38-3/4 degrees of tab movement
Rudder tabs	22°-19' left, 16°-26' right
Aileron tab control	8/9 turns of handle for 40 degrees of tab movement
Aileron tab (left hand only)	20 degrees up, 20 degrees down

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GRUMMAN AIRCRAFT ENGINEERING CORPORATION



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