Beechcraft

MODEL D18

STRUCTURAL ANALYSIS 37
REPORT 18

SUMMARY OF STRUCTURAL ANALYSIS DESIGN CRITERIA FOR THE RCAF EXPEDITER 3N AND 3T AIRPLANES

BEECH AIRCRAFT CORP.
WICHITA, KANSAS, U. S. A.

BEECH AIRCRAFT CORPORATION

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INDEX

PAGE	TITLE
1.	General Data
2.	Basic Design Criteria
3.	Basic Design Criteria (Cont'd)
4.	Basic Design Criteria (Cont'd)

GENERAL DATA

The structure of the RCAF Models 3N and 3T airplanes is essentially the same as that of the commercial Beech Model D18S airplane.

A structural analysis has been written which covers both the D18S, which is a Pratt and Whitney powered airplane, and the D18C airplane, which is powered with Continental engines. Structurally the Models D18S and D18C are the same, the only differences being in the engine installations.

For structural purposes the Model D18S was classified as a normal non-transport category airplane and the D18C was calssified as a transport category airplane as well as a normal non-transport category airplane.

The D18 transport category airplane was structurally approved for the requirements of CAR 04 (November 9, 1945). The D18 normal category airplanes were structurally approved for the requirements specified by CAR 03 (November 13, 1945). An exception to this was made, however, in the design vertical tail surface loads of the transport category airplane, in which the loads for the maneuvering conditions were determined according to the requirements of CAR 04 (November 1, 1943). The horizontal gust loads on the vertical tail surfaces were determined according to the requirements of CAR 04 (November 9, 1945).

The design allowables for the structural materials used in the airplane were taken from ANC-5 (December 1942 and Revisions).

BASIC DESIGN CRITERIA

The D18 airplanes were structurally approved through the Civil Aeronautics Administration for the conditions noted below

WEIGHTS AND LOADINGS

Normal Category

Gross Weight - 9000 lb
Wing Loading - 25.79 lb/sq ft
Power Loading - 10 lb/hp

Transport Category

Gross Weight - 9800 lb (take-off)
Landing Weight - 9000 lb
Wing Loading - 28.08 lb/sq ft
Power Loading - 9.33 lb/hp

DESIGN SPEEDS

Normal Category

V_s - Stalling Speed - Flaps Retracted - 84 mph
V_{s_f} - Stalling Speed - Flaps Extended - 75 mph
V_f - Design Flap Speed - 140 mph
V_p - Design Maneuvering Speed - 153 mph
V_c - Design Cruising Speed - 205 mph
V_d - Design Diving Speed - 285 mph

Transport Category

V_s - Stalling Speed - Flaps Retracted - 85 mph
V_{s_f} - Stalling Speed - Flaps Extended - 78 mph
V_f - Design Flap Speed - 140 mph
V_p - Design Maneuvering Speed - 135 mph
V_c - Design Cruising Speed - 205 mph
V_d - Design Diving Speed - 285 mph

BASIC DESIGN CRITERIA (CONT'D)

FLIGHT LOAD FACTORS

Transport Category

Gross Weight 9800 Pounds

Limit Positive Vertical Load Factor = 2.5
Limit Negative Vertical Load Factor = -1.0
15 ft/sec Gust at V_d = -1 ± 1.293 (285 mph)
30 ft/sec Gust at V_c = -1 ± 1.861 (205 mph)
40 ft/sec Gust at V_b = -1 ± 1.6985 (140.3 mph)

Gross Weight 9000 Pounds

Limit Positive Vertical Load Factor = 2.5
Limit Negative Vertical Load Factor = -1.0
15 ft/sec Gust at V_d = -1 ± 1.3906 (285 mph)
30 ft/sec Gust at V_c = -1 ± 2.0006 (205 mph)
40 ft/sec Gust at V_b = -1 ± 1.8307 (140.695 mph - Nose heavy airplane)
40 ft/sec Gust at V_b = -1 ± 1.7761 (136.497 mph - Tail heavy airplane)

Minimum Weight 6487 Pounds

Limit Positive Vertical Load Factor = 2.5
Limit Negative Vertical Load Factor = -1.0
15 ft/sec Gust at V_d = -1 ± 1.815 (285 mph)
30 ft/sec Gust at V_c = -1 ± 2.611 (205 mph)
40 ft/sec Gust at V_b = -1 ± 2.1298 (125 mph)

Normal Category

Gross Weight 9000 Pounds

Limit Positive Vertical Load Factor = 3.363
Limit Negative Vertical Load Factor = 1.345
15 ft/sec Gust at V_d = -1 ± 1.3906 (285 mph)
30 ft/sec Gust at V_c = -1 ± 2.0006 (205 mph)